UR Family

Communications Guide

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It is the responsibility of the user for verifying and validating the suitability of all GE Vernova products. This equipment must be used within its design limits. The proper application including configuration and setting of this product to suit the power system assets is the responsibility of the user, who is also required to ensure that all local or regional safety guidelines are adhered to. Incorrect application of this product could risk damage to property/the environment, personal injuries or fatalities and shall be the sole responsibility of the person/entity applying and qualifying the product for use.

The content in this document has been developed to provide guidance to properly install, configure and maintain this product for its intended applications. This guidance is not intended to cover every possible contingency that may arise during commissioning, operation, service, or maintenance activities. Should you encounter any circumstance's not clearly addressed in this document, contact your local GE Vernova service site.

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UR Family

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UR Family

Chapter 1: Introduction

This document outlines the communications protocols for the Universal Relay (UR) family of products. It is intended for customers who need detailed knowledge of the UR implementation of the communications protocols, for example to design a client or to troubleshoot an interoperability issue. Use this guide with the appropriate Instruction Manual for the product. Network and IP address configuration, passwords, and user roles, for example, are explained in the Instruction Manual.

This chapter outlines general, safety, and technical support information.

1.1 Products

This document applies to the following UR products: B30, B90, C30, C60, C70, C95, D30, D60, F35, F60, G30, G60, L30, L60, L90, M60, N60, T35, T60.

The communications protocols that apply depend on those ordered. Check the order code of the device.

1.2 Features per product

The table outlines the theoretical maximums.

Features also can be viewed in the EnerVista software under **Settings > Protection Summary**.

Table 1-1: Maximum number of elements per product

Feature	Rule	Max	B30	B90	C30	C60	C70	C95	D30	D60	F35	F60	G30	G60	L30	L60	L90	M60	N60	T35	T60
Accidental Energization		1											1	1							

Feature	Rule	Max	B30	B90	C30	C60	C70	C95	D30	D60	F35	F60	G30	G60	L30	L60	L90	M60	N60	T35	T60
Automatic Voltage Regulator	# of elements if voltage banks present;0 if Enhanced Capacitor Bank Control software option not ordered	3					3														
Autoreclose	# of current banks; 0 for L30 when Three-Pole Auto-Reclose not ordered	6	6						1		6	4			3						
Autoreclose 1P 3P		1				1		1		1						1	1				
Auxiliary Overvoltage	# of elements; 1 per voltage bank and 3 if C70 or T60 has voltage banks	6	6			2	3	2	1	2	3	2	2	2	1	1	2	2			3
Auxiliary Undervoltage	#of elements if at least one voltage bank	6	6			3		3	3	3	3	3	3	3	3	3	3	3			3
B90 Breaker Failure	# of feeders from software option	24		24																	
B90 Bus Differential	# of zones from software option	6		6																	
	Bus configuration	6		6																	
	Saturation detector	6		6																	
B90 Sensitive Bus Differential	# of zones from software option	6		6																	

Feature	Rule	Max	B30	B90	C30	C60	C70	C95	D30	D60	F35	F60	G30	G60	L30	L60	L90	M60	N60	T35	T60
B90 IOC	# of current terminals	24		24																	
B90 TOC	# of current terminals	24		24																	
B90 Undervoltage	# of voltage terminals	12		12																	
Basic UR Features	Clock	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Control pushbuttons	7																			
	Display properties	1																			
	Default messages	1																			
	LED test	1																			
	Setting file template	1																			
	Security	1																			
	Trip and Alarm LEDs	1																			
	Flex state parameters	256																			
	User programmable self-tests	1																			
	Installation	1																			
	Voltage rail monitor	1																			
	Temperature monitor	1																			
Breaker Arcing Current (I2t)	# of current banks; 2 if current banks < 2	6	6			4	3	4	2	2	6	4	2	2	2	2	4	2		6	6
Breaker Control	# of current banks; 2 if current banks < 2	6	6		6	4	3	4	2	4	6	4	2	2	2	2	4	2	6	6	6
(Disconnect) Breaker Switch	# of elements	24	24		24	24	12	24	8	16	24	16	8	8	8	8	24	8	24	24	24
Breaker Failure	# of elements; 2 if current banks < 2	28	28			4	3	4		4		4		2	2	2	4	2			6

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Feature	Rule	Max	B30	B90	C30	C60	C70	C95	D30	D60	F35	F60	G30	G60	L30	L60	L90	M60	N60	T35	T60
Breaker Flashover	# of elements; 2 if current banks < 2	2	2			2	1	2		2	2	2		2		2	2	2			2
Breaker Restrike	# of elements	3	3			3	3	3		2	3	3		2		2	2	2			3
Broken Conductor Detection	# of sources	6							2	2	6	2			2	2	2				
Broken Rotor Bar		1																1			
Bus Differential		6	6																		
	Bus configuration	2	2																		
	Saturation detector	2	2																		
Bus Replica Isolator		72	72	48																	
Capacitor Bank Overvoltage	# of elements	3					3														
Capacitor Control	# of elements	3					3														
Change Phase Rotation		1											1	1							
Charging Current Compensation		1														1					
Cold Load Pickup	# of elements	6									6	2									
Compensated Bank Neutral Unbalance	# of current banks	3					3														
Compensated Overvoltage		1								1						1	1				
Cont. Monitor		1															1				
Contact Inputs	# of inputs	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120
Contact Outputs	Latching can be only 14	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72
Cross Country Isolated/ Petersen Coil Solidly Grounded		1								1							1				
CT Fail	# of current banks	6							2	4		4	4	4	2	4	4	4	6	6	6
CT Trouble	# of zones from software option; 2 on B30	6	2	6																	

Feature	Rule	Max	B30	B90	C30	C60	C70	C95	D30	D60	F35	F60	G30	G60	L30	L60	L90	M60	N60	T35	T60
Current CT settings	# of CT banks	24	24			4	6	4	1	3	6	3	3	3	2	2	4	3	6	6	6
Current Terminal Metering		24		24																	
Current Unbalance		2																2			
Data Logger		1	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Demand	# of sources	6	6			4		4		4	6	4		4		4	4		6		6
Digital Counters		8	8		8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Digital Elements		96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96
Digitizer		5																	5		
Direct Inputs/ Outputs		1													1		1				
Disturbance Detection	# of sources	30	30			4	6	4	2	4	6	4	4	4	2	4	4	4	6	6	6
Downed Conductor Detection (Hi-Z)	Available for 8Z DSP only; # of HIZ records is 4; # of RMS records is 4											1									
EGD Protocol	Fast production = 1; slow production = 2	1	1		1	1		1			1	1	1	1				1		1	1
End of Fault Protection	# of elements; 1 per CT terminal	28	28	24																	
Energy Metering	# of sources	6	6			4		4		4	6	4	4	4			4	4	6		6
Event Recorder	1024 events	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Fault Location	# of elements; 1 per current bank	5				1		1	1	1	5	2			1	1	1				
Field Ground Protection		1												1							

Feature	Rule	Max	B30	B90	C30	C60	C70	C95	D30	D60	F35	F60	G30	G60	L30	L60	L90	M60	N60	T35	T60
Field Resources			1		1	1	1	1	1	1	1	1	1	1	1		1	1	1	1	1
	Field unit brick types	1																			
	Field unit contact inputs	40																			
	Field unit contact outputs	8																			
	Field unit CT/VT settings	6																			
	Field unit I/O states	1																			
	Field unit latching outputs	8																			
	Field unit raw data actuals	8																			
	Field unit raw data settings	1																			
	Field unit RTDs	8																			
	Field unit shared inputs	16																			
	Field unit shared outputs	16																			
	Field unit transducers	8																			
	Field units	8																			
FlexElements		16	16		16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16
FlexLogic Equations	1024 lines		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	FlexLogic timers	64																			
FlexMath																			1		
	Direct analogs	32																	32		
	Direct integers	16																	16		
	Summator	6																	6		
Frequency Rate of Change		4							2	4		4	4	4	2		4		4		4
Generator Unbalance		1											1	1							
Generic Comparator	8-bit comparator	6																	6		

Feature	Rule	Max	B30	B90	C30	C60	C70	C95	D30	D60	F35	F60	G30	G60	L30	L60	L90	M60	N60	T35	T60
Ground Distance	Fast distance is not available on L60	6							5	6						3	6				5
Ground Instantaneous Overcurrent	# of elements if at least one CT bank	28	28			8	12	8	2	6	12	6	1	1	4	4	8	6	12	12	12
Ground Time Overcurrent	# of elements if at least one CT bank	28	28			4	6	4	2	4	6	4	1	1	2	2	4	4	6	6	6
IEC 61850 Communications			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Configurable GOOSE Rx	16																			
	Configurable GOOSE Tx	8																			
	GGIO2 configuration	64																			
	GGIO4 analog points	32																			
	GGIO5 unsigned integer points	16																			
	MMXU deadbands	6																			
	Received analogs	32																			
	Received integers	16																			
	XCBR configuration	6																			
	XSWI configuration	24																			
	IPv4 Routes	6																			

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Feature	Rule	Max	B30	B90	C30	C60	C70	C95	D30	D60	F35	F60	G30	G60	L30	L60	L90	M60	N60	T35	T60
IEC 61850 Remote I/O (Fixed GOOSE/ GOOSE)			1	1		1	1	1	1	1	1	1	1	1	1	1	1	1		1	1
	Rx GOOSE	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64
	Rx GOOSE Boolean	256	256	256	256	256	256	256	256	256	256	256	256	256	256	256	256	256	256	256	256
	Rx GOOSE DPS	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16
	Rx GOOSE I/ O states	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Rx GOOSE status	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64
IEC 103 Communications		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Incipient Cable Fault	# of elements	6							1		6	2			1						
L60 Channel Tests		1														1					
Line Differential (87L) In-Zone Transformer		1													1		1				
Line Differential (87L) L90		1															1				
	L90 Power system	1																			
	87L trip logic	1																			
	L90 phase select	1																			
	L90 channels tests	1																			
Line Differential (87L)	No multi-end fault location														1						
Line Pickup		1							1	1						1	1				
Load Encroachment		1							1	1		1				1	1				1
Loss of Excitation		1											1	1							
Modbus Communications		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Modbus User Map		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Motor Acceleration Time		1																1			
Motor Mechanical Jam		1																1			

Feature	Rule	Max	B30	B90	C30	C60	C70	C95	D30	D60	F35	F60	G30	G60	L30	L60	L90	M60	N60	T35	T60
Motor Start Supervision		1																1			
Multi-Range Signal Oscillation Detector (MSOD)										2			2	2			2		6		2
Negative Sequence Directional OC	# of elements if at least one CT bank and one VT bank	3					2		2	2		2	2	2		2	2				3
Negative Sequence Instantaneous Overcurrent	# of elements if at least one CT bank	3					2		2	2	2	2			2	2	2				3
Negative Sequence Overvoltage C70	# of voltage banks if at least one	3					3														
Negative Sequence Overvoltage	# of elements if at least one voltage bank	3							3	3		3	3	3	3	3		3			3
Negative Sequence Time Overcurrent	# of elements if at least one CT bank	3					2		2	2	2	2			2	2	2				3
Neutral Current Unbalance	# of current banks	3					3														
Neutral Directional Overcurrent		6	6				1		2	2		2	2	2	2	2	2	2	3		3
Neutral Instantaneous Overcurrent	# of CT banks if at least one	6	6										1	1							
Neutral Instantaneous Overcurrent	# of elements if at least one CT bank	28	28			8	6	8	2	6	12	8			4	4	8	8	12		12
Neutral Overvoltage	# of elements if at least one VT bank	6	6			3	3	3	3	3	3	3	3	3	3	3	3	3			3
Neutral Time Overcurrent	# of elements if at least one CT bank	28	28			6	6	6	2	4	6	6	2	2	4	4	6	6	6		6
Neutral Voltage Unbalance	# of voltage banks	3					3														

Feature	Rule	Max	B30	B90	C30	C60	C70	C95	D30	D60	F35	F60	G30	G60	L30	L60	L90	M60	N60	T35	T60
Non Volatile Latches		16	16	16	32	32	16	32	16	16	16	16	16	16	16	16	16	16	16	16	16
Open Pole Detect (supervisory)		1																	1		
Oscillography		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Over Under Frequency Accumulation	Frequency out of band	1											1	1							
Overfrequency		4				4		4		4		4	4	4			4	4	4		4
Phase Comparison		1														1					
Phase Current Unbalance	# of current banks	3					3														
Phase Directional	# of elements if at least one CT and one VT bank	6	6				2		2	2		2	1	1	2	2	2	2	3		3
Phase Distance	L60 does not support fast distance (L60 must become fast distance)	6							5	6				3		3	6				5
Phase Instantaneous Overcurrent	# of elements if at least one CT bank	56	56			8	12	8	2	6	12	8	4	4	4	4	8	8	12	12	12
Phase Overvoltage	# of elements if at least one VT bank	6	6			3	3	3	3	3	3	3	3	3	3	3	3	3	3		3
Phase Time Overcurrent	# of elements if at least one CT bank	28	28			6	6	6	2	4	6	6	2	2	4	4	6	6	6	6	6
Phase Undervoltage	# of elements if at least one VT bank	6	6			3	3	3	3	3	3	3	3	3	3	3	3	3	3		3
PID Regulator		4			4						4										

Feature	Rule	Max	B30	B90	C30	C60	C70	C95	D30	D60	F35	F60	G30	G60	L30	L60	L90	M60	N60	T35	T60
Pilot Schemes		1																			
	Pilot blocking (1P)																				
	Pilot blocking 1 (1P)									1							1				
	Pilot DCUB									1							1				
	Pilot DUTT (1P)									1							1				
	Pilot Hybrid POTT (1P)									1							1				
	Pilot POTT (1P)									1							1				
	Pilot POTT1 (1P)									1							1				
	Pilot PUTT (1P)									1							1				
	Pilot POTT															1					
	Pilot POTT3											1									
	Pilot blocking 3 (DCB3)											1									
Platform Direct I/O		256	32	256	64	32	32	32	32	32	32	32	32	32		32		32	64	32	32
Power Swing Detect		1							1	1				1		1	1		1		1
Precision Time Protocol (1588)		3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Reduced Voltage Starting		1																1			
Restricted Ground Fault	# of elements; 0 if L90 has no inzone transformer	6										4	4	4			4			6	6
RRTD Protection		12												12				12			12
RTD Protection		48												48				48			48
Security		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Selector Switch		2	2		2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Sensitive Directional Power	# of elements if at least one VT bank	2				2		2		2		2	2	2			2	2	2		2
Setting Groups		6	6	6		6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6

Feature	Rule	Max	B30	B90	C30	C60	C70	C95	D30	D60	F35	F60	G30	G60	L30	L60	L90	M60	N60	T35	T60
Simple Network Time Protocol		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Single Pole Tripping		1				1		1		1						1	1				
	Open pole detect (1P)																				
	Phase selection																				
	Trip output																				
Sources (1 per CT/VT bank)	# of sources	30	30			4	6	4	2	4	6	4	4	4	2	4	4	4	6	6	6
Split Phase Protection		1											1	1							
Stator Differential		1												1				1			
	Saturation detector	1																			
Stator Ground		1											1	1							
Stub Bus		1													1		1				
Subharmonic Stator Ground		1												1							
Switch		6			6						6								6		
Synchrocheck		10	6			10		10	4	10		4	4	4	4	4	10		6		6
Synchrophasors	# of PMUs; software option	6				2		2		1		1		1	1		1		6		1
	# of Aggregators	4				2		2		1		1		1	1		1		4		1
Teleprotection I/O		1	1		1	1	1	1	1	1	1	1	1	1		1		1	1	1	1
Thermal Model		1																1			
	Motor setup	1																			
Thermal Overload Protection		4	2			2	2	2	2	2	2	2	2	2	2	2	2		2	4	4
Third Harmonic Neutral Undervoltage		1											1	1							
Time of Day Timer		5					5														
Transducer I/O			1		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	DCMA inputs	48																			
	DCMA outputs	48																			
	Ohm inputs	2																			
	RTD inputs	48																			

Feature	Rule	Max	B30	B90	C30	C60	C70	C95	D30	D60	F35	F60	G30	G60	L30	L60	L90	M60	N60	T35	T60
Transformer Instantaneous Differential		1																		1	1
Transformer Percent Differential		1											1							1	1
Transformer windings		6											2							6	6
Transformer Thermal Model		1											1							1	1
Transformer Through-Fault		6																		3	6
Transient Ground Fault Detection		5								4	5	4					4			4	
Trip Bus		6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Undercurrent		1																1			
Underfrequency		12	12						6	6	6	6	6	6	6		6	6	6	6	6
Underpower		2																2			
User-Programmable Fault Report		2	2	2			2						2	2				2	2	2	2
User-Programmable LEDs		48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48
User-Programmable Pushbuttons	# of pushbuttons: 6, 12, 16, or 48		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	control push-buttons	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
User-Definable Displays		16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16
Virtual Inputs		128	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128
Virtual Outputs		256	256	256	256	256	256	256	256	256	256	256	256	256	256	256	256	256	256	256	256
Voltage Differential	# of VT banks	3					3														
Volts Per Hertz	# of elements if at least one VT bank	2											2	2			2				2
VT Fuse Failure	# of sources if CT bank or VT bank	6	6			4	6	4	2	4	6	4	4	4	2	4	4	4	6		6
Wattmetric Ground Fault	# of elements	10							2	2	10	2				2	2				

1.3 Communication ports

URs are equipped with a front RS232 port, a rear RS485 port, an IRIG-B input port, and three Ethernet ports. The Ethernet ports are a combination of 100Base-TX and 100Base-FX depending on the order code option. See the relevant Instruction Manual for information on these ports.

The table list enables a user to facilitate port control through a firewall device found in their network.

Table 1: UR ports

	Services	Port number	Default port status	Configurable port number	Assigning 0 disables the port	Software option dependency
1	Modbus / TCP	502	Enabled	Yes	Yes	Not dependent on software (SW) option
2	HTTP / TCP	80	Enabled	Yes	Yes	Not dependent on SW option
3	IEC 61850 (ISO-TSAP) / TCP	102	Disabled	No	N/A	IEC 61850 option
4	PMU / TCP	4712	Enabled	Yes	Yes	PMU option
5	PMU / UDP1	4713	Enabled	Yes	Yes	PMU option
7	TFTP / UDP	69	Enabled	Yes	Yes	Not dependent on SW option
8	TFTP Data port / UDP (2)	0	Enabled	Yes	No When not configured (default value = 0), the ephemeral port range of 49152 to 65535 is used	Not dependent on SW option
9	DNP / TCP	20000	Disabled	Yes	Yes	Not dependent on SW option
10	DNP / UDP	20000	Disabled	Yes	Yes	Not dependent on SW option
11	IEC 60870-5-104 / TCP	2404	Disabled	Yes	Yes	Not dependent on SW option
12	SNTP1 / UDP	123	Disabled	Yes	No	Not dependent on SW option
13	SNTP2 / UDP	123	Disabled	Yes	No	Not dependent on SW option
14	EGD Data port / UDP	18246	Disabled	No	No	EGD option
15	SFTP/ SSH Port	22	Enabled	No	No For relays with IEC 61850 and without CyberSentry, SFTP/ SSH can be disabled from a dedicated setting. It cannot be disabled for relays with CyberSentry.	CyberSentry or IEC 61850 option
16	RADIUS	1812	Disabled	Yes	0 is out of range	CyberSentry option
17	Syslog / UDP	514	Disabled	Yes	0 is out of range	CyberSentry option

1.4 Safety symbols and definitions

Before attempting to install or use the device, review all safety indicators in this document to help prevent injury, equipment damage, or downtime.

The following safety and equipment symbols are used in this document.

DANGER **Indicates a hazardous situation which, if not avoided, will result in death or serious injury.**

WARNING **Indicates a hazardous situation which, if not avoided, could result in death or serious injury.**

CAUTION **Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.**

NOTICE Indicates practices not related to personal injury.

See the Instruction Manual for safety information.

1.5 For further assistance

For product support, contact the information and call center as follows:

GE Grid Solutions
650 Markland Street
Markham, Ontario
Canada L6C 0M1
Worldwide telephone: +1 905 927 7070
Europe/Middle East/Africa telephone: +34 94 485 88 54
North America toll-free: 1 800 547 8629
Fax: +1 905 927 5098
Worldwide e-mail: multilin.tech@ge.com
Europe e-mail: multilin.tech.euro@ge.com
Website: http://www.gegridsolutions.com/multilin

UR Family

Chapter 2: Modbus communication

This chapter outlines the Modbus protocol, which is a standard protocol used for communication among devices. Use the Modbus memory map provided when designing a client to access the UR device using Modbus.

2.1 Modbus RTU protocol

2.1.1 Introduction

The UR family supports several communications protocols to allow connection to equipment such as personal computers, remote terminal units (RTUs), supervisory control and data acquisition (SCADA) masters, and programmable logic controllers. The Modicon Modbus protocol is the most basic protocol supported by the UR. Modbus RTU is available via the RS232, RS485, or USB link (for graphical front panel), and Modbus TCP/IP is available over Ethernet. The following description is intended primarily for users who want to develop their own master communication drivers. Note that:

- The UR always acts as a slave device, meaning that it never initiates communications. It listens and responds to requests issued by a master computer.
- A subset of Modbus RTU and Modbus TCP/IP protocol format is supported that allows extensive monitoring, programming, and control functions using read and write register commands

2.1.2 Configuration

The Modbus slave address and TCP port number are configured during installation. See the Modbus Protocol section in the Settings chapter of the Instruction Manual.

The number of remaining Modbus TCP connections available can be viewed in the **Actual Values > Status > Comm Status Remaining Connect** option. The value is 4 when the EnerVista software is closed. See the Remaining Connection Status section in the Actual Values chapter of the Instruction Manual.

2.1.3 Physical layer

The Modbus RTU protocol is hardware-independent so that the physical layer can be any of a variety of standard hardware configurations including RS232, RS485, and USB (for graphical front panel). The relay includes a front panel RS232 port and a rear terminal RS485 port. Data flow is half-duplex in all configurations. See chapter 3 of the Instruction Manual for communications wiring.

2

Each data byte is transmitted in an asynchronous format consisting of 1 start bit, 8 data bits, 1 stop bit, and possibly 1 parity bit. This produces a 10 or 11 bit data frame. This can be important for transmission through modems at high bit rates (11 bit data frames are not supported by many modems at baud rates greater than 300).

The RS232 port is intended for local use, with baud rate set at 115200 or 19200 bps under **Settings > Product Setup > Communications > Serial Ports**. The rear terminal RS485 port can be set for baud rates of 300, 1200, 2400, 4800, 9600, 14400, 19200, 28800, 33600, 38400, 57600, or 115200 bps, and even, odd, and no parity options are available. The USB port is intended for local use and is included with the graphical front panel. See the Communications section of chapter 5 in the Instruction Manual for details.

The Modbus TCP/IP protocol is available on each of the rear Ethernet ports. These ports are 100Base-FX.

2.1.4 Data link layer

Modbus RTU communications takes place in packets that are groups of asynchronously framed byte data. The master transmits a packet to the slave and the slave responds with a packet. The following information describes the general format for both transmit and receive packets. For details on packet formatting, see subsequent sections describing each function code.

Table 2-1: Modbus RTU packet format

Description	Size
SLAVE ADDRESS	1 byte
FUNCTION CODE	1 byte
DATA	N bytes
CRC	2 bytes
DEAD TIME	3.5 bytes transmission time

SLAVE ADDRESS — This is the address of the slave device that is intended to receive the packet sent by the master and to perform the desired action. Each slave device on a communications bus must have a unique address to prevent bus contention. All of the relay's ports have the same address which is programmable from 1 to 254; see chapter 5 in the Instruction Manual for details. Only the addressed slave will respond to a packet that starts with its address. Note that the front panel port is an exception to this rule; it acts on a message containing any slave address.

A master transmit packet with slave address 0 indicates a broadcast command. All slaves on the communication link take action based on the packet, but none respond to the master.

FUNCTION CODE — This is one of the supported functions codes of the unit which tells the slave what action to perform. See the Supported function codes section on page 2-4 for details. An exception response from the slave is indicated by setting the high order bit of the function code in the response packet. See the Exception responses section on page 2-7 for details.

DATA — This is a variable number of bytes depending on the function code. It can include actual values, settings, or addresses sent by the master to the slave or by the slave to the master.

CRC — This is a two byte error checking code. The RTU version of Modbus includes a 16-bit cyclic redundancy check (CRC-16) with every packet which is an industry standard method used for error detection. If a Modbus slave device receives a packet in which an error is indicated by the CRC, the slave device does not act upon or respond to the packet thus preventing any erroneous operations. See the Modbus RTU CRC-16 algorithm section on page 2-3 for details on calculating the CRC.

DEAD TIME — A packet is terminated when no data is received for a period of 3.5 byte transmission times (about 15 ms at 2400 bps, 2 ms at 19200 bps, and 300 µs at 115200 bps). Consequently, the transmitting device must not allow gaps between bytes longer than this interval. Once the dead time has expired without a new byte transmission, all slaves start listening for a new packet from the master except for the addressed slave.

Modbus-TCP/IP communications takes place in application data units (ADUs), which are wrapped in the TCP/IP/Ethernet protocols. Ethernet provides layer 2 addressing and CRC-32 error checking. IP provides layer 3 addressing. TCP provides communication establishment and ending and manages data flow. The Parallel Redundancy Protocol (PRP) also can be used to provide seamless data flow in case of a single failure in the network, by using a combination of LAN duplication and frame duplication. See chapter 5 in the instruction manual for information on setting up TCP for Modbus (in the Modbus section), IP and PRP (Network section).

The ADU is described as follows.

Table 2-2: Modbus TCP/IP format

Description		Size
MBAP header	Transaction identifier	2 bytes
	Protocol identifier	2 bytes
	Length	2 bytes
	Unit identifier	1 byte
FUNCTION CODE		1 byte
DATA		N bytes

MBAP header — This Modbus Application Protocol header contains the following fields:

- Transaction Identifier: Used for transaction pairing. The Modbus server copies in the response the transaction identifier of the request.
- Protocol Identifier: Used for intra-system multiplexing. The Modbus protocol is identified by the value 0.
- Length: The length field is a byte count of the following fields, including the Unit Identifier and data fields.
- Unit Identifier: For the purposes of the UR, this field is equivalent to the Modbus RTU SLAVE ADDRESS field. The client must use the same value here as programmed in the UR setting **MODBUS SLAVE ADDRESS**.

FUNCTION CODE — This is the same as the Modbus RTU function code field described above.

DATA — This is the same as the Modbus RTU data field described above.

2.1.5 Modbus RTU CRC-16 algorithm

The Modbus TPC/IP CRC-32 algorithm is universally executed in hardware, so there is no need to describe it here.

The Modbus RTU CRC-16 algorithm essentially treats the entire data stream (data bits only; start, stop and parity ignored) as one continuous binary number. This number is first shifted left 16 bits and then divided by a characteristic polynomial (11000000000000101b). The 16-bit remainder of the division is appended to the end of the packet, MSByte first. The resulting packet including CRC, when divided by the same polynomial at the receiver will give a zero remainder if no transmission errors have occurred. This algorithm requires the characteristic polynomial to be reverse bit ordered. The most significant bit of the characteristic polynomial is dropped, since it does not affect the value of the remainder.

A C programming language implementation of the CRC algorithm can be provided upon request.

Table 2-3: Modbus RTU CRC-16 algorithm

Symbols	-->	data transfer
	A	16 bit working register
	Alow	low order byte of A
	Ahigh	high order byte of A
	CRC	16 bit CRC-16 result
	i,j	loop counters
	(+)	logical EXCLUSIVE-OR operator
	N	total number of data bytes
	Di	i-th data byte (i = 0 to N-1)
	G	16 bit characteristic polynomial = 1010000000000001 (binary) with MSbit dropped and bit order reversed
	shr (x)	right shift operator (th LSbit of x is shifted into a carry flag, a '0' is shifted into the MSbit of x, all other bits are shifted right one location)

2

Algorithm	1.	FFFF (hex) --> A	
	2.	0 --> i	
	3.	0 --> j	
	4.	Di (+) Alow --> Alow	
	5.	j + 1 --> j	
	6.	shr (A)	
	7.	Is there a carry?	No: go to 8; Yes: G (+) A --> A and continue
	8.	Is j = 8?	No: go to 5; Yes: continue
	9.	i + 1 --> i	
	10.	Is i = N?	No: go to 3; Yes: continue
	11.	A --> CRC	

2.2 Modbus function codes

2.2.1 Supported function codes

Modbus officially defines function codes from 1 to 127 though only a small subset is generally needed. The relay supports some of these functions, as summarized in the following table. Subsequent sections describe each function code.

Table 2-4: Function codes

Function code		Modbus definition	GE Multilin definition
Hex	Dec		
03	3	Read input registers	Read settings
04	4	Read input registers	Read actual values
05	5	Force single coil	Execute operation
06	6	Preset single register	Store single setting
10	16	Preset multiple registers	Store multiple settings

2.2.2 Read actual values or settings (function code 03/04h)

These function codes allow the master to read one or more consecutive data registers (actual values or settings) from a relay. Data registers are always 16-bit (two-byte) values transmitted with high order byte first. The maximum number of registers that can be read in a single packet is 125.

Up to firmware version 7.8x, actual values and settings are located in the same Modbus map and are read with either function code 0x3h or 04h interchangeably. That is, the two function codes function identically.

Starting in firmware version 7.90, settings and actual values have separate Modbus tables, or maps. Each Modbus table can use the entire available Modbus space of 65,536 data items. A Modbus master must read settings with function code 03h (read holding registers) and it must read actual values with function code 04h (read input registers). The same numeric value of a Modbus address can be located in the settings table or in the actual values table, and the function code used for reading the data determines if data from the settings or actual values map is read.

Table 2-5: Modbus address space explained

Address	Actual values map	Settings map
0x0000 to 0xFFFF	Read with function code 04h	Read with function code 03h

The following two examples show the format of the master and slave packets in Modbus RTU. Modbus TCP/IP ADUs have a MBAP instead of slave address, and CRC is in another stack layer.

The example in the table shows a master device reading two actual values registers starting at address 3000h in the actual values Modbus map from slave device 11h (17 decimal). The slave device responds with the values 5 and 3 from registers 3000h and 3001h, respectively.

Table 2-6: Modbus read actual values example function code 04h - Master/slave device packet transmission example

Master transmission	
Packet format	**Example (hex)**
SLAVE ADDRESS	11
FUNCTION CODE	04
DATA STARTING ADDRESS - high	30
DATA STARTING ADDRESS - low	00
NUMBER OF REGISTERS - high	00
NUMBER OF REGISTERS - low	02
CRC - low	7C
CRC - high	5B

Slave response	
Packet format	**Example (hex)**
SLAVE ADDRESS	11
FUNCTION CODE	04
BYTE COUNT	04
DATA #1 - high	00
DATA #1 - low	05
DATA #2 - high	00
DATA #2 - low	03
CRC - low	BA
CRC - high	45

The next example shows a master device reading three settings registers starting at address 1F36h in the settings Modbus map from slave device 11h (17 decimal). The slave device responds with the values 3, 0, and 50 from registers 1F36h, 1F37h, and 1F38h, respectively.

Table 2-7: Modbus master settings value function code 03h - Master/slave device packet transmission example

Master transmission	
Packet format	**Example (hex)**
SLAVE ADDRESS	11
FUNCTION CODE	03
DATA STARTING ADDRESS - high	1F
DATA STARTING ADDRESS - low	36
NUMBER OF REGISTERS - high	00
NUMBER OF REGISTERS - low	03
CRC - low	E0
CRC - high	81

Slave response	
Packet format	**Example (hex)**
SLAVE ADDRESS	11
FUNCTION CODE	03
BYTE COUNT	06
DATA #1 - high	00
DATA #1 - low	03
DATA #2 - high	00
DATA #2 - low	00
DATA #3 - high	00
DATA #3 - low	32
CRC - low	29
CRC - high	60

2.2.3 Execute operation (function code 05h)

This function code allows the master to perform various operations in the relay. Available operations are shown in the summary table below.

The following table shows the format of the master and slave packets in Modbus RTU. Modbus TCP/IP ADUs have a MBAP instead of slave address, and CRC is in another stack layer. The example shows a master device requesting the slave device 11h (17 decimal) to perform a reset. The high and low code value bytes always have the values “FF” and “00” respectively and are a remnant of the original Modbus definition of this function code.

Table 2-8: Master and slave device packet transmission example

Master transmission	
Packet format	**Example (Hex)**
SLAVE ADDRESS	11
FUNCTION CODE	05

Slave response	
Packet format	**Example (Hex)**
SLAVE ADDRESS	11
FUNCTION CODE	05

Master transmission		Slave response	
Packet format	**Example (Hex)**	**Packet format**	**Example (Hex)**
OPERATION CODE - high	00	OPERATION CODE - high	00
OPERATION CODE - low	01	OPERATION CODE - low	01
CODE VALUE - high	FF	CODE VALUE - high	FF
CODE VALUE - low	00	CODE VALUE - low	00
CRC - low	DF	CRC - low	DF
CRC - high	6A	CRC - high	6A

Table 2-9: Summary of operation codes for function 05h

Operation code (Hex)	Definition	Description
0000	NO OPERATION	Does not do anything
0001	RESET	Performs the same function as the front panel **RESET** key
0005	CLEAR EVENT RECORDS	Performs the same function as the front panel **CLEAR EVENT RECORDS** menu command
0006	CLEAR OSCILLOGRAPHY	Clears all oscillography records
1000 to 103F	VIRTUAL IN 1 to 64 ON/OFF	Sets the states of Virtual Inputs 1 to 64 either “ON” or “OFF”

2.2.4 Store single setting (function code 06h)

This function code allows the master to modify the contents of a single setting register in an relay. The following table shows the format of the master and slave packets in Modbus RTU. Modbus TCP/IP ADUs have a MBAP instead of slave address, and CRC is in another stack layer. The example shows a master device storing the value 200 at memory map address 4051h to slave device 11h (17 dec).

Table 2-10: Master and slave device packet transmission example

Master transmission		Slave response	
Packet format	**Example (Hex)**	**Packet format**	**Example (Hex)**
SLAVE ADDRESS	11	SLAVE ADDRESS	11
FUNCTION CODE	06	FUNCTION CODE	06
DATA STARTING ADDRESS - high	40	DATA STARTING ADDRESS - high	40
DATA STARTING ADDRESS - low	51	DATA STARTING ADDRESS - low	51
DATA - high	00	DATA - high	00
DATA - low	C8	DATA - low	C8
CRC - low	CE	CRC - low	CE
CRC - high	DD	CRC - high	DD

2.2.5 Store multiple settings (function code 10h)

This function code allows the master to modify the contents of a one or more consecutive setting registers in a relay. Setting registers are 16-bit (two byte) values transmitted high order byte first. The maximum number of setting registers that can be stored in a single packet is 123. The following table shows the format of the master and slave packets in Modbus RTU. Modbus TCP/IP ADUs have a MBAP instead of slave address, and CRC is in another stack layer. The example shows a master device storing the value 200 at memory map address 4051h, and the value 1 at memory map address 4052h to slave device 11h (17 decimal).

Table 2-11: Master and slave device packet transmission example

Master transmission		Slave response	
Packet format	**Example (Hex)**	**Packet format**	**Example (Hex)**
SLAVE ADDRESS	11	SLAVE ADDRESS	11

Master transmission	
Packet format	**Example (Hex)**
FUNCTION CODE	10
DATA STARTING ADDRESS - hi	40
DATA STARTING ADDRESS - lo	51
NUMBER OF SETTINGS - hi	00
NUMBER OF SETTINGS - lo	02
BYTE COUNT	04
DATA #1 - high order byte	00
DATA #1 - low order byte	C8
DATA #2 - high order byte	00
DATA #2 - low order byte	01
CRC - low order byte	12
CRC - high order byte	62

Slave response	
Packet format	**Example (Hex)**
FUNCTION CODE	10
DATA STARTING ADDRESS - hi	40
DATA STARTING ADDRESS - lo	51
NUMBER OF SETTINGS - hi	00
NUMBER OF SETTINGS - lo	02
CRC - lo	07
CRC - hi	64

2.2.6 Exception responses

Programming or operation errors usually happen because of illegal data in a packet. These errors result in an exception response from the slave. The slave detecting one of these errors sends a response packet to the master with the high order bit of the function code set to 1.

The following table shows the format of the master and slave packets in Modbus RTU. Modbus TCP/IP ADUs have a MBAP instead of slave address, and CRC is in another stack layer. The example shows a master device sending the unsupported function code 39h to slave device 11h.

Table 2-12: Master and slave device packet transmission example

Master transmission	
Packet format	**Example (Hex)**
SLAVE ADDRESS	11
FUNCTION CODE	39
CRC - low order byte	CD
CRC - high order byte	F2

Slave response	
Packet format	**Example (Hex)**
SLAVE ADDRESS	11
FUNCTION CODE	B9
ERROR CODE	01
CRC - low order byte	93
CRC - high order byte	95

2.3 File transfers

2.3.1 Obtaining relay files using Modbus

2.3.1.1 Description

The UR has a generic file transfer facility, meaning that you use the same method to obtain all of the different types of files from the unit. The Modbus registers that implement file transfer are found in the "Modbus File Transfer (Read/Write)" and "Modbus File Transfer (Read Only)" modules, starting at address 3100h in the Modbus Memory Map. To read a file from the UR, use the following steps:

1. Write the filename to the "Name of file to read" register using a write multiple registers command. If the name is shorter than 80 characters, you may write only enough registers to include all the text of the filename. Filenames are not case sensitive.
2. Repeatedly read all the registers in "Modbus File Transfer (Read Only)" using a read multiple registers command. It is not necessary to read the entire data block, since the UR remembers which was the last register you read. The "position" register is initially zero and thereafter indicates how many bytes (2 times the number of registers) you have

read so far. The "size of..." register indicates the number of bytes of data remaining to read, to a maximum of 244.

3. Keep reading until the "size of..." register is smaller than the number of bytes you are transferring. This condition indicates end of file. Discard any bytes you have read beyond the indicated block size.
4. If you need to re-try a block, read only the "size of.." and "block of data", without reading the position. The file pointer is only incremented when you read the position register, so the same data block is returned as was read in the previous operation. On the next read, check to see if the position is where you expect it to be, and discard the previous block if it is not (this condition would indicate that the UR did not process your original read request).

The UR retains connection-specific file transfer information, so files can be read simultaneously on multiple Modbus connections.

2.3.1.2 Other protocols

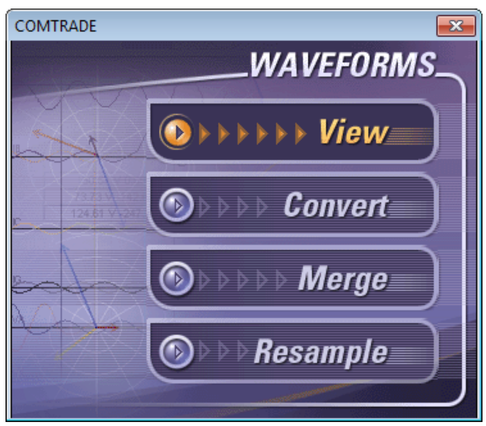
All the files available using Modbus can also be retrieved using the standard file transfer mechanisms in other protocols (for example, TFTP or Manufacturing Message Specification, MMS).

2.3.1.3 COMTRADE, oscillography, data logger, and PMU record files

Oscillography, data logger, and PMU record files are formatted using the COMTRADE file format per IEEE C37.111 (1999 or 2013) Standard Common Format for Transient Data Exchange (COMTRADE) for Power Systems. The files can be obtained in either text or binary COMTRADE format.

The EnerVista UR Setup software includes the ability to work with COMTRADE files. Access **File > COMTRADE Utility**. See the Waveforms chapter of the EnerVista Viewpoint Monitoring Instruction Manual for information on how to use the tool.

Figure 2-1: COMTRADE utility



Preferences are set within the EnerVista software in two windows.

To set COMTRADE waveform preferences:

1. With a waveform open in the EnerVista software, click the Preference icon on the toolbar.

   In the **Analog Channels** panel, ensure that similar analog channels have the same **Scale Group**.

   Put currents and voltages in different **Scale Groups** for proper scaling.

   For harmonics, ensure that the **Phasor** and **FFT** (harmonic analysis) check boxes are enabled, then click the **Harmonics** icon on the toolbar.

   In the **Digital Channels** panel, use the **Change Detected** check box to view which digital channels detected a change. Use the **Graph** check box to view a digital channel that did not detect a change.

To set COMTRADE waveform display preferences:

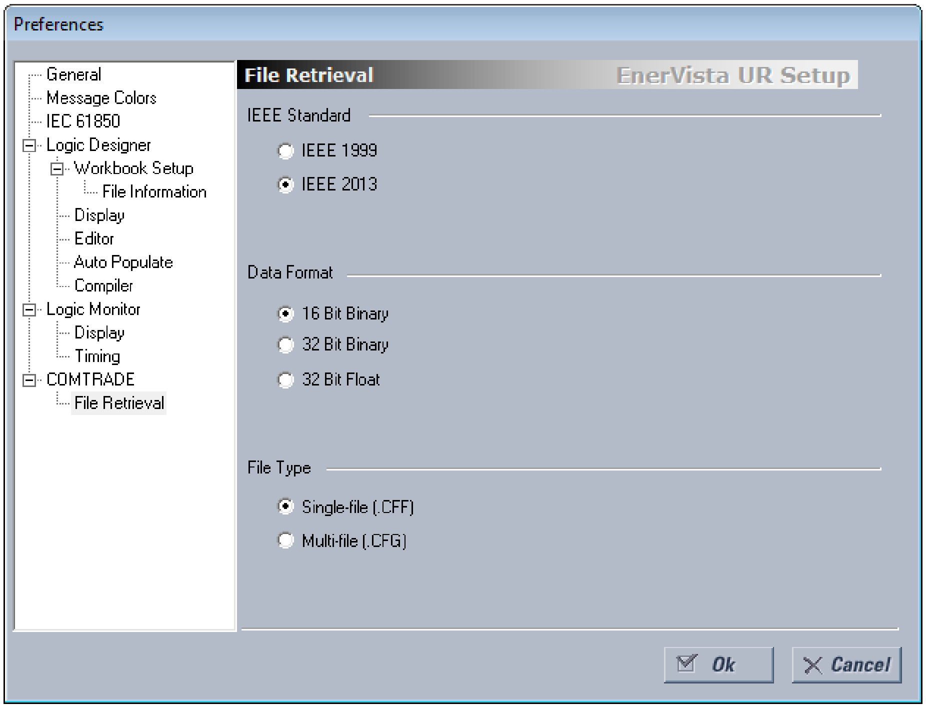
1. In the EnerVista software, click **File > Preferences**. If the option does not display, close any open waveform file. The preferences here affect only the type of file retrieved by the software from **Actual Values > Records**, by single-click in the software, or by oscillography. The same file can be retrieved in another format in the software under **Maintenance > Retrieve File** or some other means, such as TFTP or MMS, by requesting the file with the file name that reflects the

format wanted.

2. Open the lone **COMTRADE** panel and set the options.

   IEEE 1999 — All UR releases support this standard. When this option is selected, no other options are selectable and 16 bit binary data are used.

Figure 2-2: Select the COMTRADE format



   IEEE 2013 — UR 7.4 supports this standard.

   16 Bit Binary — UR 7.4 supports this.

   32 Bit Binary — UR 7.4 supports this.

   32 Bit Float — UR 7.4 supports this.

   Single-file (.CFF) — Supported by devices that support IEEE 2013, so UR 7.4 supports this. One file with .CFF extension instead of four separate .CFG, .INF, .HDR, and .DAT files.

   Multi-file (.CFG) — When IEEE 1999 is selected, this option is selected automatically. When IEEE 2013 is selected, choose between CFF or CFG format.

3. Click the **Ok** button to save and exit.

2.3.1.4 Reading oscillography files

Familiarity with the oscillography feature is required to understand the following description. See the Oscillography section in chapter 5 of the Instruction Manual for details.

The "Oscillography Number of Triggers" register increments by one every time a new oscillography file is triggered (captured) and cleared to zero when oscillography data is cleared. When a new trigger occurs, the associated oscillography file is assigned a file identifier number equal to the incremented value of this register; the newest file number is equal to the "Oscillography Number of Triggers" register. This register can be used to determine if any new data has been captured by periodically reading it to see if the value has changed; if the number has increased then new data is available.

The "Oscillography Number of Records" register specifies the maximum number of files (and the number of cycles of data per file) that can be stored in memory of the relay. The "Oscillography Available Records" register specifies the actual number of files that are stored and still available to be read out of the relay.

Writing “Yes” (that is, the value 1) to the "Oscillography Clear Data" register clears oscillography data files, clears both the "Oscillography Number of Triggers" and "Oscillography Available Records" registers to zero, and sets the "Oscillography Last Cleared Date" to the present date and time.

For the IEEE 2013 standard, the following four time fields are added at the end of the configuration (.cfg) file:

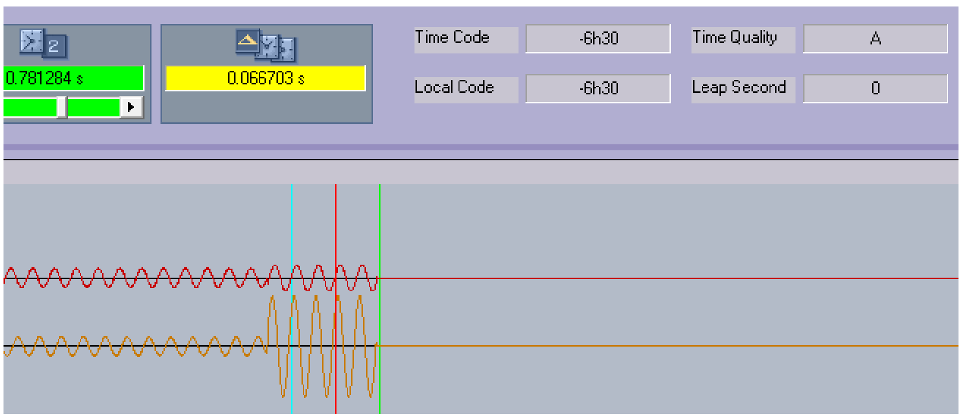
- Time Code (time_code) and Local Code (local_code) — The Time Code is the time difference between local time and UTC. The Local Code is the local time. Both are set to the same value as the **Local Time Offset from UTC** setting, and when this setting is 0, the time used is UTC time and the time zone is at UTC.
- Time Quality Indictor Code (tmq_code) and Leap Second Indicator (leapsec) — The quality indicator indicates the maximum time error between recorded time and the time synchronizing source. Examples: 0 means clock uses its source, 4 means time good within 1 ms, and F means unreliable. The leap second indicates when a second has been added or deleted, resulting in time stamps with a duplicate or missing second. Examples: 1 adds a leap second, 2 subtracts a leap second, and 3 means that time source cannot address leap seconds.

The fields are added in the file in two lines for time and time quality. An example is

-6h30, -6h30
A, 0

They display in the software.

Figure 2-3: Waveform image showing time fields



For the IEEE 2013 standard, to read binary COMTRADE oscillography files, read the following filenames, where # stands for 16B, 32B, or 32F, and nnn stands for the oscillography trigger number.

Table 2-13: Oscillography records for IEEE C37.111-2013, by data format

	BINARY	BINARY32	FLOAT32	ASCII
Multiple files	OSC16Bnnn.CFG OSC16Bnnn.DAT OSC16Bnnn.HDR	OSC32Bnnn.CFG OSC32Bnnn.DAT OSC32Bnnn.HDR	OSC32Fnnn.CFG OSC32Fnnn.DAT OSC32Fnnn.HDR	OSC###Annn.CFG OSC###Annn.DAT OSC###Annn.HDR
Single file	OSC16Bnnn.CFF	OSC32Bnnn.CFF	OSC32Fnnn.CFF	OSC###Annn.CFF

For the IEEE 1999 standard, to read binary COMTRADE oscillography files, read the following files.

Table 2-14: Oscillography records for IEEE C37.111-1999, by data format

	BINARY	ASCII
Multiple files	OSCnnn.CFG OSCnnn.DAT OSCnnn.HDR	OSCAnnn.CFG OSCAnnn.DAT OSCAnnn.HDR

For HiZ records, only the ASCII 1999 format is supported.

2.3.1.5 Reading data logger files

Familiarity with the data logger feature is required to understand this description. See the Data Logger section of chapter 5 in the Instruction Manual for details.

For IEEE 2013, to read the entire data logger in binary COMTRADE format, read the following files.

Table 2-15: Data logger records for IEEE C37.111-2013, by data format

	BINARY	BINARY32	FLOAT32	ASCII
Multiple files	Datalog16B.CFG Datalog16B.DAT	Datalog32B.CFG Datalog32B.DAT	Datalog32F.CFG Datalog32F.DAT	Datalog###A.CFG Datalog###A.DAT
Single file	Datalog16B.CFF	Datalog32B.CFF	Datalog32F.CFF	Datalog###A.CFF

For IEEE 1999, to read the entire data logger in binary COMTRADE format, read the following files.

Table 2-16: Data logger records for IEEE C37.111-1999, by data format

	BINARY	ASCII
Multiple files	Datalog.CFG Datalog.DAT	DatalogA.CFG DatalogA.DAT

To limit the range of records to be returned in the COMTRADE files, append the following to the filename before writing it:

- To read from a specific time to the end of the log: <space> startTime
- To read a specific range of records: <space> startTime <space> endTime
- Replace <startTime> and <endTime> with the number of seconds since Jan. 1 1970 as numeric text

2.3.1.6 Reading event recorder files

To read the entire event recorder contents in ASCII format (the only available format), use the following filename:

`EVT.TXT`

To read from a specific record to the end of the log, use the following filename:

`EVTnnn.TXT`

(replace nnn with the desired starting record number)

To read from a specific record to another specific record, use the following filename:

`EVT.TXT xxxxx yyyyy`

(replace xxxxx with the starting record number and yyyyy with the ending record number)

2.3.1.7 Reading fault report files

Fault report data has been available via the UR file retrieval mechanism since UR firmware version 2.00. The file name is `faultReport#####.htm`. The ##### refers to the fault report record number. The fault report number is a counter that indicates how many fault reports have ever occurred. The counter rolls over at a value of 65535. The last 15 fault reports are available for retrieval. It starts from 1 to 15, then if you have 18 reports, 3 to 18 are retrieved. A request for a non-existent fault report file yields a null file. The current value fault report counter is available in "Number of Fault Reports" Modbus register at location 3020h.

For example, if 14 fault reports have occurred then the files `faultReport5.htm`, `faultReport6.htm`, up to `faultReport14.htm` are available to be read. The expected use of this feature has an external master periodically polling the "Number of Fault Reports' register. If the value changes, then the master reads all the new files.

The contents of the file is in standard HTML notation and can be viewed via any commercial browser.

2.3.1.8 Reading PMU records

For URs that support PMU, familiarity with the PMU recording feature is required to understand the following description. For example, see the PMU Recording and later sections in the N60 instruction manual.

2

The "PMU Recording Number of Triggers" register increments by one every time a new PMU record is triggered (captured) on any of the PMU units in the relay (depending on the software option in the order code up to six PMUs can be available in a relay). When a new trigger occurs, the associated PMU record file is assigned a file identifier based on the number of the PMU module, the incremented value of this register module 1000 and the format of the COMTRADE file, as described here. This register can be used to determine if any new data has been captured by periodically reading it to see if the value has changed; if the number has increased then new data can be available.

The file "PMU_Records_List.txt" lists the available PMU records in the relay. This file can be retrieved by TFTP. This file includes information about the file name for every PMU record in the relay.

The PMU records can be retrieved using the EnerVista software or by TFTP. The file name has the format

`PMUp_xxxxn.eee`

where

p is the PMU recorder instance

xxxx is the COMTRADE format shown in the following tables

n is the file sequence number in integer format from 1 to 999. The file sequence number is unique among all PMUs.

eee is the extension (cfg, dat, hdr, cff)

For example, to retrieve file 7 from PMU 3 in binary 16 bit CFF format, retrieve the file `PMU3_16B7.cff`.

Table 2-17: PMU records for IEEE C37.111-2013, by data format

	Binary	Binary32	Float32	ASCII
Multiple files	PMUp_16Bn.cfg PMUp_16Bn.dat PMUp_16Bn.hdr	PMUp_32Bn.CFG PMUp_32Bn.DAT PMUp_32Bn.HDR	PMUp_32Fn.CFG PMUp_32Fn.DAT PMUp_32Fn.HDR	PMUp_###An.cfg PMUp_###An.dat PMUp_###An.hdr
Single file	PMUp_16Bn.CFF	PMUP_32Bn.CFF	PMUp_32Fn.CFF	PMUp_###An.cff

Table 2-18: PMU records for IEEE C37.111-1999, by data format

	Binary	ASCII
Multiple files	PMUp_n.cfg PMUp_n.dat PMUp_n.hdr	PMUp_An.cfg PMUp_An.dat PMUp_An.hdr

2.4 Memory map

Two spreadsheets provide the Modbus memory maps organized by settings and actual values. The registers actually present depend on the UR product and on the order codes software and module options.

The maps are viewable in a web browser. Enter the IP address of the UR and click the option.

“Grouped Setting” refers to content in the **Settings > Grouped Elements > Group** menus.

The data format spreadsheet that follows the memory maps provides more information for some entries.

Please note that this manual must be opened with Adobe Acrobat Reader to allow access to the attached spreadsheets. This program is freely available on the Adobe website. The spreadsheets can be opened using free web-based software such as Google Sheets.

An Open File dialogue box may open with a warning message about potential harm from programs, macros or viruses. The files supplied do not contain any harmful content, and may be safely opened.

2.4.1 Actual values map

Click on the button below to open the actual values map spreadsheet for version 8.4x.

Actual Values

2.4.2 Settings map

Click on the button below to open the settings map spreadsheet for version 8.4x.

Settings

2.4.3 Data formats

Enumeration refers to a list where we read a numeric value but want to display it as more user-friendly text. An example is that F081 can be entered as F081 or something more convenient, such as Continue and Lockout. The F codes in this section are for reference.

Click on the button below to open the data formats spreadsheet for version 8.4x.

Data Formats

UR Family

Chapter 3: IEC 61850 Ed. 2 communication

This chapter outlines the IEC 61850 Edition 2 communications protocol.

The protocol applies when ordered with the product. Check your order code.

3.1 Overview

3.1.1 Introduction

This section contains a description of IEC 61850, an International Electrotechnical Commission (IEC) series of documents entitled Communication Networks and Systems for Power Utility Automation. The focus is on those features implemented since UR 7.3x.

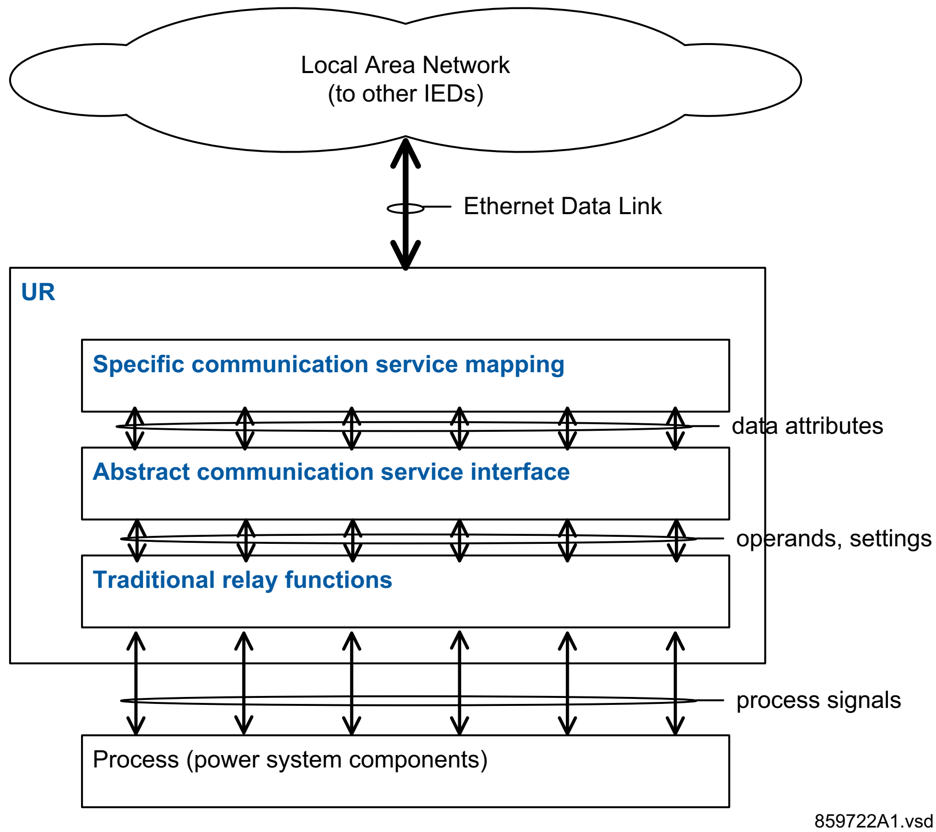
IEC 61850 is a series of international standards and technical reports applicable to power utility automation systems (PUAS). It includes semantics, abstract communication services, specific communication services, performance specifications, network engineering guidelines, configuration description methodologies, and engineering processes. The objective of the standard is to provide a framework to achieve interoperability among the intelligent electronic devices (IEDs) from different suppliers, and interoperability among software configuration tools from different suppliers. Interoperability in this case is the ability for IEDs to operate on the same network or communication path sharing information and commands, and for configuration tools to understand each other's configuration files. The standards can be obtained from the IEC (http://www.iec.ch).

The UR supports a large subset of the IEC 61850 features and virtual local area network (VLAN) IEEE 802.1Q. These are described at a high level in this chapter and include the information model, GOOSE publish, GOOSE subscribe, buffered report server, unbuffered report server, and Manufacturing Message Specification (MMS) query, read, write, and control services. In addition, the UR and the EnerVista UR Setup software support IEC 61850 Substation Configuration Language (SCL) file import/export and merging. UR releases before 7.3x use edition 1.0 of IEC 61850. Release 7.3 and later use edition 2.0. Release 7.7 and later use both Editions 1 and 2. The edition 2.0 differs from edition 1.0, particularly in SCL. Edition 2.0 GOOSE, Sampled Value, and Report messages GSSE, can be understood by edition 1.0 devices, that is to say these are backward compatible. However, only edition 2.0 61850 configuration tools can interoperate with edition 2.0 devices. Fixed GOOSE, GSSE, and Edition 1 report services are not supported beyond version 7.2x. UR devices using these features must be set to use configurable GOOSE to communicate with a 7.3x or later device.

The figure shows IEC 61850 as it pertains to an IED, such as a UR device.

3

Figure 3-1: IEC 61850 and device overview



The Process block at the bottom of the figure represents power system components monitored and controlled by the IED, such as circuit breakers, disconnect switches, and current and voltage instrument transformers. These are connected typically through conventional copper wiring to IEDs, although the possibility exists with some IEDs for connection via Ethernet communications, such as IEC 61850 process bus. The copper wiring typically connects the IED to status monitoring mechanical contacts, secondary windings of current and voltage transformers, and trip and close circuits. These process signals are represented in the figure by the lines connecting the Process block to the Traditional relay functions block inside the IED.

The Traditional Relay Functions block consist of protection, control, and monitoring functions, such as phasor and root mean square (RMS) estimators, distance protection elements, overcurrent elements, reclosing, and predictive maintenance monitors. The input and output signals of these functions (other than the process signals) are represented in the figure by the lines connecting the Traditional Relay Functions block to the Abstract Communications Service Interface. These signals are typically Boolean and numeric signals, including FlexLogic operands, FlexAnalog operands, actual values, and UR settings, and can be communicated between IEDs using IEC 61850 communications.

The Abstract Communication Service Interface (ACSI) block translates the native names of the signals, names that vary in different manufacturers' products, to names using a standard naming convention that are to be understood by all IEC 61850 compliant devices. This is also called the information model. The signals with their standard names are called data attributes, and are represented in the figure by the lines connecting the ACSI block to the Specific Communication Service Mapping block. The next section details the ASCI block.

The Specific Communication Service Mapping (SCSM) block converts the ACSI signals to/from Ethernet messages, which are carried by a local area network to/from other IEDs. The standard specifies several "services" for doing the translation, each of which is designed for different performance/capability needs. The main services, the ones implemented by UR family devices, are as follows:

- Read/write services — These services allow a client IED to obtain a directory of a server's signals and to read and write the server's signal values one at a time, or a few related values at a time. These services are implemented on a stack consisting of MMS, TCP, IP, and Ethernet protocols. UR devices participate in these services as server IEDs, not as clients.

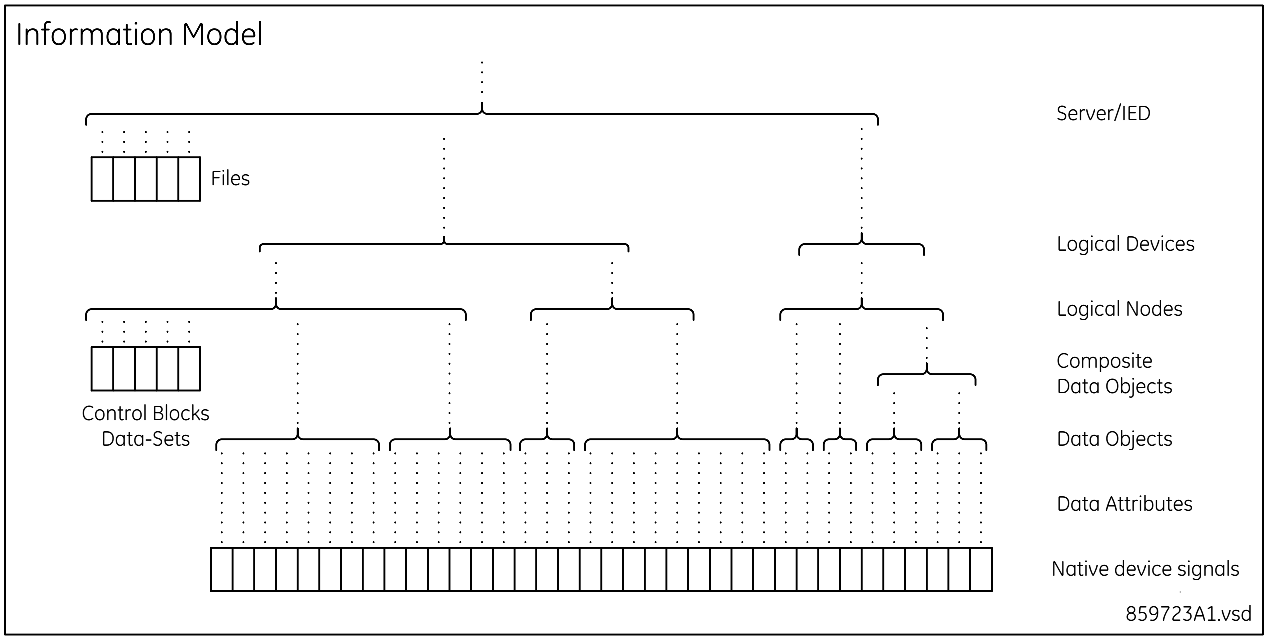
- Command services — These services allow a client IED to send commands to a server IED, to for instance open and close circuit breakers through a server IED, and to confirm that the command was successfully executed. These services are expected to be completed in the order of half a second. Again these services are implemented on a MMS, TCP, IP, and Ethernet stack, and UR devices participate as servers, not as clients.
- Report services — These services allow a client IED to set up a server IED to send the client messages containing the values of a set of predefined signals periodically, on request, and/or whenever one of the signals undergoes a change of state or value. The reports are expected to be completed in the order of one second after a signal change of state. Again these services are implemented on a MMS, TCP, IP, and Ethernet stack, and UR devices participate as servers, not as clients.
- GOOSE — This service allows a publisher IED to transfer a predefined set of signal values to one or more subscriber IEDs periodically and/or whenever one of the signals undergoes a change of state or value. This service is intended for trip and blocking signals, and is expected to be completed in the order of three milliseconds for some message types. This service is implemented directly on the Ethernet protocol. UR devices implement the publisher side of this service under the name TxGOOSE and the subscriber side of this service under the name RxGOOSE.
- Sampled values (SV) — This service allows a publisher IED to transfer a predefined set of values of its signals to one or more subscriber IEDs periodically. This service is intended for analog signals whose waveform needs to be reconstructed by the subscriber, such as power system voltage and current signals, and synchrophasor signals. Sample rates for different applications can range from thousands to once per power system cycle. This service is implemented directly on the Ethernet protocol. UR devices implement the publisher side of this service for synchrophasors.

3.1.2 Abstract Communication Service Interface (ASCI)

The Abstract Communications Service Interface (ACSI) is defined in IEC 61850 7-2, 61850 7-3, and 61850 7-4. A fundamental component of ACSI is its information model, which defines the ACSI names of signals, and attaches a "semantic" to name parts. A semantic is a usually brief description of what the named item represents. For instance, the name part "stVal" has the defined semantic "Status value of the data".

The figure shows the information model that organizes the native device signals.

Figure 3-2: ASCI block



The native IED signals (UR settings, FlexLogic operands FlexAnalog operands, and actual values) are assigned to entities known as Data Attributes (DAs). Data Attributes typically contain the value of a single signal, most often with a Boolean, Float or Enumerated value. Alternatively a data attribute can have meta-data related to another data attribute, such as the quality, timestamp, and range of the other attributes. Data attributes have defined names and semantic as defined in IEC 61850 7-3:2010 clause 8. There are 15 pages of these in the standard, so they are not listed here. A few representative data attributes are as follows:

- stVal — Status value of the data
- setVal — The value of a setting
- instMag — Magnitude of the instantaneous value of a measured value
- t — Timestamp of the last change in one of the attribute(s) representing the value of the data or in the q attribute
- q — Quality of the attribute(s) representing the value of the data

A collection of related data attributes are combined into an entity at the next level up in the hierarchy known as a Data Object (DO). Data objects are required to be formed in accordance with one of the Common Data Class (CDC) definitions in IEC 61850 7-3:2010 clause 7. A CDC defines what data attributes an implementing data object is required to contain and which data objects an implementing data object can optionally contain. CDCs also define the functional constraint (FC) of each data attribute. An FC is a two-letter code with additional information, such as ST (status information) or SP (setting). For instance, the Single point status CDC, which is named SPS, requires data attributes stVal, q, and t, and it allows certain data attributes concerned with the substitution model, value update blocking, and description. The data attribute stVal is required by the CDC to be a Boolean value, q is required to be a code for the quality of stVal, and t is required to be the time at which stVal last changed state. Thus an SPS data object contains an amalgamation of information about a Boolean condition, for instance the thermal alarm status of a thermal overload protection.

In some cases, data objects are constructed from data objects and data attributes. These are known as constructed data objects. An example is the Phase to ground/neutral related measured values of a three-phase system (WYE) CDC that is constructed of data objects implementing the Complex measured value (CMV) CDC. The complex measured values here are the individual phase and neutral phasor value measurements.

A collection of related data objects are combined into an entity at the next level up in the hierarchy known as a Logical Node. Logical nodes are required to be formed in accordance with one of the individual logical node class specifications in IEC 61850 7-4:2010 clause 5, as well as conforming to the common logical node class specifications in clause 5.3.3. A logical node class defines what kind of function an implementing logical node models (its "semantic"), what data objects an implementing logical node is required to contain, and which data objects an implementing logical node can optionally contain. A logical node class also defines the name and CDC of each of its data objects. IEC 61850 7-4:2010 clause 6 defines the semantic of standard data object names. For instance, the Instantaneous overcurrent logical node class, which has class name PIOC, requires an Op data object with the following CDC Protection activation information (ACT) and semantic:

> “Operate (common data classes ACT) indicates the trip decision of a protection function (LN). The trip itself is issued by PTRC."

Logical node class PIOC also requires the mandatory data object Beh (Behavior, meaning on, off, test, and so on) and permits the optional data objects Str (Start), OpCntRs (Resettable operation counter), StrVal (Start value setting) and several others from the common logical node class. It is possible for a device manufacturer to add data objects in addition to those specified by a logical node class, but the expansion rules in IEC 61850 7-1:2011 clause 14 must be followed. UR devices in fact do extend the standard logical nodes in many cases; the data objects implemented are as tabulated in clause 3.4 MICS.

Logical node names are required to be formed from the four-character logical node class name that it implements, a prefix text, and a suffix instance number. An example is PhsIocPIOC1, in which “PIOC” is the implemented logical node class name, “PhsIoc” is the prefix, and “1” is the instance number. UR devices adopt the convention that the prefix identifies the UR element that the logical node is used to model, and the instance number is the UR element number. For instance, all logical nodes used to model the AC sources use the prefix ACsrc. The logical nodes used to model AC source 1 have logical node instance 1, the logical nodes used to model AC source 2 have logical node instance 2, and so on. Thus the names for logical nodes modeling AC source 1 are ACsrcMMXU1, ACsrcMMXN1, and ACsrcMSQI1. Prefixes and instance numbers are fixed in UR devices, except that three special logical nodes can have user configurable prefixes (GGIO1, GGIO2, and GGIO4).

A collection of related logical nodes are combined into an entity at the next level up in the hierarchy known as a Logical Device. Logical devices are required to have one logical node implementing logical node LLN0, which addresses common issues for the containing logical device. Logical devices can also contain as many logical nodes as desired. UR devices of this release initially have six logical devices, with logical node instance names and contained logical nodes as generally described in the following table, but can be reconfigured to have from 1 to 16 logical devices. The logical device to which each logical node is assigned initially is as specified in clause 3.4 MICS, but except for the logical nodes shown there in logical device Master, logical nodes can be moved to any logical device. The assignment of logical nodes to logical devices is configurable, as is the number of logical devices from 1 to 16.

Table 3-1: Factory default logical nodes

Logical device instance name	Generally contains logical nodes modelling...
Master	communications, including GOOSE, reports, Remote I/O, Virtual Inputs, Modbus, DNP, and setting group control
Prot	protection and protection-related functions
Ctrl	control and monitoring functions
System	power system devices: breakers, switches, CTs, VTs, and so on, including interfaces to these, such as AC inputs, contact I/O, transducer I/O, HardFiber I/O
Meter	metering and measurement (other than PMU), including AC sources
Gen	FlexLogic, Virtual Outputs, non-volatile latches, FlexElements, recording (for example oscillography), security, front panel, clock
PBus	non-Hardfiber Process Bus Module, when present

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Logical devices have a product-related name and optionally a function-related name. The product-related name consists of the logical device instance name (see table) prefixed by the configured IED name. Other than the product-related name of the logical device "Master," both the product-related name and the function-related name are freely configurable, although the standard strongly recommends use of the IEC 81346 series for the derivation of function related name. The function-related names are used only when configured by the user, and then only in communications, not in Substation Configuration Language (SCL). The product-related name is used in SCL, and when no function-related name is configured, in communications. Note that the symbol "LDName" is used in standard documents to represent either the function-related or product-related name as appropriate to the context, while "ldName" is used to define the function-related name. Upper/lower case is critically significant in many 61850 names.

The complete set of logical devices in an IED are combined into an entity at the next level up in the hierarchy known as a Server. Only one server exists in most IEDs, including UR devices, so a server can usually be considered synonymous with the IED. The logical devices in an IED can be arranged in a hierarchical structure. Certain entities like revision counters have a scope that extends to lower levels that do not contain an instance of that entity. UR devices arrange their logical devices such that the Master logical device is the root of the hierarchy, and all other logical devices are direct descendants of Master.

When a particular data attribute or data object needs to be referenced by an SCL configuration file, in many cases the name of each level in the information hierarchy are independently specified. For instance, to specify the reception of the power of AC source 1 from an external IED, SCL can contain the following:

```
<ExtRef iedName="Fdr1" ldInst="Meter" prefix="ACsrc" lnClass="MMXU" lnInst="1" doName="TotW"
daName="mag.f" fc="MX" />
```

In other cases, an ObjectReference is used to identify the data attribute. An ObjectReference concatenates the names of each hierarchical level with defined delimiting characters. For instance, the ObjectReference for the previous example looks like the following:

```
Fdr1Meter/ACsrcMMXU1.TotW.mag.f
```

This format is known as the ACSI ObjectReference format, which is used exclusively in SCL, and in communication messages where the value of a data attribute containing an ObjectReference is being transmitted. However, in communications messages where an ObjectReference is a reference to the entity whose value is being communicated, it is reformatted according to the MMS addressing scheme specified in IEC 61850 8-1. Thus on the wire, one can see a message requesting the present value of source 1 power identifying the requested data attribute as

```
Fdr1Meter/ACsrcMMXU1$MX$TotW$mag$f
```

Since version 7.70, UR devices implement file transfer directories for Data Logger and User Fault Report files are fixed as follows. For IEC 61850 Edition 1, the files are located in the LD folder in which the logical nodes exist. For Edition 2, the files are located in the LD folder associated with the Master logical device.

3

3.1.3 Datasets

A dataset is an ordered list of member data objects and/or data attributes. Datasets

- Allow for a client to get the values of all members of a dataset with a single request rather than having to individually request each member
- Are used to define which data attributes to include in a GOOSE message or a sampled value message or a report

A dataset member can be either a functional constrained data attribute (FCDA) or a functional constrained data object (FCD). An FCD is a structure containing all the data attributes of a data object or composite data object as explained in the previous section, except that only those data attributes with function constraint code matching the code configured for that member are included. An FCDA is to all intents and purposes a single data attribute or constructed data attribute; the words "functional constrained" are superfluous. Note that a Substation Configuration Language (SCL) element with tag "FCDA" is used to specify both FCDAs and FCDs. If the FCDA element attribute daName is omitted, an FCD is specified. If the FCDA element attribute daName is included, an FCDA is specified.

UR devices accept both FCD and FCDA as dataset members.

The standards allow dataset names to be configured in SCL files as required, as do UR devices. The standards define a service that creates a dataset online through MMS services, but UR devices do not implement that service. Datasets in UR devices must be pre-configured.

For oscillating GOOSE, a chatter suppression service is provided for all the Boolean members configured in Fast datasets (TT6DataSet1 to TT6DataSet6). The Chatter or Oscillation on Booleans can flood the communication network with unwanted GOOSE messages. Hence, the UR oscillatory GOOSE feature monitors each Boolean data item that is configured in the fast datasets, which are scanned at fast rate of 2 ms. When four state changes are detected in 40 ms, the corresponding Boolean value is considered chattering and suppressed as long as the condition exists, and for a minimum period of one second. The oscillation event history is provided in the UR Web page IEC 61850 Oscillation History, with a buffer size of 16 events. While any of the Boolean is suppressed, the oscillatory GOOSE self-test message is activated and @Master/LPHD1.OscilGOOSE.stVal is set to TRUE.

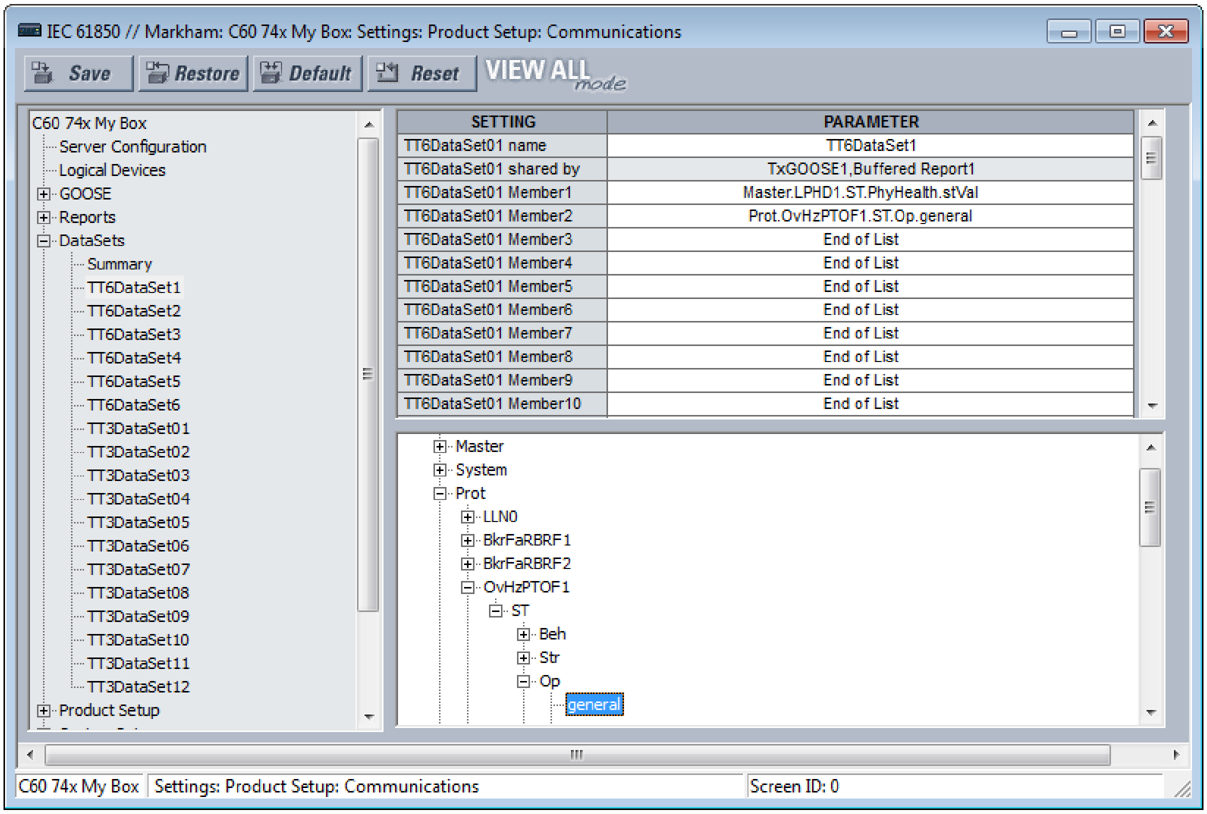
The following figure shows an EnerVista UR Setup dataset configuration page. Members are selected from a drop-down list or by dragging and dropping. Datasets also can be configured from a GOOSE or Report configuration page. Note that in EnerVista UR Setup the format of references to dataset members is:

<ldInst>.<LNName>.<fc>.<doName>.<daName>

where

ldInst is the logical device instance name (Master, Prot, Ctrl, System, Meter or Gen)
LNName is the logical node name, including prefix, class name, and instance number
fc is the functional constraint (EnerVista UR Setup uses only ST and MX)
doName is the data object name, including sub-data objects if any
daName is the data attribute name, including sub-data attributes if any

Figure 3-3: IEC 61850 DataSets



3.1.4 TxGOOSE

GOOSE is a service for communicating trip and blocking signals between IEDs. It is expected to be executed in the order of three milliseconds for Type 1A "Trip" messages within a substation. Publishing of each GOOSE message is controlled by a control block in the information model of the publishing device, which since UR 7.30 is represented by a TxGOOSE element.

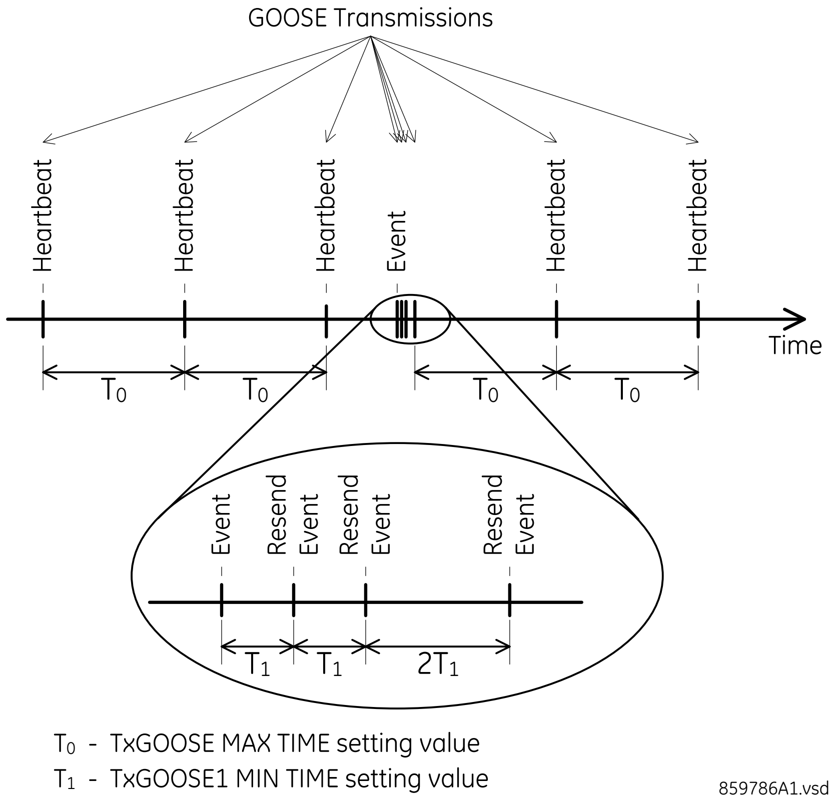
Each GOOSE message includes the values of all of the members of the dataset to which it is configured, and a number of fields that can be used by the subscriber to identify the particular GOOSE message it subscribes to. The identification fields are as follows:

- Destination MAC address — A multicast address that selects the set of destination IEDs
- Source MAC address — A globally unique identification of the publisher
- APPID — A number that is recommended by the standard to be unique within the system
- gocbRef — A reference to the control block object that controls message publishing
- datSet — A reference to the dataset whose members are published
- goID — A string that allows a user to assign an identification to the GOOSE message
- confRev — Configuration revision number to identify changes affecting message content
- ndsCom — A Boolean flag that indicates the publisher needs to be commissioned
- numDatSetEntries — The number of members in the dataset

To facilitate rapid processing in both the publisher and subscriber, the MMS/TCP/IP stacks are bypassed; GOOSE messages interface directly to the Ethernet layer. To avoid the publisher having to compose and send sequentially individual messages to each subscriber, multicast addressing is used whereby the network copies each transmitted GOOSE messages to all subscribers on the same VLAN. Finally, to avoid the long delays that handshaking type protocols can introduce when a packet is lost, GOOSE instead employs a scheme whereby messages encoding a change of state are repeated several times; if the first event message is lost, the closely following repetition gets through.

The figure shows the timing of GOOSE transmissions.

Figure 3-4: TxGOOSE timing

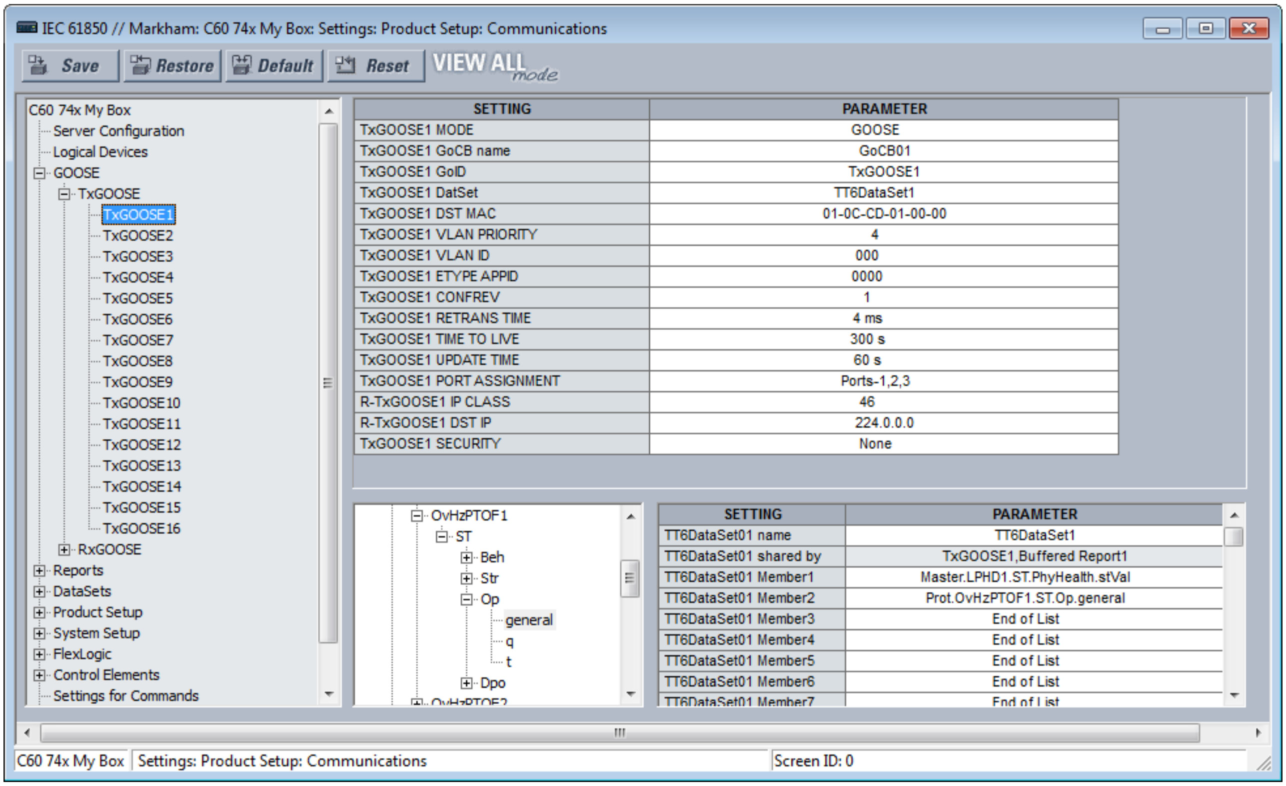


When none of the published member values are changing, the GOOSE message is sent periodically to allow subscribers to monitor the connection. These messages, called heartbeat messages, also allow a subscriber recovering from an interruption or outage to obtain the values of the members in the absence of event messages. A timeAllowedtoLive field including in each GOOSE message informs the subscriber of the maximum amount of time to wait for another message before declaring the connection lost. In UR devices, the heartbeat period is controlled by the **TxGOOSE MAX TIME** setting, and the timeAllowedtoLive value is controlled by the **TIME ALLOWED TO LIVE** setting.

When any published member value changes state, the GOOSE message is immediately sent with the new values. Such a message is called an event message. A short time after the initial event message is sent, it is resent several times. In UR devices there are normally three retransmissions, with intervals controlled by the **TxGOOSE MIN TIME** settings. However, if the **TxGOOSE MIN TIME** setting is set to zero, there are no retransmissions.

UR devices implement the publisher side of each GOOSE service under the name TxGOOSE. See the applicable UR instruction manual for the number of TxGOOSE elements available, and the performance of each.

Figure 3-5: IEC 61850 TxGOOSE panel

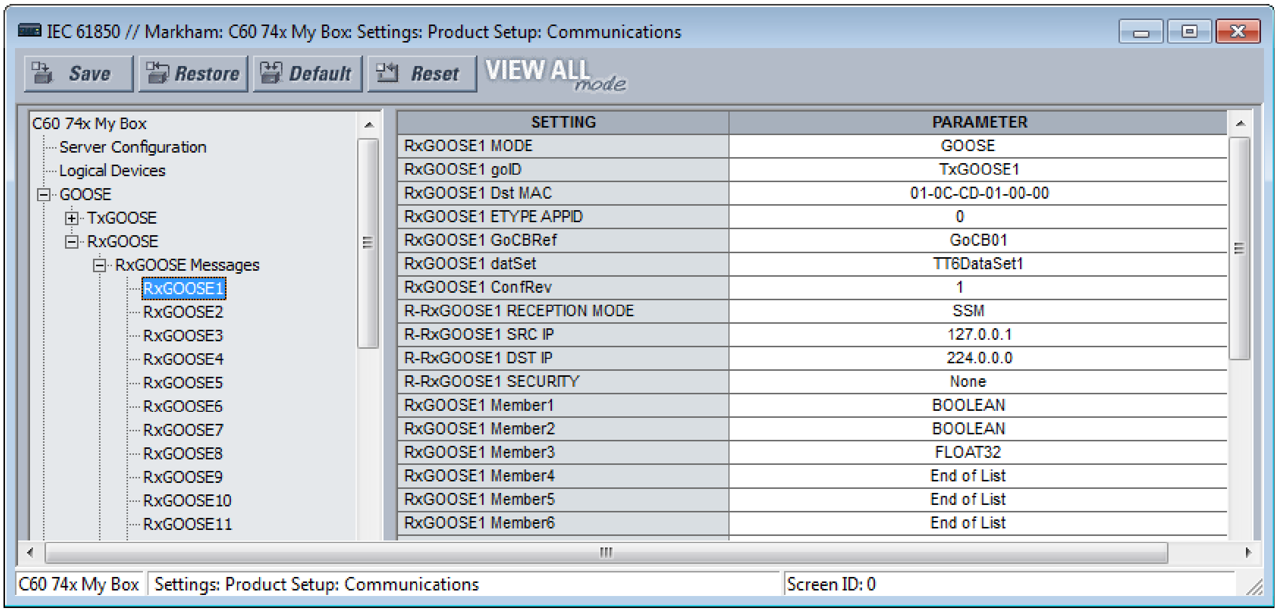


3.1.5 RxGOOSE

The IEC 61850 standard does not contain a control block or equivalent for subscribing to GOOSE messages. The standard assumes that the subscriber has access to a description of the information model of the publisher, and from that can extract the information that it needs to subscribe.

Since UR 7.30, an RxGOOSE is a UR element that contains in a single entity all the information necessary to subscribe to a specific GOOSE message. Both the UR and EnerVista UR Setup software automatically extract this information on receiving an appropriate SCL file. However, EnerVista UR Setup also allows manual entry of this information via RxGOOSE configuration pages. The figure shows an example of an RxGOOSE configuration page, which subscribes to the message generated by the TxGOOSE and dataset examples of the preceding sections of this manual. If an SCL file with the publisher's configuration is available, all of the settings on this page are completed automatically when a subscription is configured on an RxGOOSE Inputs page, except for a few settings necessary for R-GOOSE. When a subscription is configured using RxGOOSE Inputs page, the EnerVista software uses the first available RxGOOSE message to populate the publisher settings.

Figure 3-6: IEC 61850 RxGOOSE Messages panel



The RxGOOSE MODE, RxGOOSE Dst MAC, RxGOOSE GoCBRef, ConfRev, and RxGOOSE Member settings must be correctly entered for GOOSE messages to be accepted. The RxGOOSE MODE setting enables the UR to receive GOOSE rather than R-GOOSE messages. Dst MAC is used by the UR hardware to pass only subscribed messages, so the CPU does not parse messages of no interest to that device. GoCBRef is used to determine which if any of the RxGOOSE an incoming message is for. ConfRev is used to verify that the publisher has the expected configuration revision. And the Member settings define the structure of the data in the message, so that appropriate buffers can be pre-allocated. In EnerVista UR Setup, the structure must consist of the basic data types BOOLEAN, FLOAT32, INT32, Dbpos, Quality, and TimeStamp; that is to say, EnerVista UR Setup cannot manually configure reception of structured GOOSE messages that are used to communicate FCDs. However, messages with structure can be used by importing into UR Setup SCL files wherein the message structure is already defined.

When RxGOOOSE MODE is set to R-GOOSE, the R-RxGOOSE DST IP needs to be a valid multicast or unicast IP address. R-RxGOOSE RECEPTION MODE specifies the R-RxGOOSE DST IP range. When RxGOOSE RECEPTION MODE is set to SSM, R-RxGOOSE DST IP must be in the range of 232.0.0.1 to 232.255.255.255. When RxGOOSE RECEPTION MODE is set to ASM, R-RxGOOSE DST IP must be in the range of 224.0.0.1 to 239.255.255.255, excluding the SSM range. Note that the SSM range is inside the ASM range and therefore the ASM use excludes the SSM range. The default destination IP address 224.0.0.0 is reserved, and hence not a valid multicast IP address.

With R-GOOSE subscription, a UR can subscribe to a maximum of 25 unique destination IP addresses.

Each of the remaining settings on this page can be left at its default value, in which case the value in the corresponding field of incoming messages is not validated, the message is accepted no matter the received field value.

For a value received in a subscribed GOOSE to be used by the UR, it must be mapped to a FlexLogic or FlexAnalog operand. This is done by RxGOOSE Input elements, of which there are three types: an RxGOOSE Boolean Input maps a BOOLEAN Member to a FlexLogic "On" operand; an RxGOOSE DPS Input maps a Dbpos (double point position) Member to "Bad," "Interm," "On," and "Off" FlexLogic operands; and an RxGOOSE Analog Input maps a FLOAT32 Member to an Analog In FlexAnalog operand. These operands can be used as inputs wherever a FlexLogic or FlexAnalog operand can be used.

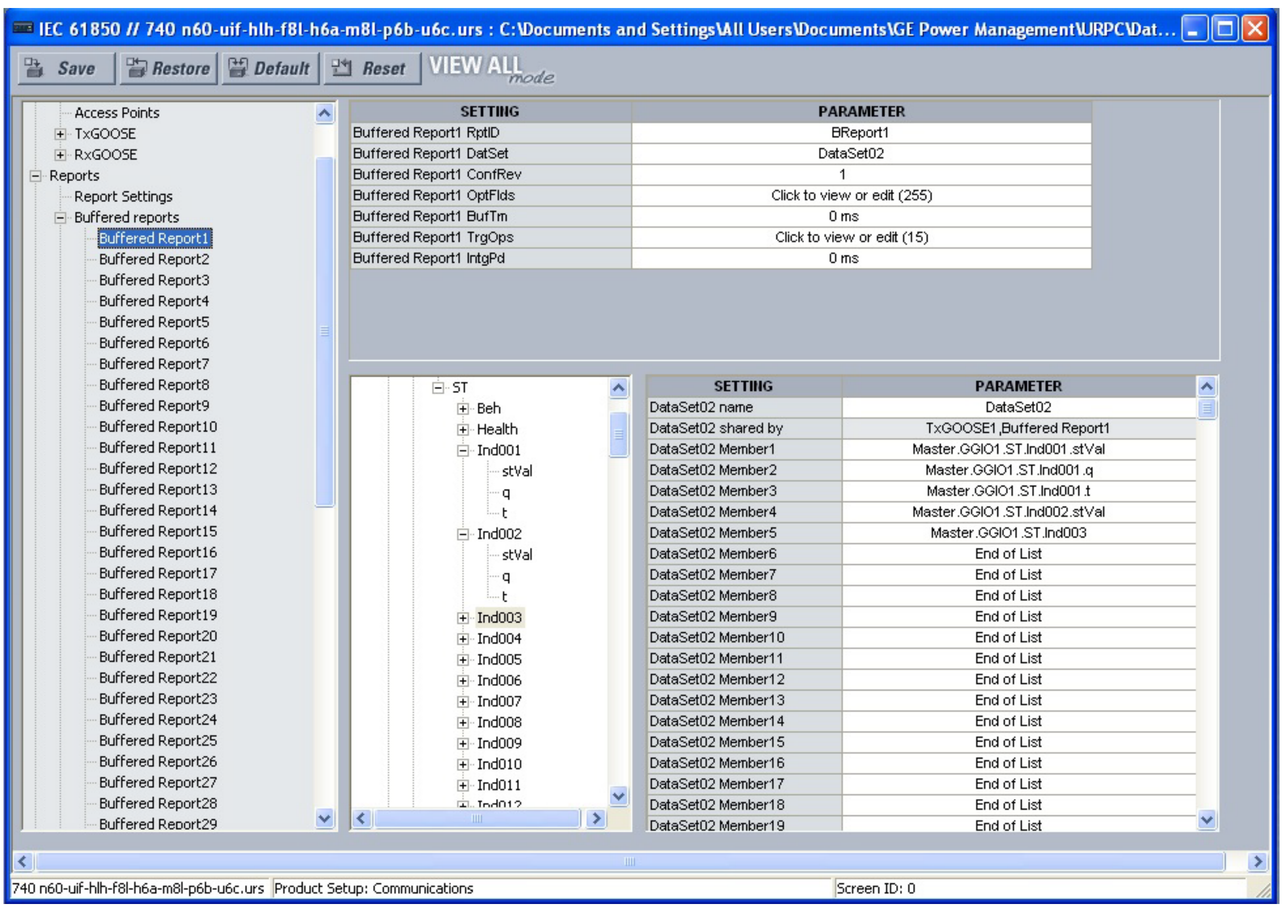
3.1.6 Reports

A report is an IEC 61850 service whereby a client IED can establish a one-to-one connection over a local area network to a server, and over this connection the server keeps the client updated on the values of a set of the server's signals. The set of signals reported on is defined by a dataset, with datasets being explained earlier in this chapter. Report messages can be configured to be issued periodically, on request, and/or on events, where an event is defined as one of the signals undergoing a change of state or value. Event messages contain only the values that have suffered events, reducing the bandwidth requirements of report services. Report services are intended for supervisory control and data acquisition (SCADA)-type applications, wherein transfer time is not as critical as in protection applications.

IEC 61850 specifies two types of report: buffered reports and unbuffered reports. The difference between these two is that when the connection between server and client is lost, unbuffered reports flush events not yet reported to the client, while buffered reports retain (buffer) any events not yet reported and any subsequent events so that the interruption does not result in the loss of events. Unbuffered reports are thus more suitable where client is just displaying the reported values or using them to make real-time decisions, such as tap-changer voltage control. In these applications, events during the interruptions are not of interest, and preservation unnecessarily consumes server resources. Buffered reports are more suitable where the client is using the data for historical purposes, such as for instance creating a load profile. In these applications, the events during an interruption are necessary to prevent gaps in the history.

Each report service is controlled by a report control block in the information model of the publishing device, which since UR 7.30 is represented by either a buffered report element or an unbuffered report element. See the applicable UR instruction manual for the number of report elements available. Typically, report control blocks are configured by the client using MMS messages defined in the standard immediately on opening the client/server connection. However, EnerVista UR Setup also allows manual entry of this information via Buffered report and Unbuffered report configuration pages. The figure shows an example of a Buffered report configuration page.

Figure 3-7: IEC 61850 buffered report panel



The RptID setting allows each report service to be given a user-specified functional name, though if left blank a system unique name in the format "<LDName>/LLN0BR"BRCB01" is used, where the last two digits are the report element number. DatSet specifies the dataset that defines what values are to be included in report messages. TrgOps is a bitmapped value, wherein each bit specifies a kind of event that is to be reported on: data-change, quality-change, data-update, integrity (for example, periodic), and/or general-interrogation (for example, on request). BufTm specifies how long after an initial event to collect and append possible additional events before sending a report message. IntgPd specifies the interval of periodic reports. OptFlds is a bitmapped value, wherein each bit specifies whether an optional particular field is to be included in the message: sequence-numer, report-time-stamp, reason-for-inclusion, data-set-name, data-reference, buffer-overflow, entryID, and/or conf-revision.

3.1.7 Commands

IEC 61850 controls are complex. The following is a brief description.

From a UR perspective, you can issue open or close controls to the UR Breaker Control element using IEC 61850 controllable points.

This is accomplished by standard IEC 61850 models and services. Bkr0XCBR1.Pos is a DPC (Dual Point Control) point that drives the Breaker Control 1 element. BkrCSWI1.Pos is also a DPC point that drives the Breaker Control 1 element. Of course, the Breaker Control element can be used entirely outside of IEC 61850 by using FlexLogic operands as the control inputs.

Similarly Disc0XSWI1.Pos and/or DiscCSWI1.Pos can be used to control the Disconnect Switch 1 element.

From an IEC 61850 standard perspective, controllable points can be SPC (Single Point Control, as used to control UR Virtual Inputs), DPC (Dual Point Control, as used to control UR Breaker Control and Disconnect Switch elements), or other less common control types.

Bkr0XCBR1.Pos is a DPC. It supports all IEC 61850 control models. The Pos.ctlModel attribute selects the control model, where

1 = Direct Control with Normal Security
2 = SBO Control with Normal Security
3 = Direct Control with Enhanced Security
4 = SBO Control with Enhanced Security

In order to execute the IEC 61850 control services, you need to know the value of ctlModel. For Direct Control with Normal Security, an IEC 61850 Client can write to the Pos.Oper structure. The entire Pos.Oper structure must be written in one MMS write transaction. Pos.Oper.ctlVal determines whether the control is "open" or "close".

For SBO Control with Normal Security, the Pos.SBO element is used. A read of this element is the "select" operation. The Pos.Oper structure can then be written as described above.

For Direct Control with Enhanced Security, only the Pos.Oper element is used. The client must write the entire Pos.Oper structure in one MMS write transaction.

For SBO Control with Enhanced Security, the Pos.SBOw element must be written first. This is the "select" operation. The Pos.Oper element can then be written.

Note that the SBOw element is always present if SBO with Enhanced Security is supported for a particular point, regardless of the current value of ctlModel. Similarly, the SBO element is always present if SBO with Normal Security is supported, regardless of the current value of ctlModel.

3.1.8 Substation Configuration Language (SCL)

The Substation Configuration Language (SCL) is a file format defined by IEC 61850-6 to describe/specify in a way understandable by configuration tools of different manufacturers the capabilities and configuration of IEDs and communication systems, as well as the relations between the utility automation system and the substation/switch yard, and describe the switch yard topology.

SCL is based on the Extensible Markup Language (XML) version 1.0, and specified in IEC 61850-6 using the XML Schema language. Both the SCL language and the XML Schema language are complex; only SCL features needed to obtain a high level understanding of SCL files are discussed here.

An SCL file, being an XML file, consists of a root element, which contains child elements, which in turn contain child elements, and so on. In SCL files, the root element is named SCL. Its standard child elements are as follows:

- Header, which can be used to identify the SCL file, its version, and history
- Substation, each of which describes the topology of a substation and either the assignment of logical nodes in the IEDs to power system elements or the required types of logical nodes for each of its power system elements

- Communications, which describes which IED access points (for example, IED Ethernet ports) are connected to which communications subnetworks, and describes the communications addresses used by the IED access points
- IED, each of which describes for a single IED its access points, logical devices, logical nodes, control blocks, and datasets. The logical nodes are described using templates. The IED element can also contain some or all of its settings and factory configured values.
- DataTypeTemplates, which describes the logical nodes used in the IED section(s) and their contained data objects and data attributes. The DataTypeTemplates element can also contain settings and factory configured values.

These elements are so-called "Public" elements, in that they are precisely defined in IEC 61850-6, a publicly available document. These elements are expected to be understood by all IEC 61850 configuration tools, and any tool is allowed modify the settings in them. UR 7.30 and later SCL files contain in these Public elements all settings that directly control implemented IEC 61850 services, including GOOSE publish and subscribe, and MMS services such as reports and commands. UR 7.30 and later SCL files also contain for each of the UR elements that have so far been mapped to IEC 61850 a description of the UR element's FlexLogic and FlexAnalog operands and of the UR element's settings that select an operand. Thus configuration tools of any manufacturer can be used to configure the IEC 61850 communication aspects of UR 7.30 and later devices.

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In addition to Public elements, SCL allows elements named "Private," whose content is not defined by the standard and which is contained within a <Private></Private> tag. The content and format of Private elements is determined by the manufacturer of the tool that inserts them into an SCL file, and as such is in general understood only by that tool. Only the owner's tools are allowed to modify a Private element. Other tools are required to preserve Private elements unchanged.

Different manufacturers, indeed even different tools from the same manufacturer, use Private elements for different purposes. A UR SCL file has two Private elements. The first Private section contains all the settings not in a Public element. The second Private section contains an authentication code that allows the UR and UR Setup to determine if a non-GE tool has modified the first one. Thus between the Public and Private elements, a UR SCL file contains all of the device's settings in that single file. In IID files, there can be a third Private element that contains information regarding subscribed GOOSE messages, information that in CID and SCD files is in Public elements.

3.1.8.1 File types

SCL file names are given different extensions based on where they have been created in the substation configuration process and where they are intended to be used, as follows.

- **.icd** — **Default settings on UR** — An IED Capability Description (ICD) SCL file describes to a system configurator tool a single type of IED. For UR 7.30 and later, an ICD file describes a UR with a particular order code. It includes all the data attributes, control blocks, and settings with the factory default values for that order code. A copy of it can be obtained directly from a UR device, or from EnerVista UR Setup.
- **.ssd** — A System Specification Description (SSD) SCL file describes the single line diagram and functions of the substation and the required logical nodes. It is intended for exchange from a system specification tool to a system configurator and as such is not used by UR 7.30 and later.
- **.scd** — A System Configuration Description (SCD) SCL file describes the complete system configuration, including the single line diagram, all the IEDs and their information models, and the data flow between IEDs. It is intended for configuration exchange from the system configurator tool to each of the IED configurator tools. Typically a system configuration tool creates an SCD file by merging an ICD file for each IED in the substation with an SSD file, then configuring the GOOSE and report communications. EnerVista UR Setup is an IED configurator tool, and can accept an SCD file and save the settings for any UR devices it contains in URS files. EnerVista UR Setup can then send the settings in these URS files to the corresponding UR devices.
- **.cid** — **Settings sent to UR (may or may not contain the present settings)** — A Configured IED Description (CID) file describes the required settings of an IED and is intended for transmission of configuration from an IED configurator to the IED. It is an SCD file, possibly stripped down to what the concerned IED needs to know. EnerVista UR Setup creates and sends a CID file to the UR device when IEC 61850 settings are involved. A UR 7.30 and later CID file includes all data attributes of the target IED, control blocks and settings, and completely re-programs the receiving device. UR 7.30 and later devices also accept a CID file from a third-party configuration tool provided that the CID file is derived from a UR ICD file and contains the elements of the ICD file, possibly with modified settings. Supported file transfer formats are SFTP and 61850 MMS. TFTP can be used to get files, but a TFTP "put" command cannot be used for security reasons. The port number can be set as per the settings in the Instruction Manual.

- **.iid** — **Actual settings on UR** — An Instantiated IED Description (IID) SCL file describes a specific IED to a system configurator tool, typically more or less as configured for its role in the system. For UR 7.30 and later, an IID file includes all the data attributes of the UR device, control blocks and settings, with setting values all as they were at the moment that the IID file was generated. A copy of it can be obtained directly from a UR device or from EnerVista UR Setup. If obtained from the EnerVista UR Setup Offline Window, the settings are from the URS file selected. See the next section for more information.
- **.sed** — A System Exchange Description (SED) file is intended for configuration exchange between system configurators of different projects. This file describes the interfaces of one project to be used by the other project, and as such is not used by UR 7.30 and later.

3.1.8.2 SCL file example

To illustrate what an SCL file looks like, this section presents parts of an ICD file generated by a D60 UR with firmware 7.40.

The following appears at the beginning of UR SCL files. The first line identifies this file as an XML formatted file. The second line is a comment unique to UR devices. The third line indicates that it is an SCL file conforming to IEC 61850-6 edition 2.0 schema revision "B." The fourth line is a mandatory element that can be used by SCL tools to identify the specific configuration in this file and its version.

```
1       <?xml version="1.0" encoding="UTF-8"?>
2       <!--Created by GE Digital Energy UR 7.40 on Tue Dec 1 05:38:26 2015-->
3       <SCL xmlns="http://www.iec.ch/61850/2003/SCL" xmlns:xsi="http://www.w3.org/2001/XMLSchema-
instance" xsi:schemaLocation="http://www.iec.ch/61850/2003/SCL SCL.xsd" version="2007" revision="B"
xmlns:eGE="http://www.gedigitalenergy.com/multilin">
4               <Header id="" nameStructure="IEDName"/>
```

Following the Header element is the Communication element. The Communications element contains a ConnectedAP element for each of the three UR Ethernet ports. Each ConnectedAP element is within its own SubNetwork element, as it is expected that each Ethernet port is connected to a separate network. Ethernet port 1 has ConnectedAP apName S1, while port 2 is S2 and port 3 is S3. The Address element at line 9 contains the IP address of the S1 port. The GSE element at line 20 contains address information of the first TxGOOSE, the interval to the first TxGOOSE message retransmission following an initial event message (MinTime), and the time allowed to live value. In the ICD file but not shown here, following this are the GSE elements for the remaining TxGOOSE, and then the SubNetwork elements for the other Ethernet ports, which are similar to the first.

```
5       <Communication>
6               <SubNetwork name="W1">
7                       <ConnectedAP iedName="TEMPLATE" apName="S1">
8                               <Address>
9                                       <P type="IP">127.0.0.1</P>
10                                      <P type="IP-SUBNET">255.0.0.0</P>
11                                      <P type="IP-GATEWAY">127.0.0.1</P>
12                                      <P type="OSI-AP-Title">1,3,9999,1</P>
13                                      <P type="OSI-AE-Qualifier">12</P>
14                                      <P type="OSI-PSEL">00000001</P>
15                                      <P type="OSI-SSEL">0001</P>
16                                      <P type="OSI-TSEL">0001</P>
17                                      <P type="OSI-AP-Invoke">102</P>
18                                      <P type="OSI-AE-Invoke">103</P>
19                              </Address>
20                              <GSE ldInst="Master" cbName="GoCB01">
21                                      <Address>
22                                              <P type="VLAN-ID">000</P>
23                                              <P type="VLAN-PRIORITY">4</P>
24                                              <P type="MAC-Address">01-0C-CD-01-00-00</P>
25                                              <P type="APPID">0000</P>
26                                              <P type="TransportInUse">0</P>
27                                              <P type="IPClassOfTraffic">46</P>
28                                              <P type="IPv6FlowLabel">0</P>
```

```
                <P type="IpAddressLength">4</P>
                <P type="IP">224.0.0.0</P>
            </Address>
            <MinTime unit="s" multiplier="m">4</MinTime>
             <MaxTime unit="s" multiplier="m">300000</MaxTime>
        </GSE>
```

When TxGOOSE# MODE is set to GOOSE, the GSE element is as follows:

```
        <GSE ldInst="Master" cbName="GoCB01">
            <Address>
                <P type="VLAN-ID">000</P>
                <P type="VLAN-PRIORITY">4</P>
                <P type="MAC-Address">01-0C-CD-01-00-00</P>
                <P type="APPID">0000</P>
            </Address>
            <MinTime unit="s" multiplier="m">4</MinTime>
            <MaxTime unit="s" multiplier="m">300000</MaxTime>
        </GSE>
```

When TxGOOSE# MODE is set to R-GOOSE, the GSE element is as follows:

```
        <GSE ldInst="Master" cbName="GoCB01">
            <Address>
                <P type="VLAN-ID">000</P>
                <P type="VLAN-PRIORITY">4</P>
                <P type="APPID">0000</P>
                <P type="IPv6ClassOfTraffic">46</P>
                <P type="IP">224.0.0.0</P>
            </Address>
            <MinTime unit="s" multiplier="m">4</MinTime>
            <MaxTime unit="s" multiplier="m">300000</MaxTime>
        </GSE>
```

Following the Communication element is the IED element, the beginning of which is as follows. As this example is an ICD file that has not been configured, the IED name has the filler "TEMPLATE." The first element in the IED element at line 296 is the Private element that contains the UR settings that are not contained in Public elements.

```
295    <IED type="L90" configVersion="7.80" desc="UR" name="Publisher" manufacturer="GE Multilin">
296        <Private type="GE_Digital_Energy_UR L90-UH7-HPH-F8L-H6R-M8L-P6S-U6L-W2H_7.80"><![CDATA[
297            16435,1,1,1,30
298            17074,1,1,1,0
299            26763,1,1,1,1.00
```

After this main Private element, the IED element has a second Private element that contains a "signature" or hash of the first Private element, which allows the UR and EnerVista UR Setup software to detect if there has been any unauthorized change in the first element. Following that is the Services element that declares the IEC 61850 services that the UR device supports. For Edition 2:

```
    <Private type="GE_Digital_Energy_UR GE_Authentication_Code">331709458</Private>
    <Services nameLength="64">
        <ClientServices goose="true"/>
           <TimeSyncProt c37_238="true" sntp="true" />
        </ClientServices>
        <DynAssociation max="5"/>
        <SettingGroups><SGEdit/></SettingGroups>
        <GetDirectory/>
```

```
                    <GetDataObjectDefinition/>
                    <DataObjectDirectory/>
                    <GetDataSetValue/>
                    <DataSetDirectory/>
                    <ConfDataSet max="18" maxAttributes="64"/>
                    <ReadWrite/>
                    <ConfReportControl max="48"/>
                    <GetCBValues/>
                   <ReportSettings cbName="Conf" datSet="Conf" rptID="Dyn/Conf" optFields="Dyn/Conf
" bufTime="Dyn/Conf " trgOps="Dyn/Conf " intgPd="Dyn/Conf "/>
                    <GSESettings datSet="Conf" appID="Conf"/>
                    <ConfLNs fixPrefix="true" fixLnInst="true"/>
                    <ConfLdName/>
                    <GOOSE max="16"/>
                    <FileHandling/>
                    <SupSubscription maxGo="64" maxSv="0"/>
             </Services>
```

For Edition 1, the Services content is as follows:

```
<Services>
  <DynAssociation />
  <SettingGroups>
       <SGEdit/>
  </SettingGroups>
  <GetDirectory/>
  <GetDataObjectDefinition/>
  <DataObjectDirectory/>
  <GetDataSetValue/>
  <DataSetDirectory/>
  <ConfDataSet max="18" maxAttributes="64"/>
  <ReadWrite/>
  <ConfReportControl max="48"/>
  <GetCBValues/>
  <ReportSettings cbName="Conf" datSet="Conf" rptID="{ReportSettings rptID setting value}"
optFields="{ReportSettings optFields setting value}" bufTime="{ReportSettings bufTime setting value}"
trgOps="{ReportSettings trgOps setting value}" intgPd="{ReportSettings intgPd setting value}"/>
  <GSESettings cbName="Conf" datSet=" Conf" appID="Conf"/>
  <ConfLNs fixPrefix="true" fixLnInst="true"/>
  <GOOSE max="16"/>
  <FileHandling/>
</Services>
```

For a unit with a non-HardFiber Process Bus Module, the Services content is as follows. For maxSV, X denotes 8, 16, or 24 based on the number of RxSV streams supported by the order code.

```
<Services nameLength="64">
   <ConfDataSet max="18" maxAttributes="64"/>
   <ConfReportControl max="48"/>
   <ReportSettings cbName="Conf" datSet="Conf" rptID="{ReportSettings rptID setting value}"
optFields="{ReportSettings optFields setting value}" bufTime="{ReportSettings bufTime setting value}"
trgOps="{ReportSettings trgOps setting value}" intgPd="{ReportSettings intgPd setting value}"/>
   <GSESettings cbName="Conf" datSet=" Conf" appID="Conf"/>
   <ConfLNs fixPrefix="true" fixLnInst="true"/>
   <ConfLdName/>
   <GOOSE max="16"/>
   <SupSubscription maxGo="64" maxSv="X"/>
</Services>
```

The "ReportSettings" element attributes "rptID," "optFields," "bufTime," "trgOps," and "intgPd" are configurable under **Settings > Product Setup > Communications > IEC 61850 > Reports > Report Settings** to either "Dyn" or "Conf."

Next in the IED element is the AccessPoint element, which describes the information model visible through Ethernet port 1. Following this AccessPoint element are AccessPoint elements for Ethernet ports 2 and 3, each of which declares that it has the same information model by referencing the first AccessPoint element. This first AccessPoint element contains an LDevice element for each logical device in the IED. Each LDevice element contains an LN0 or LN element for each logical node in that logical device. Each LN0 and LN element contains for each of its control blocks and data objects an element defining that control block or data object. In IID files for URs in which datasets have been configured, each dataset has an element defining that dataset also included here. The following code shows the first AccessPoint, its first logical device, first logical node, and first dataset.


```
<AccessPoint name ="S1">
    <Server>
        <Authentication none = "true"/>
        <LDevice inst="Master" >
            <LN0 lnType="LLN0_0" lnClass="LLN0" inst="">
                <DataSet name="TT6DataSet1" eGE:Label="TT6DataSet1">
                    <FCDA ldInst="Master" prefix="lnClass="LPHD" lnInst="1"
doName="PhyHealth" daName="stVal" fc="ST"/>
                    <FCDA ldInst="Prot" prefix="PhsIoc" lnClass="PIOC" lnInst="1"
doName="Op" daName="general" fc="ST"/>
                </DataSet>
                <ReportControl name="BRCB01"  intgPd="0" confRev="1" buffered="true"
bufTime="0" indexed="false">
                    <TrgOps dchg="true" qchg="true" dupd="false" period="true"
gi="true"/>
                    <OptFields seqNum="true" timeStamp="true" dataSet="true"
reasonCode="true" dataRef="true" bufOvfl="false" entryID="false" configRef="true"/>
                    <RptEnabled max="1"/>
                </ReportControl>
```

The Services element under the AccessPoint element is as follows.

For AccessPoints S1, S2 and S3:

```
<Services>
   <ClientServices goose="true"/>
        <TimeSyncProt c37_238="true" sntp="true" />
   </ClientServices>
   <DynAssociation max="5"/>
   <SettingGroups>
        <SGEdit/>
   </SettingGroups>
   <GetDirectory/>
   <GetDataObjectDefinition/>
   <DataObjectDirectory/>
   <GetDataSetValue/>
   <DataSetDirectory/>
   <ReadWrite/>
   <GetCBValues/>
   <FileHandling/>
</Services>
```

For AccessPoints P1 and P2, where X denotes 8, 16, or 24 based on the number of RxSV streams supported by the order code:

```
<Services>
   <ClientServices goose="true" sv="true" maxSMV="X"/>
```

```
      <TimeSyncProt sntp="true" />
   </ClientServices>
</Services>
```

Following is the element for a typical data object that is mapped to a FlexLogic operand. The Val element on line 47166 was within the TEMPLATE IED element, in the Prot LDevice element, and in the LN element with lnClass="PIOC" inst="1" prefix="PhsIoc", so the text in the Val element is the configured value of data attribute TEMPLATEProt/PhsIocPIOC1.Dpo.d.

```
47164                   <DOI name="Dpo">
47165                          <DAI name="d">
47166                                 <Val>PHASE IOC1 DPO operand</Val>
47167                          </DAI>
47168                   </DOI>
```


Following is the element for a typical data object that is mapped to a setting that selects a FlexLogic operand. The Val element on line 47186 was within the same LN element shown previously, so the text of the Val element is the configured value of TEMPLATEProt/PhsIocPIOC1.BlkRef11.setSrcRef, which has here a 61850 ObjectReference to the FlexLogic operand "Off." The "@" represents the name of the containing IED element.

```
47184                   <DOI name="BlkRef11">
47185                          <DAI name="setSrcRef">
47186                                 <Val>@Master/LLN0.Off.stVal</Val>
47187                          </DAI>
47188                          <DAI name="setSrcCB">
47189                                 <Val></Val>
47190                          </DAI>
47191                          <DAI name="d">
47192                                 <Val>PHASE IOC1 BLOCK A setting for setting group 1.</Val>
47193                          </DAI>
47194                   </DOI>
```

The IED element describes the structure of the information model by specifying for each logical node its lnType (for example, see line 13127 earlier). After the IED element, there is a DataTypeTemplates element that contains LNodeType elements that define for each lnType the data objects contained in logical nodes of that lnType. Similarly, the components of each data object type are defined in DOType elements, and the components of structured data attributes are defined in DAType elements.

3.1.8.3 Deadbands

Deadbands for measured values

The "db" data attributes are used by the relay to determine when to update the "mag" and "cVal" values from the associated "instmag" and "instcVal" values. Updates trigger reports and GOOSE messages.

Deadbands for complex measured values

A complex value, such as cVal, is a deadbanded value that contains magnitude and angle, with a specific timestamp. Although individual deadband data attributes for Magnitude (db) and Angle (dbAng) are instantiated, the cVal (mag & ang) need to be captured and frozen simultaneously with a corresponding timestamp (can be triggered by either mag or ang). This means that either a magnitude or an angle data attribute included in a GOOSE message or a report triggers a GOOSE message or report send.

"db" and "dbAng" CF parameters are configurable via SCL (CID) file and MMS clients can write the value.

Deadband parameters of measured values related to the signal sources are configurable under **Settings > Product Setup > Communications > IEC 61850 > System Setup > Signal Sources**.

Deadband parameters of measured values related to the Demand metering are configurable under **Settings > Product Setup > Communications > IEC 61850 > Product Setup > Demand**.

Deadband parameters of measured values related to the Energy metering are configurable under **Settings > Product Setup > Communications > IEC 61850 > Product Setup > Energy**.

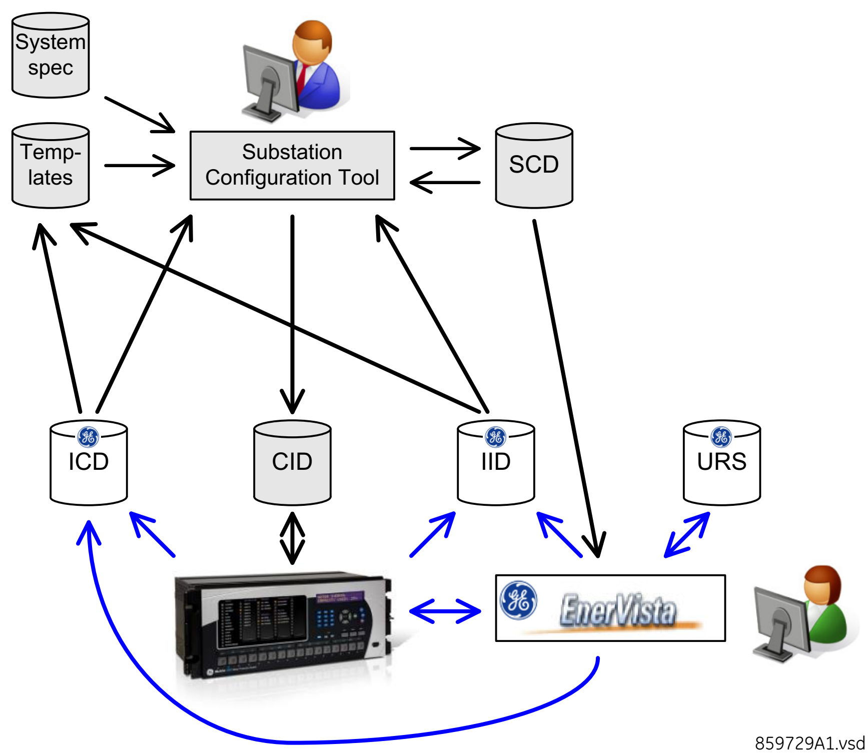
3.2 Configuring the UR using SCL

This section discusses use of an IEC 61850 Substation Configuration Tool (SCT) to configure a UR 7.30 or later device in a substation protection and control system consisting of many IEDs interconnected via an Ethernet local area network.

SCTs are available from a number of vendors. At present, GE does not market an SCT. In selecting an SCT, bear in mind that the SCT needs to understand how to use the particular SCL features used by each of the IEDs in the system; do not assume that any SCT claiming IEC 61850 can interoperate with any IED claiming 61850. A formal definition of SCL features used by UR 7.3 or later devices is contained near the end of this chapter (G2 implementation model for GOOSE configuration via SCL section on page 3-281). In addition, UR 7.3 and later devices implement an extension defined near the end of this chapter (E3-2.0 implementation model for GOOSE configuration via SCL section on page 3-297). These two sections are intended for SCT developers; an understanding of them is not required to follow this discussion.

IEC 61850 configuration consists of the exchange of SCL files, as illustrated in the figure.

Figure 3-8: Configuration for IEC 61850

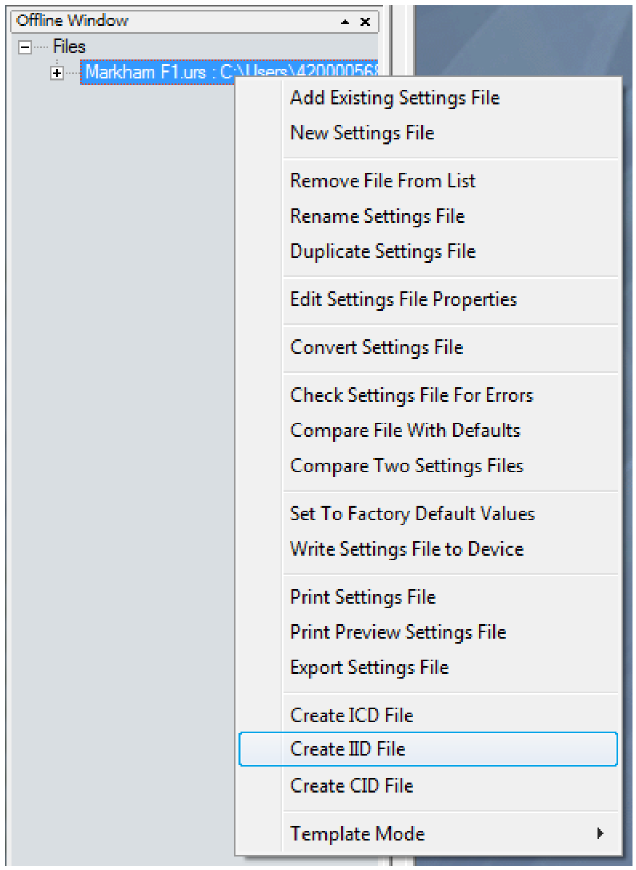


The SCT begins by importing a collection of SCL files, including a System Specification Description (SSD) that describes the single line diagram and functions of the substation, and for each IED in the system an IED Capabilities Description (ICD) that describes the functional and engineering capabilities of an IED type. In some cases System Exchange Description (SED) files are also used to exchange data between system configurators of different projects. Neither UR devices nor EnerVista UR Setup software deals with SSD or SED files, so they are not discussed further here; see instead the documentation of the SCT.

ICD files for UR devices can be obtained a number of ways, as follows:

- An ICD file can be obtained directly from the UR device using any of the supported file transfer protocols. The file name inside the UR device is "ur.icd".
- Another way that does not need a UR device is through EnerVista UR Setup software. Create a new URS settings file in the Offline Window with the exact order code of the target relay or use an existing offline settings file with the same order code, right-click on the file name, select **Create ICD File**, and enter a name for the file. A URS file is a file containing all the settings of a single UR family device in the native EnerVista UR Setup format.

Figure 3-9: Creating ICD file



An ICD file obtained from a UR 7.3 or later device or from EnerVista UR Setup software contains all of the settings in the device at their factory default values. Unlike some IEDs that use several files to contain a complete set of settings, UR-generated SCL files contain all of the device's settings. Settings related to IEC 61850 communications (such as GOOSE, reports, datasets, commands, MMS queries) are in Public elements that can be understood and configured by SCTs. The remainder of the settings are contained in a Private element that is not intended to be understood or modified by SCTs, only by EnerVista UR Setup. A second Private element contains a "signature" of the first that allows any modifications of UR Private setting data to be detected.

As these ICD files apply to all UR family devices with the same order code and firmware version, they can be given an appropriate file name, saved in a templates database, and reused for each similar UR device in the system and in future systems. However, starting the configuration from the factory default values for each of several similar UR devices applications unnecessarily duplicates setting efforts. In these cases it is more efficient to begin with a "template" ICD file in which the setting values that are the same of each application are preconfigured.

Pre-configured template ICD files can be obtained using EnerVista UR Setup software to create a settings file in its Offline Window as described, but to then to continue to use EnerVista software to configure its protection and control settings for a particular application type, for instance for a typical low voltage feeder. Some or all of its communications settings can be configured as well. Next, right-click on the file name, select **Create IID File**, enter a name for the file. Such IID files are the same as the ICD files previously described except that the settings are as modified by the EnerVista UR Setup user. Finally, rename the IID file with a .icd extension and save it in the templates database.

The SCT merges all the imported SCL files into a single System Configuration Description (SCD), and completes the communications configuration. For UR devices, this involves some or all of:

- Setting various configuration version parameters
- Giving the UR device a unique name
- Configuring the IP source address parameters
- Configuring addressing and timing parameters of GOOSE messages
- Adding datasets for publishing GOOSE messages
- Configuring GOOSE subscription
- Configuring addressing and timing parameters for reports
- Adding datasets for reports
- Configuring command models and timeouts

The following conditions apply to ensure that the resulting configuration is not rejected by the UR device or EnerVista UR Setup:

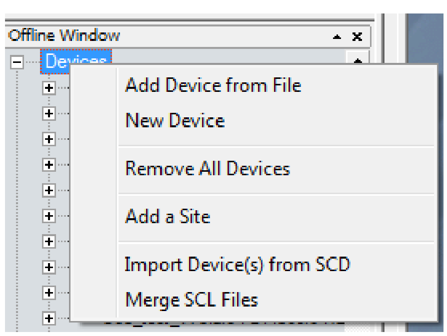
- In UR 7.40 and later, new LDevice elements can be added, LN elements other than those originally in the Master logical device can be moved between LDevice elements, and LDevice elements containing no LN elements can be removed
- The DataTypeTemplates element cannot be changed in a way that removes, adds, reorders, or changes properties of data objects or data attributes, although the template id attributes can be changed provided it is done consistently throughout the file so as to not affect the information model. EnumVal elements can be removed or reordered.
- Unused SubNetwork, GSE, and Address elements in the Communications element can be omitted as long as one SubNetwork and Communications element remains; the settings corresponding to omitted attributes are left at their factory default value. BitRate elements can be added to SubNetwork elements, but do not affect the fixed UR bit rate. Note that Access point S1 is physical Ethernet port 1, access point S2 is physical Ethernet port 2, and access point S3 is physical Ethernet port 3.
- Some other additions/changes can be tolerated on import, but are not preserved on export

If the configuration generated by the SCT in the SCD is complete, the next step is to use it to program each of the IEDs. For UR devices, there are several ways in which this can be done. A CID file can be sent directly to the UR device using any of the supported file transfer protocols. CID files, which can be directly generated by some SCTs, are just the SCD with configuration information not required by the target IED removed.

Alternatively, the SCD can be imported by EnerVista UR Setup, which generates URS files for each UR device that the SCD contains, and the configuration in those URS files sent to the URs.

To import a SCD or CID into EnerVista UR Setup, right-click on either the Offline Window label or the **Devices** label in the Offline Window, select **Import Devices from SCD**, and enter a name for a URS file for each of the IED configurations being imported. The default URS file name is the IED name in the SCD/CID. For writing settings from the imported files to the UR devices, connect to each UR device in the Online Window, and drag-and-drop the URS file in the Offline Window to the appropriate UR device in the Online Window. When the SCD file has more than one UR device in it, the system prompts for the name to use.

Figure 3-10: Importing a settings file



Note that there is no option to import IID files. This is because it is not called for in the standards and there is little need.

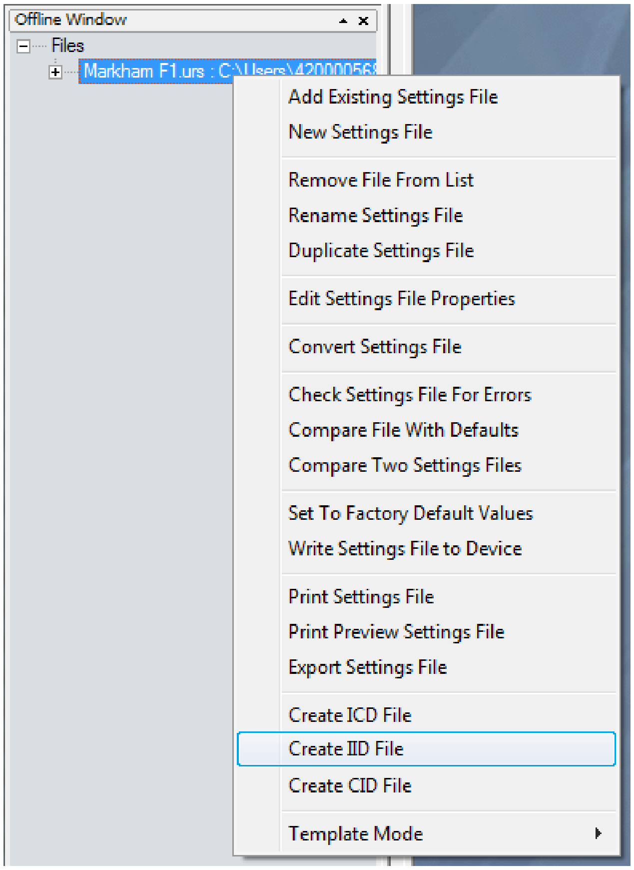
If the configuration generated by the SCT is not complete, which is typically the case, proceed as in the previous paragraph to import the SCD/CID, complete the configuration in the URS files using EnerVista UR Setup, and then drag the URS files to the UR devices.

For problems found during the commissioning stage that require a setting change, setting changes can be made using the front panel, EnerVista UR Setup, or the SCT. Changes made at any level in the SCT/UR Setup/UR device chain can be propagated down using the methods described in the preceding paragraphs. It is important that any changes made at a lower level in the UR device/UR Setup/SCT chain be propagated up to the other levels as well. Changes made through the front panel can be propagated to EnerVista UR Setup using the traditional **Add Device to Offline Window** selection in the Online Window. Changes made through the front panel can be propagated to the SCD by retrieving the IID file from the device using any of the supported file transfer protocols, and by using the SCT to merge that IID into the SCD. Changes made offline with the EnerVista UR Setup file can be propagated to the SCD by right-clicking on the file name in the Offline Window, selecting **Create IID File**, and using the SCT to merge that IID into the SCD.

As shown in the configuration figure earlier in this section, CID files can be retrieved for UR devices using any of the supported file transfer protocols. However, note that the CID that can be retrieved is the most recently received and accepted CID, renamed ur.cid. It does not contain any setting changes that have been made via the front panel. Neither does it contain any setting changes made by EnerVista UR Setup, unless the online IEC 61850 screen has been saved. Saving the online IEC 61850 screen sends a CID file to the UR.

EnerVista UR Setup can also generate a CID from a URS, using the **Create CID File** option in the Offline Window area. These CID files are the only ones sensitive to the Configuration Type setting on the **Settings > Product Setup > Communications > IEC 61850 > Server Configuration** panel. The UR 7.3 and later series devices implement two profiles of SCL, these being the G2 implementation model and the E3-2.0 implementation model, both of which are outlined near the end of this chapter. These vary in how GOOSE subscription configuration is represented. In the G2 model, either an ORG data object mapped to the final destination or a ExtRef in @Master/GGIO3 has an object reference to the quantity subscribed to and the GOOSE control block that transmits it, and the IED element of the publisher must be consulted to find information on the GOOSE message and where in the message is the subscribed quantity. In the E3-2.0 model, all the information necessary to subscribe to a published quantity is contained within the subscriber's IED element, using data objects that extend the standard logical node class LGOS. The G2 model is the way the standard intended GOOSE subscription to be configured. While the E3-2.0 model does not employ the standard's vision for subscription, it only requires CID files to contain one IED element, and the extensions do conform to the standard's rules for extensions.

Figure 3-11: Creating CID file



UR devices and EnerVista UR Setup automatically detect whether an imported CID file uses the G3 or the E3-2.0 model. UR devices do not generate CID files, they only make available a copy of the most recently received and accepted CID file. The model used when EnerVista UR Setup generates a CID file is determined by the Configuration Type setting.

ICD files generated by UR devices and EnerVista UR Setup have factory default settings that do not have GOOSE subscription configured, and so implement both the G2 and the E3-2.0 model. IID files generated by UR devices and EnerVista UR Setup are constrained by the standard to have only one IED element, and so for IID files the G2 model and the E3-2.0 model are equivalent, provided the E3-2.0 extensions are populated, which they are. Thus only CID files generated by EnerVista UR Setup are sensitive to the Configuration Type setting.

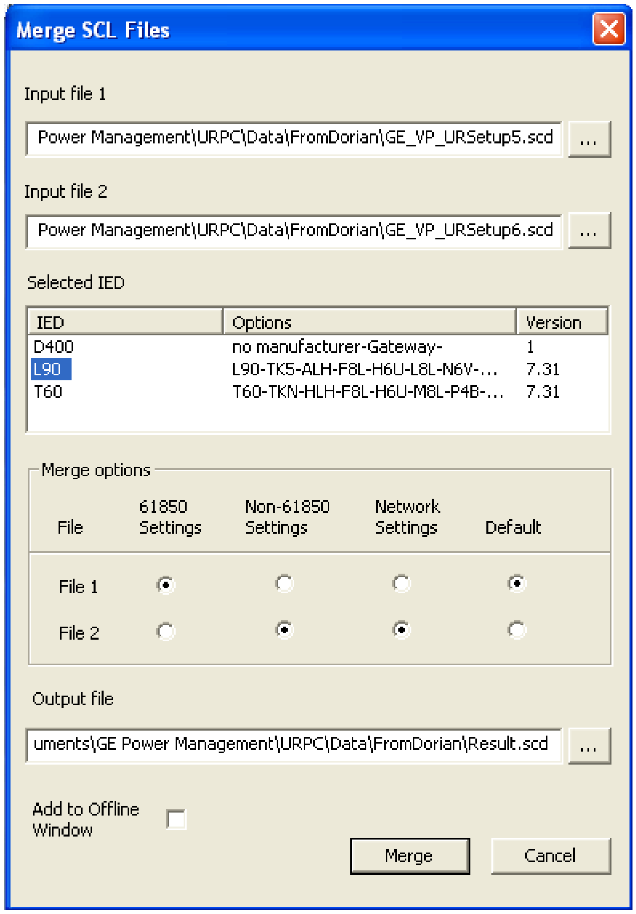
3.2.1 Merge SCL file

The EnerVista UR Setup software includes a function to merge SCL files with UR settings. ICD, CID, IID, and SCD files are accepted as input and output.

1. In the software, select the device in the Offline Window area.
2. Select the **Offline > Merge SCL Files** menu item. The window opens.

3

Figure 3-12: Merge settings files



3. Complete the fields.

   Input file 1 — Select the source file to import. Valid file types are ICD, CID, IID, and SCD.

   Input file 2 — Select a second source file to import. An example is when IP addresses or Private settings are to be imported from another source file. Valid file types are ICD, CID, IID, and SCD.

   Selected IED — The order codes in the input files must match for a device to appear in the list here. The device name, order code, and firmware version of the device display.

   61850 Settings — The source file for the Public section of IEC 61850 settings.

   Non-61850 Settings — The source file for the Private section of the file.

   Network Settings — The source file for the three port IP and subnet addresses, default gateway and routing table settings. The relay applies the network settings (IP, subnet, gateway, routes) to its interfaces from the CID file when file is written to the relay via serial interface only. When the same file is written via Ethernet interface, these settings are not applied. The redundancy setting is applied by the relay from the CID file irrespective of the interface it is received from.

   Default — Merging common settings. This operation is necessary because of potential differences between the Public and Private values for the same setting.

   Output file — Name and location of the merged file.

   Add to Offline Window — Enable to copy the output file to the Offline Window area of the software, resulting in a .urs file visible in the Offline area. If the output file is not a CID file, it is renamed temporarily to .cid, imported, and renamed back to the original name.

4. Click the **Merge** button.

5. If a window opens, specify the location for the file to be added to the Offline Window area in the **Target Folder** field

and a name for this device/folder in the **Device Name** field. Click the **Finish** button.

6. The files are validated and the settings are imported from the files identified. When the option to Add to the Offline Window was selected, the output generates as merged files in the ICD, CID, IID, and SCD formats. Otherwise, a single file generates. Check the contents in a text editor. The _MergeReports.txt file indicates when the Default was used to merge common settings.
7. To use a merged file, drag-and-drop it into the Online Window area.

3.2.2 Configurable logical devices

The configurable logical devices feature available since UR 7.40 allows the assignment of logical nodes to logical devices to be customized to user requirements, and the number of logical devices to be changed to any number from 1 to 16.

The one logical device that must remain is Master. The following logical nodes have fixed assignment to the Master logical device:

- LPHD1 — models common issues for physical devices
- The LLN0 in the Master logical device, which includes group, GOOSE and report control blocks, and datasets
- LGOS logical nodes — for GOOSE subscription
- GGIO1 — for unmapped FlexLogic operands
- GGIO2 — for Virtual Input control
- GGIO3 — for RxGOOSE Inputs
- GGIO4 — for unmapped FlexAnalog operands

Other than these, and other than the LLN0 logical nodes in logical devices other than Master, all LN elements can be moved freely between LDevice elements. Note however that LN elements cannot be deleted, only moved.

An LDevice element that has no remaining LN elements (only LN0 remaining) can be deleted, effectively removing the logical device from the information model as if it never existed.

LDevice elements can be added up to 16 in total and LN elements moved into it from other LDevice elements, provided that it contains an LN0 element with lnType referencing a DOType equivalent to the LLN0_1 DOType contained in ICD files generated by the UR or the EnerVista UR Setup software.

3.3 Protocol implementation conformance statement (PICS)

3.3.1 Basic conformance statement

The tables contain the basic conformance statement.

Table 3-2: PICS for A-profile support

Profile description		Client / subscriber	Server / publisher	Value / comments
A1	Client/Server A-Profile per IEC 61850 8 1 clause 6.2.2		Yes	
A2	GOOSE/GSE management A-Profile per IEC 61850 8 1 clause 6.3.2		Yes	
A3	GOOSE A-Profile per IEC 61850 8 1 clause 6.3.2	Yes	Yes	
A4	TimeSync A-Profile	Yes		
A5	Security for Client/server A-Profile			
A6	Security for GOOSE/GSE management A-Profile			
A7	SV A-Profile per IEC 61850 9 2 clause 5.3.2	Yes		

Table 3-3: PICS for T-profile support

Profile description		Client / subscriber	Server / publisher	Value / comments
T1	TCP/IP T-Profile per IEC 61850 8 1 clause 6.2.2		Yes	RJ-45 and/or LC

Profile description		Client / subscriber	Server / publisher	Value / comments
T2	SV T-Profile per IEC 61850 9 2 clause 5.3.3	Yes		
T3	GOOSE T-Profile per IEC 61850 8 1 clause 6.3.3	Yes	Yes	RJ-45 and/or LC
T4	GSSE T-Profile			deprecated
T5	TimeSync T-Profile per IEC 61850 8 1 clause 6.4.3		Yes	RJ-45 and/or LC

3.4 ACSI conformance statement

3

3.4.1 ACSI basic conformance statement

The table contains the Abstract Communication Service Interface (ACSI) conformance statement.

Table 3-4: ACSI basic conformance statement

		Client / subscriber	Server / publisher	Value / comments
Client-server roles				
B11	Server side (of Two-party Application-Association)		Yes	
B12	Client side (of Two-party Application-Association)			
SCSMs supported				
B21	SCSM: IEC 61850-8-1 used		Yes	
B22	SCSM: IEC 61850-9-1 used			deprecated
B23	SCSM: IEC 61850-9-2 used	Yes		
B24	SCSM: other			
Generic substation event model (GSE)				
B31	Publisher side		Yes	
B32	Subscriber side	Yes		
Transmission of sampled value model (SVC)				
B41	Publisher side			
B42	Subscriber side	Yes		

3.4.2 ACSI models conformance statement

The table contains the conformance statement.

Notes:

- Yes = Service is supported
- No or empty = Service is not supported

Table 3-5: ACSI models conformance statement

		Client / subscriber	Server / publisher	Value / comments
M1	Logical device		Yes	
M2	Logical node		Yes	
M3	Data		Yes	
M4	Data set		Yes	
M5	Substitution			
M6	Setting group control		Yes	
Reporting				
M7	**Buffered report control**		Yes	
M7-1	sequence-number		Yes	

		Client / subscriber	Server / publisher	Value / comments
M7-2	report-time-stamp		Yes	
M7-3	reason-for-inclusion		Yes	
M7-4	data-set-name		Yes	
M7-5	data-reference		Yes	
M7-6	buffer-overflow		Yes	
M7-7	entryID		Yes	
M7-8	BufTm		Yes	
M7-9	IntgPd		Yes	
M7-10	GI		Yes	
M7-11	conf-revision		Yes	
M8	**Unbuffered report control**		Yes	
M8-1	sequence-number		Yes	
M8-2	report-time-stamp		Yes	
M8-3	reason-for-inclusion		Yes	
M8-4	data-set-name		Yes	
M8-5	data-reference		Yes	
M8-6	BufTm		Yes	
M8-7	IntgPd		Yes	
M8-8	GI		Yes	
M8-9	conf-revision		Yes	
Logging				
M9	Log control (LCB)			
M9-1	IntgPd			
M10	Log			
Control				
M11	Control		Yes	
GSE				
M12	GOOSE	Yes	Yes	
M13	GSSE			deprecated
SVC				
M14	Multicast SVC	Yes		
M15	Unicast SVC			
Miscellaneous				
M16	Time	Yes		
M17	File transfer		Yes	
M18	Application association		Yes	
M19	GOOSE Control Block		Yes	
M20	Sampled Value Control Block			

3.4.3 ACSI services conformance statement

The table contains the conformance statement.

Table 3-6: ACSI services conformance statement

		Client / subscriber	Server / publisher	Comments
Server (IEC 61850-7-2 clause 7)				
S1	GetServerDirectory (LOGICAL-DEVICE)		Yes	

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		Client / subscriber	Server / publisher	Comments
Application association (IEC 61850-7-2 clause 8)				
S2-1	Associate_Request			
S2-2	Associate_Response		Yes	
S3-1	Abort_Request		Yes	
S3-2	Abort_Processing		Yes	
S4-1	Release_Request			
S4-2	Release_Response		Yes	
Logical device (IEC 61850-7-2 clause 9)				
S5	LogicalDeviceDirectory		Yes	
Logical node (IEC 61850-7-2 clause 10)				
S6	GetLogicalNodeDirectory		Yes	
S7	GetAllDataValues		Yes	
Data object (IEC 61850-7-2 clause 11)				
S8	GetDataValues		Yes	
S9	SetDataValues		Yes	
S10	GetDataDirectory		Yes	
S11	GetDataDefinition		Yes	
Data set (IEC 61850-7-2 clause 13)				
S12	GetDataSetValues		Yes	
S13	SetDataSetValues			
S14	CreateDataSet			
S15	DeleteDataSet			
S16	GetDataSetDirectory		Yes	
Substitution				
S17	SetDataValues			
Setting group control (IEC 61850-7-2 clause 16)				
S18	SelectActiveSG		Yes	
S19	SelectEditSG		Yes	
S20	SetEditSGValue			
S21	ConfirmEditSGValues			
S22	GetEditSGValue		Yes	
S23	GetSGCBValues		Yes	
Reporting (IEC 61850-7-2 clause 17)				
Buffered report control block (BRCB)				
S24	Report		Yes	
S24-1	data-change (dchg)		Yes	
S24-2	qchg-change (qchg)		Yes	
S24-3	data-update (dupd)			
S25	GetBRCBValues		Yes	
S26	SetBRCBValues		Yes	
Unbuffered report control block (URCB)				
S27	Report		Yes	
S27-1	data-change (dchg)		Yes	
S27-2	qchg-change (qchg)		Yes	
S27-3	data-update (dupd)			
S28	GetURCBValues		Yes	

		Client / subscriber	Server / publisher	Comments
S29	SetURCBValues		Yes	
Logging (IEC 61850-7-2 clause 17)				
Log control block				
S30	GetLCBValues			
S31	SetLCBValues			
Log				
S32	QueryLogByTime			
S33	QueryLogAfter			
S34	GetLogStatusValues			
Generic substation event model (GSE)				
GOOSE (Clause 18)				
S35	SendGOOSEMessage	Yes	Yes	
S36	GetGoReference			
S37	GetGOOSEElementNumber			
S38	GetGoCBValues		Yes	
S39	SetGoCBValues		Yes	
GSSE (IEC 61850-7-2 clause 18)				
S40	SendGSSEMessage			deprecated
S41	GetGsReference			deprecated
S42	GetGSSEElementNumber			deprecated
S43	GetGsCBValues			deprecated
S44	SetGsCBValues			deprecated
Transmission of sampled value model (SVC) (IEC 61850-7-2 clause 19)				
Multicast SVC				
S45	SendMSVMessage	Yes		
S46	GetMSVCBValues			
S47	SetMSVCBValues			
Unicast SVC				
S48	SendUSVMessage			
S49	GetUSVCBValues			
S50	SetUSVCBValues			
Control (IEC 61850-7-2 clause 20)				
S51	Select		Yes	
S52	SelectWithValue		Yes	
S53	Cancel		Yes	
S54	Operate		Yes	
S55	Command-Terminate		Yes	
S56	TimeActivatedOperate			
File transfer (IEC 61850-7-2 clause 23)				
S57	GetFile		Yes	
S58	SetFile		Yes	
S59	DeleteFile			
S60	GetFileAttributeValues		Yes	
S61	GetServerDirectory (FILE-SYSTEM)		Yes	

		Client / subscriber	Server / publisher	Comments
Time (clause 5.5)				
T1	Time resolution of internal clock	20		Nearest negative power of 2^{-n} in seconds (number 0 .. 24)
T2	Time accuracy of internal clock	T0 SNTP T1 IRIG-B PTP		TL (ms) (low accuracy), T3 < 7) (only Ed2) T0 (ms) (≤10 ms), 7 ≤ T3 < 10 T1 (μs) (≤1 ms), 10 ≤ T3 < 13 T2 (μs) (≤100 μS), 13 ≤ T3 < 15 T3 (μs) (≤25 μS), 15 ≤ T3 < 18 T4 (μs) (≤25 μS), 15 ≤ T3 < 18 T5 (μs) (≤1 μS), T3 ≥ 20
T3	Supported TimeStamp resolution	20		Nearest value of 2^{-n} in seconds (number 0 .. 24)

3

3.5 Model implementation conformance statement (MICS)

This model implementation conformance statement (MICS) details the information model supported by a particular UR device, including implemented logical devices, logical nodes, data objects, and data attributes. It is the top-level IEC 61850 data model. The information model also contains implemented control blocks and datasets.

The information model of a UR device depends in general on the device's order code, and it can vary widely from product to product and from option to option. The complete information model for a particular UR device with a particular order code, as it exists with factory default settings, is embodied in the device's IED capability description (ICD) file. A device's ICD file can be obtained from the device itself or from the EnerVista UR Setup software.

This section contains an outline of the information model of the UR family of devices; the information model of a particular UR device consists of the subset of what is shown here that is relevant to that UR device.

In order to contain the size of this chapter, the following repetitious data objects and data attributes are omitted from this outline. These are nonetheless implemented in the device.

Table 3-7: Common data objects and attributes

Name	Description
Beh	The data object Beh is mandatory in every logical node. The value of Beh.stVal in LLN0 of the Master logical device is test/blocked if the FlexLogic operand ANY MAJOR ERROR is On, otherwise test/blocked if the **TEST MODE FUNCTION** selection is Test Blocked, otherwise test if the **TEST MODE FUNCTION** selection is Test, otherwise on. In all other logical nodes, the value of Beh.stVal is off if the function modeled by the logical node has a Function Disabled/Enabled setting and that setting is selected Disabled, otherwise is the same as the value of Beh.stVal in the Master LLN0.
NamPlt	Although optional, the data object NamPlt is instantiated in every logical node except LPHD1. This data object contains in its d data attribute a natural language description of the UR element the containing logical node is modelling. It is included below only in the Master logical device, as there it contains several important data attributes not found in the others.
t	The data attribute t (TimeStamp) is mandatory in every status, measurand and control data object, and reflects the UR device UTC time at last value change of the status, measurand, control, or q values of the containing data object.
q	The data attribute q (Quality) is mandatory in every status, measurand and control data object, and reflects the quality of the status, measurand and control values of the containing data object. q is fixed at zero in cases where the value is an internal UR device mode or status, and thus the value is known to be good, is unaffected by test mode, cannot be operator blocked and cannot be substituted. Otherwise, q is set according to the following table. Note that the value of Beh.stVal of the logical node containing the Quality data attribute is as described a few paragraphs earlier in this section.
d	This textual description is in every logical node. When in a NamPlt data object, the description refers to the logical node, otherwise it describes the data object it is in. These data attributes are readable via MMS services and reconfigurable via SCL file download.
dataNs	The data name space is included in data objects that extend those specified by the logical node class in the standard. Where the extended data object is defined in IEC 61850 7 4, its value is "IEC 61850-7-4:2007A". Otherwise, it has the value "GE Multilin UR Namespace:2015A" and is defined in the GE Namespace subsection of this section. These data attributes are readable via MMS services.

Table 3-8: Typical Quality data attribute values in UR devices

Containing logical node's Beh.stVal	q. validity	q. test	q. detailQual	q. source	q. operatorblocked
on	good	false	0	process	false
test	good	true	0	process	false
test/blocked	invalid if ANY MAJOR ERROR, else good	true	0	process	false
off	invalid	false	0	process	false

Many of the UR family device elements have multiple instances, and in many cases the number of instances depends on the product or the device's order code. Also, many UR elements have operands and/or settings that are repetitive, such as for every phase, or for every step. Again for brevity, in the following information model outline a template representing multiple logical nodes or multiple data objects is often used. These templates are identified with a Greek or punctuation character, such as γ or #, in the logical node/data object name. In a UR device, the template is instantiated multiple times with the punctuation or Greek character replaced with the appropriate instance number or instance identifier.

The R/W/C column in the following tables is coded as follows:

- R — Value of the data object or data attribute is readable via MMS services
- W — Value of the data object or data attribute is writable via MMS services
- C — Value of the data object or data attribute is configurable via SCL file download
- Ctrl — The data object can be controlled via MMS services

The logical nodes implemented in UR devices since version 7.30 are sorted into six logical devices. The table outlines the six logical devices and the general rules for the fixed assignment of logical nodes to them. Each logical device has a section in this chapter that defines the logical nodes implemented for that logical device. In UR 7.40 and later, new LDevice elements other than those originally in the Master logical device can be moved between LDevice elements, and LDevice elements containing no LN elements can be removed.

Table 3-9: Logical devices

Logical device	Contains logical nodes modeling...
Master	communications, including GOOSE, reports, Remote I/O, Direct I/O, Virtual Inputs, Modbus, DNP, and so on. Setting group control. This is the root logical device.
Protection (Prot)	protection functions
Control (Ctrl)	control and monitoring functions
System	power system devices: breakers, switches, CTs, VTs, and so on, including interface to these such as AC inputs, contact I/O, transducer I/O, HardFiber I/O
Metering (Meter)	metering and measurement (other than PMU), including Signal Sources
General (Gen)	FlexLogic, virtual outputs, non-volatile latches, FlexElements, FlexMath, recording (for example oscillography), security, front panel, clock
Process Bus Module (PBus)	UR Process Bus Module functions, such as SV subscription, AC Banks, and process bus Time Synchronization. Order code requires a Process Bus Module. Logical device is read-only.

3.5.1 Enumerator list

The following two tables define the enumerators used in the sections that follow.

Table 3-10: Enumerations

Data attribute	FC	Enum Type
LLN0#.Beh.stVal	ST	BehKind2
<Any other LN>.Beh.stVal	ST	BehKind1
BkrCSWI#.CmdBlk.Oper.origin.orCat	CO	OriginatorCategoryKind

Data attribute	FC	Enum Type
BkrCSWI#.CmdBlk.Cancel.origin.orCat	CO	OriginatorCategoryKind
BkrCSWI#.CmdBlk.pulseConfig.cmdQual	CF	ControlOutputKind2
BkrCSWI#.CmdBlk.ctlModel	CF	CtlModelKind3
BkrCSWI#.CmdBlk.sboClass	CF	SboClassKind1
BkrCSWI#.Pos.SBOw.origin.orCat	CO	OriginatorCategoryKind
BkrCSWI#.Pos.Oper.origin.orCat	CO	OriginatorCategoryKind
BkrCSWI#.Pos.Cancel.origin.orCat	CO	OriginatorCategoryKind
BkrCSWI#.Pos.pulseConfig.cmdQual	CF	ControlOutputKind1
BkrCSWI#.Pos.ctlModel	CF	CtlModelKind
BkrCSWI#.Pos.sboClass	CF	SboClassKind1
BkrCSWI#.BlkOpn.pulseConfig.cmdQual	CF	ControlOutputKind2
BkrCSWI#.BlkOpn.ctlModel	CF	CtlModelKind3
BkrCSWI#.BlkOpn.sboClass	CF	SboClassKind1
BkrCSWI#.BlkOpn.Oper.origin.orCat	CO	OriginatorCategoryKind
BkrCSWI#.BlkOpn.Cancel.origin.orCat	CO	OriginatorCategoryKind
BkrCSWI#.BlkCls.pulseConfig.cmdQual	CF	ControlOutputKind2
BkrCSWI#.BlkCls.ctlModel	CF	CtlModelKind3
BkrCSWI#.BlkCls.sboClass	CF	SboClassKind1
BkrCSWI#.BlkCls.Oper.origin.orCat	CO	OriginatorCategoryKind
BkrCSWI#.BlkCls.Cancel.origin.orCat	CO	OriginatorCategoryKind
DiscCSWI#.CmdBlk.Oper.origin.orCat	CO	OriginatorCategoryKind
DiscCSWI#.CmdBlk.Cancel.origin.orCat	CO	OriginatorCategoryKind
DiscCSWI#.CmdBlk.pulseConfig.cmdQual	CF	ControlOutputKind1
DiscCSWI#.CmdBlk.ctlModel	CF	CtlModelKind3
DiscCSWI#.CmdBlk.sboClass	CF	SboClassKind1
DiscCSWI#.Pos.SBOw.origin.orCat	CO	OriginatorCategoryKind
DiscCSWI#.Pos.Oper.origin.orCat	CO	OriginatorCategoryKind
DiscCSWI#.Pos.Cancel.origin.orCat	CO	OriginatorCategoryKind
DiscCSWI#.Pos.pulseConfig.cmdQual	CF	ControlOutputKind1
DiscCSWI#.Pos.ctlModel	CF	CtlModelKind
DiscCSWI#.Pos.sboClass	CF	SboClassKind1
DiscCSWI#.BlkOpn.pulseConfig.cmdQual	CF	ControlOutputKind1
DiscCSWI#.BlkOpn.ctlModel	CF	CtlModelKind3
DiscCSWI#.BlkOpn.sboClass	CF	SboClassKind1
DiscCSWI#.BlkOpn.Oper.origin.orCat	CO	OriginatorCategoryKind
DiscCSWI#.BlkOpn.Cancel.origin.orCat	CO	OriginatorCategoryKind
DiscCSWI#.BlkCls.pulseConfig.cmdQual	CF	ControlOutputKind1
DiscCSWI#.BlkCls.ctlModel	CF	CtlModelKind3
DiscCSWI#.BlkCls.sboClass	CF	SboClassKind1
DiscCSWI#.BlkCls.Oper.origin.orCat	CO	OriginatorCategoryKind
DiscCSWI#.BlkCls.Cancel.origin.orCat	CO	OriginatorCategoryKind
BkrCSWI#.TagOn.SBOw.origin.orCat	CO	OriginatorCategoryKind
BkrCSWI#.TagOn.Oper.origin.orCat	CO	OriginatorCategoryKind
BkrCSWI#.TagOn.Cancel.origin.orCat	CO	OriginatorCategoryKind
BkrCSWI#.TagOn.pulseConfig.cmdQual	CF	ControlOutputKind1
BkrCSWI#.TagOn.ctlModel	CF	CtlModelKind
BkrCSWI#.TagOn.sboClass	CF	SboClassKind1

Data attribute	FC	Enum Type
DiscCSWI#.TagOn.SBOw.origin.orCat	CO	OriginatorCategoryKind
DiscCSWI#.TagOn.Oper.origin.orCat	CO	OriginatorCategoryKind
DiscCSWI#.TagOn.Cancel.origin.orCat	CO	OriginatorCategoryKind
DiscCSWI#.TagOn.pulseConfig.cmdQual	CF	ControlOutputKind1
DiscCSWI#.TagOn.ctlModel	CF	CtlModelKind
DiscCSWI#.TagOn.sboClass	CF	SboClassKind1
PIDRegFPID#.Out.units.SIUnit	CF	SIUnitKind
PIDRegFPID#.Out.units.multiplier	CF	MultiplierKind
PIDRegFPID#.DeltaOut.units.SIUnit	CF	SIUnitKind
PIDRegFPID#.DeltaOut.units.multiplier	CF	MultiplierKind
PIDRegFPID#.Spt.units.SIUnit	CF	SIUnitKind
PIDRegFPID#.Spt.units.multiplier	CF	MultiplierKind
PIDRegFPID#.KP.units.SIUnit	CF	SIUnitKind
PIDRegFPID#.KP.units.multiplier	CF	MultiplierKind
PIDRegFPID#.KI.units.SIUnit	CF	SIUnitKind
PIDRegFPID#.KI.units.multiplier	CF	MultiplierKind
PIDRegFPID#.ITmms.units.SIUnit	CF	SIUnitKind
PIDRegFPID#.ITmms.units.multiplier	CF	MultiplierKind
PIDRegFPID#.KD.units.SIUnit	CF	SIUnitKind
PIDRegFPID#.KD.units.multiplier	CF	MultiplierKind
PIDRegFPID#.DTmms.units.SIUnit	CF	SIUnitKind
PIDRegFPID#.DTmms.units.multiplier	CF	MultiplierKind
PIDRegFPID#.DFilTmms.units.SIUnit	CF	SIUnitKind
PIDRegFPID#.DFilTmms.units.multiplier	CF	MultiplierKind
PhCmp1FXOT#.StrVal.units.SIUnit	CF	SIUnitKind
PhCmp1FXOT#.StrVal.units.multiplier	CF	MultiplierKind
PhCmp2FXOT#.StrVal.units.SIUnit	CF	SIUnitKind
PhCmp2FXOT#.StrVal.units.multiplier	CF	MultiplierKind
PhCmp3FXOT#.StrVal.units.SIUnit	CF	SIUnitKind
PhCmp3FXOT#.StrVal.units.multiplier	CF	MultiplierKind
PhCmp4FXOT#.StrVal.units.SIUnit	CF	SIUnitKind
PhCmp4FXOT#.StrVal.units.multiplier	CF	MultiplierKind
PhCmp5FXOT#.StrVal.units.SIUnit	CF	SIUnitKind
PhCmp5FXOT#.StrVal.units.multiplier	CF	MultiplierKind
ColdFXUT#.StrVal.units.SIUnit	CF	SIUnitKind
ColdFXUT#.StrVal.units.multiplier	CF	MultiplierKind
TmDayGAPC#.SecondOfDay.units.SIUnit	CF	SIUnitKind
TmDayGAPC#.SecondOfDay.units.multiplier	CF	MultiplierKind
Cmp8BtGAPC#.Str.dirGeneral	ST	FaultDirectionKind
DgtzrGAPC#.Out.units.SIUnit	CF	SIUnitKind
DgtzrGAPC#.Out.units.multiplier	CF	MultiplierKind
CnMntrGAPC#.Str.dirGeneral	ST	FaultDirectionKind
DigElGAPC#.Str.dirGeneral	ST	FaultDirectionKind
FlxElGAPC#.Str.dirGeneral	ST	FaultDirectionKind
FlxElGAPC#.OpSig.units.SIUnit	CF	SIUnitKind
FlxElGAPC#.OpSig.units.multiplier	CF	MultiplierKind
FlxLgcGAPC#.Health.stVal	ST	HealthKind

Data attribute	FC	Enum Type
CapCtlGAPC#.DischargeTms.units.SIUnit	CF	SIUnitKind
CapCtlGAPC#.DischargeTms.units.multiplier	CF	MultiplierKind
GGIO1.Health.stVal	ST	HealthKind
GGIO2.SPCSO001.Oper.origin.orCat	CO	OriginatorCategoryKind
GGIO2.SPCSO001.Cancel.origin.orCat	CO	OriginatorCategoryKind
GGIO2.SPCSO001.pulseConfig.cmdQual	CF	ControlOutputKind1
GGIO2.SPCSO001.ctlModel	CF	CtlModelKind3
GGIO2.SPCSO001.sboClass	CF	SboClassKind1
......		
GGIO2.SPCSO128.Oper.origin.orCat	CO	OriginatorCategoryKind
GGIO3.SPCSO128.Cancel.origin.orCat	CO	OriginatorCategoryKind
GGIO3.SPCSO128.pulseConfig.cmdQual	CF	ControlOutputKind1
GGIO#.SPCSO128.ctlModel	CF	CtlModelKind3
GGIO3.SPCSO128.sboClass	CF	SboClassKind1
FRTDsGGIO#.AnIn1.units.SIUnit	CF	SIUnitKind
FRTDsGGIO#.AnIn1.units.multiplier	CF	MultiplierKind
FRTDsGGIO#.AnIn2.units.SIUnit	CF	SIUnitKind
FRTDsGGIO#.AnIn2.units.multiplier	CF	MultiplierKind
FRTDsGGIO#.AnIn3.units.SIUnit	CF	SIUnitKind
FRTDsGGIO#.AnIn3.units.multiplier	CF	MultiplierKind
FRTDsGGIO#.AnIn4.units.SIUnit	CF	SIUnitKind
FRTDsGGIO#.AnIn4.units.multiplier	CF	MultiplierKind
FRTDsGGIO#.AnIn5.units.SIUnit	CF	SIUnitKind
FRTDsGGIO#.AnIn5.units.multiplier	CF	MultiplierKind
FRTDsGGIO#.AnIn6.units.SIUnit	CF	SIUnitKind
FRTDsGGIO#.AnIn6.units.multiplier	CF	MultiplierKind
FRTDsGGIO#.AnIn7.units.SIUnit	CF	SIUnitKind
FRTDsGGIO#.AnIn7.units.multiplier	CF	MultiplierKind
FRTDsGGIO#.AnIn8.units.SIUnit	CF	SIUnitKind
FRTDsGGIO#.AnIn8.units.multiplier	CF	MultiplierKind
TRTDsGGIO#.AnIn01.units.SIUnit	CF	SIUnitKind
TRTDsGGIO#.AnIn01.units.multiplier	CF	MultiplierKind
TRTDsGGIO#.AnIn02.units.SIUnit	CF	SIUnitKind
TRTDsGGIO#.AnIn02.units.multiplier	CF	MultiplierKind
TRTDsGGIO#.AnIn03.units.SIUnit	CF	SIUnitKind
TRTDsGGIO#.AnIn03.units.multiplier	CF	MultiplierKind
TRTDsGGIO#.AnIn04.units.SIUnit	CF	SIUnitKind
TRTDsGGIO#.AnIn04.units.multiplier	CF	MultiplierKind
SecGSAL#.AuthFail.sev	ST	SeverityKind
SecGSAL#.AcsCtlFail.sev	ST	SeverityKind
SecGSAL#.SvcViol.sev	ST	SeverityKind
SecGSAL#.Ina.sev	ST	SeverityKind
SecGSAL#.SecDataClr.Oper.origin.orCat	CO	OriginatorCategoryKind
SecGSAL#.SecDataClr.Cancel.origin.orCat	CO	OriginatorCategoryKind
SecGSAL#.SecDataClr.pulseConfig.cmdQual	CF	ControlOutputKind1
SecGSAL#.SecDataClr.ctlModel	CF	CtlModelKind3
SecGSAL#.SecDataClr.sboClass	CF	SboClassKind1

Data attribute	FC	Enum Type
SecGSAL#.OpCntRs.Oper.origin.orCat	CO	OriginatorCategoryKind
SecGSAL#.OpCntRs.Cancel.origin.orCat	CO	OriginatorCategoryKind
SecGSAL#.OpCntRs.ctlModel	CF	CtlModelKind3
SecGSAL#.OpCntRs.sboClass	CF	SboClassKind1
LGOS#.LastStNum.units.SIUnit	CF	SIUnitKind
LGOS#.LastStNum.units.multiplier	CF	MultiplierKind
LGOS#.LastSqNum.units.SIUnit	CF	SIUnitKind
LGOS#.LastSqNum.units.multiplier	CF	MultiplierKind
LGOS#.RxConfRevNum.units.SIUnit	CF	SIUnitKind
LGOS#.RxConfRevNum.units.multiplier	CF	MultiplierKind
LGOS#.APPID.units.SIUnit	CF	SIUnitKind
LGOS#.APPID.units.multiplier	CF	MultiplierKind
LGOS#.ConfRevNum.units.SIUnit	CF	SIUnitKind
LGOS#.ConfRevNum.units.multiplier	CF	MultiplierKind
LPHD#.PhyHealth.stVal	ST	HealthKind
LPHD#.RsStat.Oper.origin.orCat	CO	OriginatorCategoryKind
LPHD#.RsStat.Cancel.origin.orCat	CO	OriginatorCategoryKind
LPHD#.RsStat.pulseConfig.cmdQual	CF	ControlOutputKind1
LPHD#.RsStat.ctlModel	CF	CtlModelKind3
LPHD#.RsStat.sboClass	CF	SboClassKind1
LPHD#.Sim.Oper.origin.orCat	CO	OriginatorCategoryKind
LPHD#.Sim.Cancel.origin.orCat	CO	OriginatorCategoryKind
LPHD#.Sim.pulseConfig.cmdQual	CF	ControlOutputKind1
LPHD#.Sim.ctlModel	CF	CtlModelKind3
LPHD#.Sim.sboClass	CF	SboClassKind1
LPHD#.TxGoSim.Oper.origin.orCat	CO	OriginatorCategoryKind
LPHD#.TxGoSim.Cancel.origin.orCat	CO	OriginatorCategoryKind
LPHD#.TxGoSim.pulseConfig.cmdQual	CF	ControlOutputKind1
LPHD#.TxGoSim.ctlModel	CF	CtlModelKind3
LPHD#.TxGoSim.sboClass	CF	SboClassKind1
LPHD#.MMSConnects.units.SIUnit	CF	SIUnitKind
LPHD#.MMSConnects.units.multiplier	CF	MultiplierKind
LPHD#.RlyUTCTms.units.SIUnit	CF	SIUnitKind
LPHD#.RlyUTCTms.units.multiplier	CF	MultiplierKind
TmClkLTMS#.TmSynSrc.stVal	ST	GE_Digital_Energy_UR_TimeSourceKind
TmClkLTMS#.TmnsDelta.units.SIUnit	CF	SIUnitKind
TmClkLTMS#.TmnsDelta.units.multiplier	CF	MultiplierKind
HThdMHAI#.Hz.units.SIUnit	CF	SIUnitKind
HThdMHAI#.Hz.units.multiplier	CF	MultiplierKind
EnrMtrMMTR#.PosTotWh.units.SIUnit	CF	SIUnitKind
EnrMtrMMTR#.PosTotWh.units.multiplier	CF	MultiplierKind
EnrMtrMMTR#.NegTotWh.units.SIUnit	CF	SIUnitKind
EnrMtrMMTR#.NegTotWh.units.multiplier	CF	MultiplierKind
EnrMtrMMTR#.PosTotVArh.units.SIUnit	CF	SIUnitKind
EnrMtrMMTR#.PosTotVArh.units.multiplier	CF	MultiplierKind
EnrMtrMMTR#.NegTotVArh.units.SIUnit	CF	SIUnitKind
EnrMtrMMTR#.NegTotVArh.units.multiplier	CF	MultiplierKind

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Data attribute	FC	Enum Type
EnrMtrMMTR#.RsStat.Oper.origin.orCat	CO	OriginatorCategoryKind
EnrMtrMMTR#.RsStat.Cancel.origin.orCat	CO	OriginatorCategoryKind
EnrMtrMMTR#.RsStat.pulseConfig.cmdQual	CF	ControlOutputKind1
EnrMtrMMTR#.RsStat.ctlModel	CF	CtlModelKind3
EnrMtrMMTR#.RsStat.sboClass	CF	SboClassKind1
B_AmpMMXN#.ChA.units.SIUnit	CF	SIUnitKind
B_AmpMMXN#.ChA.units.multiplier	CF	MultiplierKind
B_VolMMXN#.ChV.units.SIUnit	CF	SIUnitKind
B_VolMMXN#.ChV.units.multiplier	CF	MultiplierKind
B_IocPIOC#.Str.dirGeneral	ST	FaultDirectionKind
B_IocPIOC#.Str.dirPhsA	ST	PhaseFaultDirectionKind
B_IocPIOC#.Str.dirPhsB	ST	PhaseFaultDirectionKind
B_IocPIOC#.Str.dirPhsC	ST	PhaseFaultDirectionKind
B_FrqMMXN#.Hz.units.SIUnit	CF	SIUnitKind
B_FrqMMXN#.Hz.units.multiplier	CF	MultiplierKind
B_FrqMMXN#.TrcHz.units.SIUnit	CF	SIUnitKind
B_FrqMMXN#.TrcHz.units.multiplier	CF	MultiplierKind
ACsrcMMXN#.Vaux.units.SIUnit	CF	SIUnitKind
ACsrcMMXN#.Vaux.units.multiplier	CF	MultiplierKind
ACsrcMMXN#.Vaux.angRef	CF	PhaseAngleReferenceKind
ACsrcMMXN#.VauxRMS.units.SIUnit	CF	SIUnitKind
ACsrcMMXN#.VauxRMS.units.multiplier	CF	MultiplierKind
ACsrcMMXN#.Agnd.units.SIUnit	CF	SIUnitKind
ACsrcMMXN#.Agnd.units.multiplier	CF	MultiplierKind
ACsrcMMXN#.Agnd.angRef	CF	PhaseAngleReferenceKind
ACsrcMMXN#.AgndRMS.units.SIUnit	CF	SIUnitKind
ACsrcMMXN#.AgndRMS.units.multiplier	CF	MultiplierKind
ACsrcMMXU#.Str.dirGeneral	ST	FaultDirectionKind
ACsrcMMXU#.TotW.units.SIUnit	CF	SIUnitKind
ACsrcMMXU#.TotW.units.multiplier	CF	MultiplierKind
ACsrcMMXU#.TotVAr.units.SIUnit	CF	SIUnitKind
ACsrcMMXU#.TotVAr.units.multiplier	CF	MultiplierKind
ACsrcMMXU#.TotVA.units.SIUnit	CF	SIUnitKind
ACsrcMMXU#.TotVA.units.multiplier	CF	MultiplierKind
ACsrcMMXU#.TotPF.units.SIUnit	CF	SIUnitKind
ACsrcMMXU#.TotPF.units.multiplier	CF	MultiplierKind
ACsrcMMXU#.Hz.units.SIUnit	CF	SIUnitKind
ACsrcMMXU#.Hz.units.multiplier	CF	MultiplierKind
ACsrcMMXU#.PPV.angRef	CF	PhaseAngleReferenceKind
ACsrcMMXU#.VabRMS.units.SIUnit	CF	SIUnitKind
ACsrcMMXU#.VabRMS.units.multiplier	CF	MultiplierKind
ACsrcMMXU#.VbcRMS.units.SIUnit	CF	SIUnitKind
ACsrcMMXU#.VbcRMS.units.multiplier	CF	MultiplierKind
ACsrcMMXU#.VcaRMS.units.SIUnit	CF	SIUnitKind
ACsrcMMXU#.VcaRMS.units.multiplier	CF	MultiplierKind
ACsrcMMXU#.PhV.angRef	CF	PhaseAngleReferenceKind
ACsrcMMXU#.VaRMS.units.SIUnit	CF	SIUnitKind

Data attribute	FC	Enum Type
ACsrcMMXU#.VaRMS.units.multiplier	CF	MultiplierKind
ACsrcMMXU#.VbRMS.units.SIUnit	CF	SIUnitKind
ACsrcMMXU#.VbRMS.units.multiplier	CF	MultiplierKind
ACsrcMMXU#.VcRMS.units.SIUnit	CF	SIUnitKind
ACsrcMMXU#.VcRMS.units.multiplier	CF	MultiplierKind
ACsrcMMXU#.A.angRef	CF	PhaseAngleReferenceKind
ACsrcMMXU#.AaRMS.units.SIUnit	CF	SIUnitKind
ACsrcMMXU#.AaRMS.units.multiplier	CF	MultiplierKind
ACsrcMMXU#.AbRMS.units.SIUnit	CF	SIUnitKind
ACsrcMMXU#.AbRMS.units.multiplier	CF	MultiplierKind
ACsrcMMXU#.AcRMS.units.SIUnit	CF	SIUnitKind
ACsrcMMXU#.AcRMS.units.multiplier	CF	MultiplierKind
ACsrcMMXU#.AresRMS.units.SIUnit	CF	SIUnitKind
ACsrcMMXU#.AresRMS.units.multiplier	CF	MultiplierKind
ACsrcMMXU#.Adif.units.SIUnit	CF	SIUnitKind
ACsrcMMXU#.Adif.units.multiplier	CF	MultiplierKind
ACsrcMMXU#.Adif.angRef	CF	PhaseAngleReferenceKind
LinDf0MMXU#.A.angRef	CF	PhaseAngleReferenceKind
LinDf1MMXU#.A.angRef	CF	PhaseAngleReferenceKind
LinDf2MMXU#.A.angRef	CF	PhaseAngleReferenceKind
VCompMMXU#.VolLoc.units.SIUnit	CF	SIUnitKind
VCompMMXU#.VolLoc.units.multiplier	CF	MultiplierKind
VCompMMXU#.VolRem1.units.SIUnit	CF	SIUnitKind
VCompMMXU#.VolRem1.units.multiplier	CF	MultiplierKind
VCompMMXU#.VolRem2.units.SIUnit	CF	SIUnitKind
VCompMMXU#.VolRem2.units.multiplier	CF	MultiplierKind
ACsrcMSQI#.SeqA.seqT	MX	SequenceKind
ACsrcMSQI#.SeqA.phsRef	CF	PhaseReferenceKind
ACsrcMSQI#.SeqV.seqT	MX	SequenceKind
ACsrcMSQI#.SeqV.phsRef	CF	PhaseReferenceKind
PctDifPDIF#.Str.dirGeneral	ST	FaultDirectionKind
PctDifPDIF#.Str.dirPhsA	ST	PhaseFaultDirectionKind
PctDifPDIF#.Str.dirPhsB	ST	PhaseFaultDirectionKind
PctDifPDIF#.Str.dirPhsC	ST	PhaseFaultDirectionKind
PctDifPDIF#.RefWinding.units.SIUnit	CF	SIUnitKind
PctDifPDIF#.RefWinding.units.multiplier	CF	MultiplierKind
PctDifPDIF#.DifAClc.angRef	CF	PhaseAngleReferenceKind
PctDifPDIF#.DifA2ndH.angRef	CF	PhaseAngleReferenceKind
PctDifPDIF#.DifA5thH.angRef	CF	PhaseAngleReferenceKind
PctDifPDIF#.RstA.angRef	CF	PhaseAngleReferenceKind
VDif1PDIF#.Str.dirGeneral	ST	FaultDirectionKind
VDif1PDIF#.Str.dirPhsA	ST	PhaseFaultDirectionKind
VDif1PDIF#.Str.dirPhsB	ST	PhaseFaultDirectionKind
VDif1PDIF#.Str.dirPhsC	ST	PhaseFaultDirectionKind
VDif2PDIF#.Str.dirGeneral	ST	FaultDirectionKind
VDif2PDIF#.Str.dirPhsA	ST	PhaseFaultDirectionKind
VDif2PDIF#.Str.dirPhsB	ST	PhaseFaultDirectionKind

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Data attribute	FC	Enum Type
VDif2PDIF#.Str.dirPhsC	ST	PhaseFaultDirectionKind
VDif3PDIF#.Str.dirGeneral	ST	FaultDirectionKind
VDif3PDIF#.Str.dirPhsA	ST	PhaseFaultDirectionKind
VDif3PDIF#.Str.dirPhsB	ST	PhaseFaultDirectionKind
VDif3PDIF#.Str.dirPhsC	ST	PhaseFaultDirectionKind
VDif4PDIF#.Str.dirGeneral	ST	FaultDirectionKind
VDif4PDIF#.Str.dirPhsA	ST	PhaseFaultDirectionKind
VDif4PDIF#.Str.dirPhsB	ST	PhaseFaultDirectionKind
VDif4PDIF#.Str.dirPhsC	ST	PhaseFaultDirectionKind
PhCmp1PDIF#.Str.dirGeneral	ST	FaultDirectionKind
PhCmp1PDIF#.CmpCt1I1.units.SIUnit	CF	SIUnitKind
PhCmp1PDIF#.CmpCt1I1.units.multiplier	CF	MultiplierKind
PhCmp1PDIF#.CmpCt2I1.units.SIUnit	CF	SIUnitKind
PhCmp1PDIF#.CmpCt2I1.units.multiplier	CF	MultiplierKind
PhCmp1PDIF#.CmpCt1I2.units.SIUnit	CF	SIUnitKind
PhCmp1PDIF#.CmpCt1I2.units.multiplier	CF	MultiplierKind
PhCmp1PDIF#.CmpCt2I2.units.SIUnit	CF	SIUnitKind
PhCmp1PDIF#.CmpCt2I2.units.multiplier	CF	MultiplierKind
RgDifPDIF#.Str.dirGeneral	ST	FaultDirectionKind
B_DifPDIF#.StrBia.dirGeneral	ST	FaultDirectionKind
B_DifPDIF#.BDifAClc.units.SIUnit	CF	SIUnitKind
B_DifPDIF#.BDifAClc.units.multiplier	CF	MultiplierKind
B_DifPDIF#.BRstA.units.SIUnit	CF	SIUnitKind
B_DifPDIF#.BRstA.units.multiplier	CF	MultiplierKind
SttDifPDIF#.Str.dirGeneral	ST	FaultDirectionKind
SttDifPDIF#.Str.dirPhsA	ST	PhaseFaultDirectionKind
SttDifPDIF#.Str.dirPhsB	ST	PhaseFaultDirectionKind
SttDifPDIF#.Str.dirPhsC	ST	PhaseFaultDirectionKind
LinDfPDIF#.Str.dirGeneral	ST	FaultDirectionKind
LinDfPDIF#.Str.dirPhsA	ST	PhaseFaultDirectionKind
LinDfPDIF#.Str.dirPhsB	ST	PhaseFaultDirectionKind
LinDfPDIF#.Str.dirPhsC	ST	PhaseFaultDirectionKind
LinDfPDIF#.DifAClc.angRef	CF	PhaseAngleReferenceKind
LinDfPDIF#.RstA.angRef	CF	PhaseAngleReferenceKind
BusDifPDIF#.Str.dirGeneral	ST	FaultDirectionKind
BusDifPDIF#.Str.dirPhsA	ST	PhaseFaultDirectionKind
BusDifPDIF#.Str.dirPhsB	ST	PhaseFaultDirectionKind
BusDifPDIF#.Str.dirPhsC	ST	PhaseFaultDirectionKind
BusDifPDIF#.DifAClc.angRef	CF	PhaseAngleReferenceKind
BusDifPDIF#.RstA.angRef	CF	PhaseAngleReferenceKind
SpltPhPDIF#.Str.dirGeneral	ST	FaultDirectionKind
SpltPhPDIF#.Str.dirPhsA	ST	PhaseFaultDirectionKind
SpltPhPDIF#.Str.dirPhsB	ST	PhaseFaultDirectionKind
SpltPhPDIF#.Str.dirPhsC	ST	PhaseFaultDirectionKind
VDifPDIF#.Str.dirGeneral	ST	FaultDirectionKind
VDifPDIF#.Str.dirPhsA	ST	PhaseFaultDirectionKind
VDifPDIF#.Str.dirPhsB	ST	PhaseFaultDirectionKind

Data attribute	FC	Enum Type
VDifPDIF#.Str.dirPhsC	ST	PhaseFaultDirectionKind
PhsDisPDIS#.Str.dirGeneral	ST	FaultDirectionKind
GndDisPDIS#.Str.dirGeneral	ST	FaultDirectionKind
GndDisPDIS#.Str.dirPhsA	ST	PhaseFaultDirectionKind
GndDisPDIS#.Str.dirPhsB	ST	PhaseFaultDirectionKind
GndDisPDIS#.Str.dirPhsC	ST	PhaseFaultDirectionKind
LodEncPDIS#.Str.dirGeneral	ST	FaultDirectionKind
LosExtPDIS#.Str.dirGeneral	ST	FaultDirectionKind
LosExt1PDIS#.Str.dirGeneral	ST	FaultDirectionKind
LosExt2PDIS#.Str.dirGeneral	ST	FaultDirectionKind
SenPDOP#.Str.dirGeneral	ST	FaultDirectionKind
SenPDOP#.TotW.units.SIUnit	CF	SIUnitKind
SenPDOP#.TotW.units.multiplier	CF	MultiplierKind
Sen1PDOP#.Str.dirGeneral	ST	FaultDirectionKind
Sen2PDOP#.Str.dirGeneral	ST	FaultDirectionKind
UnPwrPDUP#.StrAlm.dirGeneral	ST	FaultDirectionKind
UnPwrPDUP#.Str.dirGeneral	ST	FaultDirectionKind
RteHzPFRC#.Str.dirGeneral	ST	FaultDirectionKind
RteHzPFRC#.HzChgRte.units.SIUnit	CF	SIUnitKind
RteHzPFRC#.HzChgRte.units.multiplier	CF	MultiplierKind
FldGnd0PHIZ#.Str.dirGeneral	ST	FaultDirectionKind
FldGnd0PHIZ#.GndRis.units.SIUnit	CF	SIUnitKind
FldGnd0PHIZ#.GndRis.units.multiplier	CF	MultiplierKind
FldGnd0PHIZ#.GndAmp.units.SIUnit	CF	SIUnitKind
FldGnd0PHIZ#.GndAmp.units.multiplier	CF	MultiplierKind
FldGnd0PHIZ#.Vol.units.SIUnit	CF	SIUnitKind
FldGnd0PHIZ#.Vol.units.multiplier	CF	MultiplierKind
FldGnd0PHIZ#.Amp.units.SIUnit	CF	SIUnitKind
FldGnd0PHIZ#.Amp.units.multiplier	CF	MultiplierKind
FldGnd0PHIZ#.InjVol.units.SIUnit	CF	SIUnitKind
FldGnd0PHIZ#.InjVol.units.multiplier	CF	MultiplierKind
FldGnd0PHIZ#.FltLocation.units.SIUnit	CF	SIUnitKind
FldGnd0PHIZ#.FltLocation.units.multiplier	CF	MultiplierKind
Statr1PHIZ#.Str.dirGeneral	ST	FaultDirectionKind
Statr2PHIZ#.Str.dirGeneral	ST	FaultDirectionKind
FldGnd1PHIZ#.Str.dirGeneral	ST	FaultDirectionKind
FldGnd2PHIZ#.Str.dirGeneral	ST	FaultDirectionKind
SubHa1PHIZ#.Str.dirGeneral	ST	FaultDirectionKind
SubHa2PHIZ#.Str.dirGeneral	ST	FaultDirectionKind
SubHaPHIZ#.Str.dirGeneral	ST	FaultDirectionKind
SubHaPHIZ#.GndRis.units.SIUnit	CF	SIUnitKind
SubHaPHIZ#.GndRis.units.multiplier	CF	MultiplierKind
SubHaPHIZ#.InjVol.units.SIUnit	CF	SIUnitKind
SubHaPHIZ#.InjVol.units.multiplier	CF	MultiplierKind
SubHaPHIZ#.InjAmp.units.SIUnit	CF	SIUnitKind
SubHaPHIZ#.InjAmp.units.multiplier	CF	MultiplierKind
SubHaPHIZ#.SHAmpAng.units.SIUnit	CF	SIUnitKind

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Data attribute	FC	Enum Type
SubHaPHIZ#.SHAmpAng.units.multiplier	CF	MultiplierKind
StatrPHIZ#.Str.dirGeneral	ST	FaultDirectionKind
StatrPHIZ#.Ha3NV.units.SIUnit	CF	SIUnitKind
StatrPHIZ#.Ha3NV.units.multiplier	CF	MultiplierKind
StatrPHIZ#.Ha3ZroV.units.SIUnit	CF	SIUnitKind
StatrPHIZ#.Ha3ZroV.units.multiplier	CF	MultiplierKind
StatrPHIZ#.SumHa3NVZroV.units.SIUnit	CF	SIUnitKind
StatrPHIZ#.SumHa3NVZroV.units.multiplier	CF	MultiplierKind
HiZPHIZ#.Str.dirGeneral	ST	FaultDirectionKind
HiZPHIZ#.HiZSt.stVal	ST	GE_Digital_Energy_UR_HiZStKind
HiZPHIZ#.ArcConfidA.units.SIUnit	CF	SIUnitKind
HiZPHIZ#.ArcConfidA.units.multiplier	CF	MultiplierKind
HiZPHIZ#.ArcConfidB.units.SIUnit	CF	SIUnitKind
HiZPHIZ#.ArcConfidB.units.multiplier	CF	MultiplierKind
HiZPHIZ#.ArcConfidC.units.SIUnit	CF	SIUnitKind
HiZPHIZ#.ArcConfidC.units.multiplier	CF	MultiplierKind
HiZPHIZ#.ArcConfidN.units.SIUnit	CF	SIUnitKind
HiZPHIZ#.ArcConfidN.units.multiplier	CF	MultiplierKind
HiZPHIZ#.Trigger11.stVal	ST	GE_Digital_Energy_UR_TriggerKind
HiZPHIZ#.Trigger12.stVal	ST	GE_Digital_Energy_UR_TriggerKind
HiZPHIZ#.Trigger13.stVal	ST	GE_Digital_Energy_UR_TriggerKind
HiZPHIZ#.Trigger14.stVal	ST	GE_Digital_Energy_UR_TriggerKind
HiZPHIZ#.Trigger21.stVal	ST	GE_Digital_Energy_UR_TriggerKind
HiZPHIZ#.Trigger22.stVal	ST	GE_Digital_Energy_UR_TriggerKind
HiZPHIZ#.Trigger23.stVal	ST	GE_Digital_Energy_UR_TriggerKind
HiZPHIZ#.Trigger24.stVal	ST	GE_Digital_Energy_UR_TriggerKind
HiZPHIZ#.ClrMem.Oper.origin.orCat	CO	OriginatorCategoryKind
HiZPHIZ#.ClrMem.Cancel.origin.orCat	CO	OriginatorCategoryKind
HiZPHIZ#.ClrMem.pulseConfig.cmdQual	CF	ControlOutputKind1
HiZPHIZ#.ClrMem.ctlModel	CF	CtlModelKind3
HiZPHIZ#.ClrMem.sboClass	CF	SboClassKind1
HiZPHIZ#.FrcTrigger.Oper.origin.orCat	CO	OriginatorCategoryKind
HiZPHIZ#.FrcTrigger.Cancel.origin.orCat	CO	OriginatorCategoryKind
HiZPHIZ#.FrcTrigger.pulseConfig.cmdQual	CF	ControlOutputKind1
HiZPHIZ#.FrcTrigger.ctlModel	CF	CtlModelKind3
HiZPHIZ#.FrcTrigger.sboClass	CF	SboClassKind1
HiZPHIZ#.AlgCap.Oper.origin.orCat	CO	OriginatorCategoryKind
HiZPHIZ#.AlgCap.Cancel.origin.orCat	CO	OriginatorCategoryKind
HiZPHIZ#.AlgCap.pulseConfig.cmdQual	CF	ControlOutputKind1
HiZPHIZ#.AlgCap.ctlModel	CF	CtlModelKind3
HiZPHIZ#.AlgCap.sboClass	CF	SboClassKind1
HiZPHIZ#.ReSigma.Oper.origin.orCat	CO	OriginatorCategoryKind
HiZPHIZ#.ReSigma.Cancel.origin.orCat	CO	OriginatorCategoryKind
HiZPHIZ#.ReSigma.pulseConfig.cmdQual	CF	ControlOutputKind1
HiZPHIZ#.ReSigma.ctlModel	CF	CtlModelKind3
HiZPHIZ#.ReSigma.sboClass	CF	SboClassKind1
PhsIocPIOC#.Str.dirGeneral	ST	FaultDirectionKind

Data attribute	FC	Enum Type
PhsIocPIOC#.Str.dirPhsA	ST	PhaseFaultDirectionKind
PhsIocPIOC#.Str.dirPhsB	ST	PhaseFaultDirectionKind
PhsIocPIOC#.Str.dirPhsC	ST	PhaseFaultDirectionKind
LinPkpPIOC#.Str.dirGeneral	ST	FaultDirectionKind
NeuIocPIOC#.Str.dirGeneral	ST	FaultDirectionKind
GndIocPIOC#.Str.dirGeneral	ST	FaultDirectionKind
NegIocPIOC#.Str.dirGeneral	ST	FaultDirectionKind
B_EfpPIOC#.Str.dirGeneral	ST	FaultDirectionKind
CtFailPIOC#.Str.dirGeneral	ST	FaultDirectionKind
BknCndPIOC#.Str.dirGeneral	ST	FaultDirectionKind
FlshOvPIOC#.Str.dirGeneral	ST	FaultDirectionKind
FlshOvPIOC#.Str.dirPhsA	ST	PhaseFaultDirectionKind
FlshOvPIOC#.Str.dirPhsB	ST	PhaseFaultDirectionKind
FlshOvPIOC#.Str.dirPhsC	ST	PhaseFaultDirectionKind
TmBtwnPMRI#.Str.dirGeneral	ST	FaultDirectionKind
StrRtePMRI#.Str.dirGeneral	ST	FaultDirectionKind
StrRtePMRI#.StrHrLOTm.units.SIUnit	CF	SIUnitKind
StrRtePMRI#.StrHrLOTm.units.multiplier	CF	MultiplierKind
MecJamPMSS#.Str.dirGeneral	ST	FaultDirectionKind
MAccTmPMSS#.StrTD1.units.SIUnit	CF	SIUnitKind
MAccTmPMSS#.StrTD1.units.multiplier	CF	MultiplierKind
MAccTmPMSS#.StrTD2.units.SIUnit	CF	SIUnitKind
MAccTmPMSS#.StrTD2.units.multiplier	CF	MultiplierKind
MAccTmPMSS#.StrTD3.units.SIUnit	CF	SIUnitKind
MAccTmPMSS#.StrTD3.units.multiplier	CF	MultiplierKind
MAccTmPMSS#.StrTD4.units.SIUnit	CF	SIUnitKind
MAccTmPMSS#.StrTD4.units.multiplier	CF	MultiplierKind
MAccTmPMSS#.StrTD5.units.SIUnit	CF	SIUnitKind
MAccTmPMSS#.StrTD5.units.multiplier	CF	MultiplierKind
MAccTmPMSS#.StrAccTm1.units.SIUnit	CF	SIUnitKind
MAccTmPMSS#.StrAccTm1.units.multiplier	CF	MultiplierKind
MAccTmPMSS#.StrAccTm2.units.SIUnit	CF	SIUnitKind
MAccTmPMSS#.StrAccTm2.units.multiplier	CF	MultiplierKind
MAccTmPMSS#.StrAccTm3.units.SIUnit	CF	SIUnitKind
MAccTmPMSS#.StrAccTm3.units.multiplier	CF	MultiplierKind
MAccTmPMSS#.StrAccTm4.units.SIUnit	CF	SIUnitKind
MAccTmPMSS#.StrAccTm4.units.multiplier	CF	MultiplierKind
MAccTmPMSS#.StrAccTm5.units.SIUnit	CF	SIUnitKind
MAccTmPMSS#.StrAccTm5.units.multiplier	CF	MultiplierKind
MAccTmPMSS#.StrEffA1.units.SIUnit	CF	SIUnitKind
MAccTmPMSS#.StrEffA1.units.multiplier	CF	MultiplierKind
MAccTmPMSS#.StrEffA2.units.SIUnit	CF	SIUnitKind
MAccTmPMSS#.StrEffA2.units.multiplier	CF	MultiplierKind
MAccTmPMSS#.StrEffA3.units.SIUnit	CF	SIUnitKind
MAccTmPMSS#.StrEffA3.units.multiplier	CF	MultiplierKind
MAccTmPMSS#.StrEffA4.units.SIUnit	CF	SIUnitKind
MAccTmPMSS#.StrEffA4.units.multiplier	CF	MultiplierKind

Data attribute	FC	Enum Type
MAccTmPMSS#.StrEffA5.units.SIUnit	CF	SIUnitKind
MAccTmPMSS#.StrEffA5.units.multiplier	CF	MultiplierKind
MAccTmPMSS#.StrPeakA1.units.SIUnit	CF	SIUnitKind
MAccTmPMSS#.StrPeakA1.units.multiplier	CF	MultiplierKind
MAccTmPMSS#.StrPeakA2.units.SIUnit	CF	SIUnitKind
MAccTmPMSS#.StrPeakA2.units.multiplier	CF	MultiplierKind
MAccTmPMSS#.StrPeakA3.units.SIUnit	CF	SIUnitKind
MAccTmPMSS#.StrPeakA3.units.multiplier	CF	MultiplierKind
MAccTmPMSS#.StrPeakA4.units.SIUnit	CF	SIUnitKind
MAccTmPMSS#.StrPeakA4.units.multiplier	CF	MultiplierKind
MAccTmPMSS#.StrPeakA5.units.SIUnit	CF	SIUnitKind
MAccTmPMSS#.StrPeakA5.units.multiplier	CF	MultiplierKind
WattPSDE#.Str.dirGeneral	ST	FaultDirectionKind
WattPSDE#.Watt.units.SIUnit	CF	SIUnitKind
WattPSDE#.Watt.units.multiplier	CF	MultiplierKind
ICFltPTEF#.Str.dirGeneral	ST	FaultDirectionKind
ICFltPTEF#.Str.dirPhsA	ST	PhaseFaultDirectionKind
ICFltPTEF#.Str.dirPhsB	ST	PhaseFaultDirectionKind
ICFltPTEF#.Str.dirPhsC	ST	PhaseFaultDirectionKind
ICFltPTEF#.FltCntPh1.units.SIUnit	CF	SIUnitKind
ICFltPTEF#.FltCntPh1.units.multiplier	CF	MultiplierKind
ICFltPTEF#.FltCntPh2.units.SIUnit	CF	SIUnitKind
ICFltPTEF#.FltCntPh2.units.multiplier	CF	MultiplierKind
ICFltPTEF#.FltCntPh3.units.SIUnit	CF	SIUnitKind
ICFltPTEF#.FltCntPh3.units.multiplier	CF	MultiplierKind
ICFltPTEF#.FltCntClr.Oper.origin.orCat	CO	OriginatorCategoryKind
ICFltPTEF#.FltCntClr.Cancel.origin.orCat	CO	OriginatorCategoryKind
ICFltPTEF#.FltCntClr.pulseConfig.cmdQual	CF	ControlOutputKind1
ICFltPTEF#.FltCntClr.ctlModel	CF	CtlModelKind3
ICFltPTEF#.FltCntClr.sboClass	CF	SboClassKind1
PhsTocPTOC#.Str.dirGeneral	ST	FaultDirectionKind
PhsTocPTOC#.Str.dirPhsA	ST	PhaseFaultDirectionKind
PhsTocPTOC#.Str.dirPhsB	ST	PhaseFaultDirectionKind
PhsTocPTOC#.Str.dirPhsC	ST	PhaseFaultDirectionKind
NeuTocPTOC#.Str.dirGeneral	ST	FaultDirectionKind
GndTocPTOC#.Str.dirGeneral	ST	FaultDirectionKind
NegTocPTOC#.Str.dirGeneral	ST	FaultDirectionKind
GnUnbPTOC#.Str.dirGeneral	ST	FaultDirectionKind
FldAmpPTOC#.Str.dirGeneral	ST	FaultDirectionKind
GnUnb1PTOC#.Str.dirGeneral	ST	FaultDirectionKind
GnUnb2PTOC#.Str.dirGeneral	ST	FaultDirectionKind
AmpUnbPTOC#.Str.dirGeneral	ST	FaultDirectionKind
AmpUnbPTOC#.CurUnb.units.SIUnit	CF	SIUnitKind
AmpUnbPTOC#.CurUnb.units.multiplier	CF	MultiplierKind
PhAUnPTOC#.Str.dirGeneral	ST	FaultDirectionKind
PhAUnPTOC#.Str.dirPhsA	ST	PhaseFaultDirectionKind
PhAUnPTOC#.Str.dirPhsB	ST	PhaseFaultDirectionKind

Data attribute	FC	Enum Type
PhAUnPTOC#.Str.dirPhsC	ST	PhaseFaultDirectionKind
PhAUn1PTOC#.Str.dirGeneral	ST	FaultDirectionKind
PhAUn1PTOC#.Str.dirPhsA	ST	PhaseFaultDirectionKind
PhAUn1PTOC#.Str.dirPhsB	ST	PhaseFaultDirectionKind
PhAUn1PTOC#.Str.dirPhsC	ST	PhaseFaultDirectionKind
PhAUn2PTOC#.Str.dirGeneral	ST	FaultDirectionKind
PhAUn2PTOC#.Str.dirPhsA	ST	PhaseFaultDirectionKind
PhAUn2PTOC#.Str.dirPhsB	ST	PhaseFaultDirectionKind
PhAUn2PTOC#.Str.dirPhsC	ST	PhaseFaultDirectionKind
PhAUn3PTOC#.Str.dirGeneral	ST	FaultDirectionKind
PhAUn3PTOC#.Str.dirPhsA	ST	PhaseFaultDirectionKind
PhAUn3PTOC#.Str.dirPhsB	ST	PhaseFaultDirectionKind
PhAUn3PTOC#.Str.dirPhsC	ST	PhaseFaultDirectionKind
PhAUn4PTOC#.Str.dirGeneral	ST	FaultDirectionKind
PhAUn4PTOC#.Str.dirPhsA	ST	PhaseFaultDirectionKind
PhAUn4PTOC#.Str.dirPhsB	ST	PhaseFaultDirectionKind
PhAUn4PTOC#.Str.dirPhsC	ST	PhaseFaultDirectionKind
NeAUnPTOC#.Str.dirGeneral	ST	FaultDirectionKind
NeAUnPTOC#.RawAnsp.units.SIUnit	CF	SIUnitKind
NeAUnPTOC#.RawAnsp.units.multiplier	CF	MultiplierKind
NeAUnPTOC#.CompAop.units.SIUnit	CF	SIUnitKind
NeAUnPTOC#.CompAop.units.multiplier	CF	MultiplierKind
NeAUn1PTOC#.Str.dirGeneral	ST	FaultDirectionKind
NeAUn2PTOC#.Str.dirGeneral	ST	FaultDirectionKind
NeAUn3PTOC#.Str.dirGeneral	ST	FaultDirectionKind
NeAUn4PTOC#.Str.dirGeneral	ST	FaultDirectionKind
OvHzPTOF#.Str.dirGeneral	ST	FaultDirectionKind
PhsOvPTOV#.Str.dirGeneral	ST	FaultDirectionKind
PhsOvPTOV#.Str.dirPhsA	ST	PhaseFaultDirectionKind
PhsOvPTOV#.Str.dirPhsB	ST	PhaseFaultDirectionKind
PhsOvPTOV#.Str.dirPhsC	ST	PhaseFaultDirectionKind
PhCmp1PTOV#.Str.dirGeneral	ST	FaultDirectionKind
PhCmp2PTOV#.Str.dirGeneral	ST	FaultDirectionKind
AuxOvPTOV#.Str.dirGeneral	ST	FaultDirectionKind
NeuOvPTOV#.Str.dirGeneral	ST	FaultDirectionKind
NegOvPTOV#.Str.dirGeneral	ST	FaultDirectionKind
CPhOvPTOV#.Str.dirGeneral	ST	FaultDirectionKind
CPhOvPTOV#.Str.dirPhsA	ST	PhaseFaultDirectionKind
CPhOvPTOV#.Str.dirPhsB	ST	PhaseFaultDirectionKind
CPhOvPTOV#.Str.dirPhsC	ST	PhaseFaultDirectionKind
CPhOv1PTOV#.Str.dirGeneral	ST	FaultDirectionKind
CPhOv1PTOV#.Str.dirPhsA	ST	PhaseFaultDirectionKind
CPhOv1PTOV#.Str.dirPhsB	ST	PhaseFaultDirectionKind
CPhOv1PTOV#.Str.dirPhsC	ST	PhaseFaultDirectionKind
CPhOv2PTOV#.Str.dirGeneral	ST	FaultDirectionKind
CPhOv2PTOV#.Str.dirPhsA	ST	PhaseFaultDirectionKind
CPhOv2PTOV#.Str.dirPhsB	ST	PhaseFaultDirectionKind

Data attribute	FC	Enum Type
CPhOv2PTOV#.Str.dirPhsC	ST	PhaseFaultDirectionKind
CPhOv3PTOV#.Str.dirGeneral	ST	FaultDirectionKind
CPhOv3PTOV#.Str.dirPhsA	ST	PhaseFaultDirectionKind
CPhOv3PTOV#.Str.dirPhsB	ST	PhaseFaultDirectionKind
CPhOv3PTOV#.Str.dirPhsC	ST	PhaseFaultDirectionKind
CPhOv4PTOV#.Str.dirGeneral	ST	FaultDirectionKind
CPhOv4PTOV#.Str.dirPhsA	ST	PhaseFaultDirectionKind
CPhOv4PTOV#.Str.dirPhsB	ST	PhaseFaultDirectionKind
CPhOv4PTOV#.Str.dirPhsC	ST	PhaseFaultDirectionKind
NuVUnPTOV#.Str.dirGeneral	ST	FaultDirectionKind
NuVUnPTOV#.NeutVx.units.SIUnit	CF	SIUnitKind
NuVUnPTOV#.NeutVx.units.multiplier	CF	MultiplierKind
NuVUnPTOV#.NeutVx.angRef	CF	PhaseAngleReferenceKind
NuVUnPTOV#.BusV0.units.SIUnit	CF	SIUnitKind
NuVUnPTOV#.BusV0.units.multiplier	CF	MultiplierKind
NuVUnPTOV#.BusV0.angRef	CF	PhaseAngleReferenceKind
NuVUnPTOV#.VOp.units.SIUnit	CF	SIUnitKind
NuVUnPTOV#.VOp.units.multiplier	CF	MultiplierKind
NuVUnPTOV#.VRst.units.SIUnit	CF	SIUnitKind
NuVUnPTOV#.VRst.units.multiplier	CF	MultiplierKind
NuVUn1PTOV#.Str.dirGeneral	ST	FaultDirectionKind
NuVUn2PTOV#.Str.dirGeneral	ST	FaultDirectionKind
NuVUn3PTOV#.Str.dirGeneral	ST	FaultDirectionKind
NuVUn4PTOV#.Str.dirGeneral	ST	FaultDirectionKind
CmpOvPTOV#.Str.dirGeneral	ST	FaultDirectionKind
TrBusPTRC#.Str.dirGeneral	ST	FaultDirectionKind
ThmOvlPTTR#.Str.dirGeneral	ST	FaultDirectionKind
MotThmPTTR#.Str.dirGeneral	ST	FaultDirectionKind
MotThmPTTR#.MotStatus.stVal	ST	GE_Digital_Energy_UR_MotStatusKind
MotThmPTTR#.Amp.units.SIUnit	CF	SIUnitKind
MotThmPTTR#.Amp.units.multiplier	CF	MultiplierKind
MotThmPTTR#.OvlTripTm.units.SIUnit	CF	SIUnitKind
MotThmPTTR#.OvlTripTm.units.multiplier	CF	MultiplierKind
MotThmPTTR#.ThmCap.units.SIUnit	CF	SIUnitKind
MotThmPTTR#.ThmCap.units.multiplier	CF	MultiplierKind
MotThmPTTR#.ThmLOTm.units.SIUnit	CF	SIUnitKind
MotThmPTTR#.ThmLOTm.units.multiplier	CF	MultiplierKind
MotThmPTTR#.MotUnb.units.SIUnit	CF	SIUnitKind
MotThmPTTR#.MotUnb.units.multiplier	CF	MultiplierKind
MotThmPTTR#.BiasMotLod.units.SIUnit	CF	SIUnitKind
MotThmPTTR#.BiasMotLod.units.multiplier	CF	MultiplierKind
MotThmPTTR#.TotLOTm.units.SIUnit	CF	SIUnitKind
MotThmPTTR#.TotLOTm.units.multiplier	CF	MultiplierKind
UnCurPTUC#.StrAlm.dirGeneral	ST	FaultDirectionKind
UnCurPTUC#.Str.dirGeneral	ST	FaultDirectionKind
FldAmpPTUC#.Str.dirGeneral	ST	FaultDirectionKind
UnHzPTUF#.Str.dirGeneral	ST	FaultDirectionKind

Data attribute	FC	Enum Type
HzBndPTUF#.Str.dirGeneral	ST	FaultDirectionKind
HzBnd1PTUF#.Str.dirGeneral	ST	FaultDirectionKind
HzBnd1PTUF#.HzObAccum.units.SIUnit	CF	SIUnitKind
HzBnd1PTUF#.HzObAccum.units.multiplier	CF	MultiplierKind
HzBnd2PTUF#.Str.dirGeneral	ST	FaultDirectionKind
HzBnd2PTUF#.HzObAccum.units.SIUnit	CF	SIUnitKind
HzBnd2PTUF#.HzObAccum.units.multiplier	CF	MultiplierKind
HzBnd3PTUF#.Str.dirGeneral	ST	FaultDirectionKind
HzBnd3PTUF#.HzObAccum.units.SIUnit	CF	SIUnitKind
HzBnd3PTUF#.HzObAccum.units.multiplier	CF	MultiplierKind
HzBnd4PTUF#.Str.dirGeneral	ST	FaultDirectionKind
HzBnd4PTUF#.HzObAccum.units.SIUnit	CF	SIUnitKind
HzBnd4PTUF#.HzObAccum.units.multiplier	CF	MultiplierKind
HzBnd5PTUF#.Str.dirGeneral	ST	FaultDirectionKind
HzBnd5PTUF#.HzObAccum.units.SIUnit	CF	SIUnitKind
HzBnd5PTUF#.HzObAccum.units.multiplier	CF	MultiplierKind
HzBnd6PTUF#.Str.dirGeneral	ST	FaultDirectionKind
HzBnd6PTUF#.HzObAccum.units.SIUnit	CF	SIUnitKind
HzBnd6PTUF#.HzObAccum.units.multiplier	CF	MultiplierKind
HzBnd7PTUF#.Str.dirGeneral	ST	FaultDirectionKind
HzBnd7PTUF#.HzObAccum.units.SIUnit	CF	SIUnitKind
HzBnd7PTUF#.HzObAccum.units.multiplier	CF	MultiplierKind
PhsUvPTUV#.Str.dirGeneral	ST	FaultDirectionKind
PhsUvPTUV#.Str.dirPhsA	ST	PhaseFaultDirectionKind
PhsUvPTUV#.Str.dirPhsB	ST	PhaseFaultDirectionKind
PhsUvPTUV#.Str.dirPhsC	ST	PhaseFaultDirectionKind
B_UvPTUV#.Str.dirGeneral	ST	FaultDirectionKind
AuxUvPTUV#.Str.dirGeneral	ST	FaultDirectionKind
Ha3NUvPTUV#.Str.dirGeneral	ST	FaultDirectionKind
VpHzPVPH#.Str.dirGeneral	ST	FaultDirectionKind
PhsDirRDIR#.Dir.dirGeneral	ST	FaultDirectionKind
PhsDirRDIR#.Dir.dirPhsA	ST	PhaseFaultDirectionKind
PhsDirRDIR#.Dir.dirPhsB	ST	PhaseFaultDirectionKind
PhsDirRDIR#.Dir.dirPhsC	ST	PhaseFaultDirectionKind
NeuDocRDIR#.Dir.dirGeneral	ST	FaultDirectionKind
NegDocRDIR#.Dir.dirGeneral	ST	FaultDirectionKind
OscRDRE#.FltNum.units.SIUnit	CF	SIUnitKind
OscRDRE#.FltNum.units.multiplier	CF	MultiplierKind
OscRDRE#.NumRcd.units.SIUnit	CF	SIUnitKind
OscRDRE#.NumRcd.units.multiplier	CF	MultiplierKind
OscRDRE#.NumCycPer.units.SIUnit	CF	SIUnitKind
OscRDRE#.NumCycPer.units.multiplier	CF	MultiplierKind
OscRDRE#.RsTms.units.SIUnit	CF	SIUnitKind
OscRDRE#.RsTms.units.multiplier	CF	MultiplierKind
OscRDRE#.RcdTrg.Oper.origin.orCat	CO	OriginatorCategoryKind
OscRDRE#.RcdTrg.Cancel.origin.orCat	CO	OriginatorCategoryKind
OscRDRE#.RcdTrg.pulseConfig.cmdQual	CF	ControlOutputKind1

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Data attribute	FC	Enum Type
OscRDRE#.RcdTrg.ctlModel	CF	CtlModelKind3
OscRDRE#.RcdTrg.sboClass	CF	SboClassKind1
OscRDRE#.MemClr.Oper.origin.orCat	CO	OriginatorCategoryKind
OscRDRE#.MemClr.Cancel.origin.orCat	CO	OriginatorCategoryKind
OscRDRE#.MemClr.pulseConfig.cmdQual	CF	ControlOutputKind1
OscRDRE#.MemClr.ctlModel	CF	CtlModelKind3
OscRDRE#.MemClr.sboClass	CF	SboClassKind1
DatLogRDRE#.MemClr.Oper.origin.orCat	CO	OriginatorCategoryKind
DatLogRDRE#.MemClr.Cancel.origin.orCat	CO	OriginatorCategoryKind
DatLogRDRE#.MemClr.pulseConfig.cmdQual	CF	ControlOutputKind1
DatLogRDRE#.MemClr.ctlModel	CF	CtlModelKind3
DatLogRDRE#.MemClr.sboClass	CF	SboClassKind1
FltRptRFLO#.NumRcd.units.SIUnit	CF	SIUnitKind
FltRptRFLO#.NumRcd.units.multiplier	CF	MultiplierKind
FltRptRFLO#.RsStat.Oper.origin.orCat	CO	OriginatorCategoryKind
FltRptRFLO#.RsStat.Cancel.origin.orCat	CO	OriginatorCategoryKind
FltRptRFLO#.RsStat.pulseConfig.cmdQual	CF	ControlOutputKind1
FltRptRFLO#.RsStat.ctlModel	CF	CtlModelKind3
FltRptRFLO#.RsStat.sboClass	CF	SboClassKind1
FltRFLO#.FltNum.units.SIUnit	CF	SIUnitKind
FltRFLO#.FltNum.units.multiplier	CF	MultiplierKind
FltRFLO#.FltLoop.stVal	ST	FltLoopKind
FltRFLO#.FltDiskm.units.SIUnit	CF	SIUnitKind
FltRFLO#.FltDiskm.units.multiplier	CF	MultiplierKind
FltRFLO#.RecCyc.units.SIUnit	CF	SIUnitKind
FltRFLO#.RecCyc.units.multiplier	CF	MultiplierKind
UFlt0RFLO#.FltNum.units.SIUnit	CF	SIUnitKind
UFlt0RFLO#.FltNum.units.multiplier	CF	MultiplierKind
UFlt0RFLO#.LastClrTm.units.SIUnit	CF	SIUnitKind
UFlt0RFLO#.LastClrTm.units.multiplier	CF	MultiplierKind
UFlt0RFLO#.LastRptTm.units.SIUnit	CF	SIUnitKind
UFlt0RFLO#.LastRptTm.units.multiplier	CF	MultiplierKind
UFlt0RFLO#.RsStat.Oper.origin.orCat	CO	OriginatorCategoryKind
UFlt0RFLO#.RsStat.Cancel.origin.orCat	CO	OriginatorCategoryKind
UFlt0RFLO#.RsStat.pulseConfig.cmdQual	CF	ControlOutputKind1
UFlt0RFLO#.RsStat.ctlModel	CF	CtlModelKind3
UFlt0RFLO#.RsStat.sboClass	CF	SboClassKind1
FltRFLO#.FltRis.units.SIUnit	CF	SIUnitKind
FltRFLO#.FltRis.units.multiplier	CF	MultiplierKind
FltRFLO#.FltLoopRis.units.SIUnit	CF	SIUnitKind
FltRFLO#.FltLoopRis.units.multiplier	CF	MultiplierKind
FltRFLO#.FltLoopReact.units.SIUnit	CF	SIUnitKind
FltRFLO#.FltLoopReact.units.multiplier	CF	MultiplierKind
FltRFLO#.FltSegment.stVal	ST	GE_Digital_Energy_UR_FltSegmentKind
PwrSwgRPSB#.Str.dirGeneral	ST	FaultDirectionKind
Rec13pRREC#.TrBeh.stVal	ST	TrBehKind1
Rec13pRREC#.AutoRecSt.stVal	ST	AutoRecStKind

Data attribute	FC	Enum Type
Rec3pRREC#.AutoRecSt.stVal	ST	AutoRecStKind
SynChkRSYN#.V1Src.units.SIUnit	CF	SIUnitKind
SynChkRSYN#.V1Src.units.multiplier	CF	MultiplierKind
SynChkRSYN#.V2Src.units.SIUnit	CF	SIUnitKind
SynChkRSYN#.V2Src.units.multiplier	CF	MultiplierKind
SynChkRSYN#.DifVClc.units.SIUnit	CF	SIUnitKind
SynChkRSYN#.DifVClc.units.multiplier	CF	MultiplierKind
SynChkRSYN#.DifHzClc.units.SIUnit	CF	SIUnitKind
SynChkRSYN#.DifHzClc.units.multiplier	CF	MultiplierKind
SynChkRSYN#.DifAngClc.units.SIUnit	CF	SIUnitKind
SynChkRSYN#.DifAngClc.units.multiplier	CF	MultiplierKind
SynChkRSYN#.DifAngDis.units.SIUnit	CF	SIUnitKind
SynChkRSYN#.DifAngDis.units.multiplier	CF	MultiplierKind
SynChkRSYN#.ProjectedV2.units.SIUnit	CF	SIUnitKind
SynChkRSYN#.ProjectedV2.units.multiplier	CF	MultiplierKind
SynChkRSYN#.ProjectedDif.units.SIUnit	CF	SIUnitKind
SynChkRSYN#.ProjectedDif.units.multiplier	CF	MultiplierKind
SynChkRSYN#.ProjDifDis.units.SIUnit	CF	SIUnitKind
SynChkRSYN#.ProjDifDis.units.multiplier	CF	MultiplierKind
CBArc0SCBR#.OpTmOpn.units.SIUnit	CF	SIUnitKind
CBArc0SCBR#.OpTmOpn.units.multiplier	CF	MultiplierKind
CBArc0SCBR#.MemClr.Oper.origin.orCat	CO	OriginatorCategoryKind
CBArc0SCBR#.MemClr.Cancel.origin.orCat	CO	OriginatorCategoryKind
CBArc0SCBR#.MemClr.pulseConfig.cmdQual	CF	ControlOutputKind1
CBArc0SCBR#.MemClr.ctlModel	CF	CtlModelKind3
CBArc0SCBR#.MemClr.sboClass	CF	SboClassKind1
CBArc1SCBR#.AccAbr.units.SIUnit	CF	SIUnitKind
CBArc1SCBR#.AccAbr.units.multiplier	CF	MultiplierKind
CBArc1SCBR#.SwA.units.SIUnit	CF	SIUnitKind
CBArc1SCBR#.SwA.units.multiplier	CF	MultiplierKind
CBArc1SCBR#.MaxIntrA.units.SIUnit	CF	SIUnitKind
CBArc1SCBR#.MaxIntrA.units.multiplier	CF	MultiplierKind
CBArc1SCBR#.RctTmOpn.units.SIUnit	CF	SIUnitKind
CBArc1SCBR#.RctTmOpn.units.multiplier	CF	MultiplierKind
CBArc2SCBR#.AccAbr.units.SIUnit	CF	SIUnitKind
CBArc2SCBR#.AccAbr.units.multiplier	CF	MultiplierKind
CBArc2SCBR#.SwA.units.SIUnit	CF	SIUnitKind
CBArc2SCBR#.SwA.units.multiplier	CF	MultiplierKind
CBArc2SCBR#.MaxIntrA.units.SIUnit	CF	SIUnitKind
CBArc2SCBR#.MaxIntrA.units.multiplier	CF	MultiplierKind
CBArc2SCBR#.RctTmOpn.units.SIUnit	CF	SIUnitKind
CBArc2SCBR#.RctTmOpn.units.multiplier	CF	MultiplierKind
CBArc3SCBR#.AccAbr.units.SIUnit	CF	SIUnitKind
CBArc3SCBR#.AccAbr.units.multiplier	CF	MultiplierKind
CBArc3SCBR#.SwA.units.SIUnit	CF	SIUnitKind
CBArc3SCBR#.SwA.units.multiplier	CF	MultiplierKind
CBArc3SCBR#.MaxIntrA.units.SIUnit	CF	SIUnitKind

Data attribute	FC	Enum Type
CBArc3SCBR#.MaxIntrA.units.multiplier	CF	MultiplierKind
CBArc3SCBR#.RctTmOpn.units.SIUnit	CF	SIUnitKind
CBArc3SCBR#.RctTmOpn.units.multiplier	CF	MultiplierKind
AgeSPTR#.Str.dirGeneral	ST	FaultDirectionKind
AgeSPTR#.AgeRte.units.SIUnit	CF	SIUnitKind
AgeSPTR#.AgeRte.units.multiplier	CF	MultiplierKind
HPTmpSPTR#.Str.dirGeneral	ST	FaultDirectionKind
HPTmpSPTR#.ToOilTmp.units.SIUnit	CF	SIUnitKind
HPTmpSPTR#.ToOilTmp.units.multiplier	CF	MultiplierKind
HPTmpSPTR#.HPTmpClc.units.SIUnit	CF	SIUnitKind
HPTmpSPTR#.HPTmpClc.units.multiplier	CF	MultiplierKind
LosLifSPTR#.Str.dirGeneral	ST	FaultDirectionKind
LosLifSPTR#.LosLifeRte.units.SIUnit	CF	SIUnitKind
LosLifSPTR#.LosLifeRte.units.multiplier	CF	MultiplierKind
LosLifSPTR#.LosLife.units.SIUnit	CF	SIUnitKind
LosLifSPTR#.LosLife.units.multiplier	CF	MultiplierKind
RRTDsSTMP#.Str.dirGeneral	ST	FaultDirectionKind
RRTDsSTMP#.StrAlm.dirGeneral	ST	FaultDirectionKind
RRTDsSTMP#.Tmp.units.SIUnit	CF	SIUnitKind
RRTDsSTMP#.Tmp.units.multiplier	CF	MultiplierKind
PRTDsSTMP#.Str.dirGeneral	ST	FaultDirectionKind
PRTDsSTMP#.StrAlm.dirGeneral	ST	FaultDirectionKind
PRTDsSTMP#.Tmp.units.SIUnit	CF	SIUnitKind
PRTDsSTMP#.Tmp.units.multiplier	CF	MultiplierKind
BknRotSVBR#.TmOfClc.units.SIUnit	CF	SIUnitKind
BknRotSVBR#.TmOfClc.units.multiplier	CF	MultiplierKind
BknRotSVBR#.TmOfMax.units.SIUnit	CF	SIUnitKind
BknRotSVBR#.TmOfMax.units.multiplier	CF	MultiplierKind
BknRotSVBR#.CompLevel.units.SIUnit	CF	SIUnitKind
BknRotSVBR#.CompLevel.units.multiplier	CF	MultiplierKind
BknRotSVBR#.CompHz.units.SIUnit	CF	SIUnitKind
BknRotSVBR#.CompHz.units.multiplier	CF	MultiplierKind
BknRotSVBR#.MotLoad.units.SIUnit	CF	SIUnitKind
BknRotSVBR#.MotLoad.units.multiplier	CF	MultiplierKind
BknRotSVBR#.LoadDev.units.SIUnit	CF	SIUnitKind
BknRotSVBR#.LoadDev.units.multiplier	CF	MultiplierKind
BknRotSVBR#.MaxCompLevel.units.SIUnit	CF	SIUnitKind
BknRotSVBR#.MaxCompLevel.units.multiplier	CF	MultiplierKind
BknRotSVBR#.MaxCompHz.units.SIUnit	CF	SIUnitKind
BknRotSVBR#.MaxCompHz.units.multiplier	CF	MultiplierKind
BknRotSVBR#.MaxMotLoad.units.SIUnit	CF	SIUnitKind
BknRotSVBR#.MaxMotLoad.units.multiplier	CF	MultiplierKind
BknRotSVBR#.MaxLoadDev.units.SIUnit	CF	SIUnitKind
BknRotSVBR#.MaxLoadDev.units.multiplier	CF	MultiplierKind
BknRotSVBR#.BknRotClr.Oper.origin.orCat	CO	OriginatorCategoryKind
BknRotSVBR#.BknRotClr.Cancel.origin.orCat	CO	OriginatorCategoryKind
BknRotSVBR#.BknRotClr.pulseConfig.cmdQual	CF	ControlOutputKind1

Data attribute	FC	Enum Type
BknRotSVBR#.BknRotClr.ctlModel	CF	CtlModelKind3
BknRotSVBR#.BknRotClr.sboClass	CF	SboClassKind1
Bkr0XCBR#.EEHealth.stVal	ST	HealthKind
Bkr0XCBR#.OpCnt.units.SIUnit	CF	SIUnitKind
Bkr0XCBR#.OpCnt.units.multiplier	CF	MultiplierKind
Bkr0XCBR#.Pos.SBOw.origin.orCat	CO	OriginatorCategoryKind
Bkr0XCBR#.Pos.Oper.origin.orCat	CO	OriginatorCategoryKind
Bkr0XCBR#.Pos.Cancel.origin.orCat	CO	OriginatorCategoryKind
Bkr0XCBR#.Pos.pulseConfig.cmdQual	CF	ControlOutputKind1
Bkr0XCBR#.Pos.ctlModel	CF	CtlModelKind
Bkr0XCBR#.Pos.sboClass	CF	SboClassKind1
Bkr0XCBR#.BlkOpn.Oper.origin.orCat	CO	OriginatorCategoryKind
Bkr0XCBR#.BlkOpn.Cancel.origin.orCat	CO	OriginatorCategoryKind
Bkr0XCBR#.BlkOpn.pulseConfig.cmdQual	CF	ControlOutputKind2
Bkr0XCBR#.BlkOpn.ctlModel	CF	CtlModelKind3
Bkr0XCBR#.BlkOpn.sboClass	CF	SboClassKind1
Bkr0XCBR#.BlkCls.Oper.origin.orCat	CO	OriginatorCategoryKind
Bkr0XCBR#.BlkCls.Cancel.origin.orCat	CO	OriginatorCategoryKind
Bkr0XCBR#.BlkCls.pulseConfig.cmdQual	CF	ControlOutputKind2
Bkr0XCBR#.BlkCls.ctlModel	CF	CtlModelKind3
Bkr0XCBR#.BlkCls.sboClass	CF	SboClassKind1
Bkr1XCBR#.OpCnt.units.SIUnit	CF	SIUnitKind
Bkr1XCBR#.OpCnt.units.multiplier	CF	MultiplierKind
Bkr1XCBR#.Pos.ctlModel	CF	CtlModelKind1
Bkr1XCBR#.BlkOpn.ctlModel	CF	CtlModelKind1
Bkr1XCBR#.BlkCls.ctlModel	CF	CtlModelKind1
Bkr2XCBR#.OpCnt.units.SIUnit	CF	SIUnitKind
Bkr2XCBR#.OpCnt.units.multiplier	CF	MultiplierKind
Bkr2XCBR#.Pos.ctlModel	CF	CtlModelKind1
Bkr2XCBR#.BlkOpn.ctlModel	CF	CtlModelKind1
Bkr2XCBR#.BlkCls.ctlModel	CF	CtlModelKind1
Bkr3XCBR#.OpCnt.units.SIUnit	CF	SIUnitKind
Bkr3XCBR#.OpCnt.units.multiplier	CF	MultiplierKind
Bkr3XCBR#.Pos.ctlModel	CF	CtlModelKind1
Bkr3XCBR#.BlkOpn.ctlModel	CF	CtlModelKind1
Bkr3XCBR#.BlkCls.ctlModel	CF	CtlModelKind1
Disc0XSWI#.EEHealth.stVal	ST	HealthKind
Disc0XSWI#.OpCnt.units.SIUnit	CF	SIUnitKind
Disc0XSWI#.OpCnt.units.multiplier	CF	MultiplierKind
Disc0XSWI#.SwTyp.stVal	ST	SwTypKind
Disc0XSWI#.Pos.SBOw.origin.orCat	CO	OriginatorCategoryKind
Disc0XSWI#.Pos.Oper.origin.orCat	CO	OriginatorCategoryKind
Disc0XSWI#.Pos.Cancel.origin.orCat	CO	OriginatorCategoryKind
Disc0XSWI#.Pos.pulseConfig.cmdQual	CF	ControlOutputKind1
Disc0XSWI#.Pos.ctlModel	CF	CtlModelKind
Disc0XSWI#.Pos.sboClass	CF	SboClassKind1
Disc0XSWI#.BlkOpn.Oper.origin.orCat	CO	OriginatorCategoryKind

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Data attribute	FC	Enum Type
Disc0XSWI#.BlkOpn.Cancel.origin.orCat	CO	OriginatorCategoryKind
Disc0XSWI#.BlkOpn.pulseConfig.cmdQual	CF	ControlOutputKind2
Disc0XSWI#.BlkOpn.ctlModel	CF	CtlModelKind3
Disc0XSWI#.BlkOpn.sboClass	CF	SboClassKind1
Disc0XSWI#.BlkCls.Oper.origin.orCat	CO	OriginatorCategoryKind
Disc0XSWI#.BlkCls.Cancel.origin.orCat	CO	OriginatorCategoryKind
Disc0XSWI#.BlkCls.pulseConfig.cmdQual	CF	ControlOutputKind2
Disc0XSWI#.BlkCls.ctlModel	CF	CtlModelKind3
Disc0XSWI#.BlkCls.sboClass	CF	SboClassKind1
Disc1XSWI#.OpCnt.units.SIUnit	CF	SIUnitKind
Disc1XSWI#.OpCnt.units.multiplier	CF	MultiplierKind
Disc1XSWI#.SwTyp.stVal	ST	SwTypKind
Disc1XSWI#.Pos.ctlModel	CF	CtlModelKind1
Disc1XSWI#.BlkOpn.ctlModel	CF	CtlModelKind1
Disc1XSWI#.BlkCls.ctlModel	CF	CtlModelKind1
Disc2XSWI#.OpCnt.units.SIUnit	CF	SIUnitKind
Disc2XSWI#.OpCnt.units.multiplier	CF	MultiplierKind
Disc2XSWI#.SwTyp.stVal	ST	SwTypKind
Disc2XSWI#.Pos.ctlModel	CF	CtlModelKind1
Disc2XSWI#.BlkOpn.ctlModel	CF	CtlModelKind1
Disc2XSWI#.BlkCls.ctlModel	CF	CtlModelKind1
Disc3XSWI#.OpCnt.units.SIUnit	CF	SIUnitKind
Disc3XSWI#.OpCnt.units.multiplier	CF	MultiplierKind
Disc3XSWI#.SwTyp.stVal	ST	SwTypKind
Disc3XSWI#.Pos.ctlModel	CF	CtlModelKind1
Disc3XSWI#.BlkOpn.ctlModel	CF	CtlModelKind1
Disc3XSWI#.BlkCls.ctlModel	CF	CtlModelKind1
DmdMtrMMTR#.RsStat.Oper.origin.orCat	CO	OriginatorCategoryKind
DmdMtrMMTR#.RsStat.Cancel.origin.orCat	CO	OriginatorCategoryKind
DmdMtrMMTR#.RsStat.pulseConfig.cmdQual	CF	ControlOutputKind1
DmdMtrMMTR#.RsStat.ctlModel	CF	CtlModelKind3
DmdMtrMMTR#.RsStat.sboClass	CF	SboClassKind1
DmdMtrMMTR#.AaDmd.units.SIUnit	CF	SIUnitKind
DmdMtrMMTR#.AaDmd.units.multiplier	CF	MultiplierKind
DmdMtrMMTR#.AaMaxDmdDt.units.SIUnit	CF	SIUnitKind
DmdMtrMMTR#.AaMaxDmdDt.units.multiplier	CF	MultiplierKind
DmdMtrMMTR#.AbDmd.units.SIUnit	CF	SIUnitKind
DmdMtrMMTR#.AbDmd.units.multiplier	CF	MultiplierKind
DmdMtrMMTR#.AbMaxDmdDt.units.SIUnit	CF	SIUnitKind
DmdMtrMMTR#.AbMaxDmdDt.units.multiplier	CF	MultiplierKind
DmdMtrMMTR#.AcDmd.units.SIUnit	CF	SIUnitKind
DmdMtrMMTR#.AcDmd.units.multiplier	CF	MultiplierKind
DmdMtrMMTR#.AcMaxDmdDt.units.SIUnit	CF	SIUnitKind
DmdMtrMMTR#.AcMaxDmdDt.units.multiplier	CF	MultiplierKind
DmdMtrMMTR#.WDmd.units.SIUnit	CF	SIUnitKind
DmdMtrMMTR#.WDmd.units.multiplier	CF	MultiplierKind
DmdMtrMMTR#.WMaxDmdDt.units.SIUnit	CF	SIUnitKind

Data attribute	FC	Enum Type
DmdMtrMMTR#.WMaxDmdDt.units.multiplier	CF	MultiplierKind
DmdMtrMMTR#.VArDmd.units.SIUnit	CF	SIUnitKind
DmdMtrMMTR#.VArDmd.units.multiplier	CF	MultiplierKind
DmdMtrMMTR#.VArMaxDmdDt.units.SIUnit	CF	SIUnitKind
DmdMtrMMTR#.VArMaxDmdDt.units.multiplier	CF	MultiplierKind
DmdMtrMMTR#.VADmd.units.SIUnit	CF	SIUnitKind
DmdMtrMMTR#.VADmd.units.multiplier	CF	MultiplierKind
DmdMtrMMTR#.VAMaxDmdDt.units.SIUnit	CF	SIUnitKind
DmdMtrMMTR#.VAMaxDmdDt.units.multiplier	CF	MultiplierKind
ThrFltGAPC#.TotAccmA.units.SIUnit	CF	SIUnitKind
ThrFltGAPC#.TotAccmA.units.multiplier	CF	MultiplierKind
ThrFltGAPC#.TotAccmB.units.SIUnit	CF	SIUnitKind
ThrFltGAPC#.TotAccmB.units.multiplier	CF	MultiplierKind
ThrFltGAPC#.TotAccmC.units.SIUnit	CF	SIUnitKind
ThrFltGAPC#.TotAccmC.units.multiplier	CF	MultiplierKind
ThrFltGAPC#.Evt1Tm.units.SIUnit	CF	SIUnitKind
ThrFltGAPC#.Evt1Tm.units.multiplier	CF	MultiplierKind
ThrFltGAPC#.Evt2Tm.units.SIUnit	CF	SIUnitKind
ThrFltGAPC#.Evt2Tm.units.multiplier	CF	MultiplierKind
ThrFltGAPC#.Evt3Tm.units.SIUnit	CF	SIUnitKind
ThrFltGAPC#.Evt3Tm.units.multiplier	CF	MultiplierKind
ThrFltGAPC#.Evt4Tm.units.SIUnit	CF	SIUnitKind
ThrFltGAPC#.Evt4Tm.units.multiplier	CF	MultiplierKind
ThrFltGAPC#.Evt5Tm.units.SIUnit	CF	SIUnitKind
ThrFltGAPC#.Evt5Tm.units.multiplier	CF	MultiplierKind
ThrFltGAPC#.Evt1Dur.units.SIUnit	CF	SIUnitKind
ThrFltGAPC#.Evt1Dur.units.multiplier	CF	MultiplierKind
ThrFltGAPC#.Evt2Dur.units.SIUnit	CF	SIUnitKind
ThrFltGAPC#.Evt2Dur.units.multiplier	CF	MultiplierKind
ThrFltGAPC#.Evt3Dur.units.SIUnit	CF	SIUnitKind
ThrFltGAPC#.Evt3Dur.units.multiplier	CF	MultiplierKind
ThrFltGAPC#.Evt4Dur.units.SIUnit	CF	SIUnitKind
ThrFltGAPC#.Evt4Dur.units.multiplier	CF	MultiplierKind
ThrFltGAPC#.Evt5Dur.units.SIUnit	CF	SIUnitKind
ThrFltGAPC#.Evt5Dur.units.multiplier	CF	MultiplierKind
ThrFltGAPC#.Evt1MaxA.units.SIUnit	CF	SIUnitKind
ThrFltGAPC#.Evt1MaxA.units.multiplier	CF	MultiplierKind
ThrFltGAPC#.Evt1MaxB.units.SIUnit	CF	SIUnitKind
ThrFltGAPC#.Evt1MaxB.units.multiplier	CF	MultiplierKind
ThrFltGAPC#.Evt1MaxC.units.SIUnit	CF	SIUnitKind
ThrFltGAPC#.Evt1MaxC.units.multiplier	CF	MultiplierKind
ThrFltGAPC#.Evt2MaxA.units.SIUnit	CF	SIUnitKind
ThrFltGAPC#.Evt2MaxA.units.multiplier	CF	MultiplierKind
ThrFltGAPC#.Evt2MaxB.units.SIUnit	CF	SIUnitKind
ThrFltGAPC#.Evt2MaxB.units.multiplier	CF	MultiplierKind
ThrFltGAPC#.Evt2MaxC.units.SIUnit	CF	SIUnitKind
ThrFltGAPC#.Evt2MaxC.units.multiplier	CF	MultiplierKind

Data attribute	FC	Enum Type
ThrFltGAPC#.Evt3MaxA.units.SIUnit	CF	SIUnitKind
ThrFltGAPC#.Evt3MaxA.units.multiplier	CF	MultiplierKind
ThrFltGAPC#.Evt3MaxB.units.SIUnit	CF	SIUnitKind
ThrFltGAPC#.Evt3MaxB.units.multiplier	CF	MultiplierKind
ThrFltGAPC#.Evt3MaxC.units.SIUnit	CF	SIUnitKind
ThrFltGAPC#.Evt3MaxC.units.multiplier	CF	MultiplierKind
ThrFltGAPC#.Evt4MaxA.units.SIUnit	CF	SIUnitKind
ThrFltGAPC#.Evt4MaxA.units.multiplier	CF	MultiplierKind
ThrFltGAPC#.Evt4MaxB.units.SIUnit	CF	SIUnitKind
ThrFltGAPC#.Evt4MaxB.units.multiplier	CF	MultiplierKind
ThrFltGAPC#.Evt4MaxC.units.SIUnit	CF	SIUnitKind
ThrFltGAPC#.Evt4MaxC.units.multiplier	CF	MultiplierKind
ThrFltGAPC#.Evt5MaxA.units.SIUnit	CF	SIUnitKind
ThrFltGAPC#.Evt5MaxA.units.multiplier	CF	MultiplierKind
ThrFltGAPC#.Evt5MaxB.units.SIUnit	CF	SIUnitKind
ThrFltGAPC#.Evt5MaxB.units.multiplier	CF	MultiplierKind
ThrFltGAPC#.Evt5MaxC.units.SIUnit	CF	SIUnitKind
ThrFltGAPC#.Evt5MaxC.units.multiplier	CF	MultiplierKind
ThrFltGAPC#.Evt1AccmA.units.SIUnit	CF	SIUnitKind
ThrFltGAPC#.Evt1AccmA.units.multiplier	CF	MultiplierKind
ThrFltGAPC#.Evt1AccmB.units.SIUnit	CF	SIUnitKind
ThrFltGAPC#.Evt1AccmB.units.multiplier	CF	MultiplierKind
ThrFltGAPC#.Evt1AccmC.units.SIUnit	CF	SIUnitKind
ThrFltGAPC#.Evt1AccmC.units.multiplier	CF	MultiplierKind
ThrFltGAPC#.Evt2AccmA.units.SIUnit	CF	SIUnitKind
ThrFltGAPC#.Evt2AccmA.units.multiplier	CF	MultiplierKind
ThrFltGAPC#.Evt2AccmB.units.SIUnit	CF	SIUnitKind
ThrFltGAPC#.Evt2AccmB.units.multiplier	CF	MultiplierKind
ThrFltGAPC#.Evt2AccmC.units.SIUnit	CF	SIUnitKind
ThrFltGAPC#.Evt2AccmC.units.multiplier	CF	MultiplierKind
ThrFltGAPC#.Evt3AccmA.units.SIUnit	CF	SIUnitKind
ThrFltGAPC#.Evt3AccmA.units.multiplier	CF	MultiplierKind
ThrFltGAPC#.Evt3AccmB.units.SIUnit	CF	SIUnitKind
ThrFltGAPC#.Evt3AccmB.units.multiplier	CF	MultiplierKind
ThrFltGAPC#.Evt3AccmC.units.SIUnit	CF	SIUnitKind
ThrFltGAPC#.Evt3AccmC.units.multiplier	CF	MultiplierKind
ThrFltGAPC#.Evt4AccmA.units.SIUnit	CF	SIUnitKind
ThrFltGAPC#.Evt4AccmA.units.multiplier	CF	MultiplierKind
ThrFltGAPC#.Evt4AccmB.units.SIUnit	CF	SIUnitKind
ThrFltGAPC#.Evt4AccmB.units.multiplier	CF	MultiplierKind
ThrFltGAPC#.Evt4AccmC.units.SIUnit	CF	SIUnitKind
ThrFltGAPC#.Evt4AccmC.units.multiplier	CF	MultiplierKind
ThrFltGAPC#.Evt5AccmA.units.SIUnit	CF	SIUnitKind
ThrFltGAPC#.Evt5AccmA.units.multiplier	CF	MultiplierKind
ThrFltGAPC#.Evt5AccmB.units.SIUnit	CF	SIUnitKind
ThrFltGAPC#.Evt5AccmB.units.multiplier	CF	MultiplierKind
ThrFltGAPC#.Evt5AccmC.units.SIUnit	CF	SIUnitKind

Data attribute	FC	Enum Type
ThrFltGAPC#.Evt5AccmC.units.multiplier	CF	MultiplierKind
TrsGndPTEF#.Str.dirGeneral	ST	FaultDirectionKind
TrItfPTOC#.Str.dirGeneral	ST	FaultDirectionKind
TrItfPTOC#.Str.dirPhsA	ST	PhaseFaultDirectionKind
TrItfPTOC#.Str.dirPhsB	ST	PhaseFaultDirectionKind
TrItfPTOC#.Str.dirPhsC	ST	PhaseFaultDirectionKind
TrItfPTOC#.DifARaw.angRef	CF	PhaseAngleReferenceKind
TrItfPTOC#.DifAComp.angRef	CF	PhaseAngleReferenceKind
TrItfPTOC#.KFact.angRef	CF	PhaseAngleReferenceKind
TrItfPTOC#.ClcKFact.Oper.origin.orCat	CO	OriginatorCategoryKind
TrItfPTOC#.ClcKFact.Cancel.origin.orCat	CO	OriginatorCategoryKind
TrItfPTOC#.ClcKFact.pulseConfig.cmdQual	CF	ControlOutputKind1
TrItfPTOC#.ClcKFact.ctlModel	CF	CtlModelKind3
TrItfPTOC#.ClcKFact.sboClass	CF	SboClassKind1
HDetMHAI#.Str.dirGeneral	ST	FaultDirectionKind
HDetMHAI#.Str.dirPhsA	ST	PhaseFaultDirectionKind
HDetMHAI#.Str.dirPhsB	ST	PhaseFaultDirectionKind
HDetMHAI#.Str.dirPhsC	ST	PhaseFaultDirectionKind
HDetMHAI#.Str.dirNeut	ST	PhaseFaultDirectionKind
HDetMHAI#.Hz.units.SIUnit	CF	SIUnitKind
HDetMHAI#.Hz.units.multiplier	CF	MultiplierKind
HDetMHAI#.HDetAa.units.SIUnit	CF	SIUnitKind
HDetMHAI#.HDetAa.units.multiplier	CF	MultiplierKind
HDetMHAI#.HDetAb.units.SIUnit	CF	SIUnitKind
HDetMHAI#.HDetAb.units.multiplier	CF	MultiplierKind
HDetMHAI#.HDetAc.units.SIUnit	CF	SIUnitKind
HDetMHAI#.HDetAc.units.multiplier	CF	MultiplierKind
HDetMHAI#.HDetAGnd.units.SIUnit	CF	SIUnitKind
HDetMHAI#.HDetAGnd.units.multiplier	CF	MultiplierKind
HDetMHAI#.HDetAAv.units.SIUnit	CF	SIUnitKind
HDetMHAI#.HDetAAv.units.multiplier	CF	MultiplierKind
OscDetMOSC#.HzOsc.units.SIUnit	CF	SIUnitKind
OscDetMOSC#.HzOsc.units.multiplier	CF	MultiplierKind
OscDetMOSC#.Osc.units.SIUnit	CF	SIUnitKind
OscDetMOSC#.Osc.units.multiplier	CF	MultiplierKind
OscDetMOSC#.Damp.units.SIUnit	CF	SIUnitKind
OscDetMOSC#.Damp.units.multiplier	CF	MultiplierKind
OscDetMOSC#.HzBndHi.units.SIUnit	CF	SIUnitKind
OscDetMOSC#.HzBndHi.units.multiplier	CF	MultiplierKind
OscDetMOSC#.HzBndLo.units.SIUnit	CF	SIUnitKind
OscDetMOSC#.HzBndLo.units.multiplier	CF	MultiplierKind
LSVS#.RxConfRevNum.units.SIUnit	CF	SIUnitKind
LSVS#.RxConfRevNum.units.multiplier	CF	MultiplierKind
LSVS#.ConfRevNum.units.SIUnit	CF	SIUnitKind
LSVS#.ConfRevNum.units.multiplier	CF	MultiplierKind
ACBnkTBNK#.AnCh11Sv.units.SIUnit	CF	SIUnitKind
ACBnkTBNK#.AnCh11Sv.units.multiplier	CF	MultiplierKind

Data attribute	FC	Enum Type
ACBnkTBNK#.AnCh12Sv.units.SIUnit	CF	SIUnitKind
ACBnkTBNK#.AnCh12Sv.units.multiplier	CF	MultiplierKind
ACBnkTBNK#.AnCh13Sv.units.SIUnit	CF	SIUnitKind
ACBnkTBNK#.AnCh13Sv.units.multiplier	CF	MultiplierKind
ACBnkTBNK#.AnCh14Sv.units.SIUnit	CF	SIUnitKind
ACBnkTBNK#.AnCh14Sv.units.multiplier	CF	MultiplierKind
ACBnkTBNK#.AnCh21Sv.units.SIUnit	CF	SIUnitKind
ACBnkTBNK#.AnCh21Sv.units.multiplier	CF	MultiplierKind
ACBnkTBNK#.AnCh22Sv.units.SIUnit	CF	SIUnitKind
ACBnkTBNK#.AnCh22Sv.units.multiplier	CF	MultiplierKind
ACBnkTBNK#.AnCh23Sv.units.SIUnit	CF	SIUnitKind
ACBnkTBNK#.AnCh23Sv.units.multiplier	CF	MultiplierKind
ACBnkTBNK#.AnCh24Sv.units.SIUnit	CF	SIUnitKind
ACBnkTBNK#.AnCh24Sv.units.multiplier	CF	MultiplierKind
PcClkLTMS#.TmSynSrc.stVal	ST	GE_Digital_Energy_UR_PBTimeSourceKind
PIDRegFPID.PIDAlg.setVal	SP	PIDAlgKind
LGOS.RgRxMode.setVal	SP	GE_Digital_Energy_UR_RGooseRxModeKind
LGOS.SecEna.setVal	SP	GE_Digital_Energy_UR_RGooseSecEnaKind
ACsrcMMXU.PFSign.setVal	SP	PFSignKind
DmdMtrMMTR.ClcMth.setVal	SP	ClcMthKind
LSVS.NoASDU.setVal	SP	GE_Digital_Energy_UR_noASDUKind

Table 3-11: Enumerator value options

Enum ID	Ordinal	Value
AutoRecStKind		
	1	Ready
	2	InProgress
	3	Successful
	4	WaitingForTrip
	5	TripFromProtection
	6	FaultDisappeared
	7	WaitToComplete
	8	CBclosed
	9	CycleUnsuccessful
	10	Unsuccessful
	11	Aborted
BehKind		
	1	on
	2	blocked
	3	test
	4	test/blocked
	5	off
ClcMthKind		
	1	UNSPECIFIED

Enum ID	Ordinal	Value
	2	TRUE_RMS
	3	PEAK_FUNDAMENTAL
	4	RMS_FUNDAMENTAL
	5	MIN
	6	MAX
	7	AVG
	8	SDV
	9	PREDICTION
	10	RATE
ControlOutputKind		
	0	pulse
	1	persistent
CtlModelKind		
	0	status-only
	1	direct-with-normal-security
	2	sbo-with-normal-security
	3	direct-with-enhanced-security
	4	sbo-with-enhanced-security
FaultDirectionKind		
	0	unknown
	1	forward
	2	backward
	3	both
FltLoopKind		
	1	PhaseAtoGround
	2	PhaseBtoGround
	3	PhaseCtoGround
	4	PhaseAtoB
	5	PhaseBtoC
	6	PhaseCtoA
	7	Others
GE_Digital_Energy_UR_FltSegmentKind		
	0	N/A
	1	LOCAL
	2	REMOTE 1
	3	REMOTE 2
GE_Digital_Energy_UR_HiZStKind		
	0	Normal
	1	Coordination Timeout
	2	Armed
	5	Arcing
	9	Downed Conductor
GE_Digital_Energy_UR_TriggerKind		
	0	None

Enum ID	Ordinal	Value
	1	Loss of Load
	2	Arc Suspected
	3	Arcing
	4	Overcurrent
	5	Down Conductor
	6	External
GE_Digital_Energy_UR_MotStatusKind		
	0	Motor Offline
	1	Motor Starting
	2	Motor Running
	3	Motor Overload
GE_Digital_Energy_UR_RGooseRxModeKind		
	0	Unicast
	1	SSM
	2	ASM
GE_Digital_Energy_UR_RGooseSecEnaKind		
	0	None
	1	Signature
	2	SignatureAndEncryption
GE_Digital_Energy_UR_TimeSourceKind		
	0	None
	1	Port 1 PTP Clock
	2	Port 2 PTP Clock
	3	Port 3 PTP Clock
	4	IRIG-B
	5	SNTP
GE_Digital_Energy_UR_PBTimeSourceKind		
	0	None
	1	CPU Clock
	2	PBM Clock
	3	Time Sync Stream
GE_Digital_Energy_UR_noASDUKind		
	1	1
	2	2
GE_Digital_Energy_UR_RxModeKind		
	0	Main CPU GOOSE
	1	Main CPU R-GOOSE
	2	Process Bus Module GOOSE
GE_Digital_Energy_UR_BreakerStatusKind		
	0	Not Configured
	1	Opened
	2	Closed
	3	Bad status
HealthKind		

Enum ID	Ordinal	Value
	1	Ok
	2	Warning
	3	Alarm
MultiplierKind		
	-24	y
	-21	z
	-18	a
	-15	f
	-12	p
	-9	n
	-6	µ
	-3	m
	-2	c
	-1	d
	0	None
	1	da
	2	h
	3	k
	6	M
	9	G
	12	T
	15	P
	18	E
	21	Z
	24	Y
OriginatorCategoryKind		
	0	not-supported
	1	bay-control
	2	station-control
	3	remote-control
	4	automatic-bay
	5	automatic-station
	6	automatic-remote
	7	maintenance
	8	process
PFSignKind		
	1	IEC
	2	EEI
PhaseAngleReferenceKind		
	0	Va
	1	Vb
	2	Vc
	3	Aa
	4	Ab

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Enum ID	Ordinal	Value
	5	Ac
	6	Vab
	7	Vbc
	8	Vca
	9	Vother
	10	Aother
	11	Synchrophasor
PhaseFaultDirectionKind		
	0	unknown
	1	forward
	2	backward
PhaseReferenceKind		
	0	A
	1	B
	2	C
PIDAlgKind		
	1	P
	2	I
	3	D
	4	PI
	5	PD
	6	ID
	7	PID
SboClassKind		
	0	operate-once
	1	operate-many
SequenceKind		
	0	pos-neg-zero
	1	dir-quad-zero
SeverityKind		
	0	unknown
	1	critical
	2	major
	3	minor
	4	warning
SIUnitKind		
	1	None
	2	m
	3	kg
	4	s
	5	A
	6	K
	7	mol
	8	cd

Enum ID	Ordinal	Value
	9	deg
	10	rad
	11	sr
	21	Gy
	22	Bq
	23	°C
	24	Sv
	25	F
	26	C
	27	S
	28	H
	29	V
	30	ohm
	31	J
	32	N
	33	Hz
	34	lx
	35	Lm
	36	Wb
	37	T
	38	W
	39	Pa
	41	m^2
	42	m^3
	43	m/s
	44	m/s^2
	45	m^3/s
	46	m/m^3
	47	M
	48	kg/m^3
	49	m^2/s
	50	W/m K
	51	J/K
	52	ppm
	53	1/s
	54	rad/s
	55	W/m^2
	56	J/m^2
	57	S/m
	58	K/s
	59	Pa/s
	60	J/kg K
	61	VA
	62	Watts

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Enum ID	Ordinal	Value
	63	VAr
	64	phi
	65	cos(phi)
	66	Vs
	67	V^2
	68	As
	69	A^2
	70	A^2t
	71	VAh
	72	Wh
	73	VArh
	74	V/Hz
	75	Hz/s
	76	char
	77	char/s
	78	kgm^2
	79	dB
	80	J/Wh
	81	W/s
	82	l/s
	83	dBm
	84	h
	85	min
SwTypKind		
	1	Load Break
	2	Disconnector
	3	Earthing Switch
	4	High Speed Earthing Switch
TrBehKind		
	1	Single Pole Tripping
	2	Undefined
	3	Three Pole Tripping
BehKind1		
	1	on
	3	test
	4	test/blocked
	5	off
BehKind2		
	1	on
	3	test
	4	test/blocked
CtlModelKind3		
	0	status-only
	1	direct-with-normal-security

Enum ID	Ordinal	Value
	2	sbo-with-normal-security
SboClassKind1		
	0	operate-once
CtlModelKind2		
	1	direct-with-normal-security
	2	sbo-with-normal-security
CtlModelKind1		
	0	status-only
ControlOutputKind1		
	0	pulse
ControlOutputKind2		
	1	persistent

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3.5.2 Master (root) logical device

The Master logical device contains communications-related logical nodes, including GOOSE, reports, log, and virtual inputs.

The logical devices in UR family devices are arranged in a hierarchy, with the Master logical device as the root logical device and all other implemented logical devices direct descendants. The effect of this arrangement is that the scope of certain items in the Master logical device includes the entire hierarchy, as outlined in the following table.

Table 3-12: Master/root data objects and attributes

Name	Description
Mod	The controllable data object Mod controls the test mode selection of the UR device and thus affects the status of Beh data objects and of q data attributes
configRev	The configurable data attribute configRev has a scope that includes the entire UR device. Modify this attribute whenever any logical node gets a new semantic use, for example an instance of a CSWI is now serving a different physical switch or an instance of a logical node PDIS is now used for another zone. Also modify this attribute whenever any data object gets a new semantic use, for example the use of ConInGGIO.Ind1 changes from "Door open" to "Fire alarm". As it is not in general possible for the device to know that such a change has occurred, you need to revise the value of configRev.
paramRev	The configurable data attribute paramRev has a scope that includes the entire device, and thus is modified whenever any setting in the device changes. The UR increments the value of paramRev by one whenever one or multiple setting changes occurs in one Modbus write request by any means (front panel, Modbus, or MMS) other than by SCL file download. Incrementing occurs whether or not the setting is represented in the information model. When a UR device or EnerVista UR Setup accepts an SCL file, paramRev is set to the value in that SCL file. When EnerVista UR Setup changes one or more settings, and prepares an SCL file, it increments paramRev to the next higher multiple of 10 000.
SCGB	The setting group control block in the Master logical device has a scope that includes the entire device due to the UR logical device hierarchy. That is to say, all grouped settings are controlled form this one control block.

3.5.2.1 Event recorder (EvtRcd)

See LLN0.

3.5.2.2 Logical node zero (LLN0)

This element is instantiated in all UR devices.

The following is specific to the Master logical device. LLN0 in other logical devices have different content.

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Table 3-13: Logical node zero data objects

LNName: LLN0		LDevice inst: Master		UR element: Nameplate information for the logical nodes		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Beh		ENS			This logical device's behavior	R
	stVal	ENUMERATED	ST			R
	stVal	ENUMERATED	ST	LLN0.Beh.stVal of the Master logical device		R
Health		ENS			Only instantiated in the Master logical device	R
	stVal	ENUMERATED	ST	LPHD1.PhyHealth.stVal		R
On		SPS			Only instantiated in the Master logical device	R
	stVal	BOOLEAN	ST			R
Off		SPS			Only instantiated in the Master logical device	R
	stVal	BOOLEAN	ST			R
Zero		MV			Only instantiated in the Master logical device	R
	mag	AnalogueValue	MX			
	mag.f	FLOAT32			0.0	R
ZeroSV		SAV			Only instantiated in the Master logical device and when the order code includes process bus module. Not instantiated in C30	R
	instMag	AnalogueValue	MX			
	instMag.i	INT32			0.0	R
Mod		ENC			Only instantiated in the Master logical device	R/Ctrl
	ctlVal	ENUMERATED	CO			R
	stVal	ENUMERATED	ST			R
	ctlModel	CtlModels	CF	LLN0.Mod.ctlModel	2, the code for SBO control with normal security according to IEC 61850-7-2.	R/C
	sboTimeout	INT32U	CF		30000	R
	sboClass	SboClasses	CF		0 (operate-once)	R
	operTimeout	INT32U	CF		0	R
LocKey		SPS			Only instantiated in the Master logical device	R
	stVal	BOOLEAN	ST	IED in Local operand		R
TstMod		SPS			Only instantiated in the Master logical device	R
	stVal	BOOLEAN	ST	IED Beh Test RLY IN TEST MODE		R
TstBlkMod		SPS			Only instantiated in the Master logical device	R
	stVal	BOOLEAN	ST	IED Beh Test-Blocked RLY IN TESTBLK MODE		R
OnMod		SPS			Only instantiated in the Master logical device	R
	stVal	BOOLEAN	ST	IED Beh On RLY IN ON MODE		R
LEDRs		SPC			Only instantiated in the Master logical device	R/Ctrl
	pulseConfig .cmdQual	ENUMERATED			0 (pulse)	
	pulseConfig.onDur	INT32U			2 ms (actually one pass)	
	pulseConfig .offDur	INT32U			0	

LNName: LLN0		**LDevice inst: Master**		**UR element: Nameplate information for the logical nodes**		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	pulseConfig .numPls	INT32U			1	
	ctlModel	CtlModels	CF	LLN0.LEDRs.ctlModel		R/W/C
	sboTimeout	INT32U	CF		30000	R
	sboClass	SboClasses	CF		0 (operate-once)	R
	operTimeout	INT32U	CF		0	R
GrRef		ORG			Reference to root logical device	R
	setSrcRef	ObjectReference	SP	For communications, mapped to Master ldName if not empty, otherwise to the concatenation of the IED name and “Master”. For SCL, mapped to the concatenation of the IED name and “Master”.	reference to the data attribute to input	R
MltLev		SPG			Instantiated only in the Master logical device	R
	setVal	BOOLEAN	SP	True, when Multi-Level Control is EnabledFalse, when Multi-Level Control is Disabled		R
InRef11		ORG			TEST MODE INPUT setting	R
	setSrcRef	ObjectReference	SP	TEST MODE INPUT setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef12		ORG			TEST-BLK MODE INPUT setting	R
	setSrcRef	ObjectReference	SP	TEST-BLK MODE INPUT setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef21		ORG			IED LOCAL STATUS setting	R
	setSrcRef	ObjectReference	SP	IED LOCAL STATUS setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.2.3 Physical device information (LPHD1)

This element is instantiated in all UR devices.

Table 3-14: Physical device data objects

LNName: LPHD1		**LDevice inst: Master**		**UR element:**		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
PhyNam		DPL			This physical device’s name plate	R
	vendor	VISIBLE STRING255	DC	“GE Multilin”		R
	hwRev	VISIBLE STRING255	DC	CPU type of this unit, e.g. T/U/V/W		R
	swRev	VISIBLE STRING255	DC	Firmware revision, e.g. “7.30”		R
	serNum	VISIBLE STRING255	DC	The serial number of this unit.		R
	model	VISIBLE STRING255	DC	The order code of this unit.		R
	location	VISIBLE STRING255	DC	Location		R/C
	name	VISIBLE STRING64	DC	RELAY NAME		R/C
	latitude	FLOAT32	DC	Latitude		R/C
	longitude	FLOAT32	DC	Longitude		R/C

LNName: LPHD1		LDevice inst: Master		UR element:		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	altitude	FLOAT32	DC	Altitude		R/C
PhyHealth		ENS			This physical device's health	R
	stVal	ENUMERATED	ST			R
Proxy		SPS			Indicates if this LN is a proxy	R
	stVal	BOOLEAN	ST			R
RsStat		SPC			Mapped to command CLEAR ALL RELAY RECORDS	R/Ctrl
	pulseConfig .cmdQual	ENUMERATED				R
	pulseConfig.onDur	INT32U			0 indicates the duration is locally defined	R
	pulseConfig .offDur	INT32U				R
	pulseConfig .numPls	INT32U				R
	ctlModel	CtlModels	CF	LPHD1.RsStat.ctlModel	1, the code for direct control with normal security; 2 is code for SBO with normal security; 0 is for status only according to IEC 61850-7-2. Enhanced security is not supported as there is no means of confirming successful execution of the control command.	R/C
	sboTimeout	INT32U	CF			R
	sboClass	SboClasses	CF			R
	operTimeout	INT32U	CF			R

3.5.2.4 GOOSE subscription monitor (LGOS)

This element is instantiated in all UR devices.

See the G2 implementation model for GOOSE configuration via SCL section on page 3-281 for descriptions of data objects MAC, APPID, GoDatSetRef, GoID, ConfRev and InRefδδ.

Table 3-15: GOOSE subscription monitor data objects

LNName: LGOS#		LDevice inst: Master		UR element: Mapped to setting RxGOOSE# ID if not empty string, otherwise "RxGOOSE#		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
St		SPS			RxGOOSE# On operand	R
	stVal	BOOLEAN	ST	RxGOOSE# On		R
Alm		SPS			RxGOOSE# Off operand	R
	stVal	BOOLEAN	ST	RxGOOSE# Off		R
SimSt		SPS			Status showing that Sim messages are being received and accepted for RxGOOSE#	R
	stVal	BOOLEAN	ST	Status showing that really Sim messages are received and accepted		R
LastStNum		INS			Actual value RxGOOSE# stNum	R
	stVal	INT32	ST	Actual value RxGOOSE# stNum		R
	units.SIUnit	ENUMERATED			1	
	units.multiplier	ENUMERATED			0	R
LastSqNum		INS			Actual value RxGOOSE# sqNum	R

LNName: LGOS#		**LDevice inst: Master**		**UR element: Mapped to setting RxGOOSE# ID if not empty string, otherwise “RxGOOSE#**		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	stVal	INT32	ST	Actual value RxGOOSE# sqNum		R
	units.SIUnit	ENUMERATED			1	
	units.multiplier	ENUMERATED			0	R
RxConfRev Num		INS			Status of the confRev field in last received RxGOOSE# message	R
	stVal	INT32	ST	Status of the confRev field in last received RxGOOSE# message		R
	units.SIUnit	ENUMERATED			1	
	units.multiplier	ENUMERATED			0	R
ConfRevN um		INS			Expected ConfRev number	R
	stVal	INT32	ST	value of RxGOOSE# ConfRev		R/C
	units.SIUnit	ENUMERATED			1	
	units.multiplier	ENUMERATED			0	R
GoCBRef		ORG				R
	setSrcRef	ObjectReference	SP	Mapped to RxGOOSE# GoCBRef	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
MAC		VSG			Destination MAC address of messages subscribed to by RxGOOSE#	R
	setVal	VISIBLE STRING255	SP	RxGOOSE# Dst MAC if in E32.0 mode, otherwise empty string.		R
RgRxMode		ENG			R-RxGOOSE# RECEPTION MODE setting	R
	setVal	ENUMERATED	SP	R-RxGOOSE# RECEPTION MODE		R/C
RgSrcIP		VSG			Source IP address of subscribed RGOOSE message	R
	setVal	VISIBLE STRING255	SP	R-RxGOOSE# SRC IP if in E32.0 mode, otherwise empty string.		R/C
RgDstIP		VSG			Destination IP address of subscribed R-GOOSE message	R
	setVal	VISIBLE STRING255	SP	R-RxGOOSE# DST IP if in E32.0 mode, otherwise empty string.		R/C
SecEna		ENG			R-RxGOOSE# SECURITY setting	R
	setVal	ENUMERATED	SP	RxGOOSE# SECURITY if in E32.0 mode, otherwise 0.		R/C
APPID		ING			Setting RxGOOSE# ETYPE APPID	R
	setVal	INT32	SP	RxGOOSE# ETYPE APPID if in E32.0 mode, otherwise 0.		R/C
	minVal	INT32	CF		0	R
	maxVal	INT32	CF		65535	R
	stepSize	INT32U	CF		1	R
	units.SIUnit	ENUMERATED			1	R
	units.multiplier	ENUMERATED			0	R
GoDatSet Ref		ORG			Setting RxGOOSE# datSet	R
	setSrcRef	ObjectReference	SP	Mapped to RxGOOSE# datSet prefixed with the <LDName>/ LLN0$ portion of RxGOOSE# GoCBRef if in E32.0 mode, otherwise empty string.	reference to the data attribute to input	R/C
GoID		VSG			Setting RxGOOSE# goID	R
	setVal	VISIBLE STRING255	SP	RxGOOSE# goID if in E32.0 mode, otherwise empty string.		R

LNName: LGOS#		**LDevice inst: Master**		**UR element: Mapped to setting RxGOOSE# ID if not empty string, otherwise "RxGOOSE#**		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
RxMode		ENG			RxGOOSE# MODE setting	R
	setVal	ENUMERATED	SP	RxGOOSE# MODE if in E3-2.0 mode, otherwise set to default 0		R/C
InRefδδ		ORG			RxGOOSE# Member δδ	R
	setSrcRef	ObjectReference	SP	specifying bType and intermediate data object for RxGOOSE# Member δδ	reference to the data attribute to input	R/C
	intAddr	VISIBLE STRING255	SP			R/C

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3.5.2.5 FlexLogic operand interface (GGIO1)

This element is instantiated in all UR devices.

Table 3-16: FlexLogic data objects

LNName: <configured GGIO1 prefix>GGIO1		**LDevice inst: Master**		**UR element: FlexLogic Operand Interface functionality**		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Indψψψ		SPS			The name of the operand selected by setting GGIO1 INDICATION ψ	R
	stVal	BOOLEAN	ST			R

3.5.2.6 Virtual inputs (GGIO2)

This element is instantiated in all UR devices.

Table 3-17: Virtual input data objects

LNName: <configured GGIO2 prefix>GGIO2		**LDevice inst: Master**		**UR element: Generic controllable single point**		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
SPCSOψ		SPC			Status and control of FlexLogic operand Virt Ip ψ On	R/Ctrl
	stVal	BOOLEAN	ST	FlexLogic operand Virt Ip ψ On		R
	pulseConfig .cmdQual	ENUMERATED				R
	pulseConfig.onDur	INT32U			0 indicates the duration is locally defined	R
	pulseConfig .offDur	INT32U				R
	pulseConfig .numPls	INT32U				R
	ctlModel	CtlModels	CF	GGIO2 CF SPCSO ψ CTLMODEL		R/C
	sboTimeout	INT32U	CF			R
	sboClass	SboClasses	CF			R
	operTimeout	INT32U	CF			R
DPCSOϕ		DPC			Status and control of FlexLogic operands Pairs	R/Ctrl

LNName: <configured GGIO2 prefix>GGIO2		**LDevice inst: Master**		**UR element: Generic controllable single point**		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	stVal	CODED ENUM	ST	the combined states of FlexLogic operands Virt Ip 2*ϕ-1 and Virt Ip 2*ϕ. For example, if VI 1 is “1” and VI 2 is “0”, DPCSOϕ.stVal = “10”, or if VI 1 is “0” and VI 2 is “1”, DPCSOϕ.stVal = “01		R
	pulseConfig .cmdQual	ENUMERATED				R
	pulseConfig.onDur	INT32U			0 indicates the duration is locally defined	R
	pulseConfig .offDur	INT32U				R
	pulseConfig .numPls	INT32U				R
	ctlModel	CtlModels	CF	GGIO2 CF DPCSO ϕ CTLMODEL		R/C
	sboTimeout	INT32U	CF			R
	sboClass	SboClasses	CF			R
	operTimeout	INT32U	CF			R

3.5.2.7 Intermediate GOOSE subscription objects (GGIO3)

This element is instantiated in all UR devices.

Table 3-18: Intermediate GOOSE subscription data objects

LNName: GGIO3		**LDevice inst: Master**		**UR element: RxGOOSE Inputs**		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Indψψψ		SPS			RxGOOSE Booleanψ operand	R
	stVal	BOOLEAN	ST	RxGOOSE Booleanψ On		R
IndPosψψ		DPS			RxGOOSE DPSψ actual value	R
	stVal	CODED ENUM	ST			R
OpnStψψ		SPS			RxGOOSE DPSψ Off operand	R
	stVal	BOOLEAN	ST	FlexLogic operand RxGOOSE DPSψ Off		R
ClsStψψ		SPS			RxGOOSE DPSψ On operand	R
	stVal	BOOLEAN	ST	FlexLogic operand RxGOOSE DPSψ On		R
BadStψψ		SPS			RxGOOSE DPSψ Bad operand	R
	stVal	BOOLEAN	ST	FlexLogic operand RxGOOSE DPSψ Bad		R
IntermStψψ		SPS			RxGOOSE DPSψ INTERM operand	R
	stVal	BOOLEAN	ST	FlexLogic operand RxGOOSE DPSψ Interm		R

3.5.2.8 FlexAnalog operand interface (GGIO4)

This element is instantiated in all UR devices.

Table 3-19: FlexAnalog data objects

LNName: <configured GGIO4 prefix>GGIO4		LDevice inst: Master		UR element: FlexAnalog Operand Interface functionality		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
AnInψψ		MV			OFF	R
	instMag.f	FLOAT32		the operand selected by setting ANALOG IN ψ VALUE		R
	mag.f	FLOAT32			the operand selected by setting ANALOG IN ψ VALUE, deadbanded	R
	db	INT32U	CF	ANALOG IN ψ DB		R/W/C
	zeroDb	INT32U	CF		0	R
	rangeC.hhLim.f	FLOAT32			0	R
	rangeC.hLim.f	FLOAT32			0	R
	rangeC.lLim.f	FLOAT32			0	R
	rangeC.llLim.f	FLOAT32			0	R
	rangeC.min.f	FLOAT32		ANALOG IN ψ MIN		R/C
	rangeC.max.f	FLOAT32		ANALOG IN ψ MAX		R

3.5.3 Protection (Prot) logical device

The Prot logical device contains logical nodes that model protection and protection-related functions.

The Prot logical device is available when the IEC 61850 option is purchased with the UR device.

3.5.3.1 Logical node zero (LLN0)

This element is instantiated in all UR devices implementing the Prot logical device.

Table 3-20: Logical node zero data objects for protection

LNName: LLN0		LDevice inst: Prot		UR element: Nameplate information for the logical nodes		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Beh		ENS			This logical device's behavior	R
	stVal	ENUMERATED	ST			R
	stVal	ENUMERATED	ST	LLN0.Beh.stVal of the Master logical device		R
GrRef		ORG			Reference to root logical device	R
	setSrcRef	ObjectReference	SP	For communications, mapped to Master ldName if not empty, otherwise to the concatenation of the IED name and "Master". For SCL, mapped to the concatenation of the IED name and "Master".	reference to the data attribute to input	R

3.5.3.2 Accidental energization (AcdEnr)

This element is instantiated in the following products: G30, G60.

Table 3-21: Accidental energization data objects

LNName: AcdEnrPIOC1		LDevice inst: Prot		UR element: Accidental Energization element – Over-current function		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Op		ACT			ACCDNT ENRG OP operand	R
	general	BOOLEAN	ST	ACCDNT ENRG OP		R
Dpo		SPS			ACCDNT ENRG DPO operand	R

LNName: AcdEnrPIOC1		LDevice inst: Prot		UR element: Accidental Energization element – Over-current function		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	stVal	BOOLEAN	ST	ACCDNT ENRG DPO		R
Armed		SPS			ACCDNT ENRG ARMED operand	R
	stVal	BOOLEAN	ST	ACCDNT ENRG ARMED		R
InRefγ		ORG			ACCDNT ENRG OFFLINE setting for setting group γ.	R
	setSrcRef	ObjectReference	SP	ACCDNT ENRG OFFLINE	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
BlkRefγ		ORG			ACCDNT ENRG BLOCK setting for setting group γ.	R
	setSrcRef	ObjectReference	SP	ACCDNT ENRG BLOCK	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.3.3 Auxiliary overvoltage (AuxOv)

This element is instantiated in the following products: B30, C60, C70, C95, D30, D60, F35, F60, G30, G60, L30, L60, L90, M60, T60.

Table 3-22: Auxiliary overvoltage data objects

LNName: AuxOvPTOV#		LDevice inst: Prot		UR element: Auxiliary Overvoltage element # functions		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			AUX OV# PKP operands (including individual three phases)	R
	general	BOOLEAN	ST	AUX OV# PKP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown. It is unknown as the element is non-directional	R
Op		ACT			AUX OV# OP operand	R
	general	BOOLEAN	ST	AUX OV# OP		R
Dpo		SPS			AUX OV# DPO operand, which is the inverse of AUX OV PKP	R
	stVal	BOOLEAN	ST	AUX OV# DPO		R
BlkRefγ		ORG			AUX OV# BLK setting for setting group γ.	R
	setSrcRef	ObjectReference	SP	AUX OV# BLK for group γ.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.3.4 Auxiliary undervoltage (AuxUv)

This element is instantiated in the following products: B30, C60, C95, D30, D60, F35, F60, G30, G60, L30, L60, L90, M60, T60.

Table 3-23: Auxiliary undervoltage data objects

LNName: AuxUvPTUV#		LDevice inst: Prot		UR element: Auxiliary Undervoltage element# functions		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			AUX UV# PKP operands	R
	general	BOOLEAN	ST	AUX UV# PKP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown. It is unknown as the element is non-directional	R
Op		ACT			AUX UV# OP operand	R
	general	BOOLEAN	ST	AUX UV# OP		R
Dpo		SPS			AUX UV# DPO operand, which is the inverse of AUX UV PKP	R
	stVal	BOOLEAN	ST	AUX UV# DPO		R

LNName: AuxUvPTUV#		LDevice inst: Prot		UR element: Auxiliary Undervoltage element# functions		
data obj.	data attribute	Type	FC	UR Name	Description	R/W/C
BlkRefγ		ORG			AUX UV# BLOCK setting for setting group γ.	R
	setSrcRef	ObjectReference	SP	AUX UV# BLOCK for group γ.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.3.5 B90 breaker failure (B_BFai)

This element is instantiated in the following products: B90.

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Table 3-24: B90 breaker failure current data objects

LNName: B_BFaiPIOC#		LDevice inst: Prot		UR element: B90 BREAKER FAILURE CURRENT SUPV # function		
data obj.	data attribute	Type	FC	UR Name	Description	R/W/C
Op		ACT			BKRSUPV # SUPV OP operand	R
	general	BOOLEAN	ST	BKRSUPV # SUPV OP		R
OpHiSet		ACT			BKRSUPV # HISET OP operand	R
	general	BOOLEAN	ST	BKRSUPV # HISET OP		R
OpLoSet		ACT			BKRSUPV # LOSET OP operand	R
	general	BOOLEAN	ST	BKRSUPV # LOSET OP		R

Table 3-25: B90 breaker failure logic data objects

LNName: B_BFaiRBRF#		LDevice inst: Prot		UR element: B90 BREAKER FAILURE element		
data obj.	data attribute	Type	FC	UR Name	Description	R/W/C
OpEx		ACT			BKRFAIL # TRIP OP operand	R
	general	BOOLEAN	ST	BKRFAIL # TRIP OP		R
OpIn		ACT			BKRFAIL # RETRIP operand	R
	general	BOOLEAN	ST	re-trip operand BKR FAIL # RETRIP		R
	phsA	BOOLEAN	ST	BKR FAIL # RETRIP A		R
	phsB	BOOLEAN	ST	BKR FAIL # RETRIP B		R
	phsC	BOOLEAN	ST	BKR FAIL # RETRIP C		R
BkrOp&		SPS			BKRFAIL # T& OP operand	R
	stVal	BOOLEAN	ST	BKRFAIL # T& OP		R
InRefγ21		ORG			When B90 Function is set to logic, BF# PH A INITIATE setting for setting group γ, otherwise not used	R
	setSrcRef	ObjectReference	SP	When B90 Function is set to logic, BF# PH A INITIATE for group γ.Not used when B90 FUNCTION is set to “Protection”	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRefγ22		ORG			When B90 Function is set to logic, BF# PH B INITIATE setting for setting group γ, otherwise not used	R
	setSrcRef	ObjectReference	SP	When B90 Function is set to logic, BF# PH B INITIATE for group γ.Not used when B90 FUNCTION is set to “Protection”	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRefγ23		ORG			When B90 Function is set to logic, BF# PH C INITIATE setting for setting group γ, otherwise not used	R

LNName: B_BFaiRBRF#		LDevice inst: Prot		UR element: B90 BREAKER FAILURE element		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	setSrcRef	ObjectReference	SP	When B90 Function is set to logic, BF# PH C INITIATE for group γ.Not used when B90 FUNCTION is set to "Protection"	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRefγ24		ORG			When B90 Function is logic mapped to BF# 3PH INITIATE setting, otherwise mapped to BF# INITIATE setting for setting group γ.	R
	setSrcRef	ObjectReference	SP	When B90 Function is set to logic, BF# 3PH INITIATE for group γ.When B90 Function is set to protection, BF# INITIATE for group γ.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRefγ02		ORG			When B90 Function is set to logic, BF# AMP SUPV OP A setting for setting group γ, otherwise not used	R
	setSrcRef	ObjectReference	SP	When B90 Function is set to logic, BF# AMP SUPV OP A for group γ.Not used when B90 FUNCTION is set to "Protection"	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRefγ03		ORG			When B90 Function is set to logic, BF# AMP SUPV OP B setting for setting group γ, otherwise not used	R
	setSrcRef	ObjectReference	SP	When B90 Function is set to logic, BF# AMP SUPV OP B for group γ.Not used when B90 FUNCTION is set to "Protection"	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRefγ04		ORG			When B90 Function is set to logic, BF# AMP SUPV OP C setting for setting group γ, otherwise not used	R
	setSrcRef	ObjectReference	SP	When B90 Function is set to logic, BF# AMP SUPV OP C for group γ.Not used when B90 FUNCTION is set to "Protection"	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRefγ31		ORG			When B90 Function is logic mapped to BF# BKR POS1 PH A/3PH setting, otherwise mapped to BF# BKR POS1 setting for setting group γ.	R
	setSrcRef	ObjectReference	SP	When B90 Function is set to logic, BF# BKR POS1 ΦA/3P for group γ.When B90 Function is set to protection, BF# BKR POS1 for group γ.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRefγ32		ORG			When B90 Function is set to logic, BF# BKR POS1 PH B setting for setting group γ, otherwise not used	R
	setSrcRef	ObjectReference	SP	When B90 Function is set to logic, BF# BKR POS1 ΦB for group γ.Not used when B90 FUNCTION is set to "Protection"	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRefγ33		ORG			When B90 Function is set to logic, BF# BKR POS1 PH C setting for setting group γ, otherwise not used	R

LNName: B_BFaiRBRF#		LDevice inst: Prot		UR element: B90 BREAKER FAILURE element		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	setSrcRef	ObjectReference	SP	When B90 Function is set to logic, BF# BKR POS1 ΦC for group γ.Not used when B90 FUNCTION is set to “Protection”	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRefγ41		ORG			When B90 Function is logic mapped to BF# BKR POS2 PH A/3PH setting, otherwise mapped to BF# BKR POS2 setting for setting group γ.	R
	setSrcRef	ObjectReference	SP	When B90 Function is set to logic, BF# BKR POS2 ΦA/3P for group γ.When B90 Function is set to protection, BF# BKR POS2 for group γ.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRefγ42		ORG			When B90 Function is set to logic, BF# BKR POS2 PH B setting for setting group γ, otherwise not used	R
	setSrcRef	ObjectReference	SP	When B90 Function is set to logic, BF# BKR POS2 ΦB for group γ.Not used when B90 FUNCTION is set to “Protection”	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRefγ43		ORG			When B90 Function is set to logic, BF# BKR POS2 PH C setting for setting group γ, otherwise not used	R
	setSrcRef	ObjectReference	SP	When B90 Function is set to logic, BF# BKR POS2 ΦC for group γ.Not used when B90 FUNCTION is set to “Protection”	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRefγ07		ORG			BF# BKR TEST ON setting for setting group γ.	R
	setSrcRef	ObjectReference	SP	BF# BKR TEST ON for group γ.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRefγ08		ORG			When B90 Function is set to logic, BF# AMP HISET OP A setting for setting group γ, otherwise not used	R
	setSrcRef	ObjectReference	SP	When B90 Function is set to logic, BF# AMP HISET OP A for group γ.Not used when B90 FUNCTION is set to “Protection”	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRefγ09		ORG			When B90 Function is set to logic, BF# AMP HISET OP B setting for setting group γ, otherwise not used	R
	setSrcRef	ObjectReference	SP	When B90 Function is set to logic, BF# AMP HISET OP B for group γ.Not used when B90 FUNCTION is set to “Protection”	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRefγ10		ORG			When B90 Function is set to logic, BF# AMP HISET OP C setting for setting group γ, otherwise not used	R
	setSrcRef	ObjectReference	SP	When B90 Function is set to logic, BF# AMP HISET OP C for group γ.Not used when B90 FUNCTION is set to “Protection”	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

LNName: B_BFaiRBRF#		LDevice inst: Prot		UR element: B90 BREAKER FAILURE element		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
InRefγ11		ORG			When B90 Function is set to logic, BF# AMP LOSET OP A setting for setting group γ, otherwise not used	R
	setSrcRef	ObjectReference	SP	When B90 Function is set to logic, BF# AMP LOSET OP A for group γ.Not used when B90 FUNCTION is set to “Protection”	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRefγ12		ORG			When B90 Function is set to logic, BF# AMP LOSET OP B setting for setting group γ, otherwise not used	R
	setSrcRef	ObjectReference	SP	When B90 Function is set to logic, BF# AMP LOSET OP B for group γ.Not used when B90 FUNCTION is set to “Protection”	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRefγ13		ORG			When B90 Function is set to logic, BF# AMP LOSET OP C setting for setting group γ, otherwise not used	R
	setSrcRef	ObjectReference	SP	When B90 Function is set to logic, BF# AMP LOSET OP C for group γ.Not used when B90 FUNCTION is set to “Protection”	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
BlkRefγ		ORG			BF# BLK setting for setting group γ.	R
	setSrcRef	ObjectReference	SP	BF# BLK for group γ.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.3.6 B90 bus differential (B_Dif)

This element is instantiated in the following products: B90.

Table 3-26: B90 bus differential data objects

LNName: B_DifPDIF#		LDevice inst: Prot		UR element: B90 Bus zone # differential element function		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
StrBia		ACD			BUS # BIASED PKP operand	R
	general	BOOLEAN	ST	BUS # BIASED PKP		R
	dirGeneral	ENUMERATED	ST		1 for Forward, and it is mapped to same operand BUS # BIASED PKP (since differential DIR logic condition is part of differential logic)	R
Op		ACT			BUS # OP operand	R
	general	BOOLEAN	ST	BUS # OP		R
OpBia		ACT			BUS # BIASED OP operand	R
	general	BOOLEAN	ST	BUS # BIASED OP		R
OpUnBia		ACT			BUS # UNBIASED OP operand	R
	general	BOOLEAN	ST	BUS # UNBIASED OP		R
DpoBia		SPS			BUS # BIASED DPO operand, which is the inverse of BUS BIASED PKP	R
	stVal	BOOLEAN	ST	BUS # BIASED DPO		R
PhDir1		SPS			BUS # DIR operand	R
	stVal	BOOLEAN	ST	BUS # DIR		R
Sat1		SPS			BUS # SAT operand	R
	stVal	BOOLEAN	ST	BUS # SAT		R

LNName: B_DifPDIF#		**LDevice inst: Prot**		**UR element: B90 Bus zone # differential element function**		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
BDifAClc		CMV			BUS ZONE # differential current in primary amps	R
	instCVal.mag.f	FLOAT32		BUS ZONE # DIFF current magnitude		R
	instCVal.ang.f	FLOAT32		BUS # DIFF current angle		R
	cVal.mag.f	FLOAT32				R
	cVal.ang.f	FLOAT32				R
	units.SIUnit	ENUMERATED			5, the code for primary amperes	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	B_DifPDIF#.BDifAClc.db		R/W/C
	dbAng	INT32U	CF	B_DifPDIF#.BDifAClc.dbAng		R/W/C
	zeroDb	INT32U	CF			R
BRstA		CMV			BUS ZONE # restraint current in primary amps	R
	instCVal.mag.f	FLOAT32		BUS ZONE # REST current magnitude		R
	instCVal.ang.f	FLOAT32		BUS # REST current angle		R
	cVal.mag.f	FLOAT32				R
	cVal.ang.f	FLOAT32				R
	units.SIUnit	ENUMERATED			5, the code for primary amperes	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	B_DifPDIF#.BRstA.db		R/W/C
	dbAng	INT32U	CF	B_DifPDIF#.BRstA.dbAng		R/W/C
	zeroDb	INT32U	CF			R
InRefγ01		ORG			BUS ZONE # DIFF SUPV setting for setting group γ.	R
	setSrcRef	ObjectReference	SP	BUS ZONE # DIFF SUPV for group γ.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRefγ02		ORG			BUS ZONE # DIFF TRIP setting for setting group γ.	R
	setSrcRef	ObjectReference	SP	BUS ZONE # DIFF TRIP for group γ.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
BlkRefγ		ORG			BUS ZONE # DIFF BLK setting for setting group γ.	R
	setSrcRef	ObjectReference	SP	BUS ZONE # DIFF BLK for group γ.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef9ττ		ORG			BUS ZONE #τ STATUS setting.	R
	setSrcRef	ObjectReference	SP	BUS ZONE #τ STATUS setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.3.7 B90 end fault protection (B_Efp)

This element is instantiated in the following products: B90.

Table 3-27: B90 end fault protection data objects

LNName: B_EfpPIOC#		**LDevice inst: Prot**		**UR element: B90 End fault protection element # function**		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			EFP # PKP operand	R
	general	BOOLEAN	ST	EFP # PKP		R

LNName: B_EfpPIOC#		LDevice inst: Prot		UR element: B90 End fault protection element # function		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	dirGeneral	ENUMERATED	ST		0, the code for unknown. It is unknown as the element is non-directional	R
Op		ACT			EFP # OP operand	R
	general	BOOLEAN	ST	EFP # OP		R
Dpo		SPS			EFP # DPO operand, which is the inverse of EFP PKP	R
	stVal	BOOLEAN	ST	EFP # DPO		R
InRefγ1		ORG			EFP# BREAKER OPEN setting for setting group γ.	R
	setSrcRef	ObjectReference	SP	EFP# BREAKER OPEN for group γ.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRefγ2		ORG			EFP# MANUAL CLOSE setting for setting group γ.	R
	setSrcRef	ObjectReference	SP	EFP# MANUAL CLOSE for group γ.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
BlkRefγ		ORG			EFP# BLOCK setting for setting group γ.	R
	setSrcRef	ObjectReference	SP	EFP# BLOCK for group γ.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.3.8 B90 instantaneous overcurrent (B_Ioc)

This element is instantiated in the following products: B90.

Table 3-28: B90 instantaneous overcurrent data objects

LNName: B_IocPIOC#		LDevice inst: Prot		UR element: B90 Instantaneous Overcurrent element #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			IOC # PKP operand, which indicates Op will operate when delay expires.	R
	general	BOOLEAN	ST	IOC # PKP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown.	R
Op		ACT			IOC # OP operand	R
	general	BOOLEAN	ST	IOC # OP		R
Dpo		SPS			IOC # DPO operand	R
	stVal	BOOLEAN	ST	IOC # DPO		R
BlkRefγ		ORG			IOC# BLOCK setting for setting group γ.	R
	setSrcRef	ObjectReference	SP	IOC# BLOCK	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.3.9 B90 sensitive bus differential (B_SDifPDIF)

This element is instantiated in the following products: B90.

Table 3-29: B90 sensitive bus differential data objects

LNName: B_SDifPDIF#		LDevice inst: Prot		UR element: B90 Bus zone # sensitive differential element function		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			BUS# SENS DIF PKP operand	R
	general	BOOLEAN	ST	BUS# SENS DIF PKP		R

LNName: B_SDifPDIF#		LDevice inst: Prot		UR element: B90 Bus zone # sensitive differential element function		
data obj.	data attribute	Type	FC	UR Name	Description	R/W/C
	dirGeneral	ENUMERATED	ST		1 for Forward, and it is mapped to same operand BUS # BIASED PKP (since differential DIR logic condition is part of differential logic)	R
Op		ACT			BUS# SENS DIF OP operand	R
	general	BOOLEAN	ST	BUS# SENS DIF OP		R
Dpo		SPS			BUS# SENS DIF DPO operand	R
	stVal	BOOLEAN	ST	BUS# SENS DIF DPO		R
InRefγ01		ORG			BUS Z# SENS DIF SPV setting for setting group γ.	R
	setSrcRef	ObjectReference	SP	BUS Z# SENS DIF SPV for group γ.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
BlkRefγ		ORG			BUS Z# SENS DIF BLK setting for setting group γ.	R
	setSrcRef	ObjectReference	SP	BUS Z# SENS DIF BLK for group γ.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.3.10 B90 time overcurrent (B_Toc)

This element is instantiated in the following products: B90.

Table 3-30: B90 time overcurrent data objects

LNName: B_TocPTOC#		LDevice inst: Prot		UR element: Time Overcurrent element #		
data obj.	data attribute	Type	FC	UR Name	Description	R/W/C
Str		ACD			TOC# PKP operand, which indicates Op will operate when delay expires.	R
	general	BOOLEAN	ST	TOC# PKP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown.	R
Op		ACT			TOC# OP operands (including individual three phases)	R
	general	BOOLEAN	ST	TOC# OP		R
Dpo		SPS			TOC# DPO operand	R
	stVal	BOOLEAN	ST	TOC# DPO		R
BlkRefγ		ORG			TOC# BLOCK setting for setting group γ.	R
	setSrcRef	ObjectReference	SP	TOC# BLOCK for group γ	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.3.11 B90 undervoltage (B_Uv)

This element is instantiated in the following products: B90.

Table 3-31: B90 undervoltage data objects

LNName: B_UvPTUV#		LDevice inst: Prot		UR element: B90 Undervoltage element # function		
data obj.	data attribute	Type	FC	UR Name	Description	R/W/C
Str		ACD			UNDERVOLTAGE # PKP operands	R
	general	BOOLEAN	ST	UNDERVOLTAGE # PKP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown. It is unknown as the element is non-directional	R
Op		ACT			UNDERVOLTAGE # OP operand	R
	general	BOOLEAN	ST	UNDERVOLTAGE # OP		R

LNName: B_UvPTUV#		LDevice inst: Prot		UR element: B90 Undervoltage element # function		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Dpo		SPS			UNDERVOLTAGE # DPO operand, which is the inverse of UNDERVOLTAGE PKP	R
	stVal	BOOLEAN	ST	UNDERVOLTAGE # DPO		R
BlkRefγ		ORG			UNDERVOLTAGE # BLK setting for setting group γ.	R
	setSrcRef	ObjectReference	SP	UNDERVOLTAGE # BLK for group γ.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.3.12 Breaker failure (BkrFa)

This element is instantiated in the following products: B30, C60, C70, C95, D60, F60, G60, L30, L60, L90, M60, T60.

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Table 3-32: Breaker failure data objects

LNName: BkrFaRBRF#		LDevice inst: Prot		UR element: Breaker Control element #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
InRefγ02		ORG			BF# 3-POLE INITIATE setting for setting group γ	R
	setSrcRef	ObjectReference	SP	3-POLE INITIATE input	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRefγ16		ORG			BF# 3-POLE INITIATE2 setting for setting group γ	R
	setSrcRef	ObjectReference	SP	3-POLE INITIATE input	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
BlkRefγ		ORG			BF# BLOCK setting for setting group γ	R
	setSrcRef	ObjectReference	SP	BF# BLOCK.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRefγ03		ORG			BF# BKR POS1 ϕA/3P setting for setting group γ	R
	setSrcRef	ObjectReference	SP	BF# BKR POS1 ϕA/3P.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRefγ04		ORG			BF# BKR POS2 ϕA/3P setting for setting group γ	R
	setSrcRef	ObjectReference	SP	BF# BKR POS2 ϕA/3P.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRefγ05		ORG			BF# BKR POS1 ϕB setting for setting group γ	R
	setSrcRef	ObjectReference	SP	BF# BKR POS1 ϕB.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRefγ06		ORG			BF# BKR POS1 ϕC setting for setting group γ	R
	setSrcRef	ObjectReference	SP	BF# BKR POS1 0C.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRefγ07		ORG			BF# BKR POS2 ϕB setting for setting group γ	R
	setSrcRef	ObjectReference	SP	BF# BKR POS2 ϕB.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRefγ08		ORG			BF# BKR POS2 ϕC setting for setting group γ	R
	setSrcRef	ObjectReference	SP	BF# BKR POS2 ϕC.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
OpIn		ACT			BKR FAIL # RETRIP operands	R

LNName: BkrFaRBRF#		LDevice inst: Prot		UR element: Breaker Control element #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	general	BOOLEAN	ST	re-trip operand BKR FAIL # RETRIP		R
	phsA	BOOLEAN	ST	re-trip operand BKR FAIL # RETRIPA		R
	phsB	BOOLEAN	ST	re-trip operand BKR FAIL # RETRIPB		R
	phsC	BOOLEAN	ST	re-trip operand BKR FAIL # RETRIPC		R
BkrOp&		SPS			BKR FAIL # T& OP operand	R
	stVal	BOOLEAN	ST	BKR FAIL # T& OP		R
OpEx		ACT			BKR FAIL # TRIP OP operand	R
	general	BOOLEAN	ST	trip operand BKR FAIL # TRIP OP		R
InRefγ09		ORG			BF# PH A INITIATE setting for setting group γ	R
	setSrcRef	ObjectReference	SP	BF# PH A INITIATE.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRefγ13		ORG			BF# PH A INITIATE2 setting for setting group γ	R
	setSrcRef	ObjectReference	SP	BF# PH A INITIATE2.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRefγ10		ORG			BF# PH B INITIATE setting for setting group γ	R
	setSrcRef	ObjectReference	SP	BF# PH B INITIATE.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRefγ14		ORG			BF# PH B INITIATE2 setting for setting group γ	R
	setSrcRef	ObjectReference	SP	BF# PH B INITIATE2.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRefγ11		ORG			BF# PH C INITIATE setting for setting group γ	R
	setSrcRef	ObjectReference	SP	BF# PH C INITIATE.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRefγ15		ORG			BF# PH C INITIATE2 setting for setting group γ	R
	setSrcRef	ObjectReference	SP	BF# PH C INITIATE2.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.3.13 Breaker flashover (FlshOv)

This element is instantiated in the following products: B30, C60, C70, C95, D60, F35, F60, G60, L60, L90, M60, T60.

Table 3-33: Breaker flashover data objects

LNName: FlshOvPIOC#		LDevice inst: Prot		UR element: BREAKER FLASHOVER element #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Op		ACT			BKR # FLSHOVR OP operand (including individual three phases)	R
	general	BOOLEAN	ST	BKR # FLSHOVR OP		R
	phsA	BOOLEAN	ST	BKR # FLSHOVR OP A		R
	phsB	BOOLEAN	ST	BKR # FLSHOVR OP B		R
	phsC	BOOLEAN	ST	BKR # FLSHOVR OP C		R
Str		ACD			BKR # FLSHOVR PKP operand (including individual three phases)	R

LNName: FlshOvPIOC#		LDevice inst: Prot		UR element: BREAKER FLASHOVER element #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	general	BOOLEAN	ST	BKR # FLSHOVR PKP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown.	R
	phsA	BOOLEAN	ST	BKR # FLSHOVR PKP A		R
	dirPhsA	ENUMERATED	ST		0, the code for unknown	R
	phsB	BOOLEAN	ST	BKR # FLSHOVR PKP B		R
	dirPhsB	ENUMERATED	ST		0, the code for unknown	R
	phsC	BOOLEAN	ST	BKR # FLSHOVR PKP C		R
	dirPhsC	ENUMERATED	ST		0, the code for unknown	R
Dpo		SPS			BKR # FLSHOVR DPO operand	R
	stVal	BOOLEAN	ST	BKR # FLSHOVR DPO		R
DpoPhsφ		SPS			BKR # FLSHOVR DPO θ operand	R
	stVal	BOOLEAN	ST	BKR # FLSHOVR DPO θ		R
BlkRef1		ORG			BKR # FLSHOVR BLOCK setting	R
	setSrcRef	ObjectReference	SP	BKR # FLSHOVR BLOCK	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef1		ORG			BKR # STATUS CLSD A setting	R
	setSrcRef	ObjectReference	SP	BKR # STATUS CLSD A	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef2		ORG			BKR # STATUS CLSD B setting	R
	setSrcRef	ObjectReference	SP	BKR # STATUS CLSD B	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef3		ORG			BKR # STATUS CLSD C setting	R
	setSrcRef	ObjectReference	SP	BKR # STATUS CLSD C	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef4		ORG			BKR # FLSHOVR SPV A setting	R
	setSrcRef	ObjectReference	SP	BKR # FLSHOVR SPV A	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef5		ORG			BKR # FLSHOVR SPV B setting	R
	setSrcRef	ObjectReference	SP	BKR # FLSHOVR SPV B	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef6		ORG			BKR # FLSHOVR SPV C setting	R
	setSrcRef	ObjectReference	SP	BKR # FLSHOVR SPV C	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.3.14 Bus differential (BusDif)

This element is instantiated in the following products: B30.

Table 3-34: B30 bus differential data objects

LNName: BusDifPDIF#		LDevice inst: Prot		UR element: Bus Differential element # (ANSI 87B)		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			BUS # BIASED PKP operands (including individual three phases)	R
	general	BOOLEAN	ST	logical OR of phsA, phsB and phsC		R
	dirGeneral	ENUMERATED	ST			R
	phsA	BOOLEAN	ST	BUS # BIASED PKP A		R
	phsB	BOOLEAN	ST	BUS # BIASED PKP B		R
	phsC	BOOLEAN	ST	BUS # BIASED PKP C		R

LNName: BusDifPDIF#		LDevice inst: Prot		UR element: Bus Differential element # (ANSI 87B)		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	dirPhsA	ENUMERATED	ST			R
	dirPhsB	ENUMERATED	ST			R
	dirPhsC	ENUMERATED	ST			R
Op		ACT			BUS # OP operand	R
	general	BOOLEAN	ST	BUS # OP		R
Dpo		SPS			BUS # DPO operand	R
	stVal	BOOLEAN	ST	BUS # DPO		R
DpoPhs1ϕ		SPS			BUS # BIASED DPO θ operand	R
	stVal	BOOLEAN	ST	BUS # BIASED DPO θ		R
DpoPhs2ϕ		SPS			BUS # UNBIASED DPO θ operand	R
	stVal	BOOLEAN	ST	BUS # UNBIASED DPO θ		R
OpPhs1ϕ		SPS			BUS # BIASED OP θ operand	R
	stVal	BOOLEAN	ST	BUS # BIASED OP θ		R
OpPhs2ϕ		SPS			BUS # UNBIASED OP θ operand	R
	stVal	BOOLEAN	ST	BUS # UNBIASED OP θ		R
PhDirϕ		SPS			BUS # DIR θ operand	R
	stVal	BOOLEAN	ST	BUS # DIR θ		R
Satϕ		SPS			BUS # SAT θ operand	R
	stVal	BOOLEAN	ST	BUS # SAT θ		R
DifAClc		WYE			Phase differential currents	R
	phsθ	CMV				R
	phsθ.instCVal	Vector	MX			R
	phsθ.instCVal.mag.f	FLOAT32		BUS # DIFF Iθd magnitude, in primary amps		R
	phsθ.instCVal.ang.f	FLOAT32		BUS # DIFF		R
	phsθ.cVal	Vector	MX			R
	phsθ.cVal.mag.f	FLOAT32		BUS # DIFF Iθd magnitude, in primary amps, with deadband		R
	phsθ.cVal.ang.f	FLOAT32		BUS # DIFF		R
	phsθ.units	Unit	CF			R
	phsθ.units.SIUnit	ENUMERATED			5, the code for amps	R
	phsθ.units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	phsθ.db	INT32U	CF	BusDifPDIF#.DifAClc.phsθ.db		R/W/C
	phsθ.dbAng	INT32U	CF	BusDifPDIF#.DifAClc.phsθ.dbAng		R/W/C
	phsθ.zeroDb	INT32U	CF			R
	angRef	ENUMERATED	CF		See UR product manual regarding FREQUENCY AND PHASE REFERENCE	R
RstA		WYE			Phase restraint currents	R
	phsθ	CMV				R
	phsθ.instCVal	Vector	MX			R
	phsθ.instCVal.mag.f	FLOAT32		BUS # REST Iθr magnitude, in primary amps		R
	phsθ.instCVal.ang.f	FLOAT32		BUS # REXT		R
	phsθ.cVal	Vector	MX			R
	phsθ.cVal.mag.f	FLOAT32		BUS # REST Iθr magnitude, in primary amps, with deadband		R

LNName: BusDifPDIF#		LDevice inst: Prot		UR element: Bus Differential element # (ANSI 87B)		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	phsθ.cVal.ang.f	FLOAT32		BUS # REST		R
	phsθ.units	Unit	CF			R
	phsθ.units.SIUnit	ENUMERATED			5, the code for amps	R
	phsθ.units .multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	phsθ.db	INT32U	CF	BusDifPDIF#.DifAClc.phsθ.db		R/W/C
	phsθ.dbAng	INT32U	CF	BusDifPDIF#.DifAClc.phsθ.dbAn g		R/W/C
	phsθ.zeroDb	INT32U	CF			R
	angRef	ENUMERATED	CF		See UR product manual regarding FREQUENCY AND PHASE REFERENCE	R
InRef2τ		ORG			BUS ZONE #τ STATUS setting.	R
	setSrcRef	ObjectReference	SP	BUS ZONE #τ STATUS setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef10γ		ORG			Instantiated only for B30X order code option	R
	setSrcRef	ObjectReference	SP	BUS ZONE # DIFF AUX ZONE TRIP setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef11γ		ORG			Instantiated only for B30X order code option	R
	setSrcRef	ObjectReference	SP	BUS ZONE # DIFF SUPERVISION 1 setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef12γ		ORG			Instantiated only for B30X order code option	R
	setSrcRef	ObjectReference	SP	BUS ZONE # DIFF SUPERVISION 2 setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
BlkRefγ		ORG			BUS ZONE # DIFF BLK setting for setting group γ.	R
	setSrcRef	ObjectReference	SP	BUS ZONE # DIFF BLK.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

Table 3-35: B30 bus differential CT trouble data objects

LNName: BbCtTbPIOC#		LDevice inst: Prot		UR element: Bus Differential CT Trouble function		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Op		ACT			BUS ZONE # DIFF CT TROUBLE OP operands (including individual three phases)	R
	general	BOOLEAN	ST	CT TROUBLE # OP		R
	phsA	BOOLEAN	ST	CT TROUBLE # OP A		R
	phsB	BOOLEAN	ST	CT TROUBLE # OP B		R
	phsC	BOOLEAN	ST	CT TROUBLE # OP C		R

3.5.3.15 B30 sensitive ground bus differential (BSGDifPDIF#)

This element is instantiated in the following products: B30.

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Table 3-36: B30 sensitive ground bus differential function data objects

LNName: BSGDifPDIF#		LDevice inst: Prot		UR element: B30 Bus zone # GND differential element function		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			BUS# GND DIF PKP operand	R
	general	BOOLEAN	ST	BUS# GND DIF PKP		R
	dirGeneral	ENUMERATED	ST		1 for Forward, and it is mapped to the operand BUS # GND DIF DIR (since differential DIR logic condition is part of differential logic)	R
Op		ACT			BUS# GND DIF OP operand	R
	general	BOOLEAN	ST	BUS# GND DIF OP		R
Dpo		SPS			BUS# GND DIF DPO operand	R
	stVal	BOOLEAN	ST	BUS# GND DIF DPO		R
GndDir		SPS			BUS# GND DIF DIR operand	R
	stVal	BOOLEAN	ST	BUS# GND DIF DIR		R
Sat		SPS			BUS# GND DIF DC-SAT operand	R
	stVal	BOOLEAN	ST	BUS# GND DIF DC-SAT		R
VSupv		SPS			BUS# GND DIF V-SPV operand	R
	stVal	BOOLEAN	ST	BUS# GND DIF V-SPV		R
BlkRefγ		ORG			BUS Z# GND DIF BLK setting for setting group γ.	R
	setSrcRef	ObjectReference	SP	BUS Z# GND DIF BLK for group γ.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
DifAClc		WYE			Ground differential current	R
	res	CMV				R
	res.instCVal	Vector	MX			R
	res.instCVal.mag .f	FLOAT32		BUS # GND DIF Igd magnitude, in primary amps		R
	res.instCVal.ang .f	FLOAT32		BUS # GND D		R
	res.cVal	Vector	MX			R
	res.cVal.mag.f	FLOAT32		BUS # GND DIF Igd magnitude, in primary amps, with deadband		R
	res.cVal.ang.f	FLOAT32		BUS # GND D		R
	res.units	Unit	CF			R
	res.units.SIUnit	ENUMERATED			5, the code for amps	R
	res.units .multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	res.db	INT32U	CF	BSGDifPDIF#.DifAClc.res.db		R/W/C
	res.dbAng	INT32U	CF	BSGDifPDIF#.DifAClc.res.dbAng		R/W/C
	res.zeroDb	INT32U	CF			R
	angRef	ENUMERATED	CF		See UR product manual regarding FREQUENCY AND PHASE REFERENCE	R
RstA		WYE			Ground restraint current	R
	res	CMV				R
	res.instCVal	Vector	MX			R
	res.instCVal.mag .f	FLOAT32		BUS# GND DIF Igr magnitude, in primary amps		R
	res.cVal	Vector	MX			R
	res.cVal.mag.f	FLOAT32		BUS# GND DIF Igr magnitude, in primary amps, with deadband		R
	res.units	Unit	CF			R

LNName: BSGDifPDIF#		LDevice inst: Prot		UR element: B30 Bus zone # GND differential element function		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	res.units.SIUnit	ENUMERATED			5, the code for amps	R
	res.units .multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	res.db	INT32U	CF	BSGDifPDIF#.RstA.res.db		R/W/C
	res.zeroDb	INT32U	CF			R

3.5.3.16 Capacitor bank phase overvoltage (CPhOv)

This element is instantiated in the following products: C70.

Table 3-37: C70 capacitor bank phase overvoltage function data objects

LNName: CPhOvPTOV#		LDevice inst: Prot		UR element: BANK OVERVOLTAGE element #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			BANK OV # PKP operands (including individual three phases), which indicates element will operate when delay expires.	R
	general	BOOLEAN	ST	BANK OV # PKP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown. It is unknown as the element is non-directional	R
	phsA	BOOLEAN	ST	BANK OV # PKP A		R
	dirPhsA	ENUMERATED	ST		0, the code for unknown.	R
	phsB	BOOLEAN	ST	BANK OV # PKP B		R
	dirPhsB	ENUMERATED	ST		0, the code for unknown.	R
	phsC	BOOLEAN	ST	BANK OV # PKP C		R
	dirPhsC	ENUMERATED	ST		0, the code for unknown.	R
Op		ACT			BANK OV # OP operands (including individual three phases)	R
	general	BOOLEAN	ST	BANK OV # OP		R
	phsA	BOOLEAN	ST	BANK OV # OP A		R
	phsB	BOOLEAN	ST	BANK OV # OP B		R
	phsC	BOOLEAN	ST	BANK OV # OP C		R
Dpo		SPS			BANK OV # DPO operand	R
	stVal	BOOLEAN	ST	BANK OV # DPO		R
BlkRefγ		ORG			BANK OV # BLK setting for setting group γ.	R
	setSrcRef	ObjectReference	SP	BANK OV # BLK for group γ.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
OpV		WYE			Bank Operating Voltage in per unit for Ph A, B, and C	R
	phsA	CMV				R
	phsA.instCVal	Vector	MX			R
	phsA.instCVal.mag .f	FLOAT32		Bank overvoltage # phase A operate voltage		R
	phsA.cVal	Vector	MX			R
	phsA.cVal.mag.f	FLOAT32				R
	phsA.units	Unit	CF			R
	phsA.units.SIUnit	ENUMERATED			1, the code for dimensionless (per unit)	R
	phsA.units .multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	phsA.db	INT32U	CF	CPhOvPTOV#.OpV.phsAdb		R/W/C

LNName: CPhOvPTOV#		LDevice inst: Prot		UR element: BANK OVERVOLTAGE element #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	phsA.zeroDb	INT32U	CF	(VOLTAGE CUT-OFF LEVEL) / 275 * 100 000		R
	phsB	CMV				R
	phsB.instCVal	Vector	MX			R
	phsB.instCVal.mag.f	FLOAT32		Bank overvoltage # phase B operate voltage		R
	phsB.cVal	Vector	MX			R
	phsB.cVal.mag.f	FLOAT32				R
	phsB.units	Unit	CF			R
	phsB.units.SIUnit	ENUMERATED			1, the code for dimensionless (per unit)	R
	phsB.units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	phsB.db	INT32U	CF	CPhOvPTOV#.OpV.phsB.db		R/W/C
	phsB.zeroDb	INT32U	CF	(VOLTAGE CUT-OFF LEVEL) / 275 * 100 000		R
	phsC	CMV				R
	phsC.instCVal	Vector	MX			R
	phsC.instCVal.mag.f	FLOAT32		Bank overvoltage # phase B operate voltage		R
	phsC.cVal	Vector	MX			R
	phsC.cVal.mag.f	FLOAT32				R
	phsC.units	Unit	CF			R
	phsC.units.SIUnit	ENUMERATED			1, the code for dimensionless (per unit)	R
	phsC.units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	phsC.db	INT32U	CF	CPhOvPTOV#.OpV.phsC.db		R/W/C
	phsC.zeroDb	INT32U	CF	(VOLTAGE CUT-OFF LEVEL) / 275 * 100 000		R

Table 3-38: Capacitor bank phase overvoltage stage data objects

LNName: CPhOv$PTOV#		LDevice inst: Prot		UR element: BANK OVERVOLTAGE element # Stage $		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			BANK OV # STG $ PKP operands (including individual three phases), which indicates Op will operate when delay expires.	R
	general	BOOLEAN	ST	Logical OR of data attributes phsA, phsB and phsC		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown.	R
	phsA	BOOLEAN	ST	BANK OV # STG $A PKP		R
	dirPhsA	ENUMERATED	ST		0, the code for unknown.	R
	phsB	BOOLEAN	ST	BANK OV # STG $B PKP		R
	dirPhsB	ENUMERATED	ST		0, the code for unknown.	R
	phsC	BOOLEAN	ST	BANK OV # STG $C PKP		R
	dirPhsC	ENUMERATED	ST		0, the code for unknown.	R
Op		ACT			BANK OV # STG $ OP per phase operands (including individual three phases of each stage)	R
	general	BOOLEAN	ST	Logical OR of data attributes phsA, phsB and phsC		R
	phsA	BOOLEAN	ST	BANK OV # STG $A OP		R

LNName: CPhOv$PTOV#		LDevice inst: Prot		UR element: BANK OVERVOLTAGE element # Stage $		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	phsB	BOOLEAN	ST	BANK OV # STG $B OP		R
	phsC	BOOLEAN	ST	BANK OV # STG $C OP		R

3.5.3.17 Compensated overvoltage (CompOv)

This element is instantiated in the following products: D60, L60, L90.

Table 3-39: Compensated overvoltage function data objects

LNName: CmpOv0PTOV1		LDevice inst: Prot		UR element: Compensated Overvoltage functions.		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			COMP OV PKP operand	R
	general	BOOLEAN	ST	COMP OV PKP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown. It is unknown as the element is non-directional	R
Op		ACT			COMP OV OP operand	R
	general	BOOLEAN	ST	COMP OV OP		R
Dpo		SPS			COMP OV DPO operand, which is the inverse of COMP OV PKP	R
	stVal	BOOLEAN	ST	COMP OV DPO		R
BlkRefγ		ORG			COMPENSATED OV BLK setting for setting group γ.	R
	setSrcRef	ObjectReference	SP	COMPENSATED OV BLK for group γ.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

Table 3-40: Compensated overvoltage stage data objects

LNName: CmpOvPTOV$		LDevice inst: Prot		UR element: Compensated Overvoltage stage $.		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			COMP OV STG$ PKP operand	R
	general	BOOLEAN	ST	COMP OV STG$ PKP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown. It is unknown as the element is non-directional	R
Op		ACT			COMP OV STG$ OP operand	R
	general	BOOLEAN	ST	COMP OV STG$ OP		R
Dpo		SPS			COMP OV STG$ DPO operand, which is the inverse of COMP OV STG$ PKP	R
	stVal	BOOLEAN	ST	COMP OV STG$ DPO		R

3.5.3.18 Continuous monitor (CnMntr)

This element is instantiated in the following products: L90.

Table 3-41: Continuous monitor data objects

LNName: CnMntrGAPC1		LDevice inst: Prot		UR element: Continuous Monitor element		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			CONT MONITOR PKP operand	R
	general	BOOLEAN	ST	CONT MONITOR PKP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown	R
Op		ACT			CONT MONITOR OP operand	R
	general	BOOLEAN	ST	CONT MONITOR OP		R

LNName: CnMntrGAPC1		LDevice inst: Prot		UR element: Continuous Monitor element		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
InRef1		ORG			CONT MONITOR I-OP setting.	R
	setSrcRef	ObjectReference	SP	CONT MONITOR I-OP setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef2		ORG			CONT MONITOR I-SUPV setting.	R
	setSrcRef	ObjectReference	SP	Reference to the data object selected by CONT MONITOR I-SUPV	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef3		ORG			CONT MONITOR V-OP setting.	R
	setSrcRef	ObjectReference	SP	Reference to the data object selected by CONT MONITOR V-OP	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef4		ORG			CONT MONITOR V-SUPV setting.	R
	setSrcRef	ObjectReference	SP	Reference to the data object selected by CONT MONITOR V-SUPV	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.3.19 Current (amp) unbalance (AmpUnb)

This element is instantiated in the following products: M60.

Table 3-42: Current unbalance data objects

LNName: AmpUnbPTOC#		LDevice inst: Prot		UR element: Amp Unbalance element		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			AMP UNBALANCE # PKP operand	R
	general	BOOLEAN	ST	AMP UNBALANCE # PKP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown.	R
Op		ACT			AMP UNBALANCE # OP operand	R
	general	BOOLEAN	ST	AMP UNBALANCE # OP		R
Dpo		SPS			AMP UNBALANCE # DPO operand	R
	stVal	BOOLEAN	ST	AMP UNBALANCE # DPO		R
BlkRefγ		ORG			AMP UNBAL # BLOCK setting for setting group γ.	R
	setSrcRef	ObjectReference	SP	AMP UNBAL # BLOCK for group γ."	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
CurUnb		MV			CURRENT UNBALANCE in percentage (%)	R
	instMag.f	FLOAT32		CURRENT UNBALANCE		R
	mag.f	FLOAT32		instMag.f deadbanded exception		R
	units.SIUnit	ENUMERATED			1, the code for dimensionless	R
	units.multiplier	ENUMERATED			-2 is code for percent	R
	db	INT32	CF	AmpUnbPTOC#.CurUnb.db		R/W/C
	zeroDb	INT32	CF			R

3.5.3.20 Direct under-reaching transfer trip (DUTT_)

This element is instantiated in the following products: D60, L90.

Table 3-43: DUTT data objects

LNName: DUTT_PSCH1		LDevice inst: Prot		UR element: Direct Under-reaching Transfer Trip element		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Op		ACT			DUTT OP operand	R
	general	BOOLEAN	ST	DUTT OP		R
	phsA	BOOLEAN	ST	DUTT TRIP A		R
	phsB	BOOLEAN	ST	DUTT TRIP B		R
	phsC	BOOLEAN	ST	DUTT TRIP C		R
Tr3p		ACT			DUTT TRIP 3P operand	R
	general	BOOLEAN	ST	DUTT TRIP 3P		R
Tx1		SPS			DUTT TX1 operand	R
	stVal	BOOLEAN	ST	DUTT TX1		R
Tx2		SPS			DUTT TX2 operand	R
	stVal	BOOLEAN	ST	DUTT TX2		R
Tx3		SPS			DUTT TX3 operand	R
	stVal	BOOLEAN	ST	DUTT TX3		R
Tx4		SPS			DUTT TX4 operand	R
	stVal	BOOLEAN	ST	DUTT TX4		R
BlkRef1		ORG			DUTT SCHEME BLOCK setting.	R
	setSrcRef	ObjectReference	SP	DUTT SCHEME BLOCK.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef1		ORG			DUTT RX1 setting.	R
	setSrcRef	ObjectReference	SP	DUTT RX1	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef2		ORG			DUTT RX2 setting.	R
	setSrcRef	ObjectReference	SP	DUTT RX2	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef3		ORG			DUTT RX3 setting.	R
	setSrcRef	ObjectReference	SP	DUTT RX3	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef4		ORG			DUTT RX4 setting.	R
	setSrcRef	ObjectReference	SP	DUTT RX4	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.3.21 Directional comparison blocking (DCB_)

This element is instantiated in the following products: D60, L90.

Table 3-44: DCB data objects

LNName: DCB_PSCH1		LDevice inst: Prot		UR element: Directional Comparison Blocking element		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Op		ACT			DIR BLOCK OP operand	R
	general	BOOLEAN	ST	DIR BLOCK OP		R
	phsA	BOOLEAN	ST	DIR BLOCK TRIP A		R
	phsB	BOOLEAN	ST	DIR BLOCK TRIP B		R
	phsC	BOOLEAN	ST	DIR BLOCK TRIP C		R
Tr3p		ACT			DIR BLOCK TRIP 3P operand	R
	general	BOOLEAN	ST	DIR BLOCK TRIP 3P		R
TxBlk		ACT			DIR BLOCK TX INIT operand	R
	general	BOOLEAN	ST	DIR BLOCK TX INIT		R
TxStop1		SPS			DIR BLOCK TX1 STOP operand	R

LNName: DCB_PSCH1		LDevice inst: Prot		UR element: Directional Comparison Blocking element		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	stVal	BOOLEAN	ST	DIR BLOCK TX1 STOP		R
TxStop2		SPS			DIR BLOCK TX2 STOP operand	R
	stVal	BOOLEAN	ST	DIR BLOCK TX2 STOP		R
TxStop3		SPS			DIR BLOCK TX3 STOP operand	R
	stVal	BOOLEAN	ST	DIR BLOCK TX3 STOP		R
TxStop4		SPS			DIR BLOCK TX4 STOP operand	R
	stVal	BOOLEAN	ST	DIR BLOCK TX4 STOP		R
BlkRef1		ORG			BLOCKING SCHEME BLOCK setting.	R
	setSrcRef	ObjectReference	SP	BLOCKING SCHEME BLOCK.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef6		ORG			GND DIR O/C FWD setting.	R
	setSrcRef	ObjectReference	SP	GND DIR O/C FWD	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef7		ORG			GND DIR O/C REV setting.	R
	setSrcRef	ObjectReference	SP	GND DIR O/C REV	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef1		ORG			BLOCK SCHEME RX1 setting.	R
	setSrcRef	ObjectReference	SP	BLOCK SCHEME RX1	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef2		ORG			BLOCK SCHEME RX2 setting.	R
	setSrcRef	ObjectReference	SP	BLOCK SCHEME RX2	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef3		ORG			BLOCK SCHEME RX3 setting.	R
	setSrcRef	ObjectReference	SP	BLOCK SCHEME RX3	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef4		ORG			BLOCK SCHEME RX4 setting.	R
	setSrcRef	ObjectReference	SP	BLOCK SCHEME RX4	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.3.22 Directional comparison blocking (DCB1_)

This element is instantiated in the following products: D60, L90.

Table 3-45: DCB1 data objects

LNName: DCB1_PSCH1		LDevice inst: Prot		UR element: Directional Comparison Blocking1 element		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Op		ACT			DIR BLOCK1 OP operand	R
	general	BOOLEAN	ST	DIR BLOCK1 OP		R
	phsA	BOOLEAN	ST	DIR BLOCK1 TRIP A		R
	phsB	BOOLEAN	ST	DIR BLOCK1 TRIP B		R
	phsC	BOOLEAN	ST	DIR BLOCK1 TRIP C		R
Tr3p		ACT			Instantiated only on products with single pole tripping.	R
	general	BOOLEAN	ST	DIR BLOCK1 TRIP 3P		R
TxBlk		ACT			DIR BLOCK1 TX INIT operand	R
	general	BOOLEAN	ST	DIR BLOCK1 TX INIT		R
TxStop1		SPS			DIR BLOCK1 TX1 STOP operand	R
	stVal	BOOLEAN	ST	DIR BLOCK1 TX1 STOP		R
TxStop2		SPS			DIR BLOCK1 TX2 STOP operand	R

LNName: DCB1_PSCH1		LDevice inst: Prot		UR element: Directional Comparison Blocking1 element		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	stVal	BOOLEAN	ST	DIR BLOCK1 TX2 STOP		R
TxStop3		SPS			DIR BLOCK1 TX3 STOP operand	R
	stVal	BOOLEAN	ST	DIR BLOCK1 TX3 STOP		R
TxStop4		SPS			DIR BLOCK1 TX4 STOP operand	R
	stVal	BOOLEAN	ST	DIR BLOCK1 TX4 STOP		R
BlkRef1		ORG			BLOCK1 SCHEME BLOCK setting.	R
	setSrcRef	ObjectReference	SP	BLOCKI1 SCHEME BLOCK.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef06		ORG			BLK1 SCHME DIR FWD1 setting.	R
	setSrcRef	ObjectReference	SP	BLK1 SCHME DIR FWD1	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef07		ORG			BLK1 SCHME DIR FWD2 setting.	R
	setSrcRef	ObjectReference	SP	BLK1 SCHME DIR FWD2	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef08		ORG			BLK1 SCHME DIR FWD3 setting.	R
	setSrcRef	ObjectReference	SP	BLK1 SCHME DIR FWD3	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef09		ORG			BLK1 SCHME DIR REV1 setting.	R
	setSrcRef	ObjectReference	SP	BLK1 SCHME DIR REV1	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef10		ORG			BLK1 SCHME DIR REV2 setting.	R
	setSrcRef	ObjectReference	SP	BLK1 SCHME DIR REV2	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef11		ORG			BLK1 SCHME DIR REV3 setting.	R
	setSrcRef	ObjectReference	SP	BLK1 SCHME DIR REV3	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef12		ORG			BLK1 FORCE TX STOP1 setting.	R
	setSrcRef	ObjectReference	SP	BLK1 FORCE TX STOP1	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef13		ORG			BLK1 FORCE TX STOP2 setting.	R
	setSrcRef	ObjectReference	SP	BLK1 FORCE TX STOP2	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef01		ORG			BLOCK1 SCHEME RX1 setting.	R
	setSrcRef	ObjectReference	SP	BLOCK1 SCHEME RX1	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef02		ORG			BLOCK1 SCHEME RX2 setting.	R
	setSrcRef	ObjectReference	SP	BLOCK1 SCHEME RX2	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef03		ORG			BLOCK1 SCHEME RX3 setting.	R
	setSrcRef	ObjectReference	SP	BLOCK1 SCHEME RX3	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef04		ORG			BLOCK1 SCHEME RX4 setting.	R
	setSrcRef	ObjectReference	SP	BLOCK1 SCHEME RX4	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.3.23 Directional comparison blocking (DCB3_)

This element is instantiated in the following products: F60.

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Table 3-46: DCB3 data objects

LNName: DCB3_PSCH1		LDevice inst: Prot		UR element: Directional Comparison Blocking3 element		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Op		ACT			DCB3 OP operand	R
	general	BOOLEAN	ST	DCB3 OP		R
TxBlk		ACT			DCB3 TX INIT operand	R
	general	BOOLEAN	ST	DCB3 TX INIT		R
TxStop		SPS			DCB3 TX STOP operand	R
	stVal	BOOLEAN	ST	DCB3 TX STOP		R
BlkRef1		ORG			DCB3 SCHEME BLOCK setting.	R
	setSrcRef	ObjectReference	SP	DCB3 SCHEME BLOCK.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef01		ORG			DCB3 SCHME DIR FWD1 setting.	R
	setSrcRef	ObjectReference	SP	DCB3 SCHME DIR FWD1	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef02		ORG			DCB3 SCHME DIR FWD2 setting.	R
	setSrcRef	ObjectReference	SP	DCB3 SCHME DIR FWD2	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef03		ORG			DCB3 SCHME DIR FWD3 setting.	R
	setSrcRef	ObjectReference	SP	DCB3 SCHME DIR FWD3	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef11		ORG			DCB3 SCHME DIR REV1 setting.	R
	setSrcRef	ObjectReference	SP	DCB3 SCHME DIR REV1	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef12		ORG			DCB3 SCHME DIR REV2 setting.	R
	setSrcRef	ObjectReference	SP	DCB3 SCHME DIR REV2	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef13		ORG			DCB3 SCHME DIR REV3 setting.	R
	setSrcRef	ObjectReference	SP	DCB3 SCHME DIR REV3	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef21		ORG			DCB3 FORCE TX STOP1 setting.	R
	setSrcRef	ObjectReference	SP	DCB3 FORCE TX STOP1	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef22		ORG			DCB3 FORCE TX STOP2 setting.	R
	setSrcRef	ObjectReference	SP	DCB3 FORCE TX STOP2	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef31		ORG			DCB3 RX setting.	R
	setSrcRef	ObjectReference	SP	DCB3 RX	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.3.24 Directional comparison unblocking (DCUB_)

This element is instantiated in the following products: D60, L90.

Table 3-47: Directional comparison unblocking data objects

LNName: DCUB_PSCH1		LDevice inst: Prot		UR element: Directional Comparison Unblocking element		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Op		ACT			DCUB OP operand	R
	general	BOOLEAN	ST	DCUB OP		R
	phsA	BOOLEAN	ST	DCUB TRIP A		R
	phsB	BOOLEAN	ST	DCUB TRIP B		R

LNName: DCUB_PSCH1		LDevice inst: Prot		UR element: Directional Comparison Unblocking element		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	phsC	BOOLEAN	ST	DCUB TRIP C		R
Tr3p		ACT			DCUB TRIP 3P operand	R
	general	BOOLEAN	ST	DCUB TRIP 3P		R
Tx1		SPS			DCUB TX1 operand	R
	stVal	BOOLEAN	ST	DCUB TX1		R
Tx2		SPS			DCUB TX2 operand	R
	stVal	BOOLEAN	ST	DCUB TX2		R
Tx3		SPS			DCUB TX3 operand	R
	stVal	BOOLEAN	ST	DCUB TX3		R
Tx4		SPS			DCUB TX4 operand	R
	stVal	BOOLEAN	ST	DCUB TX4		R
BlkRef1		ORG			DCUB BLOCK setting.	R
	setSrcRef	ObjectReference	SP	DCUB BLOCK.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef05		ORG			DCUB ECHO COND setting.	R
	setSrcRef	ObjectReference	SP	DCUB ECHO COND	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef06		ORG			GND DIR O/C FWD setting.	R
	setSrcRef	ObjectReference	SP	GND DIR O/C FWD	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef07		ORG			GND DIR O/C REV setting.	R
	setSrcRef	ObjectReference	SP	GND DIR O/C REV	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef01		ORG			DCUB RX1 setting.	R
	setSrcRef	ObjectReference	SP	DCUB RX1	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef11		ORG			DCUB LOG RX1 setting (Loss of Guard)	R
	setSrcRef	ObjectReference	SP	DCUB LOG1	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef02		ORG			DCUB RX2 setting.	R
	setSrcRef	ObjectReference	SP	DCUB RX2	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef12		ORG			DCUB LOG2 setting (Loss of Guard)	R
	setSrcRef	ObjectReference	SP	DCUB LOG2	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef03		ORG			DCUB RX3 setting.	R
	setSrcRef	ObjectReference	SP	DCUB RX3	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef13		ORG			DCUB LOG3 setting (Loss of Guard)	R
	setSrcRef	ObjectReference	SP	DCUB LOG3	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef04		ORG			DCUB RX4 setting.	R
	setSrcRef	ObjectReference	SP	DCUB RX4	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef14		ORG			DCUB LOG4 setting (Loss of Guard)	R
	setSrcRef	ObjectReference	SP	DCUB LOG4	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

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3.5.3.25 Field current protection (FldAmp)

This element is instantiated in the following products: G60.

Table 3-48: Field current overcurrent data objects

LNName: FldAmpPTOC1		LDevice inst: Prot		UR element: FIELD CURRENT element over current functions		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			FIELD OC PKP operand	R
	general	BOOLEAN	ST	FIELD OC PKP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown. It is unknown as the element may be connected/ configured to look forward or backward	R
Op		ACT			FIELD OC OP operand	R
	general	BOOLEAN	ST	FIELD OC OP		R
Dpo		SPS			FIELD OC DPO operand	R
	stVal	BOOLEAN	ST	FIELD OC DPO		R
BlkRefγ		ORG			FIELD CURRENT BLK setting for setting group γ.	R
	setSrcRef	ObjectReference	SP	FIELD CURRENT BLK for group γ.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

Table 3-49: Field current undercurrent data objects

LNName: FldAmpPTUC1		LDevice inst: Prot		UR element: FIELD GROUND element under current functions		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			FIELD UC PKP operand	R
	general	BOOLEAN	ST	FIELD UC PKP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown. It is unknown as the element may be connected/ configured to look forward or backward	R
Op		ACT			FIELD UC OP operand	R
	general	BOOLEAN	ST	FIELD UC OP		R
Dpo		SPS			FIELD UC DPO operand	R
	stVal	BOOLEAN	ST	FIELD UC DPO		R

3.5.3.26 Field ground protection (FldGnd)

This element is instantiated in the following products: G60.

Table 3-50: Field ground protection data objects

LNName: FldGnd0PHIZ1		LDevice inst: Prot		UR element: FIELD GROUND INJ UC element functions		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			FIELD GND INJ UC PKP operand	R
	general	BOOLEAN	ST	FIELD GND INJ UC PKP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown. It is unknown as the element may be connected/ configured to look forward or backward	R
Op		ACT			FIELD GND INJ UC OP operand	R
	general	BOOLEAN	ST	FIELD GND INJ UC OP		R
Dpo		SPS			FIELD GND INJ UC DPO operand	R
	stVal	BOOLEAN	ST	FIELD GND INJ UC DPO		R
Fail		SPS			GPM-F FAILURE operand	R
	stVal	BOOLEAN	ST	GPM-F FAILURE		R
GndRis		MV			FIELD GROUND RESIST in ohms	R

LNName: FldGnd0PHIZ1		LDevice inst: Prot		UR element: FIELD GROUND INJ UC element functions		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	instMag.f	FLOAT32		FIELD GROUND RESIST		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			30, the code for ohm	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	FldGnd0PHIZ1.GndRis.db		R/W/C
	zeroDb	INT32U	CF			R
GndAmp		MV			FIELD GROUND CURRENT in amperes	R
	instMag.f	FLOAT32		FIELD GROUND CURRENT		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			5, the code for amperes	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	FldGnd0PHIZ1.GndAmp.db		R/W/C
	zeroDb	INT32U	CF			R
Vol		MV			FIELD VOLTAGE in volts	R
	instMag.f	FLOAT32		FIELD VOLTAGE		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			29, the code for volts (W/A)	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	FldGnd0PHIZ1.Vol.db		R/W/C
	zeroDb	INT32U	CF			R
Amp		MV			FIELD CURRENT in amperes	R
	instMag.f	FLOAT32		FIELD CURRENT		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			5, the code for amperes	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	FldGnd0PHIZ1.Amp.db		R/W/C
	zeroDb	INT32U	CF			R
InjVol		MV			INJECTED VOLTAGE in volts	R
	instMag.f	FLOAT32		INJECTED VOLTAGE		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			29, the code for volts (W/A)	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	FldGnd0PHIZ1.InjVol.db		R/W/C
	zeroDb	INT32U	CF			R
FltLocation		MV			FAULT LOCATION in percentage of field winding from negative terminal in case of single point injection. If double point injection, displays Invalid value	R
	instMag.f	FLOAT32		FAULT LOCATION		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			1, the code for dimensionless (percentage)	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	FldGnd0PHIZ1.FltLocation.db		R/W/C
	zeroDb	INT32U	CF			R
BlkRefγ		ORG			FIELD GROUND BLK setting for setting group γ.	R
	setSrcRef	ObjectReference	SP	FIELD GROUND BLK for group γ.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

Table 3-51: Field ground protection stage 1 objects

LNName: FldGnd1PHIZ1		LDevice inst: Prot		UR element: FIELD GROUND element stage 1 functions		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			FIELD GND STG1 PKP operand	R
	general	BOOLEAN	ST	FIELD GND STG1 PKP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown. It is unknown as the element may be connected/ configured to look forward or backward	R
Op		ACT			FIELD GND STG1 OP operand	R
	general	BOOLEAN	ST	FIELD GND STG1 OP		R
Dpo		SPS			FIELD GND STG1 DPO operand	R
	stVal	BOOLEAN	ST	FIELD GND STG1 DPO		R

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Table 3-52: Field ground protection stage 2 objects

LNName: FldGnd2PHIZ1		LDevice inst: Prot		UR element: FIELD GROUND element stage 2 functions		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			FIELD GND STG2 PKP operand	R
	general	BOOLEAN	ST	FIELD GND STG2 PKP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown. It is unknown as the element may be connected/ configured to look forward or backward	R
Op		ACT			FIELD GND STG2 OP operand	R
	general	BOOLEAN	ST	FIELD GND STG2 OP		R
Dpo		SPS			FIELD GND STG2 DPO operand	R
	stVal	BOOLEAN	ST	FIELD GND STG2 DPO		R

3.5.3.27 Frequency rate of change (RteHz)

This element is instantiated in the following products: D30, D60, F60, G30, G60, L30, L90, N60, T60.

Table 3-53: Frequency rate of change data objects

LNName: RteHzPFRC#		LDevice inst: Prot		UR element: Frequency Rate of Change element #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			FREQ RATE # PKP operand, which is indicates Op will operate when delay expires.	R
	general	BOOLEAN	ST	FREQ RATE # PKP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown.	R
Op		ACT			FREQ RATE # OP operand	R
	general	BOOLEAN	ST	FREQ RATE # OP		R
Dpo		SPS			FREQ RATE # DPO operand	R
	stVal	BOOLEAN	ST	FREQ RATE # DPO		R
HzChgRte		MV			FREQUENCY RATE OF CHANGE # in Hz/s	R
	instMag.f	FLOAT32		FREQUENCY RATE OF CHANGE #		R
	mag.f	FLOAT32		FREQUENCY RATE OF CHANGE # on deadband exception		R
	units.SIUint	ENUMERATED			75, the code for Rate of change of frequency (Hz/s)	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	RteHzPFRC#.HzChgRte.db		R/W/C
	zeroDb	INT32U	CF			R
BlkRef1		ORG			FREQ RATE # BLOCK setting.	R

LNName: RteHzPFRC#		LDevice inst: Prot		UR element: Frequency Rate of Change element #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	setSrcRef	ObjectReference	SP	FREQ RATE # BLOCK.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.3.28 Generator unbalance (GnUnb)

This element is instantiated in the following products: G30, G60.

Table 3-54: Generator unbalance data objects

LNName: GnUnbPTOC1		LDevice inst: Prot		UR element: Generator Unbalance element		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			GEN UNBAL PKP operands (including individual three phases), which indicates Op will operate when delay expires.	R
	general	BOOLEAN	ST	GEN UNBAL PKP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown.	R
Op		ACT			GEN UNBAL OP operand	R
	general	BOOLEAN	ST	GEN UNBAL OP		R
Dpo		SPS			GEN UNBAL DPO operand	R
	stVal	BOOLEAN	ST	GEN UNBAL DPO		R
BlkRefy		ORG			GEN UNBAL BLK setting for setting group y.	R
	setSrcRef	ObjectReference	SP	GEN UNBAL BLK for group	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

Table 3-55: Generator unbalance stage objects

LNName: GnUnb$PTOC1		LDevice inst: Prot		UR element: Generator Unbalance element Stage $		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			GEN UNBAL STG$ PKP operand	R
	general	BOOLEAN	ST	GEN UNBAL STG$ PKP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown.	R
Op		ACT			GEN UNBAL STG$ OP operand	R
	general	BOOLEAN	ST	GEN UNBAL STG$ OP		R
Dpo		SPS			GEN UNBAL STG$ DPO operand	R
	stVal	BOOLEAN	ST	GEN UNBAL STG$ DPO		R

3.5.3.29 Ground distance (GndDis)

This element is instantiated in the following products: D30, D60, L60, L90, T60.

Table 3-56: Ground distance data objects

LNName: GndDisPDIS#		LDevice inst: Prot		UR element: Ground Distance Z# Settings		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			GND DIST Z# PKP operand in Phase –To –Ground	R
	general	BOOLEAN	ST	GND DIST Z# PKP		R
	dirGeneral	ENUMERATED	ST			R
	phsA	BOOLEAN	ST	GND DIST Z# PKP A		R
	dirPhsA	ENUMERATED	ST	dirGeneral		R
	phsB	BOOLEAN	ST	GND DIST Z# PKP B		R

LNName: GndDisPDIS#		LDevice inst: Prot		UR element: Ground Distance Z# Settings		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	dirPhsB	ENUMERATED	ST	dirGeneral		R
	phsC	BOOLEAN	ST	GND DIST Z# PKP C		R
	dirPhsC	ENUMERATED	ST	dirGeneral		R
Op		ACT			GND DIST Z# OP operand	R
	general	BOOLEAN	ST	GND DIST Z# OP		R
	phsA	BOOLEAN	ST	GND DIST Z# OP A		R
	phsB	BOOLEAN	ST	GND DIST Z# OP B		R
	phsC	BOOLEAN	ST	GND DIST Z# OP C		R
NeutSupn		SPS			GND DIST Z# SUPN IN operand	R
	stVal	BOOLEAN	ST	GND DIST Z# SUPN IN		R
DpoPhsϕ		SPS			GND DIST Z# DPO θ operand	R
	stVal	BOOLEAN	ST	GND DIST Z#DPO θ		R
BlkRefγ		ORG			GND DIST Z# BLK setting for setting group γ.	R
	setSrcRef	ObjectReference	SP	GND DIST Z# BLK.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.3.30 Ground instantaneous overcurrent (GndIoc)

This element is instantiated in the following products: B30, C60, C70, C95, D30, D60, F35, F60, G30, G60, L30, L60, L90, M60, N60, T35, T60.

Table 3-57: Ground instantaneous overcurrent data objects

LNName: GndIocPIOC#		LDevice inst: Prot		UR element: Ground Instantaneous Overcurrent element#		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			GROUND IOC# PKP operand, which is indicates Op will operate when delay expires.	R
	general	BOOLEAN	ST	GROUND IOC# PKP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown.	R
Op		ACT			GROUND IOC# OP operand	R
	general	BOOLEAN	ST	GROUND IOC# OP		R
Dpo		SPS			GROUND IOC# DPO operand	R
	stVal	BOOLEAN	ST	GROUND IOC# DPO		R
BlkRefγ1		ORG			GROUND IOC# BLOCK setting in setting group γ.	R
	setSrcRef	ObjectReference	SP	GROUND IOC# BLOCK.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.3.31 Ground time overcurrent (GndToc)

This element is instantiated in the following products: B30, C60, C70, C95, D30, D60, F35, F60, G30, G60, L30, L60, L90, M60, N60, T35, T60.

Table 3-58: Ground time overcurrent data objects

LNName: GndTocPTOC#		LDevice inst: Prot		UR element: Ground Time Overcurrent element#		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			GROUND TOC# PKP operand, which indicates Op will operate when delay expires.	R
	general	BOOLEAN	ST	GROUND TOC# PKP		R

LNName: GndTocPTOC#		LDevice inst: Prot		UR element: Ground Time Overcurrent element#		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	dirGeneral	ENUMERATED	ST		0, the code for unknown.	R
Op		ACT			GROUND TOC# OP operand	R
	general	BOOLEAN	ST	GROUND TOC# OP		R
Dpo		SPS			GROUND TOC# DPO operand	R
	stVal	BOOLEAN	ST	GROUND TOC# DPO		R
BlkRefγ1		ORG			GROUND TOC# BLOCK setting in setting group γ.	R
	setSrcRef	ObjectReference	SP	GROUND TOC# BLOCK.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

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3.5.3.32 Hybrid permissive over-reaching transfer trip (HPOTT_)

This element is instantiated in the following products: D60, L90.

Table 3-59: Hybrid POTT data objects

LNName: HPOTT_PSCH1		LDevice inst: Prot		UR element: Hybrid Permissive Over-reaching Transfer Trip element		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Op		ACT			HYBRID POTT OP operand	R
	general	BOOLEAN	ST	HYBRID POTT OP		R
	phsA	BOOLEAN	ST	HYBRID POTT TRIP A		R
	phsB	BOOLEAN	ST	HYBRID POTT TRIP B		R
	phsC	BOOLEAN	ST	HYBRID POTT TRIP C		R
Tr3p		ACT			HYBRID POTT TRIP 3P operand	R
	general	BOOLEAN	ST	HYBRID POTT TRIP 3P		R
Tx1		SPS			HYBRID POTT TX1 operand	R
	stVal	BOOLEAN	ST	HYBRID POTT TX1		R
Tx2		SPS			HYBRID POTT TX2 operand	R
	stVal	BOOLEAN	ST	HYBRID POTT TX2		R
Tx3		SPS			HYBRID POTT TX3 operand	R
	stVal	BOOLEAN	ST	HYBRID POTT TX3		R
Tx4		SPS			HYBRID POTT TX4 operand	R
	stVal	BOOLEAN	ST	HYBRID POTT TX4		R
BlkRef1		ORG			HYB POTT SCHEME BLOCK setting.	R
	setSrcRef	ObjectReference	SP	HYB POTT SCHEME BLOCK.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef5		ORG			HYB POTT ECHO COND setting.	R
	setSrcRef	ObjectReference	SP	HYB POTT ECHO COND	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef8		ORG			HYB POTT W/I COND setting.	R
	setSrcRef	ObjectReference	SP	HYB POTT W/I COND	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef6		ORG			GND DIR O/C FWD setting.	R
	setSrcRef	ObjectReference	SP	GND DIR O/C FWD	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef7		ORG			GND DIR O/C REV setting.	R
	setSrcRef	ObjectReference	SP	GND DIR O/C REV	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef1		ORG			HYB POTT RX1 setting.	R
	setSrcRef	ObjectReference	SP	HYB POTT RX1	reference to the data attribute to input	R/C

LNName: HPOTT_PSCH1		LDevice inst: Prot		UR element: Hybrid Permissive Over-reaching Transfer Trip element		
data obj.	data attribute	Type	FC	UR Name	Description	R/W/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef2		ORG			HYB POTT RX2 setting.	R
	setSrcRef	ObjectReference	SP	HYB POTT RX2	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef3		ORG			HYB POTT RX3 setting.	R
	setSrcRef	ObjectReference	SP	HYB POTT RX3	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef4		ORG			HYB POTT RX4 setting.	R
	setSrcRef	ObjectReference	SP	HYB POTT RX4	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

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3.5.3.33 Line current differential (LinDif)

This element is instantiated in the following products: L30, L90.

Table 3-60: Line current differential data objects

LNName: LinDfPDIF1		LDevice inst: Prot		UR element: Line Differential element (ANSI 87L) phase and general functions		
data obj.	data attribute	Type	FC	UR Name	Description	R/W/C
Str		ACD			only instantiated in L90	R
	general	BOOLEAN	ST	87L DIFF OP		R
	dirGeneral	ENUMERATED	ST		1, the code for forward	R
	phsA	BOOLEAN	ST	87L DIFF OP A		R
	dirPhsA	ENUMERATED	ST		1, the code for forward	R
	phsB	BOOLEAN	ST	87L DIFF OP B		R
	dirPhsB	ENUMERATED	ST		1, the code for forward	R
	phsC	BOOLEAN	ST	87L DIFF OP C		R
	dirPhsC	ENUMERATED	ST		1, the code for forward	R
Op		ACT			only instantiated in L90	R
	general	BOOLEAN	ST	87L TRIP OP		R
	phsA	BOOLEAN	ST	87L TRIP OP A		R
	phsB	BOOLEAN	ST	87L TRIP OP B		R
	phsC	BOOLEAN	ST	87L TRIP OP C		R
Op		ACT			only instantiated in L30	R
	general	BOOLEAN	ST	87L DIFF OP		R
StrGnd		ACD			87L DIFF PKP G operand	R
	general	BOOLEAN	ST	87L DIFF PKP G		R
	dirGeneral	ENUMERATED	ST		1, the code for forward	R
OpGnd		ACT			87L DIFF OP G operand	R
	general	BOOLEAN	ST	87L DIFF OP G		R
Tr3p		ACT			only instantiated in L90	R
	general	BOOLEAN	ST	87L TRIP 3P OP		R
Tr1p		ACT			only instantiated in L90	R
	general	BOOLEAN	ST	87L TRIP 1P OP		R
RxTr1		ACT			only instantiated in L90	R
	general	BOOLEAN	ST	logical OR of phsA, phsB, phsC		R
	phsA	BOOLEAN	ST	87L DIFF RECVD DTT A		R
	phsB	BOOLEAN	ST	87L DIFF RECVD DTT B		R
	phsC	BOOLEAN	ST	87L DIFF RECVD DTT C		R

LNName: LinDfPDIF1		**LDevice inst: Prot**		**UR element: Line Differential element (ANSI 87L) phase and general functions**		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
RxTr1		ACT			only instantiated in L30	R
	general	BOOLEAN	ST	87L DIFF RECVD DTT		R
TxTr		ACT			87L DIFF KET DTT operand, which becomes on when the differential element is sending direct transfer trip to the remote terminals.	R
	general	BOOLEAN	ST	87L DIFF KET DTT		R
PFLLfail		SPS			87L DIFF PFLL FAIL operand, which becomes on when the differential element's phase and frequency lock loop (PFLL) has failed.	R
	stVal	BOOLEAN	ST	87L DIFF PFLL FAIL		R
Asymmetry		SPS			87L DIFF CH ASYM DET operand, which becomes on when the differential element's has detected substantial communications channel asymmetry.	R
	stVal	BOOLEAN	ST	87L DIFF CH ASYM DET		R
ChFailζ		SPS			87L DIFF CH ζ FAIL operand, which becomes on when the differential element's has detected communications channel ζ failed.	R
	stVal	BOOLEAN	ST	87L DIFF CH ζ FAIL		R
LosPktζ		SPS			87L DIFF CHζ LOSTPKT operand, which becomes on when the differential element's has detected the lost packet threshold has been exceeded on channel ζ.	R
	stVal	BOOLEAN	ST	87L DIFF CHζ LOSTPKT		R
CrcFailζ		SPS			87L DIFF CHζ CRCFAIL operand, which becomes on when the differential element's has detected the CRC error threshold has been exceeded on channel ζ.	R
	stVal	BOOLEAN	ST	87L DIFF CHζ CRCFAIL		R

3.5.3.34 Line pickup (LinPkp)

This element is instantiated in the following products: D30, D60, L60, L90.

Table 3-61: Line pickup data objects

LNName: LinPkpPIOC1		**LDevice inst: Prot**		**UR element: Line Pickup functions.**		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			LINE PICKUP PKP operand	R
	general	BOOLEAN	ST	LINE PICKUP PKP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown. It is unknown as the element is non-directional	R
Op		ACT			LINE PICKUP OP operand	R
	general	BOOLEAN	ST	LINE PICKUP OP		R
Dpo		SPS			LINE PICKUP DPO operand, which is the inverse of LINE PICKUP PKP	R
	stVal	BOOLEAN	ST	LINE PICKUP DPO		R
UnAϕ		SPS			LINE PICKUP operand that activates on phase θ current below 5% of nominal	R
	stVal	BOOLEAN	ST	LINE PICKUP I<θ		R
UnV		SPS			LINE PICKUP UV PKP operand	R

LNName: LinPkpPIOC1		LDevice inst: Prot		UR element: Line Pickup functions.		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	stVal	BOOLEAN	ST	LINE PICKUP UV PKP		R
LeoSt		SPS			LINE PICKUP LEO PKP operand	R
	stVal	BOOLEAN	ST	LINE PICKUP LEO PKP		R
Zn2Tr		SPS			LINE PICKUP RCL TRIP operand	R
	stVal	BOOLEAN	ST	LINE PICKUP RCL TRIP		R
BlkRefγ		ORG			LINE PICKUP BLOCK setting for setting group γ.	R
	setSrcRef	ObjectReference	SP	LINE PICKUP BLOCK for group γ.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3

3.5.3.35 Load encroachment (LodEn)

This element is instantiated in the following products: D30, D60, F60, L60, L90, T60.

Table 3-62: Load encroachment data objects

LNName: LodEncPDIS1		LDevice inst: Prot		UR element: LOAD ENCROACHMENT functions		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			LOAD ENCHR PKP operand	R
	general	BOOLEAN	ST	LOAD ENCHR PKP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown. It is unknown as the element may be connected/ configured to look forward or backward	R
Op		ACT			LOAD ENCHR OP operand	R
	general	BOOLEAN	ST	LOAD ENCHR OP		R
Dpo		SPS			LOAD ENCHR DPO operand	R
	stVal	BOOLEAN	ST	LOAD ENCHR DPO		R
BlkRefγ		ORG			LOAD ENCRMNT BLK setting for setting group γ.	R
	setSrcRef	ObjectReference	SP	LOAD ENCRMNT BLK for group γ.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.3.36 Loss of excitation (LosExt)

This element is instantiated in the following products: G30, G60.

Table 3-63: Loss of excitation data objects

LNName: LosExtPDIS1		LDevice inst: Prot		UR element: LOSS OF EXCITATION core functions		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			LOSS EXCIT PKP operand, which becomes On when either stage 1 or stage 2 of this element has picked up.	R
	general	BOOLEAN	ST	LOSS EXCIT PKP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown. It is unknown as the element may be connected/ configured to look forward or backward	R
Op		ACT			LOSS EXCIT OP operand	R
	general	BOOLEAN	ST	LOSS EXCIT OP		R
Dpo		SPS			LOSS EXCIT DPO operand	R
	stVal	BOOLEAN	ST	LOSS EXCIT DPO		R
BlkRefγ		ORG			LOSS OF EXCIT BLK setting for setting group γ.	R

LNName: LosExtPDIS1		LDevice inst: Prot		UR element: LOSS OF EXCITATION core functions		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	setSrcRef	ObjectReference	SP	LOSS OF EXCIT BLK for group γ.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

Table 3-64: Loss of excitation stage 1 objects

LNName: LosExt1PDIS1		LDevice inst: Prot		UR element: Loss of Excitation element stage 1 functions		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			LOSS EXCIT STG1 PKP operand	R
	general	BOOLEAN	ST	LOSS EXCIT STG1 PKP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown. It is unknown as the element may be connected/ configured to look forward or backward	R
Op		ACT			LOSS EXCIT STG1 OP operand	R
	general	BOOLEAN	ST	LOSS EXCIT STG1 OP		R
Dpo		SPS			LOSS EXCIT STG1 DPO operand	R
	stVal	BOOLEAN	ST	LOSS EXCIT STG1 DPO		R

Table 3-65: Loss of excitation stage 2 objects

LNName: LosExt2PDIS1		LDevice inst: Prot		UR element: Loss of Excitation stage 2 functions		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			LOSS EXCIT STG2 PKP operand	R
	general	BOOLEAN	ST	LOSS EXCIT STG2 PKP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown. It is unknown as the element may be connected/ configured to look forward or backward	R
Op		ACT			LOSS EXCIT STG2 OP operand	R
	general	BOOLEAN	ST	LOSS EXCIT STG2 OP		R
Dpo		SPS			LOSS EXCIT STG2 DPO operand	R
	stVal	BOOLEAN	ST	LOSS EXCIT STG2 DPO		R

3.5.3.37 Mechanical jam (MecJam)

This element is instantiated in the following products: M60.

Table 3-66: Mechanical jam data objects

LNName: MecJamPMSS1		LDevice inst: Prot		UR element: MECHANICAL JAM element		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			MECHANICAL JAM PKP operand	R
	general	BOOLEAN	ST	MECHANICAL JAM PKP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown. It is unknown as the element is non-directional	R
Op		ACT			MECHANICAL JAM OP operand	R
	general	BOOLEAN	ST	MECHANICAL JAM OP		R
Dpo		SPS			MECHANICAL JAM DPO operand, which is the inverse of MECHANICAL JAM PKP	R
	stVal	BOOLEAN	ST	MECHANICAL JAM DPO		R
BlkRefγ		ORG			MECH JAM BLK setting for setting group γ.	R
	setSrcRef	ObjectReference	SP	MECH JAM BLK for group γ.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3

3.5.3.38 Motor acceleration time (MAccTm)

This element is instantiated in the following products: M60.

Table 3-67: Motor acceleration time data objects

LNName: MAccTmPMSS1		LDevice inst: Prot		UR element: Acceleration Time element		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Op		ACT			MOTOR ACCEL TIME OP operand	R
	general	BOOLEAN	ST	MOTOR ACCEL TIME OP		R
Dpo		SPS			MOTOR ACCEL TIME DPO operand	R
	stVal	BOOLEAN	ST	MOTOR ACCEL TIME DPO		R
BlkRefγ		ORG			ACCELERATION BLOCK setting.	R
	setSrcRef	ObjectReference	SP	ACCELERATION BLOCK.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
StrAccTmζ		MV			START ζ ACCELERATION TIME in Sec	R
	instMag.f	FLOAT32		START ζ ACCELERATION TIME		R
	mag.f	FLOAT32		instMag.f on deadband exception		R
	units.SIUnit	ENUMERATED			4, the code for Time (Sec)	
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	
	db	INT32	CF	MAccTmPMSS1.StrAccTmζ.db		R/W/C
	zeroDb	INT32	CF		0	R
StrEffAζ		MV			START ζ EFFECTIVE CURRENT in x FLA	R
	instMag.f	FLOAT32		START ζ EFFECTIVE CURRENT		R
	mag.f	FLOAT32		instMag.f on deadband exception		R
	units.SIUnit	ENUMERATED			1, the code for dimension less	
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	
	db	INT32	CF	MAccTmPMSS1.StrEffAζ.db		R/W/C
	zeroDb	INT32	CF		0	R
StrPeakAζ		MV			START ζ PEAK CURRENT in x FLA	R
	instMag.f	FLOAT32		START ζ PEAK CURRENT		R
	mag.f	FLOAT32		instMag.f on deadband exception		R
	units.SIUnit	ENUMERATED			1, the code for dimensionless	
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	
	db	INT32	CF	MAccTmPMSS1.StrPeakAζ.db		R/W/C
	zeroDb	INT32	CF		0	R
StrTDζ		INS			START ζ TIME/DATE actual value	R
	stVal	INT32	ST	calculated UTC time in seconds using START ζ DATE/TIME actual values		
	units.SIUnit	ENUMERATED			4, the code for time	
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R

3.5.3.39 Motor thermal model (MotThm)

This element is instantiated in the following products: M60.

Table 3-68: Thermal model data objects

LNName: MotThmPTTR1		LDevice inst: Prot		UR element: THERMAL MODEL element		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Op		ACT			MOTOR THERMAL OP operand	R
	general	BOOLEAN	ST	MOTOR THERMAL OP		R
Str		ACD			MOTOR THERMAL PKP operand	R
	general	BOOLEAN	ST	MOTOR THERMAL PKP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown.	R
Dpo		SPS			MOTOR THERMAL DPO operands	R
	stVal	BOOLEAN	ST	MOTOR THERMAL DPO		R
InRef10		ORG			MOTOR OFFLINE setting	R
	setSrcRef	ObjectReference	SP	MOTOR OFFLINE setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef20		ORG			EMERGENCY RESTART setting	R
	setSrcRef	ObjectReference	SP	EMERGENCY RESTART setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef30		ORG			SPEED2 MOTOR SWITCH setting	R
	setSrcRef	ObjectReference	SP	SPEED2 MOTOR SWITCH setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef4γ		ORG			VD VOLTAGE LOSS setting for setting group γ.	R
	setSrcRef	ObjectReference	SP	VD VOLTAGE LOSS	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef5γ		ORG			SPEED2 VD VOLTAGE LOSS setting for setting group γ.	R
	setSrcRef	ObjectReference	SP	SPEED2 VD VOLTAGE LOSS setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
BlkRefγ		ORG			THERMAL MODEL BLOCK setting for setting group γ.	R
	setSrcRef	ObjectReference	SP	THERMAL MODEL BLOCK.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
Restart		SPS			MOTOR RESTART operand	R
	stVal	BOOLEAN	ST	MOTOR RESTART		R
Offline		SPS			MOTOR OFFLINE operand	R
	stVal	BOOLEAN	ST	MOTOR OFFLINE		R
Starting		SPS			MOTOR STARTING operand	R
	stVal	BOOLEAN	ST	MOTOR STARTING		R
Running		SPS			MOTOR RUNNING operand	R
	stVal	BOOLEAN	ST	MOTOR RUNNING		R
AlmThm		SPS			MOTOR OVERLOAD operand	R
	stVal	BOOLEAN	ST	MOTOR OVERLOAD		R
StrInh		SPS			MOTOR START INHIBIT operand	R
	stVal	BOOLEAN	ST	MOTOR START INHIBIT		R
MotStatus		ENS			Thermal Model MOTOR STATUS	R
	stVal	ENUMERATED	ST	actual value for Thermal Model MOTOR STATUS		R
Amp		MV			THERMAL MODEL LOAD in x FLA	R
	instMag.f	FLOAT32		THERMAL MODEL LOAD		R
	mag.f	FLOAT32		instMag.f on deadband exception		R
	units.SIUnit	ENUMERATED			1, the code for dimensionless	R

3

LNName: MotThmPTTR1		LDevice inst: Prot		UR element: THERMAL MODEL element		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32	CF	MotThmPTTR1.Amp.db		R/W/C
	zeroDb	INT32	CF			R
OvlTripTm		MV			ESTIMATED TRIP TIME ON OVERLOAD in seconds	R
	instMag.f	FLOAT32		ESTIMATED TRIP TIME ON OVERLOAD		R
	mag.f	FLOAT32		instMag.f on deadband exception		R
	units.SIUnit	ENUMERATED			4, the code for Time (Sec)	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32	CF	MotThmPTTR1.OvlTripTm.db		R/W/C
	zeroDb	INT32	CF			R
ThmCap		MV			MOTOR THERMAL CAPACITY USED in percentage (%)	R
	instMag.f	FLOAT32		MOTOR THERMAL CAPACITY USED		R
	mag.f	FLOAT32		instMag.f deadbanded exception		R
	units.SIUnit	ENUMERATED			1, the code for dimensionless	R
	units.multiplier	ENUMERATED			-2 is code for percent	R
	db	INT32	CF	MotThmPTTR1.ThmCap.db		R/W/C
	zeroDb	INT32	CF			R
ThmLOTm		MV			THERMAL LOCKOUT TIME in seconds	R
	instMag.f	FLOAT32		THERMAL LOCKOUT TIME		R
	mag.f	FLOAT32		instMag.f on deadband exception		R
	units.SIUnit	ENUMERATED			4, the code for Time (Sec)NOTE: Modbus measures this value in Minute	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32	CF	MotThmPTTR1.ThmLOTm.db		R/W/C
	zeroDb	INT32	CF			R
MotUnb		MV			THERMAL MODEL MOTOR UNBALANCE in percentage (%)	R
	instMag.f	FLOAT32		THERMAL MODEL MOTOR UNBALANCE		R
	mag.f	FLOAT32		instMag.f deadbanded exception		R
	units.SIUnit	ENUMERATED			1, the code for dimensionless	R
	units.multiplier	ENUMERATED			-2 is code for percent	R
	db	INT32	CF	MotThmPTTR1.MotUnb.db		R/W/C
	zeroDb	INT32	CF			R
BiasMotLod		MV			THERMAL MODEL BIASED MOTOR LOAD in x FLA	R
	instMag.f	FLOAT32		THERMAL MODEL BIASED MOTOR LOAD		R
	mag.f	FLOAT32		instMag.f on deadband exception		R
	units.SIUnit	ENUMERATED			1, the code for dimensionless	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32	CF	MotThmPTTR1.BiasMotLod.db		R/W/C
	zeroDb	INT32	CF			R
TotLOTm		MV			TOTAL MOTOR LOCKOUT TIME in seconds	R

LNName: MotThmPTTR1		LDevice inst: Prot	UR element: THERMAL MODEL element			
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	instMag.f	FLOAT32		TOTAL MOTOR LOCKOUT TIME		R
	mag.f	FLOAT32		instMag.f on deadband exception		R
	units.SIUnit	ENUMERATED			4, the code for Time (Sec)NOTE: Modbus measures this value in Minute	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32	CF	MotThmPTTR1.TotLOTm.db		R/W/C
	zeroDb	INT32	CF			R

3.5.3.40 Negative sequence directional overcurrent (NegDoc)

This element is instantiated in the following products: C70, D30, D60, F60, G30, G60, L60, L90, T60.

Table 3-69: Negative sequence directional overcurrent data objects

LNName: NegDocRDIR#		LDevice inst: Prot	UR element: Negative sequence Directional Overcurrent element #			
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Dir		ACD			NEG DIR OC# FWD or NEG DIR OC# REV operands, which becomes On when Negative sequence directional overcurrent is flowing in either forward or reverse direction respectively	R
	general	BOOLEAN	ST	logical OR of operands NEG DIR OC# FWD and NEG DIR OC# REV		R
	dirGeneral	ENUMERATED	ST			R
FwdOp		SPS			NEG SEQ DIR OC# FWD operand	R
	stVal	BOOLEAN	ST	NEG SEQ DIR OC# FWD		R
RvOp		SPS			NEG SEQ DIR OC# REV operand	R
	stVal	BOOLEAN	ST	NEG SEQ DIR OC# REV		R
BlkRefγ		ORG			NEG SEQ DIR OC# BLOCK setting for setting group γ.	R
	setSrcRef	ObjectReference	SP	NEG SEQ DIR OC# BLOCK for group γ.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.3.41 Negative sequence instantaneous overcurrent (NegIoc)

This element is instantiated in the following products: C70, D30, D60, F35, F60, L30, L60, L90, T60.

Table 3-70: Negative sequence instantaneous overcurrent data objects

LNName: NegIocPIOC#		LDevice inst: Prot	UR element: Negative sequence Instantaneous Overcurrent element #			
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			NEG SEQ IOC# PKP operand, which is indicates Op will operate when delay expires.	R
	general	BOOLEAN	ST	NEG SEQ IOC# PKP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown.	R
Op		ACT			NEG SEQ IOC# OP operand	R
	general	BOOLEAN	ST	NEG SEQ IOC# OP		R
Dpo		SPS			NEG SEQ IOC# DPO operand	R
	stVal	BOOLEAN	ST	NEG SEQ IOC# DPO		R
BlkRefγ1		ORG			NEG SEQ IOC# BLOCK setting in setting group γ.	R

LNName: NegIocPIOC#		LDevice inst: Prot		UR element: Negative sequence Instantaneous Overcurrent element #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	setSrcRef	ObjectReference	SP	NEG SEQ IOC# BLOCK.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.3.42 Negative sequence overvoltage (NegOv)

This element is instantiated in the following products: C70, D30, D60, F60, G30, G60, L30, L60, M60, T60.

Table 3-71: Negative sequence overvoltage data objects

LNName: NegOvPTOV#		LDevice inst: Prot		UR element: Negative Sequence Overvoltage element # functions		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			NEG SEQ OV # PKP operands (including individual three phases)	R
	general	BOOLEAN	ST	NEG SEQ # PKP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown. It is unknown as the element is non-directional	R
Op		ACT			NEG SEQ OV # OP operand (including individual three phases)	R
	general	BOOLEAN	ST	NEG SEQ OV # OP		R
Dpo		SPS			NEG SEQ OV # DPO operand, which is the inverse of NEG SEQ OV PKP	R
	stVal	BOOLEAN	ST	NEG SEQ OV # DPO		R
BlkRefγ		ORG			NEG SEQ OV # BLK setting for setting group γ.	R
	setSrcRef	ObjectReference	SP	NEG SEQ OV # BLK for group γ.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.3.43 Negative sequence time overcurrent (NegToc)

This element is instantiated in the following products: C70, D30, D60, F35, F60, L30, L60, L90, T60.

Table 3-72: Negative sequence time overcurrent data objects

LNName: NegTocPTOC#		LDevice inst: Prot		UR element: Negative sequence Time Overcurrent element #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			NEG SEQ TOC# PKP operand, which indicates Op will operate when delay expires.	R
	general	BOOLEAN	ST	NEG SEQ TOC# PKP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown.	R
Op		ACT			NEG SEQ TOC# OP operand	R
	general	BOOLEAN	ST	NEG SEQ TOC# OP		R
Dpo		SPS			NEG SEQ TOC# DPO operand	R
	stVal	BOOLEAN	ST	NEG SEQ TOC# DPO		R
BlkRefγ1		ORG			NEG SEQ TOC# BLOCK setting for setting group γ.	R
	setSrcRef	ObjectReference	SP	NEG SEQ TOC# BLOCK.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.3.44 Neutral current unbalance (NeAun)

This element is instantiated in the following products: C70.

Table 3-73: Neutral current unbalance data objects

LNName: NeAUnPTOC#		LDevice inst: Prot		UR element: Neutral Current Unbalance element #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			NTRL CUR # PKP operands.	R
	general	BOOLEAN	ST	NTRL CUR # PKP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown.	R
Op		ACT			NTRL CUR # OP operand	R
	general	BOOLEAN	ST	NTRL CUR # OP		R
Dpo		SPS			NTRL CUR # DPO operand	R
	stVal	BOOLEAN	ST	NTRL CUR # DPO		R
RawAnsp		MV			Raw INsp in per unit	R
	instMag.f	FLOAT32		Raw INsp		R
	mag.f	FLOAT32		instMag.f deadbanded exception		R
	units.SIUnit	ENUMERATED			1, the code for dimensionless (per unit)	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32	CF	NeAUnPTOC#.RawAnsp.db		R/W/C
	zeroDb	INT32	CF			R
CompAop		MV			Comp Iop in per unit	R
	instMag.f	FLOAT32		Comp Iop		R
	mag.f	FLOAT32		instMag.f deadbanded exception		R
	units.SIUnit	ENUMERATED			1, the code for dimensionless (per unit)	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32	CF	NeAUnPTOC#.CompAop.db		R/W/C
	zeroDb	INT32	CF			R

Table 3-74: Neutral current unbalance stage objects

LNName: NeAUn$PTOC#		LDevice inst: Prot		UR element: Neutral Current Unbalance element # Stage$		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			NTRL CUR # STG$ PKP operands.	R
	general	BOOLEAN	ST	NTRL CUR # STG$ PKP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown.	R
Op		ACT			NTRL CUR # STG$ OP operands	R
	general	BOOLEAN	ST	NTRL CUR # STG$ OP		R
BlkRefγ		ORG			NTRL CUR # BLK STG$ setting for setting group γ.	R
	setSrcRef	ObjectReference	SP	NTRL CUR # BLK STG$ for group γ (where $ refers to STAGE 1, 2, 3, 4)	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.3.45 Neutral directional overcurrent (NeuDoc)

This element is instantiated in the following products: B30, C70, D30, D60, F60, G30, G60, L30, L60, L90, M60, N60, T60.

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Table 3-75: Neutral directional overcurrent data objects

LNName: NeuDocRDIR#		LDevice inst: Prot		UR element: Neutral Directional Overcurrent element #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Dir		ACD			NTRL DIR OC# FWD or NTRL DIR OC# REV operands, which becomes On when neutral directional overcurrent is flowing in either forward or reverse direction respectively	R
	general	BOOLEAN	ST	logical OR of operands NTRL DIR OC# FWD and NTRL DIR OC# REV		R
	dirGeneral	ENUMERATED	ST			R
FwdOp		SPS			NTRL DIR OC# FWD operand	R
	stVal	BOOLEAN	ST	NTRL DIR OC# FWD		R
RvOp		SPS			NTRL DIR OC# REV operand	R
	stVal	BOOLEAN	ST	NTRL DIR OC# REV		R
BlkRefγ		ORG			NEUTRAL DIR OC# BLOCK setting for setting group γ.	R
	setSrcRef	ObjectReference	SP	NEUTRAL DIR OC# BLOCK for group γ.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.3.46 Neutral instantaneous overcurrent (NeuIoc)

This element is instantiated in the following products: B30, C60, C70, C95, D30, D60, F35, F60, G30, G60, L30, L60, L90, M60, N60, T60.

Table 3-76: Neutral instantaneous overcurrent data objects

LNName: NeuIocPIOC#		LDevice inst: Prot		UR element: Neutral Instantaneous Overcurrent element #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			NEUTRAL IOC# PKP operand, which indicates Op will operate when delay expires.	R
	general	BOOLEAN	ST	NEUTRAL IOC# PKP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown.	R
Op		ACT			NEUTRAL IOC# OP operand	R
	general	BOOLEAN	ST	NEUTRAL IOC# OP		R
Dpo		SPS			NEUTRAL IOC# DPO operand	R
	stVal	BOOLEAN	ST	NEUTRAL IOC# DPO		R
BlkRefγ1		ORG			NEUTRAL IOC# BLOCK setting in setting group γ.	R
	setSrcRef	ObjectReference	SP	NEUTRAL IOC# BLOCK.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.3.47 Neutral overvoltage (NeuOv)

This element is instantiated in the following products: B30, C60, C70, C95, D30, D60, F35, F60, G30, G60, L30, L60, L90, M60, T60.

Table 3-77: Neutral overvoltage data objects

LNName: NeuOvPTOV#		LDevice inst: Prot		UR element: Neutral Overvoltage element # functions		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			NEUTRAL OV# PKP operands	R
	general	BOOLEAN	ST	NEUTRAL OV# PKP		R

LNName: NeuOvPTOV#		LDevice inst: Prot		UR element: Neutral Overvoltage element # functions		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	dirGeneral	ENUMERATED	ST		0, the code for unknown. It is unknown as the element is non-directional	R
Op		ACT			NEUTRAL OV# OP operand	R
	general	BOOLEAN	ST	NEUTRAL OV# OP		R
Dpo		SPS			NEUTRAL OV# DPO operand, which is the inverse of NEUTRAL OV PKP	R
	stVal	BOOLEAN	ST	NETRAL OV# DPO		R
BlkRefγ		ORG			NEUTRAL OV# BLK setting for setting group γ.	R
	setSrcRef	ObjectReference	SP	NEUTRAL OV# BLK for group γ.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.3.48 Neutral time overcurrent (NeuToc)

This element is instantiated in the following products: B30, C60, C70, C95, D30, D60, F35, F60, G30, G60, L30, L60, L90, M60, N60, T60.

Table 3-78: Neutral time overcurrent data objects

LNName: NeuTocPTOC#		LDevice inst: Prot		UR element: Neutral Time Overcurrent element #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			NEUTRAL TOC# PKP operand, which indicates Op will operate when delay expires.	R
	general	BOOLEAN	ST	NEUTRAL TOC# PKP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown.	R
Op		ACT			NEUTRAL TOC# OP operand	R
	general	BOOLEAN	ST	NEUTRAL TOC# OP		R
Dpo		SPS			NEUTRAL TOC# DPO operand	R
	stVal	BOOLEAN	ST	NEUTRAL TOC# DPO		R
BlkRefγ1		ORG			NEUTRAL TOC# BLOCK setting for setting group γ.	R
	setSrcRef	ObjectReference	SP	NEUTRAL TOC# BLOCK.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.3.49 Neutral voltage unbalance (NuVUn)

This element is instantiated in the following products: C70.

Table 3-79: Neutral voltage unbalance data objects

LNName: NuVUnPTOV#		LDevice inst: Prot		UR element: Neutral Voltage Unbalance element #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			NTRL VOLT # PKP operands	R
	general	BOOLEAN	ST	NTRL VOLT # PKP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown. It is unknown as the element is non-directional	R
Op		ACT			NTRL VOLT # OP operand	R
	general	BOOLEAN	ST	NTRL VOLT # OP		R
Dpo		SPS			NTRL VOLT# DPO operand, which is the inverse of NTRL VOLT # PKP	R
	stVal	BOOLEAN	ST	NTRL VOLT # DPO		R
NeutVx		CMV			Neutral point voltage in p.u.	R

LNName: NuVUnPTOV#		LDevice inst: Prot		UR element: Neutral Voltage Unbalance element #		
data obj.	data attribute	Type	FC	UR Name	Description	R/W/C
	instCVal.mag.f	FLOAT32		NEUTRAL-POINT Vx magnitude		R
	instCVal.ang.f	FLOAT32		NEUTRAL-POI		R
	cVal.mag.f	FLOAT32				R
	cVal.ang.f	FLOAT32				R
	units.SIUnit	ENUMERATED			1, the code for the dimension less (in p.u)	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	NuVUnPTOV#.NeutVx.db		R/W/C
	dbAng	INT32U	CF	NuVUnPTOV#.NeutVx.dbAng		R/W/C
	zeroDb	INT32U	CF			R
	angRef	ENUMERATED	CF		See UR product manual regarding FREQUENCY AND PHASE REFERENCE	R
BusV0		CMV			Zero Sequence Bus voltage in p.u.	R
	instCVal.mag.f	FLOAT32		BUS V0 magnitude		R
	instCVal.ang.f	FLOAT32		BUS V0, in		R
	cVal.mag.f	FLOAT32				R
	cVal.ang.f	FLOAT32				R
	units.SIUnit	ENUMERATED			1, the code for the dimension less (in p.u)	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	NuVUnPTOV#.BusV0.db		R/W/C
	dbAng	INT32U	CF	NuVUnPTOV#.BusV0.dbAng		R/W/C
	zeroDb	INT32U	CF			R
	angRef	ENUMERATED	CF		See UR product manual regarding FREQUENCY AND PHASE REFERENCE	R
VOp		MV			NEUTRAL VOLTAGE UNBALANCE # Vop, in p.u.	R
	instMag.f	FLOAT32		NEUTRAL VOLTAGE UNBALANCE # Vop		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			1 is code for dimensionless (per unit)	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	NuVUnPTOV#.VOp.db		R/W/C
	zeroDb	INT32U	CF			R
VRst		MV			NEUTRAL VOLTAGE UNBALANCE # Vres, in p.u.	R
	instMag.f	FLOAT32		NEUTRAL VOLTAGE UNBALANCE # Vres		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			1 is code for dimensionless (per unit)	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	NuVUnPTOV#.VRst.db		R/W/C
	zeroDb	INT32U	CF			R

Table 3-80: Neutral voltage unbalance stage objects

LNName: NuVUn$PTOV#		LDevice inst: Prot		UR element: Neutral Voltage Unbalance element # stage $		
data obj.	data attribute	Type	FC	UR Name	Description	R/W/C
Str		ACD			NTRL VOLT # STG$ PKP operand ”.	R
	general	BOOLEAN	ST	NTRL VOLT # STG$ PKP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown.	R
Op		ACT			NTRL VOLT # STG$ OP operand	R
	general	BOOLEAN	ST	NTRL VOLT # STG$ OP		R

LNName: NuVUn$PTOV#		**LDevice inst: Prot**		**UR element: Neutral Voltage Unbalance element # stage $**		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
BlkRefγ		ORG			NTRL VOL # BLK STG$ setting for setting group γ.	R
	setSrcRef	ObjectReference	SP	NTRL VOL # BLK STG$ for group γ	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.3.50 Open pole detector (OpnPl)

This element is instantiated in the following products: C60, C95, D60, L60, L90. It does not apply to open pole detector supervisor N60.

Table 3-81: Open pole detector data objects

LNName: OpnPl0SCBR1		**LDevice inst: Prot**		**UR element: Open Pole Detector element**		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
BlkRef1		ORG			OPEN POLE BLOCK setting	R
	setSrcRef	ObjectReference	SP	OPEN POLE BLOCK	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
ColOpn		SPS			Logical OR of status value of mapped FlexLogic operands in TRIP PHASE A, TRIP PHASE B, TRIP PHASE C”.	R
	stVal	BOOLEAN	ST	Status of Logical OR condition to OpnPl1SCBR1.ColOpn, OpnPl2SCBR1.ColOpn, OpnPl3SCBR1.ColOpn		R
PlOpn		ACT			OPEN POLE OP operand	R
	general	BOOLEAN	ST	OPEN POLE OP		R
BlkPhDis		SPS			OPEN POLE BLK N operand	R
	stVal	BOOLEAN	ST	OPEN POLE BLK N		R

Table 3-82: Open pole detector data objects

LNName: OpnPlΘSCBR1		**LDevice inst: Prot**		**UR element: Open Pole Detector element for ψ and ψτ**		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
ColOpn		SPS			Status value of mapped settings TRIP ψ	R
	stVal	BOOLEAN	ST	Status value TRIP ψ setting		R
PlOpn		ACT			OPEN POLE OP ψ operand	R
	general	BOOLEAN	ST	OPEN POLE OP ψ		R
BkrOpnPl		ACT			OPEN POLE BKR ψ OP operand	R
	general	BOOLEAN	ST	OPEN POLE BKR ψ OP		R
BlkPhDis		SPS			OPEN POLE BLK ψτ operand	R
	stVal	BOOLEAN	ST	OPEN POLE BLK ψτ		R
RemUnA		SPS			OPEN POLE REM OP ψ operand	R
	stVal	BOOLEAN	ST	OPEN POLE REM OP ψ		R
UnA		SPS			OPEN POLE I < ψ operand	R
	stVal	BOOLEAN	ST	OPEN I < ψ		R

3.5.3.51 Overfrequency (OvHz)

This element is instantiated in the following products: C60, C95, D60, F60, G30, G60, L90, M60, N60, T60.

Table 3-83: Overfrequency data objects

LNName: OvHzPTOF#		LDevice inst: Prot		UR element: Overfrequency element #		
data obj.	data attribute	Type	FC	UR Name	Description	R/W/C
Str		ACD			OVERFREQ # PKP operand which indicates Op will operate when delay expires.	R
	general	BOOLEAN	ST	OVERFREQ # PKP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown.	R
Op		ACT			OVERFREQ # OP operand	R
	general	BOOLEAN	ST	OVERFREQ # OP		R
Dpo		SPS			OVERFREQ # DPO operand	R
	stVal	BOOLEAN	ST	OVERFREQ # DPO		R
BlkRef1		ORG			OVERFREQ # BLOCK setting.	R
	setSrcRef	ObjectReference	SP	OVERFREQ # BLOCK.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.3.52 Permissive overreaching transfer trip (POTT_)

This element is instantiated in the following products: D60, L60, L90.

Table 3-84: POTT data objects

LNName: POTT_PSCH1		LDevice inst: Prot		UR element: Permissive Over-reaching Transfer Trip element		
data obj.	data attribute	Type	FC	UR Name	Description	R/W/C
Op		ACT			POTT OP operand	R
	general	BOOLEAN	ST	POTT OP		R
	phsA	BOOLEAN	ST	POTT TRIP A		R
	phsB	BOOLEAN	ST	POTT TRIP B		R
	phsC	BOOLEAN	ST	POTT TRIP C		R
Tr3p		ACT			POTT TRIP 3P operand	R
	general	BOOLEAN	ST	POTT TRIP 3P		R
Tx1		SPS			POTT TX1 operand	R
	stVal	BOOLEAN	ST	POTT TX1		R
Tx2		SPS			POTT TX2 operand	R
	stVal	BOOLEAN	ST	POTT TX2		R
Tx3		SPS			POTT TX3 operand	R
	stVal	BOOLEAN	ST	POTT TX3		R
Tx4		SPS			POTT TX4 operand	R
	stVal	BOOLEAN	ST	POTT TX4		R
BlkRef1		ORG			POTT SCHEME BLOCK setting.	R
	setSrcRef	ObjectReference	SP	POTT SCHEME BLOCK.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef5		ORG			POTT ECHO COND setting.	R
	setSrcRef	ObjectReference	SP	POTT ECHO COND	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef6		ORG			GND DIR O/C FWD setting.	R
	setSrcRef	ObjectReference	SP	GND DIR O/C FWD	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef1		ORG			POTT RX1 setting.	R
	setSrcRef	ObjectReference	SP	POTT RX1	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef2		ORG			POTT RX2 setting.	R

LNName: POTT_PSCH1		LDevice inst: Prot		UR element: Permissive Over-reaching Transfer Trip element		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	setSrcRef	ObjectReference	SP	POTT RX2	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef3		ORG			POTT RX3 setting.	R
	setSrcRef	ObjectReference	SP	POTT RX3	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef4		ORG			POTT RX4 setting.	R
	setSrcRef	ObjectReference	SP	POTT RX4	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.3.53 Permissive overreaching transfer trip 1 (POTT1_)

This element is instantiated in the following products: D60, L90.

Table 3-85: POTT1 data objects

LNName: POTT1_PSCH1		LDevice inst: Prot		UR element: Permissive Over-reaching Transfer Trip 1 element		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Op		ACT			POTT1 OP operand	R
	general	BOOLEAN	ST	POTT1 OP		R
	phsA	BOOLEAN	ST	POTT1 TRIP A		R
	phsB	BOOLEAN	ST	POTT1 TRIP B		R
	phsC	BOOLEAN	ST	POTT1 TRIP C		R
Tr3p		ACT			Instantiated only on products with single pole tripping.	R
	general	BOOLEAN	ST	POTT1 TRIP 3P		R
Tx1		SPS			POTT1 TX1 operand	R
	stVal	BOOLEAN	ST	POTT1 TX1		R
Tx2		SPS			Instantiated only on products with single pole tripping.	R
	stVal	BOOLEAN	ST	POTT1 TX2		R
Tx3		SPS			Instantiated only on products with single pole tripping.	R
	stVal	BOOLEAN	ST	POTT1 TX3		R
Tx4		SPS			Instantiated only on products with single pole tripping.	R
	stVal	BOOLEAN	ST	POTT1 TX4		R
BlkRef1		ORG			POTT1 SCHEME BLOCK setting.	R
	setSrcRef	ObjectReference	SP	POTT1 SCHEME BLOCK.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef5		ORG			POTT1 ECHO COND setting.	R
	setSrcRef	ObjectReference	SP	POTT1 ECHO COND	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef6		ORG			DIR FWD1 setting.	R
	setSrcRef	ObjectReference	SP	DIR FWD1	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef7		ORG			DIR FWD2 setting.	R
	setSrcRef	ObjectReference	SP	DIR FWD 2	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef8		ORG			DIR FWD3 setting.	R
	setSrcRef	ObjectReference	SP	DIR FWD3	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

LNName: POTT1_PSCH1		LDevice inst: Prot		UR element: Permissive Over-reaching Transfer Trip 1 element		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
InRef1		ORG			POTT1 RX1 setting.	R
	setSrcRef	ObjectReference	SP	POTT1 RX1	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef2		ORG			Instantiated only on products with single pole tripping.	R
	setSrcRef	ObjectReference	SP	POTT1 RX2	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef3		ORG			Instantiated only on products with single pole tripping.	R
	setSrcRef	ObjectReference	SP	POTT1 RX3	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef4		ORG			Instantiated only on products with single pole tripping.	R
	setSrcRef	ObjectReference	SP	POTT1 RX4	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.3.54 Permissive over-reaching transfer trip (POTT3)

This element is instantiated in the following products: F60.

Table 3-86: POTT3 data objects

LNName: POTT3_PSCH1		LDevice inst: Prot		UR element: Permissive Over-reaching Transfer Trip 3 element		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Op		ACT			POTT3 OP operand	R
	general	BOOLEAN	ST	POTT3 OP		R
TxPrm		ACT			POTT3 TX operand	R
	general	BOOLEAN	ST	POTT3 TX		R
BlkRef1		ORG			POTT3 SCHEME BLOCK setting.	R
	setSrcRef	ObjectReference	SP	POTT3 SCHEME BLOCK	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef01		ORG			POTT3 DIR FWD1 setting.	R
	setSrcRef	ObjectReference	SP	POTT3 DIR FWD1	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef02		ORG			POTT3 DIR FWD2 setting.	R
	setSrcRef	ObjectReference	SP	POTT3 DIR FWD 2	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef03		ORG			POTT3 DIR FWD3 setting.	R
	setSrcRef	ObjectReference	SP	POTT3 DIR FWD3	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef21		ORG			POTT3 RX setting.	R
	setSrcRef	ObjectReference	SP	POTT3 RX	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef22		ORG			LINE END OPEN setting.	R
	setSrcRef	ObjectReference	SP	LINE END OPEN	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.3.55 Permissive under-reaching transfer trip (PUTT_)

This element is instantiated in the following products: D60, L90.

Table 3-87: PUTT data objects

LNName: PUTT_PSCH1		LDevice inst: Prot		UR element: Permissive Under-reaching Transfer Trip element		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Op		ACT			PUTT OP operand	R
	general	BOOLEAN	ST	PUTT OP		R
	phsA	BOOLEAN	ST	PUTT TRIP A		R
	phsB	BOOLEAN	ST	PUTT TRIP B		R
	phsC	BOOLEAN	ST	PUTT TRIP C		R
Tr3p		ACT			PUTT TRIP 3P operand	R
	general	BOOLEAN	ST	PUTT TRIP 3P		R
Tx1		SPS			PUTT TX1 operand	R
	stVal	BOOLEAN	ST	PUTT TX1		R
Tx2		SPS			PUTT TX2 operand	R
	stVal	BOOLEAN	ST	PUTT TX2		R
Tx3		SPS			PUTT TX3 operand	R
	stVal	BOOLEAN	ST	PUTT TX3		R
Tx4		SPS			PUTT TX4 operand	R
	stVal	BOOLEAN	ST	PUTT TX4		R
BlkRef1		ORG			PUTT SCHEME BLOCK setting.	R
	setSrcRef	ObjectReference	SP	PUTT SCHEME BLOCK.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef1		ORG			PUTT RX1 setting.	R
	setSrcRef	ObjectReference	SP	PUTT RX1	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef2		ORG			PUTT RX2 setting.	R
	setSrcRef	ObjectReference	SP	PUTT RX2	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef3		ORG			PUTT RX3 setting.	R
	setSrcRef	ObjectReference	SP	PUTT RX3	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef4		ORG			PUTT RX4 setting.	R
	setSrcRef	ObjectReference	SP	PUTT RX4	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.3.56 Phase comparison (PhCmp)

This element is instantiated in the following products: L60.

Table 3-88: Phase comparison data objects

LNName: PhCmp1PDIF1		LDevice inst: Prot		UR element: 87PC SCHEME (except FDH element specifics) and Charging Current Compensation element		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
BlkRefγ1		ORG			87PC BLOCK setting of setting group γ.	R
	setSrcRef	ObjectReference	SP	87PC BLOCK setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRefγ1		ORG			87PC FDL AUX setting of setting group γ.	R
	setSrcRef	ObjectReference	SP	87PC FDL AUX setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRefγ2		ORG			87PC STOP TX setting of setting group γ.	R
	setSrcRef	ObjectReference	SP	87PC STOP TX setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

LNName: PhCmp1PDIF1		**LDevice inst: Prot**		**UR element: 87PC SCHEME (except FDH element specifics) and Charging Current Compensation element**		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
BlkRefγ2		ORG			CHARGE COMPENST BLK setting of setting group γ.	R
	setSrcRef	ObjectReference	SP	CHARGE COMPENST BLK setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
Str		ACD			87PC PKP operand	R
	general	BOOLEAN	ST	87PC PKP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown. It is unknown as the element is non-directional	R
Dpo		SPS			87PC DPO operand, which is the inverse of 87PC PKP	R
	stVal	BOOLEAN	ST	87PC DPO		R
Op		ACT			87PC OP operand	R
	general	BOOLEAN	ST	87PC OP		R
FDLOp		SPS			87PC FDL OP operand	R
	stVal	BOOLEAN	ST	87PC FDL OP		R
TransBlk		SPS			87PC TRANS BLOCK OP operand	R
	stVal	BOOLEAN	ST	87PC TRANS BLOCK OP		R
RXζ		SPS			87PC RXζ operand.	R
	stVal	BOOLEAN	ST	87PC RXζ		R
CmpCtβI1		MV			CT# COMP I1 Mag in amperes	R
	instMag.f	FLOAT32		CT# COMP I1 Mag		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			5, the code for amperes	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	PhCmp1PDIF1.CmpCt#I1.db		R/W/C
	zeroDb	INT32U	CF			R
CmpCt#I2		MV			CT# COMP I2 Mag in amperes	R
	instMag.f	FLOAT32		CT# COMP I2 Mag		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			5, the code for amperes	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	PhCmp1PDIF1.CmpCt#I2.		R/W/C
	zeroDb	INT32U	CF			R

Table 3-89: Phase comparison fault detector high (FDH) data objects

LNName: PhCmp2PDIF1		**LDevice inst: Prot**		**UR element: 87PC SCHEME specific to FDH element**		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
InRefγ1		ORG			87PC FDH AUX setting of setting group γ.	R
	setSrcRef	ObjectReference	SP	87PC FDH AUX setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRefγ2		ORG			87PC FDH SUPV setting of setting group γ.	R
	setSrcRef	ObjectReference	SP	87PC FDH SUPV setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
Op		ACT			87PC FDH OP operand	R
	general	BOOLEAN	ST	87PC FDH OP		R

Table 3-90: Phase comparison negative sequence voltage (excluding FDH) data objects

LNName: PhCmp1PTOV1		LDevice inst: Prot		UR element: Negative Sequence Voltage element (except FDH element specifics) as a part of Phase comparison function		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			87PC V2 FDL OP operand	R
	general	BOOLEAN	ST	87PC V2 FDL OP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown. It is unknown as the element is non-directional	R
BlkRefγ		ORG			NEG SEQ VOL FD BLK setting of setting group γ.	R
	setSrcRef	ObjectReference	SP	NEG SEQ VOL FD BLK setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

Table 3-91: Phase comparison negative sequence voltage (for FDH) data objects

LNName: PhCmp2PTOV1		LDevice inst: Prot		UR element: Negative Sequence Voltage element specific to FDH element as a part of Phase comparison function		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			87PC V2 FDH OP operand	R
	general	BOOLEAN	ST	87PC V2 FDH OP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown. It is unknown as the element is non-directional	R

Table 3-92: Phase comparison advanced fault detector rate of change of positive sequence current (excluding FDH) data objects

LNName: PhCmp1FXOT1		LDevice inst: Prot		UR element: RATE OF CHANGE OF POS SEQ CURRENT element (except FDH element specifics) as a part of Phase comparison function		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
BlkRefγ		ORG			POS SEQ di/dt BLK setting of setting group γ.	R
	setSrcRef	ObjectReference	SP	POS SEQ di/dt BLK setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
StrVal		ASG			POS SEQ di/dt FDL PICKUP setting	R
	setMag.f	FLOAT32		POS SEQ di/dt FDL PICKUP		R
	units.SIUnit	ENUMERATED			1 is code for dimensionless	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	minVal.f	FLOAT32				R
	maxVal.f	FLOAT32				R
	stepSize.f	FLOAT32				R
Op		ACT			87PC di1/dt FDL OP operand	R
	general	BOOLEAN	ST	87PC di1/dt FDL OP		R

Table 3-93: Phase comparison advanced fault detector rate of change of positive sequence current (for FDH) data objects

LNName: PhCmp2FXOT1		LDevice inst: Prot		UR element: RATE OF CHANGE OF POS SEQ CURRENT element specific to FDH element as a part of Phase comparison function		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
InRefγ		ORG			POS SEQ FDH SUPV setting of setting group γ.	R
	setSrcRef	ObjectReference	SP	POS SEQ FDH SUPV setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
StrVal		ASG			POS SEQ di/dt FDH PICKUP setting	R

LNName: PhCmp2FXOT1		LDevice inst: Prot		UR element: RATE OF CHANGE OF POS SEQ CURRENT element specific to FDH element as a part of Phase comparison function		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	setMag.f	FLOAT32		POS SEQ di/dt FDH PICKUP		R
	units.SIUnit	ENUMERATED			1 is code for dimensionless	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	minVal.f	FLOAT32				R
	maxVal.f	FLOAT32				R
	stepSize.f	FLOAT32				R
Op		ACT			87PC di1/dt FDH OP operand	R
	general	BOOLEAN	ST	87PC di1/dt FDH OP		R

Table 3-94: Phase comparison advanced fault detector rate of change of negative sequence current (excluding FDH) data objects

LNName: PhCmp3FXOT1		LDevice inst: Prot		UR element: RATE OF CHANGE OF NEG SEQ CURRENT element (except FDH element specifics) as a part of Phase comparison function		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
BlkRefγ		ORG			NEG SEQ di/dt BLK setting of setting group γ.	R
	setSrcRef	ObjectReference	SP	NEG SEQ di/dt BLK setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
StrVal		ASG			NEG SEQ di/dt FDL PICKUP setting	R
	setMag.f	FLOAT32		NEG SEQ di/dt FDL PICKUP		R
	units.SIUnit	ENUMERATED			1 is code for dimensionless	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	minVal.f	FLOAT32				R
	maxVal.f	FLOAT32				R
	stepSize.f	FLOAT32				R
Op		ACT			87PC di2/dt FDL OP operand	R
	general	BOOLEAN	ST	87PC di2/dt FDL OP		R

Table 3-95: Phase comparison advanced fault detector rate of change of negative sequence current (for FDH) data objects

LNName: PhCmp4FXOT1		LDevice inst: Prot		UR element: RATE OF CHANGE OF NEG SEQ CURRENT element specific to FDH element as a part of Phase comparison function		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
InRefγ		ORG			NEG SEQ FDH SUPV setting of setting group γ.	R
	setSrcRef	ObjectReference	SP	NEG SEQ FDH SUPV setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
StrVal		ASG			NEG SEQ di/dt FDH PICKUP setting	R
	setMag.f	FLOAT32		NEG SEQ di/dt FDH PICKUP		R
	units.SIUnit	ENUMERATED			1 is code for dimensionless	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	minVal.f	FLOAT32				R
	maxVal.f	FLOAT32				R
	stepSize.f	FLOAT32				R
Op		ACT			87PC di2/dt FDH OP operand	R
	general	BOOLEAN	ST	87PC di2/dt FDH OP		R

Table 3-96: Phase comparison advanced fault detector positive sequence current (excluding FDH) data objects

LNName: PhCmp1PIOC1		LDevice inst: Prot		UR element: Positive Sequence Current element (except FDH element specifics) as a part of Phase comparison function		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
BlkRefγ		ORG			POS SEQ I_1 BLK setting of setting group γ.	R
	setSrcRef	ObjectReference	SP	POS SEQ I_1 BLK setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
Op		ACT			87PC I_1 FDL OP operand	R
	general	BOOLEAN	ST	87PC I_1 FDL OP		R

Table 3-97: Phase comparison advanced fault detector positive sequence current (for FDH) data objects

LNName: PhCmp2PIOC1		LDevice inst: Prot		UR element: Positive Sequence Current element specific to FDH element as a part of Phase comparison function		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Op		ACT			87PC I_1 FDH OP operand	R
	general	BOOLEAN	ST	87PC I_1 FDH OP		R

Table 3-98: Phase comparison advanced fault detector negative sequence current (excluding FDH) data objects

LNName: PhCmp3PIOC1		LDevice inst: Prot		UR element: Negative Sequence Current element (except FDH element specifics) as a part of Phase comparison function		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
BlkRefγ		ORG			NEG SEQ I_2 BLK setting of setting group γ.	R
	setSrcRef	ObjectReference	SP	NEG SEQ I_2 BLK setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
Op		ACT			87PC I_2 FDL OP operand	R
	general	BOOLEAN	ST	87PC I_2 FDL OP		R

Table 3-99: Phase comparison advanced fault detector negative sequence current (for FDH) data objects

LNName: PhCmp4PIOC1		LDevice inst: Prot		UR element: Negative Sequence Current element specific to FDH element as a part of Phase comparison function		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Op		SPS			87PC I_2 FDH OP operand	R
	stVal	BOOLEAN	ST	87PC I_2 FDH OP		R

Table 3-100: Phase comparison open breaker echo data objects

LNName: PhCmp5FXOT1		LDevice inst: Prot		UR element: OPEN BREAKER ECHO element as a part of Phase comparison function		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
InRefγ1		ORG			BRK 1 AUX CONTACT setting of setting group γ.	R
	setSrcRef	ObjectReference	SP	BRK 1 AUX CONTACT setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRefγ2		ORG			BRK 1 CONT SUPV setting of setting group γ.	R
	setSrcRef	ObjectReference	SP	BRK 1 CONT SUPV setting	reference to the data attribute to input	R/C

LNName: PhCmp5FXOT1		LDevice inst: Prot		UR element: OPEN BREAKER ECHO element as a part of Phase comparison function		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRefy3		ORG			BRK 2 AUX CONTACT setting of setting group y.	R
	setSrcRef	ObjectReference	SP	BRK 2 AUX CONTACT setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRefy4		ORG			BRK 2 CONT SUPV setting of setting group y.	R
	setSrcRef	ObjectReference	SP	BRK 2 CONT SUPV setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRefy5		ORG			WEAK-INFEED KEYING setting of setting group y.	R
	setSrcRef	ObjectReference	SP	WEAK-INFEED KEYING setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRefy6		ORG			WEAK-INFEED SUPV setting of setting group y.	R
	setSrcRef	ObjectReference	SP	WEAK-INFEED SUPV setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
StrVal		ASG			Non-mapped mandatory DO, Non-configurable read only value	R
	setMag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			1, the code for dimensionless	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
Op		ACT			87PC BKR ECHO PKP operand	R
	general	BOOLEAN	ST	87PC BKR ECHO PKP		R

3.5.3.57 Phase current unbalance (PhAUn)

This element is instantiated in the following products: C70.

Table 3-101: Phase current unbalance data objects

LNName: PhAUnPTOC#		LDevice inst: Prot		UR element: Phase Current Unbalance element #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			CUR BAL # PKP operands (including individual three phases), which indicates Op will operate when delay expires.	R
	general	BOOLEAN	ST	CUR BAL # PKP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown.	R
	phsA	BOOLEAN	ST	CUR BAL # PKP A		R
	dirPhsA	ENUMERATED	ST		0, the code for unknown.	R
	phsB	BOOLEAN	ST	CUR BAL # PKP B		R
	dirPhsB	ENUMERATED	ST		0, the code for unknown.	R
	phsC	BOOLEAN	ST	CUR BAL # PKP C		R

LNName: PhAUnPTOC#		LDevice inst: Prot		UR element: Phase Current Unbalance element #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	dirPhsC	ENUMERATED	ST		0, the code for unknown.	R
Op		ACT			CUR BAL # OP operands (including individual three phases)	R
	general	BOOLEAN	ST	CUR BAL # OP		R
	phsA	BOOLEAN	ST	CUR BAL # OP A		R
	phsB	BOOLEAN	ST	CUR BAL # OP B		R
	phsC	BOOLEAN	ST	CUR BAL # OP C		R
Dpo		SPS			CUR BAL # DPO operand	R
	stVal	BOOLEAN	ST	CUR BAL # DPO		R
RawAPh		WYE			Raw Id in per unit for Ph A, B, and C	R
	phsA	CMV				R
	phsA.instCVal.mag.f	FLOAT32		Raw Id A		R
	phsA.cVal.mag.f	FLOAT32				R
	phsA.units.SIUnit	ENUMERATED			1, the code for dimensionless (per unit)	R
	phsA.units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	phsA.db	INT32U	CF	PhAUnPTOC#.RawAPh.phsA.db		R/W/C
	phsA.zeroDb	INT32U	CF			R
	phsB	CMV				R
	phsB.instCVal.mag.f	FLOAT32		Raw Id B		R
	phsB.cVal.mag.f	FLOAT32				R
	phsB.units.SIUnit	ENUMERATED			1, the code for dimensionless (per unit)	R
	phsB.units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	phsB.db	INT32U	CF	PhAUnPTOC#.RawAPh.phsB.db		R/W/C
	phsB.zeroDb	INT32U	CF			R
	phsC	CMV				R
	phsC.instCVal.mag.f	FLOAT32		Raw Id C		R
	phsC.cVal.mag.f	FLOAT32				R
	phsC.units.SIUnit	ENUMERATED			1, the code for dimensionless (per unit)	R
	phsC.units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	phsC.db	INT32U	CF	PhAUnPTOC#.RawAPh.phsC.db		R/W/C
	phsC.zeroDb	INT32U	CF			R
CompAPh		WYE			Cm Iop in per unit for Ph A, B, and C	R
	phsA	CMV				R
	phsA.instCVal.mag.f	FLOAT32		Cm Iop A		R
	phsA.cVal.mag.f	FLOAT32				R
	phsA.units.SIUnit	ENUMERATED			1, the code for dimensionless (per unit)	R
	phsA.units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	phsA.db	INT32U	CF	PhAUnPTOC#.CompAPh.phsA.db		R/W/C
	phsA.zeroDb	INT32U	CF			R
	phsB	CMV				R

LNName: PhAUnPTOC#		**LDevice inst: Prot**		**UR element: Phase Current Unbalance element #**		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	phsB.instCVal.mag.f	FLOAT32		Cm Iop B		R
	phsB.cVal.mag.f	FLOAT32				R
	phsB.units.SIUnit	ENUMERATED			1, the code for dimensionless (per unit)	R
	phsB.units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	phsB.db	INT32U	CF	PhAUnPTOC#.CompAPh.phsB.db		R/W/C
	phsB.zeroDb	INT32U	CF			R
	phsC	CMV				R
	phsC.instCVal.mag.f	FLOAT32		Cm Iop C		R
	phsC.cVal.mag.f	FLOAT32				R
	phsC.units.SIUnit	ENUMERATED			1, the code for dimensionless (per unit)	R
	phsC.units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	phsC.db	INT32U	CF	PhAUnPTOC#.CompAPh.phsC.db		R/W/C
	phsC.zeroDb	INT32U	CF			R

Table 3-102: Phase current unbalance stage objects

LNName: PhAUn$PTOC#		**LDevice inst: Prot**		**UR element: Phase Current Unbalance element # Stage $**		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			CUR BAL # STG$ PKP operands (including individual three phases of this stage), which indicates Op will operate when delay expires.	R
	general	BOOLEAN	ST	Logical OR of data attributes phsA, phsB and phsC		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown.	R
	phsA	BOOLEAN	ST	CUR BAL # STG$A PKP		R
	dirPhsA	ENUMERATED	ST		0, the code for unknown.	R
	phsB	BOOLEAN	ST	CUR BAL # STG$B PKP		R
	dirPhsB	ENUMERATED	ST		0, the code for unknown.	R
	phsC	BOOLEAN	ST	CUR BAL # STG$C PKP		R
	dirPhsC	ENUMERATED	ST		0, the code for unknown.	R
Op		ACT			CUR BAL # OP operands (including individual three phases of this stage).	R
	general	BOOLEAN	ST	Logical OR of data attributes phsA, phsB, phsC		R
	phsA	BOOLEAN	ST	CUR BAL # STG$A OP		R
	phsB	BOOLEAN	ST	CUR BAL # STG$B OP		R
	phsC	BOOLEAN	ST	CUR BAL # STG$C OP		R
BlkRefγ		ORG			CUR UNBL # BLK STG$ setting for setting group γ.	R
	setSrcRef	ObjectReference	SP	CUR UNBL # BLK STG$ for group γ.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.3.58 Phase directional (PhsDir)

This element is instantiated in the following products: B30, C70, D30, D60, F60, G30, G60, L30, L60, L90, M60, N60, T60.

Table 3-103: Phase directional data objects

LNName: PhsDirRDIR#		LDevice inst: Prot		UR element: Phase Directional element # (ANSI 67P)		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Dir		ACD			PH DIR # BLK operand, which becomes On when phase current is flowing in the set direction	R
	general	BOOLEAN	ST	PH DIR # BLK		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown. It is unknown as the element may be connected/ configured to look forward or backward	R
	phsA	BOOLEAN	ST	PH DIR # BLK A		R
	dirPhsA	ENUMERATED	ST		0, the code for unknown	R
	phsB	BOOLEAN	ST	PH DIR # BLK B		R
	dirPhsB	ENUMERATED	ST		0, the code for unknown	R
	phsC	BOOLEAN	ST	PH DIR # BLK C		R
	dirPhsC	ENUMERATED	ST		0, the code for unknown	R
BlkRefγ		ORG			PHASE DIR # BLOCK setting for setting group γ.	R
	setSrcRef	ObjectReference	SP	PHASE DIR # BLOCK for group γ.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.3.59 Phase distance (PhsDis)

This element is instantiated in the following products: D30, D60, G60, L60, L90, T60.

Table 3-104: Phase distance data objects

LNName: PhsDisPDIS#		LDevice inst: Prot		UR element: Phase Distance Z# settings		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			PHS DIST Z# PKP operand in Phase-To-Phase	R
	general	BOOLEAN	ST	PH DIST Z# PKP		R
	dirGeneral	ENUMERATED	ST			R
Op		ACT			PHS DIST Z# OP operand in Phase-To-Phase	R
	general	BOOLEAN	ST	PHS DIST Z# OP		R
StrPhsϕ		SPS			PHS DIST Z# PKP θ operand in Phase-To-Phase	R
	stVal	BOOLEAN	ST	PHS DIST Z# PKP θ		R
DpoPhsϕ		SPS			PHS DIST Z# DPO θ operand in Phase-To-Phase	R
	stVal	BOOLEAN	ST	PHS DIST Z# DPO θ		R
OpPhsϕ		SPS			PH DIST Z # OP θ operand	R
	stVal	BOOLEAN	ST	PH DIST Z# OP θ		R
ASupnϕ		SPS			PHS DIST Z# SUPN θ operand in Phase-To-Phase	R
	stVal	BOOLEAN	ST	PHS DIST Z# SUPN θ		R
BlkRefγ		ORG			PHS DIST Z# BLK setting for setting group γ.	R
	setSrcRef	ObjectReference	SP	PHS DIST Z# BLK.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRefγ2		ORG			instantiated only in logical node instance 1	R

LNName: PhsDisPDIS#		LDevice inst: Prot		UR element: Phase Distance Z# settings		
data obj.	data attribute	Type	FC	UR Name	Description	R/W/C
	setSrcRef	ObjectReference	SP	setting FORCE SELF-POLAR	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRefγ3		ORG			instantiated only in logical node instance 1	R
	setSrcRef	ObjectReference	SP	setting FORCE MEM-POLAR I	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.3.60 Phase instantaneous overcurrent (PhsIoc)

3

This element is instantiated in the following products: B30, C60, C70, C95, D30, D60, F35, F60, G30, G60, L30, L60, L90, M60, N60, T35, T60.

Table 3-105: Phase instantaneous overcurrent data objects

LNName: PhsIocPIOC#		LDevice inst: Prot		UR element: Phase Instantaneous Overcurrent element #		
data obj.	data attribute	Type	FC	UR Name	Description	R/W/C
Str		ACD			PHASE IOC# PKP operands (including individual three phases), which indicates Op will operate when delay expires.	R
	general	BOOLEAN	ST	PHASE IOC# PKP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown.	R
	phsA	BOOLEAN	ST	PHASE IOC# PKP A		R
	dirPhsA	ENUMERATED	ST		0, the code for unknown.	R
	phsB	BOOLEAN	ST	PHASE IOC# PKP B		R
	dirPhsB	ENUMERATED	ST		0, the code for unknown.	R
	phsC	BOOLEAN	ST	PHASE IOC# PKP C		R
	dirPhsC	ENUMERATED	ST		0, the code for unknown.	R
Op		ACT			PHASE IOC# OP operands (including individual three phases)	R
	general	BOOLEAN	ST	PHASE IOC# OP		R
	phsA	BOOLEAN	ST	PHASE IOC# OP A		R
	phsB	BOOLEAN	ST	PHASE IOC# OP B		R
	phsC	BOOLEAN	ST	PHASE IOC# OP C		R
Dpo		SPS			PHASE IOC# DPO operand	R
	stVal	BOOLEAN	ST	PHASE IOC# DPO		R
DpoPhsβ		SPS			PHASE IOC# DPO β operands" (where β refers to Phase-A, B or C)	R
	stVal	BOOLEAN	ST	PHASE IOC# DPO β (where β refers to Phase-A, B or C)		R
BlkRefγβ		ORG			PHASE IOC# BLOCK β setting for setting group γ." (where β refers to Phase-A, B or C)	R
	setSrcRef	ObjectReference	SP	PHASE IOC# BLOCK β (where β refers to Phase-A, B or C)	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.3.61 Phase overvoltage (PhsOv)

This element is instantiated in the following products: B30, C60, C70, C95, D30, D60, F35, F60, G30, G60, L30, L60, L90, M60, N60, T60.

Table 3-106: Phase overvoltage data objects

LNName: PhsOvPTOV#		LDevice inst: Prot		UR element: Phase Overvoltage element # functions		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			PHASE OV # PKP operands (including individual three phases)	R
	general	BOOLEAN	ST	PHASE OV # PKP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown. It is unknown as the element is non-directional	R
	phsA	BOOLEAN	ST	PHASE OV # PKP A		R
	dirPhsA	ENUMERATED	ST		0, the code for unknown. It is unknown as the element is non-directional	R
	phsB	BOOLEAN	ST	PHASE OV # PKP B		R
	dirPhsB	ENUMERATED	ST		0, the code for unknown. It is unknown as the element is non-directional	R
	phsC	BOOLEAN	ST	PHASE OV # PKP C		R
	dirPhsC	ENUMERATED	ST		0, the code for unknown. It is unknown as the element is non-directional	R
Op		ACT			PHASE OV # OP operand (including individual three phases)	R
	general	BOOLEAN	ST	PHASE OV # OP		R
	phsA	BOOLEAN	ST	PHASE OV # OP A		R
	phsB	BOOLEAN	ST	PHASE OV # OP B		R
	phsC	BOOLEAN	ST	PHASE OV # OP C		R
Dpo		SPS			PHASE OV # DPO operand, which is the inverse of PHASE OV PKP	R
	stVal	BOOLEAN	ST	PHASE OV # DPO		R
DpoPhsβ		SPS			PHASE OV# DPO β operand" (where β refers to Phase-A, B or C)	R
	stVal	BOOLEAN	ST	PHASE OV# DPO β (where β refers to Phase-A, B or C)		R
BlkRefγ		ORG			PHASE OV # BLK setting for setting group γ.	R
	setSrcRef	ObjectReference	SP	PHASE OV # BLK for group γ.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.3.62 Phase select (PhSel)

This element is instantiated in the following products: C60, C95, D60, L60, L90.

Table 3-107: Phase select data objects

LNName: PhSelGAPC1		LDevice inst: Prot		UR element: Phase select element		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
FltAG		SPS			PHASE SELECT AG operand	R
	stVal	BOOLEAN	ST	PHASE SELECT AG		R
FltBG		SPS			PHASE SELECT BG operand	R
	stVal	BOOLEAN	ST	PHASE SELECT BG		R
FltCG		SPS			PHASE SELECT CG operand	R
	stVal	BOOLEAN	ST	PHASE SELECT CG		R
FltSLG		SPS			PHASE SELECT SLG operand	R
	stVal	BOOLEAN	ST	PHASE SELECT SLG		R
FltAB		SPS			PHASE SELECT AB operand	R
	stVal	BOOLEAN	ST	PHASE SELECT AB		R
FltBC		SPS			PHASE SELECT BC operand	R
	stVal	BOOLEAN	ST	PHASE SELECT BC		R

LNName: PhSelGAPC1		**LDevice inst: Prot**		**UR element: Phase select element**		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
FltCA		SPS			PHASE SELECT CA operand	R
	stVal	BOOLEAN	ST	PHASE SELECT CA		R
FltABG		SPS			PHASE SELECT ABG operand	R
	stVal	BOOLEAN	ST	PHASE SELECT ABG		R
FltBCG		SPS			PHASE SELECT BCG operand	R
	stVal	BOOLEAN	ST	PHASE SELECT BCG		R
FltCAG		SPS			PHASE SELECT CAG operand	R
	stVal	BOOLEAN	ST	PHASE SELECT CAG		R
Flt3Ph		SPS			PHASE SELECT 3P operand	R
	stVal	BOOLEAN	ST	PHASE SELECT 3P		R
FltMulti		SPS			PHASE SELECT MULTI-P operand	R
	stVal	BOOLEAN	ST	PHASE SELECT MULTI-P		R
FltVoid		SPS			PHASE SELECT VOID operand	R
	stVal	BOOLEAN	ST	PHASE SELECT VOID		R

3.5.3.63 Phase time overcurrent (PhsToc)

This element is instantiated in the following products: B30, C60, C70, C95, D30, D60, F35, F60, G30, G60, L30, L60, L90, M60, N60, T35, T60.

Table 3-108: Phase time overcurrent data objects

LNName: PhsTocPTOC#		**LDevice inst: Prot**		**UR element: Phase Time Overcurrent element #**		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			PHASE TOC# PKP operands (including individual three phases), which indicates Op will operate when delay expires.	R
	general	BOOLEAN	ST	PHASE TOC# PKP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown.	R
	phsA	BOOLEAN	ST	PHASE TOC# PKP A		R
	dirPhsA	ENUMERATED	ST		0, the code for unknown.	R
	phsB	BOOLEAN	ST	PHASE TOC# PKP B		R
	dirPhsB	ENUMERATED	ST		0, the code for unknown.	R
	phsC	BOOLEAN	ST	PHASE TOC# PKP C		R
	dirPhsC	ENUMERATED	ST		0, the code for unknown.	R
Op		ACT			PHASE TOC# OP operands (including individual three phases)	R
	general	BOOLEAN	ST	PHASE TOC# OP		R
	phsA	BOOLEAN	ST	PHASE TOC# OP A		R
	phsB	BOOLEAN	ST	PHASE TOC# OP B		R
	phsC	BOOLEAN	ST	PHASE TOC# OP C		R
Dpo		SPS			PHASE TOC# DPO operand	R
	stVal	BOOLEAN	ST	PHASE TOC# DPO		R
DpoPhsβ		SPS			PHASE TOC# DPO β operands" (where β refers to Phase-A, B or C)	R
	stVal	BOOLEAN	ST	PHASE TOC# DPO β (where β refers to Phase-A, B or C)		R
BlkRefγβ		ORG			PHASE TOC# BLOCK β setting for setting group γ." (where β refers to Phase-A, B or C)	R

LNName: PhsTocPTOC#		LDevice inst: Prot		UR element: Phase Time Overcurrent element #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	setSrcRef	ObjectReference	SP	PHASE TOC# BLOCK β for group γ (where β refers to Phase-A, B or C)	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.3.64 Phase undervoltage (PhsUv)

This element is instantiated in the following products: B30, C60, C70, C95, D30, D60, F35, F60, G30, G60, L30, L60, L90, M60, N60, T60.

Table 3-109: Phase undervoltage data objects

LNName: PhsUvPTUV#		LDevice inst: Prot		UR element: Phase Undervoltage element # functions		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			PHASE UV# PKP operands (including individual three phases)	R
	general	BOOLEAN	ST	PHASE UV# PKP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown. It is unknown as the element is non-directional	R
	phsA	BOOLEAN	ST	PHASE UV# PKP A		R
	dirPhsA	ENUMERATED	ST		0, the code for unknown. It is unknown as the element is non-directional	R
	phsB	BOOLEAN	ST	PHASE UV# PKP B		R
	dirPhsB	ENUMERATED	ST		0, the code for unknown. It is unknown as the element is non-directional	R
	phsC	BOOLEAN	ST	PHASE UV# PKP C		R
	dirPhsC	ENUMERATED	ST		0, the code for unknown. It is unknown as the element is non-directional	R
Op		ACT			PHASE UV# OP operand (including individual three phases)	R
	general	BOOLEAN	ST	PHASE UV# OP		R
	phsA	BOOLEAN	ST	PHASE UV# OP A		R
	phsB	BOOLEAN	ST	PHASE UV# OP B		R
	phsC	BOOLEAN	ST	PHASE UV# OP C		R
Dpo		SPS			PHASE UV# DPO operand, which is the inverse of PHASE UV PKP	R
	stVal	BOOLEAN	ST	PHASE UV# DPO		R
DpoPhsβ		SPS			PHASE UV# DPO β operands" (where β refers to Phase-A, B or C)	R
	stVal	BOOLEAN	ST	PHASE UV# DPO β (where β refers to Phase-A, B or C)		R
BlkRefγ		ORG			PHASE UV# BLOCK setting for setting group γ.	R
	setSrcRef	ObjectReference	SP	PHASE UV# BLOCK for group γ.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.3.65 Power swing detection (PwrSwg)

This element is instantiated in the following products: D30, D60, G60, L60, L90, N60, T60.

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Table 3-110: Power swing detection data objects

LNName: PwrSwgRPSB1		LDevice inst: Prot		UR element: Power Swing Detect element		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			POWER SWING INCOMING operand	R
	general	BOOLEAN	ST	POWER SWING INCOMING		R
	dirGeneral	ENUMERATED	ST			R
StrOutgoing		SPS			POWER SWING OUTGOING operand	R
	stVal	BOOLEAN	ST	POWER SWING OUTGOING		R
Op		ACT			POWER SWING TRIP	R
	general	BOOLEAN	ST	POWER SWING TRIP		R
BlkZn		SPS			POWER SWING BLOCK operand	R
	stVal	BOOLEAN	ST	POWER SWING BLOCK		R
Z1Chr1		SPS			POWER SWING OUTER operand	R
	stVal	BOOLEAN	ST	POWER SWING OUTER		R
Z1Chr2		SPS			POWER SWING MIDDLE operand	R
	stVal	BOOLEAN	ST	POWER SWING MIDDLE		R
Z1Chr3		SPS			POWER SWING INNER operand	R
	stVal	BOOLEAN	ST	POWER SWING INNER		R
TmStr2		SPS			POWER SWING TMR2 PKP operand	R
	stVal	BOOLEAN	ST	POWER SWING TMR2 PKP		R
TmStr3		SPS			POWER SWING TMR3 PKP operand	R
	stVal	BOOLEAN	ST	POWER SWING TMR3 PKP		R
TmStr4		SPS			POWER SWING TMR4 PKP operand	R
	stVal	BOOLEAN	ST	POWER SWING TMR4 PKP		R
Blk		SPS			POWER SWING UN/BLOCK operand	R
	stVal	BOOLEAN	ST	POWER SWING UN/BLOCK		R
DistDet		SPS			POWER SWING 50DD operand	R
	stVal	BOOLEAN	ST	POWER SWING 50DD		R
InRefγ2		ORG			POWER SW I2 SUPV ENAB setting for setting group γ.	R
	setSrcRef	ObjectReference	SP	POWER SW I2 SUPV ENAB setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
BlkRefγ		ORG			POWER SWING BLK setting for setting group γ.	R
	setSrcRef	ObjectReference	SP	POWER SWING BLK.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.3.66 Restricted ground fault (RgDif)

This element is instantiated in the following products: F60, G30, G60, L90, T35, T60.

Table 3-111: Restricted ground fault data objects

LNName: RgDifPDIF#		LDevice inst: Prot		UR element: Restricted Ground Fault # function		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Op		ACT			RESTD GND FT# OP operands	R
	general	BOOLEAN	ST	RESTD GND FT# OP		R
Dpo		SPS			RESTD GND FT# DPO operand,	R
	stVal	BOOLEAN	ST	RESTD GND FT# DPO		R
Str		ACD			RESTD GND FT# PKP operand	R
	general	BOOLEAN	ST	RESTD GND FT# PKP		R

LNName: RgDifPDIF#		LDevice inst: Prot		UR element: Restricted Ground Fault # function		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	dirGeneral	ENUMERATED	ST		1 is code for Forward	R
DifAClc		WYE			Differential currents	R
	net	CMV				R
	net.instCVal.mag.f	FLOAT32		RGF# DIFF Igd magnitude, in primary amps		R
	net.cVal.mag.f	FLOAT32		RGF# DIFF Igd magnitude, in primary amps, with deadband		R
	net.units.SIUnit	ENUMERATED			5, the code for amps	R
	net.units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	net.db	INT32U	CF	RgDifPDIF#.DifAClc.net.db		R/W/C
	net.zeroDb	INT32U	CF			R
RstA		WYE			Restraint currents	R
	net	CMV				R
	net.instCVal.mag.f	FLOAT32		RGF# RESTR Igr magnitude, in primary amps		R
	net.cVal.mag.f	FLOAT32		RGF# RESTR Igr magnitude, in primary amps, with deadband		R
	net.units.SIUnit	ENUMERATED			5, the code for amps	R
	net.units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	net.db	INT32U	CF	RgDifPDIF#.RstA.net.db		R/W/C
	net.zeroDb	INT32U	CF			R
BlkRefγ		ORG			RESTD GND FT# BLOCK for setting group γ.	R
	setSrcRef	ObjectReference	SP	RESTD GND FT# BLOCK for group γ.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.3.67 RTD (PRTDs)

This element is instantiated in the following products: G60, M60, T60.

Table 3-112: RTD data objects

LNName: PRTDsSTMP#		LDevice inst: Prot		UR element: RTD Input ϕ		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			RTD Ip # TRIP PKP operand	R
	general	BOOLEAN	ST	RTD Ip # TRIP PKP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown	R
StrAlm		ACD			RTD Ip # ALARM PKP operand	R
	general	BOOLEAN	ST	RTD Ip # ALARM PKP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown	R
Trip		SPS			RTD Ip # TRIP OP operand	R
	stVal	BOOLEAN	ST	RTD Ip # TRIP OP		R
Alm		SPS			RTD Ip # ALARM OP operand	R
	stVal	BOOLEAN	ST	RTD Ip # ALARM OP		R
Dpo		SPS			RTD Ip # TRIP DPO operand	R
	stVal	BOOLEAN	ST	RTD Ip # TRIP DPO		R
DpoAlm		SPS			RTD Ip # ALARM DPO operand	R
	stVal	BOOLEAN	ST	RTD Ip # ALARM DPO		R
OpnCirc		SPS			RTD Ip # OPEN operand	R

LNName: PRTDsSTMP#		LDevice inst: Prot		UR element: RTD Input ϕ		
data obj.	data attribute	Type	FC	UR Name	Description	R/W/C
	stVal	BOOLEAN	ST	RTD Ip # OPEN		R
ShrtCirc		SPS			RTD Ip # SHORTED operand	R
	stVal	BOOLEAN	ST	RTD Ip # SHORTED		R
Tmp		MV			RTD INPUT ϕ Temperature in degree Celsius	R
	instMag.f	FLOAT32		RTD INPUT ϕ		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			23, the code for degree Celsius (°C)	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	PRTDsSTMP#.Tmp.db		R/W/C
	zeroDb	INT32U	CF			R
BlkRef1		ORG			RTD INPUT ϕ BLOCK setting.	R
	setSrcRef	ObjectReference	SP	RTD INPUT ϕ BLOCK.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

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3.5.3.68 RRTD (RRTDs)

This element is instantiated in the following products: G60, M60, T60.

Table 3-113: RRTD data objects

LNName: RRTDsSTMP#		LDevice inst: Prot		UR element: RRTD Input #		
data obj.	data attribute	Type	FC	UR Name	Description	R/W/C
Str		ACD			RRTD RTD # TRIP PKP operand	R
	general	BOOLEAN	ST	RRTD RTD # TRIP PKP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown	R
StrAlm		ACD			RRTD RTD # ALARM PKP operand	R
	general	BOOLEAN	ST	RRTD RTD # ALARM PKP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown	R
Trip		SPS			RRTD RTD # TRIP OP operand	R
	stVal	BOOLEAN	ST	RRTD RTD # TRIP OP		R
Alm		SPS			RRTD RTD # ALARM OP operand	R
	stVal	BOOLEAN	ST	RRTD RTD # ALARM OP		R
Dpo		SPS			RRTD RTD # TRIP DPO operand	R
	stVal	BOOLEAN	ST	RRTD RTD # TRIP DPO		R
DpoAlm		SPS			RRTD RTD # ALARM DPO operand	R
	stVal	BOOLEAN	ST	RRTD RTD # ALARM DPO		R
OpnCirc		SPS			RRTD RTD # OPEN operand	R
	stVal	BOOLEAN	ST	RRTD RTD # OPEN		R
ShrtCirc		SPS			RRTD RTD # SHORTED operand	R
	stVal	BOOLEAN	ST	RRTD RTD # SHORTED		R
Tmp		MV			RRTD INPUT # Temperature in degree Celsius	R
	instMag.f	FLOAT32		RRTD INPUT #		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			23, the code for degree Celsius (°C)	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	RRTDsSTMP#.Tmp.db		R/W/C
	zeroDb	INT32U	CF			R
BlkRef1		ORG			RRTD # BLOCK setting.	R

LNName: RRTDsSTMP#		LDevice inst: Prot		UR element: RRTD Input #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	setSrcRef	ObjectReference	SP	RRTD # BLOCK.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.3.69 Sensitive directional power (Sen)

This element is instantiated in the following products: C60, C95, D60, F60, G30, G60, L90, M60, N60, T60.

Table 3-114: Sensitive directional power general data objects

LNName: SenPDOP#		LDevice inst: Prot		UR element: Sensitive Directional Power element # core functions		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			DIR POWER # PKP operand, which becomes On when either stage 1 or stage 2 of this element has picked up.	R
	general	BOOLEAN	ST	DIR POWER # PKP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown. It is unknown as the element may be connected/ configured to look forward or backward	R
Op		ACT			DIR POWER # OP operand	R
	general	BOOLEAN	ST	DIR POWER # OP		R
Dpo		SPS			DIR POWER # DPO operand, which is the inverse of DIR POWER OP	R
	stVal	BOOLEAN	ST	DIR POWER # DPO		R
TotW		MV			DIRECTIONAL POWER # 3-PHASE, in primary watts	R
	instMag.f	FLOAT32		DIRECTIONAL POWER # 3ϕ		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			38, the code for primary watts (J/s)	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	SenPDOP#.TotW.db		R/W/C
	zeroDb	INT32U	CF			R
BlkRefγ		ORG			DIR POWER # BLK setting for setting group γ.	R
	setSrcRef	ObjectReference	SP	DIR POWER # BLK for group γ.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

Table 3-115: Sensitive directional power stage 1 data objects

LNName: Sen1PDOP#		LDevice inst: Prot		UR element: Sensitive Directional Power element # stage 1 functions		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			DIR POWER # STG1 PKP operand, which becomes On when the directional power comparator has operated.	R
	general	BOOLEAN	ST	DIR POWER # STG1 PKP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown. It is unknown as the element may be connected/ configured to look forward or backward	R
Op		ACT			DIR POWER # STG1 OP operand	R
	general	BOOLEAN	ST	DIR POWER # STG1 OP		R
Dpo		SPS			DIR POWER # STG1 DPO operand, which is the inverse of DIR POWER STG1 OP	R
	stVal	BOOLEAN	ST	DIR POWER # STG1 DPO		R

Table 3-116: Sensitive directional power stage 2 data objects

LNName: Sen2PDOP#		LDevice inst: Prot		UR element: Sensitive Directional Power element # stage 2 functions		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			DIR POWER # STG2 PKP operand, which becomes On when the directional power comparator has operated.	R
	general	BOOLEAN	ST	DIR POWER # STG2 PKP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown. It is unknown as the element may be connected/ configured to look forward or backward	R
Op		ACT			DIR POWER # STG2 OP operand	R
	general	BOOLEAN	ST	DIR POWER # STG2 OP		R
Dpo		SPS			DIR POWER # STG2 DPO operand, which is the inverse of DIR POWER STG2 OP	R
	stVal	BOOLEAN	ST	DIR POWER # STG2 DPO		R

3

3.5.3.70 Speed 2 motor acceleration time (S2AcTm)

This element is instantiated in the following products: M60.

Table 3-117: Speed 2 acceleration time data objects

LNName: S2AcTmPMSS1		LDevice inst: Prot		UR element: SPEED2 Acceleration Time element		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Op		ACT			MOTOR SPD2 ACL t OP operand	R
	general	BOOLEAN	ST	MOTOR SPD2 ACL t OP		R
Dpo		SPS			MOTOR SPD2 ACL t DPO operand	R
	stVal	BOOLEAN	ST	MOTOR SPD2 ACL t DPO		R
SPDTR		SPS			MOTOR SPD2 TR 2-1 OP operand	R
	stVal	BOOLEAN	ST	MOTOR SPD2 TR 2-1 OP		R
BlkRefγ		ORG			SPEED2 ACCEL BLOCK setting for setting group γ.	R
	setSrcRef	ObjectReference	SP	SPEED2 ACCEL BLOCK.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.3.71 Split phase (SpltPh)

This element is instantiated in the following products: G30, G60.

Table 3-118: Split phase data objects

LNName: SpltPhPDIF1		LDevice inst: Prot		UR element: Split Phase Element		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			SPLIT PHASE PKP, SPLIT PHASE A PKP, SPLIT PHASE B PKP & SPLIT PHASE C PKP operands	R
	general	BOOLEAN	ST	SPLIT PHASE PKP		R
	dirGeneral	ENUMERATED	ST			R
	phsA	BOOLEAN	ST	SPLIT PHASE A PKP		R
	dirPhsA	ENUMERATED	ST			R
	phsB	BOOLEAN	ST	SPLIT PHASE B PKP		R
	dirPhsB	ENUMERATED	ST			R
	phsC	BOOLEAN	ST	SPLIT PHASE C PKP		R
	dirPhsC	ENUMERATED	ST			R

LNName: SpltPhPDIF1		LDevice inst: Prot		UR element: Split Phase Element		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Op		ACT			SPLIT PHASE OP, SPLIT PHASE A OP, SPLIT PHASE B OP & SPLIT PHASE C OP operands	R
	general	BOOLEAN	ST	SPLIT PHASE OP		R
	phsA	BOOLEAN	ST	SPLIT PHASE A OP		R
	phsB	BOOLEAN	ST	SPLIT PHASE B OP		R
	phsC	BOOLEAN	ST	SPLIT PHASE C OP		R
Dpo		SPS			SPLIT PHASE DPO operand	R
	stVal	BOOLEAN	ST	SPLIT PHASE DPO		R
DpoPhsϕ		SPS			SPLIT PHASE θ DPO operand	R
	stVal	BOOLEAN	ST	SPLIT PHASE θ DPO		R
BlkRefγ		ORG			SPLIT PHASE BLK setting for setting group γ.	R
	setSrcRef	ObjectReference	SP	SPLIT PHASE BLK for group γ.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.3.72 Stator differential (SttDif)

This element is instantiated in the following products: G60, M60.

Table 3-119: Stator differential data objects

LNName: SttDifPDIF#		LDevice inst: Prot		UR element: Stator Differential Function		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Op		ACT			STATOR DIFF OP ,STATOR DIFF OP A, STATOR DIFF OP B & STATOR DIFF OP C operands	R
	general	BOOLEAN	ST	STATOR DIFF OP		R
	phsA	BOOLEAN	ST	STATOR DIFF OP A		R
	phsB	BOOLEAN	ST	STATOR DIFF OP B		R
	phsC	BOOLEAN	ST	STATOR DIFF OP C		R
DpoPhsϕ		SPS			STATOR DIFF# DPO θ operand	R
	stVal	BOOLEAN	ST	STATOR DIFF #DPO θ		R
Str		ACD			STATOR DIFF# PKP A, STATOR DIFF# PKP B & STATOR DIFF# PKP C operand	R
	general	BOOLEAN	ST	logical OR of phsA, phsB, phsC		R
	dirGeneral	ENUMERATED	ST			R
	phsA	BOOLEAN	ST	STATOR DIFF# PKP A		R
	dirPhsA	ENUMERATED	ST			R
	phsB	BOOLEAN	ST	STATOR DIFF# PKP B		R
	dirPhsB	ENUMERATED	ST			R
	phsC	BOOLEAN	ST	STATOR DIFF# PKP C		R
	dirPhsC	ENUMERATED	ST			R
Satϕ		SPS			STATOR DIFF # SAT θ operand	R
	stVal	BOOLEAN	ST	STATOR DIFF # SAT θ		R
PhDirϕ		SPS			STATOR DIFF # DIR θ operand	R
	stVal	BOOLEAN	ST	STATOR DIFF # DIR θ		R
BlkRefγ		ORG			STATOR DIFF BLK for setting group γ.	R
	setSrcRef	ObjectReference	SP	STATOR DIFF BLK for group γ.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.3.73 100% stator ground (Statr)

This element is instantiated in the following products: G60.

Table 3-120: Stator ground data objects

LNName: StatrPHIZ1		LDevice inst: Prot		UR element: 100% stator ground element core functions		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			100% STATOR PKP operand	R
	general	BOOLEAN	ST	100% STATOR PKP		R
	dirGeneral	ENUMERATED	ST			R
Op		ACT			100% STATOR OP operand	R
	general	BOOLEAN	ST	100% STATOR OP		R
Dpo		SPS			100% STATOR DPO operand	R
	stVal	BOOLEAN	ST	100% STATOR DPO		R
Ha3NV		MV			STATOR GND 3RD HARM VN in volts	R
	instMag.f	FLOAT32		STATOR GND 3RD HARM VN		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			29, the code for volts (W/A)	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	StatrPHIZ1.Ha3NV.db		R/W/C
	zeroDb	INT32U	CF			R
Ha3ZroV		MV			STATOR GND 3RD HARM V0 in volts	R
	instMag.f	FLOAT32		STATOR GND 3RD HARM V0		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			29, the code for volts (W/A)	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	StatrPHIZ1.Ha3ZroV.db		R/W/C
	zeroDb	INT32U	CF			R
SumHa3NVZroV		MV			STATOR GND 3RD HARM VN+V0 in volts	R
	instMag.f	FLOAT32		STATOR GND 3RD HARM VN+V0		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			29, the code for volts (W/A)	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	StatrPHIZ1. SumHa3NVZroV.db		R/W/C
	zeroDb	INT32U	CF			R
BlkRefγ		ORG			100% STATOR GND BLK setting for setting group γ.	R
	setSrcRef	ObjectReference	SP	100% STATOR GND BLK for group γ.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

Table 3-121: Stator ground stage data objects

LNName: Statr$PHIZ1		LDevice inst: Prot		UR element: 100% stator ground element stage $ functions		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			100% STATOR STG$ PKP operand	R
	general	BOOLEAN	ST	100% STATOR STG$ PKP		R
	dirGeneral	ENUMERATED	ST			R
Op		ACT			100% STATOR STG$ OP operand	R
	general	BOOLEAN	ST	100% STATOR STG$ OP		R
Dpo		SPS			100% STATOR STG$ DPO operand	R
	stVal	BOOLEAN	ST	100% STATOR STG$ DPO		R

3.5.3.74 Subharmonic stator ground (SubHa)

This element is instantiated in the following products: G60.

Table 3-122: Subharmonic stator ground data objects

LNName: SubHaPHIZ1		LDevice inst: Prot		UR element: Sub-harmonic stator ground overcurrent functions		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			SH STAT GND OC PKP operand	R
	general	BOOLEAN	ST	SH STAT GND OC PKP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown. It is unknown as the element may be connected/ configured to look forward or backward	R
Op		ACT			SH STAT GND OC OP operand	R
	general	BOOLEAN	ST	SH STAT GND OC OP		R
Dpo		SPS			SH STAT GND OC DPO operand	R
	stVal	BOOLEAN	ST	SH STAT GND OC DPO		R
Trouble		SPS			SH STAT GND TRB OP operand	R
	stVal	BOOLEAN	ST	SH STAT GND TRB OP		R
GndRis		MV			STATOR GND. RESIST in kilo ohms	R
	instMag.f	FLOAT32		STATOR GND. RESIST		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			30, the code for ohm	R
	units.multiplier	ENUMERATED			3, the code for a multiplier of kilo	R
	db	INT32U	CF	SubHaPHIZ1.GndRis.db		R/W/C
	zeroDb	INT32U	CF			R
InjVol		MV			SH INJECTION VOLTS in volts	R
	instMag.f	FLOAT32		SH INJECTION VOLTS		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			29, the code for volts (W/A)	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	SubHaPHIZ1.InjVol.db		R/W/C
	zeroDb	INT32U	CF			R
InjAmp		MV			SH INJECTION AMPS in amperes	R
	instMag.f	FLOAT32		SH INJECTION AMPS		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			5, the code for ampere (A)	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	SubHaPHIZ1.InjAmp.db		R/W/C
	zeroDb	INT32U	CF			R
SHAmpAng		MV			SH CURRENT ANGLE in degrees	R
	instMag.f	FLOAT32		SH CURRENT ANGLE		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			9, the code for degrees (deg)	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	SubHaPHIZ1.SHAmpAng.db		R/W/C
	zeroDb	INT32U	CF			R
BlkRefγ		ORG			SH STATOR GND BLK setting for setting group γ.	R
	setSrcRef	ObjectReference	SP	SH STATOR GND BLK for group γ.	reference to the data attribute to input	R/C

LNName: SubHaPHIZ1		LDevice inst: Prot		UR element: Sub-harmonic stator ground overcurrent functions		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

Table 3-123: Subharmonic stator ground stage data objects

LNName: SubHa$PHIZ1		LDevice inst: Prot		UR element: Sub-harmonic stator ground stage $ functions		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			SH STAT GND STG$ PKP operand	R
	general	BOOLEAN	ST	SH STAT GND STG$ PKP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown. It is unknown as the element may be connected/ configured to look forward or backward	R
Op		ACT			SH STAT GND STG$ OP operand	R
	general	BOOLEAN	ST	SH STAT GND STG$ OP		R
Dpo		SPS			SH STAT GND STG$ DPO operand	R
	stVal	BOOLEAN	ST	SH STAT GND STG$ DPO		R

3.5.3.75 Third harmonic neutral undervoltage (Ha3NUv)

This element is instantiated in the following products: G30, G60.

Table 3-124: Third harmonic neutral undervoltage data objects

LNName: Ha3NUvPTUV1		LDevice inst: Prot		UR element: Third Harmonic Neutral Under Voltage element		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			3RD HARM NTRL UV PKP operands	R
	general	BOOLEAN	ST	3RD HARM NTRL UV PKP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown. It is unknown as the element is non-directional	R
Op		ACT			3RD HARM NTRL UV OP operand	R
	general	BOOLEAN	ST	3RD HARM NTRL UV OP		R
Dpo		SPS			3RD HARM NTRL UV DPO operand, which is the inverse of 3RD HARM NTRL UV PKP	R
	stVal	BOOLEAN	ST	3RD HARM NTRL UV DPO		R
BlkRefγ		ORG			3RD HARM NTRL UV BLK setting for setting group γ	R
	setSrcRef	ObjectReference	SP	3RD HARM NTRL UV BLK.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.3.76 Transformer instantaneous differential (PiDif)

This element is instantiated in the following products: T35, T60.

Table 3-125: Transformer instantaneous differential data objects

LNName: PiDifPDIF1		LDevice inst: Prot		UR element: Transformer Instantaneous Differential # function		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Op		ACT			XFMR INST DIFF OP , XFMR INST DIFF OP A, XFMR INST DIFF OP B & XFMR INST DIFF OP C operands	R
	general	BOOLEAN	ST	XFMR INST DIFF OP		R
	phsA	BOOLEAN	ST	XFMR INST DIFF OP A		R
	phsB	BOOLEAN	ST	XFMR INST DIFF OP B		R
	phsC	BOOLEAN	ST	XFMR INST DIFF OP C		R

LNName: PiDifPDIF1		LDevice inst: Prot		UR element: Transformer Instantaneous Differential # function		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
BlkRefγ		ORG			INST DIFF BLOCK setting for setting group γ.	R
	setSrcRef	ObjectReference	SP	INST DIFF BLOCK.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.3.77 Transformer percent differential (PctDif)

This element is instantiated in the following products: G30, T35, T60.

Table 3-126: Transformer percent differential data objects

LNName: PctDifPDIF1		LDevice inst: Prot		UR element: Transformer Percent Differential function		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Op		ACT			XFMR PCNT DIFF OP, XFMR PCNT DIFF OP A, XFMR PCNT DIFF OP B & XFMR PCNT DIFF OP C operands	R
	general	BOOLEAN	ST	XFMR PCNT DIFF OP		R
	phsA	BOOLEAN	ST	XFMR PCNT DIFF OP A		R
	phsB	BOOLEAN	ST	XFMR PCNT DIFF OP B		R
	phsC	BOOLEAN	ST	XFMR PCNT DIFF OP C		R
Blk2ndHϕ		SPS			XFMR PCNT DIFF 2ND θ operand	R
	stVal	BOOLEAN	ST	XFMR PCNT DIFF 2ND θ		R
Blk5thHϕ		SPS			XFMR PCNT DIFF 5TH θ operand	R
	stVal	BOOLEAN	ST	XFMR PCNT DIFF 5TH θ		R
Str		ACD			XFMR PCNT DIFF PKP A, XFMR PCNT DIFF PKP B & XFMR PCNT DIFF PKP C operand	R
	general	BOOLEAN	ST	logical OR of phsA, phsB & phsB		R
	dirGeneral	ENUMERATED	ST			R
	phsA	BOOLEAN	ST	XFMR PCNT DIFF PKP A		R
	dirPhsA	ENUMERATED	ST			R
	phsB	BOOLEAN	ST	XFMR PCNT DIFF PKP B		R
	dirPhsB	ENUMERATED	ST			R
	phsC	BOOLEAN	ST	XFMR PCNT DIFF PKP C		R
	dirPhsC	ENUMERATED	ST			R
RefWinding		INS			Number of winding used as the reference winding for ratio compensation	R
	stVal	INT32	ST	REFERENCE WINDING		R
	units.SIUnit	ENUMERATED			1, the code for dimensionless	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
DifAClc		WYE			Phase differential currents	R
	phsθ	CMV				R
	phsθ.instCVal.mag.f	FLOAT32		DIFF PHASOR Iθd magnitude, in pu		R
	phsθ.instCVal.ang.f	FLOAT32		DIFF PHASOR		R
	phsθ.cVal.mag.f	FLOAT32		DIFF PHASOR Iθd magnitude, inpu, with deadband		R
	phsθ.cVal.ang.f	FLOAT32		DIFF PHASOR		R
	phsθ.units.SIUnit	ENUMERATED			1, the code for dimensionless	R
	phsθ.units.multiplier	ENUMERATED			-2, the code for a multiplier of Centi	R

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LNName: PctDifPDIF1		LDevice inst: Prot		UR element: Transformer Percent Differential function		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	phsθ.db	INT32U	CF	PctDifPDIF1.DifAClc.phsθ.db		R/W/C
	phsθ.dbAng	INT32U	CF	PctDifPDIF1.DifAClc.phsθ.dbAng		R/W/C
	phsθ.zeroDb	INT32U	CF			R
	angRef	ENUMERATED	CF		See UR product manual regarding FREQUENCY AND PHASE REFERENCE	R
DifA2ndH		WYE			Phase differential currents	R
	phsθ	CMV				R
	phsθ.instCVal.mag.f	FLOAT32		DIFF 2ND HARM Iθd magnitude, in %		R
	phsθ.instCVal.ang.f	FLOAT32		DIFF 2ND HA		R
	phsθ.cVal.mag.f	FLOAT32		DIFF 2ND HARM Iθd magnitude, in%, with deadband		R
	phsθ.cVal.ang.f	FLOAT32		DIFF 2ND HA		R
	phsθ.units.SIUnit	ENUMERATED			1, the code for dimensionless	R
	phsθ.units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	phsθ.db	INT32U	CF	PctDifPDIF1.DifA2ndH.phsθ.db		R/W/C
	phsθ.dbAng	INT32U	CF	PctDifPDIF1.DifA2ndH.phsθ.dbAng		R/W/C
	phsθ.zeroDb	INT32U	CF			R
	angRef	ENUMERATED	CF		See UR product manual regarding FREQUENCY AND PHASE REFERENCE	R
DifA5thH		WYE			Phase differential currents	R
	phsθ	CMV				R
	phsθ.instCVal.mag.f	FLOAT32		DIFF 5TH HARM Iθd magnitude, in %		R
	phsθ.instCVal.ang.f	FLOAT32		DIFF 5TH HA		R
	phsθ.cVal.mag.f	FLOAT32		DIFF 5TH HARM Iθd magnitude, in%, with deadband		R
	phsθ.cVal.ang.f	FLOAT32		DIFF 5TH HA		R
	phsθ.units.SIUnit	ENUMERATED			1, the code for dimensionless	R
	phsθ.units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	phsθ.db	INT32U	CF	PctDifPDIF#.DifA5thH.phsθ.db		R/W/C
	phsθ.dbAng	INT32U	CF	PctDifPDIF#.DifA5thH.phsθ.dbAng		R/W/C
	phsθ.zeroDb	INT32U	CF			R
	angRef	ENUMERATED	CF		See UR product manual regarding FREQUENCY AND PHASE REFERENCE	R
RstA		WYE			Phase restraint currents	R
	phsθ	CMV				R
	phsθ.instCVal.mag.f	FLOAT32		REST PHASOR Iθr magnitude, in pu		R
	phsθ.instCVal.ang.f	FLOAT32		REST PHASOR		R
	phsθ.cVal.mag.f	FLOAT32		REST PHASOR Iθr magnitude, inpu, with deadband		R
	phsθ.cVal.ang.f	FLOAT32		REST PHASOR		R
	phsθ.units.SIUnit	ENUMERATED			1, the code for dimensionless	R

LNName: PctDifPDIF1		LDevice inst: Prot		UR element: Transformer Percent Differential function		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	phsθ.units .multiplier	ENUMERATED			-2, the code for a multiplier of Centi	R
	phsθ.db	INT32U	CF	PctDifPDIF#.RstA.phsθ.db		R/W/C
	phsθ.dbAng	INT32U	CF	PctDifPDIF#.RstA.phsθ.dbAng		R/W/C
	phsθ.zeroDb	INT32U	CF			R
	angRef	ENUMERATED	CF		See UR product manual regarding FREQUENCY AND PHASE REFERENCE	R
BlkRefγ		ORG			PERCENT DIFF BLOCK for setting group γ.	R
	setSrcRef	ObjectReference	SP	PERCENT DIFF BLOCK for group γ.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.3.78 Transient ground fault (TrsGnd)

This element is instantiated in the following products: D60, F35, F60, L90, T35.

Table 3-127: Transient ground fault data objects

LNName: TrsGndPTEF#		LDevice inst: Prot		UR element: Transient Earth Fault Detection Element #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			TGFD # START operand (including the direction)	R
	general	BOOLEAN	ST	TGFD # START		R
	dirGeneral	ENUMERATED	ST			R
TrsFwd		SPS			TGFD # FORWARD operand	R
	stVal	BOOLEAN	ST	TGFD # FORWARD		R
TrsRv		SPS			TGFD # REVERSE operand	R
	stVal	BOOLEAN	ST	TGFD # REVERSE		R
BlkRefγ		ORG			TRNST GND FLT # BLK setting for setting group γ	R
	setSrcRef	ObjectReference	SP	TRNST GND FLT # BLK.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.3.79 Transformer Interturn Fault Detect (TrItf)

This element is instantiated in the following products: T35, T60.

Table 3-128: Interturn data objects

LNName: TrItfPTOC#		LDevice inst: Prot		UR element: Transformer Inter Turn Fault detection element #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			XFMR INTTURN # PKP operands (including individual three phases), which indicates Op will operate when delay expires.	R
	general	BOOLEAN	ST	XFMR INTTURN # PKP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown.	R
	phsA	BOOLEAN	ST	XFMR INTTURN # PKP A		R
	dirPhsA	ENUMERATED	ST		0, the code for unknown.	R
	phsB	BOOLEAN	ST	XFMR INTTURN # PKP B		R
	dirPhsB	ENUMERATED	ST		0, the code for unknown.	R
	phsC	BOOLEAN	ST	XFMR INTTURN # PKP C		R
	dirPhsC	ENUMERATED	ST		0, the code for unknown.	R

LNName: TrItfPTOC#		LDevice inst: Prot		UR element: Transformer Inter Turn Fault detection element #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Op		ACT			XFMR INTTURN # OP operands (including individual three phases)	R
	general	BOOLEAN	ST	XFMR INTTURN # OP		R
	phsA	BOOLEAN	ST	XFMR INTTURN # OP A		R
	phsB	BOOLEAN	ST	XFMR INTTURN # OP B		R
	phsC	BOOLEAN	ST	XFMR INTTURN # OP C		R
WrnA		SPS			XFMR INTTURN # WRN A operand	R
	stVal	BOOLEAN	ST	XFMR INTTURN # WRN A		R
WrnB		SPS			XFMR INTTURN # WRN B operand	R
	stVal	BOOLEAN	ST	XFMR INTTURN # WRN B		R
WrnC		SPS			XFMR INTTURN # WRN C operand	R
	stVal	BOOLEAN	ST	XFMR INTTURN # WRN C		R
DifARaw		WYE			Phase raw percent differential currents	R
	phsθ	CMV				R
	phsθ.instCVal.mag.f	FLOAT32		Raw Iθd magnitude, in pu		R
	phsθ.instCVal.ang.f	FLOAT32		Raw Iθd ang		R
	phsθ.cVal.mag.f	FLOAT32		Raw Iθd magnitude, in pu, with deadband		R
	phsθ.cVal.ang.f	FLOAT32		Raw Iθd ang		R
	phsθ.units.SIUnit	ENUMERATED			1, the code for dimensionless	R
	phsθ.units.multiplier	ENUMERATED			-2, the code for a multiplier of Centi	R
	phsθ.db	INT32U	CF	TrItfPTOC#.DifARaw.phsθ.db		R/W/C
	phsθ.dbAng	INT32U	CF	TrItfPTOC#.DifARaw.phsθ.dbAng		R/W/C
	phsθ.zeroDb	INT32U	CF			R
	angRef	ENUMERATED	CF		See UR product manual regarding FREQUENCY AND PHASE REFERENCE	R
DifAComp		WYE			Phase voltage compensated percent differential currents	R
	phsθ	CMV				R
	phsθ.instCVal.mag.f	FLOAT32		Comp Iθd magnitude, in pu		R
	phsθ.instCVal.ang.f	FLOAT32		Comp Iθd an		R
	phsθ.cVal.mag.f	FLOAT32		Comp Iθd magnitude, in pu, with deadband		R
	phsθ.cVal.ang.f	FLOAT32		Comp Iθd an		R
	phsθ.units.SIUnit	ENUMERATED			1, the code for dimensionless	R
	phsθ.units.multiplier	ENUMERATED			-2, the code for a multiplier of Centi	R
	phsθ.db	INT32U	CF	TrItfPTOC#.DifAComp.phsθ.db		R/W/C
	phsθ.dbAng	INT32U	CF	TrItfPTOC#.DifAComp.phsθ.dbAng		R/W/C
	phsθ.zeroDb	INT32U	CF			R
	angRef	ENUMERATED	CF		See UR product manual regarding FREQUENCY AND PHASE REFERENCE	R
KFact		WYE			K factors phase related	R
	phsθ	CMV				R

LNName: TrItfPTOC#		**LDevice inst: Prot**		**UR element: Transformer Inter Turn Fault detection element #**		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	phsθ.instCVal.mag .f	FLOAT32		Kθ magnitude, in pu		R
	phsθ.instCVal.ang .f	FLOAT32		Kθ angle, i		R
	phsθ.cVal.mag.f	FLOAT32		Kθ magnitude, in pu, with deadband		R
	phsθ.cVal.ang.f	FLOAT32		Kθ angle, i		R
	phsθ.units.SIUnit	ENUMERATED			1, the code for dimensionless	R
	phsθ.units .multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	phsθ.db	INT32U	CF	TrItfPTOC#.KFact.phsθ.db		R/W/C
	phsθ.dbAng	INT32U	CF	TrItfPTOC#.KFact.phsθ.dbAng		R/W/C
	phsθ.zeroDb	INT32U	CF			R
	angRef	ENUMERATED	CF		See UR product manual regarding FREQUENCY AND PHASE REFERENCE	R
ClcKFact		SPC			Recalculate K Factors command	R/Ctrl
	pulseConfig	PulseConfig	CF			R
	pulseConfig .cmdQual	ENUMERATED				R
	pulseConfig.onDur	INT32U			2 ms (actually one pass)	R
	pulseConfig .offDur	INT32U				R
	pulseConfig .numPls	INT32U				R
	ctlModel	CtlModels	CF	TrItfPTOC#.ClcKFact.ctlModel		R/W/C
	sboTimeout	INT32U	CF			R
	sboClass	SboClasses	CF			R
	operTimeout	INT32U	CF			R
InRef1γ		ORG			FORCE INTURN # K UP setting for setting group γ.	R
	setSrcRef	ObjectReference	SP	FORCE INTURN # K UP for group Y	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
BlkRefγ		ORG			INTTURN FLT# BLOCK setting for setting group γ.	R
	setSrcRef	ObjectReference	SP	INTTURN FLT# BLOCK for group Y	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.3.80 Trip bus (TrBus)

This element is instantiated in all UR products.

Table 3-129: Trip bus data objects

LNName: TrBusPTRC#		**LDevice inst: Prot**		**UR element: Trip Bus element #**		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Op		ACT			TRIP BUS # OP operand, which becomes On when any input is On, and the element is not blocked	R
	general	BOOLEAN	ST	TRIP BUS # OP		R
Str		ACD			TRIP BUS # PKP operand, which indicates Op will operate when delay expires.	R

LNName: TrBusPTRC#		LDevice inst: Prot		UR element: Trip Bus element #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	general	BOOLEAN	ST	TRIP BUS # PKP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown	R
InRefαα		ORG			TRIP BUS # INPUT α setting.	R
	setSrcRef	ObjectReference	SP	TRIP BUS # INPUT α setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef99		ORG			TRIP BUS # RESET setting, which when On resets the non-volatile set-dominant input conditions latch.	R
	setSrcRef	ObjectReference	SP	TRIP BUS # RESET setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
BlkRef1		ORG			TRIP BUS # BLOCK setting.	R
	setSrcRef	ObjectReference	SP	TRIP BUS # BLOCK.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.3.81 Trip output (TrOut)

This element is instantiated in the following products: C60, C95, D60, L60, L90.

Table 3-130: Trip output data objects

LNName: TrOutPTRC1		LDevice inst: Prot		UR element: Trip Output element		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Tr		ACT			TRIP OUTPUT OP (any trip) operand	R
	general	BOOLEAN	ST	TRIP OUTPUT OP		R
Tr3p		ACT			TRIP 3-POLE operand	R
	general	BOOLEAN	ST	TRIP 3-POLE		R
Tr1p		ACT			general is TRIP 1-POLE operand, phsA is TRIP PHASE A operand, phsB is TRIP PHASE B operand and phsC is TRIP PHASE C operand	R
	general	BOOLEAN	ST	TRIP 1-POLE		R
	phsA	BOOLEAN	ST	TRIP PHASE A		R
	phsB	BOOLEAN	ST	TRIP PHASE B		R
	phsC	BOOLEAN	ST	TRIP PHASE C		R
StrRec3p		SPS			TRIP AR INIT 3-POLE operand	R
	stVal	BOOLEAN	ST	TRIP AR INIT 3-POLE		R
Tr3pFrcd		SPS			TRIP FORCE 3-POLE operand (3-pole trip mode is being forced)	R
	stVal	BOOLEAN	ST	TRIP FORCE 3-POLE		R
StrZ2PhDl		SPS			TRIP Z2PH TMR INIT operand	R
	stVal	BOOLEAN	ST	TRIP Z2PH TMR INIT		R
StrZ2GndDl		SPS			TRIP Z2GR TMR INIT operand	R
	stVal	BOOLEAN	ST	TRIP Z2GR TMR INIT		R
InRef3α		ORG			TRIP 3-POLE INPUT-α setting.	R
	setSrcRef	ObjectReference	SP	TRIP 3-POLE INPUT-α setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef1α		ORG			TRIP 1-POLE INPUT-α setting.	R
	setSrcRef	ObjectReference	SP	TRIP 1-POLE INPUT-α setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef2α		ORG			TRIP RECLOSE INPUT-α setting.	R
	setSrcRef	ObjectReference	SP	TRIP RECLOSE INPUT-α setting	reference to the data attribute to input	R/C

LNName: TrOutPTRC1		LDevice inst: Prot		UR element: Trip Output element		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef01221		ORG			START TMR Z2PH Inp1 setting.	R
	setSrcRef	ObjectReference	SP	START TMR Z2PH Inp1 setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef02222		ORG			START TMR Z2PH Inp2 setting.	R
	setSrcRef	ObjectReference	SP	START TMR Z2PH Inp2 setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef03211		ORG			START TMR Z2GR Inp1 setting.	R
	setSrcRef	ObjectReference	SP	START TMR Z2GR Inp1 setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef04212		ORG			START TMR Z2GR Inp2 setting.	R
	setSrcRef	ObjectReference	SP	START TMR Z2GR Inp2 setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef05		ORG			BKR Phase A OPEN setting.	R
	setSrcRef	ObjectReference	SP	BKR ϕA OPEN setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef06		ORG			BKR Phase B OPEN setting.	R
	setSrcRef	ObjectReference	SP	BKR ϕB OPEN setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef07		ORG			BKR Phase C OPEN setting.	R
	setSrcRef	ObjectReference	SP	BKR ϕC OPEN setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef08		ORG			TRIP FORCE 3-POLE setting.	R
	setSrcRef	ObjectReference	SP	TRIP FORCE 3-POLE setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef09		ORG			REVERSE EVOLVING FAULT setting.	R
	setSrcRef	ObjectReference	SP	REVERSE EVOLVING FAULT setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
StrZ3PhDl		SPS			Instantiated only if the OC includes distance adaptation option	R
	stVal	BOOLEAN	ST	TRIP Z3PH TMR INIT		R
StrZ4PhDl		SPS			Instantiated only if the OC includes distance adaptation option	R
	stVal	BOOLEAN	ST	TRIP Z4PH TMR INIT		R
StrZ5PhDl		SPS			Instantiated only if the OC includes distance adaptation option	R
	stVal	BOOLEAN	ST	TRIP Z5PH TMR INIT		R
StrZ6PhDl		SPS			Instantiated only if the OC includes distance adaptation option	R
	stVal	BOOLEAN	ST	TRIP Z6PH TMR INIT		R
StrZ3GndDl		SPS			Instantiated only if the OC includes distance adaptation option	R
	stVal	BOOLEAN	ST	TRIP Z3GR TMR INIT		R
StrZ4GndDl		SPS			Instantiated only if the OC includes distance adaptation option	R
	stVal	BOOLEAN	ST	TRIP Z4GR TMR INIT		R

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LNName: TrOutPTRC1		LDevice inst: Prot		UR element: Trip Output element		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
StrZ5GndDl		SPS			Instantiated only if the OC includes distance adaptation option	R
	stVal	BOOLEAN	ST	TRIP Z5GR TMR INIT		R
StrZ6GndDl		SPS			Instantiated only if the OC includes distance adaptation option	R
	stVal	BOOLEAN	ST	TRIP Z6GR TMR INIT		R
InRef321		ORG			Instantiated only if the OC includes distance adaptation option	R
	setSrcRef	ObjectReference	SP	START TMR Z3PH Inp1 setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef322		ORG			Instantiated only if the OC includes distance adaptation option	R
	setSrcRef	ObjectReference	SP	START TMR Z3PH Inp2 setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef311		ORG			Instantiated only if the OC includes distance adaptation option	R
	setSrcRef	ObjectReference	SP	START TMR Z3GR Inp1 setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef312		ORG			Instantiated only if the OC includes distance adaptation option	R
	setSrcRef	ObjectReference	SP	START TMR Z3GR Inp2 setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef421		ORG			Instantiated only if the OC includes distance adaptation option	R
	setSrcRef	ObjectReference	SP	START TMR Z4PH Inp1 setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef422		ORG			Instantiated only if the OC includes distance adaptation option	R
	setSrcRef	ObjectReference	SP	START TMR Z4PH Inp2 setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef411		ORG			Instantiated only if the OC includes distance adaptation option	R
	setSrcRef	ObjectReference	SP	START TMR Z4GR Inp1 setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef412		ORG			Instantiated only if the OC includes distance adaptation option	R
	setSrcRef	ObjectReference	SP	START TMR Z4GR Inp2 setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef521		ORG			Instantiated only if the OC includes distance adaptation option	R
	setSrcRef	ObjectReference	SP	START TMR Z5PH Inp1 setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef522		ORG			Instantiated only if the OC includes distance adaptation option	R
	setSrcRef	ObjectReference	SP	START TMR Z5PH Inp2 setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef511		ORG			Instantiated only if the OC includes distance adaptation option	R
	setSrcRef	ObjectReference	SP	START TMR Z5GR Inp1 setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef512		ORG			Instantiated only if the OC includes distance adaptation option	R
	setSrcRef	ObjectReference	SP	START TMR Z5GR Inp2 setting	reference to the data attribute to input	R/C

LNName: TrOutPTRC1		LDevice inst: Prot		UR element: Trip Output element		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef621		ORG			Instantiated only if the OC includes distance adaptation option	R
	setSrcRef	ObjectReference	SP	START TMR Z6PH Inp1 setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef622		ORG			Instantiated only if the OC includes distance adaptation option	R
	setSrcRef	ObjectReference	SP	START TMR Z6PH Inp2 setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef611		ORG			Instantiated only if the OC includes distance adaptation option	R
	setSrcRef	ObjectReference	SP	START TMR Z6GR Inp1 setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef612		ORG			Instantiated only if the OC includes distance adaptation option	R
	setSrcRef	ObjectReference	SP	START TMR Z6GR Inp2 setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
CCEna		SPS			Instantiated only if the OC includes distance adaptation option	R
	stVal	BOOLEAN	ST	XC SOLID GND ENABLED		R
FltCC		SPS			Instantiated only if the OC includes distance adaptation option	R
	stVal	BOOLEAN	ST	XC CROSS COUNTRY		R
FltAGCC		SPS			Instantiated only if the OC includes distance adaptation option	R
	stVal	BOOLEAN	ST	XC PHASE SELECT AG		R
FltBGCC		SPS			Instantiated only if the OC includes distance adaptation option	R
	stVal	BOOLEAN	ST	XC PHASE SELECT BG		R
FltCGCC		SPS			Instantiated only if the OC includes distance adaptation option	R
	stVal	BOOLEAN	ST	XC PHASE SELECT CG		R
CmpEna		SPS			Instantiated only if the OC includes distance adaptation option	R
	stVal	BOOLEAN	ST	XC IS/Comp Enabled		R
CmpGndFlt		SPS			Instantiated only if the OC includes distance adaptation option	R
	stVal	BOOLEAN	ST	XC IS/Comp GF		R
NeutBias		SPS			Instantiated only if the OC includes distance adaptation option	R
	stVal	BOOLEAN	ST	XC IN>Bias		R
CmpZ2GndAG		SPS			Instantiated only if the OC includes distance adaptation option	R
	stVal	BOOLEAN	ST	XC GND Z2 PKP A COMP		R
CmpZ2GndBG		SPS			Instantiated only if the OC includes distance adaptation option	R
	stVal	BOOLEAN	ST	XC GND Z2 PKP B COMP		R
CmpZ2GndCG		SPS			Instantiated only if the OC includes distance adaptation option	R
	stVal	BOOLEAN	ST	XC GND Z2 PKP C COMP		R
CmpZ2PhAB		SPS			Instantiated only if the OC includes distance adaptation option	R
	stVal	BOOLEAN	ST	XC PH Z2 PKP AB COMP		R

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LNName: TrOutPTRC1		LDevice inst: Prot		UR element: Trip Output element		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
CmpZ2PhBC		SPS			Instantiated only if the OC includes distance adaptation option	R
	stVal	BOOLEAN	ST	XC PH Z2 PKP BC COMP		R
CmpZ2PhCA		SPS			Instantiated only if the OC includes distance adaptation option	R
	stVal	BOOLEAN	ST	XC PH Z2 PKP CA COMP		R
RawZβGndAG		SPS			Instantiated only if the OC includes distance adaptation option	R
	stVal	BOOLEAN	ST	GND DIS Zβ PKP A RAW		R
RawZβGndBG		SPS			Instantiated only if the OC includes distance adaptation option	R
	stVal	BOOLEAN	ST	GND DIS Zβ PKP B RAW		R
RawZβGndCG		SPS			Instantiated only if the OC includes distance adaptation option	R
	stVal	BOOLEAN	ST	GND DIS Zβ PKP B RAW		R

3.5.3.82 Undercurrent (UnCur)

This element is instantiated in the following products: M60.

Table 3-131: Undercurrent data objects

LNName: UnCurPTUC1		LDevice inst: Prot		UR element: Undercurrent element		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
StrAlm		ACD			U/CURR ALARM PKP operand	R
	general	BOOLEAN	ST	U/CURR ALARM PKP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown. It is unknown as the element is non-directional	R
Str		ACD			U/CURR TRIP PKP operand	R
	general	BOOLEAN	ST	U/CURR TRIP PKP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown. It is unknown as the element is non-directional	R
OpAlm		ACT			U/CURR ALARM OP operand	R
	general	BOOLEAN	ST	U/CURR ALARM OP		R
Op		ACT			U/CURR TRIP OP operand	R
	general	BOOLEAN	ST	U/CURR TRIP OP		R
BlkRefγ		ORG			UNDERCURRENT BLOCK setting in setting group γ	R
	setSrcRef	ObjectReference	SP	UNDERCURRENT BLOCK.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.3.83 Underfrequency (UnHz)

This element is instantiated in the following products: B30, D30, D60, F35, F60, G30, G60, L30, L90, M60, N60, T35, T60.

Table 3-132: Underfrequency data objects

LNName: UnHzPTUF#		LDevice inst: Prot		UR element: Underfrequency element #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			UNDERFREQ # PKP operand, which is indicates Op will operate when delay expires.	R
	general	BOOLEAN	ST	UNDERFREQ # PKP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown.	R

LNName: UnHzPTUF#		LDevice inst: Prot		UR element: Underfrequency element #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Op		ACT			UNDERFREQ # OP operand	R
	general	BOOLEAN	ST	UNDERFREQ # OP		R
Dpo		SPS			UNDERFREQ # DPO operand	R
	stVal	BOOLEAN	ST	UNDERFREQ # DPO		R
BlkRef1		ORG			UNDERFREQ # BLOCK setting.	R
	setSrcRef	ObjectReference	SP	UNDERFREQ # BLOCK.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.3.84 Underpower (UnPwr)

This element is instantiated in the following products: M60.

Table 3-133: Underpower data objects

LNName: UnPwrPDUP#		LDevice inst: Prot		UR element: Under Power element		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
StrAlm		ACD			UNDERPWR # ALARM PKP operand	R
	general	BOOLEAN	ST	UNDERPWR # ALARM PKP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown. It is unknown as the element is non-directional	R
Str		ACD			UNDERPWR # TRIP PKP operand	R
	general	BOOLEAN	ST	UNDERPWR # TRIP PKP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown. It is unknown as the element is non-directional	R
OpAlm		ACT			UNDERPWR # ALARM OP operand	R
	general	BOOLEAN	ST	UNDERPWR # ALARM OP		R
Op		ACT			UNDERPWR # TRIP OP operand	R
	general	BOOLEAN	ST	UNDERPWR # TRIP OP		R
DpoAlm		SPS			UNDERPWR # ALARM DPO operand	R
	stVal	BOOLEAN	ST	UNDERPWR # ALARM DPO		R
Dpo		SPS			UNDERPWR # TRIP DPO operand	R
	stVal	BOOLEAN	ST	UNDERPWR # TRIP DPO		R
BlkRefγ		ORG			UNDERPOWER # BLOCK setting for setting group γ.	R
	setSrcRef	ObjectReference	SP	UNDERPOWER # BLOCK for group γ.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.3.85 Voltage differential (VDif)

This element is instantiated in the following products: C70.

Table 3-134: Voltage differential data objects

LNName: VDifPDIF#		LDevice inst: Prot		UR element: Voltage Differential element # core functions		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			VOLT DIF # PKP operands (including individual three phases)	R
	general	BOOLEAN	ST	VOLT DIF # PKP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown	R
	phsA	BOOLEAN	ST	VOLT DIF # PKP A		R
	dirPhsA	ENUMERATED	ST		0, the code for unknown	R

LNName: VDifPDIF#		LDevice inst: Prot		UR element: Voltage Differential element # core functions		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	phsB	BOOLEAN	ST	VOLT DIF # PKP B		R
	dirPhsB	ENUMERATED	ST		0, the code for unknown	R
	phsC	BOOLEAN	ST	VOLT DIF # PKP C		R
	dirPhsC	ENUMERATED	ST		0, the code for unknown	R
Op		ACT			VOLT DIF # OP operand	R
	general	BOOLEAN	ST	VOLT DIF # OP		R
	phsA	BOOLEAN	ST	VOLT DIF # OP A		R
	phsB	BOOLEAN	ST	VOLT DIF # OP B		R
	phsC	BOOLEAN	ST	VOLT DIF # OP C		R
Dpo		SPS			VOLT DIF # DPO operand	R
	stVal	BOOLEAN	ST	VOLT DIF # DPO		R
DifVPh		WYE			Differential voltage in per unit for phase A, B and C	R
	phsθ	CMV				R
	phsθ.instCVal.mag.f	FLOAT32		Dif Vϕ magnitude		R
	phsθ.cVal.mag.f	FLOAT32		Dif Vϕ magnitude, with deadband		R
	phsθ.units.SIUnit	ENUMERATED			1, the code for dimensionless (per unit)	R
	phsθ.units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	phsθ.db	INT32U	CF	VDifPDIF#.DifVPh.phsθ.db		R/W/C
	phsθ.zeroDb	INT32U	CF			R
BusVPh		WYE			Bus voltage in per unit for phase A, B and C	R
	phsθ	CMV				R
	phsθ.instCVal.mag.f	FLOAT32		Bus Vϕ magnitude		R
	phsθ.cVal.mag.f	FLOAT32		Bus Vϕ magnitude, with deadband		R
	phsθ.units.SIUnit	ENUMERATED			1, the code for dimensionless (per unit)	R
	phsθ.units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	phsθ.db	INT32U	CF	VDifPDIF#.BusVPh.phsθ.db		R/W/C
	phsθ.zeroDb	INT32U	CF			R

Table 3-135: Voltage differential stage objects

LNName: VDif$PDIF#		LDevice inst: Prot		UR element: Voltage Differential element # stage $		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			VOLT DIF # STG$ PKP operands (including individual three phases)	R
	general	BOOLEAN	ST	Logical OR of data attributes phsA, phsB and phsC		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown	R
	phsA	BOOLEAN	ST	VOLT DIF # STG$A PKP		R
	dirPhsA	ENUMERATED	ST		0, the code for unknown	R
	phsB	BOOLEAN	ST	VOLT DIF # STG$B PKP		R
	dirPhsB	ENUMERATED	ST		0, the code for unknown	R
	phsC	BOOLEAN	ST	VOLT DIF # STG$C PKP		R
	dirPhsC	ENUMERATED	ST		0, the code for unknown	R

LNName: VDif$PDIF#		LDevice inst: Prot	UR element: Voltage Differential element # stage $			
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Op		ACT			VOLT DIF # STG$ OP operands	R
	general	BOOLEAN	ST	Logical OR of data attributes phsA, phsB, phsC		R
	phsA	BOOLEAN	ST	VOLT DIF # STG$A OP		R
	phsB	BOOLEAN	ST	VOLT DIF # STG$B OP		R
	phsC	BOOLEAN	ST	VOLT DIF # STG$C OP		R
BlkRefγ		ORG			VOLT DIF # BLK STG$ setting for setting group γ.	R
	setSrcRef	ObjectReference	SP	VOLT DIF # BLK STG$ for group γ.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.3.86 Volts per hertz (VpHz)

This element is instantiated in the following products: G30, G60, L90, T60.

Table 3-136: Volts per hertz data objects

LNName: VpHzPVPH#		LDevice inst: Prot	UR element: Volts per Hertz element #			
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Op		ACT			VOLTS PER HERTZ # OP operand	R
	general	BOOLEAN	ST	VOLTS PER HERTZ # OP		R
Dpo		SPS			VOLTS PER HERTZ # DPO operand,	R
	stVal	BOOLEAN	ST	VOLTS PER HERTZ # DPO		R
Str		ACD			VOLTS PER HERTZ # PKP operand	R
	general	BOOLEAN	ST	VOLTS PER HERTZ # PKP operand		R
	dirGeneral	ENUMERATED	ST			R
BlkRefγ		ORG			VOLTS /HZ # BLOCK setting for setting group γ.	R
	setSrcRef	ObjectReference	SP	VOLTS/HZ # BLOCK for group γ.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.3.87 VT fuse failure (Vtff)

This element is instantiated in the following products: C60, C70, C95, D30, D60, F35, F60, G30, G60, L30, L60, L90, M60, N60, T60.

Table 3-137: VT fuse failure data objects

LNName: VtffGAPC#		LDevice inst: Prot	UR element: VT FUSE FAILURE # function			
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
FuFail		SPS			SRC# VT FUSE FAIL OP operands	R
	stVal	BOOLEAN	ST	SRC# VT FUSE FAIL OP		R
Dpo		SPS			SRC# VT FUSE FAIL DPO operand,	R
	stVal	BOOLEAN	ST	SRC# VT FUSE FAIL DPO		R
Alm1		SPS			SRC# VT FF ALARM	R
	stVal	BOOLEAN	ST	SRC# VT FF ALARM		R
VSigLos		SPS			SRC# VT FUSE FAIL VOL LOSS operand	R
	stV al	BOOLEAN	ST	SRC# VT FUSE FAIL VOL LOSS		R
NeutOpn		SPS			SRC# VT NEU WIRE OPEN operand	R
	stV al	BOOLEAN	ST	SRC# VT NEU WIRE OPEN		R

3.5.3.88 Wattmetric ground fault (Watt)

This element is instantiated in the following products: D30, D60, F35, F60, L60, L90.

Table 3-138: Wattmetric ground fault data objects

LNName: WattPSDE#		LDevice inst: Prot		UR element: Wattmetric Ground Fault # settings		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			WATTMETRIC GND FLT # PKP operand	R
	general	BOOLEAN	ST	WATTMETRIC GND FLT # PKP		R
	dirGeneral	ENUMERATED	ST			R
Op		ACT			WATTMETRIC GND FLT # OP operand	R
	general	BOOLEAN	ST	WATTMETRIC GND FLT # OP		R
Watt		MV			SRC # Three Phase Real Power, in primary watts	R
	instMag	AnalogueValue	MX			R
	instMag.f	FLOAT32		WATT GND FLT # actual value		R
	mag.f	FLOAT32		instMag.f on deadband exception		R
	units.SIUnit	ENUMERATED			38, the code for primary watts (J/s)	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	WattPSDE#.Watt.db		R/W/C
	zeroDb	INT32U	CF			R
BlkRefγ		ORG			WATTMETRIC GND FLT # BLK setting for setting group γ.	R
	setSrcRef	ObjectReference	SP	WATTMETRIC GND FLT # BLK.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.4 Control (Ctrl) logical device

The Ctrl logical device contains logical nodes that model UR control and monitoring functions.

3.5.4.1 Logical node zero (LLN0)

This element is instantiated in UR devices implementing the Ctrl logical device.

Table 3-139: LLN0 data objects and attributes

LNName: LLN0		LDevice inst: Ctrl		UR element: Nameplate information for the logical nodes		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Beh		ENS			This logical device's behavior	R
	stVal	ENUMERATED	ST			R
	stVal	ENUMERATED	ST	LLN0.Beh.stVal of the Master logical device		R
GrRef		ORG			Reference to root logical device	R
	setSrcRef	ObjectReference	SP	For communications, mapped to Master ldName if not empty, otherwise to the concatenation of the IED name and "Master". For SCL, mapped to the concatenation of the IED name and "Master".	reference to the data attribute to input	R

3.5.4.2 8-bit switch (Sw8bit)

This element is instantiated in the following products: C30, F35, N60.

Table 3-140: 8-bit switch data objects

LNName: Sw8BitGAPC#		LDevice inst: Ctrl		UR element: 8-Bit Switch #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
IndY		SPS			8BIT SWITCH # BIT Θ operand value	R
	stVal	BOOLEAN	ST	8BIT SWITCH # BIT Θ		R
InRef1Θ		ORG			8BIT SW # ARG AΘ setting.	R
	setSrcRef	ObjectReference	SP	8BIT SW # ARG AΘ setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef2Θ		ORG			8BIT SW # ARG BΘ setting.	R
	setSrcRef	ObjectReference	SP	8BIT SW # ARG BΘ setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef01		ORG			8BIT SW # CONTROL setting.	R
	setSrcRef	ObjectReference	SP	8BIT SW # CONTROL setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.4.3 Automatic voltage regulator (Avr)

This element is instantiated in the following products: C70.

Table 3-141: Automatic voltage regulator data objects

LNName: AvrGAPC#		LDevice inst: Ctrl		UR element: Automatic Voltage Regulator # element		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
StrCls		SPS			AVR # CLOSE PKP operands.	R
	stVal	BOOLEAN	ST	AVR # CLOSE PKP		R
OpCls		ACT			AVR # CLOSE OP operand	R
	general	BOOLEAN	ST	AVR # CLOSE OP		R
DpoCls		SPS			AVR CLOSE # DPO operand	R
	stVal	BOOLEAN	ST	AVR # CLOSE DPO		R
StrOpn		SPS			AVR # OPEN PKP operands.	R
	stVal	BOOLEAN	ST	AVR # OPEN PKP		R
OpOpn		ACT			AVR # OPEN OP operand	R
	general	BOOLEAN	ST	AVR # OPEN OP		R
DpoOpn		SPS			AVR OPEN # DPO operand	R
	stVal	BOOLEAN	ST	AVR OPEN # DPO		R
BlkRef1		ORG			AVR # BLOCK setting	R
	setSrcRef	ObjectReference	SP	AVR # BLOCK	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.4.4 B90 CT trouble (B_CtTb)

This element is instantiated in the following products: B90.

Table 3-142: B90 CT trouble data objects

LNName: B_CtTbPIOC#		LDevice inst: Ctrl		UR element: B90 CT Trouble Zone element # function		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Op		ACT			CT TROUBLE ZONE# OP operand	R
	general	BOOLEAN	ST	CT TROUBLE ZONE# OP		R

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3.5.4.5 Breaker arcing current (CBArc)

This element is instantiated in the following products: B30, C60, C70, C95, D30, D60, F35, F60, G30, G60, L30, L60, L90, M60, T35, T60.

Table 3-143: Breaker arcing current data objects

LNName: CBArc0SCBR#		LDevice inst: Ctrl		UR element: BREAKER # ARCING CURRENT element		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
AbrAlm		SPS			BKR ARC # OP operand	R
	stVal	BOOLEAN	ST	BKR ARC # OP		R
Dpo		SPS			BKR ARC # DPO operand	R
	stVal	BOOLEAN	ST	BKR ARC # DPO		R
IntrAlm		SPS			BKR ARC # MAX OP operand	R
	stVal	BOOLEAN	ST	BKR ARC # MAX OP		R
IntrAlmDpo		SPS			BKR ARC # MAX DPO operand	R
	stVal	BOOLEAN	ST	BKR ARC # MAX DPO		R
InRef1		ORG			BKR # CLR ARC AMPS setting	R
	setSrcRef	ObjectReference	SP	BKR # CLR ARC AMPS	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
BlkRef1		ORG			BKR # ARC AMP BLOCK setting	R
	setSrcRef	ObjectReference	SP	BKR # ARC AMP BLOCK	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
ColOpn		SPS			Logical OR of status value of mapped FlexLogic operands in BKR # ARC AMP INT- A, BKR # ARC AMP INT- B, BKR # ARC AMP INT- C	R
	stVal	BOOLEAN	ST	Logical OR condition to CBArc1SCBR#.ColOpn, CBArc2SCBR#.ColOpn, CBArc3SCBR#.ColOpn		R
OpTmOpn		MV			BKR # OPERATING TIME in ms	R
	instMag.f	FLOAT32		Mapped BKR # OPERATING TIME		R
	mag.f	FLOAT32		instMag.f on deadband exception		R
	units.SIUnit	ENUMERATED			4, the code for Time (Sec)	R
	units.multiplier	ENUMERATED			-3, the code for a multiplier of 1/1000	R
	db	INT32	CF	CBArc0SCBR#.OpTmOpn.db		R/W/C
	zeroDb	INT32	CF			R
MemClr		SPC			CLEAR BREAKER # ARCING AMPS command	R/Ctrl
	pulseConfig	PulseConfig	CF			R
	pulseConfig .cmdQual	ENUMERATED				R
	pulseConfig.onDur	INT32U			2 ms (actually one pass)	R
	pulseConfig .offDur	INT32U				R
	pulseConfig .numPls	INT32U				R
	ctlModel	CtlModels	CF	CBArc0SCBR#.MemClr.ctlModel		R/W/C
	sboTimeout	INT32U	CF			R
	sboClass	SboClasses	CF			R
	operTimeout	INT32U	CF			R

Table 3-144: Breaker arcing current phase data objects

LNName: CBArcΘSCBR#		LDevice inst: Ctrl		UR element: BREAKER # ARCING CURRENT element		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
ColOpn		SPS			Status value of mapped FlexLogic operand in BKR # ARC AMP INT- ψ	R
	stVal	BOOLEAN	ST	Status value of mapped FlexLogic operand in BKR # ARC AMP INT- ψ setting		R
InRef1		ORG			BKR # ARC AMP INT-μ setting	R
	setSrcRef	ObjectReference	SP	BKR # ARC AMP INT- μ	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
AccAbr		MV			BKR # ACC ARCING AMP ψ in A2s	R
	instMag.f	FLOAT32		BKR # ACC ARCING AMP ψ		R
	mag.f	FLOAT32		instMag.f on deadband exception		R
	units.SIUnit	ENUMERATED			70, the code for Amps Squared time (A2t)	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32	CF	CBArcΘSCBR#.AccAbr.db		R/W/C
	zeroDb	INT32	CF			R
SwA		MV			BKR 1 ARCING AMP ψ in A2s	R
	instMag.f	FLOAT32		BKR 1 ARCING AMP ψ		R
	mag.f	FLOAT32		instMag.f on deadband exception		R
	units.SIUnit	ENUMERATED			70, the code for Amps Squared time (A2t)	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32	CF	CBArcΘSCBR#.SwA.db		R/W/C
	zeroDb	INT32	CF			R
MaxIntrA		MV			BKR 1 AMP MAX ψ	R
	instMag.f	FLOAT32		BKR 1 AMP MAX ψ		R
	mag.f	FLOAT32		instMag.f on deadband exception		R
	units.SIUnit	ENUMERATED			5, the code for ampere	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32	CF	CBArcΘSCBR#.MaxIntrA.db		R/W/C
	zeroDb	INT32	CF			R
RctTmOpn		MV			BKR # OPERATING TIME ψ in ms	R
	instMag.f	FLOAT32		Mapped BKR # OPERATING TIME ψ		R
	mag.f	FLOAT32		instMag.f on deadband exception		R
	units.SIUnit	ENUMERATED			4, the code for Time (Sec)	R
	units.multiplier	ENUMERATED			-3, the code for a multiplier of 1/1000	R
	db	INT32	CF	CBArcΘSCBR#.RctTmOpn.db		R/W/C
	zeroDb	INT32	CF			R

3.5.4.6 Breaker restrike (BkrRtk)

This element is instantiated in the following products: B30, C60, C70, C95, D60, F35, F60, G60, L60, L90, M60, T60.

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Table 3-145: Breaker restrike data objects

LNName: BkrRtkPIOC#		LDevice inst: Ctrl		UR element: Breaker Control element #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Op		ACT			BRK RESTIRKE # OP operand (including individual three phases)	R
	general	BOOLEAN	ST	BRK RESTIRKE # OP		R
	phsA	BOOLEAN	ST	BRK RESTIRKE # OP A		R
	phsB	BOOLEAN	ST	BRK RESTIRKE # OP B		R
	phsC	BOOLEAN	ST	BRK RESTIRKE # OP C		R
BlkRef1		ORG			BKR RSTR # BLOCK setting	R
	setSrcRef	ObjectReference	SP	BKR RSTR # BLOCK.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef1		ORG			BKR RSTR # BKR OPEN setting	R
	setSrcRef	ObjectReference	SP	BKR RSTR # BKR OPEN.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef2		ORG			BKR RSTR # OPEN CMD setting	R
	setSrcRef	ObjectReference	SP	BKR RSTR # OPEN CMD.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef3		ORG			BKR RSTR # CLS CMD setting	R
	setSrcRef	ObjectReference	SP	BKR RSTR # CLS CMD.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.4.7 Broken conductor detection (BknCnd)

This element is instantiated in the following products: D30, D60, F35, F60, L30, L60, L90.

Table 3-146: Broken conductor detection data objects

LNName: BknCndPIOC#		LDevice inst: Ctrl		UR element: Broken Conductor element #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			BROKEN CONDUCT # PKP operand	R
	general	BOOLEAN	ST	BROKEN CONDUCT # PKP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown.	R
Op		ACT			BROKEN CONDUCT # OP operand	R
	general	BOOLEAN	ST	BROKEN CONDUCT # OP		R
BlkRef1		ORG			BROKEN CONDCT # BLOCK setting	R
	setSrcRef	ObjectReference	SP	BROKEN CONDCT # BLOCK	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.4.8 Broken rotor bar (BkrRot)

This element is instantiated in the following products: M60.

Table 3-147: Broken rotor bar data objects

LNName: BknRotSVBR1		LDevice inst: Ctrl		UR element: Broken Rotor Bar element		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Alm		SPS			ROTOR ALARM # PKP operand	R
	stVal	BOOLEAN	ST	ROTOR ALARM # PKP		R
Trip		SPS			ROTOR ALARM # OP operand	R
	stVal	BOOLEAN	ST	ROTOR ALARM # OP		R
BlkRef1		ORG			BRB BLOCK setting	R
	setSrcRef	ObjectReference	SP	BRB BLOCK.	reference to the data attribute to input	R/C

LNName: BknRotSVBR1		LDevice inst: Ctrl		UR element: Broken Rotor Bar element		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
CompLevel		MV			COMPONENT LEVEL in dB	R
	instMag.f	FLOAT32		COMPONENT LEVEL		R
	mag.f	FLOAT32		instMag.f deadbanded exception		R
	units.SIUnit	ENUMERATED			79, the code for dB	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32	CF	BknRotSVBR1.CompLevel.db		R/W/C
	zeroDb	INT32	CF			R
CompHz		MV			COMPONENT FREQ. in Hz	R
	instMag.f	FLOAT32		COMPONENT FREQ.		R
	mag.f	FLOAT32		instMag.f deadbanded exception		R
	units.SIUnit	ENUMERATED			33, the code for hertz (1/s)	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32	CF	BknRotSVBR1.CompHz.db		R/W/C
	zeroDb	INT32	CF			R
MotLoad		MV			MOTOR LOAD AT BRB CALC. in x FLA	R
	instMag.f	FLOAT32		MOTOR LOAD AT BRB CALC.		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			1, the code for dimensionless	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	BknRotSVBR1.MotLoad.db		R/W/C
	zeroDb	INT32U	CF			R
LoadDev		MV			LOAD DEV. AT BRB CALC. in x FLA	R
	instMag.f	FLOAT32		LOAD DEV. AT BRB CALC.		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			1, the code for dimensionless	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	BknRotSVBR1.LoadDev.db		R/W/C
	zeroDb	INT32U	CF			R
TmOfClc		INS			TIME OF BRB CALC. actual value	R
	stVal	INT32	ST	TIME OF BRB CALC. actual value		R
	units.SIUnit	ENUMERATED			4, the code for time	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
MaxCompLevel		MV			MAXIMUM COMPONENT LEVEL in dB	R
	instMag.f	FLOAT32		MAXIMUM COMPONENT LEVEL		R
	mag.f	FLOAT32		instMag.f deadbanded exception		R
	units.SIUnit	ENUMERATED			79, the code for dB	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32	CF	BknRotSVBR1.MaxCompLevel.db		R/W/C
	zeroDb	INT32	CF			R
MaxCompHz		MV			MAXIMUM COMPONENT FREQ. in Hz	R
	instMag.f	FLOAT32		MAXIMUM COMPONENT FREQ.		R
	mag.f	FLOAT32		instMag.f deadbanded exception		R

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LNName: BknRotSVBR1		LDevice inst: Ctrl		UR element: Broken Rotor Bar element		
data obj.	data attribute	Type	FC	UR Name	Description	R/W/C
	units.SIUnit	ENUMERATED			33, the code for hertz (1/s)	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32	CF	BknRotSVBR1.MaxCompHz.db		R/W/C
	zeroDb	INT32	CF			R
MaxMotLoad		MV			MOTOR LOAD AT BRB MAX in x FLA	R
	instMag.f	FLOAT32		MOTOR LOAD AT BRB MAX		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			1, the code for dimensionless	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	BknRotSVBR1.MaxMotLoad.db		R/W/C
	zeroDb	INT32U	CF			R
MaxLoadDev		MV			LOAD DEV. AT BRB MAX in x FLA	R
	instMag.f	FLOAT32		LOAD DEV. AT BRB MAX		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			1, the code for dimensionless	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	BknRotSVBR1.MaxLoadDev.db		R/W/C
	zeroDb	INT32U	CF			R
TmOfMax		INS			TIME OF MAXIMUM BRB actual value	R
	stVal	INT32	ST	TIME OF MAXIMUM BRB actual value		R
	units.SIUnit	ENUMERATED			4, the code for time	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
BknRotClr		SPC			Mapped to command CLEAR BROKEN ROTOR BAR DATA	R/Ctrl
	pulseConfig .cmdQual	ENUMERATED				R
	pulseConfig.onDur	INT32U			0 indicated the duration is locally defined	R
	pulseConfig .offDur	INT32U				R
	pulseConfig .numPls	INT32U				R
	ctlModel	CtlModels	CF	BknRotSVBR1.BknRotClr.ctlModel	1, the code for direct control with normal security; 2 is code for SBO with normal security.	R/W/C
	sboTimeout	INT32U	CF			R
	sboClass	SboClasses	CF			R
	operTimeout	INT32U	CF			R

3.5.4.9 Capacitor control (CapCtl)

This element is instantiated in the following products: C70.

Table 3-148: Capacitor control data objects

LNName: CapCtlGAPC#		LDevice inst: Ctrl		UR element: Capacitor control element #		
data obj.	data attribute	Type	FC	UR Name	Description	R/W/C
RemMod		SPS			CAP # IN REMOTE operand	R
	stVal	BOOLEAN	ST	CAP # IN REMOTE		R
LocMod		SPS			CAP # IN LOCAL operand	R

LNName: CapCtlGAPC#		LDevice inst: Ctrl		UR element: Capacitor control element #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	stVal	BOOLEAN	ST	CAP # IN LOCAL		R
AutoMod		SPS			"CAP # IN AUTO operand	R
	stVal	BOOLEAN	ST	CAP # IN AUTO		R
ManMod		SPS			"CAP # IN MAN operand	R
	stVal	BOOLEAN	ST	CAP # IN MAN		R
Discharging		SPS			"CAP # DISCHARGING operand	R
	stVal	BOOLEAN	ST	CAP # DISCHARGING		R
OpOpn		ACT			CAP # BKR TRIP operand	R
	general	BOOLEAN	ST	CAP # BKR TRIP		R
OpCls		ACT			CAP # BKR CLOSE operand	R
	general	BOOLEAN	ST	CAP # BKR CLOSE		R
DischargeTms		MV			CAP # DISCHARGE TIME in seconds	R
	instMag.f	FLOAT32		CAP # DISCHARGE TIME actual value		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			4, the code for time (s)	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	CapCtlGAPC#.DschTms.db		R/W/C
	zeroDb	INT32U	CF			R
InRef01		ORG			CAP # SET REMOTE 1 setting.	R
	setSrcRef	ObjectReference	SP	CAP # SET REMOTE 1 setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef02		ORG			CAP # SET REMOTE 2 setting.	R
	setSrcRef	ObjectReference	SP	CAP # SET REMOTE 2 setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef03		ORG			CAP # SET LOCAL 1 setting.	R
	setSrcRef	ObjectReference	SP	CAP # SET LOCAL 1 setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef04		ORG			CAP # SET LOCAL 2 setting.	R
	setSrcRef	ObjectReference	SP	CAP # SET LOCAL 2 setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef05		ORG			CAP # RMT CTRL EN setting.	R
	setSrcRef	ObjectReference	SP	CAP # RMT CTRL EN setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef06		ORG			CAP # LCL CTRL EN setting.	R
	setSrcRef	ObjectReference	SP	CAP # LCL CTRL EN setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef07		ORG			CAP # RMT SET AUTO setting.	R
	setSrcRef	ObjectReference	SP	CAP # RMT SET AUTO setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef08		ORG			CAP # LCL SET AUTO setting.	R
	setSrcRef	ObjectReference	SP	CAP # LCL SET AUTO setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef09		ORG			CAP # RMT SET MAN setting.	R
	setSrcRef	ObjectReference	SP	CAP # RMT SET MAN setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef10		ORG			CAP # LCL SET MAN setting.	R

LNName: CapCtlGAPC#		LDevice inst: Ctrl		UR element: Capacitor control element #		
data obj.	data attribute	Type	FC	UR Name	Description	R/W/C
	setSrcRef	ObjectReference	SP	CAP # LCL SET MAN setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef1$		ORG			CAP # TRIP $ setting.	R
	setSrcRef	ObjectReference	SP	CAP # TRIP $ setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef22		ORG			CAP # MAN CTRL EN setting.	R
	setSrcRef	ObjectReference	SP	CAP # MAN CTRL EN setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef23		ORG			CAP # REMOTE OPEN setting.	R
	setSrcRef	ObjectReference	SP	CAP # REMOTE OPEN setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef24		ORG			CAP # LOCAL OPEN setting.	R
	setSrcRef	ObjectReference	SP	CAP # LOCAL OPEN setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef25		ORG			CAP # AUTO OPEN setting.	R
	setSrcRef	ObjectReference	SP	CAP # AUTO OPEN setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef26		ORG			CAP # BKR OPEN 52b setting.	R
	setSrcRef	ObjectReference	SP	CAP # BKR OPEN 52b setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef27		ORG			CAP # REMOTE CLOSE setting.	R
	setSrcRef	ObjectReference	SP	CAP # REMOTE CLOSE setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef28		ORG			CAP # LOCAL CLOSE setting.	R
	setSrcRef	ObjectReference	SP	CAP # LOCAL CLOSE setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef29		ORG			CAP # AUTO CLOSE setting.	R
	setSrcRef	ObjectReference	SP	CAP # AUTO CLOSE setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef30		ORG			CAP # BKR CLSD 52a setting.	R
	setSrcRef	ObjectReference	SP	CAP # BKR CLSD 52a setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
BlkRef1		ORG			CAP # BKR CLOSE BLK setting.	R
	setSrcRef	ObjectReference	SP	CAP # BKR CLOSE BLK	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef31		ORG			CAP # CLS OVERRIDE setting.	R
	setSrcRef	ObjectReference	SP	CAP # CLS OVERRIDE setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.4.10 Cold load pickup (Cold)

This element is instantiated in the following products: F35, F60.

Table 3-149: Cold load pickup data objects

LNName: ColdFXUT#		LDevice inst: Prot		UR element: Cold Load Pickup # element		
data obj.	data attribute	Type	FC	UR Name	Description	R/W/C
Op		ACT			COLD LOAD # OP operand	R
	general	BOOLEAN	ST	COLD LOAD # OP		R

LNName: ColdFXUT#		LDevice inst: Prot		UR element: Cold Load Pickup # element		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
StrVal		ASG			Start level of the current, which is fixed at 2% of Nominal CT (0.02 pu), and it is non-configurable read only value	R
	setMag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			1, the code for dimensionless	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
BlkRef1		ORG			COLD LOAD # BLK setting	R
	setSrcRef	ObjectReference	SP	COLD LOAD # BLK.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef1		ORG			COLD LOAD # INIT setting	R
	setSrcRef	ObjectReference	SP	COLD LOAD # INIT.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.4.11 CT failure detector (CtFail)

This element is instantiated in the following products: D30, D60, F60, G30, G60, L30, L60, L90, M60, N60, T35, T60.

Table 3-150: CT fail data objects

LNName: CtFailPIOC#		LDevice inst: Ctrl		UR element: CT failure detector # element		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			CT FAIL # PKP operand, which indicated Op will operate when delay expires	R
	general	BOOLEAN	ST	CT FAIL # PKP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown	R
Op		ACT			CT FAIL # OP operand	R
	general	BOOLEAN	ST	CT FAIL # OP		R
BlkRef1		ORG			CT FAIL # BLOCK setting	R
	setSrcRef	ObjectReference	SP	CT FAIL # BLOCK.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.4.12 CT trouble (CtTb)

This element is instantiated in the following products: B30, B90.

Table 3-151: CT trouble data objects

LNName: CtTbPIOC#		LDevice inst: Ctrl		UR element: CT Trouble Zone # element		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Op		ACT			CT TROUBLE ZONE # OP operands (including individual three phases)	R
	general	BOOLEAN	ST	CT TROUBLE #1 OP		R
	phsA	BOOLEAN	ST	CT TROUBLE # OP A		R
	phsB	BOOLEAN	ST	CT TROUBLE # OP B		R
	phsC	BOOLEAN	ST	CT TROUBLE # OP C		R

3.5.4.13 Digitizers (Dgtzr)

This element is instantiated in the following products: N60.

Table 3-152: Digitizer data objects

LNName: DgtzrGAPC#		LDevice inst: Ctrl		UR element: Digitizer #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
IndΘ		SPS			DIGITIZER # BIT Θ-1 operand value	R
	stVal	BOOLEAN	ST	DIGITIZER # BIT Θ-1		R
Out		MV			DIGITIZER # Out Value	R
	instMag.f	FLOAT32		DIGITIZER # Out Value		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			1, the code for dimensionless	R
	units.multiplier	ENUMERATED			0, the code for multiplier 1	R
	db	INT32U	CF	DgtzrGAPC#.Out.db		R/W/C
	zeroDb	INT32U	CF			R
InRef1		ORG			DIGITIZER # SOURCE setting.	R
	setSrcRef	ObjectReference	SP	DIGITIZER # SOURCE setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.4.14 Fault location (FltRpt)

This element is instantiated in the following products: C60, C95, D30, D60, F35, F60, L30, L60, L90.

Table 3-153: Fault report settings data objects

LNName: FltRptRFLO#		LDevice inst: Ctrl		UR element: FAULT REPORT # settings		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
TapLocFlt		SPS			TAP-LOCAL FAULT operand	R
	stVal	BOOLEAN	ST	TAP-LOCAL FAULT		R
NumRcd		INS			instantiated only in FltRptRFLO1	R
	stVal	INT32	ST	Modbus register 3020h, I.e., “Number of Fault Reports”		
	units	Unit	CF			
	units.SIUnit	ENUMERATED			1, the code for dimensionless	
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
FltZ		CMV			Mandatory data attribute which in this case is fixed at zero	R
	cVal.mag.f	FLOAT32			0	R
	cVal.ang.f	FLOAT32			0	R
RsStat		SPC			instantiated only in FltRptRFLO1	R/Ctrl
	pulseConfig .cmdQual	ENUMERATED			0 (pulse)	
	pulseConfig.onDur	INT32U			2 ms (actually one pass)	
	pulseConfig .offDur	INT32U			0	
	pulseConfig .numPls	INT32U			1	
	ctlModel	CtlModels	CF	FltRptRFLO1.RsStat.ctlModel		R/W/C
	sboTimeout	INT32U	CF		30000	R
	sboClass	SboClasses	CF		0 (operate-once)	R
	operTimeout	INT32U	CF		0	R
InRef1		ORG			FAULT REPORT# TRIG.	R
	setSrcRef	ObjectReference	SP	FAULT REPORT# TRIG.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef2		ORG			Only instantiated in FltRptRFLO1	R

LNName: FltRptRFLO#		LDevice inst: Ctrl		UR element: FAULT REPORT # settings		
data obj.	data attribute	Type	FC	UR Name	Description	R/W/C
	setSrcRef	ObjectReference	SP	CLEAR FAULT REPORTS.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

Table 3-154: Fault report data file data objects

LNName: FltRFLOψψ		LDevice inst: Ctrl		UR element: Selected values from Fault Report Data file ψψ		
data obj.	data attribute	Type	FC	UR Name	Description	R/W/C
FltZ		CMV			FAULTψψ Fault impedance converted to primary ohms	R
	cVal.mag.f	FLOAT32		Fault impedance magnitude in primary ohms calculated as shown below		R
	cVal.ang.f	FLOAT32		Fault impedance angle in degrees calculated as shown below		R
FltRis		MV			FAULTψψ FAULT RESIST converted to primary ohms	R
	mag.f	FLOAT32		Actual Value FAULTψψ FAULT RESIST converted to primary ohms		R
	units.SIUnit	ENUMERATED			30, the code for primary electric resistance in ohm (V/A)	
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
FltLoopRis		MV			FAULTψψ LOOP RESIST converted to primary ohms	R
	mag.f	FLOAT32		Actual Value FAULTψψ LOOP RESIST converted to primary ohms		R
	units.SIUnit	ENUMERATED			30, the code for primary electric resistance in ohm (V/A)	
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
FltLoopReact		MV			FAULTψψ LOOP REACT converted to primary ohms	R
	mag.f	FLOAT32		Actual Value FAULTψψ LOOP REACT converted to primary ohms		R
	units.SIUnit	ENUMERATED			30, the code for primary electric resistance in ohm (V/A)	
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
FltNum		INS			FAULT NUMBER	R
	stVal	INT32	ST	FAULT NUMBER in Fault Report Data file ψψ		
	units.SIUnit	ENUMERATED			1, the code for dimensionless	
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
FltLinID		VSS			Faulted line ID	R
	stVal	VISIBLE STRING 255	ST	LINE ID in Fault Report Data file ψψ		R
FltLoop		ENS			FAULT TYPE	R
	stVal	ENUMERATED	ST	FAULT TYPE in Fault Report Data file ψψ		R
FltSegment		ENS			FAULT ψψ FAULTED SEGMENT	R
	stVal	ENUMERATED	ST	FAULT ψψ FAULTED SEGMENT		R
FltDiskm		MV			FAULT LOCATION	R

LNName: FltRFLOψψ		LDevice inst: Ctrl		UR element: Selected values from Fault Report Data file ψψ		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	mag.f	FLOAT32		FAULT LOCATION in Fault Report Data file ψψ, converted to kilometers where required		
	units.SIUnit	ENUMERATED			2, the code for meter	
	units.multiplier	ENUMERATED			3, the code for a multiplier of 1000	R
RecCyc		INS			FAULT RECLOSE SHOT	R
	stVal	INT32	ST	FAULT RECLOSE SHOT in Fault Report Data file ψψ		
	units.SIUnit	ENUMERATED			1, the code for dimensionless	
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R

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The FltRFLO1 logical node always reads the latest fault data, when a new fault report is generated. FltRFLO2 always reads the previous fault data and FltRFLO3 reads the next previous data and so on.

3.5.4.15 Frequency out-of-band accumulation (HzBnd)

This element is instantiated in the following products: G30, G60.

Table 3-155: Frequency out-of-band accumulation data objects

LNName: HzBndPTUF1		LDevice inst: Ctrl		UR element: Frequency OOB Accumulation element		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			FREQ OOB ACCUM PKP operand, which is indicates Op will operate when delay expires.	R
	general	BOOLEAN	ST	FREQ OOB ACCUM PKP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown.	R
Op		ACT			FREQ OOB ACCUM OP operand	R
	general	BOOLEAN	ST	FREQ OOB ACCUM OP		R
BlkRef1		ORG			FREQ ACCUM BLOCK setting.	R
	setSrcRef	ObjectReference	SP	FREQ ACCUM BLOCK.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

Table 3-156: Frequency out-of-band accumulation prefix instance number $ data objects

LNName: HzBnd$PTUF1		LDevice inst: Ctrl		UR element: Frequency OOB Accumulator $		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			FREQ OOB BAND $ PKP operand, which is indicates Op will operate when delay expires.	R
	general	BOOLEAN	ST	FREQ OOB BAND $ PKP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown.	R
Op		ACT			FREQ OOB BAND $ OP operand	R
	general	BOOLEAN	ST	FREQ OOB BAND $ OP		R
Dpo		SPS			FREQ OOB BAND $ DPO operand	R
	stVal	BOOLEAN	ST	FREQ OOB BAND $ DPO		R
HzObAccum		MV			FREQUENCY OOB BAND $ ACCUMULATION in percentage (%)	R
	instMag.f	FLOAT32		FREQUENCY OOB BAND $ ACCUMULATION		R
	mag.f	FLOAT32		instMag.f deadbanded exception		R
	units.SIUnit	ENUMERATED			1, the code for dimensionless	R
	units.multiplier	ENUMERATED			-2 is code for percent	R

LNName: HzBnd$PTUF1		LDevice inst: Ctrl		UR element: Frequency OOB Accumulator $		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	db	INT32	CF	HzBnd$PTUF1.HzObAccum.db		R/W/C
	zeroDb	INT32	CF			R

3.5.4.16 Harmonic detection (HDet)

This element is instantiated in the following products: C60, D30, D60, F35, F60, G30, G60, L30, L90, N60, T35, T60.

Table 3-157: Harmonic detection data objects

LNName: HDetMHAI#		LDevice inst: Ctrl		UR element: Harmonic Detection element		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Hz		MV			SRC θ Frequency, in Hz	R
	instMag.f	FLOAT32		Frequency of the SRC θ, which is selected by setting HARMONIC DET # SOURCE		R
	mag.f	FLOAT32			instMag.f deadbanded	R
	units.SIUnit	ENUMERATED			33, the code for hertz (1/s)	
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	
	db	INT32U	CF	HDetMHAI#.Hz.db		R/W/C
	zeroDb	INT32U	CF		0	R
Str		ACD			HARMONIC DET # PKP operands (including individual three phases)	R
	general	BOOLEAN	ST	HARMONIC DET # PKP		R
	dirGeneral	ENUMERATED	ST		0	R
	phsA	BOOLEAN	ST	HARMONIC DET # PKP A		R
	dirPhsA	ENUMERATED	ST		0	R
	phsB	BOOLEAN	ST	HARMONIC DET # PKP B		R
	dirPhsB	ENUMERATED	ST		0	R
	phsC	BOOLEAN	ST	HARMONIC DET # PKP C		R
	dirPhsC	ENUMERATED	ST		0	R
	neut	BOOLEAN	ST	HARMONIC DET # PKP G		R
	dirNeut	ENUMERATED	ST		0	R
Op		ACT			HARMONIC DET # OP operands (including individual three phases)	R
	general	BOOLEAN	ST	HARMONIC DET # OP		R
	phsA	BOOLEAN	ST	HARMONIC DET # OP A		R
	phsB	BOOLEAN	ST	HARMONIC DET # OP B		R
	phsC	BOOLEAN	ST	HARMONIC DET # OP C		R
	neut	BOOLEAN	ST	HARMONIC DET # OP G		R
HDetAa		MV			Harmonic Det # IA in percentage	R
	instMag.f	FLOAT32		Harmonic Det # IA		R
	mag.f	FLOAT32			instMag.f deadbanded	R
	units.SIUnit	ENUMERATED			1, the code for dimensionless (percentage)	
	units.multiplier	ENUMERATED		-2		
	db	INT32U	CF	HDetMHAI#.HDetAa.db		R/W/C
	zeroDb	INT32U	CF		0	R
HDetAb		MV			Harmonic Det # IB in percentage	R
	instMag.f	FLOAT32		Harmonic Det # IB		R
	mag.f	FLOAT32			instMag.f deadbanded	R

LNName: HDetMHAI#		LDevice inst: Ctrl		UR element: Harmonic Detection element		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	units.SIUnit	ENUMERATED			1, the code for dimensionless (percentage)	
	units.multiplier	ENUMERATED		-2		
	db	INT32U	CF	HDetMHAI#.HDetAb.db		R/W/C
	zeroDb	INT32U	CF		0	R
HDetAc		MV			Harmonic Det # IC in percentage	R
	instMag.f	FLOAT32		Harmonic Det # IC		R
	mag.f	FLOAT32			instMag.f deadbanded	R
	units.SIUnit	ENUMERATED			1, the code for dimensionless (percentage)	
	units.multiplier	ENUMERATED		-2		
	db	INT32U	CF	HDetMHAI#.HDetAc.db		R/W/C
	zeroDb	INT32U	CF		0	R
HDetAGnd		MV			Harmonic Det # IG in percentage	R
	instMag.f	FLOAT32		Harmonic Det # IG		R
	mag.f	FLOAT32			instMag.f deadbanded	R
	units.SIUnit	ENUMERATED			1, the code for dimensionless (percentage)	
	units.multiplier	ENUMERATED		-2		
	db	INT32U	CF	HDetMHAI#.HDetAGnd.db		R/W/C
	zeroDb	INT32U	CF		0	R
HDetAAv		MV			Harmonic Det # IAVG in percentage	R
	instMag.f	FLOAT32		Harmonic Det # IAVG		R
	mag.f	FLOAT32			instMag.f deadbanded	R
	units.SIUnit	ENUMERATED			1, the code for dimensionless (percentage)	
	units.multiplier	ENUMERATED		-2		
	db	INT32U	CF	HDetMHAI#.HDetAAv.db		R/W/C
	zeroDb	INT32U	CF		0	R
BlkRef1		ORG			HARMONIC DET # BLOCK setting.	R
	setSrcRef	ObjectReference	SP	HARMONIC DET # BLOCK.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.4.17 High-impedance fault detection (HiZ)

This element is instantiated in the following products: F60.

Table 3-158: Hi-Z data objects

LNName: HiZPHIZ1		LDevice inst: Ctrl		UR element: HI-Z function		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			HI-Z ARMED operand	R
	general	BOOLEAN	ST	HI-Z ARMED		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown It is unknown as the element is non-directional.	R
Op		ACT			HI-Z ARC DETECTED operand including Phases-A, B, C	R
	general	BOOLEAN	ST	HI-Z ARC DETECTED		R
	phsA	BOOLEAN	ST	HI-Z ARC DETECTED-A		R
	phsB	BOOLEAN	ST	HI-Z ARC DETECTED-B		R
	phsC	BOOLEAN	ST	HI-Z ARC DETECTED-C		R

LNName: HiZPHIZ1		LDevice inst: Ctrl		UR element: HI-Z function		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Dpo		SPS			HI-Z ARC DETECTED DPO operand	R
	stVal	BOOLEAN	ST	HI-Z ARC DETECTED DPO		R
DisArmed		SPS			HI-Z DISARMED operand	R
	stVal	BOOLEAN	ST	HI-Z DISARMED		R
DwnCond		ACT			HI-Z DOWNED COND operand including phsA, B, C	R
	general	BOOLEAN	ST	HI-Z DOWNED COND		R
	phsA	BOOLEAN	ST	HI-Z DOWNED COND-A		R
	phsB	BOOLEAN	ST	HI-Z DOWNED COND-B		R
	phsC	BOOLEAN	ST	HI-Z DOWNED COND-C		R
ArcSuspect		ACT			HI-Z ARC SUSPECTED operand including Phases-A, B, C and Neutral	R
	general	BOOLEAN	ST	HI-Z ARC SUSPECTED		R
	phsA	BOOLEAN	ST	HI-Z ARC SUSPECTED-A		R
	phsB	BOOLEAN	ST	HI-Z ARC SUSPECTED-B		R
	phsC	BOOLEAN	ST	HI-Z ARC SUSPECTED-C		R
	neut	BOOLEAN	ST	HI-Z ARC SUSPECTED-N		R
HiZIOC		ACT			HI-Z IOC operand including Phases A, B, C.	R
	general	BOOLEAN	ST	OR logic of operands (HI-Z IOC A or HI-Z IOC B or HI-Z IOC C)		R
	phsA	BOOLEAN	ST	HI-Z IOC A		R
	phsB	BOOLEAN	ST	HI-Z IOC B		R
	phsC	BOOLEAN	ST	HI-Z IOC C		R
	neut	BOOLEAN	ST	HI-Z IOC N		R
LossLd		ACT			HI-Z LOSS OF LOAD operand including Phases A, B, C.	R
	general	BOOLEAN	ST	OR logic of operands HI-Z LOSS OF LOAD-A or HI-Z LOSS OF LOAD–B or HI-Z LOSS OF LOAD-C		R
	phsA	BOOLEAN	ST	HI-Z LOSS OF LOAD-A		R
	phsB	BOOLEAN	ST	HI-Z LOSS OF LOAD–B		R
	phsC	BOOLEAN	ST	HI-Z LOSS OF LOAD-C		R
HiZSt		ENS			HIZ STATUS actual value	R
	stVal	ENUMERATED	ST	HIZ STATUS, where 0 = Normal, 1 = Coordination Timeout, 2 = Armed, 5 = Arcing, 9 = Downed Conductor		R
ArcConfidΦ		INS			HIZ Phase Φ Arc Conf Actual Value	R
	stVal	INT32	ST	HIZ Phase Φ Arc Conf in percentage		
	units.SIUnit	ENUMERATED			1, the code for dimensionless	R
Trigger1$		ENS			HIZ RECORDS, HIZ $ actual value	R
	stVal	ENUMERATED	ST	HI-Z Capture $ Trigger Type, where 0 = None, 1 = Loss of Load, 2 = Arc Suspected, 3 = Arcing, 4 = Overcurrent, 5 = Down Conductor, 6 = External		R
Trigger2$		ENS			HIZ RECORDS, RMS $ actual value	R

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LNName: HiZPHIZ1		LDevice inst: Ctrl		UR element: HI-Z function		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	stVal	ENUMERATED	ST	HI-Z RMS Capture $ Trigger Type, where 0 = None, 1 = Loss of Load, 2 = Arc Suspected, 3 = Arcing, 4 = Overcurrent, 5 = Down Conductor, 6 = External		R
ClrMem		SPC			Hi-Z Clear Oscillography command	R/Ctrl
	pulseConfig .cmdQual	ENUMERATED			0 (pulse)	
	pulseConfig.onDur	INT32U			2 ms (actually one pass)	
	pulseConfig .offDur	INT32U			0	
	pulseConfig .numPls	INT32U			1	
	ctlModel	CtlModels	CF	HiZPHIZ1.ClrMem.ctlModel		R/W/C
	sboTimeout	INT32U	CF		30000	R
	sboClass	SboClasses	CF		0 (operate-once)	R
	operTimeout	INT32U	CF		0	R
FrcTrigger		SPC			Hi-Z Oscillography Force Trigger command	R/Ctrl
	pulseConfig	PulseConfig	CF			R
	pulseConfig .cmdQual	ENUMERATED			0 (pulse)	
	pulseConfig.onDur	INT32U			2 ms (actually one pass)	
	pulseConfig .offDur	INT32U			0	
	pulseConfig .numPls	INT32U			1	
	ctlModel	CtlModels	CF	HiZPHIZ1.FrcTrigger.ctlModel		R/W/C
	sboTimeout	INT32U	CF		30000	R
	sboClass	SboClasses	CF		0 (operate-once)	R
	operTimeout	INT32U	CF		0	R
AlgCap		SPC			Hi-Z Oscillography Force Algorithm Capture command	R/Ctrl
	pulseConfig	PulseConfig	CF			R
	pulseConfig .cmdQual	ENUMERATED			0 (pulse)	
	pulseConfig.onDur	INT32U			2 ms (actually one pass)	
	pulseConfig .offDur	INT32U			0	
	pulseConfig .numPls	INT32U			1	
	ctlModel	CtlModels	CF	HiZPHIZ1.AlgCap.ctlModel		R/W/C
	sboTimeout	INT32U	CF		30000	R
	sboClass	SboClasses	CF		0 (operate-once)	R
	operTimeout	INT32U	CF		0	R
ReSigma		SPC			Hi-Z Reset Sigma Values command	R/Ctrl
	pulseConfig .cmdQual	ENUMERATED			0 (pulse)	
	pulseConfig.onDur	INT32U			2 ms (actually one pass)	
	pulseConfig .offDur	INT32U			0	

LNName: HiZPHIZ1		LDevice inst: Ctrl		UR element: HI-Z function		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	pulseConfig .numPls	INT32U			1	
	ctlModel	CtlModels	CF	HiZPHIZ1.ReSigma.ctlModel		R/W/C
	sboTimeout	INT32U	CF		30000	R
	sboClass	SboClasses	CF		0 (operate-once)	R
	operTimeout	INT32U	CF		0	R
BlkRef1		ORG			HI-Z BLOCK setting	R
	setSrcRef	ObjectReference	SP	HI-Z BLOCK.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

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3.5.4.18 Incipient cable fault detection (ICFlt)

This element is instantiated in the following products: D30, F35, F60, L30.

Table 3-159: Incipient fault detector data objects

LNName: ICFltPTEF#		LDevice inst: Ctrl		UR element: Incipient Cable Fault Element #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			INCIPNT FLT # PKP operands (including individual three phases)	R
	general	BOOLEAN	ST	INCIPNT FLT # PKP		R
	dirGeneral	ENUMERATED	ST			R
	phsA	BOOLEAN	ST	INCIPNT FLT # PKP A		R
	dirPhsA	ENUMERATED	ST			R
	phsB	BOOLEAN	ST	INCIPNT FLT # PKP B		R
	dirPhsB	ENUMERATED	ST			R
	phsC	BOOLEAN	ST	INCIPNT FLT # PKP C		R
	dirPhsC	ENUMERATED	ST			R
Op		ACT			INCIPNT FLT # OP operands (including individual three phases)"	R
	general	BOOLEAN	ST	INCIPNT FLT # OP		R
	phsA	BOOLEAN	ST	INCIPNT FLT # OP A		R
	phsB	BOOLEAN	ST	INCIPNT FLT # OP B		R
	phsC	BOOLEAN	ST	INCIPNT FLT # OP C		R
FltCntPhϕ		INS			INCIPIENT FAULT # PH θ FAULTS.	R
	stVal	INT32	ST	INCIPIENT FAULT # PH θ FAULTS		R
	units.SIUnit	ENUMERATED			1, the code for dimensionless	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
FltCntClr		SPC			Only instantiated in ICFltPTEF1	R/Ctrl
	pulseConfig .cmdQual	ENUMERATED				R
	pulseConfig.onDur	INT32U			2 ms (actually one pass)	R
	pulseConfig .offDur	INT32U				R
	pulseConfig .numPls	INT32U				R
	ctlModel	CtlModels	CF	ICFltPTEF#.FltCntClr.ctlModel		R/W/C
	sboTimeout	INT32U	CF			R
	sboClass	SboClasses	CF			R
	operTimeout	INT32U	CF			R
BlkRef1		ORG			INCIPNT FLT # BLOCK setting.	R

LNName: ICFltPTEF#		LDevice inst: Ctrl		UR element: Incipient Cable Fault Element #		
data obj.	data attribute	Type	FC	UR Name	Description	R/W/C
	setSrcRef	ObjectReference	SP	INCIPNT FLT # BLOCK.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.4.19 Maximum starting rate (StrRte)

This element is instantiated in the following products: M60.

Table 3-160: Maximum starting rate data objects

LNName: StrRtePMRI1		LDevice inst: Ctrl		UR element: Maximum starting rate element		
data obj.	data attribute	Type	FC	UR Name	Description	R/W/C
Str		ACD			STARTS-PER-HOUR PKP operand	R
	general	BOOLEAN	ST	STARTS-PER-HOUR PKP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown. It is unknown as the element is non-directional	R
Op		ACT			STARTS-PER-HOUR OP operand	R
	general	BOOLEAN	ST	STARTS-PER-HOUR OP		R
Dpo		SPS			STARTS-PER-HOUR DPO operand, which is the inverse of STARTS-PER-HOUR PKP	R
	stVal	BOOLEAN	ST	STARTS-PER-HOUR DPO		R
BlkRef1		ORG			STARTS/HR BLK setting.	R
	setSrcRef	ObjectReference	SP	STARTS/HR BLK.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
StrHrLOTm		MV			Start/Hour Lockout Time in min	R
	instMag.f	FLOAT32		Start/Hour Lockout Time		R
	mag.f	FLOAT32		instMag.f on deadband exception		R
	units.SIUnit	ENUMERATED			4, the code for Time (Sec)	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32	CF	StrRtePMRI1.StrHrLOTm.db		R/W/C
	zeroDb	INT32	CF			R

3.5.4.20 Multi-range signal oscillation detector (MSOD) (OscDet)

This element is instantiated in the following products: D60, G30, G60, L90, N60, T60.

Table 3-161: MSOD data objects

LNName: OscDetMOSC#		LDevice inst: Ctrl		UR element: Multi range Oscillation Detector #		
data obj.	data attribute	Type	FC	UR Name	Description	R/W/C
Op		ACT			MSOD # TRIP operand	R
	general	BOOLEAN	ST	MSOD # TRIP		R
Alm		SPS			MSOD # ALARM operand	R
	stVal	BOOLEAN	ST	MSOD # ALARM		R
HzOsc		MV			MSOD # FREQ OSC measurement	R
	instMag.f	FLOAT32		MSOD # Freq_osc		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			33, the code for hertz (1/s)	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	OscDetMOSC#.HzOsc.db		R/W/C
	zeroDb	INT32U	CF			R

LNName: OscDetMOSC#		**LDevice inst: Ctrl**		**UR element: Multi range Oscillation Detector #**		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Osc		CMV			MSOD # measured oscillation magnitude in pu and phase angle	R
	instCVal.mag.f	FLOAT32		MSOD # Mag_osc		R
	instCVal.ang.f	FLOAT32		MSOD # Ph_osc		R
	cVal.mag.f	FLOAT32				R
	cVal.ang.f	FLOAT32				R
	units.SIUnit	ENUMERATED			1, the code for dimensionless	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	OscDetMOSC#.Osc.db		R/W/C
	dbAng	INT32U	CF	OscDetMOSC#.Osc.dbAng		R/W/C
	zeroDb	INT32U	CF			R
Damp		MV			MSOD# Damping Ratio of oscillations in percent	R
	instMag.f	FLOAT32		DampR_osc		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			1, the code for dimensionless	R
	units.multiplier	ENUMERATED		-1		R
	db	INT32U	CF	OscDetMOSC#.Damp.db		R/W/C
	zeroDb	INT32U	CF			R
HzBndHi		MV			High Frequency range of selected MSOD# FREQ BAND	R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			33, the code for hertz (1/s)	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
HzBndLo		MV			Low Frequency range of selected MSOD# FREQ BAND	R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			33, the code for hertz (1/s)	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
BlkRef1		ORG			MSOD # BLK setting for setting group γ	R
	setSrcRef	ObjectReference	SP	MSOD # BLK.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.4.21 PID regulator (PIDReg)

This element is instantiated in the following products: C30, F35.

Table 3-162: PID regulator data objects

LNName: PIDRegFPID#		**LDevice inst: Ctrl**		**UR element: PID Regulator element #**		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Raise		SPS			PID # RAISE operand value	R
	stVal	BOOLEAN	ST	PID # RAISE		R
Lower		SPS			PID # LOWER operand value	R
	stVal	BOOLEAN	ST	PID # LOWER		R
Out		MV			PID # Out value	R
	instMag.f	FLOAT32		PID # Out		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			1, the code for dimensionless	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	PIDRegFPID#.Out.db		R/W/C

LNName: PIDRegFPID#		LDevice inst: Ctrl		UR element: PID Regulator element #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	zeroDb	INT32U	CF			R
DeltaOut		MV			PID # Delta Out value	R
	instMag.f	FLOAT32		PID # Delta Out		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			1, the code for dimensionless	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	PIDRegFPID#.DeltaOut.db		R/W/C
	zeroDb	INT32U	CF			R
Spt		MV			PID # Setpoint value	R
	instMag.f	FLOAT32		PID # Setpoint		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			1, the code for dimensionless	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	PIDRegFPID#.Spt.db		R/W/C
	zeroDb	INT32U	CF			R
PIDAlg		ENG			Algorithm, which is fixed at PID	R
	setVal	ENUMERATED	SP		7, the code for PID	R
KP		ASG			PID # PROPORTIONAL GAIN setting	R
	setMag	AnalogueValue	SP			R
	setMag.i	INT32		PID # PROPORTIONAL GAIN		R
	units	Unit	CF			R
	units.SIUnit	ENUMERATED			1, the code for dimensionless	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	sVC	ScaledValue Config	CF			R
	sVC.scaleFactor	FLOAT32				R
	sVC.offset	FLOAT32				R
KI		ASG			PID # Integral gain value	R
	setMag.i	INT32		PID # PROPORTIONAL GAIN		R
	units.SIUnit	ENUMERATED			1, the code for dimensionless	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	sVC.scaleFactor	FLOAT32				R
	sVC.offset	FLOAT32				R
ITmms		ING			PID # INTEG. TIME CONST. setting in milliseconds	R
	setVal	INT32	SP	PID # INTEG. TIME CONST. scaled to make the result in milliseconds		R
	minVal	INT32	CF			R
	maxVal	INT32	CF			R
	stepSize	INT32U	CF			R
	units.SIUnit	ENUMERATED			4, the code for time in seconds	R
	units.multiplier	ENUMERATED			-3, the code for a multiplier of 0.001 (i.e. Milli)	R
KD		ASG			PID # Derivative gain value	R
	setMag.i	INT32		PID # PROPORTIONAL GAIN		R
	units.SIUnit	ENUMERATED			1, the code for dimensionless	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	sVC.scaleFactor	FLOAT32				R
	sVC.offset	FLOAT32				R

LNName: PIDRegFPID#		**LDevice inst: Ctrl**		**UR element: PID Regulator element #**		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
DTmms		ING			PID # DERIV. TIME CONST. setting in milliseconds	R
	setVal	INT32	SP	PID # DERIV. TIME CONST. scaled to make the result in milliseconds		R
	minVal	INT32	CF			R
	maxVal	INT32	CF			R
	stepSize	INT32	CF			R
	units.SIUnit	ENUMERATED			4, the code for time in seconds	R
	units.multiplier	ENUMERATED			-3, the code for a multiplier of 0.001 (i.e. Milli)	R
DFilTmms		ING			PID # Derivative filter time setting in milliseconds, which is the ratio of derivative time constant to derivative limit	R
	setVal	INT32	SP	(PID # DERIV. TIME CONST. divided by PID # DERIVATIVE LIMIT) scaled to make the result in milliseconds		R
	units.SIUnit	ENUMERATED			4, the code for time in seconds	R
	units.multiplier	ENUMERATED			-3, the code for a multiplier of 0.001 (i.e. Milli)	R
InRef1		ORG			PID # PROCESS SIGNAL setting.	R
	setSrcRef	ObjectReference	SP	PID # PROCESS SIGNAL setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef2		ORG			PID # TRACKING SIGNAL setting.	R
	setSrcRef	ObjectReference	SP	PID # TRACKING SIGNAL setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
BlkRef1		ORG			PID # BLK setting.	R
	setSrcRef	ObjectReference	SP	PID # BLK.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.4.22 Reduced voltage starting (LoVStr)

This element is instantiated in the following products: M60.

Table 3-163: Reduced voltage starting data objects

LNName: LoVStrGAPC1		**LDevice inst: Ctrl**		**UR element: REDUCED VOLTAGE STARTING element**		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Op		ACT			REDUCED VOLT OP operand	R
	general	BOOLEAN	ST	REDUCED VOLT OP		R
Ctrl		SPS			REDUCED VOLT CTRL operand	R
	stVal	BOOLEAN	ST	REDUCED VOLT CTRL operand		R
BlkRef1		ORG			REDUCED VOLT BLOCK setting.	R
	setSrcRef	ObjectReference	SP	REDUCED VOL BLOCK.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.4.23 Restart delay (StrDl)

This element is instantiated in the following products: M60.

Table 3-164: Restart delay data objects

LNName: StrDlPMRI1		LDevice inst: Ctrl		UR element: RESTART DELAY element		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
StrInh		SPS			RESTART TIME OP operand	R
	stVal	BOOLEAN	ST	RESTART TIME OP		R
BlkRef1		ORG			RESTART DELAY BLK setting	R
	setSrcRef	ObjectReference	SP	RESTART DELAY BLK.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
StrInhTmm		INS			RESTART DELAY LO TIME in Sec	R
	stVal	INT32	ST	RESTART DELAY LO TIME divided by 60 to convert seconds to minutes.		R

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3.5.4.24 Single pole autoreclose (Rec13p)

This element is instantiated in the following products: C60, C95, D60, L60, L90.

Table 3-165: Single pole autoreclose data objects

LNName: Rec13pRREC1		LDevice inst: Ctrl		UR element: Autoreclose element		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
TrBeh		ENS			AR FORCE 3-P TRIP operand	R
	stVal	ENUMERATED	ST			R
RecCyc		INS			AUTORECLOSE SHOT COUNT actual value	R
	stVal	INT32	ST	AUTORECLOSE SHOT COUNT		R
AutoRecSt		ENS			Autoreclosing status	R
	stVal	ENUMERATED	ST			R
Ena1		SPS			AR ENABLED operand	R
	stVal	BOOLEAN	ST	AR ENABLED		R
Disabled		SPS			AR DISABLED operand	R
	stVal	BOOLEAN	ST	AR DISABLED		R
ArRip		SPS			AR RIP operand	R
	stVal	BOOLEAN	ST	AR RIP		R
P1Rip		SPS			AR 1-P RIP operand	R
	stVal	BOOLEAN	ST	AR 1-P RIP		R
P3Rip1		SPS			AR 3-P/1 RIP operand	R
	stVal	BOOLEAN	ST	AR 3-P/1 RIP		R
P3Rip2		SPS			AR 3-P/2 RIP operand	R
	stVal	BOOLEAN	ST	AR 3-P/2 RIP		R
P3Rip3		SPS			AR 3-P/3 RIP operand	R
	stVal	BOOLEAN	ST	AR 3-P/3 RIP		R
P3Rip4		SPS			AR 3-P/4 RIP operand	R
	stVal	BOOLEAN	ST	AR 3-P/4 RIP		R
ArLO		SPS			AR LO operand	R
	stVal	BOOLEAN	ST	AR LO		R
ArBlk1		SPS			AR BKR1 BLK operand	R
	stVal	BOOLEAN	ST	AR BKR1 BLK		R
ArBlk1		SPS			AR BKR2 BLK operand	R
	stVal	BOOLEAN	ST	AR BKR2 BLK		R
OpCls		ACT			AR CLOSE BKR1 operand	R
	general	BOOLEAN	ST	AR CLOSE BKR1		R

LNName: Rec13pRREC1		LDevice inst: Ctrl		UR element: Autoreclose element		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Cls2ndBkr		SPS			AR CLOSE BKR2 operand	R
	stVal	BOOLEAN	ST	AR CLOSE BKR2		R
P3Tr		SPS			AR FORCE 3-P TRIP operand	R
	stVal	BOOLEAN	ST	AR FORCE 3-P TRIP		R
AnyShotCnt		SPS			AR SHOT CNT>0 operand	R
	stVal	BOOLEAN	ST	AR SHOT CNT>0		R
ShotCnt1		SPS			AR SHOT CNT=1 operand	R
	stVal	BOOLEAN	ST	AR SHOT CNT=1		R
ShotCnt2		SPS			AR SHOT CNT=2 operand	R
	stVal	BOOLEAN	ST	AR SHOT CNT=2		R
ShotCnt3		SPS			AR SHOT CNT=3 operand	R
	stVal	BOOLEAN	ST	AR SHOT CNT=3		R
ShotCnt4		SPS			AR SHOT CNT=4 operand	R
	stVal	BOOLEAN	ST	AR SHOT CNT=4		R
ArMod1		SPS			AR MODE = 1 operand	R
	stVal	BOOLEAN	ST	AR MODE = 1		R
ArMod2		SPS			AR MODE = 2 operand	R
	stVal	BOOLEAN	ST	AR MODE = 2		R
ArMod3		SPS			AR MODE = 3 operand	R
	stVal	BOOLEAN	ST	AR MODE = 3		R
ArMod4		SPS			AR MODE = 4 operand	R
	stVal	BOOLEAN	ST	AR MODE = 4		R
SwFail		SPS			AR MODE SWITCH FAIL operand	R
	stVal	BOOLEAN	ST	AR MODE SWITCH FAIL		R
Zn1Extend		SPS			AR ZONE 1 EXTENT operand	R
	stVal	BOOLEAN	ST	AR ZONE1 EXTENT		R
SeqTO		SPS			AR INCOMPLETE SEQ operand	R
	stVal	BOOLEAN	ST	AR INCOMPLETE SEQ		R
Rs		SPS			AR RESET operand	R
	stVal	BOOLEAN	ST	AR RESET		R
InRef01		ORG			Mode 1 Activation setting	R
	setSrcRef	ObjectReference	SP	AR Mode 1 Activation setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef02		ORG			Mode 2 Activation setting	R
	setSrcRef	ObjectReference	SP	AR Mode 2 Activation setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef03		ORG			Mode 3 Activation setting	R
	setSrcRef	ObjectReference	SP	AR Mode 3 Activation setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef04		ORG			Mode 4 Activation setting	R
	setSrcRef	ObjectReference	SP	AR Mode 4 Activation setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
BlkRef2		ORG			AR BLOCK BKR1 setting	R
	setSrcRef	ObjectReference	SP	AR BLOCK BKR 1 setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef06		ORG			AR BKR MAN CLOSE setting	R
	setSrcRef	ObjectReference	SP	AR BKR MAN CLOSE setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

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LNName: Rec13pRREC1		LDevice inst: Ctrl		UR element: Autoreclose element		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
InRef07		ORG			AR 1P INIT setting	R
	setSrcRef	ObjectReference	SP	AR 1P INIT setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef08		ORG			AR 3P INIT setting	R
	setSrcRef	ObjectReference	SP	AR 3P INIT setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef09		ORG			AR 3P TD INIT setting	R
	setSrcRef	ObjectReference	SP	AR 3P TD INIT setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef10		ORG			AR MULTI-P FAULT setting	R
	setSrcRef	ObjectReference	SP	AR MULTI-P FAULT setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef11		ORG			BKR ONE POLE OPEN setting	R
	setSrcRef	ObjectReference	SP	BKR ONE POLE OPEN setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef12		ORG			BKR 3 POLE OPEN setting	R
	setSrcRef	ObjectReference	SP	BKR 3 POLE OPEN setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef13		ORG			AR EXTEND DEAD T 1 setting	R
	setSrcRef	ObjectReference	SP	AR EXTEND DEAD T 1setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef14		ORG			AR RESET setting	R
	setSrcRef	ObjectReference	SP	AR RESET setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef15		ORG			AR BKR CLOSED setting	R
	setSrcRef	ObjectReference	SP	AR BKR CLOSED setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
BlkRef1		ORG			AR BLOCK setting	R
	setSrcRef	ObjectReference	SP	AR BLOCK.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef17		ORG			AR PAUSE setting	R
	setSrcRef	ObjectReference	SP	AR PAUSE setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
BlkRef3		ORG			AR BLOCK BKR2 setting	R
	setSrcRef	ObjectReference	SP	AR BLOCK BKR2 setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef20		ORG			AR CHNG BKR SEQNCE setting	R
	setSrcRef	ObjectReference	SP	AR CHNG BKR SEQNCE setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef19		ORG			AR BUS FLT INIT setting	R
	setSrcRef	ObjectReference	SP	AR BUS FLT INIT setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.4.25 Synchrocheck (SynChk)

This element is instantiated in the following products: B30, C60, C95, D30, D60, F60, G30, G60, L30, L60, L90, N60, T60.

Table 3-166: Synchrocheck data objects

LNName: SynChkRSYN#		LDevice inst: Ctrl		UR element: Synchrocheck element # (ANSI 25)		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Rel		SPS			SYNC # CLS OP operand, which becomes On all synchrocheck criteria are fulfilled.	R
	stVal	BOOLEAN	ST	SYNC # CLS OP		R
VInd		SPS			SYNC # VOLT DIFF PKP operand	R
	stVal	BOOLEAN	ST	SYNC # VOLT DIFF PKP		R
AngInd		SPS			SYNC # ANG DIFF PKP operand	R
	stVal	BOOLEAN	ST	SYNC # ANG DIFF PKP		R
HzInd		SPS			SYNC # FREQ DIFF PKP operand	R
	stVal	BOOLEAN	ST	SYNC # FREQ DIFF PKP		R
RelDpo		SPS			SYNC # CLS DPO operand, which becomes Off when all synchrocheck criteria are fulfilled.	R
	stVal	BOOLEAN	ST	SYNC # CLS DPO		R
LivV1		SPS			SYNC # V1 ABOVE MIN operand, which indicates that V1 is above the LivVal1 setting.	R
	stVal	BOOLEAN	ST	SYNC # V1 ABOVE MIN		R
DeaV1		SPS			SYNC # V1 BELOW MAX operand, which indicates that V1 is below the DeaVal1 setting.	R
	stVal	BOOLEAN	ST	SYNC # V1 BELOW MAX		R
LivV2		SPS			SYNC # V2 ABOVE MIN operand, which indicates that V1 is above the LivVal2 setting.	R
	stVal	BOOLEAN	ST	SYNC # V2 ABOVE MIN		R
DeaV2		SPS			SYNC # V2 BELOW MAX operand, which indicates that V2 is below the DeaVal1 setting.	R
	stVal	BOOLEAN	ST	SYNC # V2 BELOW MAX		R
LivDea		SPS			SYNC # DEAD S OP operand, which indicates that live/dead conditions have been met.	R
	stVal	BOOLEAN	ST	SYNC # DEAD S OP		R
LivDeaDpo		SPS			SYNC # DEAD S DPO operand, which indicates that live/dead conditions have not been met.	R
	stVal	BOOLEAN	ST	SYNC # DEAD S DPO		R
LivLiv		SPS			SYNC # SYNC OP operand, which indicates that both sources are live, and that angle, frequency and voltage difference and range conditions have been met.	R
	stVal	BOOLEAN	ST	SYNC # SYNC OP		R
LivLivDpo		SPS			SYNC # SYNC DPO operand, which indicates that that one or both sources are not live, or that angle, frequency and voltage difference and range conditions have been met.	R
	stVal	BOOLEAN	ST	SYNC # SYNC DPO		R
DynOp		SPS			SYNC# S-CLOSE OP operand, which becomes on when all criteria for dynamic mode are fulfilled	R
	stVal	BOOLEAN	ST	SYNC# S-CLOSE OP		R

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LNName: SynChkRSYN#		LDevice inst: Ctrl		UR element: Synchrocheck element # (ANSI 25)		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
DynDpo		SPS			SYNC# S-CLOSE DPO operand, which becomes off when all criteria for dynamic mode are fulfilled	R
	stVal	BOOLEAN	ST	SYNC# S-CLOSE DPO		R
DynArmd		SPS			SYNC# S-CLOSE ARMD operand, which becomes on when dynamic mode is armed	R
	stVal	BOOLEAN	ST	SYNC# S-CLOSE ARMD		R
DifVClc		MV			SYNCHROCHECK # DELTA VOLT, in primary volts	R
	instMag.f	FLOAT32		SYNCHROCHECK 1 DELTA VOLT		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			29, the code for volts	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	SynChkRSYN#.DifVClc.db		R/W/C
	zeroDb	INT32U	CF			R
DifHzClc		MV			SYNCHROCHECK # DELTA FREQ, in Hz	R
	instMag.f	FLOAT32		SYNCHROCHECK # DELTA FREQ		R
	mag.f	FLOAT32		SYNCHROCHECK # DELTA FREQ on deadband exception		R
	units.SIUnit	ENUMERATED			33, the code for hertz (1/s)	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	SynChkRSYN#.DifHzClc.db		R/W/C
	zeroDb	INT32U	CF			R
DifAngClc		MV			SYNCHROCHECK # DELTA PHASE, in degrees	R
	instMag.f	FLOAT32		SYNCHROCHECK # DELTA PHASE		R
	mag.f	FLOAT32		SYNCHROCHECK # DELTA PHASE on deadband exception		R
	units.SIUnit	ENUMERATED			9, the code for degrees	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	SynChkRSYN#.DifAngClc.db		R/W/C
	zeroDb	INT32U	CF			R
DifAngDis		MV			SYNCHROCHECK # SYNSCP D_PH, in degrees	R
	instMag.f	FLOAT32		SYNCHROCHECK # SYNSCP D_PH		R
	mag.f	FLOAT32		SYNCHROCHECK # SYNSCP D_PH on deadband exception		R
	units.SIUnit	ENUMERATED			9, the code for degrees	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	SynChkRSYN#.DifAngDis.db		R/W/C
	zeroDb	INT32U	CF			R
V1Src		CMV			SYNCHROCHECK # V1 voltage phasor, in primary volts	R
	instCVal.mag.f	FLOAT32		SYNCHROCHECK # V1 MAG		R
	instCVal.ang.f	FLOAT32		SYNCHROCHECK # V1 ANG		R
	cVal.mag.f	FLOAT32				R
	cVal.ang.f	FLOAT32				R
	units.SIUnit	ENUMERATED			29, the code for volts	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R

LNName: SynChkRSYN#		LDevice inst: Ctrl		UR element: Synchrocheck element # (ANSI 25)		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	db	INT32U	CF	SynChkRSYN#.V1Src.db		R/W/C
	dbAng	INT32U	CF	SynChkRSYN#.V1Src.dbAng		R/W/C
	zeroDb	INT32U	CF			R
V2Src		CMV			SYNCHROCHECK # V2 voltage phasor, in primary volts	R
	instCVal.mag.f	FLOAT32		SYNCHROCHECK # V2 MAG		R
	instCVal.ang.f	FLOAT32		SYNCHROCHECK # V2 ANG		R
	cVal.mag.f	FLOAT32				R
	cVal.ang.f	FLOAT32				R
	units.SIUnit	ENUMERATED			29, the code for volts	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	SynChkRSYN#.V2Src.db		R/W/C
	dbAng	INT32U	CF	SynChkRSYN#.V2Src.dbAng		R/W/C
	zeroDb	INT32U	CF			R
ProjectedV2		CMV			SYNCHROCHECK # V2' voltage phasor, in primary volts	R
	instCVal.mag.f	FLOAT32		SYNCHROCHECK # V2' MAG		R
	instCVal.ang.f	FLOAT32		SYNCHROCHECK # V2' ANG		R
	cVal.mag.f	FLOAT32				R
	cVal.ang.f	FLOAT32				R
	units.SIUnit	ENUMERATED			29, the code for volts	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	SynChkRSYN#.ProjectedV2.db		R/W/C
	dbAng	INT32U	CF	SynChkRSYN#.ProjectedV2.dbAng		R/W/C
	zeroDb	INT32U	CF			R
Projected Dif		MV			SYNCHROCHECK # DELTA PHASE', in degrees which is the phase angle difference between V1 and projected V2	R
	instMag.f	FLOAT32		SYNCHROCHECK # '		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			9, the code for degrees	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	SynChkRSYN#.ProjectedDif.db		R/W/C
	zeroDb	INT32U	CF			R
ProjDifDis		MV			SYNCHROCHECK # PROJ SYNSCP D_PH, in degrees	R
	instMag.f	FLOAT32		SYNCHROCHECK # PROJ SYNSCP D_PH		R
	mag.f	FLOAT32		SYNCHROCHECK # PROJ SYNSCP D_PH on deadband exception		R
	units.SIUnit	ENUMERATED			9, the code for degrees	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	SynChkRSYN#.ProjDifDis.db		R/W/C
	zeroDb	INT32U	CF			R
BlkRef1		ORG			SYNCHK# BLOCK setting.	R
	setSrcRef	ObjectReference	SP	SYNCHK# BLOCK.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef1		ORG			SYNCHK# SYNC CLOSE setting.	R

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LNName: SynChkRSYN#		LDevice inst: Ctrl		UR element: Synchrocheck element # (ANSI 25)		
data obj.	data attribute	Type	FC	UR Name	Description	R/W/C
	setSrcRef	ObjectReference	SP	SYNCHK# SYNC CLOSE setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.4.26 Thermal overload (ThmOvl)

This element is instantiated in the following products: B30, C60, C70, C95, D30, D60, F35, F60, G30, G60, L30, L60, L90, N60, T35, T60.

Table 3-167: Thermal overload data objects

LNName: ThmOvlPTTR#		LDevice inst: Ctrl		UR element: THERMAL OVERLOAD PROTECTION # element		
data obj.	data attribute	Type	FC	UR Name	Description	R/W/C
Op		ACT			THERMAL PROT # OP operand	R
	general	BOOLEAN	ST	THERMAL PROT # OP		R
Str		ACD			THERMAL PROT # PKP operand	R
	general	BOOLEAN	ST	THERMAL PROT # PKP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown.	R
Alm1		SPS			THERMAL PROT # ALARM	R
	stVal	BOOLEAN	ST	THERMAL PROT # ALARM		R
InRef1		ORG			THERMAL PROT # RESET setting.	R
	setSrcRef	ObjectReference	SP	THERMAL PROT # RESET	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
BlkRef1		ORG			THERMAL PROT # BLOCK setting.	R
	setSrcRef	ObjectReference	SP	THERMAL PROT # BLOCK.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.4.27 Three pole autoreclose (Rec3p)

This element is instantiated in the following products: B30, D30, F35, F60, L30.

Table 3-168: Three pole autoreclose data objects

LNName: Rec3pRREC#		LDevice inst: Ctrl		UR element: Autoreclose element # functions		
data obj.	data attribute	Type	FC	UR Name	Description	R/W/C
ShotCnt		INS			AUTORECLOSE# SHOT COUNT actual value	R
	stVal	INT32	ST	AUTORECLOSE# SHOT COUNT		R
AutoRecSt		ENS			Autoreclosing status	R
	stVal	ENUMERATED	ST			R
Ena1		SPS			AR# ENABLED operand	R
	stVal	BOOLEAN	ST	AR# ENABLED		R
ArRip		SPS			AR# RIP operand	R
	stVal	BOOLEAN	ST	AR# RIP		R
ArLO		SPS			AR# LO operand	R
	stVal	BOOLEAN	ST	AR# LO		R
ArBlk1		SPS			AR# BLK FROM MAN CLS operand	R
	stVal	BOOLEAN	ST	AR# BLK FROM MAN CLS		R
OpCls		ACT			AR# CLOSE operand	R
	general	BOOLEAN	ST	AR# CLOSE		R
ShotCnt0		SPS			AR# SHOT CNT=0 operand	R

LNName: Rec3pRREC#		LDevice inst: Ctrl		UR element: Autoreclose element # functions		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	stVal	BOOLEAN	ST	AR# SHOT CNT=0		R
ShotCnt1		SPS			AR# SHOT CNT=1 operand	R
	stVal	BOOLEAN	ST	AR# SHOT CNT=1		R
ShotCnt2		SPS			AR# SHOT CNT=2 operand	R
	stVal	BOOLEAN	ST	AR# SHOT CNT=2		R
ShotCnt3		SPS			AR# SHOT CNT=3 operand	R
	stVal	BOOLEAN	ST	AR# SHOT CNT=3		R
ShotCnt4		SPS			AR# SHOT CNT=4 operand	R
	stVal	BOOLEAN	ST	AR# SHOT CNT=4		R
Disabled		SPS			AR# DISABLED operand	R
	stVal	BOOLEAN	ST	AR# DISABLED		R
InRef01		ORG			AR# INITIATE setting.	R
	setSrcRef	ObjectReference	SP	AR# INITIATE setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
BlkRef1		ORG			AR# BLOCK setting.	R
	setSrcRef	ObjectReference	SP	AR# BLOCK.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef02		ORG			AR# REDUCE MAX TO 1 setting.	R
	setSrcRef	ObjectReference	SP	AR# REDUCE MAX TO 1 setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef03		ORG			AR# REDUCE MAX TO 2 setting.	R
	setSrcRef	ObjectReference	SP	AR# REDUCE MAX TO 2 setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef04		ORG			AR# REDUCE MAX TO 3 setting.	R
	setSrcRef	ObjectReference	SP	AR# REDUCE MAX TO 3 setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef05		ORG			AR# MANUAL CLOSE setting.	R
	setSrcRef	ObjectReference	SP	AR# MANUAL CLOSE setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef06		ORG			AR# MNL RST FRM LO setting.	R
	setSrcRef	ObjectReference	SP	AR# MNL RST FRM LO setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef07		ORG			AR# BKR CLOSED setting.	R
	setSrcRef	ObjectReference	SP	AR# BKR CLOSED setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef08		ORG			AR# BKR OPEN setting.	R
	setSrcRef	ObjectReference	SP	AR# BKR OPEN setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef09		ORG			AR# ADD DELAY 1 setting.	R
	setSrcRef	ObjectReference	SP	AR# ADD DELAY 1 setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef10		ORG			AR# ADD DELAY 2 setting.	R
	setSrcRef	ObjectReference	SP	AR# ADD DELAY 2 setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.4.28 Time between starts (TmBtwn)

This element is instantiated in the following products: M60.

Table 3-169: Time between starts data objects

LNName: TmBtwnPMRI1		LDevice inst: Ctrl		UR element: TIME BETWEEN STARTS element		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			TIME–BTWN-STARTS PKP operand	R
	general	BOOLEAN	ST	TIME–BTWN-STARTS PKP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown. It is unknown as the element is non-directional	R
StrInh		SPS			TIME-BTWN-STARTS OP operand	R
	stVal	BOOLEAN	ST	TIME-BTWN-STARTS OP		R
Dpo		SPS			TIME-BTWN-STARTS DPO operand, which is the inverse of TIME-BTWN-STARTS PKP	R
	stVal	BOOLEAN	ST	TIME-BTWN-STARTS DPO		R
BlkRef1		ORG			TIME-BTWN-STARTS BLK setting.	R
	setSrcRef	ObjectReference	SP	TIME-BTWN-STARTS BLK.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
StrInhTmm		INS			TIME-BTWN-STARTS LO TIME in min	R
	stVal	INT32	ST	TIME-BTWN-STARTS LO TIME		R

3.5.4.29 Transformer aging factor (Age)

This element is instantiated in the following products: G30, T35, T60.

Table 3-170: Transformer aging data objects

LNName: AgeSPTR1		LDevice inst: Ctrl		UR element: Aging Factor Function		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Op		ACT			XFMR AGING FCTR OP	R
	general	BOOLEAN	ST	XFMR AGING FCTR OP		R
Dpo		SPS			XFMR AGING FCTR DPO operand	R
	stVal	BOOLEAN	ST	XFMR AGING FCTR DPO		R
Str		ACD			XFMR AGING FCTR PKP operand	R
	general	BOOLEAN	ST	XFMR AGING FCTR PKP		R
	dirGeneral	ENUMERATED	ST			R
AgeRte		MV			AGING FACTOR actual Values.	R
	instMag.f	FLOAT32		AGING FACTOR		R
	mag.f	FLOAT32		instMag.f on deadband exception		R
	units.SIUnit	ENUMERATED				R
	units.multiplier	ENUMERATED			0 is multiplier for 1 (actually seconds per day, but there is no standard enumeration for that, probably should have divided by 86400 to make it seconds per second, or dimensionless)	R
	db	INT32U	CF	AgeSPTR1.AgeRte.db		R/W/C
	zeroDb	INT32U	CF			R
BlkRefγ		ORG			AGING FACTOR BLOCK for setting group γ.	R
	setSrcRef	ObjectReference	SP	AGING FACTOR BLOCK for group γ.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.4.30 Transformer hottest spot temperature (HPTmp)

This element is instantiated in the following products: G30, T35, T60.

Table 3-171: Hottest spot temperature data objects

LNName: HPTmpSPTR1		LDevice inst: Ctrl		UR element: Hottest-Spot Temperature Function		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Op		ACT			XFMR HST-SPOT ˚C OP	R
	general	BOOLEAN	ST	XFMR HST-SPOT ˚C OP		R
Dpo		SPS			XFMR HST-SPOT °C DPO operand	R
	stVal	BOOLEAN	ST	XFMR HST-SPOT °C DPO		R
Str		ACD			XFMR HST-SPOT °C PKP operand	R
	general	BOOLEAN	ST	XFMR HST-SPOT °C PKP		R
	dirGeneral	ENUMERATED	ST			R
ToOilTmp		MV			TOP OIL °C actual Value.	R
	instMag.f	FLOAT32		TOP OIL °C		R
	mag.f	FLOAT32		instMag.f on deadband exception		R
	units.SIUnit	ENUMERATED			23, the code for °C	R
	units.multiplier	ENUMERATED			0 is code for a multiplier 1	R
	db	INT32U	CF	HPTmpSPTR1.ToOilTmp.db		R/W/C
	zeroDb	INT32U	CF			R
HPTmpClc		MV			HOTTEST-SPOT ° C actual values.	R
	instMag.f	FLOAT32		HOTTEST-SPOT ° C		R
	mag.f	FLOAT32		instMag.f on deadband exception		R
	units.SIUnit	ENUMERATED			23, the code for °C	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	HPTmpSPTR1.HPTmpClc.db		R/W/C
	zeroDb	INT32U	CF			R
BlkRefγ		ORG			XFMR HST BLOCK for setting group γ.	R
	setSrcRef	ObjectReference	SP	XFMR HST BLOCK for group γ.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.4.31 Transformer loss of life (LosLif)

This element is instantiated in the following products: G30, T35, T60.

Table 3-172: Transformer loss of life data objects

LNName: LosLifSPTR1		LDevice inst: Ctrl		UR element: Loss of Life Function		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Op		ACT			XFMR LIFE LOST OP operands	R
	general	BOOLEAN	ST	XFMR LIFE LOST OP		R
Str		ACD			XFMR LIFE LOST PKP operand	R
	general	BOOLEAN	ST	XFMR LIFE LOST PKP		R
	dirGeneral	ENUMERATED	ST			R
LosLifeRte		MV			DAILY RATE LOL actual Values.	R
	instMag.f	FLOAT32		DAILY RATE LOL		R
	mag.f	FLOAT32		instMag.f on deadband exception		R
	units.SIUnit	ENUMERATED			4, the code for second	R
	units.multiplier	ENUMERATED			0 is multiplier for 1	R
	db	INT32	CF	LosLifSPTR1.LosLifeRte.db		R/W/C

LNName: LosLifSPTR1		LDevice inst: Ctrl		UR element: Loss of Life Function		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	zeroDb	INT32	CF			R
LosLife		MV			XFMR LIFE LOST actual Values.	R
	instMag.f	FLOAT32		XFMR LIFE LOST		R
	mag.f	FLOAT32		instMag.f on deadband exception		R
	units.SIUnit	ENUMERATED			4, the code for second	R
	units.multiplier	ENUMERATED			0 is multiplier for 1	R
	db	INT32	CF	LosLifSPTR1.LosLife.db		R/W/C
	zeroDb	INT32	CF			R
BlkRefγ		ORG			LOSS OF LIFE BLOCK for setting group γ.	R
	setSrcRef	ObjectReference	SP	LOSS OF LIFE BLOCK for group γ.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.4.32 Transformer through-fault monitoring (ThrFlt)

This element is instantiated in the following products: T35, T60.

Table 3-173: Through-fault monitoring data objects

LNName: ThrFltGAPC#		LDevice inst: Ctrl		UR element: THROUGH FAULT element		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Op		ACT			THRU FLT # OP operand (including individual three phases)	R
	general	BOOLEAN	ST	THRU FLT # OP		R
	phsA	BOOLEAN	ST	THRU FLT # OP A		R
	phsB	BOOLEAN	ST	THRU FLT # OP B		R
	phsC	BOOLEAN	ST	THRU FLT # OP C		R
OpAccm		ACT			THRU FLT # ACC OP operand (including individual three phases)	R
	general	BOOLEAN	ST	THRU FLT # ACC OP		R
	phsA	BOOLEAN	ST	THRU FLT # ACC OP A		R
	phsB	BOOLEAN	ST	THRU FLT # ACC OP B		R
	phsC	BOOLEAN	ST	THRU FLT # ACC OP C		R
OpFltCnt		ACT			THRU FLT # CNT OP operand (including individual three phases)	R
	general	BOOLEAN	ST	THRU FLT # CNT OP		R
	phsA	BOOLEAN	ST	THRU FLT # CNT OP A		R
	phsB	BOOLEAN	ST	THRU FLT # CNT OP A		R
	phsC	BOOLEAN	ST	THRU FLT # ACC OP C		R
EvtStr		SPS			THRU FLT # EVE START operand	R
	stVal	BOOLEAN	ST	THRU FLT # EVE START		R
EvtStrA		SPS			THRU FLT # EVENT A operand	R
	stVal	BOOLEAN	ST	THRU FLT # EVENT A		R
EvtStrB		SPS			THRU FLT # EVENT B operand	R
	stVal	BOOLEAN	ST	THRU FLT # EVENT B		R
EvtStrC		SPS			THRU FLT # EVENT C operand	R
	stVal	BOOLEAN	ST	THRU FLT # EVENT C		R
EvtEnd		SPS			THRU FLT # EVE END operand	R
	stVal	BOOLEAN	ST	THRU FLT # EVE END		R

LNName: ThrFltGAPC#		LDevice inst: Ctrl		UR element: THROUGH FAULT element		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
AccmWrn A		SPS			THRU FLT # ACC WRN A operand	R
	stVal	BOOLEAN	ST	THRU FLT # ACC WRN A		R
AccmWrn B		SPS			THRU FLT # ACC WRN B operand	R
	stVal	BOOLEAN	ST	THRU FLT # ACC WRN B		R
AccmWrn C		SPS			THRU FLT # ACC WRN C operand	R
	stVal	BOOLEAN	ST	THRU FLT # ACC WRN C		R
FltRcdClr		SPS			THRU FLT # CLR operand	R
	stVal	BOOLEAN	ST	THRU FLT # CLR		R
FltCntA		INS			THRU FLT # CNT A actual value	R
	stVal	INT32	ST	"THRU FLT # CNT A"		R
FltCntB		INS			THRU FLT # CNT B actual value	R
	stVal	INT32	ST	"THRU FLT # CNT B"		R
FltCntC		INS			THRU FLT # CNT C actual value	R
	stVal	INT32	ST	"THRU FLT # CNT C"		R
TotAccmA		MV			THRU FLT # TOTAL ACC A in pu	R
	instMag.f	FLOAT32		THRU FLT # TOT ACC A		R
	mag.f	FLOAT32		instMag.f on deadband exception		R
	units.SIUnit	ENUMERATED			1, the code for dimensionless	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32	CF	ThrFltGAPC#.TotAccmA.db		R/W/C
	zeroDb	INT32	CF			R
TotAccmB		MV			THRU FLT # TOTAL ACC B in pu	R
	instMag.f	FLOAT32		THRU FLT # TOT ACC B		R
	mag.f	FLOAT32		instMag.f on deadband exception		R
	units.SIUnit	ENUMERATED			1, the code for dimensionless	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32	CF	ThrFltGAPC#.TotAccmB.db		R/W/C
	zeroDb	INT32	CF			R
TotAccmC		MV			THRU FLT # TOTAL ACC C in pu	R
	instMag.f	FLOAT32		THRU FLT # TOT ACC C		R
	mag.f	FLOAT32		instMag.f on deadband exception		R
	units.SIUnit	ENUMERATED			1, the code for dimensionless	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32	CF	ThrFltGAPC#.TotAccmC.db		R/W/C
	zeroDb	INT32	CF			R
EvtβDur		MV			THRU FLT # EVβ DURATION in cycles	R
	mag.f	FLOAT32		THRU FLT # EVβ DURATION		R
	units.SIUnit	ENUMERATED			1, the code for dimensionless	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
EvtβMaxΦ		MV			THRU FLT # EVβ MAX CUR Φ in pu	R
	mag.f	FLOAT32		THRU FLT # EVβ MAX CUR Φ		R
	units.SIUnit	ENUMERATED			1, the code for dimensionless	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
EvtβAccm Φ		MV			THRU FLT # EVβ ACC Φ in pu	R

LNName: ThrFltGAPC#		LDevice inst: Ctrl		UR element: THROUGH FAULT element		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	mag.f	FLOAT32		THRU FLT # EVβ ACC Φ		R
	units.SIUnit	ENUMERATED			1, the code for dimensionless	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
InRef1		ORG			THRU FLT MON # CLR setting.	R
	setSrcRef	ObjectReference	SP	THRU FLT MON # CLR.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
BlkRef1		ORG			THRU FLT MON # BLK setting.	R
	setSrcRef	ObjectReference	SP	THRU FLT MON # BLK.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

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3.5.4.33 User-programmable fault report (UFlt)

This element is instantiated in the following products: B30, B90, C70, G30, G60, M60, N60, T35, T60.

Table 3-174: User-programmable fault report data objects

LNName: UFltRFLO#		LDevice inst: Ctrl		UR element: USER PROGRAMMABLE FAULT REPORT # settings		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
FltZ		CMV			Mandatory data attribute which in this case is fixed at zero	R
	cVal.mag.f	FLOAT32				R
	cVal.ang.f	FLOAT32				R
InRef1		ORG			PRE-FAULT # TRIGGER.	R
	setSrcRef	ObjectReference	SP	PRE-FAULT # TRIGGER.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef2		ORG			FAULT # TRIGGER.	R
	setSrcRef	ObjectReference	SP	FAULT # TRIGGER.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

Table 3-175: User-programmable fault report actual values and clear data objects

LNName: UFlt0RFLO1		LDevice inst: Ctrl		UR element: USER PROGRAMMABLE FAULT REPORT actual values and clear		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
FltZ		CMV			Mandatory data attribute which in this case is fixed at zero	R
	cVal	Vector	MX			R
	cVal.mag.f	FLOAT32				R
	cVal.ang.f	FLOAT32				R
FltNum		INS			NEWEST RECORD NUMBER	R
	stVal	INT32	ST	NEWEST RECORD NUMBER		R
	units.SIUnit	ENUMERATED			1, the code for dimensionless	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
LastClrTm		INS			LAST CLEARED DATE actual value	R
	stVal	INT32	ST	LAST CLEARED DATE actual value		R
	units.SIUnit	ENUMERATED			4, the code for time	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
LastRptTm		INS			LAST REPORT DATE actual value	R
	stVal	INT32	ST	LAST REPORT DATE actual value		R
	units.SIUnit	ENUMERATED			4, the code for time	R

LNName: UFlt0RFLO1	LDevice inst: Ctrl	UR element: USER PROGRAMMABLE FAULT REPORT actual values and clear				
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R

3.5.5 System logical device

The Ctrl logical device contains logical nodes that model UR power system devices: breakers, switches, CTs, and VTs, and including interface to these such as AC inputs and contact I/O.

3.5.5.1 Logical node zero (LLN0)

This element is instantiated in UR devices implementing the System logical device.

Table 3-176: LLN0 data objects and attributes

LNName: LLN0	LDevice inst: System	UR element: Nameplate information for the logical nodes				
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Beh		ENS			This logical device's behavior	R
	stVal	ENUMERATED	ST			R
	stVal	ENUMERATED	ST	LLN0.Beh.stVal of the Master logical device		R
GrRef		ORG			Reference to root logical device	R
	setSrcRef	ObjectReference	SP	For communications, mapped to Master ldName if not empty, otherwise to the concatenation of the IED name and "Master". For SCL, mapped to the concatenation of the IED name and "Master".	reference to the data attribute to input	R

3.5.5.2 AC inputs (CT inputs and VT inputs) (ACin)

Uses Beh and NamPlt elements outlined in the Common data objects and attributes table on page 3-30.

3.5.5.3 Breaker control (Bkr)

This element is instantiated in the following products: B30, C30, C60, C70, C95, D30, D60, F35, F60, G30, G60, L30, L60, L90, M60, N60, T35, T60.

The logical nodes are mapped to the breaker as follows. They are populated based on the **Settings > System Setup > Breakers > Breaker x > Breaker x Mode** setting, where x is the breaker instance.

Breaker 1: XCBR1
Bkr0XCBR1 - 3 phase together
Bkr1XCBR1 - A phase
Bkr2XCBR1 - B phase
Bkr3XCBR1 - C phase

Breaker 2: XCBR2
Bkr0XCBR2 - 3 phase together
Bkr1XCBR2 - A phase
Bkr2XCBR2 - B phase
Bkr3XCBR2 - C phase

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Table 3-177: Breaker control data objects

LNName: BkrCSWI#		LDevice inst: System		UR element: Breaker Control element #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
CmdBlk		SPC			Command block status of this LN	R/Ctrl
	stVal	BOOLEAN	ST			R
	pulseConfig .cmdQual	ENUMERATED				R
	pulseConfig.onDur	INT32U				R
	pulseConfig .offDur	INT32U				R
	pulseConfig .numPls	INT32U				R
	ctlModel	CtlModels	CF	CSWI# CmdBlk ctlModel		R/W/C
	sboTimeout	INT32U	CF			R
	sboClass	SboClasses	CF			R
	operTimeout	INT32U	CF			R
Blk		SPS			Breaker Block status	R
	stVal	BOOLEAN	ST	value “Bkr0XCBR#.BlkCls.stVal” AND “Bkr0XCBR#.BlkOpn.stVal”		R
Loc		SPS			Breaker # CSWI Loc status	R
	stVal	BOOLEAN	ST			R
OpOpn		ACT			Breaker Open operation	R
	general	BOOLEAN	ST	Bkr0XCBR#.OpOpn.general the output of the logic gates as shown on Sheet 1 of the Breaker Control Logic		R
	phsA	BOOLEAN	ST	Bkr0XCBR#.OpOpn.phsA		R
	phsB	BOOLEAN	ST	Bkr0XCBR#.OpOpn.phsB		R
	phsC	BOOLEAN	ST	Bkr0XCBR#.OpOpn.phsC		R
SelOpn		SPS			Breaker Select status for open operation	R
	stVal	BOOLEAN	ST			R
OpCls		ACT			BREAKER # MNL CLS operand	R
	general	BOOLEAN	ST	Bkr0XCBR#.OpCls.general operand BREAKER # MNL CLS		R
SelCls		SPS			Breaker Select status for close operation	R
	stVal	BOOLEAN	ST			R
BayAuthEna		SPS			BRK# BAY AUTHOR ON operand	R
	stVal	BOOLEAN	ST	BRK# BAY AUTHOR ON		R
StnAuthEna		SPS			BRK# STATN AUTHOR ON operand	R
	stVal	BOOLEAN	ST	BRK# STATN AUTHOR ON		R
RemAuthEna		SPS			BRK# REM AUTHOR ON operand	R
	stVal	BOOLEAN	ST	BRK# REM AUTHOR ON		R
LocAuthEna		SPS			BRK# LOCAL AUTHOR ON operand	R
	stVal	BOOLEAN	ST	BRK# LOCAL AUTHOR ON		R
LocSta		SPC			Station authority status	R/Ctrl
	stVal	BOOLEAN	ST	ORing of operand status selected by setting “BRK1 Station Author” and respective LocSTa.ctlVal		R

LNName: BkrCSWI#		LDevice inst: System		UR element: Breaker Control element #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	pulseConfig .cmdQual	ENUMERATED				R
	pulseConfig.onDur	INT32U				R
	pulseConfig .offDur	INT32U				R
	pulseConfig .numPls	INT32U				R
	ctlModel	CtlModels	CF	CSWI# LocSta ctlModel		R/W/C
	sboTimeout	INT32U	CF			R
	sboClass	SboClasses	CF			R
	operTimeout	INT32U	CF			R
Pos		DPC			Breaker position control and status	R/Ctrl
	stVal	CODED ENUM	ST	Bkr0XCBR#.Pos.stVal		R
	stSeld	BOOLEAN	ST		The controllable data status is “selected”	R
	pulseConfig .cmdQual	ENUMERATED				R
	pulseConfig.onDur	INT32U			2 ms (actually one pass)	R
	pulseConfig .offDur	INT32U				R
	pulseConfig .numPls	INT32U				R
	ctlModel	CtlModels	CF	BkrCSWI# Pos ctlModel		R/W/C
	sboTimeout	INT32U	CF	BkrCSWI# Pos sboTimeout		R/W/C
	sboClass	SboClasses	CF			R
	operTimeout	INT32U	CF	BkrCSWI# Pos operTimeout		R/C
BlkOpn		SPC			Blocks breaker open commands from all sources including protection	R/Ctrl
	stVal	BOOLEAN	ST	the output of the logic gates as shown on Sheet 1 of the Breaker Control Logic		R
	pulseConfig .cmdQual	ENUMERATED				R
	pulseConfig.onDur	INT32U				R
	pulseConfig .offDur	INT32U				R
	pulseConfig .numPls	INT32U				R
	ctlModel	CtlModels	CF	CSWI# BlkOpn ctlModel		R/W/C
	sboTimeout	INT32U	CF			R
	sboClass	SboClasses	CF			R
	operTimeout	INT32U	CF			R
BlkCls		SPC			Blocks breaker close commands from all sources	R/Ctrl
	stVal	BOOLEAN	ST	the output of the logic gates as shown on Sheet 1 of the Breaker Control Logic		R
	pulseConfig .cmdQual	ENUMERATED				R
	pulseConfig.onDur	INT32U				R
	pulseConfig .offDur	INT32U				R

LNName: BkrCSWI#		LDevice inst: System		UR element: Breaker Control element #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	pulseConfig .numPls	INT32U				R
	ctlModel	CtlModels	CF	CSWI# BlkCls ctlModel		R/W/C
	sboTimeout	INT32U	CF			R
	sboClass	SboClasses	CF			R
	operTimeout	INT32U	CF			R
TagOn		SPC			Breaker # Tag Command	R/Ctrl
	stVal	BOOLEAN	ST	Bkr0XCBR#.TagOn.stVal		R
	pulseConfig .cmdQual	ENUMERATED				R
	pulseConfig.onDur	INT32U				R
	pulseConfig .offDur	INT32U				R
	pulseConfig .numPls	INT32U				R
	ctlModel	CtlModels	CF	BkrCSWI# TagOn ctlModel		R/W/C
	sboTimeout	INT32U	CF	BkrCSWI# TagOn sboTimeout		R/W/C
	sboClass	SboClasses	CF			R
	operTimeout	INT32U	CF			R
TagOff		SPS			BREAKER # TAG OFF operand	R
	stVal	BOOLEAN	ST	Bkr0XCBR#.TagOff.stVal		R
SbstCls		SPS			BREAKER # SUBD CLSD operand	R
	stVal	BOOLEAN	ST	Bkr0XCBR#.SbstCls.stVal		R
SbstOpn		SPS			BREAKER # SUBD OPEN operand	R
	stVal	BOOLEAN	ST	Bkr0XCBR#.SbstOpn.stVal		R
BypsOn		SPS			BREAKER # BYPASS ON operand	R
	stVal	BOOLEAN	ST	Bkr0XCBR#.BypsOn.stVal		R
BypsOff		SPS			BREAKER # BYPASS OFF operand	R
	stVal	BOOLEAN	ST	Bkr0XCBR#.BypsOff.stVal		R
InRef01		ORG			BKR# CSWI Loc Stat setting.	R
	setSrcRef	ObjectReference	SP	BKR# CSWI Loc Stat	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef02		ORG			BRK# Station Author setting.	R
	setSrcRef	ObjectReference	SP	BRK# Station Author	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

Table 3-178: Breaker control data objects

LNName: BkrCILO#		LDevice inst: System		UR element: Breaker Control element #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
EnaOpn		SPS			Enable Open status	R
	stVal	BOOLEAN	ST			R
EnaCls		SPS			Enable Close status	R
	stVal	BOOLEAN	ST			R
EnaLocOpn		SPS			BRK1 LOCAL OPEN CILO operand	R
	stVal	BOOLEAN	ST	BRK1 LOCAL OPEN CILO operand		R
EnaLocCls		SPS			BRK1 LOCAL CLS CILO operand	R

LNName: BkrCILO#		LDevice inst: System		UR element: Breaker Control element #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	stVal	BOOLEAN	ST	BRK1 LOCAL CLS CILO operand		R
BypsOnLoc		SPS			BRK1 CILO BYPASS ON	R
	stVal	BOOLEAN	ST	BRK1 CILO BYPASS ON operand		R
BypsOffLoc		SPS			BRK1 CILO BYPASS OFF	R
	stVal	BOOLEAN	ST	BRK1 CILO BYPASS OFF operand		R
InRef2		ORG			BKR# OPEN INTERLOCK setting.	R
	setSrcRef	ObjectReference	SP	BKR# OPEN INTERLOCK	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef3		ORG			BKR# CLOSE INTERLOCK setting.	R
	setSrcRef	ObjectReference	SP	BKR# CLOSE INTERLOCK	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

Table 3-179: Breaker control data objects

LNName: Bkr0XCBR#		LDevice inst: System		UR element: Breaker Control element #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
EEHealth		ENS			Breaker health, value is 2 (yellow) when breaker is out of service, 3 (red) when breaker trouble is detected and breaker is not out of service	R
	stVal	ENUMERATED	ST			R
Loc		SPS			Value of operand selected by setting BKR# ST.LOC OPERAND	R
	stVal	BOOLEAN	ST			R
OpCnt		INS			Breaker operations counter.	R
	stVal	INT32	ST			R
	units.SIUnit	ENUMERATED			1, the code for dimensionless	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
OpOpn		ACT			BREAKER # OFF CMD (3-phase trip), TRIP A, TRIP B and TRIP C operands	R
	general	BOOLEAN	ST	BREAKER # OFF CMD		R
	phsA	BOOLEAN	ST	BREAKER # TRIP A		R
	phsB	BOOLEAN	ST	BREAKER # TRIP B		R
	phsC	BOOLEAN	ST	BREAKER # TRIP C		R
OpCls		ACT			BREAKER # ON CMD (close) operand	R
	general	BOOLEAN	ST	BREAKER # ON CMD		R
BadSt1		SPS			BREAKER # BAD STATUS operand	R
	stVal	BOOLEAN	ST	BREAKER # BAD STATUS		R
ClsSt1		SPS			BREAKER # CLOSED operand	R
	stVal	BOOLEAN	ST	BREAKER # CLOSED		R
OpnSt1		SPS			BREAKER # OPEN operand	R
	stVal	BOOLEAN	ST	BREAKER # OPEN		R
Dsc		SPS			BREAKER # DISCREP operand, which is breaker pole discrepancy status	R
	stVal	BOOLEAN	ST	BREAKER # DISCREP		R
Alm		SPS			BREAKER # TROUBLE operand, which is breaker pole discrepancy, bad-status, or BREAKER # EXT ALARM	R
	stVal	BOOLEAN	ST	BREAKER # TROUBLE		R

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LNName: Bkr0XCBR#	LDevice inst: System	UR element: Breaker Control element #				
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
MnlOpn		SPS			BREAKER # MNL OPEN operand	R
	stVal	BOOLEAN	ST	BREAKER # MNL OPEN		R
MnlCls		SPS			BREAKER # MNL CLS operand	R
	stVal	BOOLEAN	ST	BREAKER # MNL CLS		R
AnyPoleOpn		SPS			BREAKER # ANY P OPEN operand	R
	stVal	BOOLEAN	ST	BREAKER # ANY P OPEN		R
OnePoleOpn		SPS			BREAKER # ONE P OPEN operand	R
	stVal	BOOLEAN	ST	BREAKER # ONE P OPEN		R
OutOfSrv		SPS			BREAKER # OOS operand	R
	stVal	BOOLEAN	ST	BREAKER # OOS		R
TagOn		SPC			Breaker # Tag Command	R/Ctrl
	stVal	BOOLEAN	ST	BREAKER # TAG ON		R
	pulseConfig.cmdQual	ENUMERATED				R
	pulseConfig.onDur	INT32U				R
	pulseConfig.offDur	INT32U				R
	pulseConfig.numPls	INT32U				R
	ctlModel	CtlModels	CF	Bkr0XCBR# TagOn ctlModel		R/W/C
	sboTimeout	INT32U	CF	XCBR# TagOn sboTimeout		R/W/C
	sboClass	SboClasses	CF			R
	operTimeout	INT32U	CF			R
TagOff		SPS			BREAKER # TAG OFF operand	R
	stVal	BOOLEAN	ST	BREAKER # TAG OFF		R
SbstCls		SPS			BREAKER # SUBD CLSD operand	R
	stVal	BOOLEAN	ST	BREAKER # SUBD CLSD		R
SbstOpn		SPS			BREAKER # SUBD OPEN operand	R
	stVal	BOOLEAN	ST	BREAKER # SUBD OPEN		R
BypsOn		SPS			BRK# BLK BYPASS ON operand	R
	stVal	BOOLEAN	ST	BRK# BLK BYPASS ON		R
BypsOff		SPS			BRK# BLK BYPASS OFF operand	R
	stVal	BOOLEAN	ST	BRK# BLK BYPASS OFF		R
RecBlk		SPS			BREAKER # BLK RCLS operand	R
	stVal	BOOLEAN	ST	BREAKER # BLK RCLS		R
RecEna		SPS			BREAKER # ENA RCLS operand	R
	stVal	BOOLEAN	ST	BREAKER # ENA RCLS		R
Pos		DPC			Breaker position control and status	R/Ctrl
	stVal	CODED ENUM	ST			R
	stSeld	BOOLEAN	ST		The controllable data status is “selected”	R
	pulseConfig.cmdQual	ENUMERATED				R
	pulseConfig.onDur	INT32U			2 ms (actually one pass)	R
	pulseConfig.offDur	INT32U				R
	pulseConfig.numPls	INT32U				R
	ctlModel	CtlModels	CF	XCBR# Pos ctlModel		R/W/C

LNName: Bkr0XCBR#		LDevice inst: System		UR element: Breaker Control element #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	sboTimeout	INT32U	CF	XCBR# Pos sboTimeout		R/W/C
	sboClass	SboClasses	CF			R
	operTimeout	INT32U	CF	BREAKER # Toperate		R/C
BlkOpn		SPC			Blocks breaker open commands from all sources including protection	R/Ctrl
	stVal	BOOLEAN	ST	the output of the logic gates as shown on Sheet 1 of the Breaker Control Logic		R
	pulseConfig .cmdQual	ENUMERATED				R
	pulseConfig.onDur	INT32U				R
	pulseConfig .offDur	INT32U				R
	pulseConfig .numPls	INT32U				R
	ctlModel	CtlModels	CF	XCBR# BlkOpn ctlModel		R/W/C
	sboTimeout	INT32U	CF			R
	sboClass	SboClasses	CF			R
	operTimeout	INT32U	CF			R
BlkCls		SPC			Blocks breaker close commands from all sources	R/Ctrl
	stVal	BOOLEAN	ST	the output of the logic gates as shown on Sheet 1 of the Breaker Control Logic		R
	pulseConfig .cmdQual	ENUMERATED				R
	pulseConfig.onDur	INT32U				R
	pulseConfig .offDur	INT32U				R
	pulseConfig .numPls	INT32U				R
	ctlModel	CtlModels	CF	XCBR# BlkCls ctlModel		R/W/C
	sboTimeout	INT32U	CF			R
	sboClass	SboClasses	CF			R
	operTimeout	INT32U	CF			R
InRef1		ORG			BREAKER # OPEN CMD setting.	R
	setSrcRef	ObjectReference	SP	BREAKER # OPEN CMD	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef2		ORG			BREAKER # BLK OPEN setting.	R
	setSrcRef	ObjectReference	SP	BREAKER # BLK OPEN	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef3		ORG			BREAKER # CLOSE CMD setting.	R
	setSrcRef	ObjectReference	SP	BREAKER # CLOSE CMD	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef4		ORG			BREAKER # BLK CLOSE setting.	R
	setSrcRef	ObjectReference	SP	BREAKER # BLK CLOSE	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef8		ORG			BKR# SYNCCHECK CLS setting.	R
	setSrcRef	ObjectReference	SP	BKR# SYNCCHECK CLS	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef5		ORG			BREAKER # EXT ALARM setting.	R

LNName: Bkr0XCBR#		LDevice inst: System		UR element: Breaker Control element #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	setSrcRef	ObjectReference	SP	BREAKER # EXT ALARM	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef6		ORG			BREAKER # OUT OF SV (out-of-service) setting.	R
	setSrcRef	ObjectReference	SP	BREAKER # OUT OF SV	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef7		ORG			BKR# ST.LOC OPERAND (local control) setting.	R
	setSrcRef	ObjectReference	SP	BKR# ST.LOC OPERAND	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef9		ORG			BREAKER # RACKED-IN setting.	R
	setSrcRef	ObjectReference	SP	BREAKER # RACKED-IN	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef10		ORG			BREAKER # PUSH BUTTON CONTROL setting	R
	setSrcRef	ObjectReference	SP	BREAKER # PUSH BUTTON CONTROL	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef11		ORG			BRK# COMMS OPEN CMD setting	R
	setSrcRef	ObjectReference	SP	BRK# COMMS OPEN CMD	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef12		ORG			BRK# COMMS CLS CMD setting	R
	setSrcRef	ObjectReference	SP	BRK# COMMS CLS CMD	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

Table 3-180: Breaker control data objects

LNName: BkrΘXCBR#		LDevice inst: System		UR element: Breaker Control element #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Loc		SPS			Value of operand selected by setting XCBR# ST.LOC OPERAND	R
	stVal	BOOLEAN	ST	Bkr0XCBR#.Loc.stVal		R
OpCnt		INS			Phase ψ breaker operations counter.	R
	stVal	INT32	ST			R
	units.SIUnit	ENUMERATED			1, the code for dimensionless	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
BadSt1		SPS			BREAKER # ψ BAD ST operand	R
	stVal	BOOLEAN	ST	BREAKER # ψ BAD ST		R
ClsSt1		SPS			BREAKER # ψ CLSD operand	R
	stVal	BOOLEAN	ST	BREAKER # ψ CLSD		R
OpnSt1		SPS			BREAKER # ψ OPEN operand	R
	stVal	BOOLEAN	ST	BREAKER # ψ OPEN		R
IntermSt1		SPS			BREAKER # ψ INTERM operand	R
	stVal	BOOLEAN	ST	BREAKER # ψ INTERM		R
Pos		DPC			Breaker ϕψ position status	R
	stVal	CODED ENUM	ST			R
	ctlModel	CtlModels	CF		0, the code for status-only	R
BlkOpn		SPC			Breaker open commands blocked from all sources including protection	R
	stVal	BOOLEAN	ST	Bkr0XCBR#.BlkOpn.stVal		R

LNName: BkrΘXCBR#		LDevice inst: System		UR element: Breaker Control element #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	ctlModel	CtlModels	CF		0, the code for status-only	R
BlkCls		SPC			Breaker close commands blocked from all sources including protection	R
	stVal	BOOLEAN	ST	Bkr0XCBR#.BlkCls.stVal		R
	ctlModel	CtlModels	CF		0, the code for status-only	R
InRef1		ORG			BREAKER # ϕA/3P CLSD setting" if Θ="1", "BREAKER # ϕB CLSD setting" if Θ="2", or "BREAKER # ϕC CLSD setting" if Θ="3	R
	setSrcRef	ObjectReference	SP	BREAKER # ϕA/3P CLSD if Θ="1", BREAKER # ϕB CLSD if Θ="2", or BREAKER # ϕC CLSD if Θ="3"	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef2		ORG			BREAKER # ϕA/3P OPND setting" if Θ="1", "BREAKER # ϕB OPND setting" if Θ="2", or "BREAKER # ϕC OPND setting" if Θ="3	R
	setSrcRef	ObjectReference	SP	BREAKER # ϕA/3P OPND if Θ="1", BREAKER # ϕB OPND if Θ="2", or BREAKER # ϕC OPND if Θ="3"	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.5.4 B30 bay configuration (BbBayGAPC#)

This element is instantiated only in B30 relays with Process bus module.

Table 3-181: B30 bay configuration data objects

LNName: BbBayGAPC#		LDevice inst: System		UR element: B30 Bay # Configuration		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Op		ACT			BAY # TRIP Init operands	R
	general	BOOLEAN	ST	BAY # TRIP Init		R
InRef1ξ		ORG			BAY# ZONEξ CONNECTION setting.	R
	setSrcRef	ObjectReference	SP	BAY# ZONEξ CONNECTION.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef2α		ORG			BAY# CONNECTED ZONE TRIP α.	R
	setSrcRef	ObjectReference	SP	BAY# CONNECTED ZONE TRIP α.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef3β		ORG			BAY# AUX BREAKER TRIP β.	R
	setSrcRef	ObjectReference	SP	BAY# AUX BREAKER TRIP β.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.5.5 B90 isolator monitoring (B_Iso)

This element is instantiated in the following products: B90.

Table 3-182: B90 isolator monitoring data objects

LNName: B_IsoSSWI#		LDevice inst: System		UR element: B90 ISOLATOR # function		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
OpTmAlm		SPS			ISOLATOR # ALARM operand.	R
	stVal	BOOLEAN	ST	ISOLATOR # ALARM		R
IsoPos		ACT			ISOLATOR # POSITION operand.	R
	general	BOOLEAN	ST	ISOLATOR # POSITION		R

LNName: B_IsoSSWI#		LDevice inst: System		UR element: B90 ISOLATOR # function		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
IsoBlk		ACT			ISOLATOR # BLOCK OP operand.	R
	general	BOOLEAN	ST	ISOLATOR # BLOCK		R
InRef1		ORG			ISOLATOR # OPEN setting.	R
	setSrcRef	ObjectReference	SP	ISOLATOR # OPEN	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef2		ORG			ISOLATOR # CLOSED setting.	R
	setSrcRef	ObjectReference	SP	ISOLATOR # CLOSED	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef3		ORG			ISOLATOR # RESET setting	R
	setSrcRef	ObjectReference	SP	ISOLATOR # RESET.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

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3.5.5.6 Contact input interface (ConIn)

This element is instantiated in all UR products.

Table 3-183: Contact input data objects

LNName: ConInGGIO1		LDevice inst: System		UR element: Contact Inputs		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Ind1Θ		SPS			Cont Ip Θ On (ϕ) operand value	R
	stVal	BOOLEAN	ST	Cont Ip ϕ On		R
Ind2Θ		SPS			Cont Ip Θ Off (ϕ) operand value	R
	stVal	BOOLEAN	ST	Cont Ip ϕ Off		R
Ind2Θ		SPS			Instantiated only if the order code has more than 99 contact inputs	R
	stVal	BOOLEAN	ST	Cont Ip ϕ Off		R
Ind1Θ		SPS			Instantiated only if the order code has more than 99 contact inputs	R
	stVal	BOOLEAN	ST	Cont Ip ϕ On		R

3.5.5.7 Contact output interface (ConOut)

This element is instantiated in all UR products.

Table 3-184: Contact output data objects

LNName: ConOutGGIO1		LDevice inst: System		UR element: Contact Outputs		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Ind1Θ		SPS			only instantiated where the order code indicates that contact output Θ is equipped with a current detector	R
	stVal	BOOLEAN	ST	Cont Op ϕ IOn		R
Ind2Θ		SPS			only instantiated where the order code indicates that contact output Θ is equipped with a voltage detector	R
	stVal	BOOLEAN	ST	Cont Op ϕ VOn		R
Ind3Θ		SPS			only instantiated where the order code indicates that contact output Θ is equipped with a voltage detector	R
	stVal	BOOLEAN	ST	Cont Op ϕ VOff		R
Ind4Θ		SPS			Cont Op Θ On (ϕ) operand value	R
	stVal	BOOLEAN	ST	Cont Op ϕ On		R

LNName: ConOutGGIO1		LDevice inst: System		UR element: Contact Outputs		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
InRef1Θ		ORG			CONTACT OUTPUT ϕ OPERATE setting.	R
	setSrcRef	ObjectReference	SP	CONTACT OUTPUT ϕ OPERATE setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef2Θ		ORG			only instantiated where the order code indicates that contact output Θ is not a latching output.	R
	setSrcRef	ObjectReference	SP	CONTACT OUTPUT ϕ SEAL-IN setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef3Θ		ORG			only instantiated where the order code indicates that contact output Θ is a latching output.	R
	setSrcRef	ObjectReference	SP	OUTPUT ϕ RESET setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.5.8 Disconnect switch (Disc)

This element is instantiated in the following products: B30, C30, C60, C70, C95, D30, D60, F35, F60, G30, G60, L30, L60, L90, M60, N60, T35, T60.

The logical nodes are mapped to the disconnect switches as follows. They are populated based on the **Settings > System Setup > Switches > Switch x > Switch x Mode** setting, where x is the switch instance.

Disc 1: XSWI1
Disc0XSWI1 - 3 phase together
Disc1XSWI1 - A phase
Disc2XSWI1 - B Phase
Disc3XSWI1 - C Phase

Disc 2: XSWI2
Disc0XSWI2 - 3 phase together
Disc1XSWI2 - A phase
Disc2XSWI2 - B Phase
Disc3XSWI2 - C Phase

Table 3-185: Disconnect switch DiscCSWI data objects

LNName: DiscCSWI#		LDevice inst: System		UR element: Disconnect Control element #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
CmdBlk		SPC			Command block status of this LN	R/Ctrl
	stVal	BOOLEAN	ST			R
	pulseConfig .cmdQual	ENUMERATED				R
	pulseConfig.onDur	INT32U				R
	pulseConfig .offDur	INT32U				R
	pulseConfig .numPls	INT32U				R
	ctlModel	CtlModels	CF	DiscCSWI# CmdBlk ctlModel		R/W/C
	sboTimeout	INT32U	CF			R
	sboClass	SboClasses	CF			R
	operTimeout	INT32U	CF			R
Blk		SPS			Switch # Block status	R

LNName: DiscCSWI#		LDevice inst: System		UR element: Disconnect Control element #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	stVal	BOOLEAN	ST	value "Disc0XSWI#.BlkCls.stVal" AND "Disc0XSWI#.BlkOpn.stVal"		R
Loc		SPS			Switch # CSWI Loc status	R
	stVal	BOOLEAN	ST			R
OpOpn		ACT			SWITCH # OFF CMD operand	R
	general	BOOLEAN	ST	SWITCH # OFF CMD		R
SelOpn		SPS			Switch Select status for open operation	R
	stVal	BOOLEAN	ST			R
OpCls		ACT			SWITCH # ON CMD operand	R
	general	BOOLEAN	ST	SWITCH # ON CMD		R
SelCls		SPS			Switch Select status for close operation	R
	stVal	BOOLEAN	ST			R
BayAuthEna		SPS			SW# BAY AUTHOR ON operand	R
	stVal	BOOLEAN	ST	SW# BAY AUTHOR ON		R
StnAuthEna		SPS			SW# STATN AUTHOR ON operand	R
	stVal	BOOLEAN	ST	SW# STATN AUTHOR ON		R
RemAuthEna		SPS			SW# REM AUTHOR ON operand	R
	stVal	BOOLEAN	ST	SW# REM AUTHOR ON		R
LocAuthEna		SPS			SW# LOCAL AUTHOR ON operand	R
	stVal	BOOLEAN	ST	SW# LOCAL AUTHOR ON		R
LocSta		SPC			Station authority status	R/Ctrl
	stVal	BOOLEAN	ST	ORing of operand status selected by setting "SW# Station Author" and respective LocSTa.ctlVal		R
	pulseConfig.cmdQual	ENUMERATED				R
	pulseConfig.onDur	INT32U				R
	pulseConfig.offDur	INT32U				R
	pulseConfig.numPls	INT32U				R
	ctlModel	CtlModels	CF	CSWI# LocSta ctlModel		R/W/C
	sboTimeout	INT32U	CF			R
	sboClass	SboClasses	CF			R
	operTimeout	INT32U	CF			R
Pos		DPC			Disconnect position control and status	R/Ctrl
	stVal	CODED ENUM	ST	Disc0XSWI#.Pos.stVal		R
	stSeld	BOOLEAN	ST		The controllable data status is "selected"	R
	pulseConfig.cmdQual	ENUMERATED				R
	pulseConfig.onDur	INT32U			2 ms (actually one pass)	R
	pulseConfig.offDur	INT32U				R
	pulseConfig.numPls	INT32U				R
	ctlModel	CtlModels	CF	DiscCSWI# Pos ctlModel		R/W/C

LNName: DiscCSWI#		LDevice inst: System		UR element: Disconnect Control element #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	sboTimeout	INT32U	CF	DiscCSWI# Pos sboTimeout		R/W/C
	sboClass	SboClasses	CF			R
	operTimeout	INT32U	CF	DiscCSWI# Pos operTimeout		R/C
BlkOpn		SPC			Blocks Switch# open commands from all sources	R/Ctrl
	stVal	BOOLEAN	ST	the output of the logic gates as shown on Sheet 1 of the Disconnect Switch Control Logic		R
	pulseConfig .cmdQual	ENUMERATED				R
	pulseConfig.onDur	INT32U				R
	pulseConfig .offDur	INT32U				R
	pulseConfig .numPls	INT32U				R
	ctlModel	CtlModels	CF	DiscCSWI# BlkOpn ctlModel		R/W/C
	sboTimeout	INT32U	CF			R
	sboClass	SboClasses	CF			R
	operTimeout	INT32U	CF			R
BlkCls		SPC			Blocks Switch# close commands from all sources	R/Ctrl
	stVal	BOOLEAN	ST	the output of the logic gates as shown on Sheet 1 of the Breaker Control Logic		R
	pulseConfig .cmdQual	ENUMERATED				R
	pulseConfig.onDur	INT32U				R
	pulseConfig .offDur	INT32U				R
	pulseConfig .numPls	INT32U				R
	ctlModel	CtlModels	CF	DiscCSWI# BlkCls ctlModel		R/W/C
	sboTimeout	INT32U	CF			R
	sboClass	SboClasses	CF			R
	operTimeout	INT32U	CF			R
TagOn		SPC			SWITCH # Tag Command	R/Ctrl
	stVal	BOOLEAN	ST	Disc0XSWI#.TagOn.stVal		R
	pulseConfig .cmdQual	ENUMERATED				R
	pulseConfig.onDur	INT32U				R
	pulseConfig .offDur	INT32U				R
	pulseConfig .numPls	INT32U				R
	ctlModel	CtlModels	CF	DiscCSWI# TagOn ctlModel		R/W/C
	sboTimeout	INT32U	CF	DiscCSWI# TagOn sboTimeout		R/W/C
	sboClass	SboClasses	CF			R
	operTimeout	INT32U	CF			R
TagOff		SPS			SWITCH # TAG OFF operand	R
	stVal	BOOLEAN	ST	Disc0XSWI#.TagOff.stVal		R
SbstCls		SPS			SWITCH # SUBD CLSD operand	R

LNName: DiscCSWI#		LDevice inst: System		UR element: Disconnect Control element #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	stVal	BOOLEAN	ST	Disc0XSWI#.SbstCls.stVal		R
SbstOpn		SPS			SWITCH # SUBD OPEN operand	R
	stVal	BOOLEAN	ST	Disc0XSWI#.SbstOpn.stVal		R
BypsOn		SPS			SWITCH # BYPASS ON operand	R
	stVal	BOOLEAN	ST	Disc0XSWI#.BypsOn.stVal		R
BypsOff		SPS			SWITCH # BYPASS OFF operand	R
	stVal	BOOLEAN	ST	Disc0XSWI#.BypsOff.stVal		R
InRef01		ORG			SW# CSWI Loc Stat setting.	R
	setSrcRef	ObjectReference	SP	SW# CSWI Loc Stat	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef02		ORG			SW# Station Author setting.	R
	setSrcRef	ObjectReference	SP	SW# Station Author	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

Table 3-186: Disconnect switch DiscCILO data objects

LNName: DiscCILO#		LDevice inst: System		UR element: Disconnect Control element #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
EnaOpn		SPS			Enable Open status	R
	stVal	BOOLEAN	ST			R
EnaCls		SPS			Enable Close status	R
	stVal	BOOLEAN	ST			R
EnaLocOpn		SPS			SW1 LOCAL OPEN CILO operand	R
	stVal	BOOLEAN	ST	SW1 LOCAL OPEN CILO operand		R
EnaLocCls		SPS			SW1 LOCAL CLS CILO operand	R
	stVal	BOOLEAN	ST	SW1 LOCAL CLS CILO operand		R
BypsOnLoc		SPS			SW1 CILO BYPASS ON	R
	stVal	BOOLEAN	ST	SW1 CILO BYPASS ON operand		R
BypsOffLoc		SPS			SW1 CILO BYPASS OFF	R
	stVal	BOOLEAN	ST	SW1 CILO BYPASS OFF operand		R
InRef2		ORG			SWITCH# OPEN INTERLOCK setting.	R
	setSrcRef	ObjectReference	SP	SWITCH# OPEN INTERLOCK	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef3		ORG			SWITCH# CLOSE INTERLOCK setting.	R
	setSrcRef	ObjectReference	SP	SWITCH# CLOSE INTERLOCK	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

Table 3-187: Disconnect switch Disc0XSWI data objects

LNName: Disc0XSWI#		LDevice inst: System		UR element: Disconnect Control element #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
EEHealth		ENS			Disconnect switch health, value is 3 (red) when disconnect switch trouble is detected	R
	stVal	ENUMERATED	ST			R
Loc		SPS			Value of operand selected by XSWI# ST.LOC OPERAND	R
	stVal	BOOLEAN	ST			R

LNName: Disc0XSWI#		**LDevice inst: System**		**UR element: Disconnect Control element #**		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
OpCnt		INS			Disconnect switch operations counter.	R
	stVal	INT32	ST			R
	units.SIUnit	ENUMERATED			1, the code for dimensionless	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
SwTyp		ENS			Disconnect switch type, fixed at 2 (Disconnector)	R
	stVal	ENUMERATED	ST			R
OpOpn		ACT			SWITCH # OFF CMD (open) operand	R
	general	BOOLEAN	ST	SWITCH # OFF CMD		R
OpCls		ACT			SWITCH # ON CMD (close) operand	R
	general	BOOLEAN	ST	SWITCH # ON CMD		R
BadSt1		SPS			SWITCH # BAD STATUS operand	R
	stVal	BOOLEAN	ST	SWITCH # BAD STATUS		R
ClsSt1		SPS			SWITCH # CLOSED operand	R
	stVal	BOOLEAN	ST	SWITCH # CLOSED		R
OpnSt1		SPS			SWITCH # OPEN operand	R
	stVal	BOOLEAN	ST	SWITCH # OPEN		R
Dsc		SPS			SWITCH # DISCREP operand, which is disconnect pole discrepancy status	R
	stVal	BOOLEAN	ST	SWITCH # DISCREP		R
Alm		SPS			SWITCH # TROUBLE operand, which is disconnect pole discrepancy, bad-status, or SWITCH # EXT ALARM	R
	stVal	BOOLEAN	ST	SWITCH # TROUBLE		R
TagOn		SPC			SWITCH # Tag Command	R/Ctrl
	stVal	BOOLEAN	ST	SWITCH # TAG ON		R
	pulseConfig .cmdQual	ENUMERATED				R
	pulseConfig.onDu r	INT32U				R
	pulseConfig .offDur	INT32U				R
	pulseConfig .numPls	INT32U				R
	ctlModel	CtlModels	CF	Disc0XSWI# TagOn ctlModel		R/W/C
	sboTimeout	INT32U	CF	XSWI# TagOn sboTimeout		R/W/C
	sboClass	SboClasses	CF			R
	operTimeout	INT32U	CF			R
TagOff		SPS			SWITCH # TAG OFF operand	R
	stVal	BOOLEAN	ST	SWITCH # TAG OFF		R
SbstCls		SPS			SWITCH # SUBD CLSD operand	R
	stVal	BOOLEAN	ST	SWITCH # SUBD CLSD		R
SbstOpn		SPS			SWITCH # SUBD OPEN operand	R
	stVal	BOOLEAN	ST	SWITCH # SUBD OPEN		R
BypsOn		SPS			SW # BLK BYPASS ON operand	R
	stVal	BOOLEAN	ST	SW # BLK BYPASS ON		R
BypsOff		SPS			SW # BLK BYPASS OFF operand	R
	stVal	BOOLEAN	ST	SW # BLK BYPASS OFF		R
Pos		DPC			Disconnect switch position control	R/Ctrl
	stVal	CODED ENUM	ST			R
	stSeld	BOOLEAN	ST		The controllable data status is “selected”	R

LNName: Disc0XSWI#		**LDevice inst: System**		**UR element: Disconnect Control element #**		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	pulseConfig .cmdQual	ENUMERATED				R
	pulseConfig.onDur	INT32U			2 ms (actually one pass)	R
	pulseConfig .offDur	INT32U				R
	pulseConfig .numPls	INT32U				R
	ctlModel	CtlModels	CF	XSWI# Pos ctlModel		R/W/C
	sboTimeout	INT32U	CF	XSWI# Pos sboTimeout		R/W/C
	sboClass	SboClasses	CF			R
	operTimeout	INT32U	CF	SWITCH # Toperate		R/C
BlkOpn		SPC			Blocks disconnect switch open commands from all sources including protection	R/Ctrl
	stVal	BOOLEAN	ST			R
	pulseConfig .cmdQual	ENUMERATED				R
	pulseConfig.onDur	INT32U				R
	pulseConfig .offDur	INT32U				R
	pulseConfig .numPls	INT32U				R
	ctlModel	CtlModels	CF	Disc0XSWI# BlkOpn ctlModel		R/W/C
	sboTimeout	INT32U	CF			R
	sboClass	SboClasses	CF			R
	operTimeout	INT32U	CF			R
BlkCls		SPC			Blocks disconnect switch close commands from all sources	R/Ctrl
	stVal	BOOLEAN	ST			R
	pulseConfig .cmdQual	ENUMERATED				R
	pulseConfig.onDur	INT32U				R
	pulseConfig .offDur	INT32U				R
	pulseConfig .numPls	INT32U				R
	ctlModel	CtlModels	CF	Disc0XSWI# BlkCls ctlModel		R/W/C
	sboTimeout	INT32U	CF			R
	sboClass	SboClasses	CF			R
	operTimeout	INT32U	CF			R
InRef1		ORG			SWITCH # OPEN CMD setting.	R
	setSrcRef	ObjectReference	SP	SWITCH # OPEN CMD	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef2		ORG			SWITCH # BLK OPEN setting.	R
	setSrcRef	ObjectReference	SP	SWITCH # BLK OPEN	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef3		ORG			SWITCH # CLOSE CMD setting.	R
	setSrcRef	ObjectReference	SP	SWITCH # CLOSE CMD	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef4		ORG			SWITCH # BLK CLOSE setting.	R

LNName: Disc0XSWI#		LDevice inst: System		UR element: Disconnect Control element #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	setSrcRef	ObjectReference	SP	SWITCH # BLK CLOSE	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef5		ORG			XSWI# ST.LOC OPERAND (local control) setting.	R
	setSrcRef	ObjectReference	SP	XSWI# ST.LOC OPERAND	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef6		ORG			XSWI# PUSH BUTTON CONTROL setting	R
	setSrcRef	ObjectReference	SP	XSWI# PUSH BUTTON CONTROL	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef7		ORG			SW# COMMS OPEN CMD setting	R
	setSrcRef	ObjectReference	SP	SW# COMMS OPEN CMD	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef8		ORG			SW# COMMS CLS CMD setting	R
	setSrcRef	ObjectReference	SP	SW# COMMS CLS CMD	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

Table 3-188: Disconnect switch DiscΘXSWI data objects

LNName: DiscΘXSWI#		LDevice inst: System		UR element: Disconnect Control element #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Loc		SPS			Value of operand selected by XSWI# ST.LOC OPERAND	R
	stVal	BOOLEAN	ST	Disc0XSWI#.Loc.stVal		R
OpCnt		INS			Phase ψ disconnect switch operation counter.	R
	stVal	INT32	ST			R
	units.SIUnit	ENUMERATED			1, the code for dimensionless	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
SwTyp		ENS			Disconnect switch type, fixed at 2 (Disconnector)	R
	stVal	BOOLEAN	ST			R
BadSt1		SPS			SWITCH # ϕψ BAD STATUS operand	R
	stVal	BOOLEAN	ST	SWITCH # ϕψ BAD STATUS		R
ClsSt1		SPS			SWITCH # ϕψ CLOSED operand	R
	stVal	BOOLEAN	ST	SWITCH # ϕψ CLOSED		R
OpnSt1		SPS			SWITCH # ϕψ OPEN operand	R
	stVal	BOOLEAN	ST	SWITCH # ϕψ OPEN		R
IntermSt1		SPS			SWITCH # ϕψ INTERM operand, which is disconnect pole discrepancy status	R
	stVal	BOOLEAN	ST	SWITCH # ϕψ INTERM		R
Pos		DPC			Disconnect switch ϕψ position control	R
	stVal	CODED ENUM	ST			R
	ctlModel	CtlModels	CF		0, the code for status-only	R
BlkOpn		SPC			Disconnect switch open commands blocked from all sources including protection	R
	stVal	BOOLEAN	ST	Disc0XSWI#.BlkOpn.stVal		R
	ctlModel	CtlModels	CF		0, the code for status-only	R
BlkCls		SPC			Disconnect switch close commands blocked from all sources	R
	stVal	BOOLEAN	ST	Disc0XSWI#.BlkCls.stVal		R

LNName: DiscΘXSWI#		LDevice inst: System		UR element: Disconnect Control element #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	ctlModel	CtlModels	CF		0, the code for status-only	R
InRef1		ORG			SWITCH # ϕA/3P CLSD setting" if Θ="1", "SWITCH # ϕB CLSD setting" if Θ="2", or "SWITCH # ϕC CLSD setting" if Θ="3	R
	setSrcRef	ObjectReference	SP	SWITCH # ϕA/3P CLSD if Θ="1", SWITCH # ϕB CLSD if Θ="2", or SWITCH # ϕC CLSD if Θ="3"	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef2		ORG			SWITCH # ϕA/3P OPND setting" if Θ="1", "SWITCH # ϕB OPND setting" if Θ="2", or "SWITCH # ϕC OPND setting" if Θ="3	R
	setSrcRef	ObjectReference	SP	SWITCH # ϕA/3P OPND if Θ="1", SWITCH # ϕB OPND if Θ="2", or SWITCH # ϕC OPND if Θ="3"	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.5.9 Field contact inputs (FCIn)

This element is instantiated in all UR products.

Table 3-189: Field contact input data objects

LNName: FCInGGIO1		LDevice inst: System		UR element: Field Contact Inputs		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
IndΘ		SPS			FCI Θ On operand value	R
	stVal	BOOLEAN	ST	FCI Θ On		R

3.5.5.10 Field contact outputs (FCOut)

This element is instantiated in all UR products.

Table 3-190: Field contact output data objects

LNName: FCOutGGIO1		LDevice inst: System		UR element: Field Contact Outputs		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Ind1Θ		SPS			FCO ϕ DOn operand value	R
	stVal	BOOLEAN	ST	FCO ϕ DOn		R
Ind2Θ		SPS			Only instantiated for SSR contact outputs, i.e., OUT1 to OUT4	R
	stVal	BOOLEAN	ST	FCO ϕ IOn		R
Ind3Θ		SPS			Only instantiated for SSR contact outputs, i.e., OUT1 to OUT4	R
	stVal	BOOLEAN	ST	FCO ϕ VOn		R
InRef1Θ		ORG			FCO ϕ Operate setting.	R
	setSrcRef	ObjectReference	SP	Operate setting of FCO ϕ	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef2Θ		ORG			FCO ϕ Seal-In setting.	R
	setSrcRef	ObjectReference	SP	Seal-In setting of FCO ϕ	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.5.11 Field latching outputs (FLOut)

This element is instantiated in all UR products.

Table 3-191: Field latching output data objects

LNName: FLOutGGIO1		LDevice inst: System		UR element: Field Latching Outputs		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Ind1Θ		SPS			FLO Θ Opened operand value	R
	stVal	BOOLEAN	ST	FLO Θ Opened		R
Ind2Θ		SPS			FLO Θ Closed operand value	R
	stVal	BOOLEAN	ST	FLO Θ Closed		R
Ind3Θ		SPS			FLO Θ OpnDOn operand value	R
	stVal	BOOLEAN	ST	FLO Θ OpnDOn		R
Ind4Θ		SPS			FLO Θ ClsDOn operand value	R
	stVal	BOOLEAN	ST	FLO Θ ClsDOn		R
InRef1Θ		ORG			FLO Θ Open setting.	R
	setSrcRef	ObjectReference	SP	Open setting of FLO Θ	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef2Θ		ORG			FLO Θ Close setting.	R
	setSrcRef	ObjectReference	SP	Close setting of FLO Θ	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

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3.5.5.12 Field RTDs (FRTDs)

This element is instantiated in all UR products.

Table 3-192: Field RTD data objects

LNName: FRTDsGGIO1		LDevice inst: System		UR element: Field RTDs (Resistance Temperature Detectors)		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
IndΘ		SPS			RTDΘ Trouble On operand value	R
	stVal	BOOLEAN	ST	RTDΘ Trouble On		R
AnInΘ		MV			RTDΘ Temperature in degree Celsius	R
	instMag.f	FLOAT32		RTDΘ Temperature		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			23, the code for degree Celsius (°C)	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	FRTDsGGIO1.AnInΘ.db		R/W/C
	zeroDb	INT32U	CF			R

3.5.5.13 Field units (FUnt)

This element is instantiated in all UR products.

Table 3-193: Field unit data objects

LNName: FUnitGGIO1		LDevice inst: System		UR element: Field units		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
IndΘ		SPS			UΘ On operand value	R
	stVal	BOOLEAN	ST	UΘ On		R

3.5.5.14 Field transducers (FTDRs)

This element is instantiated in all UR products.

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Table 3-194: Field transducer data objects

LNName: FTDRsGGIO1		LDevice inst: System		UR element: Field Transducers		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
IndΘ		SPS			TDRΘ Trouble On operand value	R
	stVal	BOOLEAN	ST	TDRΘ Trouble On		R
AnInΘ		MV			TDR Θ Value	R
	instMag.f	FLOAT32		TDR Θ Value		R
	mag.f	FLOAT32				R
	db	INT32U	CF	FTDRsGGIO1.AnInΘ.db		R/W/C
	zeroDb	INT32U	CF			R
DbMaxΘ		ASG			Maximum Value in deadband calculations	R
	setMag.f	FLOAT32		“Maximum Value” of TDRΘ		R/C
	minVal.f	FLOAT32		–9999.999		R
	maxVal.f	FLOAT32				R
	stepSize.f	FLOAT32				R
DbMinΘ		ASG			Minimum Value in deadband calculations	R
	setMag.f	FLOAT32		“Minimum Value” of TDRΘ		R/C
	minVal.f	FLOAT32		–9999.999		R
	maxVal.f	FLOAT32				R
	stepSize.f	FLOAT32				R

3.5.5.15 Latched outputs (FLOut)

This element is instantiated in all UR products.

Table 3-195: Latched output data objects

LNName: FLOutGGIO1		LDevice inst: System		UR element: Field Latching Outputs		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Ind1Θ		SPS			FLO Θ Opened operand value	R
	stVal	BOOLEAN	ST	FLO Θ Opened		R
Ind2Θ		SPS			FLO Θ Closed operand value	R
	stVal	BOOLEAN	ST	FLO Θ Closed		R
Ind3Θ		SPS			FLO Θ OpnDOn operand value	R
	stVal	BOOLEAN	ST	FLO Θ OpnDOn		R
Ind4Θ		SPS			FLO Θ ClsDOn operand value	R
	stVal	BOOLEAN	ST	FLO Θ ClsDOn		R
InRef1Θ		ORG			FLO Θ Open setting.	R
	setSrcRef	ObjectReference	SP	Open setting of FLO Θ	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef2Θ		ORG			FLO Θ Close setting.	R
	setSrcRef	ObjectReference	SP	Close setting of FLO Θ	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.5.16 Shared inputs (FShIn)

This element is instantiated in all UR products.

Table 3-196: Shared input data objects

LNName: FShInGGIO1		LDevice inst: System		UR element: Field Shared Inputs		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
IndΘ		SPS			SI Θ On operand value	R
	stVal	BOOLEAN	ST	SI Θ On		R

3.5.5.17 Shared outputs (FShOut)

This element is instantiated in all UR products.

Table 3-197: Shared output data objects

LNName: FShOutGGIO1		LDevice inst: System		UR element: Field Shared Outputs		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
InRefΘ		ORG			SOΘ Operate setting.	R
	setSrcRef	ObjectReference	SP	Operate setting of SOΘ	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.5.18 Transducer DCmA inputs (TDCIn)

This element is instantiated in the following products: B30, C30, C60, C70, C95, D30, D60, F35, F60, G30, G60, L30, L60, L90, M60, N60, T35, T60.

Table 3-198: DCmA input data objects

LNName: TDCInGGIO1		LDevice inst: System		UR element: DCmA Inputs		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
AnInΘ		MV			DCMA INPUT ϕ Value	R
	instMag.f	FLOAT32		DCMA INPUT ϕ Value		R
	mag.f	FLOAT32				R
	db	INT32U	CF	TDCInGGIO1.AnInΘ.db		R/W/C
	zeroDb	INT32U	CF			R
MaxValΘ		ASG			Maximum Value in deadband calculations	R
	setMag.f	FLOAT32		"DCMA INPUT ϕ MAX VALUE"		R/C
	minVal.f	FLOAT32		–9999.999		R
	maxVal.f	FLOAT32				R
	stepSize.f	FLOAT32				R
MinValΘ		ASG			Minimum Value in deadband calculations	R
	setMag.f	FLOAT32		"DCMA INPUT ϕ MIN VALUE"		R/C
	minVal.f	FLOAT32		–9999.999		R
	maxVal.f	FLOAT32				R
	stepSize.f	FLOAT32				R

3.5.5.19 Transducer DCmA outputs (TDCOut)

This element is instantiated in the following products: B30, C30, C60, C70, C95, D30, D60, F35, F60, G30, G60, L30, L60, L90, M60, N60, T35, T60.

Table 3-199: DCmA output data objects

LNName: TDCOutGGIO1		LDevice inst: System		UR element: DCmA outputs		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
InRefΘ		ORG			DCMA OUTPUT ϕ SOURCE setting.	R
	setSrcRef	ObjectReference	SP	DCMA OUTPUT ϕ SOURCE setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
MaxValΘ		ASG			Maximum Value in deadband calculations	R
	setMag.f	FLOAT32		“DCMA OUTPUT ϕ MAX VALUE”		R/C
	minVal.f	FLOAT32		–90.000		R
	maxVal.f	FLOAT32				R
	stepSize.f	FLOAT32				R
MinValΘ		ASG			Minimum Value in deadband calculations	R
	setMag.f	FLOAT32		“DCMA OUTPUT ϕ MIN VALUE”		R/C
	minVal.f	FLOAT32		–90.000		R
	maxVal.f	FLOAT32				R
	stepSize.f	FLOAT32				R

3.5.5.20 Transducer resistance temperature detectors (TRTDs)

This element is instantiated in the following products: G60, M60.

Table 3-200: RTD input data objects

LNName: TRTDsGGIO1		LDevice inst: System		UR element: RTDs (Resistance Temperature Detectors)		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
AnInΘ		MV			RTD INPUT ϕ Temperature in degree Celsius	R
	instMag.f	FLOAT32		RTD INPUT ϕ Value		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			23, the code for degree Celsius (°C)	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	TRTDsGGIO1.AnInΘ.db		R/W/C
	zeroDb	INT32U	CF			R

3.5.6 Meter logical device

The Ctrl logical device contains logical nodes that model UR metering and measurement functions (other than PMU), including Signal Sources.

3.5.6.1 Logical node zero (LLN0)

This element is instantiated in all UR devices implementing the Meter logical device.

Table 3-201: LLN0 data objects

LNName: LLN0		LDevice inst: Meter		UR element: Nameplate information for the logical nodes		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Beh		ENS			This logical device’s behavior	R
	stVal	ENUMERATED	ST			R
	stVal	ENUMERATED	ST	LLN0.Beh.stVal of the Master logical device		R

LNName: LLN0		LDevice inst: Meter		UR element: Nameplate information for the logical nodes		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
GrRef		ORG			Reference to root logical device	R
	setSrcRef	ObjectReference	SP	For communications, mapped to Master ldName if not empty, otherwise to the concatenation of the IED name and “Master”. For SCL, mapped to the concatenation of the IED name and “Master”.	reference to the data attribute to input	R

3.5.6.2 AC signal sources (ACsrc)

This element is instantiated in the following products: B30, C30, C60, C70, C95, D30, D60, F35, F60, G30, G60, L30, L60, L90, M60, N60, T35, T60.

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Table 3-202: AC signal sources data objects

LNName: ACsrcMMXU#		LDevice inst: Meter		UR element: AC Source #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			SRC# 50DD operand, which becomes On when a disturbance (change in magnitude of a sequence current greater than twice the current cutoff level) is detected on AC Source #.	R
	general	BOOLEAN	ST	SRC# 50DD		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown	R
TotW		MV			SRC # Three Phase Real Power, in primary watts	R
	instMag.f	FLOAT32		SRC # Three Phase Real Power		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			38, the code for primary watts (J/s)	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	MMXU# TotW DEADBAND		R/W/C
	zeroDb	INT32U	CF			R
TotVAr		MV			SRC # Three Phase Reactive Power, in primary VAr	R
	instMag.f	FLOAT32		SRC # Three Phase Reactive Power		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			63, the code for primary volt amperes reactive (VIsinΘ)	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	MMXU# TotVAr DEADBAND		R/W/C
	zeroDb	INT32U	CF			R
TotVA		MV			SRC # Three Phase Apparent Power, in primary VA	R
	instMag.f	FLOAT32		SRC # Three Phase Apparent Power		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			61, the code for primary volt amperes (VA)	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	MMXU# TotVA DEADBAND		R/W/C
	zeroDb	INT32U	CF			R
TotPF		MV			SRC # Three Phase Power Factor, dimensionless	R

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LNName: ACsrcMMXU#		LDevice inst: Meter		UR element: AC Source #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	instMag.f	FLOAT32		SRC # Three Phase Power Factor		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			65, the code for power factor (dimensionless)	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	MMXU# TotPF DEADBAND		R/W/C
	zeroDb	INT32U	CF			R
PFSign		ENG			Sign convention for power factor (PF) is fixed at Lead/Lag (usually named IEEE)	R
	setVal	ENUMERATED	SP		2, the code for Lead/Lag (usually named IEEE, Enumeration name is “EEI” per http://www.tissues.iec61850.com/ tissue.mspx?issueid=686)	R
Hz		MV			SRC # Frequency, in Hz	R
	instMag.f	FLOAT32		SRC # Frequency		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			33, the code for hertz (1/s)	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	MMXU# Hz DEADBAND		R/W/C
	zeroDb	INT32U	CF			R
PPV		DEL			SRC # Phase-to-phase Voltage phasors, in primary volts	R
	phsAB.instCVal .mag.f	FLOAT32		SRC # Phase AB Voltage Magnitude		R
	phsAB.instCVal .ang.f	FLOAT32		SRC # Phase AB Voltage Angle		R
	phsAB.cVal.mag.f	FLOAT32				R
	phsAB.cVal.ang.f	FLOAT32				R
	phsAB.units .SIUnit	ENUMERATED			29, the code for primary volts (W/A)	R
	phsAB.units .multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	phsAB.db	INT32U	CF	MMXU# PPV.phsAB.db		R/W/C
	phsAB.dbAng	INT32U	CF	MMXU# PPV.phsAB.dbAng		R/W/C
	phsAB.zeroDb	INT32U	CF			R
	phsBC.instCVal .mag.f	FLOAT32		SRC # Phase BC Voltage Magnitude		R
	phsBC.instCVal .ang.f	FLOAT32		SRC # Phase BC Voltage Angle		R
	phsBC.cVal.mag.f	FLOAT32				R
	phsBC.cVal.ang.f	FLOAT32				R
	phsBC.units .SIUnit	ENUMERATED			29, the code for primary volts (W/A)	R
	phsBC.units .multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	phsBC.db	INT32U	CF	MMXU# PPV.phsBC.db		R/W/C
	phsBC.dbAng	INT32U	CF	MMXU# PPV.phsBC.dbAng		R/W/C
	phsBC.zeroDb	INT32U	CF			R
	phsCA.instCVal .mag.f	FLOAT32		SRC # Phase CA Voltage Magnitude		R
	phsCA.instCVal .ang.f	FLOAT32		SRC # Phase CA Voltage Angle		R
	phsCA.cVal.mag.f	FLOAT32				R

LNName: ACsrcMMXU#		LDevice inst: Meter		UR element: AC Source #		
data obj.	data attribute	Type	FC	UR Name	Description	R/W/C
	phsCA.cVal.ang.f	FLOAT32				R
	phsCA.units .SIUnit	ENUMERATED			29, the code for primary volts (W/A)	R
	phsCA.units .multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	phsCA.db	INT32U	CF	MMXU# PPV.phsCA .db		R/W/C
	phsCA.dbAng	INT32U	CF	MMXU# PPV.phsCA.dbAng		R/W/C
	phsCA.zeroDb	INT32U	CF			R
	angRef	ENUMERATED	CF		See UR product manual regarding FREQUENCY AND PHASE REFERENCE	R
VabRMS		MV			SRC # Phase AB Voltage RMS, in primary volts	R
	instMag.f	FLOAT32		SRC # Phase AB Voltage RMS		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			29, the code for primary volts (W/A)	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	MMXU# RMS PPV.phsAB DEADBAND		R/W/C
	zeroDb	INT32U	CF			R
VbcRMS		MV			SRC # Phase BC Voltage RMS, in primary volts	R
	instMag.f	FLOAT32		SRC # Phase BC Voltage RMS		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			29, the code for primary volts (W/A)	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	MMXU# RMS PPV.phsBC DEADBAND		R/W/C
	zeroDb	INT32U	CF			R
VcaRMS		MV			SRC # Phase CA Voltage RMS, in primary volts	R
	instMag.f	FLOAT32		SRC # Phase CA Voltage RMS		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			29, the code for primary volts (W/A)	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	MMXU# RMS PPV.phsCA DEADBAND		R/W/C
	zeroDb	INT32U	CF			R
PhV		WYE			SRC # Phase Voltage phasors, in primary volts	R
	phsA.instCVal.mag .f	FLOAT32		SRC # Phase AG Voltage Magnitude		R
	phsA.instCVal.ang .f	FLOAT32		SRC # Phase AG Voltage Angle		R
	phsA.cVal.mag.f	FLOAT32				R
	phsA.cVal.ang.f	FLOAT32				R
	phsA.units.SIUnit	ENUMERATED			29, the code for primary volts (W/A)	R
	phsA.units .multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	phsA.db	INT32U	CF	MMXU# PhV.phsA.db		R/W/C
	phsA.dbAng	INT32U	CF	MMXU# PhV.phsA .dbAng		R/W/C
	phsA.zeroDb	INT32U	CF			R

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LNName: ACsrcMMXU#		LDevice inst: Meter		UR element: AC Source #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	phsB.instCVal.mag .f	FLOAT32		SRC # Phase BG Voltage Magnitude		R
	phsB.instCVal.ang .f	FLOAT32		SRC # Phase BG Voltage Angle		R
	phsB.cVal.mag.f	FLOAT32				R
	phsB.cVal.ang.f	FLOAT32				R
	phsB.units.SIUnit	ENUMERATED			29, the code for primary volts (W/A)	R
	phsB.units .multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	phsB.db	INT32U	CF	MMXU# PhV.phsB .db		R/W/C
	phsB.dbAng	INT32U	CF	MMXU# PhV.phsB.dbAng		R/W/C
	phsB.zeroDb	INT32U	CF			R
	phsC.instCVal.mag .f	FLOAT32		SRC # Phase CG Voltage Magnitude		R
	phsC.instCVal.ang .f	FLOAT32		SRC # Phase CG Voltage Angle		R
	phsC.cVal.mag.f	FLOAT32				R
	phsC.cVal.ang.f	FLOAT32				R
	phsC.units.SIUnit	ENUMERATED			29, the code for primary volts (W/A)	R
	phsC.units .multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	phsC.db	INT32U	CF	MMXU# PhV.phsC.db		R/W/C
	phsC.dbAng	INT32U	CF	MMXU# PhV.phsC.dbAng		R/W/C
	phsC.zeroDb	INT32U	CF			R
	angRef	ENUMERATED	CF		See UR product manual regarding FREQUENCY AND PHASE REFERENCE	R
	phsToNeut	BOOLEAN	CF			R
VaRMS		MV			SRC # Phase AG Voltage RMS, in primary volts	R
	instMag.f	FLOAT32		SRC # Phase AG Voltage RMS		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			29, the code for primary volts (W/A)	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	MMXU# RMS PhV.phsA DEADBAND		R/W/C
	zeroDb	INT32U	CF			R
VbRMS		MV			SRC # Phase BG Voltage RMS, in primary volts	R
	instMag.f	FLOAT32		SRC # Phase BG Voltage RMS		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			29, the code for primary volts (W/A)	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	MMXU# RMS PhV.phsB DEADBAND		R/W/C
	zeroDb	INT32U	CF			R
VcRMS		MV			SRC # Phase CG Voltage RMS, in primary volts	R
	instMag.f	FLOAT32		SRC # Phase CG Voltage RMS		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			29, the code for primary volts (W/A)	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R

LNName: ACsrcMMXU#		LDevice inst: Meter		UR element: AC Source #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	db	INT32U	CF	MMXU# RMS PhV.phsC DEADBAND		R/W/C
	zeroDb	INT32U	CF			R
A		WYE			SRC # Current phasors, in primary amperes	R
	phsA	CMV				R
	phsA.instCVal.mag .f	FLOAT32		SRC # Phase A Current Magnitude		R
	phsA.instCVal.ang .f	FLOAT32		SRC # Phase A Current Angle		R
	phsA.cVal.mag.f	FLOAT32				R
	phsA.cVal.ang.f	FLOAT32				R
	phsA.units.SIUnit	ENUMERATED			5, the code for primary amperes	R
	phsA.units .multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	phsA.db	INT32U	CF	MMXU# A.phsA .db		R/W/C
	phsA.dbAng	INT32U	CF	MMXU# A.phsA.dbAng		R/W/C
	phsA.zeroDb	INT32U	CF			R
	phsB	CMV				R
	phsB.instCVal.mag .f	FLOAT32		SRC # Phase B Current Magnitude		R
	phsB.instCVal.ang .f	FLOAT32		SRC # Phase B Current Angle		R
	phsB.cVal.mag.f	FLOAT32				R
	phsB.cVal.ang.f	FLOAT32				R
	phsB.units.SIUnit	ENUMERATED			5, the code for primary amperes	R
	phsB.units .multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	phsB.db	INT32U	CF	MMXU# A.phsB.db		R/W/C
	phsB.dbAng	INT32U	CF	MMXU# A.phsB.dbAng		R/W/C
	phsB.zeroDb	INT32U	CF			R
	phsC	CMV				R
	phsC.instCVal.mag .f	FLOAT32		SRC # Phase C Current Magnitude		R
	phsC.instCVal.ang .f	FLOAT32		SRC # Phase C Current Angle		R
	phsC.cVal.mag.f	FLOAT32				R
	phsC.cVal.ang.f	FLOAT32				R
	phsC.units.SIUnit	ENUMERATED			5, the code for primary amperes	R
	phsC.units .multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	phsC.db	INT32U	CF	MMXU# A.phsC.db		R/W/C
	phsC.dbAng	INT32U	CF	MMXU# A.phsC.dbAng		R/W/C
	phsC.zeroDb	INT32U	CF			R
	res	CMV				R
	res.instCVal.mag .f	FLOAT32		SRC # Neutral Current Magnitude		R
	res.instCVal.ang .f	FLOAT32		SRC # Neutral Current Angle		R
	res.cVal.mag.f	FLOAT32				R

LNName: ACsrcMMXU#		LDevice inst: Meter		UR element: AC Source #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	res.cVal.ang.f	FLOAT32				R
	res.units.SIUnit	ENUMERATED			5, the code for primary amperes	R
	res.units .multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	res.db	INT32U	CF	MMXU# A.neut.db		R/W/C
	res.dbAng	INT32U	CF	MMXU# A.neut.dbAng		R/W/C
	res.zeroDb	INT32U	CF			R
	angRef	ENUMERATED	CF		See UR product manual regarding FREQUENCY AND PHASE REFERENCE	R
AaRMS		MV			SRC # Phase A Current RMS, in primary amperes	R
	instMag.f	FLOAT32		SRC # Phase A Current RMS		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			5, the code for primary amperes	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	MMXU# RMS A.phsA DEADBAND		R/W/C
	zeroDb	INT32U	CF			R
AbRMS		MV			SRC # Phase B Current RMS, in primary amperes	R
	instMag.f	FLOAT32		SRC # Phase B Current RMS		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			5, the code for primary amperes	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	MMXU# RMS A.phsB DEADBAND		R/W/C
	zeroDb	INT32U	CF			R
AcRMS		MV			SRC # Phase C Current RMS, in primary amperes	R
	instMag.f	FLOAT32		SRC # Phase C Current RMS		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			5, the code for primary amperes	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	MMXU# RMS A.phsC DEADBAND		R/W/C
	zeroDb	INT32U	CF			R
AresRMS		MV			SRC # Neutral Current RMS, in primary amperes	R
	instMag.f	FLOAT32		SRC # Neutral Current RMS		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			5, the code for primary amperes	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	MMXU# RMS A.neut DEADBAND		R/W/C
	zeroDb	INT32U	CF			R
Adif		CMV			SRC # Differential Ground Current phasor, in primary amperes	R
	instCVal.mag.f	FLOAT32		SRC # Differential Ground Current Magnitude		R
	instCVal.ang.f	FLOAT32		SRC # Differential Ground Current Angle		R
	cVal.mag.f	FLOAT32				R
	cVal.ang.f	FLOAT32				R
	units.SIUnit	ENUMERATED			5, the code for primary amperes	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R

LNName: ACsrcMMXU#		LDevice inst: Meter		UR element: AC Source #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	db	INT32U	CF	MMXU# Dif Gnd Cur.db		R/W/C
	dbAng	INT32U	CF	MMXU# Dif Gnd Cur.dbAng		R/W/C
	zeroDb	INT32U	CF			R
	angRef	ENUMERATED	CF		See UR product manual regarding FREQUENCY AND PHASE REFERENCE	R
W		WYE			SRC # Phase Real Power, in primary watts	R
	phsA	CMV				R
	phsA.instCVal.mag .f	FLOAT32		SRC # Phase A Real Power		R
	phsA.cVal.mag.f	FLOAT32				R
	phsA.units.SIUnit	ENUMERATED			38, the code for primary watts (J/s)	R
	phsA.units .multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	phsA.db	INT32U	CF	MMXU# W.phsA DEADBAND		R/W/C
	phsA.zeroDb	INT32U	CF			R
	phsB	CMV				R
	phsB.instCVal.mag .f	FLOAT32		SRC # Phase B Real Power		R
	phsB.cVal.mag.f	FLOAT32				R
	phsB.units.SIUnit	ENUMERATED			38, the code for primary watts (J/s)	R
	phsB.units .multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	phsB.db	INT32U	CF	MMXU# W.phsB DEADBAND		R/W/C
	phsB.zeroDb	INT32U	CF			R
	phsC	CMV				R
	phsC.instCVal.mag .f	FLOAT32		SRC # Phase C Real Power		R
	phsC.cVal.mag.f	FLOAT32				R
	phsC.units.SIUnit	ENUMERATED			38, the code for primary watts (J/s)	R
	phsC.units .multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	phsC.db	INT32U	CF	MMXU# W.phsC DEADBAND		R/W/C
	phsC.zeroDb	INT32U	CF			R
VAr		WYE			SRC # Phase Reactive Power, in primary VAr	R
	phsA	CMV				R
	phsA.instCVal.mag .f	FLOAT32		SRC # Phase A Reactive Power		R
	phsA.cVal.mag.f	FLOAT32				R
	phsA.units.SIUnit	ENUMERATED			63, the code for primary volt amperes reactive (VIsinΘ)	R
	phsA.units .multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	phsA.db	INT32U	CF	MMXU# VAr.phsA DEADBAND		R/W/C
	phsA.zeroDb	INT32U	CF			R
	phsB	CMV				R
	phsB.instCVal.mag .f	FLOAT32		SRC # Phase B Reactive Power		R

LNName: ACsrcMMXU#		LDevice inst: Meter		UR element: AC Source #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	phsB.cVal.mag.f	FLOAT32				R
	phsB.units.SIUnit	ENUMERATED			63, the code for primary volt amperes reactive (VIsinΘ)	R
	phsB.units .multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	phsB.db	INT32U	CF	MMXU# VAr.phsB DEADBAND		R/W/C
	phsB.zeroDb	INT32U	CF			R
	phsC	CMV				R
	phsC.instCVal.mag .f	FLOAT32		SRC # Phase C Reactive Power		R
	phsC.cVal.mag.f	FLOAT32				R
	phsC.units.SIUnit	ENUMERATED			63, the code for primary volt amperes reactive (VIsinΘ)	R
	phsC.units .multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	phsC.db	INT32U	CF	MMXU# VAr.phsC DEADBAND		R/W/C
	phsC.zeroDb	INT32U	CF			R
VA		WYE			SRC # Phase Apparent Power, in primary VA	R
	phsA	CMV				R
	phsA.instCVal.mag .f	FLOAT32		SRC # Phase A Apparent Power		R
	phsA.cVal.mag.f	FLOAT32				R
	phsA.units.SIUnit	ENUMERATED			61, the code for primary volt amperes (VA)	R
	phsA.units .multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	phsA.db	INT32U	CF	MMXU# VA.phsA DEADBAND		R/W/C
	phsA.zeroDb	INT32U	CF			R
	phsB	CMV				R
	phsB.instCVal.mag .f	FLOAT32		SRC # Phase B Apparent Power		R
	phsB.cVal.mag.f	FLOAT32				R
	phsB.units.SIUnit	ENUMERATED			61, the code for primary volt amperes (VA)	R
	phsB.units .multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	phsB.db	INT32U	CF	MMXU# VA.phsB DEADBAND		R/W/C
	phsB.zeroDb	INT32U	CF			R
	phsC	CMV				R
	phsC.instCVal.mag .f	FLOAT32		SRC # Phase C Apparent Power		R
	phsC.cVal.mag.f	FLOAT32				R
	phsC.units.SIUnit	ENUMERATED			61, the code for primary volt amperes (VA)	R
	phsC.units .multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	phsC.db	INT32U	CF	MMXU# VA.phsC DEADBAND		R/W/C
	phsC.zeroDb	INT32U	CF			R
PF		WYE			SRC # Phase Power Factor, dimensionless	R

LNName: ACsrcMMXU#		LDevice inst: Meter		UR element: AC Source #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	phsA	CMV				R
	phsA.instCVal.mag .f	FLOAT32		SRC # Phase A Power Factor		R
	phsA.cVal.mag.f	FLOAT32				R
	phsA.units.SIUnit	ENUMERATED			65, the code for power factor (dimensionless)	R
	phsA.units .multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	phsA.db	INT32U	CF	MMXU# PF.phsA DEADBAND		R/W/C
	phsA.zeroDb	INT32U	CF			R
	phsB	CMV				R
	phsB.instCVal.mag .f	FLOAT32		SRC # Phase B Power Factor		R
	phsB.cVal.mag.f	FLOAT32				R
	phsB.units.SIUnit	ENUMERATED			65, the code for power factor (dimensionless)	R
	phsB.units .multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	phsB.db	INT32U	CF	MMXU# PF.phsB DEADBAND		R/W/C
	phsB.zeroDb	INT32U	CF			R
	phsC	CMV				R
	phsC.instCVal.mag .f	FLOAT32		SRC # Phase C Power Factor		R
	phsC.cVal.mag.f	FLOAT32				R
	phsC.units.SIUnit	ENUMERATED			65, the code for power factor (dimensionless)	R
	phsC.units .multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	phsC.db	INT32U	CF	MMXU# PF.phsC DEADBAND		R/W/C
	phsC.zeroDb	INT32U	CF			R

Table 3-203: AC signal sources data object

LNName: ACsrcMMXN#		LDevice inst: Meter		UR element: AC Source #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Hz		MV			SRC # Frequency, in Hz	R
	instMag.f	FLOAT32		SRC # Frequency		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			33, the code for hertz (1/s)	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	MMXN# Hz DEADBAND		R/W/C
	zeroDb	INT32U	CF			R
Vaux		CMV			SRC # Auxiliary Voltage phasor, in primary volts	R
	instCVal.mag.f	FLOAT32		SRC # Auxiliary Voltage Magnitude		R
	instCVal.ang.f	FLOAT32		SRC # Auxiliary Voltage Angle		R
	cVal.mag.f	FLOAT32				R
	cVal.ang.f	FLOAT32				R
	units.SIUnit	ENUMERATED			29, the code for primary volts (W/A)	R

LNName: ACsrcMMXN#		LDevice inst: Meter		UR element: AC Source #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	MMXN# AuxV.db		R/W/C
	dbAng	INT32U	CF	MMXN# AuxV.dbAng		R/W/C
	zeroDb	INT32U	CF			R
	angRef	ENUMERATED	CF		See UR product manual regarding FREQUENCY AND PHASE REFERENCE	R
VauxRMS		MV			SRC # Auxiliary Voltage RMS, in primary volts	R
	instMag.f	FLOAT32		SRC # Auxiliary Voltage RMS		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			29, the code for primary volts (W/A)	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	MMXN# RMS AuxV DEADBAND		R/W/C
	zeroDb	INT32U	CF			R
Agnd		CMV			SRC # Ground Current phasor, in primary amperes	R
	instCVal.mag.f	FLOAT32		SRC # Ground Current Magnitude		R
	instCVal.ang.f	FLOAT32		SRC # Ground Current Angle		R
	cVal.mag.f	FLOAT32				R
	cVal.ang.f	FLOAT32				R
	units.SIUnit	ENUMERATED			5, the code for primary amperes	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	MMXN# GndCur.db		R/W/C
	dbAng	INT32U	CF	MMXN# GndCur.dbAng		R/W/C
	zeroDb	INT32U	CF			R
	angRef	ENUMERATED	CF		See UR product manual regarding FREQUENCY AND PHASE REFERENCE	R
AgndRMS		MV			SRC # Ground Current RMS, in primary amperes	R
	instMag.f	FLOAT32		SRC # Ground Current RMS		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			5, the code for primary amperes	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	MMXN# RMS GndCur DEADBAND		R/W/C
	zeroDb	INT32U	CF			R

Table 3-204: AC signal sources data objects

LNName: ACsrcMSQI#		LDevice inst: Meter		UR element: AC Source #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
SeqA		SEQ			SRC # Sequence Current phasors, in primary amperes	R
	c1	CMV				R
	c1.instCVal.mag.f	FLOAT32		SRC # Positive Sequence Current Magnitude		R
	c1.instCVal.ang.f	FLOAT32		SRC # Positive Sequence Current Angle		R
	c1.cVal.mag.f	FLOAT32				R
	c1.cVal.ang.f	FLOAT32				R
	c1.units.SIUnit	ENUMERATED			5, the code for primary amperes	R

LNName: ACsrcMSQI#		LDevice inst: Meter		UR element: AC Source #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	c1.units .multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	c1.db	INT32U	CF	MSQI# Seq1 Cur.db		R/W/C
	c1.dbAng	INT32U	CF	MSQI# Seq1 Cur.dbAng		R/W/C
	c1.zeroDb	INT32U	CF			R
	c2	CMV				R
	c2.instCVal.mag.f	FLOAT32		SRC # Negative Sequence Current Magnitude		R
	c2.instCVal.ang.f	FLOAT32		SRC # Negative Sequence Current Angle		R
	c2.cVal.mag.f	FLOAT32				R
	c2.cVal.ang.f	FLOAT32				R
	c2.units.SIUnit	ENUMERATED			5, the code for primary amperes	R
	c2.units .multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	c2.db	INT32U	CF	MSQI# Seq2 Cur.db		R/W/C
	c2.dbAng	INT32U	CF	MSQI# Seq2 Cur.dbAng		R/W/C
	c2.zeroDb	INT32U	CF			R
	c3	CMV				R
	c3.instCVal.mag.f	FLOAT32		SRC # Zero Sequence Current Magnitude		R
	c3.instCVal.ang.f	FLOAT32		SRC # Zero Sequence Current Angle		R
	c3.cVal.mag.f	FLOAT32				R
	c3.cVal.ang.f	FLOAT32				R
	c3.units.SIUnit	ENUMERATED			5, the code for primary amperes	R
	c3.units .multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	c3.db	INT32U	CF	MSQI# Seq0 Cur.db		R/W/C
	c3.dbAng	INT32U	CF	MSQI# Seq0 Cur.dbAng		R/W/C
	c3.zeroDb	INT32U	CF			R
	seqT	ENUMERATED	MX		0, the code for pos-neg-zero	R
	phsRef	ENUMERATED	CF		0, the code for phase A	R
SeqV		SEQ			SRC # Sequence Voltage phasors, in primary volts	R
	c1	CMV				R
	c1.instCVal.mag.f	FLOAT32		SRC # Positive Sequence Voltage Magnitude		R
	c1.instCVal.ang.f	FLOAT32		SRC # Positive Sequence Voltage Angle		R
	c1.cVal.mag.f	FLOAT32				R
	c1.cVal.ang.f	FLOAT32				R
	c1.units.SIUnit	ENUMERATED			29, the code for primary volts (W/A)	R
	c1.units .multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	c1.db	INT32U	CF	MSQI# Seq1 V.db		R/W/C
	c1.dbAng	INT32U	CF	MSQI# Seq1 V.dbAng		R/W/C
	c1.zeroDb	INT32U	CF			R
	c2	CMV				R
	c2.instCVal.mag.f	FLOAT32		SRC # Negative Sequence Voltage Magnitude		R

LNName: ACsrcMSQI#		LDevice inst: Meter		UR element: AC Source #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	c2.instCVal.ang.f	FLOAT32		SRC # Negative Sequence Voltage Angle		R
	c2.cVal.mag.f	FLOAT32				R
	c2.cVal.ang.f	FLOAT32				R
	c2.units.SIUnit	ENUMERATED			29, the code for primary volts (W/A)	R
	c2.units .multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	c2.db	INT32U	CF	MSQI# Seq2 V.db		R/W/C
	c2.dbAng	INT32U	CF	MSQI# Seq2 V.dbAng		R/W/C
	c2.zeroDb	INT32U	CF			R
	c3	CMV				R
	c3.instCVal.mag.f	FLOAT32		SRC # Zero Sequence Voltage Magnitude		R
	c3.instCVal.ang.f	FLOAT32		SRC # Zero Sequence Voltage Angle		R
	c3.cVal.mag.f	FLOAT32				R
	c3.cVal.ang.f	FLOAT32				R
	c3.units.SIUnit	ENUMERATED			29, the code for primary volts (W/A)	R
	c3.units .multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	c3.db	INT32U	CF	MSQI# Seq0 V.db		R/W/C
	c3.dbAng	INT32U	CF	MSQI# Seq0 V.dbAng		R/W/C
	c3.zeroDb	INT32U	CF			R
	seqT	ENUMERATED	MX		0, the code for pos-neg-zero	R
	phsRef	ENUMERATED	CF		0, the code for phase A	R

3.5.6.3 B90 AC channel metering (B_Mtr)

This element is instantiated in the following products: B90.

Table 3-205: B90 AC channel metering current input data objects

LNName: B_AmpMMXN#		LDevice inst: Meter		UR element: B90 Metering for current input ϕ		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
ChA		CMV			ϕ current in primary amps	R
	instCVal.mag.f	FLOAT32		ϕ CURRENT magnitude		R
	instCVal.ang.f	FLOAT32		ϕ CURRENT a		R
	cVal.mag.f	FLOAT32				R
	cVal.ang.f	FLOAT32				R
	units.SIUnit	ENUMERATED			5, the code for primary amperes	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	B_AmpMMXNϕ.ChA.db		R/W/C
	dbAng	INT32U	CF	B_AmpMMXNϕ.ChA.dbAng		R/W/C
	zeroDb	INT32U	CF			R

Table 3-206: B90 AC channel metering voltage input data objects

LNName: B_VolMMXN#		LDevice inst: Meter		UR element: B90 Metering for voltage input ϕ		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
ChV		CMV			ϕ voltage in primary volts	R
	instCVal.mag.f	FLOAT32		ϕ VOLTAGE magnitude		R

LNName: B_VolMMXN#		**LDevice inst: Meter**		**UR element: B90 Metering for voltage input ϕ**		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	instCVal.ang.f	FLOAT32		ϕ VOLTAGE a		R
	cVal.mag.f	FLOAT32				R
	cVal.ang.f	FLOAT32				R
	units.SIUnit	ENUMERATED			29, the code for primary volts (W/A)	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	B_VolMMXNϕ.ChV.db		R/W/C
	dbAng	INT32U	CF	B_VolMMXNϕ.ChV.dbAng		R/W/C
	zeroDb	INT32U	CF	(VOLTAGE CUT-OFF LEVEL) / 275 * 100 000		R

Table 3-207: B90 AC channel metering frequency data objects

LNName: B_FrqMMXN1		**LDevice inst: Meter**		**UR element: B90 Metering for frequency**		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
ActHzRef Mn		SPS			Active Freq Ref is Main	R
	stVal	BOOLEAN	ST	Active Freq Ref=Main		R
Hz		MV			Frequency in Hz	R
	instMag.f	FLOAT32		FREQUENCY		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			33, the code for hertz (1/s)	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	B_FrqMMXN1.Hz.db		R/W/C
	zeroDb	INT32U	CF			R
TrcHz		MV			Tracking Frequency in Hz	R
	instMag.f	FLOAT32		TRACKING FREQUENCY		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			33, the code for hertz (1/s)	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	B_FrqMMXN1.TrcHz.db		R/W/C
	zeroDb	INT32U	CF			R
MainRefHz		MV			Main Ref Frequency in Hz	R
	instMag.f	FLOAT32		MAIN REF FREQUENCY		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			33, the code for hertz (1/s)	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	B_FrqMMXN1.MainRefHz.db		R/W/C
	zeroDb	INT32U	CF			R
AltRefHz		MV			Alt Ref Frequency in Hz	R
	instMag.f	FLOAT32		ALT REF FREQUENCY		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			33, the code for hertz (1/s)	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	B_FrqMMXN1.AltRefHz.db		R/W/C
	zeroDb	INT32U	CF			R
ActHzPhR ef		ENS			Active Freq and PHS Ref actual value	R
	stVal	BOOLEAN	ST	Active Freq Ref=Main		R

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3.5.6.4 Demand metering (DmdMtr)

This element is instantiated in the following products: B30, C60, C95, D60, F35, F60, G60, L60, L90, N60, T60.

Table 3-208: Demand metering data objects

LNName: DmdMtrMMTR#		LDevice inst: Meter		UR element: Signal Source # NAME Demand Metering		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
ClcExp		SPS			Status information to indicate the calculation period has expired	R
	stVal	BOOLEAN	ST	TRUE | FALSE		R
ClcMth		ENG			Calculation method of statistical data objects	R
	setVal	ENUMERATED	SP	UNSPECIFIED		R
InSyn		ORG			Only instantiated in DmdMtrMMTR1	R
	setSrcRef	ObjectReference	SP	DEMAND TRIGGER	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
RsStat		SPC			Only instantiated in DmdMtrMMTR1. Clears demand for all sources.	R/Ctrl
	pulseConfig .cmdQual	ENUMERATED				R
	pulseConfig.onDur	INT32U			0 indicates the duration is locally defined	R
	pulseConfig .offDur	INT32U				R
	pulseConfig .numPls	INT32U				R
	ctlModel	CtlModels	CF	DmdMtrMMTR1.RsStat.ctlModel		R/C
	sboTimeout	INT32U	CF			R
	sboClass	SboClasses	CF			R
	operTimeout	INT32U	CF			R
AaDmd		MV			SRC # DMD IA, in primary amperes	R
	instMag.f	FLOAT32		SRC # DMD IA		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			5, the code for primary amperes	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	DmdMtrMMTR#.AaDmd.db		R/W/C
	zeroDb	INT32U	CF			R
AaMaxDmdDt		MV			SRC # DMD IA MAX, in primary amperes with associated date, SRC # DMD IA DATE	R
	mag.f	FLOAT32		SRC # DMD IA MAX		R
	units.SIUnit	ENUMERATED			5, the code for primary amperes	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
AbDmd		MV			SRC # DMD IB, in primary amperes	R
	instMag.f	FLOAT32		SRC # DMD IB		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			5, the code for primary amperes	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	DmdMtrMMTR#.AbDmd.db		R/W/C
	zeroDb	INT32U	CF			R
AbMaxDmdDt		MV			SRC # DMD IB MAX, in primary amperes with associated date, SRC # DMD IB DATE	R
	mag.f	FLOAT32		SRC # DMD IB MAX		R
	units.SIUnit	ENUMERATED			5, the code for primary amperes	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
AcDmd		MV			SRC # DMD IC, in primary amperes	R

LNName: DmdMtrMMTR#		LDevice inst: Meter		UR element: Signal Source # NAME Demand Metering		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	instMag.f	FLOAT32		SRC # DMD IC		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			5, the code for primary amperes	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	DmdMtrMMTR#.AcDmd.db		R/W/C
	zeroDb	INT32U	CF			R
AcMaxDmdDt		MV			SRC # DMD IC MAX, in primary amperes with associated date, SRC # DMD IC DATE	R
	mag.f	FLOAT32		SRC # DMD IC MAX		R
	units.SIUnit	ENUMERATED			5, the code for primary amperes	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
WDmd		MV			SRC # DMD W, in primary watt	R
	instMag.f	FLOAT32		SRC # DMD W		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			38 is unit for power in watts	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	DmdMtrMMTR#.WDmd.db		R/W/C
	zeroDb	INT32U	CF			R
WMaxDmdDt		MV			SRC # DMD W, in primary watt, with associated date, SRC # DMD W DATE	R
	mag.f	FLOAT32		SRC # DMD W MAX		R
	units.SIUnit	ENUMERATED			38 is unit for power in watts	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
VArDmd		MV			SRC # DMD VAR, in primary volt ampere reactive	R
	instMag.f	FLOAT32		SRC # DMD VAR		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			63 is unit for apparent power in volt-ampere	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	DmdMtrMMTR#.VArDmd.db		R/W/C
	zeroDb	INT32U	CF			R
VArMaxDmdDt		MV			SRC # DMD VAR, in primary volt ampere reactive, with associated date, SRC # DMD VAR DATE	R
	mag.f	FLOAT32		SRC # DMD VAR MAX		R
	units.SIUnit	ENUMERATED			63 is unit for apparent power in volt-ampere	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
VADmd		MV			SRC # DMD VA, in primary volt ampere	R
	instMag.f	FLOAT32		SRC # DMD VA		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			61 is unit for apparent power in volt-ampere	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	DmdMtrMMTR#.VADmd.db		R/W/C
	zeroDb	INT32U	CF			R
VAMaxDmdDt		MV			SRC # DMD VA, in primary volt ampere, with associated date, SRC # DMD VA DATE	R
	mag.f	FLOAT32		SRC # DMD VA MAX		R

LNName: DmdMtrMMTR#		LDevice inst: Meter		UR element: Signal Source # NAME Demand Metering		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	units.SIUnit	ENUMERATED			61 is unit for apparent power in volt-ampere	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R

3.5.6.5 Energy metering (EnrMtr)

This element is instantiated in the following products: C60, C95, D60, F35, F60, G30, G60, L90, M60, N60, T60.

Table 3-209: Energy metering data objects

LNName: EnrMtrMMTR#		LDevice inst: Meter		UR element: Signal Source # Energy Metering		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
PosTotWh		MV			SRC # Total Watt-hour in positive direction	R
	instMag.f	FLOAT32		SRC # POS WATTHOUR		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			72, the code for real energy in watt hours (Wh)	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	EnrMtrMMTR#.PosTotWh.db		R/W/C
NegTotWh		MV			SRC # Total Watt-hour in negative direction	R
	instMag.f	FLOAT32		SRC # NEG WATTHOUR		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			72, the code for real energy in watt hours (Wh)	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	EnrMtrMMTR#.NegTotWh.db		R/W/C
PosTotVArh		MV			SRC # Total VAr-hour in positive direction	R
	instMag.f	FLOAT32		SRC # T POS VARHOUR		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			73, the code for reactive energy in volt ampere hours (VArh)	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	EnrMtrMMTR#.PosTotVArh.db		R/W/C
NegTotVArh		MV			SRC # Total VAr-hour in negative direction	R
	instMag.f	FLOAT32		SRC # NEG VARHOUR		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			73, the code for reactive energy in volt ampere hours (VArh)	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	EnrMtrMMTR#.NegTotVArh.db		R/W/C
RsStat		SPC			only instantiated in EnrMtrMMTR1	R/Ctrl
	pulseConfig .cmdQual	ENUMERATED				R
	pulseConfig.onDur	INT32U			0 indicates the duration is locally defined	R
	pulseConfig .offDur	INT32U				R
	pulseConfig .numPls	INT32U				R

LNName: EnrMtrMMTR#		LDevice inst: Meter		UR element: Signal Source # Energy Metering		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	ctlModel	CtlModels	CF	EnrMtrMMTR1.RsStat.ctlModel	1, the code for direct control with normal security; 2 is code for SBO with normal security.	R/W/C
	sboTimeout	INT32U	CF			R
	sboClass	SboClasses	CF			R
	operTimeout	INT32U	CF			R
InRef1		ORG			CLEAR ENERGY setting.	R
	setSrcRef	ObjectReference	SP	setting reference to clear Energy, which shows the receiving of dynamically clearing signal for energy calculation	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.6.6 Harmonics and THD metering (HThd)

There is a single IMD for Source Current THD and Harmonics Metering, Source Voltage Harmonics and THD Metering, and Source Current THD.

This element is instantiated in the following products: C60, C70, C95, D30, F35, F60, G30, G60, L30, L60, N60, T35, T60.

Table 3-210: Harmonics and THD metering data objects

LNName: HThdMHAI#		LDevice inst: Meter		UR element: Harmonics and THD metering		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Hz		MV			SRC # Frequency, in Hz	R
	instMag.f	FLOAT32		SRC # Frequency		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			33, the code for hertz (1/s)	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	HThdMHAI#.Hz.db		R/W/C
	zeroDb	INT32U	CF			R
ThdA		WYE			Instantiated only in products that measure THD current	R
	phsθ	CMV				R
	phsθ.instCVal.mag .f	FLOAT32		SRC # THD Iф magnitude		R
	phsθ.cVal.mag.f	FLOAT32		SRC # THD Iф magnitude, with dead band		R
	phsθ.units.SIUnit	ENUMERATED			1, the code for dimensionless (percentage)	R
	phsθ.units .multiplier	ENUMERATED		-2		R
	phsθ.db	INT32U	CF	HThdMHAI#.ThdA.phsθ.db		R/W/C
	phsθ.zeroDb	INT32U	CF			R
	neut	CMV				R
	neut.instCVal.mag .f	FLOAT32		SRC # Neutral THD magnitude		R
	neut.cVal.mag.f	FLOAT32		SRC # Neutral THD magnitude, with dead band		R
	neut.units.SIUnit	ENUMERATED			1, the code for dimensionless (percentage)	R
	neut.units .multiplier	ENUMERATED		-2		R

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LNName: HThdMHAI#		LDevice inst: Meter		UR element: Harmonics and THD metering		
data obj.	data attribute	Type	FC	UR Name	Description	R/W/C
	neut.db	INT32U	CF	HThdMHAI#.ThdA.neut.db		R/W/C
	neut.zeroDb	INT32U	CF			R
HA		HWYE			Instantiated only in products that measure current harmonics	R
	phsθHar(0)	CMV				R
	phsθHar(0) .instCVal.mag.f	FLOAT32				R
	phsθHar(0).cVal .mag.f	FLOAT32				R
	phsθHar(0).units .SIUnit	ENUMERATED			1, the code for dimensionless (percentage)	R
	phsθHar(0).units .multiplier	ENUMERATED		-2		R
	phsθHar(0).db	INT32U	CF			R
	phsθHar(0).zeroD b	INT32U	CF			R
	phsθHar(1)	CMV				R
	phsθHar(1) .instCVal.mag.f	FLOAT32				R
	phsθHar(1).cVal .mag.f	FLOAT32				R
	phsθHar(1).units .SIUnit	ENUMERATED			1, the code for dimensionless (percentage)	R
	phsθHar(1).units .multiplier	ENUMERATED		-2		R
	phsθHar(1).db	INT32U	CF			R
	phsθHar(1).zeroD b	INT32U	CF			R
	phsθHar(n)	CMV				R
	phsθHar(n) .instCVal.mag.f	FLOAT32		SRC # nτ Iф		R
	phsθHar(n).cVal .mag.f	FLOAT32		SRC # nτ Iф magnitude, with dead band		R
	phsθHar(n).units .SIUnit	ENUMERATED			1, the code for dimensionless (percentage)	R
	phsθHar(n).units .multiplier	ENUMERATED		-2		R
	phsθHar(n).db	INT32U	CF	HThdMHAI#.HA.phsθHar(n).db		R/W/C
	phsθHar(n).zeroD b	INT32U	CF			R
	numHar	INT16U	CF			R
	numCyc	INT16U	CF			R
	evalTm	INT16U	CF	(1/ NOMINAL FREQUENCY) * 1000		R
	frequency	FLOAT32	CF	NOMINAL FREQUENCY		R
	rmsCyc	INT16U	CF			R
ThdPhV		WYE			Instantiated only in products that measure THD voltage	R
	phsθ	CMV				R
	phsθ.instCVal.ma g .f	FLOAT32		SRC # THD Vф magnitude		R
	phsθ.cVal.mag.f	FLOAT32		SRC # THD Vф magnitude, with dead band		R

LNName: HThdMHAI#		LDevice inst: Meter		UR element: Harmonics and THD metering		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	phsθ.units.SIUnit	ENUMERATED			1, the code for dimensionless (percentage)	R
	phsθ.units .multiplier	ENUMERATED		-2		R
	phsθ.db	INT32U	CF	HThdMHAI#.ThdPhV.phsθ.db		R/W/C
	phsθ.zeroDb	INT32U	CF			R
HPhV		HWYE			Instantiated only in products that measure voltage harmonics	R
	phsθHar(0)	CMV				R
	phsθHar(0) .instCVal.mag.f	FLOAT32				R
	phsθHar(0).cVal .mag.f	FLOAT32				R
	phsθHar(0).units .SIUnit	ENUMERATED			1, the code for dimensionless (percentage)	R
	phsθHar(0).units .multiplier	ENUMERATED		-2		R
	phsθHar(0).db	INT32U	CF			R
	phsθHar(0).zeroD b	INT32U	CF			R
	phsθHar(1)	CMV				R
	phsθHar(1) .instCVal.mag.f	FLOAT32				R
	phsθHar(1).cVal .mag.f	FLOAT32				R
	phsθHar(1).units .SIUnit	ENUMERATED			1, the code for dimensionless (percentage)	R
	phsθHar(1).units .multiplier	ENUMERATED		-2		R
	phsθHar(1).db	INT32U	CF			R
	phsθHar(1).zeroD b	INT32U	CF			R
	phsθHar(n)	CMV				R
	phsθHar(n) .instCVal.mag.f	FLOAT32		SRC # nτ Vϕ		R
	phsθHar(n).cVal .mag.f	FLOAT32		SRC # nτ Vϕ magnitude, with dead band		R
	phsθHar(n).units .SIUnit	ENUMERATED			1, the code for dimensionless (percentage)	R
	phsθHar(n).units .multiplier	ENUMERATED		-2		R
	phsθHar(n).db	INT32U	CF	HThdMHAI#.HPhV.phsθHar(n).db		R/W/C
	phsθHar(n).zeroD b	INT32U	CF			R
	numHar	INT16U	CF			R
	evalTm	INT16U	CF	(1/ NOMINAL FREQUENCY) * 1000		R
	frequency	FLOAT32	CF	NOMINAL FREQUENCY		R
	rmsCyc	INT16U	CF			R

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3.5.7 General (Gen) logical device

The Gen logical device contains logical nodes that model UR FlexLogic, Virtual Outputs, non-volatile latches, FlexElements, and recording (for example, oscillography) functions.

3.5.7.1 Logical node zero (LLN0)

This element is instantiated in all UR devices implementing the Gen logical device.

Table 3-211: LLN0 data objects

LNName: LLN0		**LDevice inst: Gen**		**UR element: Nameplate information for the logical nodes**		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Beh		ENS			This logical device's behavior	R
	stVal	ENUMERATED	ST			R
	stVal	ENUMERATED	ST	LLN0.Beh.stVal of the Master logical device		R
GrRef		ORG			Reference to root logical device	R
	setSrcRef	ObjectReference	SP	For communications, mapped to Master ldName if not empty, otherwise to the concatenation of the IED name and "Master". For SCL, mapped to the concatenation of the IED name and "Master".	reference to the data attribute to input	R

3.5.7.2 8-bit comparator (Cmp8Bt)

This element is instantiated in the following products: N60.

Table 3-212: 8-bit comparator data objects

LNName: Cmp8BtGAPC#		**LDevice inst: Gen**		**UR element: 8-Bit Comparator #**		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			8BIT COMP # PKP operand	R
	general	BOOLEAN	ST	8BIT COMP # PKP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown.	R
Op		ACT			8BIT COMP # OP operand	R
	general	BOOLEAN	ST	8BIT COMP # OP		R
Dpo		SPS			8BIT COMP # DPO operand	R
	stVal	BOOLEAN	ST	8BIT COMP # DPO		R
IndΘ		SPS			8BIT COMP # BIT Θ-1 operand value	R
	stVal	BOOLEAN	ST	8BIT COMP # BIT Θ-1		R
AnOutput 1		MV			8BIT COMP # A value	R
	instMag	AnalogueValue	MX			R
	instMag.f	FLOAT32				R
	mag	AnalogueValue	MX			R
	mag.f	FLOAT32				R
	db	INT32U	CF	Cmp8BtGAPC#.AnIn1.db		R/W/C
	zeroDb	INT32U	CF			R
AnOutput 2		MV			8BIT COMP # B value	R
	instMag	AnalogueValue	MX			R
	instMag.f	FLOAT32				R
	mag	AnalogueValue	MX			R
	mag.f	FLOAT32				R

LNName: Cmp8BtGAPC#		LDevice inst: Gen		UR element: 8-Bit Comparator #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	db	INT32U	CF	Cmp8BtGAPC#.AnIn2.db		R/W/C
	zeroDb	INT32U	CF			R
AnOutput 3		MV			8BIT COMP # Out value	R
	instMag	AnalogueValue	MX			R
	instMag.f	FLOAT32				R
	mag	AnalogueValue	MX			R
	mag.f	FLOAT32				R
	db	INT32U	CF	Cmp8BtGAPC#.AnIn3.db		R/W/C
	zeroDb	INT32U	CF			R
InRef1Θ		ORG			8BIT COMP # ARG AΘ setting.	R
	setSrcRef	ObjectReference	SP	8BIT 8BIT COMP # ARG AΘ setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef2Θ		ORG			8BIT COMP # ARG BΘ setting.	R
	setSrcRef	ObjectReference	SP	8BIT 8BIT COMP # ARG BΘ setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef01		ORG			8BIT COMP # ADD/SUB setting.	R
	setSrcRef	ObjectReference	SP	8BIT COMP # ADD/SUB setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
BlkRef1		ORG			8BIT COMP # BLOCK setting	R
	setSrcRef	ObjectReference	SP	8BIT COMP # BLOCK	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.7.3 Annunciator (Anctr)

This element is instantiated in the following products: B30, B90, C30, C60, C70, C95, D30, D60, F35, F60, G30, G60, L30, L60, L90, M60, N60, T35, T60.

Table 3-213: Annunciator data objects

LNName: AnctrCALH1		LDevice inst: Gen		UR element: Annunciator		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
GrInd		SPS			ANY ANCTR ABNORMAL operand value	R
	stVal	BOOLEAN	ST	ANY ANCTR ABNORMAL		R
RsOpRem		SPS			ANY ANCTR ALARMED operand value	R
	stVal	BOOLEAN	ST	ANY ANCTR ALARMED		R
InRef1		ORG			RESET ANNUNCIATOR setting.	R
	setSrcRef	ObjectReference	SP	Operate setting of RESET ANNUNCIATOR	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef1ψ		ORG			Alarm Input setting of Annunciator window ψ	R
	setSrcRef	ObjectReference	SP	Operate setting “Alarm Input” of Annunciator window ψ	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.7.4 Control pushbuttons (CtlPsh)

This element is instantiated in the following products: B30, B90, C30, C60, C70, C95, D30, D60, F35, F60, G30, G60, L30, L60, L90, M60, N60, T35, T60.

Table 3-214: Control pushbutton data objects

LNName: CtlPshIHMI#		LDevice inst: Gen		UR element: CONTROL PUSH BUTTON # function		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Activated		SPS			CONTROL PUSH BUTTON # ON operand.	R
	stVal	BOOLEAN	ST	CONTROL PUSHBTN # ON		R

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3.5.7.5 Current differential 87L composite voltage (VComp)

This element is instantiated in the following products: L90.

Table 3-215: Current differential composite voltage data objects

LNName: VCompMMXU1		LDevice inst: Gen		UR element: Current Differential Composite Voltage element		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
VolLoc		CMV			Local Vcomp phasor, in primary volts	R
	instCVal.mag.f	FLOAT32		Local Vcomp Mag		R
	instCVal.ang.f	FLOAT32		Local Vcomp Ang		R
	cVal.mag.f	FLOAT32				R
	cVal.ang.f	FLOAT32				R
	units.SIUnit	ENUMERATED			29, the code for primary volts	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	VCompMMXU1.VolLoc.db		R/W/C
	dbAng	INT32U	CF	VCompMMXU1.VolLoc.dbAng		R/W/C
	zeroDb	INT32U	CF			R
VolRem1		CMV			Term 1 Vcomp phasor, in primary volts	R
	instCVal.mag.f	FLOAT32		Term 1 Vcomp Mag		R
	instCVal.ang.f	FLOAT32		Term 1 Vcomp Ang		R
	cVal.mag.f	FLOAT32				R
	cVal.ang.f	FLOAT32				R
	units.SIUnit	ENUMERATED			29, the code for primary volts	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	VCompMMXU1.VolRem1.db		R/W/C
	dbAng	INT32U	CF	VCompMMXU1.VolRem1.dbAng		R/W/C
	zeroDb	INT32U	CF			R
VolRem2		CMV			Term 2 Vcomp phasor, in primary volts	R
	instCVal.mag.f	FLOAT32		Term 2 Vcomp Mag		R
	instCVal.ang.f	FLOAT32		Term 2 Vcomp Ang		R
	cVal.mag.f	FLOAT32				R
	cVal.ang.f	FLOAT32				R
	units.SIUnit	ENUMERATED			29, the code for primary volts	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	VCompMMXU1.VolRem2.db		R/W/C
	dbAng	INT32U	CF	VCompMMXU1.VolRem2.dbAng		R/W/C
	zeroDb	INT32U	CF			R

3.5.7.6 Data logger (DatLog)

This element is instantiated in the following products: B30, C30, C60, C70, C95, D30, D60, F35, F60, G30, G60, L30, L60, L90, M60, N60, T35, T60.

Table 3-216: Data logger data objects

LNName: DatLogRDRE1		LDevice inst: Gen		UR element: Data Logger		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
FltNum		INS			Fault number	R
	stVal	INT32	ST			R
RcdMade		SPS			Recording started, timestamp mapped to NEWEST SAMPLE TIME actual	R
	stVal	BOOLEAN	ST	Transitions to true whenever a new sample is recorded, cleared to false when recorder is cleared.		R
MemClr		SPC			Clear all data logger records command	R/Ctrl
	pulseConfig	PulseConfig	CF			R
	pulseConfig .cmdQual	ENUMERATED				R
	pulseConfig.onDur	INT32U			2 ms (actually one pass)	R
	pulseConfig .offDur	INT32U				R
	pulseConfig .numPls	INT32U				R
	ctlModel	CtlModels	CF	DatLogRDRE1.MemClr.ctlModel		R/W/C
	sboTimeout	INT32U	CF			R
	sboClass	SboClasses	CF			R
	operTimeout	INT32U	CF			R
InRef1		ORG			DATA LOGGER TRIGGER setting.	R
	setSrcRef	ObjectReference	SP	DATA LOGGER TRIGGER setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.7.7 Digital counters (DigCnt)

This element is instantiated in the following products: B30, C30, C60, C70, C95, D30, D60, F35, F60, G30, G60, L30, L60, L90, M60, N60, T35, T60.

Table 3-217: Digital counter data objects

LNName: DigCntFCNT#		LDevice inst: Gen		UR element: Digital Counters #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
HiLim		SPS			Counter #(CNT#) HI, which indicates the number of pulses counted is above the set number.	R
	stVal	BOOLEAN	ST	Counter #(CNT#) HI		R
EqLim		SPS			Counter #(CNT#) EQL operand, which indicates the number of pulses counted is equal to the set number	R
	stVal	BOOLEAN	ST	Counter #(CNT#) EQL		R
LoLim		SPS			Counter #(CNT#) LO operand, which indicates the number of pulses counted is below the set number.	R
	stVal	BOOLEAN	ST	Counter #(CNT#) LO		R
CntVal		BCR			Counter # ACCUM, which indicates the accumulated number of pulses	R

LNName: DigCntFCNT#		**LDevice inst: Gen**		**UR element: Digital Counters #**		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	actVal	INT64	ST	actual value of Counter # ACCUM		R
	frVal	INT64	ST	actual value of Counter # FROZEN (count)		R
	frTm	TimeStamp	ST	actual value of Counter # FROZEN (date/time) combined with Counter # MICROS (fractional seconds)		R
	units.SIUnit	ENUMERATED		COUNTER # UNITS		R
	units.multiplier	ENUMERATED		COUNTER # UNITS		R
	pulsQty	FLOAT32	CF			R
	frEna	BOOLEAN	CF			R
	strTm	TimeStamp	CF			R
	frPd	INT32	CF			R
	frRs	BOOLEAN	CF			R
InRef1		ORG			COUNTER # UP setting.	R
	setSrcRef	ObjectReference	SP	COUNTER # UP setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef2		ORG			COUNTER # DOWN setting.	R
	setSrcRef	ObjectReference	SP	COUNTER # DOWN setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef3		ORG			CNT# SET TO PRESET setting.	R
	setSrcRef	ObjectReference	SP	CNT# SET TO PRESET setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef4		ORG			COUNTER # RESET setting.	R
	setSrcRef	ObjectReference	SP	COUNTER # RESET setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef5		ORG			COUNTER # FREEZE/RESET setting.	R
	setSrcRef	ObjectReference	SP	COUNTER # FREEZE/RESET setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef6		ORG			COUNTER # FREEZE/COUNT setting.	R
	setSrcRef	ObjectReference	SP	COUNTER # FREEZE/COUNT setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
BlkRef1		ORG			COUNTER # BLOCK setting.	R
	setSrcRef	ObjectReference	SP	COUNTER # BLOCK setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.7.8 Digital elements (DigEl)

This element is instantiated all UR products.

Table 3-218: Digital element data objects

LNName: DigElGAPC#		**LDevice inst: Gen**		**UR element: Digital Element #**		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			Dig Element # PKP operand, which indicates Op will operate when delay expires.	R
	general	BOOLEAN	ST	Dig Element #(DE#) PKP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown	R

LNName: DigElGAPC#		LDevice inst: Gen		UR element: Digital Element #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Op		ACT			Dig Element # OP operand, which becomes On when the input is On, and the element is not blocked	R
	general	BOOLEAN	ST	Dig Element #(DE#) OP		R
Dpo		SPS			Dig Element # DPO operand, which indicates the element will drop out (Reset) when delay expires.	R
	stVal	BOOLEAN	ST	Dig Element #(DE#) DPO		R
InRef1		ORG			DIG ELEM #INPUT setting.	R
	setSrcRef	ObjectReference	SP	DIG ELEM #INPUT setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
BlkRef1		ORG			DIG ELEM # BLOCK setting.	R
	setSrcRef	ObjectReference	SP	DIG ELEM # BLOCK.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

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3.5.7.9 FlexElement element (FlxEl)

This element is instantiated in the following products: B30, C30, C60, C70, C95, D30, D60, F35, F60, G30, G60, L30, L60, L90, M60, N60, T35, T60.

Table 3-219: FlexElement data objects

LNName: FlxElGAPC#		LDevice inst: Gen		UR element: FlexElement element #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			FxE # PKP operand, which becomes On when this element has picked up.	R
	general	BOOLEAN	ST	FxE # PKP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown	R
Op		ACT			FxE # OP operand	R
	general	BOOLEAN	ST	FxE # OP		R
Dpo		SPS			FxE # DPO operand, which is the inverse of FxE PKP	R
	stVal	BOOLEAN	ST	FxE # DPO		R
OpSig		MV			FLEXELEMENT # OpSig, in per unit	R
	instMag.f	FLOAT32		FLEXELEMENT # OpSig		R
	mag.f	FLAOT32		FLEXELEMENT # OpSig on deadband exception		R
	units.SIUnit	ENUMERATED			1, the code for dimensionless (per unit)	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	FlxElGAPC#.OpSig.db		R/W/C
	zeroDb	INT32U	CF			R
BlkRef1		ORG			FLEXELEMENT # BLOCK setting.	R
	setSrcRef	ObjectReference	SP	FLEXELEMENT # BLOCK.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef1		ORG			FLEXELEMENT # +IN setting.	R
	setSrcRef	ObjectReference	SP	FLEXELEMENT # +IN	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef2		ORG			FLEXELEMENT # IN setting.	R
	setSrcRef	ObjectReference	SP	FLEXELEMENT # IN	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

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3.5.7.10 FlexLogic, FlexLogic timers, and virtual outputs (FlxLgc)

This element is instantiated all UR products.

Table 3-220: FlexLogic data objects

LNName: FlxLgcGAPC1		LDevice inst: Gen		UR element: FlexLogic		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Indξξξ		SPS			Virt Op ξ On (VOξξ) operand value	R
	stVal	BOOLEAN	ST	VOξξ On		R

3.5.7.11 Graphical front panel (GFPhp)

This element is instantiated all UR products.

Table 3-221: Graphical front panel data objects

LNName: GFPhpIHMI1		LDevice inst: Gen		UR element: Graphical Front Panel		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
InRef1		ORG			ENABLE CONTROLS FROM GFP setting.	R
	setSrcRef	ObjectReference	SP	“Enable Controls From GFP” setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
GFPCnt		SPS			ENABLE CTRL FROM GFP operand	R
	stVal	BOOLEAN	ST	“ENABLE CTRL FROM GFP” operand		R

3.5.7.12 Non-volatile latches (NVLat)

This element is instantiated in all UR products.

Table 3-222: Non-volatile latch data objects

LNName: NVLatGAPC#		LDevice inst: Gen		UR element: Non-Volatile Latches element #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Ind1		SPS			LATCH # ON operand value	R
	stVal	BOOLEAN	ST	LATCH # ON		R
Ind2		SPS			”LATCH # OFF operand value	R
	stVal	BOOLEAN	ST	LATCH # OFF		R
InRef1		ORG			Non-Volatile Latch LATCH # SET setting.	R
	setSrcRef	ObjectReference	SP	Non-Volatile Latch SET setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef2		ORG			Non-Volatile Latch LATCH # RESET setting.	R
	setSrcRef	ObjectReference	SP	Non-Volatile Latch RESET setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.7.13 Oscillography (Osc)

This element is instantiated in all UR products.

Table 3-223: Oscillography data objects

LNName: OscRDRE1		LDevice inst: Gen		UR element: Oscillography, core logical node		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
RcdMade		SPS			Records are available	R

LNName: OscRDRE1		LDevice inst: Gen		UR element: Oscillography, core logical node		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	stVal	BOOLEAN	ST			R
FltNum		INS			NUMBER OF TRIGGERS actual value	R
	stVal	INT32	ST	NUMBER OF TRIGGERS actual value		R
	units.SIUnit	ENUMERATED			1, the code for dimensionless	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
NumRcd		INS			AVAILABLE RECORDS actual value	R
	stVal	INT32	ST	actual value AVAILABLE RECORDS		R
	units.SIUnit	ENUMERATED			1, the code for dimensionless	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
NumCycPer		INS			CYCLES PER RECORD actual value	R
	stVal	INT32	ST	actual value CYCLES PER RECORD		R
	units.SIUnit	ENUMERATED			1, the code for dimensionless	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
RsTms		INS			LAST CLEARED DATE actual value	R
	stVal	INT32	ST	actual value LAST CLEARED DATE		R
	units.SIUnit	ENUMERATED			4, the code for time	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
RcdTrg		SPC			External command to trigger recorder	R/Ctrl
	pulseConfig.cmdQual	ENUMERATED				R
	pulseConfig.onDur	INT32U			2 ms (actually one pass)	R
	pulseConfig.offDur	INT32U				R
	pulseConfig.numPls	INT32U				R
	ctlModel	CtlModels	CF	OscRDRE1.RcdTrg.ctlModel		R/C
	sboTimeout	INT32U	CF			R
	sboClass	SboClasses	CF			R
	operTimeout	INT32U	CF			R
MemClr		SPC			Clear all oscillography records command	R/Ctrl
	pulseConfig.cmdQual	ENUMERATED				R
	pulseConfig.onDur	INT32U			2 ms (actually one pass)	R
	pulseConfig.offDur	INT32U				R
	pulseConfig.numPls	INT32U				R
	ctlModel	CtlModels	CF	OscRDRE1.MemClr.ctlModel		R/W/C
	sboTimeout	INT32U	CF			R
	sboClass	SboClasses	CF			R
	operTimeout	INT32U	CF			R

3.5.7.14 Real time clock (TmClk)

This element is instantiated in all UR products.

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Table 3-224: Real-time clock data objects

LNName: TmClkLTMS1		LDevice inst: Gen		UR element: REAL TIME CLOCK feature except LOCAL TIME		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
TmAcc		INS			ACCURACY in number of significant bits in the Fraction Of Second	R
	stVal	INT32	ST			R
TmSrc		VSS			RTC Sync Source	R
	stVal	VISIBLE STRING255	SP	Dotted decimal IP address of the time source		R
TmChSt1		SPS			Time channel status	R
	stVal	BOOLEAN	ST	logical OR of SNTP, PTP or IRIG-B time synchronization status.		R
TmSynSrc		ENS			RTC Sync Source actual value indicates time synchronizing source the device is using at present	R
	stVal	ENUMERATED	ST	Actual Value: RTC Sync Source.		R
PTPChSt$		SPS			Instantiated only if the order code includes PTP	R
	stVal	BOOLEAN	ST			R
GrdMaster ID		VSS			Instantiated only if the order code includes PTP	R
	stVal	VISIBLE STRING 255	ST	GrandMaster ID		R
TmnsDelta		MV			Instantiated only if the order code includes PTP	R
	instMag.f	FLOAT32		PTP-IRIG-B Delta		R
	mag.f	FLOAT32		instMag.f on deadband exception		R
	units.SIUnit	ENUMERATED			4, the code for Time (Sec)	
	units.multiplier	ENUMERATED			-9, the code for a multiplier of 10-9	
	db	INT32	CF	TmClkLTMS1.TmnsDelta.db		R/W/C
	zeroDb	INT32	CF		0	R

3.5.7.15 Security (Sec)

This element is instantiated in all UR products.

Table 3-225: Security data objects

LNName: SecGSAL1		LDevice inst: Gen		UR element: UR Basic Security element		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
AuthFail		SEC			Number of authorization failures: an association to the client could not be established due to an authorization failure (fixed at 0)	R
	cnt	INT32U	ST		0	R
	sev	ENUMERATED	ST		2=major	R
AcsCtlFail		SEC			Counter for Access control failures detection (fixed at 0)	R
	cnt	INT32U	ST		0	R
	sev	ENUMERATED	ST		0=Unknown	R
SvcViol		SEC			Counter for Service Violations	R

LNName: SecGSAL1		LDevice inst: Gen		UR element: UR Basic Security element		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	cnt	INT32U	ST	a new counter which increments by 1, every time the data object that the client wanted to access exists, but the requested service is not allowed		R
	sev	ENUMERATED	ST		3 = Minor	R
Ina		SEC			Counter for number of associations terminated due to inactivity	R
	cnt	INT32U	ST	New counter that counts number of associations terminated due to inactivity		R
	sev	ENUMERATED	ST		0=Unknown	R
SecDataClr		SPC			Instantiated only if the order code includes cyber security	R/Ctrl
	pulseConfig .cmdQual	ENUMERATED			0 (pulse)	
	pulseConfig.onDur	INT32U			0 indicated the duration is locally defined	
	pulseConfig .offDur	INT32U			0	
	pulseConfig .numPls	INT32U			1	
	ctlModel	CtlModels	CF	a new setting SecGSAL1.SecDataClr.ctlModel default value 1, range 1...2	1, the code for direct control with normal security; 2 is code for SBO with normal security.	R/W/C
	sboTimeout	INT32U	CF		30000	R
	sboClass	SboClasses	CF		0 (operate-once)	R
	operTimeout	INT32U	CF		0	R
OpCntRs		INC			Data object to clear all 5 security violation counters	R/Ctrl
	stVal	INT32	ST	Sum of AuthFail + AcsCtlFail + SvcViol + Ina		R
	ctlModel	CtlModels	CF	a new setting SecGSAL1.OpCntRs ctlModel default value 1, range 1...2	1, the code for direct control with normal security; 2 is code for SBO with normal security.	R/W/C
	sboTimeout	INT32U	CF		30000	R
	sboClass	SboClasses	CF		0 (operate-once)	R
	operTimeout	INT32U	CF		0	R
LocSetAcsOff		SPS			ACCESS LOC STG OFF operand	R
	stVal	BOOLEAN	ST	ACCESS LOC STG OFF		R
LocSetAcsOn		SPS			ACCESS LOC STG ON operand	R
	stVal	BOOLEAN	ST	ACCESS LOC STG ON		R
LocCmdAcsOn		SPS			ACCESS LOC CMND ON operand	R
	stVal	BOOLEAN	ST	ACCESS LOC CMND ON		R
LocCmdAcsOff		SPS			ACCESS LOC CMND OFF operand	R
	stVal	BOOLEAN	ST	ACCESS LOC CMND OFF		R
RemSetAcsOn		SPS			ACCESS REM STG ON operand	R
	stVal	BOOLEAN	ST	ACCESS REM STG ON		R
RemSetAcsOff		SPS			ACCESS REM STG OFF operand	R
	stVal	BOOLEAN	ST	ACCESS REM STG OFF		R

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LNName: SecGSAL1		LDevice inst: Gen		UR element: UR Basic Security element		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
RemCmdAcsOn		SPS			ACCESS REM CMND ON operand	R
	stVal	BOOLEAN	ST	ACCESS REM CMND ON		R
RemCmdAcsOff		SPS			ACCESS REM CMND OFF operand	R
	stVal	BOOLEAN	ST	ACCESS REM CMND OFF		R
InRef1		ORG			LOCAL SETTING AUTH setting.	R
	setSrcRef	ObjectReference	SP	LOCAL SETTING AUTH setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef2		ORG			REMOTE SETTING AUTH setting.	R
	setSrcRef	ObjectReference	SP	REMOTE SETTING AUTH setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3

3.5.7.16 Selector switch (SelSw)

This element is instantiated in the following products: B30, C30, C60, C70, C95, D30, D60, F35, F60, G30, G60, L30, L60, L90, M60, N60, T35, T60.

Table 3-226: Selector switch data objects

LNName: SelSwGAPC#		LDevice inst: Gen		UR element: Selector Switch element #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
IndY		SPS			SELECTOR # POS Y operand value	R
	stVal	BOOLEAN	ST	SELECTOR # POS Y		R
Indα		SPS			SELECTOR # BIT β operand value	R
	stVal	BOOLEAN	ST	SELECTOR # BIT β		R
Alm2		SPS			SELECTOR # STP ALARM operand value	R
	stVal	BOOLEAN	ST	SELECTOR # STP ALARM		R
Alm3		SPS			"SELECTOR # BIT ALARM operand value	R
	stVal	BOOLEAN	ST	SELECTOR # BIT ALARM		R
Alm1		SPS			"SELECTOR # ALARM operand value	R
	stVal	BOOLEAN	ST	SELECTOR # ALARM		R
Alm4		SPS			"SELECTOR # PWR ALARM operand value	R
	stVal	BOOLEAN	ST	SELECTOR # PWR ALARM		R
InRef1		ORG			SELECTOR # STEP-UP setting.	R
	setSrcRef	ObjectReference	SP	SELECTOR # STEP-UP setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef2		ORG			SELECTOR # ACK setting.	R
	setSrcRef	ObjectReference	SP	SELECTOR # ACK setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef3		ORG			SELECTOR # 3BIT A0 setting.	R
	setSrcRef	ObjectReference	SP	SELECTOR # 3BIT A0 setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef4		ORG			SELECTOR # 3BIT A1 setting.	R
	setSrcRef	ObjectReference	SP	SELECTOR # 3BIT A1 setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef5		ORG			SELECTOR # 3BIT A2 setting.	R
	setSrcRef	ObjectReference	SP	SELECTOR # 3BIT A2 setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef6		ORG			SELECTOR # 3BIT ACK setting.	R

LNName: SelSwGAPC#		LDevice inst: Gen		UR element: Selector Switch element #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	setSrcRef	ObjectReference	SP	SELECTOR #3BIT ACK setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.7.17 Target resetting (TgtRs)

This element is instantiated in all UR products.

Table 3-227: Target resetting data objects

LNName: TgtRsIHMI1		LDevice inst: Gen		UR element: Target Resetting		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
RsOp		SPS			RESET OP operand value	R
	stVal	BOOLEAN	ST	RESET OP		R
RsOpRem		SPS			RESET OP (COMMS) operand value	R
	stVal	BOOLEAN	ST	RESET OP (COMMS)		R
RsOpLoc		SPS			RESET OP (OPERAND) operand value	R
	stVal	BOOLEAN	ST	RESET OP (OPERAND)		R
RsOpPB		SPS			RESET OP (PUSHBUTTON) operand value	R
	stVal	BOOLEAN	ST	RESET OP (PUSHBUTTON)		R
InRef1		ORG			RESET OPERAND setting.	R
	setSrcRef	ObjectReference	SP	Operate setting of RESET OPERAND	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.7.18 Time of day timer (TmDay)

This element is instantiated in the following products: C70.

Table 3-228: Time of day timer data objects

LNName: TmDayGAPC#		LDevice inst: Gen		UR element: TIME OF DAY TIMER #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
IsOn		SPS			TIME OF DAY # ON operand	R
	stVal	BOOLEAN	ST	TIME OF DAY # ON		R
Start		SPS			TIME OF DAY # START operand	R
	stVal	BOOLEAN	ST	TIME OF DAY # START		R
Stop		SPS			TIME OF DAY # STOP operand	R
	stVal	BOOLEAN	ST	TIME OF DAY # STOP		R
MonthΘ		SPS			Instantiated only in the first instance of TmDayGAPC#	R
	stVal	BOOLEAN	ST	MONTH Φ		R
MonthΘ		SPS			Instantiated only in the first instance of TmDayGAPC#	R
	stVal	BOOLEAN	ST	DAY Φ		R
SecondOfDay		INS			Instantiated only in the first instance of TmDayGAPC#	R
	stVal	INT32	ST	SecondOfDay Actual Value		R
	units.SIUnit	ENUMERATED			4, the code for time in seconds	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
DayofMonth		INS			Instantiated only in the first instance of TmDayGAPC#	R
	stVal	INT32	ST	DayOfMonth Actual Value		R

LNName: TmDayGAPC#		LDevice inst: Gen		UR element: TIME OF DAY TIMER #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
DayofYear		INS			Instantiated only in the first instance of TmDayGAPC#	R
	stVal	INT32	ST	DayOfYear Actual Value		R
Year		INS			Instantiated only in the first instance of TmDayGAPC#	R
	stVal	INT32	ST	Year Actual Value		R

3.5.7.19 User-definable displays (UsrDs)

This element is instantiated in all UR products with enhanced or standard front panel.

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Table 3-229: User-definable displays data objects

LNName: UsrDsIHMI1		LDevice inst: Gen		UR element: User definable displays		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
InRef1		ORG			INVOKE AND SCROLL setting.	R
	setSrcRef	ObjectReference	SP	setting of INVOKE AND SCROLL	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.7.20 User-programmable pushbuttons (UsrPb)

This element is instantiated in all UR products.

Table 3-230: User-programmable pushbutton data objects

LNName: UsrPbIHMI#		LDevice inst: Gen		UR element: USER PUSHBUTTON # function		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
PBOn		SPS			PUSHBUTTON # ON operand.	R
	stVal	BOOLEAN	ST	PUSHBUTTON # ON		R
Deactivated		SPS			PUSHBUTTON # OFF operand.	R
	stVal	BOOLEAN	ST	PUSHBUTTON # OFF		R
AnyPBOn		SPS			Instantiated only in first Instance	R
	stVal	BOOLEAN	ST	ANY PB ON		R
InRef1		ORG			PUSHBTN # SET setting.	R
	setSrcRef	ObjectReference	SP	PUSHBTN # SET setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef2		ORG			PUSHBTN # RESET setting.	R
	setSrcRef	ObjectReference	SP	PUSHBTN # RESET setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef3		ORG			PUSHBTN # REMOTE setting.	R
	setSrcRef	ObjectReference	SP	PUSHBTN # REMOTE setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef4		ORG			PUSHBTN # LOCAL setting.	R
	setSrcRef	ObjectReference	SP	PUSHBTN # LOCAL setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef5		ORG			PUSHBTN # LED CTL setting.	R
	setSrcRef	ObjectReference	SP	PUSHBTN # LED CTL setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.7.21 User-programmable LEDs (LEDs)

This element is instantiated in all UR products with enhanced or standard front panel.

Table 3-231: User-programmable LED data objects

LNName: LEDsIHMI1		LDevice inst: Gen		UR element: Front Panel LEDs		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
InService		SPS			LED IN SERVICE operand	R
	stVal	BOOLEAN	ST	LED IN SERVICE		R
Trouble		SPS			LED TROUBLE operand	R
	stVal	BOOLEAN	ST	LED TROUBLE		R
TestMod		SPS			LED TEST MODE operand	R
	stVal	BOOLEAN	ST	LED TEST MODE		R
TripInd		SPS			LED TRIP operand	R
	stVal	BOOLEAN	ST	LED TRIP		R
AlmInd		SPS			LED ALARM operand	R
	stVal	BOOLEAN	ST	LED ALARM		R
StrInd		SPS			LED PICKUP operand	R
	stVal	BOOLEAN	ST	LED PICKUP		R
VoltsInd		SPS			LED VOLTAGE operand	R
	stVal	BOOLEAN	ST	LED VOLTAGE		R
AmpInd		SPS			LED CURRENT operand	R
	stVal	BOOLEAN	ST	LED CURRENT		R
HzLedInd		SPS			LED FREQUENCY operand	R
	stVal	BOOLEAN	ST	LED FREQUENCY		R
OtherInd		SPS			LED OTHER operand	R
	stVal	BOOLEAN	ST	LED OTHER		R
PhsAInd		SPS			LED PHASE A operand	R
	stVal	BOOLEAN	ST	LED PHASE A		R
PhsBInd		SPS			LED PHASE B operand	R
	stVal	BOOLEAN	ST	LED PHASE B		R
PhsCInd		SPS			LED PHASE C operand	R
	stVal	BOOLEAN	ST	LED PHASE C		R
GndNeutInd		SPS			LED NEUTRAL/GROUND operand	R
	stVal	BOOLEAN	ST	LED NEUTRAL/GROUND		R
TestPrgInd		SPS			LED TEST IN PROGRESS operand	R
	stVal	BOOLEAN	ST	LED TEST IN PROGRESS		R
UsrPrgmLED$$		SPS			instantiated only if the order code includes optional standard/Enhanced front panel	R
	stVal	BOOLEAN	ST	LED USER $		R
EvtLED$		SPS			Instantiated only if the order code includes graphical front panel	R
	stVal	BOOLEAN	ST	"EVENT CAUSE LED $" operand		R
InRef100		ORG			LED TEST CONTROL setting.	R
	setSrcRef	ObjectReference	SP	LED TEST CONTROL setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRefψψ		ORG			instantiated only if the order code includes optional standard/Enhanced front panel	R
	setSrcRef	ObjectReference	SP	LED ψ OPERAND setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef51		ORG			TRIP LED INPUT setting.	R

LNName: LEDsIHMI1		LDevice inst: Gen		UR element: Front Panel LEDs		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	setSrcRef	ObjectReference	SP	TRIP LED INPUT setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef52		ORG			ALARM LED INPUT setting.	R
	setSrcRef	ObjectReference	SP	ALARM LED INPUT setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef53		ORG			Instantiated only if the order code includes graphical front panel	R
	setSrcRef	ObjectReference	SP	LED 1 OPERAND setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef54		ORG			Instantiated only if the order code includes graphical front panel	R
	setSrcRef	ObjectReference	SP	LED 2 OPERAND setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef55		ORG			Instantiated only if the order code includes graphical front panel	R
	setSrcRef	ObjectReference	SP	LED 3 OPERAND setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef56		ORG			Instantiated only if the order code includes graphical front panel	R
	setSrcRef	ObjectReference	SP	LED 4 OPERAND setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef57		ORG			Instantiated only if the order code includes graphical front panel	R
	setSrcRef	ObjectReference	SP	LED 5 OPERAND setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef58		ORG			Instantiated only if the order code includes graphical front panel	R
	setSrcRef	ObjectReference	SP	LED 6 OPERAND setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef59		ORG			Instantiated only if the order code includes graphical front panel	R
	setSrcRef	ObjectReference	SP	LED 7 OPERAND setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef60		ORG			Instantiated only if the order code includes graphical front panel	R
	setSrcRef	ObjectReference	SP	LED 8 OPERAND setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef61		ORG			Instantiated only if the order code includes graphical front panel	R
	setSrcRef	ObjectReference	SP	LED 9 OPERAND setting	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.8 Process Bus Module (PBus) logical device

The PBus logical device is available when the UR device includes a non-HardFiber Process Bus Module.

3.5.8.1 Sampled value subscription (RxSV)

This element is instantiated in the following products: B30, C60, C70, C95, D30, D60, F35, F60, G30, G60, L30, L90, M60, N60, T35, T60.

Table 3-232: Sampled value subscription data objects

LNName: LSVS#		LDevice inst: PBus		UR element: RxSV#		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
St		SPS			RxSV# On operand	R
	stVal	BOOLEAN	ST	RxSV# On		R
Alm		SPS			RxSV# Off operand	R
	stVal	BOOLEAN	ST	RxSV# Off		R
LostOn		SPS			RxSV# Lost On operand	R
	stVal	BOOLEAN	ST	RxSV# Lost On		R
LostOff		SPS			RxSV# Lost Off operand	R
	stVal	BOOLEAN	ST	RxSV# Lost Off		R
DlyAlmOn		SPS			Instantiated only in L30 and L90	R
	stVal	BOOLEAN	ST	RxSV# Delay Alm On		R
DlyAlmOff		SPS			Instantiated only in L30 and L90	R
	stVal	BOOLEAN	ST	RxSV# Delay Alm Off		R
QualChkF		SPS			RxSV# QualChk Fail operand	R
	stVal	BOOLEAN	ST	RxSV# QualChk Fail		R
QualChkOk		SPS			RxSV# QualChk OK” operand	R
	stVal	BOOLEAN	ST	RxSV# QualChk OK		R
SynChkF		SPS			RxSV# SynChk Fail operand	R
	stVal	BOOLEAN	ST	RxSV# SynChk Fail		R
SynChkOk		SPS			RxSV# SynChk OK” operand	R
	stVal	BOOLEAN	ST	RxSV# SynChk OK		R
SimSt		SPS			RxSV# SimBit On operand	R
	stVal	BOOLEAN	ST	RxSV# SimBit On		R
SimStOff		SPS			RxSV# SimBit Off” operand	R
	stVal	BOOLEAN	ST	RxSV# SimBit Off		R
ProcFail		SPS			SV# Processing Fail operand	R
	stVal	BOOLEAN	ST	SV# Processing Fail		R
ProcOk		SPS			SV# Processing OK operand	R
	stVal	BOOLEAN	ST	SV# Processing OK		R
SvCBRef		ORG			Setting RxSV# SvCBRef	R
	setSrcRef	ObjectReference	SP	Mapped to RxSV# SvCBRef. If the value is empty string, URPC creates the dummy IED, LDevice and SampleValuecontrol element names and set to the value in exported SCL file:<Dummy LDName>/ LLN0.<Dummy SvCBName>	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R
InRef17		ORG			Setting RxSV# Force MU Out of Service	R
	setSrcRef	ObjectReference	SP	Mapped to RxSV# Force MU Out of Service	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
MAC		VSG			Destination MAC address of messages subscribed to by RxSV#	R
	setVal	VISIBLE STRING255	SP	RxSV# Dst MAC if in E32.0 mode, otherwise empty string.		R/C
SvID		VSG			Setting RxSV# svID	R
	setVal	VISIBLE STRING255	SP	RxSV# MsvID if in E32.0 mode, otherwise empty string.		R/C

LNName: LSVS#		LDevice inst: PBus		UR element: RxSV#		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
ConfRevNum		INS			Expected ConfRev number	R
	stVal	INT32	ST	value of RxSV# ConfRev		R
	units.SIUnit	ENUMERATED				R
	units.multiplier	ENUMERATED				R
NoASDU		ENG			RxSV# ASDUs setting	R
	setVal	ENUMERATED	SP	RxSV# ASDIUs if in E3-2.0 mode, otherwise set to default 1		R/C
InRefδδ		ORG			RxSV# Member δδ	R
	setSrcRef	ObjectReference	SP	specifying bType and intermediate data object for RxSV# Analog channel δδ	reference to the data attribute to input	R/C
	intAddr	VISIBLE STRING255	SP			R/C

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Table 3-233: AC bank data objects

LNName: ACBnkTBNK#		LDevice inst: PBus		UR element: AC Bank B#		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
AnCh1βSv		SAV			Analog Channel 1β	R
	instMag.i	INT32				R
	units.SIUnit	ENUMERATED			1, the code for None	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
AnCh2βSv		SAV			Analog Channel 2β	R
	instMag.i	INT32				R
	units.SIUnit	ENUMERATED			1, the code for None	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
CrsChkFail		SPS			ACBANK# CrsChk Fail operand	R
	stVal	BOOLEAN	ST	ACBANK# CrsChk Fail		R
InRef1Θ		ORG			AC Bank # Phase origin 1 Phs Θ Input	R
	setSrcRef	ObjectReference	SP	RxSV# CT1-Θ or RxSv# VT1- Θ, if AC Bank# Phase Origin 1 is RxSV#-CT1/PHS or RxSv#-VT1/PHS respectively if any, otherwise empty string.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef14		ORG			AC Bank # Phase origin 1 Aux Input	R
	setSrcRef	ObjectReference	SP	RxSV# CT1-N or RxSV# VT1-N, if AC Bank# Aux Origin 1 is RxSV#-CT1/NTR or RxSV#-VT1/NTR respectively if any, otherwise empty string.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef2Θ		ORG			AC Bank # Phase origin 2 Phs Θ Input	R
	setSrcRef	ObjectReference	SP	RxSV# CT1-Θ or RxSV# VT1-Θ, if AC Bank# Phase Origin 2 is RxSV#-CT1/PHS or RxSV#-VT1/PHS respectively if any, otherwise empty string.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C
InRef24		ORG			AC Bank # Phase origin 2 Aux Input	R
	setSrcRef	ObjectReference	SP	RxSV# CT1-N or RxSV# VT1-N, if AC Bank# Aux Origin 2 is RxSV#-CT1/NTR or RxSV# VT1/NTR respectively if any, otherwise empty string.	reference to the data attribute to input	R/C

LNName: ACBnkTBNK#		LDevice inst: PBus		UR element: AC Bank B#		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

3.5.8.2 Real-time clock (PcClk)

This element is instantiated in the following products: B30, C60, C70, C95, D30, D60, F35, F60, G30, G60, L30, L90, M60, N60, T35, T60.

Table 3-234: Real-time clock data objects

LNName: PcClkLTMS1		LDevice inst: PBus		UR element: PROCESS BUS MODULE REAL TIME CLOCK feature		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
PTPFail		SPS			PROCESS BUS PTP FAILURE operand	R
	stVal	BOOLEAN	ST	“PROCESS BUS PTP FAILURE”		R
ClkMis		SPS			Process bus module CLOCK MISMATCH operand	R
	stVal	BOOLEAN	ST	“CLOCK MISMATCH”		R
PBClkTrbl		SPS			Process bus module PB CLK UNSYNCHRONIZED operand	R
	stVal	BOOLEAN	ST	“PB CLK UNSYNCHRONIZED”		R
TmSynSrc		ENS			The Sync Source actual value indicates time synchronizing source the UR process bus module is using at present	R
	stVal	ENUMERATED	ST	Actual Value: Sync Source		R
GrdMaster ID		VSS			GrandMaster ID actual value	R
	stVal	VISIBLE STRING 255	ST	process bus module clock synchronizing GrandMaster ID		R
TmAcc		INS			Process bus module time ACCURACY in number of significant bits in the Fraction Of Second	R
	stVal	INT32	ST			R
TmSrc		VSS			RTC Sync Source	R
	stVal	VISIBLE STRING255	SP	Null		R

3.5.9 GE namespace

The GE namespace is an extension of the "IEC 61850-7-4:2007A" namespace, and as such includes by reference all data object names in IEC 61850-7-4 Edition 2.0 2010-03. As these names are defined in the standard, they are not described in this document. The GE namespace schema file "GEExtensionsV1_0.xsd" is located in the same folder as the UR EnerVista software installation, for example in C:\Program Files (x86)\GE Power Management\URPC\GESchema\

The name of the GE namespace specified in this document is "GE Multilin UR Namespace:2015A"

In the last column, the logical node number is not included. For example, LPHD refers to LPHD1.

Table 3-235: GE namespace

Data object name	CDC	Semantics	Used in logical nodes...
AaDmd	MV	Phase A demand. SRC 1 DMD IA, in primary amperes.	DmdMtrMMTR
AaMaxDmdDt	MV	Phase A Max Demand with Date (time stamp). The ClcMth cannot be used for MAX, as the time stamp definition of IEC 61850 is different from UR. SRC 1 DMD IA MAX, in primary amperes with associated date, SRC 1 DMD IA DATE.	DmdMtrMMTR

Data object name	CDC	Semantics	Used in logical nodes...
AaRMS	MV	Phase A current RMS. SRC 1 Phase A Current RMS, in primary amperes.	ACsrcMMXU
AbDmd	MV	Phase B demand. SRC 1 DMD IB, in primary amperes.	DmdMtrMMTR
AbMaxDmdDt	MV	Phase B Max Demand with Date (time stamp). The ClcMth cannot be used for MAX, as the time stamp definition of IEC 61850 is different from UR. SRC 1 DMD IB MAX, in primary amperes with associated date, SRC 1 DMD IB DATE.	DmdMtrMMTR
AbRMS	MV	Phase B current RMS. SRC 1 Phase B Current RMS, in primary amperes.	ACsrcMMXU
AccmWrnA	SPS	Indicates phase A thermal/mechanical damage has exceeded 0.9 of Total Acc Max setting	ThrFltGAPC
AccmWrnB	SPS	Indicates phase B thermal/mechanical damage has exceeded 0.9 of Total Acc Max setting	ThrFltGAPC
AccmWrnC	SPS	Indicates phase C thermal/mechanical damage has exceeded 0.9 of Total Acc Max setting	ThrFltGAPC
AcDmd	MV	Phase C demand. SRC 1 DMD IC, in primary amperes.	DmdMtrMMTR
AcMaxDmdDt	MV	Phase C Max Demand with Date (time stamp). The ClcMth cannot be used for MAX, as the time stamp definition of IEC 61850 is different from UR. SRC 1 DMD IC MAX, in primary amperes with associated date, SRC 1 DMD IC DATE.	DmdMtrMMTR
AcRMS	MV	Phase C current RMS. SRC 1 Phase C Current RMS, in primary amperes.	ACsrcMMXU
Activated	SPS	Activated. In this logical node, indicates position of a pushbutton. When "true", the pushbutton is asserted state; when "false", the pushbutton is in a released state. CONTROL PUSH BUTTON 1 ON operand. PUSHBUTTON 1 ON operand.	CtlPshIHMI, UsrPbIHMI
Adif	CMV	Differential current (sum of the three phase currents and the ground (fourth) current. Restricted ground differential if the fourth current measures the ground current in a grounded wye winding. Measures CT secondary circuit trouble if fourth current measures the CT secondary neutral current. SRC 1 Differential Ground Current phasor, in primary volts.	ACsrcMMXU
Agnd	CMV	Ground current (fourth input in a current AC bank). SRC 1 Ground Current phasor, in primary amperes.	ACsrcMMXN
AgndRMS	MV	Ground current RMS (fourth input in a current AC bank). SRC 1 Ground Current RMS, in primary amperes.	ACsrcMMXN
AlgCap	SPC	Command for the Hi-Z Oscillography Force Algorithm Capture	HiZPHIZ
AlmInd	SPS	An LED. The LED ALARM operand.	LEDsIHMI
AlmOvl	SPS	Indicates the motor overload condition has occurred	MotThmPTTR
AmpInd	SPS	An LED. The LED CURRENT operand.	LEDsIHMI
AnExpnSt	SPS	Expression status of the RxGOOSE Analog	GGIO3
AnFailBeh	ENG	Setting to select the behavior of the RxGOOSE Analog when the sending device is offline: 0 = Default Value, 1 = Last Known	GGIO3
AnFailVal	ASG	The value of the RxGOOSE Analog when the sending device is offline and the FailBeh is set to "Default Value"	GGIO3
AnOutput1	MV	Analog output	Cmp8BtGAPC
AnyPBOn	SPS	Indicates ANY PB ON operand state. When any of the user pushbuttons is asserted, status is "true"; when none of the user pushbuttons are asserted, status is "false."	UsrPbIHMI
AnyErr	SPS	Any of the self-test errors generated. The ANY SELF TESTS operand.	LPHD
AnyGpsFail	SPS	The GPS signal failed or is not configured properly at any terminal. The 87L DIFF GPS FAIL operand, which becomes On when the GPS signal failed or is not configured properly at any terminal.	LinDfPDIF
AnyPoleOpn	SPS	At least one pole is open. The BREAKER 1 ANY P OPEN operand.	Bkr0XCBR

Data object name	CDC	Semantics	Used in logical nodes...
AnyShotCnt	SPS	The first breaker close signal has been issued. The AR SHOT CNT greater than zero operand.	Rec13pRREC
APPID	ING	Expected value of APPID field in messages subscribed to by RxGOOSE# The RxGOOSE1 ETYPE APPID setting.	LGOS
ArBlk1	SPS	Autoreclose Breaker number indicated by the data instance number is temporarily disabled. The AR BKR1 BLK operand and the AR1 BLK FROM MAN CLS operand.	Rec13pRREC, Rec3pRREC
ArcConfid1	INS	Represents the Arc Confidence in percentage for Phase A, B, C, or N	HiZPHIZ
ArcSuspect	ACT	Indicates suspected element has operated	HiZPHIZ
AresRMS	MV	Residual Current RMS. SRC 1 Neutral Current RMS, in primary amperes.	ACsrcMMXU
ArLO	SPS	Autoreclose is locked out. The AR LO operand.	Rec13pRREC, Rec3pRREC
Armed	SPS	Accidental energization. Occurs when the generator is offline with no fault involved. The ACCDNT ENRG ARMED operand.	AcdEnrPIOC
ArMod1	SPS	Autoreclosec mode equals to the number indicated by the data instance number, in this case 1 and 3 pole mode. The AR MODE = 1 operand.	Rec13pRREC
ArRip	SPS	Autoreclose is in progress. The AR RIP operand.	Rec13pRREC, Rec3pRREC
ASupn1	SPS	Indicates the state of current supervision. The PHS DIST Z1 SUPN AB/BC/CA operand in Phase-To-Phase.	PhsDisPDIS
Asymmetry	SPS	Communications channel asymmetry detected. The 87L DIFF CH ASYM DET operand, which becomes On when the differential element's has detected substantial communications channel asymmetry.	LinDfPDIF
AutoMod	SPS	Capacitor control in auto mode. The CAP 1 IN AUTO operand.	CapCtlGAPC
BadSt1	SPS	Bad-status detected. The BREAKER/SWITCH BAD STATUS operand.	BbBkrSCBR, BkrΘXCBR, Bkr0XCBR, Disc0XSWI, DiscΘXSWI, GGIO3
BatFail	SPS	The battery is not functioning. The BATTERY FAIL operand.	LPHD
BDifAClc	CMV	B90 differential current	B_DifPDIF
BiasMotLod	MV	Indicates thermal model biased motor load. THERMAL MODEL BIASED MOTOR LOAD in x FLA.	MotThmPTTR
BknRotClr	SPC	Command to Clear BROKEN ROTOR BAR DATA. TRUE= CLEAR BROKEN ROTOR BAR DATA	BknRotSVBR
BkrOp1	SPS	Breaker failure status information operands. The BKR FAIL 1 T1 OP operand.	BkrFaRBRF, B_BFaiRBRF
BkrOpnPl	ACT	Indicates open pole condition is detected in phase A, B, or C based on the breaker auxiliary contacts. The OPEN POLE BKR phase A/B/C OP operand.	OpnPlΘSCBR
BkrSt	ENS	BKR STATUS BAY actual value	BbBkrSCBR
Blk2ndH1	SPS	Indicates second harmonic blocking active (where the last digit of instance number 1, 2, or 3 refers to phase A, B, and C respectively). The XFMR PCNT DIFF 2ND A/B/C operand.	PctDifPDIF
Blk5thH1	SPS	Indicates fifth harmonic blocking active (where the last digit of instance number 1, 2, or 3 refers to phase A, B, and C respectively). The XFMR PCNT DIFF 5TH A/B/C operand.	PctDifPDIF
BlkH1	SPS	The second harmonic of the transformer magnetizing inrush current has inhibited the current differential element from operating. The 87L HARM2 A/B/C OP operand, which becomes asserted when phase A/B/C of second harmonic of the transformer magnetizing inrush current inhibits the current differential element from operating.	LinDfPDIF (L90)
BlkPhDis	SPS	Indicates blocking signal for neutral, ground, or negative sequence overcurrent elements. The OPEN POLE BLK Phase AB/BC/CA/N operand.	OpnPl0SCBR, OpnPlΘSCBR
BrckTrbl	SPS	HardFiber Brick trouble. The BRICK TROUBLE operand.	LPHD
BRstA	CMV	B90 restraint current	B_DifPDIF
BusV0	CMV	Zero Sequence Bus voltage in pu	NuVUnPTOV
BusVPh	WYE	Bus voltage in per unit for phase A, B, and C	VDifPDIF

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Data object name	CDC	Semantics	Used in logical nodes...
BypsOff	SPS	Control interlocking is not manually bypassed. The BREAKER 1 BYPASS OFF operand.	Bkr0XCBR, BkrCSWI, DiscCSWI, Disc0XSWI
BypsOn	SPS	Control interlocking is manually bypassed. The BREAKER 1 BYPASS ON operand.	Bkr0XCBR, BkrCSWI, DiscCSWI, Disc0XSWI
ChA	CMV	B90's AC channel current	B_AmpMMXN
ChFail1	SPS	Communications channel failed. The 87L DIFF CH 1 FAIL operand, which becomes On when the differential element has detected communications channel 1 failed.	LinDfPDIF
ChV	CMV	B90's AC channel voltage	B_VolMMXN
ClcKFact	SPC	Ed1 & Ed2TRUE = recalculate K Factors	TrItfPTOC
ClkMis	SPS	This operand is set when process card and main CPU clocks are independently free running and the clocks are deviating more than 100 microseconds. Resets when the deviation is below 100 microseconds.	PcClkLTMS
ClkUnsynch	SPS	Relay is not synchronized to the international time standard. The CLOCK UNSYNCHRONIZED operand.	LPHD
ClrMem	SPC	Clear Hi-Z oscillography	HiZPHIZ
Cls2ndBkr	SPS	Close second Breaker signal. The AR CLOSE BKR2 operand.	Rec13pRREC
ClsSt1	SPS	Close status detected. The BREAKER/SWITCH CLOSED operand.	BbBkrSCBR, BkrΘXCBR, Bkr0XCBR, Disc0XSWI, DiscΘXSWI, GGIO3
CmpCt1I1	MV	Compensated I1 current magnitude for CT bank 1. CT1 COMP I1 Mag in amperes.	PhCmp1PDIF
CmpCt1I2	MV	Compensated I2 current magnitude for CT bank 1. CT2 COMP I1 Mag in amperes.	PhCmp1PDIF
CompAop	MV	Compensated operating current. Comp Iop in per unit.	NeAUnPTOC
CompAPh	WYE	Cm Iop in per unit for Phase A, B, and C	PhAUnPTOC
CompHz	MV	Indicates the frequency of the broken rotor bar spectral component. The COMPONENT FREQ. in Hz.	BknRotSVBR
CompLevel	MV	Indicates the level of the broken rotor bar spectral component relative to the spectral component of the system frequency. The COMPONENT LEVEL in dB.	BknRotSVBR
CrcFail1	SPS	The CRC error threshold has been exceeded. The 87L DIFF CH 1 CRCFAIL operand, which becomes On when the differential element has detected the CRC error threshold has been exceeded on channel 1.	LinDfPDIF
Ctrl	SPS	Asserted for one second upon any transition in any mode	LoVStrGAPC
CurUnb	MV	% UNBALANCE CURRENT	AmpUnbPTOC
Damp	MV	Damping Ratio of oscillations	OscDetMOSC
DatSetRef	GEOR G	Expected value of datSet field in messages subscribed to by RxGOOSE# . Edition 1. The setting RxGOOSE1 DatSet.	LGOS
Day1	SPS	Current day, where 1 = Sunday. The DAY operand.	TmDayGAPC
DayofMonth	INS	Represents the day of current month (range 1 to 31). The DayOfMonth Actual Value to represent in date of month in number form.	TmDayGAPC
DayofYear	INS	Represents the day of the year (range 1 to 366). The DayOfYear Actual Value to represent day of year in number form.	TmDayGAPC
DbMax1	ASG	Value of "max." in deadband calculations	FTDRsGGIO1, GGIO4
DbMin1	ASG	Value of "min." in deadband calculations	FTDRsGGIO1, GGIO4
Deactivated	SPS	Indicates PUSHBUTTON # OFF state. When user pushbutton is asserted, status is "false"; when user pushbutton is released, status is "true." The PUSHBUTTON 1 OFF operand.	UsrPbIHMI
DeaV1	SPS	This data object indicates that V1 is below the DeaVal1 setting. The SYNC 1 V1 BELOW MAX operand.	SynChkRSYN
DeltaOut	MV	PID Delta Output value	PIDRegFPID
DifA2ndH	WYE	Phase differential current	PctDifPDIF

Data object name	CDC	Semantics	Used in logical nodes...
DifA5thH	WYE	Phase differential current	PctDifPDIF
DifAngDis	MV	Synchroscope displayed value for the Phase angle difference between V1 and V2	SynChkRSYN
DifAComp	WYE	Differential current	TrItfPTOC
DifARaw	WYE	Differential current	TrItfPTOC
DifVPh	WYE	Differential voltage in per unit for phase A, B, and C	VDifPDIF
DirSupn	SPS	Directional overcurrent supervision status (not instantiated for zone 1 GndDisPDIS1). The GND DIST Z2 DIR SUPN operand.	GndDisPDIS
Disabled	SPS	Function is disabled	Rec13pRREC, Rec3pRREC
DisArmed	SPS	Indicates the high impedance fault detection element is in disarmed state	HiZPHIZ
DischargeTms	MV	Capacitor discharge time in seconds. Edition 2. CAP 1 DISCHARGE TIME in seconds.	CapCtlGAPC
Discharging	SPS	Capacitor bank is discharging. Edition 2. CAP 1 DISCHARGING operand.	CapCtlGAPC
DistDet	SPS	Sensitive current disturbance detector. For PwrSwgRPSB1, power swing element detected disturbance other than power swing. The 50DD SV operand, which becomes On when the 87L disturbance detector has operated. The POWER SWING 50DD operand.	LinDfPDIF, PwrSwgRPSB
DlyAlm	SPS	General single alarm for Sampled Value Subscription	LSVS

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Data object name	CDC	Semantics	Used in logical nodes...
Dpo	SPS	The DPO (dropout) operand. Inverse of Str, Op, or Pkp.	AcdEnrPIOC, AgeSPTR, AmpUnbPTOC, AuxOvPTOV, AuxUvPTUV, B_IocPIOC, B_EfpPIOC, B_SDifPDIF, B_TocPTOC, B_UvPTUV, BbEfpPIOC, BusDifPDIF, CBArc0SCBR, Cmp8BtGAPC, CmpOvPTOV, CPhOvPTOV, DigElGAPC, FldAmpPTOC, FldAmpPTUC, FldGnd0PHIZ, FldGnd1PHIZ, FldGnd2PHIZ, FlshOvPIOC, FlxElGAPC, GndIocPIOC, GndTocPTOC, GnUnb$PTOC, GnUnbPTOC, Ha3NUvPTUV, HiZPHIZ, HPTmpSPTR, HzBnd$PTUF, LinPkpPIOC, LodEncPDIS, LosExtPDIS, LosExt1PDIS1, LosExt2PDIS, MAccTmPMSS, MecJamPMSS, MotThmPTTR, NeAUnPTOC, NegIocPIOC, NegOvPTOV, NegTocPTOC, NeuIocPIOC, NeuTocPTOC, NeuOvPTOV, NuVUnPTOV OvHzPTOF, PhAUnPTOC, PhCmp1PDIF, PhsIocPIOC, PhsOvPTOV, PhsTocPTOC, PhsUvPTUV, PRTDsSTMP, RgDifPDIF, RRTDsSTMP, RteHzPFRC, S2AcTmPMSS1, SenPDOP, Sen1PDOP, Sen2PDOP, SpltPhPDIF, Statr$PHIZ, StatrPHIZ, StrRtePMRI, SubHa$PHIZ, SubHaPHIZ, TmBtwnPMRI, UnHzPTUF, UnPwrPDUP, VDifPDIF, VpHzPVPH, VtffGAPC
DpoAlm	SPS	Inverse of alarm Pkp. RRTD RTD 1 ALARM DPO operand. RTD Ip 1 ALARM DPO operand. UNDERPWR 1 ALARM DPO operand.	PRTDsSTMP, RRTDsSTMP, UnPwrPDUP
DpoBia	SPS	B90 Drop-out of Biased indicates the dropping of pick-up condition for biased differential element	B_DifPDIF
DpoCls	SPS	Inverse of close pkp. The AVR CLOSE 1 DPO operand.	AvrGAPC
DpoOpn	SPS	Inverse of open pkp. The AVR OPEN 1 DPO operand.	AvrGAPC
DpoPhsϕ	SPS	Split phase	SpltPhPDIF
DpoPhs1	SPS	Inverse of per phase pickup (Pkp). Individual phase DPO (dropout) operand.	BbEfpPIOC, BusDifPDIF, PhsIocPIOC, B_TocPTOC, FlshOvPIOC, GndDisPDIS, PhsDisPDIS, PhsTocPTOC, SttDifPDIF
DpoPhs1	SPS	Inverse of Op	PhsIocPIOC, PhsOvPTOV, PhsUvPTUV
DrcDevOff	SPS	A direct device is configured but not connected. The DIRECT DEVICE OFF operand.	LPHD

Data object name	CDC	Semantics	Used in logical nodes...
DrcRingBrk	SPS	The Direct I/O settings is for a ring but the connection is not in a ring. The DIRECT RING BREAK operand.	LPHD
Dsching	SPS	Capacitor bank is discharging. Edition 1. CAP 1 DISCHARGING operand.	CapCtlGAPC
DschTms	MV	Capacitor discharge time in seconds. Edition 1. CAP 1 DISCHARGE TIME in seconds.	CapCtlGAPC
DwnCond	ACT	Indicates the high impedance fault downed conductor element has operated	HiZPHIZ
DynArmd	SPS	This data object indicates that dynamic mode is armed. The SYNC1 S-CLOSE ARMD operand, which becomes On when dynamic mode is armed.	SynChkRSYN
DynDpo	SPS	The SYNC1 S-CLOSE DPO operand, which becomes Off when all criteria for dynamic mode are fulfilled	SynChkRSYN
DynOp	SPS	This data object indicates that all criteria for dynamic mode are fulfilled if value is TRUE else false. The SYNC1 S-CLOSE OP operand, which becomes On when all criteria for dynamic mode are fulfilled.	SynChkRSYN
Ena1	SPS	Function is Enabled. The AR ENABLED operand.	Rec13pRREC, Rec3pRREC
EqLim	SPS	The number of pulses counted is equal to the set number. Counter 1(CNT1) EQL operand, which indicates the number of pulses counted is equal to the set number.	DigCntFCNT
EqpMismat	SPS	The configuration of modules does not match the stored order code. The EQUIPMENT MISMATCH operand.	LPHD
Evt1AccmA	MV	Event Accumulated current in pu. One of five events (indicated by 1) and one of three phases (indicated by A).	ThrFltGAPC
EvtEna1	ENG	Setting to enable generation of events in event record, 0 = Disabled, 1 = Enabled	GGIO3
EvtEnd	SPS	Indicates fault current has dropped out in all the phases	ThrFltGAPC
EvtLED	SPS	An LED - Event Cause LED status. For graphical front panel. The EVENT CAUSE LED 1 operand.	LEDsIHMI
EvtRcdClr	SPC	Clear Event Records (erase all Events). The CLEAR EVENT RECORDS command.	Master/LLN0
EvtStr	SPS	Indicates fault current detected	ThrFltGAPC
EvtStrA	SPS	Indicates fault current detected on Phase A	ThrFltGAPC
EvtStrB	SPS	Indicates fault current detected on Phase B	ThrFltGAPC
EvtStrC	SPS	Indicates fault current detected on Phase C	ThrFltGAPC
Evt1Dur	MV	Event duration in number of cycles. One of five events.	ThrFltGAPC
Evt1MaxA	MV	Event Maximum current in pu. One of five events (indicated by 1) and one of three phases (indicated by A).	ThrFltGAPC
Evt1Tm	INS	Represents the UTC time of THRU FLT # EV1 (of 5) TIME in seconds elapsed since 1970/01/01, 00.00.00	ThrFltGAPC
Fail	SPS	Ground Protection Module Failure. GPM-F (Field Ground Protection Module) Fail status. The GPM-F FAILURE operand.	FldGnd0PHIZ
FDLOp	SPS	Overcurrent fault detector low has operated. The 87PC FDL OP operand.	PhCmp1PDIF
FlexErrTkn	SPS	A FlexLogic equation is incorrect. The FLEXLOGIC ERR TOKEN operand.	LPHD
Flt3Ph	SPS	Fault indication - Three phase fault. The PHASE SELECT 3P operand.	PhSelGAPC
FltAB	SPS	Fault indication - Phase A to B. The PHASE SELECT AB operand.	PhSelGAPC
FltABG	SPS	Fault indication - Phase A to B to ground. The PHASE SELECT ABG operand.	PhSelGAPC
FltAG	SPS	Fault indication - Phase A to ground. The PHASE SELECT AG operand.	PhSelGAPC

Data object name	CDC	Semantics	Used in logical nodes...
FltAGCC	SPS	Fault indication - Cross-country with phase A to ground	TrOutPTRC
FltBC	SPS	Fault indication - Phase B to C. The PHASE SELECT BC operand.	PhSelGAPC
FltBCG	SPS	Fault indication - Phase B to C to ground. The PHASE SELECT BCG operand.	PhSelGAPC
FltBG	SPS	Fault indication - Phase B to ground. The PHASE SELECT BG operand.	PhSelGAPC
FltBGCC	SPS	Fault indication - Cross-country with phase B to ground	TrOutPTRC
FltCA	SPS	Fault indication - Phase C to A. The PHASE SELECT CA operand.	PhSelGAPC
FltCAG	SPS	Fault indication - Phase C to A to ground. The PHASE SELECT CAG operand.	PhSelGAPC
FltCC	SPS	Fault indication - Cross-country	TrOutPTRC
FltCG	SPS	Fault indication - Phase C to ground. The PHASE SELECT CG operand.	PhSelGAPC
FltCGCC	SPS	Fault indication - Cross-country with phase C to ground	TrOutPTRC
FltCntA	INS	Number of faults in Phase A	ThrFltGAPC
FltCntB	INS	Number of faults in Phase B	ThrFltGAPC
FltCntC	INS	Number of faults in Phase C	ThrFltGAPC
FltCntClr	SPC	TRUE = clear incipient fault count. The clear incipient fault counters command.	ICFltPTEF
FltCntPhϕ	INS	Number of detected incipient faults. INCIPIENT FAULT 1 PH A/B/C FAULTS.	ICFltPTEF
FltLocation	MV	Fault location in percentage. The FAULT LOCATION in percentage of field winding from negative terminal in case of single point injection. If double point injection, displays Invalid value.	FldGnd0PHIZ
FltLoopReact	MV	D30, D60, L60, L90 - The fault loop reactance	FltRFLO
FltLoopRis	MV	D30, D60, L60, L90 - The fault loop resistance	FltRFLO
FltMulti	SPS	Fault indication - Multi phase fault. The PHASE SELECT MULTI-P operand.	PhSelGAPC
FltNumPhsA	INS	Mandatory data object: Fault number	ThrFltRDRE1
FltNumPhsB	INS	Mandatory data object: Fault number	ThrFltRDRE1
FltNumPhsC	INS	Mandatory data object: Fault number	ThrFltRDRE1
FltRcdClr	SPS	Indicates the transformer through fault records are cleared	ThrFltGAPC
FltRis	MV	L90 - The fault resistance at the fault point	FltRFLO
FltSegment	ENS	L90 - Indicates in which segment of the line the fault occurred: 0 = N/A, 1 = LOCAL, 2 = REMOTE 1, 3 = REMOTE 2	FltRFLO
FltSLG	SPS	Fault indication - single line to ground. The PHASE SELECT SLG operand.	PhSelGAPC
FltVoid	SPS	Fault indication - Fault type not detected. The PHASE SELECT VOID operand.	PhSelGAPC
FrcTrigger	SPC	Command for the Hi-Z Oscillography Force Trigger	HiZPHIZ
FrstEthFail	SPS	First Ethernet failure. The FIRST ETHERNET FAIL operand.	LPHD
Function1	ENG	Function Enable/Disable setting: 0 = Disabled, 1 = Enabled (note that TISSUE 670 suggests something like this named SetMod)	Master/LLN0
FwdOp	SPS	Fault direction is forward. The NEG SEQ DIR OC1 FWD operand. The NTRL DIR OC1 FWD operand.	NegDocRDIR, NeuDocRDIR
GFPCnt	SPS	Mapped to "ENABLE CTRL FROM GFP" status when operand assigned to Controls From Graphical Front Panel setting is On	GFPhpIHMI
GoDatSetRef	ORG	Expected value of datSet field in messages subscribed to by RxGOOSE# . Edition 2. The setting RxGOOSE1 DatSet.	LGOS

Data object name	CDC	Semantics	Used in logical nodes...
GoEnaPort1	ENG	Enable all GOOSE on Ethernet port setting: 0 = Disabled, 1 = Enabled	Master/LLN0
GoID	VSG	Expected value of goID field in messages subscribed to by RxGOOSE# . Edition 2. The setting RxGOOSE1 ID.	LGOS
GoID	GEVSG	Expected value of goID field in messages subscribed to by RxGOOSE# . Edition 1. The setting RxGOOSE1 ID.	LGOS
GndAmp	MV	Ground current. The FIELD GROUND CURRENT in amperes.	FldGnd0PHIZ
GndNeutInd	SPS	An LED. The LED NEUTRAL/GROUND operand.	LEDsIHMI
GndRis	MV	Ground resistance. FIELD GROUND RESIST in ohms. STATOR GND. RESIST in kilo ohms.	FldGnd0PHIZ, SubHaPHIZ
GpsFail1	SPS	GPS failed at terminal corresponding to instance number. The 87L DIFF GPS 1 FAIL operand.	LinDfPDIF
GrAct1	SPS	Setting group corresponding to index is active (not instantiated in C30). The SETTING GROUP ACT 1 operand.	Master/LLN0
GrdMasterID	VSS	Grand master ID actual value	TmClkLTMS, PcClkLTMS
Ha3NV	MV	Third harmonic component of neutral voltage. STATOR GND 3RD HARM VN in volts.	StatrPHIZ
Ha3NVZroV	MV	Sum of third harmonic neutral voltage and zero sequence voltage	StatrPHIZ
Ha3ZroV	MV	Third harmonic component of zero sequence voltage. STATOR GND 3RD HARM V0 in volts.	StatrPHIZ
HDetAa	MV	Phase A harmonic current	HDetMHAI
HDetAAv	MV	Average of phase harmonic currents	HDetMHAI
HDetAb	MV	Phase B harmonic current	HDetMHAI
HDetAc	MV	Phase C harmonic current	HDetMHAI
HDetAGnd	MV	Ground harmonic current	HDetMHAI
HiLimit	SPS	The number of pulses counted is above the set number	DigCntFCNT
HiZIOC	ACT	Indicates phase instantaneous overcurrent has operated	HiZPHIZ
HiZSt	ENS	Represents the status of Hi-Z fault detection function. Edition 2.	HiZPHIZ
HiZSt	INS	Represents the status of Hi-Z fault detection function. Edition 1.	HiZPHIZ
HzBndHi	MV	High Frequency range of selected MSOD# FREQ BAND	OscDetMOSC
HzBndLo	MV	Low Frequency range of selected MSOD# FREQ BAND	OscDetMOSC
HzChgRte	MV	Frequency rate of change measured value. FREQUENCY RATE OF CHANGE 1 in Hz/s.	RteHzPFRC
HzLedInd	SPS	An LED. The LED FREQUENCY operand.	LEDsIHMI
HzObAccum	MV	FREQUENCY OOB BAND 1 ACCUMULATION in percentage (%)	HzBnd$PTUF
HzOsc	MV	Measured frequency of the oscillation	OscDetMOSC
IdFail1	SPS	ID check for a peer L30/L90 on the channel has failed. 87L DIFF CH 1 ID FAIL operand, which becomes On when the differential element's ID check for a peer L30 on channel 1 has failed.	LinDfPDIF
IndFailBeh	ENG	Setting to select the behavior of the RxGOOSE Boolean when the sending device is offline: 0 = On, 1 = Off, 2 = Latest/On, 3 = Latest/Off	GGIO3
IndPos1	DPS	Generic remote DPS input status values: 0 for intermediate-state, 1 for off, 2 for on, 3 for bad-state. RxGOOSE DPS1 actual value.	GGIO3
InjAmp	MV	Injected current. SH INJECTION AMPS in amperes.	SubHaPHIZ
InjVol	MV	Injected voltage. INJECTED VOLTAGE in volts. SH INJECTION VOLTS in volts.	FldGnd0PHIZ, SubHaPHIZ
InRef1	ORG	General input reference, used for "Enable Controls From GFP" setting	GFPhpIHMI

Data object name	CDC	Semantics	Used in logical nodes...
InService	SPS	LED indication - Relay In-service. The LED IN SERVICE operand.	LEDsIHMI
IntermSt1	SPS	Intermediate-status detected. The BREAKER/SWITCH INTERM operand.	BkrΘXCBR, DiscΘXSWI, GGIO3
IntrAlm	SPS	Indicates that the current exceeded the maximum interrupting current rating during the last interruption event. The BKR ARC 1 MAX OP operand.	CBArc0SCBR
IntrAlmDpo	SPS	Inverse of IntrAlm. The BKR ARC 1 MAX DPO operand.	CBArc0SCBR
IrigbFail	SPS	A bad IRIG-B input signal has been detected. The IRIG-B FAILURE operand.	LPHD
IsoBlk	ACT	Indicates that the isolator position is invalid	B_IsoSSWI, BbIsoSSWI
IsOn	SPS	Indicates the time of day timer is on. The TIME OF DAY 1 ON operand.	TmDayGAPC
IsoPos	ACT	Position of isolator, meaning On (current included in differential zone) or Off (current excluded from differential calculations)	B_IsoSSWI, BbIsoSSWI
KFact	WYE	K factors - Phase related	TrItfPTOC
LastClrTm	INS	Represents the UTC time of user fault reports last cleared time in seconds elapsed since 1970/01/01, 00.00.00. The LAST CLEARED DATE actual value.	UFlt0RFLO
LastRptTm	INS	Represents the UTC time of last user fault report generated time in seconds elapsed since 1970/01/01, 00.00.00. The LAST REPORT DATE actual value.	UFlt0RFLO
LastSqNum	INS	Last sequence number received. Actual value RxGOOSE1 SqNum.	LGOS
LatchErr	SPS	A difference is detected between the wanted and actual latch contact state. The LATCHING OUT ERROR operand.	LPHD
LeoSt	SPS	Line end open status. The LINE PICKUP LEO PKP operand.	LinPkpPIOC
LivDea	SPS	This data object indicates that live/dead conditions have been met. The SYNC 1 DEAD S OP operand, which indicates that live/dead conditions have been met.	SynChkRSYN
LivDeaDpo	SPS	This data object indicates that live/dead conditions have not been met. The SYNC 1 DEAD S DPO operand, which indicates that live/dead conditions have not been met.	SynChkRSYN
LivLiv	SPS	This data object indicates that both sources are live, and that angle, frequency, and voltage difference and range conditions have been met. The SYNC 1 SYNC OP operand, which indicates that both sources are live, and that angle, frequency, and voltage difference and range conditions have been met.	SynChkRSYN
LivLivDpo	SPS	This data object indicates that one or both sources are not live, or that angle, frequency, and voltage difference and range conditions have been met. The SYNC 1 SYNC DPO operand, which indicates that one or both sources are not live, or that angle, frequency, and voltage difference and range conditions have been met.	SynChkRSYN
LivV1	SPS	This data object indicates that V1 is above the LivVal1 setting. The SYNC 1 V1 ABOVE MIN operand, which indicates that V1 is above the LivVal1 setting.	SynChkRSYN
LoadDev	MV	Indicates the motor load standard deviation at the time of the broken rotor bar data acquisition stage. LOAD DEV. AT BRB CALC. in x FLA.	BknRotSVBR
LocCmdAcsOff	SPS	Indicates operations of FlexLogic operand ACCESS LOC CMND OFF	SecGSAL
LocCmdAcsOn	SPS	Indicates operations of FlexLogic operand ACCESS LOC CMND ON	SecGSAL
LocMod	SPS	Capacitor control in local mode. The CAP 1 IN LOCAL operand.	CapCtlGAPC
LocSetAcsOff	SPS	Indicates operations of FlexLogic operand ACCESS LOC SETG OFF	SecGSAL
LocSetAcsOn	SPS	Indicates operations of FlexLogic operand ACCESS LOC SETG ON	SecGSAL
LoLimit	SPS	The number of pulses counted is below the set number	DigCntFCNT

Data object name	CDC	Semantics	Used in logical nodes...
LosLife	MV	XFMR LIFE LOST actual values	LosLifSPTR
LosLifeRte	MV	DAILY RATE LOL actual values	LosLifSPTR
LosPkt1	SPS	The lost packet threshold has been exceeded. The 87L DIFF CH 1 LOSTPKT operand, which becomes On when the differential element has detected the lost packet threshold has been exceeded on channel 1.	LinDfPDIF
LossLd	ACT	The high impedance fault phase A, B, C loss of load element has operated	HiZPHIZ
Lost	SPS	RxSV# stream is lost for Sampled Value Subscription	LSVS
Lower	SPS	PID Lower operand. The PID 1 LOWER operand value.	PIDRegFPID
MAC	VSG	Expected value of Destination MAC address field in messages subscribed to by RxGOOSE#	LGOS, LSVS
MajorErr	SPS	Any of the major self-test errors generated (major error). The ANY MAJOR ERROR operand.	LPHD
ManMod	SPS	Capacitor control in manual mode. The CAP 1 IN MAN operand.	CapCtlGAPC
MaxAsymOp1	SPS	Asymmetry on the channel exceeded pre-set value. The 87L DIFF CH 1 MAX ASYM operand, which becomes On when the Asymmetry on channel 1 exceeded preset value.	LinDfPDIF
MaxCompHz	MV	The frequency of the learned maximum broken rotor bar spectral component. MAXIMUM COMPONENT FREQ. in Hz.	BknRotSVBR
MaxCompLevel	MV	Indicates the learned maximum level of the broken rotor bar spectral component since the last data clear. MAXIMUM COMPONENT LEVEL in dB.	BknRotSVBR
MaxIntrA	MV	Indicates Breaker Arcing Current per phase. BKR 1 AMP MAX phase A/B/C.	CBArcΘSCBR
MaxLoadDev	MV	Indicates the motor load standard deviation at the time when data for the maximum broken rotor bar was acquired. LOAD DEV. AT BRB MAX in x FLA.	BknRotSVBR
MaxMotLoad	MV	Indicates the average motor load at the time when data for the maximum broken rotor bar was acquired. MOTOR LOAD AT BRB MAX in x FLA.	BknRotSVBR
MaxVal1	ASG	Maximum value in deadband calculations	TDCInGGIO1, TDCOutGGIO1
MinorErr	SPS	Any of the minor self-test errors generated (minor error). The ANY MINOR ERROR operand.	LPHD
MinVal1	ASG	Minimum value in deadband calculations	TDCInGGIO1, TDCOutGGIO1
MltLev	SPG	Select mode of authority for local control true means control from level below a level where Loc is true are allowed where Loc at the lower level is false	Master/LLN0
MMSConnects	MV	Number of MMS client connections active	LPHD
MnlCls	SPS	Manual close initiated. The BREAKER 1 MNL CLS operand.	Bkr0XCBR
MnlOpn	SPS	Manual open initiated. The BREAKER 1 MNL OPEN operand.	Bkr0XCBR
Month1	SPS	Current month, where 1 = January. The MONTH operand.	TmDayGAPC
MotLoad	MV	The average motor load at the time of the broken rotor bar data acquisition stage. MOTOR LOAD AT BRB CALC. in x FLA	BknRotSVBR
MotStatus	ENS	Indicated the status of the motor (in Actual Values) where 0 = Offline, 1= Starting, 2 = Running and 3 = Overload. Thermal Model MOTOR STATUS.	MotThmPTTR
MotUnb	MV	% thermal model motor unbalance. THERMAL MODEL MOTOR UNBALANCE in percentage (%).	MotThmPTTR
NegTotVArh	MV	SRC 1 Total VAr-hour in negative direction	EnrMtrMMTR
NegTotWh	MV	SRC 1 Total Watt-hour in negative direction	EnrMtrMMTR

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Data object name	CDC	Semantics	Used in logical nodes...
NeutOpn	SPS	Indicates source has lost voltage signal. The SRC1 VT NEU WIRE OPEN operand.	VtffGAPC
NeutSupn	SPS	Neutral overcurrent supervision status. The GND DIST Z1 SUPN IN operand.	GndDisPDIS
NeutVx	CMV	Neutral point voltage in pu	NuVUnPTOV
NoASDU	ENG	RxSV# ASDUs setting: 1 = 1; 2 = 2. For Sampled Value Subscription.	LSVS
NumCycPer	INS	Number of cycles of the nominal frequency. The CYCLES PER RECORD actual value.	OscRDRE
Off	SPS	Logic 0 fixed operand	Master/LLN0
Offline	SPS	Indicate the motor is offline. The MOTOR OFFLINE operand.	MotThmPTTR
On	SPS	Logic 1 fixed operand	Master/LLN0
OnePoleOpn	SPS	One pole is open, others closed. The BREAKER 1 ONE P OPEN operand.	Bkr0XCBR
OnePU	ASG	The per-unit base factor applied to the corresponding RxGOOSE analog input FlexAnalog quantity to normalize it to a per-unit quantity.	GGIO3
OnMod	SPS	Relay in On Mode	Master / LNN0
OPAccm	ACT	Indicates the thermal/mechanical damage exceeded total accumulated max setting	ThrFltGAPC
OpAlm	ACT	Operate indicates the alarm decision of a protection function. The U/CURR ALARM OP operand. The UNDERPWR 1 ALARM OP operand.	UnCurPTUC, UnPwrPDUP
OpBia	ACT	B90 Operate indicates the trip decision of a biased protection logic	B_DifPDIF
OpFltCnt	ACT	Indicates number of fault currents has exceeded Fault Counter Max setting	ThrFltGAPC
OpHiSet	ACT	B90 Operate indicates the trip decision of the HISET element of breaker failure current supervision function.	B_BFaiPIOC
OpLoSet	ACT	B90 Operate indicates the trip decision of the LOSET element of breaker failure current supervision function.	B_BFaiPIOC
OpnCirc	SPS	Open circuit detected. The RRTD RTD 1 OPEN operand. The RTD Ip 1 OPEN operand.	PRTDsSTMP, RRTDsSTMP
OpnSt1	SPS	Open status detected. The BREAKER/SWITCH OPEN operand. The RxGOOSE DPS1 Off operand.	BbBkrSCBR, BkrΘXCBR, Bkr0XCBR, Disc0XSWI, DiscΘXSWI, GGIO3
OpPhs1	SPS	Indicates a trip decision for a particular cause per phase. The BUS 1 BIASED OP A/B/C operand. The BUS 1 UNBIASED OP A/B/C operand. The PHS DIST Z1 OP AB/BC/CA operand.	BusDifPDIF, PhsDisPDIS
OpSig	MV	Operating signal, the analogue value used by the comparator. FLEXELEMENT 1 OpSig, in per unit.	FlxElGAPC
OpUnBia	ACT	B90 Operate indicates the trip decision of an unbiased protection logic	B_DifPDIF
OpV	WYE	Phase Operating Voltages. Bank Operating Voltage in per unit for Phase A, B, and C.	CPhOvPTOV
Osc	CMV	Measured oscillation magnitude and phase angle	OscDetMOSC
OscilGOOSE	SPS	One or more of GGIO1.Ind###.stVal has been frozen due to frequent status changes (chatter) in the mapped operand. The Oscillatory GOOSE operand.	LPHD
OtherInd	SPS	An LED. The LED OTHER operand.	LEDsIHMI
OvlTripTm	MV	Indicates estimation of trip time on overload. The ESTIMATED TRIP TIME ON OVERLOAD in seconds.	MotThmPTTR
OutOfSrv	SPS	Out-of-service. The BREAKER 1 OOS operand.	Bkr0XCBR
P1Rip	SPS	Autoreclose A single pole is in progress. The AR 1-P RIP operand.	Rec13pRREC

Data object name	CDC	Semantics	Used in logical nodes...
P3Rip1	SPS	Autoreclose 3-pole is in progress via dead time number indicated by the data instance number. The AR 3-P/1 RIP operand.	Rec13pRREC
P3Tr	SPS	Force any trip to 3-phase trip. The AR FORCE 3-P TRIP operand.	Rec13pRREC
PBEth$Fail	SPS	Process Bus Module Ethernet port failure indication. When order code includes UR Process Bus Module.	LPHD
PFLLfail	SPS	Phase and/or frequency lock loop (PFLL) has failed. The 87L DIFF PFLL FAIL operand, which becomes On when the differential element's phase and frequency lock loop (PFLL) has failed.	LinDfPDIF
PhDir1	SPS	Indicates Phase Comparison of differential is satisfied per phase, where the last digit of instance number 1, 2, or 3 refers to phase A, B, and C respectively. The BUS 1 DIR A/B/C operand. The STATOR DIFF1 DIR A/B/C operand.	B_DifPDIF, BusDifPDIF, SttDifPDIF
PhsAInd	SPS	An LED. The LED PHASE A operand.	LEDsIHMI
PhsBInd	SPS	An LED. The LED PHASE B operand.	LEDsIHMI
PhsCInd	SPS	An LED. The LED PHASE C operand.	LEDsIHMI
PlOpn	ACT	Open pole detector is operated. The OPEN POLE OP operand.	OpnPl0SCBR, OpnPlΘSCBR
PosTotVArh	MV	SRC 1 Total VAr-hour in positive direction	EnrMtrMMTR
PosTotWh	MV	SRC 1 Total Watt-hour in positive direction	EnrMtrMMTR
ProcBusFail	SPS	Process bus system status. The PROCESS BUS FAILURE operand.	LPHD
ProcBusTrbl	SPS	HardFiber process bus trouble. The PROCESS BUS TROUBLE operand.	LPHD
ProjDifDis	MV	Synchroscope displayed value for the Phase angle difference between V1 and projected V2 (V2')	SynChkRSYN
ProjectedDif	MV	Phase angle difference between V1 and projected V2 (V2'). Edition 2. SYNCHROCHECK 1 DELTA PHASE', in degrees which is the phase angle difference between V1 and projected V2.	SynChkRSYN
ProjectedV2	CMV	Projected V2 Voltage phasor. Edition 2. SYNCHROCHECK 1 V2' voltage phasor, in primary volts.	SynChkRSYN
PTPChSt$	SPS	$ = 1, 2, 3 represent Port 1, Port 2, and Port 3. Indicates if PTP Time Port (channel) state is down (Disabled OR No Signal) OR up (Calibrating; OR Synch'd (No PDelay); OR Synchronized. $ = 1 to 8 represent Port 1 to 8. Indicates if PTP Time Port (channel) state is down (Disabled OR No Signal) OR up (Calibrating; OR Synch'd (No PDelay); OR Synchronized; OR Qualifying; OR Master.	TmClkLTMS PcClkLTMS
PtpFail	SPS	Bad PTP Signal. The PTP FAILURE operand. No grandmaster clocks available on any of the Process Bus Module ports.	LPHD, PcClkLTMS
QualChkF	SPS	General single alarm for Sampled Value Subscription	LSVS
RackdIn	SPS	Breaker is connected to power system	BbBkrSCBR
RackdOut	SPS	Breaker is not connected to power system	BbBkrSCBR
Raise	SPS	PID 1 RAISE operand value	PIDRegFPID
RawAnsp	MV	Raw neutral split phase current. Raw INsp in per unit.	NeAUnPTOC
RawAPh	WYE	Raw Id in per unit for Phase A, B, and C	PhAUnPTOC
RecBlk	SPS	Manually block autoreclose. The BREAKER 1 BLK RCLS operand.	Bkr0XCBR
RecEna	SPS	Manually enable autoreclose. The BREAKER 1 ENA RCLS operand.	Bkr0XCBR

Data object name	CDC	Semantics	Used in logical nodes...
RefLst	SPS	This operand is set when the process card is free-running, that is, when both PTP grandmaster on process card and 1 PPS from main CPU are not available. Resets when any of the reference is available.	PcClkLTMS
RefWinding	INS	Reference winding. Number of windings used as the reference winding for ratio compensation.	PctDifPDIF
RelDpo	SPS	This data object indicates that not all criteria are fulfilled, and the switching/ operation action is not released to proceed. Complement of Rel. The SYNC 1 CLS DPO operand, which becomes Off when all synchrocheck criteria are fulfilled.	SynChkRSYN
RemCmdAcsOff	SPS	Indicates operations of FlexLogic operand ACCESS REM CMND OFF	SecGSAL
RemCmdAcsOn	SPS	Indicates operations of FlexLogic operand ACCESS REM CMND ON	SecGSAL
RemMod	SPS	Capacitor control in remote mode. The CAP 1 IN REMOTE operand.	CapCtlGAPC
RemSetAcsOff	SPS	Indicates operations of FlexLogic operand ACCESS REM SETG OFF	SecGSAL
RemSetAcsOn	SPS	Indicates operations of FlexLogic operand ACCESS REM SETG ON	SecGSAL
RemUnA	SPS	Indicates remote open pole condition is detected in phase A, B, or C. The OPEN POLE REM OP phase A/B/C operand.	OpnPlΘSCBR
ReSigma	SPC	Command for the Hi-Z Sigma Value Reset	HiZPHIZ
Restart	SPS	Indicates the motor has restarted. The MOTOR RESTART operand.	MotThmPTTR
RgDstIP	VSG	Expected value of Destination IP address field in messages subscribed to by RxGOOSE#. The multicast IP address of subscribed R-GOOSE message.	LGOS
RgRxMode	ENG	R-RxGOOSE1 Reception Mode setting: 0 = Unicast, 1 = SSM; 2=ASM.	LGOS
RgSrcIP	VSG	Expected value of Source IP address field in messages subscribed to by RxGOOSE#. The source IP address of subscribed R-GOOSE message.	LGOS
RlyUTCTms	INS	Represents the relay UTC time in seconds elapsed since 00:00:00 January 1, 1970. Mapped to Modbus register 41A0h value, that is, "Relay time clock set time" register value after converting to UTC (if time zone and DST is used).	LPHD
RrtdComFail	SPS	RRTD communication failure. The RRTD COMM FAIL operand.	LPHD
Rs	SPS	Autoreclose has been reset either manually or by the rest timer. The AR RESET operand.	Rec13pRREC
RsOp	SPS	Target resetting - General indication (binary input). The RESET OP operand value.	TgtRsIHMI
RsOpLoc	SPS	Target resetting - General indication (binary input). The RESET OP (OPERAND) operand value.	TgtRsIHMI
RsOpPB	SPS	Target resetting - General indication (binary input). The RESET OP (PUSHBUTTON) operand value.	TgtRsIHMI
RsOpRem	SPS	Target resetting - General indication (binary input). The RESET OP (COMMS) operand value.	TgtRsIHMI
RsTms	INS	The UTC time of the last clear in seconds elapsed since 00:00:00 January 1, 1970. The LAST CLEARED DATE actual value.	OscRDRE
RtdTrbl	SPS	RTD trouble. The RTD TROUBLE operand.	LPHD
Running	SPS	Indicate the motor is running. The MOTOR RUNNING operand.	MotThmPTTR
RvOp	SPS	Fault direction is reverse. The NEG SEQ DIR OC1 REV operand. The NTRL DIR OC1 REV operand.	NegDocRDIR, NeuDocRDIR
RX1	SPS	Pulse received on channel 1 or 2. The 87PC RX1 operand.	PhCmp1PDIF
RxGooseOff	SPS	One or more RxGOOSE is not responding. The RxGOOSE OFF operand.	LPHD
RxMode	ENG	RxGOOSE# Mode setting	LGOS

Data object name	CDC	Semantics	Used in logical nodes...
Sat1	SPS	Indicates CT saturation is detected. The BUS 1 SAT A/B/C operand.	B_DifPDIF, BusDifPDIF
Sat1	SPS	Indicates phase saturation of differential is detected per phase The STATOR DIFF1 SAT A/B/C operand.	SttDifPDIF
SbstCls	SPS	Manually substituted to close. The BREAKER 1 SUBD CLSD operand.	Bkr0XCBR, BkrCSWI, DiscCSWI, Disc0XSWI
SbstOpn	SPS	Manually substituted to open. The BREAKER 1 SUBD OPEN operand.	Bkr0XCBR, BkrCSWI, DiscCSWI, Disc0XSWI
SecDataClr	SPC	Command CLEAR SECURITY DATA, TRUE = CLEAR SECURITY DATA	SecGSAL
SecEna	ENG	RxRGOOSE1 Security Ena setting: 0=None; 1=Signature; 2=Signature and Encryption. Otherwise ignored.	LGOS
SecEthFail	SPS	Second Ethernet failure. The SECOND ETHERNET FAIL operand.	LPHD
SecndOfDay	INS	Represents integer number of seconds past midnight (Range1-86400). Edition 1. The SecondOfDay actual value in seconds.	TmDayGAPC
SecondOfDay	INS	Represents integer number of seconds past midnight (Range1-86400). Edition 2. The SecondOfDay actual value in seconds.	TmDayGAPC
SeqTO	SPS	The incomplete sequence timer timed out. The AR INCOMPLETE SEQ operand.	Rec13pRREC
SHAmpAng	MV	Sub harmonic current angle. SH CURRENT ANGLE in degrees.	SubHaPHIZ
ShotCnt1	SPS	Autoreclosec shot count is equal to the number indicated by the data instance number. The AR SHOT CNT=1 operand.	Rec13pRREC, Rec3pRREC
ShrtCirc	SPS	Short circuit detected. The RRTD RTD 1 SHORTED operand. The RTD Ip 1 SHORTED operand.	PRTDsSTMP, RRTDsSTMP
Sim	SPC	Simulated GOOSE values or simulated sampled measurand values are used instead of original values since they are first received	LPHD
SntpFail	SPS	SNTP server is not responding. The SNTP FAILURE operand.	LPHD
SPDTR	SPS	Motor switches from speed 2 to speed 1. MOTOR SPD2 TR 2-1 OP operand.	S2AcTmPMSS
Spt	MV	Set point value. The PID 1 Setpoint value.	PIDRegFPID
Start	SPS	One-second pulse at set time of day timer # start time. The TIME OF DAY 1 START operand.	TmDayGAPC
Starting	SPS	Indicate the motor is starting. The MOTOR STARTING operand.	MotThmPTTR
Stop	SPS	One-second pulse at set time of day timer 1 stop time. The TIME OF DAY 1 STOP operand.	TmDayGAPC
StrAccTm1	MV	Indicates motor start acceleration time. START 1 ACCELERATION TIME in seconds.	MAccTmPMSS
StrAlm	ACD	Indicates the detection of a fault or an unacceptable condition. The RRTD RTD 1 ALARM PKP operand. The RTD Ip 1 ALARM PKP operand. The U/CURR ALARM PKP operand. The UNDERPWR 1 ALARM PKP operand.	PRTDsSTMP, RRTDsSTMP, UnCurPTUC, UnPwrPDUP
StrBia	ACD	B90 Start Biased indicates the detection of a fault or an unacceptable condition by Biased Differential element	B_DifPDIF
StrCls	SPS	Close start indicates the pickup of close command, and its operation is pending. The AVR 1 CLOSE PKP operands.	AvrGAPC
StrEffA1	MV	Indicates motor start effective current. START 1 EFFECTIVE CURRENT in x FLA.	MAccTmPMSS
StrHrLOTm	MV	Start/Hour Lockout Time in minutes	StrRtePMRI
StrInd	SPS	An LED. The LED PICKUP operand.	LEDsIHMI

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Data object name	CDC	Semantics	Used in logical nodes...
StrOpn	SPS	Open start indicates the pickup of open command, and its operation is pending. AVR 1 OPEN PKP operands.	AvrGAPC
StrOutgoing	SPS	This Data Object indicates an unstable Power swing detection for outgoing Locus. The POWER SWING OUTGOING operand.	PwrSwgRPSB
StrPeak1	MV	Indicates motor start peak current. START 1 PEAK CURRENT in x FLA.	MAccTmPMSS
StrPhs1	SPS	Indicates the detection of a fault or an unacceptable condition on a particular phase-to-phase loop. The PHS DIST Z1 PKP AB/BC/CA operand in Phase-To-Phase.	PhsDisPDIS
StrRec3p	SPS	Initiate a three-pole reclose. The TRIP AR INIT 3-POLE operand.	TrOutPTRC
StrTD1	INS	Represents UTC timestamp for motor acceleration Time/DATE in seconds elapsed since 00:00:00, 1970/01/01. The START 1 TIME/DATE actual value.	MAccTmPMSS
StrZ2GndDl	SPS	Start zone 2 ground timer. The TRIP Z2GR TMR INIT operand.	TrOutPTRC
StrZ2PhDl	SPS	Start zone 2 phase timer. The TRIP Z2PH TMR INIT operand.	TrOutPTRC
StubBusOp	SPS	The stub bus function is operated. The STUB BUS OP operand, which becomes On when the Stub Bus function is active.	LinDfPDIF
SumHa3NVZroV	MV	Sum of third harmonic neutral voltage and zero sequence voltage. The STATOR GND 3RD HARM VN+V0 in volts.	StatrPHIZ
SvID	VSG	Expected value of MsvID field in messages subscribed to by RxSV#	LSVS
SwFail	SPS	Autoreclose mode switching failed. The AR MODE SWITCH FAIL operand.	Rec13pRREC
SynChkF	SPS	Unsynchronized to common time source, for Sample Value Subscription	LSVS
SysExcp	SPS	System exception. The SYSTEM EXCEPTION operand.	LPHD
TagOff	SPS	Breaker or switch not tagged. The BREAKER 1 TAG OFF operand.	Bkr0XCBR, BkrCSWI, DiscCSWI, Disc0XSWI
TagOn	SPS	Breaker or switch tagged. The BREAKER 1 TAG ON operand.	Bkr0XCBR, BkrCSWI, DiscCSWI, Disc0XSWI
TapLocFlt	SPS	L90 - The fault is identified between the local terminal and the tap point. The TAP-LOCAL FAULT operand.	FltRptRFLO
TdrTrbl	SPS	TDR trouble. The TDR TROUBLE operand.	LPHD
TempMnt	SPS	The ambient temperature is greater than the maximum operating temperature. The TEMP MONITOR operand.	LPHD
TestMod	SPS	LED indication - Relay in Test Mode. The LED TEST MODE operand.	LEDsIHMI
TestPrgInd	SPS	LED indication - Test In-Progress. The LED TEST IN PROGRESS operand.	LEDsIHMI
ThmCap	MV	% thermal model motor unbalance. MOTOR THERMAL CAPACITY USED in percentage (%).	MotThmPTTR
ThmLOTm	MV	Indicates Thermal Lockout for the motor. THERMAL LOCKOUT TIME in seconds.	MotThmPTTR
ThrdEthFail	SPS	Third Ethernet failure. The THIRD ETHERNET FAIL operand.	LPHD
TmChgOp1	SPS	Change in round trip delay on the channel exceeded pre-set value. 87L DIFF CH 1 TIME CHNG operand, which becomes On when the Change in round trip delay on channel 1 exceeded preset value.	LinDfPDIF
TmnsDelta	MV	PTP-IRIG-B Delta in ns	TmClkLTMS
TmOfClc	INS	Represents the UTC time of the broken rotor bar calculation in seconds elapsed since 1970/01/01, 00.00.00. The TIME OF BRB CALC. actual value.	BknRotSVBR

Data object name	CDC	Semantics	Used in logical nodes...
TmOfMax	INS	The TIME OF MAXIMUM BRB actual value	BknRotSVBR
TmStr1	SPS	Power swing timer picked up. The POWER SWING TMR2 PKP operand.	PwrSwgRPSB
TmSynSrc	ENS	Indicates RTC Sync Source, which is the time synchronizing source the device is using at present. Possible sources are: Port1 PTP Clock, Port2 PTP Clock, Port3 PTP Clock, IRIG-B, SNTP, and None. The Sync Source actual value is the time synchronizing source the UR Process Bus Module is using at present. Possible sources are: Port 1 PTP Clock, Port 2 PTP Clock, Port 3 PTP Clock, Port 4 PTP Clock, Port 5 PTP Clock, Port 6 PTP Clock, Port 7 PTP Clock, Port 8 PTP Clock, CPU clock, and None.	TmClkLTMS, PcClkLTMS
ToOilTmp	MV	Indicates top oil temperature. The TOP OIL degrees C actual value.	HPTmpSPTR
TotAccmA	MV	Phase A total thermal/mechanical damage	ThrFltGAPC
TotAccmB	MV	Phase B total thermal/mechanical damage	ThrFltGAPC
TotAccmC	MV	Phase C total thermal/mechanical damage	ThrFltGAPC
TotLOTm	MV	Indicates total lockout time for the motor. TOTAL MOTOR LOCKOUT TIME in seconds.	MotThmPTTR
Tr1p	ACT	Single pole trip operation initiated. The 87L TRIP 1P OP operand. General is TRIP 1-POLE operand, phsA is TRIP PHASE A operand, phsB is TRIP PHASE B operand, and phsC is TRIP PHASE C operand.	LinDfPDIF, TrOutPTRC
Tr3p	ACT	Three pole trip operation initiated. The DCUB TRIP 3P operand. The DIR BLOCK1 TRIP 3P operand. The DUTT TRIP 3P operand. The HYBRID POTT TRIP 3P operand. The 87L TRIP 3P OP operand. The POTT1 TRIP 3P operand. The PUTT TRIP 3P operand. The TRIP 3-POLE operand.	DCB_PSCH, DCB1_PSCH, DCUB_PSCH, DUTT_PSCH, HPOTT_PSCH, LinDfPDIF, POTT_PSCH, POTT1_PSCH, PUTT_PSCH, TrOutPTRC
Tr3pFrcd	SPS	Three pole trip mode is being forced. The TRIP FORCE 3-POLE operand (3-pole trip mode is being forced).	TrOutPTRC
TransBlk	SPS	Phase comparison transient blocking has operated. The 87PC TRANS BLOCK OP operand.	PhCmp1PDIF
TrcHz	MV	B90 frequency	B_FrqMMXN
Trigger11	ENS	Represents the Hi-Z Data Capture 1 trigger type. Edition 2.	HiZPHIZ
Trigger11	INS	Represents the Hi-Z Data Capture 1 trigger type. Edition 1.	HiZPHIZ
Trigger21	ENS	Represents the Hi-Z Data Capture 1 RMS type. Edition 2.	HiZPHIZ
Trigger21	INS	Represents the Hi-Z Data Capture 1 RMS type. Edition 1.	HiZPHIZ
TripInd	SPS	LED indication - Element Trip Indication. The LED TRIP operand.	LEDsIHMI
Trouble	SPS	Trouble operand or LED. The LED TROUBLE operand. The SH STAT GND TRB OP operand.	SubHaPHIZ, LEDsIHMI
TrsFwd	SPS	Fault direction is forward for transient ground fault	TrsGnd
TrsRv	SPS	Fault direction is reverse for transient ground fault	TrsGnd
TstBlkMod	SPS	Relay in Test/blocked Mode	Master/LLN0
TstMod	SPS	Relay in Test Mode	Master/LLN0
Tx1	SPS	Transmit signal. The DCUB TX1 operand. The DUTT TX1 operand. The HYBRID POTT TX1 operand. The POTT1 TX1 operand. The PUTT TX1 operand.	DCUB_PSCH, DUTT_PSCH, HPOTT_PSCH, POTT_PSCH, POTT1_PSCH, PUTT_PSCH
TxStop1	SPS	Transmit signal stop. The DIR BLOCK1 TX1 STOP operand.	DCB_PSCH, DCB1_PSCH

Data object name	CDC	Semantics	Used in logical nodes...
UnA1	SPS	Undercurrent pickup. This operand operates when an open pole condition is detected due to undercurrent in phase A, B, or C. The OPEN POLE I< phase A/B/C operand.	LinPkpPIOC, OpnPlΘSCBR
UNotPrgm	SPS	The Product Setup > Installation > Relay Settings setting is not programmed. The UNIT NOT PROGRAMMED operand.	LPHD
UnV	SPS	Undervoltage pickup. The LINE PICKUP UV PKP operand.	LinPkpPIOC
UpdateTms	ING	Periodic update time	Master/LLN0
UsrPrgmLED1	SPS	Edition 2. LED indication - User Programmable LED status. For enhanced and standard front panels. The LED USER 1 operand.	LEDsIHMI
UsrPrLED1	SPS	Edition 1. LED indication - User Programmable LED status. For enhanced and standard front panels. The LED USER 1 operand.	LEDsIHMI
V1Src	CMV	V1 Voltage phasor. SYNCHROCHECK 1 V1 voltage phasor, in primary volts.	SynChkRSYN
V2Src	CMV	V2 Voltage phasor. SYNCHROCHECK 1 V2 voltage phasor, in primary volts.	SynChkRSYN
VabRMS	MV	Phase AB Voltage RMS. SRC 1 Phase AB Voltage RMS, in primary Volts.	ACsrcMMXU
VADmd	MV	Apparent power demand in VA. SRC 1 DMD VA, in primary volt ampere.	DmdMtrMMTR
VAMaxDmdDt	MV	Max apparent power demand in VA with associated date/time stamp. The ClcMth cannot be used for MAX, as the time stamp definition of IEC 61850 is different from UR. SRC 1 DMD VA, in primary volt ampere, with associated date, SRC 1 DMD VA DATE.	DmdMtrMMTR
VArDmd	MV	Reactive power demand in VAR. SRC 1 DMD VAR, in primary volt ampere reactive.	DmdMtrMMTR
VArMaxDmdDt	MV	Max reactive power demand in VAR with associated date/time stamp. The ClcMth cannot be used for MAX, as the time stamp definition of IEC 61850 is different from UR. SRC 1 DMD VAR, in primary volt ampere reactive, with associated date, SRC 1 DMD VAR DATE.	DmdMtrMMTR
VaRMS	MV	Phase A Voltage RMS. SRC 1 Phase AG Voltage RMS, in primary volts.	ACsrcMMXU
Vaux	CMV	Auxiliary voltage (fourth input in a voltage AC bank). SRC 1 Auxiliary Voltage phasor, in primary volts.	ACsrcMMXN
VauxRMS	MV	Auxiliary voltage RMS (fourth input in a voltage AC bank). SRC 1 Auxiliary Voltage RMS, in primary volts.	ACsrcMMXN
VbcRMS	MV	Phase BC Voltage RMS. SRC 1 Phase BC Voltage RMS, in primary Volts.	ACsrcMMXU
VbRMS	MV	Phase B Voltage RMS. SRC 1 Phase BG Voltage RMS, in primary volts.	ACsrcMMXU
VcaRMS	MV	Phase CA Voltage RMS. SRC 1 Phase CA Voltage RMS, in primary Volts.	ACsrcMMXU
VcRMS	MV	Phase A Voltage RMS. SRC 1 Phase CG Voltage RMS, in primary volts.	ACsrcMMXU
VolLoc	CMV	Composite Voltage at the Local Terminal. Local Vcomp phasor, in primary volts.	VCompMMXU
VolRem1	CMV	Composite Voltage at the Remote Terminal 1, from Channel 1. Term 1 Vcomp phasor, in primary volts.	VCompMMXU
VolRem2	CMV	Composite Voltage at the Remote Terminal 2, from Channel 2	VCompMMXU
VoltMntr	SPS	Voltage Monitor. The VOLTAGE MONITOR operand.	LPHD
VoltsInd	SPS	An LED. The LED VOLTAGE operand.	LEDsIHMI
VOp	MV	NEUTRAL VOLTAGE UNBALANCE # Vop, in pu	NuVUnPTOV

Data object name	CDC	Semantics	Used in logical nodes...
VRst	MV	NEUTRAL VOLTAGE UNBALANCE # Vres, in pu	NuVUnPTOV
VSigLos	SPS	Indicates source has lost voltage signal. The SRC1 VT FUSE FAIL VOL LOSS operand.	VtffGAPC
Watt	MV	Real power in a non-three-phase circuit. In this case it is the average of 3I0 times (phase shifted 3Vo), which is not exactly real power.	WattPSDE
WDmd	MV	Power demand in Watts. SRC 1 DMD W, in primary watt.	DmdMtrMMTR
WMaxDmdDt	MV	Max real power demand in Watt with associated date/time stamp. The ClcMth cannot be used for MAX, as the time stamp definition of IEC 61850 is different from UR. SRC 1 DMD W, in primary watt, with associated date, SRC 1 DMD W DATE.	DmdMtrMMTR
WrnA	SPS	Warning: operating quantity has exceeded 0.7 × PKP for 10s in phase A	TrItfPTOC
WrnB	SPS	Warning: operating quantity has exceeded 0.7 × PKP for 10s in phase B	TrItfPTOC
WrnC	SPS	Warning: operating quantity has exceeded 0.7 × PKP for 10s in phase C	TrItfPTOC
Year	INS	Represents the year (from 1970 onwards). The Year actual value.	TmDayGAPC
Z1Chr1	SPS	Positive-sequence impedance is within the configured characteristic. This Data Object is used by power swing detection element for outer characteristic. The POWER SWING INNER operand. The POWER SWING MIDDLE operand. The POWER SWING OUTER operand.	PwrSwgRPSB
Zero	MV	Analog 0 fixed operand. FlexAnalog fixed operand Off.	Master/LLN0
ZeroSV	SAV	In Master logical device when order code includes a Process Bus Module	Master/LLN0
Zn1Extend	SPS	The zone 1 distance function must be set to the extended overreach value. The AR ZONE 1 EXTENT operand.	Rec13pRREC
Zn2Tr	SPS	Operated from overreaching zone 2 when reclosing the line. The LINE PICKUP RCL TRIP operand.	LinPkpPIOC

3.5.10 Enumerations

3.5.10.1 Standard enumerations

EnumType id and the EnumType content of standard enumerations from IEC 61850 7-4 match those in the tissues standard.

EnumType id and EnumType content of standard enumerations from IEC 61850 7-3 match those in IEC 61850 7-3:Annex D.

3.5.10.2 GE extended enumerations

For extended enumerations, EnumType id begins with the string "GE_Digital_Energy_UR_", followed by descriptive text, followed by "Kind". The following is a sample excerpt of the extended Enumerations from a firmware-generated UR.ICD file.

```
<EnumType id="GE_Digital_Energy_UR_HiZStKind">
        <EnumVal ord="0">Normal</EnumVal>
        <EnumVal ord="1">Coordination Timeout</EnumVal>
        <EnumVal ord="2">Armed</EnumVal>
        <EnumVal ord="5">Arcing</EnumVal>
        <EnumVal ord="9">Downed Conductor</EnumVal>
</EnumType>
<EnumType id="GE_Digital_Energy_UR_TriggerKind">
        <EnumVal ord="0">None</EnumVal>
        <EnumVal ord="1">Loss of Load</EnumVal>
        <EnumVal ord="2">Arc Suspected</EnumVal>
```

```
        <EnumVal ord="3">Arcing</EnumVal>
        <EnumVal ord="4">Overcurrent</EnumVal>
        <EnumVal ord="5">Down Conductor</EnumVal>
        <EnumVal ord="6">External</EnumVal>
</EnumType>
<EnumType id="GE_Digital_Energy_UR_MotStatusKind">
        <EnumVal ord="0">Motor Offline</EnumVal>
        <EnumVal ord="1">Motor Starting</EnumVal>
        <EnumVal ord="2">Motor Running</EnumVal>
        <EnumVal ord="3">Motor Overload</EnumVal>
</EnumType>
<EnumType id="GE_Digital_Energy_UR_RGooseRxModeKind">
        <EnumVal ord="0">Unicast</EnumVal>
        <EnumVal ord="1">SSM</EnumVal>
        <EnumVal ord="2">ASM</EnumVal>
</EnumType>
<EnumType id="GE_Digital_Energy_UR_RGooseSecEnaKind">
        <EnumVal ord="0">None</EnumVal>
        <EnumVal ord="1">Signature</EnumVal>
        <EnumVal ord="2">SignatureAndEncryption</EnumVal>
</EnumType>
<EnumType id="GE_Digital_Energy_UR_FltSegmentKind">
        <EnumVal ord="0">N/A</EnumVal>
        <EnumVal ord="1">LOCAL</EnumVal>
        <EnumVal ord="2">REMOTE 1</EnumVal>
        <EnumVal ord="3">REMOTE 2</EnumVal>
</EnumType>
<EnumType id="GE_Digital_Energy_UR_TimeSourceKind">
        <EnumVal ord="0">None</EnumVal>
        <EnumVal ord="1">Port 1 PTP Clock</EnumVal>
        <EnumVal ord="2">Port 2 PTP Clock</EnumVal>
        <EnumVal ord="3">Port 3 PTP Clock</EnumVal>
        <EnumVal ord="4">IRIG-B</EnumVal>
        <EnumVal ord="5">SNTP</EnumVal>
</EnumType>
```

The table outlines the logical nodes and data objects that use the extended enumerations.

Table 3-236: GE extended enumerations usage

Enum ID	Used in logical node	Using data object	CDC	Semantic
GE_Digital_Energy_UR_HiZStKind	HiZPHIZ	HiZSt	ENS	Status of High Impedance fault detection function
GE_Digital_Energy_UR_TriggerKind	HiZPHIZ	Trigger11	ENS	HIZ Capture1 Trigger Type
		Trigger12	ENS	HIZ Capture2 Trigger Type
		Trigger13	ENS	HIZ Capture3 Trigger Type
		Trigger14	ENS	HIZ Capture4 Trigger Type
		Trigger21	ENS	HIZ RMS Capture1 Trigger Type
		Trigger22	ENS	HIZ RMS Capture2 Trigger Type
		Trigger23	ENS	HIZ RMS Capture3 Trigger Type
		Trigger24	ENS	HIZ RMS Capture4 Trigger Type
GE_Digital_Energy_UR_MotStatusKind	MotThmPTTR	MotStatus	ENS	Motor status
GE_Digital_Energy_UR_RGooseRxModeKind	LGOS	RgRxMode	ENG	Routable GOOSE reception mode
GE_Digital_Energy_UR_RGooseSecEnaKind	LGOS	SecEna	ENG	Routable GOOSE security
GE_Digital_Energy_UR_FltSegmentKind	FltRFLO	FltSegment	ENS	Segment of the line fault occured
GE_Digital_Energy_UR_TimeSourceKind	TmClkLTMS	TmSrc	ENS	RTC Sync source

3.6 SCL implementation conformance statement (SICS)

The table outlines conformance to the Substation Configuration Language (SCL).

Table 3-237: SCL conformance statement

		UR firmware	UR Setup software	Value/comments
ICD Export		**Yes**	**Yes**	
I11	Fix ICD file (no adaptable export needed)	Yes	Yes	
I12	Export of ICD file or IID file according to IED preconfiguration performed by tool			
I13	State the data model name space (61850-7-3 subclause 7.2) within ICD file (LLN0.NamPlt.ldNs value)	Yes	Yes	
I14	State the data model version (61850-7-3 subclause 7.8.3) and any predefined / fixed configuration values within ICD file (9.5.4.4)	Yes	Yes	
I15	Version 2003 export			
I16	Version 2007 export	Yes	Yes	
I17	Predefined data sets			
I18	Predefined control blocks	Yes	Yes	
I19	Substation bay template with IED part			
I110	Communication section with default address	Yes	Yes	
I111	Export correct valKind value (Table 46)			
I112	Exports internal addresses as InRef or Input section (subclause 9.3.13)	Yes	Yes	
I113	Exports internal addresses in Input section with expected serviceType (subclause 9.3.13)			
I114	Exports in UTF-8 coding	Yes	Yes	
SCD import		**If renamed CID**	**Yes**	
I21	Identify IED to be configured in SCD file by IED name	Yes IP address is used to locate the IED name	Yes	
I22	Configure LD name (at least via ldInst, dependent on the IED capabilities) and IED addresses from SCD	Yes	Yes	
I23	Determine communication side addresses of IED inputs from SCD	Yes	Yes	
I24	Determine and use clock communication addresses from SCD			
I25	Configure values of (existing) control block from SCD (9.3)	Yes	Yes	
I26	Prepare (new) control block instances according to SCD file			
I27	Prepare / configure data sets according to SCD file	Yes	Yes	
I28	Modify predefined data sets according to SCD			
I29	Interpret client references in the control blocks of other IEDs to find the control block instances allocated to this IED, and data sent to this IED.	Yes	Yes	
I210	Set IED configuration values and parameter values as defined in SCD file	Yes	Yes	Where configurable
I211	Support changed (reduced capability) valKind (e.g. from Set to RO or to Conf) (able 46)			

		UR firmware	UR Setup software	Value/comments
I212	Support ldName on other IEDs (9.3.4)	Yes	Yes	
I213	Interpret input signal references to source control blocks (9.3.13)	Yes	Yes	
I214	Imports UTF-8 coding of XML	Yes	Yes	
IID export after IED engineering		**Yes**	**Yes**	
I31	IED version and instance information: LPHD.PhyNam: swRev, serNum, LLN0.NamPlt.configRev	Yes	Yes	
I32	Configuration values (fc=CF)	Yes	Yes	
I33	Setting Parameter values (fc=SP, SG)	Yes	Yes	
I34	SCL Header management (9.1)			
I35	Modify IED data model (add LN/Data object/LD, or remove unused LD/LN/Data object)			
Tool functionality				
I41	Support MustUnderstand concept (8.2)	Yes	Yes	
I42	Bind incoming 61850 signals to IED internal (input) signals	Yes	Yes	
I43	Use or create IED Input section for binding incoming (external) signals to internal signals, to document this binding	Yes	Yes	
I44	Create CID file for IED		Yes	
I45	Support ldName for LD name specification	Yes	Yes	
I46	Modify LN prefixes or ldInst			

3.7 PIXIT conformance statement

This section outlines protocol implementation extra information for testing (PIXIT), which relates to restrictions and limitations of a device. This section specifies the PIXIT of the IEC 61850 interface in UR devices.

Together with PICS and the MICS, the PIXIT forms the basis for a conformance test according to IEC 61850-10. The PIXIT entries contain information that is not available in the PICS, MICS, TICS documents or SCL file.

Each table specifies the PIXIT for applicable ACSI service model as structured in IEC 61850-10. The Edition column refers to IEC 61850 Edition 1 and/or Edition 2.

Table 3-238: PIXIT for Documentation

ID	Edition	Description	Value / Clarification
Do1	2	How to expose required firmware versions not present in the datamodel	N/A

Table 3-239: PIXIT for Association model

ID	Edition	Description	Value / Clarification
As1	1	Maximum number of clients that can set-up an association simultaneously	5
As2	1, 2	TCP_KEEPALIVE value. The recommended range is 1..20s.	20 seconds
As3	1, 2	Lost connection detection time	Configurable 11 to 7200 seconds or 10 seconds (disabled). If there is no MMS traffic for this time, the connection is dropped.

ID	Edition	Description	Value / Clarification
As5	1, 2	What association parameters are necessary for successful association: Called values:	Transport selector Y Session selector Y Presentation selector Y AP Title N AE Qualifier N
As6	1, 2	If association parameters are necessary for association, describe the correct values Called values: eg	Transport selector 0001 Session selector 0001 Presentation selector 00000001
As7	1, 2	What are the maximum and minimum MMS PDU sizes?	Max MMS PDU size 120000 Min MMS PDU size 700
As8	1, 2	What is the maximum start up time after a power supply interrupt?	120 seconds
As9	1, 2	Does this device function only as test equipment? (test equipment need not have a non-volatile configuration; but it cannot be part of the substation automation system)	No

3

Table 3-240: PIXIT for Server model

ID	Edition	Edition	Value / Clarification
Sr1	1, 2	Which analogue value (MX) quality bits are supported (can be set by server)?	Validity: Y Good Y Invalid N Reserved N Questionable Data Quality N Overflow N OutofRange N BadReference N Oscillatory N Failure N OldData N Inconsistent N Inaccurate Miscellaneous: Y Source Y Test N OperatorBlocked
Sr2	1, 2	Which status value (ST) quality bits are supported (can be set by server)?	Validity: Y Good Y Invalid N Reserved N Questionable Detail Quality N BadReference N Oscillatory N Failure N OldData N Inconsistent N Inaccurate Miscellaenous: Y Source Y Test N OperatorBlocked
Sr5	1	Which Mode values are supported	On Y [On-]Blocked N Test Y Test/Blocked Y Off Y

Data sets can be configured with up to 64 basic data attributes.

Table 3-241: PIXIT for Data set model

ID	Edition	Description	Value / Clarification
Ds1	1	What is the maximum number of data elements in one data set (compare ICD setting)?	64
Ds2	1	How many persistent data sets can be created by one or more clients? (this number includes predefined datasets)	0
Ds3	1	How many non-persistent data sets can be created by one or more clients?	0

3

Table 3-242: PIXIT for Setting group control model

ID	Edition	Description	Value / Clarification
Sg1	1	What is the number of supported setting groups for each logical device?	6, see SGCB value
Sg2	1, 2	What is the effect of when and how the non-volatile storage is updated? (compare IEC 61850-8-1 16.2.4)?	Not applicable
Sg3	1	Can multiple clients edit the same setting group?	N
Sg4	1	What happens if the association is lost while editing a setting group?	No editable grouped settings are instantiated
Sg5	1	Is EditSG value 0 allowed?	N
Sg6	2	When ResvTms is not present how long is an edit setting group locked?	60 seconds

Table 3-243: PIXIT for Reporting model

ID	Edition	Description	Value / Clarification
Rp1	1	The supported trigger conditions are (compare PICS)	integrity Y data change Y quality change Y data update N general interrogation Y
Rp2	1	The supported optional fields are	sequence-number Y report-time-stamp Y reason-for-inclusion Y data-set-name Y data-reference Y buffer-overflow Y entryID Y conf-rev Y segmentation Y
Rp3	1, 2	Can the server send segmented reports?	Y
Rp4	1, 2	Mechanism on second internal data change notification of the same analogue data value within buffer period (Compare IEC 61850-7-2 14.2.2.9)	Send report immediately
Rp5	1	Multi client URCB approach (compare IEC 61850-7-2:2003 §14.2.1)	Each URCB is visible to all clients
Rp7	1, 2	What is the buffer size for each BRCB or how many reports can be buffered?	36864 bytes
Rp9	1	May the reported data set contain: - structured data objects - data attributes	 Y Y

ID	Edition	Description	Value / Clarification
Rp10	1, 2	What is the scan cycle for binary events? Is this fixed, configurable?	All Boolean and Dbpos type values in "fast" datasets are scanned for 1/8 cycle (2.0 ms at 60 Hz, 2.5 ms at 50 Hz). All values in "slow" datasets are scanned for every 100 ms. Fixed
Rp11	1	Does the device support to pre-assign a RCB to a specific client in the SCL?	N
Rp12	2	After restart of the server is the value of ConfRev restored from the original configuration or retained prior to restart?	Retained prior to restart
Rp13	1, 2	Does the server accept any client to configure / enable a BRCB with ResvTms=-1? What fields are used to do the identification?	ResvTms not used
Rp14	1, 2	What is default value for BRCB.ResvTms if client does not write or ResvTms not exposed in the control block (must be ≥ 0)	0 milliseconds
Rp15	2	Is data model db=0 supported?	Y

Data sets can be configured with up to 64 basic data attributes.

Table 3-244: PIXIT for GOOSE publish model

ID	Edition	Description	Value / Clarification
Gp1	1, 2	Can the test (Ed1) / simulation (Ed2) flag in the published GOOSE be set?	Y
Gp2	1	What is the behavior when the GOOSE publish configuration is incorrect?	GoCB is not instantiated
Gp3	1, 2	Published FCD supported common data classes are	All instantiated FCDs Arrays are supported
Gp4	1, 2	What is the maximum value of TAL (maxTime)? Is it fixed or configurable?	1000 to 300000 ms Configured by SCL or GoCB MaxTime
Gp5	1, 2	What is the fastest retransmission time?	1 to 100 ms Configured by SCL or GoCB MinTime
Gp7	1, 2	What is the initial GOOSE sqNum after restart?	sqNum = 1
Gp8	1	May the GOOSE data set contain: - structured data objects (FCD) - timestamp data attributes	 Y Y
Gp9	1, 2	Does Server or ICT refuse GOOSE payload dataset length greater than SCSM supports?	Y

Table 3-245: PIXIT for GOOSE subscribe model

ID	Edition	Description	Value / Clarification
Gs1	1, 2	What elements of a subscribed GOOSE header are checked to decide the message is valid and the allData values are accepted? If yes, describe the conditions. Notes: • The VLAN tag may be removed by an Ethernet switch and shall not be checked • The simulation flag shall always be checked (Ed2)	Y destination MAC address Y APPID Y gocbRef Y timeAllowedtoLive Y datSet Y goID N T Y stNum N sqNum Y simulation (Ed2) / N test (Ed1) Y confRev Y ndsCom Y numDatSetEntries Y out-of-order dataset members

ID	Edition	Description	Value / Clarification
Gs2	1, 2	When is a subscribed GOOSE marked as lost? (TAL = time allowed to live value from the last received GOOSE message)	Message does not arrive prior to (2 * TAL) + 100 ms
Gs3	1, 2	What is the behavior when one or more subscribed GOOSE messages is not received or syntactically incorrect (missing GOOSE)?	When a subscribed GOOSE is marked as lost, a Self Test Alarm target is generated, and all internal data that is derived from GOOSE data is configured to default values
Gs4	1, 2	What is the behavior when a subscribed GOOSE message is out-of-order?	Sequence number order (with no state number change) is not checked. State number order is checked; the older message is ignored.
Gs5	1, 2	What is the behavior when a subscribed GOOSE message is duplicated?	Duplicate message is ignored
Gs6	1	Does the device subscribe to GOOSE messages with/ without the VLAN tag?	Y with the VLAN tag Y without the VLAN tag
Gs7	1	May the GOOSE data set contain: - structured data objects (FCD) - timestamp data attributes	 Y Y
Gs8	1, 2	Subscribed FCD supported common data classes are...	All FCDs that are defined by GOOSE publishers in the CID file. Arrays are supported.
Gs9	1, 2	Are subscribed GOOSE with test=T (Ed1) / simulation=T (Ed2) accepted in test/simulation mode?	Y
Gs10	1, 2	Max number of dataset members?	64 is the maximum number of FCDAs possible in a dataset, limited to a total number of 64 DAs
Gs11	1	Is Fixed-length encoded GOOSE supported?	N
Gs12	2	Is IEC 62351-6 security supported?	N

Table 3-246: PIXIT for GOOSE performance

ID	Edition	Description	Value / Clarification	
Gf1	1, 2	Performance class	P1 = 3 ms	
Gf2	1, 2	GOOSE ping-pong processing method	Scan cycle based	
Gf3	1, 2	Application logic scan cycle (ms)	Max.	1/8 cycle (2.0 ms @60 Hz, 2.5 ms @50 Hz) or 100 ms (configurable)
			Min.	
Gf4	1	Maximum number of data attributes in GOOSE dataset (value and quality have to be counted as separate attributes)	64	

Table 3-247: PIXIT for Control model

ID	Edition	Description	Value / Clarification
Ct1	1	What control models are supported?	DOns Y SBOns Y DOes Y (XCBR, XSWI, CSWI) SBOes Y (XCBR, XSWI, CSWI)
Ct2	1, 2	Is the control model fixed, configurable and/ or dynamic?	Fixed, Configurable, or Dynamic depending on the particular control point

ID	Edition	Description	Value / Clarification
Ct5	1	Will the DUT activate the control output when the test attribute is set in the SelectWithValue and/or Operate request (when N test procedure Ctl2 is applicable)?	N
Ct8	1	What is the behavior of the DUT when the check conditions are set? Is this behavior fixed, configurable, online changeable?	Y synchrocheck Y interlock-check DUT uses the check value to perform the check Configurable
Ct9	1, 2	Which additional cause diagnoses are supported?	N Unknown Y Not-supported Y Blocked-by-switching-hierarchy Y Select-failed Y Invalid-position Y Position-reached N Step-limit Y Blocked-by-Mode N Blocked-by-process Y Blocked-by-interlocking Y Blocked-by-synchrocheck Y Command-already-in-execution N Blocked-by-health N 1-of-n-control N Abortion-by-cancel N Time-limit-over N Abortion-by-trip Y Object-not-selected Edition 1 specific values: Y Parameter-change-in-execution (Ed 1 semantics) Edition 2 specific values: Y Object-already-selected N No-access-authority N Ended-with-overshoot N Abortion-due-to-deviation N Abortion-by-communication-loss Y Blocked-by-command N None Y Inconsistent-parameters Y Locked-by-other-client N Parameter-change-in-execution (Ed 2 semantics)
Ct10	1, 2	How to force a “test-not-ok” respond with SelectWithValue request	Not possible
Ct11	1, 2	How to force a “test-not-ok” respond with Select request	Not possible
Ct12	1, 2	How to force a “test-not-ok” respond with Operate request	DOns SBOns DOes SBOes As per IEC 61850-8-1, clause 20.11 (“Operator Test Not OK” is returned if an Operate control command is issued, with TEST=TRUE, and the operation fails.)
Ct13	1, 2	Which origin categories are supported / accepted?	Y bay-control Y station-control Y remote-control Y automatic-bay Y automatic-station Y automatic-remote Y maintenance Y process

3

3

ID	Edition	Description	Value / Clarification
Ct14	1, 2	What happens if the orCat value is not supported or invalid?	DOns: Operate fails SBOns: Operate fails DOes: Operate fails SBOes: Select fails
Ct15	1, 2	Does the IED accept a SelectWithValue / Operate with the same control value as the current status value? Is this behavior configurable?	DOns: N SBOns: N DOes: N SBOes: SelectWithValue Y Operate N Configurable Y
Ct16	1	Does the IED accept a select/operate on the same control object from two different clients at the same time?	DOns: Y SBOns: N DOes: N SBOes: N
Ct17	1	Does the IED accept a Select/ SelectWithValue from the same client when the control object is already selected (Tissue #334)?	SBOns: N SBOes: N
Ct20	1, 2	Does the IED support local / remote operation?	Y (XCBR, XSWI)
Ct21	1, 2	Does the IED send an InformationReport with LastApplError as part of the Operate response- for control with normal security?	SBOns: N DOns: N
Ct22	2	How to force a "parameter-change-in-execution"	SBOns: Not possible SBOes: Not possible
Ct23	1, 2	How many SBOns/SBOes control objects can be selected at the same time?	SBOns: n = "multiple" SBOes: n = "multiple"
Ct24	1, 2	Can a controllable object be forced to keep its old state, for example Internal Controllable Objects may not be accessible to force this, whereas a switch like a Circuit Breaker outside the DUT can?	Y (XCBR, XSWI, CSWI)
Ct25	1, 2	When CDC=DPC is supported, is it possible to have DPC (Controllable Double Point) go to the intermediate state? (00)	Y
Ct26	1, 2	Name an enhanced security point (if any) with a finite operate timeout Specify the timeout (in milliseconds)	xxxSystem/Bkr0XCBR1.Pos.operTimeout DOes: 70 ms (configurable) SBOes: 70 ms (configurable)
Ct27	2	Does the IED support control objects with external signals?	DOns: Y SBOns: Y DOes: Y SBOes: Y

Table 3-248: PIXIT for Time synchronization model

ID	Edition	Description	Value / Clarification
Tm1	1	What time quality bits are supported (may be set by the IED)?	Y LeapSecondsKnown N ClockFailure Y ClockNotSynchronized
Tm2	1, 2	Describe the behavior when all time server(s) ceases to respond. What is the time server lost detection time?	Internal clock is used 120 seconds
Tm3	1, 2	How long does it take to take over the new time from time server?	200 seconds
Tm4	1, 2	When is the time quality bit "ClockFailure" set?	Never set

ID	Edition	Description	Value / Clarification
Tm5	1	When is the time quality bit “Clock not Synchronized” set?	When connection to all time servers is lost (see PIXIT-Tm2)
Tm7	1	Does the device support time zone and daylight savings?	Y
Tm8	1, 2	Which attributes of the SNTP response packet are validated?	N Leap indicator not equal to 3 N Mode is equal to SERVER N OriginateTimestamp is equal to value sent by the SNTP client as Transmit Timestamp Y RX/TX timestamp fields are checked for reasonableness N SNTP version 3 and/or 4 N other (describe)
Tm9	1, 2	Do the COMTRADE files have local time or UTC time and is this configurable?	Local N Configurable

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Table 3-249: PIXIT for File transfer model

ID	Edition	Description	Value / Clarification
Ft1	1	What is the structure of files and directories? Where are the COMTRADE files stored? Are COMTRADE files zipped and what files are included in each zip file?	Flat file system with pseudo folders LD/<IED+LD>/COMTRADE Not zipped
Ft2	1, 2	Directory names are separated from the file name by	“/”
Ft3	1	The maximum file name size including path (recommended 64 chars)	64 chars
Ft4	1, 2	Are directory/file names case sensitive?	Not case sensitive
Ft5	1, 2	Maximum file size for SetFile	16 megabytes Only CID files can be received
Ft6	1	Is the requested file path included in the MMS fileDirectory respond file name?	Y
Ft7	1	Is the wild card supported in the MMS fileDirectory request?	Yes, wild card = *
Ft8	1, 2	Is it allowed that two clients get a file at the same time?	N one oscillography file at a time, one event record file at a time, one SCL file at a time, one of any other type of file at a time. Y different file types.
Ft9	1, 2	Which files can be deleted?	None

3.8 TICS conformance statement

A Technical Issue Implementation Conformance Statement (TICS) is required under IEC 61850.

This section provides a template for the TICS. According to the UCA International Users Group (UCAIug) Quality Assurance Program (QAP), the TICS is a required conformance test and is referenced on the certificate.

The tables are for Edition 2.

Below tables give an overview of the applicable mandatory Tissues.

Items in italic are brief interpretations provided by the UCA International Users Group to aid in interpretation and are not normative.

The original TISSUE should be consulted for details of changes.

Y — The server has implemented the Tissue

na — Not applicable if the server does not support the corresponding ACSI service(s)

Tissues 675, 735, 772, 775, 776, and 878 are not relevant for conformance testing..

Table 3-250: Part 6 Tissues

Part 6 Tissue	Description	Implemented by server?
658	Tracking related features *EntryID and CST missing, these are checked by schema*	na
663	FCDA element cannot be a "functionally constrained logical node" *doName now mandatory in FCDA element,* *SCT: refuse to make empty doName? ICT: Refuse SCD*	Y
668	Autotransformer modeling *Autotransformer model in substation section has changed*	na
687	SGCB ResvTms *SettingControl has added attribute resvTms* *see also TISSUE 845*	Y
719	ConfDataSet - maxAttributes definition is confusing maxAttributes now means max count of FCDA in dataset	Y
721	Log element name *LN0/Log now has optional attribute "name"*	na
768	bType VisString65 is missing *VisString65 added as SCL BasicType*	na
779	Object references *"@" as first character in object references now allowed*	Y
788	SICS S56 from optional to mandatory *SICS S56="Interpret IED capabilities and prohibit unsupported usage"*	na
789	ConfLdName as services applies to both server and client *Many changes made to Services section*	Y
804	valKind and IED versus System configuration *valImport missing/false DAI means ICT shall ignore value in SCD and* *SCT shall not change from ICD/IID value.* *Instance section inherits from DA/BDA element.*	Y
806	Max length of log name inconsistent between -6 and -7-2 *LogControl.logName and Log.name restricted to 32 chars*	na
807	Need a way to indicate if "Owner" present in RCB *Services/ReportSettings@owner added*	Y
823	ValKind for structured data attributes *valKind is prohibited on structured attributes*	Y
824	Short addresses on structured data attributes *sAddr is now allowed for structured attributes*	na
825	Floating point value *Server shall support <Val> with exponential notation*	na
845	SGCB ResvTms *Services/SettingGroups/SGEdit added attribute resvTms* *Services/SettingGroups/ConfSG added attribute resvTms* *See also TISSUE 687*	Y
853	SBO and ProtNs *DA[@name=SBO] element shall have ProtNS element*	Y
855	Recursive SubFunction *Substation section extension must be tolerated*	na
856	VoltageLevel frequency and phases *Substation section extension must be tolerated*	na
857	Function/SubFunction for ConductingEquipment *Substation section extension must be tolerated*	na
886	Missing 8-1 P-types *"tP_IP_UDP_PORT" and "tP_IP_TCP_PORT" added*	na

Part 6 Tissue	Description	Implemented by server?
901	tServices as AP or as IED element *Rules for contents of AP/Server/Services are now defined*	Y
936	SupSubscription parameter usage is difficult *SupSubscription "max" replaced by "maxGo" and "maxSv"*	Y
1147	tServices - FileHandling not consistent with -7-2 *Services/FileHandling now means only support for GetFile and GetFileAttributeValues and NOT SetFile/DeleteFile*	Y
1185	Valkind value Conf for EX FC data *valKind=Conf is allowed for dataNs*	Y
1284	SCSM mapping may require a communication section in an ICD file *Server IEDs supporting client/server associations to IEC 61850-8-1 shall include a <Communication> section*	Y
1328	Limitation on the size of data type templates identifiers *Identifier now limited to 255 characters*	Y
1395	Client LN attributes *ReportControl/RptEnabled/ClientLN@ldInst shall be "LD0" for pure clients (without any Logical Devices)*	na
1402	ExtRef during engineering *an ExtRef.intAddr attribute value unequal to empty string (prescribed or filled by the IED tool) is the flag indicating that the ExtRef shall not be deleted by the system tool. The system tool can however remove the link to the source IED.* *<<applicable for SCL tool test>>*	na
1415	SICS-S110 IID import mandatory for Edition2 *only the import of data model modifications and CF value changes is mandatory for system tool* *<<applicable for SCL tool test>>*	na
1419	Support of ldName on other IEDs *SICS I212 is now mandatory*	na
1444	Need to support fixed and SCT controlled Datasets *Services/xxxSetttings@datSet=fix now means "data set pointed by Control Block cannot be altered from ICD/IID value* *<<applicable for SCL tool test>>*	na
1445	ConfReportControl and a fixed ReportSettings *Control block capabilities must be consistent* *<<applicable for SCL tool test>>*	na
1450	originalSclXxx computation rules *Ed2 ICD/IID files specifying SCL@version=2007 SHALL include originalSCLVersion=2007 and originalSCLRevision as attributes of the <IED>element*	Y
1485	Need to supercede Tissue 1398 to clarify SCT behavior *Same as TISSUE 1450* *<<applicable for SCL tool test>>*	Y

Table 3-251: Part 7 Tissues

Part 7 Tissue	Description	Implemented by server?
Part 7-1		
828	Data model namespace revision IEC 61850-7-4:2007[A] *Both 2007 and 2007A are allowed for namespace name*	Y
948	Enumeration (string) values format *Enums are limited to 127 characters from Basic-Latin and Latin-1 character sets*	Y
1151	Simulated GOOSE disappears after 1st appearance when LPHD.Sim = TRUE *New LGOS state machine defined, but TISSUE is not IntOp2, therefore TISSUE is optional if LGOS is used*	Y

Part 7 Tissue	Description	Implemented by server?
1396	The use and configuration flow of LGOS and LSVS is unclear *If Services/SupSubscription@maxGo > 1 then at least 1 LGOS must exist. Same for maxSv/LSVS.* *If maxGo > count(LGOS) then SCT can create additional LGOS. Same for maxSv/LSVS.*	Y
1447	Restriction on ENUMtypes in SCL *If a ENUM DA limits write or configuration to a subset, then that subset must be declared*	Y
1457	Multiple DOI nodes with the same name *LN can have no more than one DOI with same name*	Y
1468	Re-use DO from other LN *allow standard or private dataNs*	Y
1491	CmdBlk blocks itself? *The data CmdBlk shall have no effect on the controllable data Mod or CmdBlk*	Y
1495	GetVariableAccessAttributes error code *Return MMS error access/object-non-existent if the object does not exist*	Y
Part 7-2		
728	BRCB: could PurgeBuf be set when RptEna=TRUE? *PurgeBuf while RptEna=true is prohibited*	Y
778	AddCause values – add value not-supported *Align 7-2 with 8-1 (nothing new to 8-1)*	Y
780	What are unsupported trigger option at a control block? *All control blocks must support all trigger options*	Y
783	TimOper Resp- ; add Authorization check *Clarifies Time-Operated Controls*	na
786	AddCause values 26 and 27 are switched *Annex B.2 has wrong AddCause values*	Y
820	Mandatory ACSI services (use for PICS template) *Model entries M18 (Application Association), M19 (GCB), M20 (SVCB) are new. Services S17 (Substitution) and S61 (GetServerDirectory) are new. Services S1, S3, S4, S5, S6, S8, S16, S18, S23, S36, S37, S41, S42 are changed.*	Y
858	typo in enumeration ServiceType *Tracking serviceType now has GetLogicalNodeDirectory*	na
861	dchg of ConfRev attribute *Clarifies (tracking) BTS.confRev is AFTER BRCB change*	na
1050	GTS Phycomaddr definition in SCL *(Tracking) GTS needs a special structure for SCL*	Y
1071	Length of DO name *Private DO name length shall be <=12 including instance*	Y
1127	Missing owner attribute in BTS and UTS *NSD files for 61850-7-3 show owner in (tracking) BTS/UTS*	na
1202	GI not optional *GI support is mandatory for both URCB and BRCB*	Y
1232	EntryID needs clarification *Segments of a report shall have same identifiers*	Y
1242	NTS definition *NTS.resv have been added*	na
1307	Segmented report with Buffer overflow *Segments of a report shall have identical buf-overflow value*	Y
1428	MTS and NTS should use svOptFlds *MTS.optFlds and NTS.optFlds now have bType=SvOptFlds*	na
1630	Attributes in CDC=LTS do not match 8-1 definition *Order of attributes in LTS changed to:* *logEna, logRef, datSet, oldEntrTm, newEntrTm, oldEnt, newEnt, trgOps, intgPd*	na
Part 7-3		

Part 7 Tissue	Description	Implemented by server?
697	Persistent command / PulseConfig *PulseConfig adds enum "persistent-feedback"* *DPC.cmdQual=="persistent" is conditionally allowed*	na
698	Wrong case is BAC.dB attribute *attribute renamed from "dB" to "db"*	na
711	blkEna freeze data update while setting its quality to operaterBlocked *Mode=Blocked shall not cause q.operatorBlocked*	Y
722	Units for 'h' and 'min' not in UnitKind enumeration *New unit enums 84=hours, 85=minutes*	Y
919	Presence Condition for sVC *svC may be valKind=Conf in ICD file*	Y
925	Presence of i or f attribute - Problem with writing *New constructed attribute class "AnalogueValueCtl"*	na
926	Presence Conditions within RangeConfig *All or none of hhLim+hLim+lLim+llLim shall be present*	na
954	Data attributes with FC=CF should have trgOp=dchg *Some INS and HST and CSG attributes missing dchg*	na
1078	CMV.t update if rangeAng changed *Add rangeAng to"reasons-to-update-timestamp-of-CMV"*	na
1565	db = 0 behaviour *db=0 not longer suppresses reporting*	Y
1578	dataAttribute NameSpace content *Attributes with FC=EX must be initialized in ICD/IID file*	Y
Part 7-4		
671	mistake in definition of Mod & Beh *Beh=on, q=test should be "Processed as valid"*	Y
674	CDC of ZRRC.LocSta is wrong *ZRRC LocSta should be CDC=SPC*	na
676	Same data object name used with different CDC *LCCH.Fer renamed to FerCh, LCCH.RedFer to RedFerCh*	na
677	MotStr is used with different CDC in PMMS and SOPM LN classes *Rename SOPM.MotStr to MotStrNum*	na
679	Remove CycTrMod Enum *Enum is no longer used, use TrMod instead*	na
680	SI unit for MHYD.Cndct *Change unit from S/cm^2 to S/m*	na
681	Enum PIDAlg *Typographical error, invalid XML syntax*	Y
682	ANCR.ParColMod *ParColMod enum values text have changed*	na
683	Enum QVVR.IntrDetMth *IntrDetMth enum values text have changed*	na
685	Enum ParTraMod *ParTraMod enum values text have changed*	na
686	New annex H - enums types in XML *Many changes have been made to enumeration names*	Y
694	Data object CmdBlk *CmdBlk semantics have changed*	na
696	LSVS.St (Status of subscription) *LSVS.St is now mandatory*	na
712	Interpretation of quality operatorBlocked *Mode and Behavior semantics have changed*	na
713	DO Naming of time constants in FFIL *Many DO names in FFIL have changed*	na
714	Enums for ShOpCap and SwOpCap *Type for YPSH.ShOpCap and XSWI.SwOpCap have changed*	Y

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Part 7 Tissue	Description	Implemented by server?
715	RBDR.ChNum1 *RBDR.ChNum1 changes from optional to conditional*	na
716	TAXD text for condition *TAXD.SmRte condition for inclusion has changed*	na
724	ANCR.Auto *ANCR.Auto changes from mandatory to optional*	na
725	Loc in LN A-group *Loc changes to optional, LocKey/LocSta conditions change*	na
734	LLN0.OpTmh vs. LPHD.OpTmh *LLN0.OpTmh deleted, LPHD.OpTmH added as conditional*	na
736	PFSign *MMXU.PFSign enum is extended with 3=Excitation*	Y
742	GAPC.Str, GAPC.Op and GAPC.StrVal *Objects have instance indicator removed (ex, Str1 to Str)*	Y
743	CCGR.PmpCtl and CCGR.FanCtl *Object have instance indicator added (ex:PmpCtl to PmpCtl1)*	na
744	LN STMP, EEHealth and EEName *Removed STMP.EEHealth and STMP.EEName*	Y
772	LPHD.PwrUp/PwrDn should be transient *These objects are now transient*	na
773	Loc, LocKey and LocSta YPSH and YLTC *Add Loc, LocKey and LocSta in YLTC and YPSH (optional)*	na
774	ITCI.LocKey *Add ITCI.LocKey as optional*	na
776	LPHD.OutOv/InOv and LCCH.OutOv/InOv *Clarified: stays true until buffer space again available*	na
800	Misspelling in CSYN *CSYN.VInvTmms renamed to CSYN.VIntvTmms*	na
802	CCGR and Harmonized control authority *Add Loc, LocKSta to every controllable LN (e.g. FSPT)*	na
808	Presence condition of ZMOT.DExt and new Dos *Change ZMOT.DExt to optional; add TotThmSt and MotSt*	na
831	Setting of ConfRevNum in LGOS *Add RxConfRevNum to LGOS and LSVS*	Y
838	Testing in Beh=Blocked *Change semantic of Beh=Blocked to allow controls to be acknowledged even when LN is blocked*	Y
844	MFLK.PhPiMax, MFLK.PhPiLoFil, MFLK.PhPiRoot DEL->WYE *Change these NFLK objects from cdc=DEL to cdc=WYE*	na
877	QVUB -settings should be optional *Change QVUB.UnbDetMth and QVUB.StrVal to optional*	na
908	ARIS.StrSeq - transient *Change ARIS.StrSeq to transient*	na
909	Remove ANCR.ColOpR and ColOpL *Replace ANCR.ColOpR and ANCR.ColOpL with ANCR.ColChg. Add YEFN.ColChg*	na
912	Clarification of PwrRtg/VARtg *Change many DOs in YPTR, and ZGEN, see name space 2007A2.nsd for final result*	na
920	Resettable Counter is NOT resettable *Change GGIO.CntRs to CntVal; Same for FCNT*	Y
932	Rename AVCO.SptVol to AVCO.VolSpt	na
933	Presence of LCCH.RedFerCh and RedRxCnt *Change the presence condition of LCCH.RedChLiv*	na
939	Change CDC for ANCR.FixCol *Change ANCR.FixCol from APC to ASG*	na

Part 7 Tissue	Description	Implemented by server?
991	LGOS: GoCBRef (as well as LSVS.SvCBRef) should be mandatory *LGOS.GoCBRef and LSVS.SvCBRef are now both mandatory*	Y
1007	PTRC as fault indicator - Update of description required *PTRC.Tr and Op and Str conditional (at least 1 of group)*	Y
1044	TapChg in AVCO *AVCO.TapChg is now optional*	na
1077	Rename DOnames within LTIM *LTIM.TmChgDayTm, changed to TmChgDay;* *LTIM.TmChgStdTm changed to TmChgStd*	na
1256	New DO for LTIM to set time "manually" *Add LTIM.TmSet*	na
1331	Mod, Beh and Health with q=TEST, client can't receive their states *Mod while in Blocked will always be processed*	Y
1426	Add two DO for leap seconds in LTIM *LTIM.Leap added*	na
1456	Annex A and Mod/Beh/Health *Mod.stVal writes always ignore test bits in controls*	Y
1568	ISAF.AlmReset ->transient *Change ISAF.AmlReset to transient*	na

Note: TISSUES 675, 735, 772, 775, 776, 878 are not relevant for conformance testing.

Table 3-252: Part 8 Tissues

Part 8-1 Tissue	Description	Implemented by server?
770	GoID type mismatch 18.1.1 and 18.1.2.5.2 *GoID string length is now 129*	Y
784	Tracking of control (CTS) *Tracking CTS has been added*	na
817	Fixed-length GOOSE float encoding *GOOSE float is encoded Tag-0x87, length=5, first octet=8*	na
827	Mandatory ACSI services (Part of 7-2 TISSUE resolution) *Change Table 111 (ServicesSupported): Add initiate, abort, and release.* *Change conditions for defineNamedVariables.*	Y
834	File dir name length 64 *Filename length changed from 32 to 64*	Y
951	Encoding of Owner attribute *xRCB.owner is encoded as 4 octets(IPv4) or 16 octets(IPv6)*	na
1040	More associate error codes *3 additional associate error codes added*	Y
1178	Select Response+ is non-null value *Response to SBO read should be <CO_CtrlObjectRef>*	Y
1324	The response- for DeleteNamedVariableList is not defined *numDeleted=0; error=service/object-constraint-conflict*	na
1345	Fixed-length GOOSE ASN.1 length encoding *GOOSE publisher shall always encode minimum size length field*	na
1441	Optional fields in buffered reports *Writing BRCB.optFld shall not cause a purgeBuf operation*	Y
1442	Journal variableTag for ReasonCode *Example in the standard is incorrect*	na
1453	Purge buffer on write to BRCB *PurgeBuf only occurs if different value is written*	Y
1454	Reports can be transmitted before write(RptEna=true) is confirmed	na

Part 8-1 Tissue	Description	Implemented by server?
1500	the response for DeleteNamedVariableList with a non-existent LN is not specified *CreateDataSet/DefineNamedVariableList specifying a non-existing LD/LN shall fail with access/object-non-existent*	na

Compare the TISSUE database for more details: http://iec61850.tissue-db.com

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3.9 SCL logging

3.9.1 Overview of process

The process of creating a CID file to import into a UR is described in the Configuring the UR using SCL section on page 3-19. As described, the file can be created using EnerVista software or other, third party IEC 61850 configuration software. The file transfer to the UR can be done by EnerVista or another client using one of the specified protocols. Upon receipt of the complete CID file, the UR attempts to parse the file, extract the configuration data and settings that it requires, verify the data, and then apply the data. During the data application process, the UR is taken out of service automatically if required. When complete, the UR goes back to its previous in-service or out-of-service state.

During this entire process, an internal log file in the UR is updated to provide information and possibly error logs that can be used to check the outcome of the process. Transfer this log file from the UR and examine it. This happens automatically if EnerVista is used to import the CID file to the UR.

The name of the SCL Log file is "urscl.log". This file is stored in the UR in a RAM file system, thus the file content is volatile and is lost when the UR is powered off. To view the file, open a command window and enter

```
tftp 10.10.20.34 get urscl.log
```

substituting the IP address of the device for that shown.

3.9.2 SCL file storage on UR

To provide high reliability storage of the CID file in the UR, two copies are maintained in non-volatile memory. One is the working copy and the other is the backup copy. The working copy is the configuration that is currently active in the device, and the backup copy is the last known good copy. Thus, if a CID file storage operation is not completed properly, due to a loss of control power for example, the last good CID file is still be available for use. If a CID file transfer is halted partway through, or if the UR rejects a transferred CID file, the working file settings are still in effect.

ICD and IID files obtained from a UR are created on demand when requested by a client, and thus are not stored in the UR file system. The IID file is always up to date at the time that it is requested.

3.9.3 Generation of CID files

CID files can be produced by EnerVista, a third party Subsystem Configuration Tool (SCT), or even by editing the XML file manually using a text editor. It is recommended that CID files not created by EnerVista that are intended for use in a UR, be imported into EnerVista to check for errors prior to being transferred to a UR.

3.9.4 Schema version used by UR/EnerVista

All IEC 61850 SCL files, including ICD, IID, and CID files are formatted as XML and follow some version of the IEC 61850 XML schema.

UR firmware 7.4 uses IEC 61850 Edition 2, SCL schema version "2007", revision "B", release 1, date 2014-07-18.

It is very important that all CID files sent to the UR are well-formed XML, and are valid according to this IEC schema version. Note that the UR itself does not contain a schema validator. Validate the CID file schema on a computer before the file is transferred to the UR. While the UR performs a number of parsing and data validation checks as described as follows, send only syntactically valid files to the UR.

3.9.5 CID file processing steps

When a file transfer protocol is initiated to send a CID file to a UR, the UR remains in its current operational state until the completion of the file transfer and file validation processes. That is, if the IN SERVICE indicator is on, the UR remains in service, if the IN SERVICE indicator is off, the UR remains out of service.

Upon completion of the file transfer, the UR parses the file and performs a number of validation checks. First, the file is parsed and the data is extracted and stored in internal data structures. To accomplish this, each element and attribute is parsed and the associated data is converted for local storage. Since the file can contain multiple IED elements, the UR locates the "target" IED element and then extracts the appropriate information. See the Configured IED description (CID) file section on page 3-287 for a description of the CID file contents.

If the file is found to be valid, the UR takes itself out of service (the IN SERVICE indicator turns off if it is currently on), and the new configuration is applied. This includes all IEC 61850 configurations in the standard part of the CID file, and the UR settings in the Private settings element of the CID file. If the file is valid, the UR returns to service (the IN SERVICE indicator turns on) if it was in service before the file validation. The CID file import is complete.

If the file is found to be invalid, the existing UR settings remains in place.

In either case, check the urscl.log file to determine if there were any issues found with the CID file.

3.9.6 SCL log file format and examples

The urscl.log file is a simple text file that contains a number of individual entries describing the CID file validation process. Each entry has a timestamp and a description. The entries are categorized as follows:

- INFORMATION — This entry is for information purposes and does not indicate a problem with the CID file
- ERROR — This entry indicates that the UR encountered some type of problem when parsing, validating, or applying the data in the CID file
- INTERNAL ERROR — This entry indicates that the UR encountered an internal error. This type of entry does not normally occur.

The text after the category describes in more detail what was encountered. ERROR entries commonly describe the process or element that was in progress when the error occurred. Examples include "Parsing", "GOOSE subscription", "GOOSE e3-2.0", "ReportControl", and "DAI." Additional contextual information is provided so that the location of the problem can be found in the file.

The following is an example of a log file for a successful CID file import. Note that there are no errors reported and the CID file loaded successfully.

```
2015-12-08 09:00:27.823752 : === INFORMATION: SCL file parsing started. ===
2015-12-08 09:01:09.138276 : INFORMATION: Number of ExtRef elements = 0. Number of successful GOOSE/
R-GOOSE subscriptions = 0/0.
2015-12-08 09:01:09.900773 : INFORMATION: Total number of different data in fast scan list: 0.
2015-12-08 09:01:09.900773 : INFORMATION: Total number of different data in slow scan list: 0.
2015-12-08 09:01:17.173752 : INFORMATION: File '/ram:1/ur.cid' imported.
```

In the following log file, the CID file load fails because the target IED IP address does not match the actual IP address of the UR.

```
2015-12-08 09:20:29.890419 : === INFORMATION: SCL file parsing started. ===
2015-12-08 09:20:30.311192 : ERROR: target IED not found in file.
2015-12-08 09:20:30.311192 : ERROR: Parsing SCL file failed.
```

In the following log file, the CID file load fails because the lnType (logical node type) for the PhsIocPIOCx logical nodes is missing.

```
2015-12-08 09:24:23.357086 : === INFORMATION: SCL file parsing started. ===
2015-12-08 09:24:42.152856 : ERROR: lnType for Logical Node 'TEMPLATEProt/PhsIocPIOC1' not found.
2015-12-08 09:24:42.152856 : ERROR: lnType for Logical Node 'TEMPLATEProt/PhsIocPIOC2' not found.
2015-12-08 09:24:42.152856 : ERROR: lnType for Logical Node 'TEMPLATEProt/PhsIocPIOC3' not found.
2015-12-08 09:24:42.152856 : ERROR: lnType for Logical Node 'TEMPLATEProt/PhsIocPIOC4' not found.
```

In the following log file, the CID file load fails because the IED name attribute is set to "&Test," which is not valid according to the standard as the "&" character is not allowed here.


```
2015-12-08 09:34:55.007086 : === INFORMATION: SCL file parsing started. ===
2015-12-08 09:34:55.423761 : ERROR: Parsing, IED name='&Test' is invalid.
2015-12-08 09:34:55.423761 : ERROR: Parsing SCL file failed.
```

In the following log file, the CID file load fails because the DAI value for 'SPCSO01.sboTimeout' differs from the non-configurable value given in the ICD file.

```
2015-12-08 09:47:29.540418 : === INFORMATION: SCL file parsing started. ===
2015-12-08 09:47:48.471606 : ERROR: Read only DAI 'SPCSO01$sboTimeout' (valKind="RO") in LN
'TestMaster/GGIO2' cannot be changed.
```

In the following log file, the CID file import is successful. Note also that the UR Private element contained some non IEC 61850 settings that have been stored in the UR but do not take effect until the UR is rebooted. Most UR settings take effect without a reboot, and all others generate log entries as shown.

```
2015-12-09 03:10:55.329941 : === INFORMATION: SCL file parsing started. ===
2015-12-09 03:11:36.592443 : INFORMATION: UR reboot is required for setting 'DNP Binary Input Point x'
to take effect.
2015-12-09 03:11:36.629941 : INFORMATION: UR reboot is required for setting 'DNP Channel 1 Port' to
take effect.
2015-12-09 03:11:36.659114 : INFORMATION: Number of ExtRef elements = 0. Number of successful GOOSE/
R-GOOSE subscriptions = 0/0.
2015-12-09 03:11:37.419523 : INFORMATION: Total number of different data in fast scan list: 0.
2015-12-09 03:11:37.419523 : INFORMATION: Total number of different data in slow scan list: 0.
2015-12-09 03:11:41.704931 : INFORMATION: File '/ram:1/ur.cid' imported.
```

3.9.7 Troubleshooting log file errors

When an SCL log file contains an ERROR entry, examine the CID file to find the source of the problem. The log contains sufficient information to find and correct most minor problems. Note that the UR terminates the validation process on the first occurrence of most errors. Thus fixing one error in a CID file can result in the UR detecting the next occurrence of the same type of error. So when an error is found, determine if it is a single error or just the first occurrence of a systemic error.

As described in the Schema version used by UR/EnerVista section on page 3-278, the CID file needs to be well-formed XML that is valid according to the version of the IEC 61850 XML schema currently used by the UR.

When an SCL log file contains an INTERNAL ERROR entry, save the CID file and urscl.log file. Contact the GE information and call center as outlined in the instruction manual.

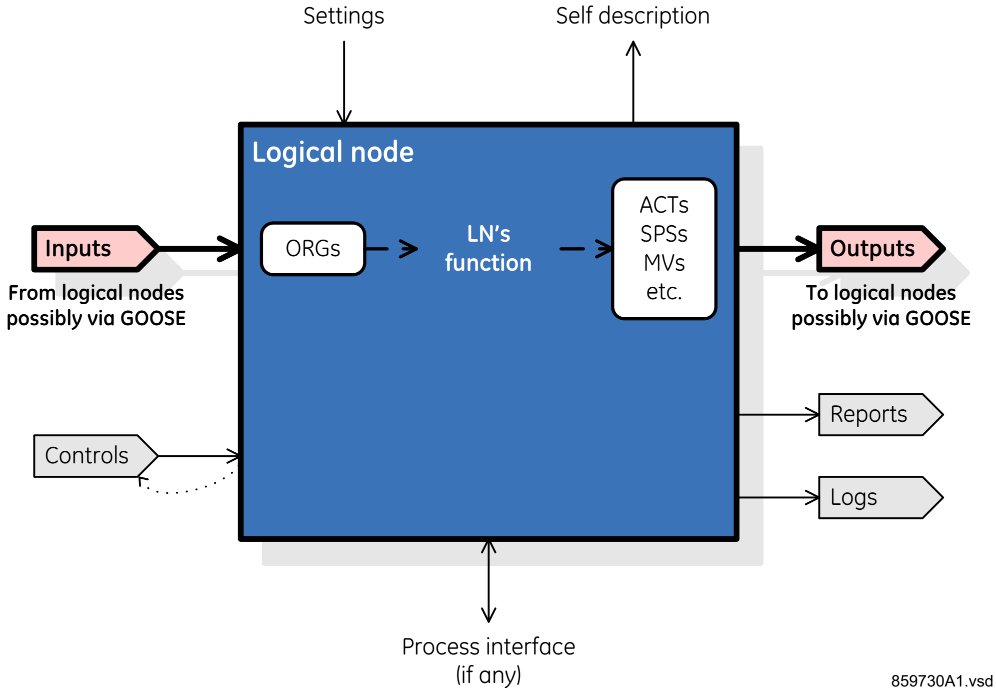
3.10 G2 implementation model for GOOSE configuration via SCL

3.10.1 Introduction

This section specifies the G2 implementation model for configuring the publishing and subscription of GOOSE messages using Substation Configuration Language (SCL) files compliant with IEC 61850 6:2009(E). For context, read the next section (E3-2.0 implementation model).

GOOSE is a communication service defined in the standards and is used to connect virtually an output signal of a logical node in one IED to an input of a logical node in another IED. In this section, the terms input and output are references to signal inputs to and outputs of logical nodes. In the standards, input and output often refer to signals from the process to an IED and from an IED to the process.

Figure 3-13: Generic logical node interfaces for the "logical nodes communicate with logical nodes" standard



The standards provide for the GOOSE configuration process to begin with each IED providing the names of the outputs it can publish in an SCL file. The SCL files at this stage have the file-name extension .icd (an acronym for IED Capability Description). The names and semantics of the outputs are strictly defined in the standards. As the names are standardized, and as SCL standardizes how they are presented in ICD files, all standards-compliant configuration tools are able to recognize the function of each output, even outputs of an IED of a manufacturer unknown to the tool.

However, definition and naming of logical node inputs are left almost exclusively to the IED manufacturer. There is no requirement in the standards for the ICD file to include descriptions of the logical node inputs or their function. Instead, the intent of the standards is that the IED manufacturer provides an "IED configurator" tool specific to the IED that this configurator knows what inputs each logical node has and their function, so that the IED configurator can determine which of the available outputs each can be connected to. The standards suggest but do not require that the IED configurator sends the input to output bindings and other settings to the IED through the use of an SCL file with the file extension .cid (an acronym for Configured IED Description).

In practice, a problem with this approach is that it requires the configuration engineers to use as many IED configurators as there are IED manufactures. As the configurators are from different manufacturers, the engineer needs to learn how to use each. Another problem is that many IEDs do not handle GOOSE publishing and subscribing in the "Logical nodes communicate with logical nodes" (that is, end-to-end) paradigm of the standards. Instead inputs and/or outputs are mapped to and from intermediate objects, such as GGIO using proprietary means, hiding their standardized names and thus their function from generic configurators.

The purpose of this section is to specify means to use the standards such that a single generic implementation model compliant Configurator can interoperate with all G2 implementation model-compliant IEDs sufficiently well that configuration of GOOSE publishing and subscription can be accomplished with moderate effort on the part of the engineer supervising the process. The means do not require proprietary IED configuration tools for GOOSE configuration. The method is strictly compliant with the standards, only requiring that some items optional in the standards be either mandatory or restricted.

3.10.2 Configuration process

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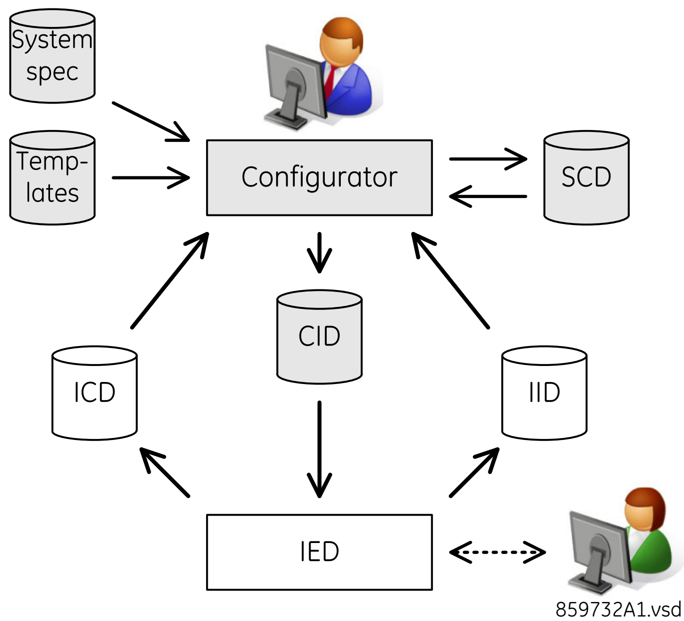
The figure shows the SCL file flow in the configuration process under this implementation model.

Figure 3-14: SCL file flow for IED configuration



An ICD file is obtained from each IED. Each ICD file contains a full description of the capabilities of the IED and all of its factory configuration/settings. Included is a description of all logical node outputs that the IED is able to publish via GOOSE, and of all logical node inputs that it is able to drive from GOOSE subscriptions.

The Configurator imports system specifications, templates, and all ICD files. At this point, the Configurator has descriptions of all inputs and all outputs of all IEDs in the project. Various configuration activities occur, including binding of logical nodes to substation functions. Under the direction of the configuration engineer, the Configurator then determines which outputs are to connect to which inputs, and determines the GOOSE publish and subscription configuration required for these connections. The Configurator can for example use the semantics from the standards, logical node to power system device bindings, and power system device interconnectivity information to prepare for each input a list of likely output candidates for the engineer to select from. Typically, the complete configuration of the project including all configuration/settings of all IEDs is saved in an SCD (an acronym for System Configuration Description) file, although that is outside the scope of this document.

When project configuration is complete, the Configurator prepares a CID file for each IED. Each CID file contains at least all of the configuration/settings relevant to the target IED. In addition to the IED element of the target IED, the CID files have IED elements for each IED that the target IED subscribes to; these other IED elements contain descriptions of the GOOSE messages subscribed to.

When the project IEDs have been installed and connected, the CID files are transmitted to their target IED using an available file transfer protocol, such as SFTP or MMS. Before transfer is initiated, the target IED needs to have settings required by the file transfer protocol entered, such as the IP address. Also, the target IED needs to already have its project specific IED name setting made so that the target IED can determine which of the IED elements in the CID file applies to itself. The IED parses the received file and checks that the CID settings can be implemented; if so it adjusts its internal settings and re-starts using the new set of settings.

At this point, the GOOSE configuration process is complete. However, there can be other settings, such as for protection pickup, that the Configurator did not or cannot set. In this case, the manufacturer's IED setup tool (lower right in the figure) or perhaps the IED's front panel is used to complete these settings. To update the project records (that is, the SCD file) the Configurator obtains and imports an IID (an acronym for Instantiated IED Description) file from the IED. IID files contain a description of the capabilities of the IED and the values of its configuration/settings as of the moment the IID file was retrieved. The IED element for the concerned IED is the only IED element in the file. As a result, the values of the subscribed GOOSE message fields datSet, goID, and confRev, and the structure of the dataset are not contained in IID files unless non-standard means, such as Private elements or logical node extensions, are used. This information can be obtained from the CID or SCD files.

A variation of this sequence is to use the manufacturer's IED setup tool before the Configurator. In this case, the Configurator begins by importing the IID file rather than the ICD file.

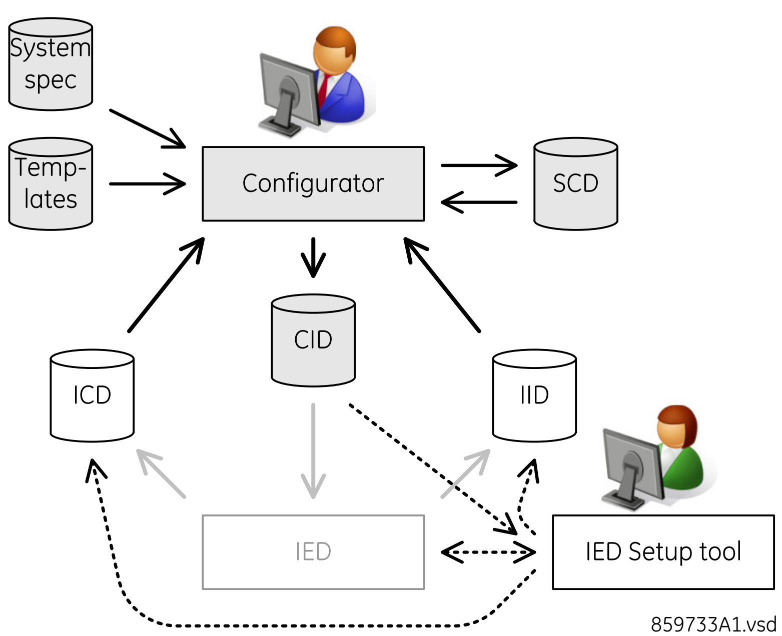
IID files can also be used long after the project is over to verify that the project settings are still present in the IED. The IID file contains the values of configRev, paramRev, and confRev, which are identical to those in the CID file if no setting changes have been made since the CID file was loaded.

3.10.3 Configuration process with IED setup tool

The GOOSE configuration process can also be completed up to the point where the configuration is sent to the IED without involving the IED. The IED setup tool provides the same ability as the IED to generate ICD and IID files and to consume CID files. See the following figure.

Use of the IED setup tool for configuring GOOSE is optional under normal conditions. However, if the hardware configuration of the IED is changed, for instance by changing the number or type of contact I/O modules, use of the IED setup tool can be required.

Figure 3-15: SCL file flow using IED setup tool



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3.10.4 IED Capability Description (ICD) file

The ICD file contains one SCL element. The SCL element contains one Header element, one Communication element, and one IED element.

3.10.4.1 Header

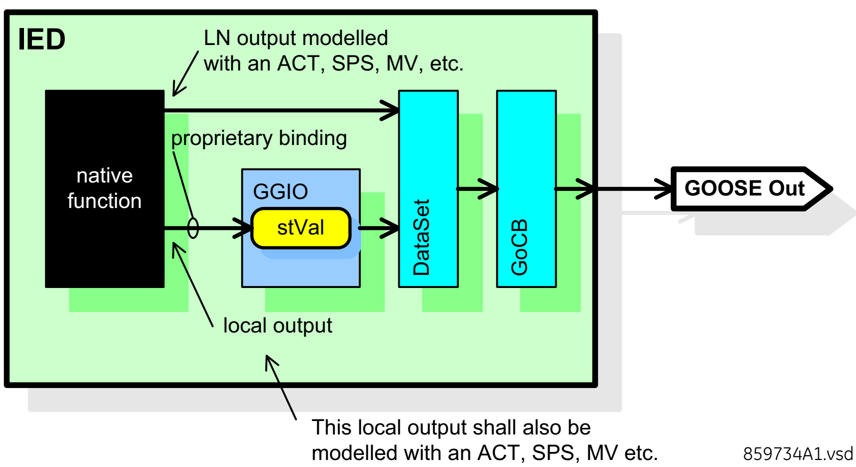
The Header element contains an id element attribute that has the make and model of the applicable IED.

3.10.4.2 Outputs

The ICD file describes an information model compliant with the standards that models all values that the IED is able to publish via GOOSE. These values are modeled within the so-called Public elements, that is, elements other than Private elements.

The values subject to these requirements include local (that is, non-standard or native) outputs that the IED is able to publish using means not defined in the standards. For example, if an IED can use non-standard means to map a local output to GGIO1.Ind1.stVal and then publish GGIO1.Ind1.stVal in a GOOSE message, then compliance to this implementation model requires that the local output be included as a named logical node output in the ICD file. This is required even though when the local output is published, the dataset member is GGIO1.Ind1.stVal rather than the local output. When a CID file is received that requires such a local output to be published, the IED allocates and configures the local resources as necessary to include the value of the local output in the GOOSE message.

Figure 3-16: Mapping local outputs



The extension rules of the standards are used to create data objects to model outputs where no suitable data objects are defined in the standards.

Each data object is to contain a d data attribute describing the IED quantity modeled. The description is to at least contain the manufacturer's designation of the quantity or some reference that can be used to find a detailed functional description of the output in the IED instruction manual.

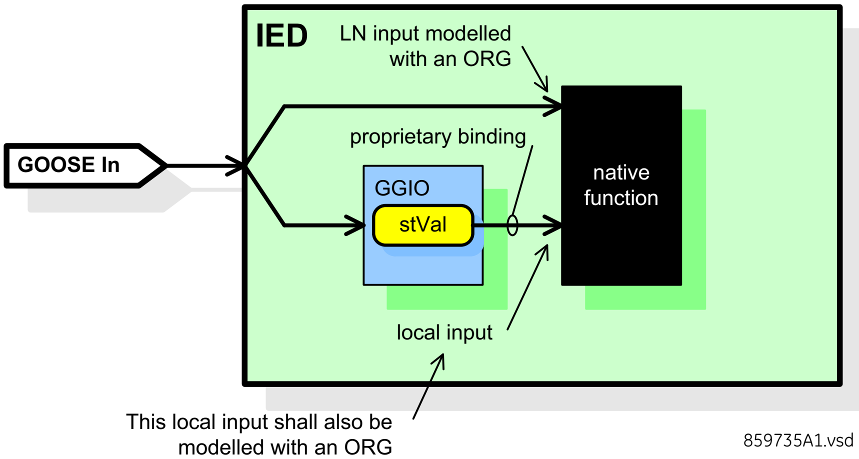
As a result of compliance with this clause, a generic configurator on importing this ICD file has at least the IED designation of all publishable outputs. A generic configurator that can import the manufacturer's namespace also has access to semantic information on all publishable outputs.

3.10.4.3 Inputs

The information model described by the ICD file also models all inputs that can be configured to receive values via GOOSE. These inputs are modeled within the so-called Public elements, that is. elements other than Private elements.

The inputs subject to these requirements include any which are able to receive values in GOOSE messages using means not defined in the standards. For example, if an IED can use standard means to receive values into GGIO1.Ind1.stVal and non-standard means to select GGIO1.Ind1.stVal to a local input of some function, then this implementation model requires that this local input be included as an input in the ICD file. Similarly, a local input that can be selected to an internal signal that receives its value directly from GOOSE messages are also included in the model. When a CID file is received that requires such a local input to receive values from a GOOSE message, the IED is to allocate and configure the local resources as necessary to make this happen, which can include mapping the GOOSE value to a data attribute and using local means to connect this data attribute to the local input.

Figure 3-17: Mapping local inputs



Each input is to include in the ICD file a description of the input modeled. The description is to at least contain the manufacturer's designation of the input or some reference that can be used to find a detailed functional description of the input in the IED instruction manual.

As a result of compliance with this clause, a generic configurator on importing this ICD file has at least the IED designation of all inputs that can receive quantities via GOOSE.

One data object of common data class ORG is to be used to model each input that can be configured to receive values via GOOSE. This data object is to be described in the ICD file as follows.

- One LN element that is used to model the function that uses the input contains one DOI element with element attribute name with value equal to the name of the ORG data object representing the input. The ORG data object name needs to be unique among the data object names in the LN element and be one of the names defined for an ORG data object in the standards. One of the defined names (InRef1) is a general input reference, and thus can be used where no other defined name is suitable. Note that where the standards define a data object name that ends in a "1", they are implying that names with any number in place of the "1" are also defined. Thus the standards allow any number of inputs to be modeled in a logical node using ORG data objects. Where the input is a grouped setting, there is to be one ORG data object for each group. The first digit of the data object instance number is to be the group number.
- The DOI element contains one DAI element with element attribute name="setSrcRef". This DAI element is to contain a single Val element. The content of the Val elements is to be empty, or in cases where there is a factory-configured selection, a valid object reference to the output selected.
- The DOI element also contains one DAI element with element attribute name="setSrcCB". This DAI element is to contain a single Val element. The content of the Val element is to be empty.
- The DOI element also contains one DAI element with element attribute name="d". This DAI element is to contain a single Val element that contains a description of the input modeled.
- Other element attributes and element content defined as optional by the standards can be included, but if included are to be used strictly according to their semantic as defined by the standards.

3.10.4.4 Communication element

The Communication element contains one SubNetwork element for each Ethernet port of the IED that can with appropriate configuration support GOOSE publishing or subscription. Each of these SubNetwork elements is to contain one ConnectedAP element. Each of these ConnectedAP elements is to contain a GSE element for each factory-configured transmit GOOSE message on the corresponding Ethernet port.

Each GSE element is to contain one Address element, one MinTime element, and one MaxTime element. The Mintime element contains the factory-configured value of the sending delay on a data change between the first immediate sending of the change and the first repetition (the value of T1 in IEC 61850 8 1:2011 Figure 8). The Maxtime element contains the factory-configured value of the source supervision time in ms (within this time a failed message from the source is to be detected by the client, some multiple of the time T0 in IEC 61850 8 1:2011 Figure 8).

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Each of the Address elements of the previous paragraph is to contain four P elements: one with type="MAC-Address" containing the factory configured destination address of the GOOSE message, one with type="APPID" containing the Application Identification number as four hexadecimal characters, one with type="VLAN-ID" containing the VLAN ID number as three hexadecimal characters, and one with type="VLAN-PRIORITY" containing the VLAN priority code.

Each GSE element in a given ConnectedAP element is to reference a different GOOSE control block using its cbName and ldInst element attributes. GSE elements in different ConnectedAP elements can reference the same GOOSE control block provided all GSE elements referencing a given GOOSE control block have the same address and time values.

3.10.4.5 IED element

The IED element is to have an element attribute name with a value equal to the factory-configured IED name, which is "TEMPLATE".

The IED element is to contain one Services element. This Services element is to contain a GSESettings element having element attributes cbName, datSet, and appID. The values of each of these element attributes are to be "Fix", "Conf", or "Dyn", depending on how the GOOSE control block attributes GoCBName, DatSet, and GoID can be modified. The value is to be "Conf" when the element attribute value can be modified via CID file transfer to the IED but not via MMS communication services, "Dyn" when the element attribute value can be modified via MMS communication services and via CID file transfer to the IED, and otherwise is to be "Fix".

The Services element also contains a GOOSE element having element attribute max. The value of this element attribute is set to the maximum number of GOOSE control blocks that the IED can support (max="0" means the IED is only a GOOSE subscriber).

The Services element is not to contain a ClientServices element with element attribute called goose.

The IED element also contains one AccessPoint element corresponding to each ConnectedAP element required for the Communication element. Each of these AccessPoint elements is to contain a Services element that in turn contains a ClientServices element having element attribute goose="true". Each of these AccessPoint elements also is to contain one GOOSE element. These GOOSE elements are to have element attribute max with value equal to the number of GOOSE messages that can be transmitted on the port. The IED element can contain other AccessPoint elements, but these are to have a ClientServices element having element attribute goose="false".

For Edition 2, one of the AccessPoint elements is to contain one Server element. All other AccessPoint elements are to contain one ServerAt element having element attribute apName with value equal to the name of the AccessPoint element containing the Server element.

For Edition 1, the AccessPoint element is to contain one Authentication element.

The Server element is to contain at least one LDevice element. Each LDevice element is to contain one LN0 element.

The LN0 elements are to contain amongst them a GSEControl element for each GOOSE control block that the IED is capable of implementing. In cases where the IED element contains multiple LN0 elements, the GSEControl elements can be distributed among the LN0 elements in any fashion.

Each GSEControl element is to have element attributes name, appID, and confRev. In cases where there is a factory-configured GOOSE dataset, the GSEControl element also is to have element attribute datSet. The datSet element attribute is to be omitted where the dataset is not factory-configured. The value of these element attributes are to be the factory configured values of the GOOSE control block attributes GoCBName, GoID, and ConfRev respectively. If element attribute datSet exists, its value is to be the factory-configured value of the GOOSE control block attribute DatSet.

Each GSEControl element having a datSet attribute is to have a corresponding DataSet element located in the same LN0 element as the GSEControl element. Each DataSet element is to contain an FCDA element for each factory-configured member of the dataset. The FCDA elements can reference any data attribute defined in the Server element that the IED is capable of publishing via GOOSE. FCDA elements are not to reference data objects (that is, omit the daName element attribute) except where the IED and all subscribing IEDs are capable of using such in GOOSE messages.

3.10.4.6 GOOSE subscription

For each GOOSE message that can be subscribed to, there is to be in the LDevice element an LN element with element attribute lnClass="LGOS". The LN element is to contain a DOI element with element attribute name="GoCBRef". The DOI element is to contain a DAI element with element attribute name="setSrcRef", and the corresponding DA element is to contain the element attribute valKind="Set". The DAI element is to contain a Val element. The content of the Val elements is to be empty.

Note that it is not practical under this implementation model to have factory-configured GOOSE subscription down to the individual input level. Configuration of inputs for GOOSE subscription consists of a reference to the external IED, and the factory is unaware of what external IEDs are to be connected or what their names are when the IED is deployed.

For this reason, external references are not included in ICD files.

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3.10.5 Instantiated IED capability description (IID) file

IEDs conforming to this implementation model are to have the ability to export an IID file compliant with the standards. This IID file is to be as specified for the ICD file, except that rather than describing the IED with factory configuration and settings, it describes the configuration and settings in effect at the time of IID file export.

Note that it can happen that unbeknownst to the IED, a GOOSE message that it is subscribing to has been reconfigured, changing the outputs published. As the IED is unaware of this, it cannot be certain that the external object references given to it in a CID file continue to be correct.

Also, it can happen that means outside of the standards such as the IED setup tool or front panel can have been used to reconfigure which GOOSE message or which GOOSE dataset member is used by an input, changing the output used by the input without the IED having knowledge of the name of that output.

Nevertheless, the external references in the IID file are to be those in the last accepted CID file.

3.10.6 Configured IED description (CID) file

The CID file is to be equivalent to an ICD or IID file from the target IED for all elements and element attributes specified for the ICD file, except as provided in this clause, and except that rather than describing the IED with factory configuration and settings, it describes the required configuration and settings.

The value of the id element attribute in the Header element can be any string of length not greater than 64.

Modify the following reference names to their project-specific names. Where the name/id of an element is modified, change all references to it so as to maintain the integrity of the references.

- Sub-network name
- Access point name
- IED name
- Logical device ldName
- Data set name, provided the value of GSESettings element's element attribute datSet is other than "Fix"
- GOOSE control block name, provided the value of GSESettings element's element attribute cbName is other than "Fix"
- Logical node type id
- DO type id
- EnumType id

Change the following parameters to their project values:

- MAC address

- APPID
- VLAN ID
- VLAN priority
- MinTime
- MaxTime
- appID (GoID), provided the value of GSESettings element's element attribute appID is other than "Fix"
- confRev
- setSrcRef
- setSrcCB (including those for the LGOS logical nodes)

Where the ICD file contains a GSEControl element with no datSet element attribute, a datSet attribute can be added to the GSEControl element and a like-named DataSet element added to the LN0 element. The data set name can be any name that conforms to the standard and is unique within its containing logical node. The contents of the DataSet elements used for GOOSE can be replaced with any number of FCDA elements up to the number that the IED is capable of.

Where "true" is the value of the element attribute goose in a ClientServices element that is contained in a Services element that is contained in an AccessPoint element, the GSE elements in the ConnectedAP element corresponding to that AccessPoint element can be replaced with new GSE elements up to the limit imposed by the max element attributes in the GOOSE elements corresponding to that ConnectedAP. The replacement GSE elements are to conform to the same rules as given previously for GSE elements in ICD files.

In addition to the ConnectedAP elements derived from an ICD or IID file from the target IED, one ConnectedAP element for each IED the target IED subscribes GOOSE messages from is to be added to each Subnetwork element on which GOOSE messages from that IED are to be received. Each of these ConnectedAP elements is to contain a GSE element for each GOOSE message subscribed to that is identical to the GSE element for that GOOSE message in the publishing IED's CID file.

In addition to the IED element derived from an ICD or IID file from the target IED, the CID also contains one IED element for each IED that the target IED receives a GOOSE message from. These other IED elements are to be identical to the IED element in the publishing IED's CID file, except that the following elements and their content can be omitted:

- Services elements
- AccessPoint elements that do not contain a Server element
- SMVSecurity elements
- Association elements
- AccessControl elements
- Elements contained within LN0 elements other than GSEControl and DataSet elements
- GSEControl elements other than those for GOOSE messages subscribed to
- DataSet elements not referenced by any remaining GSEControl element
- LN elements not referenced by any remaining FCDA element
- LDevice elements that do not contain any remaining GSEControl or LN element
- Elements contained within LN elements
- Private elements

In addition to the DataTypeTemplates element content of an ICD or IID file from the target IED, the CID also is to contain the DataTypeTemplates element content of the CID files the target IED subscribes GOOSE messages from that is referenced by elements copied from those CID files.

A device receiving a CID file can determine which of the IED elements contains its configuration by finding an Address element that is an immediate child of a ConnectedAP element and that contains the MAC address of the receiving IED. The name element attribute of the target IED element has the same value as the iedName element attribute of this ConnectedAP element.

The CID file can contain additional elements unrelated to GOOSE subscription by the target IED. The CID file can even be the entire SCD file with only the id element attribute of the Header element changed, although this results in a larger file than necessary.

The relay makes available for upload the last CID file accepted exactly as received. Setting changes since the CID file was accepted are not reflected in the uploaded file in either the Private or Public sections.

3.10.7 Sample SCL files

The process is illustrated using a simple project involving two identical IEDs, each having a single overcurrent function and a single programmable contact output. The output of the overcurrent is TEMPLATELD1/PIOC1.Op.general, and the contact output is driven by the value selected by TEMPLATELD1/ConOutGGIO1.InRef1. Each also has the capability to publish one GOOSE message and to subscribe to one GOOSE message. The project requires an overcurrent condition detected by one IED to cause the closing of the contact output of the other IED.

3.10.7.1 ICD files

As the IEDs are identical, they have identical ICD files, as follows.


```
<?xml version="1.0" encoding="UTF-8"?>
<SCL xmlns="http://www.iec.ch/61850/2003/SCL" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://www.iec.ch/61850/2003/SCL SCL.xsd" version="2007" revision="A">
<Header id="ICD file for Acme Mini model 123" />

<Communication>
<SubNetwork name="W1" type="8-MMS">
<ConnectedAP iedName="TEMPLATE" apName="S1">
<GSE ldInst="LD1" cbName="GoCB1">
<Address>
<P type="MAC-Address">01-0C-CD-01-00-01</P>
<P type="APPID">3001</P>
<P type="VLAN-ID">000</P>
<P type="VLAN-PRIORITY">4</P>
</Address>
<MinTime>10</MinTime>
<MaxTime>1000</MaxTime>
</GSE>
</ConnectedAP>
</SubNetwork>
</Communication>

<IED name="TEMPLATE">

<Services>
<GSESettings appID="Conf" cbName="Conf" datSet="Conf"/>
<GOOSE max="1"/>
</Services>

<AccessPoint name="S1">
<Server>
<Authentication none="true"/>
<LDevice inst="LD1">

<LN0 inst="" lnClass="LLN0" lnType="LN0">
<GSEControl name="GoCB1" appID="GOOSE1"/>
</LN0>

<LN lnClass="LPHD" inst="1" lnType="LPHD" />

<LN lnClass="PIOC" inst="1" lnType="PIOC">
<DOI name="Op" desc="Instantaneous Overcurrent Operated" />
</LN>

<LN lnClass="GGIO" prefix="ConOut" lnType="GGIO"  inst="1">
<DOI name="InRef1" desc="Contact Output Control">
<DAI name="setSrcRef"><Val></Val></DAI>
```

```
<DAI name="setSrcCB"><Val></Val></DAI>
</DOI>
</LN>

<LN prefix="" lnClass="LGOS" inst="1" lnType="LGOS">
<DOI name="GoCBRef">
<DAI name="setSrcRef"><Val></Val></DAI>
</DOI>
</LN>

</LDevice>
</Server>

</AccessPoint>
</IED>

<DataTypeTemplates>

<LNodeType id="LN0" lnClass="LLN0">
<DO name="NamPlt" type="LN0NamPlt"></DO>
<DO name="Beh" type="Beh"></DO>
<DO name="Health" type="Health"></DO>
<DO name="Mod" type="Mod"></DO>
</LNodeType>

<LNodeType id="LPHD" lnClass="LPHD">
<DO name="PhyNam" type="PhyNam"></DO>
<DO name="PhyHealth" type="Health"></DO>
<DO name="Proxy" type="Proxy"></DO>
</LNodeType>

<LNodeType id="PIOC" lnClass="PIOC">
<DO name="Op" type="ACT" />
</LNodeType>

<LNodeType id="GGIO" lnClass="GGIO">
<DO name="InRef1" type="ORG" />
</LNodeType>

<LNodeType id="LGOS" lnClass="LGOS">
<DO name="St" type="SPS" />
<DO name="GoCBRef" type="ORG" />
</LNodeType>

<DOType id="ORG" cdc="ORG">
<DA name="setSrcRef" fc="SG" dchg="true" bType="ObjRef" />
<DA name="setSrcCB" fc="SG" qchg="true" bType="ObjRef" />
</DOType>

<DOType id="SPS" cdc="SPS">
<DA name="stVal" fc="ST" dchg="true" bType="BOOLEAN" />
<DA name="q" fc="ST" qchg="true" bType="Quality" />
<DA name="t" fc="ST" bType="Timestamp" />
</DOType>

<DOType id="ACT" cdc="ACT">
<DA name="general" fc="ST" dchg="true" bType="BOOLEAN" />
<DA name="q" fc="ST" qchg="true" bType="Quality" />
<DA name="t" fc="ST" bType="Timestamp" />
</DOType>

<DOType id="LN0NamPlt" cdc="LPL">
<DA name="vendor" fc="DC" bType="VisString255"  />
<DA name="swRev" fc="DC" bType="VisString255" ><Val>1v00</Val></DA>
<DA name="ldNs" fc="EX" bType="VisString255"  ><Val>IEC 61850-7-4:2007</Val></DA>
```

```
<DA name="configRev" fc="DC" bType="VisString255" ><Val>not configured</Val></DA>
</DOType>

<DOType id="Beh" cdc="ENS">
<DA name="stVal" fc="ST" dchg="true" dupd="true" bType="Enum" type="Beh" />
<DA name="q" fc="ST" qchg="true" bType="Quality" />
<DA name="t" fc="ST" bType="Timestamp" />
</DOType>

<DOType id="Health" cdc="ENS">
<DA name="stVal" fc="ST" dchg="true" dupd="true" bType="Enum" type="Health" />
<DA name="q" fc="ST" qchg="true" bType="Quality" />
<DA name="t" fc="ST" bType="Timestamp" />
</DOType>

<DOType id="Mod" cdc="ENC">
<DA name="stVal" fc="ST" dchg="true" bType="Enum" type="Mod" />
<DA name="q" fc="ST" qchg="true" bType="Quality" />
<DA name="t" fc="ST" bType="Timestamp" />
<DA name="ctlModel" fc="ST" dchg="true" bType="Enum" type="CtlModels" ><Val>status-only</Val></DA>
</DOType>

<DOType id="PhyNam" cdc="DPL">
<DA name="vendor" fc="DC" bType="VisString255" >
<Val>Acme Manufacturing Ltd., 1 North Rodeo Drive, Beverley Hills, CA, 90210</Val></DA>
</DOType>

<DOType id="Proxy" cdc="SPS">
<DA name="stVal" fc="ST" dchg="true" bType="BOOLEAN" ><Val>false</Val></DA>
<DA name="q" fc="ST" qchg="true" bType="Quality" />
<DA name="t" fc="ST" bType="Timestamp" />
</DOType>

<EnumType id="Beh">
<EnumVal ord="1">on</EnumVal>
<EnumVal ord="2">blocked</EnumVal>
<EnumVal ord="3">test</EnumVal>
<EnumVal ord="4">test/blocked</EnumVal>
<EnumVal ord="5">off</EnumVal>
</EnumType>

<EnumType id="Health">
<EnumVal ord="1">Ok</EnumVal>
<EnumVal ord="2">Warning</EnumVal>
<EnumVal ord="3">Alarm</EnumVal>
</EnumType>

<EnumType id="CtlModels">
<EnumVal ord="0">status-only</EnumVal>
</EnumType>
</DataTypeTemplates>

</SCL>
```

3.10.7.2 CID files

The configurator makes a CID file for each of the two IEDs. The changes from the ICD files are shown in **red**.

CID file for E1Q1BP1 (Publishing IED)

```
<?xml version="1.0" encoding="UTF-8"?>
<SCL xmlns="http://www.iec.ch/61850/2003/SCL" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://www.iec.ch/61850/2003/SCL SCL.xsd" version="2007" revision="A">
<Header id="CID file for E1Q1BP1" />
```

```
<Communication>
<SubNetwork name="W1" type="8-MMS">
<ConnectedAP iedName="E1Q1BP1" apName="S1">
<GSE ldInst="LD1" cbName="GoCB1">
<Address>
<P type="MAC-Address">01-0C-CD-01-00-01</P>
<P type="APPID">3001</P>
<P type="VLAN-ID">010</P>
<P type="VLAN-PRIORITY">7</P>
</Address>
<MinTime>5</MinTime>
<MaxTime>5000</MaxTime>
</GSE>
</ConnectedAP>
</SubNetwork>
</Communication>
<IED name="E1Q1BP1">

<Services>
<GSESettings appID="Conf" cbName="Conf" datSet="Conf"/>
<GOOSE max="1"/>
</Services>

<AccessPoint name="S1">
<Server>
<Authentication none="true"/>
<LDevice inst="LD1">

<LN0 inst="" lnClass="LLN0" lnType="LN0">
<DataSet name="GOOSE1DS">
<FCDA ldInst="LD1" prefix="" lnClass="PIOC" lnInst="1" doName="Op" fc="ST" daName="general"/>
</DataSet>
<GSEControl name="GoCB1" datSet="GOOSE1DS" appID="E1Q1BP1LD1_GOOSE1"/>
</LN0>

<LN lnClass="LPHD" inst="1" lnType="LPHD" />

<LN lnClass="PIOC" inst="1" lnType="PIOC">
<DOI name="Op" desc="Instantaneous Overcurrent Operated" />
</LN>

<LN lnClass="GGIO" prefix="ConOut" lnType="GGIO"  inst="1">
<DOI name="InRef1" desc="Contact Output Control">
<DAI name="setSrcRef"><Val></Val></DAI>
<DAI name="setSrcCB"><Val></Val></DAI>
</DOI>
</LN>

<LN prefix="" lnClass="LGOS" inst="1" lnType="LGOS">
<DOI name="GoCBRef">
<DAI name="setSrcRef"><Val></Val></DAI>
</DOI>
</LN>

</LDevice>
</Server>

</AccessPoint>
</IED>

<DataTypeTemplates>
...
```

In this simple case, the rest of this file is the same as the ICD file.

CID file for E1Q2BP1 (Subscribing IED)

```
<?xml version="1.0" encoding="UTF-8"?>
<SCL xmlns="http://www.iec.ch/61850/2003/SCL" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://www.iec.ch/61850/2003/SCL SCL.xsd" version="2007" revision="A">
<Header id="CID file for E1Q2BP1" />

<Communication>
<SubNetwork name="W1" type="8-MMS">
<ConnectedAP iedName="E1Q1BP1" apName="S1">
<GSE ldInst="LD1" cbName="GoCB1">
<Address>
<P type="MAC-Address">01-0C-CD-01-00-01</P>
<P type="APPID">3001</P>
<P type="VLAN-ID">010</P>
<P type="VLAN-PRIORITY">7</P>
</Address>
<MinTime>5</MinTime>
<MaxTime>5000</MaxTime>
</GSE>
</ConnectedAP>
</SubNetwork>
</Communication>

<IED name="E1Q2BP1">

<Services>
<GSESettings appID="Conf" cbName="Conf" datSet="Conf"/>
<GOOSE max="1"/>
</Services>

<AccessPoint name="S1">
<Server>
<Authentication none="true"/>
<LDevice inst="LD1">

<LN0 inst="" lnClass="LLN0" lnType="LN0">
<GSEControl name="GoCB1" appID="GOOSE1"/>
</LN0>

<LN lnClass="LPHD" inst="1" lnType="LPHD" />

<LN lnClass="PIOC" inst="1" lnType="PIOC">
<DOI name="Op" desc="Instantaneous Overcurrent Operated" />
</LN>

<LN lnClass="GGIO" prefix="ConOut" lnType="GGIO"  inst="1">
<DOI name="InRef1" desc="Contact Output Control">
<DAI name="setSrcRef"><Val>E1Q1BP1LD1/PIOC1.Op.general</Val></DAI>
<DAI name="setSrcCB"><Val>E1Q1BP1LD1/LLN0.GoCB1</Val></DAI>
</DOI>
</LN>

<LN prefix="" lnClass="LGOS" inst="1" lnType="LGOS">
<DOI name="GoCBRef">
<DAI name="setSrcRef"><Val>E1Q1BP1LD1/GoCB1</Val></DAI>
</DOI>
</LN>

</LDevice>
</Server>

</AccessPoint>
</IED>
<IED name="E1Q1BP1">
```

3

```
<AccessPoint name="S1">
<Server>
<Authentication none="true"/>
<LDevice inst="LD1">

<LN0 inst="" lnClass="LLN0" lnType="LN0">
<DataSet name="GOOSE1DS">
<FCDA ldInst="LD1" prefix="" lnClass="PIOC" lnInst="1" doName="Op" fc="ST" daName="general"/>
</DataSet>
<GSEControl name="GoCB1" datSet="GOOSE1DS" appID="E1Q1BP1LD1_GOOSE1"/>
</LN0>

<LN lnClass="PIOC" inst="1" lnType="PIOC">
<DOI name="Op" desc="Instantaneous Overcurrent Operated" />

</LDevice>
</Server>

</AccessPoint>
</IED>

<DataTypeTemplates>
...
```

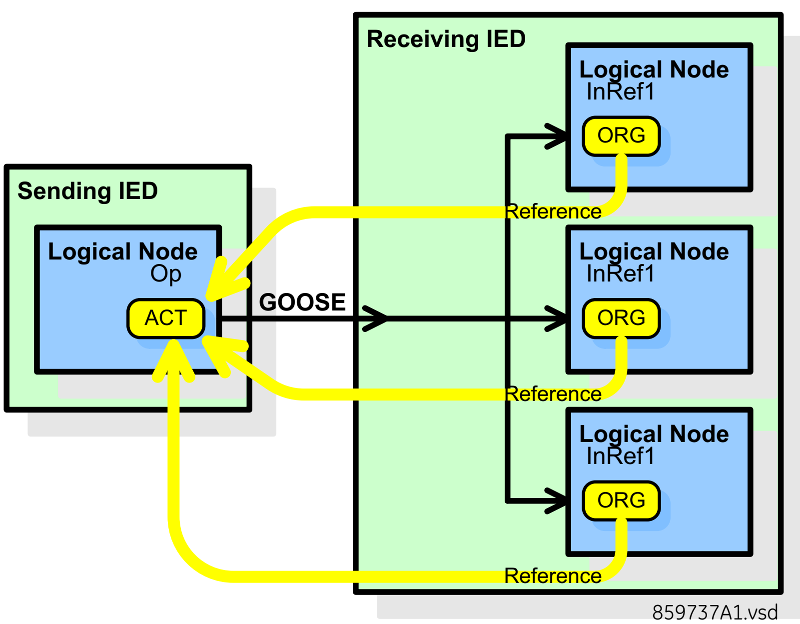
In this simple case, the rest of this file is the same as the ICD file.

3.10.8 Annex - Optional intermediate GOOSE reception objects

3.10.8.1 Introduction

IEC 61850 standards require that "logical nodes communicate with other logical nodes" (IEC 61850-7-1 Edition 2.0 2011-07 clause 9.6). That is to say, from an application viewpoint, the logical nodes (and only the logical nodes) can be understood as being in communication with one another. As illustrated in the following figure, the receiving logical nodes directly reference the sending logical node without an intermediate object in either the sending IED or the receiving IED. This is accomplished in the preceding implementation model through the use of an ORG object in the receiving logical nodes that contains a reference to the sending logical node.

Figure 3-18: Logical nodes communicate with logical nodes



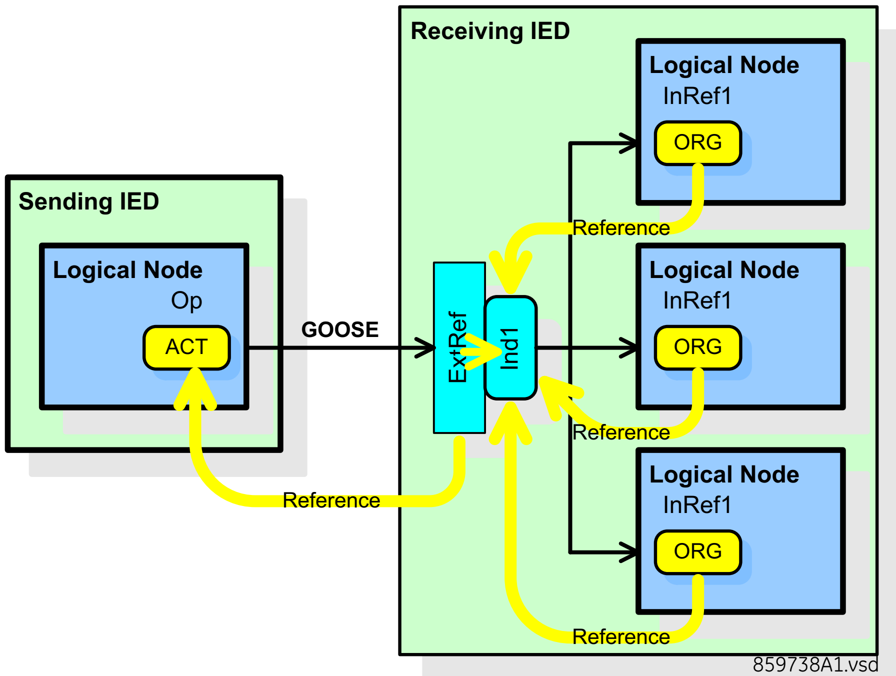
However, this requires that each logical node in the receiving IED that receives a signal via GOOSE needs to be individually configured with the final application-specific reference. This can be a disadvantage for example when a user wants to pre-configure a setting template SCL file for the receiving IED. In the template the user can want to define an application-specific signal, possibly used by multiple devices, that when in-service arrive via GOOSE. The ultimate source of the signal is not known at the template-building stage, so it is not possible to enter in the template an ObjectReference to it. Also, while at this stage, the generic semantic to the signal to be received is known; later at the system configuration stage the signals needed as inputs to the various logical nodes in the receiving IEDs may not be obvious, especially if the signal is input to user programmable logic.

A complementary example is where first a system configuration tool configures GOOSE connections only to the IED, then later an IED configurator completes the connection from where the system configurator left it to the destination logical node.

3.10.8.2 ExtRef

Therefore, the G2 implementation model also allows the IED to support in GOOSE connections intermediate objects at the receiving end, one of which is as shown in the figure.

Figure 3-19: Intermediate object at the receiving end



Each intermediate object is represented in the SCL as an ExtRef element and a data object (Ind1 in the figure) within the same logical node. In devices that implement this feature, the ICD file contains ExtRef elements each pre-configured with the name of the intermediate data object in its intAddr element attribute. The iedName, ldInst, prefix, lnClass, lnInst, doName, and daName element attributes of the ExtRef elements are user-configured to reference the source of the signal in the sending logical node, and the iedName, srcLDInst, srcPrefix, srcLNClass, srcLNInst, and srcCBName element attributes of the ExtRef elements are user-configured to specify the GOOSE control block and thus the GOOSE message the signal is sent in. The desc element attribute of the ExtRef element is available for the user to give the intermediate object an application-specific name or description.

In developing a template file, the configurator is used to assign an intermediate object of the appropriate basic data type for each signal that the IED needs to receive, by putting an application-specific name or description in the desc element attribute of its ExtRef element. The desc element attribute is used in later stages to make the intended use of this intermediate object apparent. In each logical node that uses the signal, the configurator is used to set the input ORG data object to reference the stVal data attribute of the data object referenced by the corresponding intAddr element attribute. When template configuration is complete, the configurator exports either an IID or CID file depending on the tool used, which becomes the template file.

When applying such a template file at the system configuration stage, the configurator is used to put in the ExtRef element a reference to the signal source appropriate to the description in desc element attribute. The configurator is also used to configure a GOOSE control block and dataset in the sending IED to publish the signal, and to put in the ExtRef element a reference to this control block.

3.10.8.3 SCL file example

Were the example IED of clause 7 outlined earlier to support intermediate objects according to this annex, its ICD file then defines each of them with the lines similar to the following in one of its LN or LN0 elements, in this example, in GGIO3. Note that in this example only two such are defined; typically there are many more. The changes from the files are shown in **red**.

3

```
<LN lnClass="GGIO" prefix="ConOut" lnType="GGIO"  inst="1">
<DOI name="InRef1" desc="Contact Output Control">
<DAI name="setSrcRef"><Val></Val></DAI>
<DAI name="setSrcCB"><Val></Val></DAI>
</DOI>
</LN>
<LN lnClass="GGIO" prefix="" lnType="ExtRefs"  inst="3">
<Inputs>
<ExtRef desc="unassigned GOOSE Boolean input #1" intAddr="Ind1"/>
<ExtRef desc="unassigned GOOSE Analog input #1" intAddr="AnIn1"/>
</Inputs>
</LN>

<LNodeType id="ExtRefs" lnClass="GGIO">
<DO name="Ind1" type="SPS" />
<DO name="AnIn1" type="MV" />
</LNodeType>
```

To specify that the IED receives an unspecified "Overcurrent alarm" GOOSE signal and that this signal drives a contact output, the configurator copies the previous code to the template file for the subscribing IED modified as follows.

```
<LN lnClass="GGIO" prefix="ConOut" lnType="GGIO"  inst="1">
<DOI name="InRef1" desc="Contact Output Control">
<DAI name="setSrcRef"><Val>TEMPLATELD1/GGIO3.Ind1.stVal</Val></DAI>
<DAI name="setSrcCB"><Val></Val></DAI>
</DOI>
<LN lnClass="GGIO" prefix="" lnType="ExtRefs"  inst="3">
<Inputs>
<ExtRef desc="Overcurrent alarm" intAddr="Ind1"/>
<ExtRef desc="unassigned GOOSE Analog input #1" intAddr="AnIn1"/>
</Inputs>
</LN>
```

The CID for the example IED of clause 7 earlier then has these lines further modified as follows.

```
<LN lnClass="GGIO" prefix="ConOut" lnType="GGIO"  inst="1">
<DOI name="InRef1" desc="Contact Output Control">
<DAI name="setSrcRef"><Val>E1Q2BP1LD1/GGIO3.Ind1.stVal</Val></DAI>
<DAI name="setSrcCB"><Val></Val></DAI>
</DOI>
<LN lnClass="GGIO" prefix="" lnType="ExtRefs"  inst="3">
<Inputs>
<ExtRef desc="Overcurrent alarm" intAddr="Ind1"
iedName="E1Q1BP1" ldInst="LD1" prefix="" lnClass="PIOC" lnInst="1" doName="Op" daName="general"
srcLDInst="LD1" srcPrefix="" srcLNClass="LLN0" srcCBName="GoCB1"/>
```

```
<ExtRef desc="unassigned GOOSE Analog input #1" intAddr="AnIn1"/>
</Inputs>
</LN>
```

3.11 E3-2.0 implementation model for GOOSE configuration via SCL

3.11.1 Introduction

This section specifies the E3-2.0 GOOSE subscription implementation model in UR 7.30 and later releases.

The "E3 - Spanish Electricity Companies for Studies on IEC 61850" is a working group formed by the main Spanish electricity companies, which agreed on requirements to comply with for devices to be installed in their substations under the IEC 61850 Edition 1.0 standards. These requirements are contained in the document GROUP OF SPANISH ELECTRICITY COMPANIES FOR STUDIES ON IEC 61850 - MINIMUM COMMON SPECIFICATION FOR SUBSTATION PROTECTION AND CONTROL EQUIPMENT IN ACCORDANCE WITH THE IEC 61850 STANDARD, edition 3 (09.06.10). In that document, ANNEX D: GOOSE AND SV SUBSCRIPTION MODELING sets out requirements for two means of using the IEC 61850 6 Edition 1.0 Substation Configuration Language (SCL) to model GOOSE and Sampled Value configuration. Option A specifies a model wherein all subscription information is contained within the IED element modelling the subscribing IED. Option B specifies a model wherein a portion of the information required by the subscriber is contained in IED elements modelling the publishers.

While both options are technically compliant with edition 1.0 of the standard, Option B also is consistent with the standard envisioned for SCL. Except for being implemented under edition 1.0 of the standard, Option B is the same as the G2 Implementation Model, which is outlined later.

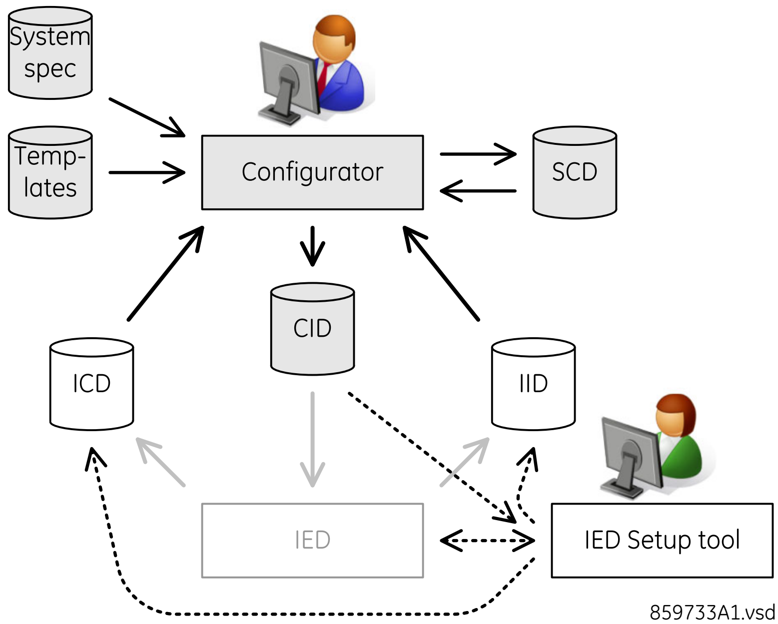
To satisfy customer preference, UR 7.30 and later releases allow SCL files to use either the G2 implementation model or the E3-2.0 implementation model. E3-2.0 is essentially E3 Option A, but with changes required to make it compliant with edition 2.0 of the standard.

3.11.2 Workflow

Workflow of SCL files under E3-2.0 is the same as described in the G2 implementation model. This is summarized in the figure that follows.

- Both the UR and EnerVista UR Setup software can generate ICD files, which contain all the factory default settings. Settings not modelled in Public elements are modelled in a Private element.
- Both the UR and EnerVista UR Setup software can generate IID files, which contain the settings as configured at the time the IID file was generated. IID files contain only a single IED element, the IED element modelling the target IED. In E3-2.0 IID files, all settings are included.
- Both UR and EnerVista UR Setup software can receive CID files. When the UR receives a CID file, it automatically verifies that it can implement the specified functionality, and if no problems are detected, reboots using the settings in the CID file. Although not shown in the figure, the most recently accepted CID file can be retrieved from the UR.
- The UR and EnerVista UR Setup software exchange 61850 configuration, including GOOSE configuration, using IID and/or CID file transfer exclusively. Modbus is retained as an alternative for non-61850 settings. Other than IP Address settings, SCL file transfer is the only means to configure 61850.

Figure 3-20: SCL file flow using IED setup tool



3.11.3 ICD files

Compared to the G2 model, E3-2.0 adds data objects to the LGOS logical nodes as specified in the following table. E3-2.0 configurations do not use the ExtRef elements used by the G2 model. Conversely, the G2 model does not use the LGOS data objects added by E3-2.0. Nevertheless, both the G2 model ExtRef elements and E3-2.0 LGOS data objects are included in ICD files.

Table 3-253: LGOS class for E3-2.0

LGOS class for E3-2.0			
Data object name	**Common data class**	**Explanation**	**T**
LNName		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22	
Data objects			
Descriptions			
NamPlt	LPL	Name plate of the logical node, with d data attribute	
Status information			
Beh	ENS	This logical node's behavior	
St	SPS	Status of the subscription (True = active, False = not active)	
Alm	SPS	Complement of St (True = not active, False = active)	
SimSt	SPS	Status showing that really Sim messages are received and accepted	
LastStNum	INS	Last state number received	
LastSqNum	INS	Last sequence number received	
ConfRevNum	INS	Last configuration revision number received	
Settings			
GoCBRef	ORG	Reference to the subscribed GOOSE control block	
MAC	VSG	Publisher IED MAC address	
APPID	ING	GOOSE message application identifier	
GoDatSetRef	ORG	Reference to the subscribed GOOSE DataSet	

LGOS class for E3-2.0			
Data object name	**Common data class**	**Explanation**	**T**
GoID	VSG	Identification for the GOOSE message	
ConfRev	ING	GOOSE configuration revision number	
InRefδδ	ORG	Data attribute intAddr specifies the intermediate data object receiving values in allData member δδ. Note that δδ is a number from 1 through to the maximum number of members the IED is capable of subscribing to using this LGOS.	

The number of GOOSE messages that can be subscribed to, and thus the number of LGOS logical nodes, is product-specific, and as such is specified elsewhere. Similarly, the maximum number of members that are allowed in a message is specified elsewhere.

3.11.4 CID files

3

A CID file is generated by modifying the configured values in an ICD or IID file, and otherwise keeping the ICD file/IID file as is. Both the G2 model ExtRef elements and the E3-2.0 LGOS data objects are retained in CID files.

E3-2.0 model configuration is assumed when only one IED element is present in the CID file.

The E3-2.0 GOOSE configuration consists of configuring the following LGOS settings for each GOOSE message that is to be subscribed to.

Unlike the G2 model wherein ORG data objects throughout the information model can reference an external data attribute, causing a GOOSE association to automatically form, under E3-2.0 external references are not allowed other than in LGOS#.GoCBRef and LGOS#.GoDatSetRef. Also, under E3-2.0 the GGIO3.Inputs.ExtRef are not allowed to be configured. Conversely, under G2, the LGOS#.InRef data objects used for E3-2.0 are not allowed to be configured. UR 7.30 and later do not accept CID files that violate these rules.

The GoCBRef setting is used by both G2 and E3-2.0 models. Otherwise, only when the UR or EnerVista UR Setup software detects that the E3-2.0 model was used for configuration are the other settings outlined here used.

GoCBRef

An empty string indicates that the LGOS is spare, and subscribes to no message. Otherwise, the setSrcRef data attribute is configured to an ACSI ObjectReference according to IEC 61850-7-2 clause 6.1.2.3 referencing the publishing GOOSE control block, except that if the publishing logical device uses function-related naming (that is, its LDevice element contains an ldName attribute), the LDName portion of the reference must use the value of ldName. Only GOOSE messages with the corresponding MMS Object Name in the gocbRef field are accepted.

MAC

The setVal data attribute is configured to a six-octet hyphen-separated string (for example, 01-0C-CD-01-00-00). Only GOOSE messages with this value of the Destination MAC address field are accepted.

APPID

The setVal data attribute is configured to an integer number from 0 through 65535. If the configured value is not zero, only GOOSE messages with the configured value in the APPID field are accepted. If the configured value is zero, any value in the APPID field is acceptable.

GoDatSetRef

The setSrcRef data attribute is configured to an ACSI ObjectReference according to IEC 61850-7-2 clause 6.1.2.3 referencing the publishing dataset, except that if the publishing logical device uses function-related naming (that is, its LDevice element contains an ldName attribute), the LDName portion of the reference must use the value of ldName. Alternatively, the setSrcRef data attribute can be configured to the empty string. If the configured value is not the empty string, only GOOSE messages with the corresponding MMS Object Name in the datSet field are accepted. If the configured value is the empty string, any value in the datSet field is acceptable.

GoID

The setVal data attribute is configured to a VisibleString with a maximum size of 129 octets. If the configured value is not the empty string, only GOOSE messages with the corresponding string in the goID field are accepted. If the configured value is the empty string, any value in the goID field is acceptable.

ConfRev

The setVal data attribute is configured to an integer number from 0 through 2147483647. If the configured value is not zero, only GOOSE messages with the configured value in the confRev field are accepted. If the configured value is zero, any value in the confRev field is acceptable.

InRefδδ

The intAddr data attribute is configured to either 1) a string that references the intermediate data attribute to which the values received in the δδth member of accepted GOOSE messages are saved, or 2) in case the δδth member is not subscribed to, "BOOLEAN", "FLOAT32", "INT32", "Dbpos", "Quality", or "Timestamp" according to the published type, or 3) "" (empty string) in the case where δδ is greater than the number of members in the subscribed GOOSE.

The first InRefδδ wherein intAddr is the empty string marks the end of the GOOSE message. Any following InRefδδ are ignored.

3

The format of LGOS#.InRefδδ.intAddr references is the referenced logical node name, a period, the data object name, a period, and the data attribute name. The LGOS#.InRefδδ.intAddr data attributes are in the same IED and same LDevice element as the referenced intermediate data attribute, so inclusion of the IED name and logical device instance name is unnecessary. In UR 7.30 and later, the referenced logical node name is always "GGIO3". The data object name is either Indψ for BOOLEAN members, AnInψ for FLOAT32 members, or PosIndψ for double-point status members, where ψ is the data object instance number. The data attribute name is either stVal for BOOLEAN or double point status members, mag.f for FLOAT32 members, q for Quality members, or t for Timestamp members.

An example of LGOS#.InRefδδ.intAddr reference is as follows: GGIO3.Ind001.stVal

Note that LGOS#.InRefδδ data attribute setSrcRef is mandatory under the standard and is present. UR 7.30 and later ignores any value in this data attribute on input, and may or may not preserve its value on output.

3.11.5 IID files

In UR-generated IID files, the LGOS configuration values outlined are identical to those in the most recently accepted CID file.

EnerVista UR Setup software offers the user a choice to generate an E3-2.0 model IID file or a G2 model IID file.

UR Family

Chapter 4: IEC 61850 Ed. 1 communication

This chapter outlines the IEC 61850 Edition 1 tables. See the previous chapter for information on the protocol.

The protocol applies when ordered with the product. Check your order code.

4.1 Model implementation conformance statement (MICS)

This model implementation conformance statement (MICS) details the information model supported by a particular UR device, including implemented logical devices, logical nodes, data objects, and data attributes. It is the top-level IEC 61850 data model. The information model also contains implemented control blocks and datasets.

The information model of a UR device depends in general on the device's order code, and it can vary widely from product to product and from option to option. The complete information model for a particular UR device with a particular order code, as it exists with factory default settings, is embodied in the device's IED capability description (ICD) file. A device's ICD file can be obtained from the device itself or from the EnerVista UR Setup software.

This section contains an outline of the information model of the UR family of devices; the information model of a particular UR device consists of the subset of what is shown here that is relevant to that UR device.

In order to contain the size of this chapter, the following repetitious data objects and data attributes are omitted from this outline. These are nonetheless implemented in the device.

Table 4-1: Common data objects and attributes

Name	Description
Beh	The data object Beh is mandatory in every logical node. The value of Beh.stVal in LLN0 of the Master logical device is test/blocked if the FlexLogic operand ANY MAJOR ERROR is On, otherwise test/blocked if the **TEST MODE FUNCTION** selection is Test Blocked, otherwise test if the **TEST MODE FUNCTION** selection is Test, otherwise on. In all other logical nodes, the value of Beh.stVal is off if the function modeled by the logical node has a Function Disabled/Enabled setting and that setting is selected Disabled, otherwise is the same as the value of Beh.stVal in the Master LLN0.
NamPlt	Although optional, the data object NamPlt is instantiated in every logical node except LPHD1. This data object contains in its d data attribute a natural language description of the UR element the containing logical node is modelling. It is included below only in the Master logical device, as there it contains several important data attributes not found in the others.
t	The data attribute t (TimeStamp) is mandatory in every status, measurand and control data object, and reflects the UR device UTC time at last value change of the status, measurand, control, or q values of the containing data object.

Name	Description
q	The data attribute q (Quality) is mandatory in every status, measurand and control data object, and reflects the quality of the status, measurand and control values of the containing data object. q is fixed at zero in cases where the value is an internal UR device mode or status, and thus the value is known to be good, is unaffected by test mode, cannot be operator blocked and cannot be substituted. Otherwise, q is set according to the following table. Note that the value of Beh.stVal of the logical node containing the Quality data attribute is as described a few paragraphs earlier in this section.
d	This textual description is in every logical node. When in a NamPlt data object, the description refers to the logical node, otherwise it describes the data object it is in. These data attributes are readable via MMS services and reconfigurable via SCL file download.
dataNs	The data name space is included in data objects that extend those specified by the logical node class in the standard. Where the extended data object is defined in IEC 61850 7 4, its value is "IEC 61850-7-4:2007A". Otherwise, it has the value "GE Multilin UR Namespace:2015A" and is defined in the GE Namespace subsection of this section. These data attributes are readable via MMS services.

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Table 4-2: Typical Quality data attribute values in UR devices

Containing logical node's Beh.stVal	q. validity	q. test	q. detailQual	q. source	q. operatorblocked
on	good	false	0	process	false
test	good	true	0	process	false
test/blocked	invalid if ANY MAJOR ERROR, else good	true	0	process	false
off	invalid	false	0	process	false

Many of the UR family device elements have multiple instances, and in many cases the number of instances depends on the product or the device's order code. Also, many UR elements have operands and/or settings that are repetitive, such as for every phase, or for every step. Again for brevity, in the following information model outline a template representing multiple logical nodes or multiple data objects is often used. These templates are identified with a Greek or punctuation character, such as γ or #, in the logical node/data object name. In a UR device, the template is instantiated multiple times with the punctuation or Greek character replaced with the appropriate instance number or instance identifier.

The R/W/C column in the following tables is coded as follows:

- R — Value of the data object or data attribute is readable via MMS services
- W — Value of the data object or data attribute is writable via MMS services
- C — Value of the data object or data attribute is configurable via SCL file download
- Ctrl — The data object can be controlled via MMS services

The logical nodes implemented in UR devices since version 7.30 are sorted into six logical devices. The table outlines the six logical devices and the general rules for the fixed assignment of logical nodes to them. Each logical device has a section in this chapter that defines the logical nodes implemented for that logical device. In UR 7.40 and later, new LDevice elements other than those originally in the Master logical device can be moved between LDevice elements, and LDevice elements containing no LN elements can be removed.

Table 4-3: Logical devices

Logical device	Contains logical nodes modeling...
Master	communications, including GOOSE, reports, Remote I/O, Direct I/O, Virtual Inputs, Modbus, DNP, and so on. Setting group control. This is the root logical device.
Protection (Prot)	protection functions
Control (Ctrl)	control and monitoring functions
System	power system devices: breakers, switches, CTs, VTs, and so on, including interface to these such as AC inputs, contact I/O, transducer I/O, HardFiber I/O
Metering (Meter)	metering and measurement (other than PMU), including Signal Sources
General (Gen)	FlexLogic, virtual outputs, non-volatile latches, FlexElements, FlexMath, recording (for example oscillography), security, front panel, clock

4.1.1 Master (root) logical device

The Master logical device contains communications-related logical nodes, including GOOSE, reports, log, and virtual inputs.

The logical devices in UR family devices are arranged in a hierarchy, with the Master logical device as the root logical device and all other implemented logical devices direct descendants. The effect of this arrangement is that the scope of certain items in the Master logical device includes the entire hierarchy, as outlined in the following table.

Table 4-4: Master/root data objects and attributes

Name	Description
Mod	The controllable data object Mod controls the test mode selection of the UR device and thus affects the status of Beh data objects and of q data attributes
configRev	The configurable data attribute configRev has a scope that includes the entire UR device. Modify this attribute whenever any logical node gets a new semantic use, for example an instance of a CSWI is now serving a different physical switch or an instance of a logical node PDIS is now used for another zone. Also modify this attribute whenever any data object gets a new semantic use, for example the use of ConInGGIO.Ind1 changes from "Door open" to "Fire alarm". As it is not in general possible for the device to know that such a change has occurred, you need to revise the value of configRev.
paramRev	The configurable data attribute paramRev has a scope that includes the entire device, and thus is modified whenever any setting in the device changes. The UR increments the value of paramRev by one whenever one or multiple setting changes occurs in one Modbus write request by any means (front panel, Modbus, or MMS) other than by SCL file download. Incrementing occurs whether or not the setting is represented in the information model. When a UR device or EnerVista UR Setup accepts an SCL file, paramRev is set to the value in that SCL file. When EnerVista UR Setup changes one or more settings, and prepares an SCL file, it increments paramRev to the next higher multiple of 10 000.
SCGB	The setting group control block in the Master logical device has a scope that includes the entire device due to the UR logical device hierarchy. That is to say, all grouped settings are controlled form this one control block.

4.1.1.1 Event recorder (EvtRcd)

See LLN0.

4.1.1.2 Logical node zero (LLN0)

This element is instantiated in all UR devices.

The following is specific to the Master logical device. LLN0 in other logical devices have different content.

Table 4-5: Logical node zero data objects

LNName: LLN0		LDevice inst: Master	UR element: Nameplate information for the logical nodes			
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Beh		INS			This logical device's behaviour	R
	stVal	ENUMERATED	ST			R
	stVal	ENUMERATED	ST	LLN0.Beh.stVal of the Master logical device		R
Health		INS			This physical device's health	R
	stVal	ENUMERATED	ST	LPHD1.PhyHealth.stVal		R
On		SPS			Only instantiated in the Master logical device	R
	stVal	BOOLEAN	ST			R
Off		SPS			Only instantiated in the Master logical device	R
	stVal	BOOLEAN	ST			R
Zero		MV			Only instantiated in the Master logical device	R
	mag	AnalogueValue	MX			R
	mag.f	FLOAT32				R
Mod		INC			This device's mode	R/Ctrl
	ctlVal	ENUMERATED	CO			R
	stVal	ENUMERATED	ST			R

LNName: LLN0		LDevice inst: Master		UR element: Nameplate information for the logical nodes		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
		ENUMERATED	ST			R
	ctlModel	CtlModels	CF	LLN0.Mod.ctlModel	2, the code for SBO control with normal security according to IEC 61850-7-2.	R/C
		CtlModels	CF			R
	sboTimeout	INT32U	CF			R
	sboClass	SboClasses	CF			R
TstMod		SPS			Only instantiated in the Master logical device	R
	stVal	BOOLEAN	ST	IED Beh Test RLY IN TEST MODE		R
TstBlkMod		SPS			Only instantiated in the Master logical device	R
	stVal	BOOLEAN	ST	IED Beh Test-Blocked RLY IN TESTBLK MODE		R
OnMod		SPS			Only instantiated in the Master logical device	R
	stVal	BOOLEAN	ST	IED Beh On RLY IN ON MODE		R
LEDRs		SPC			Only instantiated in the Master logical device	R/Ctrl
	pulseConfig .cmdQual	ENUMERATED				R
	pulseConfig.onDur	INT32U			2 ms (actually one pass)	R
	pulseConfig .offDur	INT32U				R
	pulseConfig .numPls	INT32U				R
	ctlModel	CtlModels	CF	LLN0.LEDRs.ctlModel		R/W/C
	sboTimeout	INT32U	CF			R
	sboClass	SboClasses	CF			R
GrRef		GEORG			Reference to root logical device	R
	setSrcRef	VISIBLE STRING255	SP	For communications, mapped to Master ldName if not empty, otherwise to the concatenation of the IED name and "Master". For SCL, mapped to the concatenation of the IED name and "Master".	reference to the data attribute to input	R
MltLev		SPG			Instantiated only in the Master logical device	R
	setVal	BOOLEAN	SP			R
InRef11		GEORG			TEST MODE INPUT setting	R
	setSrcRef	VISIBLE STRING255	SP	TEST MODE INPUT	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C
InRef12		GEORG			TEST-BLK MODE INPUT setting	R
	setSrcRef	VISIBLE STRING255	SP	TEST-BLK MODE INPUT	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C

4.1.1.3 Physical device information (LPHD1)

This element is instantiated in all UR devices.

Table 4-6: Physical device data objects

LNName: LPHD1		LDevice inst: Master		UR element:		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
PhyNam		DPL			This physical device's name plate	R
	vendor	VISIBLE STRING255	DC	"GE Multilin"		R
	swRev	VISIBLE STRING255	DC	Firmware revision, e.g. "7.30"		R
	serNum	VISIBLE STRING255	DC	The serial number of this unit.		R
	model	VISIBLE STRING255	DC	The order code of this unit.		R
	location	VISIBLE STRING255	DC	Location		R/C
	name	VISIBLE STRING64	DC	RELAY NAME		R/C
	latitude	FLOAT32	DC	Latitude		R/C
	longitude	FLOAT32	DC	Longitude		R/C
	altitude	FLOAT32	DC	Altitude		R/C
PhyHealth		INS			This physical device's health	R
	stVal	ENUMERATED	ST			R
Proxy		SPS			Indicates if this LN is a proxy	R
	stVal	BOOLEAN	ST			R
RsStat		SPC			Mapped to command CLEAR ALL RELAY RECORDS	R/Ctrl
	pulseConfig .cmdQual	ENUMERATED				R
	pulseConfig.onDur	INT32U			0 indicates the duration is locally defined	R
	pulseConfig .offDur	INT32U				R
	pulseConfig .numPls	INT32U				R
	ctlModel	CtlModels	CF	LPHD1.RsStat.ctlModel	1, the code for direct control with normal security; 2 is code for SBO with normal security; 0 is for status only according to IEC 61850-7-2. Enhanced security is not supported as there is no means of confirming successful execution of the control command.	R/C
	sboTimeout	INT32U	CF			R
	sboClass	SboClasses	CF			R
MMSClnts		MV			Number of MMS client connections active	R
	mag.i	INT32				R
	units.SIUnit	ENUMERATED			1, the code for dimensionless	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	sVC.scaleFactor	FLOAT32				R
	sVC.offset	FLOAT32				R
AnyErr		SPS			ANY SELF TESTS operand	R
	stVal	BOOLEAN	ST	ANY SELF TESTS		R
MajorErr		SPS			ANY MAJOR ERROR operand	R
	stVal	BOOLEAN	ST	ANY MAJOR ERROR		R
MinorErr		SPS			ANY MINOR ERROR operand	R
	stVal	BOOLEAN	ST	ANY MINOR ERROR		R
BatFail		SPS			BATTERY FAIL operand	R

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LNName: LPHD1		LDevice inst: Master		UR element:		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	stVal	BOOLEAN	ST	BATTERY FAIL		R
ClkUnsynch		SPS			CLOCK UNSYNCHRONIZED operand	R
	stVal	BOOLEAN	ST	CLOCK UNSYNCHRONIZED		R
DrcDevOff		SPS			DIRECT DEVICE OFF operand	R
	stVal	BOOLEAN	ST	DIRECT DEVICE OFF		R
DrcRingBrk		SPS			DIRECT RING BREAK operand	R
	stVal	BOOLEAN	ST	DIRECT RING BREAK		R
EqpMismat		SPS			EQUIPMENT MISMATCH operand	R
	stVal	BOOLEAN	ST	EQUIPMENT MISMATCH		R
FlexErrTkn		SPS			FLEXLOGIC ERR TOKEN operand	R
	stVal	BOOLEAN	ST	FLEXLOGIC ERR TOKEN		R
IrigbFail		SPS			IRIG-B FAILURE operand	R
	stVal	BOOLEAN	ST	IRIG-B FAILURE		R
LatchErr		SPS			LATCHING OUT ERROR operand	R
	stVal	BOOLEAN	ST	LATCHING OUT ERROR		R
OscilGOOSE		SPS			Oscillatory GOOSE operand	R
	stVal	BOOLEAN	ST	Oscillatory GOOSE		R
Eth1Fail		SPS			FIRST ETHERNET FAIL operand	R
	stVal	BOOLEAN	ST	FIRST ETHERNET FAIL		R
PtpFail		SPS			PTP FAILURE operand	R
	stVal	BOOLEAN	ST	PTP FAILURE		R
RxGooseOff		SPS			RxGOOSE OFF operand	R
	stVal	BOOLEAN	ST	RxGOOSE OFF		R
RrtdFail		SPS			RRTD COMM FAIL operand	R
	stVal	BOOLEAN	ST	RRTD COMM FAIL		R
Eth2Fail		SPS			FIRST ETHERNET FAIL operand	R
	stVal	BOOLEAN	ST	FIRST ETHERNET FAIL		R
Eth3Fail		SPS			FIRST ETHERNET FAIL operand	R
	stVal	BOOLEAN	ST	FIRST ETHERNET FAIL		R
SntpFail		SPS			SNTP FAILURE operand	R
	stVal	BOOLEAN	ST	SNTP FAILURE		R
SysExcp		SPS			SYSTEM EXCEPTION operand	R
	stVal	BOOLEAN	ST	SYSTEM EXCEPTION		R
TempMnt		SPS			TEMP MONITOR operand	R
	stVal	BOOLEAN	ST	TEMP MONITOR		R
UNotPrgm		SPS			UNIT NOT PROGRAMMED operand	R
	stVal	BOOLEAN	ST	UNIT NOT PROGRAMMED		R
PBusFail		SPS			PROCESS BUS FAILURE operand	R
	stVal	BOOLEAN	ST	PROCESS BUS FAILURE		R
PBusTrbl		SPS			PROCESS BUS TROUBLE operand	R
	stVal	BOOLEAN	ST	PROCESS BUS TROUBLE		R
VoltMntr		SPS			VOLTAGE MONITOR operand	R
	stVal	BOOLEAN	ST	VOLTAGE MONITOR		R
BrckTrbl		SPS			BRICK TROUBLE operand	R
	stVal	BOOLEAN	ST	BRICK TROUBLE		R

LNName: LPHD1		LDevice inst: Master		UR element:		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
RtdTrbl		SPS			RTD TROUBLE operand	R
	stVal	BOOLEAN	ST	RTD TROUBLE		R
TdrTrbl		SPS			TDR TROUBLE operand	R
	stVal	BOOLEAN	ST	TDR TROUBLE		R
RlyUTCTms		INS			Relay UTC time	R
	stVal	INT32	ST	Modbus register 41A0h value, i.e., "Relay time clock set time" register value after converting to UTC (if time zone and DST is used)		R

4.1.1.4 FlexLogic operand interface (GGIO1)

This element is instantiated in all UR devices.

Table 4-7: FlexLogic data objects

LNName: <configured GGIO1 prefix>GGIO1		LDevice inst: Master		UR element: FlexLogic Operand Interface functionality		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Indψψψ		SPS			The name of the operand selected by setting GGIO1 INDICATION ψ	R
	stVal	BOOLEAN	ST			R

4.1.1.5 Virtual inputs (GGIO2)

This element is instantiated in all UR devices.

Table 4-8: Virtual input data objects

LNName: <configured GGIO2 prefix>GGIO2		LDevice inst: Master		UR element: Generic controllable single point		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
SPCSOψ		SPC			Status and control of FlexLogic operand Virt Ip ψ On	R/Ctrl
	stVal	BOOLEAN	ST	FlexLogic operand Virt Ip ψ On		R
	pulseConfig .cmdQual	ENUMERATED				R
	pulseConfig.onDur	INT32U			0 indicates the duration is locally defined	R
	pulseConfig .offDur	INT32U				R
	pulseConfig .numPls	INT32U				R
	ctlModel	CtlModels	CF	GGIO2 CF SPCSO ψ CTLMODEL		R/C
	sboTimeout	INT32U	CF			R
	sboClass	SboClasses	CF			R

4.1.1.6 FlexAnalog operand interface (GGIO4)

This element is instantiated in all UR devices.

Table 4-9: FlexAnalog data objects

LNName: <configured GGIO4 prefix>GGIO4		LDevice inst: Master		UR element: FlexAnalog Operand Interface functionality		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
AnInψψ		MV			OFF	R
	instMag.f	FLOAT32		the operand selected by setting ANALOG IN ψ VALUE		R
	mag.f	FLOAT32				R
	db	INT32U	CF	ANALOG IN ψ DB		R/W/C
	zeroDb	INT32U	CF			R
DbMaxψψ		ASG			Value of max. in deadband calculations	R
	setMag.f	FLOAT32		ANALOG IN ψ MAX		R/C
	minVal.f	FLOAT32		-1 000 000 000 000		R
	maxVal.f	FLOAT32				R
	stepSize.f	FLOAT32				R
DbMinψψ		ASG			Value of min. in deadband calculations	R
	setMag.f	FLOAT32		ANALOG IN ψ MIN		R/C
	minVal.f	FLOAT32		-1 000 000 000 000		R
	maxVal.f	FLOAT32				R
	stepSize.f	FLOAT32				R

4.1.2 Protection (Prot) logical device

The Prot logical device contains logical nodes that model protection and protection-related functions.

The Prot logical device is available when the IEC 61850 option is purchased with the UR device.

4.1.2.1 Logical node zero (LLN0)

This element is instantiated in all UR devices implementing the Prot logical device.

Table 4-10: Logical node zero data objects for protection

LNName: LLN0		LDevice inst: Prot		UR element: Nameplate information for the logical nodes		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Beh		INS			This logical device's behavior	R
	stVal	ENUMERATED	ST			R
	stVal	ENUMERATED	ST	LLN0.Beh.stVal of the Master logical device		R
GrRef		GEORG			Reference to root logical device	R
	setSrcRef	VISIBLE STRING255	SP	For communications, mapped to Master ldName if not empty, otherwise to the concatenation of the IED name and "Master". For SCL, mapped to the concatenation of the IED name and "Master".	reference to the data attribute to input	R

4.1.2.2 Auxiliary overvoltage (AuxOv)

This element is instantiated in the following products: B30, C60, C70, C95, D30, D60, F35, F60, G30, G60, L30, L60, L90, M60, T60.

Table 4-11: Auxiliary overvoltage data objects

LNName: AuxOvPTOV#		LDevice inst: Prot		UR element: Auxiliary Overvoltage element # functions		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			AUX OV# PKP operands (including individual three phases)	R
	general	BOOLEAN	ST	AUX OV# PKP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown. It is unknown as the element is non-directional	R
Op		ACT			AUX OV# OP operand	R
	general	BOOLEAN	ST	AUX OV# OP		R
Dpo		SPS			AUX OV# DPO operand, which is the inverse of AUX OV PKP	R
	stVal	BOOLEAN	ST	AUX OV# DPO		R
BlkRefγ		GEORG			AUX OV# BLK setting for setting group γ.	R
	setSrcRef	VISIBLE STRING255	SP	AUX OV# BLK for group γ.	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C

4.1.2.3 Auxiliary undervoltage (AuxUv)

This element is instantiated in the following products: C60, C95, D30, D60, F35, F60, G30, G60, L30, L60, L90, M60, T60.

Table 4-12: Auxiliary undervoltage data objects

LNName: AuxUvPTUV#		LDevice inst: Prot		UR element: Auxiliary Undervoltage element# functions		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			AUX UV# PKP operands	R
	general	BOOLEAN	ST	AUX UV# PKP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown. It is unknown as the element is non-directional	R
Op		ACT			AUX UV# OP operand	R
	general	BOOLEAN	ST	AUX UV# OP		R
Dpo		SPS			AUX UV# DPO operand, which is the inverse of AUX UV PKP	R
	stVal	BOOLEAN	ST	AUX UV# DPO		R
BlkRefγ		GEORG			AUX UV# BLOCK setting for setting group γ.	R
	setSrcRef	VISIBLE STRING255	SP	AUX UV# BLOCK for group γ.	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C

4.1.2.4 B90 bus differential (B_Dif)

This element is instantiated in the following products: B90.

Table 4-13: B90 bus differential data objects

LNName: B_DifPDIF#		LDevice inst: Prot		UR element: B90 Bus zone # differential element function		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
StrBia		ACD			BUS # BIASED PKP operand	R
	general	BOOLEAN	ST	BUS # BIASED PKP		R
	dirGeneral	ENUMERATED	ST		1 for Forward, and it is mapped to same operand BUS # BIASED PKP (since differential DIR logic condition is part of differential logic)	R

LNName: B_DifPDIF#		LDevice inst: Prot		UR element: B90 Bus zone # differential element function		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Op		ACT			BUS # OP operand	R
	general	BOOLEAN	ST	BUS # OP		R
OpBia		ACT			BUS # BIASED OP operand	R
	general	BOOLEAN	ST	BUS # BIASED OP		R
OpUnBia		ACT			BUS # UNBIASED OP operand	R
	general	BOOLEAN	ST	BUS # UNBIASED OP		R
DpoBia		SPS			BUS # BIASED DPO operand, which is the inverse of BUS BIASED PKP	R
	stVal	BOOLEAN	ST	BUS # BIASED DPO		R
PhDir1		SPS			BUS # DIR operand	R
	stVal	BOOLEAN	ST	BUS # DIR		R
Sat1		SPS			BUS # SAT operand	R
	stVal	BOOLEAN	ST	BUS # SAT		R
BDifAClc		CMV			BUS ZONE # differential current in primary amps	R
	instCVal.mag.f	FLOAT32		BUS ZONE # DIFF current magnitude		R
	instCVal.ang.f	FLOAT32		BUS # DIFF current angle		R
	cVal.mag.f	FLOAT32				R
	cVal.ang.f	FLOAT32				R
	units.SIUnit	ENUMERATED			5, the code for primary amperes	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	B_DifPDIF#.BDifAClc.db		R/W/C
	zeroDb	INT32U	CF			R
BRstA		CMV			BUS ZONE # restraint current in primary amps	R
	instCVal.mag.f	FLOAT32		BUS ZONE # REST current magnitude		R
	instCVal.ang.f	FLOAT32		BUS # REST current angle		R
	cVal.mag.f	FLOAT32				R
	cVal.ang.f	FLOAT32				R
	units.SIUnit	ENUMERATED			5, the code for primary amperes	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	B_DifPDIF#.BRstA.db		R/W/C
	zeroDb	INT32U	CF			R
InRefγ01		GEORG			BUS ZONE # DIFF SUPV setting for setting group γ.	R
	setSrcRef	VISIBLE STRING255	SP	BUS ZONE # DIFF SUPV for group γ.	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C
InRefγ02		GEORG			BUS ZONE # DIFF TRIP setting for setting group γ.	R
	setSrcRef	VISIBLE STRING255	SP	BUS ZONE # DIFF TRIP for group γ.	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C
BlkRefγ		GEORG			BUS ZONE # DIFF BLK setting for setting group γ.	R
	setSrcRef	VISIBLE STRING255	SP	BUS ZONE # DIFF BLK for group γ.	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C

LNName: B_DifPDIF#		LDevice inst: Prot		UR element: B90 Bus zone # differential element function		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
InRef9ττ		GEORG			BUS ZONE #τ STATUS setting.	R
	setSrcRef	VISIBLE STRING255	SP	BUS #τ STATUS.	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C

4.1.2.5 B90 instantaneous overcurrent (B_Ioc)

This element is instantiated in the following products: B90.

Table 4-14: B90 instantaneous overcurrent data objects

LNName: B_IocPIOC#		LDevice inst: Prot		UR element: B90 Instantaneous Overcurrent element #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			IOC # PKP operand, which indicates Op will operate when delay expires.	R
	general	BOOLEAN	ST	IOC # PKP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown.	R
Op		ACT			IOC # OP operand	R
	general	BOOLEAN	ST	IOC # OP		R
Dpo		SPS			IOC # DPO operand	R
	stVal	BOOLEAN	ST	IOC # DPO		R
BlkRefγ		GEORG			IOC# BLOCK setting for setting group γ.	R
	setSrcRef	VISIBLE STRING255	SP	IOC# BLOCK	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C

4.1.2.6 B90 time overcurrent (B_Toc)

This element is instantiated in the following products: B90.

Table 4-15: B90 time overcurrent data objects

LNName: B_TocPTOC#		LDevice inst: Prot		UR element: Time Overcurrent element #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			TOC# PKP operand, which indicates Op will operate when delay expires.	R
	general	BOOLEAN	ST	TOC# PKP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown.	R
Op		ACT			TOC# OP operands (including individual three phases)	R
	general	BOOLEAN	ST	TOC# OP		R
Dpo		SPS			TOC# DPO operand	R
	stVal	BOOLEAN	ST	TOC# DPO		R
BlkRefγ		GEORG			TOC# BLOCK setting for setting group γ.	R
	setSrcRef	VISIBLE STRING255	SP	TOC# BLOCK for group γ	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C

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4.1.2.7 B90 undervoltage (B_Uv)

This element is instantiated in the following products: B90.

Table 4-16: B90 undervoltage data objects

LNName: B_UvPTUV#		LDevice inst: Prot		UR element: B90 Undervoltage element # function		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			UNDERVOLTAGE # PKP operands	R
	general	BOOLEAN	ST	UNDERVOLTAGE # PKP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown. It is unknown as the element is non-directional	R
Op		ACT			UNDERVOLTAGE # OP operand	R
	general	BOOLEAN	ST	UNDERVOLTAGE # OP		R
Dpo		SPS			UNDERVOLTAGE # DPO operand, which is the inverse of UNDERVOLTAGE PKP	R
	stVal	BOOLEAN	ST	UNDERVOLTAGE # DPO		R
BlkRefγ		GEORG			UNDERVOLTAGE # BLK setting for setting group γ.	R
	setSrcRef	VISIBLE STRING255	SP	UNDERVOLTAGE # BLK for group γ.	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C

4.1.2.8 Ground distance (GndDis)

This element is instantiated in the following products: D30, D60, L60, L90, T60.

Table 4-17: Ground distance data objects

LNName: GndDisPDIS#		LDevice inst: Prot		UR element: Ground Distance Z# Settings		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			GND DIST Z# PKP operand in Phase –To – Ground	R
	general	BOOLEAN	ST	GND DIST Z# PKP		R
	dirGeneral	ENUMERATED	ST			R
	phsA	BOOLEAN	ST	GND DIST Z# PKP A		R
	dirPhsA	ENUMERATED	ST	dirGeneral		R
	phsB	BOOLEAN	ST	GND DIST Z# PKP B		R
	dirPhsB	ENUMERATED	ST	dirGeneral		R
	phsC	BOOLEAN	ST	GND DIST Z# PKP C		R
	dirPhsC	ENUMERATED	ST	dirGeneral		R
Op		ACT			GND DIST Z# OP operand	R
	general	BOOLEAN	ST	GND DIST Z# OP		R
	phsA	BOOLEAN	ST	GND DIST Z# OP A		R
	phsB	BOOLEAN	ST	GND DIST Z# OP B		R
	phsC	BOOLEAN	ST	GND DIST Z# OP C		R
NeutSupn		SPS			GND DIST Z# SUPN IN operand	R
	stVal	BOOLEAN	ST	GND DIST Z# SUPN IN		R
DpoPhsφ		SPS			GND DIST Z# DPO θ operand	R
	stVal	BOOLEAN	ST	GND DIST Z#DPO θ		R
BlkRefγ		GEORG			GND DIST Z# BLK setting for setting group γ.	R
	setSrcRef	VISIBLE STRING255	SP	GND DIST Z# BLK.	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C

4.1.2.9 Ground instantaneous overcurrent (GndIoc)

This element is instantiated in the following products: B30, C60, C70, C95, D30, D60, F35, F60, G30, G60, L30, L60, L90, M60, N60, T35, T60.

Table 4-18: Ground instantaneous overcurrent data objects

LNName: GndIocPIOC#		LDevice inst: Prot		UR element: Ground Instantaneous Overcurrent element#		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			GROUND IOC# PKP operand, which is indicates Op will operate when delay expires.	R
	general	BOOLEAN	ST	GROUND IOC# PKP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown.	R
Op		ACT			GROUND IOC# OP operand	R
	general	BOOLEAN	ST	GROUND IOC# OP		R
Dpo		SPS			GROUND IOC# DPO operand	R
	stVal	BOOLEAN	ST	GROUND IOC# DPO		R
BlkRefγ1		GEORG			GROUND IOC# BLOCK setting in setting group γ.	R
	setSrcRef	VISIBLE STRING255	SP	GROUND IOC# BLOCK.	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C

4.1.2.10 Ground time overcurrent (GndToc)

This element is instantiated in the following products: B30, C60, C70, C95, D30, D60, F35, F60, G30, G60, L30, L60, L90, M60, N60, T35, T60.

Table 4-19: Ground time overcurrent data objects

LNName: GndTocPTOC#		LDevice inst: Prot		UR element: Ground Time Overcurrent element#		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			GROUND TOC# PKP operand, which indicates Op will operate when delay expires.	R
	general	BOOLEAN	ST	GROUND TOC# PKP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown.	R
Op		ACT			GROUND TOC# OP operand	R
	general	BOOLEAN	ST	GROUND TOC# OP		R
Dpo		SPS			GROUND TOC# DPO operand	R
	stVal	BOOLEAN	ST	GROUND TOC# DPO		R
BlkRefγ1		ORG			GROUND TOC# BLOCK setting in setting group γ.	R
	setSrcRef	ObjectReference	SP	GROUND TOC# BLOCK.	reference to the data attribute to input	R/C
	setSrcCB	ObjectReference	SP		source GoCB of input if via GOOSE	R/C

4.1.2.11 Line current differential (LinDif)

This element is instantiated in the following products: L30, L90.

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Table 4-20: Line current differential data objects

LNName: LinDfPDIF1		LDevice inst: Prot		UR element: Line Differential element (ANSI 87L) phase and general functions		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			only instantiated in L90	R
	general	BOOLEAN	ST	87L DIFF OP		R
	dirGeneral	ENUMERATED	ST		1, the code for forward	R
	phsA	BOOLEAN	ST	87L DIFF OP A		R
	dirPhsA	ENUMERATED	ST		1, the code for forward	R
	phsB	BOOLEAN	ST	87L DIFF OP B		R
	dirPhsB	ENUMERATED	ST		1, the code for forward	R
	phsC	BOOLEAN	ST	87L DIFF OP C		R
	dirPhsC	ENUMERATED	ST		1, the code for forward	R
Op		ACT			only instantiated in L90	R
	general	BOOLEAN	ST	87L TRIP OP		R
	phsA	BOOLEAN	ST	87L TRIP OP A		R
	phsB	BOOLEAN	ST	87L TRIP OP B		R
	phsC	BOOLEAN	ST	87L TRIP OP C		R
Op		ACT			only instantiated in L30	R
	general	BOOLEAN	ST	87L DIFF OP		R
StrGnd		ACD			87L DIFF PKP G operand	R
	general	BOOLEAN	ST	87L DIFF PKP G		R
	dirGeneral	ENUMERATED	ST		1, the code for forward	R
OpGnd		ACT			87L DIFF OP G operand	R
	general	BOOLEAN	ST	87L DIFF OP G		R
Tr3p		ACT			only instantiated in L90	R
	general	BOOLEAN	ST	87L TRIP 3P OP		R
Tr1p		ACT			only instantiated in L90	R
	general	BOOLEAN	ST	87L TRIP 1P OP		R
RxTr1		ACT			only instantiated in L90	R
	general	BOOLEAN	ST	logical OR of phsA, phsB, phsC		R
	phsA	BOOLEAN	ST	87L DIFF RECVD DTT A		R
	phsB	BOOLEAN	ST	87L DIFF RECVD DTT B		R
	phsC	BOOLEAN	ST	87L DIFF RECVD DTT C		R
RxTr1		ACT			only instantiated in L30	R
	general	BOOLEAN	ST	87L DIFF RECVD DTT		R
TxTr		ACT			87L DIFF KET DTT operand, which becomes on when the differential element is sending direct transfer trip to the remote terminals.	R
	general	BOOLEAN	ST	87L DIFF KET DTT		R
PFLLfail		SPS			87L DIFF PFLL FAIL operand, which becomes on when the differential element's phase and frequency lock loop (PFLL) has failed.	R
	stVal	BOOLEAN	ST	87L DIFF PFLL FAIL		R
Asymmetry		SPS			87L DIFF CH ASYM DET operand, which becomes on when the differential element's has detected substantial communications channel asymmetry.	R
	stVal	BOOLEAN	ST	87L DIFF CH ASYM DET		R

LNName: LinDfPDIF1		LDevice inst: Prot		UR element: Line Differential element (ANSI 87L) phase and general functions		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
ChFailζ		SPS			87L DIFF CH ζ FAIL operand, which becomes on when the differential element's has detected communications channel ζ failed.	R
	stVal	BOOLEAN	ST	87L DIFF CH ζ FAIL		R
LosPktζ		SPS			87L DIFF CHζ LOSTPKT operand, which becomes on when the differential element's has detected the lost packet threshold has been exceeded on channel ζ.	R
	stVal	BOOLEAN	ST	87L DIFF CHζ LOSTPKT		R
CrcFailζ		SPS			87L DIFF CHζ CRCFAIL operand, which becomes on when the differential element's has detected the CRC error threshold has been exceeded on channel ζ.	R
	stVal	BOOLEAN	ST	87L DIFF CHζ CRCFAIL		R

4.1.2.12 Negative sequence directional overcurrent (NegDoc)

This element is instantiated in the following products: C70, D30, D60, F60, G30, G60, L60, L90, T60.

Table 4-21: Negative sequence directional overcurrent data objects

LNName: NegDocRDIR#		LDevice inst: Prot		UR element: Negative sequence Directional Overcurrent element #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Dir		ACD			NEG DIR OC# FWD or NEG DIR OC# REV operands, which becomes On when Negative sequence directional overcurrent is flowing in either forward or reverse direction respectively	R
	general	BOOLEAN	ST	logical OR of operands NEG DIR OC# FWD and NEG DIR OC# REV		R
	dirGeneral	ENUMERATED	ST			R
FwdOp		SPS			NEG SEQ DIR OC# FWD operand	R
	stVal	BOOLEAN	ST	NEG SEQ DIR OC# FWD		R
RvOp		SPS			NEG SEQ DIR OC# REV operand	R
	stVal	BOOLEAN	ST	NEG SEQ DIR OC# REV		R
BlkRefγ		GEORG			NEG SEQ DIR OC# BLOCK setting for setting group γ.	R
	setSrcRef	VISIBLE STRING255	SP	NEG SEQ DIR OC# BLOCK for group γ.	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C

4.1.2.13 Negative sequence instantaneous overcurrent (NegIoc)

This element is instantiated in the following products: C70, D30, D60, F35, F60, L30, L60, L90, T60.

Table 4-22: Negative sequence instantaneous overcurrent data objects

LNName: NegIocPIOC#		LDevice inst: Prot		UR element: Negative sequence Instantaneous Overcurrent element #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			NEG SEQ IOC# PKP operand, which is indicates Op will operate when delay expires.	R

LNName: NegIocPIOC#		LDevice inst: Prot		UR element: Negative sequence Instantaneous Overcurrent element #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	general	BOOLEAN	ST	NEG SEQ IOC# PKP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown.	R
Op		ACT			NEG SEQ IOC# OP operand	R
	general	BOOLEAN	ST	NEG SEQ IOC# OP		R
Dpo		SPS			NEG SEQ IOC# DPO operand	R
	stVal	BOOLEAN	ST	NEG SEQ IOC# DPO		R
BlkRefγ1		GEORG			NEG SEQ IOC# BLOCK setting in setting group γ.	R
	setSrcRef	VISIBLE STRING255	SP	NEG SEQ IOC# BLOCK.	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C

4.1.2.14 Negative sequence time overcurrent (NegToc)

This element is instantiated in the following products: C70, D30, D60, F35, F60, L30, L60, L90, T60.

Table 4-23: Negative sequence time overcurrent data objects

LNName: NegTocPTOC#		LDevice inst: Prot		UR element: Negative sequence Time Overcurrent element #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			NEG SEQ TOC# PKP operand, which indicates Op will operate when delay expires.	R
	general	BOOLEAN	ST	NEG SEQ TOC# PKP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown.	R
Op		ACT			NEG SEQ TOC# OP operand	R
	general	BOOLEAN	ST	NEG SEQ TOC# OP		R
Dpo		SPS			NEG SEQ TOC# DPO operand	R
	stVal	BOOLEAN	ST	NEG SEQ TOC# DPO		R
BlkRefγ1		GEORG			NEG SEQ TOC# BLOCK setting for setting group γ.	R
	setSrcRef	VISIBLE STRING255	SP	NEG SEQ TOC# BLOCK.	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C

4.1.2.15 Neutral directional overcurrent (NeuDoc)

This element is instantiated in the following products: C70, D30, D60, F60, G30, G60, L30, L60, L90, M60, N60, T60.

Table 4-24: Neutral directional overcurrent data objects

LNName: NeuDocRDIR#		LDevice inst: Prot		UR element: Neutral Directional Overcurrent element #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Dir		ACD			NTRL DIR OC# FWD or NTRL DIR OC# REV operands, which becomes On when neutral directional overcurrent is flowing in either forward or reverse direction respectively	R
	general	BOOLEAN	ST	logical OR of operands NTRL DIR OC# FWD and NTRL DIR OC# REV		R
	dirGeneral	ENUMERATED	ST			R
FwdOp		SPS			NTRL DIR OC# FWD operand	R

LNName: NeuDocRDIR#		LDevice inst: Prot		UR element: Neutral Directional Overcurrent element #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	stVal	BOOLEAN	ST	NTRL DIR OC# FWD		R
RvOp		SPS			NTRL DIR OC# REV operand	R
	stVal	BOOLEAN	ST	NTRL DIR OC# REV		R
BlkRefγ		GEORG			NEUTRAL DIR OC# BLOCK setting for setting group γ.	R
	setSrcRef	VISIBLE STRING255	SP	NEUTRAL DIR OC# BLOCK for group γ.	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C

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4.1.2.16 Neutral instantaneous overcurrent (NeuIoc)

This element is instantiated in the following products: B30, C60, C70, C95, D30, D60, F35, F60, G30, G60, L30, L60, L90, M60, N60, T60.

Table 4-25: Neutral instantaneous overcurrent data objects

LNName: NeuIocPIOC#		LDevice inst: Prot		UR element: Neutral Instantaneous Overcurrent element #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			NEUTRAL IOC# PKP operand, which indicates Op will operate when delay expires.	R
	general	BOOLEAN	ST	NEUTRAL IOC# PKP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown.	R
Op		ACT			NEUTRAL IOC# OP operand	R
	general	BOOLEAN	ST	NEUTRAL IOC# OP		R
Dpo		SPS			NEUTRAL IOC# DPO operand	R
	stVal	BOOLEAN	ST	NEUTRAL IOC# DPO		R
BlkRefγ1		GEORG			NEUTRAL IOC# BLOCK setting in setting group γ.	R
	setSrcRef	VISIBLE STRING255	SP	NEUTRAL IOC# BLOCK.	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C

4.1.2.17 Neutral time overcurrent (NeuToc)

This element is instantiated in the following products: B30, C60, C70, C95, D30, D60, F35, F60, G30, G60, L30, L60, L90, M60, N60, T60.

Table 4-26: Neutral time overcurrent data objects

LNName: NeuTocPTOC#		LDevice inst: Prot		UR element: Neutral Time Overcurrent element #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			NEUTRAL TOC# PKP operand, which indicates Op will operate when delay expires.	R
	general	BOOLEAN	ST	NEUTRAL TOC# PKP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown.	R
Op		ACT			NEUTRAL TOC# OP operand	R
	general	BOOLEAN	ST	NEUTRAL TOC# OP		R
Dpo		SPS			NEUTRAL TOC# DPO operand	R
	stVal	BOOLEAN	ST	NEUTRAL TOC# DPO		R

LNName: NeuTocPTOC#		LDevice inst: Prot		UR element: Neutral Time Overcurrent element #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
BlkRefγ1		GEORG			NEUTRAL TOC# BLOCK setting for setting group γ.	R
	setSrcRef	VISIBLE STRING255	SP	NEUTRAL TOC# BLOCK.	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C

4.1.2.18 Phase directional (PhsDir)

This element is instantiated in the following products: B30, C70, D30, D60, F60, G30, G60, L30, L60, L90, M60, N60, T60.

Table 4-27: Phase directional data objects

LNName: PhsDirRDIR#		LDevice inst: Prot		UR element: Phase Directional element # (ANSI 67P)		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Dir		ACD			PH DIR # BLK operand, which becomes On when phase current is flowing in the set direction	R
	general	BOOLEAN	ST	PH DIR # BLK		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown. It is unknown as the element may be connected/ configured to look forward or backward	R
	phsA	BOOLEAN	ST	PH DIR # BLK A		R
	dirPhsA	ENUMERATED	ST		0, the code for unknown	R
	phsB	BOOLEAN	ST	PH DIR # BLK B		R
	dirPhsB	ENUMERATED	ST		0, the code for unknown	R
	phsC	BOOLEAN	ST	PH DIR # BLK C		R
	dirPhsC	ENUMERATED	ST		0, the code for unknown	R
BlkRefγ		GEORG			PHASE DIR # BLOCK setting for setting group γ.	R
	setSrcRef	VISIBLE STRING255	SP	PHASE DIR # BLOCK for group γ.	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C

4.1.2.19 Phase distance (PhsDis)

This element is instantiated in the following products: D30, D60, G60, L60, L90, T60.

Table 4-28: Phase distance data objects

LNName: PhsDisPDIS#		LDevice inst: Prot		UR element: Phase Distance Z# settings		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			PHS DIST Z# PKP operand in Phase-To-Phase	R
	general	BOOLEAN	ST	PH DIST Z# PKP		R
	dirGeneral	ENUMERATED	ST			R
Op		ACT			PHS DIST Z# OP operand in Phase-To-Phase	R
	general	BOOLEAN	ST	PHS DIST Z# OP		R
StrPhsϕ		SPS			PHS DIST Z# PKP θ operand in Phase-To-Phase	R
	stVal	BOOLEAN	ST	PHS DIST Z# PKP θ		R
DpoPhsϕ		SPS			PHS DIST Z# DPO θ operand in Phase-To-Phase	R

LNName: PhsDisPDIS#		LDevice inst: Prot		UR element: Phase Distance Z# settings		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	stVal	BOOLEAN	ST	PHS DIST Z# DPO θ		R
OpPhsϕ		SPS			PH DIST Z # OP θ operand	R
	stVal	BOOLEAN	ST	PH DIST Z# OP θ		R
ASupnϕ		SPS			PHS DIST Z# SUPN θ operand in Phase-To-Phase	R
	stVal	BOOLEAN	ST	PHS DIST Z# SUPN θ		R
BlkRefγ		GEORG			PHS DIST Z# BLK setting for setting group γ.	R
	setSrcRef	VISIBLE STRING255	SP	PHS DIST Z# BLK.	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C
InRefγ2		GEORG			instantiated only in logical node instance 1	R
	setSrcRef	VISIBLE STRING255	SP	setting FORCE SELF-POLAR	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C
InRefγ3		GEORG			instantiated only in logical node instance 1	R
	setSrcRef	VISIBLE STRING255	SP	setting FORCE MEM-POLAR I	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C

4.1.2.20 Phase instantaneous overcurrent (PhsIoc)

This element is instantiated in the following products: B30, C60, C70, C95, D30, D60, F35, F60, G30, G60, L30, L60, L90, M60, N60, T35, T60.

Table 4-29: Phase instantaneous overcurrent data objects

LNName: PhsIocPIOC#		LDevice inst: Prot		UR element: Phase Instantaneous Overcurrent element #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			PHASE IOC# PKP operands (including individual three phases), which indicates Op will operate when delay expires.	R
	general	BOOLEAN	ST	PHASE IOC# PKP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown.	R
	phsA	BOOLEAN	ST	PHASE IOC# PKP A		R
	dirPhsA	ENUMERATED	ST		0, the code for unknown.	R
	phsB	BOOLEAN	ST	PHASE IOC# PKP B		R
	dirPhsB	ENUMERATED	ST		0, the code for unknown.	R
	phsC	BOOLEAN	ST	PHASE IOC# PKP C		R
	dirPhsC	ENUMERATED	ST		0, the code for unknown.	R
Op		ACT			PHASE IOC# OP operands (including individual three phases)	R
	general	BOOLEAN	ST	PHASE IOC# OP		R
	phsA	BOOLEAN	ST	PHASE IOC# OP A		R
	phsB	BOOLEAN	ST	PHASE IOC# OP B		R
	phsC	BOOLEAN	ST	PHASE IOC# OP C		R
Dpo		SPS			PHASE IOC# DPO operand	R
	stVal	BOOLEAN	ST	PHASE IOC# DPO		R

LNName: PhsIocPIOC#		LDevice inst: Prot		UR element: Phase Instantaneous Overcurrent element #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
DpoPhsβ		SPS			PHASE IOC# DPO β operands" (where β refers to Phase-A, B or C)	R
	stVal	BOOLEAN	ST	PHASE IOC# DPO β (where β refers to Phase-A, B or C)		R
BlkRefγβ		GEORG			PHASE IOC# BLOCK β setting for setting group γ." (where β refers to Phase-A, B or C)	R
	setSrcRef	VISIBLE STRING255	SP	PHASE IOC# BLOCK β (where β refers to Phase-A, B or C)	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C

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4.1.2.21 Phase overvoltage (PhsOv)

This element is instantiated in the following products: B30, C60, C70, C95, D30, D60, F35, F60, G30, G60, L30, L60, L90, M60, N60, T60.

Table 4-30: Phase overvoltage data objects

LNName: PhsOvPTOV#		LDevice inst: Prot		UR element: Phase Overvoltage element # functions		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			PHASE OV # PKP operands (including individual three phases)	R
	general	BOOLEAN	ST	PHASE OV # PKP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown. It is unknown as the element is non-directional	R
	phsA	BOOLEAN	ST	PHASE OV # PKP A		R
	dirPhsA	ENUMERATED	ST		0, the code for unknown. It is unknown as the element is non-directional	R
	phsB	BOOLEAN	ST	PHASE OV # PKP B		R
	dirPhsB	ENUMERATED	ST		0, the code for unknown. It is unknown as the element is non-directional	R
	phsC	BOOLEAN	ST	PHASE OV # PKP C		R
	dirPhsC	ENUMERATED	ST		0, the code for unknown. It is unknown as the element is non-directional	R
Op		ACT			PHASE OV # OP operand (including individual three phases)	R
	general	BOOLEAN	ST	PHASE OV # OP		R
	phsA	BOOLEAN	ST	PHASE OV # OP A		R
	phsB	BOOLEAN	ST	PHASE OV # OP B		R
	phsC	BOOLEAN	ST	PHASE OV # OP C		R
Dpo		SPS			PHASE OV # DPO operand, which is the inverse of PHASE OV PKP	R
	stVal	BOOLEAN	ST	PHASE OV # DPO		R
DpoPhsβ		SPS			PHASE OV# DPO β operand" (where β refers to Phase-A, B or C)	R
	stVal	BOOLEAN	ST	PHASE OV# DPO β (where β refers to Phase-A, B or C)		R
BlkRefγ		GEORG			PHASE OV # BLK setting for setting group γ.	R
	setSrcRef	VISIBLE STRING255	SP	PHASE OV # BLK for group γ.	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C

4.1.2.22 Phase time overcurrent (PhsToc)

This element is instantiated in the following products: B30, C60, C70, C95, D30, D60, F35, F60, G30, G60, L30, L60, L90, M60, N60, T35, T60.

Table 4-31: Phase time overcurrent data objects

LNName: PhsTocPTOC#		LDevice inst: Prot		UR element: Phase Time Overcurrent element #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			PHASE TOC# PKP operands (including individual three phases), which indicates Op will operate when delay expires.	R
	general	BOOLEAN	ST	PHASE TOC# PKP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown.	R
	phsA	BOOLEAN	ST	PHASE TOC# PKP A		R
	dirPhsA	ENUMERATED	ST		0, the code for unknown.	R
	phsB	BOOLEAN	ST	PHASE TOC# PKP B		R
	dirPhsB	ENUMERATED	ST		0, the code for unknown.	R
	phsC	BOOLEAN	ST	PHASE TOC# PKP C		R
	dirPhsC	ENUMERATED	ST		0, the code for unknown.	R
Op		ACT			PHASE TOC# OP operands (including individual three phases)	R
	general	BOOLEAN	ST	PHASE TOC# OP		R
	phsA	BOOLEAN	ST	PHASE TOC# OP A		R
	phsB	BOOLEAN	ST	PHASE TOC# OP B		R
	phsC	BOOLEAN	ST	PHASE TOC# OP C		R
Dpo		SPS			PHASE TOC# DPO operand	R
	stVal	BOOLEAN	ST	PHASE TOC# DPO		R
DpoPhsβ		SPS			PHASE TOC# DPO β operands" (where β refers to Phase-A, B or C)	R
	stVal	BOOLEAN	ST	PHASE TOC# DPO β (where β refers to Phase-A, B or C)		R
BlkRefγβ		GEORG			PHASE TOC# BLOCK β setting for setting group γ." (where β refers to Phase-A, B or C)	R
	setSrcRef	VISIBLE STRING255	SP	PHASE TOC# BLOCK β for group γ (where β refers to Phase-A, B or C)	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C

4.1.2.23 Phase undervoltage (PhsUv)

This element is instantiated in the following products: B30, C60, C70, C95, D30, D60, F35, F60, G30, G60, L30, L60, L90, M60, N60, T60.

Table 4-32: Phase undervoltage data objects

LNName: PhsUvPTUV#		LDevice inst: Prot		UR element: Phase Undervoltage element # functions		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			PHASE UV# PKP operands (including individual three phases)	R
	general	BOOLEAN	ST	PHASE UV# PKP		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown. It is unknown as the element is non-directional	R
	phsA	BOOLEAN	ST	PHASE UV# PKP A		R
	dirPhsA	ENUMERATED	ST		0, the code for unknown. It is unknown as the element is non-directional	R

LNName: PhsUvPTUV#		LDevice inst: Prot		UR element: Phase Undervoltage element # functions		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	phsB	BOOLEAN	ST	PHASE UV# PKP B		R
	dirPhsB	ENUMERATED	ST		0, the code for unknown. It is unknown as the element is non-directional	R
	phsC	BOOLEAN	ST	PHASE UV# PKP C		R
	dirPhsC	ENUMERATED	ST		0, the code for unknown. It is unknown as the element is non-directional	R
Op		ACT			PHASE UV# OP operand (including individual three phases)	R
	general	BOOLEAN	ST	PHASE UV# OP		R
	phsA	BOOLEAN	ST	PHASE UV# OP A		R
	phsB	BOOLEAN	ST	PHASE UV# OP B		R
	phsC	BOOLEAN	ST	PHASE UV# OP C		R
Dpo		SPS			PHASE UV# DPO operand, which is the inverse of PHASE UV PKP	R
	stVal	BOOLEAN	ST	PHASE UV# DPO		R
DpoPhsβ		SPS			PHASE UV# DPO β operands" (where β refers to Phase-A, B or C)	R
	stVal	BOOLEAN	ST	PHASE UV# DPO β (where β refers to Phase-A, B or C)		R
BlkRefγ		GEORG			PHASE UV# BLOCK setting for setting group γ.	R
	setSrcRef	VISIBLE STRING255	SP	PHASE UV# BLOCK for group γ.	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C

4.1.2.24 Power swing detection (PwrSwg)

This element is instantiated in the following products: D30, D60, G60, L60, L90, N60, T60.

Table 4-33: Power swing detection data objects

LNName: PwrSwgRPSB1		LDevice inst: Prot		UR element: Power Swing Detect element		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			POWER SWING INCOMING operand	R
	general	BOOLEAN	ST	POWER SWING INCOMING		R
	dirGeneral	ENUMERATED	ST			R
StrOut		SPS			POWER SWING OUTGOING operand	R
	stVal	BOOLEAN	ST	POWER SWING OUTGOING		R
Op		ACT			POWER SWING TRIP	R
	general	BOOLEAN	ST	POWER SWING TRIP		R
BlkZn		SPS			POWER SWING BLOCK operand	R
	stVal	BOOLEAN	ST	POWER SWING BLOCK		R
Z1Chr1		SPS			POWER SWING OUTER operand	R
	stVal	BOOLEAN	ST	POWER SWING OUTER		R
Z1Chr2		SPS			POWER SWING MIDDLE operand	R
	stVal	BOOLEAN	ST	POWER SWING MIDDLE		R
Z1Chr3		SPS			POWER SWING INNER operand	R
	stVal	BOOLEAN	ST	POWER SWING INNER		R
TmStr2		SPS			POWER SWING TMR2 PKP operand	R
	stVal	BOOLEAN	ST	POWER SWING TMR2 PKP		R
TmStr3		SPS			POWER SWING TMR3 PKP operand	R

LNName: PwrSwgRPSB1		LDevice inst: Prot		UR element: Power Swing Detect element		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	stVal	BOOLEAN	ST	POWER SWING TMR3 PKP		R
TmStr4		SPS			POWER SWING TMR4 PKP operand	R
	stVal	BOOLEAN	ST	POWER SWING TMR4 PKP		R
Blk		SPS			POWER SWING UN/BLOCK operand	R
	stVal	BOOLEAN	ST	POWER SWING UN/BLOCK		R
DistDet		SPS			POWER SWING 50DD operand	R
	stVal	BOOLEAN	ST	POWER SWING 50DD		R
InRefγ2		GEORG			POWER SW I2 SUPV ENAB setting for setting group γ.	R
	setSrcRef	VISIBLE STRING255	SP	POWER SW I2 SUPV ENAB	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C
BlkRefγ		GEORG			POWER SWING BLK setting for setting group γ.	R
	setSrcRef	VISIBLE STRING255	SP	POWER SWING BLK.	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C

4.1.2.25 Restricted ground fault (RgDif)

This element is instantiated in the following products: F60, G30, G60, L90, T35, T60.

Table 4-34: Restricted ground fault data objects

LNName: RgDifPDIF#		LDevice inst: Prot		UR element: Restricted Ground Fault # function		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Op		ACT			RESTD GND FT# OP operands	R
	general	BOOLEAN	ST	RESTD GND FT# OP		R
Dpo		SPS			RESTD GND FT# DPO operand,	R
	stVal	BOOLEAN	ST	RESTD GND FT# DPO		R
Str		ACD			RESTD GND FT# PKP operand	R
	general	BOOLEAN	ST	RESTD GND FT# PKP		R
	dirGeneral	ENUMERATED	ST		1 is code for Forward	R
DifAClc		WYE			Differential currents	R
	net	CMV				R
	net.instCVal.mag .f	FLOAT32		RGF# DIFF Igd magnitude, in primary amps		R
	net.cVal.mag.f	FLOAT32		RGF# DIFF Igd magnitude, in primary amps, with deadband		R
	net.units.SIUnit	ENUMERATED			5, the code for amps	R
	net.units .multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	net.db	INT32U	CF	RgDifPDIF#.DifAClc.net.db		R/W/C
	net.zeroDb	INT32U	CF			R
RstA		WYE			Restraint currents	R
	net	CMV				R
	net.instCVal.mag .f	FLOAT32		RGF# RESTR Igr magnitude, in primary amps		R
	net.cVal.mag.f	FLOAT32		RGF# RESTR Igr magnitude, in primary amps, with deadband		R
	net.units.SIUnit	ENUMERATED			5, the code for amps	R

LNName: RgDifPDIF#		LDevice inst: Prot		UR element: Restricted Ground Fault # function		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	net.units .multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	net.db	INT32U	CF	RgDifPDIF#.RstA.net.db		R/W/C
	net.zeroDb	INT32U	CF			R
BlkRefγ		GEORG			RESTD GND FT# BLOCK for setting group γ.	R
	setSrcRef	VISIBLE STRING255	SP	RESTD GND FT# BLOCK for group γ.	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C

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4.1.2.26 Transformer instantaneous differential (PiDif)

This element is instantiated in the following products: T35, T60.

Table 4-35: Transformer instantaneous differential data objects

LNName: PiDifPDIF1		LDevice inst: Prot		UR element: Transformer Instantaneous Differential # function		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Op		ACT			XFMR INST DIFF OP , XFMR INST DIFF OP A, XFMR INST DIFF OP B & XFMR INST DIFF OP C operands	R
	general	BOOLEAN	ST	XFMR INST DIFF OP		R
	phsA	BOOLEAN	ST	XFMR INST DIFF OP A		R
	phsB	BOOLEAN	ST	XFMR INST DIFF OP B		R
	phsC	BOOLEAN	ST	XFMR INST DIFF OP C		R
BlkRefγ		GEORG			INST DIFF BLOCK setting for setting group γ.	R
	setSrcRef	VISIBLE STRING255	SP	INST DIFF BLOCK.	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C

4.1.2.27 Transformer percent differential (PctDif)

This element is instantiated in the following products: G30, T35, T60.

Table 4-36: Transformer percent differential data objects

LNName: PctDifPDIF1		LDevice inst: Prot		UR element: Transformer Percent Differential function		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Op		ACT			XFMR PCNT DIFF OP , XFMR PCNT DIFF OP A, XFMR PCNT DIFF OP B & XFMR PCNT DIFF OP C operands	R
	general	BOOLEAN	ST	XFMR PCNT DIFF OP		R
	phsA	BOOLEAN	ST	XFMR PCNT DIFF OP A		R
	phsB	BOOLEAN	ST	XFMR PCNT DIFF OP B		R
	phsC	BOOLEAN	ST	XFMR PCNT DIFF OP C		R
Blk2ndHϕ		SPS			XFMR PCNT DIFF 2ND θ operand	R
	stVal	BOOLEAN	ST	XFMR PCNT DIFF 2ND θ		R
Blk5thHϕ		SPS			XFMR PCNT DIFF 5TH θ operand	R
	stVal	BOOLEAN	ST	XFMR PCNT DIFF 5TH θ		R
Str		ACD			XFMR PCNT DIFF PKP A, XFMR PCNT DIFF PKP B & XFMR PCNT DIFF PKP C operand	R

LNName: PctDifPDIF1		LDevice inst: Prot		UR element: Transformer Percent Differential function		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	general	BOOLEAN	ST	logical OR of phsA, phsB & phsB		R
	dirGeneral	ENUMERATED	ST			R
	phsA	BOOLEAN	ST	XFMR PCNT DIFF PKP A		R
	dirPhsA	ENUMERATED	ST			R
	phsB	BOOLEAN	ST	XFMR PCNT DIFF PKP B		R
	dirPhsB	ENUMERATED	ST			R
	phsC	BOOLEAN	ST	XFMR PCNT DIFF PKP C		R
	dirPhsC	ENUMERATED	ST			R
RefWinding		INS			Number of winding used as the reference winding for ratio compensation	R
	stVal	INT32	ST	REFERENCE WINDING		R
DifAClc		WYE			Phase differential currents	R
	phsθ	CMV				R
	phsθ.instCVal.mag.f	FLOAT32		DIFF PHASOR Iθd magnitude, in pu		R
	phsθ.instCVal.ang.f	FLOAT32		DIFF PHASOR		R
	phsθ.cVal.mag.f	FLOAT32		DIFF PHASOR Iθd magnitude, inpu, with deadband		R
	phsθ.cVal.ang.f	FLOAT32		DIFF PHASOR		R
	phsθ.units.SIUnit	ENUMERATED			1, the code for dimensionless	R
	phsθ.units.multiplier	ENUMERATED			-2, the code for a multiplier of Centi	R
	phsθ.db	INT32U	CF	PctDifPDIF1.DifAClc.phsθ.db		R/W/C
	phsθ.zeroDb	INT32U	CF			R
	angRef	ENUMERATED	CF		See UR product manual regarding FREQUENCY AND PHASE REFERENCE	R
DifA2ndH		WYE			Phase differential currents	R
	phsθ	CMV				R
	phsθ.instCVal.mag.f	FLOAT32		DIFF 2ND HARM Iθd magnitude, in %		R
	phsθ.instCVal.ang.f	FLOAT32		DIFF 2ND HA		R
	phsθ.cVal.mag.f	FLOAT32		DIFF 2ND HARM Iθd magnitude, in%, with deadband		R
	phsθ.cVal.ang.f	FLOAT32		DIFF 2ND HA		R
	phsθ.units.SIUnit	ENUMERATED			1, the code for dimensionless	R
	phsθ.units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	phsθ.db	INT32U	CF	PctDifPDIF1.DifA2ndH.phsθ.db		R/W/C
	phsθ.zeroDb	INT32U	CF			R
	angRef	ENUMERATED	CF		See UR product manual regarding FREQUENCY AND PHASE REFERENCE	R
DifA5thH		WYE			Phase differential currents	R
	phsθ	CMV				R
	phsθ.instCVal.mag.f	FLOAT32		DIFF 5TH HARM Iθd magnitude, in %		R
	phsθ.instCVal.ang.f	FLOAT32		DIFF 5TH HA		R

LNName: PctDifPDIF1		**LDevice inst: Prot**		**UR element: Transformer Percent Differential function**		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	phsθ.cVal.mag.f	FLOAT32		DIFF 5TH HARM Iθd magnitude, in%, with deadband		R
	phsθ.cVal.ang.f	FLOAT32		DIFF 5TH HA		R
	phsθ.units.SIUnit	ENUMERATED			1, the code for dimensionless	R
	phsθ.units .multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	phsθ.db	INT32U	CF	PctDifPDIF#.DifA5thH.phsθ.db		R/W/C
	phsθ.zeroDb	INT32U	CF			R
	angRef	ENUMERATED	CF		See UR product manual regarding FREQUENCY AND PHASE REFERENCE	R
RstA		WYE			Phase restraint currents	R
	phsθ	CMV				R
	phsθ.instCVal.ma g .f	FLOAT32		REST PHASOR Iθr magnitude, in pu		R
	phsθ.instCVal.ang .f	FLOAT32		REST PHASOR		R
	phsθ.cVal.mag.f	FLOAT32		REST PHASOR Iθr magnitude, inpu, with deadband		R
	phsθ.cVal.ang.f	FLOAT32		REST PHASOR		R
	phsθ.units.SIUnit	ENUMERATED			1, the code for dimensionless	R
	phsθ.units .multiplier	ENUMERATED			-2, the code for a multiplier of Centi	R
	phsθ.db	INT32U	CF	PctDifPDIF#.RstA.phsθ.db		R/W/C
	phsθ.zeroDb	INT32U	CF			R
	angRef	ENUMERATED	CF		See UR product manual regarding FREQUENCY AND PHASE REFERENCE	R
BlkRefγ		GEORG			PERCENT DIFF BLOCK for setting group γ.	R
	setSrcRef	VISIBLE STRING255	SP	PERCENT DIFF BLOCK for group γ.	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C

4.1.2.28 Transient ground fault (TrsGnd)

This element is instantiated in the following products: D60, F35, F60, L90, T35.

Table 4-37: Transient ground fault data objects

LNName: TrsGndPTEF#		**LDevice inst: Prot**		**UR element: Transient Earth Fault Detection Element #**		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			TGFD # START operand (including the direction)	R
	general	BOOLEAN	ST	TGFD # START		R
	dirGeneral	ENUMERATED	ST			R
TrsFwd		SPS			TGFD # FORWARD operand	R
	stVal	BOOLEAN	ST	TGFD # FORWARD		R
TrsRv		SPS			TGFD # REVERSE operand	R
	stVal	BOOLEAN	ST	TGFD # REVERSE		R
BlkRefγ		GEORG			TRNST GND FLT # BLK setting for setting group γ	R
	setSrcRef	VISIBLE STRING255	SP	TRNST GND FLT # BLK.	reference to the data attribute to input	R/C

LNName: TrsGndPTEF#		LDevice inst: Prot	UR element: Transient Earth Fault Detection Element #			
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C

4.1.2.29 Trip output (TrOut)

This element is instantiated in the following products: C60, C95, D60, L60, L90.

Table 4-38: Trip output data objects

LNName: TrOutPTRC1		LDevice inst: Prot	UR element: Trip Output element			
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Tr		ACT			TRIP OUTPUT OP (any trip) operand	R
	general	BOOLEAN	ST	TRIP OUTPUT OP		R
Tr3p		ACT			TRIP 3-POLE operand	R
	general	BOOLEAN	ST	TRIP 3-POLE		R
Tr1p		ACT			general is TRIP 1-POLE operand, phsA is TRIP PHASE A operand, phsB is TRIP PHASE B operand and phsC is TRIP PHASE C operand	R
	general	BOOLEAN	ST	TRIP 1-POLE		R
	phsA	BOOLEAN	ST	TRIP PHASE A		R
	phsB	BOOLEAN	ST	TRIP PHASE B		R
	phsC	BOOLEAN	ST	TRIP PHASE C		R
StrRec3p		SPS			TRIP AR INIT 3-POLE operand	R
	stVal	BOOLEAN	ST	TRIP AR INIT 3-POLE		R
Tr3pFrcd		SPS			TRIP FORCE 3-POLE operand (3-pole trip mode is being forced)	R
	stVal	BOOLEAN	ST	TRIP FORCE 3-POLE		R
StrZ2PhDl		SPS			TRIP Z2PH TMR INIT operand	R
	stVal	BOOLEAN	ST	TRIP Z2PH TMR INIT		R
StrZ2GndDl		SPS			TRIP Z2GR TMR INIT operand	R
	stVal	BOOLEAN	ST	TRIP Z2GR TMR INIT		R
InRef3α		GEORG			TRIP 3-POLE INPUT-α setting.	R
	setSrcRef	VISIBLE STRING255	SP	Reference to the data object selected by TRIP 3-POLE INPUT-α	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C
InRef1α		GEORG			TRIP 1-POLE INPUT-α setting.	R
	setSrcRef	VISIBLE STRING255	SP	Reference to the data object selected by TRIP 1-POLE INPUT-α	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C
InRef2α		GEORG			TRIP RECLOSE INPUT-α setting.	R
	setSrcRef	VISIBLE STRING255	SP	Reference to the data object selected by TRIP RECLOSE INPUT-α	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C
InRef01221		GEORG			START TMR Z2PH Inp1 setting.	R

LNName: TrOutPTRC1		LDevice inst: Prot		UR element: Trip Output element		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	setSrcRef	VISIBLE STRING255	SP	Reference to the data object selected by START TMR Z2PH Inp1	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C
InRef02222		GEORG			START TMR Z2PH Inp2 setting.	R
	setSrcRef	VISIBLE STRING255	SP	Reference to the data object selected by START TMR Z2PH Inp2	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C
InRef03211		GEORG			START TMR Z2GR Inp1 setting.	R
	setSrcRef	VISIBLE STRING255	SP	Reference to the data object selected by START TMR Z2GR Inp1	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C
InRef04212		GEORG			START TMR Z2GR Inp2 setting.	R
	setSrcRef	VISIBLE STRING255	SP	Reference to the data object selected by START TMR Z2GR Inp2	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C
InRef05		GEORG			BKR Phase A OPEN setting.	R
	setSrcRef	VISIBLE STRING255	SP	Reference to the data object selected by BKR ϕA OPEN	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C
InRef06		GEORG			BKR Phase B OPEN setting.	R
	setSrcRef	VISIBLE STRING255	SP	Reference to the data object selected by BKR ϕB OPEN	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C
InRef07		GEORG			BKR Phase C OPEN setting.	R
	setSrcRef	VISIBLE STRING255	SP	Reference to the data object selected by BKR ϕC OPEN	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C
InRef08		GEORG			TRIP FORCE 3-POLE setting.	R
	setSrcRef	VISIBLE STRING255	SP	Reference to the data object selected by TRIP FORCE 3-POLE	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C
InRef09		GEORG			REVERSE EVOLVING FAULT setting.	R
	setSrcRef	VISIBLE STRING255	SP	Reference to the data object selected by REVERSE EVOLVING FAULT	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C
StrZ3PhDl		SPS			Instantiated only if the OC includes distance adaptation option	R
	stVal	BOOLEAN	ST	TRIP Z3PH TMR INIT		R
StrZ4PhDl		SPS			Instantiated only if the OC includes distance adaptation option	R

LNName: TrOutPTRC1		LDevice inst: Prot		UR element: Trip Output element		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	stVal	BOOLEAN	ST	TRIP Z4PH TMR INIT		R
StrZ5PhDl		SPS			Instantiated only if the OC includes distance adaptation option	R
	stVal	BOOLEAN	ST	TRIP Z5PH TMR INIT		R
StrZ6PhDl		SPS			Instantiated only if the OC includes distance adaptation option	R
	stVal	BOOLEAN	ST	TRIP Z6PH TMR INIT		R
StrZ3Gnd Dl		SPS			Instantiated only if the OC includes distance adaptation option	R
	stVal	BOOLEAN	ST	TRIP Z3GR TMR INIT		R
StrZ4Gnd Dl		SPS			Instantiated only if the OC includes distance adaptation option	R
	stVal	BOOLEAN	ST	TRIP Z4GR TMR INIT		R
StrZ5Gnd Dl		SPS			Instantiated only if the OC includes distance adaptation option	R
	stVal	BOOLEAN	ST	TRIP Z5GR TMR INIT		R
StrZ6Gnd Dl		SPS			Instantiated only if the OC includes distance adaptation option	R
	stVal	BOOLEAN	ST	TRIP Z6GR TMR INIT		R
InRef321		GEORG			START TMR Z3PH Inp1 setting.	R
	setSrcRef	VISIBLE STRING255	SP	Reference to the data object selected by START TMR Z3PH Inp1	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C
InRef322		GEORG			START TMR Z3PH Inp2 setting.	R
	setSrcRef	VISIBLE STRING255	SP	Reference to the data object selected by START TMR Z3PH Inp2	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C
InRef311		GEORG			START TMR Z3GR Inp1 setting.	R
	setSrcRef	VISIBLE STRING255	SP	Reference to the data object selected by START TMR Z3GR Inp1	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C
InRef312		GEORG			START TMR Z3GR Inp2 setting.	R
	setSrcRef	VISIBLE STRING255	SP	Reference to the data object selected by START TMR Z3GR Inp2	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C
InRef421		GEORG			START TMR Z4PH Inp1 setting.	R
	setSrcRef	VISIBLE STRING255	SP	Reference to the data object selected by START TMR Z4PH Inp1	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C
InRef422		GEORG			START TMR Z4PH Inp2 setting.	R
	setSrcRef	VISIBLE STRING255	SP	Reference to the data object selected by START TMR Z4PH Inp2	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C
InRef411		GEORG			START TMR Z4GR Inp1 setting.	R

LNName: TrOutPTRC1		**LDevice inst: Prot**		**UR element: Trip Output element**		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	setSrcRef	VISIBLE STRING255	SP	Reference to the data object selected by START TMR Z4GR Inp1	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C
InRef412		GEORG			START TMR Z4GR Inp2 setting.	R
	setSrcRef	VISIBLE STRING255	SP	Reference to the data object selected by START TMR Z4GR Inp2	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C
InRef521		GEORG			START TMR Z5PH Inp1 setting.	R
	setSrcRef	VISIBLE STRING255	SP	Reference to the data object selected by START TMR Z5PH Inp1	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C
InRef522		GEORG			START TMR Z5PH Inp2 setting.	R
	setSrcRef	VISIBLE STRING255	SP	Reference to the data object selected by START TMR Z5PH Inp2	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C
InRef511		GEORG			START TMR Z5GR Inp1 setting.	R
	setSrcRef	VISIBLE STRING255	SP	Reference to the data object selected by START TMR Z5GR Inp1	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C
InRef512		GEORG			START TMR Z5GR Inp2 setting.	R
	setSrcRef	VISIBLE STRING255	SP	Reference to the data object selected by START TMR Z5GR Inp2	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C
InRef621		GEORG			START TMR Z6PH Inp1 setting.	R
	setSrcRef	VISIBLE STRING255	SP	Reference to the data object selected by START TMR Z6PH Inp1	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C
InRef622		GEORG			START TMR Z6PH Inp2 setting.	R
	setSrcRef	VISIBLE STRING255	SP	Reference to the data object selected by START TMR Z6PH Inp2	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C
InRef611		GEORG			START TMR Z6GR Inp1 setting.	R
	setSrcRef	VISIBLE STRING255	SP	Reference to the data object selected by START TMR Z6GR Inp1	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C
InRef612		GEORG			START TMR Z6GR Inp2 setting.	R
	setSrcRef	VISIBLE STRING255	SP	Reference to the data object selected by START TMR Z6GR Inp2	reference to the data attribute to input	R/C

LNName: TrOutPTRC1		**LDevice inst: Prot**		**UR element: Trip Output element**		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C
CCEna		SPS			Instantiated only if the OC includes distance adaptation option	R
	stVal	BOOLEAN	ST	XC SOLID GND ENABLED		R
FltCC		SPS			Instantiated only if the OC includes distance adaptation option	R
	stVal	BOOLEAN	ST	XC CROSS COUNTRY		R
FltAGCC		SPS			Instantiated only if the OC includes distance adaptation option	R
	stVal	BOOLEAN	ST	XC PHASE SELECT AG		R
FltBGCC		SPS			Instantiated only if the OC includes distance adaptation option	R
	stVal	BOOLEAN	ST	XC PHASE SELECT BG		R
FltCGCC		SPS			Instantiated only if the OC includes distance adaptation option	R
	stVal	BOOLEAN	ST	XC PHASE SELECT CG		R
CmpEna		SPS			Instantiated only if the OC includes distance adaptation option	R
	stVal	BOOLEAN	ST	XC IS/Comp Enabled		R
CmpGndFlt		SPS			Instantiated only if the OC includes distance adaptation option	R
	stVal	BOOLEAN	ST	XC IS/Comp GF		R
NeutBias		SPS			Instantiated only if the OC includes distance adaptation option	R
	stVal	BOOLEAN	ST	XC IN>Bias		R
CmpZ2GndAG		SPS			Instantiated only if the OC includes distance adaptation option	R
	stVal	BOOLEAN	ST	XC GND Z2 PKP A COMP		R
CmpZ2GndBG		SPS			Instantiated only if the OC includes distance adaptation option	R
	stVal	BOOLEAN	ST	XC GND Z2 PKP B COMP		R
CmpZ2GndCG		SPS			Instantiated only if the OC includes distance adaptation option	R
	stVal	BOOLEAN	ST	XC GND Z2 PKP C COMP		R
CmpZ2PhAB		SPS			Instantiated only if the OC includes distance adaptation option	R
	stVal	BOOLEAN	ST	XC PH Z2 PKP AB COMP		R
CmpZ2PhBC		SPS			Instantiated only if the OC includes distance adaptation option	R
	stVal	BOOLEAN	ST	XC PH Z2 PKP BC COMP		R
CmpZ2PhCA		SPS			Instantiated only if the OC includes distance adaptation option	R
	stVal	BOOLEAN	ST	XC PH Z2 PKP CA COMP		R
RawZβGndAG		SPS			Instantiated only if the OC includes distance adaptation option	R
	stVal	BOOLEAN	ST	GND DIS Zβ PKP A RAW		R
RawZβGndBG		SPS			Instantiated only if the OC includes distance adaptation option	R
	stVal	BOOLEAN	ST	GND DIS Zβ PKP B RAW		R
RawZβGndCG		SPS			Instantiated only if the OC includes distance adaptation option	R
	stVal	BOOLEAN	ST	GND DIS Zβ PKP B RAW		R

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4.1.3 Control (Ctrl) logical device

The Ctrl logical device contains logical nodes that model UR control and monitoring functions.

4.1.3.1 Logical node zero (LLN0)

This element is instantiated in all UR devices implementing the Ctrl logical device.

Table 4-39: LLN0 data objects and attributes

LNName: LLN0		LDevice inst: Ctrl		UR element: Nameplate information for the logical nodes		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Beh		INS			This logical device's behavior	R
	stVal	ENUMERATED	ST			R
	stVal	ENUMERATED	ST	LLN0.Beh.stVal of the Master logical device		R
GrRef		GEORG			Reference to root logical device	R
	setSrcRef	VISIBLE STRING255	SP	For communications, mapped to Master ldName if not empty, otherwise to the concatenation of the IED name and "Master". For SCL, mapped to the concatenation of the IED name and "Master".	reference to the data attribute to input	R

4.1.3.2 Fault location (FltRpt)

This element is instantiated in the following products: C60, C95, D30, D60, F35, F60, L30, L60, L90.

Table 4-40: Fault report settings data objects

LNName: FltRptRFLO#		LDevice inst: Ctrl		UR element: FAULT REPORT # settings		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
TapLocFlt		SPS			TAP-LOCAL FAULT operand	R
	stVal	BOOLEAN	ST	TAP-LOCAL FAULT		R
NumRcd		INS			instantiated only in FltRptRFLO1	R
	stVal	INT32	ST	Modbus register 3020h, I.e., "Number of Fault Reports"		R
FltDiskm		MV			Mandatory data object which in this case is fixed at zero	R
	mag.f	FLOAT32				R
FltZ		CMV			Mandatory data attribute which in this case is fixed at zero	R
	cVal.mag.f	FLOAT32				R
	cVal.ang.f	FLOAT32				R
RsStat		SPC			instantiated only in FltRptRFLO1	R/Ctrl
	pulseConfig .cmdQual	ENUMERATED				R
	pulseConfig.onDu r	INT32U			2 ms (actually one pass)	R
	pulseConfig .offDur	INT32U				R
	pulseConfig .numPls	INT32U				R
	ctlModel	CtlModels	CF	FltRptRFLO1.RsStat.ctlModel		R/W/C
	sboTimeout	INT32U	CF			R
	sboClass	SboClasses	CF			R
InRef1		GEORG			FAULT REPORT# TRIG.	R

LNName: FltRptRFLO#		LDevice inst: Ctrl		UR element: FAULT REPORT # settings		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	setSrcRef	VISIBLE STRING255	SP	FAULT REPORT# TRIG.	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C
InRef2		GEORG			CLEAR FAULT REPORTS	R
	setSrcRef	VISIBLE STRING255	SP	CLEAR FAULT REPORTS.	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C

Table 4-41: Fault report data file data objects

LNName: FltRFLOψψ		LDevice inst: Ctrl		UR element: Selected values from Fault Report Data file ψψ		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
FltZ		CMV			FAULTψψ Fault impedance converted to primary ohms	R
	cVal.mag.f	FLOAT32		Fault impedance magnitude in primary ohms calculated as shown below		R
	cVal.ang.f	FLOAT32		Fault impedance angle in degrees calculated as shown below		R
FltRis		MV			FAULTψψ FAULT RESIST converted to primary ohms	R
	mag.f	FLOAT32		Actual Value FAULTψψ FAULT RESIST converted to primary ohms		R
	units.SIUnit	ENUMERATED			30, the code for primary electric resistance in ohm (V/A)	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
FltLpRis		MV			FAULTψψ LOOP RESIST converted to primary ohms	R
	mag.f	FLOAT32		Actual Value FAULTψψ LOOP RESIST converted to primary ohms		R
	units.SIUnit	ENUMERATED			30, the code for primary electric resistance in ohm (V/A)	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
FltLpReact		MV			FAULTψψ LOOP REACT converted to primary ohms	R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			30, the code for primary electric resistance in ohm (V/A)	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
FltNum		INS			FAULT NUMBER	R
	stVal	INT32	ST	FAULT NUMBER in Fault Report Data file ψψ		R
FltLinID		GEVSS			Faulted line ID	R
	stVal	VISIBLE STRING 255	ST	LINE ID in Fault Report Data file ψψ		R
FltLoop		INS			FAULT TYPE	R
	stVal	ENUMERATED	ST	FAULT TYPE in Fault Report Data file ψψ		R
FltSegment		INS			FAULT ψψ FAULTED SEGMENT	R
	stVal	ENUMERATED	ST	FAULT ψψ FAULTED SEGMENT		R

LNName: FltRFLOψψ		**LDevice inst: Ctrl**		**UR element: Selected values from Fault Report Data file ψψ**		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
FltDiskm		MV			FAULT LOCATION	R
	mag.f	FLOAT32		FAULT LOCATION in Fault Report Data file ψψ, converted to kilometers where required		R
	units.SIUnit	ENUMERATED			2, the code for meter	R
	units.multiplier	ENUMERATED			3, the code for a multiplier of 1000	R
RecCyc		INS			FAULT RECLOSE SHOT	R
	stVal	INT32	ST	FAULT RECLOSE SHOT in Fault Report Data file ψψ		R

The FltRFLO1 logical node always reads the latest fault data, when a new fault report is generated. FltRFLO2 always reads the previous fault data and FltRFLO3 reads the next previous data and so on.

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4.1.3.3 Single pole autoreclose (Rec13p)

This element is instantiated in the following products: C60, C95, D60, L60, L90.

Table 4-42: Single pole autoreclose data objects

LNName: Rec13pRREC1		**LDevice inst: Ctrl**		**UR element: Autoreclose element**		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
TrBeh		INS			AR FORCE 3-P TRIP operand	R
	stVal	INT32	ST			R
RecCyc		INS			AUTORECLOSE SHOT COUNT actual value	R
	stVal	INT32	ST	AUTORECLOSE SHOT COUNT		R
AutoRecSt		INS			Autoreclosing status	R
	stVal	ENUMERATED	ST			R
Ena1		SPS			AR ENABLED operand	R
	stVal	BOOLEAN	ST	AR ENABLED		R
Disabled		SPS			AR DISABLED operand	R
	stVal	BOOLEAN	ST	AR DISABLED		R
ArRip		SPS			AR RIP operand	R
	stVal	BOOLEAN	ST	AR RIP		R
P1Rip		SPS			AR 1-P RIP operand	R
	stVal	BOOLEAN	ST	AR 1-P RIP		R
P3Rip1		SPS			AR 3-P/1 RIP operand	R
	stVal	BOOLEAN	ST	AR 3-P/1 RIP		R
P3Rip2		SPS			AR 3-P/2 RIP operand	R
	stVal	BOOLEAN	ST	AR 3-P/2 RIP		R
P3Rip3		SPS			AR 3-P/3 RIP operand	R
	stVal	BOOLEAN	ST	AR 3-P/3 RIP		R
P3Rip4		SPS			AR 3-P/4 RIP operand	R
	stVal	BOOLEAN	ST	AR 3-P/4 RIP		R
ArLO		SPS			AR LO operand	R
	stVal	BOOLEAN	ST	AR LO		R
ArBlk1		SPS			AR BKR1 BLK operand	R
	stVal	BOOLEAN	ST	AR BKR1 BLK		R
ArBlk1		SPS			AR BKR2 BLK operand	R
	stVal	BOOLEAN	ST	AR BKR2 BLK		R
Op		ACT			AR CLOSE BKR1 operand	R
	general	BOOLEAN	ST	AR CLOSE BKR1		R

LNName: Rec13pRREC1		**LDevice inst: Ctrl**		**UR element: Autoreclose element**		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Cls2ndBkr		SPS			AR CLOSE BKR2 operand	R
	stVal	BOOLEAN	ST	AR CLOSE BKR2		R
P3Tr		SPS			AR FORCE 3-P TRIP operand	R
	stVal	BOOLEAN	ST	AR FORCE 3-P TRIP		R
AnyShotCnt		SPS			AR SHOT CNT>0 operand	R
	stVal	BOOLEAN	ST	AR SHOT CNT>0		R
ShotCnt1		SPS			AR SHOT CNT=1 operand	R
	stVal	BOOLEAN	ST	AR SHOT CNT=1		R
ShotCnt2		SPS			AR SHOT CNT=2 operand	R
	stVal	BOOLEAN	ST	AR SHOT CNT=2		R
ShotCnt3		SPS			AR SHOT CNT=3 operand	R
	stVal	BOOLEAN	ST	AR SHOT CNT=3		R
ShotCnt4		SPS			AR SHOT CNT=4 operand	R
	stVal	BOOLEAN	ST	AR SHOT CNT=4		R
ArMod1		SPS			AR MODE = 1 operand	R
	stVal	BOOLEAN	ST	AR MODE = 1		R
ArMod2		SPS			AR MODE = 2 operand	R
	stVal	BOOLEAN	ST	AR MODE = 2		R
ArMod3		SPS			AR MODE = 3 operand	R
	stVal	BOOLEAN	ST	AR MODE = 3		R
ArMod4		SPS			AR MODE = 4 operand	R
	stVal	BOOLEAN	ST	AR MODE = 4		R
SwFail		SPS			AR MODE SWITCH FAIL operand	R
	stVal	BOOLEAN	ST	AR MODE SWITCH FAIL		R
Zn1Extend		SPS			AR ZONE 1 EXTENT operand	R
	stVal	BOOLEAN	ST	AR ZONE1 EXTENT		R
SeqTO		SPS			AR INCOMPLETE SEQ operand	R
	stVal	BOOLEAN	ST	AR INCOMPLETE SEQ		R
Rs		SPS			AR RESET operand	R
	stVal	BOOLEAN	ST	AR RESET		R
InRef01		GEORG			Mode 1 Activation setting	R
	setSrcRef	VISIBLE STRING255	SP	Mode 1 Activation.	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C
InRef02		VISIBLE STRING255			Mode 2 Activation setting	R
	setSrcRef	VISIBLE STRING255	SP	Mode 2 Activation.	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C
InRef03		GEORG			Mode 3 Activation setting	R
	setSrcRef	VISIBLE STRING255	SP	Mode 3 Activation.	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C
InRef04		GEORG			Mode 4 Activation setting	R
	setSrcRef	VISIBLE STRING255	SP	Mode 4 Activation.	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C

LNName: Rec13pRREC1		LDevice inst: Ctrl		UR element: Autoreclose element		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
BlkRef2		GEORG			AR BLOCK BKR1 setting	R
	setSrcRef	VISIBLE STRING255	SP	AR BLOCK BKR1	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C
InRef06		GEORG			AR BKR MAN CLOSE setting	R
	setSrcRef	VISIBLE STRING255	SP	AR BKR MAN CLOSE	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C
InRef07		GEORG			AR 1P INIT setting	R
	setSrcRef	VISIBLE STRING255	SP	AR 1P INIT	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C
InRef08		GEORG			AR 3P INIT setting	R
	setSrcRef	VISIBLE STRING255	SP	AR 3P INIT	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C
InRef09		GEORG			AR 3P TD INIT setting	R
	setSrcRef	VISIBLE STRING255	SP	AR 3P TD INIT	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C
InRef10		GEORG			AR MULTI-P FAULT setting	R
	setSrcRef	VISIBLE STRING255	SP	AR MULTI-P FAULT	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C
InRef11		GEORG			BKR ONE POLE OPEN setting	R
	setSrcRef	VISIBLE STRING255	SP	BKR ONE POLE OPEN	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C
InRef12		GEORG			BKR 3 POLE OPEN setting	R
	setSrcRef	VISIBLE STRING255	SP	BKR 3 POLE OPEN	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C
InRef13		GEORG			AR EXTEND DEAD T 1 setting	R
	setSrcRef	VISIBLE STRING255	SP	AR EXTEND DEAD T 1	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C
InRef14		GEORG			AR RESET setting	R
	setSrcRef	VISIBLE STRING255	SP	AR RESET	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C
InRef15		GEORG			AR BKR CLOSED setting	R
	setSrcRef	VISIBLE STRING255	SP	AR BKR CLOSED	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C

LNName: Rec13pRREC1		LDevice inst: Ctrl		UR element: Autoreclose element		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
BlkRef1		GEORG			AR BLOCK setting	R
	setSrcRef	VISIBLE STRING255	SP	AR BLOCK.	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C
InRef17		GEORG			AR PAUSE setting	R
	setSrcRef	VISIBLE STRING255	SP	AR PAUSE	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C
BlkRef3		GEORG			AR BLOCK BKR2 setting	R
	setSrcRef	VISIBLE STRING255	SP	AR BLOCK BKR2	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C
InRef20		GEORG			AR CHNG BKR SEQNCE setting	R
	setSrcRef	VISIBLE STRING255	SP	AR CHNG BKR SEQNCE	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C
InRef19		GEORG			AR BUS FLT INIT setting	R
	setSrcRef	VISIBLE STRING255	SP	AR BUS FLT INIT	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C

4.1.3.4 Synchrocheck (SynChk)

This element is instantiated in the following products: C60, C95, D30, D60, F60, G30, G60, L30, L60, L90, N60, T60.

Table 4-43: Synchrocheck data objects

LNName: SynChkRSYN#		LDevice inst: Ctrl		UR element: Synchrocheck element # (ANSI 25)		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Rel		SPS			SYNC # CLS OP operand, which becomes On all synchrocheck criteria are fulfilled.	R
	stVal	BOOLEAN	ST	SYNC # CLS OP		R
RelDpo		SPS			SYNC # CLS DPO operand, which becomes Off when all synchrocheck criteria are fulfilled.	R
	stVal	BOOLEAN	ST	SYNC # CLS DPO		R
LivV1		SPS			SYNC # V1 ABOVE MIN operand, which indicates that V1 is above the LivVal1 setting.	R
	stVal	BOOLEAN	ST	SYNC # V1 ABOVE MIN		R
DeaV1		SPS			SYNC # V1 BELOW MAX operand, which indicates that V1 is below the DeaVal1 setting.	R
	stVal	BOOLEAN	ST	SYNC # V1 BELOW MAX		R
LivV2		SPS			SYNC # V2 ABOVE MIN operand, which indicates that V1 is above the LivVal2 setting.	R
	stVal	BOOLEAN	ST	SYNC # V2 ABOVE MIN		R
DeaV2		SPS			SYNC # V2 BELOW MAX operand, which indicates that V2 is below the DeaVal1 setting.	R

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LNName: SynChkRSYN#		LDevice inst: Ctrl		UR element: Synchrocheck element # (ANSI 25)		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	stVal	BOOLEAN	ST	SYNC # V2 BELOW MAX		R
LivDea		SPS			SYNC # DEAD S OP operand, which indicates that live/dead conditions have been met.	R
	stVal	BOOLEAN	ST	SYNC # DEAD S OP		R
LivDeaDpo		SPS			SYNC # DEAD S DPO operand, which indicates that live/dead conditions have not been met.	R
	stVal	BOOLEAN	ST	SYNC # DEAD S DPO		R
LivLiv		SPS			SYNC # SYNC OP operand, which indicates that both sources are live, and that angle, frequency and voltage difference and range conditions have been met.	R
	stVal	BOOLEAN	ST	SYNC # SYNC OP		R
LivLivDpo		SPS			SYNC # SYNC DPO operand, which indicates that that one or both sources are not live, or that angle, frequency and voltage difference and range conditions have been met.	R
	stVal	BOOLEAN	ST	SYNC # SYNC DPO		R
DynOp		SPS			SYNC# S-CLOSE OP operand, which becomes on when all criteria for dynamic mode are fulfilled	R
	stVal	BOOLEAN	ST	SYNC# S-CLOSE OP		R
DynDpo		SPS			SYNC# S-CLOSE DPO operand, which becomes off when all criteria for dynamic mode are fulfilled	R
	stVal	BOOLEAN	ST	SYNC# S-CLOSE DPO		R
DynArmd		SPS			SYNC# S-CLOSE ARMD operand, which becomes on when dynamic mode is armed	R
	stVal	BOOLEAN	ST	SYNC# S-CLOSE ARMD		R
DifVClc		MV			SYNCHROCHECK # DELTA VOLT, in primary volts	R
	instMag.f	FLOAT32		SYNCHROCHECK 1 DELTA VOLT		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			29, the code for volts	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	SynChkRSYN#.DifVClc.db		R/W/C
	zeroDb	INT32U	CF			R
DifHzClc		MV			SYNCHROCHECK # DELTA FREQ, in Hz	R
	instMag.f	FLOAT32		SYNCHROCHECK # DELTA FREQ		R
	mag.f	FLOAT32		SYNCHROCHECK # DELTA FREQ on deadband exception		R
	units.SIUnit	ENUMERATED			33, the code for hertz (1/s)	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	SynChkRSYN#.DifHzClc.db		R/W/C
	zeroDb	INT32U	CF			R
DifAngClc		MV			SYNCHROCHECK # DELTA PHASE, in degrees	R
	instMag.f	FLOAT32		SYNCHROCHECK # DELTA PHASE		R
	mag.f	FLOAT32		SYNCHROCHECK # DELTA PHASE on deadband exception		R
	units.SIUnit	ENUMERATED			9, the code for degrees	R

LNName: SynChkRSYN#		LDevice inst: Ctrl		UR element: Synchrocheck element # (ANSI 25)		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	SynChkRSYN#.DifAngClc.db		R/W/C
	zeroDb	INT32U	CF			R
DifAngDis		MV			SYNCHROCHECK # SYNSCP D_PH, in degrees	R
	instMag.f	FLOAT32		SYNCHROCHECK # SYNSCP D_PH		R
	mag.f	FLOAT32		SYNCHROCHECK # SYNSCP D_PH on deadband exception		R
	units.SIUnit	ENUMERATED			9, the code for degrees	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	SynChkRSYN#.DifAngDis.db		R/W/C
	zeroDb	INT32U	CF			R
V1Src		CMV			SYNCHROCHECK # V1 voltage phasor, in primary volts	R
	instCVal.mag.f	FLOAT32		SYNCHROCHECK # V1 MAG		R
	instCVal.ang.f	FLOAT32		SYNCHROCHECK # V1 ANG		R
	cVal.mag.f	FLOAT32				R
	cVal.ang.f	FLOAT32				R
	units.SIUnit	ENUMERATED			29, the code for volts	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	SynChkRSYN#.V1Src.db		R/W/C
	zeroDb	INT32U	CF			R
V2Src		CMV			SYNCHROCHECK # V2 voltage phasor, in primary volts	R
	instCVal.mag.f	FLOAT32		SYNCHROCHECK # V2 MAG		R
	instCVal.ang.f	FLOAT32		SYNCHROCHECK # V2 ANG		R
	cVal.mag.f	FLOAT32				R
	cVal.ang.f	FLOAT32				R
	units.SIUnit	ENUMERATED			29, the code for volts	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	SynChkRSYN#.V2Src.db		R/W/C
	zeroDb	INT32U	CF			R
ProjV2		CMV			SYNCHROCHECK # V2' voltage phasor, in primary volts	R
	instCVal.mag.f	FLOAT32		SYNCHROCHECK # V2’ MAG		R
	instCVal.ang.f	FLOAT32		SYNCHROCHECK # V2’ ANG		R
	cVal.mag.f	FLOAT32				R
	cVal.ang.f	FLOAT32				R
	units.SIUnit	ENUMERATED			29, the code for volts	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	SynChkRSYN#.ProjV2.db		R/W/C
	zeroDb	INT32U	CF			R
ProjDif		MV			SYNCHROCHECK # DELTA PHASE', in degrees which is the phase angle difference between V1 and projected V2	R
	instMag.f	FLOAT32		SYNCHROCHECK # ’		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			9, the code for degrees	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	SynChkRSYN#.ProjDif.db		R/W/C

LNName: SynChkRSYN#		LDevice inst: Ctrl		UR element: Synchrocheck element # (ANSI 25)		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	zeroDb	INT32U	CF			R
ProjDifDis		MV			SYNCHROCHECK # PROJ SYNSCP D_PH, in degrees	R
	instMag.f	FLOAT32		SYNCHROCHECK # PROJ SYNSCP D_PH		R
	mag.f	FLOAT32		SYNCHROCHECK # PROJ SYNSCP D_PH on deadband exception		R
	units.SIUnit	ENUMERATED			9, the code for degrees	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	SynChkRSYN#.ProjDifDis.db		R/W/C
	zeroDb	INT32U	CF			R
BlkRef1		GEORG			SYNCHK# BLOCK setting.	R
	setSrcRef	VISIBLE STRING255	SP	SYNCHK# BLOCK.	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C
InRef1		GEORG			SYNCHK# SYNC CLOSE setting.	R
	setSrcRef	VISIBLE STRING255	SP	SYNCHK# SYNC CLOSE.	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C

4.1.3.5 Three pole autoreclose (Rec3p)

This element is instantiated in the following products: D30, F35, F60, L30.

Table 4-44: Three pole autoreclose data objects

LNName: Rec3pRREC#		LDevice inst: Ctrl		UR element: Autoreclose element # functions		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
ShotCnt		INS			AUTORECLOSE# SHOT COUNT actual value	R
	stVal	INT32	ST	AUTORECLOSE# SHOT COUNT		R
AutoRecSt		INS			Autoreclosing status	R
	stVal	ENUMERATED	ST			R
Ena1		SPS			AR# ENABLED operand	R
	stVal	BOOLEAN	ST	AR# ENABLED		R
ArRip		SPS			AR# RIP operand	R
	stVal	BOOLEAN	ST	AR# RIP		R
ArLO		SPS			AR# LO operand	R
	stVal	BOOLEAN	ST	AR# LO		R
ArBlk1		SPS			AR# BLK FROM MAN CLS operand	R
	stVal	BOOLEAN	ST	AR# BLK FROM MAN CLS		R
Op		ACT			AR# CLOSE operand	R
	general	BOOLEAN	ST	AR# CLOSE		R
ShotCnt0		SPS			AR# SHOT CNT=0 operand	R
	stVal	BOOLEAN	ST	AR# SHOT CNT=0		R
ShotCnt1		SPS			AR# SHOT CNT=1 operand	R
	stVal	BOOLEAN	ST	AR# SHOT CNT=1		R
ShotCnt2		SPS			AR# SHOT CNT=2 operand	R
	stVal	BOOLEAN	ST	AR# SHOT CNT=2		R

LNName: Rec3pRREC#		LDevice inst: Ctrl		UR element: Autoreclose element # functions		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
ShotCnt3		SPS			AR# SHOT CNT=3 operand	R
	stVal	BOOLEAN	ST	AR# SHOT CNT=3		R
ShotCnt4		SPS			AR# SHOT CNT=4 operand	R
	stVal	BOOLEAN	ST	AR# SHOT CNT=4		R
Disabled		SPS			AR# DISABLED operand	R
	stVal	BOOLEAN	ST	AR# DISABLED		R
InRef01		GEORG			AR# INITIATE setting.	R
	setSrcRef	VISIBLE STRING255	SP	AR# INITIATE.	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C
BlkRef1		GEORG			AR# BLOCK setting.	R
	setSrcRef	VISIBLE STRING255	SP	AR# BLOCK.	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C
InRef02		GEORG			AR# REDUCE MAX TO 1 setting.	R
	setSrcRef	VISIBLE STRING255	SP	AR# REDUCE MAX TO 1	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C
InRef03		GEORG			AR# REDUCE MAX TO 2 setting.	R
	setSrcRef	VISIBLE STRING255	SP	AR# REDUCE MAX TO 2	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C
InRef04		GEORG			AR# REDUCE MAX TO 3 setting.	R
	setSrcRef	VISIBLE STRING255	SP	AR# REDUCE MAX TO 3	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C
InRef05		GEORG			AR# MANUAL CLOSE setting.	R
	setSrcRef	VISIBLE STRING255	SP	AR# MANUAL CLOSE	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C
InRef06		GEORG			AR# MNL RST FRM LO setting.	R
	setSrcRef	VISIBLE STRING255	SP	AR# MNL RST FRM LO	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C
InRef07		GEORG			AR# BKR CLOSED setting.	R
	setSrcRef	VISIBLE STRING255	SP	AR# BKR CLOSED	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C
InRef08		GEORG			AR# BKR OPEN setting.	R
	setSrcRef	VISIBLE STRING255	SP	AR# BKR OPEN	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C
InRef09		GEORG			AR# ADD DELAY 1 setting.	R
	setSrcRef	VISIBLE STRING255	SP	AR# ADD DELAY 1	reference to the data attribute to input	R/C

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LNName: Rec3pRREC#		LDevice inst: Ctrl		UR element: Autoreclose element # functions		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C
InRef10		GEORG			AR# ADD DELAY 2 setting.	R
	setSrcRef	VISIBLE STRING255	SP	AR# ADD DELAY 2	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C

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4.1.4 System logical device

The Ctrl logical device contains logical nodes that model UR power system devices: breakers, switches, CTs, and VTs, and including interface to these such as AC inputs and contact I/O.

4.1.4.1 Logical node zero (LLN0)

This element is instantiated in all UR devices implementing the System logical device.

Table 4-45: LLN0 data objects and attributes

LNName: LLN0		LDevice inst: System		UR element: Nameplate information for the logical nodes		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Beh		INS			This logical device's behavior	R
	stVal	ENUMERATED	ST			R
	stVal	ENUMERATED	ST	LLN0.Beh.stVal of the Master logical device		R
GrRef		GEORG			Reference to root logical device	R
	setSrcRef	VISIBLE STRING255	SP	For communications, mapped to Master ldName if not empty, otherwise to the concatenation of the IED name and "Master". For SCL, mapped to the concatenation of the IED name and "Master".	reference to the data attribute to input	R

4.1.4.2 AC inputs (CT inputs and VT inputs) (ACin)

Uses Beh and NamPlt elements outlined in the Common data objects and attributes table on page 4-1.

4.1.4.3 Breaker control (Bkr)

This element is instantiated in the following products: B30, C30, C60, C70, C95, D30, D60, F35, F60, G30, G60, L30, L60, L90, M60, N60, T35, T60.

Table 4-46: Breaker control data objects

LNName: BkrCSWI#		LDevice inst: System		UR element: Breaker Control element #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
CmdBlk		SPC			Command block status of this LN	R/Ctrl
	stVal	BOOLEAN	ST			R
	pulseConfig .cmdQual	ENUMERATED				R
	pulseConfig.onDur	INT32U				R
	pulseConfig .offDur	INT32U				R

LNName: BkrCSWI#		LDevice inst: System		UR element: Breaker Control element #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	pulseConfig .numPls	INT32U				R
	ctlModel	CtlModels	CF	CSWI# CmdBlk ctlModel		R/W/C
	sboTimeout	INT32U	CF			R
	sboClass	SboClasses	CF			R
Blk		SPS			Breaker Block status	R
	stVal	BOOLEAN	ST	value “Bkr0XCBR#.BlkCls.stVal” AND “Bkr0XCBR#.BlkOpn.stVal”		R
Loc		SPS			Breaker Loc status	R
	stVal	BOOLEAN	ST	Bkr0XCBR#.Loc.stVal		R
OpOpn		ACT			Breaker Open operation	R
	general	BOOLEAN	ST	Bkr0XCBR#.OpOpn.general the output of the logic gates as shown on Sheet 1 of the Breaker Control Logic		R
	phsA	BOOLEAN	ST	Bkr0XCBR#.OpOpn.phsA		R
	phsB	BOOLEAN	ST	Bkr0XCBR#.OpOpn.phsB		R
	phsC	BOOLEAN	ST	Bkr0XCBR#.OpOpn.phsC		R
SelOpn		SPS			Breaker Select status for open operation	R
	stVal	BOOLEAN	ST			R
OpCls		ACT			BREAKER # MNL CLS operand	R
	general	BOOLEAN	ST	Bkr0XCBR#.OpCls.general operand BREAKER # MNL CLS		R
SelCls		SPS			Breaker Select status for close operation	R
	stVal	BOOLEAN	ST			R
Pos		DPC			Breaker position control and status	R/Ctrl
	stVal	CODED ENUM	ST	Bkr0XCBR#.Pos.stVal		R
	stSeld	BOOLEAN	ST		The controllable data status is “selected”	R
	pulseConfig .cmdQual	ENUMERATED				R
	pulseConfig.onDur	INT32U			2 ms (actually one pass)	R
	pulseConfig .offDur	INT32U				R
	pulseConfig .numPls	INT32U				R
	ctlModel	CtlModels	CF	BkrCSWI# Pos ctlModel		R/W/C
	sboTimeout	INT32U	CF	BkrCSWI# Pos sboTimeout		R/W/C
	sboClass	SboClasses	CF			R
BlkOpn		SPC			Blocks breaker open commands from all sources including protection	R/Ctrl
	stVal	BOOLEAN	ST	the output of the logic gates as shown on Sheet 1 of the Breaker Control Logic		R
	pulseConfig .cmdQual	ENUMERATED				R
	pulseConfig.onDur	INT32U				R
	pulseConfig .offDur	INT32U				R
	pulseConfig .numPls	INT32U				R
	ctlModel	CtlModels	CF	CSWI# BlkOpn ctlModel		R/W/C
	sboTimeout	INT32U	CF			R

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LNName: BkrCSWI#		LDevice inst: System		UR element: Breaker Control element #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	sboClass	SboClasses	CF			R
BlkCls		SPC			Blocks breaker close commands from all sources	R/Ctrl
	stVal	BOOLEAN	ST	the output of the logic gates as shown on Sheet 1 of the Breaker Control Logic		R
	pulseConfig .cmdQual	ENUMERATED				R
	pulseConfig.onDur	INT32U				R
	pulseConfig .offDur	INT32U				R
	pulseConfig .numPls	INT32U				R
	ctlModel	CtlModels	CF	CSWI# BlkCls ctlModel		R/W/C
	sboTimeout	INT32U	CF			R
	sboClass	SboClasses	CF			R
TagOn		SPC			Breaker # Tag Command	R/Ctrl
	stVal	BOOLEAN	ST	Bkr0XCBR#.TagOn.stVal		R
	pulseConfig .cmdQual	ENUMERATED				R
	pulseConfig.onDur	INT32U				R
	pulseConfig .offDur	INT32U				R
	pulseConfig .numPls	INT32U				R
	ctlModel	CtlModels	CF	BkrCSWI# TagOn ctlModel		R/W/C
	sboTimeout	INT32U	CF			R
	sboClass	SboClasses	CF			R
TagOff		SPS			BREAKER # TAG OFF operand	R
	stVal	BOOLEAN	ST	Bkr0XCBR#.TagOff.stVal		R
SbstCls		SPS			BREAKER # SUBD CLSD operand	R
	stVal	BOOLEAN	ST	Bkr0XCBR#.SbstCls.stVal		R
SbstOpn		SPS			BREAKER # SUBD OPEN operand	R
	stVal	BOOLEAN	ST	Bkr0XCBR#.SbstOpn.stVal		R
BypsOn		SPS			BREAKER # BYPASS ON operand	R
	stVal	BOOLEAN	ST	Bkr0XCBR#.BypsOn.stVal		R
BypsOff		SPS			BREAKER # BYPASS OFF operand	R
	stVal	BOOLEAN	ST	Bkr0XCBR#.BypsOff.stVal		R

Table 4-47: Breaker control data objects

LNName: BkrCILO#		LDevice inst: System		UR element: Breaker Control element #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
EnaOpn		SPS			Enable Open status	R
	stVal	BOOLEAN	ST			R
EnaCls		SPS			Enable Close status	R
	stVal	BOOLEAN	ST			R
InRef2		GEORG			BKR# INTERLOCK OPN setting.	R
	setSrcRef	VISIBLE STRING255	SP	BKR# INTERLOCK OPN	reference to the data attribute to input	R/C

LNName: BkrCILO#		LDevice inst: System		UR element: Breaker Control element #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C
InRef3		GEORG			BKR# INTERLOCK CLS setting.	R
	setSrcRef	VISIBLE STRING255	SP	BKR# INTERLOCK CLS	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C

Table 4-48: Breaker control data objects

LNName: Bkr0XCBR#		LDevice inst: System		UR element: Breaker Control element #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
EEHealth		INS			Breaker health, value is 2 (yellow) when breaker is out of service, 3 (red) when breaker trouble is detected and breaker is not out of service	R
	stVal	ENUMERATED	ST			R
Loc		SPS			Value of operand selected by setting BKR# ST.LOC OPERAND	R
	stVal	BOOLEAN	ST			R
OpCnt		INS			Breaker operations counter.	R
	stVal	INT32	ST			R
CBOpCap		INS			Mandatory data object which in this case is fixed at 3	R
	stVal	ENUMERATED	ST			R
OpOpn		ACT			BREAKER # OFF CMD (3-phase trip), TRIP A, TRIP B and TRIP C operands	R
	general	BOOLEAN	ST	BREAKER # OFF CMD		R
	phsA	BOOLEAN	ST	BREAKER # TRIP A		R
	phsB	BOOLEAN	ST	BREAKER # TRIP B		R
	phsC	BOOLEAN	ST	BREAKER # TRIP C		R
OpCls		ACT			BREAKER # ON CMD (close) operand	R
	general	BOOLEAN	ST	BREAKER # ON CMD		R
BadSt1		SPS			BREAKER # BAD STATUS operand	R
	stVal	BOOLEAN	ST	BREAKER # BAD STATUS		R
ClsSt1		SPS			BREAKER # CLOSED operand	R
	stVal	BOOLEAN	ST	BREAKER # CLOSED		R
OpnSt1		SPS			BREAKER # OPEN operand	R
	stVal	BOOLEAN	ST	BREAKER # OPEN		R
Dsc		SPS			BREAKER # DISCREP operand, which is breaker pole discrepancy status	R
	stVal	BOOLEAN	ST	BREAKER # DISCREP		R
Alm		SPS			BREAKER # TROUBLE operand, which is breaker pole discrepancy, bad-status, or BREAKER # EXT ALARM	R
	stVal	BOOLEAN	ST	BREAKER # TROUBLE		R
MnlOpn		SPS			BREAKER # MNL OPEN operand	R
	stVal	BOOLEAN	ST	BREAKER # MNL OPEN		R
MnlCls		SPS			BREAKER # MNL CLS operand	R
	stVal	BOOLEAN	ST	BREAKER # MNL CLS		R
AnyPoleOpn		SPS			BREAKER # ANY P OPEN operand	R
	stVal	BOOLEAN	ST	BREAKER # ANY P OPEN		R

LNName: Bkr0XCBR#		LDevice inst: System		UR element: Breaker Control element #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
OnePoleOpn		SPS			BREAKER # ONE P OPEN operand	R
	stVal	BOOLEAN	ST	BREAKER # ONE P OPEN		R
OutOfSrv		SPS			BREAKER # OOS operand	R
	stVal	BOOLEAN	ST	BREAKER # OOS		R
TagOn		SPC			Breaker # Tag Command	R/Ctrl
	stVal	BOOLEAN	ST	BREAKER # TAG ON		R
	pulseConfig.cmdQual	ENUMERATED				R
	pulseConfig.onDur	INT32U				R
	pulseConfig.offDur	INT32U				R
	pulseConfig.numPls	INT32U				R
	ctlModel	CtlModels	CF	Bkr0XCBR# TagOn ctlModel		R/W/C
	sboTimeout	INT32U	CF			R
	sboClass	SboClasses	CF			R
TagOff		SPS			BREAKER # TAG OFF operand	R
	stVal	BOOLEAN	ST	BREAKER # TAG OFF		R
SbstCls		SPS			BREAKER # SUBD CLSD operand	R
	stVal	BOOLEAN	ST	BREAKER # SUBD CLSD		R
SbstOpn		SPS			BREAKER # SUBD OPEN operand	R
	stVal	BOOLEAN	ST	BREAKER # SUBD OPEN		R
BypsOn		SPS			BREAKER # BYPASS ON operand	R
	stVal	BOOLEAN	ST	BREAKER # BYPASS ON		R
BypsOff		SPS			BREAKER # BYPASS OFF operand	R
	stVal	BOOLEAN	ST	BREAKER # BYPASS OFF		R
RecBlk		SPS			BREAKER # BLK RCLS operand	R
	stVal	BOOLEAN	ST	BREAKER # BLK RCLS		R
RecEna		SPS			BREAKER # ENA RCLS operand	R
	stVal	BOOLEAN	ST	BREAKER # ENA RCLS		R
Pos		DPC			Breaker position control and status	R/Ctrl
	stVal	CODED ENUM	ST			R
	stSeld	BOOLEAN	ST		The controllable data status is “selected”	R
	pulseConfig.cmdQual	ENUMERATED				R
	pulseConfig.onDur	INT32U			2 ms (actually one pass)	R
	pulseConfig.offDur	INT32U				R
	pulseConfig.numPls	INT32U				R
	ctlModel	CtlModels	CF	XCBR# Pos ctlModel		R/W/C
	sboTimeout	INT32U	CF	XCBR# Pos sboTimeout		R/W/C
	sboClass	SboClasses	CF			R
BlkOpn		SPC			Blocks breaker open commands from all sources including protection	R/Ctrl
	stVal	BOOLEAN	ST	the output of the logic gates as shown on Sheet 1 of the Breaker Control Logic		R

LNName: Bkr0XCBR#		LDevice inst: System		UR element: Breaker Control element #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	pulseConfig .cmdQual	ENUMERATED				R
	pulseConfig.onDur	INT32U				R
	pulseConfig .offDur	INT32U				R
	pulseConfig .numPls	INT32U				R
	ctlModel	CtlModels	CF	XCBR# BlkOpn ctlModel		R/W/C
	sboTimeout	INT32U	CF			R
	sboClass	SboClasses	CF			R
BlkCls		SPC			Blocks breaker close commands from all sources	R/Ctrl
	stVal	BOOLEAN	ST	the output of the logic gates as shown on Sheet 1 of the Breaker Control Logic		R
	pulseConfig .cmdQual	ENUMERATED				R
	pulseConfig.onDur	INT32U				R
	pulseConfig .offDur	INT32U				R
	pulseConfig .numPls	INT32U				R
	ctlModel	CtlModels	CF	XCBR# BlkCls ctlModel		R/W/C
	sboTimeout	INT32U	CF			R
	sboClass	SboClasses	CF			R
InRef1		GEORG			BREAKER # OPEN setting.	R
	setSrcRef	VISIBLE STRING255	SP	BREAKER # OPEN	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C
InRef2		GEORG			BREAKER # BLK OPEN setting.	R
	setSrcRef	VISIBLE STRING255	SP	BREAKER # BLK OPEN	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C
InRef3		GEORG			BREAKER # CLOSE setting.	R
	setSrcRef	VISIBLE STRING255	SP	BREAKER # CLOSE	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C
InRef4		GEORG			BREAKER # BLK CLOSE setting.	R
	setSrcRef	VISIBLE STRING255	SP	BREAKER # BLK CLOSE	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C
InRef8		GEORG			BKR# SYNCCHECK CLS setting.	R
	setSrcRef	VISIBLE STRING255	SP	BKR# SYNCCHECK CLS	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C
InRef5		GEORG			BREAKER # EXT ALARM setting.	R
	setSrcRef	VISIBLE STRING255	SP	BREAKER # EXT ALARM	reference to the data attribute to input	R/C

LNName: Bkr0XCBR#		LDevice inst: System		UR element: Breaker Control element #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C
InRef6		GEORG			BREAKER # OUT OF SV (out-of-service) setting.	R
	setSrcRef	VISIBLE STRING255	SP	BREAKER # OUT OF SV	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C
InRef7		GEORG			BKR# ST.LOC OPERAND (local control) setting.	R
	setSrcRef	VISIBLE STRING255	SP	BKR# ST.LOC OPERAND	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C
InRef9		GEORG			BREAKER # RACKED-IN setting.	R
	setSrcRef	VISIBLE STRING255	SP	BREAKER # RACKED-IN	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C
InRef10		GEORG			BREAKER # PUSH BUTTON CONTROL setting	R
	setSrcRef	VISIBLE STRING255	SP	BREAKER # PUSH BUTTON CONTROL	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C

Table 4-49: Breaker control data objects

LNName: BkrΘXCBR#		LDevice inst: System		UR element: Breaker Control element #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Loc		SPS			Value of operand selected by setting XCBR# ST.LOC OPERAND	R
	stVal	BOOLEAN	ST	Bkr0XCBR#.Loc.stVal		R
OpCnt		INS			Phase ψ breaker operations counter.	R
	stVal	INT32	ST			R
BadSt1		SPS			BREAKER # ψ BAD ST operand	R
	stVal	BOOLEAN	ST	BREAKER # ψ BAD ST		R
ClsSt1		SPS			BREAKER # ψ CLSD operand	R
	stVal	BOOLEAN	ST	BREAKER # ψ CLSD		R
OpnSt1		SPS			BREAKER # ψ OPEN operand	R
	stVal	BOOLEAN	ST	BREAKER # ψ OPEN		R
IntermSt1		SPS			BREAKER # ψ INTERM operand	R
	stVal	BOOLEAN	ST	BREAKER # ψ INTERM		R
Pos		DPC			Breaker ϕψ position status	R
	stVal	CODED ENUM	ST			R
	ctlModel	CtlModels	CF		0, the code for status-only	R
BlkOpn		SPC			Breaker open commands blocked from all sources including protection	R
	stVal	BOOLEAN	ST	Bkr0XCBR#.BlkOpn.stVal		R
	ctlModel	CtlModels	CF		0, the code for status-only	R
BlkCls		SPC			Breaker close commands blocked from all sources including protection	R
	stVal	BOOLEAN	ST	Bkr0XCBR#.BlkCls.stVal		R
	ctlModel	CtlModels	CF		0, the code for status-only	R

LNName: BkrΘXCBR#		LDevice inst: System		UR element: Breaker Control element #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
CBOpCap		INS			Mandatory data object which in this case is fixed at 3	R
	stVal	ENUMERATED	ST			R
InRef1		GEORG			BREAKER # ϕA/3P CLSD setting" if Θ="1", "BREAKER # ϕB CLSD setting" if Θ="2", or "BREAKER # ϕC CLSD setting" if Θ="3	R
	setSrcRef	VISIBLE STRING255	SP	BREAKER # ϕA/3P CLSD if Θ="1", BREAKER # ϕB CLSD if Θ="2", or BREAKER # ϕC CLSD if Θ="3"	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C
InRef2		GEORG			BREAKER # ϕA/3P OPND setting" if Θ="1", "BREAKER # ϕB OPND setting" if Θ="2", or "BREAKER # ϕC OPND setting" if Θ="3	R
	setSrcRef	VISIBLE STRING255	SP	BREAKER # ϕA/3P OPND if Θ="1", BREAKER # ϕB OPND if Θ="2", or BREAKER # ϕC OPND if Θ="3"	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C

4.1.4.4 Contact output interface (ConOut)

This element is instantiated in all UR products.

Table 4-50: Contact output data objects

LNName: ConOutGGIO1		LDevice inst: System		UR element: Contact Outputs		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Ind1Θ		SPS			only instantiated where the order code indicates that contact output Θ is equipped with a current detector	R
	stVal	BOOLEAN	ST	Cont Op ϕ IOn		R
Ind2Θ		SPS			only instantiated where the order code indicates that contact output Θ is equipped with a voltage detector	R
	stVal	BOOLEAN	ST	Cont Op ϕ VOn		R
Ind3Θ		SPS			only instantiated where the order code indicates that contact output Θ is equipped with a voltage detector	R
	stVal	BOOLEAN	ST	Cont Op ϕ VOff		R
Ind4Θ		SPS			Cont Op Θ On (ϕ) operand value	R
	stVal	BOOLEAN	ST	Cont Op ϕ On		R
InRef1Θ		GEORG			CONTACT OUTPUT ϕ OPERATE setting.	R
	setSrcRef	VISIBLE STRING255	SP	CONTACT OUTPUT ϕ OPERATE	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C
InRef2Θ		GEORG			only instantiated where the order code indicates that contact output Θ is not a latching output.	R
	setSrcRef	VISIBLE STRING255	SP	CONTACT OUTPUT ϕ SEAL-IN	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C
InRef3Θ		GEORG			only instantiated where the order code indicates that contact output Θ is a latching output.	R

LNName: ConOutGGIO1		LDevice inst: System		UR element: Contact Outputs		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	setSrcRef	VISIBLE STRING255	SP	OUTPUT ϕ RESET	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C

4.1.4.5 Disconnect switch (Disc)

This element is instantiated in the following products: B30, C30, C60, C70, C95, D30, D60, F35, F60, G30, G60, L30, L60, L90, M60, N60, T35, T60.

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Table 4-51: Disconnect switch DiscCSWI data objects

LNName: DiscCSWI#		LDevice inst: System		UR element: Disconnect Control element #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Loc		SPS			Disconnect switch Loc status	R
	stVal	BOOLEAN	ST	Disc0XSWI#.Loc.stVal		R
Pos		DPC			Disconnect position control and status	R/Ctrl
	stVal	CODED ENUM	ST	Disc0XSWI#.Pos.stVal		R
	stSeld	BOOLEAN	ST		The controllable data status is “selected”	R
	pulseConfig .cmdQual	ENUMERATED				R
	pulseConfig.onDur	INT32U			2 ms (actually one pass)	R
	pulseConfig .offDur	INT32U				R
	pulseConfig .numPls	INT32U				R
	ctlModel	CtlModels	CF	DiscCSWI# Pos ctlModel		R/W/C
	sboTimeout	INT32U	CF	DiscCSWI# Pos sboTimeout		R/W/C
	sboClass	SboClasses	CF			R

Table 4-52: Disconnect switch DiscCILO data objects

LNName: DiscCILO#		LDevice inst: System		UR element: Disconnect Control element #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
EnaOpn		SPS			Enable Open status	R
	stVal	BOOLEAN	ST			R
EnaCls		SPS			Enable Close status	R
	stVal	BOOLEAN	ST			R
InRef2		GEORG			XSWI# INTERLOCK OPN setting.	R
	setSrcRef	VISIBLE STRING255	SP	XSWI# INTERLOCK OPN	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C
InRef3		GEORG			XSWI# INTERLOCK CLS setting.	R
	setSrcRef	VISIBLE STRING255	SP	XSWI# INTERLOCK CLS	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C

Table 4-53: Disconnect switch Disc0XSWI data objects

LNName: Disc0XSWI#		LDevice inst: System		UR element: Disconnect Control element #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
EEHealth		INS			Disconnect switch health, value is 3 (red) when disconnect switch trouble is detected	R
	stVal	ENUMERATED	ST			R
Loc		SPS			Value of operand selected by XSWI# ST.LOC OPERAND	R
	stVal	BOOLEAN	ST			R
OpCnt		INS			Disconnect switch operations counter.	R
	stVal	INT32	ST			R
SwTyp		INS			Disconnect switch type, fixed at 2 (Disconnector)	R
	stVal	ENUMERATED	ST			R
SwOpCap		INS			Mandatory data object which in this case is fixed at 4	R
	stVal	ENUMERATED	ST			R
OpOpn		ACT			SWITCH # OFF CMD (open) operand	R
	general	BOOLEAN	ST	SWITCH # OFF CMD		R
OpCls		ACT			SWITCH # ON CMD (close) operand	R
	general	BOOLEAN	ST	SWITCH # ON CMD		R
BadSt1		SPS			SWITCH # BAD STATUS operand	R
	stVal	BOOLEAN	ST	SWITCH # BAD STATUS		R
ClsSt1		SPS			SWITCH # CLOSED operand	R
	stVal	BOOLEAN	ST	SWITCH # CLOSED		R
OpnSt1		SPS			SWITCH # OPEN operand	R
	stVal	BOOLEAN	ST	SWITCH # OPEN		R
Dsc		SPS			SWITCH # DISCREP operand, which is disconnect pole discrepancy status	R
	stVal	BOOLEAN	ST	SWITCH # DISCREP		R
Alm		SPS			SWITCH # TROUBLE operand, which is disconnect pole discrepancy, bad-status, or SWITCH # EXT ALARM	R
	stVal	BOOLEAN	ST	SWITCH # TROUBLE		R
TagOn		SPS			SWITCH # TAG ON operand	R
	stVal	BOOLEAN	ST	SWITCH # TAG ON		R
TagOff		SPS			SWITCH # TAG OFF operand	R
	stVal	BOOLEAN	ST	SWITCH # TAG OFF		R
SbstCls		SPS			SWITCH # SUBD CLSD operand	R
	stVal	BOOLEAN	ST	SWITCH # SUBD CLSD		R
SbstOpn		SPS			SWITCH # SUBD OPEN operand	R
	stVal	BOOLEAN	ST	SWITCH # SUBD OPEN		R
BypsOn		SPS			SWITCH # BYPASS ON operand	R
	stVal	BOOLEAN	ST	SWITCH # BYPASS ON		R
BypsOff		SPS			SWITCH # BYPASS OFF operand	R
	stVal	BOOLEAN	ST	SWITCH # BYPASS OFF		R
Pos		DPC			Disconnect switch position control	R/Ctrl
	stVal	CODED ENUM	ST			R
	stSeld	BOOLEAN	ST		The controllable data status is "selected"	R
	pulseConfig .cmdQual	ENUMERATED				R
	pulseConfig.onDur	INT32U			2 ms (actually one pass)	R

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LNName: Disc0XSWI#		LDevice inst: System		UR element: Disconnect Control element #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	pulseConfig .offDur	INT32U				R
	pulseConfig .numPls	INT32U				R
	ctlModel	CtlModels	CF	XSWI# Pos ctlModel		R/W/C
	sboTimeout	INT32U	CF	XSWI# Pos sboTimeout		R/W/C
	sboClass	SboClasses	CF			R
BlkOpn		SPC			Blocks disconnect switch open commands from all sources including protection	R/Ctrl
	stVal	BOOLEAN	ST			R
	pulseConfig .cmdQual	ENUMERATED				R
	pulseConfig.onDur	INT32U				R
	pulseConfig .offDur	INT32U				R
	pulseConfig .numPls	INT32U				R
	ctlModel	CtlModels	CF	Disc0XSWI# BlkOpn ctlModel		R/W/C
	sboTimeout	INT32U	CF			R
	sboClass	SboClasses	CF			R
BlkCls		SPC			Blocks disconnect switch close commands from all sources	R/Ctrl
	stVal	BOOLEAN	ST			R
	pulseConfig .cmdQual	ENUMERATED				R
	pulseConfig.onDur	INT32U				R
	pulseConfig .offDur	INT32U				R
	pulseConfig .numPls	INT32U				R
	ctlModel	CtlModels	CF	Disc0XSWI# BlkCls ctlModel		R/W/C
	sboTimeout	INT32U	CF			R
	sboClass	SboClasses	CF			R
InRef1		GEORG			SWITCH # OPEN setting.	R
	setSrcRef	VISIBLE STRING255	SP	SWITCH # OPEN	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C
InRef2		GEORG			SWITCH # BLK OPEN setting.	R
	setSrcRef	VISIBLE STRING255	SP	SWITCH # BLK OPEN	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C
InRef3		GEORG			SWITCH # CLOSE setting.	R
	setSrcRef	ISIBLE STRING255	SP	SWITCH # CLOSE	reference to the data attribute to input	R/C
	setSrcCB	ISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C
InRef4		GEORG			SWITCH # BLK CLOSE setting.	R
	setSrcRef	VISIBLE STRING255	SP	SWITCH # BLK CLOSE	reference to the data attribute to input	R/C

LNName: Disc0XSWI#		LDevice inst: System		UR element: Disconnect Control element #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C
InRef5		GEORG			XSWI# ST.LOC OPERAND (local control) setting.	R
	setSrcRef	VISIBLE STRING255	SP	XSWI# ST.LOC OPERAND	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C
InRef5		GEORG			XSWI# PUSH BUTTON CONTROL setting	R
	setSrcRef	VISIBLE STRING255	SP	XSWI# PUSH BUTTON CONTROL	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C

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Table 4-54: Disconnect switch DiscΘXSWI data objects

LNName: DiscΘXSWI#		LDevice inst: System		UR element: Disconnect Control element #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Loc		SPS			Value of operand selected by XSWI# ST.LOC OPERAND	R
	stVal	BOOLEAN	ST	Disc0XSWI#.Loc.stVal		R
OpCnt		INS			Phase ψ disconnect switch operation counter.	R
	stVal	INT32	ST			R
SwTyp		INS			Disconnect switch type, fixed at 2 (Disconnector)	R
	stVal	BOOLEAN	ST			R
SwOpCap		INS			Mandatory data object which in this case is fixed at 4	R
	stVal	ENUMERATED	ST			R
BadSt1		SPS			SWITCH # ϕψ BAD STATUS operand	R
	stVal	BOOLEAN	ST	SWITCH # ϕψ BAD STATUS		R
ClsSt1		SPS			SWITCH # ϕψ CLOSED operand	R
	stVal	BOOLEAN	ST	SWITCH # ϕψ CLOSED		R
OpnSt1		SPS			SWITCH # ϕψ OPEN operand	R
	stVal	BOOLEAN	ST	SWITCH # ϕψ OPEN		R
IntermSt1		SPS			SWITCH # ϕψ INTERM operand, which is disconnect pole discrepancy status	R
	stVal	BOOLEAN	ST	SWITCH # ϕψ INTERM		R
Pos		DPC			Disconnect switch ϕψ position control	R
	stVal	CODED ENUM	ST			R
	ctlModel	CtlModels	CF		0, the code for status-only	R
BlkOpn		SPC			Disconnect switch open commands blocked from all sources including protection	R
	stVal	BOOLEAN	ST	Disc0XSWI#.BlkOpn.stVal		R
	ctlModel	CtlModels	CF		0, the code for status-only	R
BlkCls		SPC			Disconnect switch close commands blocked from all sources	R
	stVal	BOOLEAN	ST	Disc0XSWI#.BlkCls.stVal		R
	ctlModel	CtlModels	CF		0, the code for status-only	R
InRef1		GEORG			SWITCH # ϕA/3P CLSD setting" if Θ="1", "SWITCH # ϕB CLSD setting" if Θ="2", or "SWITCH # ϕC CLSD setting" if Θ="3	R

LNName: DiscΘXSWI#		LDevice inst: System		UR element: Disconnect Control element #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	setSrcRef	VISIBLE STRING255	SP	SWITCH # ϕA/3P CLSD if Θ="1", SWITCH # ϕB CLSD if Θ="2", or SWITCH # ϕC CLSD if Θ="3"	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C
InRef2		GEORG			SWITCH # ϕA/3P OPND setting" if Θ="1", "SWITCH # ϕB OPND setting" if Θ="2", or "SWITCH # ϕC OPND setting" if Θ="3	R
	setSrcRef	VISIBLE STRING255	SP	SWITCH # ϕA/3P OPND if Θ="1", SWITCH # ϕB OPND if Θ="2", or SWITCH # ϕC OPND if Θ="3"	reference to the data attribute to input	R/C
	setSrcCB	VISIBLE STRING255	SP		source GoCB of input if via GOOSE	R/C

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4.1.5 Meter logical device

The Meter logical device contains logical nodes that model UR metering and measurement functions (other than PMU), including Signal Sources.

4.1.5.1 Logical node zero (LLN0)

This element is instantiated in all UR devices implementing the Meter logical device.

Table 4-55: LLN0 data objects

LNName: LLN0		LDevice inst: Meter		UR element: Nameplate information for the logical nodes		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Beh		INS			This logical device's behavior	R
	stVal	ENUMERATED	ST			R
	stVal	ENUMERATED	ST	LLN0.Beh.stVal of the Master logical device		R
GrRef		GEORG			Reference to root logical device	R
	setSrcRef	VISIBLE STRING255	SP	For communications, mapped to Master ldName if not empty, otherwise to the concatenation of the IED name and "Master". For SCL, mapped to the concatenation of the IED name and "Master".	reference to the data attribute to input	R

4.1.5.2 AC signal sources (ACsrc)

This element is instantiated in the following products: B30, C30, C60, C70, C95, D30, D60, F35, F60, G30, G60, L30, L60, L90, M60, N60, T35, T60.

Table 4-56: AC signal sources data objects

LNName: ACsrcMMXU#		LDevice inst: Meter		UR element: AC Source #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			SRC# 50DD operand, which becomes On when a disturbance (change in magnitude of a sequence current greater than twice the current cutoff level) is detected on AC Source #.	R
	general	BOOLEAN	ST	SRC# 50DD		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown	R

LNName: ACsrcMMXU#		LDevice inst: Meter		UR element: AC Source #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
TotW		MV			SRC # Three Phase Real Power, in primary watts	R
	instMag.f	FLOAT32		SRC # Three Phase Real Power		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			38, the code for primary watts (J/s)	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	MMXU# TotW DEADBAND		R/W/C
	zeroDb	INT32U	CF			R
TotVAr		MV			SRC # Three Phase Reactive Power, in primary VAr	R
	instMag.f	FLOAT32		SRC # Three Phase Reactive Power		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			63, the code for primary volt amperes reactive (VIsinΘ)	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	MMXU# TotVAr DEADBAND		R/W/C
	zeroDb	INT32U	CF			R
TotVA		MV			SRC # Three Phase Apparent Power, in primary VA	R
	instMag.f	FLOAT32		SRC # Three Phase Apparent Power		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			61, the code for primary volt amperes (VA)	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	MMXU# TotVA DEADBAND		R/W/C
	zeroDb	INT32U	CF			R
TotPF		MV			SRC # Three Phase Power Factor, dimensionless	R
	instMag.f	FLOAT32		SRC # Three Phase Power Factor		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			65, the code for power factor (dimensionless)	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	MMXU# TotPF DEADBAND		R/W/C
	zeroDb	INT32U	CF			R
PFSign		ING			Sign convention for power factor (PF) is fixed at Lead/Lag (usually named IEEE)	R
	setVal	ENUMERATED	SP		2, the code for Lead/Lag (usually named IEEE, Enumeration name is “EEI” per http://www.tissues.iec61850.com/ tissue.mspx?issueid=686)	R
Hz		MV			SRC # Frequency, in Hz	R
	instMag.f	FLOAT32		SRC # Frequency		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			33, the code for hertz (1/s)	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	MMXU# Hz DEADBAND		R/W/C
	zeroDb	INT32U	CF			R
PPV		DEL			SRC # Phase-to-phase Voltage phasors, in primary volts	R

LNName: ACsrcMMXU#		LDevice inst: Meter		UR element: AC Source #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	phsAB.instCVal .mag.f	FLOAT32		SRC # Phase AB Voltage Magnitude		R
	phsAB.instCVal .ang.f	FLOAT32		SRC # Phase AB Voltage Angle		R
	phsAB.cVal.mag.f	FLOAT32				R
	phsAB.cVal.ang.f	FLOAT32				R
	phsAB.units .SIUnit	ENUMERATED			29, the code for primary volts (W/A)	R
	phsAB.units .multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	phsAB.db	INT32U	CF	MMXU# PPV.phsAB.db		R/W/C
	phsAB.zeroDb	INT32U	CF			R
	phsBC.instCVal .mag.f	FLOAT32		SRC # Phase BC Voltage Magnitude		R
	phsBC.instCVal .ang.f	FLOAT32		SRC # Phase BC Voltage Angle		R
	phsBC.cVal.mag.f	FLOAT32				R
	phsBC.cVal.ang.f	FLOAT32				R
	phsBC.units .SIUnit	ENUMERATED			29, the code for primary volts (W/A)	R
	phsBC.units .multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	phsBC.db	INT32U	CF	MMXU# PPV.phsBC.db		R/W/C
	phsBC.zeroDb	INT32U	CF			R
	phsCA.instCVal .mag.f	FLOAT32		SRC # Phase CA Voltage Magnitude		R
	phsCA.instCVal .ang.f	FLOAT32		SRC # Phase CA Voltage Angle		R
	phsCA.cVal.mag.f	FLOAT32				R
	phsCA.cVal.ang.f	FLOAT32				R
	phsCA.units .SIUnit	ENUMERATED			29, the code for primary volts (W/A)	R
	phsCA.units .multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	phsCA.db	INT32U	CF	MMXU# PPV.phsCA .db		R/W/C
	phsCA.zeroDb	INT32U	CF			R
	angRef	ENUMERATED	CF		See UR product manual regarding FREQUENCY AND PHASE REFERENCE	R
VabRMS		MV			SRC # Phase AB Voltage RMS, in primary volts	R
	instMag.f	FLOAT32		SRC # Phase AB Voltage RMS		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			29, the code for primary volts (W/A)	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	MMXU# RMS PPV.phsAB DEADBAND		R/W/C
	zeroDb	INT32U	CF			R
VbcRMS		MV			SRC # Phase BC Voltage RMS, in primary volts	R
	instMag.f	FLOAT32		SRC # Phase BC Voltage RMS		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			29, the code for primary volts (W/A)	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R

LNName: ACsrcMMXU#		**LDevice inst: Meter**		**UR element: AC Source #**		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	db	INT32U	CF	MMXU# RMS PPV.phsBC DEADBAND		R/W/C
	zeroDb	INT32U	CF			R
VcaRMS		MV			SRC # Phase CA Voltage RMS, in primary volts	R
	instMag.f	FLOAT32		SRC # Phase CA Voltage RMS		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			29, the code for primary volts (W/A)	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	MMXU# RMS PPV.phsCA DEADBAND		R/W/C
	zeroDb	INT32U	CF			R
PhV		WYE			SRC # Phase Voltage phasors, in primary volts	R
	phsA.instCVal.mag .f	FLOAT32		SRC # Phase AG Voltage Magnitude		R
	phsA.instCVal.ang .f	FLOAT32		SRC # Phase AG Voltage Angle		R
	phsA.cVal.mag.f	FLOAT32				R
	phsA.cVal.ang.f	FLOAT32				R
	phsA.units.SIUnit	ENUMERATED			29, the code for primary volts (W/A)	R
	phsA.units .multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	phsA.db	INT32U	CF	MMXU# PhV.phsA.db		R/W/C
	phsA.zeroDb	INT32U	CF			R
	phsB.instCVal.mag .f	FLOAT32		SRC # Phase BG Voltage Magnitude		R
	phsB.instCVal.ang .f	FLOAT32		SRC # Phase BG Voltage Angle		R
	phsB.cVal.mag.f	FLOAT32				R
	phsB.cVal.ang.f	FLOAT32				R
	phsB.units.SIUnit	ENUMERATED			29, the code for primary volts (W/A)	R
	phsB.units .multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	phsB.db	INT32U	CF	MMXU# PhV.phsB .db		R/W/C
	phsB.zeroDb	INT32U	CF			R
	phsC.instCVal.mag .f	FLOAT32		SRC # Phase CG Voltage Magnitude		R
	phsC.instCVal.ang .f	FLOAT32		SRC # Phase CG Voltage Angle		R
	phsC.cVal.mag.f	FLOAT32				R
	phsC.cVal.ang.f	FLOAT32				R
	phsC.units.SIUnit	ENUMERATED			29, the code for primary volts (W/A)	R
	phsC.units .multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	phsC.db	INT32U	CF	MMXU# PhV.phsC.db		R/W/C
	phsC.zeroDb	INT32U	CF			R
	angRef	ENUMERATED	CF		See UR product manual regarding FREQUENCY AND PHASE REFERENCE	R
VaRMS		MV			SRC # Phase AG Voltage RMS, in primary volts	R

LNName: ACsrcMMXU#		LDevice inst: Meter		UR element: AC Source #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	instMag.f	FLOAT32		SRC # Phase AG Voltage RMS		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			29, the code for primary volts (W/A)	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	MMXU# RMS PhV.phsA DEADBAND		R/W/C
	zeroDb	INT32U	CF			R
VbRMS		MV			SRC # Phase BG Voltage RMS, in primary volts	R
	instMag.f	FLOAT32		SRC # Phase BG Voltage RMS		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			29, the code for primary volts (W/A)	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	MMXU# RMS PhV.phsB DEADBAND		R/W/C
	zeroDb	INT32U	CF			R
VcRMS		MV			SRC # Phase CG Voltage RMS, in primary volts	R
	instMag.f	FLOAT32		SRC # Phase CG Voltage RMS		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			29, the code for primary volts (W/A)	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	MMXU# RMS PhV.phsC DEADBAND		R/W/C
	zeroDb	INT32U	CF			R
A		WYE			SRC # Current phasors, in primary amperes	R
	phsA	CMV				R
	phsA.instCVal.mag .f	FLOAT32		SRC # Phase A Current Magnitude		R
	phsA.instCVal.ang .f	FLOAT32		SRC # Phase A Current Angle		R
	phsA.cVal.mag.f	FLOAT32				R
	phsA.cVal.ang.f	FLOAT32				R
	phsA.units.SIUnit	ENUMERATED			5, the code for primary amperes	R
	phsA.units .multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	phsA.db	INT32U	CF	MMXU# A.phsA .db		R/W/C
	phsA.zeroDb	INT32U	CF			R
	phsB	CMV				R
	phsB.instCVal.mag .f	FLOAT32		SRC # Phase B Current Magnitude		R
	phsB.instCVal.ang .f	FLOAT32		SRC # Phase B Current Angle		R
	phsB.cVal.mag.f	FLOAT32				R
	phsB.cVal.ang.f	FLOAT32				R
	phsB.units.SIUnit	ENUMERATED			5, the code for primary amperes	R
	phsB.units .multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	phsB.db	INT32U	CF	MMXU# A.phsB.db		R/W/C
	phsB.zeroDb	INT32U	CF			R

LNName: ACsrcMMXU#		LDevice inst: Meter		UR element: AC Source #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	phsC	CMV				R
	phsC.instCVal.mag .f	FLOAT32		SRC # Phase C Current Magnitude		R
	phsC.instCVal.ang .f	FLOAT32		SRC # Phase C Current Angle		R
	phsC.cVal.mag.f	FLOAT32				R
	phsC.cVal.ang.f	FLOAT32				R
	phsC.units.SIUnit	ENUMERATED			5, the code for primary amperes	R
	phsC.units .multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	phsC.db	INT32U	CF	MMXU# A.phsC.db		R/W/C
	phsC.zeroDb	INT32U	CF			R
	res	CMV				R
	res.instCVal.mag .f	FLOAT32		SRC # Neutral Current Magnitude		R
	res.instCVal.ang .f	FLOAT32		SRC # Neutral Current Angle		R
	res.cVal.mag.f	FLOAT32				R
	res.cVal.ang.f	FLOAT32				R
	res.units.SIUnit	ENUMERATED			5, the code for primary amperes	R
	res.units .multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	res.db	INT32U	CF	MMXU# A.neut.db		R/W/C
	res.zeroDb	INT32U	CF			R
	angRef	ENUMERATED	CF		See UR product manual regarding FREQUENCY AND PHASE REFERENCE	R
AaRMS		MV			SRC # Phase A Current RMS, in primary amperes	R
	instMag.f	FLOAT32		SRC # Phase A Current RMS		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			5, the code for primary amperes	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	MMXU# RMS A.phsA DEADBAND		R/W/C
	zeroDb	INT32U	CF			R
AbRMS		MV			SRC # Phase B Current RMS, in primary amperes	R
	instMag.f	FLOAT32		SRC # Phase B Current RMS		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			5, the code for primary amperes	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	MMXU# RMS A.phsB DEADBAND		R/W/C
	zeroDb	INT32U	CF			R
AcRMS		MV			SRC # Phase C Current RMS, in primary amperes	R
	instMag.f	FLOAT32		SRC # Phase C Current RMS		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			5, the code for primary amperes	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	MMXU# RMS A.phsC DEADBAND		R/W/C
	zeroDb	INT32U	CF			R

LNName: ACsrcMMXU#		LDevice inst: Meter		UR element: AC Source #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
AresRMS		MV			SRC # Neutral Current RMS, in primary amperes	R
	instMag.f	FLOAT32		SRC # Neutral Current RMS		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			5, the code for primary amperes	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	MMXU# RMS A.neut DEADBAND		R/W/C
	zeroDb	INT32U	CF			R
Adif		CMV			SRC # Differential Ground Current phasor, in primary amperes	R
	instCVal.mag.f	FLOAT32		SRC # Differential Ground Current Magnitude		R
	instCVal.ang.f	FLOAT32		SRC # Differential Ground Current Angle		R
	cVal.mag.f	FLOAT32				R
	cVal.ang.f	FLOAT32				R
	units.SIUnit	ENUMERATED			5, the code for primary amperes	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	MMXU# Dif Gnd Cur.db		R/W/C
	zeroDb	INT32U	CF			R
	angRef	ENUMERATED	CF		See UR product manual regarding FREQUENCY AND PHASE REFERENCE	R
W		WYE			SRC # Phase Real Power, in primary watts	R
	phsA	CMV				R
	phsA.instCVal.mag .f	FLOAT32		SRC # Phase A Real Power		R
	phsA.cVal.mag.f	FLOAT32				R
	phsA.units.SIUnit	ENUMERATED			38, the code for primary watts (J/s)	R
	phsA.units .multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	phsA.db	INT32U	CF	MMXU# W.phsA DEADBAND		R/W/C
	phsA.zeroDb	INT32U	CF			R
	phsB	CMV				R
	phsB.instCVal.mag .f	FLOAT32		SRC # Phase B Real Power		R
	phsB.cVal.mag.f	FLOAT32				R
	phsB.units.SIUnit	ENUMERATED			38, the code for primary watts (J/s)	R
	phsB.units .multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	phsB.db	INT32U	CF	MMXU# W.phsB DEADBAND		R/W/C
	phsB.zeroDb	INT32U	CF			R
	phsC	CMV				R
	phsC.instCVal.mag .f	FLOAT32		SRC # Phase C Real Power		R
	phsC.cVal.mag.f	FLOAT32				R
	phsC.units.SIUnit	ENUMERATED			38, the code for primary watts (J/s)	R
	phsC.units .multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	phsC.db	INT32U	CF	MMXU# W.phsC DEADBAND		R/W/C

LNName: ACsrcMMXU#		LDevice inst: Meter		UR element: AC Source #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	phsC.zeroDb	INT32U	CF			R
VAr		WYE			SRC # Phase Reactive Power, in primary VAr	R
	phsA	CMV				R
	phsA.instCVal.mag .f	FLOAT32		SRC # Phase A Reactive Power		R
	phsA.cVal.mag.f	FLOAT32				R
	phsA.units.SIUnit	ENUMERATED			63, the code for primary volt amperes reactive (VIsinΘ)	R
	phsA.units .multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	phsA.db	INT32U	CF	MMXU# VAr.phsA DEADBAND		R/W/C
	phsA.zeroDb	INT32U	CF			R
	phsB	CMV				R
	phsB.instCVal.mag .f	FLOAT32		SRC # Phase B Reactive Power		R
	phsB.cVal.mag.f	FLOAT32				R
	phsB.units.SIUnit	ENUMERATED			63, the code for primary volt amperes reactive (VIsinΘ)	R
	phsB.units .multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	phsB.db	INT32U	CF	MMXU# VAr.phsB DEADBAND		R/W/C
	phsB.zeroDb	INT32U	CF			R
	phsC	CMV				R
	phsC.instCVal.mag .f	FLOAT32		SRC # Phase C Reactive Power		R
	phsC.cVal.mag.f	FLOAT32				R
	phsC.units.SIUnit	ENUMERATED			63, the code for primary volt amperes reactive (VIsinΘ)	R
	phsC.units .multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	phsC.db	INT32U	CF	MMXU# VAr.phsC DEADBAND		R/W/C
	phsC.zeroDb	INT32U	CF			R
VA		WYE			SRC # Phase Apparent Power, in primary VA	R
	phsA	CMV				R
	phsA.instCVal.mag .f	FLOAT32		SRC # Phase A Apparent Power		R
	phsA.cVal.mag.f	FLOAT32				R
	phsA.units.SIUnit	ENUMERATED			61, the code for primary volt amperes (VA)	R
	phsA.units .multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	phsA.db	INT32U	CF	MMXU# VA.phsA DEADBAND		R/W/C
	phsA.zeroDb	INT32U	CF			R
	phsB	CMV				R
	phsB.instCVal.mag .f	FLOAT32		SRC # Phase B Apparent Power		R
	phsB.cVal.mag.f	FLOAT32				R

LNName: ACsrcMMXU#		LDevice inst: Meter		UR element: AC Source #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	phsB.units.SIUnit	ENUMERATED			61, the code for primary volt amperes (VA)	R
	phsB.units .multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	phsB.db	INT32U	CF	MMXU# VA.phsB DEADBAND		R/W/C
	phsB.zeroDb	INT32U	CF			R
	phsC	CMV				R
	phsC.instCVal.mag .f	FLOAT32		SRC # Phase C Apparent Power		R
	phsC.cVal.mag.f	FLOAT32				R
	phsC.units.SIUnit	ENUMERATED			61, the code for primary volt amperes (VA)	R
	phsC.units .multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	phsC.db	INT32U	CF	MMXU# VA.phsC DEADBAND		R/W/C
	phsC.zeroDb	INT32U	CF			R
PF		WYE			SRC # Phase Power Factor, dimensionless	R
	phsA	CMV				R
	phsA.instCVal.mag .f	FLOAT32		SRC # Phase A Power Factor		R
	phsA.cVal.mag.f	FLOAT32				R
	phsA.units.SIUnit	ENUMERATED			65, the code for power factor (dimensionless)	R
	phsA.units .multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	phsA.db	INT32U	CF	MMXU# PF.phsA DEADBAND		R/W/C
	phsA.zeroDb	INT32U	CF			R
	phsB	CMV				R
	phsB.instCVal.mag .f	FLOAT32		SRC # Phase B Power Factor		R
	phsB.cVal.mag.f	FLOAT32				R
	phsB.units.SIUnit	ENUMERATED			65, the code for power factor (dimensionless)	R
	phsB.units .multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	phsB.db	INT32U	CF	MMXU# PF.phsB DEADBAND		R/W/C
	phsB.zeroDb	INT32U	CF			R
	phsC	CMV				R
	phsC.instCVal.mag .f	FLOAT32		SRC # Phase C Power Factor		R
	phsC.cVal.mag.f	FLOAT32				R
	phsC.units.SIUnit	ENUMERATED			65, the code for power factor (dimensionless)	R
	phsC.units .multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	phsC.db	INT32U	CF	MMXU# PF.phsC DEADBAND		R/W/C
	phsC.zeroDb	INT32U	CF			R

Table 4-57: AC signal sources data object

LNName: ACsrcMMXN#		LDevice inst: Meter		UR element: AC Source #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Vaux		CMV			SRC # Auxiliary Voltage phasor, in primary volts	R
	instCVal.mag.f	FLOAT32		SRC # Auxiliary Voltage Magnitude		R
	instCVal.ang.f	FLOAT32		SRC # Auxiliary Voltage Angle		R
	cVal.mag.f	FLOAT32				R
	cVal.ang.f	FLOAT32				R
	units.SIUnit	ENUMERATED			29, the code for primary volts (W/A)	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	MMXN# AuxV.db		R/W/C
	zeroDb	INT32U	CF			R
	angRef	ENUMERATED	CF		See UR product manual regarding FREQUENCY AND PHASE REFERENCE	R
VauxRMS		MV			SRC # Auxiliary Voltage RMS, in primary volts	R
	instMag.f	FLOAT32		SRC # Auxiliary Voltage RMS		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			29, the code for primary volts (W/A)	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	MMXN# RMS AuxV DEADBAND		R/W/C
	zeroDb	INT32U	CF			R
Agnd		CMV			SRC # Ground Current phasor, in primary amperes	R
	instCVal.mag.f	FLOAT32		SRC # Ground Current Magnitude		R
	instCVal.ang.f	FLOAT32		SRC # Ground Current Angle		R
	cVal.mag.f	FLOAT32				R
	cVal.ang.f	FLOAT32				R
	units.SIUnit	ENUMERATED			5, the code for primary amperes	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	MMXN# GndCur.db		R/W/C
	zeroDb	INT32U	CF			R
	angRef	ENUMERATED	CF		See UR product manual regarding FREQUENCY AND PHASE REFERENCE	R
AgndRMS		MV			SRC # Ground Current RMS, in primary amperes	R
	instMag.f	FLOAT32		SRC # Ground Current RMS		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			5, the code for primary amperes	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	MMXN# RMS GndCur DEADBAND		R/W/C
	zeroDb	INT32U	CF			R

Table 4-58: AC signal sources data objects

LNName: ACsrcMSQI#		LDevice inst: Meter		UR element: AC Source #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
SeqA		SEQ			SRC # Sequence Current phasors, in primary amperes	R
	c1	CMV				R

LNName: ACsrcMSQI#		LDevice inst: Meter		UR element: AC Source #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	c1.instCVal.mag.f	FLOAT32		SRC # Positive Sequence Current Magnitude		R
	c1.instCVal.ang.f	FLOAT32		SRC # Positive Sequence Current Angle		R
	c1.cVal.mag.f	FLOAT32				R
	c1.cVal.ang.f	FLOAT32				R
	c1.units.SIUnit	ENUMERATED			5, the code for primary amperes	R
	c1.units .multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	c1.db	INT32U	CF	MSQI# Seq1 Cur.db		R/W/C
	c1.zeroDb	INT32U	CF			R
	c2	CMV				R
	c2.instCVal.mag.f	FLOAT32		SRC # Negative Sequence Current Magnitude		R
	c2.instCVal.ang.f	FLOAT32		SRC # Negative Sequence Current Angle		R
	c2.cVal.mag.f	FLOAT32				R
	c2.cVal.ang.f	FLOAT32				R
	c2.units.SIUnit	ENUMERATED			5, the code for primary amperes	R
	c2.units .multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	c2.db	INT32U	CF	MSQI# Seq2 Cur.db		R/W/C
	c2.zeroDb	INT32U	CF			R
	c3	CMV				R
	c3.instCVal.mag.f	FLOAT32		SRC # Zero Sequence Current Magnitude		R
	c3.instCVal.ang.f	FLOAT32		SRC # Zero Sequence Current Angle		R
	c3.cVal.mag.f	FLOAT32				R
	c3.cVal.ang.f	FLOAT32				R
	c3.units.SIUnit	ENUMERATED			5, the code for primary amperes	R
	c3.units .multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	c3.db	INT32U	CF	MSQI# Seq0 Cur.db		R/W/C
	c3.zeroDb	INT32U	CF			R
	seqT	ENUMERATED	MX		0, the code for pos-neg-zero	R
	phsRef	ENUMERATED	CF		0, the code for phase A	R
SeqV		SEQ			SRC # Sequence Voltage phasors, in primary volts	R
	c1	CMV				R
	c1.instCVal.mag.f	FLOAT32		SRC # Positive Sequence Voltage Magnitude		R
	c1.instCVal.ang.f	FLOAT32		SRC # Positive Sequence Voltage Angle		R
	c1.cVal.mag.f	FLOAT32				R
	c1.cVal.ang.f	FLOAT32				R
	c1.units.SIUnit	ENUMERATED			29, the code for primary volts (W/A)	R
	c1.units .multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	c1.db	INT32U	CF	MSQI# Seq1 V.db		R/W/C
	c1.zeroDb	INT32U	CF			R
	c2	CMV				R

LNName: ACsrcMSQI#		LDevice inst: Meter		UR element: AC Source #		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	c2.instCVal.mag.f	FLOAT32		SRC # Negative Sequence Voltage Magnitude		R
	c2.instCVal.ang.f	FLOAT32		SRC # Negative Sequence Voltage Angle		R
	c2.cVal.mag.f	FLOAT32				R
	c2.cVal.ang.f	FLOAT32				R
	c2.units.SIUnit	ENUMERATED			29, the code for primary volts (W/A)	R
	c2.units .multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	c2.db	INT32U	CF	MSQI# Seq2 V.db		R/W/C
	c2.zeroDb	INT32U	CF			R
	c3	CMV				R
	c3.instCVal.mag.f	FLOAT32		SRC # Zero Sequence Voltage Magnitude		R
	c3.instCVal.ang.f	FLOAT32		SRC # Zero Sequence Voltage Angle		R
	c3.cVal.mag.f	FLOAT32				R
	c3.cVal.ang.f	FLOAT32				R
	c3.units.SIUnit	ENUMERATED			29, the code for primary volts (W/A)	R
	c3.units .multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	c3.db	INT32U	CF	MSQI# Seq0 V.db		R/W/C
	c3.zeroDb	INT32U	CF			R
	seqT	ENUMERATED	MX		0, the code for pos-neg-zero	R
	phsRef	ENUMERATED	CF		0, the code for phase A	R

4.1.5.3 B90 AC channel metering (B_Mtr)

This element is instantiated in the following products: B90.

Table 4-59: B90 AC channel metering current input data objects

LNName: B_AmpMMXN#		LDevice inst: Meter		UR element: B90 Metering for current input ϕ		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
ChA		CMV			ϕ current in primary amps	R
	instCVal.mag.f	FLOAT32		ϕ CURRENT magnitude		R
	instCVal.ang.f	FLOAT32		ϕ CURRENT a		R
	cVal.mag.f	FLOAT32				R
	cVal.ang.f	FLOAT32				R
	units.SIUnit	ENUMERATED			5, the code for primary amperes	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	B_AmpMMXNϕ.ChA.db		R/W/C
	zeroDb	INT32U	CF			R

Table 4-60: B90 AC channel metering voltage input data objects

LNName: B_VolMMXN#		LDevice inst: Meter		UR element: B90 Metering for voltage input ϕ		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
ChV		CMV			ϕ voltage in primary volts	R
	instCVal.mag.f	FLOAT32		ϕ VOLTAGE magnitude		R
	instCVal.ang.f	FLOAT32		ϕ VOLTAGE a		R
	cVal.mag.f	FLOAT32				R

LNName: B_VolMMXN#		LDevice inst: Meter		UR element: B90 Metering for voltage input ϕ		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	cVal.ang.f	FLOAT32				R
	units.SIUnit	ENUMERATED			29, the code for primary volts (W/A)	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	B_VolMMXNϕ.ChV.db		R/W/C
	zeroDb	INT32U	CF	(VOLTAGE CUT-OFF LEVEL) / 275 * 100 000		R

Table 4-61: B90 AC channel metering frequency data objects

LNName: B_FrqMMXN1		LDevice inst: Meter		UR element: B90 Metering for frequency		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Hz		MV			Frequency in Hz	R
	instMag.f	FLOAT32		FREQUENCY		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			33, the code for hertz (1/s)	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	B_FrqMMXN1.Hz.db		R/W/C
	zeroDb	INT32U	CF			R
TrcHz		MV			Tracking Frequency in Hz	R
	instMag.f	FLOAT32		TRACKING FREQUENCY		R
	mag.f	FLOAT32				R
	units.SIUnit	ENUMERATED			33, the code for hertz (1/s)	R
	units.multiplier	ENUMERATED			0, the code for a multiplier of 1	R
	db	INT32U	CF	B_FrqMMXN1.TrcHz.db		R/W/C
	zeroDb	INT32U	CF			R

4.1.6 General (Gen) logical device

The Gen logical device contains logical nodes that model UR FlexLogic, Virtual Outputs, non-volatile latches, FlexElements, and recording (for example, oscillography) functions.

4.1.6.1 Logical node zero (LLN0)

This element is instantiated in all UR devices implementing the Gen logical device.

Table 4-62: LLN0 data objects

LNName: LLN0		LDevice inst: Gen		UR element: Nameplate information for the logical nodes		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Beh		INS			This logical device's behavior	R
	stVal	ENUMERATED	ST			R
	stVal	ENUMERATED	ST	LLN0.Beh.stVal of the Master logical device		R
GrRef		GEORG			Reference to root logical device	R
	setSrcRef	VISIBLE STRING255	SP	For communications, mapped to Master ldName if not empty, otherwise to the concatenation of the IED name and "Master". For SCL, mapped to the concatenation of the IED name and "Master".	reference to the data attribute to input	R

4.1.6.2 FlexLogic, FlexLogic timers, and virtual outputs (FlxLgc)

This element is instantiated all UR devices.

Table 4-63: FlexLogic data objects

LNName: FlxLgcGAPC1		LDevice inst: Gen		UR element: FlexLogic		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
Str		ACD			Mandatory data object which in this case is fixed at False	R
	general	BOOLEAN	ST	False		R
	dirGeneral	ENUMERATED	ST		0, the code for unknown.	R
Op		ACT			Mandatory data object which in this case is fixed at False	R
	general	BOOLEAN	ST	False		R
Indξξξ		SPS			Virt Op ξ On (VOξξ) operand value	R
	stVal	BOOLEAN	ST	VOξξ On		R

4.1.6.3 Oscillography (Osc)

This element is instantiated in all UR devices.

Table 4-64: Oscillography data objects

LNName: OscRDRE1		LDevice inst: Gen		UR element: Oscillography, core logical node		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
RcdMade		SPS			Records are available	R
	stVal	BOOLEAN	ST			R
FltNum		INS			NUMBER OF TRIGGERS actual value	R
	stVal	INT32	ST	NUMBER OF TRIGGERS actual value		R
NumRcd		INS			AVAILABLE RECORDS actual value	R
	stVal	INT32	ST	actual value AVAILABLE RECORDS		R
NumCycPer		INS			CYCLES PER RECORD actual value	R
	stVal	INT32	ST	actual value CYCLES PER RECORD		R
RsTms		INS			LAST CLEARED DATE actual value	R
	stVal	INT32	ST	actual value LAST CLEARED DATE		R
RcdTrg		SPC			External command to trigger recorder	R/Ctrl
	pulseConfig.cmdQual	ENUMERATED				R
	pulseConfig.onDur	INT32U			2 ms (actually one pass)	R
	pulseConfig.offDur	INT32U				R
	pulseConfig.numPls	INT32U				R
	ctlModel	CtlModels	CF	OscRDRE1.RcdTrg.ctlModel		R/C
	sboTimeout	INT32U	CF			R
	sboClass	SboClasses	CF			R
MemClr		SPC			Clear all oscillography records command	R/Ctrl
	pulseConfig.cmdQual	ENUMERATED				R
	pulseConfig.onDur	INT32U			2 ms (actually one pass)	R

LNName: OscRDRE1		LDevice inst: Gen		UR element: Oscillography, core logical node		
data obj.	**data attribute**	**Type**	**FC**	**UR Name**	**Description**	**R/W/C**
	pulseConfig .offDur	INT32U				R
	pulseConfig .numPls	INT32U				R
	ctlModel	CtlModels	CF	OscRDRE1.MemClr.ctlModel		R/W/C
	sboTimeout	INT32U	CF			R
	sboClass	SboClasses	CF			R

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4.1.7 GE namespace

The GE namespace is an extension of the "IEC 61850-7-4:2007A" namespace, and as such includes by reference all data object names in IEC 61850-7-4 Edition 2.0 2010-03. As these names are defined in the standard, they are not described in this document.

The name of the GE namespace specified in this document is "GE Multilin UR Namespace:2016A".

In the last column, the logical node number is not included. For example, LPHD refers to LPHD1.

Table 4-65: GE namespace

Data object name	CDC	Semantics	Used in logical nodes...
AaRMS	MV	Phase A current RMS. SRC 1 Phase A Current RMS, in primary amperes.	ACsrcMMXU
AbRMS	MV	Phase B current RMS. SRC 1 Phase B Current RMS, in primary amperes.	ACsrcMMXU
AcRMS	MV	Phase C current RMS. SRC 1 Phase C Current RMS, in primary amperes.	ACsrcMMXU
Adif	CMV	Differential current (sum of the three phase currents and the ground (fourth) current. Restricted ground differential if the fourth current measures the ground current in a grounded wye winding. Measures CT secondary circuit trouble if fourth current measures the CT secondary neutral current. SRC 1 Differential Ground Current phasor, in primary volts.	ACsrcMMXU
Agnd	CMV	Ground current (fourth input in a current AC bank). SRC 1 Ground Current phasor, in primary amperes.	ACsrcMMXN
AgndRMS	MV	Ground current RMS (fourth input in a current AC bank). SRC 1 Ground Current RMS, in primary amperes.	ACsrcMMXN
AnExpnSt	SPS	Expression status of the RxGOOSE Analog	GGIO3
AnyErr	SPS	Any of the self-test errors generated. The ANY SELF TESTS operand.	LPHD
AnyGpsFail	SPS	The GPS signal failed or is not configured properly at any terminal. The 87L DIFF GPS FAIL operand, which becomes On when the GPS signal failed or is not configured properly at any terminal.	LinDfPDIF
AnyPoleOpn	SPS	At least one pole is open. The BREAKER 1 ANY P OPEN operand.	Bkr0XCBR
AnyShotCnt	SPS	The first breaker close signal has been issued. The AR SHOT CNT greater than zero operand.	Rec13pRREC
APPID	ING	Expected value of APPID field in messages subscribed to by RxGOOSE# The RxGOOSE1 ETYPE APPID setting.	LGOS
ArBlk1	SPS	Autoreclose Breaker number indicated by the data instance number is temporarily disabled. The AR BKR1 BLK operand and the AR1 BLK FROM MAN CLS operand.	Rec13pRREC, Rec3pRREC
AresRMS	MV	Residual Current RMS. SRC 1 Neutral Current RMS, in primary amperes.	ACsrcMMXU
ArLO	SPS	Autoreclose is locked out. The AR LO operand.	Rec13pRREC, Rec3pRREC
ArMod1	SPS	Autoreclosec mode equals to the number indicated by the data instance number, in this case 1 and 3 pole mode. The AR MODE = 1 operand.	Rec13pRREC

Data object name	CDC	Semantics	Used in logical nodes...
ArRip	SPS	Autoreclose is in progress. The AR RIP operand.	Rec13pRREC, Rec3pRREC
Asymmetry	SPS	Communications channel asymmetry detected. The 87L DIFF CH ASYM DET operand, which becomes On when the differential element's has detected substantial communications channel asymmetry.	LinDfPDIF
BadSt1	SPS	Bad-status detected. The BREAKER/SWITCH BAD STATUS operand.	BbBkrSCBR, BkrΘXCBR, Bkr0XCBR, Disc0XSWI, DiscΘXSWI, GGIO3
BatFail	SPS	The battery is not functioning. The BATTERY FAIL operand.	LPHD
BDifAClc	CMV	B90 differential current	B_DifPDIF
BkrSt	ENS	BKR STATUS BAY actual value	BbBkrSCBR
Blk2ndH1	SPS	Indicates second harmonic blocking active (where the last digit of instance number 1, 2, or 3 refers to phase A, B, and C respectively). The XFMR PCNT DIFF 2ND A/B/C operand.	PctDifPDIF
Blk5thH1	SPS	Indicates fifth harmonic blocking active (where the last digit of instance number 1, 2, or 3 refers to phase A, B, and C respectively). The XFMR PCNT DIFF 5TH A/B/C operand.	PctDifPDIF
BlkH1	SPS	The second harmonic of the transformer magnetizing inrush current has inhibited the current differential element from operating. The 87L HARM2 A/B/C OP operand, which becomes asserted when phase A/B/C of second harmonic of the transformer magnetizing inrush current inhibits the current differential element from operating.	LinDfPDIF (L90)
BrckTrbl	SPS	HardFiber Brick trouble. The BRICK TROUBLE operand.	LPHD
BRstA	CMV	B90 restraint current	B_DifPDIF
ChA	CMV	B90's AC channel current	B_AmpMMXN
ChFail1	SPS	Communications channel failed. The 87L DIFF CH 1 FAIL operand, which becomes On when the differential element has detected communications channel 1 failed.	LinDfPDIF
ChV	CMV	B90's AC channel voltage	B_VolMMXN
ClkUnsynch	SPS	Relay is not synchronized to the international time standard. The CLOCK UNSYNCHRONIZED operand.	LPHD
Cls2ndBkr	SPS	Close second Breaker signal. The AR CLOSE BKR2 operand.	Rec13pRREC
ClsSt1	SPS	Close status detected. The BREAKER/SWITCH CLOSED operand.	BbBkrSCBR, BkrΘXCBR, Bkr0XCBR, Disc0XSWI, DiscΘXSWI, GGIO3
ConfRev	ING	Expected value of confRev field in messages subscribed to by RxGOOSE#	LGOS
CrcFail1	SPS	The CRC error threshold has been exceeded. The 87L DIFF CH 1 CRCFAIL operand, which becomes On when the differential element has detected the CRC error threshold has been exceeded on channel 1.	LinDfPDIF
DatSetRef	GEORG	Expected value of datSet field in messages subscribed to by RxGOOSE# . Edition 1. The setting RxGOOSE1 DatSet.	LGOS
DbMax1	ASG	Value of “max.” in deadband calculations	GGIO4
DbMin1	ASG	Value of “min.” in deadband calculations	GGIO4
DeaV1	SPS	This data object indicates that V1 is below the DeaVal1 setting. The SYNC 1 V1 BELOW MAX operand.	SynChkRSYN
DifA2ndH	WYE	Phase differential current	PctDifPDIF
DifA5thH	WYE	Phase differential current	PctDifPDIF
DifAngDis	MV	Synchro scope displayed value for the Phase angle difference between V1 and V2	SynChkRSYN
DirSupn	SPS	Directional overcurrent supervision status (not instantiated for zone 1 GndDisPDIS1). The GND DIST Z2 DIR SUPN operand.	GndDisPDIS
Disabled	SPS	Function is disabled	Rec13pRREC, Rec3pRREC

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Data object name	CDC	Semantics	Used in logical nodes...
DistDet	SPS	Sensitive current disturbance detector. For PwrSwgRPSB1, power swing element detected disturbance other than power swing. The 50DD SV operand, which becomes On when the 87L disturbance detector has operated. The POWER SWING 50DD operand.	LinDfPDIF, PwrSwgRPSB
Dpo	SPS	The DPO (dropout) operand. Inverse of Str, Op, or Pkp.	AuxOvPTOV, AuxUvPTUV, B_TocPTOC, B_UvPTUV, GndIocPIOC, GndTocPTOC, NegIocPIOC, NegTocPTOC, NeuIocPIOC, NeuTocPTOC, PhsIocPIOC, PhsOvPTOV, PhsTocPTOC, PhsUvPTUV, RgDifPDIF, SubHa$PHIZ
DpoBia	SPS	B90 Drop-out of Biased indicates the dropping of pick-up condition for biased differential element	B_DifPDIF
DpoPhs1	SPS	Inverse of per phase pickup (Pkp). Individual phase DPO (dropout) operand.	B_TocPTOC, PhsIocPIOC, GndDisPDIS, PhsDisPDIS, PhsTocPTOC
DpoPhs1	SPS	Inverse of Op	PhsIocPIOC, PhsOvPTOV, PhsUvPTUV
DrcDevOff	SPS	A direct device is configured but not connected. The DIRECT DEVICE OFF operand.	LPHD
DrcRingBrk	SPS	The Direct I/O settings is for a ring but the connection is not in a ring. The DIRECT RING BREAK operand.	LPHD
DynArmd	SPS	This data object indicates that dynamic mode is armed. The SYNC1 S-CLOSE ARMD operand, which becomes On when dynamic mode is armed.	SynChkRSYN
DynDpo	SPS	The SYNC1 S-CLOSE DPO operand, which becomes Off when all criteria for dynamic mode are fulfilled	SynChkRSYN
DynOp	SPS	This data object indicates that all criteria for dynamic mode are fulfilled if value is TRUE else false. The SYNC1 S-CLOSE OP operand, which becomes On when all criteria for dynamic mode are fulfilled.	SynChkRSYN
Ena1	SPS	Function is Enabled. The AR ENABLED operand.	Rec13pRREC, Rec3pRREC
EqpMismat	SPS	The configuration of modules does not match the stored order code. The EQUIPMENT MISMATCH operand.	LPHD
Eth1Fail	SPS	First Ethernet port failure	LPHD
Eth2Fail	SPS	Second Ethernet port failure	LPHD
Eth3Fail	SPS	Third Ethernet port failure	LPHD
EvtEna1	ENG	Setting to enable generation of events in event record, 0 = Disabled, 1 = Enabled	GGIO3
EvtRcdClr	SPC	Clear Event Records (erase all Events). The CLEAR EVENT RECORDS command.	Master/LLN0
FlexErrTkn	SPS	A FlexLogic equation is incorrect. The FLEXLOGIC ERR TOKEN operand.	LPHD
FltAGCC	SPS	Fault indication - Cross-country with phase A to ground	TrOutPTRC
FltBGCC	SPS	Fault indication - Cross-country with phase B to ground	TrOutPTRC
FltCC	SPS	Fault indication - Cross-country	TrOutPTRC
FltCGCC	SPS	Fault indication - Cross-country with phase C to ground	TrOutPTRC
FltLpReact	MV	D30, D60, L60, L90 - The fault loop reactance	FltRFLO
FltLpRis	MV	D30, D60, L60, L90 - The fault loop resistance	FltRFLO
FltRis	MV	L90 - The fault resistance at the fault point	FltRFLO
Function1	ENG	Function Enable/Disable setting: 0 = Disabled, 1 = Enabled (note that TISSUE 670 suggests something like this named SetMod)	Master/LLN0

Data object name	CDC	Semantics	Used in logical nodes...
FwdOp	SPS	Fault direction is forward. The NEG SEQ DIR OC1 FWD operand. The NTRL DIR OC1 FWD operand.	NegDocRDIR, NeuDocRDIR
GoDatSetRef	ORG	Expected value of datSet field in messages subscribed to by RxGOOSE# The setting RxGOOSE1 DatSet.	LGOS
GoEnaPort1	ENG	Enable all GOOSE on Ethernet port setting: 0 = Disabled, 1 = Enabled	Master/LLN0
GoID	VSG	Expected value of goID field in messages subscribed to by RxGOOSE# The setting RxGOOSE1 ID.	LGOS
GpsFail1	SPS	GPS failed at terminal corresponding to instance number. The 87L DIFF GPS 1 FAIL operand.	LinDfPDIF
GrAct1	SPS	Setting group corresponding to index is active (not instantiated in C30). The SETTING GROUP ACT 1 operand.	Master/LLN0
HDetAa	MV	Phase A harmonic current	HDetMHAI
HDetAAv	MV	Average of phase harmonic currents	HDetMHAI
HDetAb	MV	Phase B harmonic current	HDetMHAI
HDetAc	MV	Phase C harmonic current	HDetMHAI
HDetAGnd	MV	Ground harmonic current	HDetMHAI
IdFail1	SPS	ID check for a peer L30/L90 on the channel has failed. 87L DIFF CH 1 ID FAIL operand, which becomes On when the differential element's ID check for a peer L30 on channel 1 has failed.	LinDfPDIF
IndFailBeh	ENG	Setting to select the behavior of the RxGOOSE Boolean when the sending device is offline: 0 = On, 1 = Off, 2 = Latest/On, 3 = Latest/Off	GGIO3
IndPos1	DPS	Generic remote DPS input status values: 0 for intermediate-state, 1 for off, 2 for on, 3 for bad-state. RxGOOSE DPS1 actual value.	GGIO3
InRef1	GEORG	General input reference, used for "Enable Controls From GFP" setting	GFPhpIHMI
IntermSt1	SPS	Intermediate-status detected. The BREAKER/SWITCH INTERM operand.	BkrΘXCBR, DiscΘXSWI, GGIO3
IrigbFail	SPS	A bad IRIG-B input signal has been detected. The IRIG-B FAILURE operand.	LPHD
IsoBlk	ACT	Indicates that the isolator position is invalid	B_IsoSSWI, BbIsoSSWI
IsoPos	ACT	Position of isolator, meaning On (current included in differential zone) or Off (current excluded from differential calculations)	BbIsoSSWI
LastSqNum	INS	Last sequence number received. Actual value RxGOOSE1 SqNum.	LGOS
LatchErr	SPS	A difference is detected between the wanted and actual latch contact state. The LATCHING OUT ERROR operand.	LPHD
LivDea	SPS	This data object indicates that live/dead conditions have been met. The SYNC 1 DEAD S OP operand, which indicates that live/dead conditions have been met.	SynChkRSYN
LivDeaDpo	SPS	This data object indicates that live/dead conditions have not been met. The SYNC 1 DEAD S DPO operand, which indicates that live/dead conditions have not been met.	SynChkRSYN
LivLiv	SPS	This data object indicates that both sources are live, and that angle, frequency, and voltage difference and range conditions have been met. The SYNC 1 SYNC OP operand, which indicates that both sources are live, and that angle, frequency, and voltage difference and range conditions have been met.	SynChkRSYN
LivLivDpo	SPS	This data object indicates that one or both sources are not live, or that angle, frequency, and voltage difference and range conditions have been met. The SYNC 1 SYNC DPO operand, which indicates that one or both sources are not live, or that angle, frequency, and voltage difference and range conditions have been met.	SynChkRSYN
LivV1	SPS	This data object indicates that V1 is above the LivVal1 setting. The SYNC 1 V1 ABOVE MIN operand, which indicates that V1 is above the LivVal1 setting.	SynChkRSYN

Data object name	CDC	Semantics	Used in logical nodes...
LosPkt1	SPS	The lost packet threshold has been exceeded. The 87L DIFF CH 1 LOSTPKT operand, which becomes On when the differential element has detected the lost packet threshold has been exceeded on channel 1.	LinDfPDIF
MAC	GEVSG	Expected value of Destination MAC address field in messages subscribed to by RxGOOSE#	LGOS
MajorErr	SPS	Any of the major self-test errors generated (major error). The ANY MAJOR ERROR operand.	LPHD
MaxAsymOp1	SPS	Asymmetry on the channel exceeded pre-set value. The 87L DIFF CH 1 MAX ASYM operand, which becomes On when the Asymmetry on channel 1 exceeded preset value.	LinDfPDIF
MinorErr	SPS	Any of the minor self-test errors generated (minor error). The ANY MINOR ERROR operand.	LPHD
MltLev	SPG	Select mode of authority for local control true means control from level below a level where Loc is true are allowed where Loc at the lower level is false	Master/LLN0
MMSClnts	MV	Number of MMS client connections active	LPHD
MnlCls	SPS	Manual close initiated. The BREAKER 1 MNL CLS operand.	Bkr0XCBR
MnlOpn	SPS	Manual open initiated. The BREAKER 1 MNL OPEN operand.	Bkr0XCBR
NeutSupn	SPS	Neutral overcurrent supervision status. The GND DIST Z1 SUPN IN operand.	GndDisPDIS
NumCycPer	INS	Number of cycles of the nominal frequency. The CYCLES PER RECORD actual value.	OscRDRE
Off	SPS	Logic 0 fixed operand	Master/LLN0
On	SPS	Logic 1 fixed operand	Master/LLN0
OnePoleOpn	SPS	One pole is open, others closed. The BREAKER 1 ONE P OPEN operand.	Bkr0XCBR
OnePU	ASG	The per-unit base factor applied to the corresponding RxGOOSE analog input FlexAnalog quantity to normalize it to a per-unit quantity.	GGIO3
OnMod	SPS	Relay in On Mode	Master / LNN0
OpBia	ACT	B90 Operate indicates the trip decision of a biased protection logic	B_DifPDIF
OpnSt1	SPS	Open status detected. The BREAKER/SWITCH OPEN operand. The RxGOOSE DPS1 Off operand.	BbBkrSCBR, BkrΘXCBR, Bkr0XCBR, Disc0XSWI, DiscΘXSWI, GGIO3
OpPhs1	SPS	Indicates a trip decision for a particular cause per phase. The BUS 1 BIASED OP A/B/C operand. The BUS 1 UNBIASED OP A/B/C operand. The PHS DIST Z1 OP AB/BC/CA operand.	PhsDisPDIS
OpUnBia	ACT	B90 Operate indicates the trip decision of an unbiased protection logic	B_DifPDIF
OscilGOOSE	SPS	One or more of GGIO1.Ind###.stVal has been frozen due to frequent status changes (chatter) in the mapped operand. The Oscillatory GOOSE operand.	LPHD
OutOfSrv	SPS	Out-of-service. The BREAKER 1 OOS operand.	Bkr0XCBR
P1Rip	SPS	Autoreclose A single pole is in progress. The AR 1-P RIP operand.	Rec13pRREC
P3Rip1	SPS	Autoreclose 3-pole is in progress via dead time number indicated by the data instance number. The AR 3-P/1 RIP operand.	Rec13pRREC
P3Tr	SPS	Force any trip to 3-phase trip. The AR FORCE 3-P TRIP operand.	Rec13pRREC
PBusFail	SPS	HardFiber process bus system status	LPHD
PBusTrbl	SPS	HardFiber process bus trouble	LPHD

Data object name	CDC	Semantics	Used in logical nodes...
PFLLfail	SPS	Phase and/or frequency lock loop (PFLL) has failed. The 87L DIFF PFLL FAIL operand, which becomes On when the differential element's phase and frequency lock loop (PFLL) has failed.	LinDfPDIF
PhDir1	SPS	Indicates Phase Comparison of differential is satisfied per phase, where the last digit of instance number 1, 2, or 3 refers to phase A, B, and C respectively. The BUS 1 DIR A/B/C operand. The STATOR DIFF1 DIR A/B/C operand.	B_DifPDIF
ProcBusTrbl	SPS	HardFiber Process bus trouble. The PROCESS BUS TROUBLE operand.	LPHD
ProjDif	MV	Phase angle difference between V1 and projected V2 (V2'). Edition 1. SYNCHROCHECK 1 DELTA PHASE', in degrees which is the phase angle difference between V1 and projected V2.	SynChkRSYN
ProjDifDis	MV	Synchroscope displayed value for the Phase angle difference between V1 and projected V2 (V2')	SynChkRSYN
ProjectedDif	MV	Phase angle difference between V1 and projected V2 (V2'). SYNCHROCHECK 1 DELTA PHASE', in degrees which is the phase angle difference between V1 and projected V2.	SynChkRSYN
ProjectedV1	CMV	Projected V2 Voltage phasor. SYNCHROCHECK 1 V2' voltage phasor, in primary volts.	SynChkRSYN
ProjV2	CMV	Projected V2 Voltage phasor. Edition 1. SYNCHROCHECK 1 V2' voltage phasor, in primary volts.	SynChkRSYN
PtpFail	SPS	Bad PTP Signal. The PTP FAILURE operand.	LPHD
RackdIn	SPS	Breaker is connected to power system	BbBkrSCBR
RackdOut	SPS	Breaker is not connected to power system	BbBkrSCBR
RefWinding	INS	Reference winding. Number of windings used as the reference winding for ratio compensation.	PctDifPDIF
RelDpo	SPS	This data object indicates that not all criteria are fulfilled, and the switching/ operation action is not released to proceed. Complement of Rel. The SYNC 1 CLS DPO operand, which becomes Off when all synchrocheck criteria are fulfilled.	SynChkRSYN
RlyUTCTms	INS	Represents the relay UTC time in seconds elapsed since 00:00:00 January 1, 1970. Mapped to Modbus register 41A0h value, that is, "Relay time clock set time" register value after converting to UTC (if time zone and DST is used).	LPHD
RrtdComFail	SPS	RRTD communication failure. The RRTD COMM FAIL operand.	LPHD
RrtdFail	SPS	RRTD communication failure	LPHD
Rs	SPS	Autoreclose has been reset either manually or by the rest timer. The AR RESET operand.	Rec13pRREC
RsTms	INS	The UTC time of the last clear in seconds elapsed since 00:00:00 January 1, 1970. The LAST CLEARED DATE actual value.	OscRDRE
RtdTrbl	SPS	RTD trouble. The RTD TROUBLE operand.	LPHD
RvOp	SPS	Fault direction is reverse. The NEG SEQ DIR OC1 REV operand. The NTRL DIR OC1 REV operand.	NegDocRDIR, NeuDocRDIR
RxGooseOff	SPS	One or more RxGOOSE is not responding. The RxGOOSE OFF operand.	LPHD
Sat1	SPS	Indicates CT saturation is detected. The BUS 1 SAT A/B/C operand.	B_DifPDIF
SecDataClr	SPC	Command CLEAR SECURITY DATA, TRUE = CLEAR SECURITY DATA	SecGSAL
SeqTO	SPS	The incomplete sequence timer timed out. The AR INCOMPLETE SEQ operand.	Rec13pRREC
ShotCnt1	SPS	Autoreclosec shot count is equal to the number indicated by the data instance number. The AR SHOT CNT=1 operand.	Rec13pRREC, Rec3pRREC

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Data object name	CDC	Semantics	Used in logical nodes...
SntpFail	SPS	SNTP server is not responding. The SNTP FAILURE operand.	LPHD
StIGMP	SPS	Indicates status of IGMP connection for R-GOOSE multicast reception. The R-RxGOOSE1 IGMP On operand.	LGOS
StrBia	ACD	B90 Start Biased indicates the detection of a fault or an unacceptable condition by Biased Differential element	B_DifPDIF
StrOutgoing	SPS	This Data Object indicates an unstable Power swing detection for outgoing Locus. The POWER SWING OUTGOING operand.	PwrSwgRPSB
StrPhs1	SPS	Indicates the detection of a fault or an unacceptable condition on a particular phase-to-phase loop. The PHS DIST Z1 PKP AB/BC/CA operand in Phase-To-Phase.	PhsDisPDIS
StrRec3p	SPS	Initiate a three-pole reclose. The TRIP AR INIT 3-POLE operand.	TrOutPTRC
StrZ2GndDl	SPS	Start zone 2 ground timer. The TRIP Z2GR TMR INIT operand.	TrOutPTRC
StrZ2PhDl	SPS	Start zone 2 phase timer. The TRIP Z2PH TMR INIT operand.	TrOutPTRC
StubBusOp	SPS	The stub bus function is operated. The STUB BUS OP operand, which becomes On when the Stub Bus function is active.	LinDfPDIF
SwFail	SPS	Autoreclose mode switching failed. The AR MODE SWITCH FAIL operand.	Rec13pRREC
SysExcp	SPS	System exception. The SYSTEM EXCEPTION operand.	LPHD
TapLocFlt	SPS	L90 - The fault is identified between the local terminal and the tap point	FltRptRFLO
TdrTrbl	SPS	TDR trouble. The TDR TROUBLE operand.	LPHD
TempMnt	SPS	The ambient temperature is greater than the maximum operating temperature. The TEMP MONITOR operand.	LPHD
TmChgOp1	SPS	Change in round trip delay on the channel exceeded pre-set value. 87L DIFF CH 1 TIME CHNG operand, which becomes On when the Change in round trip delay on channel 1 exceeded preset value.	LinDfPDIF
TmStr1	SPS	Power swing timer picked up. The POWER SWING TMR2 PKP operand.	PwrSwgRPSB
Tr1p	ACT	Single pole trip operation initiated. The 87L TRIP 1P OP operand. General is TRIP 1-POLE operand, phsA is TRIP PHASE A operand, phsB is TRIP PHASE B operand, and phsC is TRIP PHASE C operand.	LinDfPDIF, TrOutPTRC
Tr3p	ACT	Three pole trip operation initiated. The DCUB TRIP 3P operand. The DIR BLOCK1 TRIP 3P operand. The DUTT TRIP 3P operand. The HYBRID POTT TRIP 3P operand. The 87L TRIP 3P OP operand. The POTT1 TRIP 3P operand. The PUTT TRIP 3P operand. The TRIP 3-POLE operand.	LinDfPDIF, TrOutPTRC
Tr3pFrcd	SPS	Three pole trip mode is being forced. The TRIP FORCE 3-POLE operand (3-pole trip mode is being forced).	TrOutPTRC
TrcHz	MV	B90 frequency	B_FrqMMXN
TrsFwd	SPS	Fault direction is forward for transient ground fault	TrsGnd
TrsRv	SPS	Fault direction is reverse for transient ground fault	TrsGnd
TstBlkMod	SPS	Relay in Test/blocked Mode	Master/LLN0
TstMod	SPS	Relay in Test Mode	Master/LLN0
UNotPrgm	SPS	The Product Setup > Installation > Relay Settings setting is not programmed. The UNIT NOT PROGRAMMED operand.	LPHD

Data object name	CDC	Semantics	Used in logical nodes...
UpdateTms	ING	Periodic update time	Master/LLN0
V1Src	CMV	V1 Voltage phasor. SYNCHROCHECK 1 V1 voltage phasor, in primary volts.	SynChkRSYN
V2Src	CMV	V2 Voltage phasor. SYNCHROCHECK 1 V2 voltage phasor, in primary volts.	SynChkRSYN
VabRMS	MV	Phase AB Voltage RMS. SRC 1 Phase AB Voltage RMS, in primary Volts.	ACsrcMMXU
VaRMS	MV	Phase A Voltage RMS. SRC 1 Phase AG Voltage RMS, in primary volts.	ACsrcMMXU
Vaux	CMV	Auxiliary voltage (fourth input in a voltage AC bank). SRC 1 Auxiliary Voltage phasor, in primary volts.	ACsrcMMXN
VauxRMS	MV	Auxiliary voltage RMS (fourth input in a voltage AC bank). SRC 1 Auxiliary Voltage RMS, in primary volts.	ACsrcMMXN
VbcRMS	MV	Phase BC Voltage RMS. SRC 1 Phase BC Voltage RMS, in primary Volts.	ACsrcMMXU
VbRMS	MV	Phase B Voltage RMS. SRC 1 Phase BG Voltage RMS, in primary volts.	ACsrcMMXU
VcaRMS	MV	Phase CA Voltage RMS. SRC 1 Phase CA Voltage RMS, in primary Volts.	ACsrcMMXU
VcRMS	MV	Phase A Voltage RMS. SRC 1 Phase CG Voltage RMS, in primary volts.	ACsrcMMXU
VoltMntr	SPS	Voltage Monitor. The VOLTAGE MONITOR operand.	LPHD
Z1Chr1	SPS	Positive-sequence impedance is within the configured characteristic. This Data Object is used by power swing detection element for outer characteristic. The POWER SWING INNER operand. The POWER SWING MIDDLE operand. The POWER SWING OUTER operand.	PwrSwgRPSB
Zero	MV	Analog 0 fixed operand. FlexAnalog fixed operand Off.	Master/LLN0
Zn1Extend	SPS	The zone 1 distance function must be set to the extended overreach value. The AR ZONE 1 EXTENT operand.	Rec13pRREC

4.1.8 Enumerations

4.1.8.1 Standard enumerations

EnumType id and the EnumType content of standard enumerations from IEC 61850 7-4 match those in the tissues standard.

EnumType id and EnumType content of standard enumerations from IEC 61850 7-3 match those in IEC 61850 7-3:Annex D.

4.1.8.2 GE extended enumerations

For extended enumerations, EnumType id begins with the string "GE_Digital_Energy_UR_", followed by descriptive text, followed by "Kind". The following is a sample excerpt of the extended Enumerations from a firmware-generated UR.ICD file.

```
<EnumType id="GE_Digital_Energy_UR_HiZStKind">
        <EnumVal ord="0">Normal</EnumVal>
        <EnumVal ord="1">Coordination Timeout</EnumVal>
        <EnumVal ord="2">Armed</EnumVal>
        <EnumVal ord="5">Arcing</EnumVal>
        <EnumVal ord="9">Downed Conductor</EnumVal>
</EnumType>
```

```
<EnumType id="GE_Digital_Energy_UR_TriggerKind">
        <EnumVal ord="0">None</EnumVal>
        <EnumVal ord="1">Loss of Load</EnumVal>
        <EnumVal ord="2">Arc Suspected</EnumVal>
        <EnumVal ord="3">Arcing</EnumVal>
        <EnumVal ord="4">Overcurrent</EnumVal>
        <EnumVal ord="5">Down Conductor</EnumVal>
        <EnumVal ord="6">External</EnumVal>
</EnumType>
<EnumType id="GE_Digital_Energy_UR_MotStatusKind">
        <EnumVal ord="0">Motor Offline</EnumVal>
        <EnumVal ord="1">Motor Starting</EnumVal>
        <EnumVal ord="2">Motor Running</EnumVal>
        <EnumVal ord="3">Motor Overload</EnumVal>
</EnumType>
<EnumType id="GE_Digital_Energy_UR_FltSegmentKind">
        <EnumVal ord="0">N/A</EnumVal>
        <EnumVal ord="1">LOCAL</EnumVal>
        <EnumVal ord="2">REMOTE 1</EnumVal>
        <EnumVal ord="3">REMOTE 2</EnumVal>
</EnumType>
<EnumType id="GE_Digital_Energy_UR_TimeSourceKind">
        <EnumVal ord="0">None</EnumVal>
        <EnumVal ord="1">Port 1 PTP Clock</EnumVal>
        <EnumVal ord="2">Port 2 PTP Clock</EnumVal>
        <EnumVal ord="3">Port 3 PTP Clock</EnumVal>
        <EnumVal ord="4">IRIG-B</EnumVal>
        <EnumVal ord="5">SNTP</EnumVal>
</EnumType>
<EnumType id="GE_Digital_Energy_UR_ClcMthKind">
        <EnumVal ord="1">UNSPECIFIED</EnumVal>
        <EnumVal ord="2">TRUE_RMS</EnumVal>
        <EnumVal ord="3">PEAK_FUNDAMENTAL</EnumVal>
        <EnumVal ord="4">RMS_FUNDAMENTAL</EnumVal>
        <EnumVal ord="5">MIN</EnumVal>
        <EnumVal ord="6">MAX</EnumVal>
        <EnumVal ord="7">AVG</EnumVal>
        <EnumVal ord="8">SDV</EnumVal>
        <EnumVal ord="9">PREDICTION</EnumVal>
        <EnumVal ord="10">RATE</EnumVal>
</EnumType>
<EnumType id="GE_Digital_Energy_UR_PIDAlg">
        <EnumVal ord="1">P</EnumVal>
        <EnumVal ord="2">I</EnumVal>
        <EnumVal ord="3">>D</EnumVal>
        <EnumVal ord="4">PI</EnumVal>
        <EnumVal ord="5">PD</EnumVal>
        <EnumVal ord="6">ID</EnumVal>
        <EnumVal ord="7">PID</EnumVal>
</EnumType>
<EnumType id="GE_Digital_Energy_UR_PFSignKind">
        <EnumVal ord="1">IEC</EnumVal>
        <EnumVal ord="2">EEI</EnumVal>
</EnumType>
```


The table outlines the logical nodes and data objects that use the extended enumerations.

Table 4-66: GE extended enumerations usage

Enum ID	Used in logical node	Using data object	CDC	Semantic
GE_Digital_Energy_UR_HiZStKind	HiZPHIZ	HiZSt	INS	Status of High Impedance fault detection function

Enum ID	Used in logical node	Using data object	CDC	Semantic
GE_Digital_Energy_UR_TriggerKind	HiZPHIZ	Trigger11	INS	HIZ Capture1 Trigger Type
		Trigger12	INS	HIZ Capture2 Trigger Type
		Trigger13	INS	HIZ Capture3 Trigger Type
		Trigger14	INS	HIZ Capture4 Trigger Type
		Trigger21	INS	HIZ RMS Capture1 Trigger Type
		Trigger22	INS	HIZ RMS Capture2 Trigger Type
		Trigger23	INS	HIZ RMS Capture3 Trigger Type
		Trigger24	INS	HIZ RMS Capture4 Trigger Type
GE_Digital_Energy_UR_MotStatusKind	MotThmPTTR	MotStatus	INS	Motor status
GE_Digital_Energy_UR_FltSegmentKind	FltRFLO	FltSegment	INS	Segment of the line fault occurred
GE_Digital_Energy_UR_TimeSourceKind	TmClkLTMS	TmSrc	INS	RTC Sync source
GE_Digital_Energy_UR_ClcMthKind	DmdMtrMMTR	ClcMth	ING	Calculation Method
GE_Digital_Energy_UR_PIDAlg	PIDRegFPID	PIDAlg	ING	PID Algorithm
GE_Digital_Energy_UR_PFSignKind	ACSrcMMXU	PFSign	ING	PF Sign

4.2 PIXIT conformance statement

See the previous chapter.

4.3 TICS conformance statement

A Technical Issue Implementation Conformance Statement (TICS) is required under IEC 61850.

This section provides a template for the TICS. According to the UCA International Users Group (UCAIug) Quality Assurance Program (QAP), the TICS is a required conformance test and is referenced on the certificate.

The tables outline applicable mandatory technical issues (Tissues).

Y — The server has implemented the Tissue

ni — No impact on testing

na — Not applicable if the server does not support the corresponding ACSI service(s)

Notes follow the tables, which are for Edition 1.

Table 4-67: Part 6 Tissues

Part 6 Tissue	Description	Implemented by server?
1	Syntax	Y
5	tExtensionAttributeNameEnum is restricted	Y
8	SIUnit enumeration for W	Y
10	Base type for bitstring usage	Y
17	DAI/SDI elements syntax	Y
169	Ordering of enum differs from 7-3	na
245	Attribute RptId in SCL	Y
529	Replace sev - Unknown by unknown	Y

4

Table 4-68: Part 7 Tissues

Part 7 Tissue	Description	Implemented by server?
Part 7-2		
30	control parameter T	Y
31	Typo	na
32	Typo in syntax	na
35	Typo Syntax Control time	na
36	Syntax parameter DSet-Ref missing	Y
37	Syntax GOOSE "T" type	Y
39	Add DstAddr to GoCB	Y
40	GOOSE Message "AppID" to "GoID"	Y
41	GsCB "AppID" to "GsID"	na
42	SV timestamp: "EntryTime" to "TimeStamp"	na
43	Control "T" semantic	Y
44	AddCause - Object not sel	Y
45	Missing AddCauses	na
46	Synchro check cancel	na
47	"." in LD Name?	Y
49	BRCB TimeOfEntry (part of #453)	-
50	LNName start with number?	Y
51	ARRAY [0..num] missing	na
52	Ambiguity GOOSE SqNum	Y
53	Add DstAddr to GsCB, SV	na
151	Name constraint for control blocks etc.	Y
166	DataRef attribute in Log	na
185	Logging - Integrity period	na
189	SV Format	na
190	BRCB: EntryId and TimeOfEntry (part of #453)	-
191	BRCB: Integrity and buffering reports (part of #453)	-
278	EntryId not valid for a server (part of #453)	-
333	Enabling of an incomplete GoCB	Y
453	Combination of all reporting and logging tissues	Y
1281	Trigger option GI is by default	Y
Part 7-3		
28	Definition of APC	na
54	Point def xVal, not cVal	na
55	Ineut = Ires ?	Y
63	mag in CDC CMV	Y
65	Deadband calculation of a Vector and trigger option	Y
219	operTm in ACT	na
270	WYE and DEL rms values	Y
1199	BCR	Y

Table 4-69: Part 8 Tissues

Part 8-1 Tissue	Description	Implemented by server?
116	GetNameList with empty response?	Y
165	Improper Error Response for GetDataSetValues	Y
183	GetNameList error handling	Y
246	Control negative response (SBOns) with LastApplError	Y
545	Skip file directories with no files	Y

NOTES:

- Tissues 49, 190, 191, 275, and 278 are part of tissue 453, all other technical tissues in the table are mandatory if applicable
- Editorial tissues are marked as "na"
- Final proposal on tissue 45 is not defined yet

UR Family

Chapter 5: DNP communication

This chapter outlines the Distributed Network Protocol (DNP).

5.1 Device profile document

The following table provides a 'Device Profile Document' in the standard format defined in the DNP 3.0 Subset Definitions Document.

Table 5-1: DNP v3.00 device profile

(Also see the IMPLEMENTATION TABLE in the following section)	
Vendor Name: **General Electric Multilin**	
Device Name: **UR Series Relay**	
Highest DNP level supported For Requests: **Level 2** For Responses: **Level 2**	**Device function** ☐ Master ☒ Slave
Notable objects, functions, and/or qualifiers supported in addition to the Highest DNP Levels Supported (the complete list is described in the attached table): **Binary Inputs (Object 1)** **Binary Input Changes (Object 2)** **Binary Outputs (Object 10)** **Control Relay Output Block (Object 12)** **Binary Counters (Object 20)** **Frozen Counters (Object 21)** **Counter Change Event (Object 22)** **Frozen Counter Event (Object 23)** **Analog Inputs (Object 30)** **Analog Input Changes (Object 32)** **Analog Deadbands (Object 34)** **Time and Date (Object 50)** **File Transfer (Object 70)** **Internal Indications (Object 80)**	

Maximum data link frame size (octets) Transmitted: **292** Received: **292**	**Maximum application fragment size (octets)** Transmitted: **configurable up to 2048** Received: **2048**
Maximum data link re-tries ☒ None ☐ Fixed at 3 ☐ Configurable	**Maximum application layer re-tries** ☒ None ☐ Configurable
Requires data link layer confirmation ☒ Never ☐ Always ☐ Sometimes ☐ Configurable	
Requires application layer confirmation ☐ Never ☐ Always ☒ When reporting Event Data ☒ When sending multi-fragment responses ☐ Sometimes ☐ Configurable	

Timeouts while waiting for

Data Link Confirm:	☒ None	☐ Fixed at ____	☐ Variable	☐ Configurable
Complete Appl. Fragment:	☒ None	☐ Fixed at ____	☐ Variable	☐ Configurable
Application Confirm:	☐ None	☒ Fixed at 10 s	☐ Variable	☐ Configurable
Complete Appl. Response:	☒ None	☐ Fixed at ____	☐ Variable	☐ Configurable

Others

Transmission Delay:	**No intentional delay**
Need Time Interval:	**Configurable (default = 24 hrs.)**
Select/Operate Arm Timeout:	**10 s**
Binary input change scanning period:	**8 times per power system cycle**
Analog input change scanning period:	**500 ms**
Counter change scanning period:	**500 ms**
Frozen counter event scanning period:	**500 ms**
Unsolicited response notification delay:	**100 ms**
Unsolicited response retry delay:	**configurable 0 to 60 sec.**

Sends/executes control operations

WRITE Binary Outputs	☒ Never	☐ Always	☐ Sometimes	☐ Configurable
SELECT/OPERATE	☐ Never	☒ Always	☐ Sometimes	☐ Configurable
DIRECT OPERATE	☐ Never	☒ Always	☐ Sometimes	☐ Configurable
DIRECT OPERATE – NO ACK	☐ Never	☒ Always	☐ Sometimes	☐ Configurable

Count > 1	☒ Never	☐ Always	☐ Sometimes	☐ Configurable
Pulse On	☐ Never	☐ Always	☒ Sometimes	☐ Configurable
Pulse Off	☐ Never	☐ Always	☒ Sometimes	☐ Configurable
Latch On	☐ Never	☐ Always	☒ Sometimes	☐ Configurable
Latch Off	☐ Never	☐ Always	☒ Sometimes	☐ Configurable
Queue	☒ Never	☐ Always	☐ Sometimes	☐ Configurable
Clear Queue	☒ Never	☐ Always	☐ Sometimes	☐ Configurable

Explanation of 'Sometimes': Object 12 points are mapped to UR Virtual Inputs. The persistence of Virtual Inputs is determined by the **VIRTUAL INPUT X TYPE** settings. Both "Pulse On" and "Latch On" operations perform the same function in the UR; that is, the appropriate Virtual Input is put into the "On" state. If the Virtual Input is set to "Self-Reset", it will reset after one pass of FlexLogic. The On/Off times and Count value are ignored. "Pulse Off" and "Latch Off" operations put the appropriate Virtual Input into the "Off" state. "Trip" and "Close" operations both put the appropriate Virtual Input into the "On" state.

Reports Binary Input Change Events when no specific variation requested

☐ Never
☒ Only time-tagged
☐ Only non-time-tagged
☐ Configurable

Reports time-tagged Binary Input Change Events when no specific variation requested

☐ Never
☒ Binary Input Change With Time
☐ Binary Input Change With Relative Time
☐ Configurable (attach explanation)

Sends unsolicited responses

☐ Never
☒ Configurable
☐ Only certain objects
☐ Sometimes (attach explanation)
☒ ENABLE/DISABLE unsolicited Function codes supported

Sends static data in unsolicited responses

☒ Never
☐ When Device Restarts
☐ When Status Flags Change
No other options are permitted.

Default counter object/variation

☐ No Counters Reported
☐ Configurable (attach explanation)
☒ Default Object: 20
Default Variation: 1
☒ Point-by-point list attached

Counters roll over at

☐ No Counters Reported
☐ Configurable (attach explanation)
☒ 16 Bits (Counter 8)
☒ 32 Bits (Counters 0 to 7, 9)
☐ Other Value: _____
☒ Point-by-point list attached

Sends multi-fragment responses

☒ Yes
☐ No

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5.1.1 Implementation table

The following table identifies the variations, function codes, and qualifiers supported by the UR in both request messages and response messages. For static (non-change-event) objects, requests sent with qualifiers 00, 01, 06, 07, or 08, are responded to with qualifiers 00 or 01. Static object requests sent with qualifiers 17 or 28 are responded to with qualifiers 17 or 28. For change-event objects, qualifiers 17 or 28 are always responded.

Table 5-2: DNP implementation table

Object			Request		Response	
Object no.	**Variation no.**	**Description**	**Function codes (dec)**	**Qualifier codes (hex)**	**Function codes (dec)**	**Qualifier codes (hex)**
1	0	Binary Input Change (Variation 0 is used to request default variation)	1 (read) 22 (assign class)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited quantity) 17, 28 (index)		
	1	Binary Input	1 (read) 22 (assign class)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited quantity) 17, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index) (see Note 2)
	2	Binary Input with Status	1 (read) 22 (assign class)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited quantity) 17, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index) (see Note 2)
2	0	Binary Input Change (Variation 0 is used to request default variation)	1 (read)	06 (no range, or all) 07, 08 (limited quantity)		
	1	Binary Input Change without Time	1 (read)	06 (no range, or all) 07, 08 (limited quantity)	129 (response) 130 (unsol. resp.)	17, 28 (index)
	2	Binary Input Change with Time	1 (read)	06 (no range, or all) 07, 08 (limited quantity)	129 (response 130 (unsol. resp.)	17, 28 (index)
	3	Binary Input Change with Relative Time	1 (read)	06 (no range, or all) 07, 08 (limited quantity)		
10	0	Binary Output Status (Variation 0 is used to request default variation)	1 (read)	00, 01(start-stop) 06 (no range, or all) 07, 08 (limited quantity) 17, 28 (index)		
	2	Binary Output Status	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited quantity) 17, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index) (see Note 2)
12	1	Control Relay Output Block	3 (select) 4 (operate) 5 (direct op) 6 (dir. op, noack)	00, 01 (start-stop) 07, 08 (limited quantity) 17, 28 (index)	129 (response)	echo of request

Note 1: A default variation refers to the variation responded when variation 0 is requested and/or in class 0, 1, 2, or 3 scans. The default variations for object types 1, 2, 20, 21, 22, 23, 30, and 32 are selected via relay settings. See the Communications section in Chapter 5 of the Instruction Manual for details. This optimizes the class 0 poll data size.

Note 2: For static (non-change-event) objects, qualifiers 17 or 28 are only responded when a request is sent with qualifiers 17 or 28, respectively. Otherwise, static object requests sent with qualifiers 00, 01, 06, 07, or 08, will be responded with qualifiers 00 or 01 (for change-event objects, qualifiers 17 or 28 are always responded).

Note 3: Cold restarts are implemented the same as warm restarts, meaning that the UR is not restarted, but the DNP process is restarted.

Object			Request		Response	
Object no.	**Variation no.**	**Description**	**Function codes (dec)**	**Qualifier codes (hex)**	**Function codes (dec)**	**Qualifier codes (hex)**
20	0	Binary Counter (Variation 0 is used to request default variation)	1 (read) 7 (freeze) 8 (freeze noack) 9 (freeze clear) 10 (frz. cl. noack) 22 (assign class)	00, 01 (start-stop) 06(no range, or all) 07, 08 (limited quantity) 17, 28 (index)		
	1	32-Bit Binary Counter	1 (read) 7 (freeze) 8 (freeze noack) 9 (freeze clear) 10 (frz. cl. noack) 22 (assign class)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited quantity) 17, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index) (see Note 2)
	2	16-Bit Binary Counter	1 (read) 7 (freeze) 8 (freeze noack) 9 (freeze clear) 10 (frz. cl. noack) 22 (assign class)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited quantity) 17, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index) (see Note 2)
	5	32-Bit Binary Counter without Flag	1 (read) 7 (freeze) 8 (freeze noack) 9 (freeze clear) 10 (frz. cl. noack) 22 (assign class)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited quantity) 17, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index) (see Note 2)
	6	16-Bit Binary Counter without Flag	1 (read) 7 (freeze) 8 (freeze noack) 9 (freeze clear) 10 (frz. cl. noack) 22 (assign class)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited quantity) 17, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index) (see Note 2)

Note 1: A default variation refers to the variation responded when variation 0 is requested and/or in class 0, 1, 2, or 3 scans. The default variations for object types 1, 2, 20, 21, 22, 23, 30, and 32 are selected via relay settings. See the Communications section in Chapter 5 of the Instruction Manual for details. This optimizes the class 0 poll data size.

Note 2: For static (non-change-event) objects, qualifiers 17 or 28 are only responded when a request is sent with qualifiers 17 or 28, respectively. Otherwise, static object requests sent with qualifiers 00, 01, 06, 07, or 08, will be responded with qualifiers 00 or 01 (for change-event objects, qualifiers 17 or 28 are always responded).

Note 3: Cold restarts are implemented the same as warm restarts, meaning that the UR is not restarted, but the DNP process is restarted.

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Object			Request		Response	
Object no.	**Variation no.**	**Description**	**Function codes (dec)**	**Qualifier codes (hex)**	**Function codes (dec)**	**Qualifier codes (hex)**
21	0	Frozen Counter (Variation 0 is used to request default variation)	1 (read) 22 (assign class)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited quantity) 17, 28 (index)		
	1	32-Bit Frozen Counter	1 (read) 22 (assign class)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited quantity) 17, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index) (see Note 2)
	2	16-Bit Frozen Counter	1 (read) 22 (assign class)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited quantity) 17, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index) (see Note 2)
	9	32-Bit Frozen Counter without Flag	1 (read) 22 (assign class)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited quantity) 17, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index) (see Note 2)
	10	16-Bit Frozen Counter without Flag	1 (read) 22 (assign class)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited quantity) 17, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index) (see Note 2)
22	0	Counter Change Event (Variation 0 is used to request default variation)	1 (read)	06 (no range, or all) 07, 08 (limited quantity)		
	1	32-Bit Counter Change Event	1 (read)	06 (no range, or all) 07, 08 (limited quantity)	129 (response) 130 (unsol. resp.)	17, 28 (index)
	2	16-Bit Counter Change Event	1 (read)	06 (no range, or all) 07, 08 (limited quantity)	129 (response) 130 (unsol. resp.)	17, 28 (index)
	5	32-Bit Counter Change Event with Time	1 (read)	06 (no range, or all) 07, 08 (limited quantity)	129 (response) 130 (unsol. resp.)	17, 28 (index)
	6	16-Bit Counter Change Event with Time	1 (read)	06 (no range, or all) 07, 08 (limited quantity)	129 (response) 130 (unsol. resp.)	17, 28 (index)
23	0	Frozen Counter Event (Variation 0 is used to request default variation)	1 (read)	06 (no range, or all) 07, 08 (limited quantity)		
	1	32-Bit Frozen Counter Event	1 (read)	06 (no range, or all) 07, 08 (limited quantity)	129 (response) 130 (unsol. resp.)	17, 28 (index)
	2	16-Bit Frozen Counter Event	1 (read)	06 (no range, or all) 07, 08 (limited quantity)	129 (response) 130 (unsol. resp.)	17, 28 (index)

Note 1: A default variation refers to the variation responded when variation 0 is requested and/or in class 0, 1, 2, or 3 scans. The default variations for object types 1, 2, 20, 21, 22, 23, 30, and 32 are selected via relay settings. See the Communications section in Chapter 5 of the Instruction Manual for details. This optimizes the class 0 poll data size.

Note 2: For static (non-change-event) objects, qualifiers 17 or 28 are only responded when a request is sent with qualifiers 17 or 28, respectively. Otherwise, static object requests sent with qualifiers 00, 01, 06, 07, or 08, will be responded with qualifiers 00 or 01 (for change-event objects, qualifiers 17 or 28 are always responded).

Note 3: Cold restarts are implemented the same as warm restarts, meaning that the UR is not restarted, but the DNP process is restarted.

Object			Request		Response	
Object no.	**Variation no.**	**Description**	**Function codes (dec)**	**Qualifier codes (hex)**	**Function codes (dec)**	**Qualifier codes (hex)**
23 cont'd	5	32-Bit Frozen Counter Event with Time	1 (read)	06 (no range, or all) 07, 08 (limited quantity)	129 (response) 130 (unsol. resp.)	17, 28 (index)
	6	16-Bit Frozen Counter Event with Time	1 (read)	06 (no range, or all) 07, 08 (limited quantity)	129 (response) 130 (unsol. resp.)	17, 28 (index)
30	0	Analog Input (Variation 0 is used to request default variation)	1 (read) 22 (assign class)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited quantity) 17, 28 (index)		
	1	32-Bit Analog Input	1 (read) 22 (assign class)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited quantity) 17, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index) (see Note 2)
	2	16-Bit Analog Input	1 (read) 22 (assign class)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited quantity) 17, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index) (see Note 2)
	3	32-Bit Analog Input without Flag	1 (read) 22 (assign class)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited quantity) 17, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index) (see Note 2)
	4	16-Bit Analog Input without Flag	1 (read) 22 (assign class)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited quantity) 17, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index) (see Note 2)
	5	short floating point	1 (read) 22 (assign class)	00, 01 (start-stop) 06(no range, or all) 07, 08(limited quantity) 17, 28(index)	129 (response)	00, 01 (start-stop) 17, 28 (index) (see Note 2)

Note 1: A default variation refers to the variation responded when variation 0 is requested and/or in class 0, 1, 2, or 3 scans. The default variations for object types 1, 2, 20, 21, 22, 23, 30, and 32 are selected via relay settings. See the Communications section in Chapter 5 of the Instruction Manual for details. This optimizes the class 0 poll data size.

Note 2: For static (non-change-event) objects, qualifiers 17 or 28 are only responded when a request is sent with qualifiers 17 or 28, respectively. Otherwise, static object requests sent with qualifiers 00, 01, 06, 07, or 08, will be responded with qualifiers 00 or 01 (for change-event objects, qualifiers 17 or 28 are always responded).

Note 3: Cold restarts are implemented the same as warm restarts, meaning that the UR is not restarted, but the DNP process is restarted.

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Object			Request		Response	
Object no.	**Variation no.**	**Description**	**Function codes (dec)**	**Qualifier codes (hex)**	**Function codes (dec)**	**Qualifier codes (hex)**
32	0	Analog Change Event (Variation 0 is used to request default variation)	1 (read)	06 (no range, or all) 07, 08 (limited quantity)		
	1	32-Bit Analog Change Event without Time	1 (read)	06 (no range, or all) 07, 08 (limited quantity)	129 (response) 130 (unsol. resp.)	17, 28 (index)
	2	16-Bit Analog Change Event without Time	1 (read)	06 (no range, or all) 07, 08 (limited quantity)	129 (response) 130 (unsol. resp.)	17, 28 (index)
	3	32-Bit Analog Change Event with Time	1 (read)	06 (no range, or all) 07, 08 (limited quantity)	129 (response) 130 (unsol. resp.)	17, 28 (index)
	4	16-Bit Analog Change Event with Time	1 (read)	06 (no range, or all) 07, 08 (limited quantity)	129 (response) 130 (unsol. resp.)	17, 28 (index)
	5	short floating point Analog Change Event without Time	1 (read)	06 (no range, or all) 07, 08 (limited quantity)	129 (response) 130 (unsol. resp.)	17, 28 (index)
	7	short floating point Analog Change Event with Time	1 (read)	06 (no range, or all) 07, 08 (limited quantity)	129 (response) 130 (unsol. resp.)	17, 28 (index)
34	0	Analog Input Reporting Deadband (Variation 0 is used to request default variation)	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited quantity) 17, 28 (index)		
	1	16-bit Analog Input Reporting Deadband (default – see Note 1)	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited quantity) 17, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index) (see Note 2)
			2 (write)	00, 01 (start-stop) 07, 08 (limited quantity) 17, 28 (index)		
	2	32-bit Analog Input Reporting Deadband	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited quantity) 17, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index) (see Note 2)
			2 (write)	00, 01 (start-stop) 07, 08 (limited quantity) 17, 28 (index)		
	3	Short floating point Analog Input Reporting Deadband	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited quantity) 17, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index) (see Note 2)

Note 1: A default variation refers to the variation responded when variation 0 is requested and/or in class 0, 1, 2, or 3 scans. The default variations for object types 1, 2, 20, 21, 22, 23, 30, and 32 are selected via relay settings. See the Communications section in Chapter 5 of the Instruction Manual for details. This optimizes the class 0 poll data size.

Note 2: For static (non-change-event) objects, qualifiers 17 or 28 are only responded when a request is sent with qualifiers 17 or 28, respectively. Otherwise, static object requests sent with qualifiers 00, 01, 06, 07, or 08, will be responded with qualifiers 00 or 01 (for change-event objects, qualifiers 17 or 28 are always responded).

Note 3: Cold restarts are implemented the same as warm restarts, meaning that the UR is not restarted, but the DNP process is restarted.

Object			Request		Response	
Object no.	Variation no.	Description	Function codes (dec)	Qualifier codes (hex)	Function codes (dec)	Qualifier codes (hex)
50	1	Time and Date (default – see Note 1)	1 (read) 2 (write)	00, 01 (start-stop) 06 (no range, or all) 07 (limited qty=1) 08 (limited quantity) 17, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index) (see Note 2)
52	2	Time Delay Fine			129 (response)	07 (limited quantity) (quantity = 1)
60	0	Class 0, 1, 2, and 3 Data	1 (read) 20 (enable unsol) 21 (disable unsol) 22 (assign class)	06 (no range, or all)		
	1	Class 0 Data	1 (read) 22 (assign class)	06 (no range, or all)		
	2	Class 1 Data	1 (read) 20 (enable unsol) 21 (disable unsol) 22 (assign class)	06 (no range, or all) 07, 08 (limited quantity)		
	3	Class 2 Data				
	4	Class 3 Data				
70	0	File event - any variation	1 (read)	06 (no range, or all) 07, 08 (limited quantity)		
			22 (assign class)	06 (no range, or all)		
	2	File authentication	29 (authenticate)	5b (free format)	129 (response)	5b (free format)
	3	File command	25 (open) 27 (delete)	5b (free format)		
	4	File command status	26 (close) 30 (abort)	5b (free format)	129 (response) 130 (unsol. resp.)	5b (free format)
	5	File transfer	1 (read) 2 (write)	5b (free format)	129 (response) 130 (unsol. resp.)	5b (free format)
	6	File transfer status			129 (response) 130 (unsol. resp.)	5b (free format)
	7	File descriptor	28 (get file info.)	5b (free format)	129 (response) 130 (unsol. resp.)	5b (free format)
80	1	Internal Indications	1 (read)	00, 01 (start-stop) (index =7)	129 (response)	00, 01 (start-stop)
			2 (write) (see Note 3)	00 (start-stop) (index =7)		
---		No Object (function code only) (see Note 3)	13 (cold restart)			
---		No Object (function code only)	14 (warm restart)			
---		No Object (function code only)	23 (delay meas.)			

Note 1: A default variation refers to the variation responded when variation 0 is requested and/or in class 0, 1, 2, or 3 scans. The default variations for object types 1, 2, 20, 21, 22, 23, 30, and 32 are selected via relay settings. See the Communications section in Chapter 5 of the Instruction Manual for details. This optimizes the class 0 poll data size.

Note 2: For static (non-change-event) objects, qualifiers 17 or 28 are only responded when a request is sent with qualifiers 17 or 28, respectively. Otherwise, static object requests sent with qualifiers 00, 01, 06, 07, or 08, will be responded with qualifiers 00 or 01 (for change-event objects, qualifiers 17 or 28 are always responded).

Note 3: Cold restarts are implemented the same as warm restarts, meaning that the UR is not restarted, but the DNP process is restarted.

5.2 DNP point lists

5.2.1 Binary input points

The DNP binary input data points are configured through the **PRODUCT SETUP ⇨⇩ COMMUNICATIONS ⇨⇩ DNP / IEC104 POINT LISTS ⇨ BINARY INPUT / MSP POINTS** menu. See the Communications section of chapter 5 in the Instruction Manual for details. When a freeze function is performed on a binary counter point, the frozen value is available in the corresponding frozen counter point.

BINARY INPUT POINTS
Static (Steady-State) Object Number: **1**
Change Event Object Number: **2**
Request Function Codes supported: **1 (read), 22 (assign class)**
Static Variation reported when variation 0 requested: **2 (Binary Input with status), Configurable**
Change Event Variation reported when variation 0 requested: **2 (Binary Input Change with Time), Configurable**
Change Event Scan Rate: **8 times per power system cycle**
Change Event Buffer Size: **500**
Default Class for All Points: **1**

5.2.2 Binary and control relay output

Supported Control Relay Output Block fields: Pulse On, Pulse Off, Latch On, Latch Off, Paired Trip, Paired Close.

BINARY OUTPUT STATUS POINTS
Object Number: **10**
Request Function Codes supported: **1 (read)**
Default Variation reported when Variation 0 requested: **2 (Binary Output Status)**
CONTROL RELAY OUTPUT BLOCKS
Object Number: **12**
Request Function Codes supported: **3 (select), 4 (operate), 5 (direct operate), 6 (direct operate, noack)**

Table 5-3: Binary/control outputs

Point	Name/Description	Point	Name/Description	Point	Name/Description	Point	Name/Description
0	Virtual Input 1	32	Virtual Input 33	64	Virtual Input 65	96	Virtual Input 97
1	Virtual Input 2	33	Virtual Input 34	65	Virtual Input 66	97	Virtual Input 98
2	Virtual Input 3	34	Virtual Input 35	66	Virtual Input 67	98	Virtual Input 99
3	Virtual Input 4	35	Virtual Input 36	67	Virtual Input 68	99	Virtual Input 100
4	Virtual Input 5	36	Virtual Input 37	68	Virtual Input 69	100	Virtual Input 101
5	Virtual Input 6	37	Virtual Input 38	69	Virtual Input 70	101	Virtual Input 102
6	Virtual Input 7	38	Virtual Input 39	70	Virtual Input 71	102	Virtual Input 103
7	Virtual Input 8	39	Virtual Input 40	71	Virtual Input 72	103	Virtual Input 104
8	Virtual Input 9	40	Virtual Input 41	72	Virtual Input 73	104	Virtual Input 105
9	Virtual Input 10	41	Virtual Input 42	73	Virtual Input 74	105	Virtual Input 106
10	Virtual Input 11	42	Virtual Input 43	74	Virtual Input 75	106	Virtual Input 107
11	Virtual Input 12	43	Virtual Input 44	75	Virtual Input 76	107	Virtual Input 108
12	Virtual Input 13	44	Virtual Input 45	76	Virtual Input 77	108	Virtual Input 109
13	Virtual Input 14	45	Virtual Input 46	77	Virtual Input 78	109	Virtual Input 110
14	Virtual Input 15	46	Virtual Input 47	78	Virtual Input 79	110	Virtual Input 111
15	Virtual Input 16	47	Virtual Input 48	79	Virtual Input 80	111	Virtual Input 112
16	Virtual Input 17	48	Virtual Input 49	80	Virtual Input 81	112	Virtual Input 113
17	Virtual Input 18	49	Virtual Input 50	81	Virtual Input 82	113	Virtual Input 114
18	Virtual Input 19	50	Virtual Input 51	82	Virtual Input 83	114	Virtual Input 115
19	Virtual Input 20	51	Virtual Input 52	83	Virtual Input 84	115	Virtual Input 116
20	Virtual Input 21	52	Virtual Input 53	84	Virtual Input 85	116	Virtual Input 117
21	Virtual Input 22	53	Virtual Input 54	85	Virtual Input 86	117	Virtual Input 118
22	Virtual Input 23	54	Virtual Input 55	86	Virtual Input 87	118	Virtual Input 119
23	Virtual Input 24	55	Virtual Input 56	87	Virtual Input 88	119	Virtual Input 120
24	Virtual Input 25	56	Virtual Input 57	88	Virtual Input 89	120	Virtual Input 121
25	Virtual Input 26	57	Virtual Input 58	89	Virtual Input 90	121	Virtual Input 122
26	Virtual Input 27	58	Virtual Input 59	90	Virtual Input 91	122	Virtual Input 123
27	Virtual Input 28	59	Virtual Input 60	91	Virtual Input 92	123	Virtual Input 124
28	Virtual Input 29	60	Virtual Input 61	92	Virtual Input 93	124	Virtual Input 125
29	Virtual Input 30	61	Virtual Input 62	93	Virtual Input 94	125	Virtual Input 126
30	Virtual Input 31	62	Virtual Input 63	94	Virtual Input 95	126	Virtual Input 127
31	Virtual Input 32	63	Virtual Input 64	95	Virtual Input 96	127	Virtual Input 128

5.2.3 Counters

The following table lists both Binary Counters (Object 20) and Frozen Counters (Object 21). When a freeze function is performed on a Binary Counter point, the frozen value is available in the corresponding Frozen Counter point.

BINARY COUNTERS

Static (Steady-State) Object Number: **20**

Change Event Object Number: **22**

Request Function Codes supported: **1 (read), 7 (freeze), 8 (freeze noack), 9 (freeze and clear), 10 (freeze and clear, noack), 22 (assign class)**

Static Variation reported when variation 0 requested: **1 (32-Bit Binary Counter with Flag)**

Change Event Variation reported when variation 0 requested: **1 (32-Bit Counter Change Event without time)**

Change Event Buffer Size: **10**

Default Class for all points: **3**

FROZEN COUNTERS

Static (Steady-State) Object Number: **21**

Change Event Object Number: **23**

Request Function Codes supported: **1 (read)**

Static Variation reported when variation 0 requested: **1 (32-Bit Frozen Counter with Flag)**

Change Event Variation reported when variation 0 requested: **1 (32-Bit Frozen Counter Event without time)**

Change Event Buffer Size: **10**

Default Class for all points: **3**

5

Table 5-4: Binary and frozen counters

Point index	Name/Description
0	Digital Counter 1
1	Digital Counter 2
2	Digital Counter 3
3	Digital Counter 4
4	Digital Counter 5
5	Digital Counter 6
6	Digital Counter 7
7	Digital Counter 8
8	Oscillography Trigger Count
9	Events Since Last Clear

A counter freeze command has no meaning for counters 8 and 9. UR Digital Counter values are represented as 32-bit integers. The DNP 3.0 protocol defines counters to be unsigned integers. Take care when interpreting negative counter values.

5.2.4 Analog inputs

The DNP analog input data points are configured through the **PRODUCT SETUP ⇨⇩ COMMUNICATIONS ⇨⇩ DNP / IEC104 POINT LISTS ⇨ ANALOG INPUT / MME POINTS** menu. See the Communications section of chapter 5 in the Instruction Manual for details.

Note that 16-bit and 32-bit variations of analog inputs are transmitted through DNP as signed numbers. Even for analog input points that are not valid as negative values, the maximum positive representation is 32767 for 16-bit values and 2147483647 for 32-bit values. This is a DNP requirement.

The deadbands for all Analog Input points are in the same units as the Analog Input quantity. For example, an Analog Input quantity measured in volts has a corresponding deadband in units of volts. This is in conformance with DNP Technical Bulletin 9809-001: Analog Input Reporting Deadband. Relay settings are available to set default deadband values according to data type. Deadbands for individual Analog Input Points can be set using DNP Object 34.

Static (Steady-State) Object Number: **30**
Change Event Object Number: **32**
Request Function Codes supported: **1 (read), 2 (write, deadbands only), 22 (assign class)**
Static Variation reported when variation 0 requested: **1 (32-Bit Analog Input)**
Change Event Variation reported when variation 0 requested: **1 (Analog Change Event without Time)**
Change Event Scan Rate: defaults to **500 ms**
Change Event Buffer Size: **256**
Default Class for all Points: **2**

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UR Family

Chapter 6: IEC 60870-5-103 communication

This chapter outlines the IEC 60870-5-103 communications protocol.

The protocol applies when ordered with the product. Check your order code.

6.1 Overview

IEC 60870-5-103 is defined as a companion standard for the informative element of the protection equipment. IEC 60870-5-103 defines communication for a serial, unbalanced link only. Communication speeds are defined as either 9600 or 19200 baud.

This manual assumes basic knowledge of the IEC 60870-5-103 protocol and the standard IEC 60870 documents relating to the protocol.

Standard IEC 60870 documents relating to IEC 60870-5-103:

- IEC 60870-5-1 Transmission frame formats
- IEC 60870-5-2 Link transmission procedures
- IEC 60870-5-3 General structure of application data
- IEC 60870-5-4 Definition and coding of application information elements
- IEC 60870-5-5 Basic application functions
- IEC 60870-5-6 Conformance testing guidelines

An IEC 60870-5-103 device is required to provide an interoperability table. Interoperability means that any required application data in the device, which can be coded into an IEC 60870-5-103 data type, can be mapped into the IEC 60870-5-103 address space. This data is recognized by any IEC 60870-5-103 master.

6.2 Factor and offset calculation to transmit measurand

The general formula for the transmitted value is $Xt = a * X + b$

where

X is the measurand
a is the multiplication factor
b is the offset
Xt is the value transmitted

The conditions for determining a and b, when the values exceed the range are:

4096 = a*Xmax + b (Xmax is the maximum value for the measurand)

-4095 =a*Xmin + b (Xmin is the minimum value for the measurand)

By solving the above system of equations for a and b, we find that:

a = 8191 / (Xmax - Xmin)

b = -4096 * (Xmax + Xmin) / (Xmax - Xmin)

So

Xt = 8191/(Xmax - Xmin)) * X - 4096 * (Xmax + Xmin) / (Xmax - Xmin)

We can further simplify the formula for situations where:

1)

Xmin = -Xmax (positive and negative values) :

Xt = (8191/2*Xmax) * X

a = 4096/Xmax

b = 0

6

2)

If Xmin = 0 (only positive values)

Xt = (8191/Xmax) * X - 4096

a = 2 * 4096/Xmax

b = -4096

To calculate Xmax, one needs to know the rated value for the specific type of measurand.

Xmax = 2.4 * Xrated

6.3 Interoperability document

The boxes indicate the following:

☒ – used in standard direction
☐ – not used

1. PHYSICAL LAYER

Electrical interface

- ☒ EIA RS-485
- **32** Number of loads for one protection equipment

Optical interface

- ☐ Glass fibre
- ☐ Plastic fibre
- ☐ F-SMA type connector
- ☐ BFOC/2.5 type connector

Transmission speed

- ☒ 9600 bits/s
- ☒ 19200 bits/s

2. LINK LAYER

There are no choices for the link layer.

3. APPLICATION LAYER

Transmission mode for application data

Mode 1 (least significant octet first), as defined in 4.10 of IEC 60870-5-4, is used exclusively in this companion standard.

Common address of ASDU

☒ One COMMON ADDRESS OF ASDU (identical with station address)

☐ More than one COMMON ADDRESS OF ASDU

Selection of standard information numbers in monitor direction

System functions in monitor direction

INF Semantics

☒ <0> End of general interrogation

☒ <0> Time synchronization

☒ <2> Reset FCB

☒ <3> Reset CU

☒ <4> Start/restart

☒ <5> Power on

Status indications in monitor direction

INF Semantics

☐ <16> Auto-recloser active

☐ <17> Teleprotection active

☐ <18> Protection active

☐ <19> LED reset

☐ <20> Monitor direction blocked

☐ <21> Test mode

☐ <22> Local parameter setting

☐ <23> Characteristic 1

☐ <24> Characteristic 2

☐ <25> Characteristic 3

☐ <26> Characteristic 4

☐ <27> Auxiliary input 1

☐ <28> Auxiliary input 2

☐ <29> Auxiliary input 3

☐ <30> Auxiliary input 4

Supervision indications in monitor direction

INF Semantics

☐ <32> Measurand supervision I

☐ <33> Measurand supervision V

☐ <35> Phase sequence supervision

☐ <36> Trip circuit supervision

☐ <37> I>> back-up operation

☐ <38> VT fuse failure

☐ <39> Teleprotection disturbed

☐ <46> Group warning

☐ <47> Group alarm

Earth fault indications in monitor direction

INF Semantics

☐ <48> Earth fault L_1
☐ <49> Earth fault L_2
☐ <50> Earth fault L_3
☐ <51> Earth fault forward, meaning line
☐ <52> Earth fault reverse, meaning busbar

Fault indications in monitor direction

INF Semantics

☐ <64> Start/pick-up L_1
☐ <65> Start/pick-up L_2
☐ <66> Start/pick-up L_3
☐ <67> Start/pick-up N
☐ <68> General trip
☐ <69> Trip L_1
☐ <70> Trip L_2
☐ <71> Trip L_3
☐ <72> Trip I>> (back-up operation)
☐ <73> Fault location X in ohms
☐ <74> Fault forward/line
☐ <75> Fault reverse/busbar
☐ <76> Teleprotection signal transmitted
☐ <77> Teleprotection signal received
☐ <78> Zone 1
☐ <79> Zone 2
☐ <80> Zone 3
☐ <81> Zone 4
☐ <82> Zone 5
☐ <83> Zone 6
☐ <84> General start / pick-up
☐ <85> Breaker failure
☐ <86> Trip measuring system L_1
☐ <87> Trip measuring system L_2
☐ <88> Trip measuring system L_3
☐ <89> Trip measuring system E
☐ <90> Trip I>
☐ <91> Trip I>>
☐ <92> Trip IN>
☐ <93> Trip IN>>

Auto-reclosure indications in monitor direction

INF Semantics

☐ <128> CB 'on' by AR
☐ <129> CB 'on' by long-time AR
☐ <130> AR blocked

Measurands in monitor direction

INF Semantics

☐ <144> Measurand I
☐ <145> Measurands I, V
☐ <146> Measurands I, V, P, Q
☐ <147> Measurands I_N, V_{EN}

☐ <148> Measurands I_{L123}, V_{L123}, P, Q, f

Generic functions in monitor direction

INF Semantics

☐ <240> Read headings of all defined groups
☐ <241> Read values or attributes of all entries of one group
☐ <243> Read directory of a single entry
☐ <244> Read value or attribute of a single entry
☐ <245> End of general interrogation of generic data
☐ <249> Write entry with confirmation
☐ <250> Write entry with execution
☐ <251> Write entry aborted

Selection of standard information numbers in control direction

System functions in control direction

INF Semantics

☒ <0> Initiation of general interrogation
☒ <0> Time synchronization

General commands in control direction

INF Semantics

☐ <16> Auto-recloser on/off
☐ <17> Teleprotection on/off
☐ <18> Protection on/off
☐ <19> LED reset
☐ <23> Activate characteristic 1
☐ <24> Activate characteristic 2
☐ <25> Activate characteristic 3
☐ <26> Activate characteristic 4

Generic functions in control direction

INF Semantics

☐ <240> Read headings of all defined groups
☐ <241> Read values or attributes of all entries of one group
☐ <243> Read directory of a single entry
☐ <244> Read value or attribute of a single entry
☐ <245> General interrogation of generic data
☐ <248> Write entry
☐ <249> Write entry with confirmation
☐ <250> Write entry with execution
☐ <251> Write entry abort

Basic application functions

☐ Test mode
☐ Blocking of monitor direction
☐ Disturbance data
☐ Generic services
☐ Private data

Miscellaneous

Measurand	**max Mval = times rated value**		
	1,2	**or**	**2,4**
Current L_1	☐		☒

Measurand	max Mval = times rated value		
	1,2	or	2,4
Current L_2	☐		☒
Current L_3	☐		☒
Voltage L_{1-E}	☐		☒
Voltage L_{2-E}	☐		☒
Voltage L_{3-E}	☐		☒
Active power P	☐		☒
Reactive power Q	☐		☒
Frequency f	☐		☒
Voltage L_1-L_2	☐		☒

UR Family

Chapter 7: IEC 60870-5-104 communication

This chapter outlines the IEC 60870-5-104 communications protocol.

The protocol applies when ordered with the product. Check your order code.

7.1 Interoperability document

This document is adapted from the IEC 60870-5-104 standard. The boxes indicate the following:

☒ – used in standard direction
☐ – not used
■ – cannot be selected in IEC 60870-5-104 standard

1. SYSTEM OR DEVICE

☐ System Definition
☐ Controlling Station Definition (Master)
☒ Controlled Station Definition (Slave)

2. NETWORK CONFIGURATION

■ ~~Point-to-Point~~
■ ~~Multiple Point-to-Point~~
■ ~~Multipoint~~
■ ~~Multipoint Star~~

3. PHYSICAL LAYER

Transmission speed (control direction)

Unbalanced interchange circuit V.24/V.28 standard	Unbalanced interchange circuit V.24/V.28 recommended if >1200 bits/s	Balanced interchange circuit X.24/X.27
■ ~~100 bits/sec.~~ ■ ~~200 bits/sec.~~ ■ ~~300 bits/sec.~~ ■ ~~600 bits/sec.~~ ■ ~~1200 bits/sec.~~	■ ~~2400 bits/sec.~~ ■ ~~4800 bits/sec.~~ ■ ~~9600 bits/sec.~~	■ ~~2400 bits/sec.~~ ■ ~~4800 bits/sec.~~ ■ ~~9600 bits/sec.~~ ■ ~~19200 bits/sec.~~ ■ ~~38400 bits/sec.~~ ■ ~~56000 bits/sec.~~ ■ ~~64000 bits/sec.~~

Transmission speed (monitor direction)

Unbalanced interchange circuit V.24/V.28 standard	Unbalanced interchange circuit V.24/V.28 recommended if >1200 bits/s	Balanced interchange circuit X.24/X.27
■ ~~100 bits/sec.~~ ■ ~~200 bits/sec.~~ ■ ~~300 bits/sec.~~ ■ ~~600 bits/sec.~~ ■ ~~1200 bits/sec.~~	■ ~~2400 bits/sec.~~ ■ ~~4800 bits/sec.~~ ■ ~~9600 bits/sec.~~	■ ~~2400 bits/sec.~~ ■ ~~4800 bits/sec.~~ ■ ~~9600 bits/sec.~~ ■ ~~19200 bits/sec.~~ ■ ~~38400 bits/sec.~~ ■ ~~56000 bits/sec.~~ ■ ~~64000 bits/sec.~~

4. LINK LAYER

Link transmission procedure	Address field of the link
■ ~~Balanced Transmission~~ ■ ~~Unbalanced Transmission~~	■ ~~Not Present (Balanced Transmission Only)~~ ■ ~~One Octet~~ ■ ~~Two Octets~~ ■ ~~Structured~~ ■ ~~Unstructured~~
Frame Length (maximum length, number of octets): Not selectable in companion IEC 60870-5-104 standard	

When using an unbalanced link layer, the following Application Service Data Unit (ASDU) types are returned in class 2 messages (low priority) with the indicated causes of transmission:

■ ~~The standard assignment of ASDUs to class 2 messages is used as follows:~~

■ ~~A special assignment of ASDUs to class 2 messages is used as follows:~~

5. APPLICATION LAYER

Transmission mode for application data

Mode 1 (least significant octet first), as defined in Clause 4.10 of IEC 60870-5-4, is used exclusively in this companion standard.

Common address of ASDU

■ ~~One Octet~~

☒ Two Octets

Information object address

■ ~~One Octet~~

■ ~~Two Octets~~

☒ Three Octets

☒ Structured

☒ Unstructured

Cause of transmission

■ ~~One Octet~~

☒ Two Octets (with originator address). Originator address is set to zero if not used.

Maximum Length of APDU: 253 (the maximum length may be reduced by the system)

Selection of standard ASDUs

For the following lists, the boxes indicate the following:

☒ – used in standard direction

☐ – not used

■ – cannot be selected in IEC 60870-5-104 standard

Process information in monitor direction

☒ <1> := Single-point information	M_SP_NA_1
■ ~~<2> := Single-point information with time tag~~	~~M_SP_TA_1~~
☐ <3> := Double-point information	M_DP_NA_1
■ ~~<4> := Double-point information with time tag~~	~~M_DP_TA_1~~
☐ <5> := Step position information	M_ST_NA_1
■ ~~<6> := Step position information with time tag~~	~~M_ST_TA_1~~
☐ <7> := Bitstring of 32 bits	M_BO_NA_1
■ ~~<8> := Bitstring of 32 bits with time tag~~	~~M_BO_TA_1~~
☐ <9> := Measured value, normalized value	M_ME_NA_1
■ ~~<10> := Measured value, normalized value with time tag~~	~~M_NE_TA_1~~
☐ <11> := Measured value, scaled value	M_ME_NB_1
■ ~~<12> := Measured value, scaled value with time tag~~	~~M_NE_TB_1~~
☒ <13> := Measured value, short floating point value	M_ME_NC_1
■ ~~<14> := Measured value, short floating point value with time tag~~	~~M_NE_TC_1~~
☒ <15> := Integrated totals	M_IT_NA_1
■ ~~<16> := Integrated totals with time tag~~	~~M_IT_TA_1~~
■ ~~<17> := Event of protection equipment with time tag~~	~~M_EP_TA_1~~
■ ~~<18> := Packed start events of protection equipment with time tag~~	~~M_EP_TB_1~~
■ ~~<19> := Packed output circuit information of protection equipment with time tag~~	~~M_EP_TC_1~~
☐ <20> := Packed single-point information with status change detection	M_SP_NA_1
☐ <21> := Measured value, normalized value without quantity descriptor	M_ME_ND_1
☒ <30> := Single-point information with time tag CP56Time2a	M_SP_TB_1
☐ <31> := Double-point information with time tag CP56Time2a	M_DP_TB_1
☐ <32> := Step position information with time tag CP56Time2a	M_ST_TB_1
☐ <33> := Bitstring of 32 bits with time tag CP56Time2a	M_BO_TB_1
☐ <34> := Measured value, normalized value with time tag CP56Time2a	M_ME_TD_1
☐ <35> := Measured value, scaled value with time tag CP56Time2a	M_ME_TE_1
☐ <36> := Measured value, short floating point value with time tag CP56Time2a	M_ME_TF_1
☒ <37> := Integrated totals with time tag CP56Time2a	M_IT_TB_1
☐ <38> := Event of protection equipment with time tag CP56Time2a	M_EP_TD_1
☐ <39> := Packed start events of protection equipment with time tag CP56Time2a	M_EP_TE_1
☐ <40> := Packed output circuit information of protection equipment with time tag CP56Time2a	M_EP_TF_1

Either the ASDUs of the set <2>, <4>, <6>, <8>, <10>, <12>, <14>, <16>, <17>, <18>, and <19> or of the set <30> to <40> is used.

Process information in control direction

☒ <45> := Single command	C_SC_NA_1
☐ <46> := Double command	C_DC_NA_1
☐ <47> := Regulating step command	C_RC_NA_1
☐ <48> := Set point command, normalized value	C_SE_NA_1
☐ <49> := Set point command, scaled value	C_SE_NB_1
☐ <50> := Set point command, short floating point value	C_SE_NC_1
☐ <51> := Bitstring of 32 bits	C_BO_NA_1
☒ <58> := Single command with time tag CP56Time2a	C_SC_TA_1
☐ <59> := Double command with time tag CP56Time2a	C_DC_TA_1
☐ <60> := Regulating step command with time tag CP56Time2a	C_RC_TA_1
☐ <61> := Set point command, normalized value with time tag CP56Time2a	C_SE_TA_1
☐ <62> := Set point command, scaled value with time tag CP56Time2a	C_SE_TB_1
☐ <63> := Set point command, short floating point value with time tag CP56Time2a	C_SE_TC_1
☐ <64> := Bitstring of 32 bits with time tag CP56Time2a	C_BO_TA_1

Either the ASDUs of the set <45> to <51> or of the set <58> to <64> is used.

System information in monitor direction

☒ <70> := End of initialization	M_EI_NA_1

System information in control direction

☒ <100> := Interrogation command	C_IC_NA_1
☒ <101> := Counter interrogation command	C_CI_NA_1
☒ <102> := Read command	C_RD_NA_1
☒ <103> := Clock synchronization command (see Clause 7.6 in standard)	C_CS_NA_1
■ ~~<104> := Test command~~	~~C_TS_NA_1~~
☒ <105> := Reset process command	C_RP_NA_1
■ <106> := Delay acquisition command	C_CD_NA_1
☒ <107> := Test command with time tag CP56Time2a	C_TS_TA_1

Parameter in control direction

☐ <110> := Parameter of measured value, normalized value	PE_ME_NA_1
☐ <111> := Parameter of measured value, scaled value	PE_ME_NB_1
☒ <112> := Parameter of measured value, short floating point value	PE_ME_NC_1
☐ <113> := Parameter activation	PE_AC_NA_1

File transfer

☐ <120> := File Ready	F_FR_NA_1
☐ <121> := Section Ready	F_SR_NA_1
☐ <122> := Call directory, select file, call file, call section	F_SC_NA_1
☐ <123> := Last section, last segment	F_LS_NA_1
☐ <124> := Ack file, ack section	F_AF_NA_1
☐ <125> := Segment	F_SG_NA_1

☐ <126> := Directory (blank or X, available only in monitor [standard] direction) C_CD_NA_1

Type identifier and cause of transmission assignments
(station-specific parameters)

In the following table:

- Shaded boxes are not required
- Black boxes are not permitted in this companion standard
- Blank boxes indicate functions or ASDU not used
- 'X' if only used in the standard direction

Type identification		Cause of transmission																		
		PERIODIC, CYCLIC	BACKGROUND SCAN	SPONTANEOUS	INITIALIZED	REQUEST OR REQUESTED	ACTIVATION	ACTIVATION CONFIRMATION	DEACTIVATION	DEACTIVATION CONFIRMATION	ACTIVATION TERMINATION	RETURN INFO CAUSED BY LOCAL CMD	FILE TRANSFER	INTERROGATED BY GROUP <NUMBER>	REQUEST BY GROUP <N> COUNTER REQ	UNKNOWN TYPE IDENTIFICATION	UNKNOWN CAUSE OF TRANSMISSION	UNKNOWN COMMON ADDRESS OF ASDU	UNKNOWN INFORMATION OBJECT ADDR	UNKNOWN INFORMATION OBJECT ADDR
No.	**Mnemonic**	1	2	3	4	5	6	7	8	9	10	11	12	13	20 to 36	37 to 41	44	45	46	47
<1>	M_SP_NA_1			X		X						X	X		X					
<2>	M_SP_TA_1																			
<3>	M_DP_NA_1																			
<4>	M_DP_TA_1																			
<5>	M_ST_NA_1																			
<6>	M_ST_TA_1																			
<7>	M_BO_NA_1																			
<8>	M_BO_TA_1																			
<9>	M_ME_NA_1																			
<10>	M_ME_TA_1																			
<11>	M_ME_NB_1																			
<12>	M_ME_TB_1																			
<13>	M_ME_NC_1	X		X		X									X					
<14>	M_ME_TC_1																			
<15>	M_IT_NA_1			X												X				
<16>	M_IT_TA_1																			
<17>	M_EP_TA_1																			
<18>	M_EP_TB_1																			
<19>	M_EP_TC_1																			
<20>	M_PS_NA_1																			
<21>	M_ME_ND_1																			

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Type identification		Cause of transmission																		
		PERIODIC, CYCLIC	BACKGROUND SCAN	SPONTANEOUS	INITIALIZED	REQUEST OR REQUESTED	ACTIVATION	ACTIVATION CONFIRMATION	DEACTIVATION	DEACTIVATION CONFIRMATION	ACTIVATION TERMINATION	RETURN INFO CAUSED BY LOCAL CMD	FILE TRANSFER	INTERROGATED BY GROUP <NUMBER>	REQUEST BY GROUP <N> COUNTER REQ	UNKNOWN TYPE IDENTIFICATION	UNKNOWN CAUSE OF TRANSMISSION	UNKNOWN COMMON ADDRESS OF ASDU	UNKNOWN INFORMATION OBJECT ADDR	UNKNOWN INFORMATION OBJECT ADDR
No.	Mnemonic	1	2	3	4	5	6	7	8	9	10	11	12	13	20 to 36	37 to 41	44	45	46	47
<30>	M_SP_TB_1			X								X	X							
<31>	M_DP_TB_1																			
<32>	M_ST_TB_1																			
<33>	M_BO_TB_1																			
<34>	M_ME_TD_1																			
<35>	M_ME_TE_1																			
<36>	M_ME_TF_1																			
<37>	M_IT_TB_1			X												X				
<38>	M_EP_TD_1																			
<39>	M_EP_TE_1																			
<40>	M_EP_TF_1																			
<45>	C_SC_NA_1						X	X	X	X	X									
<46>	C_DC_NA_1																			
<47>	C_RC_NA_1																			
<48>	C_SE_NA_1																			
<49>	C_SE_NB_1																			
<50>	C_SE_NC_1																			
<51>	C_BO_NA_1																			
<58>	C_SC_TA_1						X	X	X	X	X									
<59>	C_DC_TA_1																			
<60>	C_RC_TA_1																			
<61>	C_SE_TA_1																			
<62>	C_SE_TB_1																			
<63>	C_SE_TC_1																			
<64>	C_BO_TA_1																			
<70>	M_EI_NA_1*)				X															
<100>	C_IC_NA_1						X	X	X	X	X									
<101>	C_CI_NA_1						X	X			X									
<102>	C_RD_NA_1					X														
<103>	C_CS_NA_1			X			X	X												
<104>	C_TS_NA_1																			

7

Type identification		Cause of transmission																		
		PERIODIC, CYCLIC	BACKGROUND SCAN	SPONTANEOUS	INITIALIZED	REQUEST OR REQUESTED	ACTIVATION	ACTIVATION CONFIRMATION	DEACTIVATION	DEACTIVATION CONFIRMATION	ACTIVATION TERMINATION	RETURN INFO CAUSED BY LOCAL CMD	FILE TRANSFER	INTERROGATED BY GROUP <NUMBER>	REQUEST BY GROUP <N> COUNTER REQ	UNKNOWN TYPE IDENTIFICATION	UNKNOWN CAUSE OF TRANSMISSION	UNKNOWN COMMON ADDRESS OF ASDU	UNKNOWN INFORMATION OBJECT ADDR	UNKNOWN INFORMATION OBJECT ADDR
No.	Mnemonic	1	2	3	4	5	6	7	8	9	10	11	12	13	20 to 36	37 to 41	44	45	46	47
<105>	C_RP_NA_1						X	X												
<106>	C_CD_NA_1																			
<107>	C_TS_TA_1																			
<110>	P_ME_NA_1																			
<111>	P_ME_NB_1																			
<112>	P_ME_NC_1						X	X							X					
<113>	P_AC_NA_1																			
<120>	F_FR_NA_1																			
<121>	F_SR_NA_1																			
<122>	F_SC_NA_1																			
<123>	F_LS_NA_1																			
<124>	F_AF_NA_1																			
<125>	F_SG_NA_1																			
<126>	F_DR_TA_1*)																			

6. BASIC APPLICATION FUNCTIONS

Station initialization

☒ Remote initialization

Cyclic data transmission

☒ Cyclic data transmission

Read procedure

☒ Read procedure

Spontaneous transmission

☒ Spontaneous transmission

Double transmission of information objects with cause of transmission spontaneous

The following type identifications may be transmitted in succession caused by a single status change of an information object. The particular information object addresses for which double transmission is enabled are defined in a project-specific list.

☐ Single point information: M_SP_NA_1, M_SP_TA_1, M_SP_TB_1, and M_PS_NA_1
☐ Double point information: M_DP_NA_1, M_DP_TA_1, and M_DP_TB_1
☐ Step position information: M_ST_NA_1, M_ST_TA_1, and M_ST_TB_1
☐ Bitstring of 32 bits: M_BO_NA_1, M_BO_TA_1, and M_BO_TB_1 (if defined for a specific project)
☐ Measured value, normalized value: M_ME_NA_1, M_ME_TA_1, M_ME_ND_1, and M_ME_TD_1
☐ Measured value, scaled value: M_ME_NB_1, M_ME_TB_1, and M_ME_TE_1
☐ Measured value, short floating point number: M_ME_NC_1, M_ME_TC_1, and M_ME_TF_1

Station interrogation

☒ Global

☒ Group 1	☒ Group 5	☒ Group 9	☒ Group 13
☒ Group 2	☒ Group 6	☒ Group 10	☒ Group 14
☒ Group 3	☒ Group 7	☒ Group 11	☒ Group 15
☒ Group 4	☒ Group 8	☒ Group 12	☒ Group 16

Clock synchronization

☒ Clock synchronization (optional, see Clause 7.6)

Command transmission

☒ Direct command transmission
☐ Direct setpoint command transmission
☒ Select and execute command
☐ Select and execute setpoint command
☒ C_SE ACTTERM used
☒ No additional definition
☒ Short pulse duration (duration determined by a system parameter in the outstation)
☒ Long pulse duration (duration determined by a system parameter in the outstation)
☒ Persistent output

☒ Supervision of maximum delay in command direction of commands and setpoint commands
Maximum allowable delay of commands and setpoint commands: **10 s**

Transmission of integrated totals

☒ Mode A: Local freeze with spontaneous transmission
☒ Mode B: Local freeze with counter interrogation
☒ Mode C: Freeze and transmit by counter-interrogation commands
☒ Mode D: Freeze by counter-interrogation command, frozen values reported simultaneously

☒ Counter read
☒ Counter freeze without reset
☒ Counter freeze with reset
☒ Counter reset

☒ General request counter
☒ Request counter group 1
☒ Request counter group 2
☒ Request counter group 3
☒ Request counter group 4

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Parameter loading

☒ Threshold value
☐ Smoothing factor
☐ Low limit for transmission of measured values
☐ High limit for transmission of measured values

Parameter activation

☐ Activation/deactivation of persistent cyclic or periodic transmission of the addressed object

Test procedure

☐ Test procedure

File transfer

File transfer in monitor direction:
☐ Transparent file
☐ Transmission of disturbance data of protection equipment
☐ Transmission of sequences of events
☐ Transmission of sequences of recorded analog values
File transfer in control direction:
☐ Transparent file

Background scan

☐ Background scan

Acquisition of transmission delay

■ ~~Acquisition of transmission delay~~

Definition of time outs

Parameter	Default value	Remarks	Selected value
t_0	30 s	Timeout of connection establishment	120 s
t_1	15 s	Timeout of send or test APDUs	15 s
t_2	10 s	Timeout for acknowledgements in case of no data messages $t_2 < t_1$	10 s
t_3	20 s	Timeout for sending test frames in case of a long idle state	20 s

Maximum range of values for all time outs: 1 to 255 s, accuracy 1 s.

Maximum number of outstanding I-format APDUs k and latest acknowledge APDUs (w)

Parameter	Default value	Remarks	Selected value
k	12 APDUs	Maximum difference receive sequence number to send state variable	12 APDUs
w	8 APDUs	Latest acknowledge after receiving w I-format APDUs	8 APDUs

Maximum range of values k:1 to 32767 (2^{15} – 1) APDUs, accuracy 1 APDU
Maximum range of values w:1 to 32767 APDUs, accuracy 1 APDU
Recommendation: w should not exceed two-thirds of k

Portnumber

Parameter	Value	Remarks
Portnumber	2404	In all cases

RFC 2200 suite

RFC 2200 is an official Internet Standard which describes the state of standardization of protocols used in the Internet as determined by the Internet Architecture Board (IAB). It offers a broad spectrum of actual standards used in the Internet. The suitable selection of documents from RFC 2200 defined in this standard for given projects has to be chosen by the user of this standard.

☒ Ethernet 802.3

☐ Serial X.21 interface

☐ Other selection(s) from RFC 2200 (list below if selected)

7.2 IEC 60870-5-104 points

The IEC 60870-5-104 data points are configured through the **SETTINGS** ⇨ **PRODUCT SETUP** ⇨⇩ **COMMUNICATIONS** ⇨⇩ **DNP / IEC104 POINT LISTS** menu. See the Communications section of chapter 5 in the Instruction Manual for details.

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Appendix A: Miscellaneous

This chapter provides the revision history.

A.1 Revision history

The tables outline the releases and revision history of this document.

Table A-1: Revision history (English)

GE publication code	Firmware	Release date	ECO
1601-0401-AB1	7.3x	7 November 2014	14-1408
1601-0401-AB2	7.3x	1 September 2015	15-2215
1601-0401-AC1	7.40x	8 December 2016	16-3319
1601-0401-AE1	7.41x	31 January 2017	17-3427
1601-0401-AE3	7.4x	28 April 2017	17-3561
1601-0401-AF1	7.6x	30 June 2017	17-3779
1601-0401-AF2	7.6x	31 October 2017	17-3935
1601-0401-AG1	7.7x	31 March 2018	18-4430
1601-0401-AG2	7.7x	4 May 2018	18-4517
1601-0401-AH1	7.8x	17 December 2018	18-4703
1601-0401-AI1	7.9x	24 October 2019	19-5181
1601-0401-AJ1	8.0x	30 October 2019	19-5182
1601-0401-AJ2	8.0x	12 June 2020	20-5580
1601-0401-AK1	8.1x	20 November 2020	20-6096
1601-0401-AL1	8.2x	16 February 2021	21-6228
1601-0401-AL2	8.2x	23 July 2021	21-6482
1601-0401-AM1	8.3x	6 May 2022	22-6815
1601-0401-AM2	8.3x	14 October 2022	22-7224
1601-0401-AN1	8.4x	December 2022	22-7333

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A.1.1 Major changes

For information on the updates included in this release of the UR Family manual, please refer to the latest release notes for the UR Family 8.4x version online.

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