

Reason RT430/RT434

GNSS Precision-Time Clocks

The demand for accurate time synchronization available 24/7 increases with the growth of critical substation applications, such as phasor measurement, merging units, travelingwave fault location and current differential protection operating over Synchronous Optical Networking (SONET) and Multi-Protocol Label Switching (MPLS) systems. In order to yield the best accuracy and granularity from such applications, the use of a common, precision-time reference is essential.

GNSS Clocks

RT430/RT434 GNSS* clock now tracks the american Global Positioning System (GPS) and the russian Global Navigation Satellite System (GLONASS) satellites simultaneously, and whenever one constellation is lost, or reports bad quality, the clock will continue running in full synchronization based on the healthy source (with zero switchover time). Using GNSS is also a great way to guarantee time availability when the antenna is installed in places close to buildings or mountains, as the clock has more satellites as time reference, offering greater immunity to “shadow” effects.

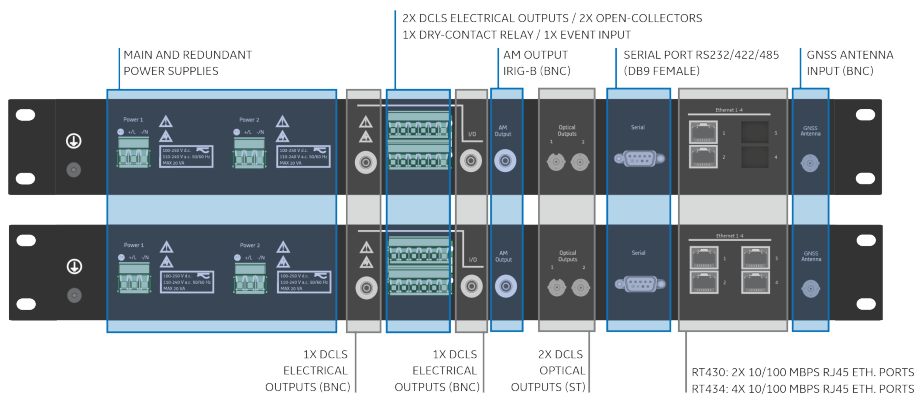
*Global Navigation Satellite System

RT430 and RT434

Offering a complete solution, these clocks are the universal precision time synchronization units, with an extensive number of outputs which supports many timing protocols, including Daylight Saving Time (DST) rules frequently used on power systems applications.

Choose the RT430 in Ethernet applications where IEC 62439 Parallel Redundancy Protocol (PRP) redundant architectures are required, choose the RT434 where three or four electrical network ports are required.

RT430/RT434 rear view



Precise Time Synchronization

- Mean time accuracy of 50 ns for IRIG-B/PPS signals
- IEEE 1588v2 Precision Time Protocol (PTP), with better than 100 ns accuracy
- Operates as a PTP master clock or ordinary clock
- PTP Power Profile, in accordance with latest IEEE C37.238:2017 and its previous 2011 version
- PTP Profile for Power Utility automation, in accordance with IEC 61850-9-3:2016 standard
- Network Time Protocol/Simple Network Time Protocol (NTP/SNTP) time server
- PTP and NTP/SNTP simultaneously through each Ethernet port
- PRP with zero-time recovery for NTP and PTP (only RT430)

Flexible Design

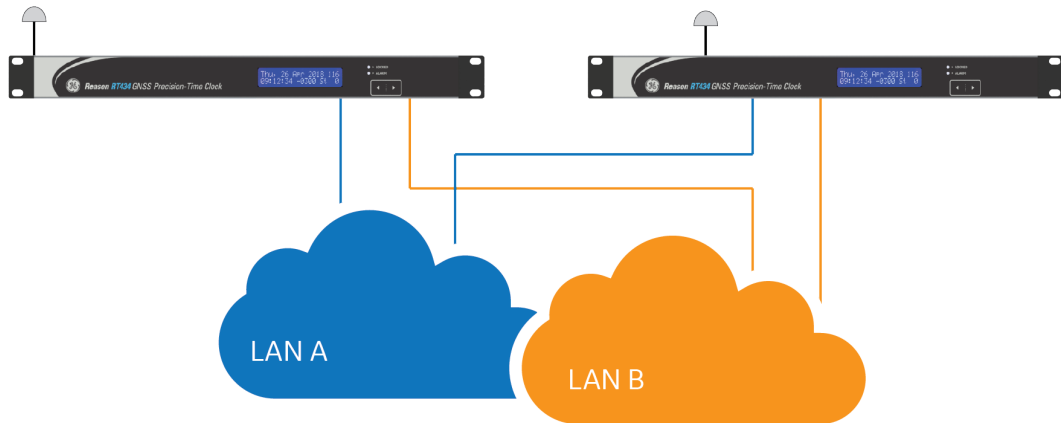
- Up to four 10/100 Mbps Ethernet ports
- Extensive DC Level Shift output interfaces, electrical and optical
- DCLS signal is configurable through the Web Interface
- One amplitude Modulated (AM) IRIG-B output
- Two open-collector outputs (voltage free contact)
- Web Interface available in five different languages

Hardened for Industry

- Robust design for harsh environments
- Redundant Power Supplies
- Dry-Contact relay for sync status
- Supports Simple Network Management Protocol (SNMP) (v1, v2c and v3), including Management Information Base (MIB) files

PTP, NTP and SNTP in PRP Networks

The RT430 offers the highly accurate IEEE 1588v2 PTP combined with the Parallel Redundancy Protocol IEC 62439-3:2016, ensuring 100 ns accuracy and high availability in time synchronization over Ethernet networks. Furthermore, the NTP/SNTP protocols are also supported in a PRP network, and in the case of a failure in one of the redundant networks, the recovery-time for PTP, NTP and SNTP is zero.



PTP Power Profiles

Following the latest standards, RT430/RT434 offers the most recent IEEE 1588v2 extended profiles for power system protection, control automation, and data communication applications, such as: IEEE C37.238:2017, IEC/IEEE 61850-9-3:2016 and IEEE C37.238:2011. All these are pre-configured on the RT430/RT434, making it easier to configure an IEEE 1588v2 network. The following table presents a comparison between the main characteristics of each profile.

	IEEE C37.238:2011 PTP Power Profile	IEEE C37.238:2017 PTP Power Profile	IEC 61850-9-3:2016 PTP Profile for Power Utility Automation
Network Protocol	Ethernet Layer 2	Ethernet Layer 2	Ethernet Layer 2
Delay Mechanism	Peer-to-Peer (P2P)	Peer-to-Peer (P2P)	Peer-to-Peer (P2P)
Operation Mode	One Step	One or Two Step(s)	One or Two Step(s)
Sync / Announce Message Interval	1 per second / 1 per second	1 per second / 1 per second	1 per second / 1 per second
Grandmaster Priority	#1 and #2 = 128 Equal for all Grandmaster	Selectable, allowing to choose the best grandmaster for holdover conditions	Selectable, allowing to choose the best grandmaster for holdover conditions

The IEEE C37.238:2017 and IEC/IEEE 61850-9-3 are completely compatible and can work together without restrictions on the same network by setting its domain number. Although the C37.238:2011 was superseded by the other two standards, it is still available for legacy networks and may be compatible depending on the IEEE 1588v2 network configuration.

Technical Specification

ENVIRONMENT

Environment Specification	
Operating temperature range	-40°C ... +55°C (-40°F to +131°F)
As tested per IEC 60068-2-1	-40°C
As tested per IEC 60068-2-2	+85°C
Maximum operating altitude	2000 m (6560 ft)
Relative humidity	5 ... 95%, non-condensing
Enclosure Protection IEC 60529	
Front flush mounted with panel	IP40
Rear and sides	IP20
Product safety protection	IP20 (due to live Connections on the terminal block)

DRY-CONTACT RELAY

Number of Outputs	1
Max AC Voltage and Current Capacity	250 Vac / 500 mA
Max DC Current Capacity	500 mA @ 24 Vdc 500 mA @ 48 Vdc 400 mA @ 125 Vdc 150mA @ 250 Vdc (max voltage)
Contact	Normally Closed

EVENT INPUT

Number of Inputs	1
TTL Voltage Level	5 Vdc
Signals	PPS, PPM or any other pulse with frequency lower than 100Hz

OUTPUTS

TTL Level Electrical Outputs

Number of Outputs	4
Time Accuracy	50 ns (mean) 100 ns (peak)
TTL Voltage Level	5 Vdc
High Level	> 4.8 Vdc
Low Level	< 0.2 Vdc
Impedance	18 Ω
Maximum Current	150 mA
Connectors	2x 2-pin Euro Type 2x BNC

Two electrical outputs are insulated, one from 2-pin connector and another from BNC connector.

Open Collector Electrical Outputs

Number of Outputs	2
Maximum collector emitter DC voltage	400 Vdc
Maximum current	300 mA
Connectors	2-pin Euro Type

Optical Outputs

Number of Outputs	2
Connector	ST
Time Accuracy	50 ns (mean) 100 ns (peak)
Wavelength	820 nm
Fiber Type	Multimode 50/125 μm, 62.5/125 μm, 100/140 μm or 200 μm HCS
Emission power	17.8 dBm (50 / 125 μm) 14.0 dBm (62,5 / 125 μm) 8.5 dBm (100 / 140 μm) 5.7 dBm (200 μm HCS)

Amplitude Modulated Output

Number of Outputs	1
Signal	IRIG-B124
Connector	BNC (female)
Empty Amplitude	4 Vpp
50 Ω Load Amplitude	3 Vpp
Relative level High/Low	3.3
Carrier Frequency	1 kHz
Outputs Impedance	15 Ω
Maximum Current	80 mA

Serial Output

Number of Outputs	1
Signal Level	RS232 or RS422/485
Bitrate	1200, 2400, 4800, 9600, 19200 or 38400 bps
Data bits	7 or 8
Stop bits	1 or 2
Parity	none, even or odd
Connector	DB9 (female), standard DTE

POWER SUPPLY

Number of Power Supply	Up to 2 power supplies	
Operating nominal voltage	100-250Vdc 110-240Vac	24/48Vdc
Operating voltage range	80-300Vdc 88-264Vac	18-75Vdc
Frequency	50/60 Hz ± 3 Hz	N/A
Power Consumption	MAX 20 VA Typical 15 W	MAX 10 W Typical 8 W

SAFETY TESTS

IEC 61010-1 CE Certification	Safety requirements
IEC 60255-5	Impulse: 5 kV Dielectric withstand: 3.3 kVdc Insulation: > 100 MQ

TYPE TEST

EMC tests were performed according to IEC 60255-26 referring to the following standards

IEC 61000-4-2:2008	6 kV contact / 8 kV air
IEC 61000-4-3:2006	10 V/m
IEC 61000-4-4:2012	2 kV @ 5 kHz
IEC 61000-4-5:2005	Differential mode: 1 kV Common mode: 2 kV
IEC 61000-4-6:2008	10 V
IEC 61000-4-8:2009	30 A/m continuous 300 A/m @ 1 s - A.C. and D.C. voltage dips Test level: 0% residual voltage Duration time A.C.: 1 cycle D.C.: 16.6 ms - Test level: 40% residual voltage Duration time A.C.: 12 cycles D.C.: 200ms
IEC 61000-4-11:2004 IEC 61000-4-29:2000	- Test level: 70% residual voltage Duration time A.C.: 30 cycles D.C.: 500 ms - A.C. and D.C. voltage interruptions Test level: 0% residual voltage Duration time A.C.: 300 cycles D.C.: 5 s
IEC 61000-4-17:1999	Test level: 15% of rated DC value Test frequency: 120 Hz, sinusoidal waveform
IEC 61000-4-18:2006	Voltage oscillation frequency: 1 MHz Differential mode: 1 kV peak voltage; Common mode: 2.5 kV peak voltage
IEC 60255-26:2013 Gradual shut down / start-up tests	Shut-down ramp: 60 s Power off: 5 m Start-up ramp: 60 s
CISPR11:2009	Radiated emission Limits: 30 to 230 MHz – 50 dB (μV/m) quasi peak at 3 m 230 to 1000 MHz – 57 dB (μV/m) quasi peak at 3 m
CISPR22:2008	Radiated emission The definition of the limit frequency is based on the maximum internal frequency of the equipment. On RT430/434, the maximum internal frequency is 100 MHz. For this case, the levels of CISPR 11 satisfy the normative IEC 60255-26. Conducted emission Limits: 0.15 to 0.50 MHz - 79dB (μV) quasi peak; 66 dB (μV) average 0.5 to 30 MHz - 73dB (μV) quasi peak; 60 dB (μV) average

Environmental Tests

IEC 60068-2-1	-40°C, 16 hours (Cold)
IEC 60068-2-2	+85°C, 16 hours (Dry heat)
IEC 60068-2-30	95% no condensation, +55°C (Damp heat)
IEC 60068-2-14	-40°C to +85°C / 9 hours / 2 cycles (Change of temperature)
IEC 60255-21-1	Class 1 (Vibration)
IEC 60255-21-2	Class 1 (Shock)
IEC 60255-21-3	Class 2 (Seismic)

DIMENSIONS, WEIGHT

Height	44.45 mm (1 U; 1.75 in)
Width (body)	430 mm (16.9 in)
Depth	180 mm (7.1 in)
Weight	2.7 kg (5.9 lbs)

GNSS ANTENNA

GNSS Antenna Receiver

GNSS Receiver	GPS + GLONASS L1 Frequency
Sensibility	-165 dBm (Tracking & Navigation) -160 dBm (Reacquisition) -148 dBm (Cold Start)
Antenna type	Active
Antenna's supply	3.3 V, max 100 mA
Connector	BNC (female)

Time Receiver Autonomous Integrity Monitoring (TRAIM) supported.

GNSS Antenna Type

Type	3.3 V Active GNSS antenna (<20 mA)
Frequency	1588 ± 3MHz
Output / VSWR	2.0 Max
Impedance	50 Ω
Gain	30dB @ 25°C
Noise	3.3dB max (25°C ± 5°C)
Azimuth coverage	360° (omni-directional)
Elevation coverage	0°-90° elevation (hemispherical)
Operating Temperature	-40°C to +90°C
Connector	TNC Female

SURGE ARRESTER

Nominal discharge current In (8/20μs)	10 kA
Dynamic residual voltage	< 600 V
Band width	< 4 GHz
Insertion Loss	≤ 0.1dB
Impedance	50 Ω
Connector	BNC

Includes 1 meter long cable

INTERNAL OSCILLATOR

Internal Oscillator Type	TCXO
Short Term Stability	5 ns / s
Time Pulse Accuracy ¹	≤ 50 ns
Drift, One day	± 800 μs (typical ²) < 100 ppb (max)
Accuracy GNSS Synchronous - Average 24h	5 ppb
Super Capacitor Autonomy ³	80 hours

REASON RT CLOCKS COMPARISON

	RT430	RT431	RT434
GNSS (GPS + GLONASS)	✓	GPS only	✓
IEEE 1588 PTP and NTP/SNTP protocols	✓	✓	✓
SNMP Monitoring	✓	✓	✓
TCXO Internal Oscillator	✓	--	✓
Parallel Redundancy Protocol (PRP)	✓	--	--
10/100 BASE-T Ethernet ports	2	1	4
TTL (electric) outputs	4	2	4
Open collector outputs	2	1	2
Optical outputs	2	--	2
IRIG-B 004, PPS, PPM, DCF77 and low frequency pulses	✓	✓	✓
IRIG-B 124 AM outputs	✓	--	✓
Time sync through serial port	✓	✓	✓
LOCKED dry contact relay	✓	--	✓
Web-browser configuration*	✓	✓	✓
Full range power supply	✓	✓	✓
Redundant power supply	✓	--	✓
Power Consumption (Typical)	15W	10W	15W
Mouting	19" Rack	DIN Rail	19" Rack

* Web-browser configuration is available in English, French, Portuguese, Russian and Spanish.

¹ RT430/434 output signal. GNSS PPS Accuracy is ≤ 20ns

² Typical drift was measured indoors in laboratory

³ Super capacitor supplies energy to keep internal time after power supply outage.

ETHERNET PORTS

Number of ports	RT430: 2 Ethernet ports RT434: 4 Ethernet ports
Transmission Rates	10/100 Mbps
Connector	RJ45
Protocols Supported	NTP v2 (RFC 1119) NTP v3 (RFC 1305) NTP v4 (RFC 5905) SNTP (RFC 1769/2030/4330) SNMP (v1, v2c and v3), including MIB support. IEEE 1588v2:2008 IEC 62439-3 PRP (RT430 only)HTTP, TCP/IP, UDP

ANTENNA CABLE

Length	Delay (ns)	Description	Attenuation @1500MHz
15 m (50 ft)	62.0	TNC Male to BNC Male connectors, RG58 Type	< 0.5 dB/m
25 m (82 ft)	102.6	TNC Male to BNC Male connectors, RG58 Type	< 0.5 dB/m
40 m (131 ft)	163.6	TNC Male to BNC Male connectors, RG58 Type	< 0.5 dB/m
75 m (246 ft)	305.9	TNC Male to BNC Male connectors, RG8 Type	< 0.2 dB/m
100 m (328 ft)	407.5	TNC Male to BNC Male connectors, RG8 Type	< 0.2 dB/m
150 m (492 ft)	611.3	TNC Male to BNC Male connectors, RG8 Type	< 0.2 dB/m
Velocity of propagation	82%		
Impedance	50 ohms		
Capacitance	81pF/m		

PRECISION TIME PROTOCOL PTP (IEEE 1588)

Time Accuracy	<100 ns
Protocols	UDP/IPv4 (Layer 3) IEEE 802.3 (Layer 2)
Delay Compensation	End-to-End (E2E) Peer-to-Peer (P2P)
Profiles	- Power - IEEE C37.238/2017 and 2011 - Power Utility - IEC/IEEE 61850-9-3/2016 - P2P Default - Custom

RT430 Ordering

Model Type	RT430	*	*	*	*	*	2	C	*	B	*	*	*	RT430 GNSS Precision-Time Clock
Power Supply 1	1													24-48 Vdc
	3													100-250 Vdc / 110-240 Vac
Power Supply 3	1													24-48 Vdc
	3													100-250 Vdc / 110-240 Vac
	X													Not Installed
Ethernet Interface 1	C													RJ45 copper 100BASE-TX for configuration only
	N													RJ45 copper 100BASE-TX for NTP server and configuration
	P													RJ45 copper 100BASE-TX for PTP (IEEE 1588) server, NTP server and configuration
Ethernet Interface 2	C													RJ45 copper 100BASE-TX for configuration only
	N													RJ45 copper 100BASE-TX for NTP server and configuration *
	P													RJ45 copper 100BASE-TX for PTP (IEEE 1588) server, NTP server and configuration **
	R													PRP-redundant RJ45 copper 100BASE-TX port (same function as interface 1) *
Satellite constellations supported	A													GPS
	B													GPS and GLONASS
Oscillator Type	2													TCXO
Customization / Regionalisation	C													GE branding
Firmware Version	08													Latest available firmware - 08
Hardware Design Suffix	B													GNSS version
GPS Antenna	0													Without antenna
	2													3.3V TNC Female active GNSS antenna
Antenna Cable	0													No cable
	1													15 m (50 ft) TNC Male to BNC Male (Attenuation < 0.5 dB/m @ 1500 MHZ)
	2													25 m (82 ft) TNC Male to BNC Male (Attenuation < 0.5 dB/m @ 1500 MHZ)
	3													40 m (131 ft) TNC Male to BNC Male (Attenuation < 0.5 dB/m @ 1500 MHZ)
	4													75 m (246 ft) TNC Male to BNC Male (Attenuation < 0.2 dB/m @ 1500 MHZ)
	5													100 m (328 ft) TNC Male to BNC Male (Attenuation < 0.2 dB/m @ 1500 MHZ)
	6													150 m (492 ft) TNC Male to BNC Male (Attenuation < 0.2 dB/m @ 1500 MHZ)
Surge Arrester	0													Without surge arrester
	1													10 kA, 50 Ohms, BNC-type connector Surge Arrester for 0-2000 MHz

* Option only available if "N" or "P" selected in Ethernet Interface 1

** Option only available if "P" selected in Ethernet Interface 1

RT434 Ordering

Model Type	RT434	*	*	*	*	*	2	C	*	B	*	*	*	RT434 GNSS Precision-Time Clock
Power Supply 1	1													24-48 Vdc
	3													100-250 Vdc / 110-240 Vac
Power Supply 3	1													24-48 Vdc
	3													100-250 Vdc / 110-240 Vac
	X													Not Installed
Ethernet Interface 1 and 2			C											RJ45 copper 100BASE-TX for configuration only
			N											RJ45 copper 100BASE-TX for NTP server and configuration
			P											RJ45 copper 100BASE-TX for PTP (IEEE 1588) server, NTP server and configuration
Ethernet Interface 3 and 4			C											RJ45 copper 100BASE-TX for configuration only
			N											RJ45 copper 100BASE-TX for NTP server and configuration *
			P											RJ45 copper 100BASE-TX for PTP (IEEE 1588) server, NTP server and configuration **
Satellite constellations supported				A										GPS
				B										GPS and GLONASS
Oscillator Type						2								TCXO
Customization / Regionalisation							C							GE branding
Firmware Version								08						Latest available firmware - 08
Hardware Design Suffix									B					GNSS version
GPS Antenna										0				Without antenna
										2				3.3V TNC Female active GNSS antenna
Antenna Cable											0			No cable
											1			15 m (50 ft) TNC Male to BNC Male (Attenuation < 0.5 dB/m @ 1500 MHZ)
											2			25 m (82 ft) TNC Male to BNC Male (Attenuation < 0.5 dB/m @ 1500 MHZ)
											3			40 m (131 ft) TNC Male to BNC Male (Attenuation < 0.5 dB/m @ 1500 MHZ)
											4			75 m (246 ft) TNC Male to BNC Male (Attenuation < 0.2 dB/m @ 1500 MHZ)
											5			100 m (328 ft) TNC Male to BNC Male (Attenuation < 0.2 dB/m @ 1500 MHZ)
											6			150 m (492 ft) TNC Male to BNC Male (Attenuation < 0.2 dB/m @ 1500 MHZ)
Surge Arrester											0			Without surge arrester
											1			10 kA, 50 Ohms, BNC-type connector Surge Arrester for 0-2000 MHz

* Option only available if "N" or "P" selected in Ethernet Interface 1 and 2

** Option only available if "P" selected in Ethernet Interface 1 and 2

Accessories

RT411 Time Signal Distributor



Optical or Electrical input for time reference
 Up to 10 optical outputs
 Up to 10 electrical outputs (Two BNC connector)
 Full range power supply

Model Type	RT411	*	C	A	RT411 Time Signal Distributor
Power Supply 1		3			100-250 Vdc / 110-240 Vac
Customization / Regionalisation			C		GE branding
Hardware Design Suffix				A	Initial version

RT412 Optical Transceiver



Optical-electrical or electrical-optical converter
 One Optical output
 Two Electrical outputs
 DIN rail mounting
 Full range power supply

Model Type	RT412	*	C	A	RT412 Optical Transceiver
Power Supply 1		3			100-250 Vdc / 110-240 Vac
Customization / Regionalisation			C		GE branding
Hardware Design Suffix				A	Initial version

Antenna + Cables + Kit Mounting



GNSS Antenna (Order Code: Q020)
 Surge Arrester (Order Code: Q010)
 Antenna wall mount kit (Order Code: Q065)
 Antenna Cable options: - 15 m (50 ft) (Order Code: Q001)
 - 25 m (82 ft) (Order Code: Q002)
 - 40 m (131 ft) (Order Code: Q003)
 - 75 m (246 ft) (Order Code: Q004)
 - 100 m (392 ft) (Order Code: Q005)
 - 150 m (492 ft) (Order Code: Q064)

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GEA-32058D
 English
 2109