

Multilin™ G100

Substation Gateway



Instruction Manual

994-0155

Version 5.40 Revision 0



GE VERNOVA

GE Vernova Information

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About this Document

Purpose

This manual provides information about installing, setting up, using and maintaining your G100 Substation Gateway. This manual does not provide any procedures for configuring the G100 software.

Intended Audience

This manual is intended for use by field technicians and maintenance personnel who are responsible for the installation, wiring and maintenance of SCADA equipment. This guide assumes that the user is experienced in:

- Electrical utility applications
- Electrical wiring and safety procedures
- Related other manufacturers' products, such as protective relays and communications equipment

Additional documentation

For further information about the G100, refer to the following documents.

- G100 Quick Start Guide (SWM0116)
- MCP Software Configuration Guide (SWM0101)
- Configuring UEFI Settings on G100 User Guide (SWM0122)
- Module layouts, as available
- MCP HMI Online Help
- DS Agile MCP Studio Online Help

How to use this document

This document describes how to install the G100.

Procedures are provided for all component options available for the G100. The components included in your G100 depend on what was ordered for your substation application. Follow only the procedures that apply to your G100 model.

To check what options are included in your G100, see [Order Code](#).

Safety words 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:



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



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



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



Indicates practices that are not related to personal injury.



Important information about the product, product handling which must be given attention.

Product Support

If you need help with any aspect of your G100 product, you can:

- Access the G100 Web site
- Search the GE Vernova Technical Support library
- Contact Technical Support

Also covered are:

- The GE Vernova Grid Solutions address
- Instructions on returning a G100

Access the GE Vernova Grid Solutions web site

The G100 Web site provides fast access to technical information, such as manuals, release notes and knowledge base topics.

Visit us on the Web at:

<https://www.gevernova.com/grid-solutions/>

Search GE Vernova Grid Solutions Technical Support Library

This site serves as a document repository for post-sales requests. To get access to the Technical Support Web site visit us on the Web at:

<https://www.gevernova.com/grid-solutions/events/signup.asp?sid=208>

Contact Technical Support

GE Vernova Grid Solutions Technical Support is open 24 hours a day, seven days a week for you to talk directly to a GE Vernova representative.

Region	E-mail	Telephone
Global Contact Centre	GA.support@GEVernova.com	+44 1785 250070
Central, East Asia, Pacific	GA.supportCEAP@GEVernova.com	+65 6749 0777
India	GA.supportIND@GEVernova.com	No Phone Line
Middle East, North Africa, Turkey	GA.supportMENAT@GEVernova.com	+971 4 375 6950
Europe, Russia, CIS, Sub-Saharan Africa	ERCIS: GA.supportERCIS@GEVernova.com France: SAM_Aftersales@gevernova.com Poland: support.PLS@gevernova.com Russia: support.AMR@gevernova.com (not in use) UK: support.AGS@gevernova.com	+34 94 4858854
North America	GA.supportNAM@GEVernova.com	+1-877-605-6777 (Global toll-free) +1-800-547-8629 (NAM toll-free) +1-678-844-6777 (Direct)
Latin America	GA.supportLAM@GEVernova.com	+55 48 2108 0300

Have the following information ready to give to Technical Support:

- Ship to address (the address that the product is to be returned to)
- Bill to address (the address that the invoice is to be sent to)
- Contact name
- Contact phone number
- Contact fax number
- Contact e-mail address
- Product number / serial number
- Description of problem

Technical Support will provide you with a case number for your reference.

GE Vernova Grid Solutions address

The GE Vernova Grid Solutions company address is:

GE Vernova Grid Solutions
650 Markland Street
Markham, Ontario
Canada L6C 0M1

Product returns

A Return Merchandise Authorization (RMA) number must accompany all equipment being returned for repair, servicing, or for any other reason. Before you return a product, please contact GE Vernova Grid Solutions to obtain an RMA number and instructions for return shipments.

You are sent the RMA number and RMA documents via fax or e-mail. Once you receive the RMA documents, attach them to the outside of the shipping package and ship to GE.



Product returns are not accepted unless accompanied by the Return Merchandise Authorization number.

Chapter 1 - Introduction to G100

Before you begin installing and using the G100, review the information in this chapter, including the following topics:

- [Safety precautions](#)
- [Warning symbols](#)
- [Informational symbols](#)
- [Hardware overview](#)
- [Order Code](#)
- [MCP Spares and Accessories](#)
- [G100 Redundancy Kit \(N\) - Single RS232 SWITCH PANEL \(SW PNL\) for firmware v3.00 and higher](#)

Read and thoroughly understand this guide before installing and operating the unit. Save these instructions for later use and reference.



Failure to observe the instructions in this manual may result in serious injury or death.

Disclaimer

It is the responsibility of the user to verify and validate the suitability of all GE Vernova Grid Automation products. This equipment must be used within its design limits. The proper application including the 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 of 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 circumstances not clearly addressed in this document, please contact your local GE Vernova service site. The information contained in this document is subject to change without notice.

IT IS THE SOLE RESPONSIBILITY OF THE USER TO SECURE THEIR NETWORK AND ASSOCIATED DEVICES AGAINST CYBER SECURITY INTRUSIONS OR ATTACKS. GE VERNOVA GRID AUTOMATION AND ITS AFFILIATES ARE NOT LIABLE FOR ANY DAMAGES AND/OR LOSSES ARISING FROM OR RELATED TO SUCH SECURITY INTRUSION OR ATTACKS.

Safety precautions

Follow all safety precautions and instructions in this manual.

Only qualified personnel should install and work on the G100. Maintenance personnel should be familiar with the technology and the hazards associated with electrical equipment.

- *Never* work alone.
- Class 1 Equipment. This equipment must be earthed. The power plug must be connected to a properly wired earth ground socket outlet. An improperly wired socket outlet could place hazardous voltages on accessible metal parts.
- This product contains components rated as Class 1 Laser Products.
- A ground wire (18AWG) is required to be connected from the G100 chassis to protective earth.
- This product is intended to be supplied by a UL listed DC power supply or DC power source which is rated for 12/24/48Vdc, 5/2.5/1.25A minimum, Tma = 70 degree C, and the altitude of operation = 5000m.
- The device can only be used in a fixed location. Ensure that the protective earth connection is verified by qualified personnel.
- Before performing visual inspections, tests, or maintenance on this equipment, isolate or disconnect all hazardous live circuits and sources of electric power. Assume that all circuits are live until they have been completely de-energized, tested, and tagged. Pay particular attention to the design of the power system. Consider all sources of power, including the possibility of back feed.
- Turn off all power supplying the equipment in which the G100 is to be installed before installing and wiring the G100.
- Operate only from the power source specified on the installed power supply module.
- Beware of potential hazards and wear appropriate personal protective equipment, safety shoes, eye protection and gloves.
- The successful operation of this equipment depends upon proper handling, installation, and operation. Neglecting fundamental installation requirements may lead to personal injury as well as damage to electrical equipment or other property.
- All electronic components within the G100 are susceptible to damage from electrostatic discharge. To prevent damage when handling this product use approved static control procedures.
- Hazardous voltages can cause shock, burns or death. To prevent exposure to hazardous voltages, disconnect and lock out all power sources before servicing and removing components.
- If the G100 is used in a manner not specified in this manual, the protection provided by the equipment may be impaired.
- Changes or modifications made to the unit not authorized by GE Vernova could void the warranty.

Warning symbols

Table 1 explains the meaning of warning symbols that may appear on the G100 or in this manual.

Table 1: Warning symbols that may appear on the G100 and in this manual

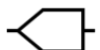
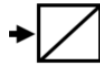
Symbol	Description
	The relevant circuit is direct current.
	The relevant circuit is alternating current.
	Caution: Refer to the documentation for important operation and maintenance instructions. Failure to take or avoid specified actions could result in loss of data or physical damage.
	Warning: Dangerous voltage constituting risk of electric shock is present within the unit. Failure to take or avoid specified actions could result in physical harm to the user.
	Protective Ground Terminal
	Caution: Hot Surface

Informational symbols

Table 1 explains the meaning of informational symbols that may appear on the G100 or in this manual.

Table 2: Informational symbols that appear on the G100 and in this manual

Symbol	Description
	Power On
	CPU Status
	Ethernet Port
	Serial Port
	IRIG-B Time In

Symbol	Description
	Display Port
	Analog DC Input (AI)
	Binary Input (DI)
	Binary Output (DO)

Hardware overview

MCP is the Multifunction Controller Platform family of Substation Gateways by GE Vernova Grid Solutions.

G100 is the smaller member of the family, together with G500.

G100 is based on Intel® Apollo Lake SOC, with Intel Atom X5-E3930 1.3GHz Processor to provide quality performance with low power consumption and wide operating temperature. It has 8 Gigabytes of SoDIMM 204 pin DDR3L memory.

The G100 is distinguished by the noticeable lack of a hard drive and fan, employing instead the rugged and reliable Solid State Drive (SSD) mass storage and engineered heat sink.

The G100 supports various communication media types through a choice of input/output (I/O):

- Serial: 4 factory installed ports, RS-232 and RS-485 configurable, accessible via individual RJ45 connectors.
- Ethernet: 2 factory installed RJ45 Ethernet interfaces with to 2 additional SFP cages..
- D.20 Link HDLC ports: A dual channel PCIe card for communication with up to 60 – D.20 Peripherals channel, including redundant D.20 link configuration.
- IRIG-B TTL input
- Local General Purpose IO (GPIO) interface, providing:
- 8 Binary Inputs (DI), wetted internally from main unit power supply circuit using single common (positive voltage through external contacts). The binary inputs are individually isolated internally.
- 4 Binary Outputs (DO), isolated, as N.O. (Normal Open) single contact
- 4 DC Analog Input (AI) channels, +5V DC/ 20mA

The G100 device has 3 noticeable side panels for operation.



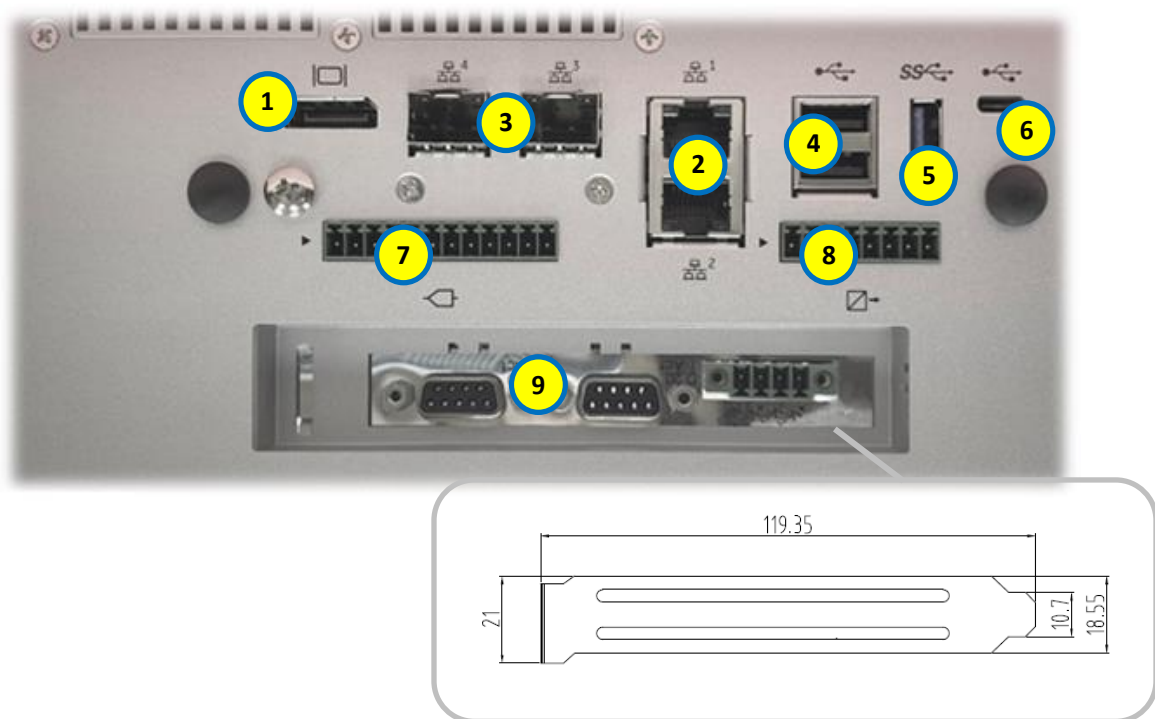
The names of each side panel as referenced in this document assume a **G100** being positioned vertically.

Top Panel

The top panel of the G100 provides access to:

1. 1x DP display port
2. 2x TP Ethernet ports with LED indications (labelled 1, 2)
3. 2x SFP Ethernet ports (labelled 3, 4)
4. 2x USB2 ports
5. 1x USB3 port
6. 1x USB-C port (future, currently not used)
7. 4x Analog Input (AI) connections (12 pin connector)
8. 4x Binary Output (DO) connections (8 pin connector)
9. D.20 HDLC connections, with LED indications (optional, in PCIe slot)

Figure 1: G100 Top Panel

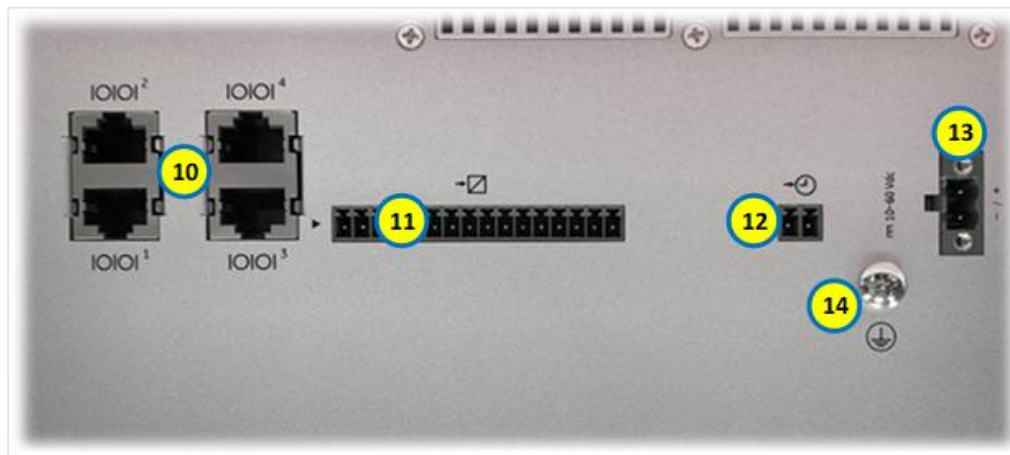


Bottom Panel

The bottom panel of the G100 provides access to:

10. 4x Serial ports (RS232/485, RJ45, labelled 1-4)
11. 8x Binary Input (DI) connections (16 pin connector)
12. Time synchronization input with IRIG-B TTL input (2 pin connector)
13. Power Supply connection (2 pin connector)
14. Protective Earth (PE) Ground connection (screw)

Figure 2: G100 Bottom Panel

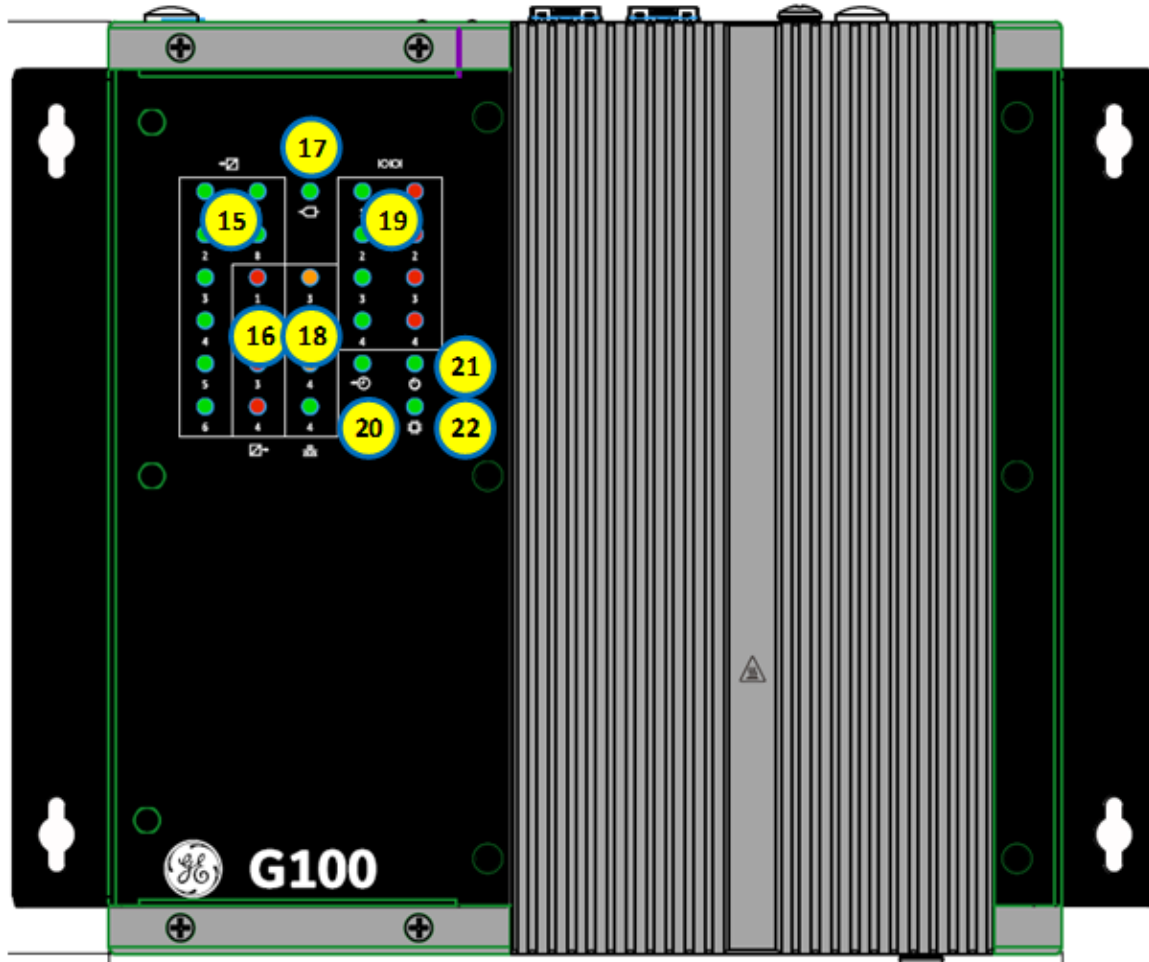


Front Panel

The front panel of the G100 provides the following LED indications:

15. 8x LED for Binary Input (DI)
16. 4x LED for Binary Output (DO)
17. LED for Analog Input (AI) sampling indication
18. SFP Ethernet (3, 4) link status LED
19. 4x Serial ports status LED
20. IRIG-B Input status LED
21. Power On LED
22. CPU/HW status LED, is ON when the unit operates normally

Figure 3: G100 Front Panel



Ordering guides

The latest ordering guides are available on the GE Vernova Grid Solutions website:

<https://www.gevernova.com/grid-solutions/multilin/catalog/g100.htm>

You can select the required options from the available Product Option items. The Order Code automatically updates as each option is selected.

The following ordering guides are available:

- [Order Code](#)
- [MCP Spares and Accessories](#)
- [G100 Redundancy Kit \(N\) - Single RS232 SWITCH PANEL \(SW PNL\) for firmware v3.00 and higher](#)

The Ordering Guide information provided in this manual does not reflect the full complexity of the ordering options provided on the GE Vernova Grid Solutions Online Store; the Online Store provides the full set of G100 options and their sub-option inter-dependencies while this manual shows all sub-options, regardless of the parent option chosen.

Order Code

Table 3: G100 Order Code

[illegible]

Changes to G100 Order Code

Up to and including V3.10 the G100 Order Code is in the form of:

G100-AAL-DA-4TTUU-DUU-C1070-UU

Starting with V4.00 – the G100 Order Code is in the form of (replaced and added digits at the end):

G100-AAL-DA-4TTUU-DUU-D0070-**S-0000000**

(the bold underline digits are added to support D2x **in a future G100 release**).

Order G100 as MCP Function

S indicates MCP functionality and in this case the D2x part is "UUUUUUUU".

The new resulting G100 as MCP model number is extended with "S-UUUUUUUU" at the end, without other changes, ensuring backwards compatibility.

For e.g.:

G100-AAL-DA-4TTUU-DUU-D0070-**S-0000000**

To know the Order Code of your G100, run ***mcp*** command through the Shell access utility (see Quick Start Guide and Software Manual for more details).

As-Built model number digits

The "As-Built" model number remains always the one set from factory. This shows the initial factory built deployed modules and functions of a given MCP device.

As-Is model number

The "As-Is" model number always shows the current deployed modules and functions of a given MCP device. These can be changed from the "As-Built" stage.

An embedded MCP application runs every time when the MCP and D2x applications start and updates the "As-Is" MCP Model number to reflect what is installed and configured in the device – regardless of the functional personality.

The generation of **HW digits** is according to the G100 Order Code sheet.

G100-AAL-DA-4TTUU-DUU-D0000-S-UUUUUUU

The **Function Type (S, C, D)** is read from the set Function.

G100-AAL-DA-4TTUU-DUU-D0000-**S**-UUUUUUUU

The generation of **SW digits related to MCP function** is according to the G100 Order Code. For e.g., D0 indicates MCP version 4.00

G100-AAL-DA-4TTUU-DUU-**D0000**-S-UUUUUUUU

The generation of **SW digits related to D2x function** is always performed regardless of the function type and follows the rules below (all CAPS letters for the digits); this ensures a true representation of the absence or presence and version of the D2x environment.

G100 v4.00 has always: S-**UUUUUUUU** for the last group of 8 digits.

In the example below, after the unit was built in the factory, there were added and configured two Fiber Optic SFP (F) and a D.20 PCIe card (D) and the firmware upgraded to v4.00.

```
admin@G100:~$ mcp si
Retrieving the GE Multilin MCP system information, please wait ...
=====
                        GE Multilin MCP System Information
=====
Model Number:
    As-Built:      G100-AAL-DA-4TTUU-UUU-B2022-UU
    As-Is       :      G100-AAL-DA-4TTFF-DUU-D0070-S-UUUUUUUU
```

Please visit the online store for application licenses ordering codes. For latest configuration and options, please visit the online store and search for G100:

<https://store.gegridsolutions.com/Home.aspx>

Software Licenses

Table 4: Software Licenses

Value	Assignment
1	Remote Desktop HMI (not available after June 1, 2024)
2	ARRM
4	IEC61850 Client
8	IEC61850 Server
16	LogicLinx
64	Tejas V Server

Order G100 as D2x Function

This is not available in V4.00 and V4.10.

MCP Spares and Accessories

Description	Applicable Product	Previous P/N (until 2025)	New P/N (starting 2025)
SFP Transceiver options			
SFP Module 100BASE-FX LC TRANSCEIVER OPTICAL MULTI-MODE 1300nm -40 TO 85C [580-3784]	G100/G500	MCP-S-1-F	MCPS-1-Q
SFP Module 1000BASE-SX LC TRANSCEIVER OPTICAL MULTI-MODE 850nm -40 TO 85C [580-3785]	G100/G500	MCP-S-1-S	MCPS-1-B
SFP Module 1000BASE-TX RJ45 TRANSCEIVER COPPER -40 TO 85C W/WO RX_LOS [580-3786]	G100/G500	MCP-S-1-T	MCPS-1-T
SFP Module 1000BASE-LX LC TRANSCEIVER OPTICAL SINGLE-MODE 1310nm -40 TO 85C [580-3787]	G100/G500	MCP-S-1-L	MCPS-1-I
SFP Module 10/100BASE-TX RJ45 TRANSCEIVER COPPER -40 TO 85C W/WO RX_LOS [0123-0004]	G100	MCP-S-1-C	MCPS-1-C
Power Supply			
G500 PSU, HV 90-264VAC/88-330VDC [528-2001LF-CC]	G500	MCP-S-2-H	MCPS-2-H
G500 PSU, LV 18-60VDC [528-2002LF-CC]	G500	MCP-S-2-L	MCPS-2-L
DIN Mount Power Supply IP 85-264VAC/90-350VDC OP 24VDC/5A [580-3466]	G100	N/A	MCPS-2-X
DIN Mount Power Supply IP 85-264VAC/90-350VDC OP 48VDC/3.75A [580-3484]	G100	N/A	MCPS-2-Y
PCIe Card options			
G500 PCIe UART CARD, 4x PORT (RJ45) RS232/485 [528-1001LF]	G500	MCP-S-3-S	MCPS-3-F
G500 BUILT-IN UART CARD, 4x PORT (RJ45) RS232/485 [528-1003LF]	G500	MCP-S-3-R	MCPS-3-G
G500/G100 PCIe D.20 HDLC CARD, 2x D.20 Link Ports [528-1002LF]	G100/G500	MCP-S-3-D	MCPS-3-D
Termination Panel			
RJ45 to DB9 Adapter Panel with Cables (528-1006LF [1], 977-0546/2.5 [4], 977-0563/3.0 [4])	G500	MCP-S-4-A	MCPS-4-A
Mounting Kit			
G500 19 INCH RACK MOUNT KIT [528-1010]	G500	N/A	MCPS-5-R
G100 MOUNT KIT [528-1011]	G100	N/A	MCPS-5-S
G100 19 INCH MOUNT PANEL, 4U [E952-4136]	G100	N/A	MCPS-5-Z
Upgrade License			
Automated Record Retrieval Manager (ARRM) [SGA0069]	G100/G500	MCP-S-L-A	MCPS-L-J
IEC61850 Client [SGA0074]	G100/G500	MCP-S-L-B	MCPS-L-K
LogicLinx Executor [SGA0067]	G100/G500	MCP-S-L-C	MCPS-L-M

Description	Applicable Product	Previous P/N (until 2025)	New P/N (starting 2025)
IEC61850 Server [SGA0088]	G100/G500	MCP-S-L-D	MCPS-L-N
Tejas V Server [SGA0089]	G100/G500	MCP-S-L-E	MCPS-L-O
Change from D2x to MCP	G500	N/A	MCPS-L-E
Change from MCP to D2x	G500	N/A	MCPS-L-U
Add D2x to MCP	G500	N/A	MCPS-L-V
Add MCP to D2x	G500	N/A	MCPS-L-W
Add D2x Classic Applications License	G500	N/A	MCPS-L-1
Add D2x Advanced Automation License	G500	N/A	MCPS-L-2
Add D2x Classic Applications and Advanced Automation Licenses	G500	N/A	MCPS-L-3

G100 Redundancy Kit (N) - Single RS232 SWITCH PANEL (SW PNL) for firmware v3.00 and higher

Order Code Item	MCP-RED	*_	*	*	***	***	***	***	***	Description
Kit Type										
N										MCP version v3.0 and higher Included: - RS232 SWITCH PANEL RoHS [517-0247LF] qty 1 - Power Cable [970-0161] qty 180 inch - Ground Cable [970-0182] qty 180 inch - MCP A/B RS232 DB9F SWITCH JUMPER (P1/P9) [977-0562] qty 2
Power Supply										
			U							None
			A							PS, Input range 100-240VAC/90-350VDC, Output 10-15VDC@8A, DIN Rail Mt
Power Supply										
			U							None
			A							PS, Input range 100-240VAC/90-350VDC, Output 10-15VDC@8A, DIN Rail Mt
MCP Watchdog Cable to Connect MCP A to RS232 Switch Panel Options										
				036						MCP Watchdog cable, 36" [977-0568/36]
				048						MCP Watchdog cable, 48" [977-0568/48]
				060						MCP Watchdog cable, 60" [977-0568/60]
				072						MCP Watchdog cable, 72" [977-0568/72]
				096						MCP Watchdog cable, 96" [977-0568/96]
				120						MCP Watchdog cable, 120" [977-0568/120]
MCP Watchdog Cable to Connect MCP B to RS232 Switch Panel Options										
				036						MCP Watchdog cable, 36" [977-0568/36]
				048						MCP Watchdog cable, 48" [977-0568/48]

Order Code Item	MCP-RED	*_	*	*	***	***	***	***	***	Description	
						060				MCP Watchdog cable, 60" [977-0568/60]	
						072				MCP Watchdog cable, 72" [977-0568/72]	
						096				MCP Watchdog cable, 96" [977-0568/96]	
						120				MCP Watchdog cable, 120" [977-0568/120]	
MCP Ping Cables											
						012				MCP-A/B RJ45 Ping Cable, 12" [977-0559/012]	
						018				MCP-A/B RJ45 Ping Cable, 18" [977-0559/018]	
						024				MCP-A/B RJ45 Ping Cable, 24" [977-0559/024]	
						030				MCP-A/B RJ45 Ping Cable, 30" [977-0559/030]	
						042				MCP-A/B RJ45 Ping Cable, 42" [977-0559/042]	
						048				MCP-A/B RJ45 Ping Cable, 48" [977-0559/048]	
						054				MCP-A/B RJ45 Ping Cable, 54" [977-0559/054]	
						060				MCP-A/B RJ45 Ping Cable, 60" [977-0559/060]	
MCP Serial Cable MCP A to RS232 Switch Panel Options (qty 1)											
						036				MCP-A to RS232 Switch Panel Transition Cable, 36" [977-0556/036]	
						048				MCP-A to RS232 Switch Panel Transition Cable, 48" [977-0556/048]	
						060				MCP-A to RS232 Switch Panel Transition Cable, 60" [977-0556/060]	
MCP Serial Cable MCP B to RS232 Switch Panel Options (qty 1)											
							036			MCP-A to RS232 Switch Panel Transition Cable, 36" [977-0556/036]	
							048				MCP-A to RS232 Switch Panel Transition Cable, 48" [977-0556/048]
							060				MCP-A to RS232 Switch Panel Transition Cable, 60" [977-0556/060]

Chapter 2 - Unpacking and Inspection

This chapter covers the suggested inspection and preparation considerations and background information necessary prior to using the G100.

Unpacking, initial inspection, and first time operation of the G100 are covered.

Following the procedures given in the chapter is recommended, and they will verify proper operation before the product is integrated into your system.



Hot Surface: During operation of the G100 the surface of the heat sink, can reach a temperature of 60°C and above. Therefore, be careful and do not touch it with bare fingers.

Electro Static Discharge - ESD

The discharge of static electricity, known as Electro Static Discharge or ESD, is a major cause of electronic component failure. The Industrial Computer has been packed in a static-safe bag which protects it from ESD while it is in the bag. Before removing the Boards or any other electronic product from its static-safe bag, be prepared to handle it in a static-safe environment.



You should wear a properly-functioning anti-static strap and ensure you are fully grounded. Any surface upon which you place on the unprotected G100 should be static- safe, usually facilitated by the use of anti-static mats. From the time the board is removed from the anti-static bag until it is in the card cage and functioning properly, extreme care should be taken to avoid “zapping” the board with ESD. You should be aware that you could “zap” the board without you knowing it; a small discharge, imperceptible to the eye and touch, can often be enough to damage electronic components. Extra caution should be taken in cold and dry weather when electrostatic charge easily builds up.

Only after ensuring that both you and the surrounding area are protected from ESD, carefully remove the board or module from the shipping carton by grasping the module on its edges. Place the board, in its anti-static bag, flat down on a suitable surface. You may then remove the board from the anti-static bag by tearing the ESD warning labels.

Initial inspection

After unpacking the products, you should inspect it for visible damage that could have occurred during shipping or unpacking. If damage is observed (usually in the form of bent component leads or loose socketed components), contact GE Vernova Technical Support for additional instructions. Depending on the severity of the damage, it may be necessary to return the product to the factory for repair.

⚠ WARNING

DO NOT apply power to the product if it has visible damage!

Doing so may cause further, possibly irreparable damage, as well as introduce a fire or shock hazard.

The G100 shipment will include the following:

- G100 Substation Gateway
- Wall / Panel mounting kit
 - Wall / panel mounting bracket (quantity 2)
- DIN rail and Hardware kit
 - DIN Rail (quantity 1)
 - Screws (quantity 6)
- Analog DC Input (AI) connector (quantity 1)
- Binary Input (DI) connector (quantity 1)
- Binary Output (DO) connector (quantity 1)
- Power input connector (quantity 1)
- IRIG-B input connector (quantity 1)



Unpacking

Please read the manual carefully before unpacking the board or module or fitting the device into your system. Also adhere to the following:

- Observe all precautions for electrostatic sensitive modules.
- Do not place the board on conductive surfaces, anti-static plastic, or sponge, which can cause shocks and lead to board trace damage.
- Do not exceed the specified operational temperatures.
- Keep all original packaging material for future storage or warranty shipments of the board.

Although the products are carefully packaged to protect against the rigors of shipping, it is still possible that shipping damage can occur. Careful inspection of the shipping carton should reveal some information about how the package was handled by the shipping service. If evidence of damage or rough handling is found, you should notify the shipping service and GE Vernova Technical Support as soon as possible.



PCIe Cards and storage devices may also have temperature restrictions.

Retain all packing material in case of future need.

WARNING

Before installing or removing any board, please ensure that the system power and external supplies have been turned off!

Chapter 3 - Installing the G100

This chapter covers the installation of the G100 and initial power-on operations.

⚠ WARNING

Before you install and operate the G100, read and follow the safety guidelines and instructions in [Safety precautions](#).

Installation

The G100 device can be installed as either wall / panel mounted, or DIN Rail mounted.

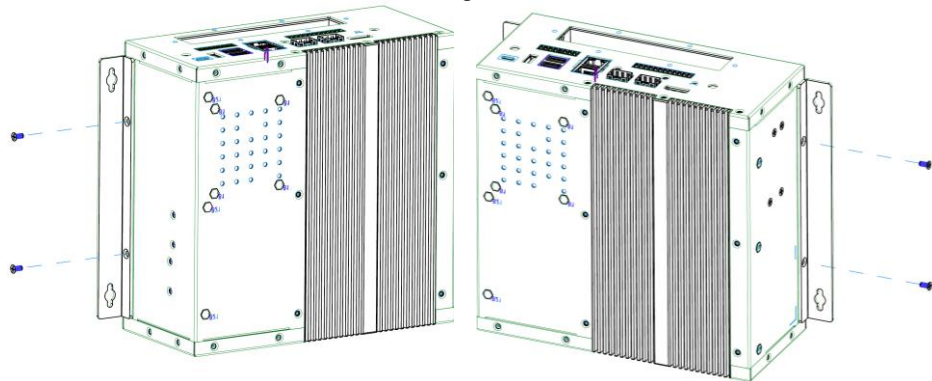
The G100 shall be installed in:

- Pollution Degree II, non-hazardous and restricted access location,
- Environment where the ambient temperature does not exceed the rating of the product,
- Air flow is not restricted.

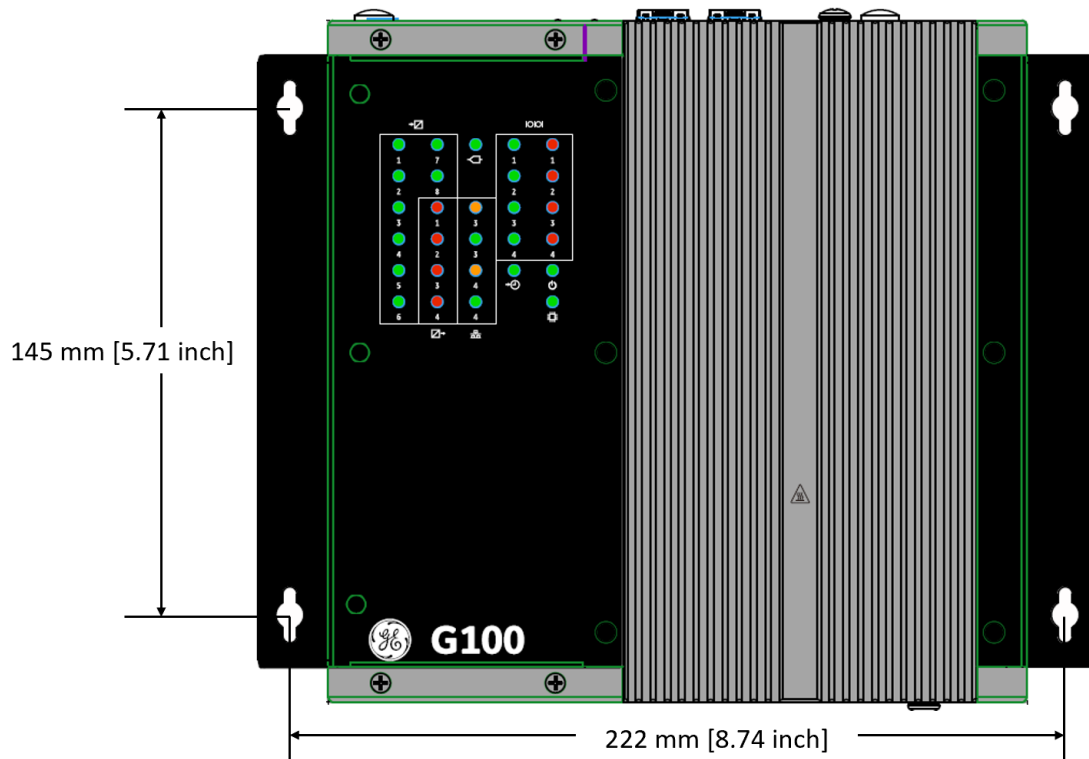
Wall / Panel Mounting instructions

Please see following instructions to mount it.

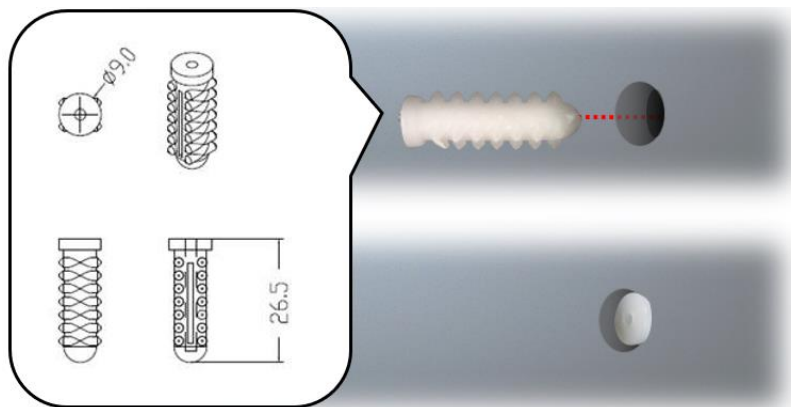
1. Mount the wall/panel mount bracket as shown below.
 - a. Locate and retrieve the wall/panel mount brackets from the G100 carton.
 - b. Locate and removed the 2x M3 screws on the left side of the chassis closest to the rear.
 - c. Position one of the wall/panel mount brackets to the chassis, aligning the mounting holes in the bracket to the chassis.
 - d. Reinstall the 2 screws removed in the step above on the left side of the chassis to secure the bracket to the chassis. The recommended torque setting for the M3 screws are 5.2 in-lb [0.59 Nm].
 - e. Repeat the above steps for the mounting the bracket to the right side of the chassis.



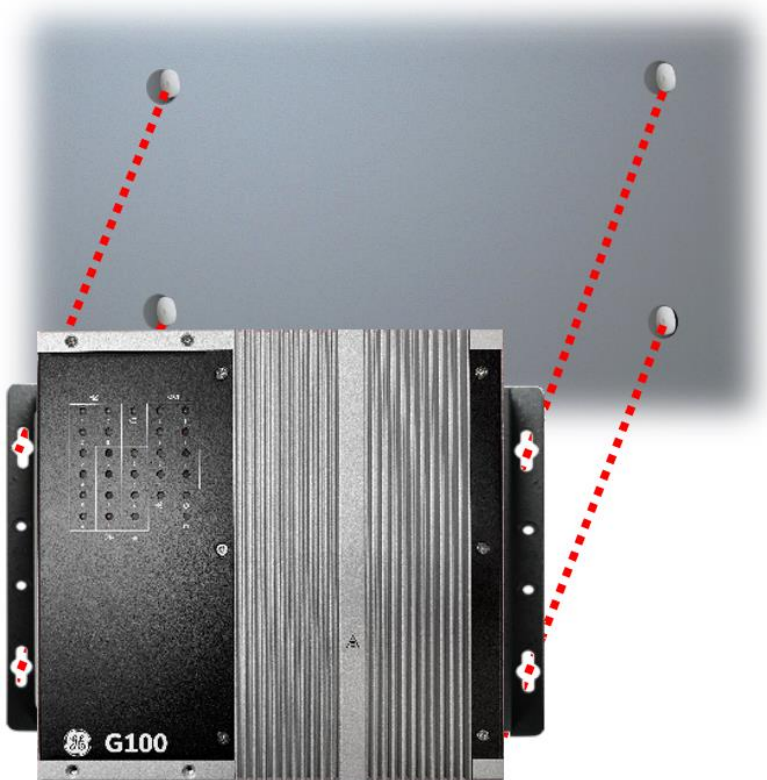
2. On the wall / panel, measure the exact place where you want to install the G100 and drill four holes that match the four mounting holes on both brackets.



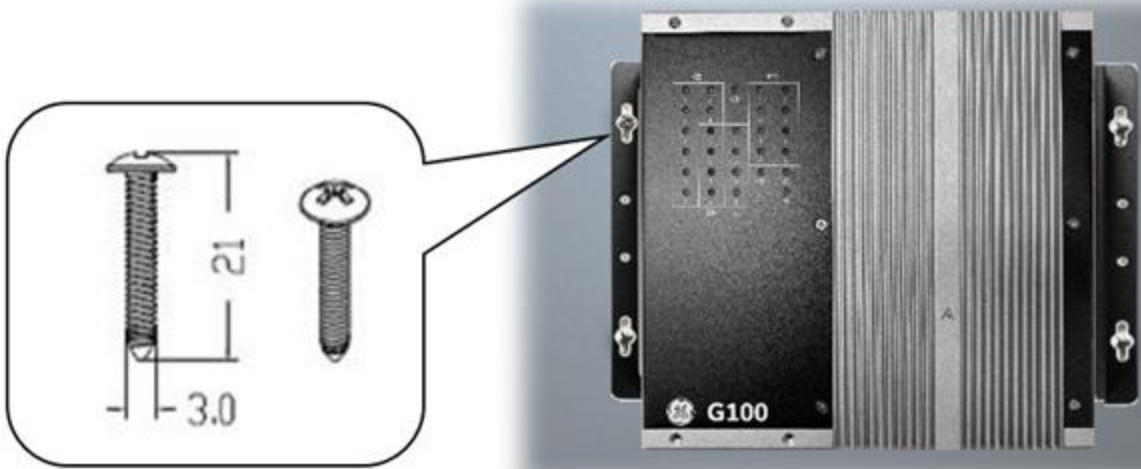
3. Insert four anchoring bolts into the holes, or suitable panel nuts that match your mounting screws.



4. Align the G100 brackets with the four bolts / nuts you just installed on the wall / panel.



5. Drive the mounting screws into the anchoring bolts / nuts to secure the G100.



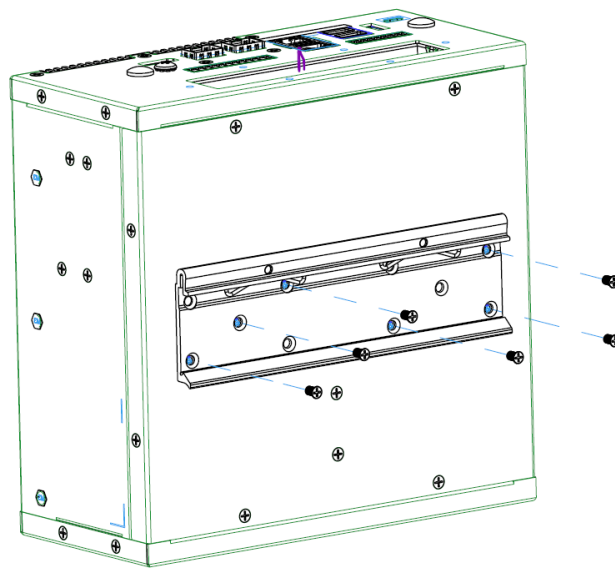
DIN Rail Mounting instructions

Please see following instructions to mount it.

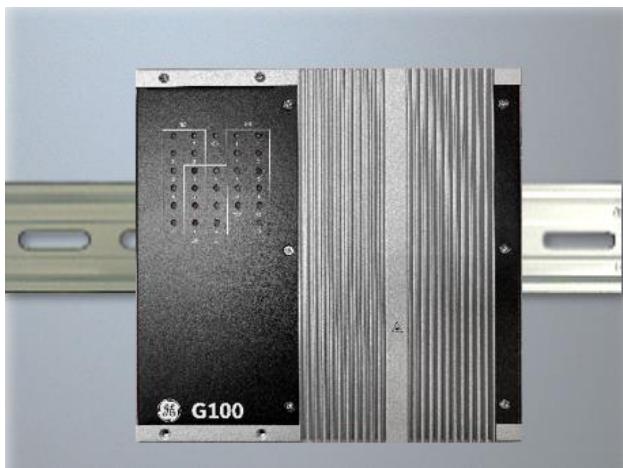
1. Mount the DIN rail as shown below.
 - a. Locate and retrieve the DIN rail bracket and mounting screws from the G100 carton.
 - b. Position the DIN rail bracket to the rear of the chassis, aligning the mounting holes in the rail to the chassis.
 - c. Install the 6 screws provided with the DIN rail bracket to secure the bracket to the chassis. The recommended torque setting for the 6/32 screws are 5.2 in-lb [0.59 Nm].



The top of the DIN rail bracket should be positioned to align with the top of the G100 chassis.



2. Position the G100 on a slight angle and slowly lower until the top of the DIN bracket on the G100 engages the DIN rail. Pull the G100 firmly downward and press flat against the wall/panel until the DIN rail bracket locks into position.



Installation of optional D.20 HDLC Card

The optional D.20 HDLC card can be ordered already installed with the unit at factory time, or can be installed later, as follows.

NOTICE

Before you open the G100 chassis to install the D.20 HDLC Card, read and follow the guidelines and instructions in [Electro Static Discharge - ESD](#).

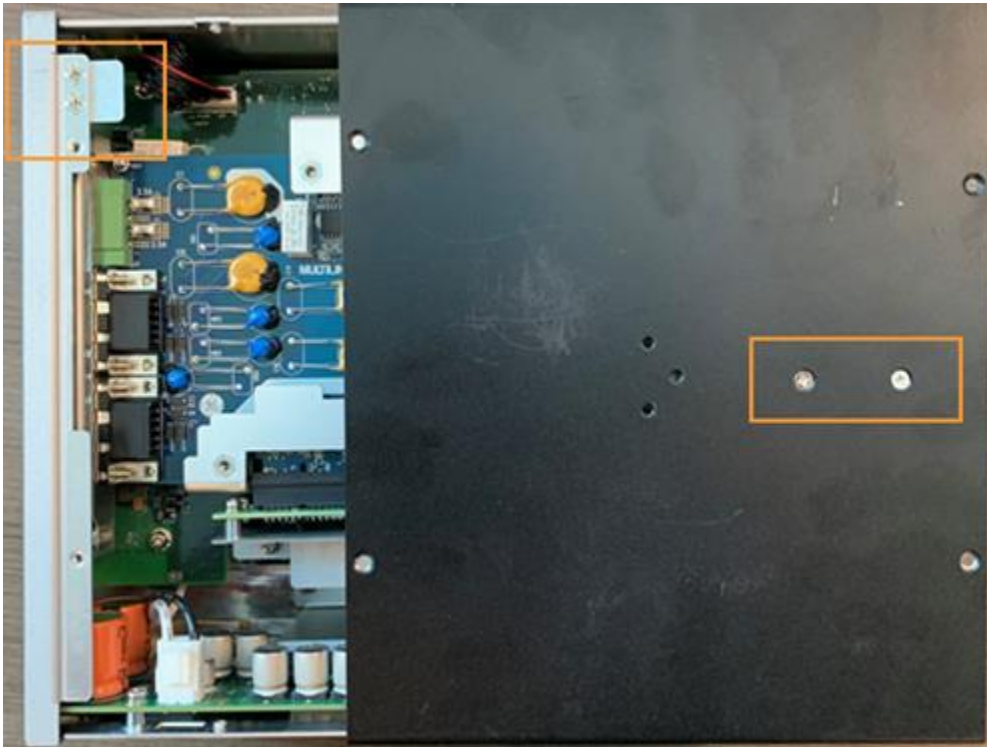
1. To install the D.20 HDLC card, flip over the system and loosen and remove the eight screws indicated below so that the chassis cover can be removed.



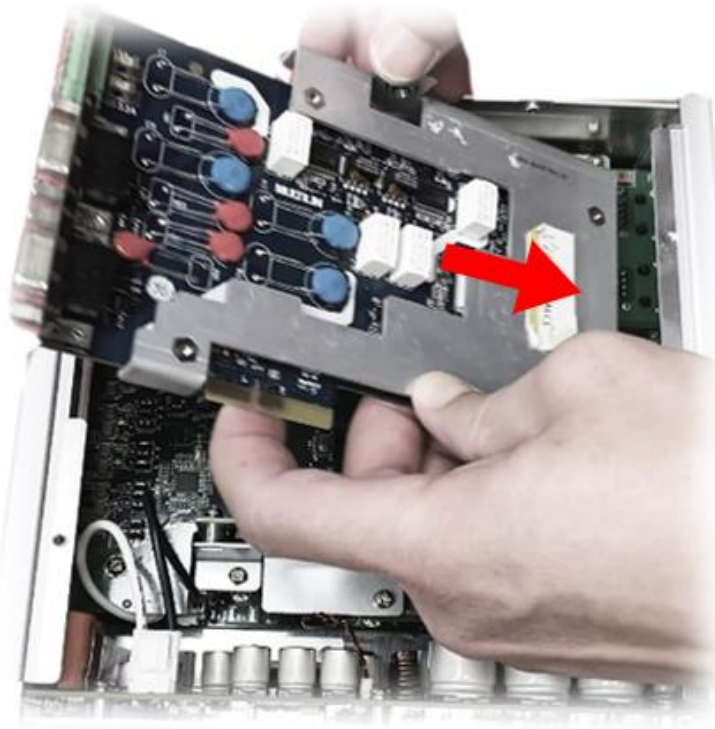
2. After taking the lid off, remove the metal sheet as shown in the picture.



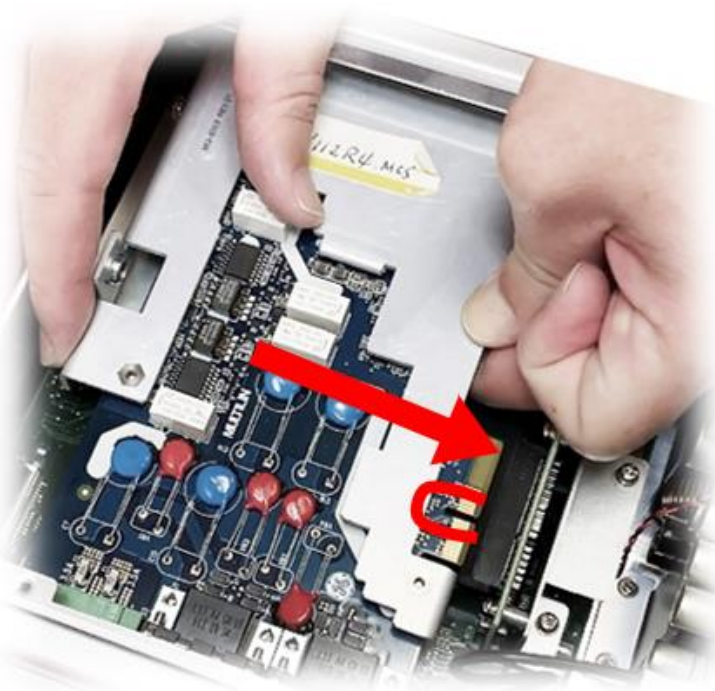
3. Remove the terminal block from the PCIe card before inserting it, so is possible to slide it in.



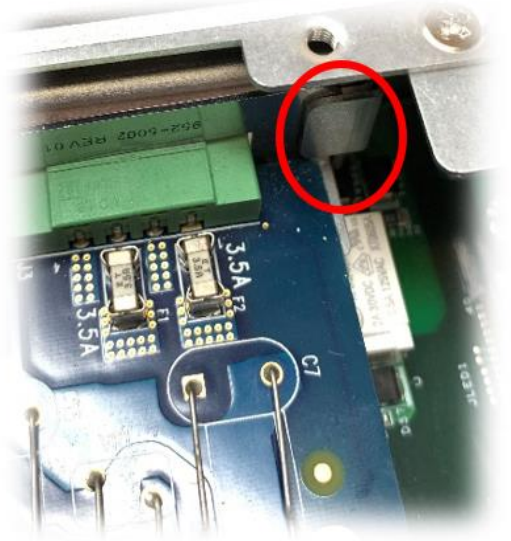
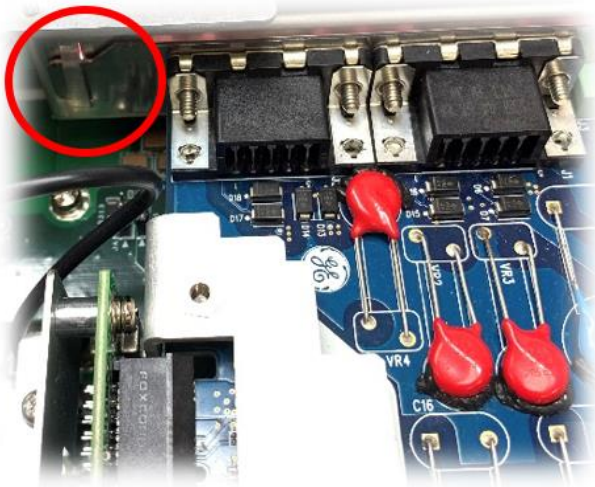
4. Place the card into the system as shown in the picture.



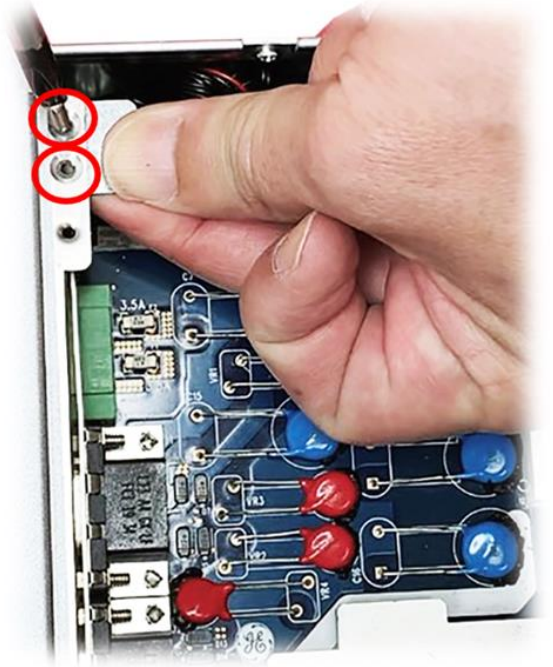
5. Align the notch of the module with the socket key in the slot and carefully insert the card into the slot.



6. Make sure the card slot has complete insert to these 2 metal sheets.



7. Connect the metal sheets with the system by securing the two screws.



8. Place the cover back to the system and secure it with eight screws removed in Step 1.



Grounding

It is required to connect the G100 chassis to cabinet ground, which then **MUST BE CONNECTED TO** Building Protective Earth (PE) ground using the ground connection screw located near the G100 power supply connector on the bottom side panel.

⚠ WARNING An improperly wired ground connection could place hazardous voltages on accessible metal parts.



Power Supply

The G100 is intended to be powered by a UL list DC power supply or DC power source, via one 2 Pin DC-IN connector located on the bottom side panel.

The power input is rated 12/24/48Vdc, 5/2.5/1.25A minimum, Tmax = 70 degree C, and the altitude of operation = 5000m.

The external DC power supply must be rated at minimum 60 W.

Make sure you connect the “+” and “-” wires according to the label adjacent to the connector.

Wires	The conductor size is from 16 AWG to 12 AWG and Strip Length is 7mm. After plugging cable lines into the mating connector, plug the mating connector to the product and secure the plug with the two screws.
Breaker circuit	A 20A IEC/USA/Canada breaker circuit is required as pre fuse.
Disconnect device	A readily accessible disconnect device shall be incorporated external to the unit.
Inrush current	The inrush current is typically 8A when powering up.
Reverse polarity protection	The product is equipped with built-in reverse polarity protection. If + and - are swapped the unit will not power-up and harm to neither the power supply nor the unit will occur.
Overcurrent protection	The overcurrent protection function interrupts an uncontrolled fault current or overcurrent before serious damage can occur, such as overheating of the equipment. The internal fuse is rated for 10A continuous current. If that current is exceeded by factor 10 the fuse will blow in between 1ms and 10ms. The fuse is placed in “+” connection of the power supply.

G100 System redundancy

G100 system redundancy is available starting with Firmware version 3.00.

A redundant G100 setup allows a secondary G100 to automatically take over operations from a paired G100 unit that has failed.

G100 redundancy requires two identical model and configuration G100 units and zero, one, or two RS232 switch panels when connecting to RS232 devices. RS232 switch panels are not required when connecting to RS-485 devices. For RS-485 redundant wiring approaches, refer to [RS-485 Serial Connections](#).

When using the G100 in redundant mode, and wiring the RS232 switch panel, you must ensure the switch panel cables connected to A and B units match the A and B designations in software.



The RS-232 switch panel and associated connected wiring is optional for Warm Standby, Hot Standby and Hot-Hot redundancy.



Starting with **MCP V4.00** release, **Warm-Standby** and **Hot-Standby** redundancy modes are no longer available and have been superseded by **Hot-Hot** redundancy mode. **Hot-Hot** redundancy mode has the same functionality as the superseded modes.

Using the redundancy configurations given in this section, a pair of LEDs on the RS232 switch panel marked CCU A and CCU B indicate which of the G100 unit is currently active. A toggle switch on the RS232 switch panel can be used to manually switch the G100 devices between active and standby states, if the switch panel is configured as Master.

MCP Redundancy Operation

Please refer to **SWM0101 MCP Software Configuration Guide**, section **MCP System Redundancy** for a detailed explanation of MCP redundant modes.

RS232 Switch Panel(s) may be installed for the purpose of switching serial communications to external devices from the active MCP device. The RS232 Switch Panel is either in state (position) A or B and cannot be physically in both states.

At runtime, with a correctly configured G100 redundant system: only one MCP device is in an "active" state, the other MCP device is considered to be in "standby" state. Even when configured as hot-hot redundancy - the "standby" state and designation still applies for all subsystems not running as hot-hot.

Active vs. Standby States

If RS232 Switch Panel is not installed, or if is installed and configured as Slave: the runtime active and standby states are given by mutual arbitration in software.

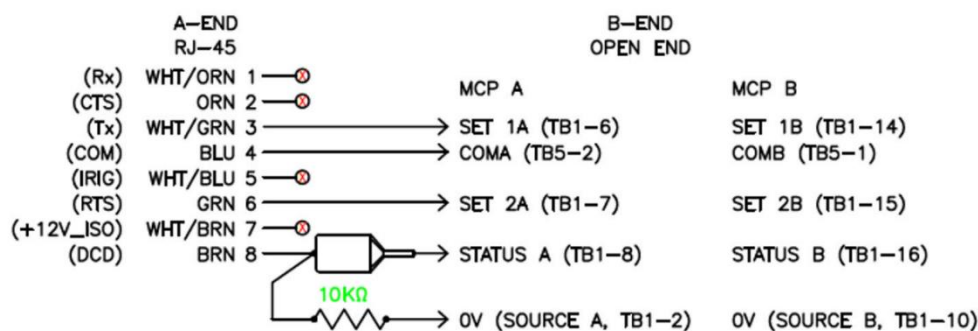
If RS232 Switch Panel is installed and configured as Master: the runtime active and standby states are given by the DCD signal (STATUS, BROWN wire) on the watchdog cable serial port. When DCD is positive voltage level - the device is in Active state.

There is no functional preference on which MCP device should be active; this is a function of what was the last negotiated value.

A vs B Designation

The runtime A and B designation in the MCP database is given by the configured A and B setting in the redundancy configuration regardless of RS232 Switch Panel being installed or not. This simplifies the RS232 Switch Panel connections, allows usage of the same watchdog cable for both devices A and B.

Pinout of watchdog cable 977-0568:



Note: This is the cable wiring and pinout. G100 does not provide "+12V_ISO" on pin 7.

Runtime behavior

MCP devices A and B communicate constantly with each other to confirm each one's state, using what we call a "heartbeat" signal. If this communication stops - it triggers the standby device to become active. This is why it is critical that Heart Beat Communication does not have a single point of failure in itself and is implemented using at least two separate mediums: **Serial PING** and LAN. If serial is not possible, then implement **LAN1** and **LAN2**.

Disconnecting **all** Heart Beat Communications while both MCP devices are healthy and powered on will result in either of:

1. One MCP will fail if RS232 Switch Panel is present and configured as Master.
 - In this case Human Intervention is required to restore the MCP redundancy after the Heart Beat Communications are restored.
2. Both MCP devices become active if RS232 Switch Panel is present and configured as Slave, with serial communications being questionable since the RS232 Switch Panel cannot switch and follow both units as active.
 - In this case MCP redundancy should recover itself after the Heart Beat Communications are restored, with the last active MCP before the interruption remaining active, and the RS232 Switch Panel switched towards the active MCP.
3. Both MCP devices become active if an RS232 Switch Panel is not present.
 - In this case MCP redundancy should recover itself after the Heart Beat Communications are restored, with the last active MCP before the interruption remaining active.

Notes:

After experiencing both MCP being in active state, and after correcting the Heart Beat communication defects, and if the D.20 IO is configured: it is required to power cycle both MCP devices to clear this state on the D.20 PCIe card.

In general, after recovering from any redundancy failures there should be comprehensive checks performed to ensure the active device is operating as required, D.20 IO (if configured) are online and the standby device shows online in the active device. And then same checks should be performed after a switchover, with the second device being active.

Switchover initiated in database

Switchover initiated in database is when both MCP devices operate as Active-Standby and there is a database initiated request to change the Active MCP device, e.g. using the Redundancy Manager DO point "Start Change Over".

In this case, the Active MCP sends to the Standby a request to become active, over the Heartbeat Communication channel(s).

This is followed by different actions, depending on the RS232 Switch Panel configuration - see next:

If an RS232 Switch Panel is configured as Master and installed:

The Standby MCP device asserts both TX (SET 1) and RTS (SET 2) signals on the serial port connected to the watchdog cable, for a duration of approximately 50 ms.

As a result, the RS232 Switch Panel will change positions (should occur within 25 ms and with a maximum timeout of 50 ms), resulting in a swap of the STATUS A and STATUS B signal levels. The Standby MCP device confirms this change by monitoring the DCD (STATUS) signal, de-asserts the TX (SET 1) and RTS (SET 2) signals and initiates the actions to run the applications as Active.

The RS232 Switch Panel transfers all serial field connections to the new Active MCP.

If the DCD (STATUS) signal did not change to reflect the new RS232 Switch Position even after the duration 50 ms - the Standby MCP will fail and will not become active.

If the Standby MCP confirms becoming active and communicates this to the former Active MCP which made the request - the former Active MCP will have its applications restart in standby mode or change the applications to standby mode, as a result of the agreements exchanged over the Heartbeat Communication channel(s).

The switchover is finalized.

If an RS232 Switch Panel is configured as Slave and installed:

The Standby MCP device acknowledge the request and initiates the actions to run the applications as Active, without checking the DCD (STATUS) signal.

Once the Standby MCP confirms becoming active and communicates this to the former Active MCP which made the request - the former Active MCP will have its applications restart in standby mode, as a result of the agreements exchanged over the Heartbeat Communication channel(s).

The Standby MCP device also asserts both TX (SET 1) and RTS (SET 2) signals on the serial port connected to the watchdog cable, for a duration of approximately 50 ms. As a result, the RS232 Switch Panel will change positions, resulting in a swap of the STATUS A and STATUS B signal levels. The Standby MCP device confirms this change by monitoring the DCD (STATUS) signal.

If the DCD (STATUS) signal did not change to reflect the new RS232 Switch Position even after the duration of 50 ms - the Standby MCP will log an error and continue to operate as Active now. The RS232 Switch Panel did not transfer the serial field connections to the new Active MCP.

If the Standby MCP confirms becoming active and communicates this to the former Active MCP which made the request - the former Active MCP will have its applications restart in standby mode or change the applications to standby mode, as a result of the agreements exchanged over the Heartbeat Communication channel(s).

The switchover is finalized.

If an RS232 Switch Panel is not present:

The Standby MCP device acknowledge the request and initiates the actions to run the applications as Active, without checking the DCD (STATUS) signal.

Once the Standby MCP confirms becoming active and communicates this to the former Active MCP which made the request - the former Active MCP will have its applications restart in standby mode or change the applications to standby mode, as a result of the agreements exchanged over the Heartbeat Communication channel(s).

The switchover is finalized.

Switchover initiated from RS232 Switch Panel

Switchover initiated from the button located on the RS232 Switch Panel applies only when an RS232 Switch Panel is configured as Master and installed.

In this case the DCD (STATUS) signal swaps the STATUS A and STATUS B signal levels as a result of the RS232 Switch Panel initiated action.

The Standby MCP device observes this change by monitoring the DCD (STATUS) signal and initiates the actions to run the applications as Active.

The Active MCP device observes this change by monitoring the DCD (STATUS) signal and initiates the actions to have its applications restart in Standby mode or change the applications to Standby mode.

The two MCP devices also confirm the switchover to each other over the Heartbeat Communication channel(s).

The RS232 Switch Panel transfers all serial field connections to the new Active MCP.

The switchover is finalized.

Failover event

A Failover event occurs when the Standby MCP can no longer communicate with the Active MCP. In this case, after exhausting the configured number of retries over the Heartbeat Communication channel(s) - the following actions occur, depending on the RS232 Switch Panel configuration:

If an RS232 Switch Panel is configured as Master and installed:

The Standby MCP device asserts both TX (SET 1) and RTS (SET 2) signals on the serial port connected to the watchdog cable, for a duration of approximately 50 ms.

As a result, the RS232 Switch Panel will change positions (should occur within 25 ms and with a maximum timeout of 50 ms), resulting in a swap of the STATUS A and STATUS B signal levels. The Standby MCP device confirms this change by monitoring the DCD (STATUS) signal, de-asserts the TX (SET 1) and RTS (SET 2) signals and initiates the actions to run the applications as Active.

The RS232 Switch Panel transfers all serial field connections to the new Active MCP.

If the DCD (STATUS) signal did not change to reflect the new RS232 Switch Position - the Standby MCP will fail and will not become active.

The failover is finalized.

If an RS232 Switch Panel is configured as Slave and installed:

The Standby MCP device initiates the actions to run the applications as Active, without checking the DCD (STATUS) signal.

The Standby MCP device also asserts both TX (SET 1) and RTS (SET 2) signals on the serial port connected to the watchdog cable, for a duration of approximately 50 ms. As a result, the RS232 Switch Panel will change positions, resulting in a swap of the STATUS A and STATUS B signal levels. The Standby MCP device confirms this change by monitoring the DCD (STATUS) signal.

The RS232 Switch Panel transfers all serial field connections to the new Active MCP.

If the DCD (STATUS) signal did not change to reflect the new RS232 Switch Position - the Standby MCP will log an error and continue to operate as Active now. The RS232 Switch Panel did not transfer the serial field connections to the new Active MCP.

The failover is finalized.

If an RS232 Switch Panel is not present:

The Standby MCP device initiates the actions to run the applications as Active, without checking the DCD (STATUS) signal.

The failover is finalized.

G100 Required components

To implement a redundant G100 system, you need the following components:

Component	Function	GE Vernova part number
RS232 Switch Panel	Communications switch.	517-0247
Power Supply	Power supply to power the RS232 switch panel. Input: 85 – 264 VAC or 90 – 350 VDC.	580-0046
G100 RJ45 to RS232 Serial Cable	Connects the G100 to the RS232 switch panel which is then connected to external field devices.	977-0556/LLL
Watchdog Cable Assembly	Connects G100 A to the RS232 switch panel.	977-0568/LLL
	Connects G100 B to the RS232 switch panel.	977-0568/LLL
Ping Cable Assembly	Links both G100 units to facilitate a heartbeat message that determines the status of the active unit.	977-0559/LLL
G100 A/B RS232 Switch panel Jumper (P1/P9)	Connects the isolates common of serial port to the signal used in switch panel so G100 (A or B) can make itself the active unit.	977-0562
Power Cable	Connects the RS232 switch panel to an external power supply.	970-0161
Ground Cable	Provides a ground connection for the RS232 switch panel.	970-0182

(/LLL) is length of the cable in inches, i.e., 36 inches is /036.



The serial ports on the G100 are galvanically isolated from each other, however, when the RS232 switch panel is used, the serial common of all ports are tied together. CCU A ports are tied together, CCU B ports are tied together, CCU A and CCU B remain separate.



Pins 4 on switch panel connectors J2 through J9 are tied together and to the panel's power supply. Any loading from field devices on these pins, loads the RS232 panel power supply and should be taken into consideration when sizing power supplies.



The watchdog (control) must be configured to be the same port number on both G100A and G100B.



The G100 heartbeat (ping) port is software configurable, but must be configured to the same port number on both G100A and G100B.



For serial heartbeat interconnection of 2 redundant G100, a half crossed Ethernet cable can be used, in either RS-232 or RS-485-4W modes. RS-485-2W mode is not allowed.



The assignment of G100A and G100B must be done in Settings.

To set up a redundant system:

It is recommended that you install and configure one standalone G100 unit to ensure that your configuration is valid and that device communications are operating properly. Once this is done, proceed with the installation of the redundant system as shown in [Figure 4: Redundancy Wiring - Single RS232 Switch Panel](#).

1. Mount the G100 units in a rack and connect power and ground.
2. Mount the RS232 switch panel.
3. Plug the connector of watchdog cable A (GE Vernova part number 977-0568/LLL) to the watchdog (control) serial port RJ45 connector on the first G100 (CCU A).
4. Plug the connector of watchdog cable B (GE Vernova part number 977-0568/LLL) to the watchdog (control) serial port RJ45 connector on the second G100 (CCU B). This cable must be connected to the same watchdog (control) serial port number on both G100 units.
5. Connect the bare leads of both watchdog cables to TB1 on the RS232 switch panel as shown in [Figure 4: Redundancy Wiring - Single RS232 Switch Panel](#).
6. Connect one end of the ping cable to the first G100 and the other end to the second G100. This ping cable must be connected to the same serial port number on both units.
7. Use a G100 RJ45 to RS232 Serial Cable (977-0556/LLL) to connect the G100 serial communication ports to the serial ports on the RS232 switch panel. P2 through P8 are connected to the first G100, P10 through P16 are connected to the second G100. Connections from the switch panel to both G100 units should be made in the same order. For example, if P2 is connected to port 3 on the first G100, P10 should also be connected to port 3 on the second G100.
8. Use a two RS232 DB9F SWITCH JUMPER A/B 977-0562 installed on P1 and P8 to connect the switched CCU ground for control and detection to the Currently active CCU.
9. Connect field devices to J2 through J8 on the RS232 switch panel.

RS232 switch panel

The RS232 switch panel has two sets of indicator LEDs:

- PWR A/PWR B: When lit, power and communications are received from the connected units. Normally, both LEDs are lit.
- CCU A/CCU B: Normally, one LED is lit, indicating which unit is active.

The active/standby switch on the front of the RS232 switch panel is used to:

- Restore a previously failed unit to active status once it has been repaired.
- Manually force a unit to active status so that routine maintenance can be performed on the other unit.

To manually operate the RS232 switch as Master:

1. Pull the active/standby switch straight out to release it from the locked position.
2. Switch it up to make unit A active or down to make unit B active.

The CCU A/CCU B LED indicator indicates which unit has been activated.

Redundancy wiring diagrams

The following diagrams illustrate how to wire the G100 units and RS232 switch panels to enable system redundancy:

- Redundancy Wiring - Single RS232 Switch Panel see Figure 4: Redundancy Wiring - Single RS232 Switch Panel.
- Redundancy Wiring - Redundant RS232 Switch Panel. The wiring drawing is provided in two parts: left and right.
 - For the left side of the drawing, see Figure 5: Redundancy Wiring - Redundant RS232 Switch Panel (1 of 2).
 - For the right side of the drawing, see Figure 6: Redundancy Wiring - Redundant RS232 Switch Panel (2 of 2).

This configuration is used to provide RS232 panel redundancy for up to 7 serial connections.

Figure 4: Redundancy Wiring - Single RS232 Switch Panel

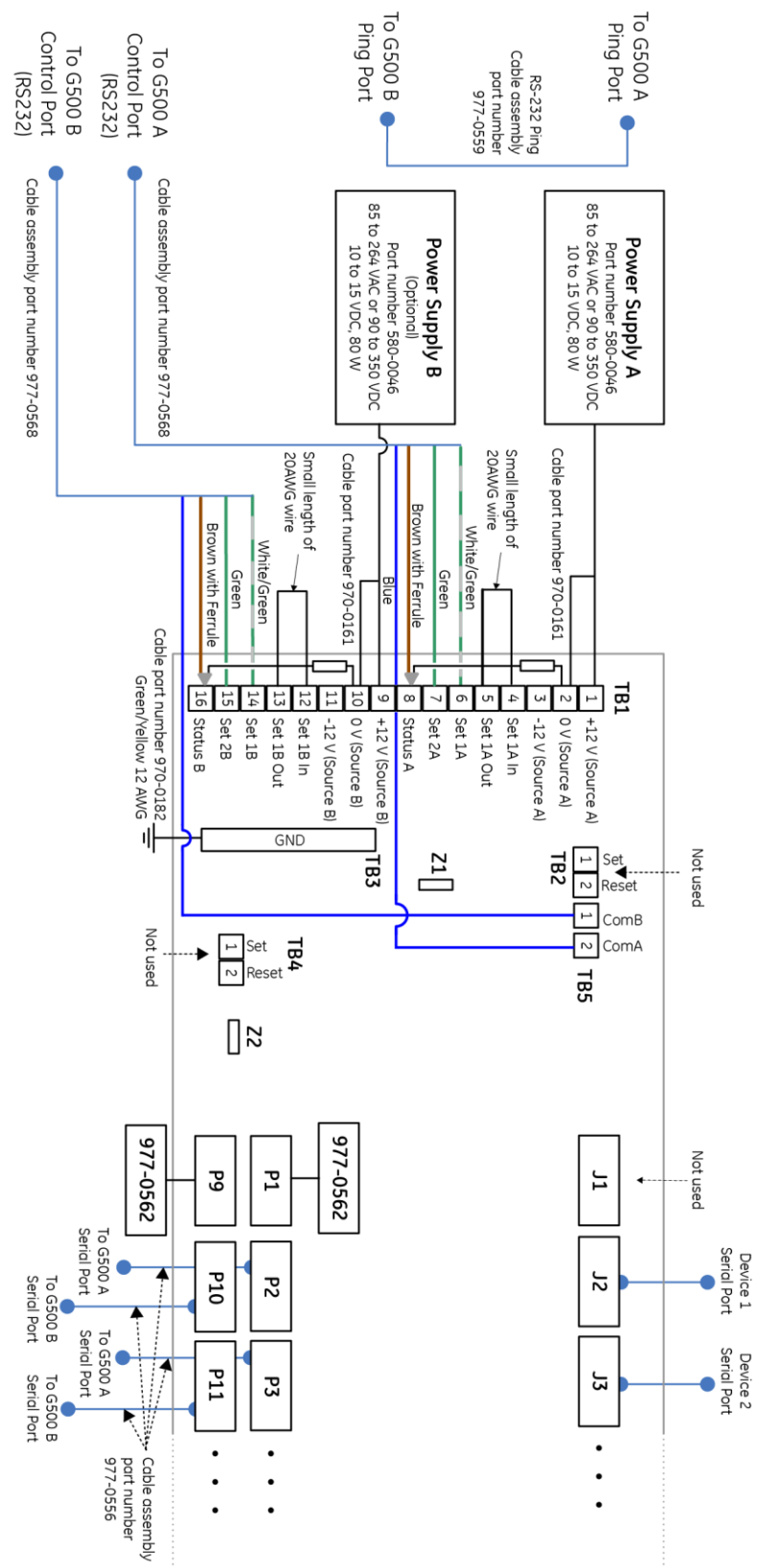


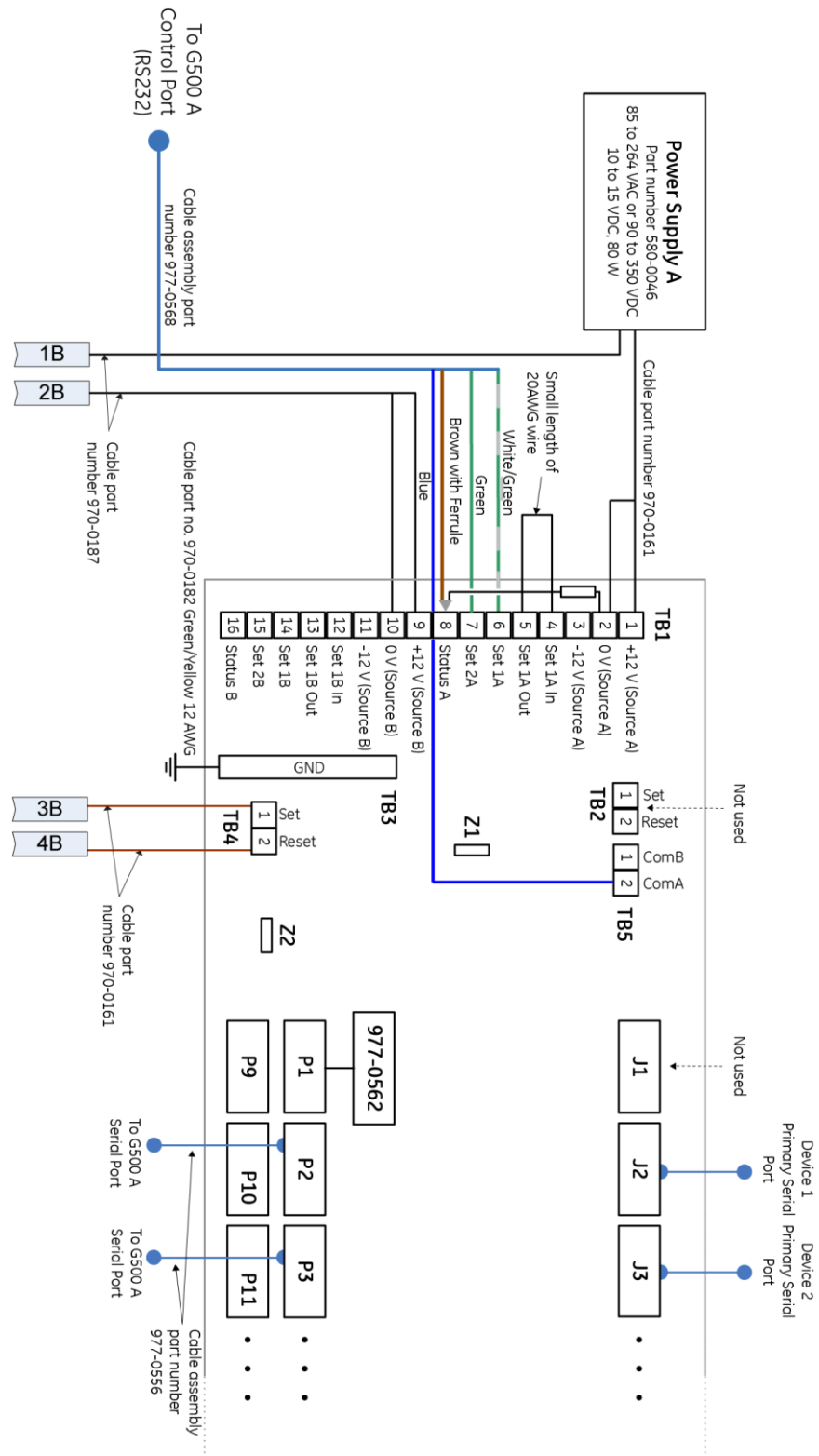
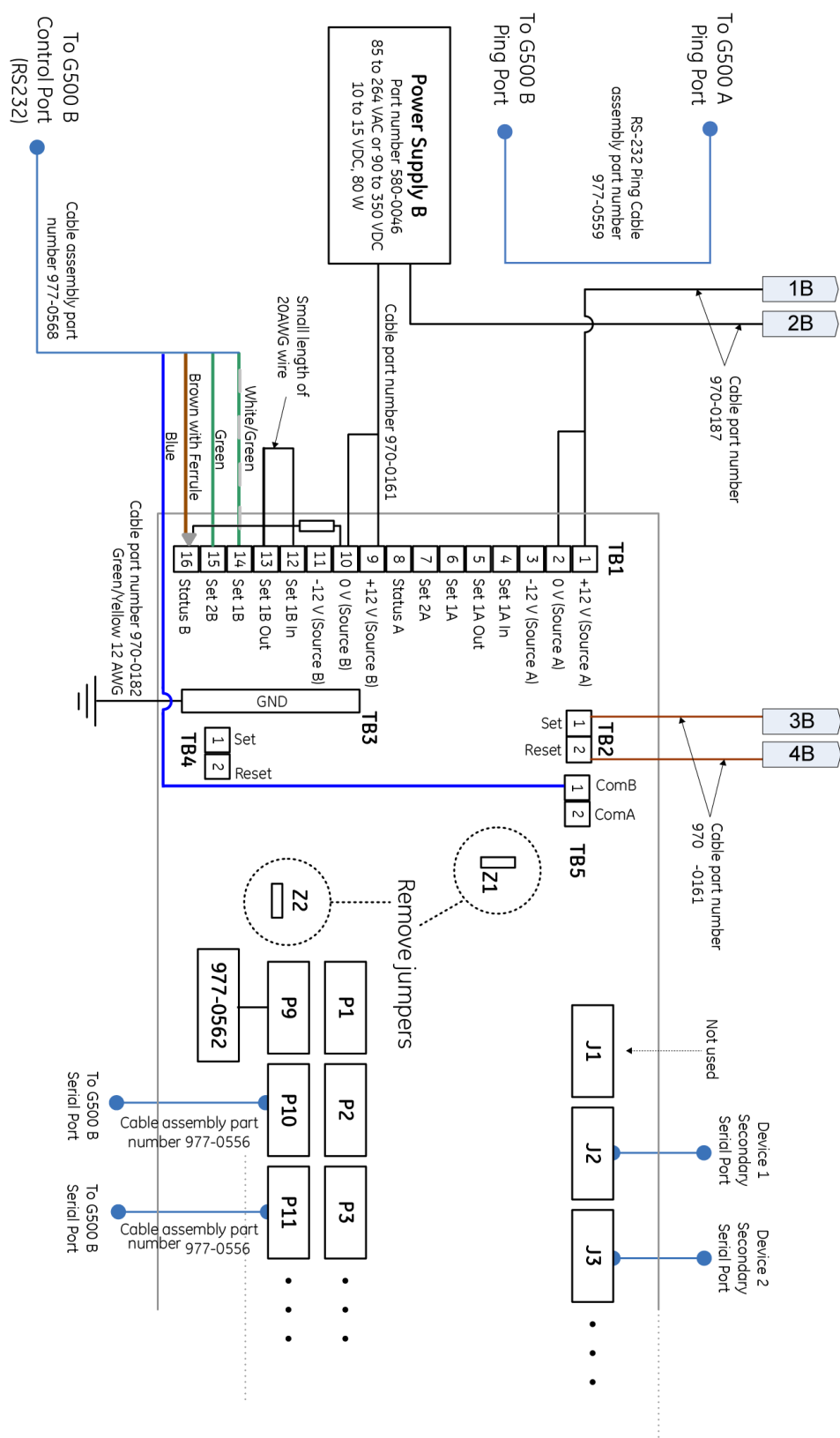
Figure 5: Redundancy Wiring - Redundant RS232 Switch Panel (1 of 2)

Figure 6: Redundancy Wiring - Redundant RS232 Switch Panel (2 of 2)

Power-On Self-Test (POST)

Each time the G100 boots up it must pass the POST (Power-On Self-Test).

If the G100 does not pass POST, the board will fail the POST and “beep” in a specific pattern. Please contact GE Vernova Grid Solution support in this case.

To interrupt the POST process from a KVM connected directly to the **G100** and to boot from an already inserted USB drive - press F7 repeatedly immediately after power on.

To interrupt the POST process from a KVM connected directly to the **G100** and to access UEFI settings - press <TAB> or key repeatedly immediately after power on.

Is not possible to directly access the BOOT menu when using the Serial Maintenance port (i.e., equivalent to KVM and F7); use instead the UEFI options (see latest version of “TN0116 MCP Firmware Upgrade and Restore to Defaults Workflows”).

To interrupt the POST process from the Serial Maintenance port connected directly to the **G100** and to access UEFI settings – after power on wait (typically 10 seconds) for the message below:

Press <Tab> or to enter setup.

And press <TAB> or **within 4 seconds** when the message shows on the terminal console (the setup prompt timeout in UEFI/Boot is set by default to 5 seconds).

NOTICE POST messages are shown only on the Video Output (DP) port.

The message to interrupt POST is not shown on the Serial Maintenance port while a monitor is connected to the DP port.

Refer to section “[Default Serial Maintenance port \(port 4, RS232\)](#)” on page 80 for additional information on the serial maintenance port.



First time after a firmware upgrade - full completion of the POST may take up to 15 minutes. This is why is recommended to perform this process via KVM, or – if the serial maintenance port was used for the firmware upgrade – to connect a monitor to the DP port **after** the user interactive workflow to upgrade the firmware is finished.

Full completion of the POST may take up to 5 minutes after a first boot.

Super Capacitor and Real Time Clock (RTC)

The G100 does not include a battery. Instead, the G100 contains one super capacitor, powering the real-time clock (RTC). This super capacitor will power the RTC for at least 5 days with no connection to power.

After this super capacitor discharges, the **RTC** time will be reset **internally** to an invalid time (e.g. 12:00 AM, 01-10-2000), and will be later updated to the correct time after the system will be powered on again and time synchronized again.

When the system is subsequently powered up, the system time will be initialized to the RTC time if the super capacitor was not discharged. If the super capacitor was discharged, the system time will be initialized to the last time when the system was still powered on.

Chapter 4 - Interfaces and Indicators

This chapter covers the interfaces of the G100 Substation Gateway.

UEFI Settings

Please refer to the document *Configuring UEFI Settings on G100 User Guide (SWM0122)* for details.

G100 device has the following UEFI settings.

These UEFI settings are applicable only while the G100 is starting.

After the applications started, these settings are over-written by the values configured in *MCP Local Configuration Utility (mcpcfg)* or *MCP Settings GUI*.

- Default Serial Maintenance Port used as UEFI (boot) console when KVM is not available (Advanced->Serial Port Console Redirection)
 - Console Redirection is set to Disabled for COM1-COM3, please do not change these settings.
 - Console Redirection for COM4 should be enabled/disabled and have the “Bits per second”, to be same as in *the Serial Maintenance Port in MCP Studio (See MCP Software Configuration Guide SWM0101 > Serial Maintenance Port)*.
- Default Serial Ports Modes (Advanced->Super IO Configuration)
 - Please ensure are enabled/disabled as required for secure hardening purposes and set to RS-232.

General Purpose IO (GPIO)

G100 is equipped with an internal General Purpose Input/Output (GPIO) interface.

The available GPIO signal types are as follows.

Binary Inputs (DI): 8

All DI are wetted internally from main power supply circuit using single common for all 8 channels.

Each DI channel can be triggered by N.O. potential free external contacts, with the wetted positive voltage being switched through the external contacts.

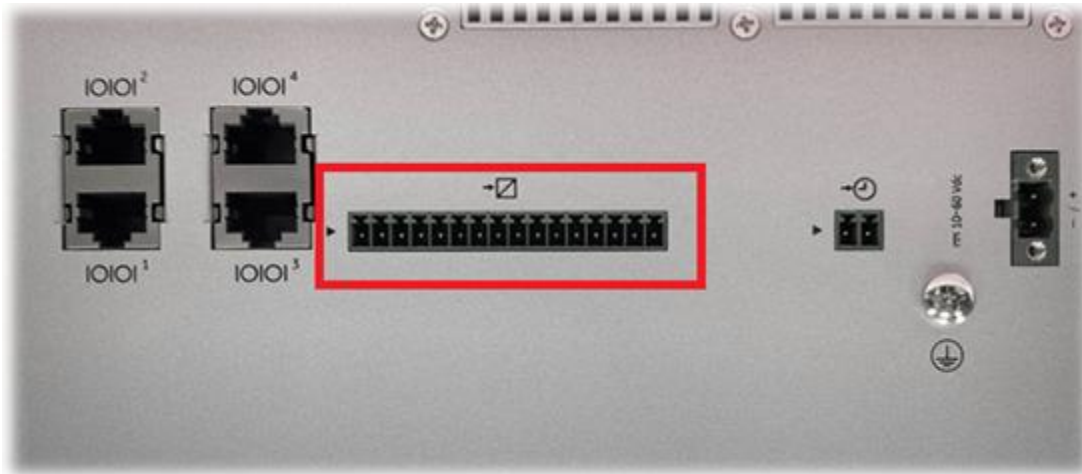


NOTE

The DI wetting voltage is protected internally by the main fuse.

The DI voltage supply is the same as the G100 Power Supply: 12/24/48 VDC, with each DI channel consuming typically 5mA.

DI wiring is via a pluggable connector, pitch 3.5mm x 16 pins, located on the bottom side panel:

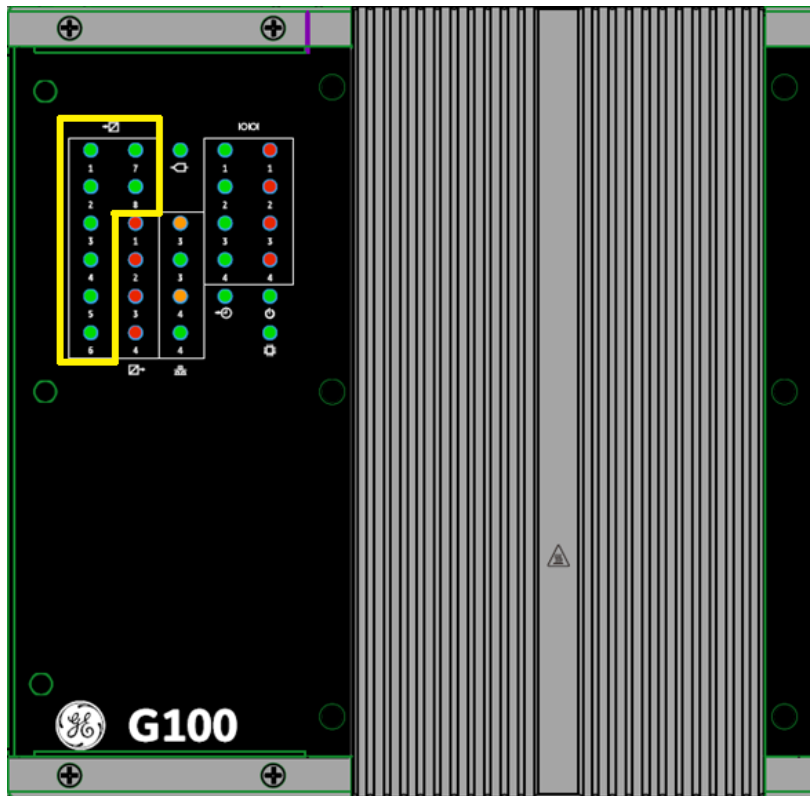


The small arrow on the left indicates PIN 1.

Table 5: GPIO DI connector pin assignments

PIN NO.	DESCRIPTION
1 (arrow)	DI_1
2	DI_COM (+)
3	DI_2
4	DI_COM (+)
5	DI_3
6	DI_COM (+)
7	DI_4
8	DI_COM (+)
9	DI_5
10	DI_COM (+)
11	DI_6
12	DI_COM (+)
13	DI_7
14	DI_COM (+)
15	DI_8
16	DI_COM (+)

Each DI channel is indicated as “input active” (ON) at runtime via a numbered LED located on the front side of the G100:



Binary Outputs (DO): 4

Each DO channel is isolated and independent, and provides a N.O. (Normal Open) dry relay single contact, rated at 10 – 60 VDC / 1A (Max.).



The DO channels are not fused internally.

DO wiring is via a pluggable connector, pitch 3.5mm x 8 pins, located on the top side panel:

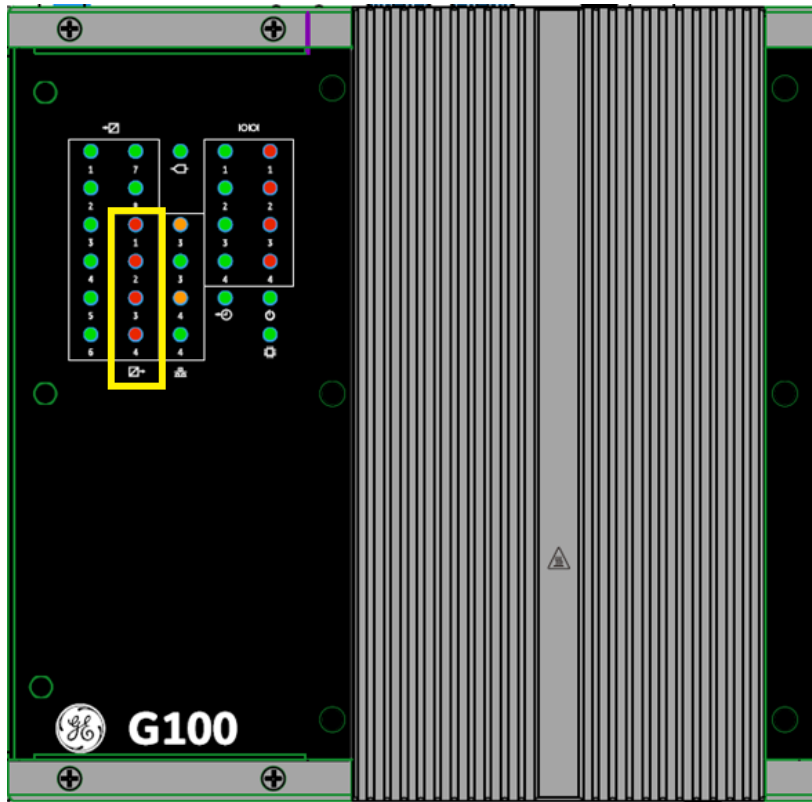


The small arrow on the left indicates PIN 1.

Table 6: GPIO DO connector pin assignments

PIN NO.	DESCRIPTION
1 (arrow)	RELAY1_NO1
2	RELAY1_COM1
3	RELAY2_NO1
4	RELAY2_COM1
5	RELAY3_NO1
6	RELAY3_COM1
7	RELAY4_NO1
8	RELAY4_COM1

Each DO channel is indicated as “active” (ON) at runtime via a numbered LED located on the front side of the G100:



The DO operation types are PULSE, LATCH_ON and LATCH_OFF.

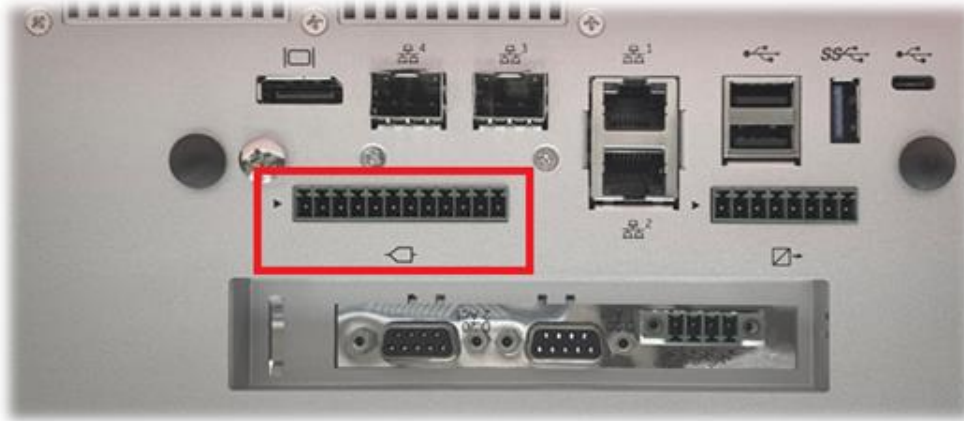
At runtime, commands received as CLOSE/ON are translated to LATCH_ON, and commands received as TRIP/OFF are translated to LATCH_OFF. The PULSE command types are executed as PULSE, according to their associated count and duration parameters.

Analog DC Inputs (AI): 4

Each AI channel is configurable via internal jumpers as Full Scale either +5 VDC (Default setting) or 20 mA.

The resolution is 12-bit plus sign, self-calibrating.

AI wiring is via a pluggable connector, pitch 3.5mm x 12 pins, located on the top side panel:



The small arrow on the left indicates PIN 1.

Table 7: GPIO AI connector pin assignments

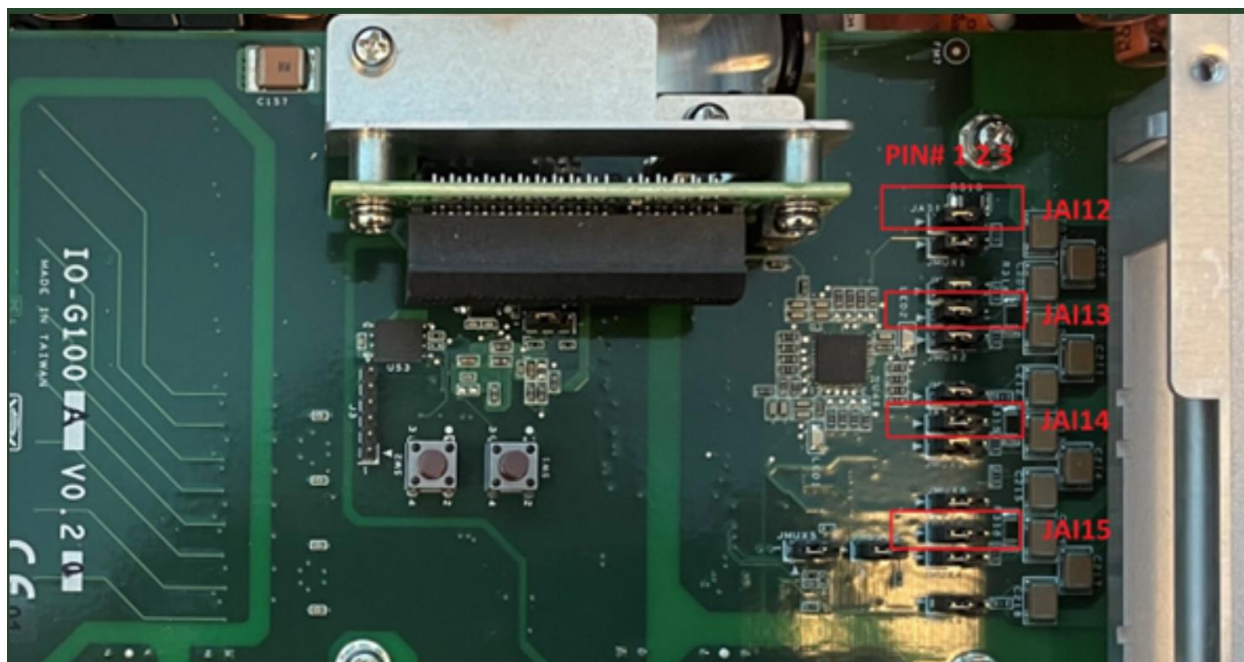
PIN NO.	DESCRIPTION
1 (arrow)	A_VIN0+/IIN0 +
2	A_VIN0 -
3	AGND_ISO_CHS
4	A_VIN1+/IIN1 +
5	A_VIN1 -
6	AGND_ISO_CHS
7	A_VIN2+/IIN2 +
8	A_VIN2 -
9	AGND_ISO_CHS
10	A_VIN3+/IIN3 +
11	A_VIN3 -
12	AGND_ISO_CHS



In the pin description, “_CHS” is the shield connection for each AI channel (all CHS are common wired internally).

The jumpers for Voltage or Current input selection JAI12~JAI15 are located on the GPIO internal board and their settings are as follows:

Jumper JAI12~JAI15	
1-2 (Default)	Voltage
2-3	Current



If the G100 Unit is already equipped with D.20 HDLC card, you will need to uninstall the card temporarily before you can change the AI jumper settings and install back the card after the change is done. Refer to the chapter of "Installing the G100" for more details on the installation of optional D.20 HDLC Card.

Table 8: GPIO AI Voltage / Current selection jumper

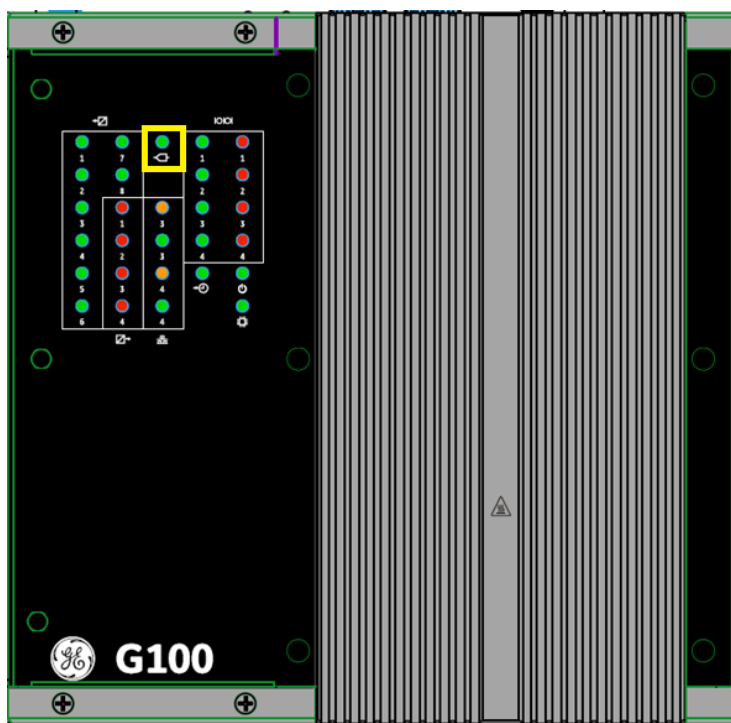
Jumper JAI12	DESCRIPTION
1-2 (Default)	V_IN_CH_1
2-3	I_IN_CH_1

Jumper JAI13	DESCRIPTION
1-2 (Default)	V_IN_CH_2
2-3	I_IN_CH_2

Jumper JAI14	DESCRIPTION
1-2 (Default)	V_IN_CH_3
2-3	I_IN_CH_3

Jumper JAI15	DESCRIPTION
1-2 (Default)	V_IN_CH_4
2-3	I_IN_CH_4

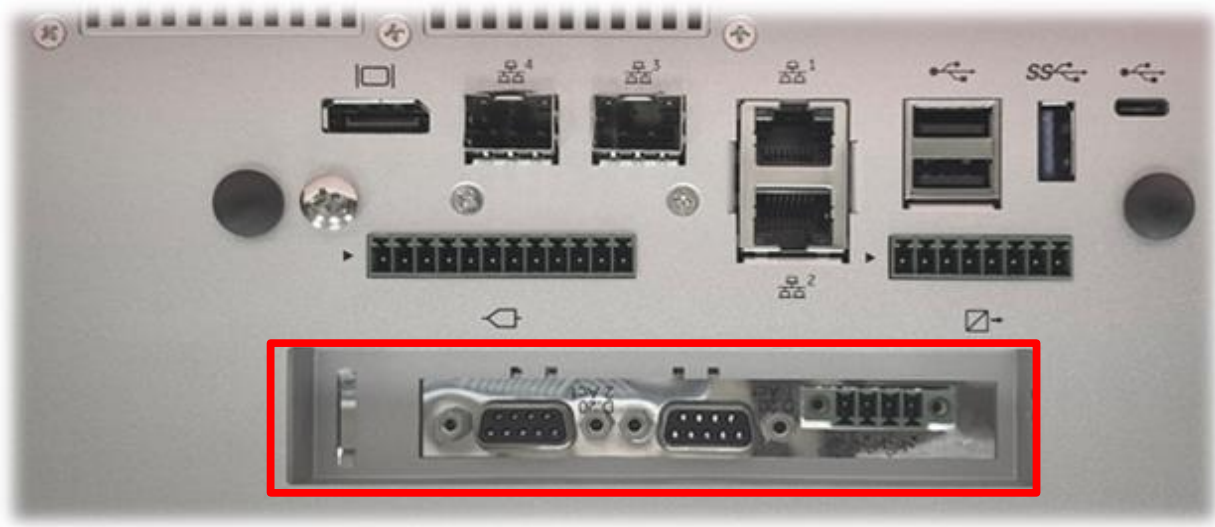
AI sampling is indicated at runtime via one LED (for all AI channels) located on the front side of the G100:



D.20 Link Connections

G100 is able to communicate with D20 peripheral modules.

To communicate with D20 peripheral I/O modules the G100 requires the installation and configuration of the optional D.20 HDLC PCIe card.



D.20 Communications between the D.20 HDLC PCIe card and the D20 peripheral I/O modules are carried over a proprietary high-speed, high-level data link control (HDLC) protocol called the D.20 Link.

The D.20 HDLC PCIe card supports two D.20 Link communications ports. The G100 system can be ordered from the factory with the D.20 HDLC PCIe card pre-installed using the Product configurator through the Online Store or can be installed in the field by ordering the D.20 HDLC PCIe card as an accessory from the MCP Substation Gateway Spare Parts and following the [Installation of optional D.20 HDLC Card](#) on page 35.

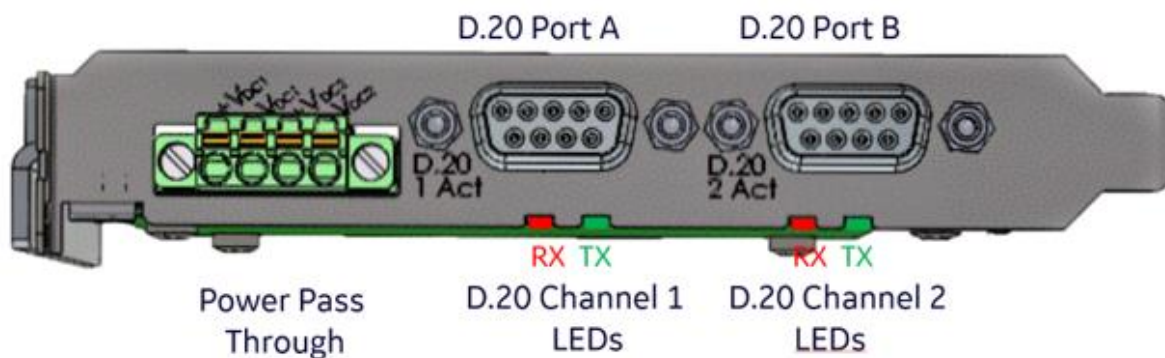


G100 is limited by performance to communicate with up to **60** D.20 peripheral I/O modules.

Please consider the G500 product for more D20 peripheral I/O modules (up to the maximum of 120).

G100 D.20 HDLC PCIe card

The D.20 HDLC PCIe card is equipped with a Power Pass Through connector, two D.20 ports and four LEDs.



The Power Pass Through connector allows the D.20 peripheral connected to the D.20 Link to be powered through the D.20 port. The Power Pass Through requires one or two external power supplies to be connected. Refer to “Supplying power through the D.20 Link” on page 29 section for further details.

Two sets of LEDs are present on the D.20 HDLC PCIe card to indicate activity status. The first set of LEDs, on the left labeled D.20 1 Act, shows the transmit and receive activity on D.20 Channel 1 and the second set to show activity on D.20 Channel 2 on the right labeled D.20 2 Act. The receive LEDs will flash red and the transmit LEDs will flash green.

The D.20 HDLC PCIe card has two D.20 ports. Each port contains D.20 Channel 1, D.20 Channel 2, DC Supply 1, and DC Supply 2. For D.20 port A, the above signals are always available. For D.20 port B, D.20 Channel 1 and D.20 Channel 2 are configurable but DC Supply 1 and DC Supply 2 are always available. Refer to Table 9: D.20 Port A and B pin out and configuration options and Table 10: Default D.20 Relay settings. D.20 Port B settings are software controlled and are accessible through the Settings GUI on your G100. Refer to GE Vernova part number SWM0101 for further details on configuration.

Table 9: D.20 Port A and B pin out and configuration options

Pin Number	D.20 port A	D.20 Port B	
1	No Connection	No Connection	
2	D.20 Channel 1 TX/RX +	D.20 Channel 2 TX/RX +	OPEN
3	D.20 Channel 1 TX/RX -	D.20 Channel 2 TX/RX -	OPEN
4	VDC1 +	VDC1 +	
5	VDC1 -	VDC1 -	
6	D.20 Channel 2 TX/RX +	D.20 Channel 1 TX/RX +	OPEN
7	D.20 Channel 2 TX/RX -	D.20 Channel 1 TX/RX -	OPEN
8	VDC2 +	VDC2 +	
9	VDC2 -	VDC2 -	

End of link termination is required at each end of the D.20 Link and is critical for proper operation. The D.20 HDLC PCIe card has two relays which control the End of Link termination, one for each D.20 Channel. Refer to Table 10: Default D.20 Relay settings. End of Link termination settings are software controlled and are accessible through the Settings GUI on your G100. Refer to GE Vernova part number SWM0101 for further details on configuration.

Table 10: Default D.20 Relay settings

D.20 Relay setting	Default
End of Link termination on channel 1	Enabled
End of Link termination on channel 2	Enabled
D.20 channel 1 to D.20 port B connection	Disabled
D.20 channel 2 to D.20 port B connection	Disabled

Supplying power through the D.20 Link

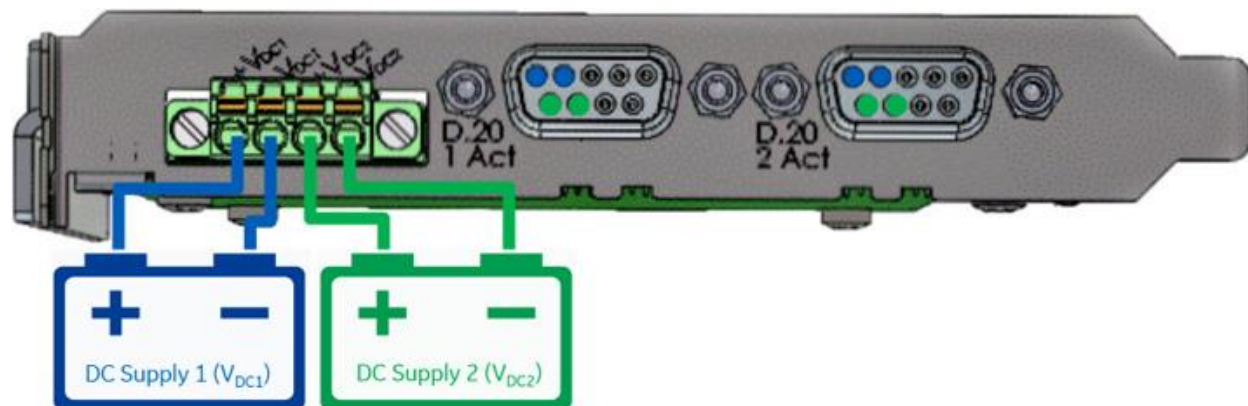
Power is typically supplied to peripheral devices directly through the WESTERM boards or inject power into the D.20 link using the D.20 DC Interface module (520-0154). However, with the D.20 HDLC PCIe card the Power Pass Through connections can be utilized to inject power into the D.20 link to supply power to peripheral devices through the D.20 ports.

One or two independent power supplies can be connected to DC Supply 1 (VDC1) and DC Supply 2 (VDC2). DC Supply 1 (VDC1) is connected through to pins 4 and 5 on both D.20 ports (DB9 connector), respectively DC Supply 2 (VDC2) is connected to pins 8 and 9.

The DC supply load on the D.20 port by the peripheral link must not to exceed 2.5A and 20 -60 VDC



The Power Pass Through connections are protected to 2.5A



The mating connector is the 4-pin "Phoenix 1827729". This connector type is required for IP30 compliance.

D.20 Link feature

The D.20 Link has the following features:

- D.20 frame using HDLC protocol format with Manchester encoding.
- RS-485 typical cable is p/n 977-0089, half duplex at 250 kbps, 24 AWG twisted pair, for applications up to 330 meters, and maximum 32 devices in total:
 - one single G100 counts as one device,
 - redundant G100 count as two devices,
 - each I/O Peripheral module counts as one device.
- Repeater/extension modules may be used to extend this limit to a maximum of 60 peripheral I/O modules, considering the RS-485 serial link limits listed above.
 - Multi-Mode Glass Fiber (GFO), up to 2 km (each GFO counts as one device in the RS-485 serial link)
- Each set of RS-485 D.20 Link wiring must be terminated at both ends (the termination does not count as a device)

D.20 Communications Interface

Use the D.20 Communication Interface module (520-0117) when you require one-to-one communication links with peripherals.

D.20 Termination

Use the D.20 Termination (977-0049) when you need to terminate the RS-485 serial links outside of the G100.

D.20 Fiber Optic Splitter

Use the D.20 Fiber Optic Splitter (520-0118) when you require one-to-four communication links with peripherals, especially if peripherals are clustered in different areas of the substation.

GFO adapters

Glass Fiber Optic (GFO, 520-0148) adapters are used to provide glass fiber optical cable extensions to the D.20 Link. These allow interference free links to peripherals that are sited at a remote distance from the main D20 installation.

D.20 DC interface

When power requirements for multiple peripherals exceed the basic system limitations, or when necessary to power peripherals connected via GFO use the D.20 DC Interface module (520-0154).

D.20 Peripheral Types

D.20 Peripheral I/O modules are intelligent modules containing an on-board microprocessor. They are configured as slaves to the G100. In this way, specific I/O processing is distributed throughout the to the appropriate I/O module.

There are four types of I/O peripherals supported by the D.20 HDLC PCIe:

- D20A analog input
- D20S digital inputs
- D20K digital output
- D20C combination input/output

Optional high-voltage peripherals are also available.

Redundant D.20 communication channels are available on all peripherals. To utilize this function redundant D.20 LAN cards are required to be installed on the D.20 Peripheral I/O modules. D.20 A, S and K Peripheral I/O modules require 540-0207 and D.20 C requires 540-0209.

The D.20 HDLC PCIe card is only compatible with CCU BASE and PCOMMON v3.00 or higher.



Refer to Peripheral Compatibility with the D.20 HDLC PCIe card section in this manual for complete list of D.20 Peripheral I/O compatibility.

For further information on I/O peripherals, see the D20/D200 Installation and Operations Guide (refer to GE Vernova part number 994-0078); see section: Connections and Configuration.

Peripheral compatibility with the D.20 HDLC PCIe card

Use the tables in this section to check compatibility with existing D.20 Peripheral I/O modules and devices.

Table 11: D20A Analog Input Module Compatibility

Component	GE Vernova Item #	Description	Compatible release	Date of release
WESDAC	511-0101	WESDAC D20A TYPE 1 VERSION 1	REL 21-higher	April 1998
WESDAC	511-0102	WESDAC D20AHV	All	
WESDAC	511-0103	WESDAC D20AHV2	All	
WESTERM	517-0163	WESTERM D20A TYPE 1 VERSION 1	All	
	517-0178	WESTERM D20 AD	All	
Redundant D.20 LAN	540-0207	WESDAC D20 ASK D.20 I/F	All	
PCOMMON	306	PCOMMON v3.06	All	
	305	PCOMMON v3.05	All	
	301	PCOMMON v3.01	All	
	300	PCOMMON v3.00	All	

Table 12: D20S Status Input Module Compatibility

Component	GE Vernova Item #	Description	Compatible release	Date of release
WESDAC	507-0101	WESDAC D20S TY1 VER 1	REL 18-higher	March 1998
WESDAC	507-0103	WESDAC D20SHV2	All	
WESTERM	517-0165	WESTERM D20S TYPE 1 VERSION 1	All	
Redundant D.20 LAN	540-0207	WESDAC D20 ASK D.20 I/F	All	
PCOMMON	306	PCOMMON v3.06	All	
	305	PCOMMON v3.05	All	
	301	PCOMMON v3.01	All	
	300	PCOMMON v3.00	All	

Table 13: D20K Control Output Module Compatibility

Component	GE Vernova Item #	Description	Compatible release	Date of release
WESDAC	508-0101	WESDAC D20K TYPE 1 VERSION 1	REL 17-higher	April 1998
WESDAC	508-0102	WESDAC D20KHV	All	
WESTERM	517-0164	WESTERM D20K TYPE 1 VERSION 1	All	
Redundant D.20 LAN	540-0207	WESDAC D20 ASK D.20 I/F	All	
PCOMMON	306	PCOMMON v3.06	All	
	305	PCOMMON v3.05	All	
	301	PCOMMON v3.01	All	
	300	PCOMMON v3.00	All	

Table 14: D20C Combination Input/Output Module Compatibility

Component	GE Vernova Item #	Description	Compatible release	Date of release
WESDAC	504-0002	WESDAC D20C+	REL 27-higher	November 1998
WESDAC	504-0003	WESDAC D20CHV	All	
WESTERM	517-0169	WESTERM D20C Type 1 Version 1	All	
	517-0180	WESTERM D20 CD	All	
Redundant D.20 LAN	540-0209	WESDAC D20C D.20/WESMAINT I/F	All	
PCOMMON	305	PCOMMON v3.05	All	
	300	PCOMMON v3.00	All	

Table 15: Repeater/Splitter Compatibility

Component	GE Vernova Item #	Description	Compatible release	Date of release
REPEATER	520-0117	D.20 COMMUNICATION INTERFACE	REL 13 -higher	April 1999
SPLITTER	520-0118	D.20 FIBER OPTIC SPLITTER 4-WA	REL 11 -higher	April 1999
GFO	520-0148	WESDAC D.20 RS485/GFO I/F 48V	REL 12 -higher	May 1996

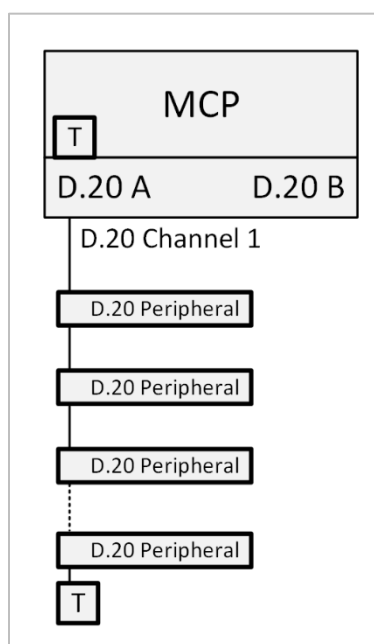
D.20 Connection topologies

The D.20 HDLC PCIe card supports the below D.20 topologies:

- Single D.20 terminated, single link
- Dual D.20 link terminated
- Dual D.20 terminated, Ch 1 only
- Single D.20 link, redundant LAN
- Redundant D.20 link, redundant LAN
- Single D.20 link with redundant G100
- Dual D.20 terminated, with redundant G100
- Single D.20 link, redundant LAN with redundant G100
- Single Ring and Fiber Optic (FO) D.20 link with redundant G100
- Single Ring and Fiber Optic (FO) D.20 link, redundant LAN with redundant G100

Single D.20 terminated, single link

Figure 7: Single D.20 terminated, single link - Topology



Up to 31 D.20 Peripherals in total can be present.

D.20 redundant LAN daughter card can optionally be installed with the corresponding configuration (Single Link) in DSAS.

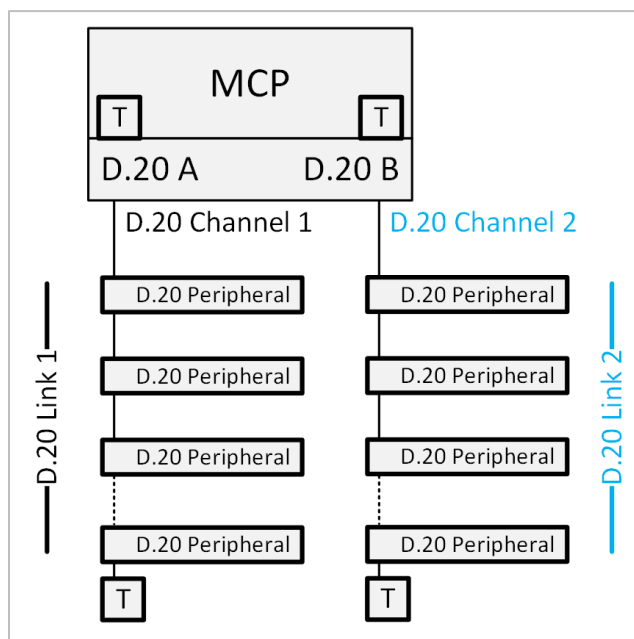
The last D.20 peripheral must be terminated with D.20 terminator (GE Vernova part number 977-0049).

Table 16: Single D.20 terminated, Single Link - Default settings

Function	State
End of Link - D.20 Channel 1	ON
End of Link - D.20 Channel 2	ON
Port B - D.20 Channel 1 (pin 6/7)	OFF
Port B - D.20 Channel 2 (pin 2/3)	OFF

Dual D.20 link terminated

Figure 8: Dual D.20 link terminated - Topology



Up to 30 D.20 Peripherals in total can be present.

D.20 redundant LAN daughter card can optionally be installed with the corresponding configuration (Redundant Link) in DSAS.

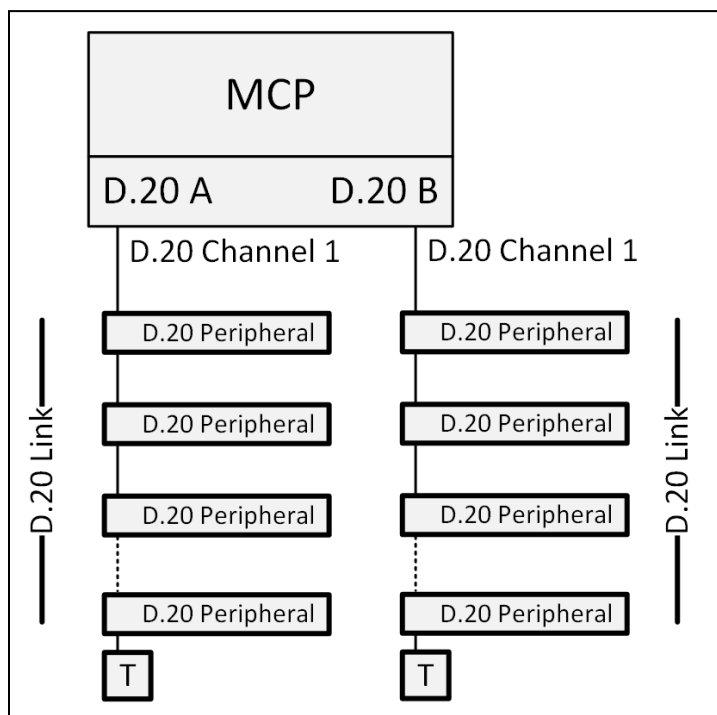
The last D.20 peripheral must be terminated with D.20 terminator (GE Vernova part number 977-0049).

Table 17: Dual D.20 link terminated - Default settings

Function	State
End of Link - D.20 Channel 1	ON
End of Link - D.20 Channel 2	ON
Port B - D.20 Channel 1 (pin 6/7)	OFF
Port B - D.20 Channel 2 (pin 2/3)	ON

Dual D.20 terminated, Ch 1 only

Figure 9: Dual D.20 terminated, Ch 1 only - Topology



Up to 30 D.20 Peripherals in total can be present.

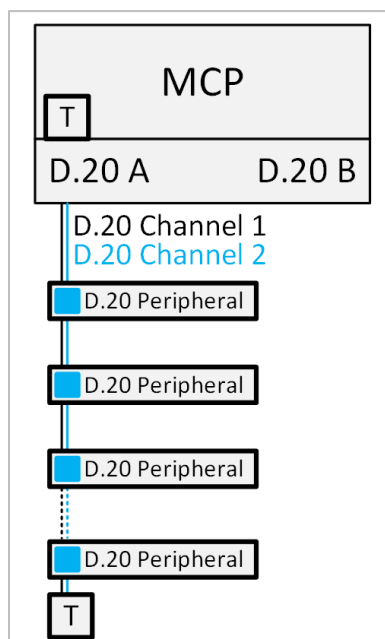
The last D.20 peripheral must be terminated with D.20 terminator (GE Vernova part number 977-0049).

Table 18: Dual D.20 terminated, Ch 1 only - Default settings

Function	State
End of Link - D.20 Channel 1	OFF
End of Link - D.20 Channel 2	OFF
Port B - D.20 Channel 1 (pin 6/7)	OFF
Port B - D.20 Channel 2 (pin 2/3)	ON

Single D.20 link, redundant LAN

Figure 10: Single D.20 link, redundant LAN - Topology



Up to 31 D.20 Peripherals in total can be present.

D.20 redundant LAN daughter card (GE Vernova part number 540-0209 for D.20C and GE Vernova part number 540-0207 for D.20A,S,K) must be installed with the corresponding configuration (Redundant Link) in DSAS.

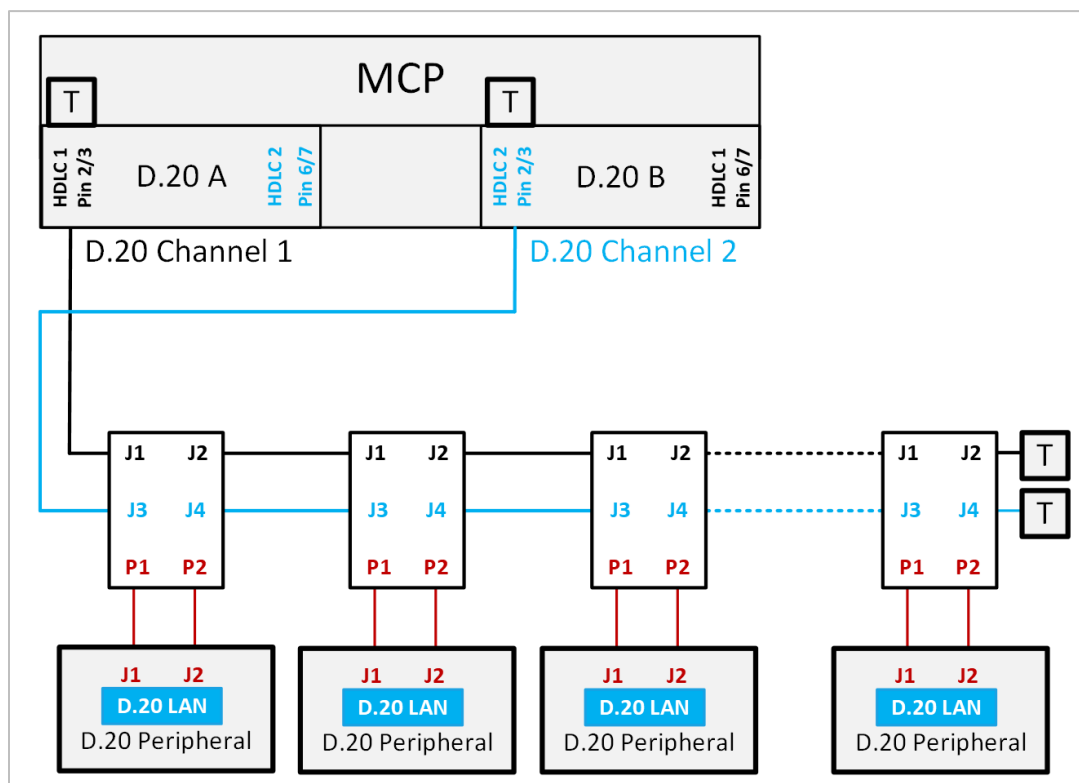
The last D.20 peripheral must be terminated with D.20 terminator (GE Vernova part number 977-0049).

Table 19: Single D.20 link, redundant LAN - Default settings

Function	State
End of Link - D.20 Channel 1	ON
End of Link - D.20 Channel 2	ON
Port B - D.20 Channel 1 (pin 6/7)	OFF
Port B - D.20 Channel 2 (pin 2/3)	OFF

Redundant D.20 link, redundant LAN

Figure 11: Redundant D.20 link, redundant LAN - Topology



Up to 30 D.20 Peripherals in total can be present.

D.20 redundant LAN daughter card (GE Vernova part number 540-0209 for D.20C and GE Vernova part number 540-0207 for D.20A,S,K) must be installed.

D.20 link adapter must be installed on each D.20 peripheral (GE Vernova part number 540-0313)

The D.20 Link crossover cable must be installed from CCU D.20 Port B to peripheral link (GE Vernova part number 977-0561)

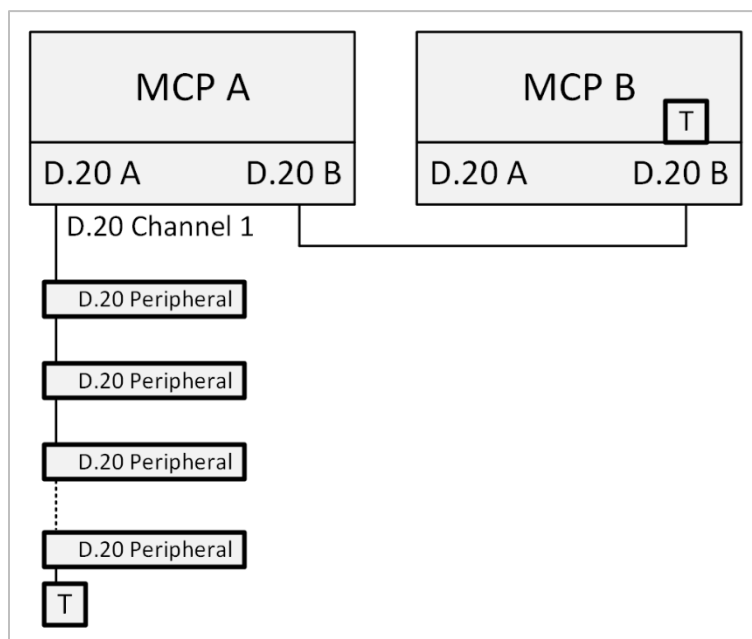
The last D.20 peripheral must be terminated with D.20 terminator (GE Vernova part number 977-0049)

Table 20: Redundant D.20 link, redundant LAN - Default settings

Function	State
End of Link - D.20 Channel 1	ON
End of Link - D.20 Channel 2	ON
Port B - D.20 Channel 1 (pin 6/7)	ON
Port B - D.20 Channel 2 (pin 2/3)	ON

Single D.20 link with redundant G100

Figure 12: Single D.20 link with redundant G100 - Topology



Up to 30 D.20 Peripherals in total can be present.

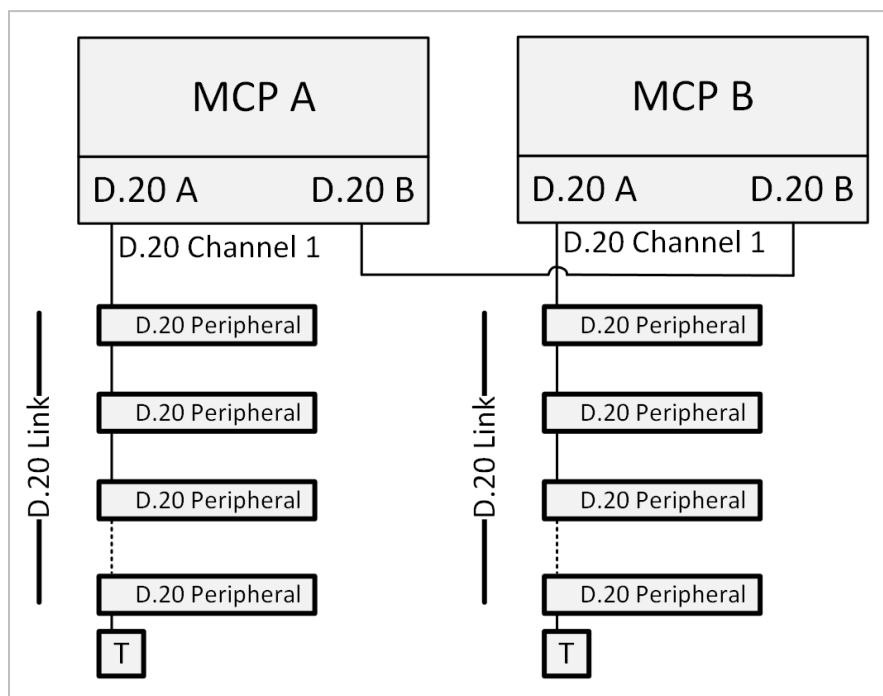
D.20 redundant LAN daughter card are not supported in Loop mode and must NOT be installed.

Table 21: Single D.20 link with redundant G100 - Default settings

Function	State MCP A	State MCP B
End of Link - D.20 Channel 1	OFF	ON
End of Link - D.20 Channel 2	OFF	ON
Port B - D.20 Channel 1 (pin 6/7)	ON	ON
Port B - D.20 Channel 2 (pin 2/3)	ON	ON

Dual D.20 terminated, with redundant G100

Figure 13: Dual D.20 terminated, with redundant G100 - Topology



Up to 30 D.20 Peripherals in total can be present.

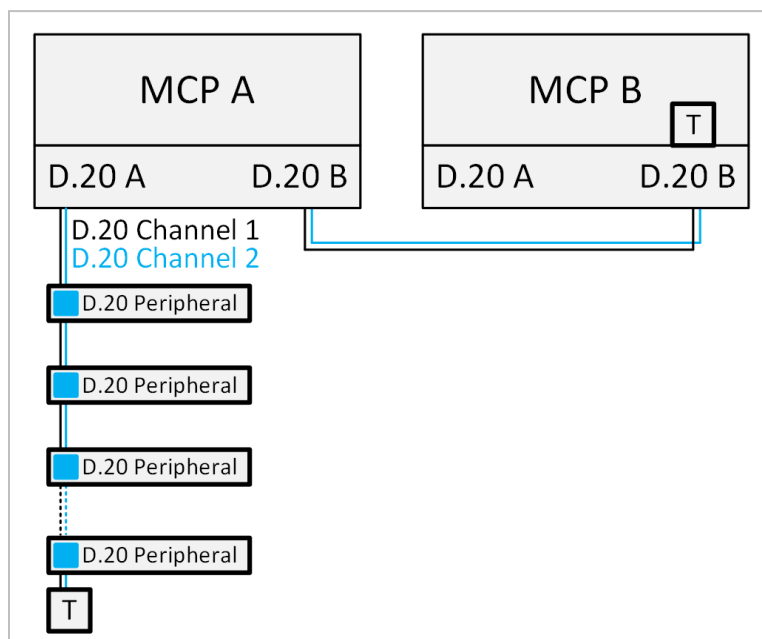
The last D.20 peripheral must be terminated with D.20 terminator (GE Vernova part number 977-0049).

Table 22: Dual D.20 terminated, with redundant MCP – Default settings

Function	State MCP
End of Link - D.20 Channel 1	OFF
End of Link - D.20 Channel 2	OFF
Port B - D.20 Channel 1 (pin 6/7)	ON
Port B - D.20 Channel 2 (pin 2/3)	ON

Single D.20 link, redundant LAN with redundant G100

Figure 14: Single D.20 link, redundant LAN with redundant G100 - Topology



Up to 30 D.20 Peripherals in total can be present.

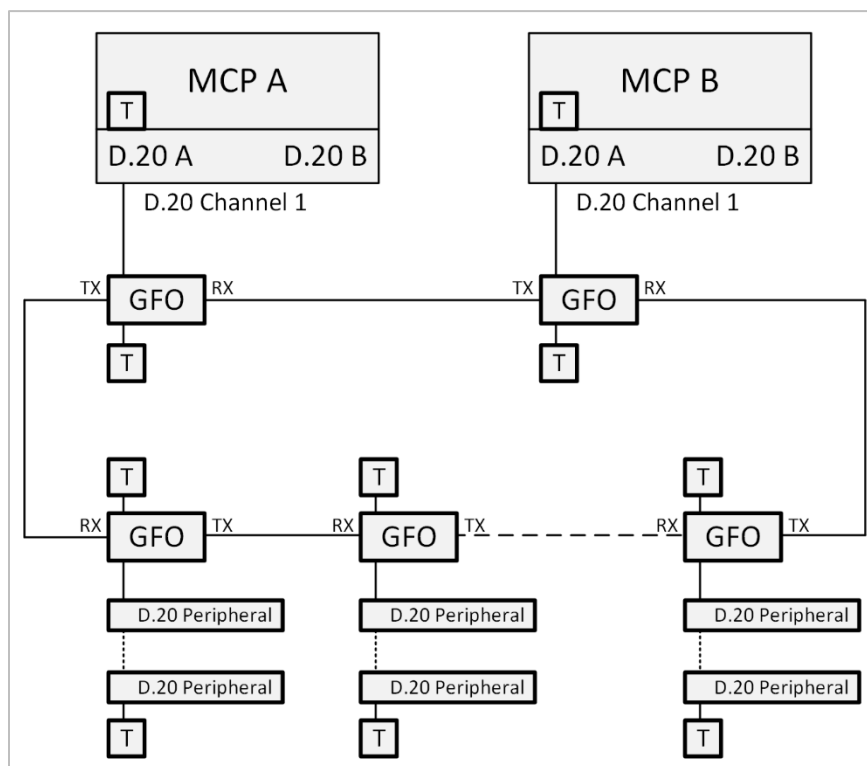
D.20 redundant LAN daughter card (GE Vernova part number 540-0209 for D.20C and GE Vernova part number 540-0207 for D.20A,S,K) must be installed with the corresponding configuration in DSAS.

Table 23: Single D.20 link, redundant LAN with redundant G100 - Default settings

Function	State MCP A	State MCP B
End of Link - D.20 Channel 1	OFF	ON
End of Link - D.20 Channel 2	OFF	ON
Port B - D.20 Channel 1 (pin 6/7)	ON	ON
Port B - D.20 Channel 2 (pin 2/3)	ON	ON

Single Ring and Fiber Optic (FO) D.20 link with redundant G100

Figure 15: Single Ring and Fiber Optic (FO) D.20 link with redundant G100 - Topology



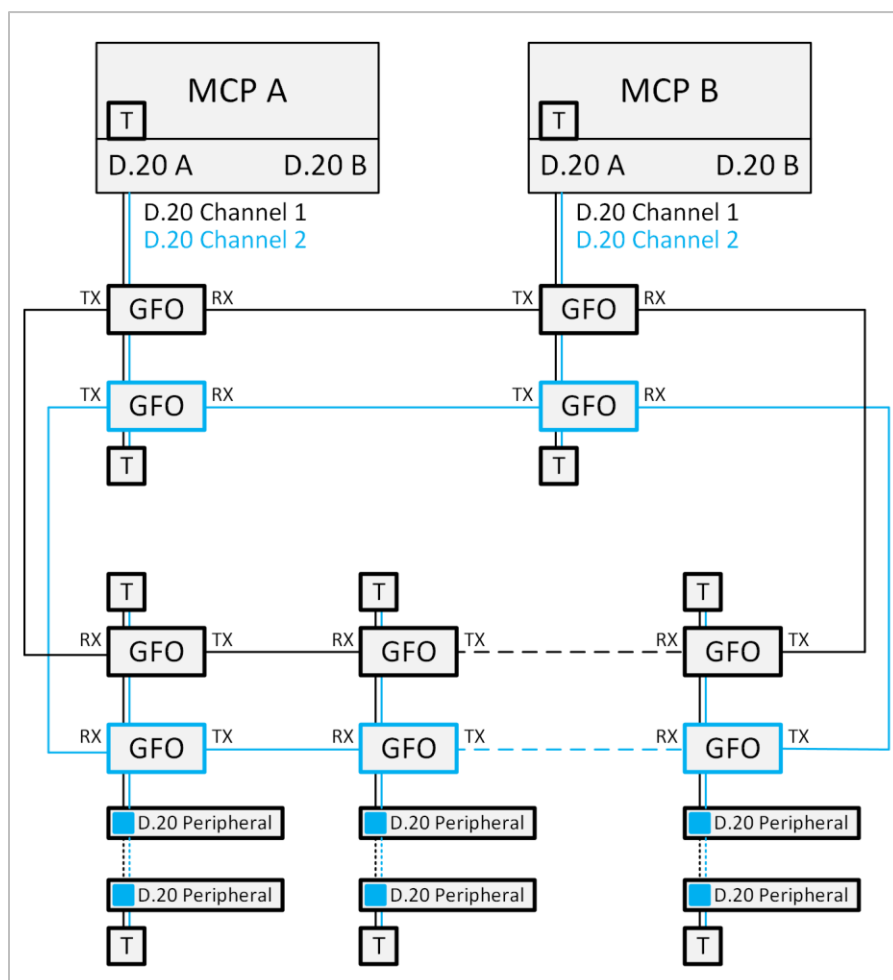
Up to 30 D.20 Peripherals can be present on a single copper D.20 link, subject to total maximum of 60. This ring was tested with up to 8 D.20 Peripheral GFO drops.

Table 24: Single Ring and Fiber Optic (FO) D.20 link with redundant G100 - Default settings

Function	State MCP A	State MCP B
End of Link - D.20 Channel 1	ON	ON
End of Link - D.20 Channel 2	ON	ON
Port B - D.20 Channel 1 (pin 6/7)	OFF	OFF
Port B - D.20 Channel 2 (pin 2/3)	OFF	OFF

Single Ring and Fiber Optic (FO) D.20 link, redundant LAN with redundant G100

Figure 16: Single Ring and Fiber Optic (FO) D.20 link, redundant LAN with redundant G100 - Topology



Up to 30 D.20 Peripherals can be present on a single copper D.20 link, subject to total maximum of 60.

D.20 redundant LAN daughter card (GE Vernova part number 540-0209 for D.20C and GE Vernova part number 540-0207 for D.20A,S,K) must be installed with the corresponding configuration in DSAS.

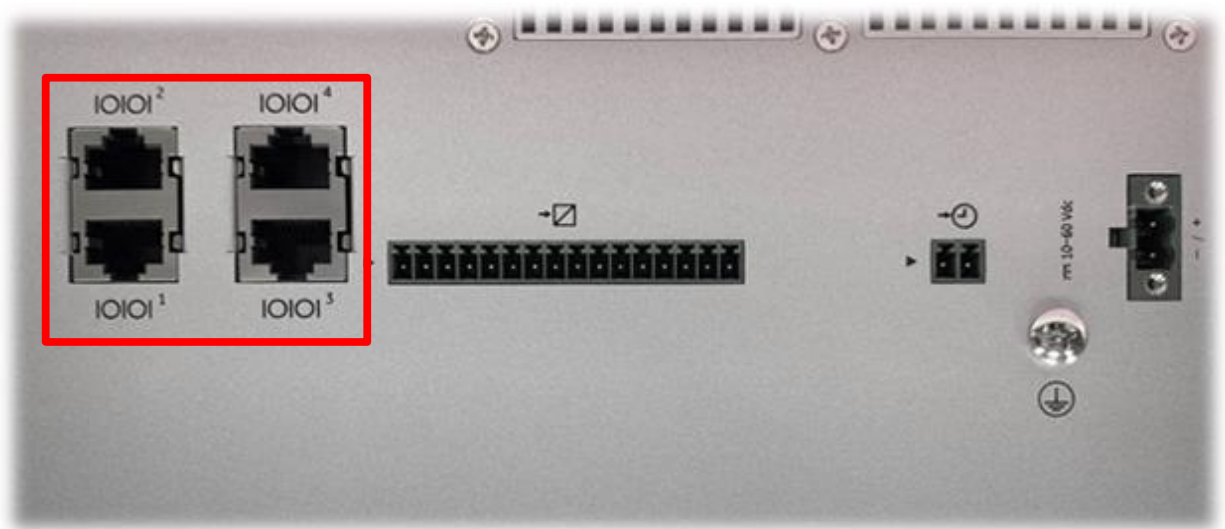
This ring was tested with up to 8 D.20 Peripheral GFO drops.

Table 25: Single Ring and Fiber Optic (FO) D.20 link, redundant LAN with redundant G100 - Default settings

Function	State MCP A	State MCP B
End of Link - D.20 Channel 1	ON	ON
End of Link - D.20 Channel 2	ON	ON
Port B - D.20 Channel 1 (pin 6/7)	OFF	OFF
Port B - D.20 Channel 2 (pin 2/3)	OFF	OFF

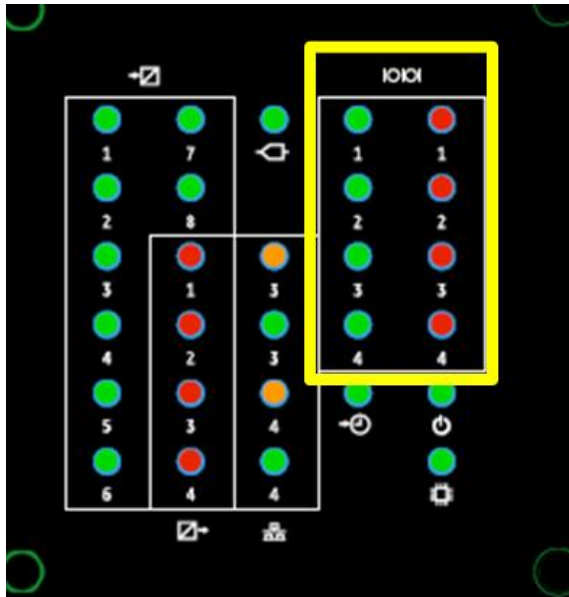
Serial ports (RS232/485, RJ45, labelled 1-4)

The G100 has 4 Built-in Serial ports available as RJ45 connectors on the bottom panel of the unit.



Each serial port has LED activity (Tx/Rx) indicators on the front panel:

- Tx Activity (Green)
- Rx Activity (Red)



The serial ports are isolated from the rest of the system at 1.5KV AC / 2.1KV DC.

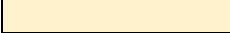
The serial ports support the following communication modes:

- RS232
- RS485 2-Wire

For every port an Rx Termination Resistor of 120 Ohms can be enabled through the software interface.

The pin assignment of the Serial Interfaces is dependent on the operation mode selected for the interface:

Table 26: RJ45 Pin outs for Serial Port Signals

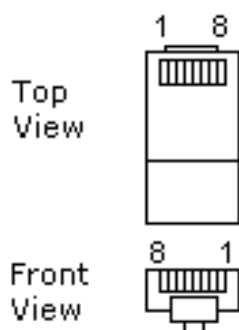
EIA568	TIA/EIA 568A	RJ45 Pin out	RS232	RS485 2-Wire
		1	Rx	D-
		2	CTS	D+
		3	Tx	-
		4	GND	GND
		5	IRIG-B OUT	IRIG-B OUT
		6	RTS	-
		7	-	-
		8	DCD	-



IRIG-B OUT is available only when an IRIG-B IN signal is connected. The G100 does not have an internal IRIG-B signal generator.

The supported levels are compliant to TTL by a load of 120 Ohm or higher. It is current limited and protected against damage by short to GND (Pin 4).

Figure 17: Modular connector 8P8C (RJ45) pins



Shielded twisted pair cables shall be used for wiring.

RS-485 Serial Connections

The G100 can be configured to communicate with RS-232 or RS-485 2-wire type devices using the 4 Built-in Serial Ports.

Each serial port can be independently configured through the Settings GUI. All port configurations persist through a power cycle and when power is lost.

In RS-485 mode End of Link Termination (120 Ohm) can be enabled through the Settings GUI.



When enabled in Settings, End of Link Termination is active only when the device is powered on and applications are running. This has no operational impact because the G100 is meant to act as a master to other devices.

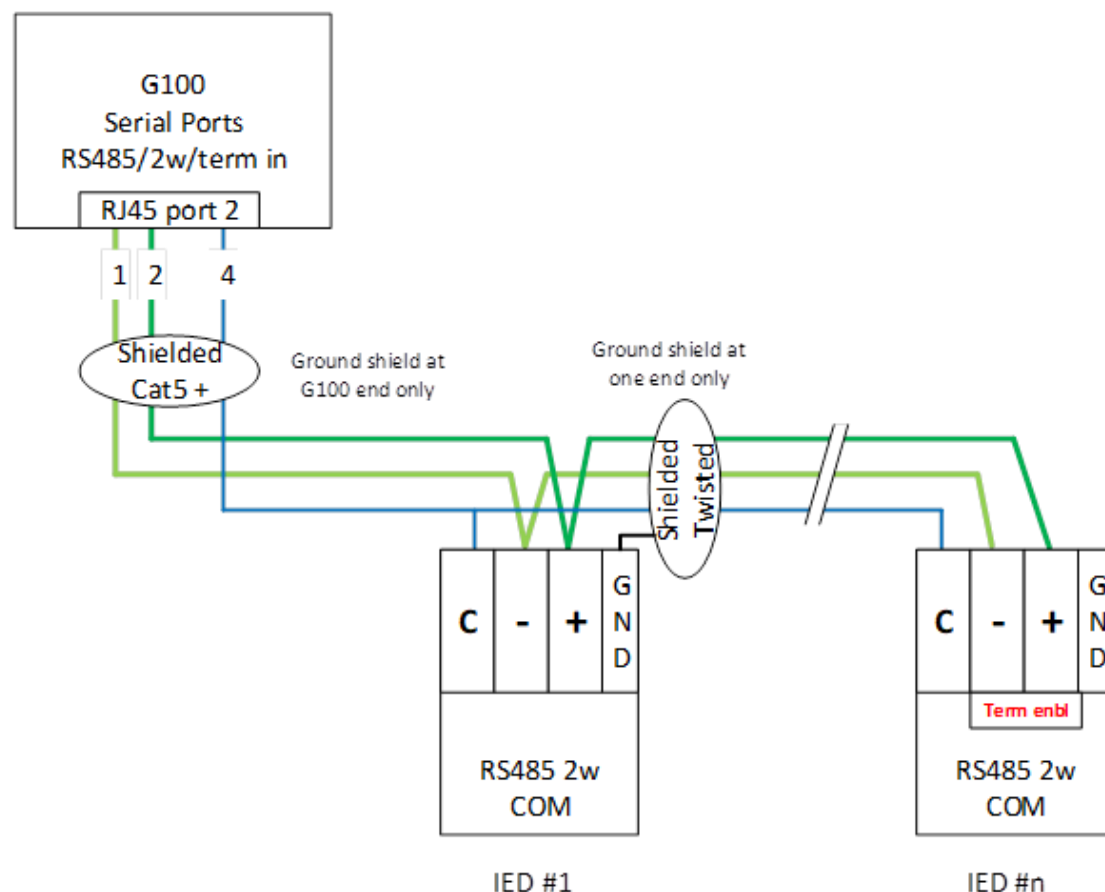
The cables must be shielded and the shield of each RS-485 cable section should be grounded at one end only. This prevents circulating currents and can reduce surge-induced current on long communication lines.

Signal ground on pin4 is to be considered different then shield on cable.

When creating custom cables, it is recommended to only wire the required pins.

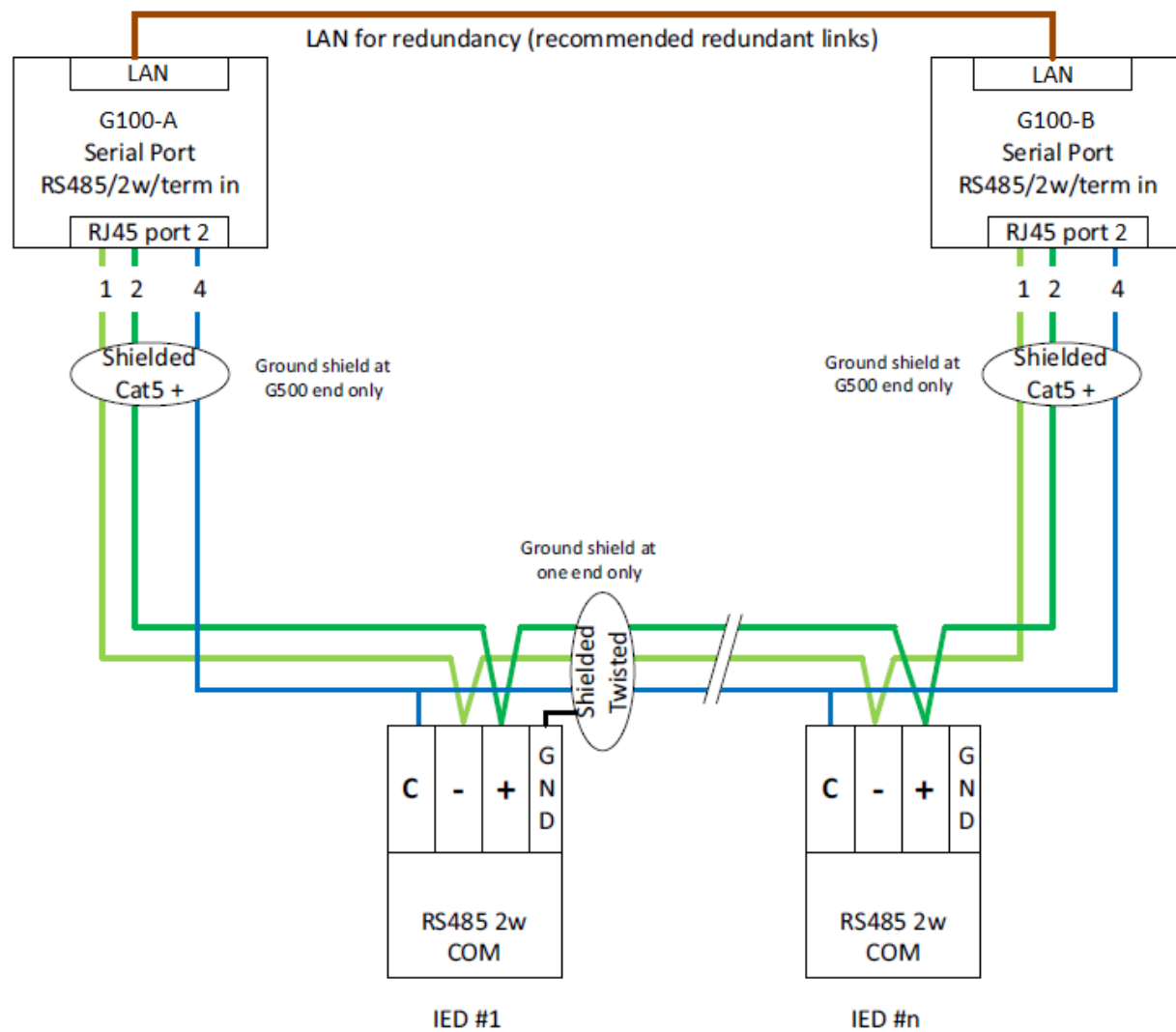
The following diagram illustrates how to wire the G100 units using RS485 2-wire.

Figure 18: G100 connection using RS485 2-wire



The following diagram illustrates how to wire redundant G100 units using RS485 2-wire.

Figure 19: Redundant G100 connection using RS485 2-wire



Default Serial Maintenance port (port 4, RS232)

When running the *Factory Default* configuration, G100 has one serial maintenance port enabled, which is **always allocated to Port 4**.

This maintenance port allows users to perform the following workflows:

- Intercept POST and access UEFI settings (useful when a KVM is not connected to G100)
- Access Shell for maintenance actions after the applications started

The following documents provide details for each workflow:

- Configuring UEFI Settings on G100 User Guide (SWM0122)
- G100 Substation Gateway Quick Start Guide (SWM0116)
- MCP Substation Gateway Software Configuration Guide (SWM0101)

NOTICE

While the serial maintenance port is enabled as #4, this same port cannot be used for other applications.

The serial maintenance port can be disabled as following:

- In UEFI for the POST access only. Make sure that UEFI is set to RS232.
- In Settings for Shell access and use by other runtime applications.

If the serial maintenance port is disabled, users can still access the device using either the KVM or Ethernet ports.

UEFI allocation of the serial maintenance port is intended for UEFI access in absence of KVM (during startup), and it is different than Settings serial maintenance port “shell” access (during normal operation).

NOTICE

The default settings for the maintenance port in UEFI are: 115200, 8, N, 1, VT100.

```

Aptio Setup Utility - Copyright (C) 2021 American Megatrends, Inc.
  Advanced
-----+-----+-----+
| COM4                                     | Emulation: ANSI: |
| Console Redirection Settings            | Extended ASCII char |
|                                         | set. VT100: ASCII char |
| Terminal Type                          [VT100+] | set. VT100+: Extends |
| Bits per second                        [115200] | VT100 to support color, |
| Data Bits                             [8]       | function keys, etc. |
| Parity                                [None]    | VT-UTF8: Uses UTF8 |
| Stop Bits                             [1]       | encoding to map Unicode |
| Flow Control                           [None]   | |
| VT-UTF8 Combo Key                      [Enabled] | -----+-----+ |
| Support                               | ><: Select Screen |
| Recorder Mode                         [Disabled] | ^v: Select Item |
| Resolution 100x31                     [Disabled] | Enter: Select |
| Putty KeyPad                           [VT100]  | +/-: Change Opt. |
|                                         | F1: General Help |
|                                         | F2: Previous Values |
|                                         | F3: Optimized Defaults |
|                                         | F4: Save & Exit |
|                                         | ESC: Exit |
-----+-----+-----+
Version 2.18.1263. Copyright (C) 2021 American Megatrends, Inc.

```

The serial maintenance port in UEFI can be disabled, or baud rate changed. However - do not change maintenance port assignment in UEFI from port # 4 to another port!

```

Aptio Setup Utility - Copyright (C) 2021 American Megatrends, Inc.
  Advanced
/-----+-----\
| COM1                                         | Console Redirection |
| Console Redirection      [Disabled]         | Enable or Disable.  |
|> Console Redirection Settings              |                     |
| COM2                                         |                     |
| Console Redirection      [Disabled]         |                     |
|> Console Redirection Settings              |                     |
| COM3                                         |                     |
| Console Redirection      [Disabled]         |><: Select Screen    |
|> Console Redirection Settings              |^v: Select Item     |
| COM4                                         |Enter: Select       |
| Console Redirection      [Enabled]          |+/-: Change Opt.    |
|> Console Redirection Settings              |F1: General Help    |
|                                             |F2: Previous Values |
|                                             |F3: Optimized Defaults|
|                                             |F4: Save & Exit     |
|                                             |ESC: Exit           |
\-----+-----/
Version 2.18.1263. Copyright (C) 2021 American Megatrends, Inc.

```

NOTICE

The serial maintenance port will not show POST messages while a monitor is connected to the DP port.

If the serial maintenance port was disabled in UEFI (i.e., Console Redirection disabled) – then UEFI access can be done only using KVM.

If the serial maintenance port was disabled in Settings (for shell access), and the IP addresses are not known or SSH access is blocked in the firewall – then access can be done only using KVM.

Ethernet ports

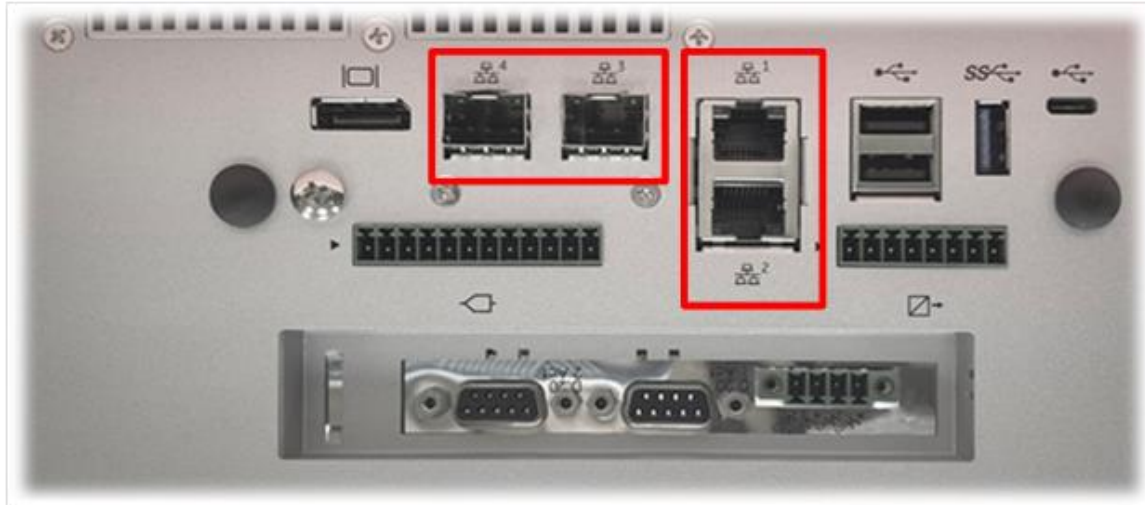
The top panel of the G100 provides 4 independent Ethernet ports, labelled 1 to 4.

NOTICE

The G100 Ethernet ports use separate MAC addresses.

The G100 Ethernet ports cannot be configured as Redundant Single MAC.

G100 does not support PRP (Parallel Redundancy Protocol IEC62439-3).



TP Ethernet ports and LED indications (labelled 1, 2)

Ports 1 and 2 are RJ45 Copper (RJ45 10/100/1000BASE-TX) with separate NICs (LAN1/2).

Each RJ45 port has LED indicators inside the RJ45 connector:

- Activity (Green)
- Link (Orange)

Each RJ45 port is isolated to 1.5KV AC / 2.1KV DC

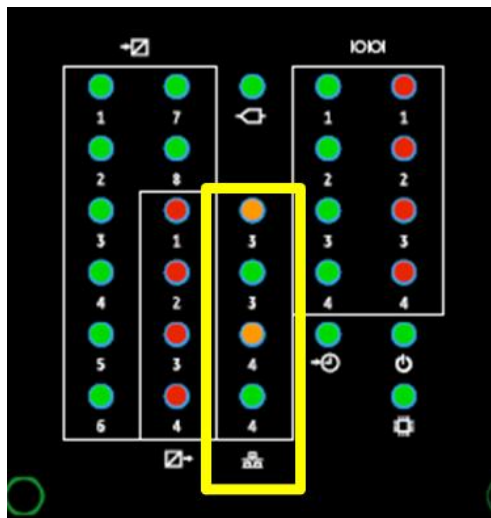
SFP Ethernet ports (labelled 3, 4)

Ports 3 and 4 are SFP with separate NICs (LAN3/4).

Into each slot an SFP module can be inserted.

Each SFP port has LED indicators on the front panel:

- Activity (Green)
- Link (Orange)



Each SFP port is isolated to 1.5KV AC / 2.1KV DC

For corresponding SFP modules and order codes see following sections in this document:

Order Code

MCP Spares and Accessories

The following table presents in detail the SFP modules supported by the G100.

Table 27: SFP modules supported by the G100

Item	Description	Manufacturer	Mfg. Part number
580-3784	SFP Module 100BASE-FX LC TRANSCEIVER OPTICAL	BROADCOM (FOXCONN, AVAGO)	HFBR-57E0APZ
	SFP Module 100BASE-FX LC TRANSCEIVER OPTICAL MULTI-MODE 1300nm	AXCEN	AXFE-1314-0523
580-3785	SFP Module 1000BASE-SX LC TRANSCEIVER OPTICAL	BROADCOM (FOXCONN, AVAGO)	AFBR-5710ALZ
		Coherent (FINISAR)	FTLF8519P3BTL
580-3786	SFP Module 1000BASE-TX RJ45 TRANSCEIVER COPPER	Coherent (FINISAR)	FCLF8522P2BTL
		BROADCOM (FOXCONN, AVAGO)	ABCU-5730ARZ
		BROADCOM (FOXCONN, AVAGO)	ABCU-5731ARZ
0123-0004	SFP Module 10/100BASE-TX RJ45 TRANSCEIVER COPPER	AXCEN	AXFE-R1S4-05H3
580-3787	SFP Module 1000Base-LX LC TRANSCEIVER OPTICAL SINGLE-MODE 5km 1310nm -40 to 85C	BROADCOM (FOXCONN, AVAGO)	AFCT-5715ALZ

The cables required to make physical connections to the G100 are as follows:

Table 28: Ethernet cables required by the G100

Media	Designation	Cable	Connector
Twisted Pair Ethernet	100/1000BASE-TX	UTP (Unshielded Twisted Pair) – Cat-5 or better	RJ45
Fiber optic	100BASE-FX	Fiber optic cable multimode	LC
Fiber optic	1000BASE-SX	Fiber optic cable multimode	LC

CAUTION This product contains components rated as Class 1 Laser Products.



G100 cannot read the SFP model automatically. Each SFP Ethernet port must be configured correctly to match the installed SFP type, in the Settings utilities (**mcpcfg, Settings GUI**) – please see the *G100 Quick Start Guide* and *MCP Software Configuration Guide* documents.

The SFP Module 1000BASE-SX LC (580-3785) requires the switch port to have the speed configured for 1GB instead of Auto, and for full duplex mode.

A device reboot is required for new SFP settings to take effect.

Time synchronization IRIG-B input (2 pin connector)

The bottom panel of the unit provides one IRIG-B input connector.

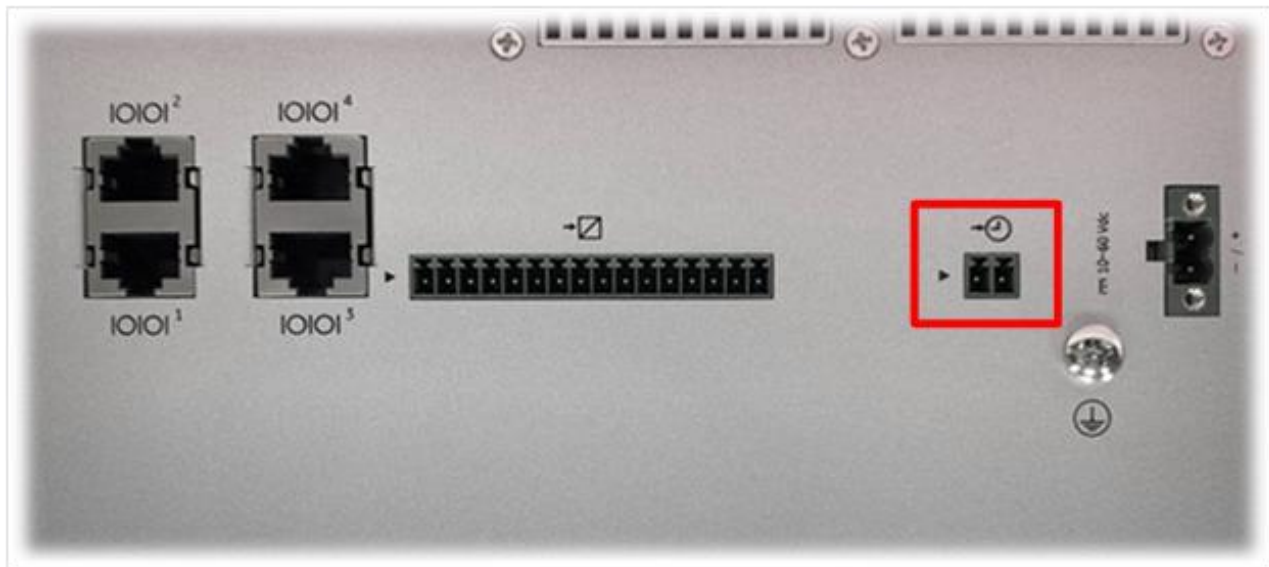
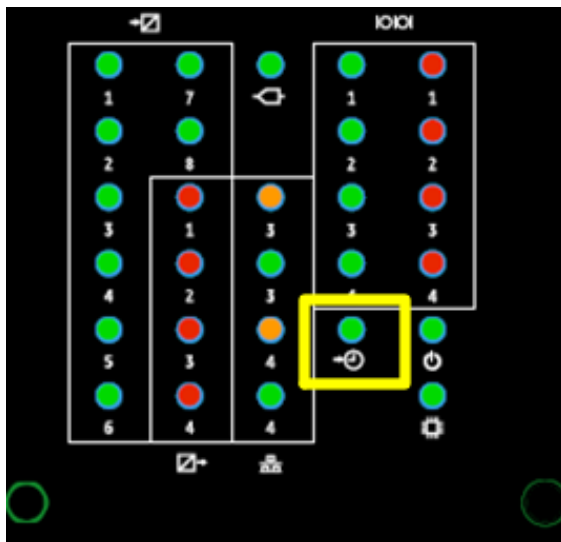


Table 29: IRIG-B input connector pin assignments

PIN NO.	DESCRIPTION
1 (arrow)	SIGNAL
2	GND

This input can be used to synchronize the precision timer of the unit. The supported IRIG-B formats are B002 and B006.

Presence of an IRIG-B signal is indicated by one LED located on the front panel:



When configured as B006 the clock requires a corresponding configuration where the year and quality are included in the IRIG-B signal. If the clock is not configured to provide the year the G100 will show the year 2000.

This Port is isolated from the rest of system with an isolation voltage of 1.5kV AC / 2.1kV DC.

The supported levels are compliant to TTL or TIA232, selectable by an internal jumper:

Green PIN HEADER 1x3 Male 180° 2.0mm DIP



IRIG-B input signal selection jumper JIRIGB1 can be found on the GPIO internal board as shown below.

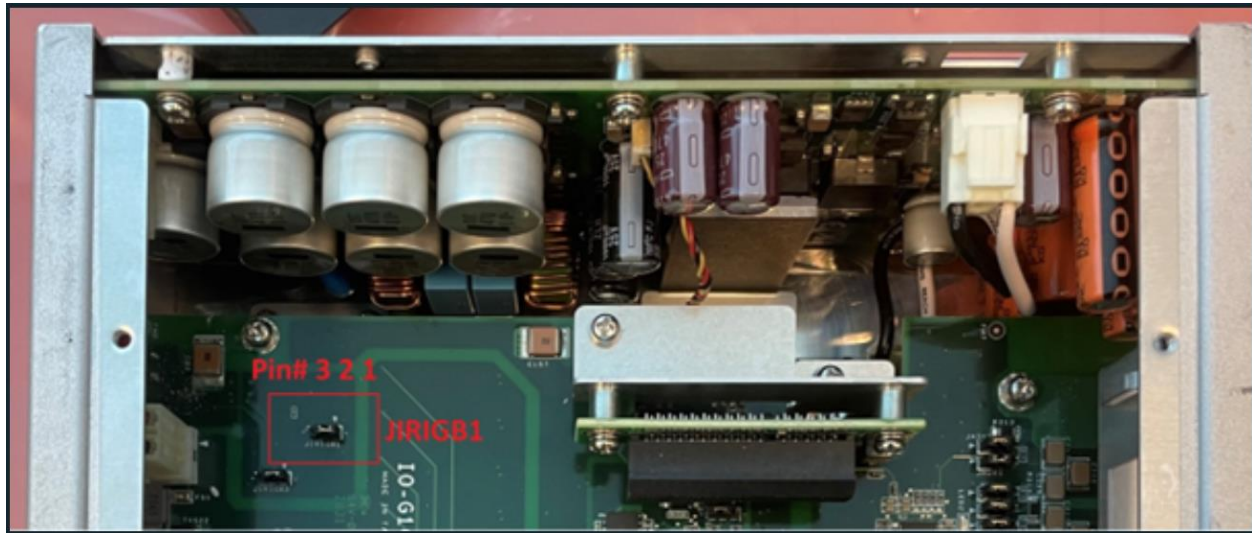


Table 30: IRIG-B input signal selection TTL/RS-232

Jumper JIRIGB1	DESCRIPTION
1-2	TTL
2-3	RS232

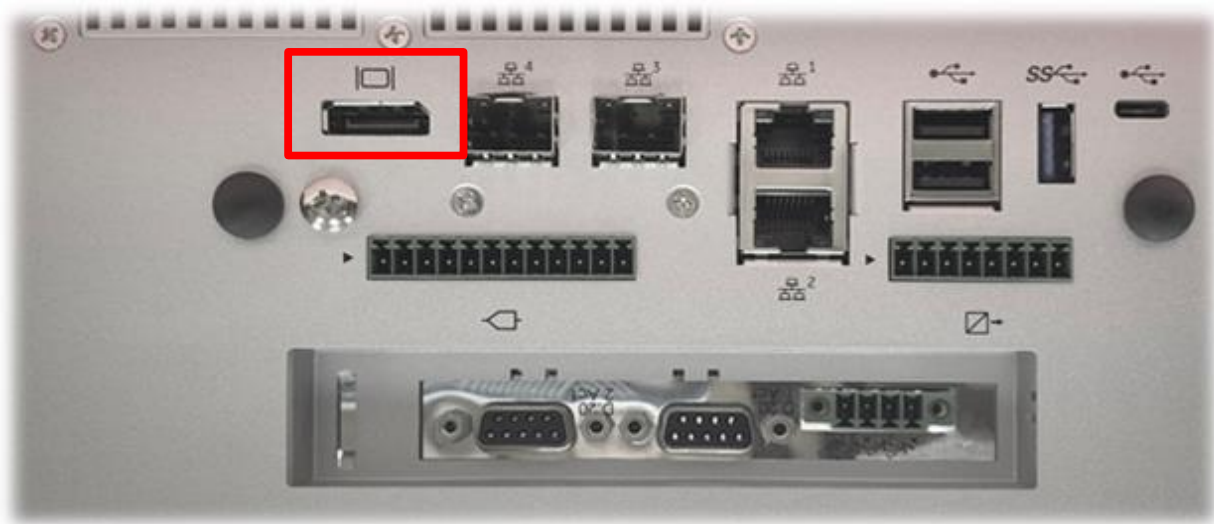
NOTICE

G100 does not support PTP IEEE1588.

NTP and SNTP are supported.

DP Display Port

The top panel of the unit provides one DisplayPort™ connector.



The interface is DisplayPort™ Version 1.2 compliant which is used mainly to enable installation personnel to connect a display for the initial configuration of the device, or a Local Runtime HMI display.



Multi Stream Transport (MST) for multiple attached displays is not supported.

The DisplayPort™ is fused internally. For normal operation don't exceed 0.5 A.

The G100 DP port requires active DP to HDMI or active DP to DVI-D adapters. Passive adapters are not supported.



G100 doesn't support Touch Screen Panel controls due to the absence of external vendor USB drivers. It's recommended to use a Windows Panel PC and the Remote HMI application instead.

USB ports



The top panel of the unit provides the following USB ports:

One USB 3.0 type A connector, mainly used to enable maintenance personnel to connect their equipment and storage devices for software updates.

The USB 3.0 A port is fused internally. For normal operation don't exceed 0.9 A per connector.

The maximum cable length for USB 3.0 cables is 3m (=118in).

Using longer cables than specified for each port might result in data loss.

Two USB 2.0 Type A connectors. Main purpose of these connectors is to enable installation personnel to connect Mouse, Keyboard and equivalent equipment for initial configuration of the device.

Each USB 2.0 A connector is fused separately. For normal operation don't exceed 0.9 A per connector.

The cumulative current draw of all four ports is limited to 1A due to thermal and power budget restrictions.

The maximum cable length for USB 2.0 cables is 3m (=118in).

The USB Type C connector is for future applications, currently not used. Please do not connect external devices to it.

Internal Buzzer

The G100 has an internal buzzer, which is intended for local and close proximity general purpose usage.



NOTE

This buzzer has a very low volume and as such is not suitable for critical operators' notifications.

The Local HMI and the DO points in the database can operate the buzzer, subject to above note on low sound level.

Home Dir	Point ID	Point Reference	Point Description
SS00001	-2021	DisableAllControls	DisableAllControls
SS00001	-204	Disable Buzzer	Disable Buzzer
SS00001	-204	Buzzer Sound ON	Buzzer Sound ON

Chapter 5 - Specifications

G100 Product Specifications

System

Processor	Intel Atom X5-E3930 1.3GHz Processor
Memory	8GB SoDIMM 204 pin DDR3L (up to 1866MHz)
Storage	16GB mSATA SSD
Real Time Clock (RTC)	When powered off, the real-time clock remains active for 5 days The G100 provides an internal free running clock with no more than 0.9 second drift in 24 hours when not synchronized with an external source
Operating system	Predix Edge OS
LED indicators	Power indicator, CPU Status indicator, IRIG-B Input indicators, 2x SFP Ethernet port indicators, 2x TP Ethernet port indicators, 4X Serial port indicators, 8x DI channel indicator, 4x DO channel indicator, AI sampling indicator

Communications

Ethernet connections	2 RJ45 Ethernet ports + 2 SFP modules Supported SFP types: 10/100BASE-TX (RJ45 copper medium, Cat-5 or better) 100/1000BASE-TX (RJ45 copper medium, Cat-5 or better) 100BASE-FX 1300nm (LC fiber multimode) 1000BASE-SX 850nm (LC fiber multimode) 1000BASE-LX 1310nm (LC fiber single-mode)
Serial communications	4x serial interfaces accessible via individual RJ45 connectors Serial interfaces use 16550 compatible UART. Support baud rates 200, 300, 600, 1200, 2400, 4800, 9600, 19.2k, 38.4k, 57.6k, 115.2k. Software controlled mode of operation between RS232 or RS485 2-wire. Software controlled termination resistor (120 ohm) for RS485 mode (termination is not active while powered off). All software selection persist when power cycled. IRIG-B available on all serial interfaces.
D.20 Link HDLC Communications	A dual channel card is available to communicate D.20 Link protocol to up to 60 D20 Peripherals per channel. Each channel communicates at 250kbps. Channels are isolated from each and from other internal circuits.
Time synchronization	IRIG-B (TTL) Input Connector available as 2 positions removable Phoenix terminal block on bottom panel

Video Output	DisplayPort (DP) version 1.2 available on top panel
USB Ports	1x USB 3.0 Type A (male) on top panel 2x USB 2.0 Type A (male) on top panel 1x USB 2.0 Type C (male) on top panel (Future use)

Electrical

G100 rated input	Nominal 12/24/48 VDC $\pm 10\%$, 5A/2.5A/1.25A Minimum/Maximum DC voltage: 10 VDC to 60 VDC	
GPIO (DI/DO/AI)	Isolation rating: 820V _{RMS} /1150V _{DC}	
GPIO AI	Full Scale	Configurable, either 0-5V or 0-20mA
	Accuracy	$\pm 0.1\%$ FS (Voltage) / $\pm 0.2\%$ FS (Current)
	Input Impedance (A)	250 OHM $\pm 10\%$
	Conversion range (A)	0 to 20 mA
	Conversion range (V)	0 to 5 V
	Overall conversion update time:	0.25sec (max.)
G100 maximum power consumption	21W Measured under full CPU load, without DI/DO/AI, without PCIe card, at 25°C 50%RH.	

G100 Environmental Specifications

Temperature and Humidity

Storage	-40°C to 85°C
Operating Conditions	-40°C to 70°C
Humidity	5%~90% relative humidity, non-condensing

Ingress Protection (IEC 60529)

IP40 Protected from tools and small wires greater than 1 millimeter. Not protected from liquids.

Mechanical Specifications

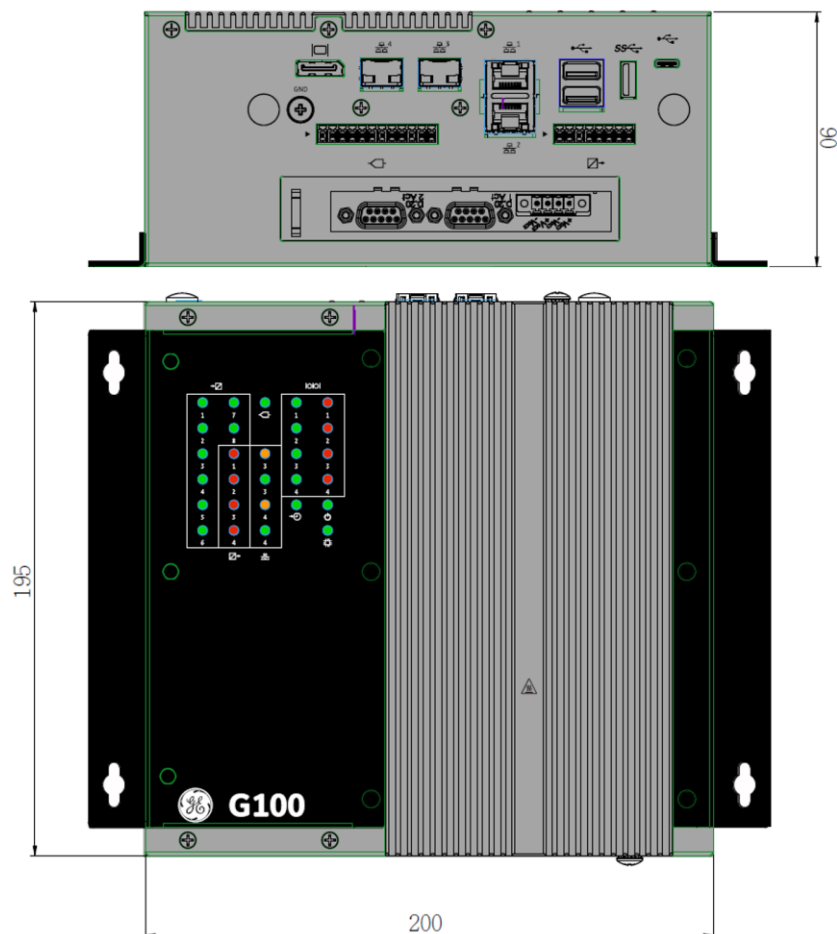
Weight

Part	Weight in kg
G100	2.47
D.20 Link HDLC PCIe Card	0.18
Packaging + accessories	2.15

Dimensions

All dimensions are in mm

200 (L) x 90(W) x 195(H) mm



Storage recommendations

Storage conditions

Always store the G100 in an environment compatible with operating conditions. Recommended environmental conditions for storage are:

- Temperature: -40°C to +85°C
- Relative humidity: 5% to 95%, non-condensing

Exposure to excessive temperature or other extreme environmental conditions might cause damage and/or unreliable operation.

To avoid deterioration and early failure of electrolytic capacitors, power up units that are stored in a de-energized state once every 12 months, for one hour continuously.

Chapter 6 - Removing the G100 from Service

Before you begin installing and using the G100, review the information in this chapter, including the following topics:

When the G100 is to be removed from service, it is necessary to:

- Remove the configuration data and sensitive information from:
 - The G100
 - The PC used to remotely configure the G100
- Dispose of the equipment.

Remove configuration data and sensitive information from the G100

In the event that it is necessary to remove the configuration data and sensitive information from the G100 (for example, the G100 is being disposed of or being returned for maintenance [i.e., RMA]), this chapter provides the data removal procedure.

For additional information, please refer to “SWM0123 G100 Secure Deployment User Guide”.

To remove configuration data and sensitive information from the G100:

1. For an RMA: GE Vernova recommends restoring the unit to factory default state using the procedure in Section 3 of TN0116 MCP Firmware Upgrade and Restore to Defaults Workflows.
2. For hardware decommissioning and disposal: GE Vernova recommends that you destroy the device as per NIST* recommendations.

* Publication 800-88 Revision 1. Guidelines for Media Sanitization, Recommendations of the National Institute of Standards and Technology:

<http://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.800-88r1.pdf>

Removing configuration data on a PC

When a PC application is used to configure the G100, configuration data resides on the data storage media (e.g., hard drives, memory cards, etc.) of the PC running the configuration application.

The G100 configuration data can be removed from the PC by either:

- Recommended: Physically removing and destroying the data storage media, or
- Using a program to securely wipe (that is, completely erase) the data storage media (that is, not just reformat or remove the names of the files from the file allocation table).

Appendix A – Standards & Compliance

Compliance Standards

The G100 complies with the tests listed below.

Standard	Description	Test Level / Class	Pass Criteria
IEEE 1613	IEEE Standard Environmental and Testing Requirements for Communications Networking Devices Installed in Electric Power Substations	Per standard	
IEC 61850-3	Communication Networks and systems for power Utility Automation-Part 3	Per standard	
IEC 62368-1	Audio/Video, Information And Communication Technology Equipment - Part 1: Safety Requirements	Per standard	
IEC 60068-2-1	Cold	-40°C for 16hours	A
	Cold start	1hour soak, 3 power ups every 10 mins	A
IEC 60068-2-2	Dry Heat	+70°C for 16hours	A
	Hot start	1hour soak, 3 power ups every 10 mins	A
IEC 60068-2-78	Damp Heat, steady-state	+40°C, 95%RH, non-condensing, 96hours	A
IEC 60068-2-6	Vibration (sinusoidal)	0.5g, 1 sweep, 3 axes, with EUT energized	A
IEC 60255-21-1		1g, 10 sweep, 3 axes, with EUT non-energized	
IEC 60068-2-27	Shock Response	5g, 3 +/- shocks, 3 axes, with EUT energized.	A
	Shock Withstand	15g, 3 +/- shocks, 3 axes, with EUT non-energized.	
IEC 60068-2-27	Bump (Non-operating test)	10g, 1k bumps, 6 axes, with EUT non-energized.	No damage, functions
IEC 60068-2-31	Drop & Topple	100mm non-energized	No damage, functions
IEC 60255-21-3	Seismic	1-35Hz; X axis: 7.5mm, 2g; Y axis: 3.5mm, 1g	A
EN 60255-27	Product safety requirements: information technology equipment	Impulse: 1/5kV _{PEAK}	No damage, breakdown or flashover
		Dielectric: 820V _{RMS} /1150V _{DC}	
		Insulation Resistance: >100MΩ	
CISPR22	Radiated RF Emission	Radiated Emissions: 30 MHz to 6 GHz	Class A

Standard	Description	Test Level / Class	Pass Criteria
	Conducted Emission	NA	
IEC 61000-4-2	Immunity to Electrostatic Discharge	8kV - Contact/15kV – Air	A
IEEE C37.90.3			
IEC 61000-4-3	Immunity to Radiated RF	80 MHz- 3 GHz @ 10V/m (35V/m)	A
IEEE C37.90.2			
IEC 61000-4-4	Immunity to Fast Transient Burst	4kV/5kHz	A/B
IEEE C37.90.1			
IEC 61000-4-5	Immunity to Surge	Power and Signal ports: 4/2/1/0.5kV	A/B
IEEE 1613			
IEC 61000-4-6	Immunity to Conducted RF	10Vrms/150kHz-80MHz	A
IEC 61000-4-18	Immunity to Damped Oscillatory	2.5kV/1MHz	A/B
IEEE C37.90.1			
IEC 61000-4-8	Immunity to Power Magnetic Field	100A/m @ 180s	A
		1000A/m @ 3s	
IEC 61000-4-11	Immunity to Voltage Dip and Interrupt	100% @ 5, 10-200msec (10msec increments)	A
IEC 61000-4-16	Immunity to Conducted CM Disturbances (DC-150kHz)	30Vrms & 300Vrms	A/B
IEC 61000-4-17	Ripple on DC power supply	10% AC ripple on DC Power Port	A
IEC 61000-4-29	Dip and Interrupt on DC power supply	Voltage Dips: 40%/70% for 0.01 sec	A
		Interruptions: 0% for 0.01 sec	
		Variations: 85% to 120% for 10 sec	

Appendix B – Warranty

Warranty

For products shipped as of October 1st, 2013, G100 warrants most of its GE Vernova manufactured products for 10 years. For warranty details including any limitations and disclaimers, see the GE Vernova Grid Solutions Terms and Conditions at:

<https://www.gevernova.com/grid-solutions/multilin/warranty.htm>

Appendix C – Glossary of terms used in this document

D

DP: Display Port

G

GPIO: General Purpose I/O

GUI: Graphical User Interface (also called Human Machine Interface – HMI)

GW / GTW: Gateway (in Substation Automation context)

H

HMI: Human Machine Interface (also called Graphical User Interface – GUI)

HMI Client: Client-side functionality that resides in the user's browser

HMI Server: Server-side functionality that resides on the G100 and provides services to the client-side browsers

HTTP: HyperText Transfer Protocol

HTTPS: Designated the use of HTTP but with a different default port and an additional encryption/authentication layer between HTTP and TCP

I

IED: Intelligent Electronic Device

IP: Internet Protocol

IRIG-B: Inter Range Instrumentation Group (IRIG) - an American standardized network time code format

L

LAN: Local Area Network

M

MAC: Media Access Control

MCP: Multifunction Controller Platform

N

NIC: Network Interface Card

NTP: Network Time Protocol

NVRAM: Non-Volatile Random Access Memory

P

P: Power

PRP: Parallel Redundancy Protocol

PTP: Precision Time Protocol

R

RTC: Real-time clock

S

SCADA: Supervisory Control And Data Acquisition

SNTP: Simple Network Time Protocol

SSH: Secure Shell

T

TCP: Transmission Control Protocol

U

UR: Universal Relay

URL: Universal Resource Locator

Modification Record

Version	Revision	Date	Change Description
1.00	0	25 th May, 2021	Initial release.
	1	5 th July, 2021	Updated GPIO DO types and Compliance standards.
	2	6 th January, 2022	Updated to reflect that UEFI settings are retained even after super cap discharges.
	3	19 th September, 2022	In Chapter 3, - Updated the steps for Installation of optional D.20 HDLC Card In Chapter 4, - Added Table 13, GE Item # (517-0169) In Chapter 5, - Added Real Time Clock (RTC), clock free running accuracy content in System table
3.00	0	17 th April, 2023	In Chapter 1, - Added Disclaimer - Updated Order Code and added MCP Redundancy Kit Switch Panel (SW PNL) table In Chapter 3, - Added redundancy operation for v3.0 - Added Redundancy wiring for v3.0 - Updated Power-On Self-Test (POST) section
	1	18 th July, 2023	In Chapter 3, - Updated Power-On Self-Test (POST) section In Chapter 4, - Updated DP Display Port section, added content for Display port and adapters required for G100
	2	18 th August, 2023	Corrected G500 reference to G100 in Ordering guides section.

Version	Revision	Date	Change Description
3.10	0	23 rd August, 2023	In Chapter 1 , Updated Order Code
4.00	0	28 th March, 2024	GE Vernova Logo is added on the first page. In Chapter 1, - Updated Order Code - Added sections - Changes to G100 Model Number, As-Built model number digits and As-is model number In Chapter 3, Note is added describing the redundancy mode available for v4.0 in G100 System redundancy section In Chapter 4, - In Supplying power through the D.20 Link section, corrected D.20 power supply rating - Added 4-pin mating connector P/N for D.20 HDLC connectors - Added new sections under D.20 Connection topologies: - Single D.20 link with redundant G100 - Single D.20 link, redundant LAN with redundant G100 - Redundant D.20 link, redundant LAN with redundant G100 In Chapter 5, - In the Communications table, updated the baud rates for Serial Communications
4.10	0	20 th August, 2024	Updated Company name, Copyright Notice and Trademark Notice. In Chapter 1, Updated Order Code

Version	Revision	Date	Change Description
			- Remote Desktop HMI functionality and license are no longer available In Chapter 4, - Added section to specify D.20 Link Capabilities and Restrictions In Chapter 5, - In the Communications table, updated the Ethernet connections
5.00	0	01 st November, 2024	In Chapter 1, - Updated Order Code In Chapter 4, - Updated connections of D.20 link for G100 (A & B) for the following: - Single D.20 link with redundant G100 layout - Single D.20 link, redundant LAN with redundant G100 layout - Updated Table 20 and Table 21 - Removed section Redundant D.20 link, redundant LAN with redundant G100 and Table 22
5.10	0	17 th December, 2024	In Chapter 1, - Updated Order Code In Chapter 4, - Added new sections under D.20 Connection topologies: - Single Ring and Fiber Optic (FO) D.20 link with redundant G100 - Single Ring and Fiber Optic (FO) D.20 link, redundant LAN with redundant G100
5.20	0	08 th May, 2025	In Product Support, Updated GE Vernova email addresses and phone numbers in Contact Technical Support section

Version	Revision	Date	Change Description
			In Chapter 1 , - Updated Order Code - Updated MCP Spares and Accessories table In Chapter 4 , - In the D.20 Connection topologies section, updated all D.20 layouts
	1	24 th June, 2025	In Chapter 4 , - Added clarification for each D.20 layout with maximum supported peripherals - Added new layouts - Dual D.20 terminated, Ch 1 only - Dual D.20 terminated, with redundant G100
	2	03 rd October, 2025	In Chapter 1 , - Updated Order Code with DC Analog Inputs A,V In Chapter 4 , - In Analog DC Inputs (AI) section, added a note and supported illustration showing: - Analog Input selection jumpers (JAI12~JAI15) - IRIG-B Input selection jumper (JIRIGB1) - Updated SFP modules supported by the G100 table In Chapter 5 , - In the Electrical table, added maximum power consumption for G100
5.40	0	09 th February, 2026	In Chapter 1 , - Updated Order Code In Chapter 4 , - Clarified D.20 cable p/n in D.20 Link feature section - Updated SFP modules supported by the G100 table

Version	Revision	Date	Change Description
			In Chapter 5, • In the Electrical table, added GPIO AI – Full Scale, Accuracy, Impedance, Conversion range (A & V) and Conversion time