



Operation & Maintenance Manual

IP-MAN-G4-0325-EN



G4 POWER CONTROLLER

600 VDC, 13.2 Amps

This manual covers model numbers:

IP-POWER-G4-M

IP-POWER-G4-R

IONPURE® is a registered trademark of Xylem or one of its affiliates.

MODBUS® is a registered trademark of Schneider Electric, USA, Inc. All other Trademarks are those of their respective owner.



Revision History

NOTE: **Ensure printed copies of this manual are kept up-to-date with the latest revisions.**

Date	Revision	Author/ Engineer	Description
March 2025		ATR	Original publication

Table of Contents

Preface Pages.....	6
Disclaimer Statement	6
Proprietary Rights Statement.....	6
Compliance	7
1. Introduction	8
1.1. Caution and Warning Messages.....	8
1.2. General Description	8
1.3. Connection and Configuration Points.....	10
2. Installation	11
2.1. Environment	11
2.2. Mounting.....	11
2.2.1. Orientation and Spacing	12
2.3. AC Supply	13
2.3.1. Isolation Transformer.....	13
2.3.2. Over-Current Protection.....	14
2.3.3. Electrical Surge Suppression.....	14
2.4. High Voltage Connections	15
2.4.1. P2 Power Connector Wiring.....	15
2.4.2. P2 Connector Ratings.....	16
2.4.3. P2 Power Connector Wire Insertion	16
2.5. Low Voltage Connections	17
2.5.1. P1 Command Connector Wiring	17
2.5.2. P1 Command Connector Specifications.....	18
2.5.3. Signal Wiring Guidelines.....	18
2.5.4. Control of DC Output Current (P1-1, P1-2)	18
2.5.5. Remote Run/Stop (Enable Signal, P1-3, P1-4)	19
2.5.6. Analog Outputs (P1-5, P1-6; P1-7, P1-8).....	19
2.5.7. 12V Display Power (P1-9, P1-10)	19
2.5.8. Alarm Relay (P1-11, P1-12).....	20
2.6. Selector Switches	22
2.6.1. DIP Switch for Current Range Selection	22

2.6.2. Rotary Switch	22
3. USB-C Interface and Power Panel Software	25
3.1. Minimum PC Requirements for Power Panel.....	25
4. Operation	26
4.1. Initial Startup – Example.....	26
4.2. DC Current Adjustment.....	26
5. Indicator LEDs.....	27
6. CEDI Module Protection Parameters	28
6.1. Voltage Limit [SP-11]	28
6.2. Current Limit [SP-12]	28
6.3. Ground Current Threshold [SP-13 / SP-15]	28
6.4. CEDI Module Resistance [MP-227 / MP-228]	28
7. Troubleshooting.....	30
7.1. Problem Analysis Table	30
7.2. Warning Alarms	30
7.2.1. Voltage Limit.....	31
7.2.2. Current Limit.....	31
7.2.3. SIC Module High Temperature	31
7.2.4. Fan 1 or Fan 2 Loss.....	31
7.2.5. Open Load/No Load	32
7.2.6. Shorted Load/Output Short Circuit.....	32
7.2.7. High CEDI Module Resistance	32
7.2.8. Network Timeout (shutdown not selected)	32
7.2.9. Ground Current Alarm Threshold Exceeded	32
7.3. Inhibit Alarms.....	32
7.3.1. AC Line Sync Loss	33
7.3.2. Over Current Trip.....	33
7.3.3. SIC Module Over Temperature.....	33
7.3.4. Input Voltage High	33
7.3.5. Input Voltage Low.....	33
7.3.6. High Ground Current	33
7.3.7. Invalid Current Range Setting.....	34
7.3.8. Network Timeout (shutdown selected)	34

7.3.9. I/O Power Supply Failure	34
7.3.10. Control Loop Reset.....	34
7.4. Other Non-Typical Alarms	34
7.4.1. “WATCHDOG TIMEOUT, EEPROM ERROR”	34
Appendix A. Design Considerations	35
A.1. Basic Isolation Transformer Design Considerations	35
A.2. Isolation Transformer Temperature Rise and Insulation Class	35
A.3. Other Isolation Transformer Design Considerations	35
Construction	35
Electrostatic Shield	36
Thermal Switch.....	36
Voltage Taps, Primary	36
A.4. CEDI Module Power Requirements and Isolation Transformer Sizing for a Single G4 Power Controller.....	37
A.5. Fuses and Circuit Breakers	38
A.6. Snubbers (optional)	38
A.7. Enclosure	38
A.8. Contactor (Optional)	39
Appendix B. Engineering Documents and Drawings	40
B.1. Full-Scale Dimensional Drawing for IP-POWER-G4-M and IP-POWER-G4-R.....	41
B.2. Electrical Drawing of Typical Single-Module Installation – Single-Phase Transformer ..	42
B.3. Electrical Drawing of Typical Two-Module Installation – Single-Phase Transformer, Shared Secondary Winding	43
B.4. Electrical Drawing of Typical Three-Module Installation – Three-Phase Transformer, Independent Secondary Windings	44
B.5. Electrical Connections to the CEDI Module	45
Appendix C. Modbus TCP (G4-M Models Only).....	46
C.1. Data Addresses in Modbus Messages	46
C.2. Modbus Registers	49
Setup Parameters, Range 1–199	49
Monitor Parameters, Range 200–389	59

Preface Pages

Disclaimer Statement

The operation and maintenance manual should provide complete and accurate information to meet your operating and/or service requirements based on the information available at the time of publication. The information in this manual may not cover all operating details or variations or provide for all conditions in connection with installation, operation, and maintenance. Should questions arise which are not answered specifically in this manual, contact your equipment supplier.

IONPURE® reserves the right to make engineering refinements that may not be reflected in this manual. The material in this manual is for informational purposes and is subject to change without notice.

Proprietary Rights Statement

This manual discloses information in which IONPURE® has proprietary rights. Neither receipt nor possession of this manual confers or transfers any right to the client, and by its retention hereof, the client acknowledges that it will not reproduce or cause to be reproduced, in whole or in part, any such information except by written permission from IONPURE®. The client shall have the right to use and disclose to its employees the information contained herein for the purpose of operating and maintaining the IONPURE® equipment, and for no other purpose.

In the event the content of this manual is altered, or section/items are omitted during reproduction, in whole or in part, and instructions or definitions within the reproduction result in personal injury to those who follow the altered instructions, the burden of responsibility for personal injury falls solely on the party who effects the reproduction.

© 2025 Xylem Inc. or its affiliate. All rights reserved.

IONPURE® is a registered trademark of Xylem or one of its affiliates.

Compliance

The IONPURE® G4 Power Controller (IP-POWER-G4-M and IP-POWER-G4-R) conforms to the following marks:



100 kA Short Circuit Current Rating



EN 60947-4-3
IP 20



Part 15 Subpart B
Class B Device



1. Introduction

1.1. Caution and Warning Messages

WARNING and CAUTION labels are used to attract attention to essential or critical information in this manual. The labels are located to the left of the associated messages. Caution and Warning messages will be located immediately before related text.



Warnings indicate condition, practices, or procedures that must be observed to avoid personal injury or fatalities.



Cautions indicate a situation that may cause damage or destruction of equipment or may pose a long-term health hazard.

Notes are also used to draw attention to information. Notes may be located before or after the related text.

NOTE: **Notes are used to add information, state exceptions, and point out areas that may be of greater interest or importance.**

1.2. General Description

The IONPURE® G4 power controller is a compact, high-performance, microprocessor-based single-phase DC power controller.

The unit was designed specifically as a component of a DC power supply system used with CEDI modules manufactured by IONPURE®. This unit can be used with the MX, LX, and VNX lines of CEDI modules.

The power controller is designed for operation in constant current mode. In constant current mode, the output current is maintained at the selected value, by adjusting the output voltage as the electrical resistance of the module varies.

The G4 accepts a nominal input voltage range of 220-660 VAC (45-65 Hz), has a maximum output voltage of 600 VDC (or 90% of the AC input voltage), and can deliver a maximum output current of 13.2 ADC.

The controller has five selectable DC output current ranges: 0-2.5 A, 0-4.0 A, 0-6.5 A, 0-10.0 A, and 0-13.2 A. One of these current ranges is selected with the on-board DIP switch to match the maximum current requirement of the CEDI module.

There are two models available:

- IP-POWER-G4-M: Modbus TCP version.
- IP-POWER-G4-R: version to retrofit IONPURE® G1, G2 and DCR-R power controllers.

The DC output current can be adjusted by one of following methods:

- IP-POWER-G4-M models:
 - A digital IONPURE® touch panel display, Model No. IP-POWERDSP-TP, which can operate up to sixteen power controllers.
 - A Modbus TCP client (master).
 - A 4-20 mA input signal from a remote process controller, such as a PLC.
- IP-POWER-G4-R models:
 - An IONPURE® digital display board, Model No. IP-POWERDSP-G2, which can operate up to sixteen power controllers.
 - An IONPURE® analog display board, Model No. IP-DSP1 or IP-DSP1P, which can operate one power controller. 12 VDC (300 mA) power is available on-board to conveniently power the display.
 - An IONPURE® analog display board, Model No. IP-DSP8 or IP-DSP8P, which can operate up to eight power controllers.
 - A 0-5 VDC input signal from a remote process controller, such as a PLC.

The power controller output can be turned on and off by a dry signal from a remote set of contacts. This feature allows the use of remote instrumentation, such as a flow switch, for turning off controller output.

The on-board Modbus TCP fieldbus interface (IP-POWER-G4-M model only) allows remote monitoring of multiple operating parameters including output voltage and current, module resistance, unit temperature, alarms, etc.

Both G4 models are supplied with two analog metering outputs to provide feedback of output voltage and current to a control system.

Power and Status LEDs aid in troubleshooting, while a USB-C connection allows for full system diagnostics via the IONPURE® Power Panel software.

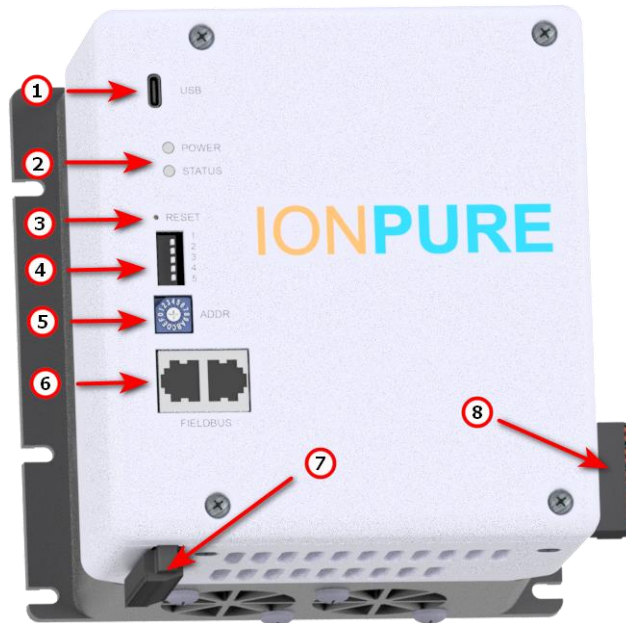
The unit's robust design allows for continuous full frame current up to 50 °C (122 °F) at up to 1,830 meters (6,000 feet) altitude. Cooling is accomplished via forced air.

The DC power controller is a component of the DC power supply used with IONPURE® CEDI modules. A complete DC power supply must include all the following:

- The DC power controller
- An isolation transformer
- Circuit protection (fuses or circuit breakers)
- Controls and operator interface
- Enclosure with cooling

Full-size dimensional drawings of the G4 Power Controllers are included in Appendix B.

1.3. Connection and Configuration Points



Label	Name	Description
1	USB-C Port	For connection to a PC to monitor, configure, update or perform diagnostics using the IONPURE® Power Panel software.
2	Indicator LEDs	Power state and unit Status to assist with diagnostics.
3	Controller Reset	Momentary switch for hardware reset of the G4 processor.
4	DIP Switch	For selection of DC output current range.
5	Rotary Switch	For selection of unit ID and analog metering scaling (G4-R) or setting the Modbus TCP network address (G4-M).
6	Ethernet Ports	Modbus TCP (G4-M) or G2 protocol (G4-R) interface
7	P1 Command Connector	12-pin connector providing analog Setpoint and Metering, Run/Stop, Alarm Relay, and 12V power (for IP-DSP1 or IP-DSP1P display).
8	P2 Power Connector	5-pin connector for AC input, DC output, and ground connections.

2. Installation

2.1. Environment

Allowed storage temperature range for the G4 power controller (when not in operation) is -20 to 70°C (-4 to 158°F)

The environmental limits for operation are 0 to 50°C (32 to 122°F), at up to 95% relative humidity (non-condensing). An enclosure with at least an IP52/NEMA 12 rating is recommended.

The maximum heat generated by each G4 is approximately 150 watts at full power output. Additional heat generation may be contributed by other equipment in the enclosure.

The G4 contains on-board cooling fans; however, the enclosure should also include a cooling fan that draws through ambient air (enter at side bottom, exhaust at opposite side top).

In installations where a water-resistant enclosure (IP56/NEMA 4) is necessary, cooling the interior of the enclosure is more difficult. Typical cooling methods include:

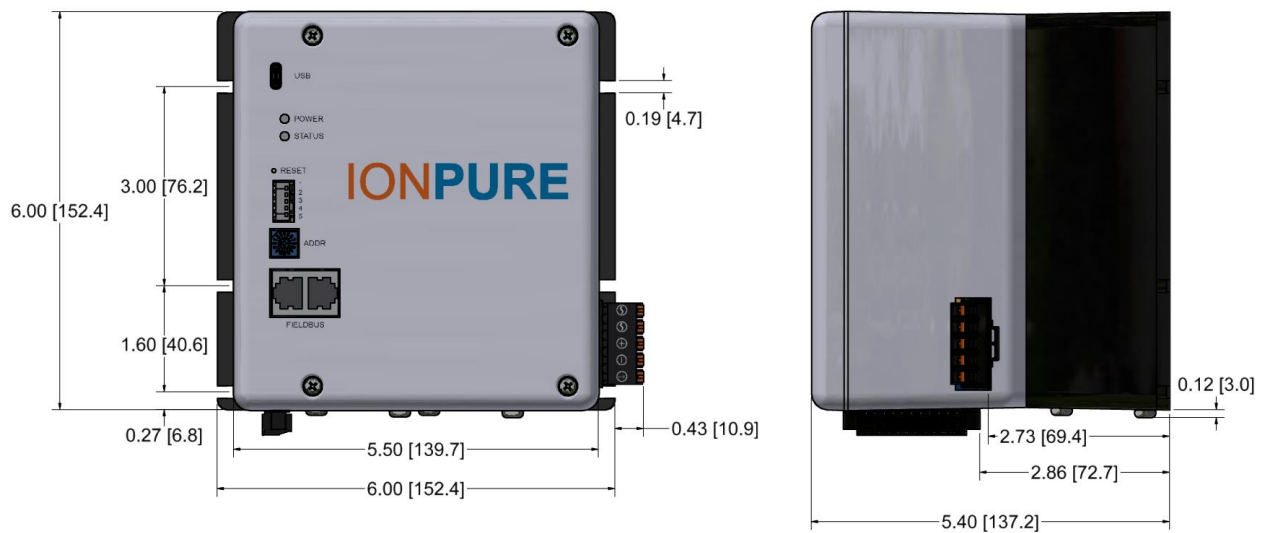
- Sizing the enclosure for a sufficient rate of heat transfer to the environment through the enclosure walls.
- Using an air-to-air or water-to-air heat exchanger.
- Installing an air conditioning unit.
- Using vortex cooling.

2.2. Mounting



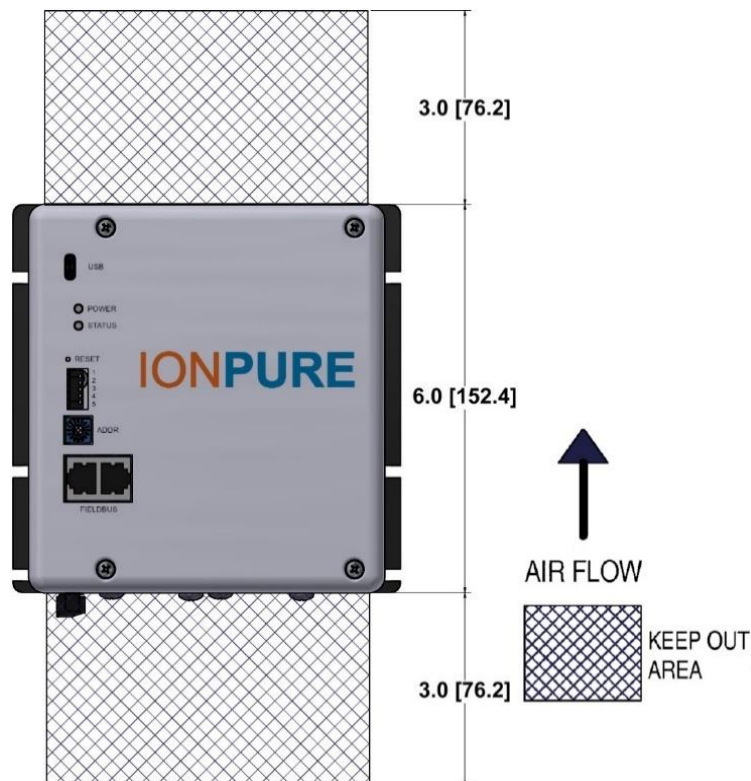
Electrostatic discharge can damage electronic components. Make contact with a grounded conductive pad and/or wear a grounded wrist strap when you handle the power controller.

The G4 power controller is intended for mounting on a sub-panel inside an enclosure using four to six screws, either M4 or UNC 8-32 (not included). The location of the mounting slots is shown below.



2.2.1. Orientation and Spacing

Mount the power controller vertically. The top and bottom of the controller must have a minimum of 3.0 inches (76.2 mm) free from obstructions, as measured from the edge of the heatsink. Dimensions below are measured from the edge of the heatsink base. The keep out area on the top and bottom are for air circulation.



2.3. AC Supply

The G4 accepts single-phase power ranging from 220 to 660 VAC. The AC voltage supplied to the power controller should be at least 1.1 times the maximum DC voltage required by the CEDI module. For example: if the maximum DC voltage required by a CEDI module is 300 VDC, then the input to the G4 must be at least 330 VAC.

CAUTION

The power controller can tolerate input voltage variations of $\pm 5\%$ over the nominal working range of 220 – 660 VAC. The unit must not be operated outside this tolerated range.

Electrical drawings for typical installations are shown in Figures B.2, B.3, and B.4 in Appendix B.

2.3.1. Isolation Transformer

The AC input to the power controller must be isolated from the AC mains by an isolation transformer that is correctly sized for the maximum power required by the CEDI module (See Appendix A).

WARNING

For safe and proper operation, this controller may only be used on the output of an isolation transformer. Do not apply power to this controller without an isolation transformer upstream. Failure to follow this warning may result in injury or death.

The purpose of the transformer is to:

- Provide isolation from the AC mains so that the cathode of the CEDI module can be grounded. This is grounded effectively on the DC negative, internally on the G4.
- Convert the voltage of the AC mains to an optimum value for operation of the power controller and the CEDI module.
- The transformer shown in Figure B.2, for example, can convert the 480 VAC from AC mains to a 660 VAC input to the G4.

WARNING

The secondary of the transformer MUST NOT be connected to earth ground. Failure to follow this warning will damage the G4 and may result in injury or death.

Refer to Appendix A for design recommendations for isolation transformers.

2.3.2. Over-Current Protection



The G4 does not have built-in fuses for the AC input. Over-current protection devices, such as circuit breakers or fuses, must be installed between the isolation transformer and the AC input terminals, for example as shown in Figures B.2, B.3 and B.4.

NOTE: Consult applicable local codes on sizing of upstream fuses or circuit breakers to protect the power controller. Review section A.5 of this manual.

Review section A.4 to find the maximum AC current draw at the given AC input voltage and maximum DC output requirements. A fuse size of 1.25 the maximum AC current draw, rounded up to the nearest available fuse size is typical.

Over-current protection devices must also be installed on the primary of the isolation transformer and sized correctly according to applicable local electrical codes.



Do NOT install fuses, circuit breakers or any type of switching device between the DC output of the G4 and the CEDI module.

2.3.3. Electrical Surge Suppression

Inductive elements in a circuit can generate harmful voltage spikes when a switch, contactor or breaker opens and cuts the current flow abruptly. Snubbers are energy absorbing circuits used to suppress those spikes and may be desirable for an extra layer of protection at sites with poor electric power quality.



Although the power controller's input section is protected by an MOV (metal oxide varistor), an IONPURE® snubber should be considered at sites with poor electric power quality indicated by swells, over-voltages, surges, transients, etc.

Snubbers are most effective when installed on the secondary of the transformer, between any switching devices and the power controller.

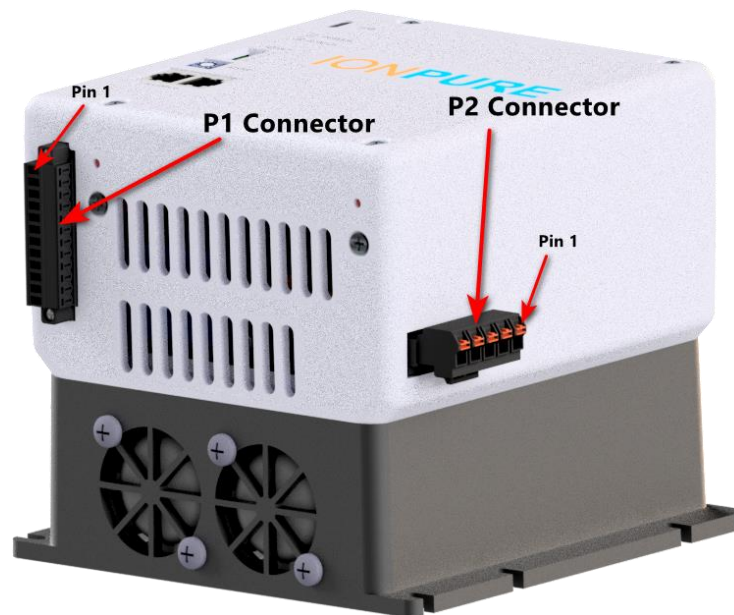
IONPURE® offers snubber circuits, model numbers IP-SNUBCIRC-1PH and IP-SNUBCIRC-3PH. The 3-phase version is only suitable for installation on the primary side of the isolation

transformer, while the single-phase version can be installed on the transformer secondary. Refer to the Voltage Snubber instruction manual (available at www.ionpure.com) for details.

2.4. High Voltage Connections

AC input, DC output and ground connections are made at the P2 Power connector (5-pin) as described below.

2.4.1. P2 Power Connector Wiring



P2 Terminal	Connection	Picture
1 and 2	AC input from isolation transformer	
3	DC positive output to anode of CEDI module (red terminal)	
4	DC negative output to cathode of CEDI module (black terminal)	
5	Earth ground inside panel enclosure	

NOTE: You must wire controllers in conformance with applicable local wiring codes.



The ground terminal (P2-5) of the power controller must be connected to earth ground (PE) inside the power supply enclosure.



DO NOT install a jumper between terminals P2-4 and P2-5 of the power controller, nor between the negative and ground terminals of the CEDI module. The DC- terminal is internally grounded inside the G4. Follow the wiring guidelines illustrated in Figure B.5.



Do NOT install fuses, circuit breakers or any type of switching device between the DC output of the power controller and the CEDI module.

2.4.2. P2 Connector Ratings

	UL	IEC
Rated Voltage	600 V	1000 V
Rated Current	20 A	20 A
Suitable Solid Wire	24 –12 AWG	0.2 – 2.5 mm
Suitable Flex Wire	24 –12 AWG	0.2 – 2.5 mm
Impulse Volts		8 KV
Wire Strip Length	11 mm	

2.4.3. P2 Power Connector Wire Insertion

The P2 connector uses a push-in wire clamping method. It accepts 24 –12 AWG (UL) / 0.2 – 2.5 (IEC) solid or flexible wire. Wire must be stripped to 11 mm (about 7/16 inches).



Using a small screwdriver or flat blade, press the orange spring tab to release the wire clamp.



With the clamp button pressed, insert the stripped wire fully into the open connector terminal.

Ensure the wire is stripped to proper length (11 mm) and is inserted all the way in the connector.



Release the terminal clamp button by removing pressure with the screwdriver or blade.

The wire should resist pull-out and be firmly clamped on stripped portion of the wire.

2.5. Low Voltage Connections

The P1 Command connector (12-pin) provides terminals for output current analog setpoint, output voltage and current analog metering, Run/Stop signal, Alarm relay, and 12V power for an IP-DSP1 or IP-DSP1P display.

2.5.1. P1 Command Connector Wiring

P1 Terminal	Connection	Picture
1	Output Current Analog Setpoint – Ic-	
2	Output Current Analog Setpoint – Ic+	
3	Enable Signal (dry contact) – Common	
4	Enable Signal (dry contact) – Run/Stop	
5	Output Voltage Analog Metering – Vm-	
6	Output Voltage Analog Metering – Vm+	
7	Output Current Analog Metering – Im-	
8	Output Current Analog Metering – Im+	
9	IP-DSP1 Display Power – Ground	
10	IP-DSP1 Display Power – +12V	
11	Alarm Relay Output – Common	
12	Alarm Relay Output – N.O.	

2.5.2. P1 Command Connector Specifications

Number of wires	Wire Size Suitable for Connector (AWG)	Recommended Tightening Torque
1	16 – 26	3.0 lbf·in [0.34 N·m]
2	20	3.0 lbf·in [0.34 N·m]

2.5.3. Signal Wiring Guidelines

Proper grounding and wiring of all electrical equipment are important to help ensure optimum operation of your system and to provide additional electrical noise protection for your application.

Please follow these guidelines for your signal wiring:

- The ground connections of the power controller(s) and the analog signal processing equipment (e.g. PLC module, panel meter, etc.) should be connected to the earth ground of the system.
- All ground wires should be as short as possible.
- Always use shielded twisted-pair cables for analog signals.
- Connect only one end of the cable shield to earth ground.
- Keep cable length as short as possible. Recommended length is 100 feet (30.5 meters) or less for current signals (4-20 mA), 15 feet (4.6 meters) or less for voltage signals (0-5 VDC), and 328 feet (100 meters) or less for Ethernet (CAT5 or CAT6) cable.
- Keep signal wires as far away as possible from AC wires and rapidly switched DC wires. Place them in separate wire trays or ducts.
- Follow other grounding and wiring guidelines for your analog signal processing equipment.
- If possible, use analog signal metering devices with differential inputs for improved noise immunity.

2.5.4. Control of DC Output Current (P1-1, P1-2)

It is necessary to provide a setpoint to control the DC output current to the CEDI module.

Use **only one** of the following options to control the DC output current:

- For IP-POWER-G4-M models:
 - Modbus TCP client, which can operate an unlimited number of power controllers (set via IP address).
 - IONPURE® Touch Panel Display, Model No. IP-POWERDSP-TP, which can operate up to sixteen power controllers. Use standard CAT6 cable between units.
 - A 4-20 mA input signal (Ic) from a remote process controller, such as a PLC, connected to P1-2 (Ic+) and P1-1 (Ic-). The analog signal corresponds to 0-100% of the selected DC output current range.

- For IP-POWER-G4-R models:
 - IONPURE® G2 digital display board, Model No. IP-POWERDSP-G2, which can operate up to sixteen power controllers. Use standard CAT6 cables, IONPURE® model number IP-CABLE50CM-G2 or IP-CABLE2M-G2.
 - IONPURE® single-channel display board, Model No. IP-DSP1 or IP-DSP1P, which can operate one power controller. Wiring to adapter IP-VNXCABLE06 or IP-VNXCABLE10 is required.
 - IONPURE® eight-channel display board, Model No. IP-DSP8 or IP-DSP8P, which can operate up to eight power controllers. Wiring to adapter IP-VNXCABLE06 or IP-VNXCABLE10 is required.
 - A 0-5VDC input signal (Ic) from a remote process controller, such as a PLC, connected to P1-2 (Ic+) and P1-1 (Ic-). The analog signal corresponds to 0-100% of the selected DC output current range.

2.5.5. Remote Run/Stop (Enable Signal, P1-3, P1-4)

The DC output is switched on/off by a remote isolated non-powered (dry) contact connected to the terminals 3 and 4 on the P1 connector. A closed contact enables the power controller's DC output; an open contact shuts it off.

A possible implementation: flow switches on the feed, product and/or reject streams of the CEDI module or system, and an auxiliary contact of the motor starter of the RO or CEDI feed pump could be wired in series to the coil of a time-delay relay (to allow the flow signals to stabilize before activating). One of the relay contacts would be wired to the remote Run/Stop input to apply DC power to the module only when there is water flow.

2.5.6. Analog Outputs (P1-5, P1-6; P1-7, P1-8)

The analog outputs for the unit are listed below with associated connection information:

- A 4-20 mA (for I IP-POWER-G4-M models) or selectable (via Rotary Switch) 0-5 VDC or 0-6 VDC (for IP-POWER-G4-R models) output is provided at terminals 5 and 6 on the P1 connector for remote display of output voltage. The signal is calibrated to correspond to 0-100% of the DC output voltage range.
- A 4-20 mA (for IP-POWER-G4-M models) or 0-5 VDC (for I IP-POWER-G4-R models) output is provided at terminals 7 and 8 of the P1 connector for remote display of output current. The signal is calibrated to correspond to 0-100% of the selected (via DIP switch) DC output current range.



The allowable load impedance for current outputs is 0-500 ohms, and 500-1,000 ohms for voltage outputs.

2.5.7. 12V Display Power (P1-9, P1-10)

A 12V power supply is available to power a legacy IONPURE® IP-DSP1 or IP-DSP1P display. This is used only when retrofitting a G4-R model in systems using any of these displays.



Do not use these terminals to power any device other than an IONPURE® IP-DSP1 or IP-DSP1P display.

2.5.8. Alarm Relay (P1-11, P1-12)

There is one normally-open relay available on the G4. By default, the alarm relay will energize when the power controller is outputting DC power. This signal can be used for remote status indication (e.g. Run/Standby status light).

The relay can be configured with the Power Panel software to indicate other conditions and/or alarms. Both the Relay Alarm Mask (SP-16) and the System Relay Mask (SP-85) map to the relay. In the Power Panel software, select the check box next to the alarm/function that you wish to energize the relay if the condition is met. Any number of conditions may be mapped to the relay.

The Relay Alarm Mask maps any or all the following events:

Name	Description
Fan 1 or 2 Loss	Loss of operating signal for either fan is detected.
Input Voltage Too High	DC-Link voltage is too high for operation.
Voltage Limiting	The voltage limit is reached.
Current Limiting	The current limit is reached.
Digital Run Enable is Set	Alarm relay will energize when run enable is set to run.
High CEDI Module Resistance	CEDI module resistance reaches or exceeds the resistance limit. See Modbus Register SP-160 for threshold details.
High Temperature Warning	The SIC module is within 5°C of the maximum temperature rating. The relay will turn off when the temperature returns 5°C below the maximum temperature rating for the SIC module.
Current Trip	A current trip has occurred. This will keep the relay energized until the fault condition is reset.
Over Temperature Shutdown	SIC Module reached overtemperature. The controller will remain in a fault state until the temperature drops into a safe range and the fault is cleared.

The System Relay Alarm Mask maps any or all the following events:

Name	Description
Processor Error Trap	These are types of errors where the controller will not be functioning. To clear errors connect to Power Panel software.
Communications Error	A communication problem occurred when using digital communications.
Memory Error	EEPROM checksum failure.
Watchdog Timeout	Specific processor error trap (MP-210 bit 7).
Output is ON	Relay is enabled when controller is outputting.
Controller is in RUN State	The Controller State (MP-248) is in Run.
RUN Enable	The Run/Stop switch is closed on the P1 Connector.

The following conditions must be met for the controller to be in “Run” state:

- The RUN/STOP input (P1-4) on the P1 connector must be shorted to Common (P1-3).
- If enabled, the Digital RUN/STOP must be set to 1.
- AC Line has to be ON (supplied to the controller).
- DC-Link voltage must be high enough ($10V < DC\text{-}Link < 1000V$).
- The controller must have AC Line synchronization = No “AC Line Sync Loss”.
- The controller’s SIC module temperature must be below the shutdown threshold.
- If enabled, there must be no I/O Power supply failure alarm active.

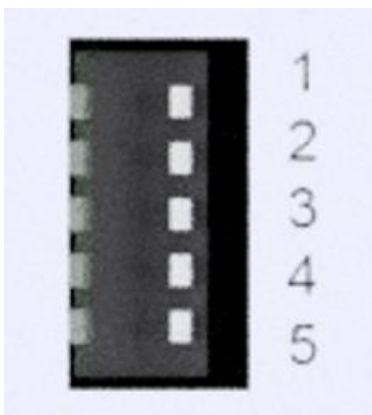
2.5.8.1. Alarm Relay Specifications

Parameter	Value
Rated Load	0.3 A at 125 VAC 1 A at 30 VDC
Rated Carry Current	2 A
Maximum Switching Voltage	125 VAC 60 VDC
Maximum Switching Current	1 A

2.6. Selector Switches

2.6.1. DIP Switch for Current Range Selection

DC output current range is selected via the current range DIP switch, as shown below. The ON position is left; OFF is right (towards the IONPURE® logo).



Current Range	Switch 1	Switch 2	Switch 3	Switch 4	Switch 5
0-2.5	OFF	OFF	OFF	OFF	OFF
0-4	ON	OFF	OFF	OFF	OFF
0-6.5	OFF	ON	OFF	OFF	OFF
0-10	OFF	OFF	ON	OFF	OFF
0-13.2	OFF	OFF	OFF	ON	OFF

Refer to section A.4 in Appendix A for correct current range selection from column “Maximum Required DC Amps”.

2.6.2. Rotary Switch



For both G4 models, the primary function of the Rotary Switch is to set a unique address to each G4 when multiple units will communicate with an IONPURE® digital display or a Modbus TCP client. In G4-R models, the Rotary Switch also selects the range for the output voltage analog metering (Vm) for compatibility with legacy IONPURE® displays.

2.6.2.1. IP-POWER-G4-M Models: Selection of Modbus TCP Octet Address

The Rotary Switch sets the Modbus TCP octet address for each G4 power controller. The switch position is added to the last octet of the base IP address. The table below shows the IP

addresses that will be assigned for the various Rotary Switch settings when using the G4 default base IP address of 192.168.0.200. This allows setting unique addresses for up to 16 units.

For Default Case of Base IP Address 192.168.0.200		
G4 Unit Number	Rotary Switch Position	Modbus TCP Slave IP Address
1	0	192.168.0.200
2	1	192.168.0.201
3	2	192.168.0.202
4	3	192.168.0.203
5	4	192.168.0.204
6	5	192.168.0.205
7	6	192.168.0.206
8	7	192.168.0.207
9	8	192.168.0.208
10	9	192.168.0.209
11	A	192.168.0.210
12	B	192.168.0.211
13	C	192.168.0.212
14	D	192.168.0.213
15	E	192.168.0.214
16	F	192.168.0.215

To connect more than 16 G4 units in a single daisy chain, it is necessary to use the IONPURE® Power Panel software (Communications page) to reconfigure the base IP address of some of the units. For example, if G4 units 17 to 32 are given the base IP address of 192.168.0.216, then setting the Rotary Switch would assign IP addresses from 192.168.0.216 to 192.168.0.231. Likewise, for G4 units 33 to 48, using the base IP address of 192.168.0.232 would assign IP addresses from 192.168.0.232 to 192.168.0.247 (and so on for additional addresses).

NOTE: **All connected G4s must be given a unique identifying address, without any duplication.**

2.6.2.2. IP-POWER-G4-R Models: Selection of Voltage Metering Output Range and Unit ID

In G4-R models, the Rotary Switch has dual functionality:

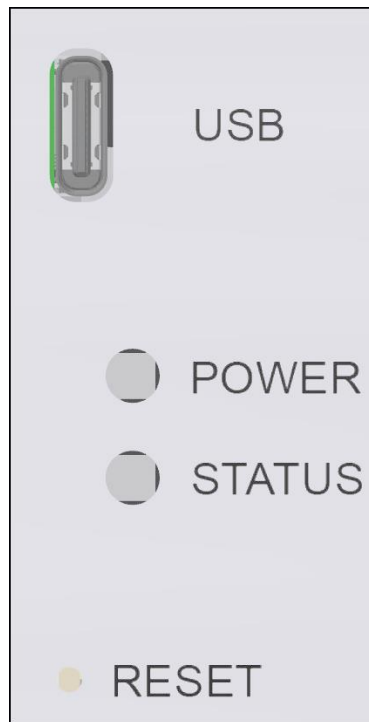
- Switches the analog output range for voltage metering (Vm) between 0-5VDC and 0-6 VDC:

- Positions 0 to E set the voltage range to 0-5 VDC. This range should be set when using IONPURE® IP-DSP1P or IP-DSP8P display boards.
- Position F sets the voltage range to 0-6 VDC. This range should be set when using IONPURE® IP-DSP1 or IP-DSP8 display boards.
- Assigns a unique identification number/letter to the power controller when using an IONPURE® G2 display.

In summary:

G4 Model	Rotary Switch Selection	Output Current Analog Setpoint Type (Ic)	Output Voltage Analog Metering Type (Vm)	Output Current Analog Metering Type (Im)	Display Compatibility
G4-R	0-E	0-5 VDC	0-5 VDC	0-5 VDC	IP-DSP1P, IP-DSP8P and IP-POWERDSP-G2
	F	0-5 VDC	0-6 VDC	0-5 VDC	IP-DSP1, IP-DSP8, and IP-POWERDSP-G2
G4-M	0-F	4-20 mA	4-20 mA	4-20 mA	IP-POWERDSP-TP

3. USB-C Interface and Power Panel Software



A USB-C interface is standard on all G4 power controllers for connecting the unit to a Windows PC running the IONPURE® Power Panel software application (available to registered users at ipro.evoqua.com). This software assists with the installation, parameter setup, operation and troubleshooting of G4 power controllers. For more details, download the Power Panel Software Manual at ipro.evoqua.com.

3.1. Minimum PC Requirements for Power Panel

Minimum PC requirements for the IONPURE® Power Panel Software are as follows:

- 1 GHz Single-Core Processor
- 1 GB RAM
- 7 GB of available hard disk space
- 1280 x 768 x 60 Hz Compatible Display Adapter
- Windows 7® (32/64 bit) or higher
- Microsoft® .NET Framework 4.0 – Client Profile
- USB port, 2.0 or higher

4. Operation

4.1. Initial Startup – Example

The startup sequence depends on the design of the CEDI system. Please consult the Operation Manual for the CEDI system. The following startup procedure is only an example for a typical single module CEDI system with an electrical drawing as shown in Figure B.2 in Appendix B.

- Close the main disconnect switch (or circuit breaker) for the CEDI system.
- Open the appropriate valves and start the pretreatment equipment, such as the reverse osmosis (RO) system, upstream of the CEDI system.
- Adjust the flow rates of the dilute and concentrate streams through the module.
- Slowly increase the DC output current to the startup current value calculated by the IONPURE® IP-PRO online tool at ippro.evoqua.com. The power controller will maintain the current at that setting if the required voltage to drive the current is lower than the maximum DC voltage available.

NOTE: If the DC output voltage reaches the maximum limit (90% of the RMS AC input voltage), it cannot increase further. If the module's resistance continues to increase, the output current will decrease per Ohm's law.

- Verify that the DC output is removed when the CEDI module flow is interrupted.



Operation with DC power on and insufficient water flow can cause irreparable damage to the CEDI module(s) and system.

During normal operation, no further attention to the power controller should be required.

4.2. DC Current Adjustment

The DC output current may need to be adjusted if there is a change in feed water conditions and/or flow rate.

5. Indicator LEDs

The G4 status (normal operation or fault conditions) is indicated by the LEDs on the front of the unit. See chart below for LED colors and indicated condition.

POWER	
Off	No mains voltage, DC-Link voltage low
Green	Mains voltage present
Red	DC-Link voltage too high
Orange	Loss of AC line synchronization
STATUS	
Off	In STOP state (no faults)
Green (solid)	In RUN state (no alarms or faults)
Green (flashing)	No command (in RUN state, but 0 A setpoint) or No load (resistance $\geq 2.1 \text{ k}\Omega$)
Red (solid)	In FAULT state ¹
Red (flashing)	Halted during initialization
Red/Green (alternating)	Shorted DC output detected
Orange (solid)	In ALARM state or in initialization ²

¹ Faults (solid red Status LED): Overcurrent Trip, Over Temperature, Output Voltage Too High, Ground Current Too High, I/O Power Supply Failure.

² Alarms (solid orange Status LED): Current Limit, Voltage Limit, High Temperature, Network Timeout, High CEDI Module Resistance.

6. CEDI Module Protection Parameters

These are features designed to help protect the CEDI module. They can be viewed and/or set using the Power Panel software or via Modbus TCP.

6.1. Voltage Limit [SP-11]

The power controller can deliver a maximum DC output voltage of approximately 90% of the AC input voltage. This parameter can limit the output voltage to an even lower level to prevent the controller from exceeding this value. If the voltage reaches the limit value, a Warning Alarm will be triggered indicating that the Voltage Limit has been achieved.

6.2. Current Limit [SP-12]

Limits the output current to prevent the controller from exceeding this value. If the current reaches the limit value a Warning Alarm will be triggered. This value will be set to 105% of the full-scale current set by the DIP switch (see section 2.6.1).

6.3. Ground Current Threshold [SP-13 / SP-15]

The G4 DC controller measures the output current to the CEDI module and the return current from it. Ground current is the difference between the output current and the return current, which could also be described as current loss and indicates that there may be a problem with the CEDI module or output wiring that is allowing current to flow into something other than the module, such as earth ground.

The Ground Current Alarm Threshold (SP-13) sets the value at which a Warning Alarm will be triggered. See section 7.2.9.

The Ground Current Inhibit Threshold (SP-15) sets the value at which an Inhibit Alarm will be triggered. See section 7.3.6.

6.4. CEDI Module Resistance [MP-227 / MP-228]

The electrical resistance of the CEDI module is calculated by the G4 controller. The resistance is captured once after the G4 has provided power to the module for 2 continuous hours after a cumulative total of 48 hours of powered operation from the initial startup.

The CEDI module resistance is recorded as the Initial Resistance (MP-227). When the Initial Resistance is recorded, the G4 also records a value for the Resistance Limit (SP-160). The Resistance Limit is set to $1.5 \times \text{Initial Resistance}$. This is higher than the recommendation in the CEDI manual (25%) to allow for temperature fluctuations. Once the Initial Resistance and Resistance Limit have been recorded, the Resistance Change % (MP-228) is updated continuously and the actual module resistance is compared with the Resistance Limit.

When the Module Resistance (MP-223) is higher than the Resistance Limit (SP-160), an alarm is indicated in Warning Alarms (MP-212 bit 7).

The G4 will record the CEDI module resistance paired with the DC output current, every 24 hours of operation. The 60 most recent records will be maintained in memory and can be viewed using the Power Panel software.

A "New Module" button is provided on the Diagnostics page of the Power Panel software. After a CEDI module replacement, use the "New Module" button to clear the Initial Resistance, Resistance Limit, historic data, and to reset the CEDI Module time to start the process over.

7. Troubleshooting



Troubleshooting should be performed by qualified personnel only. Safety procedures should be reviewed prior to working with the G4.

7.1. Problem Analysis Table

Condition	Possible Causes	Action
Current setpoint is set, but G4 stays in STOP state (no alarms)	Enable signal (RUN/STOP) not closed	Check for a closed RUN/STOP signal across G4 terminals P1-3 and P1-4 or using the Power Panel software. Use the Power Panel software to check that the RUN/STOP Configuration setting is set as desired. Typical setting is "Use RUN/STOP switch only (dry contact)".
G4 in RUN state, but no DC output (Status LED flashing green)	No output current setpoint	Make sure the G4 is receiving an output current setpoint > 0% from one of these possible sources: IONPURE® display, Modbus TCP client, or analog signal. Use the Power Panel software to verify that the G4 is configured for the proper setpoint source.
	CEDI module is disconnected or has loose wires	Check connections between the G4 and the CEDI module
G4 doesn't power on or Power LED is orange	AC input voltage is not present or too low	Check fuses and any disconnects upstream of the G4. Ensure AC input voltage is at least 220 VAC.
G4 will not communicate with IONPURE® display or Modbus TCP client	Duplicate Rotary Switch setting	Check that each G4 in the daisy chain has a unique Rotary Switch setting
	IP address conflict	Make sure there are no duplicate IP addresses in the Ethernet network
	Bad Ethernet cable or connection	Verify that the Ethernet cable is plugged in properly or test a different cable

7.2. Warning Alarms

During a Warning Alarm the STATUS LED can be solid orange, flashing green, or alternating between red and green. The alarm description will be visible in the Power Panel software or the IONPURE® Touch Panel display model IP-POWERDSP-TP. The alarm codes can also be read via Modbus TCP. See Appendix C: Modbus TCP (G4-M models only).

The warning alarms may be mapped to the Alarm Relay using the Power Panel software.

NOTE: An active Warning Alarm does not prevent DC output. The alarm will automatically reset when the alarm condition goes away.

Warning Alarm Limit Settings	
Voltage Limit	600 V _{RMS}
Current Limit	105 % of output current range setting
SIC Module High Temperature	105 °C < Temperature < 110 °C
Open Load	Resistance > 2.1 kΩ
Shorted Load/Output	Load Current > 0.5 A _{RMS} & Load Resistance < 0.5 Ω
Ground Current Alarm Threshold Exceeded	Ground Current > 0.1 A _{RMS}

7.2.1. Voltage Limit

The controller will not be allowed to exceed the voltage limit setting. The voltage limit alarm will clear when the output voltage is less than the voltage limit.

7.2.2. Current Limit

The controller will not be allowed to exceed the current limit setting. The current limit alarm will clear when the current is less than the current limit setting.

7.2.3. SIC Module High Temperature

The SIC module is within 5°C of the maximum temperature rating. This alarm will only clear when the temperature returns 5°C below the maximum temperature rating for the module.

7.2.4. Fan 1 or Fan 2 Loss

Indication that one or both cooling fans is not functioning. This will not prevent the controller from providing power to the load. The fans should be checked and repaired to prevent overheating of the controller.

NOTE: The fans have a spin-up delay of 5 seconds on controller startup. The fan speeds are variable based on operating temperature controlled by the microprocessor. Fan speeds are reduced at lower temperatures (below 32° C).

7.2.5. Open Load/No Load

The G4 has detected that the DC output isn't connected to a CEDI module. This condition is checked only when the output is ON. The electrical connections and wiring to and from the CEDI module should be checked for an open circuit.

7.2.6. Shorted Load/Output Short Circuit

Indication that the G4 has detected a short in the DC output. This condition is checked only when the output is ON. Detection of a shorted load will shut off the output, preventing the controller from achieving the output commanded by the setpoint. The electrical connections and wiring to and from the CEDI module should be checked for a short circuit.

7.2.7. High CEDI Module Resistance

The alarm is triggered when the module resistance (MP-223) is higher than the Resistance Limit (SP-160). See section 6.4.

7.2.8. Network Timeout (shutdown not selected)

The controller did not receive any communications via Modbus in a timeout period. The timeout period is configurable using Communications Heartbeat Time (SP-125).

Fault state will remain even after a fault reset if communications has not been re-established.

7.2.9. Ground Current Alarm Threshold Exceeded

See section 6.3. When detected current flowing to ground is greater than the specified value (default is 0.1 A RMS) a warning alarm will be triggered. Indicates that there may be a problem with the CEDI module or output wiring that is allowing current to flow into something other than the module, such as earth ground.

7.3. Inhibit Alarms

During an Inhibit Alarm the STATUS LED will be red. The alarm description will be visible in the Power Panel software or the IONPURE® Touch Panel display model IP-POWERDSP-TP. The alarm codes can also be read via Modbus TCP. See Appendix C: Modbus TCP (G4-M models only).

The inhibit alarms may be mapped to the Alarm Relay using the Power Panel software.

NOTE: An active Inhibit Alarm prevents DC output. Some alarms require a fault reset to get the power controller back in operation.

Fault reset methods:

- Toggle the RUN/STOP signal on the P1 connector.
- If Digital RUN/STOP Command is enabled, connect with the Power Panel software and toggle the RUN/STOP button.

Processor reset methods (also clears faults):

- Press the hardware reset button on the front of the power controller.
- Cycle the controller power.
- Connect with the Power Panel software, click on the “Actions” menu and select “Reset”.

Inhibit Alarm Limit Settings	
Over Current Trip	Current > 20 A _{RMS}
SIC Module Over Temperature	Temperature > 110 °C
Input (DC-Link) Voltage High	Voltage > 1000 V _{RMS}
Input (DC-Link) Voltage Low	Voltage < 10 V _{RMS}
High Ground Current	Ground Current > 0.5 A _{RMS}

7.3.1. AC Line Sync Loss

The controller is not able to synchronize with the AC line signal. AC line sync loss is indicated whenever the controller loses synchronization with the AC line zero-cross pulses.

7.3.2. Over Current Trip

The controller has exceeded the output current trip level. This event will shut down the DC output. A fault reset is required to clear this alarm.

7.3.3. SIC Module Over Temperature

The SIC module has exceeded the temperature rating. Check for obstructions preventing the fans from operating correctly. This alarm will clear when the temperature returns to 5°C below the maximum temperature rating for the SIC Module. A fault reset is required to restore normal operation but can only be accomplished after the alarm clears.

7.3.4. Input Voltage High

Indicates the DC-Link voltage has exceeded 1000 Volts RMS. This alarm will clear when the DC-Link voltage returns to within normal operating range (below 1000 Volts RMS).

7.3.5. Input Voltage Low

Indicates the DC-Link voltage has dropped below 10 Volts RMS. This alarm will clear when the DC-Link voltage returns to within normal operating range (above 10 Volts RMS).

7.3.6. High Ground Current

Ground current is greater than the specified value (default is 0.5 Amps RMS). Indicates that there may be a problem with the CEDI module or output wiring that is allowing current to flow into something other than the module, such as earth ground.

The alarm remains active, and the controller is in fault state until a reset or clear fault is performed.

7.3.7. Invalid Current Range Setting

During initialization (boot up) the controller has detected an invalid DIP switch setting and has halted startup. Controller start will continue when a correct switch configuration is set.

7.3.8. Network Timeout (shutdown selected)

The controller did not receive any communications via Modbus in a timeout period. The Network Timeout inhibit alarm will only be active if the Network Timeout Action (SP-128) is set to “STOP, fault shutdown”. The timeout period is configurable using Communications Heartbeat Time (SP-125). A fault reset is required to clear this alarm.

7.3.9. I/O Power Supply Failure

Indication that the power supply in the G4 controller that is specifically used for the analog I/O power is not functional.

7.3.10. Control Loop Reset

Indicates that the control loop is not executing because it is held in reset due to an internal error. An attempt should be made to clear the alarm by resetting the controller. If this alarm re-occurs after performing a hardware reset, contact IONPURE® for instructions.

7.4. Other Non-Typical Alarms

7.4.1. “WATCHDOG TIMEOUT, EEPROM ERROR”

These types of errors are uncommon but may occur under specific conditions. Press ‘ENTER’ from the Power Panel Software (preferred), press the hardware reset button, or cycle controller power, if any of these warnings continue to appear, contact IONPURE® support

Appendix A. Design Considerations

A.1. Basic Isolation Transformer Design Considerations

- Primary: single or three-phase, selected to match the power available at the site. Three phase primary should be Delta, not Wye.
- Secondary: single-phase, with voltage matched to CEDI module as shown in section A.4. The AC voltage required should be no less than 220 VAC, and at least 1.1 times higher than the maximum DC voltage required by the CEDI module.
- Number of Secondary Windings: the preferred configuration is a dedicated secondary winding for each G4 power controller, but it is also possible to feed multiple G4 power controllers from a single secondary winding.
- Frequency: 50 or 60 Hz.
- Duty Cycle: 100%
- The DC power requirements, recommended input voltage to the power controller (VAC), maximum current draw per power controller (AAC), and minimum isolation transformer rating (KVA) for various CEDI single module systems are listed in A.4 in Appendix A.

A.2. Isolation Transformer Temperature Rise and Insulation Class

Transformers with 130 or 150 °C temperature rise with an insulation class of 220 °C are commonly available. Transformers with lower temperature rise are more efficient and have longer service life but are priced higher.

Selection is left up to the user. IEC standards specify the maximum temperature rise of transformers in relation to the insulating material used, for a maximum ambient temperature of 40°C, as listed below.

Insulation Class (°C)	Max Permitted Temperature Increase in Windings (°C)	
	(IEC60085)	(EN61558)
105 (A)	60	60
120 (E)	75	75
130 (B)	80	80
155 (F)	100	100
180 (H)	125	125
220	150	---

A.3. Other Isolation Transformer Design Considerations

Construction

Use open frame transformers with copper windings. Copper-wound transformers are usually more efficient and smaller than aluminum-wound units.

Electrostatic Shield

Electrostatically shielded transformers are recommended. The shield will prevent some noise and transients from coupling through the capacitance that exists between the transformer primary and secondary windings. Transients coupled to the transformer secondary could potentially cause disturbances and failures within any connected electronic equipment.

Thermal Switch

It is recommended to have a thermal switch embedded in the secondary winding to shut off the AC supply to the transformer if the temperature exceeds a set value, below the insulation class temperature.

Voltage Taps, Primary

Voltage taps in the primary are recommended by most transformer manufacturers. A common tap arrangement is two 2.5% taps above and four 2.5% taps below nominal voltage. Transformers are shipped with the taps connected for nominal voltage. The installing electrician must change the taps if the supply voltage differs from the nominal voltage rating.

A.4. CEDI Module Power Requirements and Isolation Transformer Sizing for a Single G4 Power Controller

IONPURE® CEDI Module Type	Maximum Required DC Volts	Maximum Required DC Amps	Recommended Input Voltage to G4 (VAC)	Maximum AC Current Draw by G4 (Amps)	Minimum Transformer kVA Rating
MX30	27	2.5	220	0.6	0.2
MX60	53	2.5	220	1.1	0.3
MX125	106	2.5	220	1.5	0.4
MX250	213	2.5	330	2.2	0.8
MX500	426	2.5	550	2.7	1.5
LX04 X-4 & Z-5	27	6	220	1.1	0.3
LX10 X-4 & Z-5	67	6	220	2.3	0.6
LX18 X-4 & Z-5	120	6	220	3.7	0.9
LX24 X-4 & Z-5	160	6	220	5	1.1
LX30 X-4 & Z-5	200	6	220	6	1.4
LX45 X-4 & Z-5	300	6	330	6.1	2.1
LX04HI-3	50	10	220	3	0.7
LX10HI-3	125	10	220	7.3	1.7
LX18HI-3	225	10	330	7.1	2.4
LX24HI-3	300	10	330	9.7	3.3
LX30HI-3	375	10	440	10.5	4.7
LX45HI-3	600	10	660	10.2	6.8
VNX 28EP-2	300	6.6	330	7.3	2.5
VNX 55EP-2	300	13.2	330	13.2	4.4
VNX 55E-2	300	13.2	330	13.2	4.4
VNX 55EX-2	300	13.2	330	13.2	4.4
VNX15CDIT-2	600	6.6	660	6.6	4.4
VNX30CDIT-2	600	13.2	660	13.2	8.8
VNX55HH-2	600	8*	660	8.6	5.7
VNX-MAX-1	600	7	660	7.5	5
VNX-MINI-1	600	7	660	7.5	5
VNX55ULTRA-2	600	10	660	10.2	6.8

* Up to 8 Amps recommended for VNX-HH applications between 1-2 ppm hardness as CaCO₃.

In most cases, custom designed transformers will be required (example: 660 VAC secondaries are not standard). The primary windings must be wound for the available AC mains voltage.

NOTE: **For older IONPURE® modules not covered here, contact your local IONPURE® technical support.**

A.5. Fuses and Circuit Breakers

- Over-current protection devices such as circuit breakers or fuses must be installed between the output of the isolation transformer and the AC input of the power controller.
 - Fast acting Class J or T fuses must be used to meet the 100 kA SCCR rating of the G4. Alternate fuses may be used if specified in accordance with UL508A.
 - Fast acting class J or T fuses, or an equivalent short circuit protection device with similar trip characteristics and breaking capacity must be used to be CE compliant.
- 20 Amp fuses will protect the G4, so fuse trip rating is generally dictated by the wire size used to connect the transformer to the G4. The voltage rating should match or exceed the nominal AC input voltage to the power controller.
- Over-current protection devices must also be installed on the primary of the isolation transformer and sized according to applicable local electrical codes.
- Do NOT install fuses, circuit breakers or any type of switching device between the DC output of the power controller and the CEDI module.

A.6. Snubbers (optional)

Snubbers may be desirable for an extra layer of protection against very high energy spikes at sites with poor electric power quality indicated by swells, over-voltages, surges, etc.

Snubbers are most effective when installed on the secondary of the transformer, between any switching devices and the power controller.

IONPURE® offers voltage snubber circuits, model numbers IP-SNUBCIRC-1PH and IP-SNUBCIRC-3PH. The 3-phase version is only suitable for installation on the primary side of the isolation transformer, while the single-phase version can be installed on the transformer secondary. Refer to the Voltage Snubber instruction manual (available at www.ionpure.com) for details.

A.7. Enclosure

- Sizing: the width and height will depend on size and number of components inside the enclosure. There should be at least two inches of clearance from the top of the power controller to the door of the enclosure to allow proper air flow.
- Cooling: the power controller will dissipate a maximum of 150 watts in the form of heat. The panel enclosure should have proper ventilation to ensure the power controllers operate at a temperature no higher than 50 °C.

A.8. Contactor (Optional)

A contactor can be installed downstream of the over-current protection devices (fuses or breakers) to completely remove AC power to the power controller. This might be desired for emergency stop and/or manual override implementation.

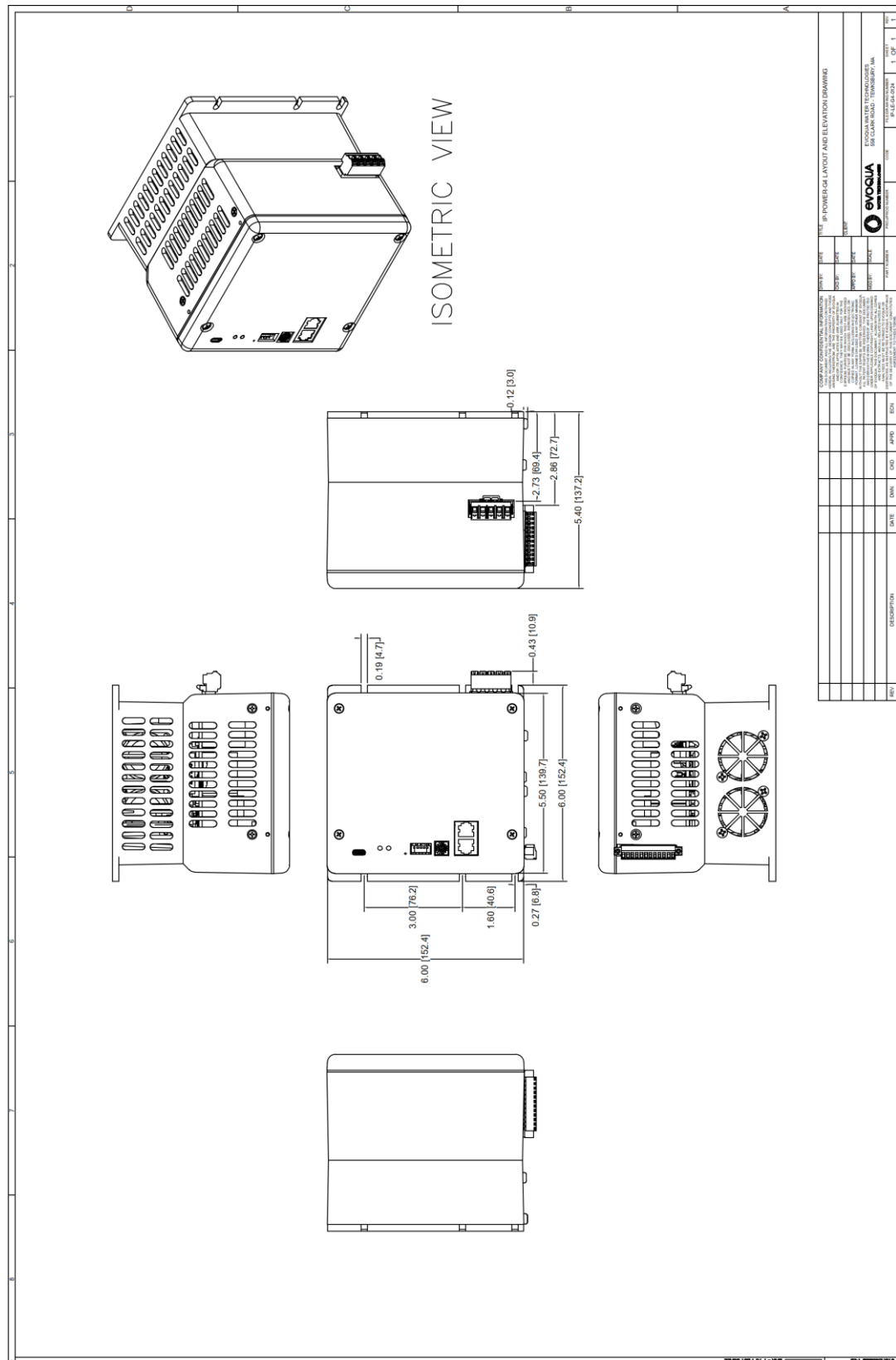
Power to the CEDI module must be enabled/disabled using the Remote RUN/STOP input of the power controller, as described in Section 2.5.5.

Appendix B. Engineering Documents and Drawings

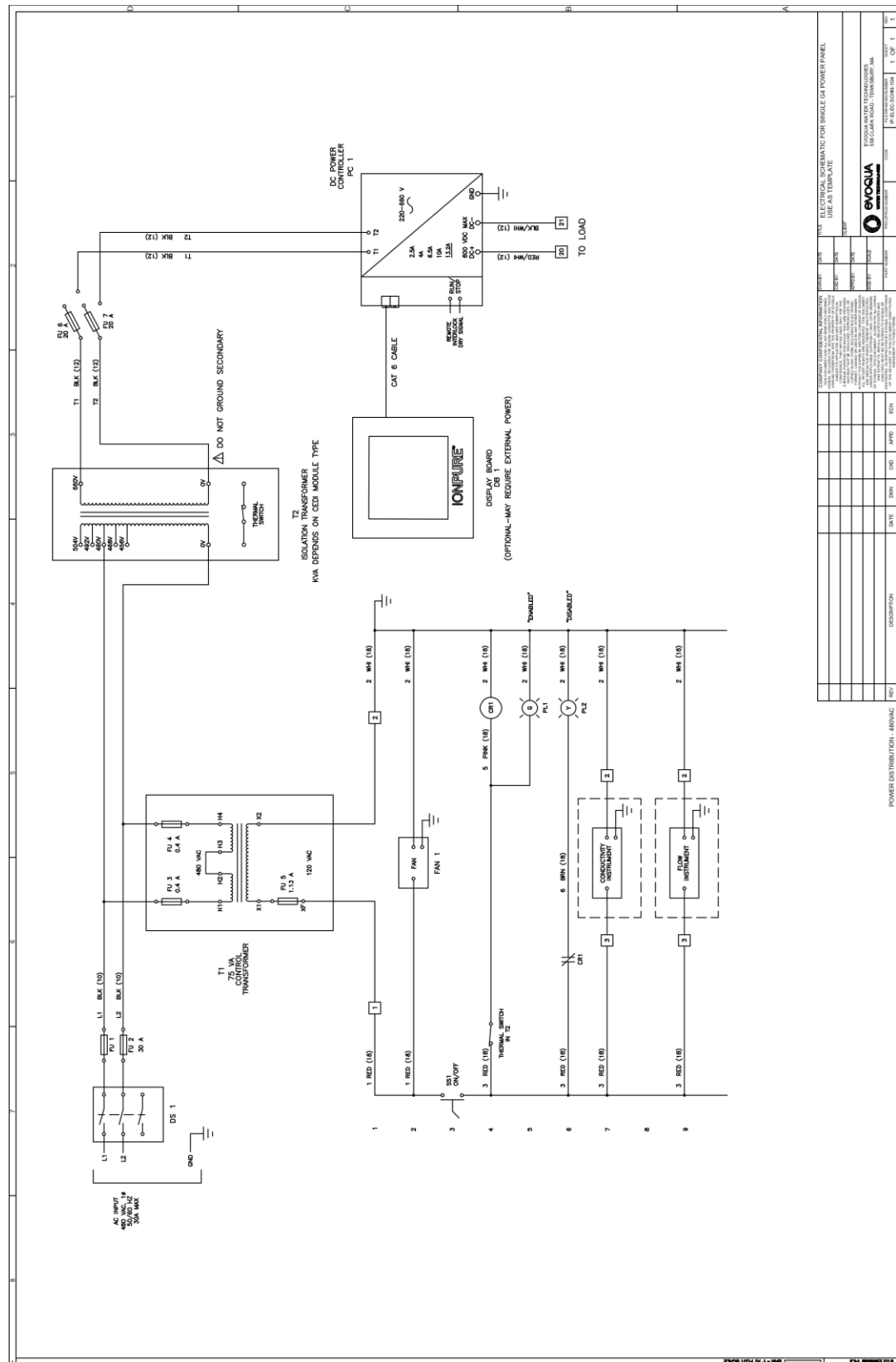
Engineering Drawings included in this section:

- Figure B.1: Full-Scale Dimensional Drawing for IP-POWER-G4-M and IP-POWER-G4-R
- Figure B.2: Electrical Drawing of a Typical Single-module installation - Single-phase Transformer
- Figure B.3: Electrical Drawing of a Typical Multi-module Installation - Single-phase Transformer with Shared Secondary Winding
- Figure B.4: Electrical Drawing of a Typical Multi-module Installation - Three-phase
- Figure B.5: Electrical Connections

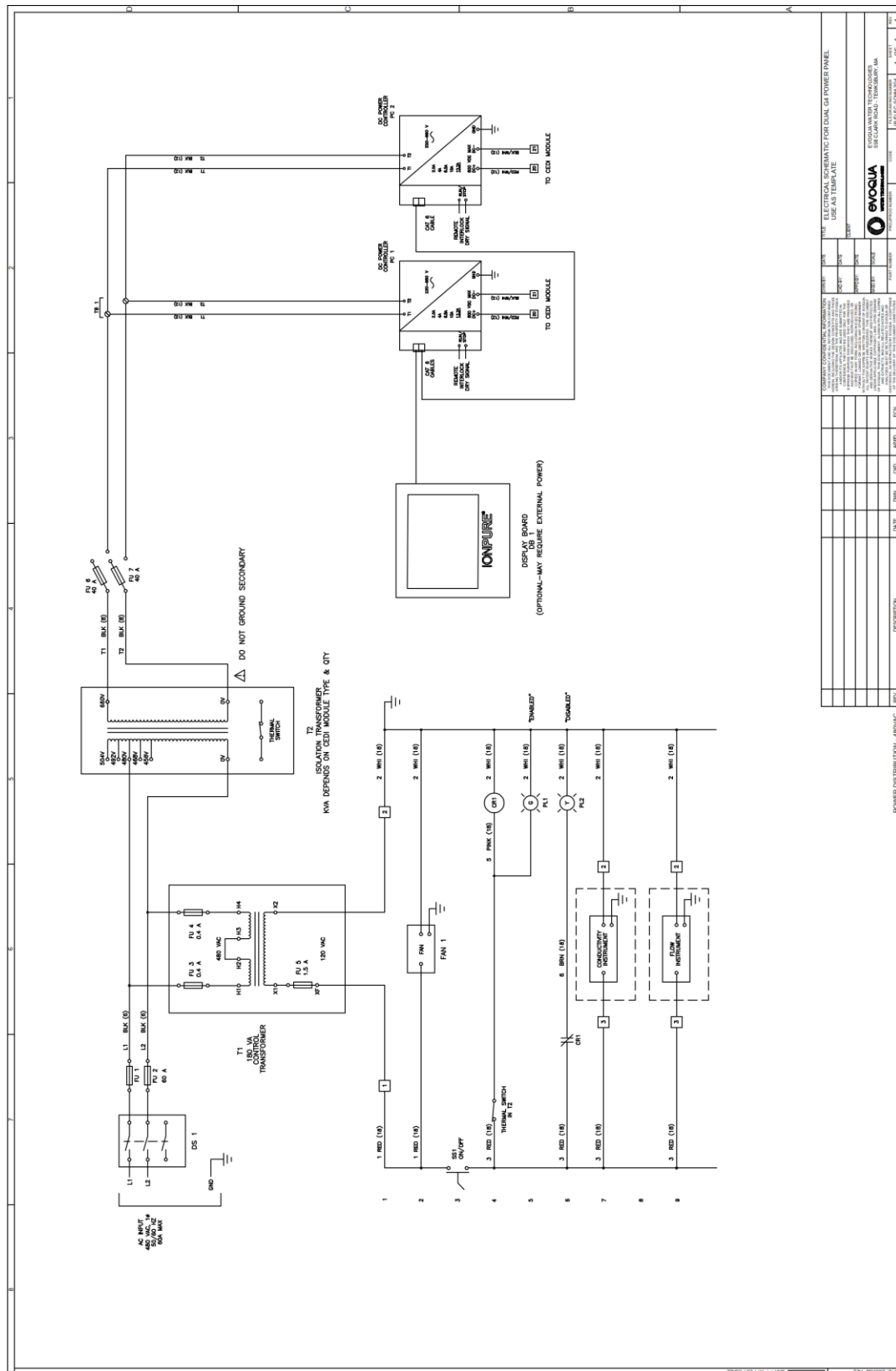
B.1. Full-Scale Dimensional Drawing for IP-POWER-G4-M and IP-POWER-G4-R



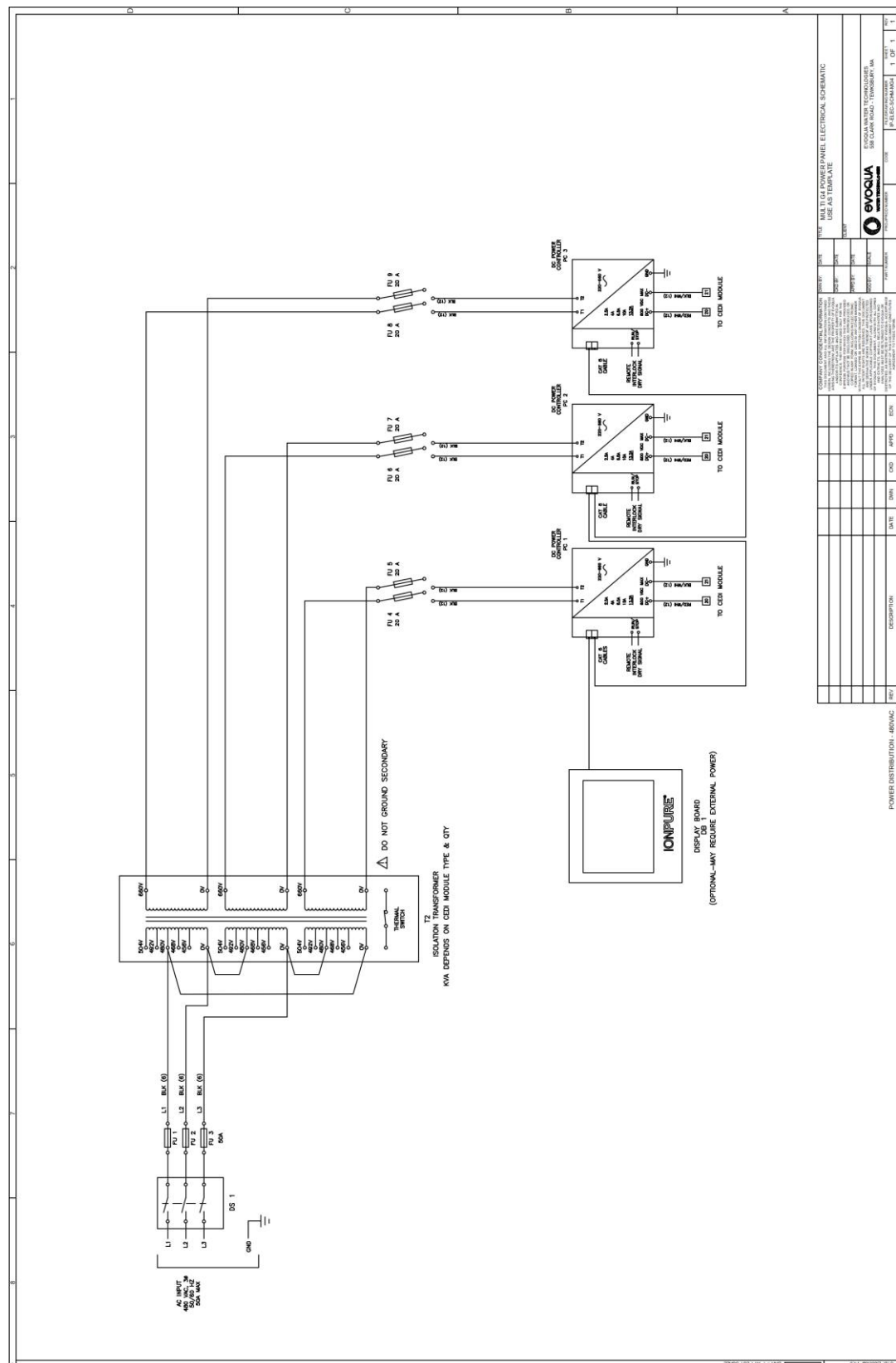
B.2. Electrical Drawing of Typical Single-Module Installation – Single-Phase Transformer



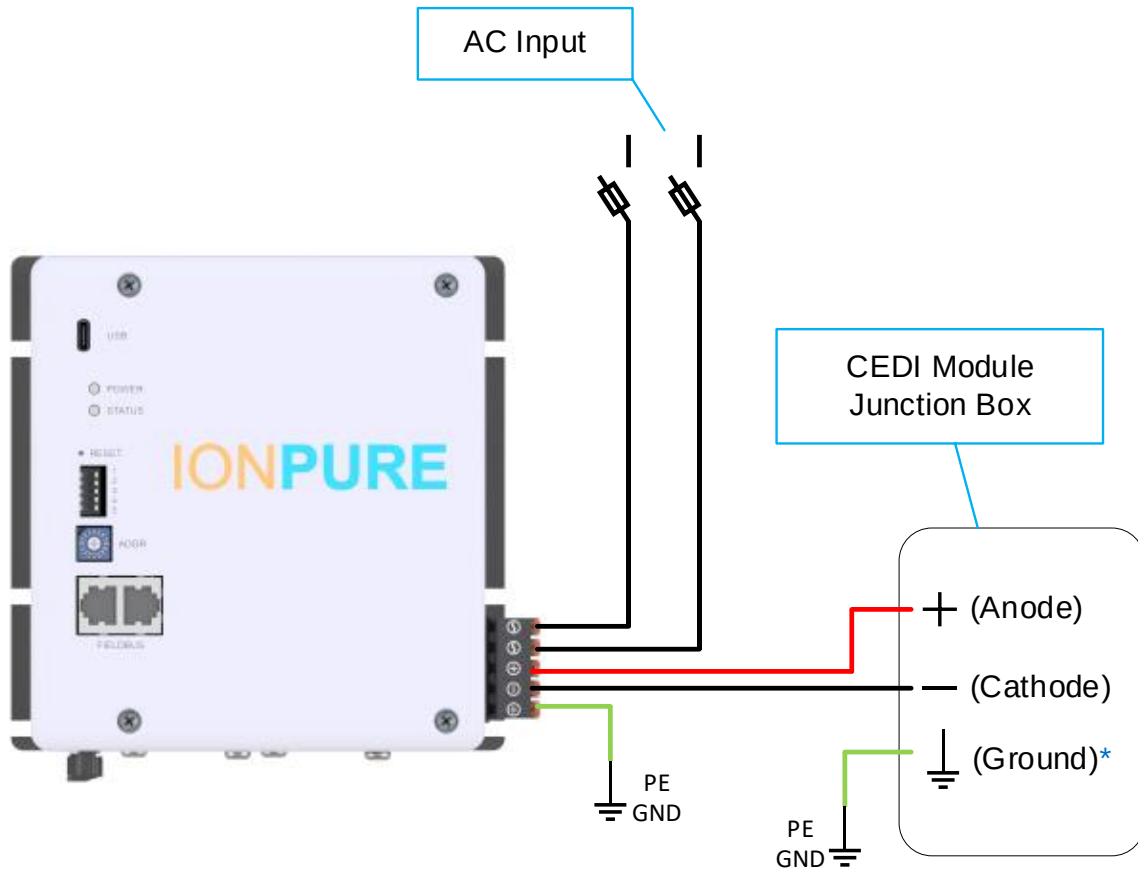
B.3. Electrical Drawing of Typical Two-Module Installation – Single-Phase Transformer, Shared Secondary Winding



B.4. Electrical Drawing of Typical Three-Module Installation – Three-Phase Transformer, Independent Secondary Windings



B.5. Electrical Connections to the CEDI Module



*MX modules do not have a ground terminal. Only (+) and (-) terminals need to be connected.

Appendix C. Modbus TCP (G4-M Models Only)

C.1. Data Addresses in Modbus Messages

The G4 is the Modbus TCP server (or slave). The client (or master) would be the host PLC or computer, running appropriate application software.

The destination port used for Modbus TCP is 502, the source port is random assigned/used by the client.

The Ethernet cable can be connected physically to either connector on the G4.

Modbus Protocol

In general, the G4 parameters are all 16-bit integer values. However, there are some parameters such as MP 245 Load Power which use two registers for the value (32-bit value). MP 245 is the HI word; MP 246 is the LO word. These long word situations are clearly documented.

Some values may have digits to the right of the decimal point. The decimal point, or resolution, will not be part of the message. Rather a parameter with one decimal place will be scaled x10, two decimal places scaled x100.

Example: 5.00 must be scaled and sent as 500 and will also need to be scaled when read using a “scale-factor” of 100.

NOTE: Block reads of up to 24 parameters are permitted with a recommended maximum polling rate of 4 Hz.

Parameter Read

Modbus function 0x03 “Read Holding Registers.”

Allows reading of multiple parameters

Parameter limit = 24 registers per message (G4 limit, not Modbus)

“Long Word” (32 bit) parameter values are returned using two (2) consecutive integer slots, MSW first

Parameter Write

Modbus function 0x06 “Preset Single Register.”

Limited to one parameter that is integer-only (no larger values)

Parameter Write, Multiple

Modbus Function 0x10 [16] “Preset Multiple Registers.”

Allows setting multiple parameters.

Parameter limit = 24 registers per message [G4 limit, not Modbus]

Use two consecutive integer slots in the message to send “Long Word” (32 bit) parameter values to the parameters that accept a 32-bit value (MSW first).

NOTE: G4 controllers contain nonvolatile EEPROMs and writing too frequently to an individual parameter may wear out the EEPROM and cause the controller to fail.

IONPURE® recommends allowing an average of five minutes between consecutive writes to an individual parameter within the range of 1-199, with the exception of digital set point commands 100-101 and the Digital Run/Stop 129. Digital set points and digital Run/Stop may be written continually as they are RAM variables.

Read Alarm Status, or Read System Status

Modbus Function 0x07 “Read Exception Status”

Response contains a single byte field that may be used to return 8 status flags to indicate the status of the power controller.

Additional Comments

According to the Modbus Application protocol specification: “In the PDU registers are addressed starting at zero. Therefore, registers numbered 1 – 16 are addressed as 0 – 15.” And “The pre-mapping between the MODBUS data model and the device application is totally vendor device specific.”

The MODICON Modbus Protocol Reference guide states that all data addresses in Modbus messages are referenced to zero. The first occurrence of a data item is addressed as item number zero. For example:

- The coil known as ‘coil 1’ in a programmable controller is addressed as coil 0000 in the data address field of a Modbus message.
- Coil 127 decimal is addressed as coil 007E hex (126 decimal)
- Holding register 40001 is addressed as register 0000 in the data address field of the message. The function code field already specifies a ‘holding register’ operation. Therefore the ‘4XXXX’ reference is implicit.
- Holding register 40108 is addressed as register 006B hex (107 decimal).

When the Modbus TCP packet is received by the G4 controller, it expects the register (parameter) number in the Modbus PDU of the packet to be exactly the parameter number in the controller (not offset by 1).

Modbus is ambiguous as to what should be used for the register at the application level in the host. As a result, some host applications require it to be offset by 1, and others require the register number to be not only offset by one but also have an additional value added according to the Modbus function (i.e., $40000 + 108 = 40108$ for parameter 107) as shown above.

You may need to experiment with your host application until you get the result you need.

It may be helpful to use the IONPURE® Power Panel software to set the value of the setpoint, then read the setpoint parameter over Modbus TCP. That way you can verify that the value read is correct, and you can change the setpoint value with Power Panel to observe the value change over Modbus TCP as well. Then the opposite can be performed by Monitoring the setpoint with Power Panel and changing the value by writing to the setpoint via Modbus TCP.

Wireshark can be very useful in determining what is actually being transmitted over the wire.

C.2. Modbus Registers

Setup Parameters, Range 1–199

[SP-1] Feedback Type [READ ONLY]	
Units:	N/A
Minimum:	1
Maximum:	2
Default:	2
Selections:	1 = Load Voltage 2 = Load Current
Selects what the control loop uses for feedback.	

[SP-2] Reserved	
N/A	

[SP-3] Control Mode	
Units:	N/A
Minimum:	0
Maximum:	1
Default:	1
Selections:	0 = Open Loop 1 = Closed Loop
When Open Loop is selected the control loop does not use feedback to control the output but sets the output directly proportional to the setpoint. Closed loop sets the output so that the feedback matches the setpoint.	

[SP-4 to 5] Reserved	
N/A	

[SP-6] Control Loop Response	
Units:	N/A
Minimum:	50 (Tau $\approx$ 50 ms)
Maximum:	500 (Tau $\approx$ 500 ms)
Default:	200 (Tau $\approx$ 200 ms)
Sets the control loop gain affecting response to changes in the load, power source, and setpoint. Times are estimated and may vary depending on load and power source characteristics.	

[SP-7] Reserved	
N/A	

[SP-8] Full Scale Voltage	
Units:	Volts AC+DC RMS
Minimum:	10
Maximum:	600
Default:	600
Full Scale Voltage is used to scale the Meter analog output signal for the Meter output used to represent Load Voltage. Default for Meter output 1.	

[SP-9] Full Scale Current [READ ONLY]	
Units:	Amps AC+DC RMS
Minimum:	2.5
Maximum:	13.2
Default:	13.2 (determined by DIP switch settings on power-up/reset)
Full Scale Current is set to the maximum allowable output current commanded by the setpoint. This value is set by the DIP switch during initialization following power-up or reset. This value is also used to scale the Meter analog output signal for the Meter output used to represent Load Current. Default for Meter output 2.	

[SP-10] Reserved	
N/A	

[SP-11] Voltage Limit	
Units:	Volts AC+DC RMS
Minimum:	10
Maximum:	640
Default:	600
Voltage Limit is used to set the maximum allowable output voltage. The controller will not allow the output voltage to be higher than this setting.	

[SP-12] Current Limit [READ ONLY]	
Units:	Amps AC+DC RMS
Minimum:	0.5
Maximum:	15.0
Default:	13.9 (determined by DIP switch settings on power-up/reset)
Current Limit sets the absolute maximum output current allowed by the controller. This value is set by the DIP switch during initialization following power-up or reset. The value set for current limit is 105% of the Frame Current Rating value.	

[SP-13] Ground Current Alarm Threshold	
Units:	Amps
Minimum:	0.1
Maximum:	14.0
Default:	0.1
Sets the threshold to trigger the Ground Current warning alarm when Ground current (MP-226) exceeds this value.	

[SP-14] Current Trip [READ ONLY]	
Units:	Amps AC+DC RMS
Minimum:	1
Maximum:	35
Default:	17 (always the setting at power-up/reset)
Sets the inhibit threshold for load current. If load current exceeds this value the output will shut down in fault state. The value is set during the default initialization and cannot be changed by the user.	

[SP-15] Ground Current Inhibit Alarm Threshold	
Units:	Amps
Minimum:	0.1
Maximum:	14.0
Default:	0.5
Sets the threshold to trigger the Ground Current inhibit alarm when Ground current (MP-226) exceeds this value.	

[SP-16] Relay 1 Alarm Mask

Units:	N/A
Minimum:	0 = 0x0000
Maximum:	65535 = 0xFFFF
Default:	0 = 0x0000
Bits:	15 = not used 14 = Over Temperature Shutdown 13 = Current Trip 12 = High Temperature Warning 11 = High CEDI Module Resistance 10 = not used 9 = not used 8 = Current Limiting 7 = Voltage Limiting 6 = Digital Run/Enable = RUN 5 = Input Voltage High 4 = Input Voltage Low 3 = not used 2 = Fan 2 Loss 1 = Fan 1 Loss 0 = not used

Relay 1 Alarm mask determines the alarm events that will energize the on-board relay. When a bit is set to 1 and the corresponding event occurs the relay will energize.

[SP-17 to 25] Reserved

N/A

[SP-26] High Voltage Shutdown Threshold [READ ONLY]

Units:	Volts AC+DC RMS
Minimum:	150
Maximum:	1200
Default:	1000

If the input voltage reaches this threshold the controller output immediately shuts down. When the input voltage drops below this threshold the output will turn back ON after 1/2 second.

[SP-27] Low Voltage Shutdown Threshold [READ ONLY]

Units:	Volts AC+DC RMS
Minimum:	0
Maximum:	550
Default:	10

If the input voltage reaches this threshold the controller output immediately shuts down. When the input voltage rises above this threshold the output will turn back ON after 1/2 second.

[SP-28 to 84] Reserved

N/A

[SP-85] Relay 1 System Alarm Mask

Units:	N/A
Minimum:	0 = 0x0000
Maximum:	65535 = 0xFFFF
Default:	16 = 0x0010
Bits:	7 to 15 = not used 6 = RUN Enable via switch input 5 = In RUN State 4 = Output ON (generating power) 3 = Watchdog Timeout 2 = Memory Error 1 = Communications Error 0 = Processor Trap Error

Relay 1 System Alarm mask determines the system events that will energize the on-board relay. When a bit is set to 1 and the corresponding event occurs the relay will energize. (Relay 1 is by default the "Output ON" relay)

[SP-86 to 89] Reserved

N/A

[SP-90] Analog Input Type [READ ONLY]

Units:	N/A
Minimum:	1
Maximum:	2
Default:	1 (G4-R) 2 (G4-M)
Selections:	1 = Voltage Input 2 = Current Input
Analog Input type is used to display the input signal type that the PCB is designed to accept.	

[SP-91] Analog Input Low Command

Units:	V, mA
Minimum:	-5.00
Maximum:	25.00
Default:	0.00 or 4.00 (G4-M) 0.00 (G4-R)
This sets the analog input signal level that corresponds to the command value set by SP-92 Analog Input Low Output.	

[SP-92] Analog Input Low Output

Units:	% (Based on Full Scale value for Feedback type selected)
Minimum:	0.00
Maximum:	125.00
Default:	0.00
This sets the commanded percent, of the Full Scale feedback value for the Feedback Type selected, that corresponds to the signal level set by SP-91 Analog Input Low Command.	

[SP-93] Analog Input High Command

Units:	V, mA
Minimum:	-5.00
Maximum:	25.00
Default:	5.00 or 20.00 (G4-M) 5.00 (G4-R)
This sets the analog input signal level that corresponds to the command value set by SP-94 Analog Input High Output.	

[SP-94] Analog Input High Output

Units:	% (Based on Full Scale value for Feedback type selected)
Minimum:	0.00
Maximum:	125.00
Default:	100.00
This sets the commanded percent, of the Full Scale feedback value for the Feedback Type selected, that corresponds to the signal level set by SP-93 Analog Input High Command.	

[SP-95 to 99] Reserved

N/A

[SP-100] Digital Setpoint 1 [RAM]

Units:	% (Based on Full Scale value for Feedback type selected)
Minimum:	0.00
Maximum:	100.00 = 100%
Default:	0.00
This sets the commanded percent of the Full Scale feedback value for the Feedback Type selected, used as the control loop setpoint when Digital Setpoint 1 is selected as the Setpoint source (See SP-102).	

[SP-101] Digital Setpoint 2 [EEPROM]	
Units:	% (Based on Full Scale value for Feedback type selected)
Minimum:	0.00
Maximum:	100.00 = 100%
Default:	0.00
This sets the commanded percent, of the Full Scale feedback value for the Feedback Type selected. This parameter value is used as the control loop setpoint when Digital Setpoint 2 is selected as the Setpoint Source. (See SP-102).	

[SP-102] Setpoint Source	
Units:	N/A
Minimum:	1
Maximum:	3
Default:	2
Selections:	1 = Analog Input 2 = Digital Setpoint 1 [RAM] 3 = Digital Setpoint 2 [EEPROM]
This determines the setpoint that the control loop will use.	

[SP-103 to 107] Reserved	
N/A	

[SP-108] Network Timeout Setpoint	
Units:	% (Based on Full Scale value for Feedback type selected)
Minimum:	0.00
Maximum:	100.00 = 100%
Default:	0.00
This sets the commanded percent, of the Full Scale feedback value for the Feedback Type selected, used as the control loop setpoint when SP-128 Network Timeout Action is set to 2 = use Network Timeout Setpoint and the Heartbeat timer (SEE SP-125) expires resulting in a Network Timeout event.	

[SP-109] Clear Error Latch [RAM]	
Units:	N/A
Minimum:	0
Maximum:	1
Default:	0
Selections:	0 = Do Not Clear 1 = Clear Latch bits to 0
Setting the value to 1 clears the Error Latch (MP-345). After Error Latch has been cleared this parameter's value returns to 0.	

[SP-110] Clear Fault [RAM]	
Units:	N/A
Minimum:	0
Maximum:	1
Default:	0
Selections:	0 = Do Not Clear 1 = Clear Fault State
This parameter makes it possible to clear an inhibit alarm when in Fault Reset state. Setting this value to 1 will clear the inhibit alarms unless the alarm condition still exists. After writing a 1 to this parameter it will automatically return back to 0.	

[SP-111] I/O Power Supply Failure Inhibit Enable

Units:	N/A
Minimum:	0
Maximum:	1
Default:	1
Selections:	0 = Disable (ignore power supply failure) 1 = Enable (cause Fault State = shutdown)

When set to Enable (1) and the I/O Power supply fails, an inhibit alarm will be indicated and the controller will transition to FAULT state which will shut down the output. If controlling with a digital setpoint and digital run/stop, the FAULT state shut down can be disabled by setting this parameter to Disable (0). The inhibit alarm will still be present, however the controller will not be put into FAULT state when disabled.

[SP-112 to 123] Reserved

N/A

[SP-124] IP Address Configuration G4-M only

Units:	N/A
Minimum:	1
Maximum:	2
Default:	1
Selections:	1 = Static (use values in SP-126 & SP-127) 2 = DHCP

Use this parameter to select the method used for obtaining the IP Address to use for Ethernet communications. If DHCP is enabled and fails, the controller will attempt to use the static IP address in SP-126 & 127.

[SP-125] Communications Heartbeat Time

Units:	Seconds
Minimum:	0
Maximum:	65535
Default:	0 (disabled)

Sets the interval, in seconds that the controller will wait for a Modbus TCP message packet before indicating communication timeout and executing the selected Timeout Action set by SP-128.

NOTE: A value of 0 seconds disables the Heartbeat timer, therefore no timeout will occur.

[SP-126] IP Address base HI G4-M only

Units:	N/A
Minimum:	0 (0.0)
Maximum:	65535 (255.255)
Default:	49320 (192.168)

This sets the two most significant octets of the controller's base IP Address.

[SP-127] IP Address base LO G4-M only

Units:	N/A
Minimum:	0 (0.0)
Maximum:	65520 (255.240)
Default:	200 (0.200)

This sets the two least significant octets of the controller's base IP Address.

NOTE: The value used by the controller for the last octet is determined by the value of this parameter and the Rotary Switch setting.

[SP-128] Network Timeout Action

Units:	N/A
Minimum:	0
Maximum:	2
Default:	0
Selections:	0 = None, continue 1 = Stop, fault shutdown 2 = Use Network timeout setpoint (SP-108)

This setting determines how the controller will react to a network timeout event that occurs when the Heartbeat timer expires waiting for a Modbus message (either Modbus TCP or RTU).

A setting of 0 = NONE will result in no action: the controller will indicate the timeout but continue to operate as before.

A setting of 1 = STOP will result in the controller immediately transitioning to FAULT shutdown state with the output power OFF when a timeout occurs.

When this parameter is set to 2 the controller will use the Network Timeout Setpoint (SP-108) immediately after a timeout occurs, until the timeout is cleared by the reception of another Modbus message (either Modbus TCP or RTU).

[SP-130 to 131] Reserved

N/A

[SP-132] Digital RUN/Stop Configuration

Units:	N/A
Minimum:	0
Maximum:	1
Default:	0
Selections:	0 = Disabled (Use RUN/Stop switch only) 1 = Enabled (Digital and Analog setpoints with switch closed)

This selects how SP-129 Digital RUN/Stop is used.

A setting of 0 (default) will ignore SP-129 and only use the RUN/STOP switch input (P1-4).

With a setting of 1, both SP-129 Digital RUN/Stop and the RUN/STOP switch input (P1-4) will be used.

NOTE: With ALL selections the hardwired RUN/STOP terminal (P1-4) must be connected to common (P1-3) in order to put the controller into RUN state. If the RUN/STOP terminal (P1-4) is left unwired the controller cannot be put into RUN state.

[SP-129] Digital RUN/Stop**[RAM]**

Units:	N/A
Minimum:	0
Maximum:	1
Default:	0
Selections:	0 = STOP 1 = RUN

This may be used to command the controller into RUN or STOP state via digital communications (USB or Ethernet/Modbus TCP/Modbus RTU).

This parameter is used in conjunction with the RUN/STOP switch input on the P1 connector (PIN 4).

NOTE: SEE SP-132 Digital RUN/Stop configuration as SP-132 determines how this parameter is used along with the hardwired RUN/STOP input (P1-4).

[SP-133] Reserved

N/A

[SP-134] Trace Trigger Select

Units:	N/A
Minimum:	0
Maximum:	11
Default:	1
Selections:	0 = None 1 = Over-current Trip 2 = FAULT state 3 = RUN state 4 = STOP state 5 = Output Voltage High 6 = Input Voltage High 7 = High Ground Current 8 = Output Limit Active 9 = Open Load 10 = Shorted Load 11 = AC Line Lock Loss

[SP-135 to 139] Reserved

N/A

[SP-140] Meter 1 Output Type [Read Only]

Units:	N/A
Minimum:	1
Maximum:	2
Default:	1 (G4-R) 2 (G4-M)
Selections:	1 = Voltage 2 = Current

Meter 1 Output Type sets the type of signal generated by the controller for the Meter 1 Output (P2-1 P2-2). The signal is scaled with SP-142 through SP-145.

[SP-141] Meter 1 Signal Select

Units:	N/A
Minimum:	1
Maximum:	2
Default:	1
Selections:	1 = Load Voltage 2 = Direct Out (SP-146)

This determines what the Meter 1 Output signal represents.

[SP-142] Meter 1 Command Low Value

Units:	% (Based on Full Scale value for signal selected)
Minimum:	0.00
Maximum:	100.00
Default:	0.00

This sets the value, in percent of the Full Scale, corresponding to the selection for SP-141 Meter 1 Signal Select that generates the output signal set by SP-143 Meter 1 Signal Low Output.

[SP-143] Meter 1 Signal Low Output

Units:	V, mA
Minimum:	0.00
Maximum:	20.00
Default:	0.00

This sets the output signal level generated for Meter 1 out corresponding to the value determined by SP-142 Meter 1 Command Low Value.

[SP-144] Meter 1 Command High Value

Units:	% (Based on Full Scale value for signal selected)
Minimum:	0.00
Maximum:	100.00
Default:	100.00

This sets the value, in percent of the Full Scale, corresponding to the selection for SP-141 Meter 1 Signal Select that generates the output signal set by SP-145 Meter 1 Signal High Output.

[SP-145] Meter 1 Signal High Output

Units:	V, mA
Minimum:	0.00
Maximum:	6.00 (G4-R) 20.00 (G4-M)
Default:	G4-R: 5.00, 6.00 G4-M: 5.00, 6.00, or 20.00

This sets the output signal level generated for Meter 1 out corresponding to the value determined by SP-144 Meter 1 Command High Value.

G4-R: When RS-485 address switch is set 'F' value will be 5.00, all other selections set value to 6.00.

[SP-146] Meter 1 Out Direct

Units:	V, mA
Minimum:	0.00
Maximum:	20.00
Default:	0.00

Used to set the Meter output signal level when SP-141 Meter 1 Signal Select is set to 2 = Direct out.

[SP-147] Meter 2 Output Type [Read Only]

Units:	N/A
Minimum:	1
Maximum:	2
Default:	1 (G4-R) 2 (G4-M)
Selections:	1 = Voltage 2 = Current

Meter 2 Output Type sets the type of signal generated by the controller for the Meter 2 Output (P1-7 P1-8). The signal is scaled with SP-149 through SP-152.

[SP-148] Meter 2 Signal Select

Units:	N/A
Minimum:	1
Maximum:	2
Default:	1
Selections:	1 = Load Voltage 2 = Direct Out (SP-153)

This determines what the Meter 2 Output signal represents.

[SP-149] Meter 2 Command Low Value

Units:	% (Based on Full Scale value for signal selected)
Minimum:	0.00
Maximum:	100.00
Default:	0.00

This sets the value, in percent of the Full Scale, corresponding to the selection for SP-148 Meter 2 Signal Select that generates the output signal set by SP-150 Meter 2 Signal Low Output.

[SP-150] Meter 2 Signal Low Output

Units:	V, mA
---------------	-------

Minimum:	0.00
-----------------	------

Maximum:	20.00
-----------------	-------

Default:	0.00
-----------------	------

This sets the output signal level generated for Meter 2 out corresponding to the value determined by SP-149 Meter 2 Command Low Value.

[SP-151] Meter 2 Command High Value

Units:	% (Based on Full Scale value for signal selected)
---------------	---

Minimum:	0.00
-----------------	------

Maximum:	100.00
-----------------	--------

Default:	100.00
-----------------	--------

This sets the value, in percent of the Full Scale, corresponding to the selection for SP-148 Meter 2 Signal Select that generates the output signal set by SP-152 Meter 2 Signal Hi Output.

[SP-152] Meter 2 Signal High Output

Units:	V, mA
---------------	-------

Minimum:	0.00
-----------------	------

Maximum:	20.00
-----------------	-------

Default:	5.00, 6.00, or 20.00
-----------------	----------------------

This sets the output signal level generated for Meter 2 out corresponding to the value determined by SP-151 Meter 2 Command High Value.

[SP-153] Meter 2 Out Direct

Units:	V, mA
---------------	-------

Minimum:	0.00
-----------------	------

Maximum:	20.00
-----------------	-------

Default:	0.00
-----------------	------

Sets the Meter output signal level when SP-148 Meter 2 Signal Select is set to 2 = Direct out.

[SP-154 to 159] Reserved

N/A

[SP-160] Resistance Limit

Units:	Ohms
---------------	------

Minimum:	1
-----------------	---

Maximum:	999
-----------------	-----

Default:	999
-----------------	-----

This is the high resistance threshold for the module in service. This value is set automatically when the value for initial resistance is captured. It is set to 150% of the initial resistance. This is used to trigger an alarm when the module resistance becomes higher than this threshold.

[SP-161] New CEDI Module [RAM]

Units:	N/A
---------------	-----

Minimum:	0
-----------------	---

Maximum:	1
-----------------	---

Default:	0
-----------------	---

Selections:	0 = Module is the same 1 = Module is new
--------------------	---

Use this parameter when a module is replaced. Setting the value to 1 will reset the module operating hours, initial resistance, and resistance limit, then the value for this parameter will automatically return to a value of 0.

[SP-162 to 199] Reserved

N/A

Monitor Parameters, Range 200–389

[MP-200] Active Setpoint	
Units:	N/A
Minimum:	1
Maximum:	3
Representation:	1 = Analog Setpoint 2 = Digital Setpoint 1 3 = Digital Setpoint 2

[MP-201] Reserved	
N/A	

[MP-202] Analog Input	
Units:	% (Based on Full Scale Values)
Representation:	SXXX.XX

[MP-203] Analog Input Command Value	
Units:	Amps or Volts (corresponding to Feedback type selected)
Representation:	SXXX.X

[MP-204] Analog Input Signal	
Units:	V, mA
Representation:	SXX.XX

[MP-205 to 209] Reserved	
N/A	

[MP-210] Inhibit Alarm Status	
Units:	N/A
Representation:	0 = not active 1 = active
Bits:	15 = not used 14 = not used 13 = not used 12 = not used 11 = Control Loop Reset 10 = IO Power Supply Fail (Analog Input) 9 = Network Timeout (shutdown in Fault State) 8 = Invalid Current Switch Setting (during Boot) 7 = High Ground Current 6 = not used 5 = Input Voltage High 4 = not used 3 = SIC Module Over Temperature 2 = Over Current Trip 1 = not used 0 = AC Line Sync Loss

[MP-211] Controller Status	
Units:	N/A
Minimum:	0
Maximum:	3
Representation:	0 = Disabled 1 = Enabled 2 = Diagnostic 3 = Calibration

[MP-212] Warning Alarm Status	
Units:	N/A
Representation:	0 = not active 1 = active
Bits:	9 = Network Timeout (Shutdown Not Selected) 8 = Ground Current 7 = High CEDI Module Resistance 6 = Shorted Load/Output Short Circuit 5 = Open Load/No Load 4 = Fan 2 Loss 3 = Fan 1 Loss 2 = SIC Module High Temperature 1 = Current Limit 0 = Voltage Limit

[MP-213] Digital I/O Status	
Units:	N/A
Representation:	0 = open/not active 1 = closed/active
Bits:	8 = not used 7 = not used 6 = not used 5 = not used 4 = Relay 1 3 = not used 2 = not used 1 = not used 0 = Run/Stop-Reset

[MP-214] Load Current DIP Switch Status	
Units:	N/A
Representation:	0 = open/not active 1 = closed/active
Bits:	7 = not used 6 = not used 5 = not used 4 = not used 3 = SW4 2 = SW3 1 = SW2 0 = SW1

[MP-215] Load Current Selection	
Units:	Amps
Representation:	XX.X

[MP-216] Meter 1 Output Signal	
Units:	V, mA
Representation:	SXX.XX

[MP-217] Meter 2 Output Signal	
Units:	V, mA
Representation:	SXX.XX

[MP-218] Load Current DIP Switch Selection (live)	
Units:	Amps
Representation:	XX.X

[MP-219] Reserved	
N/A	

[MP-220] DC-Link (Input) Voltage	
Units:	Volts
Representation:	XXXX.X

[MP-221] Load Voltage	
Units:	Volts
Representation:	SXXX.X

[MP-222] Load Current	
Units:	Amps
Representation:	SXX.XX

[MP-223] Load Resistance	
Units:	Ohms
Representation:	XXXX.X

[MP-224] SIC Module Temperature	
Units:	°C
Representation:	XXX.X

[MP-225] Processor Temperature	
Units:	°C
Representation:	XXX.X

[MP-226] Ground Current	
Units:	Amps
Representation:	SXX.X

[MP-227] Initial Load Resistance	
Units:	Ohms
Representation:	XXXX.X

[MP-228] Load Resistance Change	
Units:	%
Representation:	SXXX.X

[MP-229 to 247] Reserved	
N/A	

[MP-248] Controller State	
Units:	N/A
Minimum:	0
Maximum:	3
Representation:	0 = STOP 1 = RUN 2 = FAULT 3 = FAULT RESET

[MP-249] Output Command	
Units:	%
Representation:	XX.X

[MP-250] Command Reference (HI word) [MP-251] Command Reference (LO word)	
Units:	Volts, Amps
Representation:	XXX.X

[MP-252] Feedback (HI word) [MP-253] Feedback (LO word)	
Units:	Volts, Amps
Representation:	XXX.X

[MP-254] Control Loop Error (HI word) [MP-255] Control Loop Error (LO word)	
Units:	Volts, Amps
Representation:	SXXX.X

[MP-256 to 306] Reserved	
N/A	

[MP-307] Power-up Count

Units:	Counts
Representation:	XXXXXX
The number of times the controller has been powered up.	

[MP-308] Low Power Count

Units:	Counts
Representation:	XXXXXX
The number of times the controller has detected a low power supply voltage without losing power altogether.	

[MP-309] In Service Time (HI word)
[MP-310] In Service Time (LO word)

Units:	Hours
Representation:	XXXXXXXXXX
The number of hours the control has had power applied.	
NOTE: In Service Time is stored to non-volatile memory every 10 minutes.	

[MP-311] Module Time (HI word)
[MP-312] Module Time (LO word)

Units:	Hours
Representation:	XXXXXXXXXX
The number of hours the CEDI Module has been in service.	
NOTE: Module Time is stored to non-volatile memory every 10 minutes.	

[MP-313 to 318] Reserved

N/A

**[MP-319] IP Address Switch Selection
G4-M only**

Units:	N/A
Representation:	XX
The value set by the Rotary Switch. RANGE: TCP = 0 to 15, RS-485 = 1 to 16	

[MP-320] IP Address (HI word)
[MP-321] IP Address (LO word)
G4-M only

Units:	N/A
Representation:	XXXXXXXXXX (4 bytes = xxx.xxx.xxx.xxx)
Example: 3232235720 = C0A800C8 _h = 192.168.0.200	

[MP-322 to 323] Reserved

N/A

**[MP-324] RS-485 Address Selection
G4-R only**

Units:	N/A
Representation:	XX

[MP-325] RS-485 Status G4-R only	
Units:	N/A
Representation:	0 = open/not active 1 = closed/active
Bits:	15 = not used 14 = not used 13 = not used 12 = not used 11 = not used 10 = not used 9 = not used 8 = not used 7 = Heartbeat Timer timeout 6 = Heartbeat Timer active 5 = not used 4 = not used 3 = Parity Error 2 = Framing Error 1 = RX Overrun Error 0 = Ready

[MP-326] Ethernet Status G4-M only	
Units:	N/A
Representation:	0 = open/not active 1 = closed/active
Bits:	15 = not used 14 = not used 13 = not used 12 = not used 11 = not used 10 = IP Address conflict (Offline) 9 = Packet transmission error 8 = Packet reception error 7 = Heartbeat Timer timeout 6 = Heartbeat Timer active 5 = IP Address is OK (Online) 4 = not used 3 = TCP Connection established 2 = Port 2 cable is connected 1 = Port 1 cable is connected 0 = Ready

[MP-327] EE Calibration Bits (HI word) [MP-328] EE Calibration Bits (LO word)	
Units:	ADC Bits
Representation:	XXXXXXXXXX

[MP-329] Live Calibration Bits (HI word) [MP-330] Live Calibration Bits (LO word)	
Units:	ADC Bits
Representation:	XXXXXXXXXX

[MP-331] Firmware ID	
Units:	N/A
Representation:	XXXXXX

[MP-332] Firmware Version (Major)	
Units:	N/A
Minimum:	0.00.01
Maximum:	99.99.99
Representation:	XX.XX
Full with MP-333 Minor revision appended.	

[MP-333] Firmware Version (Minor)	
Units:	N/A
Maximum:	99
Representation:	XX

[MP-334] Reserved	
N/A	

[MP-335] Misc Status	
Units:	N/A
Bits:	15 = not used 14 = not used 13 = not used 12 = not used 11 = not used 10 = not used 9 = not used 8 = not used 7 = not used 6 = Trace is triggered, collecting data 5 = not used 4 = Trace enabled, waiting for trigger 3 = Wait for 'ENTER' key during Init 2 = not used 1 = USB Powered 0 = not used

[MP-336] EEPROM Status	
Units:	N/A
Representation:	0 = open/not active 1 = closed/active
Bits:	15 = not used 14 = not used 13 = EEPROM SP Definition Table update required 12 = EEPROM write protected 11 = Backup User SP checksum failure 10 = not used 9 = not used 8 = Repair Record checksum failure 7 = Fault Record checksum failure 6 = MFG Table checksum failure 5 = Cal Table checksum failure 4 = not used 3 = MFG SP Table checksum failure 2 = USER SP Table checksum failure 1 = Blank, Initialization required 0 = Read/Write failure

[MP-337 to 341] Reserved
N/A

[MP-342] AC Line Status	
Units:	N/A
Representation:	0 = open/not active 1 = closed/active
Bits:	15 = not used 14 = not used 13 = not used 12 = not used 11 = not used 10 = Secondary OK, Secondary control loop phase locked 9 = Secondary Pre-Lock 2, Secondary control loop phase locked 8 = Secondary Pre-Lock 1, Frequency OK, Secondary control loop 7 = not used 6 = not used 5 = not used 4 = not used 3 = not used 2 = Primary OK, Primary control loop phase locked 1 = Primary Pre-Lock 2, Primary control loop phase locked 0 = Primary Pre-Lock 1, Frequency OK, Primary control loop

[MP-343 to 344] Reserved
N/A

[MP-345] Error Latch	
Units:	N/A
Representation:	0 = open/not active 1 = closed/active
Bits:	7 = not used 6 = not used 5 = not used 4 = Shorted output detected 3 = DC-Link too high 2 = DC-Link too low 1 = Sync Timing loss, Secondary control 0 = Sync Timing loss, Primary control

[MP-346 to 348] Reserved	
N/A	

[MP-349] Firmware Update Code	
Units:	N/A
Representation:	XXXXXX

[MP-350] Fan 1 Speed	
Units:	RPM
Representation:	XXXX

[MP-351] Fan 2 Speed	
Units:	RPM
Representation:	XXXX

[MP-352 to 369] Reserved	
N/A	

[MP-370] Network Heartbeat Timer	
Units:	Seconds
Representation:	XXXXXX

[MP-371 to 378] Reserved	
N/A	

[MP-379] Bootloader Version	
Units:	N/A
Representation:	XX.XX

[MP-380 to 389] Reserved	
N/A	

Xylem Tel: (866) 876-3340
558 Clark Road Fax: (978) 934-9499
Tewksbury, Massachusetts 01876, USA www.xylem.com www.ionpure.com

This information is subject to revision without notice. Users are responsible for evaluating suitability for specific applications. Xylem makes no implied warranties including without limitation warranties as to fitness for a particular purpose. Xylem makes no representation regarding the completeness or accuracy of this information and is not liable for any direct or indirect damages arising from or relating to this information or its use.

© 2025 Xylem Inc. or its affiliate. All rights reserved. IONPURE® is a trademark of Xylem or one of its subsidiaries.

IP-MAN-G4-0325-EN

