POWELL

DRAFT



01.4IB.48040 BriteSpot™ BSG3

Powered by Safety®

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Signal Words

As stated in ANSI Z535.4-2007, the signal word is a word that calls attention to the safety sign and designates a degree or level of hazard seriousness. The signal words for product safety signs are **"Danger"**, **"Warning"**, and **"Caution"**. These words are defined as:

⚠ DANGER

DANGER indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

⚠ WARNING

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

⚠ CAUTION

CAUTION, used with the safety alert symbol, indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

CAUTION

CAUTION, used without the safety alert symbol, is used to address practices not related to personal injury.

NOTICE

NOTICE is used to address practices not related to personal injury.

Qualified Person

For the purposes of this manual, a qualified person, as stated in NFPA 70E®, is one who has skills and knowledge related to the construction and operation of the electrical equipment and installations and has received safety training to recognize and avoid the hazards involved. In addition to the above qualifications, one must also be:

1. trained and authorized to energize, de-energize, clear, ground, and tag circuits and equipment in accordance with established safety practices.
2. trained in the proper care and use of personal protective equipment (PPE) such as rubber gloves, hard hat, safety glasses or face shields, flash clothing, etc., in accordance with established safety practices.
3. trained in rendering first aid if necessary.

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Ch 1 General Information

⚠ WARNING

The equipment described in this document may contain high voltages and currents which can cause serious injury or death.

The equipment is designed for use, installation, and maintenance by knowledgeable users of such equipment having experience and training in the field of high voltage electricity. This document and all other documentation shall be fully read, understood, and all warnings and cautions shall be abided by. If there are any discrepancies or questions, the user shall contact Powell immediately at 1.800.480.7273.

⚠ WARNING

Before any adjustment, servicing, part replacement, or any other act is performed requiring physical contact with the electrical working components or wiring of this equipment, the power supply must be disconnected. Failure to follow this warning may result in injury or death.

NOTICE

The information in this instruction bulletin is not intended to explain all details or variations of the Powell equipment, nor to provide for every possible contingency or hazard to be met in connection with installation, testing, operation, and maintenance of the equipment. For additional information and instructions for particular problems, which are not presented sufficiently for the user's purposes, contact Powell at 1.800.480.7273.

NOTICE

Powell reserves the right to discontinue and to change specifications at any time without incurring any obligation to incorporate new features in products previously sold.

A. Scope

The information in this instruction bulletin describes the following fiber optic temperature monitoring system

- BriteSpot™

B. Purpose

The information in this instruction bulletin is intended to provide information required to properly operate and maintain the fiber optic temperature monitoring system described in ***Ch 1 General Information,*** **A. Scope.**

This instruction bulletin provides:

1. Safety guidelines
2. General descriptions of the operation and maintenance of the BriteSpot temperature monitoring system
3. Information for ordering renewal parts
4. Illustrations, photographs, and description of the BriteSpot temperature monitoring system

The illustrations contained in this document may not represent the exact construction details of each BriteSpot installation. The illustrations in this document are provided as general information to aid in showing component locations only.

All illustrations and photos are shown using de-energized equipment.

⚠ WARNING

Be sure to follow the appropriate safety precaution while handling any of the equipment. Failure to do so may result in serious injury or death.

C. Approvals and Certifications

1) Safety Information

BriteSpot temperature monitoring system is designed and tested to comply with IEC 61010.

2) FCC Statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

3) EMC Directive

The BriteSpot Conversion Module has been designed and tested to meet the European Electromagnetic Compatibility Directive (EMC Directive, 204/108/EC). The Declaration of Conformity for BriteSpot lists the specific standards to which the BriteSpot system was tested.

Immunity of BriteSpot Conversion Module was tested for use in Power Station and Substation Environments according to IEC61000-6-5:2001.

D. Instruction Bulletins Available Electronically

NOTICE

Changes to the instruction bulletin may be implemented at any time and without notice. Go to www.powellind.com to ensure use of the current instruction bulletin for the Powell equipment.

To contact the Powell Service Division call 1.800.480.7273 or 713.944.6900, or email info@powellservice.com.

For specific questions or comments pertaining to this instruction bulletin email documents@powellind.com with the Instruction Bulletin number in the subject line.

Ch 2 Safety

A. Safe Work Condition

The information in Section A is quoted from *NFPA 70E 2012 - Article 120, 120.1 Establishing an Electrically Safe Work Condition.*

120.1 Process of Achieving an Electrically Safe Work Condition

1. Determine all possible sources of electrical supply to the specific equipment. Check applicable up-to-date drawings, diagrams, and identification tags.

2. After properly interrupting the load current, OPEN the disconnecting device(s) for each source.

3. Wherever possible, visually verify that all blades of the disconnecting devices are fully OPEN or that drawout type circuit breakers are withdrawn to the fully disconnected position.

4. Apply lockout/tagout devices in accordance with a documented and established policy.

5. Use an adequately rated voltage detector to test each phase conductor or circuit part to verify they are de-energized. Test each phase conductor or circuit part both phase-to-phase, and phase-to-ground. Before and after each test, determine that the voltage detector is operating satisfactorily.

   Informational Note: See ANSI/ISA-61010-1 (82.02.01)/UL 61010-1, *Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use - Part 1: General Requirements*, for rating and design requirements for voltage measurement and test instruments intended for use on electrical systems 1000 V and below.

6. Where the possibility of induced voltages or stored electrical energy exists, ground the phase conductors or circuit parts before touching them. Where it could be reasonably anticipated that the conductors or circuit parts being de-energized could contact other exposed energized conductors or circuit parts, apply ground connecting devices rated for the available fault duty.

B. Safety Guidelines

Study this instruction bulletin and all other associated documentation before installing the BriteSpot™ temperature monitoring system.

Each user has the responsibility to instruct and supervise all personnel associated with usage, installation, operation, and maintenance of this equipment on all safety procedures. Furthermore, each user has the responsibility of establishing a safety program for each type of equipment encountered.

The safety rules in this instruction bulletin are not intended to be a complete safety program. The rules are intended to cover only some of the important aspects of personnel safety related to BriteSpot™ temperature monitoring system.

C. General

1. Only supervised and qualified personnel trained in the usage, installation, operation, and maintenance of the monitoring system shall be allowed to work on this equipment. It is mandatory that this instruction bulletin, any supplements, and service advisories be studied, understood, and followed.

2. Maintenance programs must be consistent with both customer experience and manufacturer's recommendations, including service advisories and instruction bulletin(s).

3. Service conditions and equipment applications shall also be considered in the development of safety programs. Variables include ambient temperature; humidity; actual continuous current; thermal cycling; number of operations; interrupting duty; and any adverse local conditions including excessive dust, ash, corrosive atmosphere, vermin and insect infestations.

D. Specific

1. **DO NOT WORK ON AN ENERGIZED EQUIPMENT.** If work must be performed on a circuit breaker, remove it from service and remove it from the metal-clad switchgear.

2. **DO NOT WORK ON EQUIPMENT WITH THE CONTROL CIRCUIT ENERGIZED.**

3. **ALL COMPONENTS SHALL BE DISCONNECTED BY MEANS OF A VISIBLE BREAK AND SECURELY GROUNDED FOR SAFETY OF PERSONNEL PERFORMING MAINTENANCE OPERATIONS ON THE EQUIPMENT.**

4. Interlocks are provided to ensure the proper operating sequences of the equipment and for the safety of the user. If for any reason an interlock does not function as described, do not make any adjustments, modification, or deform the parts. **DO NOT FORCE THE PARTS INTO POSITION. CONTACT POWELL FOR INSTRUCTIONS.**

E. Safety Labels

The equipment described in this document has **DANGER**, **WARNING, CAUTION,** and instruction labels attached to various locations. All equipment **DANGER**, **WARNING, CAUTION,** and instruction labels shall be observed when the circuit breaker is handled, operated, or maintained.

NOTICE

Warning and Caution labels are located in various places in and on the switchgear and on the circuit breaker's removable element. Always observe these warnings and caution labels. Do NOT remove or deface any of these warning/caution labels.

Ch 3 Equipment Description

A. General

The BriteSpot G3 Fiber Optic Temperature Monitoring System is intended for use in environments with high voltages and currents, where standard measurement methods such as RTDs, thermocouples, and IR scans are not suitable. Point-source temperatures are measured optically using a polymer optical fiber as a conduit for the optical signals which are used for relaying the temperature data. The materials exposed to energized components are made of inherently insolating materials and pose no risk to the equipment. Each BriteSpot unit provides temperature information for either nine or eighteen locations, which can then be extracted in real-time via MODBUS RS-485, MODBUS TCP/IP, or Ethernet I/P. In addition, temperature values can be logged internally and retrieved via standard CAT5 Ethernet cable.

B. Sensing System Overview

The BriteSpot Fiber-Optic Temperature Monitoring System consists of three major components:

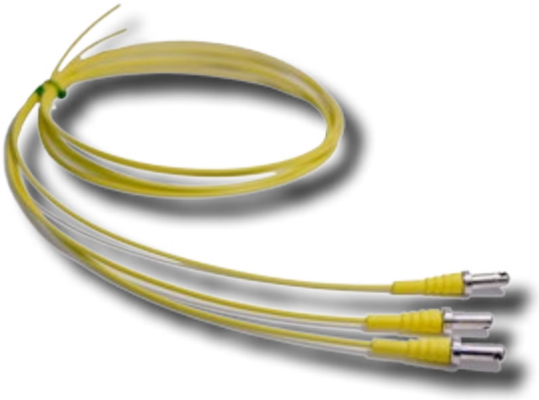
1. The G3 Conversion Module provides the internal control signals, interface telemetry and light generation/detection that are needed to interrogate the Location of Interest (LOI). Each Conversion Module can measure either nine or eighteen discrete points when Fiber-Optic Probes are attached.

Figure 1 G3 Conversion Modules

Table A Conversion Module Configurations		
BSG3.18	***BSG3.9***	***BSG3.9S***
Channels: 18	*Channels: 9*	*Channels: 9*
HMI: No	*HMI: No*	*HMI: Yes*
		

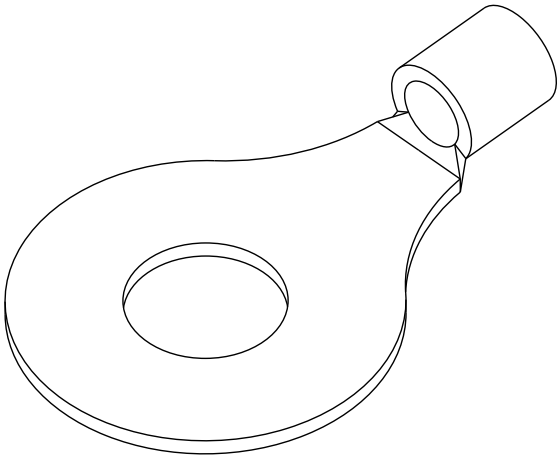
2. The Fiber-Optic Probe provides the optically encoded temperature information from the LOI to the conversion module. Composed of a polymer-based optical fiber and sensing tip with locking feature, the probe is designed to withstand voltages commonly found in low and medium voltage applications.

Figure 2 Fiber-Optic Probe



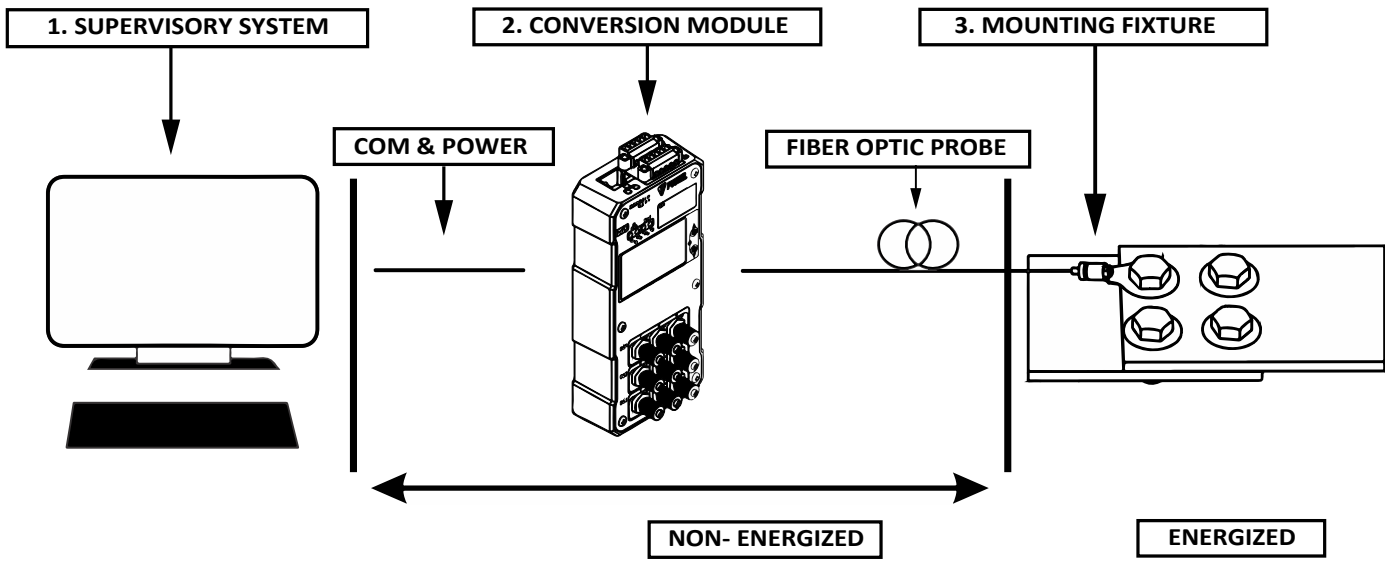
3. Probe Mounting Fixture has several different mounting fixtures available, all of which provide the physical contact between the Probe and the Location of Interest. It is important that the fixture be connected securely, in order to provide robust thermal contact and accurate measurements.

Figure 3 Ring-Style Mounting Fixture



4. Once installed, the three primary components look schematically like shown in Figure 4.

Figure 4 BriteSpot System Overview



C. Specifications

1. System Specifications
   a. Model Name:
   BSG3.9S, BSG3.9, BSG3.18 (3 models)
   b. Number of Sensor/ Channels: 9 (BSG3.9S & BSG3.9) or 18 (BSG3.18)
   c. Resolution: 1˚C (1˚F)
   d. Accuracy: ±2˚C (±3˚F)
   e. Measurement Range: -40°C to +160°C (-40°F to +320°F) (probe dependent, see below)
   f. Calibration: Not Required. Calibrated @ Factory.
   g. Data Refresh Time: ~3sec
   h. Communication Protocols:
   MODBUS RTU, MODBUS TCP/IP, ETHERNET I/P, HTTP
   i. Onboard Data Storage: 16MB (350,000 logs)
   j. LCD Interface (BSG3.9S only): 2 Buttons, LCD

2. G3 Conversion Module Specifications
   a. Dimensions: 155mmx75mmx50mm (6”x 3”x 2”)
   b. Power Requirements:
   Voltage: 12-24 VDC (0.12A@24VDC)
   Power: 3 Watts (*Max)
   c. Operating Environment Conditions:
   Temp. Range (BSG3.18 / BSG3.9):-40°C to +70°C (-40°F to +158°F)
   Temp. Range (BSG3.9S): -20°C to +70°C (-4°F to +158°F)
   Humidity: 0-95% Non-Condensing
   Altitude: 0-2000m (0-6500ft)
   Pollution Degree: 1
   d. Enclosure Material: Aluminum 6061 and Molded ABS/ PC
   e. Mounting: 35mm DIN rail
   f. Power / Data Connections: 2x 5 position pluggable terminal block w flange, 3.81mm pitch Phoenix Contact, PN: 1827732
   g. Output Relay Specifications: Normally Open, 2A/250VDC/VAC TE Connectivity, PN: IM01GR
   h. Real Time Clock and Calendar: RTCC, 21 days backup, no daylight saving.

3. Standard Probe Specifications (BSL007, BSL010, BSL015)
   a. Material: Nylon
   b. Minimum Bend Radius:12 mm (½")
   c. Probe length: 7,10,15m (21,30,45ft)
   d. Operating Temp Range: -40°C to +120°C (-40°F to +248°F)
   e. High Voltage Characteristics: 38 kV, over 8" gap

4. High Temperature Probe Specifications (BSP-HT)
   a. Material: Fluoropolymer
   b. Minimum Bend Radius: 12 mm (½")
   c. Probe length: detachable probe 0.25m(10"), max. Fiber extension 10m
   d. Operating Temp Range: -40°C to +160°C (-40°F to +320°F)
   e. High Voltage Characteristics: 38 kV, over 8" gap

5. Probe Mounting Fixture Specifications
   a. Material: Tin-Plated Copper
   b. Manufacturer: Tyco/ Amp
   c. Approvals: UL/CSA
   d. Part Numbers:
      i. ¼" Hardware (Tyco/Amp PN 33465)
      ii. ⅜" Hardware (Tyco/Amp PN 33465)
      iii. ½" Hardware (Tyco/Amp PN 33465)

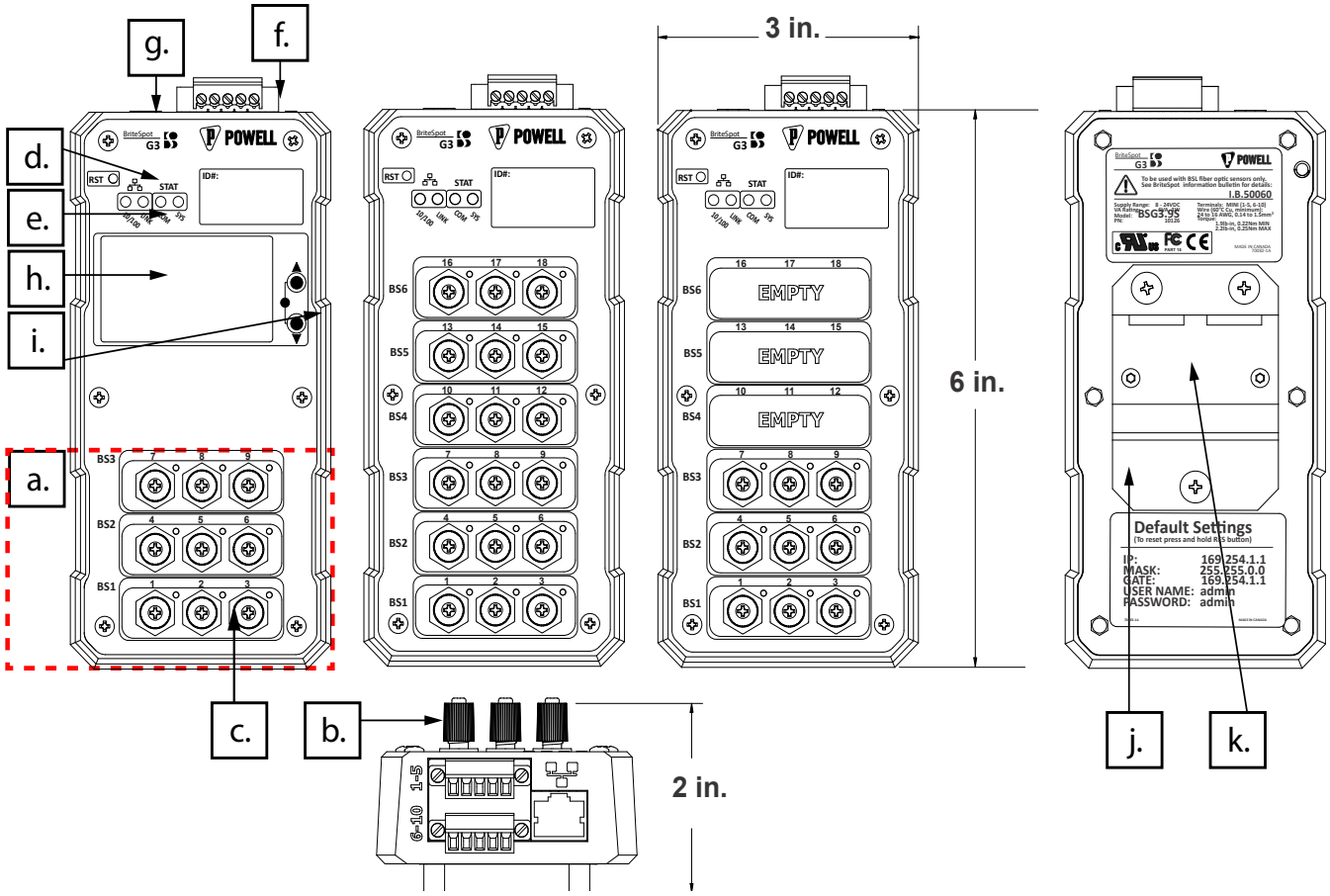
D. Hardware Description

1. Physical Interface

   The G3 BriteSpot has the following physical features:

   a. Optical Fiber Connection Ports (9 or 18)
   b. Fiber Retention Nut
   c. BriteSpot Status LEDs
   d. Reset Button
   e. G3 Indicator LEDs
   f. Input Power Connection , RS-485 Serial Port
   g. Ethernet Port
   h. LCD Interface
   i. Interface Buttons
   j. DIN Rail Mounting Clip
   k. DIN Rail Grounding Contact Plate

Figure 5 G3 Conversion Module Overall Views



2. There are four G3 Indicator LEDs visible from the front of the BriteSpot G3 Conversion Module. The meaning of the Indicator LEDs is shown in *Table B G3 Indicator LED's*.

Figure 6 Indicator LED's

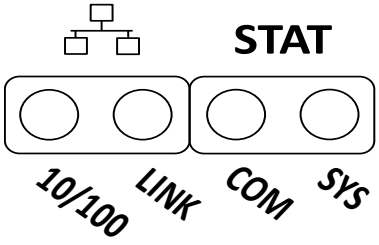


Table B G3 Indicator LED's			
	G3 Indicator LED	**Color**	**Meaning**
NETWORK	10/100	ORANGE	100 Mbit Mode
		OFF	10 Mbit Mode
	LINK	FLASHING GREEN	Ethernet Traffic
		GREEN	Connection Established
		OFF	No Connection Established
STATUS	COM	FLASHING GREEN	MODBUS/EIP Communication
		FLASHING RED	Alarm Triggered
	SYS	FLASHING GREEN	Normal Operation
		RED	Write to Flash
		FLASHING ORANGE	Bootload Mode

3. Each BriteSpot channel has a small indicator LED. The LED is used for indicating the status of the sensor channel. It is of particular use during installation to verify that the fiber has been installed correctly.

Figure 7 BriteSpot Status LED's

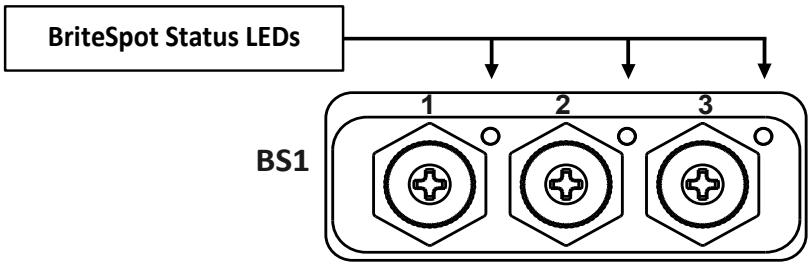
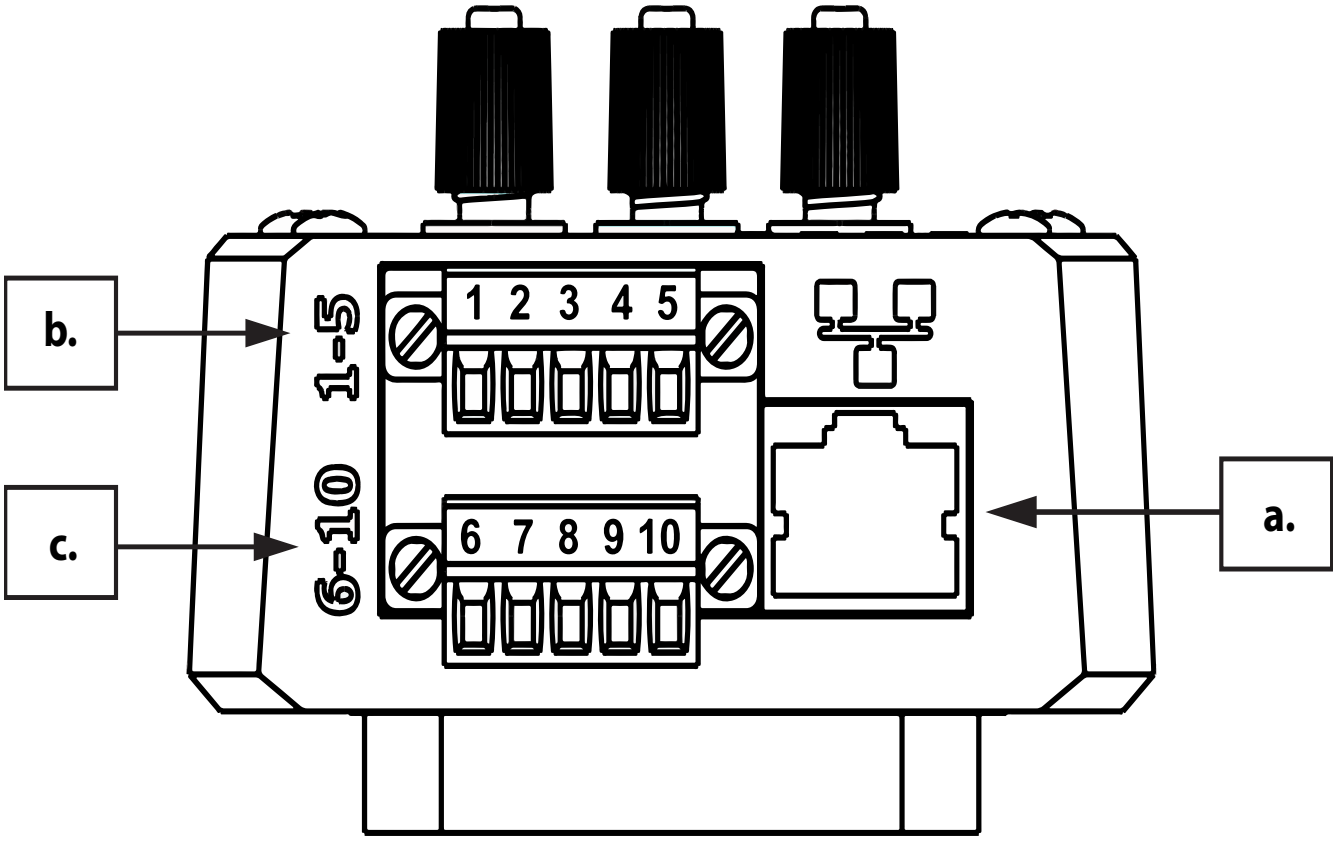


Table C BriteSpot Status LED	
LED Color	**Channel Status**
Red	Fail/Not Ready
Green	Good

4. The conversion modules have 3 interface ports with various applications
   a. Ethernet Port: MODBUS TCP/IP, ETHERNET I/P, Web Interface
   b. Terminals 1-5: RS485, 2 wire, MODBUS
   c. Terminals 6-10: Input Power, Relay Output

Figure 8 Interface Ports



Ch 4 Installation

The installation of the BriteSpot™ Fiber Optic Temperature Measurement System is comprised of several steps. The G3 Conversion Module and Fiber Optic Probe can be installed independently of each other, and hence the order of certain aspects of the installation are at the user's discretion. Many of the images will show installation on medium voltage switchgear, as this provides a typical installation. However, the principles of installation can be carried over to many other applications where temperature monitoring is needed. Other examples include: wiring splices, circuit breakers, motor control centers, bus-duct, dry-type transformers and so on.

A. Select a Location of Interest

BriteSpot can measure temperatures on any equipment within its operational range. The start of the process is to select a Location of Interest (LOI). The tip of the fiber will eventually be placed at this location and secured via the fixture.

Some recommended principles to follow when selecting the LOI include:

1. The LOI should ideally be as close to a potential source of failure as possible. For example, if a splice or bolted connection is present and critical, consider mounting the fiber sensing tip right at, or adjacent to the connection point.
2. The probe can measure temperatures in locations that are not visible, therefore consider locations where infrared monitoring will not be effective. In many situations, important connections are hidden behind ducting and sheet metal. Main Bus compartments are an ideal example as they cannot be viewed in operation.
3. There must be a method for affixing one of the various fixture options to the LOI. Each fixture type has specific requirements for proper attachment.
4. There must be a continuous path going from the LOI to the mounting location for the Conversion Module which can be followed by the fiber. This will be termed the "Fiber Path".

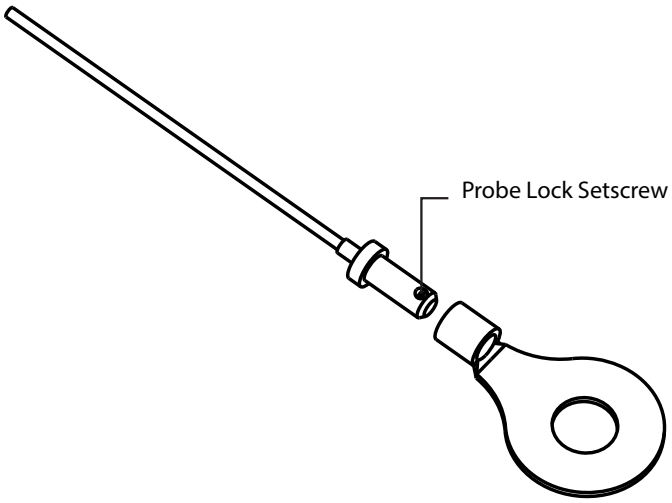
There are additional aspects that need to be considered before proceeding with installation:

1. The LOI and mounting location for the G3 Conversion Module must not be farther apart than the length of the fiber. In practice, they must be even closer as the fiber will frequently not take a direct path, following surface features instead.
2. Provide continuous low-voltage (12-24 VDC) power to the G3 Conversion Module. In addition, if RS-485 or Ethernet ports are used for real-time communication, the associated communication wires must be capable of being routed to the G3 Conversion Module.
3. Temperature at the LOI must not exceed the maximum rated temperature of the fiber for an extended period.
4. No point on the fiber path (in contact with the fiber) shall exceed 100˚C (212˚F). This excludes the LOI where the fiber is attached to the mounting fixture.

B. Secure Probe to LOI

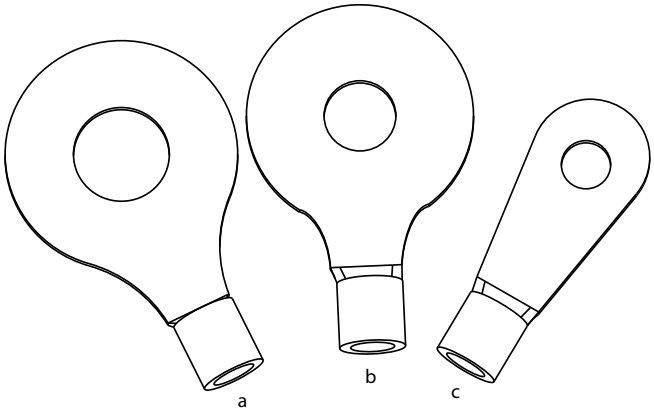
The most common Probe Mounting Fixture for use with the BriteSpot system is based on industry standard ring-style cable termination lugs. These lugs have proven to be reliable, easy to install, and virtually maintenance free. In addition, if installed at locations with existing hardware, no modifications to hardware lengths or specifications are needed. The fiber probe has a special feature, called the Probe-Lock which secures the Probe to the lug without crimping, allowing lugs to be installed and then connected.

Figure 9 Fiber-Optic Probe with Probe Lock



1. Select the proper lug of the application based on the existing hardware (if present) or planned hardware. Any #6 AWG Tyco/Amp Solistrand™ ring-style lug should be compatible, however not all have been tested. If purchased in kit form, three standard lug sizes have been included, and are specified in Figure 11. When selecting the lug for a given location, ensure that the lug with the tightest fit around the hardware is selected – this aids in proper thermal conduction and will result in more accurate readings.

Figure 10 Tyco/Amp Ring Style Lugs



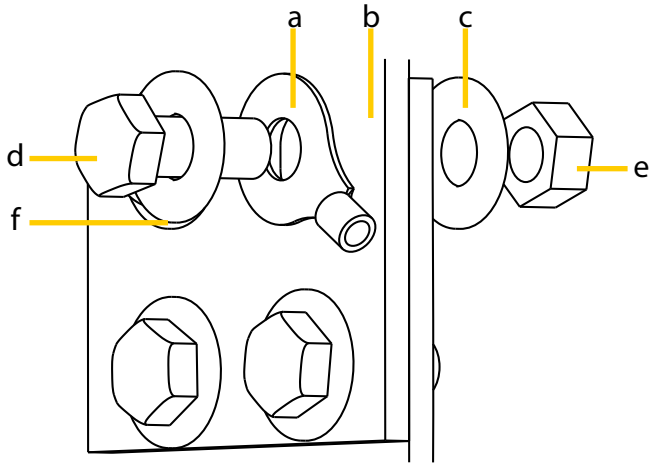
a. ½" Hardware (Tyco/Amp PN 36808)
b. ⅜" Hard ware (Tyco/Amp PN 36807)
c. ¼" Hardware (Tyco/Amp PN 33465)

2. To make probe installation easier, consideration must first be given to the rotational orientation of the lug before it is mounted. When the probe is eventually installed, the fiber will need to have a relatively unobstructed path to be inserted into the lug. For example, in some situations protective boots are placed over bolted connections, posing an inconvenience when routing the fiber. Align the fixture to allow the fiber to be threaded through existing seams in the dielectric boot. The lug must also be placed such that the Probe-Lock is accessible to an Allen Key for tightening.
3. Mount the lug so that it is directly contacting the surface to be measured. Washers should NOT be placed between the lug and the surface to be measured; instead they should be placed on the other side of the lug, as shown in Figure 12. Figure 13 shows the proper installation when Belleville washers are used. Absolutely no greases and / or pastes should be used between the lug and the surface it is contacting.

NOTICE

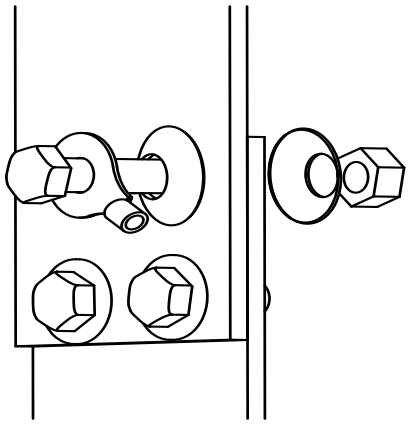
Once the fixture has been put in place, follow the manufacturer's recommended torque setting for the original hardware.

Figure 11 Installation Sequence of Lug with Standard Washers



a. Lug
b. Measurement Surface
c. Washer
d. Bolt
e. Nut
f. Washer

Figure 12 Installation Sequence of Lug with Belleville Washers

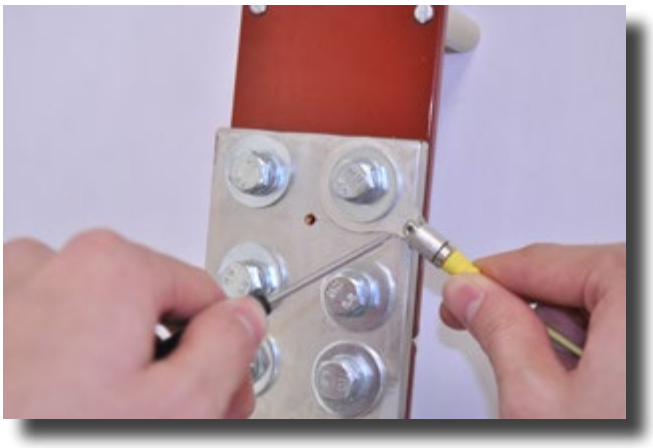


4. Once the lug is mounted, the Probe can be installed. This is simply done by inserting the probe tip into the end of the lug. Ensure that the head of the Probe-Lock set screw is visible and easily accessible to allow it to be secured.

Figure 13 Mounting Lug

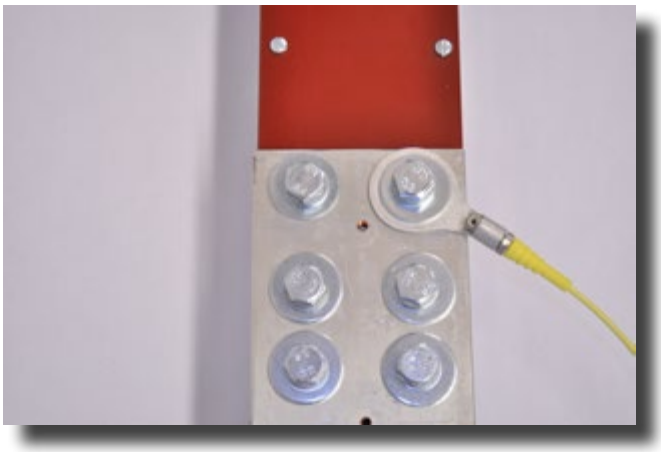
5. With the Probe installed, fasten the head of the Allen setscrew. This is performed with a 1.5 mm Allen Key. The setscrew is designed to bite in the lug and is retained by military grade friction patch to ensure immunity to vibration. The set screw should be torqued to approximately
5 inch-lbs.

Figure 14 Secure Probe by Tightening Allen Key



6. Validate that the probe is properly secured into the lug by giving a gentle tug. At this point the joint can be carefully dressed, if required, while ensuring the probe is not abused.

Figure 15 Correctly Installed Probe and Lug

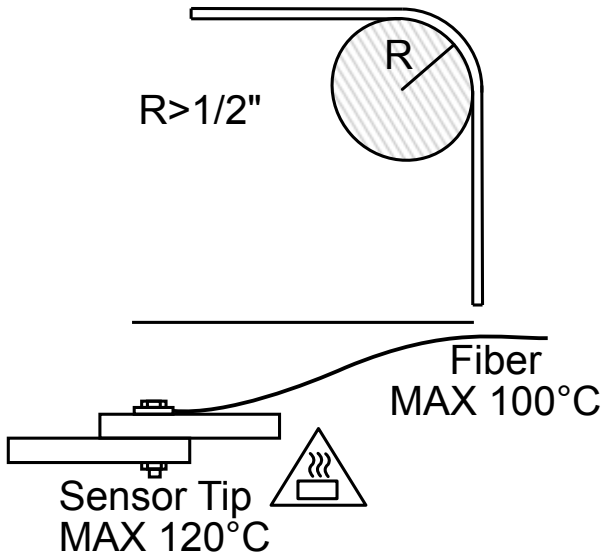


C. Route Fiber-Optic Probe

Proper routing of the probe is important to facilitate proper installation of the BriteSpot. The optical fiber has some general guidelines that must be followed during installation:

1. Ensure that bend radii are greater than 1.3 cm (½"). Bends smaller than this will cause a loss in optical signal.
2. Keep exposed sections of the fiber away from excessive temperatures. The tip has been designed to allow for temperatures up to 120˚C (248˚F) and the fiber for temperatures up to 100˚C (212˚F). Temperatures in excess of these could cause premature failure of the fiber.

Figure 16 Fiber Limitations



3. Securing the fiber along its routing path is best done with tie-wraps at even intervals every 1-2 m (3-6 ft) depending on the types of features that must be navigated. When securing tie-wraps, ensure that fiber is not pinched excessively as this can degrade the optical signal. Cables can be bundled together and routed for ease of installation whenever possible. Ensure to clip all extra length from tie-wraps once they have been secured.

Figure 17 Tie-Wrap Being Secured Over Fiber

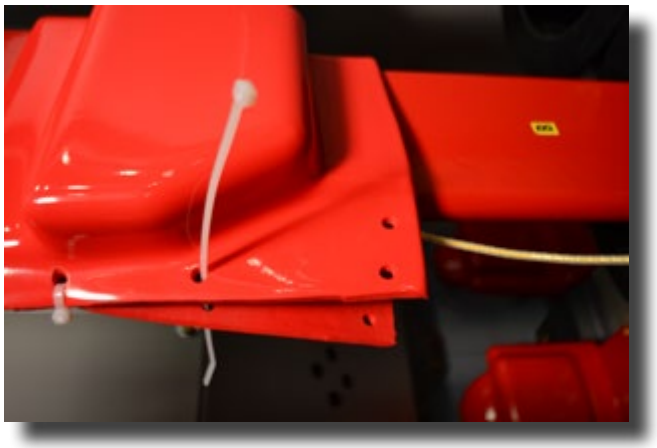
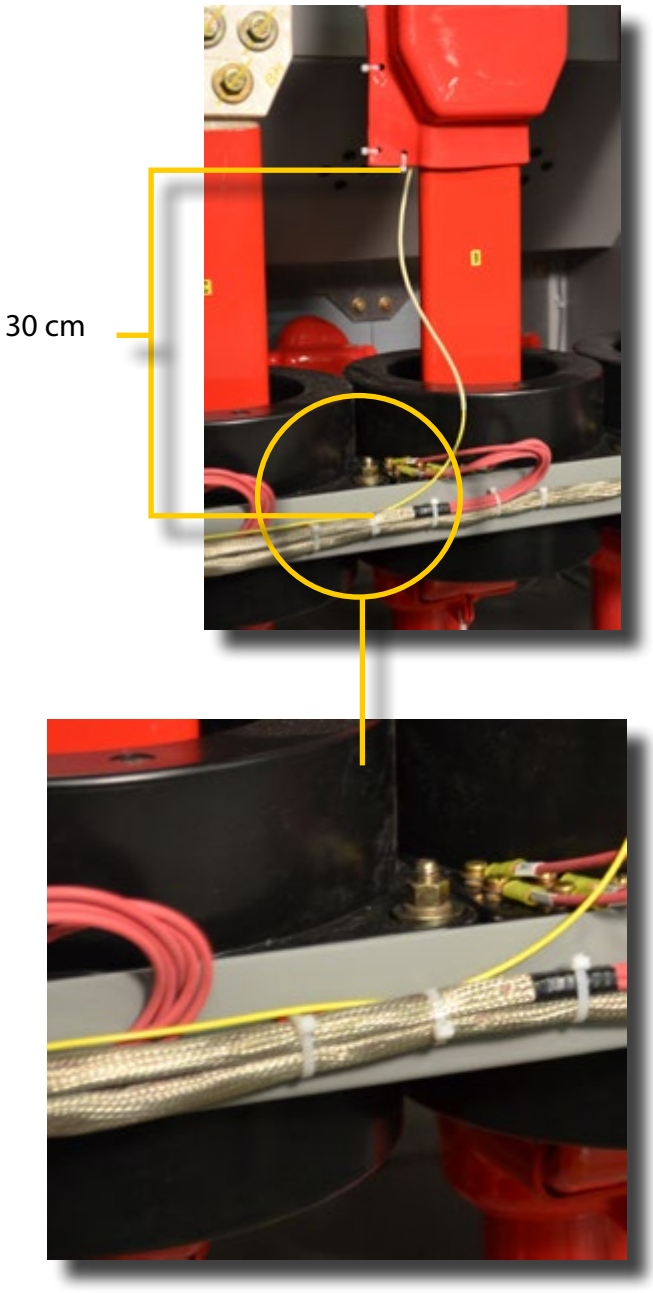


Figure 18 Completed Fiber Installation

⚠ WARNING

Do not fasten or attach ANY mounting hardware (tie-wraps, etc.) to at least a 30 cm (12") length of fiber between the portion of the Probe at high voltage and its first non-energized point of contact. This section of suspended fiber provides increased dielectric strength to the probe and therefore must be left unsecured and ungrounded. It is good practice to maintain more than 30 cm (12") of suspended fiber, but not required.

Figure 19 Safe Dielectric Routing Practices



Note: *Ensure that at least 30 cm (12") of fiber is suspended prior to fastening.*

4. Do not straddle phases with the fiber. The fiber must go from the LOI to any non-energized contact point and then to the BriteSpot G3 Conversion Module.
5. Mark each end of the fiber with a means to identify each fiber when finalizing the installation. If this is not done, it can be very challenging to correlate installation location with the fiber. Black marker and tape are acceptable, as are approved wire markers (preferred). Ensure to make all markings a safe distance from the energized end, typically this is 60-100 cm (2-3 ft).

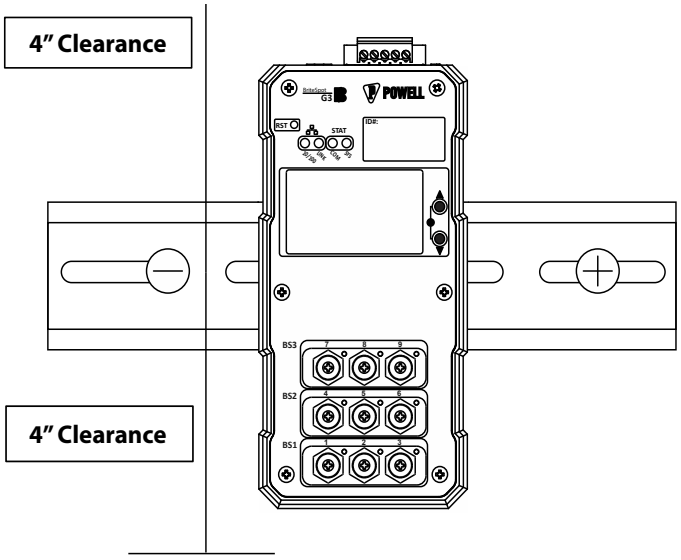
D. Mount G3 Conversion Module

The G3 Conversion Module provides the power, telemetry, and user interface to the sensors. Once installed, the G3 Conversion Module can be configured to provide a wide range of features through the Ethernet and serial ports. In addition to proximity to the LOI, thought should also be given to ensuring that there is access to the G3 Conversion Module following installation. This is needed for initial configuration and retrieval of onboard logged data.

1) Mount DIN Rail

Attach a segment of 35 mm DIN rail to a location where the BriteSpot G3 Conversion Module will be secured. When selecting a location for installation, ensure that the ambient temperature will be below 70˚C (158˚F). Approximately 13 cm (5”) of DIN rail is needed for mounting the conversion module. If other peripherals, such as DC power supplies or MODBUS gateways are also installed, consider increasing the length of DIN Rail to accommodate the extra items. Other items to consider include leaving adequate room for the fibers and wire connections to the module. Approximately 100 mm (4 in) should be left both above and below the center of the DIN rail.

Figure 20 DIN Rail Clearances



2) Attaching G3 Conversion Module to the DIN Rail

While tilting the top of the conversion module away from the DIN rail, hook the bottom onto the DIN rail. Push the conversion module up and towards the DIN rail until it clips on. In order to remove the unit, first push up and then tilt the top away from the DIN rail.

Figure 21 Installing G3 Conversions Module onto DIN Rail

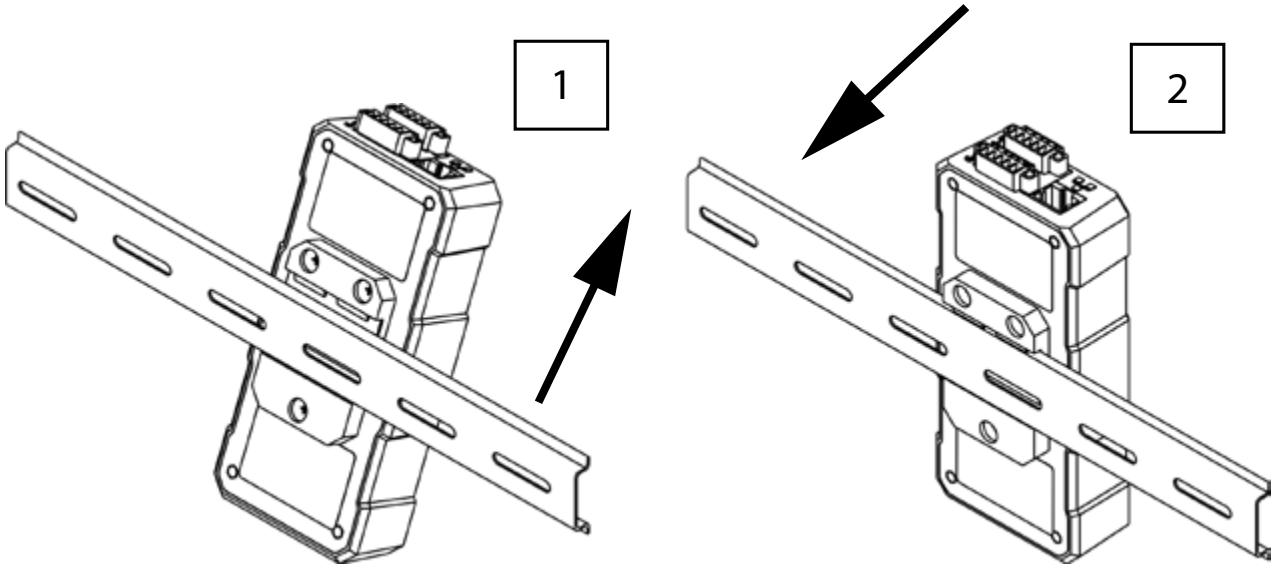
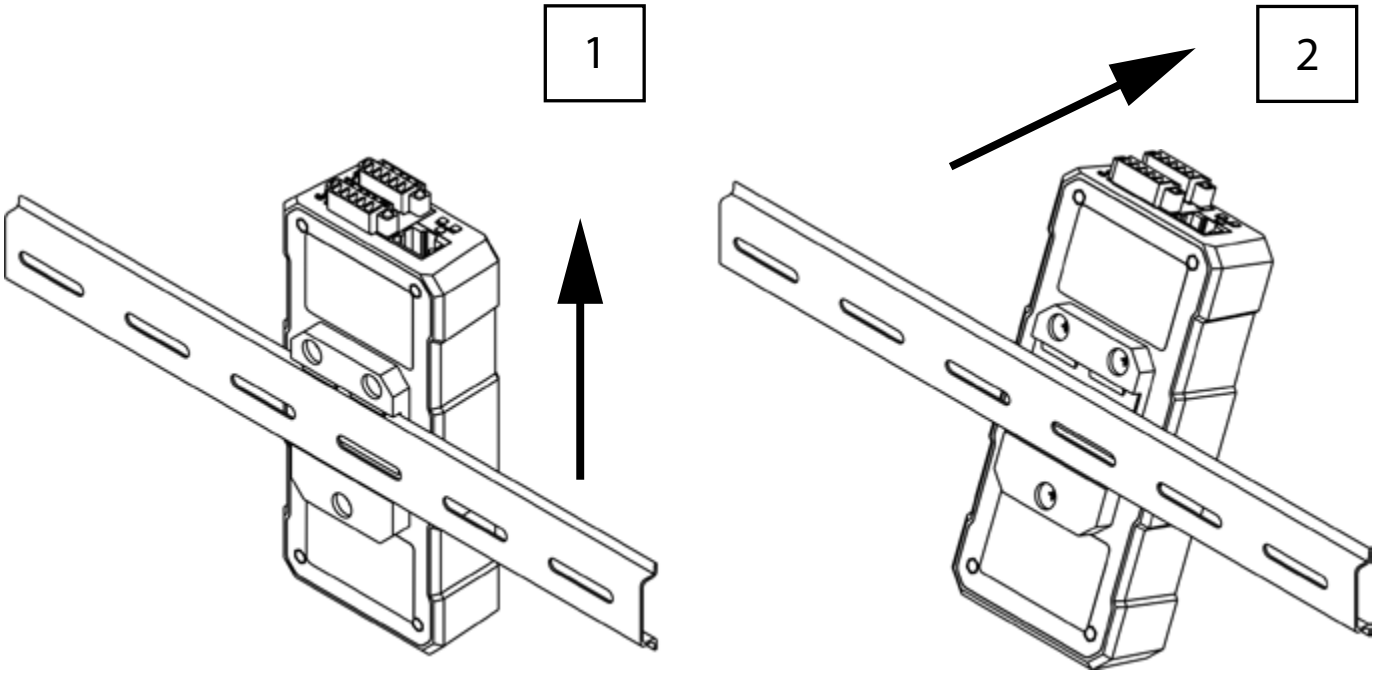


Figure 22 Removing G3 Conversion Module from DIN Rail



E. Connect Network and Power Wiring

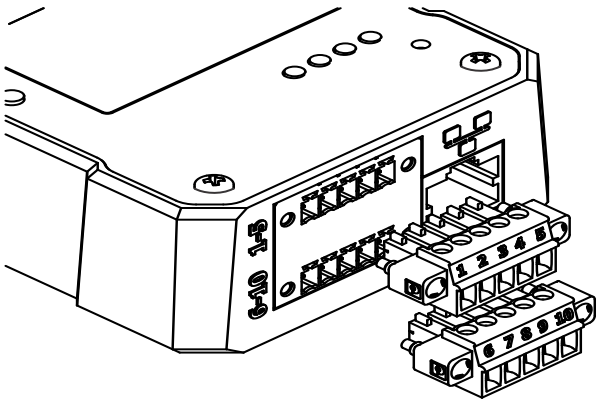
1) *Power Requirements*

The G3 Conversion Module requires a 12-24VDC voltage source to operate. Any industrial DC power source that provides power within the range specified can be used. When selecting a DC power supply, ensure that it is capable of providing enough power for all of the units that it will be supplying. Each unit requires 3 Watts of power under maximum load conditions, and considerably less during normal operations. Ensure to add capacity if the power supply will be used for supplying peripherals such as MODBUS gateways.

2) *Remove Terminal Connector*

Begin by removing the Terminal Connector from G3 Conversion Module. This is easily done by hand or by prying a screwdriver between it and its mating connector. Make sure to loosen connector flange securing screws.

Figure 23 Terminal Connectors of G3 Conversion Module



⚠ CAUTION

Ensure the power is turned OF to prevent damage to the equipment prior to connecting the power of circuitry.

3) *Connect DC Power Wiring*

With the Terminal Connector labeled "6-10" removed, connect the wires as indicated in *Table D*. Secure the wires into place by using a standard slot screwdriver. For short local connection (<3 m/10 ft) inside the low voltage compartment use unshielded duplex wire such as Belden 8442. For longer runs use twisted shielded cable such as Belden #3105 or similar. ADD this to table.

Table D Terminals 6-10

Terminal Number	Name	Function	Wire Gauge	Wire Type
6	V-	Input Voltage Negative	22	Unshielded (<3 m/ 10 ft) Shielded (<3 m/ 10 ft)
7	V+	Input Voltage Positive		
8	PE	Chassis Grounding		
9	COM	Relay: Common Terminal		
10	NO	Relay: Normally Open Terminal		

4) *Connect Communication Wiring (Two Wire RS-485 MODBUS)*

The only serial protocol that is recognized by the G3 Conversion Module is 2 wire RS-485 MODBUS. The device acts as a slave on the network. The wiring table below refers to Figure 23 and details that terminals 3, 4, and 5 are reserved for the RS-485 port. Twisted shielded cable shall be used such as Belden #3105.

Table E Terminals 1-5

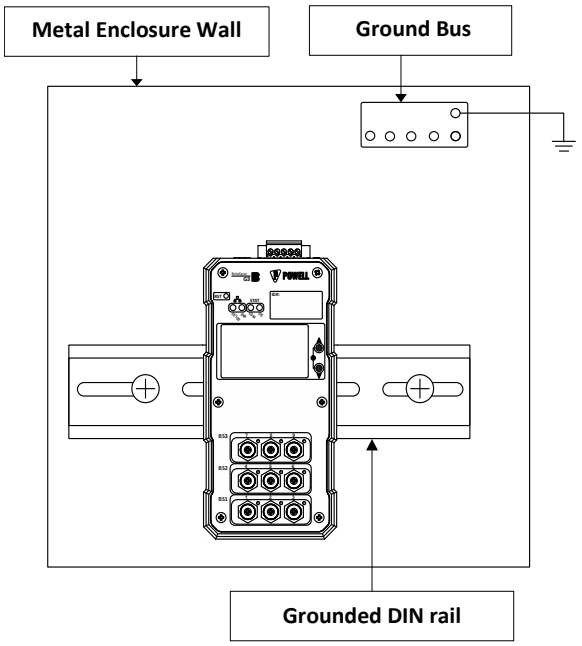
Terminal Number	Name	Function	Wire Gauge	Wire Type
1	V-	Input Voltage Negative	22	Unshielded (<3m) Shielded (>3m)
2	V+	Input Voltage Positive		
3	Rx-	Inverting, 2-wire, RS-485		
4	Tx+	Non-Inverting, 2 wire, RS-485		Shielded twisted pair
5	Shd	Shielding of communication pair		

5) *Grounding*

Grounding of the unit can be achieved via DIN rail contact or via rounding terminal.

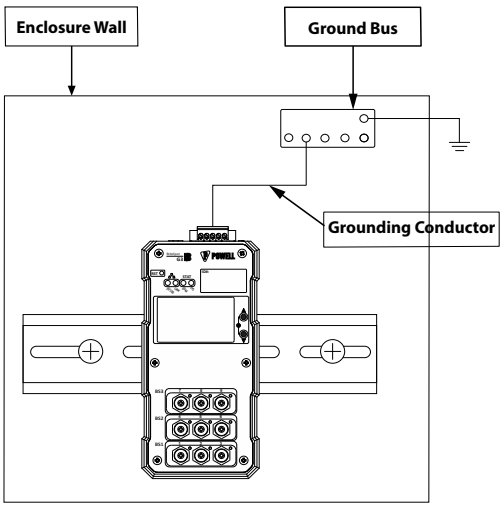
a. Grounding via DIN rail
The G3 unit is intended to be mounted to a grounded DIN rail. For this purpose unit is equipped with a grounding plate located on the DIN mounting clip. This plate provides contact between the G3 chassis and the DIN rail. Use zinc-plated yellow-chromate steel DIN rail to assure proper grounding. Secure the DIN rail to the mounting surface approximately every 200 mm (8").

Figure 24 Typical Grounding via Grounded Din Rail



b. Grounding via dedicated PE terminal and grounding conductor.
The G3 unit is equipped with a dedicated PE terminal (Terminal 8). This terminal is internally connected to grounding DIN clip contact plate. Use this contact to ground the unit if grounded DIN rail is not available.

Figure 25 Typical Grounding via PE Terminal



6) *Connect Communication Wiring (MODBUS TCP/IP and ETHERNET I/P)*

Shielded twisted-pair 10/100 Base-T cables (CAT5) with RJ45 connectors are supported. Connect cable to the Ethernet port on the device should either MODBUS TCP/IP or ETHERNET I/P protocols be selected for real-time communication with the device.

7) *Relay Output*

The device is configured with a relay that is normally open during typical operation. The relay contacts close when ANY of the Alarm registers have been triggered. See ***Ch 5 Usage,* D. Special Registers,** *2) Alarm & Warning Registers* for operation of the Alarms. The relay contacts are found on Terminals 9 and 10 of the "6-10" Terminal Block.

Table F Output Relay Status

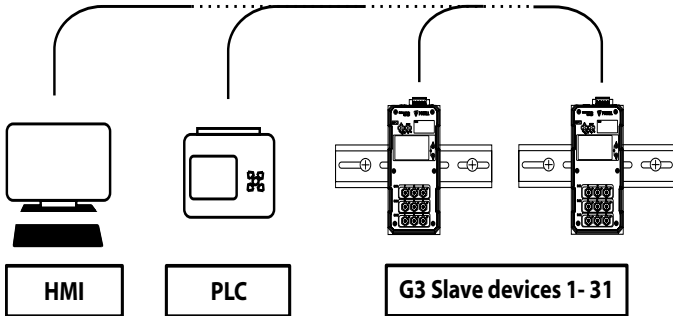
Relay	Status
On (Closed)	Any one channel temperature has exceeded alarm threshold
Off (Open)	All temperatures below individual thresholds

8) *Network Topologies*

The following sections only pertain to the networking and real-time data collection of temperature data from the BriteSpot. This section is intended for those planning to connect the G3 Conversion Module to a SCADA network.

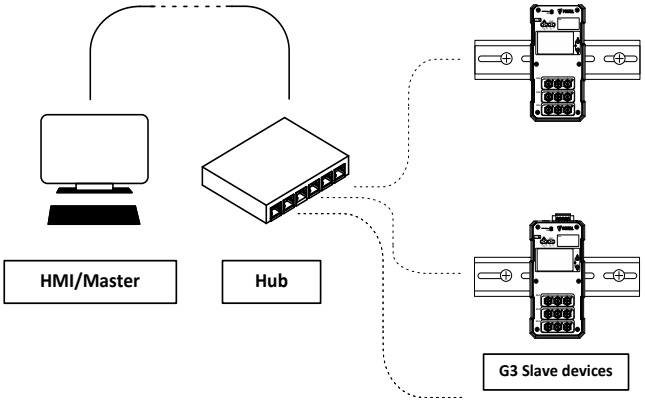
a. RS-485 MODBUS RTU Network Topology
This topology is usually referred to as a "ring topology" in that each unit is connected sequentially along a databus. The flexibility of the system allows for one databus to communicate with up to 31 units. If more than 31 units are required, an additional databus must be added.

Figure 26 Typical Serial Topology for MODBUS RTU



b. MODBUS TCP/IP and ETHERNET I/P Network Topologies. When using either of the Ethernet based communication protocols (Ethernet I/P or MODBUS TCP/IP), the topology is considered a "star". Each unit is typically wired directly to the master through a network switch as shown in Figure 26.

Figure 27 Star Topology



9) *Fiber Connection / Termination at G3 Conversion Module*

a. Determine Trim Location

Once the fibers have been secured along their length, they can be prepared for final installation. Determine where the fibers must be trimmed to remove the excess fiber and still reach the G3 Conversion Modules. Once a section of fiber has been cut, it can only be cut shorter, therefore be careful to ensure that enough length has been allocated to reach the G3 Conversion Module. It is best to leave at least 25-50 mm (1-2") of extra fiber as a precautionary measure.

b. Trim the Fiber

Slide the fiber through either of the two holes labeled "2.2" on the provided guillotine trimmer. Once above the location to be cut, push down briskly on the trimmer to complete the cut. Each location on the trimmer should only be used maximum 10 times, so keep track of the locations that have already been used.

Figure 28 Fiber Trimmer

Figure 29 Fiber Trimmed

NOTICE

Once the fiber is cut, it is imperative to ensure that the cut end is kept clean and free from debris. If the end becomes contaminated, trim off several millimeters.

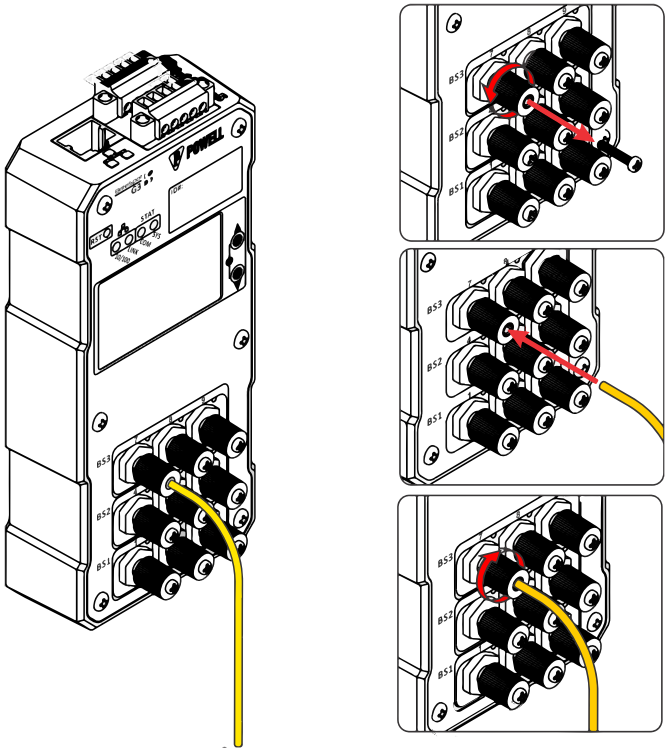
c. Connect the Fiber to Conversion Module

Ensure that the cut surface of the fiber is clean. Fully disengage the fiber retention nuts on each sensor. This is done by turning them counter-clockwise several turns. They are designed to stay in place once disengaged; if they are inadvertently removed they can be replaced by simply pushing them back on.

Insert the fibers into the proper optical connector. If the fibers have not been marked to identify installation location already, see the procedure in the troubleshooting section for a method of identifying fibers that are not labeled.

Insert the fibers individually into the optical connectors until they come to a hard stop. The stop will be very noticeable and does not require excessive force. Secure the Fiber Retention Nut with moderate force by screwing it in clockwise as shown in Figure 29. Do not over tighten the nut, as it is plastic and can be broken if too much force is applied.

Figure 30 Fiber Installation



d. Ensure that Optical Signal is adequate once all the fibers are installed and connected, they must be checked to ensure that the optical signal is strong enough for proper operation of the device.
   i. Apply power to the device and wait several minutes for all probes to stabilize.
   ii. For each probe, look at the color of the BriteSpot Status LED and follow the actions recommended in *Table G BriteSpot Status LED Colors*.

Table G BriteSpot Status LED Colors		
Status LED Color	**Status**	**Action**
Green	OK	No Action
Red	Fail	Trim several mm off of fiber end, re-insert

   iii. Complete the procedure by checking the fiber power for the remaining probes. Read the fiber power screen (only BSG3.9S) or read fiber power registers (BSG3.9 and BSG3.18). Fiber power shall be 7,8,9 or 10 (strongest signal)
   iv. If any of the probes continue to fail, see ***Ch 6 Troubleshooting*** for remedial actions.

Ch 5 Usage

A. User Interface Overview

1) Web Interface

Once connected to the G3 via the web interface, a host of information and configuration options are presented. The following section provides a general overview of the pages displayed. More detailed analysis and specifics on establishing the connection is provided in the remaining sections of this chapter.

The general format of the web interface is that of a Navigation Bar in the left portion of the page and data fields on the right, as shown in Figure 31. Clicking on any one of the cells in the Navigation Bar will update the page and display the corresponding content.

Figure 31 Web Interface Navigation

2) LCD Interface (BSG3.9S Only)

LCD and Buttons

The BSG3.9S is equipped with a simple LCD and set of buttons which allows for basic data display and configuration.

Figure 32 LCD Interface Navigation

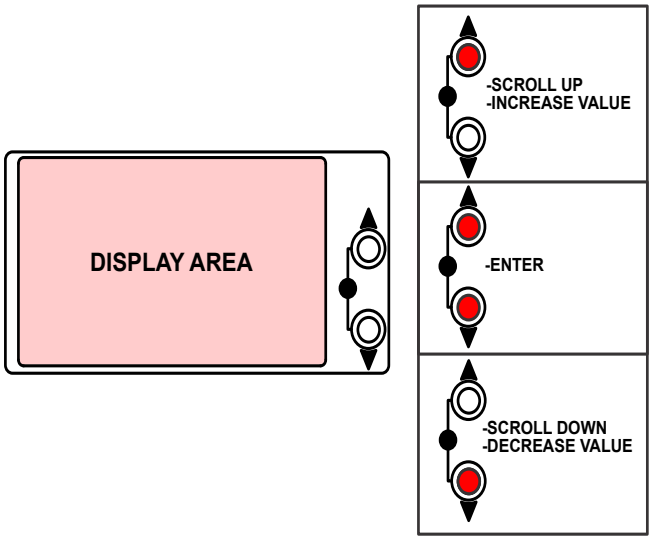
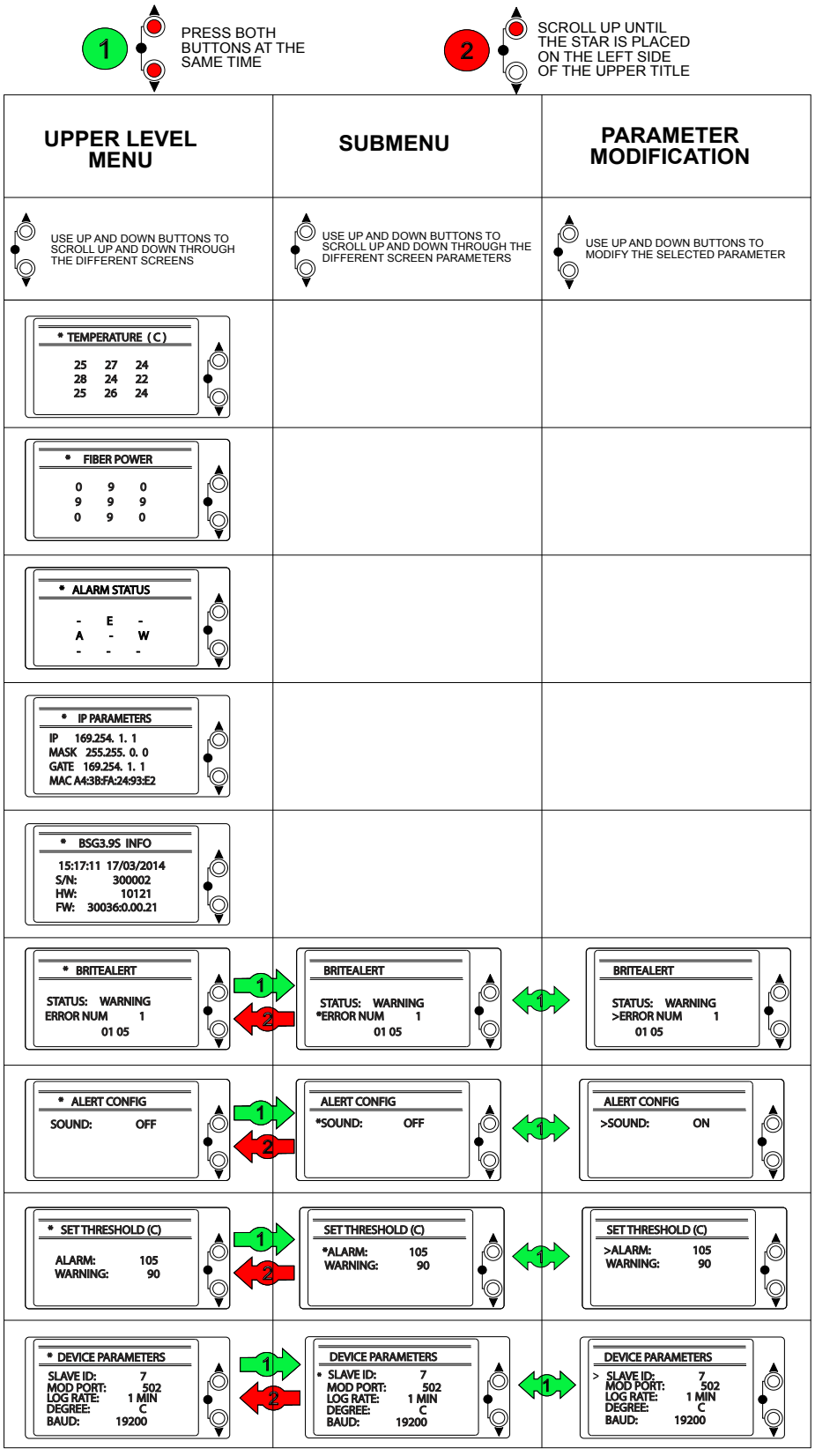


Figure 33 LCD Menu and Navigation



B. Configuration

1) *Web Interface*

Connecting to the Device

i. Connect a CAT5 Ethernet cable directly between the Ethernet ports on the computer and G3 to be configured.
ii. Ensure the power is connected to the device and link is established.
iii. Type in the IP address in the browser (default: 192.168.1.50). A field has been provided on the back sticker in case it has been changed.
iv. From the home page you can navigate through the rest of the site by clicking on the cells of the Navigation Bar on the left.

Configuration Pages

i. Credential Validation
The changing of some parameters will require a username and password. The default values are:

Username: admin
Password: admin

Figure 34 Credential Validation Screen

ii. Network Configuration
Any changes to the network configuration settings will automatically reboot the system.

Figure 35 Network Configuration Web Page

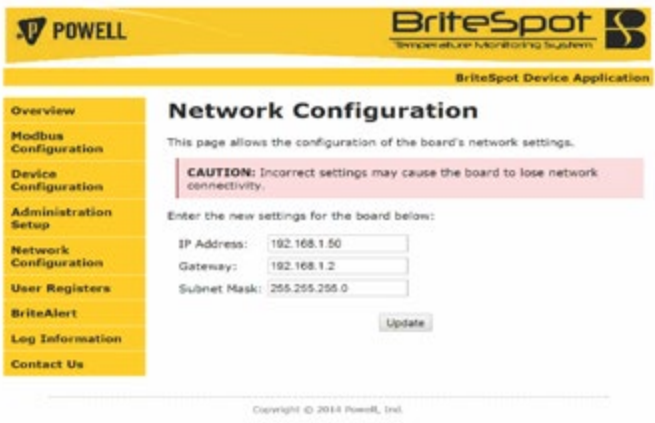


Table H Network Configuration Web Page Settings

Parameter	Default Value	Range/Options
IP Address	192.168.1.50	XXX.XXX.XXX.XXX (XXX is 0-255)
Gateway	192.168.1.2	XXX.XXX.XXX.XXX (XXX is 0-255)
Subnet Mask	255.255.255.0	XXX.XXX.XXX.XXX (XXX is 0-255)

iii. MODBUS Parameters
The MODBUS parameters page displays all the parameters that can be changed.

Figure 36 MODBUS Configuration Web page

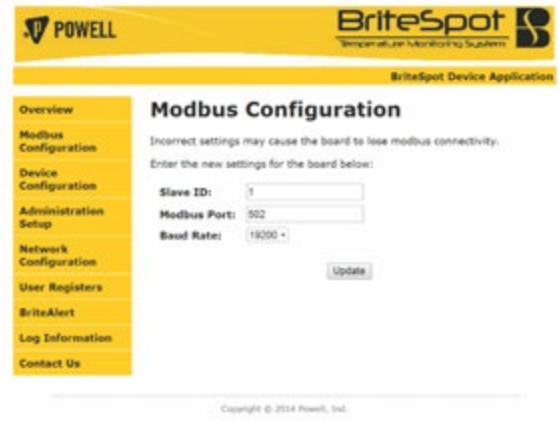


Figure 37 Device Configuration Web page

Table I MODBUS Configuration Web Page Settings		
Parameter	**Default Value**	**Range/Options**
Slave ID	1	1-31
MODBUS PORT	502	0-9999
Baud Rate	19200	9600, 19200, 38400 Baud

iv. Device Configuration

The Device Configuration Page provides some basic interface options and the setting of Warnings and Alarms. See ***Ch 5 Usage, D. Special Registers,*** *2) Alarm & Warning Registers* for full description on the operation of the Warnings and Alarms.

When updating the Warnings / Thresholds, the "Update" button must be pressed to enter the changes into the memory of the device.

Table J Device Configuration Web Page Settings		
Parameter	**Default Value**	**Range/Options**
Measurement Units**	°C	°C/ °F
Audible Alarm	On	Mute /Unmute
Warning Thresholds	90 °C (194°F)	0-120°C (248° F)
Alarm Thresholds	90 °C (194°F)	0-120°C (248° F)
Log Time	60 min	1 min – 6 hours

Note: ***Measurement units only affect way data is presented on the web pages and LCD screen (if present).*

v. Administration Setup

The Administration Setup is used for changing the Administration rights. The username and password must be known prior to changing any values.

Figure 38 Administration Setup Web Page

Table K Administration Setup Web Page		
Parameter	**Default Value**	**Range/ Options**
Username	admin	16 characters
Password	admin	16 characters

2) LCD Screen (BSG3.9S Only)

a. Configuration Screens
The LCD Screen provides an alternate method for configuration. The system for navigation and entering data is universal and described in Figure 31.

Figure 39 Device Parameters HMI Screen

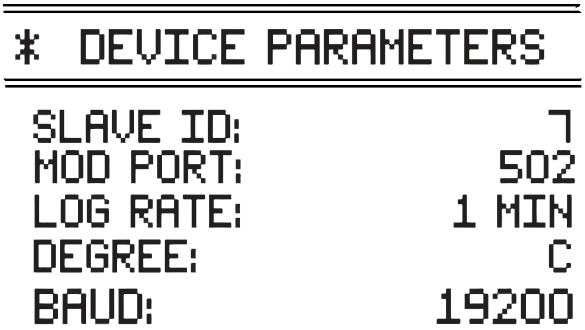


Table L Device Parameters HMI Screen Settings		
Parameter	**Default Value**	**Range/Options**
Slave ID	1	1-31
MODBUS Port	502	0-9999
Log Rate	60 min	1 min – 6 hours
Degree	°C	°C or °F
Baud	19200	9600, 19200,38400

C. Real-Time Data Acquisition

Although the G3 device provides onboard logging, the most significant utility is derived when the data is collected in real-time. There are several protocols available for extracting the data, each of which will be covered briefly.

1) MODBUS RTU (RS-485 2 Wire)

In order to make a MODBUS RTU connection, use ***Ch 4 Installation,*** **E. Connect Network and Power Wiring,** *4) Connect Communication Wiring (Two Wire RS-785 MODBUS)* as a guide for the physical connection of the device. It is assumed the user has a basic working knowledge of the MODBUS parameters, therefore, only the salient details of the implementation on the G3 are provided. A detailed MODBUS register listing is provided in *Appendix A*.

Table M MODBUS RTU Parameters		
Parameter	**Default Value**	**Range/Options**
Baud Rate	19200 Baud	9600, 19200, 38400 Baud
Data Bits	8	N/A
Parity	None	N/A
Stop Bits	1	N/A
Max # of Registers per Query	N/A	32
Max Polling Rate	3 Seconds	N/A

2) *MODBUS TCP / IP*

In order to make a MODBUS TCP/IP connection, use ***Ch. 4 Installation,*** **E. Connect Network and Power Wiring,** *6) Connect Communication Wiring (Modbus TCP/IP & Ethernet IP)* as a guide for the physical connection of the device. It is assumed the user has a basic working knowledge of the MODBUS TCP parameters, therefore, only the salient details of the implementation on the G3 are provided. A detailed MODBUS register listing is provided in Appendix A.

Table N MODBUS TCP/IP Parameters

Parameter	Default Value	Range/Options
IP Address	192.168.1.50	XXX.XXX.XXX.XXX (XXX is 0-255)
Port	502	1-9999

3) *Basic MODBUS Queries*

The information in Table O is intended to provide several basic examples of queries that can be issued to the G3 Conversion Modules. The examples are far from exhaustive.

Table O Basic MODBUS Queries

Type	Read Slave ID 1, Ch 1	Read Slave ID 1, Ch 1 Temperature °F	Read Slave ID 1, Ch 1 Registers
Slave ID	1	1	1
MODBUS Function	04 (Read Input Registers)	04 (Read Input Registers)	04 (Read Input Registers)
Quantity	1	1	18
Start Address	97	115	79
Absolute Address	30098	30116	30080-30097

4) *Basic Ethernet I/P Queries*

The conversion module can communicate using the CIP through Ethernet I/P. This requires an Ethernet connection to the host device. An EDS is provided to assist with the setup. Ensure that desired IP address information is accessible. Refer to *Appendix A* for details.

Table P Basic Ethernet I/P Queries

Type	Read Ch 1 Temperature °C	Read Slave ID 1, Ch 1 Temperature °F	Read FW revision
Connection	User Info	User Info	Device Info (101)
Array Offset	18	36 - 53	3

D. Special Registers

There are several special register types that warrant particular attention when polling the BriteSpot:

1) *Status Registers Interpretation*

The Status Registers provide a generic set of status codes for each channel independently. These codes can identify one of several problems that may need to be rectified. In general, the Status Registers provide more detailed description when problems arise. The status registers can be accessed via MODBUS (See *Appendix A*) or through the LCD screen (BSG3.9S only).

Table Q Status Register Error Codes for BriteSpot Channels	
Status Register Value	**Description**
0	No Errors
1	Optical Probe not detected (broken or not connected)
2	Optical signal too weak
4	Temperature out of range
8	BriteSpot module is still initializing

2) Alarm & Warning Registers

Each temperature channel on the G3 Conversion Module is equipped with a pair of registers that are used to indicate that the temperature has exceeded a predefined threshold. In some cases, users may prefer to just monitor these registers and take action if they become active. The lower threshold, called the Warning Register, is typically set 10-15^{0}C below the Alarm Register. The location of the Warning / Alarm registers can be found in *Appendix A*.

a. Operation
Each bit for the alarms is found in a 16 bit Input Register that is packed from Least Significant Bit (for Sensor Channel 1) to Most Significant Bit (For Sensor Channel 16). BSG3.18 have additional registers for the last 2 channels. If no Warnings or Alarms are set on any of the channels, all the associated registers will read as "0". See *Appendix A* for details.

Example: Reading Input Register 30055

Table R Example Warning Flag			
Input Register Address (Name)	**Integer**	**Hex**	**Binary**
30055 (W Flag L)	64	0x 0000	0b 0000 0000 0100 0000

In the case above, the bit that is set refers to the Warning Register for Sensor 7. A similar register for the Alarm flags is also available. Therefore, in the example above, Sensor 7 has exceeded the warning threshold.

b. Default Values

Table S Recommended Alarm and Warning Actions		
Register	**Default Temperature**	**Recommended Action**
Warning Registers	90°C (194°F)	Visually inspect and service warning location at next scheduled maintenance
Alarm Registers	105°C (221°F)	Service Alarm Location at soonest

c. Alarms and Warnings with the LCD (BSG3.9S Only). The warning and alarm set point registers can be viewed and changed with the optional LCD screen, the details for which can be seen in Figure 32. In addition, the current status of the alarms can be viewed on the Alarm Status LCD Screen as shown in Figure 40.

Figure 40 Alarm Status LCD Screen

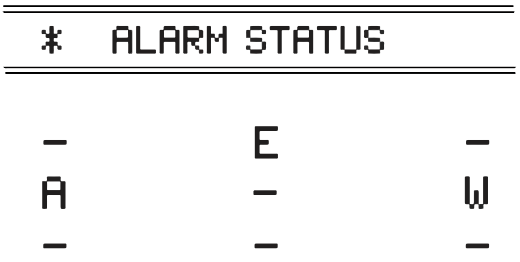


Table T Alarm Status LCD Screen Values	
Value	**Condition**
-	Channel OK
A	Alarm flag for channel is set
W	Warning flag for channel is set
E	Status Code is non-zero (problem with channel)

d. Relay Output
The G3 Conversion Module is equipped with a Normally Open dry-contact type relay on terminals 9 and 10. The relay is intended to be used by the operator for wiring to an annunciator or any device similar should action be desired upon the occurrence of an Alarm.

Table U Relay Conditions	
Contact State	**Condition**
Open	All sensor readings are below the respective Alarm Set point
Closed	Any one sensor reading is above Alarm Set point

E. BriteAlert

The G3 is equipped with a data processing feature intended to simplify operators decision making. BriteAlert interprets raw data and alerts user via single BriteAlert register. The G3 will collect, interpret, and archive the data and alerts user only when action needs to be taken.

1) BriteAlert Status Register

Each temperature channel on the G3 Conversion Module is equipped with a pair of registers that are used to indicate that the temperature has exceeded a predefined threshold.

Table V BriteAlert Error Code Table	
BriteAlert Status Register Value	**Description**
0	OK - No action needed system OK
1	WARNING – schedule maintenance of the gear – no immediate action needed
2	ALERT – dangerous situation, shut down the gear

2) *BriteAlert Error Code Register*

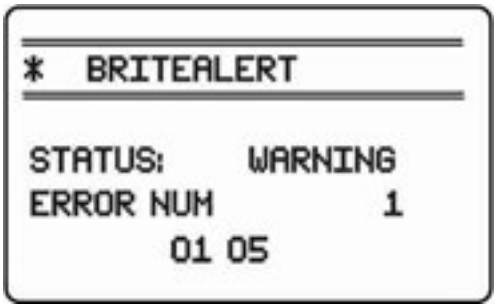
There is maximum of 10 BriteAlert Error Codes kept up to date. All error codes are logged internally.

Table W BriteAlert Status Register	
BriteAlert Error Code Register Value	**Description**
01 XX	Over temperature
02 XX	Alarm - Over temperature
03 XX	BriteSpot error - self diagnostics
	XX is qualifier and indicates the channel number (1-18) in HEX format, 1=CH 1,… F=CH 15, 10=CH16, 11=CH17 and 12=CH18

3) *BriteAlert LCD screen (BSG3.9S only)*

Below is the main BriteAlert LCD screen.

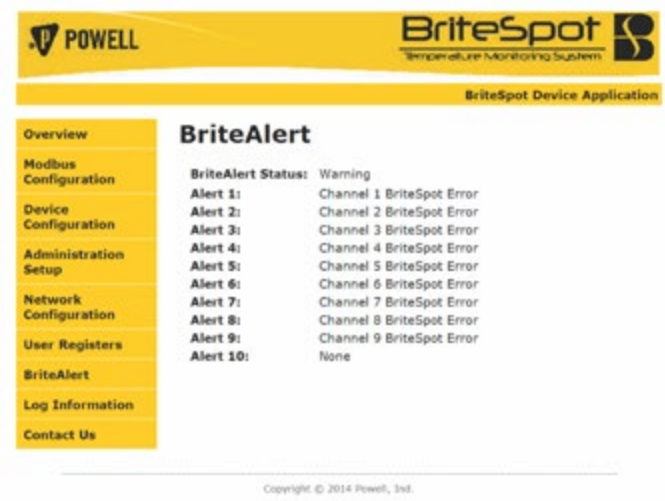
Figure 41 BriteAlert LCD Screen



4) *BriteAlert Web interface*

Below is the main BriteAlert web interface page screen.

Figure 42 BriteAlert Web Interface



F. Data Log

The Data Log allows the user to visualize and download temperature logs for data analysis and trend recognition.

1) *Log Rate and Timespan*

There is a fixed amount of memory available on the device for storage of the Data Log. The data collection interval can be set between 1 minute and 6 hours. Increasing the frequency of the data collection affects the timespan for which data can be collected. Table 24 provides approximate estimates for the how long data can be logged.

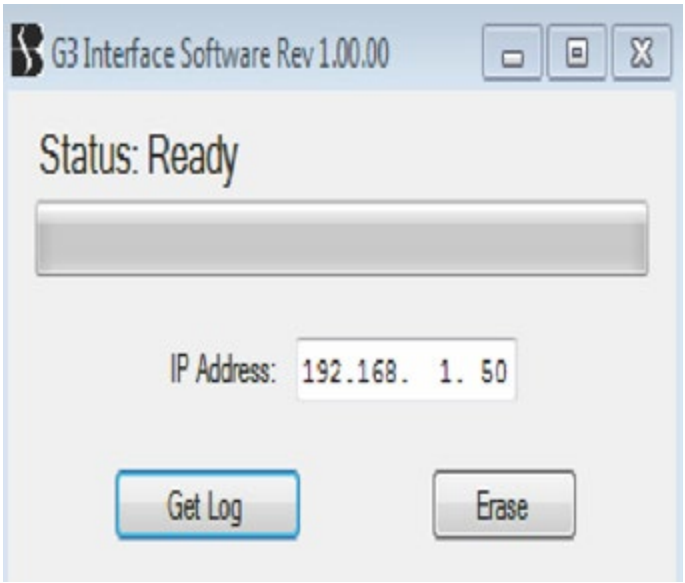
Table X Onboard Data Acquisition Timespans

Log Rate Interval	Memory Timespan
1 min	8 months
5 min	3 years
15 min	9 years
30 min	18 years
1 hour	36 years
2 hours	72 years
6 hours	216 years

2) *Downloading Log File Onto Windows PC*

a. Obtain the data extraction executable, G3 Interface Software.
b. Ensure power is applied to the device and connect an Ethernet Cable between the computer and the G3.
c. Initiate communication between the two. Alternately, if the device is connected to a local LAN and the address of the device is known, the web interface can be accessed directly through any device connected to the same LAN.
d. Launch the executable.
e. Ensure that the SYS LED is blinking green and that the LINK and 10/100 LEDs are on.
f. Enter the IP Address of the device into the IP Address field.

Figure 43 G3 Interface Software



g. Click the "Get Log" button to download the logged data. This will download all the data since the last reset. In the case the Data Log has exceeded the available memory; the oldest data is progressively deleted and replaced with new data.
h. The file will download with a name BSG3-9S_30003_2014-03-26-14-08 (MODEL_SN_DATE&TIME)
i. Depending on the amount of data contained in the log file, it can take up to 20 minutes to download should the memory be full.
j. In the case of error messages, click "Stop" and recheck IP Address. Attempt to download once again
k. The log can be erased by pressing "Erase" on the application.

3) Log Application Status

The Application Status provides information to the user about the current actions under progress. The location of the Application Status is shown in Figure 43.

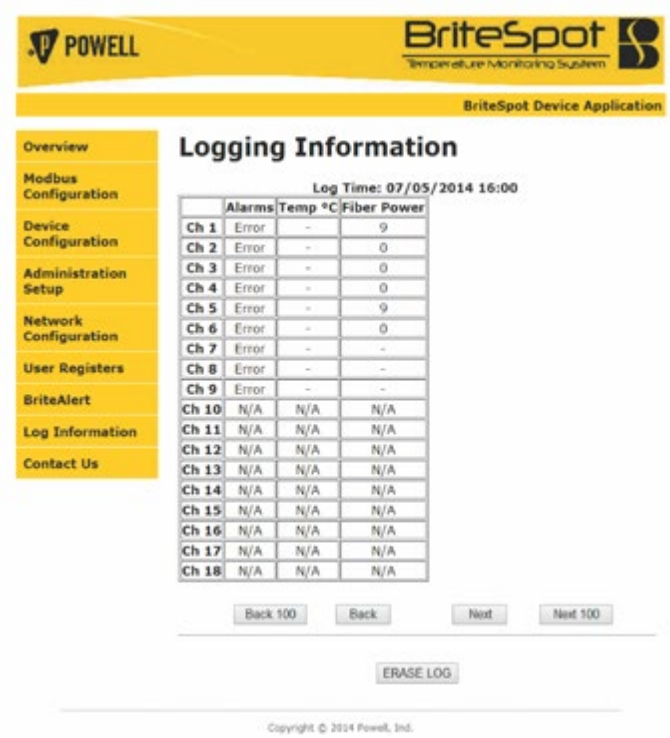
Table Y Log Application Status

Status	Description
Ready	The application is ready for a task.
Timeout Error	Something is stopping the connection from working. Ensure that the Ethernet cable is plugged in and the device is still running.
Not Connected	The application was never able to connect to the device. Check the IP address and connections.
Downloading Log	Valid log information is being downloaded from the device
Downloading Empty Log	Empty log information is being downloaded from the device. This occurs if trying to download the full log.
Erasing Log	The log is being erased.
Log Download Successfully Finished	The log has finished downloading without errors.
Erase Successfully Finished	The log has been erased.
Cancelled	The user has stopped the log download (the user will have an incomplete log).
Other Errors	If showing any other errors and it isn't able to recover try to restart the device and application.

4) Displaying Log Information Through Web-Interface

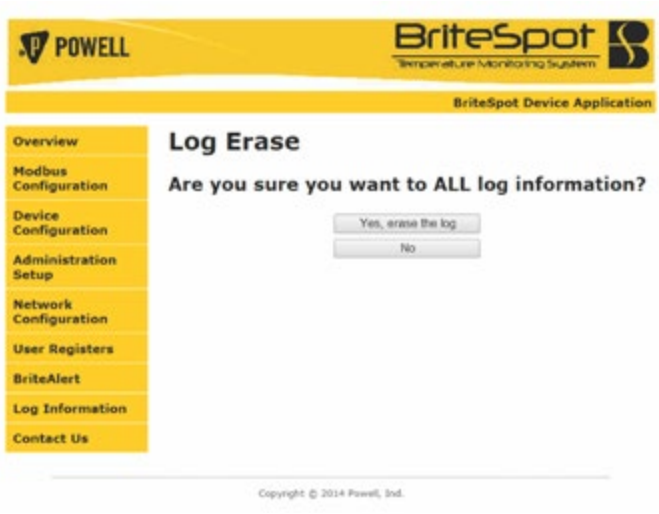
a. Apply power to the device and connect an Ethernet Cable between the computer and the G3. Initiate communication between the two.
b. Navigate to the Log Information page

Figure 44 Logging Information Webpage



c. The initial log that will be displayed shows the log information that occurred at the most recent alarm event.
d. Use the "Back 100", "Back", "Next" and "Next 100" buttons to navigate through the log
e. If the Log Time says "No information" then the log is finished or no logging has taken place.
f. The ERASE LOG button will erase the log, only use this if necessary.
g. Confirm the erase by pressing "Yes, erase the log" button

Figure 45 Confirming Log Erase

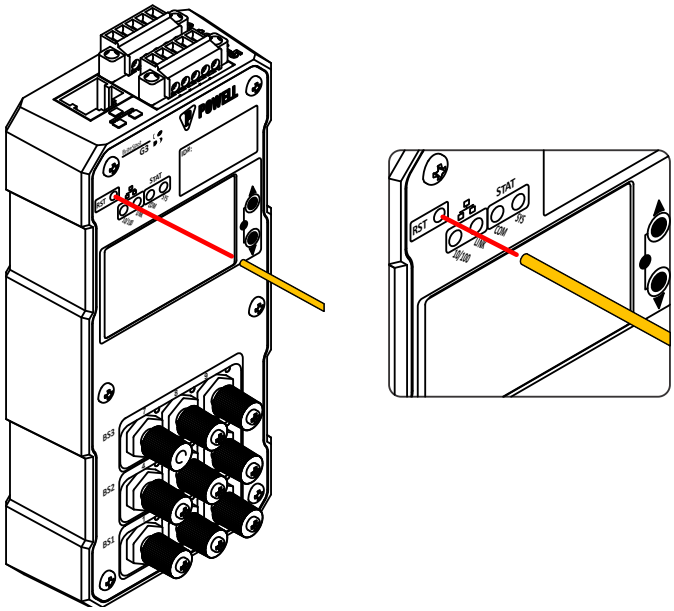


G. Factory Reset

Under some circumstances it may be desirable to return the G3 Conversion Module back to the factory configuration. In situations where the administrator password or IP address are lost are compromised, perform the reset procedure as outlined.

1. Remove power from the conversion module.
2. Insert an object into the hole labeled "RST" and depress the concealed button while applying power to the device. Keep the button depressed until both the "SYS" and "COM" LEDs stay green (about 5 seconds). The hole for the "RST" button has been designed to allow an end from one of the probes to be inserted.
3. Release the button and device will restart with its default values.

Figure 46 Inserting Fiber into RST Button



Ch 6 Troubleshooting

A. Troubleshooting the Fiber-Optic Probes

1. *Problem*: Sensor / LOI mapping. The user is unsure about which sensors are mapped to which locations. This can happen if several wire tags fall off during the installation of the fibers.
   a. Identify the unknown fibers at their respective LOIs.
   b. Apply an indirect heat source to the vicinity of the LOI. Heat guns are recommended for the task but should never be directly at the fiber or the sensing tip. Heat the adjacent area.
   c. Return to the G3 Conversion Module and identify which unknown sensor has shown an increase in temperature due to the application of heat.
   d. Alternatively, apply a heat source sequentially to each fixture and look for a change in measured temperature.
   e. Repeat the process above until all fibers have been properly identified and marked.

2. *Problem*: BriteSpot Indicator LEDs remain red (optical signal too low)
   a. Determine if the problem is related to the Fiber-Optic Probe or the Optical Connection Port by moving the probe in question to another port that has already been determined to work. If the Probe functions in the test port, then the original Optical Connection Port is likely the problem.
   b. Optical Port Related Problems. Attempt to blow any contaminants off the surface of the LED inside the port with clean compressed air. DO NOT USE UNFILTERED, NON-INSTRUMENTATION TYPE COMPRESSED AIR. Re-insert fiber into connector and allow 30 seconds to stabilize. Proceed next step if BriteSpot Indicator LED remains red.
   c. Probe Related Problems
      ii. Trim ~3 mm (⅛") from the end of the fiber. Re-insert fiber into connector and allow 30 seconds to stabilize. Proceed next step if BriteSpot Indicator LED remains red.
      iii. Replace the Probe.

B. Troubleshooting the Onboard Web-page

1. *Problem*: Web page does not display (HTTP error 404)
   a. Restart the unit.
   b. Ensure the device is powered and working (the SYS LED flashing green and the LINK and 10/100 LEDs are on).
   c. Ensure the Ethernet cable from the device is connected to the computer.
   d. Ensure the correct IP address is entered in the address bar
   e. If problem persists, perform Hardware Reset.

2. *Problem*: The website isn't loading properly
   a. Restart the unit.

3. *Problem*: Memory capacity is 100%
   Explanation: Once the memory is full it will start writing over the beginning.
   a. Download the Log file using the application G3 and save it.
   b. Erase the log, this will set the memory back to 0%, follow the instructions in "data Log section".

APPENDIX A - MODBUS Memory Map

MODBUS Memory Map

Category	Register Name	Read/ Write	Register Type	Description	Default	Range, Format	UOM	Register #	Modbus Offset #	EIP Offset *2	Interpretations	BSG3.18	BSG3.9	BSG3.9S	EIP Instances
General Parameters	PCB Serial No. LSB	R	Input	LSW of Serial Number	N/A	0-65535	N/A	30005	4	0		x	x	x	Device Instance 101
	PCB Serial No. MSB	R	Input	MSW of Serial Number	N/A	0-65535	N/A	30006	5	1		x	x	x	
	HW P/N	R	Input	HW Part Number	10121	0-65535	N/A	30007	6	2		x	x	x	
	FW Rev	R	Input	FW Revision	22	0-65535	N/A	30008	7	3		x	x	x	
System Time	Day	R	Input	Device Days from RTC	N/A	1 - 31	N/A	30009	8	4		x	x	x	Device Instance 101
	Month	R	Input	Device Months from RTC	N/A	1 - 12	N/A	30010	9	5		x	x	x	
	Year	R	Input	Device Years from RTC	N/A	2000 - 2099	N/A	30011	10	6		x	x	x	
	Hour	R	Input	Device Hours from RTC	N/A	0 - 23	N/A	30012	11	7		x	x	x	
Board Param	Mem Capacity	R	Input	Amount of Log Storage Memory	N/A	0-100	%	30015	14	10		x	x	x	
	BM0	R	Input	Board Map 0 for determining the type of G3 configuration	N/A	0x0000-0x003F	N/A	30016	15	11		x	x	x	
Comm Parameters	Instance	R	Input	EIP User Assembly Instance	102	0-65535	N/A	30022	21	N/A		x	x	x	
	MB Port	R	Input	Modbus Port	502	1-9999	N/A	30023	22	N/A		x	x	x	
	MB Baud L	R	Input	MODBUS Baud Rate Low Word	19200	9.6K / 19.2K / 38.4K	Baud	30024	23	N/A		x	x	x	
	MB Baud H	R	Input	MODBUS Baud Rate High Word	0	9.6K / 19.2K / 38.4K	Baud	30025	24	N/A		x	x	x	
	MB Slave ID	R	Input	MODBUS Slave ID	1	1-31	N/A	30026	25	N/A		x			
Time Rate	Log Time	R	Input	Log Interval Amount	5	0-7	N/A	30027	26	N/A	See log table (ref. XXX)	x	x	x	
	Timer	R	Input	Tick Timer (100 ms)	N/A	0-65535	s	30028	27	N/A		x	x	x	
Ethernet Parameters	IP H	R	Input	High Word of the IP Address	169.254	0x0000-0xFFFF	N/A	30029	28	N/A	The values must be parsed, each register contains the MSB and LSB of the address. For example if IP H is 0xA9FE the IP address would start with A9->169 and FE->254.	x	x	x	
	IP L	R	Input	Low Word of the IP Address	001.001	0x0000-0xFFFF	N/A	30030	29	N/A		x	x	x	
	Mask H	R	Input	High Word of the Subnet Mask	255.255	0x0000-0xFFFF	N/A	30031	30	N/A		x	x	x	
	Mask L	R	Input	Low Word of the Subnet Mask	000.000	0x0000-0xFFFF	N/A	30032	31	N/A		x	x	x	
	Gate H	R	Input	High Word of the Gateway	169.254	0x0000-0xFFFF	N/A	30033	32	N/A		x	x	x	
	Gate L	R	Input	Low Word of the Gateway	001.001	0x0000-0xFFFF	N/A	30034	33	N/A		x	x	x	
	MAC 1	R	Input	First 2 Bytes of the MAC Address	0x3B A4	0x0000-0xFFFF	N/A	30035	34	N/A	The MAC address should be parsed starting with the MSB of MAC 1 to the LSB of MAC 3. For example using defaults would be 3B:A4:24:Fx:xx:xx	x	x	x	
	MAC 2	R	Input	Second 2 Bytes of the MAC Address	0x24 Fx	0x0000-0xFFFF	N/A	30036	35	N/A		x	x	x	
	MAC 3	R	Input	Third 2 Bytes of the MAC Address	N/A	0x0000-0xFFFF	N/A	30037	36	N/A		x	x	x	

MODBUS Memory Map (cont.)

Category	Register Name	Read/ Write	Register Type	Description	Default	Range, Format	UOM	Register #	Modbus Offset #	EIP Offset *2	Interpretations	BSG3.18	BSG3.9	BSG3.9S	EIP Instances
HMI Info	Degree CF	R	Input	Degree C or F Flag (1 = C, 2 = F)	1	1-2	N/A	30038	37	N/A	(1 = C, 2 = F)			x	
	Sound Mute	R	Input	Beep and Alarm Mute Flag (0 = Sound, 1= Muted)	0	0 - 1	N/A	30039	38	N/A	(0 = Sound, 1= Muted)			x	
Alarm Registers	Alert Lvl	R	Input	Alert Level for operator	0	0-2	N/A	30040	39	0	(0 = OK, 1 = Warning, 2= Alarm	x	x	x	Alarm Instance 104
	Alert Code 1	R	Input	Brite Alert Code slot 1	0	0x0000-0xFFFF	N/A	30041	40	1	See Error Code List	x	x	x	
	Alert Code 2	R	Input	Brite Alert Code slot 2	0	0x0000-0xFFFF	N/A	30042	41	2		x	x	x	
	Alert Code 3	R	Input	Brite Alert Code slot 3	0	0x0000-0xFFFF	N/A	30043	42	3		x	x	x	
	Alert Code 4	R	Input	Brite Alert Code slot 4	0	0x0000-0xFFFF	N/A	30044	43	4		x	x	x	
	Alert Code 5	R	Input	Brite Alert Code slot 5	0	0x0000-0xFFFF	N/A	30045	44	5		x	x	x	
	Alert Code 6	R	Input	Brite Alert Code slot 6	0	0x0000-0xFFFF	N/A	30046	45	6		x	x	x	
	Alert Code7	R	Input	Brite Alert Code slot 7	0	0x0000-0xFFFF	N/A	30047	46	7		x	x	x	
	Alert Code 8	R	Input	Brite Alert Code slot 8	0	0x0000-0xFFFF	N/A	30048	47	8		x	x	x	
	Alert Code 9	R	Input	Brite Alert Code slot 9	0	0x0000-0xFFFF	N/A	30049	48	9		x	x	x	
	Alert Code 10	R	Input	Brite Alert Code slot 10	0	0x0000-0xFFFF	N/A	30050	49	10		x	x	x	
	W ThresC	R	Input	The Warning Temperature Threshold in C	90	-50 - 200	˚C	30051	50	11		x	x	x	
	A ThresC	R	Input	The Alarm Temperature Threshold in C	105	-50 - 200	˚C	30052	51	12		x	x	x	
	W ThresF	R	Input	The Warning Temperature Threshold in F	194	-58 - 392	˚F	30053	52	13		x	x	x	
	W ThresF	R	Input	The Alarm Temperature Threshold in F	221	-58 - 392	˚F	30054	53	14		x	x	x	
	W Flag H	R	Input	High word of warning flags	N/A	0x0000-0x0003	N/A	30055	54	15	Bitwise representation the channels	x	x	x	
	W Flag L	R	Input	Low word of warning flags	N/A	0x0000-0xFFFF	N/A	30056	55	16		x	x	x	
	A Flag H	R	Input	High word of alarm flags	N/A	0x0000-0x0003	N/A	30057	56	17		x	x	x	
	A Flag L	R	Input	Low word of alarm flags	N/A	0x0000-0xFFFF	N/A	30058	57	18		x	x	x	

MODBUS Memory Map (cont.)

Category	Register Name	Read/ Write	Register Type	Description	Default	Range, Format	UOM	Register #	Modbus Offset #	EIP Offset *2	Interpretations	BSG3.18	BSG3.9	BSG3.9S	EIP Instances
	L S/N BS 1	R	Input	Low Word of Serial Number for BS1	N/A	0-65535	N/A	30068	67	N/A		x	x	x	
	H S/N BS 1	R	Input	High Word of Serial Number for BS1	N/A	0-65535	N/A	30069	68	N/A		x	x	x	
	L S/N BS 2	R	Input	Low Word of Serial Number for BS2	N/A	0-65535	N/A	30070	69	N/A		x	x	x	
	H S/N BS 2	R	Input	High Word of Serial Number for BS2	N/A	0-65535	N/A	30071	70	N/A		x	x	x	
	L S/N BS 3	R	Input	Low Word of Serial Number for BS3	N/A	0-65535	N/A	30072	71	N/A		x	x	x	
	H S/N BS 3	R	Input	High Word of Serial Number for BS3	N/A	0-65535	N/A	30073	72	N/A		x	x	x	
	L S/N BS 4	R	Input	Low Word of Serial Number for BS4	N/A	0-65535	N/A	30074	73	N/A		x			
	H S/N BS 4	R	Input	High Word of Serial Number for BS4	N/A	0-65535	N/A	30075	74	N/A		x			
	L S/N BS 5	R	Input	Low Word of Serial Number for BS5	N/A	0-65535	N/A	30076	75	N/A		x			
	H S/N BS 5	R	Input	High Word of Serial Number for BS5	N/A	0-65535	N/A	30077	76	N/A		x			
	L S/N BS 6	R	Input	Low Word of Serial Number for BS6	N/A	0-65535	N/A	30078	77	N/A		x			
	H S/N BS 6	R	Input	High Word of Serial Number for BS6	N/A	0-65535	N/A	30079	78	N/A		x			
Status Registers	Status 1	R	Input	Status of Ch 1	N/A	0x0000 - 0x000F, 7FFF	N/A	30080	79	N/A	"0 - The channel is good 1 - Optical Probe not detected 2 - Optical signal too weak 4 - Temperature out of range 8 - BriteSpot module is still initializing 0x7FFF - Channel invalid"	x	x	x	
	Status 2	R	Input	Status of Ch 2	N/A	0x0000 - 0x000F, 7FFF	N/A	30081	80	N/A		x	x	x	
	Status 3	R	Input	Status of Ch 3	N/A	0x0000 - 0x000F, 7FFF	N/A	30082	81	N/A		x	x	x	
	Status 4	R	Input	Status of Ch 4	N/A	0x0000 - 0x000F, 7FFF	N/A	30083	82	N/A		x	x	x	
	Status 5	R	Input	Status of Ch 5	N/A	0x0000 - 0x000F, 7FFF	N/A	30084	83	N/A		x	x	x	
	Status 6	R	Input	Status of Ch 6	N/A	0x0000 - 0x000F, 7FFF	N/A	30085	84	N/A		x	x	x	
	Status 7	R	Input	Status of Ch 7	N/A	0x0000 - 0x000F, 7FFF	N/A	30086	85	N/A		x	x	x	
	Status 8	R	Input	Status of Ch 8	N/A	0x0000 - 0x000F, 7FFF	N/A	30087	86	N/A		x	x	x	
	Status 9	R	Input	Status of Ch 9	N/A	0x0000 - 0x000F, 7FFF	N/A	30088	87	N/A		x	x	x	
	Status 10	R	Input	Status of Ch 10	N/A	0x0000 - 0x000F, 7FFF	N/A	30089	88	N/A		x			
	Status 11	R	Input	Status of Ch 11	N/A	0x0000 - 0x000F, 7FFF	N/A	30090	89	N/A		x			
	Status 12	R	Input	Status of Ch 12	N/A	0x0000 - 0x000F, 7FFF	N/A	30091	90	N/A		x			
	Status 13	R	Input	Status of Ch 13	N/A	0x0000 - 0x000F, 7FFF	N/A	30092	91	N/A		x			
	Status 14	R	Input	Status of Ch 14	N/A	0x0000 - 0x000F, 7FFF	N/A	30093	92	N/A		x			
	Status 15	R	Input	Status of Ch 15	N/A	0x0000 - 0x000F, 7FFF	N/A	30094	93	N/A		x			
	Status 16	R	Input	Status of Ch 16	N/A	0x0000 - 0x000F, 7FFF	N/A	30095	94	N/A		x			
	Status 17	R	Input	Status of Ch 17	N/A	0x0000 - 0x000F, 7FFF	N/A	30096	95	N/A		x			
	Status 18	R	Input	Status of Ch 18	N/A	0x0000 - 0x000F, 7FFF	N/A	30097	96	N/A		x			

MODBUS Memory Map (cont.)

Category	Register Name	Read/ Write	Register Type	Description	Default	Range, Format	UOM	Register #	Modbus Offset #	EIP Offset *2	Interpretations	BSG3.18	BSG3.9	BSG3.9S	EIP Instances
Temperature in C	Temp C 1	R	Input	Temperature in C of Ch 1	N/A	-50 - 200, -999, 0x7FFF	°C	30098	97	0	"(-)999 - Temperature invalid 0x7FFF - Channel invalid"	x	x	x	TempC Instance 102
	Temp C 2	R	Input	Temperature in C of Ch 2	N/A	-50 - 200, -999, 0x7FFF	°C	30099	98	1		x	x	x	
	Temp C 3	R	Input	Temperature in C of Ch 3	N/A	-50 - 200, -999, 0x7FFF	°C	30100	99	2		x	x	x	
	Temp C 4	R	Input	Temperature in C of Ch 4	N/A	-50 - 200, -999, 0x7FFF	°C	30101	100	3		x	x	x	
	Temp C 5	R	Input	Temperature in C of Ch 5	N/A	-50 - 200, -999, 0x7FFF	°C	30102	101	4		x	x	x	
	Temp C 6	R	Input	Temperature in C of Ch 6	N/A	-50 - 200, -999, 0x7FFF	°C	30103	102	5		x	x	x	
	Temp C 7	R	Input	Temperature in C of Ch 7	N/A	-50 - 200, -999, 0x7FFF	°C	30104	103	6		x	x	x	
	Temp C 8	R	Input	Temperature in C of Ch 8	N/A	-50 - 200, -999, 0x7FFF	°C	30105	104	7		x	x	x	
	Temp C 9	R	Input	Temperature in C of Ch 9	N/A	-50 - 200, -999, 0x7FFF	°C	30106	105	8		x	x	x	
	Temp C 10	R	Input	Temperature in C of Ch 10	N/A	-50 - 200, -999, 0x7FFF	°C	30107	106	9		x			
	Temp C 11	R	Input	Temperature in C of Ch 11	N/A	-50 - 200, -999, 0x7FFF	°C	30108	107	10		x			
	Temp C 12	R	Input	Temperature in C of Ch 12	N/A	-50 - 200, -999, 0x7FFF	°C	30109	108	11		x			
	Temp C 13	R	Input	Temperature in C of Ch 13	N/A	-50 - 200, -999, 0x7FFF	°C	30110	109	12		x			
	Temp C 14	R	Input	Temperature in C of Ch 14	N/A	-50 - 200, -999, 0x7FFF	°C	30111	110	13		x			
	Temp C 15	R	Input	Temperature in C of Ch 15	N/A	-50 - 200, -999, 0x7FFF	°C	30112	111	14		x			
	Temp C 16	R	Input	Temperature in C of Ch 16	N/A	-50 - 200, -999, 0x7FFF	°C	30113	112	15		x			
	Temp C 17	R	Input	Temperature in C of Ch 17	N/A	-50 - 200, -999, 0x7FFF	°C	30114	113	16		x			
	Temp C 18	R	Input	Temperature in C of Ch 18	N/A	-50 - 200, -999, 0x7FFF	°C	30115	114	17		x			

MODBUS Memory Map (cont.)

Category	Register Name	Read/ Write	Register Type	Description	Default	Range, Format	UOM	Register #	Modbus Offset #	EIP Offset *2	Interpretations	BSG3.18	BSG3.9	BSG3.9S	EIP Instances
Temperature in F	Temp F 1	R	Input	Temperature in F of Ch 1	N/A	-58 - 392, -999, 0x7FFF	°F	30116	115	0	0x7FFF - Channel invalid	x	x	x	TempF Instance 103
	Temp F 2	R	Input	Temperature in F of Ch 2	N/A	-58 - 392, -999, 0x7FFF	°F	30117	116	1		x	x	x	
	Temp F 3	R	Input	Temperature in F of Ch 3	N/A	-58 - 392, -999, 0x7FFF	°F	30118	117	2		x	x	x	
	Temp F 4	R	Input	Temperature in F of Ch 4	N/A	-58 - 392, -999, 0x7FFF	°F	30119	118	3		x	x	x	
	Temp F 5	R	Input	Temperature in F of Ch 5	N/A	-58 - 392, -999, 0x7FFF	°F	30120	119	4		x	x	x	
	Temp F 6	R	Input	Temperature in F of Ch 6	N/A	-58 - 392, -999, 0x7FFF	°F	30121	120	5		x	x	x	
	Temp F 7	R	Input	Temperature in F of Ch 7	N/A	-58 - 392, -999, 0x7FFF	°F	30122	121	6		x	x	x	
	Temp F 8	R	Input	Temperature in F of Ch 8	N/A	-58 - 392, -999, 0x7FFF	°F	30123	122	7		x	x	x	
	Temp F 9	R	Input	Temperature in F of Ch 9	N/A	-58 - 392, -999, 0x7FFF	°F	30124	123	8		x	x	x	
	Temp F 10	R	Input	Temperature in F of Ch 10	N/A	-58 - 392, -999, 0x7FFF	°F	30125	124	9		x			
	Temp F 11	R	Input	Temperature in F of Ch 11	N/A	-58 - 392, -999, 0x7FFF	°F	30126	125	10		x			
	Temp F 12	R	Input	Temperature in F of Ch 12	N/A	-58 - 392, -999, 0x7FFF	°F	30127	126	11		x			
	Temp F 13	R	Input	Temperature in F of Ch 13	N/A	-58 - 392, -999, 0x7FFF	°F	30128	127	12		x			
	Temp F 14	R	Input	Temperature in F of Ch 14	N/A	-58 - 392, -999, 0x7FFF	°F	30129	128	13		x			
	Temp F 15	R	Input	Temperature in F of Ch 15	N/A	-58 - 392, -999, 0x7FFF	°F	30130	129	14		x			
	Temp F 16	R	Input	Temperature in F of Ch 16	N/A	-58 - 392, -999, 0x7FFF	°F	30131	130	15		x			
	Temp F 17	R	Input	Temperature in F of Ch 17	N/A	-58 - 392, -999, 0x7FFF	°F	30132	131	16		x			
	Temp F 18	R	Input	Temperature in F of Ch 18	N/A	-58 - 392, -999, 0x7FFF	°F	30133	132	17		x			
Fiber Power	Fib Power 1	R	Input	Fiber Power of Ch 1	N/A	0 - 10, 0x7FFF	N/A	30134	133	N/A	0x7FFF - Channel invalid	x	x	x	
	Fib Power 2	R	Input	Fiber Power of Ch 2	N/A	0 - 10, 0x7FFF	N/A	30135	134	N/A		x	x	x	
	Fib Power 3	R	Input	Fiber Power of Ch 3	N/A	0 - 10, 0x7FFF	N/A	30136	135	N/A		x	x	x	
	Fib Power 4	R	Input	Fiber Power of Ch 4	N/A	0 - 10, 0x7FFF	N/A	30137	136	N/A		x	x	x	
	Fib Power 5	R	Input	Fiber Power of Ch 5	N/A	0 - 10, 0x7FFF	N/A	30138	137	N/A		x	x	x	
	Fib Power 6	R	Input	Fiber Power of Ch 6	N/A	0 - 10, 0x7FFF	N/A	30139	138	N/A		x	x	x	
	Fib Power 7	R	Input	Fiber Power of Ch 7	N/A	0 - 10, 0x7FFF	N/A	30140	139	N/A		x	x	x	
	Fib Power 8	R	Input	Fiber Power of Ch 8	N/A	0 - 10, 0x7FFF	N/A	30141	140	N/A		x	x	x	
	Fib Power 9	R	Input	Fiber Power of Ch 9	N/A	0 - 10, 0x7FFF	N/A	30142	141	N/A		x	x	x	
	Fib Power 10	R	Input	Fiber Power of Ch 10	N/A	0 - 10, 0x7FFF	N/A	30143	142	N/A		x			
	Fib Power 11	R	Input	Fiber Power of Ch 11	N/A	0 - 10, 0x7FFF	N/A	30144	143	N/A		x			
	Fib Power 12	R	Input	Fiber Power of Ch 12	N/A	0 - 10, 0x7FFF	N/A	30145	144	N/A		x			
	Fib Power 13	R	Input	Fiber Power of Ch 13	N/A	0 - 10, 0x7FFF	N/A	30146	145	N/A		x			
	Fib Power 14	R	Input	Fiber Power of Ch 14	N/A	0 - 10, 0x7FFF	N/A	30147	146	N/A		x			
	Fib Power 15	R	Input	Fiber Power of Ch 15	N/A	0 - 10, 0x7FFF	N/A	30148	147	N/A		x			
	Fib Power 16	R	Input	Fiber Power of Ch 16	N/A	0 - 10, 0x7FFF	N/A	30149	148	N/A		x			
	Fib Power 17	R	Input	Fiber Power of Ch 17	N/A	0 - 10, 0x7FFF	N/A	30150	149	N/A		x			
	Fib Power 18	R	Input	Fiber Power of Ch 18	N/A	0 - 10, 0x7FFF	N/A	30151	150	N/A		x			

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