H2scan®

Advanced Hydrogen Sensing

OPERATION MANUAL

BRO-1

Battery Room Relay Output Module

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IMPORTANT NOTICES

Read and understand this operating manual before installing or using the unit. If this equipment is used in a manner not specified by H2scan, the warranty may be void. If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

⚠ WARNING

If the product seems defective, DO NOT attempt to repair it. Immediately send the product back to H2scan for repairs.

LIMITATION OF LIABILITY - seller shall under no circumstances be liable for any incidental, consequential, special, punitive, or other damages, including, but not limited to, loss of business or profit, promotional or manufacturing expenses, injury to reputation, or loss of customer, based on any alleged negligence, breach of warranty, strict liability, breach of contract, or any other legal theory arising out of the use, misuse, purchase, sale or possession of its goods or its performance of this contract to the extent that such liability extends seller's obligations beyond the price paid by buyer to seller for the item on which such claim is based. Seller advises buyer to perform acceptable tests on all hardware prior to deployment and to perform maintenance as described in the seller's instruction guide. Under no circumstances shall the equipment provided hereunder be used in a manner where it is the sole protective system for facilities, equipment, and personnel safety; the equipment is intended for use in conjunction with other appropriate protective systems.

LIMITED WARRANTY

H2scan Limited Warranty: Each BRO-1 Battery Room Relay Output Module ("Product") will conform, as to all substantial operational features, to the Product specifications set forth in this Manual and will be free of defects which substantially affect such Product's performance for 36 months from the ship date for such Product.

Must Provide Notice of Defect: If you have a Product that you believe is defective, you must notify H2scan in writing, within the warranty period of your claim regarding any such defect.

Return Product to H2scan for Repair, Replacement or Credit: The customer is responsible for shipping and handling costs. If the Product is found defective by H2scan, H2scan's sole obligation under this warranty is to either (i) repair the Product, (ii) replace the Product, or (iii) issue a credit for the purchase price for such Product, the remedy to be determined by H2scan on a case-by-case basis. A valid RMA number must be assigned by H2scan and clearly marked on the package when the unit is returned.

Voided Warranty: H2scan's three-year Limited Warranty is void for any of the following:

- Unauthorized repair work performed at the customer's location or conducted by anyone other than H2scan's factory trained technicians.
- Equipment or parts that have been tampered with, misused, neglected, mishandled, improperly adjusted, or modified in any way without the written consent of H2scan.
- Equipment or parts that have been damaged due to shipping, misuse, accidents, mishandling, neglect, or problems with electrical power sources.
- Repair work performed during the warranty period does not prolong the warranty period past the original period.
- System operation in incorrect or inappropriate environments.
- Usage that is not in accordance with system guidelines or an operator's failure to follow manual instructions.

Limitation of Warranty: THE ABOVE IS A LIMITED WARRANTY AS IT IS THE ONLY WARRANTY MADE BY H2SCAN. H2SCAN MAKES NO OTHER WARRANTY EXPRESS OR IMPLIED AND EXPRESSLY EXCLUDES ALL WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. YOUR SOLE REMEDY HEREUNDER IS REPAIR OR REPLACEMENT OF THE PRODUCT OR A CREDIT FOR THE PURCHASE PRICE FOR SUCH PRODUCT, THE PARTICULAR REMEDY TO BE DETERMINED BY H2SCAN ON A CASE-BY-CASE BASIS. H2SCAN SHALL HAVE NO LIABILITY WITH RESPECT TO ITS OBLIGATIONS UNDER THIS AGREEMENT FOR CONSEQUENTIAL, EXEMPLARY, OR INCIDENTAL DAMAGES, EVEN IF IT HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. THE STATED EXPRESS WARRANTY IS IN LIEU OF ALL LIABILITIES OR OBLIGATIONS OF H2SCAN FOR DAMAGES ARISING OUT OF OR IN CONNECTION WITH THE DELIVERY, USE OR PERFORMANCE OF THE PRODUCTS.

Symbol	Meaning
	Safety instructions that must always be followed: The respective data must be noted and/or the safety-related instructions contained in the operating instructions must be followed for devices with this symbol!

1. INTRODUCTION

The BRO-1 Battery Room Relay Output Module provides reliable alarm conditions to support up to four HY-ALERTA® hydrogen area monitors through Modbus. Its compact design, robust electronics, and supplied fittings enable easy, secure installation in rugged battery room applications.

Nominal 9–48 VDC powers the BRO-1 and passes through to the HY-ALERTA hydrogen area monitors.

Each of the three isolated-contact SPDT relays — 1% hydrogen setpoint/alarm, 2% hydrogen setpoint/alarm, fail indicator alarm — provide three outputs to the customer.

In the presence of hydrogen more than 2%, 1% and 2% relays continue operating while 1% and 2% LEDs of the related sensor illuminate. When the hydrogen level reduces below 2%, the 2% contact closure(s) opens, clearing the alarm condition for 2% hydrogen and turning off the 2% LED. This process repeats with the 1% relay and 1% LED when the hydrogen level reduces below 1%.

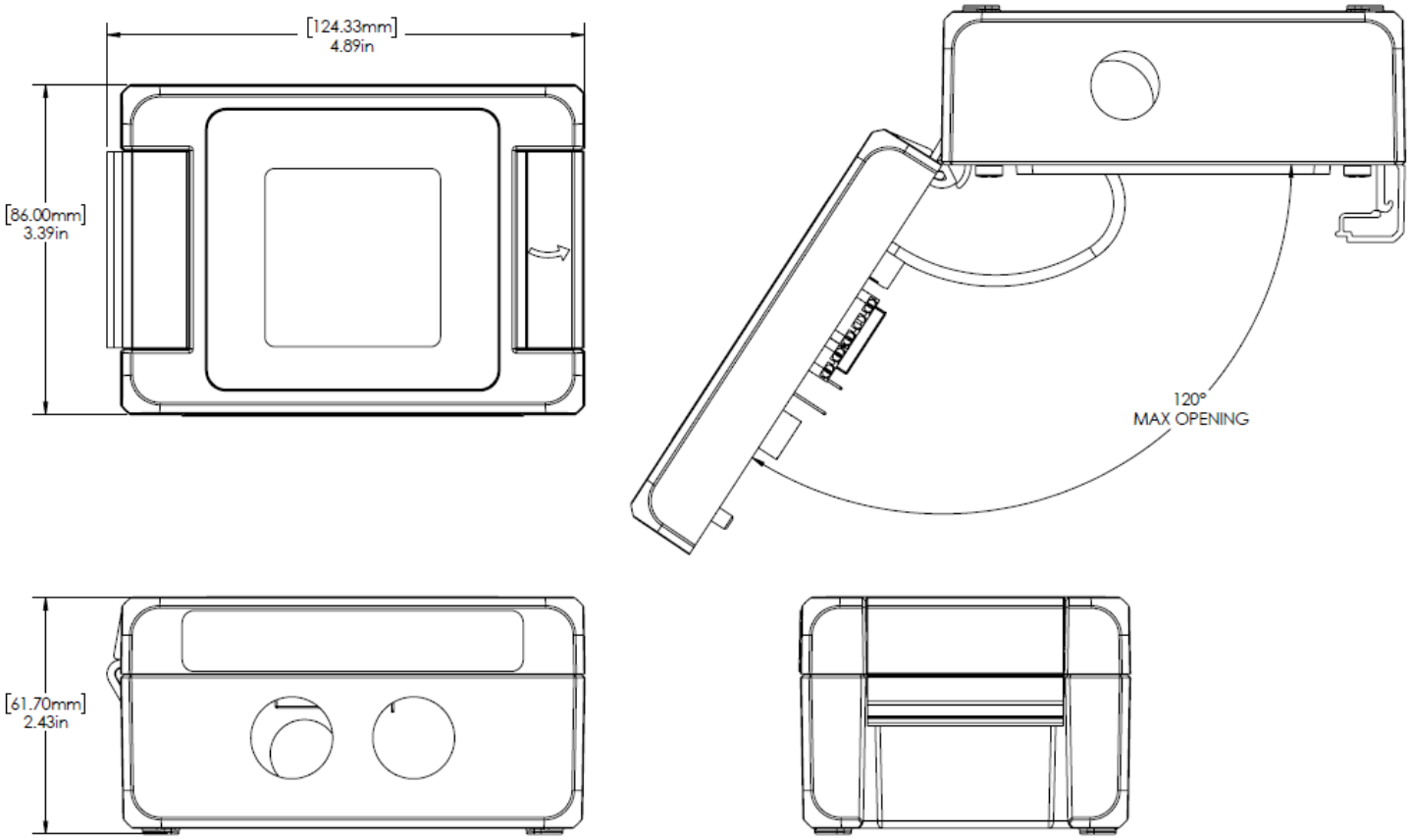

Figure 1: BRO-1 Dimensions

2. PRE-INSTALLATION REQUIREMENTS

2.1 BOX CONTENTS

Every BRO-1 is shipped with the following:

- Two 1/2 NPT cable glands
- Two 1/2 NPT conduit fitting nuts
- Two square-profile o-rings
- One 3/8 NPT cable gland
- Three cable ties

- One steel Torx bit
- One nine-position terminal block plug
- One two-position terminal block plug
- One Quick-Start Guide

2.2 INSTALLATION TOOLS

For mounting the BRO-1 to panels, the following tools are required:

- Electric drill with bit extender – to drill pilot holes and hold the driver bit
- 3 mm (1/8") hardened drill bit – to make pilot holes
- #2 Phillips head drive bit – to drive the mounting screws with drill
- #2 Phillips head screwdriver – to secure cable shield grounding
- Adjustable wrench – to tighten the cable gland fittings
- Wire cutters – to trim wires and cable ties
- Wire strippers – to properly strip wires without damage to the conductors
- Marker or pencil – to mark holes to drill and wiring stripping

2.3 CABLES

The BRO-1 requires three cables.

2.3.1 Modbus Cable

A cable meeting the following specifications is required for connecting the BRO-1 to Modbus (RS-485) data lines to communicate with up to four HY-ALERTA monitors.

- Single four-pin, multi-conductor M12 cable for connection to a single monitor
- No braiding
- No shielding
- Data+, Data-, DC+, DC-
- Connector and cable rating IP66 or better to match the monitor installation conditions
- Individual wire leads on the other end of the cable for connection to the BRO-1

For operations that require shielding, a five-conductor M12 cable can be used.

If more than one area monitor is a requirement, a T-adaptor, extension box, or DIN rail is recommended to establish power and communication with all monitors. The end user is responsible for properly establishing the RS-485 interface for multiple monitors.

NOTE: Please consult with H2scan if you intend to use a different Modbus cable than supplied by H2scan. M12 pinout and configuration should match HY-ALERTA sensor end to avoid damage to the device.

2.3.2 DC Power Cable

A DC+ and DC- power cable meeting the following specifications is required to provide power to the BRO-1 and all connected HY-ALERTA area monitors.

- Two-conductor
- Wire size up to 4 mm (12 AWG)
- 9–48 V, 13 W

2.3.3 Relay Output Cable

The BRO-1 has three relays, each of which provides three outputs — NC (Normally Closed), C (Common), NO (Normally Open).

Relay output cable(s) for the nine outputs must meet the following specifications:

- Nine-conductor
- Black
- Rated to 200 VAC
- Wire size up to 4 mm (12 AWG)

3. INSTALLATION

3.1 ENCLOSURE ACCESS

3.1.1 Opening the Lid

1. Using a flat-edge tool, i.e., a flat-head screwdriver, pop open the hinge lid on the right side of the BRO-1 enclosure.
2. Using the supplied T20 Torx bit and an appropriate driver, loosen the screws until they unlock the lid from the base and it easily swings open to the left.

3.1.2 Closing the Lid

1. Close the door and tighten the screws to torque of approximately 1.13 N*m (10 in*lbf).

⚠ WARNING

Failure to tighten the screws can compromise the sealing of the BRO-1 and may compromise the IP rating of the system.

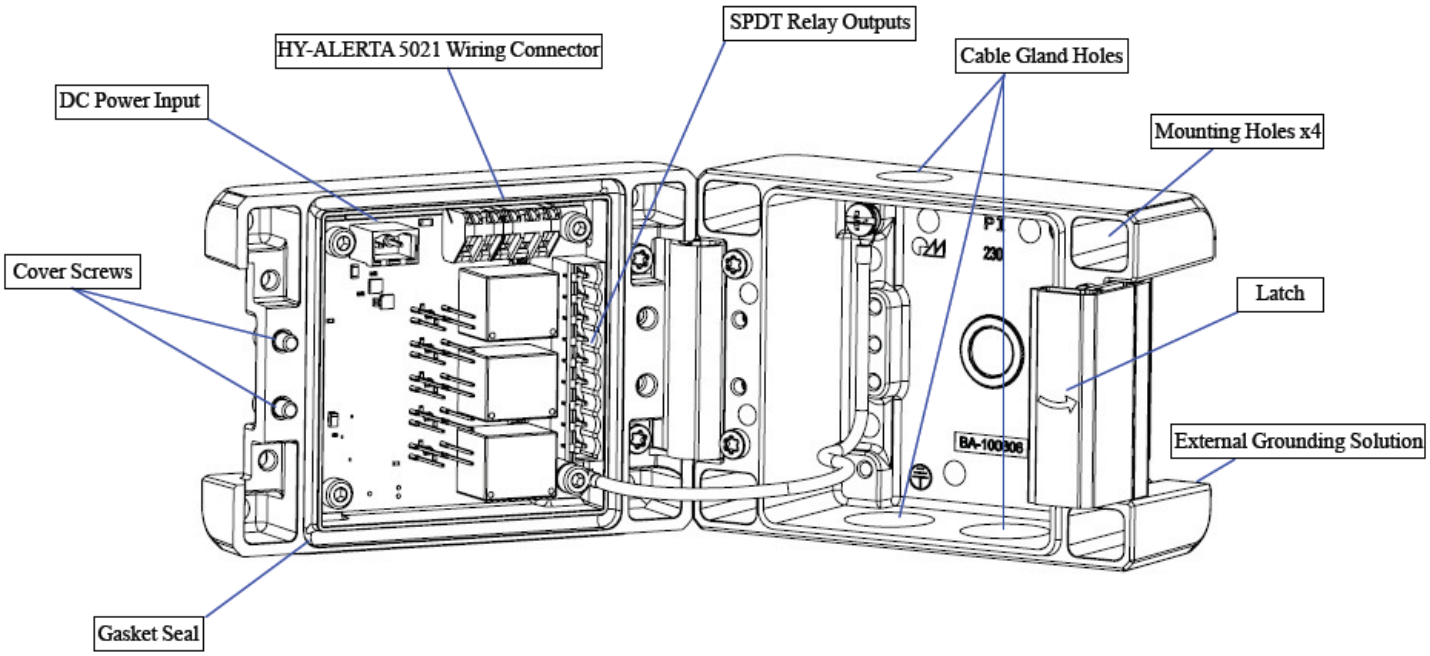

Figure 2: Enclosure

3.2 MOUNTING

1. Prior to mounting the BRO-1, drill pilot holes into the #10 stainless steel machine screws with a 3 mm (1/8") drill bit.
2. Match the mounting holes with the 1:1 template.
3. Install the unit with the screws to approximately 6.3 N*m (56 in*lbf).
4. Mount the BRO-1 within ±10° of level.

The BRO-1 can be mounted using DIN rail, Unistrut, or wedge anchors into concrete or masonry.

The end user is responsible for properly grounding the BRO-1.

3.3 EXTERNAL GROUNDING

The enclosure has four mounting holes as shown in Figure 2 that can be accessed to secure a metal-to-metal contact ground.

Use an appropriate grounding lug in conjunction with the mounting screws to secure an external ground connection.

3.4 CABLE FITTINGS

The BRO-1 Relay Output Module is supplied with three IP68 rated cable gland fittings that accommodate 5–12 mm (0.20–0.47") outside-diameter jacketed cables.

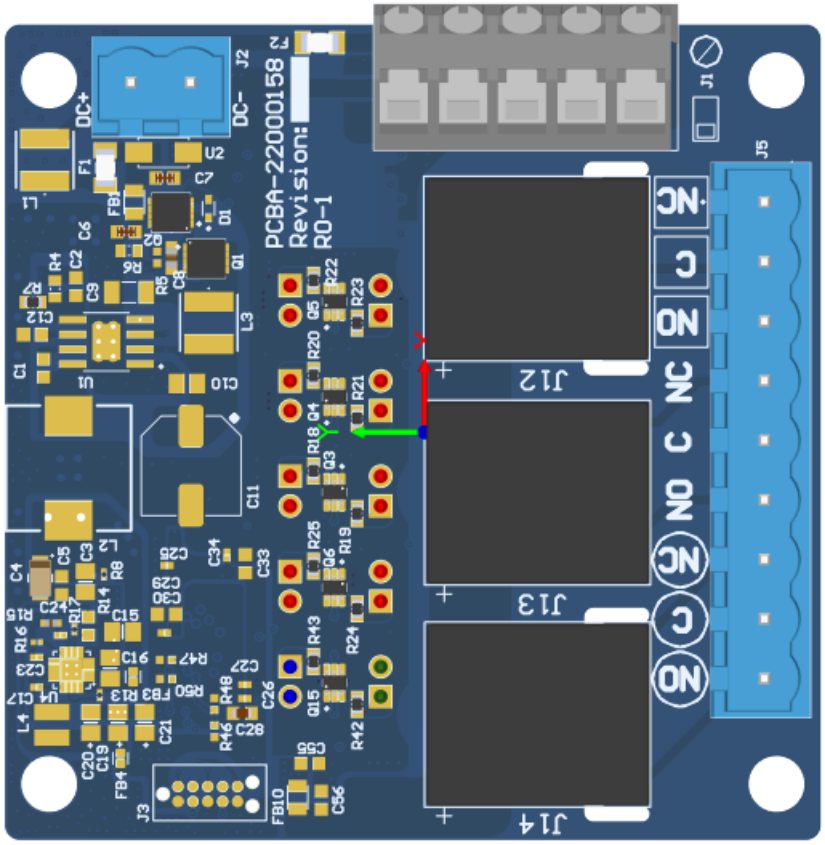

Figure 3: Realistic View of BRO-1 PCBA

CAUTION

If using conduit to route cables to and from the BRO-1, the cable gland fittings and port plugs can be replaced by standard ½" conduit gland fittings without modification to the enclosure. As the IP rating of the BRO-1 is dependent upon the rating and construction of the conduit gland fittings, only use IP66 or better rated conduit gland fittings. Use of lower-rated fittings can damage the BRO-1 and void the warranty.

Do not install more than one cable per cable gland fitting. Installing more than one cable per gland fitting will compromise the IP rating of the fitting and BRO-1 module.

If the cable gland fittings are replaced with conduit gland fittings, the IP rating is considered to be IP66 or less regardless of conduit gland rating.

If conduit gland fittings are used, mounting the BRO-1 where it will be submerged voids the warranty.

Modification of the BRO-1 enclosure to increase the size of the gland fitting ports is not recommended. It can compromise the IP rating of the system and can void the warranty.

3.5 WIRING CONNECTIONS

All electrical connections to the BRO-1 are supplied through three multi-conductor cables.

- DC power
- Relay output
- Modbus cable

Wiring locations for BRO-1 are provided in the Quick-Start Guide.

The mating connector that plugs into the PCBA includes openings where stripped wires are inserted and screws that, when tightened, secure the wires into the connector slots. The HY-ALERTA 5021 hydrogen area monitor wiring connector has five wiring slots and DC power has two wiring slots.

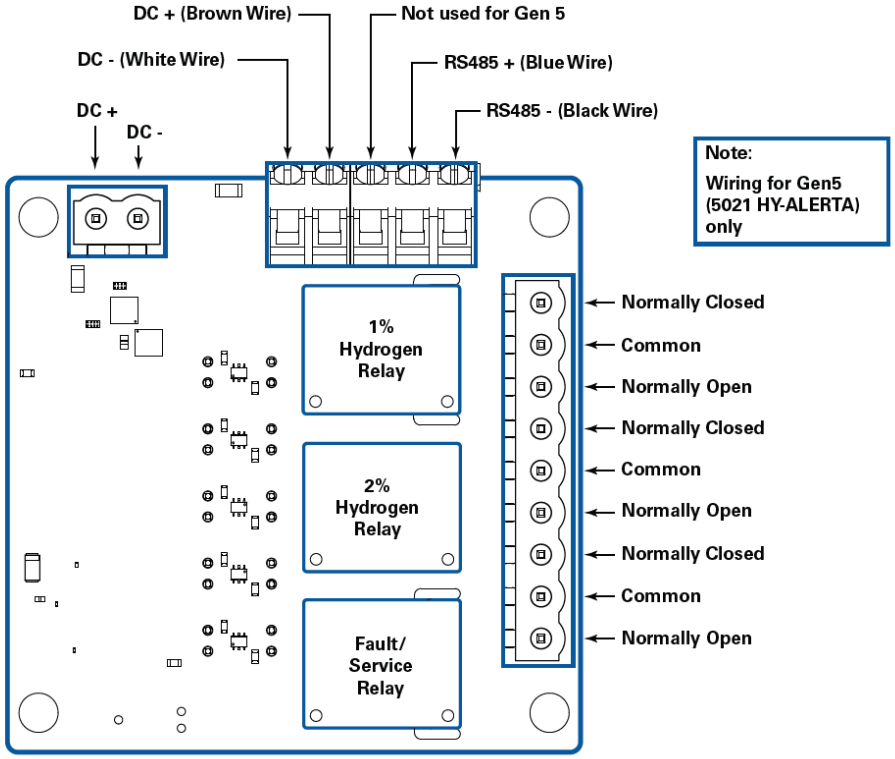

Figure 4: Pinout Configuration for BRO-1 PCBA

3.5.1 Relay Output Connection

The end user wiring connector (relay outputs) has nine wiring slots. The mating connector for the relay outputs terminal block is provided in the BRO-1 Accessories Kit. Wire should directly enter this mating connector and then plug into the PCBA.

Wires between 1 mm (18 AWG) and 4 mm (12 AWG) can be used. Smaller or larger wires are not recommended or supported. End user should pay attention to power switching requirements of the relays and the application to use proper AWG for relay output wirings.

NOTE: Bare stripped wire should be used. Tinning is not recommended.

3.5.2 HY-ALERTA Hydrogen Monitor Wiring Connections

The connector for HY-ALERTA is a five-position terminal block mounted on the PCBA. Wires should directly enter this connector without the need for a mating part.

Wires between 1 mm (18 AWG) and 4 mm (12 AWG) can be used. Smaller or larger wires are not recommended or supported.

The standard H2scan multi-conductor cable has four 1 mm (18 AWG) conductors and a foil shield with a drain wire.

1. After connecting the cable to the HY-ALERTA monitor, route the cable to the BRO-1.
2. Secure cable as necessary.
3. Trim the cable to length so that there will be approximately 160 mm (6.5") inside the BRO-1 module when assembled
4. Strip the cable outer jacket to 152 mm (6").

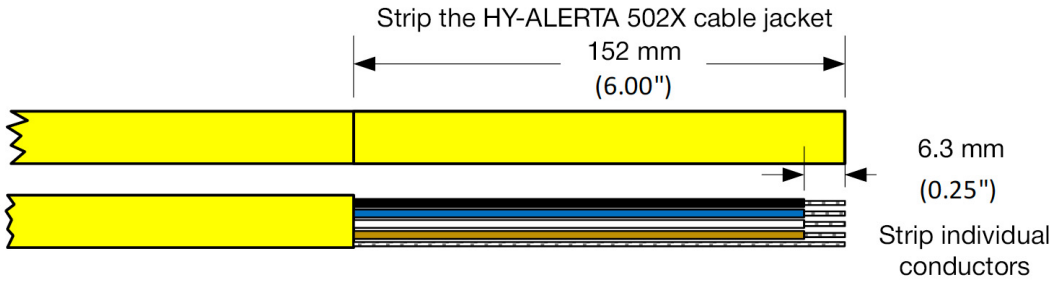

Figure 5: HY-ALERTA 502X Cable Stripping

5. Strip the ends of the conductors 6 mm (¼") from the end. Do not tin or solder the bare metal conductors.
6. After all wires are stripped, insert the monitor cable through the right gland fitting on the BRO- 1 enclosure closest to the hinge so that 10 mm (½") of the cable jacket is visible inside the enclosure above the gland fitting.
7. Securely tighten the gland fitting to the cable using an adjustable wrench. 0.28 N*m (2.5 in*lbf)
8. Insert each wire into the slotted opening on the five-pin black terminal block on the PCBA in accordance with the Quick-Start Guide and as illustrated in Figure 6. Insert only the bare wire and not the insulated portion of the conductor.
9. Secure the wire by tightening the corresponding screw using the provided flat blade screwdriver to 0.5 N*m (4.42 in*lbf). Do not over tighten or strip the screws.
10. After tightening, gently pull on the wire to ensure a secure connection.
11. Repeat until all wiring connections have been made.

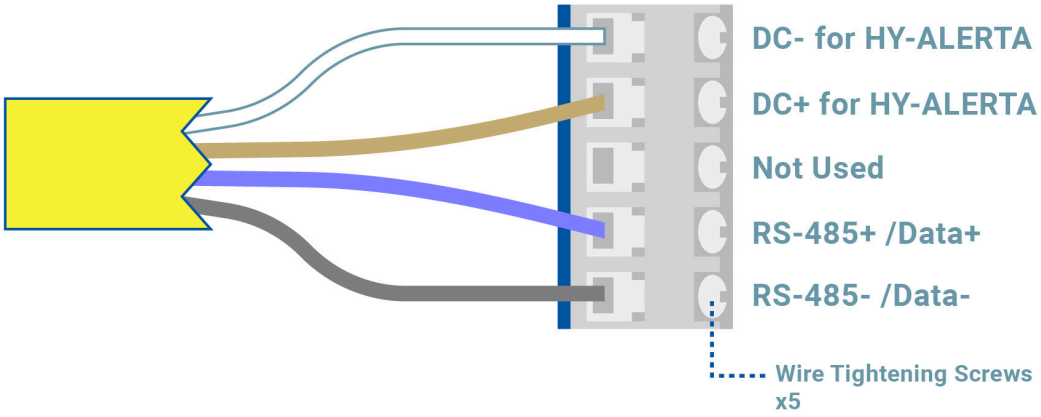

Figure 6: HY-ALERTA Wiring Connections

NOTE: Confirm color coding if not using a cable supplied by H2scan.

12. Trim the drain wire for the cable shield to length and secure to one of the multiple locations inside the enclosure using a provided grounding screw to 1.13 n*m (10 in*lbf).
13. After all wires are securely connected, plug the mating connector into the PCBA and secure with the two connector locking screws to 0.4 N*m (3.54 in*lbf). Do not over-tighten.

3.5.3 End User Wiring Connections

1. After all wires are stripped, insert the cable through the left gland fitting on the BRO-1 enclosure so 10 mm (½") of the cable jacket is visible inside the enclosure above the gland fitting.
2. Securely tighten the gland fitting to the cable using an adjustable wrench.
3. Insert each wire into the slotted opening on the mating connector in accordance with the label on the connector and as illustrated in Figure 6.
4. Insert only the bare wire, NOT the insulated portion of the conductor.
5. Secure the wire by tightening the corresponding screw using the provided flat-blade screwdriver.
6. Do not over-tighten or strip the screws.
7. After tightening, gently pull on the wire to ensure a secure connection.
8. Repeat until all wiring connections have been made.
9. After all wires are securely connected, plug the mating connector in the PCBA and secure with the two connector locking screws. Do not over-tighten.

3.5.4 Wire Dressing

Use the supplied cable ties to manage any loose wires in the BRO-1 enclosure assembly.

3.6 DAISY-CHAINED HY-ALERTA 5021 AREA HYDROGEN MONITORS

BRO-1 can handle data processing of up to four HY-ALERTA 5021 hydrogen area monitors. Refer to 4. Operation for alarm conditions and functional modes. In case more than one HY-ALERTA 5021 unit is connected to BRO-1, sensors will share Service LED and three SPDT relays while 1% and 2% H2 LEDs remain specific to each sensor module.

As inserting more than one cable per cable gland will violate the BRO-1 enclosure's IP68 rating, use of tee-adaptors to establish a Modbus/RS-485 daisy-chain is recommended.

Contact H2scan for further information regarding multiple sensors with BRO-1.

4. OPERATION

4.1 STARTUP

After connecting the cables and applying power from the supply, the BRO-1 delivers power to the HY-ALERTA 5021. Both the BRO-1 and monitor will execute startup sequences. The BRO-1 boots within 30 seconds while the HY-ALERTA monitor can take 30 minutes to 16 hours to provide accurate data.

Upon startup, the BRO-1 initiates its firmware and attempts to establish communications with the hydrogen monitor.

4.1.1 Connecting a Single Monitor

1. Plug the cable into the HY-ALERTA monitor.
2. Power on the BRO-1.
3. Wait for initialization sequence to complete. The Monitor 1 red LEDs will flash five times. When the monitor successfully communicates with the BRO-1, the green power LEDs will be steady green.
4. Immediately power cycle the BRO-1 after initialization to prevent monitors from producing erroneous H_2 readings. Failure to power cycle promptly may necessitate plugging in the monitor overnight to restore proper functionality.

4.1.2 Connecting Multiple Monitors

Attach each monitor one at a time so each receives the correct Modbus Address. The BRO-1 will give any monitor with Modbus ID 1 a new Modbus address so any monitor with default settings from the factory can be connected. If four monitors are connected, they will receive Modbus Addresses 2–5.

1. Power on the BRO-1 with no monitor connected.
2. Connect the first monitor.
3. Wait for initialization sequence to complete. The Monitor 1 red LEDs will flash five times. When the monitor successfully communicates with the BRO-1, the green power LEDs will be solid green.
4. Connect Monitor 2 after Monitor 1's initialization sequence is finished. Connect Monitors 3 and 4 in the same way, one at a time after the initialization sequence of each monitor is finished.
5. Wait for the final initialization sequence to complete.
6. Immediately power cycle the BRO-1 after initialization to prevent monitors from producing erroneous H_2 readings. Failure to power cycle promptly may necessitate plugging the monitor in overnight to restore proper functionality.

NOTE: Replacing a monitor without power cycling results in a change in the new monitor's Modbus ID to 6. The BRO-1 can communicate only with Modbus addresses 2–5.

4.2 COMMUNICATION CONSTRAINTS

The BRO-1 can only communicate to monitors with default settings (e.g., baud rate 19200, no parity, 1 stop bit).

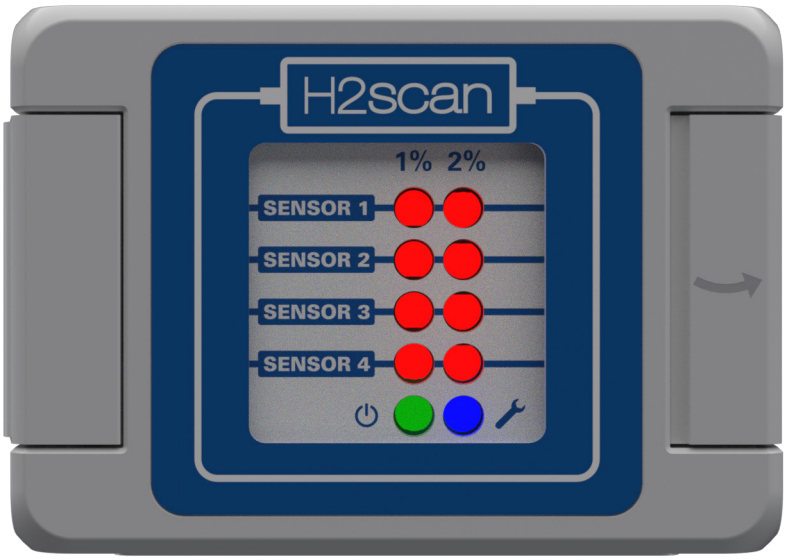

Figure 7: BRO-1 LEDs

Table 1: BRO-1 Front Panel LED Indications

LEDs and Indicators	LED Color	Meaning
Power	Green	BRO-1 unit is powered on. Flashing when powered on and no monitors connected. Steady when powered on and communication is established with at least one monitor.
Service	Blue	See Table 2 for fault conditions and operation modes of this LED.
1%	Red	Monitor detects H_2 with a concentration of 1%.
2%	Red	Monitor detects H_2 with a concentration of 2% or more.

4.3 SERVICE CONDITIONS

The following conditions will cause the BRO-1 to display a service condition and activate the Blue LED.

Table 2: BRO-1 Fault Conditions, Reasoning, and Remedies

LED Indication	Cause	Remedy
Service LED (blue) is illuminated and two red LEDs associated with that monitor module (1% and 2%) are flashing.	The BRO-1 loses communication to any of the four HY-ALERTA hydrogen area monitors.	The system will automatically retry to establish communications. If this becomes problematic, check RS-485 (Modbus) and grounding cables.
Power LED (green) is not illuminating.	DC power is not being delivered to BRO-1.	Check the power supply, power supply cable, and cable connection to J2 (terminal block for power). Confirm the polarity of the DC input is correct according to the Quick-Start Guide.

For service conditions for the HY-ALERTA hydrogen area monitor system, refer to the Operation Manual (p/n 9000177).

For further questions and help, contact: technicalsupport@h2scan.com.

NOTE: LEDs for 1% and 2% immediately turn off once hydrogen is reported below threshold levels while relays remain open for 30 minutes after the unit no longer reaches the threshold (hysteresis).

APPENDIX A: SPECIFICATIONS

Table A.1: Relay Output Specifications

Relay Specifications	
Contact Arrangement	1C = SPDT
Contact Material	AgSnO2
Contact Resistance	< 50 milliohms initial
Maximum Switching Power	2500 VA, 420 W
Maximum Switching Voltage	380 VAC, 110 VDC
Maximum Switching Current	20 A
Coil Operate Time	7 ms
Coil Release Time	4 ms
Insulation Resistance	100 M Ω min. @ 500 VDC initial
Operating Temperature	-55—+125 °C
Coil Voltage	5 VDC
Coil Power	0.36 W

Table A.2: BRO-1 Operating Conditions

Parameter	Value			
	Minimum	Nominal	Maximum	Units
Environment – Ambient				
Operating Temperature	-20	25	70	°C
Storage Temperature	-20		85	°C
Ingress Protection	IP68 (IEC 60529) with provided cable gland fittings			
Humidity	0 to 100% RH, condensing			
Altitude	Up to 2000 m (6560')			
Electrical				
Voltage Input, Absolute Maximum	12	-	30	VDC
Power Consumption	1		13**	W

** Daisy chained with four HY-ALERTA 5021 hydrogen area monitors @ STP