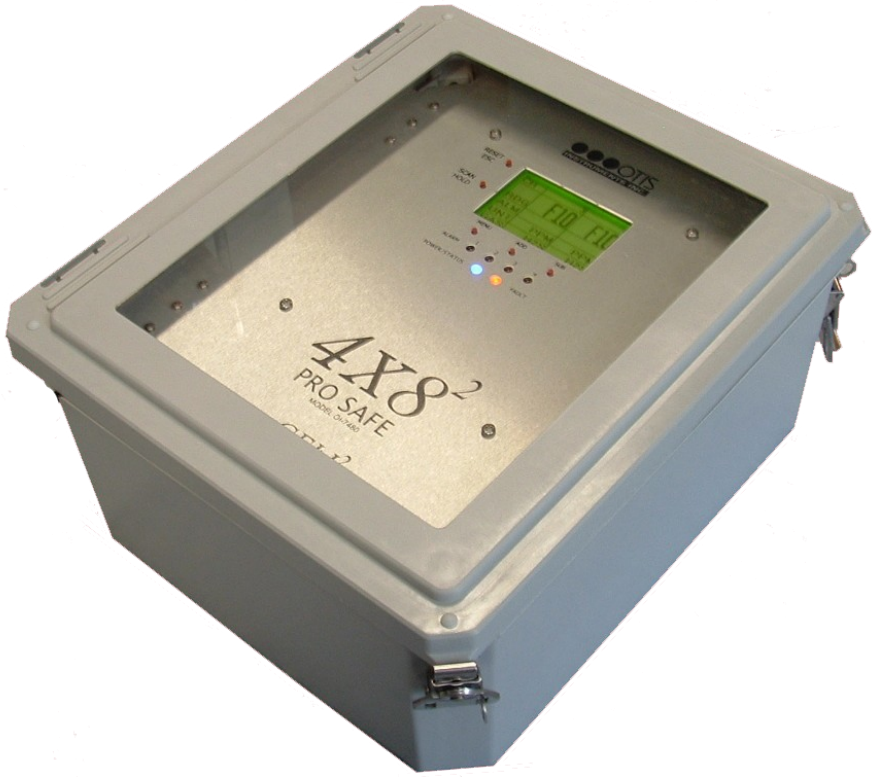
GEN²

Model OI-7480

4x8² *ProSafe*

Operation Manual

Revision 2.2.1w



OTIS
INSTRUMENTS INC.

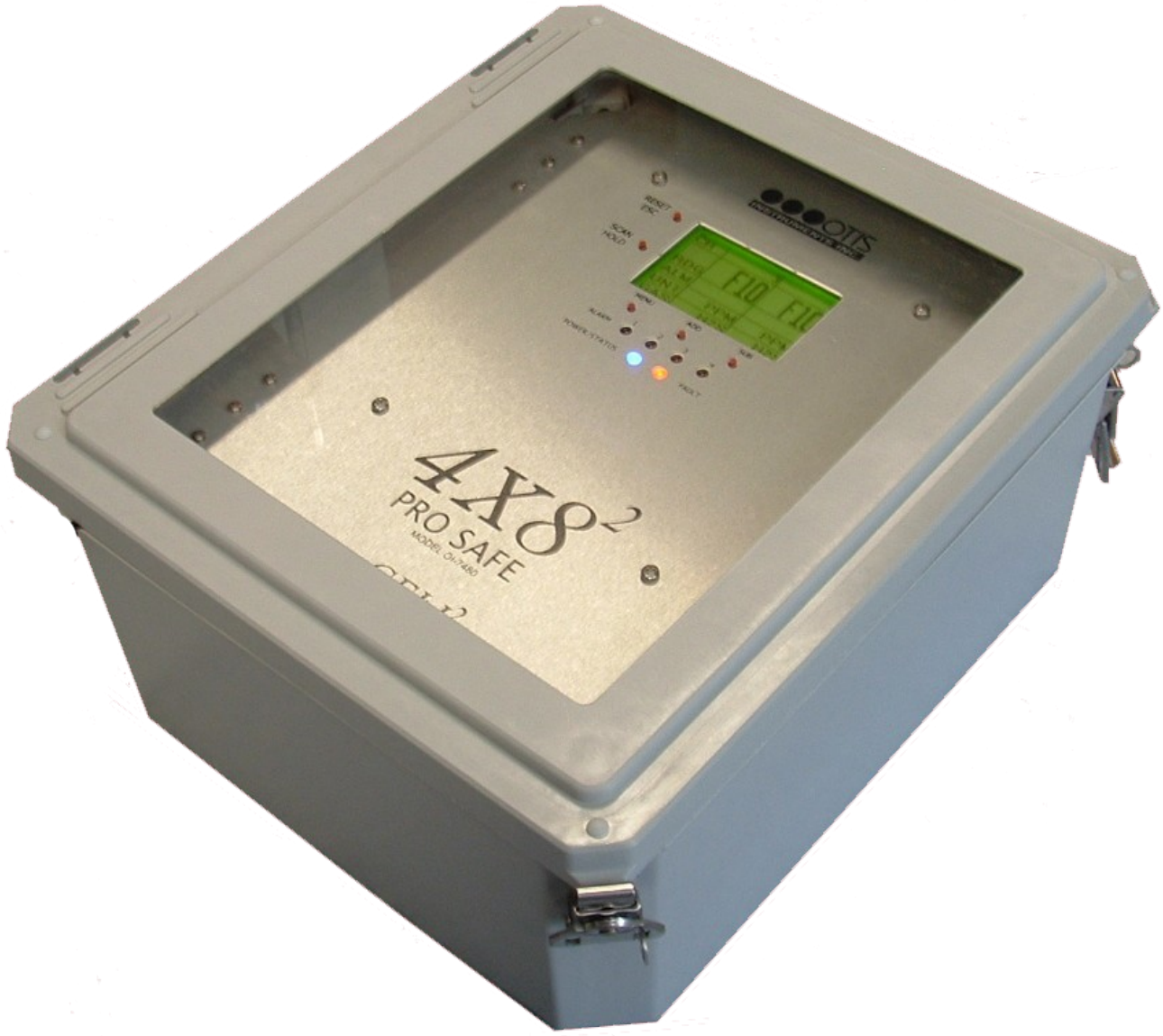
Product Overview

The Otis Instruments, Inc. GenII *ProSafe* 4x8^2 Model OI-7480 is a eight (or twelve) channel gas monitor that functions as a transmission controller. The OI-7480 monitors toxic, combustible and oxygen gas levels in ambient air by receiving and displaying 4-20mA signals from up to eight (or twelve) wired sensor assemblies.

The OI-7480 features a 160x104 graphical LCD display and is equipped with four “dry contact” (Form C) 5 Amp alarm relays (with 4 Amp fuses) that are full-scale adjustable.

The OI-7480 operates with either 12-35 Volts DC or 110/240 Volts AC power-in and includes a Modbus output with optional real-time monitoring software.

The ability to display data and activate alarms in relation to readings sent from on-site sensors make the OI-7480 a truly phenomenal product in the safety realm of the gas industry.



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Introduction

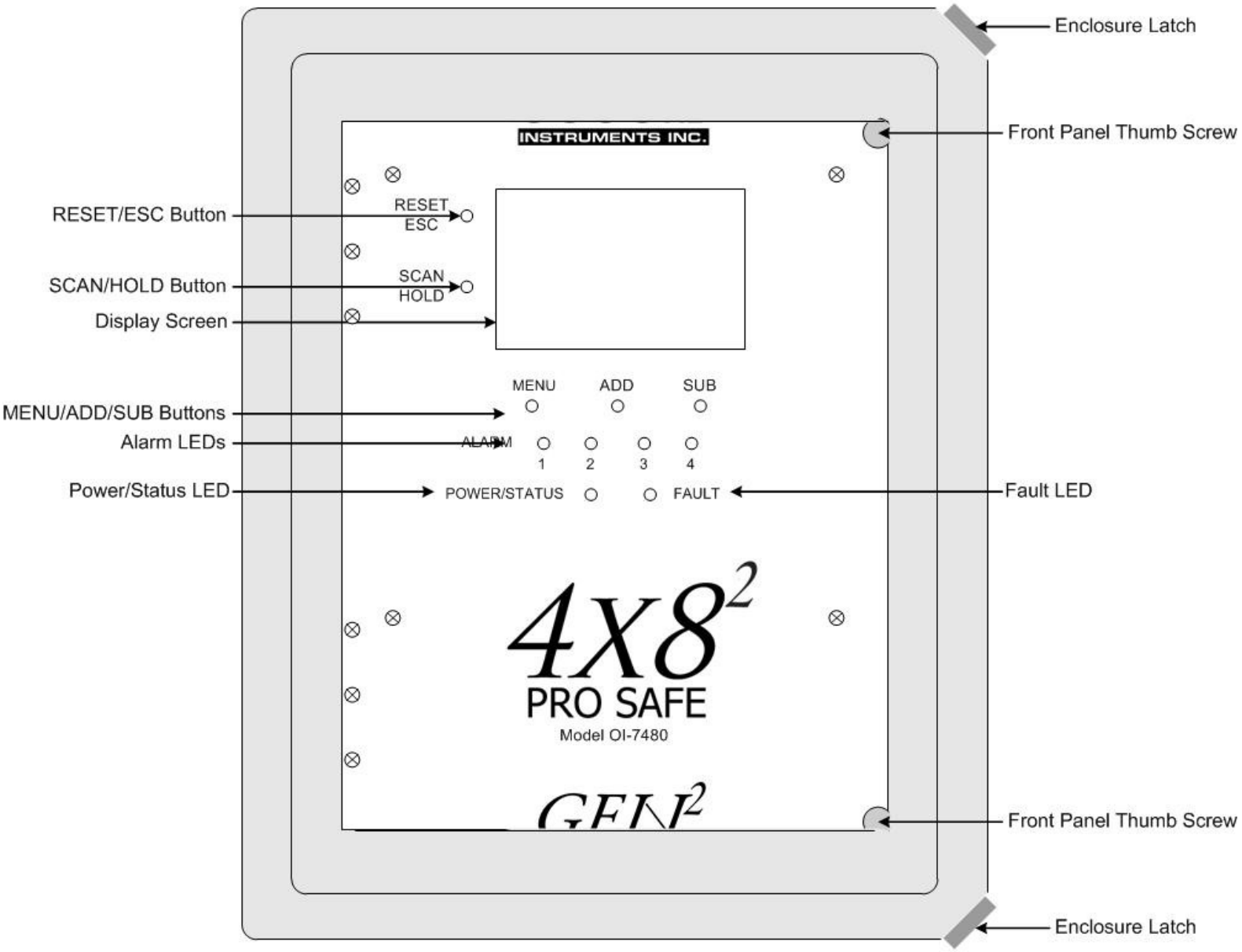
This document is an Operation Manual containing diagrams and step-by-step instruction for proper operation of the Otis Instruments, Inc. GenII *ProSafe* 4x8^2 OI-7480. This document should be read before initial operation of the product.

Should a question arise during the use of the product, this document will serve as a first reference for consultation. If further questions arise, or if the device is not working properly, please contact the sales representative of this product.

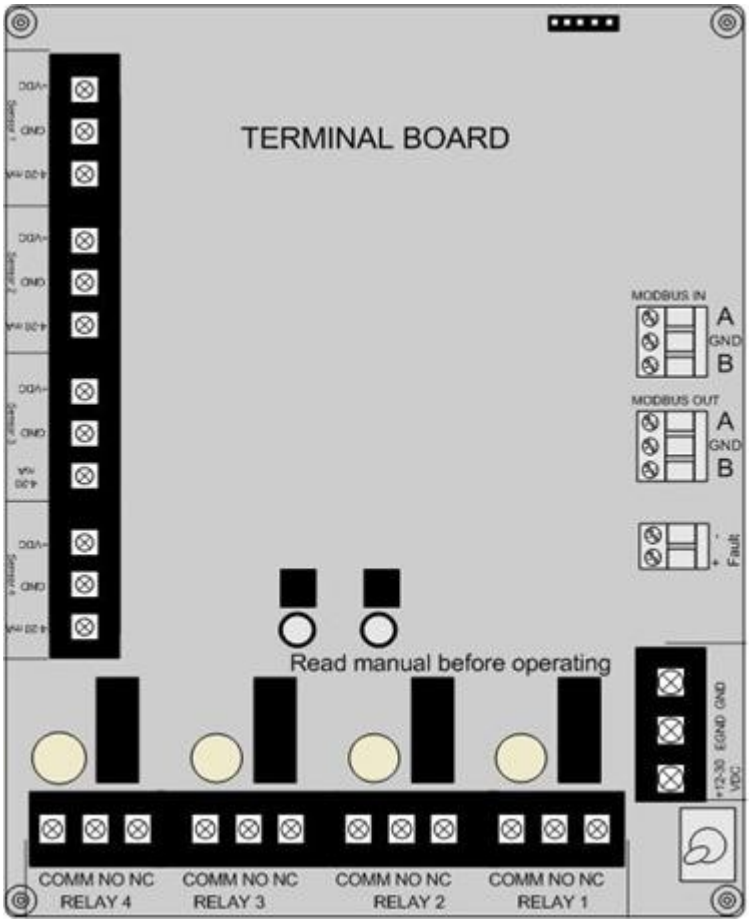
Complete System Diagrams

The following diagrams should be consulted for identification of Panels, Boards, and any other system part that may be referred to in this Operation Manual.

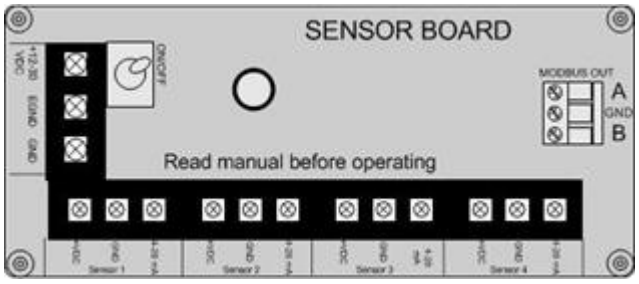
Front Panel



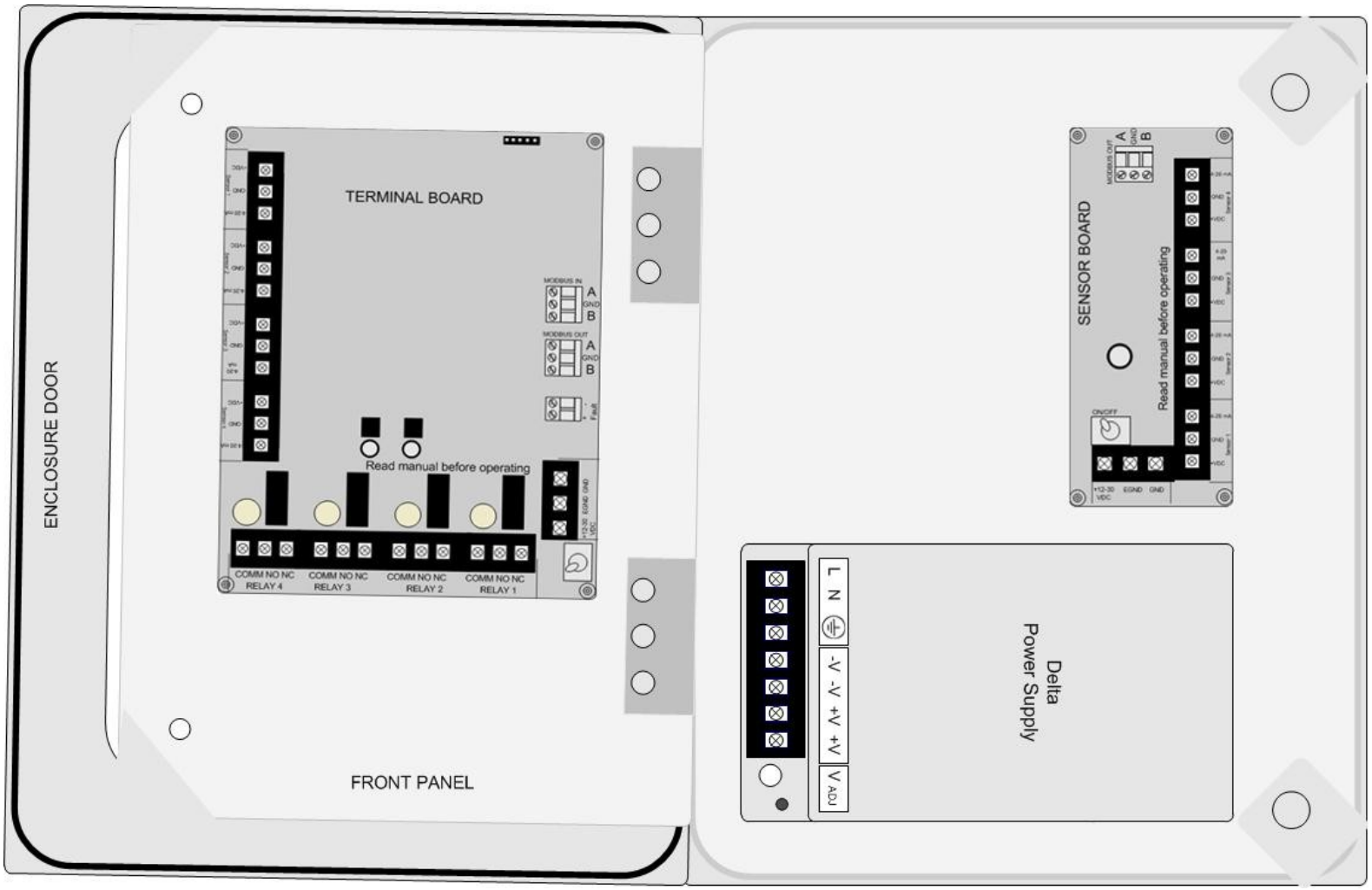
Terminal Board



Sensor Board(s)



Internal Diagram



Wiring Configurations

The following Wiring Configurations must be completed before initial operation of the product.

CAUTION: THE INTERNAL COMPONENTS CAN BE STATIC SENSITIVE. USE CAUTION WHEN OPENING THE ENCLOSURE AND HANDLING INTERNAL COMPONENTS.

DC Power-in (12-35 Volts DC)

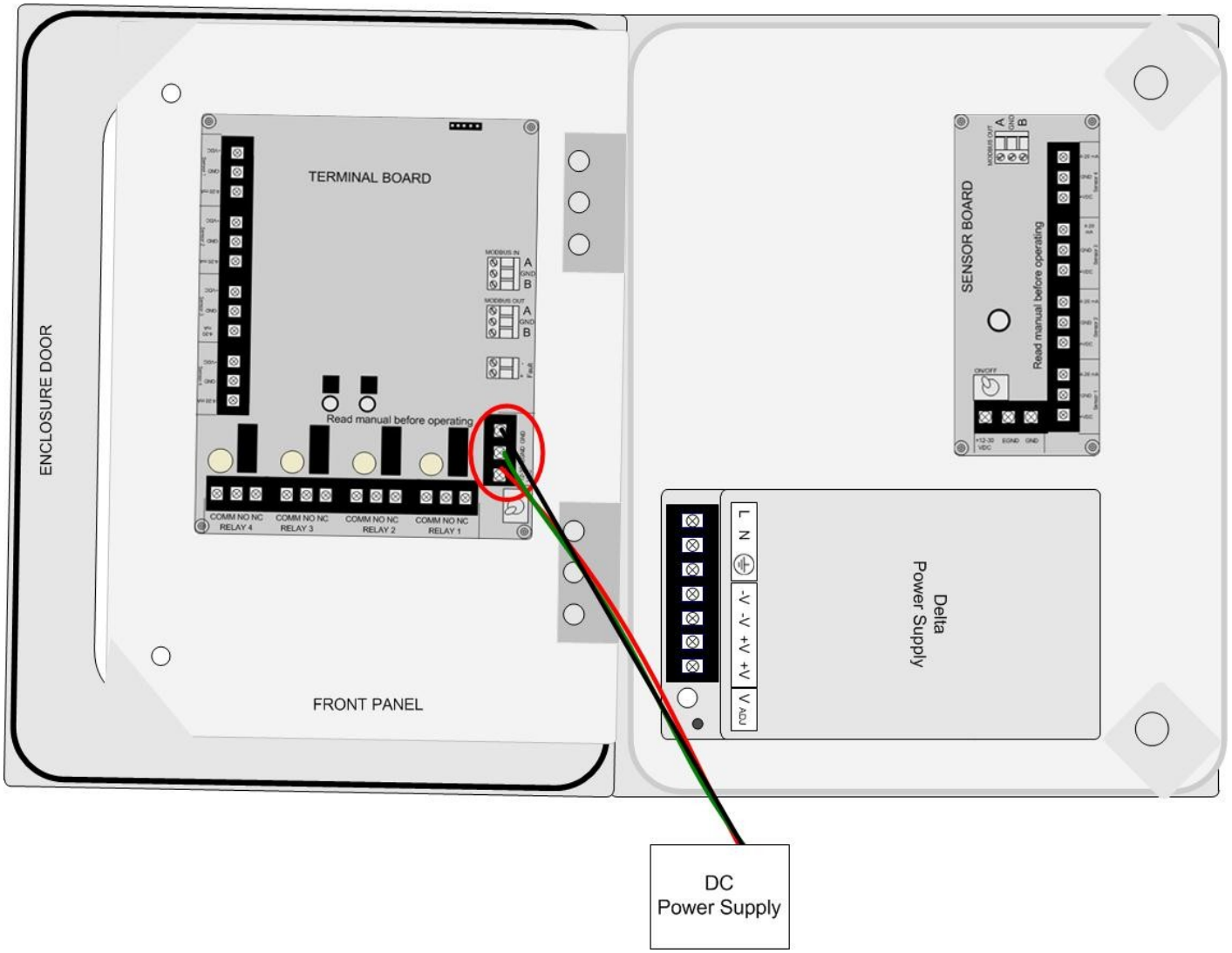
NOTE: The unit will be wired for the power-type that is requested by the purchaser when shipped from Otis Instruments, Inc.

- Provide a clean and stable 12-35 Volts DC voltage. Failure to to do so may cause the unit (and any wired sensors that are connected to the unit) to not operate properly.
- Voltage spikes higher than 35 Volts may damage the unit.
- Solar Panel power (with battery backup): This options may be used to power the unit, however, care must be taken to ensure the proper voltage and wattage is used.

NOTE: The size that the solar panel should be (10, 30, 50, or 100 watts, for example) depends on several factors, including: geographical area, line-of-sight access to the sun, number of wired sensors connected, and weather conditions.

Please consult a solar panel manufacture for specific details. Otis Instruments may also be contacted to provide guidance and recommendations.

1. Open the enclosure box to expose the Front Panel.
2. Unscrew the two thumb screws on the Front Panel.
3. Open the Front Panel so that the Terminal Board is exposed (reverse of Front Panel).
4. Locate the Power Terminal (on the lower right side of the Back Panel) and connect the DC-live wire (red) to the terminal marked “+12-35 VDC”.
5. Connect the DC-ground wire (black) to the terminal marked “GND”.
6. If desired, connect an Earth Ground wire (green) to the terminal marked “EGND” (required for surge suppression).



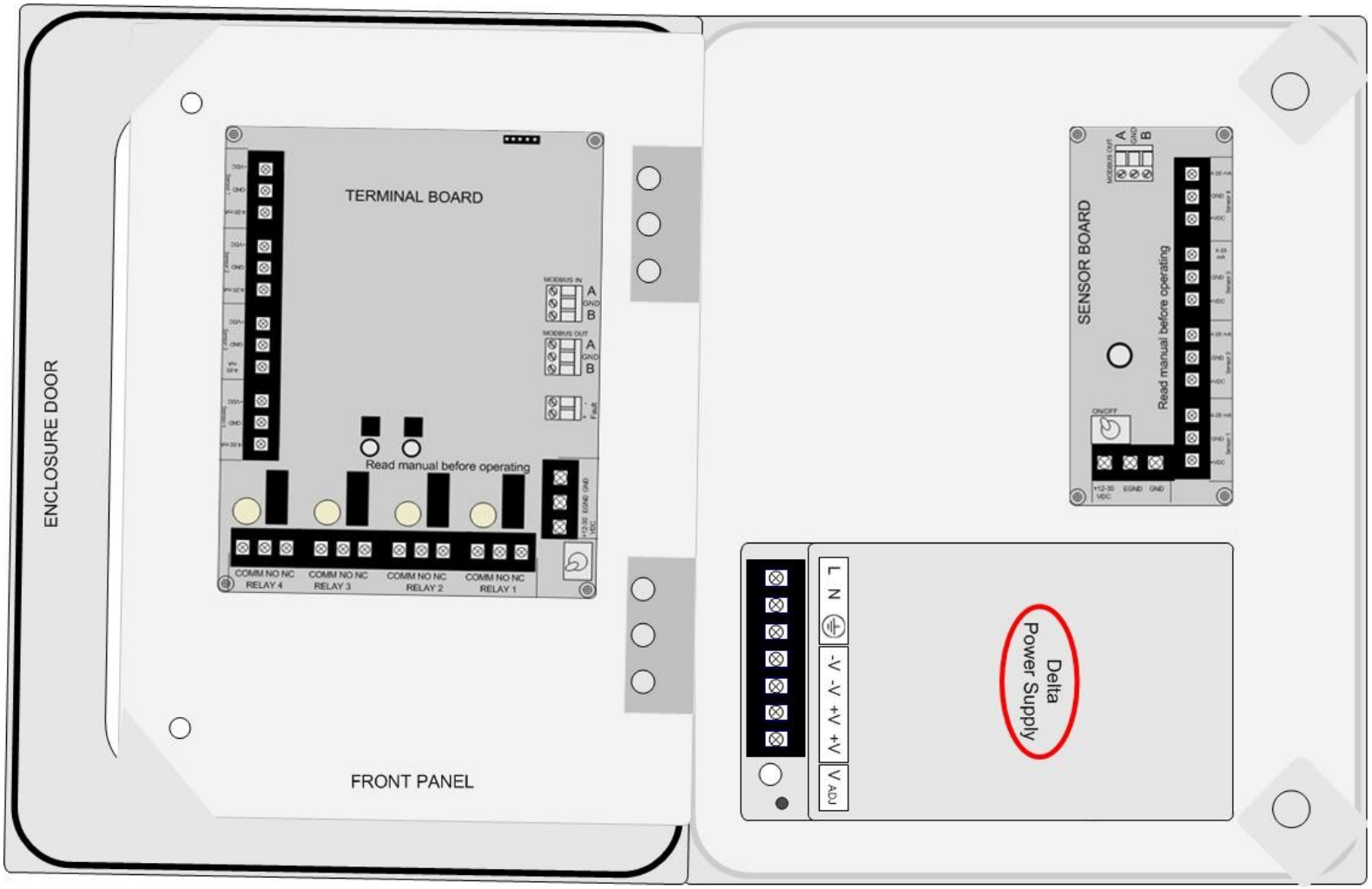
7. Close the Front Panel.
8. Screw in the thumb-screws.
9. Close the enclosure box.
10. Clamp down the enclosure latches.

AC Power Supply Connection

For AC Power applications, the Delta Power Supply (located inside the enclosure box) should be used.

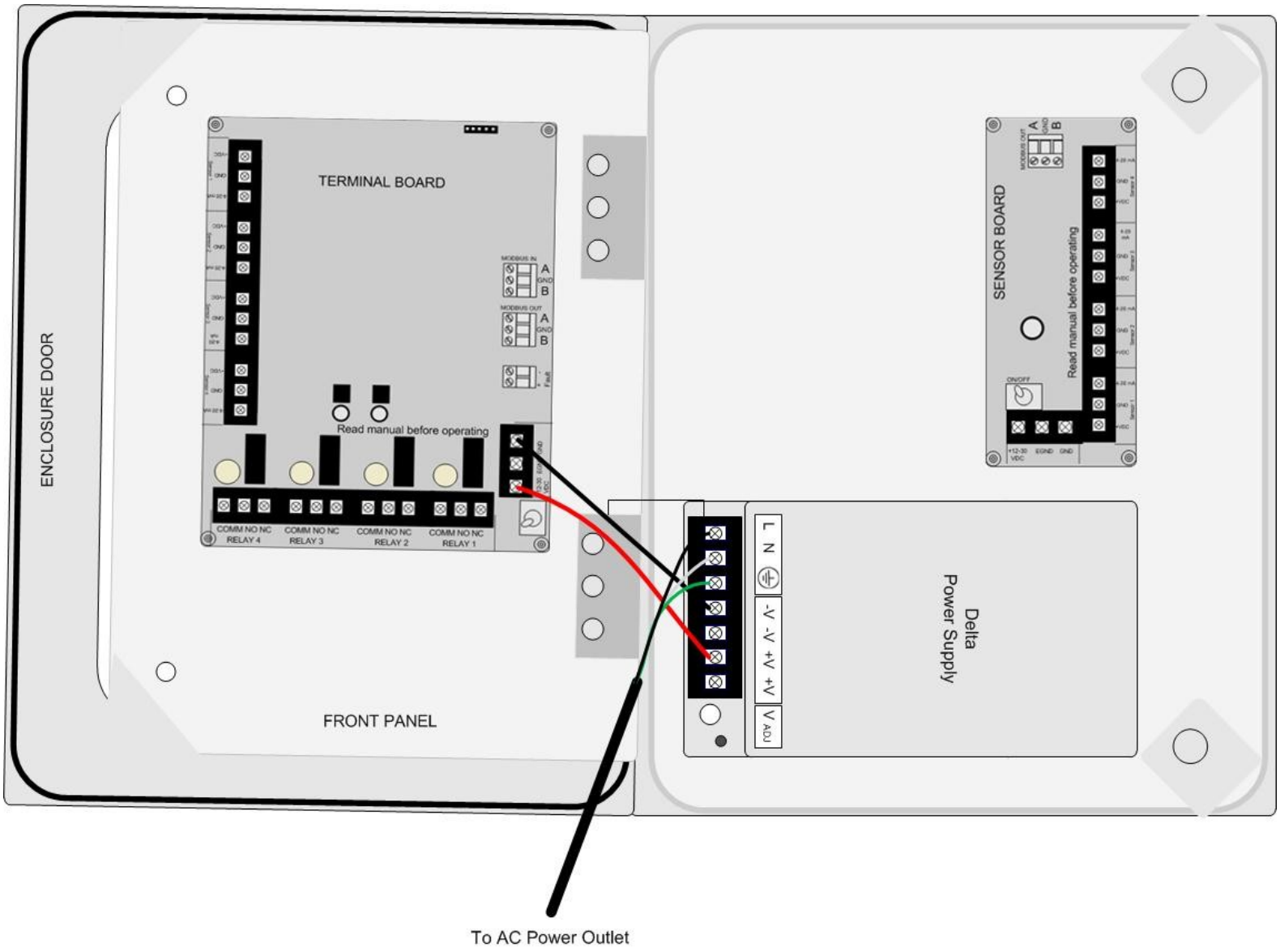
NOTE: The unit will be wired for the power-type that is requested by the purchaser when shipped from Otis Instruments, Inc.

1. Open the enclosure box to expose the Front Panel.
2. Unscrew the two thumb-screws on the Front Panel.
3. Open the Front Panel so that the AC (Delta) Power Supply is exposed.



4. Connect a positive (red) wire to the Power Terminal terminal labeled “+12-35 VDC” on the Terminal Board.
5. Connect the other end of that same positive (red) wire from the Terminal Board to the terminal labeled “+V” on the Delta power supply.

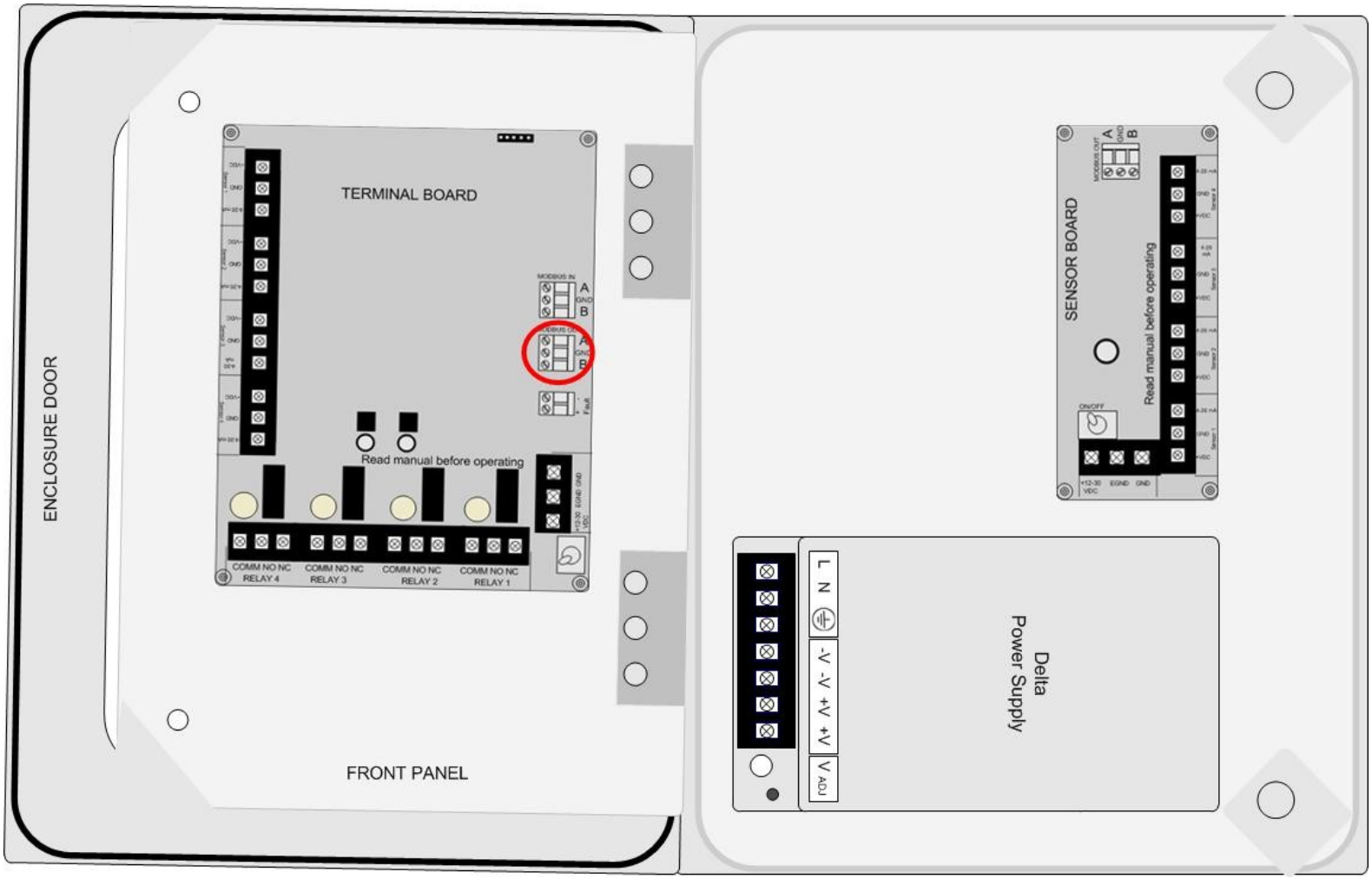
6. Connect a negative (black) wire from the Power Terminal terminal labeled “GND” on the Terminal Board.
7. Connect the other end of that same negative (black) wire from the Terminal Board to the terminal labeled “-V” on the Delta power supply.
8. There will be three wires (black, white and green) pre-wired from the Delta power supply terminals “L” (AC Load IN), “N” (AC Neutral IN), and “EG” (Chassis GND or Earth GND). This set of wires will be used to plug into an AC power outlet ONCE ALL WIRING CONFIGURATIONS ARE COMPLETE.



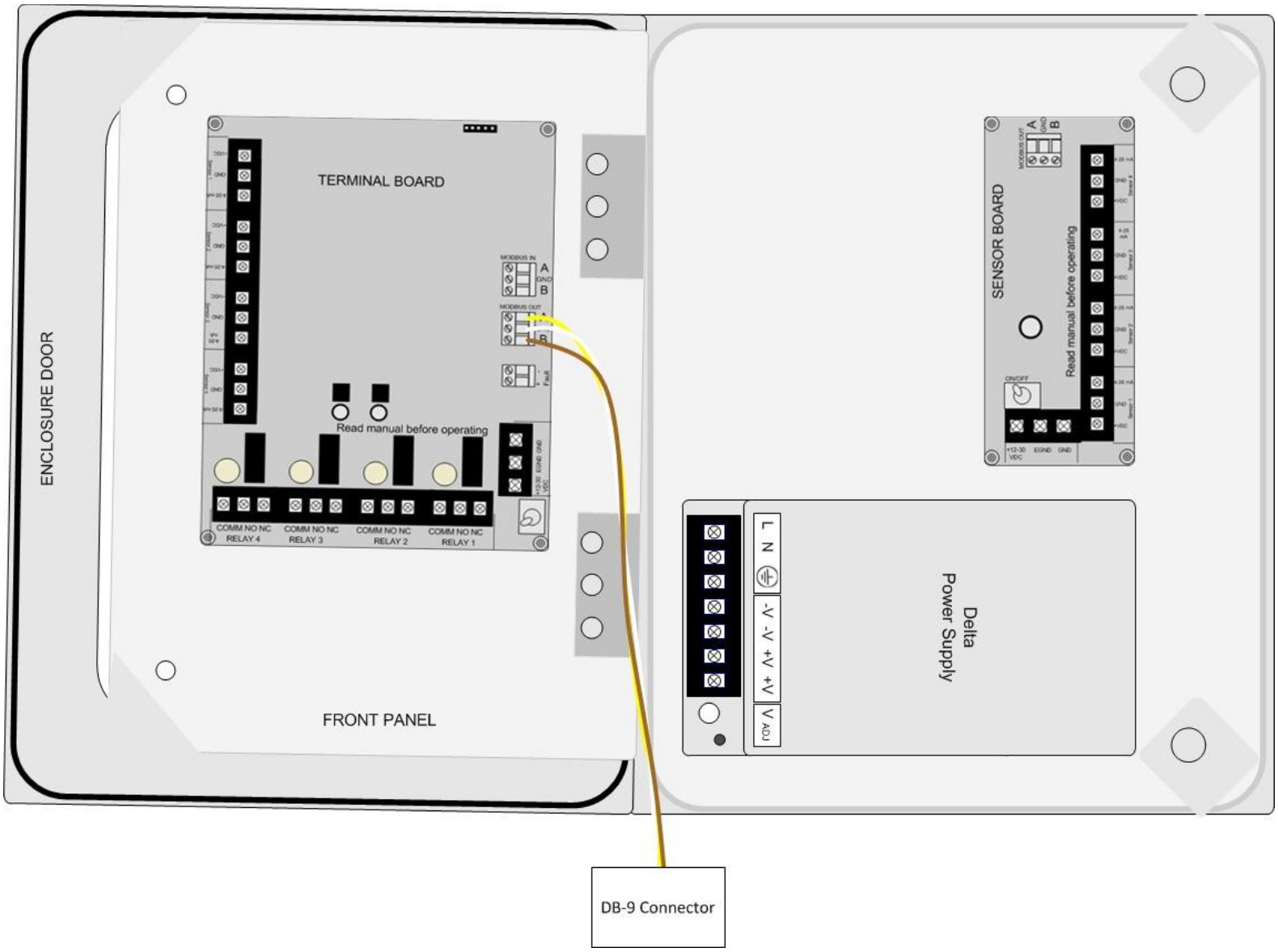
9. Close the Front Panel.
10. Screw in the thumb-screws.
11. Close the enclosure box.
12. Clamp down the enclosure latches.

RS-485 Modbus Connection (Modbus Out)

1. Open the enclosure box to expose the Front Panel.
2. Unscrew the two thumb-screws on the Front Panel.
3. Open the Front Panel so that the back of the Terminal Board is exposed.
4. Locate the Modbus Out Terminal Block.



5. Connect the yellow wire from a DB-9 connector (or the connector-type that best suits your application) to the terminal labeled “A” on the Modbus Out Terminal Block.
6. Connect the white wire from a DB-9 connector to the terminal labeled “GND” on the Modbus Out Terminal Block.
7. Connect the brown wire from a DB-9 connector to the terminal labeled “B” on the Modbus Out Terminal Block.
8. Plug the DB-9 connector into a PLC.

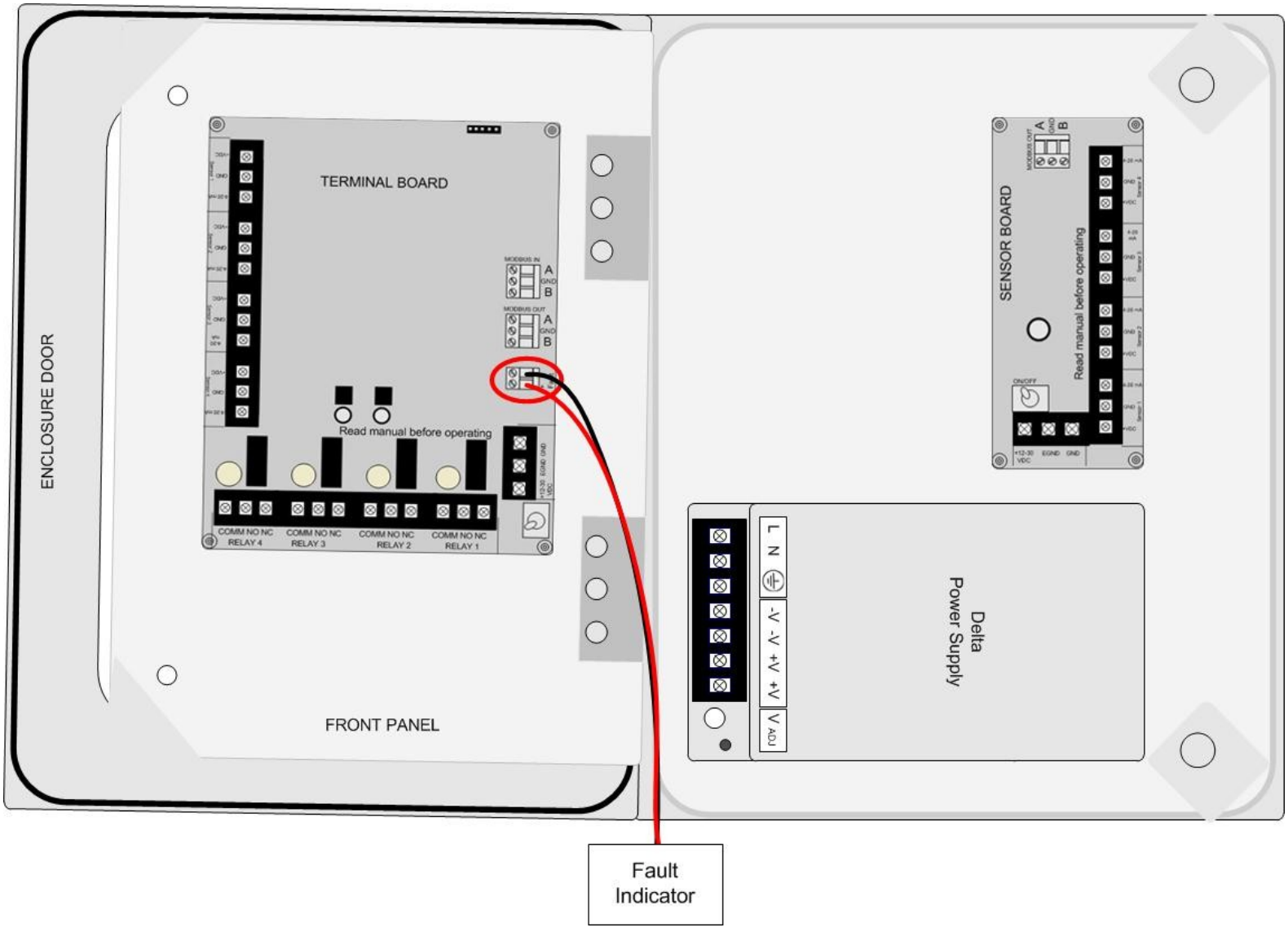


9. Close the Front Panel.
10. Screw in the thumb-screws.
11. Close the enclosure box.
12. Clamp down the enclosure latches.

Fault Indicator Connection

The Fault terminal provides an output to power some form of Fault indicator. The Fault terminal uses the same supply voltage that is fed into the board, and is a DC only output.

1. Locate the Fault Terminal Block on the terminal board.
2. Connect a positive (red) wire to the terminal labeled “+”.
3. Connect a negative (black) wire to the terminal labeled “-”.

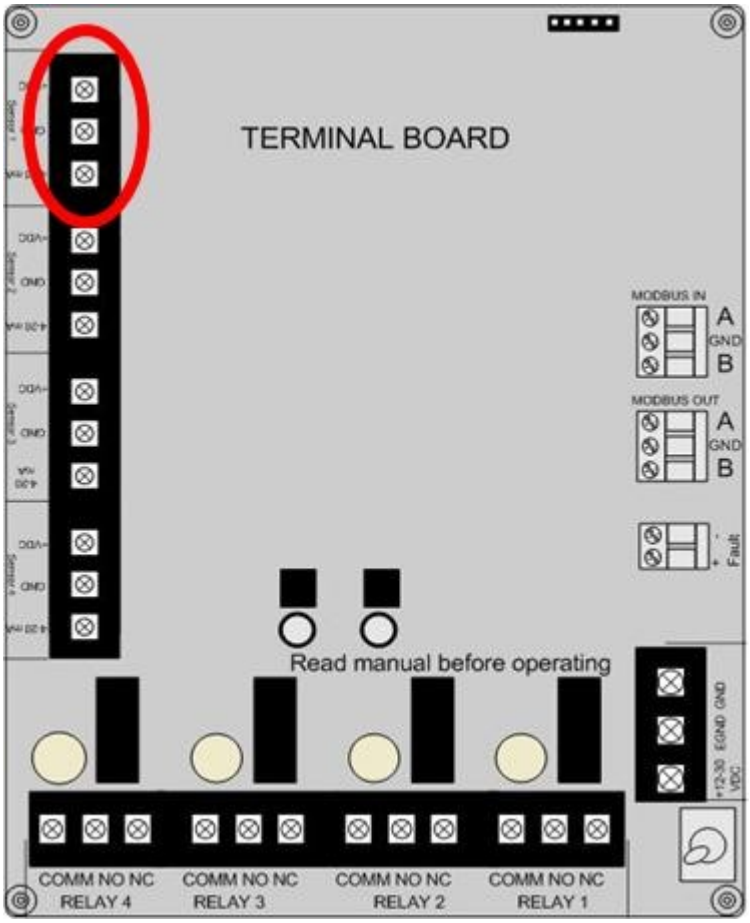


Connecting Sensors

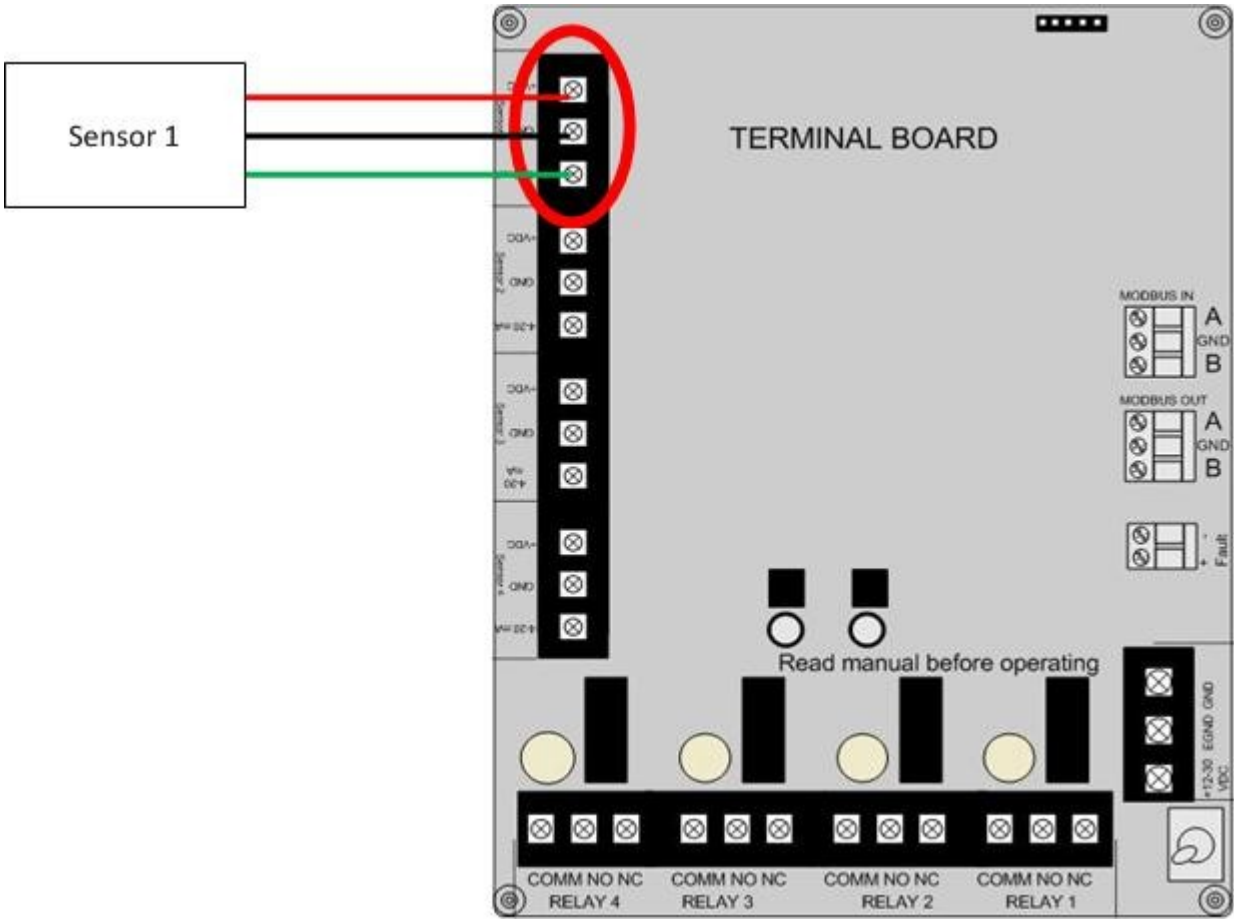
The OI-7480 allows up to eight (or 12) wired (4-20mA) sensors to be monitored.

Connecting Sensor 1

1. Locate the Sensor 1 Terminal Block on the Terminal Board.

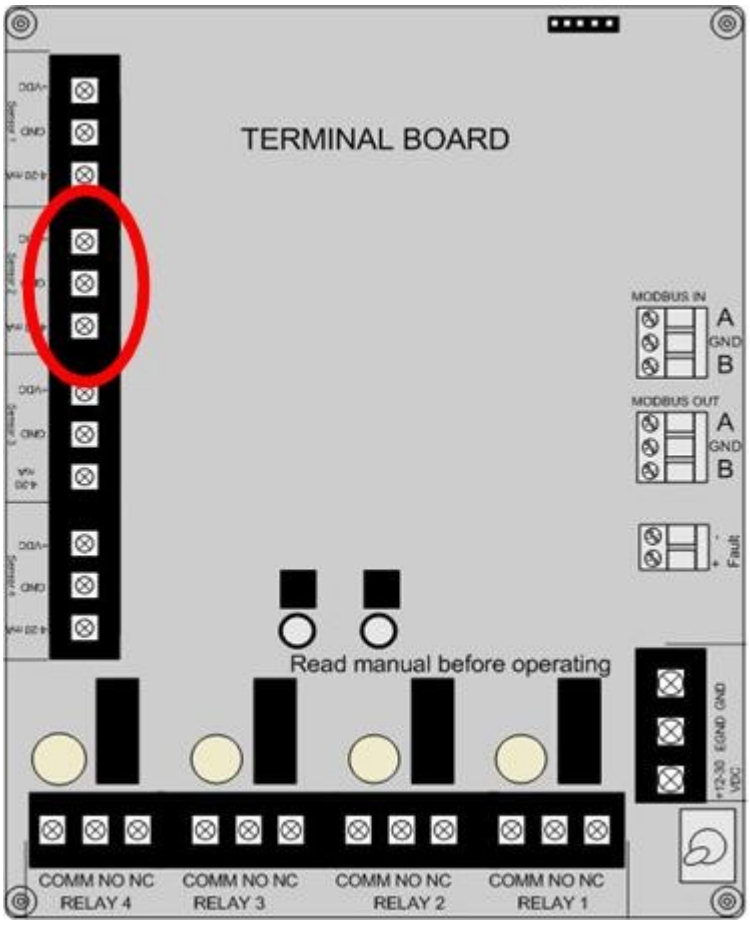


2. Connect the positive (red) wire to the terminal labeled “+VDC”.
3. Connect the signal (green) wire to the terminal labeled “4-20mA”.
4. Connect the negative (black) wire to the terminal labeled “GND”.

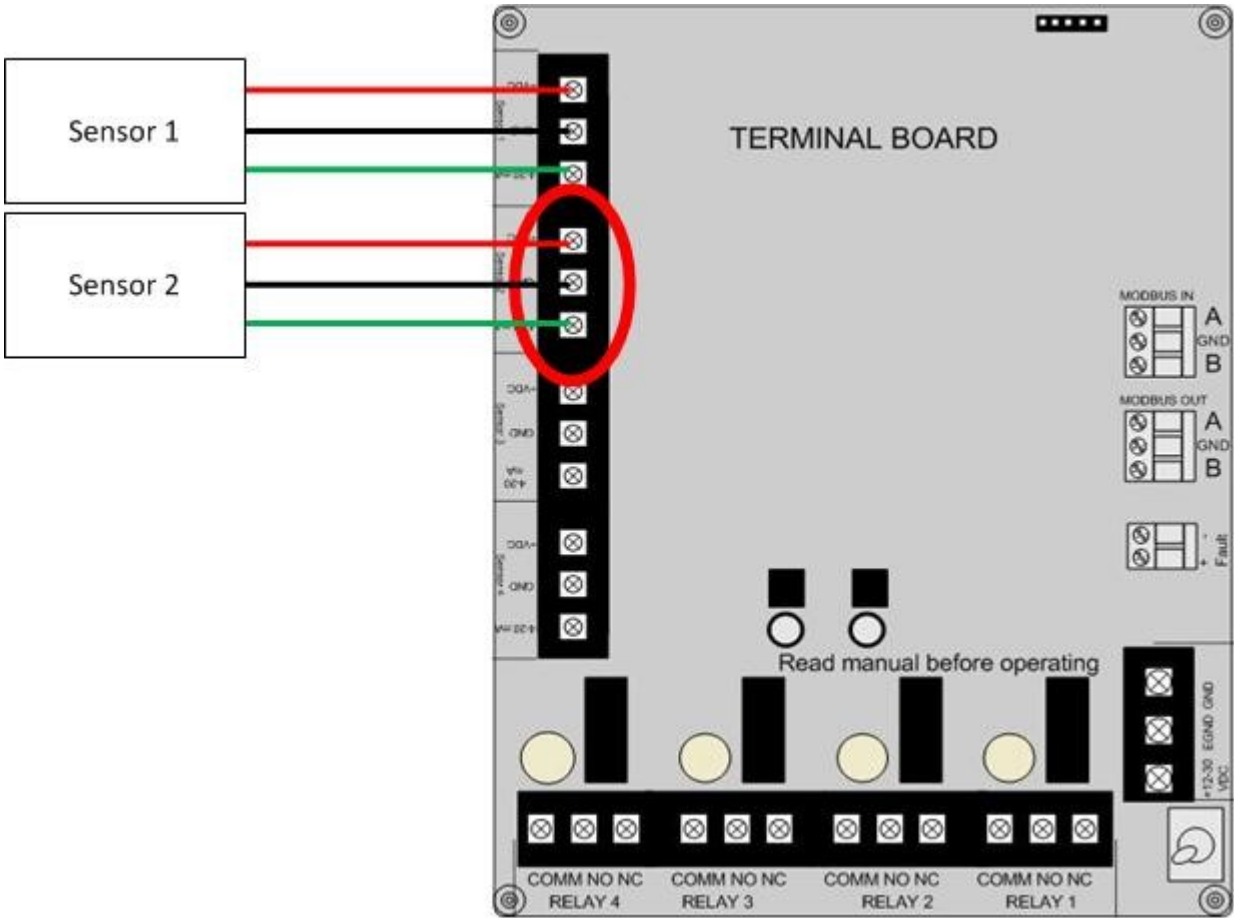


Connecting Sensor 2

1. Locate the Sensor 2 Terminal Block on the Terminal Board.

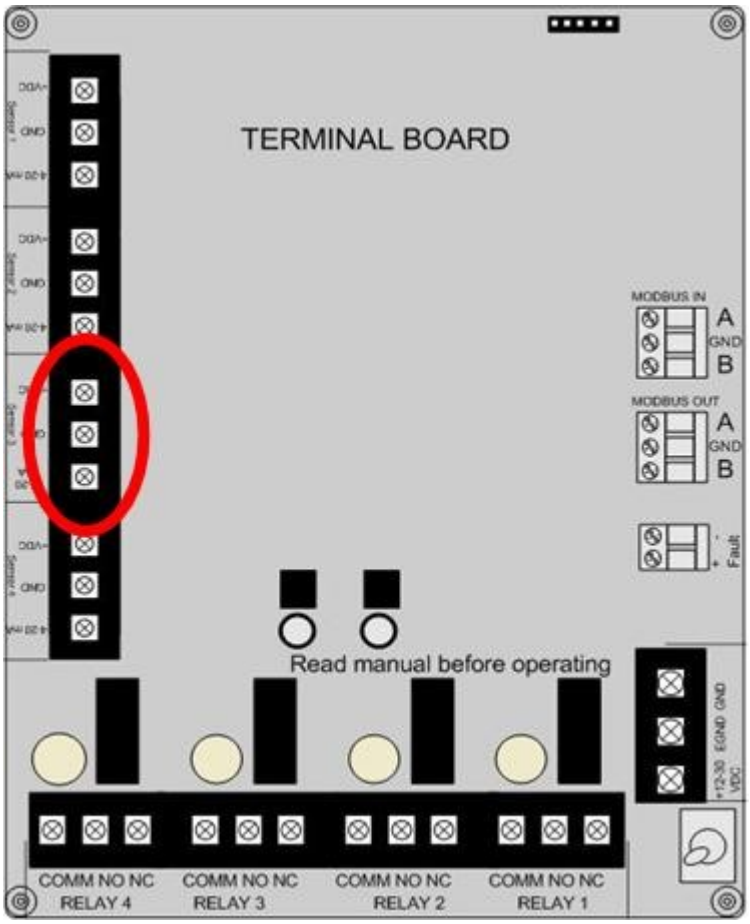


2. Connect the positive (red) wire to the terminal labeled “+VDC”.
3. Connect the signal (green) wire to the terminal labeled “4-20mA”.
4. Connect the negative (black) wire to the terminal labeled “GND”.



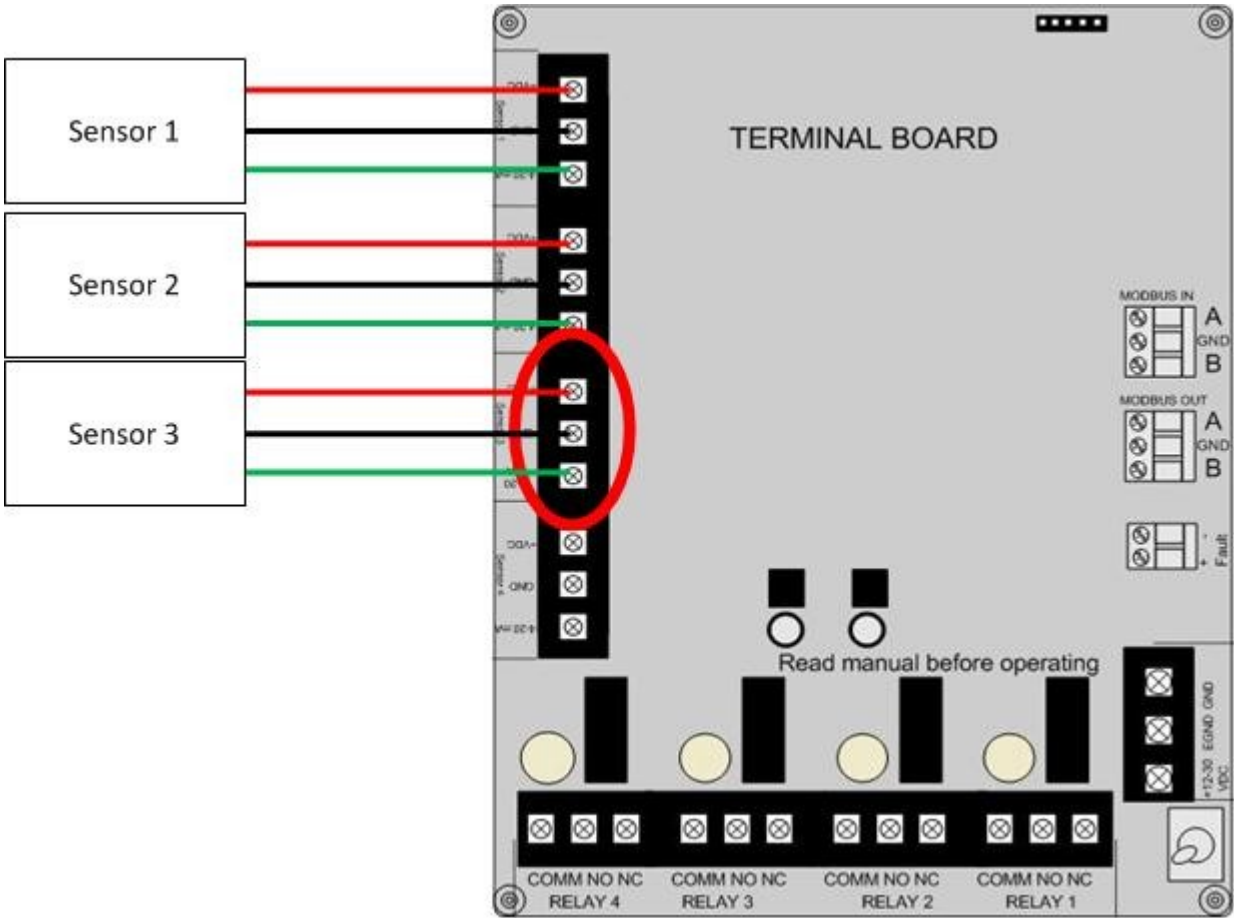
Connecting Sensor 3

1. Locate the Sensor 3 Terminal Block on the Terminal Board.



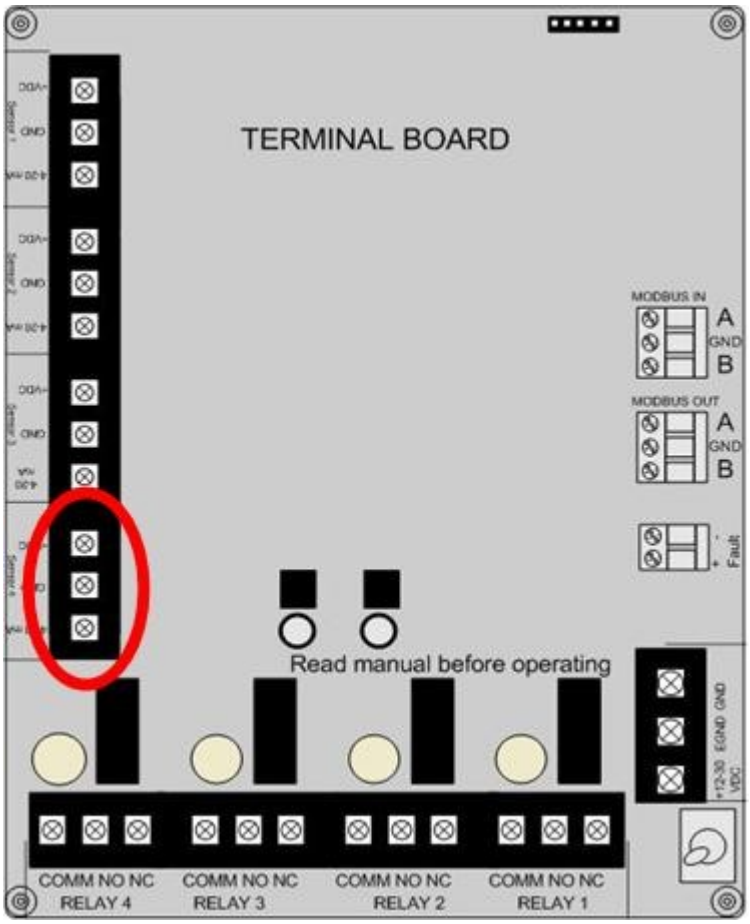
Connecting Sensor 3 cont...

2. Connect the positive (red) wire to the terminal labeled “+VDC”.
3. Connect the signal (green) wire to the terminal labeled “4-20mA”.
4. Connect the negative (black) wire to the terminal labeled “GND”.



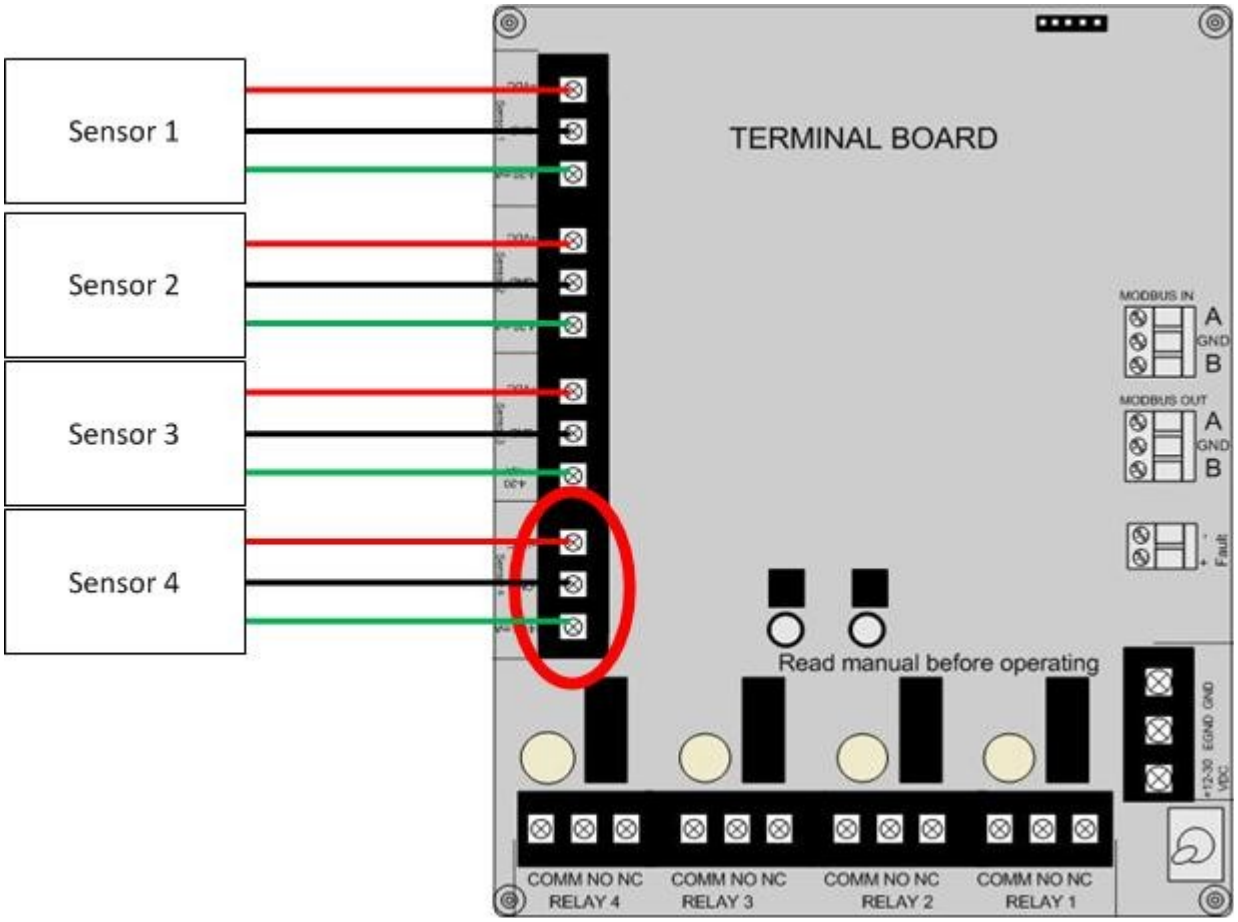
Connecting Sensor 4

1. Locate the Sensor 4 Terminal Block on the Terminal Board.



Connecting Sensor 4 cont...

2. Connect the positive (red) wire to the terminal labeled “+VDC”.
3. Connect the signal (green) wire to the terminal labeled “4-20mA”.
4. Connect the negative (black) wire to the terminal labeled “GND”.

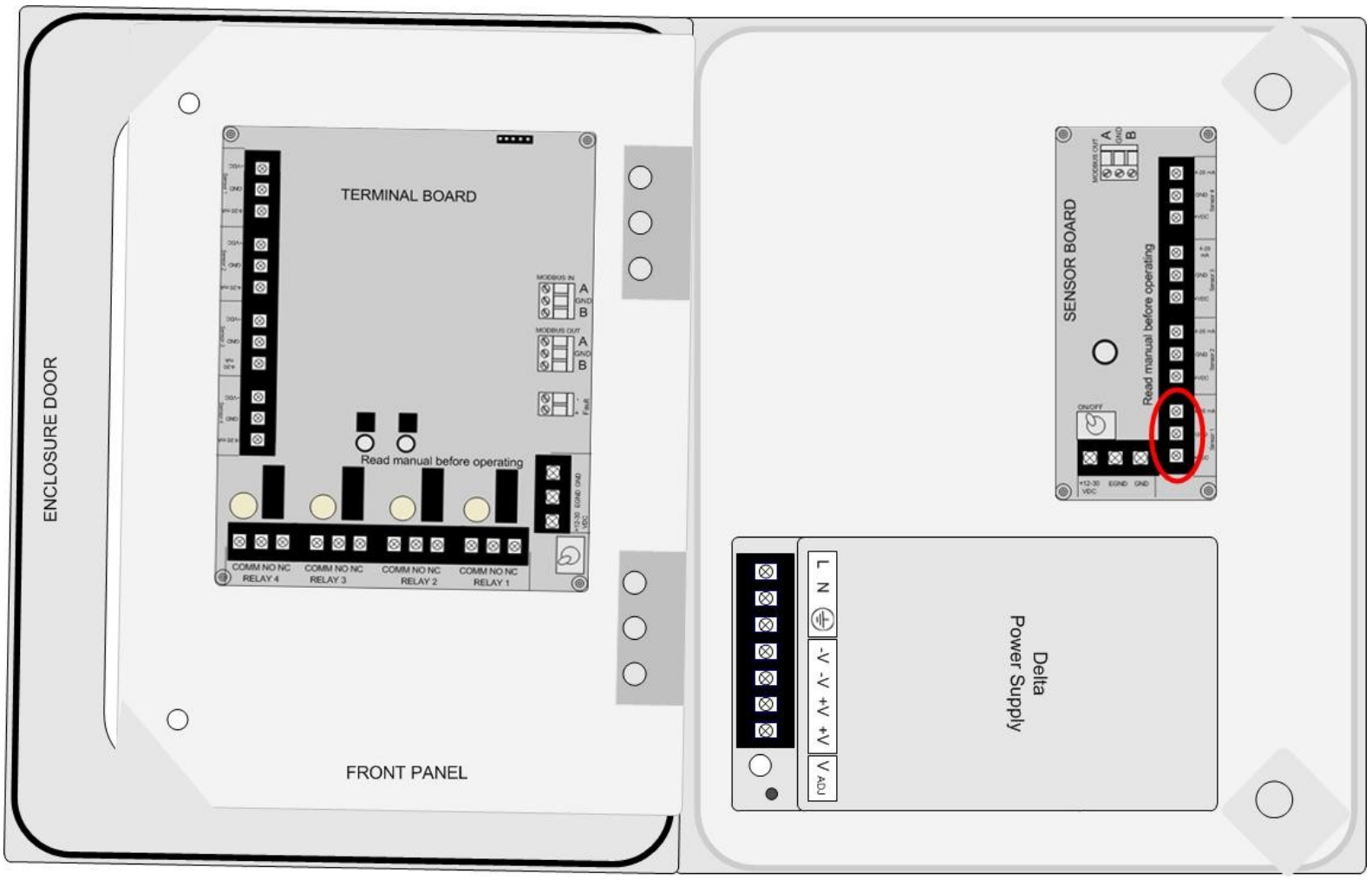


Connecting Additional Sensors: 5-8 and 9-12

When using more than 4 sensor assemblies, a Sensor Board(s) that is separate from the Terminal Board is used. To connect sensors 5-8 (and 9-12 (if applicable)), complete the following wiring configurations.

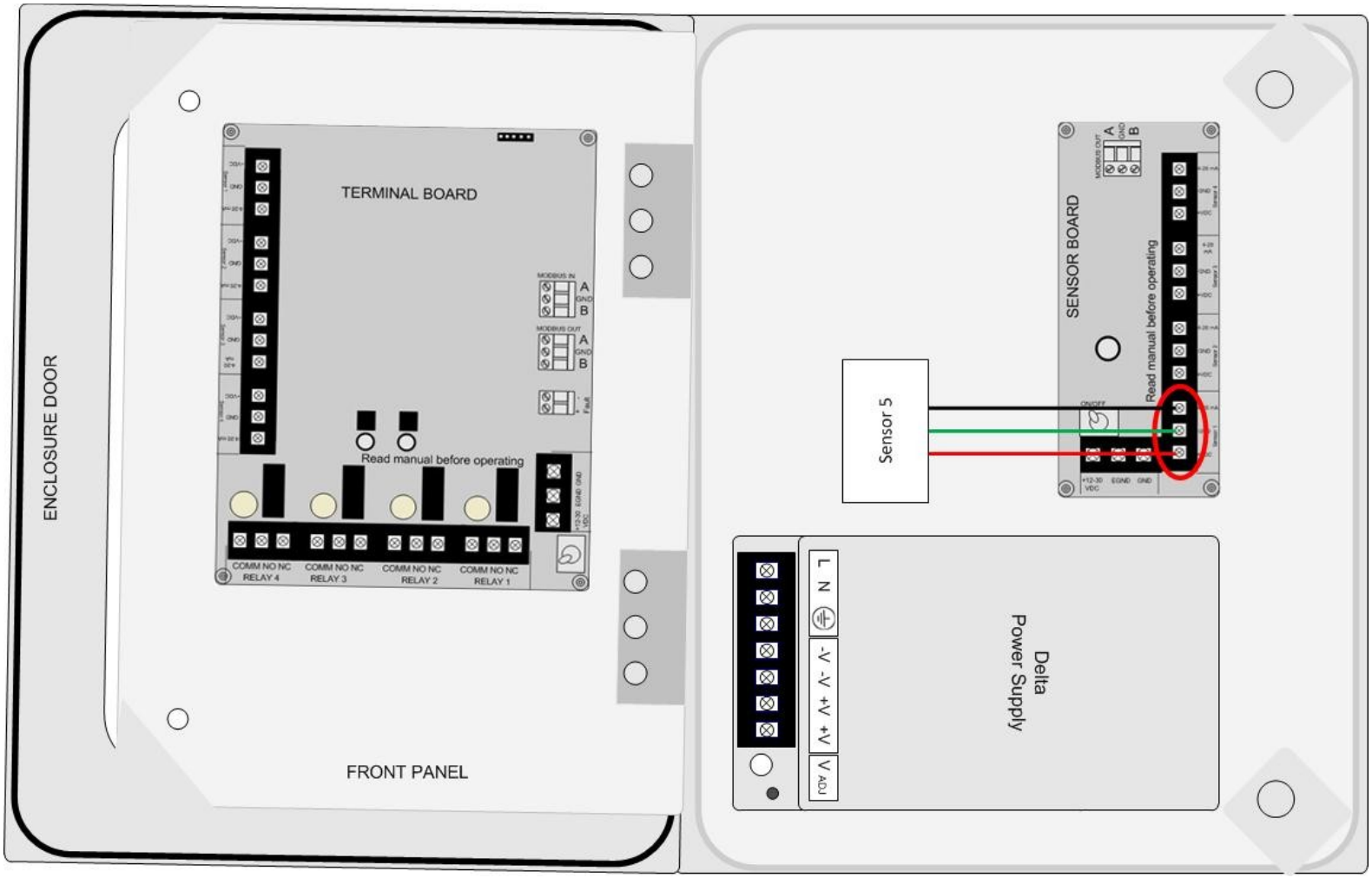
Connecting Sensors 5-8

1. Locate the Sensor 5 Terminal Block (and next, all consecutive Sensor Terminal Blocks to be connected) on the Sensor Board.



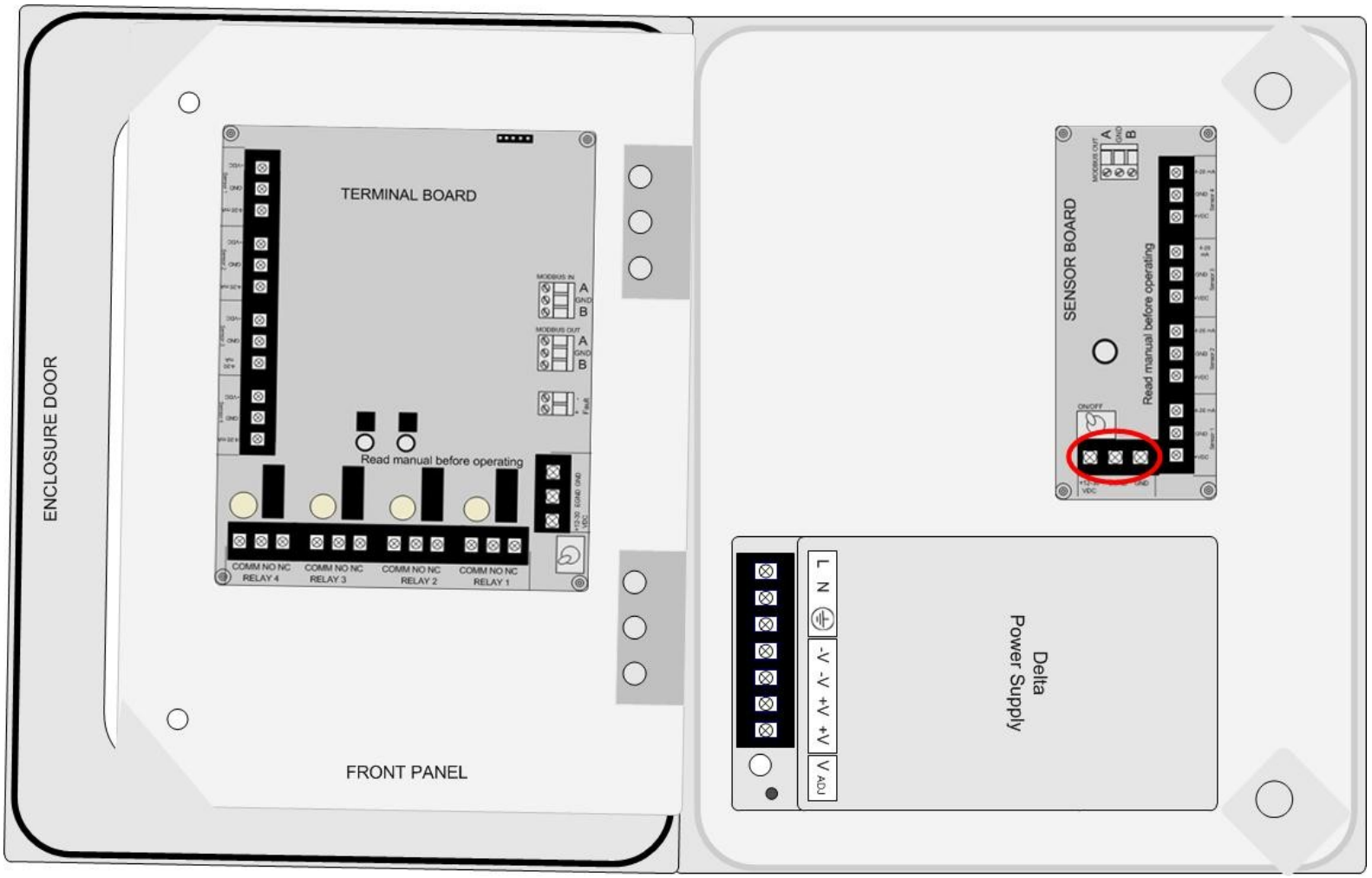
Connecting Sensor 5 cont...

2. Connect the positive (red) wire to the terminal labeled “+VDC”.
3. Connect the signal (green) wire to the terminal labeled “4-20mA”.
4. Connect the negative (black) wire to the terminal labeled “GND”.
5. Repeat steps 2, 3 and 4 for sensors 6, 7 and 8, if applicable.

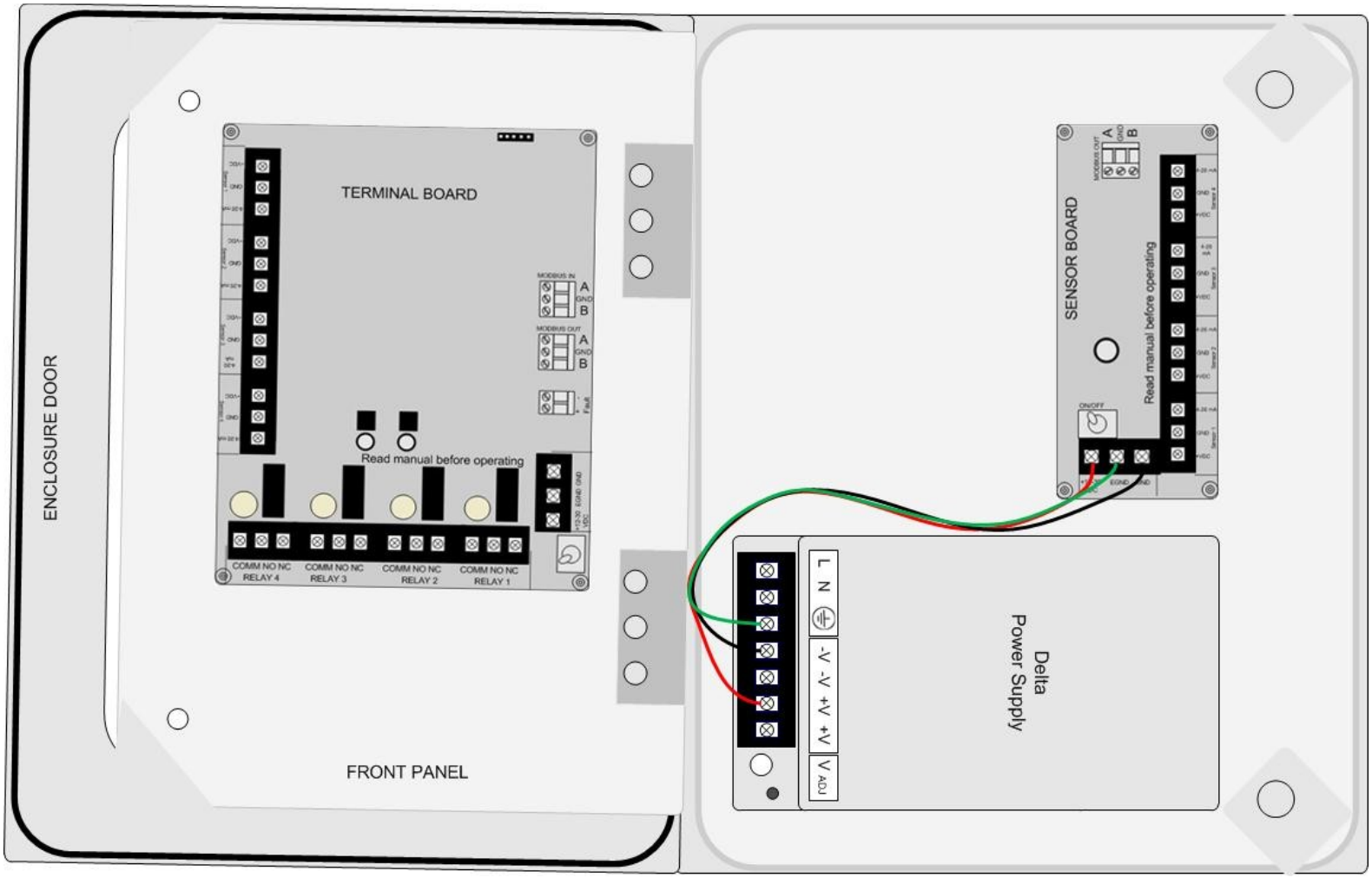


Powering Sensors 5-8

1. Locate the Power Terminal on the Sensor Board.

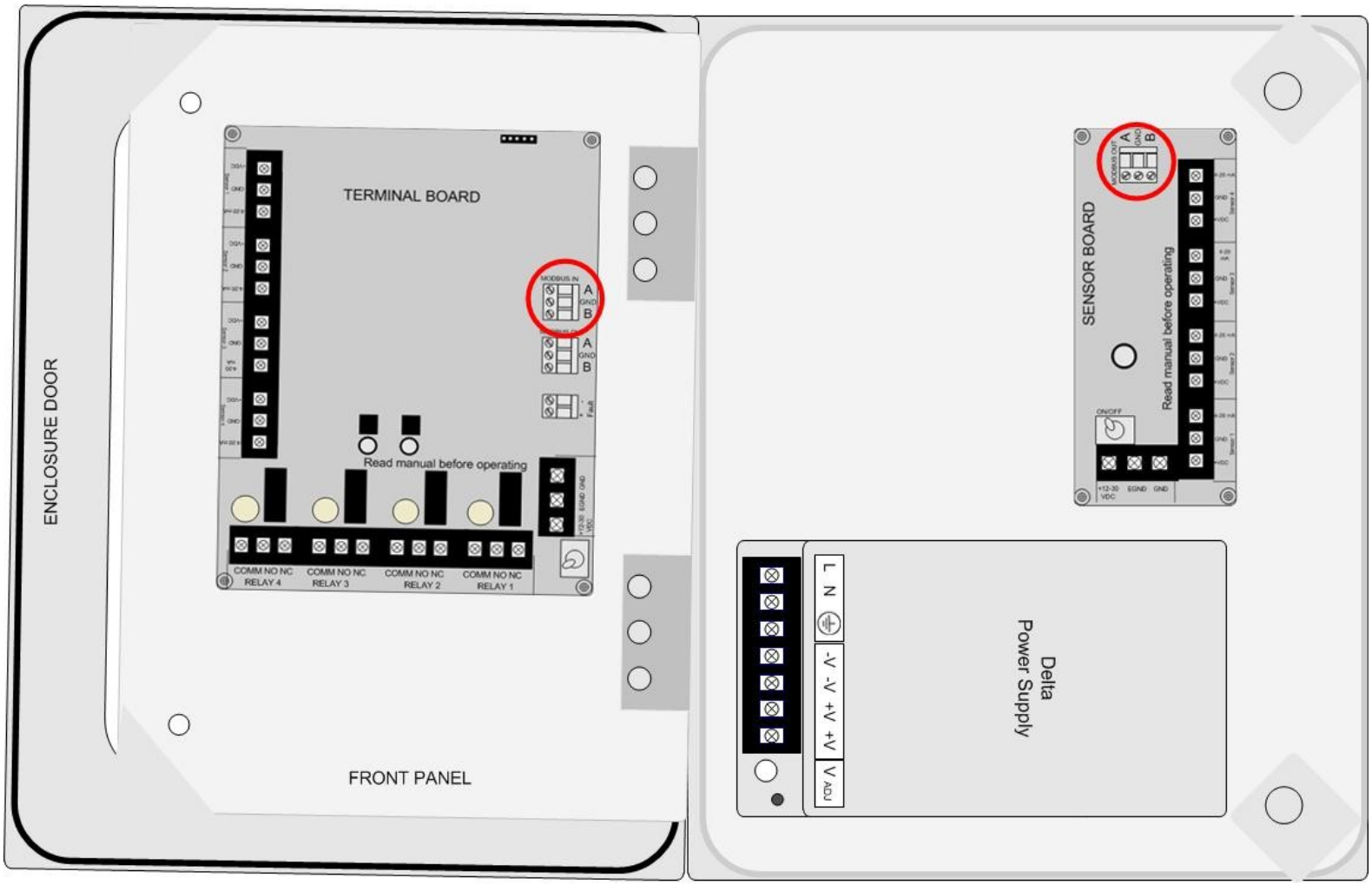


2. Connect a positive (red) wire to the Power Terminal terminal labeled “+12-35 VDC” on the Sensor Board.
3. Connect the other end of that same positive (red) wire from the Sensor Board to the terminal labeled “+V” on the Delta power supply.
4. Connect a negative (black) wire from the Power Terminal terminal labeled “GND” on the Sensor Board.
5. Connect the other end of that same negative (black) wire from the Terminal Board to the terminal labeled “-V” on the Delta power supply.
6. Connect a ground (green) wire from the Power Terminal terminal labeled “EGND” on the Sensor Board.
7. Connect the other end of that same ground (green) wire from the Terminal Board to the terminal labeled “EG” on the Delta power supply.

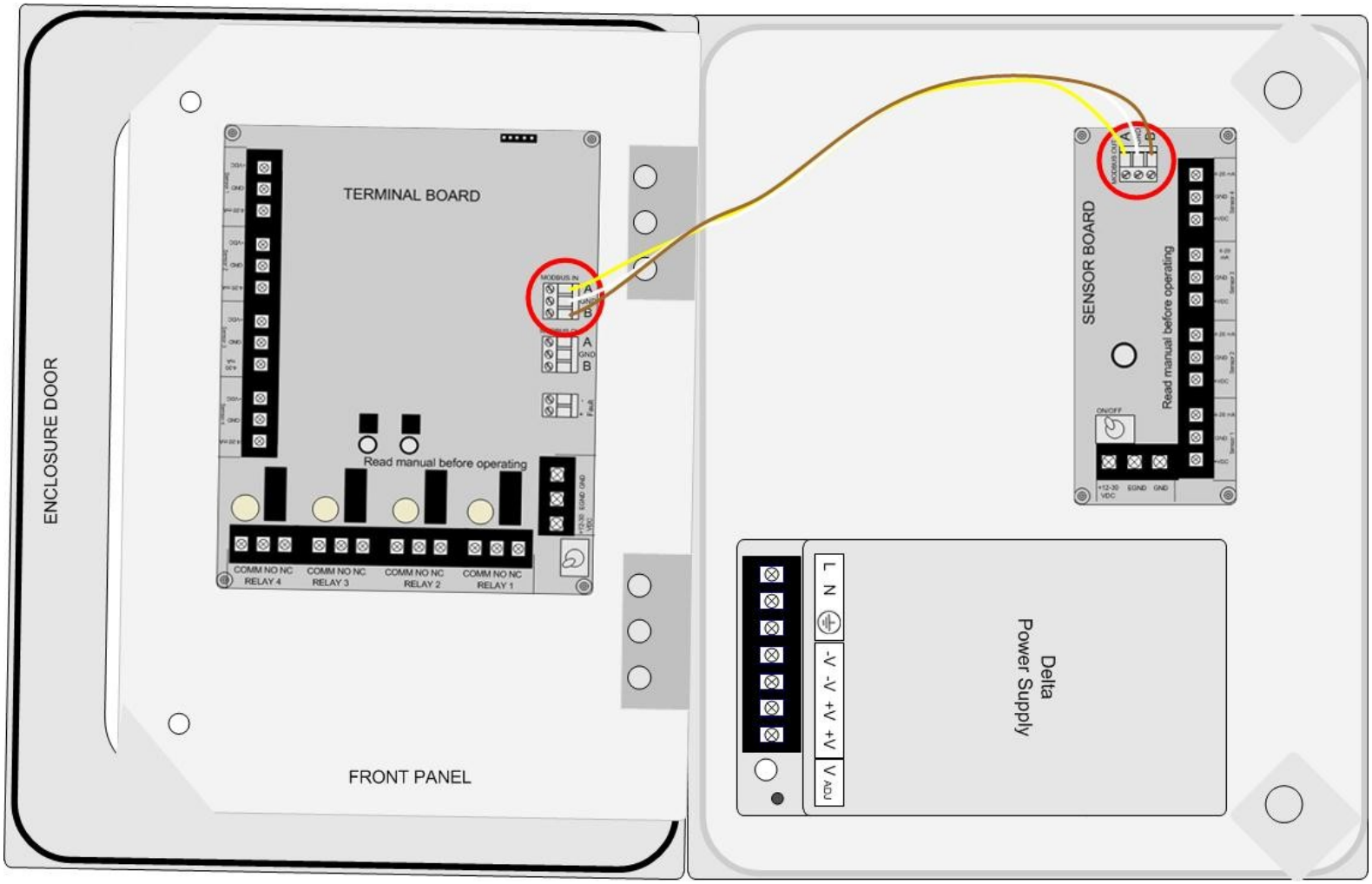


Sensor Board RS-485 Modbus Connection

1. Locate the Modbus Out Terminal Block on the Sensor Board.
2. Locate the Modbus In Terminal Block on the Terminal Board.

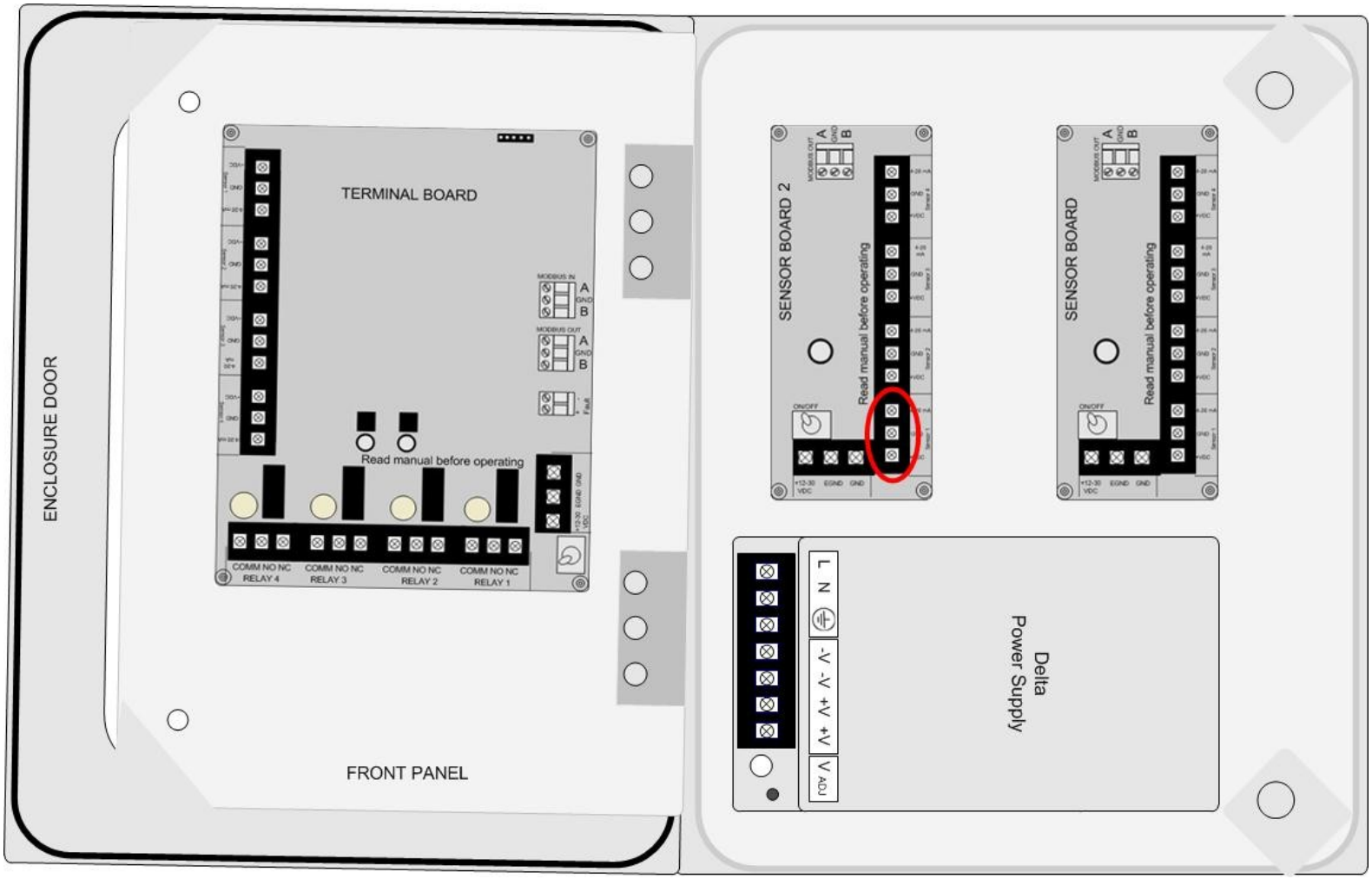


3. Connect a yellow wire from the terminal marked “A” on the Sensor Board's Modbus Out Terminal Block, to the terminal marked “A” on the Terminal Board's Modbus In Terminal Block.
4. Connect a white wire from the terminal marked “GND” on the Sensor Board's Modbus Out Terminal Block, to the terminal marked “GND” on the Terminal Board's Modbus In Terminal Block.
5. Connect a brown wire from the terminal marked “B” on the Sensor Board's Modbus Out Terminal Block, to the terminal marked “B” on the Terminal Board's Modbus In Terminal Block.



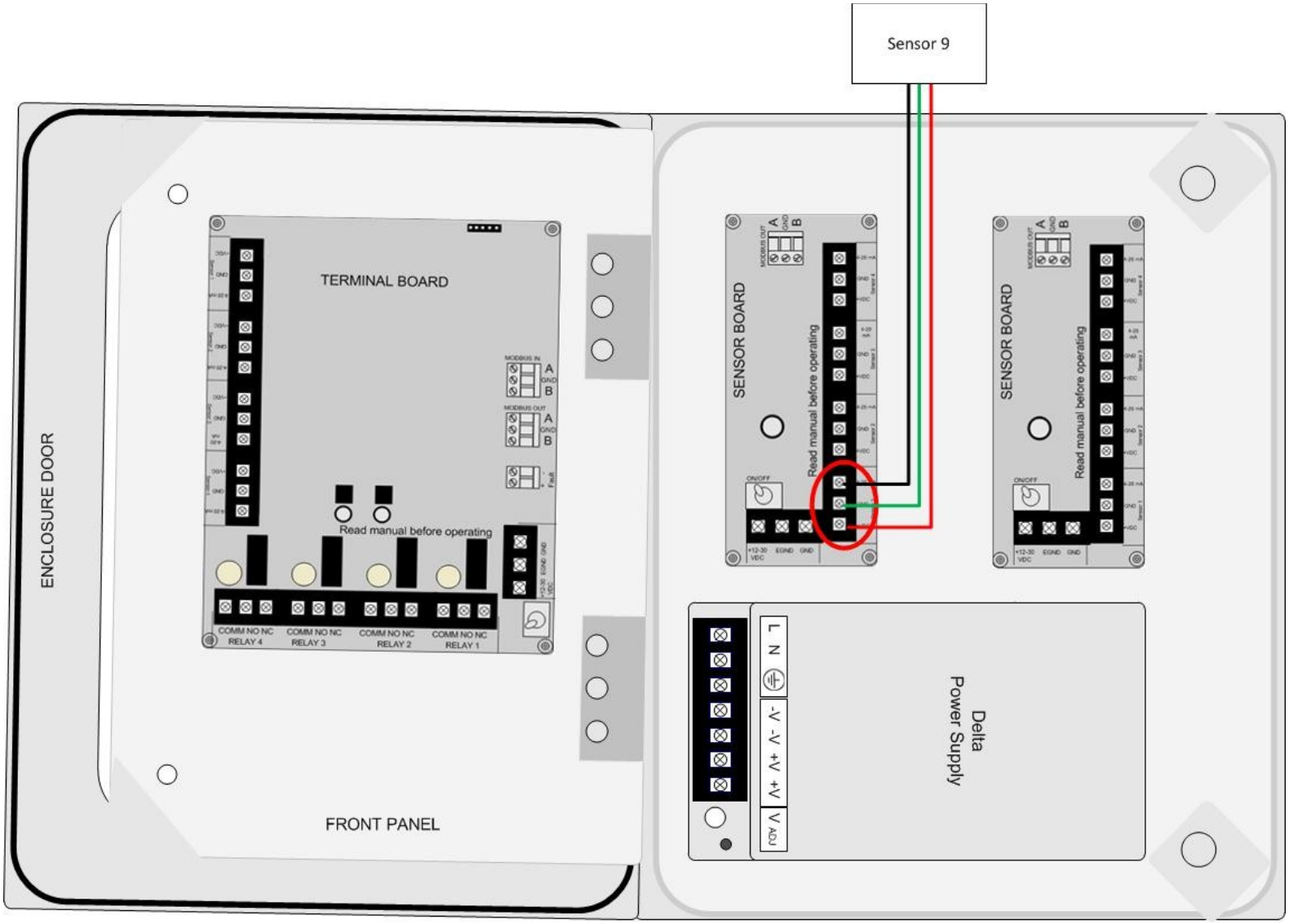
Connecting Sensors 9-12

1. Locate the Sensor 9 Terminal Block (and next, all consecutive Sensor Terminal Blocks to be connected) on the Sensor Board 2.



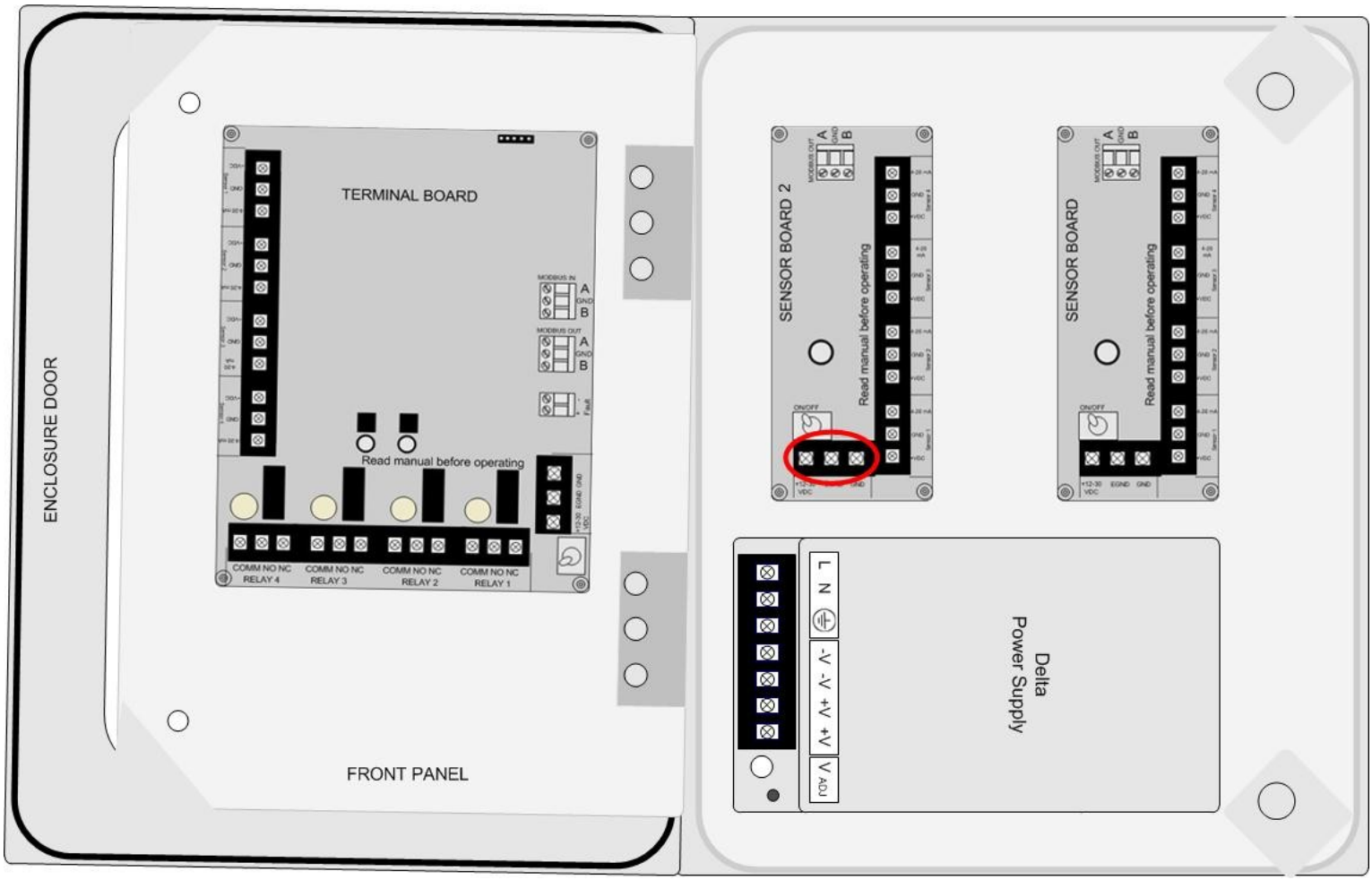
Connecting Sensor 9 cont...

2. Connect the positive (red) wire to the terminal labeled “+VDC”.
3. Connect the signal (green) wire to the terminal labeled “4-20mA”.
4. Connect the neutral (black) wire to the terminal labeled “GND”.
5. Repeat these steps for sensors 10, 11 and 12, if applicable.

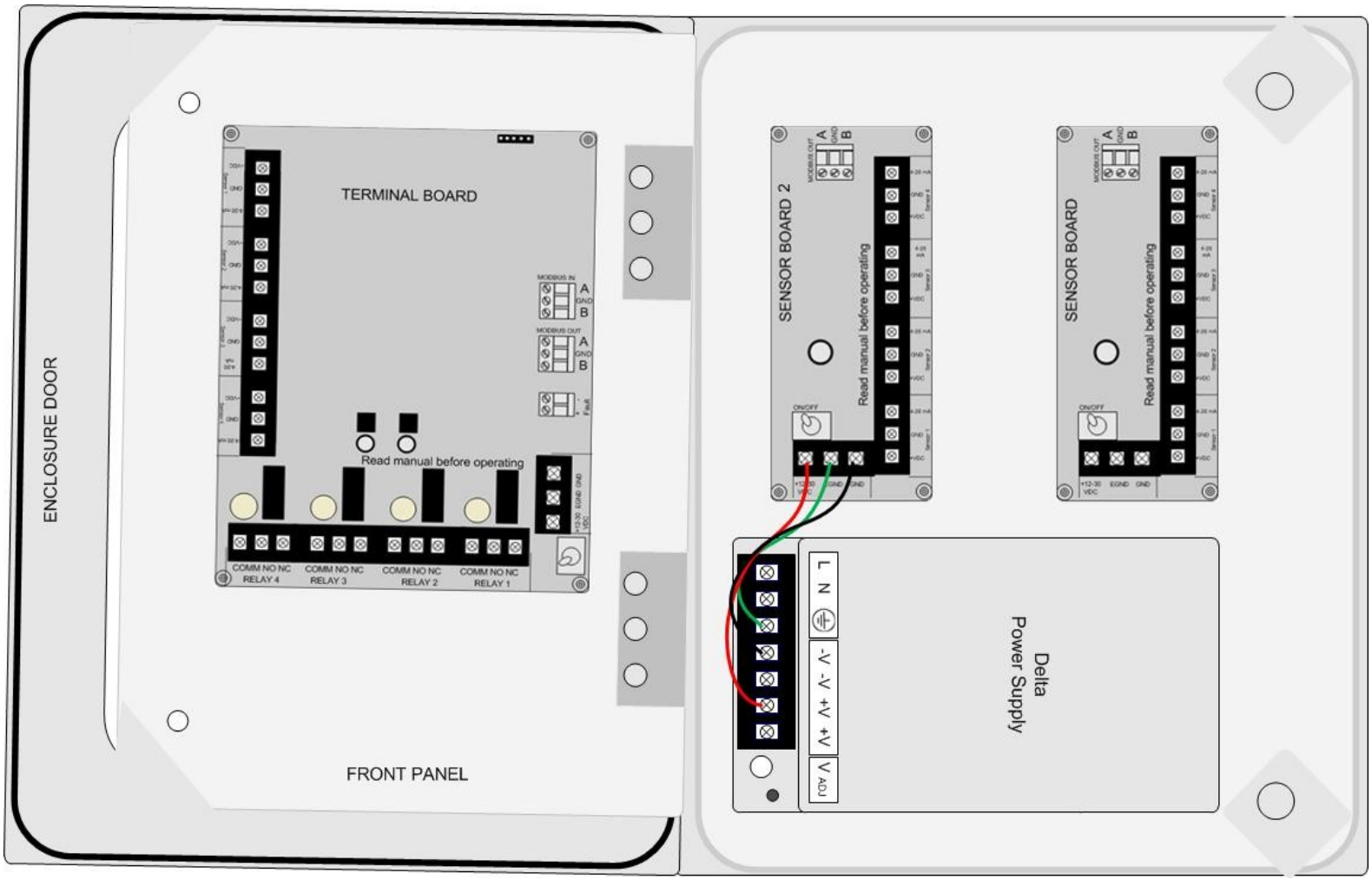


Powering Sensors 9-12

1. Locate the Power Terminal on the Sensor Board 2.

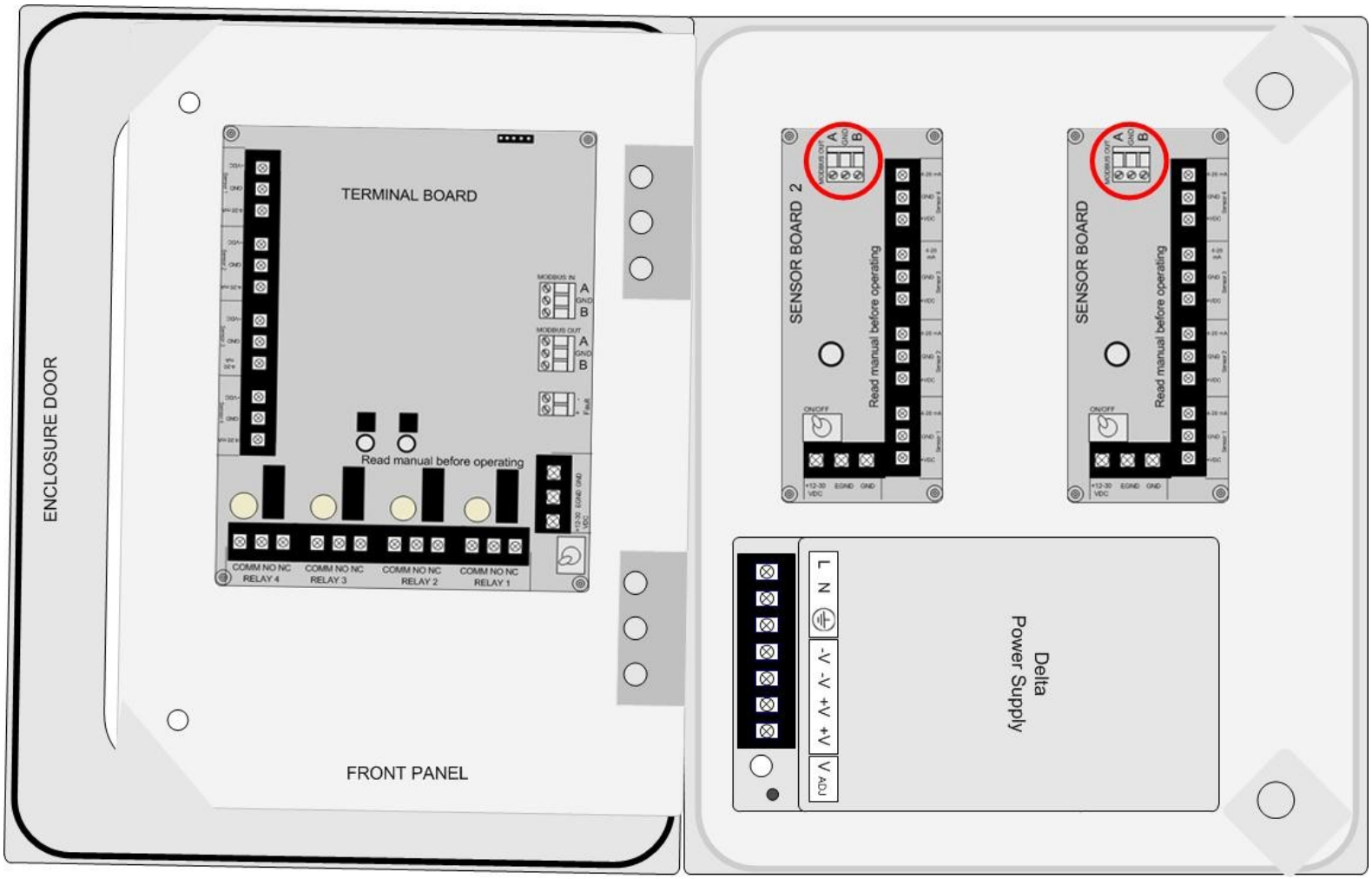


2. Connect a positive (red) wire to the Power Terminal terminal labeled “+12-35 VDC” on the Sensor Board 2.
3. Connect the other end of that same positive (red) wire from the Sensor Board 2 to the terminal labeled “+V” on the Delta power supply.
4. Connect a negative (black) wire from the Power Terminal terminal labeled “GND” on the Sensor Board 2.
5. Connect the other end of that same negative (black) wire from the Terminal Board to the terminal labeled “-V” on the Delta power supply.
6. Connect a ground (green) wire from the Power Terminal terminal labeled “EGND” on the Sensor Board 2.
7. Connect the other end of that same ground (green) wire from the Terminal Board to the terminal labeled “EG” on the Delta power supply.

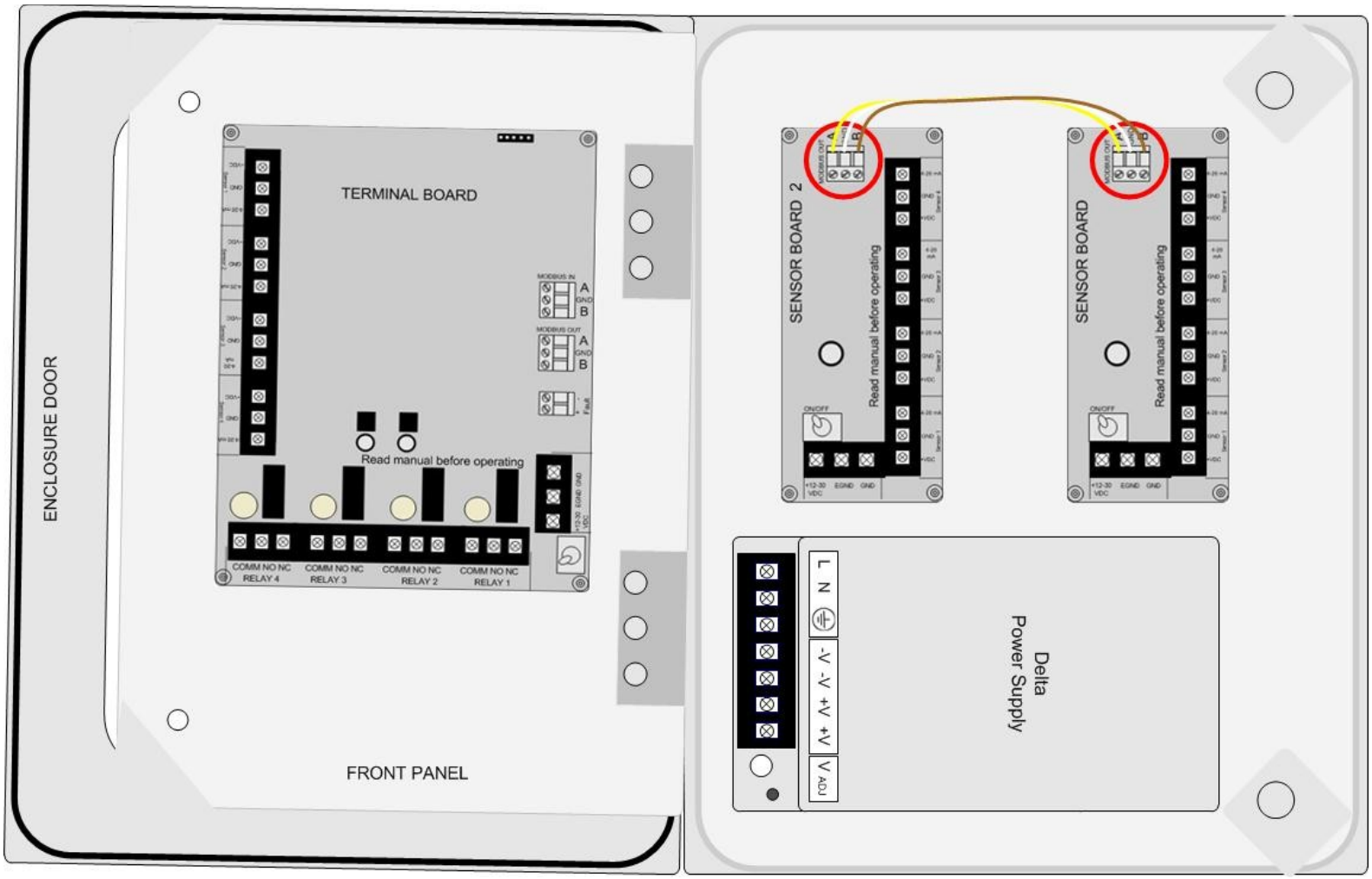


Sensors 9-12 RS-485 Modbus Connection

1. Locate the Modbus Out Terminal Block on the Sensor Board 2.
2. Locate the Modbus In Terminal Block on the Terminal Board.



3. Connect a yellow wire from the terminal marked “A” on the Sensor Board 2's Modbus Out Terminal Block, to the terminal marked “A” on the first Sensor Board's Modbus Out Terminal Block.
4. Connect a white wire from the terminal marked “GND” on the Sensor Board 2's Modbus Out Terminal Block, to the terminal marked “GND” on the first Sensor Board's Modbus Out Terminal Block.
5. Connect a brown wire from the terminal marked “B” on the Sensor Board 2's Modbus Out Terminal Block, to the terminal marked “B” on the first Sensor Board's Modbus Out Terminal Block.

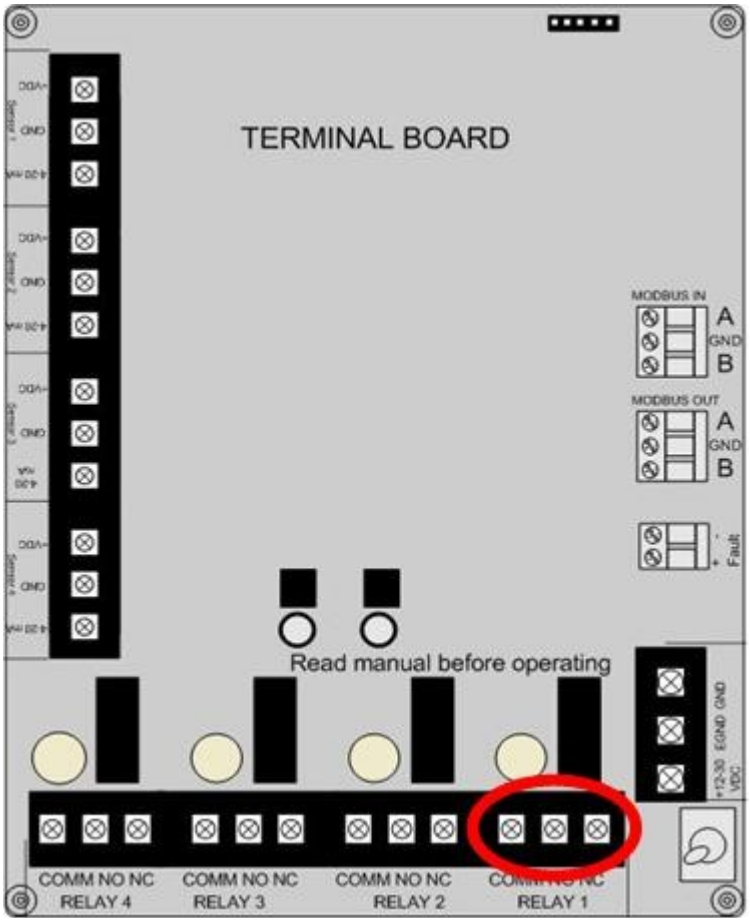


Relay Configurations

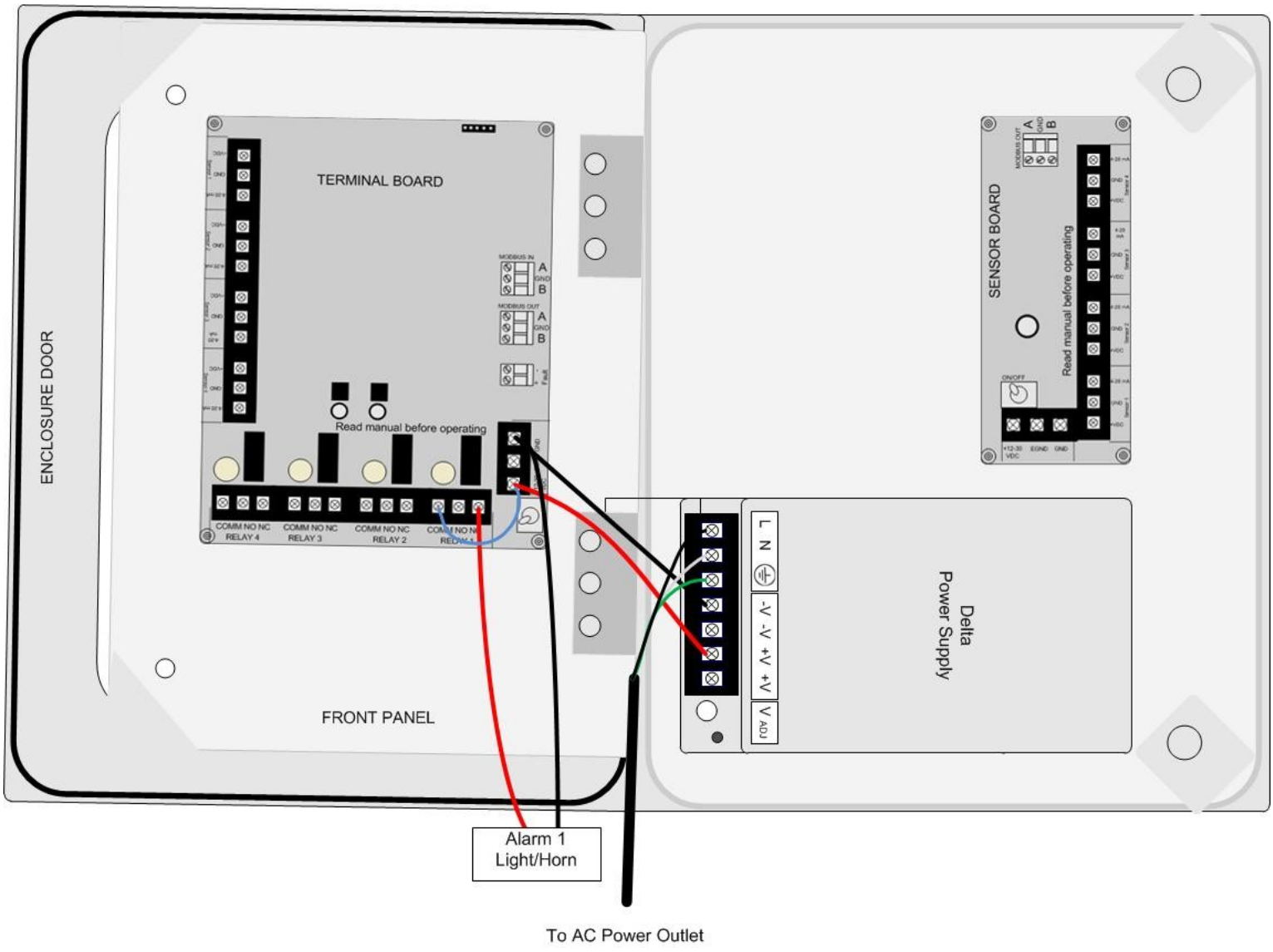
The OI-7480 offers four relays to be setup. Each of the four relays may be setup as Normally Open (NO) or Normally Closed (NC).

Connecting Relay 1

1. Locate the Relay 1 Terminal Block on the Terminal Board.

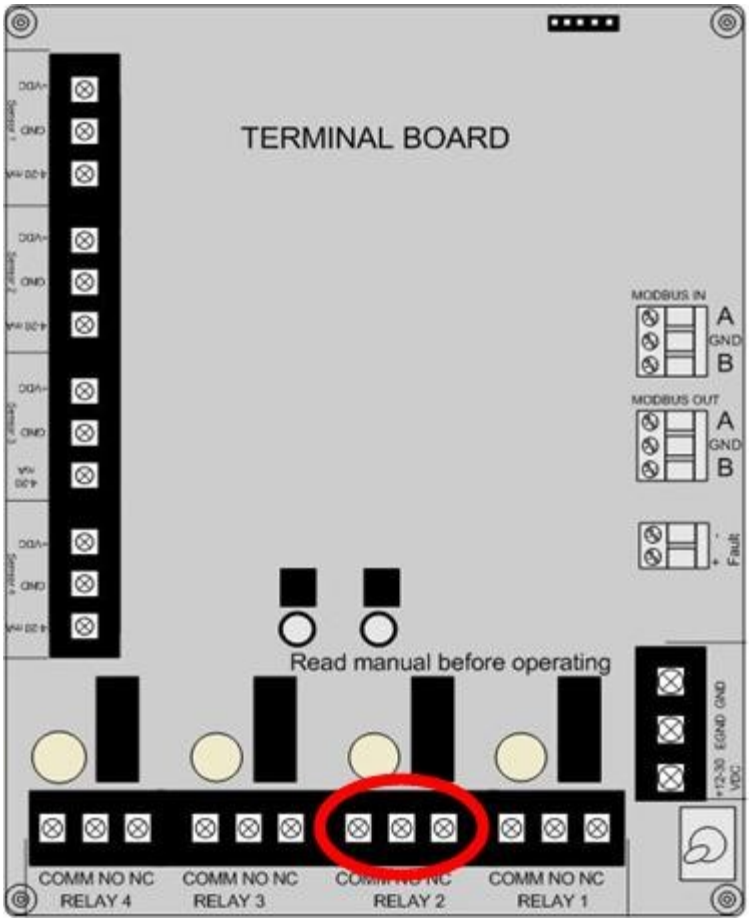


2. Connect the live wire (red) from the Relay 1 Alarm (light/horn) to the terminal labeled “NO” (or “NC”) on the Relay 1 Terminal Block.
3. Connect the neutral wire (black) from the Relay 1 Alarm (light/horn) to the terminal labeled “GND” on the DC Power Supply Terminal Block.
4. Connect the jumper wire (blue) from the terminal labeled “+12-35 VDC” on the DC Power Supply Terminal Block to the terminal labeled “COM” on the Relay 1 Terminal Block.

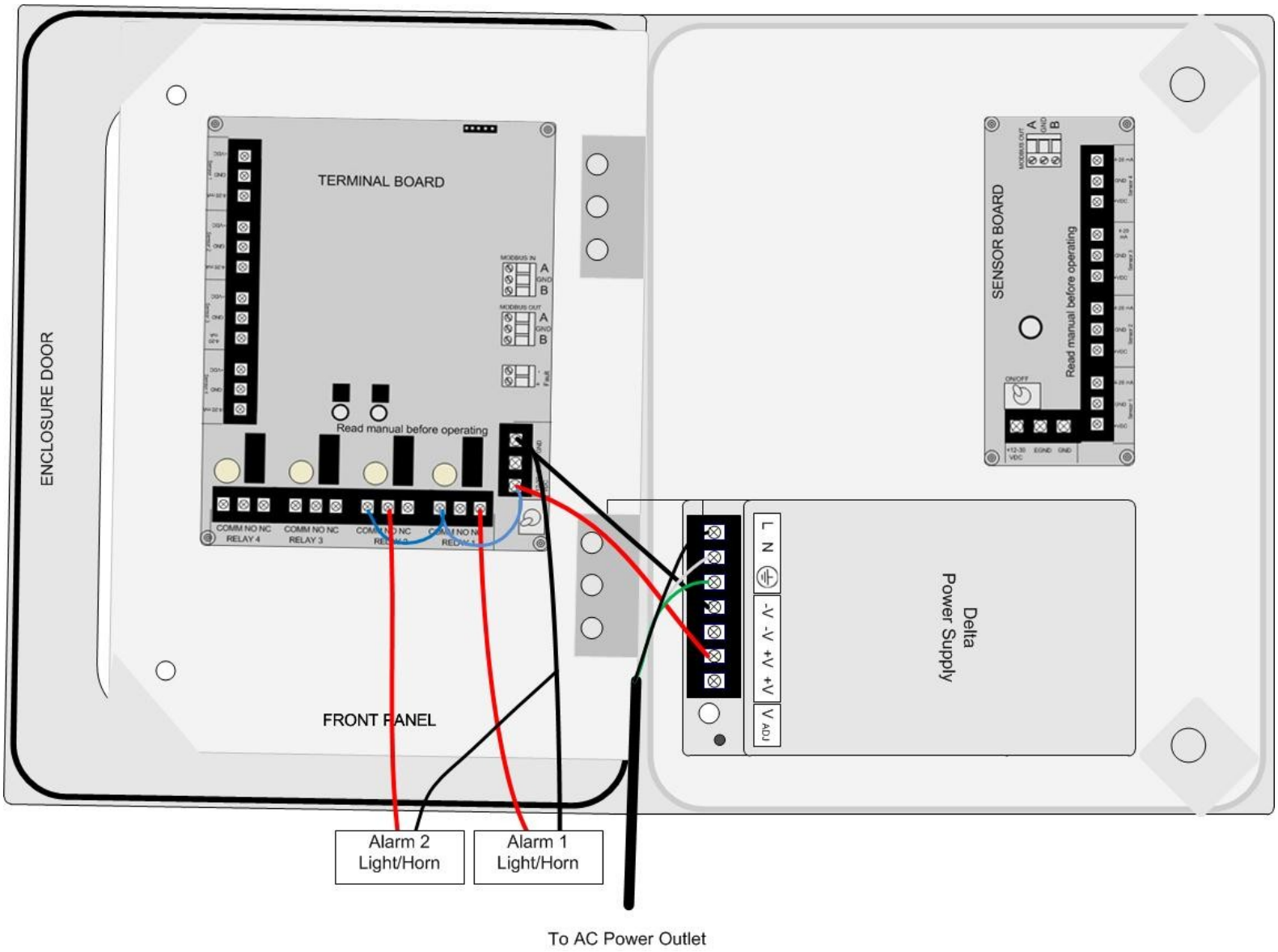


Connecting Relay 2

1. Locate the Relay 2 Terminal Block on the Terminal Board.

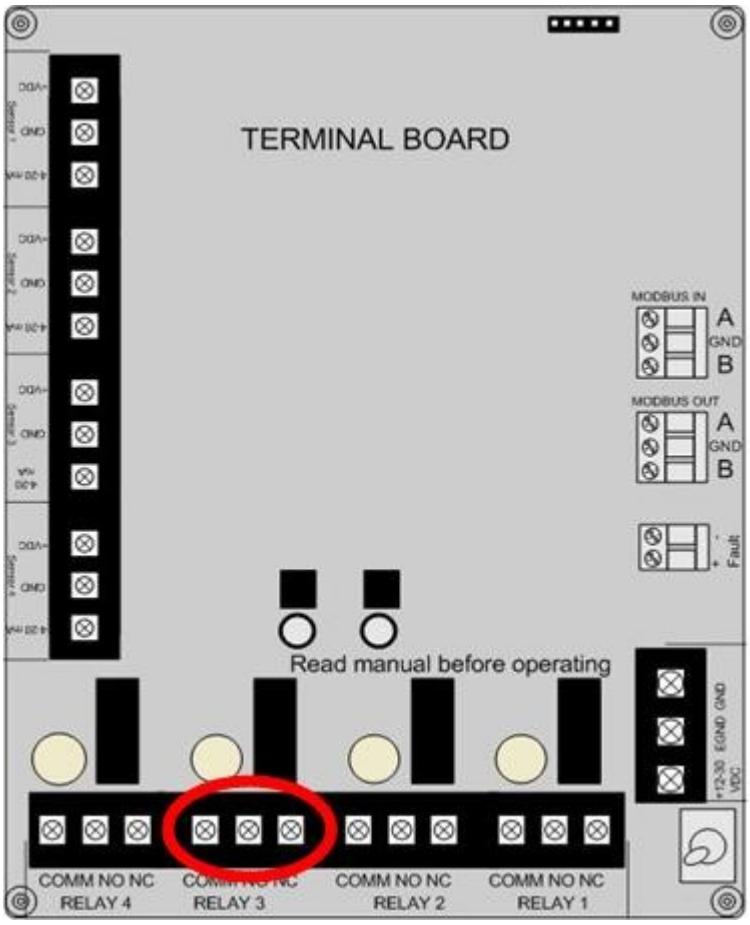


2. Connect the live wire (red) from the Relay 2 Alarm (light/horn) to the terminal labeled “NO” (or “NC”) on the Relay 2 Terminal Block.
3. Connect the neutral wire (black) from the Relay 2 Alarm (light/horn) to the terminal labeled “GND” on the DC Power Supply Terminal Block.
4. Connect a jumper wire (blue) from the terminal labeled “COM” on the Relay 1 terminal block to the terminal labeled “COM” on the Relay 2 terminal block.

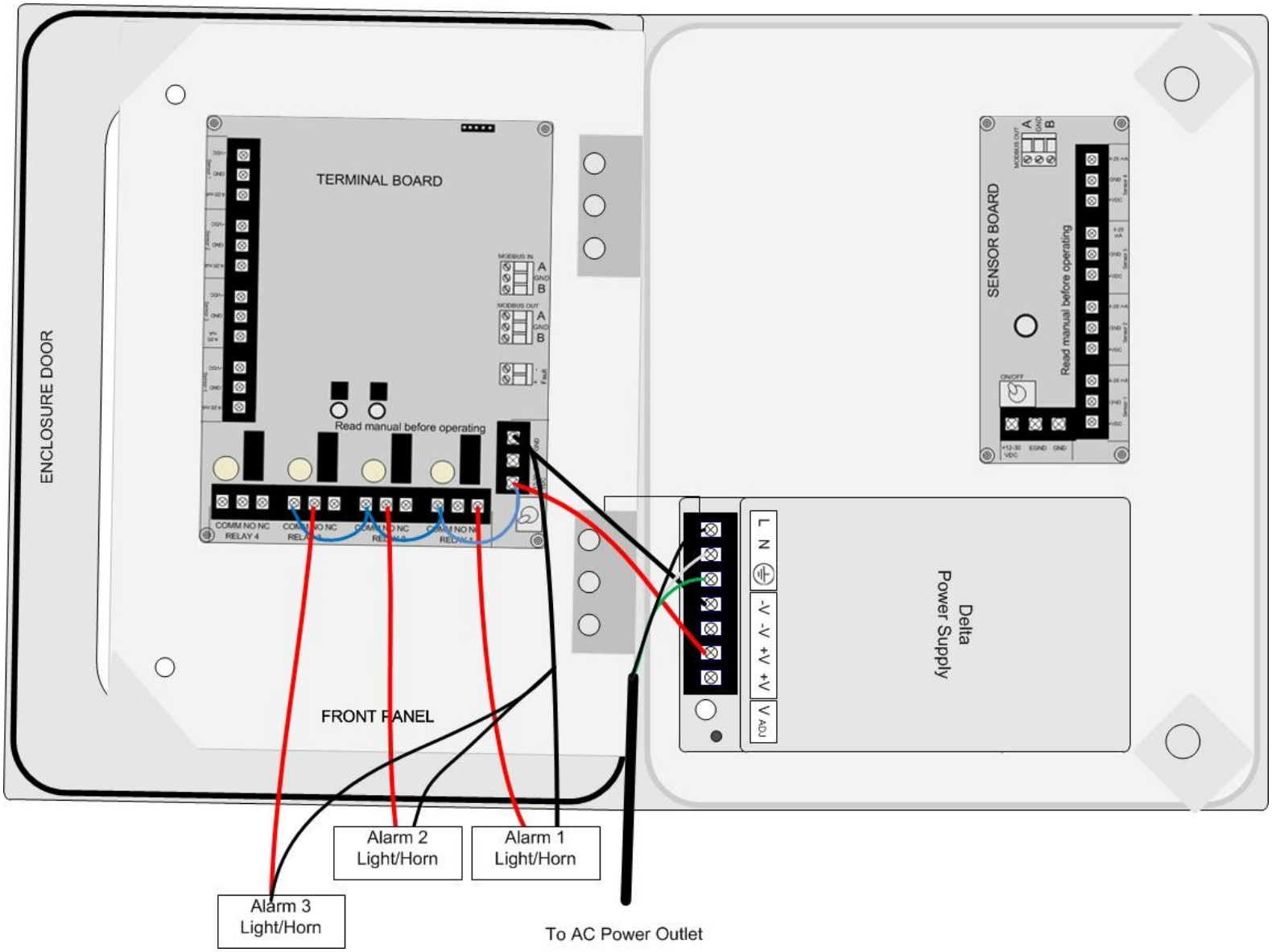


Connecting Relay 3

1. Locate the Relay 3 Terminal Block on the Terminal Board.

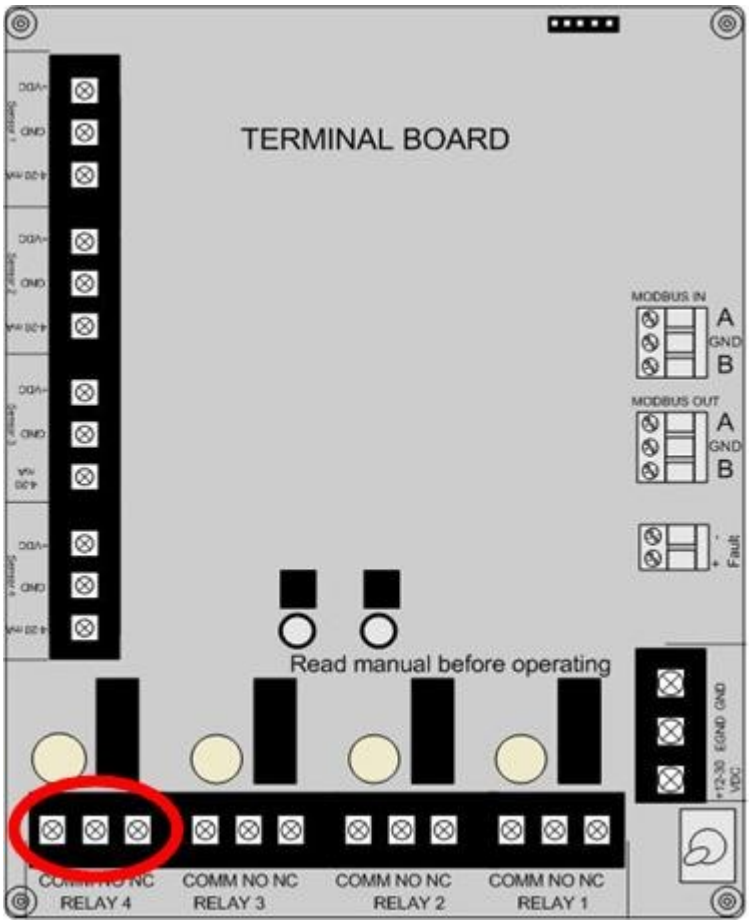


2. Connect the live wire (red) from the Relay 3 Alarm (light/horn) to the terminal labeled “NO” (or “NC”) on the Relay 3 Terminal Block.
3. Connect the neutral wire (black) from the Relay 3 Alarm (light/horn) to the terminal labeled “GND” on the DC Power Supply Terminal Block.
4. Connect a jumper wire (blue) from the terminal labeled “COM” on the Relay 2 terminal block to the terminal labeled “COM” on the Relay 3 terminal block.

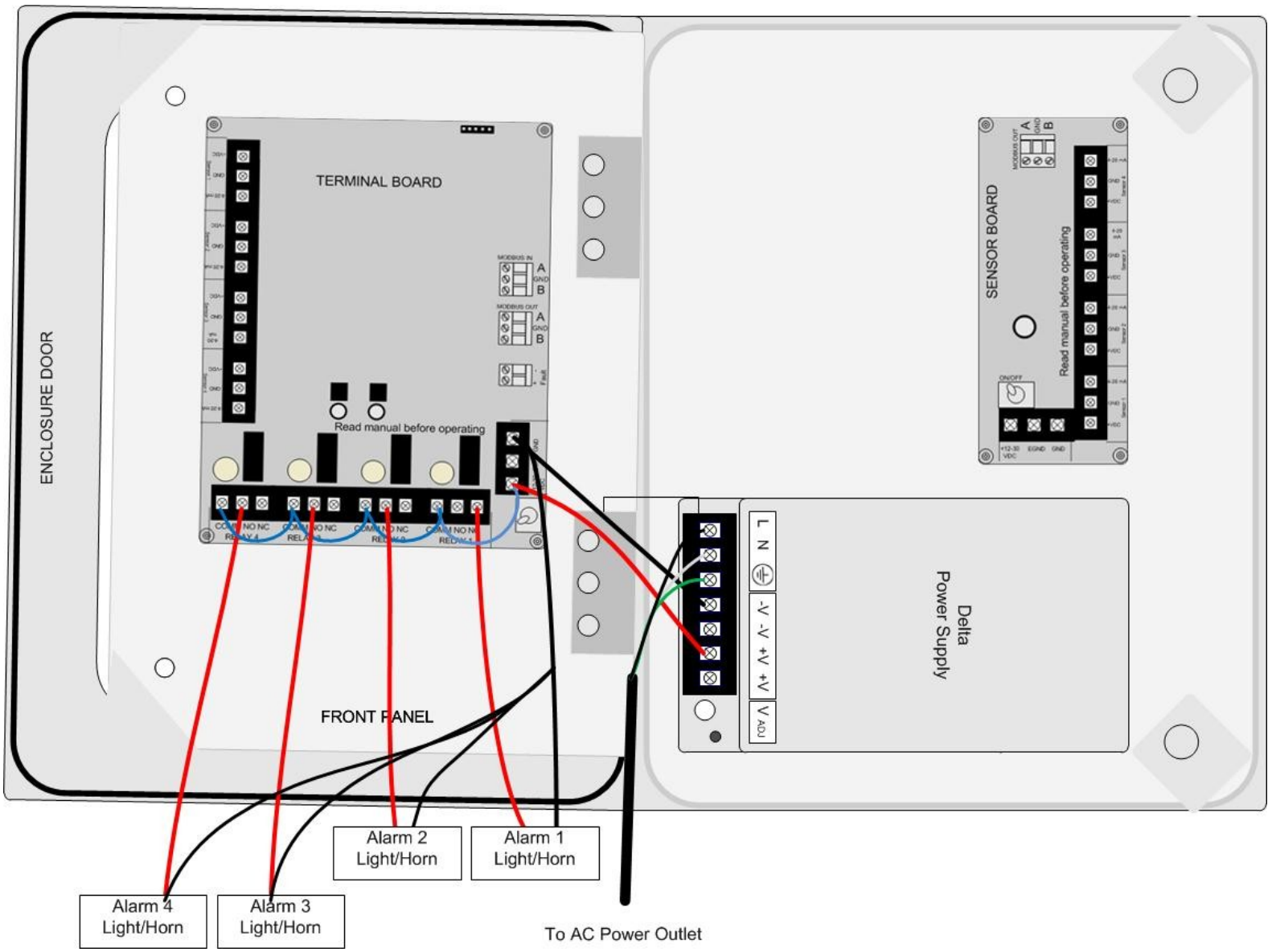


Connecting Relay 4

1. Locate the Relay 4 Terminal Block on the Terminal Board.



2. Connect the live wire (red) from the Relay 4 Alarm (light/horn) to the terminal labeled “NO” (or “NC”) on the Relay 4 Terminal Block.
3. Connect the neutral wire (black) from the Relay 4 Alarm (light/horn) to the terminal labeled “GND” on the DC Power Supply Terminal Block.
4. Connect a jumper wire (blue) from the terminal labeled “COM” on the Relay 3 terminal block to the terminal labeled “COM” on the Relay 4 terminal block.



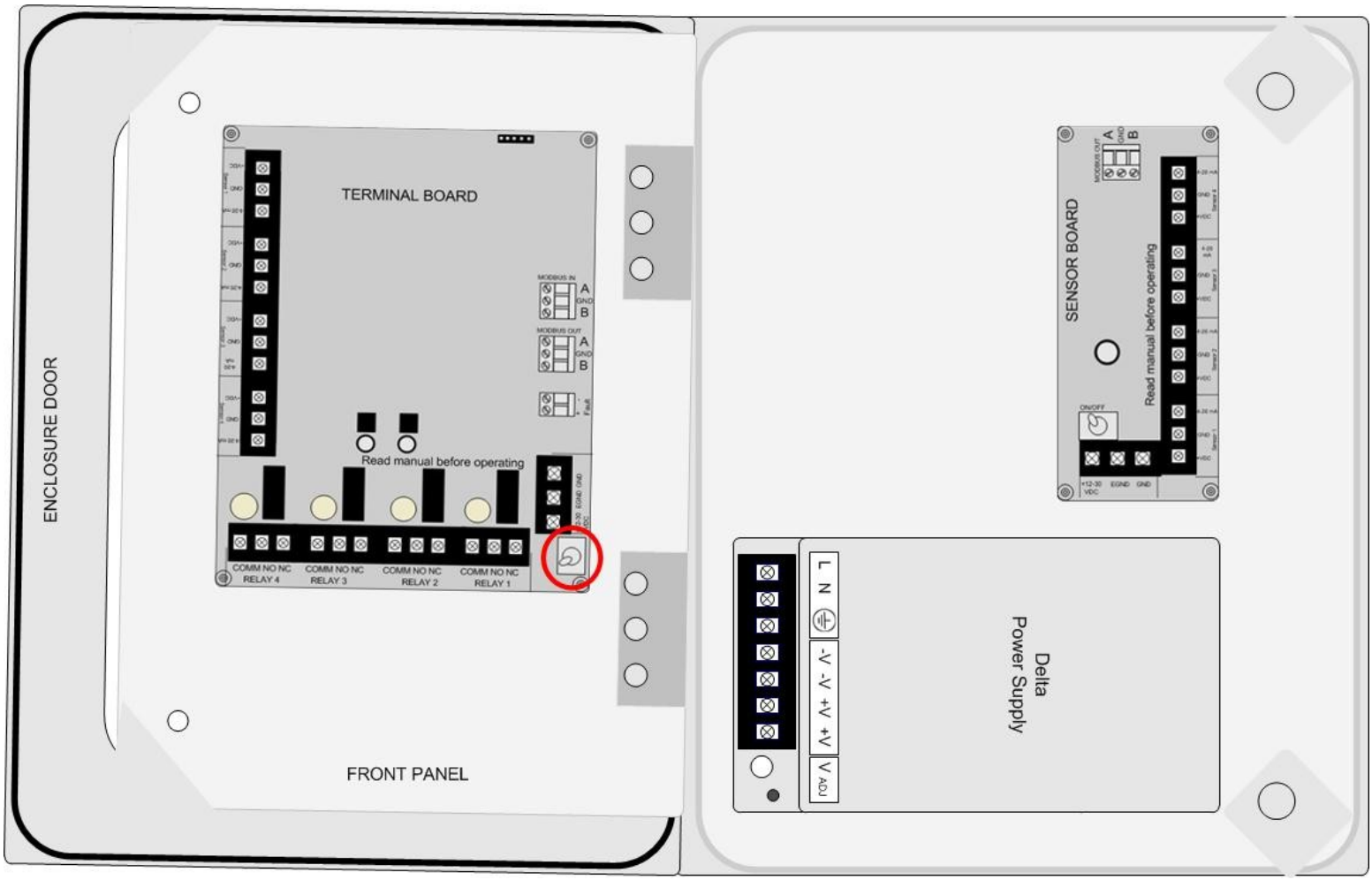
Power On/Off

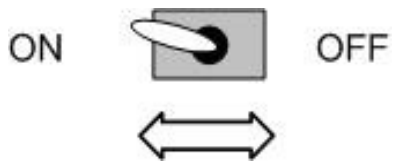
Powering on the device activates its functions. When powered on, the device is fully functional and access to system and settings menus is allowed.

CAUTION: THE INTERNAL COMPONENTS CAN BE STATIC SENSITIVE. USE CAUTION WHEN OPENING THE ENCLOSURE AND HANDLING INTERNAL COMPONENTS.

NOTE: Once power is supplied to the OI-7480—by being plugged into an AC outlet or by being wired to a DC power supply—the display screen and LEDs will illuminate.

To cycle the Terminal Board power, flip the Power Switch (located on the lower right side of the Terminal Board) to the OFF (and then ON) position.





Channel Setup (Channels 1-8 or (1-12))

This feature is used to setup: Channel Selection, Channel On/Off, Sensor Type, Scale, # of Decimals, and Relay Setup (On/Off, Low/High, Value, Latching/Unlatching)—for each of the channels that the device is monitoring. System Information is also viewable in Setup Mode.

NOTE: Each channel must be setup individually for each sensor.

NOTE: To Exit Channel Setup at any time, press ESC.

Entering Setup Mode

1. Open the enclosure box.
2. Press and hold *MENU* and *ADD* for 6 to 8 seconds to enter Setup Mode.

Channel Selection

1. Once in Setup Mode, press *ADD* (increase) or *SUB* (decrease) to select the desired channel to be setup (1-8 (or 12)).

   NOTE: To view system information, press ADD (or SUB) if greater than "8" (or "12"), or less than "1".

2. Once the desire channel is selected press *MENU* (Next), then proceed to the next step.

Channel On/Off

1. After the Channel Selection has been made, press *ADD* or *SUB* to change the state of the channel to On or Off.
2. Once the desired setting is selected press *MENU* (Next), then proceed to the next step.

NOTE: All channels must be setup as On/Off before the information screen is available. If the channel is set to "On", additional settings will be available to set. If the channel is set to "Off", there will be no additional settings available for that channel, and pressing MENU will allow the user to move to the next channel to be set to On/Off. Once all channels are set, press MENU once more to view System Information (see page 56).

Settings for Channels Designated as "On"

The following settings will be available for channels that have been set to "On".

Set Sensor Type

1. Press *ADD* or *SUB* to specify what gas the sensor will see. Options include: H2S, SO2, O2, CO, Cl2, CO2, LEL, VOC, FEET, HCl, NH3, H2, or None.

   NOTE: Selecting the gas type will preset the scale and relay settings to common values, which are also user-settable in the following pages.

2. Press *MENU* (Next) to continue to the next menu option.

Set Scale

1. Press *ADD* (increase) or *SUB* (decrease) to manipulate the sensor's scale (1-65,000).

2. Press *MENU* (Next) to continue to the next menu option.

Set # of Decimals (wired only)

1. Press *ADD* (increase) or *SUB* (decrease) to manipulate the display screen's number of decimals. The number of decimals available to be set will depend on the previously set scale.

    - 3 decimals: Scale 1 or less
    - 2 decimals: Scale 10 or less
    - 1 decimal: Scale 100 or less
    - 0 decimal: Scale greater than 100 (the Set # of Decimals option will not show up in this case)

2. Press MENU (Next) to continue to the next menu option.

Individual Relay Setup

NOTE: Repeat the Individual Relay Setup process for each relay—and each channel—to be setup.

Relay On/Off

1. Press *ADD* or *SUB* to manipulate the relay's On/Off status.

2. Press *MENU* (Next) to continue to the next menu option.

Relay Rises/Falls

1. Press *ADD* or *SUB* to manipulate the relay's Rises/Falls status.

2. Press *MENU* (next) to continue to the next menu option.

Relay Value

1. Press *ADD* (increase) or *SUB* (decrease) to manipulate the relay threshold value (1-65,000).

NOTE: If a decimal was previously selected, that will also be user-settable.

2. Press *MENU* (Next) to continue to the next menu option.

Relay Latching/Unlatching

1. Press *ADD* or *SUB* to manipulate the relay's Latching/Unlatching status.

2. Press *MENU* (Next) to continue to the next option—setting up the next consecutive relay.

Once all four relays have been setup, the display screen will show the following:

3. Based on the specific application, choose <u>one</u> of the following steps to complete:

   - Press *MENU* (Next) to setup the next channel
   - Press *ADD* (Yes) to duplicate the settings to all consecutive channels—and *ADD* (Yes) again to confirm the operation
   - Continue to the next section, "Exiting the Basic Configuration Menu"

View System Information

After the eighth (or 12th) channel is set, press *MENU* to view the system's information, including the:

- Build Date (Example: 07/11/2011)
- Serial # (Example: L00590)
- Unit Type: OI-7480-8 (or OI-7480-12)
- Version (Example: 3.0)
- Build (Example: 0)

Exiting the Basic Configuration Menu

Complete the following steps to exit the Basic Configuration Menu at any time.

1. Press *ESC* to exit the Basic Configuration Menu.

NOTE: After the eighth channel is set—and if MENU is pressed instead of ESC—there is an information-update on the display screen indicating the build date, serial #, unit type, version, and build of the OI-7480.

2. Close the enclosure box**.**
3. Screw in the thumb-screws.
4. Clamp down the enclosure latches.

NOTE: The monitor will automatically exit Chanbel Setup after 15 minutes.

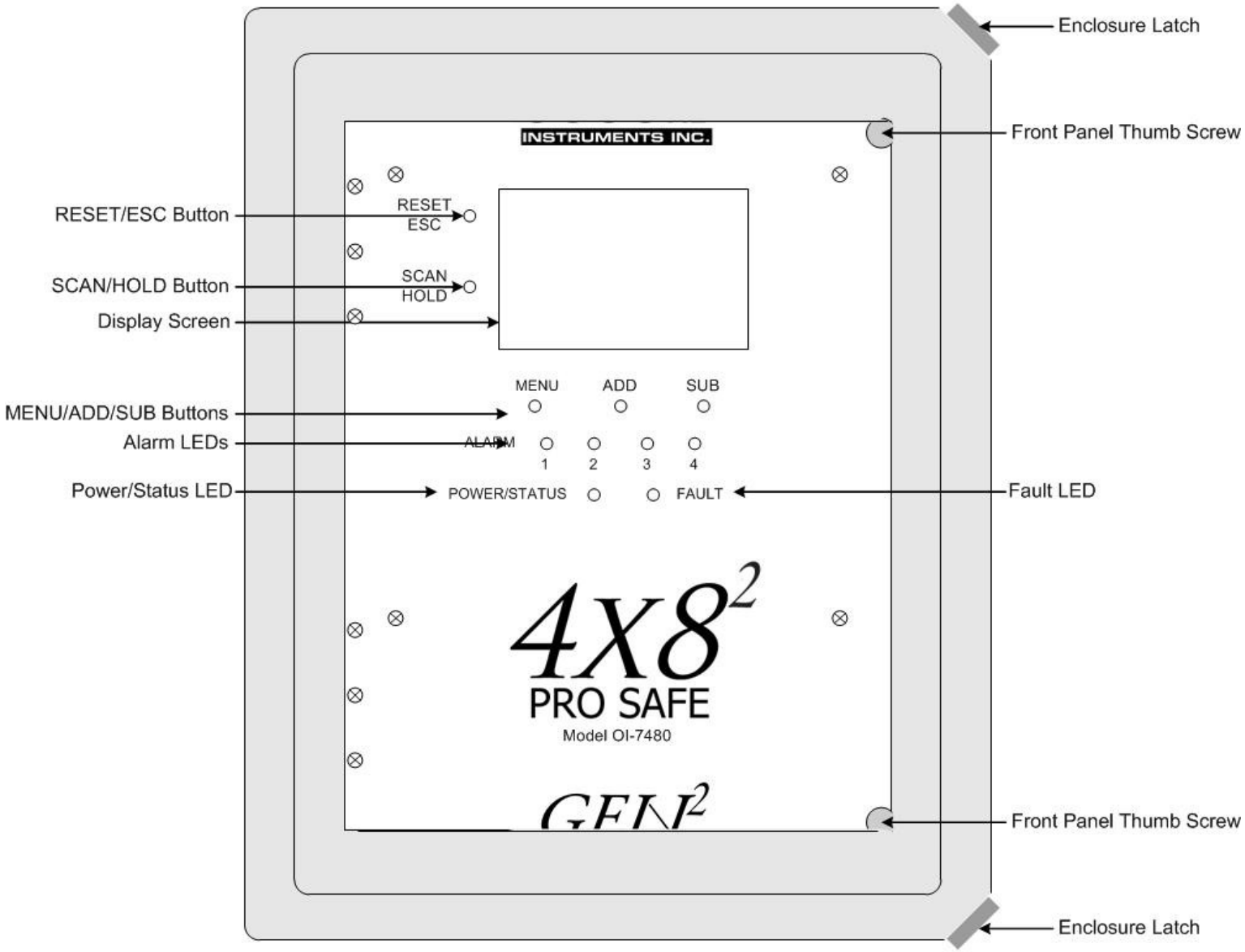
CHANNEL SETUP MUST BE COMPLETED INDIVIDUALLY FOR *EACH* CHANNEL. REPEAT THE CHANNEL SETUP INSTRUCTIONS FOR EACH CHANNEL.

Advanced Configuration Menu (Global Settings)

The Advanced Configuration Menu is used to manipulate global settings. To setup individual channels, use the Channel Configuration Menu.

Entering Advanced Configuration Menu

1. Open the enclosure box to expose the Front Panel.



2. Cycle the unit's power (turn OFF, then ON). For instructions on how to cycle the unit's power, refer to the "Power On/Off" section of this manual (see page 44).
3. When the Otis Logo is shown on the Display Screen, press *MENU*.

Adjusting LCD Contrast

1. Press *ADD* (increase) or *SUB* (decrease) to manipulate the LCD contrast.

2. Press *MENU* to continue to the next Advanced Configuration Menu option.

Restore Factory Default Settings

Press *ADD* or *SUB* (Yes/No—as indicated on the display screen) to set the unit back to the factory's default settings. To leave the settings as they are, press *MENU* (Next).

Factory settings are:

- Channels 1-8 (or 12) “On”
- Relays set at “10, 15, 20 and 25”
- All relays set to “Unlatching” / “High”
- Baud set at 9600
- Address set at 1
- Gas Type set at H2S
- Scale set at 100
- # of Decimals set at 0

Fault Relay Setup: Relay 4 Fault Relay

Press *ADD* or *SUB* (Yes/No—as indicated on the display screen) to setup Relay 4 as the Fault Relay. To leave the setting as it is, press *MENU* (Next).

NOTE: With this feature enabled, if any Fault occurs (on any channel) the Fault Relay is engaged. In addition, Relay 4 is removed from all setup options.

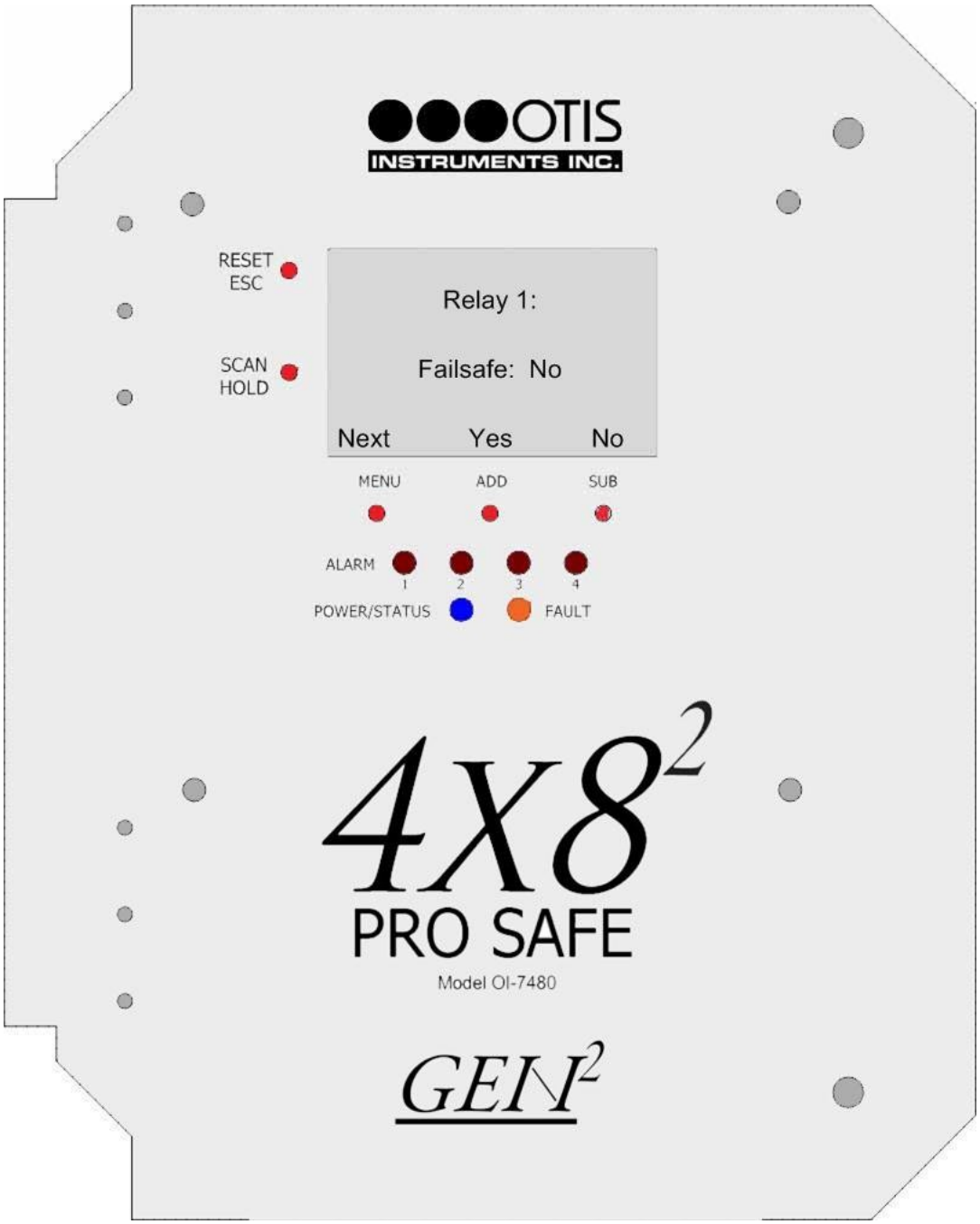
Fault Relay Setup: Latching or Unlatching

NOTE: This option will only appear if "Yes" is chosen on the previous option, setting Relay 4 as a Fault Relay.

Press *ADD* or *SUB* (Yes/No—as indicated on the display screen) to set Relay 4 as Latching or Unlatching. To leave the setting as it is, press *MENU* (Next).

Fault Relay Setup: Relay Failsafe Setting

1. Press *ADD* or *SUB* (Yes/No—as indicated on the display screen) to setup Relay 1 as failsafe (or not failsafe). To leave the setting as it is, press *MENU* (Next).
2. Repeat the instructions in the previous step for Relays 2, 3, and 4.



Fault Relay Setup: Fault Terminal Failsafe Setting

Press *ADD* or *SUB* (Yes/No—as indicated on the display screen) to setup the Fault terminal as failsafe (or not failsafe). To leave the setting as it is, press *MENU* (Next).

Modbus Setup: Modbus Address

2. Press *ADD* (increase) or *SUB* (decrease) to manipulate the global Modbus Address setting (between 1 and 247).

3. Press *MENU* (Next) to continue to the next Advanced Configuration Menu option.

Modbus Setup: Baud Setting

1. Press *ADD* (increase) or *SUB* (decrease) to manipulate the global Baud setting to: 4800, 9600, or 19200.

   NOTE: Baud default is 9600.

2. Press *MENU* (Next) to exit the Advanced Configuration Menu and return to Normal Operating Mode.

Exiting the Advanced Configuration Menu

Complete the following steps to exit the Advanced Configuration Menu at any time.

1. Press *ESC* to exit the Advanced Configuration Menu.

2. Close the enclosure box.
3. Clamp down the enclosure latches.

Calibration Mode

Entering Calibration Mode disables the relays and allows the sensors to be calibrated without triggering alarms. Once in Calibration Mode, the unit will remain in this state for two hours—unless *RESET/ESC* is pressed.

1. Open the enclosure box to expose the Front Panel.
2. To enter Calibration Mode, press and hold *MENU* for five seconds.

3. Once in Calibration Mode, the display screen will show “CAL” beside the “ALM” identifier.

4. To return to Normal Operating Mode, press *RESET/ESC*.

NOTE: If RESET/ESC is not pressed, the unit will remain in Calibration Mode for two hours.

5. Close the enclosure box.
6. Clamp down the enclosure latches.

Relay Test Mode

Relay Test Mode activates each relay, and can be used to determine whether or not the relays and attached alarms are functioning properly.

1. Open the enclosure box to expose the Front Panel.

2. To enter Relay Test Mode, press and hold *RESET*.

3. Relay 1 will activate after five seconds, Relay 2 will activate after an additional five seconds, etc.

4. To return to Normal Operating Mode, continue holding—or release and press—*RESET/ESC*.
5. Close the enclosure box.
6. Clamp down the enclosure latches.

Holding Channels

This feature can be used to monitor a select channel, rather than the continuous scanning of channels while in Normal Operating Mode.

1. Open the enclosure box.
2. Locate *HOLD* on the Front Panel.

3. Press *HOLD* once to "freeze" the channel scan sequence.
4. Press *ESC* to return to Normal Operating Mode.

NOTE: The device will automatically return to Normal Operating Mode after five minutes of inactivity.

5. Close the enclosure box.
6. Clamp down the enclosure latches.

APPENDIX A: Additional Product Information

LED Indication Key (Alarms, Faults, and Power/Status)

There are four red LEDs, one orange LED, and one tricolored LED (only blue and red will be used).

LED	Color / Status	Description
ALARM 1	off	no alarm condition has occurred on relay 1 since the last reset or power up
	solid red	an alarm condition is currently happening on relay 1
	blinking red	an alarm condition has occurred on relay 1, but condition has now gone
ALARM 2	off	no alarm condition has occurred on relay 2 since the last reset or power up
	solid red	an alarm condition is currently happening on relay 2
	blinking red	an alarm condition has occurred on relay 2, but condition has now gone
ALARM 3	off	no alarm condition has occurred on relay 3 since the last reset or power up
	solid red	an alarm condition is currently happening on relay 3
	blinking red	an alarm condition has occurred on relay 3, but condition has now gone
ALARM 4	off	no alarm condition has occurred on relay 4 since the last reset or power up
	solid red	an alarm condition is currently happening on relay 4
	blinking red	an alarm condition has occurred on relay 4, but condition has now gone
Fault	off	no Fault condition has occurred on any sensor unit sense the last reset or power up
	solid orange	a Fault condition is currently happening on at least one sensor unit
POWER/STATUS	red	a Fault condition is occurring on the monitor
	blue	Normal Operating Mode

Fault 10 (F10)

Reason: When using a monitor with wired sensor assemblies attached, the sensor is not communicating with the monitor. The problem could be that the sensor assembly is not connected properly, or there may be board issues with the sensor or monitor.

Solution: Check all connections. If there is a 4-20mA connection, use a current meter inline to see if the current is correct.

Fault 13 (F13)

Reason: When using a monitor with a 4-20mA wired connection, F13 may appear when the sensor assembly is in a fault condition.

Solution: Since it is 4-20mA, the monitor does not know the exact fault condition. Therefore, check the sensor assembly to see what the fault is and then consult other items in this chart for a solution.

APPENDIX B: 4-20mA Loop Current Introduction

4-20mA Current Loop Introduction

This appendix in only an introduction. The information should serve as a brief overview of 4-20mA, and should not be considered a complete reference for proper implementation or use.

Prior knowledge of industry standards pertaining to 4-20mA specifically, and other aspects of electronics, are assumed to be known by the technician. For proper connection to a monitor or PLC, refer to the manufacturer's specific Operation Manual or instructions for that particular piece of hardware.

Overview

4-20mA ("four to twenty"), is an analog electrical transmission standard used by Otis Instruments for some of its ambient gas sensors and monitors. The signal is a current loop where 4mA represents zero percent signal, and 20mA represents 100 percent signal (full scale of the sensor assembly). The relationship between the current loop and the gas value is linear.

The 4mA allows the receiving monitor/PLC to distinguish between a zero signal, a broken wire, or a dead instrument. Benefits of 4-20mA convention are that it is: an industry standard, low-cost to implement, can reject some forms of electrical noise, and the signal does not change value around the "loop" (as apposed to a voltage). Only one current level can be present at any time; each device which operates via 4-20mA must to wired directly to the monitoring device.

Calculations

$$I_{(4-20)} = \left(\frac{(16 \cdot value)}{scale} \right) + 4$$

$I_{(4-20)}$: current of loop, measured in mA
value : PPM or %, of gas concentration
scale : full scale of sensor (see below for usual ranges)

Target Gas	Range	Temp.
H2S = Hydrogen Sulphide	0-100 ppm	-20 to 50C
O2 = Oxygen	0-25 %	-30 to 55C
SO2 = Sulfur Dioxide	0-20 ppm	-20 to 50C
CL2 = Chlorine	0-10 ppm	-20 to 50C
H2 = Hydrogen	0-4 %	-20 to 40C
NH3 = Ammonia	0-100 ppm	-40 to 40C
CO = Carbon Monoxide	0-999 ppm	-20 to 50C
F2 = Florine	0-1 ppm	-10 to 40C
HF = Hydrogen Fluoride	0-10 ppm	-10 to 40C
H2S-2 = Hydrogen Sulphide (extended temp)	0-100 ppm	-40 to 50C

Table – Gas Sensor Details

Actual ranges may vary with our product. If unsure, confirm with the actual gas sensor assembly distributor, Otis Instruments sales representative, or call the main Otis Instruments office for more details.

Measuring Current

If the value measured is 0mA, then: the loop wires are broken, the sensor assembly is not powered up, the sensor assembly is malfunctioning, or the monitor is malfunctioning. A DMM (digital multi meter) or Current Meter may be used to test a 4-20mA signal. Place the DMM or Current Meter in line with the loop and measure current. The DMM/Current Meter may be used in conjunction with the normal monitoring device.

APPENDIX C: Modbus Information

The complete OI-7480 Modbus Register Map may be downloaded from the “Service” section of our website (www.otisinstruments.com).

Modbus Terms

Modbus: RTU
Setting: Baud Rate = 9600
Data Bits: 8
Parity: None
Stop Bits: 1
Time Out: 1000 ms
Device Address: 1-247
Data Type: Holding Registers
Start Address: The first register the user would like to view (must be between 1-255)
Length: Depends on the number of addresses the user would like to view
Scan Rate:1000 ms
Data Format: Hex, Decimal, Float

APPENDIX D: Operation of Relays

Relays are offered in certain Otis Instruments devices for the purpose of activating alarms, horns, and other equipment upon the detection of gas.

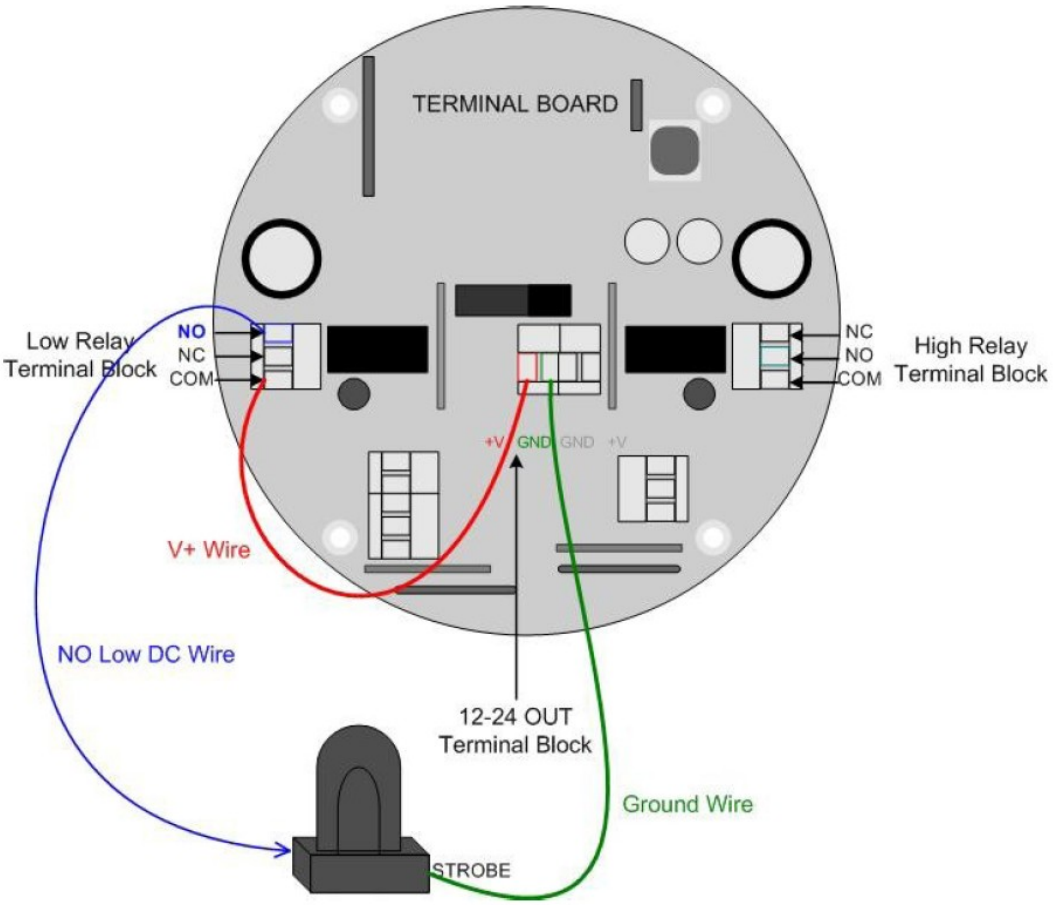
There are two key terms to remember when using relays.

- Deactivated: refers to a relay is in its normal state
- Activated: refers to a relay in the event of an alarm

"Dry" Contact and "Wet" Contact Relays

In regard to power, there are two types of relays.

1. Dry Contact Relays: This type of relay does not provide power to the equipment attached to it (i.e. if there is a light hooked up to this type of relay, it must be powered by another source).
2. Wet Contact Relays: This type of relay does provide power to the equipment attached to it (i.e. if a light was hooked up to this type of relay, it would be powered by the relay). When using a Wet Contact Relay, power should run through the "COMM" terminal to the end equipment.



Drawing 1: "Dry" Contact Relay Configured as a "Wet" Contact

Both the Wet Contact and Dry Contact Relays can be further broken into their connection type.

Normally Open and Normally Closed Relays

There are two different connection types used in Otis Instruments products:

1. Normally Open (NO): when the relay is deactivated, it is "open". When a signal is received to activate the relay, the connection will "close"—providing a closed circuit. This will allow whatever device that is connected (strobe, horn, etc) to be activated (turned on) when a signal is sent to the relay to activate it. This is the most common configuration. It can be used to set off an alarm or strobe light to indicate that there is an issue.
2. Normally Closed (NC): when the relay is deactivated, it is "closed". When a signal is received to activate the relay, the connection will "open"—providing an open circuit. This will allow whatever device that is connected to the relay to be deactivated (turned off) when a signal is sent to the relay to activate it. Ex: If there was a powered light connected to this relay to indicate that the system was up and running, when the signal to activate the relay is sent the light will turn off. Therefore, the user is made aware that there is an issue.

If a light was connected in the NO configuration with the default setting (not failsafe), then the light would not turn on in the event of a power loss. If the light was used in the NC configuration, the light would stay lit (provided the light is powered by a different source).

Failsafe Relays

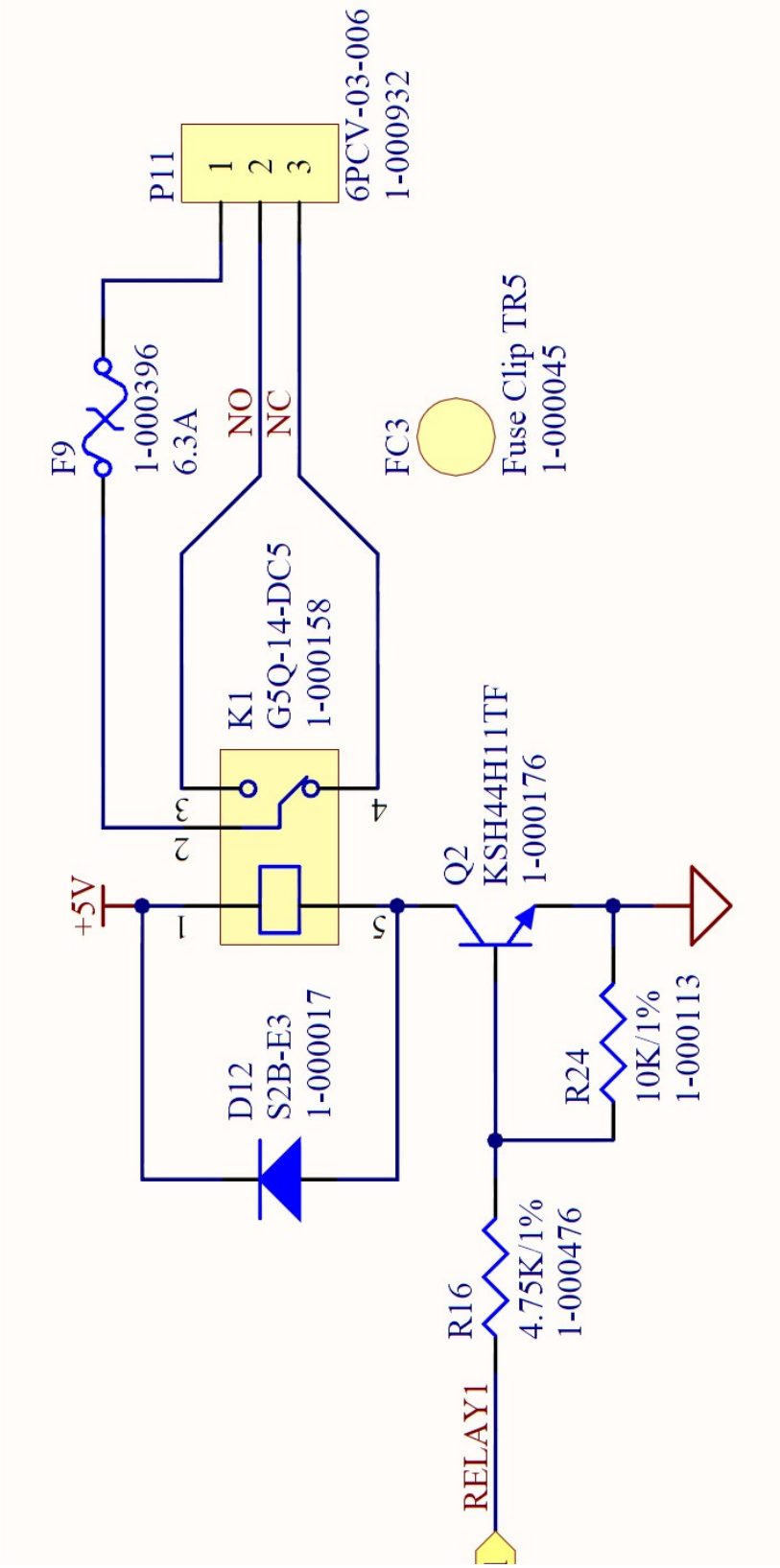
There is an option in Otis Instruments devices to set the relays as "failsafe" or "not failsafe". This refers to what type of signal is being sent through the relay, which can be a "high" or a "low" (on or off). The default setting is "not failsafe", which means that the devices will operate as described above.

Failsafe mode was introduced to be able to show a change in state (or alarm) in the event of a power loss. If the NO configuration was used in failsafe mode, it could indicate that there was a power loss by turning off of a light.

If the "failsafe" setting is used, the relays will behave as follows:

1. Normally Open (NO): when the relay is deactivated, it is "closed". When a signal is received to activate the relay, the connection will "open"—leaving the circuit open. This means that if a light was configured to this connection in failsafe mode, it would be powered on until the relay activated—then the light would go out. This can be used to alert the user of an issue.
2. Normally Closed (NC): when the relay is deactivated, it is "open". When a signal is received to activate the relay, the connection will "close"—providing an closed circuit. For instance, this configuration can be used to set off an alarm or strobe light to indicate that there is an issue.

If a light was connected in the NO configuration with the failsafe setting, then the light would not stay lit in the event of a power loss (provided the light has a separate power source). If the light was used in the NC configuration, then the light would turn on (provided the light has a separate power source).



Drawing 2: Schematic of Relay Circuit

Specifications

Operating Voltage:	12-35 VDC, 110/240 VAC
Input Signal:	4-20mA
Output (Internal Alarm Power):	+12-35 VDC (Fault Indicator) RS-485 Modbus
Current Draw:	250mA at 12 VDC (monitor only); 3 Watts max
Channels:	8 or 12
Gases:	All that are supported by Otis sensor assemblies
Display:	Graphical LCD (160x104), transflective, sunlight readable, LED backlight
Relays:	Four Dry Contact (5 Amp) w/ 4 Amp Fuses
Protection:	Power EMI filter, surge suppression, 4-20mA and RS-485 surge suppression
Enclosure:	Stahlin fiberglass with clear window
Enclosure Dimensions:	12” x 10” x 6”
Enclosure Mounting:	Wall Mount
Certifications:	NEMA 4 (enclosure only)
Warranty:	Hardware: One year (limited)

Hardware

Otis Instruments, Inc. (Manufacturer) warrants its products to be free of defects in workmanship and materials—under normal use and service—from the date of purchase from the manufacturer or from the product's authorized reseller. The hardware for this device is under a one year limited warranty.

The manufacturer is not liable (under this warranty) if its testing and examination disclose that the alleged defect in the product does not exist or was caused by the purchaser's (or any third party's) misuse, neglect, or improper installation, testing or calibrations. Any unauthorized attempt to repair or modify the product, or any other cause of damage beyond the range of the intended use, including damage by fire, lightening, water damage or other hazard, voids liability of the manufacturer.

In the event that a product should fail to perform up to manufacturer specifications during the applicable warranty period, contact the product's authorized reseller or return the product directly to the manufacturer with a Return Material Authorization (RMA). This number will be assigned upon contacting customer service at 979.776.7700 or Otis@otisinstruments.com. The manufacturer will--at its option and expense--repair or replace the product, or deliver an equivalent product or part to the purchaser at no additional charge.

Any replaced or repaired product or part has either a 90-day warranty or the remainder of the initial warranty period (whichever is longer).

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