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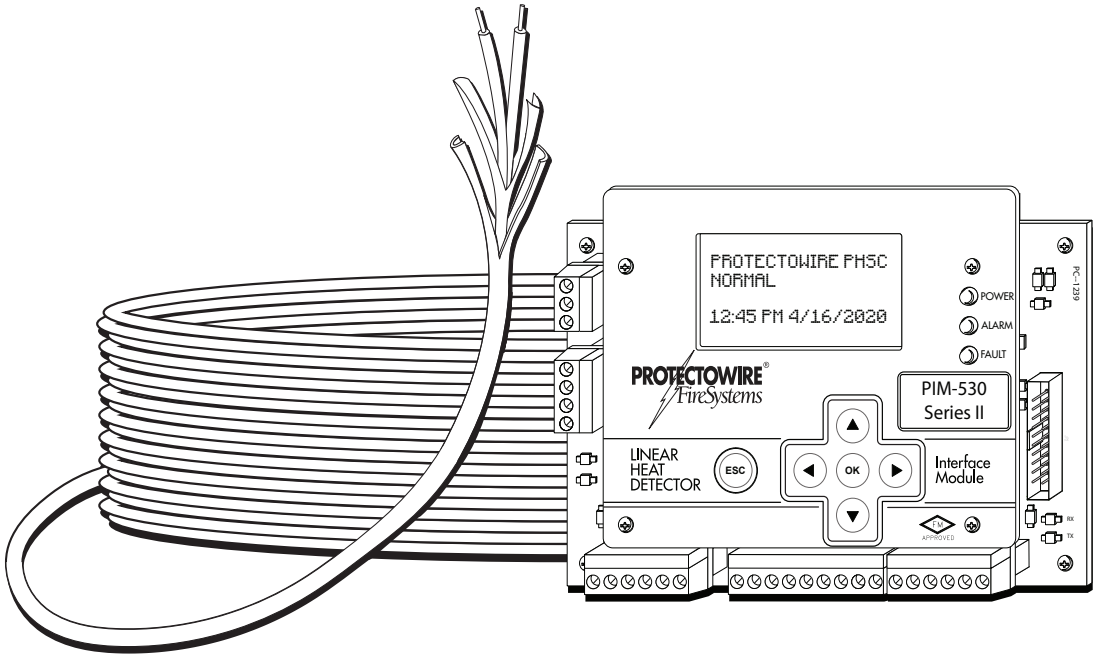
FireSystems



PIM-530 Series II Interface Module with Modbus Over RS-485 & Ground Fault Detection

Installation and Operation Guide

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PIM-530 Series 2 Interface Module
Installation and Operation Guide

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Modbus Over RS-485 Operation Guide

Introduction to Digital Linear Heat Detection Technology

Protectowire Linear Heat Detector is a sensor cable that detects heat anywhere along its length. The sensor cable is comprised of two steel conductors individually insulated with a heat sensitive polymer. The insulated conductors are twisted together to impose a spring pressure between them, then wrapped with a protective tape and finished with an outer jacket suitable for the environment in which the detector will be installed.

Invented and Patented by The Protectowire Co., Inc. in 1938, Digital Linear Heat Detectors have been utilized in the fire protection industry for over 80 years.

Ideally suited to industrial high risk hazards as well as many types of commercial applications, Protectowire Linear Heat Detector has unique advantages over other types of detectors, especially when difficult installation factors or severe environmental conditions are present.

How Digital Linear Heat Detection Works

To understand how Digital Linear Heat Detectors work it is important to have an understanding of how they are constructed.

Figure 1 - Digital linear heat detectors are constructed of a twisted pair of spring conductors coated with a thermoplastic coating designed to soften at a specific temperature. An initiating device circuit monitors a length of this detector installed in an area to be protected.

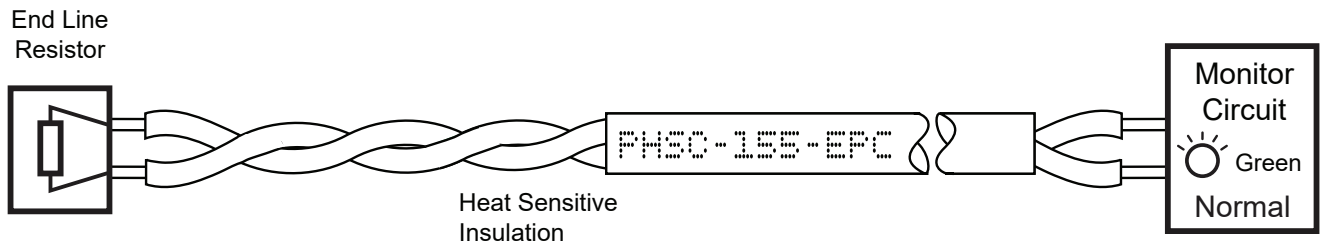


Figure - 1

Figure 2 - When the detector is exposed to heat at any point along its length the thermoplastic coating at that point softens and the spring pressure between conductors causes them to contact each other creating a short circuit. The short circuit is sensed by the initiation device circuit.

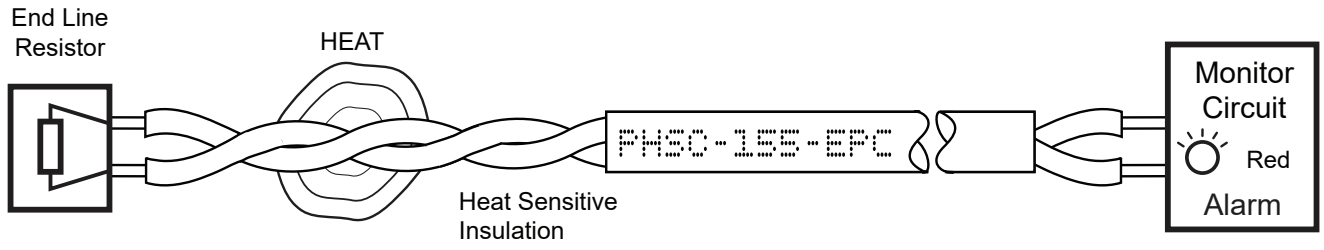
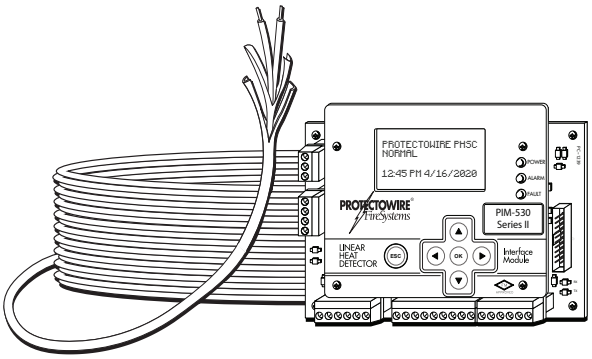


Figure - 2

The PIM-530 Series Interface Module



General Information

The Protectowire PIM-530 is a detection control module that is an interface between a main fire alarm control panel detection circuit or addressable node and Protectowire Type Digital Linear Heat Detector. The module provides one (1) supervised detection circuit that may be field wired for either Class A (Style D) or Class B (Style B) service. The alarm initiation circuit is capable of operating up to 6,560 feet (2000 meters) of Protectowire Digital Linear Heat Detector. The PIM-530 initiating circuit is designed to monitor Protectowire Digital Linear Heat Detector and also supports other types of normally open contact alarm initiation devices. Two wire smoke detectors which require initiating device circuit power to operate are **NOT** supported.

Description

The PIM-530 operates using standard initiating device circuit technology. When paired with Protectowire Digital Linear Heat Detectors, the module provides full supervision and alarm condition monitoring of the detector loop.

The PIM-530 is designed for easy installation and is available in an optional NEMA-4X (IP-66) rated enclosure for mounting outside of the host fire alarm control panel or remotely near the hazard to be protected. In order to ensure proper operation, each PIM-530 module requires clean, regulated & filtered resettable external power which is normally provided by the host fire alarm panel. Each module contains a green “Power-On” LED indicator, one (1) red “Alarm” LED indicator and one (1) yellow “Fault” LED indicator. One (1) set of Form C alarm contacts and one (1) set of Form C general fault contacts are provided to connect the unit to the host fire alarm panel. The module also provides two 4-20mA outputs one which allows monitoring of the module status and the other for alarm point location information.

In addition to the features listed above the standard version of the module, model PIM-530, provides a 4x20 LED back-lit LCD display and navigation buttons for access to a complete menu driven user interface.

Specifications

Electrical
- Power input - Regulated 12 to 24 VDC (+10% / -15%) @ 1.6 Watts
- Power Limited, on board surge and EMI protection device
- End of Line Resistor - 10K 1/2 Watt

Inputs
- One initiating device circuit capable of monitoring up to 6,560 Feet (2000 Meters) of Protectowire PHSC and PLR Digital Linear Heat Detectors. Minimum conductor size is 20AWG (0.812mm), or as require by local code.
- For intrinsically safe applications (Option I), the maximum detector length per zone is 6,560 feet (2000m) or less, as determined by the hazardous location calculation and application.

Ground Fault Detector
- Ground fault detection circuit capable of detecting high resistance faults from any IDC input leg to the PIM-530 power supply ground reference.

Environmental
- Ambient temperature range: -20° to 140°F (-29° to 60°C)
- Humidity: Max. 95% non-condensing

Visual Annunciation
- 128 x 64 Dot Matrix LED back-lit LCD display
- One green “Power” indicator
- One red “Alarm” indicator
- One yellow “Fault” indicator

Languages
- Menu selectable language options.
  Currently supports English, Russian, Simplified Chinese & Spanish

Status Relay Contacts (Rated 1 amp @ 24VDC Resistive Load)
- One (1) set of Form C (SPDT) Fault Contacts
- One (1) set of Form C (SPDT) Alarm Contacts

4-20mA Outputs
- One (1) 4-20mA Output for module status
- One (1) 4-20mA Output for Alarm Point Location Readings

RS-485 Serial Port
- One RS-485 Serial Port
- Half duplex (2-wire with common) 1/8th load
- Supports Modbus RTU V1.1b

Specifications - Continued

Board Assembly Dimensions

- 6” W x 4” H x 1.5” D (27.24cm x 10.16cm x 3.8cm)
- Mounting holes #4 holes at 5.5” (13.97cm) x 3.5” (8.89cm) spacing

Enclosure Option

- 8” H x 6” W x 4” D (20.32cm x 15.24cm x 10.16cm)
- Add 1.6” (4cm) to overall height for external mounting feet
- Clear full view door
- *NEMA 4X Rated (Rating UL listed only)
  (Closest IEC equivalent - IP66)
  Note: Option I (ISB) increases enclosure size to 10.5” H x 8.5” W x 4.5”D
  (26.67cm x 21.59cm x 11.43cm)

** Additional enclosures and sizes available. Consult factory.*

4-20mA Output Information

Description - The PIM-530 provides two 4-20mA outputs that allow for monitoring of the module status and active alarm point location reading. These outputs are intended for annunciation purposes only. Module monitoring is intended to be accomplished using the on board supplied dry contacts connected to a listed or approved fire detection control panel initiation device circuit.

For Class "A" wiring configuration the status output will also indicate which detector connection is currently being measured by the alarm point location meter. The measurement is alternated between connections approximately every 3 seconds with the status output indicating which input is currently being read.

The output levels are detailed below.

Status Output - 4-20mA Output Loop 1:
Loop Fault - 4mA or less
Open - 6mA
Normal - 10mA
Initiating Device Circuit Out Alarm - 17mA
Initiating Device Circuit Return Alarm - 19mA
Note: For systems employing an isolated power source for the 4-20mA loops; Module Power Failure will report at greater than or equal to 20mA.

Alarm Point Location Output - 4-20mA Output Loop 2:
4-20mA Full Scale corresponds to 0-8000 Feet
4mA = 0 Feet -20mA = 8000 Feet.
Normal standby (No event) = 0 Feet or 4mA

To calculate current to distance in feet use the following formula:
Current in mA = (I)
(I-4) / 0.002 = Distance in Feet

To convert to Meters:
Distance in Feet x 0.3048

Note: To insure status levels the total 4-20mA measurement loop resistance including feed cable, measurement device and load resistor must not exceed the values below.

Supply Voltage @ 12VDC - Total loop resistance not to exceed 300 Ohms
Supply Voltage @ 24VDC - Total loop resistance not to exceed 800 Ohms

Installation and Wiring

Mounting and Location - The PIM-530 is available as a complete module assembly for installation in a customer supplied enclosure or optionally provided pre-mounted in a factory supplied enclosure. Please refer to the specification section for enclosure information. When mounting the PIM-530 please follow the installation guidelines below.

The PIM-530 interface module shall be located in a clean, dry, vibration free environment and shall not be subjected to temperatures or humidity that exceeds the module's specifications.

The PIIM-530 should be mounted in an accessible location where the user interface can be viewed without obstruction.

The enclosure rating should meet or exceed that which is required for the installation environment. All enclosure penetrations should be via connectors and/or conduit hardware that meet or exceed the rating of the enclosure.

To utilize the maximum detector length capacity of the PIM-530, feed cable lengths should be kept to a minimum by locating the PIM-530 as close to the area of detection as possible.

Wiring Diagram

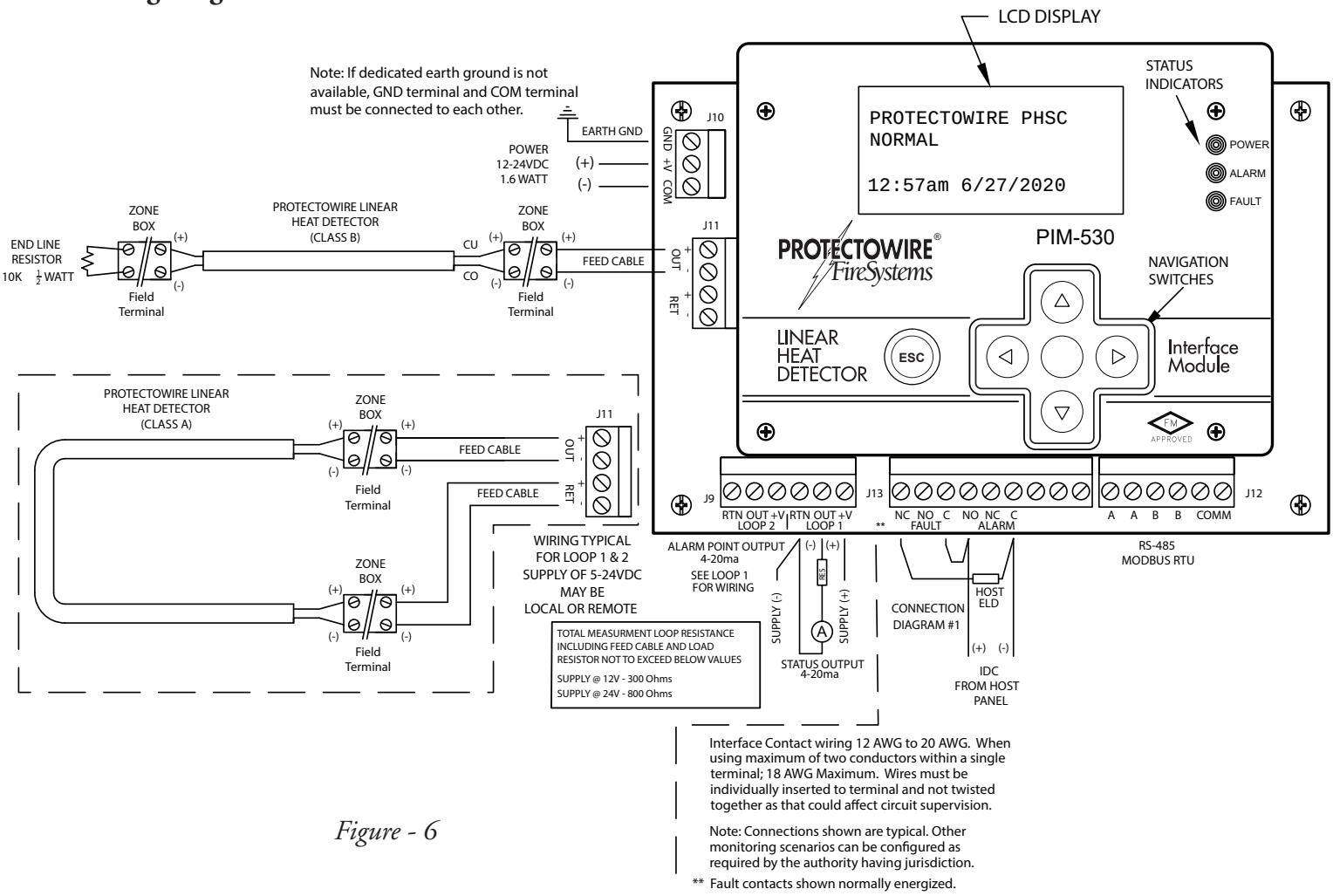


Figure - 6

Note: See last page of manual for full size view of this wiring diagram

Installation and Wiring - (continued)

Wire the system according to this manual using Figure 6 as reference. Wiring must be in accordance with applicable National and/or Local Electrical Fire Alarm Codes.

Detector Wiring - The PIM-530 provides one (1) supervised detection circuit that may be field wired for either Class A (Style D) or Class B (Style B)service. The alarm initiating circuit is capable of operating up to 6,560 feet (2000 meters) of Protectowire Digital Linear Heat Detector. The PIM-530 initiation circuit is designed to monitor Protectowire Digital Linear Heat Detector and also supports other types of normally open contact alarm initiating devices. Two wire smoke detectors which require initiating device circuit power to operate are not supported.

Step 1 - Remove the factory supplied 10K 1/2w end-of-line resistor (ELR) from terminal J11 Out (+) and (-). Retain this resistor for installation at the end of the detector run as shown in the Class "B" field wiring diagram (Figure 6). For Class "A" configuration the ELR shall be removed and retained for future troubleshooting.

Step 2 - Connect the Protectowire Linear Heat Detector to the PIM-530 interface module at terminal J11 as shown in the field wiring diagram (Figure 6) in either a Class "B" or Class "A" configuration

Wiring Terminations - All termination and splices in the detector loop must be made utilizing Protectowire recommended terminals. Only zone boxes and splicing connectors specifically recommended by The Protectowire Co., Inc. shall be utilized.

Interface Wiring - The PIM-530 is a detection control module that provides an interface between a main fire alarm control panel detection circuit or addressable node and Protectowire Digital Linear Heat Detector. The most common interface connections utilize the three from "C" contacts provided for Fault and Alarm conditions.

Step 3 - Connect the hosts panel's initiation device circuit(s) to terminals J13 as shown on the field wiring diagram (Figure 6). Reference the host panel wiring specifications for correct wiring configuration and requirements.

Power Wiring - The PIM-530 requires external, clean regulated and filtered uninterruptible DC power. The module provides an internal switch regulator which supports input voltages between 12 to 24 VDC (+10% - 15%) @ 1.6 Watts. To implement remote resetting of the module from the host panel, the supplied power may be interrupted during the host panels reset sequence.

Step 4 - Connect a regulated 12-24VDC resettable power supply to terminal J10 as shown in the field wiring diagram (Figure 6). See the "Specification" section for power requirements.

Important! - The PIM-530 must be connected to earth ground via the J10 GND terminal as depict ed in the field wiring diagram. If earth ground is unavailable, for example in vehicle applications, the GND and COM terminals must be connected to each other with a jumper wire.

Installation and Wiring - (continued)

4-20mA Output Wiring - The PIM-530 provides two 4-20mA outputs which allow the status of the module to be remotely monitored. See the specifications section of this manual and the 4-20mA Output Information section for additional information on each outputs function.

Step 1 - Connect a regulated 12-24VDC power supply to Loop - 1 terminal J9 +V and to terminal J9 RTN as shown in the field wiring diagram (Figure 6). Repeat this step for Loop - 2.

Step 2 - Select a conditioning resistor value from the list below based on the supply voltage and the loop resistance of the measurement wiring. The total loop resistance including the resistor value should not exceed the resistance value shown for the supply voltage.

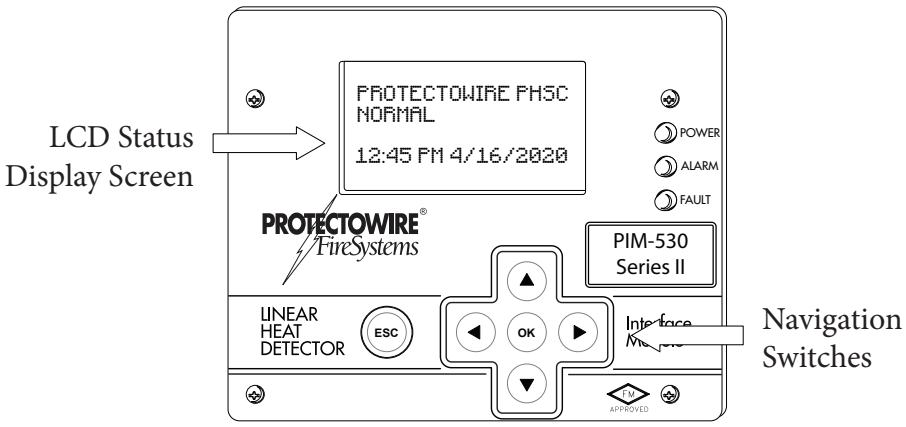
Supply @ 12VDC - 300 Ohms
Supply @ 24VDC - 800 Ohms

Step 3 - Connect the measurement device wiring and load resistor determined in step 2 to terminals J9 OUT and J9 RTN as shown on field wiring diagram (Figure 6). Repeat this step for Loop 2 if the second loop is to be monitored.

Configuration and Feature Selection

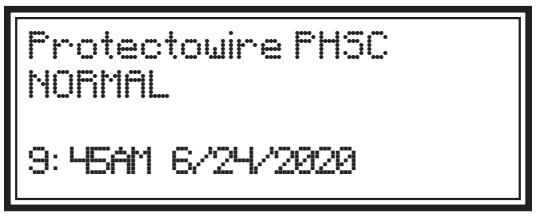
Configuration Prerequisites - The PIM-530 must be configured and tested before service. Configuration and testing of detection equipment shall be performed by competent, qualified personnel having jurisdiction over this detection equipment. Monitoring equipment connected to the PIM-530 should be bypassed or disabled prior to setup to avoid unintended activation of the monitoring equipment.

Display, Menus and Navigation Controls - The standard version of the PIM-530 has an integrated LCD display an navigation controls which allow user access to the detector status information and the setup menu.



Initial Power Up - When power is applied, the PIM-530 will go through a short boot sequence. The green power on LED will illuminate and the boot screen will display the currently configured detector type followed by the firmware version and date. When the boot sequence is complete the module will display a normal status message.

Boot Screen



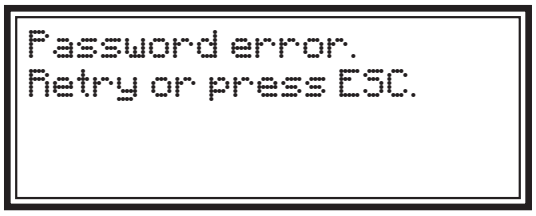
Status Screen

Accessing the Menu - The PIM-530 menu is password protected. The two levels of access are User level (USER) and Technician (TECH) level. User level access is limited to Detector Reset and Event History viewing functions. Technician level access permits full access to the configuration menu.

To enter the Menu press the center navigation button labeled “OK” and the password entry screen will appear.

Note: During menu access detection monitoring is halted. While detection monitoring is halted the PIM-530 will report a fault condition via the “FAULT” led indicator and the fault contacts will transfer. Normal standby operation will be restored once the menu is exited and detection monitoring resumes.

Password Entry Screen



Password Error Screen

Use the left and right navigation buttons to select each character and the up and down navigation buttons to change the character. Once all characters have been entered press the center navigation button labeled OK to access the menu.

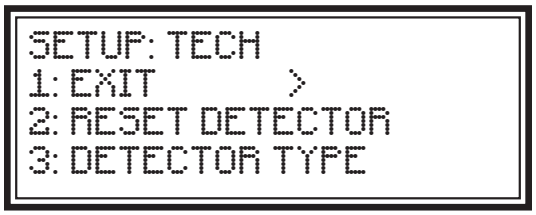
Entering an incorrect password will produce a password entry error and the user will be returned to the password entry screen. Press the escape ESC at any time to return to the main display.

The PIM-530 is supplied from the factory with default passwords for the user and technician level. During initial setup it is recommended the technician level password be set to a new value to prevent unauthorized access to the settings. The User level password can also be set to a new value at the installers discretion but is not required in most cases.

Default User level password = 1000
Default Technician level password = 2000

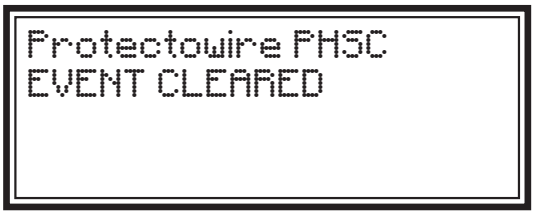
Once the correct user level password has been entered the setup menu will be displayed. The current user level will be shown in the setup menu heading as seen below. The available menu items are numbered and can be accessed by using the up and down navigation keys. The ">" symbol indicates the currently selected menu item.

The setup menu can be exited at any time by either pressing the "ESC" key or by selecting the "1: EXIT" menu item and then pressing the "OK" key. While accessing the setup menu the inputs will remain inactive. After 30 seconds of inactivity the module will automatically exit the setup menu and resume normal operation.

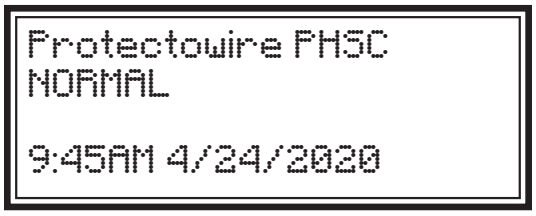


Menu Screen

Resetting the Detector - Once an alarm condition has been detected the module status will remain in that condition until the detector has been reset. To reset the detector enter the setup menu and select the "2: RESET DETECTOR" option.



Status Screen



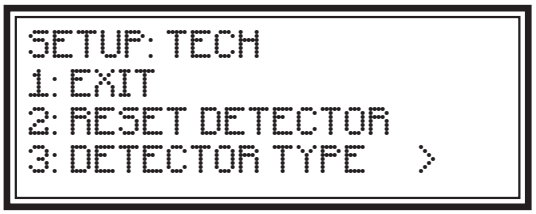
Status Screen

The display will show an “EVENT CLEARED” message while the detector resets. All outputs should return to normal standby states. Once the reset process has completed the display will return to a normal standby display.

Notes: If a detectable condition exists in the field, for example a short in the linear heat detector, the condition must be repaired before resetting the detector. Failure to do so will result in the condition being detected again after a reset completes.

Open conditions do not require the detector be reset. Once the open condition is repaired in the field the module will return to a normal standby automatically.

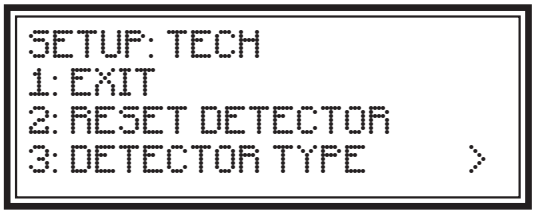
Detector Type Selection - The PIM-530 is designed to operate with all the available detector types (PHSC & PLR) in the Protectowire Digital Heat Detector family. A Detector Type selection menu has been included to allow for future support of other detector types.



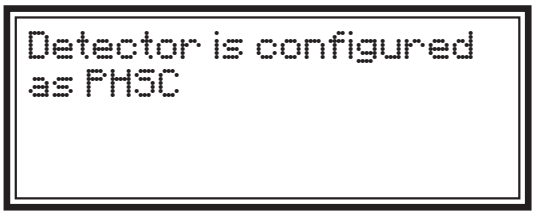
Menu Screen

Detector Type Selection Screen

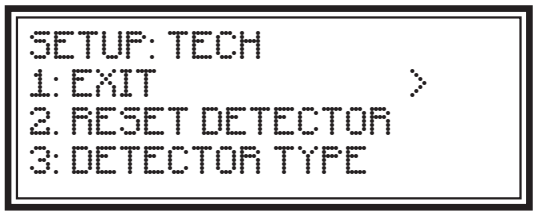
Currently the PIM-530 has no selectable options in the Detector Type Selection screen and will display the detector type configured for PHSC (Protectowire Heat Sensitive Cable) and then return the user to the menu.



Menu Screen

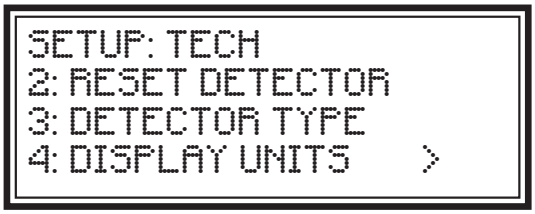


Reset Screen



Status Screen

Display Units - The PIM-530 can be configured to display measurement information in either US Standard (Distance = Feet) or Metric units (Distance = Meters). Select a unit type by entering the setup menu and selecting the "4: DISPLAY UNITS" menu item and press the "OK" button. The units selection screen will be displayed.



Menu Screen *Display Units Selection Screen*

Using the Up/Down navigation buttons select the desired units from the drop down list. The currently selected type is followed by the ">" character. Once your selection is made press the "OK" button and you will be returned to the main setup menu. Choose the "1: EXIT" menu item and press "OK" to return to the status display.

Alarm Point Location (APL) Setup - The PIM-530 features an integrated Alarm Point Location Meter (APL) which will identify the distance from the beginning of a detector run to the shorted portion of the detector. Field calibration of the Alarm Point Location reading increases accuracy and provides the user a means to compensate for changes introduced by addition of extension cable and also reading variations due to ambient temperature.

Before calibrating the Alarm Point Location feature please follow these guidelines.

1. Calibration should be performed at the expected nominal ambient temperature for the installed detector. For example, refrigerated storage installations should be calibrated after cool down.
2. To perform a calibration you must have access to the connections at the beginning of the detector run and the end of the detector run.
3. All short circuits placed across the detector loop during calibration should be created with a low resistance copper jumper directly across the junction terminals to ensure accuracy. Using clip leads or pressing jumper wires across terminations does not insure a true short and can affect calibration accuracy. This method is the best practice for shorting the detector loop and should be used to ensure the best results. A test probe should not be used for alarm point calibration due to these probes having internal resistance that will introduce a measurement error. This method is the suggested best practice for shorting the detector loop and should be used to ensure the best results.

Before starting the APL Calibration the detection loop must be properly installed and the PIM-530 module confirmed to be in a NORMAL standby condition. Figure 7 depicts a typical Class B field wiring arrangement. Figure 7A depicts a typical Class A field wiring arrangement. The procedure is the same for both Class B and A wiring configuration unless otherwise noted. Where feed cable is not utilized shorts should be placed across the detector terminations on the PIM-530 module.

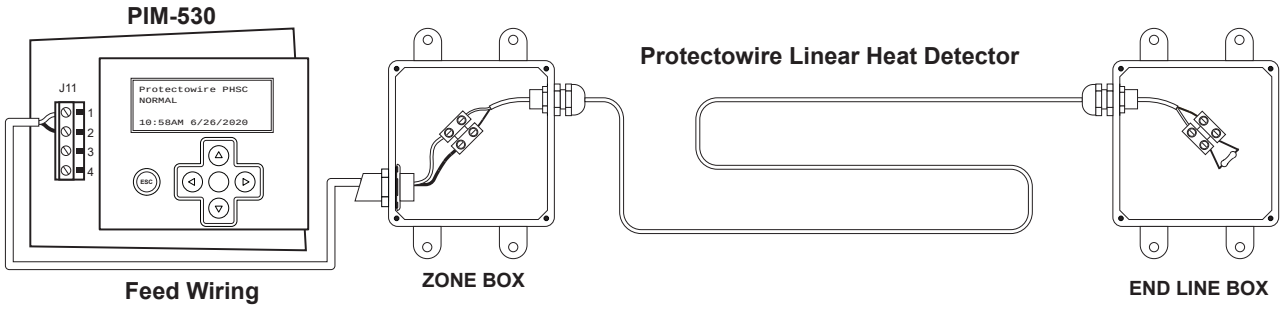


Figure 7

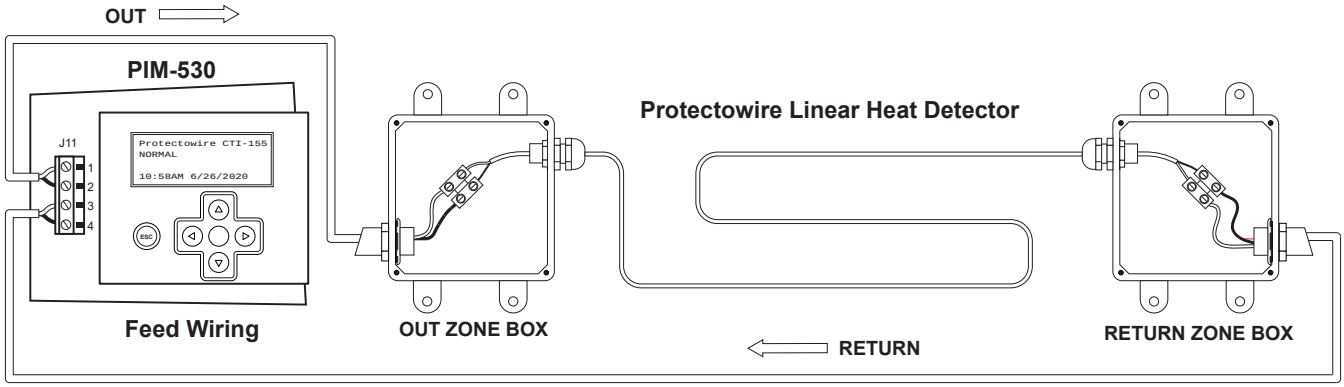


Figure 7A

Step 1 - Before beginning the calibration procedure place a short across the beginning (ZERO distance) of the digital linear heat detector run as depicted in Figure 8.

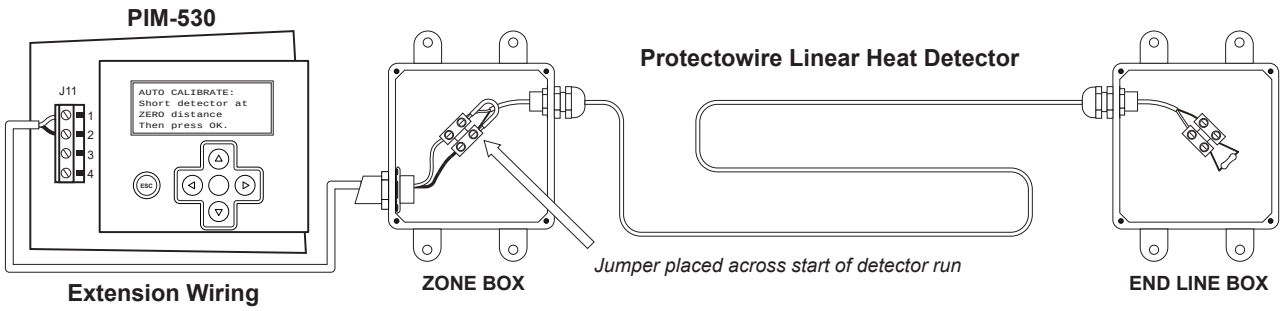


Figure 8

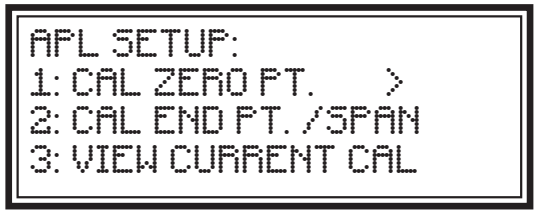
To calibrate the Alarm Point Location ZERO distance, enter the setup menu and select the "5: APL SET-UP" menu item then press the "OK" button. The "APL SETUP:" screen will be displayed. Select the "1: CAL ZERO PT." option from the menu and press the "OK" button. The AUTO CALIBRATE: ZERO Distance message will be displayed.

APL Setup Menu Screen

Zero Calibration Start Screen

Press the OK button to begin the ZERO distance calibration. The module will measure the resistance to the beginning of the detector run and offset future readings by this value.

Zero Calibration Measurement Screen



APL Setup Menu Screen

Once the ZERO distance calibration has been completed you will automatically be returned to the "APL SETUP:" screen. Remove the short placed across the beginning of the detector run and proceed to Step 2.

Step 2 - Place a short across the end (END distance) of the digital linear heat detector run as depicted in Figure 9 for Class B and as depicted in Figure 10 for Class A.

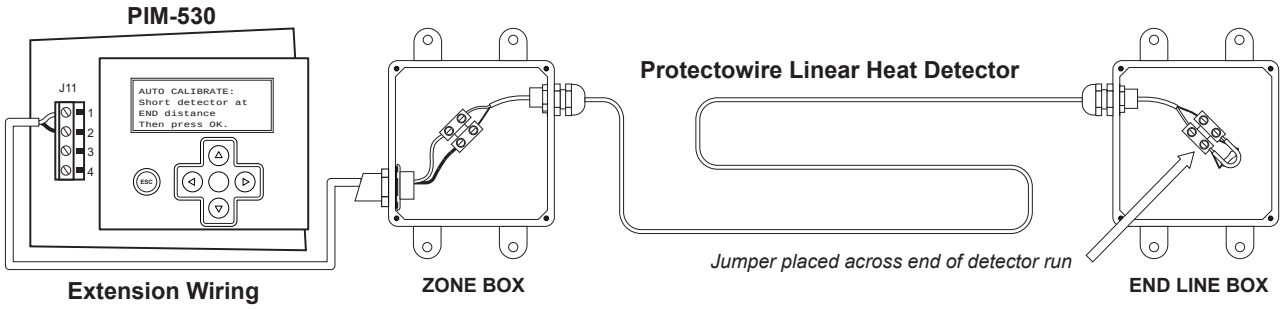


Figure 9

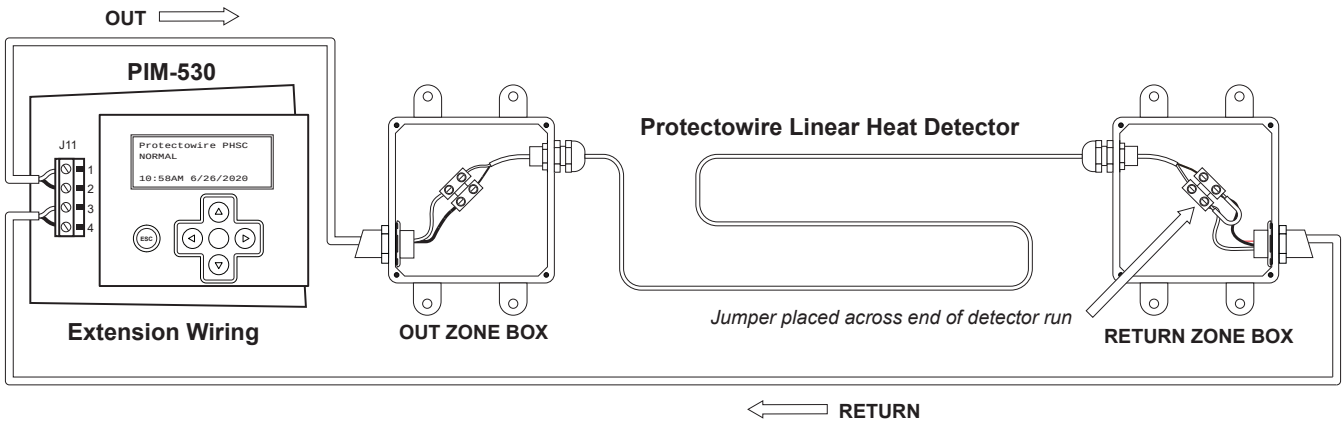


Figure 10

To calibrate the Alarm Point Location END point / SPAN distance, enter the setup menu and select the "5: APL SETUP" menu item and press the "OK" button. The "APL SETUP:" screen will be displayed. Select the "2: CAL END PT./SPAN" option from the menu and press the "OK" button. The AUTO CALIBRATE: END Distance message will be displayed.

Press the OK button to begin the END distance calibration. In the case of Class A installation (Figure 10) the module will first measure feed cable resistance between the Input Return terminals and the detectors end termination. The module will then measure the resistance of the linear heat detector and store it to be used in the final span adjustment of Step 3.

End Calibration Start Screen

End Calibration Return Measurement Screen

Step 3 - When the PIM-530 has completed all calibration measurements the detector end distance adjustment screen will be displayed. This screen displays the current measured distance to the end of the detector using the default distance multiplier and offsets obtained in steps 1 and 2. The distance should be very close to the actual installed detector length at this point. To improve the accuracy of the measurement the actual installed length of detector can be entered in place of the displayed reading.

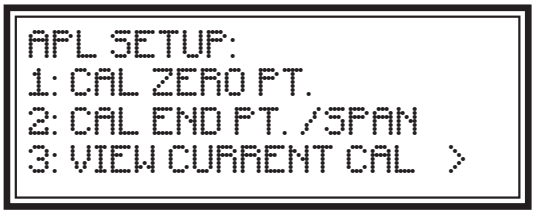
End Calibration Return Measurement Screen

End Distance Adjustment Screen

Enter the new end distance value by using the Left and Right navigation buttons to select a digit of the displayed value and use the Up and Down navigation buttons to change the value.

Once the desired distance has been entered, press OK to accept the distance reading and calculate the new calibration value. At this point the calibration process is completed and the APL SETUP menu is displayed. Remove the short placed across the end of the detector run.

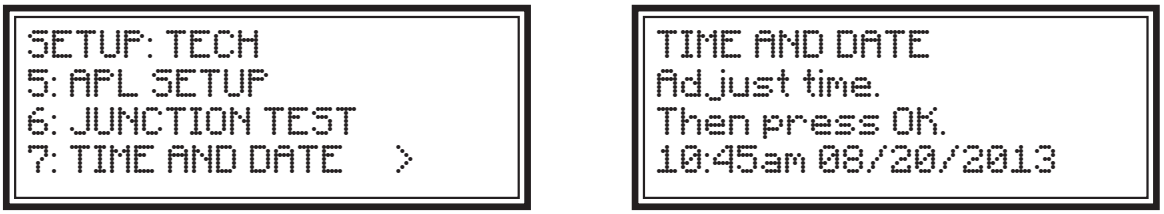
View the current calibration settings by selecting the “3: VIEW CURRENT CAL” option from the APL SETUP menu. The current calibration settings screen is displayed. Line one shows the current Ohms per foot or Ohms per Meter multiplier used to convert resistance to distance. Line two shows the outgoing offset resistance in Ohms which should be equivalent to the outgoing extension wire total resistance. Line three shows the return offset resistance in Ohms which should be equivalent to the return extension wire total resistance.



APL Setup Menu Screen *Current Calibration Settings Screen*

Time and Date Setup - The PIM-530 features a real time clock with date. Time is displayed in 12 hour format and the date is displayed in Month/Day/Year format. The clock will maintain time and date settings even in the event of complete power failure via an on board battery.

To set the time and date enter the setup menu and select the “7: TIME AND DATE” menu item and press the “OK” button. The TIME AND DATE setup screen will be displayed.



Menu Screen *Time and Date Screen*

Using the Left/Right navigation buttons select the Hours/Minutes or Month /Day/Year as required. The currently selected value will be highlighted with a blinking cursor. Use the Up/Down navigation buttons to change the value of the current section. Once all values are set press the “OK” button to save the changes and exit to the setup menu. Choose the “1: EXIT” menu item and press “OK to return to the status display.

Password Setup - All menu access to the PIM-530 is password protected. The two levels of access are the User level (USER) and Technician (TECH) level. User level access is limited to Detector Reset and Event History viewing functions. Technician level access allows full access to the setup menu including the ability to change the USER and TECH level password.

To change a password enter the setup menu and select the “8: USER PASSWORD” or “9: TECH PASSWORD” menu item and press the “OK” button. The SET USER PASSWORD or SET TECH PASSWORD setup screen will be displayed along with the current password value.

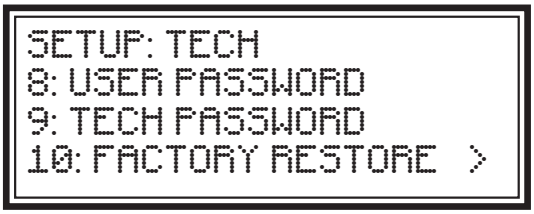
Menu Screen *Password Setup Screen*

Using the Left/Right navigation buttons select each character of the password and required. The currently selected value will be highlighted with a blinking cursor. Use the Up/Down navigation buttons to change the value of the current section. Once all values are set press the OK button to save changes and exit to the setup menu. Choose the “1: EXIT” menu item and press “OK” to return to the status display.

Factory Restore - The PIM-530 features a factory restore option. A factory restore will reset all module settings back to the original factory supplied state. A factory restore will affect the following settings.

1. Display Units - Defaults to US (Standard)
2. APL Setup - All offset data set to zero value, Per Foot multiplier defaults to 0.187
3. Time and Date - Time and Date not affected
5. Passwords - USER level reset to 1000, TECH level reset to 2000
6. Cold Junction - Cold junction is not affected
7. Event History - History is cleared
8. Modbus - All Modbus settings reset. Slave ID = 1, Parity 8-E-1, Baud Rate = 19.2Kbps

To perform a factory restore enter the setup menu and select the “10: FACTORY RESTORE” menu item an depress the “OK” button. The FACTORY RESTORE screen will be displayed.



Menu Screen

Factory Restore Screen

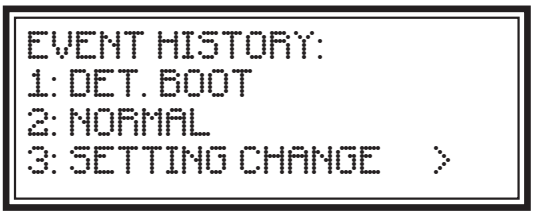
Press the “OK” button to initiate the restore or press the “ESC” key to cancel. Once the restore has been initiated the PIM-530 will re-boot with the settings listed above. The module can now be re-configured using the setup procedures outlined in this manual.

Event History - The PIM-530 features a 64 event history buffer. Events are stored in a first in first out format (FIFO) and provide a record of all recent events including configuration changes, detection events and user access.

To access and view the event history enter the setup menu and select the “11: EVENT HISTORY” menu item and press the “OK” button. The EVENT HISTORY menu screen will be displayed.

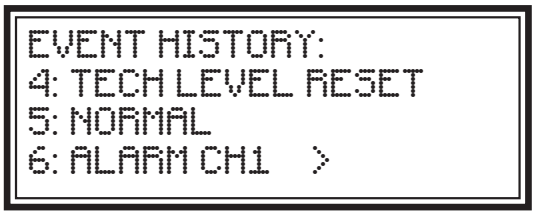
Menu Screen *Event History Sub-Menu*

To view the event history select the “1: VIEW HISTORY” sub-menu item and press the “OK” button. The event list view will be displayed. Each event appears in the numerical order with the oldest event at the top of the list and the newest at the bottom. The initial view will always display the latest event. Use the navigation UP/Down buttons to scroll through items in the list. The currently selected event will be shown with a “>” character.



Event History List *Event History List*

Once an event has been selected using the navigation UP/Down buttons, press the “OK” button to view additional information for the selected event. As shown in the screen shots below, event 6, a short fault condition on the channel 1 is selected.



Event History List *Additional Event Information*

The additional information for this event 6 shows the Event Type, Distance to the Event in feet and the time and date the event occurred on. To return to the Event History List press the “ESC” key.

4-20mA Outputs Calibration - The PIM-530 features a calibration adjustment for each of the 4-20mA output loops. The outputs are factory calibrated but to achieve the best accuracy a qualified technician can adjust the output levels as required. A calibrated current meter must first be connected to each output before beginning the calibration procedure.

To access the 4-20mA calibration settings for output loop 1 enter the setup menu and select the "14: LOOP 1 CAL" sub-menu item and press the "OK button. The "LOOP 1 CAL:" start menu will be displayed.

Menu Screen *Loop 1 - 4mA Calibration Screen*

The PIM-530 will immediately output 4mA on Loop 1. Use the left and right navigation buttons for coarse adjustments and the up and down navigation buttons for fine adjustments. Adjust the output until it is as close to 4mA as possible then depress the center "OK" button.

Loop 1 - 20mA Calibration Screen *Loop 1 - 12mA Confirmation Screen*

The PIM-530 will then output 20mA on Loop 1. Use the left and right navigation buttons for coarse adjustment and the up and down navigation buttons for fine adjustment. Adjust the output until it its as close to 20mA as possible then depress the center "OK" button.

The PIM-530 will then output 12mA on Loop 1. The reading should be very close to the required output. To verify the calibration was successful press the "OK" button and you will be returned to the setup menu.

Follow this procedure using the setup menu "LOOP 2 CAL" menu item to calibrate the Loop 2 4-20mA output.

Operation and Testing

Testing Notes - The PIM-530 must be configured and tested before service. Configuration and testing of detection equipment shall be performed by competent, qualified personnel having jurisdiction over this detection equipment. Any monitoring equipment connected to the PIM-530 should be bypassed or disabled during testing to avoid unintended activation of the monitoring equipment. Remote monitoring should then be verified under controlled conditions as the final phase of testing.

It is recommended all linear heat detection installations be tested and inspected for proper operation a minimum of once per year.

Inspection of the Installation - Before performing any operational testing of the detection system it is recommended that the following inspections be performed:

Visually inspect the linear heat detector installation and confirm conformance with the Installation, Operation and Maintenance Manual for Protectowire Linear Heat Detectors. Check for any signs of physical damage or wear to the detector and associated installation hardware.

Confirm that the Installation and Setup Configuration of the PIM-530 conforms to the applicable installation and configuration sections of this manual.

During the inspection process make note of the location and quantity of all field connections including zone boxes, end of line boxes, and field splices. All terminations should be inspected for proper connection and polarity. Confirm all connections are suitable for the environment in which they are located, i.e. properly sealed or contained within a properly rated enclosure.

Detection Operation and Testing - The module provides one (1) supervised detection circuit that may be field wired for either Class A (Style D) or Class B (Style B) service. This initiating device circuit is capable of operating up to 6,560 feet (2000 meters) of Protectowire Digital Linear Heat Detector or equivalent combination of detector and feed cable. See Figure 11 for an example of a typical field wiring for Class A and B configuration.

Class B wiring configurations consist of a single length of detector connected to the outgoing “OUT” field terminals of the PIM-530 directly or through a length of extensions cable. The detector is then terminated with an End Line Resistor (ELR) which is monitored by the PIM-530 to confirm continuity.

Class A wiring configurations consists of a single length of detector connected to the outgoing “OUT” field terminals of the PIM-530 directly or through a length of extension cable. The detector is then connected to the return “RTN” field terminals of the PIM-530 directly or through a length of extension cable. No End Line Resistor is required in this configuration. Continuity is confirmed through the return connection.

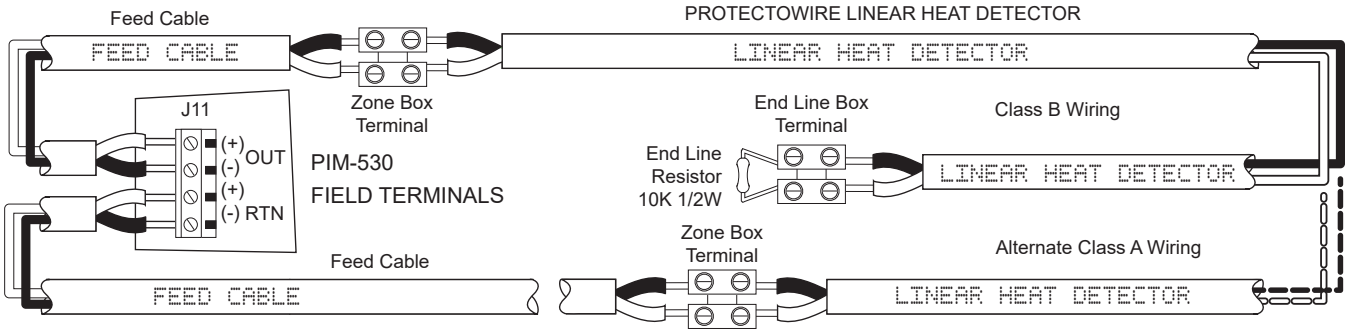


Figure - 11

Step 1 - **Test Open Circuit Monitoring** - At the end of the Protectowire Linear Heat Detector, open the circuit by disconnecting one leg of the detector from the ELR, see Figure 12, or return field terminals, see Figure 13.

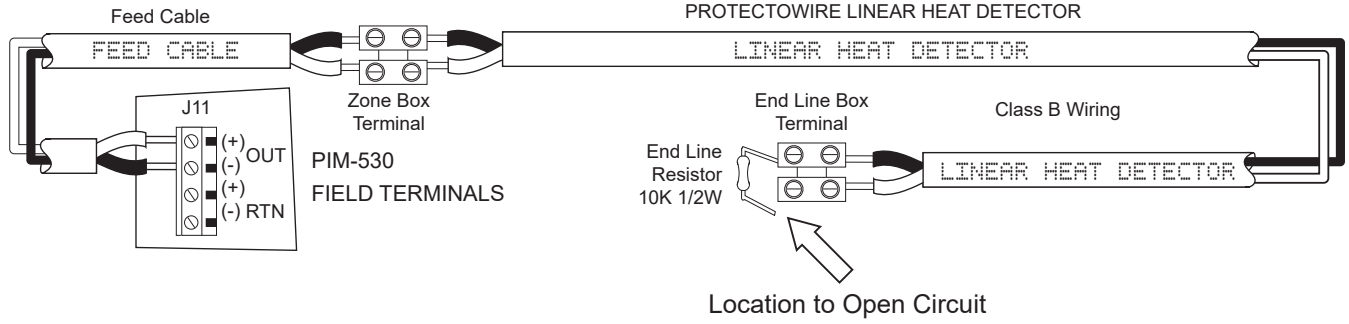


Figure - 12

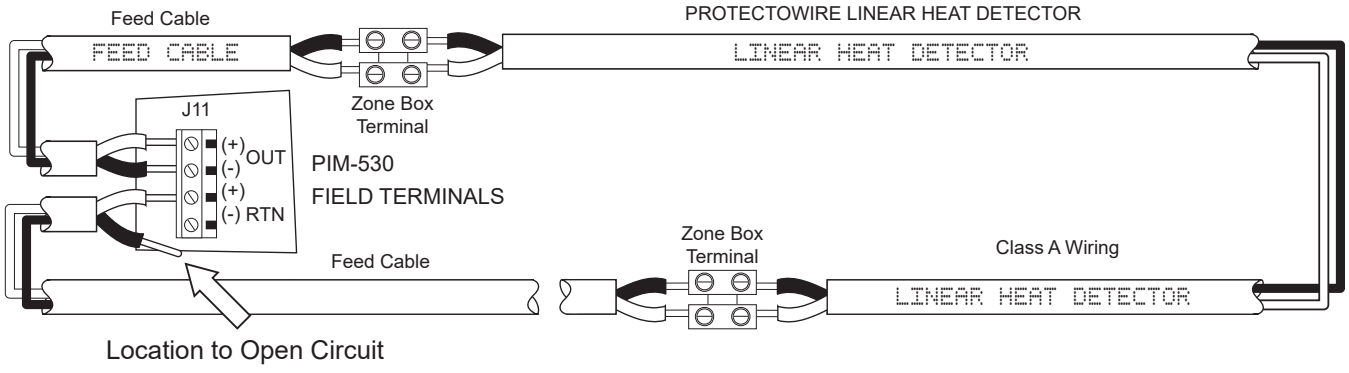
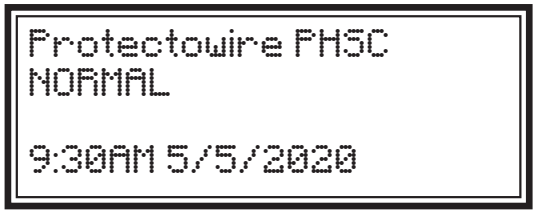


Figure - 13

The PIM-530 LCD display will display an “OPEN FAULT” message and the yellow fault indicator LED will be ON steady. Any remote device monitoring the PIM-530 status should indicate an open/fault condition. Re-connect the detector to the ELR or return “RTN” terminals. The PIM-530 should display an “Event Cleared” message then return to a “NORMAL” standby condition.

Open Fault Display



Normal Standby Display

Step 2 - **Test Alarm Monitoring** - At the end of the Protectowire Linear Heat Detector, connect a jumper lead across both legs of the detector at the ELR, see Figure 14 or return field terminals, see Figure 15.

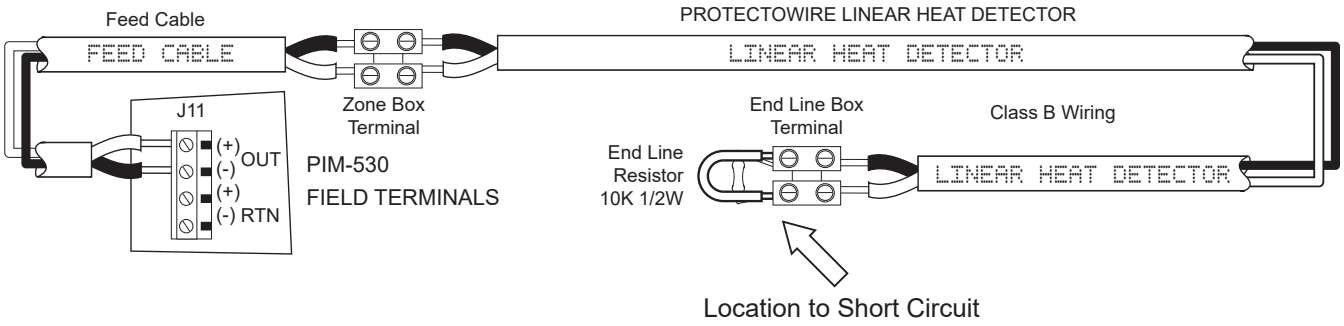


Figure - 14

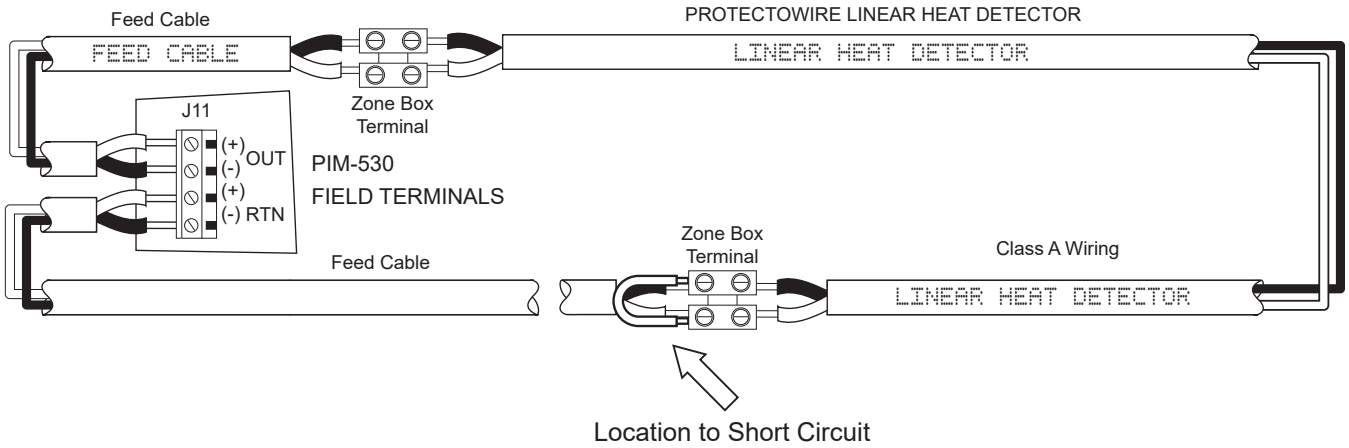
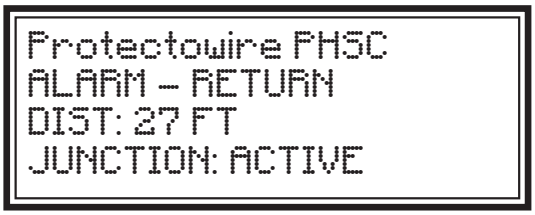


Figure - 15

After approximately 10 seconds the PIM-530 LCD display should display a “ALARM” message along with a “DIST:XXX”where “XXX” is the distance to the short. For Class A circuits the display message will alternate every 5 seconds between the “ALARM” and “ALARM - RETURN” indicating the displayed information is being displayed for the OUT or RET direction. The red alarm indicator should be on steady. Any remote device monitoring the PIM-530 status should indicate an alarm condition. Remove the short and reset the interface module to return to a normal standby condition.

Alarm Display



Alarm Return Display
** Class A Only*

Ground Fault Detector - The PIM-530 includes a ground fault detector capable of detecting ground faults between the IDC connections and the modules earth ground reference. Operation of the ground fault detector can be verified by connecting a low resistance jumper lead from the PIM-530 earth ground terminal J10 GND to any of the IDC terminations, J11 - (+) OUT, (-) OUT, (+) RTN or (-) RTN terminals. The detector will respond to a fault in approximately 10 seconds. The PIM-530 display will report a “GROUND FAULT” condition. The “FAULT” indicator will flash on and off to identify the existing ground fault condition and the fault relay contact will change state.

A ground fault can only be restored by locating and removing the ground fault path from the IDC connections to earth ground. The PIM-530 will continue to detect overheat conditions with a single ground fault present but all ground faults should be addressed as soon as possible to prevent potential adverse effects on detector operation.

Ground Fault Indication Screen

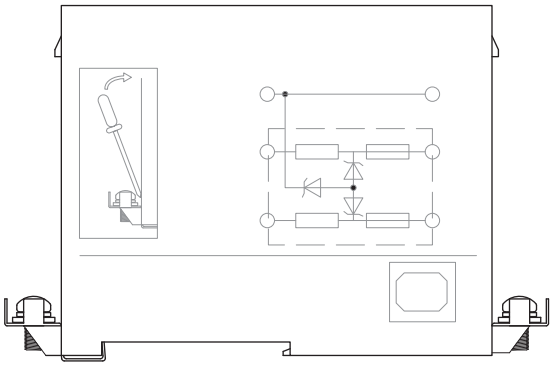
Status Screen after Ground Fault Located & Repaired

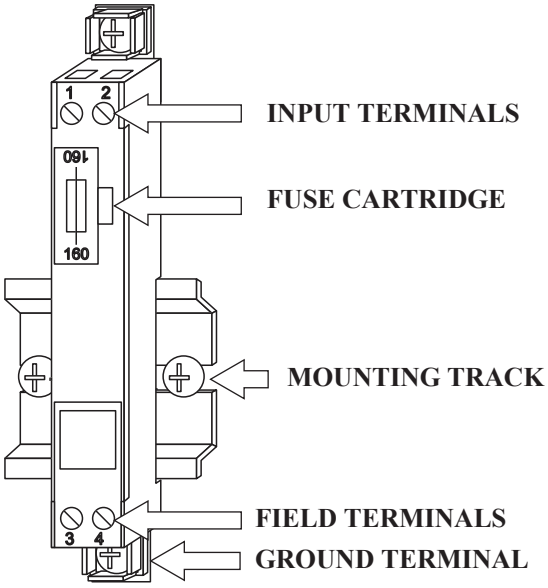
PIM-530 Interface Module Employing Linear Heat Detector In Intrinsic Safety Barrier for Special Hazard Applications
DS-9285 9/7/16

DESCRIPTION:
Some applications of PROTECTOWIRE PIM-530 linear heat detection circuits require energy limiting to prevent explosions in areas classified as hazardous locations. One method used to accomplish this "Intrinsic Safety" is to utilize diode shunt barriers. Diode shunt barriers consist of Zener diodes with current limiting resistors which "shunt" excess voltage spikes to ground.

OPERATION:
The Stahl # 9002/77-093-040-001 is a dual channel barrier used with the PIM-530 interface module to provide protection in hazardous locations. If excess voltage appears across the detection circuit, the internal Zener diodes of the barriers instantaneously conduct in the reverse bias direction passing the overflow current directly to earth ground. The replaceable 160mA fuse protects the barrier from reverse polarity connection or from exposure to damaging current levels.

Intrinsic Safety Barrier
Stahl 9002/77-093-040-001

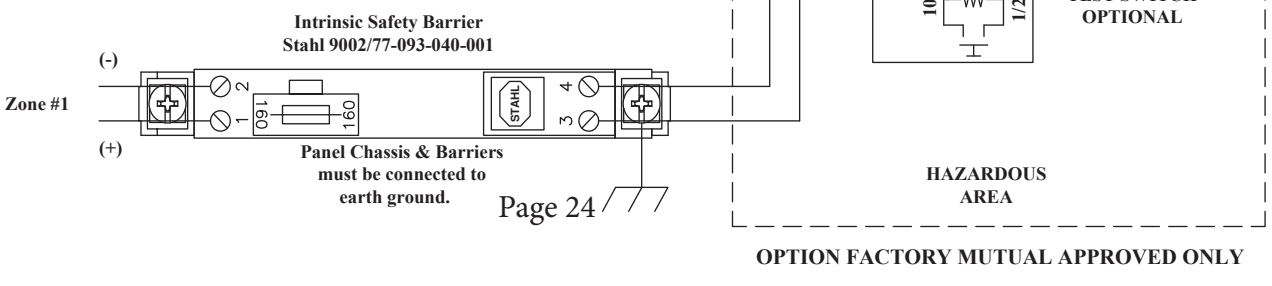




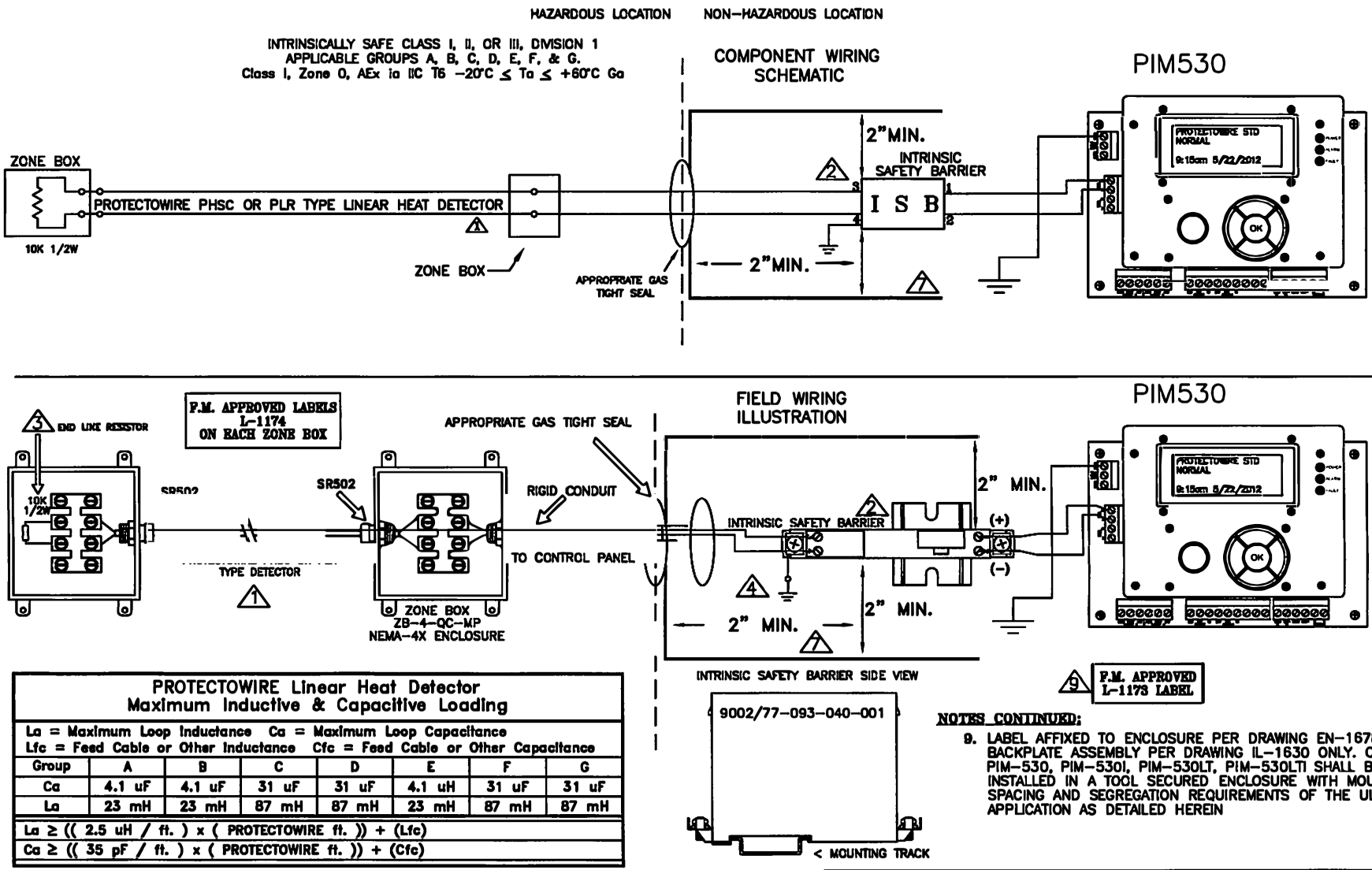
ELECTRICAL	
Nominal Input Voltage	9.3VDC
Maximum Input Voltage	9.3VDC
Internal Resistance	518 ohms per channel +/- 27 ohms
Fuse Rating	160mA rep.#011239
Leakage Current	less than 1uA

SPECIAL NOTES:

1. Resistance from barrier mounting strip to earth ground **must be** 1 ohm or less.
2. ALL intrinsically safe wiring **must be isolated from non-safe wiring and routed in a separate conduit.**
3. **Non-safe** wiring **must not** cross into safe wiring area segregated by black lines within the system enclosure.
4. The system ground fault detection circuit is disabled due to the negative leg of the initiating circuit being connected to earth ground.
5. **WARNING: The negative of initiating circuit is connected to earth ground, therefore a ground fault from the positive leg of the initiating circuit will result in a false alarm.**
6. Suitable for hazardous locations Class I, II and III, Division 1, Groups A, B, C, D, E, F and G; [AEx ia Ga] IIC hazardous (classified) locations and Intrinsically Safe for Class I, II & III, Division I, Groups A, B, C, D, E, F and G; Class I, Zone 0, AEx ia IIC T6 Ga -29°C ≤ Ta ≤ +49°C.
7. Reference control drawing IL-1626 for installation.
8. The PIM-530 and associated intrinsic safety barriers **must** be installed and located outside of the hazardous area.



OPTION FACTORY MUTUAL APPROVED ONLY



PROTECTOWIRE Linear Heat Detector Maximum Inductive & Capacitive Loading							
La = Maximum Loop Inductance Ca = Maximum Loop Capacitance Lfc = Feed Cable or Other Inductance Cfc = Feed Cable or Other Capacitance							
Group	A	B	C	D	E	F	G
Ca	4.1 uF	4.1 uF	31 uF	31 uF	4.1 uH	31 uF	31 uF
La	23 mH	23 mH	87 mH	87 mH	23 mH	87 mH	87 mH
La ≥ ((2.5 uH / ft.) x (PROTECTOWIRE ft.)) + (Lfc)							
Ca ≥ ((35 pF / ft.) x (PROTECTOWIRE ft.)) + (Cfc)							

NOTES CONTINUED:

9. LABEL AFFIXED TO ENCLOSURE PER DRAWING EN-1678 OR BACKPLATE ASSEMBLY PER DRAWING IL-1630 ONLY. OTHERWISE PIM-530, PIM-530I, PIM-530LT, PIM-530LTI SHALL BE INSTALLED IN A TOOL SECURED ENCLOSURE WITH MOUNTING SPACING AND SEGREGATION REQUIREMENTS OF THE ULTIMATE APPLICATION AS DETAILED HEREIN

NOTES:

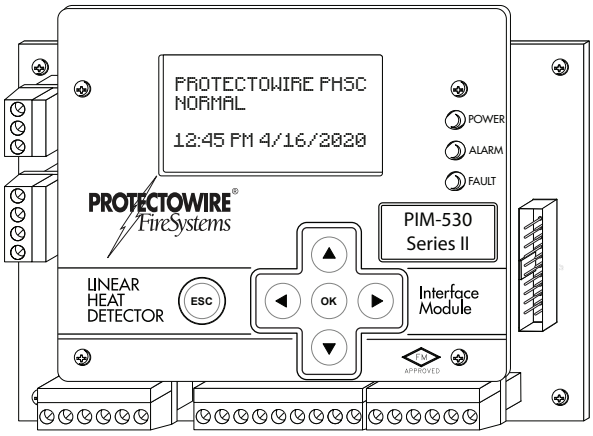
1. PROTECTOWIRE LINEAR HEAT DETECTOR, REGULAR, INTERMEDIATE, HIGH TEST AND EXTRA HIGH TYPE EPC, TYPE EPN, TYPE EPR, TYPE XLT, TYPE XCR AND PLR SERIES. MAXIMUM LENGTH PER ZONE UP TO 3500 FEET (1 Km) OR AS PERMITTED BY HAZARDOUS LOCATION CALCULATION AND APPLICATION.
2. INTRINSIC SAFETY BARRIER (ISB) PART NO. 9002/77-093-040-001, R. STAHL INC.
3. END OF LINE RESISTOR, PART NO. RB-103-5, 10K 1/2W 5%
4. RESISTANCE FROM ISB GROUNDSTRAP TO EARTH GROUND MUST BE ONE OHM OR LESS. COPPER WIRE, #12 AWG MIN.
5. EQUIPMENT SHALL NOT USE OR GENERATE GREATER THAN 250V.
6. WIRE ACCORDINGLY FOLLOWING NATIONAL ELECTRICAL CODE & ANSII/ISARP12.6
7. INTRINSICALLY SAFE WRING MUST BE SEPARATED FROM ALL OTHER WIRING AND CIRCUITS BY AT LEAST 2 INCHES (51mm).
8. GROUND FAULT DETECTOR IN HOST PANEL MAY REQUIRE DISABLING

PROTECTOWIRE FireSystems
Manufacturer of Special Hazard Fire Detection Systems

TYPICAL PIM530/LT/-EI/-I INTERFACE MODULE W/ INTRINSIC SAFETY BARRIER (STAHL) ILLUSTRATION DIAGRAM

DATE	REVISION	DWN: JPG	CHKD:	APPD:
5/2019	ADD NOTE 9	DATE: 1-27-16	SCALE: NTS	TOL:
3/2020	Ta range was -29 to 49C	THE PROTECTOWIRE CO., INC. Hanover, Massachusetts	DWG NO: IL-1626H	
4/2022	max. per zone was 6562ft			

Modbus Over RS-485 Operation Guide



RS-485 Description

RS-485 is a standard which describes a physical layer utilized in serial communication. RS-485 allows for installation of inexpensive local network systems and supports multi-drop communication links. Due to its use of differential balanced line signaling over twisted pair wiring, RS-485 can span distances of up to 4,000 feet (1,220 meters) without repeaters. RS-485 has been widely adopted in many industries as the underlying physical layer of industrial automation networks.

Modbus Description

Modbus is a communication protocol originally developed and published by Modicon in 1979. It is now a de facto - standard protocol utilized in a wide array of communication applications. The standard is openly published and a royalty-free protocol.

PIM-530 Modbus over RS-485 Description

The PIM-530 interface module provides integrated Modbus over RS-485 communications. Each module can be configured as a Modbus slave device on an RS-485 network. Once configured to communicate on a network, each module can be polled by a master device for a variety of module specific data. A master device, such as a PLC (Programmable Logic Controller) can monitor the status of one or more modules and take actions based on their status. Modbus over RS-485 communication is a convenient method for utilizing detector status information to implement equipment shutdown or other automation events.

Specifications

Port Specifications

- RS-485 Serial Port compatible with TIA/EIA-485 specifications
- Supports Half Duplex Mode (2 wire)
- Baud Rates Supported, 9.6K, 19.2K, 57.6K, 115.2K
- Network Bus Load, 1/8th Load
- Biasing, None
- Wiring method, Two wire with common via module supply common

Protocol Information

- Modbus RTU
- Modbus Application Protocol Specification, V1.1b, Modbus-IDA, 12/28/2006
- Cyclic redundancy check, CRC-16

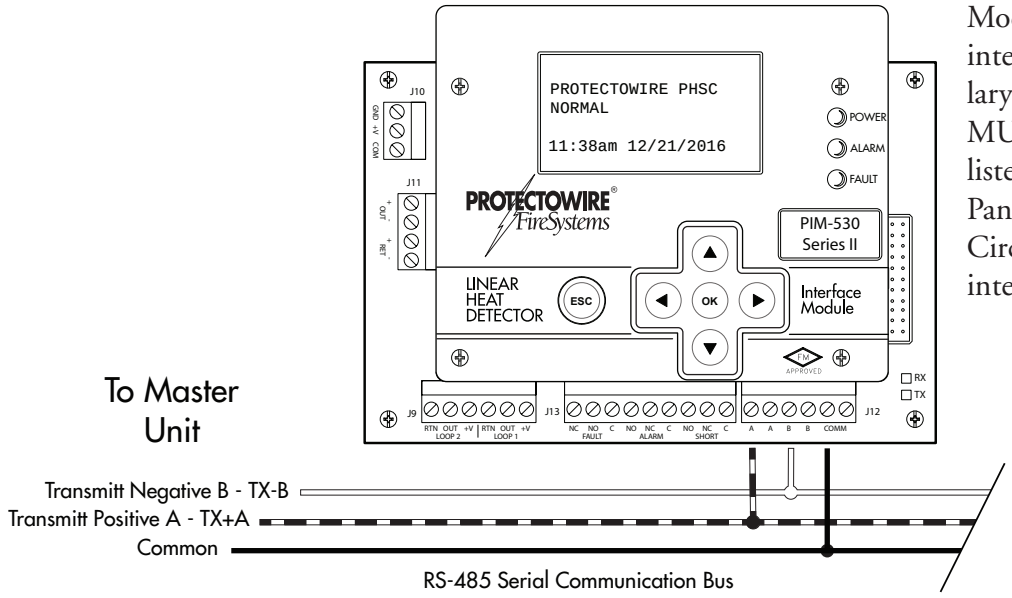
RS-485 Wiring

Wiring Description

Wiring connection for the RS-485 port are made via Terminal J12 on the lower right corner of the module. Wiring should be made using communications cable suitable for the environment and rated for the intended purpose.

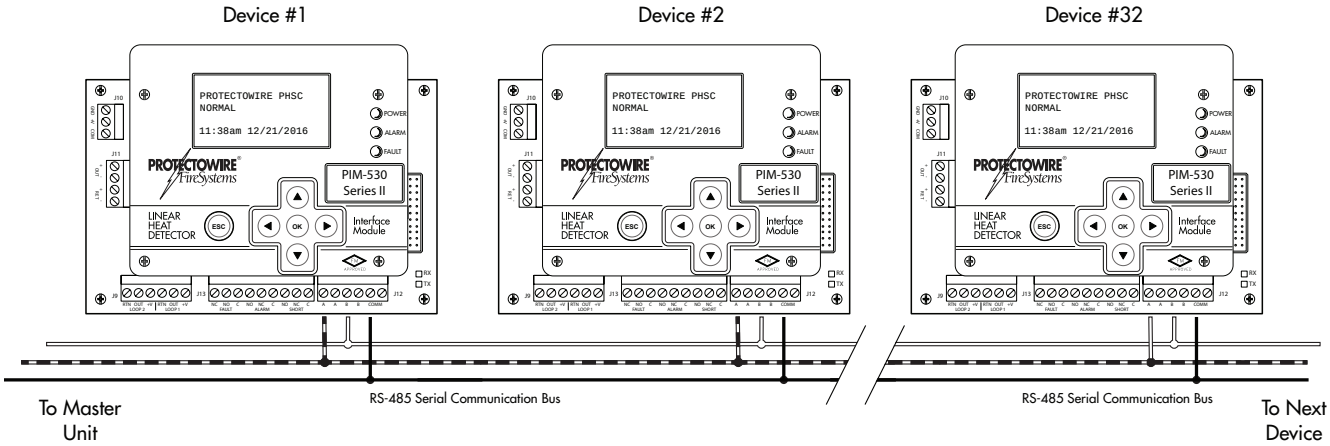
Each module requires three connection to the communication bus. Transmit A (+), Transmit B (-) and common (COM). The module operates in half duplex mode. To operate in this mode the Transmit (+) and (-) terminals are internally connected to the receive (+) and receive (-) terminals respectively. The module does not currently support full duplex operation.

Wiring Diagram - Figure 1



Modbus over RS-485 is intended to provide ancillary information. Each unit MUST be monitored by a listed Fire Alarm Control Panel Initiation Device Circuit (IDC) via contact interface.

Bus Example - Figure 2



Configuration Settings

Once properly wired to the communication bus each module must be configured to communicate on the network. The following network settings must be known before configuring the module.

Slave Address - Each device is assigned a unique slave address to identify it on the network. The Modbus protocol specification allows for addresses in the range from 1 to 247.

Parity - Each device must be configured to use the same parity as the network. Each module can be configured for the following.

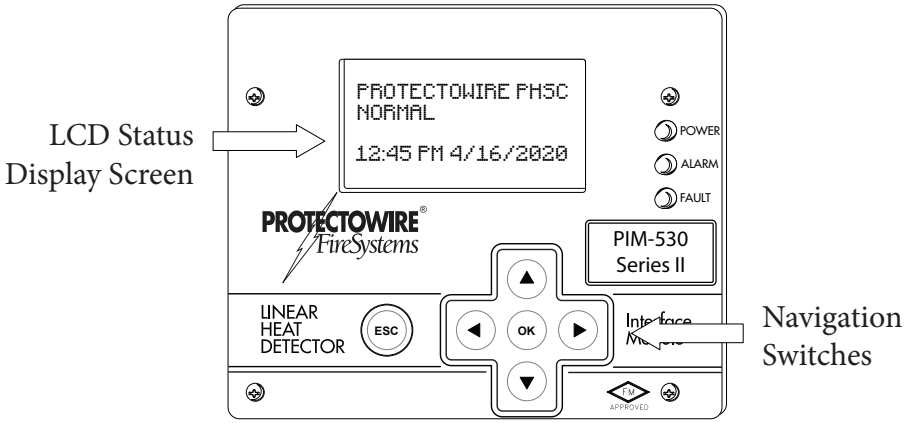
8-E-1 - 8 Data bits, Even Parity Bit, 1 stop bit
8-O-1 - 8 Data bits, Odd Parity Bit, 1 stop bit
8-N-2 - 8 Data bits, No Parity Bit, 2 stop bits

Baud Rate - Each device must be configured to use the same baud rate in bits per second as the network. Each module can be configured for the following baud rates.

9.6K Baud, 19.2K Baud, 56.7K Baud & 115.2K Baud

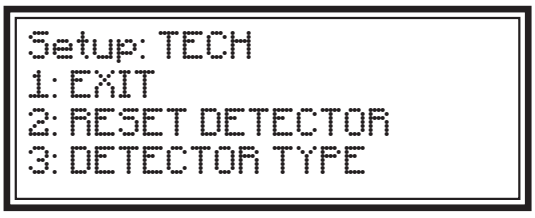
Accessing the Modbus Menu

Display, Menus and Navigation Controls - The standard version of the PIM-530 has an integrated LCD display and navigation controls which allow user access to the detectors status information and the setup menu. For full instructions on the menu access and settings please see the PIM-530 user manual.



Accessing the Modbus Menu - The PIM-530 menu is password protected. Accessing the Modbus settings requires technician level access. Press the center navigation button to access the password screen and enter the technician level password then press the center button to enter the menu selection screen.

Password Entry Screen



Technician Level Menu Screen

Use the down navigation key to scroll to the “MODBUS” menu item and then press the center button to enter the Modbus menu.

Modbus Menu Item *Technician Level Menu Screen*

Setting the Slave Address - Once in the “MODBUS” menu use the UP/DOWN navigation keys to select the “SLAVE ADDRESS” menu item. Depress the center navigation button to enter the slave address menu.

Modbus Menu Item *Settings Saved Indication Screen*

Change the slave address by selecting the desired digit with the LEFT/RIGHT navigation switches the use the UP/DOWN navigation switches to change the value. The Modbus Protocol allows addresses in the range of 1 to 247 and each device must have a unique address. Once the desired value has been entered press the center navigation button to save the settings. You will be returned to the Modbus settings menu.

Setting the Parity - Once in the “MODBUS” menu use the UP/DOWN navigation keys to select the “PARITY” menu item. Depress the center navigation button to enter the parity menu.

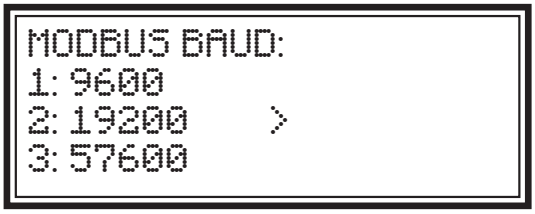
Modbus Parity Setting *Settings Saved Indication Screen*

Using the UP/DOWN navigation buttons to select the desired parity value. The module supports:

8-E-1 - 8 Data bits, Even Parity Bit, 1 stop Bit
8-O-1 - 8 Data bits, Odd Parity Bit, 1 stop Bit.
8-N-2 - 8 Data bits, No Parity Bit, 2 stop Bits.

Once the desired value has been entered press the center navigation button to save the settings. You will be returned to the Modbus settings menu.

Setting the Baud Rate - Once in the "MODBUS" menu use the UP/DOWN navigation keys to select the "Baud Rate" menu item. Depress the center navigation button to enter the Baud Rate menu.



Modbus Baud Rate Setting

Settings Saved Indication Screen

Using the UP/DOWN navigation buttons to select the desired baud rate value. The module supports:

9.6K Baud
19.2K Baud
57.6K Baud
115.2K Baud

Once the desired value has been entered press the center navigation button to save the settings. You will be returned to the Modbus settings menu.

Modbus Communications

Modbus Protocol - MODBUS is an application-layer messaging protocol, positioned at level 7 of the OSI model. It provides client/server communication between devices connected on different types of buses or networks. Documentation of the Modbus Protocol and its implementation is beyond the scope of this manual.

To gain a better understanding of MODBUS Protocol and it's implementation it is recommended you visit http:///www.modbus.org/ where the full MODBUS Protocol specification can be obtained along with implementation guides and many other resources.

Register Overview - The PIM-530 Modbus interface makes a variety of internal registers available for reading via the Modbus Protocol. It is assumed the user has an understanding of the Modbus Protocol and its implementation.

Module Status - The PIM-530 Status is available from a single 16 bit Modbus holding register at protocol address 40001. Each bit of the holding register represents a function status of the module. The status bits are arranged so monitoring only the 3 least significant bits provides the priority status of the module. The priority status bit states are Normal (All bits zero), Fault (Bit zero active) and Alarm (Bit 2 Active). Bit 1 has no function. Each additional bit (3 through 9) provides additional non-essential status information. Bits 10 through 15 are reserved for future use.

Table 1.

Register			Name	Access	Range	Type	Function Code
Modbus Address	Decimal	Hex					
40001	0	0	Status	Read Only	1 = Active	Word/Bits	03

Table 2.

Status Bits Assignments															
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Reserved						Ground Fault	Menu Accessed	Alarm Return	Alarm Out	None	None	Open	General Alarm	None	General Fault

Table 3.

	Status Bits Event Grid										
Ground Fault	Menu Access	Alarm Return	Alarm Out	Short Return	Short Out	Open	Alarm	Short	Fault	
9	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**	< Bit
0	0	0	0	-	-	0	0	-	0	Normal
0	1	0	0	-	-	0	0	-	1	Normal then > Menu Access
										Class B Status Events
0	0	0	0	-	-	0	0	0	1	Normal then > Open
0	0	0	1	-	-	0	1	-	0	Class B Alarm
										Class A Status Events
0	0	0	1	-	-	1	0	-	1	Alarm present on Out, Return Open
0	0	1	0	-	-	1	1	-	1	Alarm present on Return, Out Open
0	0	1	1	-	-	0	1	-	0	Alarm present on Out & Return
1	0	0	0	-	-	0	0	-	0	Ground Fault present on IDC Wiring

Event Distance Measurements - The PIM-530 event distance measurements are available as a single integer value at Modbus holding register 40006 through 40009. These values are only available when an Alarm status has been detected on the corresponding out or return terminals. The distances are available in both Feet and Meters.

Table 5.

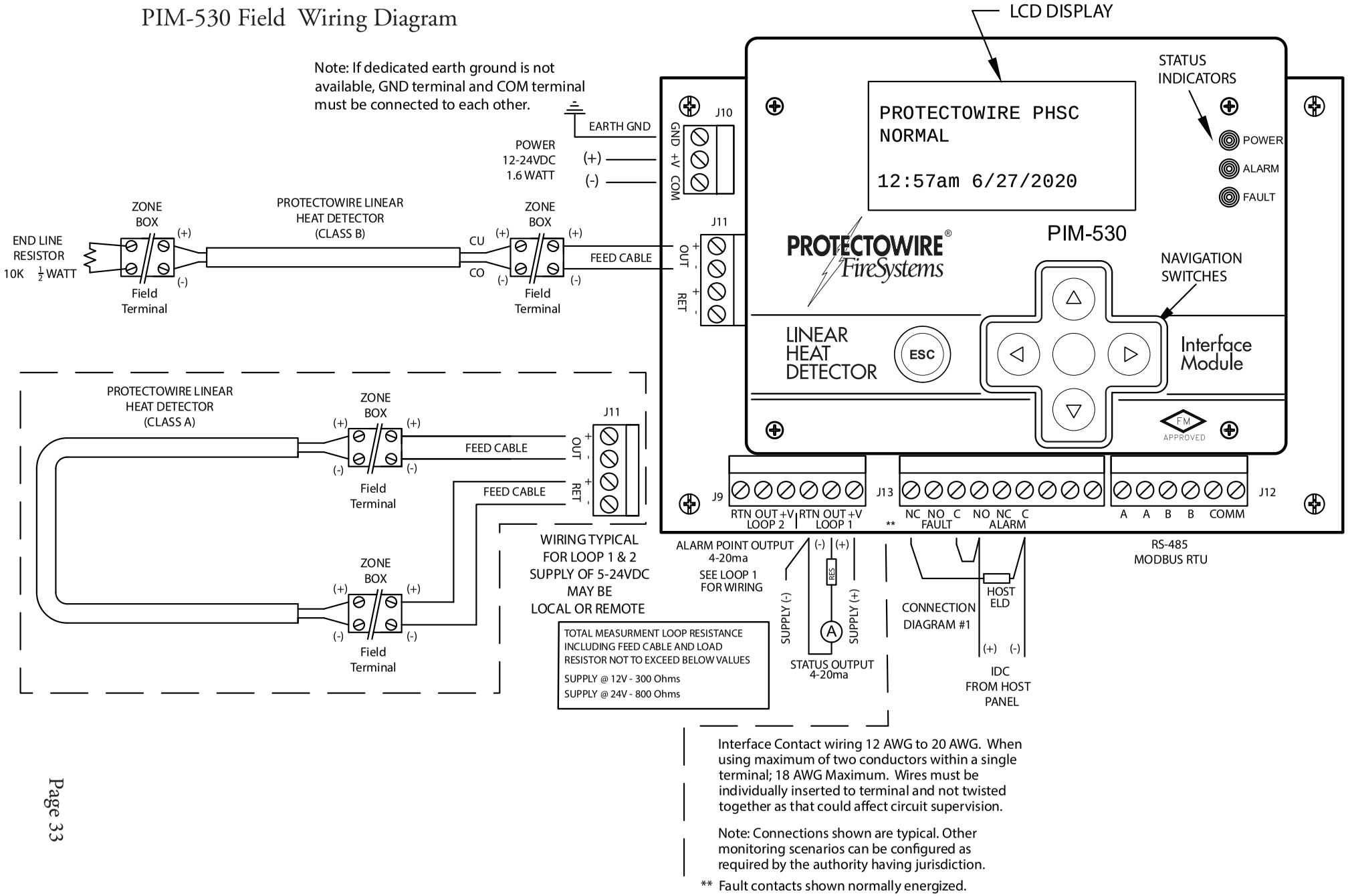
Register			Name	Access	Range	Type	Function Code
Modbus Address	Decimal	Hex					
40006	5	5	Distance Out Feet	Read Only	0 to +5000	Integer	03
40007	6	6	Distance Out Meters	Read Only	0 to +1550	Integer	03
40008	7	7	Distance Return Feet	Read Only	0 to +5000	Integer	03
40009	8	8	Distance Return Meters	Read Only	0 to +1550	Integer	03

Initialize / Reset - The PIM-530 interface module can be re-initialized or reset remotely by wiring an integer value of 65280 (0xFF00) to Modbus holding register 40101. Writing this value will re-initialize the module with and identical function to a “Reset” command from the local menu. Writing any other value to this register will have no effect. There is no read function for this register.

Table 8.

Register			Name	Access	Range	Type	Function Code
Modbus Address	Decimal	Hex					
40101	100	64	Initialize	Read Only	65280 (0xFF00)	Integer	06

PIM-530 Field Wiring Diagram



Interface Contact wiring 12 AWG to 20 AWG. When using maximum of two conductors within a single terminal; 18 AWG Maximum. Wires must be individually inserted to terminal and not twisted together as that could affect circuit supervision.

Note: Connections shown are typical. Other monitoring scenarios can be configured as required by the authority having jurisdiction.

** Fault contacts shown normally energized.

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