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C	Add Linear Heat Detection, PHD and Spot Heat Detection	EB		2/18/2015
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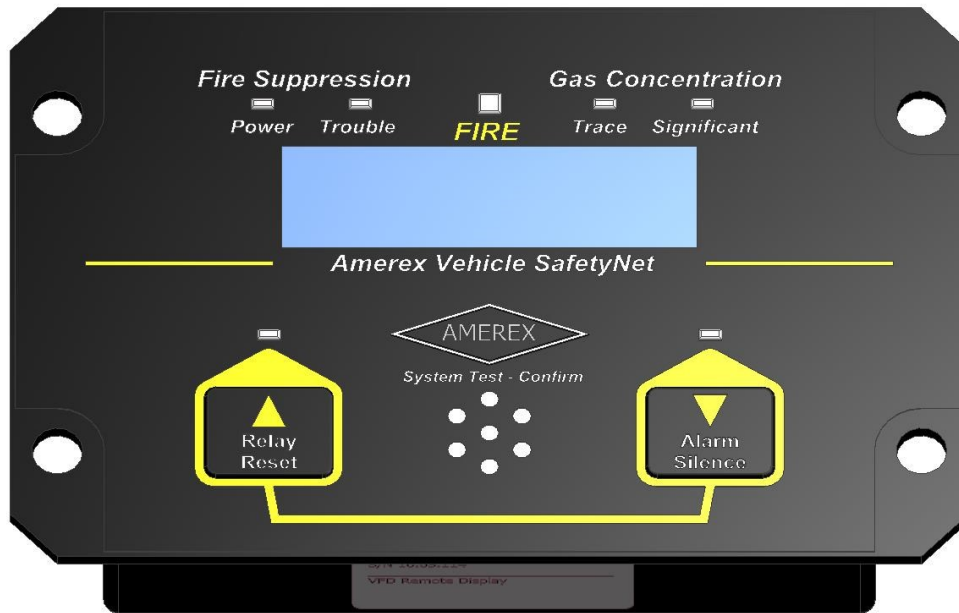
Fire Suppression Systems

SafetyNet

Installation, Operation and Instruction Manual

P/N 16601 - January, 2015

Revision C



Vehicle Fire Suppression System

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AMEREX CORPORATION

7595 GADSDEN HIGHWAY – TRUSSVILLE, AL 35173

www.amerex-fire.com

Phone: 205.655.3271

Fax: 205.655.3279



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Chapter 1: General Information

This document must be used in conjunction with the following standards:

1. All applicable NFPA standards.
2. All other standards or laws deemed applicable to an installation by local authorities having jurisdiction.

This manual was written to be used as an option for electronics used in conjunction with an Amerex Suppression System.

⚠ AMEREX ELECTRONIC PANELS ARE TO BE USED ONLY WITH AMEREX SYSTEM COMPONENTS AND CABLES. THE USE OF UNAPPROVED COMPONENTS WILL VOID AMEREX WARRANTY ON ALL SYSTEM COMPONENTS AND THE FACTORY MUTUAL LISTING. IT IS THE RESPONSIBILITY OF INDIVIDUALS WHO INSTALL, OPERATE, INSPECT, RECHARGE AND/OR MAINTAIN THESE SYSTEMS TO READ THIS ENTIRE MANUAL.

Updated Installation, Operation, and Maintenance Manuals and Technical Bulletins will be available online at www.amerex-fire.com. It is important that these updates and additions be added to this manual according to the instructions that will accompany them.

The applications and use of the Amerex SafetyNet System are limited to the applications and uses described in this manual. Technical data contained herein is based on controlled laboratory testing deemed appropriate by Factory Mutual Research Corp. and other listing agencies, and is intended for informational purposes only. The data presented is accurate for the testing performed, but is published with no guarantee relative to a given hazard where factors are different from those encountered during actual tests. Amerex disclaims any liability for any use of the data and information contained herein by any and all other parties. Please direct questions concerning information in this manual to:

AMEREX CORPORATION
Vehicle Systems Group
P.O. Box 81 Trussville, AL 35173-0081
Phone: (205) 655-3271
Fax: (205) 655-3279
Email: sales@amerex-fire.com

1.1 Introduction

The Amerex Vehicle SafetyNet electronics are pre-engineered FM Approved products that are designed specifically for automatic fire detection and system actuation for vehicle equipment hazard areas. The SafetyNet electronics are also used as part of a combustible gas detection system. The SafetyNet electronics consist of self-configuring, microprocessor based Vehicle Safety Networks that give added flexibility to the proven Amerex Vehicle Systems Design. For the advanced user needing additional system flexibility, SafetyNet offers easy to use Windows based pull-down menu screens for application specific programming. More advanced features of SafetyNet allow the user to gather data in real-time from system sensors (event / data logging). The Amerex Vehicle SafetyNet has been tested to FM, SAE, and CE standards.

Benefits of the SafetyNet System:

- System status indicating and trouble shooting via discrete LEDs and VFD display
- Simple programming features
- Event data recording with time and date stamp
- 24-hour rechargeable backup battery for protection during extended shutdown
- Multiple detection input types
 - * Programmable Heat Detectors (PHD)
 - * AMGaDS Combustible Gas Sensors
 - * Safe IR Optical Flame Sensors (OFD)
 - * Linear Heat Detection (LHD)
 - * Spot Heat Detectors (SHD)
- Uses existing AMGaDS cables
- Allows for multiple cylinder release, and second shot release
- Multiple zoned heat detection
- Multiple zoned system actuation protection
- Allows for overheat, early warning and temperature monitoring
- Event logging (4000+ events)
- Internal audible alarm with silence
- Trouble ring back feature
- Relay outputs for alarm, trouble and significant gas conditions
- System reset / relay override
- 12 / 24 VDC operation

1.2 What Can Be Protected

A complete hazard analysis must be performed for each piece of equipment being protected to determine the machine components that would require fire protection. Protection may include but is not limited to:

- Earth Moving Equipment - Dozers, Haul Trucks, Cranes, Shovel Excavators, Drill Trucks, Conveyers
- Forestry / Land Clearing - Brush Cutters, Skidders, Feller Bunchers, Chippers

- Landfill / Refuse - Garbage Trucks, Compactors, Track Dozers
- Farming Equipment - Tractors, Harvesters, Mowers, Spreaders
- Transit - Rail, Bus
- Mobile Equipment - Pumps, Generators, Compressors

1.3 Testing Performed

- Factory Mutual
- SAE
- CE

Chapter 2: Component Description

This chapter describes the various components available for use with the Amerex SafetyNet Electronics. These include electronic panels, detection sensors, cables and other components that comprise a complete system. For fire suppression systems and components, reference the appropriate Amerex Fire Suppression Installation, Operation and Maintenance Manual. Item numbers shown in brackets in the following section titles (**[ITEM X]**) correspond to the item numbers from the Parts List (See Section 2.10).

2.1 SafetyNet Electronic Panels

2.1.1 SafetyNet Operator Display Panel (P/N 16389) [ITEM 1]

The Amerex Vehicle SafetyNet Operator's Display Panel indicates vehicle fire suppression system status to the vehicle operator or maintenance personnel. Basic system status is indicated via easy to read LEDs and audible alarm indications. Detailed "Event" text messages are shown on the panel display. The Operator's Display Panel functions as the central control for various other system modules. The Operator's Display Panel coordinates all communication between all other modules used.

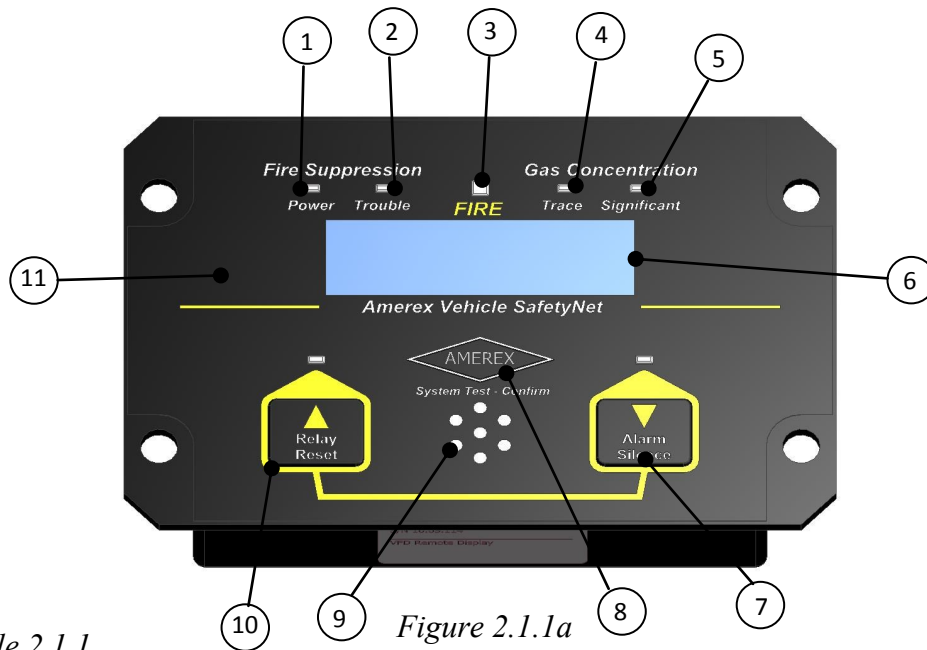


Table 2.1.1

Figure 2.1.1a

SAFETYNET OPERATOR DISPLAY PANEL FEATURES			
1	System Power - Green LED	7	Alarm Silence Button & Red LED
2	System Trouble - Yellow LED	8	Push to Test & System
3	Fire Indication - Red LED		Confirmation Switch
4	Trace Gas - Yellow LED	9	Audible Alarm
5	Significant Gas - Red LED	10	Relay Reset & Red LED
6	Vacuum Florescent Display VFD	11	Ambient Light Sensor

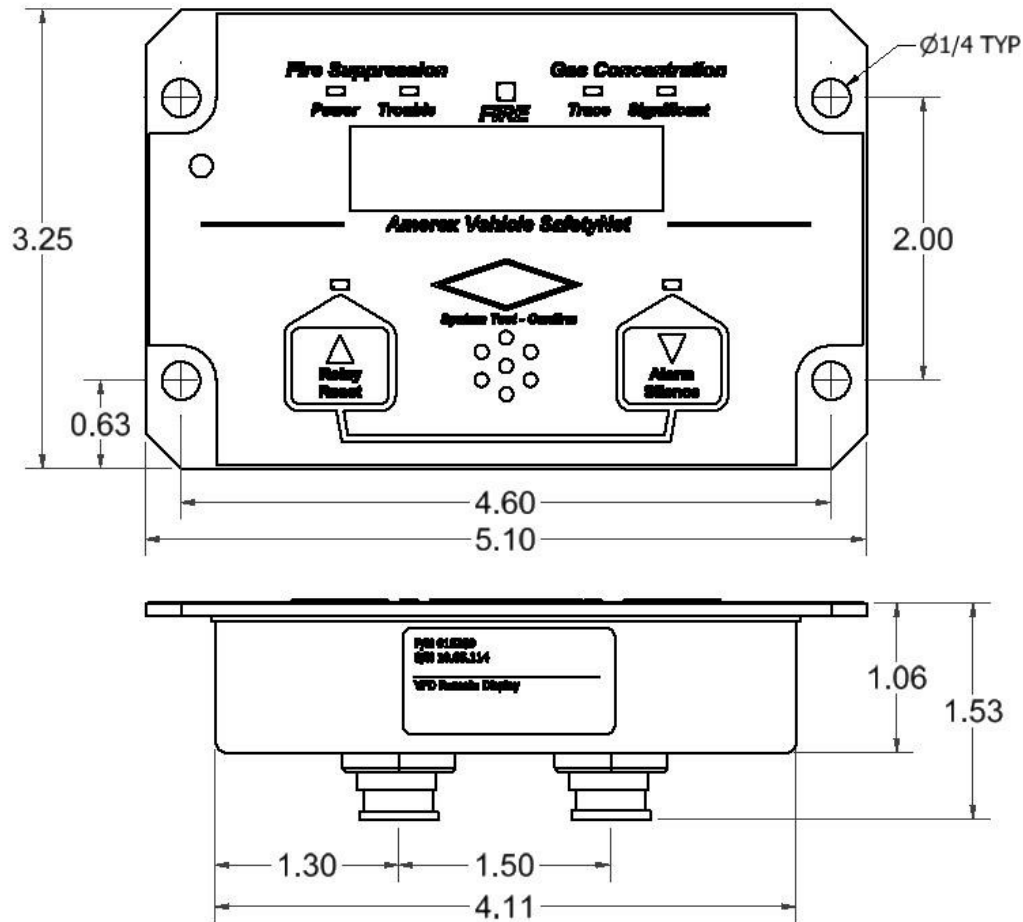


Figure 2.1.1b

2.1.2 SafetyNet Driver Panel (P/N 16390) [ITEM 3]

The Amerex Vehicle SafetyNet Driver Panel includes the most common features required for vehicle fire protection and gas detection systems. The Driver Panel is supplied with modular lead assemblies that provide connecting points for fire suppression/gas detection field wiring inputs and outputs. Connections are provided for:

- System Power
- Fire Suppression Actuation
- Class B Heat Detection Devices
- Manual Actuation
- Agent Cylinder Pressure Supervision
- Relay Contacts (Fire, Gas, Trouble)
- Four additional Detection Zones for Methane Gas Sensors, Optical Flame Detection and also can be used for additional Class B Heat Detection Devices or Programmable Heat Detectors with use of additional adapter cables.
- Network Output/Input Connectivity

While the Driver Panel includes most system features, the network capability of the system allows for the addition of other specific system modules. The Driver Panel includes battery backup for up to 24-hours of fire suppression capability in the event of system power failure. The Driver Panel includes sensor recognition software. Using

this software, the Driver Panel has the capability to automatically identify and differentiate:

- Amerex Gas Sensors
- Safe-IR Optical Flame Detectors
- Programmable Heat Detectors
- Class B Spot Heat Detectors or Linear Heat Detector.

Sensor alarm warning is provided to the Operator Display Panel via a network cable. In the event of network failure, the Driver Panel contains default operating software, which allows the module to continue operation. Multiple Driver Panels may be used in a SafetyNet system if necessary.

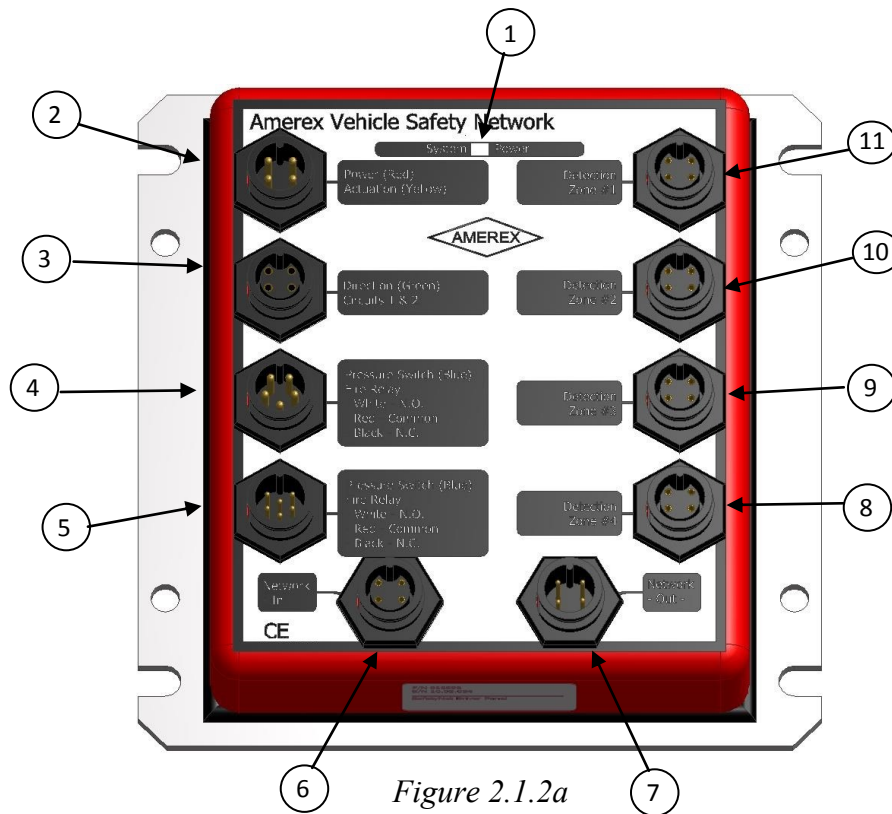


Table 2.1.2

SAFETYNET DRIVER PANEL FEATURES			
1	System Power - Green LED	6	Network Input
	System Trouble - Yellow LED	7	Network Output
2	System Power & Linear Actuator	8	Detection Zone #4
3	Class B Detection & Manual Act. Circuits	9	Detection Zone #3
4	Pressure Switch & Fire Relay Contacts	10	Detection Zone #2
5	Gas Relay & Trouble Relay Contacts	11	Detection Zone #1

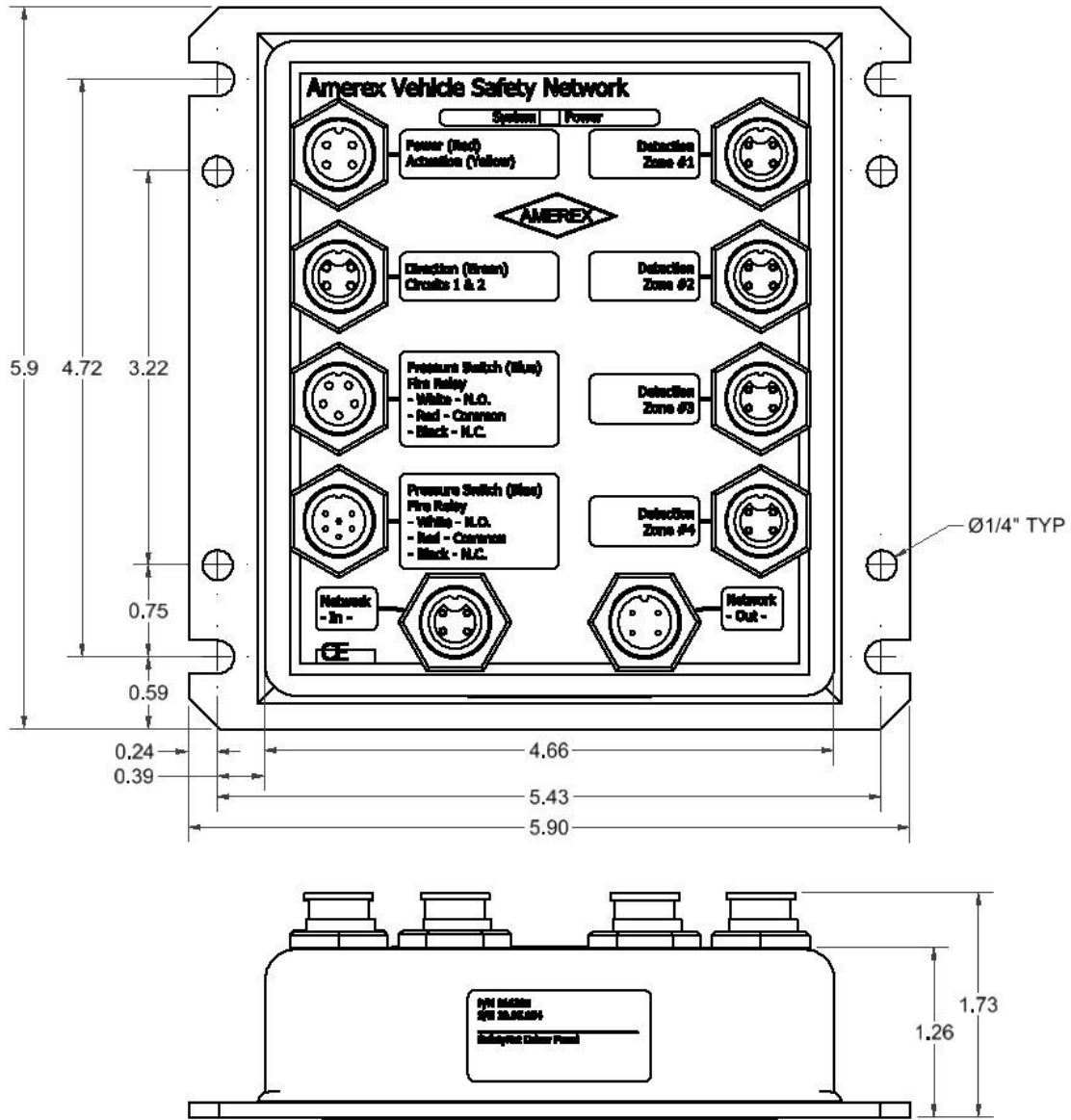


Figure 2.1.2.a

2.1.3 SafetyNet Detection Module (P/N 16391) [ITEM 4]

The P/N 16391 Detection Module allows for zoned fire, heat or gas detection capability. The Detection Module can interface to:

- Amerex gas sensors,
- Safe IR optical flame detectors,
- PHD heat sensors,
- Linear heat detection cable,
- Class B detection devices.

Any mix of detection types is acceptable. The Detection Module has the capability to automatically identify and discriminate between all of the above listed devices.

Sensor alarm warning is provided to the Operator Display Panel via a network cable. All system sensors are monitored for proper operation. Detection of a fire or gas condition transfers an on-board relay. Depending upon the application, the relay may be wired into the vehicle engine shutdown circuit, fuel shutoff valves or other warning devices. Network capability is built into the Detection Module allowing connection of multiple SafetyNet modules. More than one Detection Module may be used in a SafetyNet system as necessary.

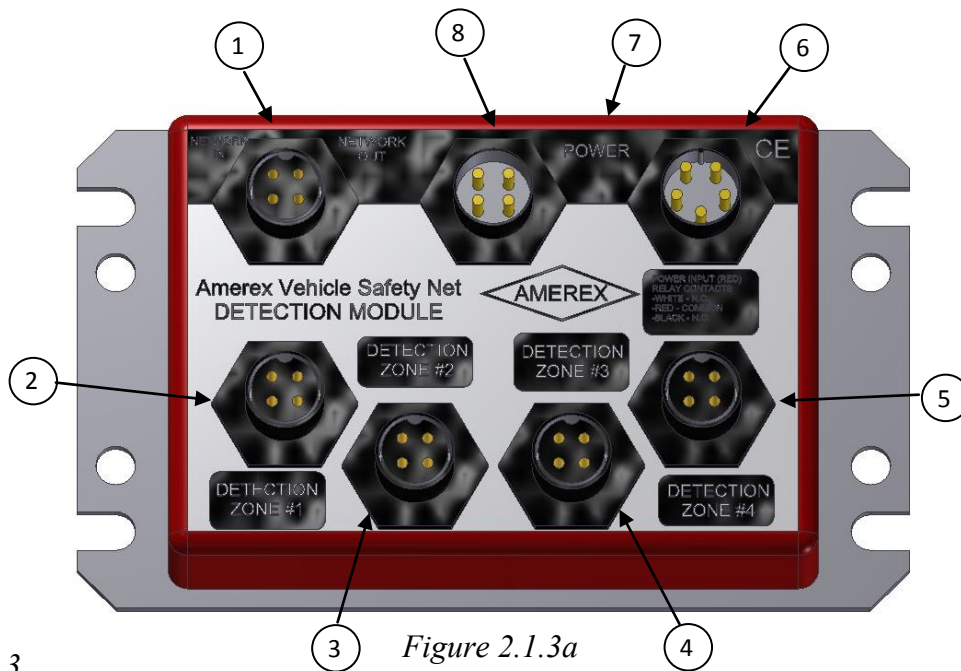


Table 2.1.3

Figure 2.1.3a

SAFETYNET DETECTION MODULE FEATURES			
1	Network Input Connection	6	System Power & Fire Relay Contacts
2	Detection Zone #1	7	Modular Power - Green LED
3	Detection Zone #2		Trouble LED - Yellow LED
4	Detection Zone #3	8	Network Output Connection
5	Detection Zone #4		

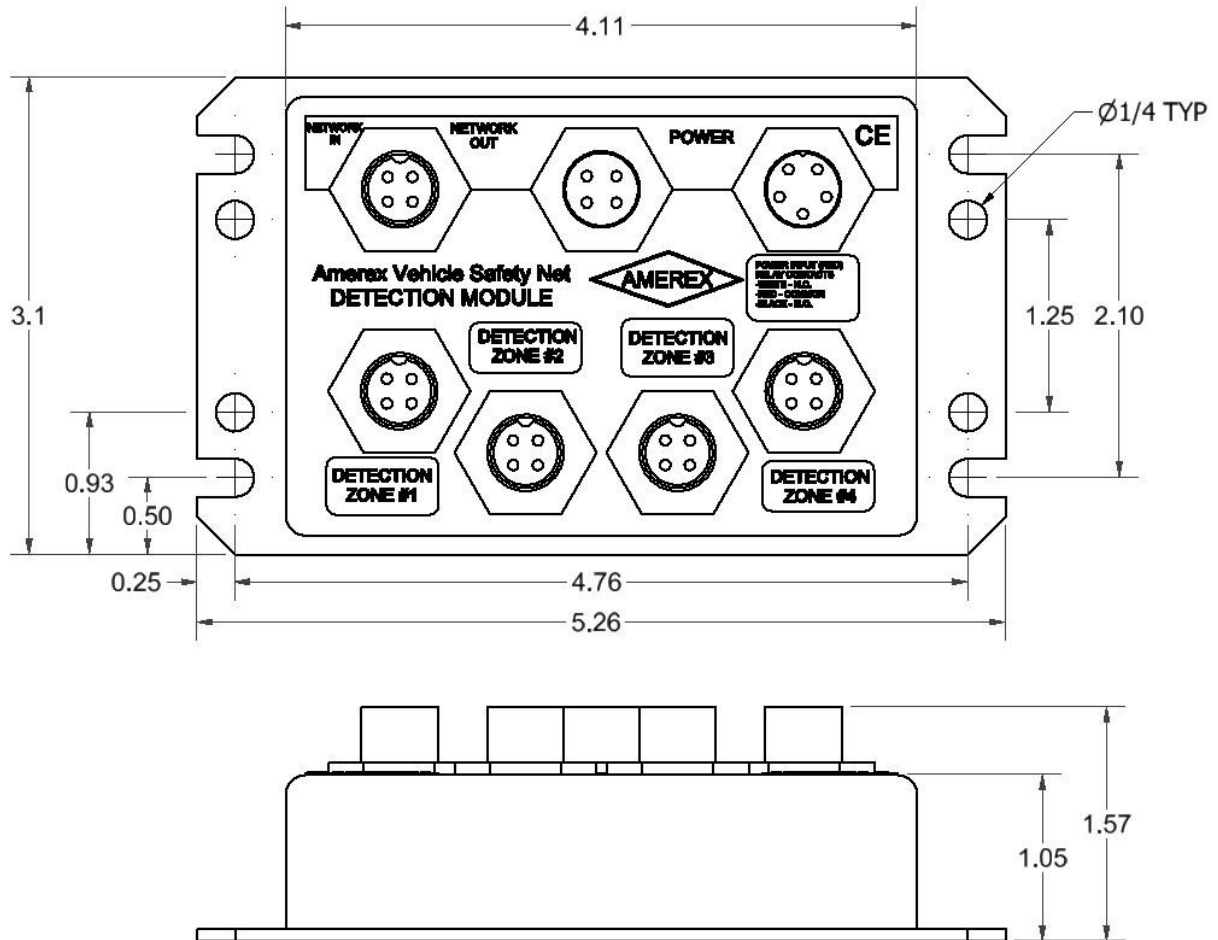


Figure 2.1.3b

A modular lead assembly is provided with the P/N 16391 Detection Module for connection to 12-24VDC power input (color coded red) and relay connection circuits. Replacement power/relay lead assemblies are available as P/N 16611. If 12-24VDC power is to be supplied to the Detection Module, a Modular Power Supply Lead is required. Select a Power Lead from available lengths in the wiring harness section on at the end of Section 2. If power is supplied from another SafetyNet Module, the power connection plug must remain unused.

2.1.4 SafetyNet Releasing Module (P/N 16392) [ITEM 5]

The P/N 16392 Releasing Module allows for zoned fire system agent cylinder actuation capability. The Releasing Module will support up to (4) separate Amerex Agent Cylinders. Agent Cylinder release timing can be programmed to occur immediately upon fire recognition, sequentially timed, or upon other external inputs. This module is capable of releasing cylinders using different fire suppression agents. More than one Releasing Module may be used in a SafetyNet system. Separate connections are available for monitoring the pressure of each Agent Cylinder through the Agent Cylinder Pressure Switch. Release of any agent cylinder triggers an on-board relay. Depending upon the application, the relay may be wired into the vehicle engine shutdown circuit, fuel shutoff or other warning devices.

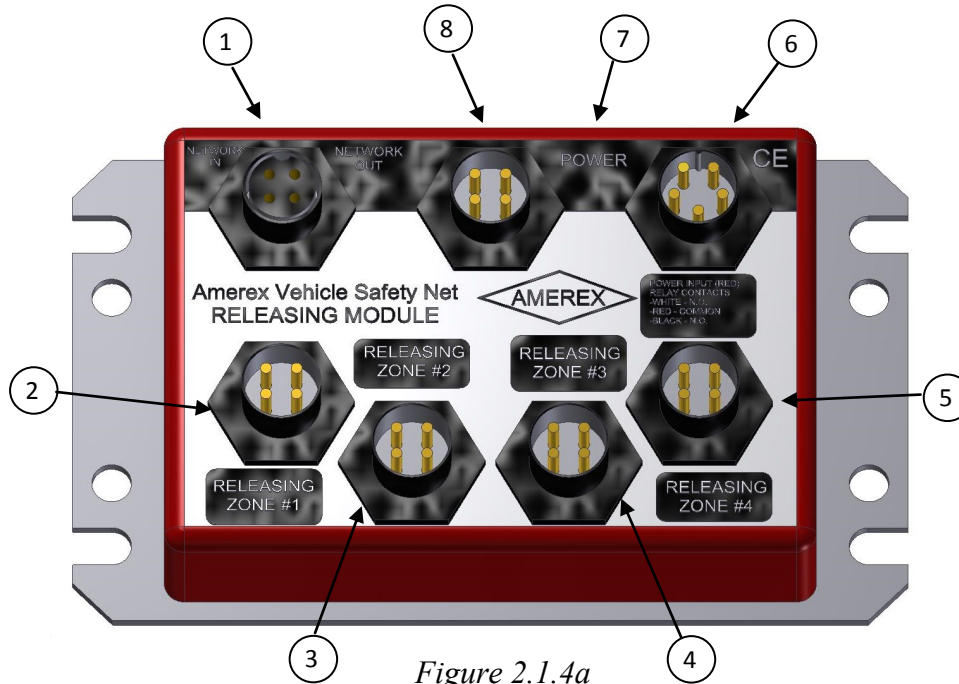


Figure 2.1.4a

Table 2.1.4

SAFETYNET RELEASING MODULE FEATURES			
1	Network Input Connection	6	System Power & Fire Relay Contacts
2	Releasing Zone #1	7	Modular Power - Green LED
3	Releasing Zone #2		Trouble LED - Yellow LED
4	Releasing Zone #3	8	Network Output Connection
5	Releasing Zone #4		

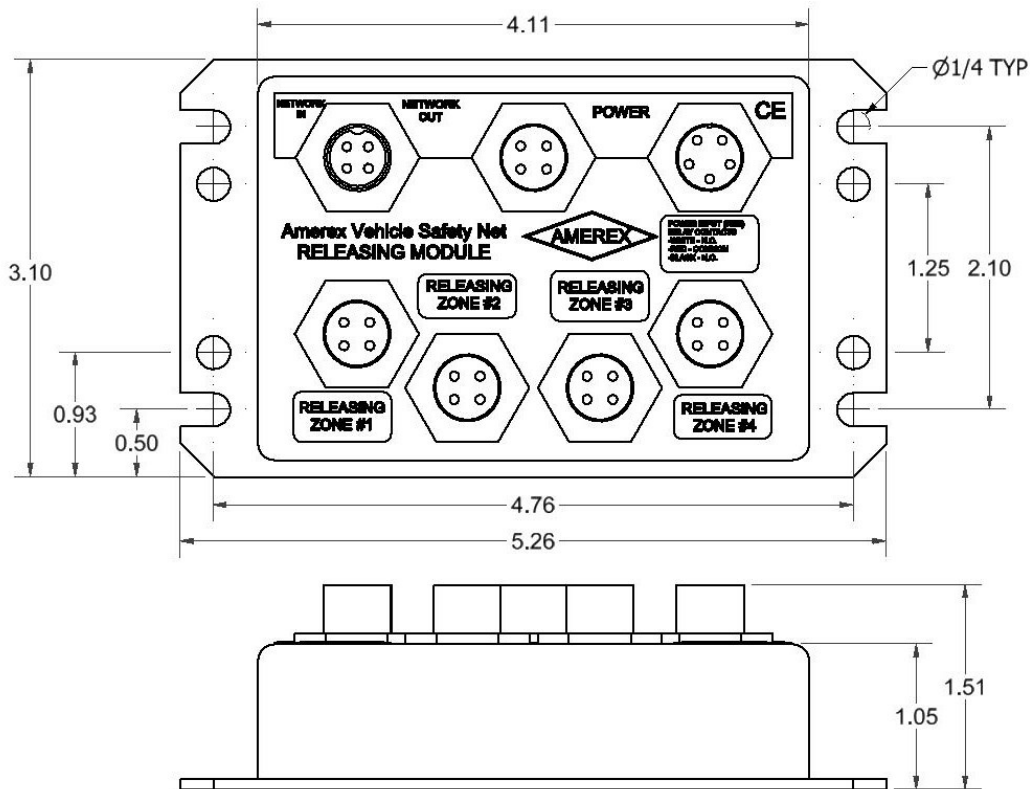


Figure 2.1.4b

A modular lead assembly is provided with the P/N 16392 Releasing Module for connection to 12-24VDC power input (color coded red) and relay connection circuits. Replacement power/relay lead assemblies are available as P/N 16611. The Releasing Module can connect to additional SafetyNet Modules using standard AMGaDS four wire sensor cables ordered separately. Select from available lengths in Wiring Harness Section on at the end of Section 2.

2.1.5 SafetyNet Detection and Releasing Module (P/N 16395) [ITEM 6]

The P/N 16395 Detection-Releasing Module allows for zoned fire detection and releasing capability. The Detection-Releasing Module provides an interface for:

- Amerex Gas Sensors
- Safe IR Optical Flame Detectors
- Programmable Heat Detectors
- Class B detection devices
- Spot thermostats
- Linear Heat Detection Cable
- Manual actuation button
- Actuation Circuits/Electric Actuators

Any mix of detection types is acceptable. The Detection-Releasing Module has the capability to automatically identify and discriminate between any sensor type listed above. Sensor warning is provided to the Operator Display Panel via a network cable. All system sensors are monitored for proper operation. Detection of a fire or gas condition transfers an on-board relay. Depending upon the application, the relay

may be wired into the vehicle engine shutdown circuit or other warning devices. Network capability allows for connection of multiple SafetyNet modules. More than one Detection-Releasing Module may be used in a SafetyNet system. The Detection-Releasing Module includes sensor recognition software. Default operation settings are programmed into this module releasing only the fire suppression system cylinders connected to this module. A second agent cylinder can be programmed to release upon an additional fire condition or a timed release. This module is capable of releasing cylinders using different fire suppression agents as necessary. A separate connection is available for Agent Cylinder pressure monitoring.

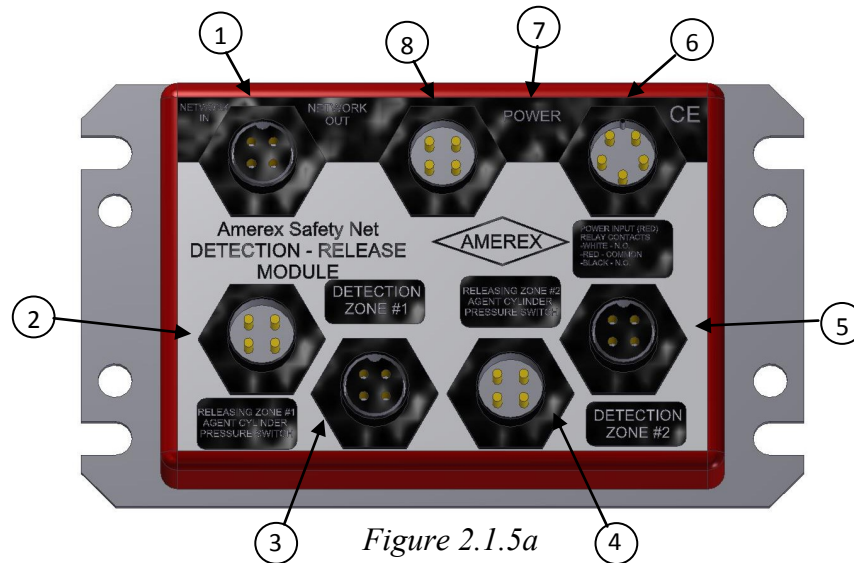


Table 2.1.5

Figure 2.1.5a

SAFETYNET DETECTION AND RELEASING MODULE FEATURES			
1	Network Input Connection	5	Detection Zone #2
2	Releasing Zone #1	6	System Power & Fire Relay Contacts
	Agent Cylinder Pressure Switch		Modular Power - Green LED
3	Detection Zone #1	7	Trouble LED - Yellow LED
4	Releasing Zone #2	8	Network Output Connection
	Agent Cylinder Pressure Switch		

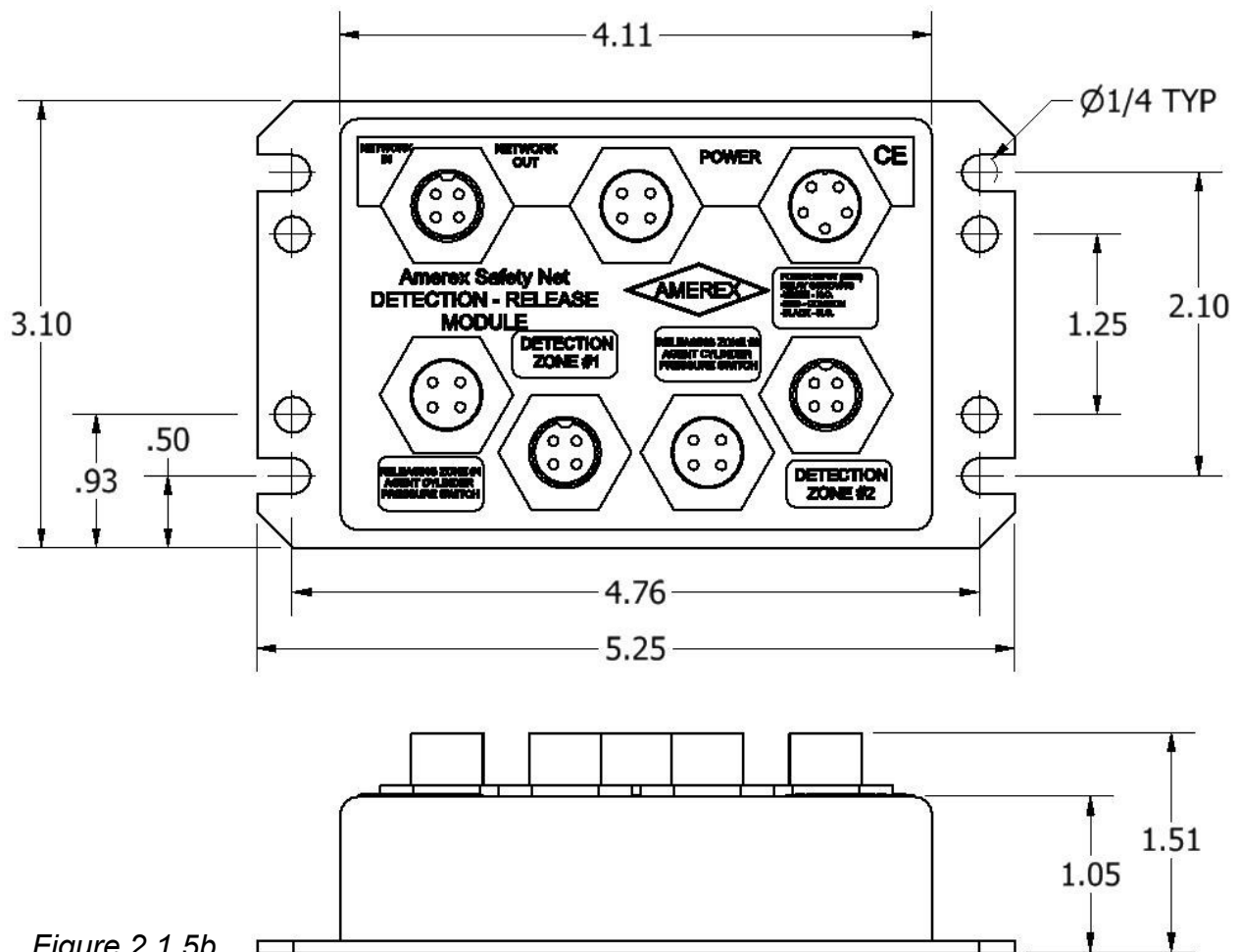


Figure 2.1.5b

A modular lead assembly is provided with the P/N 16395 Detection-Release Module for connection to 12-24VDC power input (color coded red) and relay connection circuits. Replacement power/relay lead assemblies are available as P/N 16611. If 12-24VDC power is to be supplied to the Detection-Release Module, a modular power supply lead is required. Select a power lead from available lengths in wiring harness section at the end of Section 2.

If power is supplied from another SafetyNet Module, the power connection plug must remain unused. Two additional modular lead assemblies are also provided with the Detection-Releasing Module for connection to:

- the actuation leads (color coded yellow)
- the agent cylinder pressure switch circuits (color coded blue).

Replacement actuation/pressure switch leads are available as P/N 16612. Connection of Class B detection devices requires the use of one Spot Sensor Interface Cable P/N 16610 per circuit to connect to detection zones 1 through 4 on the Detection Module.

2.2 Detection

Amerex offers a variety of heat detectors for detecting fires and overheat conditions. A hazard analysis must be performed to identify the proper selection of heat detection methods.

2.2.1 Safe IR Optical Flame Sensor (P/N 15799) [ITEM 7]

The P/N 15799 Safe IR Optical Flame Sensor is designed specifically for rapid response flame detection in under-hood, vehicle applications. The sensor operates by detecting CO₂ emissions from a hydrocarbon fire. The Infrared wavelength of CO₂ and the specific characteristics of a hydrocarbon fire allow the Safe IR sensor to discriminate against background noise and other hot bodies common in vehicle engine compartments. The detection range of the Safe-IR system is a ratio function of the sensor field of view versus the emitted energy created by a fire condition. That is, as the field of view is increased (i.e. distance from the lens increases) the size of the fire to be detected must also increase in order to maintain constant detection sensitivity. The characteristics of a fire condition are differentiated from other signals commonly found in an engine compartment.

The sensor housing is water and vibration resistant. The low profile/flexible design allows for ease of design application and installation. The Safe-IR Sensor is designed with a wide field of view of (approximately 90 degrees).

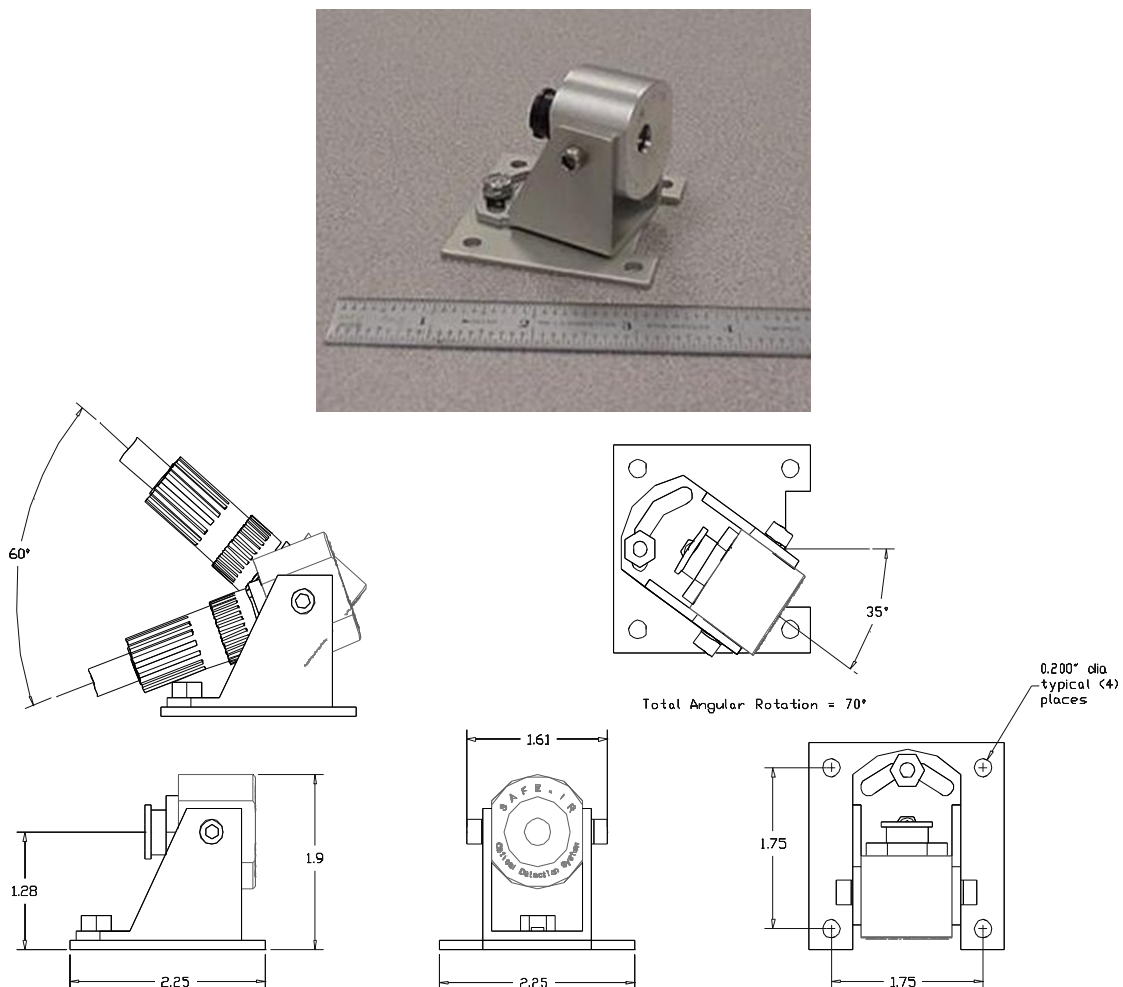


Figure 2.2

2.2.2 Spot Heat Detectors (P/N 14087 & P/N 14088 bracket style; 16615 bulkhead style) [ITEM 8]

A Spot Heat Detector is a normally open, self resetting contact closure device. The device is configured with four wires for allowing supervision of series connected circuitry. The internal contacts of the device will close upon reaching designed temperature set point parameters. Three versions of the device are available. Two styles of the device are supplied with a 280°F set point rating (P/N 14087) shown in Figure 2.2.2a and 350°F set point rating (P/N 14088) shown in Figure 2.2.2b. Mounting configurations are shown below in figures 2.2.2a and 2.2.2b. Another style of the device is supplied with a 450°F set point rating (P/N 16615) and has the mounting configuration shown in figure 2.2.2c.

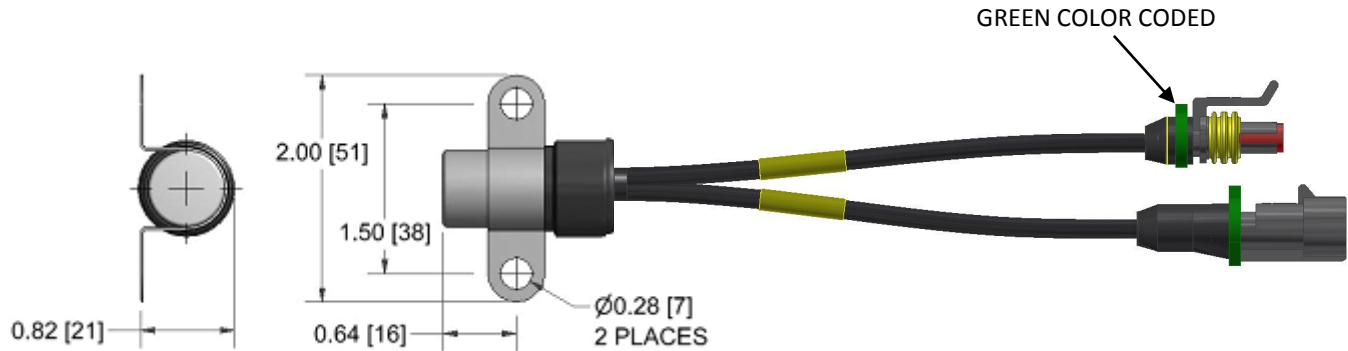


Figure 2.2.2a

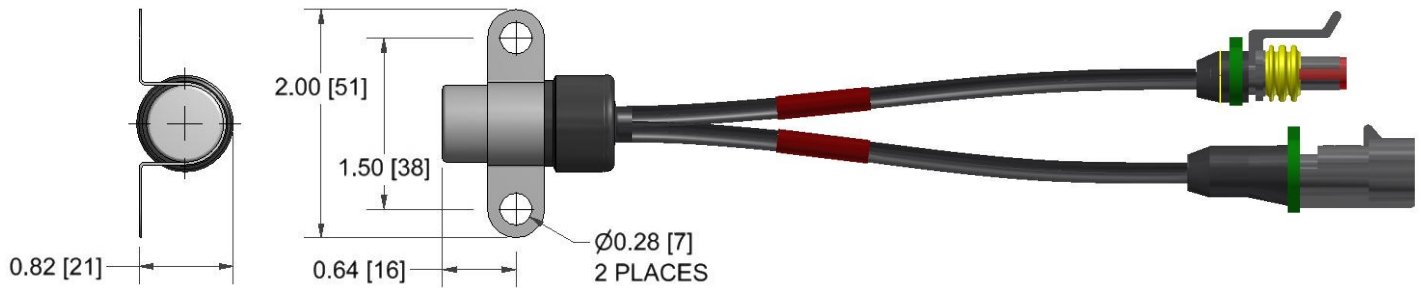


Figure 2.2.2b

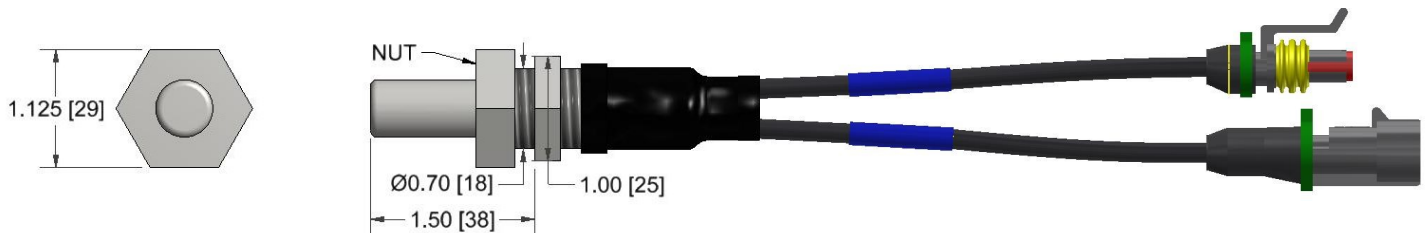


Figure 2.2.2c

2.2.3 Linear Heat Detector (P/N 20083 with protective spring; 20075 without protective spring) [ITEM 8]

A Linear Heat Detector is a normally open device that closes when subjected to heat. The device is comprised of two internal coiled spring loaded conductors. The Amerex Linear Heat Detector is green in color and has a temperature set-point of 356°F.

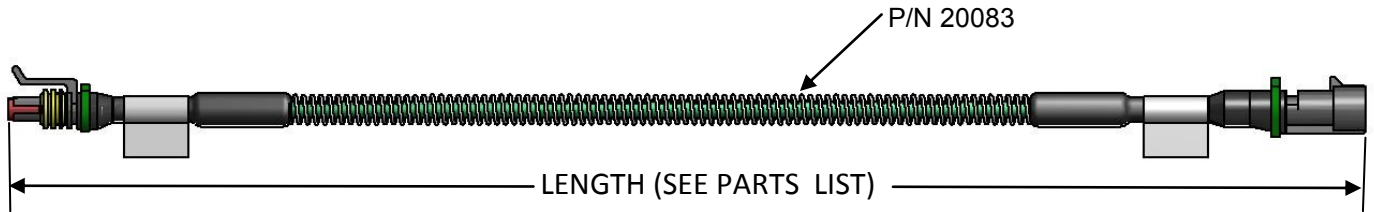


Figure 2.2.3a

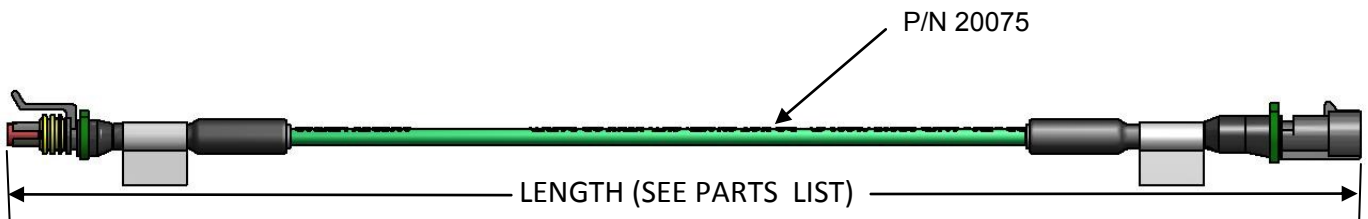


Figure 2.2.3b

2.2.4 Programmable Heat Detectors (PHD) (P/N 16603) [ITEM 9]

The Programmable Heat Detector (PHD) provides automatic fire detection and overheat warning capabilities and interfaces with a variety of Amerex Vehicle System Electronics. The PHD thermal sensor is designed specifically for the rugged Vehicle Systems market and provides a rapid, reliable response to overheat conditions. The PHD can be programmed to a set point temperature range from 140°F to 550°F. The PHD sensor combines the capability of a data acquisition system and a traditional fire suppression system in a single device.

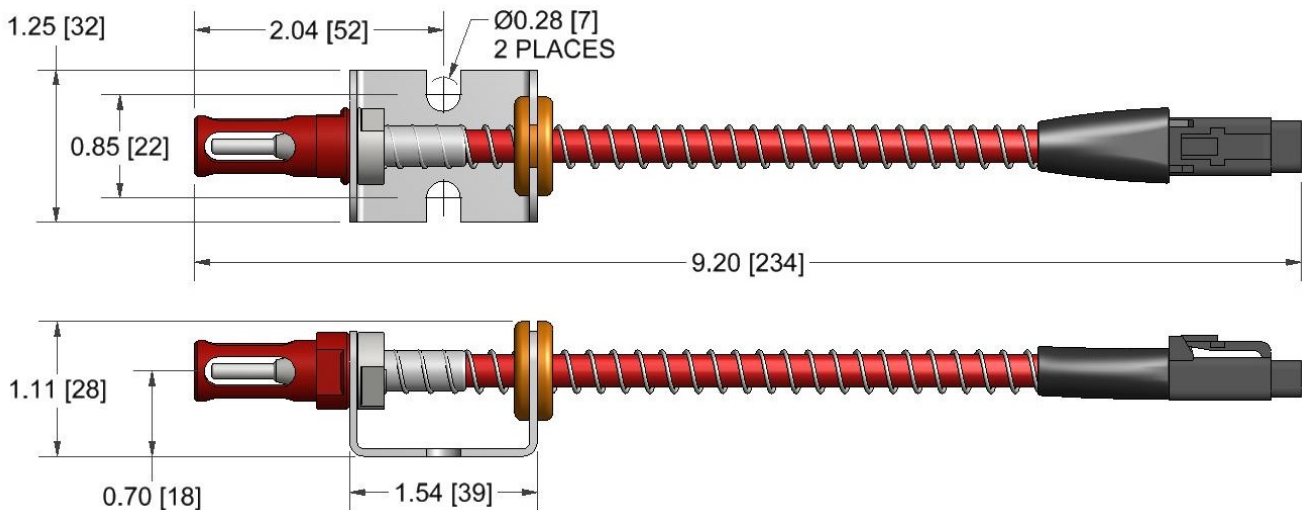


Figure 2.2.4a

2.2.5 Combustible Gas Sensors [ITEM 10]

Each Gas Sensor continuously samples the atmosphere through a gas permeable membrane. An electrical signal from the sensor is monitored by the Control Panel. If combustible gas is present, the electrical signal may exceed a specific target gas level. If this happens the Control Panel provides a signal to the front panel LED's and sounds an audible alarm. A mounting "P" clamp is provided with each Gas Sensor.

2.2.5.1 Methane Gas Sensor (P/N 14198)

The Methane Gas Sensor is designed specifically for vehicle use. Methane (CH₄) is the primary component in CNG and LNG fuels. Methane gas is lighter than air and can be flammable in concentrations ranging from 5% to 15% volume in atmosphere. The Methane Gas Sensor is designed to provide detection of methane gas in concentrations below the Lower Flammability Limit (LFL) of methane, more specifically 20% of the LFL for Trace Alarm and 50% of the LFL for Significant Alarm. The Methane Gas Sensor will detect other combustible hydrocarbon gases if present, but is factory calibrated specifically to provide early warning in the event of methane gas leakage. Methane Gas Sensors are anodized silver. Dimensions are in inches [mm].

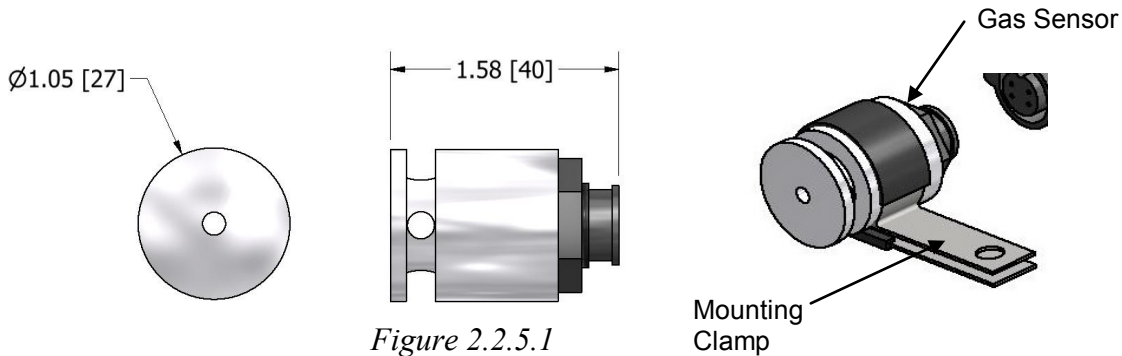


Figure 2.2.5.1

2.2.5.2 Select Methane Gas Sensor (P/N 17357)

The Select Methane Gas Sensor is very similar to the standard Methane Gas Sensor, except with a tighter tolerance range for indication of "Trace" and "Significant" gas concentrations. The Select Methane Gas sensor is housed in an aluminum body that is anodized silver with a permanent mark "Select Sensor" and the Month-Year of manufacture. Dimensions are in inches [mm].

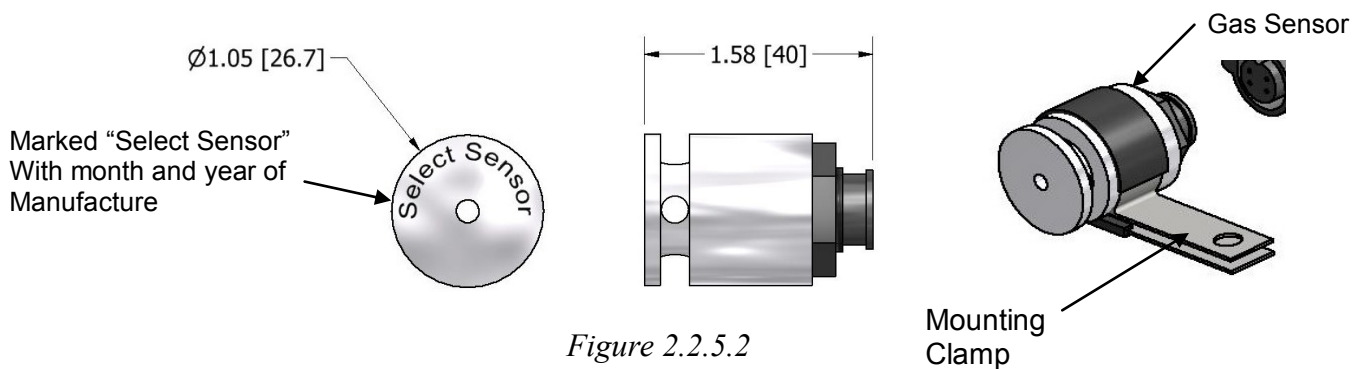


Figure 2.2.5.2

2.2.5.3 Hydrogen Gas Sensor (P/N 16352)

The Hydrogen Gas Sensor is designed specifically for vehicle use. Hydrogen gas is lighter than air and can be flammable in concentrations ranging from 4% to 75% volume in atmosphere. The Hydrogen Gas Sensor is designed to provide detection of hydrogen gas in concentrations below the Lower Flammability Limit (LFL) of hydrogen, more specifically 20% of the LFL for Trace Alarm and 50% of the LFL for Significant Alarm. The Hydrogen Gas Sensor will detect other combustible hydrocarbon gases if present, but is factory calibrated specifically to provide early warning in the event of hydrogen gas leakage. Hydrogen Gas Sensors are anodized gold. Dimensions are in inches [mm].

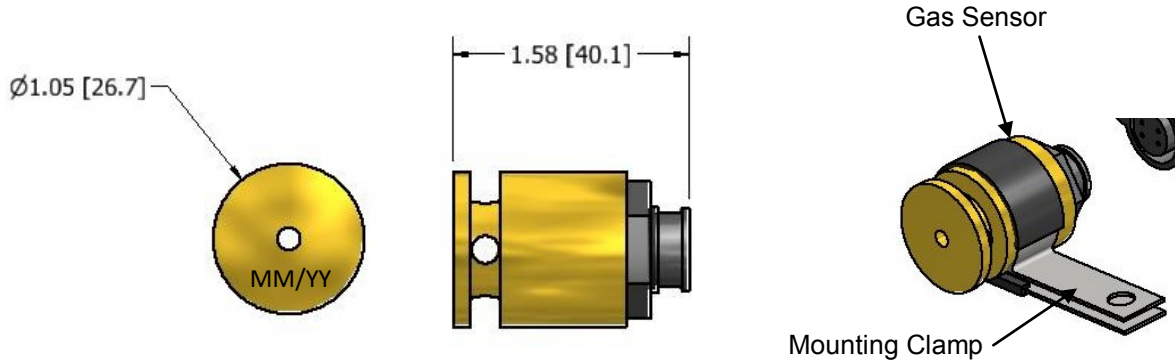


Figure 2.2.5.3

2.3 Cables

Amerex offers pre-assembled modular cables. Most of the Amerex cables are terminated with connectors. Amerex cables are color coded to allow for easy troubleshooting and installation.

2.3.1 Gas Sensor Cable [ITEM 21]

The standard AMGaDS four-wire sensor cable is used for connection of SafetyNet Operator Display Panel to other SafetyNet modules and for connection of additional modules to each other. They are also used to connect the Safe IR Optical Flame Detector, Amerex Gas Sensors to various SafetyNet modules.

Connector With Pins
(TYP)



Figure 2.3.1

2.3.2 Power Supply Cable Assembly, Power Supply Extension Cable & Replacement Fuse 10 AMP [ITEM 28]

The Power Cable is terminated sealed connectors. Color coding (red) for the Power Cable can be found near the terminated connector.

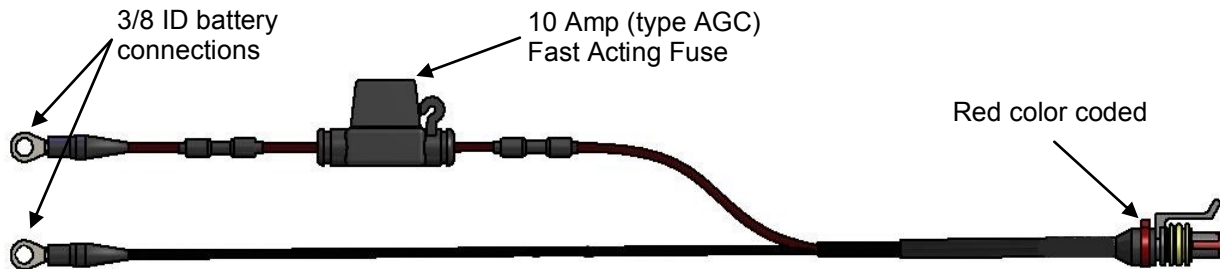


Figure 2.3.2

2.3.3 Class B Hazard Detection Cable [ITEM 19]

The Class B Hazard detection cable is identified by the single green color coded tie wrap shown at each end of the cable. The Class B cable is used to connect to either a Linear Heat Detector, Spot Heat Detector or Manual Actuation Button with controls of the associated electronics package. The cable is available in various lengths and is equipped with suitable green color coded pluggable connectors on each end.



Figure 2.3.3

Class B Hazard Detection Cable Shielded [ITEM 20]

An additional line of heavy-duty hazard wire Class B Detection Circuit *Figure 2.3.5* assemblies are now available for the Amerex SafetyNet System. The new hazard wire Class B Detection Circuit assemblies are supplied with an abrasion resistant outer sleeve installed over the standard hazard wire and sealed over the modular pluggable connectors at each end.



Figure 2.3.3a

2.3.4 Class B Detection Interface Cable (P/N 16610) [item 22]

The Class B Detection Interface Cable allows the SafetyNet Driver Panel, Detection and Release Module, and Detection Module to connect to:

- Spot Heat Detectors
- Linear Heat Detectors
- Manual Actuation Buttons
- 100 PSI Pressure Switches

Each Class B Detection Interface Cable is supplied with an End of Line Module.

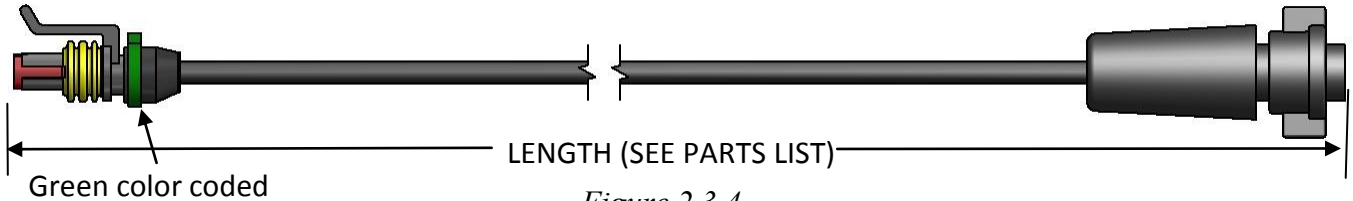


Figure 2.3.4

2.3.5 Programmable Heat Detector (PHD) Cable (P/N 16612) [item 23]

The use of PHD Adapter Lead Assembly P/N 16612 will be required for connecting to SafetyNet modules. See connection diagram example Section 4 Installation.

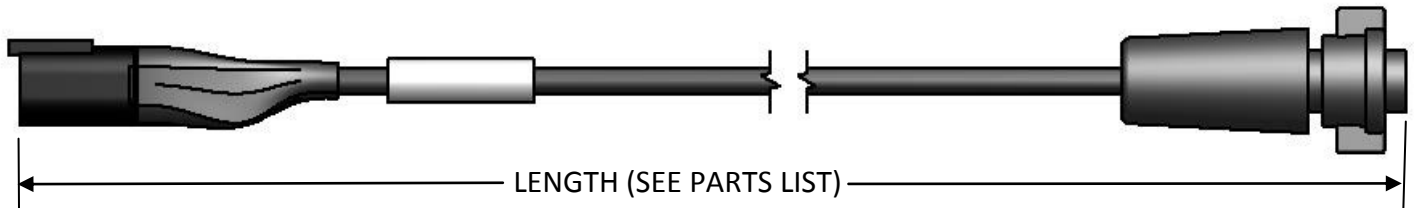


Figure 2.3.5

2.3.6 Programmable Heat Detector (PHD) Bulkhead Cables (P/N 23854 & 23855) [ITEM 24 & 25]

The use of PHD Bulkhead Cables can be used for connecting PHDs to SafetyNet modules.

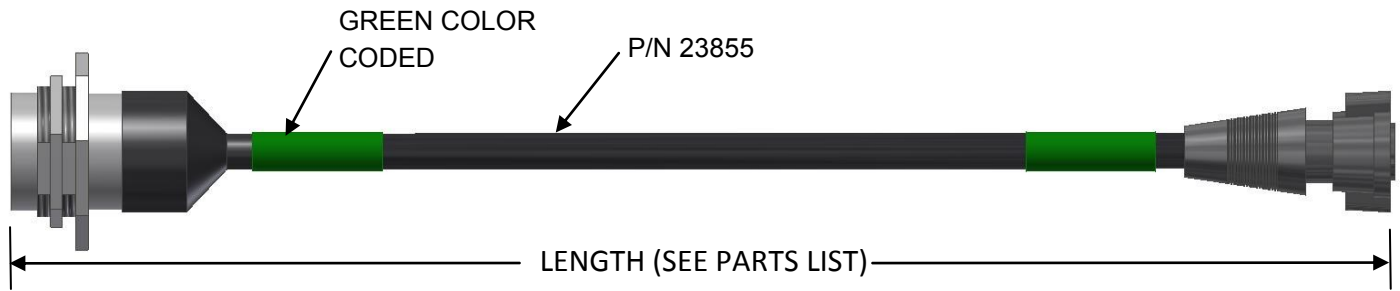


Figure 2.3.6

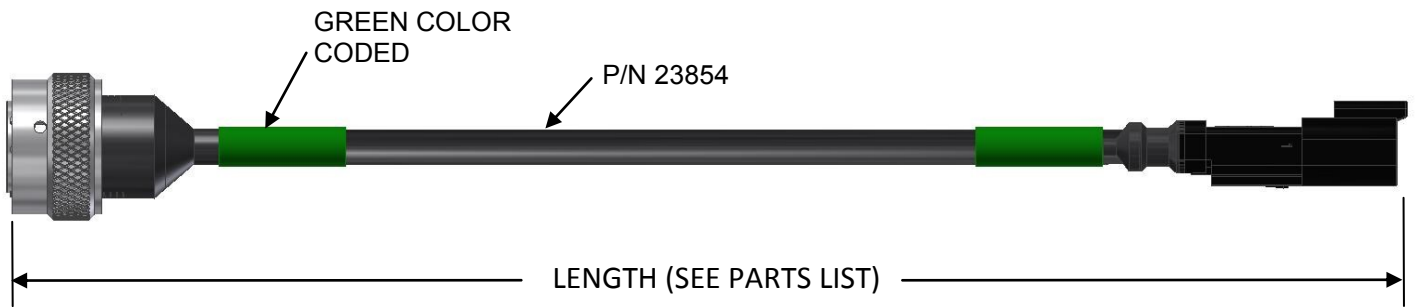


Figure 2.3.6a

2.3.7 Detection Splitter Hazard Cable, Bulkhead (P/N 23869 / 23871) [ITEM 32 / Item 33] / Detection Lead Cable, Bulkhead (P/N 23380) [ITEM 34]

The Bulkhead Detection Splitter Hazard Cable and Bulkhead Detection Lead Cable can be used when the cables need to pass through a surface. Each contains a circular 10 pin bulkhead style connector. Both of these cables must be used together.

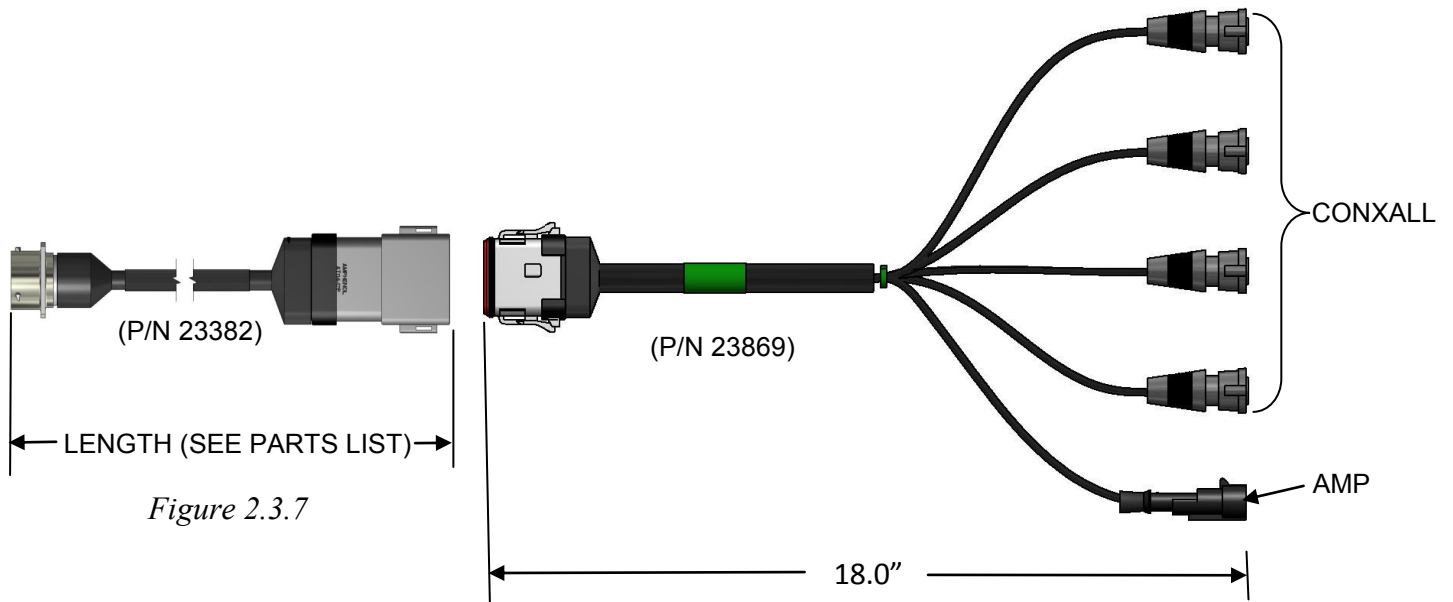


Figure 2.3.7

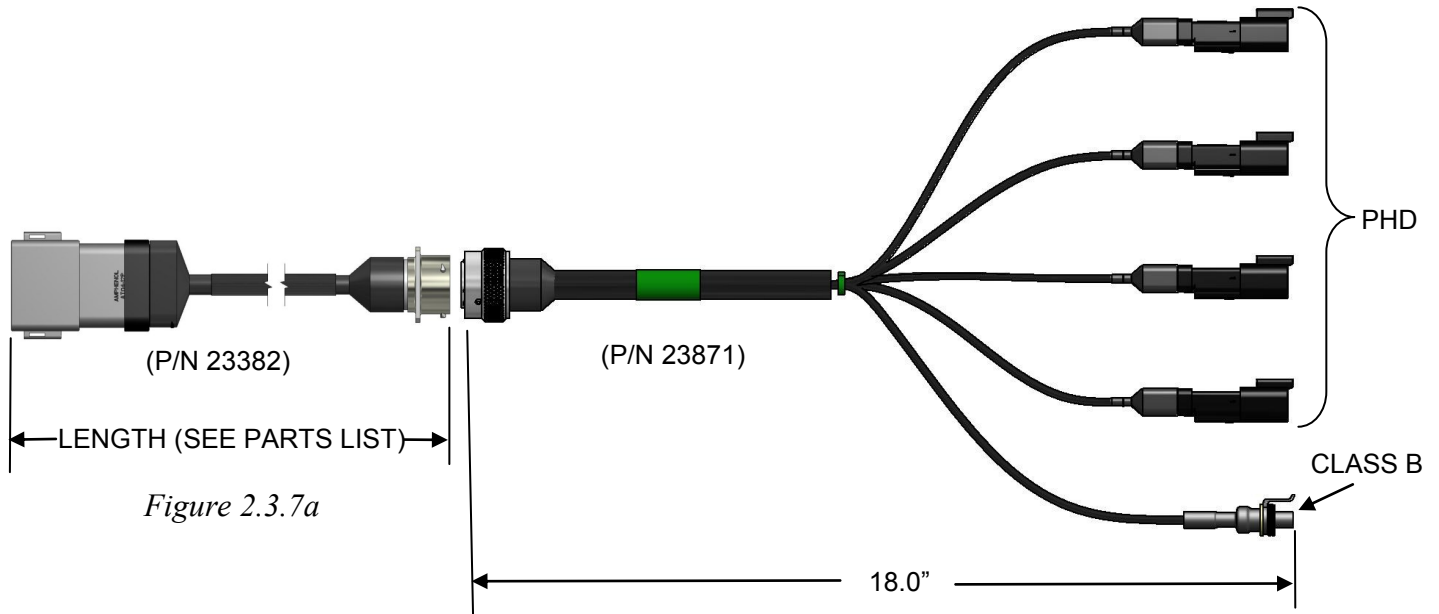


Figure 2.3.7a

2.3.8 Actuation Cable [ITEM 26]

The Linear Actuator Connector Lead Assembly must be used to connect the Linear Actuator to the Driver Panel or Release Module. The Actuator Connector Lead is a two-conductor wire equipped with yellow color-coded Amerex connectors. These connectors mate with the associated connector at the Control Panel and the Linear Actuator.



Figure 2.3.8

Actuation Cable Shielded [ITEM 27]

An additional line of heavy-duty actuator lead wire assemblies is now available for the Amerex Modular Fire Suppression Systems. The new lead assemblies come with a solid abrasion resistant outer sleeve installed over the standard red hazard area wire and sealed to the modular pluggable connectors at each end.



Figure 2.3.8a

2.3.9 Pressure Switch Cable (P/N 21539) [ITEM 29]

The Pressure Switch Cable is used to connect the Dual or Quad Master Harness to a Pressure Switch located on an Agent Cylinder Valve. Additional cables can also be used to connect link multiple Agent Cylinders to the same pressure switch circuit. Each is terminated with sealed connectors and color coding (blue) can be found on each connector. Various lengths of this cable are available and shown in the Parts List (See Section 2.9).

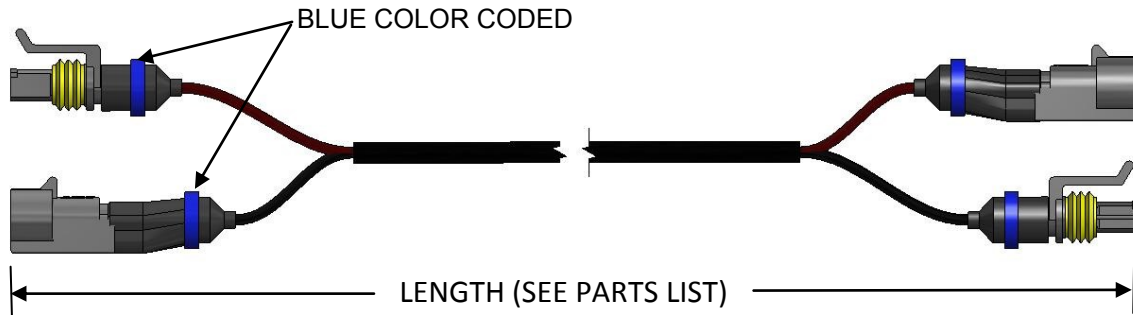


Figure 2.3.9

2.4 Pressure Switch

2.4.1 Agent Cylinder Pressure Switch (P/N 17609) [ITEM 11]

The Agent Cylinder Pressure Switch utilizes 1/4" NPT threads for securing to the agent cylinder valve. The switch is designed to monitor agent cylinder pressure. The switch is normally open and closes when pressure in excess of 330 PSI is exerted on it. The internal contacts of the switch will open when pressure exerted on it drops below 270 PSI.

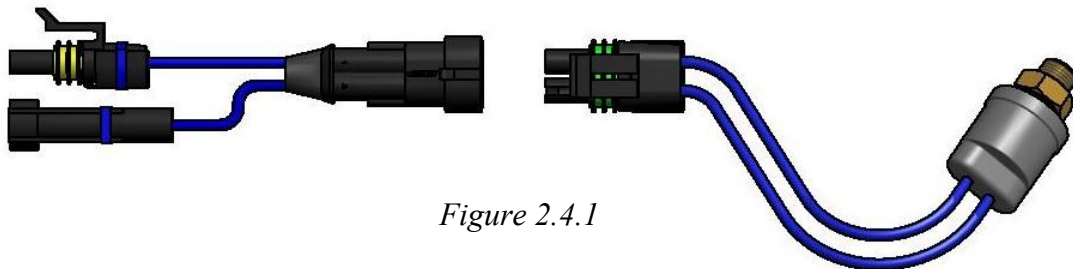


Figure 2.4.1

2.4.2 50 PSI Pressure Switch (P/N 22573 Non Terminated; P/N 22574 Terminated) **[ITEM 12]**

The 50 PSI Pressure Switch is designed to be used in the Pneumatic Actuation Network of a vehicle system. The Switch (P/N 22573 non-terminated version; P/N 22574 terminated version) is normally in the open position and closes when subjected to nitrogen pressure in excess of 50 PSI. The Switch is threaded with a 1/4" NPT male port. The Switch must be installed in a tee in the Pneumatic Actuation Network just before the first Pneumatic (P/N 10147), or Electric / Pneumatic (P/N 17068) Control Head. The Switch can be utilized to send a signal such as "system discharge" back to the associated electronics panel, or to an external relay for sounding an auxiliary alarm or illuminating a light in the event of system discharge.



Figure 2.4.2

2.5 Linear Actuator (P/N 22579) [ITEM 14]

The Linear Actuator is a device when electrically activated extends a metal shaft which mechanically opens the Agent Cylinder Valve when used in a control head or opens a Nitrogen Cylinder when used in an Electric Nitrogen Actuator. Once activated it cannot be reused and must be replaced. Service life of the Linear Actuator is 6 years after which it must be replaced. Shelf life of the Linear Actuator is 10 years after which it must be replaced whether it has been placed in service or not. Each Linear Actuator is supplied with a Mylar style label for identifying date of manufacture. An O-RING (P/N 17137) is provided with each Linear Actuator, and must be used each time that a Linear Actuator is installed. The Linear Actuator will be connected to the vehicle's Amerex Modular Electronics System.

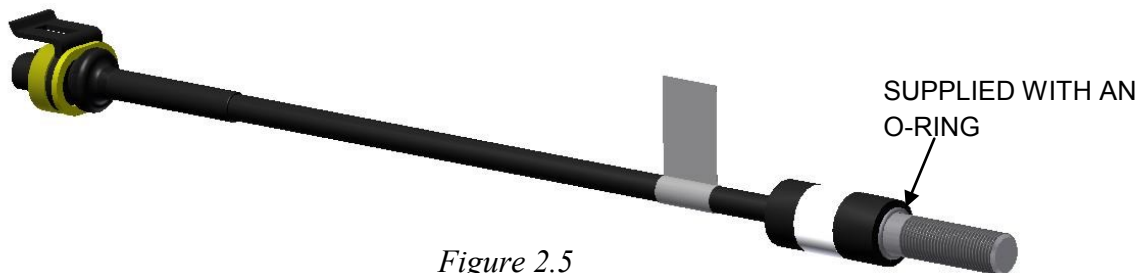
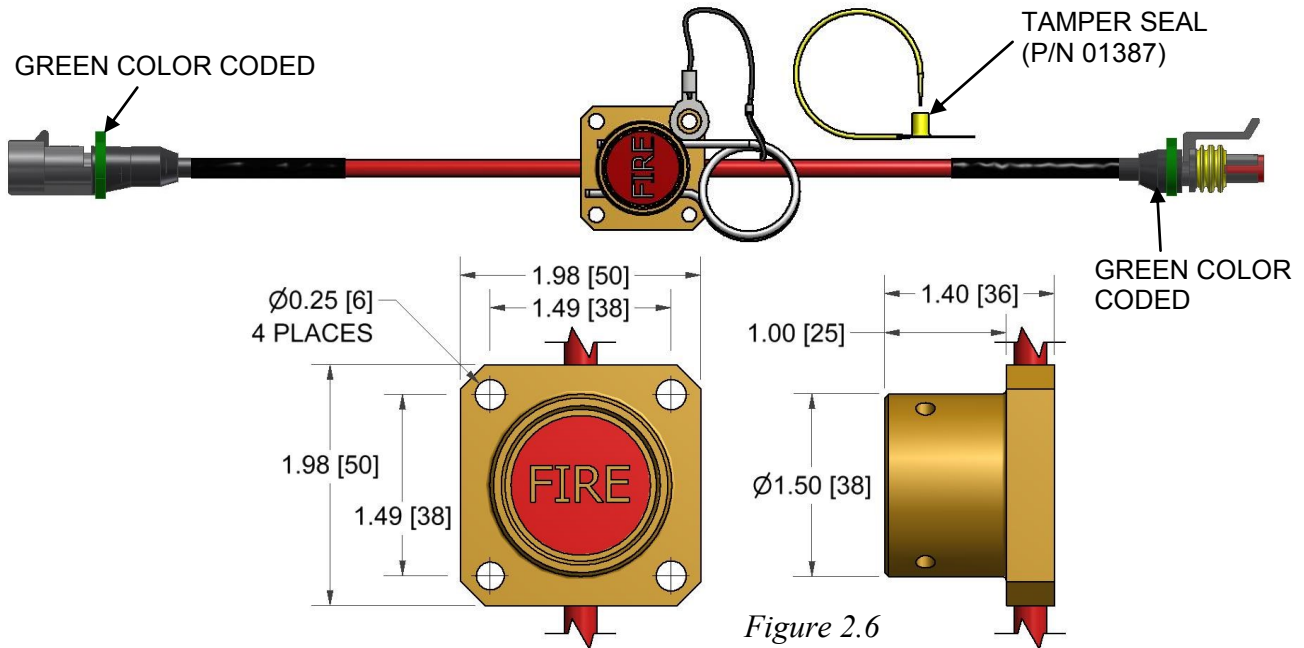


Figure 2.5

2.6 Manual Actuation Switch (P/N 14053) [ITEM 15]

All installations require at least one manual means of activating the fire suppression system. Use of the Manual Actuation Button is one way of manually actuating the fire suppression system. Multiple Manual Actuation Switches may be used if more than one manual actuation switch is required. To use the switch, the operator pulls out the safety ring pin breaking the tamper seal, and presses the red "FIRE" button. This action provides electrical power to the Electric Actuator, which discharges the fire extinguishing system.

Note: Plastic tamper seal included. Replacement tamper seals are available as P/N 01387.



2.7 Replacement Battery for Driver Panel (P/N 19667) [ITEM 17]

The Replacement Battery is composed of 7 Nickel Metal Hydride cells in series. Nominal voltage is 8.4 VDC for this product. It takes approximately 8 hours to fully charge this battery from a fully discharged state.



Figure 2.7

2.8 SafetyNet Interface Module (P/N 16609) [ITEM 15]

The SafetyNet Interface Module includes both Male and Female connectors and is supplied with an Gas Sensor Cable (P/N 14925) which can be installed to fit either Male or Female SafetyNet output ports. Each SafetyNet installation will end up with two unused communication ports – either Male or Female - at the first and last modules in the system.

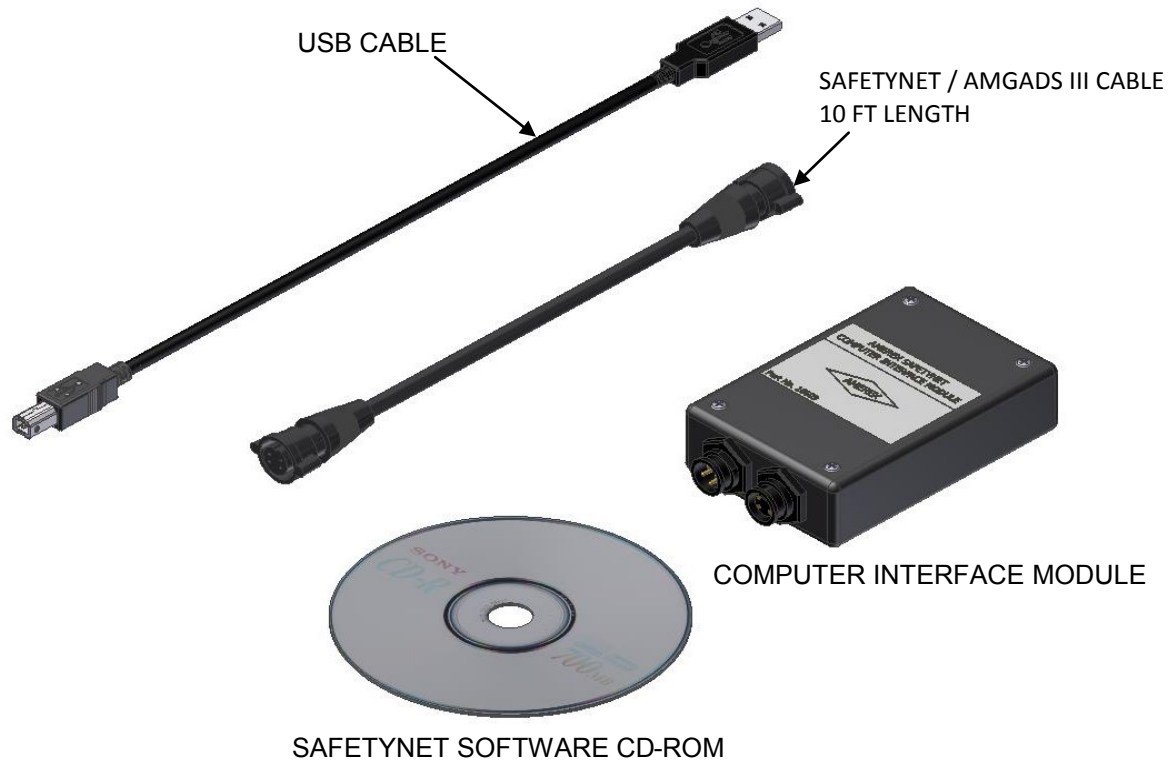


Figure 2.8

2.9 End of Line Module (P/N 14010) [ITEM 16]

The End Of Line Device (EOL) is utilized to supervise circuitry on the Class B Detection Network. The EOL is color coded green. The device provides a continuous electrical circuit allowing for electronic display panel supervision of the normally open detection network.

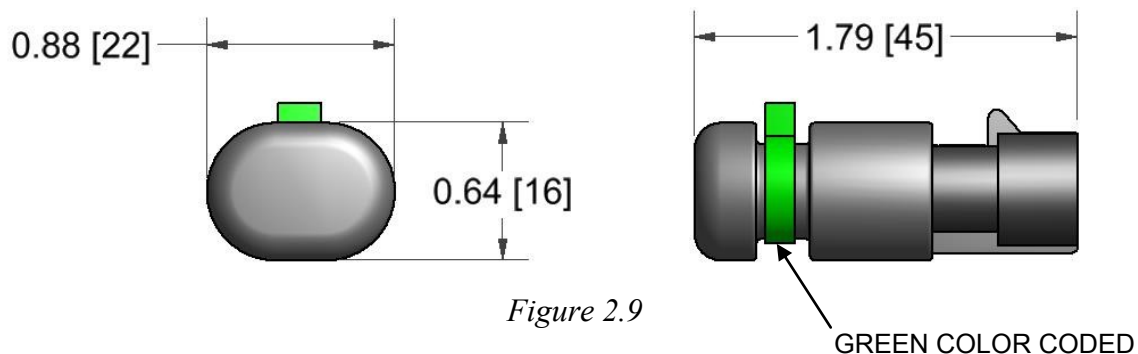



Figure 2.9

2.10 Parts List and Service Tools

Parts List			
Item Number	Part Number	Description	Qty. per System
1	16389	SafetyNet Operator Display Fire Suppression and Gas Detection	1
2	17422	SafetyNet Operator Display Fire Suppression Only	
3	16390	SafetyNet Driver Panel	
4	16391	SafetyNet Detection Module	
5	16392	SafetyNet Releasing Module	
6	16395	SafetyNet Detection and Releasing Module	
7	15799	Safe IR Optical Flame Detector	Optional
8	14087	Spot Heat Detector 280°F (Bracket Mount)	Optional
	14088	Spot Heat Detector 350°F (Bracket Mount)	Optional
	16615	Spot Heat Detector 450°F (Bulkhead Mount)	Optional
9	16603	Programmable Heat Detector (PHD) (Bracket Mount)	Optional
10	14198	Methane Gas Sensor	Optional
	17357	Select Methane Gas Sensor	Optional
	16352	Hydrogen Gas Sensor	Optional
11	17609	Agent Cylinder Pressure Switch	REF
12	22573	50 PSI Pressure Switch non terminated	REF
	22574	50 PSI Pressure Switch Terminated	REF
13	22579	Linear Actuator	REF
14	14053	Manual Actuation Switch	Optional
	01387	Tamper Seal	Optional
15	16609	SafetyNet Interface Module	Optional
16	14010	End of Line Module	Varies
17	19667	Replacement Battery Driver Panel	Replacement
18	23463-03	Linear Heat Detector (With Protective Spring) 3 Foot length	Max 100 Feet Per Detection Zone
	23463-06	Linear Heat Detector (With Protective Spring) 6 Foot Length	
	23463-10	Linear Heat Detector (With Protective Spring) 10 Foot Length	
	23463-16	Linear Heat Detector (With Protective Spring) 16 Foot Length	
	23643-20	Linear Heat Detector (With Protective Spring) 20 Foot Length	
	23643-25	Linear Heat Detector (With Protective Spring) 25 Foot Length	

Parts List			
Item Number	Part Number	Description	Qty. per System
18	23463-30	Linear Heat Detector (With Protective Spring) 30 Foot Length	Max 100 Feet Per Detection Zone
	23463-40	Linear Heat Detector (With Protective Spring) 40 Foot Length	
	23463-50	Linear Heat Detector (With Protective Spring) 50 Foot Length	
	23464-03	Linear Heat Detector (Without Protective Spring) 3 Foot Length	
	23464-06	Linear Heat Detector (Without Protective Spring) 6 Foot Length	
	23464-10	Linear Heat Detector (Without Protective Spring) 10 Foot Length	
	23464-16	Linear Heat Detector (Without Protective Spring) 16 Foot Length	
	23464-20	Linear Heat Detector (Without Protective Spring) 20 Foot Length	
	23464-25	Linear Heat Detector (Without Protective Spring) 25 Foot Length	
	23464-30	Linear Heat Detector (Without Protective Spring) 30 Foot Length	
	23464-40	Linear Heat Detector (Without Protective Spring) 40 Foot Length	
	23464-50	Linear Heat Detector (Without Protective Spring) 50 Foot Length	
	19	13981	
13982		Hazard/Detection Cable 6 Foot	
13983		Hazard/Detection Cable 10 Foot	
13984		Hazard/Detection Cable 15 Foot	
13986		Hazard/Detection Cable 30 Foot 	
13987		Hazard/Detection Cable 40 Foot	
13988		Hazard/Detection Cable 50 Foot	
17063		Hazard/Detection Cable 60 Foot	
20	16457	Hazard/Detection Cable Shielded 3 Foot	Optional
	16458	Hazard/Detection Cable Shielded 6 Foot	
	16459	Hazard/Detection Cable Shielded 10 Foot	
	16460	Hazard/Detection Cable Shielded 15 Foot	
	16461	Hazard/Detection Cable Shielded 20 Foot	

Parts List			
Item Number	Part Number	Description	Qty. per System
21	14925	Gas Sensor Cable 10 Foot	Optional
	14376	Gas Sensor Cable 20 Foot	
	14201	Gas Sensor Cable 35 Foot	
	14203	Gas Sensor Cable 50 Foot	
	14466	Gas Sensor Cable 65 Foot	
	14714	Gas Sensor Cable 85 Foot	
22	16610	Class B Detection Interface Cable 18 inches	Optional
23	16612-01	Programmable Heat Detector Cable 1 Foot	Optional
	16612-05	Programmable Heat Detector Cable 5 Foot	
	16612-10	Programmable Heat Detector Cable 10 Foot	
	16612-16	Programmable Heat Detector Cable 16 Foot	
	16612-20	Programmable Heat Detector Cable 20 Foot	
	16612-30	Programmable Heat Detector Cable 30 Foot	
24	23854-03	PHD Bulkhead Flange Cable 3 Foot	Optional
	23854-06	PHD Bulkhead Flange Cable 6 Foot	
	23854-10	PHD Bulkhead Flange Cable 10 Foot	
	23854-16	PHD Bulkhead Flange Cable 16 Foot	
	23854-20	PHD Bulkhead Flange Cable 20 Foot	
	23854-25	PHD Bulkhead Flange Cable 25 Foot	
	23854-30	PHD Bulkhead Flange Cable 30 Foot	
	23854-40	PHD Bulkhead Flange Cable 40 Foot	
	23854-50	PHD Bulkhead Flange Cable 50 Foot	
25	23855-03	PHD Bulkhead Cable 3 Foot	Optional
	23855-06	PHD Bulkhead Cable 6 Foot	
	23855-10	PHD Bulkhead Cable 10 Foot	
	23855-16	PHD Bulkhead Cable 16 Foot	
	23855-20	PHD Bulkhead Cable 20 Foot	
	23855-25	PHD Bulkhead Cable 25 Foot	
	23855-30	PHD Bulkhead Cable 30 Foot	
	23855-40	PHD Bulkhead Cable 40 Foot	
	23855-50	PHD Bulkhead Cable 50 Foot	
26	14723	Actuation Cable 3 Foot	Optional
	14724	Actuation Cable 6 Foot	
	14123	Actuation Cable 10 Foot	
	14124	Actuation Cable 20 Foot	
	14125	Actuation Cable 30 Foot	
	14126	Actuation Cable 40 Foot	

Parts List			
Item Number	Part Number	Description	Qty. per System
26	14127	Actuation Cable 50 Foot	Optional
27	16470	Actuation Cable Shielded 3 Foot	Optional
	16471	Actuation Cable Shielded 6 Foot	
	16472	Actuation Cable Shielded 10 Foot	
	16473	Actuation Cable Shielded 20 Foot	
28	14016	Power Supply Cable 10 Foot	1
	14799	Power Supply Cable 15 Foot	
	14017	Power Supply Cable 25 Foot	
	14018	Power Supply Cable 40 Foot	
	14019	Power Supply Cable 50 Foot	
	14915	Power Supply Cable 60 Foot	
	15150	Power Supply Cable 75 Foot	
	14800	Power Supply Cable Extension 10 Foot	
	16527	Power Supply Cable Extension 20 Foot	
	14801	Power Supply Cable Extension 40 Foot	
29	15779	Replacement Fuse 10 AMP	Optional
	23855-03	PHD Bulkhead Cable 3 Foot	
	23855-06	PHD Bulkhead Cable 6 Foot	
	23855-10	PHD Bulkhead Cable 10 Foot	
	23855-16	PHD Bulkhead Cable 16 Foot	
	23855-20	PHD Bulkhead Cable 20 Foot	
	23855-25	PHD Bulkhead Cable 25 Foot	
	23855-30	PHD Bulkhead Cable 30 Foot	
	23855-40	PHD Bulkhead Cable 40 Foot	
23855-50	PHD Bulkhead Cable 50 Foot		
30	21539-10	Pressure Switch Cable 10 Foot	Optional
	21539-20	Pressure Switch Cable 20 Foot	
	21539-30	Pressure Switch Cable 30 Foot	
	21539-40	Pressure Switch Cable 40 Foot	
	21539-50	Pressure Switch Cable 50 Foot	
	21539-55	Pressure Switch Cable 55 Foot	
31	14841	Cable Set Replacement for SafetyNet Panels	Replacement
32	23869	Detection Splitter Hazard Cable, Bulkhead 18 Inch Length	Optional
33	23871	Detection Splitter Hazard Cable, Bulkhead 18 Inch Length	Optional

Parts List			
Item Number	Part Number	Description	Qty. per System
34	23380-01	Detection Lead Cable, Bulkhead 1 Foot Length	Optional
	23380-05	Detection Lead Cable, Bulkhead 5 Foot Length	
	23380-10	Detection Lead Cable, Bulkhead 10 Foot Length	
	23380-16	Detection Lead Cable, Bulkhead 16 Foot Length	
	23380-20	Detection Lead Cable, Bulkhead 20 Foot Length	
	23380-25	Detection Lead Cable, Bulkhead 25 Foot Length	
	23380-30	Detection Lead Cable, Bulkhead 30 Foot Length	

Chapter 3: Hazard Analysis

3.1 Introduction

Before any component of the Amerex fire suppression system is installed including electronics, the hazards to be protected must be identified. These hazards determine where and type of detection that is required along with the type of and quantity of fire suppression agent necessary for protection. When performing a hazard analysis, some helpful tools that can be useful are:

- Flashlights – for those hard to see places.
- Cameras and note pads – for helping with documenting the construction of the vehicle fire suppression system and creating a bill of materials. Installers must document and retain all system designs.
- Temperature measuring devices – Thermocouples work well in helping to identify vehicle operating temperatures. Knowing the vehicle operating temperature details is crucial in selecting appropriate hardware when doing a hazard analysis and system layout.
- Access to all Amerex Installation, Operation, & Maintenance Literature – System may require hardware not located in this manual.

NOTE: On all installations, consult the vehicle manufacturer and property owner before making any modifications to equipment.

3.2 Fire Hazard Analysis

A hazard analysis is used as the first step in a process used to assess risk of fire. The result of a hazard analysis is the identification of fire risks. A fire hazard is an area that has the coexistence of fuel and potential ignition sources.

3.2.1 Identify the Ignition Source(s)

The potential for hot surfaces such as exhaust manifolds, muffler compartments, hydraulic pumps, and turbochargers can be ignition sources. Other hot surface ignition sources can be friction buildup from bearings, brakes, and gears. Electrical shorts from vehicle electronics and batteries can also be ignition sources.

3.2.2 Identify the Fuel Source(s)

Fuels can be found in many different forms including, but not limited to:

- Class A Material: wood, paper, coal dust, rags, hoses, tires, combustible refuse buildup.
- Class B Material: Flammable and combustible liquids such as gasoline, diesel fuel, cleaning fluids, hydraulic fluids, brake fluids, transmission fluids.
- Class C Material: Class C items describe sources of electrical current that can energize an area where a fire is present.

3.2.3 Consulting Vehicle Owner and/or Original Equipment Manufacturer

Previous experience with machinery may indicate where special hazards exist. Knowing the history about a particular model of vehicle/machine may help with decisions in protection.

3.2.4 Potential Workplace Hazards for the Equipment

Refuse vehicles frequently work in landfills. Some landfills carry substantial class A fuel sources. Machines working in steel refineries can be exposed to external ignition sources. These types of external hazards will have to be considered when determining the right protection required for the particular machine.

3.2.5 Considerations to be Evaluated

- Is the hazard in an open area or closed compartment? In an open area, each hazard must be treated as a local application with direct aim of nozzles. Open area hazards are more difficult to contain, and will require a more conservative approach for selecting agent and nozzle quantities. Closed compartments can aid in keeping total flooding agents in the hazard area longer allowing for better coverage.
- Are there many obstructions? Obstructions can limit the effectiveness of fire suppression agents on fires. Direct application of agent is a very effective way to extinguish many fires. It may be necessary to use additional nozzles to compensate for obstructions.
- How much air flows through the hazard? Airflow can adversely affect aim of nozzles and dispersion of fire suppression agents. It may be necessary to use additional nozzles to compensate for air flow.
- What are the dimensions of the hazard? Determining hazard dimensions allows for Agent Cylinder size(s) and Nozzle quantities to be calculated.
- What is the potential for the hazard to spread to other areas of the vehicle/machine? Additional protection may be required for those areas as well.
- Does the vehicle/machine have additional hand portable extinguishers? Hand portable fire extinguishers are necessary to be used as a backup to an automatic fire suppression system. Appropriate type and rating of hand portable fire extinguishers must be considered.

3.2.6 Selecting The Appropriate Agent

After identifying ignition and fuel sources (see Sections 3.2.1 and 3.2.2), the appropriate fire suppression agent must be selected.

- ABC Dry Chemical - Works well on all Class A, B, and C types of fires.
- Purple K - Works well of Class B fires.
- ICE - Works well of Class A and B fires and is good for cooling hot surfaces. (turbochargers, exhaust manifolds) but must not be used on electrically energized equipment (batteries, alternators, starters).

3.2.7 Selecting The Appropriate Method of Detection

After identifying vehicle hazard areas, it is necessary to select the appropriate form of detection for those areas.

- Spot Heat Detectors - Localized area devices that react to “set point” temperature ranges. Limited to 280°F, 350°F and 450°F.
- Programmable Heat Detectors - Localized area devices that react to “set point” temperature ranges. Can be effectively programmed to a range between 140°F and 550°F for rapid response to heat.

- Linear Heat Detectors - Devices that have large surface area for heat detection. Devices that have pre-determined set-point of 356°F.
- Optical Flame Detectors Rapid response to a visual flame signature. Must have visible line of sight to flame to be effective.

3.2.8 Determine Methods of Actuation

If the system is designed to automatically activate a fire suppression agent cylinder, a manual means of activating the fire suppression agent cylinder is also required. At least one manual means of activating the fire suppression agent bottle must be located within reach of the vehicle operator during normal vehicle operation. Additional manual means of activating the fire suppression agent cylinder should be located conveniently in paths of egress. Manual actuation devices include:

- Manual actuation button located in the drivers area or other locations accessible in case of fire.
- Manual Nitrogen Actuator located in the drivers area or other locations accessible in case of fire.

3.3 Gas Detection Hazard Analysis

It should be recognized by the system designer and installer that even though the Amerex Fire Suppression System and Amerex Mobile Gas Detection Systems (AMGaDS) share various electronic components, they operate independently of each other. A gas concentration alarm will not discharge the fire suppression system, nor will a fire alarm cause a gas alarm. Consequently a separate Hazard Analysis must be performed for each system for those systems to be effective.

The Vehicle Gas Detection Hazard Analysis consists of five phases:

1. Identifying the Characteristics of Combustible Gases.
2. Identifying Areas Where Gas Can Leak and Concentrate.
3. Identifying Ignition Sources.
4. Consulting Vehicle Owner and/or Equipment Manufacturer.
5. Selecting the appropriate gas detection system components.

3.3.1 Characteristics of Combustible Gases

It is critical to understand the characteristics of a particular combustible gas when preparing to install Amerex Gas Detection Systems.

- Density of combustible gas varies depending on the type of gas being used for a particular vehicle fuel source. The chosen fuel gas, when exposed to atmospheric pressure, may be heavier or lighter than air. This is referred to as the vapor density of the gas. Air has a vapor density of 1.0. If the vapor density is heavier/greater than air, the gas or fuel vapor will fall when a gas leak occurs and combustible gas will accumulate in low areas. Both LPG and gasoline vapors are heavier than air. If the vapor density is lighter/less than air, the gas will rise in the event of a leak until it escapes into the atmosphere or until trapped by an obstruction such as a compartment bulkhead or vehicle interior. Hydrogen, LNG and CNG (methane) all have vapor densities lighter/less than air. Gas Sensors must be placed in areas where vapor concentrations will accumulate to be effective. Table 3.3.1

below shows the vapor density of common motor fuels

- All fuels have a range of mixture of fuel vapors and air that will support combustion. If the fuel and air mixture is too lean (doesn't have enough fuel to support combustion) it is said to be below the "Lower Flammability Limit" or LFL. If the fuel and air mixture is too rich (has too much fuel and not enough oxygen to support combustion) it is said to be above the "Upper Flammability Limit" or UFL. See Table 3.1 for LFL/UFL ranges for typical gases found in mobile vehicle applications.

Table 3.3.1

Fuel	Vapor Density	LFL %	UFL %	Lighter or Heavier than Air
Air	1.0	n/a	n/a	n/a
Ethanol	1.59	3.3%	19%	Heavier—Falls
Gasoline	3.0—4.0	1.3%	6.0%	Heavier—Falls
LNG / CNG (methane)	0.6	5.3%	15%	Lighter—Rises
Hydrogen	0.07	4%	75%	Lighter—Rises
Methanol	1.11	6.0%	36.5%	Heavier—Falls
Propane LPG	1.56	2.3%	9.5%	Heavier—Falls

3.3.2 Identifying Areas of Gas Concentrations

The following are important steps in determining areas of potential gas concentration.

3.3.2.1 Locate Potential Gas Leak Points:

- Fuel tanks, fuel tank bulkheads and fuel tank fittings.
- Regulators that reduce fuel pressure.
- Pressure Relief Devices (PRD's).
- Fuel pumps that have pressure seals to atmosphere.
- Engine compartments with fuel distribution manifolds.
- Fuel evaporation equipment converting liquid fuel to gas.

3.3.2.2 Locate Potential Gas Accumulation Areas

- Limited ventilation compartments such as fuel tank compartments, luggage storage areas and engine compartments.
- Occupant areas with limited ventilation or air intake from other accumulation points.

3.3.3 Identifying Gas Ignition Sources

Potential ignition sources for gas concentrations should be considered when locating Gas Sensors.

- Determine the location of electrical ignition sources such as brushed DC motors, unsealed solenoids and relays, electrical clutches, and exposed wiring connections.
- Determine the location of thermal ignition sources. Turbochargers, exhaust manifolds and friction brakes can produce enough heat to ignite accumulated gas concentrations.
- Determine the existence of external ignition sources—smoking by nearby personnel, welding, or spark from grinding tools for example.

Chapter 4: System Design & Installation

This Chapter describes design and installation of the Amerex SafetyNet system. For mechanical components such as nozzles, agent cylinders and pneumatic actuation devices reference the appropriate Amerex Fire Suppression Installation, Operation and Maintenance manual located on the www.amerex-fire.com website.

4.1 Steps to System Design

- The appropriate quantity and selection of agent cylinders, nozzles and heat detection devices should be made along with an idea of how the electronic programming should be set up after a hazard analysis has been completed.
- The electronic panels must be properly located and installed (See Section 4.2).
- The appropriate heat detection devices and manual means of system activation must be located and installed. (See Section 4.3)
- Appropriate lengths and selection of wiring harnesses must be made to accommodate the particular style of heat detection device. Appropriate wiring paths must be made from the heat detection device to the electronic panels. (See Section 4.3).
- Appropriate lengths and selection of wiring harnesses must be made to accommodate the release zone circuit(s). Appropriate wiring paths must be made from the release zone(s) to the electronic panels. (See Section 4.4).
- Any auxiliary input/output devices shall be selected and located/installed. Wiring for such devices must be installed. Proper termination of the wiring harness must be performed (See Section 4.5).
- The vehicle power input wiring must be installed. (See Section 4.5).
- Once all wiring connections are made, Control Panel testing and programming must be performed (See Section 4.6).
- Component testing and initial commissioning must be performed (See Section 4.7).

4.2 Electronic Panel Installations

All electronic panels must be mounted in convenient locations permitting periodic maintenance and inspection along with minimal wiring and cable lengths. Proper routing of all wiring and cables to each system component is required and should be considered when choosing an appropriate location. Any obstacles, moving parts, hazard areas, or bulkheads that may inhibit complete connection of all system components or cause damage to components must be avoided.

4.2.1 SafetyNet Operator Display Panel (P/N 16389)

The SafetyNet Operator Display Panel must be mounted where the visual indicators may readily be seen from the driver's seat. The Panel should be mounted in a dry location safe from any potential weather, moisture and excessive vibration. Using the dimensions shown in Figure 2.1b, drill four holes for mounting screws. Cut a rectangular slot to accept the back of the control panel wire exit area. Assemble the Control Panel to the mounting surface using the appropriate hardware.

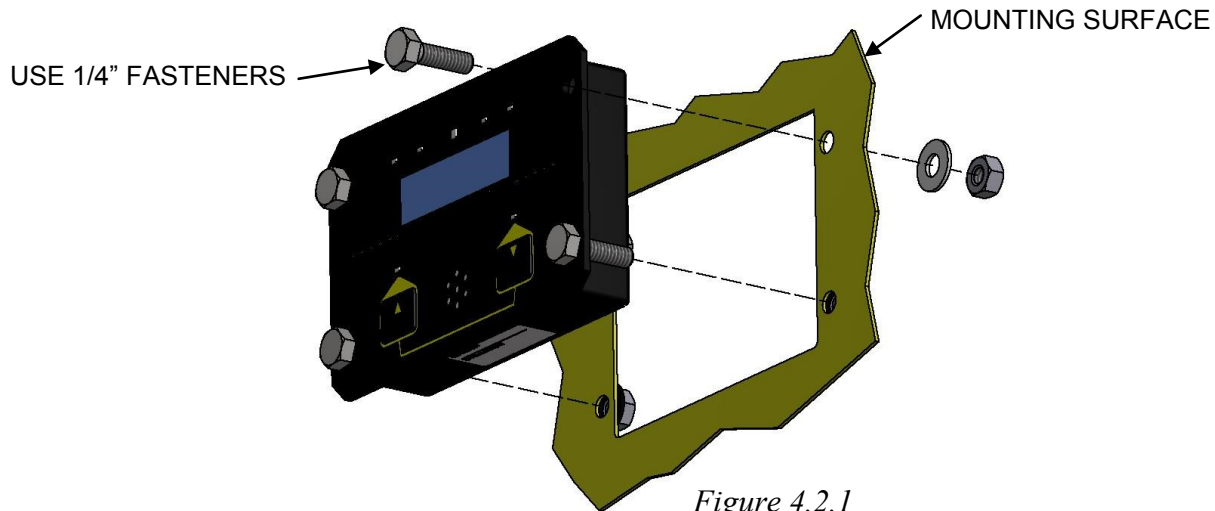


Figure 4.2.1

4.2.2 SafetyNet Driver Panel (P/N 16390)

The SafetyNet Driver Panel must be mounted where the visual indicators may readily be seen during maintenance. The Panel should be mounted in a dry location safe from any potential weather, moisture and excessive vibration. Using the dimensions shown in Figure 2.1.1a, drill four holes for mounting screws. Assemble the Control Panel to the mounting surface using the appropriate hardware. Plug cables (P/N 20229, 20228, 20230 & 20227) into the appropriate mating connector on the front of the panel.

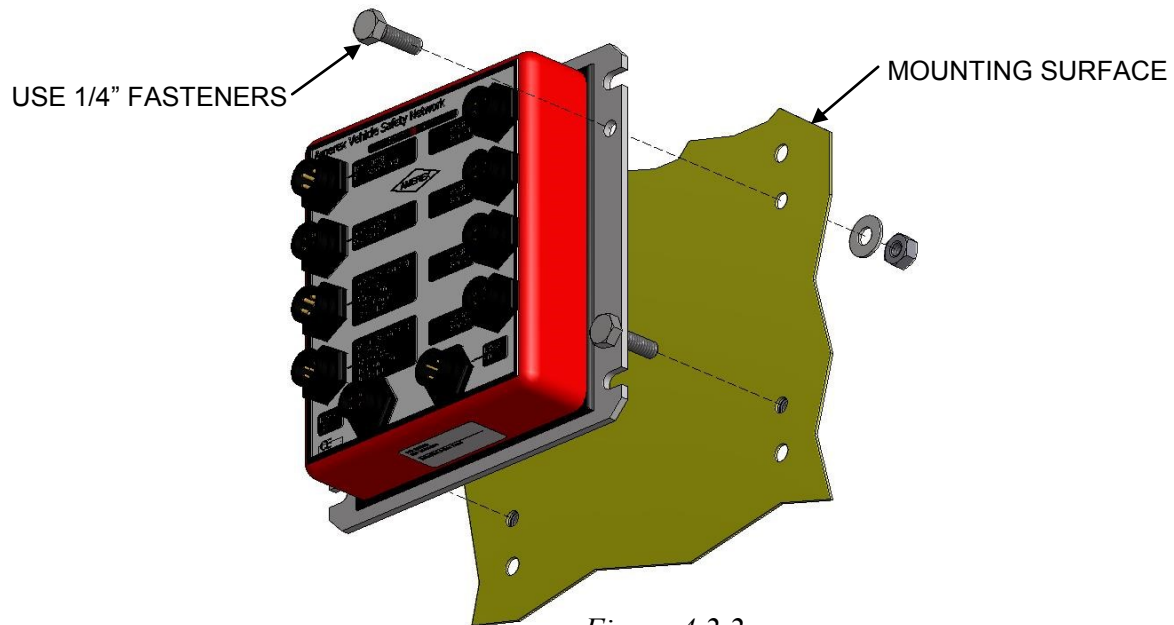


Figure 4.2.2

4.2.3 SafetyNet Detection, Releasing & Detection & Releasing Modules (P/N 16391, 16392 & 16395)

The SafetyNet Detection, Releasing, Detection & Releasing Modules must be mounted where the visual indicators may readily be seen during maintenance. The Modules should be mounted in a dry location safe from any potential weather, moisture and excessive vibration. Using the dimensions shown in Figure 2.1.2b to drill four holes for mounting screws. Assemble the Control Panel to the mounting surface using the appropriate hardware. Plug cables supplied with the Modules into the appropriate mating connector on the front of the panel.

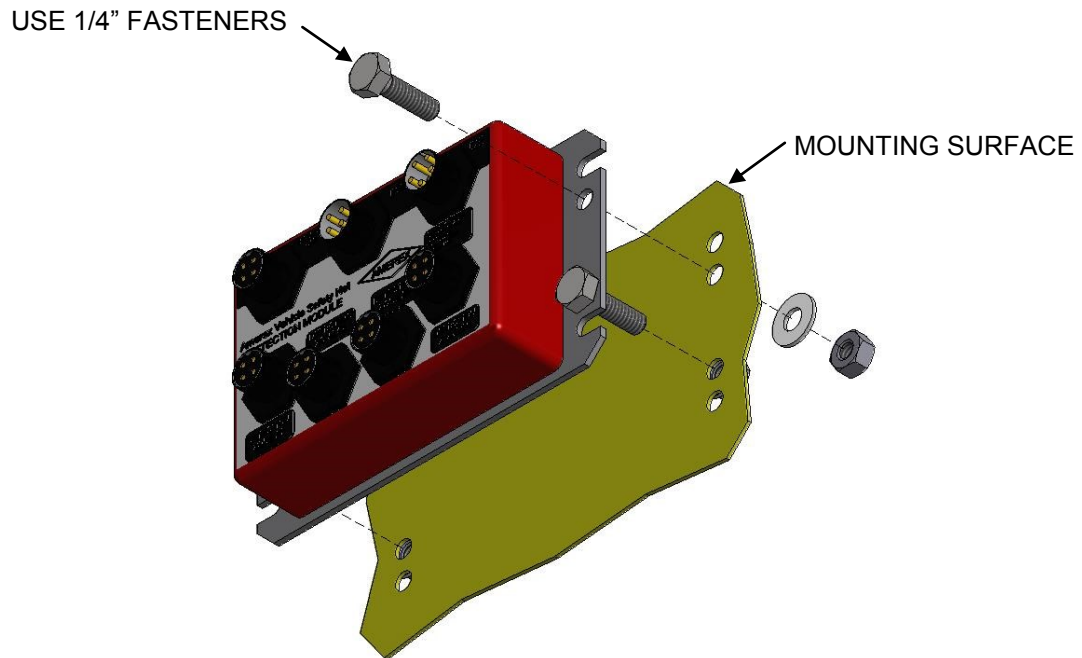


Figure 4.2.3

4.3 Detection Components Installations

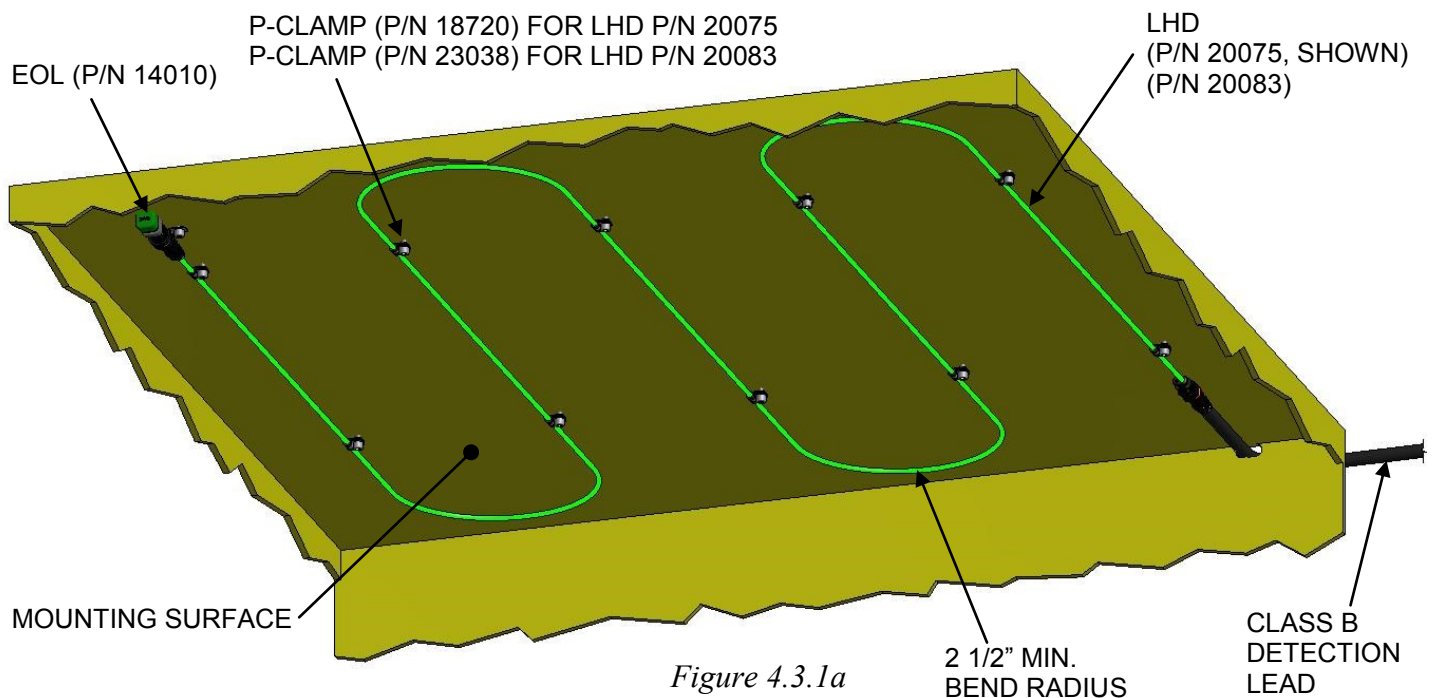
Amerex offers several styles of heat detection devices that can be utilized in the SafetyNet system.

4.3.1 Linear Heat Detector (LHD)

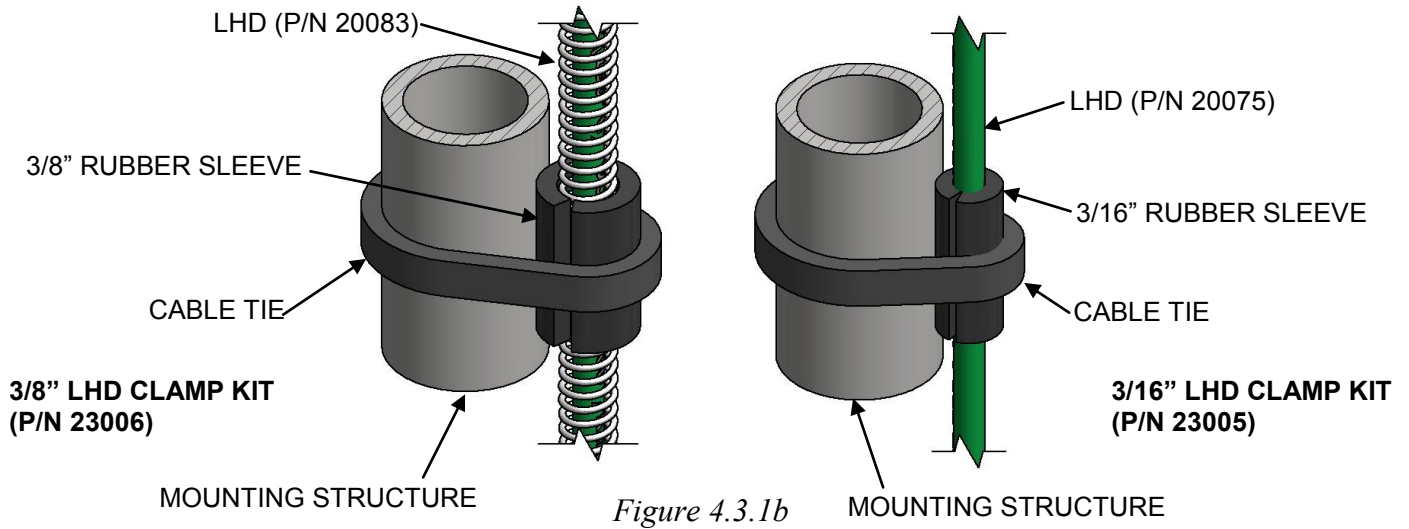
The Linear Heat Detector is a preset (356°F/180°C) heat sensing device capable of sensing an overheat condition at any point along its routed path. All LHDs must be installed in accordance with the following instructions:

- The LHD must be installed in a hazard area where the potential for fire or overheat conditions exist.
- The LHD must be installed in areas where potential damage resulting from normal vehicle operation will not occur. The LHD cannot be chafed, cut, kinked or crushed. The LHD with protective spring (P/N 20083) should be used when extra protection of the LHD is needed.
- The LHD wire must not be installed within any hazard area that exceeds 256°F (124°C) during normal operating conditions. Physical contact with any high heat surfaces exceeding 256°F (124°C) is not permitted.
- Selection of the LHD length should be such that it adequately covers the hazard area but is not excessively long, reducing the potential of damage. The LHD must not interfere with routine vehicle maintenance.

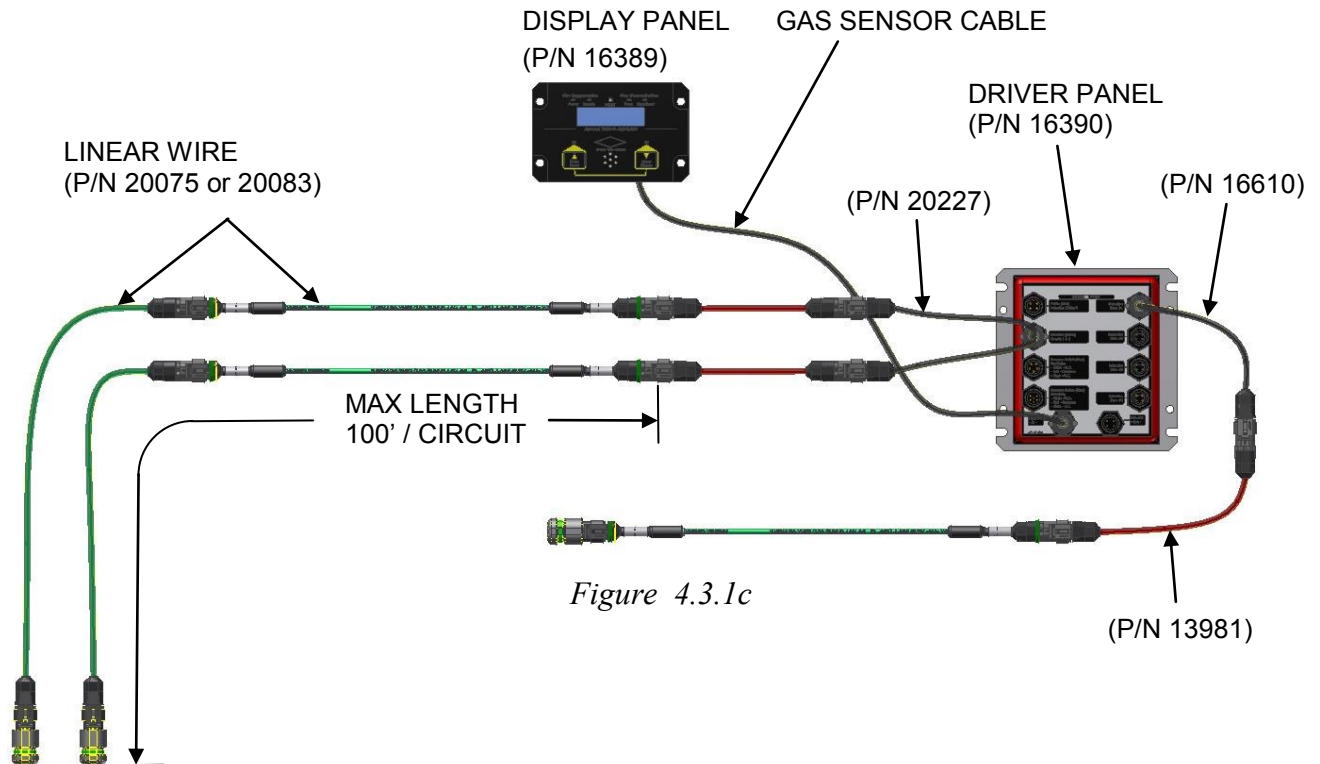
- The LHD must be installed in the Class B detection circuit. Multiple LHDs can be connected in series or used in the same circuit, but combined length of all LHDs used in a single circuit must not exceed 100 feet (30 m).
- The cable should be mounted high in the hazard compartment where higher temperatures are prevalent in overheat conditions.
- The LHD must not be installed taught without strain relief. The LHD must not be crimped, pinched or bent beyond it's minimum bend radius of 2 1/2".
- Each LHD must be installed using padded p-clamps (See Figure 4.3.1a) or the p-clamps can be substituted with cable ties and rubber sleeves (See Figure 4.3.1b). If p-clamps are used, LHDs without the stainless steel spring wire (P/N 20075) will use a 3/16" padded p-clamp (P/N 18720), while LHDs with the protective stainless steel spring wire (P/N 20083) will use a 3/8" padded p-clamp (P/N 21806). The LHD must be secured a minimum of every 18 inches (0.46 m).



Use of cable ties and rubber sleeve material is permitted only when using Amerex kits (P/N 23005 or P/N 23006). If using LHDs without the protective spring (P/N 20075), the 3/16" LHD Clamp Kit (P/N 23005) must be used, while LHDs with the protective spring (P/N 20083) will require the 3/8" LHD Clamp Kit (P/N 23006). The LHD must be secured to supporting structure by cinching the cable tie over hose, LHD, and structure as shown. The LHD must be secured a minimum of every 18 in (0.46 m).



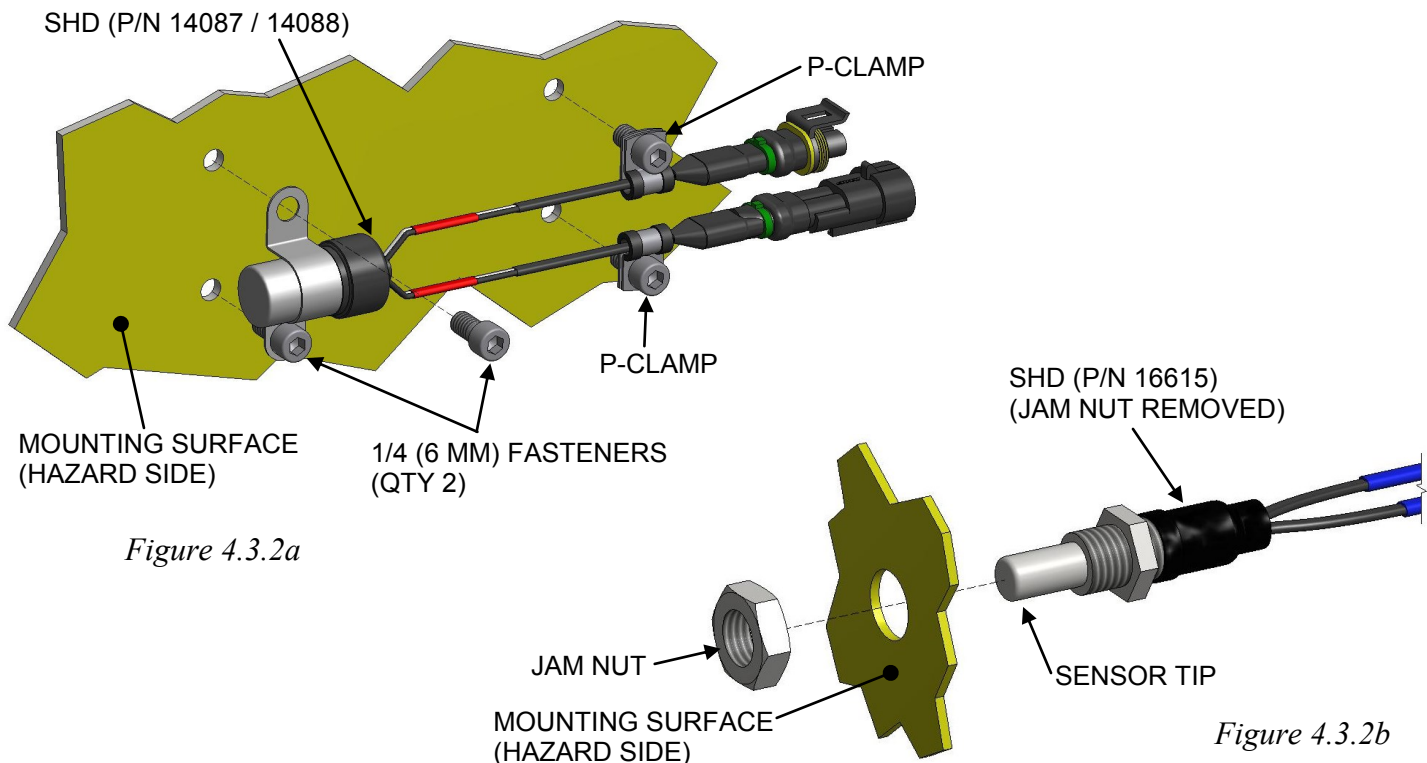
Typical Installation using Linear Heat Detectors



4.3.2 Spot Heat Detector (SHD) (P/N 14087 / 14088 / 16615)

The Spot Heat Detector (SHD) is a preset heat sensing device designed to detect heat in localized areas of the hazard compartment. Three SHDs are available with preset temperature set points and mounting styles. All SHDs must be installed in accordance with the following instructions:

- The SHD must be installed in a hazard area where the potential for fire or overheat conditions exist. Ambient operating temperature range for a SHD is 100°F below its alarm set point, but maximum temperature for the wiring portion of the SHD must not exceed 250°F (121°C) for extended periods of time.
- The SHD can be mounted in any orientation as long as the metallic sensor tip is subjected to the hazard area that is to be protected. Locate the SHD where mud, oil or foreign debris do not interfere with the sensor tip. Locations subject to environmental extremes should also be avoided.
- The SHD and its wiring must be installed in a location allowing access for testing and maintenance.
- The SHD sensor is vibration resistant. However, do not install the sensor and wiring in locations with different vibration characteristics. For example, the sensor should not be mounted on an engine and the wiring fixed to the chassis unless proper cable routing and support are provided.
- Secure the SHD sensor wiring using a padded p-clamp (or high temperature rated cable tie) located on or within 4" of each connector (See Figure 4.3.2a).
- The bracket style SHDs (P/N 14087/14088) must be mounted using their standard bracket and the appropriate hardware (See Figure 4.3.2a). The bulkhead style SHD (P/N 16615) must be mounted in a bulkhead configuration (See Figure 4.3.2b) by drilling a single 25/32"-7/8" hole through the bulkhead (3/16" MAX thickness) and inserting the SHD. Secure by threading the 1 1/8" jam nut to the threaded portion of the SHD using a medium grade thread locking compound. Tighten to a maximum of 10 inch-lbs.



4.3.3 Manual Actuation Button (P/N 14053)

A fire suppression system is required to have at least one manual means of system actuation or release of the fire extinguishing agent. This manual release must be located within an operator's reach or along a path of egress. Amerex offers two methods of manual actuation. The first is a manual means of pneumatic actuation using nitrogen cartridges within the pneumatic actuation network. Reference the appropriate Amerex Fire Suppression Installation, Operation and Maintenance Manual for installation instructions. The second option is a Manual Actuation Button that can be used in the electrical system. This button is a normally open switch that closes when the red "FIRE" button is pressed. The button is installed in the Class B detection circuit and can be flush mounted by drilling a single 1 1/2"-1 5/8" hole through a surface (7/16" MAX thickness) and inserting the Button (See Figure 4.3.3a). Attach using appropriate hardware. The button can also be surface mounted (See Figure 4.3.3b) using appropriate hardware. Use the dimensions shown in Figure 2.6. Locate "In Case Of Fire" label (P/N 14067) close to the Manual Actuation Button. The tamper seal (P/N 01387) must be in place after the system has been initially commissioned (See Figure 4.3.3c).

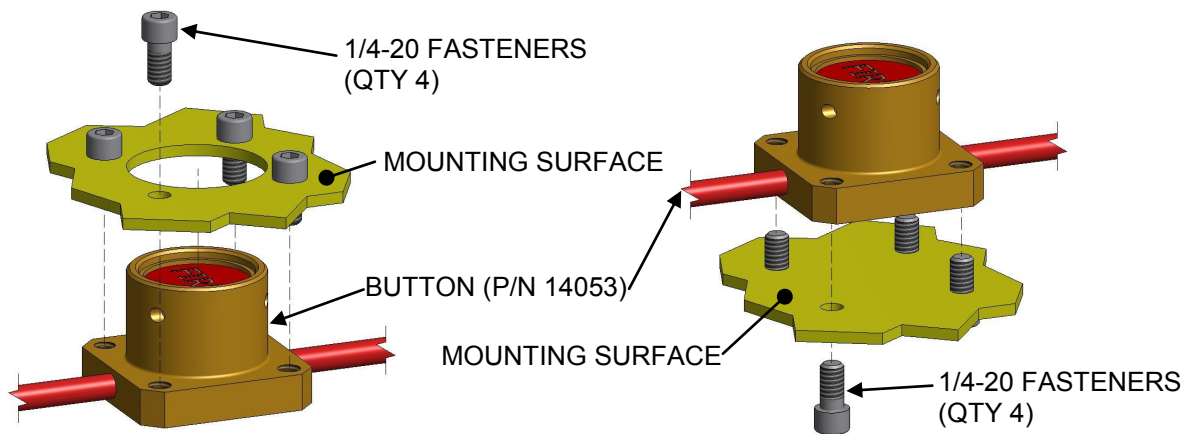


Figure 4.3.3a

Figure 4.3.3b

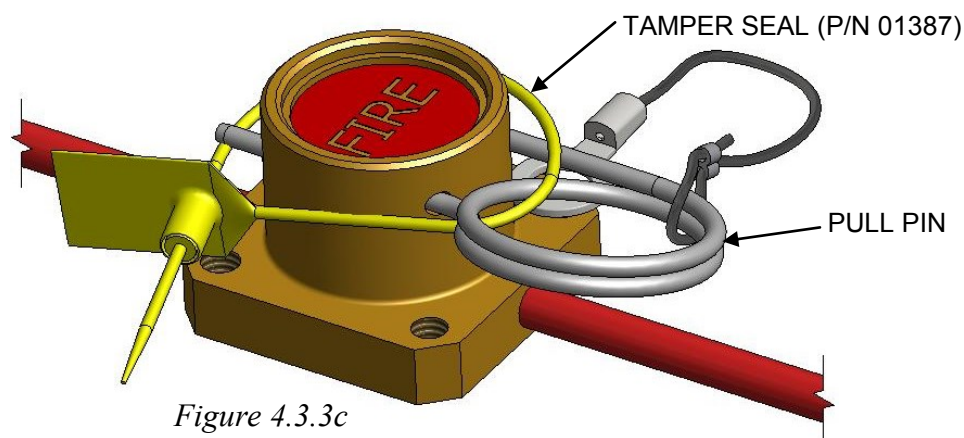


Figure 4.3.3c

4.3.4 50 PSI Pressure Switch Installation (P/N 22574)

The 50 PSI Pressure Switch is installed using an installer supplied 1/4" NPT tee in the Pneumatic Actuation Network just before the first Pneumatic Control Head or Electric / Pneumatic Control Head (See Figure 4.3.4a). Use PTFE thread tape on all connections at the tee. The 50 PSI Pressure Switch has a temperature rating of -40°F to +150°F (-40°C to +65°C) and a maximum current rating of 3 amps.

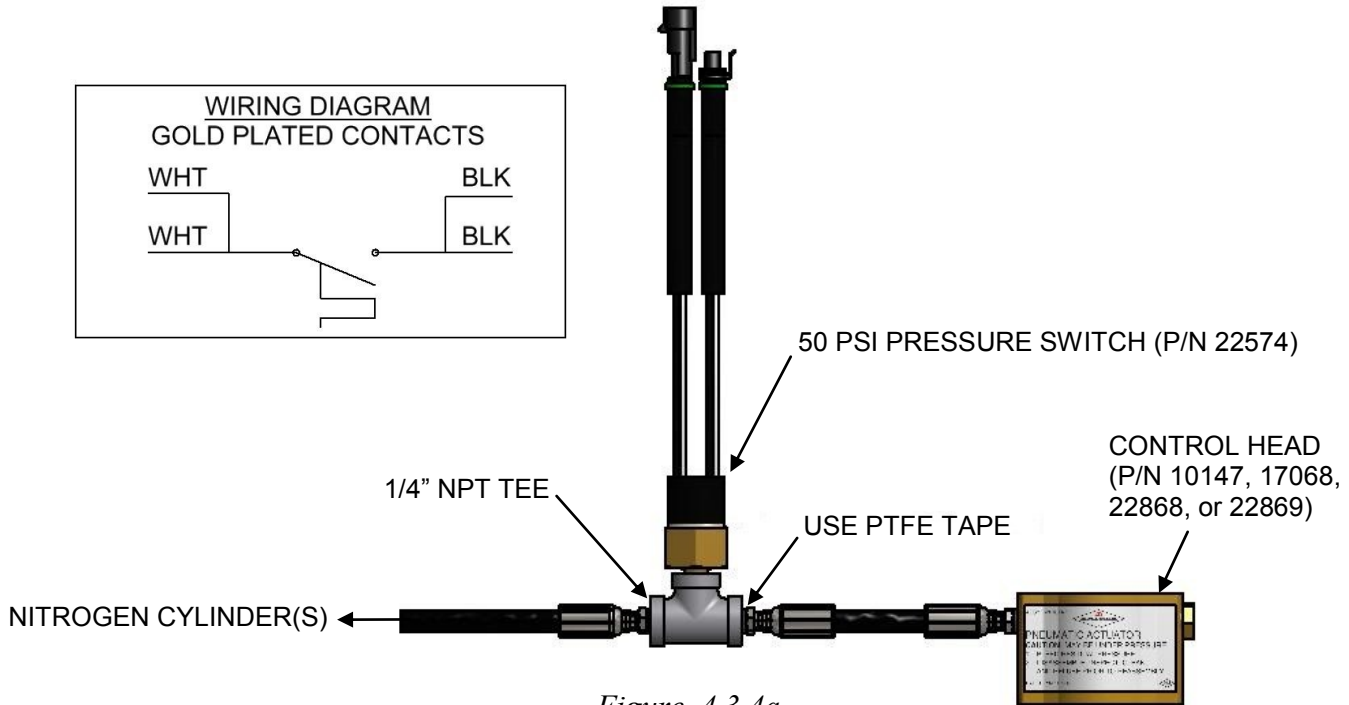
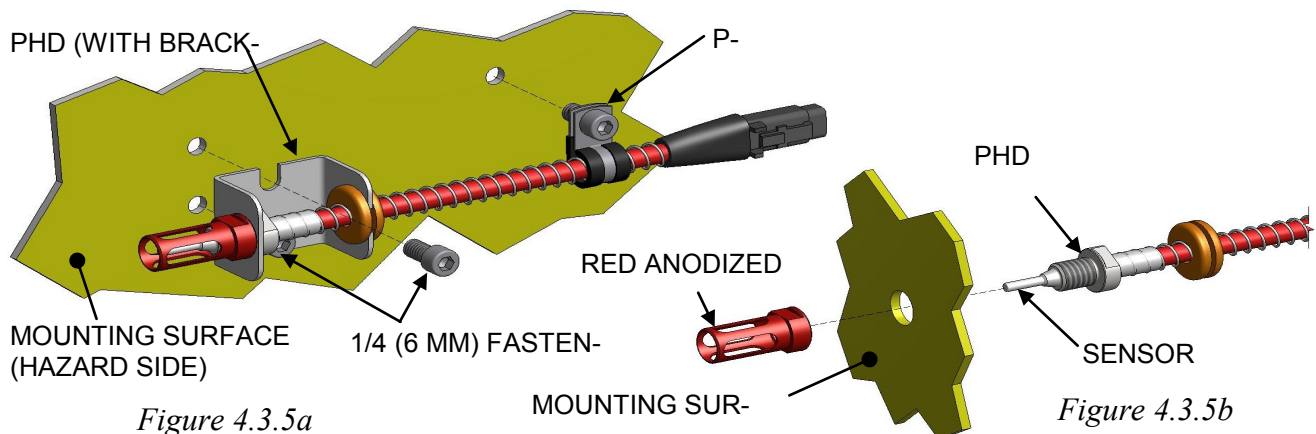


Figure 4.3.4a

4.3.5 Programmable Heat Detector Installation (P/N 16603)

The PHD is a rapid response heat sensing device that can be programmed to a set point temperature from 140°F to 550°F (61°C to 288°C) in 5°F (2°C) increments. The PHD is designed to detect heat in localized areas of a hazard compartment. All PHDs must be installed in accordance with the following instructions:

- The PHD must be installed in a hazard area where the potential for fire or over-heat conditions exist. Ambient operating temperature range for a PHD is -40°F to 550°F (-40°C to 288°C), but maximum temperature for the wiring portion of the PHD must not exceed 284°F (140°C) for extended periods of time.
- The PHD can be mounted in any orientation as long as the sensor tip is subjected to the hazard area that is to be protected. The sensor tip provides rapid response to temperature changes. Locate the PHD where mud, oil or foreign debris do not interfere with the sensor tip. Locations subject to environmental extremes should also be avoided.
- The PHD and its wiring must be installed in locations allowing access for testing and maintenance.
- The PHD sensor is vibration resistant. However, do not install the sensor and wiring in locations with different vibration characteristics. For example, the sensor should not be mounted on an engine and the wiring fixed to the chassis unless proper cable routing and support are provided.
- Secure the PHD sensor wiring using a padded p-clamp or high temperature UV resistant cable tie located on or within 4" of the connector (See Figure 4.3.5a).
- The minimum bend radius for the PHD sensor wiring is 1 inch.
- The PHD can be mounted using its standard bracket and the appropriate hardware (See Figure 4.3.5a) or the PHD can be mounted in a bulkhead configuration by removing the standard bracket (See Figure 4.3.5b). The maximum continuous operational temperature of the sensor, when mounted as shown in figure 4.3.5a must not exceed 284°F (140°C). If the sensor is mounted in the bulkhead configuration as shown in figure 4.3.5b, the sensor tip can be used in ambient operating temperatures not exceeding the maximum set point temperature of 550°F (288°C). For bulkhead configuration, drill a single 7/16"-1/2" hole through the bulkhead (1/2" MAX thickness) and insert PHD. Secure by threading the red anodized aluminum cover to the threaded sensor tip portion of the PHD using a medium grade thread locking compound. Tighten to a maximum of 10 inch-lbs.



Typical Installation using Programmable Heat Detectors

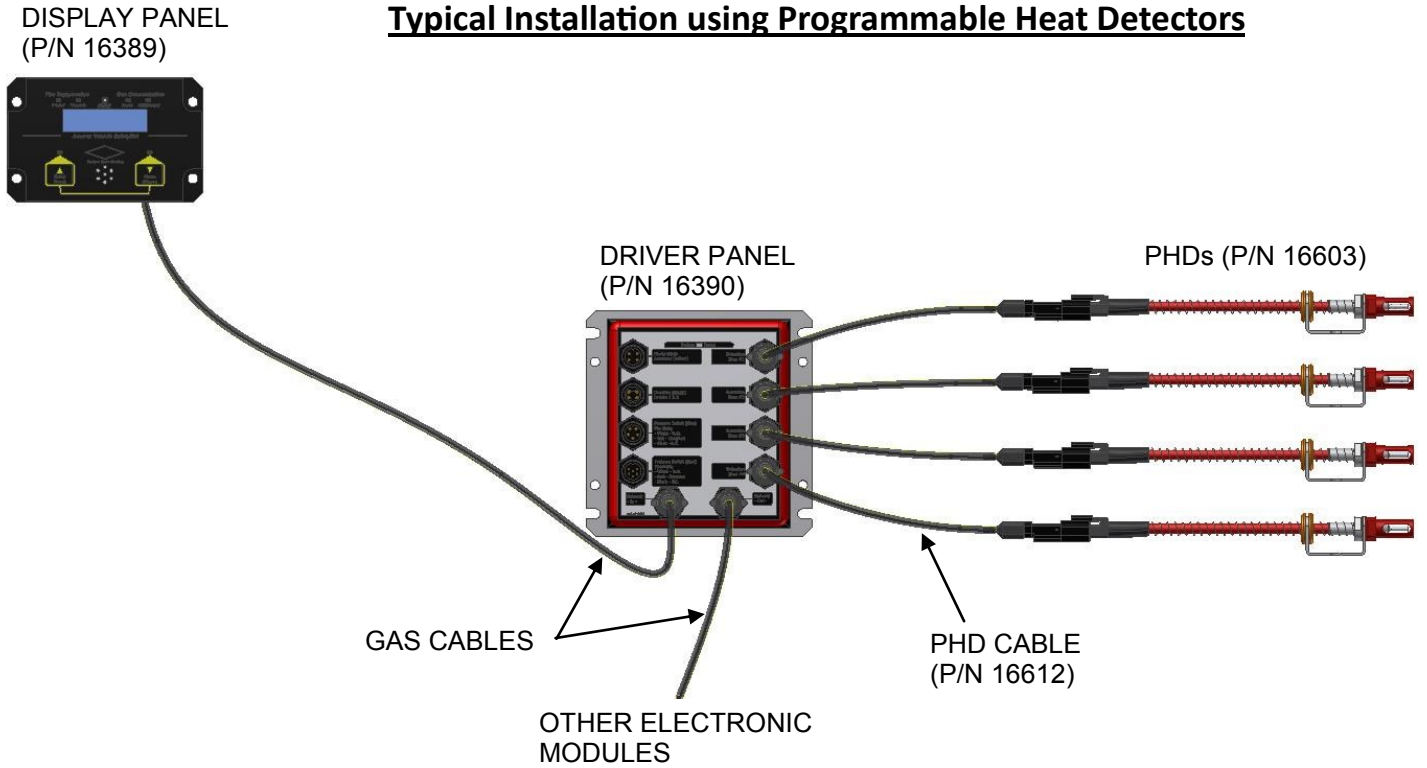


Figure 4.3.5c

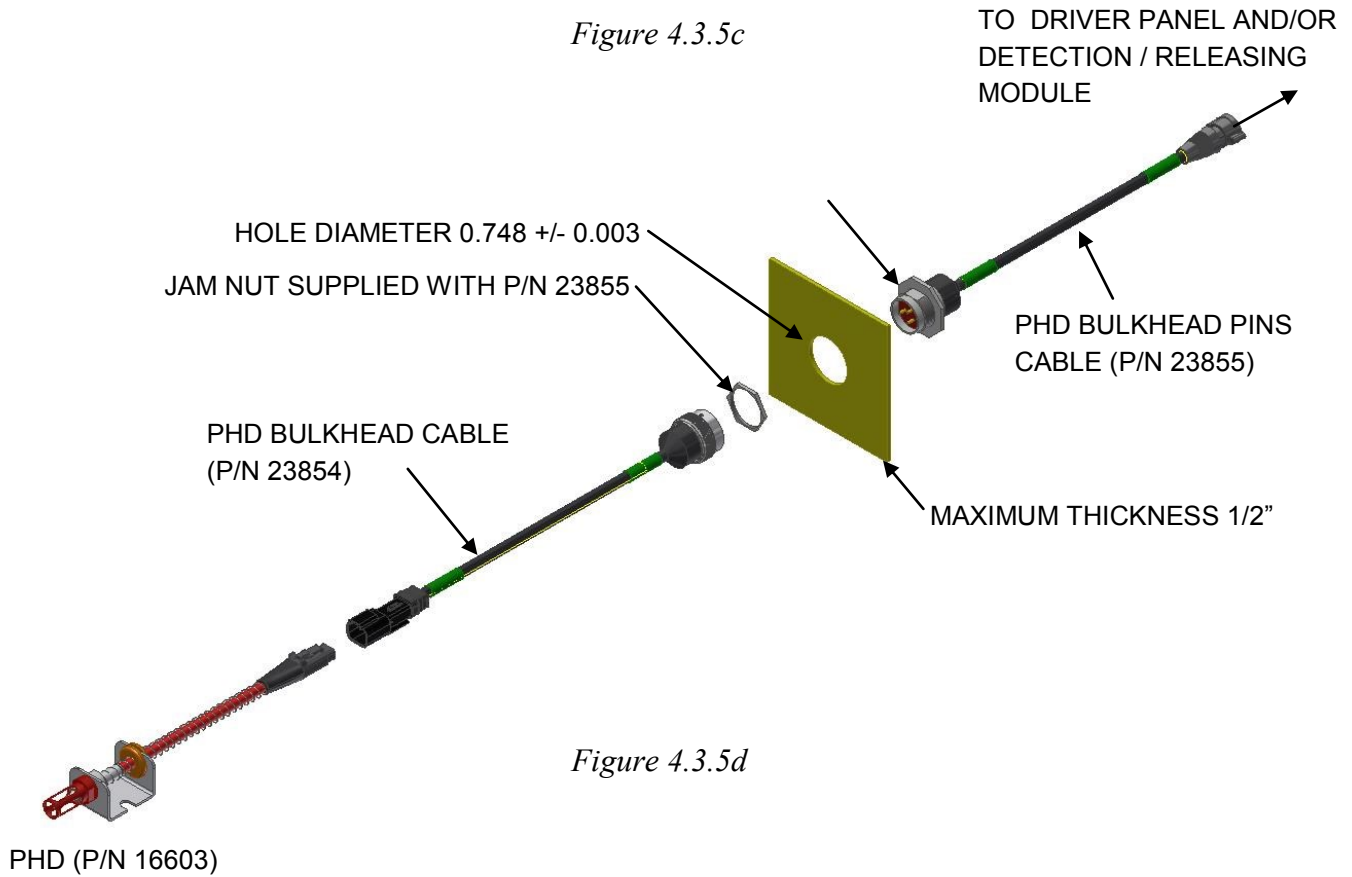
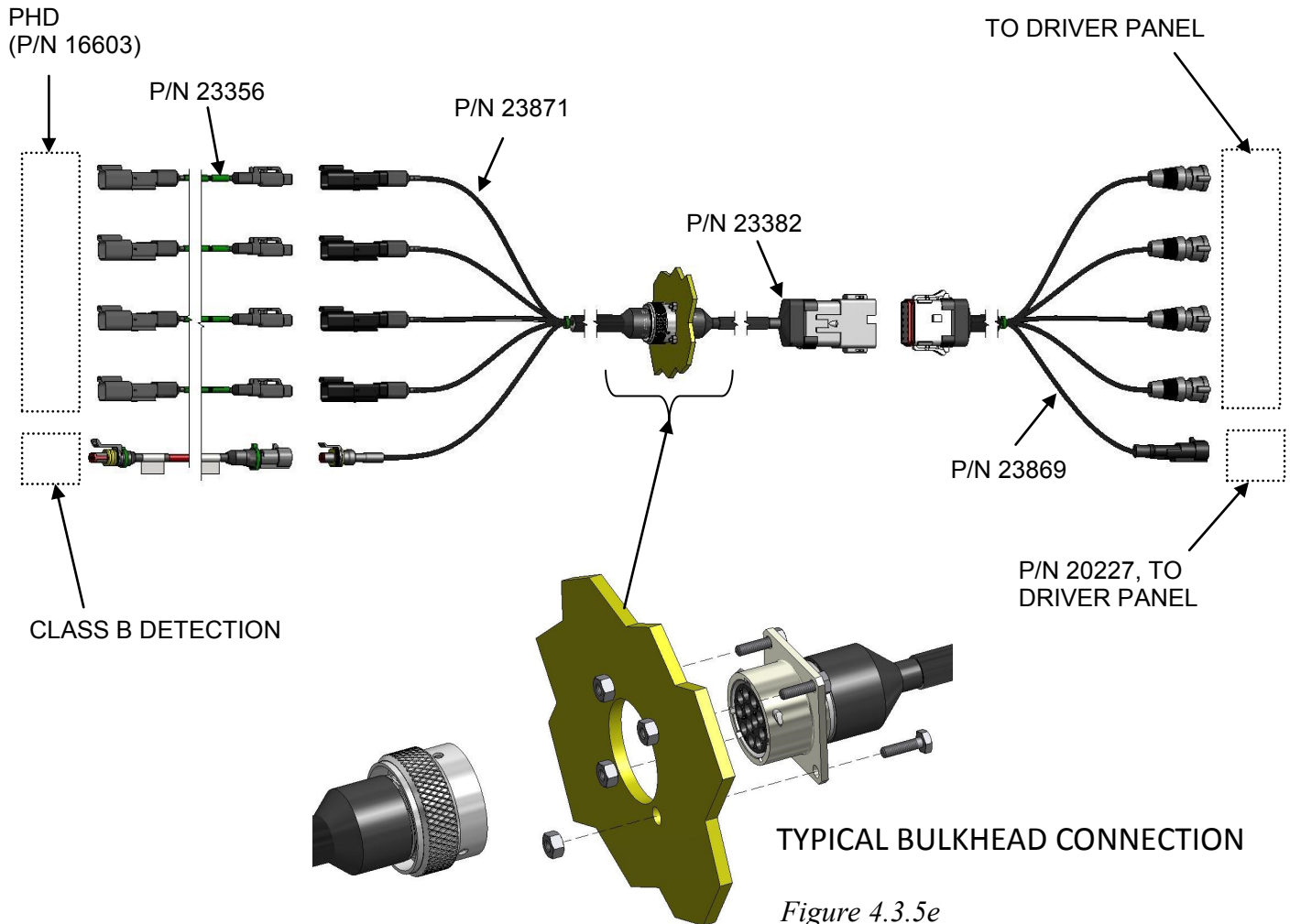


Figure 4.3.5d



4.3.6 Gas Sensor (P/N 14198, 17357, or 16352)

Consider the following when selecting mounting locations for Gas Sensors:

- Know the characteristics of the combustible gas. Gas that has a vapor density that is heavier than air will need Gas Sensors mounted in lower pocket accumulation areas. Gas that has a vapor density lighter than air will need Gas Sensors mounted in higher pocket accumulation areas. Ideally, the sensors should be located directly above potential leak points in cavities as high as possible where rising gas will be trapped. See Table 3.3.1 in this manual for specific gas characteristics.
- Understand the vehicle operation and component functions. For example venting of fuel cylinder excess pressure may be normal. Sensors should not be located in close proximity to these areas.
- Mount the Gas Sensors in a protected environment where possible. Water, mud, grease etc. can mask gas fumes from the sensor element. Do not mount in the direct path of road spray or oil spray.
- Do not mount the sensors where the temperature will exceed 221°F (+105°C).

Attach the Gas Sensors to the vehicle with the padded “P” clamps provided. **CAUTION: Do not attempt to use any other manufacturer’s sensor or previously installed sensors. It is necessary to use on genuine Amerex AMGaDS IV Gas Sensors (which are designed specifically for this unit) from your Amerex Distributor.**

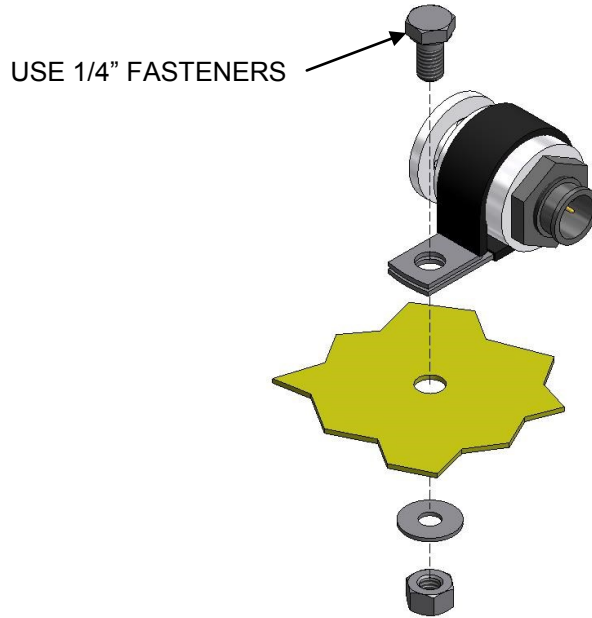


Figure 4.3.6a

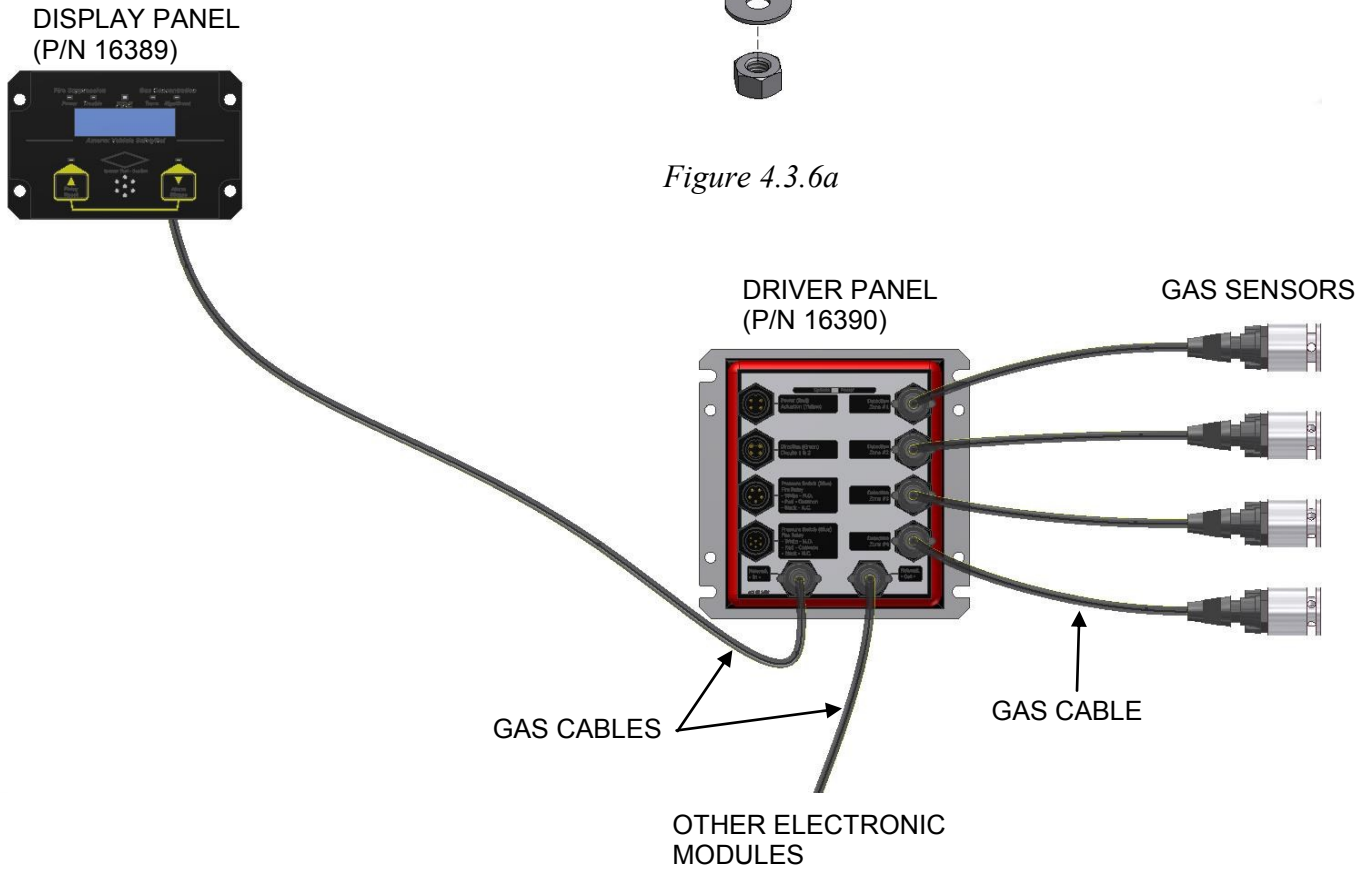
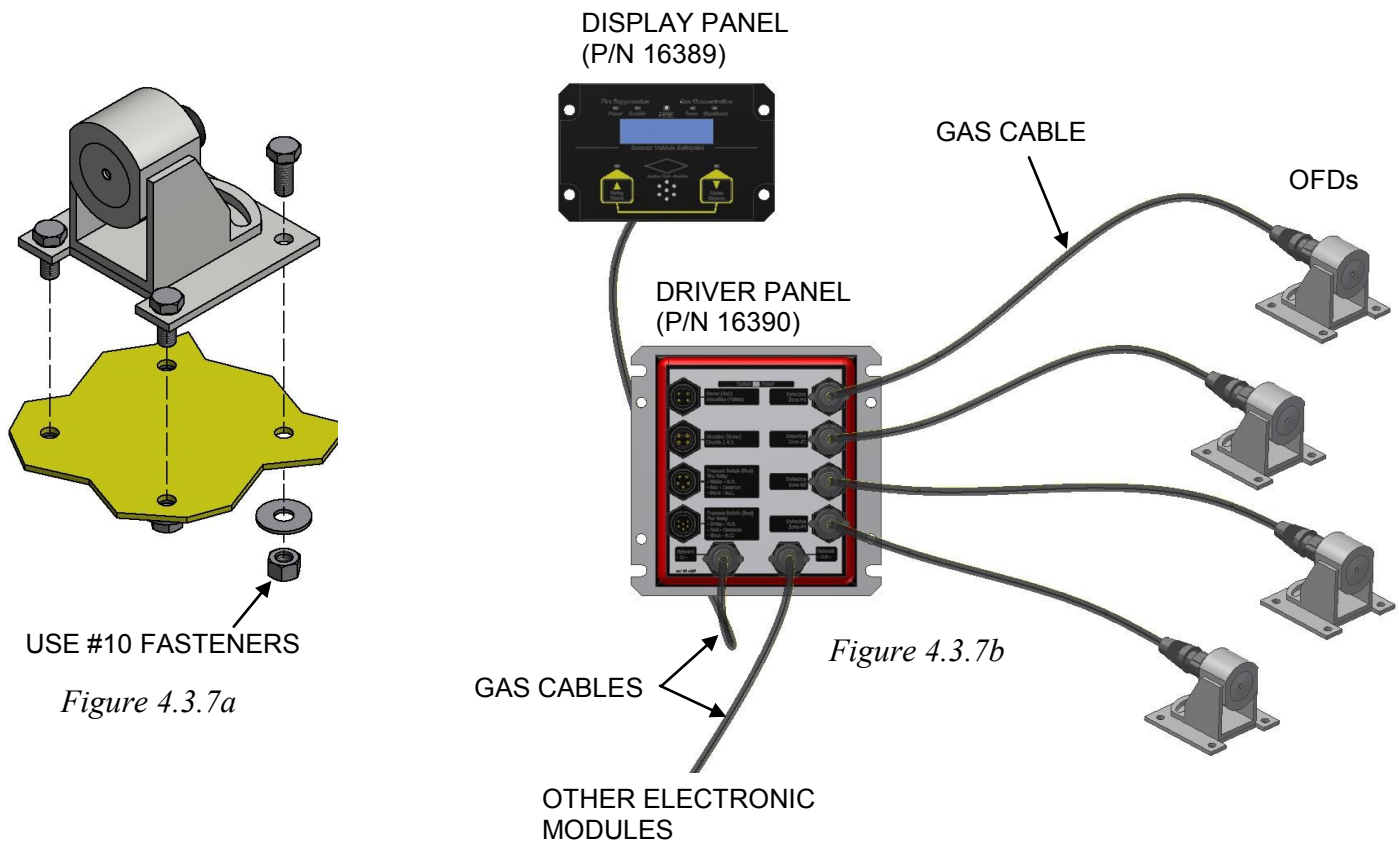


Figure 4.3.6b

4.3.7 Optical Flame Detector (P/N 15799)

- Operating temperature range for sensor and cable assemblies must be within -40°F to +220°F (-40°C to 105°C). The sensor housing contains electronic components, which may be damaged by continued exposure to extreme high temperatures. **Do not place sensors in close proximity to high heat sources such as turbochargers or exhaust manifolds.**
- The Safe-IR Optical Flame Detector requires direct viewing of a flame and must not be visually blocked by other objects. It cannot operate if the flame cannot be "seen" by the sensor.
- Mount the sensor in an area where vibration is minimized.
- Consider testing and maintenance when choosing a sensor location. SafeIR sensors are designed for rugged environments but must be tested and **cleaned periodically**. Ensure the sensor location is practical for both application and maintenance.



4.3.8 PHD, Gas Sensor, Optical Flame Detector & Class B Detection Schematic

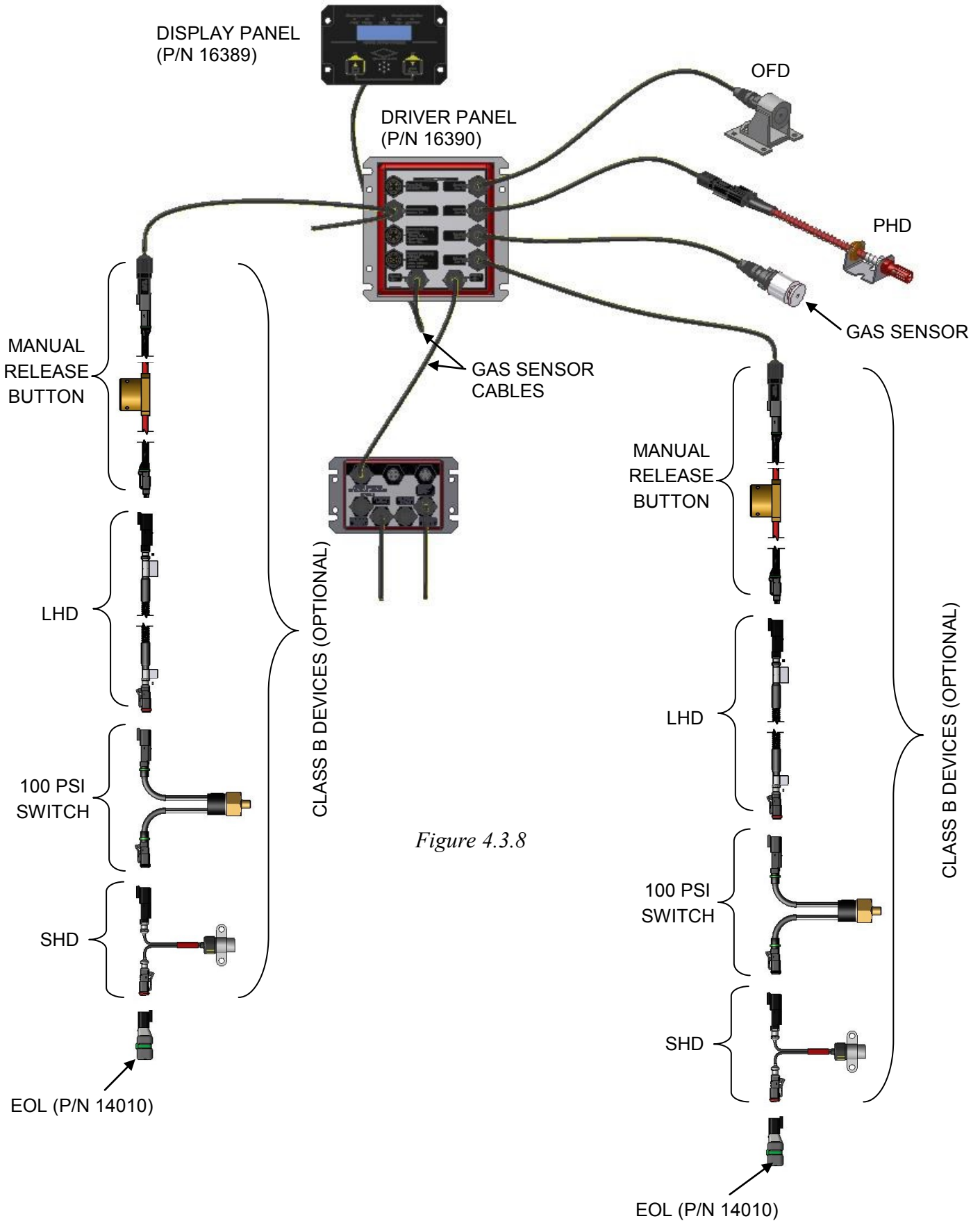


Figure 4.3.8

4.4 Actuation Components and Release Zones

Actuation components are the lifeline of the fire suppression system. The installer must avoid routing any component related to the actuation network through hazard areas.

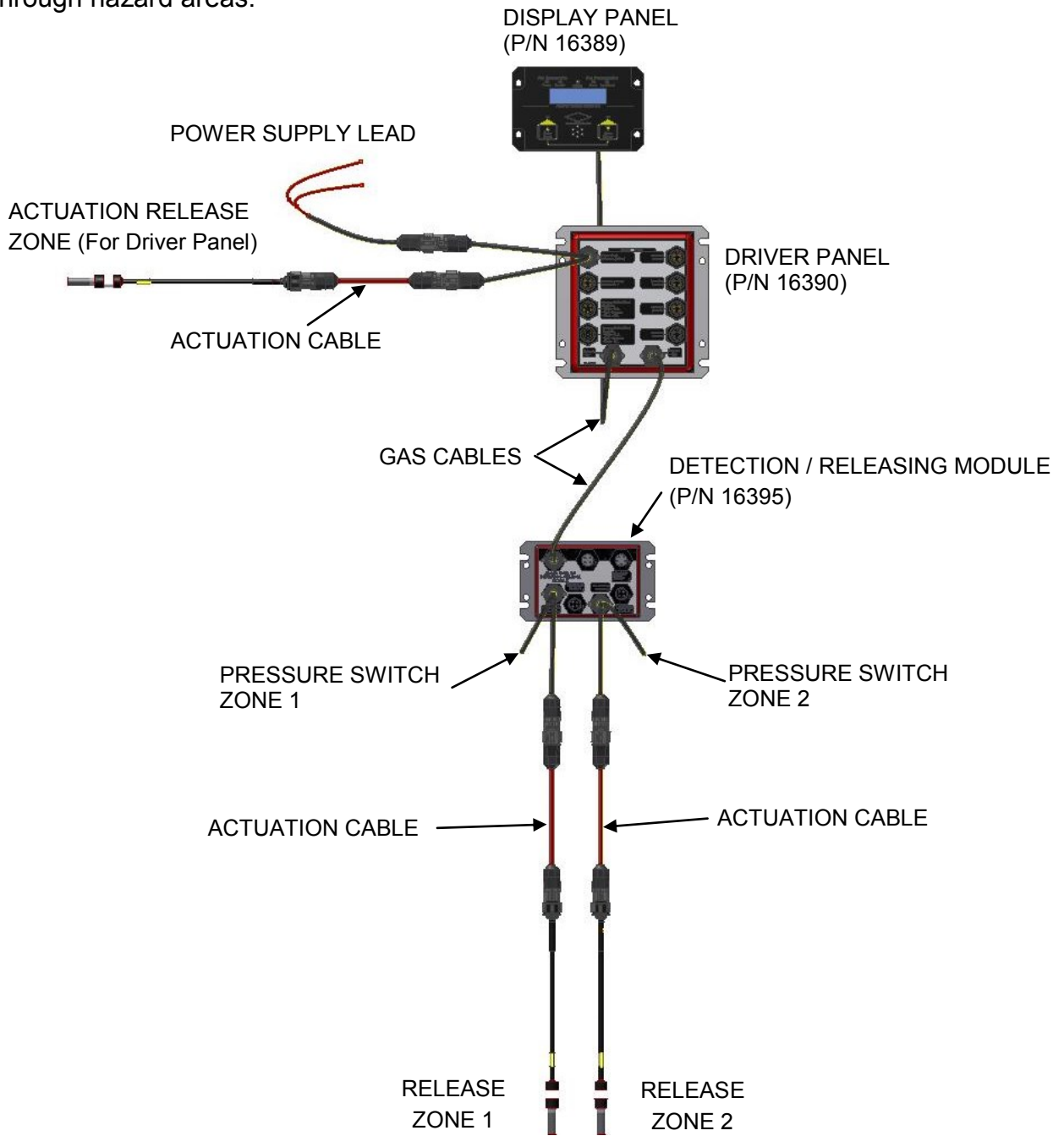


Figure 4.4

4.5 Input / Output Devices

All cables and wiring should be secured to vehicle structure within a minimum distance of every 18" (0.46m). Gas Sensor Cables are used to connect the Display Panel, Driver Panel, Detection Module, Detection / Releasing module and Releasing Module together.

4.5.1 Vehicle Power Input

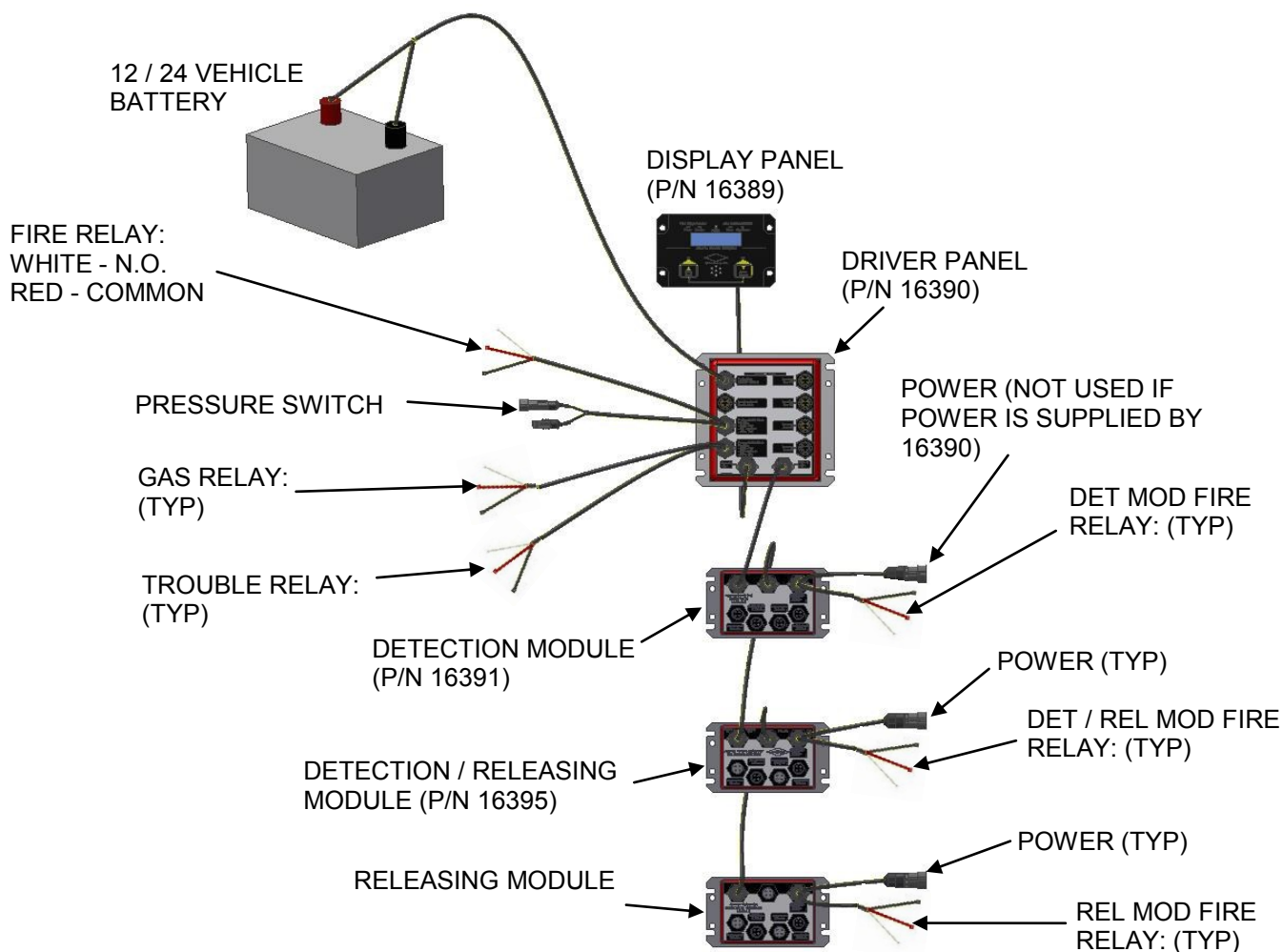


Figure 4.5.3

Once all other connections are made, the vehicle power input circuit can be connected. Input power to the SafetyNet system must be 12-24 VDC. The Power Cable (Item # 28 section 2.10) connects the Driver Panel (P/N 16395) to the power supply from the vehicle. The Power Cable red positive (+) wire is fused with a 10 AMP fast blow type fuse. The Power Cable is color coded red at the connector.

4.5.2 Agent Cylinder Pressure Switch Input

The Pressure Switch (P/N 17609) located on a fire suppression agent cylinder is connected to the releasing panel (Driver Panel, Detection/Release Panel, or Releasing Panel) through a pressure switch circuit. This normally closed circuit monitors the pressure within an agent cylinder and indicates a fault if pressure is lost. If more than one agent cylinder is used, the additional agent cylinder pressure switch(es) will be connected in series using a Pressure Switch Cable (P/N 21539), forming a circuit loop. **If no agent cylinder pressure switch is used, the male and female connectors on the pressure switch leads must be connected together to prevent system pressure fault condition.**

4.5.3 Auxiliary Outputs, (Trouble, Fire, and Significant Gas)

These output relays are used to send signals to external devices or alarms when a trouble, fire, or significant gas condition occurs. These output relays can be used to power down the vehicle or components on the vehicle to enhance fire fighting measures. During a hazard analysis, the external components that may impede the abilities or dispersion of the fire suppression system must be evaluated and accounted for by using these output signals. Each output relay is rated for a maximum of 5 Amp at 30 VDC.

Fire Relay / Pressure Switch (P/N 20228)

- Pressure Switch circuit is color coded blue.
- Overheat from the detection circuit will cause the Fire Relay to transfer state.
 - Black - Normally Closed Signal.
 - Red - Common Signal.
 - White - Normally Open Signal.

Gas Relay / Trouble Relay (P/N 20229)

- Gas and trouble relay circuits are identified by Mylar labels.
 - Black - Normally Closed Signal.
 - Red - Common Signal.
 - White - Normally Open Signal.

Relays can be used for:

- Removing ignition source.
- Sounding external alarm.
- Powering ventilation system down.
- Signaling engine power down.

4.6 Control Panel Programming and Operation

4.6.1 Self Configuration

Once the SafetyNet system is installed, module connections are made and 12 or 24 Volts DC are applied, the Operator Interface panel will display the following information as it self-configures.



Figure 4.6.1a—Identifies this as the Vehicle SafetyNetwork



Figure 4.6.1b—Displays the current Software Revision Level (May be different than shown here)



Figure 4.6.1c—SafetyNet is searching for Network Modules



Figure 4.6.1d—Identifies Number of Modules Found (Driver, Detection, Detection Release, and/or Release Module)



Figure 4.6.1e—Indicates all connected components are OK

After the System OK message is displayed, SafetyNet is operational and will display no message until the system normal status changes. Any change in status is recorded as an event which is logged. A change in system status is accompanied by a Display Message, an audible alarm and an indicating LED warning.

As described earlier, SafetyNet will self-configure by recognizing the number and type of Modules, Sensors and where each component is located in the installation. SafetyNet also recognizes when Sensor inputs and Releasing Circuit outputs are not populated. SafetyNet requires installer confirmation of intentionally unpopulated Detection and Releasing Zones. If an input or releasing zone is “missing,” the SafetyNet System installer must choose to leave the zone unpopulated and “confirm” the choice on the Operator Display.

If input or output zone zones are not used, a separate Operator Display menu selection is displayed. The following Operator Display screens illustrate the confirmation process:



Figure 4.6.1f – Missing Sensor

Figure 4.6.1f shows a screen display of a missing sensor on module #1. SafetyNet asks you to confirm whether this sensor should really be missing. Use either of the two outside buttons to scroll up or down to choose Yes or No.

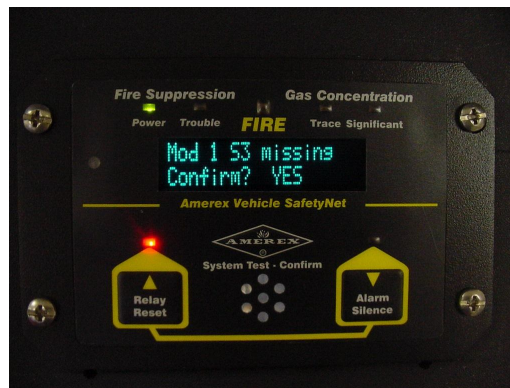


Figure 4.6.1g - Missing Sensor Confirmed

Figure 4.6.1g shows the screen display after you have scrolled to select Yes. Press the Amerex Logo Button to confirm your choice.



Figure 4.6.1h - System Configuration Saved

Figure 4.6.1h shows the screen display after the technician has pressed the Amerex Logo Button to confirm the sensor should be missing. If other sensors or actuators are found to be missing, SafetyNet will move to the next missing device and ask to confirm that the device should be missing. Once all of the missing devices have been confirmed, SafetyNet saves the configuration. As long as the configuration is not changed, sensors of the same type may be changed or the system may be powered down. SafetyNet will keep the configuration in memory and will not require another reconfiguration.

Note: The SafetyNet electronic control system is now self configured according to the components as installed at the time of the self-configuration function just completed. The system may also be custom configured in an almost infinite number of possible ways. Custom programming is done via a laptop or tablet computer interfaced with the SafetyNet software using the P/N 16609 SafetyNet Interface Module. (See Item 2.8 of this manual). Complete Interface Module and programming instructions are found in the P/N 16602 SafetyNet Programming Manual available separately or on-line at: www.amerex-fire.com

4.7 SafetyNet Function Testing & Initial Commissioning

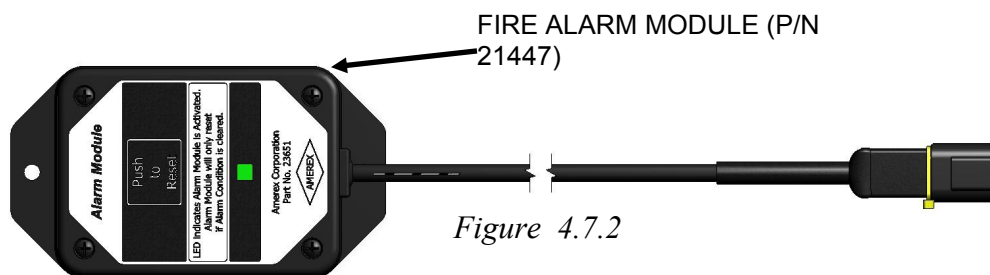
After the configuration has been confirmed or uploaded from a PC, the SafetyNet system and components must be functionally tested as part of the initial commissioning. These tests include Operator Display Panel, Manual Release, actuation circuit, detection sensors, and circuit fault testing as shown in the following sections. Ensure that power is supplied to the system and that all circuits are connected before proceeding. The green 'POWER' LED on the Operator Display Panel face should only be illuminated. A "SYSTEM OK" message may also temporarily be displayed on the screen. If not, recheck all connections until only the "POWER" LED is illuminated.

4.7.1 Operator Display Panel Testing

Operator Display LED and audible alarm testing is performed using the 'Push to Test' button (Amerex Logo) located on the front of the Panel. Press and hold the button for 3 seconds. All Operator Display Panel LEDs will illuminate, the audible alarm will sound, and the relay countdown will start indicating that the Display Panel is functioning properly.

4.7.2 Manual Actuation Button Testing

This test verifies the Manual Actuation Button (P/N 14053) is connected and functions properly. Before performing Manual Actuation testing, disconnect all Linear Actuators (P/N 22579) from the system and replace each with a Fire Alarm Module (P/N 21447 as shown (See Figure 4.7.2). A fault condition will occur on the Operator Display Panel until the Alarm Modules are connected. **Caution: A fire suppression system discharge may occur if all Linear Actuators are not disconnected before proceeding!** A Manual Actuation Button is normally located in the drivers area. There may be additional Manual Actuation Buttons located elsewhere in the green color coded detection wiring network. Each must be tested individually. Break the lock wire seal, pull out the safety ring pin and press the red FIRE button. Verify the Operator Display goes into fire alarm mode as described in Table 4.7.3. Press the alarm silence button on the Operator Display.



The alarm will silence and the "Alarm Silenced" LED will remain on. Press the 'Push to Reset' button located on each Alarm Module. Remaining illuminated LEDs will go OFF, and the green 'Power' LED will illuminate. Replaced the safety pin and lock wire seal on the button. Repeat test for all addition Manual Actuation Buttons on the system.

4.7.3 Detection Sensor Testing

Individual heat detection sensors (PHDs and SHDs only) require testing upon initial commissioning of the SafetyNet system. Each heat sensor must be subjected to its set point temperature to ensure that a system alarm condition and actuation of the associated release zone will occur. As in local manual release testing, all Linear Actuators (P/N 22579) must be removed and replaced with Fire Alarm Modules (P/N 21447) (See Figure 4.7.2). A fault condition will occur on the Display Panel until the Alarm Modules are connected. **Caution: A fire suppression system discharge will occur if all Linear Actuators are not disconnected before proceeding!**

- Programmable Heat Detectors: PHD sensors must be subjected to the set point or 'Alarm Temp.' as programmed in the system configuration. Use an electric heat gun to heat the sensor tip only to the programmed set point. PHD sensors are set to 350°F (177°C) from the factory. Do not overheat any PHD beyond 550°F (288°C), since damage to the sensor could result. Immediately remove the heat gun once the set point is reached. Verify that the following results have occurred on the Display Panel and Alarm Modules (See Table 4.7.3).

Table 4.7.3

Indicator	Result After Alarm Condition
Green 'Power' LED	ON
Red 'SYSTEM ALARM' LED	ON
Text Screen	"ALARM MODULE # ZONE #
Yellow 'System Reset' LED	NOT APPLICABLE
Red 'Release' LEDs (for selected 'Release Zones')	NOT APPLICABLE
Audible Alarm	ON (continuously)
Red LED on each Alarm Module (P/N 21447)	ON (for selected 'Release Zones')
Enabled Auxiliary Alarm Outputs	Transfer state (normally open to closed; normally closed to open)

Reset: After the sensor has cooled below set point temperature, press the 'Alarm Silence' button located on the face of the Display Panel. The audible alarm will silence and the red 'Alarm Silence' LED will illuminate. The system can now be reset by pressing the "Push To Reset" button located on the face of each Alarm Module (P/N 21447). The green 'SYSTEM NORMAL' LED will illuminate. Repeat this test procedure for each PHD in the SafetyNet system.

4.7.3 Detection Sensor Testing:

- **Linear Heat Detector:** LHDs are one time use devices and therefore cannot be subjected to set point temperatures for testing purposes. The Class B detection circuit that contains LHDs can be tested using a spare Manual Actuation Button (P/N 14053) installed temporarily between the LHD and End Of Line (EOL) device in the circuit. Once installed, press the Manual Actuation Button and verify that the Display Panel goes into alarm (See Table 4.7.3b). To reset, remove the Manual Actuation Button and reconnect the circuit. Push the “Push To Reset” button located on the face of each Alarm Module (P/N 21447). The green ‘SYSTEM NORMAL’ LED will illuminate. Repeat this test procedure for each section of Linear Heat Detector wire that is used in the SafetyNet system.
- **Spot Heat Detectors:** SHD sensors must be subjected to their pre-programmed set point temperature. Use an electric heat gun to heat the sensor tip only to this set point. Set point temperatures are:
 - Bracket Mount SHD (P/N 14087): 280°F (138°C) +/- 14°F (130 to 146°C)
 - Bracket Mount SHD (P/N 14088): 350°F (177°C) +/- 17°F (167 to 186°C)
 - Bulkhead Mount SHD (P/N 16615): 450°F (232°C) +/- 22°F (220 to 244°C)

Do not overheat any SHD by more than 100°F over the set point. Overheating the unit beyond these limitations may cause the unit’s set point to change from factory settings. Immediately remove the heat gun once the set point is reached. Verify that the results (from Table 4.7.3) have occurred on the Display Panel and Alarm Modules.

Reset: After the sensor has cooled below set point temperature, press the ‘Alarm Silence’ button located on the face of the Display Panel. The audible alarm will silence and the red ‘Alarm Silence’ LED will illuminate. The system can now be reset by pressing the “Push To Reset” button located on the face of each Alarm Module (P/N 21447). The green ‘SYSTEM NORMAL’ LED will illuminate. Repeat this test procedure for each Spot Heat Detector in the SafetyNet system.
- **Gas Sensors:** System gas response tests are performed using Gas Response Test Kit (20188).
 - * Trace Gas Test (20% LFL)
 - ⇒ Verify the system is in operation mode and not in Trace or Significant Alarm.
 - ⇒ Remove Gas Sensor from “P” clamp leaving sensor attached to Gas Sensor Cable.
 - ⇒ Connect 25% LFL gas (P/N 20165) to regulator (P/N 20179). Connect hose (P/N 20181) between regulator and gas test adaptor assembly (P/N 20186).
 - ⇒ Place gas test adaptor assembly (P/N 20186) over the Gas Sensor.
 - ⇒ Open valve to apply “Trace Gas” (25% LFL) test gas to the Gas Sensor.
 - ⇒ The yellow “Trace Gas” LED will begin to flash on the Control Panel. Verify the correct sensor zone is indicated (See Section 6.1.1).
 - ⇒ After one minute the sensor test is complete.
 - ⇒ If the fault LED is illuminated on the Control Panel, replace the Gas Sensor and restart the test process.
 - ⇒ Turn off test gas, remove the gas test adapter assembly (P/N 20186) and reinstall Gas Sensor in “P” clamp. Verify the Control Panel returns to normal and the “System Normal” LED illuminates.
 - ⇒ Repeat for each sensor zone.

* Significant Gas Level Test (50% LFL)

- ⇒ Verify the system is in operation and not in alarm.
- ⇒ Remove Gas Sensor from “P” clamp leaving sensor attached to Gas Sensor Cable.
- ⇒ Connect 55% LFL gas (P/N 20166) to regulator (P/N 20179). Connect hose (P/N 20181) between regulator and gas test adaptor assembly (P/N 20186).
- ⇒ Place gas test adaptor assembly (P/N 20186) over Gas Sensor.
- ⇒ Open valve to apply “Significant Gas” (55% LFL) test gas to the Gas Sensor.
- ⇒ The yellow “Trace Gas” LED will begin to flash on the Control Panel, and the System Normal output will switch OFF. Five seconds after “Trace Gas” is indicated, the first (lower) red “Significant Gas” LED will illuminate and the audible alarm will sound continuously. The Significant Alarm outputs will switch ON after the programmed delay. Verify the correct sensor zone is indicated (See Section 6.1.1).
- ⇒ After one minute the second (upper) red “Significant Gas” LED flash and the audible alarm will change to a steady chirp. The Control Panel is now in latched alarm. The sensor test is complete.
- ⇒ If the fault LED is illuminated on the Control Panel, replace the Gas Sensor and restart the test process for both trace and significant gas conditions.
- ⇒ Turn off test gas, remove the gas test adapter assembly (P/N 20186) and reinstall Gas Sensor in “P” clamp. Press the “System Reset” button. Verify the Control Panel returns to normal, the outputs switch back, and the “System Normal” LED illuminates.
- ⇒ Repeat for each sensor zone.

4.8 SafetyNet Applications Diagram & Installation

The following diagrams represent examples of SafetyNet system applications.

4.8.1 Fire Detection / Suppression & Multiple Zone Gas Detection

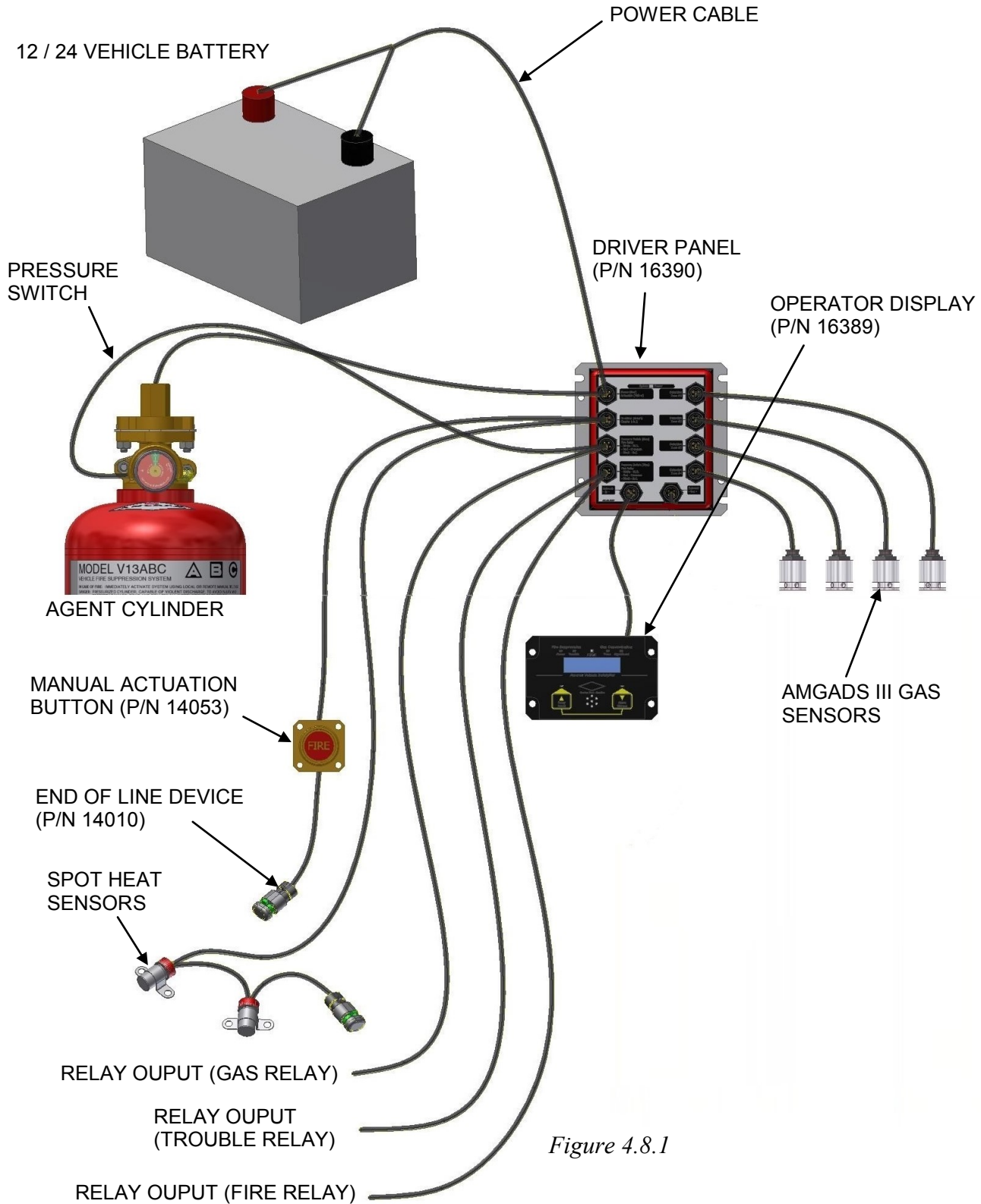


Figure 4.8.1

4.8.2 Multiple Gas Detection Zones and Optical Flame Detection

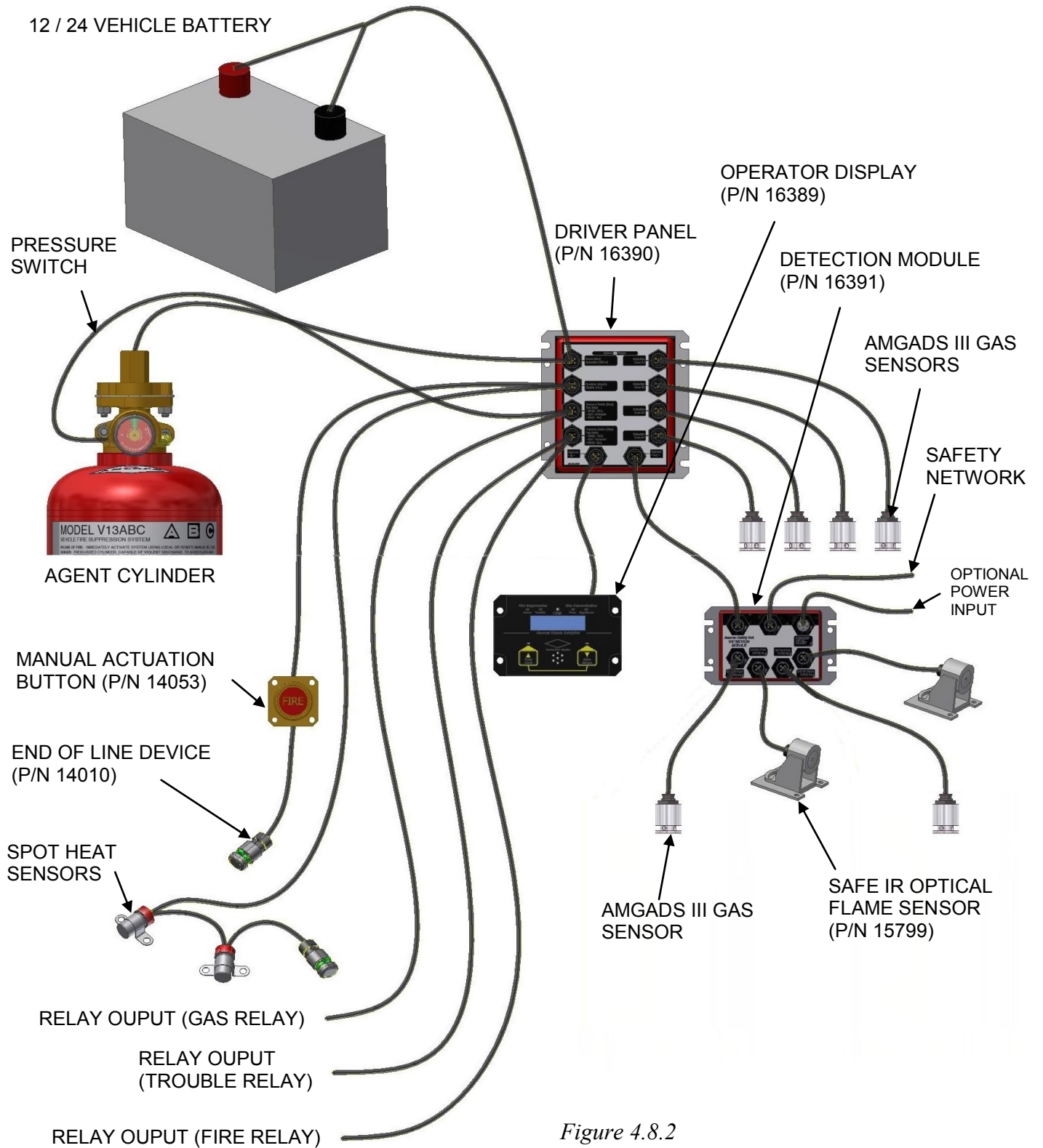


Figure 4.8.2

4.8.3 Gas Detection, Multiple Detection Zones and Multiple Agent Cylinder Release Zones

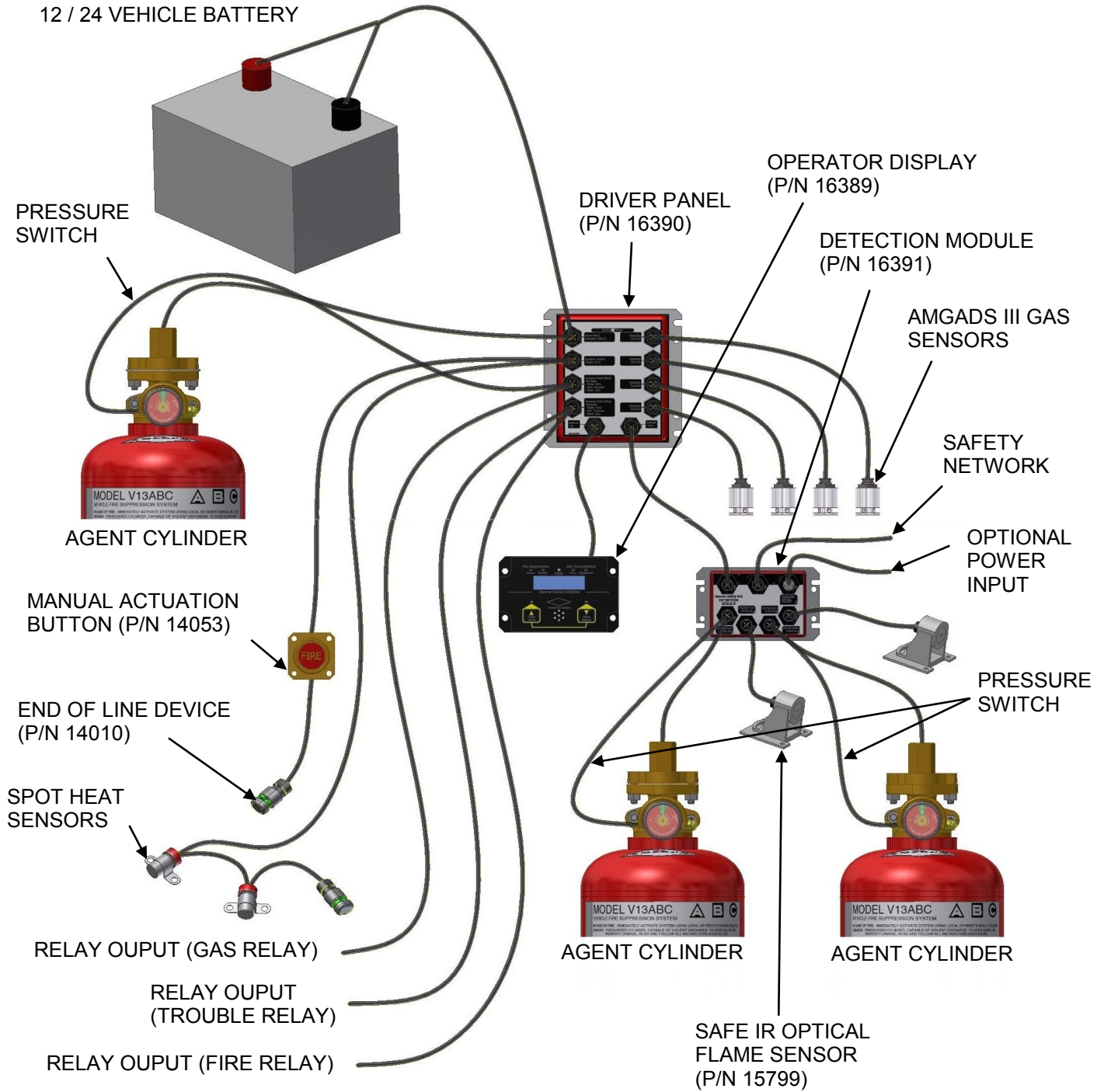


Figure 4.8.3

4.8.4 Multiple Zone Gas Detection System

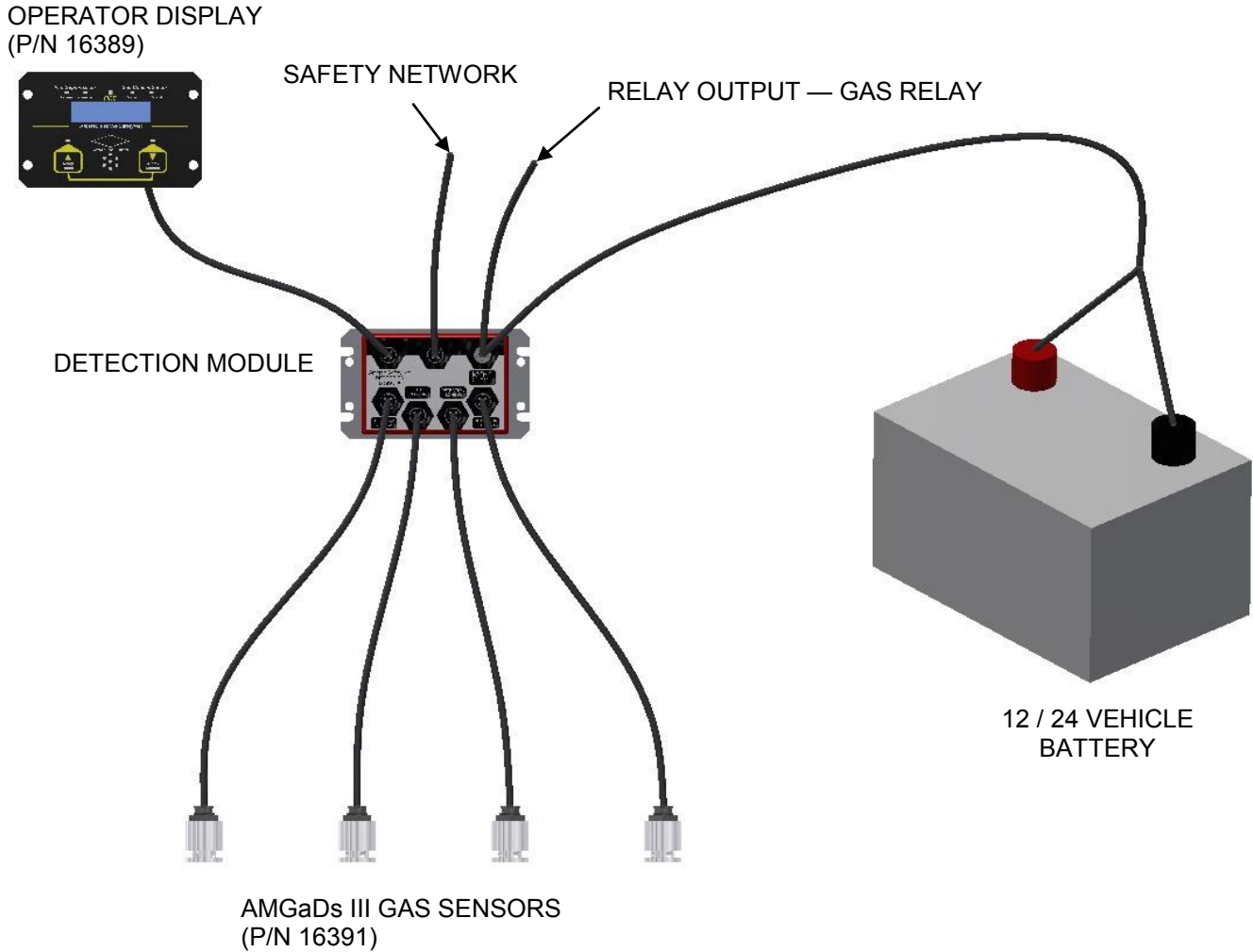


Figure 4.8.4

4.8.5 Multiple Programmable Heat Detection

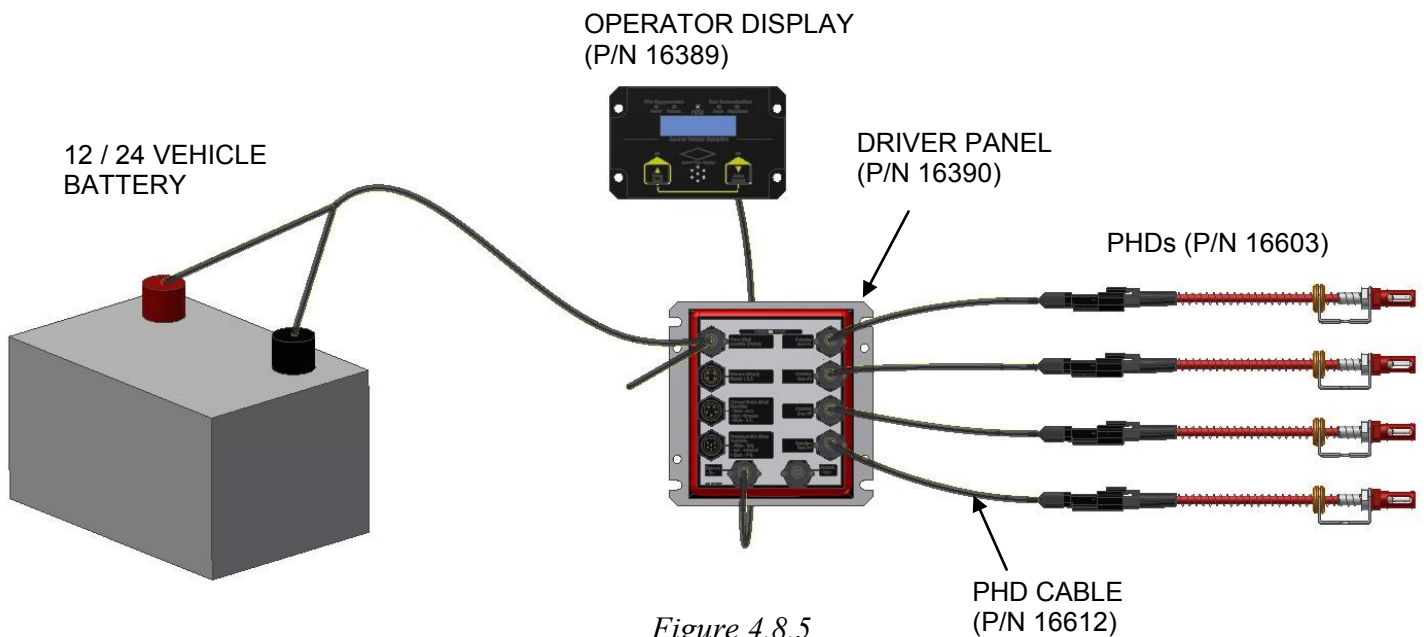


Figure 4.8.5

Chapter 5: Inspection & Maintenance

Amerex SafetyNet System requires periodic care to provide maximum assurance that the system will operate effectively and safely. Inspection frequency should be based on the requirements of the equipment on which the fire suppression system will operate. Inspection and maintenance schedules are shown in this manual and must be followed to ensure reliable system performance. Equipment operating continually and/or in harsh environments will require more frequent inspection and maintenance. The latest revisions of any Amerex Installation, Operation, and Maintenance Manuals referenced in this chapter can be found at www.amerex-fire.com. **Note: All NFPA guidelines that are applicable to the system must be followed for service and maintenance. The following inspections and maintenance requirements are additional Amerex requirements.**

5.1 Daily Inspection: OPERATOR / OWNER

- Verify that a green “OK” status LED is illuminated on the Operator Display Panel.

5.2 Monthly Inspection: OPERATOR/ OWNER

- Verify that all components are present and in their original location and securely fastened.
- Verify that all manual actuation devices are unobstructed by vehicle modifications or clutter.
- Verify that the maintenance tag or certificate is in place and up to date. Record the date of inspection and initials of inspector.
- Verify the physical condition of all components. Inspect for damage or conditions that may prevent operation.

If any service is required as a result of monthly inspections, it should be done only by an Amerex Certified and Authorized Servicing Technician.

5.3 Semi-Annual Maintenance : AUTHORIZED AMEREX TECHNICIAN

The Amerex SafetyNet System must be serviced by an Authorized Amerex Technician that is trained and certified on the Amerex SafetyNet System and in accordance with NFPA and any federal, state, and/or local code requirements. Service and maintenance shall be done at intervals of six (6) months or more frequent if deemed necessary.

- Perform the monthly inspection procedure.
- Verify that hazards have not changed. Look for changes in vehicle operation or cleaning procedures that may have increased the hazard. Compare with the original vehicle hazard analysis.
- Examine and test all detection devices per Section 4.7.2 and 4.7.3. **Warning: Do not perform these tests on the system until all Linear Actuators (P/N 22579 are replaced with Fire Alarm Modules (P/N 21447). Otherwise, a system discharge will result!** Perform a visual inspection of each detector, detection network and discharge (release) network. During the visual inspection, verify no dents, dings, cracks, scorch marks from flames, or any other physical damage has occurred to any detector, component, or cable. Replace any suspect components. If a build-up of grease, dust, or any other foreign matter has accumulated on the detector or circuitry, clean with a vacuum or soft dry cloth.

- Document all work completed during service for record retention. Disclose any anomalies, deficiencies to the property owner for corrective action requirements
- For systems using a gas sensor, the sensor must be tested in accordance with the parameters described in section 4.7.3. Gas sensors must be evaluated for contaminants such as dirt or grease that can prevent the sensor from being exposed to leaking gas. Gas sensors may be cleaned with a soft brush under warm running water if needed. Shake off excessive water before reinstalling. Do not use compressed shop air to clean the gas sensor as the filter membrane can be damaged. Replace any components related to the gas sensor that are suspected to have damage. If harsh cleaning solutions are used in the area of the gas sensor, the gas sensor must be sealed from those chemicals.

5.4 Two Year Maintenance:

- The internal Nickel Metal Hydride (NiMH) backup battery (P/N 19667) installed in the SafetyNet Driver Panel (P/N16390) will require periodic replacement. Verify battery date shown on label on the back side of the Driver Panel. If the battery is out of date or will be out of date before the next six months service, replace it and the Replacement Battery Label. Before replacing the backup battery or performing system maintenance, it is a safe practice to disconnect the main power and the actuation circuits. When should the battery be replaced?
 - * 2 years from label date or date of original installation.
 - * Battery Replacement Label is missing from front of panel area.
 - * A Backup Battery trouble event occurs.
 - * Low battery indicator on front of panel is illuminated.
 - * Label information is not legible.

The backup battery may be accessed by loosening 4 cover screws (See Fig. 5.4a and Fig and removing the back cover. Take care not to damage the electronic components when maintaining the battery. Loosen the two screws holding the battery. Unplug the out of date battery from the pc board and dispose of properly. Plug in new battery and secure with the original two screws. Replace back cover and secure with the four original screws. Place new label on back cover so that the four screws are covered. Write next battery replacement date on label. See Figure 5.4a and Figure 5.4b on the next page for details.

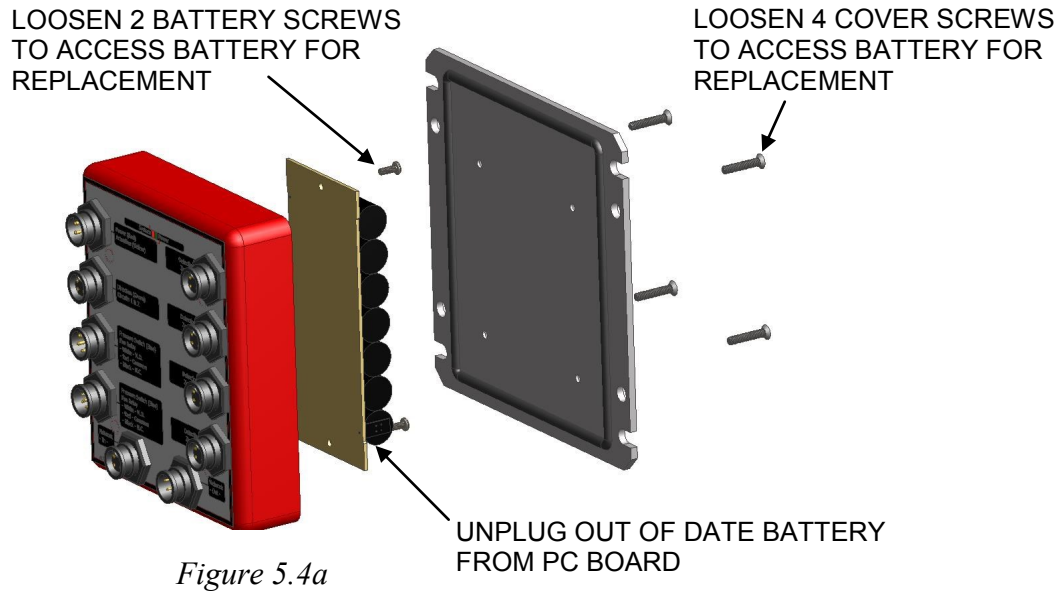


Figure 5.4a

REPLACE LABEL WHEN BATTERY HAS BEEN REPLACED

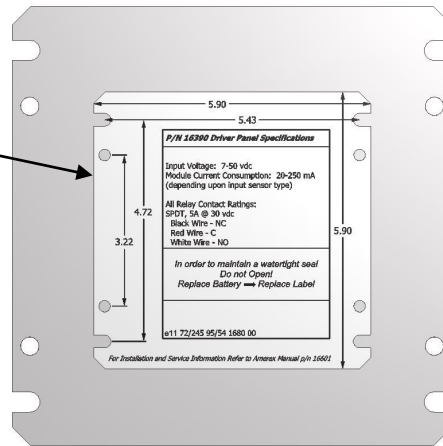


Figure 5.4b

- Gas sensors must be replaced every 2 years.

5.5 Six Year Maintenance: AUTHORIZED AMEREX TECHNICIAN

- Perform semi-annual inspection.
- Replace Linear Actuators if in service for 6 years.

Chapter 6: System Alarms & Troubleshooting

Under normal working conditions, the green 'Power' LED on the Operator Panel will be illuminated. If an alarm or trouble condition exists within the system the "Trouble" LED will be illuminated and the text screen will display an alarm code or a fault code. In the event of a fire the red "FIRE" LED will be illuminated, the audible alarm with sound, and the fire relay will engage. In the event of a gas leak detection the appropriate gas level LED will be illuminated either Trace or Significant. A significant gas alarm will also sound the audible alarm and engage the gas relay. These events are time stamped and recorded in the SafetyNet memory. Both Fire Suppression System and Gas Detection System codes will be stored. The event log can be viewed or downloaded to a PC as Word documents for storage, trouble shooting. The event log can be accessed using the P/N 16609 SafetyNet Interface Module and your personal computer using simple Windows pull down menus. For detailed explanations and user programming refer to SafetyNet Programming and Troubleshooting Manual P/N 16602.

Event Type	Event Cause	Event Record	Operator Display	LED Indication	Audible Alarm
Trouble	Communications Error	No Response Invalid Response Invalid Module Missing Module Invalid command Software error	Trouble Module# Comm	Yellow Trouble Steady	Pulsed
Trouble	Sensor trouble	Sensor missing Sensor wrong Sensor disabled	Trouble Module# Sensor#	Yellow Trouble Steady	Pulsed
Trouble	Over-temperature level 1	Variable Overheat Sensor Level 1 Exceeded		Yellow Trouble Steady	Single Pulse
Trouble	Over-temperature level 2	Variable Overheat Sensor Level 2 Exceeded		Yellow Trouble Steady	Steady On
Trouble	Discharge	Open Circuit at Actuator	Trouble Module# Discharge	Yellow Trouble Steady	Pulsed
Trouble	Pressure low	Open Circuit at Pressure Switch Input	Trouble Module# Press. Low	Yellow Trouble Steady	Pulsed
Trace Gas	20% to 50% Gas Level	Trace Gas Level Exceeded	Trace Gas Module# Sensor#	Yellow Trace Flashing	Pulsed
Significant Gas	50%+ Gas Level	Significant Gas Level Exceeded	Significant Gas Module# Sensor#	Red Significant Steady	Steady On
Fire	Fire	Fire	FIRE Module# Sensor#	Red Fire Steady	Steady On

Table Continues Next Page

None	System	Clock set Configuration written Configuration erased Configuration reset Self-test Relays cleared Alarm silenced Reset (at power-on) User reset (logo button) Event log erased Configuration mismatch Power failure Maintenance schedule set Maintenance schedule reset	None	No	No
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6.1 Event Definitions

- Module Communications Error – These errors consist of network errors. An error in data transmission or interruption in the data network will cause a Comm Error. Check all data cables and verify proper system configuration.
- Sensor Trouble – This could indicate one of several problems:
 - * A system sensor in the SafetyNet configuration is missing
 - * A system sensor is different than the SafetyNet configuration
 - * A system sensor is damaged or disabled
 - * Sensor wiring is broken or disconnected
- Over-temperature level 1 – Variable Overheat Sensor warning level 1 is exceeded. The Programmable Heat Detector sensor temperature level is set at the module level. If this level is exceeded, the event will be recorded and will be indicated by a yellow Trouble LED and pulsed audible alarm.
- Over-temperature level 2 – Variable Overheat Sensor warning level 2 is exceeded. The sensor temperature level is set at the module level. If this level is exceeded, the event will be recorded.
- Actuator Fault - This could indicate a disconnected actuator cable, open wire in the actuator cable, open or activated actuator.
- Pressure Low – Open circuit at the agent cylinder pressure switch. This could indicate a disconnected pressure switch cable, or open wire in the pressure switch circuit.
- Fire – A sensor has recorded a Fire event.
- System – There are a number of things that are recorded as System Events. Any user interaction with the Operator Display or Configuration adjustments is recorded as a System Event.
- Trace gas – Trace Gas Level is exceeded. Combustible gas exists in the area of the sensor. The default setting is 20% of the LEL of Methane in a normal atmosphere.
- Significant gas – Significant Gas Level is exceeded. Combustible gas exists in the area of the sensor. The default setting is 50% of the LEL of Methane in a normal atmosphere.

Chapter 7: Warranty

Warranty Statement:

Warranty and Limitation of Liabilities, Buyers Remedies, and Indemnification

Amerex Corporation (Seller) warrants that Vehicle Fire Suppression System components (Goods) delivered are free from defects in material and workmanship under conditions of normal use for a period of three (3) years from the date of purchase except Small Vehicle Fire Suppression System components, batteries, and AMGaDS gas sensors which are warranted for a period of one (1) year. Non-standard products manufactured by Seller to customer specifications are warranted for a period of one (1) year. Contact Amerex Corporation for warranty statements for other Amerex Corporation products. Seller reserves the right to make any modifications required by production conditions to the information set forth in the Seller's catalogues and advertising literature. Seller shall not be liable or responsible, however, for (A) any defects attributed to normal wear and tear, erosion or corrosion or improper storage, use or maintenance, or (B) defects in any portion or part of the Goods manufactured by others. If (B) above is applicable, Seller will, as an accommodation to Buyer, assign to Buyer any warranties given to it by any such other manufacturers. Any claim by Buyer with reference to the Goods for any cause shall be deemed waived by Buyer unless submitted to Seller in writing within ten (10) days from the date Buyer discovered, or should have discovered, any claimed breach. Buyer shall give Seller an opportunity to investigate.

Provided that Seller is furnished prompt notice by Buyer of any defect and an opportunity to inspect the alleged defect as provided herein, Seller shall, at its option and in its sole discretion either: (i) repair the defective or non-conforming Goods, (ii) replace the nonconforming Goods, or part thereof, which are sent to Seller by Buyer within sixty days after receipt of the Goods at Buyer's plant or storage facilities, or (iii) if Seller is unable or chooses not to repair or replace, return the purchase price that has been paid and cancel any obligation to pay unpaid portions of the purchase price of nonconforming Goods. In no event shall any obligation to pay or refund exceed the purchase price actually paid. This warranty does not cover defects resulting from modification, alteration, misuse, exposure to corrosive conditions or improper installation or maintenance. Repair and/or replacement as provided above shall be at Seller's plant and shipped F.O.B. Plant unless otherwise agreed to by Seller. Transportation charges for the return of the Goods or part thereof to Seller shall be prepaid by Buyer, unless otherwise agreed to in writing by Seller. Seller shall, in no event, be responsible for any labor, removal or installation charges that may result from the above-described repair and/or replacement of any Goods. The foregoing warranty does not cover failure of any part or parts manufactured by others, the failure of any part or parts from external forces, including but not limited to earthquake, installation, vandalism, vehicular or other impact, application of excessive torque to the operating mechanism or frost heave. The exclusive remedy of Buyer and the sole liability of Seller, for any loss, damage, injury or expense of any kind arising from the manufacture, delivery, sale, installation, use or shipment of the Goods and whether based on contract, warranty, tort or any other basis of recovery whatsoever, shall be, at the election of Seller, the remedies described above.

The foregoing is intended as a complete allocation of the risks between the parties and Buyer understands that it will not be able to recover consequential damages even though it may suffer such damages in substantial amounts. Because this Agreement and the price paid reflect such allocation, this limitation will not have failed of its essential purpose even if it operates to bar recovery for such consequential damages.

THE FOREGOING WARRANTY IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES WHETHER EXPRESS OR IMPLIED BY LAW. THERE IS NO IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. IN NO EVENT, WHETHER AS A RESULT OF BREACH OF CONTRACT, WARRANTY, TORT (INCLUDING NEGLIGENCE) OR STRICT LIABILITY, SHALL SELLER BE LIABLE FOR ANY PUNITIVE, SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES INCLUDING, BUT NOT LIMITED TO, LOSS OF PROFIT, LOSS OF USE OF THE GOODS OR OTHER PROPERTY EQUIPMENT, DAMAGE TO OTHER PROPERTY, COST OF CAPITAL, COST OF SUBSTITUTE GOODS, DOWNTIME, OR THE CLAIMS OF BUYER'S CUSTOMERS FOR ANY OF THE AFORESAID DAMAGES. SELLER SHALL NOT BE LIABLE FOR AND BUYER AGREES TO DEFEND AND INDEMNIFY SELLER AGAINST ALL CLAIMS OR LOSSES (INCLUDING ATTORNEYS' FEES), INCLUDING PERSONAL INJURY, PROPERTY DAMAGE OR OTHER LIABILITY, RESULTING IN WHOLE OR IN PART FROM (1) THE NEGLIGENCE OF BUYER OR ITS CUSTOMERS; (2) BUYER'S OR ITS CUSTOMER'S MISUSE, DAMAGE, ALTERATION OR MODIFICATION OF SELLER'S GOODS; (3) BUYER'S OR ITS CUSTOMER'S USE OF THE GOODS IN ANY PRODUCT OR SYSTEM DESIGNED, MANUFACTURED OR SOLD BY BUYER OR ITS CUSTOMERS; OR (4) ANY BREACH OF THIS AGREEMENT; PROVIDED, HOWEVER, THAT BUYER SHALL HAVE NO OBLIGATION TO INDEMNIFY SELLER FOR CLAIMS OR LOSSES THAT ARISE SOLELY FROM THE NEGLIGENCE OR MISCONDUCT OF SELLER.

In any contract by Buyer for resale of the Goods, Buyer shall effectively disclaim, as against Seller, any implied warranty of merchantability and all liability for property damage or personal injury resulting from the handling, possession or use of the Goods, and shall exclude, as against Seller, any liability for special or consequential damages.