SiteSentinel® Integra® Installation Manual

Part Number: M1800

Revision: 10.1

Integra®

IMPORTANT: Before you use this manual, make sure you have the most recent revision. Look at the revision of this document to make sure it agrees with the most current revision found in the FMS Technical Library. Download the latest revision if necessary.

IMPORTANT: All references to other manuals and instructions in this manual can be found in the FMS Technical Library. Make sure you have the most recent revision.

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Section 1 Get Started: Safety

This manual will show the necessary steps to install your Integra console, devices and peripheral options.

Topics covered in this section include:

1.1 Safety Warnings

This manual contains many important Safety Alerts. There can be a risk of injury or damage to property if you do not obey these alerts. The panels below show the types of safety warnings that can be seen and how each is specified.

DANGER: Indicates an immediately hazardous condition that, if not prevented, will result in death or serious injury.

WARNING: Indicates a possibly hazardous condition that, if not prevented, could result in death or serious injury.

CAUTION: Indicates a possibly hazardous situation that, if not prevented, could result in minor or moderate injury.

NOTICE: Indicates important information not related to hazards. A condition that, if not prevented, can result in property damage.

SAFETY INSTRUCTIONS: Indicates instructions and procedures related to safety or gives the location of safety equipment.

1.2 Information Panels

NOTE: This panel gives more information about an instruction or procedure.

IMPORTANT: This panel contains special information that is important and must be read and obeyed.

REMINDER: This panel shows information that has been given before in the manual that is important to show again.

TIP: A step or procedure that is recommended to make another step or procedure easier.

INFORMATION: This panel shows references to more information in other sources.

READ CAREFULLY: This panel points to information that must be fully read and understood before doing the procedure(s) that comes after.

1.3 Applicable Warnings - Integra

The inside of this OPW-FMS automatic tank-gauge system console contain high-voltage circuitry.

NOTE: ONLY certified OPW technicians are authorized to install and program this automatic tank gauge system. This is necessary for warranty registration.

DANGER: The coin cell battery may explode if mistreated. Do not recharge, disassemble or dispose of in fire. Replace coin cell battery with Panasonic or Matsushita Electric Part Number CR-2032. ONLY. Use of another battery may present a risk of fire or explosion.

The rechargeable battery used in this device may present a risk of fire or chemical burn if mistreated. Do not disassemble, heat above 60°C or incinerate. Replace the battery with Part No. WU025680-0001. R/C (BBFS2), manufactured by Varta AG, Model No. 2S/LIC 18650, rated 7.4V, 2400mAH, max charge voltage 8.6V, max charge current 2.4A. ONLY. Use of another battery may present a risk of fire or explosion.

Dispose of used battery promptly. Keep away from children. Do not disassemble and do not dispose of in fire.

The console can remain powered via the backup battery, even though the line power has been removed.

A readily accessible external disconnect device must be installed for any permanently connected equipment!

A readily accessible electrical outlet should be installed near any equipment requiring access via a plug connection!

The inside of the console contains high-voltage circuitry; ONLY certified technicians should be permitted access to the console.

IMPORTANT: A used battery must be removed from the console. Used batteries must be moved to a battery-recycling center for approved disposal.

NOTICE: The Integra console must stay energized when the lithium battery is charged or all configuration data will be erased.

1.4 Hazardous Areas

NFPA/NEC – Class I, Div. 1 & Div. 2

Class I locations. Class I locations: Where flammable gases or vapors are or can be in the air in quantities sufficient to cause explosive or ignitable mixtures. Class I locations include:

- **Class I, Division 1**. A Class I, Division 1 location is a location where:
  - There can be concentrations of flammable vapors during normal operation.
  - There can be concentrations of flammable vapors during repair or maintenance operations or when the leakage of liquid fuel can occur.
  - A release of concentrations of flammable vapors can occur as a result of equipment failure, incorrect operation or unsatisfactory procedures that could also cause a failure of electrical equipment.
- **Class I, Division 2**. A Class I, Division 2 location is a location where:
  - An accidental failure or incorrect operation of vapor containment system equipment or containers that can release hazardous vapors from flammable liquids or gases.
  - A failure or incorrect operation of positive mechanical ventilation precautions result in the release of hazardous concentrations of flammable gases or vapors.
  - Concentrations of flammable gases or vapors can occasionally flow from a containment or ventilation system to an adjacent Class I, Division 1 location. This flow of gases or vapors must be prevented by sufficient positive-pressure ventilation from a source of clean air. Sufficient precautions to prevent ventilation failure must be installed.

1.5 I.S. Barriers - Special Conditions for Safe Use

The intrinsic safety barriers provide intrinsically safe circuits suitable for use with Category 1 equipment located in a Group II, Gas Group IIA hazardous location. The devices are intended for use in a non-hazardous location as associated apparatus.

- The operating temperature range for all device types is -40°C to +70°C (for DMP probes it is -40°C to + 60°C).
- Maximum permissible voltage (Um) must not be above 250 V.
- The electrical parameters of the intrinsically safe connected devices must be compatible with the electrical parameters of the barrier with which it is connected.
- The intrinsically safe barriers are intended for use only inside their respective installed enclosures.
    - DO NOT use a barrier removed from a console as standalone equipment.
    - Installation must be in accordance with the U.S. National Electrical Code (NFPA No. 70) and the Code for Motor Fuel Dispensing Facilities and Repair Garages (NFPA No. 30A).
    - Refer to the Installation Guide of the applicable console for the correct installation procedure.*
- The terminal strip of each barrier is clearly labeled for Power (PWR), Signal (SIG) and Ground (GND) connections. The wiring of intrinsically safe devices to the barrier must agree with the labeling of the terminal strip.
- Spacing requirements between the non-intrinsically safe circuit connections and the intrinsically safe connection facilities must be maintained in accordance with EN 60079-11.
- Refer to the applicable console Field Wiring Diagrams and Installation Guides for correct wiring of all Earth Ground and I.S. Ground terminals between the console and main electrical service panel.*

* All OPW-FMS Installation Guides and Field Wiring Diagrams can be found here: FMS Technical Library.

1.6 Technician Certifications

All installers must work with an OPW certified technician in order to ensure requirements of intrinsically safe devices are met and must strictly obey the instructions in this manual to perform a safe installation.

There are several types of OPW Certified ATG technicians:

- SiteSentinel® iSite™
- SiteSentinel® Integra 100™
- SiteSentinel® Integra 500™ (including LLD and ACR)
- SiteSentinel® iTouch™

The OPW certified technician must assume 100% responsibility for all pipe fitters, electricians and any additional contractor hired.

1.7 Installer Safety

CAUTION: Incorrect installation can cause a risk of injury to installers and users of this equipment. Incorrect installation can result in environmental contamination or equipment damage. Read these instructions carefully!

Refer to the National Electrical Code (NFPA No. 70) and the Motor Fuel Dispensing Facilities and Repair Garages Code (NFPA No. 30A) to make sure your installation is correct.

Installers must know the requirements of intrinsically safe devices and must obey the instructions in this document to complete a safe installation.

For installations outside the United States, make sure that the installation obeys all applicable local codes.

When installing in a hazardous area as defined by the NEC, only intrinsically safe devices can be installed in or above the Class 1, Division 1 and 2 Hazardous Area.

The installer must know and obey all applicable local codes in the country or county where this unit is installed.

NOTE: Local codes can specify special installation requirements. Installation is subject to approval by the local authority with jurisdiction at the site.

1.8 Precision Leak Test

A third-party precision leak test must be performed on each tank and product line (especially older tanks) before installing the console. This test will make sure that leak data supplied by the system is accurate and reliable. A pressurized precision leak test can be done on a tank after the probe has been installed (pressure must NOT be more than 5 psi [0.34 bar]).

NOTE: Most regulatory agencies will accept the ATG tank test as the acceptance test on new tank installations. Make sure this applies to your local agency before testing any tank.

1.8.1 Before Initial Inspection

Refer to the initial Site Survey form (M00-2027- Site Survey) and compare the equipment that was shipped to what is listed in the site survey.

NOTE: Not all Site Survey questions will require an answer; for all unanswered questions, please respond with “N/A.” Do not leave any field empty!

1.8.2 Initial Inspection

All packed items should be given a full visual inspection for damage that could have occurred during shipping.

The console Data Sheet found in the product container supplies important details about the tank gauge system. Store the data sheet and OPW Technical Documentation USB in a secure location.

The Field Wiring Diagram found in the product container should be given to your installer or electrician.

The most up to date Field Wiring Diagrams and other documentation related to your SiteSentinel Integra console can also be found and downloaded from the Integra Tank Gauge Console Product Category in the FMS Technical Library.

Section 2 Integra Console Installation

The Integra 100 and 500 consoles are equipped with one (1) internal relay. While the Integra 100 has four (4) internal barrier positions, this is optional with the Integra 500. The Integra 500 can use up to four (4) OM4 relay modules to control up to 16 external output devices. The Integra 500 can have a maximum of 60 barrier positions total with its internal barrier and up to seven (7) VSmart modules.

The Integra console can be operated with the integrated 15″ (38.1 cm) touch screen display, a local PC connection, or a remote PC connection. To operate the console with a PC, an Internet browser capable of rendering Flash 7.0 or higher is required.

NOTE: Since Adobe Systems stopped distribution and support of Flash in 2020, you must download a plug-in from Adobe to configure your Integra console remotely. See the appendix "OPW-FMS Integra and End of Life for Adobe Flash" on page 221 for instructions on how to download and install this plug-in.

Operation of the console through a local PC connection requires a crossover Ethernet connection cable. To connect remotely through a local or corporate LAN/WAN, the system's IP address can be entered into your Internet browser's address bar. For remote connections that use other methods (or for a blank door unit), including VNC Viewer software, consult an IT professional for assistance.

The ATG system supports up to 10 simultaneous browser sessions in addition to one session through the integrated LCD touch screen.

The remaining instructions in this section will show the necessary steps to install the unit and the possible wiring procedures.

Topics in this section include:

2.1 Blank Door Unit

Available for SiteSentinel® Integra 500® only

A Blank Door option with no touch screen is available for the SiteSentinel® Integra 500® to operate the console through a remote connection only.

The illuminated red push button on the front panel is used for alarm notification and acknowledgment.

2.2 Integra Console Specifications

Integra Console Specifications	
Dimensions:	14.5 inch W x 12 inch H x 4 inch D (37 cm x 30 cm x 10 cm)
Power Requirements:	96-264 VAC, 50/60 Hz
Operating Temperature:	32° F to 122° F (0° C to 50° C)
Module Capacity:	One (1) Internal I.S. Barrier (standard on the Integra 100) with four (4) barrier positions
Optional Module Capacity (only for Integra 500):	Up to eight (8) optional VSmart Modules* Up to four (4) optional Output Modules (OM4) Up to four (4) optional Line Interface Modules (LIM)
Display:	Color LCD touch-screen display GUI
Printer:	Optional External USB or Network Office Printer
Modem:	One (1) Optional Internal Modem
Standard Alarms:	Buzzer; Light and Acknowledgment on the Blank Door unit
Optional Alarms:	External Tank Alert (internal relay) External OM4 module (only for Integra 500)
Alarm Notification:	External LIM (only for Integra 500) Email, Fax (with modem SMS (with GSM modem)
Communication Ports:	Two (2) RS-232 Comm. ports One (1) RS-485 Comm. port (only for Integra 500) One (1) Ethernet port Four (4) USB ports Optional wireless communication between console and VSmart (only for Integra 500)
Network Connectivity:	DHCP/static addressable RJ-45 Ethernet ports, supports corporate and local LANs
Typical Mounting Location:	Indoor, Non-Hazardous Area

NOTE: *One (1) VSmart module can contain up to two (2) I.S. Barriers for a total of eight (8) barrier positions.

2.2.1 Leak Test Certification SiteSentinel® Integra 500®

EPA Static Leak and Continuous Test Certified (ATGS & CITLDS Methods):
0.2 gph (0.76 L/hr) Statistical Leak Test 397,000 gallons (1,502,809 liters)/ month throughput for single-tank, 2-tank or 3-tank manifold installations; 30,000-gallon (113,562 liters) combined maximum capacity
0.2 gph (0.76 L/hr) Static Leak Test
0.1 gph (0.38 L/hr) Static Leak Test
3.0 gph (11.4 L/hr) Catastrophic Line Leak Test
0.2 gph (0.76 L/hr) Precision Line Leak Test

2.2.2 Leak Test Certification SiteSentinel® Integra 100®

EPA Static Leak and Continuous Test Certified (ATGS & CITLDS Methods):
0.2 gph (0.76 L/hr) Statistical Leak Test 397,000 gallons (1,502,809 liters)/month throughput for single-tank, 2-tank or 3-tank manifold installations; 30,000-gallon
0.2 gph (0.76 L/hr) Static Leak Test
0.1 gph (0.38 L/hr) Static Leak Test

2.3 Installation

Install the console on a wall in a secure indoor location. The display should be at a comfortable eye level to be seen easily.

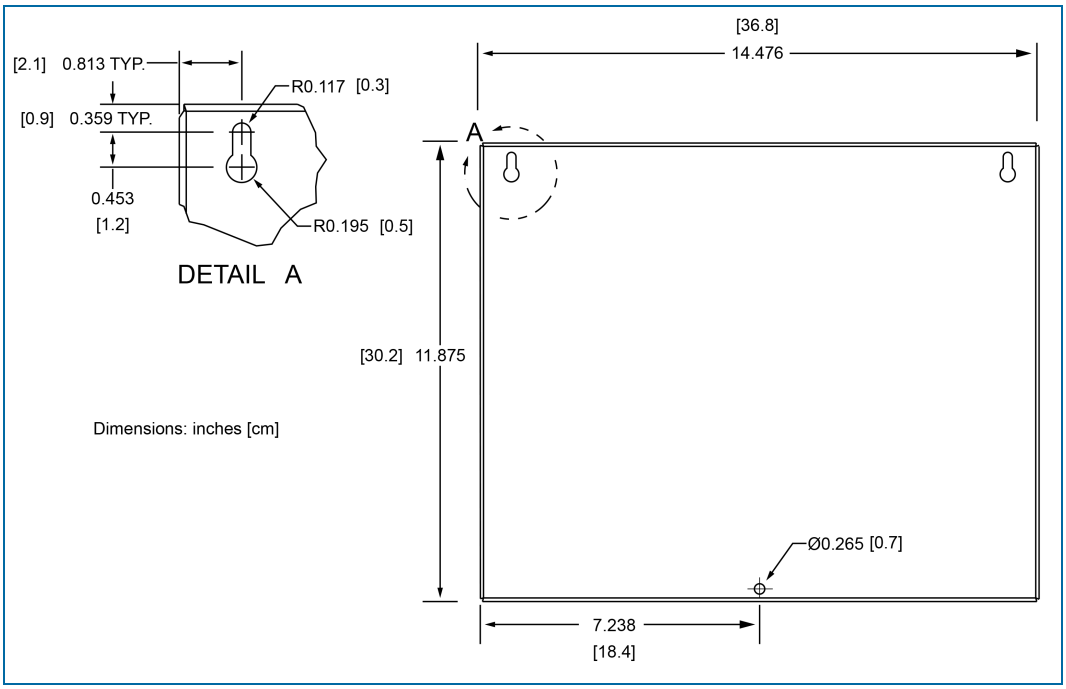


Figure 2-1 Rear Panel Install Hole Locations and Dimensions

Hold the unit against the wall where it will be mounted. There are three (3) mounting screw holes in the unit (see the illustration above). Use a pen to mark the screw hole locations on the wall.

NOTE: Make sure to keep sufficient space below the unit to run power and communication conduits to the console.

Drill the holes where the locations were marked and tap or insert screw anchors in the holes.

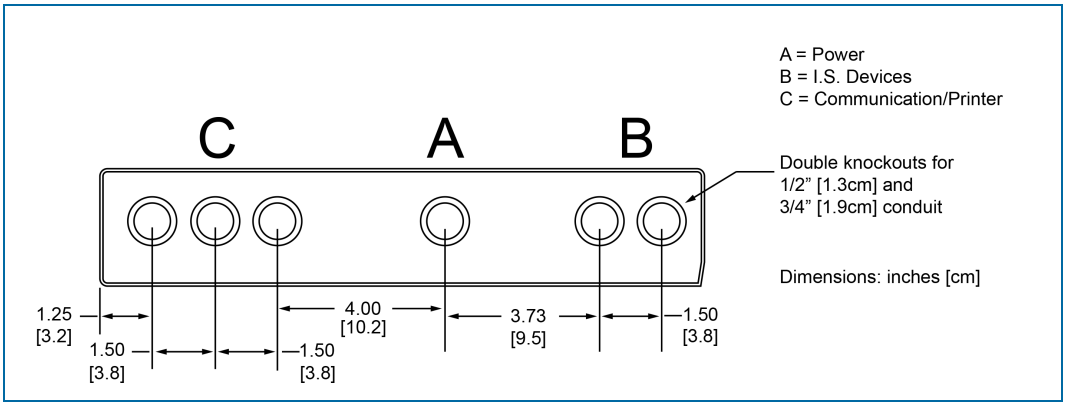


Figure 2-2 Console Conduit Knockout Locations

Remove the applicable knockouts that will be used to install conduit from the bottom of the unit (see above). The knockouts can be removed by inserting a small screwdriver into the groove and hit it firmly with a hammer.

TIP: As an alternative, for a safe and clean removal of the knockouts you can use a Greenlee hole punch, or equivalent hardware if available.

IMPORTANT: All unused knockouts must be sealed.

Slide the unit onto the top screws, install the bottom "locking screw" and then make sure that all three screws are tight.

To watch the short instruction video Integra Console Installation Demonstration click the link or scan the QR code below.

URL:
https://www.youtube.com/watch?v=cdaoS5BYQg0&list=PLZ3d7sJYbYsfYBDIAF5D8zCSm3GPROiYr&index=16

2.4 Console Wiring

For console power wiring, please refer to the appropriate field wiring diagram. See"Field Wiring Diagram for Integra 100" on page 32 and "Field Wiring Diagram for Integra 500" on page 33 for the type of console to be installed.

WARNING: To prevent the possibility of electrical shock, obey all electrical codes and lockout-tagout procedures before you begin console wiring.

Console Power, Ground and Communication Wiring Requirements	
Line, Neutral and Ground	14 AWG (2.5 mm^2) minimum stranded copper
I.S. Ground	12 AWG (4 mm^2) minimum stranded copper
Petro-Net (Integra 500 only) RS485 Communication	2-Conductor, 18 AWG (0.75 mm^2) TFFN Twisted (OPW part number 20-1029)

The console must share the same phase with all other OPW ATG components. Use knockouts “A” in "Console Conduit Knockout Locations" on the previous page to route three (3) (14 AWG minimum) stranded copper wires for Line, Neutral and Ground. A fourth wire (12 AWG minimum) is needed if the console is equipped with an internal I.S. barrier, which is always needed with **Integra 100** consoles.

2.4.1 Petro-Net™ Wiring (only for Integra 500)

Wired RS-485 **Petro-Net™** connections can be used for communications between the **VSmart** module, **OM4** and the console. For this type of connection, a single run of twisted-pair wiring (10 twists per foot) is required. Make sure polarity is correct for Petro-Net connections.

The twisted-pair wiring must be connected to positions 7 and 8 of the RS-485 terminal block (J21) at each module (see "Console Board Inputs" on page 34). Petro-Net™ connections can be wired in parallel (modules can be connected to each other in different combinations as long as one module in the chain is connected to the console).

NOTE: Petro-Net™ connections must be made with twisted-pair wiring. The use of conduit is recommended to protect the Petro-Net™ wires This can be required by the NEC where applicable. If conduit is not used, bushings must be installed in the cabinet knockouts to protect wiring and to seal the enclosure.

REMINDER: Twisted-pair wiring is available from OPW as Part No. 12-1029.

2.4.2 Wireless Connections (only for Integra 500)

Wireless connections can be used for communications between the **VSmart** module and the console. A wireless modem is connected to the **VSmart** module, and a second modem is wired to the console's **RS-485** port. The **VSmart** modems must have a clear line-of-sight. See "Wireless Petro-Net Installation with VSmart Indoors" on page 30. Refer to the *M00-20-7074 Wireless Petro-Net Modem Installation Manual*. Scan the QR link below.

IMPORTANT: Wireless connections are not always alternative options at all installation sites because of interference or line-of-site blockage. Although test kits are available, A SITE SURVEY IS STRONGLY RECOMMENDED BEFORE YOU COMMIT TO WIRELESS INSTALLATIONS.

Scan the QR code below to download the *M00-2027 SiteSentinel Integra 100/Integra 500 Site Survey*.

2.4.3 Ethernet Connections to VSmart (only for Integra 500)

With the optional VSmart LAN function, Ethernet connections are the only option to establish communications between the console and **VSmart**. For this type of connection an Ethernet cable is run between devices at a maximum length of 300 feet (92 m). This distance can be extended through the use of hubs and routers.

IMPORTANT: The use of conduit to protect the cable is recommended if more than 6 feet (1.85 m) of cable is necessary.

NOTE: The VSmart module must be ordered with this option.

To make connection through a network, connect the console to one node on the network and the VSmart Module to another node. See "Petro-Net Over Ethernet" on page 31.

NOTE: It will be necessary to get the aid of the site's IT personnel with this type of installation.

2.4.4 RS-232 Communications Conduits

Conduit must be installed to hold the RS-232 cable if the connected terminal or PC is more than 6 feet (1.8 m) from the console.

IMPORTANT: The maximum length for serial communication cable is 50 feet (15.24 m).

2.5 Wireless Petro-Net Installation with VSmart Indoors

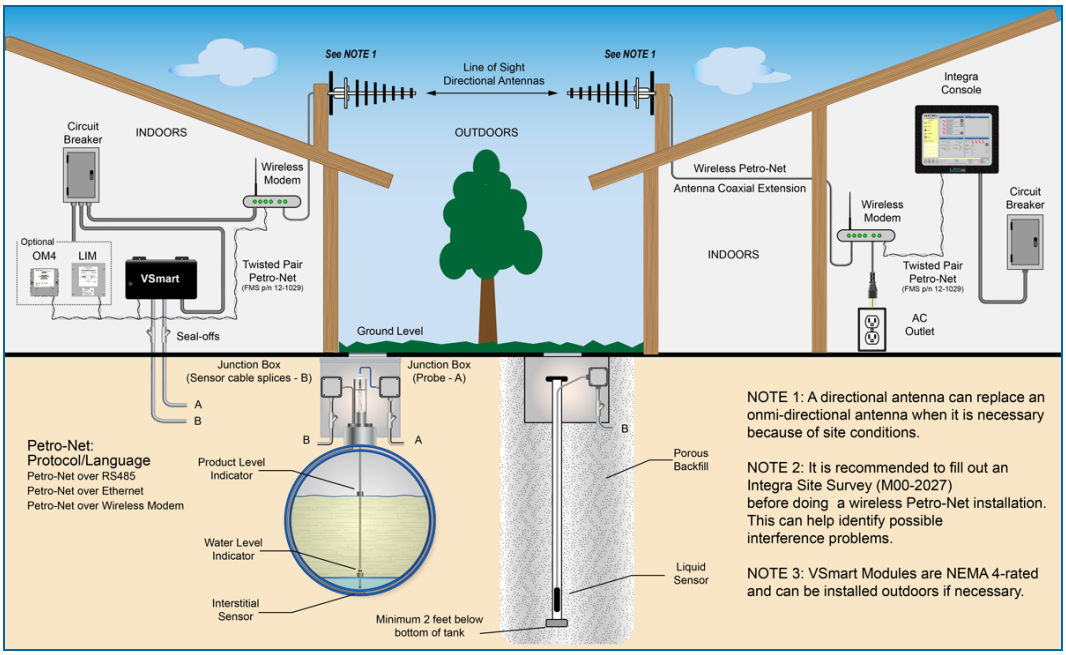


Figure 2-1 Wireless Petro-Net Installation with VSmart Indoors

2.6 Petro-Net Over Ethernet

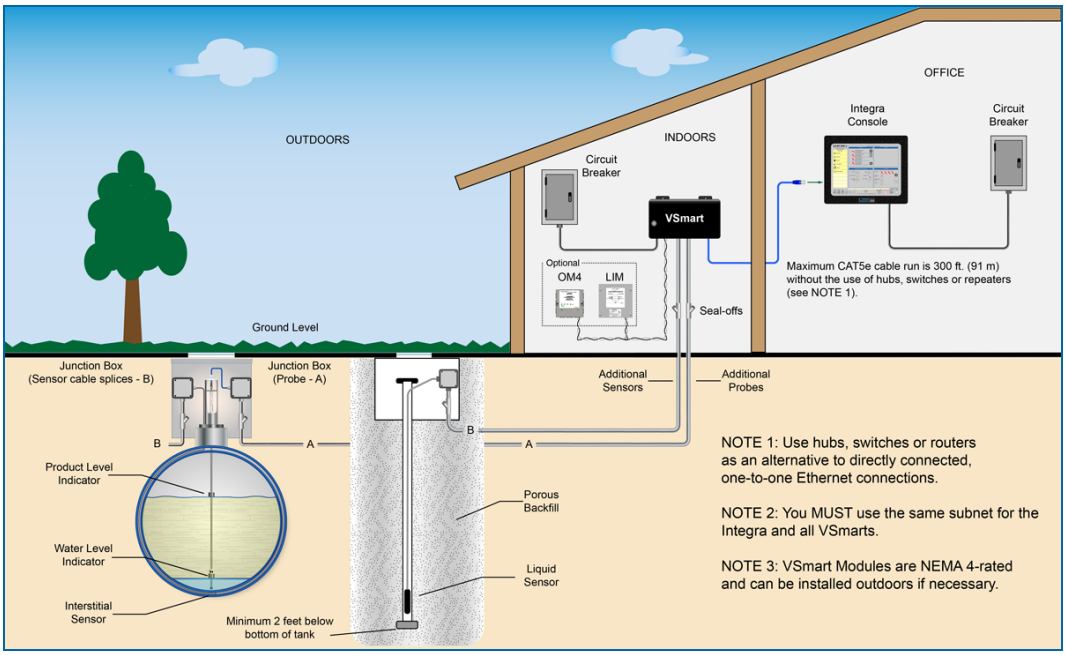
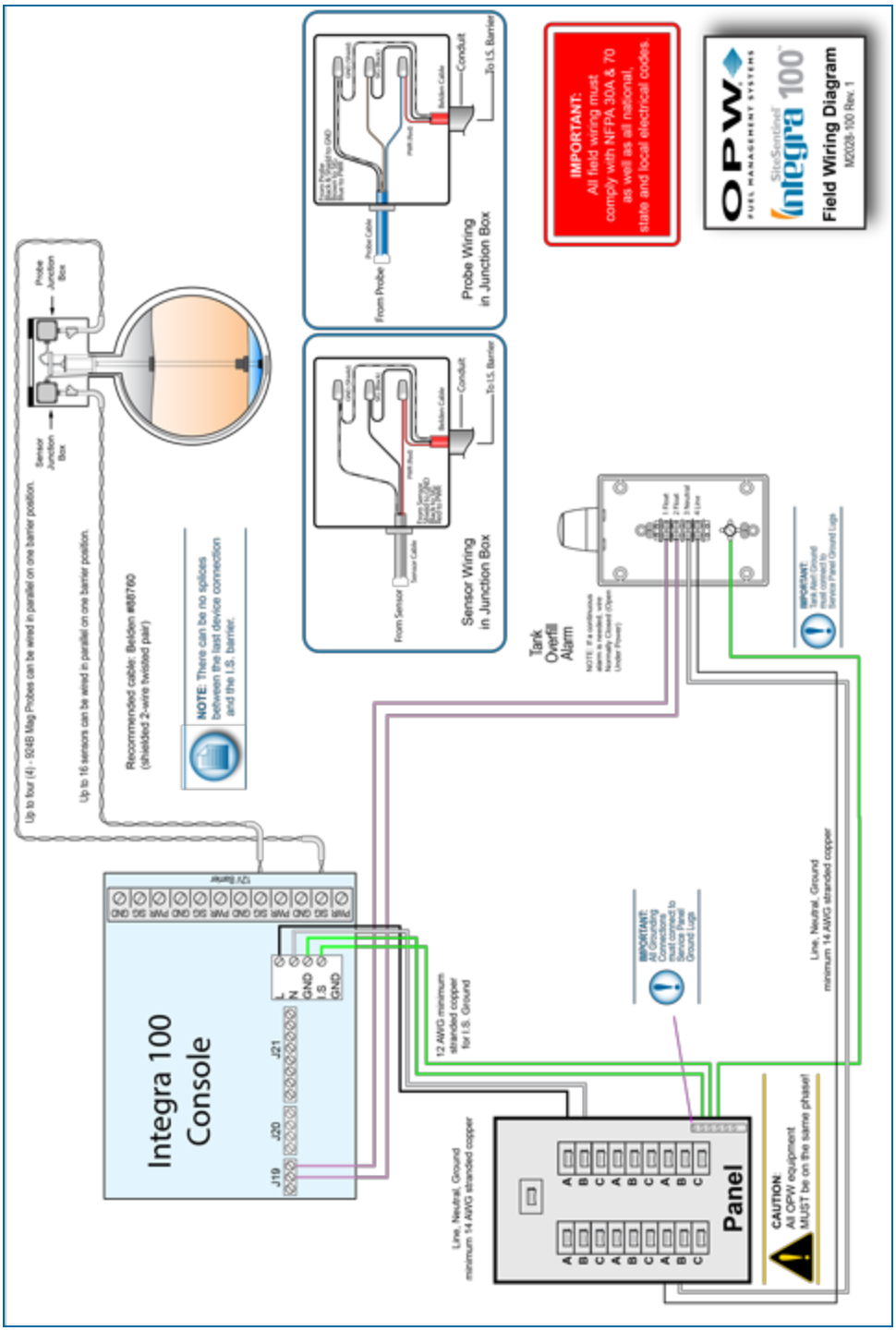
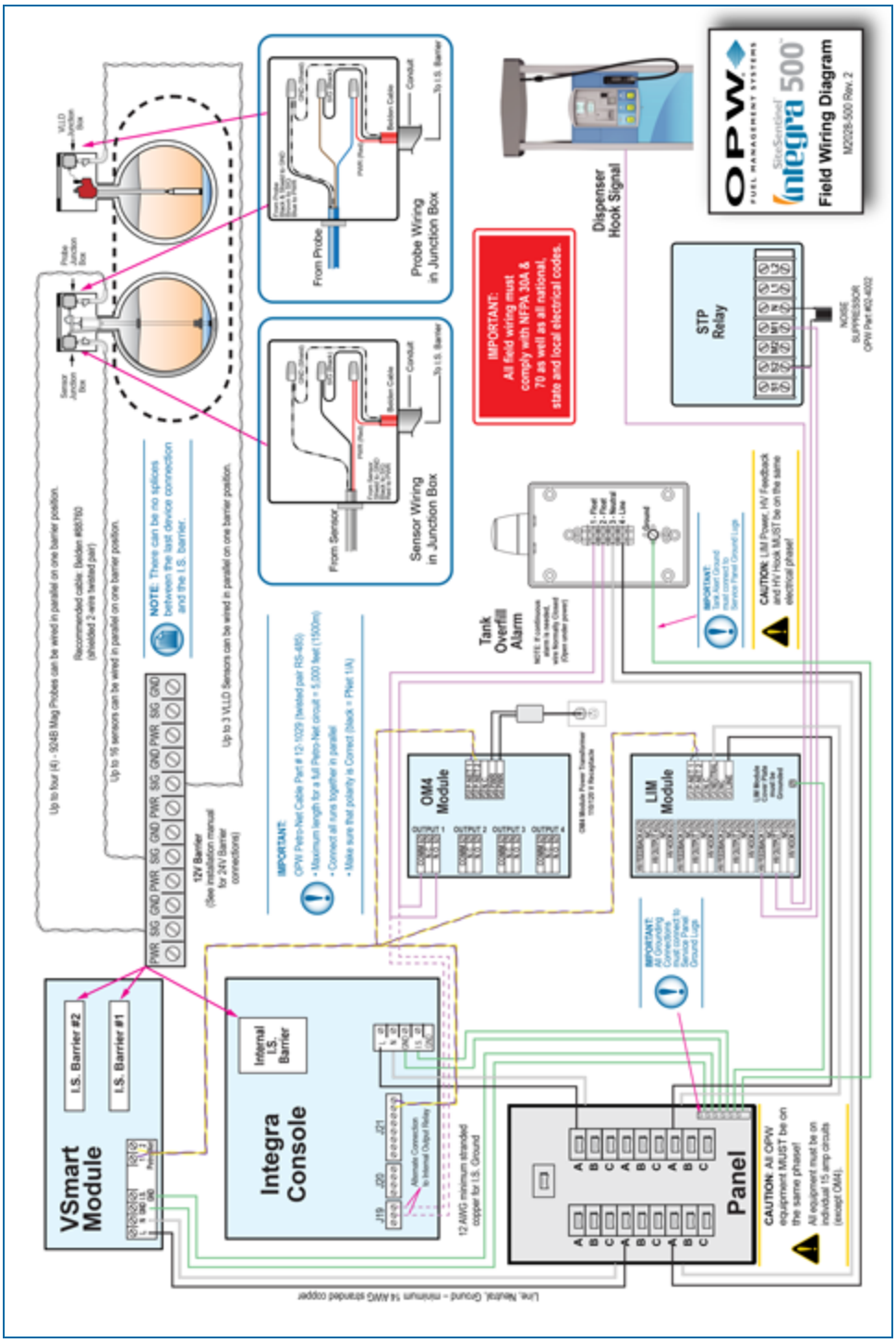


Figure 2-1 Petro-Net Over Ethernet

2.7 Field Wiring Diagram for Integra 100

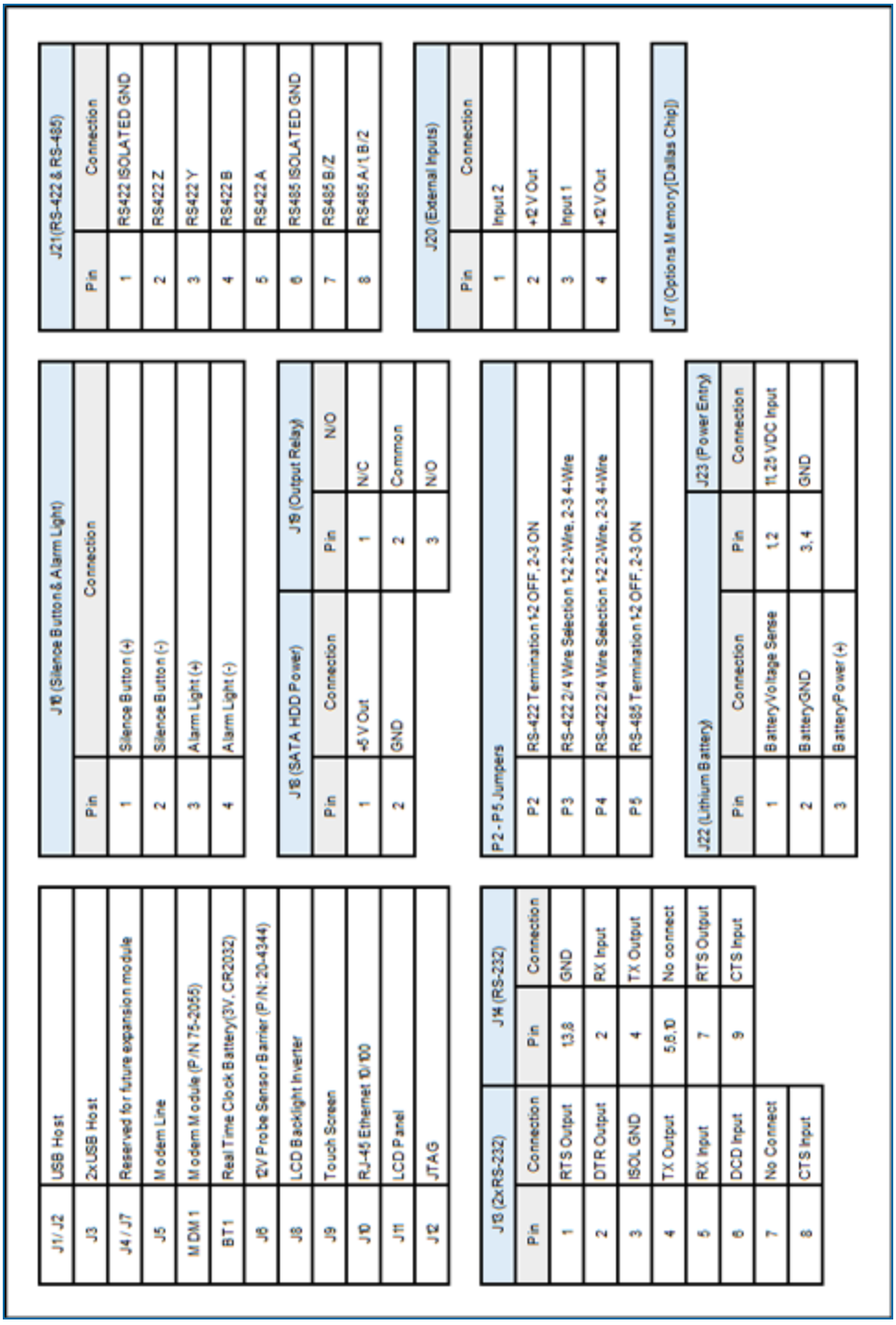


2.8 Field Wiring Diagram for Integra 500



2.9 Console Board Inputs

Use these jumper settings to set board inputs as necessary.



J1/ J2	USB Host
J3	2x USB Host
J4 / J7	Reserved for future expansion module
J5	Modem Line
MDM 1	Modem Module (P/N 75-2055)
BT1	Real Time Clock Battery(3V, CR2032)
J6	12V Probe Sensor Barrier (P/N: 20-4344)
J8	LCD Backlight Inverter
J9	Touch Screen
J10	RJ-45 Ethernet 10/100
J11	LCD Panel
J12	JTAG

J10 (Silence Button & Alarm Light)	
Pin	Connection
1	Silence Button (+)
2	Silence Button (-)
3	Alarm Light (+)
4	Alarm Light (-)

J8 (SATA HDD Power)	
Pin	Connection
1	+5 V Out
2	GND

J19 (Output Relay)	
Pin	N/O
1	N/C
2	Common
3	N/O

P2 - P5 Jumpers	
P2	RS-422 Termination 1-2 OFF, 2-3 ON
P3	RS-422 2/4 Wire Selection 1-2 2-Wire, 2-3 4-Wire
P4	RS-422 2/4 Wire Selection 1-2 2-Wire, 2-3 4-Wire
P5	RS-485 Termination 1-2 OFF, 2-3 ON

J22 (Lithium Battery)	
Pin	Connection
1	Battery Voltage Sense
2	Battery GND
3	Battery Power (+)

J23 (Power Entry)	
Pin	Connection
1,2	11.25 VDC Input
3, 4	GND

J13 (2x RS-232)		J14 (RS-232)	
Pin	Connection	Pin	Connection
1	RTS Output	1,3,8	GND
2	DTR Output	2	RX Input
3	ISOL GND	4	TX Output
4	TX Output	5,6,10	No connect
5	RX Input	7	RTS Output
6	DCD Input	9	CTS Input
7	No Connect		
8	CTS Input		

J21 (RS-422 & RS-485)	
Pin	Connection
1	RS422 ISOLATED GND
2	RS422 Z
3	RS422 Y
4	RS422 B
5	RS422 A
6	RS485 ISOLATED GND
7	RS485 B/Z
8	RS485 A/1 B/2

J20 (External Inputs)	
Pin	Connection
1	Input 2
2	+12 V Out
3	Input 1
4	+12 V Out

J17 (Options Memory [Dallas Chip])

2.10 Main Board DIP-Switch Configuration

The photo below shows the location of the main board DIP-Switch block. The switches should all be placed in the ON position as shown.

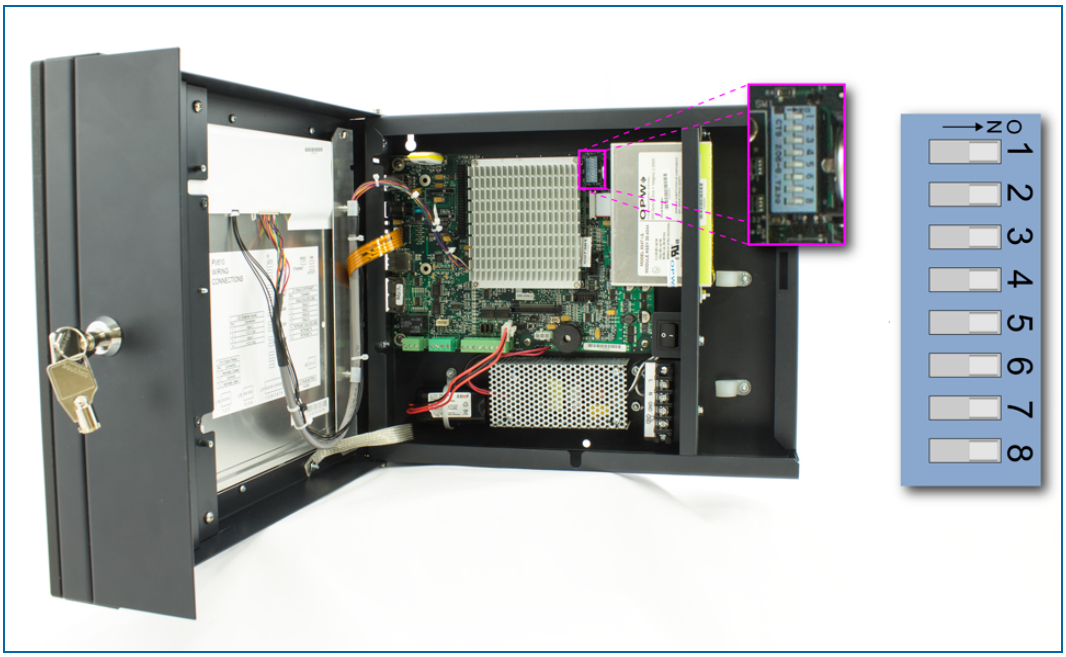


Figure 2-1 Main Board DIP-Switch Location and Configuration

Section 3 VSmart Module (Optional for Integra 500)

OPW-FMS Part Number 20-8319

VSmart Module (OPW-FMS Part Number 20-8319)

The VSmart Module is used to connect monitored devices (e.g., probes, sensors, leak detection devices) to the tank-gauge system through Intrinsically Safe (I.S.) barriers. The VSmart Module can contain one (1) or two (2) 4-channel I.S. barriers.

There are two (2) types of I.S. barriers that can be used with a VSmart Module, a 12 -volt model (for 924/924B Probes, DMP 1-Wire probes and Smart Sensors) and a 24-volt model (for Model 7100V AST Flex Probes and EECO Probes).

NOTE: Conduit is recommended for Petro-Net connections between VSmart Modules and consoles, but it is not required.

IMPORTANT: Refer to the Console Wiring section of the M2020 Integra Installation Guide for important information on Petro-Net wiring, wireless connections and Ethernet connections between the VSmart module, Integra 500 console and applicable peripheral devices.

3.1 VSmart Specifications

VSmart Specifications	
Dimensions:	Width: 28.7 cm (11.3 in) Height: 14.2 cm (5.6 in) Depth: 14.7 cm (5.8 in)
Standard Voltage Supply:	105 to 265 VAC, 50-60 Hz
Power Consumption:	60 watts maximum
Temperature Range:	-40°C to 70°C (-40°F to 158°F)

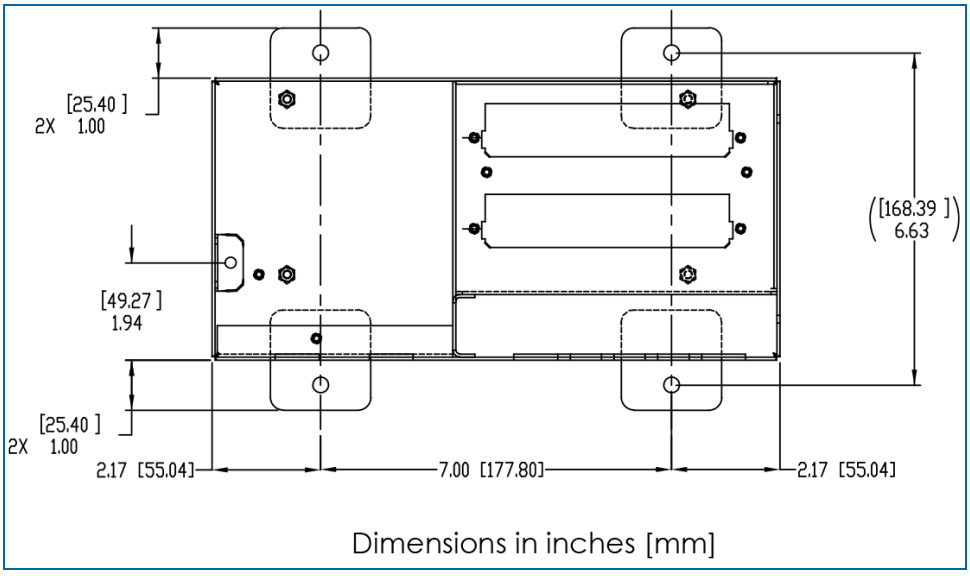
VSmart Specifications	
Device Capacity:	Up to two (2) I.S. Barriers Up to eight (8) Barrier Positions
Maximum Total-Run I.S. Wiring Length*:	304.8 m (1,000 ft) Use Belden 88770
Petro-Net™ Communication Wiring Requirement:	18-AWG/ 0.75 mm^2 twisted pair, oil-and-gas resistant (TFFN, THHN, THWN)
Maximum Petro-Net™ Extension using RS485:	1524 m (5,000 ft)**
Barrier Part Numbers:	P/N: 20-4344 12V Barrier P/N: 20-4345 24V Barrier

NOTE: *Maximum I.S. Wiring Length is the maximum length of cable that can be used to connect all probes or sensors on one channel. The length includes the run of cable from an I.S. Barrier to each probe or sensor board in the string.

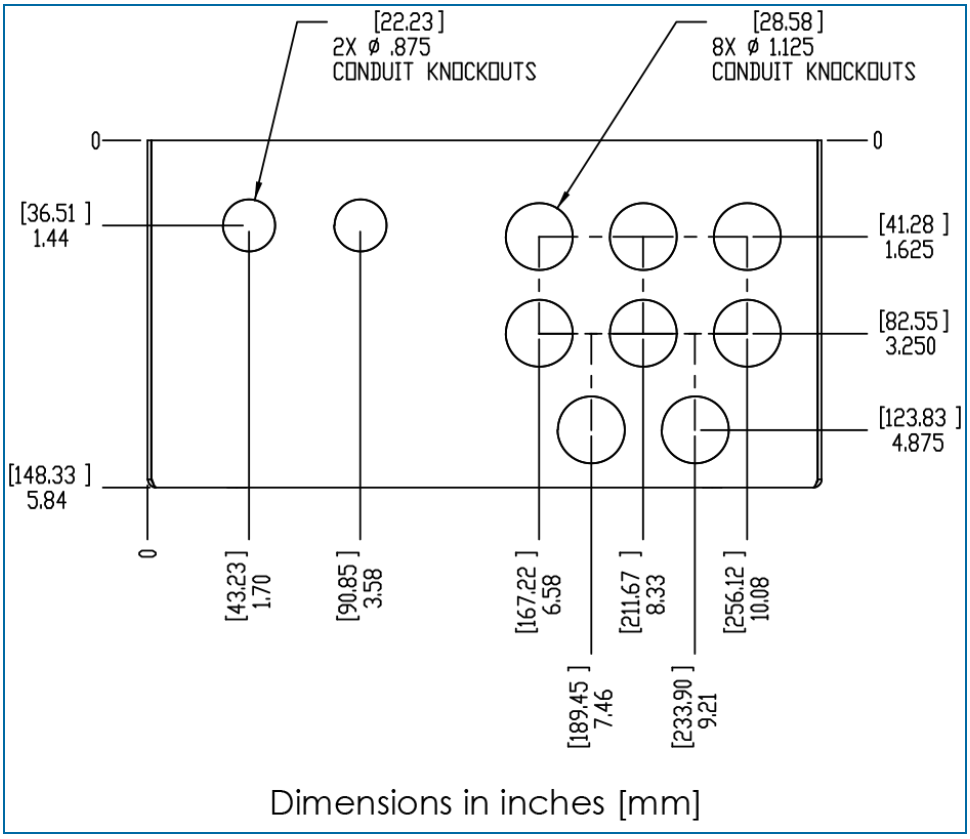
**Maximum Petro-Net extension using RS-485 is the maximum length of Petro-Net cable that can be used to connect all Petro-Net devices.

3.2 VSmart Module Installation

The VSmart module must be installed on a wall. Use the supplied tabs. Module installation tab and conduit knockout dimensions and locations are shown in the drawings below.



Installation Tab Locations and Dimensions



Conduit Knockout Locations and Dimensions

3.2.1 Probe & Sensor Conduits

IMPORTANT: You must obey all local, state and federal regulations when this product is installed. Rigid steel conduit could be required. It is recommended to use rigid steel conduit when possible.

Each VSmart Module is equipped with eight (8) ¾-inch (19 mm) knockouts to accommodate conduit for probe cables and sensor wiring. Two (2) additional ½-inch (13 mm) knockouts are provided for power and communication wiring conduits.

For probe and sensor field connections, always use a weatherproof junction box.

3.2.2 Circuit Breaker Conduits

Install ½-inch (13 mm) conduit from the power knockout in the console to the circuit breaker box. Install a ½-inch (13 mm) conduit from the power knockout in each VSmart Module to the circuit-breaker box.

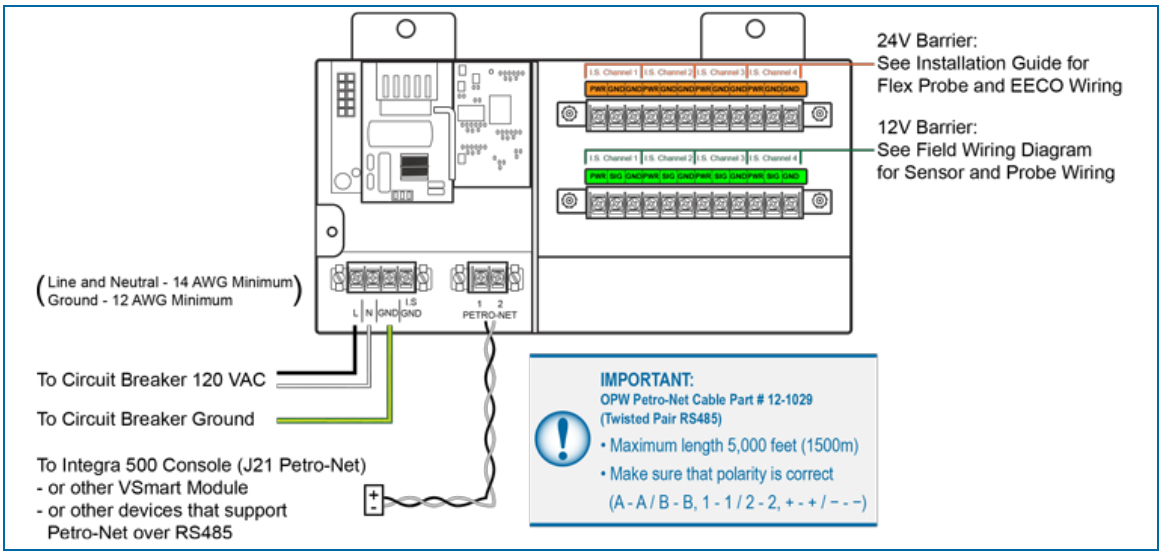
3.3 External VSmart Module Wiring

IMPORTANT: VSmart modules must have dedicated AC power and two (2) ground connections for the module and barrier.

- Pull two (2) AC power wires and one (1) ground wire (14-AWG minimum) from the circuit breaker to each module. More than one module can use the same circuit as long as they are not more than the circuit breaker rating.
- Pull one (1) ground (12-AWG minimum) from the circuit breaker for the I.S. barrier ground.

NOTE: See the Integra 500 Field Wiring Diagram for more VSmart Module wiring information.

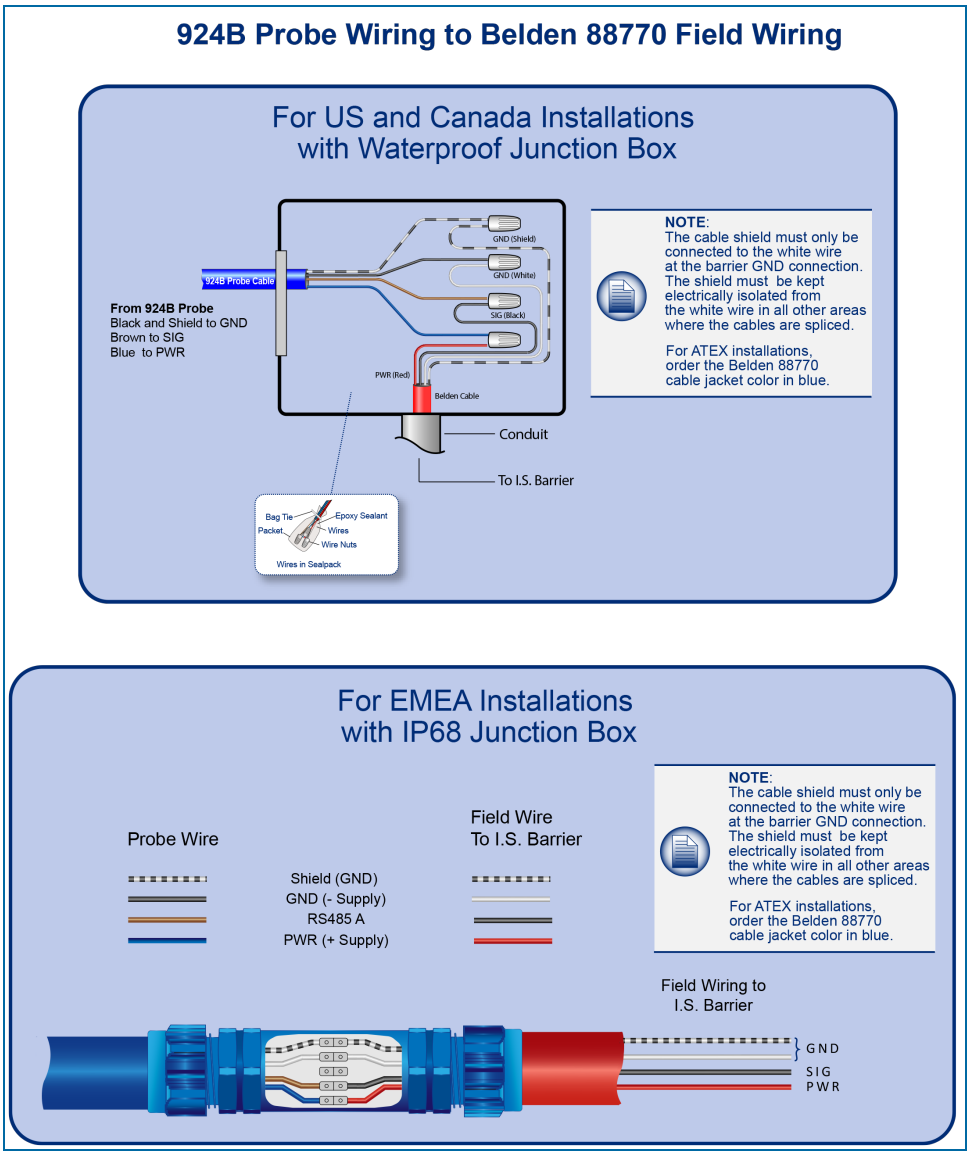
- All OPW equipment must be on the same phase of AC power.

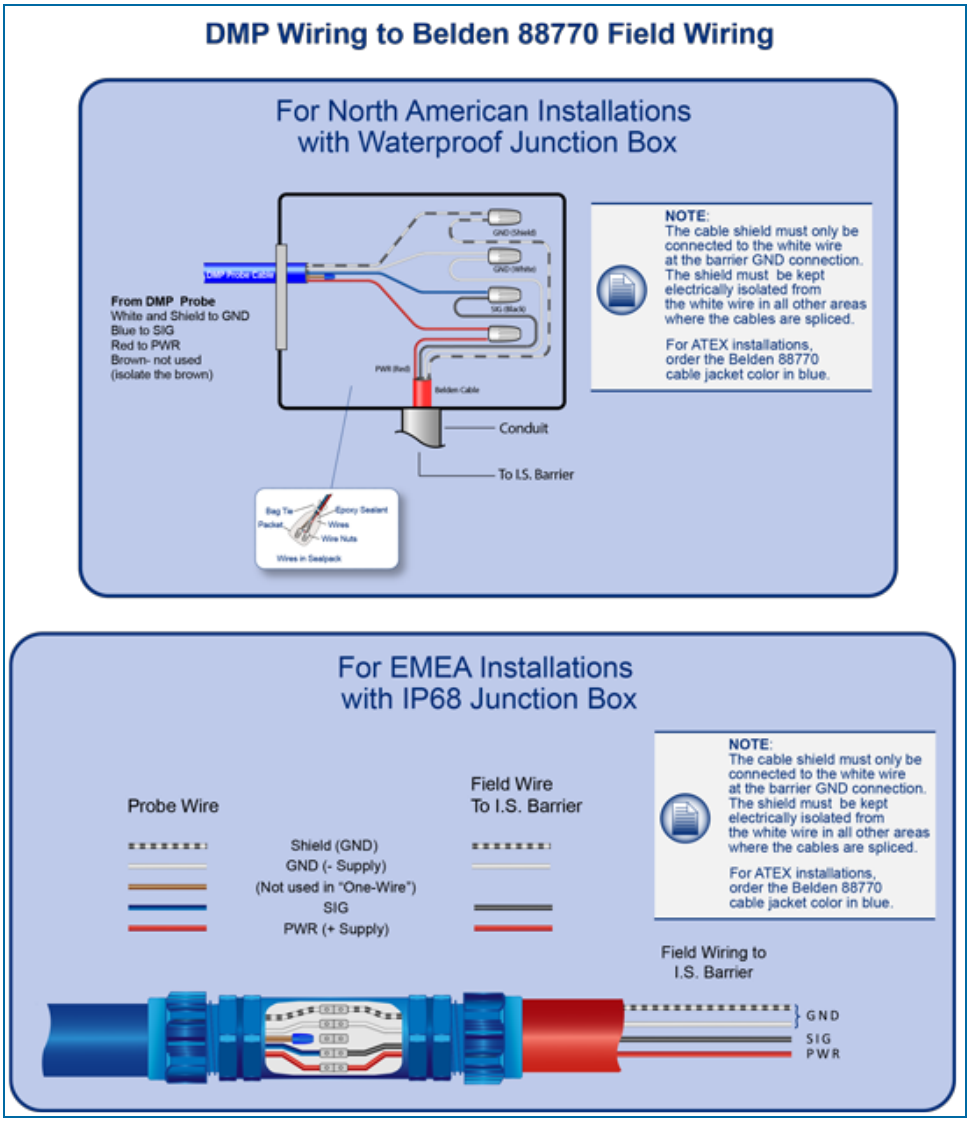


External VSmart Wiring

3.3.1 Device Wiring to Barriers

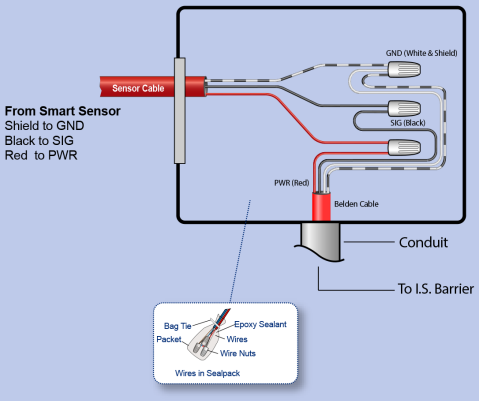
The illustrations below show how 924B probes, DMP probes and Smart Sensors should be connected to Belden 88770 field wiring in junction boxes and how the field wiring is connected to a VSmart 12V Barrier.




DMP Wiring to Belden 88770 Field Wiring
For North American Installations
with Waterproof Junction Box
From DMP Probe
White and Shield to GND
Blue to SIG
Red to PWR
Brown- not used
(isolate the brown)
GND (Shield)
GND (White)
SIG (Black)
PWR (Red)
Belden Cable
Conduit
To I.S. Barrier
Bag Tie
Packet
Epoxy Sealant
Wires
Wire Nuts
Wires in Sealpack
NOTE:
The cable shield must only be connected to the white wire at the barrier GND connection. The shield must be kept electrically isolated from the white wire in all other areas where the cables are spliced.
For ATEX installations, order the Belden 88770 cable jacket color in blue.
For EMEA Installations
with IP68 Junction Box
Probe Wire
Field Wire
To I.S. Barrier
Shield (GND)
GND (- Supply)
(Not used in "One-Wire")
SIG
PWR (+ Supply)
NOTE:
The cable shield must only be connected to the white wire at the barrier GND connection. The shield must be kept electrically isolated from the white wire in all other areas where the cables are spliced.
For ATEX installations, order the Belden 88770 cable jacket color in blue.
Field Wiring to
I.S. Barrier
GND
SIG
PWR

Smart Sensor Wiring to Belden 88770 Field Wiring

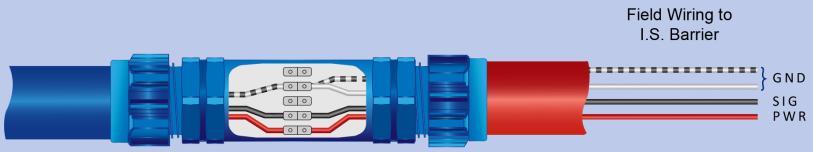
For US and Canada Installations with Waterproof Junction Box

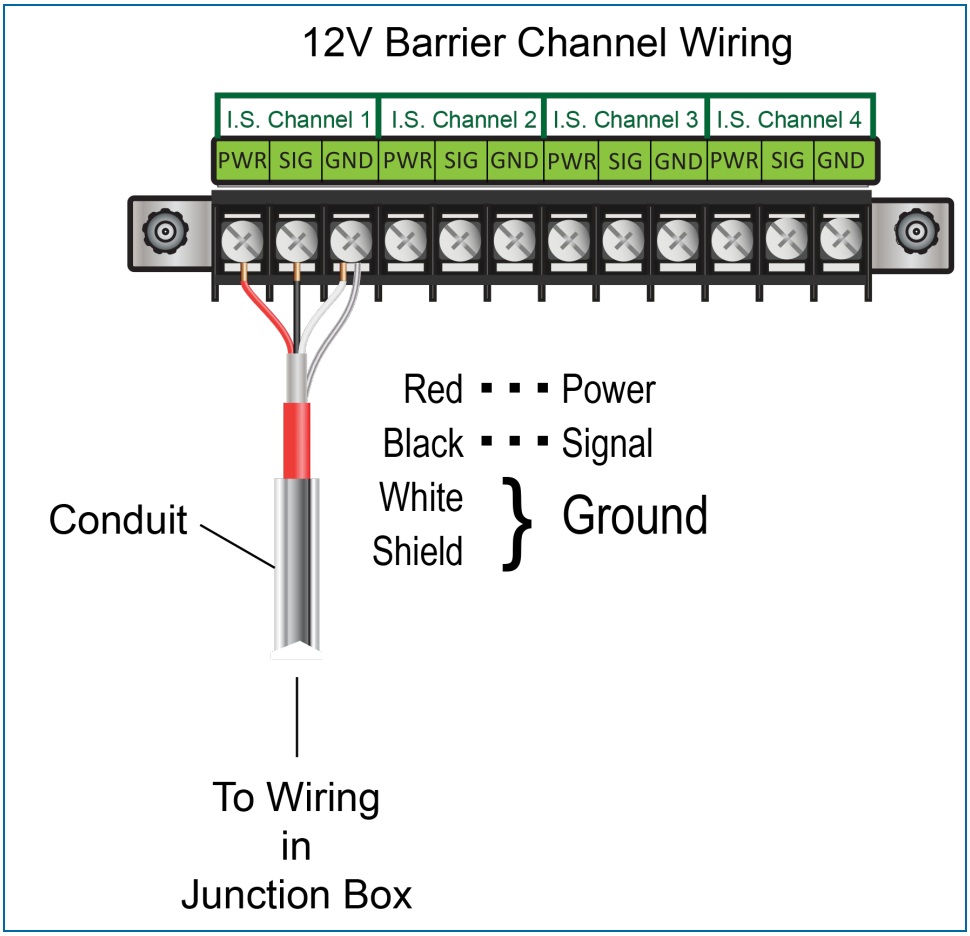


NOTE:
For ATEX installations, order the Belden 88770 cable jacket color in blue.

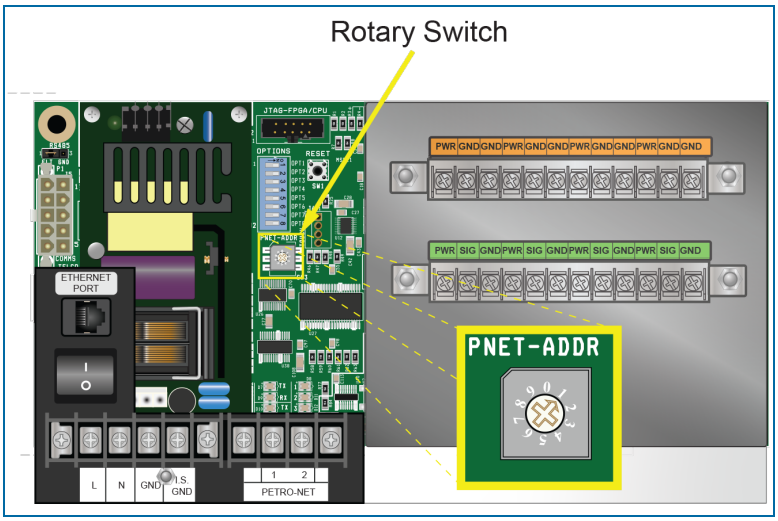
For EMEA Installations with IP68 Junction Box

NOTE:
For ATEX installations, order the Belden 88770 cable jacket color in blue.




12V Barrier Channel Wiring
I.S. Channel 1
I.S. Channel 2
I.S. Channel 3
I.S. Channel 4
PWR SIG GND PWR SIG GND PWR SIG GND PWR SIG GND
Red ▪ ▪ ▪ Power
Black ▪ ▪ ▪ Signal
White
Shield
} Ground
Conduit
To Wiring
in
Junction Box

3.3.2 Petro-Net Address



VSmart modules must be given an identification number to correctly communicate with the system through the Petro-Net protocol. This number must be different than all other VSmart modules in the system.

A small rotary switch is located on the PC board under the DIP-Switch block. The switch has 10 positions, from “0” to “9.” A small arrow on the switch points to the applicable position. The default setting is “1.”

NOTE: Although the switch has 10 settings, only settings 1-8 can be used. DO NOT set the switch to “0” or “9." The module will NOT be sensed by the system.

To set the Petro-Net address:

1. Turn the module power OFF.
2. Use a ¼-inch (6 mm) blade screwdriver to carefully turn the rotary switch to the applicable location.
3. Turn the module power to ON.

NOTICE: Do not change the module number while the module power is ON.

NOTE: The eight-position DIP-Switch must stay in the closed position for normal operation.

3.4 VSmart Capacities

Refer to the table that follows for capacities of the VSmart Module in connection with different peripheral devices.

I.S. Barrier Capacity (up to two [2] I.S. Barriers per VSmart Module, four [4] positions per Barrier)		
	Maximum each Channel	**Maximum each I.S. Barrier**
Sensors:	12	64
924B and DMP 1-Wire Probes:	4	16

Where there can be more than one device on a barrier channel, devices can be connected in parallel. This is referred to as a "multi-drop" connection. Each type of sensor or probe that is connected to a module is sensed through IntelliSense™ Technology.

For more information on the VSmart's Multi-Drop functions, use the QR Code or URL link below to see the video "Multidrop Probe & Sensor Wiring Instructions."

URL: https://www.youtube.com/watch?v=84lf8Hg41aY

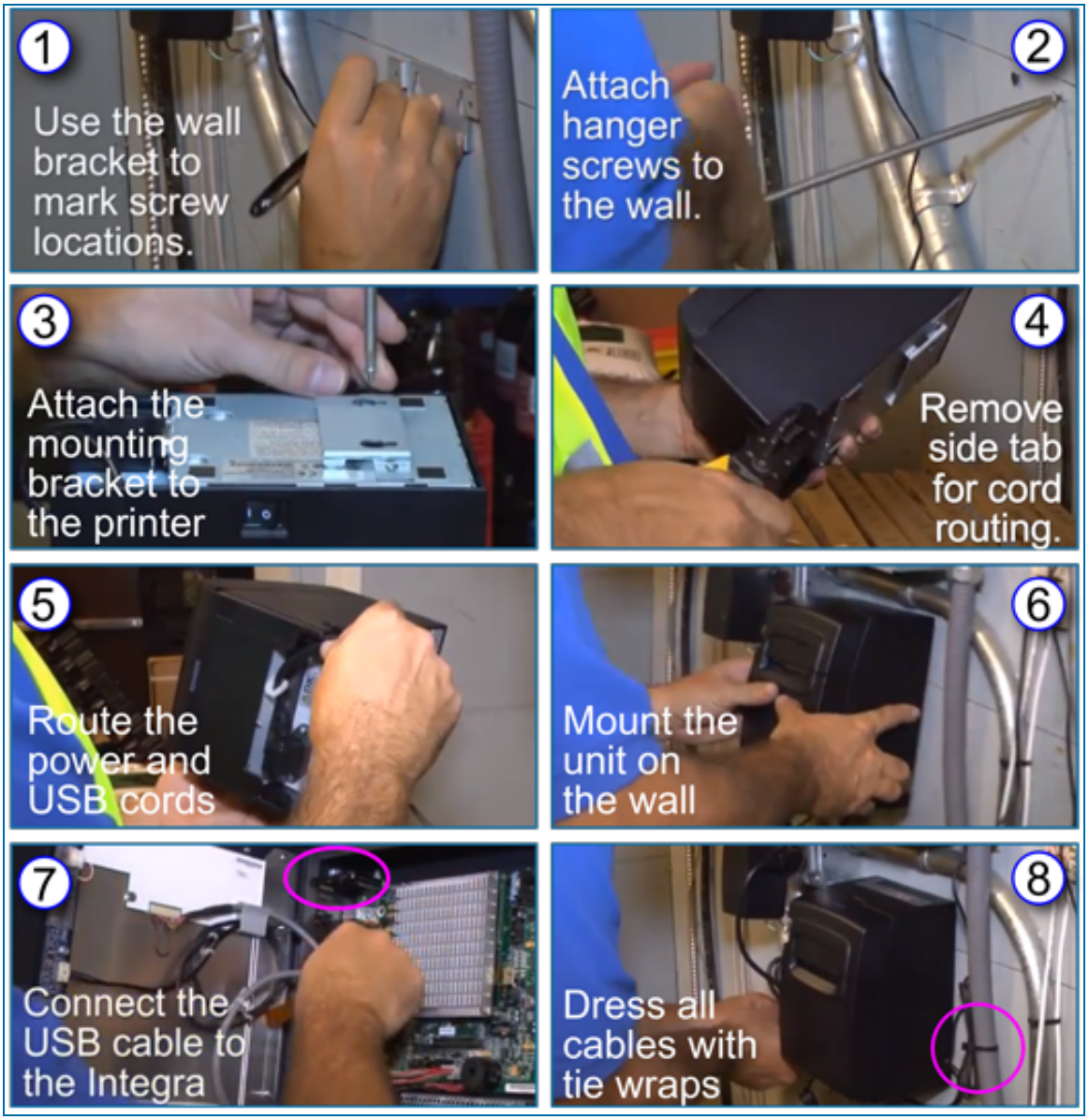
4.1 External Printer Option

FMS Part Number 75-0130

An external thermal printer option is available for the SiteSentinel Integra console. The printer will be used to print reports available with the tank gauge system.

The printer can be placed on a table or desk. See the manufacturer's manual that comes with the printer to see how to attach the included rubber feet.

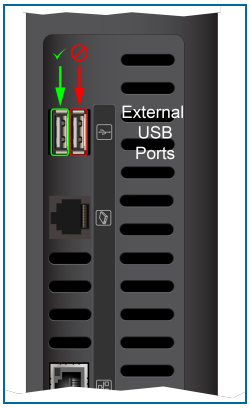
Alternatively, the printer can be installed on a wall with the included Wall-mounting Bracket Kit. To install the printer on a wall:



1. Use the Wall Bracket to mark the location for two (2) hanger screws (not included in the kit).
2. Attach the hanger screws to the wall where you made the marks. Do not put the screws all the way in. You must keep enough space for the bracket to hang onto the screws.
3. Attach the mounting bracket to the printer with the two (2) screws included in the kit.
4. There is a tab on the side of the printer. Remove this tab with a pair of pliers.
5. With the tab removed, route the power and USB cables through the side of the unit.
6. Align the bracket holes with the hager screws. Move the unit down so that the narrow part of the screw holes fit over the hanger screw heads.
7. Connect the USB cable from the printer to the USB port on the main board located on the inside of the Integra console. See the Important note below.
8. Dress the USB and power cables cables with tie wraps to keep the area neat.

You can now connect the power cable to an electrical receptacle.

IMPORTANT: All available INTERNAL USB ports can be used for the printer; however, you can only connect the printer to the EXTERNAL USB port nearest to the wall. See the illustration below.



To see the Printer Installation part of the **Integra Console Installation Demonstration** video, scan the QR code or use the URL link:

URL: https://youtu.be/cdaoS5BYQg0?t=155

Section 5 Line Interface Module LIM (Optional)

5.1 Introduction

The LIM is an external device that controls submersible turbine pumps (STP) and monitors the input/output status of fuel dispenser hook signals and STP relays.

You can install a maximum of four (4) LIM modules in a (missing or bad snippet) system. Each LIM module can monitor up to four (4) STP motors for a total of 16 STP motors. For manifold tank installations, when one (1) Pressure Line Leak Detector (PLLD) sensor is installed, the system must use one (1) LIM position for each STP pump.

Usually, the dispenser sends a “hook signal” (110 VAC / 220 VAC) to the submersible pump controller. The LIM intercepts this hook signal and communicates with the console through Petro-Net™. The LIM sends a 110/220 signal to the STP controller to turn the submersible pump ON (unless an alarm condition is sensed, then no signal is sent). An HV feedback signal will make sure that the submersible pump is turned ON.

The LIM operates with the console to do tests of the lines during periods when they are not in operation to monitor the site for leaks in the line(s).

5.2 LIM Specifications

LIM Specifications	
Monitors:	Nozzle Signal and STP Relays
Dimensions (W x H x D):	8” x 8” x 4” (20.3 cm x 20.3 cm x 10.2 cm)
Power Requirements:	110/220 VAC, 50/60 Hz, 0.5A Max.
Temperature Range:	-40°F to 158°F (-40°C to 70°C)

5.3 Items Included with the 20-8321-LIM

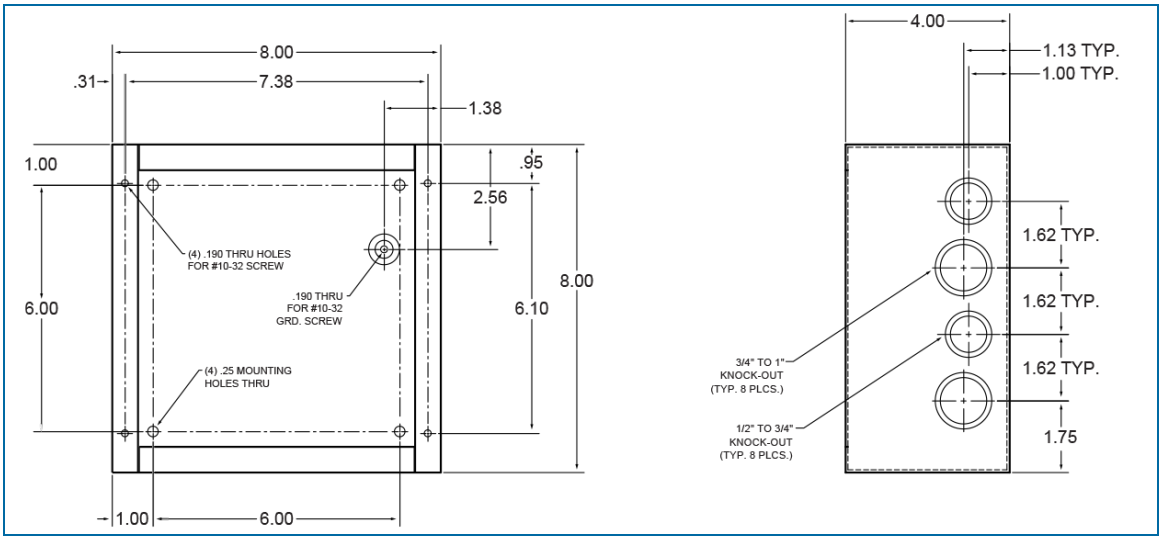
Item	*OPW-FMS Part Number*
Noise Suppressors (qty 4)	02-4002
Fuel-Type Stickers	54-0538
LIM Line Leak Interface Procedure Guide	M00-20-8321-LIM

5.4 LIM Installation

The LIM must be installed on a wall. Use only the supplied installation holes. Knockout locations are shown below. LIMs must have communication connections to the console and AC power.

IMPORTANT: The LIM module is not NEMA-rated and must not be installed outdoors.

IMPORTANT: DO NOT DRILL HOLES IN THE ENCLOSURE. Only use the supplied knockouts. Seal all unused knockouts.



LIM Dimensions and Knockout Positions

NOTE: The knockout pattern of the bottom panel of the enclosure is the opposite from the top and sides.

5.4.1 LIM Wiring

To watch the instructional video “LIM Wiring Instructions,” scan the QR Code or use the URL link below:

URL: https://www.youtube.com/watch?v=-KFeC402EZA

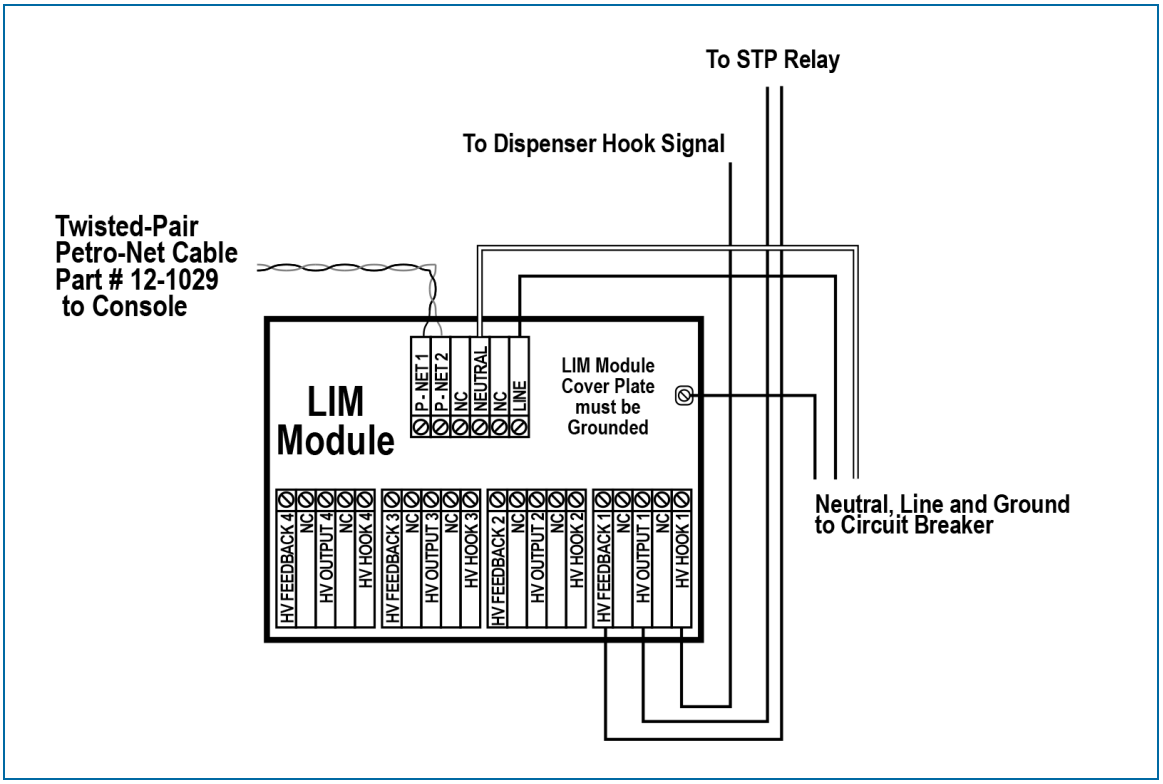
NOTE: LIM modules must have dedicated AC power and two (2) ground connections for the module and barrier.

Noise suppressors are necessary with each LIM installation to decrease the electrical “noise” when the STP coil contact closes (sends the noise back through the HV Feedback and HV Output.

1. Pull two (2) AC power wires and one (1) ground wire (14-AWG / 2.5 mm^2 minimum) from the circuit breaker to each LIM module.
2. All AC power must be in the same phase.

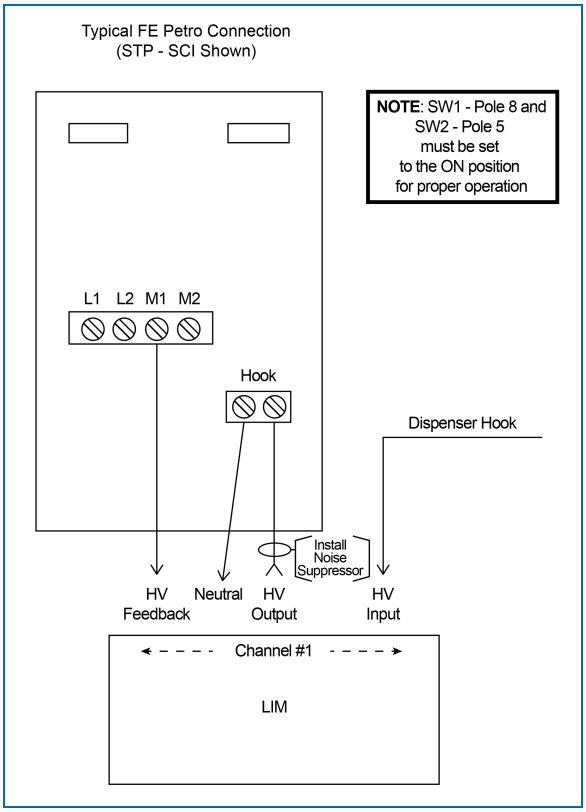
NOTE: The phase that the LIM relay is on is connected to the STP terminal motor. The LIM must be on the STP HV Feedback phase, as shown in the illustration below (the type of STP on site can change this. See the STP manufacturer's instructions).

3. Install the noise suppressor across the Neutral and Hot of the STP coil (see the illustration below).

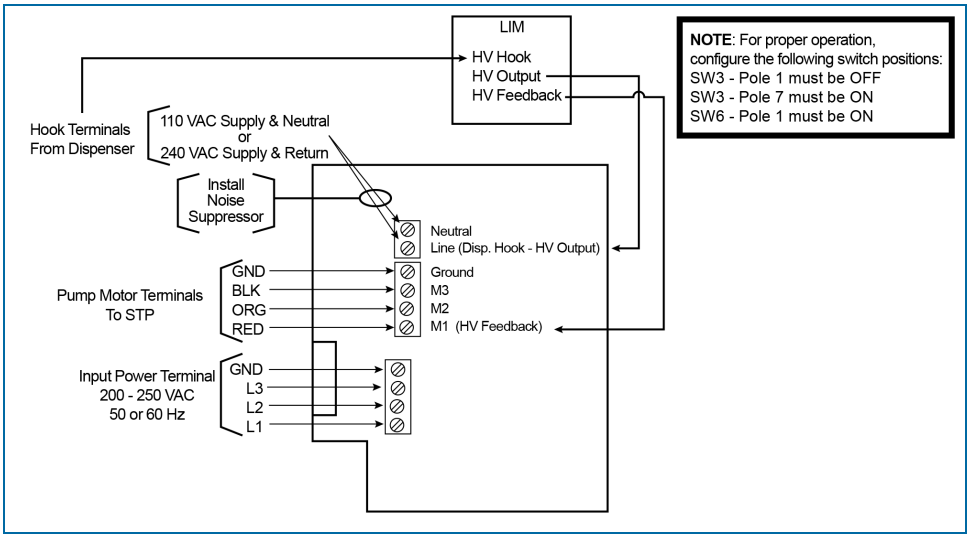

To STP Relay
To Dispenser Hook Signal
Twisted-Pair
Petro-Net Cable
Part # 12-1029
to Console
LIM
Module
P - NET 1
P - NET 2
NC
NEUTRAL
NC
LINE
LIM Module
Cover Plate
must be
Grounded
HV FEEDBACK 4
NC
HV OUTPUT 4
NC
HV HOOK 4
HV FEEDBACK 3
NC
HV OUTPUT 3
NC
HV HOOK 3
HV FEEDBACK 2
NC
HV OUTPUT 2
NC
HV HOOK 2
HV FEEDBACK 1
NC
HV OUTPUT 1
NC
HV HOOK 1
Neutral, Line and Ground
to Circuit Breaker

LIM Wiring

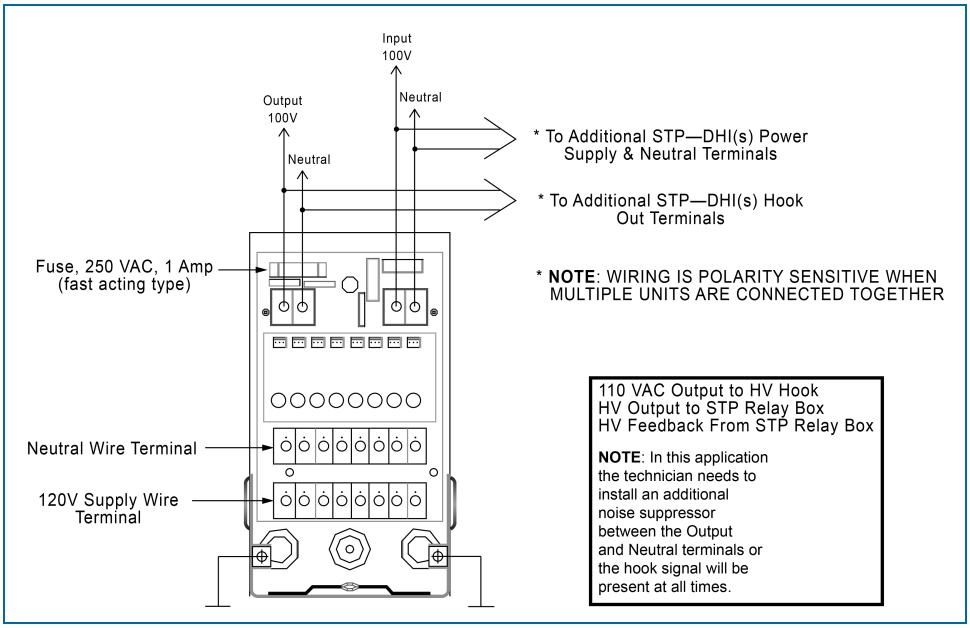
5.4.1.1 Typical FE Petro Wiring Connections



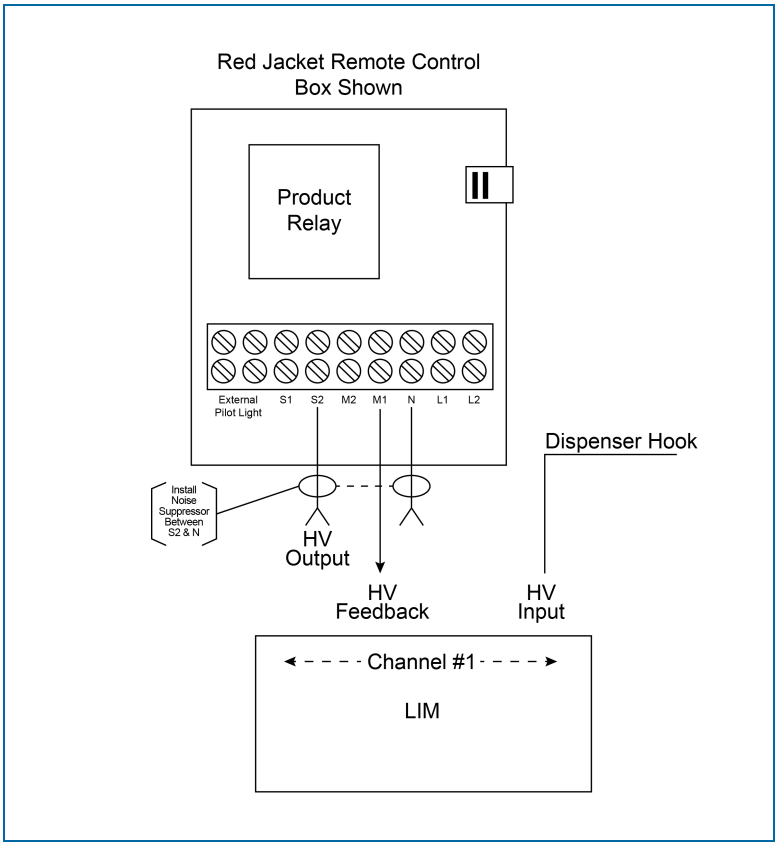
5.4.1.2 Variable Speed Control for FE Petro



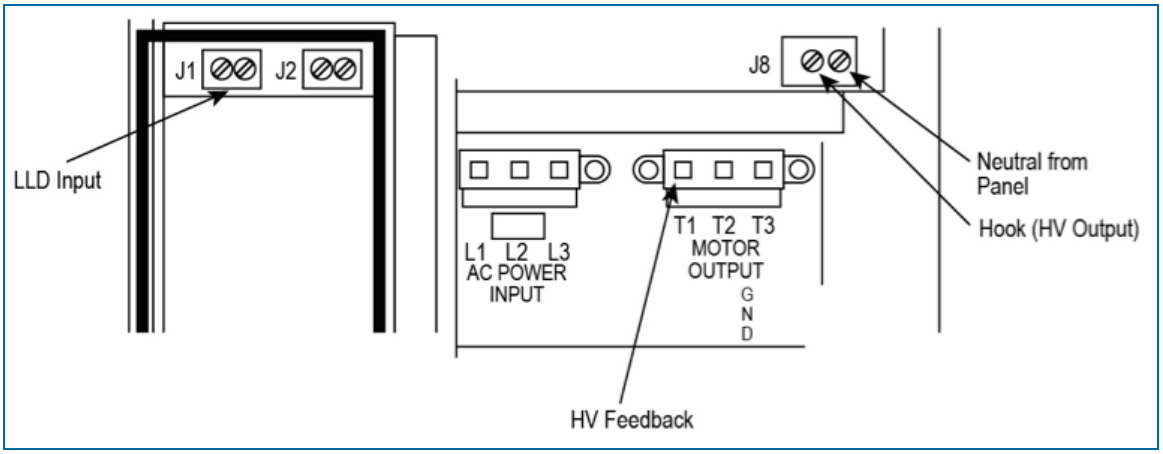
5.4.1.3 FE Petro STP-DHI (used in conjunction with Fe Petro STP-SCI or FE Petro VFC)



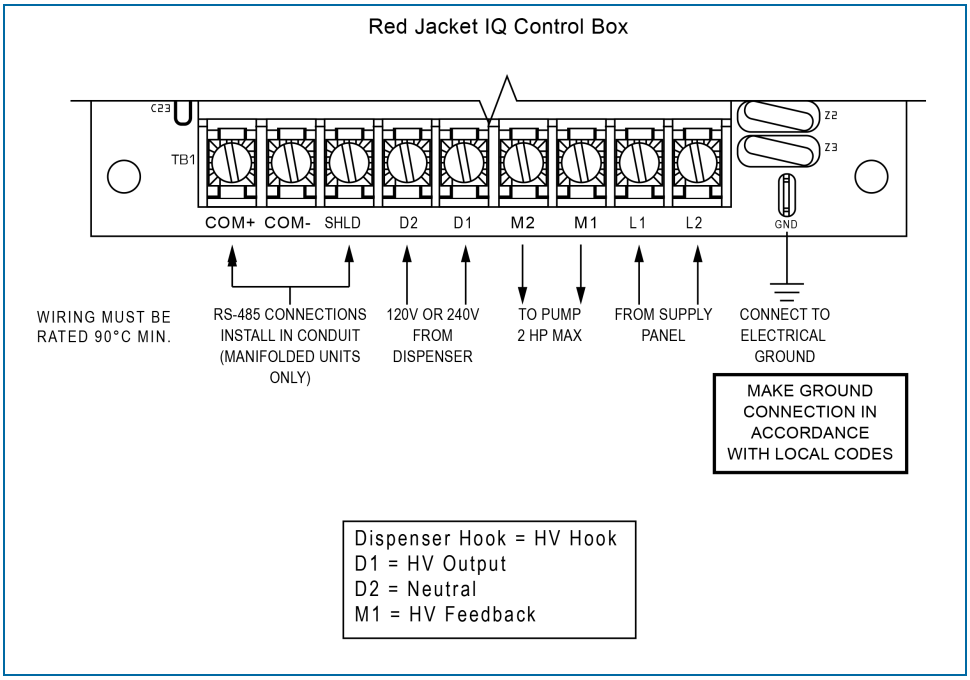
5.4.1.4 Typical Red Jacket Wiring Connections



5.4.1.5 Variable Speed Control Wiring for Red Jacket

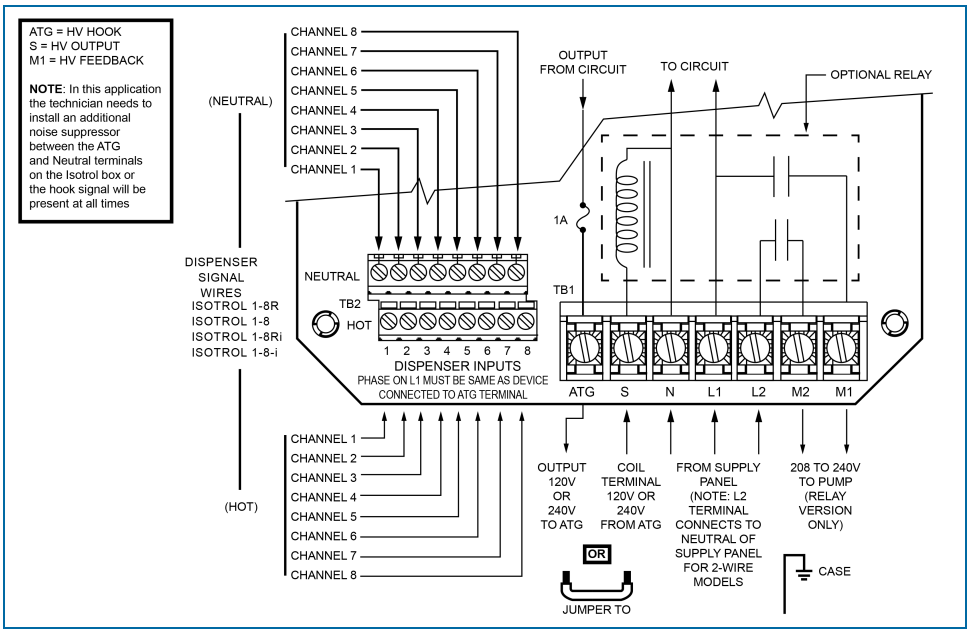


5.4.1.6 Red Jacket IQ Control Box



5.4.1.7 Red Jacket Isotrol

DANGER: To prevent the possibility of electrical shock, check for multiple power disconnects at your site. Be sure all power is off before installing or maintaining this unit.



5.4.2 Petro-Net Address

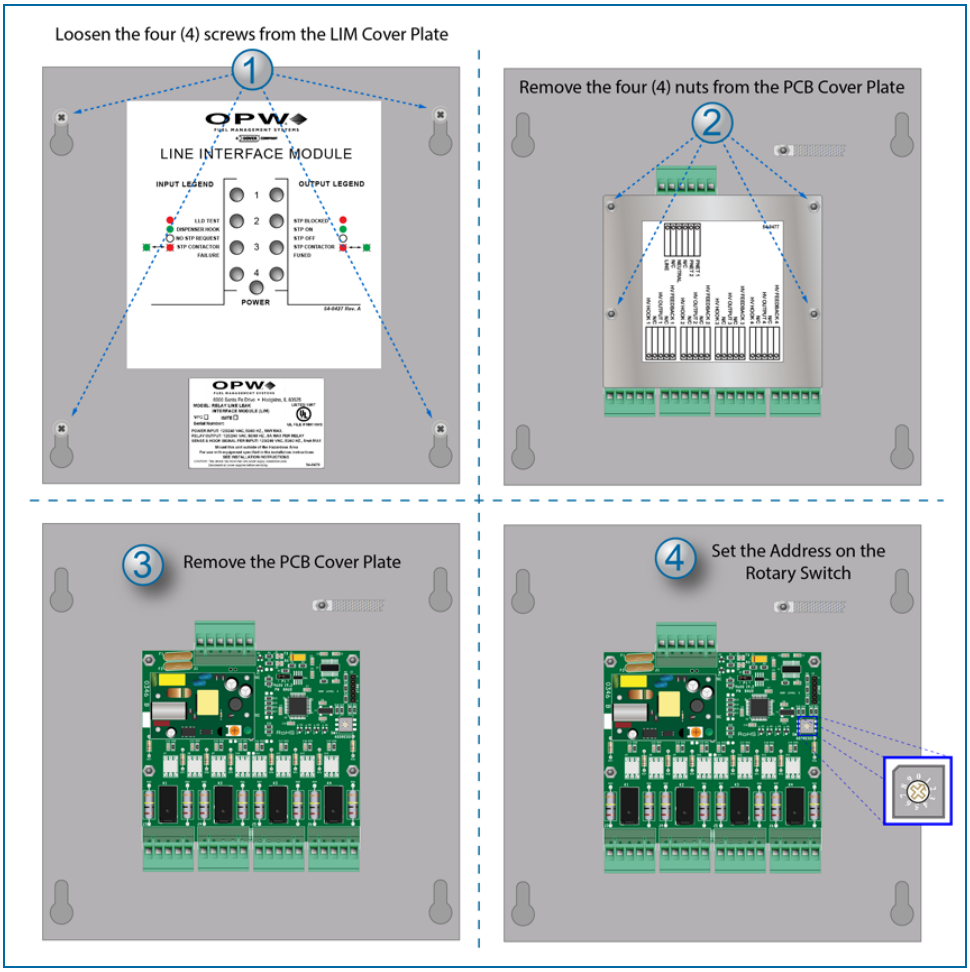
LIM modules must be given an identification number to correctly communicate with the system through the Petro-Net protocol. This number must be different than all other LIM modules in the system. The module numbers are used during system configuration. Refer to the M2051 LX4/Plus Configuration Manual for information about system setup.

A small rotary switch is located at the top of the PC board inside each module. The switch has 10 positions, marked “0” to “9.” A small arrow on the switch points to the current position. The default switch setting is “1.”

IMPORTANT: Although the switch has 10 settings, only settings 1-8 are applicable. DO NOT set the switch to “0” or “9” – the module will NOT be sensed by the system.

Use this procedure to set the Petro-Net™ address:

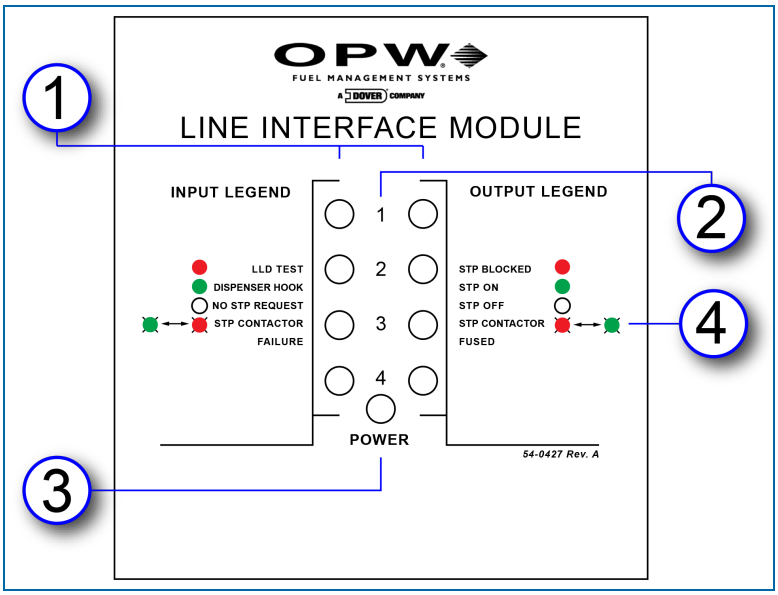
WARNING: To prevent the possibility of electrical shock, de-energize the module before you do the procedure that follows.



1. Loosen the four (4) screws that hold the LIM enclosure Cover Plate. It is not necessary to completely remove the screws. Move the plate so the screw heads align with the larger part of the screw hole slot. Remove the enclosure Cover Plate. Turn the plate around to get access to the PCB cover.
2. Remove the four (4) nuts from the PCB Cover Plate.
3. Remove the PCB Cover Plate from the standoffs to get access to the PCB.
4. Use a ¼-inch (6-mm) blade screwdriver to carefully turn the rotary switch to the correct number position. See the illustration above for the location of the Rotary Switch.
5. Put the PCB Cover back on the standoffs. Put the nuts back on the standoff post threads and tighten them.
6. Turn the LIM Cover Plate back around. Align the screw hole slots with the screw heads. Move the plate so the small part of the slots are flush against the screws. Tighten thew screws
7. Energize the module.

NOTICE: Do not change the module number while the LIM module power is ON.

5.5 LIM Front Panel Legend



LIM Front Panel Label

The LED lights on the front panel of the LIM show the status of the different LIM functions. Each channel is shown with input (left) and output (right) status LEDs. The Input Legend and Output Legend tells what each LED light indicates.

1. Input (nozzle signal) and output (STP contractors) LED lights.
2. LIM channel numbers.
3. Power indicator LED.
4. Blinking lights on the legend are indicated by these symbols:

LED Legend for LIM Diagnostics

The LIM Diagnostics screen shows the current LIM status and it will automatically refresh every five (5) seconds. The LIM module LED input/output status lights will show:

- GREEN/GREEN: The dispenser hook signal is started and the STP controller sends a signal to the pump to come on. If the input LED shows RED, this shows that the tank gauge system is in control and line diagnostics are in progress.
- RED/GREEN: This shows that a line leak test is in progress in the Tank Gauge system. During 0.2 or 0.1 GPH scheduled precision tests, the RED LED will stay on longer (this can be hours).
- GREEN/RED: This shows that the dispenser hook signal is sensed, but an alarm condition was identified. The signal to the STP is blocked by the LIM and the pump will not come ON.
- If the HV INPUT does not sense high voltage feedback from the STP contactor when the relay is closed, the LIM module will flash. This identifies a contactor failure in the STP.

- If the HV INPUT continues to sense high voltage feedback from the STP after the relay is opened, the LIM module will flash. This identifies that a contactor has been fused-off and there is a problem in the line.

A 3.0 GPH catastrophic test is done after the STP is started if there is no customer hook request for the related product.

NOTE: The customer must always come first if no problem is sensed in the line. This will cancel a test in progress.

5.5.1 Fuel-Type Stickers

Gas-Reg	*Gas-Reg*	*Gas-Reg*	*Gas-Reg*
Gas-Mid	*Gas-Mid*	*Gas-Mid*	*Gas-Mid*
Gas-Prem	*Gas-Prem*	*Gas-Prem*	*Gas-Prem*
Diesel	*Diesel*	*Diesel*	*Diesel*
LPG	*LPG*	*LPG*	*LPG*
E10	*E10*	*E10*	*E10*
E15	*E15*	*E15*	*E15*
E85	*E85*	*E85*	*E85*
Bio Fuel	*Bio Fuel*	*Bio Fuel*	*Bio Fuel*

Fuel Type Stickers

A sheet of “peel and stick” fuel-type stickers comes with each LIM. These can be used to attach to the front label on the numbers 1 – 4 to identify the fuel type that is related to each position.

5.6 LLD Warning Tag (OPW p/n 54-0531)

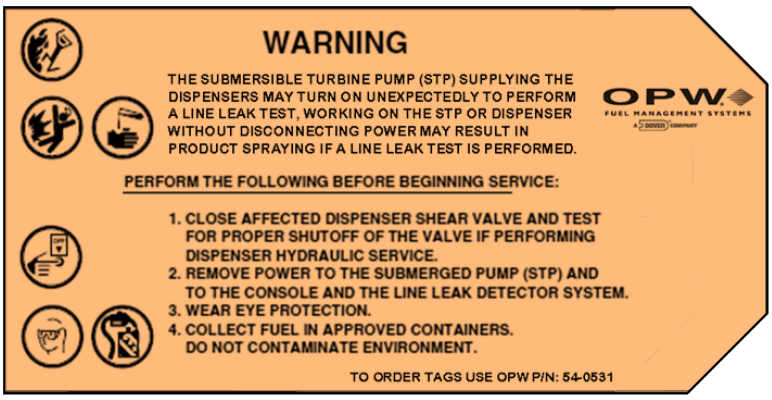
WARNING: Disconnect power to the LIM, Submersible Turbine Pump (STP) and tank-gauge console before any system maintenance. Failure to disconnect the power can result in product spray if a line-leak test is done by the system.

Make sure applicable dispenser shear valves are closed. Test for proper valve shutoff before dispenser hydraulic service.

Wear approved eye protection and complete any applicable lockout/tagout procedures required by site, local or state regulations.

Collect fuel spills only in approved containers to prevent environmental contamination.

Eight (8) LLD Warning tags with cable ties (OPW p/n 54-0531) come with the parts kit (OPW p/n 20-6206) that is supplied with the PLLD Sensor. Use a cable tie to attach a tag at each LIM, STP, dispenser and console. These tags show the precautions shown in the warning panel above for site maintenance personnel.



LLD Warning Tag

Section 6 OM4 Output Module (Optional)

OM4 Output Module

The OM4 Output Module has four (4) relay positions. Four (4) OM4 units can be connected together for a total of 16 relays. The wiring instruction on the inside of the OM4 shows the correct PetroNet communications and power connections.

See the tank-gauge console Configuration Manual for information on alarms, events and Output Module relay configuration.

Some typical OM4 functions include:

- Stop a submersible pump if a low product level is sensed in a tank.
- Cause an alarm when high product is sensed in a tank.

6.1 Safety Precautions

WARNING: DO NOT connect the OM4 output Module directly to a submersible pump! The OM4 controls pumps INDIRECTLY, through relays or contactors.

There can be high voltages in the OM4. Servicing of the unit must only be done by an approved technician.

The output relays in the OM4 are not intrinsically safe! Before you do servicing of the OM4 unit, disconnect the power. Power to and from the relays must also be disconnected.

Do not put probe or sensor wiring in conduit that contains wiring for devices that are connected to the OM4 Output Module.

6.2 Codes

Relay wiring is in the Class 1 wiring category. Refer to the National Electrical Code (NFPA No. 70) and the Motor Fuel Dispensing Facilities and Repair Garages Code (NFPA No. 30A) to make sure your installation is correct. The installer must know and obey all applicable local codes in the country or county where this unit is installed.

6.3 Hazardous Area Definition

A fuel dispenser is a hazardous area as specified in the National Electrical Code.

DANGER: Do not install the OM4 Output Module in a hazardous area.

Do not connect this unit to devices that are in a hazardous area.

6.4 OM4 Technical Specifications

OM4 Technical Specifications	
Field Wiring Rating:	105°C, 600V Type RH. TW, RFH-2 or equivalent
Power Requirements:	12 VAC, 0.5A Max.
Dimensions (W x H x D):	15 cm x 15 cm x 10 cm (6” x 6” x 4”)
Temperature Rating:	0°C - 40°C (32°F - 104°F)
Relay Output Rating:	5A @ 240 VAC; 5A @ 24 VDC

6.5 Product Certifications

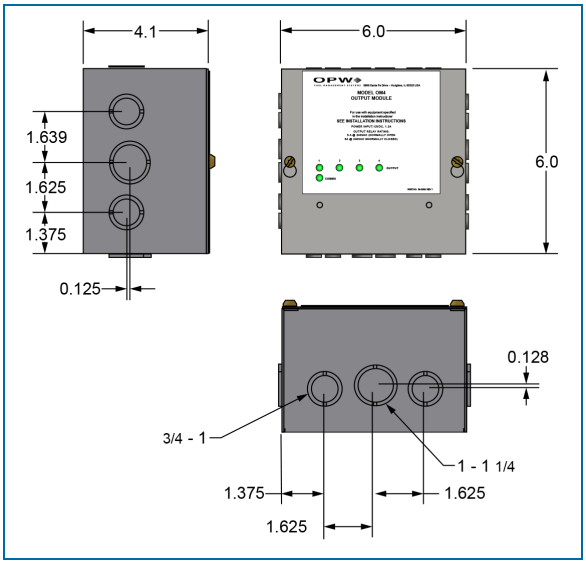
- Electronic Testing Labs Canada (cETL)
- Electronic Testing Labs (ETL)

6.6 OM4 Installation

The OM4 must be installed on a wall. Use only the drilled installation holes supplied on the unit. Knockout locations are shown below. OM4 Modules must have communication connection to the console and AC power.

The OM4 module is not NEMA-rated. Do not install this unit outdoors where bad weather conditions can occur.

Use only the supplied knockouts. Seal all unused knockouts.



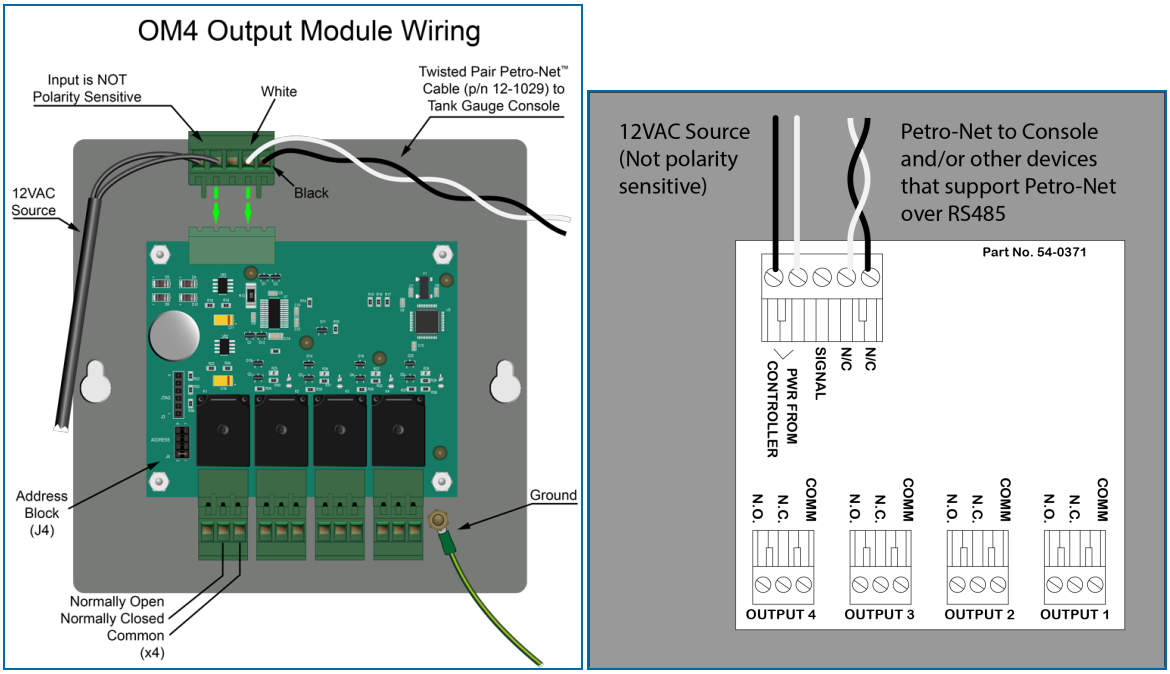
OM4 Dimensions and Knockout Locations

6.7 OM4 Connections

See the wiring instructions inside the unit (see the 54-0371 label illustration below) for the correct (missing or bad snippet) communications and power wiring instruction.

NOTE: The Petro-Net twisted pair cable (OPW-FMS p/n 12-1029) can connect to the console and to other devices that support the Petro-Net over RS485 protocol. Maximum length for all parallel connected devices is 5,000 feet (1524 meters). Petro-Net polarity must be kept for the console and all devices through the entire system.

Connect all relay wiring to the correct terminal block(s).



OM4 Wiring Connections and Wiring Instruction Label 54-0371

6.8 Petro-Net Address Jumper Settings

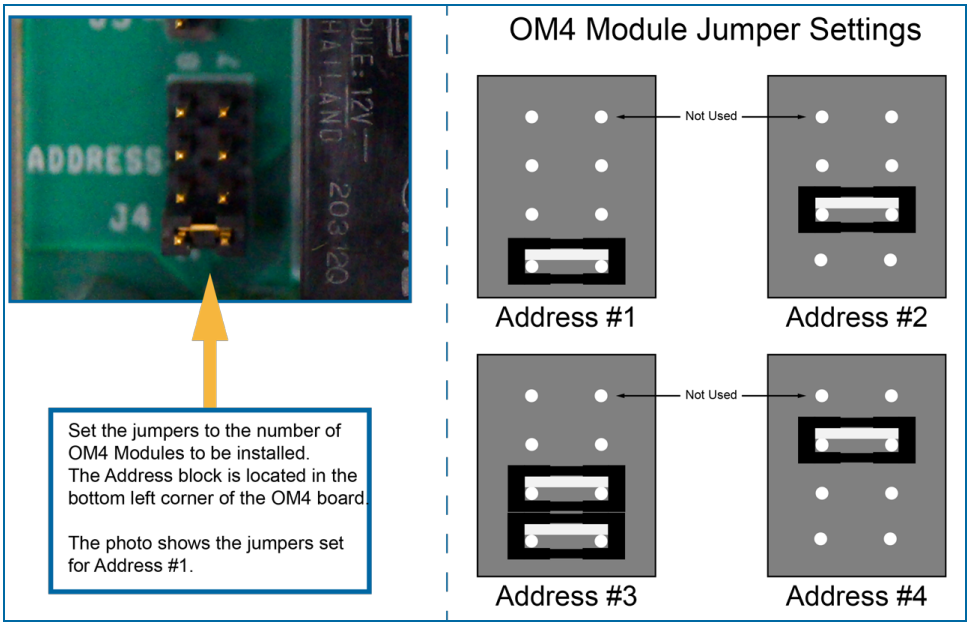
WARNING: Do not change the module jumpers while the module is energized. The relay positions must not be energized during jumper adjustment.

When more than one OM4 Module is installed in a system the Petro-Net address must be set in the jumper block for each module. Each of the modules must be given a different address so they can be correctly

identified in the Petro-Net protocol. The Address block (J4) is located in the bottom left corner of the OM4 board next to the Output 4 connector.

To install two (2) or more OM4 Output Module units:

- Remove the nuts that attach the aluminum cover.
- Remove the cover to get access to the circuit board.
- Set the jumpers to the correct address.
- Put the aluminum cover back on the unit.
- Attach and tighten the nuts.



OM4 Jumper Settings for Multiple OM4 Operation

Section 7 Tank Alert (Overfill Alarm) (Optional)

The (missing or bad snippet) can use one of its internal output contacts or an output relay of a connected OM4 Module to cause an overfill alarm condition in a connected Tank Alert. The Tank Alert has a buzzer and an external light to tell you of an overfill condition or high-product alarm.

NOTE: The overfill alarm can be set to operate with any alarm that has relay 1 or relay 2 operation.

7.1 Safety Information

WARNING: EXPLOSION or FIRE HAZARD. Do not install this unit in a hazardous location as specified by the National Electrical Code, ANSI/NFPA 70.

ELECTRICAL SHOCK HAZARD. Disconnect power before you install or when servicing this unit. Only an approved technician can install or do the servicing of this unit. Refer to applicable electrical and plumbing codes.

7.2 Tank Alert Specifications

Tank Alert Specifications - 120V	
Voltage:	120 VAC, 50/60 Hz
Enclosure Dimensions (H x W x D):	6.5 x 4.5 x 3 inches (16.51 x 11.43 x 7.62 cm)
Alarm Horn:	Alarm Horn: 85 decibels at 10 feet (3 meters)
Alarm Beacon:	UL Listed, Type 4X beacon assembly
Auxiliary Alarm Contacts (Optional):	120 VAC. 5 amps max., 50/60 Hz
Pre-Mounted Terminal Block (Optional):	20 amps, 120/230 VAC

Tank Alert Specifications - 240V	
Voltage:	220-240 VAC, 50/60 Hz
Enclosure Dimensions (H x W x D):	6.5 x 4.5 x 3 inches (16.51 x 11.43 x 7.62 cm)
Alarm Horn:	85 decibles at 10 feet (3 meters)
Alarm Beacon:	UL Listed, Type 4X beacon assembly
Auxiliary Alarm Contacts (Optional):	240 VAC. 5 amps, 50/60 Hz
Pre-Mounted Terminal Block (Optional):	240 VAC, 20 amps

7.3 Tank Alert Installation

The Tank Alert can be installed in a building or an outdoor location.

Two (2) #8 x 1.25 self-tapping screws and sealing washers are included with the Tank Alert. Select an installation location over a wall stud or use wall anchors. The illustration below shows the installation screw hole locations.

Drill holes of the correct size for an applicable conduit.

IMPORTANT: Be careful to not cause damage to internal components when you drill holes for conduit.

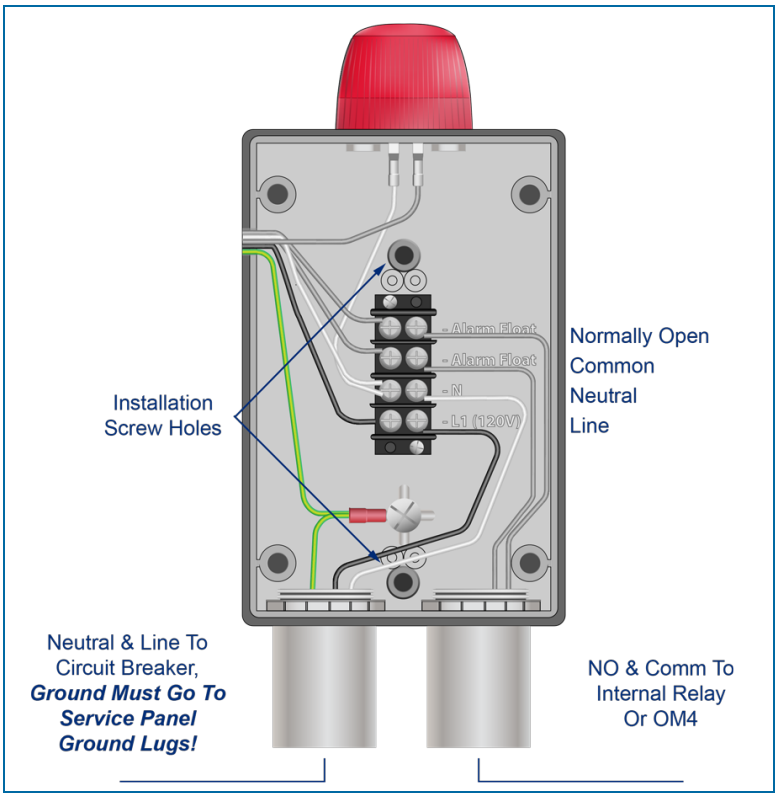
Attach the conduit to the Tank Alert enclosure. Apply a sealant around the conduit(s) to keep gases or fluids out of the enclosure.

7.4 Tank Alert Wiring

NOTE: Refer to the "LX Plus Field Wiring Diagram" on page 1 for wiring connections inside the Tank Alert enclosure.

IMPORTANT: Use a minimum gauge 14 AWG stranded copper wire.

See the connection diagram below for relay (internal or OM4) and power connections to the Tank Alert.



Section 8 Probe Installation Preparation

This section shows the procedures necessary for installation of tank-probes that will be connected to your Nano console.

Topics in this section include:

8.1 Probe Installation in Underground Storage Tanks

1. Install a manhole of a minimum of 18 inches (45.7 cm) diameter around an unused fitting in the top of the tank. This manhole must be of a sufficient size to contain a weatherproof junction box together with the probe and riser assembly.

NOTE: If the fitting is not in the center of the tank, additional measurements are required for probe compensation.
If the fitting is not in the center of the tank more measurements will be necessary to maintain the minimum distances between the probe and the fill and sump tubes.

2. The probe cable (OPW P/N 10-1185) is 6 feet (1.83 M) in length. Make sure there is sufficient length of cable from the probe to where a weatherproof junction box is to be installed.
3. Leave a minimum 12 inches (30.5 cm) of extra, coiled wiring (probe wire and field wire) inside the weatherproof junction box. The box must be large enough to contain a 0.5 inch (12.7 mm) conduit, coiled field wiring and epoxy seal-pack, as shown in the field wiring diagram.

CAUTION: Seal-offs are required any time I.S. wiring enters conduit. Install one conduit seal fitting in the manhole where the conduit leaves the junction box and one in the building before the conduit goes into the console.

4. Install a 1/2-inch NPT bushing in the weatherproof junction box.

8.2 Probe Placement

CAUTION: Model 924B and DMP probes must be installed as shown in this section. If the installation cannot be done with the minimum or maximum dimensions specified, do not continue with the installation.

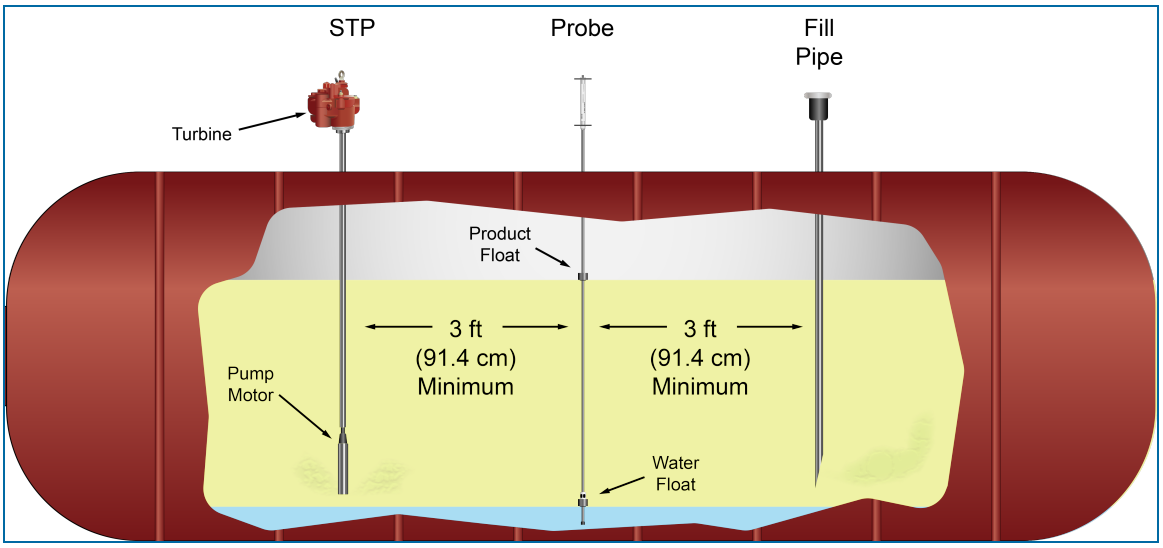
Model 924B and DMP probes are safe for Class 1, Div 1, Group D hazardous locations. This includes tanks containing regular, super, diesel and unleaded gasoline; antifreeze; kerosene; mineral spirits; oxinol, methanol and methanol blends; motor, torque and transmission oil; and alcohol. If you are not sure if a product is included in this class, speak to your product specialist or distributor.

The best location to install a probe is in the center of the tank (see the illustration below).

The probe must be installed (approximately) a minimum of three (3) feet (91 cm) from the tank fill-pipe. If the distance is less than this interval, the force of the product that goes into the tank can cause the water float to travel up the shaft of the probe. This can cause the controller to give an incorrect high-water alarm.

Adjust the drop-tube of the fill pipe so that the product flow is pointed away from the probe.

A Submersible Turbine Pump (STP) must be installed (approximately) a minimum of three (3) feet (91 cm) from the probe. If the distance is less than this interval, the force of the product that the pump pulls from the tank can cause incorrect indications of the water and product floats.



Probe Placement

8.3 Product Offset Calculation

It is possible to calculate product offset for a probe that is not installed in the center of a "pitched" tank. Pitch occurs when a tank is installed tilted along its horizontal axis. Some tanks are installed with one end lower than the other to let water and sediment collect at the low end, so that clear product can be pulled from the high end. Tank "settling" can also occur and can cause a tank a tank to become tilted. Use a dipstick to measure the level of product at two points of the tank. It is recommended that these measurements be taken at opposite ends of the tank (see the figure below).

The product depth at the lower end of the tank is value “A.” The product depth at the higher end is value “B.” The distance between the two measuring points is “C.”

The formula for pitch is:

(A-B)/C

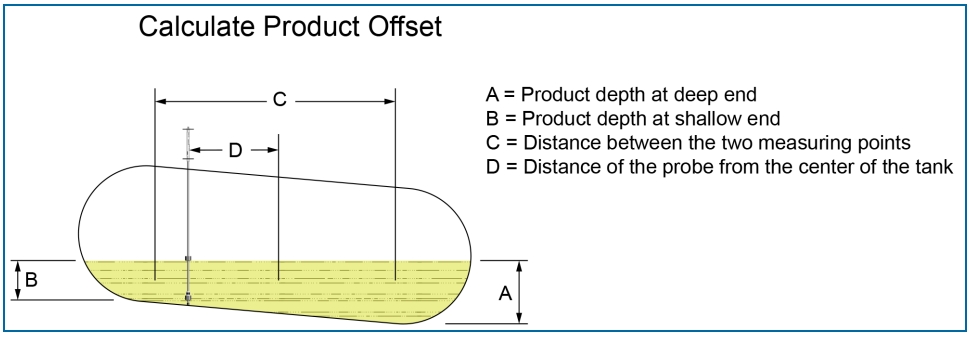
For example:

(46"-40")/120" = 6"/120" = 0.05”

To calculate the product offset, measure value “D,” the distance of the probe from the center of the tank. The formula for product offset is **“D” x pitch**. For the example above: 36” x 0.05 = 1.8”.

If the probe is located closer to the higher end of the tank, the product offset is positive. For the example above: 1.8”.

If the probe is located closer to the lower end of the tank, the product offset is negative; for the example above: -1.8”.



Product Offset

8.4 Riser, Manhole and Junction Box Installation

Install the components shown below after the probe installation location in the tank has been selected.

WARNING: To prevent explosion or fire, it is recommended to use non-sparking tools in an environment that could contain flammable hydrocarbon vapors. DO NOT USE CORDED ELECTRIC OR BATTERY OPERATED POWER TOOLS. Only use pneumatic or manual tools.

8.4.1 Riser Assembly

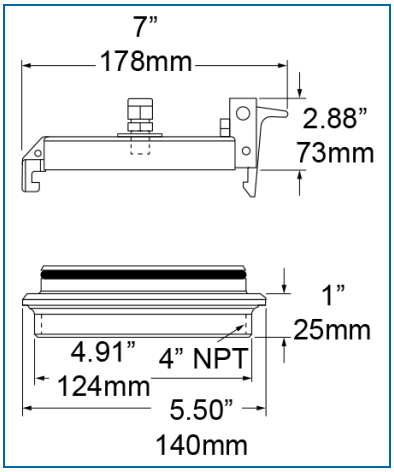
A four (4) inch diameter riser pipe must be installed on the tank opening where the probe will be installed. The riser pipe must be of sufficient length to hold the probe head, connector and an applicable length of cable.

An adapter collar and riser cap must be installed on the riser pipe to keep contamination out of the fuel tank. The riser must be tapped to accept the correct thread for the adapter collar and riser cap assembly.

NOTICE: Tap the applicable threads on the top of the riser before it is installed so that contamination does not enter the tank.

OPW-FMS recommends to use the OPW 62M-0375 Monitor Probe Cap & Adapter Kit (P/N 30-0219) for 924B probe installations. The illustration below shows the cap and adapter dimensions and thread specifications for reference.

NOTE: For DMP probe installations, it is recommended to use the OPW 62M-0500. Visit https://www.opwglobal.com/products/us/retail-fueling-products/underground-storage-tank-equipment/caps-adaptors/62m-monitor-probe-cap-adaptor-kit for information.



You can keep the cap off of the assembly until after the probe as been put in the tank and riser.

8.4.2 Manhole and Junction Box, US and Canada Installations

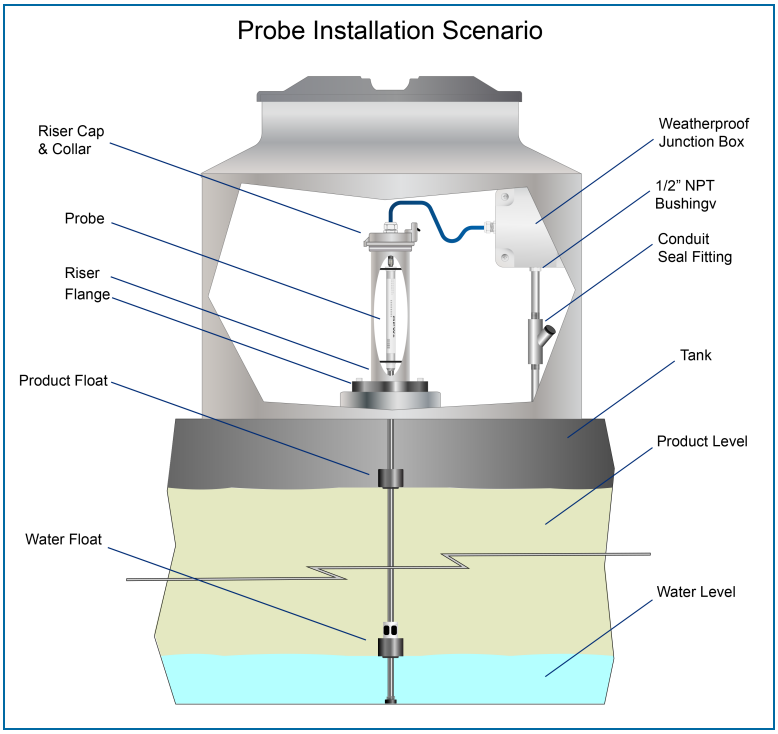
Install a manhole of at least 45.7 cm (18 inches) diameter around an unused fitting in the top of the tank. This manhole must be of sufficient dimensions to contain the riser for the probe and a weatherproof junction box.

NOTE: The probe cable (OPW-FMS P/N 10-1185) is 6 feet (1.83 M) in length. Make sure there is sufficient length of cable from the probe to where a weatherproof junction box is to be installed.

The weatherproof junction box must be of sufficient dimensions to contain a 0.5 inch (12.7 mm) conduit, a minimum 12 inches (30.5 cm) coiled field wiring, all applicable probe and sensor cables and an epoxy resin seal-pack.

Install a 1/2-inch NPT bushing in the weatherproof junction box for the conduit.

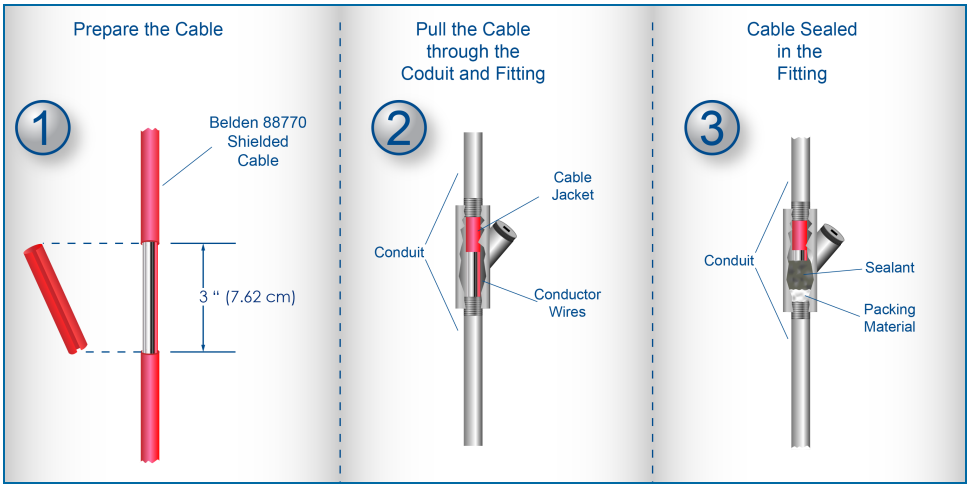
WARNING: Seal-offs are required any time I.S. wiring enters conduit. Install one conduit seal fitting in the manhole where the conduit leaves the junction box and one in the building before the conduit goes into the console. See the Conduit Seal Fittings for Cables section that follows for more information.


Probe Installation Scenario
Riser Cap & Collar
Probe
Riser Flange
Product Float
Water Float
Weatherproof Junction Box
1/2" NPT Bushingv
Conduit Seal Fitting
Tank
Product Level
Water Level

8.5 Conduit Seal Fittings for Cables

IMPORTANT: To comply with Article 501 of the National Elecrical Code, Seal-offs must be installed where I.S. wiring enters conduit. Install one conduit seal fitting in the manhole where the conduit leaves the junction box and one in the building before the conduit goes into the console.

WARNING: The Tank-Probe cables must be sealed ***before*** they go into the I.S. barrier (explosive fumes can travel through the cable *jacket*). This will keep explosive fumes away from the I.S. barrier.

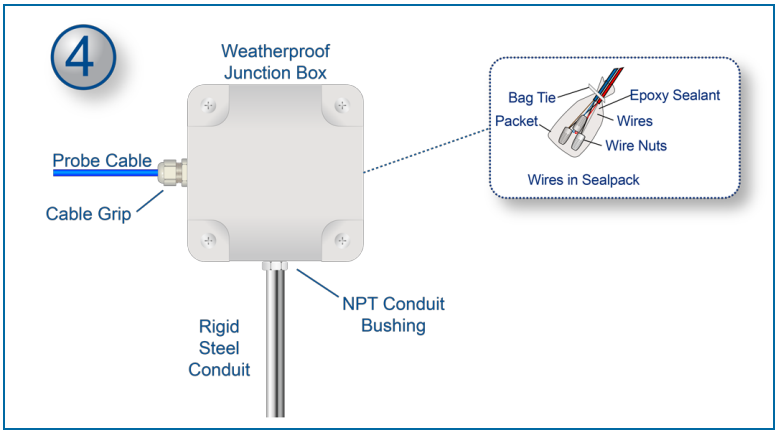


1. Prepare the Cable: Remove a sufficient length of the cable *jacket* so that the *conductor* wires can extend into the conduit seal fitting (approximately 3 inches [7.62 cm]).

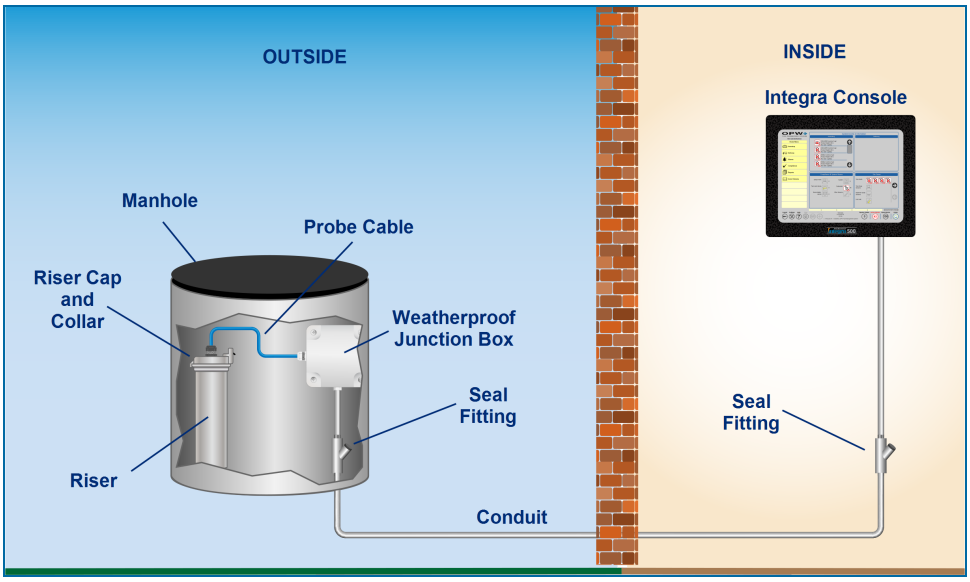
IMPORTANT: Make sure you do not cause damage to the conductor wire insulation!

2. Pull the prepared Cable through the assembled conduit and fitting so that the *conductor* wires extend into the conduit seal fitting.
3. See the manufacturer's instructions that came with your Conduit Seal Fittings for the correct procedure to fill the seal cavity with an applicable sealing compound.

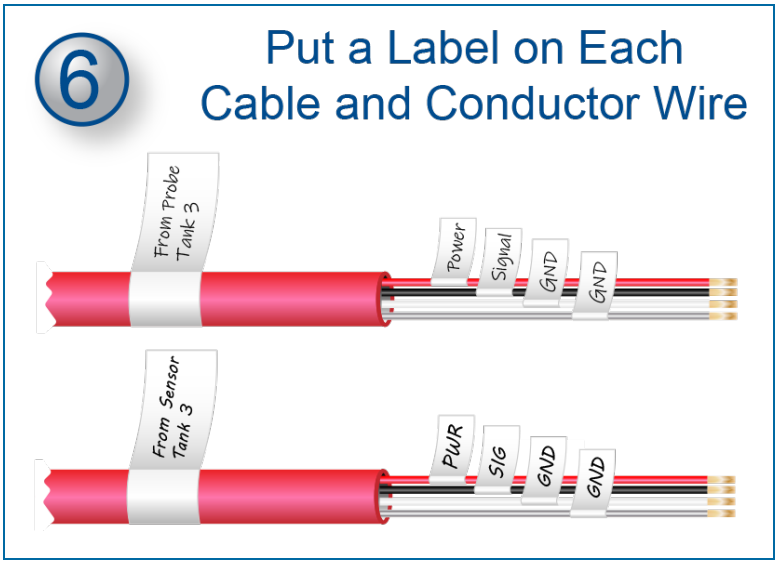
IMPORTANT: Make sure that the open ends of the prepared cable inside the fitting are completely sealed. This will prevent the flow of explosive fumes through the Cable *jacket*.



4. Tank-Probe or Smart Sensor wires that use a prepared Belden cable must go through NPT bushings into a weatherproof junction box. Bushings must be used in all junction boxes.



5. The cable must go through rigid steel conduit from the junction box directly to the I.S. barrier.



6. Put a label on each cable and conductor wire to identify its connection.

CAUTION: The console must have a dedicated power circuit and must be on the same phase as all other OPW-FMS equipment.

Only OPW-FMS probe cables and sensor wiring can be in the same conduit that goes to the I.S. barriers.

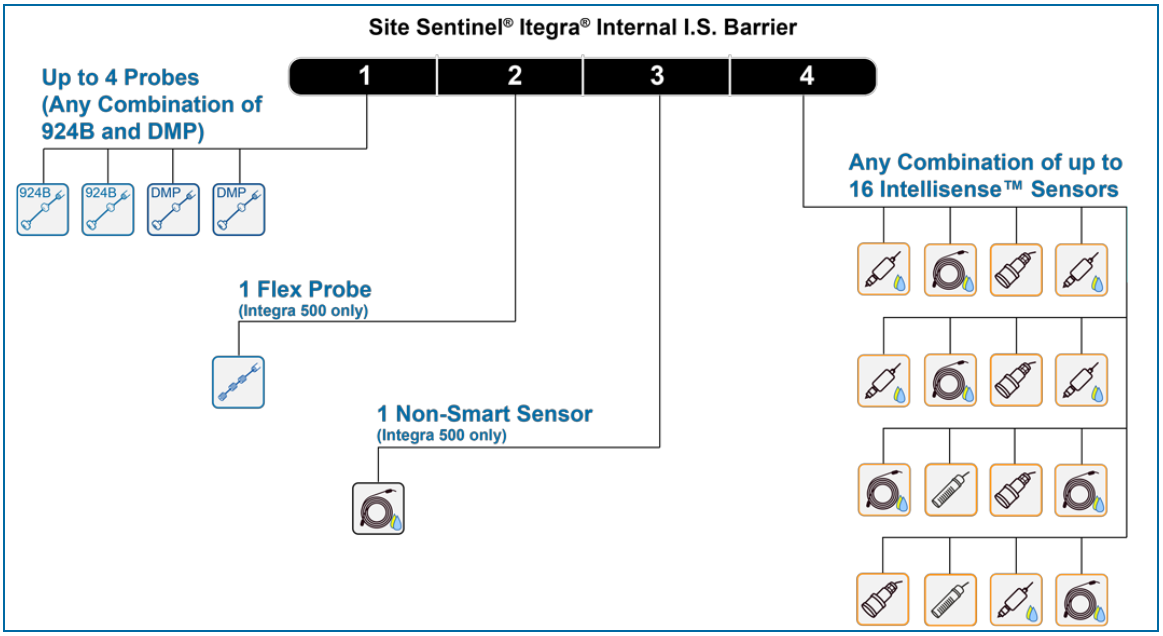
NOTICE: Incorrect cables, wiring, or conduit can cause electronic noise interference with probe/sensor measurements. This can cause measurement indications at the console that can show as a hardware error. The warranty is voided if incorrect cables, wiring and/or conduit are installed. The ground wire must be correctly installed for the noise-filtering circuitry to operate correctly. Thus, the conduit must not be used for operation of the ground.

8.6 Integra Multi-drop Capabilities

With the Integra internal barrier and optional VSmart Module you can "Multi-drop" probes and sensors. See the diagram below that shows the restrictions and capacities for installation of devices on a single barrier channel.

NOTE: The OPW-FMS model 924B probe and the DMP probe can be on the same internal Integra or external VSmart I.S. barrier position for multi-drop installations.

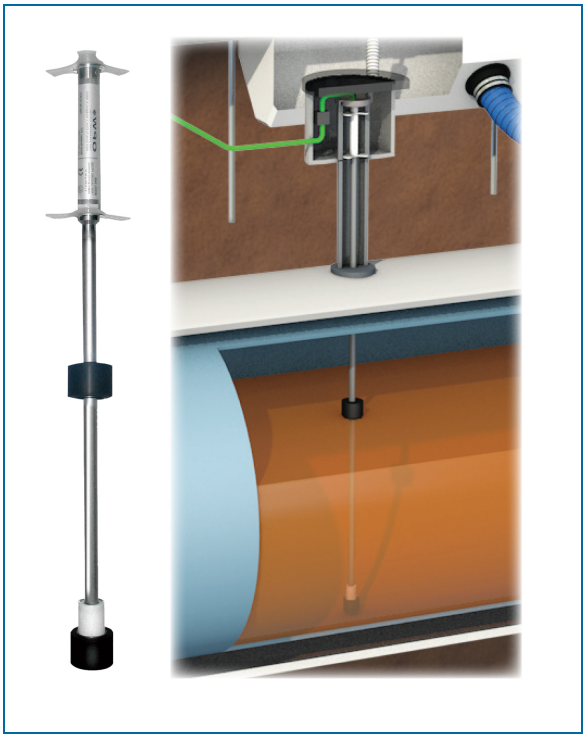
NOTE: **ONLY 924B Probes made after September 1, 2007, (version 7.xx firmware) can be installed in a multi-drop installation.



A single I.S. barrier position can have:

- Up to four (4) probes, 924B and/or DMP
- One (1) Flex Probe (Integra 500 only)
- One (1) Non-Smart Sensor (Integra 500 only)
- Any Combination of up to 16 Intellisense™ Smart Sensors

Section 9 924B Probe Installation



9.1 Probe Floats

There are three types of floats used with the 924B probe: Product, Water for Diesel, and Water for Gasoline.

IMPORTANT: The two types of water floats are NOT interchangeable. Because diesel has more density than gasoline, the diesel floats are heavier than the gasoline floats. If an incorrect water float is installed in a diesel tank, it will not go through the product to the water below. As a result, the fuel tank will have unusually high water measurements. This can also cause irregular product measurements because the water float can cause interference with the product float.

Probe Type/Float Style	*Float Kits*
924B 2” (5.1 cm) Floats:	Gas: 30-1509-02 Diesel: 30-1509-01

NOTICE: The product float for LPG is not approved for installations where it can be pressurized at or more than 300PSI. Pressures higher than 300PSI will damage the device and it will not be easy to get accurate measurements.

9.2 Model 924B Probe Specifications

924B Magnetostrictive Probe

The 924B probe is made of stainless steel and can be used in fluids, that include gasoline, diesel and water.

CAUTION: Special Conditions for Safe Use:

Static electricity can cause fires. To prevent static electricity in the probe, do not rub or clean the probe with a cloth. Make sure to release static electricity from the probe in an area away from the hazardous area before it is installed.

These devices have not been approved for use across a boundary wall.

The housing cover at the top of the probe is made of aluminum. To avoid ignition hazards do not let the head hit or rub against another object.

924B Magnetostrictive Probe Specifications	
Power Requirements:	Nominal 12+ VDC from I.S. Barrier
Operating Temperature:	-40°C to +70°C (-40°F to 158°F)
Maximum Total-Run Wiring Length*:	305 m (1,000 feet) Belden 88760 or Alpha 55371 152 m (500 feet) Belden88761 (or equivalent)
Level Measurement, Product:	± 0.0127 mm (± 0.0005 inches)
Level Measurement, Water:	± 0.254 mm (± 0.012 inches)
Temperature Resolution/Accuracy:	± 0.1°C / ± 0.5°C
Classifications:	Class I, Division 1, Group D
Certifications:	IECEx UL 11.0012X DEMKO 11 ATEX 1012670X

924B Magnetostrictive Probe Specifications	
I.S. Barrier Used:	12V ONLY; OPW-FMS P/N: 20-4344 (Green Label)
Multi-drop Restriction**:	924B is the only probe that can be multi-dropped at a maximum of four (4) probes per channel
Connections:	Blue = Power, Brown = Signal, Black and Shield = Ground

NOTE: *This is the maximum length of wire to be used to connect all probes on one channel. This length includes the wire from the I.S. barrier to each probe in the string.

NOTE: **ONLY 924B Probes made after September 1, 2007, (version 7.xx firmware) can be installed in a multi-drop installation.

9.3 Waterproof Electrical Connections

9.3.1 Components

Each probe/sensor wiring kit will have all the necessary components you will need to complete the sealpack assembly for waterproofing the electrical connections. You will need:

- Three (3) wire nuts
- Two (2) cable tie wraps
- 3M™ Scotchcast™ Electrical Insulating Resin packet

9.3.2 Personal Protective Equipment

In addition to the safety vest and barricades you are required to use for the wire installation you will also be required to wear the following items when assembling the epoxy resin sealpack:

- Safety glasses
- Chemical resistant gloves

9.3.3 Tools Required

- Wire stripper/cutter

9.3.4 Instructional Video

Scan the code or use the URL link below to see the instructional video**, Field Wiring for Probes and Sensors:**

URL: https://youtu.be/84lf8Hg41aY?t=165

9.3.5 Safety Information

DANGER: This epoxy seal-pack contains vinyl cyclohexene dioxide. Harmful if swallowed. Do not get product on skin or in eyes. Do not inhale fumes.

For product hazard information see the MSDS for the 3M™ Scotchcast™ 3570G-N (Parts A & B). Scan the code or use the URL link below:

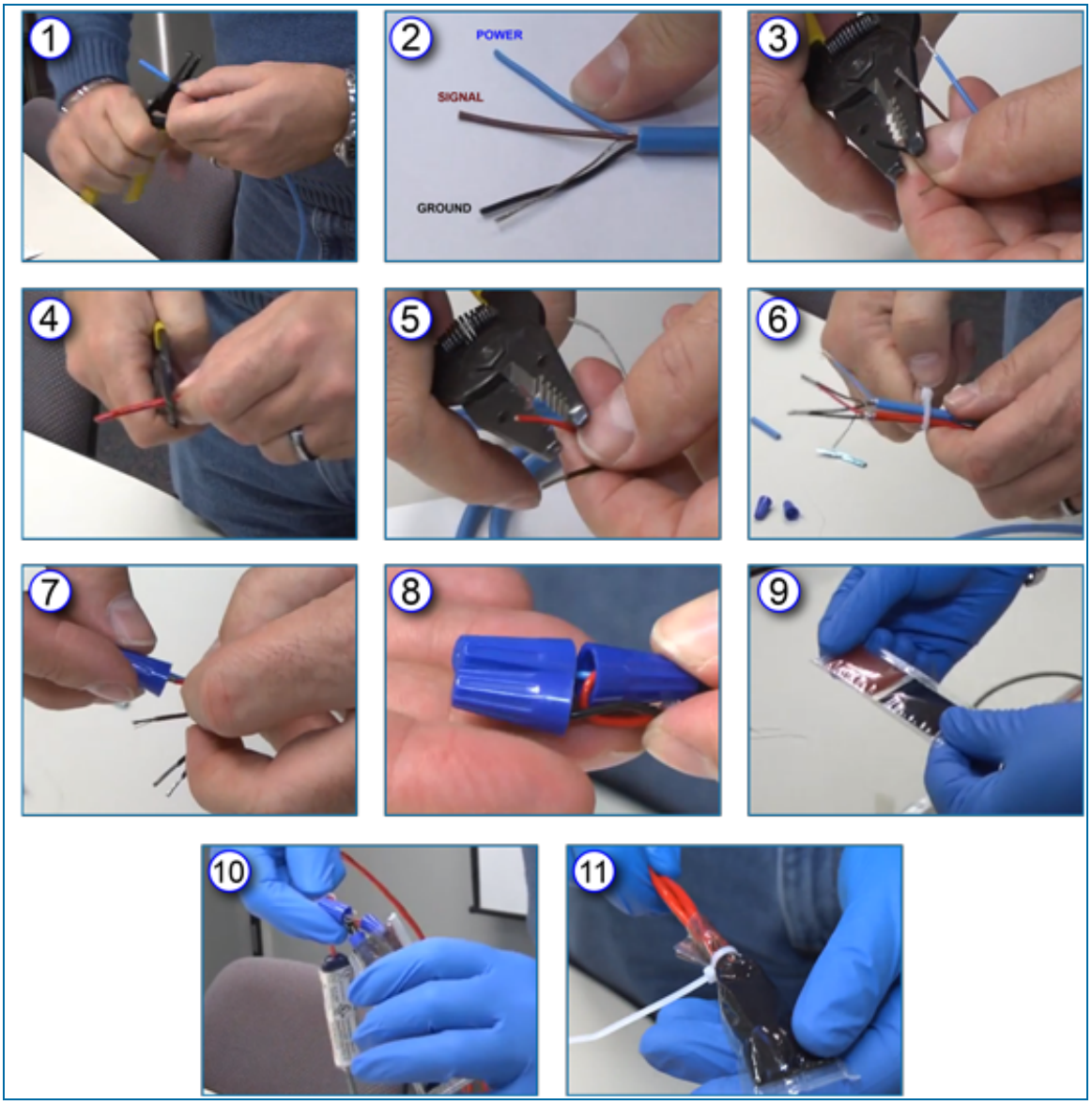
URL: https://multimedia.3m.com/mws/mediawebserver?mwsId=SSSSSuUn_zu8l00xMY_SNYteOv70k17zHvu9lxtD7SSSSSS--

9.3.6 Probe Floats

For more information on the correct installation of OPW-FMS probe floats for Product, Water and Aqueous Ethanol, refer to M00-040.00 Level Indicator Kit Procedure Guide.

9.3.7 Assembly Procedure

The procedure for assembling the wire connections and resin sealpacks is shown below:



Assembly of the the Epoxy Seal-pack for Waterproof Electrical Connections

NOTICE: It is VERY important to seal all probe and sensor connections in the junction box to prevent corrosion of the wires.

To make the connections waterproof, use the supplied Scotchcast™ epoxy-resin Insulating Resin Sealpacks. They are provided to seal the electrical connections from moisture and water and prevent corrosion of the connections. Install one for each cable connection.

1. Strip approximately 1.5 inches of the cable jacket from the end of the probe/sensor cable to expose the four (4) wires inside (power, signal ground and shield).

IMPORTANT: When stripping cables and wires do not cut so deep as to nick the wiring inside the jacket material.

2. There are four (4) wires inside the probe/sensor cable.
    - The Blue wire is the Power connection
    - The Brown wire is the Signal connection
    - The Black wire and Braided Shield are the Ground
3. Strip 0.5 inch of jacket material from the ends of the Blue, Brown and Black wires.
4. Strip approximately 1.5 inches of the cable jacket from the end of the Home-run cable (Belden 88760 or 88761) to expose the three (3) wires inside (Red = Power, Black = Signal, Braided Shield = Ground).
5. Strip 0.5 inch of jacket material from the ends of the Red and Black wires.
6. Place a wire tie wrap around both of the stripped cables about 1 inch from the end of the cable jackets. Pull the tie snug and cut the excess tie material at the clamp.
7. Connect the Power, Signal and Grounds of the probe/sensor cable to the Power, Signal and Ground of the Home-run cable together using the three (3) supplied wire nuts.
    - Twist the ends of the exposed wires together
    - Insert the twisted wires into the end of the wire nut
    - Turn the nut clockwise several turns until the wires are firmly attached

NOTE: Refer to the wiring diagrams in the product manual for specific information on probe/sensor wiring.

8. Fold one of the fastened wire nuts back as shown in the photo. This will allow the entire wire nut assembly to fit completely into the epoxy bag.

CAUTION: To prevent exposure to the chemicals in the epoxy packs, always wear protective gloves and safety glasses when handling the epoxy resin packs!

9. Prepare the epoxy resin sealpack.
    - Bend the sealpack until the barrier between the two resins weakens
    - Thoroughly mix the two (2) resins together for approximately two (2) minutes. The mixed epoxy will become warm to the touch.
    - Push all of the mixed resin to the bottom of the bag
    - Cut and tear the top of the bag to open
10. Insert the wire-nut assembly all the way into the bottom of the bag. Fold the bag tightly around the tied cables. Attach a second tie wrap around the bag just above the tie wrap holding the wires (this will prevent the wire-nut assembly from slipping out of the bag.

Move the epoxy around to thoroughly cover all of the wires and wire nuts inside the bag. Once the epoxy has set this will provide a secure, waterproof electrical connection and will prevent corrosion of the wiring connections.

Section 10 Dover Magnetostrictive Probe (DMP)

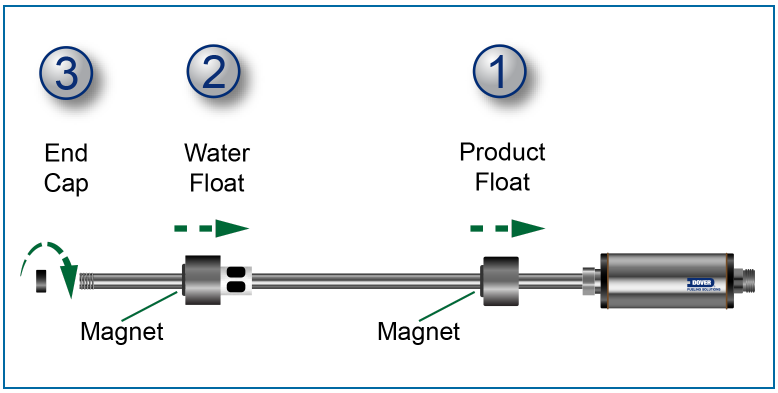
INFORMATION: For complete information on the installation, operation and maintenance of the Dover Magnetostrictive Probe, see M2040 DMP Probe Installation, Operation and Maintenance Manual in the FMS Technical Library.

The Dover Magnetostrictive Probe (DMP) is installed almost the same as a 924B Probe.

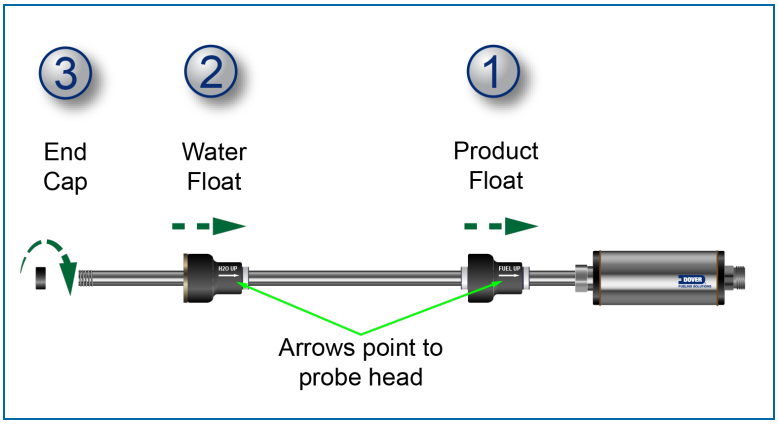
10.1 DMP Probe Installation

IMPORTANT: To prevent damage to the probe, be careful when you remove the probe from its packaging and when you install it in a tank. Do not let probe components hit the sides of manholes or tank openings. Make sure the stainless steel probe shaft does not get bent. This can cause incorrect indications in fluid levels.

IMPORTANT: If the fitting is not in the center of the tank, a Product Offset Calculation will be necessary. See "Product Offset Calculation" on page 74 for information.



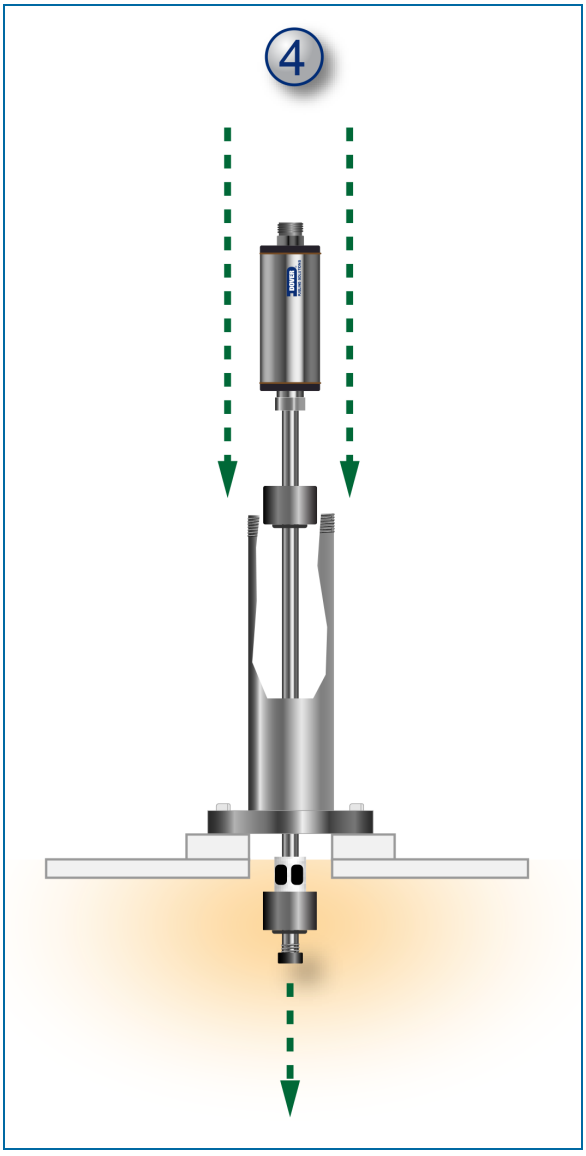
DMP Probe with OPW-FMS Floats



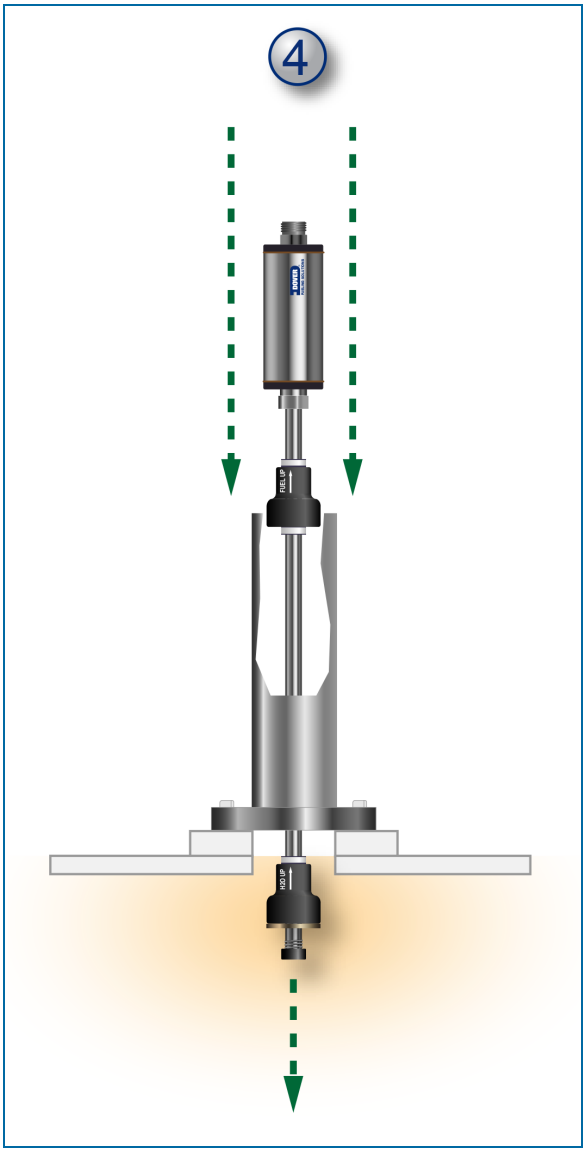
DMP Probe with ProGauge Floats

The DMP probe is shipped fully assembled. You can skip to step 4 to install an assembled probe. If it becomes necessary to disassemble the probe components, use steps 1-3 below to assemble the floats and end cap to the probe before you continue.

1. Put the Product Float on the probe shaft. Make sure the magnet side points toward the bottom of the probe shaft for FMS Floats. Make sure the arrow points toward the probe head for ProGauge floats.
2. Put the Water Float on the probe shaft (if applicable). Make sure the magnet side points toward the bottom of the probe shaft for FMS Floats. Make sure the arrow points toward the probe head for ProGauge floats.
3. Attach the End Cap to the end of the probe shaft. Turn it clockwise to tighten.



DMP Probe with FMS Floats



DMP Probe with ProGauge Floats

4. Carefully put the assembled probe down through the riser into the tank until the probe end cap touches the bottom of the tank.

NOTICE: Carefully lower the probe down into the tank. To prevent damage to the probe, do not let the probe fall and hit the bottom of the tank wall.

5. Connect the 7/8" probe cable connector to the probe.

NOTE: The DMP cable is 1.5 M (3.28 ft.) by default but can be ordered with a different specified length.

10.2 Spacer Assembly (6-3/4 RA SS) and Adjustment

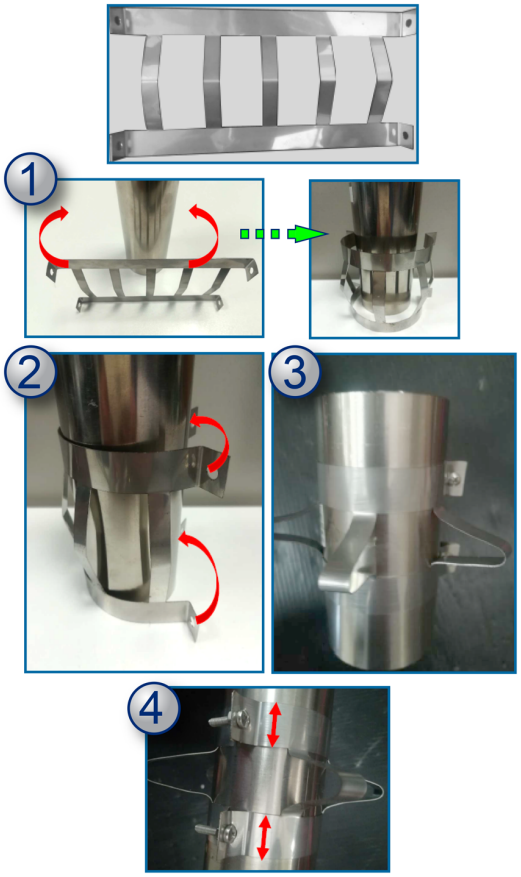
IMPORTANT: The minimum inner diameter for a riser is 52 mm (2.05 in.). This gives an allowance for the head gaskets so the probe can move freely inside the riser

The DMP Probe can be installed in a minimum 52 mm (2.05 in.) inner diameter riser without modification. If the probe is to be installed in a riser with an inner diameter up to 4-inches (101.6 mm), a spacer must be installed. This will keep the probe in the center of the riser and in a vertical position through the bottom of the tank.

The Probe Spacer kit contains:

- One (1) stainless steel, flexible spacer.
- Two (2) M3x8 screws
- Two (2) M3 nuts

DMP Spacer Assembly and Adjustment



NOTICE: Be careful to not cause damage to the probe label when you install or when you make adjustments to the spacer. The label contains important safety and product information.

To assemble and adjust the probe spacer:

1. Bend the probe spacer around the probe head.
2. Align the holes of the 90° bends of the top and bottom strips.
3. Put the two (2) screws through the two (2) pairs of holes and fasten with the two (2) nuts. Do not tighten the screws completely at this time.
4. To adjust the width of the spacer, move the top and bottom strips nearer to or away from each other. This will cause the outer diameter of the vertical strips to move in or out until you find the correct fit inside the riser. When the correct fit has been found, tighten the screws completely.

10.3 DMP Probe Cable Wiring to Nano I.S. Barrier

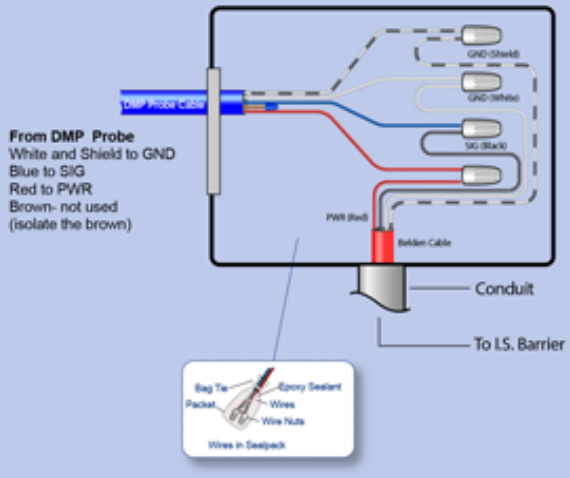
The illustrations below show the wiring of the DMP Probe "One-Wire" to typical field wiring a US installation in a weatherproof jucnction box and in an IP68 rated junction box for EU installations.

IMPORTANT: Belden 88770 field wiring is recommended for all new installations.

The illustration for Belden 88760 is shown for reference and should only be used where this type of site wiring already exists.

DMP Wiring to Belden 88770 Field Wiring

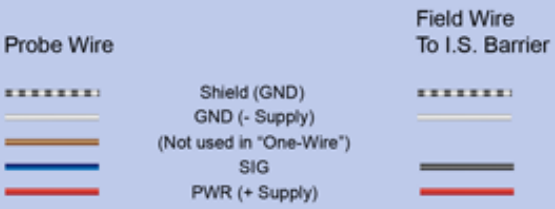
For North American Installations with Waterproof Junction Box



NOTE:
The cable shield must only be connected to the white wire at the barrier GND connection. The shield must be kept electrically isolated from the white wire in all other areas where the cables are spliced.

For ATEX installations, order the Belden 88770 cable jacket color in blue.

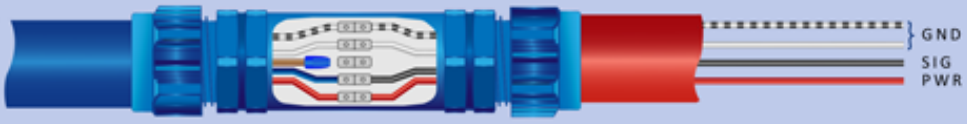
For EMEA Installations with IP68 Junction Box



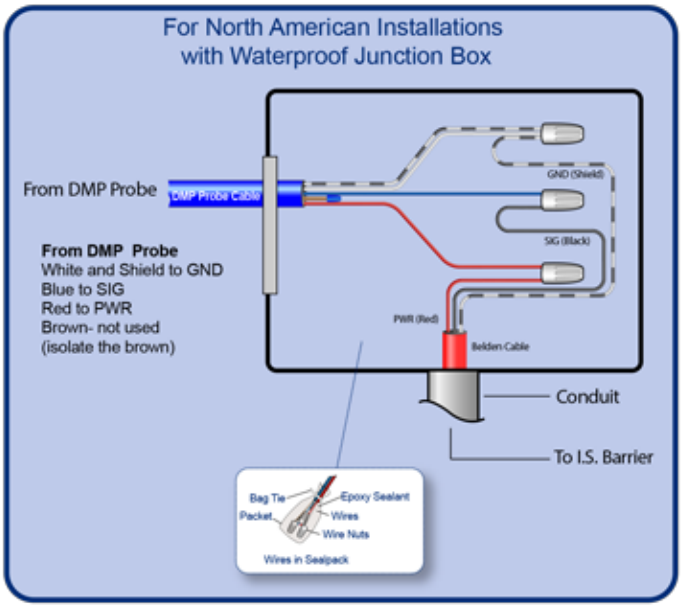
NOTE:
The cable shield must only be connected to the white wire at the barrier GND connection. The shield must be kept electrically isolated from the white wire in all other areas where the cables are spliced.

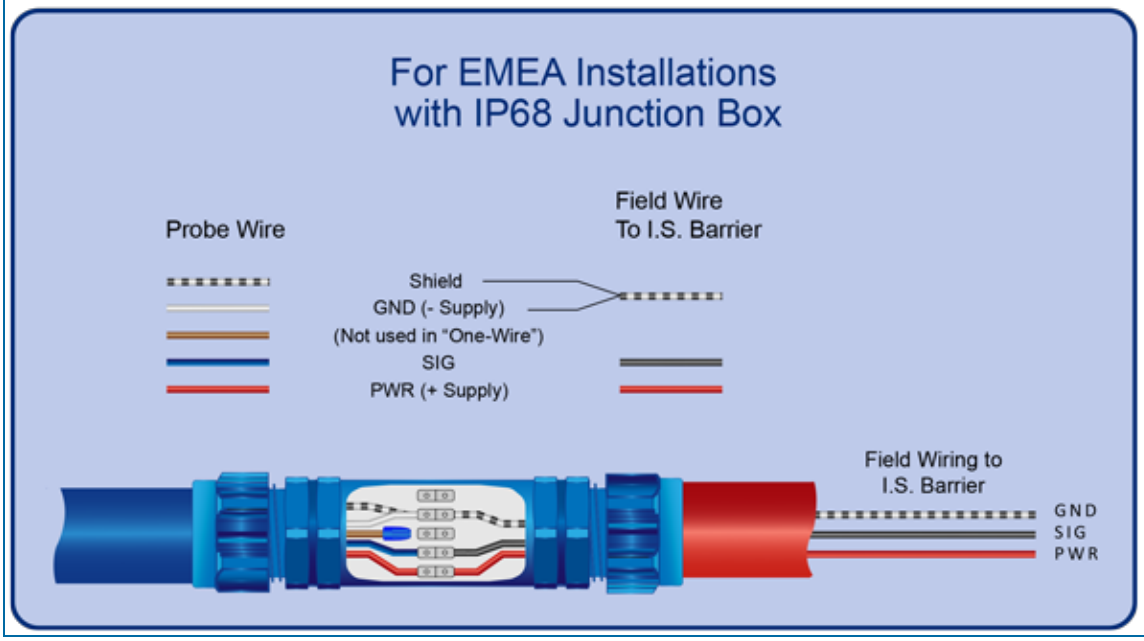
For ATEX installations, order the Belden 88770 cable jacket color in blue.

Field Wiring to I.S. Barrier



DMP wiring to Belden 88760 (or equivalent) Field Wiring





Section 11 7100V AST Flex Probe (for Integra 500 only)

11.1 Important Information

NOTICE: Be careful and do not cause damage to the Flex Probe during installation. Obey all instructions in this manual so you do not void the warranty. Always keep the diameter of the coils between 40 and 48 inches (approximately 1 [one] meter) when you unpack and install the Flex Probe.

NOTICE: The Flex Probe head and wiring must be installed in a weatherproof junction box with seal packs for wiring connections. You can void your warranty if you do not obey this instruction. See "Waterproof Electrical Connections" on page 85 for instructions on seal pack assembly and wiring.

11.2 Flex Probe Installation Demonstration

To watch the instructional video **OPW 7100V AST Flex Probe Installation Demonstration**, scan the QR code or use the URL below.

URL: https://www.youtube.com/watch?v=FDEemrRcXhI

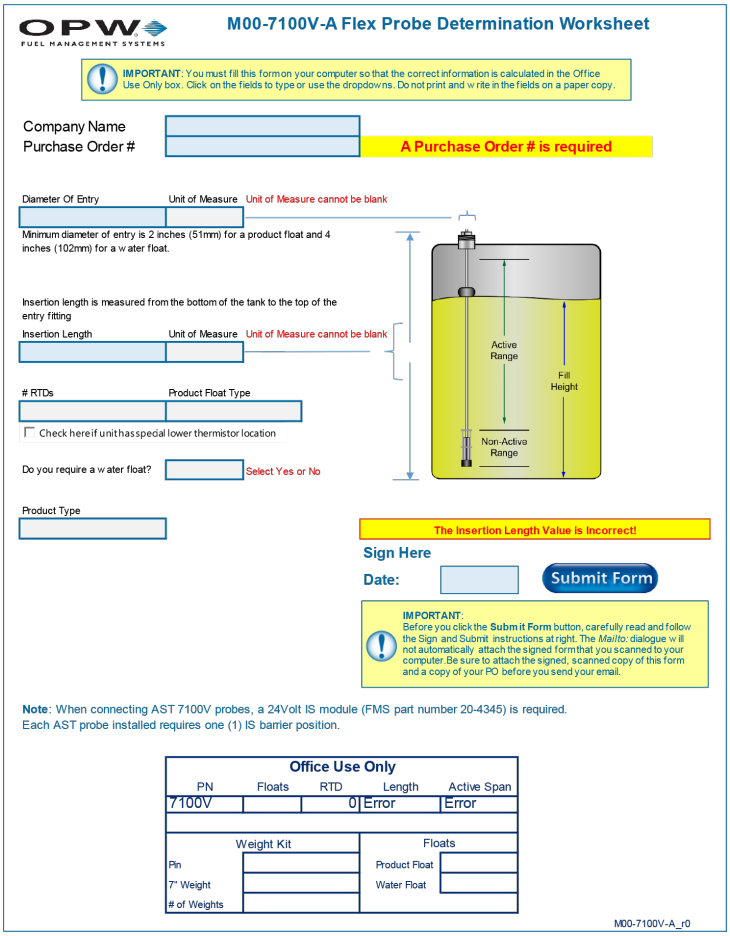
11.3 Model 7100V Flex Probe Specifications

Flex Probe Specifications	
Flex Probe Specifications Input Voltage:	23 - 28 VDC
Probe Length:	12’ to 70’ in one-inch increments
Enclosure Material:	PVDF
Rating:	IP68
Resolution:	0.010” (0.25 mm) Inventory Mode
Linearity:	+/- 0.01% of Full Scale +/- 0.010” (0.254 mm), whichever is greater
Repeatability:	+/- 0.001% of Full Scale +/- 0.00025” (0.64 mm), whichever is greater
Temperature Accuracy:	Absolute +/- 2°F (+/- 1°C)
Temperature Measurement:	Up to five (5) along the sensor span; Resolution: +/- 0.01°F (+/- 0.02°C)
Temperature Sensing:	-40°F to +150°F (-40°C to +66°C)
Operating Temperature:	-40°F to +158°F (-40°C to +70°C)
Environment:	NEMA 4-rated
Floats (not included) (refer to the Probe Floats section of the console installation manual):	Specifications based on 4” (10.2 cm) standard floats
Listings:	UL; Intrinsically Safe; ATEX; IECEx
I.S. Barrier:	24V; OPW P/N: 20-4345
Multi-Drop Capability:	Requires one I.S. Barrier channel for each probe
Connection:	Black and Shield – Ground, Red - Power

11.4 How to Order

For the Flex Probe to work correctly in your ATG system you must order the correct length. If the probe is too long, it will touch the bottom of the tank and bend. This will cause incorrect readings. If the probe is too short, the product measurement range will be incorrect.

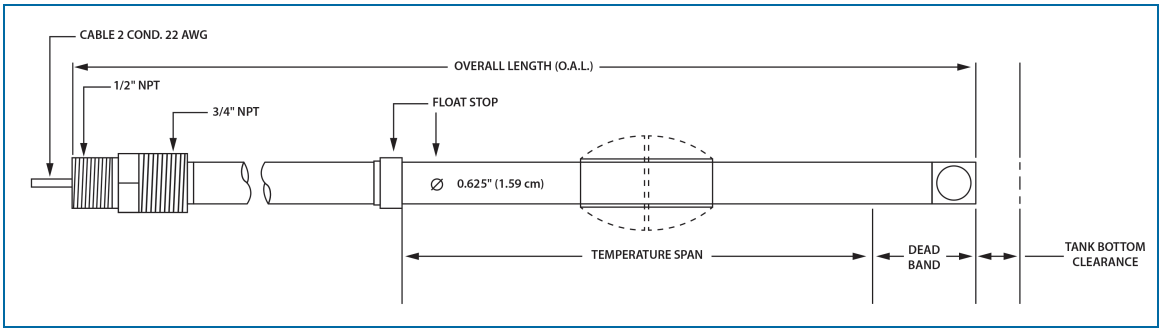
11.4.1 M00-7100V-A Flex Probe Determination Worksheet



M00-7100V-A Flex Probe Determination Worksheet

You can download this interactive form from the FMS Technical Library: M00-7100V-A Flex probe Determination Worksheet

11.4.2 Calculate the Flex Probe Length



Flex Probe Dimensions

- The Flex Probe has a 3/4-inch NPT male thread for installation. You must get the correct fittings to adapt the tank opening to a 3/4-inch NPT female thread.

IMPORTANT: Do not use the tank's vent opening to install the flex probe.

- Install the fitting in the tank opening.
- Use a plumb bob or tape measure to find the distance (in inches) from the top of the 3/4-inch NPT flange to the bottom of the tank. Keep this measurement (this is the Insertion Length on the form).

NOTE: Flex probes are ordered by overall length (OAL). Overall length is the distance from the top of the 3/4-inch NPT probe bushing to the tip of the probe. The M00-7100V-A Flex Probe Determination Worksheet automatically calculates the overall length from the Insertion Length measurement. This length is used by FMS Customer Service to order the correct length for your probe and tank.

Overall Length	*Dead Band*	*Tank Bottom Clearance*
51" - 144" (130 - 366 cm)	6.00" (15.2 cm)	1.00" (2.5 cm)
145" - 288" (368 - 732 cm)	8.00" (20.3 cm)	2.00" (5.1 cm)
289" - 432" (734 - 1097 cm)	12.00" (30.5 cm)	3.00" (7.6 cm)
433" - 600" (1100 - 1524 cm)	14.00" (35.6 cm)	4.00" (10.2 cm)
601" - 720" (1527 - 1778 cm)	17.00" (43.2 cm)	5.00" (12.7 cm)
721 - 840" (1831 - 21134 cm)	19.00" (48.3 cm)	6.00" (15.2 cm)

11.4.3 Cable Requirements

IMPORTANT: There are some electrical code requirements that intrinsically safe wiring must have a blue jacket for identification. Be sure to carefully read and obey the electrical code requirements for your installation location.

- If your full cable length requirement is 750 feet (229 meters) or less, you can use Belden #88761.
- If your full cable length requirement is up to 1,000 feet (305 meters) you must use Belden #8760, #88760 or #8761.

11.4.4 Float Specifications

There are three types of floats that can be used with the Flex Probe: Product, Water for Diesel, and Water for Gasoline.

The two types of water floats are NOT interchangeable. Because of the difference in product density, the Water for Diesel floats are heavier than the Water for Gasoline floats. You must select the correct float for the type of fuel in the tank where the Flex Probe will be installed. Select the applicable Product Type from the Product Type dropdown list on the M00-7100V-A Probe Determination Worksheet.

IMPORTANT: If you select the wrong Product Type, you will get incorrect water measurements that can have an unwanted effect on product measurements.

NOTE: Water float assemblies for AST probes are only available for use in 4-inch (10.2 cm) riser installations.

7100V Flex Probe Float Specifications	
AST Flex Probe Product Floats:	2” (5.1 cm) product only: 30-1503-01 4”(10.2 cm) product only: 439485
AST Flex Probe Water Float for 7” (17.9 cm) weight:	Gas 4” (10.2 cm): 30-0120-GAS Diesel 4” (10.2 cm): 30-120-DSL
AST Flex Probe Water Float for 13” (33 cm) weight:	Gas 4” (10 cm): 30-0121-GAS Diesel 4” (10 cm): 30-121-DSL

7100V Flex Probe Float Specifications	
AST Flex Probe Water Float for 16” (40.6 cm) weight:	Gas: 30-0124-GAS Diesel: 30-0124-DSL
AST Flex Probe Water Float for 19” (48.3 cm) weight:	Gas: 30-0127-GAS Diesel: 30-0127-DSL

IMPORTANT: The selections you make on the M00-7100V-A Flex Probe Determination Worksheet will automatically show the weight kit and float part numbers for Customer Service to order. Be sure you make the correct selections on the form.

11.5 Flex Probe Installation

11.5.1 Safety

CAUTION: Read and obey all instructions and procedures in this manual.

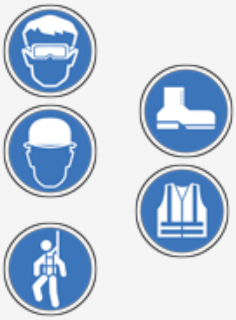
All OPW automatic tank gauge systems and components must be installed in accordance with the National Electric Code (NFPA 30A and 70) and all local codes.

Understand and obey OSHA regulations to work safely in a potentially hazardous environment.

11.5.2 Personal Protective Equipment

CAUTION: The PPE in the list below must be used when you install the 7100V Flex Probe in an AGT:

- Safety Glasses
- Safety Shoes
- Hard Hat
- Reflective Safety Vest
- Safety Harness



11.5.3 Prepare for Installation

1. Measure the product level in the tank. Keep the tank out of operation so the product level does not change.
2. Record the probe information found on the probe serial number tag.
3. Locate standard plumbing fittings to adapt your tank opening (2-inch or 4-inch) to the 3/4-inch NPT necessary for the probe.
    a. Standard: 2-inch or 4-inch male flange and 3/4-inch reducer coupling.
    b. Compression fitting assembly (see Compression Fitting Assembly and Installation below).
4. Clean unwanted sealant from the inside of the fittings. Do not get sealant on the probe shaft during installation.

Yellow Tag

NOTE: Do not remove the yellow tag inside of the Flex probe junction box.

11.5.4 Flex Probe Wiring

1. Install one data cable for each probe. There can be no splices between the probe junction box and the console. More than one Flex Probe Cables can be in one conduit. Use labels to mark the TANK NUMBER on each cable at the console.
2. Keep 16 inches (40.6 cm) of extra cable inside the probe junction box.
3. Install EY sealing fittings with fiber dam and sealing compound for each junction box conduit.

11.5.5 Install the Probe in the Tank

Flex Probe Installation Steps

NOTICE: It is necessary to have a minimum of two (2) people to install the Flex Probe.

Use a coupling at the 3/4-inch NPT thread to hold the probe and install the 1/2-inch section in a waterproof junction box. Do not let the probe material get expanded. This can cause damage to the internal electronic head components. Do not try to hold the probe only by the 1/2-inch threaded bushing section.

Carefully carry the probe to the top of the tank as it is rolled-up. Do not remove the tie-wraps. Carry the floats and remaining installation components to the top of the tank.

1. Cut only the tie wrap (Labeled #1) that holds the tip of the probe to the rest of the coil. This will give you enough length to install the float and related hardware.
2. Assemble the remaining adapter hardware that the float will not fit through and slide this adapter assembly on the probe. Do not apply thread sealant at this time.
3. Install the product float on the probe shaft with the magnet towards the bottom of the probe.
4. Install the weight on the probe shaft with the recess toward the bottom of the probe.
5. Install additional weights (if applicable).
6. Install the weight-retaining pin through the hole in the tip of the probe.
7. Position the coiled probe so that the coil is vertical with the float in front of you. Hold the adapter hardware and carefully feed the weight and floats into the tank opening. Be careful not to scratch the probe shaft during the installation.
8. Carefully slide the flange down into the bung and thread it in place.
9. Cut the next tie wrap (Labeled #2) and continue to feed the probe into the tank.
10. While you slowly uncoil the probe, continue to cut the tie wraps in order until the probe is fully installed in the tank.
11. Hand-tighten the adapter hardware (reducer coupling/tank flange) and the 3/4-inch NPT threaded portion of the probe head. Thread sealant is not required on the nylon probe bushing.

NOTICE: Make sure you do not cross-thread the reducer coupling and 3/4-inch NPT section of the probe head. This can cause damage to the nylon bushing.

Hold the probe stable and only turn the adapter. DO NOT let the probe (with the weights installed at the bottom) get twisted inside the tank. This can cause damage to the installed probe.

12. Write down the serial number of the probe found on the yellow tag. Keep this in a secure place for reference.

11.5.6 Complete the Installation

1. Connect the probe wiring bushing 1/2-inch NPT to the junction box using a short length (18 inches [45.7 cm] max) of flex conduit.
2. Connect the probe to the cable in the junction box and console. Verify that the probe is operating correctly at the console.
3. Waterproof the probe connections at the junction box with the epoxy seal-pack (see M00-390008, Waterproof Electrical Connections for detailed instructions on the seal pack assemblies) and close the junction box.

11.6 Compression Fitting Assembly and Installation

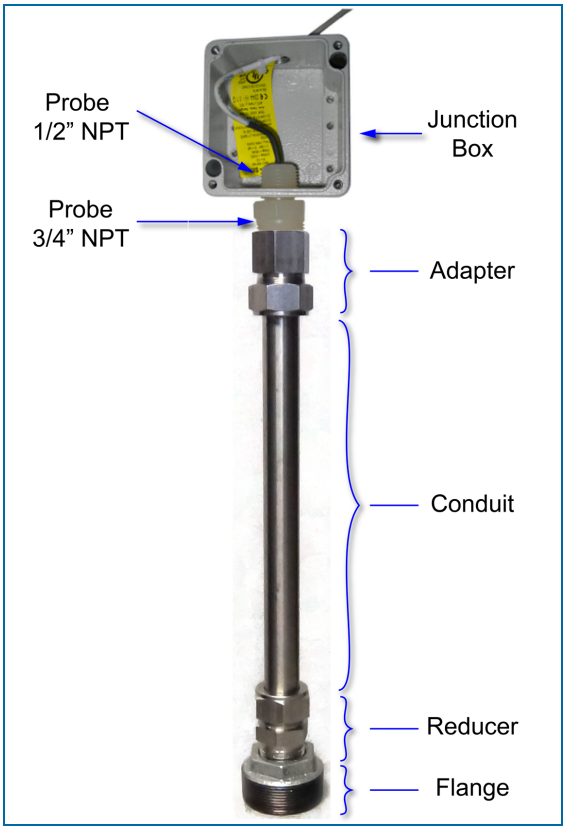
The compression fitting assembly lets you make small adjustments to the length of the probe in the tank. This will be necessary because of temperature changes or if the flexible material of the probe becomes expanded in time.

NOTE: OPW-FMS does not sell these items. These components are usually available at home improvement and electrical/plumbing supply outlets.

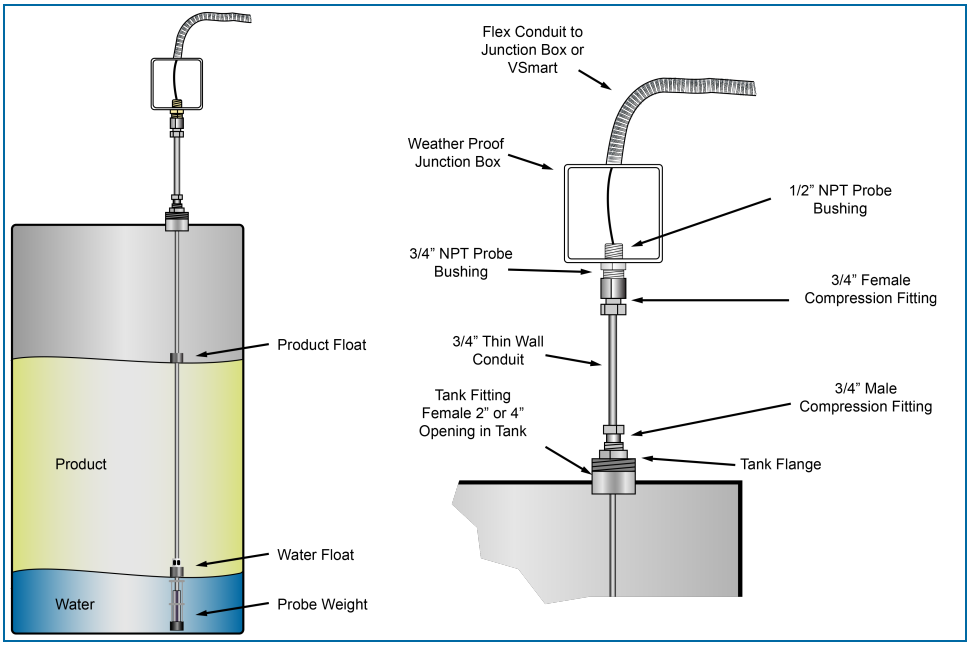
Because of the effects of weather, it is recommended to use stainless steel components for this function.

Compression Fitting Components

Compression Fitting Component Specifications	
Adapter	3/4-inch NPT female stainless steel conduit compression fitting
Reducer	3/4-inch NPT male stainless steel conduit compression fitting
Conduit	Stainless steel thin-wall conduit (¾” diameter, 18” length)
Flange	For 2 inch or 4 inch tank opening



Compression Fitting Assembly with Probe and Junction Box



Compression Fitting Installation

Section 12 Sensor Support

The Integra system supports OPW-FMS Smart Sensors that use IntelliSense™ Technology. The OPW smart sensors can monitor all contained areas of the fuel-storage system: tank interstice, piping sumps, STP containment sumps, dispenser sumps and pans, monitoring wells and site locations. Sensors connected to the I.S. barrier are automatically detected and identified by the console.

12.1 IntelliSense™ Technology

This technology lets the Integra's internal I.S. barrier and external VSmart automatically find the sensor's connection, type and status. IntelliSense will minimize user entry errors and identify hardware issues with minimal troubleshooting.

IMPORTANT: Seal packs and weatherproof junction boxes are REQUIRED with ALL I.S. field connections.

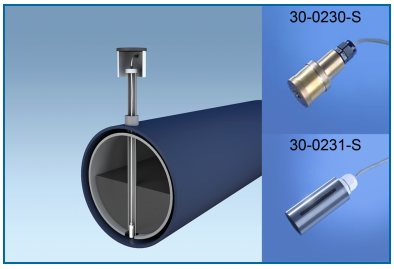
12.2 Smart Sensors for Integra

Part Number	*Description*
30-0230-S & 30-0231-S	Interstitial Sensor-Float Switch (Plastic/Brass)
30-0231-L	Sump Sensor-Float Switch - (Large Plastic)
30-0232-D-10&20	Dual Float Non-Discriminating Dispenser Sump & STP Sump Sensors
30-0232-DH-10_20	Discriminating Dispenser Sump & STP Sump Sensors
30-0232-D-XXB	Dual Float Brine Sensor for Containment Sump & for Fiberglass Tanks
30-0234-HW-01	Interstitial Hydrocarbon Liquid with Water Indicator
30-0234-HW-XX	Hydrocarbon Liquid Sensor with water indicator (6, 15 and 24 ft. lengths)
30-0235-V	Hydrocarbon Vapor Sensor
30-0236-LW	Discriminating Interstitial Sensor (Optical)

12.3 Interstitial Level Sensor

Smart Sensor Equipped with Intellisense™ Technology

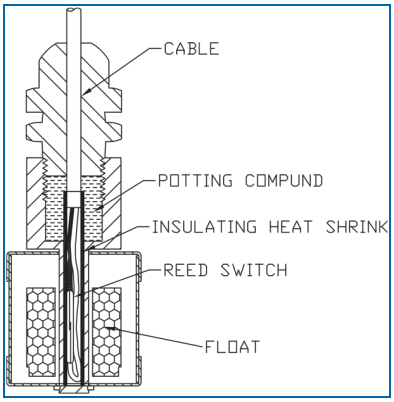
30-0230-S Liquid Only Float Sensor (Brass) & 30-0231-S Interstitial Sensor-Float Switch



Description

The primary function of these sensors is to sense liquid in the interstitial area of a double-walled steel tank (these sensors are not for use in a double-walled fiberglass tank). A float inside the sensor moves up when the liquid level increases. The float switch will operate and cause an alarm condition in the controller. The 30-0230-S is made of brass and the 30-0321-S is made of a chemical resistant, non-metallic material.

These sensors can also be used in sumps, fuel dispenser pans and other locations where there is liquid that could indicate that a leak has occurred. These sensors can also be used together with a vapor sensor (30-0235-V) to monitor wet wells to make sure that there is a normal liquid level. If there is a break in the cable it will cause an alarm condition in the system.



Specifications	
Primary Use:	30-0230-S: STP Sumps and Fuel Dispenser Pans 30-0231-S: Interstitial Area
Alternate Use:	30-0230-S: Steel Tank Interstitial 30-0231-S: Sumps and Fuel Dispenser Pans

Specifications	
Detects:	Liquid
Operating Temperature:	-20°C to +50°C (-4°F to +122°F)
Dimensions - 30-0231-S	Diameter: 1.3 inches (3.4cm), Length: 3.9 inches (10 cm)
Cable Requirements:	Belden #88760 or Alpha #55371 4.5m (15 feet) of gas & oil resistant cable to the inline ISIM + 1.3m (4 feet) ISIM tail.
Maximum Wiring Length*:	1,000' (305 m) field wiring
Alarm Threshold Configuration:	Fully Automatic
Diagnostic Reading on sensor setup:	**0 - 0.5** (normal), **485 - 495** (in alarm)
Multi-Drop Restriction	See "Nano Mixed Multi-drop Installation" on page 1
Connections:	Red = Power, Black = Signal, Shield = Ground

NOTE: *This is the maximum length of wire to be used to connect all sensors on one channel. This length includes the wire from the VSmart to each sensor board in the string.

Installation

WARNING: Make sure you read and fully understand the warnings and information found in the **Hazardous Areas** section of your console's Installation Guide before you install or do the servicing of this sensor.

CAUTION: ALWAYS obey Local and National Electrical Codes applicable to the installation location.

Make sure that the cables (gas and oil resistant OPW Fuel Management Systems part # 12-1030) from the field wiring to the controller are in conduit that is dedicated to intrinsically safe wiring.

Use wire-nuts and epoxy-resin seal-packs for field connections (refer to M00-390008 Waterproof Electrical Connections for information).

NOTE: If this sensor is used to monitor a normally dry well, use a meter to set the float position so the sensor is in a closed position when there is NO liquid level (the float will be in the lower position). To monitor a normally wet well, use a meter to set the float so that the sensor is in a closed condition WITH a liquid level (the float will be in the upper position).

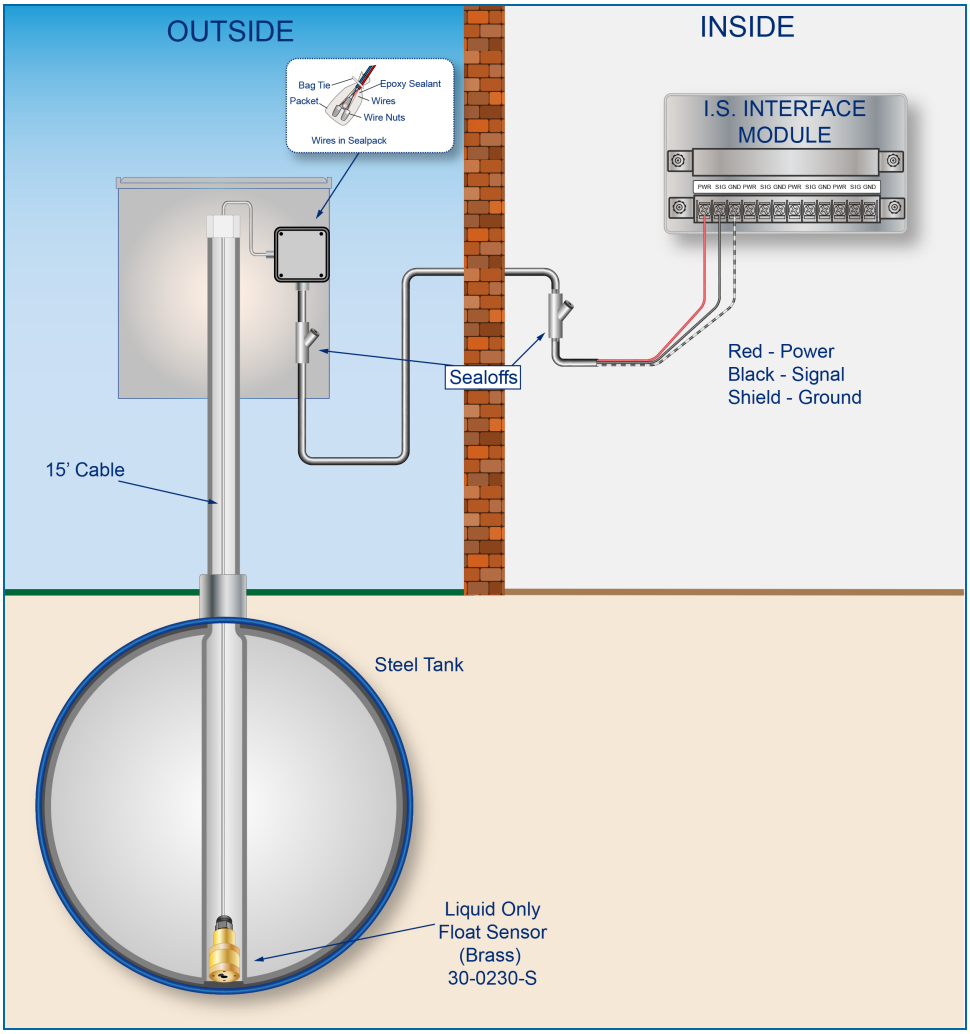
- This sensor uses ONE Controller Interface I.S. Module position
- Start with the Connections table and “Typical Installation" drawing below.
- Make sure the sump pit or pan is dry.
- Install the sensor approximately 1/2” (1.3 cm) above the bottom of the sump/pan. Attach the sensor wire to a pipe or bracket with a tie wrap.
- Connect the sensor cable to the sensor.
- Connect the sensor wires to the field wires in the junction box. Use the supplied cable gland and silicon wire nuts.
- Seal the electrical connections with the epoxy seal packs (refer to M00-390008 Waterproof Electrical Connections for instructions).
- Install explosion-resistant sealing fittings at both ends of the conduit. Refer to the **Probe-Cable Seal-offs** section of the console's Installation Guide for instructions.

Connections

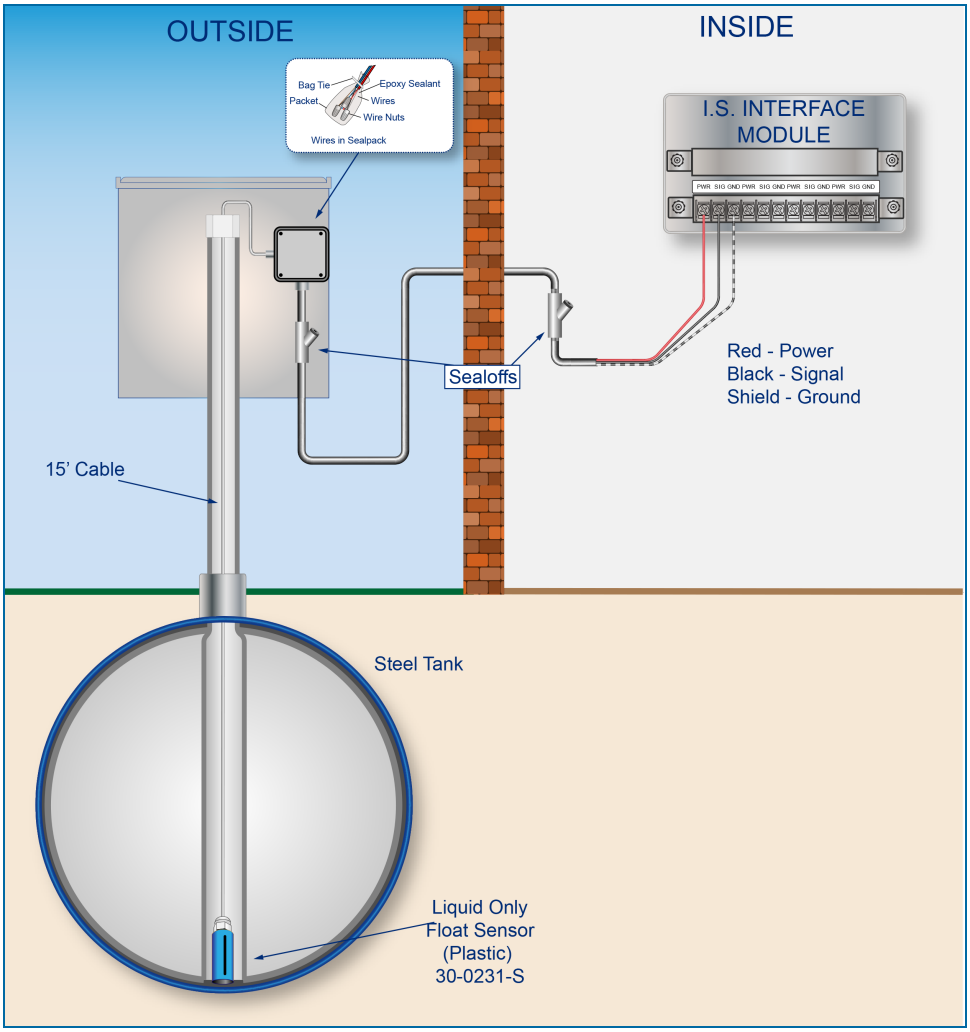
Sensor Wire Color	*12V Smart Sensor Interface Channel*
Red	Power
Black (hydrocarbon sensor)	Signal
Shield (or 3rd conductor)	Ground

Typical Installation Drawings

30-0230-S



30-0231-S



Controller Setup

The sensor must be **Auto Detected** on the console (Refer to the M2011 Nano Configuration Manual). Alarm thresholds are configured automatically through the *Intellisense* mechanism between the sensor and the console.

Float Sensor Test

CAUTION: Use caution to prevent dangerous conditions when you do work in a hazardous area.

Make sure that the area has sufficient airflow when you do a test or remove contamination from the sensor. Make sure there are no open flames or hot surfaces near the work area.

Sensor installed in a normally dry well

- Put the float in the HIGH position. This will cause an alarm condition in the controller.
- Put the float back in the LOW position. Make sure that the controller is not in an alarm condition.

Sensor installed in a normally wet well

- Put the float in the LOW position. This will cause an alarm condition in the controller.
- Put the float back in the HIGH position. Make sure that the controller is not in an alarm condition.

If the controller does not go into an alarm condition, look to see if the thresholds are correctly programmed in the system. Look to see if the float is in the correct position (refer to the applicable instruction above). A sensor or wiring fault will cause a system alarm. Do a continuity test in the wiring and junction boxes. Make sure there is continuity with no short circuits.

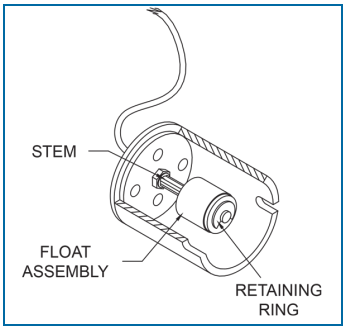
12.4 Single Level Sump Sensor-Float Switch

Smart Sensor Equipped with Intellisense™ Technology

30-0231-L

Description

The primary function of the single-level sensor is to sense liquid in sumps, fuel dispenser pans and other locations where there is liquid that could indicate that a leak has occurred. A float inside the sensor moves up when the liquid level increases. The float switch will operate and cause an alarm condition in the controller. If there is a break in the cable it will cause an alarm condition in the system.



Specifications	
Primary Use(s):	Sumps and Fuel Dispenser Pans
Detects:	Liquid
Operating Temperature:	-40°C to +70°C (-40°F to 158°F)
Dimensions:	Diameter: 7.4 cm (2.90 inches), 9.5 cm (3.70 inches)

Specifications	
Cable Requirements:	Belden #88760 or Alpha #55371 3.6m (12 feet) of gas & oil resistant cable to the inline ISIM + 1.3m (4 feet) ISIM tail.
Maximum Wiring Length*:	305 m (1,000 ft.) field wiring
Alarm Threshold Configuration:	Fully Automatic
Diagnostic Reading on sensor setup:	**0 to 0.5** (normal), **485 to 495** (in alarm)
Multi-Drop Restriction	See "Nano Mixed Multi-drop Installation" on page 1
Connections:	Red = Power, Black = Signal, Shield = Ground

NOTE: *This is the maximum length of wire to be used to connect all sensors on one channel. This length includes the wire from the VSmart to each sensor board in the string.

Installation

WARNING: Make sure you read and fully understand the warnings and information found in the **Hazardous Areas** section of your console's Installation Guide before you install or do the servicing of this sensor.

CAUTION: ALWAYS obey Local and National Electrical Codes applicable to the installation location.

Make sure that the cables (gas and oil resistant OPW Fuel Management Systems part # 12-1030) from the field wiring to the controller are in conduit that is dedicated to intrinsically safe wiring.

Use wire-nuts and epoxy-resin seal-packs for field connections (refer to M00-390008 Waterproof Electrical Connections for information).

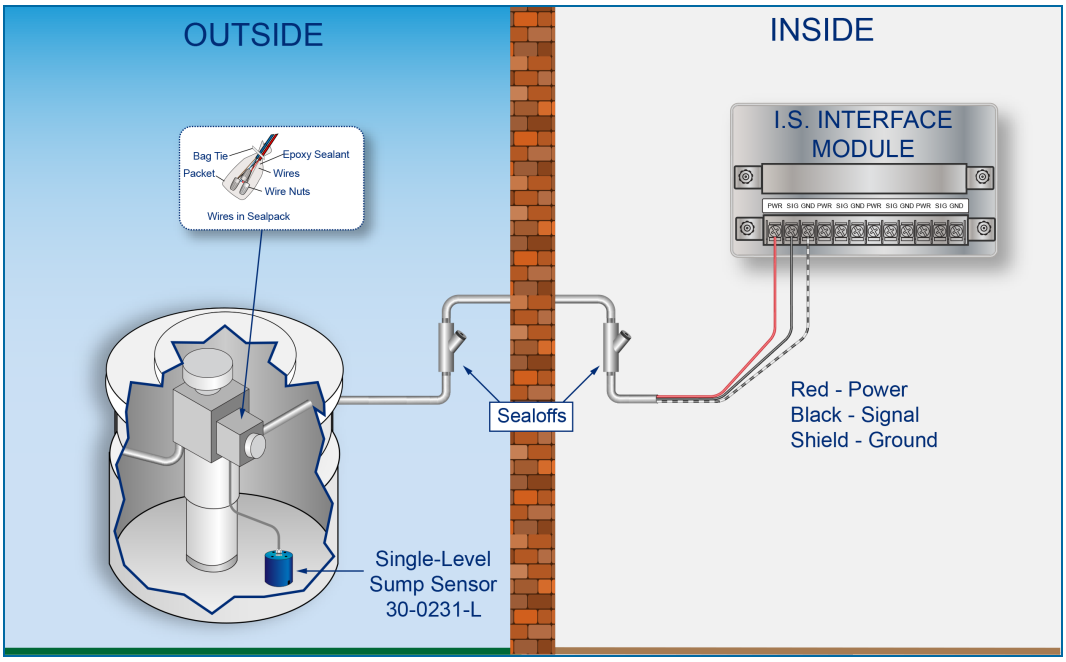
NOTE: If this sensor is used to monitor a normally dry well, use a meter to set the float position so the sensor is in a closed position when there is NO liquid level (the float will be in the lower position). To monitor a normally wet well, use a meter to set the float so that the sensor is in a closed condition WITH a liquid level (the float will be in the upper position).

- This sensor uses ONE Controller Interface I.S. Module position
- Start with the Connections table and “Typical Installation" drawing below.
- Make sure the sump pit or pan is dry.
- Install the sensor on the bottom of the sump/pan. Attach the sensor wire to a pipe or bracket with a tie wrap.
- Connect the sensor cable to the sensor.
- Connect the sensor wires to the field wires in the junction box. Use the supplied cable gland and silicon wire nuts.
- Seal the electrical connections with the epoxy seal packs (refer to M00-390008 Waterproof Electrical Connections for instructions).
- Install explosion-resistant sealing fittings at both ends of the conduit. Refer to the **Probe-Cable Seal-offs** section of the console's Installation Guide for instructions.

Connections

Sensor Wire Color	*12V Smart Sensor Interface Channel*
Red	Power
Black (hydrocarbon sensor)	Signal
Shield (or 3rd conductor)	Ground

Typical Installation Drawing



Controller Setup

The sensor must be **Auto Detected** on the console (Refer to the M2011 Nano Configuration Manual). Alarm thresholds are configured automatically through the *Intellisense* mechanism between the sensor and the console.

Float Sensor Test

CAUTION: Use caution to prevent dangerous conditions when you do work in a hazardous area.

Make sure that the area has sufficient airflow when you do a test or remove contamination from the sensor. Make sure there are no open flames or hot surfaces near the work area.

- Turn the sensor so the bottom opening points up and wait for a minimum of two (2) minutes.
- Make sure that the controller is not in an alarm condition.
- Put the sensor back in its normal position. Make sure that the alarm condition stops.

If the controller does not go into an alarm condition, look to see if the thresholds are correctly programmed in the system. Look to see if the float is in the correct position (refer to the applicable instruction above). A sensor or wiring fault will cause a system alarm. Do a continuity test in the wiring and junction boxes. Make sure there is continuity with no short circuits.

12.5 Dual Float Non-Discriminating Sensors

Smart Sensor Equipped with Intellisense™ Technology

30-0232-D-10 Dispenser Sump Sensor & 30-0232-D-20 STP Sump Sensor

Description

IMPORTANT: This float body is the same as the 30-0232-D-10B / D-20B and 30-0232-DH-10 / DH-20 (DH-XX has a carbon-polymer strip in the bottom). Look at the label to make sure you have the correct sensor for the applicable function.

The primary function of the Dual Float Non-Discriminating Sensor is to sense liquid hydrocarbons and water in sumps, fuel dispenser pans and other locations where there is liquid that could indicate that a leak has occurred. This sensor looks almost the same as the 30-0232-DH-XX but is non-discriminating. This means that the sensor does *not* use a carbon/polymer material to sense liquid hydrocarbons. Use the D-10 on fuel dispenser pans and transition sumps. Use the D-20 in tank sump pits. Two (2) float switches are used in the body of the sensor to sense low and high liquid levels. If there is a break in the cable it will cause an alarm condition in the system.

Specifications	
Primary Use(s):	D-10: Fuel Dispenser Pan/Sump D-20: STP Sumps
Alternate Uses:	D-10: STP Sumps D-20: Fuel Dispenser Pan/Sump

Specifications	
Detects:	Low Liquid, High Liquid, Fuel (non-discriminating)
Operating Temperature:	-40°C to +70°C (-40°F to 158°F)
D-10 Dimensions: D-20 Dimensions:	Diameter: 5.8 cm (2.3 in.), Length: 28.2 cm (11.1 in.) Diameter: 5.8 cm (2.3 in.), Length: 53.6 cm (21.1 in.)
Float Requirements:	Low: 3.8 cm (1.5 in.), High: 27.9 cm (11 in.)
Cable:	Belden #88760 or Alpha #55371 3.6m (12 feet) of gas & oil resistant cable to the inline ISIM + 1.3m (4 feet) ISIM tail.
Maximum Wiring Length*:	305 m (1,000 ft.) field wiring
Alarm Threshold Configuration:	Fully Automatic
Diagnostic Reading on sensor setup:	**12 to 13** (normal), **3 to 4** (lower float in alarm - raised), **1 to 2** (upper and lower float in alarm - raised)
Multi-Drop Restriction	See "Nano Mixed Multi-drop Installation" on page 1
Connections:	Red = Power, Black = Signal, Shield = Ground

NOTE: *This is the maximum length of wire to be used to connect all sensors on one channel. This length includes the wire from the VSmart to each sensor board in the string.

Installation

WARNING: Make sure you read and fully understand the warnings and information found in the **Hazardous Areas** section of your console's Installation Guide before you install or do the servicing of this sensor.

CAUTION: ALWAYS obey Local and National Electrical Codes applicable to the installation location.

Make sure that the cables (gas and oil resistant OPW Fuel Management Systems part # 12-1030) from the field wiring to the controller are in conduit that is dedicated to intrinsically safe wiring.

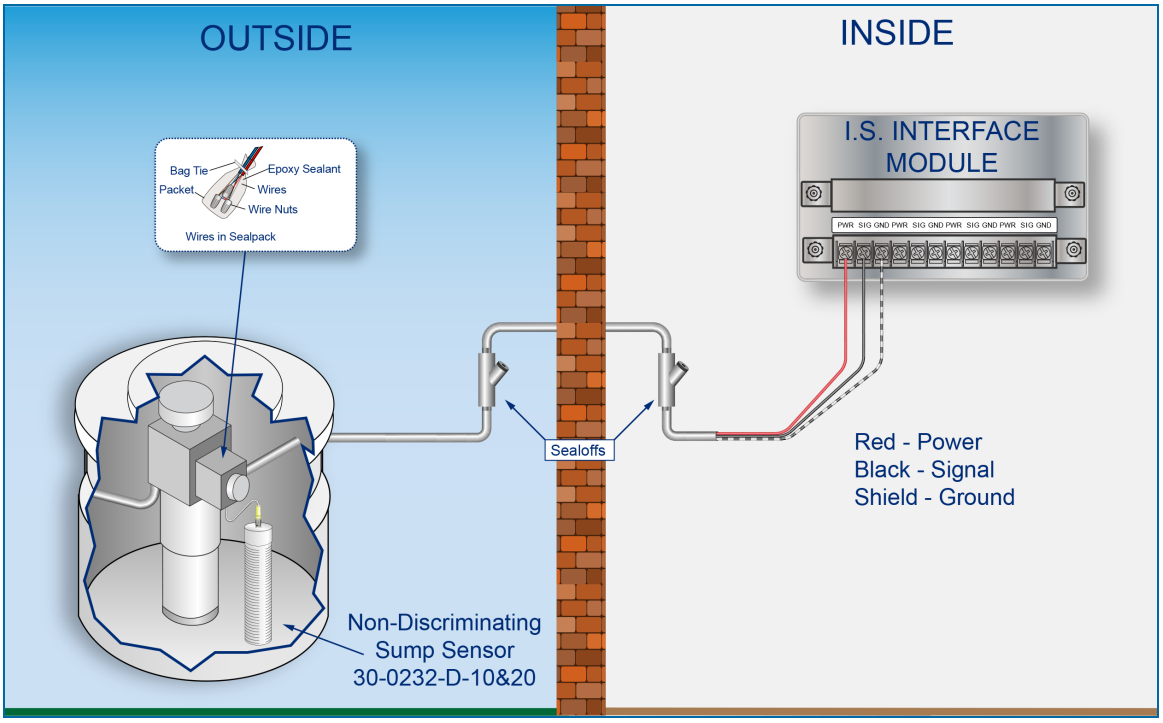
Use wire-nuts and epoxy-resin seal-packs for field connections (refer to M00-390008 Waterproof Electrical Connections for information).

- This sensor uses ONE Controller Interface I.S. Module position
- Start with the Connections table and “Typical Installation" drawing below.
- Make sure the sump pit or pan is dry.
- Install the sensor so that it touches the bottom of the sump pit or pan.
- Connect the sensor cable to the sensor.
- Connect the sensor wires to the field wires in the junction box. Use the supplied cable gland and silicon wire nuts.
- Seal the electrical connections with the epoxy seal packs (refer to M00-390008 Waterproof Electrical Connections for instructions).
- Install explosion-resistant sealing fittings at both ends of the conduit. Refer to the **Probe-Cable Seal-offs** section of the console's Installation Guide for instructions.

Connections

Sensor Wire Color	*12V Smart Sensor Interface Channel*
Red	Power
Black (hydrocarbon sensor)	Signal
Shield (or 3rd conductor)	Ground

Typical Installation Drawing



Controller Setup

The sensor must be **Auto Detected** on the console (Refer to the M2011 Nano Configuration Manual). Alarm thresholds are configured automatically through the *Intellisense* mechanism between the sensor and the console.

Float Sensor Test

CAUTION: Use caution to prevent dangerous conditions when you do work in a hazardous area.

Make sure that the area has sufficient airflow when you do a test or remove contamination from the sensor. Make sure there are no open flames or hot surfaces near the work area.

Sensor installed in a normally dry well

- Put the float in the HIGH position. This will cause an alarm condition in the controller.
- Put the float back in the LOW position. Make sure that the controller is not in an alarm condition.

Sensor installed in a normally wet well

- Put the float in the LOW position. This will cause an alarm condition in the controller.
- Put the float back in the HIGH position. Make sure that the controller is not in an alarm condition.

If the controller does not go into an alarm condition, look to see if the thresholds are correctly programmed in the system. Look to see if the float is in the correct position (refer to the applicable instruction above). A sensor or wiring fault will cause a system alarm. Do a continuity test in the wiring and junction boxes. Make sure there is continuity with no short circuits.

12.6 Discriminating Dispenser Sump/STP Sump Sensor

Smart Sensor Equipped with Intellisense™ Technology

30-0232-DH-10 & 30-0232-DH-20

Description

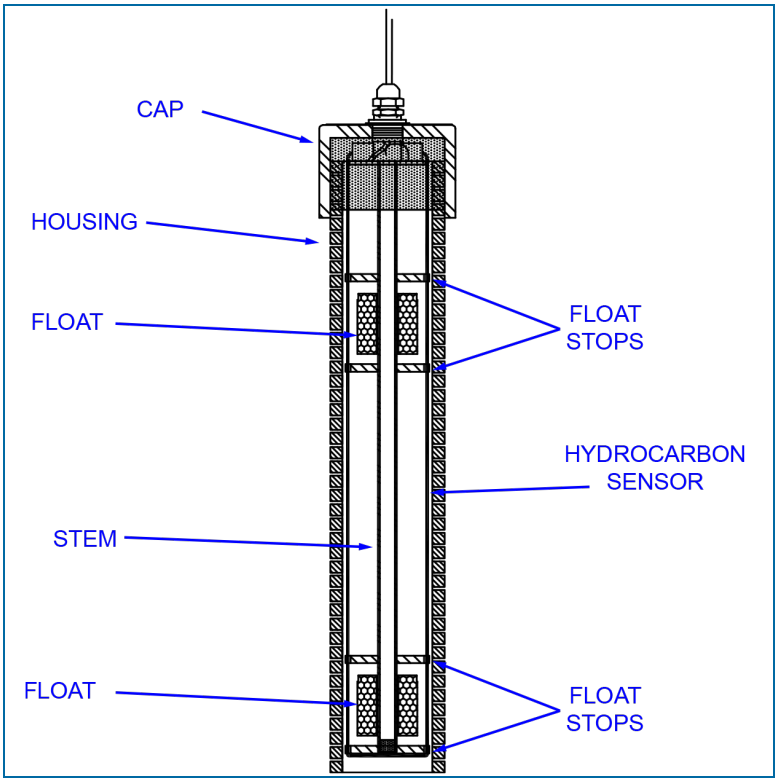
IMPORTANT: This float body is the same as the 30-0232-D10 / D20 and 30-0232-D-10B / D-20B. Look at the label to make sure you have the correct sensor for the applicable function.

The primary function of the Discriminating Dispenser Sump/STP Sump Sensor is to sense liquid hydrocarbons and water in sumps, fuel dispenser pans and other locations where there is liquid that could indicate that a leak has occurred. Use the DH-10 on fuel dispenser pans and transition sumps. Use the DH-20 in tank sumps.

The sensor has a strip made of a carbon/polymer material that changes its electrical resistance when it is touched by liquid hydrocarbons.

Sensor with Carbon/polymer Strip

Two (2) float switches are used in the body of the sensor to sense low and high liquid levels. If there is a break in the cable it will cause an alarm condition in the system.



Cutaway View of Sensor that Shows Internal Floats

Specifications	
Primary Use(s):	DH-10: Fuel Dispenser Pan/Sump DH-20: STP Sumps
Alternate Uses:	DH-10: STP Sumps DH-20: Fuel Dispenser Pan/Sump
Detects:	Low Liquid, High Liquid, Fuel
Operating Temperature:	-40°C to +70°C (-40°F to 158°F)
DH-10 Dimensions: DH-20 Dimensions:	Diameter: 5.8 cm (2.3 in.), Length: 28.2 cm (11.1 in.) Diameter: 5.8 cm (2.3 in.), Length: 53.6 cm (21.1 in.)
Float Requirements:	Low: 3.8 cm (1.5 in.), High: 27.9 cm (11 in.)
Nominal resistance (uncontaminated)	Less than 5,000 ohms
Nominal resistance (contaminated)	More than 30,000 ohms

Specifications	
Cable:	Belden #88760 or Alpha #55371 3.6 m (12 feet) of gas & oil resistant cable to the inline ISIM + 1.3 m (4 feet) ISIM tail
Maximum Wiring Length*:	305 m (1,000 ft.) field wiring
Alarm Threshold Configuration:	Fully Automatic
Diagnostic Reading on sensor setup:	
Clean Carbon/polymer (no Hydrocarbon)	**12 to 13** (normal), **3 to 4** (lower float in alarm - raised), **1 to 2** (upper and lower float in alarm - raised)
Belcor Active (Hydrocarbon present)	**3.5 to 3.7** (normal), **1.8 to 2.0** (lower float in alarm - raised), **1.2 to 1.4** (upper and lower float in alarm - raised)
Multi-Drop Restriction	See "Nano Mixed Multi-drop Installation" on page 1
Connections:	Red = Power, Black = Signal, Shield = Ground

NOTE: *This is the maximum length of wire to be used to connect all sensors on one channel. This length includes the wire from the VSmart to each sensor board in the string.

Installation

WARNING: Make sure you read and fully understand the warnings and information found in the **Hazardous Areas** section of your console's Installation Guide before you install or do the servicing of this sensor.

CAUTION: ALWAYS obey Local and National Electrical Codes applicable to the installation location.

Make sure that the cables (gas and oil resistant OPW Fuel Management Systems part # 12-1030) from the field wiring to the controller are in conduit that is dedicated to intrinsically safe wiring.

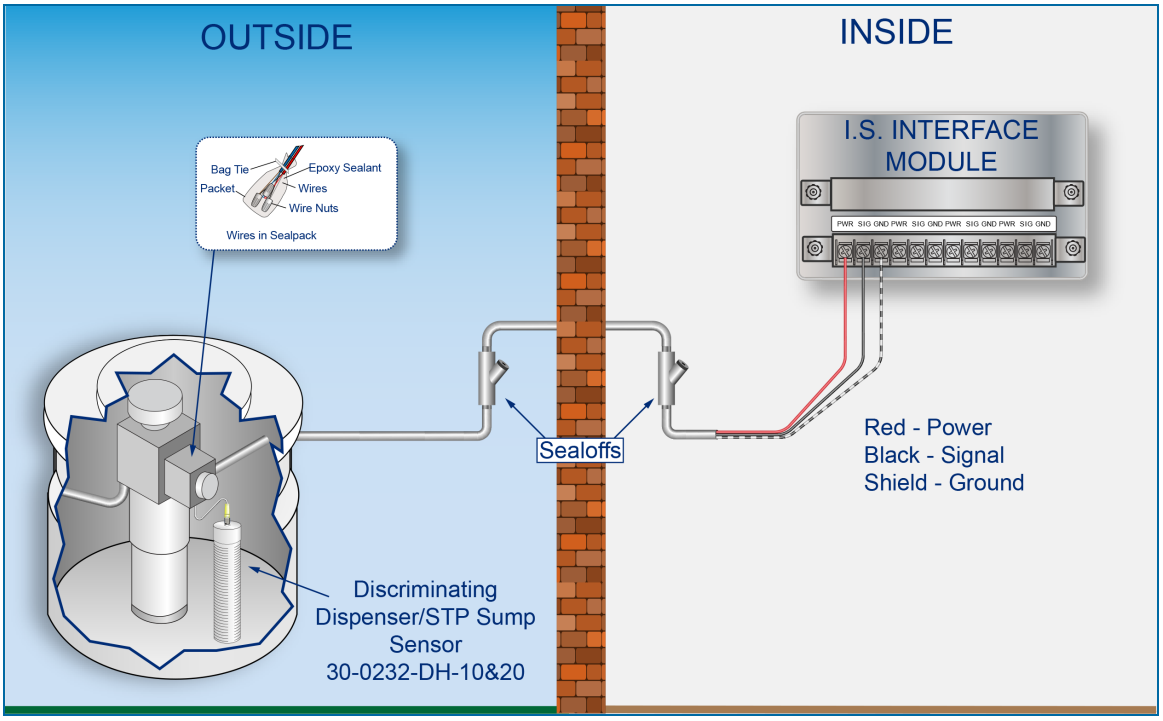
Use wire-nuts and epoxy-resin seal-packs for field connections (refer to M00-390008 Waterproof Electrical Connections for information).

- This sensor uses ONE Controller Interface I.S. Module position
- Start with the Connections table and “Typical Installation" drawing below.
- Make sure the sump pit or pan is dry.
- Install the sensor so that it touches the bottom of the sump pit or pan.
- Connect the sensor cable to the sensor.
- Connect the sensor wires to the field wires in the junction box. Use the supplied cable gland and silicon wire nuts.
- Seal the electrical connections with the epoxy seal packs (refer to M00-390008 Waterproof Electrical Connections for instructions).
- Install explosion-resistant sealing fittings at both ends of the conduit. Refer to the **Probe-Cable Seal-offs** section of the console's Installation Guide for instructions.

Connections

Sensor Wire Color	*12V Smart Sensor Interface Channel*
Red	Power
Black (hydrocarbon sensor)	Signal
Shield (or 3rd conductor)	Ground

Typical Installation Drawing



Controller Setup

The sensor must be **Auto Detected** on the console (Refer to the M2011 Nano Configuration Manual). Alarm thresholds are configured automatically through the *Intellisense* mechanism between the sensor and the console.

Float Sensor Test

CAUTION: Use caution to prevent dangerous conditions when you do work in a hazardous area.

Make sure that the area has sufficient airflow when you do a test or remove contamination from the sensor. Make sure there are no open flames or hot surfaces near the work area.

Sensor installed in a normally dry well

- Put the float in the HIGH position. This will cause an alarm condition in the controller.
- Put the float back in the LOW position. Make sure that the controller is not in an alarm condition.

Sensor installed in a normally wet well

- Put the float in the LOW position. This will cause an alarm condition in the controller.
- Put the float back in the HIGH position. Make sure that the controller is not in an alarm condition.

If the controller does not sense the alarm conditions simulated by these tests, look to see if the thresholds and alarms are correctly programmed in the system. Look to see if the float is in the correct position (refer to the applicable instruction above). A sensor or wiring fault will cause a system alarm. Do a continuity test in the wiring and junction boxes. Make sure there is continuity with no short circuits.

Hydrocarbon Sensor - Functional Test and Remove Contamination

IMPORTANT: It is recommended to only do the procedures below when it becomes necessary and only as a last alternative. These procedures can cause a decrease in the original electrical resistance of the polymer. If possible, speak with a certified OPW-FMS technician before you do these procedures.

NOTICE: **Do not use fuel (gasoline, diesel etc.) to test or clean the sensor!** Once the carbon/polymer material has touched liquid hydrocarbon, it is possible that the sensor will not return to its initial electrical resistance. This can have an unwanted effect on its

operation. Replace the sensor if necessary. If you do not obey this instruction it can void your warranty.

Functional Test - Hydrocarbon Liquid Sensor of the Device

- Put the polymer fully into *Mineral Spirits* and wait approximately 10 minutes.
- Remove the sensor and let it hang to air dry for another 10 minutes.
- The test is satisfactory if an alarm condition or other event related to the hydrocarbon part of the sensor occurs. If the test results are unsatisfactory, replace the sensor.

Functional Test - Water Sensor of the Device

- Put the end of the sensor fully into *TAP water* for at least two (2) minutes.
- The test is satisfactory if an alarm condition or other event related to the water sensor of the device occurs.

Clean the Hydrocarbon Sensor of the Device

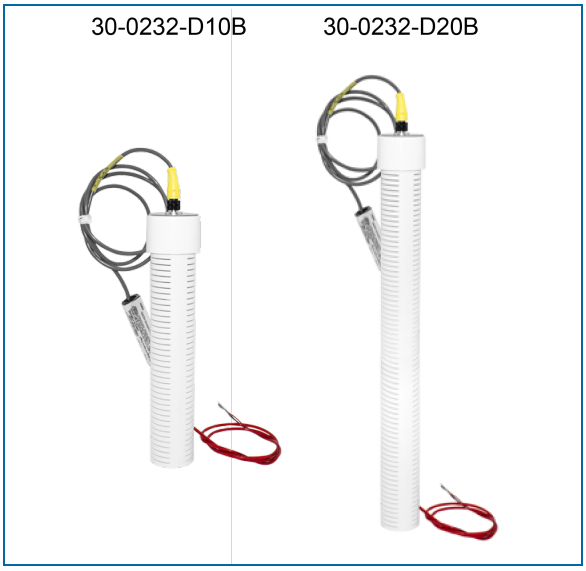
- Make sure the sensor is disconnected.
- Put the contaminated portion of the sensor fully into *Denatured Alcohol* for one (1) hour.
- Flush the sensor with water to remove all remaining contamination.
- Let the sensor dry in the air for one (1) hour.
- Reconnect the sensor.

NOTE: If the sensor does not return to near its original resistance after you do a functional test or contamination has been removed, it is recommended to replace the sensor.

12.7 Dual Float Brine Sensors

Smart Sensor Equipped with Intellisense™ Technology

30-0232-D-10B (for Containment Sump) and 30-0232-D-20B (for Fiberglass Tanks)



Description

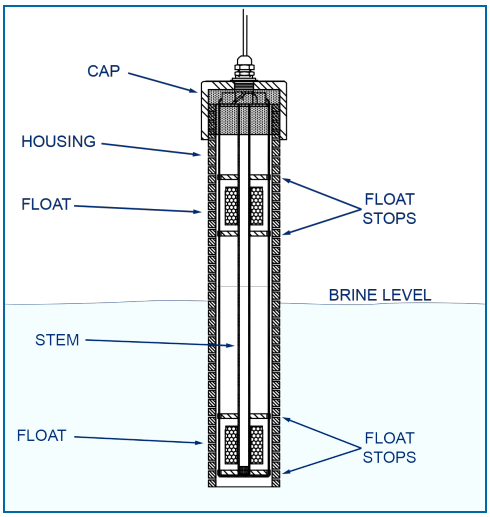
IMPORTANT: This float body is the same as the 30-0232-D-10 / D-20 and 30-0232-DH-10 / DH-20 (DH-XX has a carbon-polymer strip in the bottom). Look at the label to make sure you have the correct sensor for the applicable function.

The primary function of the Dual Float Brine Sensor is to sense liquid in the brine-filled reservoir of the interstitial area of a doubled-walled tank. Two (2) float switches are used in the body of the sensor to sense fluid level changes. The device will cause an alarm condition in the system if the fluid level increases or decreases more than the normal constant level in the middle between the upper and lower floats. If there is a break in the cable it will cause an alarm condition in the system.

Since this sensor is not made to sense hydrocarbons it does not use a carbon/polymer strip.

No Carbon/Polymer Strip

The bottom float of the brine sensor will stay in the up position in a normal condition. When the sensor is in an alarm condition, the upper float will be in a position to cause the alarm condition or the fluid level has decreased below the bottom float.



Cutaway View of Sensor Showing Internal Floats

Specifications	
Primary Use:	Measure the level of brine solution
Detects:	Low Liquid, High Liquid
Operating Temperature:	-40°C to +70°C (-40°F to 158°F)
D-10B Dimensions: D-20B Dimensions:	Diameter: 5.8 cm (2.3 in.), Length: 28.2 cm (11.1 in.) Diameter: 5.8 cm (2.3 in.), Length: 53.6 cm (21.1 in.)
Float Requirements:	Low: 3.8 cm (1.5 in.), High: 27.9 cm (11 in.)
Cable:	Belden #88760 or Alpha #55371 3.6 m (12 feet) of gas & oil resistant cable to the inline ISIM + 1.3 m (4 feet) ISIM tail
Maximum Wiring Length*:	305 m (1,000 ft.) field wiring
Alarm Threshold Configuration:	Fully Automatic
Diagnostic Reading on sensor setup:	**3 to 4** (normal), **12 to 13** (bottom float in alarm - bottom and top floats in the down position), **1 to 2** (upper float in alarm - top and bottom floats in the up position)
Multi-Drop Restriction	See "Nano Mixed Multi-drop Installation" on page 1
Connections:	Red = Power, Black = Signal, Shield = Ground

NOTE: *This is the maximum length of wire to be used to connect all sensors on one channel. This length includes the wire from the VSmart to each sensor board in the string.

Installation

WARNING: Make sure you read and fully understand the warnings and information found in the **Hazardous Areas** section of your console's Installation Guide before you install or do the servicing of this sensor.

CAUTION: ALWAYS obey Local and National Electrical Codes applicable to the installation location.

Make sure that the cables (gas and oil resistant OPW Fuel Management Systems part # 12-1030) from the field wiring to the controller are in conduit that is dedicated to intrinsically safe wiring.

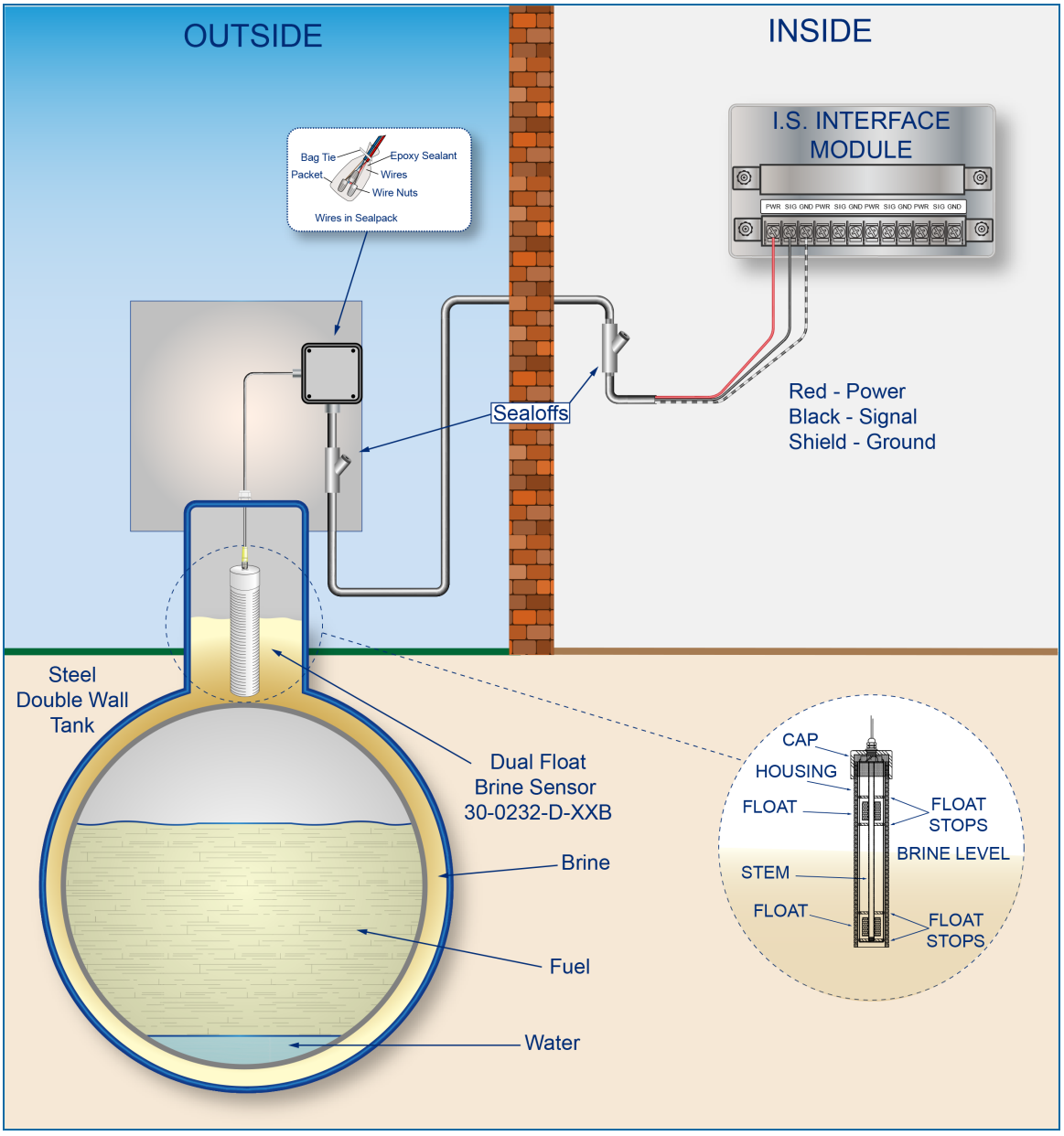
Use wire-nuts and epoxy-resin seal-packs for field connections (refer to M00-390008 Waterproof Electrical Connections for information).

- This sensor uses ONE Controller Interface I.S. Module position
- Start with the Connections table and “Typical Installation" drawing below.
- Connect the sensor cable to the sensor.
- Connect the sensor wires to the field wires in the junction box. Use the supplied cable gland and silicon wire nuts.
- Seal the electrical connections with the epoxy seal packs (refer to M00-390008 Waterproof Electrical Connections for instructions).
- Install explosion-resistant sealing fittings at both ends of the conduit. Refer to the **Probe-Cable Seal-offs** section of the console's Installation Guide for instructions.

Connections

Sensor Wire Color	*12V Smart Sensor Interface Channel*
Red	Power
Black (hydrocarbon sensor)	Signal
Shield (or 3rd conductor)	Ground

Typical Installation Drawing



Controller Setup

The sensor must be **Auto Detected** on the console (Refer to the M2011 Nano Configuration Manual). Alarm thresholds are configured automatically through the *Intellisense* mechanism between the sensor and the console.

Float Sensor Test

CAUTION: Use caution to prevent dangerous conditions when you do work in a hazardous area.

Make sure that the area has sufficient airflow when you do a test or remove contamination from the sensor. Make sure there are no open flames or hot surfaces near the work area.

Sensor installed in an interstitial monitoring reservoir

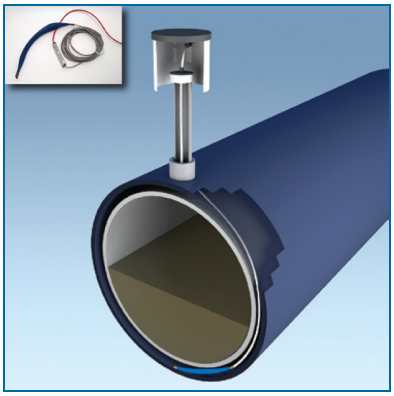
- Put the bottom float in the low position and the top float in the low position. This will cause a low-level alarm condition in the controller.
- Put the bottom float in the high position and the top float in the high position. This will cause a high-level alarm condition in the controller.
- Put the bottom float in the high position and the top float in the low position. Make sure that the controller is not in an alarm condition.

If the controller does not go into an alarm condition, look to see if the thresholds are correctly programmed in the system. Look to see if the float is in the correct position (refer to the applicable instruction above). A sensor or wiring fault will cause a system alarm. Do a continuity test in the wiring and junction boxes. Make sure there is continuity with no short circuits.

12.8 Interstitial Hydrocarbon Liquid Sensor with Water Indicator

Smart Sensor Equipped with Intellisense™ Technology

30-0234-HW-01



Description

The primary function of the Interstitial Hydrocarbon Liquid with Water Indicator Sensor is to sense liquid hydrocarbons and water in the interstitial area of a double-walled tank. The sensor has a carbon/polymer material that changes its resistance when it is touched by liquid hydrocarbons. The sensor also has a conductive strip to sense water. This lets the sensor tell the difference between hydrocarbon liquid and water. If there is a break in the cable it will cause an alarm condition in the system.

Specifications	
Operating Temperature:	-40°C to +70°C (-40°F to 158°F)
Dimensions:	Length: 35 cm (13.8 in.), Width: 2.5 cm (1.0 in.)
Nominal resistance (uncontaminated)	Less than 3,000 ohms per foot
Nominal resistance (contaminated)	More than 10,000 ohms
Cable:	Belden #88760 or Alpha #55371
Maximum Wiring Length*:	1,000’ (305 m) field wiring
Multi-Drop Restriction	See "Nano Mixed Multi-drop Installation" on page 1
Connections:	Red = Power, Black = Signal, Shield: = Ground

NOTE: *This is the maximum length of wire to be used to connect all sensors on one channel. This length includes the wire from the VSmart to each sensor board in the string.

Installation

WARNING: Make sure you read and fully understand the warnings and information found in the **Hazardous Areas** section of your console's Installation Guide before you install or do the servicing of this sensor.

CAUTION: ALWAYS obey Local and National Electrical Codes applicable to the installation location.

Make sure that the cables (gas and oil resistant OPW Fuel Management Systems part # 12-1030) from the field wiring to the controller are in conduit that is dedicated to intrinsically safe wiring.

Use wire-nuts and epoxy-resin seal-packs for field connections (refer to M00-390008 Waterproof Electrical Connections for information).

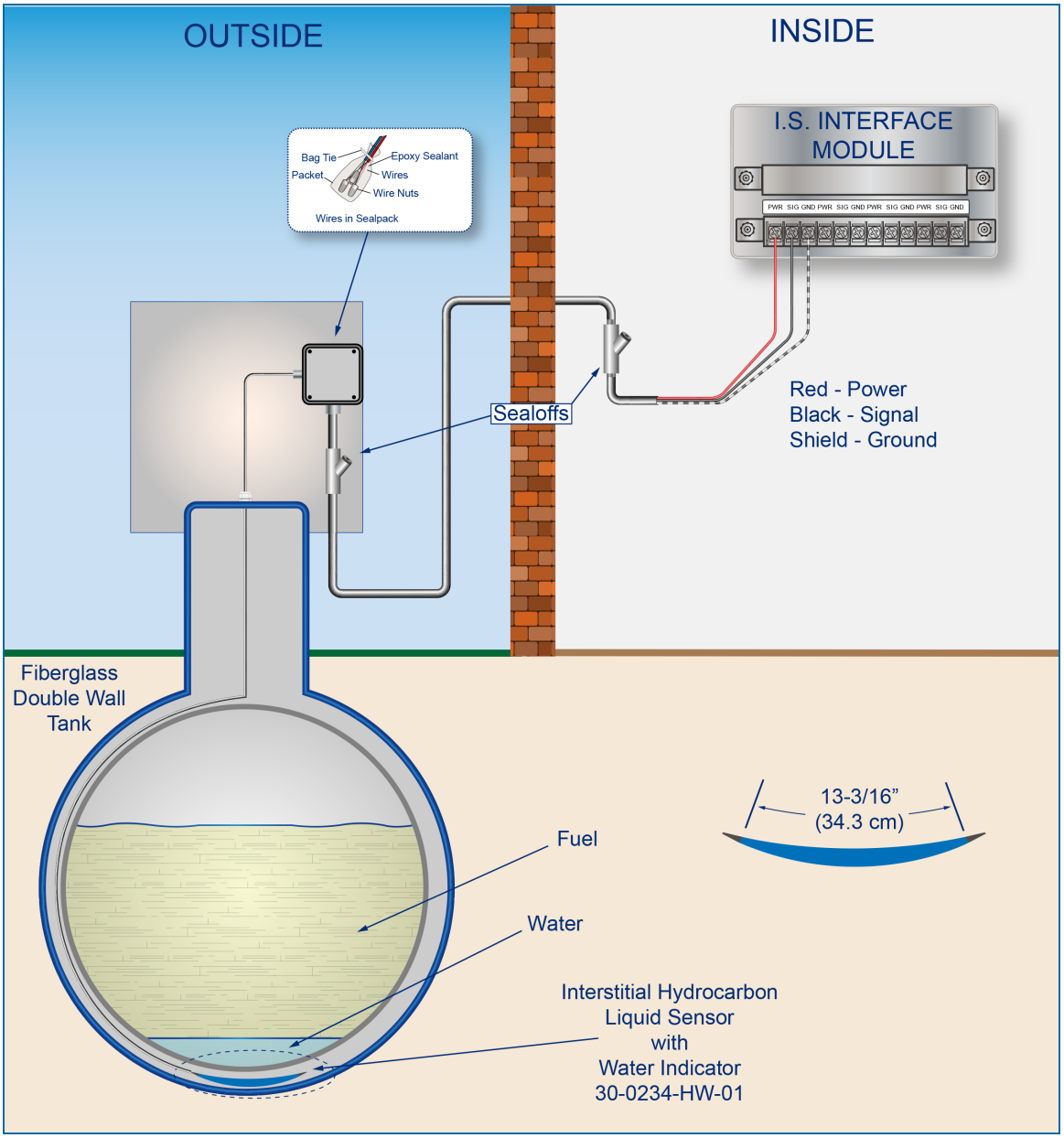
REMINDER: Hydrocarbons float on water. If the sensor is put fully in water, the polymer will not sense hydrocarbon liquid.

- This sensor uses ONE Controller Interface I.S. Module position
- Start with the Connections table and “Typical Installation" drawing below.
- Connect the sensor cable to the sensor.
- Connect the sensor wires to the field wires in the junction box. Use the supplied cable gland and silicon wire nuts.
- Seal the electrical connections with the epoxy seal packs (refer to M00-390008 Waterproof Electrical Connections for instructions).
- Install explosion-resistant sealing fittings at both ends of the conduit. Refer to the **Probe-Cable Seal-offs** section of the console's Installation Guide for instructions.

Connections

Sensor Wire Color	*12V Smart Sensor Interface Channel*
Red	Power
Black	Signal
Shield	Ground

Typical Installation Drawing



Controller Setup

The sensor must be **Auto Detected** on the console (Refer to the M2011 Nano Configuration Manual). Alarm thresholds are configured automatically through the *Intellisense* mechanism between the sensor and the console.

Interstitial Hydrocarbon Liquid Sensor with Water Indicator - Functional Test and Remove Contamination

CAUTION: Use caution to prevent dangerous conditions when you do work in a hazardous area.

Make sure that the area has sufficient airflow when you do a test or remove contamination from the sensor. Make sure there are no open flames or hot surfaces near the work area.

NOTICE: **Do not use fuel (gasoline, diesel etc.) to test or clean the sensor!** Once the carbon/polymer material has touched liquid hydrocarbon, it is possible that the sensor will not return to its initial electrical resistance. This can have an unwanted effect on its operation. Replace the sensor if necessary. If you do not obey this instruction it can void your warranty.

Functional Test - Hydrocarbon Liquid Sensor of the Device

- Put the polymer fully into *Mineral Spirits* and wait approximately 10 minutes.
- Remove the sensor and let it hang to air dry for another 10 minutes.
- The test is satisfactory if an alarm condition or other event related to the hydrocarbon sensor of the device occurs. If the test results are unsatisfactory, replace the sensor.
- Disconnect the Hydrocarbon Sensor from the I.S. terminal strip in the controller. The test is satisfactory if an alarm condition occurs.
- Connect the sensor back to the I.S. terminal strip.
- Short across the power and signal terminals. This test is satisfactory if NO alarm condition occurs.

If the controller does not sense the alarm conditions simulated by these tests, look to see if the thresholds and alarms are correctly programmed in the system. A sensor or wiring fault will cause a system alarm. Do a continuity test in the wiring and junction boxes. Make sure there is continuity with no short circuits.

Functional Test - Water Sensor of the Device

- Put only the end of the sensor into *tap water*. The test is satisfactory if an alarm condition or other event related to the water sensor of the device occurs.
- Disconnect the Water Sensor from the I.S. terminal strip in the controller. The test is satisfactory if NO alarm condition occurs.
- Connect the sensor back to the I.S. terminal strip.
- Short across the power and signal terminals. This test is satisfactory if an alarm condition occurs.

If the controller does not sense the alarm conditions simulated by these tests, look to see if the thresholds and alarms are correctly programmed in the system. A sensor or wiring fault will cause a system alarm. Do a continuity test in the wiring and junction boxes. Make sure there is continuity with no short circuits.

Clean the Hydrocarbon Sensor of the Device

If it is necessary to clean hydrocarbon contamination from the sensor after a test or actual use:

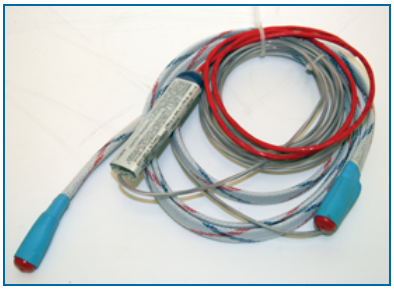
- Make sure the sensor is disconnected.
- Put the dirty part of the sensor fully into *denatured alcohol* for one (1) hour.
- Flush the sensor with water to remove all remaining contamination.
- Let the sensor dry in the air for one (1) hour.
- Reconnect the sensor.

NOTE: If the sensor does not return to near its original resistance after you do a functional test or contamination has been removed, it is recommended to replace the sensor.

12.9 Hydrocarbon Liquid Sensor with Water Indicator

Smart Sensor Equipped with Intellisense™ Technology

30-0234-HW-06, -15, -20



Description

The primary function of the Hydrocarbon Liquid Sensor with Water Indicator is to monitor dry wells with groundwater tables that can change levels. This sensor uses a carbon/polymer material that changes its resistance when it is touched by liquid hydrocarbons. The device also has a water sensor that has conductive material to sense water. This lets the device tell the difference between hydrocarbon liquid and water.

The sensor can tell the system if there is water in a containment area. It can also tell the system if there are fuel leaks in a containment area. If there is a break in the cable it will cause an alarm condition in the system.

Specifications	
Primary Use:	Monitoring Wells
Detects:	Liquid Hydrocarbons and Water
Operating Temperature:	-40°C to +70°C (-40°F to 158°F)
Dimensions:	Length: 6’ (1.9 m), 15’ (4.6 m) or 20’ (6.1 m) Diameter: 0.7” (1.8 cm)
Nominal resistance (uncontaminated)	Less than 3,000 ohms per foot
Nominal resistance (contaminated)	More than 30,000 ohms
Cable:	Belden #88760 or Alpha #55371
Maximum Wiring Length*:	1,000’ (305 m) field wiring
Multi-Drop Restriction	See "Nano Mixed Multi-drop Installation" on page 1
Connections:	Red = Power, Black = Signal, Shield = Ground

NOTE: *This is the maximum length of wire to be used to connect all sensors on one channel. This length includes the wire from the VSmart to each sensor board in the string.

Installation

WARNING: Make sure you read and fully understand the warnings and information found in the **Hazardous Areas** section of your console's Installation Guide before you install or do the servicing of this sensor.

CAUTION: ALWAYS obey Local and National Electrical Codes applicable to the installation location.

Make sure that the cables (gas and oil resistant OPW Fuel Management Systems part # 12-1030) from the field wiring to the controller are in conduit that is dedicated to intrinsically safe wiring.

Use wire-nuts and epoxy-resin seal-packs for field connections (refer to M00-390008 Waterproof Electrical Connections for information).

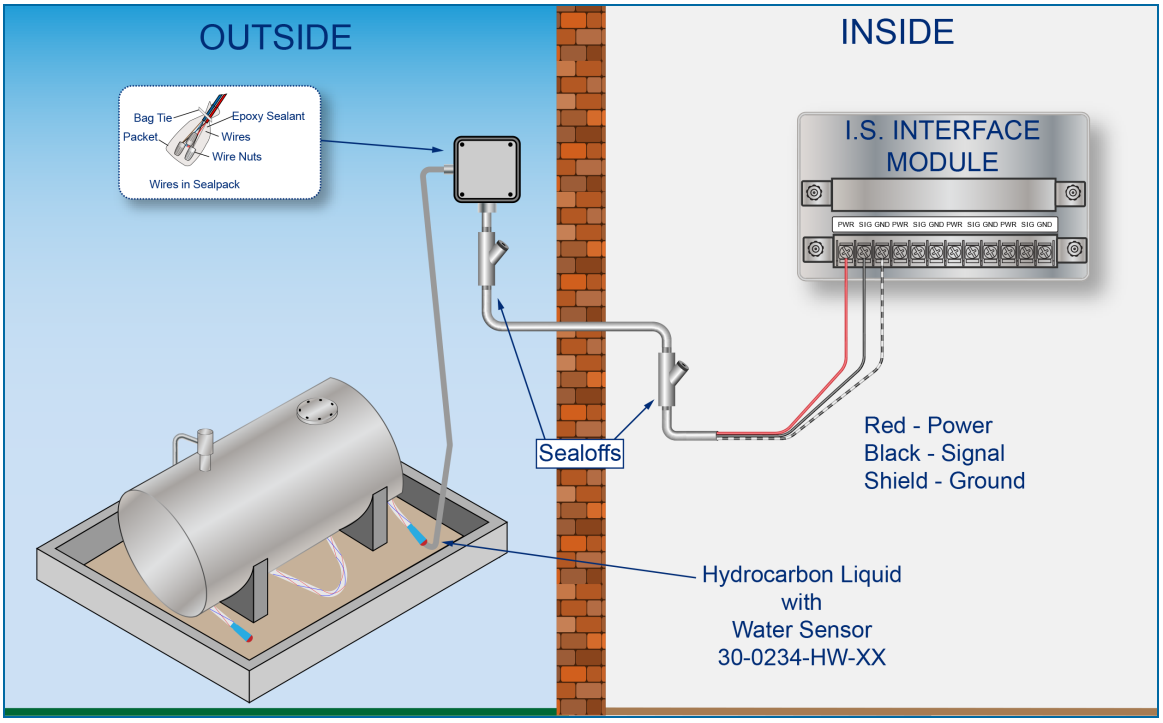
REMINDER: Hydrocarbons float on water. If the sensor is fully submerged in water, the polymer is unable to detect hydrocarbon liquid.

- This sensor uses ONE Controller Interface I.S. Module position
- Start with the Connections table and “Typical Installation" drawing below.
- Connect the sensor cable to the sensor.
- Connect the sensor wires to the field wires in the junction box. Use the supplied cable gland and silicon wire nuts.
- Seal the electrical connections with the epoxy seal packs (refer to M00-390008 Waterproof Electrical Connections for instructions).
- Install explosion-resistant sealing fittings at both ends of the conduit. Refer to the **Probe-Cable Seal-offs** section of the console's Installation Guide for instructions.

Connections

Sensor Wire Color	*12V Smart Sensor Interface Channel*
Red	Power
Black	Signal
Shield	Ground

Typical Installation Drawing



Controller Setup

The sensor must be **Auto Detected** on the console (Refer to the M2011 Nano Configuration Manual). Alarm thresholds are configured automatically through the *Intellisense* mechanism between the sensor and the console.

Hydrocarbon Liquid/Water Sensor - Functional Test and Remove Contamination

IMPORTANT: It is recommended to only do the procedures below when it becomes necessary and only as a last alternative. These procedures can cause a decrease in the original electrical resistance of the polymer. If possible, speak with a certified OPW-FMS technician before you do these procedures.

CAUTION: Use caution to prevent dangerous conditions when you do work in a hazardous area.

Make sure that the area has sufficient airflow when you do a test or remove contamination from the sensor. Make sure there are no open flames or hot surfaces near the work area.

NOTICE: **Do not use fuel (gasoline, diesel etc.) to test or clean the sensor!** Once the carbon/polymer material has touched liquid hydrocarbon, it is possible that the sensor will not return to its initial electrical resistance. This can have an unwanted effect on its operation. Replace the sensor if necessary. If you do not obey this instruction it can void your warranty.

Functional Test - Hydrocarbon Liquid Sensor of the Device

- Put the polymer fully into *Mineral Spirits* and wait approximately 10 minutes.
- Remove the sensor and let it hang to air dry for another 10 minutes.
- The test is satisfactory if an alarm condition or other event related to the hydrocarbon sensor of the device occurs. If the test results are unsatisfactory, replace the sensor.
- Disconnect the Hydrocarbon Sensor from the I.S. terminal strip in the controller. The test is satisfactory if an alarm condition occurs.
- Connect the sensor back to the I.S. terminal strip.
- Short across the power and signal terminals. This test is satisfactory if NO alarm condition occurs.

If the controller does not sense the alarm conditions simulated by these tests, look to see if the thresholds and alarms are correctly programmed in the system. A sensor or wiring fault will cause a system alarm. Do a continuity test in the wiring and junction boxes. Make sure there is continuity with no short circuits.

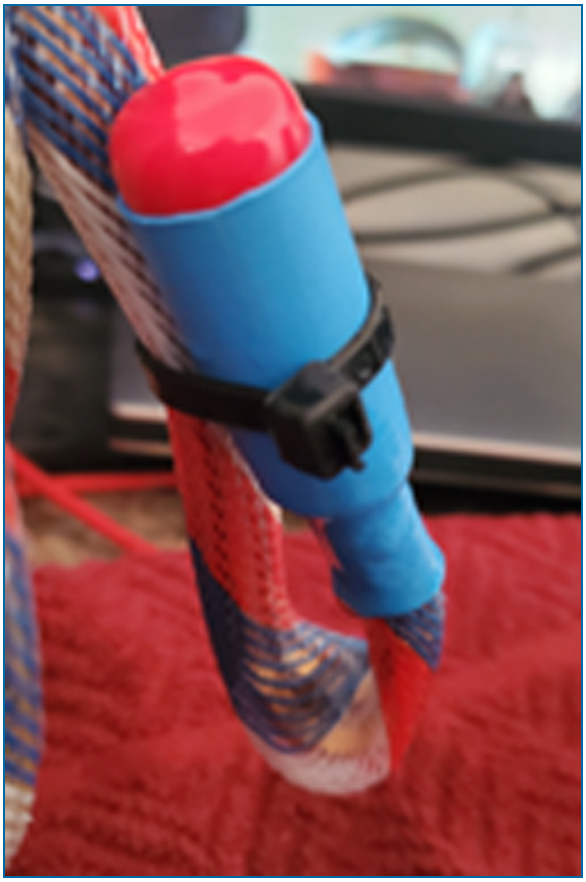
Functional Test - Water Sensor of the Device

- Put only the end of the sensor into *tap water*. The test is satisfactory if an alarm condition or other event related to the water sensor of the device occurs.
- Disconnect the Water Sensor from the I.S. terminal strip in the controller. The test is satisfactory if NO alarm condition occurs.
- Connect the sensor back to the I.S. terminal strip.
- Short across the power and signal terminals. This test is satisfactory if an alarm condition occurs.

If the controller does not sense the alarm conditions simulated by these tests, look to see if the thresholds and alarms are correctly programmed in the system. A sensor or wiring fault will cause a system alarm. Do a continuity test in the wiring and junction boxes. Make sure there is continuity with no short circuits.

IMPORTANT: During a Functional Test, liquid can collect inside the shrink tubing (see the image below. This can cause an unusually long time for the sensor to dry.

TIP: It is recommended to first pat the sensor dry with a soft, clean cloth. Then, fold the sensor over and hold it in place with a zip-tie to let any remaining liquid drip out of the sensor (see the image below. These steps can help reduce the drying time so the alarm condition can be cleared from 30-45 minutes to 2-10 minutes.



Clean the Hydrocarbon Sensor of the Device

If it is necessary to clean hydrocarbon contamination from the sensor after a test or actual use:

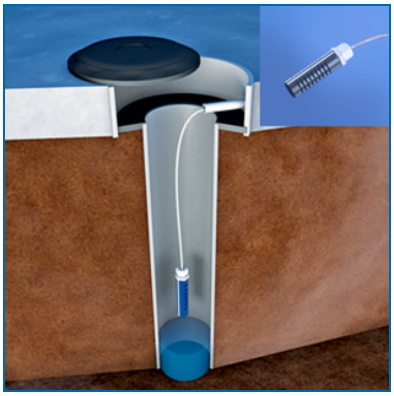
- Make sure the sensor is disconnected.
- Put the dirty part of the sensor fully into *denatured alcohol* for one (1) hour.
- Flush the sensor with water to remove all remaining contamination.
- Let the sensor dry in the air for one (1) hour.
- Reconnect the sensor.

NOTE: If the sensor does not return to near its original resistance after you do a functional test or contamination has been removed, it is recommended to replace the sensor.

12.10 Hydrocarbon Vapor Sensor

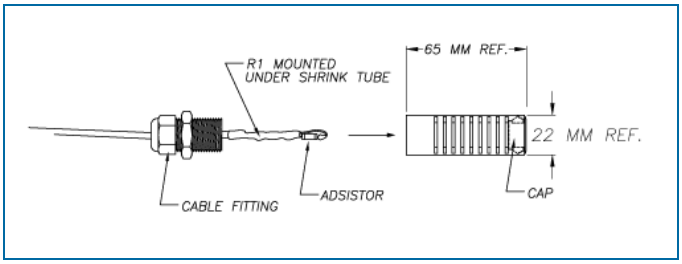
Smart Sensor Equipped with Intellisense™ Technology

30-0235-V



Description

The primary function of the Hydrocarbon Vapor Sensor is to sense hydrocarbon vapors in monitoring wells and the interstitial areas of a double-walled tank. These vapors could indicate a possibly dangerous leak that could lead to safety and environmental problems. The sensor is made from a long-life resistive element that will increase in resistance when there are hydrocarbon vapors in the closed space where the device is installed. The sensor will return to normal resistance when hydrocarbon vapors are gone. If there is a break in the cable it will cause an alarm condition in the system.



Specifications	
Primary Use:	Monitoring wells
Alternate Use(s):	Interstitial areas of a double-walled tank
Detects:	Hydrocarbon vapor
Operating Temperature:	-40°C to +70°C (-40°F to 158°F)
Dimensions:	Length: 8.9 cm (3.5”), Diameter: 2.3 cm (0.9”)
Nominal resistance (uncontaminated)	Less than 5,000 ohms

Specifications	
Nominal resistance (contaminated)	More than 10,000 ohms
Cable:	Belden #88760 or Alpha #55371 3.6m (12 feet) of gas & oil resistant cable to the inline ISIM + 1.3m (4 feet) ISIM tail.
Maximum Wiring Length*:	305 m (1,000 ft.) field wiring
Alarm Threshold Configuration:	Fully Automatic
Diagnostic Reading on Sensor Setup:	0 to 1 (normal) above 5 (in-alarm)
Multi-Drop Restriction	See "Nano Mixed Multi-drop Installation" on page 1
Connections:	Red = Power, Black = Signal, Shield = Ground

NOTE: *This is the maximum length of wire to be used to connect all sensors on one channel. This length includes the wire from the VSmart to each sensor board in the string.

Installation

WARNING: Make sure you read and fully understand the warnings and information found in the **Hazardous Areas** section of your console's Installation Guide before you install or do the servicing of this sensor.

CAUTION: ALWAYS obey Local and National Electrical Codes applicable to the installation location.

Make sure that the cables (gas and oil resistant OPW Fuel Management Systems part # 12-1030) from the field wiring to the controller are in conduit that is dedicated to intrinsically safe wiring.

Use wire-nuts and epoxy-resin seal-packs for field connections (refer to M00-390008 Waterproof Electrical Connections for information).

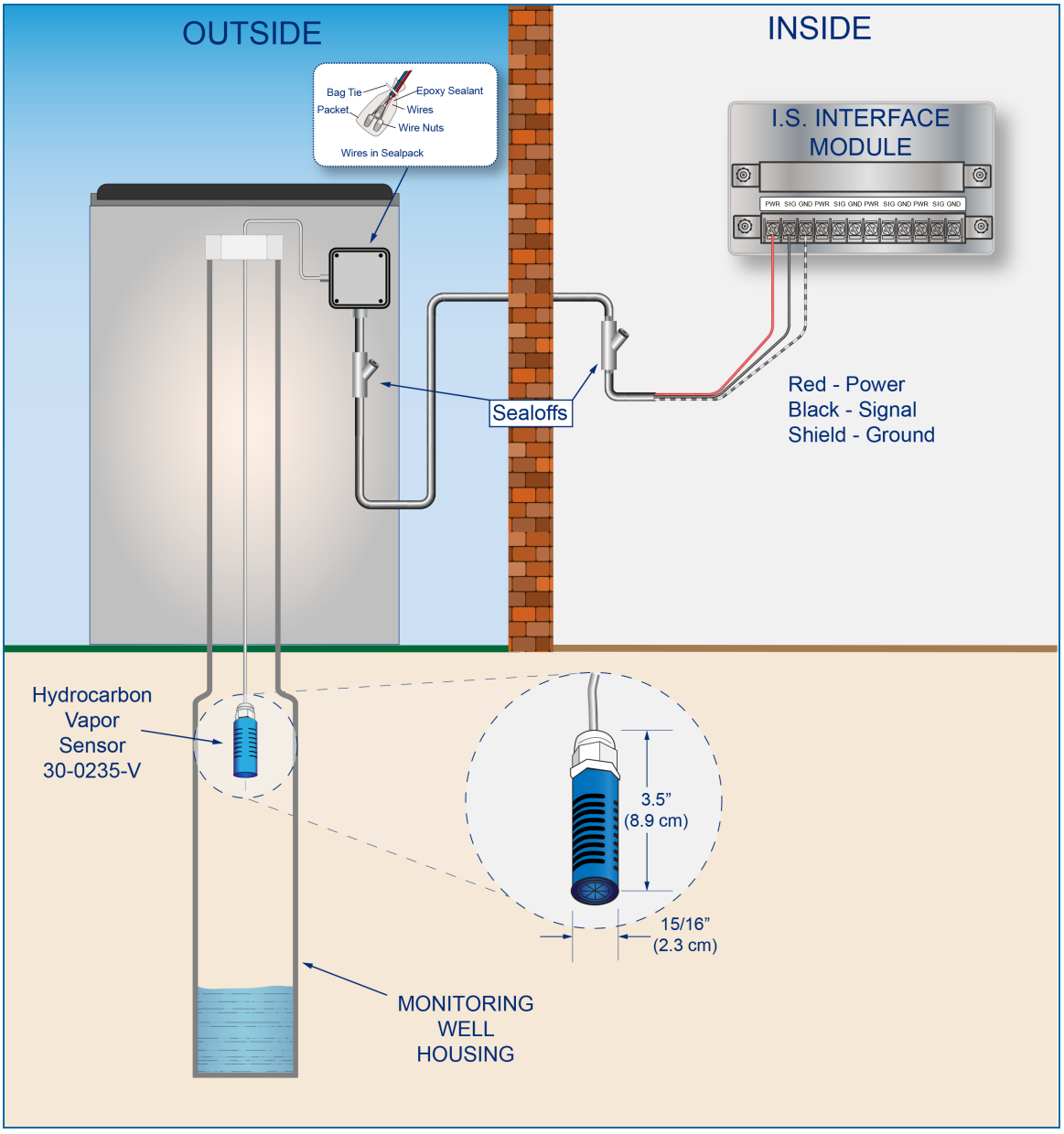
NOTE: The device will NOT sense hydrocarbon vapor if it is fully in water.

- This sensor uses ONE Controller Interface I.S. Module position
- Start with the Connections table and “Typical Installation" drawing below.
- Do a check to make sure there are no hydrocarbon vapors before you install this sensor in a Dry Monitoring Well.
- Install the sensor close to the top, above the water level, if applicable (if the sensor is under water it will not operate).
- Connect the sensor cable to the sensor.
- Connect the sensor wires to the field wires in the junction box. Use the supplied cable gland and silicon wire nuts.
- Seal the electrical connections with the epoxy seal packs (refer to M00-390008 Waterproof Electrical Connections for instructions).
- Install explosion-resistant sealing fittings at both ends of the conduit. Refer to the **Probe-Cable Seal-offs** section of the console's Installation Guide for instructions.

Connections

Sensor Wire Color	*12V Smart Sensor Interface Channel*
Red	Power
Black (hydrocarbon sensor)	Signal
Shield (or 3rd conductor)	Ground

Typical Installation Drawing



Controller Setup

The sensor must be **Auto Detected** on the console (Refer to the M2011 Nano Configuration Manual). Alarm thresholds are configured automatically through the *Intellisense* mechanism between the sensor and the console.

Test the Hydrocarbon Vapor Sensor

CAUTION: Use caution to prevent dangerous conditions when you do work in a hazardous area.

Make sure that the area has sufficient airflow when you do a test or remove contamination from the sensor. Make sure there are no open flames or hot surfaces near the work area.

- Put the sensor in the air space of a container half full with Mineral Spirits.
- Wait approximately 10 minutes. The test is satisfactory if an alarm condition or other event occurs. If the test results are unsatisfactory, replace the sensor.

If the controller does not go into an alarm condition, look to see if the thresholds are correctly programmed in the system. A sensor or wiring fault will cause a system alarm. Do a continuity test in the wiring and junction boxes. Make sure there is continuity with no short circuits.

Clean the Hydrocarbon Vapor Sensor

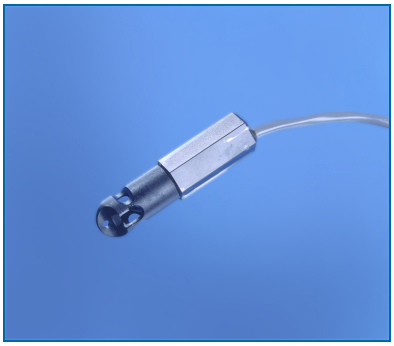
- Put the sensor fully into Denatured Alcohol for one (1) hour.
- Remove the sensor and let it dry in the air for one (1) hour.
- Reconnect the sensor.

NOTE: If the sensor does not return to sufficient resistance, replace the sensor if necessary.

12.11 Discriminating Interstitial Sensor (Optical)

Smart Sensor Equipped with Intellisense™ Technology

30-0236-LW



Description

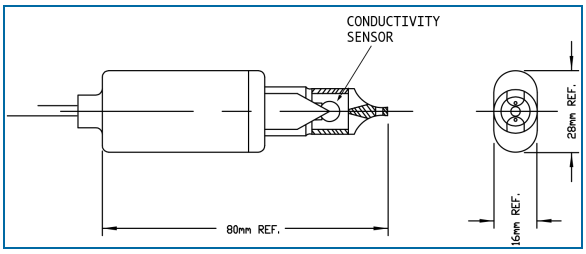
The primary function of the Discriminating Interstitial Optical Liquid Sensor is to monitor the interstitial area of double-walled tanks. This sensor uses a long-life, solid-state optical prism. These sensors can also be used in sumps, fuel dispenser pans and other locations where there is liquid that could indicate that a leak has occurred.

The sensor can tell the difference between water and hydrocarbons and will cause an alarm condition when it senses a liquid. If there is a break in the cable it will cause an alarm condition in the system.

Specifications	
Primary Use:	Liquid detection in the interstitial space of double-walled tanks.
Alternate Use(s):	Fuel Dispenser Pans and STP Sumps
Detects:	Liquids: Hydrocarbon and Water
Operating Temperature:	-40°C to +70°C (-40°F to 158°F)
Dimensions:	0.7 inches (1.8cm) x 2.8 inches (7cm)
Nominal resistance (uncontaminated)	Less than 5,000 ohms
Nominal resistance (contaminated)	More than 30,000 ohms
Cable:	Belden #88760 or Alpha #55371 4.5 m (15 feet) of gas & oil resistant cable to the inline ISIM + 1.3 m (4 feet) ISIM tail
Maximum Wiring Length*:	305 m (1,000 ft.) field wiring
Alarm Threshold Configuration:	Fully Automatic

Specifications	
Diagnostic Reading on Sensor Setup:	**0.02 to 0.03 and 0.23 to 0.25** (normal), **0.02 to 0.03 and 0.02 to 0.03** (water alarm), **0.23 to 0.25 and 0.23 to 0.25** (hydrocarbon alarm)
Multi-Drop Restriction	See "Nano Mixed Multi-drop Installation" on page 1
Connections:	Red = Power, Black = Signal, Shield = Ground

NOTE: *This is the maximum length of wire to be used to connect all sensors on one channel. This length includes the wire from the VSmart to each sensor board in the string.



30-0236-LW Dimensions

Installation

WARNING: Make sure you read and fully understand the warnings and information found in the **Hazardous Areas** section of your console's Installation Guide before you install or do the servicing of this sensor.

CAUTION: ALWAYS obey Local and National Electrical Codes applicable to the installation location.

Make sure that the cables (gas and oil resistant OPW Fuel Management Systems part # 12-1030) from the field wiring to the controller are in conduit that is dedicated to intrinsically safe wiring.

Use wire-nuts and epoxy-resin seal-packs for field connections (refer to M00-390008 Waterproof Electrical Connections for information).

- This sensor uses ONE Controller Interface I.S. Module position

- Start with the Connections table and “Typical Installation" drawing below.
- Measure the length of the circular space in the monitoring pipe from top to bottom and subtract 1.3 cm (0.5 in.) for a total measurement to be used for the sensor installation.
- Measure the calculated length from the sensor tip along the sensor cable and identify it with tape or a marker.
- Put the sensor and wire through the monitoring opening until the mark is level with the top of the opening.

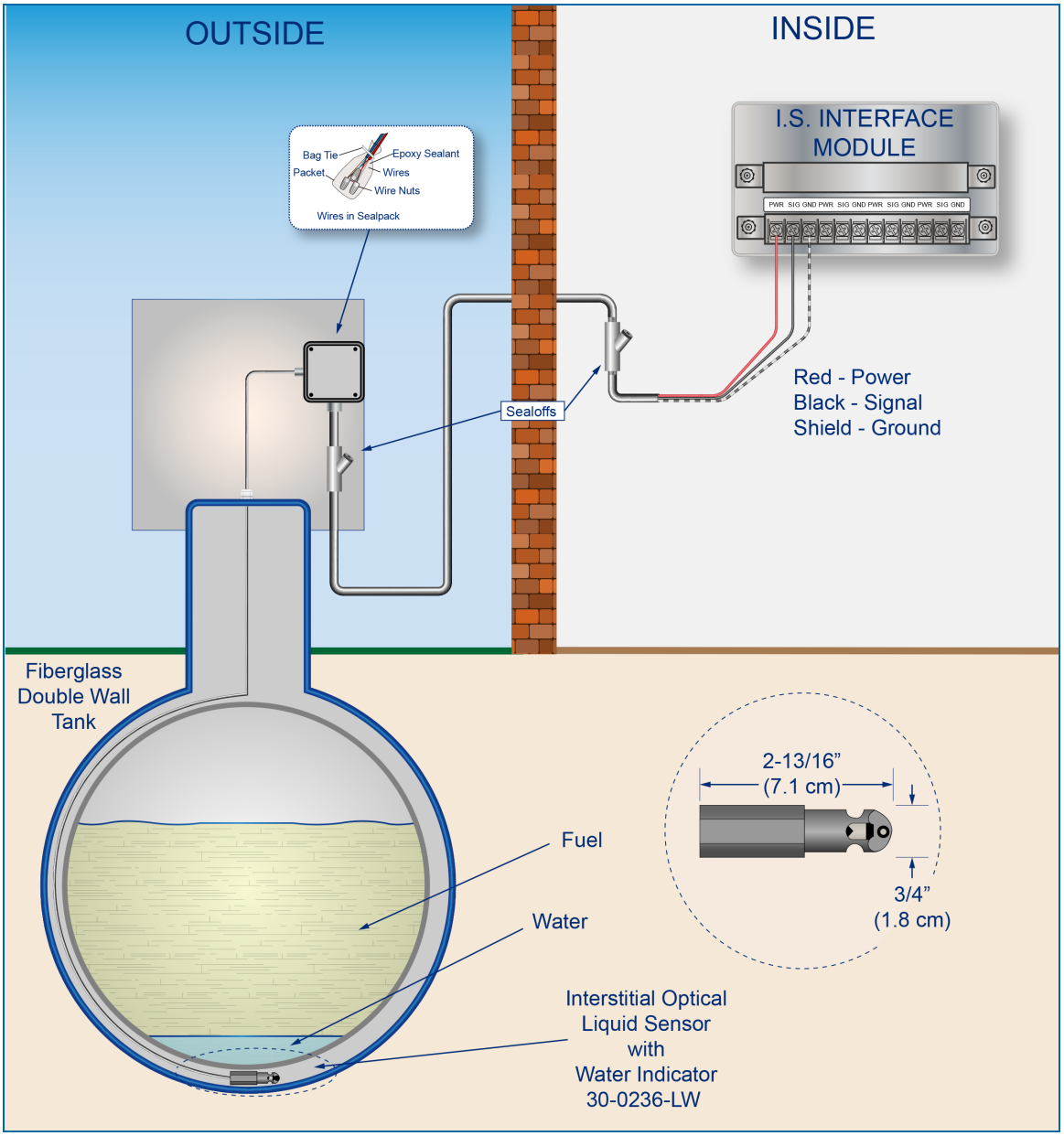
IMPORTANT: To prevent false alarms, the sensor must not touch the bottom of the monitoring tube

- Connect the sensor wires to the field wires in the junction box. Use the supplied cable gland and silicon wire nuts.
- Seal the electrical connections with the epoxy seal packs (refer to M00-390008 Waterproof Electrical Connections for instructions).
- Install explosion-resistant sealing fittings at both ends of the conduit. Refer to the **Probe-Cable Seal-offs** section of the console's Installation Guide for instructions.

Connections

Sensor Wire Color	*12V Smart Sensor Interface Channel*
Red	Power
Black (hydrocarbon sensor)	Signal
Shield (or 3rd conductor)	Ground

Typical Installation Drawing



Controller Setup

The sensor must be **Auto Detected** on the console (Refer to the M2011 Nano Configuration Manual). Alarm thresholds are configured automatically through the *Intellisense* mechanism between the sensor and the console.

Test the Optical Sensor

CAUTION: Use caution to prevent dangerous conditions when you do work in a hazardous area.

Make sure that the area has sufficient airflow when you do a test or remove contamination from the sensor. Make sure there are no open flames or hot surfaces near the work area.

IMPORTANT: Make sure to test the Optical Sensor in a dark area. The sensor's optical element is light sensitive. Light can cause the sensor to not test accurately.

Test the Water Sensor of the Device

- Put the sensor fully into water. The test is satisfactory if an alarm condition or other event related to the water part of the sensor occurs.
- Remove the sensor from the water. Make sure that the controller is not in an alarm condition.

Test the Hydrocarbon Liquid Sensor of the Device

- Put the sensor fully into a non-conductive hydrocarbon (or equivalent) liquid. The test is satisfactory if an alarm condition or other event related to the hydrocarbon part of the sensor occurs. If the test results are unsatisfactory, replace the sensor.
- Remove the sensor from the hydrocarbon liquid. Make sure that the controller is not in an alarm condition.

If the controller does not go into an alarm condition, look to see if the thresholds are correctly programmed in the system. A sensor or wiring fault will cause a system alarm. Do a continuity test in the wiring and junction boxes. Make sure there is continuity with no short circuits.

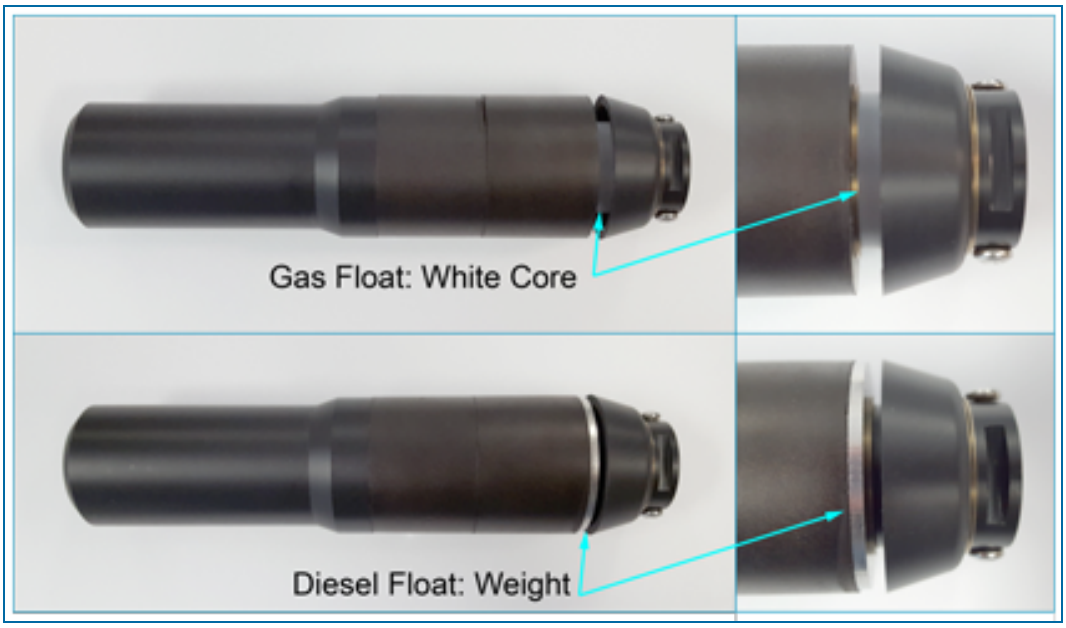
TIP: This sensor can be cleaned with a dry cloth and put back into service again immediately.

Section 13 Density Measurement Float (DMF)

OPW-FMS Part Number 20-4431 (Gas - White Core) & 20-4432 (Diesel - Black Core)

The Density Measurement Float (DMF) can be installed on a pre-existing probe. The DMF continuously measures the average density of the fuel in the tank. This can measure the smallest change in product density in the API density range. Fuel-density reports can be shown real-time on the console or exported to an external device. The readings can be a nominal or temperature-corrected density.

There are two (2) types of the DMF. One that measures density for gasoline (20-4431) and another for diesel (20-4432). They can be identified by the white core of the gasoline float or the metal weight of the diesel float. See the image below.



Density Measurement Float Specifications	
Materials:	Nitrophyl, Delrin, and Stainless-Steel spring
Dimensions:	Length: 20.3 cm (8 inches) Diameter: 5.1 cm (2 inches)
Precision:	±0.04%
Suggested Location:	15.2 cm (6 inches) from the bottom of the probe **NOTE**: Use two (2) set screws at the top of the float to hold it in position

Product Density and Chemical Compatibility			
Product Group	*Compatibility*	*API*	*Specific Gravity*
Gasoline	Gasoline Aviation Gasoline Regular Unleaded Regular Leaded Premium Unleaded Gasoline/Methanol blend, less than 5% methanol Gasohol, less than 40% ethanol	45 < API < 78	0.68 < d < 0.80
Diesel	Diesel Jet Fuel Kerosene Motor Oil Toluene Gear Oil Transmission Oil	26 < API < 45	0.80 < d < 0.90

13.1 DMF Installation

WARNING: THIS IS A STATIC SENSITIVE DEVICE! To prevent the risk of explosion from static discharge, do not clean or rub this device with a dry cloth.

NOTICE: To prevent damage to the I.S. barrier, you must turn off the power to the module that the probe is connected to before you begin the procedure below.

1. Turn off the power to the module that the probe is connected to before you remove the probe from the tank.
2. Remove the probe from the tank and remove the clip and the nylon probe foot from the bottom of the probe.
3. Remove the water float. Put the density float on the probe shaft (make sure the top of the float points toward the probe head) and tighten the screws of the float (the screws are at the top of the float). Keep a space of 10.2 cm to 15.2 cm (4 to 6 inches) at the bottom of the probe shaft so the water float can detect at least 7.6 cm (3 inches) of water.
4. Put the water float, nylon probe foot and end clip back on the probe shaft.
5. Put the probe back in the tank.

6. Turn on the power to the module.

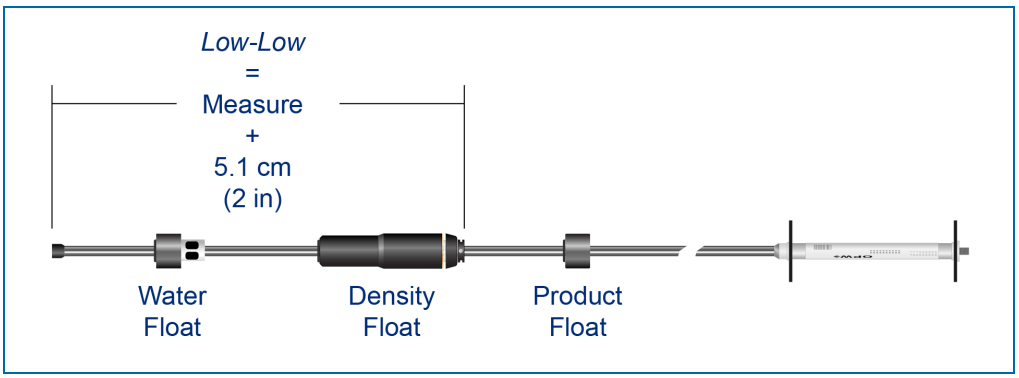
For DMF configuration and calibration refer to your M2011 Configuration Manual.

You will need the A and B Factors that are etched into the body of the float. See the image below.

NOTICE: The Density Measurement Float is not to be used in a pressurized tank.

13.2 Tank Thresholds

- Make sure that the Density float is installed between the Water Float and the Product Float. When you set the product threshold levels (*Low* and *Low-Low*) in the console's **Tank Thresholds** screen, make sure the values are higher than where the Density Float is installed. Refer to your console's configuration guide.
- Measure the distance between the end of the probe shaft and the top end of the Density Float. Add 5.1 cm (2 inches) to this distance to include the dead zone at the end of the probe. The result is the value of the minimum *Low-Low* product threshold.



Calculate Low-Low Threshold

Appendix B - Non-Smart Sensors (for Integra 500 only)

The OPW-FMS Non-Smart Sensors do not use Intellisense™ Technology. While their functions are the same as their Smart Sensor counterparts, they are not detected automatically by the console therefore, these sensors must be configured manually (see M2021 Integra Configuration Manual for information).

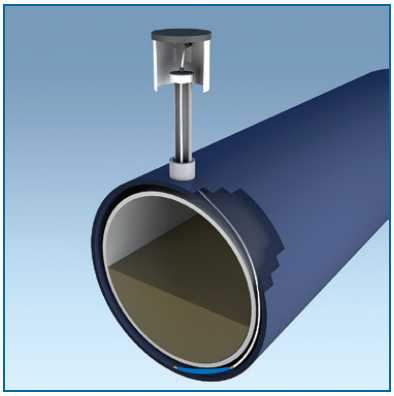
IMPORTANT: Non-Smart Sensors can only be installed on an Integra 500 console. DO NOT use these sensors with an Integra 100 console.

Non-Smart Sensors (for Integra 500 only)

Part Number	*Description*
30-3206	Interstitial Hydrocarbon Liquid with Water Indicator
30-3207	Hydrocarbon Liquid Sensor
30-3210	Hydrocarbon Liquid Sensor with Water Indicator
30-3219	Hydrocarbon Liquid Sump Sensor
30-3221-1	Universal Sump Sensor
30-3221-1B	Interstitial Level Sensor
30-3221-2	Dual-Level Reservoir Sensor
30-3222	Hydrocarbon Vapor Sensor
30-3223	Optical Liquid Sensor
30-3224	Combo Single-Level-HC Liquid Sensor
30-3225	Combo Dual-Level-HC Liquid Sensor

Appendix B - 1 - Interstitial Hydrocarbon Liquid Sensor with Water Indicator

OPW Fuel Management Systems P/N 30-3206



Description

The primary function of the Interstitial Hydrocarbon Liquid with Water Indicator Sensor is to sense liquid hydrocarbons and water in the interstitial area of a double-walled tank. The sensor has a carbon/polymer material that changes its resistance when it is touched by liquid hydrocarbons. The sensor also has a conductive strip to sense water. This lets the sensor tell the difference between hydrocarbon liquid and water. If there is a break in the cable it will cause an alarm condition in the system.

Specifications	
Operating Temperature:	20°C to +50°C (-4°F to 122°F)
Dimensions:	Length: 35 cm (13.8 in.), Width: 2.5 cm (1.0 in.)
Nominal resistance (uncontaminated)	Less than 3,000 ohms per foot
Nominal resistance (contaminated)	More than 10,000 ohms
Cable:	6.1 m (20 ft) of gas & oil resistant cable

IMPORTANT: For maximum safe operation this sensor must only be connected to an OPW Fuel Management Systems controller.

Installation

CAUTION: ALWAYS obey Local and National Electrical Codes applicable to the installation location.

Make sure that the cables (gas and oil resistant OPW Fuel Management Systems part # 12-1030) from the field wiring to the controller are in conduit that is dedicated to intrinsically safe wiring.

Use wire-nuts and epoxy-resin seal-packs for field connections (refer to M00-390008 Waterproof Electrical Connections for information).

REMINDER: Hydrocarbons float on water. If the sensor is put fully in water, the polymer will not sense hydrocarbon liquid.

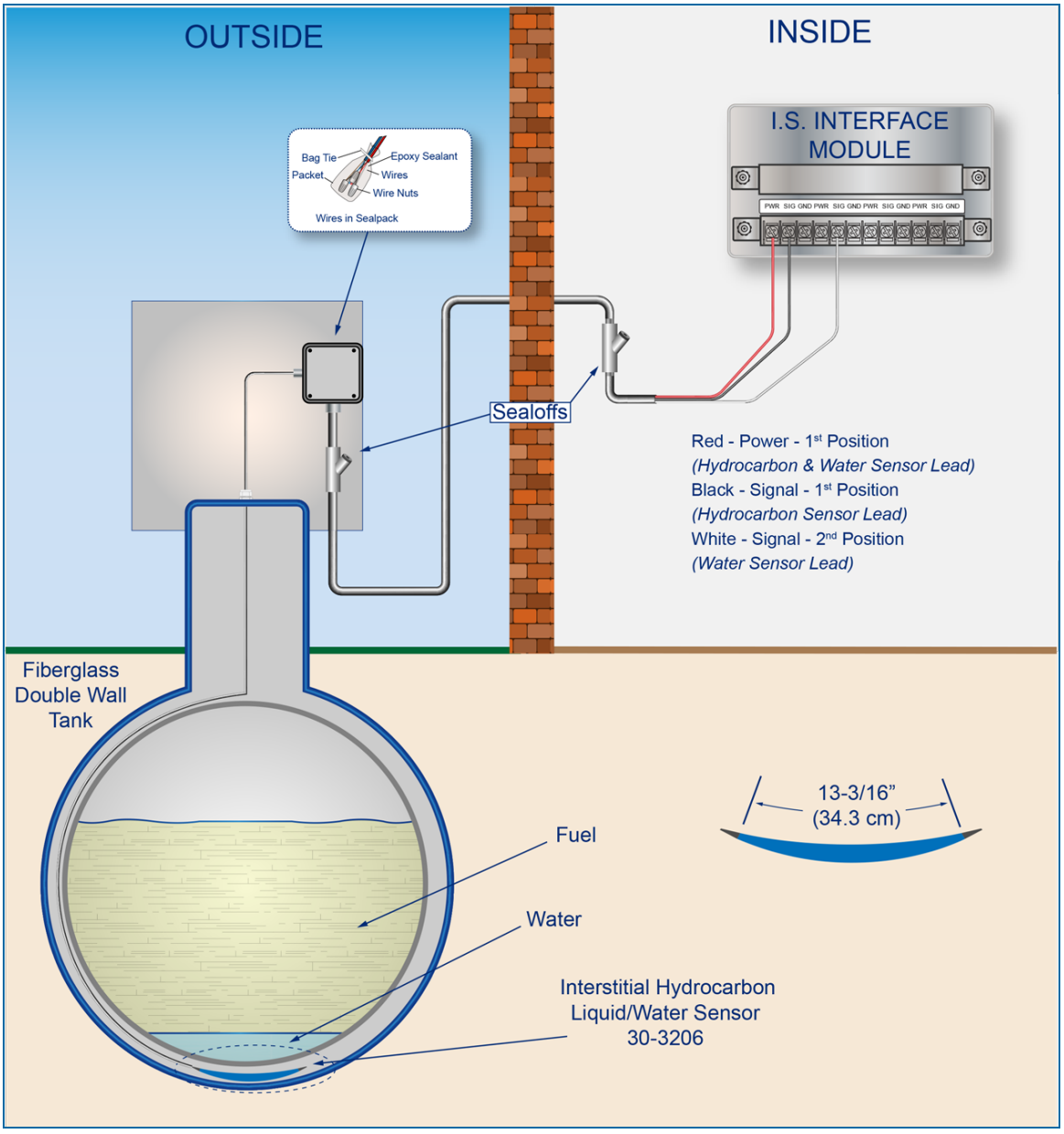
- This sensor uses two (2) Controller Interface Module Positions.
- Start with the Connections table and “Typical Installation" drawing below.
- Connect the sensor cable to the sensor.
- Connect the sensor wires to the field wires in the junction box. Use the supplied cable gland and silicon wire nuts.
- Seal the electrical connections with the epoxy seal packs (refer to M00-390008 Waterproof Electrical Connections for instructions).
- Install explosion-resistant sealing fittings at both ends of the conduit. Refer to the **Probe-Cable Seal-offs** section of the console's Installation Guide for instructions.

Connections

I.S. Interface Module Position 1 Terminals	*Sensor Wire Color*
Power	Red
Signal	Black (Hydrocarbon)
Ground	No Connection

I.S. Interface Module Position 2 Terminals	*Sensor Wire Color*
Power	No Connection
Signal	White (Water)
Ground	No Connection

Typical Installation Drawing



Controller Setup

1st Module Position - Hydrocarbon Liquid

1. Configure the barrier position to be a **generic** sensor (if *SiteConnect* software is used, select the applicable icon). Install that position.

2. In the controller (or SiteConnect), take a dynamic reading of the hydrocarbon sensor of the device.
3. Set the **lower** alarm threshold to be 0.5 volts lower than the reading taken (if there is no hydrocarbon contamination).

NOTE: SiteConnect will ask to adjust the lower threshold automatically, to 0.1 V below the current voltage reading. Answer YES.

4. Set the **upper** alarm threshold to 5.0 volts (this will disable the upper threshold).
5. Program the alarms related to the lower threshold that will start if the device senses hydrocarbon liquid.

2nd Module Position - Water

1. Configure the barrier position to be a **generic** sensor (if *SiteConnect* software is used, select the applicable icon). Install that position.
2. Set the **upper** alarm threshold to 0.5 volts.
3. Set the **lower** alarm threshold to 0 volts (this will disable the lower threshold).
4. Program the alarms related to the upper threshold that will start if the device senses water.

Interstitial Hydrocarbon Liquid/Water Sensor - Functional Test and Remove Contamination

IMPORTANT: It is recommended to only do the procedures below when it becomes necessary and only as a last alternative. These procedures can cause a decrease in the original electrical resistance of the polymer. If possible, speak with a certified OPW-FMS technician before you do these procedures.

CAUTION: Use caution to prevent dangerous conditions when you do work in a hazardous area.

Make sure that the area has sufficient airflow when you do a test or remove contamination from the sensor. Make sure there are no open flames or hot surfaces near the work area.

NOTICE: **Do not use fuel (gasoline, diesel etc.) to test or clean the sensor!** Once the carbon/polymer material has touched liquid hydrocarbon, it is possible that the sensor will

not return to its initial electrical resistance. This can have an unwanted effect on its operation. Replace the sensor if necessary. If you do not obey this instruction it can void your warranty.

Functional Test - Hydrocarbon Liquid Sensor of the Device

- Put the polymer fully into *Mineral Spirits* and wait approximately 10 minutes.
- Remove the sensor and let it hang to air dry for another 10 minutes.
- The test is satisfactory if an alarm condition or other event related to the hydrocarbon sensor of the device occurs. If the test results are unsatisfactory, replace the sensor.
- Disconnect the Hydrocarbon Sensor from the I.S. terminal strip in the controller. The test is satisfactory if an alarm condition occurs.
- Connect the sensor back to the I.S. terminal strip.
- Short across the power and signal terminals. This test is satisfactory if NO alarm condition occurs.

If the controller does not sense the alarm conditions simulated by these tests, look to see if the thresholds and alarms are correctly programmed in the system. A sensor or wiring fault will cause a system alarm. Do a continuity test in the wiring and junction boxes. Make sure there is continuity with no short circuits.

Functional Test - Water Sensor of the Device

- Put only the end of the sensor into *tap water*. The test is satisfactory if an alarm condition or other event related to the water sensor of the device occurs.
- Disconnect the Water Sensor from the I.S. terminal strip in the controller. The test is satisfactory if NO alarm condition occurs.
- Connect the sensor back to the I.S. terminal strip.
- Short across the power and signal terminals. This test is satisfactory if an alarm condition occurs.

If the controller does not sense the alarm conditions simulated by these tests, look to see if the thresholds and alarms are correctly programmed in the system. A sensor or wiring fault will cause a system alarm. Do a continuity test in the wiring and junction boxes. Make sure there is continuity with no short circuits.

Clean the Hydrocarbon Sensor of the Device

If it is necessary to clean hydrocarbon contamination from the sensor after a test or actual use:

- Make sure the sensor is disconnected.
- Put the dirty part of the sensor fully into *denatured alcohol* for one (1) hour.
- Flush the sensor with water to remove all remaining contamination.
- Let the sensor dry in the air for one (1) hour.
- Reconnect the sensor.

NOTE: If the sensor does not return to near its original resistance after you do a functional test or contamination has been removed, it is recommended to replace the sensor.

Appendix B - 2 - Hydrocarbon Liquid Sensor

OPW Fuel Management Systems P/N 30-3207-nn

Description

The primary function of the Hydrocarbon Liquid Sensor is to monitor wet wells with groundwater tables that can change levels. This sensor uses a carbon/polymer material that changes its resistance when it is touched by liquid hydrocarbons.

This sensor can also be installed in the containment area of tanks, pumps and pipes. It will tell the system if there are fuel leaks in a containment area. If there is a break in the cable it will cause an alarm condition in the system.

Specifications	
Operating Temperature:	20°C to +50°C (-4°F to 122°F)
Dimensions:	Length: 1.8 cm (0.7 in) dia. x (available lengths)
Nominal resistance (uncontaminated)	Less than 3,000 ohms per foot
Nominal resistance (contaminated)	More than 30,000 ohms
Cable:	3.05 m (10 ft) gas & oil resistant cable

IMPORTANT: For maximum safe operation this sensor must only be connected to an (missing or bad snippet) controller.

Installation

CAUTION: ALWAYS obey Local and National Electrical Codes applicable to the installation location.

Make sure that the cables (gas and oil resistant OPW Fuel Management Systems part # 12-1030) from the field wiring to the controller are in conduit that is dedicated to intrinsically safe wiring.

Use wire-nuts and epoxy-resin seal-packs for field connections (refer to M00-390008 Waterproof Electrical Connections for information).

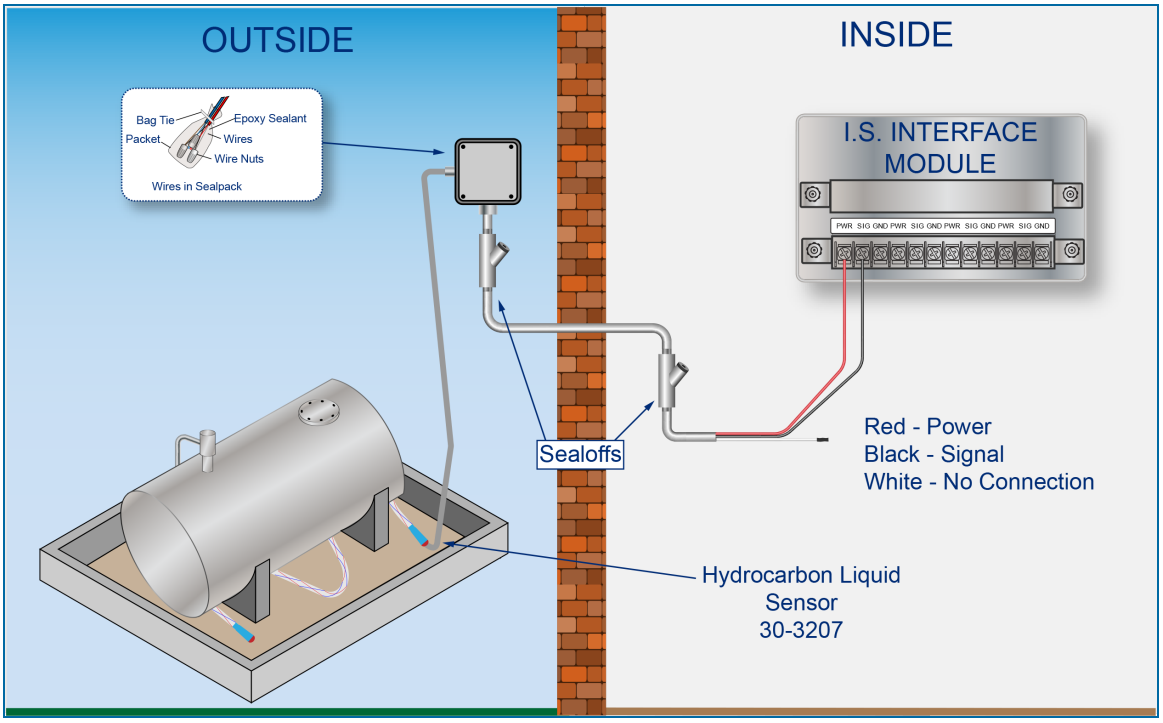
REMINDER: Hydrocarbons float on water. If the sensor is put fully in water, the polymer will not sense hydrocarbon liquid.

- This sensor uses one (1) Controller Interface Module Position.
- Start with the Connections table and “Typical Installation" drawing below.
- Connect the sensor cable to the sensor.
- Connect the sensor wires to the field wires in the junction box. Use the supplied cable gland and silicon wire nuts.
- Seal the electrical connections with the epoxy seal packs (refer to M00-390008 Waterproof Electrical Connections for instructions).
- Install explosion-resistant sealing fittings at both ends of the conduit. Refer to the **Probe-Cable Seal-offs** section of the console's Installation Guide for instructions.

Connections

I.S. Interface Module Position 1 Terminals	*Sensor Wire Color*
Power	Red
Signal	Black (Hydrocarbon)
Ground	No Connection

Typical Installation Drawing



Controller Setup

1. Configure the barrier position to be a **generic** sensor (if *SiteConnect* software is used, select the applicable icon). Install that position.
2. In the controller (or SiteConnect), take a dynamic reading of the hydrocarbon sensor of the device.
3. Set the **lower** alarm threshold to be 0.5 volts lower than the reading taken (if there is no hydrocarbon contamination).

NOTE: SiteConnect will ask to adjust the lower threshold automatically, to 0.1 V below the current voltage reading. Answer YES.

4. Set the **upper** alarm threshold to 5.0 volts (this will disable the upper threshold).
5. Program the alarms related to the lower threshold that will start if the device senses hydrocarbon liquid.

Interstitial Hydrocarbon Liquid Sensor - Functional Test and Remove Contamination

IMPORTANT: It is recommended to only do the procedures below when it becomes necessary and only as a last alternative. These procedures can cause a decrease in the original electrical resistance of the polymer. If possible, speak with a certified OPW-FMS technician before you do these procedures.

CAUTION: Use caution to prevent dangerous conditions when you do work in a hazardous area.

Make sure that the area has sufficient airflow when you do a test or remove contamination from the sensor. Make sure there are no open flames or hot surfaces near the work area.

NOTICE: **Do not use fuel (gasoline, diesel etc.) to test or clean the sensor!** Once the carbon/polymer material has touched liquid hydrocarbon, it is possible that the sensor will not return to its initial electrical resistance. This can have an unwanted effect on its operation. Replace the sensor if necessary. If you do not obey this instruction it can void your warranty.

Functional Test - Hydrocarbon Liquid Sensor of the Device

- Put the polymer fully into *Mineral Spirits* and wait approximately 10 minutes.
- Remove the sensor and let it hang to air dry for another 10 minutes.
- The test is satisfactory if an alarm condition or other event related to the hydrocarbon part of the sensor occurs. If the test results are unsatisfactory, replace the sensor.
- Disconnect the Hydrocarbon Sensor from the I.S. terminal strip in the controller. The test is satisfactory if an alarm condition occurs.
- Connect the sensor back to the I.S. terminal strip.
- Short across the power and signal terminals. This test is satisfactory if NO alarm condition occurs.

If the controller does not sense the alarm conditions simulated by these tests, look to see if the thresholds and alarms are correctly programmed in the system. A sensor or wiring fault will cause a system alarm. Do a continuity test in the wiring and junction boxes. Make sure there is continuity with no short circuits.

Clean the Hydrocarbon Sensor of the Device

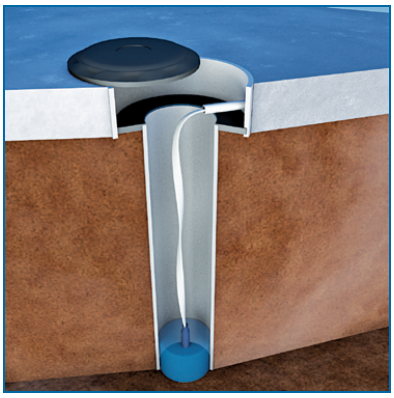
If it is necessary to clean hydrocarbon contamination from the sensor after a test or actual use:

- Make sure the sensor is disconnected.
- Put the dirty part of the sensor fully into *denatured alcohol* for one (1) hour.
- Flush the sensor with water to remove all remaining contamination.
- Let the sensor dry in the air for one (1) hour.
- Reconnect the sensor.

NOTE: If the sensor does not return to near its original resistance after you do a functional test or contamination has been removed, it is recommended to replace the sensor.

Appendix B - 3 - Hydrocarbon Liquid/Water Sensor

OPW Fuel Management Systems P/N 30-3210-nn



Description

The primary function of the Hydrocarbon Liquid Sensor with Water Indicator is to monitor wet wells with groundwater tables that can change levels. This sensor uses a carbon/polymer material that changes its resistance when it is touched by liquid hydrocarbons. The device also has a water sensor that has conductive material to sense water. This lets the device tell the difference between hydrocarbon liquid and water.

The sensor can tell the system if there is no ground water in a monitoring well or if there is water in a containment area. It can also tell the system if there are fuel leaks in a containment area. If there is a break in the cable it will cause an alarm condition in the system.

Specifications	
Operating Temperature:	20°C to +50°C (-4°F to 122°F)
Dimensions:	Length: 1.8 cm (0.7 in) dia. x (available lengths)
Nominal resistance (uncontaminated)	Less than 3,000 ohms per foot
Nominal resistance (contaminated)	More than 30,000 ohms
Cable:	3.05 m (10 ft) gas & oil resistant cable

IMPORTANT: For maximum safe operation this sensor must only be connected to an OPW Fuel Management Systems controller.

Installation

CAUTION: ALWAYS obey Local and National Electrical Codes applicable to the installation location.

Make sure that the cables (gas and oil resistant OPW Fuel Management Systems part # 12-1030) from the field wiring to the controller are in conduit that is dedicated to intrinsically safe wiring.

Use wire-nuts and epoxy-resin seal-packs for field connections (refer to M00-390008 Waterproof Electrical Connections for information).

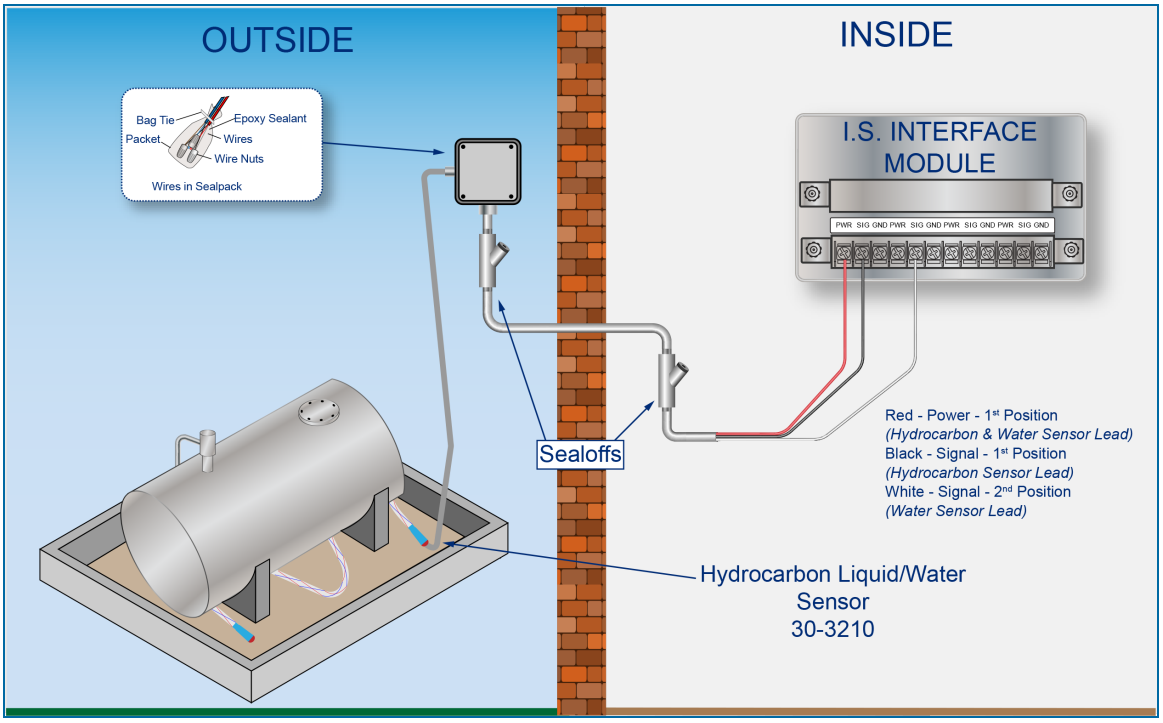
REMINDER: Hydrocarbons float on water. If the sensor is put fully in water, the polymer will not sense hydrocarbon liquid.

- This sensor uses two (2) Controller Interface Module Positions.
- Start with the Connections table and “Typical Installation" drawing below.
- Connect the sensor cable to the sensor.
- Connect the sensor wires to the field wires in the junction box. Use the supplied cable gland and silicon wire nuts.
- Seal the electrical connections with the epoxy seal packs (refer to M00-390008 Waterproof Electrical Connections for instructions).
- Install explosion-resistant sealing fittings at both ends of the conduit. Refer to the **Probe-Cable Seal-offs** section of the console's Installation Guide for instructions.

I.S. Interface Module Position 1 Terminals	*Sensor Wire Color*
Power	Red
Signal	Black (Hydrocarbon)
Ground	No Connection

I.S. Interface Module Position 2 Terminals	*Sensor Wire Color*
Power	No Connection
Signal	White (Water)
Ground	No Connection

Typical Installation Drawing



Controller Setup

1st Module Position - Hydrocarbon Liquid

1. Configure the barrier position to be a **generic** sensor (if *SiteConnect* software is used, select the applicable icon). Install that position.
2. In the controller (or SiteConnect), take a dynamic reading of the hydrocarbon sensor of the device.
3. Set the **lower** alarm threshold to be 0.5 volts lower than the reading taken (if there is no hydrocarbon contamination).

NOTE: SiteConnect will ask to adjust the lower threshold automatically, to 0.1 V below the current voltage reading. Answer YES.

4. Set the **upper** alarm threshold to 5.0 volts (this will disable the upper threshold).
5. Program the alarms related to the lower threshold that will start if the device senses hydrocarbon liquid.

2nd Module Position - Water

1. Configure the barrier position to be a **generic** sensor (if *SiteConnect* software is used, select the applicable icon). Install that position.
2. Set the **upper** alarm threshold to 0.5 volts.
3. Set the **lower** alarm threshold to 0 volts (this will disable the lower threshold).
4. Program the alarms related to the upper threshold that will start if the device senses water.

Hydrocarbon Liquid/Water Sensor - Functional Test and Remove Contamination

IMPORTANT: It is recommended to only do the procedures below when it becomes necessary and only as a last alternative. These procedures can cause a decrease in the original electrical resistance of the polymer. If possible, speak with a certified OPW-FMS technician before you do these procedures.

CAUTION: Use caution to prevent dangerous conditions when you do work in a hazardous area.

Make sure that the area has sufficient airflow when you do a test or remove contamination from the sensor. Make sure there are no open flames or hot surfaces near the work area.

NOTICE: **Do not use fuel (gasoline, diesel etc.) to test or clean the sensor!** Once the carbon/polymer material has touched liquid hydrocarbon, it is possible that the sensor will not return to its initial electrical resistance. This can have an unwanted effect on its operation. Replace the sensor if necessary. If you do not obey this instruction it can void your warranty.

Functional Test - Hydrocarbon Liquid Sensor of the Device

- Put the polymer fully into *Mineral Spirits* and wait approximately 10 minutes.
- Remove the sensor and let it hang to air dry for another 10 minutes.
- The test is satisfactory if an alarm condition or other event related to the hydrocarbon sensor of the device occurs. If the test results are unsatisfactory, replace the sensor.
- Disconnect the Hydrocarbon Sensor from the I.S. terminal strip in the controller. The test is satisfactory if an alarm condition occurs.
- Connect the sensor back to the I.S. terminal strip.
- Short across the power and signal terminals. This test is satisfactory if NO alarm condition occurs.

If the controller does not sense the alarm conditions simulated by these tests, look to see if the thresholds and alarms are correctly programmed in the system. A sensor or wiring fault will cause a system alarm. Do a continuity test in the wiring and junction boxes. Make sure there is continuity with no short circuits.

Functional Test - Water Sensor of the Device

- Put only the end of the sensor into *tap water*. The test is satisfactory if an alarm condition or other event related to the water sensor of the device occurs.
- Disconnect the Water Sensor from the I.S. terminal strip in the controller. The test is satisfactory if NO alarm condition occurs.
- Connect the sensor back to the I.S. terminal strip.
- Short across the power and signal terminals. This test is satisfactory if an alarm condition occurs.

If the controller does not sense the alarm conditions simulated by these tests, look to see if the thresholds and alarms are correctly programmed in the system. A sensor or wiring fault will cause a system alarm. Do a continuity test in the wiring and junction boxes. Make sure there is continuity with no short circuits.

Clean the Hydrocarbon Sensor of the Device

If it is necessary to clean hydrocarbon contamination from the sensor after a test or actual use:

- Make sure the sensor is disconnected.
- Put the dirty part of the sensor fully into *denatured alcohol* for one (1) hour.
- Flush the sensor with water to remove all remaining contamination.
- Let the sensor dry in the air for one (1) hour.
- Reconnect the sensor.

NOTE: If the sensor does not return to near its original resistance after you do a functional test or contamination has been removed, it is recommended to replace the sensor.

Appendix B - 4 - Hydrocarbon Liquid Sump Sensor

OPW Fuel Management Systems P/N 30-3219-12

Description

The primary function of the Hydrocarbon Liquid Sump Sensor is to sense liquid in sumps, fuel dispenser pans and other locations where there is liquid that could indicate that a leak has occurred. The sensor has a carbon/polymer material that changes its resistance when it is touched by liquid hydrocarbons. If there is a break in the cable it will cause an alarm condition in the system.

Specifications	
Operating Temperature:	20°C to +50°C (-4°F to 122°F)
Dimensions:	4.4 cm (1.7 in) dia. x 33.5 cm (13.2 in) long
Nominal resistance (uncontaminated)	Less than 5,000 ohms
Nominal resistance (contaminated)	More than 30,000 ohms
Cable:	3.6m (12 ft) of gas & oil resistant cable

IMPORTANT: For maximum safe operation this sensor must only be connected to an (missing or bad snippet) controller.

Installation

CAUTION: ALWAYS obey Local and National Electrical Codes applicable to the installation location.

Make sure that the cables (gas and oil resistant OPW Fuel Management Systems part # 12-1030) from the field wiring to the controller are in conduit that is dedicated to intrinsically safe wiring.

Use wire-nuts and epoxy-resin seal-packs for field connections (refer to M00-390008 Waterproof Electrical Connections for information).

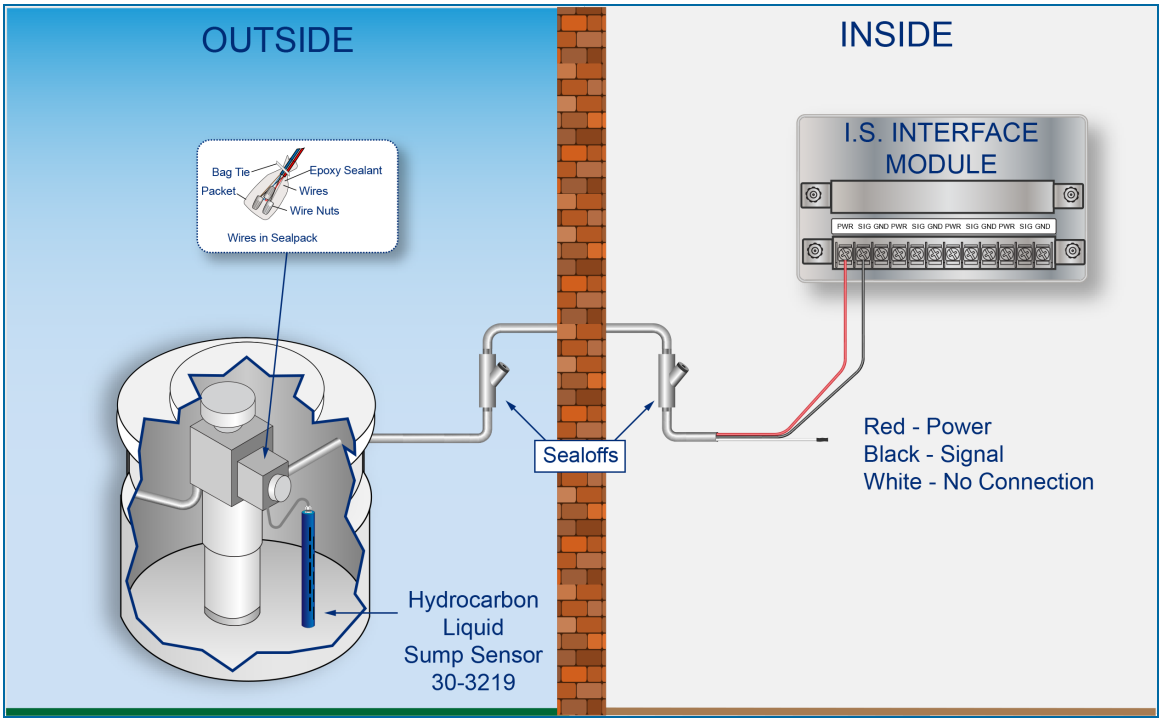
REMINDER: Hydrocarbons float on water. If the sensor is put fully in water, the polymer will not sense hydrocarbon liquid.

- This sensor uses one (1) Controller Interface Module Position.
- Start with the Connections table and “Typical Installation" drawing below.
- Connect the sensor cable to the sensor.
- Connect the sensor wires to the field wires in the junction box. Use the supplied cable gland and silicon wire nuts.
- Seal the electrical connections with the epoxy seal packs (refer to M00-390008 Waterproof Electrical Connections for instructions).
- Install explosion-resistant sealing fittings at both ends of the conduit. Refer to the **Probe-Cable Seal-offs** section of the console's Installation Guide for instructions.

Connections

I.S. Interface Module Position 1 Terminals	*Sensor Wire Color*
Power	Red
Signal	Black (Hydrocarbon)
Ground	No Connection

Typical Installation Drawing



Controller Setup

1. Configure the barrier position to be a **generic**sensor (if *SiteConnect* software is used, select the applicable icon). Install that position.
2. In the controller (or SiteConnect), take a dynamic reading of the hydrocarbon sensor of the device.
3. Set the **lower** alarm threshold to be 0.5 volts lower than the reading taken (if there is no hydrocarbon contamination).

NOTE: SiteConnect will ask to adjust the lower threshold automatically, to 0.1 V below the current voltage reading. Answer YES.

4. Set the **upper** alarm threshold to 5.0 volts (this will disable the upper threshold).
5. Program the alarms related to the lower threshold that will start if the device senses hydrocarbon liquid.

Hydrocarbon Liquid Sump Sensor - Functional Test and Remove Contamination

IMPORTANT: It is recommended to only do the procedures below when it becomes necessary and only as a last alternative. These procedures can cause a decrease in the original electrical resistance of the polymer. If possible, speak with a certified OPW-FMS technician before you do these procedures.

CAUTION: Use caution to prevent dangerous conditions when you do work in a hazardous area.

Make sure that the area has sufficient airflow when you do a test or remove contamination from the sensor. Make sure there are no open flames or hot surfaces near the work area.

NOTICE: **Do not use fuel (gasoline, diesel etc.) to test or clean the sensor!** Once the carbon/polymer material has touched liquid hydrocarbon, it is possible that the sensor will not return to its initial electrical resistance. This can have an unwanted effect on its operation. Replace the sensor if necessary. If you do not obey this instruction it can void your warranty.

Functional Test - Hydrocarbon Liquid Sensor

- Put the polymer fully into *Mineral Spirits* and wait approximately 10 minutes.
- Remove the sensor and let it hang to air dry for another 10 minutes.
- The test is satisfactory if an alarm condition or other event related to the hydrocarbon part of the sensor occurs. If the test results are unsatisfactory, replace the sensor.
- Disconnect the Hydrocarbon Sensor from the I.S. terminal strip in the controller. The test is satisfactory if an alarm condition occurs.
- Connect the sensor back to the I.S. terminal strip.
- Short across the power and signal terminals. This test is satisfactory if NO alarm condition occurs.

If the controller does not sense the alarm conditions simulated by these tests, look to see if the thresholds and alarms are correctly programmed in the system. A sensor or wiring fault will cause a system alarm. Do a continuity test in the wiring and junction boxes. Make sure there is continuity with no short circuits.

Clean the Hydrocarbon Sensor

If it is necessary to clean hydrocarbon contamination from the sensor after a test or actual use:

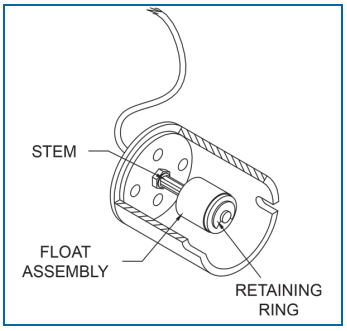
- Make sure the sensor is disconnected.
- Put the dirty part of the sensor fully into *denatured alcohol* for one (1) hour.
- Flush the sensor with water to remove all remaining contamination.
- Let the sensor dry in the air for one (1) hour.
- Reconnect the sensor.

NOTE: If the sensor does not return to near its original resistance after you do a functional test or contamination has been removed, it is recommended to replace the sensor.

Appendix B - 5 - Universal Sump Sensor - Float Switch

OPW Fuel Management Systems P/N 30-3221-1

The primary function of the single-level sensor is to sense liquid in sumps, fuel dispenser pans and other locations where there is liquid that could indicate that a leak has occurred. A float inside the sensor moves up when the liquid level increases. The float switch will operate and cause an alarm condition in the controller. If there is a break in the cable it will cause an alarm condition in the system.



This sensor can also be used to monitor wet wells with normal liquid levels.

Specifications	
Operating Temperature:	20°C to +50°C (-4°F to 122°F)
Dimensions:	7.4 cm (2.9 in) dia. x 9.5 cm (3.7 in) long
Cable:	4.5 m (15 ft) of gas & oil resistant cable

IMPORTANT: For maximum safe operation this sensor must only be connected to an OPW Fuel Management Systems controller.

Installation

CAUTION: ALWAYS obey Local and National Electrical Codes applicable to the installation location.

Make sure that the cables (gas and oil resistant OPW Fuel Management Systems part # 12-1030) from the field wiring to the controller are in conduit that is dedicated to intrinsically safe wiring.

Use wire-nuts and epoxy-resin seal-packs for field connections (refer to M00-390008 Waterproof Electrical Connections for information).

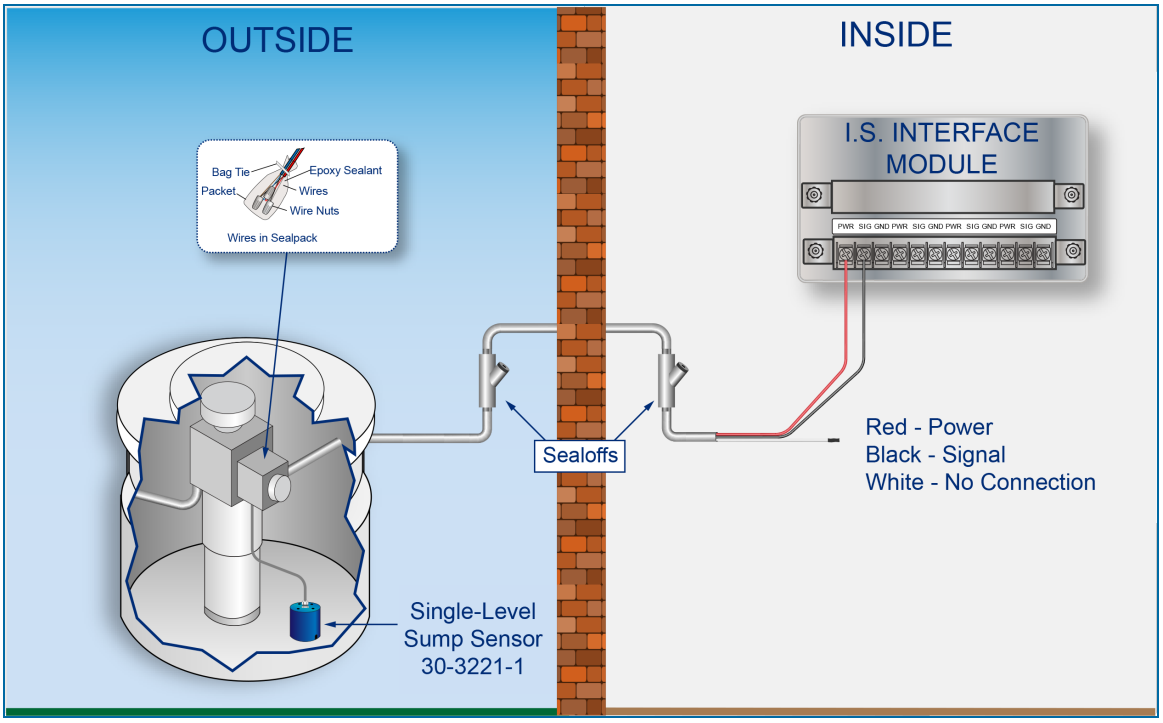
NOTE: If this sensor is used to monitor a normally dry well, use a meter to set the float position so the sensor is in a closed position when there is NO liquid level (the float will be in the lower position). To monitor a normally wet well, use a meter to set the float so that the sensor is in a closed condition WITH a liquid level (the float will be in the upper position).

- This sensor uses ONE Controller Interface I.S. Module position
- Start with the Connections table and “Typical Installation" drawing below.
- Make sure the sump pit or pan is dry.
- Install the sensor on the bottom of the sump/pan. Attach the sensor wire to a pipe or bracket with a tie wrap.
- Connect the sensor cable to the sensor.
- Connect the sensor wires to the field wires in the junction box. Use the supplied cable gland and silicon wire nuts.
- Seal the electrical connections with the epoxy seal packs (refer to M00-390008 Waterproof Electrical Connections for instructions).
- Install explosion-resistant sealing fittings at both ends of the conduit. Refer to the **Probe-Cable Seal-offs** section of the console's Installation Guide for instructions.

Connections

I.S. Interface Module Position 1 Terminals	*Sensor Wire Color*
Power	Red
Signal	Black (Hydrocarbon)
Ground	White - No Connection

Typical Installation Drawing



Controller Setup

1. Configure the barrier position to be a **generic**sensor (if *SiteConnect* software is used, select the applicable icon). Install that position.
2. Set the **lower** alarm threshold to 2.5 volts.
   - When the sensor is used to monitor a normally *wet* well, the lower threshold indicates the liquid is too low.
   - When the sensor is used to monitor a normally *dry*well, the lower threshold indicates the liquid is too high.
3. Set the **upper** alarm threshold to 5.0 volts (this will disable the upper threshold).
4. Program the alarms related to the lower threshold that will start if the device senses hydrocarbon liquid.

Float Sensor Test

CAUTION: Use caution to prevent dangerous conditions when you do work in a hazardous area.

Make sure that the area has sufficient airflow when you do a test or remove contamination from the sensor. Make sure there are no open flames or hot surfaces near the work area.

When the Sensor is Installed in a Normally DRY Well

- Put the float in the UPPER position. The test is satisfactory if an alarm condition is caused in the controller.
- Return the float to the LOWER position. If the alarm condition stops, the test is satisfactory.
- Disconnect the sensor. The test is satisfactory if an alarm condition is caused in the controller.
- Short the sensor leads. The test is satisfactory if an alarm condition is **not** caused in the controller

If the open lead test and/or short lead test are unsatisfactory do a continuity test in the wiring and junction boxes. Make sure there is continuity with no short circuits. Look to see if the float is in the correct position (refer to the applicable instruction above).

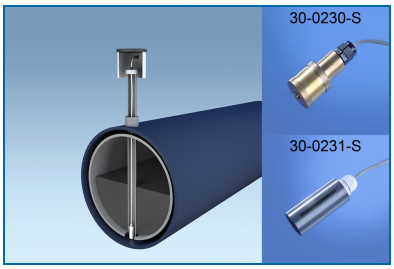
When the Sensor is Installed in a Normally WET Well

- Put the float in the LOWER position. The test is satisfactory if an alarm condition is caused in the controller.
- Return the float to the UPPER position. If the alarm condition stops, the test is satisfactory.
- Disconnect the sensor. The test is satisfactory if an alarm condition is caused in the controller.
- Short the sensor leads. The test is satisfactory if an alarm condition is **not** caused in the controller

If the controller does not go into an alarm condition, look to see if the thresholds are correctly programmed in the system.

Appendix B - 6 - Interstitial Level Sensor

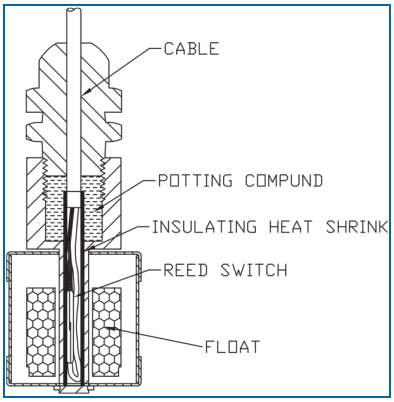
OPW Fuel Management Systems P/N 30-3221-1A & 1B



Description

The primary function of these sensors is to sense liquid in the interstitial area of a double-walled tank. A float inside the sensor moves up when the liquid level increases. The float switch will operate and cause an alarm condition in the controller. The 30-3221-1A is made of a chemical resistant, non-metallic material. The 30-3221-1B is made of brass

These sensors can also be used in sumps, fuel dispenser pans and other locations where there is liquid that could indicate that a leak has occurred. These sensors can also be used together with a vapor sensor (30-3222) to monitor wet wells to make sure that there is a normal liquid level. If there is a break in the cable it will cause an alarm condition in the system.



Specifications	
Operating Temperature:	20°C to +50°C (-4°F to 122°F)
Dimensions 30-3221-1A:	3.4 cm (1.3 in) dia. x 10 cm (3.9 in) long
Dimensions 30-3221-1B:	3.5 cm (1.4 in) dia. x 9.0 cm (3.5 in) long
Cable:	4.5 m (15 ft) of gas & oil resistant cable

IMPORTANT: For maximum safe operation this sensor must only be connected to an OPW Fuel Management Systems controller.

Installation

CAUTION: ALWAYS obey Local and National Electrical Codes applicable to the installation location.

Make sure that the cables (gas and oil resistant OPW Fuel Management Systems part # 12-1030) from the field wiring to the controller are in conduit that is dedicated to intrinsically safe wiring.

Use wire-nuts and epoxy-resin seal-packs for field connections (refer to M00-390008 Waterproof Electrical Connections for information).

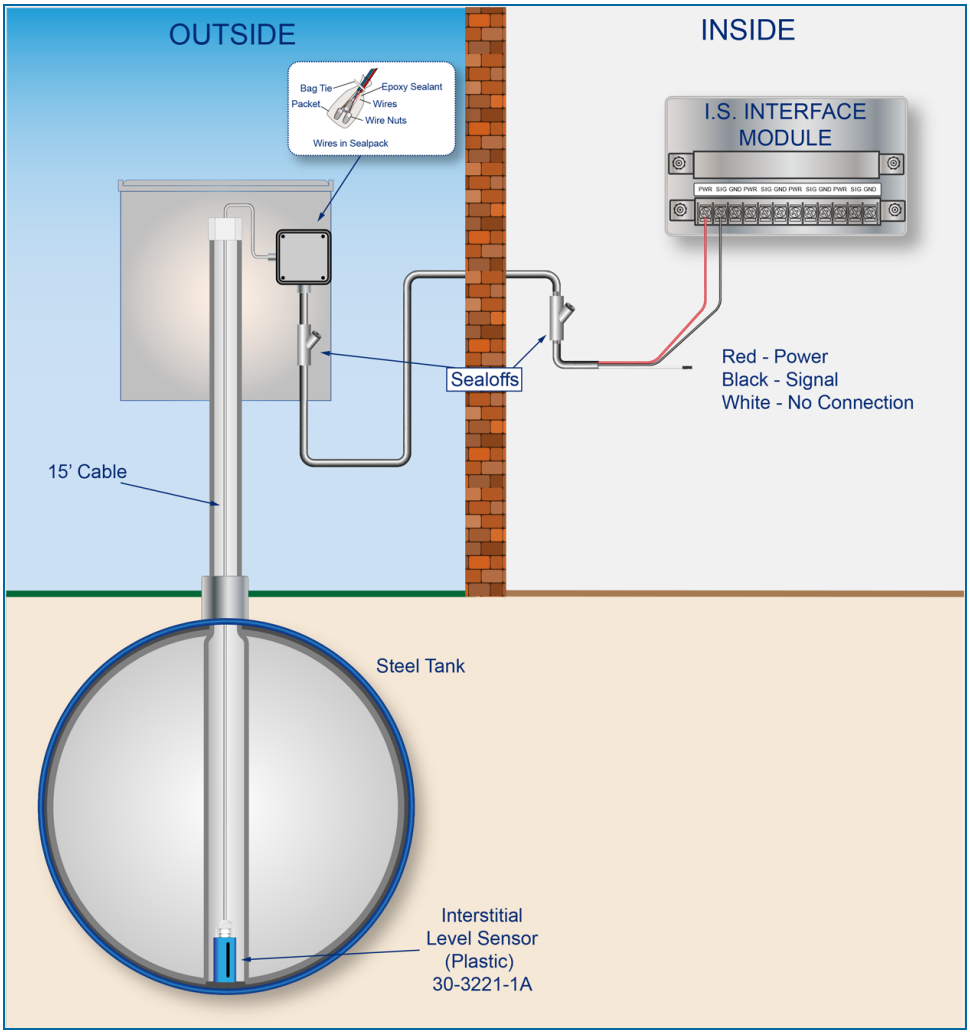
- This sensor uses ONE Controller Interface I.S. Module position
- Start with the Connections table and “Typical Installation" drawing below.
- Make sure the sump pit or pan is dry.
- Install the sensor approximately 1/2” (1.3 cm) above the bottom of the sump/pan. Attach the sensor wire to a pipe or bracket with a tie wrap.
- Connect the sensor cable to the sensor.
- Connect the sensor wires to the field wires in the junction box. Use the supplied cable gland and silicon wire nuts.
- Seal the electrical connections with the epoxy seal packs (refer to M00-390008 Waterproof Electrical Connections for instructions).
- Install explosion-resistant sealing fittings at both ends of the conduit. Refer to the **Probe-Cable Seal-offs** section of the console's Installation Guide for instructions.

Connections

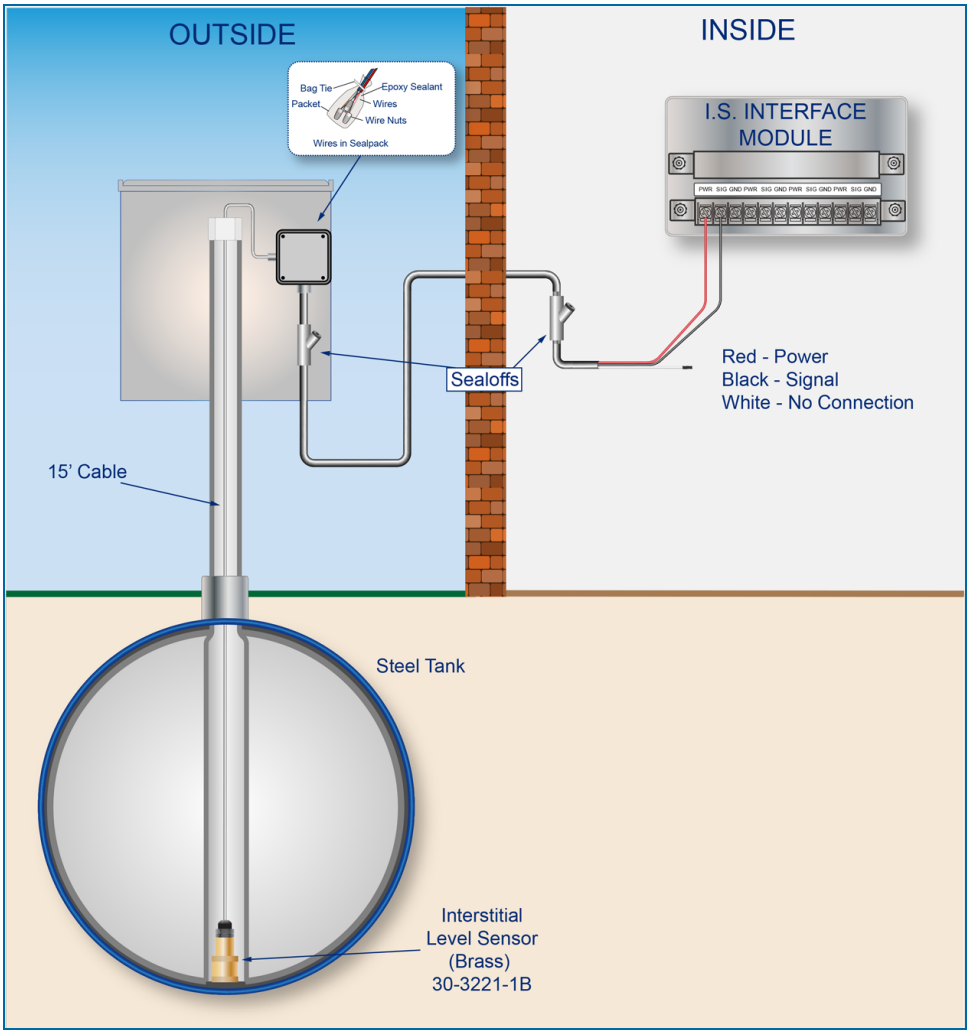
I.S. Interface Module Position 1 Terminals	*Sensor Wire Color*
Power	Red
Signal	Black (Hydrocarbon)
Ground	White - No Connection

Typical Installation Drawings

30-3221-1A



30-3221-1B



Controller Setup

1. Configure the barrier position to be a **generic**sensor (if *SiteConnect* software is used, select the applicable icon). Install that position.
2. Set the **lower** alarm threshold to 2.5 volts.
   - When the sensor is used to monitor a normally *wet* well, the lower threshold indicates the liquid is too low.
   - When the sensor is used to monitor a normally *dry*well, the lower threshold indicates the liquid is too high.
3. Set the **upper** alarm threshold to 5.0 volts (this will disable the upper threshold).
4. Program the alarms related to the lower threshold that will start if the device senses hydrocarbon liquid.

Float Sensor Test

CAUTION: Use caution to prevent dangerous conditions when you do work in a hazardous area.

Make sure that the area has sufficient airflow when you do a test or remove contamination from the sensor. Make sure there are no open flames or hot surfaces near the work area.

When the Sensor is Installed in a Normally DRY Well

- Put the float in the UPPER position. The test is satisfactory if an alarm condition is caused in the controller.
- Return the float to the LOWER position. If the alarm condition stops, the test is satisfactory.
- Disconnect the sensor. The test is satisfactory if an alarm condition is caused in the controller.
- Short the sensor leads. The test is satisfactory if an alarm condition is **not** caused in the controller

If the open lead test and/or short lead test are unsatisfactory do a continuity test in the wiring and junction boxes. Make sure there is continuity with no short circuits. Look to see if the float is in the correct position (refer to the applicable instruction above).

When the Sensor is Installed in a Normally WET Well

- Put the float in the LOWER position. The test is satisfactory if an alarm condition is caused in the controller.
- Return the float to the UPPER position. If the alarm condition stops, the test is satisfactory.
- Disconnect the sensor. The test is satisfactory if an alarm condition is caused in the controller.
- Short the sensor leads. The test is satisfactory if an alarm condition is **not** caused in the controller

If the controller does not go into an alarm condition, look to see if the thresholds are correctly programmed in the system.

Appendix B - 7 - Dual-Level Reservoir Sensor

OPW Fuel Management Systems P/N 30-3221-2

Description

The primary function of the Dual Level Reservoir Sensor is to sense liquid in the brine-filled reservoir of the interstitial area of a doubled-walled tank. Two (2) float switches are used in the body of the sensor to sense fluid level changes. The device will cause an alarm condition in the system if the fluid level increases or decreases more than the normal constant level in the middle between the upper and lower floats. If there is a break in the cable it will cause an alarm condition in the system.

This sensor can also be used in other areas that are usually dry (e.g. dispenser containment pans). When liquid is sensed, the system will give a low-level warning followed by a high level alarm.

Specifications	
Operating Temperature:	20°C to +50°C (-4°F to 122°F)
Dimensions:	6 cm (2.4 in) dia. x 35.6 cm (14 in) long
Cable:	4.5 m (15 ft) of gas & oil resistant cable

IMPORTANT: For maximum safe operation this sensor must only be connected to an (missing or bad snippet) controller.

Installation

CAUTION: ALWAYS obey Local and National Electrical Codes applicable to the installation location.

Make sure that the cables (gas and oil resistant OPW Fuel Management Systems part # 12-1030) from the field wiring to the controller are in conduit that is dedicated to intrinsically safe wiring.

Use wire-nuts and epoxy-resin seal-packs for field connections (refer to M00-390008 Waterproof Electrical Connections for information).

- This sensor uses ONE Controller Interface I.S. Module position
- Start with the Connections table and “Typical Installation" drawing below.
- Connect the sensor cable to the sensor.
- Connect the sensor wires to the field wires in the junction box. Use the supplied cable gland and silicon wire nuts.
- Seal the electrical connections with the epoxy seal packs (refer to M00-390008 Waterproof Electrical Connections for instructions).
- Install explosion-resistant sealing fittings at both ends of the conduit. Refer to the **Probe-Cable Seal-offs** section of the console's Installation Guide for instructions.

NOTE: The lower float is adjustable so that it can monitor wet and dry wells. The float is installed at the factory to monitor wet wells. To change the direction of the float to monitor dry wells:

- Remove the C-clip on the bottom of the float with a needle-nose pliers.
- Remove the plastic cover.
- Remove the float clip.
- Remove the float.
- Turn the float so that the CLOSED arrow marked on the side of the float points to the top of the float.
- Reassemble the sensor.

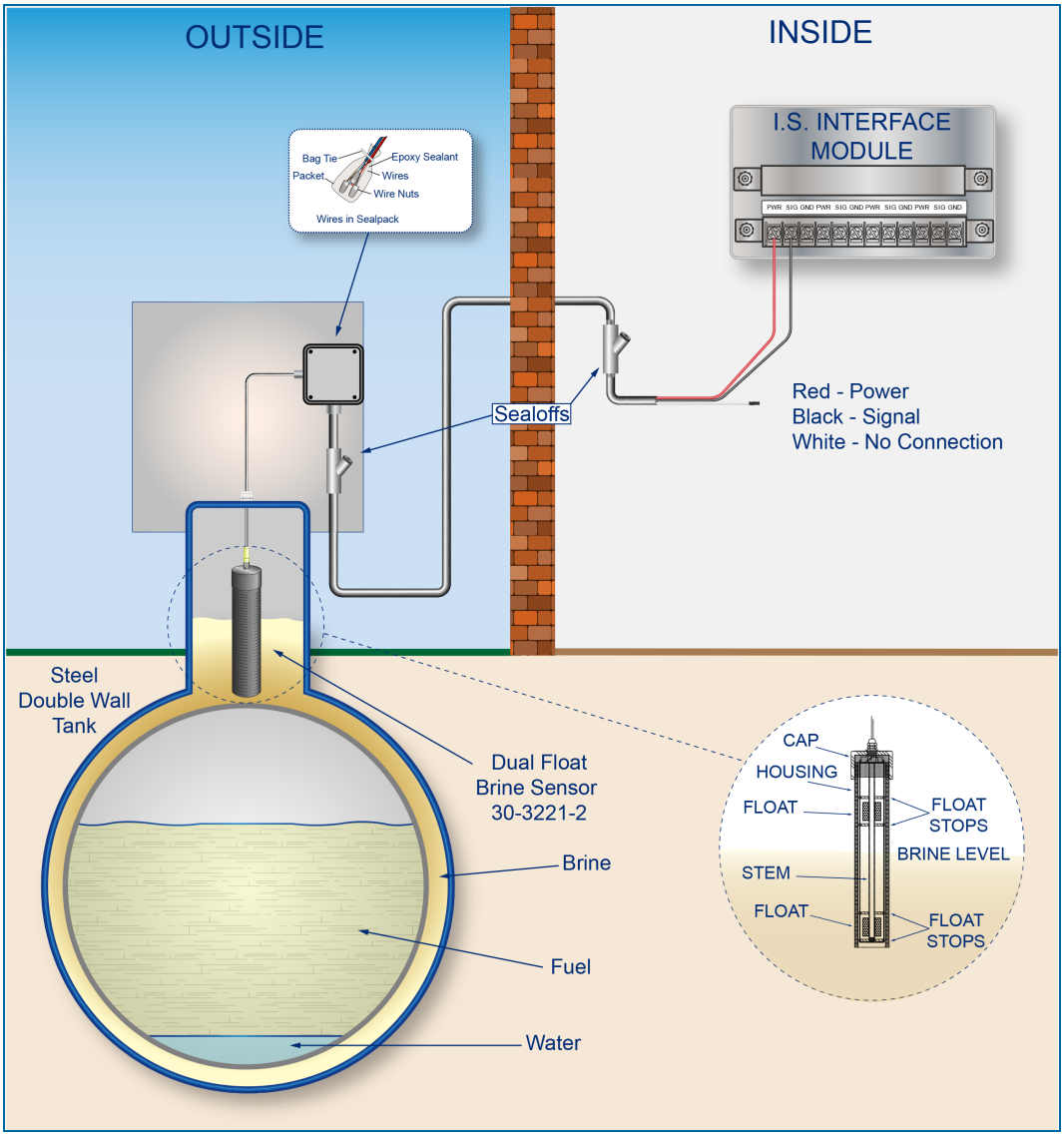
To monitor a wet well (i.e. brine-filled reservoir), the CLOSED arrow marked on the side of the float must point to the bottom of the float.

To monitor a dry well (e.g. dispenser containment pans), the CLOSED arrow marked on the side of the float must point to the top of the float.

Connections

I.S. Interface Module Position 1 Terminals	Sensor Wire Color
Power	Red
Signal	Black (Hydrocarbon)
Ground	White - No Connection

Typical Installation Drawing



Controller Setup

1. Configure the barrier position to be a **generic**sensor (if *SiteConnect* software is used, select the applicable icon). Install that position.
2. Set the lower alarm threshold to 2.2 volts.
3. Set the upper alarm threshold to 3.4 volts.
   - When the sensor is set to monitor a wet well, the 3.4-volt upper threshold indicates that the liquid level is too low. The 2.2-volt threshold indicates that the liquid level is too high.
   - When the sensor is set to monitor a dry well, the 3.4-volt upper threshold indicates that the liquid level is above the lower float. The 2.2-volt threshold indicates that the liquid level is above the top float.
4. Program the alarms related to the thresholds that will start if the device senses the related liquid levels.

Float Sensor Test

CAUTION: Use caution to prevent dangerous conditions when you do work in a hazardous area.

Make sure that the area has sufficient airflow when you do a test or remove contamination from the sensor. Make sure there are no open flames or hot surfaces near the work area.

When the Sensor is Installed in a Normally DRY Well

- Put the bottom float in the high position and the top float in the low position. The test is satisfactory if a low-level alarm is caused in the controller..
- Put the bottom float in the high position and the top float in the high position. The test is satisfactory if a high-level alarm is caused in the controller..
- Return the two floats to the low position. This test is satisfactory if there is no alarm condition caused in the controller.
- Disconnect the sensor. This test is satisfactory if an alarm condition is caused in the controller.

If test results are unsatisfactory do a continuity test in the wiring and junction boxes. Make sure there is continuity with no short circuits.

When the Sensor is Installed in a Normally Wet Well

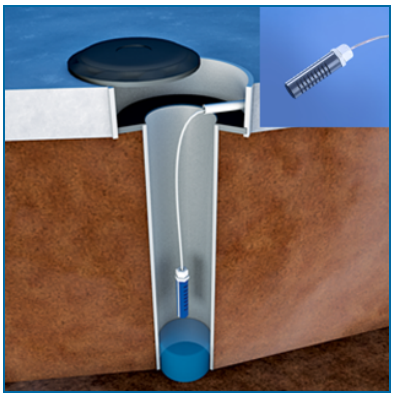
- Put the bottom float in the low position and the top float in the low position. The test is satisfactory if a low-level alarm is caused in the controller..
- Put the bottom float in the high position and the top float in the high position. The test is satisfactory if a high-level alarm is caused in the controller..
- Put the bottom float in the high position and the top float in the low position. The test is satisfactory if there is no alarm condition caused in the controller.

- Disconnect the sensor. This test is satisfactory if an alarm condition is caused in the controller.

If the controller does not go into an alarm condition when a test is unsatisfactory, look to see if the thresholds are correctly programmed in the system. Look to see if the float is in the correct position (refer to the applicable instruction above). A sensor or wiring fault will cause a system alarm. Do a continuity test in the wiring and junction boxes. Make sure there is continuity with no short circuits.

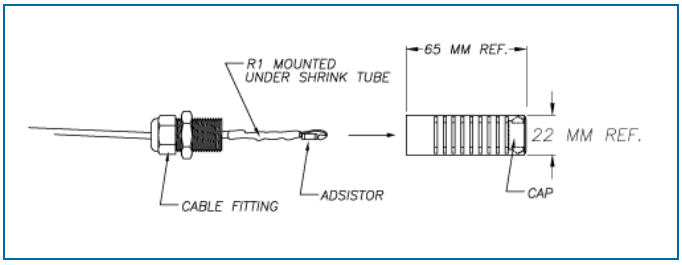
Appendix B - 8 - Hydrocarbon Vapor Sensor

OPW Fuel Management Systems P/N 30-3222



Description

The primary function of the Hydrocarbon Vapor Sensor is to sense hydrocarbon vapors in monitoring wells and the interstitial areas of a double-walled tank. These vapors could indicate a possibly dangerous leak that could lead to safety and environmental problems. The sensor is made from a long-life resistive element that will increase in resistance when there are hydrocarbon vapors in the closed space where the device is installed. The sensor will return to normal resistance when hydrocarbon vapors are gone. If there is a break in the cable it will cause an alarm condition in the system.



Specifications	
Operating Temperature:	20°C to +50°C (-4°F to 122°F)
Dimensions:	2.3 cm (0.9 in) dia. x 8.9 cm (3.5 in) long
Nominal resistance (uncontaminated)	Less than 5,000 ohms
Nominal resistance (contaminated)	More than 10,000 ohms
Cable:	4.5 m (15 ft) of gas & oil resistant cable.

IMPORTANT: For maximum safe operation this sensor must only be connected to an OPW Fuel Management Systems controller.

Installation

CAUTION: ALWAYS obey Local and National Electrical Codes applicable to the installation location.

Make sure that the cables (gas and oil resistant OPW Fuel Management Systems part # 12-1030) from the field wiring to the controller are in conduit that is dedicated to intrinsically safe wiring.

Use wire-nuts and epoxy-resin seal-packs for field connections (refer to M00-390008 Waterproof Electrical Connections for information).

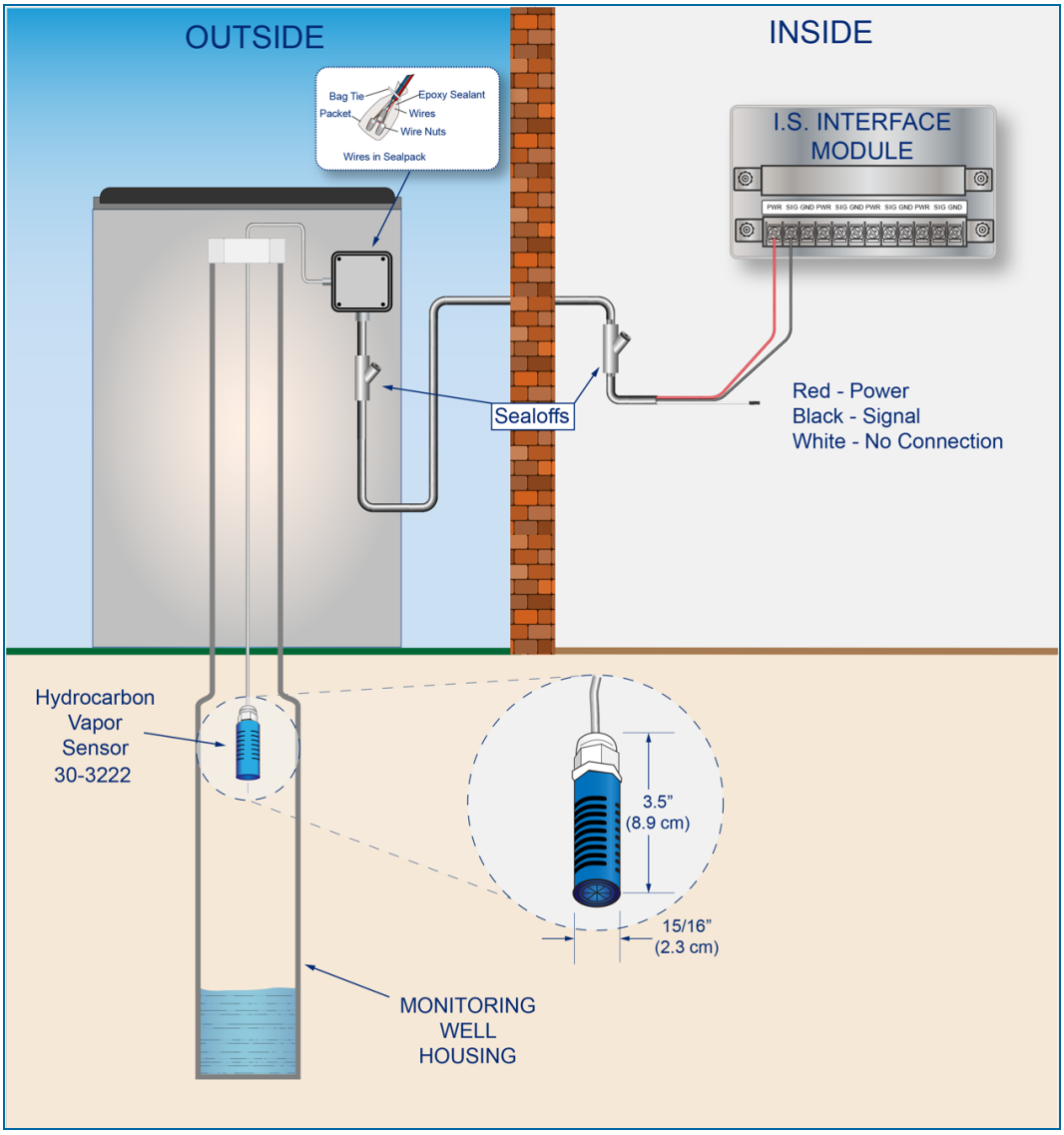
IMPORTANT: Do not let this sensor be put fully in water or hydrocarbon liquid. This can prevent correct operation and will shorten the life of the sensor.

- This sensor uses one (1) Controller Interface Module Position.
- Start with the Connections table and “Typical Installation" drawing below.
- Connect the sensor cable to the sensor.
- Connect the sensor wires to the field wires in the junction box. Use the supplied cable gland and silicon wire nuts.
- Seal the electrical connections with the epoxy seal packs (refer to M00-390008 Waterproof Electrical Connections for instructions).
- Install explosion-resistant sealing fittings at both ends of the conduit. Refer to the **Probe-Cable Seal-offs** section of the console's Installation Guide for instructions.

Connections

I.S. Interface Module Position 1 Terminals	*Sensor Wire Color*
Power	Red
Signal	Black (Hydrocarbon)
Ground	No Connection

Typical Installation Drawing



Controller Setup

1. Configure the barrier position to be a **generic**sensor (if *SiteConnect* software is used, select the applicable icon). Install that position.
2. In the controller (or SiteConnect), take a dynamic reading of the hydrocarbon sensor of the device.
3. Set the **lower** alarm threshold to be 0.1 volts lower than the reading taken (if there is no hydrocarbon contamination).
4. Set the **upper** alarm threshold to 5.0 volts (this will disable the upper threshold).

5. Program the alarms related to the lower threshold that will start if the device senses hydrocarbon vapors.

Test the Hydrocarbon Vapor Sensor

CAUTION: Use caution to prevent dangerous conditions when you do work in a hazardous area.

Make sure that the area has sufficient airflow when you do a test or remove contamination from the sensor. Make sure there are no open flames or hot surfaces near the work area.

NOTICE: **Do not use fuel (gasoline, diesel etc.) to test or clean the sensor!** Once the carbon/polymer material has touched liquid hydrocarbon, it is possible that the sensor will not return to its initial electrical resistance. This can have an unwanted effect on its operation. Replace the sensor if necessary. If you do not obey this instruction it can void your warranty.

- Put the sensor in the air space of a container half full with Mineral Spirits.
- Wait approximately 10 minutes. The test is satisfactory if an alarm condition or other event occurs. If the test results are unsatisfactory, replace the sensor.
- Disconnect the sensor. This test is satisfactory if an alarm condition is caused in the controller.

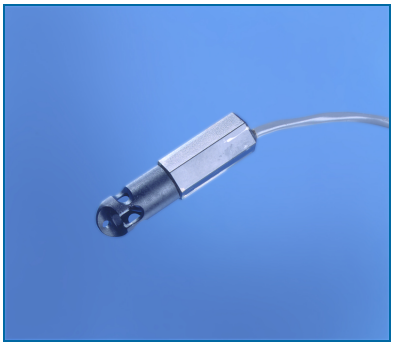
If the controller does not go into an alarm condition, look to see if the thresholds are correctly programmed in the system. A sensor or wiring fault will cause a system alarm. Do a continuity test in the wiring and junction boxes. Make sure there is continuity with no short circuits.

Clean the Hydrocarbon Vapor Sensor

- Put the sensor fully into Denatured Alcohol for one (1) hour.
- Remove the sensor and let it dry in the air for one (1) hour.
- Reconnect the sensor. If the sensor does not return to sufficient resistance, replace the sensor.

Appendix B - 9 - Discriminating Interstitial Sensor (Optical)

OPW Fuel Management Systems P/N 30-3223



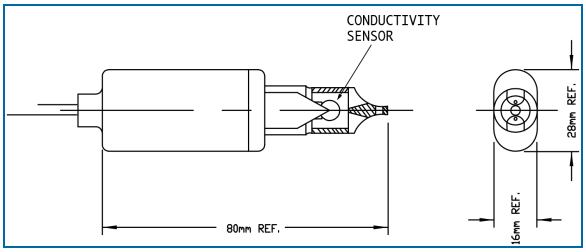
Description

The primary function of the Discriminating Interstitial Optical Liquid Sensor is to monitor the interstitial area of double-walled tanks. This sensor uses a long-life, solid-state optical prism. These sensors can also be used in sumps, fuel dispenser pans and other locations where there is liquid that could indicate that a leak has occurred.

This sensor does not tell the difference between water and hydrocarbons. If there is a break in the cable it will cause an alarm condition in the system.

Specifications	
Operating Temperature:	20°C to +50°C (-4°F to 122°F)
Dimensions:	1.8 cm (0.7 in) dia. x 7.0 cm (2.8 in) long
Cable:	6.1 m (20 ft) of gas & oil resistant cable

IMPORTANT: For maximum safe operation this sensor must only be connected to an OPW Fuel Management Systems controller.



Installation

CAUTION: ALWAYS obey Local and National Electrical Codes applicable to the installation location.

Make sure that the cables (gas and oil resistant OPW Fuel Management Systems part # 12-1030) from the field wiring to the controller are in conduit that is dedicated to intrinsically safe wiring.

Use wire-nuts and epoxy-resin seal-packs for field connections (refer to M00-390008 Waterproof Electrical Connections for information).

- This sensor uses ONE Controller Interface I.S. Module position
- Start with the Connections table and “Typical Installation" drawing below.
- Measure the length of the circular space in the monitoring pipe from top to bottom and subtract 1.3 cm (0.5 in.) for a total measurement to be used for the sensor installation.
- Measure the calculated length from the sensor tip along the sensor cable and identify it with tape or a marker.
- Put the sensor and wire through the monitoring opening until the mark is level with the top of the opening.

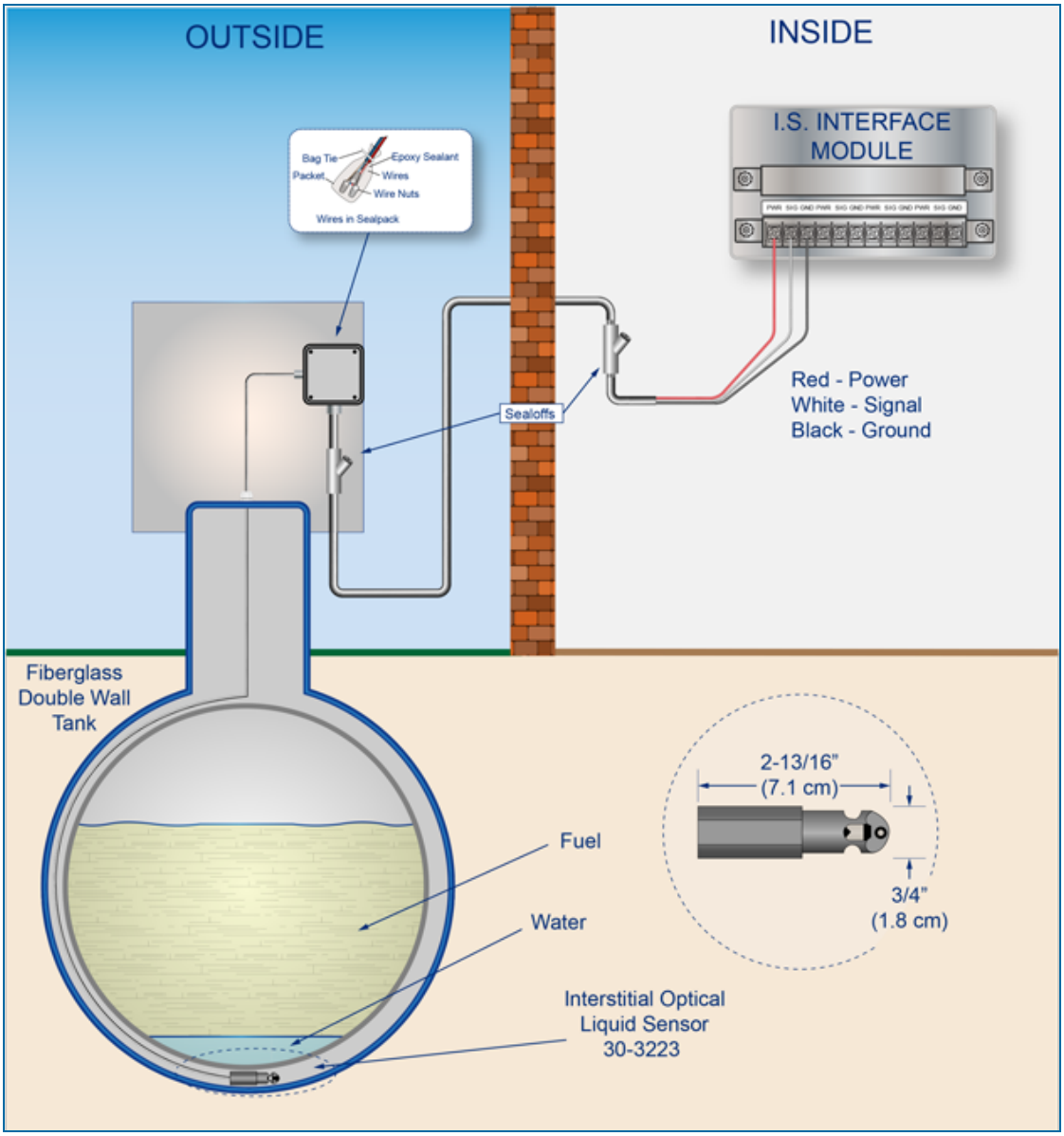
IMPORTANT: To prevent false alarms, the sensor must not touch the bottom of the monitoring tube

- Connect the sensor wires to the field wires in the junction box. Use the supplied cable gland and silicon wire nuts.
- Seal the electrical connections with the epoxy seal packs (refer to M00-390008 Waterproof Electrical Connections for instructions).
- Install explosion-resistant sealing fittings at both ends of the conduit. Refer to the **Probe-Cable Seal-offs** section of the console's Installation Guide for instructions.

Connections

I.S. Interface Module Position 1 Terminals	*Sensor Wire Color*
Power	Red
Signal	White
Ground	Black

Typical Installation Drawing



Controller Setup

1. Configure the barrier position to be a **generic**sensor (if *SiteConnect* software is used, select the applicable icon). Install that position.
2. Set the **lower** alarm threshold to 0.2 volts.
3. Set the **upper** alarm threshold to 5.0 volts (this will disable the upper threshold).
4. Program the alarms related to the lower threshold that will start if the device senses hydrocarbon liquid.

Test the Optical Sensor

CAUTION: Use caution to prevent dangerous conditions when you do work in a hazardous area.

Make sure that the area has sufficient airflow when you do a test or remove contamination from the sensor. Make sure there are no open flames or hot surfaces near the work area.

IMPORTANT: Make sure to test the Optical Sensor in a dark area. The sensor's optical element is light sensitive. Light can cause the sensor to not test accurately.

- Put the sensor fully into water. The test is satisfactory if an alarm condition or other event related to the water part of the sensor occurs.
- Remove the sensor from the water. Make sure that the controller is not in an alarm condition.
- Disconnect the sensor. The test is satisfactory if an alarm condition is caused in the controller.
- Short the sensor leads. The test is satisfactory if an alarm condition is **not** caused in the controller

If the open lead test and/or short lead test are unsatisfactory do a continuity test in the wiring and junction boxes. Make sure there is continuity with no short circuits. Look to see if the float is in the correct position (refer to the applicable instruction above).

If the controller does not go into alarm conditions as simulated above, look to see if the thresholds are correctly programmed in the system.

TIP: This sensor can be cleaned with a dry cloth and put back into service again immediately.

Appendix B - 10 - Combo Single Level/Hydrocarbon Liquid Sump Sensor

OPW Fuel Management Systems P/N 30-3224

This sensor is made from the Hydrocarbon Liquid Sump Sensor (30-3219-12) with an Interstitial Level Sensor (30-3221-1A) attached. The primary function of this sensor is to sense liquid hydrocarbons and water in sumps, fuel dispenser pans and other locations where there is liquid that could indicate that a leak has occurred.

The Hydrocarbon Liquid Sump Sensor (30-3219-12) has a carbon/polymer material that changes its resistance when it is touched by liquid hydrocarbons. The Interstitial Level Sensor (30-3221-1A) that is attached can be positioned anywhere along the length of the Hydrocarbon Liquid Sump Sensor. This sensor can be used to monitor wet wells and can be set to cause a system alarm at a specified liquid level.

If there is a break in the cable it will cause an alarm condition in the system.

Specifications	
Operating Temperature:	20°C to +50°C (-4°F to 122°F)
Dimensions 30-3221-1A:	3.4 cm (1.3 in) dia. x 10 cm (3.9 in) long
Dimensions 30-3219-12:	4.4 cm (1.7 in) dia. x 33.5 cm (13.2 in) long
Nominal resistance (30-3219-12) (uncontaminated)	Less than 5,000 ohms
Nominal resistance (30-3219-12) (contaminated)	More than 30,000 ohms
Cable:	3.6 m (12 ft) gas & oil resistant cable

IMPORTANT: For maximum safe operation this sensor must only be connected to an OPW Fuel Management Systems controller.

Installation

CAUTION: ALWAYS obey Local and National Electrical Codes applicable to the installation location.

Make sure that the cables (gas and oil resistant OPW Fuel Management Systems part # 12-1030) from the field wiring to the controller are in conduit that is dedicated to intrinsically safe wiring.

Use wire-nuts and epoxy-resin seal-packs for field connections (refer to M00-390008 Waterproof Electrical Connections for information).

REMINDER: Hydrocarbons float on water. If the sensor is put fully in water, the polymer will not sense hydrocarbon liquid.

- This sensor uses two (2) Controller Interface Module Positions.
- Start with the Connections table and “Typical Installation" drawing below.
- Connect the sensor cable to the sensor.
- Connect the sensor wires to the field wires in the junction box. Use the supplied cable gland and silicon wire nuts.
- Seal the electrical connections with the epoxy seal packs (refer to M00-390008 Waterproof Electrical Connections for instructions).
- Install explosion-resistant sealing fittings at both ends of the conduit. Refer to the **Probe-Cable Seal-offs** section of the console's Installation Guide for instructions.

NOTE: To set the Level Sensor to monitor a dry well, use a meter to adjust the float to be in the low position (closed condition) when there is no liquid in the well. To set the Level Sensor to monitor a wet well, use a meter to adjust the float to be in the high position (closed condition) with liquid in the well.

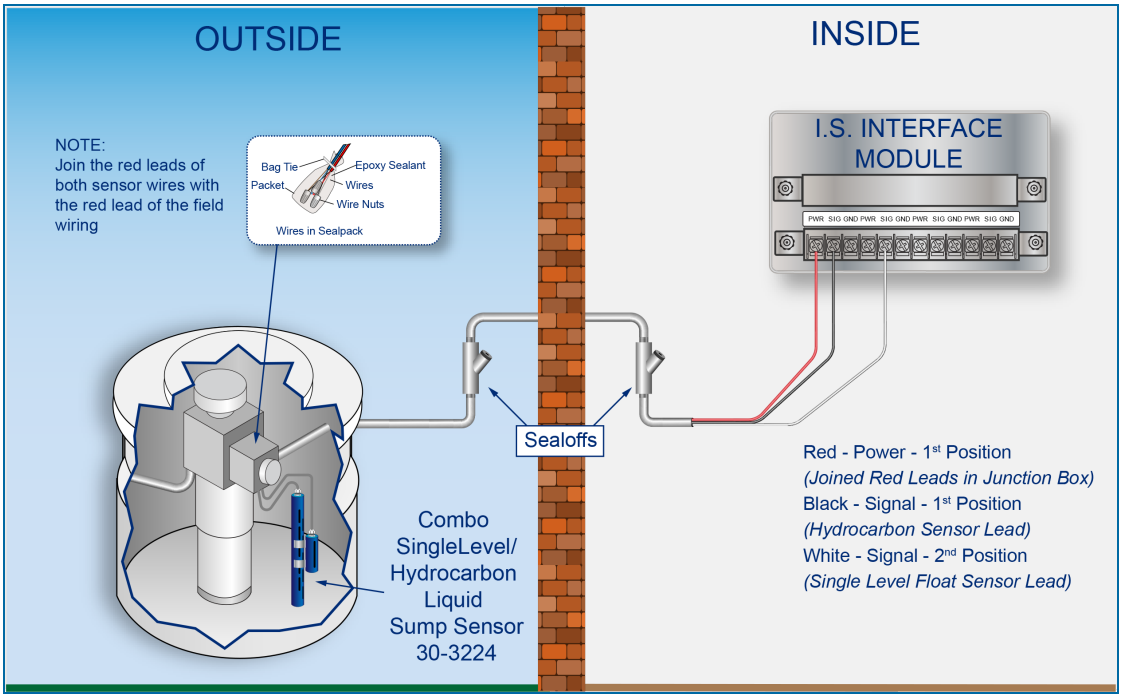
Connections

NOTE: Join the red wires of both sensors with the red wire of the field wiring in the junction box to bring power to the two sensors along the same line. The black wire transmits the Hydrocarbon data signals and the white wire transmits the Liquid Level data signals back to the separate controller data terminals.

I.S. Interface Module Position 1 Terminals	*Sensor Wire Color*
Power	Red
Signal	Black (from the Hydrocarbon Sensor)
Ground	No Connection

I.S. Interface Module Position 2 Terminals	*Sensor Wire Color*
Power	No Connection
Signal	White (from the Liquid Level Float Sensor)
Ground	No Connection

Typical Installation Drawing



Controller Setup

1st Barrier Position (Hydrocarbon Sensor)

1. Configure the barrier position to be a **generic**sensor (if *SiteConnect* software is used, select the applicable icon). Install that position.
2. In the controller (or SiteConnect), take a dynamic reading of the hydrocarbon sensor of the device.
3. Set the **lower** alarm threshold to be 0.5 volts lower than the reading taken (if there is no hydrocarbon contamination).

NOTE: SiteConnect will ask to adjust the lower threshold automatically, to 0.1 V below the current voltage reading. Answer YES.

4. Set the **upper** alarm threshold to 5.0 volts (this will disable the upper threshold).
5. Program the alarms related to the lower threshold that will start if the device senses hydrocarbon liquid.

2nd Barrier Position (Liquid Level Sensor)

1. Configure the barrier position to be a **generic**sensor (if *SiteConnect* software is used, select the applicable icon). Install that position.

2. Set the **lower** alarm threshold to 2.5 volts.
    - When the sensor is used to monitor a normally *wet* well, the lower threshold indicates the liquid is too low.
    - When the sensor is used to monitor a normally *dry*well, the lower threshold indicates the liquid is too high.
3. Set the **upper** alarm threshold to 5.0 volts (this will disable the upper threshold).
4. Program the alarms related to the lower threshold that will start if the device senses liquid.

Hydrocarbon Liquid Sump Sensor (30-3219-12) - Functional Test and Remove Contamination

CAUTION: Use caution to prevent dangerous conditions when you do work in a hazardous area.

Make sure that the area has sufficient airflow when you do a test or remove contamination from the sensor. Make sure there are no open flames or hot surfaces near the work area.

NOTICE: **Do not use fuel (gasoline, diesel etc.) to test or clean the sensor!** Once the carbon/polymer material has touched liquid hydrocarbon, it is possible that the sensor will not return to its initial electrical resistance. This can have an unwanted effect on its operation. Replace the sensor if necessary. If you do not obey this instruction it can void your warranty.

Functional Test - Hydrocarbon Liquid Sensor

- Put the polymer fully into *Mineral Spirits* and wait approximately 10 minutes.
- Remove the sensor and let it hang to air dry for another 10 minutes.
- The test is satisfactory if an alarm condition or other event related to the hydrocarbon part of the sensor occurs. If the test results are unsatisfactory, replace the sensor.
- Disconnect the Hydrocarbon Sensor from the I.S. terminal strip in the controller. The test is satisfactory if an alarm condition occurs.
- Connect the sensor back to the I.S. terminal strip.
- Short across the power and signal terminals. This test is satisfactory if NO alarm condition occurs.

If the controller does not sense the alarm conditions simulated by these tests, look to see if the thresholds and alarms are correctly programmed in the system. A sensor or wiring fault will cause a system alarm. Do a continuity test in the wiring and junction boxes. Make sure there is continuity with no short circuits.

Clean the Hydrocarbon Sensor

If it is necessary to clean hydrocarbon contamination from the sensor after a test or actual use:

- Make sure the sensor is disconnected.
- Put the dirty part of the sensor fully into *denatured alcohol* for one (1) hour.
- Flush the sensor with water to remove all remaining contamination.
- Let the sensor dry in the air for one (1) hour.
- Reconnect the sensor.

NOTE: If the sensor does not return to near its original resistance after you do a functional test or contamination has been removed, it is recommended to replace the sensor.

Liquid Level Sensor (30-3221-1A) Test

CAUTION: Use caution to prevent dangerous conditions when you do work in a hazardous area.

Make sure that the area has sufficient airflow when you do a test or remove contamination from the sensor. Make sure there are no open flames or hot surfaces near the work area.

When the Sensor is Installed in a Normally DRY Well

- Put the float in the UPPER position. The test is satisfactory if an alarm condition is caused in the controller.
- Return the float to the LOWER position. If the alarm condition stops, the test is satisfactory.
- Disconnect the sensor. The test is satisfactory if an alarm condition is caused in the controller.
- Short the sensor leads. The test is satisfactory if an alarm condition is **not** caused in the controller

If the open lead test and/or short lead test are unsatisfactory do a continuity test in the wiring and junction boxes. Make sure there is continuity with no short circuits. Look to see if the float is in the correct position (refer to the applicable instruction above).

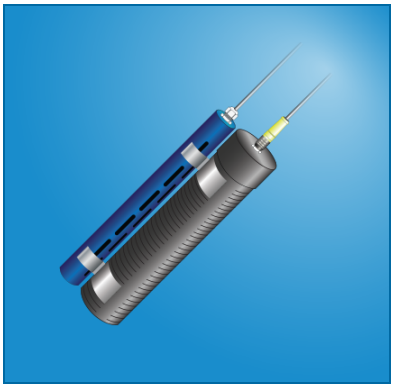
When the Sensor is Installed in a Normally WET Well

- Put the float in the LOWER position. The test is satisfactory if an alarm condition is caused in the controller.
- Return the float to the UPPER position. If the alarm condition stops, the test is satisfactory.
- Disconnect the sensor. The test is satisfactory if an alarm condition is caused in the controller.
- Short the sensor leads. The test is satisfactory if an alarm condition is **not** caused in the controller

If the controller does not go into an alarm condition as simulated above, look to see if the thresholds are correctly programmed in the system.

Appendix B - 11 - Combo Dual Level/Hydrocarbon Liquid Sump Sensor

OPW Fuel Management Systems P/N 30-3225



This sensor is made from the Hydrocarbon Liquid Sump Sensor (30-3219-12) with a Dual-Level Reservoir Sensor (30-3221-2) attached. The primary function of this sensor is to sense liquid hydrocarbons and water in sumps, fuel dispenser pans and other locations where there is liquid that could indicate that a leak has occurred.

The Hydrocarbon Liquid Sump Sensor (30-3219-12) has a carbon/polymer material that changes its resistance when it is touched by liquid hydrocarbons. The Dual-Level Reservoir Sensor (30-3221-2) has two (2) float switches in the body of the sensor to sense fluid level changes. If there is a break in the cable it will cause an alarm condition in the system.

Specifications	
Operating Temperature:	20°C to +50°C (-4°F to 122°F)
Dimensions 30-3221-2:	6 cm (2.4 in) dia. x 35.6 cm (14 in) long
Dimensions 30-3219-12:	4.4 cm (1.7 in) dia. x 33.5 cm (13.2 in) long
Nominal resistance (30-3219-12) (uncontaminated)	Less than 5,000 ohms
Nominal resistance (30-3219-12) (contaminated)	More than 30,000 ohms
Cable:	3.6 m (12 ft) gas & oil resistant cable

IMPORTANT: For maximum safe operation this sensor must only be connected to an OPW Fuel Management Systems controller.

Installation

CAUTION: ALWAYS obey Local and National Electrical Codes applicable to the installation location.

Make sure that the cables (gas and oil resistant OPW Fuel Management Systems part # 12-1030) from the field wiring to the controller are in conduit that is dedicated to intrinsically safe wiring.

Use wire-nuts and epoxy-resin seal-packs for field connections (refer to M00-390008 Waterproof Electrical Connections for information).

REMINDER: Hydrocarbons float on water. If the sensor is put fully in water, the polymer will not sense hydrocarbon liquid.

- This sensor uses two (2) Controller Interface Module Positions.
- Start with the Connections table and “Typical Installation" drawing below.
- Connect the sensor cable to the sensor.
- Connect the sensor wires to the field wires in the junction box. Use the supplied cable gland and silicon wire nuts.
- Seal the electrical connections with the epoxy seal packs (refer to M00-390008 Waterproof Electrical Connections for instructions).
- Install explosion-resistant sealing fittings at both ends of the conduit. Refer to the **Probe-Cable Seal-offs** section of the console's Installation Guide for instructions.

NOTE: The lower float of the 30-3221-2 Sensor is adjustable so that it can monitor wet and dry wells. The float is installed at the factory to monitor wet wells. To change the direction of the float to monitor dry wells:

- Remove the C-clip on the bottom of the float with a needle-nose pliers.
- Remove the plastic cover.
- Remove the float clip.
- Remove the float.
- Turn the float so that the CLOSED arrow marked on the side of the float points to the top of the float.
- Reassemble the sensor.

- To monitor a wet well (i.e. brine-filled reservoir), the CLOSED arrow marked on the side of the float must point to the bottom of the float.

- To monitor a dry well (e.g. dispenser containment pans), the CLOSED arrow marked on the side of the float must point to the top of the float.

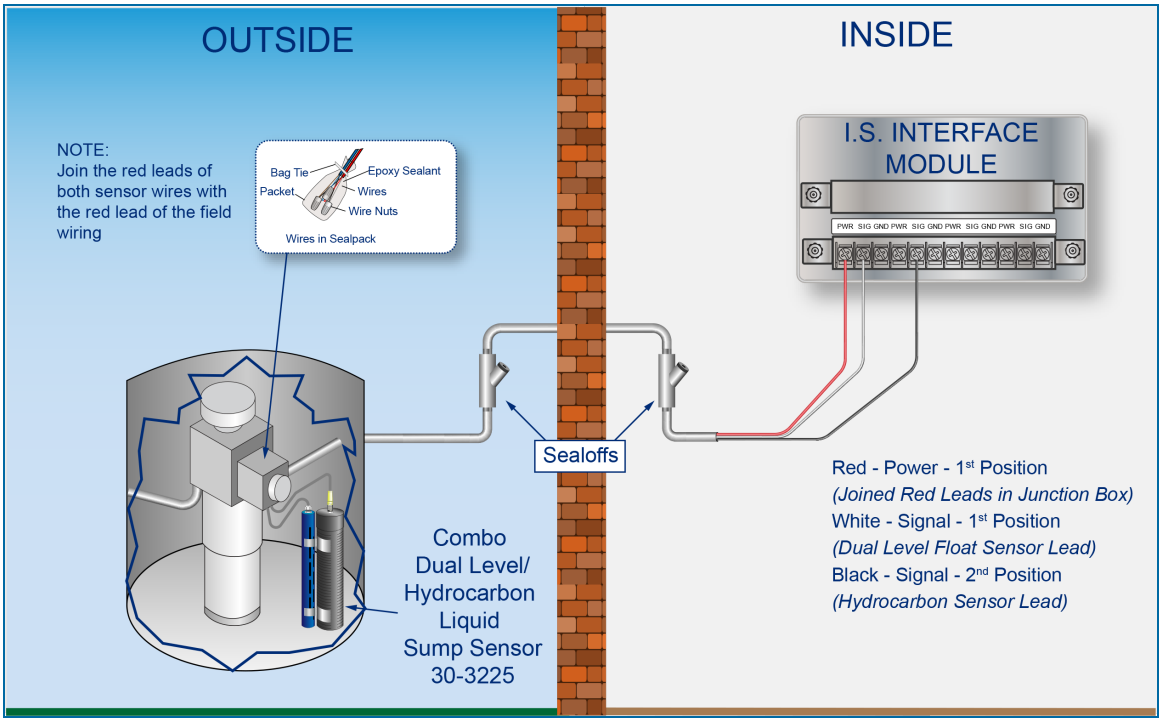
Connections

NOTE: Join the red wires of both sensors with the red wire of the field wiring in the junction box to bring power to the two sensors along the same line. The black wire transmits the Hydrocarbon data signals and the white wire transmits the Liquid Level data signals back to the separate controller data terminals.

I.S. Interface Module Position 1 Terminals	*Sensor Wire Color*
Power	Red
Signal	White (from the Dual Level Float Sensor)
Ground	No Connection

I.S. Interface Module Position 2 Terminals	*Sensor Wire Color*
Power	No Connection
Signal	Black (from the Hydrocarbon Sensor)
Ground	No Connection

Typical Installation Drawing



Controller Setup

1st Barrier Position (Dual Level Float Sensor)

1. Configure the barrier position to be a **generic**sensor (if *SiteConnect* software is used, select the applicable icon). Install that position.
2. Set the lower alarm threshold to 2.2 volts.
3. Set the upper alarm threshold to 3.4 volts.
   - When the sensor is set to monitor a wet well, the 3.4-volt upper threshold indicates that the liquid level is too low. The 2.2-volt threshold indicates that the liquid level is too high.
   - When the sensor is set to monitor a dry well, the 3.4-volt upper threshold indicates that the liquid level is above the lower float. The 2.2-volt threshold indicates that the liquid level is above the top float.
4. Program the alarms related to the thresholds that will start if the device senses the related liquid levels.

2nd Barrier Position (Hydrocarbon Sensor)

5. Configure the barrier position to be a **generic**sensor (if *SiteConnect* software is used, select the applicable icon). Install that position.
6. In the controller (or SiteConnect), take a dynamic reading of the hydrocarbon sensor of the device.

7. Set the **lower** alarm threshold to be 0.5 volts lower than the reading taken (if there is no hydrocarbon contamination).

NOTE: SiteConnect will ask to adjust the lower threshold automatically, to 0.1 V below the current voltage reading. Answer YES.

8. Set the **upper** alarm threshold to 5.0 volts (this will disable the upper threshold).
9. Program the alarms related to the lower threshold that will start if the device senses hydrocarbon liquid.

Float Sensor Functional Test (30-3221-2)

CAUTION: Use caution to prevent dangerous conditions when you do work in a hazardous area.

Make sure that the area has sufficient airflow when you do a test or remove contamination from the sensor. Make sure there are no open flames or hot surfaces near the work area.

When the Sensor is Installed in a Normally DRY Well

- Put the bottom float in the high position and the top float in the low position. The test is satisfactory if a low-level alarm is caused in the controller..
- Put the bottom float in the high position and the top float in the high position. The test is satisfactory if a high-level alarm is caused in the controller..
- Return the two floats to the low position. This test is satisfactory if there is no alarm condition caused in the controller.
- Disconnect the sensor. This test is satisfactory if an alarm condition is caused in the controller.

If test results are unsatisfactory do a continuity test in the wiring and junction boxes. Make sure there is continuity with no short circuits.

When the Sensor is Installed in a Normally Wet Well

- Put the bottom float in the low position and the top float in the low position. The test is satisfactory if a low-level alarm is caused in the controller..
- Put the bottom float in the high position and the top float in the high position. The test is satisfactory if a high-level alarm is caused in the controller..
- Put the bottom float in the high position and the top float in the low position. The test is satisfactory if there is no alarm condition caused in the controller.
- Disconnect the sensor. This test is satisfactory if an alarm condition is caused in the controller.

If the controller does not go into an alarm condition when a test is unsatisfactory, look to see if the thresholds are correctly programmed in the system. Look to see if the float is in the correct position (refer to the

applicable instruction above). A sensor or wiring fault will cause a system alarm. Do a continuity test in the wiring and junction boxes. Make sure there is continuity with no short circuits.

Hydrocarbon Liquid Sump Sensor (30-3219-12) - Functional Test and Remove Contamination

IMPORTANT: It is recommended to only do the procedures below when it becomes necessary and only as a last alternative. These procedures can cause a decrease in the original electrical resistance of the polymer. If possible, speak with a certified OPW-FMS technician before you do these procedures.

CAUTION: Use caution to prevent dangerous conditions when you do work in a hazardous area.

Make sure that the area has sufficient airflow when you do a test or remove contamination from the sensor. Make sure there are no open flames or hot surfaces near the work area.

NOTICE: **Do not use fuel (gasoline, diesel etc.) to test or clean the sensor!** Once the carbon/polymer material has touched liquid hydrocarbon, it is possible that the sensor will not return to its initial electrical resistance. This can have an unwanted effect on its operation. Replace the sensor if necessary. If you do not obey this instruction it can void your warranty.

Functional Test - Hydrocarbon Liquid Sensor of the Device

- Put the polymer fully into *Mineral Spirits* and wait approximately 10 minutes.
- Remove the sensor and let it hang to air dry for another 10 minutes.
- The test is satisfactory if an alarm condition or other event related to the hydrocarbon part of the sensor occurs. If the test results are unsatisfactory, replace the sensor.
- Disconnect the Hydrocarbon Sensor from the I.S. terminal strip in the controller. The test is satisfactory if an alarm condition occurs.
- Connect the sensor back to the I.S. terminal strip.
- Short across the power and signal terminals. This test is satisfactory if NO alarm condition occurs.

If the controller does not sense the alarm conditions simulated by these tests, look to see if the thresholds and alarms are correctly programmed in the system. A sensor or wiring fault will cause a system alarm. Do a continuity test in the wiring and junction boxes. Make sure there is continuity with no short circuits.

Clean the Hydrocarbon Sensor of the Device

If it is necessary to clean hydrocarbon contamination from the sensor after a test or actual use:

- Make sure the sensor is disconnected.
- Put the dirty part of the sensor fully into *denatured alcohol* for one (1) hour.
- Flush the sensor with water to remove all remaining contamination.
- Let the sensor dry in the air for one (1) hour.
- Reconnect the sensor.

NOTE: If the sensor does not return to near its original resistance after you do a functional test or contamination has been removed, it is recommended to replace the sensor.

Appendix C - OPW-FMS Integra and End of Life for Adobe Flash

Adobe Systems officially stopped distribution and support for Flash on December 31, 2020. To continue to be able to configure your Integra console remotely you will need to download a plug-in from the Adobe website. See the instructions below for the download link and the steps on how to use this plug-in.

1. Download the Flash plug-in from the website in the link below (click this link or type it into your browser).

https://fpdownload.macromedia.com/pub/flashplayer/updaters/32/flashplayer_32_sa.exe

2. When the download is complete, open the .exe file.
3. Click Run when the “Do you want to open this file” prompt comes up.
4. When the Adobe Flash Player 32 screen comes up click File > Open.
5. In the Location field of the “Open” dialogue, type: http:// and the numeric URL of the Integra console (xxx.xxx.xxx.xxx) followed by /opw.swf. The full URL should look like this:

http://10.111.11.10/opw.swf

6. Click OK. Your console viewer will come up and prompt you for your Username and password as usual.

NOTE: It is recommended to save the download in a location on your computer where it can be located easily. The File dropdown will save URLs that you have previously entered. This will be handy when it is necessary to store multiple URLs for sites.

For Technical Support & Service Issues Call:

877-OPW-TECH

(877-679-8324)

Hours: Monday through Friday, 7:00 am to 6:00 pm US CST

Warranty

OPW Fuel Management Systems warrants that all OPW Tank Gauge and Petro Vend Fuel Control systems supplied by OPW Fuel Management Systems to the Original Purchaser will be free from defects in material and/or workmanship under normal use and service for a period of 12 months from the date of installation or 15 months from the date of shipment from OPW. Additionally, OPW Fuel Management Systems warrants that all upgrades and replacement parts (new and remanufactured) supplied by OPW Fuel Management Systems will be free from defects in material and workmanship under normal use and serviced for a period of 90 days from the date of installation or for the remainder of the system's original warranty, whichever is greater, as set forth in the first sentence of this statement. The foregoing warranties will not extend to goods subjected to misuse, neglect, accident, or improper installation or maintenance or which have been altered or repaired by anyone other than OPW Fuel Management Systems or its authorized representative. The buyer's acceptance of delivery of the goods constitutes acceptance of the foregoing warranties and remedies, and all conditions and limitations thereof.

If a claim is made within the warranted time period that any equipment and/or remanufactured part is defective in material or workmanship under normal use and service, such equipment and/or remanufactured part shall be returned to OPW Fuel Management Systems, freight prepaid. If such equipment or remanufactured part is found by OPW Fuel Management Systems in its sole judgment to be defective in material or workmanship under normal use and service, OPW Fuel Management Systems shall, at its sole option, repair or replace such equipment and/or remanufactured part (excluding, in all instances, fuses, ink cartridges, batteries, other consumable items, etc.) OPW Fuel Management Systems shall not be held responsible for data loss or retrieval on returned products.

The warranties, as set forth above, are made expressly in lieu of all other warranties, either expressed or implied (including, without limitation, warranties of merchantability and fitness for any particular purpose and of all other obligations or liabilities on OPW Fuel Management Systems' part.) Further, OPW Fuel Management Systems neither assumes, nor authorizes any other person to assume for it, any other liability in connection with the sale of the systems, or any new/replacement part that has been subject to any damage from any act of nature or any force majeure. Any terms proposed by the Original Purchaser either orally or in writing are expressly rejected. The terms and conditions expressed in this document may only be changed upon the express written consent of OPW Fuel Management Systems.

The term "Original Purchaser" as used in these warranties shall be deemed to mean the authorized OPW Fuel Management Systems' distributor to which the system or any new/replacement part was originally sold. These warranties may be assigned by the original purchaser to any of its customers who purchase any OPW Fuel Management Systems' systems or new/replacement parts. This document shall be governed by and construed in accordance with the law of the State of Illinois. OPW Fuel Management Systems and Original Purchaser agree that any legal action or proceeding under or with respect to this document may ONLY be brought in the courts of the State of Illinois, or the United States District Court having jurisdiction in the City of Hodgkins, Illinois. Original Purchaser expressly consents to personal jurisdiction in any of the above-mentioned forums and agrees to waive all defenses based on improper venue or inconvenient form should an action be brought therein.

The sole liability of OPW Fuel Management Systems, for any breach of warranty, shall be as set forth above. OPW Fuel Management Systems does not warrant against damage caused by accident, abuse, faulty or improper installation or operation. In no event shall manufacturer's liability on any claim for damages arising out of the manufacture, sale, delivery or use of the goods exceed the original purchase price of the goods. In no event shall OPW Fuel Management Systems be liable for any direct, indirect, incidental or consequential damage or loss of product.

TERMS

Ex-works our factory, Hodgkins, Illinois, USA
Installation not included.
All trade names are registered. Patents pending.
Subject to engineering improvement and/or other changes.

Revisions - M2020

Revision #	Approved	Effective	Software Version	Key Changes
M1800 - 0	ECO-438	1/22/13		Initial Release
1	NA	NA		
2	498	8/14/13		W&M Calibration Lock
3	620	7/2/14		Battery change caution notes, Field wiring diagram. Adding noise suppressor to STP Relay
4	621	5/29/15		Remove 20-1520-04, and Add 20-1520-05
5	657	11/7/14		Replacing Zeus Battery with new Datamax rechargeable battery pack 20-8344.
6	974	5/23/16		Updated Declaration of Conformity
7	1684	1/17/20		Updated Declaration of Conformity
8	UL	1/9/23		Updated battery warning and replacement part numbers. Change links to videos or remove links where videos are no longer available. Updated web links
9	EF	3/17/23		Updated with battery warning and replacement info, updated Declarations of Conformity.
10	GD	6/26/23		General update to align with latest versions of peripherals, DFS brand standard, FMS P/N scheme. Preparation for archiving and future product EOL plans.
10.1	EF	7/12/23		UL corrected p/n for battery replacement.

NOTE: It is possible that older software versions might not support all features