Part Number: M2010-EU, Rev. 13
Issue Date: February 19, 2020
Supersedes: January 15, 2020

OPW
FUEL MANAGEMENT SYSTEMS

M2010-EU - SiteSentinel® Nano®

Tank Gauge System

Installation Guide

3.71.56.3 Bld 61.1

DOVER
FUELING SOLUTIONS

NOTE: Before you use this guide, make sure you have the latest revision. Check the revision level of this document against the most current revision found at http://www.opwglobal.com/opw-fms/tech-support/manuals-how-to-videos. Download the latest revision if necessary.

FUELING SOLUTIONS

OPW Fuel Management Systems is a part of Dover Fueling Solutions.

Copyright Information

Contact OPW Fuel Management Systems

Visit us at http://www.opwglobal.com/opw-fms, or contact us at:

Call 1-877-OPW-TECH (877-679-8324)
For calls outside US and Canada, call +1-708-485-4200

Monday through Friday, 7 a.m. to 6 p.m., US CST

For technician registration, see
http://www.opwglobal.com/opw-fms/tech-support/technician-registration

For in-depth training via OPW University, see
http://www.opwglobal.com/opw-fms/tech-support/training-certification

Listings and Certifications

ISO 17025 ACCREDITED LABORATORY

FUEL MANAGEMENT SYSTEMS
ISO 9001:2015-Certified Quality Management System

Table of Contents

Section 1 Get Started: Safety

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

Topics 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.

1.3 Applicable Warnings

The inside of OPW-FMS automatic tank-gauge system consoles 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.

To avoid possible explosion or fire, do not replace the lithium battery with a type that is not compatible.

Battery can explode if mistreated. Do not recharge, disassemble or dispose of in fire.

The battery used in this device may present a risk of fire or chemical burn if mistreated. Do not disassemble, heat above or incinerate.

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

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

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

An external disconnect device must be installed for any permanently connected equipment!

An electrical outlet must be installed near any equipment requiring access through a plug connection!

The console has one (1) lithium battery. Replace the battery when it can no longer hold sufficient electrical power.

IMPORTANT: Replace the battery with a recommended replacement ONLY. Use of a different battery can cause a risk of fire or explosion.

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

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.
- 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 at http://www.opwglobal.com/opw-fms/tech-support/manuals-how-to-videos.

1.6 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.

1.7 Precision Leak Test

A third-party Precision Leak Test must be done on each tank and product line (of special importance for older tanks) before the console is installed. This test will make sure that leak data supplied by the system is accurate and correct. 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 for the acceptance test on new tank installations. Make sure this applies to your local agency before a tank is tested.

1.7.1 Before Initial Inspection

Refer to the initial Site Survey form (M00-2017- Site Survey) and compare the equipment that was shipped to what is recorded in the site survey.

NOTE: It is not necessary for all site survey questions to be answered. For all unanswered questions, please respond with “N/A.” Do not leave empty fields!

1.7.2 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 information about the tank gauge system. Keep the Data Sheet and OPW Technical Documentation CD in a safe location.

A Field Wiring Diagram is included in the product container. Give this diagram to your installer or electrician.

The console Data Sheet, Field Wiring Diagram and other documentation related to your SiteSentinel® Nano® can also be found and downloaded from the OPW global website at www.opwglobal.com.

Section 2 SiteSentinel® Nano® Console

The SiteSentinel® Nano® console can monitor up to 12, 924B Tank-Probes and has two (2) relays that can be used at the same time. Since only AC power connections and Petro-Net communication connections are necessary, the console can be installed in many locations of a fueling facility.

It is necessary to use the supplied crossover Ethernet-connection cable to operate the console through a local PC connection. To connect through a local or corporate LAN/WAN, you can enter the system's IP address into an internet browser address bar. Speak with your IT professional for help with remote connections.

2.1 Communication Lights

The SiteSentinel® Nano® console has three (3) communication lights on the front of the enclosure that indicate:

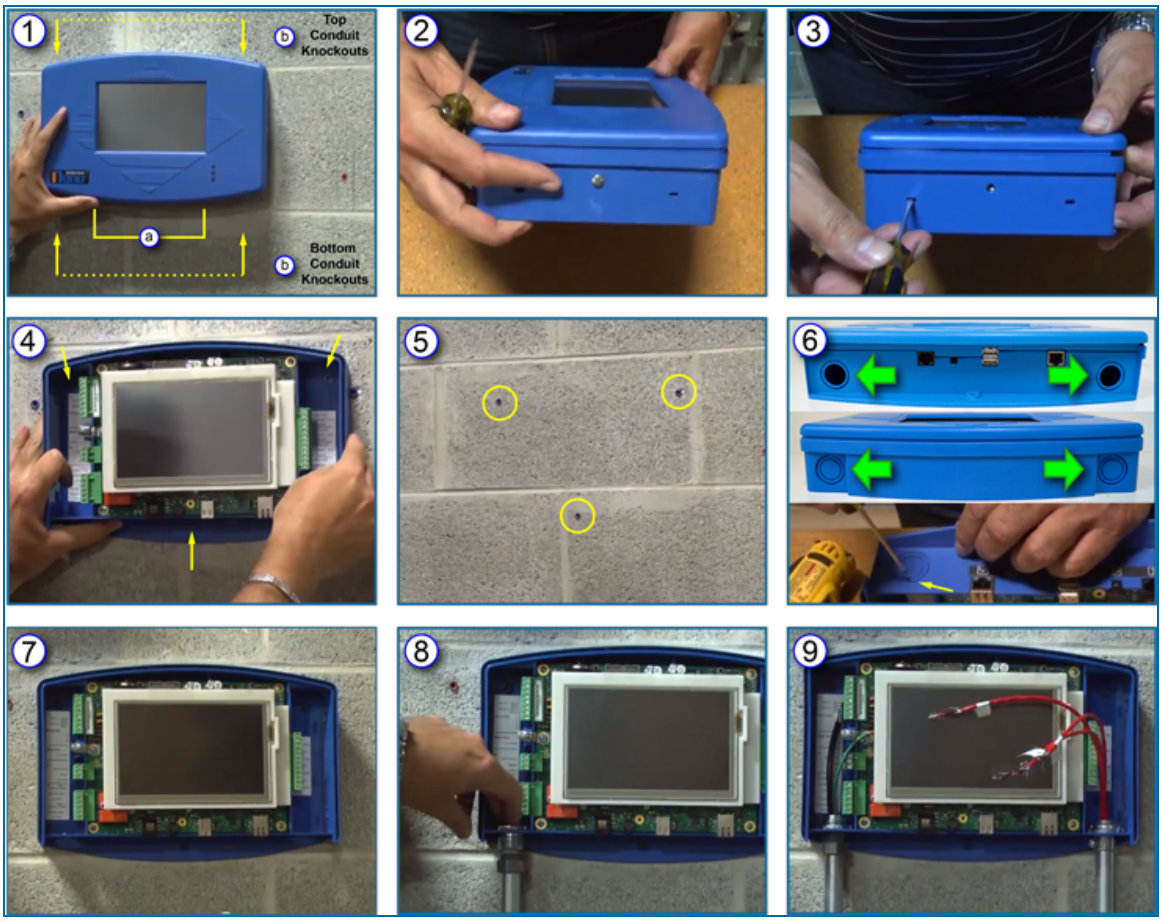
- Red = Alarm
- Yellow = Warning
- Green = Power

2.2 Console Specifications

Console Specifications	
Power:	120/240 VAC +/- 10%, 50/60 Hz, 30 W
Relay Contacts:	250V AC 10A Max.
Operating Temperature:	0°C to 50°C (32°F to 122°F)
Console Dimensions [H x W x D]:	21 cm x 32.5 cm x 6 cm (8.3 inches x 12.8 inches x 2.4 inches)
Display:	17.8 cm (7 inches) color LCD touch screen display Graphical User Interface (GUI)
Printer:	External USB
Standard Alarms: Optional Alarms: Alarm Notification:	Buzzer, Light and Acknowledge External Tank Alert (internal relay) Email, SMS
Communication Ports:	One (1) RS-232 Communication port; or One (1) RS-485 Communication port One (1) RS-422 Communication port One (1) Ethernet port Two (2) USB ports Two (2) Internal inputs Two (2) Internal outputs
Network Connectivity:	DHCP/static addressable RJ-45 Ethernet ports, supports corporate and local LANs

2.3 Console Installation

2.3.1 Installation Instructions



1. Select an area to install the SiteSentinel® Nano® console on a wall in a safe indoor location. The display must be at approximately eye level and easily seen.
    a. Make sure there is sufficient access to the communication ports on the bottom of the console.
    b. Make sure to keep sufficient clearance below or above the unit to install power and communication conduits to the console.
2. Remove the two (2) screws on the two sides of the console that hold the cover in position. Keep them in a safe area to be used again below in "Complete the Installation" on page 23.
3. Put a small screwdriver into one of the two (2) release holes on the left side of the console. Push the screwdriver in until you feel the cover release. Do the same with the second release hole. Set the cover aside.
4. Hold the unit against the wall where it will be installed. There are three (3) screw holes in the unit. Use a pen to make a mark to show the screw hole locations on the wall.
5. Drill the holes at the pen marks. Tap the hole with the correct size screw threads or put screw anchors in the hole.

NOTICE: Make sure to remove the main board and put it in a static-free area before you go to the next step. This will prevent damage to the main board components when you remove the knockouts.

ATTENTION: Electrostatic Sensitive Device - OBEY THE PRECAUTIONS FOR ELECTROSTATIC-DISCHARGE SENSITIVE (ESDS) DEVICES

Obey the instructions below to keep possible damage from Electrostatic-Discharge (ESD) at a minimum.

- Keep a new component to be installed in its anti-static packaging as long as possible before you do the installation.
- Hold ESDS components by the edges. Do not touch the circuitry.

6. Remove the knockouts from the bottom or top of the unit (as selected in Step 1 above). Put a small screwdriver into the groove and hit it with force 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 tool if available.

7. Install the main board again and put the unit on the wall with screws the size of the screw holes or anchors that were installed in Step 5.
8. Install the conduits in the empty knockout holes.
9. Pull the electrical wires and Tank-Probe and Smart-Sensor wires through the conduit to the console.

2.3.2 Installation Video

Scan the code below or click the link to see the video, "Installation of an OPW Nano Tank Gauge."

https://www.youtube.com/watch?v=qPZAe5_oWVk&feature=youtu.be

IMPORTANT: Make sure the electrical wiring is connected on the left side of the console and the Tank-Probe and Smart-Sensor wiring is connected on the right side.

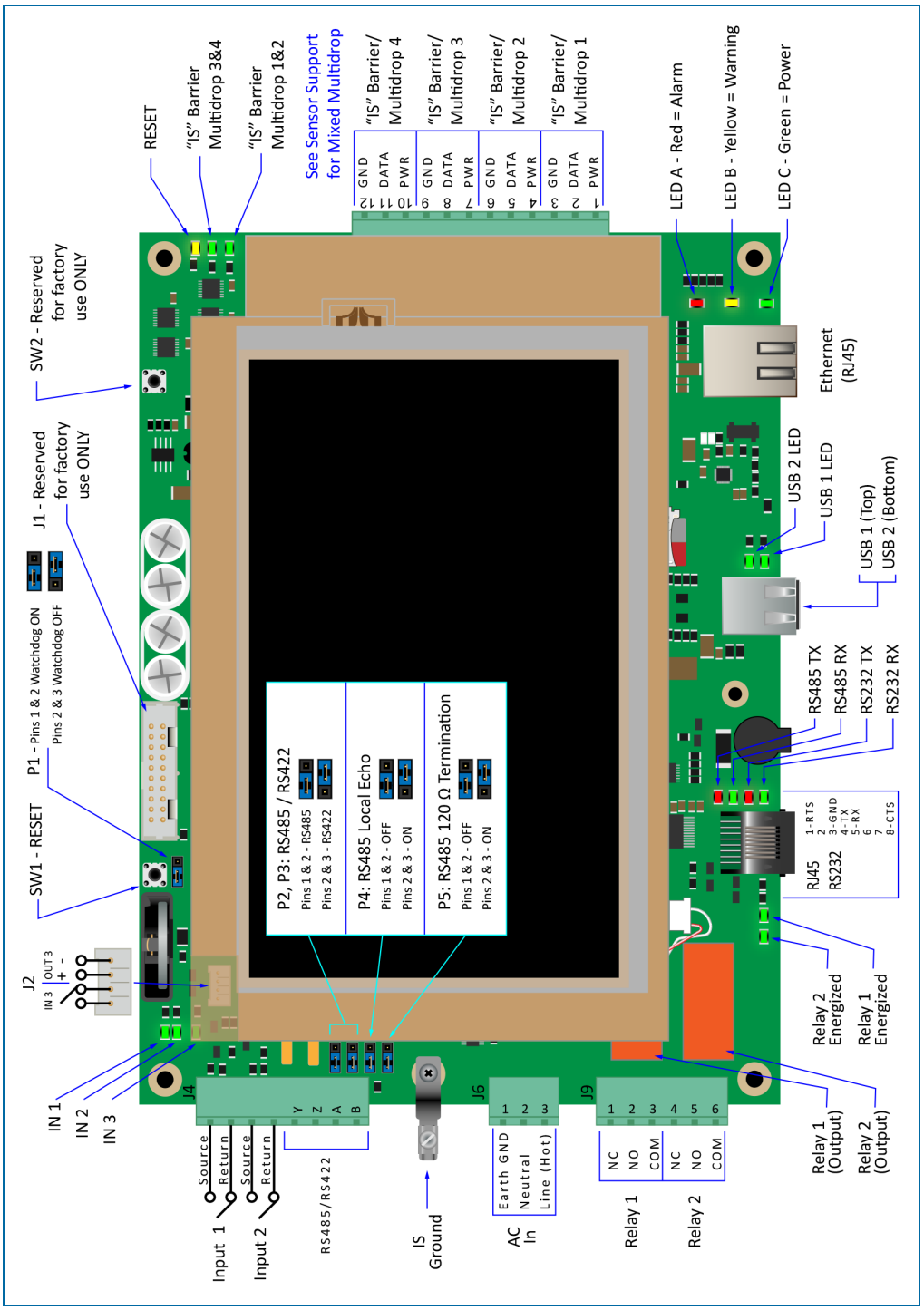
2.4 Wiring Requirements

CAUTION: Refer to local regulations for all installations. Rigid steel conduit must be used if possible.

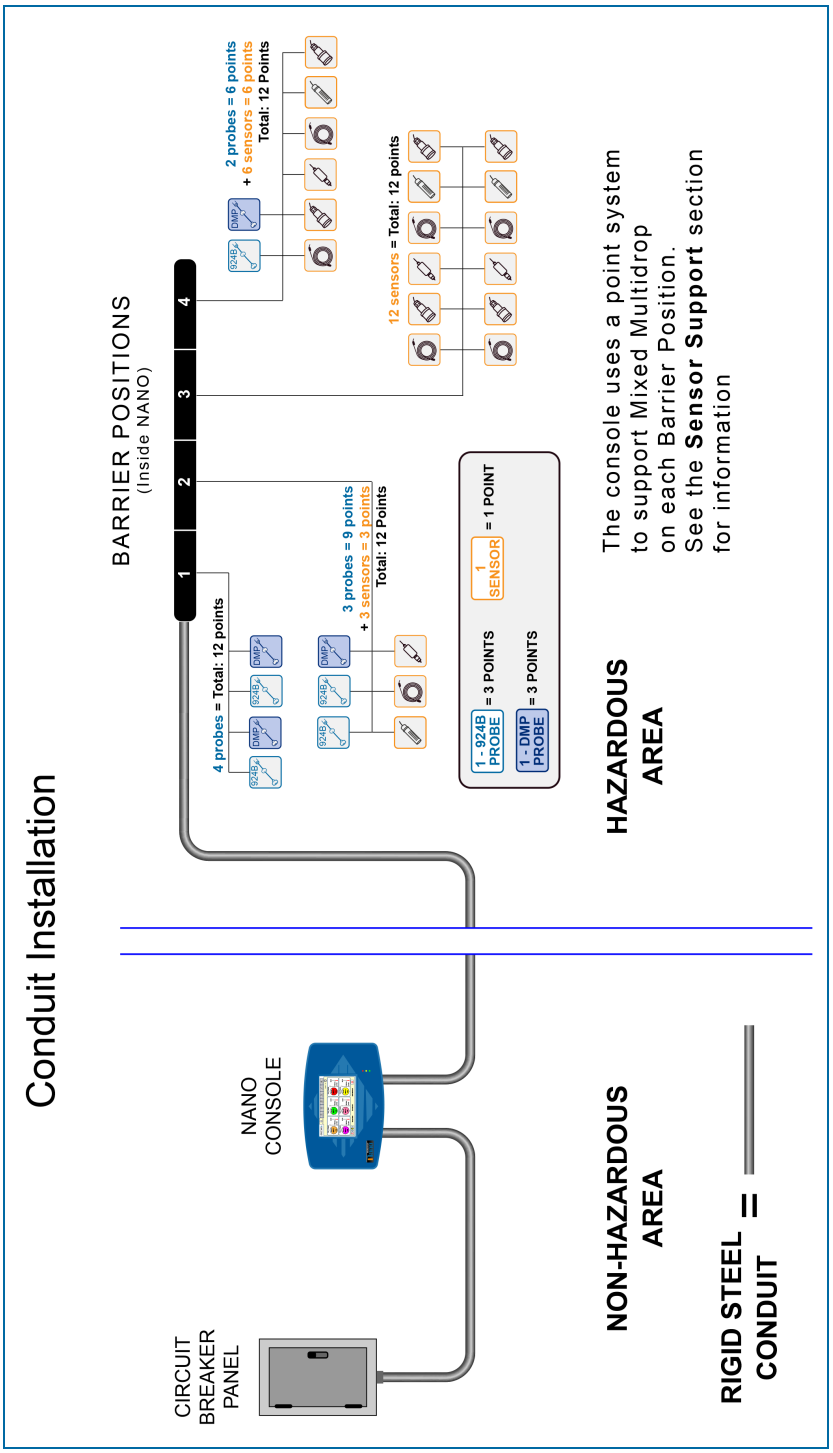
2.4.1 Electrical and I.S. Barrier Wiring

CAUTION: Make sure that the I.S. ground wire and Earth ground are correctly attached to the console back to the electrical panel. This is to prevent high-voltages sent to the I.S. wiring side if there is a field short.

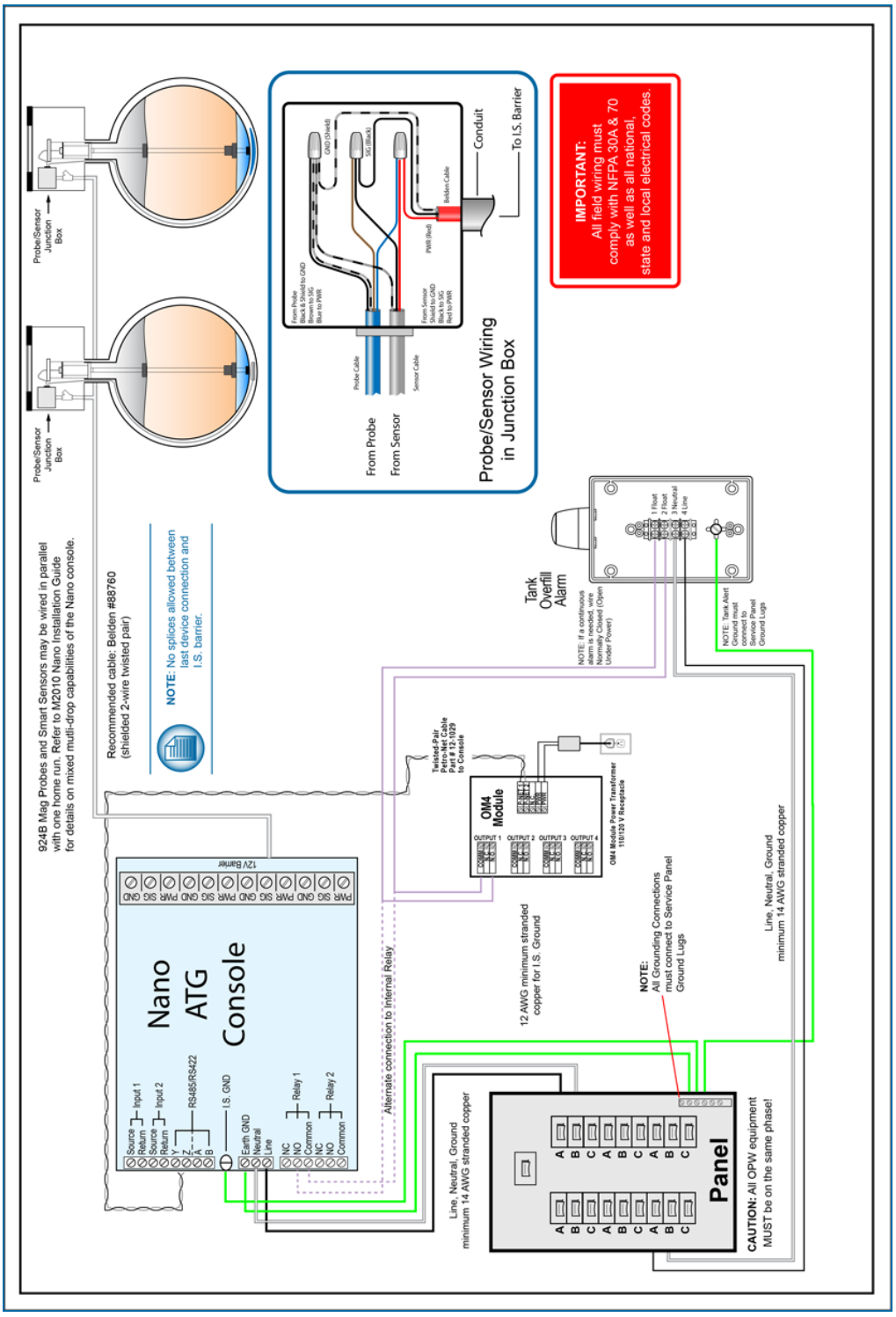
NOTICE: Make sure there are no bare wires outside of the block when you connect wires to the connectors. This is to prevent shorts to the high-voltage on the electrical side and to prevent damage to the barrier and/or the Tank-Probe from shorts on the I.S. side.



Main Board Connections, Jumpers and LEDs



Conduit Installation



Field Wiring Diagram

2.5 Console and Peripheral Connections

2.5.1 Direct Connections

NOTE: The SiteSentinel® Nano® console comes with a given IP address. Do not change this address if you use a crossover cable.

To make a wired connection between the console and a PC, a standard RJ45 crossover cable is necessary. Refer to the section **Direct Connection with a Crossover Cable** in the *M2011 SiteSentinel® Nano® Configuration Guide* for information.

2.5.2 Ethernet Connections

To make an Ethernet connection, an Ethernet cable is connected between devices at a maximum length of 91.4 m (300 feet).

TIP: This distance can be extended through the use of hubs and routers. If more than 1.8 m (6 feet) of cable is necessary, it is recommended to use conduit for protection of the cable.

2.5.3 RS-232 Communications Conduits

If there is more than 1.8 m (6 feet) between the terminal or PC and the console, conduit must be installed to contain the RS-232 cable.

NOTE: The maximum length for serial communication cable is 15.2 m (50 feet).

2.6 Complete the Installation

After the console and conduits have been installed and all wiring and connections have been completed:

- Put the console front panel cover back into position on the front of the unit. Push it in until it clicks.
- Install the two (2) side screws that hold the front panel cover in place.
- Go to the breaker panel and energize the console.

Section 3 OM4 Output Module

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 Petro-Net™ 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.

3.1 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.

3.2 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.

3.3 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.

3.4 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

3.5 Product Certifications

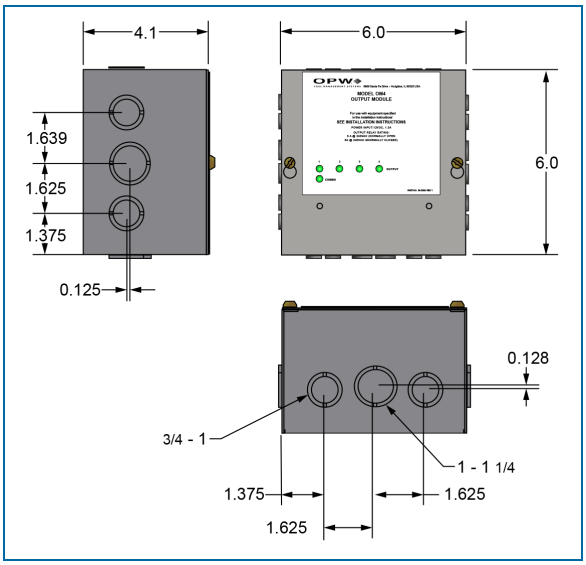
- Electronic Testing Labs Canada (cETL)
- Electronic Testing Labs (ETL)

3.6 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.



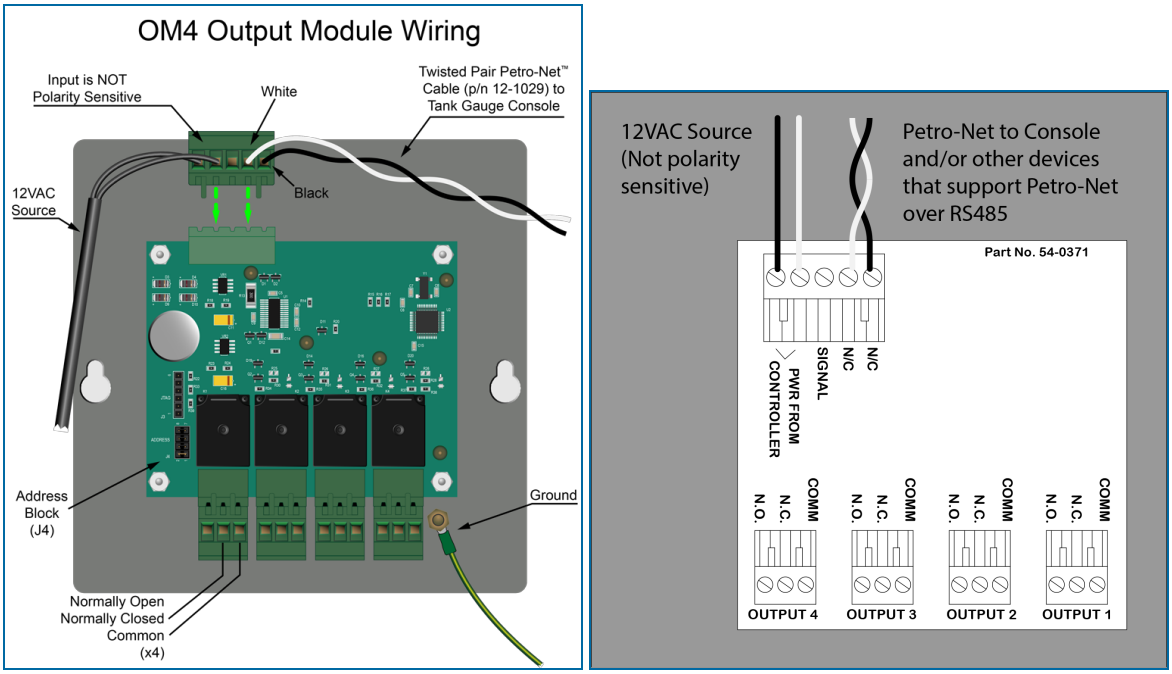
OM4 Dimensions and Knockout Locations

3.7 OM4 Connections

See the wiring instructions inside the unit (see the 54-0371 label illustration below) for the correct Petro-Net™ 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

3.8 Petro-Net Address Jumper Settings

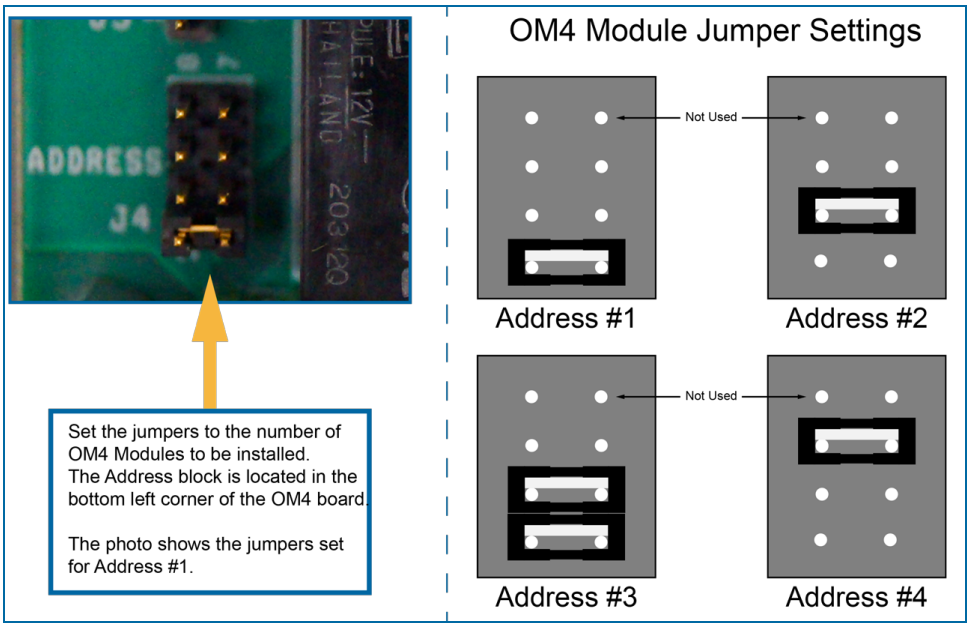
WARNING: Do not change the module jumpers while the module is energized. The relay positions must not be energized during jumper adjustment.

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 4 Tank Alert (Overfill Alarm)

The SiteSentinel® Nano® 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.

4.1 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.

4.2 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

4.3 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.

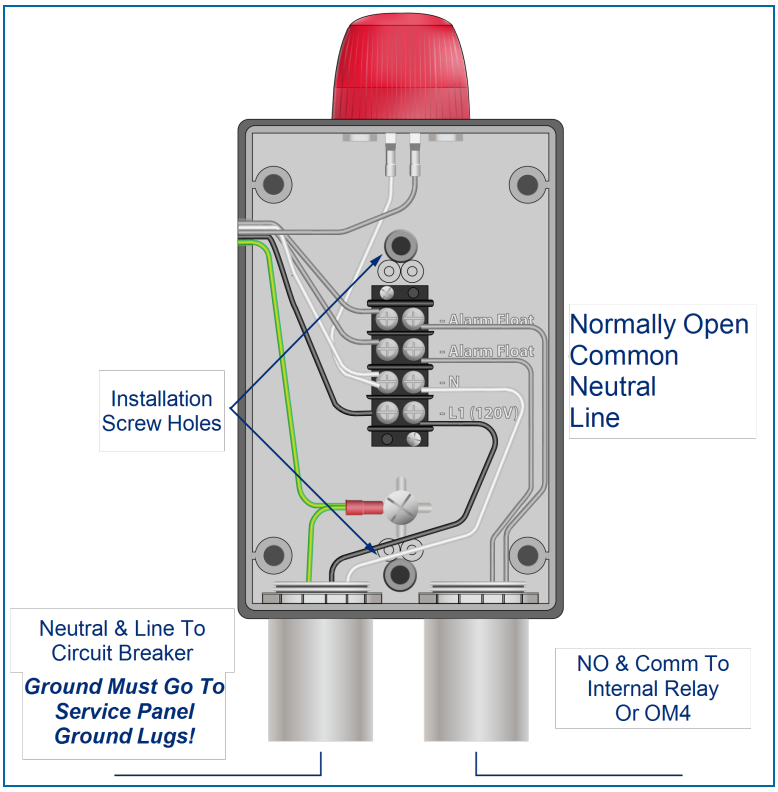
Attach the conduit to the Tank Alert enclosure. Apply a sealant around the conduit(s) to keep gases or fluids out of the enclosure.

4.4 Tank Alert Wiring

NOTE: Refer to the M2018 Nano Field Wiring Diagram 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.


Alarm Float
Alarm Float
N
L1 (120V)
Installation Screw Holes
Normally Open
Common
Neutral
Line
Neutral & Line To Circuit Breaker
Ground Must Go To Service Panel Ground Lugs!
NO & Comm To Internal Relay Or OM4

Section 5 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:

5.1 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.

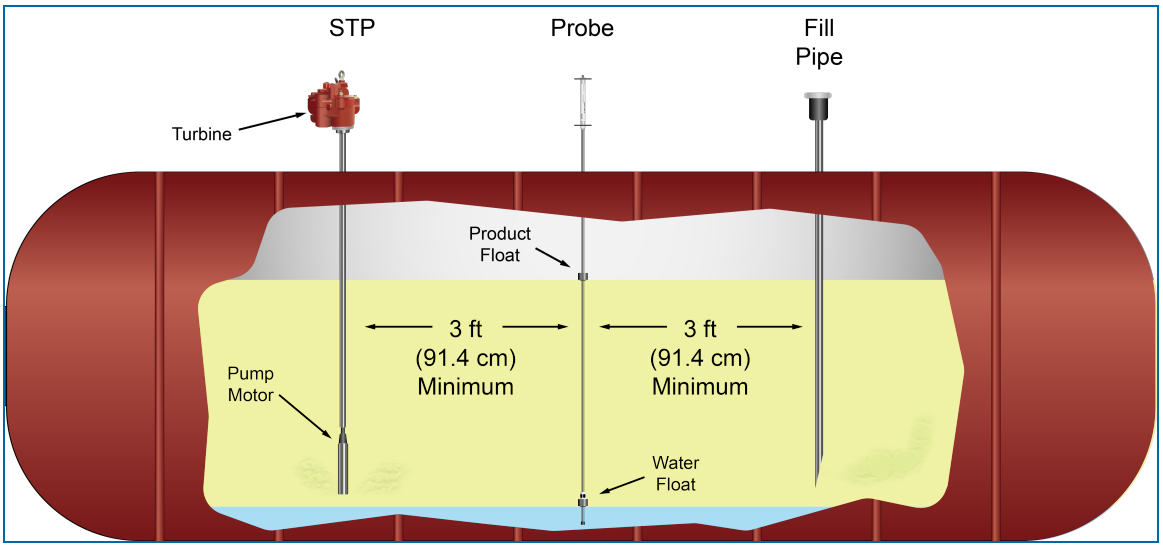
Model 924B and DMP probes are safe for Class 1, Div 1, Group D hazardous locations. This includes tanks containing regular, super, diesel and unleaded gasoline; antifreeze; kerosene; mineral spirits; oxinol, methanol and methanol blends; motor, torque and transmission oil; and alcohol. If you are not 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

5.2 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

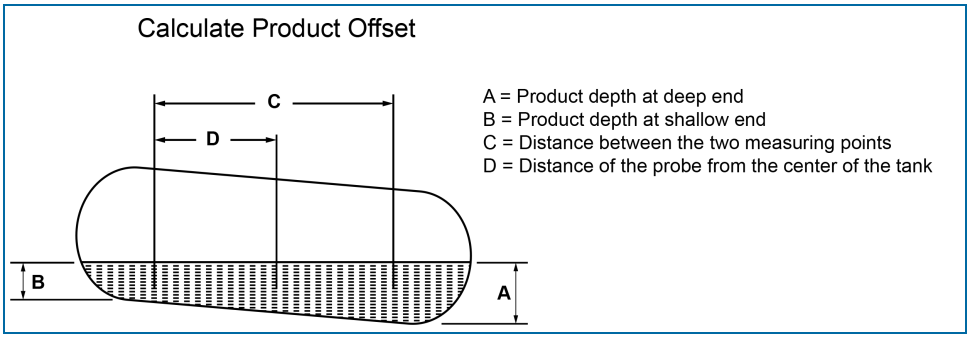
For example:

(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

5.3 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.

5.3.1 Riser Assembly

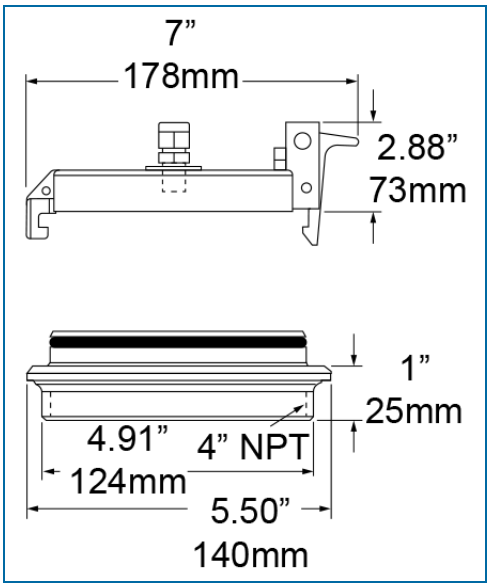
A four (4) inch diameter riser pipe must be installed on the tank opening where the probe will be installed. The riser pipe must be of sufficient length to hold the probe head, connector and an applicable length of cable.

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.

NOTE: The probe cap and adapter kit below can only be used for the OPW-FMS 924B probe. For DMP probes, use an applicable riser cap with a 9.50 mm cable gland.

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



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

5.3.2 Manhole and Junction Box

NOTE: The section that follows is applicable to the OPW-FMS 924B junction box installation. For information on DMP probe installation with an IP68 junction box see "Dover Magnetostrictive Probe (DMP)" on page 53.

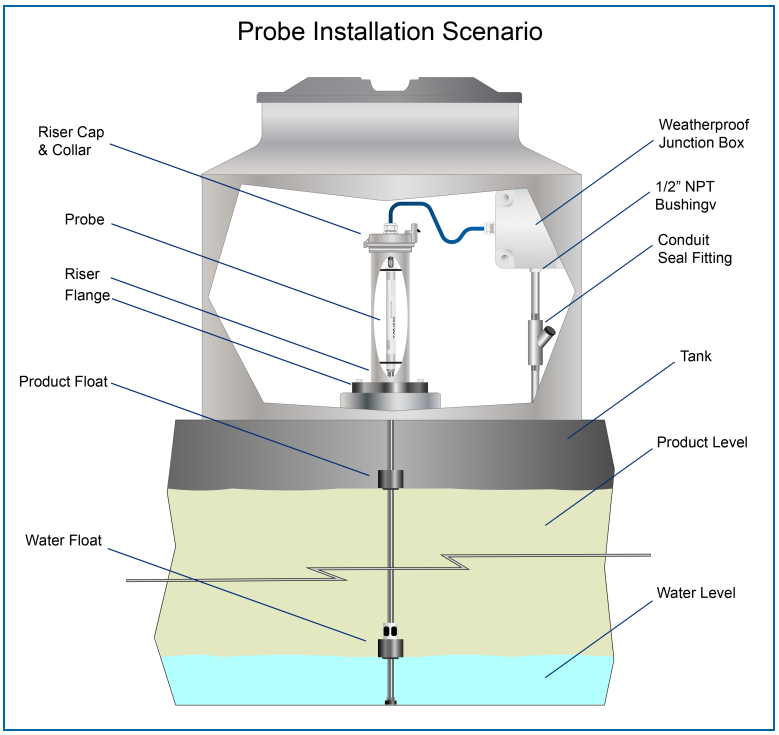
Install a manhole of at least 45.7 cm (18 inches) diameter around an unused fitting in the top of the tank. This manhole must be of sufficient dimensions to contain the riser for the probe and a weatherproof junction box.

NOTE: The 924B 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.

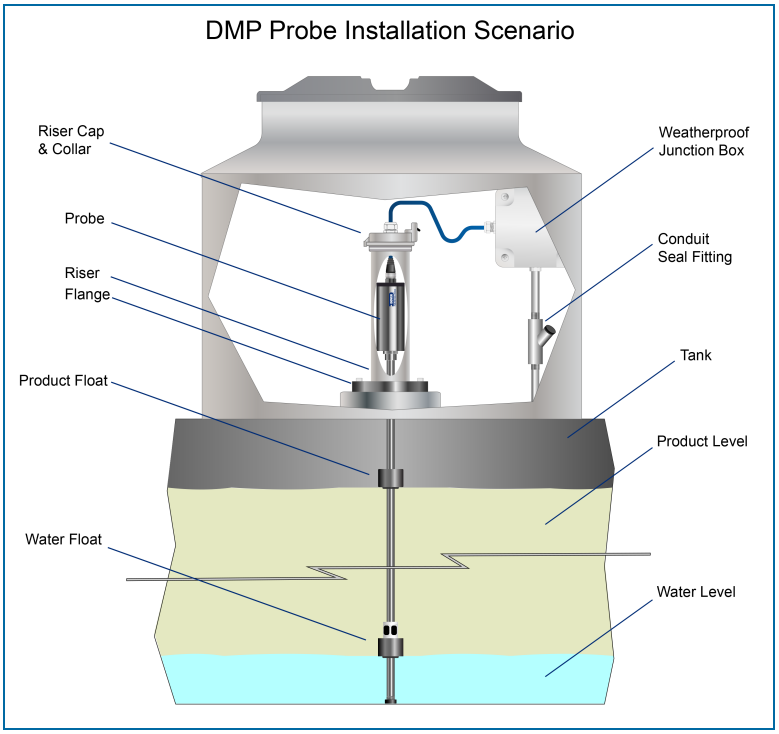
The weatherproof junction box must be of sufficient dimensions to contain a 0.5 inch (12.7 mm) conduit, a minimum 12 inches (30.5 cm) coiled field wiring, all applicable probe and sensor cables and an epoxy resin seal-pack.

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.



924B Probe Installation

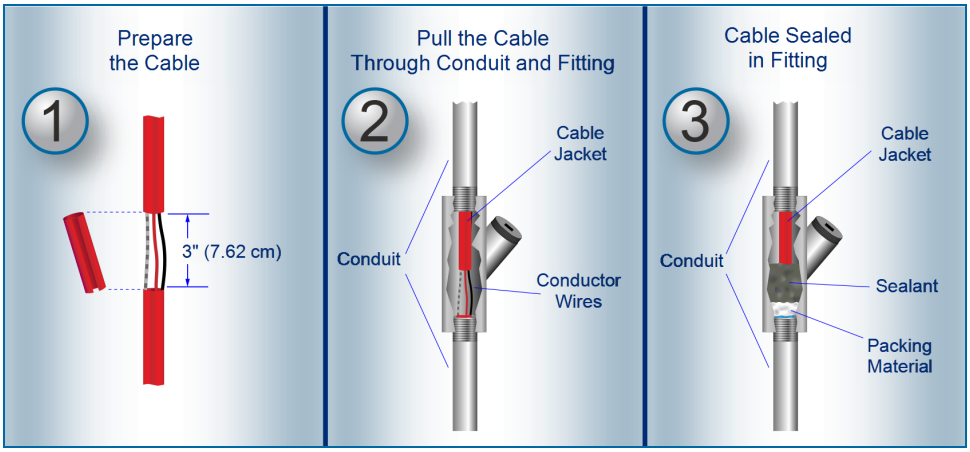


DMP Probe Installation

5.4 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.

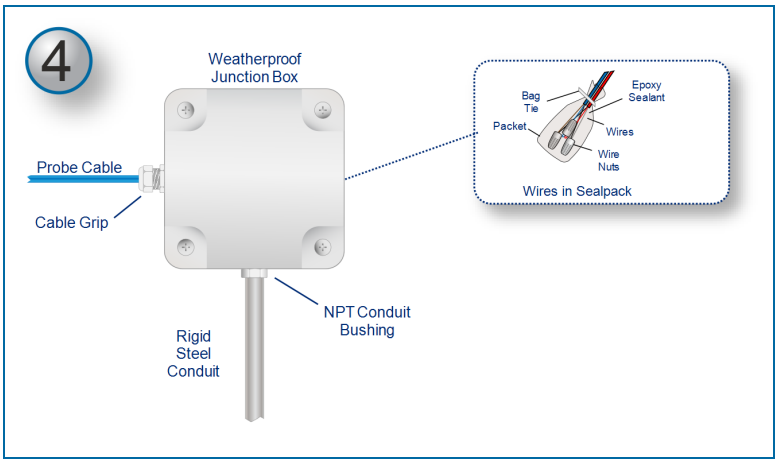


1. Prepare the Cable: Remove a sufficient length of the cable *jacket* so that the *conductor* wires can extend into the conduit seal fitting (approximately 3 inches [7.62 cm]).

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*.

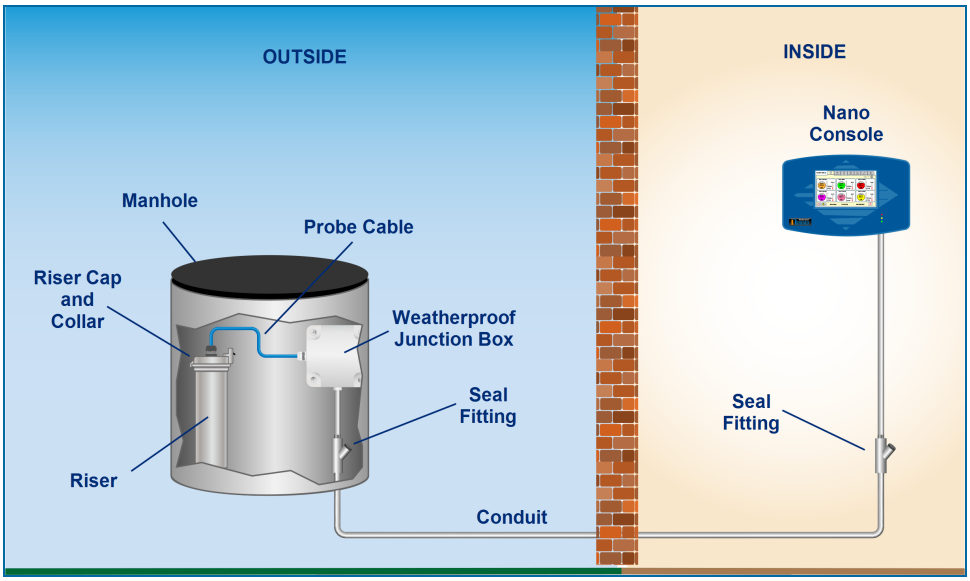


4. Tank-Probe or Smart Sensor wires that use a prepared Belden or Alpha cable must go through NPT bushings into a weatherproof junction box. Bushings must be used in all junction boxes.
5. The cable must go through rigid steel conduit from the junction box directly to the I.S. barrier.
6. Put a label 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 equipment.

Only OPW 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.


OUTSIDE
INSIDE
Nano
Console
Manhole
Probe Cable
Riser Cap
and
Collar
Weatherproof
Junction Box
Seal
Fitting
Riser
Conduit
Seal
Fitting

5.5 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.

5.6 Nano Mixed Multi-drop Installation

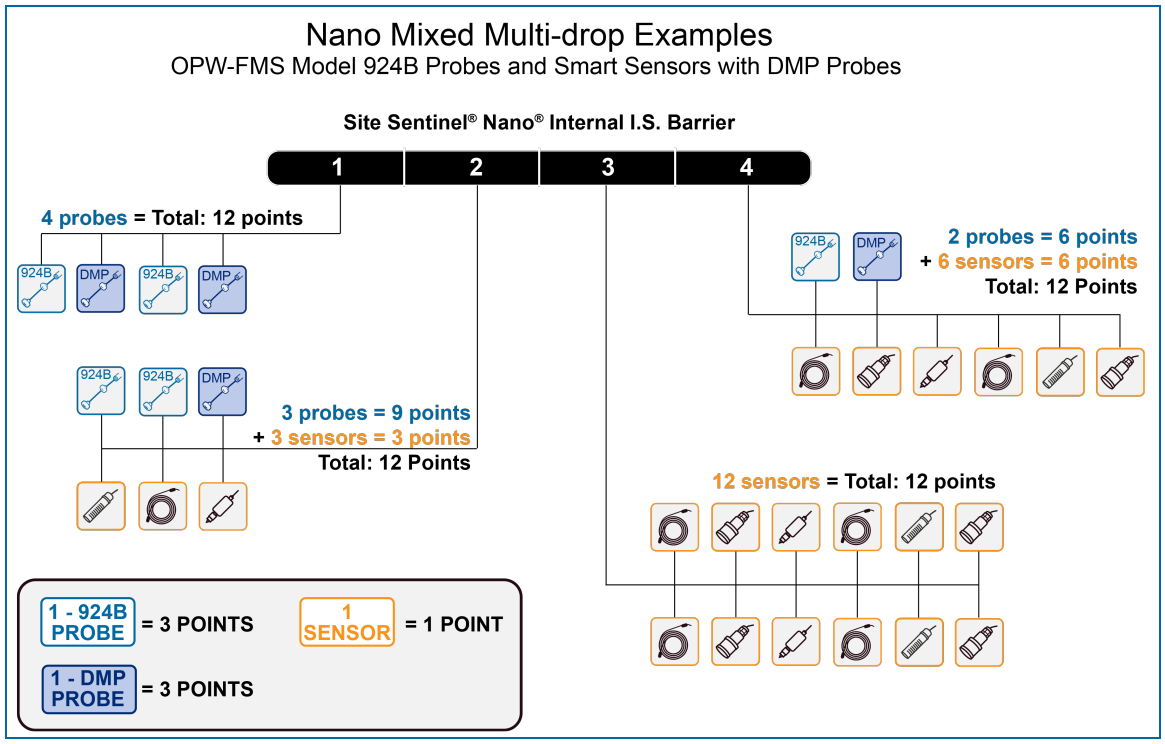
The Nano's internal I.S. barrier can hold a maximum of 12 probes and 24 sensors. The console uses a point system to calculate the mix of probes and sensors that can be installed on each of the four (4) barrier positions.

NOTE: The OPW-FMS model 924B probe and the DMP probe can be on the same internal Nano I.S. barrier position for multi-drop installations. The two probes are equal to the same point values to calculate the mix of probes and sensors on a barrier position.

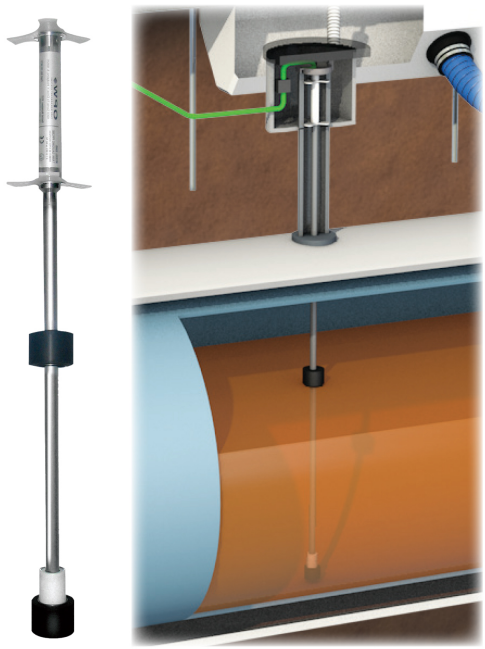
One (1) probe (924B and/or DMP) is equal to three (3) points and one (1) sensor is equal to one (1) point.

One barrier position can hold a total of 12 points (4 Tank-Probes, or 12 Smart-Sensors or a mix of probes and sensors).

Some examples of possible Mixed Multi-drop barrier channel installations are shown below. Other combinations are possible if the total number of points is not more than 12 on one barrier.



Section 6 924B Probe Installation



6.1 Probe Floats

There are three types of floats used with the probes: 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.

6.2 Model 924B Probe Specifications

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: Level Measurement, Water: Temperature Res-olution/Accuracy:	± 0.0127 mm (± 0.0005 inches) ± 0.254 mm (± 0.012 inches) ± 0.1°C / ± 0.5°C
Classifications:	Class I, Division 1, Group D
Certifications:	IECEx UL 11.0012X DEMKO 11 ATEX 1012670X
I.S. Barrier Used:	12V ONLY; OPW 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.

6.3 Waterproof Electrical Connections

Components

Each 924B Tank-Probe and OPW-FMS Smart-Sensor wiring kit will have all the necessary components to complete the seal-pack assembly for electrical connections. Each kit includes:

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

Personal Protective Equipment

CAUTION: Wear Personal Protective Equipment to install the resin seal-pack (safety vest, safety glasses and chemical resistant gloves). Before you do the assembly, barricade the work area.

Tools

- Wire stripper and cutter

Instructional Video

If you have a QR code scanner or reader app for your smartphone you can scan this code (or click the link) to see the instruction video, **Multidrop Probe and Sensor Wiring Instructions**.

Multidrop Probe and Sensor Wiring Instructions

Safety Information

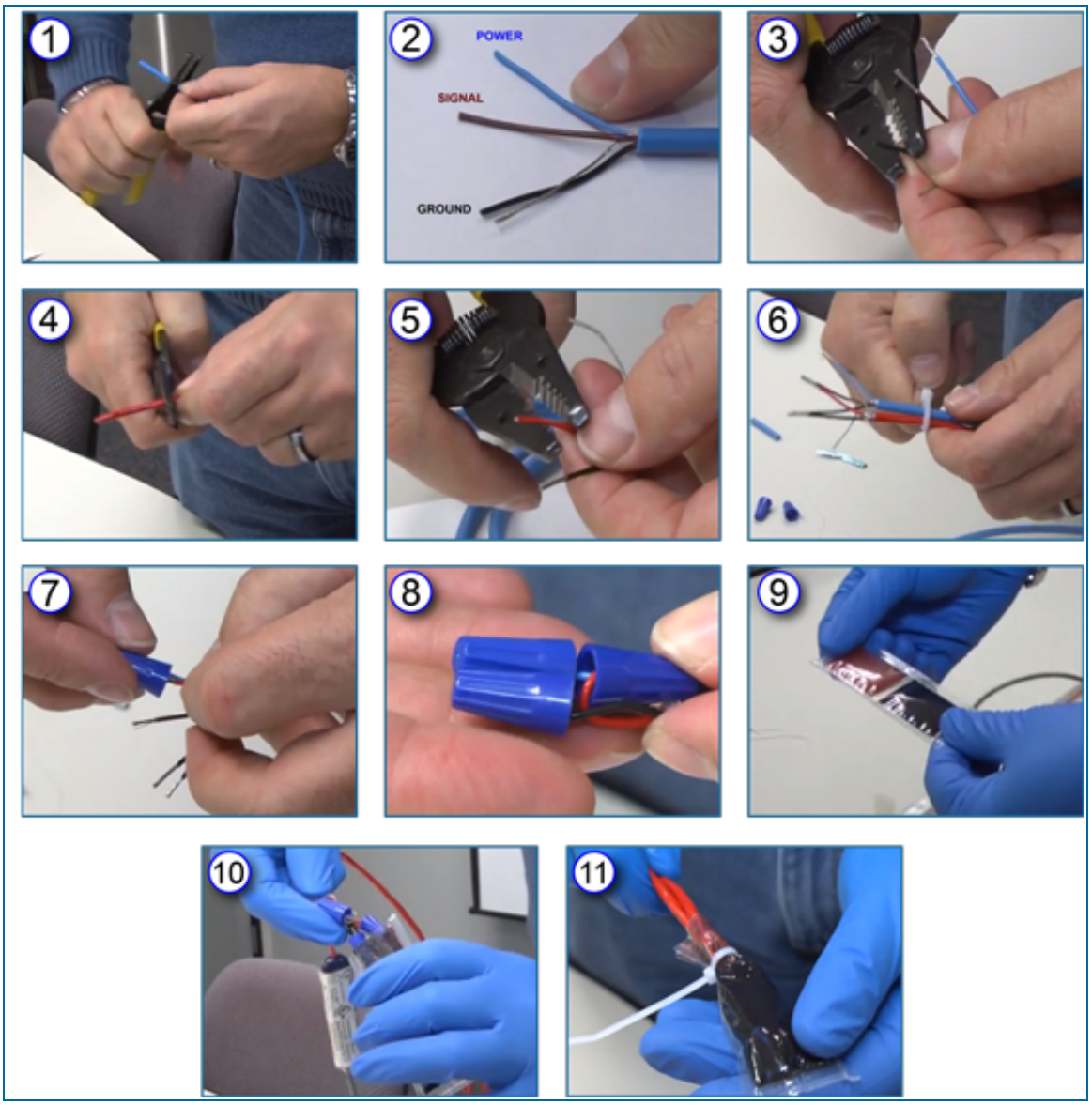
DANGER: This product contains vinyl cyclohexene dioxide. Do not swallow the resin or let it touch your skin or eyes. Do not breath the fumes.

Scan the code or use the link below to get access to the Safety Data Sheet for the 3M™ Scotchcast™ 3570G-N (Parts A & B).

3M™ Scotchcast™ 3570G-N (Parts A & B) Safety Data Sheet

Assembly Procedure

To assemble the wire connections and Scotchcast™ resin seal-packs:



Assemble the Epoxy Seal Pack for Waterproof Electrical Connections

NOTICE: It is VERY important to seal all Tank-Probe and Smart-Sensor connections in the junction box to prevent corrosion of the wires.

1. Remove approximately 1.5 inches of the cable *jacket* from the end of the Tank-Probe (or Smart-Sensor) cable to show the *conductor* wires inside (power, signal, ground and/or shield).

IMPORTANT: When you remove the insulation from the cables or conductors be careful to not cut the metal wires inside the insulation material.

NOTE: The photo in the procedure above shows wiring for OPW-FMS 924B Tank-Probes. The inner *conductor* wires in the Smart-Sensor cables are different colors. Refer to the illustration under **Sensor Wiring** below for the correct wiring for Smart-Sensors.

2. The *conductor* wires inside the cables are:
   - Power: The Tank-Probe conductor is Blue. The Smart-Sensor conductor is Red.
   - Signal: The Tank-Probe conductor is Brown The Smart-Sensor conductor is Black.
   - Ground: The Tank-Probe conductors are Black and Braided Shield. The Smart-Sensor conductor is the Braided Shield.
3. Remove approximately 0.5 inches of insulation material from the ends of the conductor wires.
4. Remove approximately 1.5 inches of the cable *jacket* from the end of the Field Wiring cable (Belden 88760 or 88761) to show the three (3) *conductor* wires inside (Red = Power, Black = Signal, Braided Shield = Ground).
5. Remove approximately 0.5 inches of insulation material from the ends of the Field Wiring Cable's Red and Black *conductor* wires.
6. Put a tie wrap around both of the cables approximately 1 inch from the end of the cable *jacket*. Pull the tie wrap tight and cut the unwanted tie material at the clamp.
7. Make three (3) *conductor* wire groups:
   - Twist the ends of the bare wires of the Power *conductor* wires together.
   - Twist the ends of the bare wires of the Signal *conductor* wires together.
   - Twist the ends of the bare wires of the Ground *conductor* wires together.
   - Put each of the twisted *conductor* wire groups into the open end of a wire-nut.
   - Turn each nut clockwise several turns until the wires are attached tightly.

REMINDER: See the illustration under Sensor Wiring below for the correct wiring for Smart-Sensors.

NOTE: Refer to the wiring diagrams in the product manual for more information about the Tank-Probe or Smart-Sensor wiring.

8. Fold one of the assembled wire-nuts back as shown in the photo. The full wire-nut assembly can be contained in the epoxy bag.

CAUTION: Always wear protective gloves and safety glasses when you do work with the epoxy resin packs!

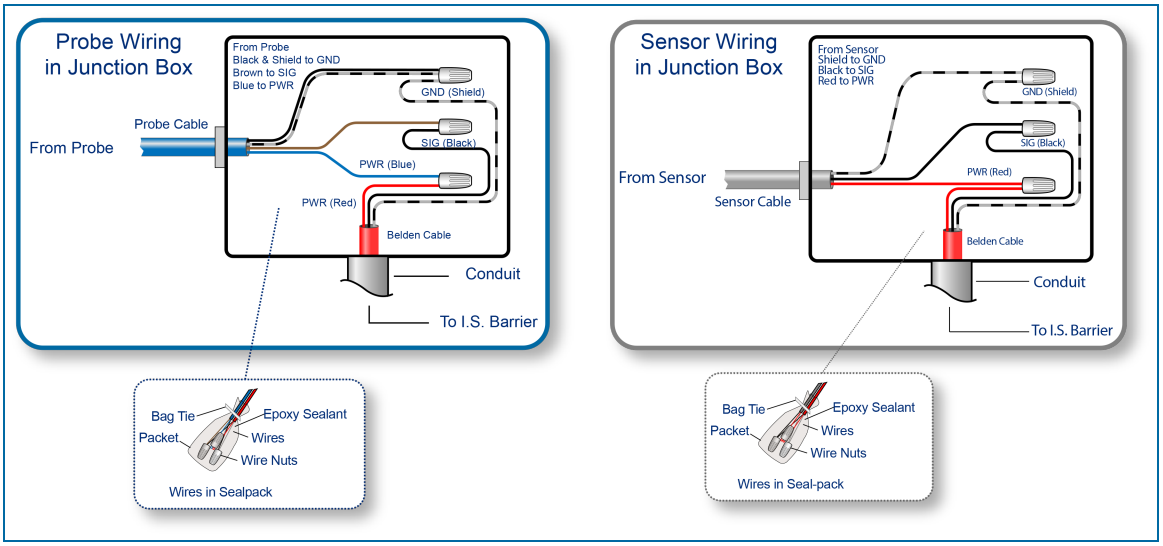
9. Prepare the epoxy resin seal-pack.
    - Bend the package until the separation between the two resins breaks.
    - Mix the two (2) resins together fully for approximately two (2) minutes. The mixed epoxy will be warm when you touch it.
    - Push all of the mixed resin to the bottom of the bag.
    - Cut and remove the top of the bag.
10. Put the wire-nut assembly all the way in 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 that holds the wires (this will keep the wire-nut assembly in the bag).
11. Move the epoxy around to fully cover all of the wires and wire-nuts inside the bag. Let the epoxy become hard. This will seal the electrical connection and will prevent corrosion of the wiring connections.

Sensor Wiring

The procedure for wiring the Smart-Sensors is the same as for Tank-Probes. The internal *conductor* wires of the Tank-Probe and Smart-Sensor cables are different. In step 2 above, there are three (3) *conductor* wires inside the Smart-Sensor cable The colors are the same as the Field Wiring cable (Belden 88760 or 88761):

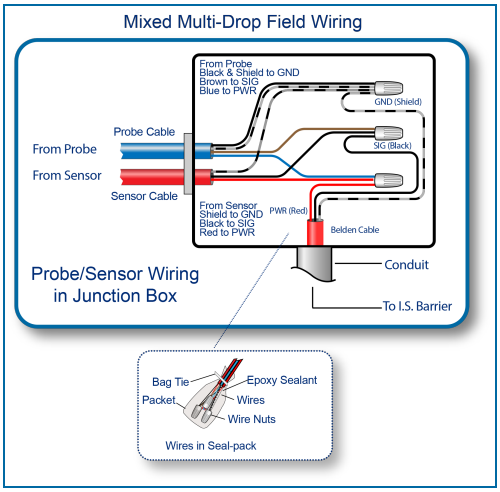
- The Red *conductor* wire is the Power connection.
- The Black *conductor* wire is the Signal connection.
- The Braided Shield is the Ground.

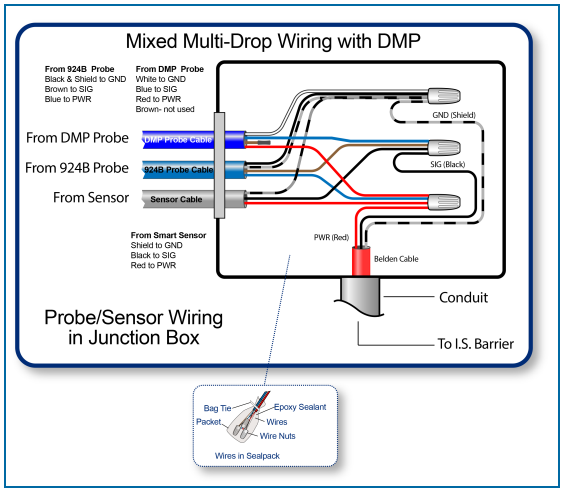
The illustration below shows the difference in the cable wire colors between the Tank-Probe and Smart-Sensors.



Mixed Multi-drop Field Wiring

The Nano console can accept Mixed Multi-drop Field Wiring. Tank-Probes and Smart-Sensors can be wired on the same Field Wiring cable to the same I.S. barrier channel. Refer to the Section Mixed Multi-drop Installation for the limits on the number of probes and sensors that can be on a barrier channel.





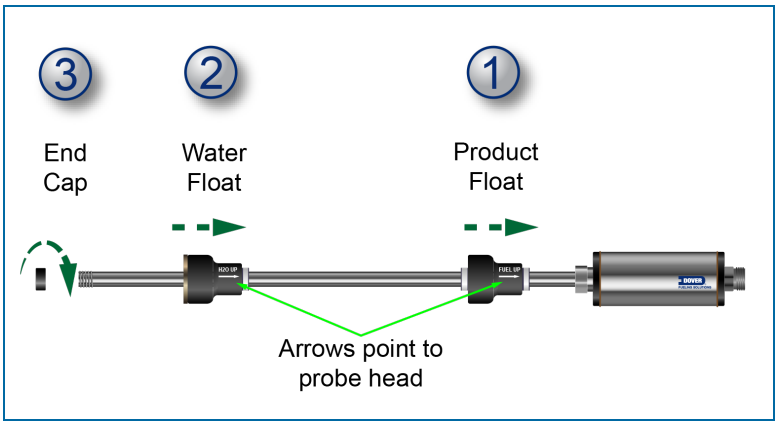
Section 7 Dover Magnetostrictive Probe (DMP)

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

7.1 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.

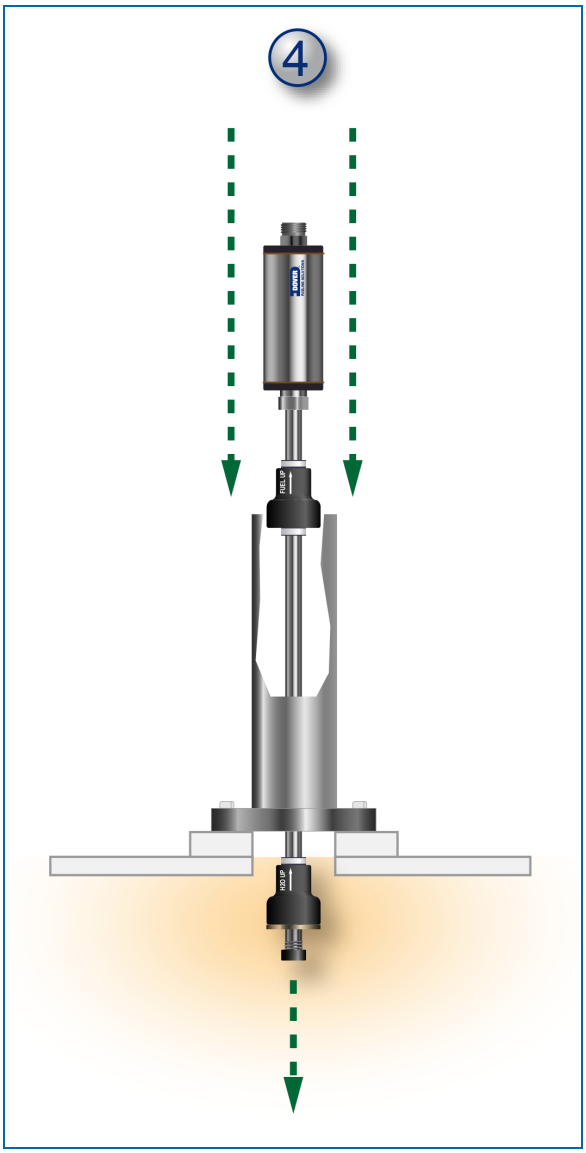
IMPORTANT: If the fitting is not in the center of the tank, a Product Offset Calculation will be necessary. See Product Offset Calculation for information.



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 arrow points toward the probe head.
2. Put the Water Float on the probe shaft (if applicable). Make sure the arrow points toward the probe head.
3. Attach the End Cap to the end of the probe shaft. Turn it clockwise to tighten.



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.

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

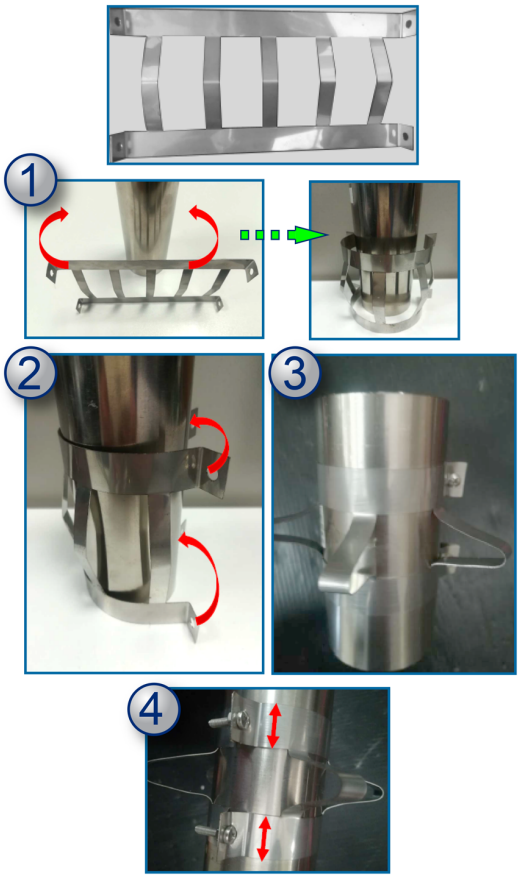
IMPORTANT: The minimum inner diameter for a riser is 52 mm (2.05 in.). This gives an allowance for the head gaskets so the probe can move freely inside the riser

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

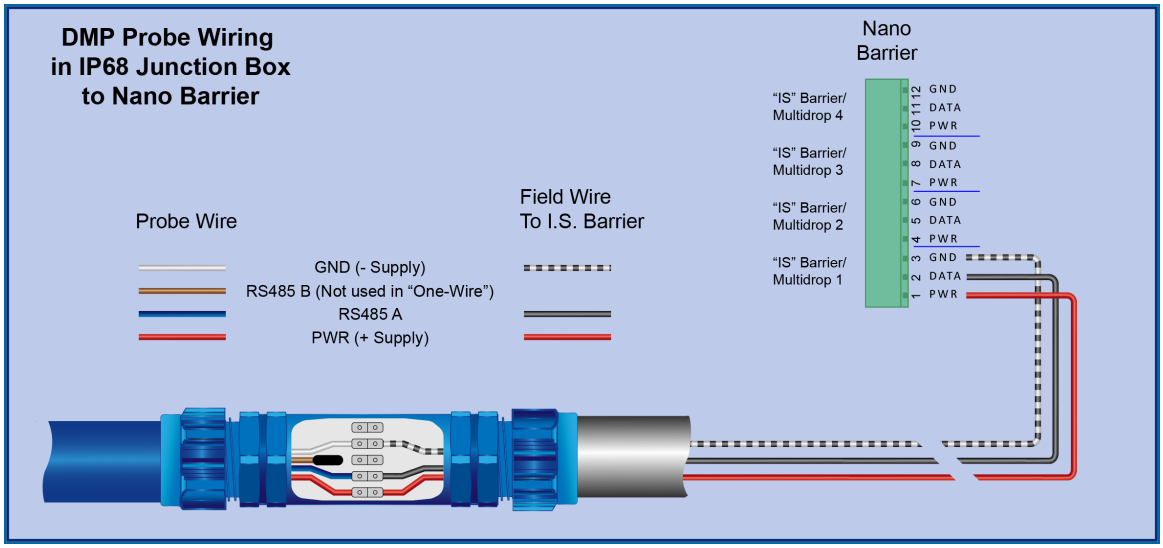


NOTICE: Be careful to not cause damage to the probe label when you install or when you make adjustments to the spacer. The label contains important safety and product information.

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.

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

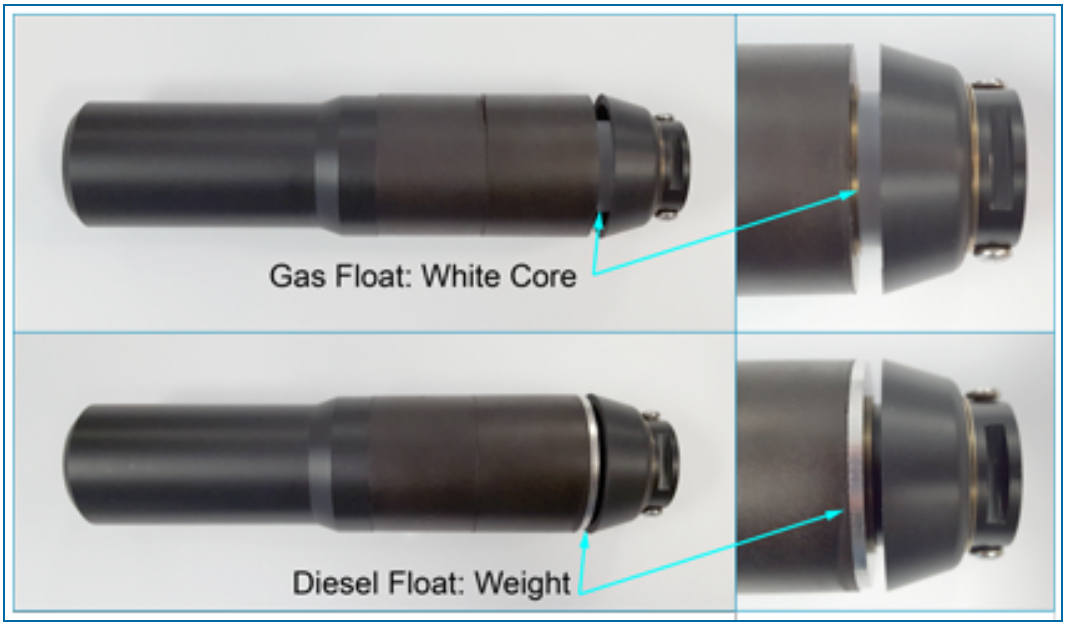


Section 8 Density Measurement Float (DMF)

OPW 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

8.1 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.

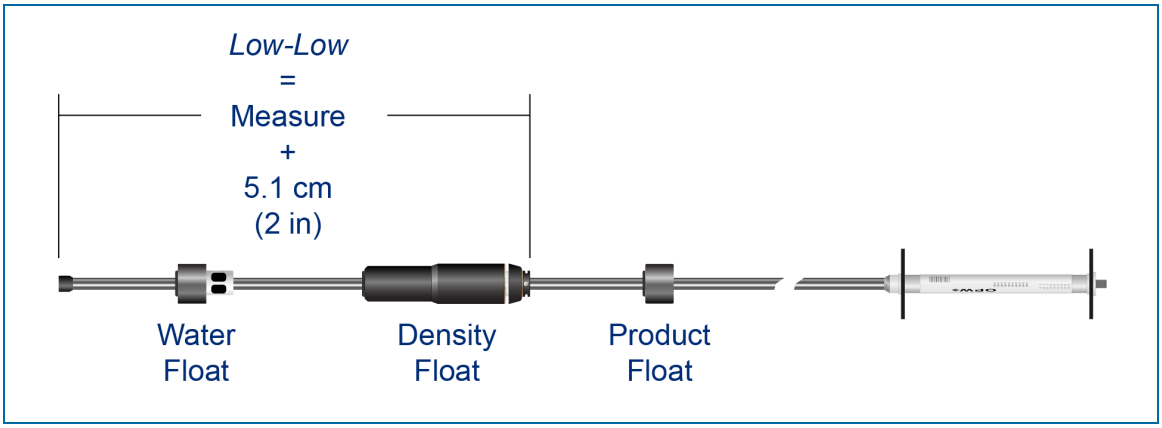
For DMF configuration and calibration refer to your M2011 SiteSentinel® Nano® Configuration Guide.

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.

8.2 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

Section 9 Sensor Support

As of Release 3 the SiteSentinel® Nano® 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.

9.1 IntelliSense™ Technology

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

9.2 Mixed Multi-Drop Installation

The Nano's **Mixed Multi-Drop technology** can run probes and sensors on one cable back to the tank gauge. See "Nano Mixed Multi-drop Installation" on page 43 for more information.

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

9.3 Smart Sensors for Nano

Part Number	Description
30-0232-DH-10	Discriminating Dispenser Sump Sensor
30-0232-DH-20	Discriminating STP Sump Sensor
30-0236-LW	Discriminating Interstitial Sensor (Optical)
30-0234-HW-06/15/20	Hydrocarbon Liquid Sensor with water indicator (6, 15 and 24 ft. lengths)
30-0234-HW-01	Interstitial Hydrocarbon Liquid with water indicator
30-0231-S	Interstitial Sensor-Float Switch – (Small Plastic)
30-0231-L	Sump Sensor-Float Switch – (Large Plastic)

Part Number	Description
30-0230-S	Liquid Only Float Sensor (Brass) - steel tank interstitial containment area
30-0232-D-10	Dual Float Non-Discriminating Dispenser Sump Sensor
30-0232-D-20	Dual Float Non-Discriminating STP Sump Sensor
30-0232-D-10B	Dual Float Brine Sensor for Containment Sump
30-0232-D-20B	Dual Float Brine Sensor for Fiberglass Tanks
30-0235-V	Hydrocarbon Vapor Sensor

9.4 Discriminating Dispenser Sump/STP Sump Sensor

Smart Sensor Equipped with Intellisense™ Technology

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

Description

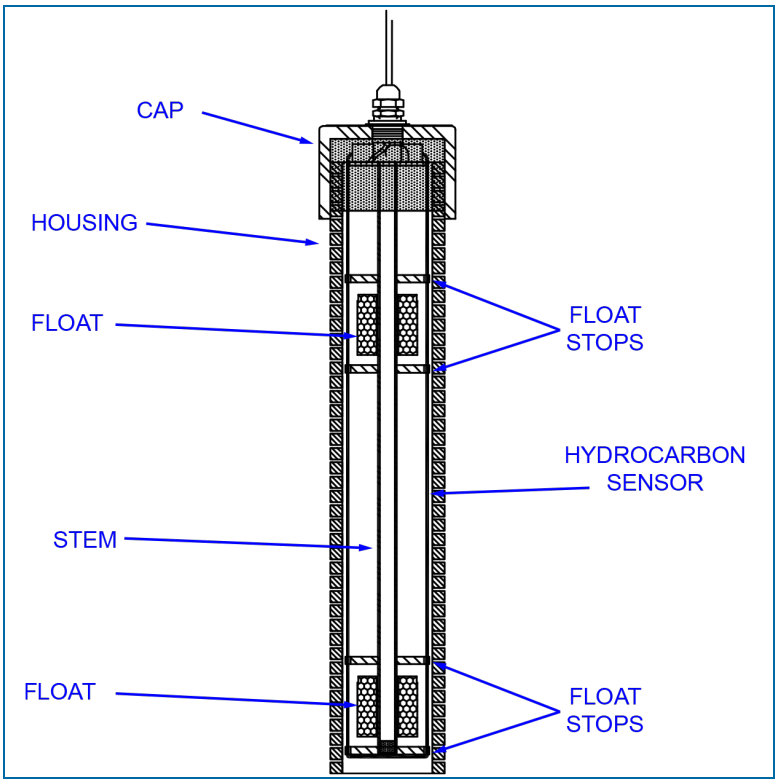
IMPORTANT: This float body is the same as the 30-0232-D10 / D20 and 30-0232-D-10B / D-20B. Look at the label to make sure you have the correct sensor for the applicable function.

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
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

Specifications	
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 Mixed Multi-Drop Installation
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

IMPORTANT: This Smart Sensor must ONLY be connected to an OPW Fuel Management Systems 12V VSmart Module. This will make sure that operation conditions are safe. Smart Sensors CANNOT be used with SS1, 2 or 3, iTouch or EECO consoles.

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).

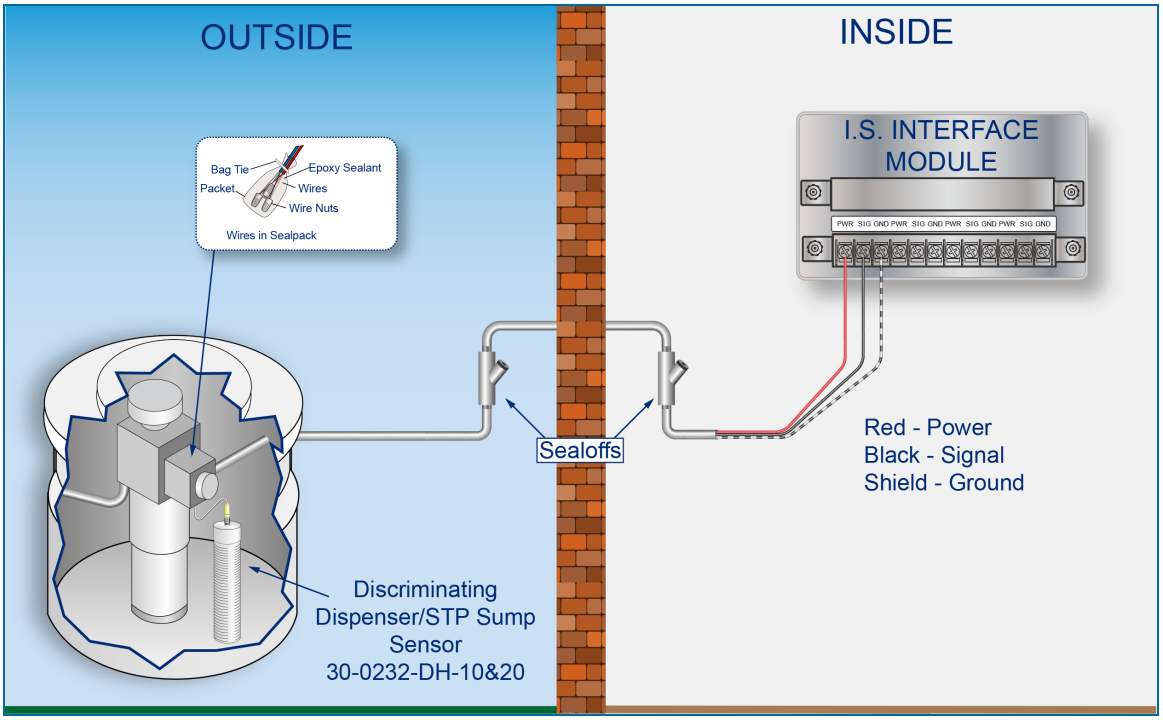
- This sensor uses ONE Controller Interface I.S. Module position
- Start with the Connections table and “Typical Installation" drawing below.
- Make sure the sump pit or pan is dry.
- Install the sensor so that it touches the bottom of the sump pit or pan.
- Connect the sensor cable to the sensor.

- 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 Guide). 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

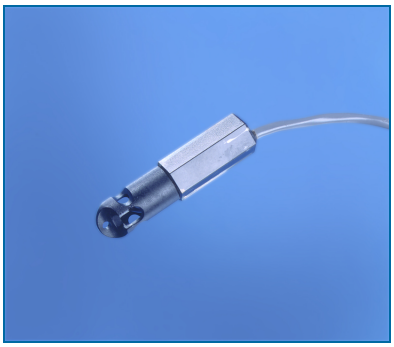
- Make sure the sensor is disconnected.
- Put the contaminated portion of the sensor fully into *Denatured Alcohol* for one (1) hour.
- Flush the sensor with water to remove all remaining contamination.
- Let the sensor dry in the air for one (1) hour.
- Reconnect the sensor.

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.

9.5 Discriminating Interstitial Sensor (Optical)

Smart Sensor Equipped with Intellisense™ Technology

30-0236-LW



Description

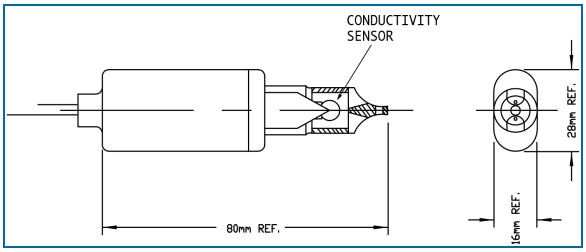
The primary function of the Discriminating Interstitial Optical Liquid Sensor is to monitor the interstitial area of double-walled tanks. This sensor uses a long-life, solid-state optical prism. These sensors can also be used in sumps, fuel dispenser pans and other locations where there is liquid that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

IMPORTANT: This Smart Sensor must ONLY be connected to an OPW Fuel Management Systems 12V VSmart Module. This will make sure that operation conditions are safe. Smart Sensors CANNOT be used with SS1, 2 or 3, iTouch or EECO consoles.

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.

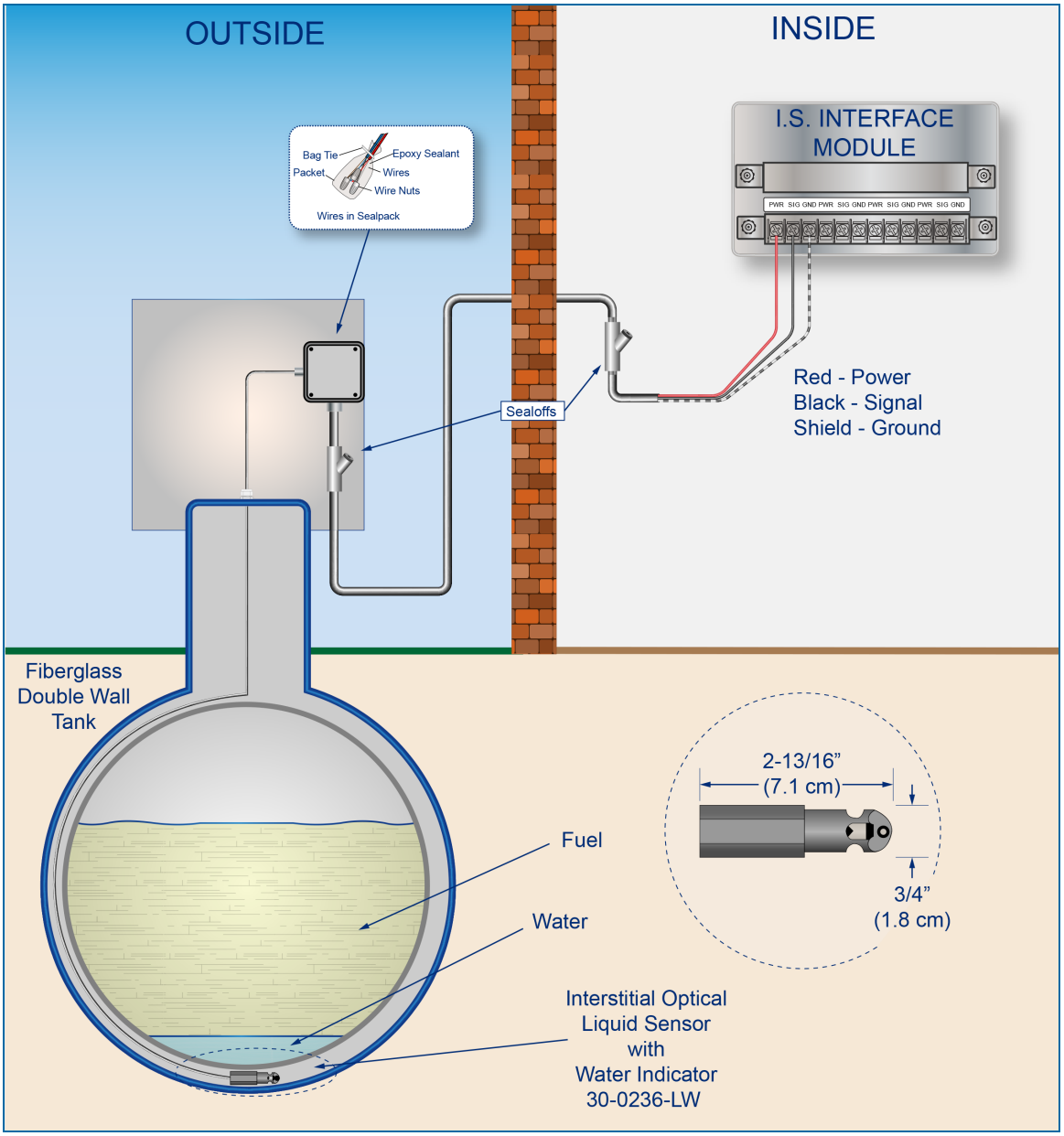
IMPORTANT: To prevent false alarms, the sensor must not touch the bottom of the monitoring tube

- 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 Guide). 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.

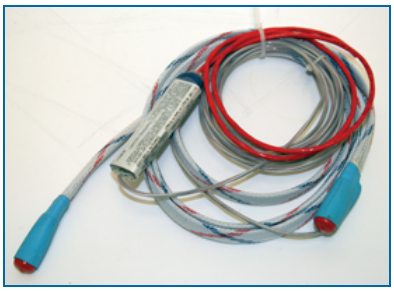
If the controller does not go into an alarm condition, look to see if the thresholds are correctly programmed in the system. A sensor or wiring fault will cause a system alarm. Do a continuity test in the wiring and junction boxes. Make sure there is continuity with no short circuits.

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

9.6 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 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	
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 Mixed Multi-Drop Installation
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

IMPORTANT: This Smart Sensor must ONLY be connected to an OPW Fuel Management Systems 12V VSmart Module. This will make sure that operation conditions are safe. Smart Sensors CANNOT be used with SS1, 2 or 3, iTouch or EECO consoles.

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.

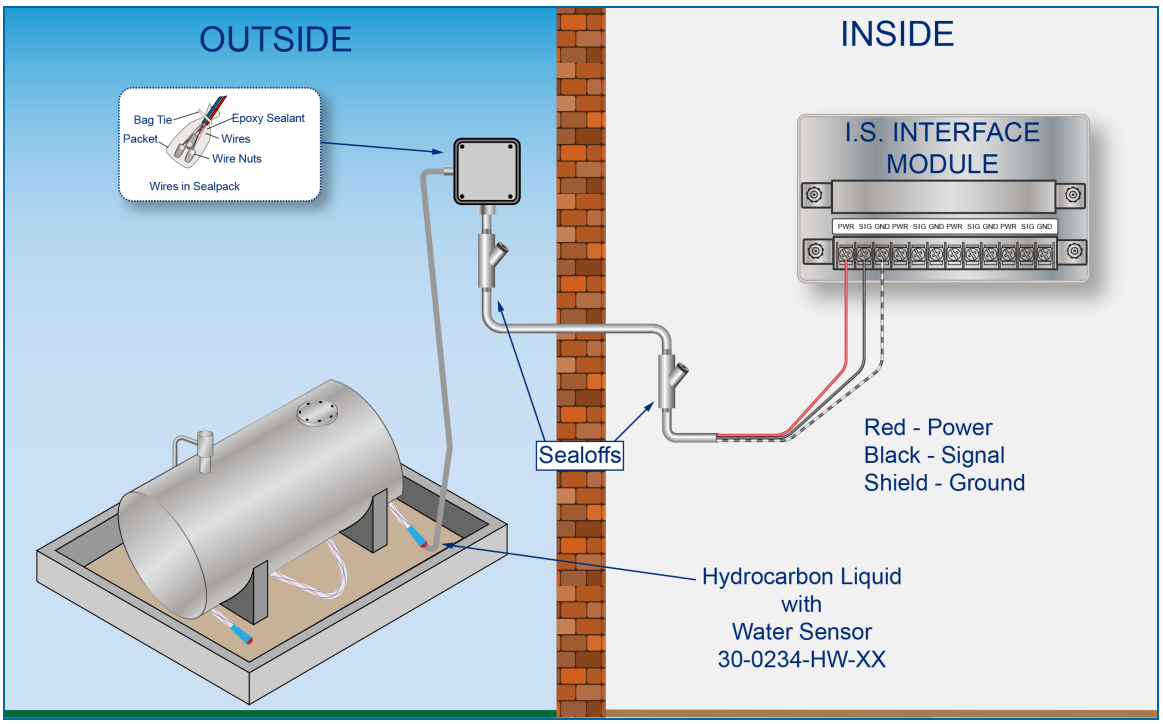
- This sensor uses ONE Controller Interface I.S. Module position
- Start with the Connections table and “Typical Installation" drawing below.
- Connect the sensor cable to the sensor.
- Connect the sensor wires to the field wires in the junction box. Use the supplied cable gland and silicon wire nuts.
- 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

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

Typical Installation Drawing



Controller Setup

The sensor must be **Auto Detected** on the console (Refer to the M2011 Nano Configuration Guide). 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.

Clean the Hydrocarbon Sensor of the Device

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

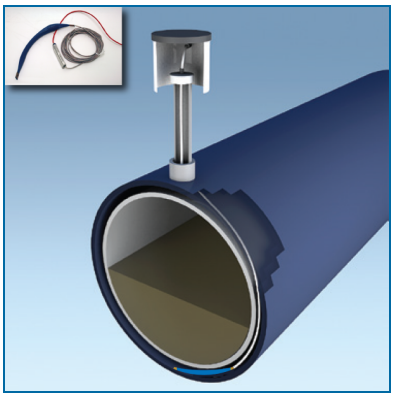
- Make sure the sensor is disconnected.
- Put the dirty part of the sensor fully into *denatured alcohol* for one (1) hour.
- Flush the sensor with water to remove all remaining contamination.
- Let the sensor dry in the air for one (1) hour.
- Reconnect the sensor.

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.

9.7 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 Mixed Multi-Drop Installation
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

IMPORTANT: This Smart Sensor must ONLY be connected to an OPW Fuel Management Systems 12V VSmart Module. This will make sure that operation conditions are safe. Smart sensors CANNOT be used with SS1, 2 or 3, iTouch or EECO consoles.

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).

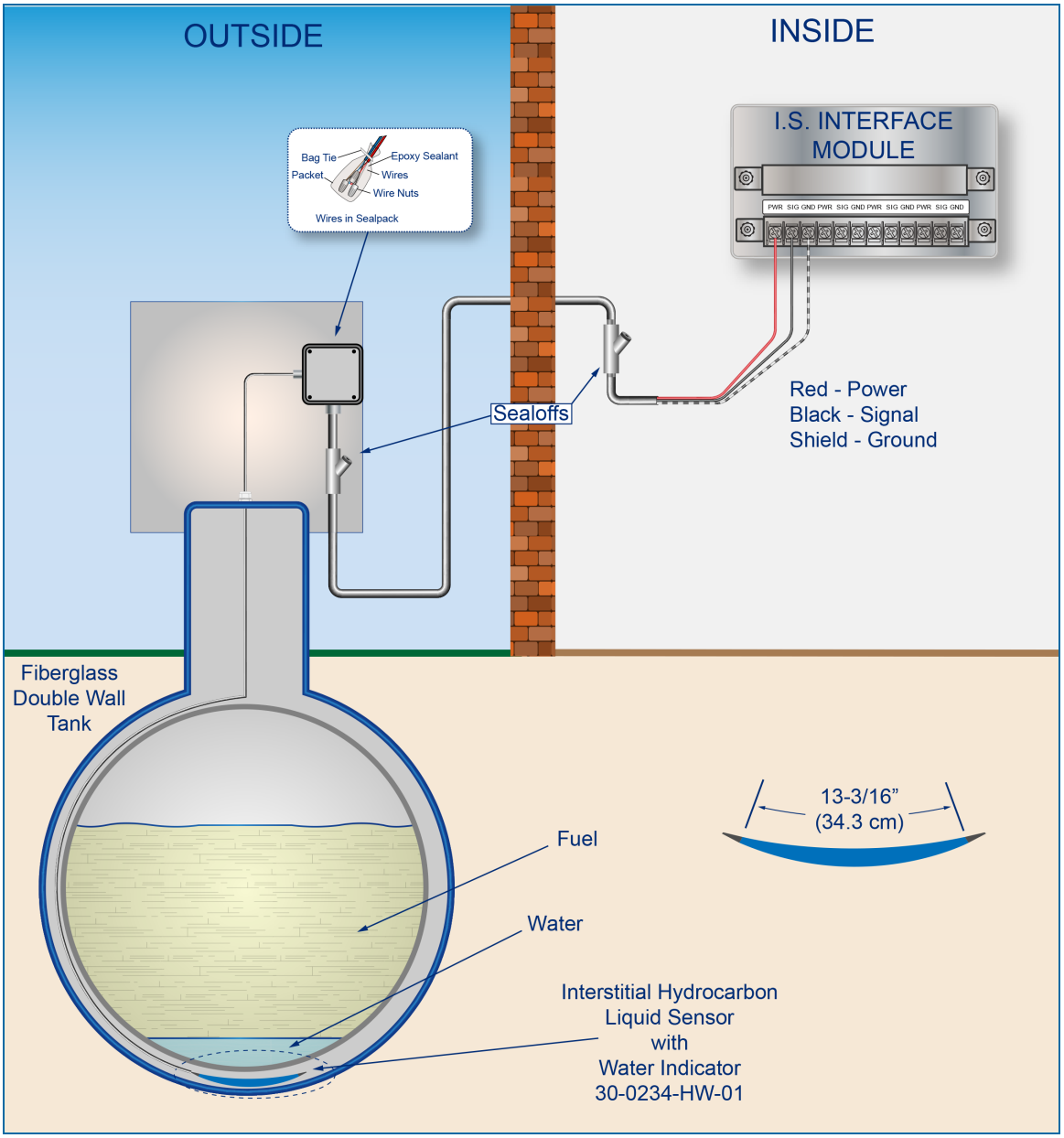
REMINDER: Hydrocarbons float on water. If the sensor is put fully in water, the polymer will not sense hydrocarbon liquid.

- 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 Guide). 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:

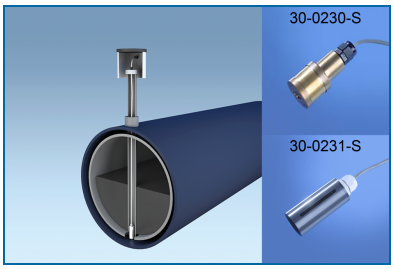
- Make sure the sensor is disconnected.
- Put the dirty part of the sensor fully into *denatured alcohol* for one (1) hour.
- Flush the sensor with water to remove all remaining contamination.
- Let the sensor dry in the air for one (1) hour.
- Reconnect the sensor.

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.

9.8 Interstitial Level Sensor

Smart Sensor Equipped with Intellisense™ Technology

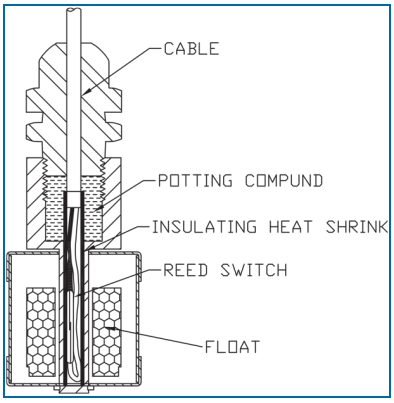
30-0230-S Liquid Only Float Sensor (Brass) & 30-0231-S Interstitial Sensor-Float Switch



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
Detects:	Liquid

Specifications	
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 Mixed Multi-Drop Installation
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

IMPORTANT: This Smart Sensor must ONLY be connected to an OPW Fuel Management Systems 12V VSmart Module. This will make sure that operation conditions are safe. Smart Sensors CANNOT be used with SS1, 2 or 3, iTouch or EECO consoles.

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).

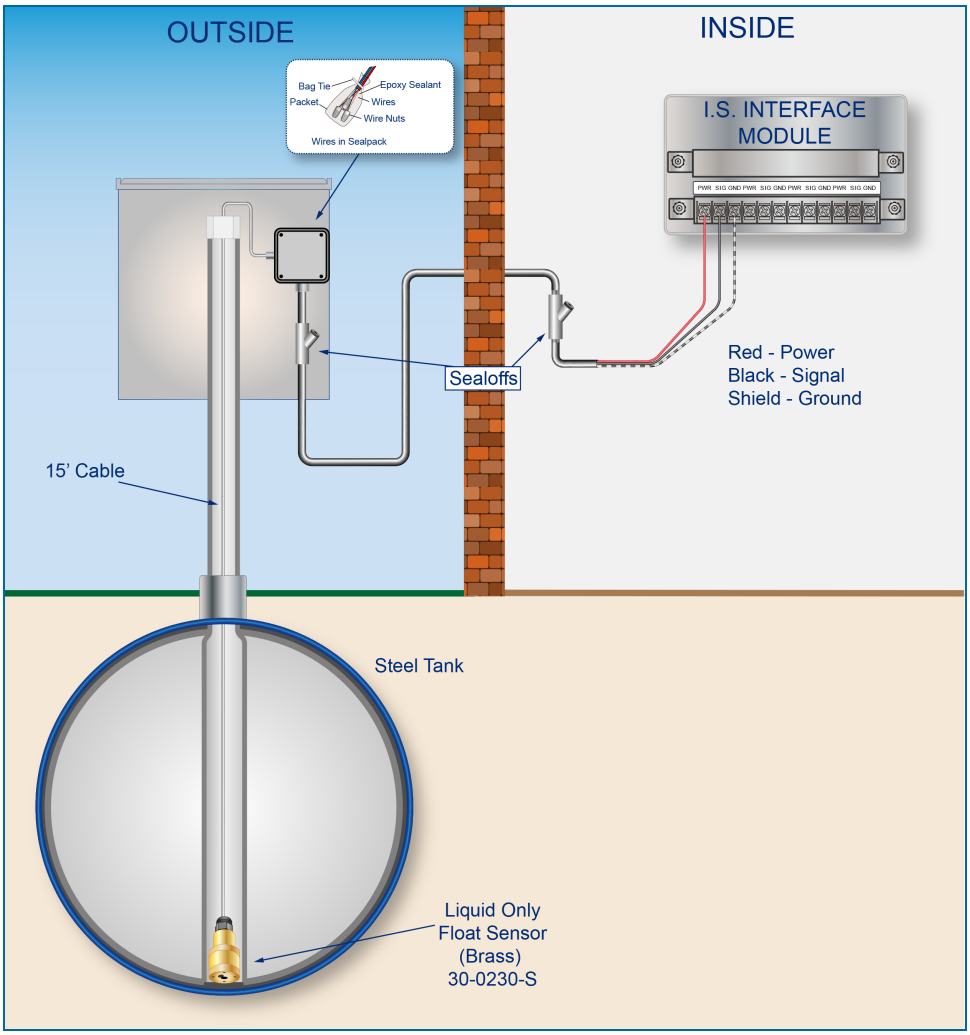
- This sensor uses ONE Controller Interface I.S. Module position
- Start with the Connections table and “Typical Installation" drawing below.
- Make sure the sump pit or pan is dry.
- Install the sensor approximately 1/2” (1.3 cm) above the bottom of the sump/pan. Attach the sensor wire to a pipe or 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

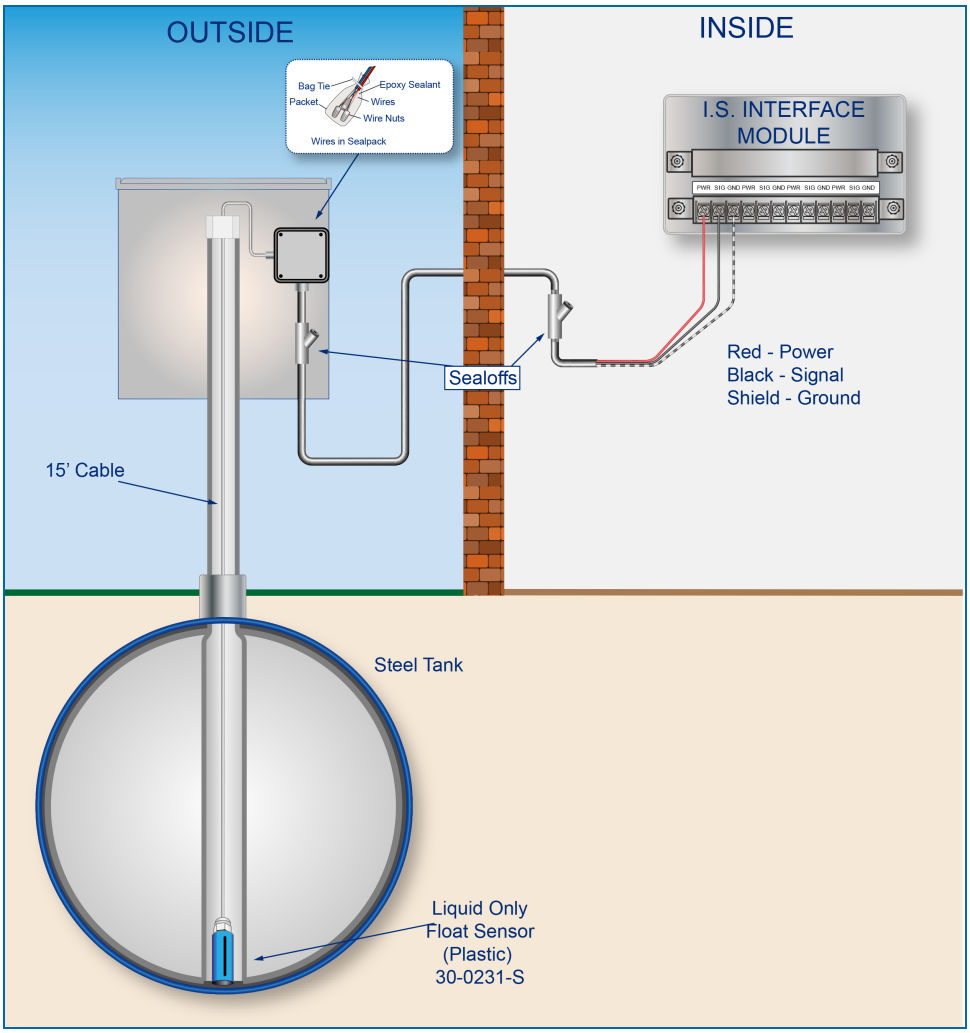
Sensor Wire Color	12V Smart Sensor Interface Channel
Red	Power
Black (hydrocarbon sensor)	Signal
Shield (or 3rd conductor)	Ground

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 Guide). 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.

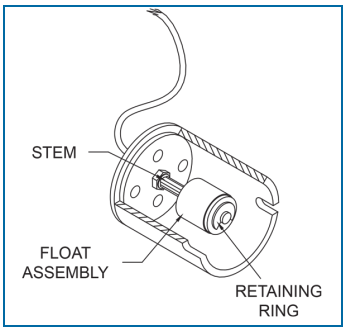
9.9 Single Level Sump Sensor-Float Switch

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)
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

Specifications	
Alarm Threshold Configuration:	Fully Automatic
Diagnostic Reading on sensor setup:	**0 to 0.5** (normal), **485 to 495** (in alarm)
Multi-Drop Restriction	See Mixed Multi-Drop Installation
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

IMPORTANT: This Smart Sensor must ONLY be connected to an OPW Fuel Management Systems 12V VSmart Module. This will make sure that operation conditions are safe. Smart Sensors CANNOT be used with SS1, 2 or 3, iTouch or EECO consoles.

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).

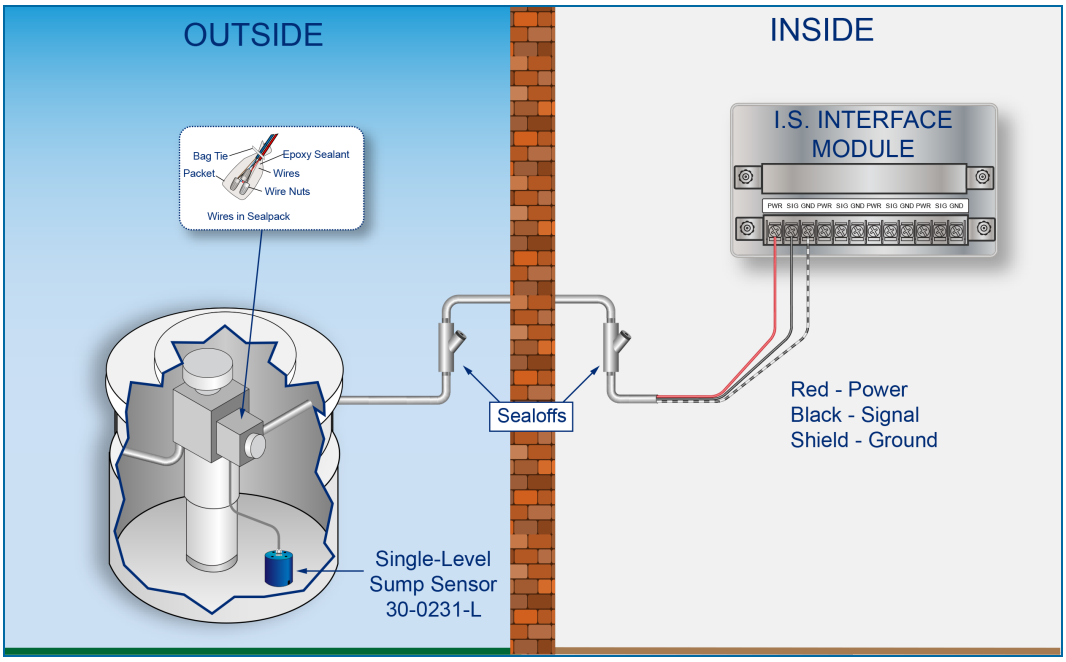
NOTE: If this sensor is used to monitor a normally dry well, use a meter to set the float position so the sensor is in a closed position when there is NO liquid level (the float will be in the lower position). To monitor a normally wet well, use a meter to set the float so that the sensor is in a closed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

9.10 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
Detects:	Low Liquid, High Liquid, Fuel (non-discriminating)

Specifications	
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 Mixed Multi-Drop Installation
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

IMPORTANT: This Smart Sensor must ONLY be connected to an OPW Fuel Management Systems 12V VSmart Module. This will make sure that operation conditions are safe. Smart Sensors CANNOT be used with SS1, 2 or 3, iTouch or EECO consoles.

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.

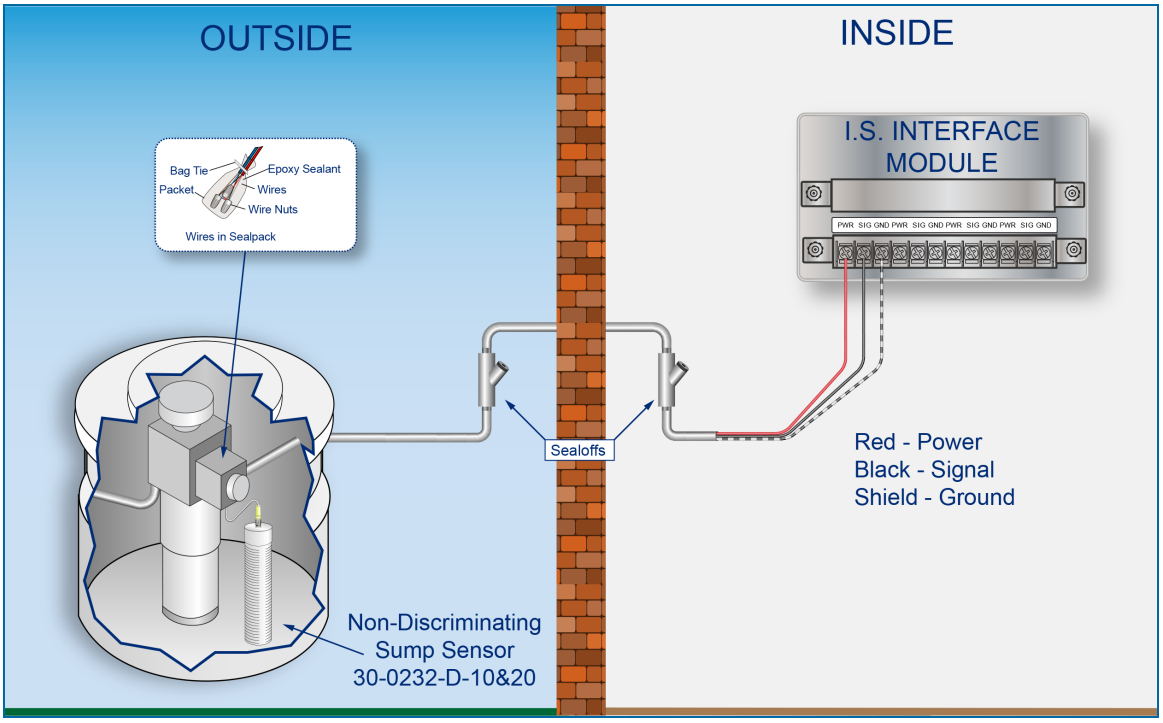
Use wire-nuts and epoxy-resin seal-packs for field connections (refer to M00-390008 Waterproof Electrical Connections for information).

- 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 Guide). 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.

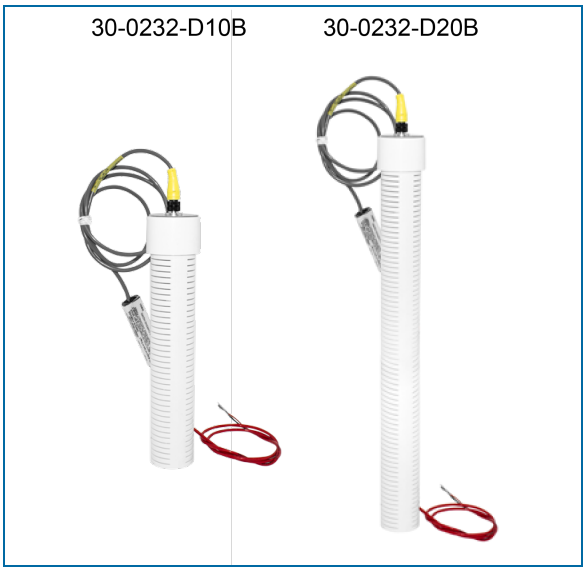
- Put the float back in the HIGH position. Make sure that the controller is not in an alarm condition.

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.

9.11 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

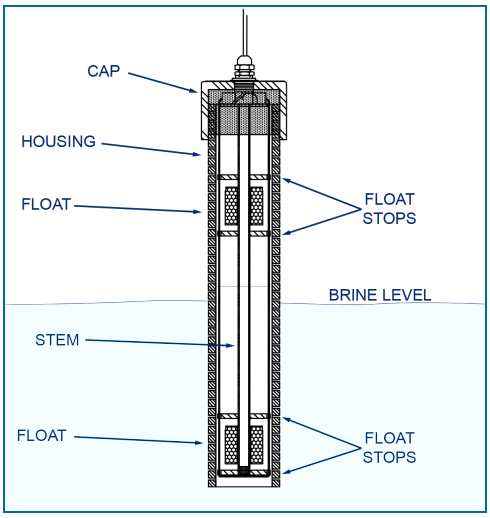
IMPORTANT: This float body is the same as the 30-0232-D-10 / D-20 and 30-0232-DH-10 / DH-20 (DH-XX has a carbon-polymer strip in the bottom). Look at the label to make sure you have the correct sensor for the applicable function.

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 Mixed Multi-Drop Installation
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

IMPORTANT: This Smart Sensor must ONLY be connected to an OPW Fuel Management Systems 12V VSmart Module. This will make sure that operation conditions are safe. Smart Sensors CANNOT be used with SS1, 2 or 3, iTouch or EECO consoles.

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.

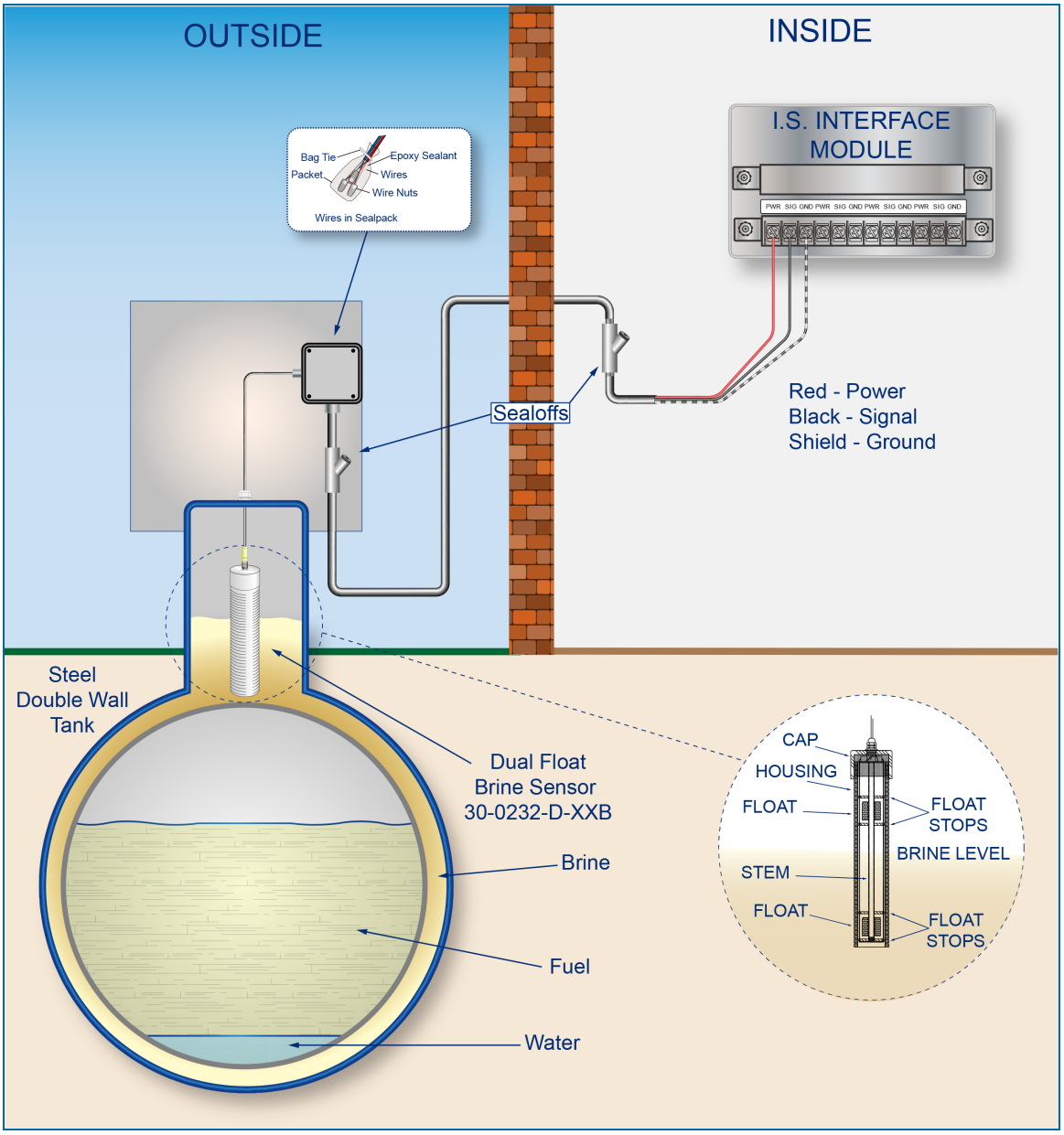
Use wire-nuts and epoxy-resin seal-packs for field connections (refer to M00-390008 Waterproof Electrical Connections for information).

- 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 Guide). 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

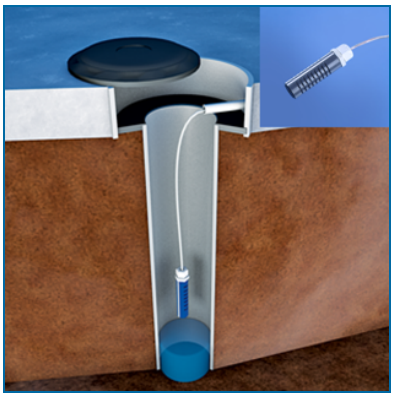
- Put the bottom float in the low position and the top float in the low position. This will cause a low-level alarm condition in the controller.
- Put the bottom float in the high position and the top float in the high position. This will cause a high-level alarm condition in the controller.
- Put the 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.

9.12 Hydrocarbon Vapor Sensor

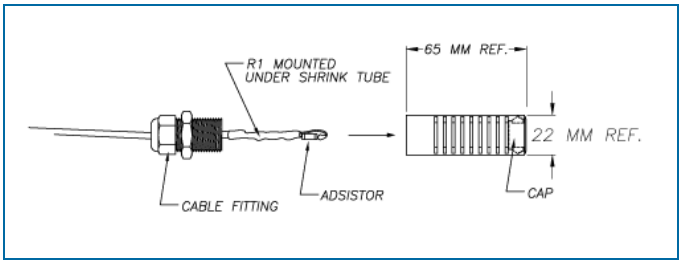
Smart Sensor Equipped with Intellisense™ Technology

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
Nominal resistance (contaminated)	More than 10,000 ohms

Specifications	
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 Mixed Multi-Drop Installation
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

IMPORTANT: This Smart Sensor must ONLY be connected to an OPW Fuel Management Systems 12V VSmart Module. This will make sure that operation conditions are safe. Smart Sensors CANNOT be used with SS1, 2 or 3, iTouch or EECO consoles.

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.

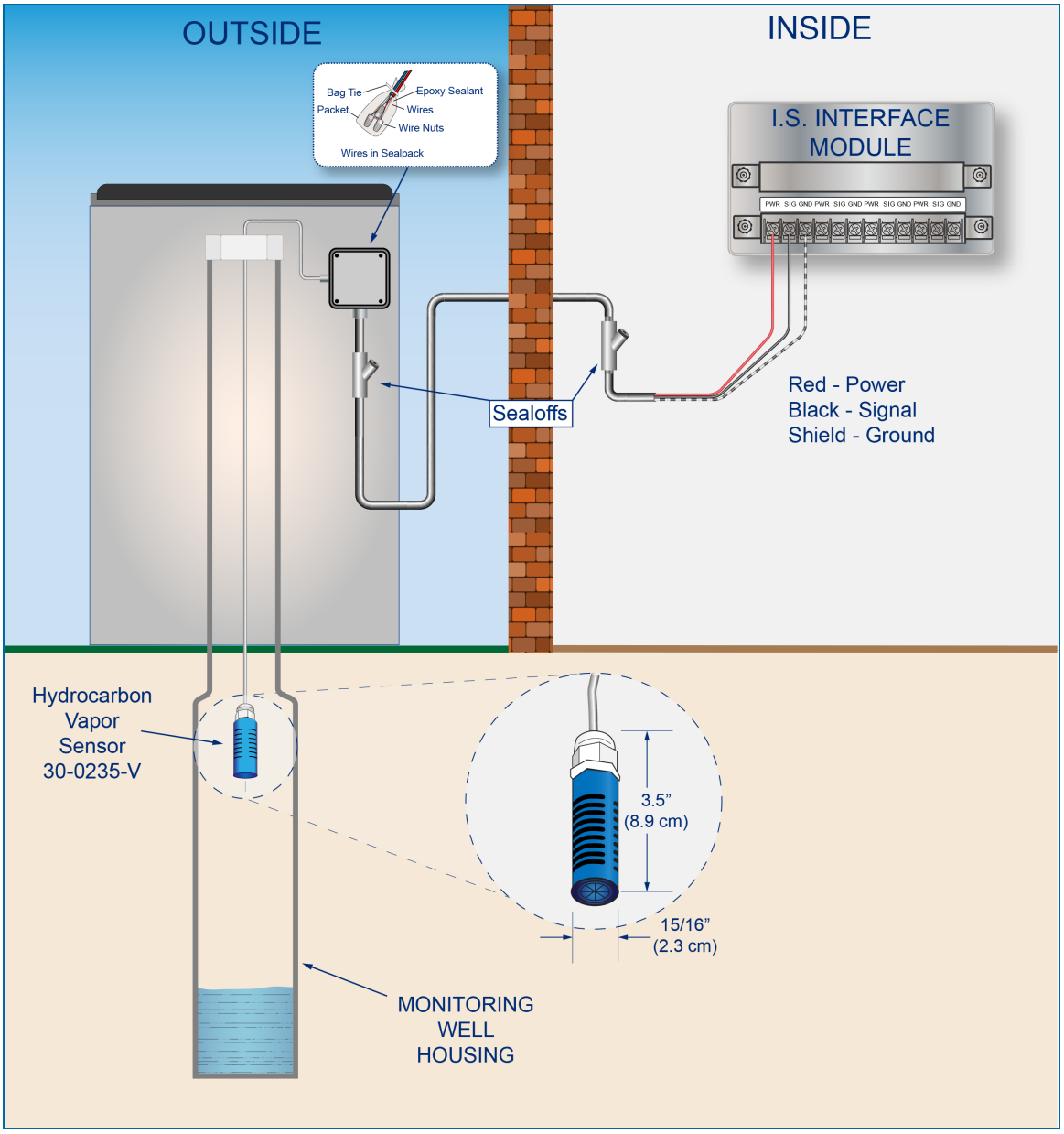
- This sensor uses ONE Controller Interface I.S. Module position
- Start with the Connections table and “Typical Installation" drawing below.
- Do a check to make sure there are no hydrocarbon vapors before you install this sensor in a Dry Monitoring Well.

- 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 Guide). 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.

Appendix A - Model 924B Probe Part Numbers

Model 924B Probe Part Numbers			
Probe Length (inches)	**Description**	**Length (cm)**	**Part Number**
53	Mag Probe for 122 cm (4 feet) Diameter/Height Tank	135	30-B053
69	Mag Probe for 152 cm (5.5 feet) Diameter/Height Tank	175	30-B069
77	Mag Probe for 183 cm (6 feet) Diameter/Height Tank	196	30-B077
89	Mag Probe for 213 cm (7 feet) Diameter/Height Tank	226	30-B089
101	Mag Probe for 244 cm (8 feet) Diameter/Height Tank	257	30-B101
105	Mag Probe for 244 cm (8 feet) Diameter/Height Double-Wall Tank	267	30-B105
113	Mag Probe for 274 cm (9 feet) Diameter/Height Double-Wall Tank	287	30-B113
125	Mag Probe for 305 cm (10 feet) Diameter/Height Double-Wall Tank	318	30-B125
137	Mag Probe for 335 cm (11 feet) Diameter/Height Double-Wall Tank	348	30-B137
149	Mag Probe for 366 cm (12 feet) Diameter/Height Double-Wall Tank	378	30-B149

Appendix B - Probe Installation Records

Probe Serial Number	Tank Number	Product in Tank	Internal Barrier #	Barrier Position (1-4) (Number in Chain, if applicable 1-4)

Appendix C - Declaration of Conformity

OPW FUEL MANAGEMENT SYSTEMS
A DOVER COMPANY
ONE COMPANY.
ONE WORLD.
ONE SOURCE.

DECLARATION OF CONFORMITY

In accordance with the Council Directive 2014/34/EU, equipment intended for use in potentially explosive atmospheres.

Standard (s) to which conformity is declared:	EN 60079-0: 2012+A11:2013 EN 60079-11: 2012
Manufacturers Name:	OPW Fuel Management Systems, Inc.
Manufacturers Address:	6900 Santa Fe Drive Hodgkins, IL. 60525 USA
Type of Equipment:	Tank Gauge/Sensor Controller
Model:	SiteSentinel NANO
Marking:	Ex II (1)G [Ex ia] IIA
Notified Body:	UL International Demko A/S. Notified Body Number 0539 Czech Metrology Institute
EC Type Certificates:	DEMKO 13 ATEX 1311712X R85/2008-CZ-14.04

I, the undersigned, hereby declare that the equipment specified above conforms to the above Directive (s) and Standard (s).

Place: Hodgkins, IL.

Date: 7 October 2019

Nicole Chavez
Engineering Compliance Technician

6900 SANTA FE DRIVE • HODGKINS, IL USA 60525 • www.opwfms.com • 708-485-4200 • (fax) 708-485-7137

OPW FUEL MANAGEMENT SYSTEMS

OPW FUEL MANAGEMENT SYSTEMS A DOVER COMPANY | ONE COMPANY. ONE WORLD. ONE SOURCE.

DECLARATION OF CONFORMITY

In accordance with the Council Directive 2014/34/EU, equipment intended for use in potentially explosive atmospheres. Given in Annex II to the Directive.

Standard (s) to which conformity is declared:	EN 60079-0: 2012+A11:2013 EN 60079-11: 2012 EN 60079-26: 2015
Manufacturers Name:	OPW Fuel Management Systems, Inc.
Manufacturers Address:	6900 Santa Fe Drive Hodgkins, IL. 60525 USA
Type of Equipment:	Magnetostrictive Probes
Model:	Model 924B & Model TLM-B
Marking:	Ⓔx II 1 G Ex ia IIA T4
Notified Body:	UL International Demko A/S. Notified Body Number 0539
EC Type Certificates:	DEMKO 11 ATEX 1012670X

I, the undersigned, hereby declare that the equipment specified above conforms to the above Directive (s) and Standard (s).

Place: Hodgkins, IL.

Date: 30 March 2018

Nicole Chavez
Engineering Compliance Technician

6900 SANTA FE DRIVE • HODGKINS, IL USA 60525 • www.opwfms.com • 708-485-4200 • (fax) 708-485-7137

OPW FUEL MANAGEMENT SYSTEMS

OPW FUEL MANAGEMENT SYSTEMS ONE COMPANY. ONE WORLD. ONE SOURCE.

DECLARATION OF CONFORMITY

In accordance with Article 9 of the Council Directive 2014/34/EU, equipment intended for use in potentially explosive atmospheres. Given in Annex II to the Directive.

Standard (s) to which conformity is declared:	EN 60079-0:2012+A11:2013 EN 60079-11: 2012 EN 60079-26: 2015
Manufacturers Name:	OPW Fuel Management Systems, Inc.
Manufacturers Address:	6900 Santa Fe Drive Hodgkins, IL. 60525 USA
Type of Equipment:	Intrinsic Safety Barriers
Model:	Models 0324, 0347 & 0348
Marking:	Ex II (1) G [Ex ia]
Notified Body:	UL International Demko A/S. Notified Body Number 0539
EC Type Certificates:	DEMKO 07 ATEX 0522559U

I, the undersigned, hereby declare that the equipment specified above conforms to the above Directive (s) and Standard (s).

Place: Hodgkins, IL.

Date: 30 December 2019

N Chavez

Nicole Chavez
Engineering Compliance Technician

6900 SANTA FE DRIVE • HODGKINS, IL USA 60525 • www.opwfms.com • 708-485-4200 • (fax) 708-485-7137

OPW FUEL MANAGEMENT SYSTEMS

OPW FUEL MANAGEMENT SYSTEMS
A DOVER COMPANY
ONE COMPANY.
ONE WORLD.
ONE SOURCE.

DECLARATION OF CONFORMITY

In accordance with Article 9 of the Council Directive 94/9/EC, equipment intended for use in potentially explosive atmospheres. Given in Annex II to the Directive.

Standard (s) to which conformity is declared:	EN 60079-0:2012+A11:2013 EN 60079-11:2012 EN 60079-26:2015
Manufacturers Name:	OPW Fuel Management Systems, Inc.
Manufacturers Address:	6900 Santa Fe Drive Hodgkins, IL. 60525 USA
Type of Equipment:	Intrinsically Safe Interface with and without Sensors
Model:	Models: 20-0349-ISI, 30-0230-S, 30-0231 followed by –L or –S, 30-0232 followed by -D-XX or –DH-XX, 30-0233 followed by -H or –HW, 30-0234 followed by –H-XX or -HW-XX or 30-0235 followed by –V or –VW, 30-0236 followed by –L or –LW.
Marking:	Ⓔx II 1G Ex ia IIA T4
Notified Body:	UL International Demko A/S. Notified Body Number 0539
EC Type Certificates:	DEMKO 07 ATEX 0633790X

I, the undersigned, hereby declare that the equipment specified above conforms to the above Directive (s) and Standard (s).

Place: Hodgkins, IL.

Date: 10 December 2019

Nicole Chavez
Engineering Compliance Technician

6900 SANTA FE DRIVE • HODGKINS, IL USA 60525 • www.opwfms.com • 708-485-4200 • (fax) 708-485-7137

Appendix D - NWGLDE Evaluation

OPW Fuel Management Systems
Site Sentinel Nano
(Model 924B with 2 inch dia. floats)

Automatic Tank Gauging Method

Certification	Leak rate of 0.2 gph with PD = 98.18% and PFA = 1.82% using 924B probe with 2” dia float.
Leak Threshold	0.1 gph for leak rate of 0.2 gph using 924B probe with 2” dia floats. A tank system should not be declared tight if the test result indicates a loss or gain that equals or exceeds this threshold.
Applicability	Gasoline, diesel, aviation fuel. Other liquids with known coefficients of expansion and density may be tested after consultation with the manufacturer.
Tank Capa-city	Maximum of 20,000 gallons. Tank must be minimum 50% full for leak rate of 0.2 gph using 924B probe.
Waiting Time	Minimum of 6 hours between delivery and testing using 924B probe. There must be no delivery during waiting time.
Test Period	Average data collection time of 2 hours using 924B probe for leak rate of 0.2 gph. Test data are acquired and recorded by system's computer. There must be no dispensing or delivery during test.
Temperature	Average for product is determined by a probe containing 5 thermistors.
Water Sensor	Minimum detectable water level that can be detected by the 2” dia float is 0.75 inch. Minimum detectable change in water level that can be detected by the 2” dia float is 0.080 inch.
Calibration	Thermistors (or RTDs) and probe must be checked and, if necessary, calibrated in accordance with manufacturer's instructions.
Comments	Not evaluated using manifolded tank systems. Therefore, this certification is only applicable when there is a probe used in each tank and the siphon is broken during testing. Tests only portion of tank containing product. As product level is lowered, leak rate in a leaking tank decreases (due to lower head pressure). Consistent testing at low levels could allow a leak to remain undetected. EPA leak detection regulations require testing of the portion of the tank system which routinely contains product. 2012 console comparison with OPW iSite; which was based on 2-26-2008 evaluation of OPW iSite.

OPW Fuel Management Systems
6900 Santa Fe Dr. Hodgkins, IL60525-9909
Tel: (708) 485-4200
E-Mail: info@opwfms.com
URL: www.opwfms.com

Evaluator: Ken Wilcox Asso-ciatesTel: (816) 443-2494
Date of Evaluation: 08/03/2013

Appendix E - Pro Gauge Probe Installation

The installation instructions in this section are applicable for sites that will use ProGauge XMT-SI-RF probes.

IMPORTANT: ProGauge probes cannot be connected to the internal I.S. barrier of the OPW-FMS SiteSentinel NANO. The XMT-SI-RF wireless probe first sends a signal to an RF Receiver that will then communicate with the NANO through an RS485 serial connection. The appendices that follow will give all of the necessary information on the installation of these devices.

General Information

Safety

Read these instructions carefully

The manufacturer is not responsible for any operation not given in these instructions.

Failure or unsatisfactory operation of this equipment must be referred to authorized personnel for maintenance or, contact the manufacturer directly.

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.

NOTICE: The manufacturer is not responsible for injury and/or property damage.

IMPORTANT: Please refer to "Installer Safety" on page 13 for important safety information related to installation of this equipment.

Technical Characteristics

XMT-SI-RF

- Internal power supply through an instrinsically safe battery 3.6V, 16Ah
- Low frequency transmission to a receiver located in a safety zone
- Consumption <15 mA @ 12 Vdc normal function
- Consumption < 200 uA @12 Vdc in sleep mode

Measurement Characteristics

- Electronics based on a Microprocessor
- Support telediagnostics and telemaintenance
- Possibility to configure remotely the functional parameters
- When maintenance is necessary, the internal parts of the probe can be removed and it will not be necessary to remove fuel from the tank. This is good for LPG applications where tanks are pressurized.
- Stainless steel case, IP68.
- Probe shaft Stainless Steel AISI 304 / 316
- Measurement range: from 200 mm. to 12.500 mm.
- Maximum mechanical length: 13.000 mm.
- Data transmitted:
  - Product level in 0.01 mm
  - Water level in 0.01 mm
  - Medium temperature detected through digital temperature sensor placed along the probe shaft (standard 1, max 5)
- Measurement accuracy: Better than +/- 0.5 mm.
- Measurement resolution: +/- 0.01 mm.
- Temperature accuracy: +/- 0,2°C
- Approvals :
  - OIML-R85 for fixed applications
  - OIML-R80 per mobile applications (pending)

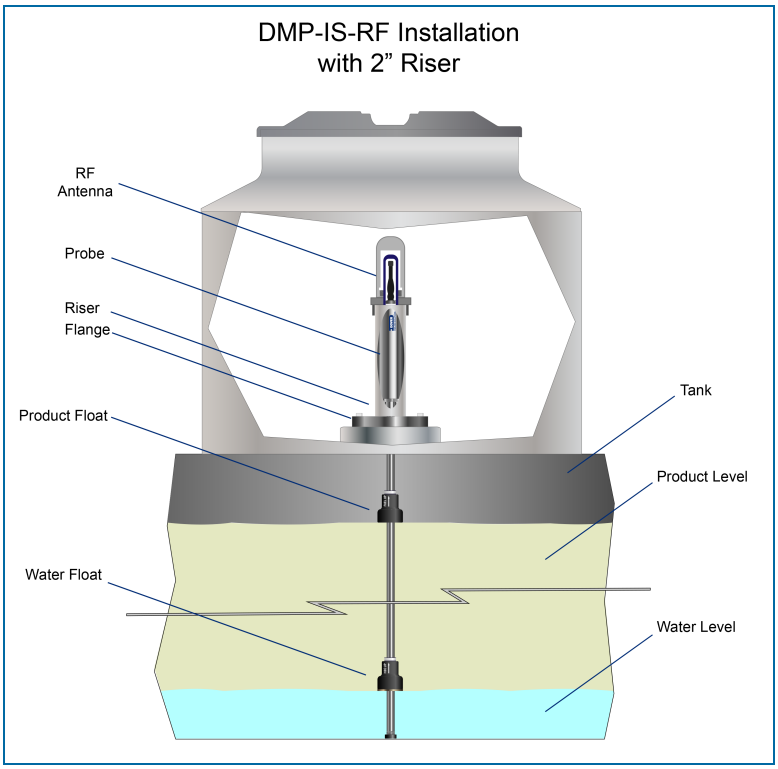
Installation

NOTICE: Install this electronic device carefully. Make sure the stainless steel tube does not bend when installed in a tank man-hole. This could cause damage to the electronic components inside.

Probe placement: Please refer to "Probe Placement" on page 34 for instructions on probe installation location and distances from fill tubes and pumps.

Before you install the probe, be sure the floats are positioned correctly. Make sure the plastic probe shaft end cap is correctly installed on the bottom of the probe shaft so that the floats can correctly identify water and fuel levels.

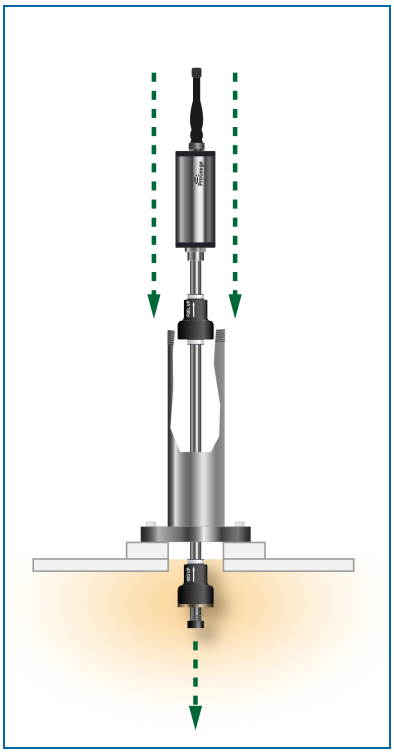
Make sure that when a riser is used, that the probe is installed high enough so it cannot get flooded. Put the probe through the 2 inch opening and carefully lower it until it touches the bottom of the tank.



Riser Preparation for RF Probes

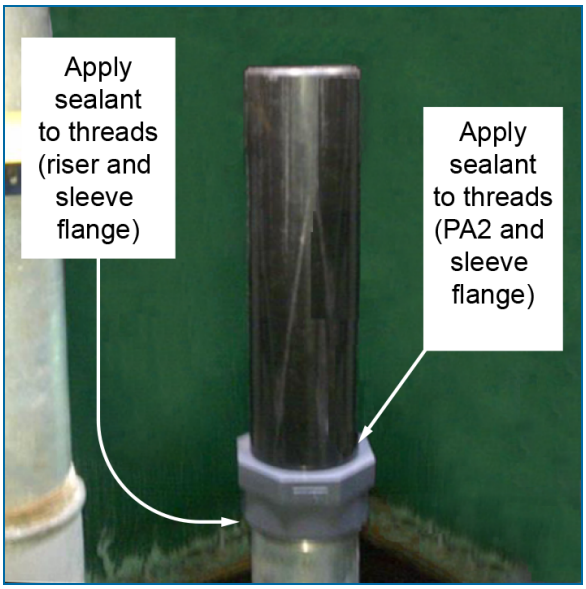
- Use galvanized pipe with an internal diameter of 2.05 inches (52 mm).
- Cut the galvanized pipe to the correct size. The riser should cover the probe head while the antenna is kept open at the top.

- Seal the threads at the sides of the flange with plumber's hemp and sealant to make a tight seal.



- Carefully install the assembled probe through the riser and flange into the tank.

- Assemble the Antenna Cover.
  - Put the cover over the antenna.
  - Turn clockwise to tighten the cover.
  - Make sure that the seal between the cover and the brown gasket is tight. Do not over-tighten as this could cause damage to the threads.

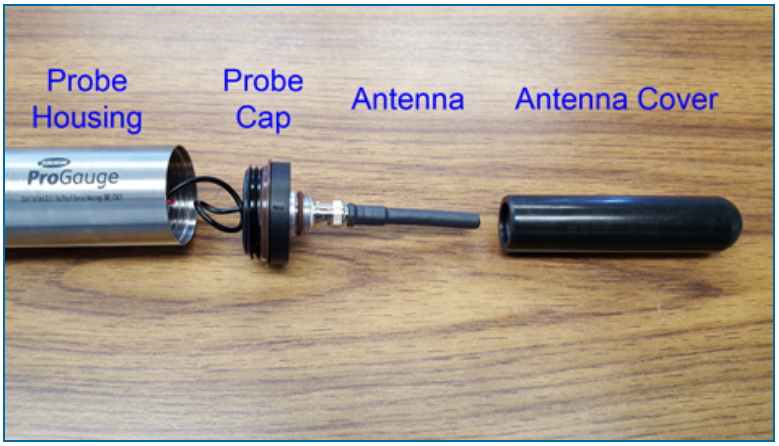


- Install the PA 2 inch protective sleeve (purchased option when the XMT-SI-RF is installed in a riser). Apply a thread sealant to the male threads of the riser and the female sleeve flange and between the male threads of the PA2 and the female sleeve flange.

IMPORTANT: Do not use a permanent type sealant. The sealant is used only to keep water out of the riser. It is necessary for the PA2 to be easily turned and removed to gain access to the battery housing and other probe components.

XMT-SI-RF Housing

IMPORTANT: Do not lose or cause damage to dis-assembled components.



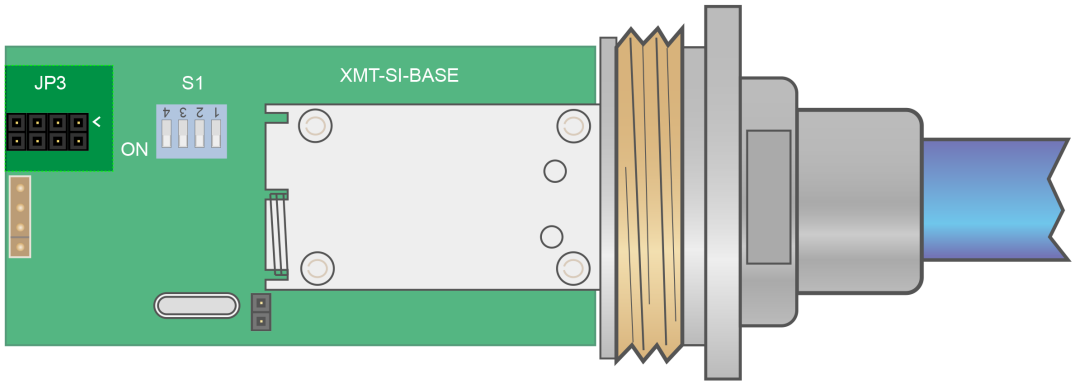
To get access to the probe's inner components (battery housing, probe board with jumper block and DIP-Switches), turn the cap counter-clockwise and carefully remove it from the housing.

Jumper Setting

Jumper settings are shown below. The Jumpers are read during device startup. When changes are made, the device must be switched off and restarted for the changes to be applied.

Jumper #	Inserted	Removed
1	1 Float	2 Floats
2	Diagnostic Mode (for production use only)	NORMAL Mode (recommended)
3	Wired Probe	RF Probe
4	Select Protocol 1 (applicable only for RS485 probe)	Select Protocol 2 (applicable only for RS485 probe)

The illustration below shows the location of the Jumper Block on the probe board.

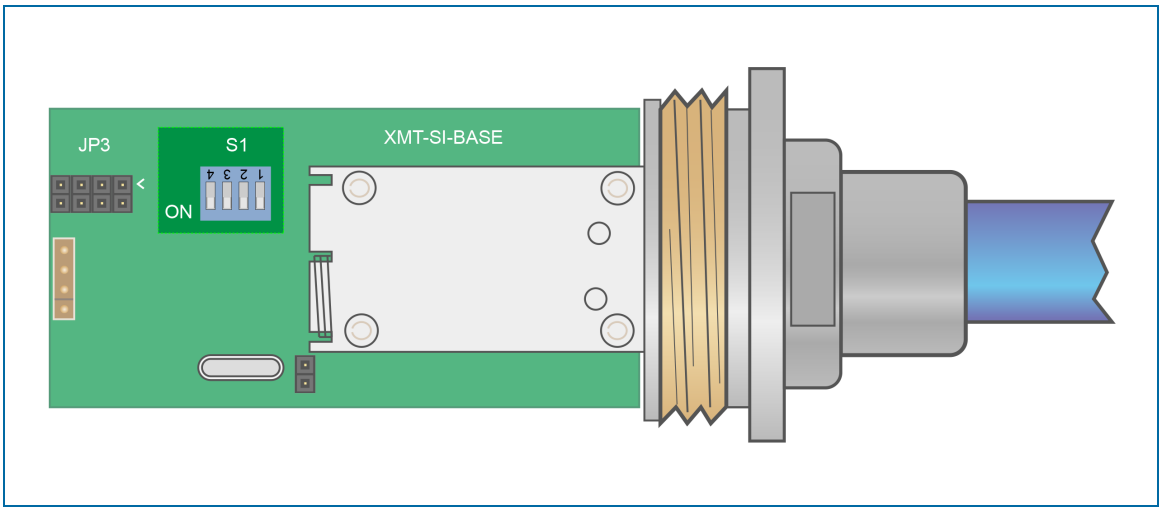


XMT-SI-RF DIP-Switch Settings

The RF probes have a selection of Operation Modes that have an effect on battery life. The internal DIP-Switch block is used to configure the Operation Mode.

NOTE: RF probes use a frequency of 169,4 Mhz, transmit on channel 5 (169,468 MHz), power 80 mW (standard) up to 200 mW.

The illustration below shows the location of the DIP-Switch Block on the probe board.



DIP-Switch settings are shown below. The DIP-Switches are read during device startup. When changes are made, the device must be switched off and restarted for the changes to be applied.

To optimize battery life, the probe usually operates in Sleep Mode.

The probe will be started at the time increment set by the selected Operation Mode and will make its measurement. If the product or water level measurement is ±1 mm compared to the last measurement, the probe will transmit the measurement. If the measurement comparison is less than 1 mm, the probe will return to Sleep Mode.

NOTE: To prevent a time-out of the system, the probe will always transmit data after 10 minutes of non-transmission.

The probe is not supplied with the battery because the lithium battery is a Class 9 Hazmat. The battery must be purchased separately. Before the probe is installed, open the probe housing to connect the battery. More information on the battery can be found in the section "Important Battery Information" on page 124 below.

If the Operation Mode is set between 1 - 5, the probe will transmit data after power-up every five (5) seconds for the first 24 hours. After that period, the probe will begin to transmit at the selected Operation Mode.

NOTE: This feature lets you do a check of the signal and not have to wait for the longer periods of Sleep Mode. This feature is not available for Operation Modes 12 - 16.

XMT-SI-RF DIP-Switch Configuration, Operation Modes and Battery Life

SW 1	SW 2	SW 3	SW 4	Mode	Transmission Interval	Battery Life (in years) at 200 mW Power
OFF	OFF	OFF	OFF	Op 1	wake up probe every 1 minute (Default setting)	3
ON	OFF	OFF	OFF	Op 2	wake up probe every 2 minutes	3.5
OFF	ON	OFF	OFF	Op 3	wake up probe every 4 minutes	4
ON	ON	OFF	OFF	Op 4	wake up probe every 5 minutes	4.5
OFF	OFF	ON	OFF	Op 5	wake up probe every 10 minutes	5
ON	OFF	ON	OFF	Op 6	not active, don't set	---
OFF	ON	ON	OFF	Op 7	not active, don't set	---
ON	ON	ON	OFF	Op 8	not active, don't set	---
---	---	---	---	---	---	---
ON	ON	OFF	ON	Op 12	wake up probe every 30 seconds	1.3
OFF	OFF	ON	ON	Op 13	wake up probe every 20 seconds	0.9
ON	OFF	ON	ON	Op 14	wake up probe every 15 seconds	0.7
OFF	ON	ON	ON	Op 15	wake up probe every 10 seconds	0.5
ON	ON	ON	ON	Op 16	wake up probe every 5 seconds	0.3

Data calculation uses worst conditions (for example, if the probe is programmed to transmit every one minute and effectively transmits every minute). The battery life will be extended if the probe does not transmit with a reading difference of ±1 mm.

IMPORTANT: This data is calculated with a 16.5 Ah battery. This is a certified Intrinsically Safe device and the battery recommended by the manufacturer complies with the conditions of certification. Use of a type of battery other than that specified by the manufacturer will compromise the Intrinsically Safe certification. OPW-FMS, Tokheim/Pro Gauge or Start Italiana cannot be held responsible for equipment failures or safety issues related to use of an non-certified battery.

More information on the battery can be found in the section "Important Battery Information" on the next page below.

LED Behavior

There are two (2) LEDs inside the probe that give important status information.

GREEN LED:

The GREEN LED shows the status of the probe's float detection.

- GREEN LED flashes quickly: This is an indication that the probe is in normal operation.
- GREEN LED flashes slowly: The probe cannot detect the float. This could be caused by:
  - A missing float
  - The float was installed upside-down
  - A bent probe shaft
  - A damaged float

RED LED:

The RED LED identifies the status of serial communication.

- RED LED is OFF: No data is received on the serial communication RS485 port.
- RED LED is ON: Serial communication is received but the probe address is not read.
- RED LED is ON then turns OFF: Three (3) seconds of timeout has passed without any serial communication or the probe has been addressed and it is in reply.

NOTE: The polling cycle and frequency as well as the number of probes installed on the same bus will have a direct effect on the RED LED behavior.

Important Battery Information

DANGER: Because of new Federal Regulations, all lithium batteries are Class 9 Hazmat. Lithium batteries must be shipped on a separate order or purchased separately. Use only a **SAFT LS33600** in this device.

The lithium battery can cause fire or explosion if they are not used correctly.

Replace the battery with **SAFT LS33600** ONLY. Use of another battery can cause a risk of fire or explosion.

To prevent possible explosion or fire, do not replace the lithium battery with a type that is not compatible.

The battery used in this device can cause a risk of fire or chemical burn if used incorrectly. Do not recharge, short circuit, crush, disassemble, heat above 100° C, let contents touch water or put in fire.

A used battery must be removed and brought to a battery-recycling center to be discarded in an approved procedure. Keep away from children.

Appendix F - ProGauge RF Receiver

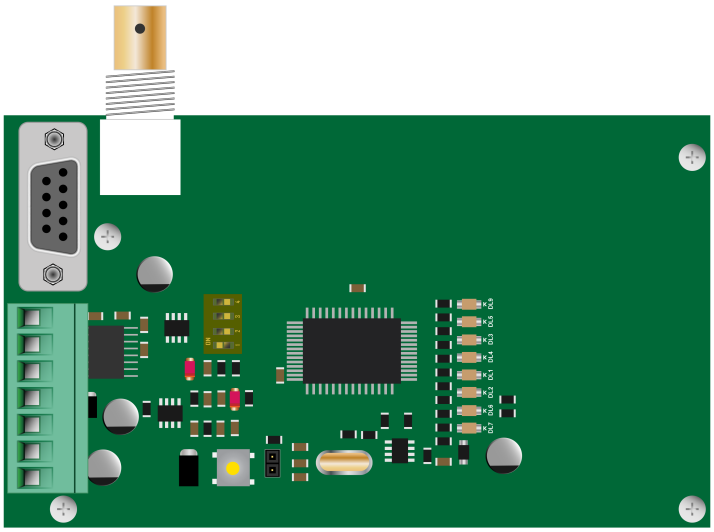
The ProGauge RF Receiver lets the ProGauge XMT-SI-RF probe interface with the OPW-FMS SiteSentinel Nano console.

The RF Receiver device can receive wireless probes model XMT-SI-RF 169,4 MHz

Technical Information

Features	
Power Supply	12-24V
RF Module 169MHZ	1
RF Module 434MHz (currently not available; for future usage)	1
Serial RS485	1
Antenna 169.4 MHz	1
Antenna 434 MHz (currently not available; for future usage)	1
LED Diagnostics TX-RX	4
LED Diagnostics functioning	4
Repeater/Receiver functionality	SI
Power supply 220Vac	Optional
Antenna Harmattan 169,4MHz	1
Dipswitch functions programming	4-Way
Dimensions	24x16x9cm

Electrical Connection



		7
		6
		5
White	GND	4
Petro-Net	RS485 A	3
Petro-Net	RS485 B	2
Red	+	1

Power Supply

White Terminal, GND - CN1 position 4

Red terminal, +Vcc - CN1 position 1

RS485 Connection

Blue Data RS485 A - CN1 position 3

Brown Data RS485 B - CN1 position 2

NOTE: OPW-FMS Petro-Net can also be used for RS485 connections.

High Gain Harmattan 169 MHz Antenna

ELECTRICAL	
Frequency range: (V.S.W.R. < 2 : 1)	162-174 MHz
Impedance:	50 Ω
V.S.W.R. at 169 Mhz:	< 2 : 1
Max power:	15 W
Polarization:	Linear
Irradiation:	Omnidirectional
Gain at 169 MHz:	2.1 dBi

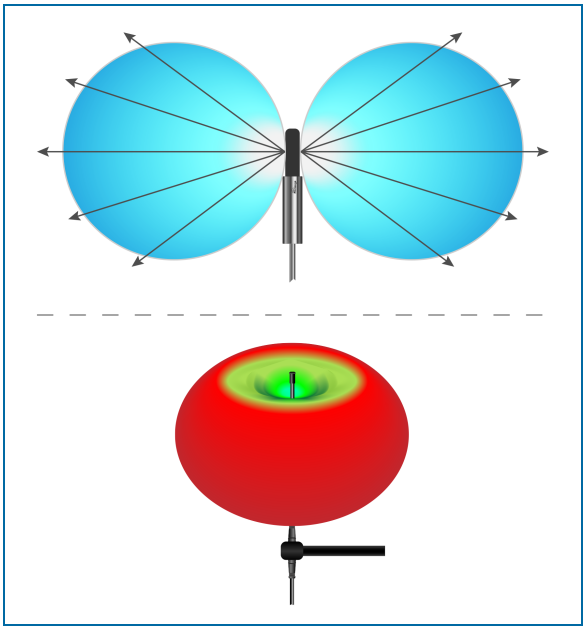
MECHANICAL	
Dimensions (approximate):	830 x 150 x 85 mm
Connection:	BNC male
Operating temperature range:	-40° / +80° C
Weight:	0.250 kg
Radiating element material:	Whip made of steel and brass, thermoretractable sheath.
Accessories:	Bracket for pole mounting (from Ø min. 40 mm to max. 60 mm)

Antenna Installation

Each antenna has its own radiation diagram.

The radiation diagram shows the directions where the antenna can transmit the signal with the most power.

The diagrams below show the directional patterns of the probe antenna and the receiver antenna.



To have the best reception without signal loss, the antennas must be pointed in the same direction.

> **EXAMPLE:**
>
> You cannot set up the receiver antenna horizontally if all of the probe transmitters are all set up vertically. This would result in almost complete loss of signal because of different polarization (horizontal instead of vertical).

The probe antenna does not transmit or receive from its top, but through its side (see the illustration above). The antennas must always be kept parallel to each other.

If it is necessary to install a probe antenna under asphalt horizontally, the receiver antenna must also be installed horizontally.

Wireless probes use a battery with a low frequency for data transmission. The bandwidth used is 169.4 MHz with a narrow canalization of 12.5 KHz. Since the transmission occurs underground, his band has low attenuation because of blockage or surrounding land.

This transmission must not be mistaken for wi-fi which uses higher frequencies of 1.2-2.4 GHz. Wi-fi does not have the minimum requirement to transmit through the manhole.

If the antennas are installed outdoors, the transmission can reach to 1 km. For usage at service stations where the antennas are installed underground (integrated into the probe head) the distance of transmission in normal conditions is 100-200 m.

Normal conditions include installations where it is not necessary to have a *Faraday Cage* that would block the signal transmission.

Common manhole constructions that block signal transmission like a Faraday Cage include:

- Those made completely of iron
- A reinforced concrete square with welded mesh.

Common manhole constructions that do not block signal transmission like a Faraday Cage include:

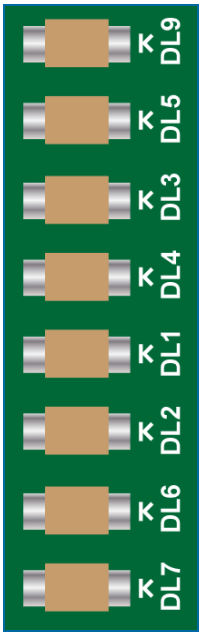
- A standard manhole with an iron or cast iron lead cover.
- A manhole of bricks.
- An asphalt square.
- Vehicles parked over a manhole cover.

The table below can be used to see if wireless probes can be installed at a site with an unblocked signal from the probes to the receiver.

NOTE: When a highly attenuated signal can occur, put the probe antenna outside of the manhole. "Repeaters" can be installed to boost or extend the signal if necessary.

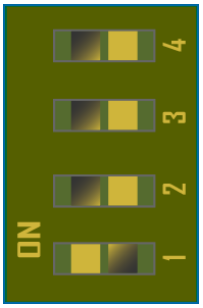
Installer RF Probe Determination Worksheet		
Topic	**Condition**	**Installer Notes: (to find out if RF Probes are possible before installation)**
Environment	Depot or Service Station?	
Manhole	Material Type (iron, cast iron, composite…):	
	Manhole Depth:	
	Installation with: Riser or Sliding Connection?	
	Moveable or isolated?	
	Can vehicles park above? (y/n)	
	Normally empty and clean or water-filled?	
Distance from Receiver	Min/Max Distance from Receiver (in meters):	
	Tank Locations: One area or different?	
	Number of Tanks:	
	Permanent objects between Tank And Receiver?	
	Type of permanent objects:	
	Temporary objects between Tank And Receiver?	
	Type and how long will they be in place:	
Floor	Material Type:	
	Is there a welded net? (y/n)	
Repeater (if necessary) (Only one permitted)	External power supply? (y/n)	
	Can the antenna be installed on a pole or wall?	
Tank	Buried? (y/n)	
	Diameter:	
	Aerial height:	
Antenna	Can the antenna be installed on a pole or wall NOT in front of a metal surface?	

LED Diagnostics



LED Diagnostic Functions		
LED Label	**Function**	**Behavior**
DL2	On startup, refers to RUN.	Must flash and indicates that the board is working properly.
DL8	Wired on RX line of the 169,4MHz module.	Flashing indicates that a valid frame has been received by the module and transmitted to the microprocessor.
DL9	wired on TX line of the 169,4MHz module.	Flashing indicates that a valid frame has been sent to the module to be transmitted.
Information about the probes registered and received:		
DL4	Refers to the units.	Flashes from 0 to 9.
DL1	Refers to the tens.	Flashes from 0 to 6.
Example: If 16 probes have been registered there will be 1 flash for DL1 and 6 flashes for DL4.		
DL3	Off (currently not available; for future usage)	

DIP-Switch Settings



RF Receiver Board DIP-Switch Binary Combinations

Setting	SW1	SW2	SW3	SW4
0	OFF	OFF	OFF	OFF
1 (Default)	ON	OFF	OFF	OFF
2	OFF	ON	OFF	OFF
3	ON	ON	OFF	OFF
4	OFF	OFF	ON	OFF
5	ON	OFF	ON	OFF
6	OFF	ON	ON	OFF
7	ON	ON	ON	OFF
8	OFF	OFF	OFF	ON
9	ON	OFF	OFF	ON
10	OFF	ON	OFF	ON
11	ON	ON	OFF	ON
12	OFF	OFF	ON	ON
13	ON	OFF	ON	ON
14	OFF	ON	ON	ON
15	ON	ON	ON	ON

Setting 1:

Normal functioning, answers through the new protocol both on RS485 and RS232.

EXAMPLE:

D) M03744+chr(13)

R) 03744N0=+250=00129.37=00031.00=082+chr(10)+chr(13)

Probe address: 03744

Probe status: (0 = OK) in case of error status=1

Temperature: +25,0 °C

Product level: 129,37 mm

Water level: 31,00 mm

Setting 2:

Normal functioning, answers through the old protocol both on RS485 and RS232.

EXAMPLE:

D) M03744+chr(13)

R) 03744=0=+250=01294=0031=237+chr(10)+chr(13)

Probe address: 03744

Probe status: (0 = OK) in case of error status=1

Temperature: +25,0 °C

Product level: 129,4 mm

Water level: 31,00 mm

Setting 3:

Inside the receiver, 10.000 is added to the wireless probe address, answers through the new protocol both on RS485 and RS232.

Use this setting when two (2) receivers are installed for maximum signal coverage. The two receivers must be connected in parallel on the RS485 line. To avoid conflicts on the transmission bus this setting should be used on only one of the receivers.

Select and read the message from the receiver with the stronger signal. Configure the console with the probe address or with the probe address +10.000 to receive the message.

EXAMPLE:

If the wireless probe has address 03744, it is necessary to add 10.000 to query the receiver.

D) M13744+chr(13)

R) 13744N0=+250=00129.37=00031.00=083+chr(10)+chr(13)

Probe address: 03744

Probe status: (0 = OK) in case of error status=1

Temperature: +25,0 °C

Product level: 129,37 mm

Water level: 31,00 mm

Setting 4:

Inside the receiver 10.000 is added to the wireless probe address, answers through the old protocol both on RS485 and RS232.

Use this setting when two (2) receivers are installed for maximum signal coverage. The two receivers must be connected in parallel on the RS485 line. To avoid conflicts on the transmission bus this setting should be used on only one of the receivers.

Configure the console with the probe address or with the probe address +10.000 to receive the message.

EXAMPLE:

If the wireless probe has address 03744, it is necessary to add 10.000 to query the receiver.

D) M03744+chr(13)

R) 03744=0=+250=01294=0031=237+chr(10)+chr(13)

Probe address: 03744

Probe status: (0 = OK) in case of error status=1

Temperature: +25,0 °C

Product level: 129,4 mm

Water level: 31,00 mm

Setting 8:

Repeater mode: Everything received on the radio channel is always immediately retransmitted on the radio channel.

Transmission always done with frame recognition: The receiver waits with a silence of at least 20 ms on the radio channel. This is to specify the end of a transmission and then continue with the retransmission.

Answers with the new protocol both on RS485 and RS232.

Setting 15:

ByPass function: This can only be used during the system test. Everything received on the radio channel is retransmitted on RS232 as a character. This will not reply to any command.

Available Commands

Speed 9600

Data bits: 8

Parity bit: none

Stop bit: 1

Command M

Asks for the measurement. See the examples above.

Command D

Asks for the diagnostics.

EXAMPLE:

D) D14832+chr(13)

R)
14832D105=00000118=00006721=00000118=001=005=200=015=048=113=078=045=100=071=197

Probe address: 14832

Window of the signal: 105

Packets transmitted by the probe: 118

Counter of packets of the probe: 6721 (shows how long the probe has been switched on)

Packets received by the receiver: 118

Number of floats: 1

Transmission channel: 5

Signal power: 200

Operating mode: 15

Level of the local signal: -48 dB

Level of the local noise: -113 dB

Tension of the receiver: 78/21.1=3,7V (value transmitted to be divided by 21,1)

Level of the probe signal:

- -45 dB to -80 dB (Good Signal)
- -80 dB to -90 dB (Poor Signal)
- More than -90 dB (Signal cannot be used)

Level of the probe noise: -100 dB

Tension of the receiver: 71/21.1=3,4V (value transmitted to be divided by 21,1)

Command V

Asks for the version.

Command C

Asks for the list of all the registered probes.

EXAMPLE:

D) C+chr(13)

R)

03746N0=+290=00105.68=00028.64=102

03967N0=+290=00092.30=00016.32=093

03745N0=+290=00090.78=00015.47=102

03962N0=+280=00090.57=00015.61=095

14832N0=+260=00254.01=00000.00=069

Order Code

When you place your order please use these order codes:

POWER SUPPLY 24V

RECEIVER WITH LOW GAIN ANTENNA: .....RIC-RF

RECEIVER WITH HIGH GAIN HARMATTAN ANTENNA: .....RIC-RF-HARM

POWER SUPPLY 220Vac

RECEIVER WITH LOW GAIN ANTENNA: RIC-RF-220

RECEIVER WITH HIGH GAIN HARMATTAN ANTENNA: RIC-RF-HARM-2

Appendix G - Nano Control Drawing

NOTES:

1. Associated Apparatus Entity Parameters: Group IIA

   Voc (or Uo) = 14.85Vdc
   Isc (or Io) = 305mA
   Po = 974mW
   Ca (or Co) = 7.15uF
   La (or Lo) = 1.52mH

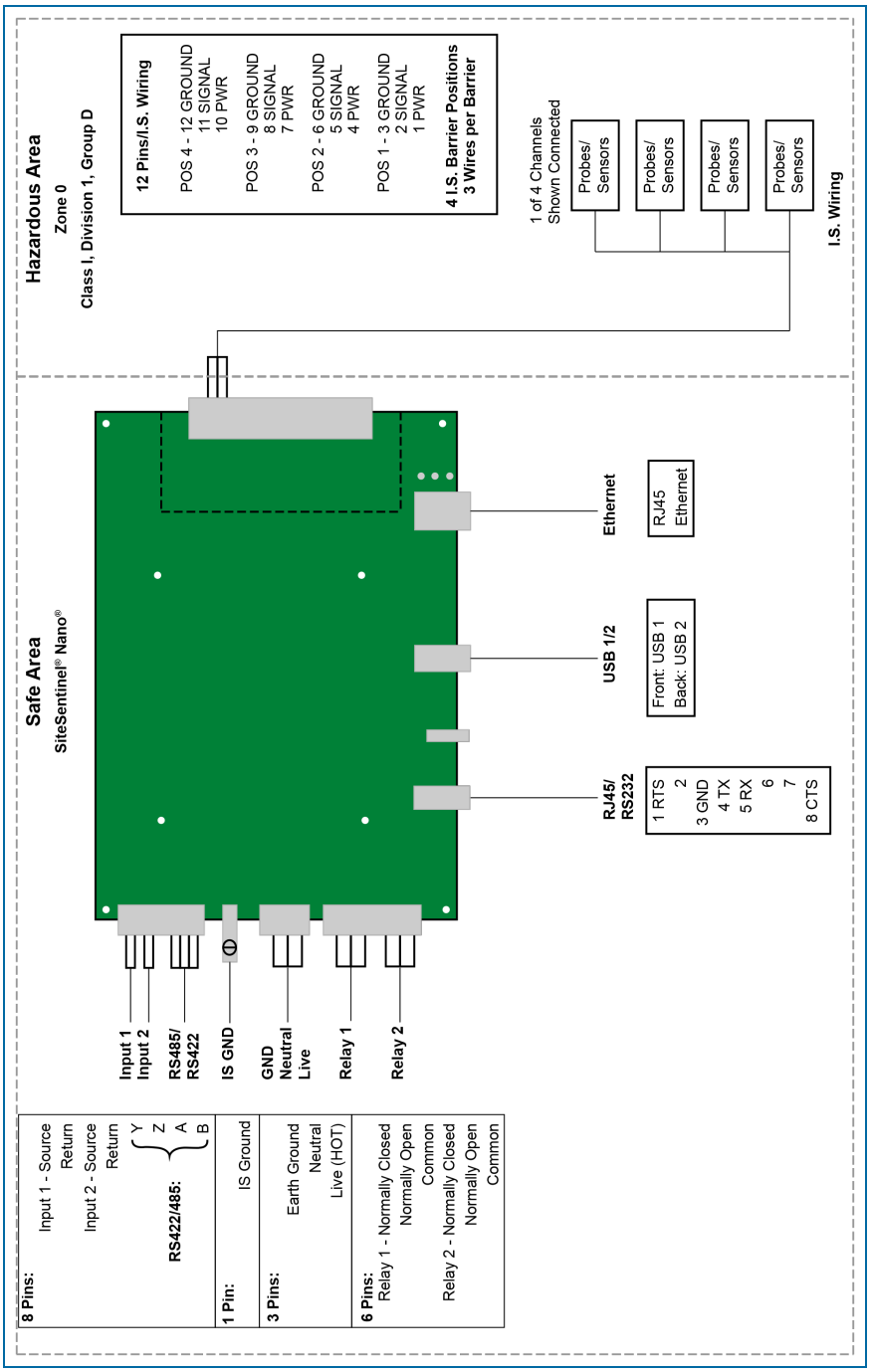
2. The voltage current of this associated apparatus is limited by a resistor such that the output voltage-current plot is a straight line drawn between open-circuit voltage and short-circuit current.
3. Selected intrinsically safe equipment must be third party listed as intrinsically safe for the application and have intrinsically safe entity parameters conforming with the following:

TABLE 1 Group IIA

I.S. EQUIPMENT		ASSOCIATED APPARATUS
v MAX (or Ui)	≥	Voc or Vt (or Uo)= 14.85V
I max (or Ii)	≥	Isc or It (or Io) = 305mA
P max Pi	≥	Po = 974mW
Ci + Ccable	≤	Ca (or Co) = 7.15uF
Li + Lcable	≤	La (or Lo) = 1.52mH

4. This associated apparatus may also be connected to simple apparatus as defined in Article 504.2 and installed and temperature classified in accordance with Article 504.10(B) of the National Electrical Code (ANSI/NFPA 70) or other local codes, as applicable.
5. Capacitance and inductance of the field wiring from the intrinsically safe equipment to the associated apparatus shall be calculated and must be included in the system calculations as shown in Table 1. Cable capacitance, Ccable, plus intrinsically safe equipment capacitance, Ci must be less than the marked capacitance, Ca (or Co), shown on any associated apparatus used. The same applies for inductance (Lcable, Li and La or Lo, respectively). Where the cable capacitance and inductance per foot are not known, the following values shall be used: Ccable = 60pF/ft., Lcable = 0.2uH/ft.
6. The associated apparatus must be connected to a suitable ground electrode per the National Electrical Code (ANSI/NFPA 70), the Canadian Electrical Code or other local installation codes, as applicable. The resistance of the ground path must be less than 1 ohm.
7. Where multiple circuits extend from the same piece of associated apparatus, they must be installed in separate cables or in one cable having suitable insulation. Refer to Article 504.30(B) of the National Electrical Code (ANSI/NFPA 70) and Instrument Society of America Recommended Practice ISA RP12.6 for installing Intrinsically safe equipment.
8. Intrinsically safe circuits must be wired and separated in accordance with Article 504.20 of the National Electrical Code (ANSI/NFPA 70) or other local codes as applicable.
9. This associated apparatus has not been evaluated for use in combination with another associated apparatus.

10. Control equipment must not use or generate more than 250V rms or dc with respect to earth



Appendix H - 924B Probe Control Drawing

NOTES:

1. Entity Parameters:

(Vmax),	Ui = 14.9V	(Imax),	Ii = 362mA
	Ci = 0uf		Li = 363uH
For Pi	≤ 1.3W	-40°C ≤ Tamb ≤ 40°C	
For Pi	≤ 1.2W	-40°C ≤ Tamb ≤ 60°C	
For Pi	≤ 1.0W	-40°C ≤ Tamb ≤ 70°C	

2. Associated Apparatus output current must be limited by a resistor such that the output voltage-current plot is a straight line between open-circuit voltage and short-circuit current.
3. Selected Associated Apparatus must be third party listed as providing intrinsically safe circuits for the application and have Voc or Vt not exceeding Vmax (or Uo not exceeding Ui), Isc or It not exceeding Imax (or Io not exceeding Ii), and the Po of the associated apparatus must be less than or equal to the Pmax or Pi of the intrinsically safe equipment as shown below.
4. Capacitance and inductance of the field wiring from the intrinsically safe equipment to the Associated Apparatus shall be calculated and must be included in the system calculations as shown below. Cable capacitance, Ccable, plus intrinsically safe equipment capacitance, Ci must be less than the marked capacitance, Ca (or Co), shown on any associated apparatus used. The same applies for inductance (Lcable, Li and La or Lo, respectively). Where the cable capacitance of inductance per foot are known, the following values shall be used: Ccable = 60pF /ft., Lcable = 0.2uH/ft.

Use the following to determine the suitability of connections:

924B entity parameters		Associated Apparatus
14.9V (Ui)	≥	Voc or Vt or Uo
362mA (Ii)	≥	Isc or It or Io
1.3W (Pi)	≥	Po
0uF (Ci)+Ccable	≤	Ca or Co
363uH (Li)+Lcable	≤	La or Lo

If Po of the associated apparatus is not known, it may be calculated using the following formula, Po= (Uo*Io)/4

Example of a single 924B probe connected to a single position on the Associated Apparatus:

EXAMPLE:

Example Associated Apparatus 14.28V (Uo), 361mA (Io), 6.4uF (Co), 2,100uH (Lo)

Cable 1,000 feet, 60pF/ft, 0.2uH/ft = 0.060uF (60,000pf), 200uH

924B entity parameters		Associated Apparatus
14.9V (Ui)	≥	14.28V (Uo)
362mA (Ii)	≥	361mA (Io)
1.3W (Pi)	≥	(14.28*0.361)/4 = 1.29W (Po)
0uF (Ci)+0.060uF (Ccable)=0.060uF	≤	6.4uF (Co)
363uH (Li)+200uH (Lcable) = 563uF	≤	2,100uH (Lo)

If the above statements are true (which they are) then it is safe to connect.

Example of 4 x 924B probes connected to a single position an the Associated Apparatus:

EXAMPLE:

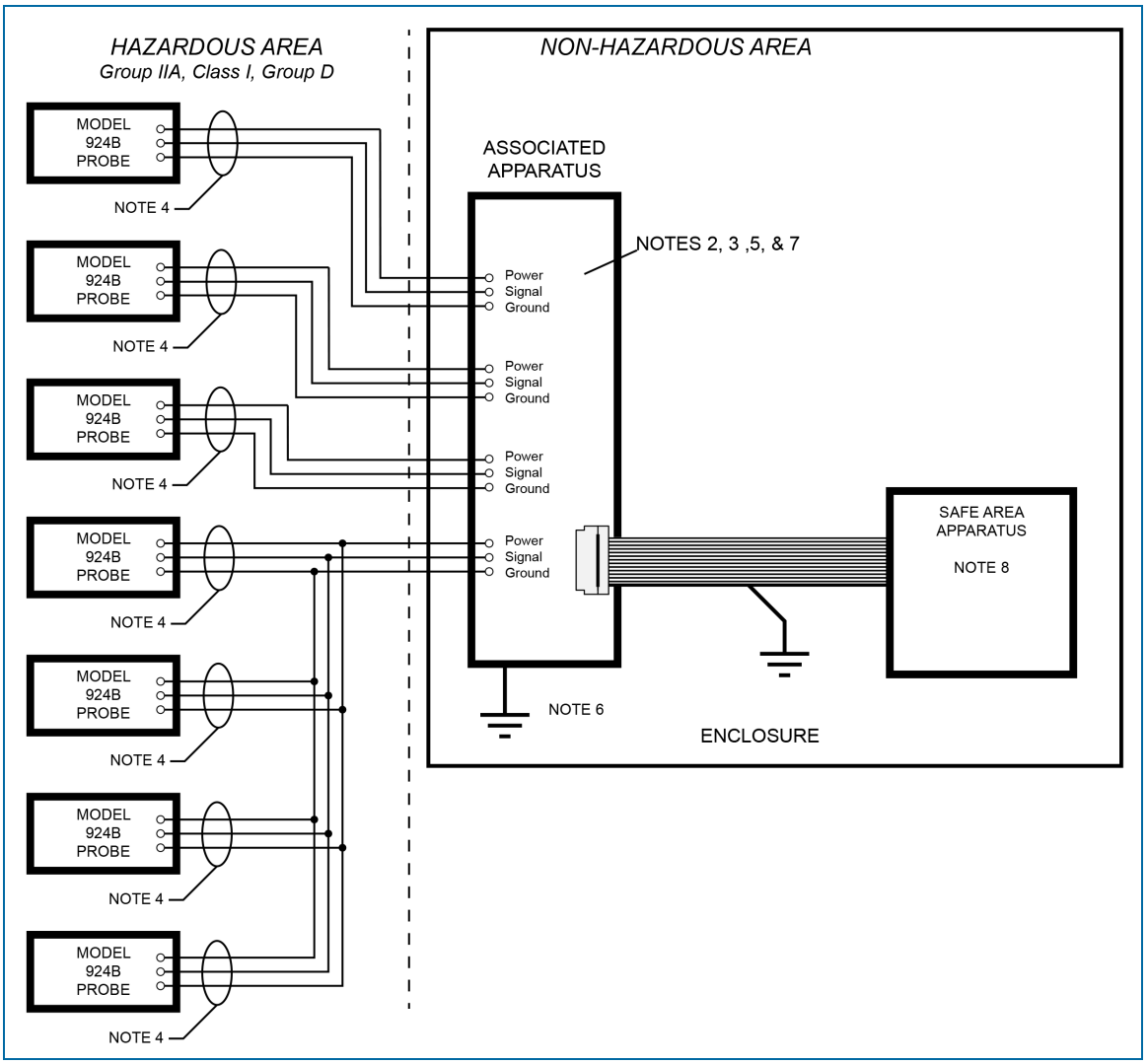
Example Associated Apparatus 14.28V (Uo), 338mA (Io), 16.1 uF (Co), 2,240uH (Lo)

Cable 2,000 feet, 60pF/ft, 0.2uH/ft = 0.120uF (120,000pf), 400uH

924B entity parameters		Associated Apparatus
14.9V (Ui)	≥	14.28V (Uo)
362mA (Ii)	≥	338mA (Io)
1.3W (Pi)	≥	(14.28*0.338)/4 = 1.21W (Po)
0uF (Ci)+0.060uF (Ccable)=0.060uF	≤	16.1uF (Co)
363uHx4(Li)400uH (Lcable)= 1,852uF	≤	2,240uH (Lo)

If the above statements are true (which they are) then it is safe to connect.

5. Associated apparatus must be installed in accordance with its manufacturer's control drawing and Article 504 of the National Electrical Code (ANSI/NFPA 70) for installation in the United States, or Section 18 of the Canadian Electrical Code for installations in Canada. other local codes, as applicable.
6. When required by the manufacturer's control drawing, the associated apparatus must be connected to a suitable ground electrode per the National Electrical Code (ANSI/NFPA 70), the Canadian Electrical Code, or other local installation codes as applicable. The resistance of the ground path must be less than 1 ohm7
7. Associated apparatus must not be used in combination unless permitted by the associated apparatus certification.
8. Control equipment must not use or generate more than 250Vrms or dc with respect to earth.


HAZARDOUS AREA
Group IIA, Class I, Group D
NON-HAZARDOUS AREA
ASSOCIATED APPARATUS
NOTES 2, 3 ,5, & 7
MODEL 924B PROBE
NOTE 4
Power
Signal
Ground
SAFE AREA APPARATUS
NOTE 8
NOTE 6
ENCLOSURE

Appendix I - ISIM Control Drawing

NOTES:

1. **Description**

The Intelligent Sensor Interface Module (ISi) allows multiple sensors (maximum of 16) connected to a single cable run and a single barrier position. The equipment is intended for installation in Category 1, Group IIA Hazardous Locations.

2. **Model numbers covered in this control drawing**

ISI with small single float switch , brass	Model 30-0230-S	
ISI with small single float switch , plastic	Model 30-0231-S	
ISI with large single float switch , plastic	Model 30-0231-L	
ISI with dual float switch, plastic	Model 30-0232-D-XX	
ISI with dual float switch with hydrocarbon detection, plastic	Model 30-0232-DH-XX	
ISI with hydrocarbon detection, interstitial	Model 30-0233-H	
ISI with hydrocarbon and water detection, interstitial	Model 30-0233-HW	
ISI with hydrocarbon detection liquid phase	Model 30-0234-H-XX	
ISI with hydrocarbon and water detection liquid phase	Model 30-0234-HW-XX	
ISI with hydrocarbon vapor detection	Model 30-0235-V	
ISI with hydrocarbon vapor detection and water	Model 30-0235-VW	
ISI with liquid detection	Model 30-0236-L	Only UL Certified
ISI with liquid and water detection	Model 30-0236-LW	Only UL Certified
ISI standalone for attaching to a third party certified device	Model 20-0349-ISI	

3. **Entity parameters**

Entity input parameters of Intelligent Sensor Interface Module (ISI) when attached to sensor Includes a maximum 15m cable between sensor and ISI.

Vmax,Ui 14.9 V	Imax, Ii 305 mA	Ci 0u F	Li 50uH	Pi 1.0 W

Entity input and output parameters of Intelligent Sensor Interface Module (ISI) for attaching to unspecified approved sensor. Includes a maximum 15 m cable between sensor and ISI.

Vmax,Ui 14.9 V	Imax, Ii 305 mA	Ci 0u F	Li 165mH	Pi 1.0 W
Vt, Uo 14.9V	It, Io 148mA	Ca, Co 2uF	La, Lo 0.15mH	Po 0.56 W

Associated Apparatus must be third party listed (certified) as providing intrinsically safe circuits for the application. Use the following to determine suitability of connections:

14.9V (Vmax, Ui)	≥ Voc or Vt or Uo
305mA (Imax, Ii)	≥ Isc or It or Io
1.0W (Pi)	≥ Po

If Po of the associated apparatus is not known, it may be calculated using the following formula: Po= (Uo*Io)/4

Associated Apparatus output current must be limited by resistor such that the output voltage current plot is a straight line between open-circuit voltage and short-circuit current.

4. **Calculating Capacitance**

Capacitance of the field wiring from the intrinsically safe equipment to the Associated Apparatus shall be calculated and must be included in the system calculations. Capacitance of the cable is Ccable. When the cable capacitance per foot is not known, the following value shall be used: Ccable = 60pF/ft

The ISI, with or without sensor, has a Ci of OuF, so only the capacitance of the field wiring cable need to be totaled and compared with the Associated Apparatus.

Total ISI(s) Ci + Ccable		Associated Apparatus output parameters
Ci (s) + Ccable	≤	Ca, Co

5. Calculating Inductance

Inductance of the field wiring from the intrinsically safe equipment to the Associated Apparatus shall be calculated and must be included in the system calculations. Inductance of the cable is Lcable. When the cable inductance per foot is not known, the following value shall be used: Lcable 0.2uH/Ft.

Add the Li Inductance of all the Sensors connected to the network and the cable inductance and compare it to the Associated Apparatus.

Total ISI(s) Li + Lcable		Associated Apparatus output parameters
Li (s) + Lcable	≤	La, Lo

EXAMPLE:

1,000 ft cable	0.0002 * 1000	= 0.2mH
8 sensors Li = 0.165mH	0.165 * 8	= 1.32mH
8 sensors Li = 50uH	0.00005 * 8	= 0.0004mH
Total inductance in network	0.2mH + 1.32mH + .0004mH	= 1.5204mH

6. Connecting a third party sensor to standalone ISI

To determine the safe connection of the ISi stand alone to a third party approved sensor with entity parameters the following considerations should be used.

The maximum cable length used to connect the ISI to the sensor shall be less than 15M. The Lo entity parameter has already factored in the sensor / ISI connecting cable of 15M. maximum.

The sensor must meet the following criteria:

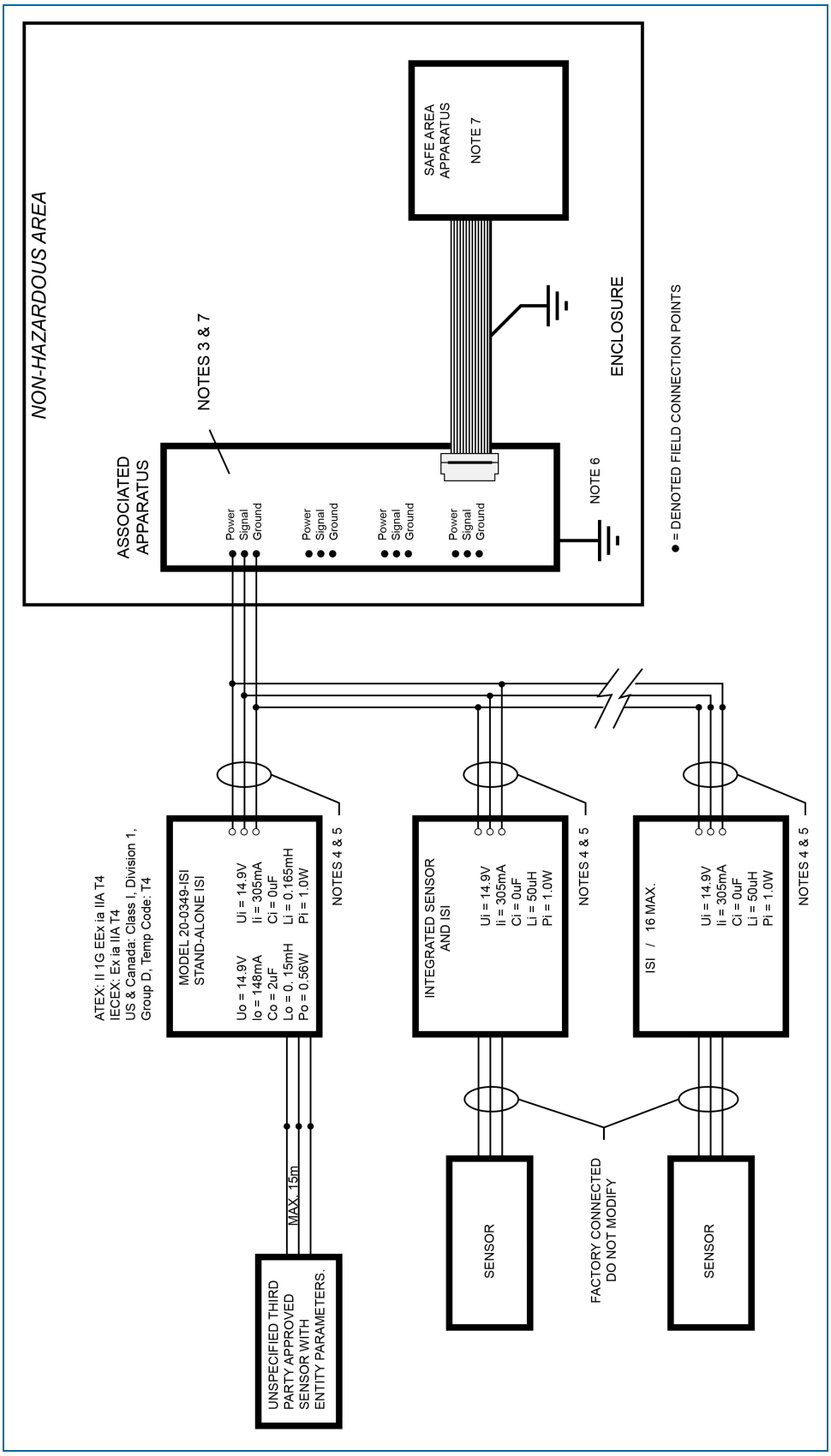
Sensor entity parameters		ISI output entity parameters
Vmax, Ui	≥	Vt, Uo 14.9V
Imax, Ii	≥	It,Io 148mA
Pi	≥	Po 0.56W
Ci	≤	Ca, Co 2uF
Li	≤	La, Lo 0.15mH

7. Installation

Associated apparatus must be installed in accordance with its manufacturers control drawing and Article 504 of the National Electrical Code (ANSI/NFPA 70) for installation in the United States, or Section 18 of the Canadian Electrical Code for installations in Canada or other local codes as applicable.

When required by manufacturer's control drawing, the associated apparatus must be connected to a suitable ground electrode per the National Electrical Code (ANSI/NFPA 70), the Canadian Electrical Code or other local installation codes as applicable. The resistance of the ground path must be less than 1 ohm.

Associated Apparatus must not be used in combination unless permitted by the Associated Apparatus Control drawing. Must not use or generate more than 250Vrrns or dc with respect to earth.


NON-HAZARDOUS AREA
SAFE AREA APPARATUS
NOTE 7
ENCLOSURE
NOTES 3 & 7
ASSOCIATED APPARATUS
Power
Signal
Ground
NOTE 6
● = DENOTED FIELD CONNECTION POINTS
ATEX: II 1G EEx ia IIA T4
IECEX: Ex ia IIA T4
US & Canada: Class I, Division 1,
Group D, Temp Code: T4
MODEL 20-0349-ISI
STAND-ALONE ISI
Uo = 14.9V
Io = 148mA
Co = 2uF
Lo = 0. 15mH
Po = 0.56W
Ui = 14.9V
Ii = 305mA
Ci = 0uF
Li = 0.165mH
Pi = 1.0W
NOTES 4 & 5
INTEGRATED SENSOR
AND ISI
Ui = 14.9V
Ii = 305mA
Ci = 0uF
Li = 50uH
Pi = 1.0W
NOTES 4 & 5
ISI / 16 MAX.
Ui = 14.9V
Ii = 305mA
Ci = 0uF
Li = 50uH
Pi = 1.0W
NOTES 4 & 5
MAX. 15m
UNSPECIFIED THIRD
PARTY APPROVED
SENSOR WITH
ENTITY PARAMETERS.
SENSOR
FACTORY CONNECTED
DO NOT MODIFY
SENSOR

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.

Revision History

Revision #	ECO #	Effective	Software Version*	Key Changes
0	624	7/18/14		Initial Release
1	696	3/3/15		Adds UL suggested battery warnings. Add probe/STP graphic update. Add detailed instruction for sec. 5.1 Waterproof Elec Conn. Add density sensor/pressure note
2	834	11/6/15	3.42.38.3	Sensor support…S07402 - Main Nano Application Oracle Rev: 42 - Description: "Version: 3.42.38.3- Build 29"
3	846	11/30/15		Updated image for Nano Field Wiring Diagram (added sensors)
4	974	5/23/16		Updated Declaration of Conformity for Nano Console and added DOC for 924B Probes.
5	1041	9/21/16		Added Density Floats
6	1088	12/22/16		Remove the sentence from page 37…"Sensors and probes cannot be multi-dropped from the same I.S. channel. You must run sensors and probes to different channels on the barrier." Update relevant images.
7	1105	01/11/17		Add Precision spec for Density Floats Update 924B specs for Prod & Water Level Measurements
8	1109	01/30/2017		In M4020: Applicable Warnings.htm - Add Integra condition tag to NOTICE panel so that it does not appear on Nano M2010 output.
9	1137	3/6/2017		Relabel the connection drawing to match 54-0525 label.
10	1187	11/3/17		Update to include support for ProGauge probes. Added control drawing and grounding appendices for UL compliance.
11	1350	4/13/18		Added Field Wiring appendix for ProGauge/MagDirect.
12	1678	1/15/20	3.71.56.3 Bld 61.1	DMP Probe support (EU), Remove XMT-SI-485 and MagDirect Barrier sections (EU), update graphics. Update DOCs in Appendix C.
13	1697	2/19/20		Update to correct DMP Wiring illustrations

NOTE: *It is possible that older software versions might not support all features.

DOVER®
FUELING SOLUTIONS

INNOVATIVE SOLUTIONS FUELING BUSINESS SUCCESS WORLDWIDE

Dover Fueling Solutions Global Locations

Corporate Headquarters
3814 Jarrett Way
Austin, Texas 78728
United States
Phone: +1 512 388 8311
www.doverfuelingsolutions.com

North America
Richardson, TX, USA
Hodgkins, IL, USA
Brighton, Ontario, CAN

Latin America
Rio de Janeiro, Brazil

Europe
Midlothian, UK
Elland, UK
Dundee, UK
London, UK
Skelmersdale, UK
Grenthville, FR
Paris, FR
Munich, DE
Bladel, NL
Turnhout, NL
Malmö, SE
Bovisio Masciago, IT
Castione Adevenno, IT
Turkey

Asia Pacific
Mumbai, IN
Petaling, MY
Guangzhou, CN
Shanghai, CN

OPW FUEL MANAGEMENT SYSTEMS