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OPW
FUEL MANAGEMENT SYSTEMS

M2010 - SiteSentinel® Nano®

Tank Gauge System

Installation Guide

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

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Listings and Certifications

Table of Contents

Section 1 Get Started: Safety

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

Topics covered in this section include:

1.1 Safety Alerts

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

DANGER: Indicates an immediately hazardous situation, which, if not avoided, will result in death or serious injury. Danger is limited to the most extreme situations.

WARNING: Indicates a potentially hazardous situation, which, if not avoided, could result in death or serious injury.

CAUTION: Indicates a potentially hazardous situation, which, if not avoided, could result in minor or moderate injury. Caution can also be used to alert against unsafe practices

NOTICE: Indicates a property damage message.

1.2 Applicable Warnings

The inside of this automatic tank-gauge system console contains high-voltage circuitry. ONLY certified technicians should gain access the console.

NOTE: Only certified OPW technicians are authorized to install and program this automatic tank gauge system. Failure to comply could result in a voided warranty.

DANGER: The coin cell battery may explode if mistreated. Do not recharge, disassemble or dispose of in fire. Replace 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 50°C 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 SiteSentinel®Nano® 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 SiteSentinel® Nano® console has one (1) lithium battery. When the battery can no longer hold sufficient electrical power it must be replaced.

IMPORTANT: Replace the battery with recommended replacement ONLY. Use of another battery may present a risk of fire or explosion.

A used battery must be removed and brought to a battery-recycling center for approved disposal.

1.3 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.

1.4 Installer Safety

CAUTION: Incorrect installation can endanger installers and users of this equipment and could result in environmental contamination or equipment damage. Read these instructions carefully!

Installation must be in accordance with the U.S. National Electrical Code (NFPA No. 70) and the Automotive and Marine Service Station Code (NFPA No. 30A).

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.

It is the installer's responsibility to examine and obey any local codes.

NOTE: Local codes may dictate special installation requirements. Installation is subject to approval by the local authority having jurisdiction at the site.

1.5 Precision Leak Test

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

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

1.5.1 Before Initial Inspection

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

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

1.5.2 Initial Inspection

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

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

The Field Wiring Diagram found in the product container should be given 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 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 required, the console can be installed in many locations of a fueling facility.

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

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

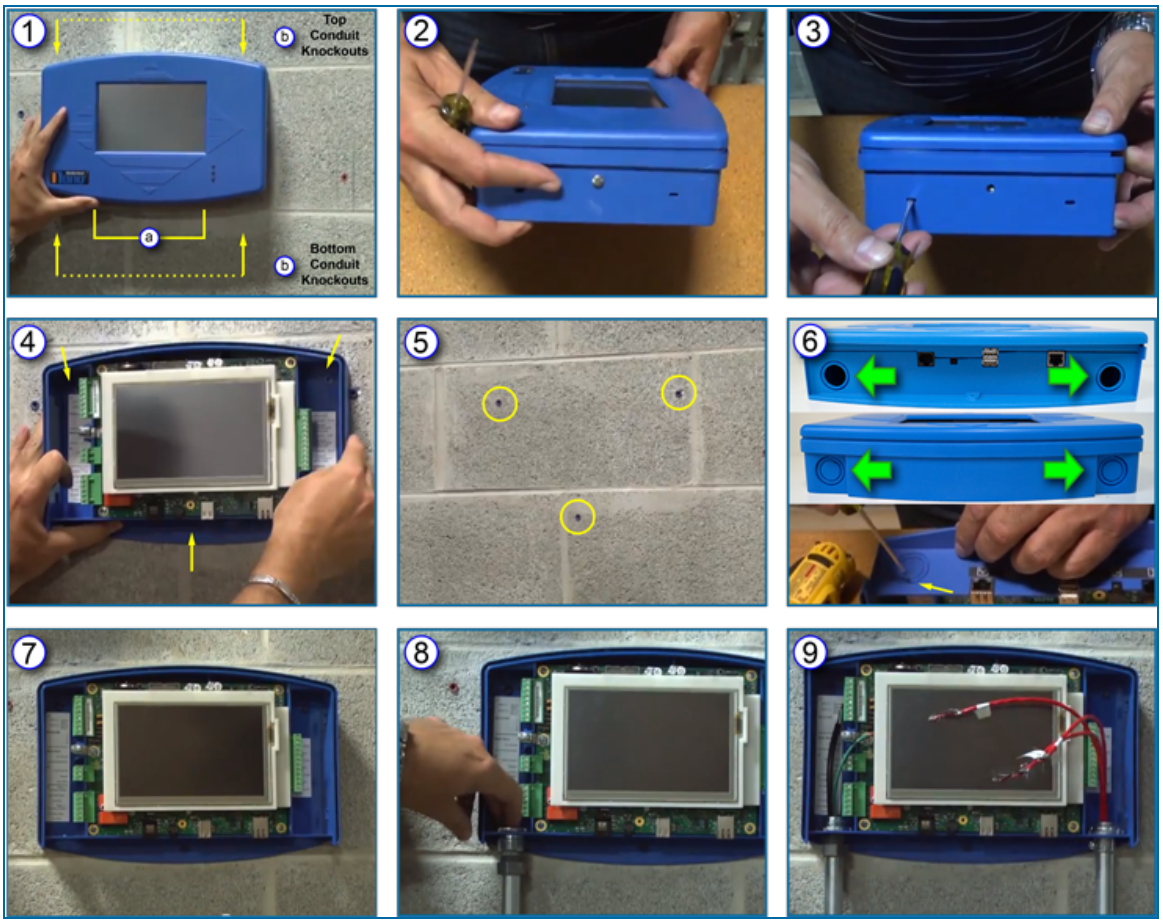


Figure 2-1 Install the Console

1. Select a spot to mount the SiteSentinel® Nano® console on a wall in a secure indoor location so the display is easily visible and at a comfortable eye level.
    a. Make sure there is sufficient access to the communication ports on the bottom of the console.
    b. Make sure to leave sufficient space either below or above the unit to run power and communication conduits to the console.
2. Remove the two (2) screws located on either side of the console that hold the cover in place. Set them aside where they will not be lost to be reinstalled later.
3. Put a small screwdriver into one of the two (2) release holes located on the left side of the console. Push the screwdriver in till 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 mounted. There are three (3) mounting screw holes in the unit. Use a pen to mark the screw hole locations on the wall.
5. Drill the holes where you marked the locations and tap or insert screw anchors in the hole.

NOTICE: Be sure to remove the main board and set it in a static-free environment before proceeding to the next step. This will prevent damage to the main board components when removing the knockouts.

ATTENTION: Electrostatic Sensitive Device - OBSERVE PRECAUTIONS FOR HANDLING ELECTROSTATIC DISCHARGE SENSITIVE DEVICES

Following the guidelines below can minimize the potential for damage from Electrostatic Discharge (ESD).

» A new component to be installed should be kept in its anti-static packaging as long as possible prior to installation.

» Handle ESDS components by the edges. Avoid touching any of the circuitry

6. Remove the knockouts from either the bottom or top of the unit (as determined in Step 1 above). The knockouts can be removed by inserting a small screwdriver into the groove and hit it firmly with a hammer.

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

7. Reinstall the main board and mount the unit to the wall with screws that match 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 probe/sensor wires through the conduit to the console.

2.3.2 Installation Video

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

IMPORTANT: Make sure the electrical wiring is routed to the left side of the console and the probe/sensor wiring is routed to the right side.

2.4 Wiring Requirements

CAUTION: All installations must be done in accordance with local regulations. Rigid steel conduit should be used when possible

2.4.1 Electrical and I.S. Barrier Wiring

CAUTION: Make sure that the I.S. ground wire and Earth ground are properly attached to the console back to the electrical panel to prevent high-voltage being sent to the I.S. wiring side in the event of a field short.

NOTICE: When wiring the connectors, be sure there are no exposed stripped wires outside of the block. This is to prevent shorting the high-voltage on the electrical side and to prevent damage to the barrier and/or the probe itself from shorting on the probe side.

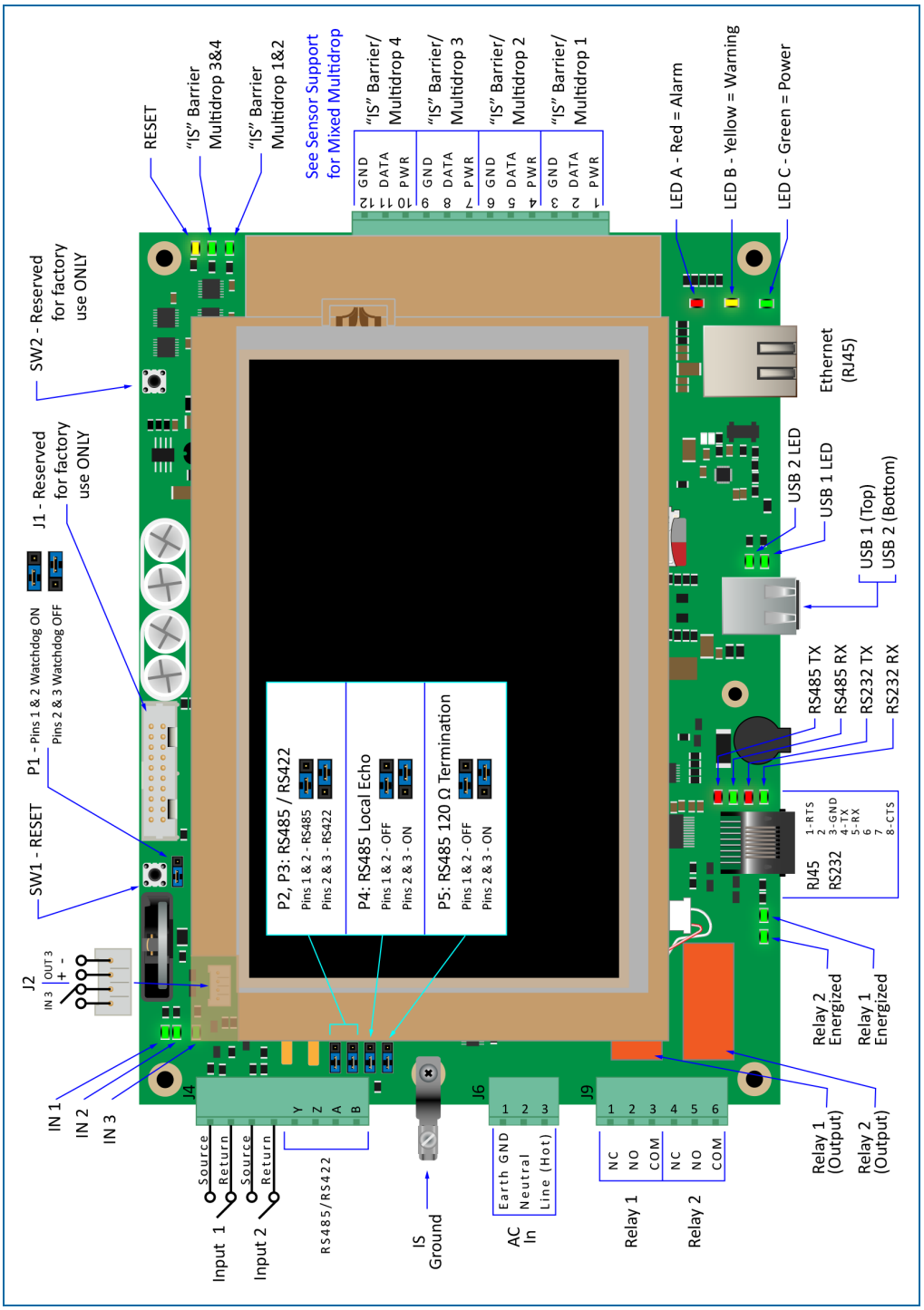


Figure 2-2 Main Board Connections, Jumpers and LEDs

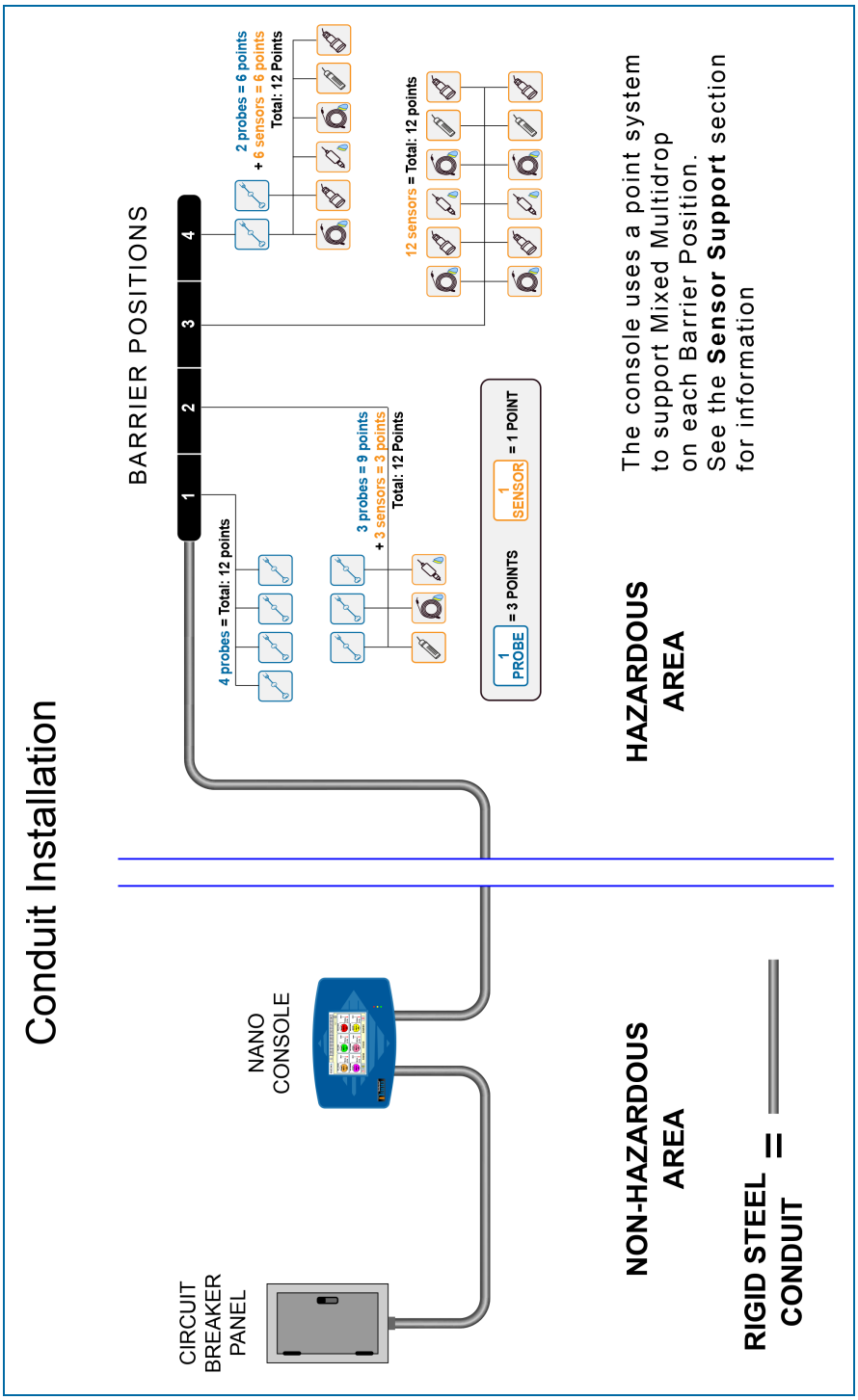


Figure 2-3 Conduit Installation

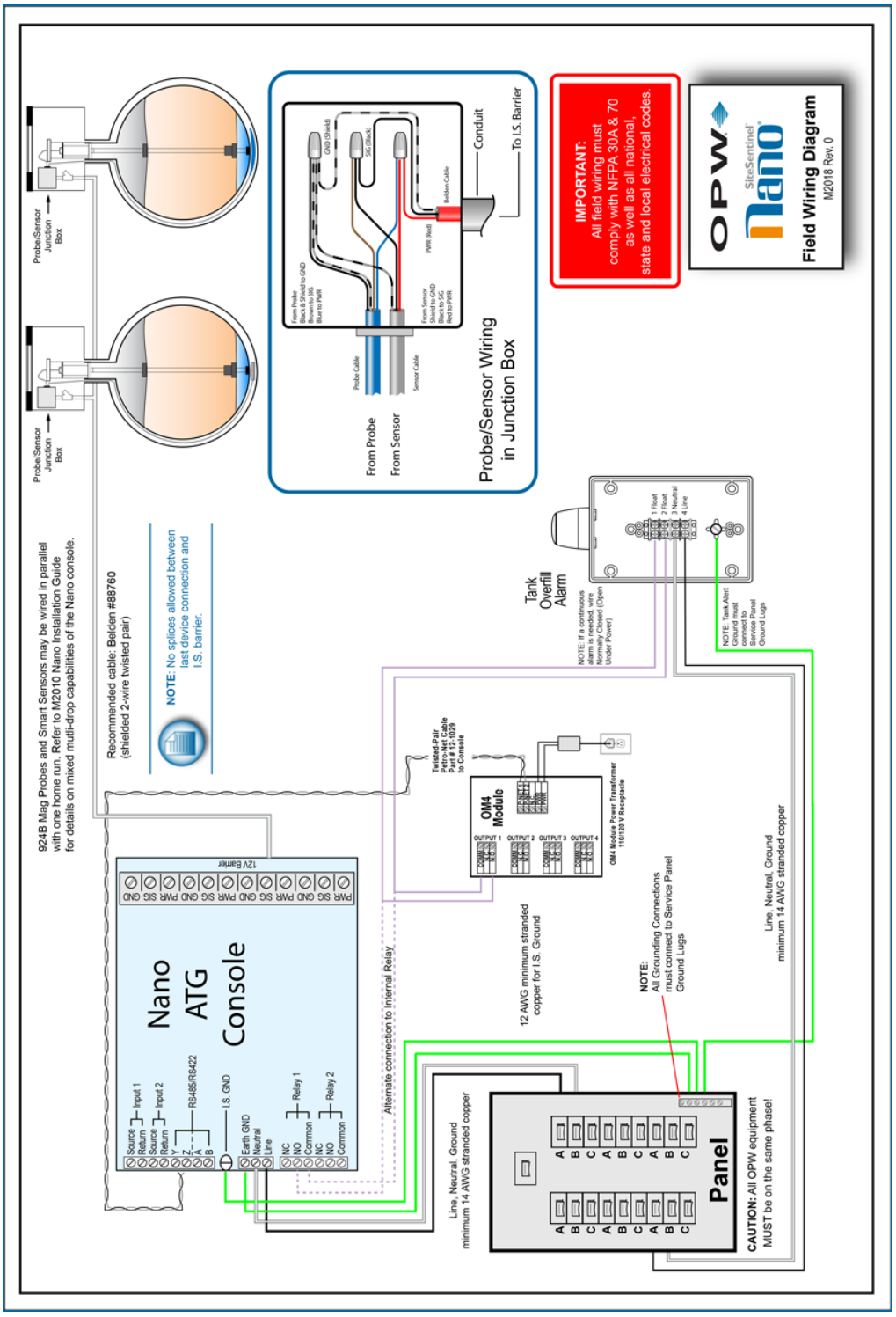


Figure 2-4 Field Wiring Diagram

2.5 Console and Peripheral Connections

2.5.1 Direct Connections

NOTE: The SiteSentinel® Nano® console comes with a set IP address. Do not change this address if using a crossover.

To establish a direct, wired connection between the console and a PC, a standard RJ45 crossover cable is required. For details on setting up a direct connection between a PC/laptop and the console refer to the introductory section **Direct Connection with a Crossover Cable** in the *M2011 SiteSentinel® Nano® Configuration Guide*.

2.5.2 Ethernet Connections

Ethernet connections are the final alternative for establishing communications between the console and peripheral devices. For this type of connection, an Ethernet cable is run 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 required, the use of conduit to protect the cable is recommended.

2.5.3 RS-232 Communications Conduits

If a terminal or PC located more than 1.8 m (6 feet) from the console is to be connected, conduit must be installed to accommodate the RS-232 cable.

NOTE: The maximum runs 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:

- Snap the console front panel cover back into place on the front of the unit.
- Reinstall the two (2) side screws that hold the front panel cover in place.
- Go to the breaker box and power up the console.

Section 3 OM4 Output Module

OM4 Output Module

The OM4 Output Module expands the tank-gauge console functions by allowing up to 4 (four) OM4 units each with 4 (four) relay positions for a total of 16 relays. The OM4 communicates with the controller via (missing or bad snippet) and is powered by a 12 VAC wall pack source that is supplied with the unit. See the wiring instructions inside the OM4 unit for the correct (missing or bad snippet) communications and power wiring connections.

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

Some common OM4 functions include:

- Turn off a submersible pump when low product is sensed in a tank.
- Activate an alarm when high product is sensed in a tank.

3.1 Safety Precautions

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

High voltages exist inside the OM4. Only qualified technicians should open the unit.

Output relays in the OM4 are not intrinsically safe! Before working on the OM4 Output Module, disconnect the power, including power to and from the relays.

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

3.2 Codes

Relay wiring is classified as Class 1 wiring. Installations must be in accordance with the National Electrical Code (NFPA No. 70) and the Motor Fuel Dispensing Facilities and Repair Garages Code (NFPA No. 30A). It is the installer's responsibility to investigate and obey any applicable local codes in the country\county of installation.

3.3 Hazardous Area Definition

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

DANGER: Do not mount the OM4 Output Module within a hazardous area.

Do not attach this unit to any devices that are located in the 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

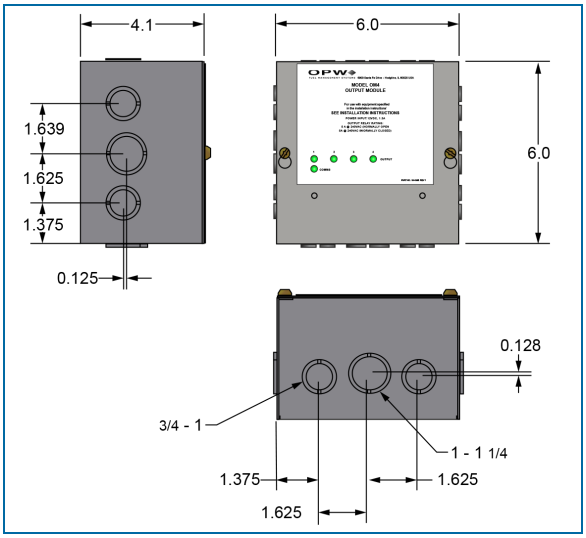
- Electronic Testing Labs Canada (cETL)
- Electronic Testing Labs (ETL)

3.6 OM4 Installation

The OM4 must be mounted on a wall using only the mounting holes provided. Knockout locations are shown below. OM4 Modules require communication connection to the console and AC power.

The OM4 module is not NEMA-rated and must not be mounted with direct exposure to the elements.

Only use the knockouts provided. Seal all unused knockouts.

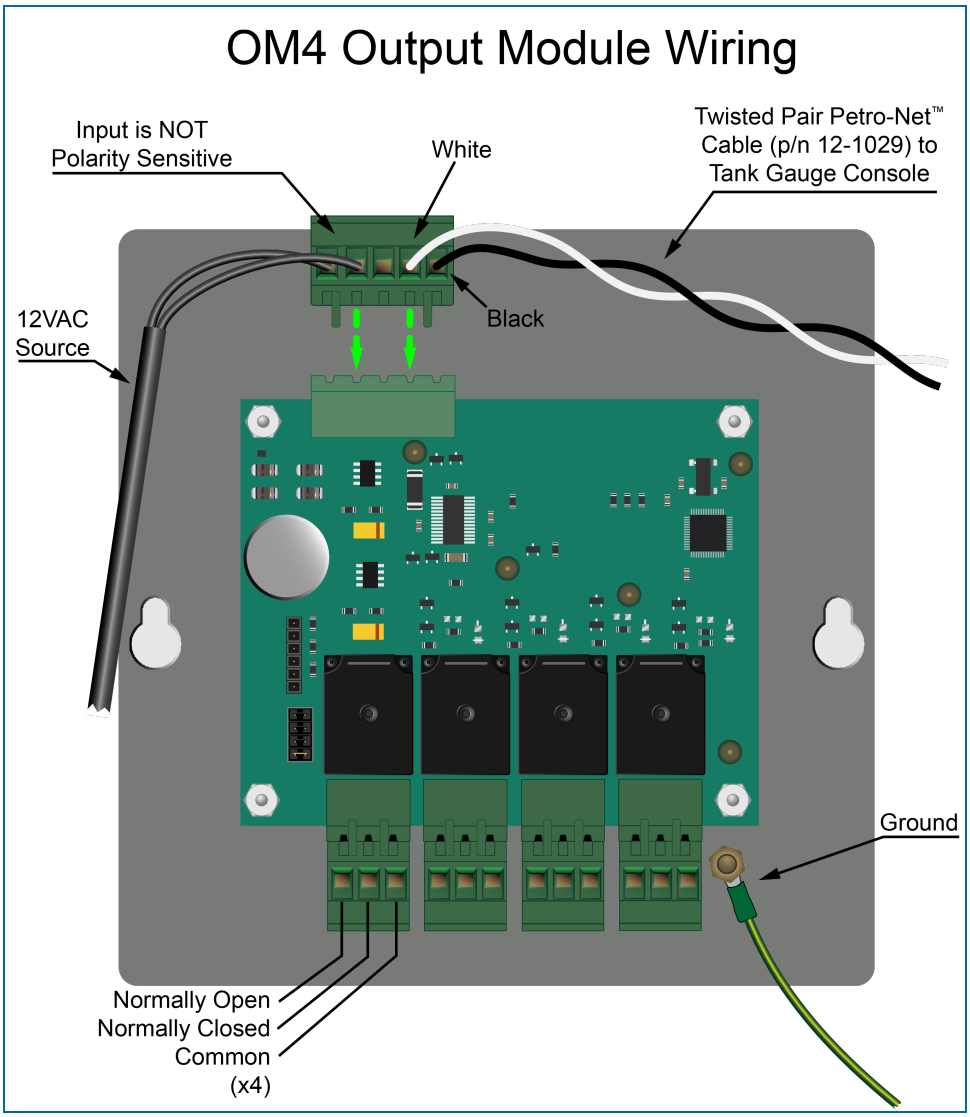


OM4 Dimensions and Knockout Locations

3.7 OM4 Connections

Follow the wiring instructions inside the module for proper Petro-Net communications and power wiring instruction.

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

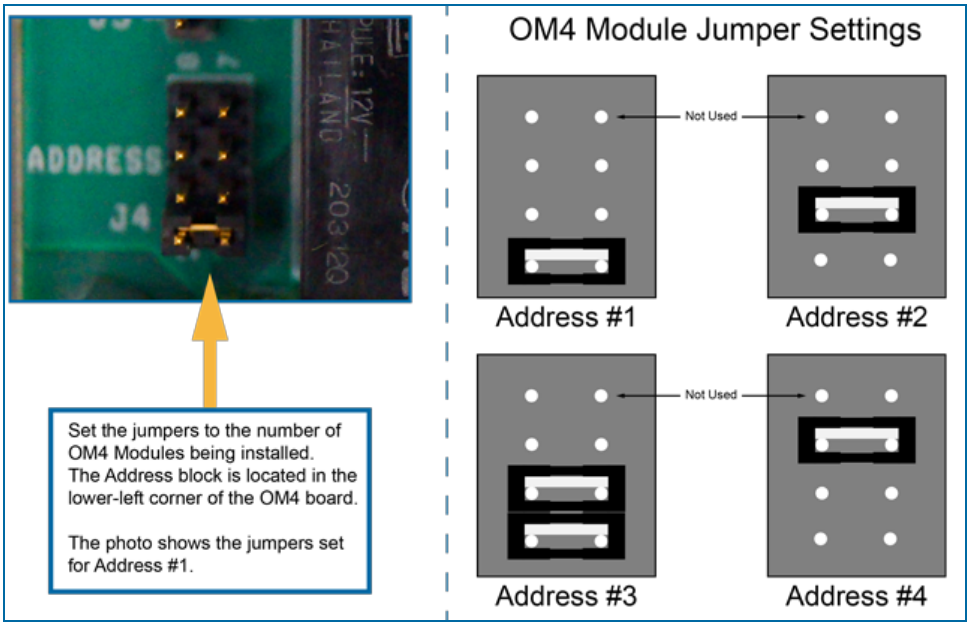


OM4 Wiring Connections

3.8 Jumper Settings for Multiple OM4 Operation

To install 2 or more OM4 Output Module boxes:

- Remove the nuts that attach the aluminum cover.
- Remove the cover. This will expose the circuit board.
- Set the jumpers to the correct address.
- Place the aluminum cover 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 trigger an overfill alarm using either the console's internal output contacts or an output relay of a connected OM4 Module. The Tank Alert has a buzzer and an external light to warn users of an overfill condition or high-product alarm.

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

4.1 Safety Information

EXPLOSION or FIRE HAZARD. Do not install this unit in hazardous locations as defined by the National Electrical Code, ANSI/NFPA 70.

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

ELECTRICAL SHOCK HAZARD. Disconnect power before installing or servicing this unit. A qualified service individual must install and service this unit according 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 Wiring

NOTE: Refer to the Field Wiring Diagram for your specific ATG system to connect wires inside the Tank Alert box

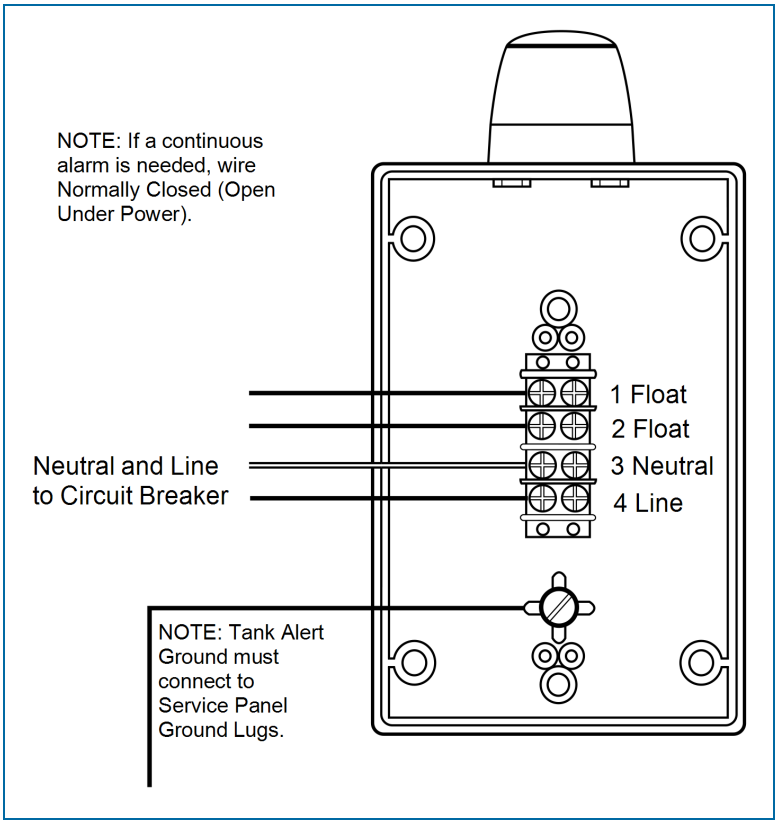


Figure 4-1 Tank Alert Wiring Connections

Section 5 Tank & Pre-Installation Preparation

5.1 Waterproof Electrical Connections

Components

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

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

Personal Protective Equipment

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

- Safety glasses
- Chemical resistant gloves

Tools Required

- Wire stripper/cutter

Instructional Video

If you have a QR code scanner/reader app for your smartphone you can scan this code to view the instructional video**, Multidrop Probe & Sensor Wiring Instructions**. If you are viewing this manual on a computer or tablet, simply click on the code.

NOTE: This link starts the video at a midway point where the relevant section begins.

Safety Information

DANGER: Contains vinyl cyclohexene dioxide. Harmful if swallowed. Do not get product on skin or in eyes. Do not inhale fumes.

For detailed product hazard information see the MSDS for the 3M™ Scotchcast™ 3570G-N (Parts A & B). If you have a QR code scanner/reader app for your smartphone you can scan this code, then go to the Documents tab and select the MSDS:

Assembly Procedure

The procedure for assembling the wire connections and resin sealpacks is outlined below.

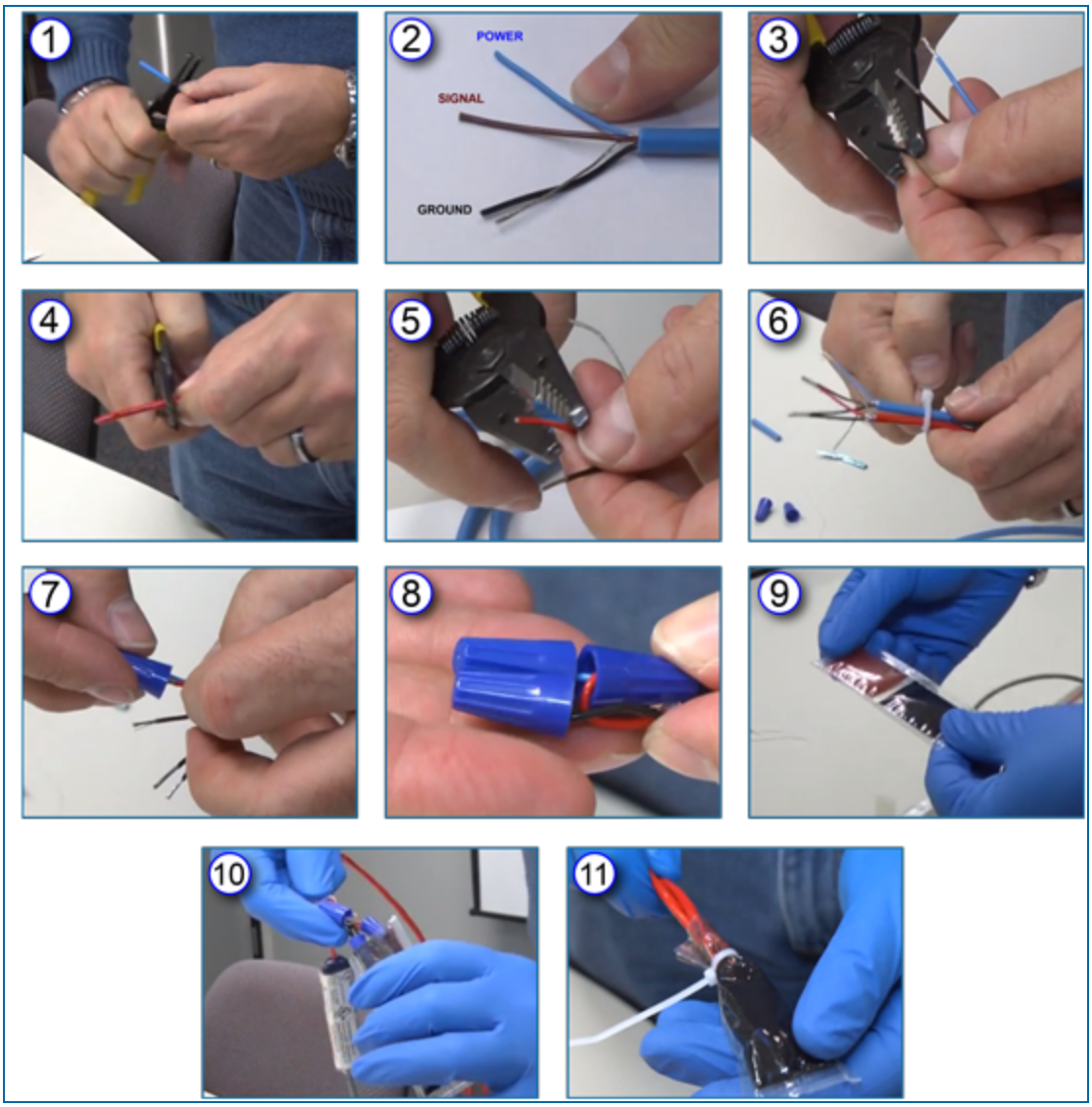


Figure 5-1 Assembling the Epoxy Sealpack for Waterproof Electrical Connections

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

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

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

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

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

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

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

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

9. Prepare the epoxy resin sealpack.
   - Bend the sealpack until the barrier between the two resins weakens
   - Thoroughly mix the two (2) resins together for approximately two (2) minutes. The mixed epoxy will become warm to the touch.
   - Push all of the mixed resin to the bottom of the bag
   - Cut and tear the top of the bag to open

10. Insert the wire-nut assembly all the way into the bottom of the bag. Fold the bag tightly around the tied cables. Attach a second tie wrap around the bag just above the tie wrap holding the wires (this will prevent the wire-nut assembly from slipping out of the bag.

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

5.2 Probe-Cable Seal-offs

WARNING: To prevent explosive vapors from entering the I.S. barrier, seal-off the probe cables ***before*** they enter the I.S. barrier.

1. Remove enough of the jacket to allow approximately 7.6 cm (3 inches) of wire leads to extend past each seal-off. **DO NOT nick the wire insulation**.
2. Probe or sensor wires using prepared Belden or Alpha cable go through NPT bushings into a weatherproof junction box. Bushings must be used in all junction boxes.
3. The cable is then routed—via rigid steel conduit—out of the box and directly to the I.S. barrier.
4. Label each cable and wire.

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 share the conduit to the I.S. barriers.

NOTICE: Improper cables, wiring, or conduit allow electronic noise to interfere with probe/sensor measurements. This may cause measurement readings at the console resembling hardware failure. The warranty is voided if improper cables, wiring and/or conduit are installed. The ground wire must be properly installed for the operation of the noise-filtering circuitry. Do not rely on the conduit for the operation of the ground.

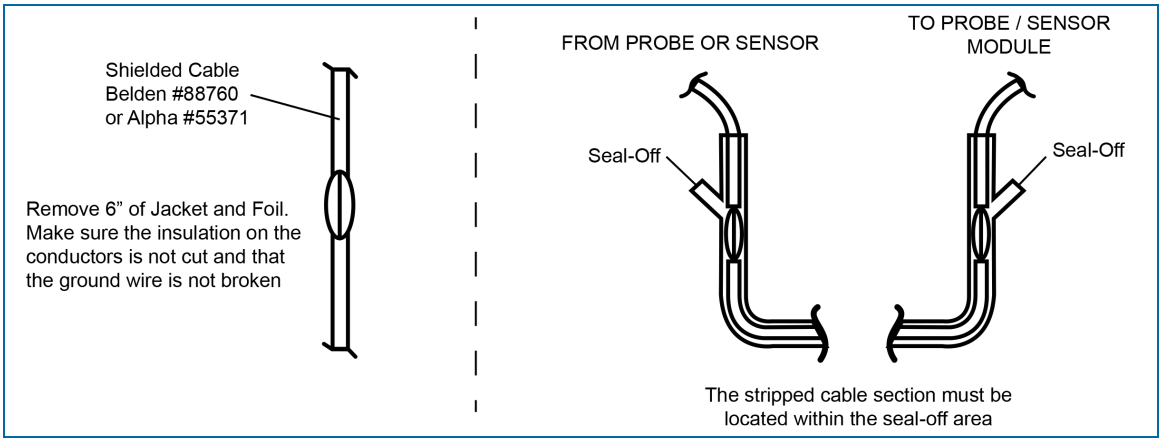


Figure 5-1 Probe-Cable Seal-Offs

5.3 Probe Placement

CAUTION: Model 924B probes must be installed as described in this section. If the minimum or maximum dimensions specified cannot be met, do not proceed with the installation.

Model 924B 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 have any questions about whether a product is included in this classification, please contact your product specialist or OPW distributor.

The ideal location for a probe is in the center of the tank (See the illustration below).

The probe should be located at least 91.4 cm (3 feet) from the tank fill pipe. If this distance is less than 91.4 cm (3 feet), the force of the product entering the tank can cause the water float to rise up the shaft of the probe. This may cause the controller to generate a false high-water alarm.

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

Similarly, a Submersible Turbine Pump (STP) should be located at least 91.4 cm (3 feet) from the probe. If this distance is less than 91.4 cm (3 feet), the force of the product being pumped from the tank can adversely impact readings of both, the water and product floats.

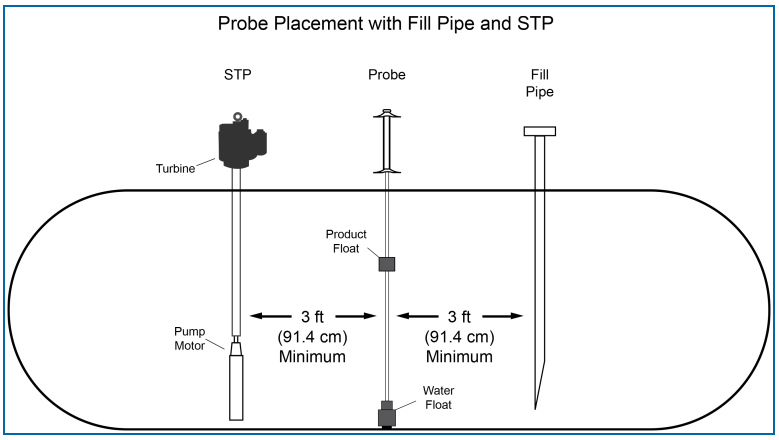


Figure 5-1 Probe Placement

5.4 Probe Installation in Underground Storage Tanks

1. 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 large enough to contain a weatherproof junction box.

NOTE: If the fitting is not in the center of the tank, additional measurements are required for probe compensation.

2. When installing the probe, allow enough cable from the probe to reach a weatherproof junction box.
3. Leave minimum 30.5 cm (12 inches) of extra, coiled wiring (probe wire and field wire) inside the weatherproof junction box. The box must be large enough to contain a 12.7 mm (0.5 inch) conduit, coiled field wiring and epoxy pack, as shown in field wiring diagram.

CAUTION: Seal-offs are required any time I.S. wiring enters conduit.

4. Install the 1/2-inch NPT bushing (supplied with each probe) in the weatherproof junction box.

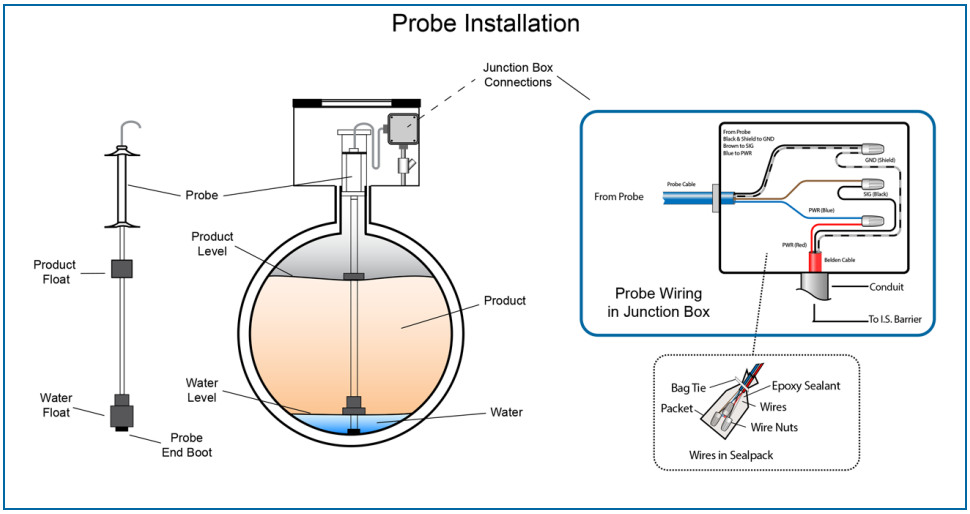


Figure 5-1 Probe Installation

5.5 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 is the tilt of a tank along its horizontal axis. Some tanks are intentionally installed with one end lower than the other to allow water and sediment to collect at the low end, while clear product is drawn from the high end. Tank settling can also cause pitch. The rate of pitch can be measured by using a dipstick to measure the level of product at two points (preferably opposite ends) of the tank (see the figure below).

The product depth at the deep (lower) end of the tank is value “A.” The product depth at the shallow (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 shallow end of the tank, the product offset is positive. For the example above: 1.8”.

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

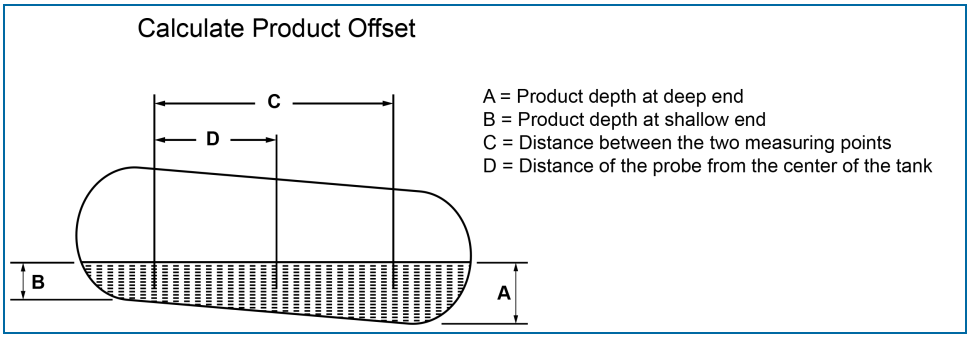


Figure 5-1 Product Offset

Section 6 Rigid Probe Installation

6.1 Adaptor Collar & Riser Cap

A modified adaptor collar and riser cap (OPW Model 62M) is required for each probe. These collar and riser cap kits are available from OPW Fuel Management System.

1. Install the modified adaptor collar onto the riser pipe.
2. Screw in the OPW-supplied bushing (62 mm) with the probe into the 3/8-inch NPT hole in the riser cap.
3. After the probe is lowered into the tank, snap the cap into place.

6.2 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 is denser than gasoline, the water/diesel floats are heavier than the water/gasoline floats. If the wrong water float is installed in a diesel tank, it does not sink through the product to the water below. As a result, the tank will have unusually high water measurements and possibly erratic product measurements as the water float interferes 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 certified for applications in which it will be subjected to pressures at or above 300PSI. Pressures higher than 300PSI will damage the device, preventing it from providing accurate measurements.

6.3 Multi-drop Installation

The Nano's internal barrier permits the installation of multi-dropped probes. When using this installation method, follow the directions below to make sure the wiring is correct.

IMPORTANT: Seal packs are required with all wiring applications in the field. Weatherproof junction boxes are REQUIRED with ALL I.S. field connections.

See Waterproof Electrical Connections.

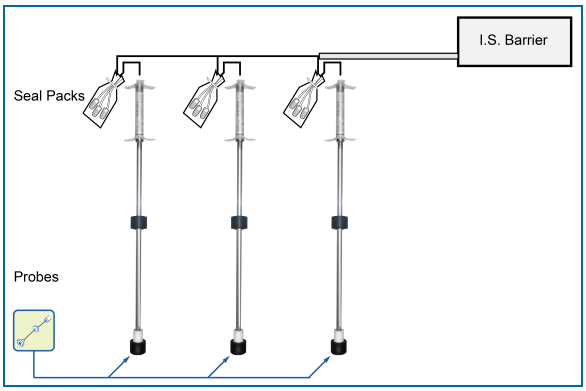


Figure 6-1 Multi-drop Probes

6.4 Model 924B Probe

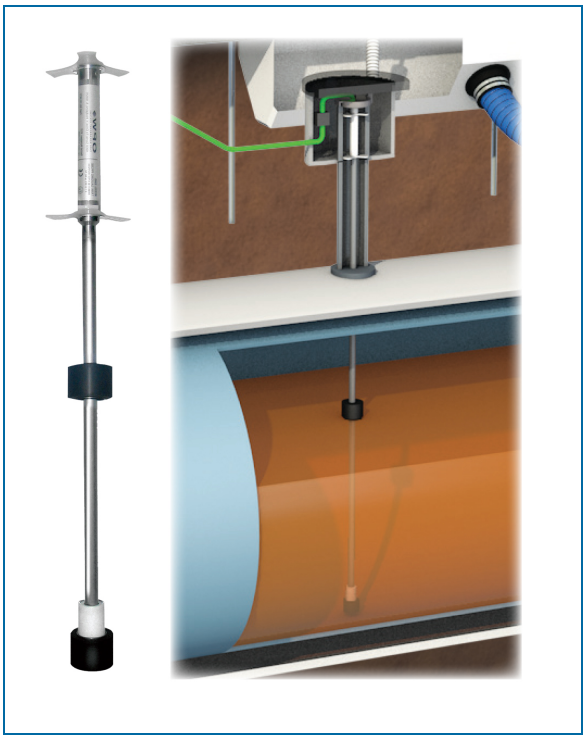


Figure 6-2 924B Magnetostrictive Probe

The 924B probe comes standard in stainless steel and can be used in a variety of liquids, including gasoline, diesel and water.

The 924B Probe wiring can be multi-dropped with up to four (4) probes connected to the same I.S. barrier channel.

CAUTION: Special Conditions for Safe Use:

To avoid a build-up of static charge, do not rub with a dry cloth or clean in any manner that would result in a charge build-up. Discharge the outside of the hazardous area before putting into service.

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

The upper housing cover in the top of the enclosure is aluminum. Care must be taken to avoid ignition hazards due to impact or friction.

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

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

Section 7 Density Measurement Sensor (DMS)

OPW Part Number 30-3232

The Density Measurement Sensor (DMS) can be installed on an existing probe. The DMS continuously measures the average density of the fuel in the tank. This can measure the smallest change in product density within 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 either nominal or temperature-corrected density.

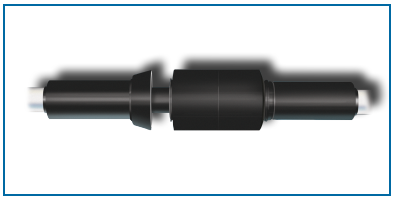


Figure 7-1 Density Measurement Sensor

Density Measurement Sensor Specifications	
Materials:	Nitrophyl, Delrin, and Stainless-Steel spring
Resolution:	0.00004 g/cc
Accuracy:	+/- 0.0025 g/cc
Density Range:	0.6 – 1.0 g/cc
Operating Temperature:	-40°C to +70°C (-40°F to 158°F)
Dimensions:	Length: 27.9 cm (11 inches), Diameter: 5.1 cm (2 inches)
Sensors per Barrier:	12 maximum
Suggested Location:	15.2 cm (6 inches) from bottom of probe **NOTE**: Use two (2) set screws at the top and the bottom of the sensor to hold in position.

7.1 DMS Installation

NOTE: As density sensing is no longer an option in the system, the sensor itself will be picked up by the system once the device is installed and after redoing Auto-Detection of the probe.

1. Remove the probe from the tank and detach the clip and nylon probe foot from the bottom of the probe.
2. Remove the water float, slide the density sensor on and tighten the screws of the sensor onto the probe shaft (the umbrella should be facing down). Leave 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.
3. Replace the water float, nylon probe foot and end clip.
4. Place the probe back in the tank.

NOTICE: The Density Measurement Sensor is not certified for applications in which it will be subjected to pressures at or above 20.7 bar (300 psig). Pressures higher than 20.7 bar (300 psig) will damage the device, preventing it from providing accurate measurements.

7.2 Tank Thresholds

- Since the Density Sensor is installed between the water and Product Float, the Product Float cannot be placed beyond the Density Sensor. In order to provide low-product alarms, the Low and Low-Low product threshold level should be set above the Density Sensor. The suggested level is 43.2 cm (17 inches) or higher.
- Measure the distance between the end of the probe shaft and top end of the Density Sensor. Add 5.1 cm (2 inches) to this distance to account for the dead zone at the end of the probe. The resulting value represents the minimum product Low-Low threshold.

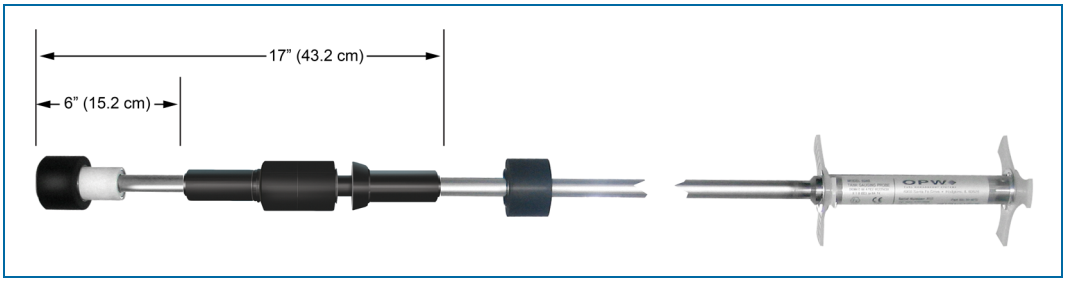


Figure 7-2 Low-Low Threshold Measurement with DMS

7.3 DMS Configuration & Preliminary Calibration

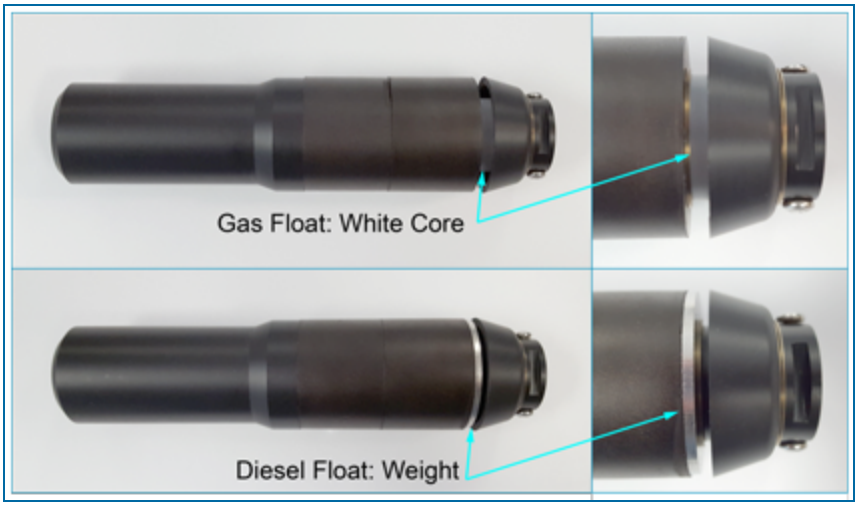
For DMS configuration and calibration please refer to the M2011 SiteSentinel® Nano® Configuration Guide

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 the 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 within 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 either nominal or temperature-corrected density.

There are two (2) versions of the DMF. One that measures density for gasoline (20-4431) and another for diesel (20-4432). They can be identified by the features in 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 power down the module that the probe is connected to before you begin the procedure below.

1. Power down the module that the probe is connected to before you remove the probe from the tank.
2. Remove the probe from the tank and detach the clip and nylon probe foot from the bottom of the probe.
3. Remove the water float, slide the density float on and tighten the screws of the float onto the probe shaft (the umbrella should be facing down). Leave 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. Replace the water float, nylon probe foot and end clip.
5. Place the probe back in the tank.
6. Power up the module.

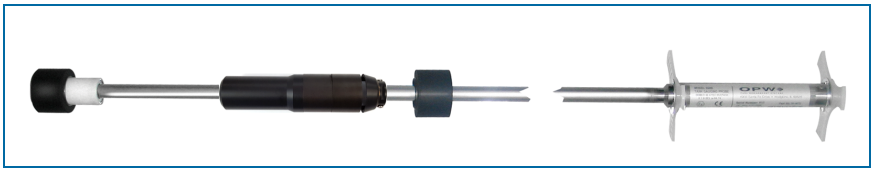
For DMF configuration and calibration please refer to your M2011 SiteSentinel® Nano® Configuration Guide.

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

- Since the Density Float is installed between the water and Product Float, the Product Float cannot be placed beyond the Density Float. In order to provide low-product alarms, the Low and Low-Low product threshold level should be set above the Density Float.
- Measure the distance between the end of the probe shaft and top end of the Density Float. Add 5.1 cm (2 inches) to this distance to account for the dead zone at the end of the probe. The resulting value represents the minimum product Low-Low threshold.



Section 9 Sensor Support

As of Release 3 the SiteSentinel® Nano® system supports OPW Smart Sensors that utilize IntelliSense™ Technology. The OPW smart sensors have the ability to monitor all contained areas of the fuel-storage system: tank interstice, piping sumps, STP containment sumps, dispenser sumps/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 allows the Nano's internal I.S. barrier to automatically detect sensor connection, sensor type and sensor 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 wire back to the tank gauge.

With mixed multi-drop, each of the Nano's four (4) I. S. barrier positions can hold up to 12 probes or 24 sensors in any combination. Possible combinations are driven by a point system: one probe = three points; one sensor = one point.

One barrier position can hold a total of 12 points (4 probes, or 12 sensors or a combination of probes and sensors).

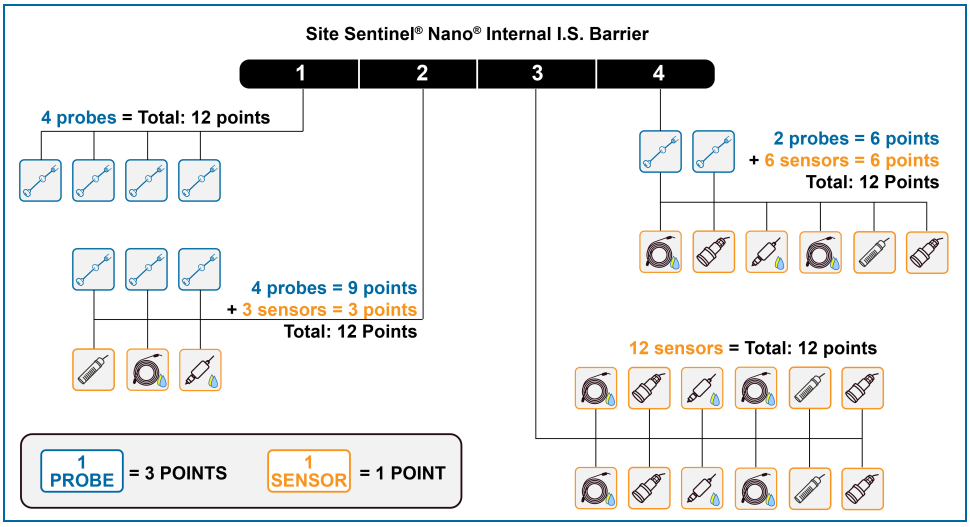


Figure 9-1 Mixed Multi-drop Probe and Sensor Point System

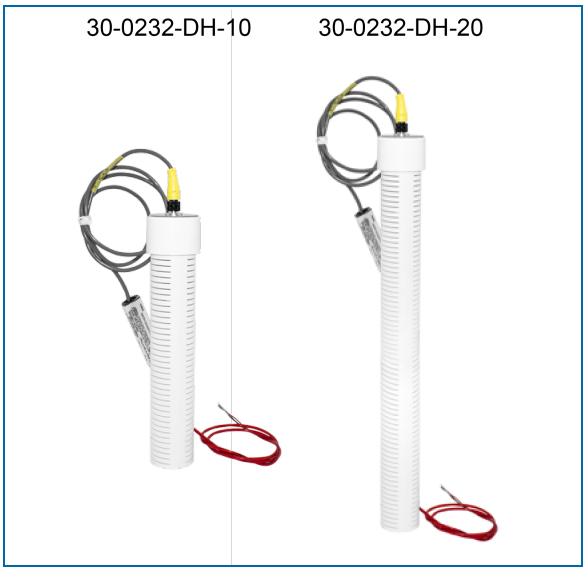
IMPORTANT: Seal packs and weatherproof junction boxes are REQUIRED with ALL I.S. field connections.

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)
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 Pan/STP Sump Sensor – Smart Sensor Equipped with Intellisense Technology

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



Description

IMPORTANT: This float body is identical to the 30-0232-D10 & D20 and 30-0232-D-10B & D-20B. Check the label to make sure you are using the correct sensor for the intended purpose.

The dual level sump sensor is designed to detect the presence of liquid hydrocarbons and water in sumps, dispenser pans and other locations where the presence of a liquid could indicate that a leak has occurred. The DH-10 is intended for use on dispenser pans and transition sumps, the DH-20 is intended for use in tank sumps.

The sensor contains a carbon/polymer material (Belcor®) that changes its resistance when exposed to liquid hydrocarbons.

Figure 9-1 Sensor with Belcor® Carbon/polymer Strip

Dual float switches are incorporated into the body that cause an alarm condition when low and high levels are detected. The system will also cause an alarm condition in the event of a break in the cable or sensor malfunction.

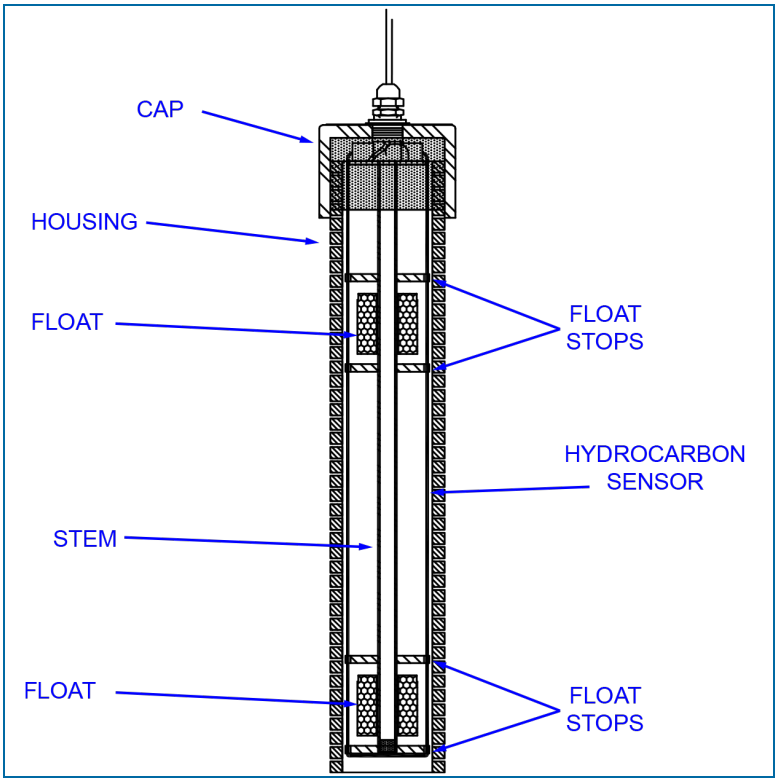


Figure 9-2 Cutaway View of Sensor Showing Internal Floats

Specifications	
Primary Use(s):	DH-10: Dispenser Pan/Sump DH-20: STP Sumps
Alternate Uses:	DH-10: STP Sumps DH-20: 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)	1K – 5K ohms
Nominal resistance (contaminated)	30K – 200K ohms
Cable:	Belden #88760 or Alpha #55371 3.6 m (12 feet) of gas & oil resistant cable to 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 from sensor setup:	
Belcor Clean (no Hydrocarbon)	**12 to 13** (normal), **3 to 4** (lower float in alarm - raised), **1 to 2** (lower and upper 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** (lower and upper float in alarm - raised)
Multi-Drop Restriction:	See Mixed Multi-drop Installation
Connections:	Red = Power, Black = Signal, Shield = Ground

NOTE: *Maximum Wiring Length is the maximum length of cable to be used to connect all sensors on an individual channel. This length includes run of cable from VSmart to each sensor board in the string.

Installation

NOTE: To ensure safe operating conditions this sensor has been designed to connect to OPW Tank Gauges Smart Sensor 12V IS Module ONLY. Smart sensors CANNOT be used with SS1, 2 or 3, iTouch or any EECO consoles.

CAUTION: ALWAYS observe Local and National Electrical Codes for installation location.

Ensure the cabling (gas and oil resistant FMS part # 12-1030) back to the controller is in conduit that is dedicated to intrinsically safe wiring.

Use wire nuts and seal pack for field connection.

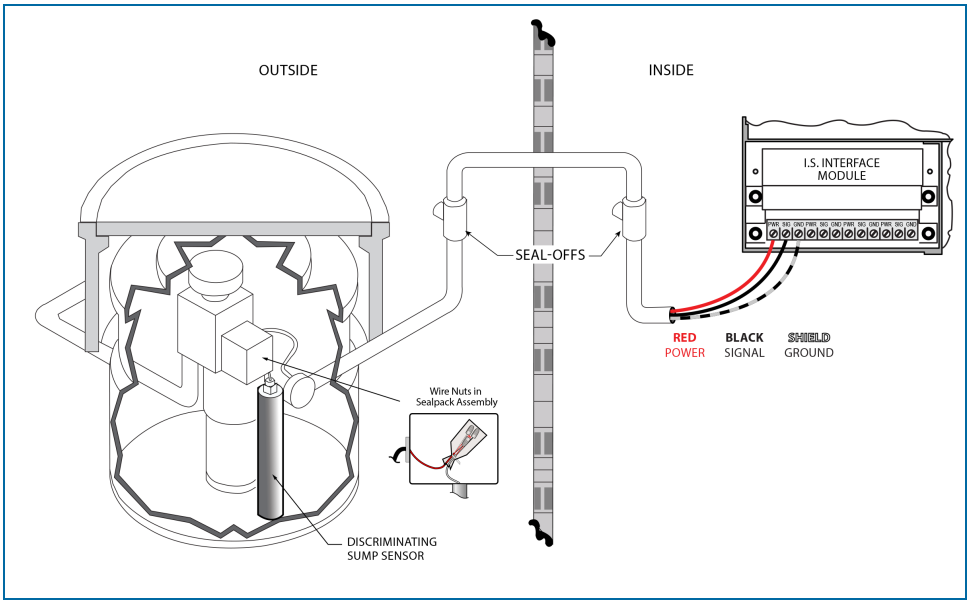
- This sensor requires ONE Controller Interface Module position
- Begin with the “Typical Installation" drawing.
- Make sure the sump/dispenser pan is dry.
- Position the sensor so that it is touching the bottom of the sump/dispenser pan.
- Connect the sensor cable to the sensor.

- 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 detaied instruction).
- Install seal-offs at both ends of the conduit run.

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

- On the console, the sensor should be **Auto Detected** (see the console configuration manual). Alarm thresholds are configured automatically through the *Intellisense* mechanism between the sensor and the console.

Testing the Float Sensor

Sensor installed in a normally dry well

- Place the float in the high position. This should trigger an alarm in the controller.
- Return the float to the low position and check that the controller is no longer in alarm.

Sensor installed in a normally wet well

- Place the float in the low position. This should trigger a alarm in the controller.
- Return the float to the upper position and check that the controller is no longer in alarm.

If the controller fails to go in to alarm check that the thresholds programmed in the system are correct. Check the orientation of the float as described earlier. A sensor or wiring fault will trigger a system alarm. Check all wiring and junction boxes to ensuring continuity without shorts.

Testing / Decontaminating the Hydrocarbon Sensor

CAUTION: When working in the hazardous area use caution to avoid a hazardous situation.

When conducting testing or decontamination of the sensor work in a well ventilated area with no hot surfaces or open flames near by.

To test the hydrocarbon liquid portion of the sensor:

- Put the polymer fully into *Mineral Spirits* and wait approximately 10 minutes.
- Remove the sensor and let it hang to air dry for another 10 minutes.
- This should cause controller alarms or events associated with the hydrocarbon portion of the sensor.

To test the water detector of the sensor:

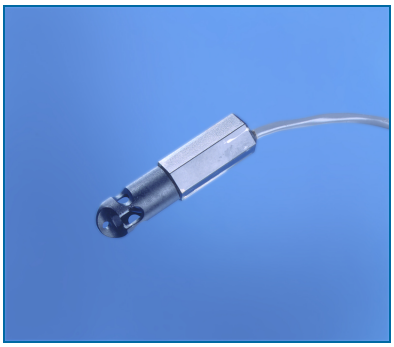
- Put the end of the sensor fully into *TAP water* for at least two (2) minutes.
- This should cause controller alarms or events associated with the water detector portion of the sensor.

To clean the polymer of hydrocarbon contamination:

- Make sure the sensor is disconnected.
- Put the contaminated portion of the sensor fully into *Denatured Alcohol* and let stand for one (1) hour.
- Flush the sensor with water to remove any residue.
- Let the sensor settle for one (1) hour.
- Reconnect the sensor.
- The sensor will return to its original resistance.

9.5 Discriminating Interstitial Sensor (Optical) – Smart Sensor Equipped with Intellisense Technology

30-0236-LW



Description

The Discriminating Interstitial optical liquid sensor is used primarily to monitor the interstitial area of double-walled tanks. This sensor incorporates a long-life, solid-state optical prism and can also be used in sumps, dispenser pans and other locations where the presence of a liquid could indicate that a leak has occurred.

The sensor distinguishes between water and hydrocarbons. Detection of liquid will cause an alarm condition.The system will also cause an alarm condition in the event of a break in the cable or sensor malfunction.

Specifications	
Primary Use:	Liquid detection in the interstitial space of double-walled tanks.
Alternate Use(s):	Dispenser Pans and STP Sumps
Detects:	Liquids: Hydrocarbon and Water
Operating Temperature:	-40°C to +70°C (-40°F to 158°F)
Dimensions:	Length: 8.2 cm (3.22 in.), Width: 2.8 cm x 1.6 cm (1.1 in. x .62 in.)
Nominal resistance (uncontaminated)	1K – 5K ohms
Nominal resistance (contaminated)	30K – 200K ohms
Cable:	Belden #88760 or Alpha #55371 4.5 m (15 feet) of gas & oil resistant cable to 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 from 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),

Specifications	
	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: *Maximum Wiring Length is the maximum length of cable to be used to connect all sensors on an individual channel. This length includes run of cable from VSmart to each sensor board in the string.

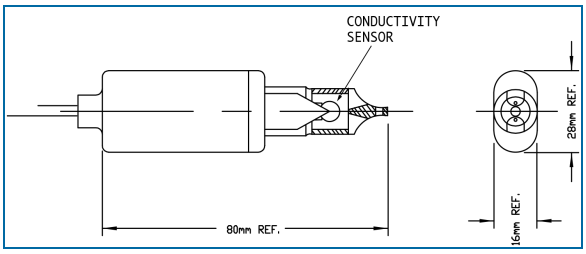


Figure 9-1 30-0236-LW Dimensions

Installation

NOTE: To ensure safe operating conditions the sensor has been designed to connect to OPW Tank Gauges Smart Sensor 12V IS Module ONLY. Smart sensors CANNOT be used with SS1, 2 or 3, iTouch or any EECO consoles.

CAUTION: ALWAYS observe Local and National Electrical Codes for installation location.

Ensure the cabling (gas and oil resistant FMS part # 12-1030) back to the controller is in conduit that is dedicated to intrinsically safe wiring.

Use wire nuts and seal pack for field connection.

- This sensor requires ONE Controller Interface Module position
- Begin with the “Typical Installation" drawing.
- Measure the length of the annular space-monitoring pipe from top to bottom and subtract 1.3 cm (0.5 in.) for a total measurement to be used for sensor placement.
- Measure the calculated length from the sensor tip along the sensor cable and mark with tape or a marker.
- Feed the sensor into the monitoring pipe until the tape mark is even with the top of the pipe.

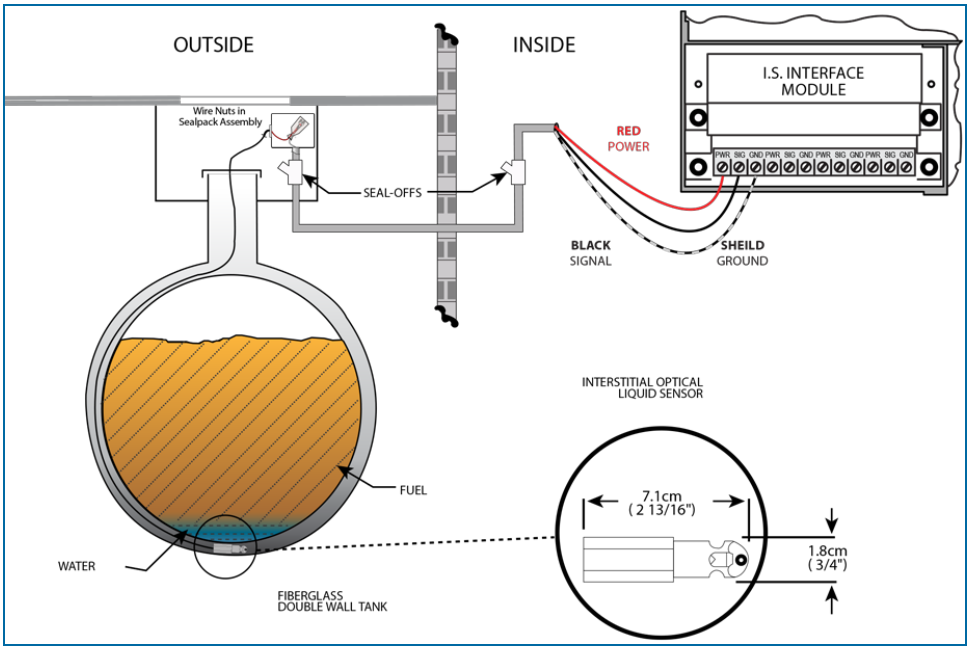
IMPORTANT: To prevent false alarms, the sensor should not touch the bottom of the monitoring tube

- 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 detaied instruction).
- Install seal-offs at both ends of the conduit run.

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

- On the console, the sensor should be **Auto Detected** (see the console configuration manual). Alarm thresholds are configured automatically through the *Intellisense* mechanism between the sensor and the console.

Testing the Optical Sensor

CAUTION: When working in the hazardous area use caution to avoid a hazardous situation.

When conducting testing or decontamination of the sensor work in a well ventilated area with no hot surfaces or open flames near by.

To test the water detection of the sensor:

- Put the sensor fully into water. This should cause a water alarm condition in the controller.
- Remove the sensor from the water. Check that the controller is no longer in alarm.

To test the hydrocarbon liquid detection of the sensor:

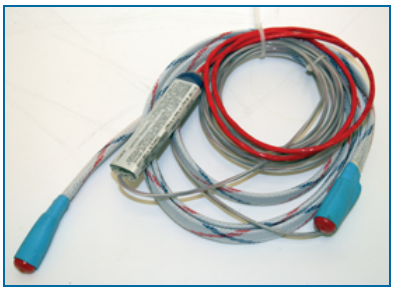
- Put the sensor fully into a non-conductive hydrocarbon (or equivalent) liquid. This should cause a hydrocarbon alarm condition in the controller.
- Remove the sensor from the hydrocarbon liquid. Check that the controller is no longer in alarm.

TIP: This sensor can be wiped clean and does not require any recovery time before being put back into active service again.

NOTE: If the controller fails to go into alarm, check all wiring and junction boxes to verify continuity without shorts. Any sensor or wiring fault will trigger a system alarm.

9.6 Hydrocarbon Liquid Sensor with Water Indicator

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



Description

The Hydrocarbon Liquid/Water Sensor (available in lengths of 6 feet [1.8 m], 15 feet [4.6 m] and 20 feet [6.1 m]), is used primarily for monitoring wet wells with fluctuating groundwater tables. This sensor uses a carbon/polymer material that changes its resistance when exposed to liquid hydrocarbons.

A water sensor is also used that relies on the conductivity of water to detect its presence. This functionality lets the sensor discern between hydrocarbon liquid and water.

The sensor will alert the system to the absence of ground water in a monitoring well or the presence of water in containment areas. It will also alert the system of any fuel leaks into the containment area. In the event of a break in the cable or sensor malfunction, the system will also result in an alarm condition.

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)	1,000 – 3,000 ohms/ft
Nominal resistance (contaminated)	30,000 – 200,000 ohms/ft
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: *Maximum Wiring Length is the maximum length of cable to be used to connect all sensors on an individual channel. This length includes run of cable from the console to each sensor board in the string.

Installation

NOTE: To ensure safe operating conditions the sensor has been designed to connect to OPW Tank Gauges Smart Sensor 12V IS Module ONLY. Smart sensors CANNOT be used with SS1, 2 or 3, iTouch or any EECO consoles.

CAUTION: ALWAYS observe Local and National Electrical Codes for installation location.

Ensure the cabling (gas and oil resistant FMS part # 12-1030) back to the controller is in conduit that is dedicated to intrinsically safe wiring.

Use wire nuts and seal pack for field connection.

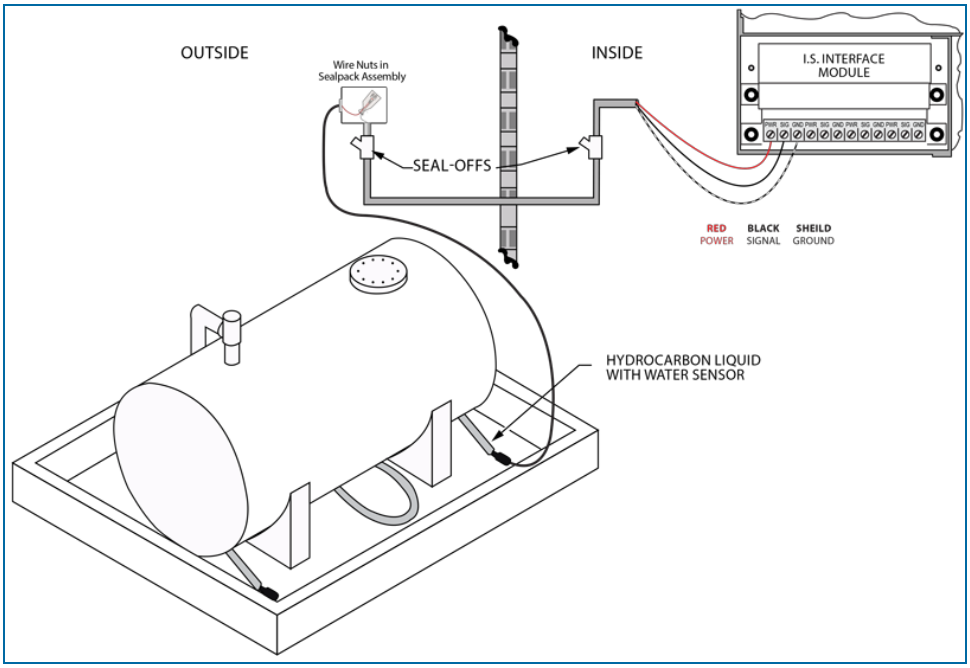
REMINDER: Hydrocarbons float on water. If the sensor is fully submerged in water, the polymer is unable to detect hydrocarbon liquid.

- This sensor requires ONE (1) Controller Interface Module position
- Begin with the “Typical Installation" drawing
- 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 detaied instruction).
- Install seal-offs at both ends of the conduit run.

Connections

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

Typical Installation Drawing



Controller Setup

- On the console, the sensor should be **Auto Detected** (see the console configuration manual). Alarm thresholds are configured automatically through the *Intellisense* mechanism between the sensor and the console.

Testing the Hydrocarbon Liquid/Water Sensor Float

CAUTION: When working in the hazardous area use caution to avoid a hazardous situation.

When conducting testing or decontamination of the sensor work in a well ventilated area with no hot surfaces or open flames near by.

Testing the Hydrocarbon Liquid Sensor Portion

- 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.
- This should cause controller alarms or events associated with the hydrocarbon portion of the sensor.
- Disconnect the hydrocarbon portion of the sensor. This should cause an alarm condition.
- Reconnect the hydrocarbon portion of the sensor and then short across the leads.
  This should NOT cause an alarm condition.
- If the open lead and/or short lead test fail, check all wiring and junction boxes to make sure of continuity without shorts.

Testing the Water Sensor Portion

- Put just the end of the sensor into *tap water*. This should cause controller alarms or events associated with the water portion of the sensor.
- Disconnect the water portion of the sensor. This should NOT cause an alarm condition.
- Short this portion of the sensor. This should cause an alarm condition.

If the controller fails to detect alarm conditions simulated here, check that the thresholds programmed in the system are correct. A sensor or wiring fault will cause an alarm condition.

Cleaning the Hydrocarbon Sensor Portion

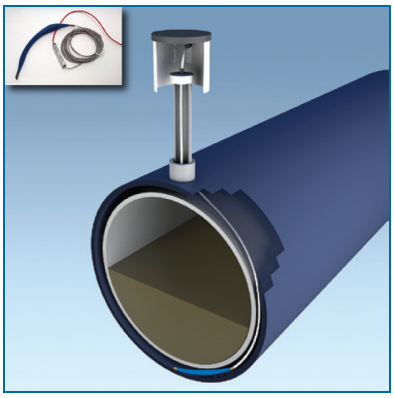
It might be necessary to periodically clean hydrocarbon contamination from the sensor from testing or actual use.

- 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 any residue.
- Let the sensor "settle" for one (1) hour.
- Reconnect the sensor.

NOTE: The sensor should return to nearly its original resistance, however, it might be necessary to readjust the controller's thresholds.

9.7 Interstitial Hydrocarbon Liquid Sensor with Water Indicator

30-0234-HW-01



Description

The Interstitial Hydrocarbon Liquid/Water Sensor is designed for use in the interstitial area of a fiberglass double-walled tank. The hydrocarbon liquid/water sensor uses a carbon/polymer material that changes its resistance when exposed to liquid hydrocarbons.

A conductive strip is also used to detect the presence of water. This functionality lets the sensor discern between hydrocarbon liquid and water.

In the event of a break in the cable, the system will activate the alarm.

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)	1,000 – 3,000 ohms
Nominal resistance (contaminated)	10,000 – 200,000 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: *Maximum Wiring Length is the maximum length of cable to be used to connect all sensors on an individual channel. This length includes run of cable from I.S. Barrier to each sensor board in the string.

Installation

CAUTION: ALWAYS observe Local and National Electrical Codes for installation location.

Ensure the cabling (gas and oil resistant FMS part # 12-1030) back to the controller is in conduit that is dedicated to intrinsically safe wiring.

Use wire nuts and seal pack for field connection.

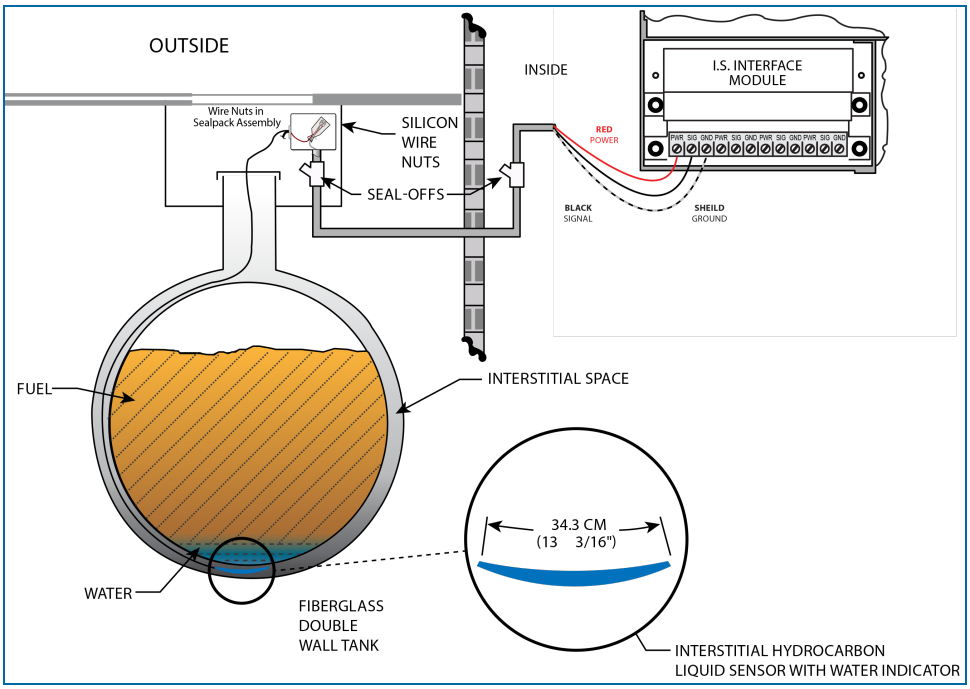
REMINDER: Hydrocarbons float on water. If the sensor is fully submerged in water, the polymer is unable to detect hydrocarbon liquid.

- This sensor requires ONE (1) Controller Interface Module position
- Begin with the “Typical Installation" drawing
- 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 detaied instruction).
- Install seal-offs at both ends of the conduit run.

Connections

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

Typical Installation Drawing



Controller Setup

- On the console, the sensor should be **Auto Detected** (see the console configuration manual). Alarm thresholds are configured automatically through the *Intellisense* mechanism between the sensor and the console.

Testing and Decontaminating the Interstitial Hydrocarbon Liquid Sensor with Water Indicator

CAUTION: When working in the hazardous area use caution to avoid a hazardous situation.

When conducting testing or decontamination of the sensor work in a well ventilated area with no hot surfaces or open flames near by.

Testing the Hydrocarbon Liquid Sensor Portion

- 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.
- This should cause controller alarms or events associated with the hydrocarbon portion of the sensor.
- Disconnect the hydrocarbon portion of the sensor. This should cause an alarm condition.
- Reconnect the hydrocarbon portion of the sensor and then short across the + (positive) and terminals. This should NOT cause an alarm condition.
- If the open lead and/or short lead test fail, check all wiring and junction boxes to make sure of continuity without shorts.

Testing the Water Sensor Portion

- Put just the end of the sensor into *tap water*. This should cause controller alarms or events associated with the water portion of the sensor.
- Disconnect the water portion of the sensor. This should NOT cause an alarm condition.
- Reconnect the water sensor, and then short across the +12 and SIGNAL terminals. This should cause an alarm condition.
- If the open lead and/or short lead test fail, check all wiring and junction boxes to make sure of continuity without shorts.

If the controller fails to detect alarm conditions simulated here, check that the thresholds programmed in the system are correct. A sensor or wiring fault will cause an alarm condition.

Cleaning the Hydrocarbon Sensor Portion

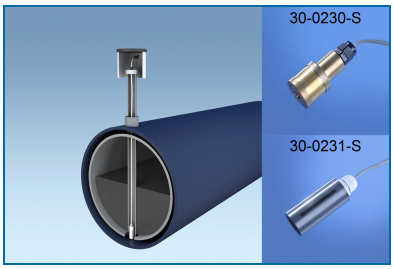
It might be necessary to periodically clean hydrocarbon contamination from the sensor from testing or actual use.

- 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 any residue.
- Let the sensor "settle" for one (1) hour.
- Reconnect the sensor.

NOTE: The sensor should return to nearly its original resistance, however, it might be necessary to readjust the controller's thresholds.

9.8 Interstitial Level Sensor – Smart Sensor Equipped with Intellisense Technology

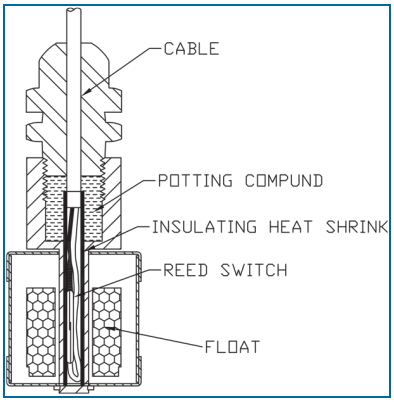
30-0230-S & 30-0231-S



Description

These two types of interstitial level sensors are used primarily in the interstitial area of a double walled tank. The sensors have a float switch that activates in the presence of a liquid. The 30-0230-S is constructed from brass and the 30-0321-S is constructed from chemical resistant, non-metallic material.

These sensors can also be used in sumps, dispenser pans and other locations where the presence of a liquid could indicate that a leak has occurred. Combined with a vapor sensor, this interstitial sensor can be used to monitor wet wells to ensure that a liquid is normally present. In the event of a break in the cable the system will activate an alarm.



Specifications	
Primary Use:	30-0230-S: STP Sumps and Dispenser Pans 30-0231-S: Interstitial Area
Alternate Use:	30-0230-S: Steel Tank Interstitial 30-0231-S: Sumps and Dispenser Pans
Detects:	Liquid
Operating Temperature:	–20°C to +50°C (–4°F to +122°F)
Dimensions - 30-0231-S	Diameter: 1.3 inches (3.4cm), Length: 3.9 inches (10 cm)
Cable Requirements:	Belden #88760 or Alpha #55371

Specifications	
	4.5m (15 feet) of gas & oil resistant cable to inline ISIM + 1.3m (4 feet) ISIM tail.
Maximum Wiring Length*:	1,000’ (305 m) field wiring
Alarm Threshold Configuration:	Fully Automatic
Diagnostic Reading from 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

Installation

NOTE: To ensure safe operating conditions the sensor has been designed to connect to OPW Tank Gauges Smart Sensor 12V IS Module ONLY. Smart sensors CANNOT be used with SS1, 2 or 3, iTouch or any EECO consoles.

CAUTION: ALWAYS observe Local and National Electrical Codes for installation location.

Ensure the cabling (gas and oil resistant FMS part # 12-1030) back to the controller is in conduit that is dedicated to intrinsically safe wiring.

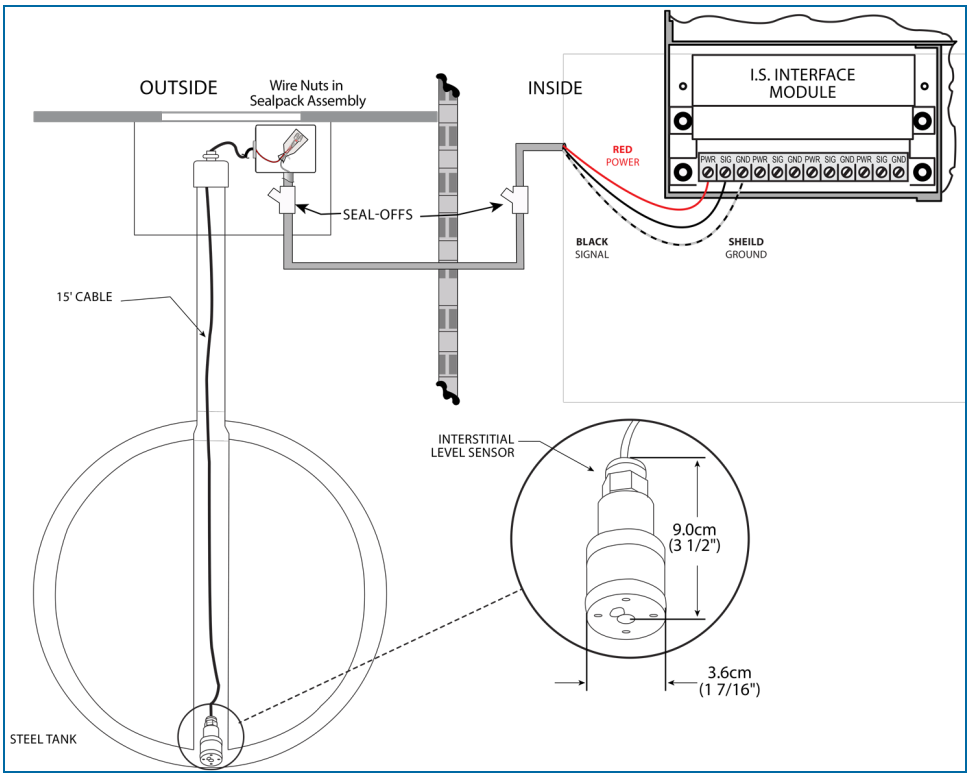
Use wire nuts and seal pack for field connection.

- This sensor requires ONE Controller Interface Module position
- Begin with the Connections table and “Typical Installation" drawing below.
- Make sure the sump/pan is dry.
- Position the sensor approximately 1/2” (1.3 cm) above the bottom of the sump/pan and secure the sensor wire to an existing pipe or bracket with a tie wrap.
- 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 detailed instruction).
- Install seal-offs at both ends of the conduit run.

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

- On the console, from the Home\Settings\Probe and Sensor screen the sensor should be Auto Detected (see the console configuration manual). Alarm thresholds are configured automatically through the *Intellisense* mechanism between the sensor and the console.

Testing the Float Sensor

When working in the hazardous area use caution to avoid a hazardous situation.

When conducting testing or decontamination of the sensor work in a well ventilated area with no hot surfaces or open flames near by.

CAUTION: When working in the hazardous area use caution to avoid a hazardous situation.

When conducting testing or decontamination of the sensor work in a well ventilated area with no hot surfaces or open flames near by.

Sensor installed in a normally dry well

- Place the float in the HIGH position. This should trigger a alarm in the controller.
- Return the float to the LOW position and check that the controller is no longer in alarm.

Sensor installed in a normally wet well

- Place the float in the LOW position. This should trigger an alarm in the controller.
- Return the float to the HIGH position and check that the controller is no longer in alarm.

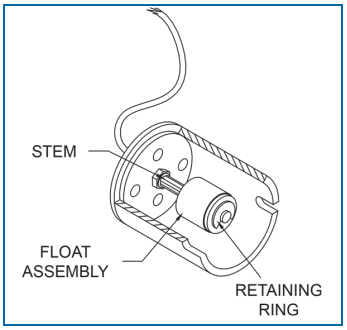
If the controller fails to go in to alarm, check that the thresholds programmed in the system are correct. Check the orientation of the float as described earlier. A sensor or wiring fault will trigger a system alarm. Check all wiring and junction boxes to ensure continuity without shorts.

9.9 Single Level Sump Sensor – Smart Sensor Equipped with Intellisense Technology

30-0231-L

Description

The single-level sensor is designed to detect the presence of liquid in sumps, dispenser pans and other locations where the presence of a liquid could indicate that a leak has occurred.. The sensor contains a float switch that activates in the presence of liquid. In the event of a break in the cable, the system will activate the alarm.



Specifications	
Primary Use(s)	Sumps and 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 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 from sensor setup:	**0 to 5** (normal), **485 to 495** (in alarm)
Multi-Drop Restriction:	See Mixed Multi-drop Installation
Connections:	Red = Power, Black = Signal, Shield = Ground

NOTE: *Maximum Wiring Length is the maximum length of cable to be used to connect all sensors on an individual channel. This length includes run of cable from the console to each sensor board in the string.

Installation

NOTE: To ensure safe operating conditions the sensor has been designed to connect to OPW Tank Gauges Smart Sensor 12V IS Module ONLY. Smart sensors CANNOT be used with SS1, 2 or 3, iTouch or any EECO consoles.

CAUTION: ALWAYS observe Local and National Electrical Codes for installation location.

Ensure the cabling (gas and oil resistant FMS part # 12-1030) back to the controller is in conduit that is dedicated to intrinsically safe wiring.

Use wire nuts and seal pack for field connection.

NOTE: If monitoring a normally dry well, use a meter to set the float so the sensor is in the closed state with NO liquid present (float in the lower position). If monitoring a normally wet well, use a meter to set the float so that it is in the closed state WITH liquid present (float in the upper position).

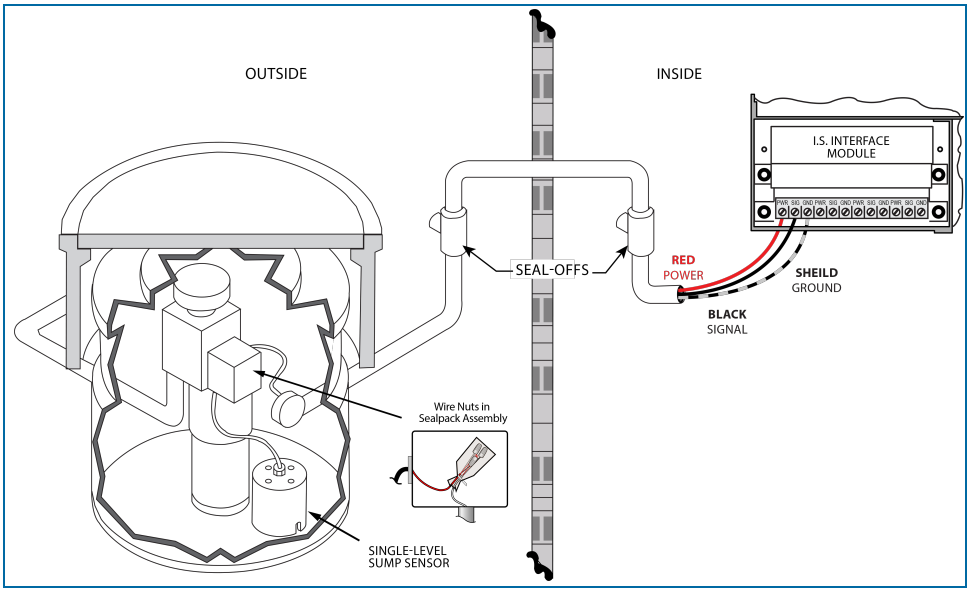
- This sensor requires ONE Controller Interface Module position
- Begin with the “Typical Installation" drawing.
- Make sure the sump/pan is dry.
- Position the sensor on the bottom of the sump/pan and secure the sensor wire to an existing pipe or bracket with a tie wrap.
- Connect the sensor wires to 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 detaied instruction).
- Install seal-offs at both ends of the conduit run.

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

- On the console, from the Home\Settings\Probe and Sensor screen the sensor should be Auto Detected (see the console configuration manual). Alarm thresholds are configured automatically through the *Intellisense* mechanism between the sensor and the console.

Testing the Float Sensor

CAUTION: When working in the hazardous area use caution to avoid a hazardous situation.

When conducting testing or decontamination of the sensor work in a well ventilated area with no hot surfaces or open flames near by.

- Invert the sensor and wait for at least 2 minutes.
- Check to see if the sensor has entered an alarm state.
- Return the sensor to its normal position.
- The alarm condition should stop.

If the controller fails to go in to alarm, check that the thresholds programmed in the system are correct. A sensor or wiring fault will cause an alarm condition. Check all wiring and junction boxes to make sure of continuity without shorts.

9.10 Dual-Level Liquid Sump Sensor – Smart Sensor Equipped with IntelliSense™ Technology

30-0232-D-10 & 30-0232-D-20

Description

IMPORTANT: This float body is identical to the 30-0232-D-10B & D-20B and 30-0232-DH-10 & DH-20 (DH-XX has a carbon-polymer strip in the base). Check the label to make sure you are using the correct sensor for the intended purpose.

The dual level sump sensor is designed to detect the presence of liquid hydrocarbons and water in sumps, dispenser pans and other locations where the presence of a liquid could indicate that a leak has occurred. This sensor is similar to the 30-0232-DH-XX but is NON-DISCRIMINATING (i.e. the sensor does NOT contain a carbon/polymer material to sense liquid hydrocarbons). The DH-10 is intended for use on dispenser pans and transition sumps, the DH-20 is intended for use in tank sumps. Dual float switches are incorporated into the body to detect low and high levels. In the event of a break in the cable, the system will activate the alarm.

Specifications	
Primary Use(s):	D-10: Dispenser Pan/Sump D-20: STP Sumps
Alternate Uses:	D-10: STP Sumps D-20: Dispenser Pan/Sump
Detects:	Low Liquid, High Liquid, Fuel (non-discriminating)
Operating Temperature:	-40°C to +70°C (-40°F to 158°F)

Specifications	
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 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 from 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: *Maximum Wiring Length is the maximum length of cable to be used to connect all sensors on an individual channel. This length includes run of cable from VSmart to each sensor board in the string.

Installation

NOTE: To ensure safe operating conditions the sensor has been designed to connect to OPW Tank Gauges Smart Sensor 12V IS Module ONLY. Smart sensors CANNOT be used with SS1, 2 or 3, iTouch or any EECO consoles.

CAUTION: ALWAYS observe Local and National Electrical Codes for installation location.

Ensure the cabling (gas and oil resistant FMS part # 12-1030) back to the controller is in conduit that is dedicated to intrinsically safe wiring.

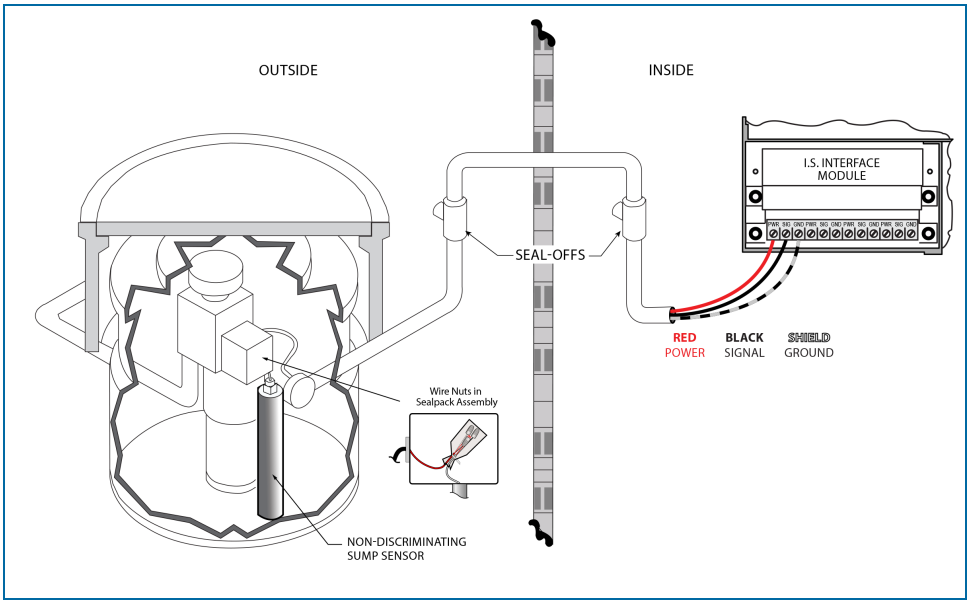
Use wire nuts and seal pack for field connection.

- This sensor requires ONE Controller Interface Module position
- Begin with the “Typical Installation" drawing.
- Make sure the sump/dispenser pan is dry.
- Position the sensor so that it is touching the bottom of the sump/dispenser 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 detaied instruction).
- Install seal-offs at both ends of the conduit run.

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

- On the console, from the Home\Settings\Probe and Sensor screen the sensor should be Auto Detected (see the console configuration manual). Alarm thresholds are configured automatically through the *Intellisense* mechanism between the sensor and the console.

Testing the Float Sensor

Sensor installed in a normally dry well

- Place the float in the high position. This should cause an alarm condition in the controller.
- Return the float to the low position and check that the controller is no longer in alarm.

Sensor installed in a normally wet well

- Place the float in the low position. This should cause an alarm condition in the controller.
- Return the float to the upper position and check that the controller is no longer in alarm.

If the controller fails to go in to alarm please check that the thresholds programmed in the system are correct. Check the orientation of the float as described earlier. A sensor or wiring fault will trigger a system alarm. Check all wiring and junction boxes to ensuring continuity without shorts.

Testing / Decontaminating the Hydrocarbon Sensor

CAUTION: When working in the hazardous area use caution to avoid a hazardous situation.

When conducting testing or decontamination of the sensor work in a well ventilated area with no hot surfaces or open flames near by.

To test the hydrocarbon liquid portion of the sensor:

- Immerse the polymer in *Mineral Spirits* and wait approximately 10 minutes.
- Remove the sensor and let it hang in air for another 10 minutes.
- Any controller alarms or events associated with the hydrocarbon portion of the sensor should have been triggered.

To test the water detector of the sensor:

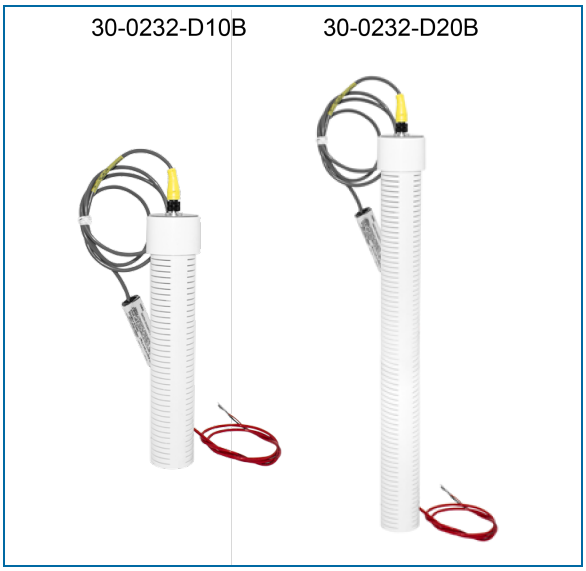
- Immerse the end of the sensor in *TAP water* for at least 2 mins.
- Any controller alarms or events associated with the water detector portion of the sensor should have been triggered.

To clean the polymer of hydrocarbon contamination:

- Immerse the contaminated portion in *Denatured Alcohol* and leave for one (1) hour.
- Flush the sensor with water to remove any residue.
- Let the sensor settle for one (1) hour.
- The sensor should return close to its original resistance.

9.11 Dual Float Brine Sensor

30-0232-D-10B and 30-0232-D-20B



Description

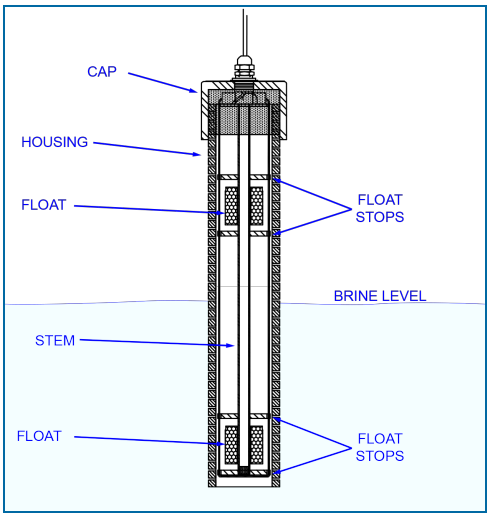
IMPORTANT: This float body is identical to the 30-0232-D10 & D20 and 30-0232-DH-10 & DH-20. Check the label to make sure you are using the correct sensor for the intended purpose.

The dual-level reservoir sensor, either 10 inch (25cm) or 20 inch (50cm), is designed for use in the brine-filled reservoir of the interstitial area of a doubled-walled tank. This sensor contains a dual-level float switch that detects level changes of fluid in the reservoir of the tank. The sensor expects the liquid to be at a constant level midway between the upper and lower floats. The system will activate the alarm when the brine level in the interstitial space either rises or falls.

Since this sensor is not intended for detection of hydrocarbons it does not use a carbon/polymer strip.

No Carbon/Polymer Strip

Dual float switches are incorporated into the body that cause an alarm condition when low and high levels are detected. The bottom float of the brine sensor will remain in the up position in a normal condition. When in alarm, the sensor will have either triggered the upper float or the level has dropped below the bottom float.



Cutaway View of Sensor Showing Internal Floats

Specifications	
Primary Use:	Measure 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.)
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 inline ISIM + 1.3 m (4 feet) ISIM tail
Cable:	Belden #88760 or Alpha #55371 3.6 m (12 feet) of gas & oil resistant cable to 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** (lower float in alarm - down, upper float - down), **1 to 2** (upper float in alarm - lower float up, upper float up)
Multi-Drop Restriction:	See Mixed Multi-drop Installation
Connections:	Red = Power, Black = Signal, Shield = Ground

NOTE: *Maximum Wiring Length is the maximum length of cable to be used to connect all sensors on an individual channel. This length includes run of cable from VSmart to each sensor board in the string.

Installation

NOTE: To ensure safe operating conditions this sensor has been designed to connect to OPW Tank Gauges Smart Sensor 12V IS Module ONLY. Smart sensors CANNOT be used with SS1, 2 or 3, iTouch or any EECO consoles.

CAUTION: ALWAYS observe Local and National Electrical Codes for installation location.

Ensure the cabling (gas and oil resistant FMS part # 12-1030) back to the controller is in conduit that is dedicated to intrinsically safe wiring.

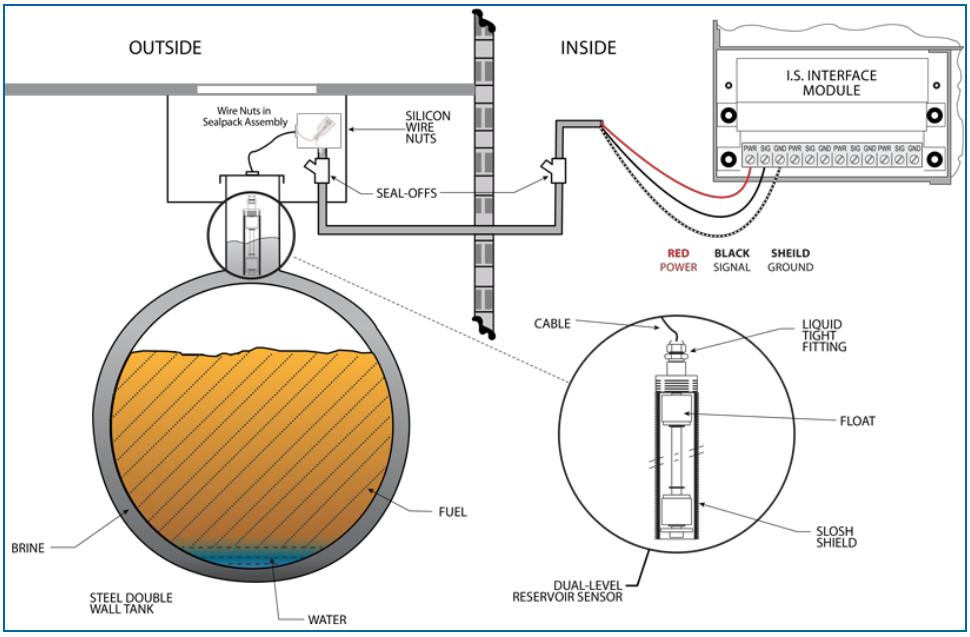
Use wire nuts and seal pack for field connection.

- This sensor requires ONE Controller Interface Module position
- Begin with the “Typical Installation" drawing.
- 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 detaied instruction).
- Install seal-offs at both ends of the conduit run.

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

- On the console, the sensor should be **Auto Detected** (see the console configuration manual). Alarm thresholds are configured automatically through the *Intellisense* mechanism between the sensor and the console.

Testing the Float Sensor

CAUTION: When working in the hazardous area use caution to avoid a hazardous situation.

When conducting testing or decontamination of the sensor work in a well ventilated area with no hot surfaces or open flames near by.

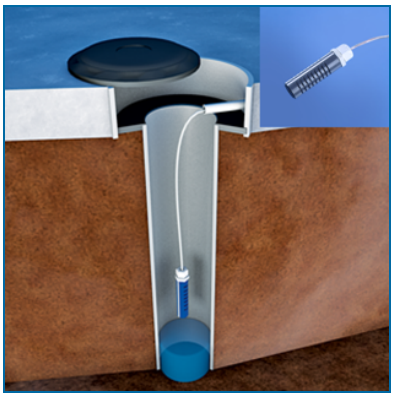
Sensor installed in an interstitial monitoring reservoir

- Place the lower-float in the low position and the upper-float in the low position. This should cause a low-level alarm condition in the controller.
- Place the lower-float in the high position and the upper-float in the high position this should cause a high-level alarm condition in the controller.
- Place the lower-float in the high position and the upper-float in the low position and check that the controller is no longer in alarm.

If the controller fails to go in to alarm, check that the thresholds programmed in the system are correct. Check the orientation of the float as described earlier. A sensor or wiring fault will trigger a system alarm. Check all wiring and junction boxes to ensuring continuity without shorts.

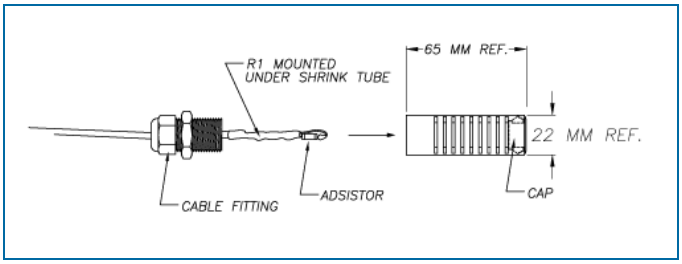
9.12 Hydrocarbon Vapor Sensor

30-0235-V



Description

The hydrocarbon vapor sensor is designed to detect hydrocarbon vapors in monitoring wells and the interstitial areas of a double-walled tank. The presence of these vapors could indicate a potentially dangerous leak that could lead to safety and environmental problems. The sensor is made from a long-life resistive element that increases dramatically in resistance in the presence of hydrocarbon vapors. After the vapors have dissipated, the sensor returns to normal and is ready to detect hydrocarbon vapors again. In the event of a break in the cable, the system will activate the alarm.



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)	Uncontaminated: 3,000 - 5,000 ohms
Nominal resistance (contaminated)	Contaminated: 10,000 - 200,000 ohms
Cable:	Belden #88760 or Alpha #55371

Specifications	
	12 feet (3.6m) of gas & oil resistant cable to inline ISIM + 4 feet (1.3m) ISIM tail.
Maximum Wiring Length*:	305 m (1,000 ft.) field wiring
Alarm Threshold Configuration:	Fully Automatic
Diagnostic Reading from 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: *Maximum Wiring Length is the maximum length of cable to be used to connect all sensors on an individual channel. This length includes run of cable from VSmart to each sensor board in the string.

Installation

CAUTION: ALWAYS observe Local and National Electrical Codes for installation location.

Ensure the cabling (gas and oil resistant FMS part # 12-1030) back to the controller is in conduit that is dedicated to intrinsically safe wiring.

Use wire nuts and seal pack for field connection.

NOTE: If this sensor becomes fully immersed in water it will NOT be able to detect hydrocarbon vapor.

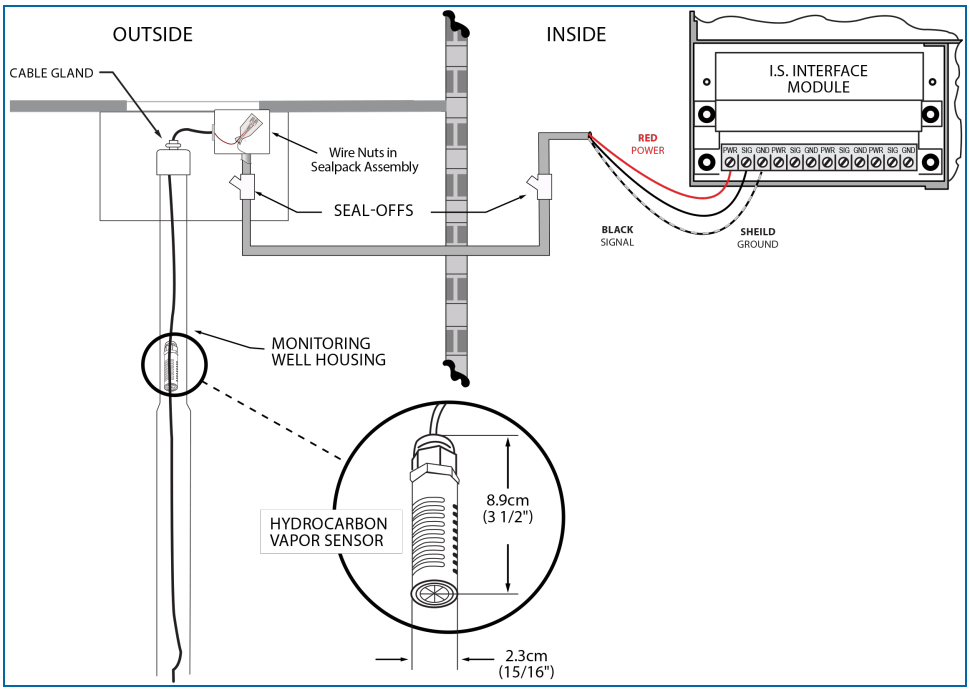
- This sensor requires ONE Controller Interface Module position
- Begin with the “Typical Installation" drawing.
- Check Dry Monitoring Wells for vapors before installing.
- Mount the sensor close to the top, above the water level, if applicable (if the sensor is submerged in water it will not function).
- 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 detaied instruction).

- Install seal-offs at both ends of the conduit run.

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

- On the console, the sensor should be **Auto Detected** (see the console configuration manual). Alarm thresholds are configured automatically through the *Intellisense* mechanism between the sensor and the console.

Testing the Hydrocarbon Vapor Sensor

CAUTION: When working in the hazardous area use caution to avoid a hazardous situation.

When conducting testing or decontamination of the sensor work in a well ventilated area with no hot surfaces or open flames near by.

- Place the sensor in the air space of a container filled halfway with Mineral Spirits.
- Wait approximately 10 minutes. This should cause an alarm condition in the controller.
- If the controller fails to go into alarm, check that the thresholds programmed in the system are correct. A sensor or wiring fault will trigger a system alarm. Check all wiring and junction boxes to ensure continuity without shorts.

Cleaning the Hydrocarbon Vapor Sensor

- Put the sensor fully into Denatured Alcohol for one (1) hour.
- Remove the sensor and let it set to dry for one (1) hour.
- The sensor should return close to its original resistance (it may be necessary to re-adjust the controller's thresholds)

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 - Model 924B 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

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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+11:2013 EN 60079-11: 2012 EN 60079-26: 2007
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: 30 March 2016

Nicole Chavez
Engineering Compliance Technician

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: 2007
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 2016

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 Capacity	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 AssociatesTel: (816) 443-2494
Date of Evaluation: 08/03/2013

Appendix E - Pro Gauge Probe Installation

For sites that will use ProGauge XMT-SI-485 or XMT-SI-RF probes, follow the installation instructions in this section.

IMPORTANT: ProGauge probes cannot be connected to the internal I.S. barrier of the OPW-FMS SiteSentinel NANO. The XMT-SI-485 probe must be connected to either a MagDirect active or passive I.S. barrier device that will communicate with the NANO through an RS485 serial connection. The XMT-SI-RS 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.

Any failure or faulty operation of this equipment should be referred to authorized personnel for maintenance or, contact the manufacturer directly.

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

IMPORTANT: Please refer to "Installer Safety" on page 11 for important safety information related to installation of this equipment.

Technical Characteristics

XMT-SI-485

- Power supply 12 VDC through an intrinsically safe barrier
- Consumption < 15 mA @ 12 Vdc normal function
- Consumption < 200 uA @12 Vdc in sleep mode
- Connection cable: hydrocarbons resistant, suitable for underground pose with insulation 0,6-1KV, 2 shielded and twisted pairs, section of the power cable pair of at least 1mm2.
- Type of cable supplied: LiYstCYY INSULATION LEVEL 4 (0,6/1KV) - (4x0.50mm²) + CEI 20-22II IEC 60332-3A ENI 00.181.00.
- Maximum transmission distance: up to 2 Km based on standard of RS485 interface.

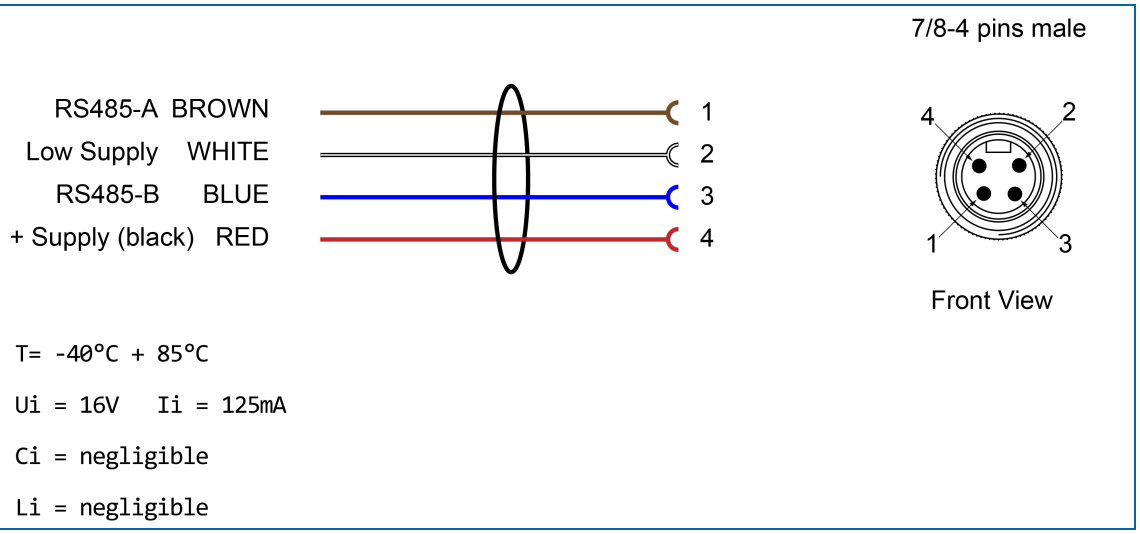
XMT-SI-RF

- 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.
- Tank connection:
  - Not needed if probe is inserted into a riser with internal diameter 2”
  - 2” sliding connection (optional).
  - Other type of optional connections under request (nippled fixed, flanged, …)
- 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)

Connector Wiring



T= -40°C + 85°C

Ui = 16V Ii = 125mA

Ci = negligible

Li = negligible

The serial number is applicable to each probe and is used as the probe address for configuration in the console. See "XMT-SI-485 DIP-Switch Settings" on page 110 for more information.

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.

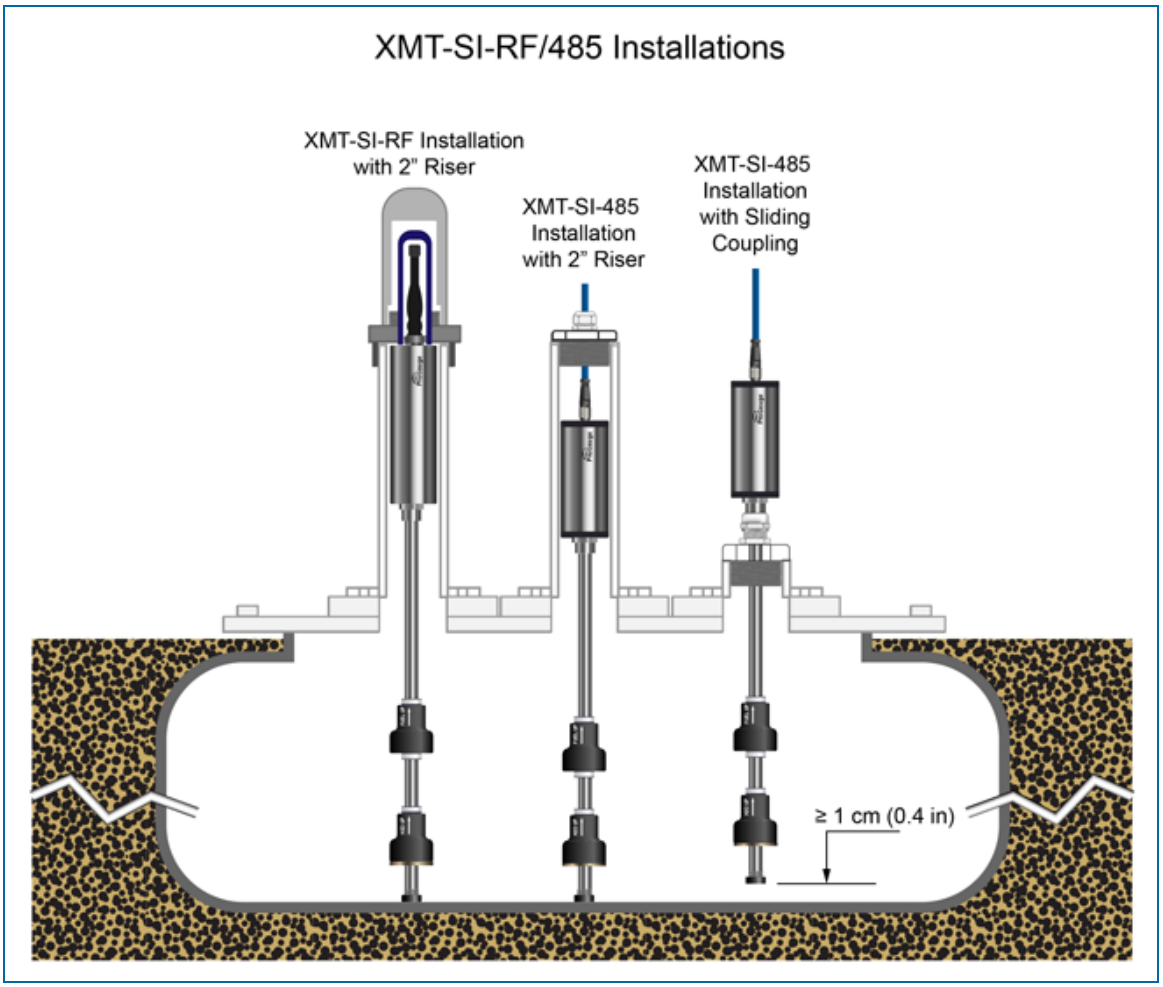
The standard version of the XMT-SI probe is supplied with a sliding 2 inch gas "M" fitting. This fitting is not supplied when the installation occurs in a protection riser.

The probe assembly with the sliding 2 inch gas "M" fitting and floats can be easily put through the 2 inch tank opening without dis-assembly.

Probe placement: Please refer to "Probe Placement" on page 36 for instructions on probe installation location and distances from fill tubes and pumps.

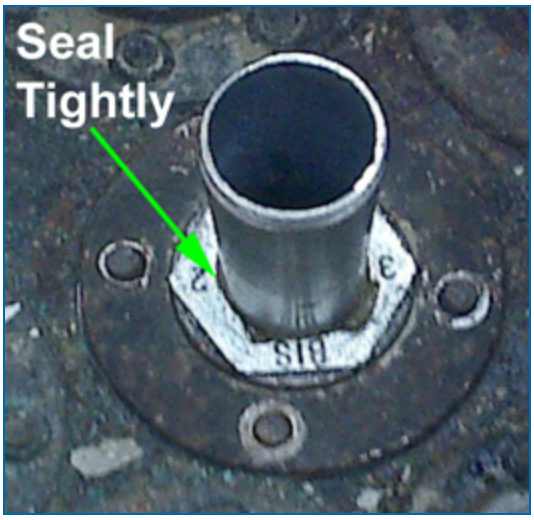
Before you install the probe, be sure the floats are positioned correctly. Make sure the plastic probe shaft end cap is correctly installed on the bottom of the probe shaft so that the floats can correctly identify water and fuel levels.

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.

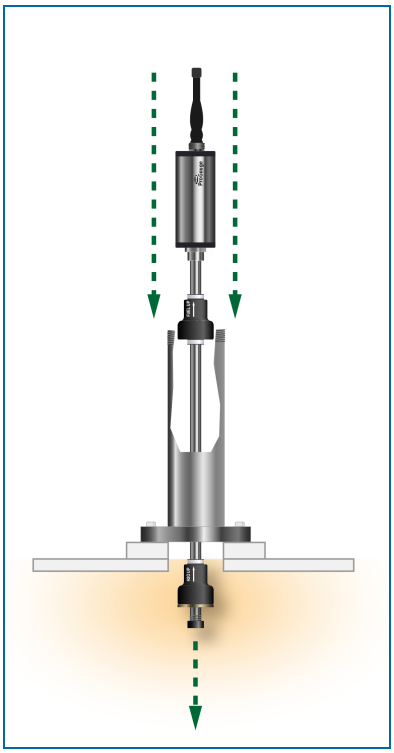


Riser Preparation for RF Probes

- 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.

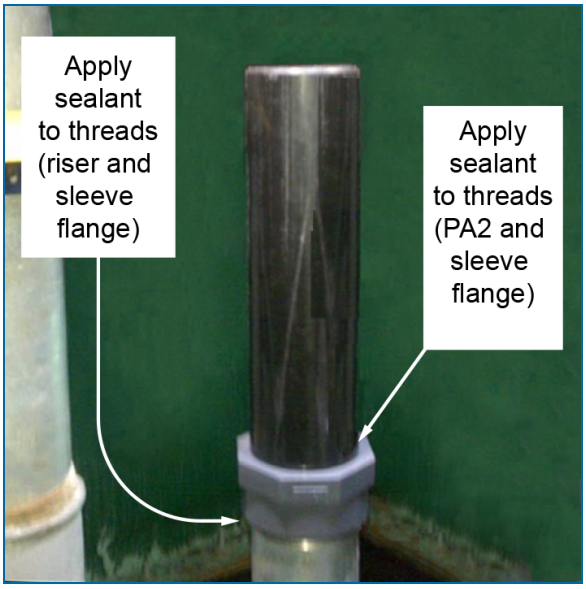


- Seal the threads at the sides of the flange with plumber's hemp and sealant to make a tight seal.



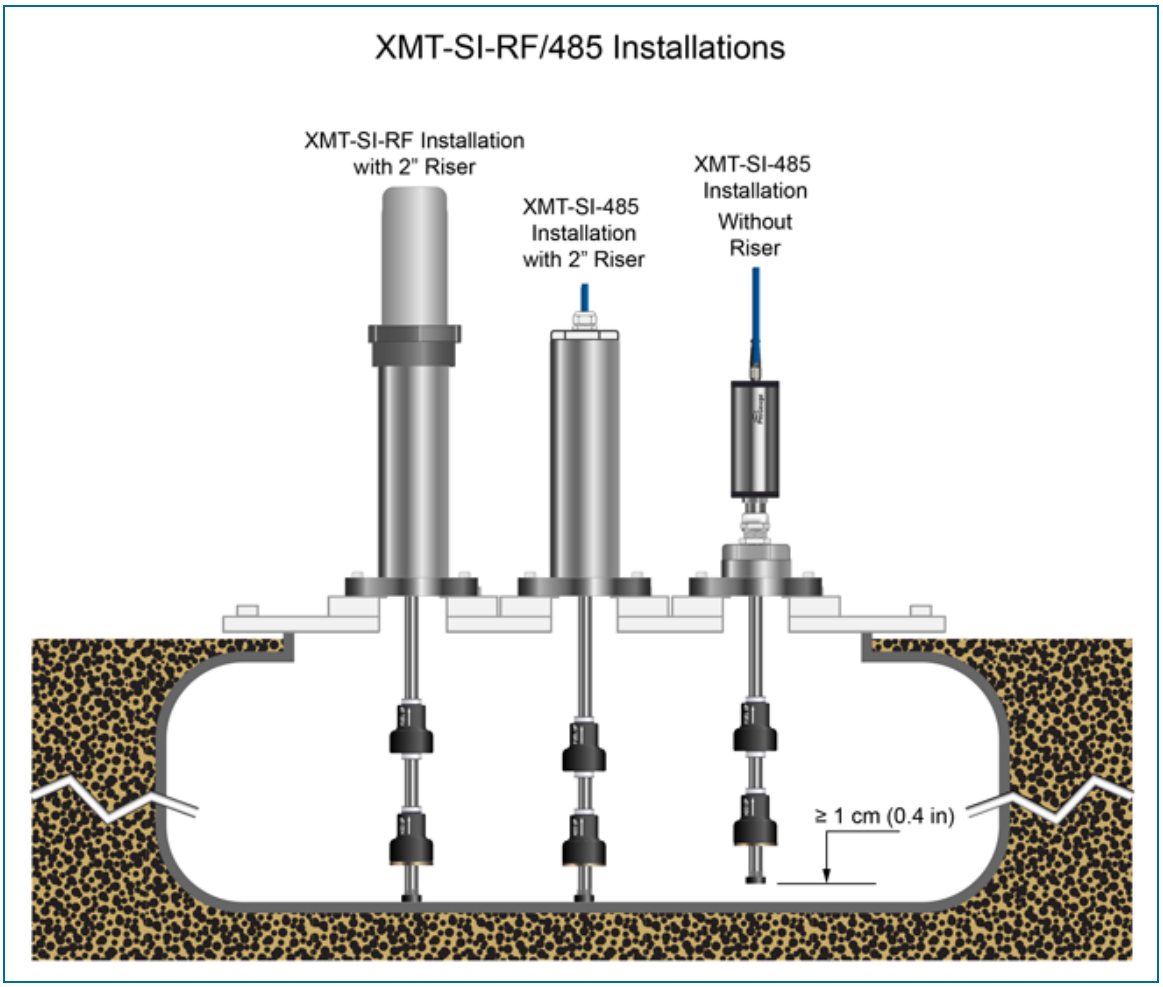
- Carefully install the assembled probe through the riser and flange into the tank.

- Assemble the Antenna Cover.
  - Slide 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.

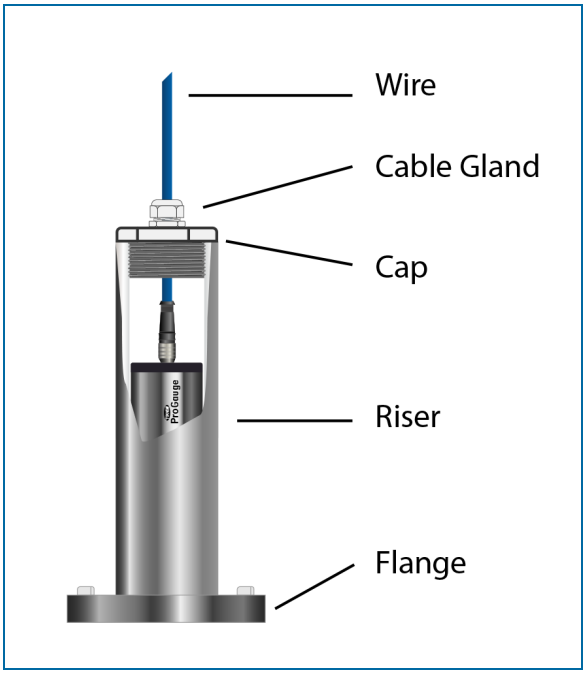


- Install the PA 2 inch protective sleeve (purchased option when the XMT-SI-RF is installed in a riser). Apply a thread sealant to the male threads of the riser and the female sleeve flange and between the male threads of the PA2 and the female sleeve flange.

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 unscrewed to gain access to the battery housing and other probe components.


XMT-SI-RF/485 Installations
XMT-SI-RF Installation with 2" Riser
XMT-SI-485 Installation with 2" Riser
XMT-SI-485 Installation Without Riser
≥ 1 cm (0.4 in)

Wired Probe Installed in a Riser



Installation is the same as for an RF probe but with the differences that follow:

- The riser must be long enough to contain the full length of the probe.
- The inside diameter of the riser must be tapped with the correct thread so that the riser cap can be tightened correctly.
- A cable gland must be installed at the top of the cap to correctly hold the wire cable.
- All components of the riser assembly must be sealed correctly so outside contamination cannot enter the tank.

Electrical Connection

WARNING: To prevent explosion or fire, it is recommended to use non-sparking tools in an environment that could contain flammable hydrocarbon vapors.

Refer to the safety instructions and procedures found in "Installer Safety" on page 11, "Probe Installation in Underground Storage Tanks" on page 37 and "Probe-Cable Seal-offs" on page 35.

- The installation should only be done by approved persons.
- Obey all safety rules and regulations.
- Read these instructions carefully.
- The manufacturer is not responsible for property damage or costs related to incorrect installation.

The probe is supplied with 1.5 meters (5 ft) of cable connected through a 7/8" connector to the probe head. This cable must be connected to the field wiring in a junction box.

IMPORTANT: Use a junction box rated IP68 of the IP Code, International Protection Marking, IEC standard 60529 (International Electrotechnical Commission).

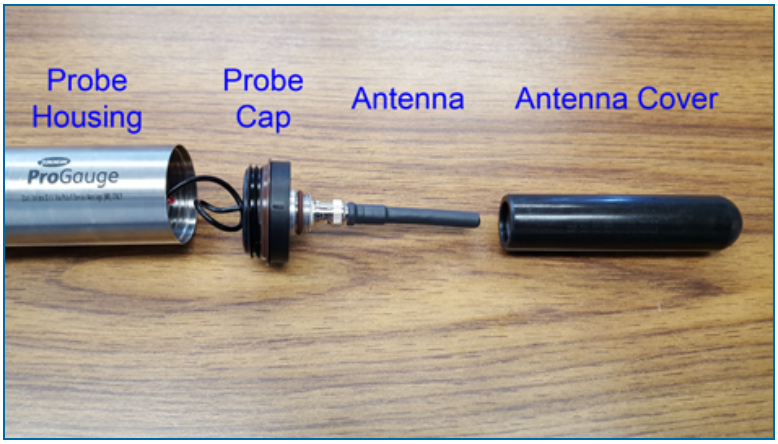
The 4 wire connection cable has red (or black)-brown-blue and white wire colors.

At the terminal box, connect wires to the same color, red to red, white to white etc.

The cable shield must be connected in parallel as a fifth wire and connected to the earth ground in the office. The ground tap must not be shared with other power systems or motors.

XMT-SI-RF Housing

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



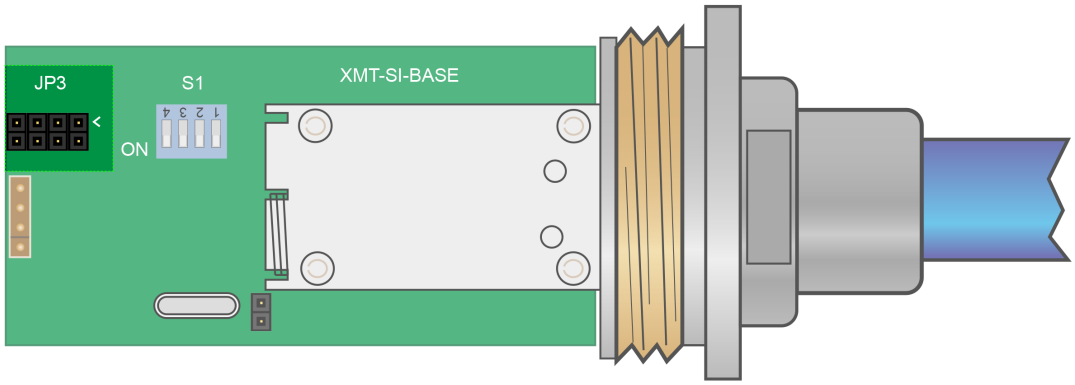
To get access to the probe's inner components (battery housing, probe board with jumper block and DIP-Switches), turn the cap counter-clockwise and carefully remove it from the housing.

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.

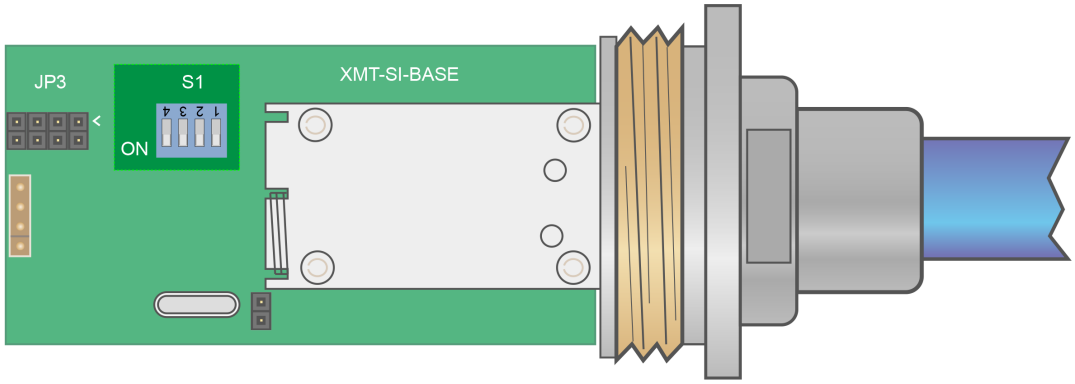


XMT-SI-RF DIP-Switch Settings

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 awakened 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 113 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

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 page 113 below.

XMT-SI-485 DIP-Switch Settings

For installations where the device address related to its serial number cannot be specified in the console memory, an address between 1 - 15 can be set in the probe DIP-Switch settings.

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.

XMT-SI-485 Address Settings

SW 1	SW 2	SW 3	SW 4	Address
OFF	OFF	OFF	OFF	Memory Address
ON	OFF	OFF	OFF	1
OFF	ON	OFF	OFF	2
ON	ON	OFF	OFF	3
OFF	OFF	ON	OFF	4
ON	OFF	ON	OFF	5
OFF	ON	ON	OFF	6
ON	ON	ON	OFF	7
---	---	---	---	
ON	ON	OFF	ON	11
OFF	OFF	ON	ON	12
ON	OFF	ON	ON	13
OFF	ON	ON	ON	14
ON	ON	ON	ON	15

Transmission Protocol

Protocol is valid only for XMT-SI-485 probes. Do not use this protocol for RF probes.

Transmission parameters:

- Speed: 9600 bps
- Parity: none
- Data bit: 8
- Stop bit: 1
- Flow control: none

When this setting is used, the probe does not go into Sleep Mode but stays in operation. All data transmission is received and answered only when a message comes in on its address.

Two (2) different replies (see the jumper settings below) are available to be compatible with earlier protocols.

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)

Command for data reading:

M[address]CrLf

Reply nr.1:
00348=0=+216=03722=0038=241
address=status=temperature in 10th of degree=product in 10th of mm=water in mm= checksum

Reply nr.2:
00348N0=+217=00682.84=00073.22=098
address=status=temperature in 10th of degree=product in mm=water in mm= checksum

Checksum calculation:
ASCII sum from the beginning up to the last one = included module 255.

Status:
0 = OK
1 probe unable to do the measure, check number of floats inserted with reference to the jumper setting, the orientation, check if the shaft is bended and if there is presence of humidity inside the probe.

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.

Certifications

Consorzio Europeo Certificazione

CE
Organismo Notificato n. 1131

[1] **CERTIFICATO DI ESAME CE DEL TIPO (All. III)**
EC-TYPE EXAMINATION CERTIFICATE (Annex III)

[2] **Apparecchio o Sistema di Protezione inteso per l'uso in atmosfere potenzialmente esplosive, Direttiva 94/9/CE**
Equipment or Protective Systems Intended for use in Potentially Explosive Atmospheres, Directive 94/9/EC

[3] **Certificato di Esame CE del Tipo numero.....:** **CEC 09 ATEX 131 Rev.4**
EC-Type Examination Certificate number **14/2010 –AET604**

[4] **Apparecchio o Sistema di Protezione.....:**
Equipment or Protective System

Codice sensore di livello magnetostrittivo con uscita seriale RS485 alimentato esternamente tipo XMT-SI-485
Codice sensore di livello magnetostrittivo con uscita RS485 alimentato esternamente e con batteria interna per memorizzazione eventi in assenza di alimentazione esterna e mancato polling dati tipo XMT-SI-485-LOG
Codice sensore di livello magnetostrittivo con uscita analogica 4-20 mA/Hart Protocol tipo XMT-SI-4-20mA
Codice sensore di livello magnetostrittivo alimentato a batteria, wireless tipo XMT-SI-RF
Codice sensore di livello di livello magnetostrittivo con uscita TTL collegato a dispositivo radio esterno certificato a sicurezza intrinseca ed alimentato a batteria, tipo XMT-SI-TTL
Code magnetostrictive sensor with serial output RS485 type XMT-SI-485
Code magnetostrictive sensor with serial output RS485 with inside battery to record events without external supply and without data polling type XMT-SI-485-LOG
Code magnetostrictive sensor with analogical output 4-20mA/Hart Protocol type XMT-SI-4-20mA.
Code magnetostrictive sensor with battery power, wireless type XMT-SI-RF
Code magnetostrictive sensor with TTL output connected to intrinsically safe external radio appliance and battery-powered type XMT-SI-TTL

Codice sensore di livello a catena reed con uscita RS485 alimentato esternamente tipo XCR-SI-485
Codice sensore di livello a catena reed con uscita RS485 alimentato esternamente e con batteria interna per memorizzazione eventi in assenza di alimentazione esterna e mancato polling dati tipo XCR-SI-485-LOG
Codice sensore di livello a catena reed con uscita analogica 4-20 mA/ Hart protocol tipo XCR-SI-4_20mA
Codice sensore di livello a catena reed alimentato a batteria con uscita RF tipo XCR-SI-RF
Codice sensore di livello a catena reed con uscita TTL collegato a dispositivo radio esterno certificato a sicurezza intrinseca ed alimentato a batteria tipo XCR-SI-TTL
Code reed chain sensor with serial output RS485 type XCR-SI-485
Code reed chain sensor with serial output RS485 with inside battery to record events without external supply and without data polling type XCR-SI-485-LOG
Code reed chain sensor with analogical output 4-20mA/Hart Protocol type XCR-SI-4-20mA.
Code reed chain sensor with battery power, wireless type XCR-SI-RF

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Code reed chain sensor with TTL output connected to intrinsically safe external radio appliance and battery-powered type XCR-SI-TTL

Codice sensore ON-OFF switch con uscita RS485 alimentato esternamente tipo XLR-SI-485
Codice sensore ON-OFF switch con uscita RS485 alimentato esternamente e con batteria interna per memorizzazione eventi in assenza di alimentazione esterna e mancato polling dati tipo XLR-SI-485-LOG
Codice sensore ON-OFF switch con uscita 4-20mA/Hart protocol opzionale tipo XLR-SI-4_20mA
Codice sensore ON-OFF switch con uscita RF alimentato a batteria tipo XLR-SI-RF
Codice sensore ON-OFF switch con uscita TTL collegato a dispositivo radio esterno certificato a sicurezza intrinseca ed alimentato a batteria tipo XLR-SI-TTL
Code ON-OFF switch sensor with serial output RS485 type XLR-SI-485
Code ON-OFF switch sensor with serial output RS485 with inside battery to record events without external supply and without data polling type XLR-SI-485-LOG
Code ON-OFF switch sensor with analogical output 4-20mA/Hart Protocol type XLR-SI-4-20mA.
Code ON-OFF switch sensor with battery power, wireless type XLR-SI-RF
Code ON-OFF switch sensor with TTL output connected to intrinsically safe external radio appliance and battery-powered type XLR-SI-TTL

[5] **Costruttore** ..... : **START ITALIANA S.r.l.**
Manufacturer

[6] **Indirizzo** ..... : **Via Pola, 6 – 20813 Bovisio Masciago (MB) - Italy**
Address

[7] **Questo apparecchio o sistema di protezione ed ogni sua variante approvata è descritto nell'allegato al presente certificato e nei documenti descrittivi in esso richiamati.**
This equipment or protective system and any acceptable variation thereto is specified in the schedule to this certificate and the documents therein referred to.

[8] **Il CEC, organismo notificato n° 1131, in conformità all'articolo 9 della Direttiva 94/9/CE del Consiglio dell'Unione Europea del 23 Marzo 1994, certifica che questa apparecchiatura o sistema di protezione è conforme ai Requisiti Essenziali di Sicurezza e Salute per il progetto e la fabbricazione di apparecchiature e sistemi di protezione destinati ad essere utilizzati in atmosfere potenzialmente esplosive, definiti nell'Allegato II della Direttiva.**
CEC, notified body No. 1131, in accordance with Article 9 of the Council Directive 94/9/EC of 23 March 1994, certifies that this equipment or protective system has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres given in Annex II to the Directive.
I risultati dell'esame e dei test sono descritti nel rapporto confidenziale elencato nella sezione 16.
The examination and test results are recorded in confidential reports listed in section 16.

[9] **La conformità ai Requisiti Essenziali di Sicurezza e Salute è assicurata dalla conformità alle:**
Compliance with the Essential Health and Safety Requirements has been assured by compliance with:
EN 1127-1: 2011; EN 60079-0: 2012; EN 60079-11: 2012; EN60079-25: 2010; EN 60079-26: 2007; EN 60079-31: 2009
Nel caso in cui tra le norme tecniche citate fossero presenti norme non armonizzate, la conformità ai Requisiti essenziali in materia di Sicurezza e Salute è comunque stata verificata.
If standards not listed in the list of Atex Harmonised Standards are used, compliance to the Essential Health and Safety Requirements is verified anyway.

Il simbolo "X" posto dopo il numero del certificato indica che l'apparecchiatura o il sistema di

OPW FUEL MANAGEMENT SYSTEMS

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[10] **protezione è soggetto a condizioni speciali per un utilizzo sicuro, specificate nell'allegato al presente certificato.**
If the sign "X" is placed after the certificate number, it indicates that the equipment or protective system is subject to special conditions for safe use specified in the schedule to this certificate.

[11] **Questo Certificato di esame CE del Tipo è relativo soltanto al progetto, agli esami ed alle prove dell'apparecchio o sistema di protezione specificato in accordo con la Direttiva 94/9/CE. Ulteriori requisiti di questa Direttiva si applicano al processo di produzione e fornitura dell'apparecchiatura o sistema di protezione. Questi requisiti non sono oggetto del presente certificato.**
This EC-Type Examination Certificate relates only to the design, examination and tests of the specified equipment or protective system in accordance to the Directive 94/9/EC. Further requirements of the Directive apply to the manufacturing process and supply of this equipment or protective system. These are not covered by this certificate.

[12] **L'apparecchiatura o sistema di protezione deve riportare i seguenti contrassegni:**
The marking of the equipment or protective system shall include the following:

II 1G Ex ia IIB T4 Ga

II 1D Ex ta IIIC T135°C Da IP66/68
FISCO Field device Exia IIC T4

Legnano, 18 02 2015

CONSORZIO EUROPEO CERTIFICAZIONE
L'ORGANO DELIBERANTE

Il Direttore Tecnico
(A. FUGAZZI)

Il Direttore Generale
(L.TIMOSSI)

ACCREDIA
L'ENTE ITALIANO DI ACCREDITAMENTO
PRD n° 114B ISP n° 071E
Membro degli Accordi di Mutuo Riconoscimento EA, IAF e ILAC
Signatory of EA, IAF and ILAC Mutual Recognition Agreement

DOVER FUELING SOLUTIONS

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[13] **ALLEGATO** – SCHEDULE

[14] **CERTIFICATO DI ESAME CE DEL TIPO n° CEC 09 ATEX 131 Rev.4**
to EC-TYPE EXAMINATION CERTIFICATE no. CEC 09 ATEX 131 Rev.4

[15] **Descrizione** – Description

Sensore Magnetostrittivo a sicurezza intrinseca:
Codice sensore di livello magnetostrittivo con uscita seriale RS485 tipo XMT-SI-485
Codice sensore di livello magnetostrittivo con uscita RS485 alimentato esternamente e con batteria interna per memorizzazione eventi in assenza di alimentazione esterna e mancato polling dati tipo XMT-SI-485-LOG
Codice sensore di livello magnetostrittivo con uscita analogica 4-20mA/Hart Protocol tipo XMT-SI-4-20mA
Codice sensore di livello magnetostrittivo alimentato a batteria, wireless tipo XMT-SI-RF
Codice sensore di livello magnetostrittivo con uscita TTL collegato a dispositivo radio esterno certificato a sicurezza intrinseca ed alimentato a batteria, tipo XMT-SI-TTL

Sensore a catena reed a sicurezza intrinseca:
Codice sensore di livello a catena reed con uscita RS485 alimentato esternamente tipo XCR-SI-485
Codice sensore di livello a catena reed con uscita RS485 alimentato esternamente e con batteria interna per memorizzazione eventi in assenza di alimentazione esterna e mancato polling dati tipo XCR-SI-485-LOG
Codice sensore di livello a catena reed con uscita analogica 4-20 mA/ Hart protocol tipo XCR-SI-4_20mA
Codice sensore di livello a catena reed alimentato a batteria con uscita RF tipo XCR-SI-RF
Codice sensore di livello a catena reed con uscita TTL collegato a dispositivo radio esterno certificato a sicurezza intrinseca ed alimentato a batteria tipo XCR-SI-TTL

Sensore ON-OFF switch a sicurezza intrinseca:
Codice sensore ON-OFF switch con uscita RS485 alimentato esternamente tipo XLR-SI-485
Codice sensore ON-OFF switch con uscita RS485 alimentato esternamente e con batteria interna per memorizzazione eventi in assenza di alimentazione esterna e mancato polling dati tipo XLR-SI-485-LOG
Codice sensore ON-OFF switch con uscita 4-20mA/Hart protocol opzionale tipo XLR-SI-4-20mA
Codice sensore ON-OFF switch con uscita RF alimentato a batteria tipo XLR-SI-RF
Codice sensore ON-OFF switch con uscita TTL collegato a dispositivo radio esterno certificato a sicurezza intrinseca ed alimentato a batteria tipo XLR-SI-TTL

Caratteristiche nominali / Dati Elettrici – Rated characteristics / Electrical data

Nel collegamento elettrico tra barriere a sicurezza intrinseca e sensori, vengono installati dei diodi. Questi hanno lo scopo di ridurre le capacità interne ad un valore trascurabile.

La parte elettronica è costituita da una scheda di preamplificazione, una scheda madre di elaborazione analogica e digitale del segnale e di schede plug-in che ne caratterizzano la funzionalità.
Ci saranno 5 tipologie di schede plug-in:

- **alimentazione esterna + RS485**
- **alimentazione esterna + RS485 + batteria interna per DATA LOGGER in assenza di alimentazione esterna o polling dati**
- **modulo RF + alimentazione a batteria**
- **modulo 4-20mA 2 fili (Hart protocol opzionale)+ gestione della alimentazione**
- **prodotto OEM con uscita TTL da collegare ad un apparato radio senza collegamenti esterni già certificato.**

Intrinsically Safe Magnetostrictive Sensor.
Code magnetostrictive sensor with serial output RS485 type XMT-SI.
Code magnetostrictive sensor with serial output RS485 with inside battery to record events without external supply and without data polling type XMT-SI-485-LOG
Code magnetostrictive sensor with analogical output 4-20mA/Hart Protocol type XMT-SI-4-20mA
Code magnetostrictive sensor with battery power, wireless type XMT-SI-RF
Code magnetostrictive sensor with TTL output connected to intrinsically safe external radio appliance and battery-powered type XMT-SI-TTL
Intrinsically safe reed chain Sensor.
Code reed chain sensor with serial output RS485 type XCR-SI-485
Code reed chain sensor with serial output RS485 with inside battery to record events without external supply and without data polling type XCR-SI-485-LOG

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[13] **ALLEGATO** – SCHEDULE

[14] **CERTIFICATO DI ESAME CE DEL TIPO n° CEC 09 ATEX 131 Rev.4**
to EC-TYPE EXAMINATION CERTIFICATE no. CEC 09 ATEX 131 Rev.4

Code reed chain sensor with analogical output 4-20mA/Hart Protocol type XCR-SI-4-20mA.
Code reed chain sensor with battery power, wireless type XCR-SI-RF
Code reed chain sensor with TTL output connected to intrinsically safe external radio appliance and battery-powered type XCR-SI-TTL
Intrinsically safe On-OFF switch sensor
Code ON-OFF switch sensor with serial output RS485 type XLR-SI-485
Code ON-OFF switch sensor with serial output RS485 with inside battery to record events without external supply and without data polling type XLR-SI-485-LOG
Code ON-OFF switch sensor with analogical output 4-20mA/Hart Protocol type XLR-SI-4-20mA.
Code ON-OFF switch sensor with battery power, wireless type XLR-SI-RF
Code ON-OFF switch sensor with TTL output connected to intrinsically safe external radio appliance and battery-powered type XLR-SI-TTL
A connection between intrinsic safety barriers and sensors are installed diodes. These are intended to reduce domestic capacity to a negligible value.

The electronic part consists of a preamp card, a motherboard of analogical and digital signal processing and plug-in cards that characterize the feature. Five type electrical output available:

- External Power + RS485
- External power supply + RS485 + internal battery per DATA LOGGER in case of external power off or data pulling off
- RF module + battery power
- Module 4-20 mA 2-wire (Optional Hart protocol) + power management
- OEM product with TTL out connect with radio apparatus

	Ui (V)	Ii (mA)	Li	Ci	Uo(V)	Io (mA)	Lo	Co
XMT-SI-485 XCR-SI-485 XLR-SI-485	16	125	trascurabile negligible	trascurabile negligible	5,2	100	trascurabile negligible	trascurabile negligible
XMT-SI-485-LOG XCR-SI-485-LOG XLR-SI-485-LOG	16	125	trascurabile negligible	trascurabile negligible	5,2	100	trascurabile negligible	trascurabile negligible
XMT-SI-RF XCR-SI-RF XLR-SI-RF	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
XMT-SI-TTL XCR-SI-TTL XLR-SI-TTL	5	125	trascurabile negligible	trascurabile negligible	4,6	100	trascurabile negligible	trascurabile negligible
XMT-SI-4_20mA XCR-SI-4_20mA XLR-SI-4_20mA	28	100	trascurabile negligible	trascurabile negligible				

Gli apparecchi XMT-SI-485, XCR-SI-485, XLR-SI-485; XMT-SI-485-LOG, XCR-SI-485-LOG, XLR-SI-485-LOG e XMT-SI-4_20mA, XCR-SI-4_20mA, XLR-SI-4_20mA possono essere collegati solo ad un apparecchio associato certificato a sicurezza intrinseca (barriera di sicurezza) e questa combinazione deve rispettare le norme di sicurezza intrinseca.
Negli apparecchi XMT-SI-485-LOG, XCR-SI-485-LOG, XLR-SI-485-LOG in presenza di alimentazione esterna la batteria è disconnessa dall'elettronica. La batteria viene automaticamente collegata all'elettronica quando l'alimentazione esterna è assente.
The equipments XMT-SI-485, XCR-SI-485, XLR-SI-485; XMT-SI-485-LOG, XCR-SI-485-LOG, XLR-SI-485-LOG and XMT-SI-4_20mA, XCR-SI-4_20mA, XLR-SI-4-20mA can be only connected to a certified associated intrinsically safe apparatus (safety barrier) and this combination must be compatible as regard intrinsic safety rules.

In equipments XMT-SI-485-LOG, XCR-SI-485-LOG, XLR-SI-485-LOG, when there is an external supply, the battery is disconnected from electronics. The battery is automatically connected to electronics when there is not external supply.

Test di Routine / Routine tests

EN 60079-11 §11.1: Routine tests for diode safety barriers

Avvertenze di targa / Warning label

None

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[13] **ALLEGATO** – SCHEDULE

[14] **CERTIFICATO DI ESAME CE DEL TIPO n° CEC 09 ATEX 131 Rev.4**
to EC-TYPE EXAMINATION CERTIFICATE no. CEC 09 ATEX 131 Rev.4

[16] **Rapporto numero** / Report Number: **CEC 14/2010 – RET 001**

[17] **Condizioni speciali per un utilizzo sicuro** – Special conditions for safe use

Nessuna – None.

L'efficacia e l'affidabilità di questi apparecchi sono garantite seguendo le istruzioni del Manuale d'uso. Non sono ammesse modifiche non autorizzate rispetto al fascicolo tecnico agli atti.
Special conditions for safe use depends on correct following of manufacturer's manual. Further modification are not allowed.

[18] **Requisiti Essenziali di Sicurezza e Salute** – Essential Health and Safety Requirements

Nessuno – None. **Riguardo ai Requisiti Essenziali di Sicurezza e Salute questo documento verifica la conformità solo agli standard Ex. La dichiarazione di Conformità del Produttore dichiara la conformità con altre Direttive pertinenti.**

Concerning EHSR this schedule verifies the compliance with the Ex standards only. The manufacturer's Declaration of Conformity declares compliance with other relevant Directives.

[19] **Documenti descrittivi** – Descriptive documents

I documenti di riferimento listati di seguito costituiscono la documentazione tecnica dell'apparecchio o sistema di protezione oggetto di questo certificato. Questi documenti sono confidenziali e sono a disposizione delle sole autorità competenti.
Una copia di questi documenti è conservata presso l'archivio del CEC.
The descriptive documents quoted hereafter constitute the technical documentation of the equipment or protective system, subject of this certificate. This documents are confidential and they are available only to the authorities.
One copy of all documents is kept in CEC files.

Analisi dei rischi, AR15ExTR001, AR15TEST011

L'ISPETTORE INCARICATO
Dott. Ing. Giuseppe TERZAGHI

Organo deliberante | Antonio FUGAZZI | Data: 18/02/2015

OPW FUEL MANAGEMENT SYSTEMS

CESI

NOTIFICATION

CESI S.p.A.
Via Rubattino 54
I-20134 Milano - Italy
Tel: +39 02 21251
Fax: +39 02 21255440
e-mail: info@cesi.it
www.cesi.it

Schema di certificazione CESI-ATEX

ACCREDIA
PRD N. 018B
membro degli Accordi di Mutuo Riconoscimento EA, IAF e ILAC
Signatory of EA, IAF and ILAC Mutual Recognition Agreements

[1] **PRODUCTION QUALITY ASSURANCE NOTIFICATION**

[2] **Equipment or Protective System or Component intended for use in potentially explosive atmospheres Directive 94/9/EC**

[3] Notification number:

CESI 06 ATEX 031 Q

[4] Equipment or component type: Transmitters and level switches
Capacitive sensors for continuous liquid level measurement and discriminative function for different
Terminal boxes
Magnetostrictive level sensors
Galvanically isolated barriers

Protection concepts: Flameproof enclosures "d"
Intrinsic safety "i"
Encapsulation "m"
Dust ignition protection "tD"
Mechanical protection by constructional safety "c"
Dust ignition protection "t"
Pressurization "p"

[5] Applicant: START Italiana S.r.l.
via Pola, 6
20813 Bovisio Masciago - MB

[6] Manufacturer: START Italiana S.r.l.
via Pola, 6
20813 Bovisio Masciago - MB

[7] CESI, notified body n. 0722 in accordance with Article 9 of the Council Directive 94/9/EC of 23 March 1994, notifies to the applicant that the actual manufacturer has a production quality system which complies to Annex IV of the Directive.

[8] This notification is based on audit report n. EX-B5006989 issued the 9/03/2015.

This notification can be withdrawn if the manufacturer no longer satisfies the requirement of Annex IV.

Results of periodical re-assessment of the quality system are a part of this notification.

[9] This notification is **valid until 17/03/2018** and can be withdrawn if the Manufacturer does not satisfy the production quality assurance re-assessment.

[10] According to Article 10 [1] of the Directive 94/9/EC the CE marking shall be followed by the identification n. 0722 identifying the notified body involved in the production control stage.

Date of 1st issue	Date of renewal
17th March 2006	17th March 2015

Translation issued 17th March 2015

Prepared	Verified	Approved
Sergio G. Giugno	Mirko Balaž	Roberto Piccin

CESI S.p.A.
Testing & Certification Division

Prot. B5006995 P. 1 Rin. 3

DOVER FUELING SOLUTIONS

Appendix F - ProGauge RF Receiver

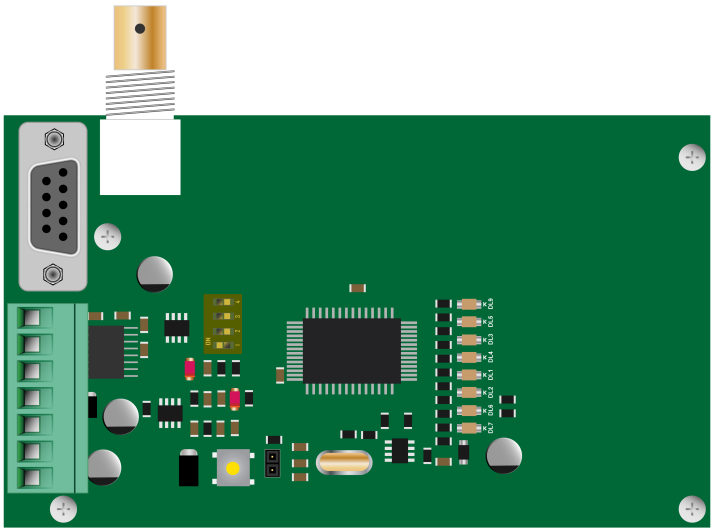
The ProGauge RF Receiver lets the ProGauge XMT-SI-RF probe interface with the OPW-FMS SiteSentinel Nano console.

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

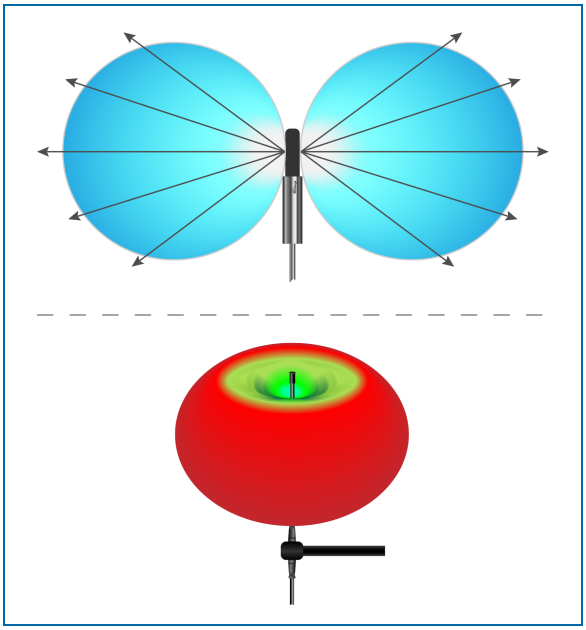
MECHANICAL	
Dimensions (approximate):	830 x 150 x 85 mm
Connection:	BNC male
Operating temperature range:	-40° / +80° C
Weight:	0.250 kg
Radiating element material:	Whip made of steel and brass, thermoretractable sheath.
Accessories:	Bracket for pole mounting (from Ø min. 40 mm to max. 60 mm)

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:

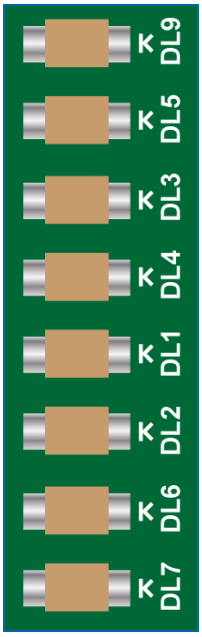
- A standard manhole with an iron or cast iron lead cover.
- A manhole of bricks.
- An asphalt square.
- Vehicles parked over a manhole cover.

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.

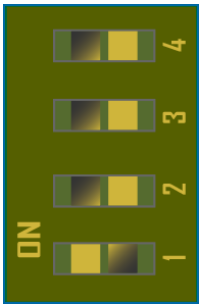
Installer RF Probe Determination Worksheet		
Topic	**Condition**	**Installer Notes: (to find out if RF Probes are possible before installation)**
Environment	Depot or Service Station?	
Manhole	Material Type (iron, cast iron, composite…):	
	Manhole Depth:	
	Installation with: Riser or Sliding Connection?	
	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 - Magdirect I. S. Barriers

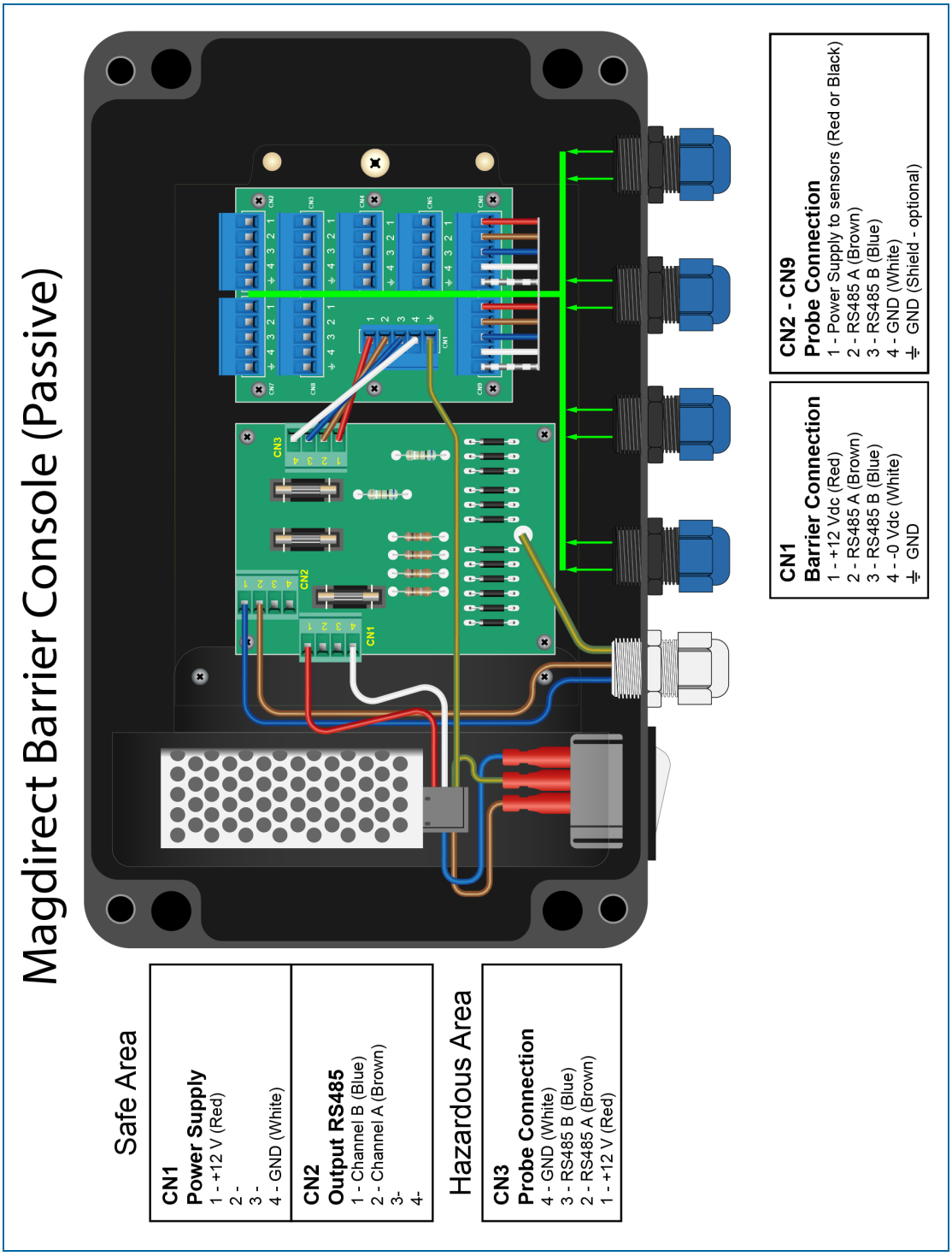
Technical Description: MagDirect BRA-SIP Passive Barrier

This Magdirect device contains an intrinsically safe BRA-SIP barrier used to supply and transfer data with devices located in a Hazardous Area. This device is equipped with a channel for power supply and with a double channel for RS485 interface. A typical device application is a process data transmitter with 12Vdc power supply and RS485 interface. Specification data for the MagDirect BRA-SIP intrinsically safe passive barrier can be found here: "BRA-SIP" on page 144.

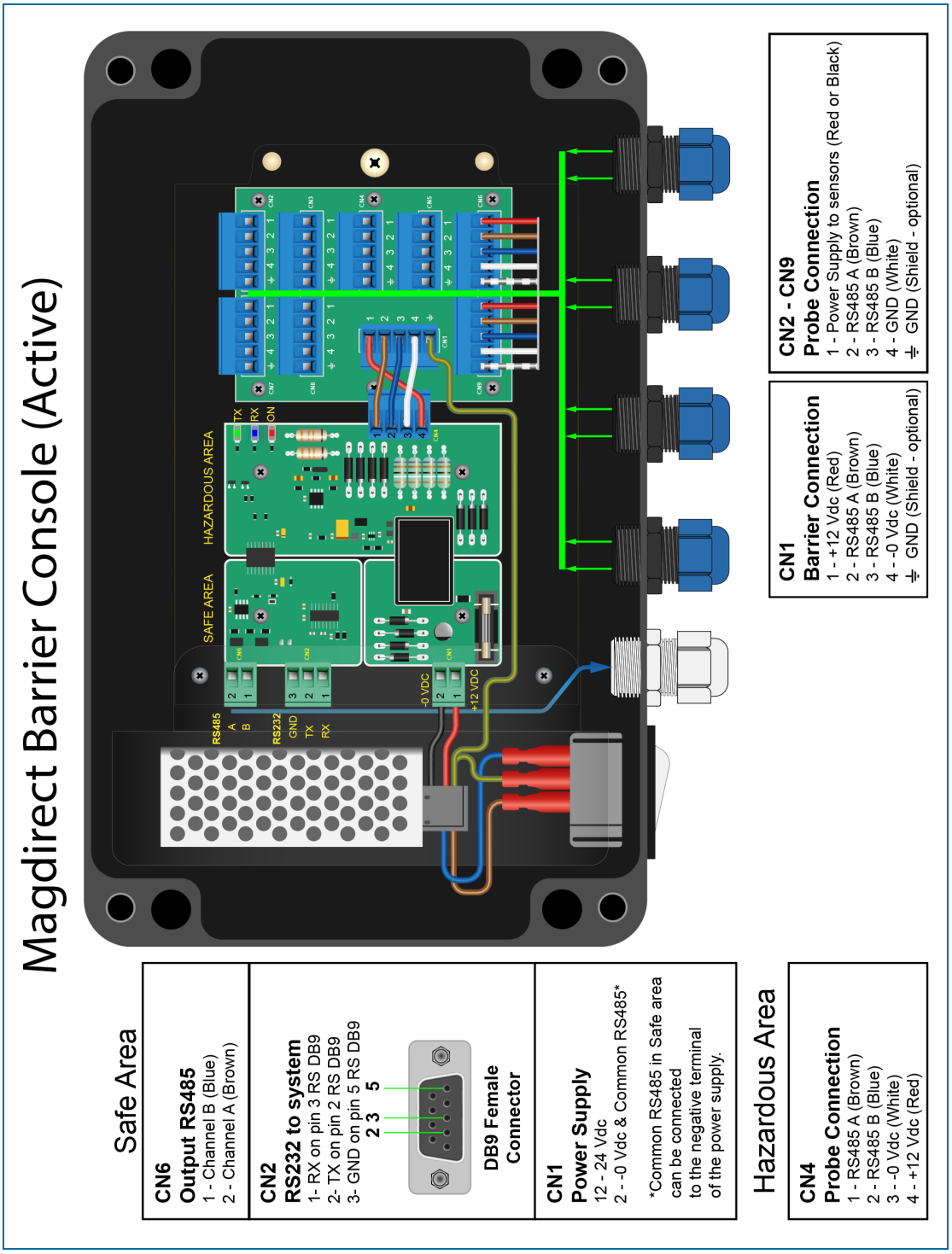
Technical Description: MagDirect BRA-SI Active Barrier

This Magdirect device contains an intrinsically safe BRA-SI barrier, galvanically isolated to power and interchange data with devices in a Hazardous Area. It is not necessary to have a ground connection. The BRA-SI barrier is equipped with a power supply channel and a dual-channel for RS485 interface. Specification data for the MagDirect BRA-SI intrinsically safe active barrier can be found here: "BRA-SI" on page 147

BRA-SIP Passive Barrier Connections (from 1 to 8 Probes)



BRA-SI Active Barrier Connections (from 1 to 8 Probes)



On both BRA-SIP and BRA-SI, connectors from CN2 to CN9 are used to connect up to eight (8) probes.

CN2 - 9 Terminal Connections	Probe Connection -BRA-SIP	Probe Connection- BRA-SI
1	Power supply to sensors (Red or Black)	Power supply to sensors (Red or Black)
2	RS485-A (Brown)	RS485-A (Brown)
3	RS485-B (Blue)	RS485-B (Blue)
4	GND (White)	GND (White)
⏚	Shield (Optional)	Shield (Optional)

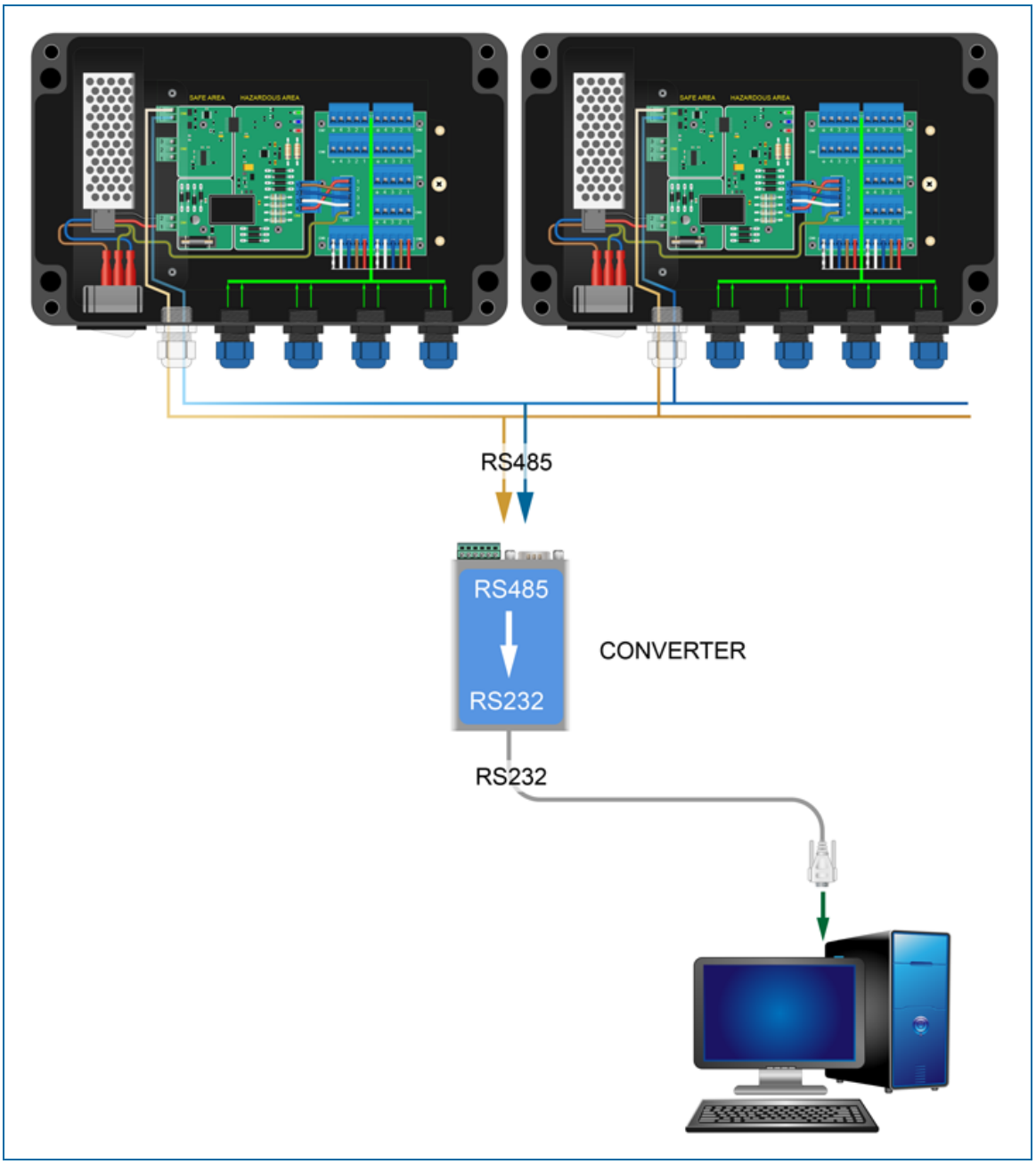
CN1 Terminal Connections	Barrier Connection -BRA-SIP	Barrier Connection- BRA-SI
1	+12 Vdc (Red)	Power supply (Red)
2	RS485-A (Brown)	RS485-A (Brown)
3	RS485-B (Blue)	RS485-B (Blue)
4	- 0 Vdc (White)	GND (White)
⏚	GND (Green Ground)	Shield (Optional)

NOTE: On the BRA-SI Active Barrier these two modes are handled in parallel and cannot be used simultaneously.

The case is equipped with eight (8) cable glands (PG11 color BLUE) for cable entry of eight (8) probes maximum, and one (1) cable gland (PG9 color WHITE) to connect the interface to the system.

Connections for More Than 8 Probes

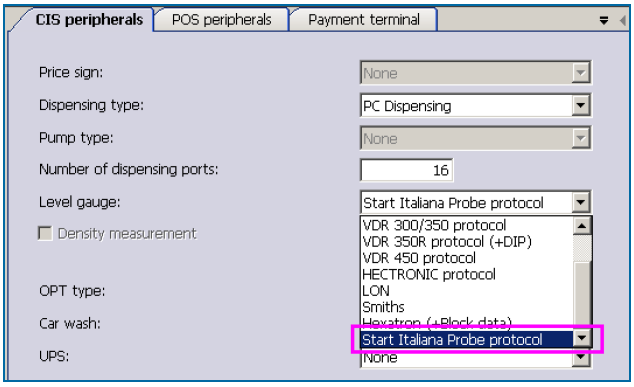
Each Magdirect console can be connected to a maximum of 8 probes. If more than 8 probes are to be connected it will be necessary to add more consoles. The devices must be wired in parallel on the RS485 output (CN2 on the BRA-SIP Passive Barrier and CN6 on the BRA-SI Active Barrier) and connected to an RS232/485 converter for connection to the system. See the illustration below (illustration is shown with BRA-SI Active Barrier).


SAFE AREA
HAZARDOUS AREA
RS485
RS485
RS232
CONVERTER
RS232

System Examples

Fuel POS

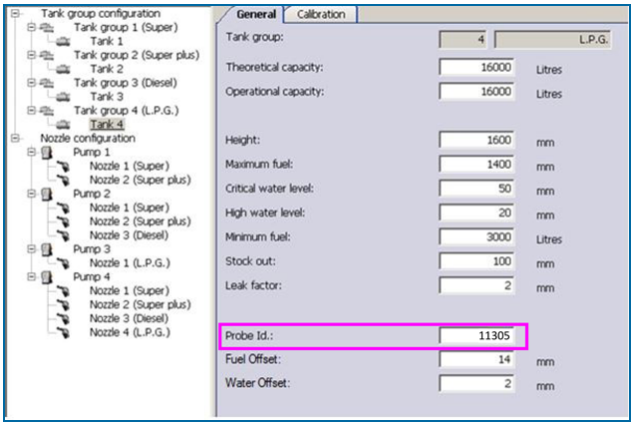
To configure the Magdirect to use with a Fuel POS (Point of Sale):



- Select the correct Protocol – Start Italiana

- Find the Serial Number printed on the probe.

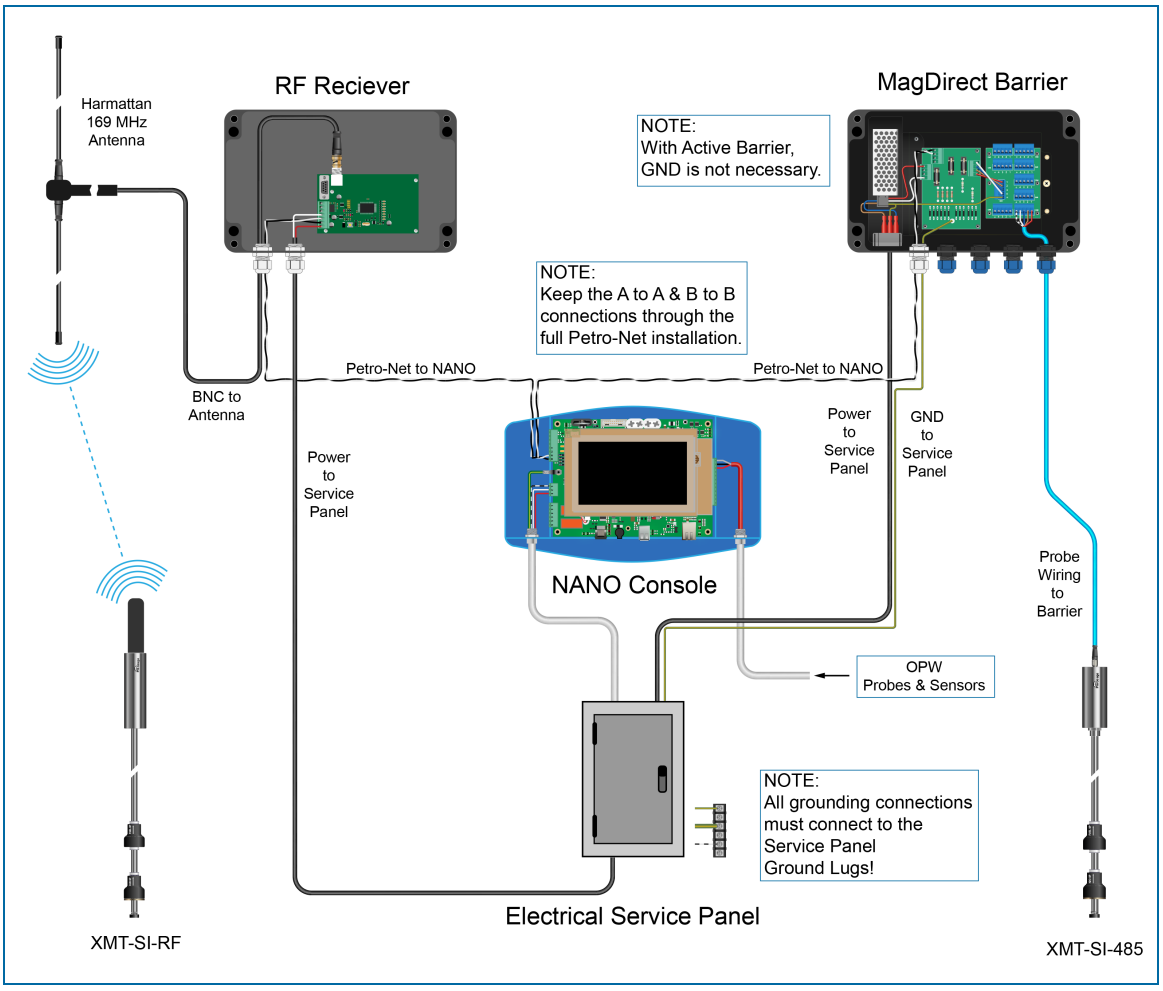
IMPORTANT: Keep a record of the probe serial numbers and the tanks where they are installed as a reference for configuration in the console.



- Enter the Serial Number into the Probe ID field. If a bar code scanner is connected to your PC you can scan the serial number bar code to enter the Serial Number.

Appendix H - Site Wiring with ProGauge/MagDirect

The illustration below shows how to wire the necessary ProGauge equipment for wired probe (XMT-SI-485) and RF probe (XMT-SI-RF) applications with the OPW-FMS SiteSentinel Nano console. RS485 communications are shown with OPW-FMS Petro-Net™ communication wiring (OPW-FMS part number 12-1029). Petro-Net™ is a 2 conductor 18AWG TFFN twisted pair.



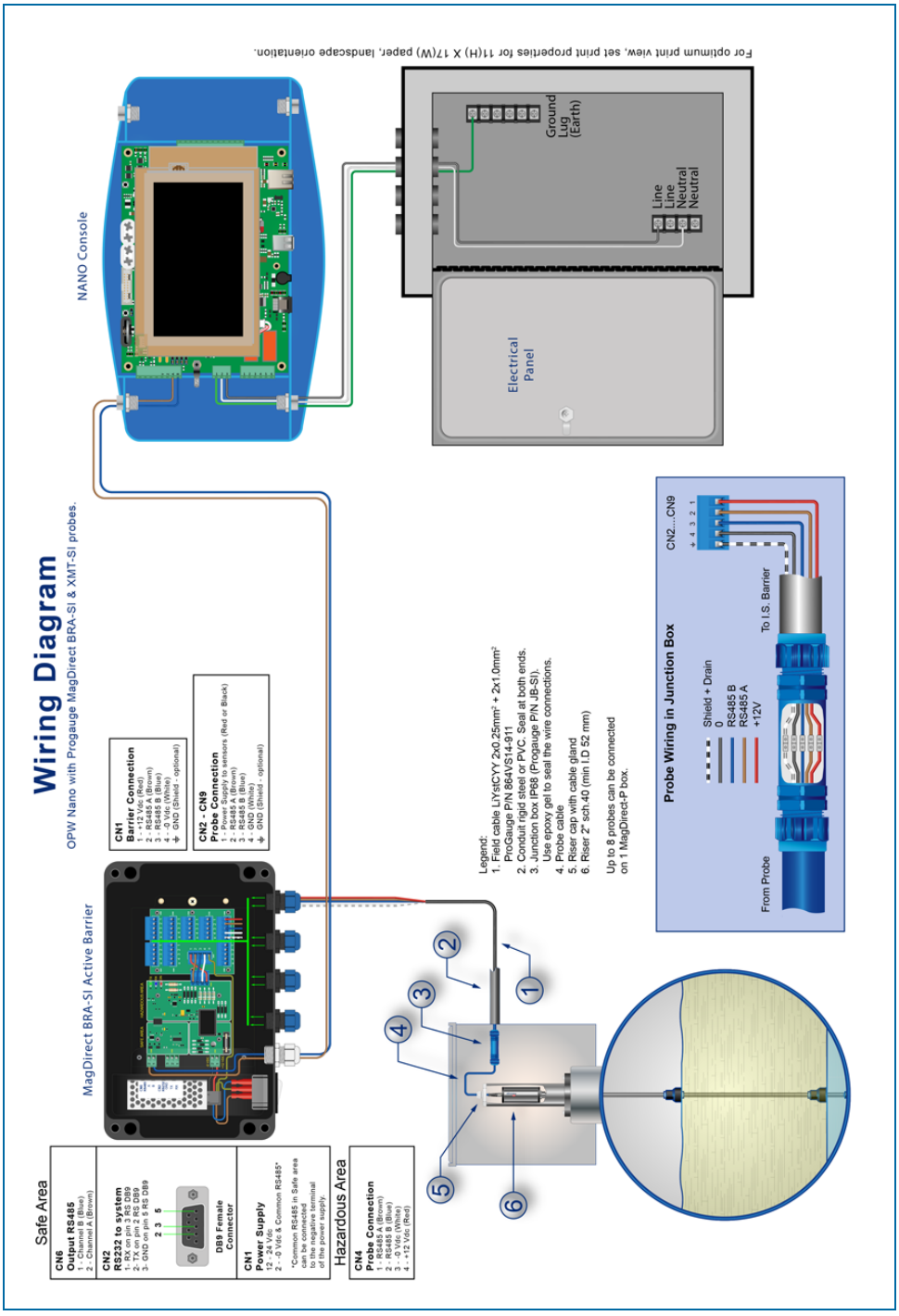
Appendix I - Field Wiring Diagrams

The Field Wiring Diagrams that follow show the correct wiring for:

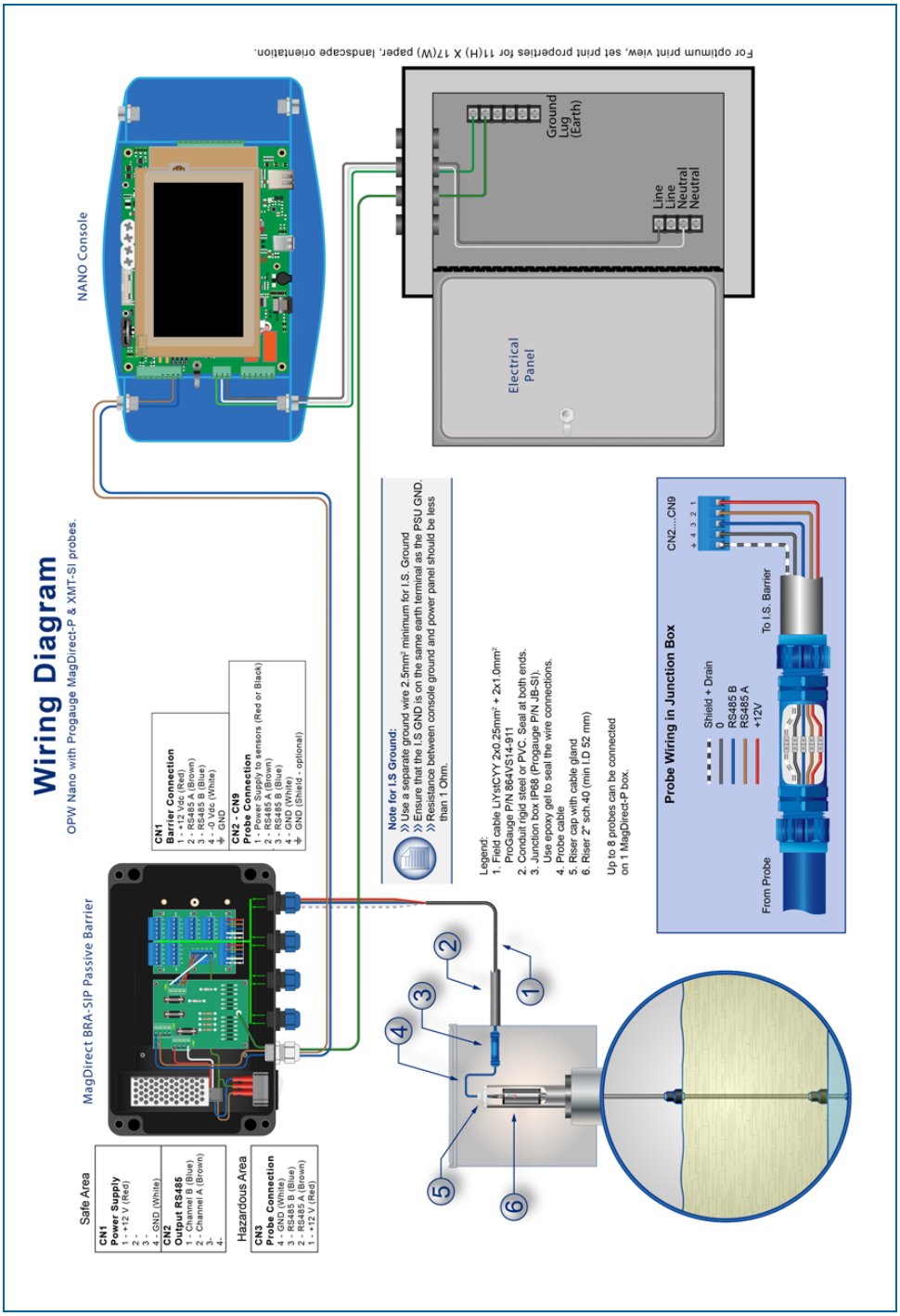
- OPW FMS Nano Tank Gauge with ProGauge XMT-SI Probes and MagDirect BRA-SI Active Barrier
- OPW FMS Nano Tank Gauge with ProGauge XMT-SI Probes and MagDirect BRA-SIP Passive Barrier

As an alternative, to get access to interactive versions of these diagrams visit the OPW-FMS Manuals & Installation Instructions EMEA Technical Support page of the http://www.opwglobal.com/ web site to download these wiring diagrams.

With MagDirect Active Barrier



With MagDirect Passive Barrier



Appendix J - MagDirect Barrier Safety

BRA-SIP

Description:

BRA-SIP is an intrinsically safe passive barrier needed to supply and transfer data with devices located in Hazardous Area.

BRA-SIP is equipped with a channel for power supply and with a double channel for RS485 interface.

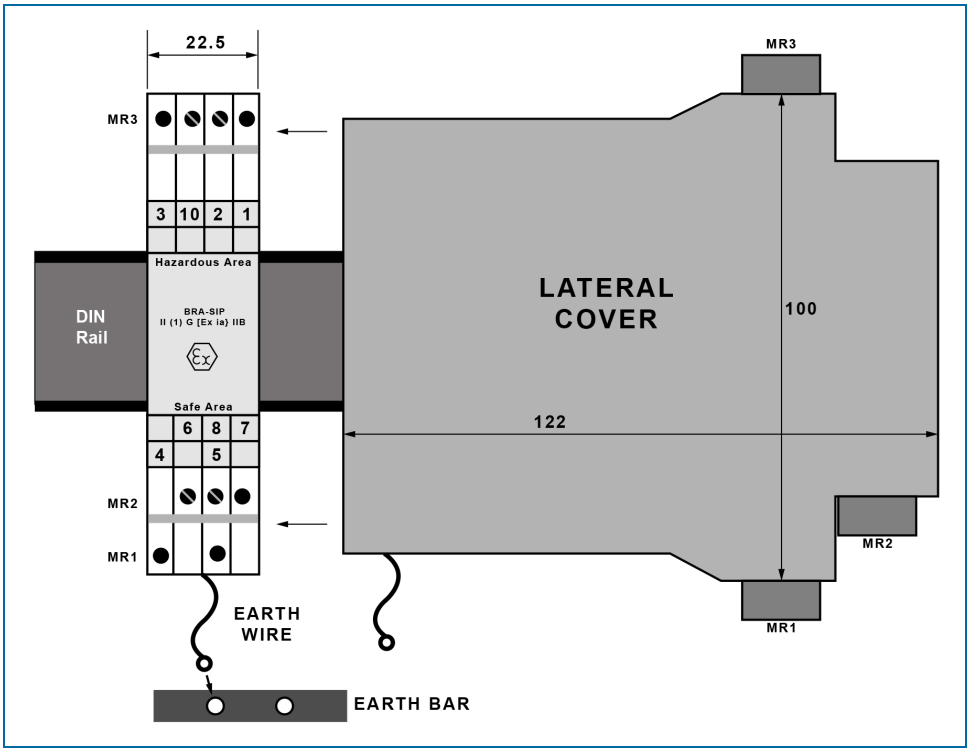
An example of typical device is a process data transmitter with 12Vdc power supply and RS485 interface.

Device Marking:

II (1) G [Ex ia] IIB

FISCO Power Supply Um = 250 V [Ex ia] IIB

Certificate Number: CEC 10 ATEX 025 Rev. 3



Connections:

- Safety zone -

JH5 - positive power supply

JH4 - negative power supply

JH8 - RS485 " B "

JH7 - RS485 " A "

JH6 - common RS485 (earth)

EARTH WIRE - connection to earth bar

- Hazardous zone -

JH5 - positive power supply

JH4 - negative power supply

JH8 - RS485 " B "

JH7 - RS485 " A "

JH6 - common RS485 (earth)

EARTH WIRE - connection to earth bar

NOTE: The EARTH WIRE cable is internally connected to terminals JH4, JH6, JH10. It must be connected to the earth bar that, on its side, must be connected to the earth of the system with a separate cable. The earth connection must have a maximum resistance of 1 Ohm.

The transmitter (or transmitters) located in Hazardous Area must not be connected to the earth.

The terminal JH6 (common RS485 in Safety Zone) could be left not connected if the power supply (terminals JH5 and JH4) integrates RS485 interface. In this case we will have:

JH4 – common and negative power supply and RS485
JH7 - RS485 " A " JH8 - RS485 " B "
JH5 – positive power supply

MR 3 - SAFETY ZONE
TO PROBE
PIN 3: +12V OUT .....(RED)
PIN10: -0V OUT .....(WHITE)
PIN 2: CHANNEL DATA B .....(BLUE)
PIN 1: CHANNEL DATA A .....(BROWN)
MR 2 - HAZARDOUS ZONE
TO SYSTEM
PIN 8: CHANNEL DATA A .....(BROWN)
PIN 7: CHANNEL DATA B .....(BLUE)
MR 1 - HAZARDOUS ZONE TO SYSTEM

PIN 4: -0V IN .....(WHITE)
PIN 5: +12V IN .....(RED)

Characteristics: BRA-SIP

Device: BRA-SIP

Ex Classification: II (1) G [Ex ia] IIB - FISCO Power Supply Um = 250 V [Ex ia] IIB

Certificate Number: CEC 10 ATEX 025 Rev. 3

MagDirect BRA-SIP Specifications		
	Power Supply Section	**RS485 Section**
Maximum input voltage	Um = 250 Vrms	Um = 6 Vdc
Maximum output voltage	Uo = 14 Vdc @ Io = 0	Uo = 6 Vdc @ Io = 0
Maximum input current	Ii =100 mA	Ii = 100 mA
Fuse rating	5x20 100mA L250	5x20 100mA L250
Maximum input current	Ii =100 mA	Ii = 100 mA
Maximum input power	Pi = 1.4 W	Pi = 0.6 W
Maximum output power	Po = 0.153 W	Po = 0.126 W
Maximum external capacitance	Co = 3.55 uF	Co = 40 uF
Maximum external inductance	Lo = 1.5 mH	Lo = 6 mH
Internal capacitance and inductance	Ci, Li = Negligile	Ci, Li = Negligible
Resistance end to end JH5-JH3	Ree1 = 15.3 Ohm +/- 5%	
Resistance end to end JH7-JH2 (JH8-JH1)		Ree2 = 12.6 Ohm +/- 5%
Maximum storing temperature	-30 °C ÷ +75 °C	<==
Maximum operating temperature	-10 °C ÷ +50 °C	<==
Type of material	Thermoplastic, UL 94	<==
Housing protection	IP 41	IP 41
Terminal strip protection	IP 20	IP 20
Cable section for terminal strip	1.5 mm	1.5 mm
Earth cable section	2.5 mm	<==
Safety Zone connection	MR1 (JH4, JH5)	MR2 (JH6, JH7, JH8)

MagDirect BRA-SIP Specifications		
	Power Supply Section	**RS485 Section**
Danger Zone connection	MR3 (JH10, JH3)	MR3 (JH1, JH2)
Max voltage between input and input-earth	250 V ac rms / dc	250 V ac rms / dc

BRA-SI

Description:

BRA-SI device is a barrier with galvanic isolation and intrinsically safe, used to connect/power devices placed in a hazardous zone.

BRA-SI device has:

- One power channel.
- Two RS485 communication channels.
- One RS232 communication channel in the safe zone.

A typical device is a data transmitter, 12Vdc powered that uses the RS485 communication port.

Device Marking:

II (1) G [Ex ia] IIB

FISCO Power Supply Um = 400 V [Ex ia] IIB

Certificate Number: CEC 10 ATEX 025 Rev. 3

Connections:

- Safety Zone -

CN 1-1 = positive supply

CN1-2 = negative supply

CN6-2 = RS485 “A“

CN6-1 = RS485 “B“

CN2-3 = common RS485

CN2-3 = common RS232

CN2-1 = RS232 “RX“

CN2-2 = RS232 “TX“

- Hazardous zone -

CN4-4 = positive supply

CN4-1 = RS485 “A“

CN4-2 = RS485 “B“

CN4-3 = common RS485 and supply

NOTE: BRA-Si barrier provides galvanic isolation.

» Power supply negative terminal on Safe Area can be connected to ground.

» The data interface in Safe Area is both RS485 (CN6) and RS232 (CN2). The two modes are managed in parallel and cannot be used simultaneously.

» The terminal CN2-3 (commonly RS485 Safe Area) can be connected to the negative power supply (terminal CN 1-2) if the power supply incorporates the RS485 interface.

In this case it will have:
CN 1-2 = negative power and RS485
CN 6-2 = RS485 “A”
CN 6-1 = RS485 “B”
CN 1-1 = positive power

» If RS232 is used (CN2) it is recommended to keep the galvanic isolation between power supply (CN1) and connect RS232 (CN2).

» The transmitter site in Danger Zone may be grounded.

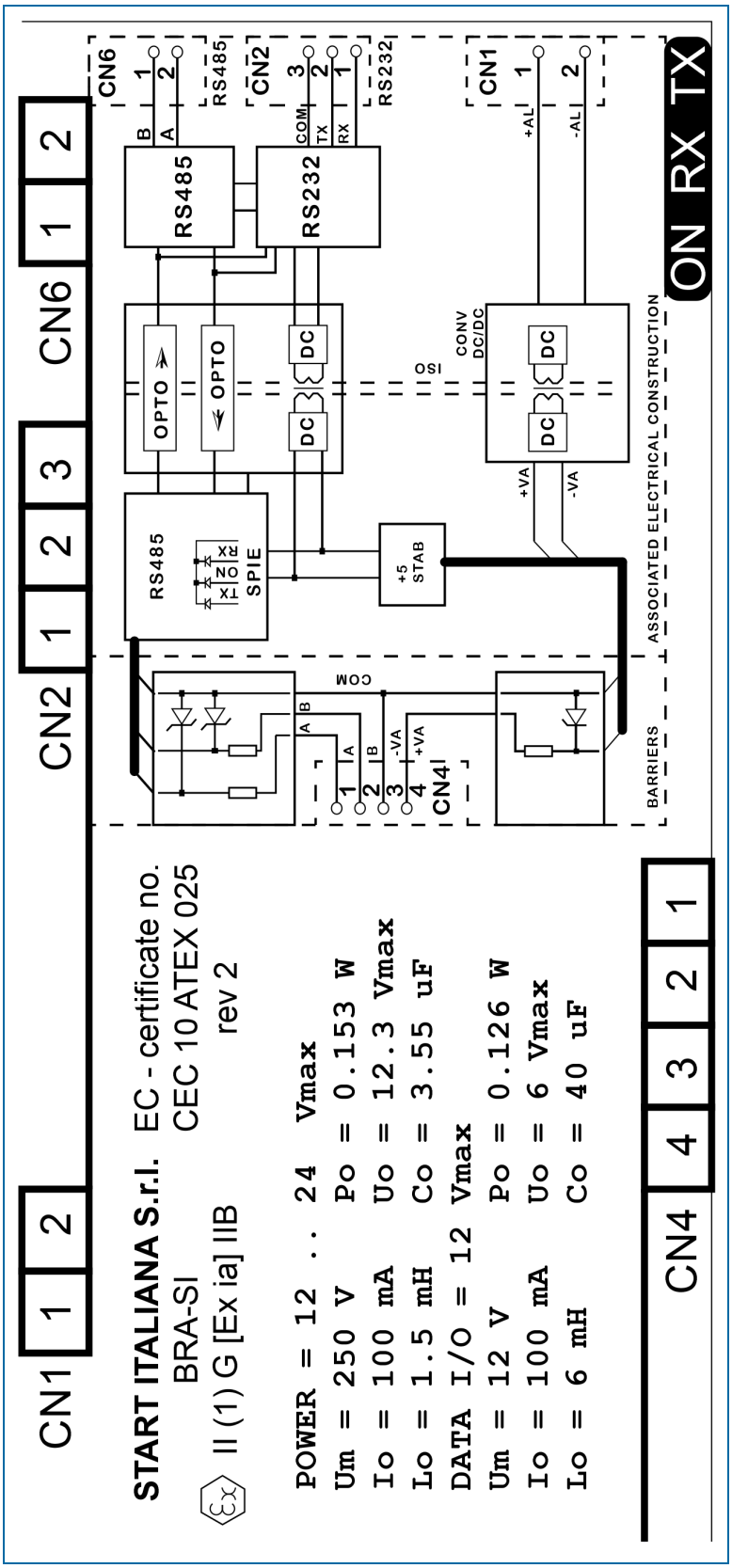
Characteristics: BRA-SI

Device: BRA-SI

Ex Classification: II (1) G [Ex ia] IIB - FISCO Power Supply Um = 400 V [Ex ia] IIB

Certificate Number: CEC 10 ATEX 025 Rev. 3

Magdirect BRA-SI Specifications		
	Power supply	**RS485 / RS232**
Maximum input voltage through which the device is protected	Um = 250 Vrms	Um = 12 Vdc (1)
Maximum input current through which the device is protected	Ii =250 mA	Ii = 125 mA (1)
Nominal input voltage (RS485 / 232)	Uo = 12 .. 24 Vdc	U=5 Vdc +/- 5% / +/- 12Vdc
Isolation input to output	1.5 KV rms	1.5 KV rms
Fuse rating	5x20 1A L250	---
Maximum output current	Io = 100 mA	Io = 100 mA
Maximum input power	Pi = 3.5 W	Pi = 0.6 W
Maximum output power	Po = 0.153 W	Po = 0.126 W
Maximum external capacity	Co = 3.55 uF	Co = 40 uF
Maximum external inductance	Lo = 1.5 mH	Lo = 6 mH
Internal capacity and inductance	Ci, Li = Negligible	Ci, Li = Neg-ligible
Maximum storage temperature	-30 .. +75 °C	<==
Maximum operating temperature	-20 .. +40 °C	<==
Housing protection degree	IP 41	IP 41
Terminal protection degree	IP 20	IP 20
Terminal cable section	1.5 mm	1.5 mm
Ground cable section	---	---
Safe area connection	CN1 (1, 2)	CN 2 (1, 2, 3); CN6 J4 (1, 2)
Hazardous area connection	CN4 (3, 4)	CN4 (1, 2)
Maximum voltage between ground input and output	250 V ac rms / dc	250 V ac rms / dc


CN1 1 2
CN2 1 2 3
CN6 1 2
START ITALIANA S.r.l. EC - certificate no.
BRA-SI CEC 10 ATEX 025
II (1) G [Ex ia] IIB rev 2
POWER = 12 .. 24 Vmax
Um = 250 V Po = 0.153 W
Io = 100 mA Uo = 12.3 Vmax
Lo = 1.5 mH Co = 3.55 uF
DATA I/O = 12 Vmax
Um = 12 V Po = 0.126 W
Io = 100 mA Uo = 6 Vmax
Lo = 6 mH Co = 40 uF
CN4 4 3 2 1
CN6
B
A
RS485
CN2
COM
TX
RX
RS232
CN1
+AL
-AL
RS485
RS232
OPTO
OPTO
DC
DC
DC
DC
ISO
CONV DC/DC
RS485
SPIE
+5 STAB
+VA
-VA
COM
A B
1 A
2 B
3 -VA
4 +VA
CN4
BARRIERS
ASSOCIATED ELECTRICAL CONSTRUCTION
ON RX TX

Safety Instructions

Manufactured in accordance with European Standards

EN 60079-0: 2012

EN 60079-11: 2012

EN 60079-14: 2014

EN 60079-25: 2010

And in accordance with ATEX Directive 2014/34/UE of 26/02/2014

Certificate number:

CEC 10 ATEX 025 REV.3

CE 0722 - Start Italiana Srl – Via Pola 6, 20813 Bovisio Masciago (MB)

BRA-SIP:

Ex II (1) G [Exia] IIB

FISCO power supply Um=250 V [Exia] IIB

BRA-SI

Ex II 1G [Ex ia] IIB

FISCO power supply Um=400 V [Exia] IIB

Addressed to qualified personnel in accordance with national laws, including relevant standards, and where applicable in accordance with IEC 60079-17 referred to electrical device for potentially explosive atmospheres.

- Technical data indicated on the label of the device level meter to be respected.
- Amendments on the product are not permitted.
- The barrier can be installed only if fully intact.
- Only START Italiana spare parts shall be used.
- Ordinary and extraordinary operations of maintenance must be carried out only by qualified personnel with the approval of “expert technicians”.
- The following instructions must be observed scrupulously to get a perfect installation.
- The national standards of safety and accident prevention and the requirements indicated with ⚠ in this technical dossier must be strictly observed.
- Take probes to safety zone before barrier substitution.

Safety Instructions in Explosive Atmospheres

The device has the following marking:

BRA-SIP:

II (1) G [Exia] IIB

FISCO power supply Um=250 V [Exia] IIB

BRA-SI

II 1G [Ex ia] IIB

FISCO power supply Um=400 V [Exia] IIB

...providing the following information:

- The device belongs to the equipment group II, corresponding to equipment intended to be used at all sites except of mines that could be endangered by explosive atmosphere.
- The device is suitable for use in Zone 0 (1G): *place where an explosive atmosphere consisting of a mixture of air and flammable substances in the formof gas, vapor or mist is present continuously or for long periods, or frequently.*
- The device is compatible with category 1 indicating the environments in which it is present continuously, frequently or for long periods, an explosive atmosphere due to a mixture of air and gases, vapors.

For category 1, in case of failure of a means of protection, the security level is guaranteed at least by a second independent means of protection. Furthermore, the level of security is guaranteed even in the event of two faults occurring independently of each other.

- The type of protection against ignition used is structural reliability “Ex ia” for environments with explosive atmosphere consisting of a mixture of air and flammable substances in the form of gas, vapor or mist.
- In the form of a cloud of combustible dust in the air.
- The product is suitable for use in explosive atmospheres caused by gases, vapors or mists.
- The product is suitable for use in environments with gas type IIB.

Warnings

- The employ of this equipment in hazardous areas requires special attention and special precautions during use and maintenance. Avoid dust deposit.
- Clean only with damp cloth and / or anti-static and not aggressive products.
- The equipment has been approved for areas of use with specific characteristics: do not install and use the unit in environments different from those provided.
- Installation, maintenance and repair of the equipment should be performed only by qualified, skilled, instructed and authorized technicians.
- The equipment security is guaranteed only if device is installed, checked, maintained, used and maintained according to the provisions outlined in the installation guide.
- Do not cover with coverage made of materials that can be loaded electrostatically.
- It is forbidden to modify or repair the equipment using components not conforming to the certification; this operation undermines the intrinsic safety of the instrument (with consequent loss of Ex approval) and causes the invalidation of the product warranty.
- All connections must be performed in accordance with regulations applicable in the area and environment of installation, as per standard EN 60079-14. Please separate, protect and highlight with appropriate color reference the intrinsically safe signals.
- The stockings of any shielded cables must be grounded in the external devices connected, so as not to complicate the wiring in the box.
- Perform maintenance in accordance with the standard EN 60079-17 and EN 61241-17.

Safety Data

BRA-SIP		**BRA-SI**		**CABLE (typical)**
Power	Data I/O	Power	Data I/O	R=74,19 Ohm x km
14 Vmax	6 Vmax	18,25 Vmax	12 Vmax	R=18,55 Ohm x km
Um=250 V	Um=6 V	Um=400 V	Uo=6 Vmax	C/C<150 pF x m
Io=100 Ma	Io=100 Ma	Io=100 Ma	Io=100 Ma	C/S<200 Pf x m
Lo=1,5 Mh	Lo=6 Mh [3]	Lo=1,5 Mh [3]	Lo=6 Mh [3]	Lo<1 Nh x m
Po=0,153 W	Po=0,126 W	Po=0,153 W	Po=0,126 W	Riso>200 Mohm x km
Uo=14 Vmax	Uo=6 Vmax	Uo=14,05 Vmax	Uo=6 Vmax	
Co=3,55 Uf	Co=40 Uf [2]	Co=3,55 Uf	Co=40 Uf [2]	
Ree=15,3	Ree=12,6	- [1]	- [1]	

[1] Not applicable because of galvanic isolation

[2] ref. EN 60079-11, table A.2, per IIB x 1.5, V=Vo

[3] ref. EN 60079-11, graph fig. A.4, for IIB, I=Io x 1.5

NOTE: CONNECT WIRING IN COMPLIANCE WITH: (IEC) EN 60079 -14

Appendix K - MagDirect Barrier Certification

Consorzio Europeo Certificazione

CE
Organismo Notificato n. 1131

[1] **CERTIFICATO DI ESAME CE DEL TIPO (All. III)**
EC-TYPE EXAMINATION CERTIFICATE (Annex III)

[2] **Apparecchio o Sistema di Protezione inteso per l'uso in atmosfere potenzialmente esplosive, Direttiva 94/9/CE**
Equipment or Protective Systems Intended for use in Potentially Explosive Atmospheres, Directive 94/9/EC

[3] **Certificato di Esame CE del Tipo numero .....:** CEC 10 ATEX 025 Rev.3
EC-Type Examination Certificate number 14/2010 –AET637

[4] **Apparecchio o Sistema di Protezione .....:** **Barriera a sicurezza intrinseca Tipo BRA-SIP, BRA-SI e BRA-2SIP**
Equipment or Protective System Intrinsic safety barrier type BRA-SIP, BRA-SI and BRA-2SIP

[5] **Costruttore .....:** **START ITALIANA S.r.l.**
Manufacturer

[6] **Indirizzo .....:** **Via Pola, 6 – 20813 Bovisio Masciago (MB) - Italy**
Address

[7] **Questo apparecchio o sistema di protezione ed ogni sua variante approvata è descritto nell'allegato al presente certificato e nei documenti descrittivi in esso richiamati.**
This equipment or protective system and any acceptable variation thereto is specified in the schedule to this certificate and the documents therein referred to.

[8] **Il CEC, organismo notificato n° 1131, in conformità all'articolo 9 della Direttiva 94/9/CE del Consiglio dell'Unione Europea del 23 Marzo 1994, certifica che questa apparecchiatura o sistema di protezione è conforme ai Requisiti Essenziali di Sicurezza e Salute per il progetto e la fabbricazione di apparecchiature e sistemi di protezione destinati ad essere utilizzati in atmosfere potenzialmente esplosive, definiti nell'Allegato II della Direttiva.**
CEC, notified body No. 1131, in accordance with Article 9 of the Council Directive 94/9/EC of 23 March 1994, certifies that this equipment or protective system has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres given in Annex II to the Directive.
I risultati dell'esame e dei test sono descritti nel rapporto confidenziale elencato nella sezione 16.
The examination and test results are recorded in confidential reports listed in section 16.

[9] **La conformità ai Requisiti Essenziali di Sicurezza e Salute è assicurata dalla conformità alle:**
Compliance with the Essential Health and Safety Requirements has been assured by compliance with:
EN 60079-0: 2012; EN 60079-11: 2012
Nel caso in cui tra le norme tecniche citate fossero presenti norme non armonizzate, la conformità ai Requisiti essenziali in materia di Sicurezza e Salute è comunque stata verificata.
If standards not listed in the list of Atex Harmonised Standards are used, compliance to the Essential Health and Safety Requirements is verified anyway.

[10] **Il simbolo "X" posto dopo il numero del certificato indica che l'apparecchiatura o il sistema di protezione è soggetto a condizioni speciali per un utilizzo sicuro, specificate nell'allegato al presente certificato.**
If the sign "X" is placed after the certificate number, it indicates that the equipment or protective system is subject to special conditions for safe use specified in the schedule to this certificate.

[11] **Questo Certificato di esame CE del Tipo è relativo soltanto al progetto, agli esami ed alle prove dell'apparecchio o sistema di protezione specificato in accordo con la Direttiva 94/9/CE. Ulteriori requisiti di questa Direttiva si applicano al processo di produzione e fornitura dell'apparecchiatura o sistema di protezione. Questi requisiti non sono oggetto del presente certificato.**

CEC - CONSORZIO EUROPEO CERTIFICAZIONE S.C.A.R.L.
Sede Legale e Uffici: Via Pisacane, 46- 20025 LEGNANO (Mi) Italy - tel. +39.0331.442 266- fax +39.0331.440 054
www.consorziocec.com - info@consorziocec.com - C.F./P.IVA 13073160155 – Reg. Impr. MI 13073160155 – R.E.A. 1612104

CEC – CONSORZIO EUROPEO CERTIFICAZIONE

Certificato di Esame CE del Tipo

EC-Type Examination Certificate

CE

Organismo Notificato n. 1131

This EC-Type Examination Certificate relates only to the design, examination and tests of the specified equipment or protective system in accordance to the Directive 94/9/EC. Further requirements of the Directive apply to the manufacturing process and supply of this equipment or protective system. These are not covered by this certificate.

[12] **L'apparecchiatura o sistema di protezione deve riportare i seguenti contrassegni:**
The marking of the equipment or protective system shall include the following:

Barriera BRA-SIP, BRA2SIP:

Ex II (1) G [Exia] IIB
FISCO power supply U_m= 250 V [Exia] IIB

Barriera BRA-SI:

Ex II (1) G [Exia] IIB
FISCO power supply U_m= 400 V [Exia] IIB

Legnano, 18 02 2015

CONSORZIO EUROPEO CERTIFICAZIONE
L'ORGANO DELIBERANTE
Il Direttore Tecnico (A. FUGAZZI)
Il Direttore Generale (L.TIMOSSI)

ACCREDIA
ENTE ITALIANO DI ACCREDITAMENTO
PRD n° 114B ISP n° 071E
Membro degli Accordi di Mutuo Riconoscimento EA, IAF e ILAC
Signatory of EA, IAF and ILAC Mutual Recognition Agreement

CEC – CONSORZIO EUROPEO CERTIFICAZIONE
Certificato di Esame CE del Tipo
EC-Type Examination Certificate

CE
Organismo Notificato n. 1131

[13] **ALLEGATO** – SCHEDULE

[14] **CERTIFICATO DI ESAME CE DEL TIPO n° CEC 10 ATEX 025 Rev.3**
to EC-TYPE EXAMINATION CERTIFICATE no. CEC 10 ATEX 025 Rev.3

[15] **Descrizione** – Description

Il dispositivo BRA-SIP è una barriera passiva a sicurezza intrinseca per alimentare e scambiare dati con dispositivi siti in zona pericolosa. La BRA-SIP è dotata di un canale per l'alimentazione e di un doppio canale per l'interfaccia RS485.
The BRA-SIP device is an intrinsic safety passive barrier which is used to power and to exchange data with devices in the hazardous zone. The Bra-SIP has a channel for power supply and it has a dual-channel for the RS485 interface.

Il dispositivo BRA-SI è una barriera completamente isolata galvanicamente per alimentare e scambiare i dati con dispositivi siti in zona pericolosa. Un dispositivo tipico è, ad esempio, un trasmettitore di dati di processo con alimentazione a 12 Vdc ed interfaccia RS485.
The BRA-SI device is a completely galvanically isolated barrier which is used to power and to exchange data with devices in the hazardous area sites. A typical device is, for example, a process data transmitter with a 12 Vdc power supply and a RS485 interface.

Il dispositivo BRA-2SIP è una barriera passiva a due canali per alimentare e scambiare dati con dispositivi siti in zona pericolosa. La barriera è costituita da due unità identiche aventi le stessa configurazione della barriera singola BRA-SIP.
The BRA-2SIP device is a dual-channel passive barrier which is used to power and to exchange data with devices in the hazardous zone. The barrier consists of two identical units (UNIT1 and UNIT2) with the same configuration of the single barrier BRA-SIP.

Caratteristiche nominali / Dati Elettrici – Rated characteristics / Electrical data

BRA-SIP e BRA-2SIP:

Alimentazione/Power = **14 Vmax**
- Um= 250 V
- Io= 100 mA
- Lo= 1.5 mH
- Po= 0.153 W
- Uo= 14 Vmax
- Co= 3.55 µF

Ree (5-3) = 15.3Ω

DATA I/O = 6 Vmax
- Um= 6 V
- Io= 100 mA
- Lo= 6 mH
- Po= 0.126 W
- Uo= 6 Vmax
- Co= 40 µF

Ree (8-1) = 12.6 Ω

BRA-SI:

Alimentazione/Power = **18…25 Vmax**
- Um= 400 V
- Io= 100 mA
- Lo= 1.5 mH
- Po= 0.153 W
- Uo= 14.05 Vmax
- Co= 3.55 µF

CEC – CONSORZIO EUROPEO CERTIFICAZIONE
Certificato di Esame CE del Tipo
EC-Type Examination Certificate

CE
Organismo Notificato n. 1131

[13] **ALLEGATO** – SCHEDULE

[14] **CERTIFICATO DI ESAME CE DEL TIPO n° CEC 10 ATEX 025 Rev.3**
to EC-TYPE EXAMINATION CERTIFICATE no. CEC 10 ATEX 025 Rev.3

DATA I/O = 12 Vmax
- Um= 12 V
- Io= 100 mA
- Lo= 6 mH
- Po= 0.126 W
- Uo= 6 Vmax
- Co= 40 µF

Test di Routine / Routine tests
EN 60079-11 §11.1: Routine tests for diode safety barriers

Avvertenze di targa / Warning label
None

[16] **Rapporto numero** / Report Number: **CEC 14/2010 – RET 001**

[17] **Condizioni speciali per un utilizzo sicuro** – Special conditions for safe use

Nessuna – None.

L'efficacia e l'affidabilità di questi apparecchi sono garantite seguendo le istruzioni del Manuale d'uso. Non sono ammesse modifiche non autorizzate rispetto al fascicolo tecnico agli atti.
Special conditions for safe use depends on correct following of manufacturer's manual. Further modification are not allowed.

[18] **Requisiti Essenziali di Sicurezza e Salute** – Essential Health and Safety Requirements

Nessuno – None. **Riguardo ai Requisiti Essenziali di Sicurezza e Salute questo documento verifica la conformità solo agli standard Ex. La dichiarazione di Conformità del Produttore dichiara la conformità con altre Direttive pertinenti.**

Concerning EHSR this schedule verifies the compliance with the Ex standards only. The manufacturer's Declaration of Conformity declares compliance with other relevant Directives.

[19] **Documenti descrittivi** – Descriptive documents

I documenti di riferimento listati di seguito costituiscono la documentazione tecnica dell'apparecchio o sistema di protezione oggetto di questo certificato. Questi documenti sono confidenziali e sono a disposizione delle sole autorità competenti.
Una copia di questi documenti è conservata presso l'archivio del CEC.
The descriptive documents quoted hereafter constitute the technical documentation of the equipment or protective system, subject of this certificate. This documents are confidential and they are available only to the authorities.
One copy of all documents is kept in CEC files.

Fascicolo tecnico, AR15ExTR001

L'ISPETTORE INCARICATO
Dott. Ing. Giuseppe TERZAGHI

Organo deliberante Antonio FUGAZZI

Data: 18/02/2015

Appendix L - 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

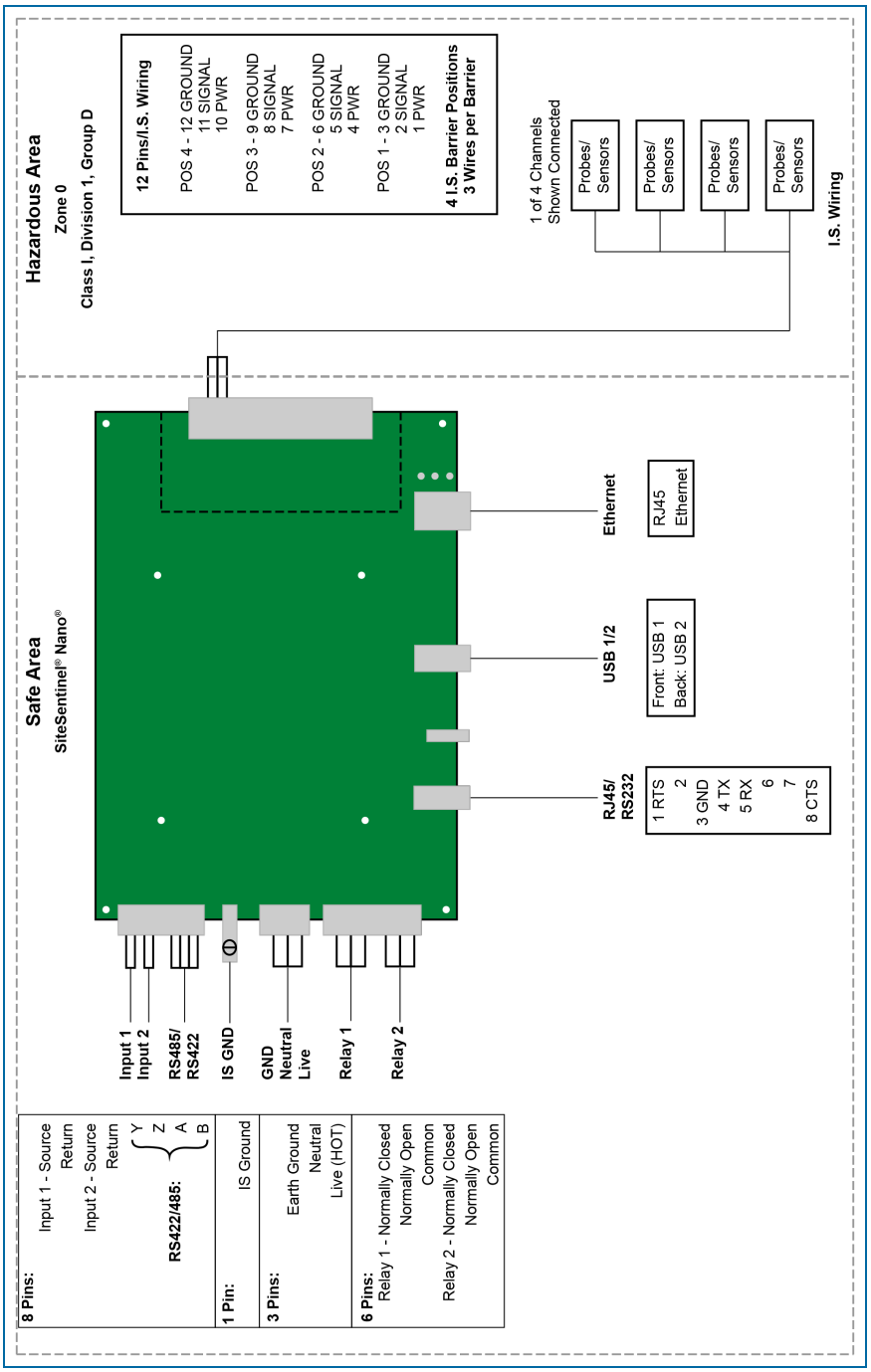
2. The voltage current of this associated apparatus is limited by a resistor such that the output voltage-current plot is a straight line drawn between open-circuit voltage and short-circuit current.
3. Selected intrinsically safe equipment must be third party listed as intrinsically safe for the application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

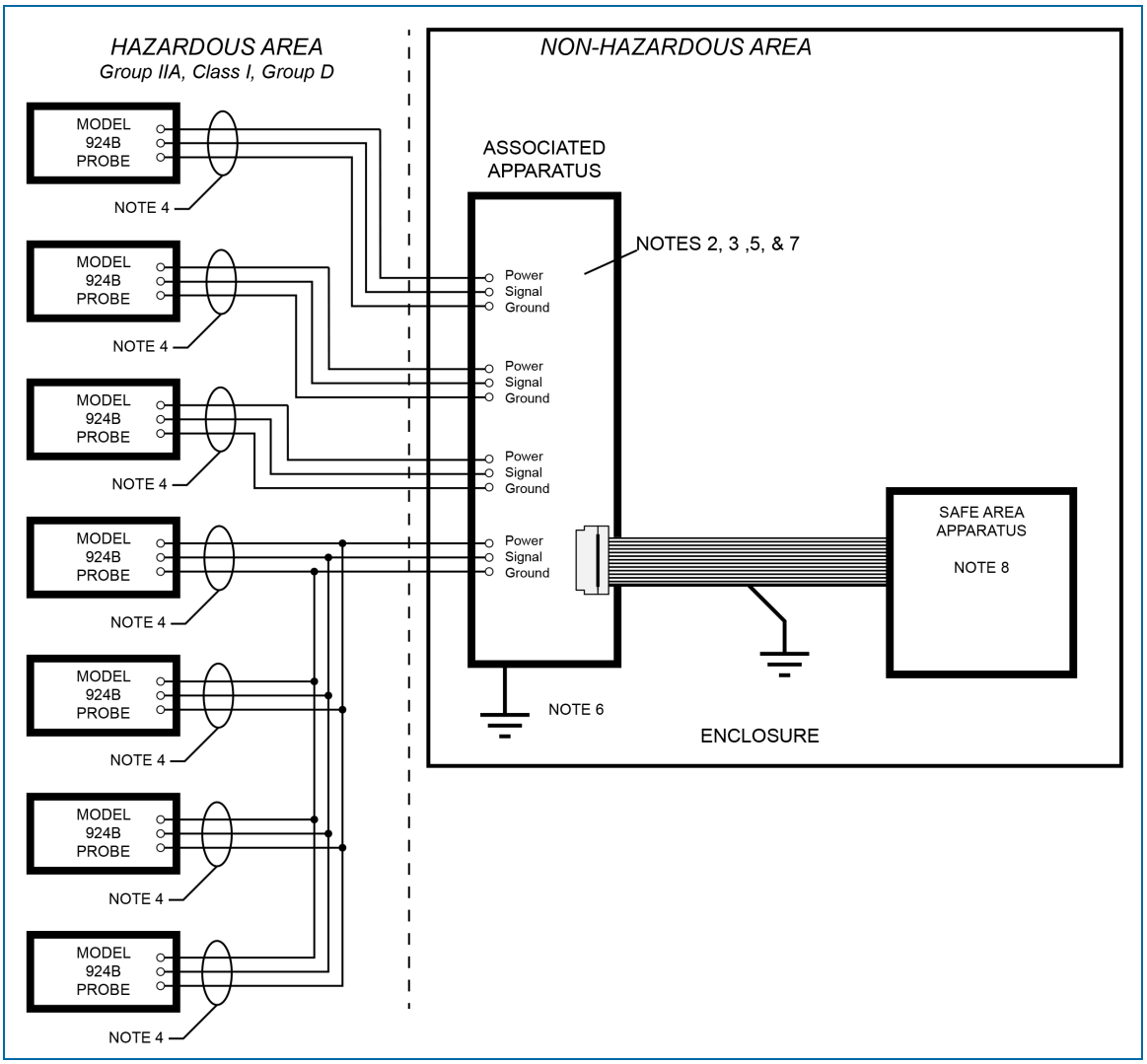
Example Associated Apparatus 14.28V (Uo), 338mA (Io), 16.1 uF (Co), 2,240uH (Lo)

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
MODEL 924B PROBE
NOTE 4
ASSOCIATED APPARATUS
NOTES 2, 3 ,5, & 7
Power
Signal
Ground
SAFE AREA APPARATUS
NOTE 8
NOTE 6
ENCLOSURE

Appendix N - 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 /IA 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:

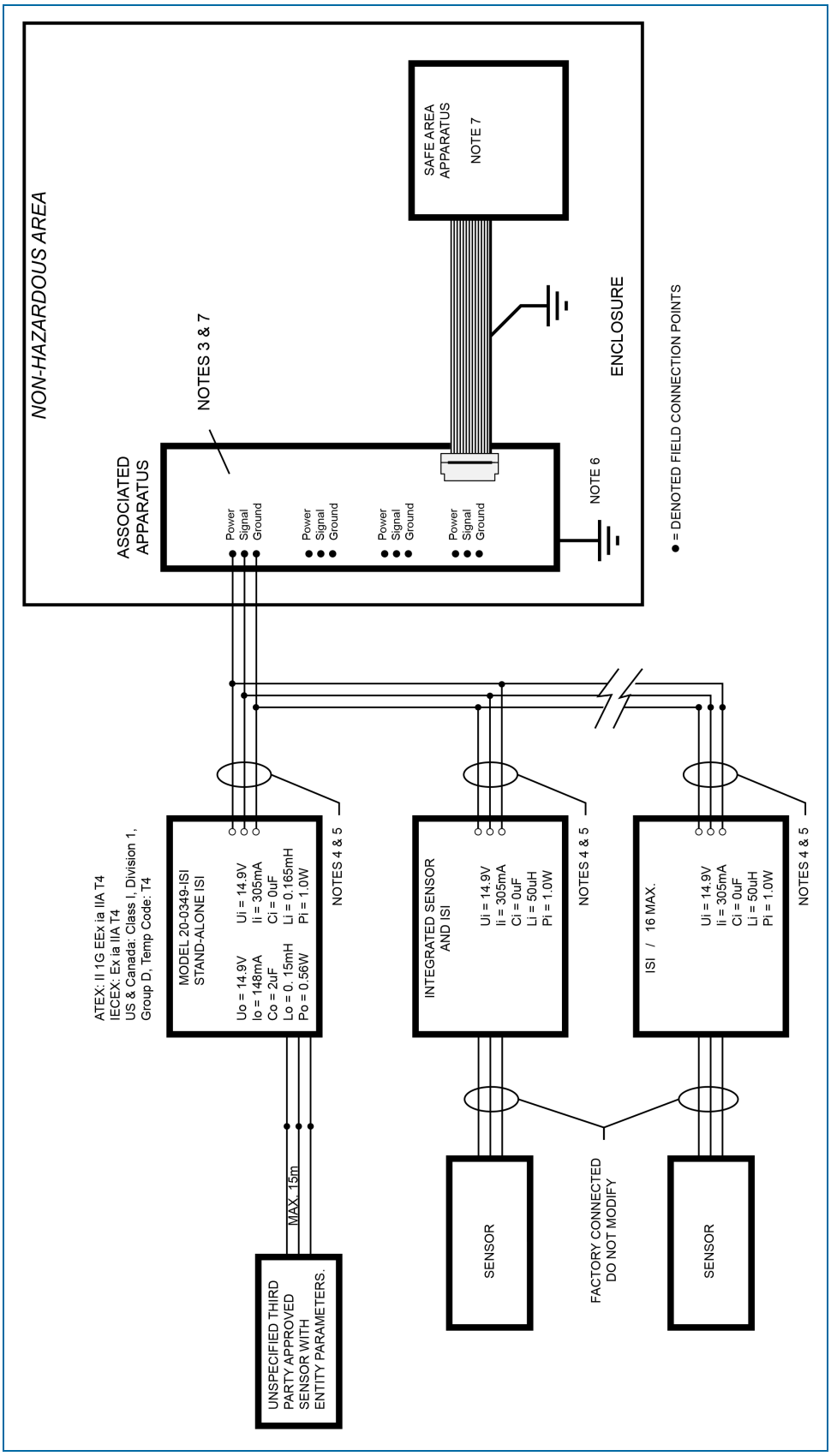
Sensor entity parameters		ISI output entity parameters
Vmax, Ui	≥	Vt, Uo 14.9V
Imax, Ii	≥	It,Io 148mA
Pi	≥	Po 0.56W
Ci	≤	Ca, Co 2uF
Li	≤	La, Lo 0.15mH

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		ProGauge support. Adds Control dwgs for Nano, 924B Probe and ISIM Sensors
11	1350	4/13/18		Add M2018-PG-A&P in *Site Wiring PG* for EMEA (ProGauge/MagDirect)

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

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