Veeder-Root TLS2 Console
Gilbarco EMC2 Console

Site Prep Manual

VEEDER-ROOT

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Figures

Tables

Introduction

This manual describes the site preparation and installation procedures for the following Touch-Screen consoles:

• Veeder-Root TLS2 Console

• Gilbarco EMC2 Console

This manual assumes that you installing the console in a new site (before pavement is put down and with no wiring runs in place). Among the topics covered are:

• Site layout considerations.

• Installing the console and connecting wiring from the 120 or 240 Vac power panel.

• Probe assembly and installation procedures.

• Installing wiring conduit between the console and its probes.

• Probe-to-console field junction box wiring diagram.

• Attaching probe wiring to the console.

• RS-232 serial communication connection requirements and serial commands.

After the console is wired to its power source and probes, you should program the console following the setup instructions contained in the Setup and Operation manual.

Contractor Certification Requirements

Veeder-Root requires the following minimum training certifications for contractors who will install and setup the equipment discussed in this manual:

Installer (Level 1) Certification: Contractors holding valid Installer Certification are approved to perform wiring and conduit routing; equipment mounting; probe, sensor and carbon canister vapor polisher installation; tank and line preparation; and line leak detector installation.

TLS-350 Technician (Level 2/3 or 4) Certification: Contractors holding valid TLS-350 Technician Certifications are approved to perform installation checkout, startup, programming and operations training, troubleshooting and servicing for all Veeder-Root TLS-300 or TLS-350 Series Tank Monitoring Systems, including Line Leak Detection and associated accessories.

Warranty Registrations may only be submitted by selected Distributors.

Related Manuals

577013-757	TLS2/EMC2 Setup & Operation Manual
577013-767	TLS2 RS-232 Serial Interface Manual
576013-859	Direct Burial Cable Installation Manual

Safety Symbols

The following safety symbols are used in this manual to alert you to important safety hazards and precautions.

	EXPLOSIVE Fuels and their vapors are extremely explosive if ignited.		**FLAMMABLE** Fuels and their vapors are extremely flammable.
	ELECTRICITY High voltage exists in, and is supplied to, the device. A potential shock hazard exists.		**TURN POWER OFF** Live power to a device creates a potential shock hazard. Turn Off power to the device and associated accessories when servicing the unit.
	NO SMOKING Sparks and embers from burning cigarettes or pipes can ignite fuels and their vapors.		**NO OPEN FLAMES** Open flames from matches, lighters, welding torches, etc. can ignite fuels and their vapors.
	INJURY Careless or improper handling of materials can result in bodily injury.		**READ ALL RELATED MANUALS** Knowledge of all related procedures before you begin work is important. Read and understand all manuals thoroughly. If you do not understand a procedure, ask someone who does.
	WARNING Heed the adjacent instructions to avoid equipment damage or personal injury.		**STATIC SENSITIVE COMPONENTS** Handling static sensitive electronic components without grounding your body can subject them to damaging voltage potentials.

WARNING! Failure to properly ground this console will result in a hazardous condition! Follow all of the installation methods as described in this manual.

CAUTION! Both the touch panel display and serial communications will fail if this console becomes ungrounded.

Control Drawing

Hazardous Area

Non-Hazardous Area

consoles/tls2/newsysdia.eps
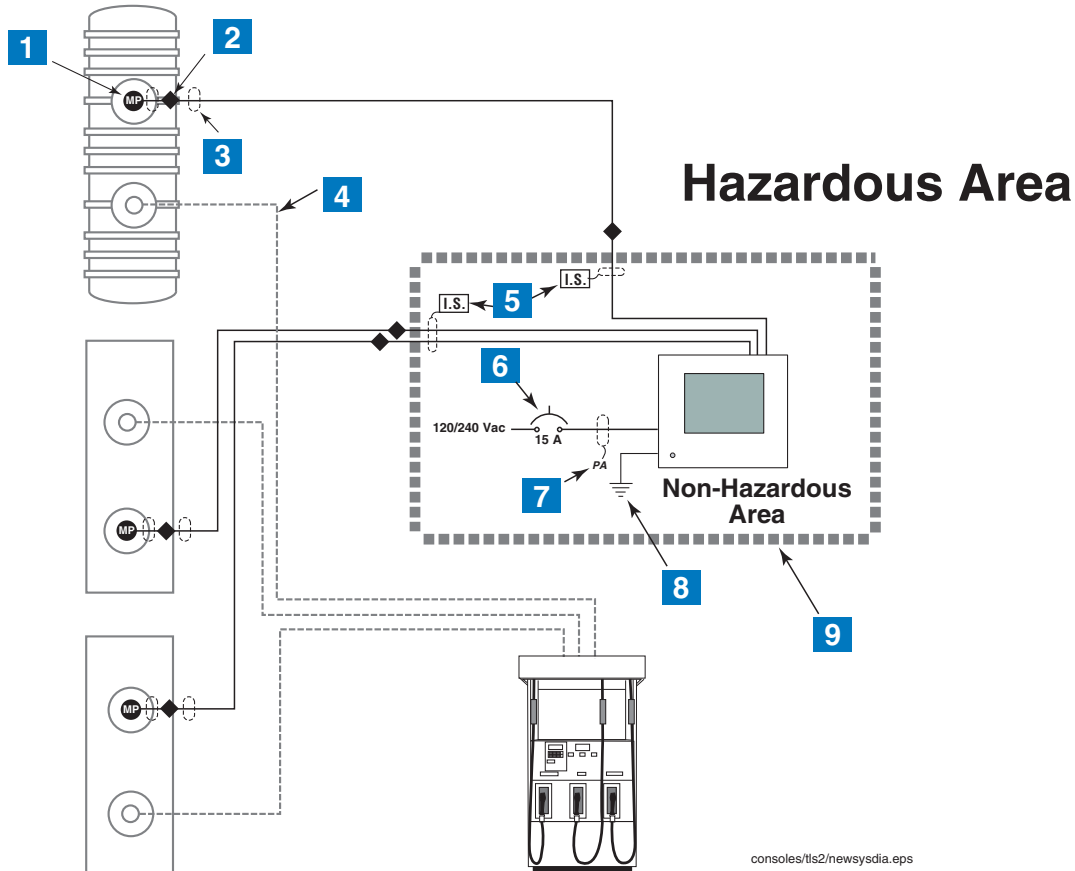
Legend for numbered boxes

1   Magnetostrictive probe field wiring connection enclosed in a weatherproof junction box
2   Seal off
3   Rigid conduit
4   Product piping
5   Intrinsically safe wiring marked ⎵I.S.⎵ shall be installed in accordance with Article 504-20 of the NEC, ANSI/NFPA 70 and enters an intrinsically safe knockout in the console
6   15 ampere circuit breaker; or fused, switched, neon indication spur
7   This conduit enters a power area knockout in the console
8   12 AWG (4mm^2) barrier ground wire
9   Dotted line denotes isolation from hazardous area (e.g., a building).

Notes

To be installed in accordance with the National Electrical Code, NFPA 70 and the Code for Motor Fuel Dispensing Facilities and Repair Garages (NFPA 30A), or other local codes such as the CEC, Canadian Electrical Code.

Conduit requirements are dependent on local electrical regulations. For probe-to-console wiring, shielded cable is required regardless of conduit requirements.

WARNING: Substitution of components may impair intrinsic safety.

Circuitry within the console barrier forms an intrinsically safe, energy-limited system. This system makes console probes safe for use in a Class I, Group D hazardous locations. Console probe wiring is intrinsically safe only when connected to Veeder-Root/Gilbarco Consoles. Reference Console Form Number 8560 and Probe Form Numbers 8462, 8463, 8468, and 8473.

Figure 1. Control Drawing - Example TLS2/EMC2 System Site Layout

National Electrical Code Compliance

The following information is for general reference and is not intended to replace recommended National Electric Code (NEC) procedures. It is important for the installer to understand that electrical equipment and wiring located in Class I, Division 1 and 2 installations shall comply with the latest appropriate articles found in the National Electric Code (NFPA 70) and the Automotive and Marine Service Station Code (NFPA 30A), or other local code such as the CEC, Canadian Electrical Code.

PROBE-TO-CONSOLE WIRING

Shielded Cable or Veeder-Root Direct Burial Cable Required
To ensure the best operating systems available, Veeder-Root **REQUIRES** the use of shielded cable for all probes regardless of conduit material or application. In these installations, shielded cable must be rated less than 100 picofarad per foot (100 pF/304 mm) and be manufactured with a material suitable for the environment, such as Carol™ C2534 or Belden™ 88760, 8760, or 8770.

Note: Throughout this manual, when mentioning any cable being used for probe-to-console wiring, it will be referring to shielded cable.

Wire Length
Improper system operation could result in undetected potential environmental and health hazards if the probe-to-console wire runs exceed 1000 feet (304 m). Wire runs must be less than 1000 feet to meet intrinsic safety requirements.

Splices
Veeder-Root recommends that no splices be made in the wire run between a probe junction box and the console. Each splice degrades signal strength and could result in poor system performance.

Wire Gauges - Color coded
Shielded cable must be used in all installations. Probe-to-console wires should be #14 - #18 AWG (2.5 to 0.8 mm^2) stranded copper wire and installed as a Class 1 circuit. As an alternate method when approved by the local authority having jurisdiction, #22 AWG ($>$0.3 mm^2) wires such as Belden 88761 may be suitable in installations with the following provisions:

- Wire run is less than 750 feet (228 m)

- Capacitance does not exceed 100 pF/foot (100 pF/304 mm)

- Inductance does not exceed 0.2 μH/foot (0.2 μH/304 mm).

POWER WIRING

Wires carrying 120 or 240 Vac from the power panel to the console should be #14 AWG (2.5 mm^2) copper wire for line, neutral and chassis ground (3 wires); and #12 AWG (4 mm^2) copper wire for barrier ground (1 wire).
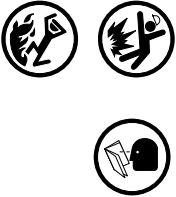
PROBE JUNCTION BOXES

Weatherproof electrical junction boxes with a gasketed cover are required on the end of each probe conduit run at the manhole location. Gasketing or sealing compound must be used at each entry to the junction box to ensure a waterproof junction. The interior volume of each junction box must be a minimum of 16 cubic inches (262 cm^3).

Veeder-Root recommends the following junction box or equivalent:

- Appleton Electric Co. - JBDX junction box, JBK-B cover, and JB-GK-V gasket

- Crouse-Hinds Co. - GRFX-139 junction box, GRF-10 cover, and GASK-643 gasket.

Probe Wiring Safety Issues

⚠ **WARNING**	
	Probes operate in areas where flammable liquids and explosive vapors may be present.
	FAILURE TO COMPLY WITH THE FOLLOWING WARNINGS AND SAFETY PRECAUTIONS COULD CAUSE DAMAGE TO PROPERTY, ENVIRONMENT, RESULTING IN SERIOUS INJURY OR DEATH.
	Improper installation may result in fire or explosion causing serious injury or death.
	1. **Read thoroughly and follow the instructions shipped with each probe.**
	2. **Probe wiring must enter the console only through their designated areas.**
	3. **Power wires and conduit must not enter the intrinsically safe compartment of the console.**
	4. **Substitution of components may impair intrinsic safety.**

Wiring between the console and the probes is of limited electrical power so that there is insufficient energy to ignite fuel. In the console, the low power probe wiring is considered intrinsically safe because it is physically isolated from all high power wiring. To maintain the integrity of this safety feature probe wiring can not share the same conduit with power wiring. In addition, probe cables can only enter the console through the designated intrinsically safe area knockouts.

If the TLS2/EMC2 System is being retrofitted into a paved site, you run direct burial cable to the probes, and then seal over the cable grooves. Before trenching, you should diagram all conduit runs between the console's intended location and its deployed probes. Before considering buried cable runs, check with the local authority having jurisdiction to be sure that direct burial practices are acceptable at your location.

Your site diagram will help you calculate conduit and wiring lengths, and necessary quantities of junction boxes, sealing boxes, clamps, brackets, etc.

Throughout this planning process and in the actual installation, you must follow all latest National Electric Codes, and applicable federal, state, and local codes as regards conduit type, depth below grade, sealing, grounding, wire capacities, direct burial (if permitted), etc.

Console Installation

Selecting a Console Location

⚠ WARNING	
	Explosive vapors or flammable liquids could be present near locations where fuels are stored or being dispensed. The console is not explosion proof. **An explosion or fire resulting in serious injury or death, property loss and equipment damage could occur if the console is installed in a volatile, combustible or explosive atmosphere (Class I, Division 1 or 2).** **Do not install this console in a volatile, combustible, or explosive atmosphere.**

Select a mounting location inside the building. The console must be protected from severe vibration, extremes in temperature and humidity, rain, and other conditions that could harm computerized electronic equipment.

The equipment is designed to operate safely under the following range of conditions:

- Temperature range 0 to 40°C - (storage temperature range of -20 to +70°C)

- A maximum relative humidity of 95% RH (non-condensing) at temperatures up to 40°C.

- Console may be powered by either 120 or 240 Vac. A switchmode power supply automatically detects the input voltage (no jumpers required).

- Main supply voltage fluctuations not exceeding ±10%

- Pollution Degree Category 2

- Installation Category II.

Important! This console must be installed inside a building. It is not suitable for any external location. If the unit requires cleaning, do not use any liquids, wipe only with a clean, dry cloth - Console must be turned Off when cleaning the display.

Ensure that the console is located where neither the console nor its associated cabling will be damaged by doors, furniture, barrows, etc. Consider the ease of routing wiring, ducting, and probe cables to the console. Check that the mounting surface material is strong enough to support the console's weight of about 5 pounds (2.3 kg).

ACCESSING THE CONSOLE'S MOUNTING HOLES

Open the console door by removing the right side (looking at the front) top and bottom #15 Torx screws. Swing open the door to the left. The display and CPU board assembly are now visible. Gently lifting on the right side of the CPU board, swing the CPU mounting plate to the left. The power supply board and Intrinsically safe cover are now visible. The left top and bottom console mounting holes should be visible. Swing the small Intrinsically safe area cover to the left and you should see the right top and bottom console mounting holes.

Console Dimensions

Figure 2 shows the console dimensions, mounting hole pattern, and designated knockouts through which power wiring and intrinsically safe wiring must enter the console.
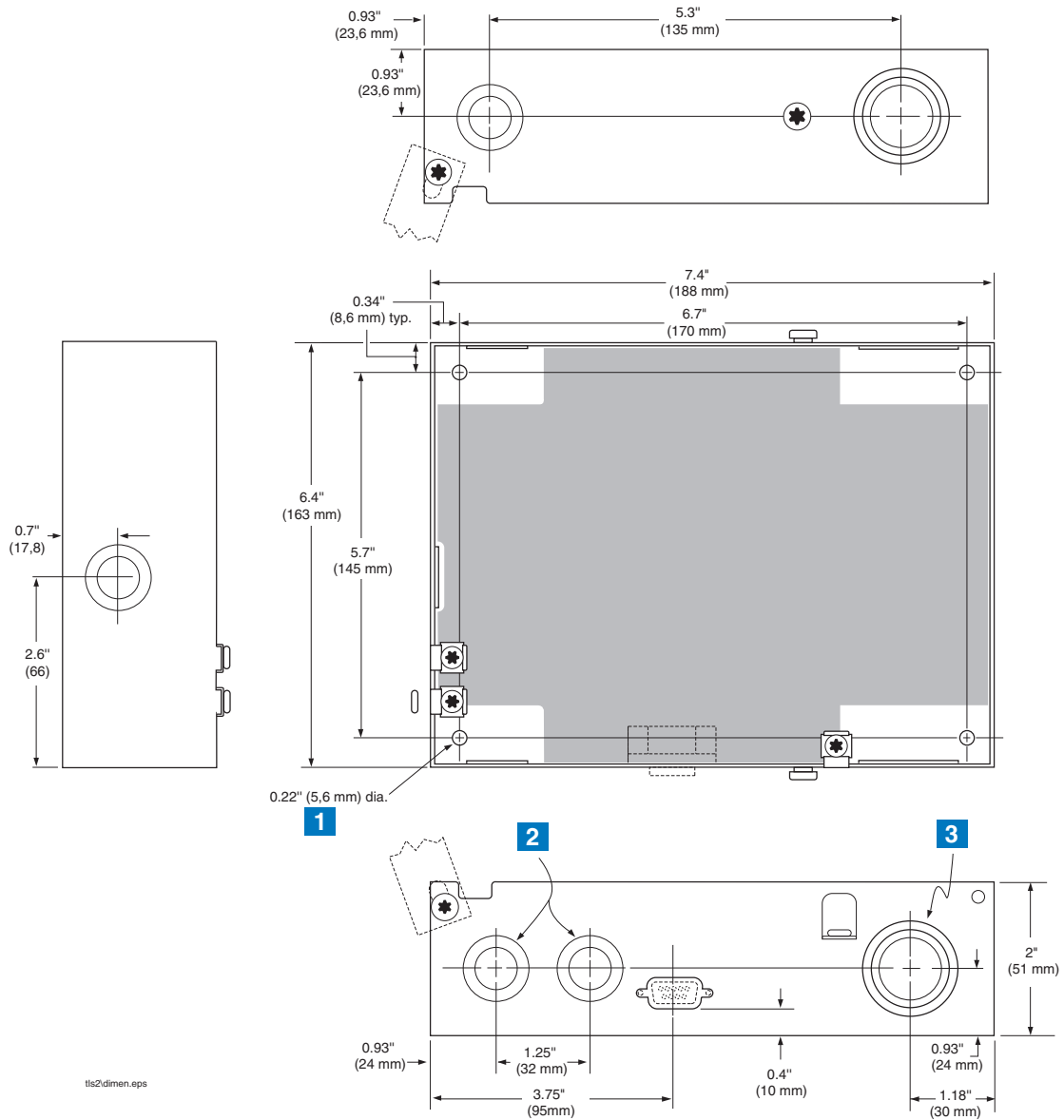
Legend for numbered boxes

1   Console mounting holes - 4 places.
2   1/2-inch I.P.S. & 0.56 inch (22 and 14 mm) - Power wiring only conduit knockouts (4 places).
3   1/2-, 3/4-, & 1-inch I.P.S. (22, 28, & 35 mm) - Intrinsically safe only conduit knockouts (2 places).

Figure 2. Console Dimensions and Designated Wiring Entry Knockouts

Mounting the Console

Install 1/2-inch I.P.S. (14 mm) metal conduit between the console and the power panel as shown in Figure 3 for international installations or Figure 4 for U.S. installations.
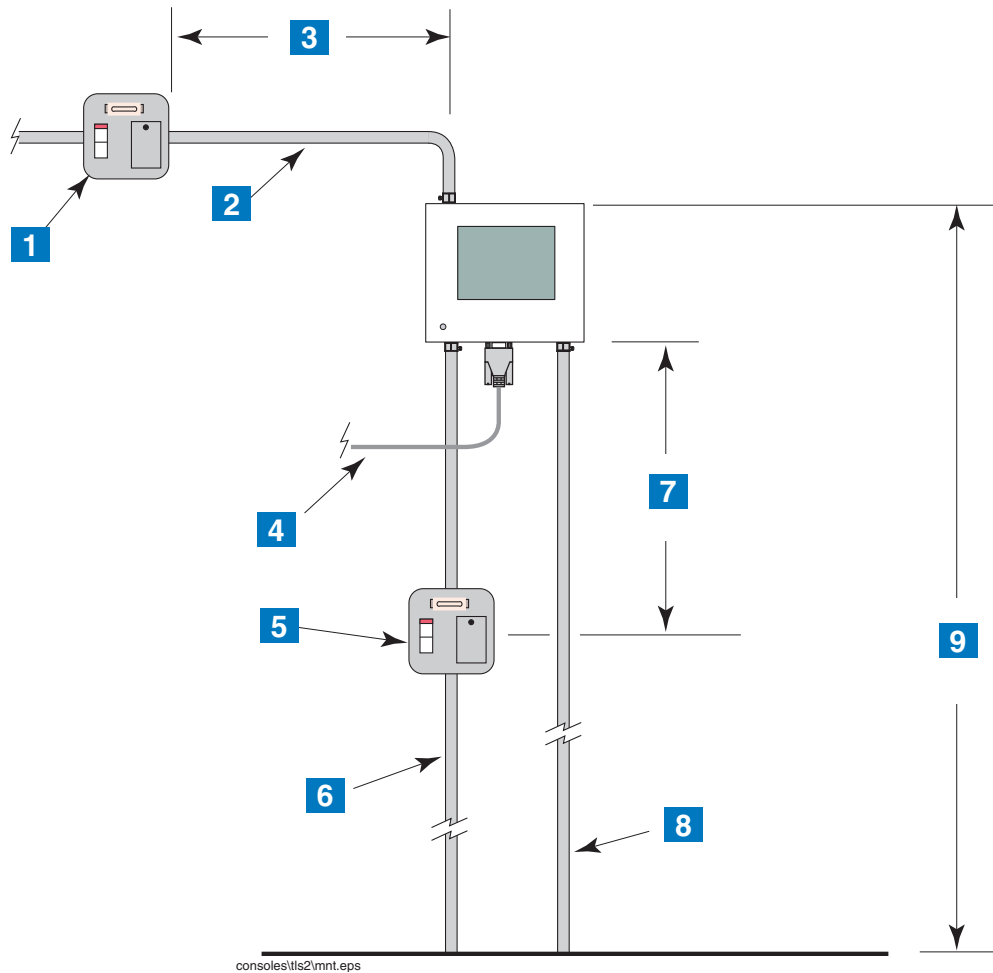
consoles\tls2\mnt.eps

Legend for numbered boxes

1   2A neon spur
2   To an external alarm (i.e., forecourt alarm)
3   1000 mm, maximum
4   Communication cable.
5   5A neon spur
6   From an independent power supply at the distribution panel, run three 2.5 mm^2 - minimum standard color coded wires; live, neutral, and earth, to the fused spur. Run one 4 mm^2 - minimum wire, color coded green/yellow, from the earth bus bar at the distribution panel direct to the console location. Leave enough free cable for connection to the console.
7   1000 mm, maximum
8   Probe field cables.
9   1500 mm, maximum

Figure 3.   Recommended Mounting of Console - International Installations
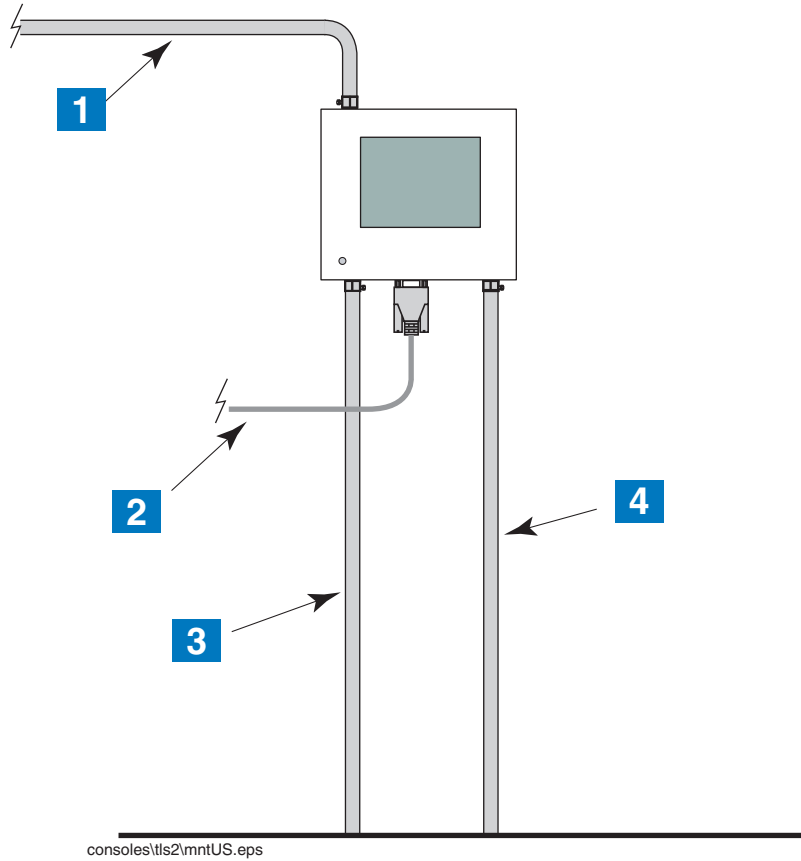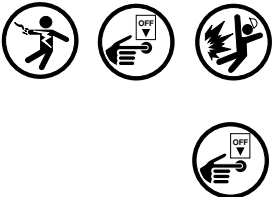
consoles\tls2\mntUS.eps

Legend for numbered boxes

1   To an optional overfill alarm
2   Communication cable.
3   A dedicated circuit breaker rated for 15 amperes, 120 Vac or 240 Vac. NOTE, circuit breaker must be marked as the power
     disconnect for the console. Run three 14 AWG standard color coded wires; live, neutral, and earth, to the console. Run one
     12 AWG wire, color coded green, from the earth bus bar at the distribution panel direct to the console location. Leave enough
     free cable for connection to the console.
4   Conduit for probe field cables.

Figure 4.   Recommended Mounting of Console - Alternate Installations

Wiring the Console

	⚠ **WARNING**
(icons)	**The console contains voltages which can be lethal. It is connected to devices that must be intrinsically safe.**
	Connecting power wires to a live circuit can cause electrical shock that may result in serious injury or death.
	1. Turn off, tag and lockout power at the circuit breaker connecting the power supply wires.
	2. Attach conduit from the power panel to the console's Power Area knockouts only (1 on top and 2 on bottom, ref. Figure 2).

1. Pull four wires between the power panel and the console; three #14 AWG color-coded wires for AC line (L), AC neutral (N) and chassis ground; and one #12 AWG green and yellow wire for barrier ground.

    For international applications using 240 Vac, pull four wires between the power panel and a 5 A fused, switched, neon indication spur; three 2.5 mm^2 AWG color-coded wires for AC line (L), AC neutral (N) and chassis ground; and one 4 mm^2 green and yellow wire for barrier ground. Pull four identical wires between the spur and the console.

2. Open the door of the console. The display and CPU board are mounted to a hinged plate that must be swung open to access the power input terminals and ground lugs. Connect the four power/ground wires as shown in [Figure 5]. Do not connect the power wires to breaker panel at this time.

3. Peel away the protective film from the surface of the display's touch screen.

⚠ **WARNING! Failure to properly ground this console will result in a hazardous condition! Follow all of the installation methods as described in this manual.**

CAUTION! Both the touch panel display and serial communications will fail if this console becomes ungrounded.

WARNING!
Shock hazard. Do not touch metal ends of capacitors C24/C27 or the metal bands on chokes L2/L4.

consoles/tls2/pcon.eps
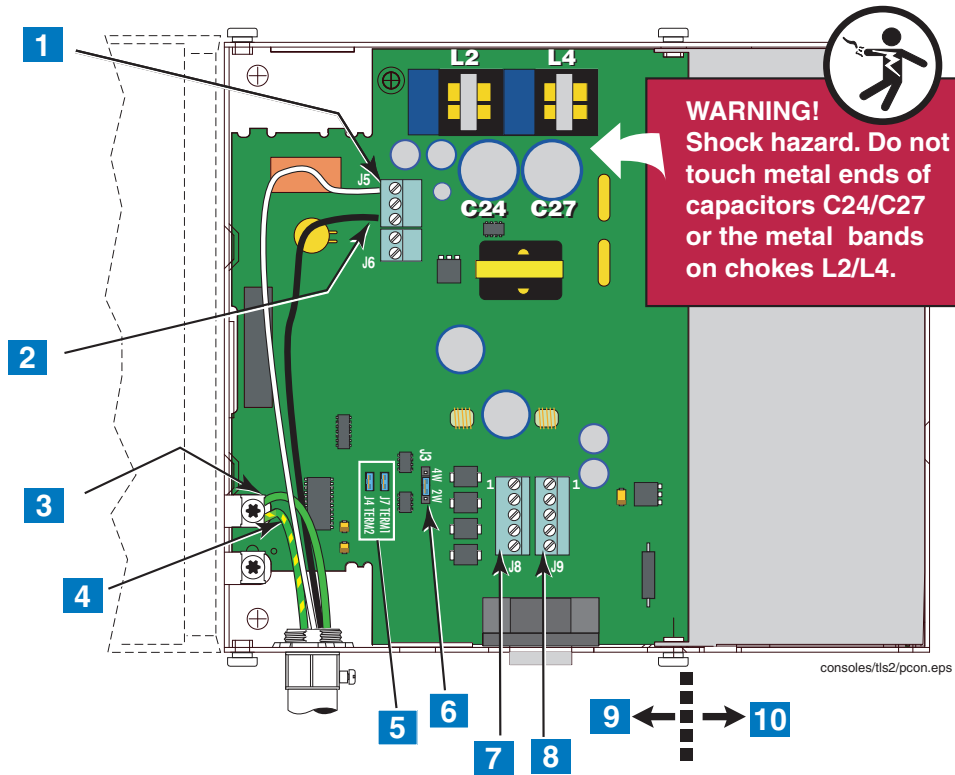
Legend for numbered boxes

1   Attach neutral wire (N) to top terminal (J5).
2   Attach hot wire (L) to bottom terminal (J5).
3   Attach chassis ground wire to ground lug.
4   Attach protective earthing conductor (green and yellow) - 4 mm^2 (minimum) barrier ground wire to ground lug. (The other end of this conductor must be connected to a "known good earth ground").
5   Term1 (J7) and Term2 (J4) jumpers. Remove these two jumpers when using the Comm 2 port in RS-485 multidrop mode and the console is not at the end of the network.
6   Comm 2 Port configuration jumper J3. Pin 1 is on the bottom of the 4-pin jumper. Jumper shown in the RS-422 configuration position (on pins 2 & 3). For RS-485 2-wire configuration put jumper on pins 1 & 2. For RS-485 4-wire configuration put jumper on pins 3 & 4.
7   Comm 2 port connector J8 - RS-422/RS-485 only (pin 1 on top).
8   Comm 2 port connector J9 - RS-232 only (pin 1 on top).
    Note: Comm 2 can support either RS-232 or RS-422/ RS-485. Only one terminal connector (J8 or J9) can be installed at a time. For Comm 2 port pin outs, see page 37.
9   Power side of console.
10 Intrinsically safe side of console (under cover).

Power Wiring Notes

• Barrier ground must be #12 AWG (4mm^2) or larger wire.

• Use an ohmmeter to check the electrical resistance between the console's metal case and the earthing ground wire's connection at the "known good earth ground". It should read less than 1 ohm.

• Connect the power supply wires in the power panel to a separate dedicated circuit.

• Electrical rating of power input - 120 or 240 Vac, 50/60 Hz, 2 ampere maximum.

• See Figure 2 for locations of power conduit knockouts into the console. Power wiring must enter the console through designated knockouts.

Figure 5.   Wiring AC Power to the Console

CPU Board Component Locations

Figure 6 shows important component locations on the CPU board.
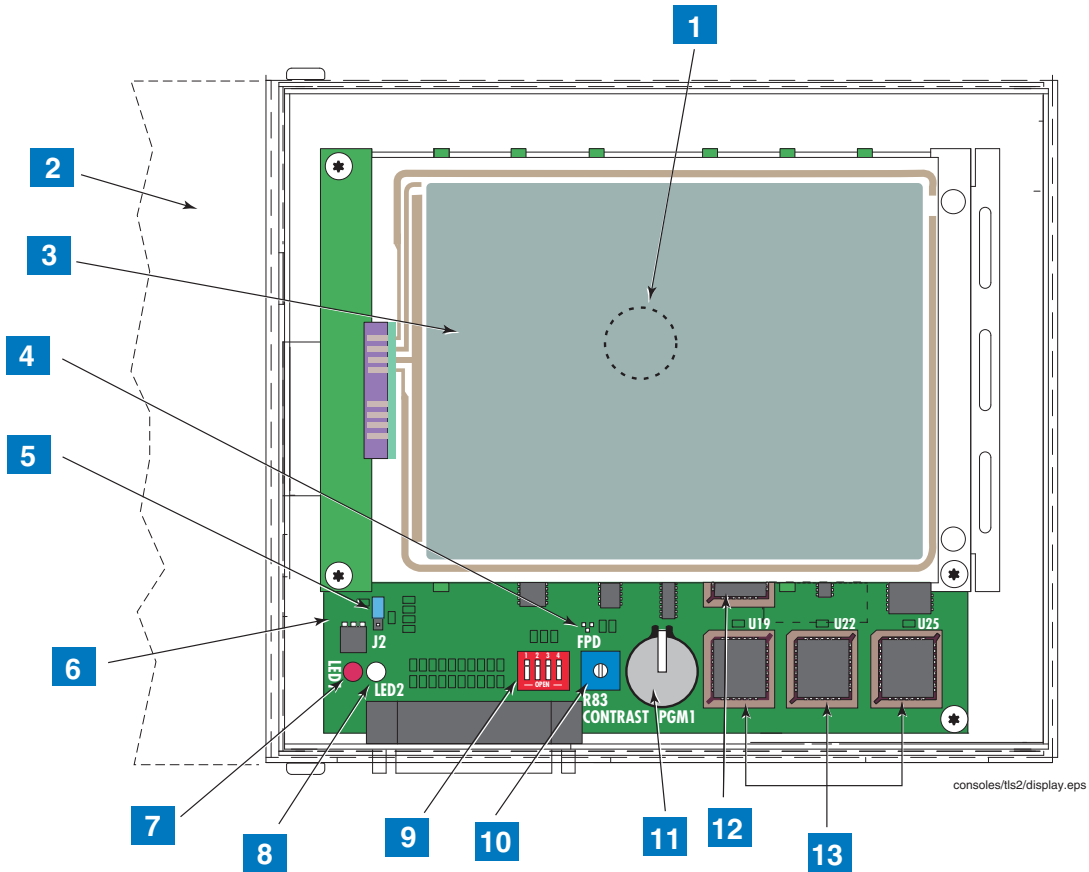
Legend for numbered boxes

1   Console features ibutton (under display)
2   Door (reference)
3   Liquid crystal touch screen display
4   Filtered probe data indicator
5   RAM clear jumper J2 (shown in normal position)
6   CPU board (extends under display)
7   Alarm indicator LED1
8   Power indicator LED2
9   Dip switch with all switches in the open position (normal). Set switch 1 to Closed position to access diagnostic screens. Switches 2-4 are unused.
10   Display contrast adjustment
11   Console features update ibutton
12   Console setup archive history
13   Console system software U19, U22, and U25.

Figure 6.   CPU Board Components

Determining Mag Probe Length

Probe Manhole Installation

At each underground probe location there must be a 14-inch (356 mm) minimum diameter manhole. If necessary you must install this manhole according to the manufacturer's instructions (Note: probes should not be located within 24 inches (610 mm) of the submersible pump (STP) to avoid erroneous probe readings when the pump is running). Position the manhole so that there is necessary clearance for junction box installation and wiring.

Determining Mag Probe Length for Installation in a Dedicated Riser

If tank diameter is unknown, perform the following procedure (ref. Figure 7):

1. Measure the distance from the bottom of the tank to the top of the probe riser pipe (A).

2. Measure the distance from the bottom of the probe riser pipe to the top of the probe riser pipe (B).

3. Subtract (B) from (A) to determine the correct tank diameter (C). Round tank diameter (C) up to next highest inch and order this length probe.

consoles/tls2/figure6.eps
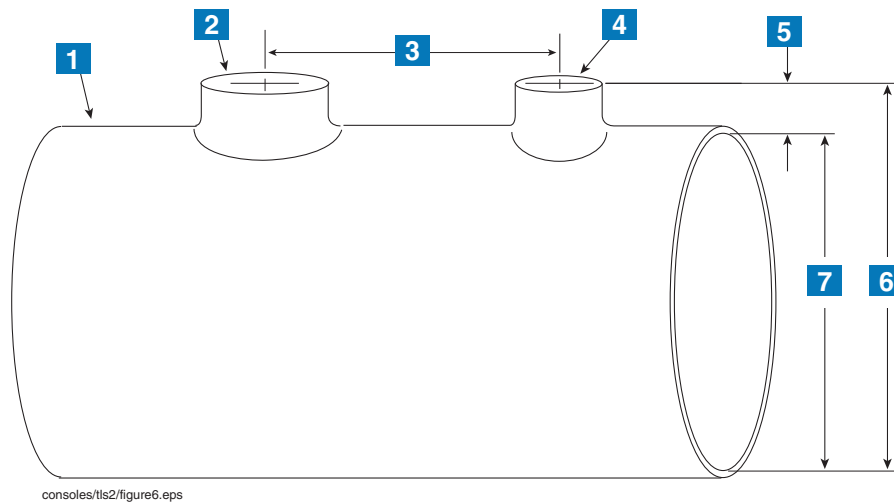
Legend for numbered boxes

1   Tank
2   STP
3   24" (610mm) minimum
4   Probe riser pipe
5   Dimension B
6   Dimension A
7   Dimension C or probe length = dimension A minus dimension B

Figure 7.   Calculating the Correct Mag Probe Length for dedicated riser installation

Special Mag Probe Installation Kits

In addition to the Mag Probe installation kits shipped with each probe (containing floats, spacer rings, cable, etc.), your installation may also require one or more of the special kits described in this section.

AST Installation Kit

This kit is recommended when installing Mag Probes into an above ground storage tank (AST). This kit contains a length of flexible conduit, connectors, etc., for easier probe access. The kit contents are listed in Table 1 and shown in Figure 8.

Table 1. Mag Probe AST installation kit - Part No. 312020-984

Quantity	Description	Part Number
5 ft.	3/8" Flexible conduit	576008-294
1	3/8" Adaptor nut	329972-002
2	3/8" Straight liquidtite connectors and related parts	576008-295
1	Cord Grip Group	331028-001

tls2/astkit.eps
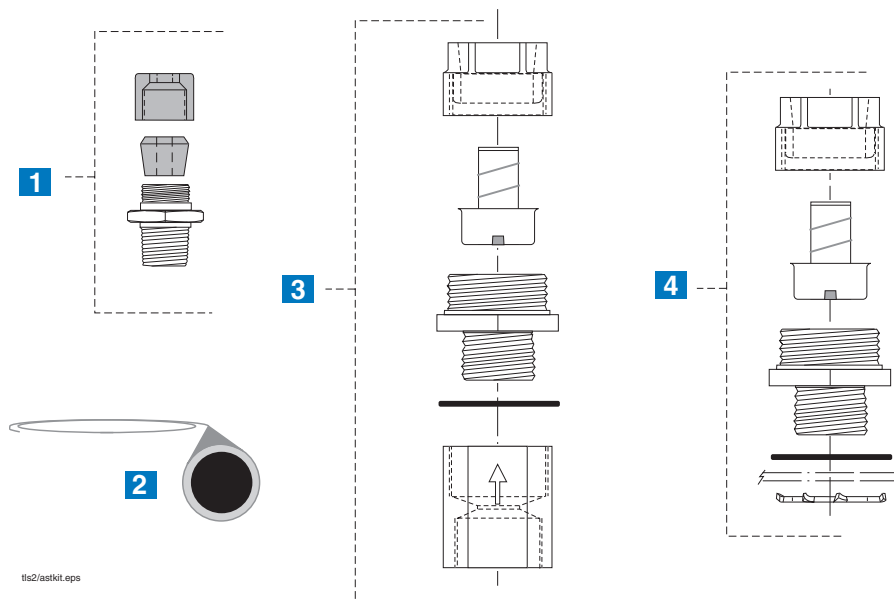
Legend for numbered boxes

1   Cord grip
2   Flexible conduit 5 ft (1.5 m)
3   Liquidtight connector assembly (at riser cap)
4   Liquidtight connector assembly (at J-box)

Figure 8.   Mag Probe AST Installation Kit

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Riser Cap Kit for Mag Probe Installations

The cap on the riser containing the Mag Probe must be modified to allow the probe's cable to exit the riser. This modification requires making a 1/2"-14 NPT tapped hole in the cap for a cord grip. Two types of drilled and tapped Riser Cap kits are available for purchase, or you may be able to modify the existing riser cap.

CAP AND CORD GRIP KIT

This Riser Cap kit (Table 2) contains a plastic cap which screws onto the 4-inch NPT riser (Figure 9). The cap comes drilled and tapped with a cord grip.

Table 2. Cap and cord grip kit - Part No. 330020-282

Quantity	Description	Part Number
1	Plastic Riser Cap	331106-001
1	Gasket	331140-001
1	Bushing - Cord Grip	330787-001
1	Nut - Cord Grip	330594-001

tls2\risercap.eps
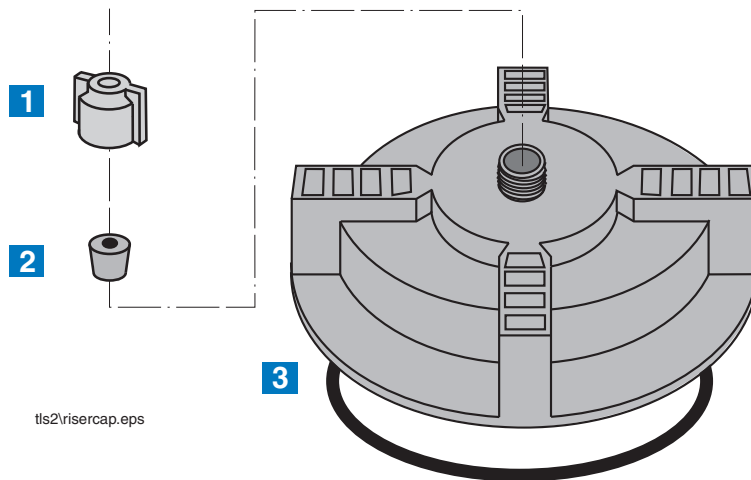
Legend for numbered boxes

1   Cord grip nut
2   Cord grip bushing
3   Riser cap and gasket

Figure 9.   Cap and Cord Grip Kit

METAL CAP AND RING KIT

This riser cap kit contains a metal ring which screws onto the 4-inch NPT riser and a quick-release metal cap which clamps onto the ring (Table 3). The cap comes drilled and tapped with a cord grip (Figure 10).

Table 3. Metal Cap and Ring Kit - Part No. 312020-952

Quantity	Description	Part Number
1	Ring Adaptor and gasket	514100-332
1	Cap and gasket	327869-003
1	Group Cord Grip	331028-001

Note: watch orientation of bevels and tapers when assembling these cord grip components.

Cord Grip Nut

Bushing

Body

Cord Grip Fitting

probes\cap&ring.eps

Metal cap w/1/2" NPT tapped hole

Cap gasket

Adapter ring
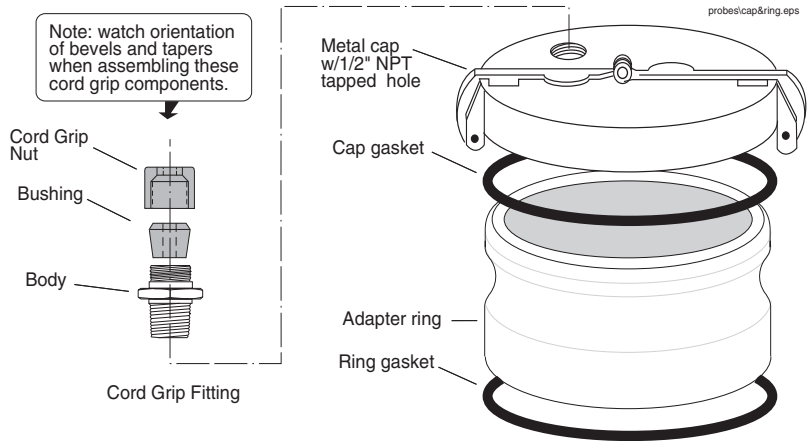
Ring gasket

Legend for numbered boxes

1 Cord grip assembly
2 Metal cap w/ tapped hole for cord grip
3 O-ring cap gasket
4 Metal ring
5 O-ring gasket

Figure 10.   Metal Cap and Ring Kit

MODIFYING AN EXISTING METAL CAP

In order to ensure that the riser cap seals properly to the probe cable and riser, we recommend that you purchase one of the kits available for this purpose. Riser Caps from other manufacturers may require modification. If you use your own metal riser cap, you must drill and tap it for a cord grip fitting (V-R P/N 331028-001) as follows:

1. Remove the cap to a non-hazardous location.

2. Drill and tap the cap for a 1/2"-14 NPT cord grip thread [Figure 11].

1.625 ±0.062 (41.27 ±1.6)

1/2" - 14 NPT hole

1.438 ±0.062 (36.53 ±1.6)

probes\prbricp.eps
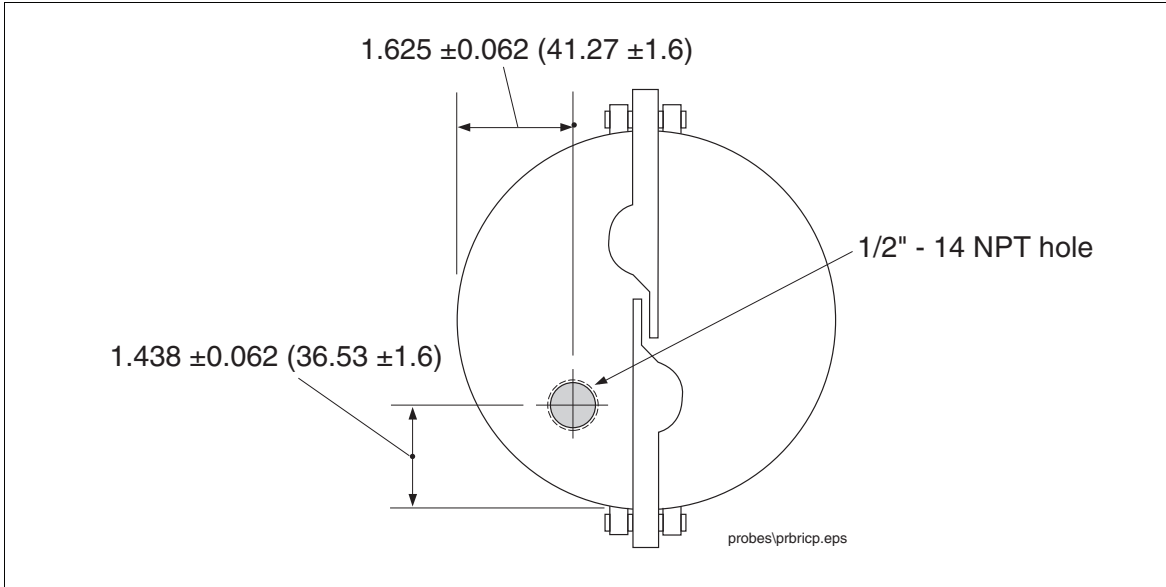
Figure 11.   Modifying an Existing Metal Riser Cap

Mag Probe Assembly

The following assembly instructions are for Global Mag Plus and Mag Plus probes. For other probe types follow assembly instructions included with probe.

Attaching Probe Canister Spacer Rings

Open the probe shipping carton so that you have access to the probe. Also open the installation kit.

For 3- and 4-inch risers

After adjusting the spacers for a 3- or 4-inch riser, install the two spacer rings as shown in Figure 12. Note: you must slide the bottom spacer up over the probe and onto the lower end of the canister.

For 2-inch risers

Install the two canister insulator sleeves onto the probe canister as shown in Figure 13. Note: you must slide the bottom sleeve up over the probe and onto the lower end of the canister.

Assembling Floats onto Probe Shaft

The Product float, Water or Water/Density Float and Boot from the Probe Installation Kit are assembled on the probe shaft in the exact sequence and orientation shown in Figure 14.

IMPORTANT! Failure to push the boot as far as possible onto the probe shaft could cause the boot and float(s) to fall into the tank. The boot must be pushed on until it "locks" on the probe shaft. Also, water floats must be installed, if ordered, for the probe to operate correctly.

Handle the probe carefully. Striking or dropping the probe will result in loss of calibration and could cause permanent damage.

Attaching Cable Connector to Probe Canister

Attach the connector end of the probe cable to the threaded connector on top of the probe canister and tighten down the integral nut.

This completes the probe assembly. Save the remaining kit components. They will be needed to install the probe into the tank.

tls2/figure12.eps
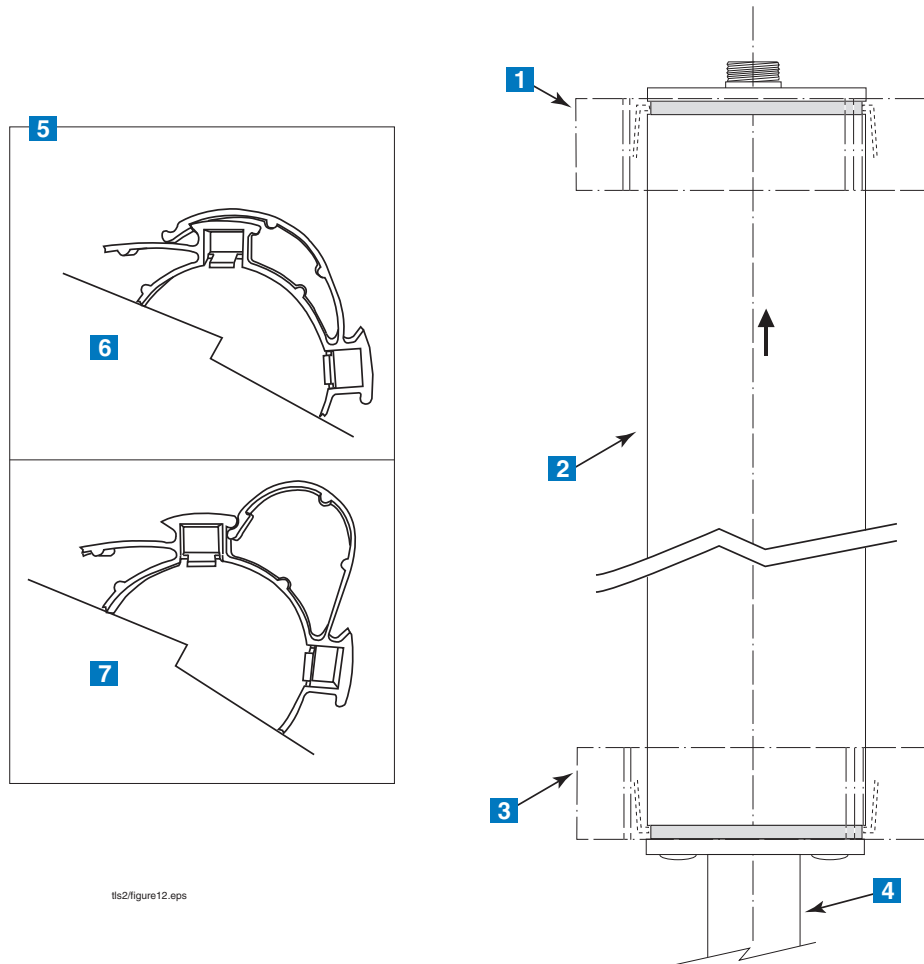
Legend for numbered boxes

1   After setting arms (see insert) install top spacer ring. Orient locking tabs as shown, and then slide ring over top of canister until tabs snap into groove in canister.
2   Probe canister
3   After setting arms (see insert) install bottom spacer ring. Orient locking tabs as shown, and then slide ring up over probe shaft and onto bottom of canister, until tabs snap in groove.
4   Probe shaft
5   Spacer Ring Settings
6   For 3"riser - set 4 spacer ring arms as shown.
7   For 4"riser - set 4 spacer ring arms as shown.

Figure 12.   Installing Probe Canister Spacer Rings for 3- & 4-inch Risers

probes\sleeveinst2.eps
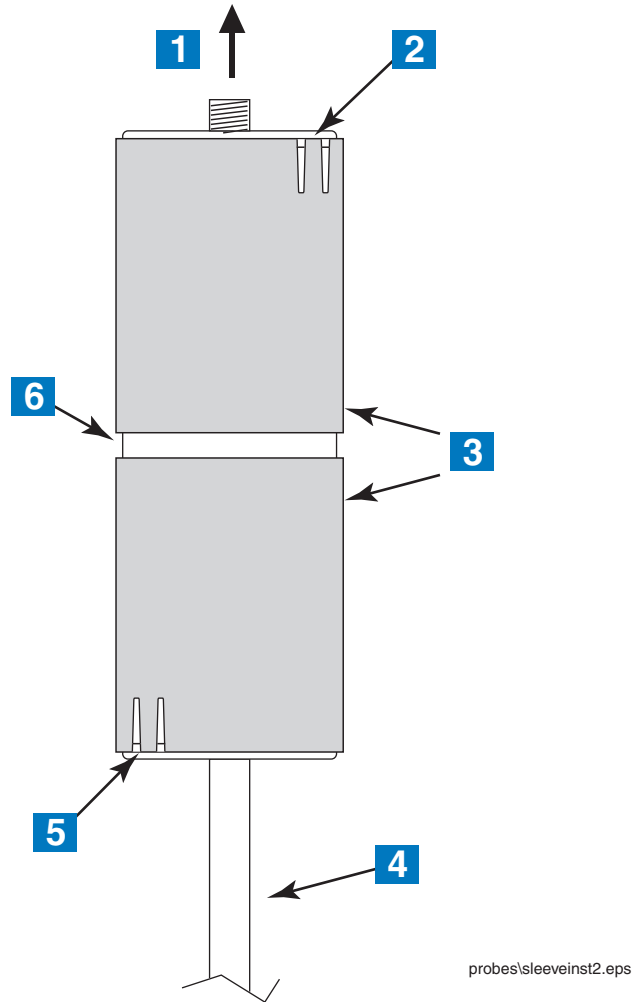
Legend for numbered boxes

1   Canister connector up
2   Sleeve tabs up (snap into canister groove)
3   Canister insulator sleeves (2).
4   Probe shaft
5   Sleeve tabs down (snap into canister groove)
6   Probe canister

Figure 13.   Installing Insulating Sleeves for 2-inch Risers
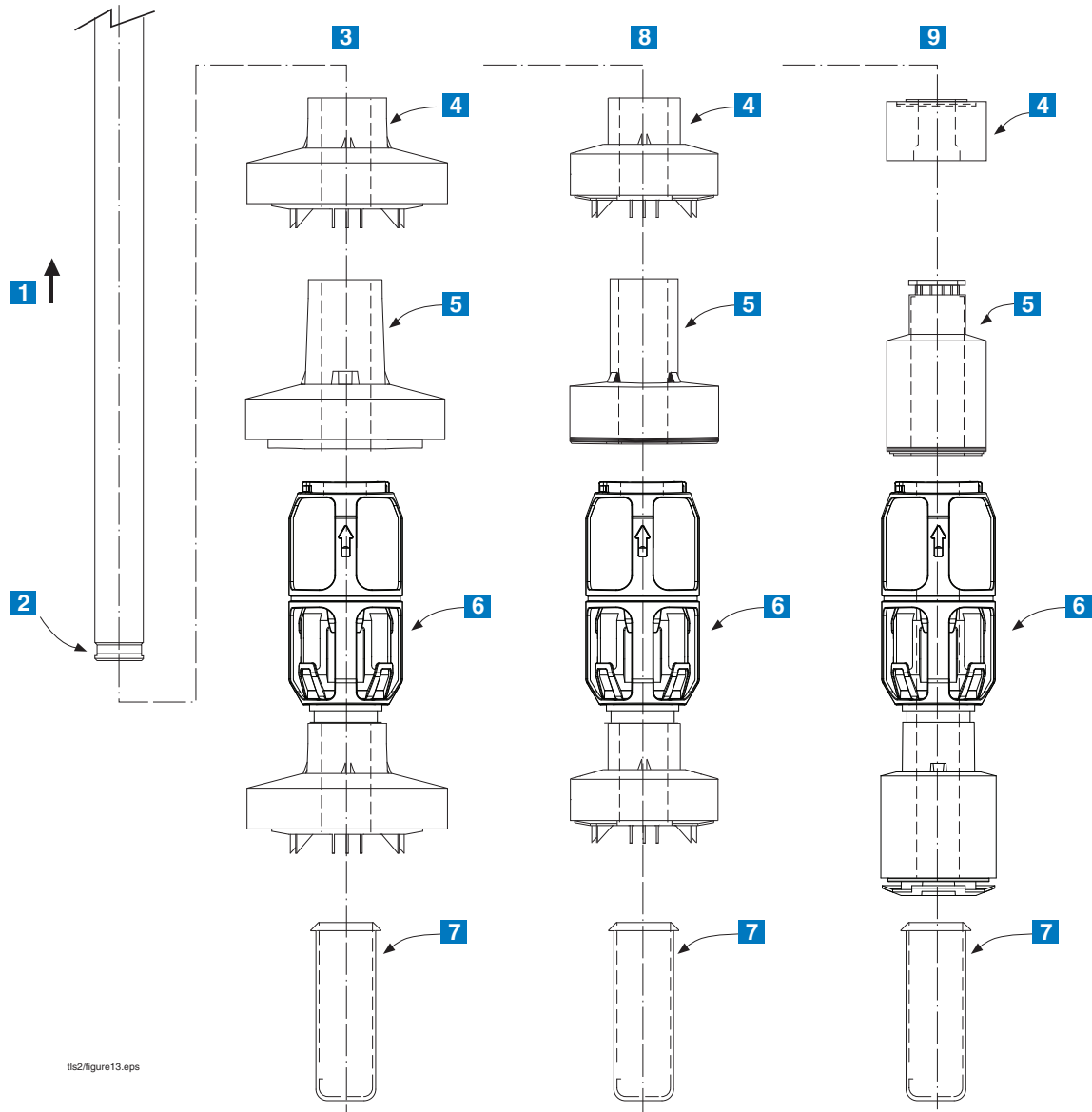
tls2/figure13.eps

Legend for numbered boxes

1   Up
2   Bottom of probe shaft
3   4-Inch Float set
4   Product float - slide on probe shaft first
5   Optional Water float OR (6) Water/Density float - slide on probe shaft second.
7   Boot - slide on probe shaft last
8   3-Inch Float set
9   2-Inch Float set

Figure 14.   Probe Float/Boot Installation

Mag Probe Installation

UST/AST Tank - Dedicated Riser

1. Turn Off power to the console.

2. Remove any sludge from the bottom of the tank.

3. Check that floats, boot, and cable are assembled correctly on probe.

4. Gently slide the float(s) to the bottom of the probe shaft before lifting the probe canister. Carefully lower the probe shaft into the riser pipe until the boot rests on the bottom of the tank [See Figure 15 for UST installation or Figure 16 for AST installation].

   CAUTION! Handle probes carefully. Striking or dropping the probe will result in loss of calibration and could cause permanent damage.

UST RISER CAP ATTACHMENT

1. If you are using the one piece cap (see Figure 9 on page 15), push the end of the probe cable through the cord grip bushing and nut on the cap, leaving a minimal amount of slack between the probe and cap. Screw the cap onto the riser by hand until the gasket first contacts the pipe. Then lightly tap the cap with a hammer to tighten it an additional 3/4 turn. Go to Step 3.

2. If you are installing the metal cap and ring (see Figure 10 on page 16), screw the ring onto the 4-inch riser until the gasket contacts the pipe, then use a pipe wrench to tighten it an additional 3/4 turn. Using UL-classified pipe sealant (suitable for the fuels involved), screw the cord grip fitting into the tapped hole. Push the cable through the metal cap and cord grip, then clamp the cap onto the ring.

   At sites that require installation of a riser adaptor (Phil-Tite M/F 4X4 or equivalent) at the top of the riser, do so following the manufacturer's instructions. Next screw the adapter ring from the Veeder-Root kit (P/N 312020-952) onto the riser adaptor by hand until the gasket contacts the sealing surface. Then use a torque wrench attached to an appropriate strap wrench (K-D Specialty tools nylon strap oil filter wrench, or equivalent) and tighten the ring to 35 - 45 ft-lbs. Loosen the cord grip nut and push the cable through the metal cap and cord grip, then clamp the cap onto the ring (see Figure 17).

3. Make sure there is a minimal amount of slack between the probe and cap, then tighten the cord grip nut until the cable is held firmly. Push the end of the cable through the field J-box cord grip, then tighten that cord grip nut as well. Splice and seal the wires in the J-box (see Probe Field Wiring on page 28).

AST RISER CAP ATTACHMENT

1. If you are using the one piece cap (see Figure 9 on page 15), push the end of the probe cable through the cap and cord grip bushing, leaving a minimal amount of slack between the probe and cap. Screw the cap onto the riser by hand until the gasket first contacts the pipe. Then lightly tap the cap with a hammer to tighten it an additional 3/4 turn. Discard the cord grip nut and attach the Adaptor Nut from the AST kit to the cap (see Figure 8 on page 14). Tighten the Adaptor Nut until the cable is held firmly. Go to Step 3.

2. If you are installing the metal cap and ring (see Figure 10 on page 16), screw the ring onto the 4-inch riser until the gasket contacts the pipe, then use a pipe wrench to tighten it an additional 3/4 turn. Using UL-classified pipe sealant (suitable for the fuels involved), screw the cord grip fitting into the tapped hole and tighten. Place the cord grip bushing in the fitting. Discard the cord grip nut and loosely screw the Adaptor Nut from the AST kit onto the cord grip fitting (see Figure 8 on page 14). Push the cable through the metal cap, bushing, and Adaptor nut, then clamp the cap onto the ring. Make sure there is a minimal amount of slack between the probe and cap, then tighten the Adaptor Nut until the cable is held firmly.

3. Next assemble the liquidtight connectors on both ends of the flexible conduit as shown in Figure 8. Push the cable through the flexible conduit assembly and into the J-box. Connect the flexible conduit assembly to the

Adaptor Nut on one end and the J-box on the other. Tighten the fittings until snug. Splice and seal the wires in the J-box (see Probe Field Wiring on page 28).

probes\pinst.eps
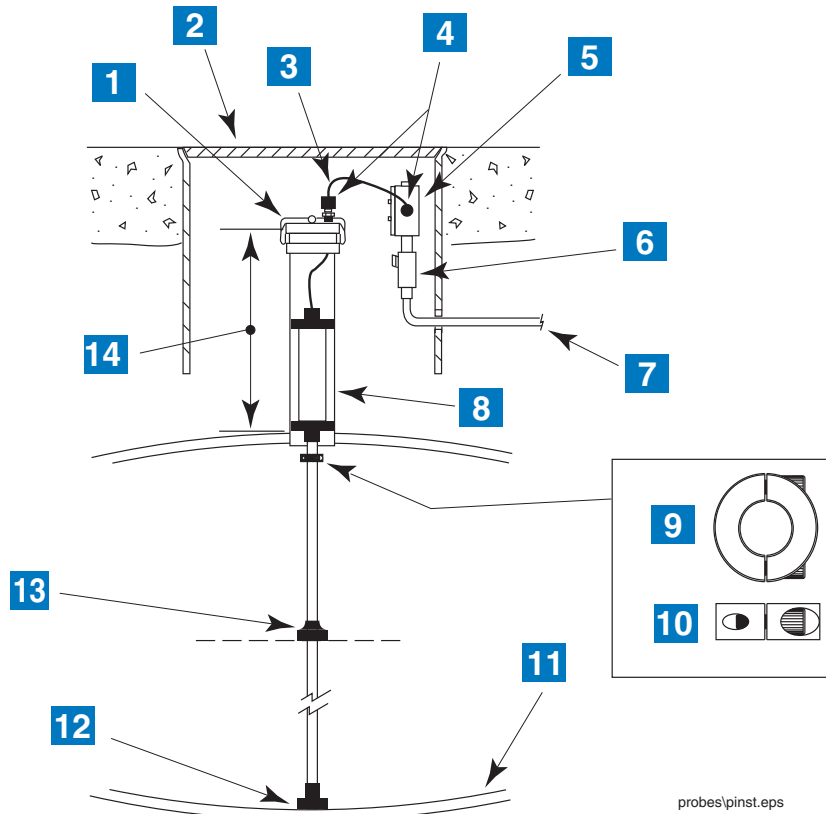
Legend for numbered boxes

1   Riser cap and cord grip
2   14-inch diameter or larger manhole
3   Probe cable
4   Cord grip seals
5   Weatherproof junction box with 1/2" NPT threads (16 cubic inch minimum).
6   Seal off - epoxy seal per NFPA specifications
7   1/2-inch rigid conduit to console
8   Riser pipe: 2-, 3-, or 4-inch API schedule 40 depending on probe type (to prevent erroneous probe readings, install probe riser a minimum of 24 inches from the submersible pump)
9   Top view of split ring collar (P/N 576008-617) - required if probe enters riser,i.e., when probe length exceeds tank diameter.
10 Side view of optional split ring collar
11 Tank
12 Water float (Magnetostrictive probe rests against bottom)
13 Product float
14 14" minimum for global mag plus/mag plus probes. When installing a probe longer than the tank diameter, increase this minimum dimension to compensate. (Example: a 7'-6" diameter tank will use an 8' probe, in which case you must add 6" to minimum riser length 'A', i.e., 20").

Figure 15.   Probe Installation Example - Underground Storage Tank

probes\apins.eps
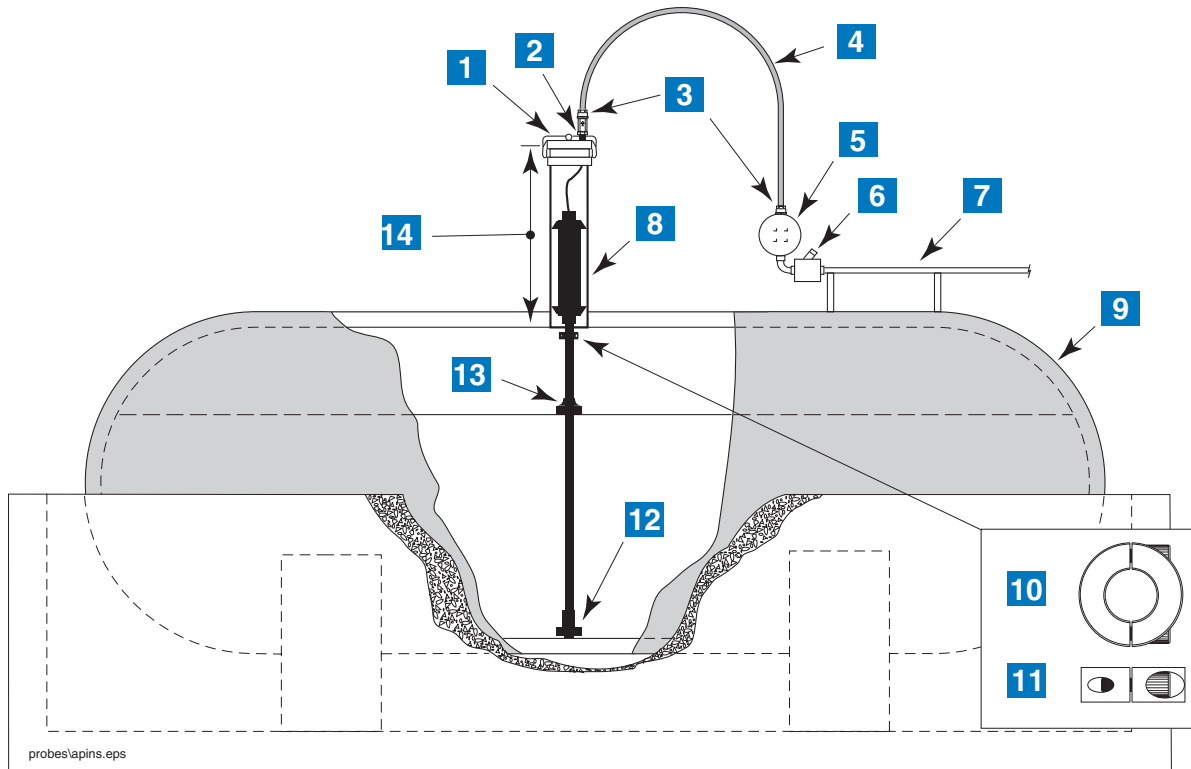
Legend for numbered boxes

1 Riser cap and cord grip
2 Use bushing and body of grip fitting supplied with probe and adaptor nut supplied with AST kit (V-R P/N 312020-984
3 Liquidtight fittings from AST kit
4 Flexible metal conduit supplied with AST kit
5 Weatherproof junction box with 1/2" NPT threads (16 cubic inch minimum).
6 Seal off - epoxy seal per NFPA specifications
7 1/2-inch rigid conduit to console
8 Riser pipe: 2-, 3-, or 4-inch API schedule 40 depending on probe type
9 Tank
10 Top view of optional split ring collar (P/N 576008-617) - required if probe enters riser,i.e., when probe length exceeds tank diameter.
11 Side view of optional split ring collar
12 Water float (Magnetostrictive probe rests against bottom)
13 Product float
14 14" minimum for global mag plus/mag plus probes. When installing a probe longer than the tank diameter, increase this minimum dimension to compensate. (Example: a 7'-6'' diameter tank will use an 8' probe, in which case you must add 6" to minimum riser length 'A', i.e., 20").
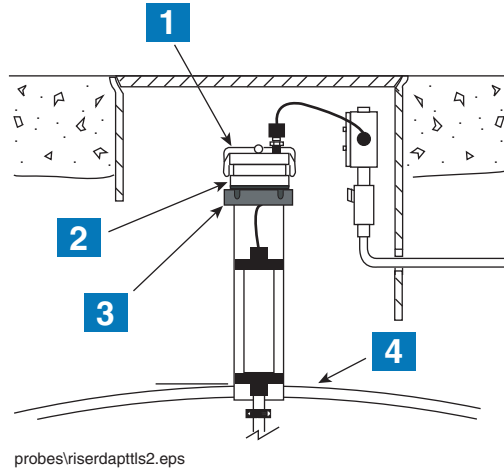
Figure 16.   U.S. Probe Installation Example - Above Ground Storage Tank

probes\riserdapttls2.eps

Legend for numbered boxes

1   Metal cap from kit
2   Adaptor ring from kit
3   Riser adaptor (Phil-Tite M/F4X4, or equivalent)
4   Tank

Figure 17.   Installing the Riser Adaptor

Probe Conduit Installation

⚠ WARNING
Probes operate in areas where flammable liquids and explosive vapors may be present.
Improper installation may result in fire or explosion causing serious injury or death.
1. **Read thoroughly and follow the instructions in this manual and those shipped with the probe.**
2. **Probe wiring conduit must not contain any other device's wiring.**
3. **Probe wiring and conduits must enter the console only through the designated intrinsically safe knockouts in the console (see Figure 2).**

Wiring Run Methods

⚠ IMPORTANT! The maximum probe-to-console cable length is 1000 feet (305m).

Two wiring run methods are commonly used for probes - shielded wiring pulled through buried, sealed 1/2-inch rigid conduit (see Figure 18); or direct burial cable (see Figure 19). The preferred method, especially in new sites before driveway surfaces are paved, is to pull probe wiring through buried rigid conduit.

RIGID CONDUIT

Pull shielded cable consisting of two conductors, color-coded #14-18 AWG (0.8 - 2.0 mm^2) stranded copper wire, between the console and the junction box at each probe location (do not gang wires together). Use single lengths of wire with no splices to ensure optimum signal strength.

Since wires for multiple probes may enter the console through a single conduit, it is recommended that you use a different color-code for each wire or individually mark each wire to identify probe inputs. Also, if the intrinsically safe wires enter the building in a wiring trough, only intrinsically safe wires (from TLS2 probes) can be in the trough. Keep all low power (intrinsically safe) wiring physically isolated from high power wires in all wiring troughs per the NEC.

consoles/tls2/pwrc.eps
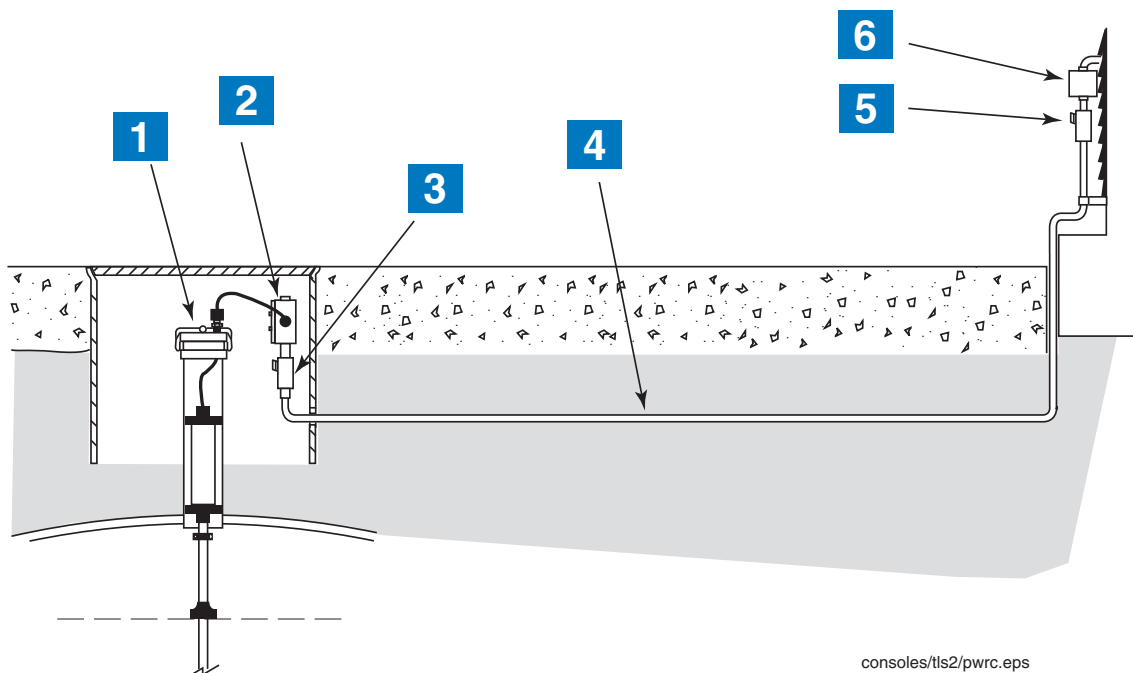
Legend for numbered boxes

1   Riser cap and cord grip
2   Weatherproof junction box, 16 in^3 minimum
3   Seal off - epoxy seal per NFPA specifications
4   Rigid conduit to building seal off
5   Seal off - epoxy seal per NFPA specifications
6   Splice closure

Figure 18.   Example Probe Wiring Run in Buried Rigid Conduit

DIRECT BURIAL

The direct burial method requires grinding a groove in the pavement surface, laying Veeder-Root supplied direct burial cable in the bottom of the groove, and then covering the cable with a protective backer rod and sealant.

Prior to installing direct burial cable with epoxy splices, consult with the local authority having jurisdiction. Use of direct burial cable is only allowed in locations where local codes permit the use of buried cable.

If you decide to use the direct burial method, you should order the Veeder-Root Direct Burial Cable Preparation Kit, P/N 848100-500.

3" (8 mm) Min.

consoles/tls2/db.eps
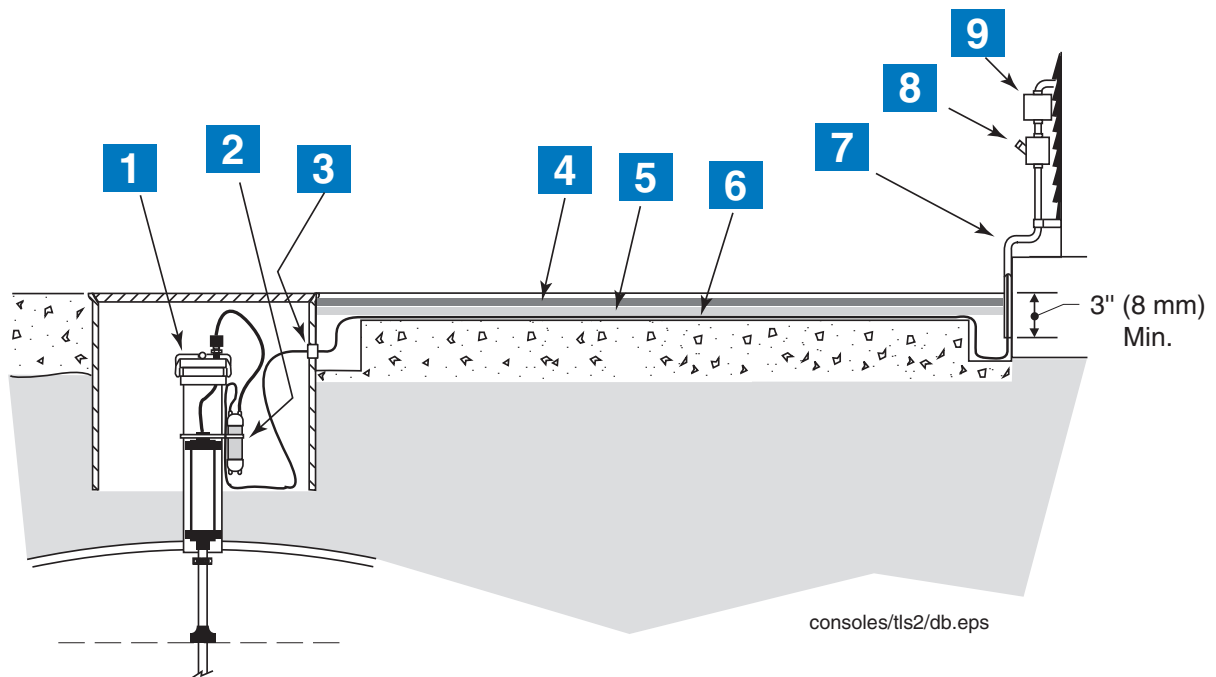
Legend for numbered boxes

1   Riser cap and cord grip
2   Splice closure.
3   Cord grip
4   890-SL Dow Corning silicone joint sealant
5   Sof Rod backer rod (expanded polyethylene foam rod from Applied-Extrusion Technologies)
6   Veeder-Root direct burial cable
7   Rigid conduit
8   Seal off
9   Splice closure

Figure 19.   Example Probe Wiring Run Using the Direct Burial Method

Probe Field Wiring

Figure 20 diagrams a typical probe field wiring connection in the junction box.
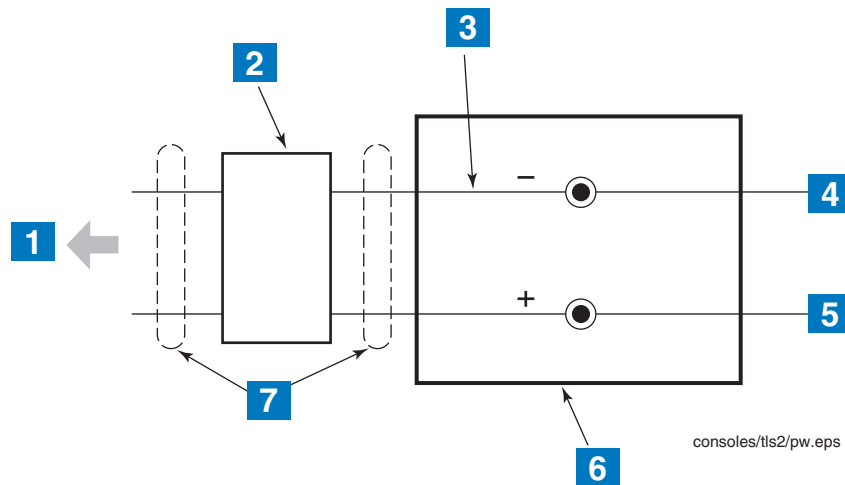
Legend for numbered boxes

1   To console
2   Seal off
3   Do not ground drain wire in junction box
4   Black wire (-) from probe
5   White wire (+) from probe
6   Weatherproof junction box
7   Rigid conduit

Figure 20.   Probe Field Wiring Connection

Sealing Field Connections

WIRING RUN THROUGH RIGID CONDUIT

1. Pull the wires from the probe canister into the junction box. Pull two wires from the console through the seal-off box and into the junction box.

2. Using wire nuts, connect the two wires from the probe to the two wires coming from the console. Be sure to observe color codes or tags when making these connections.

3. Do NOT terminate drain wire at this location, ground drain wire at console only.

4.   Seal wire nuts with epoxy sealant using one bag for two-wire nut connections (Figure 21).

CAUTION: Epoxy sealant is irritating to eyes, respiratory system, and skin. Can cause allergic skin reaction. Contains: epoxy resin and Cycloaliphatic epoxycarboxylate. Precautions: Wear suitable protective clothing, gloves, eye, and face protection. Use only in well ventilated areas. Wash thoroughly before eating, drinking, or smoking.

consoles/tls2/epxy.eps

Legend for numbered boxes

NOTE: When temperature is below 50°F (10°C), keep resin in a warm place prior to mixing (e.g., in an inside pocket next to body).Remove guard bag, using caution not to damage inner bag.

1   Open epoxy package from cable seal kit and remove resin pak. Holding resin pak as shown in 1, bend pak along long length.

2   As shown in 2, firmly squeeze the RED SIDE of the resin, forcing it through the center seal and into BLACK SIDE. Mix thoroughly to a unifo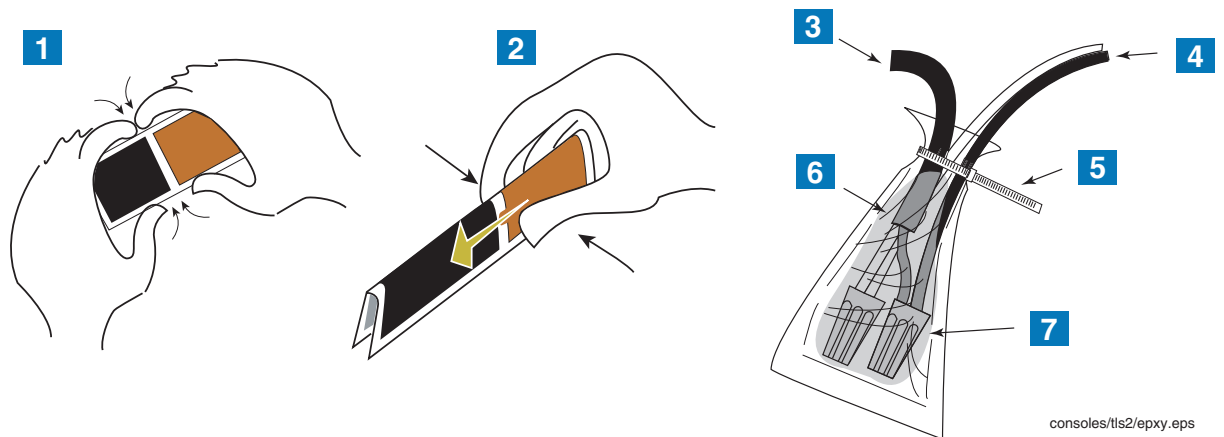rm color by squeezing contents back and forth 25-30 times. Squeeze mixed, warm resin into one end of bag and cutoff other end.

3   Connect wires in cable from Probe (3) to color coded wires to console (4) using wire nuts (5). Maintain polarity!

4   Make sure that end of probe cable sheathing is submerged in sealant (6).

5   Twist open end of bag and use tie wrap (7) to close it off, or wrap open end of bag with vinyl electrical tape (not included) and position the taped end up until the resin jells.

Figure 21.   Epoxy Sealing Connections

5.   Push the tie-wrapped, epoxy sealed bag into the junction box. Replace and tighten the junction box cover.

DIRECT BURIAL CABLE

When using direct burial cable for probe-to-console wiring runs, the sealing materials and procedure to encapsulate the wiring connections are completely different. If you are using Direct Burial Cable you must follow the sealing instructions in the Direct Burial Cable Installation Manual.

Connecting Probes to the Console

⚠ WARNING
The equipment is used in location where lethal voltages and explosive vapors or flammable fuels may be present.
Care must be taken when installing, servicing or replacing parts in the system or serious injury or death from explosion, fire or shock may occur.
For this system:
1. Comply with the latest National Electric Code, federal, state, and local codes, and any other applicable safety codes. In addition, take necessary precautions during installation, service, and repair to prevent personal injury, property loss and equipment damage.
2. Refer servicing to trained and qualified personnel only.
3. Turn 'Off', lock out, and tag AC power to the console at the breaker before opening the console panel cover and connecting probe wires. Do not short any voltage across any barrier terminal including probes.
4. Substitution of components may impair intrinsic safety.

Probe Wiring Precautions

To The Installer! You Must Read And Understand This Information.

INPUT/OUTPUT WIRING POSITIONS AND LABELING

In all cases, the devices wired to the console's input/output terminal blocks must be recorded to prevent improper connections during installation or service. During programming, the probes wired to each position are identified and stored in memory. If a probe is removed and reconnected to a different set of input terminals after programming, the system will not properly recognize the data being received.

PROBE WIRING ASSIGNMENTS

Identify all probe wires according to their terminal block location using the self-adhesive numbering labels furnished. As you connect probes to the console, record the tank number in which the probe is installed on the Circuit Directory label (see item 1 in Figure 22).

IMPORTANT! Once a device has been wired to certain terminals and the system has been programmed, the wires from that device may not be relocated to other terminals without reprogramming the system.

GROUNDING PROBE SHIELDS AND DRAIN WIRES

Connect probe cable shields and drain wires to ground in the console only, not at the field junction boxes. Do not ground both ends of the shield.

CONNECTING PROBES TO THE CONSOLE - OBSERVE POLARITY

Connect the two color-coded/marked wires from the each probe to the appropriate terminals of the Probe Terminal Block as shown in Figure 22.

WARNING!
Shock hazard. Do not touch metal ends of capacitors C24/C27 or the metal bands on chokes L2/L4.

consoles/tls2/pbwr.eps
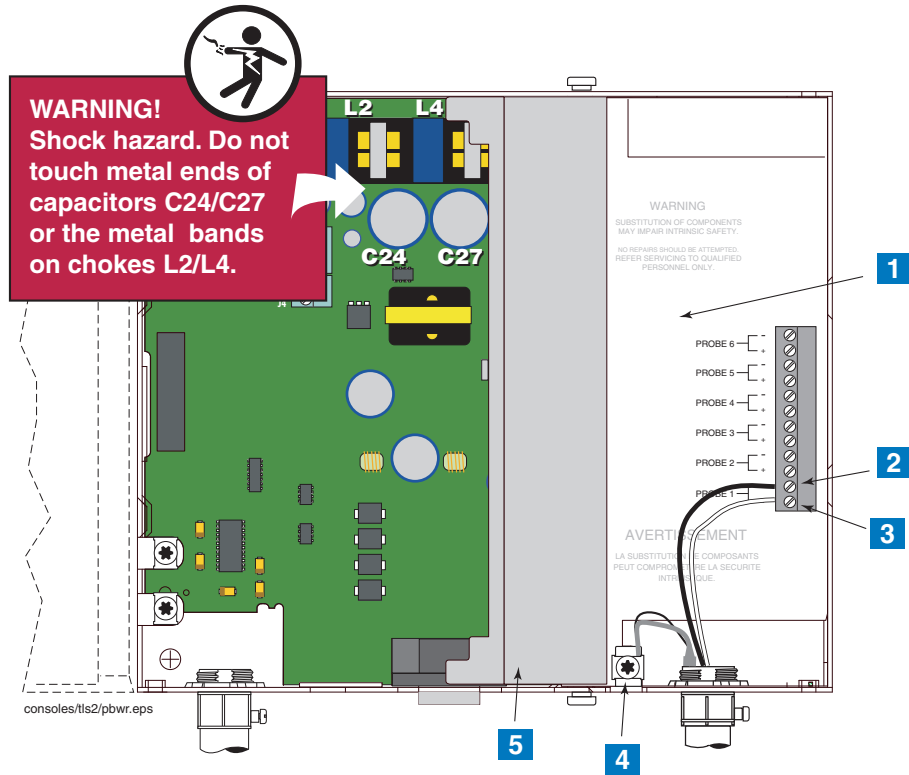
Legend for numbered boxes

1 Circuit Directory label
2 Black wire from probe 1 connects to (-) terminal
3 White wire from probe 1 connects to (+) terminal
4 Attach probe 1 cable shield and /or drain wire to ground lug
5 Intrinsically safe wiring cover (shown swung open to left)

Figure 22.   Connecting Probe Wiring to Console

Overfill Alarm Relay

The console has one dry contact relay output that closes when an overfill alarm is activated. You can connect an external audible/visual warning device to this relay. Connect the two wires from the external warning device to the either of the two overfill relay terminals (J5) [see Figure 23].

⚠️ **Important! Note these Output Relay Connection Restrictions:**

• Output relays can not be connected to a device that draws more than 2 amperes of current.

• Output power - output relay contact, resistive load - 120/240 Vac, 2 A max.
Alarm relays cannot be used for flow control. Alarm relays provide only a momentary closure and cannot actuate flow control devices such as valves and pump motor relays for extended periods of time.

WARNING!
Shock hazard. Do not touch metal ends of capacitors C24/C27 or the metal bands on chokes L2/L4.

consoles/tls2/rcon.eps
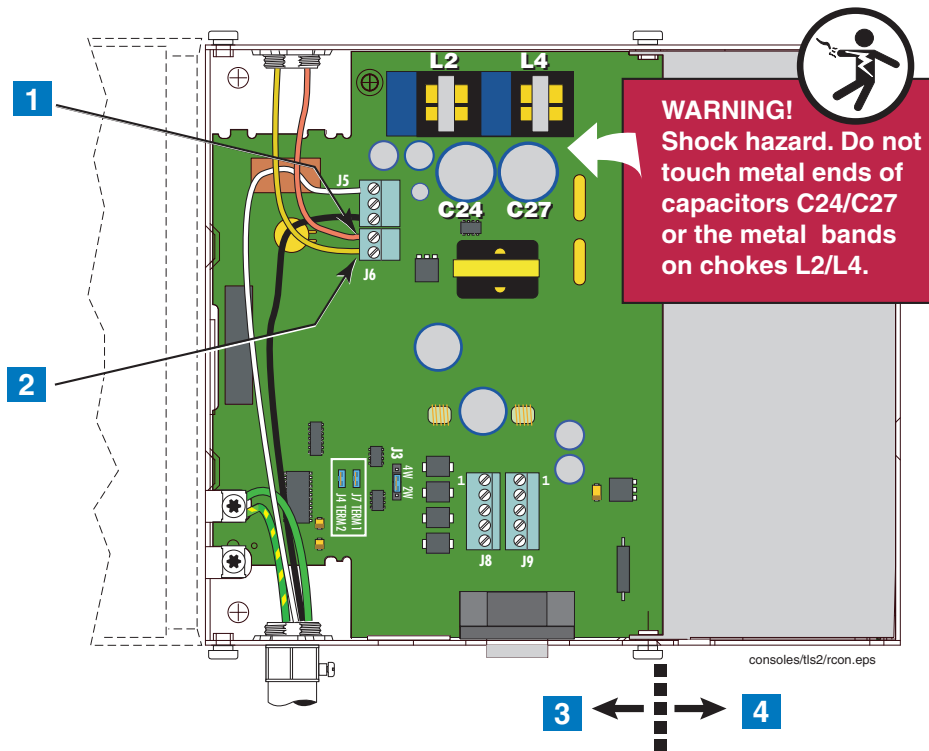
Legend for numbered boxes

1 Connect one wire from relay to top terminal of J6 (no polarity)
2 Connect second wire from relay to lower terminal of J6 (no polarity)
3 Power area of console
4 Intrinsically safe area of console (under cover)

Figure 23. Connecting Output Relay to Console

Applying Power to System

Cold Boot

On initial power up or after upgrading system software, you must reset the system with a RAM clear/cold boot to ensure that the Flash/RAM is cleared completely.

1. Turn the power to the console Off. Locate the RAM Clear jumper J2 on the CPU board (Item 5 in Figure 6 on page 12). Figure 24 shows the RAM Clear jumper in the Operating position and in the RAM Clear position.
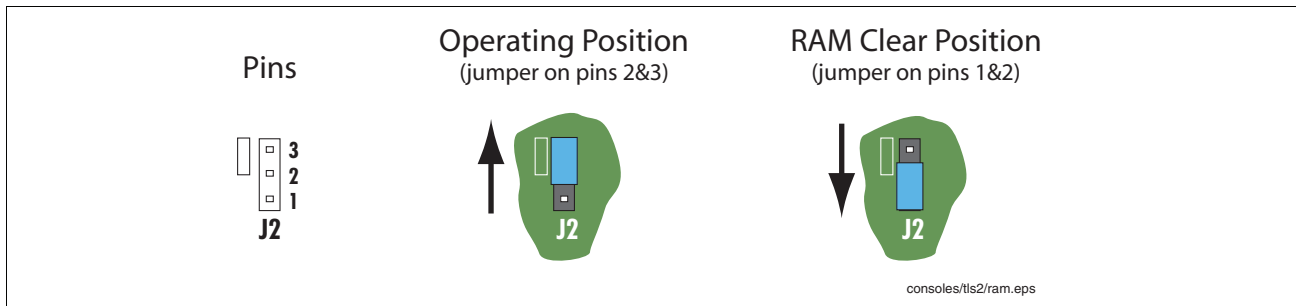
Figure 24. RAM Clear Jumper Positions

2. Move the jumper down to the RAM Clear position (pins 1&2). Turn the power to the console 'On' and wait until the console completely boots up.

3. As the console boots up it will perform a series of tests and display the messages below:

Test Passed Message	Test Failed Message	Action (If Failed)
RAM TEST - OK	RAM FAIL	Replace CPU board
ROM TEST - OK	ROM FAIL	Replace CPU board
COLD BOOT		
NVRAM TEST - OK	NVRAM FAIL	Replace CPU board
STARTUP COMPLETE		

4. You see the 'No Tanks Configured' message (see Figure 25) following the successful completion of the self tests. After approximately 2 seconds the console will automatically reboot.

5. When the 'No Tanks Configured' message is visible the second time, turn the power to the console 'Off'.

6. Move the jumper up to the Operating position (pins 2&3).

7. If you have not done so already, peel away the protective film from the display's touch screen. Close the front panel of the console.

8. Turn the power to the console 'On'. Once again the system will cold boot and display the 'No Tanks Configured' message as shown in Figure 25.

9. Go to the Setup and Operation manual to program the console.

```
┌─────────────────────────────────────────────────────────────────┐
│   ┌──────────┬──────────────────────┐   ┌───┐   ┌───┐            │
│   │01-01-2000│ALL FUNCTIONS NORMAL   │   │ ▲ │   │ 🖨 │            │
│   │12:00 AM  │                      │   └───┘   └───┘            │
│   ├──────────┴──────────────────────┤   ┌───┐                    │
│   │ SYSTEM STATUS                    │   │   │                    │
│   ├──────────────────────────────────┤   ├───┤                    │
│   │                                  │   │   │                    │
│   │                                  │   └───┘                    │
│   │        NO TANKS CONFIGURED       │                            │
│   │                                  │                            │
│   │                                  │                            │
│   ├──────────────────────────────────┤                            │
│   │ ┌────┐  ┌────┐  ┌────┐  ┌────┐   │                            │
│   │ │    │  │    │  │    │  │    │   │                            │
│   │ INVENTORY DELIVERY ALARMS ENVIRONMENT                         │
│   └──────────────────────────────────┘                            │
└─────────────────────────────────────────────────────────────────┘
```
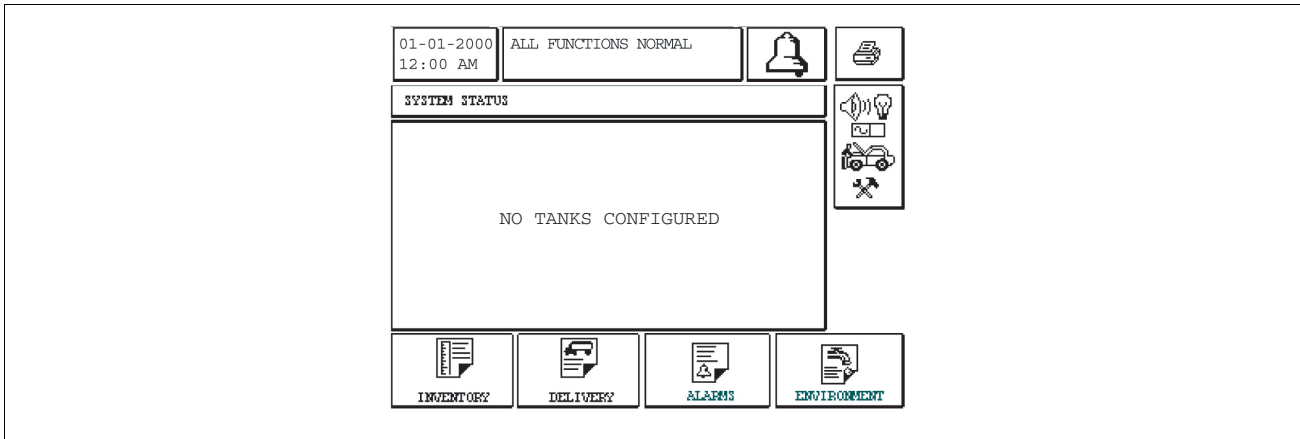
Figure 25.   Cold boot 'No Tanks Configured' message

Warm Boot

After the system has been setup, and power to the console is switched 'Off' and 'On', the software will run a self-diagnostic warm boot program and display the test results:

<u>Test Passed Message</u>	<u>Test Failed Message</u>	<u>Action (If Failed)</u>
RAM TEST - OK	RAM FAIL	Replace CPU board
ROM TEST - OK	ROM FAIL	Replace CPU board
WARM BOOT		
STARTUP COMPLETE		

If a fault is detected an error message will be displayed and the system will halt. When the warm boot completes, the display returns to the top level status message.

Communications

RS-232 Peripheral Equipment Requirements

The RS-232 port allows you to connect the console to a serial printer, modem or terminal.

Any peripheral equipment connected to an RS-232 serial port must meet the following criteria:

1. Peripheral equipment must be UL listed.

2. The equipment must have an EIA standard RS-232C or RS-232D communications protocol.

3. The equipment must NOT be installed over or in a hazardous location.

RS-232 Connections

TO A DEVICE LESS THAN 50 FEET (15 METRES) FROM THE CONSOLE

Veeder-Root recommends that you use a null-modem cable no longer than 50 feet for direct connections between the console and a remote device. Cable runs longer than 50 feet can result in data errors, component damage, or both.

TO A DEVICE MORE THAN 50 FEET FROM THE CONSOLE

If cable runs longer than 50 feet are needed, two short-haul modems should be used, one at the console and one at the remote device. We recommend an asynchronous short-haul modem, Black Box model ME800A, or equivalent, at the console and at the remote device. For more information on the ME800A, you can contact Black Box at P.O. Box 12800, Pittsburgh, PA 15241, U.S.A., phone: 1-412-746-5500, fax: 1-412-746-0746, or at their Internet address *http://www.blackbox.com.*

Figure 26 illustrates how to connect two ME800A short-haul modems between the console and a remote personal computer.

Connections to telephone lines must meet the following criteria:

• Connection to telephone equipment is subject to local regulations.

• Maximum short circuit current: 0 amperes.

• Maximum open circuit voltage: 0 volts.

Surge Protection for Communication Devices

In locations that are subject to high levels of noise and power surges, the use of a surge protector is recommended. The following models are available from B&B Electronics, telephone 1-815- 433-5100, or at their Internet address *http://www.bb-elec.com:*

• Telephone Line Surge Protector, model TLSP

• RS-232 Surge Protector, model 232DSP
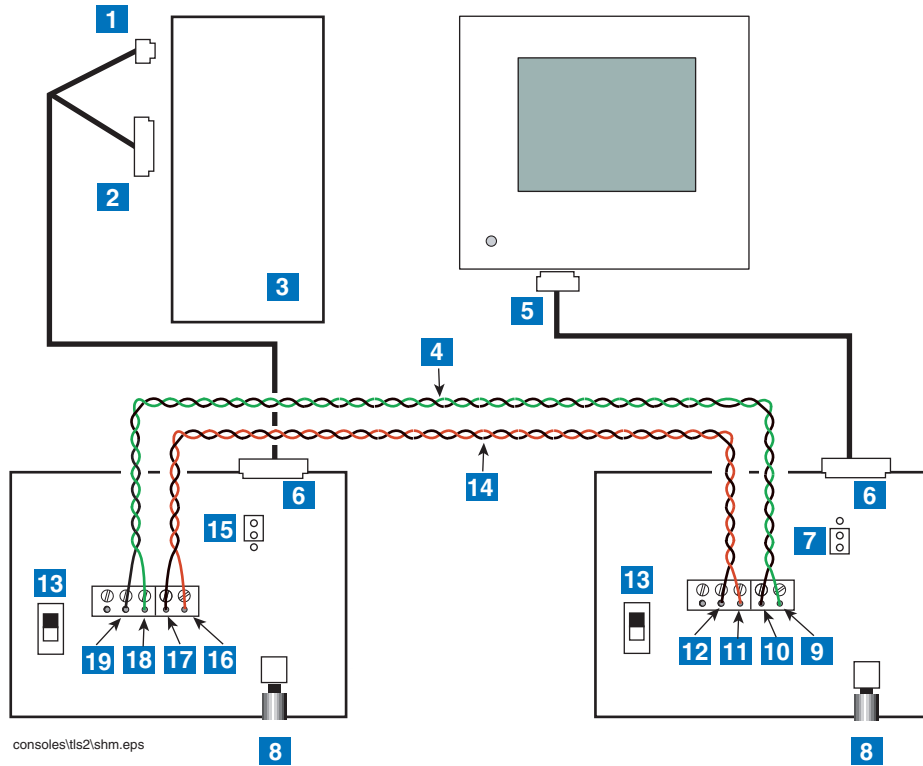
consoles\tls2\shm.eps

Legend for numbered boxes

1   DB9 connector or (2) DB25 connector - depends on availability
3   Personal Computer
4   Twisted pair 24 or 26 AWG (0.2 mm^2) cable
5   DB9 connector on bottom of console
6   DB25 connector on rear of short haul modem
7   RTS/DTR Control jumper (in modem) - select DIS position
8   Front panel switch - select Normal position
9   RX+ terminal - attach color 2 wire of twisted pair (4) to this terminal (in modem)
10 RX- terminal - attach color 1 wire of twisted pair (4) to this terminal
11 TX+ terminal - attach color 2 wire of twisted pair (14) to this terminal
12 TX- terminal - attach color 1 wire of twisted pair (14) to this terminal
13 DCE/DTE switch (in modem) - select DCE position
14 Twisted pair 24 or 26 AWG (0.2 mm2) cable
15 RTS/DTR Control jumper (in modem) - select EN position
16 Attach color 2 wire of twisted pair (14) to this terminal
17 Attach color 1 wire of twisted pair (14) to this terminal
18 Attach color 2 wire of twisted pair (4) to this terminal
19 Attach color 1 wire of twisted pair (4) to this terminal

Figure 26.   Example of Console Connected to a Remote Device Via MDE800A Short-Haul Modems

DB-9 Connector Pin-Outs

Communicating with the console from a remote computer is done through the RS-232 serial port (DB-9 connector) on the bottom of the console.

Pin layout to connect the console's Serial Interface DB-9 connector to a 25-pin computer terminal connector are shown in Table 1 below. These connections are standard for "AT" style modem cables.

Table 4. TLS2/EMC2 DB-9 Pin-Outs

Console (DB-9)		Computer (DB-25)	
Signal	Pin	Pin	Signal
CD	1	8	DCD
RXD	2	2	TXD
TXD	3	3	RXD
DTR	4	20	DTR
GND	5	7	GND
DSR	6	6	DSR
RTS	7	4	RTS
CTS	8	5	CTS
N/C	9	22	Ring Indicator

Comm Port 2 Pin-Outs

Comm Port 2 is selectable for RS-232, RS-422, or RS-485 2-wire and 4-Wire. The Comm Port 2 communications cable connects to Power Supply board connector J8 for RS-422 and RS-485, or to connector J9 for RS-232 use (Figure 5 on page 11). Only one communication type can be connected to Comm Port 2 at one time. Table 2 below lists the connector and pin outs for each Comm Port 2 configuration.

Table 5. Comm Port 2 Configuration

Comm Port 2 Configuration	Connector J8 (Pin Outs)	Connector J9 (Pin Outs)	Jumper J3 Position
RS-422	TX- (1), TX+(2), RX- (3), RX+ (4), Gnd (5)		On pins 2 and 3
RS-485, 2-Wire	RXTX- (3), RXTX+ (4), Gnd (5)		On pins 1 and 2
RS-485, 4-Wire	TX- (1), TX+ (2), RX- (3), RX+ (4), Gnd (5)		On pins 3 and 4
RS-232		TX (1), RX (2), Gnd (5)	On pins 2 and 3

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