

The 869 MHz Wireless System

Site Prep & Installation Manual



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Introduction

This manual describes site preparation and installation procedures for the Veeder-Root 869 MHz Wireless System which operates at a central frequency of 869.525 MHz with a bandwidth of 250 kHz.

This system is designed for inventory-only tank monitoring applications in which in-ground probe wiring is either impractical or non-existent. Procedures contained within this manual include:

Mounting the TLS-RF Wireless Interface Unit (TLS-RF) and connecting power wiring.

Installing the 869 MHz Wireless System's receiver, transmitter, and repeater components throughout the site.

Connecting the TLS-RF to the TLS console.

Other required devices, such as the TLS console and necessary magnetostrictive (Mag) probes are to be installed following instructions shipped with those devices.

After installing the 869 MHz Wireless System, you must configure the probes in the TLS console following instructions contained in the console's System Setup Manual.

Component Compatibility

The Veeder-Root Form Number/Part Number the 869 MHz Wireless System compatible components are as follows:

8466 TLS-IB console
8469 TLS-50 console
8470 TLS-350 console
8482 TLS-350R console
8485 TLS-300 console
8560 TLS2 console
8600 TLS-450 console
8601 TLS4 console
8603...TLS-XB console

- 332235-004 Transmitter with 332425-001 Battery Pack will monitor probe/sensor form numbers listed below:
 - 8463 Mag Plus Probe
 - 8468 Global Mag Probe
 - 8473 Mag Probe
 - 8493 Low Level Mag Probe
 - 8895 Mag-FLEX Probe

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; wireless equipment installation; tank and line preparation; and line leak detector installation.

ATG Technician (Level 2/3 or 4) Certification: Contractors holding valid ATG Technician Certifications are approved to perform installation checkout, startup, programming and operations training, system tests,

troubleshooting and servicing for all Veeder-Root Series Tank Monitoring Systems, including Line Leak Detection. In addition, Contractors with the following sub-certification designations are approved to perform installation checkout, startup, programming, system tests, troubleshooting, service techniques and operations training on the designated system.

- Wireless
- Tall Tank

Warranty Registrations may only be submitted by selected Distributors.

RF Transmitter Considerations

Installation of this equipment in wet or below grade locations requires that the installer take steps to ensure that the equipment is mounted above the maximum water level.



CAUTION! – The Transmitter will not function properly in water. Also, submersion of the Transmitter in water can cause permanent damage to the internal electronics.

Wireless devices will not function properly if certain conditions arise such as, but not limited to, the following:

- **Ambient Interference – Due to site layout or vehicles parked in the RF transmission path. For example, the TLS Console/System, including In-Tank and Leak Detect features will not function if the transmission path is blocked for more than a few minutes.**
- **Improper equipment installation – Keep objects from improperly coming in contact with the antenna. Follow these installation instructions and mount the transmitter in a fixed position to ensure maximum RF connectivity. Antenna orientation is significant in achieving an optimal transmission path.**
- **Equipment Sump Parameters – Sumps intended for use with RF equipment must accommodate the worst case rainfall condition that could reasonably occur. The RF Transmitter and antenna are weatherproof but will not function properly underwater.**

TLS System performance will be degraded should any of the above conditions occur and is not covered under the Veeder-Root Product Warranty. Corrective actions to such conditions are the responsibility of the station-site owner. Veeder-Root is not liable for any event that is a result of an improper installation or use of this equipment.

It is important that installers have knowledge of all relevant procedures before installing a wireless system. Read and understand all manuals thoroughly. If you do not understand a procedure, contact a certified contractor or contact Veeder-Root. Each TLS Console has its own setup and installation manuals.

Safety Precautions

Retain and follow all product safety and operating instructions. Observe all warnings on the product and in the operating instructions. To reduce the risk of bodily injury, electric shock, fire, or damage to the equipment, observe the following precautions.

GENERAL PRECAUTIONS

Heed service markings: Opening or removing the console cover may expose you to electric shock. Servicing of Veeder-Root equipment must be done by Veeder-Root authorised service contractors.

Use product with approved equipment: This product should be used only with Veeder-Root components identified as suitable for use with the 869 MHz Wireless System.

Use the correct external power sources: This product should be operated only from the type of power sources indicated on the electrical ratings labels affixed to the components. If you are not sure of the type of power source required, consult your Veeder-Root authorised service contractor.

SPECIAL TOOLS REQUIRED

#10 Torx screwdriver







Small blade screwdriver (maximum blade width 2.4 mm)

Wire strippers

Laptop computer, RS-232 serial communication cable (TLS-RF has a male DB9 connector), and terminal mode software may be necessary for troubleshooting.

SAFETY SYMBOLS

The following safety symbols are used throughout 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.
	WARNING Heed the adjacent instructions to avoid equipment damage or personal 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.

Site Considerations - Control Drawing

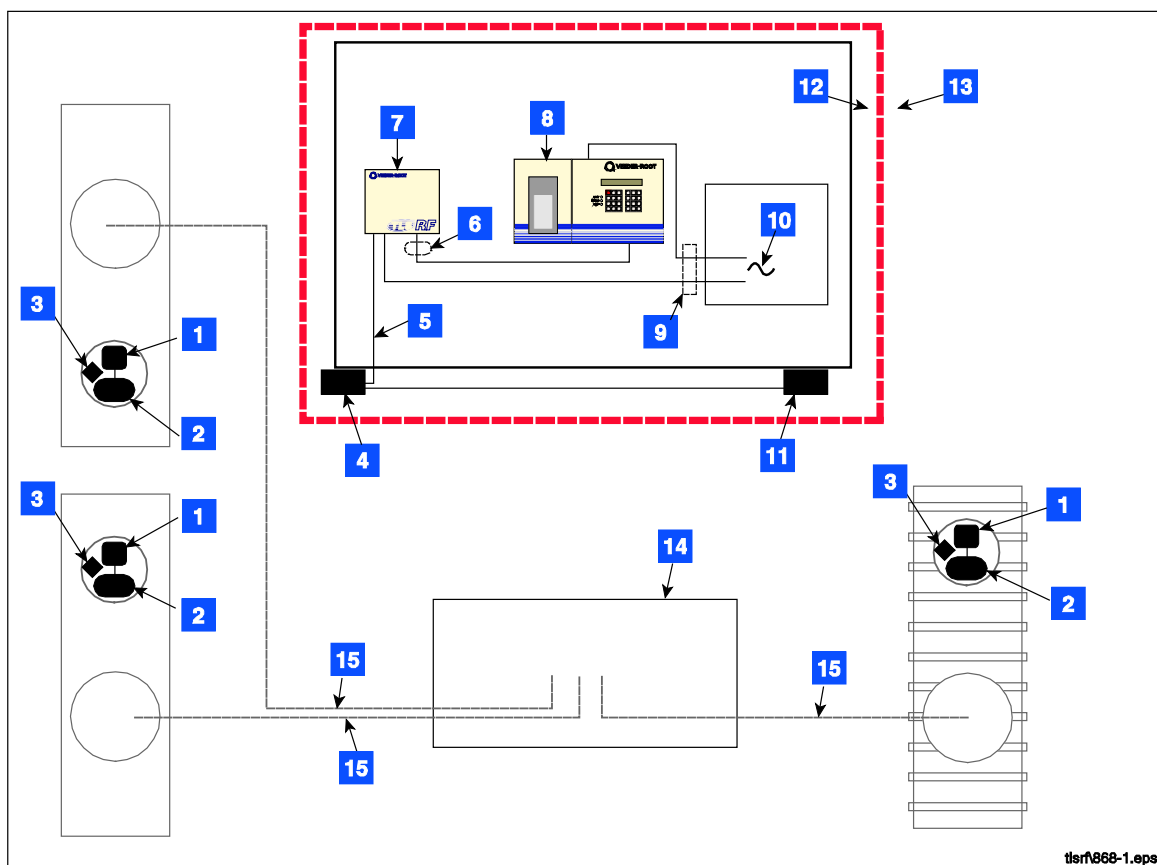


Figure 1. Control Drawing - Example 869 MHz Wireless System Site Layout

LEGEND FOR NUMBERED BOXES IN FIGURE 1



WARNING! Substitution of components may impair intrinsic safety.

Circuitry within the console barrier forms an intrinsically safe, energy-limited system. Probe wiring is intrinsically safe only when connected to the Veeder-Root consoles listed on page 1.

1. Battery Pack
2. Transmitter
3. Mag probe
4. Receiver
5. RS-485 Cable (Belden #3107A or equiv.)



NOTE: Intrinsically safe wiring. Maximum probe/sensor cable length 25m.

6. TLS-RF ($V_m = 250\text{ V}$)
7. TLS console ($V_m = 250\text{ V}$)
9. Conduit that enters power wiring knockouts.
10. 120 or 240 Vac from power panel.
11. Repeater
12. Non-hazardous area
13. Hazardous area
14. Dispenser sump
15. Underground product lines

TLS-RF POWER WIRING

Wires carrying 120 or 240 Vac from the power panel to the TLS-RF should be 2.5 mm² copper wire for line, neutral and chassis ground and 4 mm² copper wire for barrier ground.

The 869 MHz Wireless System Overview

Figure 2 illustrates a simplified 869 MHz Wireless System installation. In the figure only one tank is shown, but each tank being monitored by a Mag probe would require a battery pack/transmitter pair. The repeater component may be required if the system receiver, mounted on building's outside wall, has difficulty receiving signals from any of the transmitters.

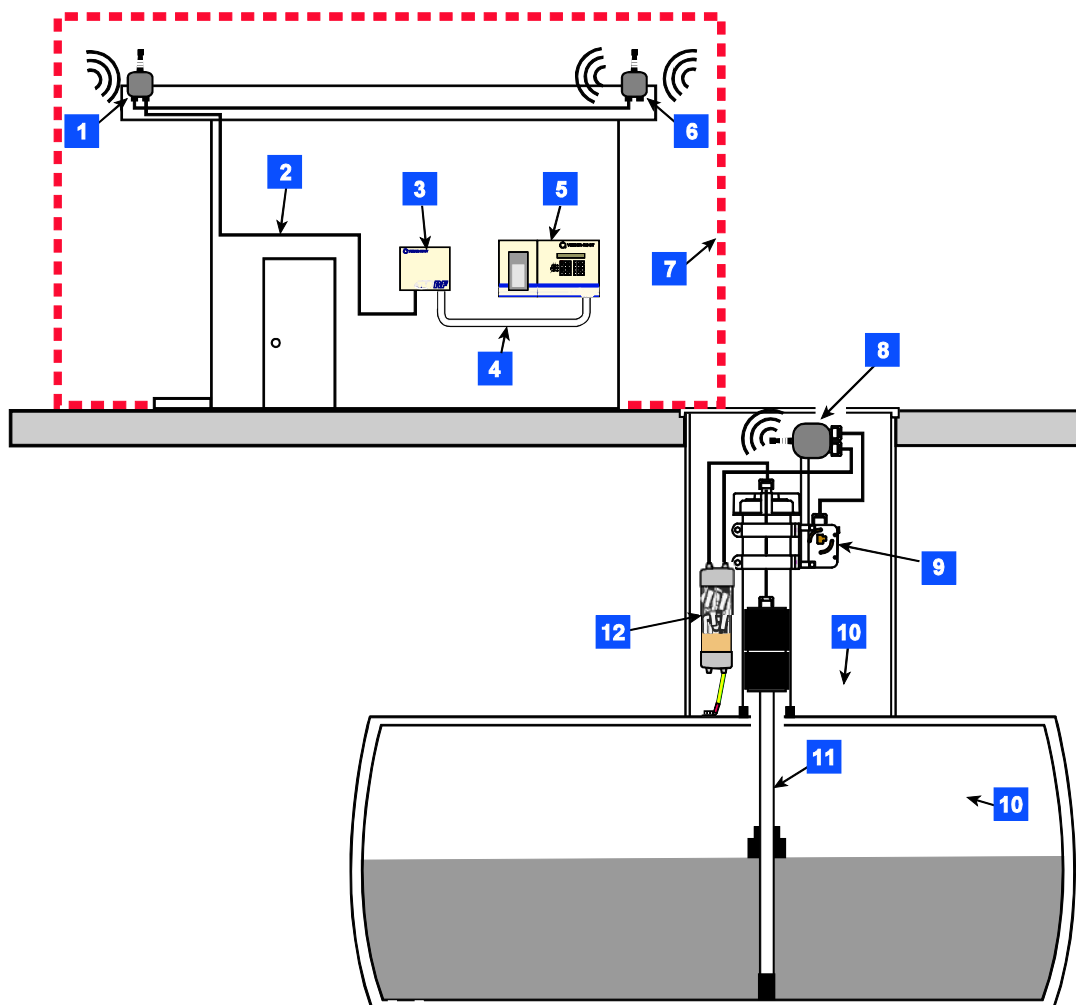


Figure 2. Example 869 MHz Wireless System component installation

LEGEND FOR NUMBERED BOXES IN FIGURE 2

1. Receiver	8. Transmitter
2. RS-485 cable (Belden #3107A or equiv.)	9. Battery pack
3. TLS-RF	10. Hazardous areas
4. Probe wiring (up to 8 Mag probes) - conduit connects via intrinsically safe knockouts on both consoles.	11. Mag probe
5. TLS console	12. Surge protector (V-R P/N 848100-001)
6. Repeater	
7. Non-hazardous area	

Equipment Dimensions

Dimensions of the TLS-RF are shown in Figure 3.

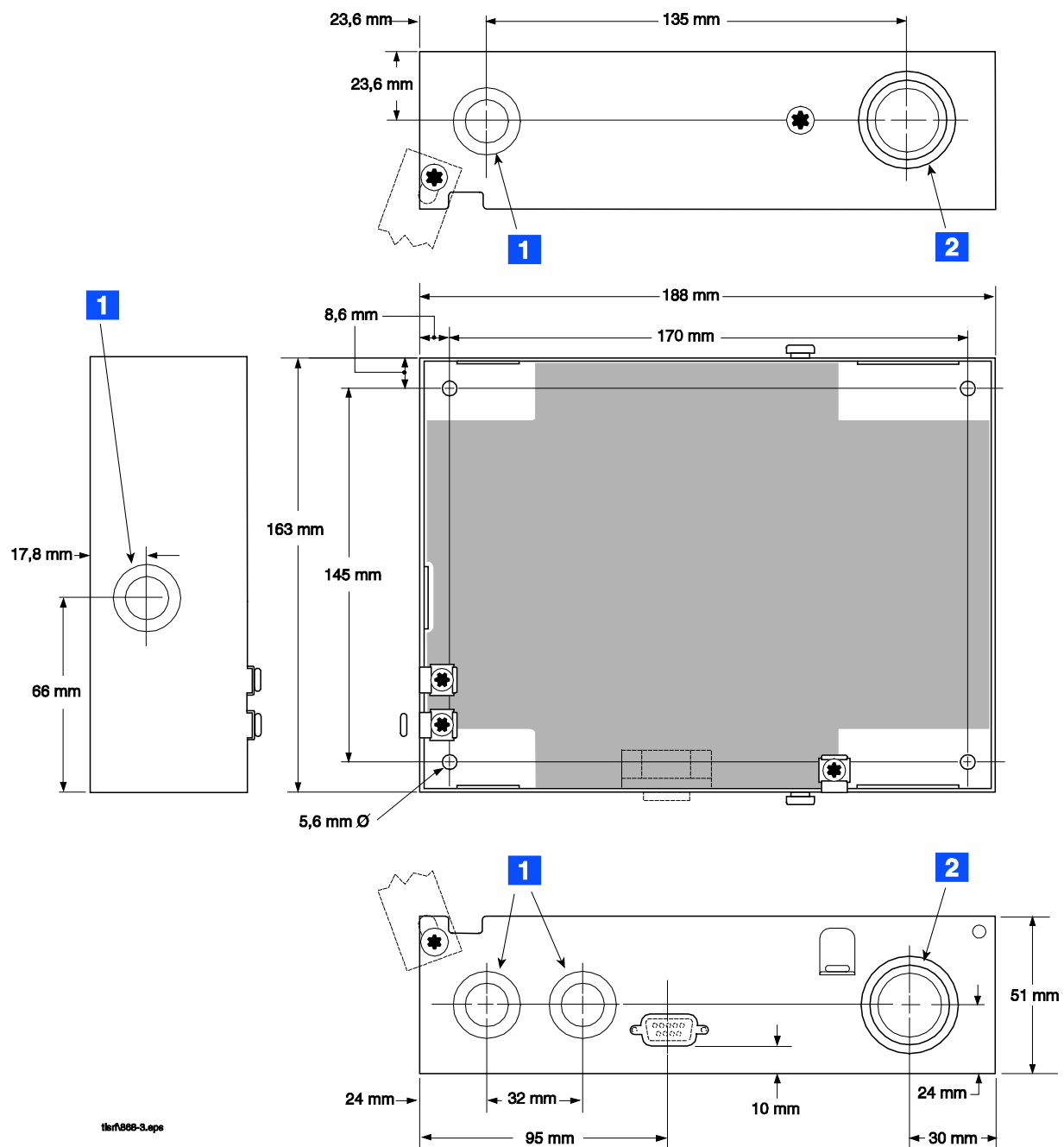


Figure 3. TLS-RF dimensions and designated conduit knockouts

LEGEND FOR NUMBERED BOXES IN FIGURE 3	
1. Designated power wiring knockouts.	2. Designated intrinsically-safe wiring knockouts.

Dimensions of the receiver, transmitter, repeater, and battery housing are shown in Figure 4.

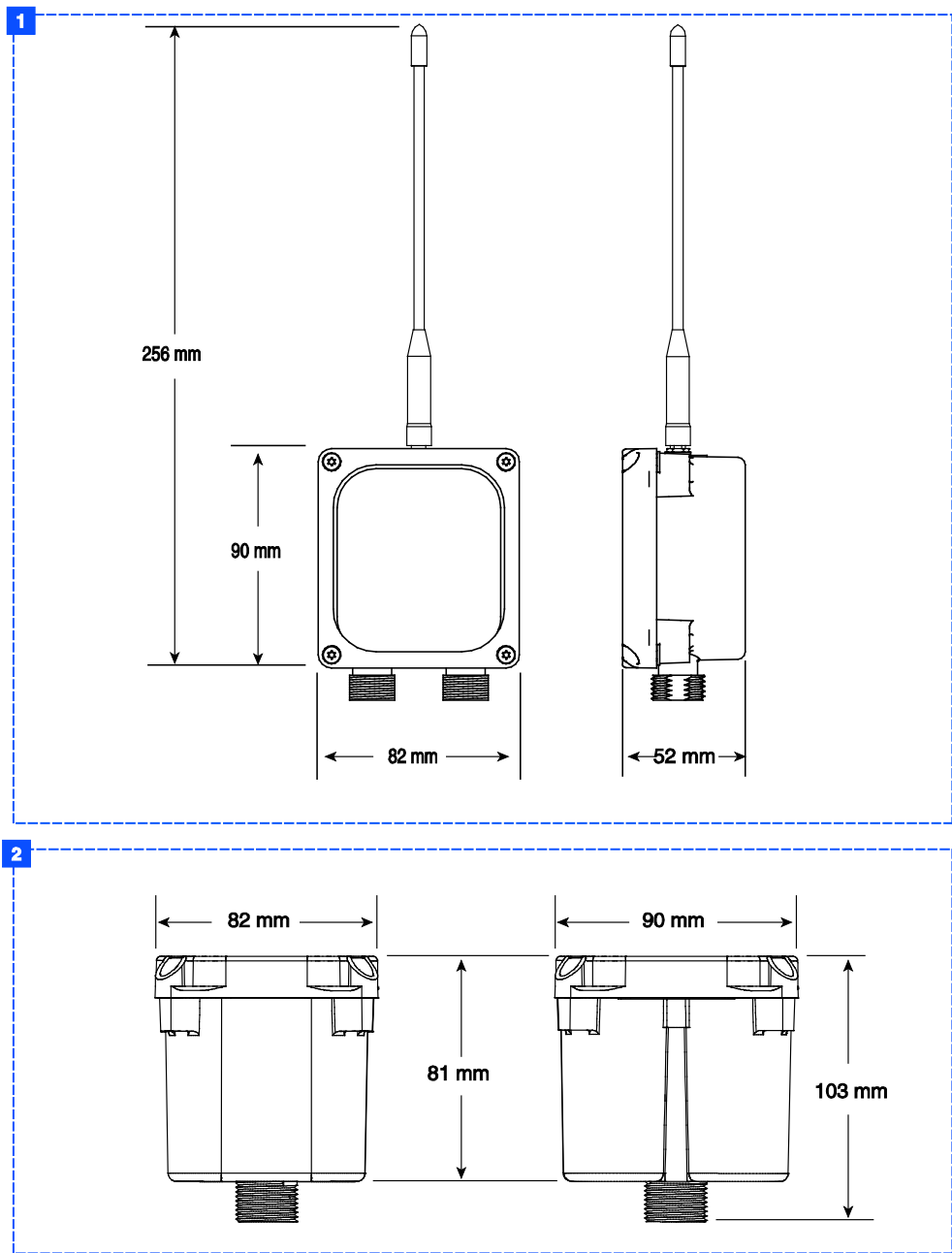


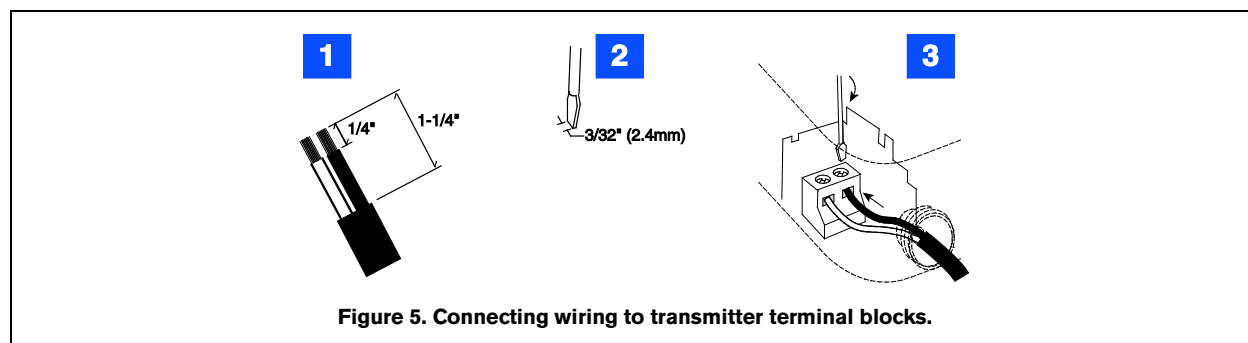
Figure 4. Wireless component dimensions

LEGEND FOR NUMBERED BOXES IN FIGURE 4	
1. Receiver, transmitter, and repeater dimensions	2. Battery housing dimensions


Pre-Installation Component Setup and Functional Check

The steps below describe the process of verifying the Wireless System component functionality; listed steps are only for one TLS-RF. If there are more than 8 Sensors installed at the site, refer to Appendix A on how to setup the DIP Switches for auxiliary TLS-RF(s).

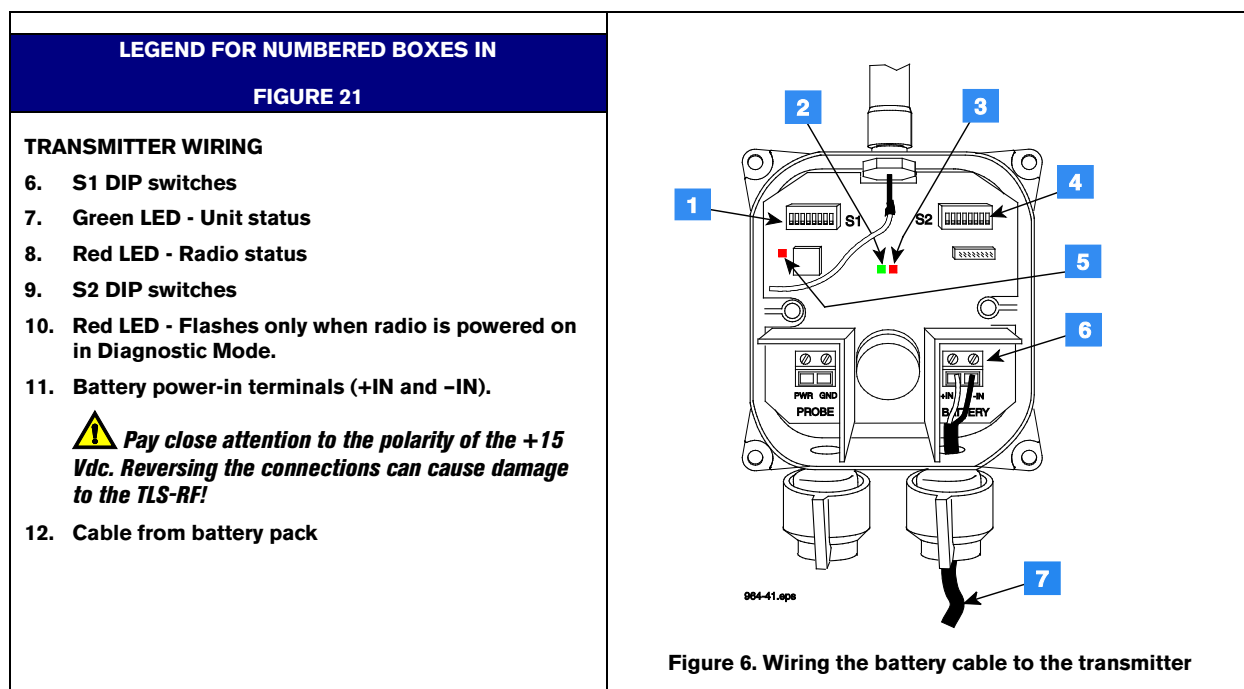
1. Remove all the hardware from their boxes; lay the TLS-RF, Receiver, Repeater, and all the Transmitters on a table.
2. Set Site ID for the Receiver, Repeater, and all the Transmitters (refer Appendix A on how to set up the Site ID). Typically the Site ID is set to 0 (default). If there is a nearby wireless site, the Site IDs must be different.
3. Set all Transmitter's Device Numbers and connect the battery cables to all the Transmitters. Label each Transmitter with its site ID.
 - a. Using a T15 torx driver, remove the cover of the Transmitter.
 - b. Remove the nut from the battery cable cord grip (right side cord grip) and slide it over the non-connector end of the battery cable.
 - c. Make sure the battery/dc power cable is not connected to the battery pack or dc power source at this time. Push the battery cable through the battery cable cord grip bushing and into the Transmitter.
 - d. Strip back the cable jacket and wires as shown in Figure 5.



LEGEND FOR NUMBERED BOXES IN FIGURE 5

3. Strip back cable and wire jackets the amount shown.
4. Use a screwdriver with the proper blade width.
5. Both wires must be tight in terminals! 

- e. Connect the battery pack/dc power cable to the BATTERY terminal block (white to +IN and black to -IN) as shown in Figure 6.





- f. Hand tighten both cable entry cord grip nuts to prevent water entry!
 - g. Replace the cover of the Transmitter, but do not tighten down cover screws at this time.
4. RF's RS-485 terminals to the Receiver's RS-485 terminals (refer to Figure 20). Connect a necessary length of 2-conductor cable from the Receiver's Repeater terminals to the Repeater's Repeater terminals (refer to Figure 21).
 5. The steps below are to verify the communication between the TLS-RF Unit and the Receiver.
 - a. Plug the TLS-RF's ac power cord into a 120/240 Vac outlet. Confirm the Green /Red LEDs (refer to item 2 in Figure 12), are flashing rapidly. This is an indication there is RS-485 network activity between the TLS-RF and the Receiver.
 - b. If it is, continue to Step 6.
 - c. If it is not, check PWR LED (refer to item 3 in Figure 12), if not lit; check power wiring. If the wiring is correct, measure the voltage across the twisted pair power wires, it should read +15Vdc. If it is not, the TLS-RF is bad.
 - d. If the Red LED (refer to item 2 in Figure 12) is not flashing, confirm the TLS-RF address is set to Master (refer to Appendix B, Figure B-1Appendix B, Figure B-1Appendix C, Figure C-1 on how to set the TLS-RF Device Number). If it is, the TLS-RF has failed.
 - e. If the Red LED is flashing and the Green LED is not flashing, the TLS-RF is not receiving a response from the Receiver.
 - f. Confirm the Receiver PWR LED is lit (refer to item 1 in Figure 20). If not check the power wiring.
 - If the power wiring is correct, measure across the +15V and GND (refer to item 4 in Figure 20), it should be +15Vdc. If it is not, measure the voltage across the +15V and GND terminals in the TLS-RF, it should read +15Vdc. If it does, replace the twisted pair power wires. If it does not, the Receiver is bad.

- Check the RS-485 Green LED (refer to item 1 (PWR LED) in Figure 20), if it is flashing; it is receiving Data from the TLS-RF. If it is not flashing, check the RS-485 cabling between the TLS-RF and the Receiver.
 - Check the Red LED (XMIT LED, [item 1 in Figure 20]), if it is flashing; check the cabling. If it is not flashing, the Receiver is at fault; replace the Receiver.
6. This step is to verify to make sure Data from the Transmitter is being received by the TLS-RF. Make sure the power to the Repeater is off.
 - a. Connect the first Transmitter's battery cable to a battery pack; noting the Red LED should be flashing momentarily then followed by the Green LED (refer to item 2 and 3 in Figure 5). Since there is no Sensor connected, the two LEDs should be flashing. This is an indication a Sensor communication error and is acceptable at this step.
 - b. TIP - Normal flashing is when an LED turns On for over 1 second and turns Off for over 1 second. Error flashing is when an LED turns On and Off every 1/2 second or less.
 - c. Go to the TLS-RF, open its cover. One of the 8 Red received LEDs should be flashing (refer to item 5 in Figure 12). Observe which LED is lit and compare it against the Transmitter Device Number; they should match. For example, if the Transmitter ID is set to 1, the LED number 1 in the TLS-RF should be flashing.
 - d. If the Transmitter Device Number and the LED in the TLS-RF do not match, disconnect the Transmitter's battery cable from the battery pack. Move these DIP switches back and forth a few times to make sure they are set properly. Reset these DIP Switches to the correct setting; reconnect the battery cable; confirm that the correct LED is flashing.
 - e. If they still do not match, disconnect the Transmitter's battery cable from the battery pack; change the Transmitter Device Number to a different setting and repeat Step 6.
 - f. If resetting the Transmitter to a different Device Number and the LED position in the TLS-RF matches; that DIP Switch position is bad, the Transmitter is at fault.
 - g. If resetting the Transmitter to a different Device Number and the LEDs in the TLS-RF and the Transmitter are not matched; remove the power from the Transmitter and put it aside.
 - h. Repeat Step 6 with the next Transmitter.
 - i. If both Transmitters have the same problems, it could be the Receiver or the TLS-RF.
 - j. In the case where the LED in the TLS-RF is not flashing, check the Site ID in the Receiver and the Transmitter to make sure they are correct. If the Site IDs are correct, the Transmitter or the Receiver is at fault. NOTE: Sometimes it is necessary to disconnect the battery cable from the battery pack and wait for 2 minutes and retry again to make sure the connection is established properly.
 7. If all the Transmitters have been verified to be working properly, they are now ready to be installed.
 8. Unplug the TLS-RF, disconnect the temporary power cable and RS-485 cable to the Receiver and close the cover of the TLS-RF, but do not tighten the cover screws at this time.
 9. Disconnect the temporary RS-485 and 2-conductor cables from the Receiver and replace its cover, but do tighten at this time. Disconnect the temporary 2-conductor cable from the Repeater and replace its cover, but do not tighten at this time.

TLS-RF Installation

Selecting a Location for the TLS-RF

 WARNING	
	<p>Explosive vapors or flammable liquids could be present near locations where fuels are stored or being dispensed. The TLS-RF is not explosion proof.</p> <p>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.</p> <p>Do not install this unit in a volatile, combustible, or explosive atmosphere.</p>

The TLS-RF must be mounted indoors, protected from severe vibration, extremes in temperature and humidity, and other conditions that could harm computerized electronic equipment.

Ensure that the TLS-RF is located where neither it nor its associated cabling will be damaged by doors, furniture, barrows, etc. Consider the ease of routing wiring, and ducting to the TLS console. Check that the mounting surface is strong enough to support the unit's weight of about 1.8 kg.

Mounting the TLS-RF

Figure 7 illustrates recommended unit mounting. Install the unit's fastening devices to the mounting surface using the hole pattern (170 x 145 mm) shown in Figure 3. Mounting screws up to 4.7 mm diameter may be used.

Install metal conduit between the upper power side knockout on the unit and the power panel. Figure 3 shows the three designated knockouts (one each on top, left side, and bottom) through which power wiring can safely enter the unit.

Also install metal conduit between the lower intrinsically-safe wiring knockout on the TLS-RF and an intrinsically-safe wiring knockout on the TLS console for device data wiring.

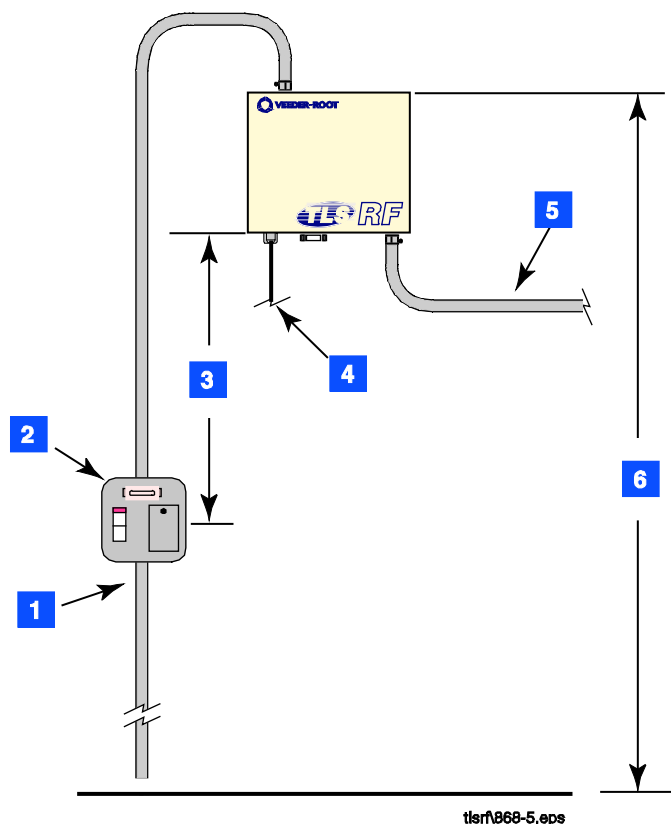


Figure 7. Recommended mounting of TLS-RF

LEGEND FOR NUMBERED BOXES IN FIGURE 7	
<p>1. From an independent 24 hour power supply at the distribution panel, run three 2.5 mm² (minimum) standard color coded wires; two for ac power and one for earth to the fused spur. Run one 4 mm² wire, color coded green/ yellow, from the earth bus bar at the distribution panel direct to the console location. Leave at least 1 meter of free cable for connection to the console.</p> <p>2. One 5 A fused, switched, neon indication spur (for 240 Vac), or a dedicated circuit breaker rated for 15 A, 120 or 240 Vac. NOTE: circuit breaker must be marked as the power disconnect for the TLS-RF.</p>	<p>3. 1000 mm (maximum)</p> <p>4. RS-485 cable (Belden #3107A or equiv.) to Receiver - maximum length 76 m.</p> <p>5. Conduit for probe data to TLS console.</p> <p>6. 1500 mm (maximum)</p>

Wiring the TLS-RF

WARNING



The unit contains voltages which can be lethal.

Connecting power wires to a live circuit can cause electrical shock that may result in serious injury or death.

Turn power off at the circuit breaker before connecting wiring to the TLS-RF.

Attach conduit from the power panel to the unit's power wiring knockouts only (1 on top and 1 on bottom, ref. Figure 3)

To connect power wiring see Figure 8. To connect receiver wiring see Figure 9. To daisy chain multiple TLS-RFs see Figure 11. To connect TLS-RF data output wiring to the TLS console see Figure 12.

LEGEND FOR NUMBERED BOXES IN FIGURE 8

1. Attach chassis ground wire (2.5 mm²) to ground lug.
2. Protective earthing conductor (green and yellow). Attach 4 mm² barrier ground wire to ground lug. Ground must be the same as the supply and less than 1.0 ohms to ground.
3. AC power input wires (2.5 mm²) to AC INPUT terminals.
4. **POWER WIRING NOTES:**
 - Barrier ground must be 4 mm² or larger diameter.
 - Check to be sure that the electrical resistance - between the unit ground lug and a known good earth ground is less than 1 ohm.
 - Connect the power supply wires in the power panel to a separate dedicated circuit.
 - Electrical rating power input - 120 Vac or 240 Vac, 50/60 Hz, 2 A max.
 - See Figure 3 for actual locations of power conduit knockouts into the unit. Power wiring must enter only in one of these knockouts.
5. Intrinsically-safe side
6. Power side
7. RS-232 diagnostic port:
 - Baud rate - 9600
 - Data length - 8
 - Parity - None
 - Stop bits - 1

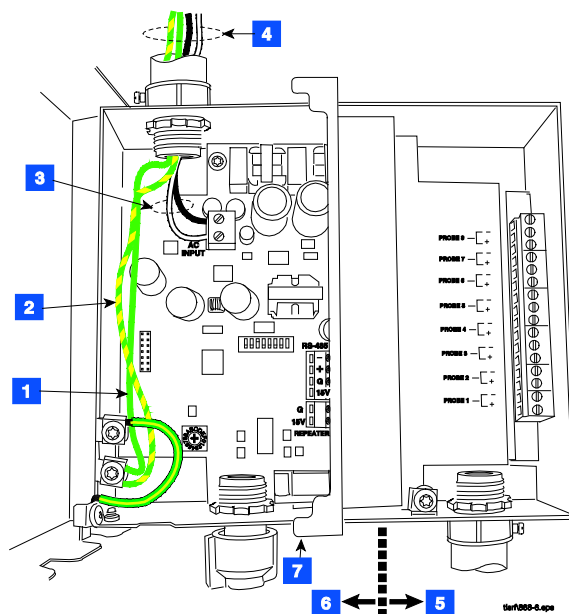


Figure 8. Wiring AC power to the TLS-RF

LEGEND FOR NUMBERED BOXES IN FIGURE 9

1. Connect the shield of the RS-485 cable to the ground lug.
2. Cord grip
3. **NOTE:** Attach one end of RS-485 cable to RS-485 terminals in the TLS-RF and other end to RS-485 terminals in the receiver. One twisted pair connects to terminals (- & +) and the second twisted pair connects to terminals (+15 & G). You must connect each wire of each pair to the identical terminals in the receiver (e.g., white w/blue stripes to “-” and white w/blue stripes to “+”). (ref. Figure 24 on page 26). **NOTE:** see Figure 10 for wire connection tips.

NOTE: In sites with multiple TLS-RFs, the Receiver is only connected to the TLS-RF that monitors the first 8 devices.

4. Power side
5. Intrinsically-safe side
6. RS-485 terminal strip

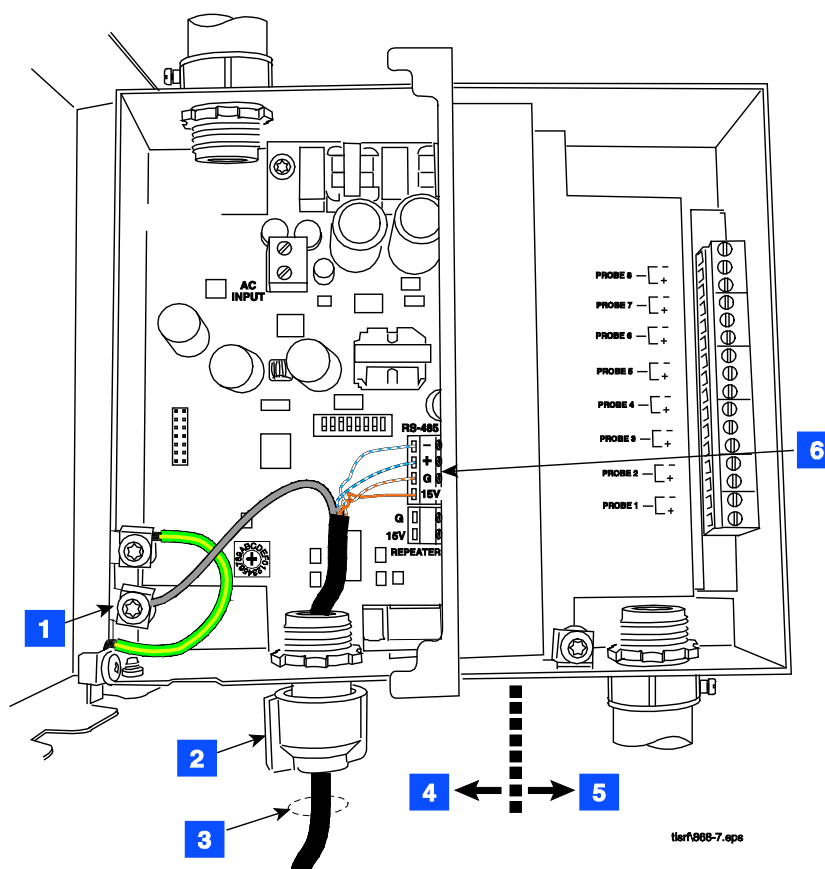


Figure 9. Wiring receiver to the TLS-RF

LEGEND FOR NUMBERED BOXES IN FIGURE 10

1. Strip each wire to ensure metal-to-metal contact inside the connector.
2. Use small blade screwdriver and loosen terminal by turning top screw over desired terminal counter clockwise. **DO NOT** raise screw head above top of hole or it may disengage from clamp.
3. Insert 7mm striped wire into terminal clamp's side opening and tighten screw clockwise until wire cannot be moved in or out.

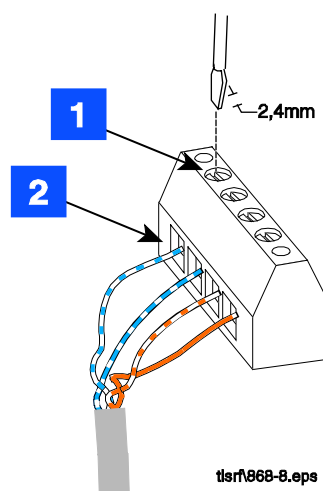


Figure 10. Connecting RS-485 Wiring

LEGEND FOR NUMBERED BOXES IN FIGURE 11

1. POWER WIRING NOTES:

- Barrier ground must be 4 mm² or larger diameter.
- Check to be sure that the electrical resistance - between the unit ground lug and a known good earth ground is less than 1 ohm.
- Connect the power supply wires in the power panel to a separate dedicated circuit.
- Electrical rating power input - 120 Vac or 240 Vac, 50/60 Hz, 2 A max.
- See Figure 3 for actual locations of power conduit knockouts into the unit. Power wiring must enter only in one of these knockouts.

2. AC power input wires (2.5 mm²) to AC input terminals.
3. Protective earthing conductor (green and yellow). Attach 4 mm² barrier ground wire to ground lug. Ground must be the same as the supply and less than 1.0 ohms to ground.
4. Attach chassis ground wire (2.5 mm²) to ground lug.
5. Connect the shields of the RS-485 cables to the ground lug.
6. To TLS-RF #1
7. RS-485 cables -
Connect the wires of one twisted pair to the - and + terminals of the RS-485 terminal block.



NOTE: the second twisted pair is not used.

Make sure the colored wires of the twisted pair attach to the same terminals (i.e., white w/blue stripe wire attaches to '-' terminal in each TLS-RF).

NOTE see Figure 10 for wire connection tips.

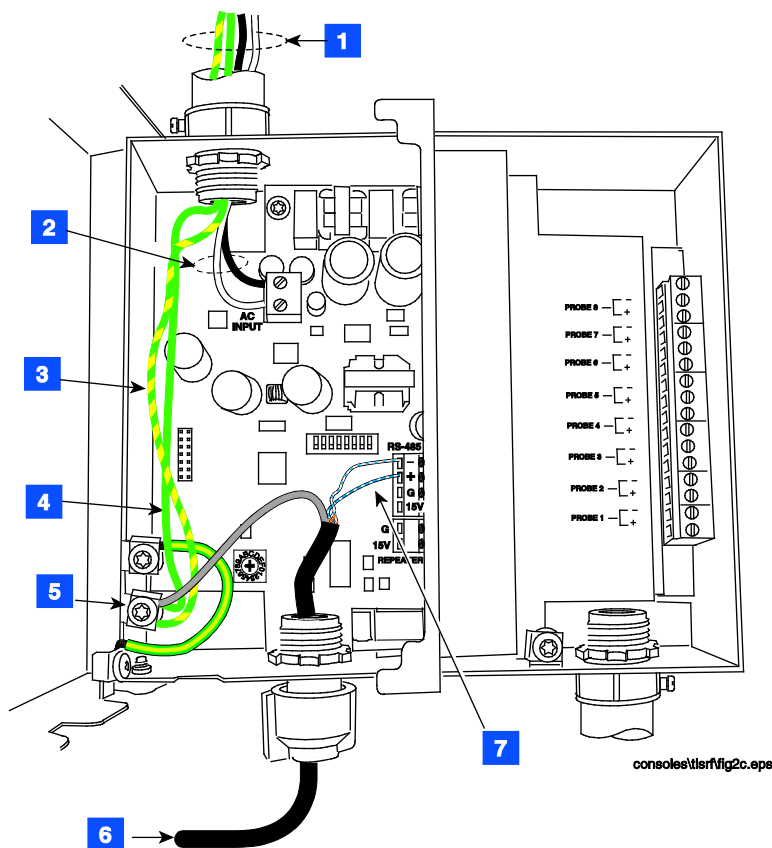


Figure 11. Daisy chaining TLS-RFs

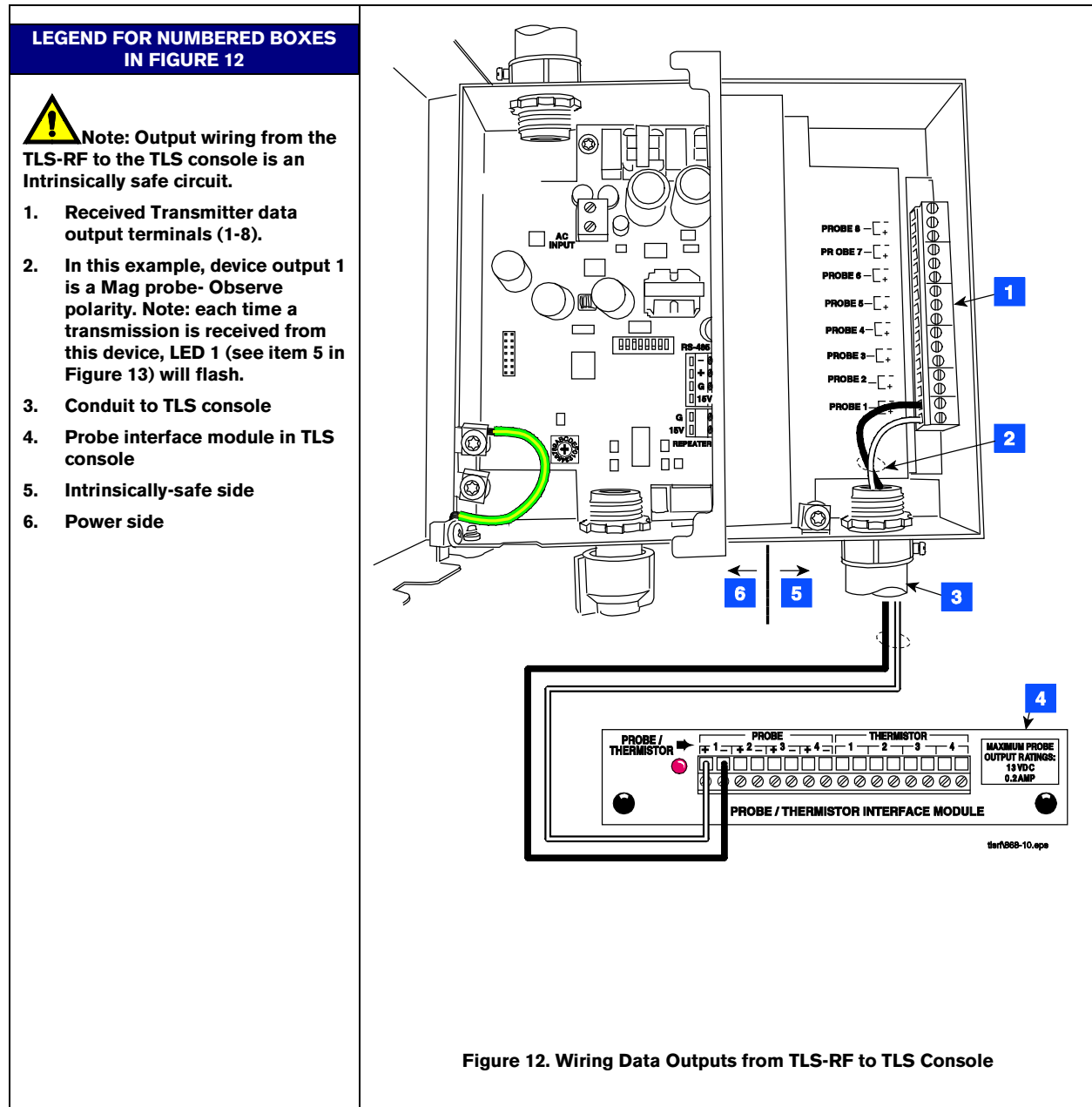
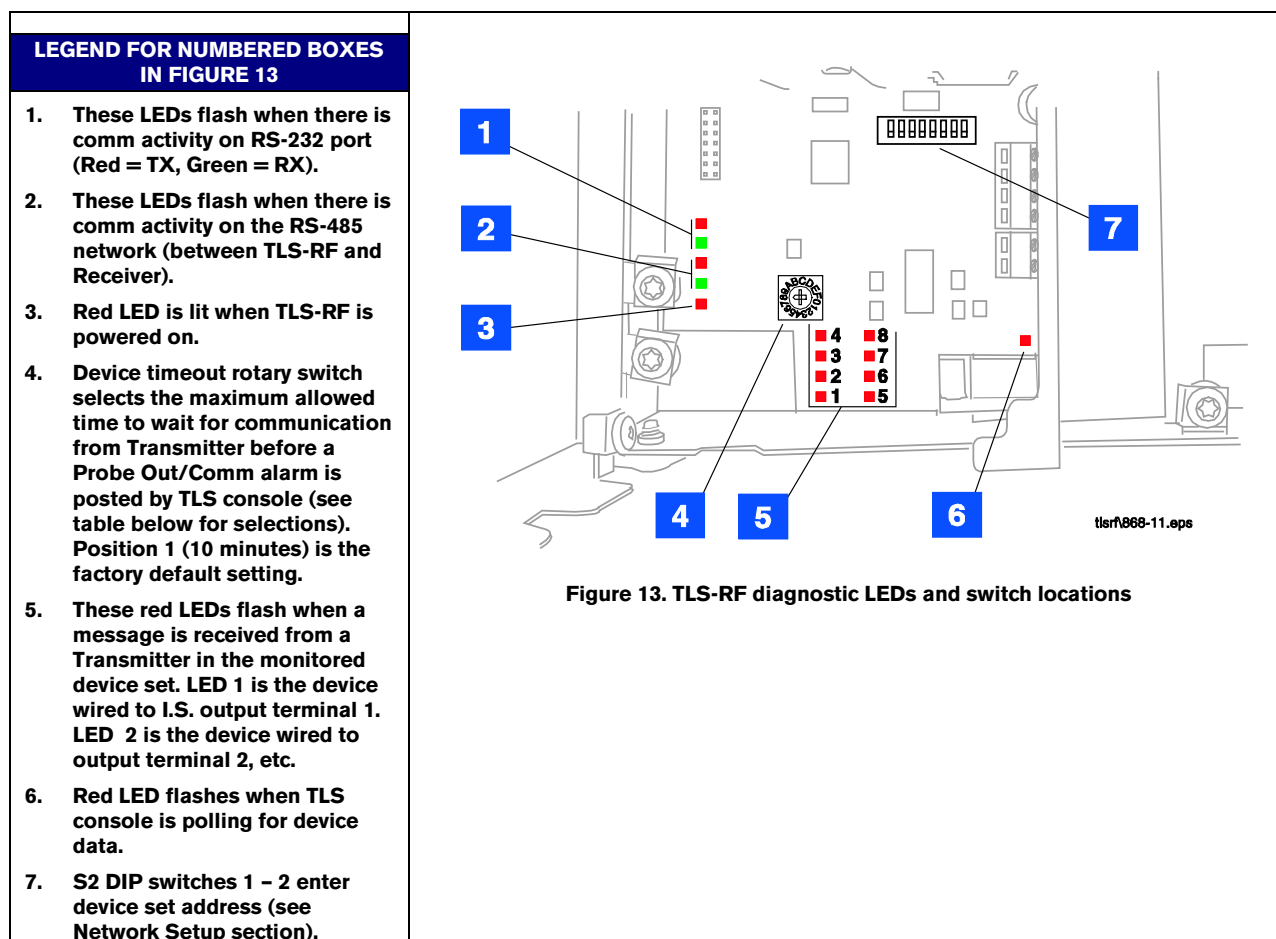


Figure 13 locates the diagnostic lights and setup switches in the TLS-RF.

Each TLS-RF in the site network must have a unique device set number (0 – 3). You must select '0' for the unit assigned the first device set (transmitters 1 – 8), '1' for the unit assigned the second device set (transmitters 9 – 16), etc. The site's receiver must also be connected to the '0' TLS-RF. The factory default setting is '0'. If second TLS-RF is required, enter '1' in second TLS-RF.



Device Timeout Rotary Switch																
Setting	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Timeout	5m	10m (default)	15m	20m	30m	45m	60m	90m	2h	3h	4h	6h	8h	12h	18h	24h

M = minutes, H = hours



Do not set timeout for more than 10 minutes if the TLS console has CSLD enabled for any tank(s).

Probe Out alarms indicate that the TLS system is not functioning.

Wireless Component Installation

Transmitter Installation

! WARNING



Explosive vapors or flammable liquids could be present near locations where fuels are stored or being dispensed. The TLS Transmitter and Battery Pack are not explosion proof but are intrinsically safe devices approved for use in Group IIA hazardous locations.

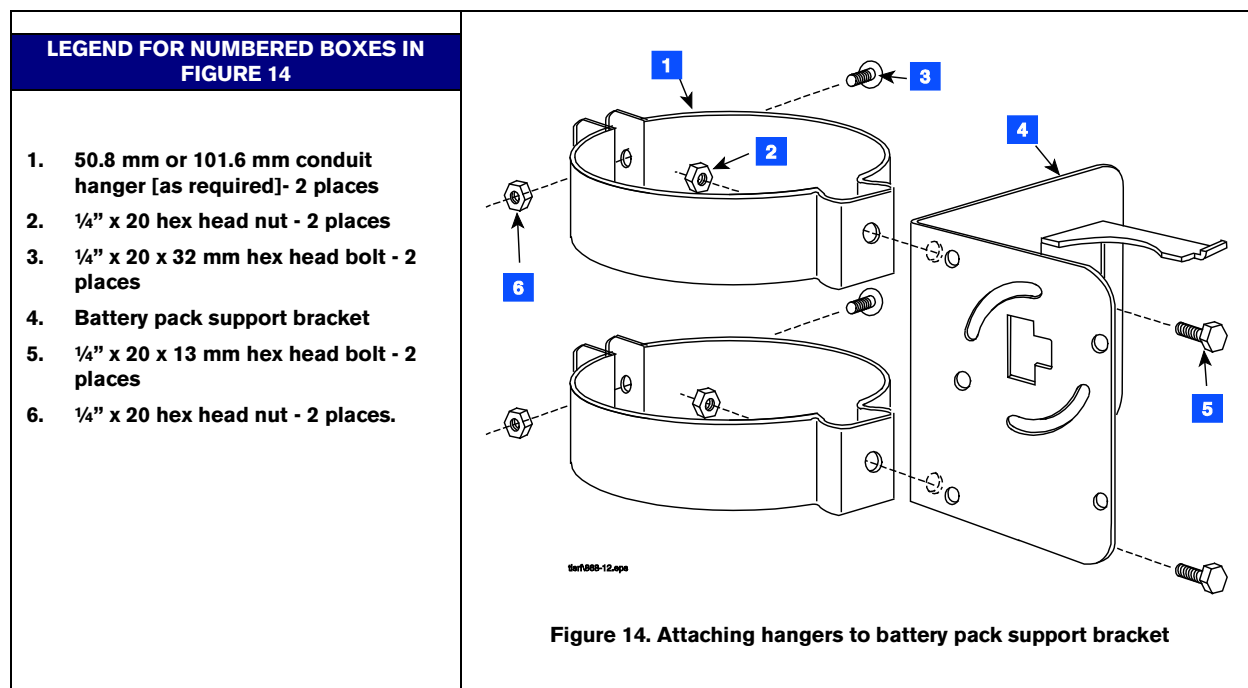
An explosion or fire resulting in serious injury or death, property loss and equipment damage could occur if the console is installed in a volatile, combustible or explosive atmosphere (Class I, Division 1 or 2).

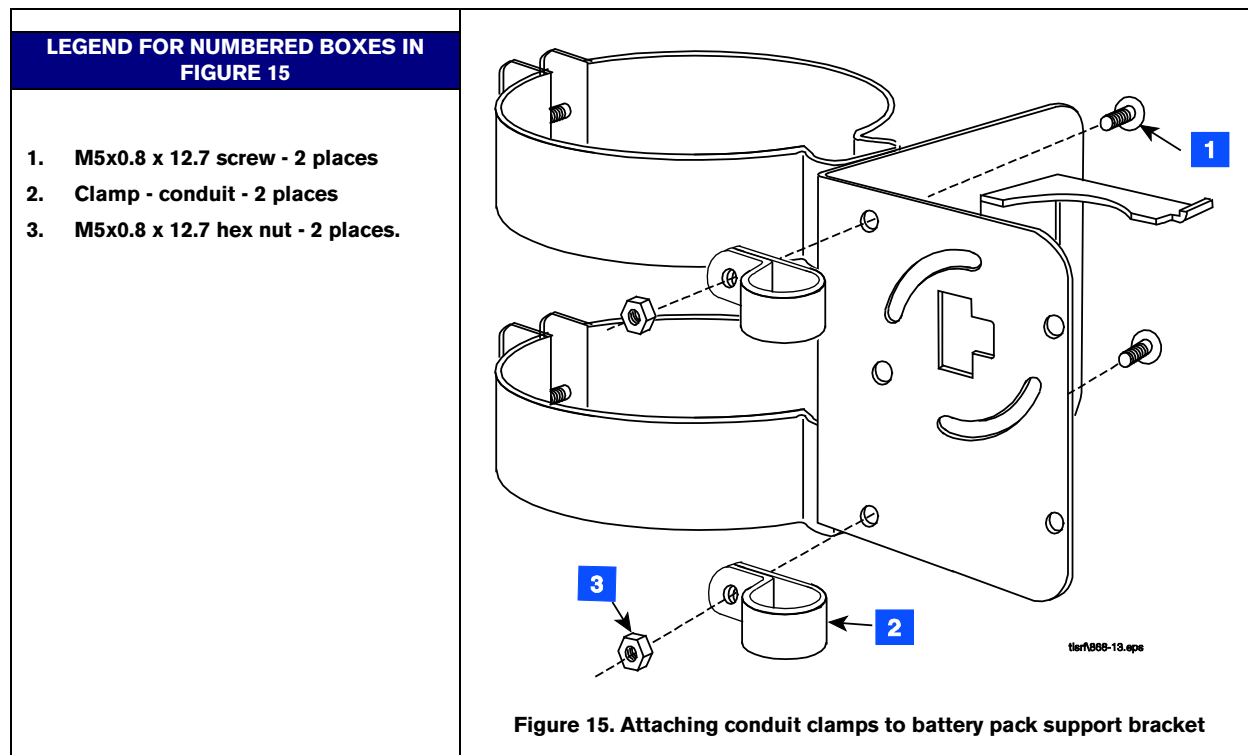
The TLS Transmitter is suitable to work in Zone 1.

MAG PROBE

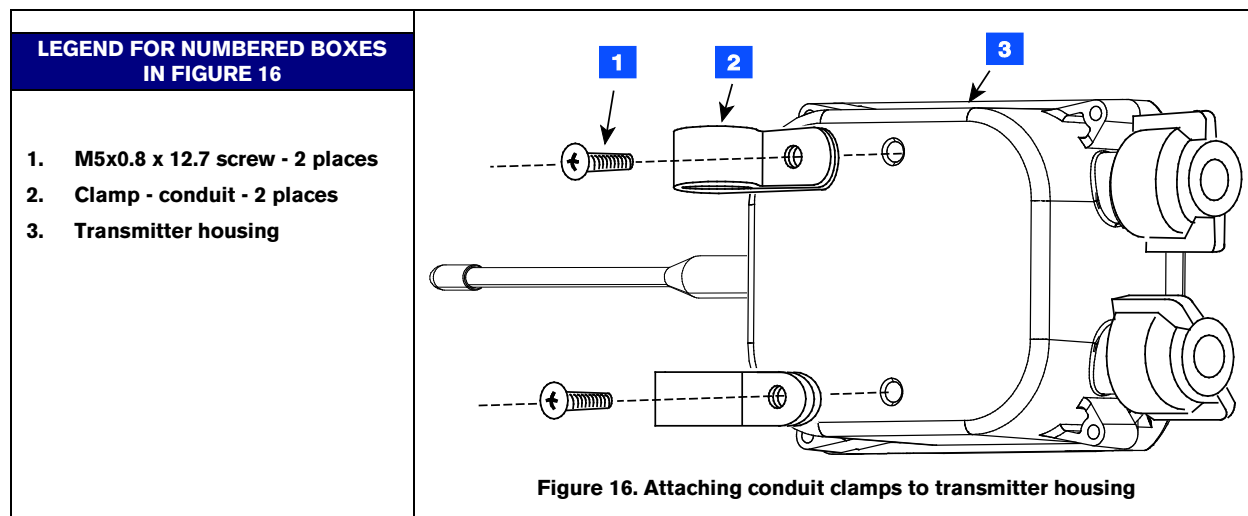
A transmitter / battery pack pair must be installed at every tank's Mag probe that will be monitored by the TLS-RF. Follow the steps below to install the transmitter assembly.

1. Connect the two conduit hangers from the kit (50.8 or 101.6 mm as required) to the battery pack support bracket as shown in Figure 14.
2. Attach two conduit clamps to the battery pack support bracket as shown in Figure 15. Do not tighten screws at this time.

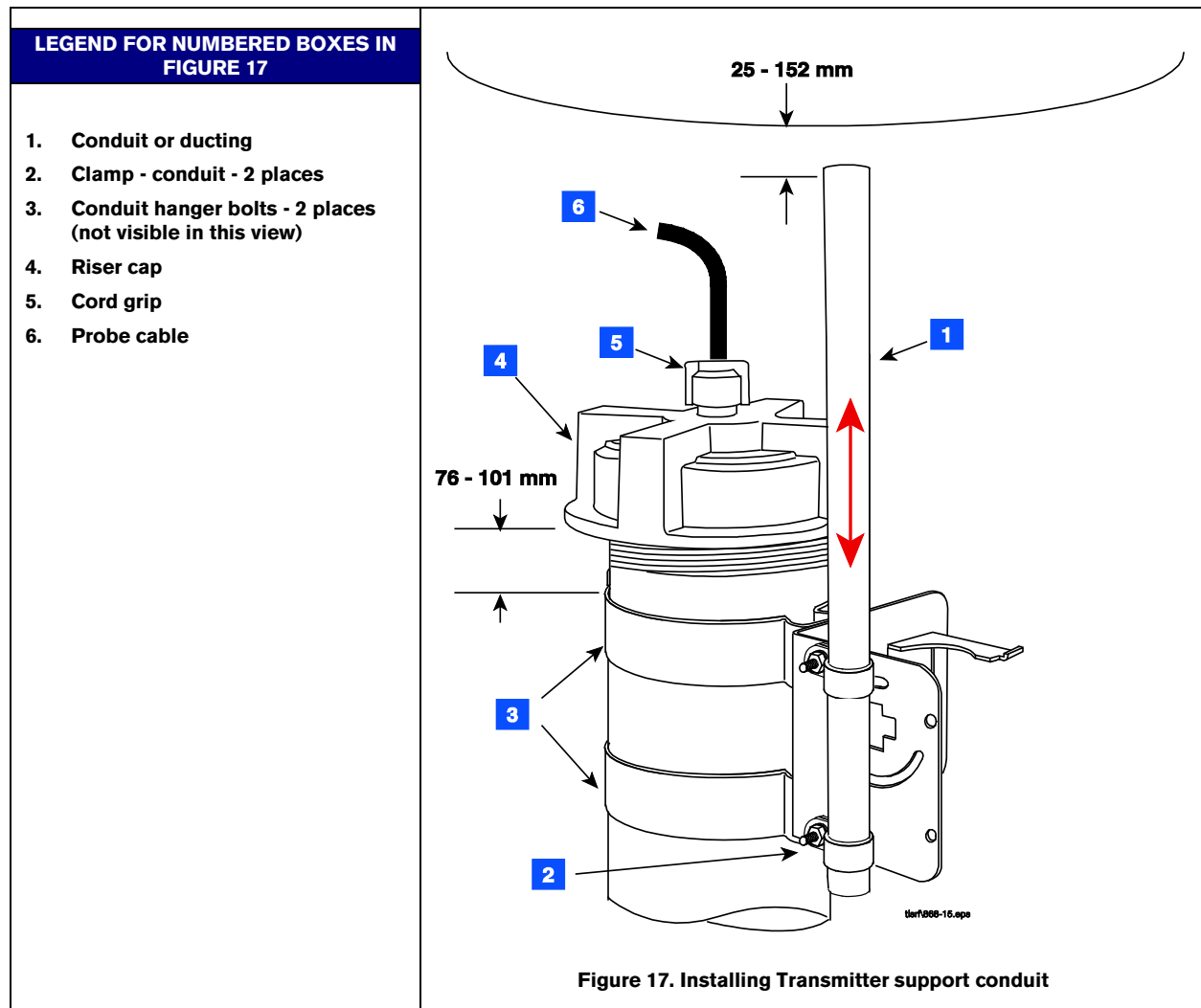




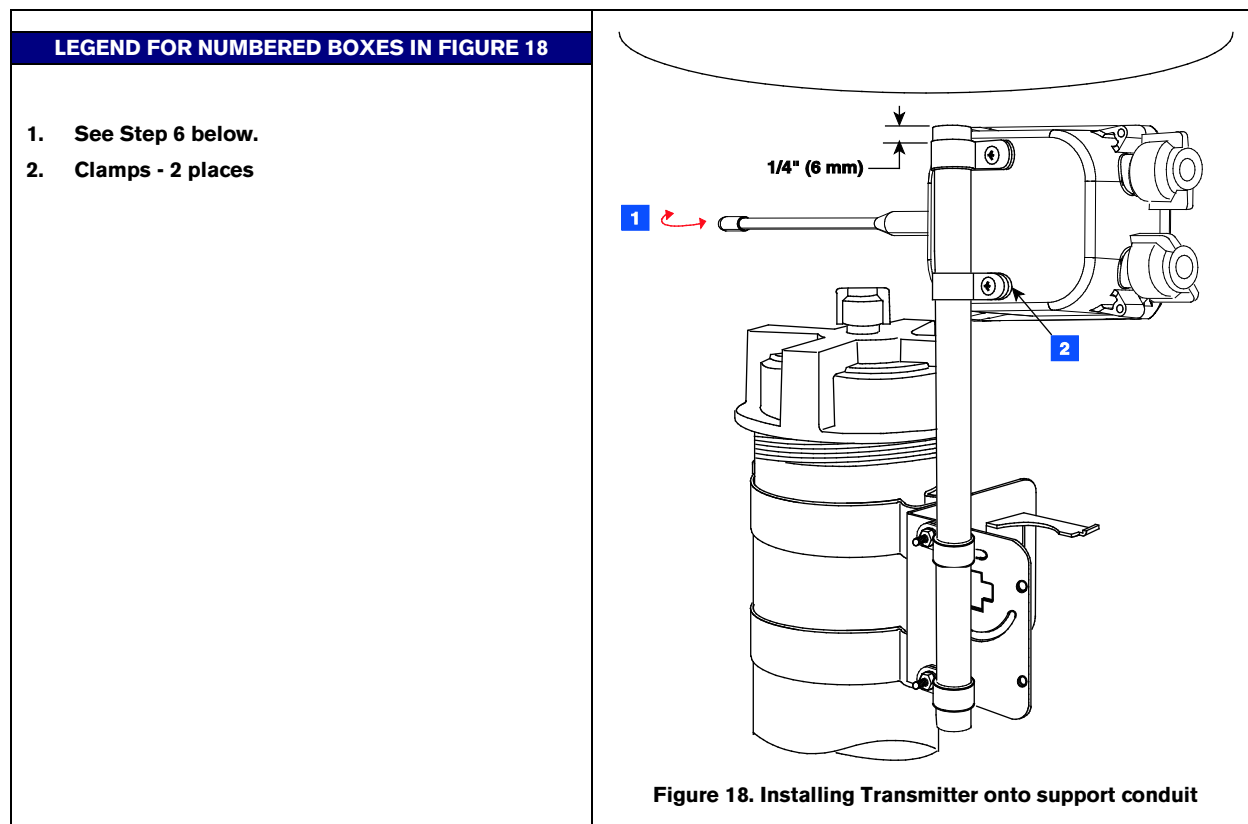
3. Attach two conduit clamps to the transmitter as shown in Figure 16. Do not tighten screws at this time.



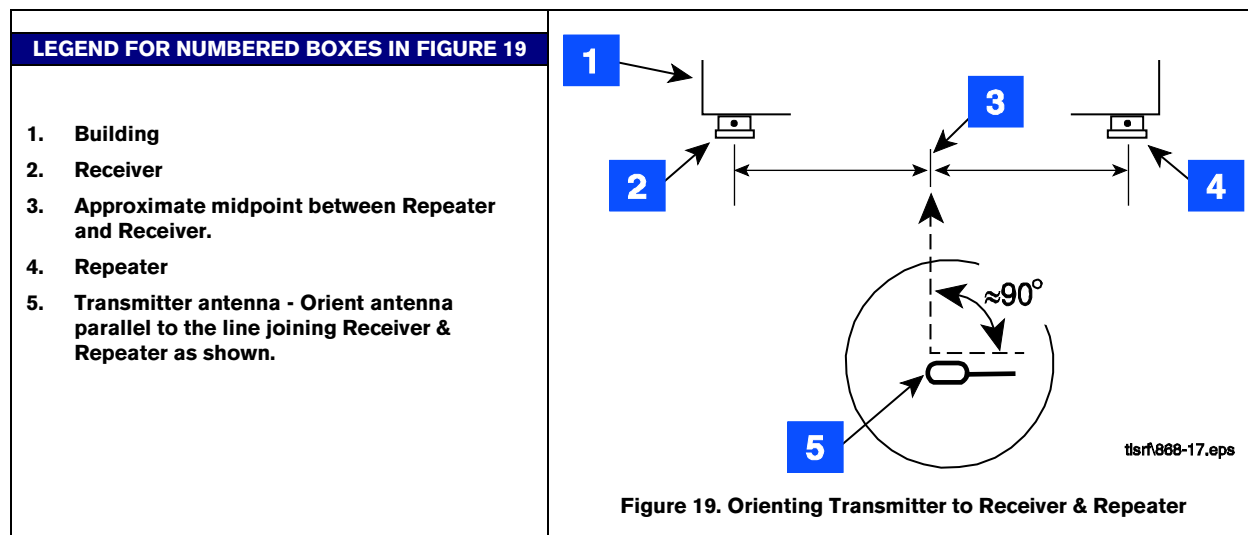
4. Loosen the probe cable cord grip and remove the riser cap. Thread the probe cable through the two conduit hangers as you slide the hanger/bracket assembly onto the riser. Adjust the conduit hangers until the top one is 76 - 101 mm below the top of the riser as shown in Figure 17. Tighten the two conduit hanger bolts to secure the bracket on the riser. Loosen the cord grip in the top of the riser cap and push the probe cable up through the cord grip and replace the riser cap and tighten the probe cable cord grip. Insert a piece of conduit or ducting into the loosened conduit clamps in the battery pack support bracket. The conduit can be positioned below the manhole cover from 25 - 152 mm, as required for best signal reception. Place a mark on the conduit above the top clamp. Remove the conduit to a non-hazardous location and cut off the excess length. Push the conduit down through the two clamps until the top clamp is below the mark on the conduit and tighten the two clamps.



5. Loosen the clamps on the back of the transmitter and slide the two clamps down over the conduit as shown in Figure 18. Position the transmitter until the top clamp is about 6 mm below the top of the conduit and tighten the clamps just enough to keep the transmitter from sliding down.




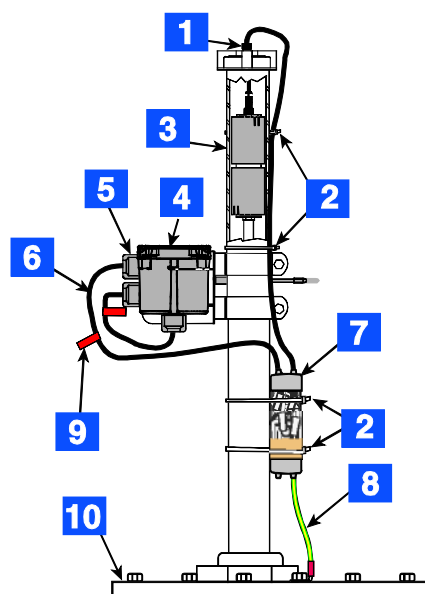
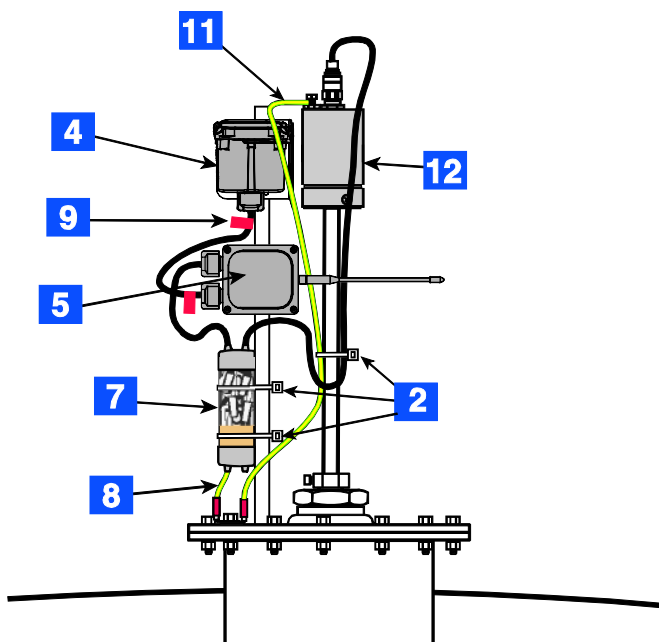
6. Rotate the transmitter until its antenna is oriented relative to the repeater/receiver antennas as shown in Figure 19 and tighten the two clamps on the back of the transmitter.



7. Insert the battery pack into the battery support bracket as shown in Figure 20.

**LEGEND FOR NUMBERED BOXES
IN FIGURE 20**

1.  Push the male probe cable plug into probe canister connector as far as it will go and then firmly hand tighten the connector ring nut to seal the connection.
2. Tie wrap (typical)
3. Riserspipe
4. Battery pack (this side of support bracket)
5. Transmitter (far side of bracket upper figure)
6. Cable from surge protector
7. Single Channel Surge Protector (P/N 848100-001) – NOTE: Install surge protector within 3 feet (1m) of tank entry
8. Bond 10 AWG (4mm² dia. min.) ground wire locally to tank
9. Red battery labels (two places)
10. Tank flange
11. Bond 10 AWG (4mm² dia. min.) ground wire from probe canister to tank
12. Mag-FLEX probe canister


Installing Wireless Components To A Mag Probe

Installing Wireless Components To A Mag-FLEX Probe
Figure 20. Installing Wireless Components To Mag Probes

CONNECTING CABLES TO THE TRANSMITTER

8. Note that the cover of the transmitter indicates the cable entry points to be used for the Mag probe and battery pack power cables.
9. Make sure the battery cable is not connected to the battery pack at this time. Remove the cover of the transmitter and set it aside.



WARNING! To prevent ignition of flammable or combustible atmosphere disconnect power before servicing.

10. Set DIP switches on both S1 and S2 (reference Appendix A).
11. Attach the Mag probe cable to the PROBE terminal block (white to PWR and black to GND) and the battery pack/dc power cable to the BATTERY terminal block (white to +IN and black to -IN) as shown in Figure 21 and Figure 22. Tighten cable entry cord grip nuts.



NOTE: Observe polarity for all cables and wires.

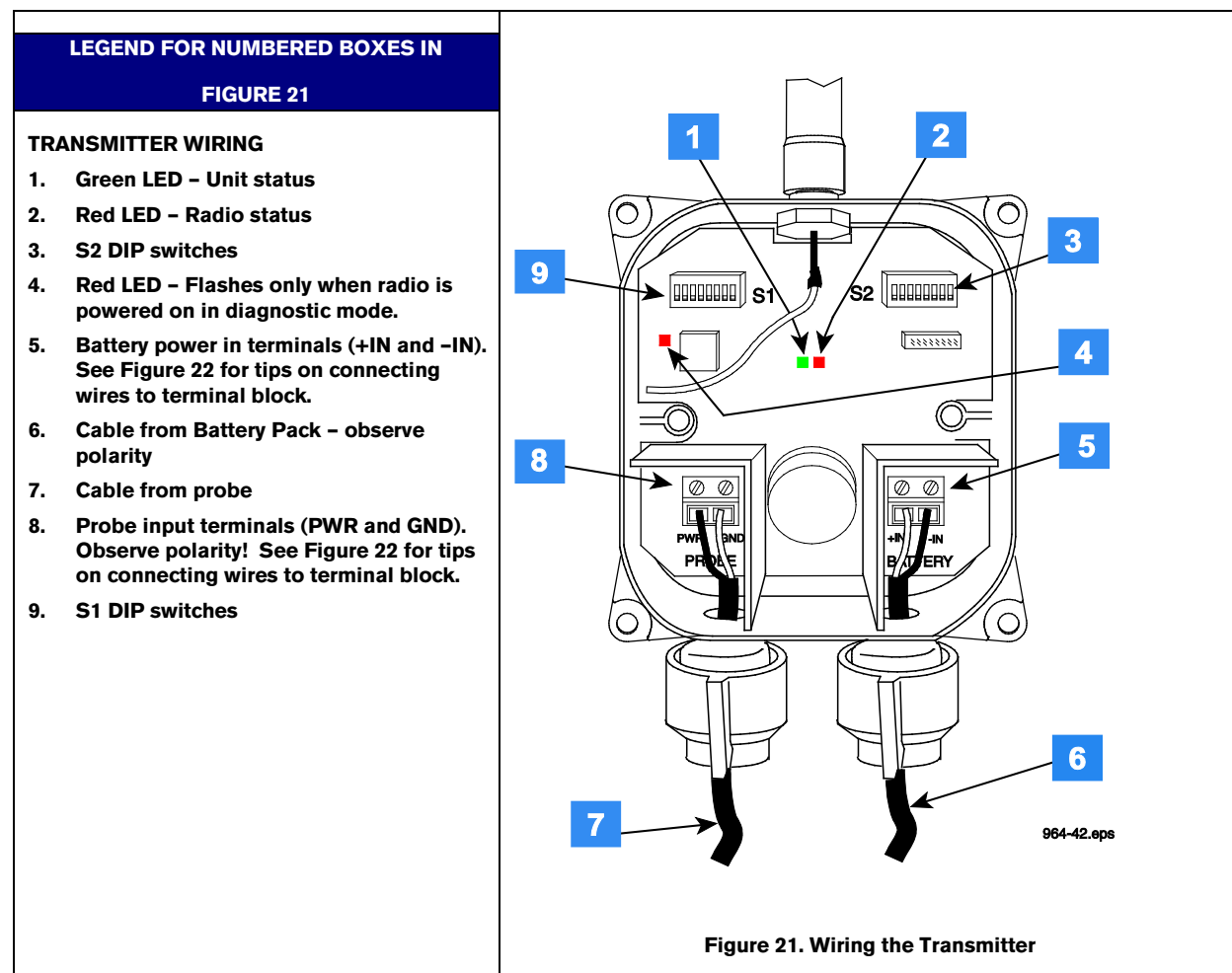


Figure 21. Wiring the Transmitter

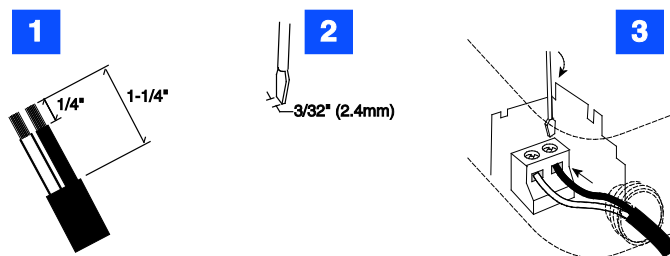





Figure 22. Connecting wiring to transmitter terminal blocks.

LEGEND FOR NUMBERED BOXES IN FIGURE 22

1. Strip back cable and wire jackets the amount shown.
2. Use a screwdriver with the proper blade width.
3. Both wires must be tight in terminals! 

12. Replace the cover securely onto the housing following the procedure below to ensure a watertight seal.
 - Insert the four cover screws through the cover and then press on the retaining washers to hold the screws in place.
 - Make sure that the cover gasket is free of dirt and debris on both sides of the gasket and that the inside of the cover is clean in the gasket area.
 - Position the gasket into the cover groove, assuring that it is pressed fully into the groove and sitting completely flat.
 - Assemble the cover onto the enclosure, tightening the screws in a couple of turns each. Using an alternating 'X' pattern, continue to tighten the screws until they are all tight.
 13. Attach the red battery ID labels from the installation kit to the battery cable at both ends as shown in Figure 18.
 14. Refer to the Site Startup Procedure before attaching battery cable to battery pack connector.
- Repeat the above steps to install transmitters in the remaining Mag probes.

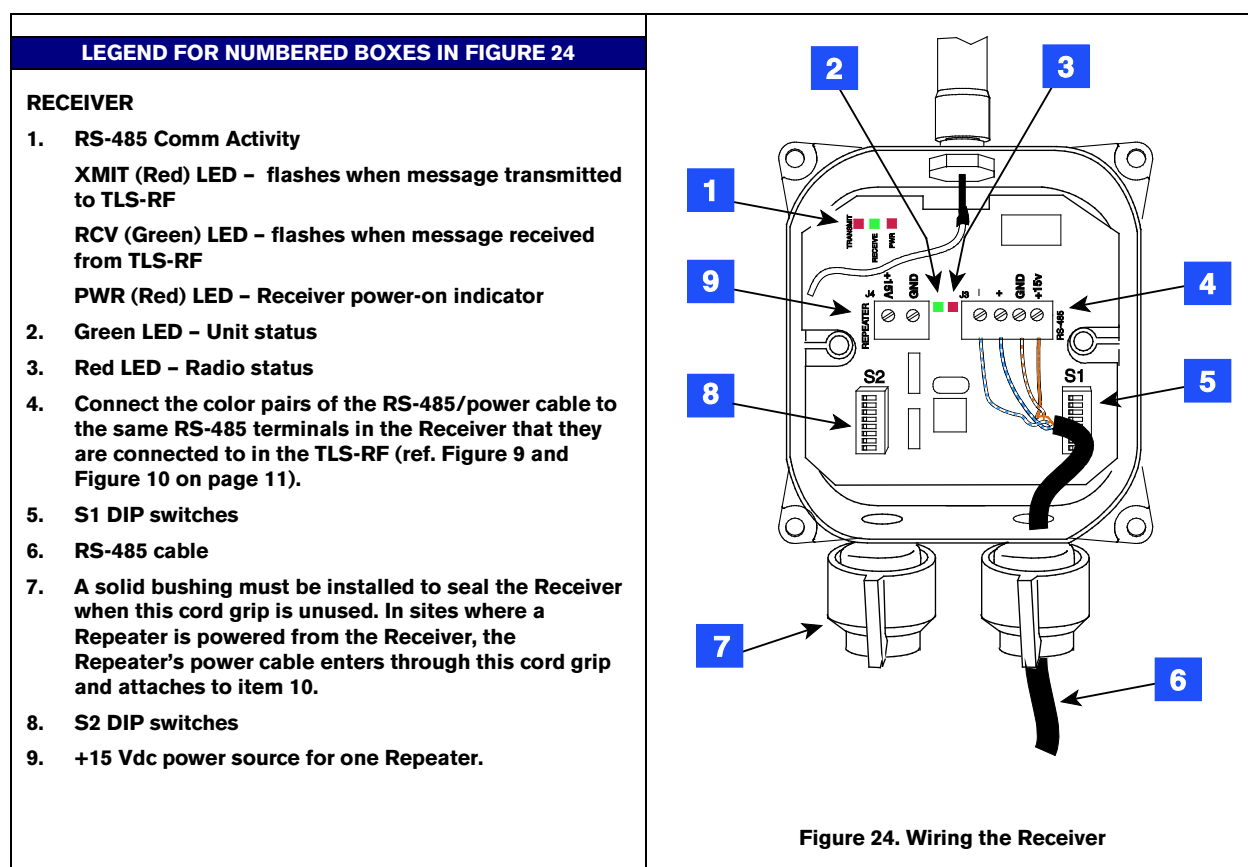
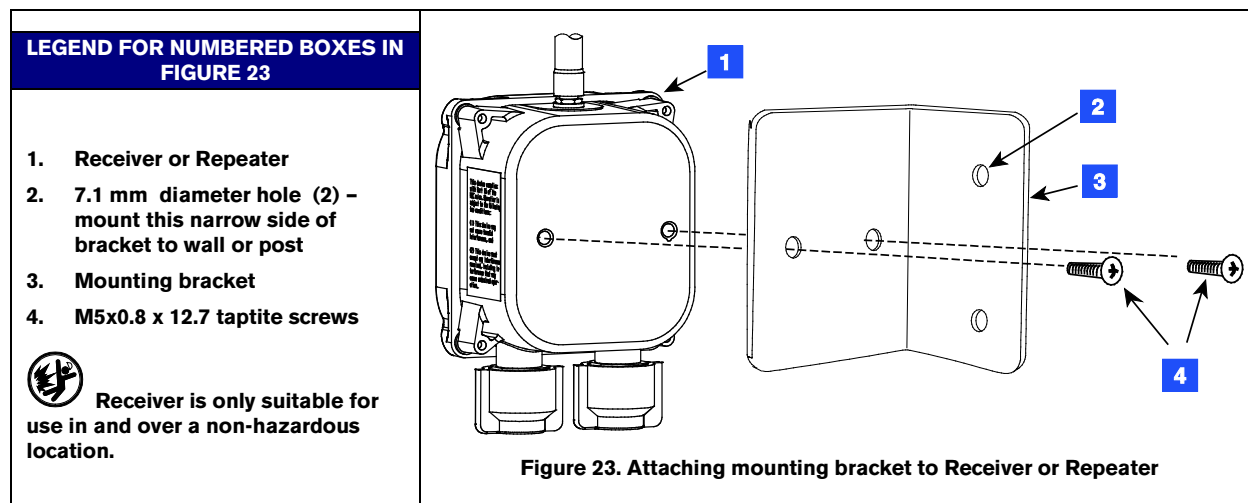
Receiver Installation

 WARNING	
	<p>Explosive vapors or flammable liquids could be present near locations where fuels are stored or being dispensed. The Receiver is not explosion proof.</p> <p>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.</p> <p>Do not install the Receiver in a volatile, combustible, or explosive atmosphere.</p>

1. One receiver is required per site and it is mounted in the vertical position (antenna up) on the outer wall of the same building housing the TLS-RF. The receiver is attached to its mounting bracket with M5x0.8 x 12.7 taptite screws from its install kit (see Figure 23). The L-bracket is then mounted on the outer wall of the building using appropriate fasteners (customer supplied).
NOTE: Locate the receiver on the side of the building facing the tanks to provide an unobstructed signal path. When locating the mounting position, keep in mind that the RS-485 cable connecting the receiver to the TLS-RF must be less than 76m in length. Avoid placing the receiver near motors (e.g., power roof vents), fluorescent lighting (min. 305 mm separation), pumps, welders.
2. Run the RS-485 cable (Belden #3107A or equiv.) from the TLS-RF through the building's wall to the receiver. Caulk the cable where it passes through wall openings. Use cable clamps at appropriate intervals to secure the cable to the walls.
3. Note that the receiver cover label indicates the cord grip to be used for the RS-485 cable from the TLS-RF. Loosen that cord grip then remove the cover of the receiver and set it aside.
4. Push the RS-485 cable through the loosened cord grip. Strip back the jacket from the end of the cable about 50mm. Note that there are two twisted pair color-coded wires in the cable (e.g., a white with blue stripe and blue with white stripe pair and a white with orange strip and orange with white stripe pair). Strip back each wire's insulation about 7 mm.
5. One of the pairs is for RS-485 communication (- & + terminals) and the other pair is for receiver power (+15 Vdc & Gnd). Using Figure 22 as a guide, attach the wires of the two twisted pairs to the RS-485 terminals.



Record which wire attaches to each terminal to help you attach the other end of that wire to the identically marked terminal in the TLS-RF.

6. Referring to your connection notes in step 5 above, connect the other end of the RS-485 cable to the RS-485 terminal block in the TLS-RF (ref. Figure 9 on page 14).



7. Make S1 and S2 DIP settings as desired (ref. Appendix A).
8. Follow the procedure in Step 12 of the Transmitter Installation to replace the Receiver Cover.


Repeater Installation


 WARNING	
	<p>Explosive vapors or flammable liquids could be present near locations where fuels are stored or being dispensed. The repeater is not explosion proof.</p> <p>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.</p> <p>Do not install the repeater in a volatile, combustible, or explosive atmosphere.</p>

1. One repeater is installed per site which relays transmitter signals to the site's receiver. The repeater is mounted in a vertical position on same side of the building as the receiver (preferably), and in a direct line of sight with the receiver (ref. Figure 19 on page 21).
2. The repeater is attached to its mounting bracket with M5x0.8 x 12.7 taptite screws from its install kit (ref. Figure 23 on page 26). The L-bracket is then mounted on the outer wall of the building using appropriate fasteners (customer supplied).
3. Note the cover of the repeater indicated the cord grip to be used for the cable connecting the repeater to its dc power source. Loosen the +15 Vdc labeled cord grip, then remove the cover of the repeater and set it aside.
4. Set S1 and S2 (refer to Appendix A).
5. Attach the dc power cable to the repeater terminal block as shown in Figure 25 (white to +15 and black to GND).
6. Follow the procedure in Step 12 of the Transmitter Installation to replace the Receiver Cover.
7. Connect the other end of the repeater's dc power cable (black wire to ground and white wire to +15 Vdc) to the receiver's +15 Vdc output terminal (ref. item 10 in Figure 24), or to a non-interruptible, Class 2, 15 Vdc power source.

LEGEND FOR NUMBERED BOXES IN FIGURE 25**REPEATER**

1. Red LED – on when power is applied.
2. Green LED – Unit status
3. Red LED – Radio status
4. S1 DIP switches
5. DC Power input cable
6. S2 DIP switches
7. DC power input terminals - +15 Vdc and ground (from receiver, if nearby, or from dc power source)

 Pay close attention to the polarity of the +15 V. Reversing the connections can cause damage to the TLS-RF!

 Repeater is only suitable for use in and over a non-hazardous location.

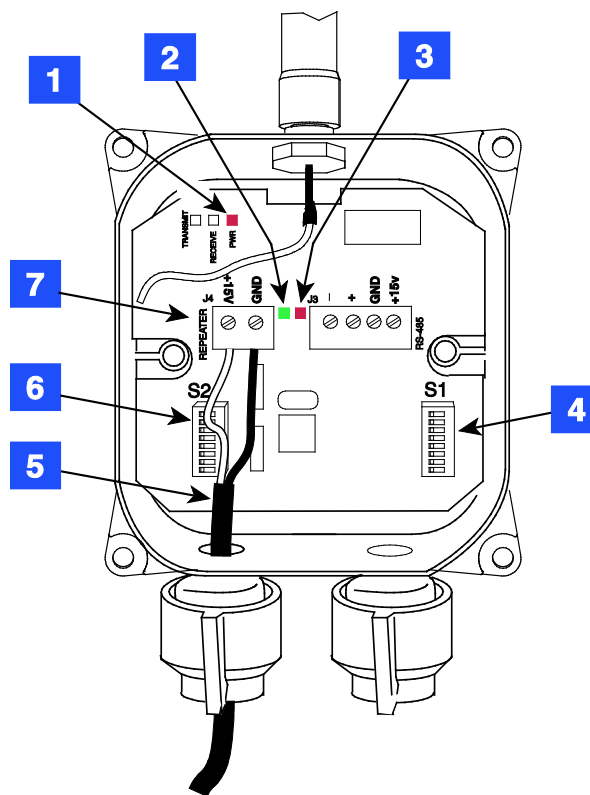
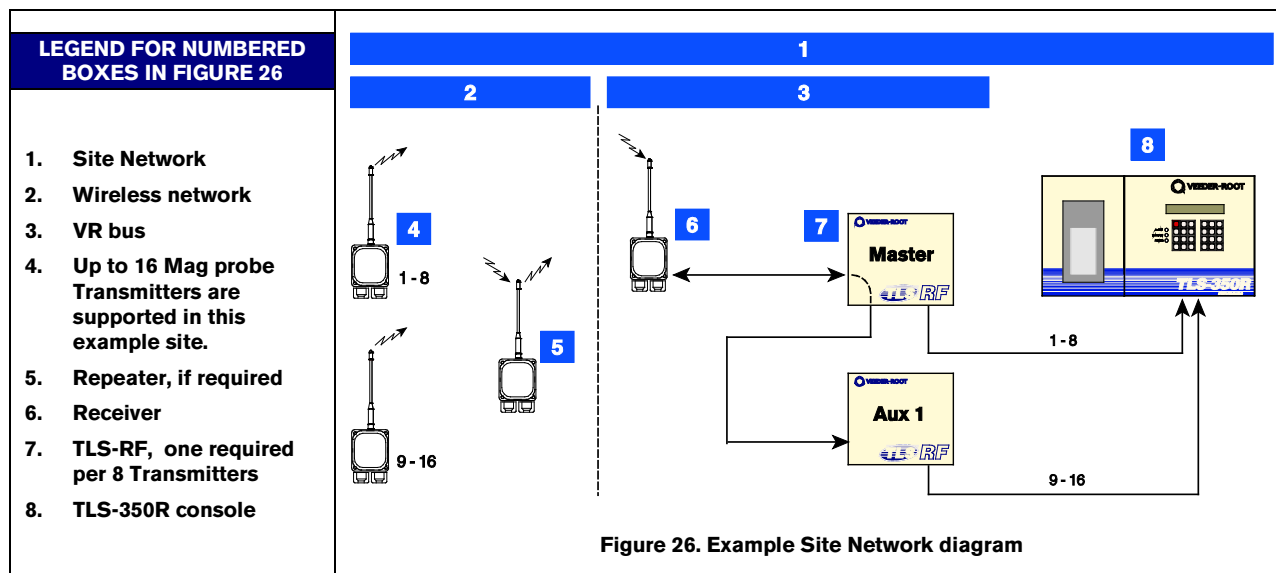


Figure 25. Wiring the Repeater

Network Setup

Hardware Overview

An example TLS-RF site network illustrating a 16 transmitter configuration is shown in Figure 26.



NOTE: The device type (e.g., Mag probe) and quantity permissible in your site's network is dependent on the capabilities of the installed TLS console.

Identifying Devices in the TLS-RF Site Network

The Site ID must be identical for all transmitters and repeaters, and the receiver in the site's wireless network.

Each transmitter in the site's wireless network must have a unique Device ID number (from 1 – 16)

Each repeater in the site's wireless network must have a unique repeater ID number (from 1 – 16)

The receiver on the site's VR bus must have a unique VR bus address (from 0 – 3).

Each TLS-RF in the site's network must have a unique Device Set address (from 1 - 4).

All ID numbers are converted into binary form and entered using DIP switches located in each device.

Make a sketch of the site locating the devices (probe transmitters, receiver, etc) then assign an individual device ID and the common site ID to each device in the sketch. This will help you avoid mistakes when actually setting the DIP switches in each device and when connecting wires between the TLS-RF and the TLS console. You must enter the IDs in each device before it is installed.

Site Startup Procedure

After installing and wiring all equipment, follow the startup steps below.

1. Disconnect the power cable at the battery pack for all site transmitters. Open the cover of the TLS-RF, then power it up. The green/red LEDs indicating RS-485 network activity between the receiver and TLS-RF should be flashing rapidly (ref. item 2 in Figure 13 on page 17). If **Yes**, continue to the next step. If **No**, check the red LED. If it is not flashing, replace the TLS-RF. If the green LED is not flashing, the receiver is not responding. Go to the receiver and remove its cover. Check the RS-485 wiring connections to verify that each wire of the twisted pairs is connected to the same terminal in the receiver that its other end is connected to in the TLS-RF. If the wiring connections are correct, the PWR LED (item 1 in Figure 24) and green LED (item 2 in Figure 24) should be lit. If the PWR LED is lit, but the green LED is not lit, the receiver is inoperative and needs replacing. If the PWR LED is not lit, measure the voltage across the twisted pair power wires, it should be +15 Vdc. To isolate a faulty cable, measure the voltage across the +15 and GND terminals of the RS-485 terminal strip in the TLS-RF (Item 6 in Figure 9 on page 14). Replace the cable, TLS-RF, or receiver as necessary.
2. Referencing your Site Network Worksheet, go to the first transmitter and connect its power cable to the battery pack. This will put the transmitter into the continuous mode, 'forcing' it to transmit every 6 seconds for 30 minutes (default).
3. At the TLS-RF, you should see one of the 8 red transmission received LEDs flashing every 6 seconds, indicating receipt of each transmission from the transmitter (item 5 in Figure 13 on page 17). If yes, record on your Site Network Worksheet which number LED is flashing for this transmitter and then go to step 3a. If one of the LEDs is not flashing, go to step 3b.
 - a. Go back to the transmitter and replace the sump lid, or if a dispenser, close the sump's access cover. Return to the TLS-RF and verify that the same LED continues to flash every 6 seconds. If yes, the receiver is continuing to communicate with the transmitter after the manhole cover or other obstruction was replaced. Go back to the same transmitter, remove the manhole cover and disconnect the power cable from the battery pack and continue to step 4. If the LED is not flashing every 6 seconds, the receiver is not picking up the transmitter's signal. Return to the transmitter and remove the obstruction. Referring to your Site Network Worksheet, verify that the correct Site ID is entered in the transmitter's S2 DIP switches 5-8 (item 3 in Figure 21 on page 23). Verify that the transmitter's antenna is oriented to the receiver as shown in Figure 19 on page 21, if it is move it around and recheck at the TLS-RF to see if the new position helps. Replace the obstruction and recheck the LED in the TLS-RF. If it is not flashing, try repositioning the transmitter lower on the conduit or ducting, then replace the obstruction and recheck the LED in the TLS-RF. If reorienting the antenna or lowering the transmitter doesn't help, make a note on your worksheet that the signal from this transmitter is not being received, disconnect the transmitter power cable at the battery pack, and continue to Step 4.
 - b. Remove the cover of the problem transmitter. The green LED (item 1 in Figure 21 on page 23) should flash indicating that the probe is being read. The red LED (item 2) should also flash indicating the transmitter linked with the receiver and transmitted the probe's data. This green/red flash sequence should occur every 6 seconds while the transmitter is in continuous mode. If there is no green flash, check the probe cable's wiring connections. If the green LED flashes every 6 seconds, but the red LED doesn't flash, then the transmitter is reading the probe data, but for some reason is not linking with, and transmitting to the receiver. However, you will have to wait until you check additional transmitters before determining that the receiver is not functioning correctly. If the green LED is blinking quickly (about a tenth of a second) every 6 seconds, it can

- mean one of several probe errors depending on the number of blinks. Before continuing to step 4, disconnect the transmitter power cable at the battery pack.
4. Repeat Steps 2 and 3 for each of the remaining transmitters. As you power up each of the remaining transmitters and check their reception at the TLS-RF, make notes on your Site Network Worksheet as to whether the transmitter signals are being received successfully, which one of the 8 red transmission received LEDs in the TLS-RF is flashing every 6 seconds, probe problems, etc., for later troubleshooting.
 5. If each transmitter is being received at the TLS-RF(s), go around to each transmitter, reconnect the transmitter's power cable to the battery, and replace the sump or dispenser cover as appropriate. Go to the TLS console and configure all of the site's Mag probes. Check for any probe out/comm alarms. If none are observed, the startup is complete.

If some transmitters are not being received at the TLS-RF, you will have to install additional repeaters as necessary. The repeater requires a Class 2, 15 Vdc power source.

Troubleshooting

Antenna Propagation Basics

The Veeder-Root TLS-RF Wireless site consists of one Master (Receiver) and one or more Slave units (Transmitters/Repeaters).

The propagation of radio waves in the 869 MHz Wireless System, is influenced by several factors:

ANTENNA OPERATION

The antenna is a *transducer*, which converts radio frequency electrical energy fed to it (via the transmission line) to an electromagnetic wave propagated into space. Assuming that the operating frequency in both cases is the same, as in the 869 MHz Wireless System, *this process is reciprocal in nature - the antenna will perform identically in Transmit or Receive mode*. The same Antenna and Transmission Line path is used for both transmit and receive functions.

FREE SPACE LOSS

Signal power is diminished by geometric spreading of the wavefront, commonly known as Free Space Loss (FSL). For TLS Wireless sites having relatively small distances between the Receiver and Transmitters, FSL is not an issue.

ATTENUATION

When the RF signal passes through solid objects, some of the signal power is absorbed. The most convenient way to express this is by adding an "allowed loss" to the Free Space loss. Attenuation can vary greatly depending upon the structure of the object the signal is passing through. Metal in the barrier greatly increases the attenuation. Thickness also increases the loss. General rules of thumb for attenuation are:

Trees account for 10 to 20 dB of loss per tree in the direct path. Loss depends upon the size and type of tree.

Large trees with dense foliage create greater loss.

Walls account for 10 to 15 dB depending upon the construction. Interior walls are on the low end and exterior walls, especially those with stucco, create more loss.

Floors of buildings account for 12 to 27 dB of loss. Floors with concrete and steel are at the high end and wood floors are at the low end.

Mirrored walls have very high loss because the reflective coating is conductive.

SCATTERING

RF signals can reflect off of many things and the direct signal combines with signals that have reflected off of objects that are not in the direct path. This effect is usually described as multipath, fading, Rayleigh fading or signal dispersion. When RF signals combine they can be distorted. The distortion degrades the ability the receiver to recover the signal in a manner much like signal loss.

RADIO LINE OF SIGHT

Radio Line of Sight (LOS) refers to the ability of the receiver to 'see' the transmitter. In TLS-RF Wireless sites, the preferred positioning of the Receiver is one that is visible from the Transmitter's location. When Radio line of sight is impossible, e.g., tanks are on opposite sides of the building, a Repeater should be installed that is positioned at a point that is both visible from the Transmitter and from the Receiver.

ANTENNA POLARIZATION

Polarized omni-directional antennas (used in the TLS Wireless System) are subject to severe pattern distortion in the direction of their mounting (vertically or horizontally). For this reason, the 869 MHz Wireless System Receiver's antenna must be mounted vertically and the Transmitter's antenna mounted horizontally (90 degrees apart).

INTERFERENCE

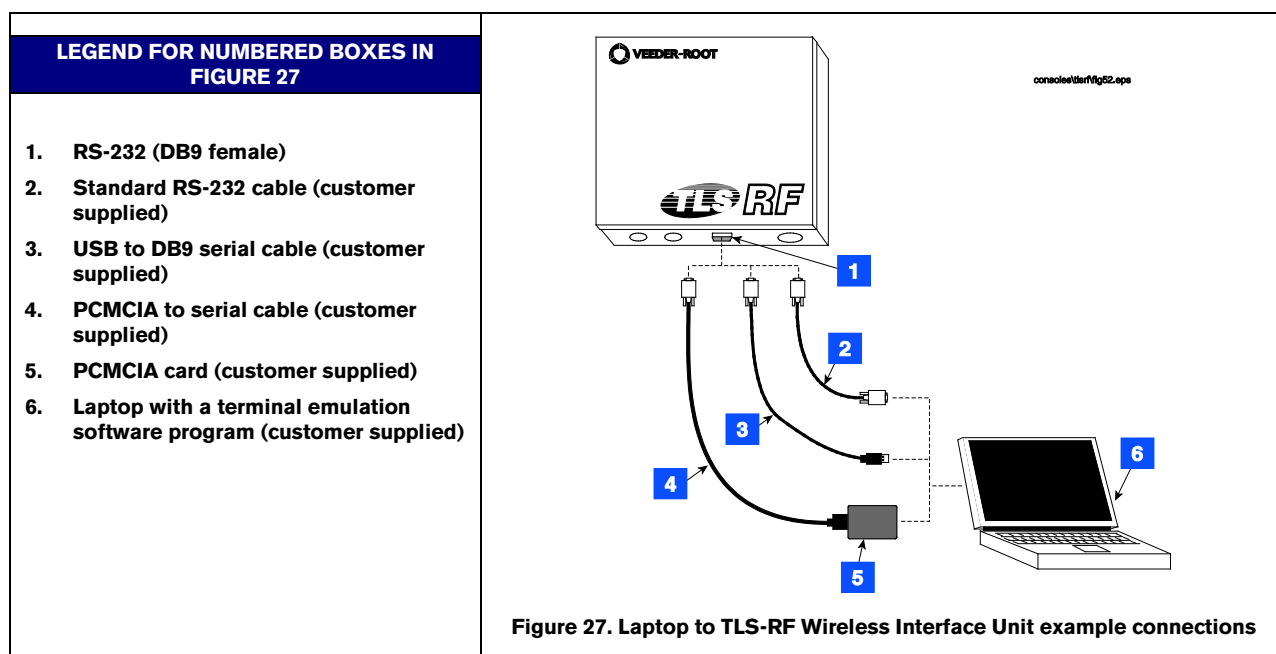
Interference may be caused by several possible sources:

- In-band signals originating from other systems
- Reflections, multipath
- Receiver front-end overload, produced by adjacent transmitters such as a microwave tower, etc.

When all antenna orientation possibilities are tried and one or more transmitters still cannot be received, additional repeater(s) will have to be installed.

Probe Troubleshooting

1. Attach your laptop to the TLS-RF's RS-232 serial port (see Figure 27).



2. Open the terminal emulation program. Set the laptop comm port settings to: 9600 Baud, 8 data bits, no parity, 1 stop bit.
3. Perform the following steps with the terminal emulation program running. TLS commands are case sensitive and use a Control-A to identify the start of a command. Enter a Control-A by holding the **Ctrl** key down while pressing the **A** key, then release the **Ctrl** key. Next type in the command `I31500` and click the SEND button. An example of the 315 command response in a site with 8 transmitters is shown below:

I31500

SMART DEVICE STATUS

DEV	TXID	STATE	REASON	TYPE	S/N	TOTL COMMS	REPT COMMS	LAST COMM
01	01	OK		PROBE	999553	161	80	0000:00:00:03
02	02	OUT	NO_DATA	PROBE	999569	0	0	9999:99:99:99
03	03	OUT	TIMEOUT	PROBE	999503	0	0	0000:13:21:13
04	04	OUT	NO_READ	MAGSN	999023	360	180	0000:00:00:01
05	05	OUT	NO_CNST	?????	000000	0	0	9999:99:99:99
06	06	OUT	NO_CNST	?????	000000	0	0	9999:99:99:99
07	07	OUT	NO_CNST	?????	000000	0	0	9999:99:99:99
08	08	OUT	NO_CNST	?????	000000	0	0	9999:99:99:99

*NOTE: MAG SN = Mag Sumo Sensor***DEV column**

The TLS-RF supports 8 devices (Mag probes), numbered 01 thru 08. The device number corresponds to its I.S. data-out terminal wiring position on the TLS-RF.

TXID Column

A site's wireless system can support up to 16 transmitters and each must have a unique ID. This column shows the ID that was set in the transmitter before it was installed.

STATE Column

The device state is OK or OUT. When the state is OUT, the TLS-RF will not respond to the TLS console polling for this device. The OUT state will cause the TLS console to post a Probe-Out or Comm alarm for this device.

REASON Column

There are four reasons for a device to have an OUT state:

NO_CNST

In order to conserve energy the transmitter sends messages in 3 groups: constant data, fuel/water data, and fuel/water/temperature data.

For a given sensor, constant data never changes so it only needs to be transmitted once. It is however transmitted for two-minutes following transmitter power-up, or the triggering of its service switch (magnetically activated reed switch) and then settles down to once every 4-hours. The TLS-RF will store the constants in non-volatile memory so that the constant data can be restored after a power cycle. The status of a device will be OUT if the constant data has not been received (NO_CNST).

NO_DATA

Fuel/Water data is transmitted at different rates depending on activity and power-up/service switch status. The maximum transmission period is 2-minutes, the minimum 5-seconds.

Temperature does not have to be read as often as fuel/water data. It is transmitted once every 2 minutes along with the fuel/water data. The status of a device will be OUT if it has not received fuel/water/temperature data (NO_DATA).

TIMEOUT

If no transmissions are received for the timeout duration programmed in the TLS-RF, the device OUT status's reason will be set to TIMEOUT. This state overrides all other states.

NO_READ

The transmitter can detect when a device is not responding correctly. In this case the transmitter will transmit a device-out message. In turn the TLS-RF will set the status of a device to OUT (NO_READ).

On power-up the TLS-RF will read its non-volatile memory to restore constant data. If the constant data is available it will then set the device to the OUT condition with the reason code: NO_DATA. When fuel/water level and temperature data are received the NO_DATA condition will be removed and the device will be set to the OK status. If there is no constant data the device OUT reason code will be NO_CNST. The device will be removed from this state when constant and fuel/water/temperature data are received. If no transmissions are being received from the device the TIMEOUT reason code will replace the previous reason code.

TYPE and SN Columns

If the device constants are available, the device type and device serial number will be placed in these columns. If the constants are not available the type column will be filled in with '?????' and the serial column with all zeros (000000).

TOTL COMMS

A running total of all messages received from this device. This includes messages that were repeated by a repeater(s).

REPT COMMS Column

This column displays a running total of all messages received from this device that were repeated from a repeater. Subtracting the repeated total from the total comms value will result in the total number of direct messages received: Total Direct Messages = TOTL COMMS - REPT COMMS.

LAST COMM Column

This column displays the duration since the last message received from this device. Display is in days:hours:minutes:seconds format. The 9999:99:99:99 time indicates no messages have been received since the TLS-RF has been powered on.

TLS-RF Wireless Troubleshooting

Possible reasons for not receiving data from a device are:

- Dead battery
- Defective transmitter
- Incorrect addressing on transmitter
- Two devices with the same address
- Defective probe/sensor
- Faulty cable or connection
- Wiring between TLS-RF and probe/sensor board is incorrect or faulty

- Bad channel on probe/sensor board

SINGLE DEVICE OUT

1. Remove the cover of the relevant Transmitter to access the LEDs (refer to Figure 21).
2. If there is no activity with the LEDs in the transmitter, measure the voltage of the battery which should be 3.4 Vdc or higher.
 - a. If less than 3.0 Vdc, replace battery.
 - b. If battery tests okay disconnect and reconnect transmitter.
 - c. If no LED activity replace Transmitter.
 - d. Continue on to step 3.
3. Transmitter LEDs timing
 - Mag Sump Sensors
 - The green LED will blink every 32 seconds.
 - The red LED will blink twice, pause for a second, then blink twice, if there is an error.
 - Probes
 - Red and Green LEDs will blink every 2 minutes when idle.
 - LEDs will blink every 8 seconds during a delivery.

If LED timing is incorrect, check the setting of the DIP switches.

- a. Determine if Transmitter has a valid address on S1 or S2 (Refer to Appendix A).
 - b. Determine if Site ID is correct; (Refer to Appendix A).
 - c. Ensure that there are no other devices with the same address.
4. Determine if the probe/sensor or the cable is defective. Connect the probe/sensor directly up to the tank monitor. If the device is not read replace device and/or cable.
 5. If no problems are found with the device or the Transmitter, check the wiring between the TLS-RF and the TLS console.
 - a. Check for any loose connections
 - b. Ensure the wires have the correct polarity.

MULTIPLE OR ALL DEVICES OUT

TLS-RF

1. Locate the 5 LEDs on the left side of the main board in the TLS-RF. (Refer to Figure 13). The red LED (item 3) indicates power.
 - a. If the power LED is not lit, measure voltage on the AC input terminal. If 120/240 Vac is not present check breaker in power panel.
 - b. If there is power going to the TLS-RF but it fails to operate, replace the TLS-RF.

2. The red and green LEDs (Item 2) above the power LED flash when the TLS-RF communicates with the Receiver. If the LEDs are not active, measure voltage on the RS-485 4-position wiring connector across the G and +15 terminals. (Refer to Figure 9).
 - a. If there is no voltage replace the TLS-RF board.
 - b. If there is voltage proceed with the Receiver troubleshooting.
3. Locate the red LED (Item 6 in Figure 13) in the TLS-RF. This LED flashes when TLS console is polling device data.
 - a. If the red LED is not flashing check connections to the TLS console.
 - i. Verify the TLS console and wiring are operational.
 - ii. If the TLS console and connections are good replace the TLS-RF.
 - b. If the red LED (Item 6 in Figure 13) is flashing check for individual device LEDs (item 5 in Figure 12). If a device LED is not flashing refer to single device out troubleshooting.
4. The top red and green LEDs (Item 1 in Figure 13) will flash only when the RS-232 port is accessed for diagnostics.
5. Check the S2 DIP switches (Item 7 in Figure 13). The default setting for positions 1 and 2 is OFF.

Receiver

The 3 LEDs located along the top of the Receiver indicate transmit (red), receive (green) and power (red). (Refer to Item 1 in Figure 24).

1. If the red power LED is not lit check for 15Vdc on the RS-485, 4 position wire connector on the right side of the board.
 - a. If voltage is present but the LED is not lit, replace the Receiver.
 - b. If there is no voltage, check for faulty wiring going to the TLS-RF and double check the voltage in the TLS-RF at the RS-485 4-position wiring connector across the G and +15 terminals.
2. If the red power LED is lit but the transmit and receive LEDs are not flashing, check DIP switches (item 8 in Figure 24).
 - a. DIP switch positions 1 to 8 should be set to Off.
 - b. Verify S2 to make sure Site ID is set correct (refer to Appendix A).

RESETTING DATA IN THE TLS-RF

NOTE: The data is reset when the TLS-RF is power cycled or reset with the serial command S001 (except Constants which are in stored in flash memory).

It is also possible to reset the Total and Repeater Comms totals remotely with the following command: S315ss149.

Site Survey for Wireless Probes

Objective

The objective of the site survey are:-

- To acquire information that will ensure that all the items necessary to complete the installation are ordered and supplied.
- To establish where the system assemblies will be best located, so that this information can be passed on to the installation team.
- To establish any site conditions or anomalies that will affect the installation
- Ultimately to ensure the completed installation is of the required high standard

METHOD

A trained person certified by GVR should undertake the site survey: this person will collect the necessary information and then submit this information in a specified format.

Instructions to Survey Engineer

OBJECTIVE

The Survey engineer needs to provide accurate site information so that when the System is installed and commissioned it will function reliably, and meet the requirements of the customer.

METHOD

The need for a survey will be triggered by a sales enquiry: The surveyor will require the following basic information:-

- Site name and address.
- Customer
- Telephone number
- Gauge type
- Number of tanks to be gauged
- Additional sensors
- Special instructions

Completion of Site Survey Form

OBJECTIVE

The aim of the survey sheets (or PC software) is to record data collected at the time of the survey to enable correct equipment specification, identify all works necessary before the installation date, special tools or equipment required for installation, and site specific data required for a successful commissioning.

METHOD

Take all details and measurements necessary to complete the site survey.

The form has to be completed in the same format by all surveyors. This is so that when or orders are placed (with the local distributor or direct to GVR EMEA Sales Admin) the administrator will understand clearly the information on the survey, and will be able to compile an accurate parts list.

Note: The local installer will be responsible for the labour element and any locally supplied parts, the survey should provide enough information for them to be able to do this successfully.

Key Information

SURVEYORS DETAILS

- Name of surveyor
- Company
- Date of survey
- Name/address/telephone number of installation company

GENERAL SITE DETAILS

- Site name and address (include country and local postcode)
- Telephone number (s)
- Site contact name
- Oil company (or group company name)

TANK INFORMATION

- Number of tanks to be monitored
- No of any tanks not to be monitored
- State available probe entry size for each tank
- Check that there are no internal obstructions to the probe
- Determine the tank diameter (height) and probe length required
- Identify any tank lid that has no entry and advise action required
- Note product type of each tank

- Note SWC's for each tank
- Note max tank capacity of each tank if available (e.g. dipstick top mark or dipchart)
- State whether the tank is single tank, and indicate the end shape if known
- State whether the tank is a compartment, its compartment number, and indicate the end shape if known
- State if the tank is siphon or line manifolded
- Indicate the number of lids on the tank
- Indicate if the tank has a STP fitted
- State whether the tank is single or double skinned
- State the material the tank is made of (steel, GRP)
- If double skinned, does it have a leak monitoring device fitted, or are we to provide same
- State whether the tank is direct fill or offset fill
- State the approximate age of the tank

MANHOLE CHAMBER INFORMATION

- Manhole construction
 - Shape (circular, square etc.)
 - Wall material (GRP, brick, concrete etc.)
 - Wall profile (smooth, ribbed)
- Manhole depth (Underside of cover to top surface of lid)
- Lid material
- Ease of removal (Two-man, special lifter required etc.)
- Accessibility (any restrictions?)
- Vehicle parking (are vehicles regularly parked for long periods)

PROBE RISER SPECIFICATION

- Fittings required to adapt a 50 mm riser to the riser entry orifice
- Max allowable riser length (formula = manhole depth – [transmitter unit height – 75 mm])

PROBE TRANSMITTER CONSIDERATIONS

- The transmitter needs to be installed towards the centre of the manhole chamber, away from metal edges.
- They should be installed as high up in the chamber as possible, but no closer than 25 mm from the cover.
- Manholes that have vehicles parked over them for any length of time should be avoided.
- The antenna will need to be horizontal and bisecting the angle between the receiver and the repeater
- The most suitable type of fixing bracket will need to be specified for each manhole.

TLS CONSOLE

State the pre-specified location for the TLS and indicate this on your site plan. Note: If the position for the new TLS has not been specified the Survey engineer should advise and agree with the customer the most suitable location for the console. (Note to survey compiler: Add a list of the normal considerations in the reference notes section)

RECEIVER LOCATION

You should choose a suitable site for the receiver, based on the following guidelines:

- One receiver is required per site
- The receiver is mounted with its antenna in a vertical position on the outer wall of the building in which the TLS-RF is installed. Locate the receiver on the side the structure facing the tanks to provide an unobstructed signal path to all transmitter units.
- The RS-485 cable (Belden #3107A or equiv.) connecting the receiver to the TLS-RF must be less than 76 m.
- Avoid placing receiver near fluorescent lighting (min. 310 mm) or other source of electrical interference.

TLS-RF LOCATION

You should choose a suitable location for the TLS-RF, this would normally be within close proximity to the TLS console, with consideration given to the following guidelines:

- The TLS-RF must be protected from severe vibration, extremes in temperature and humidity, rain, and other conditions that could harm computerized electronic equipment. Select a mounting location on the inside of the same building housing the TLS console.
- The distance between the TLS-RF and the receiver can not exceed 76 m.
- Once you have tagged the ideal mounting position for the TLS-RF and the receiver, measure the RS-485 cable run between the two. If the connecting cable's length would exceed 76 m, it would be better to move the TLS-RF's mounting position closer to the receiver (i.e., within the 76 m limit) since the receiver must have close proximity (ideally line of sight) to the sump transmitter.

REPEATER LOCATION

You should choose a suitable location for each repeater, based on the following guidelines:

- The repeater is mounted in a vertical position so as to establish a line of sight between it and the transmitter in the probe sump, and, if possible, between the it and the receiver as well.
- The most important concern is to ensure an unobstructed secondary path for data transmission between the transmitters and receiver.

SITE CONDITIONS OR SPECIAL NEEDS

State any site conditions or special requirements that will be needed to complete the installation and commissioning, for example:

- Suitable water pump for removing Manhole water
- Two men and specialist equipment for deep manholes

- Tower scaffold or ladders for fixing the repeater and receiver
- Additional lighting if working in dark rooms/lofts etc.
- Heavy or abnormal manhole covers
- Accessibility - Locked rooms, etc.

Sketches

The surveyor should produce sketches that show the locations of the transmitters, repeaters, receiver, TLS-RF and TLS console relative to each other. These sketches to include distances were appropriate, traffic flow and parking areas for vehicles including fuel and other delivery vehicles to site.

General Information

Battery Pack Replacement

Battery packs are sealed units which should not be tampered with or forced open. They are installed in a hazardous location and must only be replaced by authorised service personnel for reasons of safety and to ensure correct system operation. New or service exchange replacement battery packs are available from Gilbarco Veeder-Root and can be ordered by authorised distributors through the usual sales channel for TLS spare parts.

NOTE: Prolonged exposure to low temperatures reduces the expected life of the batteries.


Lithium Battery Disposal Considerations

1. Waste disposal must be in accordance with the applicable regulations.
2. Disposal of the Lithium batteries should be performed by permitted, professional disposal firms knowledgeable in Federal, State or Local requirements of hazardous waste treatment and hazardous waste transportation.
3. Incineration should never be performed by battery users, but eventually by trained professional in authorized facility with proper gas and fume treatment.
4. Recycling of battery can be done in authorized facility, through licensed waste carrier.

Applicable EN Standards

GENERAL OVERVIEW OF THE ATEX DIRECTIVE

The Veeder-Root TLS (Tank Level System) Consoles are installed in an indoor, non-hazardous area. The consoles have barriers that protect the linked apparatus by an **[Exia]** intrinsically safe mode of protection and are suitable to control apparatus installed into areas that are likely to become hazardous in the presence of concentrations of gases, vapours or mists formed by Group **IIA** dangerous substances. The symbols on the nameplate have the following meaning:


	Device suitable to be installed in potentially explosive areas
II	Group II: for installations in areas other than mines and related surface equipment
(I)	Category 1: suitable to control apparatus installed into Zone 0, Zone 1 or Zone 2 hazardous areas
G	For potentially hazardous areas characterised by the presence of gases, vapours or mists

All ATEX models of **TLS Consoles** are in compliance with Directive **94/9/EC (ATEX)**.

A sample Console has been evaluated and tested by **UL International Demko A/S** P.O. Box 514 Lyskaer 8, DK-2730 Herlev, Denmark and approved by the issue of the EC type certificates:

DEMKO 11 ATEX 11659X for TLS4/8601 Consoles
DEMKO 07 ATEX 16184X for TLS-450/8600 Consoles
DEMKO 06 ATEX 137481X for TLS-350 & TLS-350R Consoles
DEMKO 06 ATEX 137484X for TLS-300 Consoles
DEMKO 06 ATEX 137478X for TLS-50, TLS2, TLS-IB Consoles
DEMKO 12 ATEX 1204670X for TLS-XB/8603 Consoles

The Veeder-Root MAG Probes and Sump Sensors and Pressurized Line Leak Sensors are intrinsically safe apparatus, marked **Ex ia**, suitable for installation into areas that are likely to become hazardous in the presence of concentrations of gases, vapours or mists formed by group **IIA** dangerous substances. The temperature class of the devices is **T4** (surfaces temperatures lower than 135°C). The symbols on the nameplate have the following meaning:

	Device suitable to be installed in potentially explosive areas
II	Group II: for installations in areas other than mines and related surface equipment
I	Category 1: suitable to control apparatus installed into Zone 0, Zone 1 or Zone 2 hazardous areas
G	For potentially hazardous areas characterised by the presence of gases, vapours or mists

All ATEX models of **Probes, Vapour and Pressure Sensors** are in compliance with Directive **94/9/EC (ATEX)**.


A sample has been evaluated and tested by **UL International Demko A/S** P.O. Box 514 Lyskaer 8, DK-2730 Herlev, Denmark and approved by the issue of the EC type certificates:

DEMKO 06 ATEX 0508841X for MAG probes and Mag Sump sensors
DEMKO 07 ATEX 141031X for DPLLD Line Liquid Leak Detection sensors
DEMKO 06 ATEX 137486X for Pressure Line Liquid Leak Detection sensors
DEMKO 07 ATEX 29144X for Vacuum Sensors
DEMKO 06 ATEX 137478X for TLS Radio Transmitter
DEMKO 13 ATEX 1306057X for Surge Protector

A sample has been evaluated and tested by TUV NORD CERT GmbH, Hanover Office Am TUV1 30519 Germany and approved by the issue of the EC type certificate:

TUV 12 ATEX 105828 for MAG Flex Probes

Symbol X used as suffix in all of the EC type test certificates listed above indicates the need for observing special conditions for safe use. Further information is provided in each respective EC type certificate under the paragraph, **SPECIAL CONDITIONS FOR SAFE USE**.


	Equipment marking is compliant with requirements in the CE Marking Directive.
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The manufacturers Quality System has been reviewed and is notified by *Baseefa(2001) Ltd, Harpur Hill, Buxton, Derbyshire, SK17 9JN, United Kingdom* authorizing the use of its ID **1180** in conjunction with the CE mark. The manufacturer is notified via Baseefa(2001) Ltd. QAN No. BASEEFA ATEX 1968. The CE mark may indicate compliance with other relevant EC directives. Consult the manufacturers EC Declarations of Conformity for details.

In addition to certified intrinsically safe apparatus, Veeder-Root also provides simple apparatus that comply with the requirements of EN 60079-11, Clause 5.7. These devices include; Mag Sump Sensors, Interstitial Sensors, Steel Tank Sensors, Position Sensitive Sensors, Containment Sump Sensors, Hydrostatic Sensors, Ground Water Sensors and Vapour Sensors. Figures showing these devices may contain devices that are outside the scope of this ATEX Certificate.

SURGE PROTECTORS

In a Veeder-Root TLS-RF system, each Mag Probe must use a surge protector P/N 848100-001 in place of the weatherproof junction box located in Zone 1. Surge protectors consist of a certified in-line device or a simple apparatus conforming to the requirements of Standard No. IEC/EN 60079-14, Electrical installations design, selections and erection.

Surge Protectors are either an ATEX Certified Device as  II 2(1) G Ex ib [ia Ga] IIA T4 Gb per Certificate No. DEMKO 13 ATEX 1306057X or are Simple Apparatus. Surge Protectors can also be an IECEx certified device per Certificate No. IECEx UL 13.0074X.

NF EN 300220-1 July 2006; Electromagnetic compatibility and Radio spectrum matters (ERM) - Short range devices (SRD) - Radio equipment to be used in the 25 MHz to 1 000 MHz frequency range with power levels ranging up to 500 mW. Part 1 : technical characteristics and test methods (V2.1.1)

Assessment Documents

This appendix includes assessment documents for intrinsically safe systems installed in Group IIA locations, type protection “i”.

Certification Description

SPECIAL CONDITIONS FOR SAFE USE

The devices must be installed as part of the intrinsic safety system as defined in the descriptive system documents, included with this certificate.

A risk analysis, used to determine if the installation location is susceptible to lightning or other electric surges, is not necessary with TLS-RF systems as surge protector P/N 848100-001 is always used in conjunction with TLS-RF and Mag Probes.

Intrinsically Safe TLS Tank Gauge System

EC-Type Examination Type Certificate: **DEMKO 06 ATEX 137480X**

IECEx Certificate of Conformity: **IECEx ULD 08.0002X**

An Intrinsically System is comprised of a combination of Associated Apparatus and Intrinsically

Safe Apparatus described in their respective Type Examination Certificates.

Installation requirements for TLS Systems appear in the Descriptive System Documents listed below:

<u>Associated Apparatus</u>	<u>ATEX Document No.</u>	<u>IECEx Document No.</u>
TLS-350R or TLS-350 Plus	331940-001	331940-101
TLS-300	331940-002	331940-102
TLS-50 or TLS2 or TLS-IB	331940-003	331940-103
Tank Gauge Accessories	331940-005	331940-105
TLS-450/8600	331940-006	331940-106
TLS4/8601	331940-017	331940-117
TLS-XB/8603	331940-020	331940-120

Associated Apparatus

Cable and wiring used to connect the Associated Apparatus to the Intrinsically Safe Devices, shall have a maximum L/R ratio of 200 $\mu\text{H}/\text{ohm}$.

The acceptable operating temperature range for the Associated Apparatus is:

For the TLS4/8601 and the TLS-XB -- $0^{\circ}\text{C} \leq T_a \leq 50^{\circ}\text{C}$

For all other Associated Apparatus -- $0^{\circ}\text{C} \leq T_a \leq 40^{\circ}\text{C}$

Electrical Data Table for Associated Apparatus

Console Description	EC Type Examination Certificate Numbers	Data Per TLS Console			Total Per TLS-450/8600 USM Module		
		Uo volts	Io amps	Po watts	Lo mH	Co μF	Maximum Cable Capacitance and Length
TLS-450/8600 with Two-Wire I.S. Devices	DEMKO 07 ATEX 16184X IECEX US/UL 07.0012X	12.6	0.177	0.563	4.50	13.4	5.0 μF 15,240 Metres (applied to all combinations of I.S. Devices)
TLS-450/8600 with Three-Wire I.S. Devices		14.1	0.196	0.63	2.90	8.24	

Console Description	EC Type Examination Certificate Numbers	Data Per TLS Console			Total Per TLS4/8601		
		Uo volts	Io amps	Po watts	Lo mH	Co μF	Maximum Cable Capacitance and Length
TLS4/8601 with Two-Wire I.S. Devices	DEMKO 11 ATEX 1111659X IECEX US/UL 11.0049X	12.6	0.177	0.563	4.50	13.4	5.0 μF 15,240 Metres (applied to all combinations of I.S. Devices)
TLS4/8601 with Three-Wire I.S. Devices		14.1	0.196	0.63	2.90	8.24	

Console Description	EC Type Examination Certificate Numbers	Data Per TLS Console			Total Per TLS-XB/8603		
		Uo volts	Io amps	Po watts	Lo mH	Co μF	Maximum Cable Capacitance and Length
TLS-XB/8603 with Two-Wire I.S. Devices	DEMKO 12 ATEX 1204670X IECEX UL 12.0022X	12.6	0.177	0.563	4.50	13.4	5.0 μF 15,240 Metres (applied to all combinations of I.S. Devices)
TLS-XB/8603 with Three-Wire I.S. Devices		14.1	0.196	0.63	2.90	8.24	

Associated Apparatus (Continued)

Cable and wiring used to connect the Associated Apparatus to the Intrinsically Safe Devices, shall have a maximum L/R ratio of 200 $\mu\text{H}/\text{ohm}$. The acceptable operating temperature range for the Associated Apparatus is: $0^{\circ}\text{C} \leq T_a \leq 40^{\circ}\text{C}$.

Electrical Data Table for Associated Apparatus

Console Description	EC Type Examination Certificate Numbers	Data Per TLS Console			Total Per TLS System		
		Uo volts	Io amps	Po watts	Lo mH	Co μF	Maximum Cable Capacitance and Length
TLS-350 Plus 8470 TLS-350R 8482	DEMKO 06 ATEX 137481X IECEX UL 08.0015X	12.6	0.196	0.62	3.70	13.5	5.0 μF 15240 Metres
TLS-300 8485	DEMKO 06 ATEX 137484X IECEX UL 11.0002X	12.6	0.194	0.62	3.70	13.5	3.2 μF 9753 Metres
TLS-50 8469 TLS2 8560 TLS-IB 8466	DEMKO 06 ATEX 137485X IECEX UL 09.0032X	12.6	0.189	0.60	3.70	13.5	0.8 μF 2438 Metres

Intrinsically Safe Apparatus

The acceptable operating temperature range for the Intrinsically Safe Devices are listed below.

The temperature classification for the Intrinsically Safe Devices T4.

Input Electrical Data Table for Intrinsically Safe Devices

Product Description	EC Type Examination Certificate Numbers	Operating Temperature Range	Ui volts	Ii amps	Pi watts	Li mH	Ci μF
Mag Plus Probe 8462, 8463, 8563	DEMKO 06 ATEX 0508841X IECEX UL 06.0001X	$-40^{\circ}\text{C} \leq T_a \leq 60^{\circ}\text{C}$	12.6	0.196	0.62	2.83	1.22
Mag Sump Sensor 8570	DEMKO 06 ATEX 0508841X IECEX UL 06.0001X	$-40^{\circ}\text{C} \leq T_a \leq 60^{\circ}\text{C}$	12.6	0.196	0.62	2.83	1.22
TLS-RF Console 8580	DEMKO 06 ATEX 137478X IECEX UL 06.0003X	$0^{\circ}\text{C} \leq T_a \leq 40^{\circ}\text{C}$	12.6	0.196	0.62	3.70	0.962
TLS Radio Transmitter Inputs 332235	DEMKO 06 ATEX 137478X IECEX UL 06.0003X	$-40^{\circ}\text{C} \leq T_a \leq 60^{\circ}\text{C}$	3.90	1.29	1.20	0.283	12076
Mag Plus1 Probe	TUV 12 ATEX 105828 IECEX TUN 12.0027	$-20^{\circ}\text{C} \leq T_a \leq 60^{\circ}\text{C}$	13	0.200	0.62	0.41	20 nF
Surge Protector 8481	DEMKO 13 ATEX 1306057X IECEX UL 13.0074X	$-40^{\circ}\text{C} \leq T_a \leq 60^{\circ}\text{C}$	12.6	0.196	0.62	4.00	1.221

Output Electrical Data Table for Intrinsically Safe Devices

Product Description	EC Type Examination Certificate Numbers	Operating Temperature Range	Uo volts	Io amps	Po watts	Lo mH	Co μ F
TLS Radio Transmitter Outputs 332235	DEMKO 06 ATEX 137478X IECEX UL 06.0003X	$-40^{\circ}\text{C} \leq T_a \leq 60^{\circ}\text{C}$	10.30	0.193	0.5	3.70	13.5
Battery Pack Outputs 332425	DEMKO 06 ATEX 137478X IECEX UL 06.0003X	$-40^{\circ}\text{C} \leq T_a \leq 60^{\circ}\text{C}$	3.90	1.29	1.20	0.283	12076
Surge Protector 8481	DEMKO 13 ATEX 1306057X IECEX UL 13.0074X	$-40^{\circ}\text{C} \leq T_a \leq 60^{\circ}\text{C}$	12.6	0.196	0.62	4.00	1.221

For additional conditions, please see Manual Number 577013-578.

Appendix A: Device DIP Switch Settings

Use this appendix for DIP switch settings for all devices in the site.

TLS-RF Device Number Settings

The Dip Switch Locations to set the unique Device number for the TLS-RF unit are shown in the Figure A-1. The TLS-RF that monitors Transmitter IDs 1 - 8 is considered the site's master TLS-RF unit and must have its Device ID set to 0 (default).



CAUTION: Setting the Device Timeout delay to less than 10 minutes may result in Device Out errors since the transmitter's transmit time intervals are programmable and may have been set to a value greater than the Device Timeout you set here.

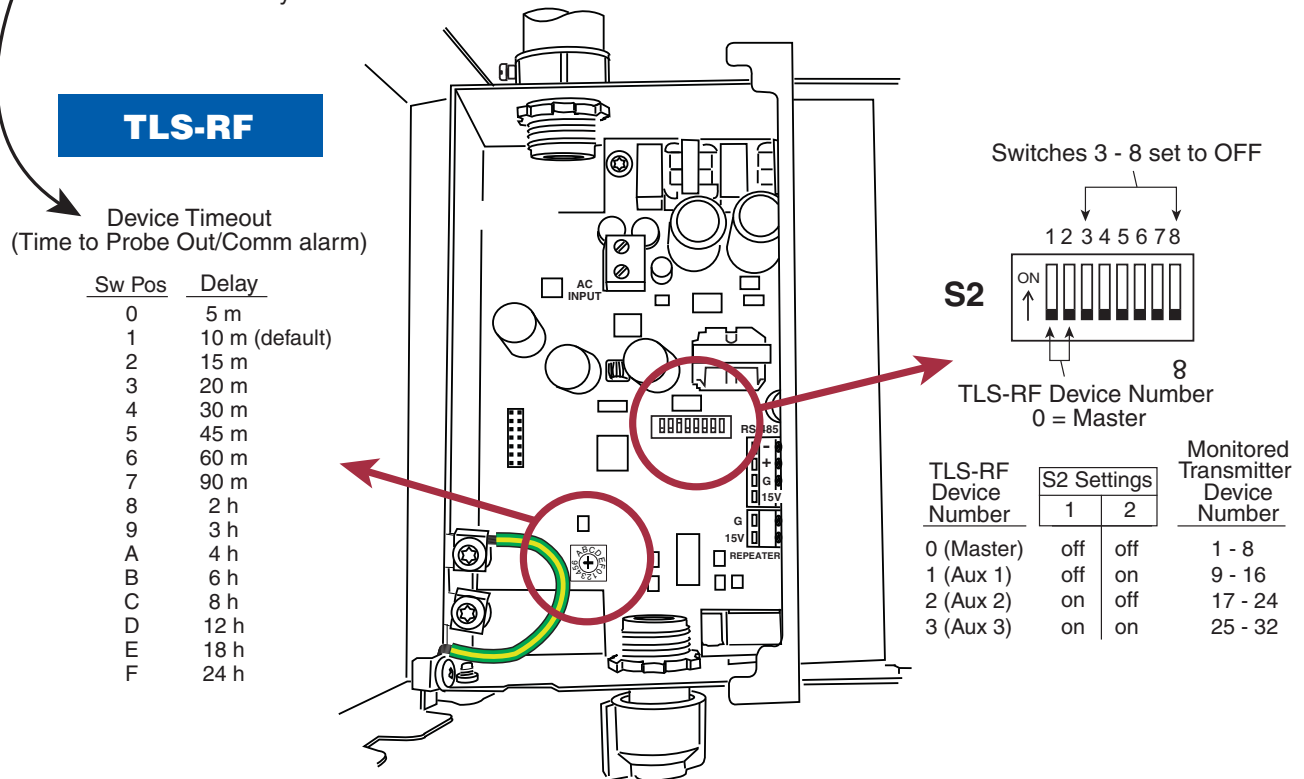


Figure A-1. TLS-RF switch settings

Transmitter/Receiver/Repeater DIP Switch Settings

DIP switch locations for the Transmitter, Receiver and Repeater are shown in Figure A-2. Device DIP switch settings for these devices are listed in Figure A-3 through Figure A-6 (use the appropriate settings for your software version 1 or 3).

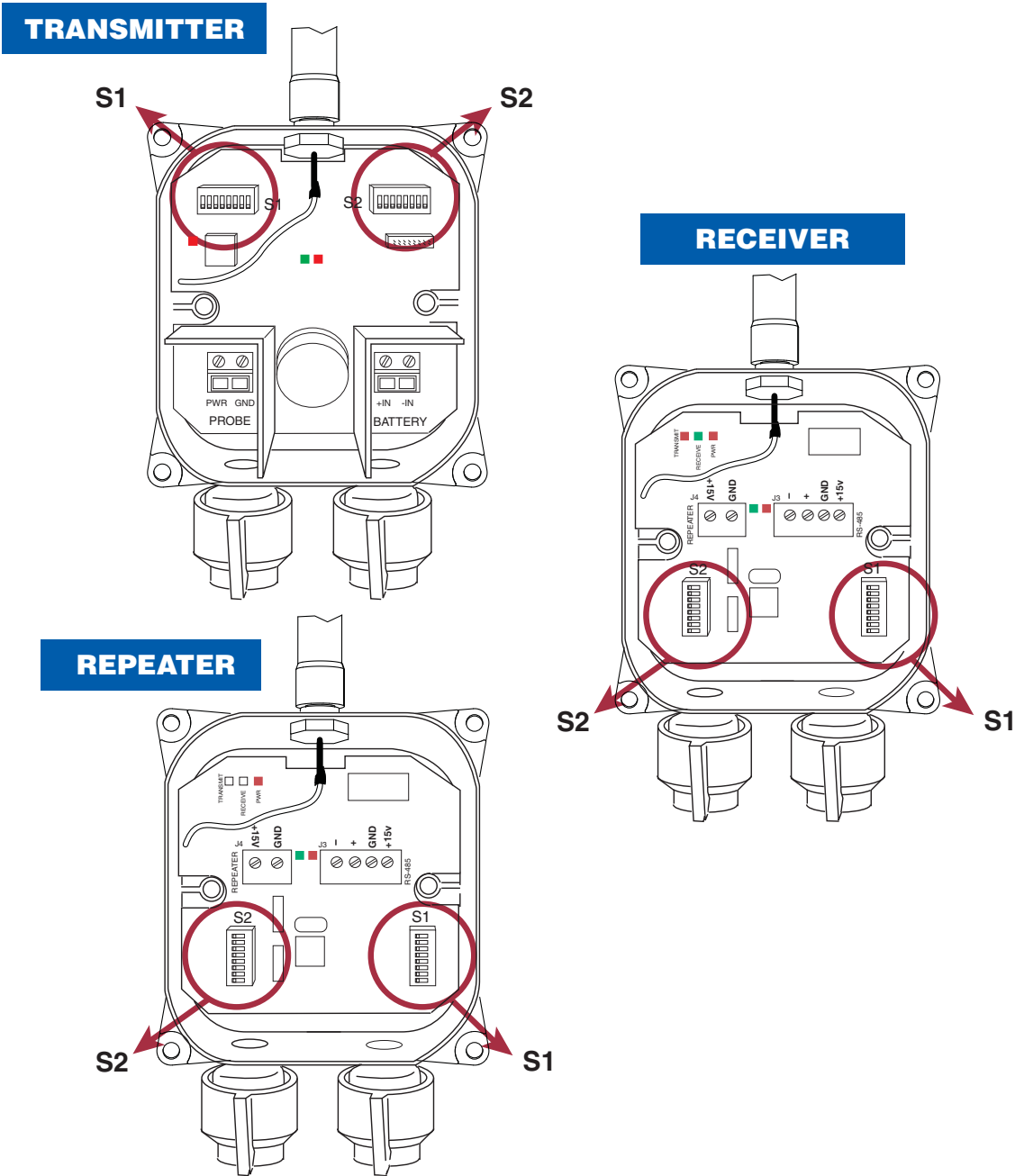


Figure A-2. DIP switch settings

Switch Set S1 (1st three switches)

Version 1 (NA/EMEA only)										
S1: SW1~3					XMTR: Diagnostic Time Out (Minutes)		RPTR		RCVR	
	1	2	3		900MHz Radio	869MHz Radio	900MHz Radio	869MHz Radio	900MHz Radio	869MHz Radio
	OFF	OFF	OFF		30	30	Always	Always	Always	Always
	OFF	OFF	ON		Do Not Set	Do Not Set	Do Not Set	Do Not Set	Do Not Set	Do Not Set
	OFF	ON	OFF		60	60	Do Not Set	Do Not Set	Do Not Set	Do Not Set
	OFF	ON	ON		Do Not Set	Do Not Set	Do Not Set	Do Not Set	Do Not Set	Do Not Set
	ON	OFF	OFF		10	10	Do Not Set	Do Not Set	Do Not Set	Do Not Set
	ON	OFF	ON		Do Not Set	Do Not Set	Do Not Set	Do Not Set	Do Not Set	Do Not Set
	ON	ON	OFF		240	240	Do Not Set	Do Not Set	Do Not Set	Do Not Set
	ON	ON	ON		Do Not Set	Do Not Set	Do Not Set	Do Not Set	Do Not Set	Do Not Set

Version 3 : Country/Regulation Type										
S1: SW1~3					XMTR		RPTR		RCVR	
	1	2	3		900MHz Radio	869MHz Radio	900MHz Radio	869MHz Radio	900MHz Radio	869MHz Radio
	OFF	OFF	OFF		North America	EMEA - 250mV	North America	EMEA - 250mV	North America	EMEA - 250mV
	OFF	OFF	ON		Australia	Italy - 25mV	Australia	Italy - 25mV	Australia	Italy - 25mV
	OFF	ON	OFF		Do Not Set	UAE - 90mV	Do Not Set	UAE - 90mV	Do Not Set	UAE - 90mV
	OFF	ON	ON		Do Not Set	Do Not Set	Do Not Set	Do Not Set	Do Not Set	Do Not Set
	ON	OFF	OFF		Do Not Set	Do Not Set	Do Not Set	Do Not Set	Do Not Set	Do Not Set
	ON	OFF	ON		Do Not Set	Do Not Set	Do Not Set	Do Not Set	Do Not Set	Do Not Set
	ON	ON	OFF		Do Not Set	Do Not Set	Do Not Set	Do Not Set	Do Not Set	Do Not Set
	ON	ON	ON		Do Not Set	Do Not Set	Do Not Set	Do Not Set	Do Not Set	Do Not Set

Figure A-3. S1:DIP switches 1-3

Switch Set S1 (Last 5 switches): Transmitter ID

Version 1 and 3										
S1: SW4~8					XMTR	RPTR	RCVR			
4	5	6	7	8	Tank / Device Number	(Unused)	(Unused)			
OFF	OFF	OFF	OFF	OFF	Do Not Set	Always	Always			
OFF	OFF	OFF	OFF	ON	1 (Master TLSRF Port 1)	Do Not Set	Do Not Set			
OFF	OFF	OFF	ON	OFF	2 (Master TLSRF Port 2)	Do Not Set	Do Not Set			
OFF	OFF	OFF	ON	ON	3 (Master TLSRF Port 3)	Do Not Set	Do Not Set			
OFF	OFF	ON	OFF	OFF	4 (Master TLSRF Port 4)	Do Not Set	Do Not Set			
OFF	OFF	ON	OFF	ON	5 (Master TLSRF Port 5)	Do Not Set	Do Not Set			
OFF	OFF	ON	ON	OFF	6 (Master TLSRF Port 6)	Do Not Set	Do Not Set			
OFF	OFF	ON	ON	ON	7 (Master TLSRF Port 7)	Do Not Set	Do Not Set			
OFF	ON	OFF	OFF	OFF	8 (Master TLSRF Port 8)	Do Not Set	Do Not Set			
OFF	ON	OFF	OFF	ON	9 (2nd TLSRF Port 1)	Do Not Set	Do Not Set			
OFF	ON	OFF	ON	OFF	10 (2nd TLSRF Port 2)	Do Not Set	Do Not Set			
OFF	ON	OFF	ON	ON	11 (2nd TLSRF Port 3)	Do Not Set	Do Not Set			
OFF	ON	ON	OFF	OFF	12 (2nd TLSRF Port 4)	Do Not Set	Do Not Set			
OFF	ON	ON	OFF	ON	13 (2nd TLSRF Port 5)	Do Not Set	Do Not Set			
OFF	ON	ON	ON	OFF	14 (2nd TLSRF Port 6)	Do Not Set	Do Not Set			
OFF	ON	ON	ON	ON	15 (2nd TLSRF Port 7)	Do Not Set	Do Not Set			
ON	OFF	OFF	OFF	OFF	16 (2nd TLSRF Port 8)	Do Not Set	Do Not Set			

Figure A-4. Device ID Settings - S1:DIP switches 4-8

Switch Set S2 (1st four switches): Mode

Version 1 (NA/EMEA only)

S2: SW1~4					Mag Probe XMTR: Read/Transmit Interval			Mag Sump XMTR: Read/Transmit Interval		RPTR	RCVR
	1	2	3	4	No Change (Idle)	Fall (Dispense)	Rise (Delivery)	No Change (Idle)	Change (Leak)		
					Read/Tx	Read/Tx	Read/Tx	Poll/Tx	Poll/Tx	ID	VR Bus Address
	OFF	OFF	OFF	OFF	6/120	6/30	6/6	6/120	6/6	0	0
	OFF	OFF	OFF	ON	6/120	6/6	6/6	6/120	6/6	1	0
	OFF	OFF	ON	OFF	120/120	120/120	120/120	120/120	120/6	2	0
	OFF	OFF	ON	ON	600/600	600/600	600/600	600/600	600/6	3	0
	OFF	ON	OFF	OFF	3600/3600	3600/3600	3600/3600	3600/3600	3600/6	4	1
	OFF	ON	OFF	ON	Do Not Set	Do Not Set	Do Not Set	Do Not Set	Do Not Set	5	1
	OFF	ON	ON	OFF	Do Not Set	Do Not Set	Do Not Set	Do Not Set	Do Not Set	6	1
	OFF	ON	ON	ON	Do Not Set	Do Not Set	Do Not Set	Do Not Set	Do Not Set	7	1
	ON	OFF	OFF	OFF	Do Not Set	Do Not Set	Do Not Set	Do Not Set	Do Not Set	8	2
	ON	OFF	OFF	ON	Do Not Set	Do Not Set	Do Not Set	Do Not Set	Do Not Set	9	2
	ON	OFF	ON	OFF	Do Not Set	Do Not Set	Do Not Set	Do Not Set	Do Not Set	10	2
	ON	OFF	ON	ON	Do Not Set	Do Not Set	Do Not Set	Do Not Set	Do Not Set	11	2
	ON	ON	OFF	OFF	Do Not Set	Do Not Set	Do Not Set	Do Not Set	Do Not Set	12	3
	ON	ON	OFF	ON	Do Not Set	Do Not Set	Do Not Set	Do Not Set	Do Not Set	13	3
	ON	ON	ON	OFF	Do Not Set	Do Not Set	Do Not Set	Do Not Set	Do Not Set	14	3
	ON	ON	ON	ON	Do Not Set	Do Not Set	Do Not Set	Do Not Set	Do Not Set	15	3

Version 3

S2: SW1~4					Mag Probe XMTR: Read/Transmit Interval			Mag Sump XMTR: Read/Transmit Interval		RPTR	RCVR	
Mode		1	2	3	4	No Change (Idle)	Fall (Dispense)	Rise (Delivery)	No Change (Idle)	Change (Leak)		
No.						Read/Tx	Read/Tx	Read/Tx	Poll/Tx	Poll/Tx	ID	VR Bus Address
0	OFF	OFF	OFF	OFF	OFF	6/120	6/30	6/6	6/120	6/6	0	0
1	OFF	OFF	OFF	ON	ON	6/120	6/6	6/6	6/120	6/6	1	0
2	OFF	OFF	ON	OFF	OFF	120/120	120/120	120/120	120/120	120/6	2	0
3	OFF	OFF	ON	ON	ON	600/600	600/600	600/600	600/600	600/6	3	0
4	OFF	ON	OFF	OFF	OFF	3600/3600	3600/3600	3600/3600	3600/3600	3600/6	4	1
5	OFF	ON	OFF	ON	ON	6/120	6/30	6/6	6/120	6/6	5	1
6	OFF	ON	ON	OFF	OFF	6/120	6/30	6/6	6/120	6/6	6	1
7	OFF	ON	ON	ON	ON	6/120	6/30	6/6	6/120	6/6	7	1
8	ON	OFF	OFF	OFF	OFF	6/120	6/30	6/6	6/120	6/6	0	2
9	ON	OFF	OFF	ON	ON	SystemID: Green Blinks = Software Version; Red Blinks- 1: 900MHz, 2:869MHz						
10	ON	OFF	ON	OFF	OFF	RF Status: Green - On/Off with Radio power; Red: On during host to radio communication						
11	ON	OFF	ON	ON	ON	Reserved for future use						
12	ON	ON	OFF	OFF	OFF	Reserved for future use						
13	ON	ON	OFF	ON	ON	Reserved for future use						
14	ON	ON	ON	OFF	OFF	Reserved for future use						
15	ON	ON	ON	ON	ON	Reserved for future use						

Note: In mode number 0 through 8:

Green LED blinks once per second during 1st 30 minutes after boot-up and then never. Any other blink pattern indicates error condition

Red LED blinks after a successful transmission, 1 blink in Delivery mode, 2 in Dispense & 3 in Idle mode

Figure A-5. Mode Settings - S2:DIP switches 1-4

Switch Set S2 (Last 4 switches): Site ID

					Version 1 and 3		
S2: SW5~8					XMTR	RPTR	RCVR
5	6	7	8		Site ID	Site ID	Site ID
OFF	OFF	OFF	OFF		0	0	0
OFF	OFF	OFF	ON		1	1	1
OFF	OFF	ON	OFF		2	2	2
OFF	OFF	ON	ON		3	3	3
OFF	ON	OFF	OFF		4	4	4
OFF	ON	OFF	ON		5	5	5
OFF	ON	ON	OFF		6	6	6
OFF	ON	ON	ON		7	7	7
ON	OFF	OFF	OFF		8	8	8
ON	OFF	OFF	ON		9	9	9
ON	OFF	ON	OFF		10	10	10
ON	OFF	ON	ON		11	11	11
ON	ON	OFF	OFF		12	12	12
ON	ON	OFF	ON		13	13	13
ON	ON	ON	OFF		14	14	14
ON	ON	ON	ON		15	15	15

Figure A-6. Site ID Settings - S2:DIP switches 5-8

