

TLS-IB

Site Prep Manual

Form Number 8466X0-180 Series (RS-232 w/IFSF)

Form Number 8466X0-380 Series (RS-232 w/o IFSF)

Form Number 8466X0-580 Series (RS-232/RS-485)

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1 Introduction

This manual describes site preparation, installation, wiring and set up for TLS-IB consoles. Consult Table 1-1 below to determine the sections of this manual that will apply to your TLS-IB console.

Table 1-1. Applicable Manual Sections By Console Form Number

Section	TLS-IB Console Form Number
1	All
2	
3	
4	Applies To: 846620-180, 846660-180, 846690-180 (RS-232 with IFSF) 846620-380, 846660-380, 846690-380 (RS-232 w/o IFSF)
5	Applies To: 846620-580, 846660-580, 846690-580 (RS-232/RS-485)

Related Manuals

577013-578 TLS Monitoring Systems Contractors' Site Preparation Guide
576013-858 Direct Burial Cable Installation Instructions
577014-031 TLS Magnetostrictive Probes International Installation Instructions
577013-744 Mag Plus Probe Installation Guide
576013-635 Veeder-Root RS-232 Serial Interface 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 Certification (Level 1): 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.

Technician Certification (Level 2/3): Contractors holding valid 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 2
- Tall Tank

Warranty Registrations may only be submitted by selected Distributors.

Safety Symbols

The following safety symbols may be used throughout this manual to alert you to important safety hazards and precautions.

 <p>EXPLOSIVE Fuels and their vapors are extremely explosive if ignited.</p>	 <p>FLAMMABLE Fuels and their vapors are extremely flammable.</p>
 <p>ELECTRICITY High voltage exists in, and is supplied to, the device. A potential shock hazard exists.</p>	 <p>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.</p>
 <p>WEAR EYE PROTECTION Fuel spray from residual pressure in the lines can cause serious eye injuries. Always wear eye protection.</p>	 <p>INJURY Careless or improper handling of materials can result in bodily injury.</p>
 <p>GLOVES Wear gloves to protect hands from irritation or injury.</p>	 <p>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.</p>
 <p>WARNING Indicates a hazardous situation which, if not avoided, could result in death or serious injury.</p>	 <p>STATIC SENSITIVE COMPONENTS Wear grounded anti-static wrist strap before handling a TLS-IB CPU board.</p>

Control Drawing

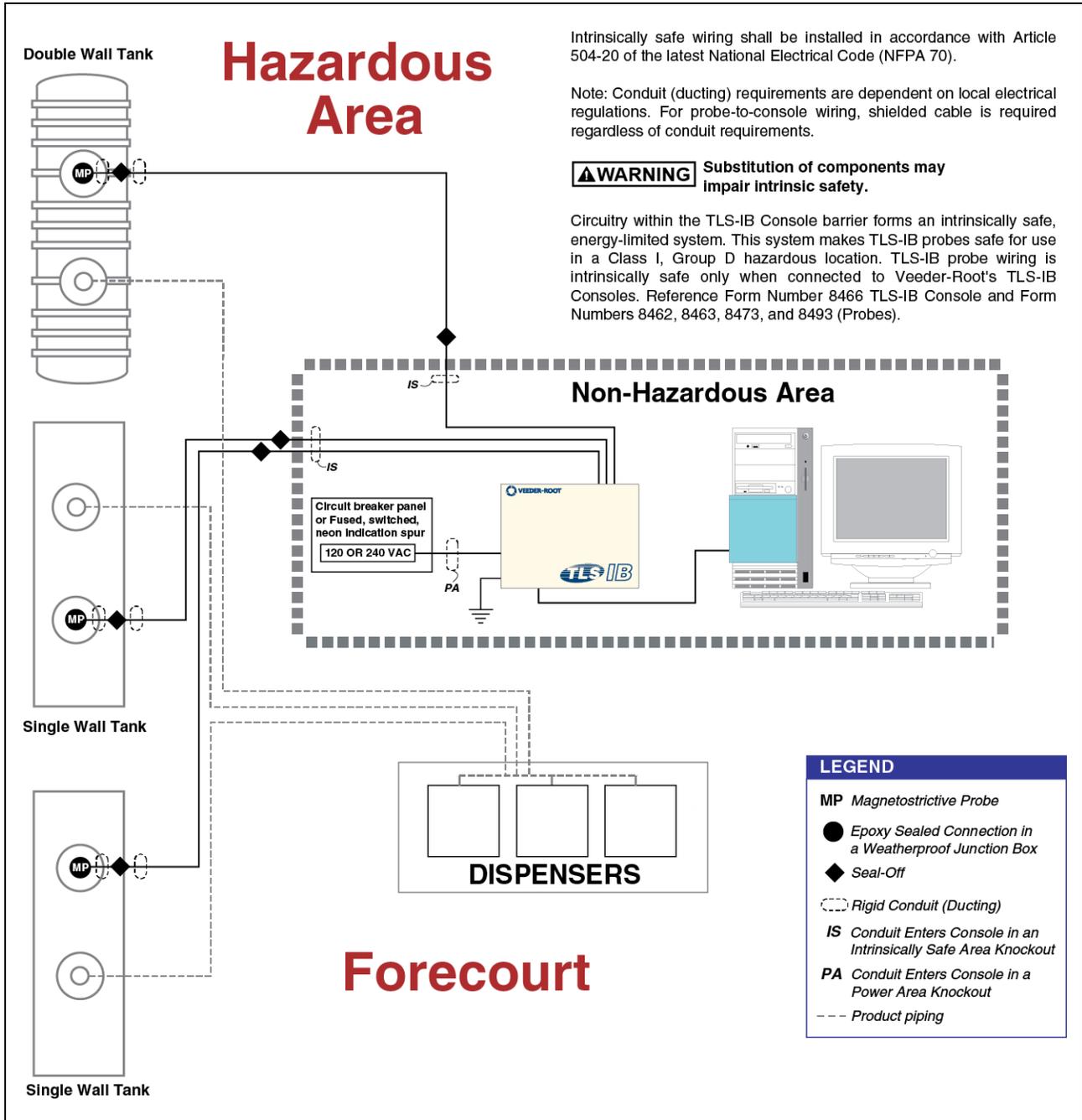


Figure 1-1. Control Drawing Showing An Example TLS-IB System Site Layout

2 Site Prep - International Installations

General

This document describes the procedures necessary to prepare the site, ready for the installation of the Veeder–Root TLS Series Underground Storage Tank Monitoring Systems.

This manual does *not* cover the site preparation necessary for the installation of Veeder–Root Delivery Information Systems (DIS). For information on these products please refer to the relevant manuals.

Veeder–Root maintains a continuous process of product development and therefore product specifications may not be as described in this manual. Please contact the Veeder–Root office nearest you, or visit our website at www.veeder.com for information on new or updated products. Changes affecting products or procedures described in this manual will be reported in subsequent revisions. Veeder–Root has taken every care in the compilation of this manual; however it is the installers' responsibility to take every precaution to safeguard themselves and others.

Every person working with Veeder–Root equipment is expected to take every safety precaution possible and to have read this manual, particularly the sections referring to health and safety.

NOTICE Deviation from the specifications contained in this manual can result in rework, delays in system installation and additional installation charges.

Contractors are advised to contact their nearest Veeder–Root office where local conditions may preclude using the specifications contained in this manual.

INSTALLATION LEVELS

Veeder–Root require that certain facilities are installed by contractors, nominated by the customer, prior to Veeder–Root attending the site for the installation of a TLS-IB system. These facilities vary dependent on the installation contract agreed between Veeder–Root and the customer. Two levels of site preparation exist and are described below:

Level 1 Installation

The customer or his elected contractor will supply (unless stated otherwise) and install the following:

- Console power supply and earth.
- External devices power supply and cabling.
- Peripheral devices cabling.
- Probe cable ducting
- Probe field cables
- Probe risers
- The contractor will seal all ducting after system testing has been carried out.

Level 2 Installation

The contractor will install the following:

- TLS-IB power supply and earth.
- External devices power supply and cabling.

- Probe cable ducting.
- The contractor will seal all ducting after system testing has been carried out.

NOTICE Unless stated otherwise, instructions in this manual refer to both levels of site preparation.

IN-TANK PROBES

Magnetostrictive Probes are capable of performing precision tank testing, as described by the United States Environmental Protection Agency, at [0.38 litres per hour (0.1 gph) and 0.76 litres per hour (0.2 gph)] when combined with the in-tank leak testing features of a TLS Console.

Determining Mag Probe Length For Installation In A Dedicated Riser

1. Measure the distance from the bottom of the tank to the top of the probe manway, or the 2-, 3- or 4-inch (50, 76, or 102mm) tank opening - this is the minimum probe length (ref. Figure 2-1).
2. The probe canister must be within the riser pipe (minimum length of 10 inches [254mm]).

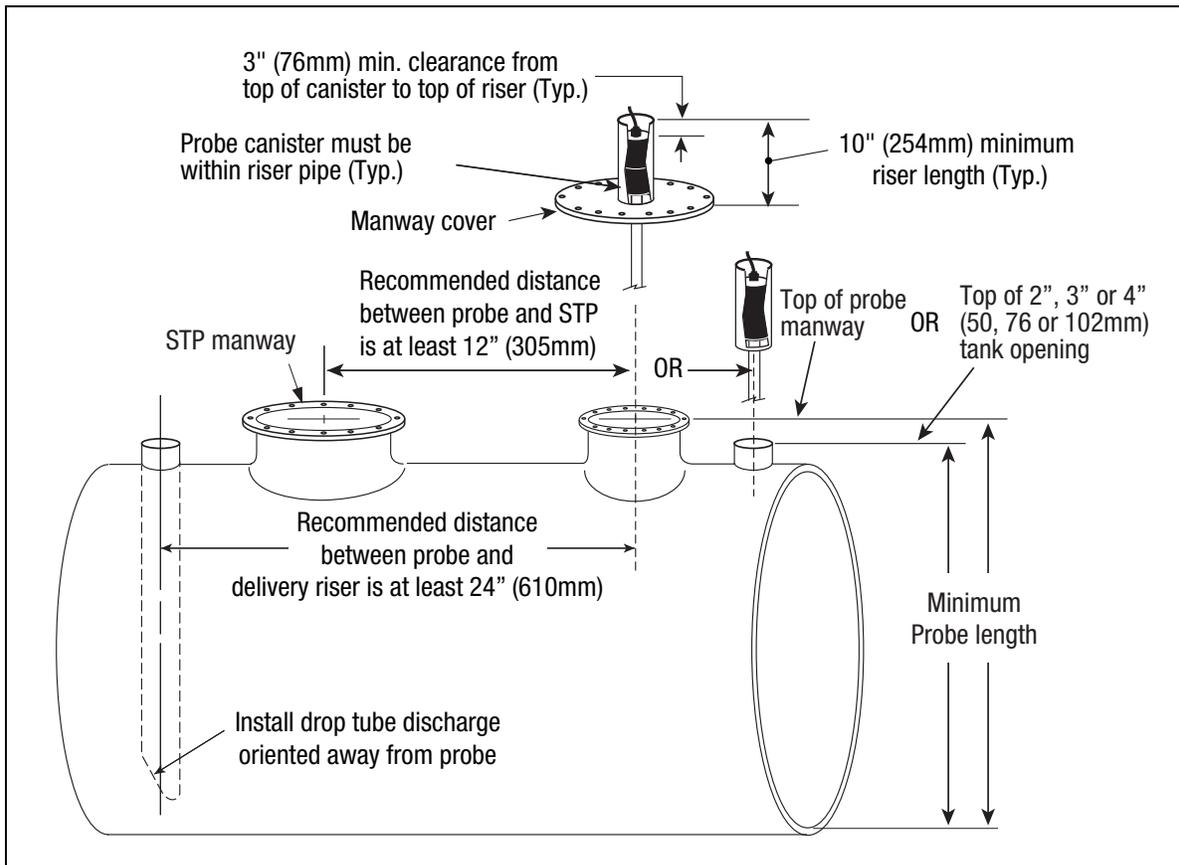


Figure 2-1. Determining The Minimum Mag Probe Length

For further information on the performance, specification and selection of in-tank probes, please contact your local Veeder-Root representative.

Health and Safety

GENERAL

Ensure that all local council, U.K. and E.C. laws and regulations are complied with. Also ensure that all recognised safety codes are followed.

⚠ WARNING Every person working with Veeder-Root equipment is expected to take every safety precaution possible in the installation of the TLS-IB and probes.

Contractors must ensure that supervisory personnel on the installation site are aware of their presence and requirements, especially the provision of safe working areas and isolation from AC electrical power.

Leaking underground tanks can create serious environmental and health hazards. It is the contractor's responsibility to comply with the instructions and warnings found in this manual.

Reference manual number 577013-578 for additional product safety information.

DANGER AREAS

⚠ WARNING	
	<p>TLS System products will be operated near the highly combustible environment of a fuel storage tank.</p> <p>FAILURE TO COMPLY WITH THE FOLLOWING WARNINGS AND SAFETY PRECAUTIONS COULD CAUSE DAMAGE TO PROPERTY, ENVIRONMENT, RESULTING IN SERIOUS INJURY OR DEATH.</p>

If the underground storage tank to be fitted with a TLS system either contains or at any time has contained petroleum products then the tank inspection chamber must be considered a hazardous environment as defined in IEC EN 60079-10 Classification of Hazardous Areas. Suitable working practices for this environment must be observed.

INTRINSIC SAFETY

The design of Veeder-Root products limits the power in the wiring to the in-tank probes and keeps this wiring physically separated from any other. It is the responsibility of the contractor to maintain the effectiveness of these safety features by preparing the installation site in accordance with the instructions and warnings which follow. Failure to do so could create danger to life and property.

Circuitry within the probe and console barrier forms an intrinsically safe, energy limited system. This system makes the probes suitable for use in hazardous locations. Probe wiring is intrinsically safe only when connected to the TLS-IB unit.

NOTICE Substitution of specified components may impair intrinsic safety.

All probe wiring must be contained in dedicated ducts.

⚠ WARNING	
	<p>An explosion could occur if other wires share ducts with intrinsically safe probe wiring. Ducting from probes must not contain any other wiring circuits.</p> <p>FAILURE TO COMPLY WITH THIS WARNING COULD RESULT IN EXPLOSION, DEATH, SERIOUS PERSONAL INJURY, PROPERTY LOSS OR EQUIPMENT DAMAGE.</p>

TLS-IB Location

The TLS-IB should be located on an inside wall of the forecourt building. Be sure the console will be protected from vibration, extremes in temperature and humidity, rain and other conditions that could cause equipment malfunction.

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

- Altitude up to 2000 m.
- Temperature range of 0 to 40°C.
- A maximum relative humidity of 95% RH (non-condensing) at temperatures up to 40°C.
- Main supply voltage fluctuations not exceeding +/- 10%
- Pollution Degree Category 2 Installation Category II

NOTICE The TLS-IB unit must be installed within the interior of buildings. This unit is not suitable for any external location.

Ensure that the TLS-IB is located where neither it nor its associated cabling will be damaged by doors, furniture, barrows, etc. Consider the ease of routing wiring, ducting and probe cables to the unit.

Overall dimensions and weight of the TLS-IB are: height - 163 mm, width - 188 mm, depth - 50 mm, weight - 1.8 kg.

To allow for maintenance ensure that the console is in an accessible area, even when the console doors are open.

If the unit requires cleaning, do not use any liquid materials (e.g. cleaning solvents). It is recommended that the unit be wiped with a clean dry cloth when necessary.

Ensure that all relevant subcontractors and other personnel are aware of the selected location.

The TLS-IB is installed by Veeder-Root authorised engineers.

TLS-IB power must come from a dedicated circuit via a fused, switched, neon indication spur within 1 metre of the console position. The spur must be clearly marked to identify it as the means for disconnecting the console. Input power must be a 24-hour clean supply. A typical installation is shown in Figure 2-2.

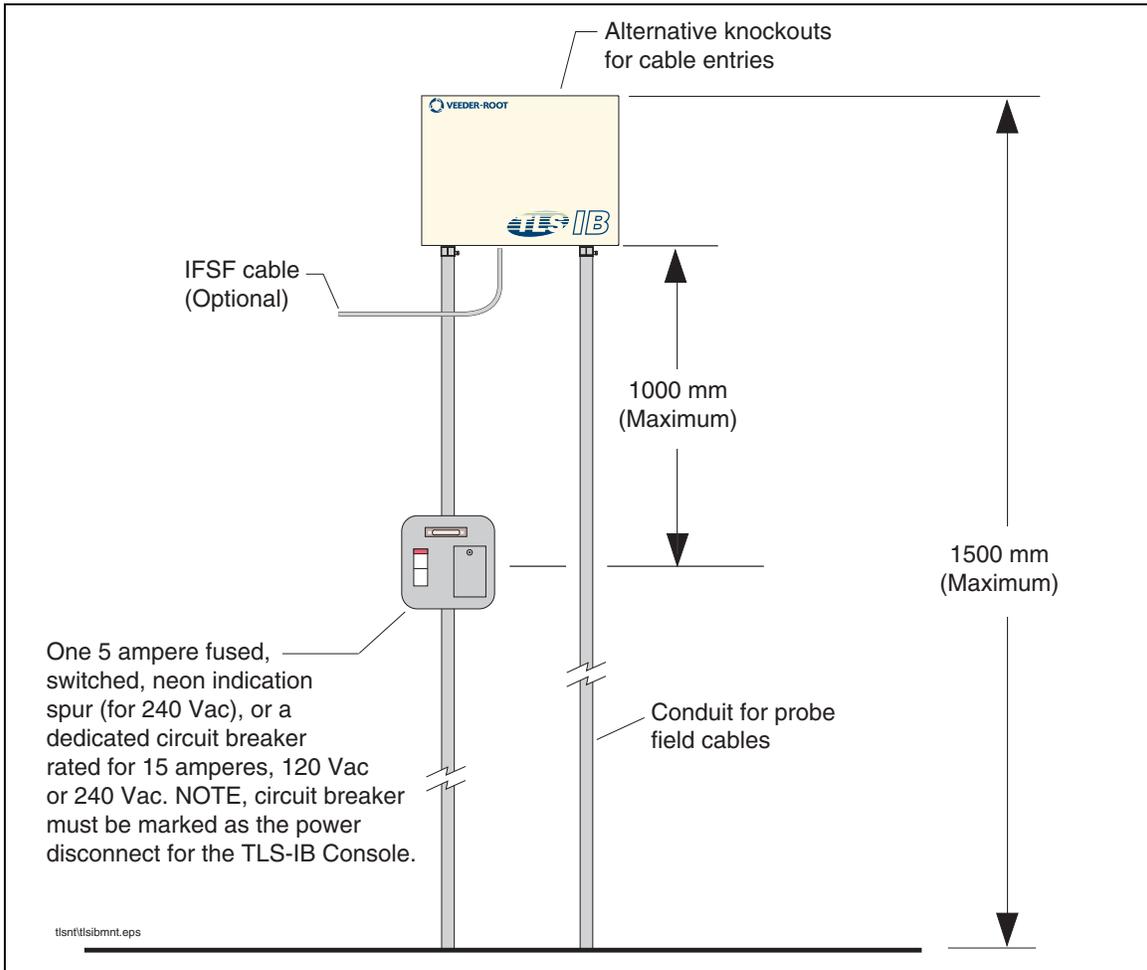


Figure 2-2. Typical TLS-IB Installation

Cable Specifications

⚠WARNING The cable type tables listed below form part of the individual system ATEX approval. Substitution of cable may impair intrinsic safety and may invalidate system approval.

All specifications are in free air at +30°C:

Table 2-1. Probe Cable Specification (GVR P/N 222-001-0029) - Maximum Of 305 Metres Per Probe

Number of Cores	2
Conductors	Bare copper, 24/0.20mm, diameter 1.1mm
Insulation	PVC R2 to CEI 20-11, colour black 1/black 2, radial thickness 0.54mm, twisting 1 x 2, lay pitch 76mm
Shielding	Aluminium polyester tape, tinned copper drain wire 7/0.30mm
Sheath	PVC RZ FR hydrocarbon resistant, colour blue, radial thickness 0.80mm
Diameter	6.10mm
Conductor Resistance	25 ohm/km
Drain Wire Resistance	15 ohm/km
Capacitance	0.14 μ F/km (140 pF/m)
Inductance	0.65 mH/km (0.65 μ H/m)
LR Ratio	17 μ H/ohm
Insulation Resistance	1050 Mohm/km
Voltage Core to Core	500
Voltage Core to Screen	500
Voltage Earth to Screen	500
Voltage Test	1kV/1 minute
Standard	IEC 227-74

Table 2-2. Data Transmission Cable Specification (GVR P/N 4034-0147)

Cable Type	2 x twisted pair, PVC insulated, foil wrapped, common drain
Conductor Stranding	7/0.25mm
Characteristic Impedance	58 ohms
Capacitance	203 pF per metre
Attenuation	5.6 dB per 100 m
Operating Temp. Range	-30°C to +70°C
Insulation	PVC
Sheath	Polyethylene
Sheath Colour	Grey

Table 2-2. Data Transmission Cable Specification (GVR P/N 4034-0147)

Cable Type	2 x twisted pair, PVC insulated, foil wrapped, common drain
Core Colours	Black, red, green, white
Nominal Outside Diameter	4.2 mm
Recommended UK Supplier:	RS Components Ltd., Stock number (500metre drum) 368-312

Field Wiring

PROBE TO TLS-IB LOCATION (*LEVEL 1 INSTALLATIONS ONLY*)

Pull one two core, Probeflex cable from the TLS-IB location to each probe location.

⚠ WARNING An explosion could occur if other, non–intrinsically safe wires share TLS intrinsically safe wire conduits or wiring troughs. Conduits and wiring troughs from probes and sensors to the console must not contain any other wires.

NOTICE At least 2 metres of free cable must be left for connection at both the TLS-IB and the probe locations.

Ensure that all cables are correctly identified. All probe field wiring **must** be legibly and permanently labelled with the tank number.

NOTICE Failure to correctly mark probe field wiring may lead to rework, delays in system installation and additional charges.

MAXIMUM CABLE LENGTHS

A maximum of 305 metres of cable length per sensor or probe must be observed.

DUCTING ENTRY TO TLS-IB LOCATION

Connection to the TLS-IB may only be made by a Veeder–Root authorised engineer.

The cable route from the ducting entry to the TLS-IB must be clearly defined and all necessary preliminary work undertaken. All necessary holes must be drilled through walls, counters, etc.; cable trays fitted, ducting with draw cords installed and adequate access for the installation of the cable provided.

Equipment Connected To The RS-232 Port

Any equipment such as a pump controller or point–of–sale terminal connected to the RS-232 port must meet the following criteria:

- The equipment must have an EIA standard RS-232C or RS-232D communications protocol.
- The equipment must *NOT* be installed over or in a hazardous location.

The RS-232 Interface can be used for direct local attachment of terminals if the cable run is no more than 15 metres. Veeder-Root do not guarantee proper equipment operation if RS-232 cable runs exceed 15 metres.

NOTICE RS-232 cable runs longer than 15 metres could result in data errors.

Run cable from the peripheral equipment location to the system console location. At least 1 metre of free cable must be left for subsequent connection at both ends.

3 Site Prep - U.S and Canadian Installations

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).

PROBE-TO-CONSOLE WIRING

Wire Type

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 and be manufactured with a material suitable for the environment, such as Carol™ C2534 or Belden™ 88760, 8760, or 8770.

NOTICE Throughout this manual, when mentioning any cable or wire 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. 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. Wires should be #14-#18 AWG stranded copper wire and installed as a Class 1 circuit. As an alternate method when approved by the local authority having jurisdiction, 22 AWG wire such as Belden 88761 may be suitable in installations with the following provisions:

- Wire run is less than 750 feet
- Capacitance does not exceed 100 pF/foot
- Inductance does not exceed 0.2 μ H/foot
- Total cable length per installation 22,000 feet.

POWER WIRING

Wires carrying 120 or 240 Vac from the power panel to the console should be #14 AWG (or larger) copper wire for line, neutral and chassis ground (3); and #12 AWG copper wire for barrier ground.

IN-TANK PROBES

Magnetostrictive Probes are capable of performing precision tank testing, as described by the United States Environmental Protection Agency, at 0.1 gph and 0.2 gph per hour when combined with the in-tank leak testing features of a TLS Console. Reference Figure 2-1 on page 2-2 to determine the minimum Mag Probe length for installation in a dedicated riser.

PROBE JUNCTION BOXES

Weatherproof electrical junction boxes with a gasketed cover are required on the end of each probe conduit run at the manhole or monitoring well 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.

Veeder-Root recommends the following junction boxes 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	
	<p>Probes operate in areas where flammable liquids and explosive vapors may be present.</p> <p>FAILURE TO COMPLY WITH THIS WARNING COULD RESULT IN EXPLOSION, DEATH, SERIOUS PERSONAL INJURY, PROPERTY LOSS OR EQUIPMENT DAMAGE.</p> <ol style="list-style-type: none"> 1. Read thoroughly and follow the instructions shipped with each probe. 2. Probe wiring conduit must not contain any other wires. 3. Probe wiring and conduits must enter the TLS-IB only through their designated areas (see Figure 2-3 on page 2-6). 4. Power and communication wires and conduit must not enter the intrinsically safe compartment of the TLS-IB.

Wiring between the TLS-IB and the probes is of limited electrical power so that there is insufficient energy to ignite fuel. In the TLS-IB, 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 TLS-IB through the designated intrinsically safe area knockouts.

If the TLS-IB is being retrofitted into a paved site, you can cut grooves in the pavement, run direct burial cable to the probes, and then seal over the cable grooves.

Before trenching, you should diagram all conduit runs between the TLS-IB's intended location and its deployed probes. 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.

NOTICE If the intrinsically safe wires enter the building in a wiring trough, only intrinsically safe wires (from TLS-IB 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.

Mounting the TLS-IB

Install the TLS-IB fastening devices to the mounting surface using the hole pattern 170 x 145mm (6.7 x 5.7 inches) shown in Figure 2-3 on page 2-6. Mounting screws up to 4.7mm (3/16-inch) diameter may be used.

Mount the TLS-IB to the mounting surface using the four mounting flanges on the back of the unit. Install ducting or conduit between the TLS-IB and the power panel. Figure 2-3 shows the three designated knockouts (one each on top, left side, and bottom) through which power wiring can safely enter the TLS-IB.

4 Wiring/Miscellaneous For TLS-IB Consoles W/RS-232 & With & W/O IFSF)

This section applies only to TLS-IB consoles with the following Form Numbers:

- 846620-180, 846660-180, 846690-180 (RS-232 with IFSF)
- 846620-380, 846660-380, 846690-380 (RS-232 w/o IFSF)

NOTICE For Console Form Numbers 846620-580, 846660-580 and 846690-580 skip Section 4 and proceed to Section 5.

⚠ WARNING	
	<p>The equipment is used in location where lethal voltages and explosive vapors or flammable fuels may be present.</p> <p>FAILURE TO COMPLY WITH THE FOLLOWING WARNINGS AND SAFETY PRECAUTIONS COULD CAUSE DAMAGE TO PROPERTY, ENVIRONMENT, RESULTING IN SERIOUS INJURY OR DEATH.</p> <p>For this system:</p> <ol style="list-style-type: none">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. Substitution of components may impair intrinsic safety.4. Be sure AC power is “Off” before opening the TLS-IB cover and connecting probe wires. Do not short any voltage across any barrier terminal including probes.

Probe Wiring Precautions



To The Installer! You Must Read And Understand This Information. Reference manual number 577013-578 for additional safety related information.

PROBE WIRING POSITIONS AND LABELING

In all cases, the devices wired to the TLS-IB input terminal blocks must be recorded to prevent improper replacement during installation or service.

Wiring Assignments

Identify all probe wires according to their terminal block location using the self-adhesive numbering labels furnished. Accurately record on the circuit directory label (top of I.S. compartment cover plate - see Figure 4-1), the tank number of each probe **as you attach wires** to the probe input terminal block.

NOTICE 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.

Connecting Probes to the TLS-IB

Connect the two color-coded/marked wires from each probe to the appropriate connectors (e.g., Probe 1) of the Probe Terminal Block as shown in Figure 4-1.

NOTICE Observe polarity when connecting probe wires!

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

AUTO PROBE CONFIGURATION

During a cold boot, the TLS-IB will automatically configure connected probes - **CAUTION! For auto configuration to occur, probes must be connected in sequence, starting at the Probe 1 input and continuing with no skipped inputs.**

For example, if you have 4 probes and you connect them to Probe inputs 1, 2, 3, and 4, auto configuration works fine. But if you connect them to Probe 1, 3, 5, and 7 auto configuration doesn't work, resulting in probe out alarms. Also, the skipped inputs will be unusable.

MANUAL PROBE CONFIGURATION

If you connect probes after the system has been powered they must be manually configured. To configure probes for the TLS-IB, use either the IFSF command Data ID 1, "Nb-Tanks" (see Table 4-4 on page 4-16); or the RS-232 "Set Tank Configuration", serial command 601 (see Table 4-3 on page 4-15).

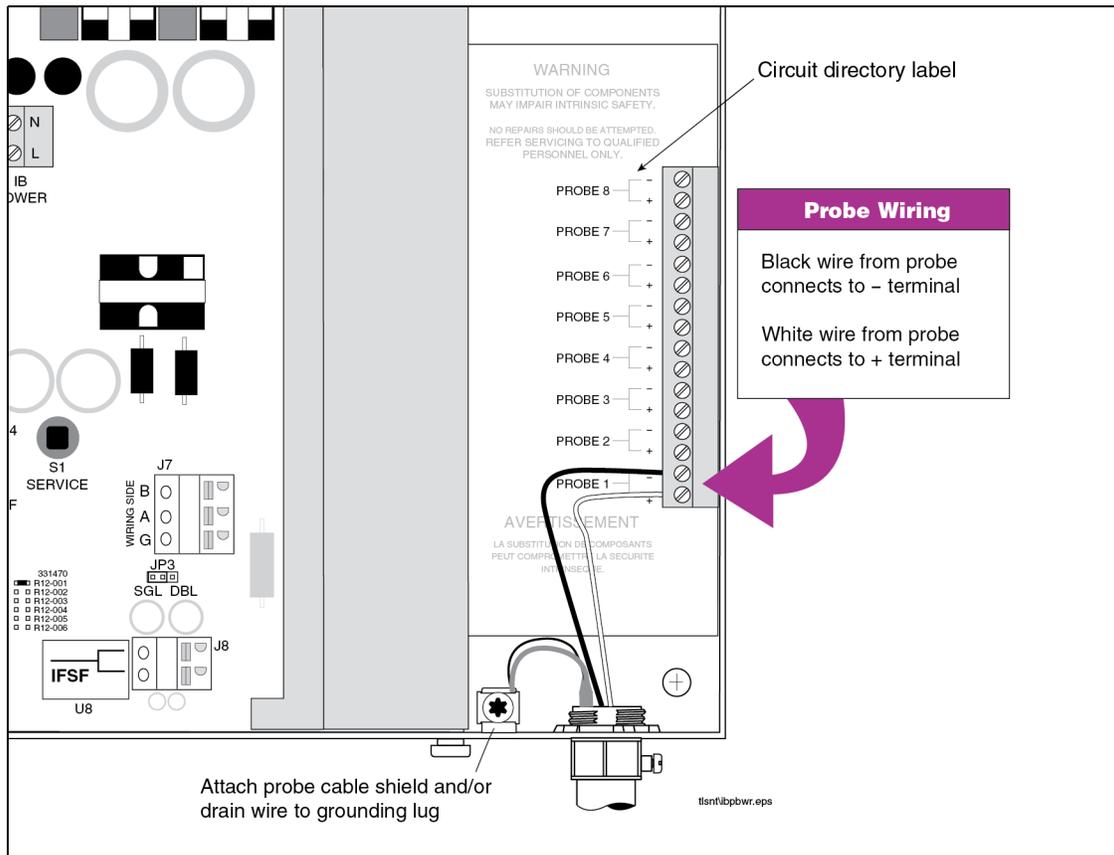


Figure 4-1. Connecting Mag Probe Wiring To TLS-IB

Connecting IFSF Wiring to TLS-IB

⚠ WARNING




The TLS-IB's circuit boards have lethal voltages present.
FAILURE TO COMPLY WITH THE FOLLOWING WARNINGS AND SAFETY PRECAUTIONS COULD CAUSE DAMAGE TO PROPERTY, ENVIRONMENT, RESULTING IN SERIOUS INJURY OR DEATH.

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. **Substitution of components may impair intrinsic safety.**
4. **Be sure AC power is "Off" before opening the TLS-IB cover and connecting wiring.**



1. With AC power switched Off, connect the IFSF network wires to J8 in the TLS-IB as shown in Figure 4-2 below:

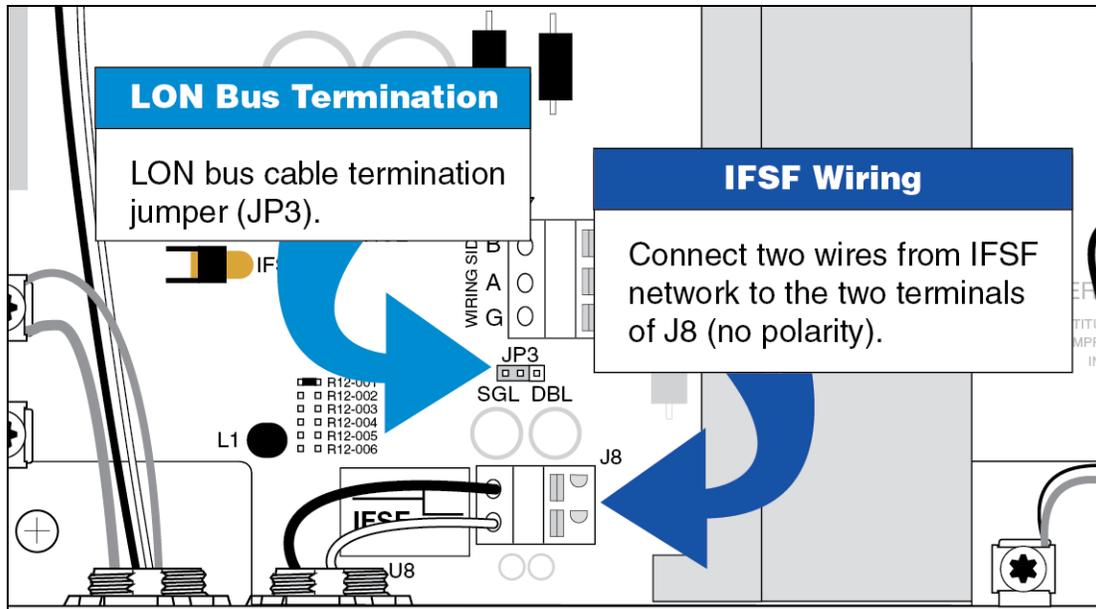


Figure 4-2. Connecting IFSF Network Wiring To TLS-IB

2. The LON cable termination jumper (JP3 in Figure 4-2) is shown in the single position (SGL). The single position is used when the TLS-IB is a Free Topology Segment in the LON network and only one termination is required. The double position (DGL) is used when the TLS-IB is a Doubly Terminated Bus Topology Segment in the LON network and two terminations are required. To set the jumper in the DGL position, move it to the right (jumper over the middle and right pins).

NOTICE If the TLS-IB is not a terminating device on the IFSF network, you must remove the LON cable termination jumper (JP3) from the board. Failure to do so will result in improper operation.

3. Set the IFSF Node Address DIP switches on the CPU board (S1 in Figure 4-5 on page 4-8) to the desired Node Address using the table below (U = switch open [up], D= set switch to closed position [down]). For example, to enter a IFSF node address of 06, set switches 2 and 4 up, and switches 1 and 3 down.

Table 4-1. TLS-IB IFSF Node Address Selections

IFSF Address	Dip Switch Setting			
	1	2	3	4
01	U	U	U	U
02	D	U	U	U
03	U	D	U	U
04	D	D	U	U
05	U	U	D	U

Table 4-1. TLS-IB IFSF Node Address Selections

IFSF Address	Dip Switch Setting			
	1	2	3	4
06	D	U	D	U
07	U	D	D	U
08	D	D	D	U
09	U	U	U	D
0A	D	U	U	D
0B	U	D	U	D
0C	D	D	U	D
0D	U	U	D	D
0E	D	U	D	D
0F	U	D	D	D
10	D	D	D	D

Connecting Serial Communication Wiring to the TLS-IB



With AC power switched Off, connect the serial communication wiring to J7 in the TLS-IB as shown in Figure 4-3.

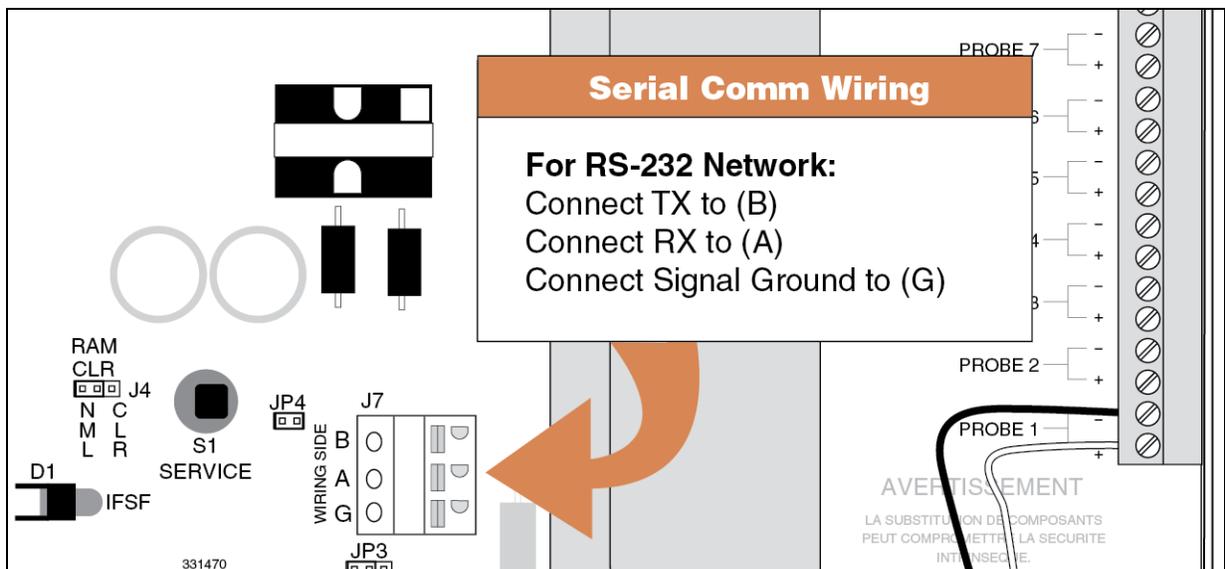
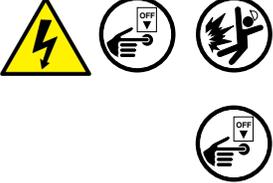


Figure 4-3. Connecting Serial Communication Wiring To TLS-IB

Connecting Power Wiring to TLS-IB

⚠ WARNING	
	<p>The TLS-IB contains voltages which can be lethal. It is connected to devices that must be intrinsically safe.</p> <p>FAILURE TO COMPLY WITH THE FOLLOWING WARNINGS AND SAFETY PRECAUTIONS COULD CAUSE DAMAGE TO PROPERTY, ENVIRONMENT, RESULTING IN SERIOUS INJURY OR DEATH.</p> <ol style="list-style-type: none"> 1. Turn power Off at the circuit breaker connecting the power supply wires. 2. Attach conduit from the power panel to the TLS-IB Power Area knockouts only (1 on top and 2 on bottom, ref. Figure 2-3 on page 2-6).

1. Pull four wires between the power panel and the TLS-IB; three #14 AWG or larger diameter color-coded wires for AC line (L), AC neutral (N) and chassis ground; and one #12 AWG (4 mm² cross-sectional area) green and yellow wire for barrier ground.

For international applications, console power should come from a dedicated circuit via a fused, switched, neon indication spur within one metre of the console position. From an independent 24 hour supply at the distribution panel, run three 2.5 mm² (minimum) standard colour coded wires, live, neutral and earth, to the fused spur. Run three similar wires from the spur to the console location. Run one 4mm² wire, colour coded green/yellow, from the earth bus bar at the distribution panel direct to the console location. Leave at least 1 metre of free cable for connection to the console.

NOTICE 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" (copper rod driven into ground, etc.). It should read less than 1 ohm.

2. Open the door of the TLS-IB and connect the four power/ground wires as shown in [Figure 4-4]. Do not connect the power wires to breaker panel at this time.

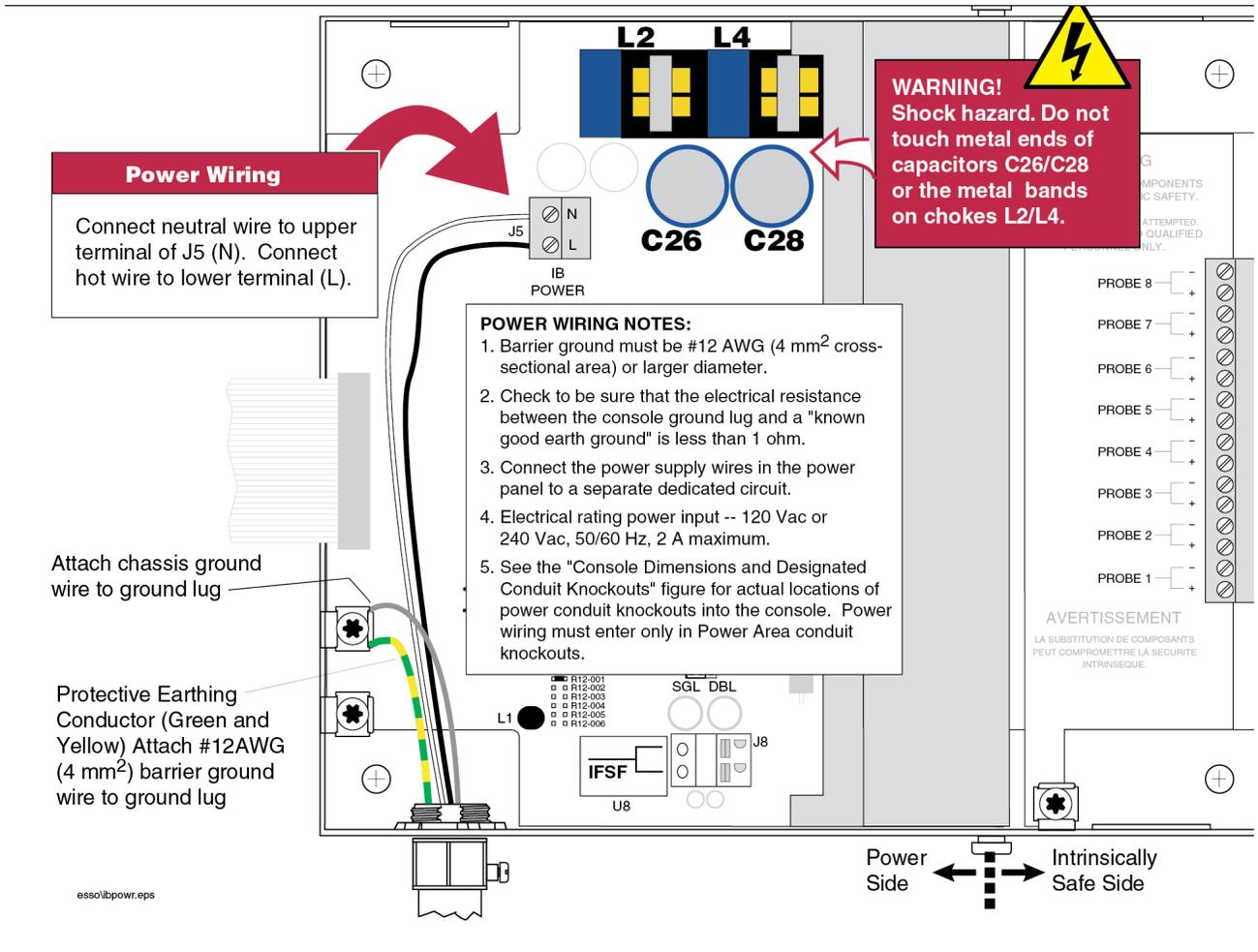


Figure 4-4. Wiring AC Power To The TLS-IB

Troubleshooting

This section contains information to help you diagnose system problems. Instructions are included for replacing CPU and Power Supply boards in the event of a hardware failure and for installing a software upgrade. Also, the location and use of the neuron service switch is discussed.

At the end of this section you will find a list of specifications for the TLS-IB.

REPLACING THE CPU BOARD

The CPU board must be replaced if the TLS-IB fails to communicate. Check the voltage between the GND and 5V test points [Figure 4-5] on the back of the CPU board. This voltage should be between 4.75 - 5.25 Vdc; if not, replace CPU board as follows.



1. Turn Off power to the system. Attach the anti-static strap to your wrist and to a good ground.
2. Disconnect the CPU cable from the Power Supply board. The CPU board snaps securely into place in the door of the TLS-IB without the use of screws. There are two tabs on the top of the board that fit into two slots in the top edge of the door. The bottom of the CPU board snaps in place between two pairs of detents protruding from the bottom edge of the door. The CPU board is removed by inserting a straight-slot screwdriver into one of the two indents on the bottom of the board and then gently prying against the door until the board clears the upper detents, then rotating the board up slightly and toward you to clear the top tabs from the slots in the door.
3. Replace the CPU board reversing the above steps.

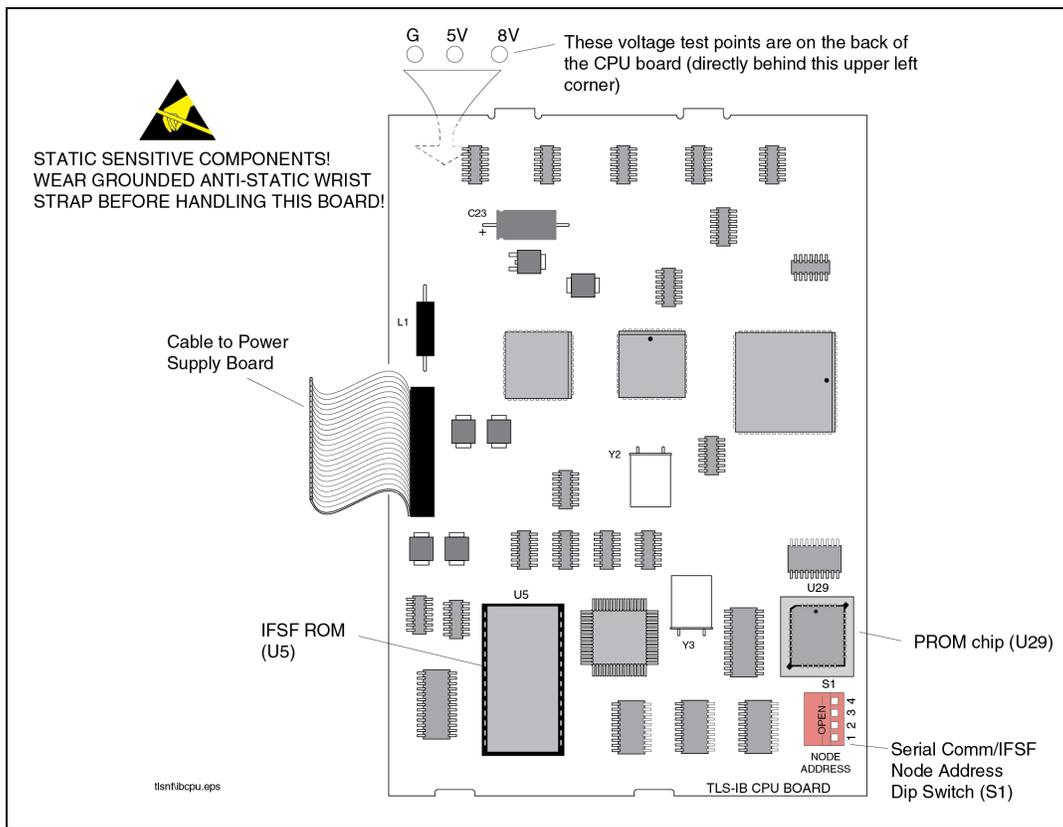


Figure 4-5. TLS-IB CPU Board

PROM CHIP REPLACEMENT (SOFTWARE UPGRADE)

The PROM chip (U29) is replaced when a software upgrade is installed. This procedure requires that you perform a RAM clear.



1. If possible, record the current setup information. Switch Off power to the system.
2. Open the front door of the TLS-IB. The CPU board is installed in the door.
3. Attach an anti-static strap to your wrist and to a good ground.
4. Move RAM clear jumper from NML to CLR position (Figure 4-6). Switch On power to TLS-IB and wait 30 seconds, then switch Off power to TLS-IB. Move the RAM clear jumper back to NML position.
5. Disconnect the ribbon cable connector from the CPU board. Remove the CPU board following the instructions on the previous page.
6. Locate the PROM chip on the board (see Figure 4-5).
7. Remove the PROM chip following instructions in Figure 4-7.
8. Replace the PROM chip following instructions in Figure 4-8.
9. Replace the CPU board in the front door of the TLS-IB. Connect the CPU board cable to the Power Supply board.
10. Switch On power to the TLS-IB and check your system configuration for proper setup.

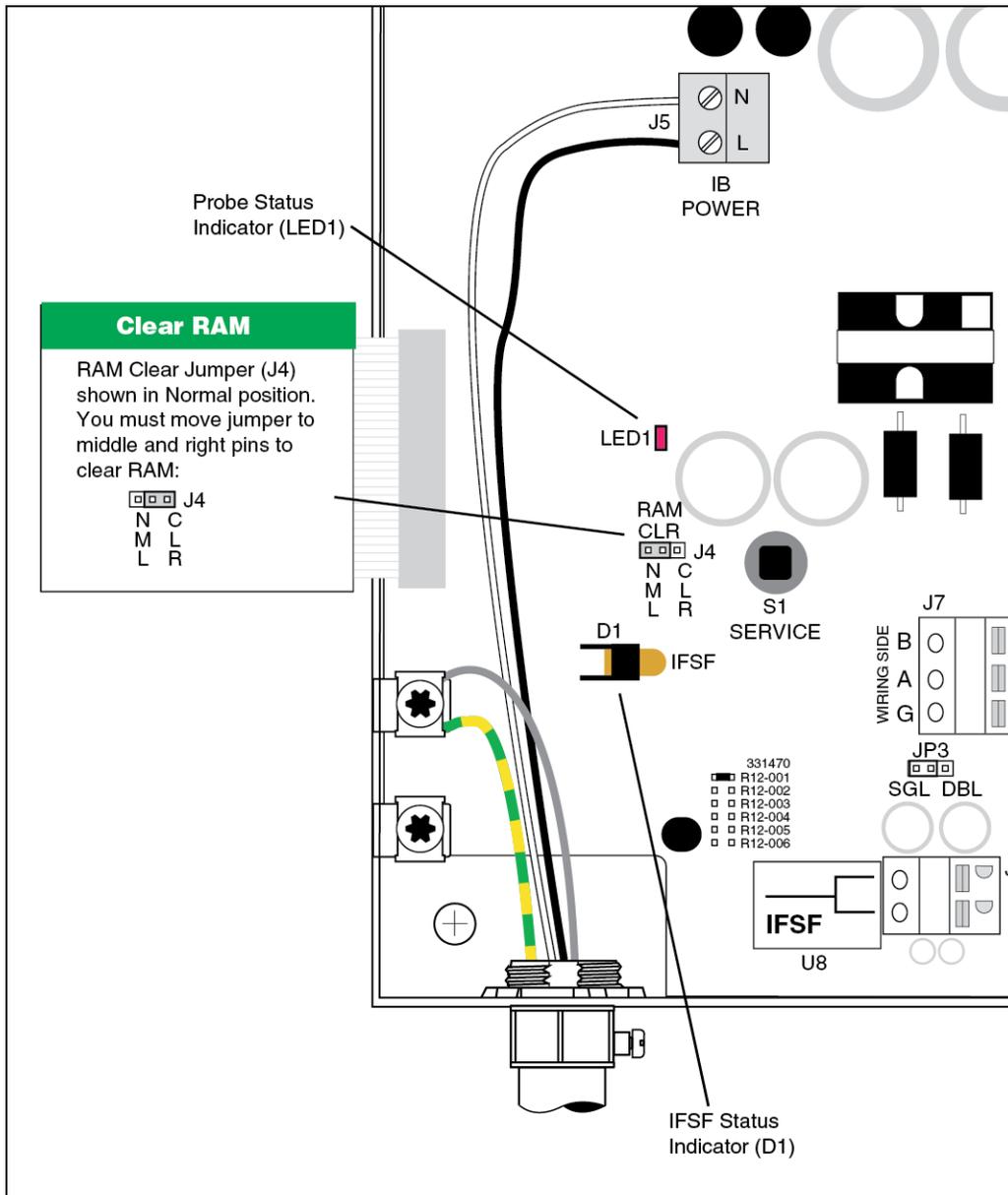


Figure 4-6. Clearing RAM

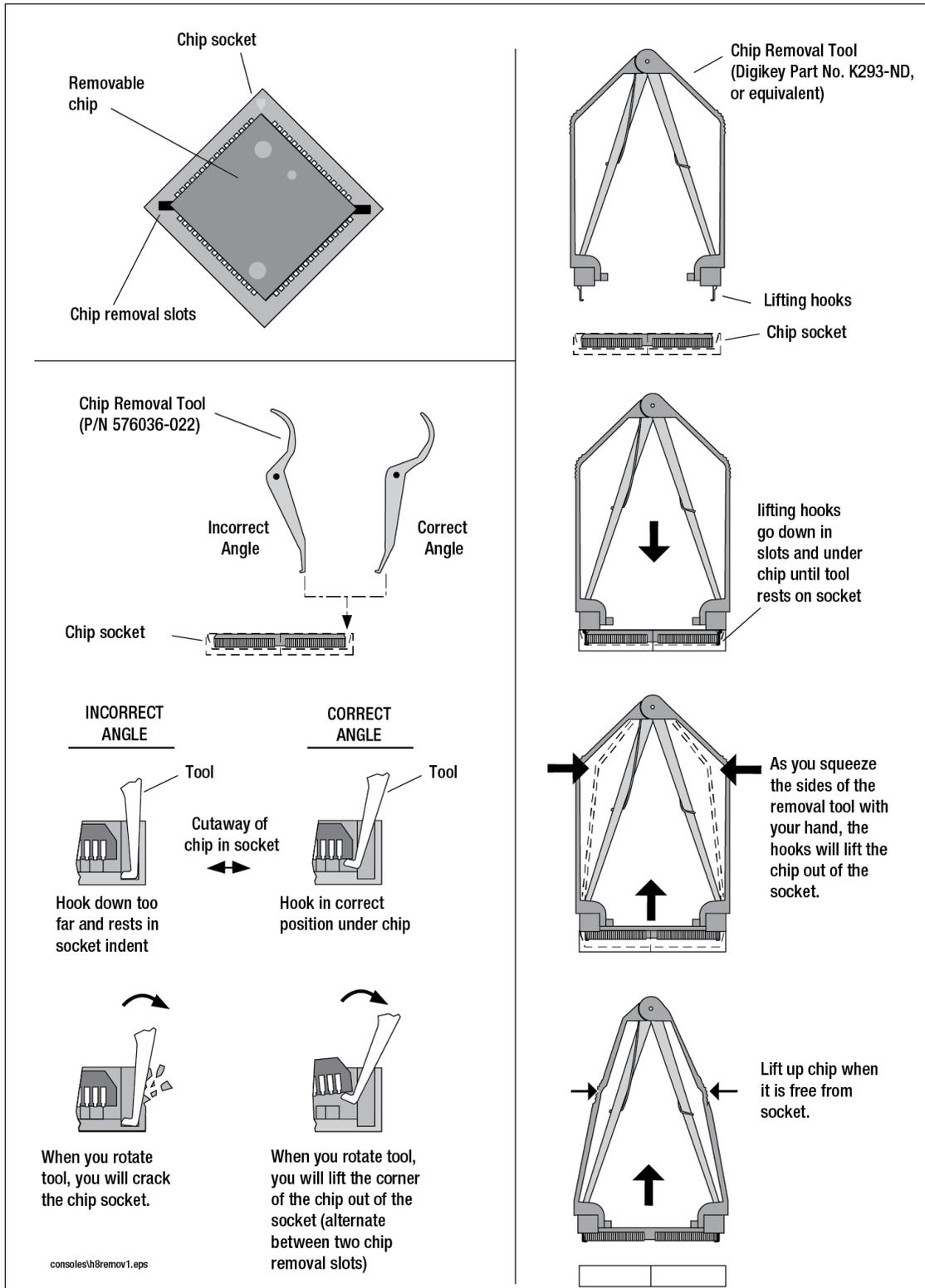


Figure 4-7. Removing PROM Chip

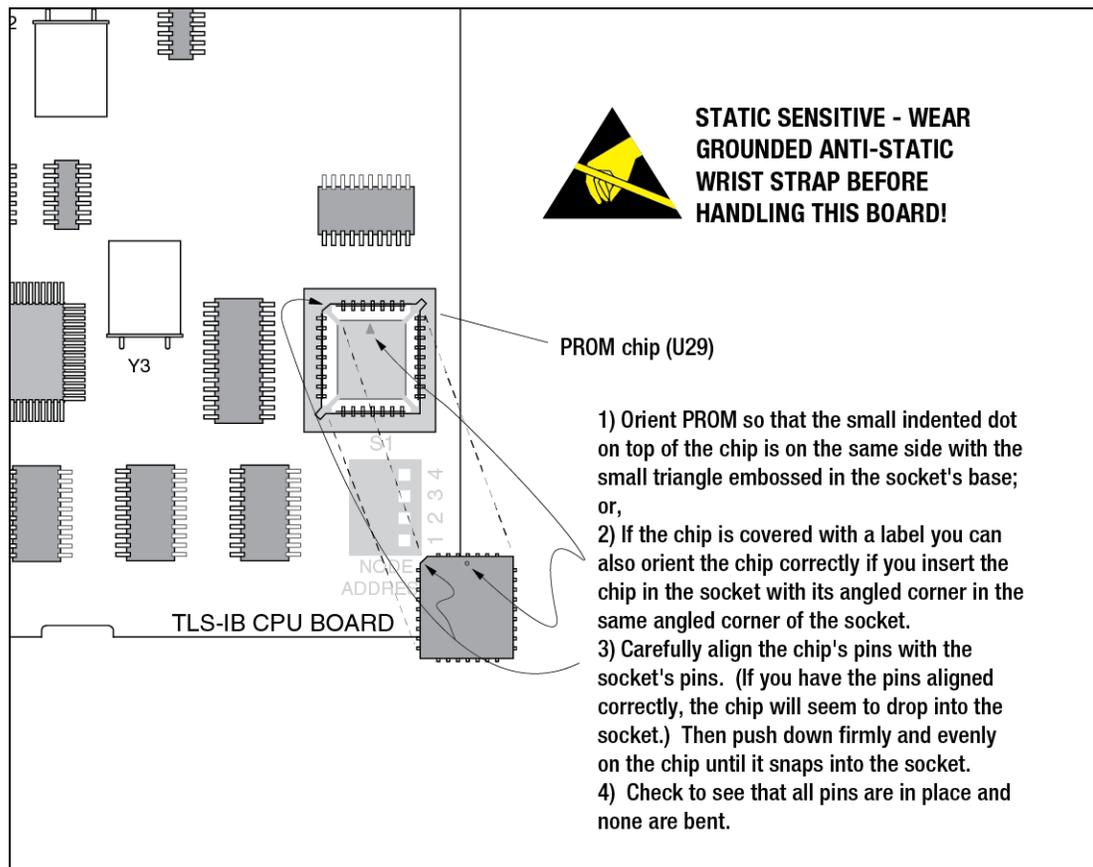


Figure 4-8. Replacing PROM Chip

REPLACING THE POWER SUPPLY BOARD

When to Replace the Power Supply Board

The Power Supply board must be replaced either when:

- Probe data is not being processed. (You can check the Probe Status Indicator [LED1 - see Figure 4-6 on page 4-10] to verify that the probe is communicating with the TLS-IB. If LED1 is flashing, the CPU is acquiring valid probe data), or,
- The voltage between the GND and 8V test points (Figure 4-5 on page 4-8) on the back of the CPU board is less than 7 Vdc.

How to Replace the Power Supply Board



1. To replace the Power Supply board, turn Off power to the system.
2. Disconnect the CPU cable from the Power Supply board.
3. Tag and disconnect probe, power, and overfill alarm relay wiring to the Power Supply board.
4. The Power Supply board is secured by two T-15 Torx screws in the top of the board. After removing the Torx screws, slowly lift up on the board until the lower tabs on the board clear the slots in the bottom of the TLS-IB, then continue to lift the board out.

5. Replace the board by reversing the above steps.
6. Switch On power to the TLS-IB and check your system configuration for proper setup.

NEURON SERVICE SWITCH

To manually transmit the TLS-IB neuron ID, press S1 (service switch) shown in Figure 4-9. The figure also locates the IFSF LED (D1) which indicates if the neuron application is, or is not, running. If the IFSF status indication LED (D1) remains lit, replace the CPU board (see "Replacing the CPU Board" on page 4-8).

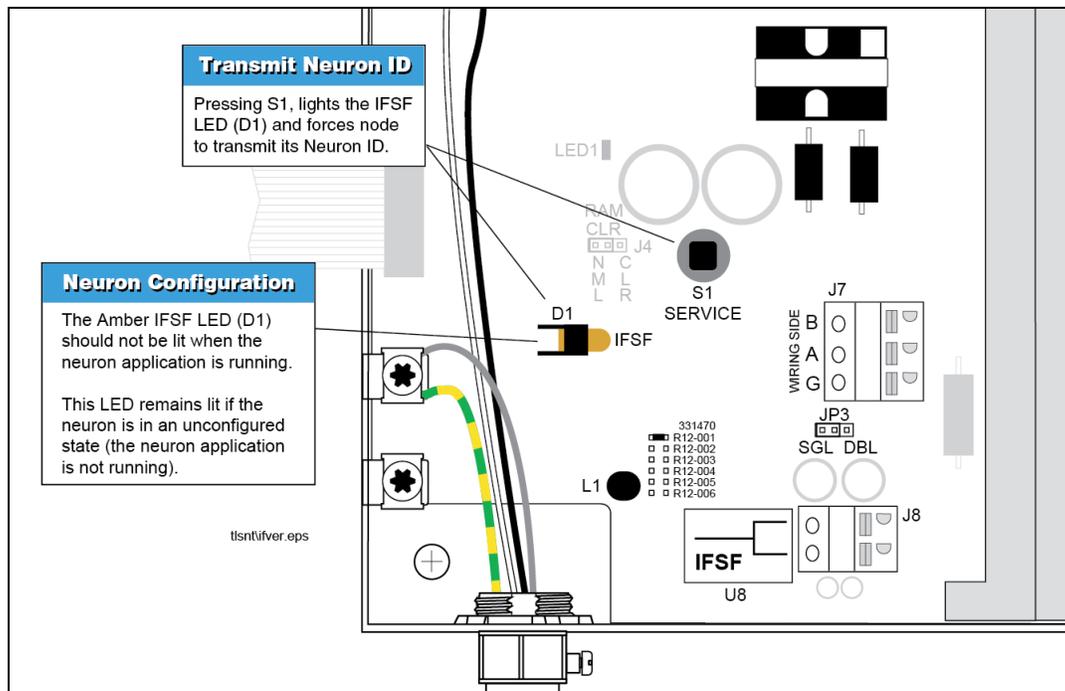


Figure 4-9. Manually Transmitting Neuron ID

TLS-IB Specifications

PHYSICAL SPECIFICATIONS

- Width w/door closed: 188 mm (7.6") - Width w/door open: 235 mm (9.6").
- Height: 163 mm (6.7").
- Depth w/door closed: 50 mm (2.6"), Depth w/door open: 228 mm (9").
- Weight: 1.8 kg (3.5 lbs).
- The TLS-IB unit contains two PC boards: CPU (in door) and Power Supply (in unit).
- Removable plug type connections.
- Conduit knockouts for intrinsically-safe wiring: 1/2", 3/4", and 1" I.P.S. (2 places).

ENVIRONMENTAL SPECIFICATIONS

- TLS-IB storage and operation: indoor, climate controlled.
- Operating temperature range: 0 to +40°C.
- Storage temperature range: -40 to +74°C.
- LVD and EMC compliant.
- UL/cUL approved and ATEX approved.

ELECTRICAL SPECIFICATIONS

- TLS-IB operating voltage: 120/240 Vac, 2 A max.
- The Power Supply board fuses F1 and F2 are **NOT** field replaceable. The rating for both fuses is 2 A, Type T (Time Lag).
- Intrinsically-safe circuit for scanning Mag Probes.

SOFTWARE SPECIFICATIONS

- Two system interface modes: Serial and IFSF interface.
- System, test, and alarm messages are transmitted through both the IFSF and the Serial interfaces.
- System setup information is stored in EEPROM.
- System software is contained in a snap-in PROM integrated circuit.
- RAM clear jumper.
- Factory boot-up mode for self testing.
- Optional tank volume reports.

IFSF INTERFACE

- International forecourt Standards Forum - The protocol for tank level gauge applications, Part III.3.
- System hardware includes: 3150 Neuron, FTT-10 Free Topology Transceiver, 32K PROM, 32K SRAM, dip-switch selectable node address.
- Neuron controller software is contained in a PROM integrated circuit.

OPTIONAL RS-232 SERIAL INTERFACE

- Baud rate options: 300, 600, 1200, 2400, 4800, 9600; default 9600.
- Parity options: None, Odd, Even; default None.
- Data length options: 8 or 7; default 8.
- Number of stop bits options: 1 or 2; default 1.
- No RS-232 hardware handshaking options; RX, TX, and Signal Ground. The TLS-IB serial interface connections to J7 (on TLS-IB Power Supply Board, see Figure 4-3 on page 4-5) are shown in Table 4-2.

Table 4-2. TLS-IB Serial Interface Connections

J7 Connections	Computer Terminal (DB-25 Connector)
A (receive)	TXD (pin 2)
B (transmit)	RXD (pin 3)
G (signal ground)	GND (pin 7)

- Veeder-Root RS-232 command protocol format applies. Table 4-3 lists serial commands recognized by the TLS-IB:

Table 4-3. TLS-IB Serial Commands

Command	Description
001	System Reset
002	Clear Power Reset Flag
003	Remote Alarm Reset
201	In-Tank Inventory Report (height, water, and temp only)
205	In-Tank Status Report
517	Set System Type & Language Flags (ext. lang. set)
601	Set Tank Configuration
62F	Set Mag Probe Float Size
881	Set Communication Port Data
882	Initialize Communication Port Data
902	System Revision Level Report
A01	Probe Type and Serial Number
A02	Probe Factory Dry Calibration Values
A10	Probe Last Sample Buffers
A11	Probe Fast Average Buffers
A12	Probe Standard Average Buffers

SIGNAL INPUT SPECIFICATIONS

- Up to 8 Veeder-Root Magnetostrictive probes can be monitored.
- Probe data: 0.2 A at 13 volts.

TLS-IB IFSF COMMANDS

The IFSF commands recognized by the TLS-IB are divided into 5 databases; Tank Level Gauge Database (Table 4-4), Tank Level Gauge Error Code Database (Table 4-5), Tank Probe Database (Table 4-6), Tank Temperature Table Database (Table 4-7), and Tank Probe Error Code Database (Table 4-8).

Table 4-4. Tank Level Gauge Database

Data Identification	Data Element Name
1	Nb_Tanks
3	TLG_Measurement_Units
6	Country_Code
7	Maint_Password
50	TLG_Manufacturer_Id
51	TLG_Model
52	TLG_Type
53	TLG_Serial_Nb
54	TLG_Appl_Software_Ver
58	IFSF_Protocol_Ver
61	SW_Checksum
70	Enter_Maint_Mode
71	Exit_Maint_Mode
255	V-R protocol pass through

Table 4-5. Tank Level Gauge Error Code Database

Data Identification	Data Element Name
1	TLG_Error_Type
3	TLG_Error_Total
100	TLG_Error_Type_Mes

Table 4-6. Tank Probe Database

Data Identification	Data Element Name
1	TP_Manufacturer_Id
2	TP_Type

Table 4-6. Tank Probe Database

Data Identification	Data Element Name
3	TP_Serial_Nb
4	TP_Model
5	TP_Appl_Software_Ver
32	TP_Status
33	TP_Alarm
64	Product_Level
68	Water_Level
100	TP_Status_Message

Table 4-7. Tank Temperature Table Database

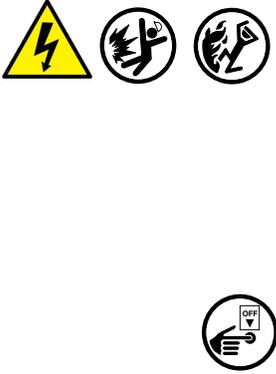
Data Identification	Data Element Name
1	Temp_height
2	Temp_value

Table 4-8. Tank Probe Error Code Database

Data Identification	Data Element Name
1	TP_Error_Type
3	TP_Error_Total
5	TP_Error_Status
100	TP_Error_Type_Mes

5 Wiring/Miscellaneous For TLS-IB Consoles W/RS-232 & RS-485

This section applies only to TLS-IB consoles with the following Form Numbers:
846620-580, 846660-580, 846690-580 (RS-232/RS-485)

⚠ WARNING	
	<p>The equipment is used in location where lethal voltages and explosive vapors or flammable fuels may be present.</p> <p>FAILURE TO COMPLY WITH THE FOLLOWING WARNINGS AND SAFETY PRECAUTIONS COULD CAUSE DAMAGE TO PROPERTY, ENVIRONMENT, RESULTING IN SERIOUS INJURY OR DEATH.</p> <p>For this system:</p> <ol style="list-style-type: none">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. Substitution of components may impair intrinsic safety.4. Be sure AC power is “Off” before opening the TLS-IB cover and connecting probe wires. Do not short any voltage across any barrier terminal including probes.

Probe Wiring Precautions

 To The Installer! You Must Read And Understand This Information. Reference manual number 577013-578 for additional safety related information.

PROBE WIRING POSITIONS AND LABELING

In all cases, the devices wired to the TLS-IB input terminal blocks must be recorded to prevent improper replacement during installation or service.

Wiring Assignments

Identify all probe wires according to their terminal block location using the self-adhesive numbering labels furnished. Accurately record on the circuit directory label (top of I.S. compartment cover plate), the tank number of each probe **as you attach wires** to the probe input terminal block.

NOTICE 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.

Connecting Probes to the TLS-IB

Connect the two color-coded/marked wires from each probe to the appropriate connectors (e.g., Probe 1) of the Probe Terminal Block as shown in Figure 5-1.

NOTICE Observe polarity when connecting probe wires!

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

AUTO PROBE CONFIGURATION

During a cold boot, the TLS-IB will automatically configure connected probes - **CAUTION! For auto configuration to occur, probes must be connected in sequence, starting at the Probe 1 input and continuing with no skipped inputs.**

For example, if you have 4 probes and you connect them to Probe inputs 1, 2, 3, and 4, auto configuration works fine. But if you connect them to Probe 1, 3, 5, and 7 auto configuration doesn't work, resulting in probe out alarms. Also, the skipped inputs will be unusable.

MANUAL PROBE CONFIGURATION

If you connect probes after the system has been powered they must be manually configured. To configure probes for the TLS-IB, use the RS-232 "Set Tank Configuration" command 601 (see Table 5-3 on page 5-9).

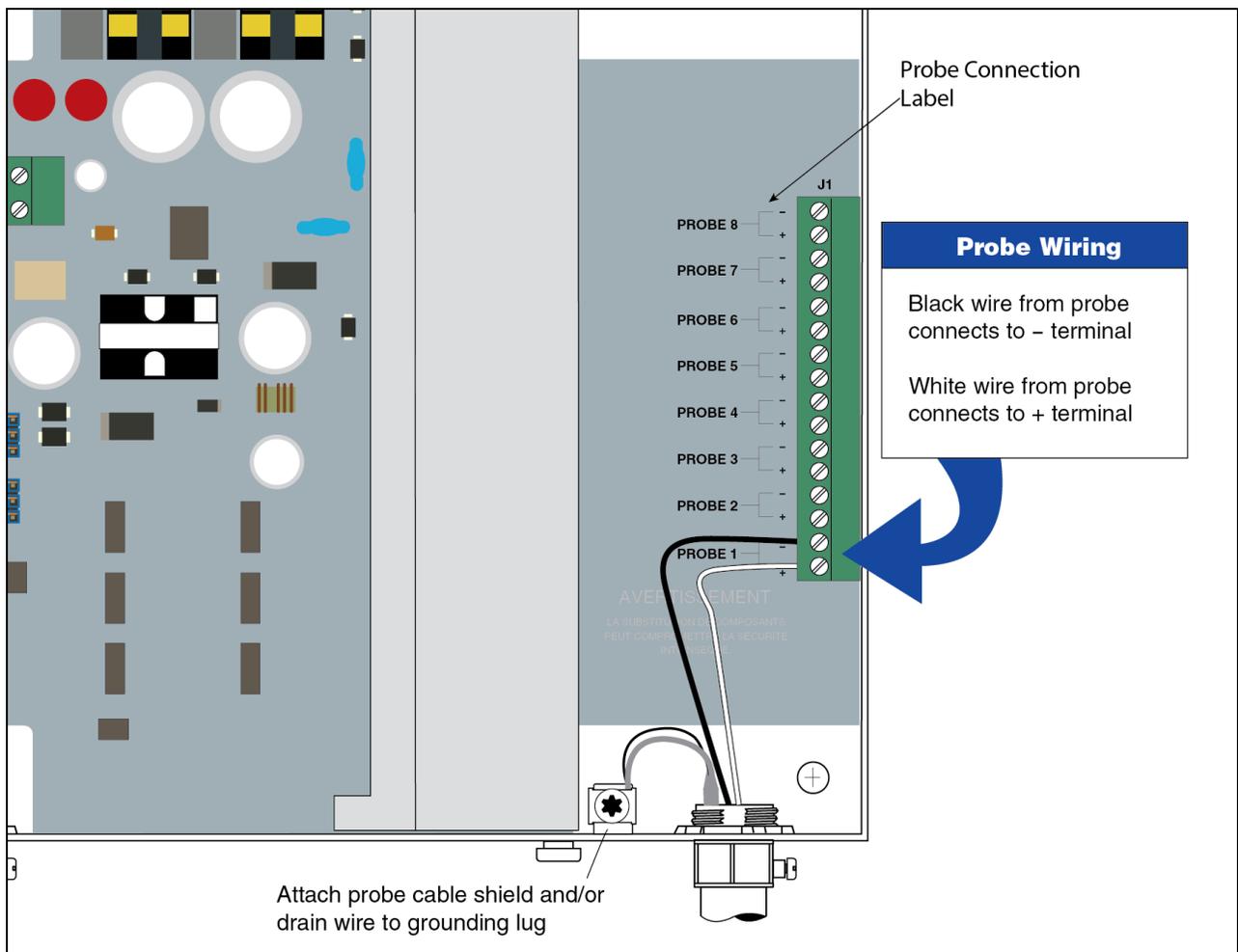


Figure 5-1. Connecting Mag Probe wiring to TLS-IB

Connecting Serial Communication Wiring to the TLS-IB



With AC power switched Off, connect the serial communication wiring to J3 in the TLS-IB as shown in Figure 5-2.

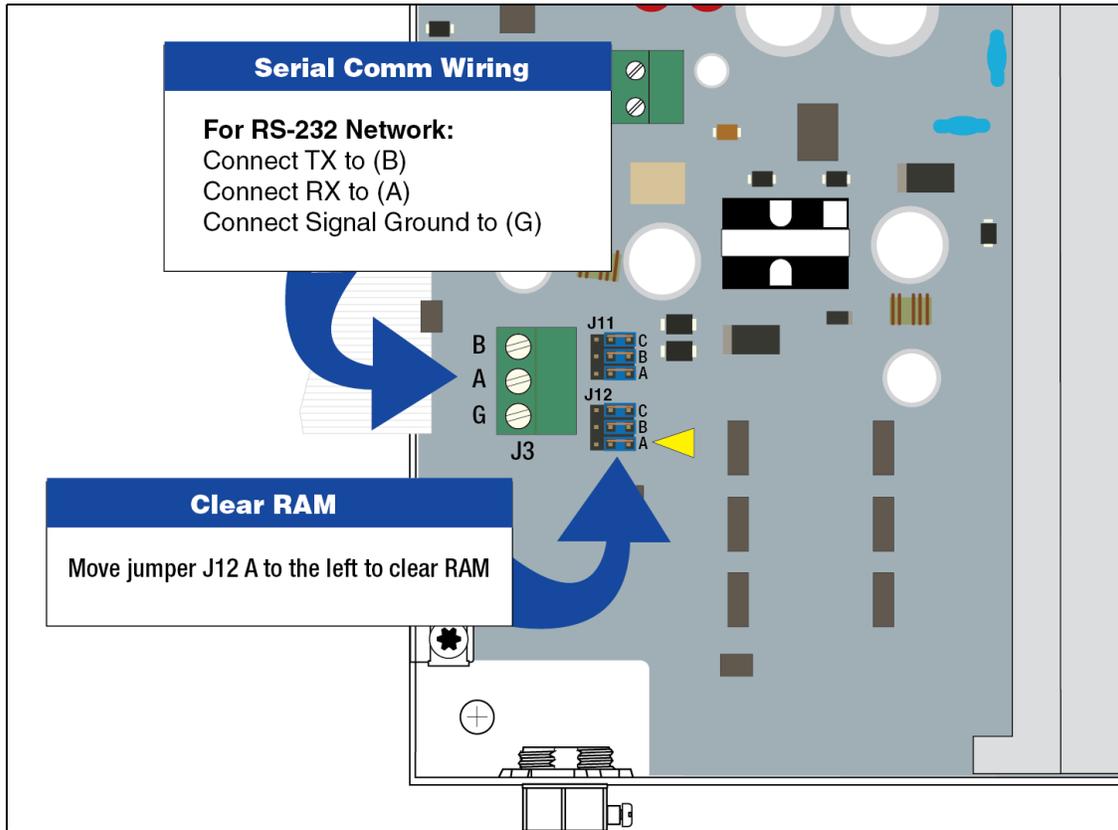


Figure 5-2. Connecting Serial Communication Wiring To TLS-IB

J11/J12 JUMPER POSITIONS (TABLE 5-1)

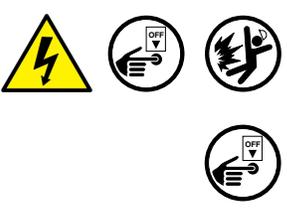
Table 5-1. J11/J12 Jumper Positions

Jumper(s)	Position	Result
J11 C, B, A	Right	RS-232 Serial Communication
J11 C, B, A	Left	RS-485 Serial Communication
J12C	Right	-----
	Left	Puts Load Termination on RS-485 circuit
J12B	Right	-----
	Left	Enables serial security code (default is 000000) - Refer to Serial Interface manual for more details (see "Related Manuals" on page 1-1)

Table 5-1. J11/J12 Jumper Positions

Jumper(s)	Position	Result
J12A	Right	-----
	Left	Clears RAM (Follow instructions provided by V-R Tech Support)

Connecting Power Wiring to TLS-IB

⚠ WARNING	
	<p>The TLS-IB contains voltages which can be lethal. It is connected to devices that must be intrinsically safe.</p> <p>FAILURE TO COMPLY WITH THE FOLLOWING WARNINGS AND SAFETY PRECAUTIONS COULD CAUSE DAMAGE TO PROPERTY, ENVIRONMENT, RESULTING IN SERIOUS INJURY OR DEATH.</p> <ol style="list-style-type: none"> 1. Turn power Off at the circuit breaker connecting the power supply wires. 2. Attach conduit from the power panel to the TLS-IB Power Area knockouts only (1 on top and 2 on bottom, ref. Figure 2-3 on page 2-6).

1. Pull four wires between the power panel and the TLS-IB; three #14 AWG or larger diameter color-coded wires for AC line (L), AC neutral (N) and chassis ground; and one #12 AWG (4 mm² cross-sectional area) green and yellow wire for barrier ground.

For international applications, console power should come from a dedicated circuit via a fused, switched, neon indication spur within one metre of the console position. From an independent 24 hour supply at the distribution panel, run three 2.5 mm² (minimum) standard colour coded wires, live, neutral and earth, to the fused spur. Run three similar wires from the spur to the console location. Run one 4mm² wire, colour coded green/yellow, from the earth bus bar at the distribution panel direct to the console location. Leave at least 1 metre of free cable for connection to the console.

NOTICE 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" (copper rod driven into ground, etc.). It should read less than 1 ohm.

2. Open the door of the TLS-IB and connect the four power/ground wires as shown in [Figure 5-3]. Do not connect the power wires to breaker panel at this time.

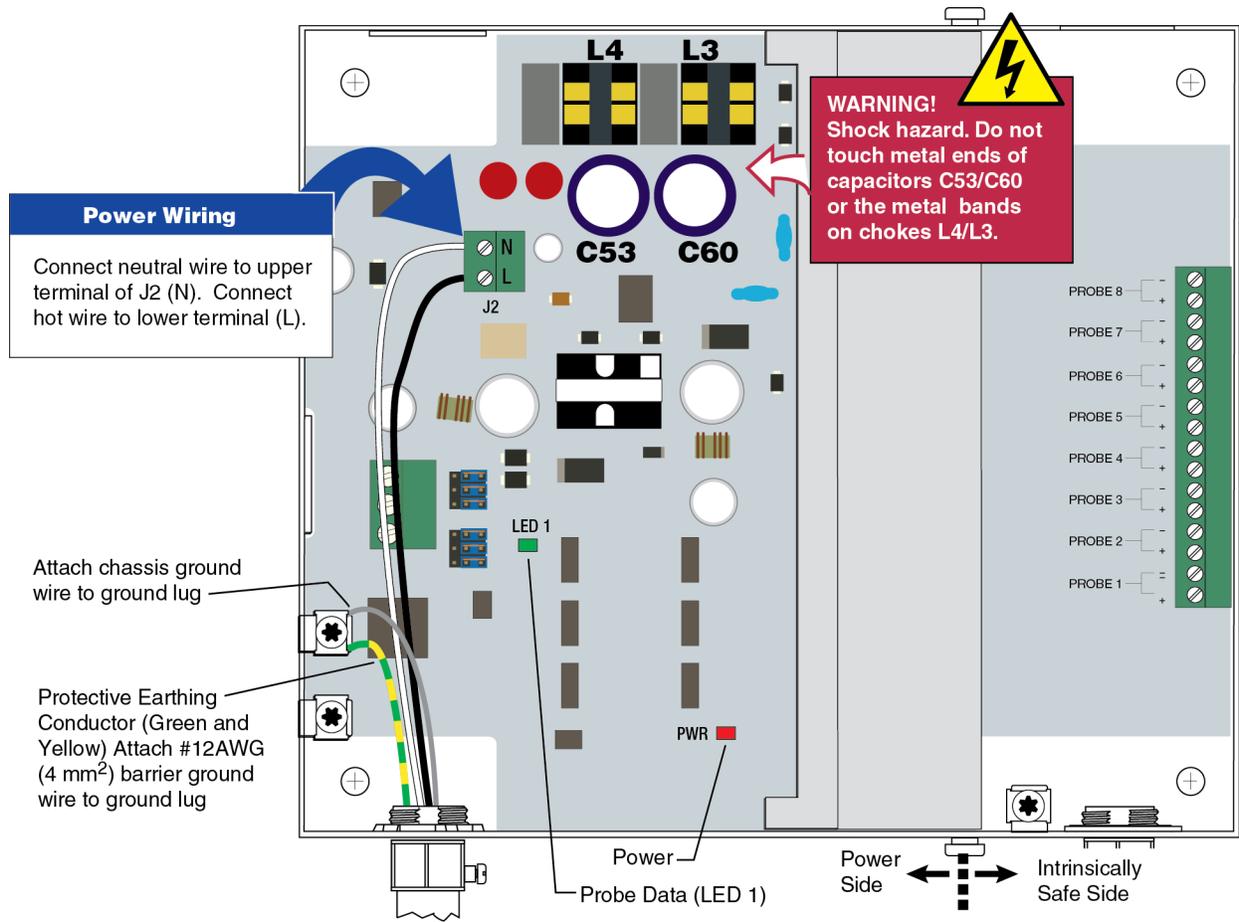


Figure 5-3. Wiring AC Power To The TLS-IB

Troubleshooting

This section contains information to help you diagnose system problems. Instructions are included for replacing the CPU/Power Supply board in the event of a hardware failure and for installing a software upgrade.

At the end of this section you will find a list of specifications for the TLS-IB.

REPLACING THE CPU/POWER SUPPLY BOARD

The CPU/Power Supply board must be replaced if the TLS-IB fails for the reasons below:

- Probe data is not being processed - LED1 is Off (Figure 5-3 on page 5-5), or
- Power LED is Off (Figure 5-3 on page 5-5).



1. Turn Off, tag and lockout power to the system. Attach an anti-static strap to your wrist and to a good ground.
2. Tag and disconnect probe, power, serial comm and overfill alarm relay wiring to the CPU/Power Supply board.
3. The CPU/Power Supply board is secured by two T-15 Torx screws in the top of the board. After removing the Torx screws, slowly lift up on the board until the lower tabs on the board clear the slots in the bottom of the TLS-IB, then continue to lift the board out.
4. Replace the CPU/Power Supply board reversing the above steps.
5. Switch On power to the TLS-IB and check your system configuration for proper setup.

SOFTWARE UPGRADE

The TLS-IB firmware upgrade procedure requires the following items:

- A 3-wire serial cable constructed with a connector on one end that matches your laptop's serial port connector and 3-wires stripped wires on the other end that will connect to the Serial Comm plug (J3) on the TLS-IB CPU/Power Supply board (ref. Table 5-2 on page 5-9 for pin outs).
- The TLS-IB.exe program and Firmware Upgrade file - available from Veeder-Root.
- A laptop running Windows 7 or later software.
- The serial interface type, RS-232 or RS-485, must match between the PC and the TLS-IB. (If the PC only has 232 and the IB is configured for 485 you can temporarily use the J11 C,B,A jumpers to configure the TLS-IB to 232 (or vice versa) - see Figure 5-2 on page 5-3.

Upgrade Procedure



1. With AC power switched Off, open the front cover of the TLS-IB and mark each of the three wires connected to the TLS-IB Serial Comm plug at J3. See Figure 5-2 on page 5-3.
2. Attach the serial cable between your laptop's serial port connector and the Serial Comm plug on the CPU/Power Supply board.
3. Turn On power to the TLS-IB.
4. Download the V-R TLSIB Upgrade.exe program onto the laptop.
5. Install the TLSIB_Upgrade program by running TLSIB_Setup.msi or setup.msi.
6. Once installed, the TLSIB_Upgrade.exe program can be found under C:\Program Files (x86)\Veeder-Root\TLS-IB. Double click the TLSIB_Upgrade.exe to open the program and display the **TLS-IB Firmware Upgrade** window (see Figure 5-4).
7. Click the **Select Upgrade File** button and browse for the desired firmware upgrade file, e.g., 349876-001A.txt. Select the file and click the Open button and it displays in the **Firmware File** field (see Figure 5-4).

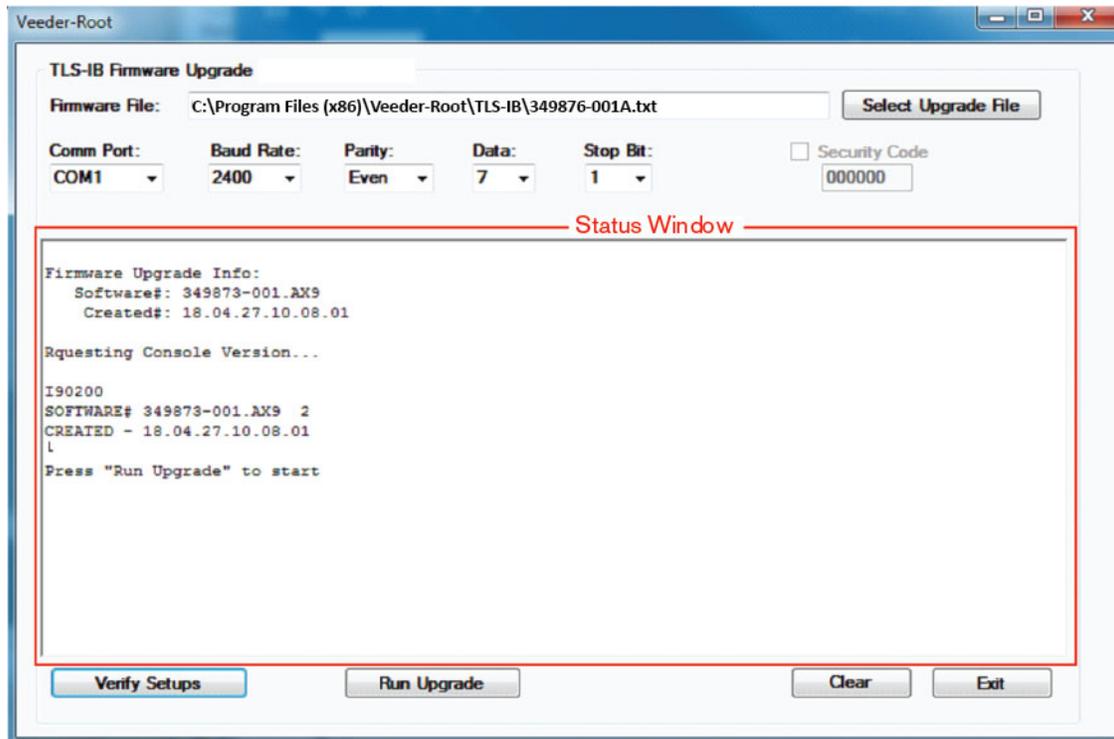


Figure 5-4. TLS-IB Firmware Update Screen

8. Select the Comm Port of the connected laptop using the up/down arrows of the **Comm Port** selector.
9. Select the communication parameters, **Baud Rate**, **Parity**, **Data** and **Stop Bit** to connect to the TLS-IB using the up/down arrows for each selection.
10. Use the **Security Code** checkbox when security code is enabled to connect to the TLS-IB.
11. Select the **Verify Setup** button to validate all the settings.
 - a. Verify that the firmware upgrade exists and valid.
 - b. Verify that the communications are setup correctly.
 - c. Verify that the TLS-IB Console is ready to accept firmware upgrade.
12. Click the **Run Upgrade** button to start the firmware upgrade. This button will be activated when setup has been verified. As the firmware is being upgraded, status messages will be displayed in the Status Window.
13. Select the **Clear** button to clear status messages written in the Status Window.
14. Select the **Exit** button to exit the TLSIB_Upgrade program.
15. Turn Off AC power to the TLS-IB.
16. Disconnect the laptop serial cable from J3 on the CPU/Power Supply board.
17. Reconnect the site's three serial comm wires back into the Serial Com plug, observing their previously marked positions as you do so.
18. Switch On power to the TLS-IB and check your system configuration for proper setup.



TLS-IB Specifications

PHYSICAL SPECIFICATIONS

- Width w/door closed: 188 mm (7.6") - Width w/door open: 235 mm (9.6")
- Height: 163 mm (6.7")
- Depth w/door closed: 50 mm (2.6"), Depth w/door open: 228 mm (9")
- Weight: 1.8 kg (3.5 lbs)
- The TLS-IB unit contains one CPU/Power Supply board (in unit)
- Removable plug type connections
- Conduit knockouts for intrinsically-safe wiring: 1/2", 3/4", and 1" I.P.S. (2 places)

ENVIRONMENTAL SPECIFICATIONS

- TLS-IB storage and operation: indoor, climate controlled
- Operating temperature range: 0 to +40°C
- Storage temperature range: -40 to +74°C
- LVD and EMC compliant
- UL/cUL approved and ATEX approved

ELECTRICAL SPECIFICATIONS

- TLS-IB operating voltage: 120/240 Vac, 2 A max
- Power Supply fuses F1 and F2 are **NOT** field replaceable. The rating for both fuses is 2 A, Type T (Time Lag)
- Intrinsically-safe circuit for scanning Mag Probes

SOFTWARE SPECIFICATIONS

- System software upgradeable by a PC program
- RAM clear jumper (Figure 5-2 on page 5-3)
- Factory boot-up mode for self testing
- Supports tank volume reports.
- Supports Density and Density Offset

SERIAL COMMUNICATIONS INTERFACE (SCI)

- RS-232 or RS-485
- Baud rate options: 300, 600, 1200, 2400, 4800, 9600; default 9600
- Parity options: None, Odd, Even; default None
- Data length options: 8 or 7; default 8
- Number of stop bits options: 1 or 2; default 1

WIRING CONNECTIONS

The TLS-IB SCI wiring connections to J3 (on TLS-IB CPU/Power Supply Board, see Figure 5-2 on page 5-3) are shown in Table 5-2.

Table 5-2. SCI Wiring Connections

TLS-IB J3 Connector	Laptop Serial Port Connector
RS-232 Serial Interface	
A (receive)	TXD (pin 2)
B (transmit)	RXD (pin 3)
G (signal ground)	GND (pin 5 DB9, pin 7 DB25)
RS-485 Serial Interface	
A (receive)	A
B (transmit)	B
G (signal ground)	G

SERIAL INTERFACE COMMANDS

Veeder-Root RS-232 command protocol format applies. Table 5-3 lists the serial commands recognized by the TLS-IB:

Table 5-3. TLS-IB Serial Commands

Command	Description
001	System Reset
002	Clear Power Reset Flag
003	Remote Alarm Reset
201	In-Tank Inventory Report (height, water, and temp only)
205	In-Tank Status Report
214	In-Tank Mass/Density Inventory Report
233	Density Offset History Report
234	In-Tank Mass/Density Inventory Report 2
504	Set RS-232 Security Code
50D	Set Print Temperature Compensation Flag
50E	Set Temperature Compensation Value
514	Set H-Protocol Height/Volume Format
517	Set System Type & Language Flags (ext. lang. set)

Table 5-3. TLS-IB Serial Commands

Command	Description
51F	Set Euro-Protocol Prefix
545	Set TC Density Enable
601	Set Tank Configuration
604	Set Tank 1 Point Full Height Volume
605	Set Tank 4 point Full and 3/4, 1/2, 1/4 Volumes
606	Set Tank 20 Point Full, 95%, 90%,. . . Volumes
607	Set Tank Diameter
608	Set Tank Tilt
609	Set Tank Thermal Expansion Coefficient
60A	Set Tank Linear Calculated Full Volume
62F	Set Mag Probe Float Size
641	Set Density Code
644	Set Probe Density Float Serial Number
645	Set Tank GOST Volume Correction Enable
64C	Set Field Density And Temperature
881	Set Communication Port Data
882	Initialize Communication Port Data
883	Set System Measurement Type And Language
902	System Revision Level Report
A01	Probe Type and Serial Number
A02	Probe Factory Dry Calibration Values
A10	Probe Last Sample Buffers
A11	Probe Fast Average Buffers
A12	Probe Standard Average Buffers

RESPONSE MESSAGE FORMAT FOR FUNCTION CODE 214**Function Code:** 214

Version 1

Function Type: In-Tank Mass/Density Inventory Report**Command Format:****Display:** <SOH>I214TT**Computer:** <SOH>i214TT**Typical Response Message, Display Format:**<SOH>
I214TT

IN-TANK MASS INVENTORY

TANK	PRODUCT	VOLUME	MASS	DENSITY	OFFSET	HEIGHT	WATER	TEMP
1		7343	44521	45.35	-0.022	16.5	0.0	78.8

<ETX>

Typical Response Message, Computer Format:

```
<SOH>i214TTYMMDDHmTTpssssNNFFFFFFFF...
      TTpssssNNFFFFFFFF...&&CCCC<ETX>
```

Notes:

1. YYMMDDHm - Current Date and Time
2. TT - Tank Number (Decimal, 00=all)
3. p - Product Code (single ASCII character [20h-7Eh])
4. ssss - Tank Status Bits:
 - Bit 1=(LSB) Delivery in Progress
 - Bit 2=Leak test in Progress
 - Bit 3=Invalid Fuel Height Alarm (MAG Probes Only)
 - Bit 4-16 - Unused
5. NN - Number of eight character Data Fields to follow (Hex)
6. FFFFFFFF - ASCII Hex IEEE float:
 1. Volume
 2. Mass
 3. Density
 4. Height
 5. Water
 6. Temperature
 7. TC Density
 8. TC Volume
 9. Ullage
 10. Water Volume
 11. Total TC Density Offset
7. && - Data Termination Flag
8. CCCC - Message Checksum

RESPONSE MESSAGE FORMAT FOR FUNCTION CODE 64C

The **Set Field Density And Temperature** (64C) Function Code is applicable to TLS-IB Form Numbers 846620-580, 846660-580 and 846690-580 only.

Function Code: 64C	Version 1
Function Type: Set Field Density/Temperature Measurement	
Command Format:	Inquire:
Display: <SOH>S64CTDD.tttTTT.hh	<SOH>I64CTT
or: <SOH>S64CTDD.t,TT.h	
Computer: <SOH>s64CTDdddddddtttttttt	<SOH>i64CTT

Notes:

1. TT - Tank Number (Decimal, 00=all for inquiry only)
2. DD.ttt - Field Density Measurement (Decimal)
3. TTT.hh - Field Temperature Measurement (Decimal)
4. dddddddd - Field Density Measurement (ASCII Hex IEEE float)
5. tttttttt - Field Temperature Measurement (ASCII Hex IEEE float)

Typical Response Message, Display Format:

```
<SOH>
I64CTT

T 1

DATE / TIME          DENSITY    TEMP    TC DENSITY  TC REF TEMP  TC OFFSET
                TLS:   721.82    21.94    728.19      15.00      0.00
                FIELD: 721.79    22.06    728.26      15.00      0.07
                TOTAL:
<ETX>
```

Typical Response Message, Computer Format:

```
<SOH>i64CTTYMMDDHHmmTTNNYYMMDDHHmmnnFFFFFFFF...FFFFFFFF
                YMMDDHHmmnnFFFFFFFF...FFFFFFFF&&CCCC<ETX>
```

Notes:

1. YYMMDDHHmm - Current Date and Time
2. TT - Tank Number (Decimal, 00=all)
3. NN - Number of Records to follow (Hex)
4. YYMMDDHHmm - Date/Time
5. nn - Number of eight character Data Fields to follow (Hex)
6. FFFFFFFF - ASCII Hex IEEE float:
 1. TLS Density
 2. TLS Temp
 3. TLS TC Density
 4. Previous TLS TC Reference Temp
 5. Previous TLS TC Density Offset
 6. Field Density
 7. Field Temperature
 8. Field TC Density
 9. Field TC Reference Temperature
 10. TLS Temp
7. && - Data Termination Flag
8. CCCC - Message Checksum

