IOM099GVAE1912

TacFuels®
Fuels Inventory Management System

Installation and Operations Manual

Automation Solutions for oil & gas, defense and aviation applications

Varec®

Safety Precaution Definitions

Caution! Damage to equipment may result if this precaution is disregarded.

Warning! Direct injury to personnel or damage to equipment which can cause injury to personnel may result if this precaution is not followed.

Safety Precautions

Read this manual carefully and make sure you understand its contents before using this product. Follow all instructions and safety guidelines presented in this manual when using this product. If the you do not follow these instructions properly, Varec cannot guarantee the safety of the system.

Note Comply with all applicable regulations, codes, and standards. For safety precautions, the user should refer to the appropriate industry or military standards.

Caution! Electrical Hazard! Read and understand static and lightning electrical protection and grounding described in API 2003. Make certain that the tank installation, operation, and maintenance conforms with the practice set forth therein.

Warning! Volatile fumes may be present! Observe appropriate safety precautions in flammable or hazardous liquid storage areas. Wear safety glasses as appropriate. Use a hard hat.

Warning! Sparks or static charge could cause fire or explosion! Worker activity and worker clothing may accumulate electrostatic charges on the body of a worker. Care should be used in flammable environments to avoid the hazard.

Warning! Remove the Tactical Fuel Gauge prior to performing low-level Collapsible Storage Tank (CST) fuel removal when a vacuum is possible. Failure to remove the Tactical Fuel Gauge sensor under these conditions can result in sensor diaphragm rupture.

Contents

1 Introduction

This manual is designed to assist the user with the installation, connection of field devices, and maintenance of the Varec TacFuels System. Personnel performing installation and/or maintenance on this system are assumed to be familiar with industry practices, safety guidelines, and instrumentation.

1.1 Overview

The TacFuels System is an integration of specifically designed field devices and software to allow the automation of Collapsible Storage Tanks (CST) volume determinations and comprehensive inventory management of stored fuel stocks. The TacFuels System includes tank gauging, data processing, and computing devices.

- **Tactical Fuel Gauge (TFG) 7660** — the Tactical Fuel Gauge or TFG consists of a pressure and temperature sensor that is incorporated into a specially designed vent pipe with minimal support or maintenance requirements. It is a direct replacement for an existing collapsible storage tank vent pipe in new or existing CST installations. Venting characteristics are not compromised and the sensor can be easily installed or removed in a few minutes with no specialized tools. All power and communications cables are connected via military style "quick" connect/disconnects.
- **Tactical Data Unit (TDU) 8240** — the Tactical Data Unit or TDU provides three key functions:
  - It provides power to the fuel gauges and acts as a communications interface from the fuel gauges to the system software installed on the mobile computers.
  - Most importantly and key to the overall system, it dynamically creates a "tank strap" ("strapping table") for each CST in a Fuels Inventory Measurement System — **an automatic "Tank Strapping" process**. To minimize power requirements, the fuel gauge is normally in a suspended mode of operation that requires no power. When a measurement request is received by the TDU from a mobile computer, it activates the gauge to perform a measurement cycle. Inventory measurement cycle times and manpower allocations are dramatically reduced by providing an immediate measurement of product when requested.
  - Up to four (4) fuel gauges can be connected in a series (daisy chained) from a single power and communications port of a TDU. The TDU has configurations to support tactical fuel points with multiple fuel gauges. It is also designed for use in hazardous areas and can be installed within the operating area on a standard military style ground rod. To provide support for larger tactical fuel points, multiple TDUs can be used. Multiple TDUs can be connected in a series and supported with continuous power or installed as a standalone battery operated units using an integrated battery pack. Under battery operation, the TDU automatically shuts down when not in use. When polled by a Fuels Inventory system computing device, it activates and collects inventory measurements. It is able to store data under battery power for up to six (6) months.

  Note Because the TDU contains a generic meter interface, the units can also be used with other flow meters to capture and monitor the bulk fuel received and issued from receipt and issue points that are equipped with pulse out capability (contact Varec, Inc. for more information).

- **Tactical Mobile Computer (TMC) 9760** — the Tactical Mobile Computer or TMC runs FuelsManager Defense software, which provides the local fuel farm operator improved inventory monitoring and reporting capabilities. The local mobile laptop (TMC) is a ruggedized device for use in harsh environments. It is deployed from Varec and pre-configured for the specific fuel point. It connects to the Tactical Interface Convertor (TIC) via military style “quick” connect/disconnects.
- **Automatic “Tank Strapping”** — the TDU is designed to dynamically create a unique tank strap” (strapping table) for each CST. Creating a unique “tank strap” for a CST involves creating a gauge chart of entries correlating volume measurements from the Tactical Flow Meter (TFM) to pressure measurements inside the CST at the metered product temperature. The TDU performs a continuous data collection cycle until a strap table has been constructed. This table, which can include up to 1,000 data entry points, is then stored in the non-volatile memory of the TDU.

  The tank strapping process compensates for the variances in tank construction and installation conditions, such as tank expansion, tank bulge, and height measurements above manufacture specifications. It allows increased accuracy and reliability of physical inventory measurements that can then be used throughout the system. Varec’s mobile computer runs dedicated tactical fueling software that assists decision making at an accelerated pace. Laptop computers are utilized in the control area to manage, reconcile, and report fuel inventories.

- **Tactical Flow Meter (TFM)** — the Tactical Flow Meter or TFM is a portable 4" Turbine flow meter that is connected to the TDU during the tank strapping process to provide a reference volume for each tank strap point.

  Note The *C-LB45-A Fuel Meter Assembly Installation and Operation Manual* accompanies the TFM. Specific provisions are included within this manual (see Section 2.7, "Installation of the Tactical Flow Meter (TFM) — Model C-LB45-A" on page 17).

- **Tactical Interface Convertor (TIC) 8250** — the Tactical Interface Convertor or TIC provides a communications interface between the TDU and the TMC. The TIC translates data received from the TDU via the RS485 communication protocol and translates it to the RS232 communication protocol, then sends it to the TMC. The TIC also provides continuous DC power to the attached TDUs.

  The TIC provides two (2) TDU connectors on the standard version, with the option to expand this to four (4).

  Three (3) LED Indicators are used to indicate the following:

  1. Power LED - indicates whether the power to the TIC is "ON" or "OFF".
  2. Transmit LED - indicates whether or not the TIC is actively transmitting data to the TMC.
  3. Receive LED - indicates whether or not the TIC is actively receiving data from the TMC.

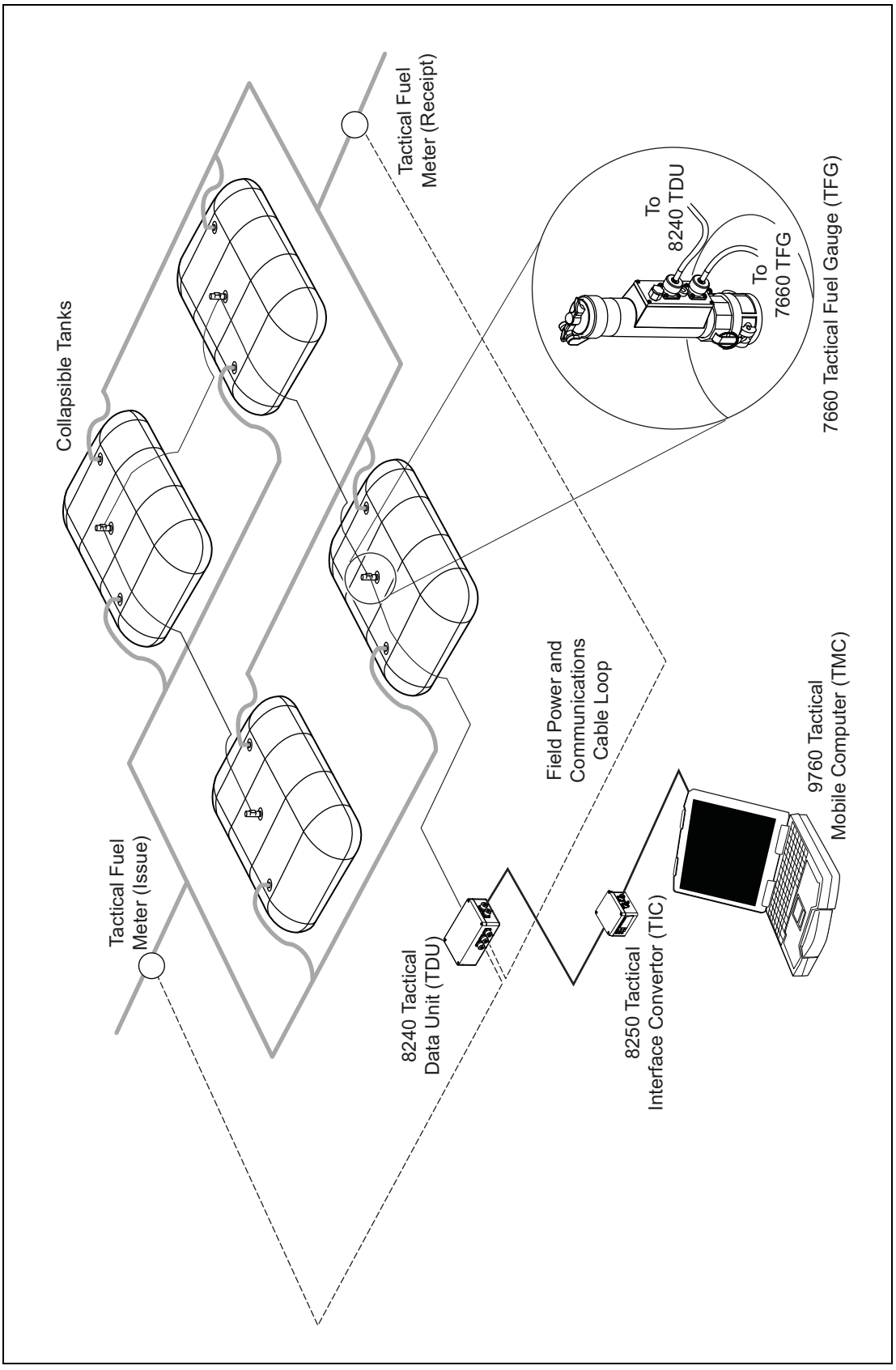

Figure 1-1: TacFuels SystemOverview (Installation for this configuration is described in Chapter 2 on page 9.)

1.2 Hardware Descriptions

1.2.1 TDU

The 8240 TDU consists of the following hardware components, as shown in Figure 1-2:

A. Weatherproof Enclosure
B. Processor Board
C. Battery Pack Assembly (optional)
D. MIL Electrical Connectors
E. Intrinsic Barrier
F. Grounding Log

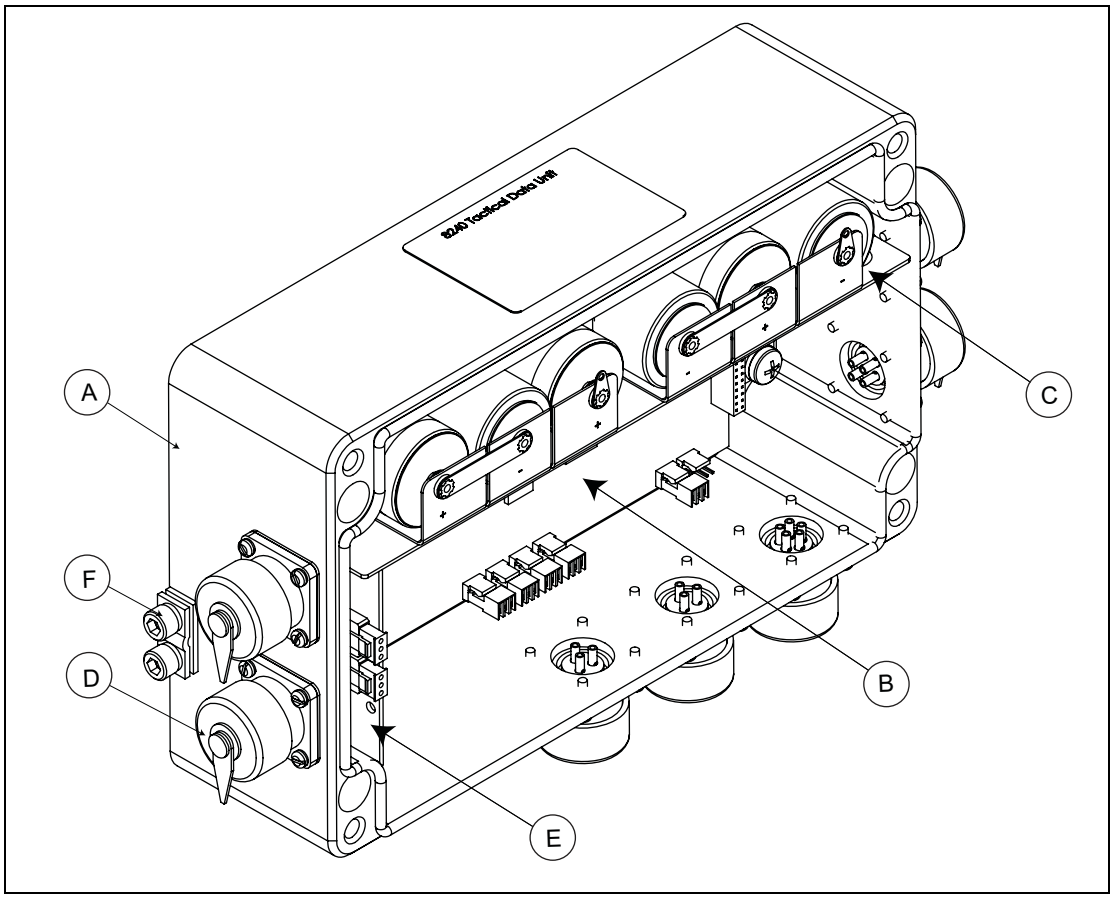

Figure 1-2: 8240 TDU - Hardware Components

Figure 1-3 shows the details of the Tactical Fuel Gauge Transmitter and Vent Pipe integrated.

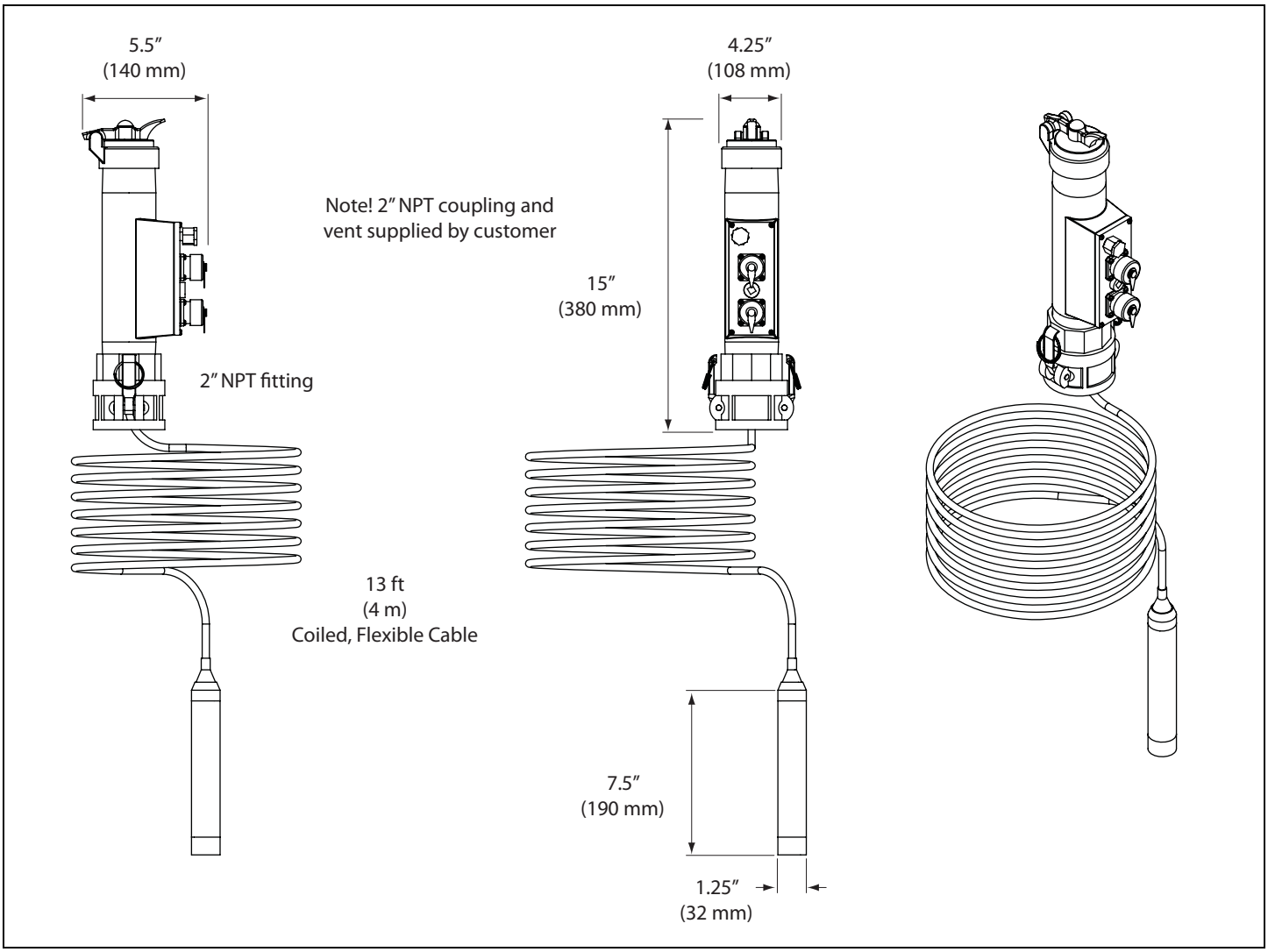

Figure 1-3: 7660 TFG Transmitter and Vent Pipe Integrated – Details

1.2.2 TIC

The 8250 TIC consists of the following hardware components, as shown in Figure 1-4:

A. LED Indicators (Power LED, Receive LED, Transmit LED)
B. RS485 MIL Electrical Connectors (2 standard)
C. RS485 MIL Electrical Connectors (2 optional)
D. Power Switch
E. RS232 MIL Electrical Connector
F. Power Connector
G. USB MIL Electrical Connector (optional)

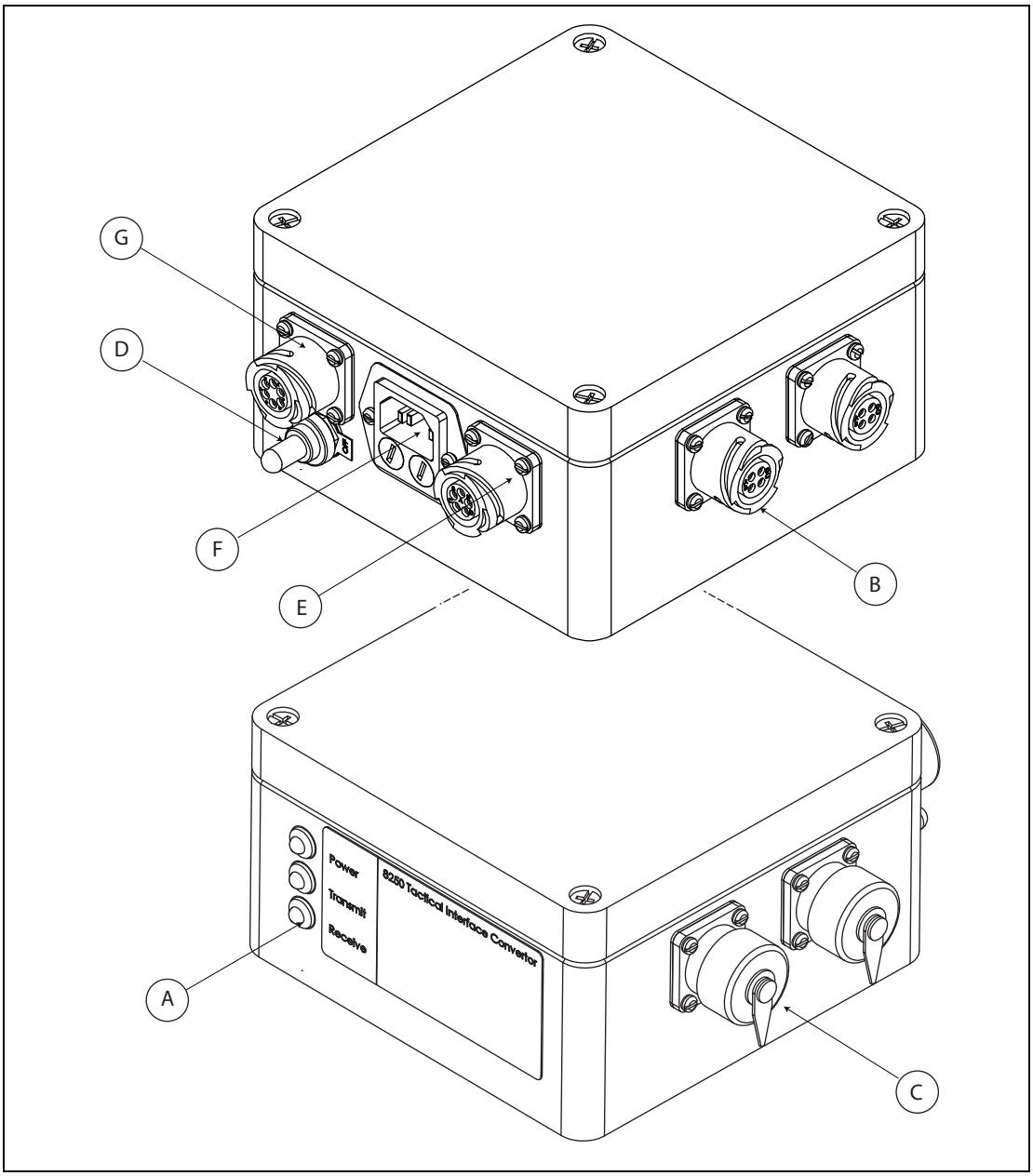

Figure 1-4: 8250 TIC - Hardware Components

1.3 Deployment

The TacFuels System components are typically deployed from Varec during the construction phase and prior to fuel receipt into the system, and pre-configured for the specific tactical fuel point. However, the TacFuels System can be retrofitted on existing fuel systems.

2 Installation

Installing the TacFuels System hardware consists of the following procedures:

2.1 Safety Guidelines

2.1.1 General safety guidelines

Follow safety guidelines provided by the Occupational Safety and Health Administration (OSHA) for additional protection. Information may be obtained from the following sources:

- National Electrical Code (NEC)
- National Fire Protection Association (NFPA)
- Instrument Society of America (ISA)
- FM Approvals (FM)
- Underwriters Laboratories Incorporated (UL)
- Canadian Standards Association (CSA)

When in doubt about the safety of an area, the user should check with the local safety authorities. Always observe warning signs posted in the area and all labels on equipment.

Warning! Explosion Hazard. To prevent an ignition of a flammable atmosphere, do not connect or disconnect the battery pack assembly unless the area is known to be non-hazardous.

2.1.2 Installation safety guidelines

- Never attempt to make voltage measurements within the TDU. Do not remove the TDU cover in a hazardous area.
- Before installing/repairing any connections to the TDU or TIC, make sure the TDU is disconnected from the TIC and that the TIC is disconnected from the TMC.
- Before connecting the TIC and when installation is complete, make sure the cover of the TDU case is in place and tightly closed. NEVER REMOVE ANY COVERS WITHOUT FIRST DISCONNECTING THE TIC.
- To prevent shock hazards, the housing of all units should be properly grounded in accordance with the National Electrical Code. A grounding conductor should be wired to the grounding terminal provided on the TDU.
- Caution should be exercised when entering any area that is posted or otherwise assumed to contain hazardous gases. Always follow the guidelines provided by the Occupational Safety and Health Administration for your own protection.

2.2 Connecting the 7660 TFG to a CST

2.2.1 7660 TFG installation diagram

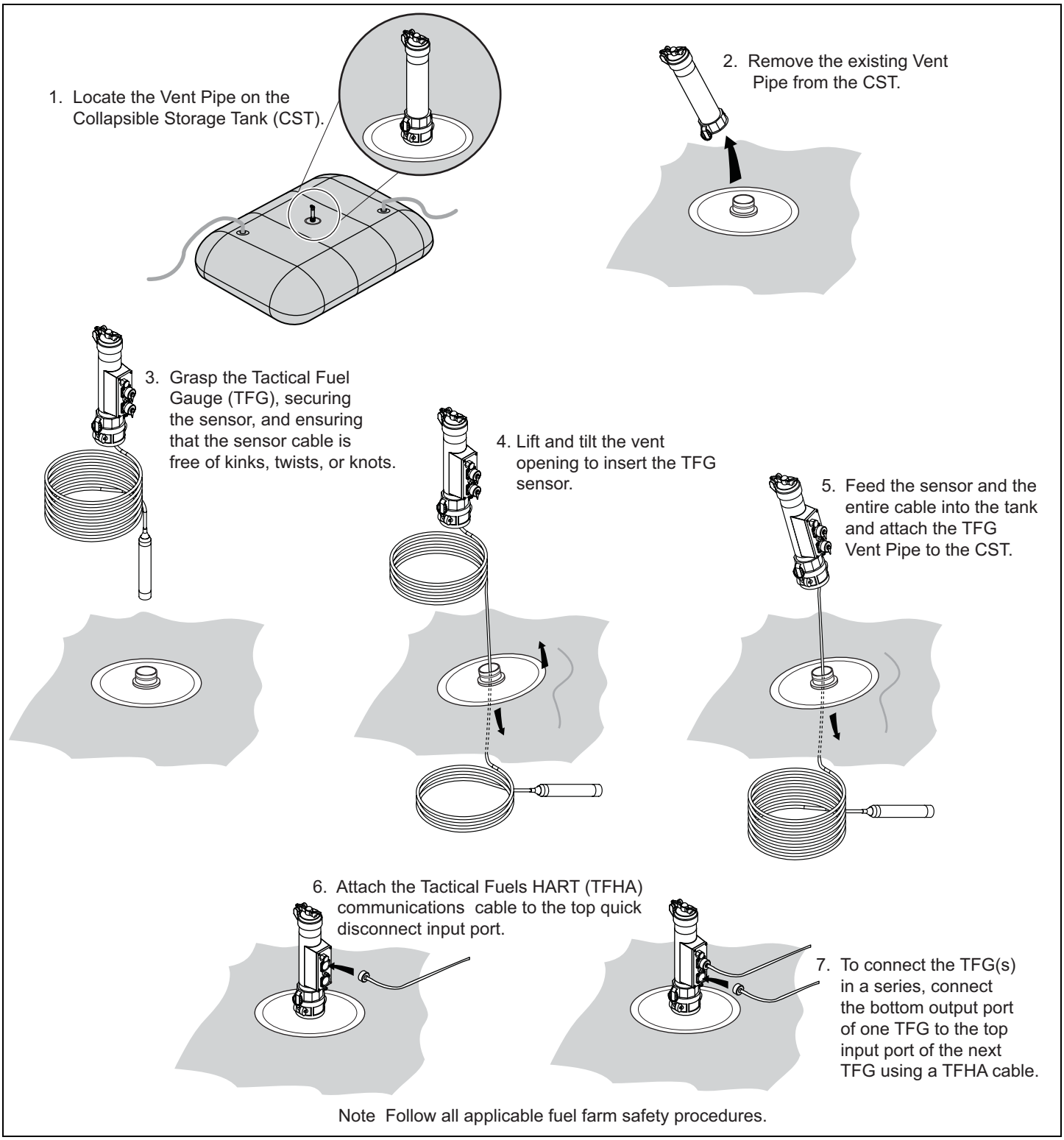

Figure 2-1: 7660 TFG Installation

2.3 Mounting the 8240 TDU to a Grounding Rod

The TDU should be positioned to allow adequate space between the first CST centerline and the TDU. Varec recommends mounting the TDU outside the tank containment area. An optional mounting bracket is supplied to attach the TDU to a grounding rod as shown in Figure 2-2. A TFHAxxxx, where xxxx is equal to the length in feet, power and HART protocol communications cable should then be connected from the TDU HART1 or HART2 position to the first Tactical Fuel Gauge (TFG) in the fuel farm loop, see Figure 2-2.

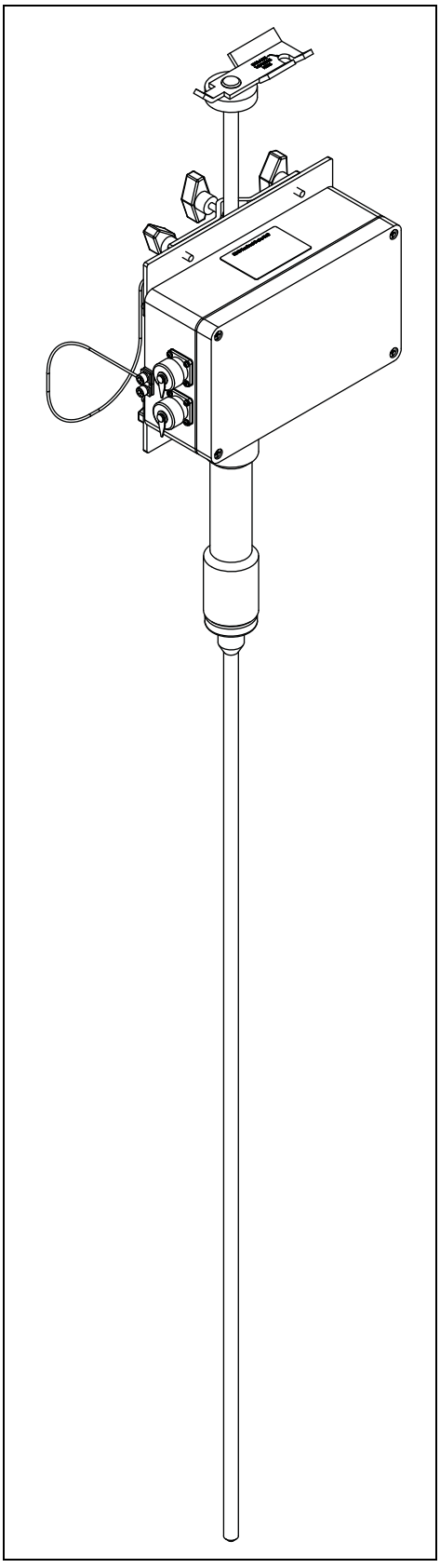

Figure 2-2: 8240 TDU Mounted to a Grounding Rod

The TDU is equipped with an internal intrinsically safe (I.S.) barrier for powering the TFG. The TDU requires positive grounding and is equipped with a ground wire assembly. Each TDU comes equipped with a mounting bracket system that permits mounting to a grounding rod provided with each TacFuels System (if additional grounding rod assemblies are required, contact Varec, Inc.). TDUs should be mounted a minimum of 24 inches off the ground (see Figure 2-2 on page 12 for a TDU mounting example). The standard cable, part number TFHA0150, length to the TFG is 150 feet, which is a direct bury cable. TDUs should be positioned to maximize this distance ensuring that the TDUs are installed outside the tank containment area and positioned away from low lying areas within the fuel storage area that may accumulate fuel vapors. Part Number TFHAC01 is a coupler cable that allows the coupling of 2 standard TFH0150 cables to a 300 feet maximum distance to achieve safe installation conditions in order to accommodate the various TacFuels System layouts permissible.

The TDU provides meter value data upon request via an RS485 connection. FuelsManager uses this data to show the total volume pumped.

Figure 2-3 shows the dimensions of the TDU.

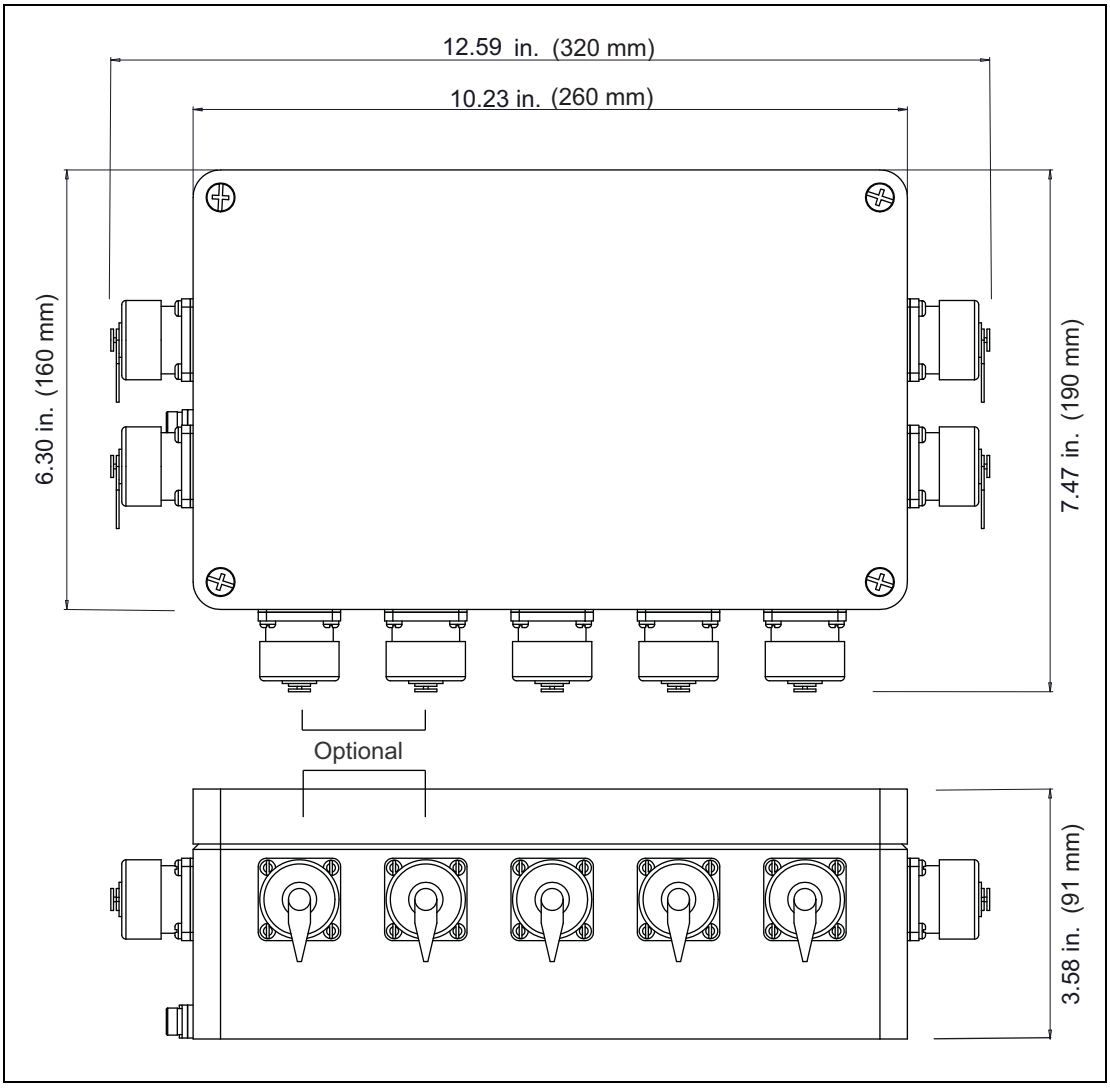

Figure 2-3: TDU Dimensions

Figure 2-4 shows the dimensions of the TIC.

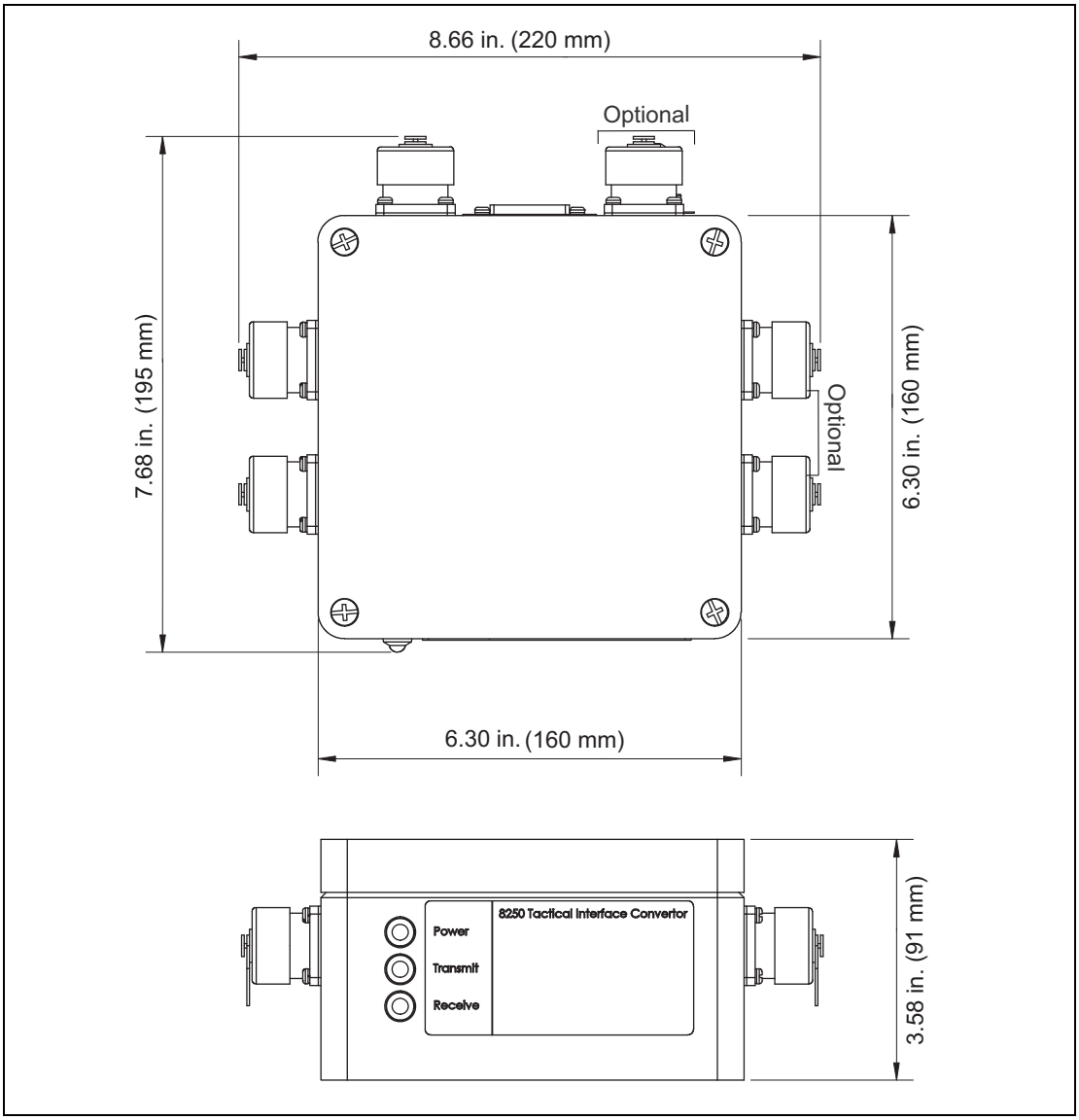

Figure 2-4: TIC Dimensions

2.4 Connecting the RS485 Interface Cable to the TIC

To operate, the TDU must be connected to the powered TIC using an RS485 cable (TF485COMPW). The RS485 cable connects to the top 4-pin RS485 input connector on the TDU as indicated below. See Figure 2-5 on page 16 for an overview of the TDU connections.

Note If extra cable length is required, an RS485 coupler (TF485COMPWC01) and an RS485 communication and power cable (TF485COMPW) may be attached (maximum recommended length should not exceed the overall combined length of 1,000 feet).

1. Align the red dots on the TDU RS485 OUT connector and the RS485 cable.
2. Screw the RS485 cable into the RS485 input connector until there is a snap.

2.5 Connecting the TMC to the TIC

Using a TF232COM cable (included), the RS232 input on the powered TIC connects to the TMC. See Figure 2-5 on page 16 for an overview of the TIC connections.

2.6 Connecting the 8240 TDU to the TIC

To operate, the TDU must be connected to the TIC. See Figure 2-5 on page 16 for an overview of the TDU connections.

2.6.1 TacFuels System system connections diagram

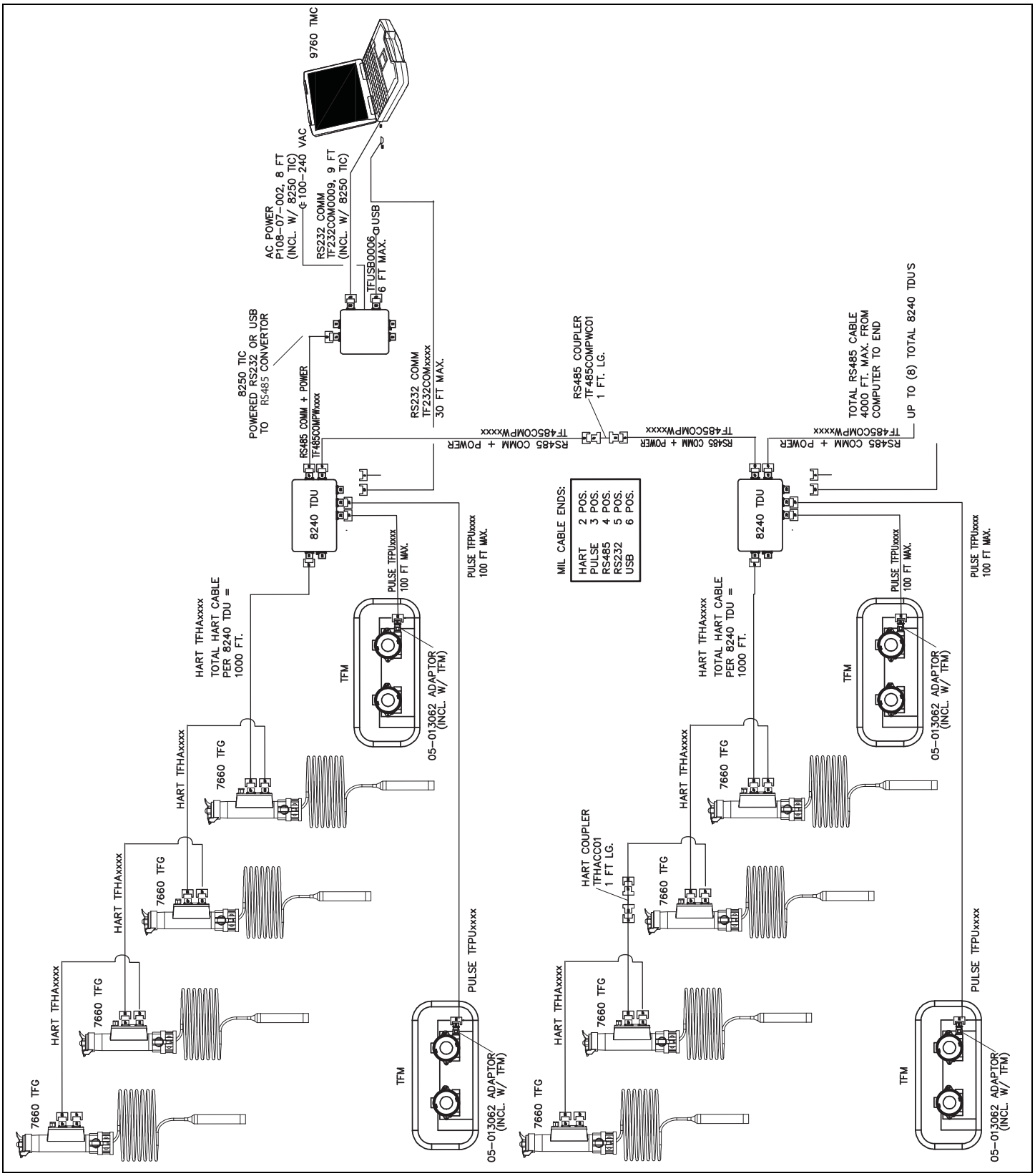

Figure 2-5: TacFuels System System Connections

2.7 Installation of the Tactical Flow Meter (TFM) — Model C-LB45-A

Note TFMs are provided as part of the TacFuels System kits are pre-configured and the password is set to "0".

The C-LB45-A TFM is designed to withstand the rigorous demands of the most remote flow measurement applications. It maintains measurement accuracy and mechanical integrity in a military expeditionary environment from the Arctic to the desert or tropical regions of the world.

The TFM provided with the TacFuels System supports 4" fuel lines (see Figure 1 on page 6 of the *C-LB45-A Meter Assembly Installation & Operation Manual* for the different sizes).

- The TFM supports 50 – 900 GPM flow rates and weighs 43 lbs and is 26.5 x 17 x 12 inches. This unit is equipped with a dual display and a single reset key (one display cannot be reset).

Note The TFM is powered by a single "D" cell lithium battery. A standard alkaline battery can be used to power the meter as long as the battery is kept above -22°F. This is for temporary use only as an alkaline battery will last only a few months depending on the environmental conditions.

The C-LB45-A series TFM is not equipped with an "on/off" button. The meter is always on as long as the battery is installed. If the unit has been in storage and the display(s) are not working, please check the battery. A visual check of the meter is all that is required to verify if there has been any shipping damage.

2.7.1 Pre-installation of the TFM

Prior to installation, the TFM should be checked internally for foreign material and to ensure the turbine rotor spins freely. Fuel hoses should also be checked and cleared of all debris before being attached to the TFM.

Note During transportation, the displayed totalization may be affected. The displayed total should be written down if the data is to be kept. The TFM should then be reset upon arrival at its destination.

Caution! The liquid being measured should be free of any large particles that may obstruct rotation of the rotor. If particles are present, a mesh strainer should be installed upstream before operation of the TFM (see Table 2-1).

Part Number	Strainer Mesh	Clearance	Filter Size
C-LB46-A0006-MIL	20 x 20	.0340	.86mm
C-LB46-A0009-MIL	10 x 10	.0650	1.6mm
C-LB46-A0010-MIL	4 x 4	.1875	4.8mm

Table 2-1: Mesh Strainer

2.7.2 TFM installation safety guidelines

The TFM must be positioned within 100 feet maximum of the supporting TDU during the "Tank Strap" operation.

The TFM must be installed with the female cam lock on the upstream side of the fluid flow. Though the meter is designed to function in any position, it is recommended, where possible, to install it horizontally.

Note All control valves must be located downstream of the TFM. This is true with any restriction in the flow line that may cause the liquid to flash. If necessary, air eliminators should be installed to ensure that the meter is not incorrectly measuring entrained air or gas.

Caution! Damage can be caused by striking an empty meter with a high velocity flow stream.

It is recommended that a minimum length of straight hose, equal to ten (10) hose diameters of straight hose, be installed on the up-stream (female cam lock) side and five (5) diameters on the downstream (male cam lock) side of the TFM. Otherwise, meter accuracy can be affected. Piping should be the same size as the meter bore or threaded port size. Use of reducing or expansion couplers, tees, and wyes is not recommended due to the possibility of decreased accuracy.

Caution! Do not locate the TFM or connection cable close to electric motors, transformers, sparking devices, high voltage lines, or place connecting cable in conduit with wires furnishing power for such devices. These meters are being used to measure highly flammable fluids. Ignition sources could cause these fuels to explode or burn causing serious injury or death. In addition, these devices can induce false signals in the flow meter coil or cable, causing the meter to read inaccurately.

2.7.3 Installing and starting the TFM

Follow the steps below when installing and starting the meter.

Warning! Make sure that fluid flow has been shut off and pressure in the line released before attempting to install the meter in an existing system.

Caution! High velocity air or gas may damage the internal components of the meter.

1. Open upstream isolating the valve slowly to eliminate hydraulic shock while charging the meter with the liquid. Open the valve to full open.
2. Open downstream isolating the valve to permit the meter to operate.
3. Adjust the downstream valve to provide the required flow rate through the meter.

Note The downstream valve may be used as a control valve (see Figure 4: Meter installation utilizing a bypass line and Figure 5: Meter installation without utilizing a bypass line in the *C-LB45-A Meter Assembly Installation & Operation Manual* on pages 10 and 11).

These TFMs include a reset button to reset the total displayed on the monitor. The four-inch TFM includes an additional monitor that is not normally reset. This monitor is designed to keep track of the total fuel usage. To reset the totalized display of the TFM, press the reset button (see Figure 2-6 on page 22 for the location of the reset switch).

2.7.4 Programming using pulse output TFMs

Refer to Fig. 13: Programming menu on page 29 of the *C-LB45-A Meter Assembly Installation & Operation Manual* for the programming menu diagram.

Each TFM and/or repair kit is shipped with ten (10) linearized K-Factor values (see the "General Notes on Scaling" section at the end of the *C-LB45-A Meter Assembly Installation & Operation Manual* on page 30.

Pulse output signals for linear processes (for applications where linearization is not necessary)

Pulse output signals are related to flow rate by a constant, usually referred to as the "K-Factor". The K-Factor is reported as the number of accumulated pulses that represents a particular volume such as gallon or liter. K-Factors are indicated in pulsed per unit volume or counts per unit volume. An example of a K-Factor, normally supplied by the meter's manufacturer, might be 2000 counts per gallon.

The K-Factor is correlated to flow through a simple mathematical relationship

Frequency = K-Factor x Volume per unit of time / 60

Using the previous example of 2000 counts per gallon and further assuming this meter has a maximum flow rate of 25GPM, the formula can be rearranged to calculate the input frequency required for a scaling point as follows:

Frequency = 2,000 x 1 (gallon) / 60 = 33.333Hz at 1 GPM

Given that the meter has a maximum flow rate of 25GPM, the maximum frequency would then be:

Frequency = 2,000 x 25 (gallons) / 60 = 833.333Hz at 25GPM

A programmable display requires at least two (2)points. The first point is going to be zero or minimum flow and the second would normally be the maximum flow rate. For the imaginary TFM used in the example above, the scaling would be as follows:

Input Value for Scaling Point 1 = 0
Display Value for Scaling Point 1 = 0

Input Value for Scaling Point 2 = 833.33
Display Value for Scaling Point 2 = 25

Pulse output signals for non-linear processes (for applications that can benefit from linearization)

Few TFMs actually behave in a linear way. This is always some uncertainty about the “exact” flow at a given reported input value. For many common flow measurement applications the assumption of linear flow is adequate for the process being measured. When higher accuracy is required, a technique called “Linearization” is often employed.

When the TFM is being calibrated, multiple data points are obtained for the particular meter being tested. A typical five (5) point calibration run is displayed in Table 2-2.

GPM	AVG Frequency	UUT Hz Counts/Gallons	UUT K(Hz*60)/NK GPM	ERROR % FS
15.00	769.7	3,078.59	14.90	-0.65
9.06	466.1	3,066.75	9.03	-0.38
5.49	285.2	3,118.64	5.52	0.65
3.32	171.7	3,103.95	3.32	0.17
2.0	103.6	3,101.80	2.01	0.10

UUT = Unit Under Test

Table 2-2: A Typical Five Point Calibration Run

If this meter produced an actual linear output, the K-Factor calculation for the Unit Under Test would be exactly the same for each measurement point. Inspection of the UUT in the example above shows that this is not the case and indicates that this meter is not a perfectly linear device.

Many programmable displays allow for linearization and can provide a better match for the displayed flow values with the actual flow values by incorporating more measurement points. In the example, the unit would be programmed for six (6) points, the five (5) data points and a zero point, and use pairs of input values to accomplish the linearization.

2.7.5 Password protection of the TFM

Password protection prevents unauthorized users from changing the programming information. Initially, the password is set to zeros.

To change the password

1. Press ENTER once at the password prompt. The first digit of the password value will begin to flash.
2. Using the arrow keys, enter the password value
3. Pressing ENTER once will store the password and return to the RST PSWD screen.

Password will allow users to reset total.

2.7.6 Totalizer pulse output

The pulse output parameter can be either enabled or disabled. When enabled, this output generates a 20ms duration pulse for every time the least significant digit of the totalizer increments. The amplitude of the pulse is dependent on the voltage level of the supply connected to the pulse output and is limited to a maximum of 30VDC (see Figure 11: Explosion proof circuit board layout (battery powered) on page 25 of the *C-LB45-A Meter Assembly Installation & Operation Manual*).

2.7.7 Connecting the Varec Pulse Adapter Kit to the Pulse Out on the TFM

Figure 2-6 shows the Pulse Adapter Kit connected to the Pulse Out on the TFM wiring diagram.

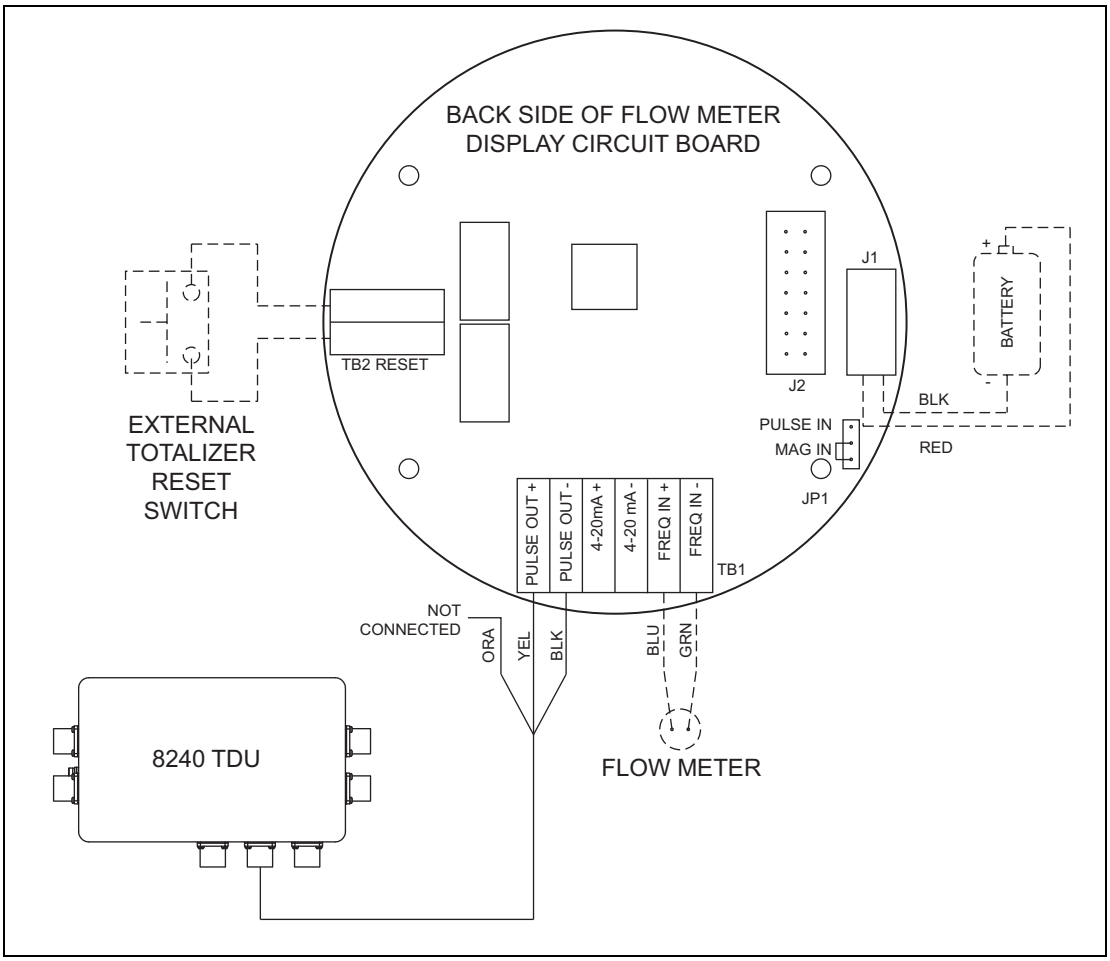

Figure 2-6: TFM Wiring

2.7.8 Connecting the TFM to the 8240 TDU

Table 2-3 describes the wiring of the Varec Pulse Adapter Kit on the TFM Circuit Board.

Wiring on the Varec Pulse Adapter Kit	Pulse Out on the TFM Circuit Board
Yellow	Pulse Out (+)
Black	Pulse Out (-)
Orange (power)	Unused

Table 2-3: TFM Circuit Board Layout

To connect the TFM to the 8240 TDU

Connect the TFM to the Pulse-1 connector on the 8240 TDU (refer to Figure 2-6).

2.8 Connecting Tanks (CST) to the System

2.8.1 Replacing a TDU

To replace a TDU:

Ensure that the new TDU is configured the same as the unit being replaced.

2.8.2 Data flow

Figure 2-7 shows the data flow for the TacFuels System.

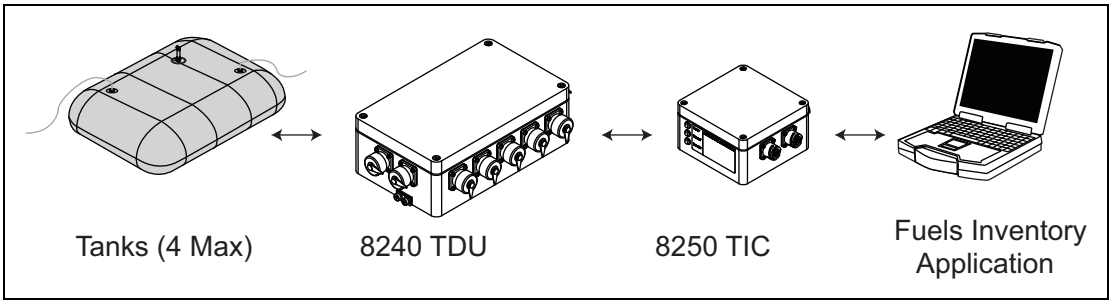

Figure 2-7: Data Flow for the TacFuels System

3 Configuration

3.1 Configuring the Major Components of the 8240 TDU

3.1.1 TDU connectors, switches, LEDs, jumpers, and fuses diagram

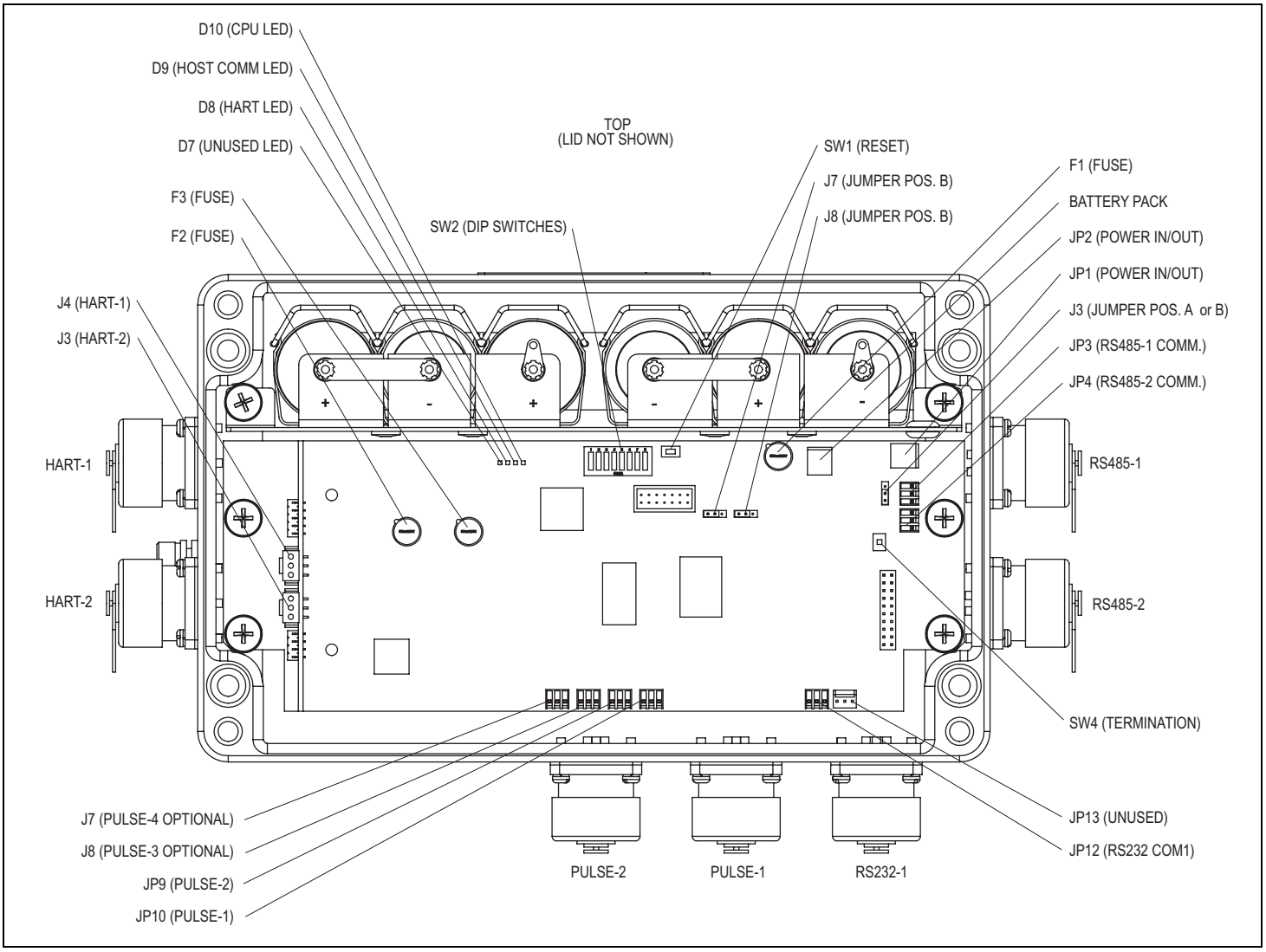

Figure 3-1: 8240 TDU – Internal Wiring

3.1.2 Power connections (2-position connectors)

This section lists the three (3) possible ways to power the TDU. It also describes how to connect them to the power connections on the vertical intrinsically safe (I.S.) board. Please reference Figure 3-1 on page 25 for the major components discussed in this section.

The TDU can be powered by one of the following methods:

1. Battery Power
2. RS485-1 Connector Power
3. RS232-2 Connector Power

If powered by...	Do this...
Battery	Plug the battery pack 2-position connector into either JP1 or JP2 (identical electrically) see “Dip Switch SW2 — RS232 Operation” on page 28.
RS485-1 connector	• Plug the RS485-1 (right-hand side, top connector) into JP1 or JP2. • Plug the RS485-2 (right-hand side, bottom connector) into JP2 or JP1. This allows power to go out to the next TDU in the system.
RS232-1 connector	Plug the RS232-1 (bottom side, right most connector) into JP1 or JP2.

Table 3-1: Power Connections (2-position connectors)

3.1.3 Communication connections (3-position connectors)

This section lists the different communication protocols used with the TDU. It also describes how to connect them to the communication connectors on the vertical I.S. board. Please reference Figure 3-1 on page 25 for the major components discussed in this section.

The TDU uses the following connectors for communication:

- HART-1
- HART-2
- RS485-1
- RS485-2
- RS232-1
- PULSE-1
- PULSE-2
- PULSE-3 (optional)
- PULSE-4 (optional)

If communicating through the...	Do this.....
HART-1 connector	Plug the HART-1 connector into J4.
HART-2 connector	Plug the HART-2 connector into J3.
RS485-1 connector	Plug the RS485-1 connector into JP3.
RS485-2 connector	Plug the RS485-2 connector into JP4.
RS232-1 connector	Plug the RS232-1 connector into JP12 (COM1).
PULSE-1 connector	Plug the PULSE-1 connector into JP10.
PULSE-2 connector	Plug the PULSE-2 connector into JP9.
optional PULSE-3 connector	Plug the optional PULSE-3 connector into JP8.
optional PULSE-4 connector	Plug the optional PULSE-4 connector into JP7.

Table 3-2: Communication Connections (3-position connectors)

3.1.4 Switches

This section lists three (3) different switches used to reset, control the power, and conserve power using DIP switches, etc. on the TDU. It also describes how to set them on the vertical I.S. board. Please reference Figure 3-1 on page 25 and Figure 3-2 on page 29 for the major components discussed in this section.

The TDU uses the following switches:

1. Reset Switch (SW1)
2. DIP Switches (SW2), (see Table 3-3 - Table 3-5 on page 28 for more information on Dip Switch Settings)
3. Termination Switch (SW4)

Reset switch (SW1)

Use switch 1 (SW1) to reset the TDU.

The following tables display how dip switches (SW2) are used for RS485, RS232 operations, and a hard reset.

RS485 Operation								
Switch 1 SW2-1	**Switch 2 SW2-2**	**Switch 3 SW2-3**	**Switch 4 SW2-4**	**Switch 5 SW2-5**	**Switch 6 SW2-6**	**Switch 7 SW2-7**	**Switch 8 SW2-8**	**Comments**
CLOSED	CLOSED	OPEN	OPEN	CLOSED	OPEN	OPEN	OPEN	TDU 0 — MODBUS Address 0 – Do not use
CLOSED	CLOSED	OPEN	OPEN	CLOSED	OPEN	OPEN	CLOSED	TDU 1 — MODBUS Address 1
CLOSED	CLOSED	OPEN	OPEN	CLOSED	OPEN	CLOSED	OPEN	TDU 2 — MODBUS Address 2
CLOSED	CLOSED	OPEN	OPEN	CLOSED	OPEN	CLOSED	CLOSED	TDU 3 — MODBUS Address 3
CLOSED	CLOSED	OPEN	OPEN	CLOSED	CLOSED	OPEN	OPEN	TDU 4 — MODBUS Address 4
CLOSED	CLOSED	OPEN	OPEN	CLOSED	CLOSED	OPEN	CLOSED	TDU 5 — MODBUS Address 5
CLOSED	CLOSED	OPEN	OPEN	CLOSED	CLOSED	CLOSED	OPEN	TDU 6 — MODBUS Address 6
CLOSED	CLOSED	OPEN	OPEN	CLOSED	CLOSED	CLOSED	CLOSED	TDU 7 — MODBUS Address 7

Table 3-3: Dip Switch SW2 — RS485 Operation

RS232 Operation								
Switch 1 SW2-1	**Switch 2 SW2-2**	**Switch 3 SW2-3**	**Switch 4 SW2-4**	**Switch 5 SW2-5**	**Switch 6 SW2-6**	**Switch 7 SW2-7**	**Switch 8 SW2-8**	**Comments**
CLOSED	CLOSED	OPEN	OPEN	OPEN	Not used	Not used	Not used	TDU 1 — MODBUS Address is always 1

Table 3-4: Dip Switch SW2 — RS232 Operation

Hard Reset - (Erases al Strap Table Data, Gauge Address, and Relax factors)								
Switch 1 SW2-1	**Switch 2 SW2-2**	**Switch 3 SW2-3**	**Switch 4 SW2-4**	**Switch 5 SW2-5**	**Switch 6 SW2-6**	**Switch 7 SW2-7**	**Switch 8 SW2-8**	**Comments**
CLOSED	CLOSED	CLOSED	CLOSED	CLOSED	CLOSED	CLOSED	CLOSED	• Closes all switches. • Press and release SW1. • Set all switches for desired operation. • Press and release SW1 again.

Table 3-5: Dip Switch SW2 — Hard Reset

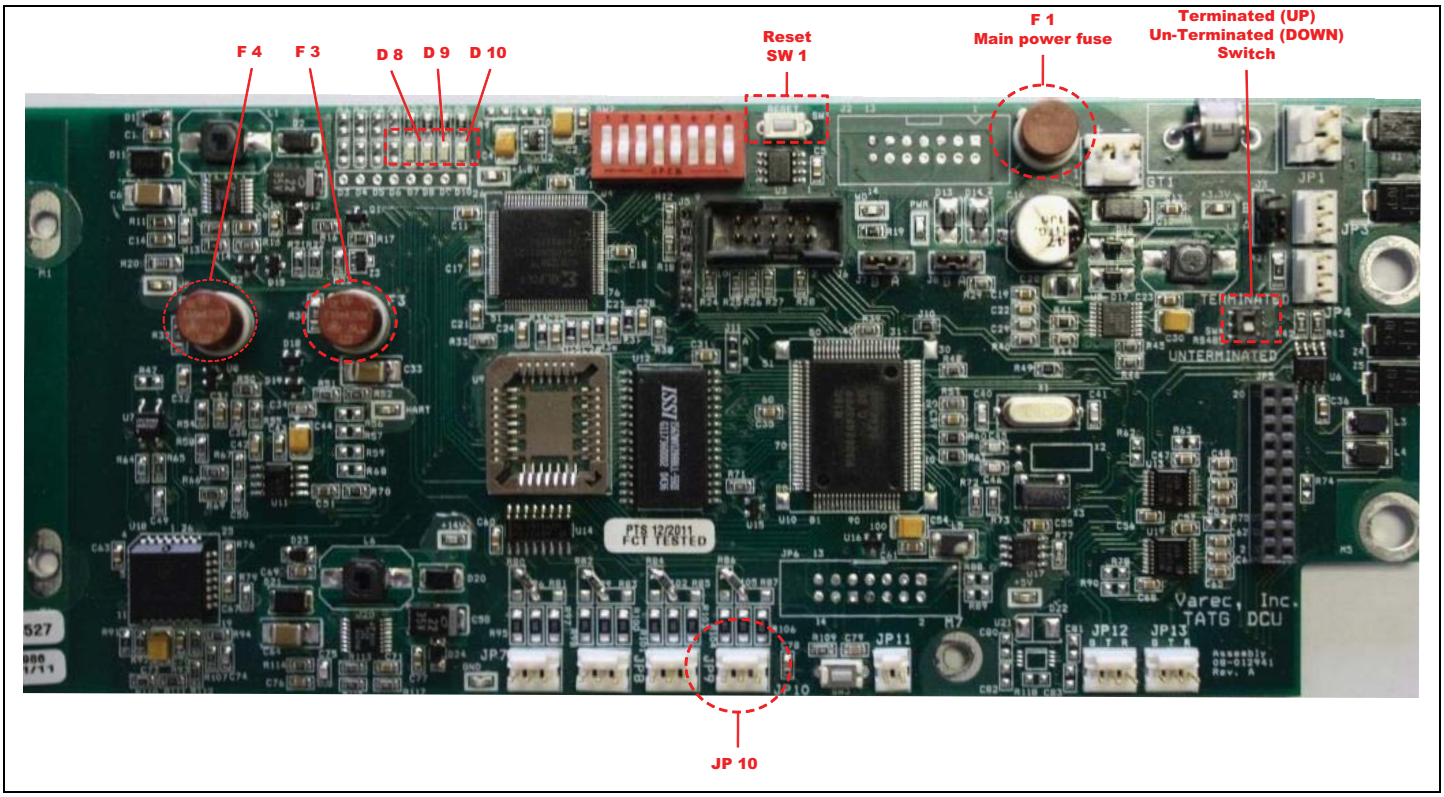

Figure 3-2: 8240 TDU Main Board Layout

The following tables display how dip switches (SW2) are used for continuous power operations and internal battery operations when using the 8250 TIC to power the 8240 TDU (see “Appendix” on page 55 for additional drawings).

Continous Power Operations								
Switch 1 SW2-1	**Switch 2 SW2-2**	**Switch 3 SW2-3**	**Switch 4 SW2-4**	**Switch 5 SW2-5**	**Switch 6 SW2-6**	**Switch 7 SW2-7**	**Switch 8 SW2-8**	**Comments**
CLOSED	CLOSED	CLOSED	OPEN	CLOSED	OPEN	OPEN	OPEN	TDU 0 — MODBUS Address 0 - Do not use
CLOSED	**CLOSED**	**CLOSED**	**OPEN**	**CLOSED**	**OPEN**	**OPEN**	**CLOSED**	**TDU 1 — MODBUS Address 1**
CLOSED	CLOSED	CLOSED	OPEN	CLOSED	OPEN	CLOSED	OPEN	TDU 2 — MODBUS Address 2
CLOSED	CLOSED	CLOSED	OPEN	CLOSED	OPEN	CLOSED	CLOSED	TDU 3 — MODBUS Address 3
CLOSED	CLOSED	CLOSED	OPEN	CLOSED	OPEN	OPEN	OPEN	TDU 4 — MODBUS Address 4
CLOSED	CLOSED	CLOSED	OPEN	CLOSED	CLOSED	OPEN	CLOSED	TDU 5 — MODBUS Address 5
CLOSED	CLOSED	CLOSED	OPEN	CLOSED	CLOSED	CLOSED	OPEN	TDU 6 — MODBUS Address 6
CLOSED	CLOSED	CLOSED	OPEN	CLOSED	CLOSED	CLOSED	CLOSED	TDU 7 — MODBUS Address 7

Table 3-6: Dip Switch SW2 — Continuous Power Operations

Note To prevent communication conflicts experienced in direct power applications using the 8250 TIC, set SW2-3 to the CLOSED position. This prevents the TDU from cycling in and out of "sleep" mode.

Internal Battery Operations								
Switch 1 SW2-1	**Switch 2 SW2-2**	**Switch 3 SW2-3**	**Switch 4 SW2-4**	**Switch 5 SW2-5**	**Switch 6 SW2-6**	**Switch 7 SW2-7**	**Switch 8 SW2-8**	**Comments**
CLOSED	CLOSED	OPEN	OPEN	CLOSED	OPEN	OPEN	OPEN	TDU 0 — MODBUS Address 0 - Do not use
CLOSED	CLOSED	OPEN	OPEN	CLOSED	OPEN	OPEN	CLOSED	TDU 1 — MODBUS Address 1
CLOSED	CLOSED	OPEN	OPEN	CLOSED	OPEN	CLOSED	OPEN	TDU 2 — MODBUS Address 2
CLOSED	CLOSED	OPEN	OPEN	CLOSED	OPEN	CLOSED	CLOSED	TDU 3 — MODBUS Address 3
CLOSED	CLOSED	OPEN	OPEN	CLOSED	OPEN	OPEN	OPEN	TDU 4 — MODBUS Address 4
CLOSED	CLOSED	OPEN	OPEN	CLOSED	CLOSED	OPEN	CLOSED	TDU 5 — MODBUS Address 5
CLOSED	CLOSED	OPEN	OPEN	CLOSED	CLOSED	CLOSED	OPEN	TDU 6 — MODBUS Address 6
CLOSED	CLOSED	OPEN	OPEN	CLOSED	CLOSED	CLOSED	CLOSED	TDU 7 — MODBUS Address 7

Table 3-7: Dip Switch SW2 — Internal Battery Operations

Note SW2-3 controls the "sleep" mode of the TDU. When set to the OPEN position, the TDU powers down, conserving power consumption when operating under internal battery power. This setting has presented communication conflicts when continuous power is supplied by the 8250 TIC for 24/7 CST monitoring.

DIP switches (SW2)

Note Please refer to Table 3-3 on page 28 through Table 3-7 on page 30 for more information about DIP switch (SW2) settings.

Use DIP switch #1 (SW2-1) for LED power.

1. If the TDU is battery powered, turn off (OPEN) DIP switch #1 (SW2-1) when not using the LEDs to conserve power.
2. If the TDU is externally powered, either position is acceptable:
   - Off (OPEN) turns off the LEDs
   - On (CLOSED) turns on the LEDs
3. Use DIP switch #2 (SW2-2) for sleep mode (on/off):
   - Allows the TDU to go into sleep mode to conserve power
   - Confirms On (CLOSED) position
4. Use DIP switch #3 (SW2-3) for internal use only.
   - Confirms Off (OPEN) position
5. Use DIP switch #4 (SW2-4) for internal use only.
   - Confirms Off (OPEN) position
6. Use DIP switch #5 (SW2-5) for RS232 and RS485 communication protocols.
   - RS232 mode — Off (OPEN) position
   - RS485 mode — On (CLOSED) position
7. Use DIP switches #6, #7, and #8 (SW2-6, SW2-7 and SW2-8) for RS232 binary address.
   - If SW2-5 is CLOSED (RS232 mode), then the positions of these switches do not matter (DON'T CARE).
   - Enter the TDU binary address from zero (000=all OPEN) - seven (111 all CLOSED). SW2-6 is the most significant bit and SW2-8 is the least significant bit.
8. Use Termination Switch (SW-4)
   - If the TDU is the last one in the line, then set SW4 to "Terminated" (upwards) position
   - If the TDU is not the last one in the line, then set SW4 to "Unterminated" (downwards) position

LEDs

Use the following LEDs as follows:

1. D7 — Internal use only
2. D8 — HART
   - Pulses on/off when communicating
   - Continuously on or off indicates that there is a problem communicating
3. D9 — Communication to the HOST
   - Pulses on/off when communicating
   - Continuously on or off indicates that there is a problem communicating
4. D10 — CPU
   - Pulses on/off when CPU is active
   - Continuously on or off indicates that the CPU is locked up and needs to be reset (SW1)

3.1.5 Jumpers (factory set) — only needed when troubleshooting

- Confirms that J3 is in position A (lower two pins) or position B (upper two pins)
  - The jumper must be installed but its position does not matter (DON'T CARE)
- Confirms that J7 is in position B (left two pins)
- Confirms that J8 is in position B (left two pins)

3.1.6 Fuses

There are three (3) replaceable fuses (part # P117-01-006) (refer to Section 4.1.2, "8240 TDU spare parts list" on page 39 for more information about the fuses on the board). Please refer to Figure 3-1 on page 25 for the location of the fuses).

3.2 Configuring the Major Components of the 8250 TIC

3.2.1 TIC connectors, switches, LED indicators, and fuses diagram

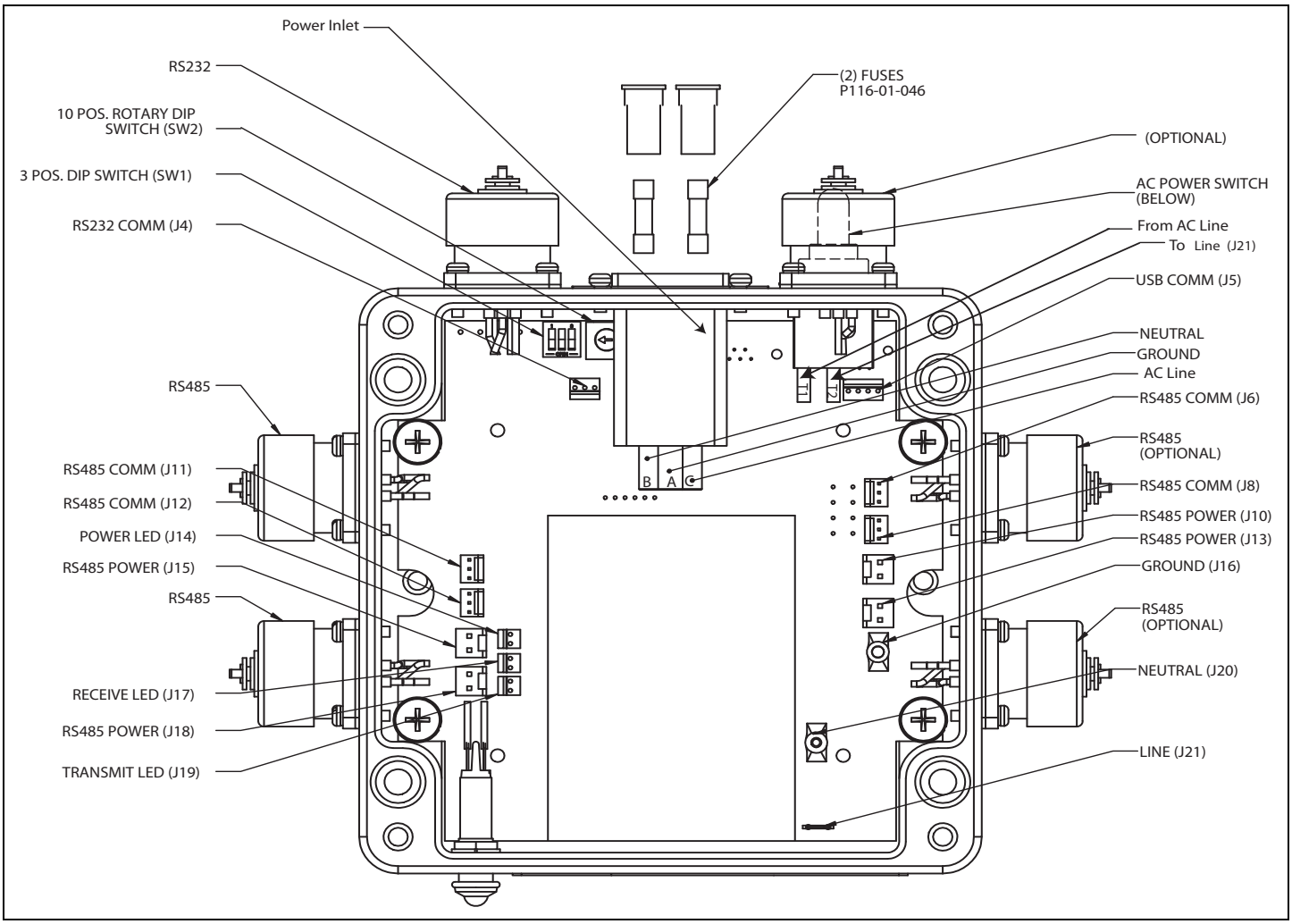

Figure 3-3: 8250 TIC - Internal Wiring

3.2.2 AC power connections (2-position connectors)

This section describes how to connect the AC power supply to the AC connectors on the TIC. Please reference Figure 3-3 for the major components discussed in this section.

Note The 8250 TIC has a universal power supply rated 100 - 240 VAC.

AC Power Supply	Do this.....
Switch "T1"	Plug into Power Inlet "C".
Power Inlet "A"	Plug into Ground (J16).
Power Inlet "B"	Plug into Neutral (J20).
Switch "T2"	Plug into Line (J21).

Table 3-8: AC Power Connections (2-position connectors)

3.2.3 Communication connections (3-position connectors)

This section lists the different communication protocols used with the TIC. Please reference Figure 3-3 on page 33 for the major components discussed in this section.

The TIC uses the following connectors for communication.

- RS485 (2 standard and 2 optional)
- RS232
- USB (optional)

Note The TIC can supply power to the TDU through the RS485 interface cable.

3.2.4 LED indicators

This section lists the three (3) LED indicators used with the TIC. Please reference Figure 3-3 on page 33 for the major components discussed in this section.

1. Power LED
2. Transmit LED
3. Receive LED

3.2.5 Switches

This section lists the three (3) different switches used with the TIC. Please reference Figure 3-3 on page 33 for the major components discussed in this section.

The TIC uses the following switches:

1. Power switch - Turns the power on the TIC ON or OFF.
2. Rotary switch (10-positions) SW2 (sets the baud rate)
   Verify that position 5 is set to the **default baud rate** of **9600** (see Table 3-9 for other possible baud rate settings).
3. RS485 Bias and Termination (3-position DIP switches) - SW1 and SW2 set the bias voltage. SW3 sets the impedance. Verify that all 3 positions are set to CLOSED.

Table 3-9 lists all the possible baud rate settings for the rotary switch (SW2).

SW2 Position	Baud Rate Setting
0	300 Baud
1	600 Baud
2	1200 Baud
3	2400 Baud
4	4800 Baud
5	**9600 Baud**
6	19200 Baud
7	38400 Baud
8	57600 Baud
9	115200 Baud

Table 3-9: Rotary Switch (SW2) - Baud Rate Settings

3.2.6 Fuses

There are two (2) replaceable fuses (part # P116-01-046) located on the power connector of the TIC (refer to Section 4.2.2, "8250 TIC spare parts list" on page 40 for more information about the fuses). Please refer to Figure 4-2 on page 40 for the location of the fuses

4 Maintenance

To maintain the TacFuels System components, remove them from the TacFuels System, clean, and then replace.

Caution! The TFG vent pipe's upper chamber breather could become clogged during harsh weather (for example sandstorms).

Warning! Maintenance should be performed only by authorized personnel.

Warning! Disconnect the TMC before performing system maintenance and terminate the system power.

4.1 8240 TDU Spare Parts and Assembly

4.1.1 TDU assembly diagram

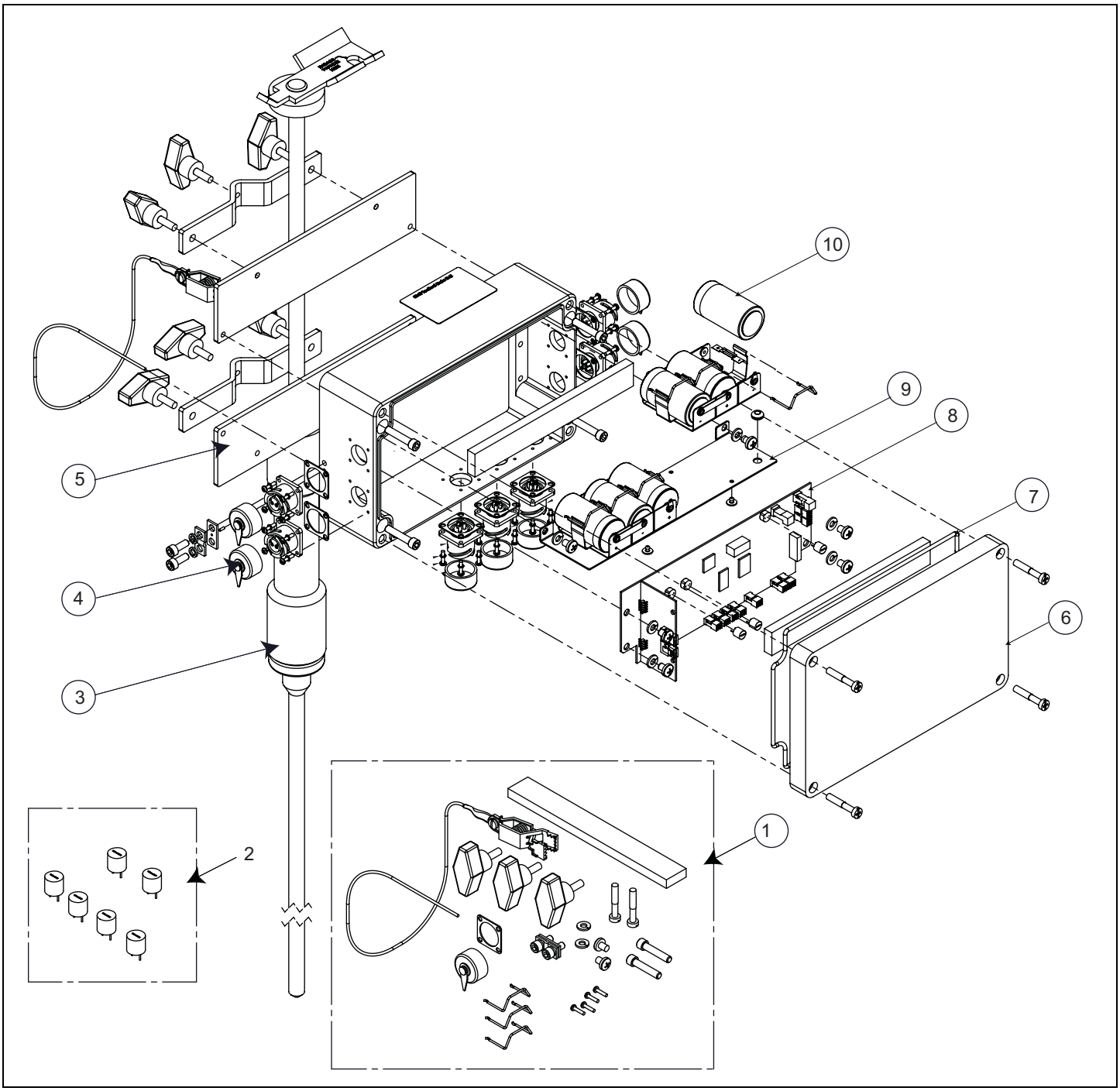

Figure 4–1: 8240 TDU Assembly

4.1.2 8240 TDU spare parts list

Item Number	Part Number	Quantity	Description
1	13-012992		8240 TDU - Hardware Kit
2	13-012993		8240 TDU - Fuse Kit
3	P49-275	1	Grounding Rod — 68" with Slide Hammer
4	P102-02-100	7	MIL Connector Dust Cap
5	05-012985	1	8240 TDU - Mounting Bracket Assembly
6	02-012973-LID	1	8240 TDU - Enclosure Cover
7	P015-01-033	1	8240 TDU - Enclosure Gasket
8	08-012986	1	8240 TDU - Multiboard PCB Assembly
9	05012980	1	8240 TDU - Battery Pack Assembly (optional)
10	P117-01-006	6	Battery, D-Cell (sold separately and within Battery Pack Assembly) (optional)

Table 4-1: 8240 TDU Spare Parts List

4.1.3 8240 TDU accessories

Part Number	Description
P49-276	Grounding Rod — A-A-55804, Type III, Class B

Table 4-2: 8240 TDU Accessories

4.2 8250 TIC Spare Parts and Assembly

4.2.1 8250 TIC fuse location diagram

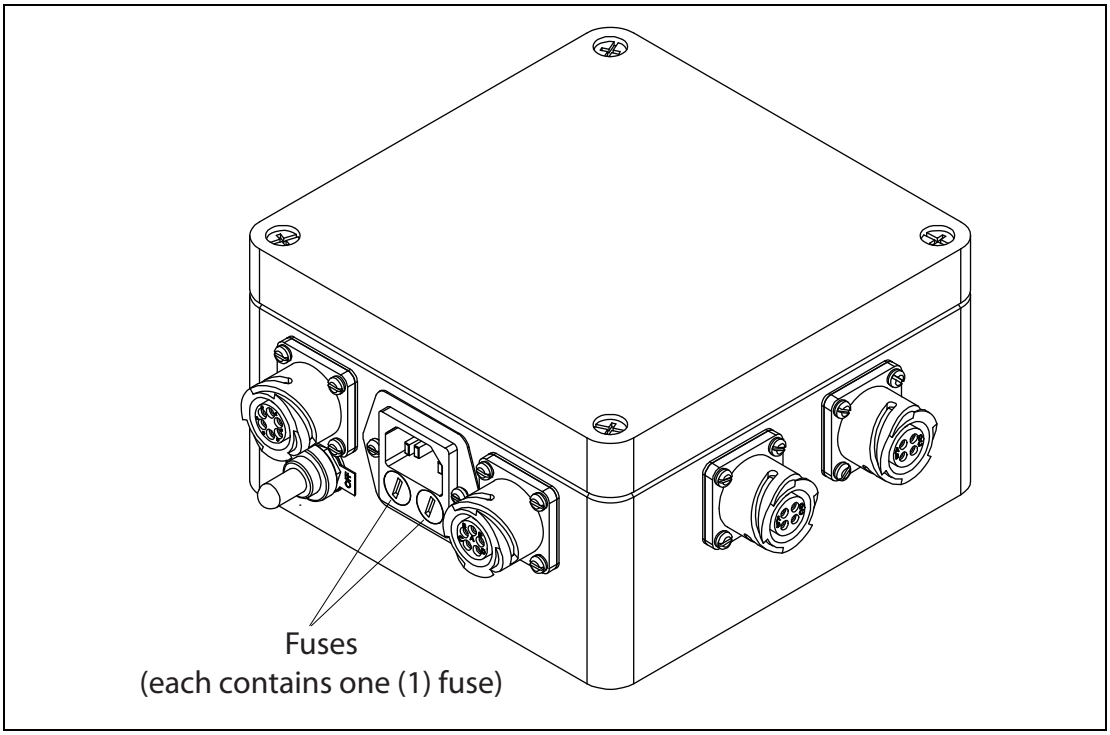

Figure 4-2: 8250 TIC - Fuse Location

4.2.2 8250 TIC spare parts list

Item Number	Part Number	Quantity	Description
1	P108-07-002	1	Power Cable (125 VAC, IEC 60320 C13 x NEMA 5-15)
2	13-013167		8250 TIC - Fuse Kit 10 PCS, 3.15A 250 V TLAG IEC 5 x 20 mm
3	P102-02-100	6	MIL Connector Dust Cap
4	TFUSB0006	1	USB Cable
5	TF232COM0009	1	RS232 Communication Cable

Figure 4-3: 8250 TIC Spare Parts List

4.3 Replacing Fuses

4.3.1 Replace a fuse on the 8240 TDU

Warning! Explosion Hazard. To prevent an ignition of a flammable atmosphere, do not disconnect the battery pack assembly from the TDU unless the area is known to be non-hazardous.

1. Remove the cover of the TDU.
2. Using needle-nosed pliers, remove fuse 1 (F1), fuse 2 (F2), or fuse 3 from the main PCB board fuse holder and replace it with a new fuse. To locate the fuse holder, refer to Figure 3-1 on page 25.

4.3.2 Replace a fuse on the 8250 TIC

Using a flathead screwdriver, remove the fuse from the fuse holder and replace it with a new fuse. To locate the fuse holder, refer to Figure 4-2 on page 40.

Note If the TIC does not power up, check both fuses.

4.4 Replacing the Battery Pack Assembly on the 8240 TDU

This section describes how to remove and replace the battery pack assembly.

Warning! Explosion Hazard. To prevent an ignition of a flammable atmosphere, do not disconnect the battery pack assembly from the TDU unless the area is known to be non-hazardous.

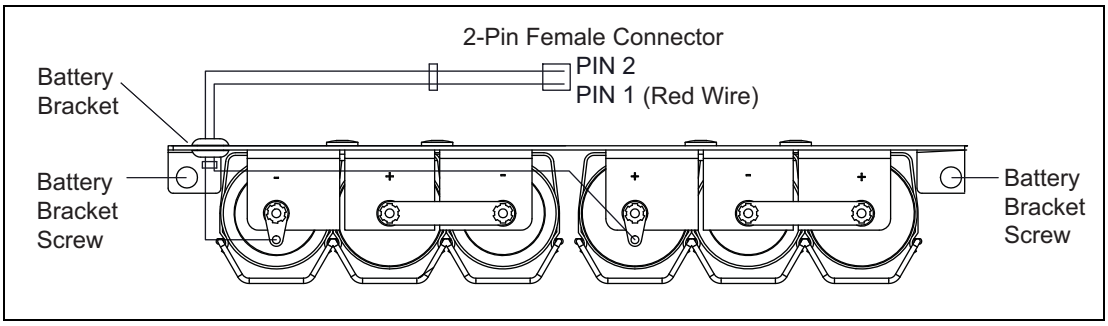

Figure 4-4: 8240 TDU Battery Pack Assembly

1. Disconnect the TMC from the TDU (the unit should be in sleep mode).
2. Remove the TDU cover.
3. Unplug the red wire from the 2-pin female connector on the processor board.
4. Using a Philips screwdriver, remove the battery bracket mounting screws.
5. Remove the battery pack assembly from the battery bracket and replace it with a new battery pack assembly (battery pack assembly includes 6 D-cell batteries). To locate the battery bracket, refer to Figure 1-2 on page 4.
6. Using a Philips screwdriver, replace the battery bracket mounting screws.
7. Plug the red wire back into the 2-pin female connector on the processor board.
8. Replace the TDU cover.

4.5 Battery Replacement on the TFM

Battery powered monitors use a single 3.6V, D size, lithium battery. When replacement is necessary, use a clean fresh battery to ensure continued trouble-free operation. It is recommended that the total be saved to memory before the battery is removed (see "Store Total" in the programming section on page 24 of the *C-LB45-A Meter Assembly Installation & Operation Manual)*.

Warning! Do not open enclosure unless the area is known to be free of hazards. Failure to make the area safe before opening the enclosure can result in a hazardous situation with a potential for injury.

4.5.1 Replacing the battery on the TFM

1. Carefully unscrew the enclosure cover to access the circuit board.
2. Remove the four (4) screws securing the circuit board to the enclosure.
3. Lay the circuit board to the side being careful not to pull any wires from their connections.
4. Clip the battery retaining wire/strap and remove the battery.
5. Replace the battery being sure to observe the proper polarity and install the new retaining strap or wire.
6. Reassemble the monitor reversing the disassembly process.

4.6 TDU Board Replacement Instructions

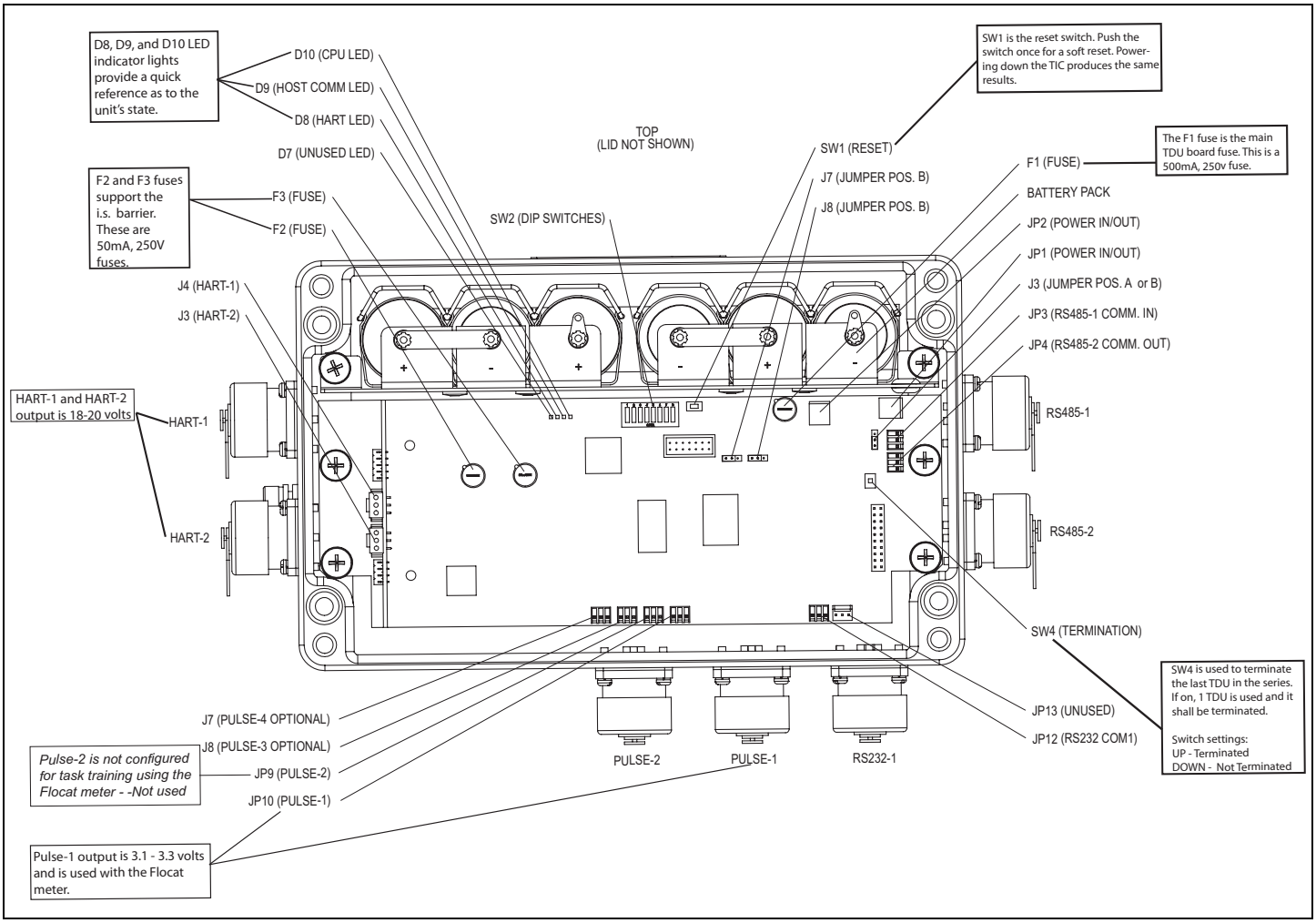

Figure 4-5: Instructions for Replacing the TDU Board

Problem: Cannot find the TFG when executing a search from FuelsManager (FM)
Step 1: Check to see if the LED at D8 is blinking. This indicates that the board is powered. If no LED is detected, go to Step 2.
Step 2: Check F3 and F4 (50mA, 250v) fuses. A good fuse will read < 10 ohms when checked with an ohm meter.
Step 3: Check with a multi meter at the connector (HART-1 and HART-2). The output from A and B should read 18 to 20 DC volts. If the problem persists, go to Step 4.
Step 4: HART-1 is connected to J3 and HART-2 isconnected to J4. Remove the connector and test the outboard pins, 18 - 20 DC volts indicates that the I.S. barrier fuse is good. 0 DC volts indicate that the I.S. barrier is blown. Replace the TDU board. Return the board to Varec, Inc. for an RMA.

Problem: IM receiving no meter pulse when employing the instrument (FloCat) TacFuels Meter
Step 1: Check the TDU Pulse-1 connection with a multi meter. A good output will read 3.1 to 3.3 DC volts. This can also be checked at the FloCat meter by disconnecting the pulse adapter wires. Pulses can be generated by touching the wires together. If receiving 3.1 to 3.3 volts and pulses can be manually generated by touching the disconnected wires, a faulty meter may be the root cause.

Follow the steps below to replace the TDU board.

1. Disconnect all cables and remove the TDU from the grounding rod.
2. Replace the cables, dust plugs, and caps.
3. Remove the TDU from the field to a clean/dry facilicity to perform the internal repairs/ inspection.
4. Remove the TDU cover.
5. Inspect the lid for the condition of the lid and the condition of the gasket.
6. Confirm dip switch MODBUS address IAW - the continuous power operations.
7. Verify that nothing is shorting the connector pins and that none of the pins are touching each other.
8. Verify that the power connectors JP1 and JP2 from the RS485 IN and OUT, that the communication connections JP3 and JP4 are attached to the sockets on the board, and that they are in the correct sockets and are not in reverse order (see Figure 4-5 above).
9. Pull fuses F3 and F4 off the board and check with an ohm meter (see Step 2 on page 44).
10. Disconnect all plugs from the TDU board sockets.
11. Remove the board mounting screws.
12. Remove the board.
13. Replace the TDU board.
14. Insert the mounting screws.

    Note Use caution when handling the board to prevent damage.

15. Reconnect all plugs to board sockets as follows:
    - JP1 (POWER IN) to RS485-1 (IN) (see Figure 4-5 on page 44 to locate JP1 and RS485-1 (IN) on the TDU).
    - JP2 (POWER IN) to RS485-2 (OUT) (see Figure 4-5 on page 44 to locate to JP2 and RS485-2 (OUT) on the TDU).
    - JP3 (RS485-1 COMM IN) (see Figure 4-5 on page 44 to locate JP3 (RS485-1 COMM IN) on the TDU).
    - JP4 (RS485-2 COMM OUT) (see Figure 4-5 on page 44 to locate JP4 (RS485-2 COMM OUT) on the TDU).
    - JP10 to PULSE-1 (see Figure 4-5 on page 44 to locate JP10 and PULSE-1on the TDU).
    - J4 to HART-1 (see Figure 4-5 on page 44 to locate J4 and HART-1 on the TDU).
    - J3 to HART-2 (see Figure 4-5 on page 44 to locate J3 and HART-2 on the TDU).

4.6.1 TIC Power Validation

Check the TIC power output before attaching to the TDU

1. Verify the power coming out of the TIC's RS485 connector. A reading of 24v DC should be received when placing the voltmeter's red probe on the pin that is connected to the red wire, and the voltmeter's black probe on the pin that is connected to the black wire.
2. Perform a continuity check on the RS485 cable. Check that pin "A" on the female end is connected to pin "A" on the male end, make sure to get a resistance reading. Now touch pin "A" on either end with one meter probe and touch the other meter probe to any part of the metal connector casing, make sure there is **not** a reading (this ensures that there is not a short on that wire).
3. Repeat Step 2 above for pins B, C, and D.

4.7 Removing the 7660 TFG from a CST

4.7.1 7660 TFG removal diagram

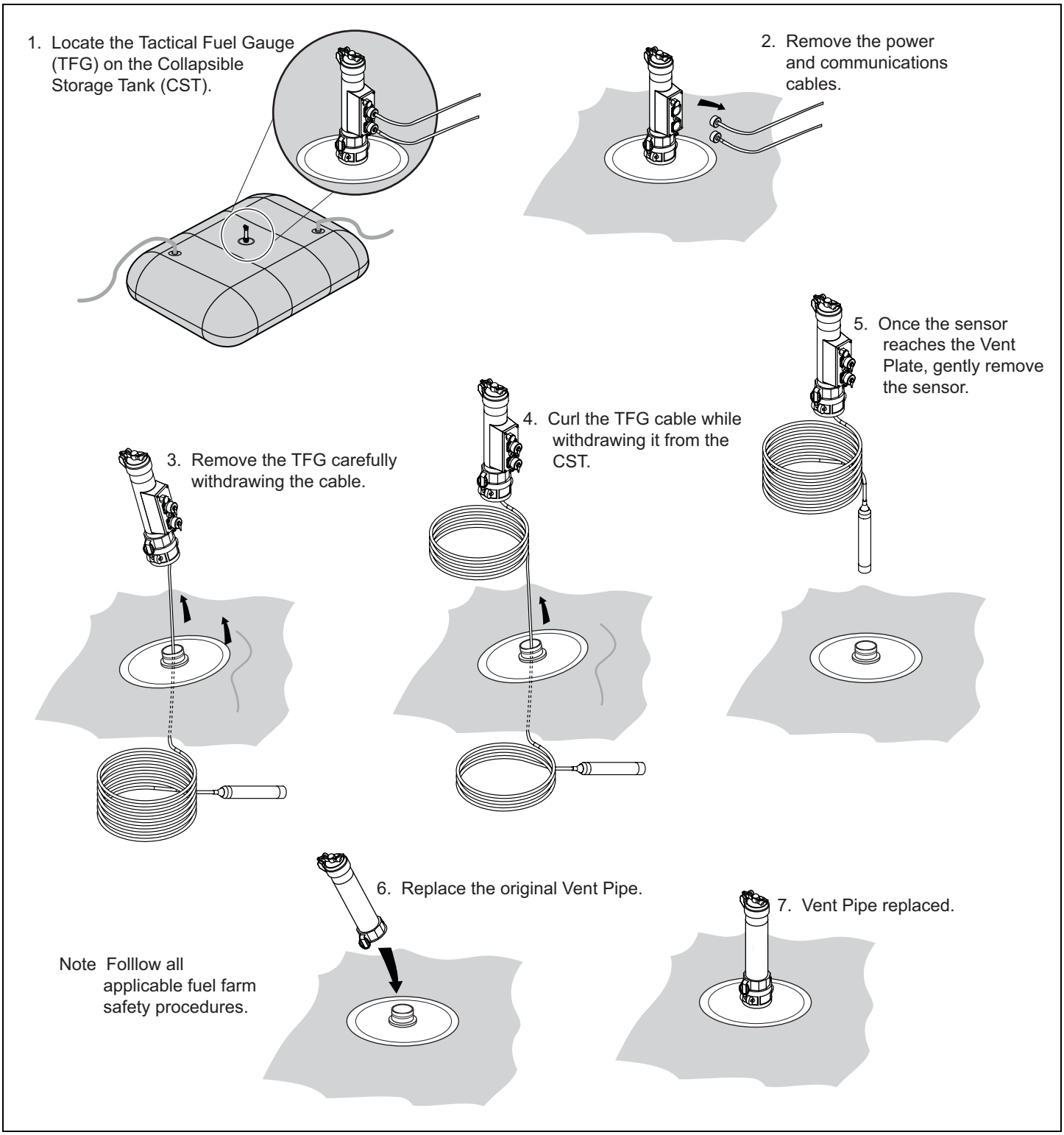

Figure 4-6: 7660 TFG Removal

5 Specifications

This section lists the specifications for the following TacFuels System components:

- 8240 Tactical Data Unit (see page 49 – page 50)
- 8250 Tactical Interface Convertor (see page 51 – page 52)
- 7660 Tactical Fuel Gauge (see page 53 – page 54)
- 9760 Tactical Mobile Computer (see page 54)
- Tactical Flow Meter (see page 54)

5.1 8240 Tactical Data Unit

The following sections list the specifications for the 8240 Tactical Data Unit (see Section 5.1.1 – Section 5.1.5).

5.1.1 Data Transmission

Item	Description
Protocol	MODBUS
Pulse Accumulator Channels	4 (2 standard + 2 optional)

5.1.2 Environmental

Item	Description
Operating Temperature	-40 °F to +167 °F (-40 °C to +75 °C)
Humidity	5 to 95% (non-condensing)
Lightning Protection	Solid state transient voltage suppressors, current limiting resistors and fuses.

5.1.3 Power Supply

Item	Description
Operating Voltage	8 – 36 VDC
Power Consumption	25 mA

5.1.4 Mechanical Construction

Item	Description
Material	Powder coated aluminium
Mounting	Wall mounted
Dimensions	10.2" x 6.3" x 3.6" (260 x 160 x 90 mm)

5.1.5 Input/Output

Item	Description
HART	2-position terminal, fused
Pulse Input	• 4 channels available • 3 to 30 VDC voltage range • 30 KHz pulse frequency limit • 3-position, plub-able terminal block

5.2 8250 Tactical Interface Convertor

The following sections list the specifications for the 8250 Tactical Interface Convertor (see Section 5.2.1 – Section 5.2.6).

5.2.1 Data Transmission

Item	Description
Protocol	RS232/RS485

5.2.2 Environmental

Item	Description
Operating Temperature	-22 °F to +140 °F (-30 °C to +60 °C)
Humidity	5 to 95% (non-condensing)
Lightning Protection	Solid state transient voltage suppressors, current limiting resistors and fuses.

5.2.3 Power Supply

Item	Description
Operating Voltage	100 to 240 VAC

5.2.4 Mechanical Construction

Item	Description
Material	Powder coated aluminium
Mounting	Desk mounted
Dimensions	6.3" x 6.3" x 3.6" (160 x 160 x 90 mm)

5.2.5 Indicators

Item	Description
LED Indicators	Sealed LEDs indicating when the unit is: • Powered ON • Actively transmitting data to the host computer • Actively receiving data from the host computer

5.2.6 Input/Output

Item	Description
Ports	• 2 RS485 standard ports • 2 additional RS485 ports (optional) • 1 USB (optional)

5.3 7660 Tactical Fuel Gauge

The following sections list the specifications for the 7660 Tactical Fuel Gauge (see Section 5.3.1 – Section 5.3.5).

5.3.1 Data Transmission

Item	Description
Protocol	4 – 20 mA (HART)

5.3.2 Environmental

Item	Description
Operating Temperature	–4 °F to +176 °F (–20 °C to +80 °C)
Ambient Temperatures	• Vent pipe and cable –40 °F to +185 °F (–40 °C to +85 °C) • Sensor –4 °F to +176 °F (–20 °C to +80 °C) • Storage and transport –4 °F to +176 °F (–20 °C to +80 °C)
Humidity	5 to 95% (non-condensing)

5.3.3 Power Supply

Item	Description
Operating Voltage	9.6 to 36 VDC
Consumption	4 mA

5.3.4 Sensor Element

Item	Description
Mounting	Vent Pipe
Material	• Sensor – 1.4462 Duplex • Measuring cell seal – FFKM (Perlast G75S) • Suspension cable – FEP
Pressure Measurement	• Measuring range 0 to 0.2 bar (0 to + 20 kPa)
Temperature Measurement Specifications	• Integrated resistance thermometer Pt 100 according to DIN EN 60751 • Range: –58 to +212 °F (–50 to +100 °C) • Resolution: 1°K
Dimensions	1.25Ø x 7.5" long – 13’ cable (32Ø x 190 mm long – 4m cable)
Protection	IP68 (30 bar)

5.3.5 Vent Pipe Housing

Item	Description
Material	Powder coated aluminium
Mounting	Standard 2" NPT mounting
Dimensions	4.25 x 5.5 x 15" (108 x 140 x 380 mm)
Electrical Connections	YG95 234/MIL-C-5015 Bayonet Quick Disconnects (x2)

5.4 9760 Tactical Mobile Computer

Please refer to the *C-LB45-A Fuel Meter Assembly Installation & Operation Manual* for the latest specifications for this product.

5.5 Tactical Flow Meter

Please contact a Varec sales respresentative for the latest specifications for this product.

A Appendix

This section lists some additional drawings for printing purposes when troubleshooting in the field.

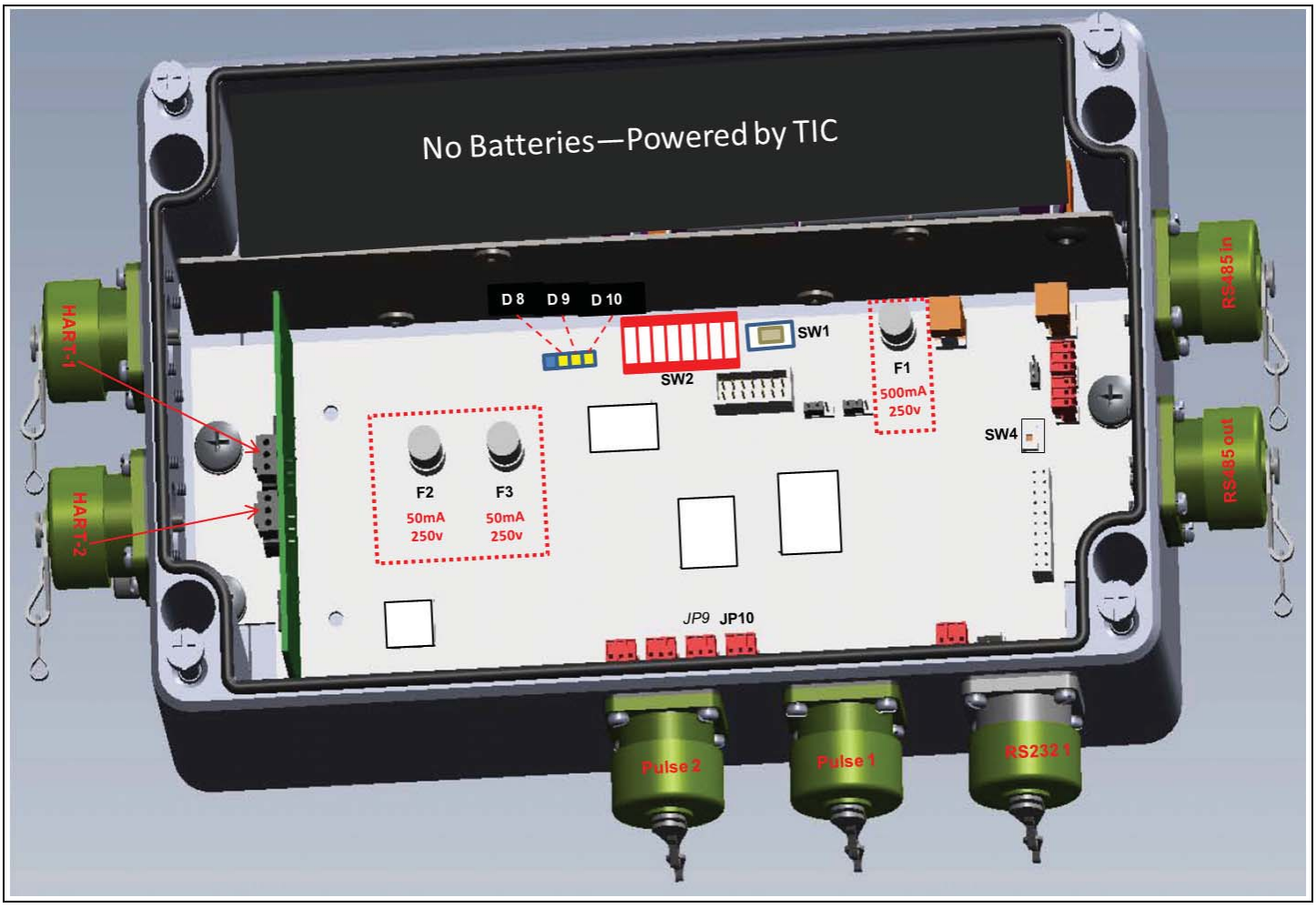

Figure A-1: 8240 TDU — Powered by the 8250 TIC

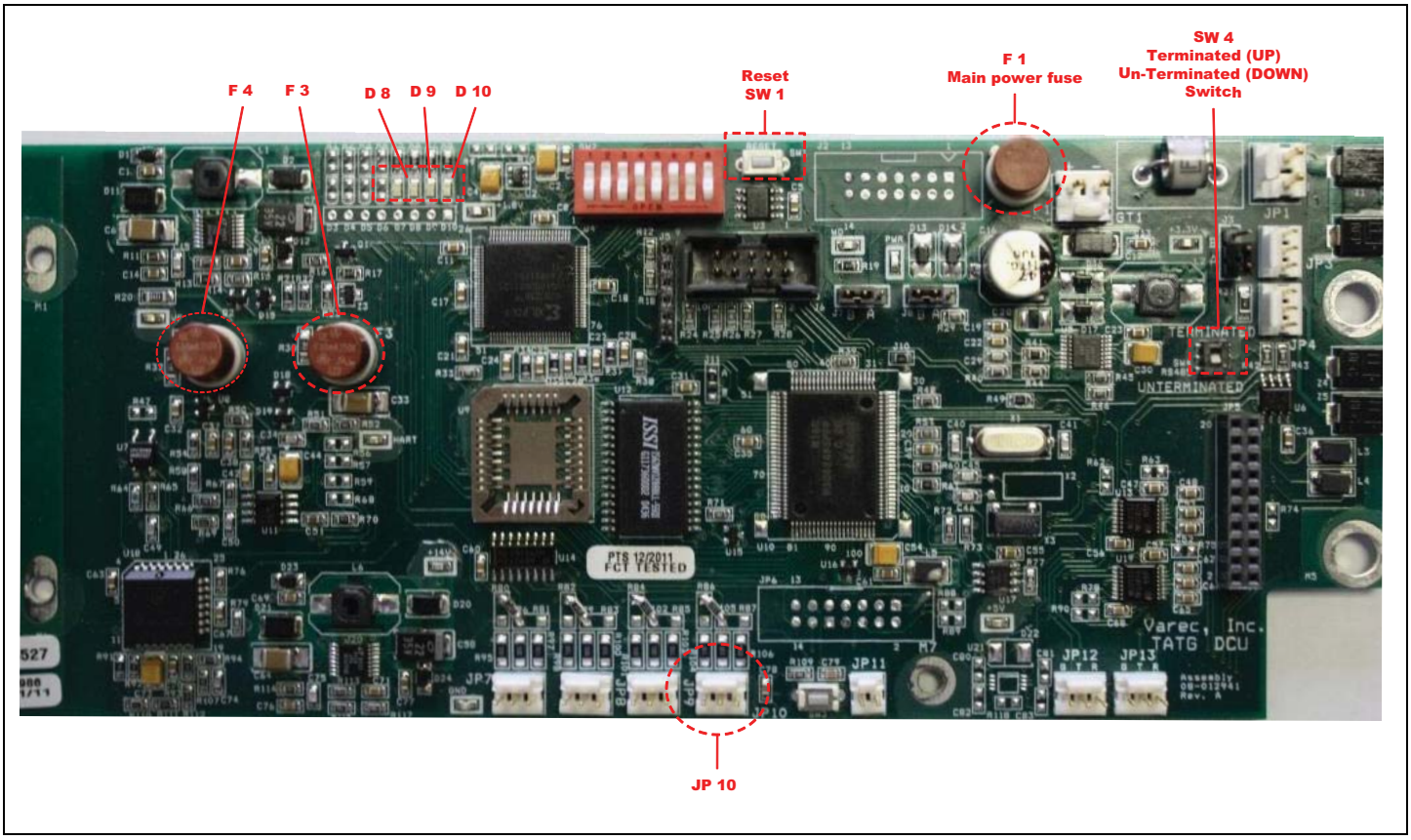

Figure A-2: 8240 TDU Main Board without the Intrinsically Safe (I.S.) Barrier

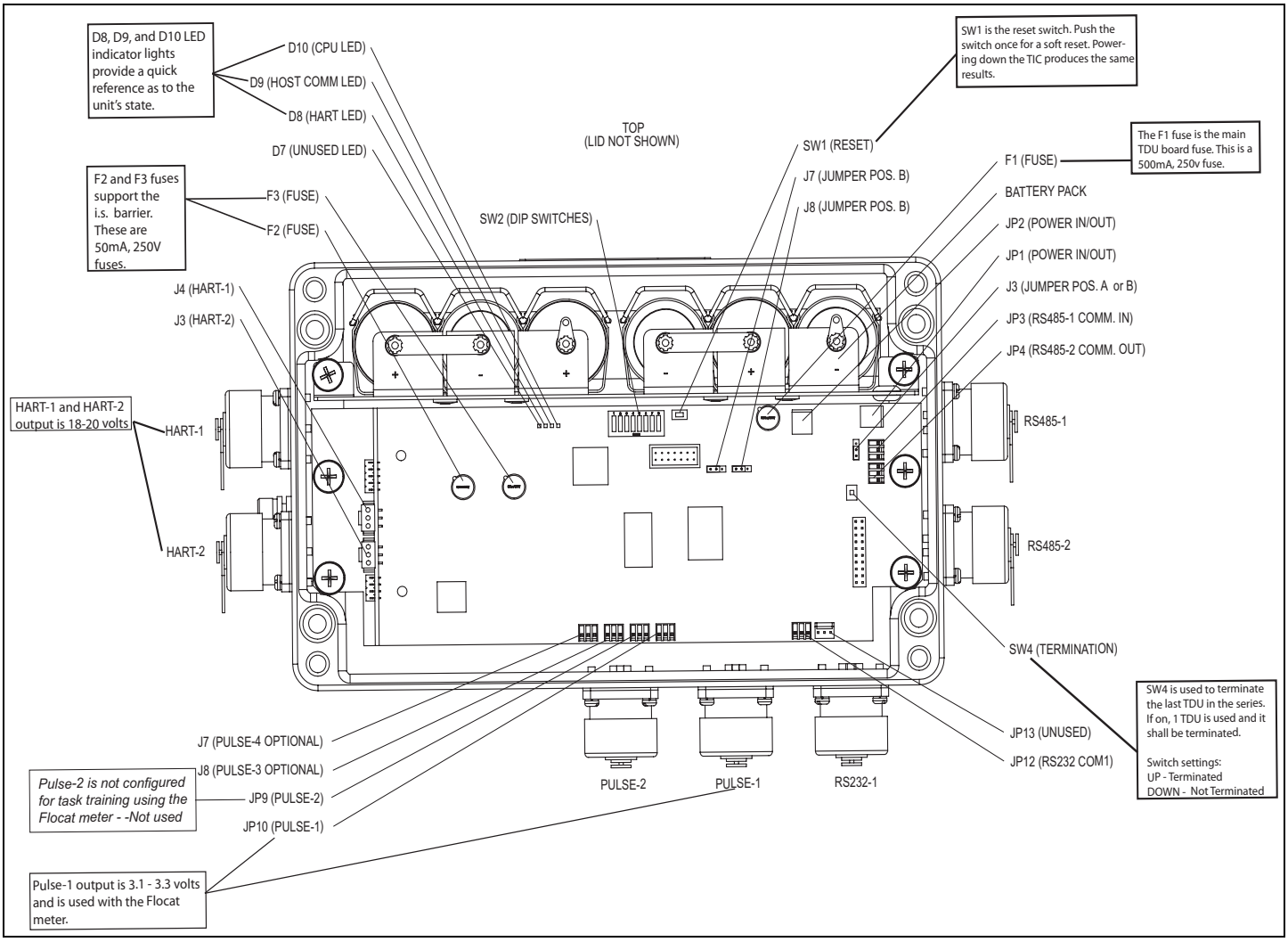

Figure A–3: 8240 TDU with Troubleshooting Comments

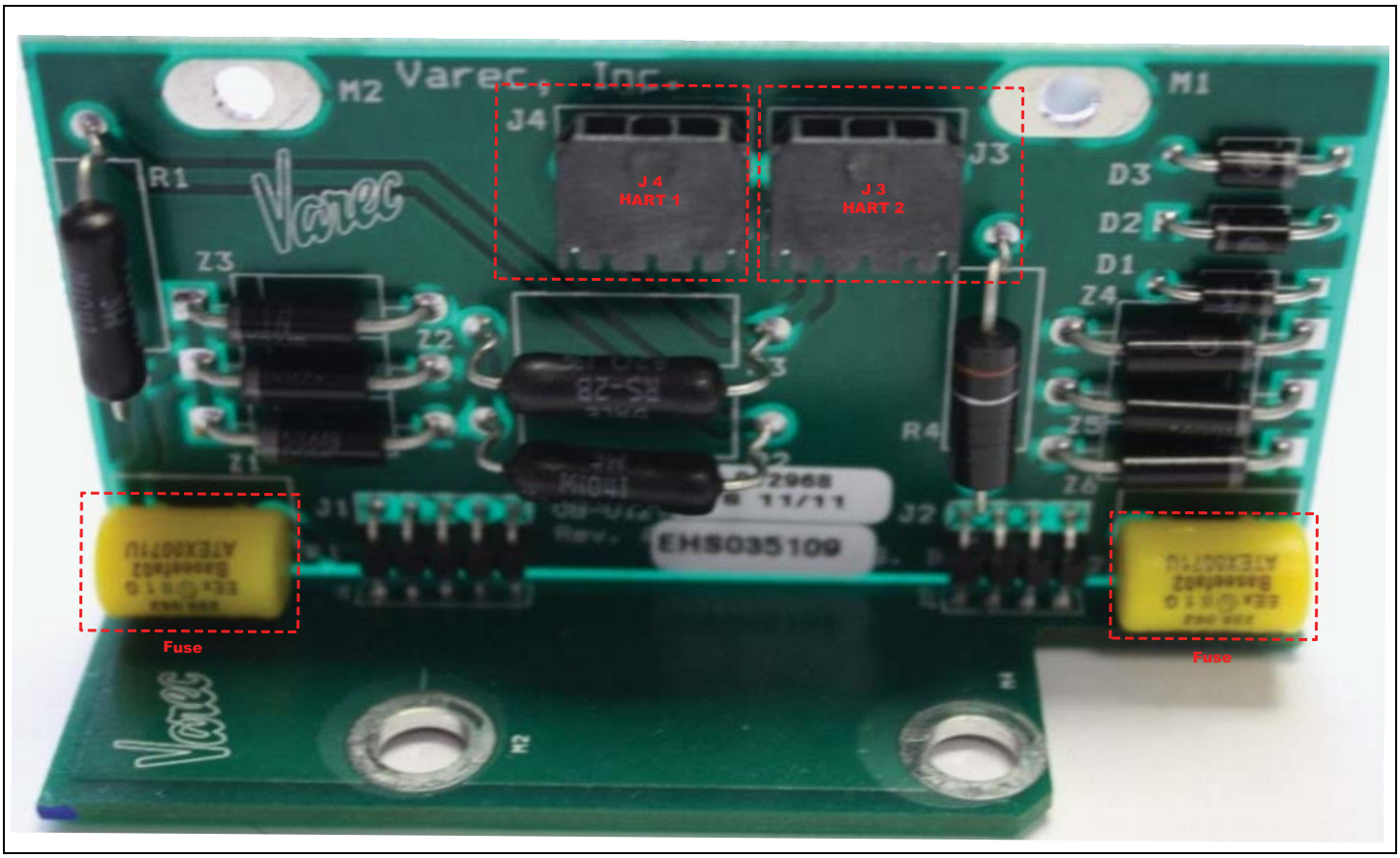

Figure A-4: 8240 TDU Board I.S. Barrier

Note The fuses shown above are soldered into the board and are not be serviced in the field. Contact your Varec representive if you have any questions or comments.

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