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TacFuels®
Fuels Inventory Management System

Installation and Operations Manual

Automation Solutions for oil & gas, defense and aviation applications

Varec®
a Leidos company

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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

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 maintenance on this system are assumed to be familiar with industry practices, safety guidelines, and instrumentation.

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 the following tank gauging, data processing, and computing devices.

- 7660 Tactical Fuel Gauge (TFG)
- 8240 Tactical Data Unit (TDU)
- 8250 Tactical Interface Convertor (TIC)
- 9760 Tactical Mobile Computer (TMC)
- Tactical Flow Meter (TFM)

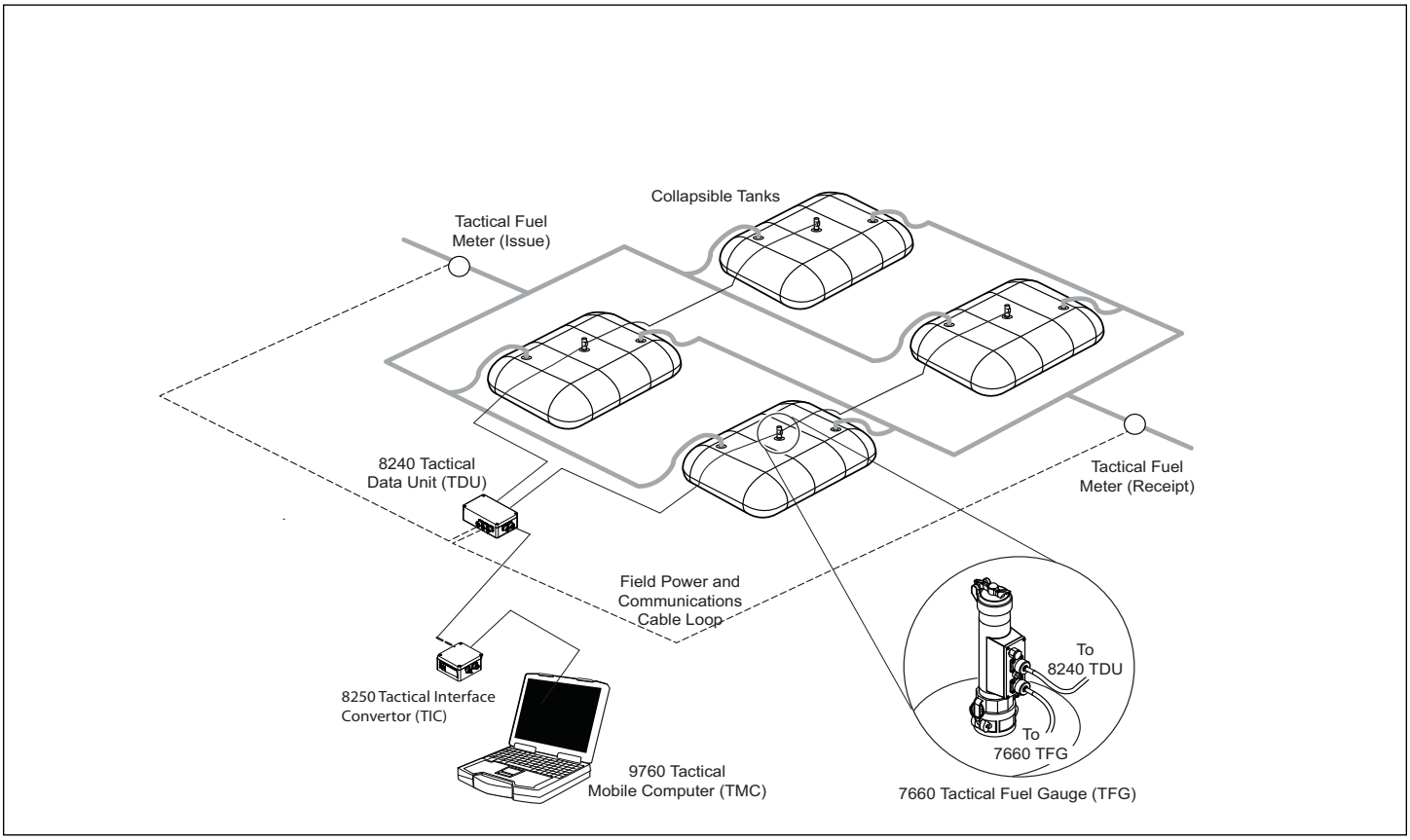


Figure 1: TacFuels System Overview

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.

System Components

7660 Tactical Fuel Gauge (TFG)

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.

Warning Up to four, TFG7660 may be daisy chained from either of the two power and communications ports on the TDU8240. The Intrinsically Safe, TFG7660 may be connected or disconnected while energized.

Specifications

Data Transmission

Item	Description
Protocol	4 - 20 mA (HART)

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)

Power Supply

Item	Description
Operating Voltage	9.6 to 36 VDC
Current Consumption	4 mA

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)

Vent Pipe Housing

Item	Description
Material	Powder coated aluminum
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)

Certifications and Approvals

Item	Description
North America and Canada	Hazardous Locations: • Class I, Division 1, Groups C & D
ATEX	Class 1, Zone 0, Ex ia IIB T6 -20°C ≤ Ta ≤ 80°C, IP66, NEMA 4

Dimensions

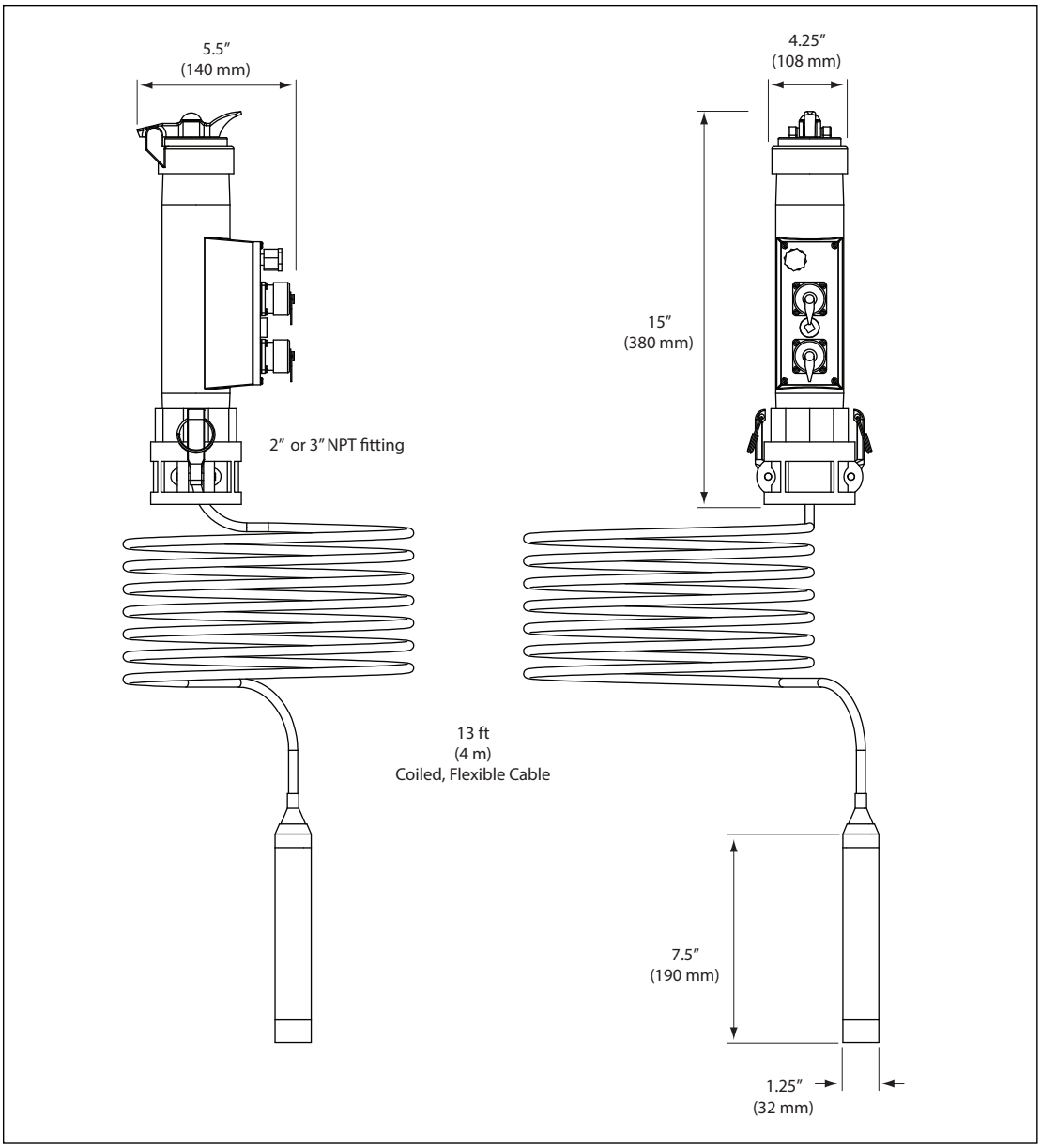


Figure 2: 7660 TFG Transmitter and Vent Pipe Integrated - Details

8240 Tactical Data Unit (TDU)

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 map” (unique strap table) for each CST in a Fuels Inventory Measurement System — an automatic “Tank Mapping” process. Inventory measurement cycle times and manpower allocations are dramatically reduced by providing an immediate measurement of product when requested.
- Up to four 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 grounding 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 from the 8250 Tactical Interface Convertor.
- Automatic “Tank Mapping” — the TDU is designed to dynamically create a unique “tank map” (strap 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 map table has been constructed. This table, which can include up to 1,000 data index points, is then stored in the non-volatile memory of the TDU.
- The tank mapping process compensates for the variances in tank construction and installation conditions. It allows increased accuracy and reliability of physical inventory measurements that can then be used throughout the system. Varec’s mobile computer runs dedicated software that assists decision making at an accelerated pace. Laptop computers are utilized in the control area to manage, reconcile, and report fuel inventories.

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 output capability.

Warning The TDU must only be supplied from the 24VDC maximum derived from the TIC, either connected directly or daisy chained via a TDU.

Warning No connections must be made in the hazardous area, to the TDU two 3-pin connectors which accept a pulse input from connection to a TFM, and the single5-pin connector which provides an RS232 connection.

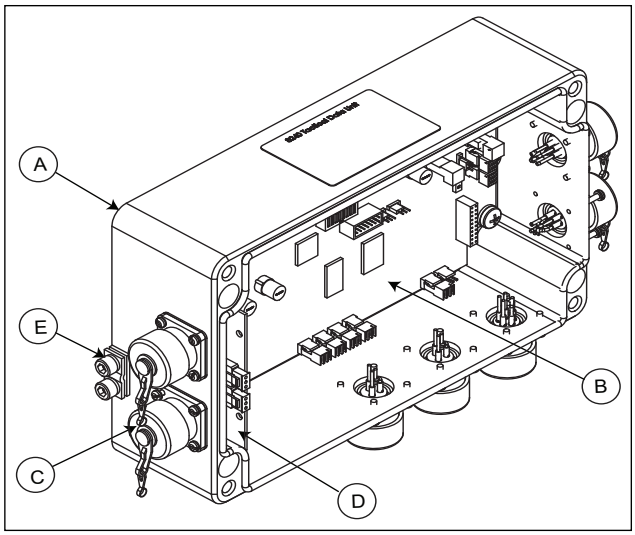
Warning In large systems up to seven TDUs may be daisy chained from a single TIC.

Warning Any unused connectors must have dust caps fitted to maintain the IP66 Rating.

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

A. Weatherproof Enclosure
B. Processor Board
C. MIL Electrical Connectors
D. Intrinsic Barrier
E. Grounding Log

Figure 3: 8240 TDU - Hardware Components



Specifications

Data Transmission

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

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.

Power Supply

Item	Description
Operating Voltage	8 - 36 VDC
Current Consumption	25 mA

Mechanical Construction

Item	Description
Material	Powder coated aluminum

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

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

Certifications and Approvals

Item	Description
North America and Canada	Hazardous Locations • Class I, Division 2, Groups C & D
Europe	Class1, Zone 0, Ex i a IIB T6

Dimensions

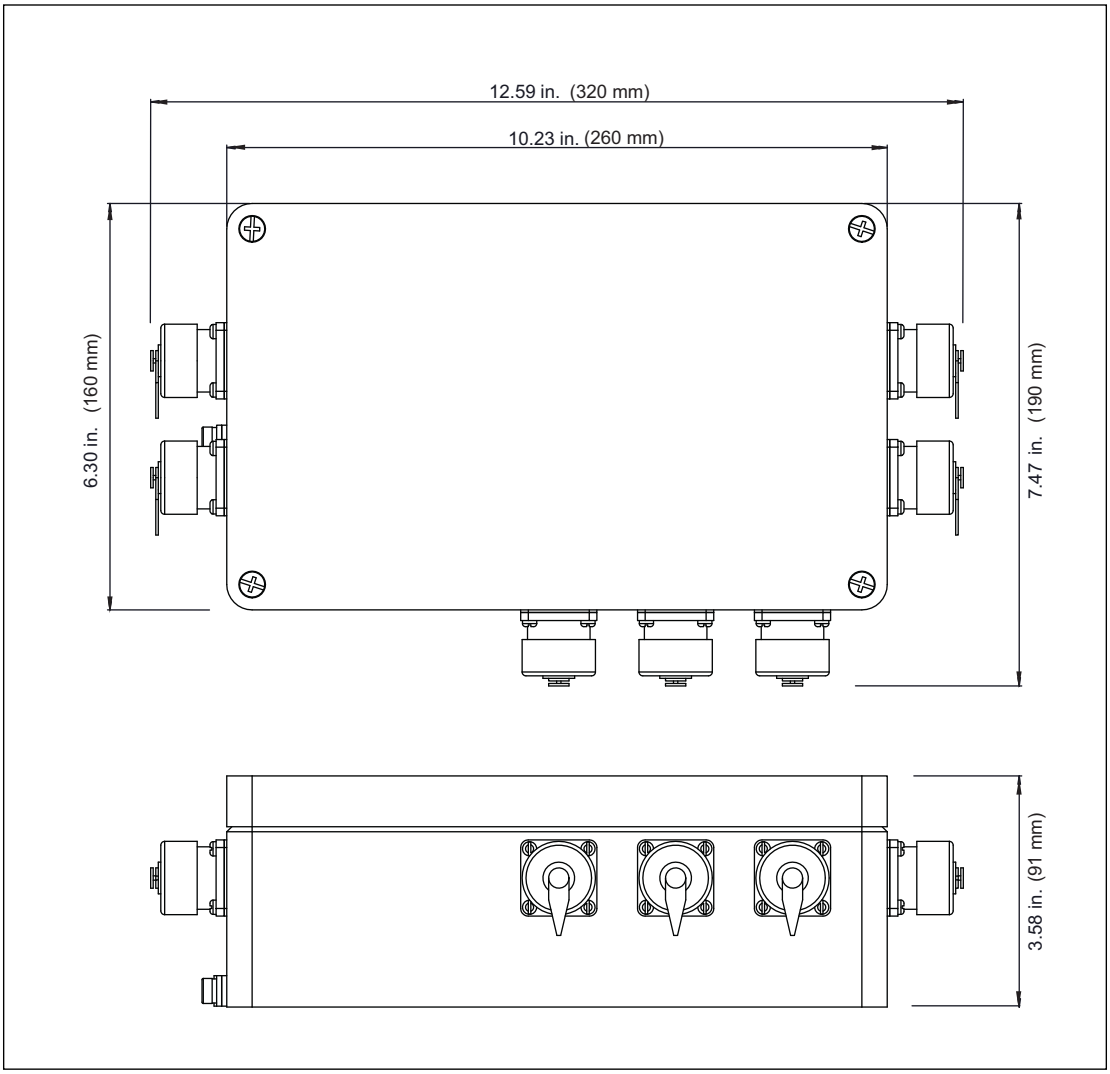


Figure 4: TDU Dimensions

8250 Tactical Interface Convertor (TIC)

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 TDU connectors on the standard version, with the option to expand this to four.

Three 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.

The 8250 TIC consists of the following hardware components, as shown in Figure 5:

A. LED Indicators
B. RS485 MIL Electrical Connectors
C. Power Switch
D. RS232 or USB MIL Electrical Connector (depending on option selected)
E. Power Connector
F. Fuses (x2)

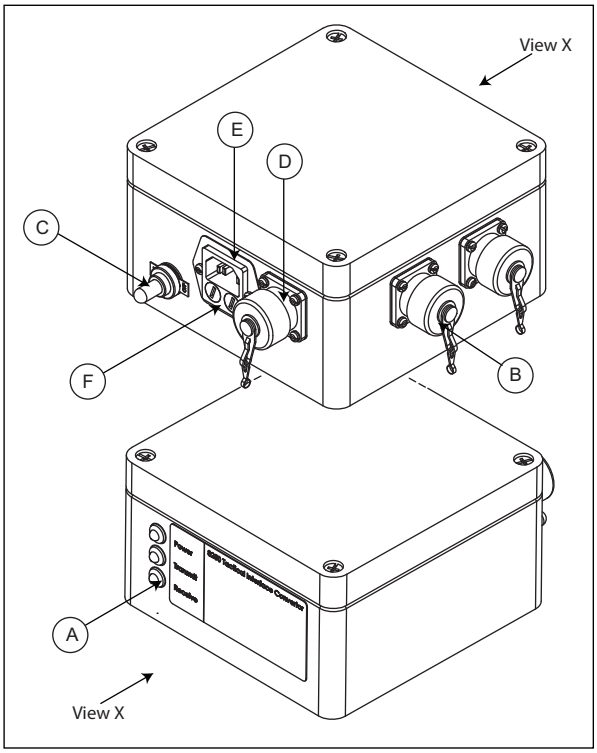


Figure 5: 8250 TIC - Hardware Components

Warning Do not connect or disconnect TIC8250 cable, open the enclosure, or replace fuses when energized.

Specifications

Data Transmission

Item	Description
Protocol	RS232/RS485

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.

Power Supply

Item	Description
Operating Voltage	100 to 240 VAC
Current Consumption	0.375 A max.
Frequency	50 to 60 Hz

Mechanical Construction

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

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

Input/Output

Item	Description
Ports	• 2 RS485 ports • 1 RS232 or USB

Certifications and Approvals

Item	Description
North America and Canada	Normal Locations
Europe	Class1, Zone 0, Ex i a IIB T6

Dimensions

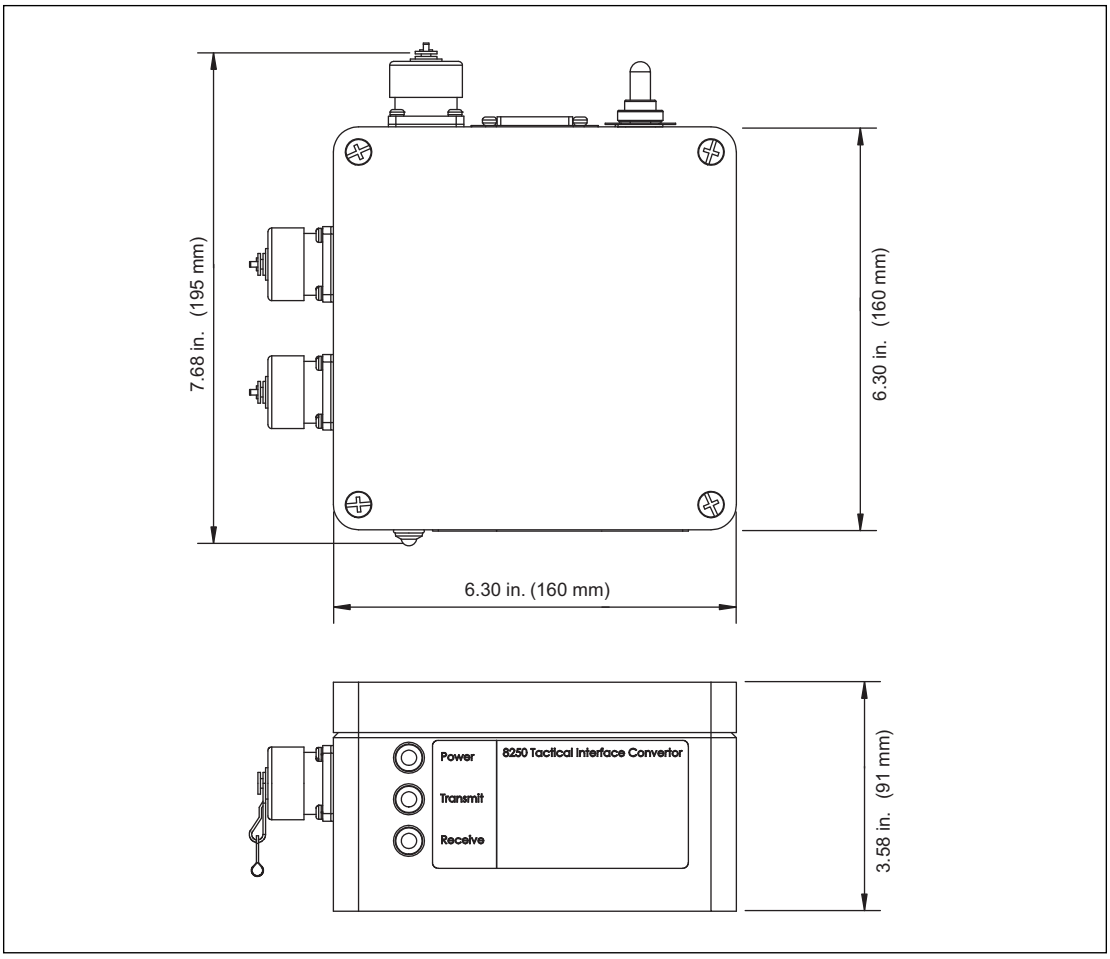


Figure 6: TIC Dimensions

9760 Tactical Mobile Computer (TMC)

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.

Varec also offers a standard duty computer system for use in permanent facilities where a ruggedized device is not required.

Specifications

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

Tactical Flow Meter (TFM)

The Tactical Flow Meter or TFM is a portable 4" positive displacement meter that is connected to the TDU Pulse 1 port. This is the only port used for CST mapping. Pulse 2 does not support the mapping process.

For more information, see the "Installation of the Tactical Flow Meter (TFM)" on page 21.

Specifications

Please refer to the TFM’s installation & operation manual for the latest specifications for this product.

Installation

Installing the TacFuels System hardware consists of the following procedures:

Safety Guidelines

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. Do not disconnect equipment unless power has been switched off or the area is known to be non-hazardous.

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.
- Prior to performing any maintenance on the TIC, make sure that the power is disconnected from the unit.

Installing the 7660 TFG on to a Collapsible Storage Tank

Install the 7660 TFG using the following procedure:

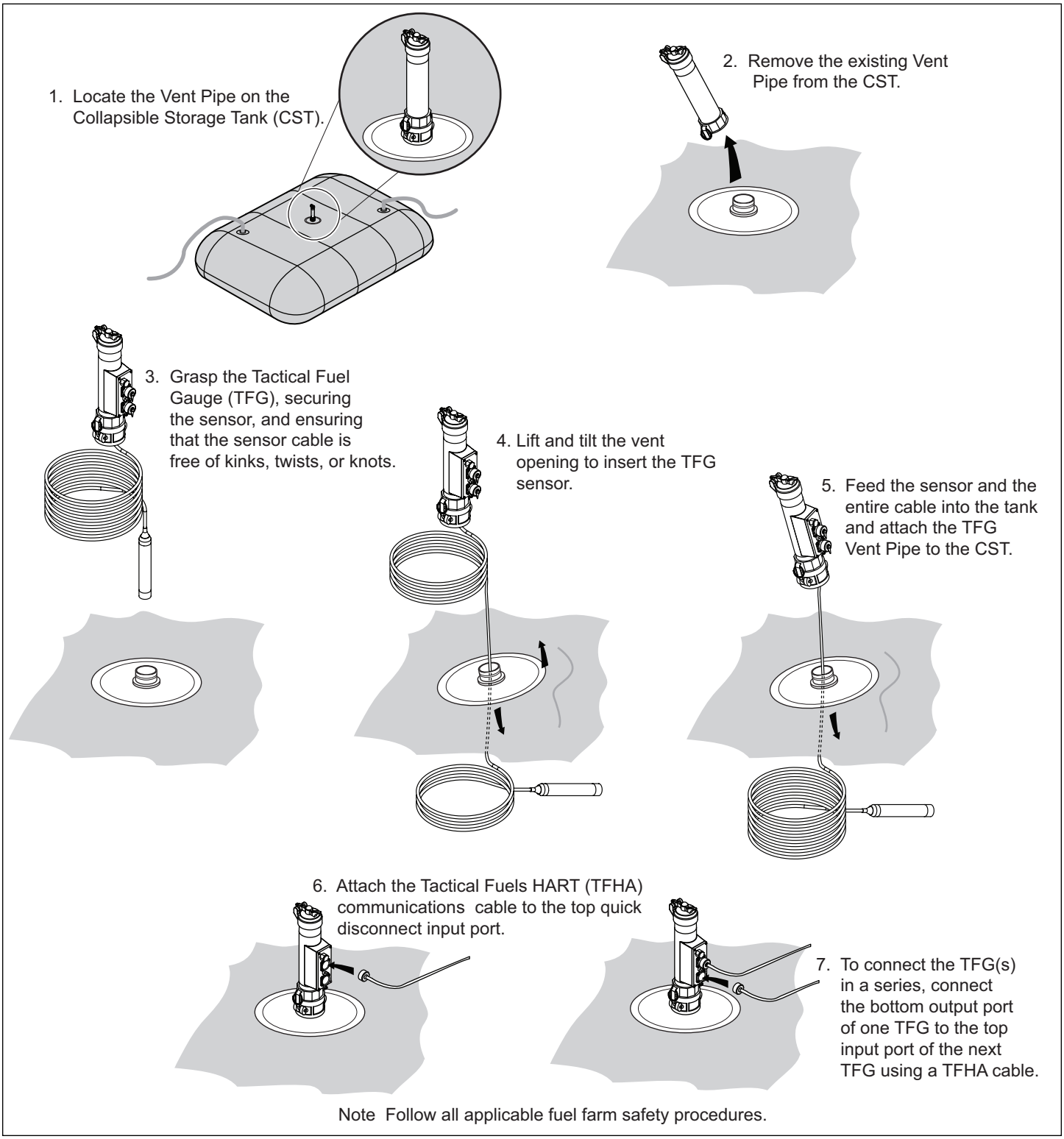


Figure 7: 7660 TFG Installation

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 8. A TFHAxxxx, where xxxx is equal to the length in feet, power and HART protocol communications cable should then be connected from the TDU TFG1 or TFG2 position to the first Tactical Fuel Gauge (TFG) in the fuel farm loop.

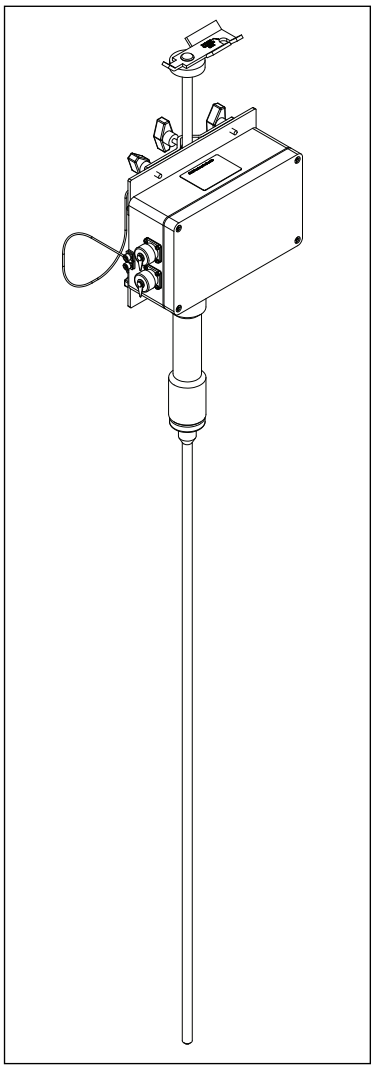


Figure 8: 8240 TDU Mounted to a Grounding Rod

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 8 on page 18 for a TDU mounting example). The standard cable is a direct bury cable. TDUs should be positioned to maximize the 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 two cables to achieve safe installation conditions in order to accommodate the various TacFuels System layouts permissible.

Connecting the RS485 Interface Cable to the TIC

To operate, the TDU must be connected to the powered TIC using an RS485 cable (TF485COMPW). When connecting cables to the TDU, the TIC must be powered off. The RS485 cable connects to the top 4-pin RS485 input connector on the TDU as indicated below. See Figure 9 on page 20 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.

Connecting the TMC to the TIC

Using a TF232COM cable (included), the RS232 input on the powered TIC connects to the TMC. See Figure 9 on page 20 for an overview of the TIC connections.

Connecting the 8240 TDU to the TIC

To operate, the TDU must be connected to the TIC. See Figure 9 for an overview of the TDU connections. When connecting cables to the TDU, the TIC must be powered off.

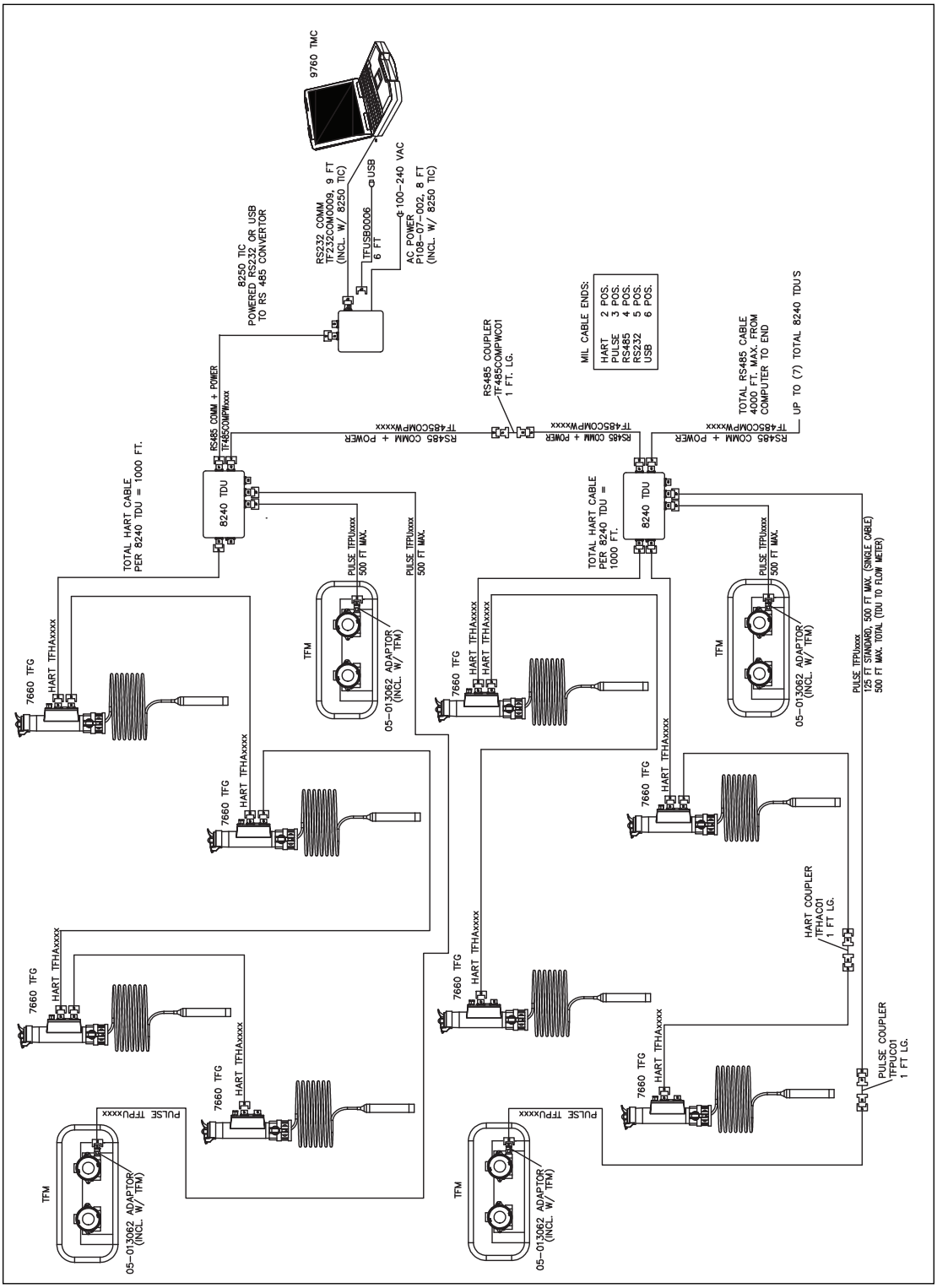


Figure 9: System Connection Overview Diagram

Installation of the Tactical Flow Meter (TFM)

The 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 TFM installation and operation manual for the different sizes).

The 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.

Note Consult the factory for other meter options.

TFM installation safety guidelines

The TFM must be positioned within the limits of the supporting pulse cable length of the supporting TDU during the “Tank Mapping” 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 Consult the Brodie Model BERT-E Installation and Operation Manual for more information.

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.

To connect the TFM to the 8240 TDU

Connect the TFM to the Pulse-1 connector on the 8240 TDU. When mapping, always use the Pulse-1 connector. Only after mapping is complete can Pulse-2 and Pulse-3 connectors be used to record meter pulses.

Connecting Collapsible Storage Tanks (CST) to the System

Data flow

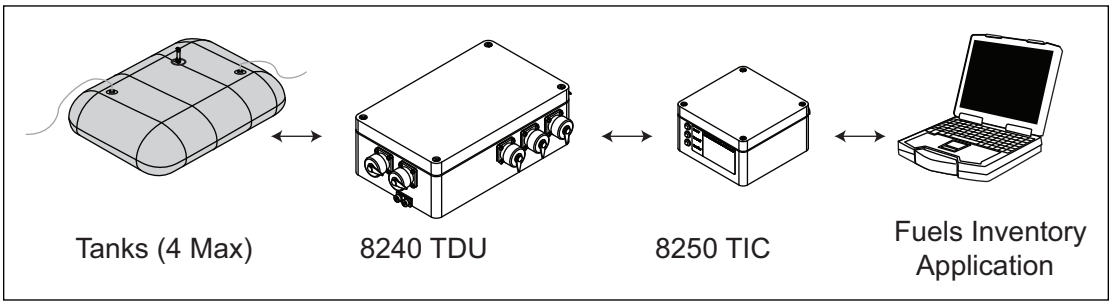


Figure 10: Data Flow for the TacFuels System

Configuration

Configuring Major Components of the 8240 TDU

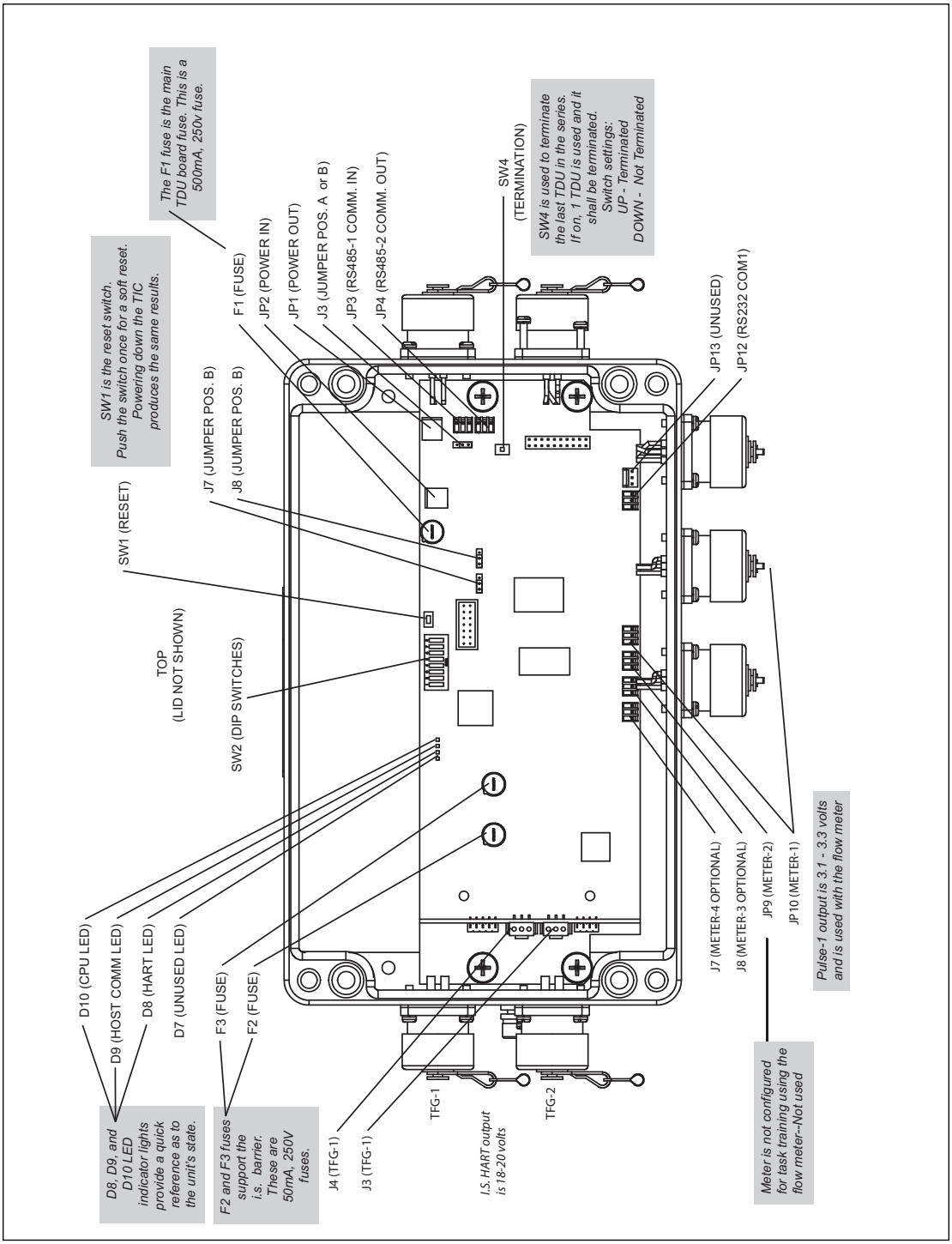


Figure 11: TDU connectors, switches, LEDs, jumpers, and fuses diagram

Power connections (2-position connectors)

This section describes the power connection to the TDU. It also describes how to connect them to the power connections on the vertical intrinsically safe (I.S.) board. Please reference Figure 11 on page 23 for the major components discussed in this section.

The TDU can be powered by RS485-1 Connector Power:

- 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.

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 11 on page 23 for the major components discussed in this section.

The TDU uses the following connectors for communication:

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.

Switches

This section lists three different switches used to reset and control the power using DIP switches, etc. on the TDU. It also describes how to set them on the vertical I.S. board. Please reference Figure 11 on page 23 for the major components discussed in this section. The TDU uses the following switches:

1. Reset Switch (SW1)
2. DIP Switches (SW2)
3. Termination Switch (SW4)

Reset switch (SW1)

Use switch 1 (SW1) to reset the TDU.

DIP switches (SW2)

Note Please refer to the tables in this section for more information about DIP switch (SW2) settings.

1. Use DIP switch #1 (SW2-1) for meter interface.
   - Meter interface operates at 3.3V — Off (OPEN) position.
   - Meter interface operates at 12V — On (CLOSED) position.
2. Use DIP switch #2 (SW2-2) for constant TFG power during training.
   - TDU provides constant power to the TFG during training — Off (OPEN) position. setting is reserved for battery power. No battery is currently supplied.
   - TDU will not provide constant power to the TFG during training — On (CLOSED) position.
3. Use DIP switch #3 (SW2-3) for ensure that power will be supplied. No battery is currently used. Low Power Sleep is not currently available.
   - TDU will not operate continuously — Off (OPEN) position. This setting is reserved for battery power. No battery is currently supplied.
   - TDU operates continuously — On (CLOSED) position.
4. Use DIP switch #4 (SW2-4) for internal use only.
   - Confirms Off (OPEN) position.
5. Use DIP switch #5 (SW2-5) for RS485 communication protocols.
   - RS485 mode — On (CLOSED) position
6. Use DIP switches #6, #7, and #8 (SW2-6, SW2-7, and SW2-8) for the binary address.
   - 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.

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

Meter Interface	
Switch 1 SW2-1	**Comments**
OPEN	Meter Interface Operates at 3.3V. (Flow Cat.)
CLOSED	Meter Interface Operates at 12V. (VR — Powering the Pulser.)

Power Down TFG (Open)	
Switch 2 SW2-2	**Comments**
OPEN	TDU will provide constant power to the TFG during training.
CLOSED	This setting requires a battery. Not currently in use.

Low Power Sleep (Closed)	
Switch 3 SW2-3	**Comments**
OPEN	This setting requires a battery. Not currently in use.
CLOSED	TDU operates continuously.

RS485 Operation					
Switch 4 SW2-4	**Switch 5 SW2-5**	**Switch 6 SW2-6**	**Switch 7 SW2-7**	**Switch 8 SW2-8**	**Comments**
OPEN	CLOSED	OPEN	OPEN	CLOSED	TDU 1 — MODBUS Address 1
OPEN	CLOSED	OPEN	CLOSED	OPEN	TDU 2 — MODBUS Address 2
OPEN	CLOSED	OPEN	CLOSED	CLOSED	TDU 3 — MODBUS Address 3
OPEN	CLOSED	CLOSED	OPEN	OPEN	TDU 4 — MODBUS Address 4
OPEN	CLOSED	CLOSED	OPEN	CLOSED	TDU 5 — MODBUS Address 5
OPEN	CLOSED	CLOSED	CLOSED	OPEN	TDU 6 — MODBUS Address 6
OPEN	CLOSED	CLOSED	CLOSED	CLOSED	TDU 7 — MODBUS Address 7

For a soft reset, leave the dip switches in place and do one of the following:

- Press Reset.
- Power the TIC off and then back on.

Hard Reset - (Erases all Map 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.

The following tables display how dip switches (SW2) are used for continuous power operations when using the 8250 TIC to power the 8240 TDU.

Continuous Power Operations							
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	CLOSED	OPEN	OPEN	CLOSED	TDU 1 — MODBUS Address 1
CLOSED	CLOSED	OPEN	CLOSED	OPEN	CLOSED	OPEN	TDU 2 — MODBUS Address 2
CLOSED	CLOSED	OPEN	CLOSED	OPEN	CLOSED	CLOSED	TDU 3 — MODBUS Address 3
CLOSED	CLOSED	OPEN	CLOSED	CLOSED	OPEN	OPEN	TDU 4 — MODBUS Address 4
CLOSED	CLOSED	OPEN	CLOSED	CLOSED	OPEN	CLOSED	TDU 5 — MODBUS Address 5
CLOSED	CLOSED	OPEN	CLOSED	CLOSED	CLOSED	OPEN	TDU 6 — MODBUS Address 6
CLOSED	CLOSED	OPEN	CLOSED	CLOSED	CLOSED	CLOSED	TDU 7 — MODBUS Address 7

Note To prevent communication conflicts experienced in direct power applications using the 8250 TIC, set SW2-2 and SW2-3 to the CLOSED position. This prevents the TDU from cycling in and out of sleep mode.

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 — Gauge
   - Pulses on/off when communicating
   - Continuously on or off indicates that there is a problem communicating
3. D9 — Communication to the HOST — Computer
   - 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)

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)

Fuses

There are three replaceable fuses (part # P117-01-006)

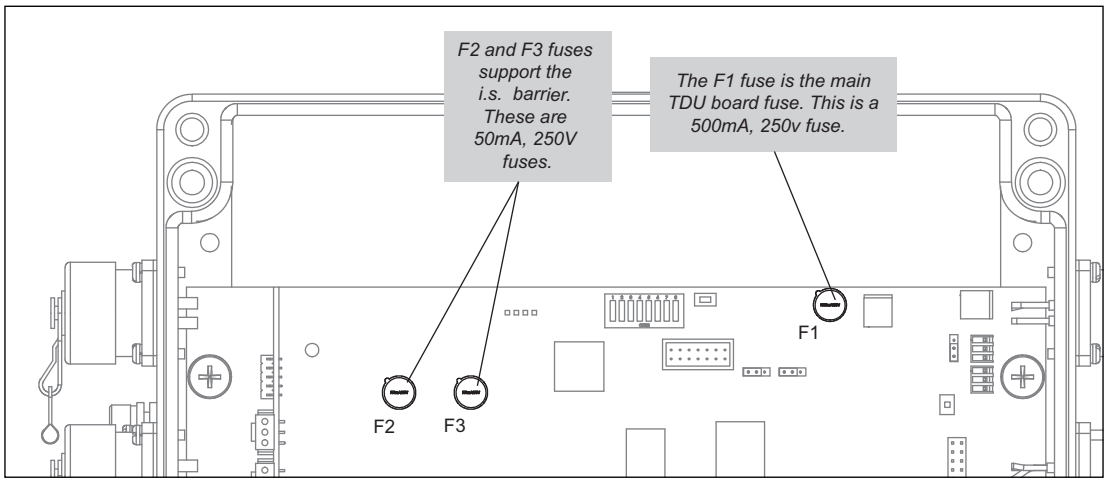


Figure 12: 8240 TDU Fuse Locations

Configuring the Major Components of the 8250 TIC

TIC connectors, switches, LED indicators, and fuses diagram

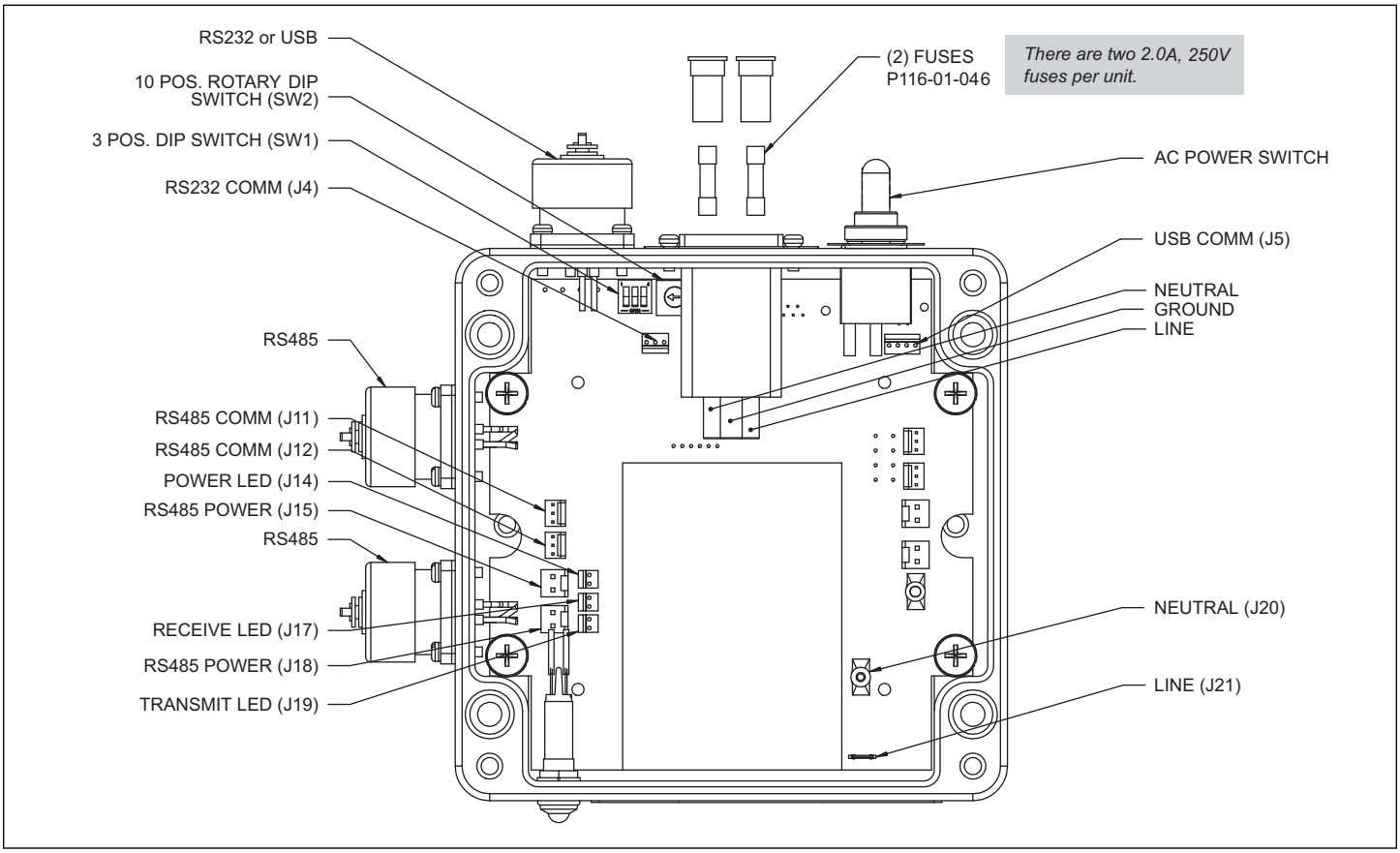


Figure 13: 8250 TIC - Internal Wiring

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 13 on page 29 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).

Communication connections (3-position connectors)

This section lists the different communication protocols used with the TIC. Please reference Figure 13 on page 29 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.

LED indicators

This section lists the three LED indicators used with the TIC. Please reference Figure 13 on page 29 for the major components discussed in this section.

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

Switches

This section lists the three different switches used with the TIC. Please reference Figure 13 on page 29 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 1 on page 31 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. For the USB configuration SW2 should be set to position 0.

The following table lists all the possible baud rate settings for the rotary switch (SW2).

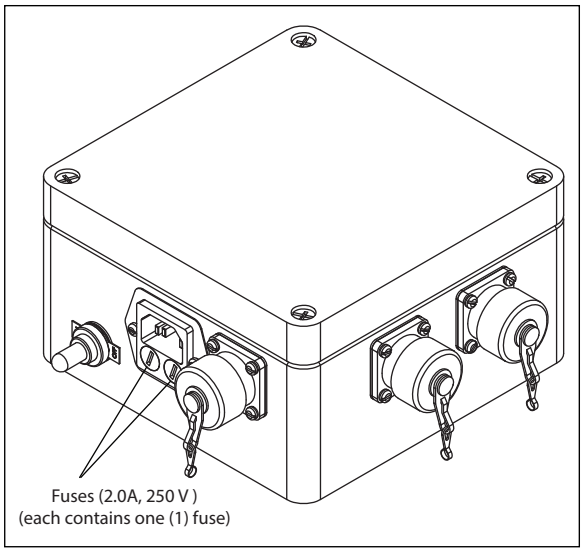
SW2 Position	Baud Rate Setting
0	300 Baud
1	600 Baud and USB setting
2	1200 Baud
3	2400 Baud
4	4800 Baud
5	9600 Baud
6	19200 Baud
7	38400 Baud
8	57600 Baud
9	115200 Baud

Table 1: Rotary Switch (SW2) - Baud Rate Settings

Fuses

There are two replaceable fuses (part # P116-01-046) located on the power connector of the 8250 TIC.

Figure 14: 8250 TIC Fuse Locations



Warning Do not connect or disconnect TIC Cables, open enclosure, or Replace fuses when energized.

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). See "7660 TFG Vent Filter" on page 35.

Warning Maintenance should be performed only by authorized personnel.

Warning Disconnect the TIC before performing system maintenance and terminate the system power.

Warning Explosion Hazard - Substitution of components may impair suitability for Class I, Division 2.

Avertissement! Risque D'explosion – La substitution de composants peut rendre ce matériel inacceptable pour les emplacements de Classe I, division 2.

7660 Tactical Fuel Gauge Maintenance

Removing the 7660 TFG from a CST

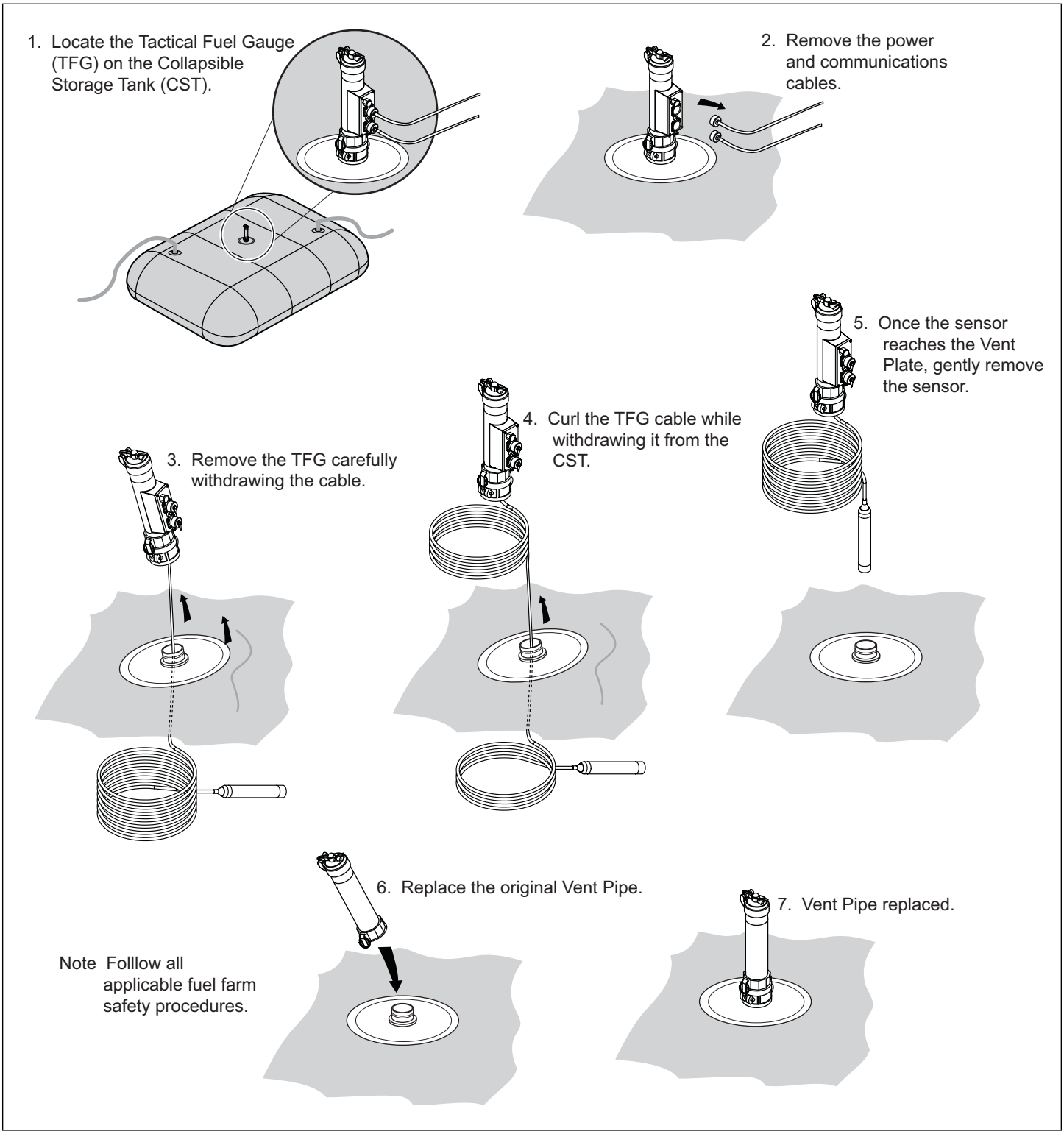


Figure 15: 7660 TFG Removal

7660 TFG Vent Filter

Ensure that the hole in the TFG Vent that holds the Vent Filter is completely clear before mapping or remapping a tank. Inspect and clean the TFG Vent Filter every six months or as needed based on field conditions and events. For example, events such as sand or dust storms may require more frequent inspections.

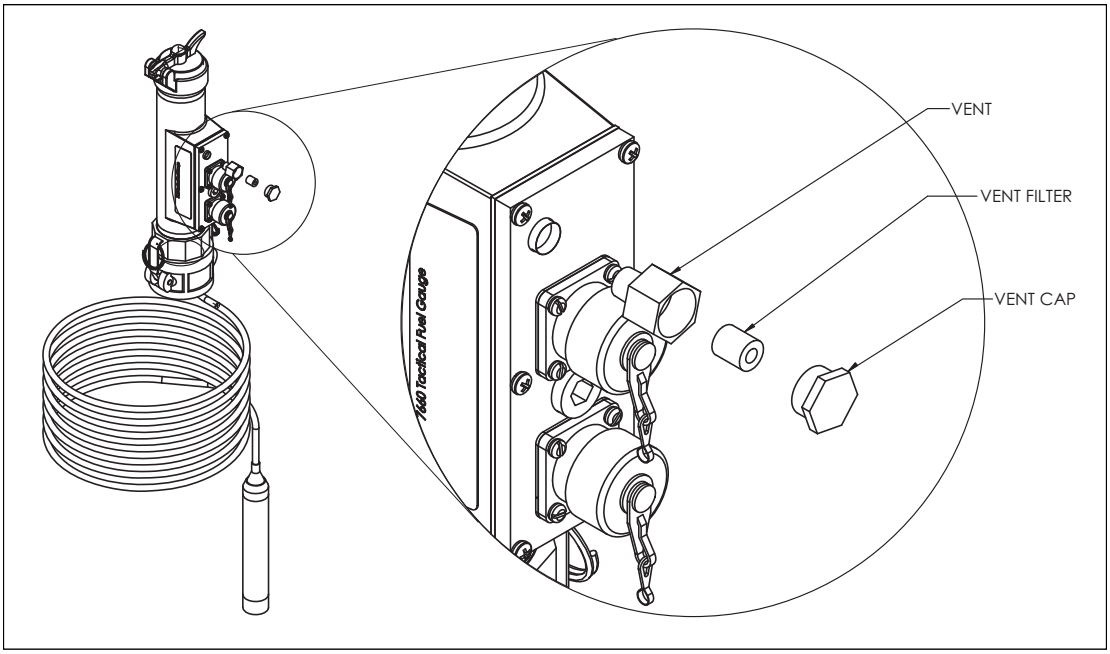


Figure 16: 7660 TFG Vent Filter

8240 Tactical Data Unit Maintenance

8240 TDU and Assembly Spare Parts

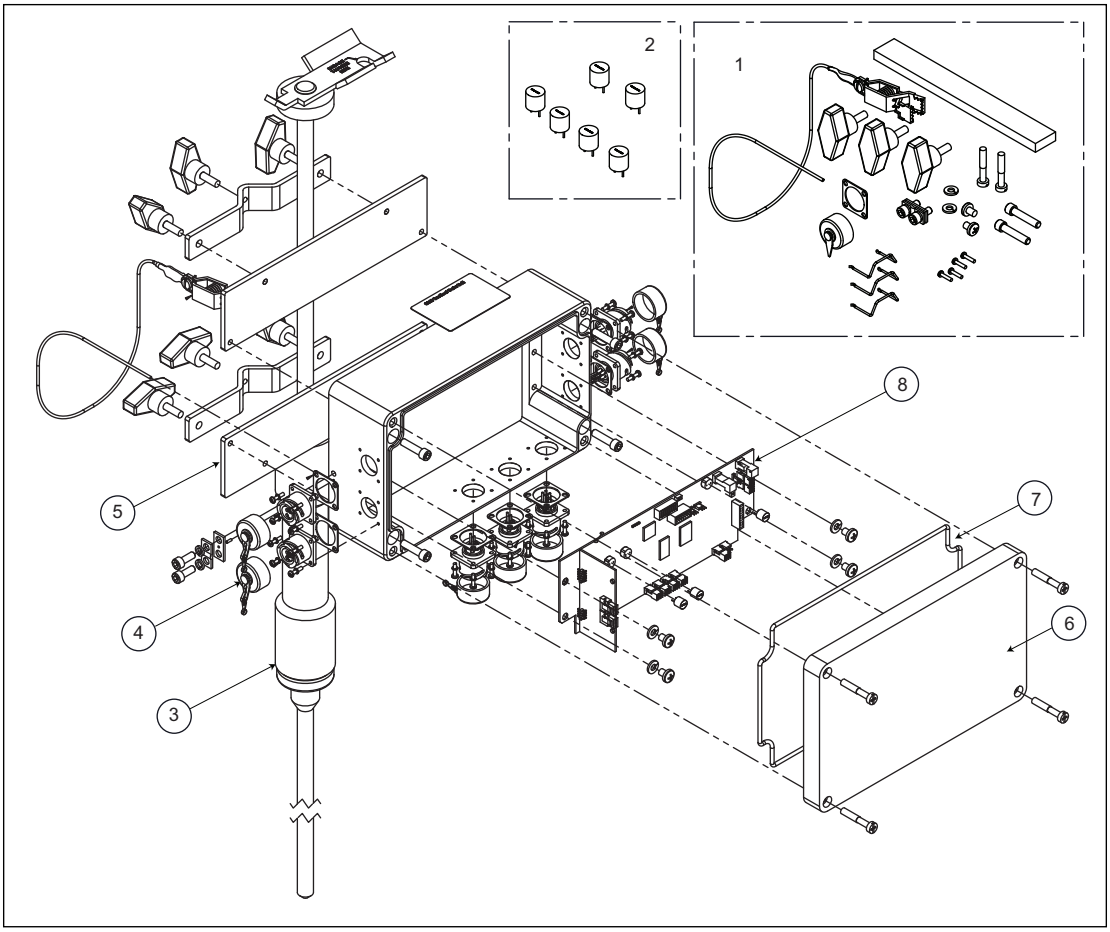


Figure 17: 8240 TDU Assembly and Spare Parts

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
	P49-276	1	Grounding Rod — A-A-55804, Type III, Class B
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

Table 2: 8240 TDU Spare Parts List

Replacing the 8240 TDU in the System

To replace a TDU ensure that the new TDU is configured the same as the unit being replaced.

8240 TDU Fuse Replacement

Warning Explosion Hazard - Do not replace fuses unless power has been switched off or the area is known to be non-hazardous.

Avertissement! Risque D'explosion – Couper le courant ou s'assurer que l'emplacement est designe non dangereux avant de replacer le fusibles.

4. Remove the cover of the TDU.
5. 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.

Caution The fuses shown below (Fig 5-4) on the I.S. Barrier are soldered into the board and are not be serviced in the field. Contact your Varec representative if you have any questions or comments.

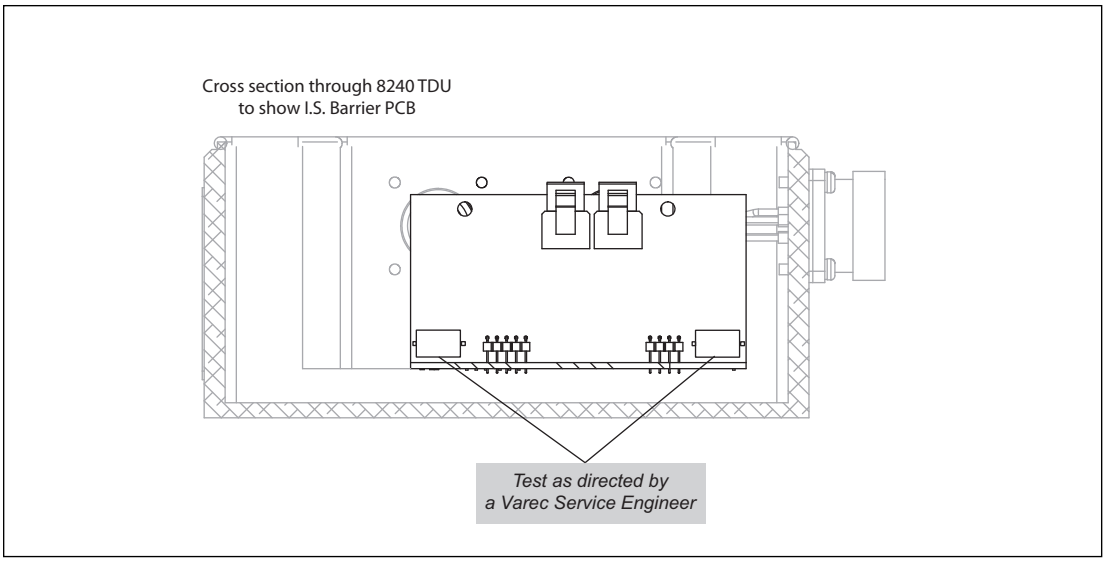


Figure 18: 8240 TDU Board I.S. Barrier

8240 TDU Main Electronics Board Replacement

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. Move the TDU from the field to a clean/dry facility 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 “Configuring Major Components of the 8240 TDU” on page 23).
9. Pull fuses F3 and F4 off the board and check them with an ohm meter.
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 (see “Configuring Major Components of the 8240 TDU” on page 23 to locate components):
    - JP1 (POWER IN) to RS485-1 (IN)
    - JP2 (POWER IN) to RS485-2 (OUT)
    - JP3 (RS485-1 COMM IN)
    - JP4 (RS485-2 COMM OUT)
    - JP10 to PULSE-1
    - J4 to TFG-1
    - J3 to TFG-2

Troubleshooting Problems

Problem: Cannot find the TFG when executing a search from FuelsManager (FM)

Steps to resolve:

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.
2. Check F3 and F4 (50mA, 250v) fuses. A good fuse will read < 10 ohms when checked with an ohm meter.
3. Check with a multi meter at the connector (TFB-1 and TFG-2). The output from A and B should read 18 to 20 DC volts. If the problem persists, go to Step 4.
4. TFG-1 is connected to J3 and TFG-2 is connected 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 TacFuels Meter

Steps to resolve:

1. Check the TDU Pulse-1 connection with a multi meter. A good output will read 3.1 to 3.3 DC volts. 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.

8250 Tactical Interface Convertor Maintenance

Caution Prior to performing any maintenance on the TIC, make sure that the power is disconnected from the unit.

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, P116-01-046, 2.0A 250 V
3	P102-02-100	6	MIL Connector Dust Cap
4	TFUSB0006	1	USB Cable
5	TF232COM0009	1	RS232 Communication Cable

Figure 19: 8250 TIC Spare Parts List

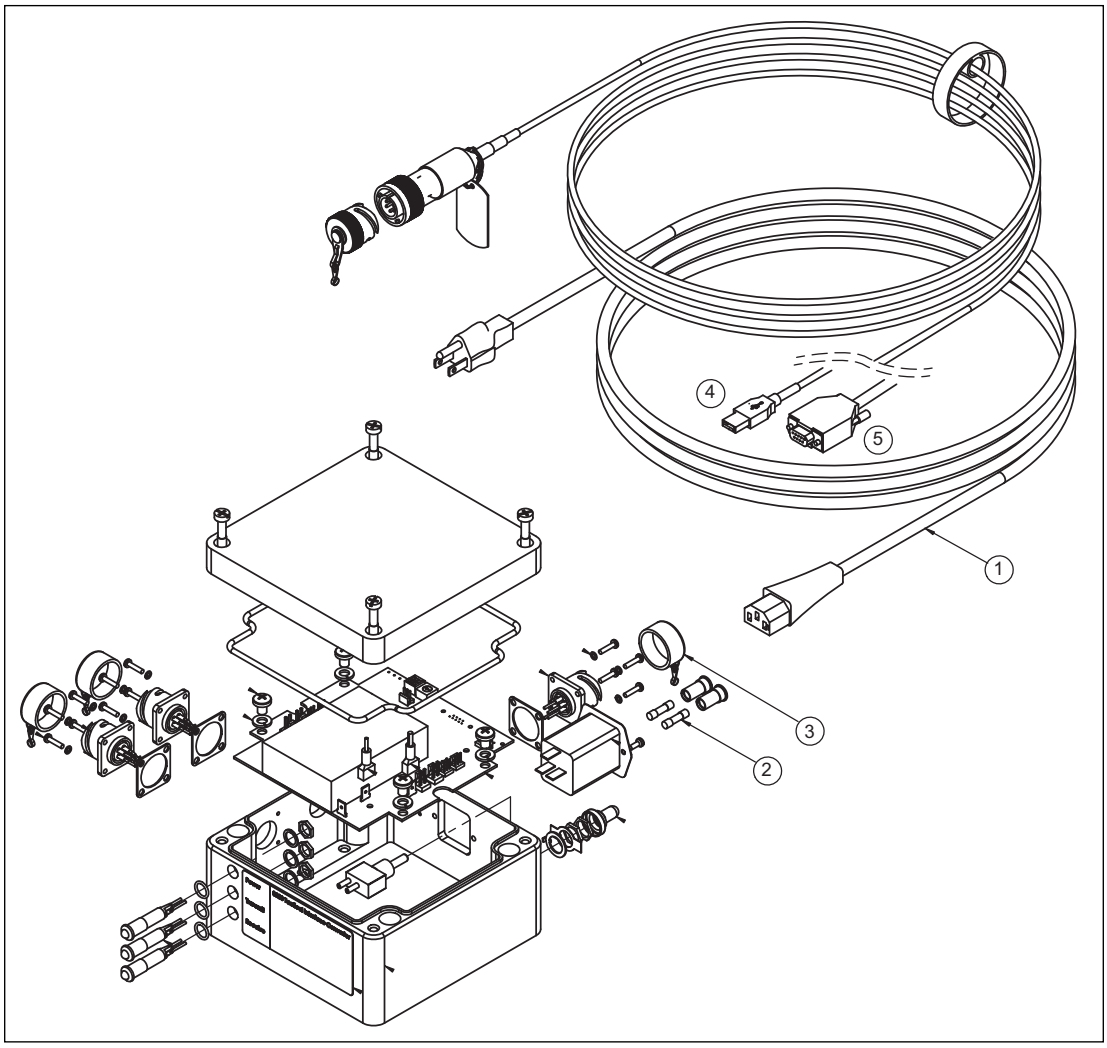


Figure 20: 8250 Spare Parts

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 14 on page 31.

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

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).

Note Repeat Step 2 above for pins B, C, and D.

Index

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