

EMR4

Application Guide

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Introduction

General

This manual covers truck and terminal - fueling depot installation of the Veeder-Root Electronic Meter Register (EMR4) System. The EMR4 System consists of several major components:

- **Display Head (DH)** - The Display Head replaces the mechanical register on a truck or a terminal - fueling depot flow meter. Using the Display Head front panel display and the keys on its face, the operator can choose to dispense either a preset or a variable quantity of product. A Temperature Probe is included for optional temperature compensated product deliveries.
The Display Head must be configured and calibrated before it is placed in service. Once the initial Configuration and Calibration procedures are complete, the Display Head is sealed for weights and measures certification.
- **Interconnect Box (IB)** - The IB box contains the EMR4 System control circuitry. The IB is mounted in the truck cab or the terminal - fueling depot office. The IB provides an intrinsically-safe barrier for connections to one or two Display Heads located at dispensing points in the hazardous area. IB boxes can accept either 12 or 24 Vdc input power. Note: check label affixed to outside of IB box to verify input power ratings.
- **Printer** (optional) - A multi-part slip printer (truck cab) or roll printer (terminal - fueling depot office)
- **Remote Display** (Optional) - For use as a secondary Display unit in the cab along with a meter mounted Display Head, or for use as a Display Head (w/ Remote Pulser) in dual meter configurations.
- **Remote Pulser** (Optional) - Mounts directly onto meter. This pulser is functionally identical to the internal encoder.

EMR4 – Legal Disclaimer Notice

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THE COMBINATION OF THE EMR4 AND THE PRODUCT METER MUST BE CALIBRATED PRIOR TO PERFORMING CUSTOMER TRANSACTIONS.

System Specifications

- **System power:** 10 - 28 Vdc, fused @ 5 A
- **Pulser Capacity:** 0 - 1000 rpm (0-1667 Hz)
- **Temperature compensation range:** -40 to +158°F (-40 to +70°C)

- **Communication between Display Head and IB:** RS-485; 2-wire half duplex; custom protocol; 115,200 baud; 8 bit; no parity; 1 stop bit
- **Communication between Printer and IB:** RS-232; 9600 baud; 8 bit; no parity; 1 stop bit
- **Display Head Operating temperature range:** -40 to +140°F (-40 to +60°C)
- **IB Operating temperature range:** -13 to +104°F (-25 to +40°C)
- **Display Head and IB Storage temperature range:** -40 to +185°F (-40 to +85°C)
- **Printer power:** +24 Vdc, 2 A (supplied by the IB)
- **Printer Operating temperature range:** +32 to +122°F (0 to +50°C)
- **Printer Storage temperature range:** +32 to +122°F (0 to +50°C)
- **Weights and Measures:** Designed to meet NIST, OIML, Australian and Canadian W&M specifications.
- **Relay Ratings:** 5A at 120 Vac, 2.5A at 240Vac, 5A at 24 Vdc
- **Vibration:** MIL-STD-810G, Method 514.6; Table 514.6 C-VI Category 4
- **Shock:** MIL-STD-810G, Method 516.6; 20G, 11ms, 1/2-Sine

Available Parts

All available EMR4 system parts, including options, are listed below.

- Display Head (P/N 84559X-XXX) - standard
- Keypad Group (P/N 845900-014) - optional
- Bracket with internal V-R Encoder Installation Kit (P/N 845900-015) - included with Display Head
- C&C Corner Switch Group, Normally Open (P/N 845900-018) - included with Display Head
- Slip Printer Kit (10 feet [3.04m] cable included) (P/N 845900-020) - optional
- Temp Probe Kit (P/N 845900-002) - replacement
- Thermowell group - UL/cUL Listed, 350 psi working pressure, Canadian W&M Approved (P/N 0331373-001)
- Interconnect Box (P/N 8457XX-XXX) - standard
- Display Head Hookup Cable: 4-conductor cable from 6 to 1000 feet (1.83 to 152.4 m) lengths (P/N 846000-1XX)
- Emergency Stop Switch (ESS) Kit (P/N 845900-021) - optional
- Remote Display Head (P/N 84559X-002) - optional
- Remote Display Bracket Install Kit (P/N 845900-024) - optional
- RS-232 Cable Kit (P/N 330020-432 [10 feet {3.04 m}]) - optional
- Top Mount Remote Pulser Kit (P/N 845900-504) - optional
- Front Mount Remote Pulser Kit (P/N 845900-505, 845900-506) - optional
- Epson TM-U220A Roll Printer Only (Cable in separate kit) (P/N 845900-067)
- Printer Cable Kit - 10 feet (3.04 m) (845900-013) - optional
- Printer Cable Kit - 35 feet (10.67m) (845900-071) - optional












If the EMR4 Display Head will be installed in an application other than replacing a V-R Mechanical Meter Register, you must also have the Veeder-Root approved installation kit for that meter.

NOTICE The 300 series installation kits, include the necessary meter connection parts as well as 35 feet of communications cable for a typical truck application. A printer cable kit - 10', 845900-313, and temperature probe kit, 845900-302, will need to be selected if required.


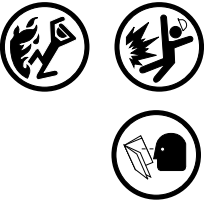
- Kit - installation for Tokheim, Daniels, Energy Flow Systems (Donovan) - Temp Comp (P/N 845900-304)
- Kit - installation for Smith - Temp Comp (P/N 845900-305) Satam, Avery Hardoll, Alfons Haar, Petrol Instruments
- Kit - installation for Liquid Controls, SAMPI, Total Controls Systems - Temp Comp (P/N 845900-306) Tuthill
- Kit - installation for 1-1/2" - 4" Neptune/Liquatech with existing mechanical Temp Comp - Temp Comp (P/N 845900-308)
- Kit - installation for 1-1/2" - 4" Neptune/Liquatech with no existing mechanical Temp Comp - Temp Comp (P/N 845900-309)
- Kit - installation for Brodie Brooks - Temp Comp (P/N 845900-327)
- Kit - Installation for 3/4" and 1" Neptune/Liquatech with existing mechanical Temp Comp (P/N 845900-010)
- Kit - Installation to retrofit 3/4" and 1" Neptune/Liquatech with electronic Temp Comp (P/N 845900-310)

Safety Symbols

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

 <p>EXPLOSIVE Fuels and their vapors are extremely explosive if ignited.</p>	 <p>FLAMMABLE Fuels and their vapors are extremely flammable.</p>
 <p>TURN POWER OFF Live power to a device creates a potential shock hazard. Turn Off power to the device and associated accessories when servicing the unit.</p>	 <p>WARNING Indicates a hazardous situation which, if not avoided, could result in death or serious injury.</p>
 <p>NOTICE Alerts the user to practices not related to physical injury.</p>	 <p>CAUTION Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.</p>
 <p>NO OPEN FLAMES Open flames from matches, lighters, welding torches, etc. can ignite fuels and their vapors.</p>	 <p>INJURY Careless or improper handling of materials can result in bodily injury.</p>
 <p>GLOVES Wear gloves to protect hands from irritation or injury.</p>	 <p>WEAR EYE PROTECTION Fuel spray from residual pressure in the lines can cause serious eye injuries. Epoxy sealant can cause eye injury. Always wear eye protection when working with pressurized lines and epoxy mixtures.</p>
 <p>READ ALL RELATED MANUALS Knowledge of all related procedures before you begin work is important. Read and understand all manuals thoroughly. If you do not understand a procedure, ask someone who does.</p>	

Safety Warnings

 WARNING	
	<p>This system operates near highly combustible fuel storage tanks.</p> <p>FAILURE TO COMPLY WITH THE FOLLOWING WARNINGS AND SAFETY PRECAUTIONS COULD CAUSE DAMAGE TO PROPERTY, ENVIRONMENT, RESULTING IN SERIOUS INJURY OR DEATH.</p> <p>VEEDER-ROOT'S EMR4 PRODUCT IS NOT APPROVED FOR USE AS A COMPONENT THAT PROVIDES LIQUID ADDITIVES TO AN AIRCRAFT FUELING SYSTEM.</p> <p>To ensure proper installation, operation, and continued safe use of this product:</p> <ol style="list-style-type: none"> 1. Read and follow all instructions in this manual, including all safety warnings. 2. Have equipment installed by a contractor trained in its proper installation and in compliance with all applicable codes including: the National Electrical Code; federal, state, and local codes; and other applicable safety codes. 3. To prevent ignition of flammable or combustible atmospheres, disconnect power before servicing. 4. Operate this equipment in accordance with the instructions in this manual. 5. Do not modify or use service parts other than those provided by Veeder-Root. Substitution of components may impair intrinsic safety.

NOTICE

This system operates on low dc voltage/current inputs. To avoid equipment damage:

- **Disconnect the EMR power wire prior to using vehicle battery charging equipment.**
- **Disconnect the EMR power wire prior to jump starting the vehicle.**
- **Disconnect the EMR power wire prior to replacing the vehicle's battery.**
- **Always disconnect the IB box from truck power before welding on the truck.**

If the storage tank to be fitted with an EMR4 system either contains or at any time has contained petroleum products then the tank inspection chamber must be considered a hazardous environment as defined in IEC EN 60079-10 Classification of Hazardous Areas. Suitable working practices for this environment must be observed.

Special Conditions for Safe Use

All installations must be made in accordance with the accompanying Descriptive System Documentation (see Appendix A for certificate descriptions).

EMR4 Truck Installation

Installation of the EMR4 System involves installing the Display Head(s), the Interconnect Box, and any optional devices (e.g., Remote Pulser, printer, etc.). This equipment must be installed according to the applicable installation document. For UL/cUL installations use Control Drawing number 331940-021 and for ATEX installations use Descriptive System Document number 331940-022. Figure 1 shows an example dual Display Head installation.

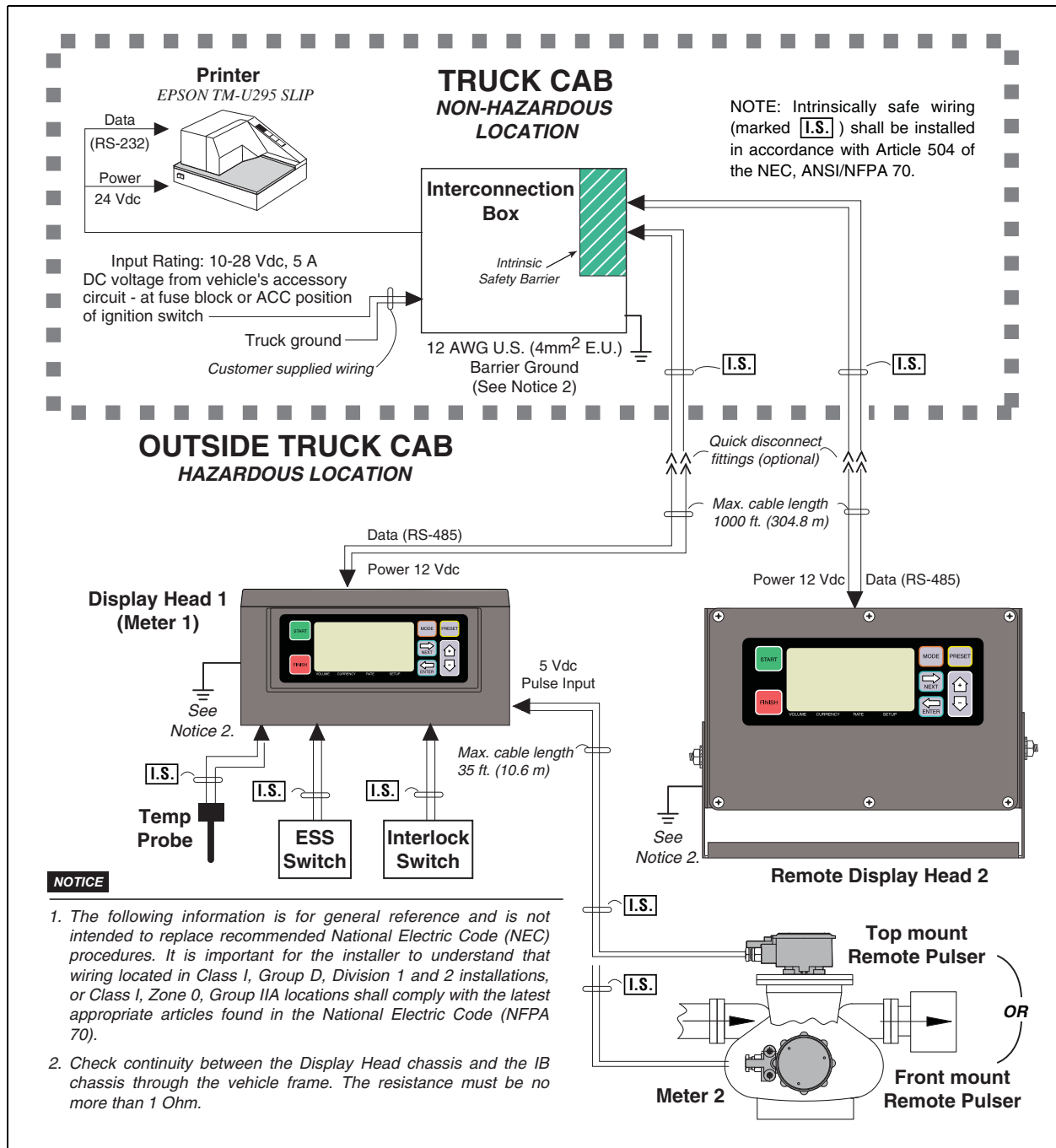


Figure 1. Example EMR4 truck Installation With 2 Display Heads And Optional Remote Pulser

Installation Procedures - Fuel Oil Truck Application

Follow the installation procedures below for your particular EMR4 approved Flow Meter Installation.

LIQUID CONTROLS/TOTAL CONTROL SYSTEMS FLOW METER INSTALLATION

Table 1 lists the parts included in the EMR4 approved adapter kit.

Table 1. Display Head-to-Liquid Controls Adapter Kit 845900-006

Item	Qty	V-R P/N
Wire - Sealing 24" LG	1	011853-285
Shaft - Drive Short L.C.	1	328907-001
Groove Pin - 0.063" D x 0.375"	1	510162-001
Coupling - Double End Short	1	331413-001
Coupling - Double End Long	1	331413-002
Sleeve - Hex Coupling Shaft	1	331955-001
O-ring - 0.145" x 0.070" W	1	512700-242

INSTALLATION PROCEDURE



1. Remove and put aside the four mounting bolts holding the existing meter register assembly to the meter adapter mounting flange. Remove the existing register. Put the bolts aside.
2. Run the flow meter and verify that the flow meter's vertical drive shaft (Figure 3) is rotating in a counter clockwise direction. If not, make the necessary mechanical adjustment(s) to ensure the vertical drive shaft rotates counter-clockwise.
3. Remove adjuster dust cover plate from front of meter (Figure 2). Remove existing adjuster and coupling shaft. Notice the type of vertical drive shaft in the meter (Figure 3).

If vertical drive shaft has a hex with pins protruding on opposite sides, slide the open end of the kit's short drive shaft (P/N 328907-001) over the EMR4 input shaft and secure with kit's groove pin (P/N 510162-001). Lower Display Head onto meter, guiding the encoder shaft assembly into meter, then insert the long (P/N 331413-002) or short (P/N 331413-001) shaft as required over the pins on the meter's drive shaft.

If vertical drive is hexagon style, slide the kit's o-ring (P/N 512700-242) over the end of the encoder shaft just past the shaft's through-hole. Slide the end of the hex shaft (P/N 331955-001) with the small through-hole over the encoder shaft and secure with groove pin from kit (P/N 510162-001). Slide the o-ring down the encoder shaft until it seats in the end of the hex shaft. Lower Display Head onto meter, guiding the encoder shaft assembly into meter. As you lower the Display Head, guide the bottom end of the hex coupling over the vertical drive shaft of the meter.

4. Place the EMR4 Display Head unit on the meter adapter mounting flange and rotate the unit until the display is facing in the desired direction and check to see that the four meter adapter flange mounting holes align with four of the eight tapped (1/4 - 28 UNF-2B threads) mounting holes in the base of the Display Head's housing. You may have to rotate the Display Head right or left a little to line up the four holes. Replace the four mounting bolts and tighten them securely.

5. Replace the adjuster dust cover plate on the front of the meter.
6. If you have the optional temperature probe, remove the existing temperature probe and replace it with the Display Head temperature probe.

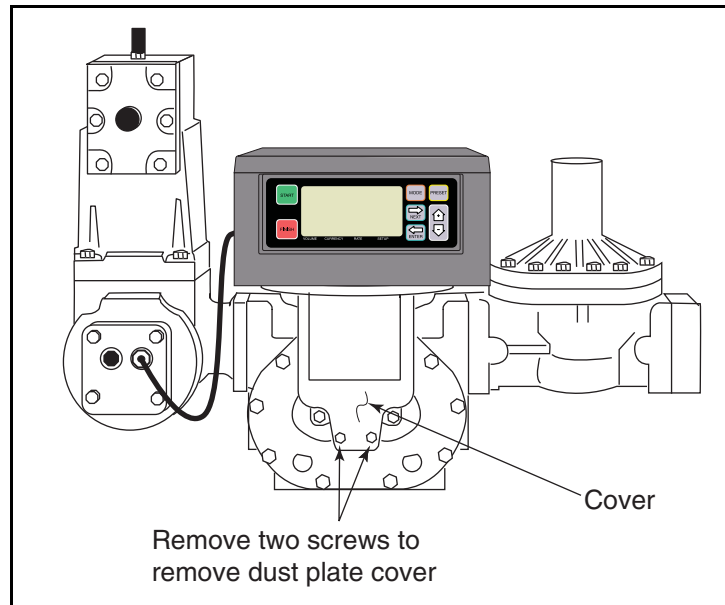


Figure 2. Remove Adjuster Dust Cover Plate

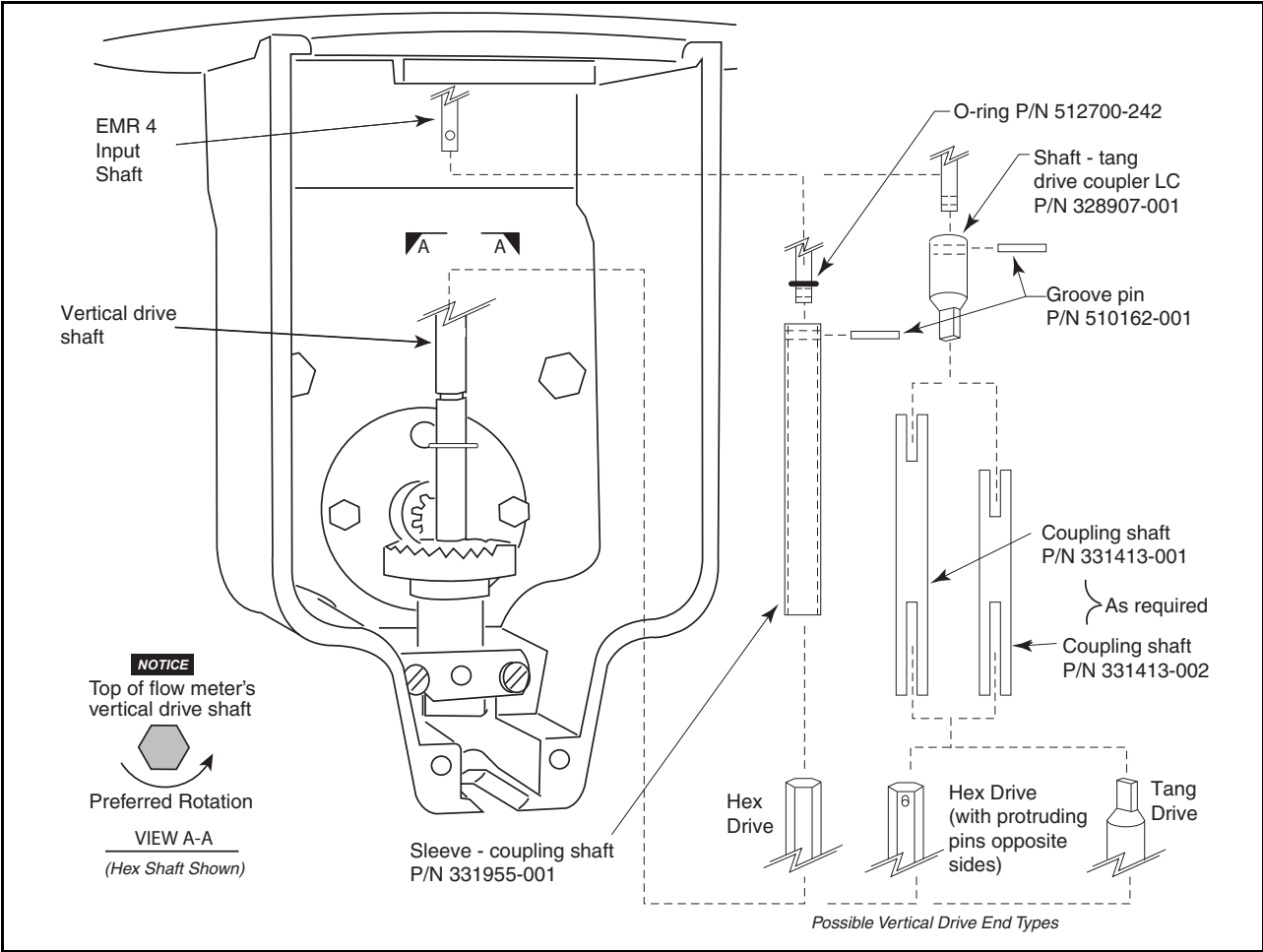


Figure 3. Installing Meter Encoder Adapter Coupling

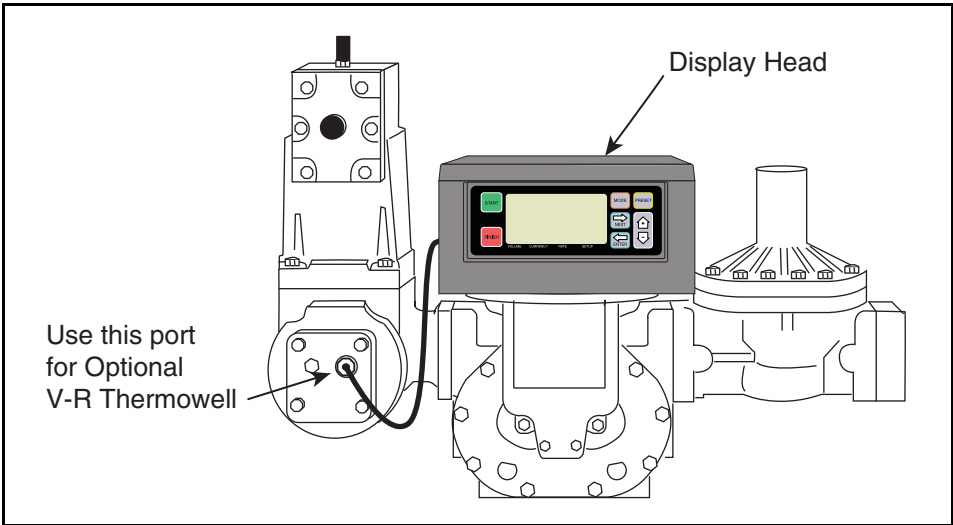


Figure 4. Example Of Temperature Probe Installation

TOTAL CONTROL SYSTEMS MODEL 682 PISTON FLOW METER INSTALLATION

Table 2 lists the Veeder-Root parts needed for this installation.

Table 2. V-R Parts Required for Display Head-to-TCS 682 Piston Meter Installation

Item	Qty	V-R P/N
Wire - Sealing 24" LG	1	011853-285
Coupling	1	065004-005
Pin	1	510105-177

INSTALLATION PROCEDURE

1. The TCS Model 682 Piston Meter installation requires a coupling (V/R Pt No. 065004-005) and pin (V/R Pt No. 510105-177) be installed on the Display Head input drive shaft.
2. Run the flow meter and verify that the flow meter's vertical drive shaft (Figure 5) is rotating in a counter clockwise direction. If not, make the necessary mechanical adjustment(s) to ensure the vertical drive shaft rotates counter-clockwise.
3. Remove and put aside the four mounting bolts holding the old meter register assembly to the TCS 682 meter adapter mounting flange. Remove the existing register.
4. Following the steps in Figure 5, assemble the coupling onto the encoder shaft and lower the Display Head onto the TCS meter adapter while aligning the slot in the bottom of the coupling with the pin in the shaft in the top of the adapter.
5. Rotate the Display Head on the meter adapter mounting flange until the display is facing in the desired direction and check to see that the meter adapter flange mounting holes align with the tapped (1/4 - 28 UNF-2B threads) mounting holes in the base of the Display Head's housing. You may have to rotate the Display Head right or left a little to line up the holes. Replace the mounting bolts and tighten them securely.

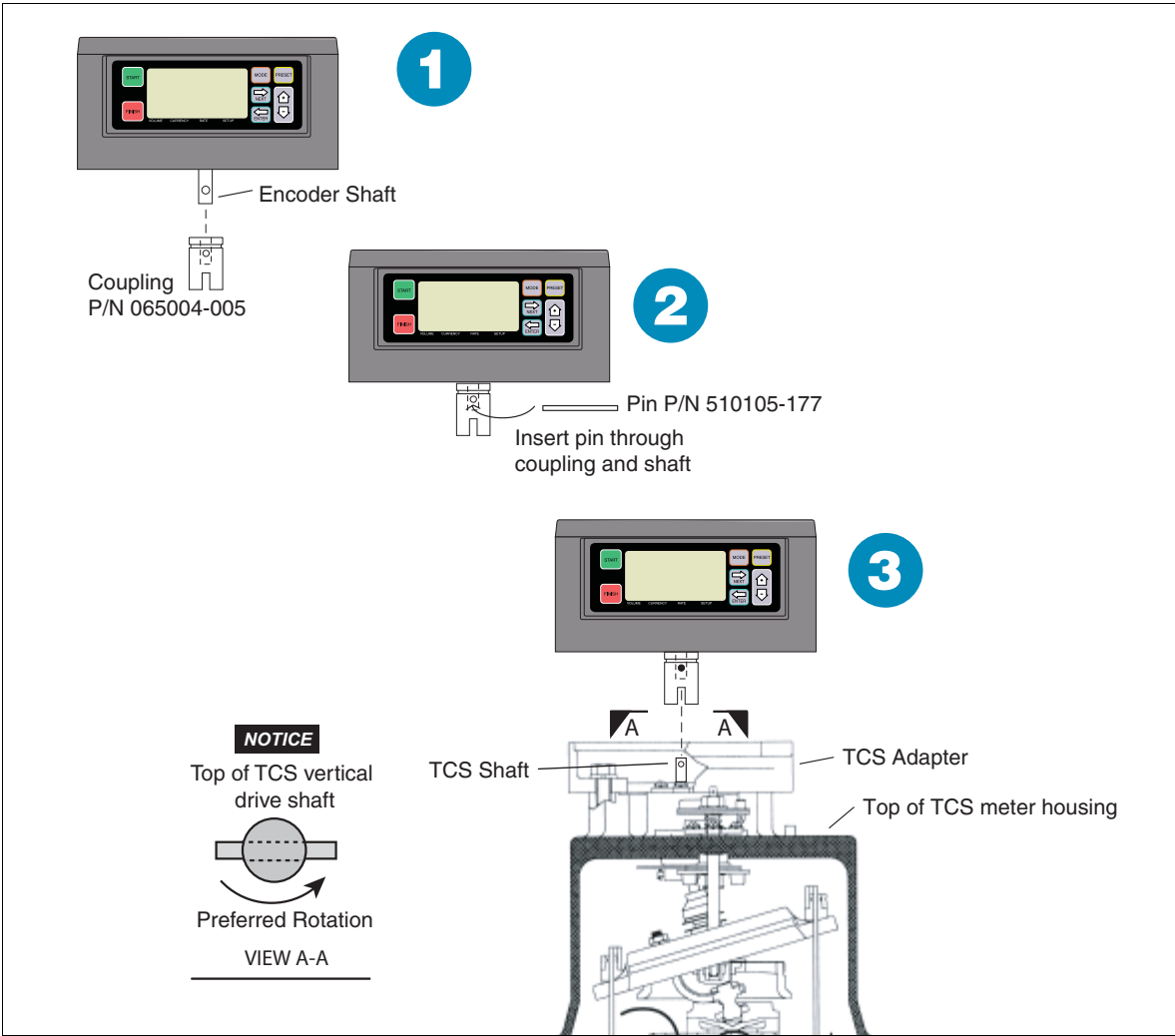


Figure 5. Display Head Mounted On TCS 682 Piston Meter

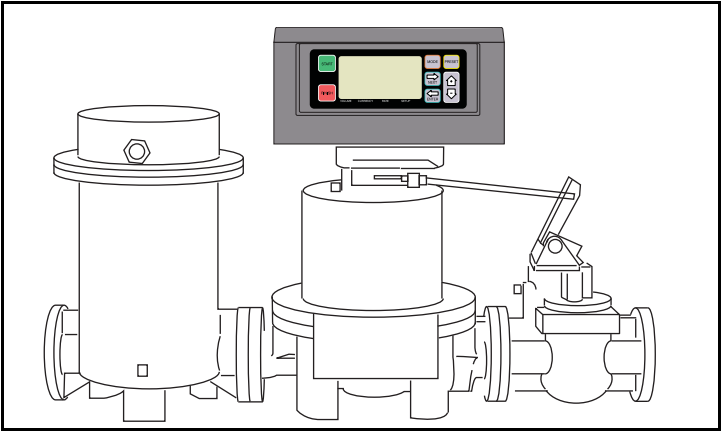


Figure 6. Completed TCS 682 Piston Meter Installation

TOKHEIM, DANIELS & DONOVAN FLOW METER INSTALLATION

Table 3 lists the parts included in the EMR4 approved kit. In addition to the "Installation Procedure" on page 6, see Figure 7 on page 12, Figure 8 on page 13, and Figure 9 on page 14 for instructions on how to disassemble then reassemble the calibrator.

Run the flow meter and verify that the flow meter's vertical drive shaft (Figure 7) is rotating in a counter clockwise direction. If possible, make the necessary mechanical adjustment(s) to ensure the vertical drive shaft rotates counter-clockwise.

Table 3. Display Head-to-Tokheim, Daniels & Donovan Adapter Kit 845900-004

Item	Qty	V-R P/N
Washer - 0.258" x 0.010" x 0.500"	2	011071-325
Wire - Sealing 24" Lg	1	011853-285
Coupling - Slot 0.156" W	1	065004-010
Screw - 1/4-28 x 0.62" Hex	4	503615-001
Lockwasher - 0.256" x 0.02"	4	510003-006
Groove Pin - 0.125" D x 0.750"	1	510105-140
Groove Pin - 0.063" D x 0.781"	1	510105-177
Retaining Ring	2	511810-001
Group - Adapter Shaft	1	331431-001

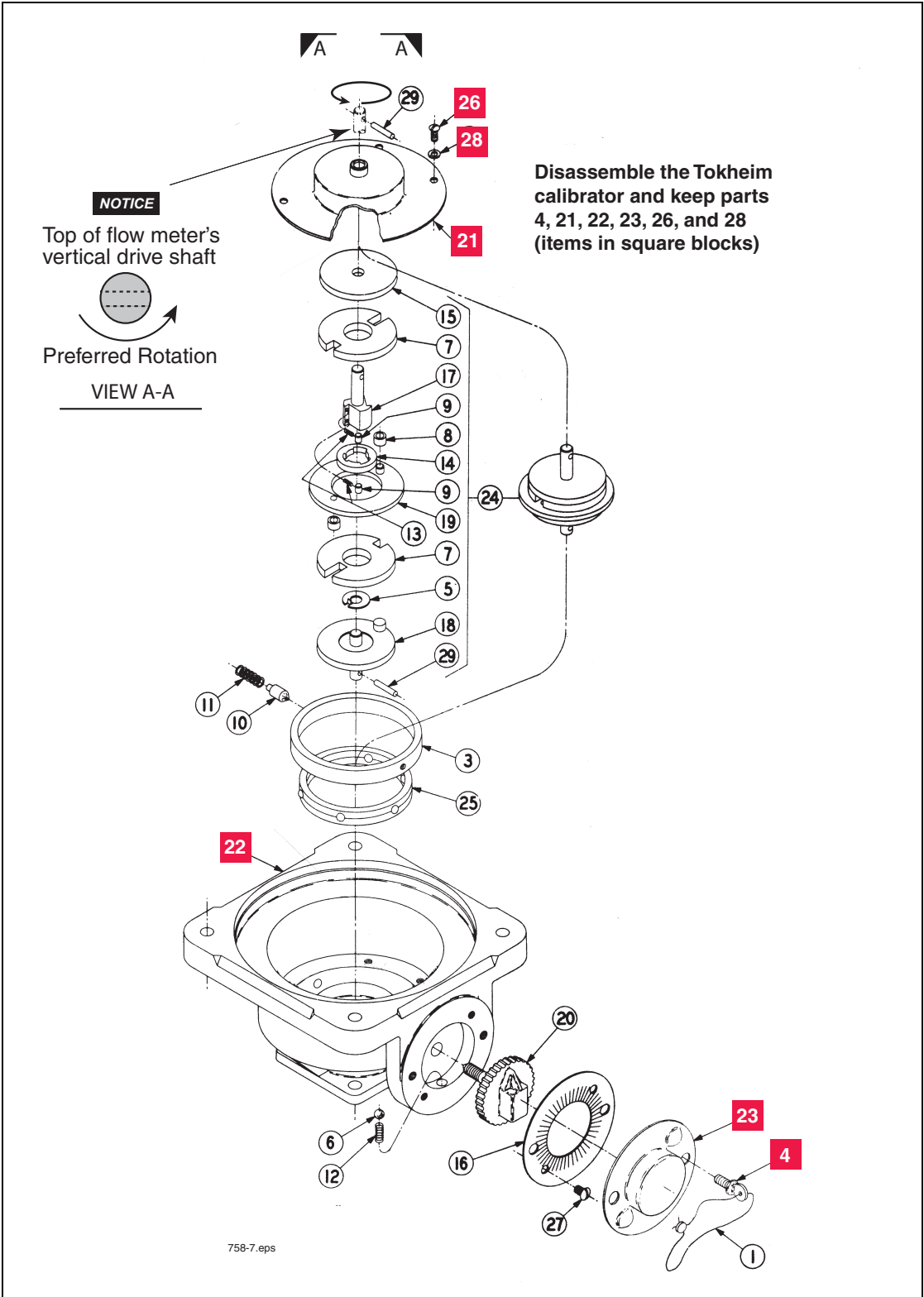


Figure 7. Disassembling The Tokheim Daniels, & Donovan Calibrator

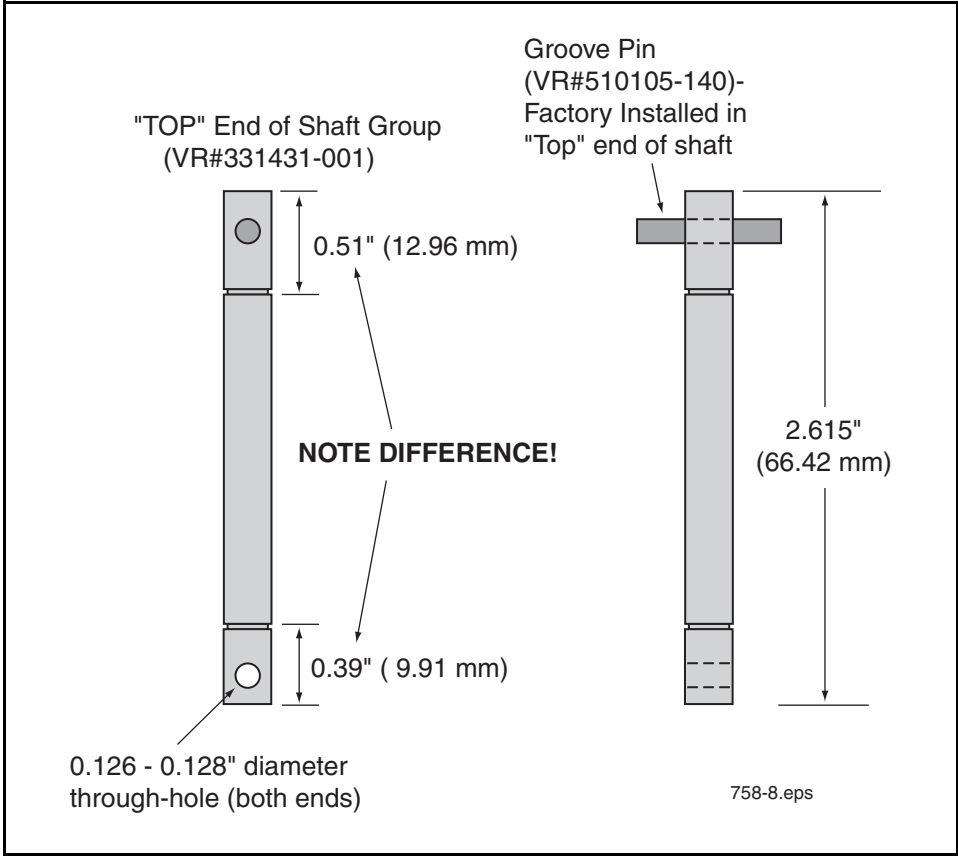


Figure 8. Adapter Shaft Group And Groove Pin For Tokheim, Daniels, & Donovan

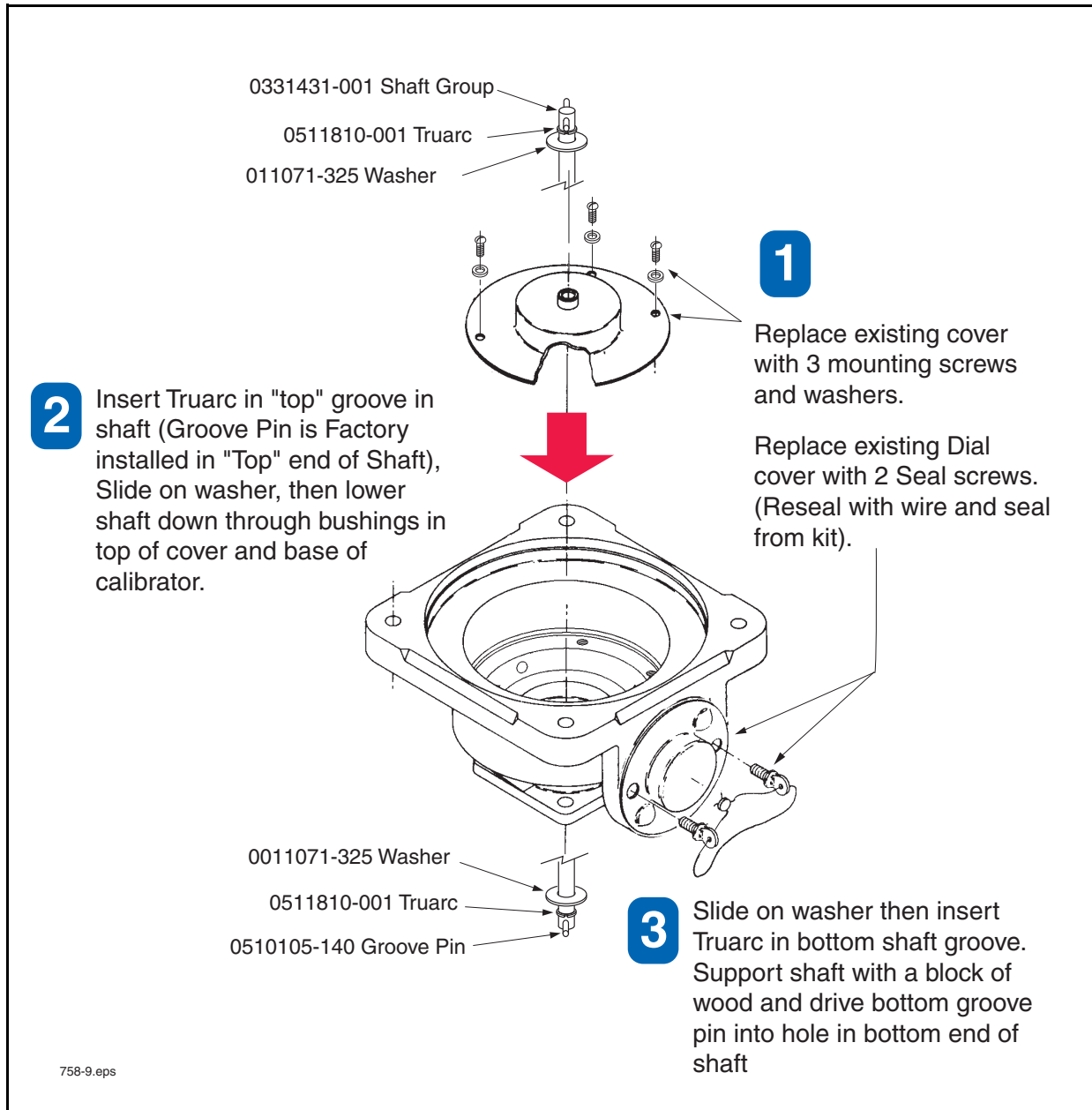


Figure 9. Replacing The Tokheim Daniels, & Donovan Calibrator

SMITH FLOW METER INSTALLATION

Table 4 lists the parts included in the EMR4 approved adapter kit. In addition to "Installation Procedure" on page 6, see Figure 10 on page 16, Figure 11 and Figure 12 on page 17, and Figure 13 on page 18 for instructions on how to disassemble then reassemble the calibrator.

Table 4. Display Head-to-Smith Meter Adapter Kit 845900-005

Item	Qty	V-R P/N
Wire - Sealing 24" LG	1	011853-285
Coupling - Slot 0.130" W	1	065004-005
Screw - 1/4-28 x 0.62 Hex	4	503615-001
Lockwasher - 0.256" x 0.02"	4	510003-006
Groove Pin - 0.078" D x 0.562"	1	510114-001
Groove Pin - 0.063" D x 0.781"	1	510105-177
Group - Short Shaft	1	331433-001
Group - Long Shaft	1	331433-002
Coupling	1	068845-005

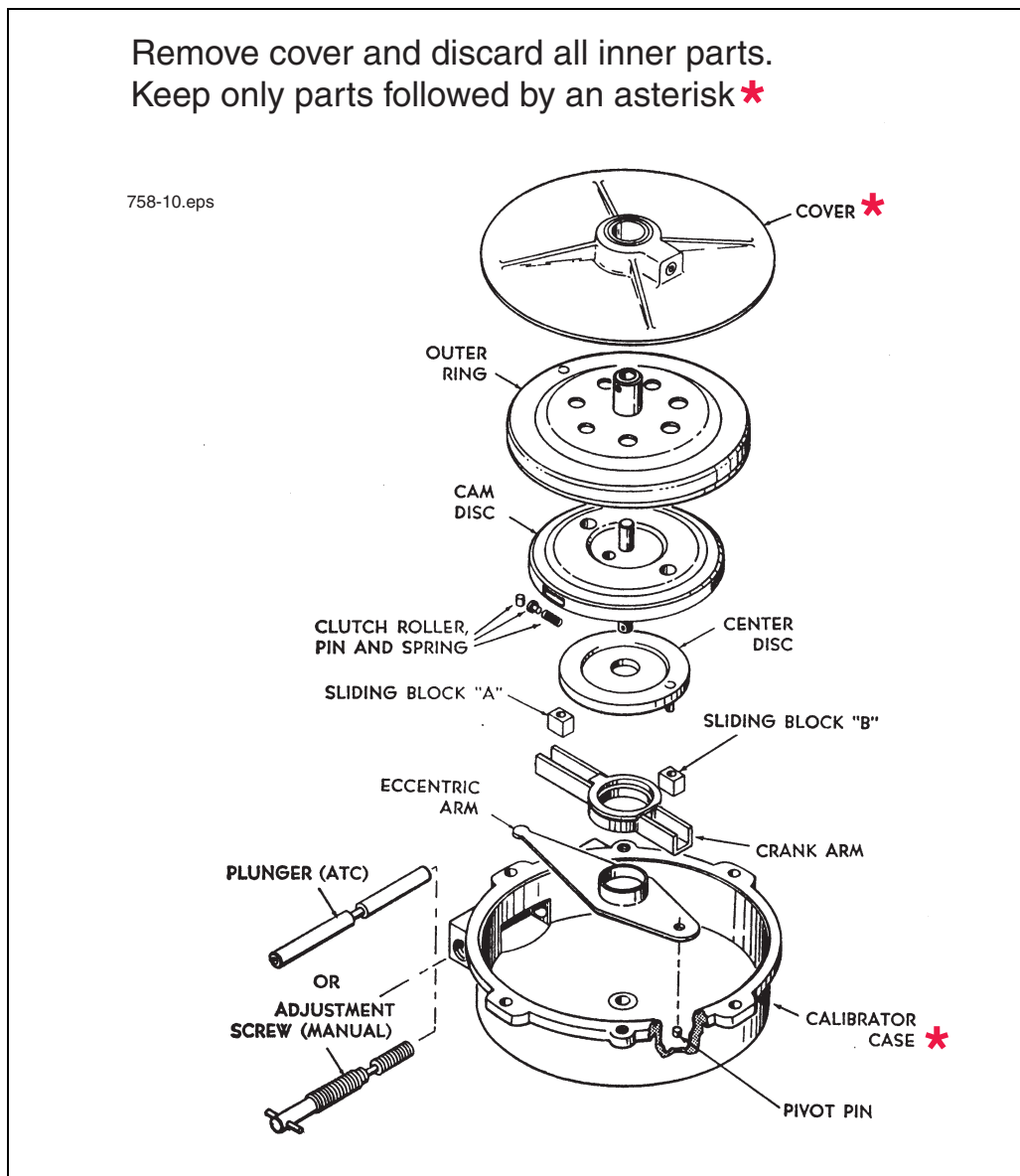


Figure 10. Disassembling The Smith Meter Calibrator

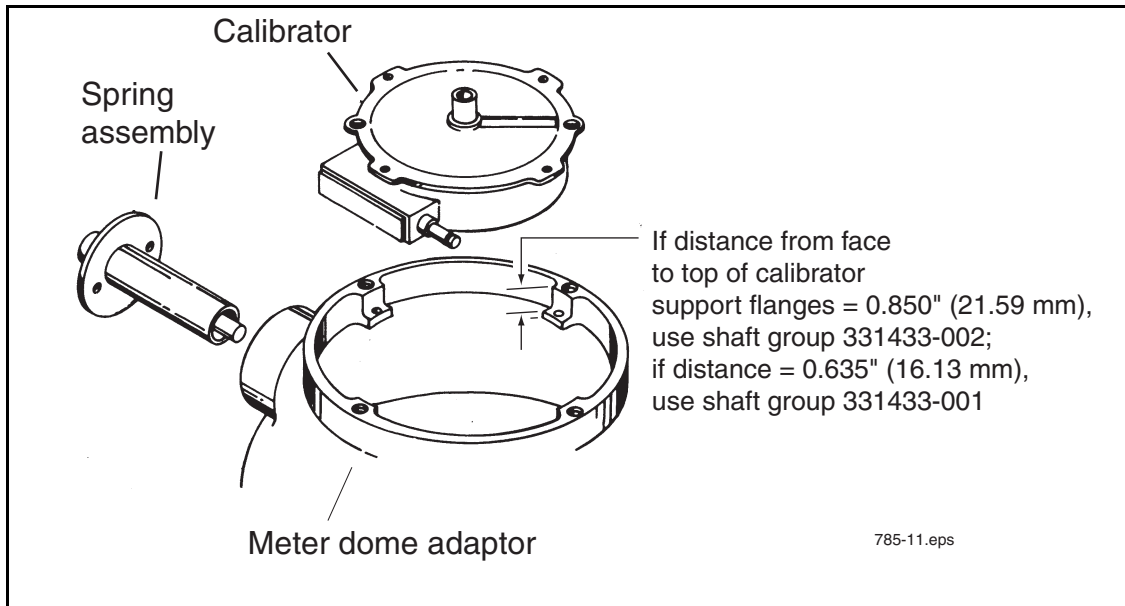


Figure 11. Calibrator, Spring Assembly, And Meter Dome Adapter

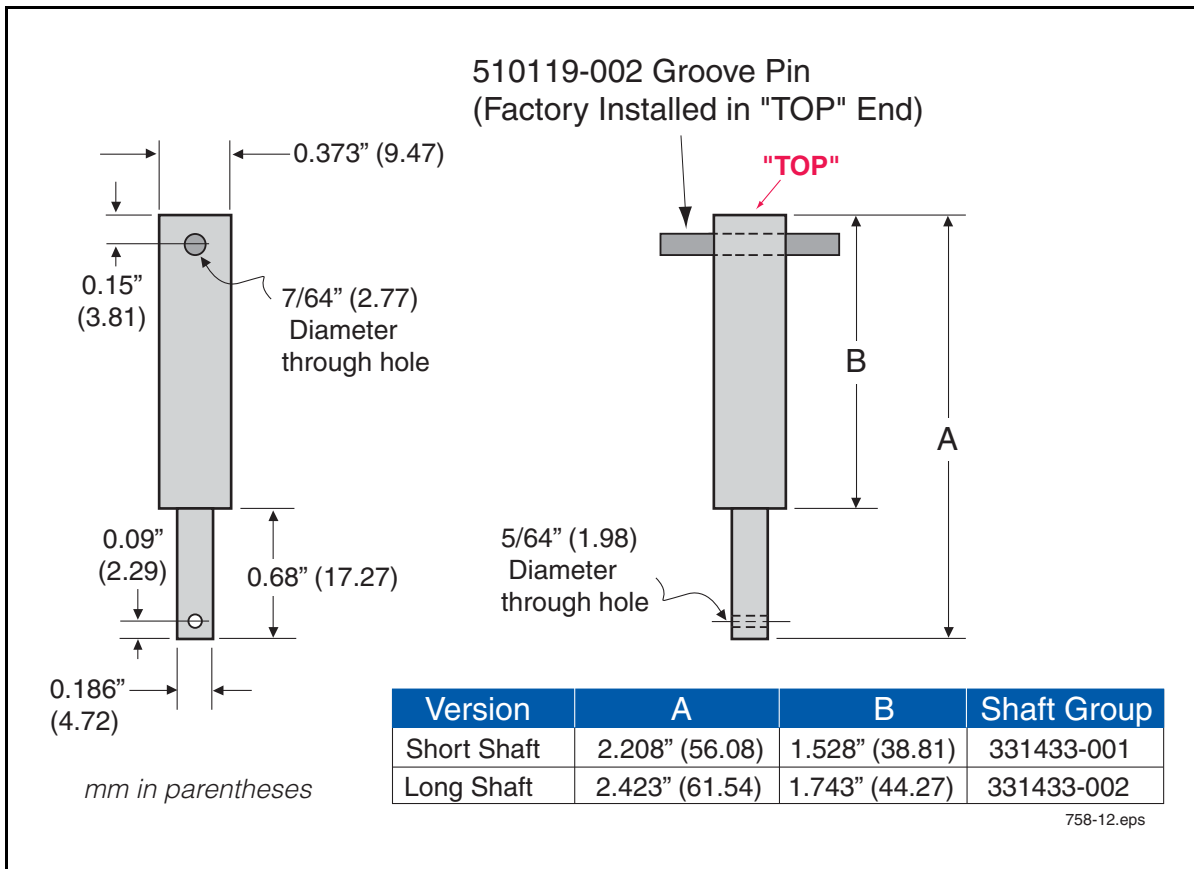


Figure 12. Adapter Shaft And Groove Pin For Smith Meter

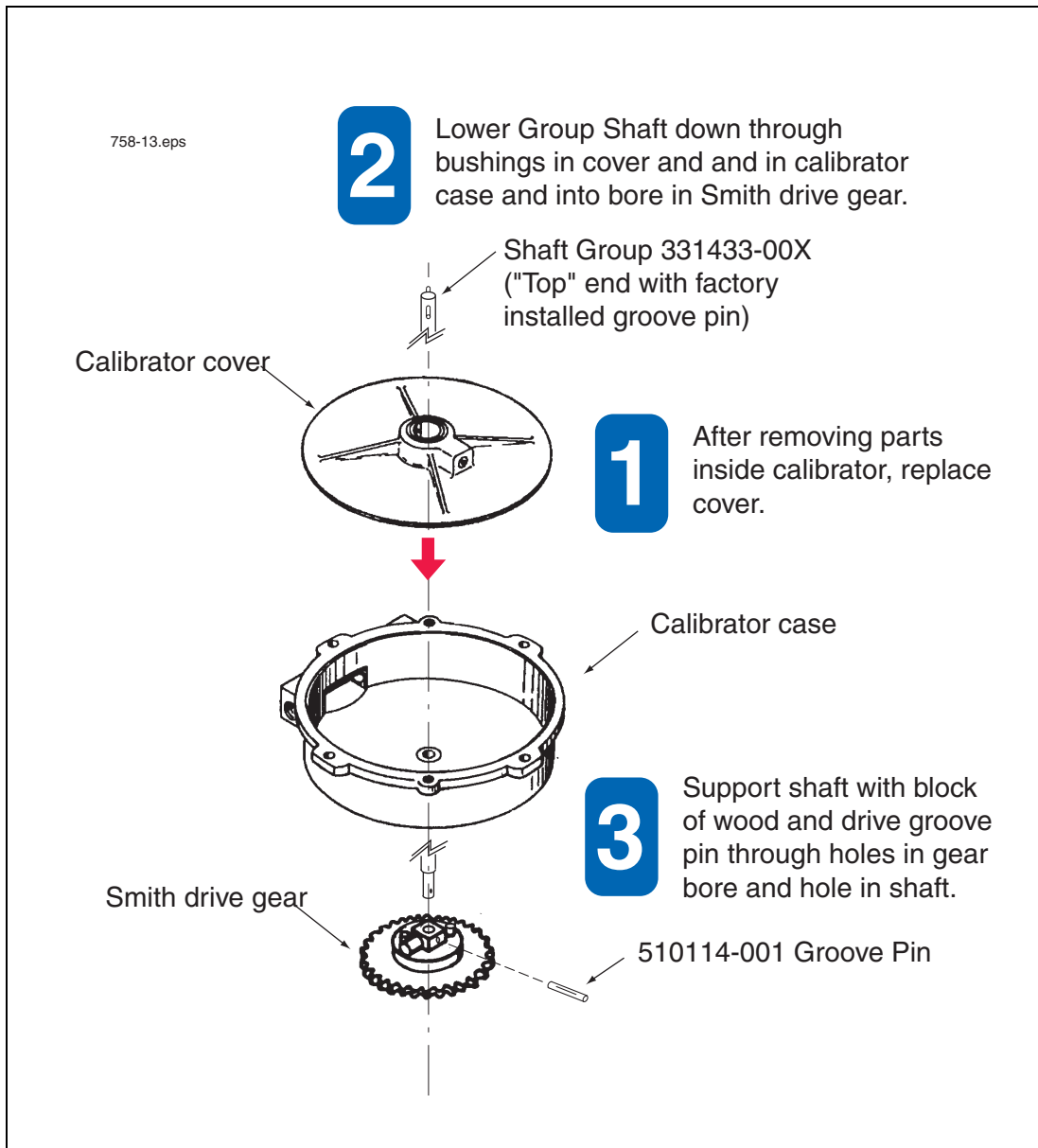


Figure 13. Reassembling The Smith Meter Calibrator

Neptune Flow Meter Installation

Follow the installation procedures for your particular EMR4 approved Flow Meter Installation.

NEPTUNE FLOW METER WITH TEMPERATURE COMPENSATION

Table 5. Display Head-to-Neptune With Temp. Comp. Adapter Kit 845900-008

Item	Qty	V-R P/N
Neptune Adapter Ring	1	333746-001
Input Shaft	1	331656-001
Screws - 1/4-20 x 3/4"	4	510500-325
Screws - 1/4-20 x 5/8"	4	503615-001
Seal Wire	1	011853-285
Groove Pin	1	510107-002
Lockwashers	8	510003-006
Washer - 0.010" thick	1	011071-929
Washer - 0.005" thick	1	011071-785
Truarc Retaining Ring	1	511816-001
Coupling	1	323372-001

NEPTUNE FLOW METER WITHOUT TEMPERATURE COMPENSATION

Table 6. Display Head-to-Neptune W/o Temp. Compensation Adapter Kit 845900-009

Item	Qty	V-R P/N
Neptune Spacer	1	323672-002
Stud	2	036788-005
Lockwasher	2	510023-001
Nut	2	511041-001
Screw-Seal (Meter Register Mounting)	4	503615-001
Lockwasher	4	510003-006
Seal Wire	1	011853-285
Coupling	1	323372-001
Groove Pin	1	510107-002

1. Remove and put aside the four mounting bolts holding the meter register assembly to the meter adapter mounting flange. Remove the existing mechanical register.
2. Remove the cover, P/N 86665-000, from the mechanical register's lever arm assembly.
3. Remove the lever arm assembly from the meter. Keep the locking pin (P/N 86661-001).
4. Remove and put aside the four mounting bolts holding the meter register assembly to the spacer (these bolts may be needed for reassembly).
5. Remove the mechanical meter register and the (4) temperature compensator bolts. Take out the compensator gear assembly.
6. Keep the main case cover (P/N 400081-002) and the spacer (P/N 86711-000) in place. Clean off the top of the spacer.
7. Set the V-R Adapter (P/N 333746-001) on top of the spacer and mount it using (4) bolts (P/N 510500-325) with lockwashers [see Figure 14].

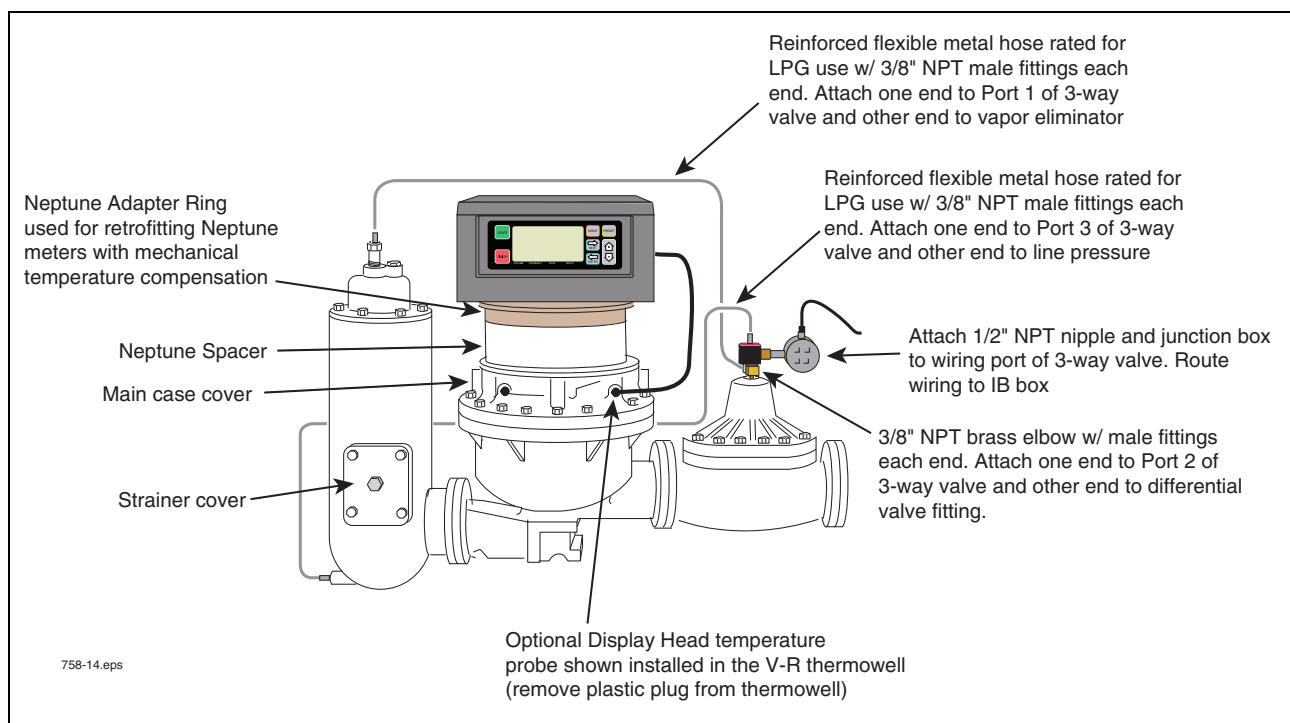


Figure 14. Example Of Temperature Probe Installation In Main Case Cover

8. Notice the type of coupling connecting the register/preset to the meter adapter input shaft.
9. Remove the four cover bolts of the Display Head and lift off the cover. Put the cover and bolts aside.
10. Look at the base of the Display Head. Locate the Encoder Drive Spring (see Figure 20). Pull/slide the encoder spring off of the encoder shaft.
11. The end of the encoder input shaft projecting out of the bottom of the Display Head has a small cotter pin inserted in it to keep it from sliding up into the Display Head and a washer (P/N 011071-933). Remove this cotter pin. Remove the encoder input shaft and washer.
12. Get the 4" (101.60 mm) long encoder input shaft, the 0.010" and 0.005" thick washers, the retaining ring, the groove pin, and the coupling from the installation kit.

13. With the encoder spring in your left hand and the input shaft in your right, orient the input shaft as shown in Figure 15, then rotate the input shaft in a counter-clockwise direction as you 'screw' it into the spring until the flange on the input shaft is about 1/8" from the end of the spring.

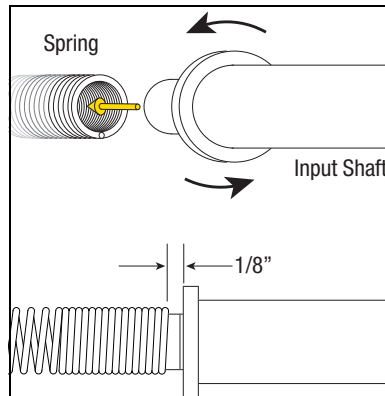


Figure 15. Screwing Input Shaft CCW Into Encoder Spring

14. Assemble the new shaft, the 0.005" and 0.010" washers and the retaining ring in the Display Head base as shown in Figure 16.

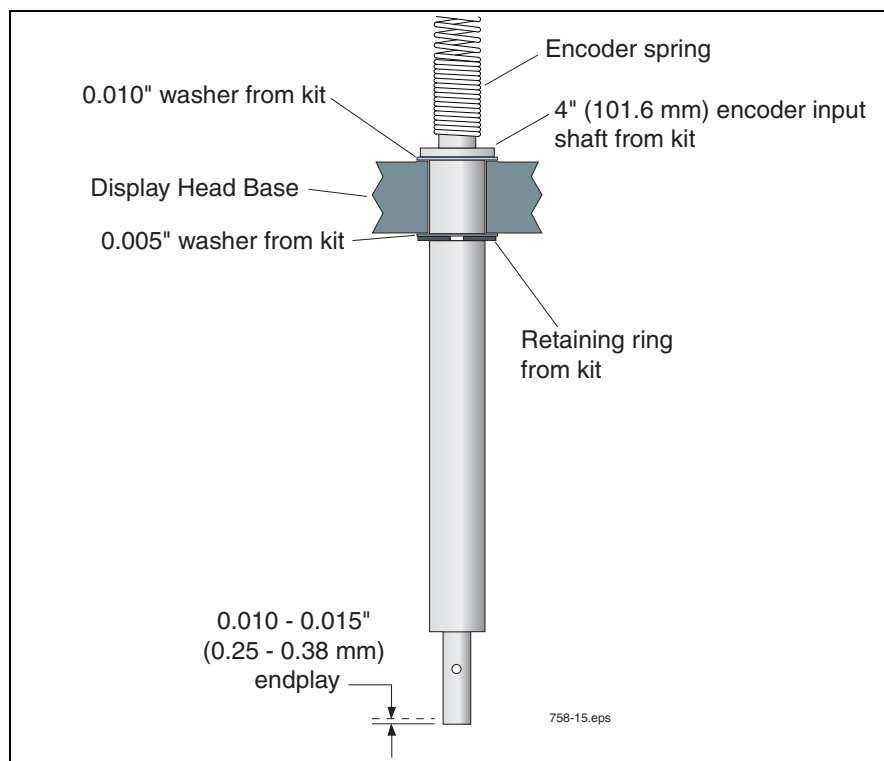


Figure 16. Assembling Neptune Adapter Shaft Group In Display Head Base

15. Carefully bend the encoder spring over to the encoder shaft and push the open spring end onto the shaft. Work the spring onto the shaft until it is about 1/8" from the pulse encoder (Figure 17).

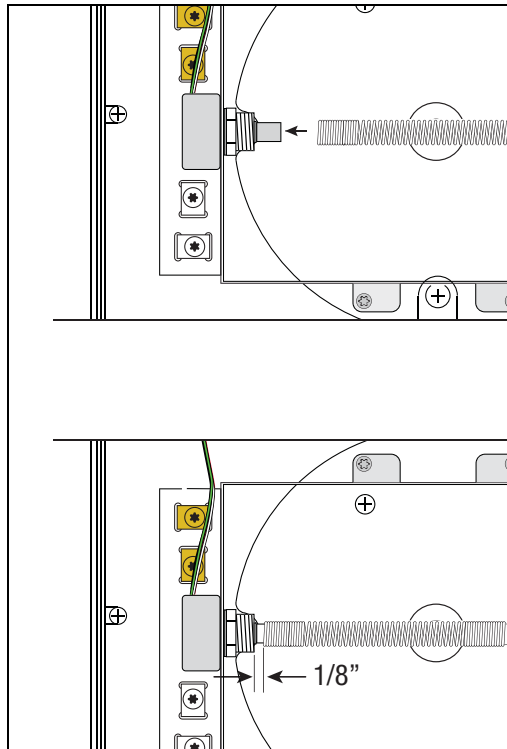


Figure 17. Pushing Encoder Spring Onto Pulse Encoder Shaft

16. With the end play within limits, get the coupling and groove pin from the kit and attach the coupling to the bottom of the input shaft with the pin as shown in Figure 18.

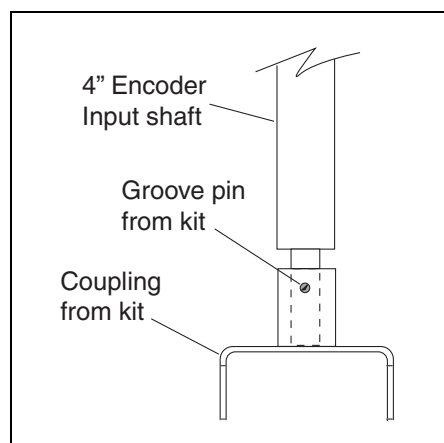


Figure 18. Attaching Coupling To Neptune Adapter Shaft

17. Orient the encoder input shaft coupling so that it 'mates' with the meter adapter input shaft, then lower the Display Head onto the meter adapter mounting flange.
18. Rotate the Display Head on the meter adapter mounting flange until the display is facing in the desired direction and check to see that the four meter adapter flange mounting holes align with four of the eight tapped (1/4 - 28 UNF-2B threads) mounting holes in the base of the Display Head's housing. You may have to

rotate the Display Head right or left a little to line up four holes. Use (4) hex bolts with the seal wire hole in the bolt head (P/N 503615-001) to mount the Display Head to the adapter.

19. If a mechanical (or other) temperature compensator is being replaced, remove the temperature sensing element from the thermowell.

NOTICE

Remove or disable the mechanical compensator. The EMR4 will not work with mechanical temperature compensation and trying to do so will result in inaccurate deliveries.

20. Reference section of the EMR4 Setup and Operation manual for Temperature Probe Verification.

Emergency Stop Switch (ESS) Switch (Optional)

1. If you have the optional ESS switch (P/N: 845900-021), you should install it on the truck near the Display Head. There are two 0.181" (4.6 mm) diameter mounting holes in the ESS switch base. Also, you will need a length of 2-wire cable to connect the ESS switch to the Display Head (see Figure 19),
2. Unscrew the yellow top half of the ESS switch and put it and the gasket aside. Push out the bottom knockout in the black bottom half of the switch housing. Mount the bottom half of the switch to the truck in a place that will be quickly accessible during a delivery, using (2) 0.157" (4 mm) screws. Screw the cord grip fitting from the kit into the knockout in the switch's bottom half. Loosen the cord grip nut/bushing and push one end of the 2-wire (black and white) cable through the cord grip fitting and into the switch housing.
3. Connect the black wire of the cable to the #4 terminal of the ESS switch assembly and the white wire of the cable to the #3 terminal of the ESS switch assembly. Tighten the cord grip nut to seal the cable.
4. Position the ESS switch's yellow top half on the mounted black half, being careful that the gasket is in place. Screw in the four screws in the yellow half of the housing.

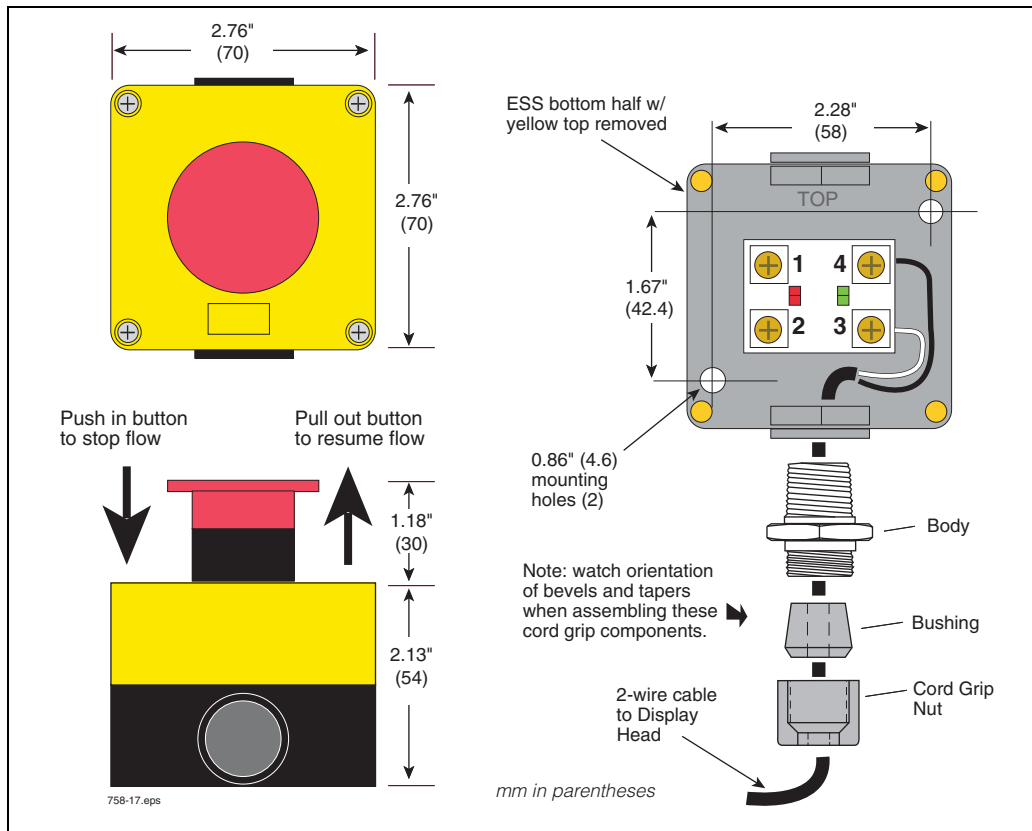


Figure 19. Emergency Stop Switch Mounting And Wiring Diagram

Wiring the Display Head

1. With the Display Head cover still off, remove the nut and bushing from the top side panel cord grip connector. Note: the maximum cable length between the Interconnect Box and the Display Head is 1000 feet (304.8 meters).
2. Slide the cord grip nut and then the bushing over the IB cable leads. Pull enough cable through so that the leads reach the terminal block on the display assembly and can be tie wrapped to the pulse encoder mounting base as shown in Figure 20. Slide the tapered end of the bushing into the cord grip, then screw on the cord grip nut and tighten securely.
3. Attach the four-wire IB cable to the terminal block where shown in Figure 20. Attach the drain wire of the IB cable to a grounding lug on the Pulse Encoder mounting base.

When stripping wire for terminal block connections, be careful not to nick the individual strands. Also, be sure to tighten each terminal so the wire can not be pulled out. A failure to follow either of these instructions can result in signal loss and faulty operation.

4. If you have the optional temperature probe and/or ESS switch, remove the lower cord grip nut and slide it, then the tapered bushing, over the temperature probe and/or ESS switch cable. Pull enough cable through so that the leads reach the terminal block on the display assembly and can be tie wrapped to the pulse encoder mounting base as shown in Figure 20. Slide the bushing into the cord grip and then screw the cord grip nut onto the cord grip and tighten securely. Attach the shield of the temperature probe cable and/or ESS switch cable to a grounding lug on the pulse encoder mounting base.

5. Attach each wire (no polarity) of the 2-conductor temperature probe and/or ESS switch cable(s) where shown on the terminal block label.
6. Tie wrap the IB, ESS switch, and temp probe (if installed) cables to the Pulse Encoder mounting base.
7. For transfer Interlock applications, attach the two wires in the switch cable where shown on the terminal block label and tie wrap the cable to the pulse encoder's mounting base.
8. Replace the Display Head cover and screw in the four cover retaining bolts just enough to hold them in (the cover will be removed later for system calibration).
9. Using the tie wraps from the installation kit, attach the 4-wire cable from the Display Head to the Interconnect Box along the inside of the truck frame, to existing piping, or to the reel motor cable back to the cab. Avoid sharp bends and placements where vibration might wear through the cable. Allow ample cable length to compensate for tilt-cab trucks and to avoid putting additional stress on the assembly. Running the cable through a split loom or tubing will offer added protection from weather and abrasion. Use a rubber grommet or cord grip to line the hole where cable passes through truck cab wall or floor. Tractor-trailer installations will require detachable plugs, and either a separate tensioning device much like that used to protect air lines, or perhaps attach the cable to one of the existing air lines with tie wraps.
10. Check continuity between the Display Head chassis and IB chassis through the vehicle frame. This resistance must be less than 1 ohm.

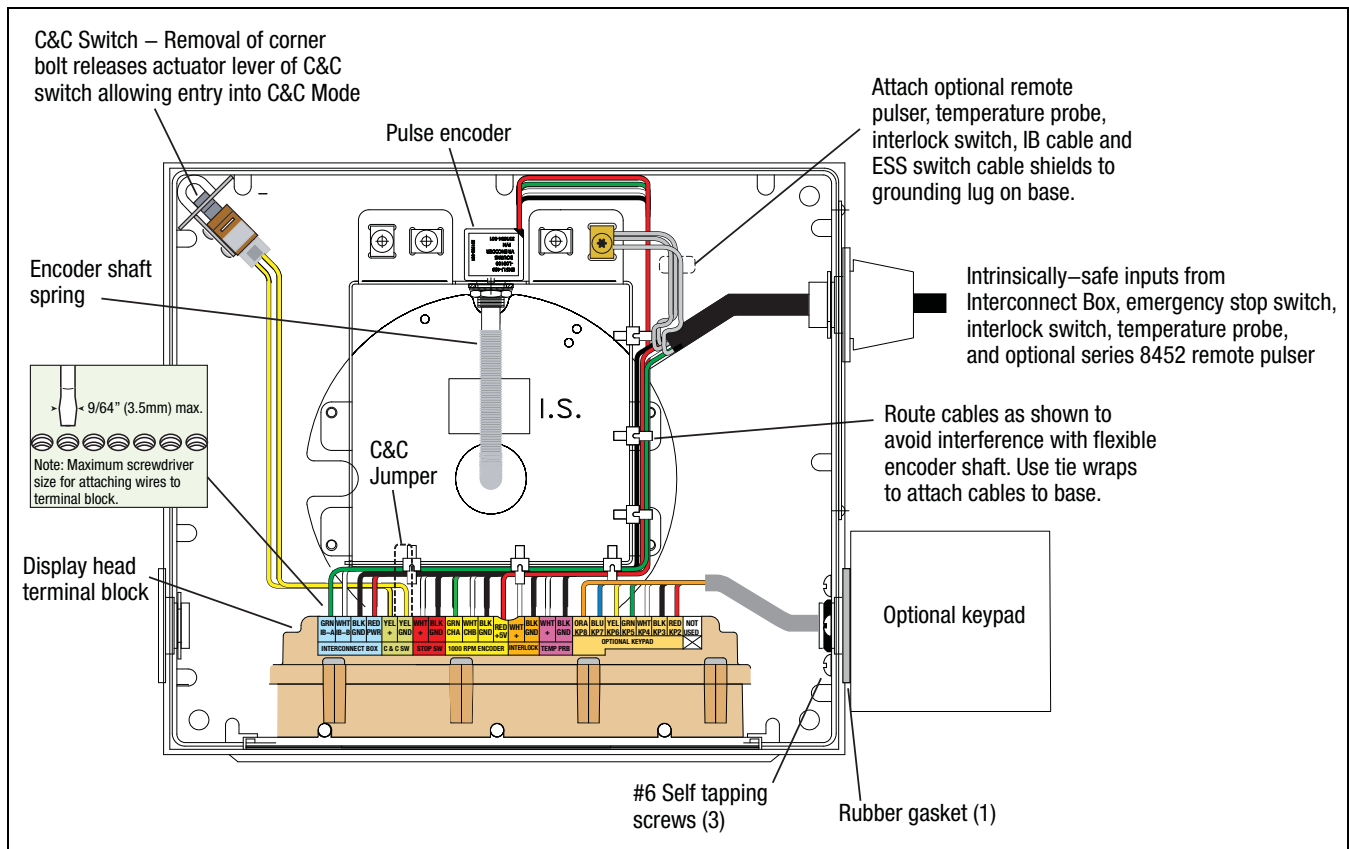


Figure 20. Display Head Cable Connections

C&C Mode Switch

The C&C corner switch assembly (P/N 845900-018) that fits into one corner of the Display Head's housing (see Figure 20). To enter C&C mode, remove the corner bolt from the Display Head's cover. To exit C&C mode, replace the bolt. When using the corner switch, remove the C&C jumper.

Installing Optional Keypad Kit - Right or Left Side

Figure 20 shows the installation and wiring of the optional keypad. To attach the keypad housing mounting screws, you will need to pull/slide up the display assembly away from the Display Head. Insert the keypad wires through the center hole in the gasket, slide the gasket down against the keypad and align its three holes with the mounting holes in the keypad. Hold the keypad against the Display Head and screw in the 3 mounting screws, replace the display assembly and then connect the keypad wiring to the terminal block as shown in Figure 20. The screws are self-tapping. The user may want to pre-tap the holes using the screw to ease installation.

Installing the Interconnect Box (IB)

NOTICE The IB is not rated for mounting in outdoor locations. The IB can be mounted only in a protected enclosure or protected location.

The following information is for general reference and is not intended to replace recommended National Electric Code (NEC) procedures. It is important for the installer to understand that electrical equipment and wiring located in Class I, Division 1 and 2 installations shall comply with the latest appropriate articles found in the National Electric Code (NFPA 70) and other applicable code requirements.

1. The physical dimensions of the Interconnect Box (IB) are shown in Figure 21. The IB is installed in the truck's cab either under the seat, mounted on the wall inside the cab, mounted to the passenger side of the "dog house" in cab-over trucks, or mounted to a custom-made bracket that can also support the optional printer. Use four, 3/16" (4 mm) bolts to mount the IB to the mounting surface. In the event of limited access, the front cover of the IB can be completely removed rather than swung open, by removing four #15 Torx screws. Put the excess coils of cable under the seat or clamp them to the IB mounting stand.
2. Figure 22 shows IB Power Side terminal wiring connections. Remove hole plugs and use cord grips for all cables attaching to this terminal block.

Run the power cable from the truck fuse block or ignition switch to the IB. Clamp the power wire at suitable intervals between the power source and the IB.

Before connecting the truck power wiring, verify the following:

- a. Electrical system has a negative ground.
- b. Battery terminals and cables are in good condition.
- c. Alternator current output is sufficient to supply EMR4 System current requirement of 5 amperes.

Attach the wire from truck ground to the GND terminal of the Power Side terminal block (J8, Pin 2). Also attach the wire from the truck's Accessory (ACC) circuit to the Input-Pwr terminal of the terminal block (J8-Pin 1).

3. Refer to Figure 22 for the IB intrinsically safe terminal wiring connections. Remove hole plugs and use cord grips for Display Head cable entries. The drain wire from the Display Head cable must be connected to the chassis ground clamp in the Interconnect Box.

Input Power – Critical Ground Connection

On some vehicles, the battery minus terminal, BAT(-), may not be common with the chassis ground or the defined vehicle ground located in either the accessory panel or in the power distribution box. In this case, directly run the ground connection for Input Power at J8, Pin 2 (GND) terminal as shown in Figure 22, directly to the BAT(-) terminal connection point.

Proper operation of the EMR4 hardware depends on the quality of the ground connection from the Interconnect Box to the source of INPUT-PWR power.

If the INPUT-PWR connection is made at the accessory panel, it must be fused at 5 amps. The installer must ensure that a minimum of 12.0 volts, between the INPUT-PWR terminal and the GND terminal, is available from the power source. If an improper ground point is used for input power to the EMR4 there may be insufficient power for the Display Head to operate properly resulting in various E## error codes or possibly a blank display.

Pay careful attention to the wiring labels on both the EMR4 Display Head and the Interconnect Box. Each connection must be made according to the wiring tables listed in this manual. Use shielded cable to connect each device to the Interconnect Box and Display Head and ensure that each cable jacket is resistant to gas and oil.

NOTICE Installations With High Amperage Devices

The input power for an EMR4 must be isolated from devices that use large amounts of electric current such as reel motors. Connect the EMR4 using dedicated wiring between the voltage source and the Interconnect Box. On vehicles with multiple voltage sources it may be necessary to use a separate battery or voltage source to power the EMR4. Also, a battery isolator can be used between the voltage source and the IB to prevent voltage spikes from entering the Interconnect Box when the high amperage devices are de-energized.

NOTICE Recharging Vehicle Batteries

In the Interconnect Box, disconnect the wires for both the INPUT-PWR and GND Terminals while charging the vehicle's battery. Failure to do so can result in hardware damage to the circuit board inside the Interconnect Box.

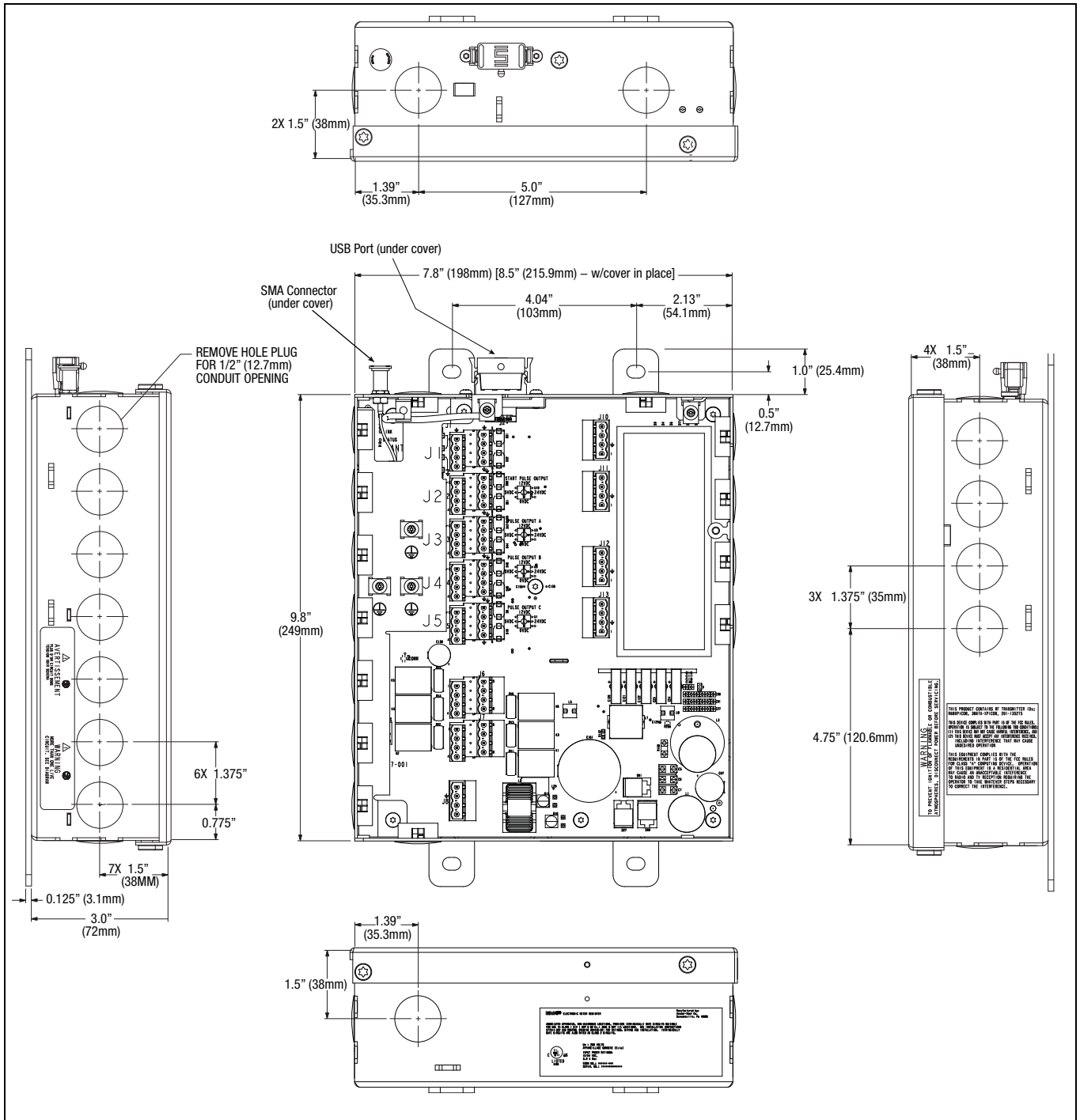


Figure 21. Interconnect Box Physical Dimensions (Shown With Cover Removed)

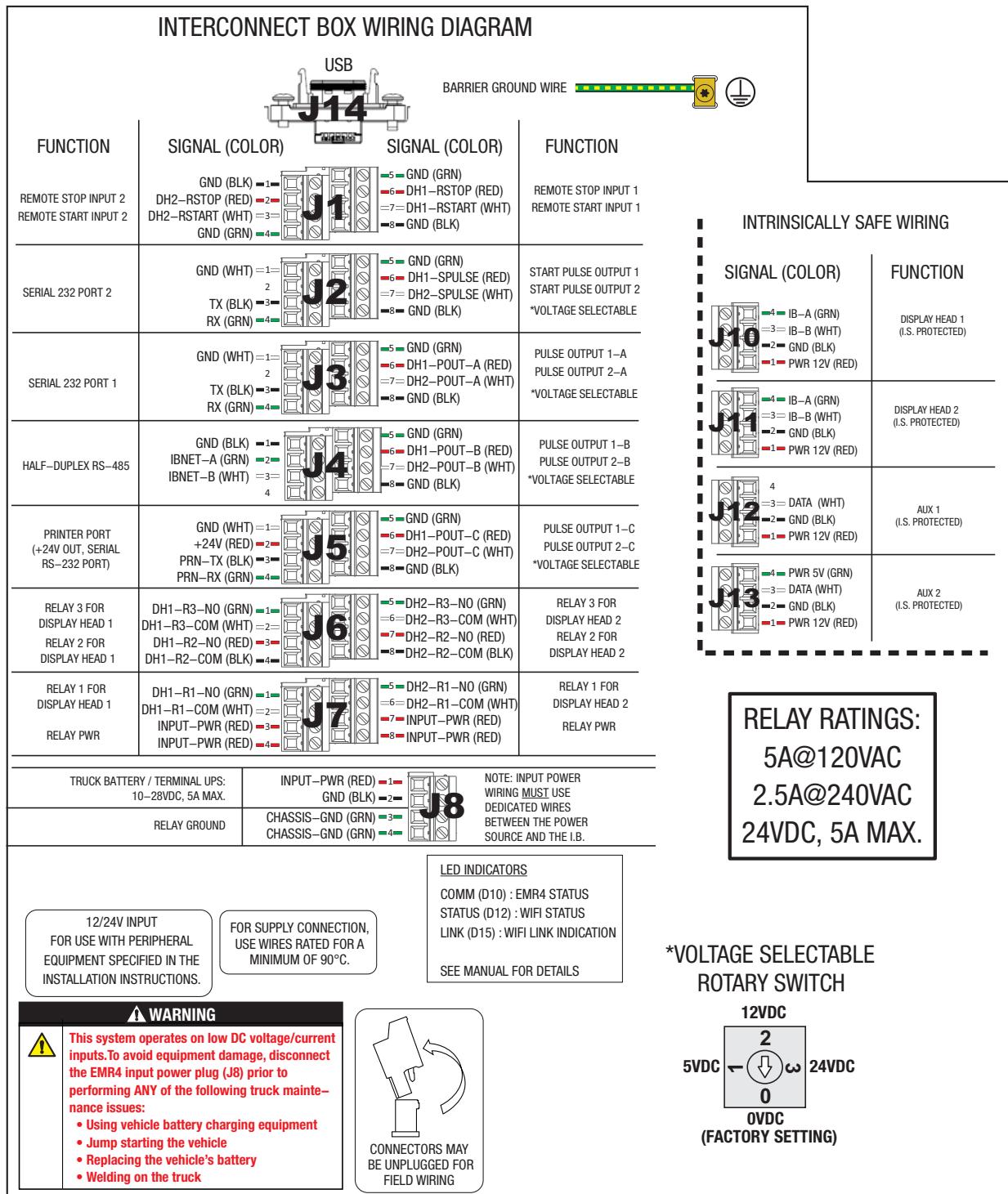


Figure 22. EMR4 Interconnect Box Wiring Connections

2-STAGE SOLENOID VALVE CONNECTIONS

A 2-stage solenoid flow valve is shown in Figure 23 and wiring connections in Table 7.

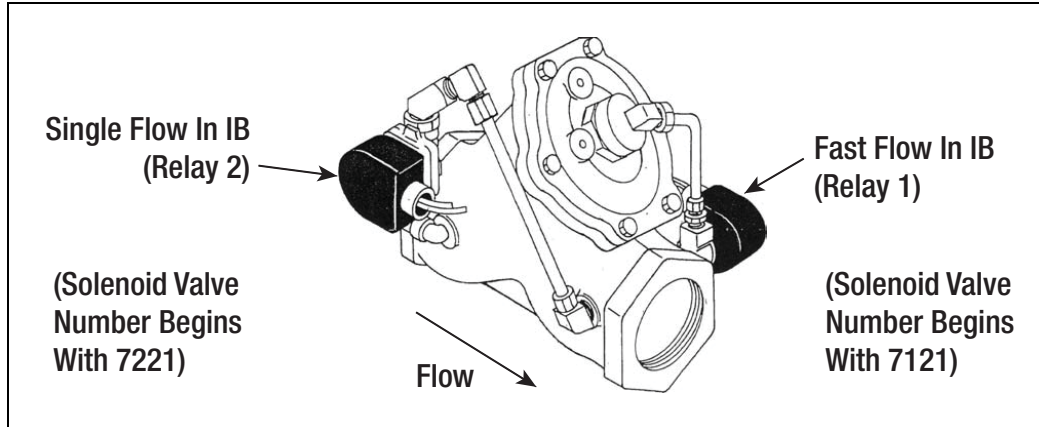


Figure 23. 2-Stage Solenoid Valve

Table 7. 2-Stage Solenoid Wiring

Display Head	Relay Function	Diagram In Installation Manual		Setup Manual	
Head 1	DH 1 Relays	Single Flow	COM	Relay Control Set Advance Stop	(2nd Stage Knockoff)
			N.O.		
		Fast Flow	COM	Relay Control Set Slow Flow	(1st Stage Knockoff)
			N.O.		
Head 2	DH 2 Relays	Single Flow	COM	Relay Control Set Advance Stop	(2nd Stage Knockoff)
			N.O.		
		Fast Flow	COM	Relay Control Set Slow Flow	(1st Stage Knockoff)
			N.O.		

VALVE OPERATION WITH THE EMR4

Full Flow

The valve is normally closed. When the START button is pushed on the EMR4 display, both relays for that head are energized, opening the solenoid-operated valves. The Fast Flow solenoid valve allows the main valve diaphragm to open via the pump pressure pushing on the diaphragm. Full flow is obtained. The Slow Flow solenoid valve allows flow around the main diaphragm valve. When the FINISH button is pushed on the EMR4 display, both relays are de-energized, the solenoid valves close stopping flow.

Preset

The valve is normally closed. When the START button is pushed on the EMR4 display, both relays for that head are energized, opening the solenoid valves and fast/full flow is obtained.



- First Stage Knockoff - When the first stage/slow flow point is reached (1st stage knockoff), the fast flow/relay 1 de-energizes and the spring assisted main diaphragm of the valve closes as the pressure equalizes. The single flow/relay 2 bypass remains open for slow flow.

- Second Stage Knockoff - When the advance stop (2nd stage knockoff) point is reached, the single flow/relay 2 de-energizes and the single flow/bypass valve closes stopping flow.

Knockoff Control Adjustments - The 'volume to go' adjustments are made under RELAY CONTROL in setup mode. The 1st stage defaults to 5 and the 2nd stage defaults to 0.1. Adjustments to these knockoff points, particularly the 2nd stage/stop point may be required to accommodate the specific systems dynamics.

3-Way Safety Valve for Truck LP Gas Systems

The 3-Way Safety Valve is not intended for flow control or preset control.

 WARNING	
	<p>The Three-Way Safety Valve is installed and operated in the highly combustible environment of an LPG tank.</p> <p>FAILURE TO COMPLY WITH THE FOLLOWING WARNINGS AND SAFETY PRECAUTIONS COULD CAUSE DAMAGE TO PROPERTY, ENVIRONMENT, RESULTING IN SERIOUS INJURY OR DEATH.</p> <ol style="list-style-type: none"> 1. It is essential that you carefully read and follow the warnings and instructions in this manual to protect yourself and others from serious injury due to fire, explosion, or electrical shock. LPG systems shall be installed in accordance with the national standards and regulations that apply. 2. Comply with all federal, state, and local codes, and other applicable safety codes. All wiring must comply with standard electrical practices, the local authority, and the latest editions of the National Electrical Code (NFPA 70) and other applicable code requirements. All work on LPG systems must comply with NFPA 58, Liquefied Petroleum Gas Code and other applicable code requirements. 3. LPG tanks must be depressurized (drained) and free of liquid and combustible vapors before work begins. 4. Flow control valves connected to the EMR4 must be UL Listed. Also, flow control valves must be suitable for the intended application, i.e., gasoline, fuel oil, LPG and must be rated for use in a Class 1, Division 1, Group C or Group D Hazardous Location. For LPG applications, such as propane, each valve must have a minimum pressure rating of 350 psi.

INSTALLING THE 3-WAY VALVE

NOTICE On the male pipe threads, use a pipe sealant when installing fittings or conduit to either the valve or the junction box.

1. On the valve, install a rigid metal conduit nipple in the threaded opening, provided for the solenoid wiring. Run the two red wires from the 3-way valve, through the nipple and into a metal junction box. Mechanically attach the valve/nipple combination to junction box as shown in Figure 24. *Even though the 3-way valve will operate in any position, it will last longer and perform best if mounted vertically upright (port 3 up).* Secure the junction box to the vehicle's frame.
2. Run a 2-wire shielded cable from the Relay Terminals located at J7 in the IB Box, located in the truck cab, to the 3-way valve junction box. Pass the cable through a cord grip fitting in one of the J-box openings. Cut off 1-inch (25.4 mm) of the cable's shield and jacket, then strip off 1/2-inch (12.7 mm) of each wire's insulation.

- Using the wire nuts, connect the stripped wires from the IB box to the 3-way valve wires (see Figure 24). There is no polarity to the 3-way valve's wiring. Seal the wire nuts with epoxy sealant using one bag for both wire nut connections and place bag in junction box (see Figure 24).

CAUTION

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

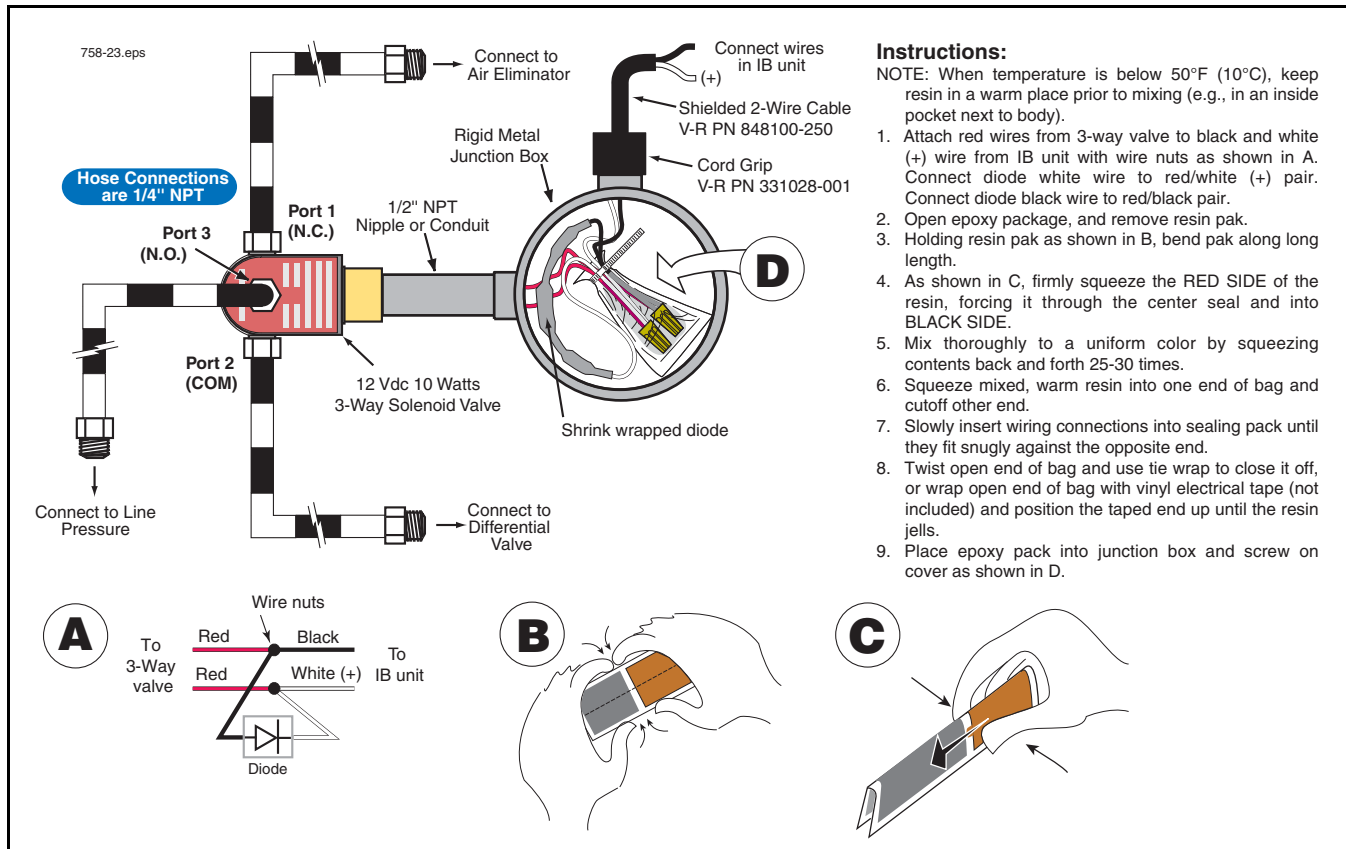


Figure 24. Connecting 3-Way Valve To Neptune Meter - Truck LP Gas Installations

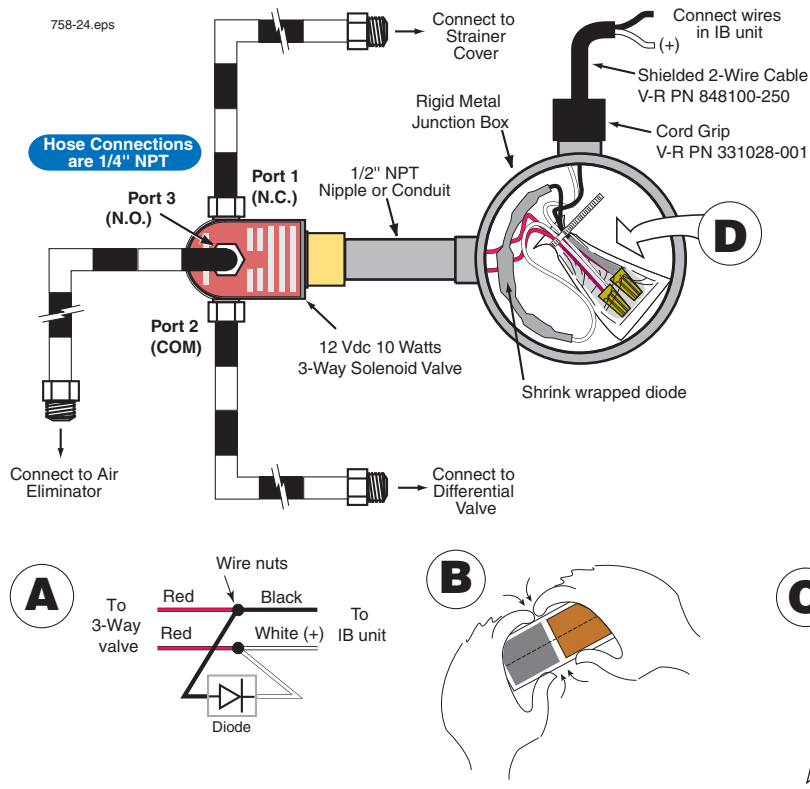
- Tighten the cable bushing nuts on the cord grip to ensure a watertight seal at the cable's entry.
- Remove the protective closures from the 3-way valve ports.

Neptune meters:

Connect a hose from line pressure to port 3 (normally open port) of the 3-way valve (see Figure 24). On some systems, line pressure is available at an opening in the vapor eliminator housing. Connect another hose from the 3-way valve's port 1 (normally closed port) to the air eliminator. Connect a third hose from the 3-way valve's port 2 (common port) to the differential valve.

L.C./TCS Meters:

Connect a hose from the air eliminator to port 3 (normally open port) of the 3-way valve (see Figure 25). Connect another hose from the 3-way valve's port 1 (normally closed port) to the strainer cover. Connect a third hose from the 3-way valve's port 2 (common port) to the differential valve.



Instructions:

NOTE: When temperature is below 50°F (10°C), keep resin in a warm place prior to mixing (e.g., in an inside pocket next to body).

1. Attach red wires from 3-way valve to black and white (+) wire from IB unit with wire nuts as shown in A. Connect diode white wire to red/white (+) pair. Connect diode black wire to red/black pair.
2. Open epoxy package, and remove resin pak.
3. Holding resin pak as shown in B, bend pak along long length.
4. As shown in C, firmly squeeze the RED SIDE of the resin, forcing it through the center seal and into BLACK SIDE.
5. Mix thoroughly to a uniform color by squeezing contents back and forth 25-30 times.
6. Squeeze mixed, warm resin into one end of bag and cutoff other end.
7. Slowly insert wiring connections into sealing pack until they fit snugly against the opposite end.
8. Twist open end of bag and use tie wrap to close it off, or wrap open end of bag with vinyl electrical tape (not included) and position the taped end up until the resin jells.
9. Place epoxy pack into junction box and screw on cover as shown in D.

Figure 25. Connecting 3-Way Valve To L.C./TCS Meter - Truck LP Gas Installations

6. At the IB Box, connect the 3-way valve solenoid and a jumper to J7 and J8 as shown in Figure 26.

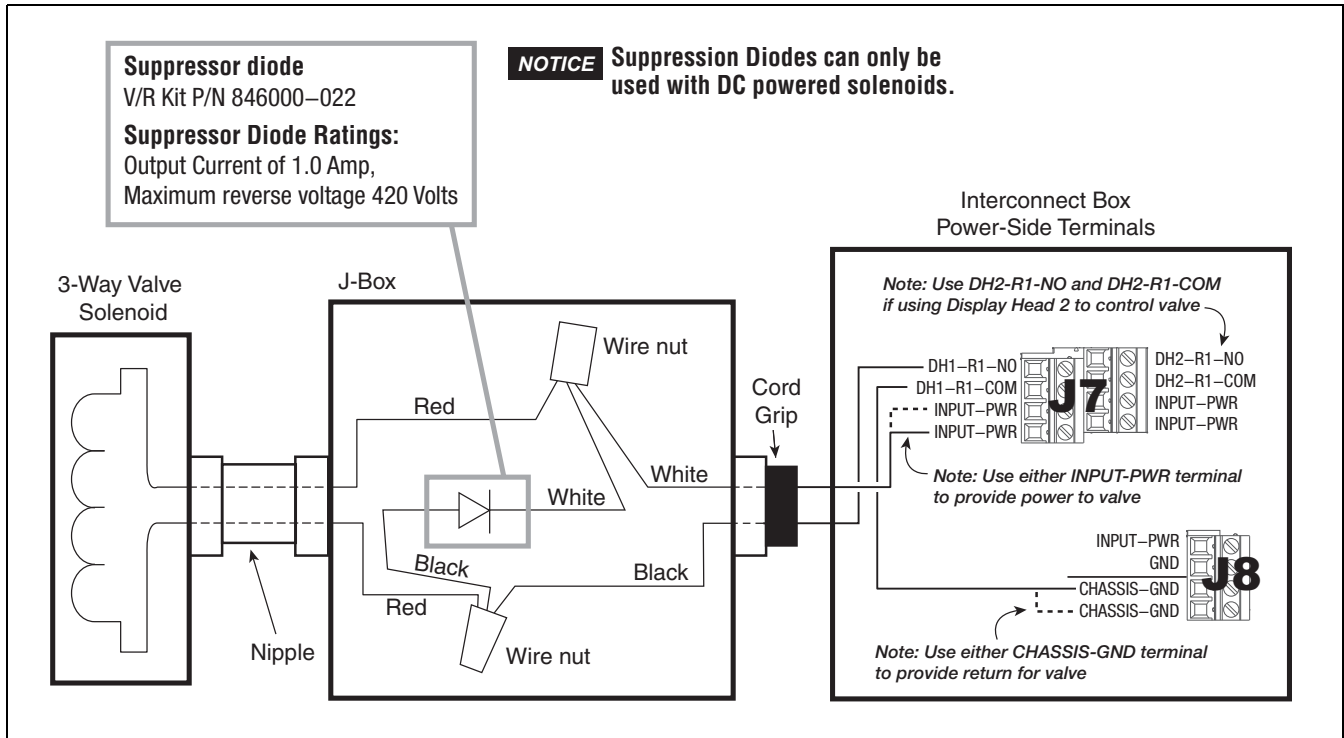


Figure 26. Connecting 3-Way Valve To The Interconnect Box

SOLENOID VALVES

Figure 27 illustrates wiring examples when connecting DC or AC solenoid valves to the IB box.

DC Solenoid Wiring

NOTICE

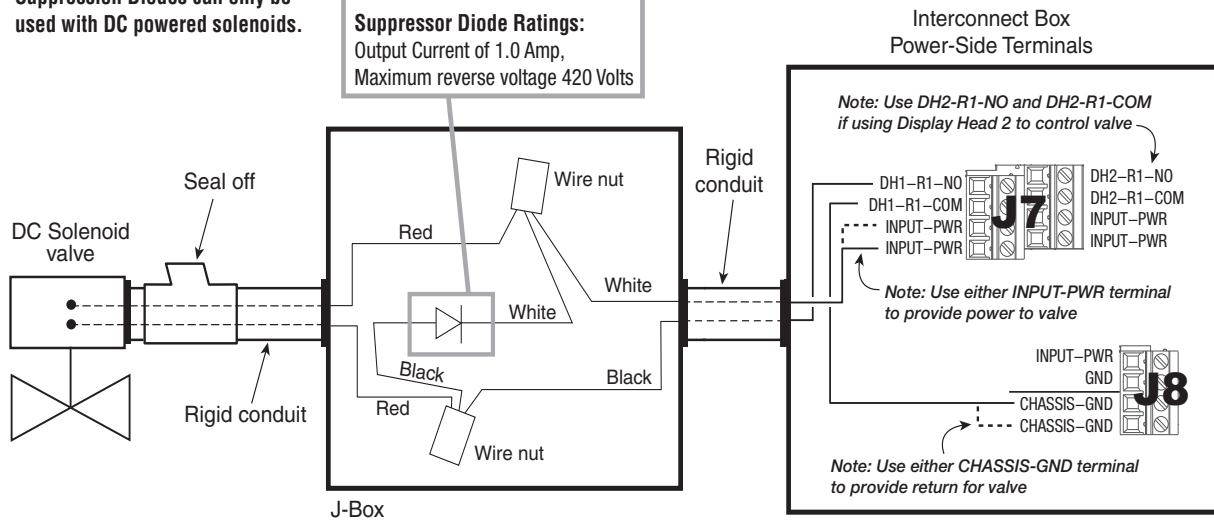
Suppression Diodes can only be used with DC powered solenoids.

Suppressor diode

V/R Kit P/N 846000-022

Suppressor Diode Ratings:

Output Current of 1.0 Amp,
Maximum reverse voltage 420 Volts



AC Solenoid Wiring

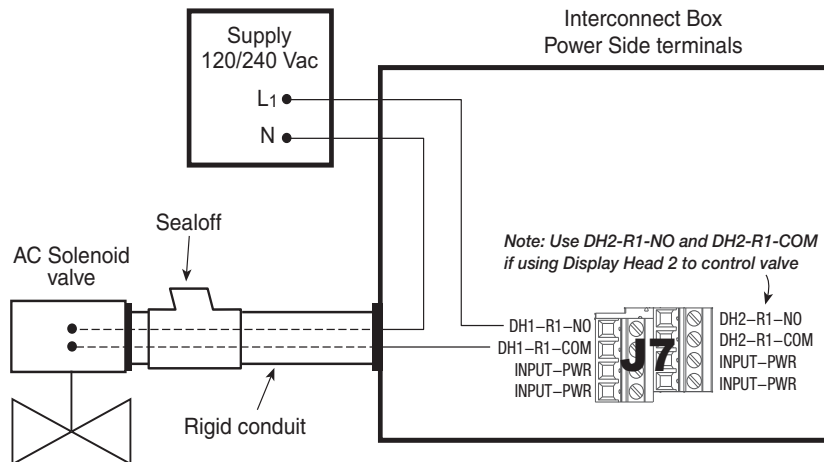


Figure 27. Example Wiring Connections For DC And AC Solenoid Valves

Installing the Temperature Probe (Optional)

1. Locate the thermowell in the metering system (see Figure 28).

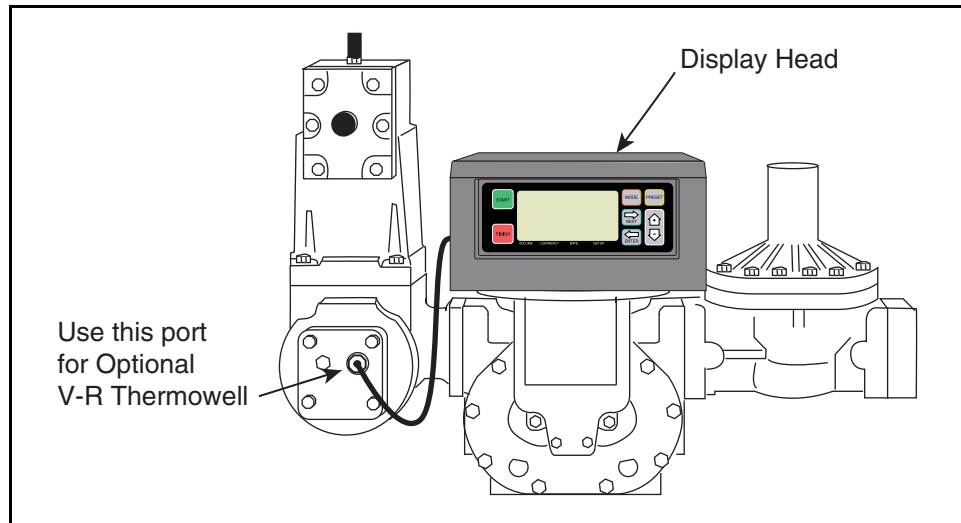


Figure 28. Example Thermowell Installation

2. The temperature probe should be verified prior to installation. Reference section "Temperature Calibration" on page 38 of the EMR4 Setup And Operation manual (P/N 577014-350) for verification procedure.
3. If a mechanical (or other) temperature compensator is being replaced, remove the temperature sensing element from the thermowell.

NOTICE

Remove or disable the mechanical compensator. The EMR4 will not work with mechanical temperature compensation and trying to do so will result in inaccurate deliveries.

4. Install the temperature probe in the thermowell. It is highly recommended that the dry well be full at the time of probe installation for best results. Use a thermo-conductive liquid such as antifreeze (ethylene glycol) or any non-freezing thermo-compound.

NOTICE

A second port may not be available on all meters (which may be required during flow meter proving). Check with the local inspector prior to flow meter proving.

NOTICE

Before threading the temperature probe, disconnect wires from the display head to avoid twisting and breaking the cable.

5. Install the temperature probe's vinyl cap (P/N 514100-485) over the temperature probe cable by making a small bend in the cable no more than one inch above the probe's hex nut (see Figure 29).

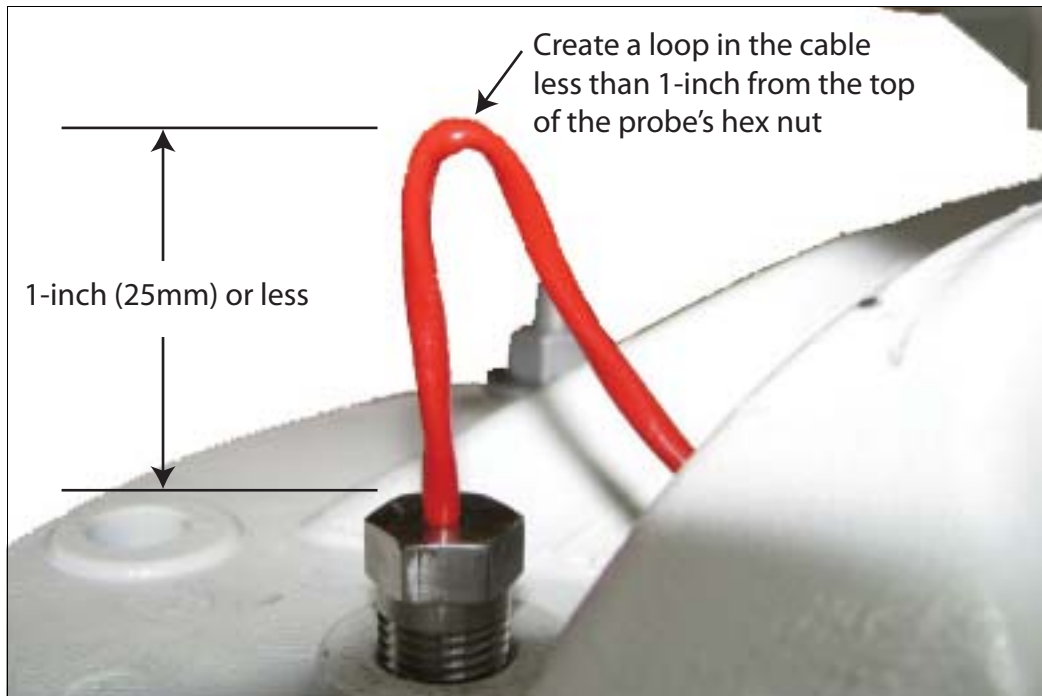


Figure 29. Preparing The Temperature Probe's Cable For The Protective Cap

6. Slide the cap over the bend of the cable and push it down over the hex nut until it rests against the meter. Get the tie wrap (P/N 576008-161) from the temperature probe kit and position it around the end of the cap just under the temperature probe's hex nut and tighten it (see Figure 30).

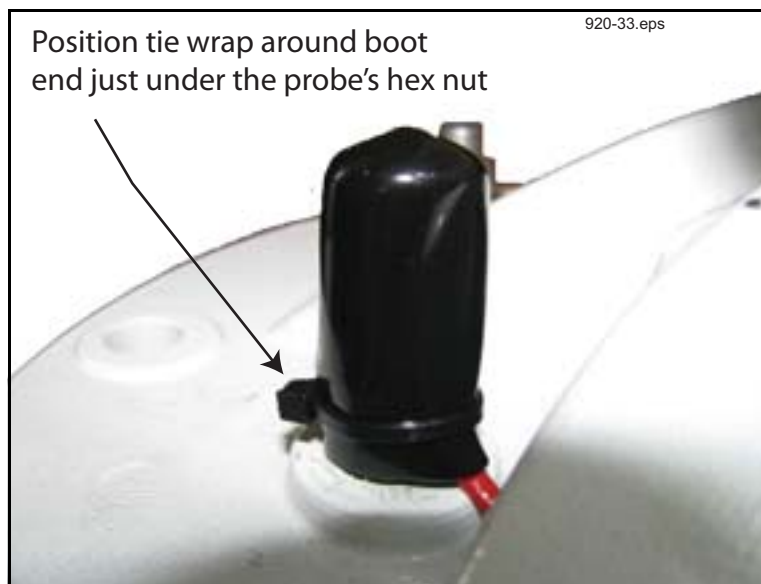


Figure 30. Positioning The Tie Wrap Over The Temperature Probe's Protective Cap

TEMPERATURE PROBE WIRE DESCRIPTION

To ensure the best operating systems available, Veeder-Root **REQUIRES** the use of shielded cable (P/N 848100-250) when wiring a Temperature Probe (maximum length 25 feet [7.6 m]). In these installations, shielded cable must be rated less than 100 picofarad per foot and be manufactured with a material suitable for the environment, such as Belden™ 83552 or equivalent.

Installing the Optional Slip Printer

The Epson TM-U295 dot matrix slip printer is attached with self-adhesive Velcro strips to a customer supplied mounting plate or printer stand located somewhere in the truck's cab.

A power/data cable and three 2" x 3" (50 x 75 mm) Velcro strips are included in the printer kit. Figure 31 shows the front panel lights and controls, and the rear panel connections to the TM-U295 Slip printer and illustrates the TM-U295 printer's address code setup for DIP switch 3 (**which must be set as shown or it will not work**) and suggested positions for the Velcro strips. Remove the rubber feet from the base of the printer to permit maximum contact between the Velcro strips and the mounting plate.

Attach the four wires of the printer power/data cable to the appropriate terminals of the Power Side terminal block in the IB (Figure 22 on page 29) and the DB-25 connector and the round power connector to the appropriate connectors on the rear of the printer

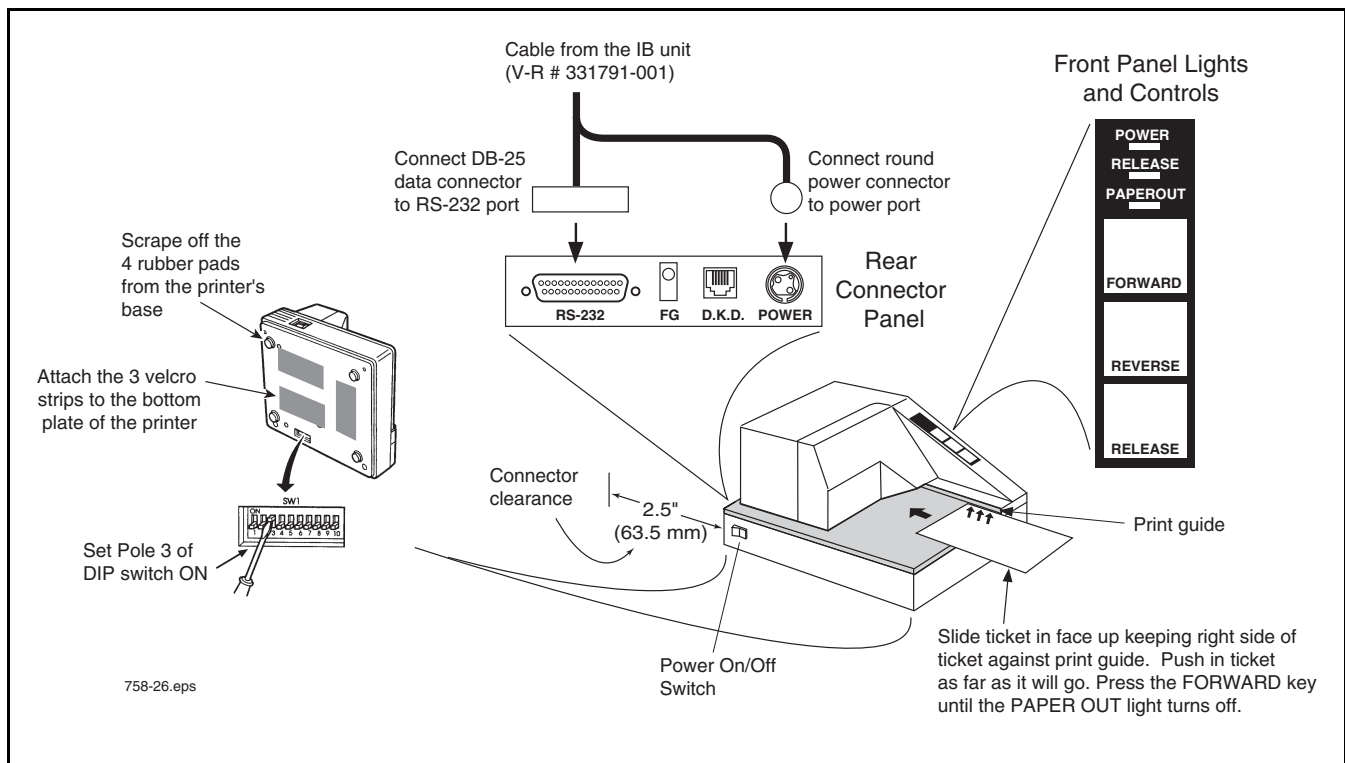


Figure 31. TM-U295 Printer

NOTICE

The printer ribbon should be removed if using "carbonless forms". Power to the printer is required to release the carriage and install/remove a printer ribbon.

Installing the Optional Roll Printer

The Epson TM-U220A dot matrix roll printer has a power/data cable is included in the printer kit. Figure 32 shows the rear panel connections to the printer. The on/off switch is on the front of the printer.

Figure 32 also illustrates two required and one optional settings of the printer's DIP switches (under side of printer). Note: all other DIP switch settings are set to Off.

Attach the four wires end of the printer power/data cable to the appropriate terminals of the power side terminal block in the IB (Figure 22). Attach the DB-25 connector and the round power connector on the other end of the cable to the appropriate connectors on the rear of the printer (Figure 32).

NOTICE

When using a roll printer, you must enter the EMR4's setup and set the Printer Option to roll printer and the System Address > Port 1 > to Roll Printer. The default settings for these two setups are slip printer.

NOTICE

The cable from the IB box (331791-001) must be connected to the printer before applying power to the system.

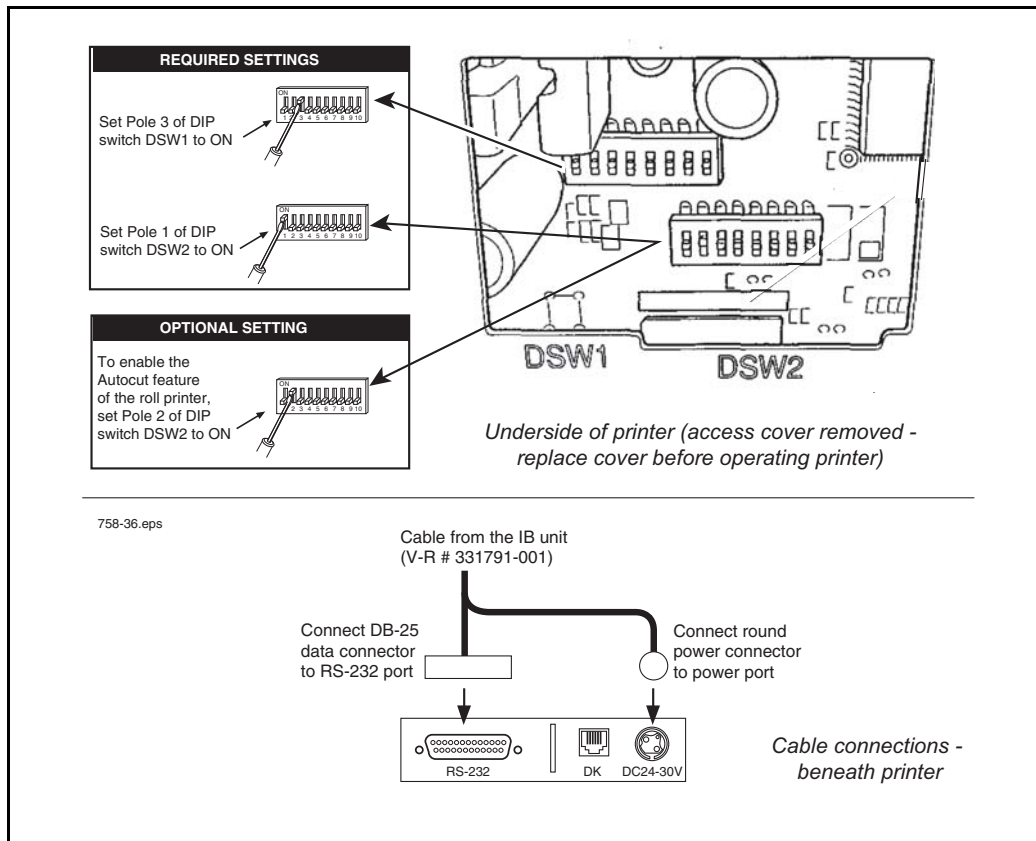


Figure 32. TM-U220A Roll Printer

Installing the Remote Display (Optional)

The Remote Display consists of the items listed in Table 8:

Table 8. Remote Display (84559X-00X) Components

Description	V-R P/N
Remote Display install kit	330020-430
Opt. Mounting Bracket kit	845900-024
Opt. 4 conductor cable - 6 ft (1.83 m)	846000-107
Opt. 4 conductor cable - 35 ft (10.67 m)	846000-106
Opt. 4 conductor cable - 50 ft (15.24 m)	846000-100
Opt. 4 conductor cable - 100 ft (30.48 m)	846000-101
Opt. 4 conductor cable - 200 ft (60.96 m)	846000-102
Opt. 4 conductor cable - 300 ft (91.44 m)	846000-103
Opt. 4 conductor cable - 400 ft (121.92 m)	846000-104
Opt. 4 conductor cable - 500 ft (152.4 m)	846000-105

Figure 33 shows the Remote Display assembly and Figure 34 shows how to wire the display to the Interconnect Box. You can mount the display on a wall or dashboard of a truck, a wall in a building, or outside in a hazardous location. Use appropriate fasteners in any of the pre-drilled holes in the base of the optional bracket when attaching the bracket to the mounting surface. Adjust the angle of the display by loosening the side bolts and rotating the unit to the desired position.

Following wiring routing precautions and procedures discussed earlier (page 24) for the meter mounted Display Head, connect the Remote Display to the Interconnect Box. Wiring connections at the Remote Display are shown in Figure 34. Install optional cord grip fitting in rear of Remote Display for cable egress. Wiring connections at the IB are to the identical terminals of the unused Display Head terminal block.

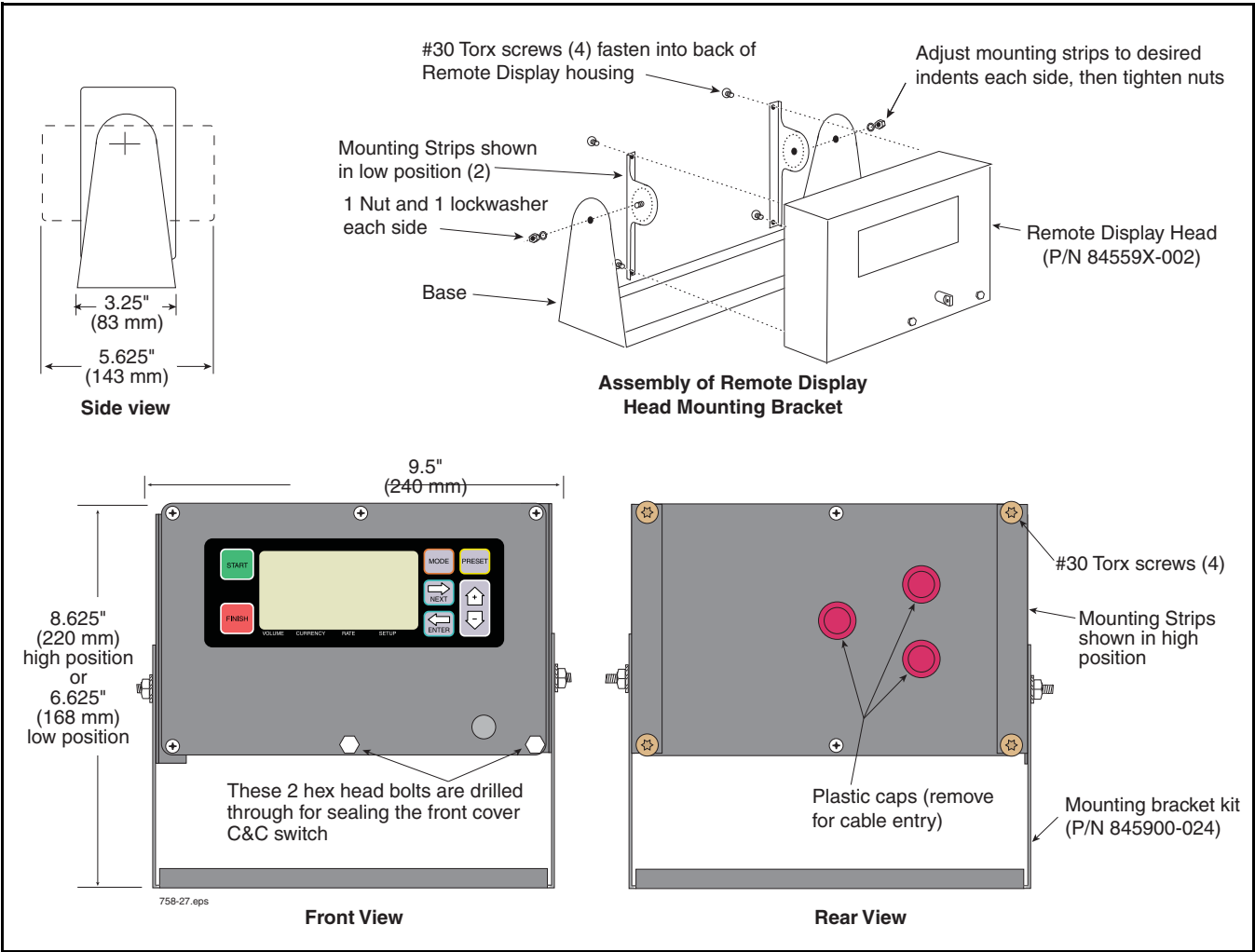


Figure 33. Remote Display Assembly

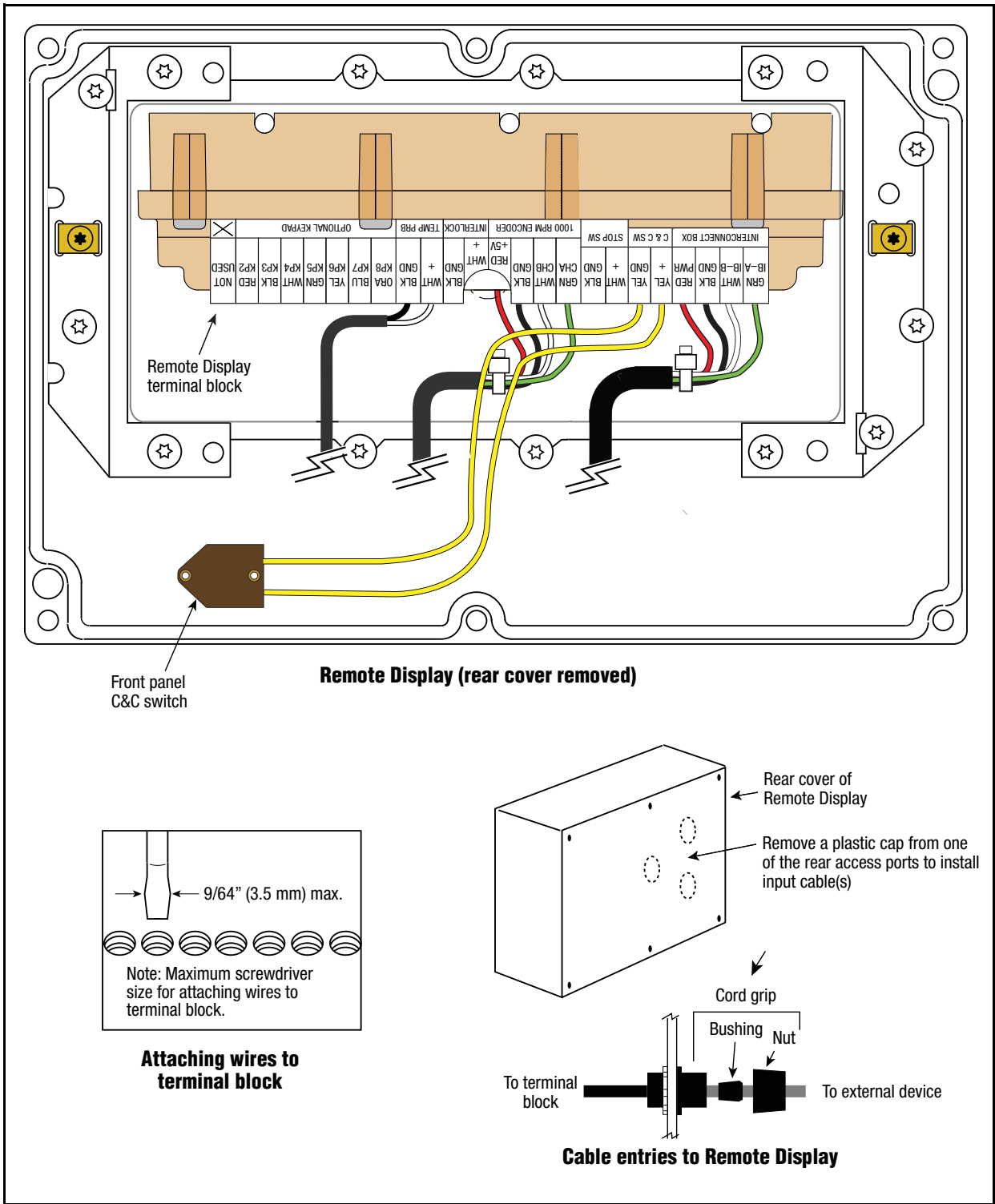


Figure 34. Remote Display Connections (Rear Cover Removed)

Installing the Remote Pulser (Optional)

The EMR4 remote pulser consists of a 5 Vdc optical encoder assembled into a stand-alone cast housing. The Remote Pulser can be mounted to either the top or the front of the meter using one of two available kits. The remote pulser operates under the same specifications as the existing internal pulse encoder. Refer to Veeder-Root manual number 577014-355 for detailed pulser mounting instructions.

- The top mount kits (P/N 845900-504, 845900-552) contain the remote pulser, mounting plate and mounting hardware.
- The front mount kits (P/N 845900-505, 845900-506) contain the remote pulser and limited mounting hardware. The customer or end user will have to supply the mounting scheme to install the remote pulser to the front of the meter.

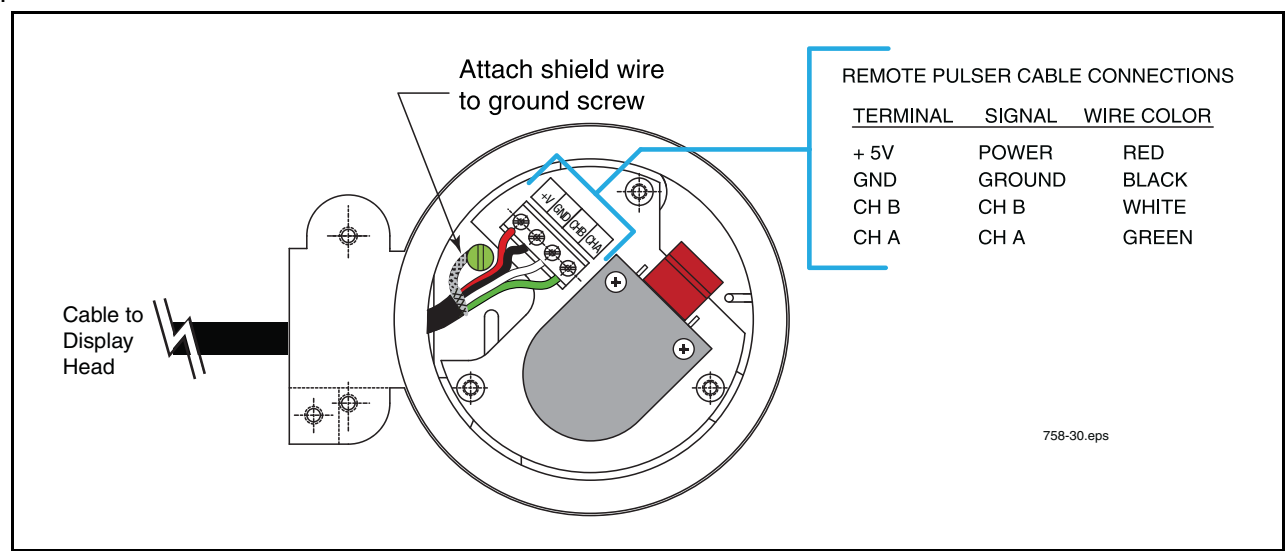


Figure 35. Wiring Connections In Remote Pulser (Top Cover Removed)

PULSE ENCODER SPECIFICATIONS

- Power: 5 Vdc, 30 mA \pm 10%
- Shaft Rotation: 1000 rpm maximum, bidirectional, 20 oz-in
- Pulse: 100 ppr, Quadrature type

EMR4 Terminal & Fueling Depot Installation

Installation of the EMR4 System involves installing the Display Head(s), installing the interconnect box, and installing any optional devices (e.g., remote pulser, printer, etc.). This equipment must be installed according to the applicable installation document. For UL/cUL installations use Control Drawing number 331940-021 and for ATEX installations use Descriptive System Document number 331940-022. Figure 36 shows an example dual Display Head installation.

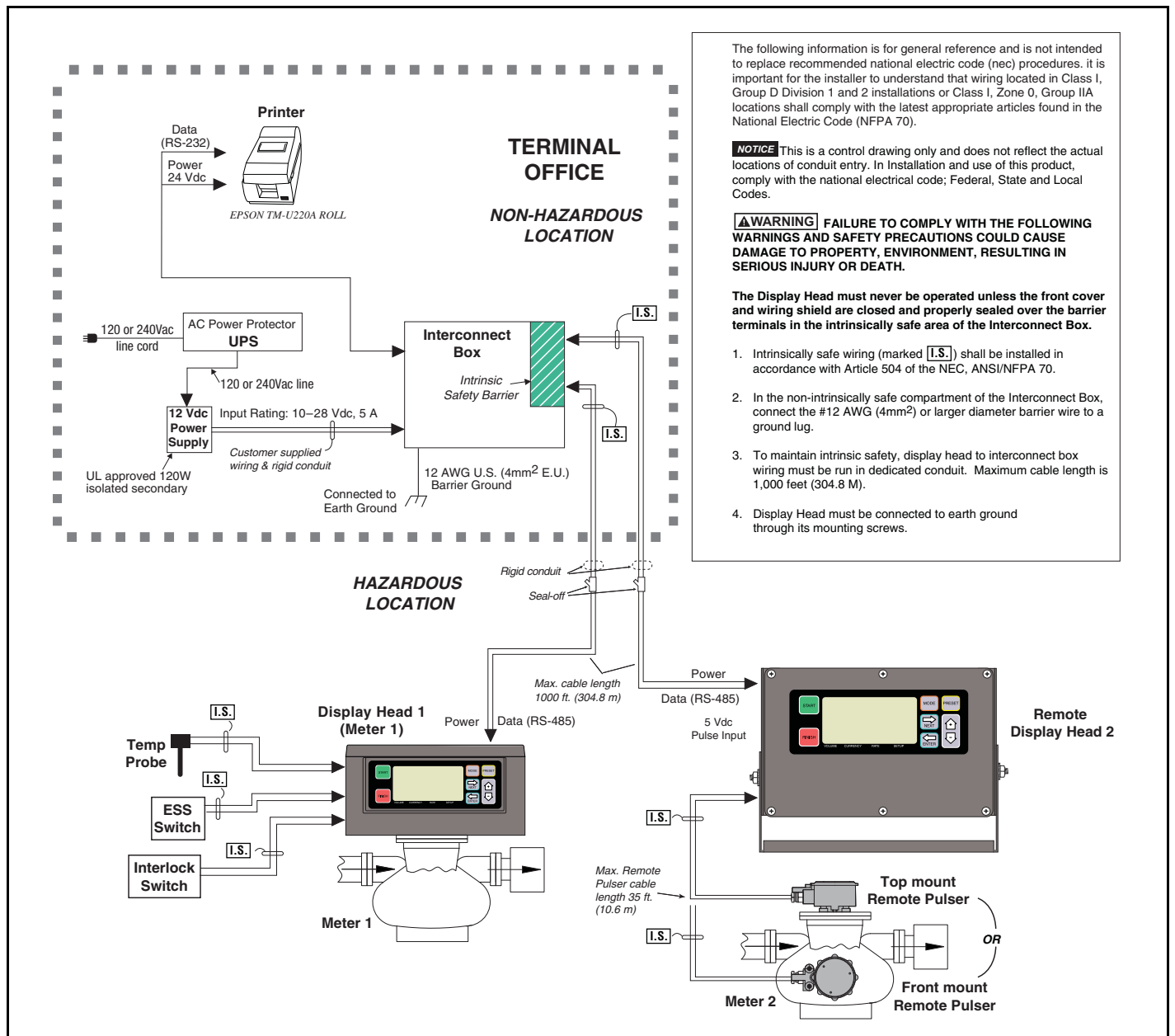


Figure 36. Example Terminal Fueling Depot Installation With 2 Display Heads And Optional Remote Pulser

Power Conditioning Requirements

Two separate electrical components are installed in EMR4 terminal - fueling depot applications - an uninterruptable power supply (UPS) (recommended) and a +24 Vdc power supply (required). Veeder-Root recommendations for this equipment are discussed below.

1. UPS (Uninterrupted Power Supply) - Optional

Veeder-Root recommends the Tripp Lite UPS model BC PERS450 (or equivalent) for up to 15 minutes of power backup to the +24 Vdc power supply. For pricing or additional information, you can phone Tripp Lite customer support or visit their website at www.tripplite.com/support/bcpers450.

2. Power supply - UL certified, 120 watt minimum, AC to DC - Two Vendors Recommended: Digi-Key or TDK-Lambda

Digi-Key Model 285-2346-ND 24 Vdc, 6.5 ampere power supply. (See Figure 37 for connection wiring diagram) To order, visit their website at www.digikey.com.

TDK-Lambda 24 volt power supply - Model No. HWS150A-24/A. To order, visit their website at www.us.tdk-lambda.com/lp/products/hws-series.htm.

NOTICE The power supply must be rated for at least 120 watts or improper operation of the EMR4 system will occur.

NOTICE Power supplies are open-type devices and must be mounted in an enclosure suitable for the application.

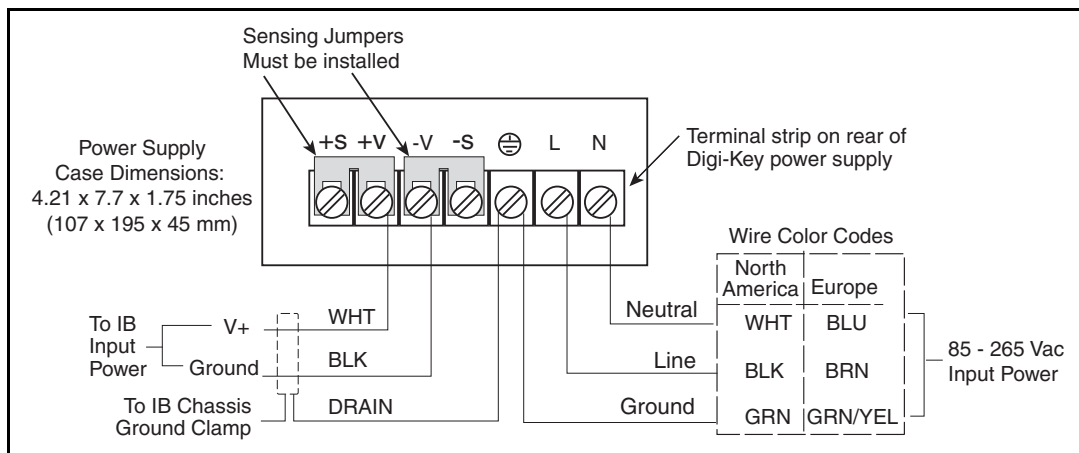


Figure 37. Digi-Key Power Supply Wiring Diagram

Display Head Installation Procedure

1. Remove and put aside the four mounting bolts holding the meter register assembly to the meter adapter mounting flange (these bolts will be used to attach the Display Head to the meter adapter mounting flange). Remove the existing mechanical register.
2. If you are replacing a Veeder-Root, Liquid Controls, or TCS register go to the next steps. For more information, start with "Available Parts" on page 2 and continue up to "Neptune Flow Meter Installation".

If you are replacing a TCS 682 Piston register install the necessary meter adaption parts as per directions in "Total Control Systems Model 682 Piston Flow Meter Installation" on page 9.

If you are replacing a Brodie, Brooks, or Neptune register install the necessary meter adaption kit as per directions in "Neptune Flow Meter Installation" on page 19.

3. Notice the type of coupling connecting the register/preset to the meter adapter input shaft.
4. Look at the base of the meter register. The projecting encoder shaft has a small cotter pin inserted in it to keep it from sliding up into the unit and a washer (P/N 011071-933). Remove this cotter pin.

Remove an identical coupling from the installation kit and attach it with an enclosed groove pin to the encoder input shaft projecting from the base of the Display Head (make sure that you support the encoder shaft when inserting the pin to avoid damaging the shaft).

NOTICE **Make sure the washer is on the shaft between the end of the coupling and the Display Head.**

5. Remove the four cover bolts of the Display Head and lift off the cover. Put the cover and bolts aside.
6. Orient the encoder input shaft coupling so that it 'mates' with the meter adapter input shaft, then lower the Display Head onto the meter adapter mounting flange.
7. Rotate the Display Head on the meter adapter mounting flange until the display is facing in the desired direction and check to see that the four meter adapter flange mounting holes align with four of the eight tapped (1/4 - 28 UNF-2B threads) mounting holes in the base of the Display Head's housing. You may have to rotate the Display Head right or left a little to line up four holes. Reuse the four mounting bolts and tighten them securely.
8. If you have the optional temperature probe, remove the existing temperature probe and replace it with the Display Head temperature probe.

Wiring the Display Head

1. With the Display Head cover still off, remove the nut and bushing from the right side panel cord grip connector. Note: the maximum cable length between the Interconnect Box and the Display Head is 1000 feet (304.8 meters).
2. Slide the cord grip nut and then the bushing over the IB cable leads. Pull enough cable through so that the leads reach the terminal block on the display assembly and can be tie wrapped to the pulse encoder mounting base as shown in Figure 38. Slide the tapered end of the bushing into the cord grip, then screw on the cord grip nut and tighten securely.
3. Attach the four-wire IB cable to the terminal block as shown in Figure 38.

When stripping wire for terminal block connections, be careful not to nick the individual strands. Also, be sure to tighten each terminal so the wire can not be pulled out. A failure to follow either of these instructions can result in signal loss and faulty operation.

4. If you have the optional temperature probe and/or ESS switch, remove the lower cord grip nut and slide it, then the tapered bushing, over the temperature probe cable and/or ESS switch cable. Pull enough cable through so that the leads reach the terminal block on the display assembly and can be tie wrapped to the pulse encoder mounting base as shown in Figure 38. Slide the bushing into the cord grip and then screw the cord grip nut onto the cord grip and tighten securely. Attach the shield of the temperature probe cable to a grounding lug on the Pulse Encoder mounting base.
5. Attach each wire (no polarity) of the 2-connector temperature probe cable and/or ESS switch where shown on the terminal block label.
6. Tie wrap the IB, ESS switch and temp probe (if installed) cables to the pulse encoder mounting base.
7. For transfer Interlock applications, attach the two wires in the switch cable where shown on the terminal block label and tie wrap the cable to the pulse encoder's mounting base.

8. Replace the Display Head cover and screw in the four cover retaining bolts just enough to hold them in (the cover will be removed later for system calibration).

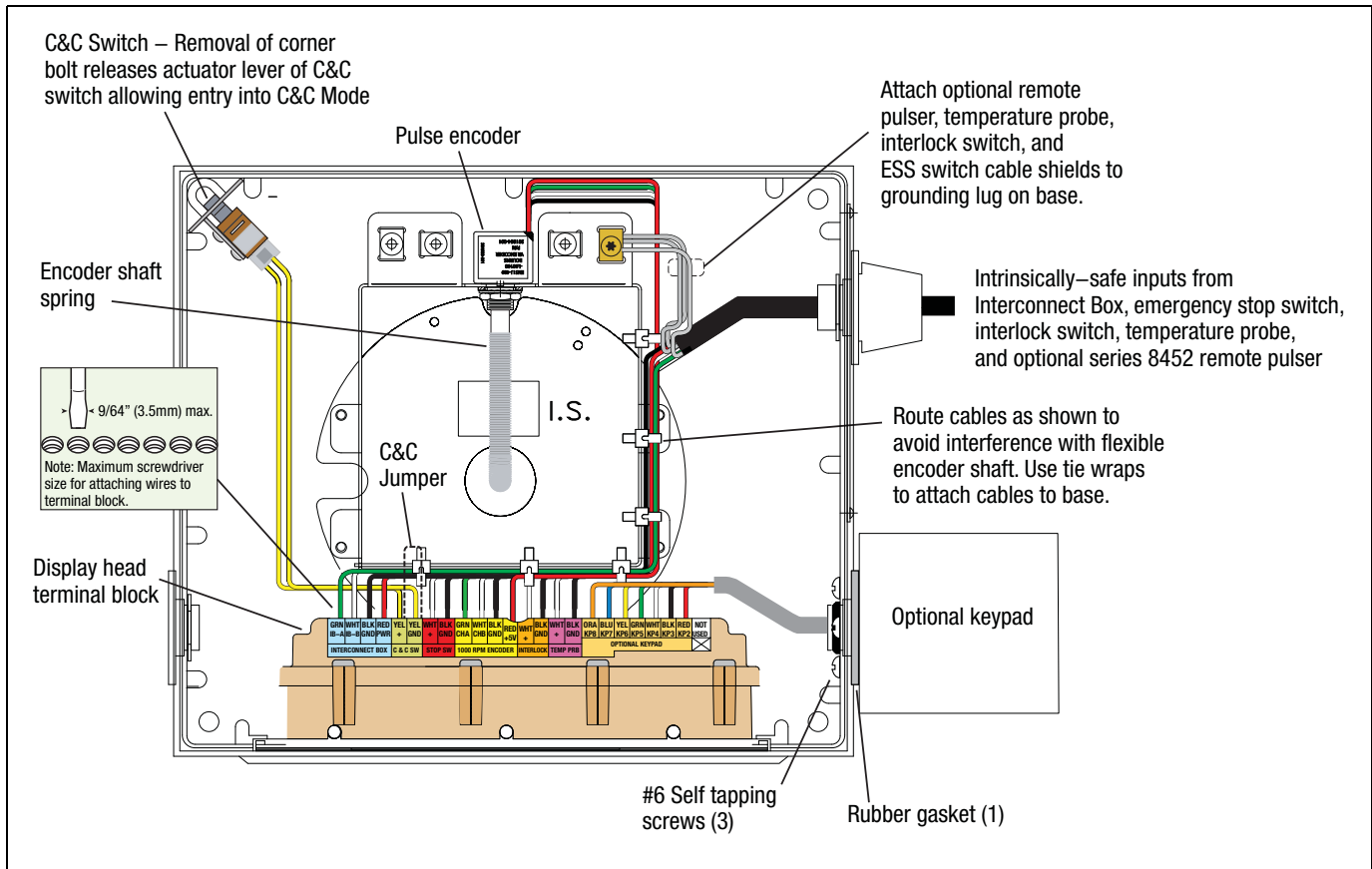


Figure 38. Display Head Cable Wiring And Switch Locations

C&C Mode Switch Options

There are two C&C mode switch configurations:

1. A standard C&C corner switch assembly (P/N 845900-018) that fits into one corner of the Display Head's housing (see Figure 38). To enter C&C mode, remove the corner bolt from the Display Head's cover. To exit C&C mode, replace the bolt.
2. A standard front panel C&C switch for the Remote Display Head (ref. Figure 34 on page 42).

Installing Optional Keypad Kit - Right or Left Side

Figure 38 shows the installation and wiring of the optional keypad. To attach the keypad housing mounting screws you will need to pull/slide up the display assembly away from the Display Head. Insert the keypad wires through the center hole in the gasket, slide the gasket down against the keypad and align its three holes with the mounting holes in the keypad. Hold the keypad against the Display Head and screw in the 3 mounting screws, replace the display assembly and then connect the keypad wiring to the terminal block as shown in Figure 38. The screws are self-tapping. The user may want to pre-tap the holes using the screw to ease installation.

Installing the Interconnect Box

NATIONAL ELECTRICAL CODE COMPLIANCE

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

GROUNDING

Proper grounding of the EMR equipment is essential for several reasons. First, in a typical installation, grounding prevents hazardous voltages from being present on the equipment. Secondly, grounding prevents the build-up of static charge on the equipment. Either of these conditions could be very hazardous when in the proximity of explosive mixtures found at fuel supply depots and terminals. Proper grounding requires that a very low impedance connection be made to the earth. At the distribution panel, this is accomplished by means of a dedicated conductor buried in the earth. It is imperative that all local, regional and national regulations are followed when connecting to the grounding system.

WIRE TYPE FOR METALLIC OR PVC CONDUIT

Veeder-Root requires the use of shielded cable when using metallic or PVC conduit in any portion of the wiring between the Display Head and the IB. In these installations, shielded cable must be rated less than 100 picofarad per foot and 0.2 microhenry per foot (per 304.8 mm) and be manufactured with a material suitable for the environment.

Use either the 4-wire cable supplied by V-R, P/N 846000-1XX or any equivalent cable or wiring with rated capacitance of less than 100 picofarads per foot (per 304.8 mm) and inductance of less than 0.2 microhenry per foot (per 304.8mm). Note that conductor wire colors vary depending on the cable manufacturer (caution: the Display Head to IB wiring illustrations in this section show wire colors in the V-R cable. Alternate cables may have different wire colors).

NOTICE Field wiring may be both above ground or below grade.

WIRE LENGTH

Improper system operation could result in undetected potential environmental and health hazards if the Display Head to IB wire runs exceed 1000 feet (304.8 m). Wire runs must be less than 1000 feet to be within the limits of the UL Certification.

MOUNTING AND WIRING THE IB UNIT

1. The physical dimensions of the Interconnect Box (IB) are shown in Figure 21 on page 28. The IB is installed in the terminal - fueling depot office. Use four, 3/16" (4 mm) bolts to mount the IB to the mounting surface.
2. Figure 39 shows IB wiring connections. For IB Power Side terminal wiring connections, remove hole plugs and use cord grips for all cables attaching to this terminal block.

For IB J10 and J11 terminal I.S. wiring connections, remove hole plugs and use cord grips for all cables attaching to these terminal blocks. The drain wire from each Display Head cable must be connected to the chassis ground clamp in the IB I.S. area.

3. The printer **must** be within 6 feet (1.83 m) of the IB box.

NOTICE All field wiring entering the IB box should be run as straight as possible from the conduit entry knockout to their designated terminal connectors.

SOLENOID VALVES

Figure 40 illustrates wiring examples when connecting dc or ac solenoid valves to the IB box.

NOTICE

The IB box is not rated for mounting in outdoor locations. The IB box can be mounted only in a protected enclosure or protected location.

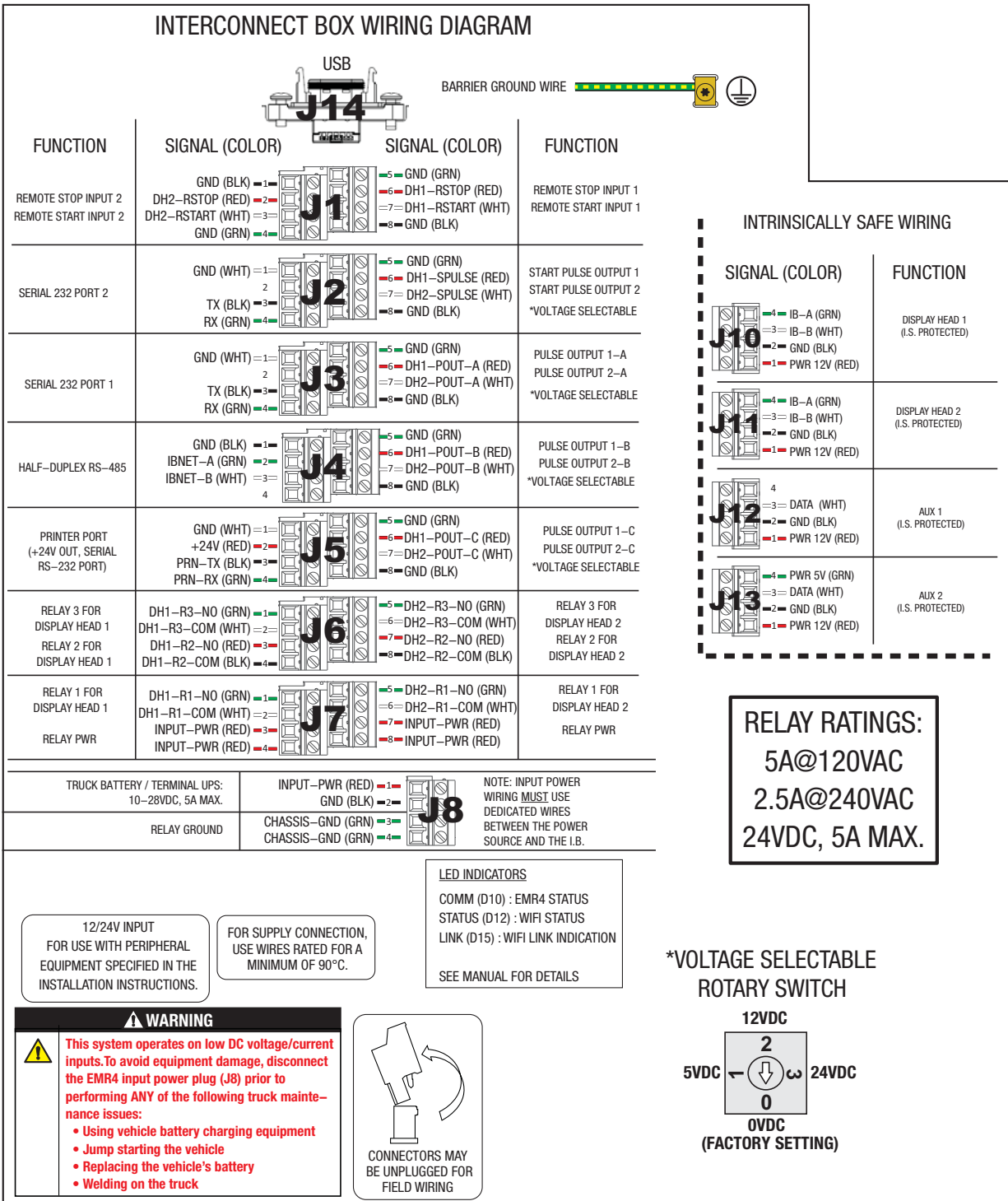
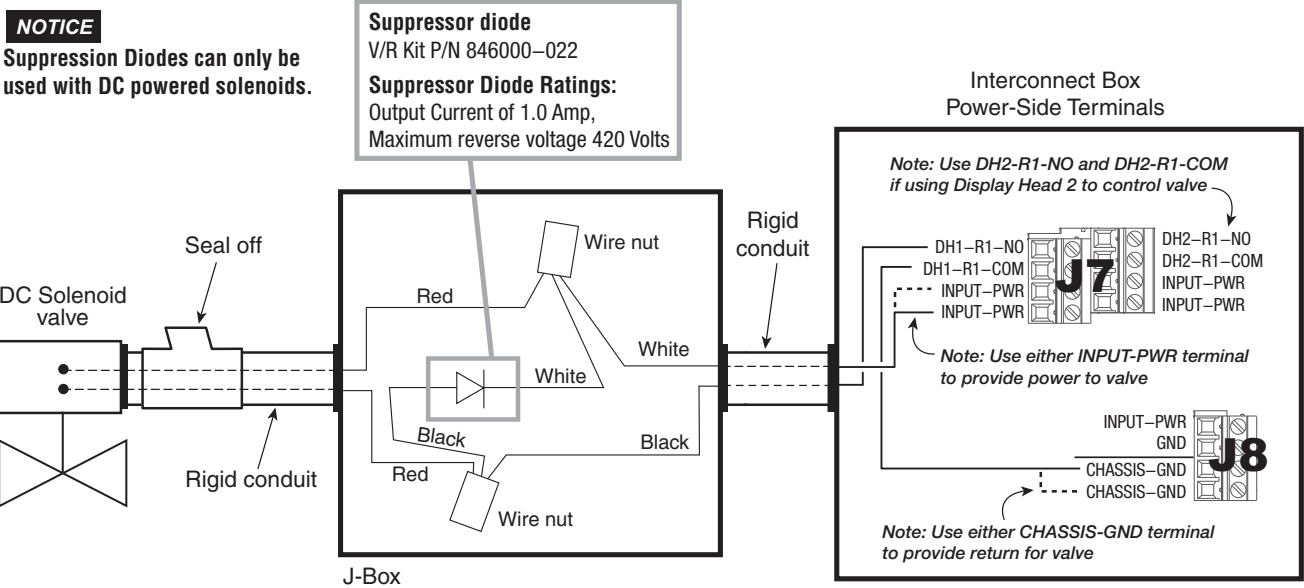


Figure 39. Terminal Interconnect Box Wiring

DC Solenoid Wiring



AC Solenoid Wiring

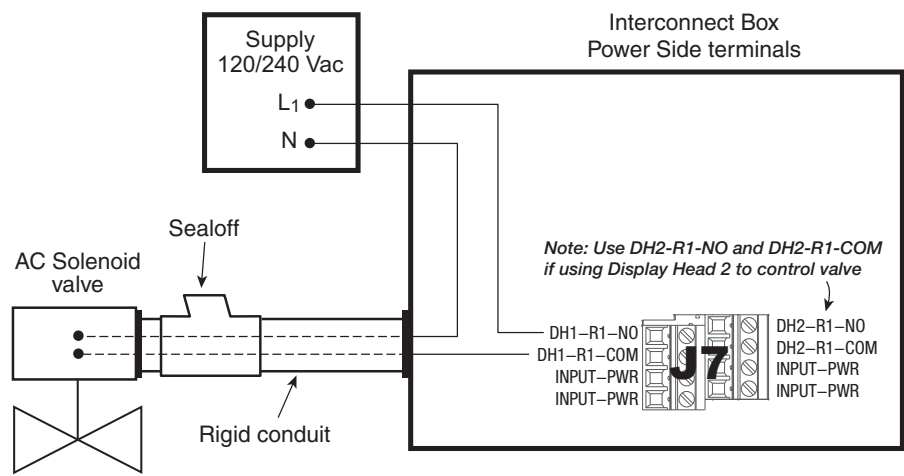


Figure 40. Example Wiring Connections For DC And AC Solenoid Valves

Installing the Optional Roll Printer

The Epson TM-U220A dot matrix roll printer has a power/data cable is included in the printer kit. Figure 41 shows the rear panel connections to the printer. The on/off switch is on the front of the printer.

Figure 41 also illustrates two required and one optional settings of the printer's DIP switches (under side of printer). Note: all other DIP switch settings are set to Off.

Attach the four wires end of the printer power/data cable to the appropriate terminals of the power side terminal block in the IB (Figure 39). Attach the DB-25 connector and the round power connector on the other end of the cable to the appropriate connectors on the rear of the printer (Figure 41).

NOTICE When using a roll printer, you must enter the EMR4's setup and set the **Printer Option** to **roll printer** and the **System Address > Port 1 > to Roll Printer**. The default settings for these two setups are slip printer.

NOTICE The cable from the IB box (331791-001) must be connected to the printer before applying power to the system.

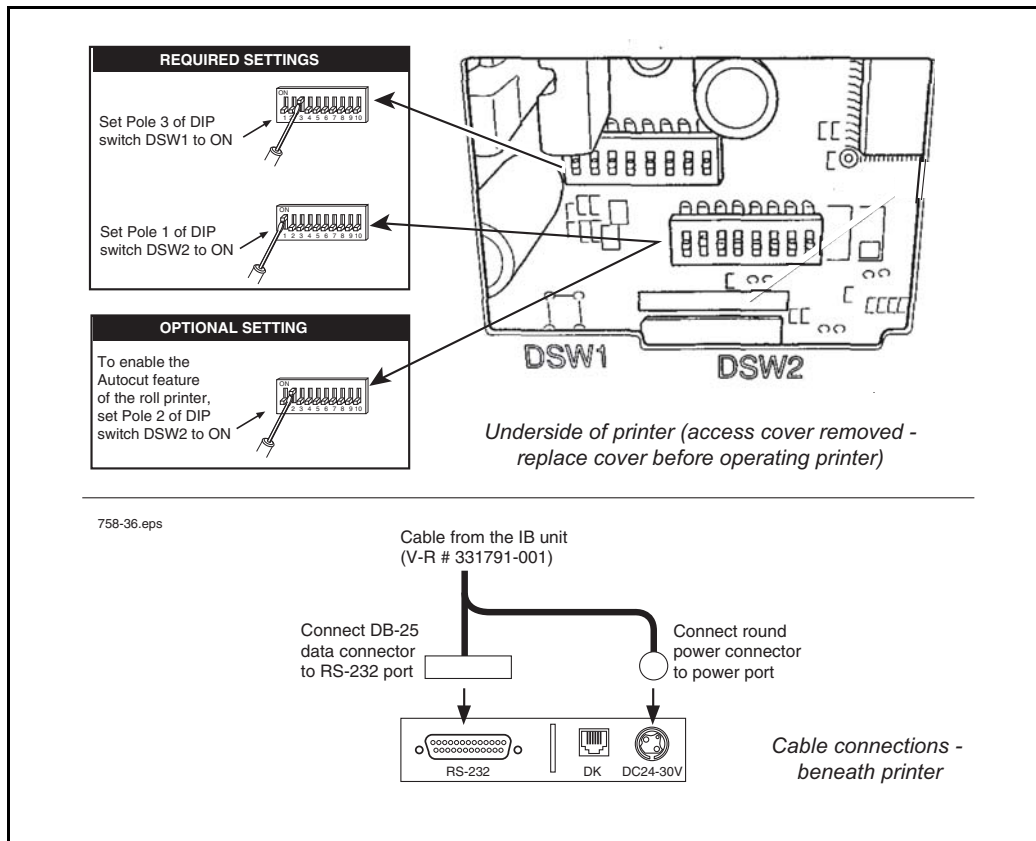


Figure 41. TM-U220A Roll Printer

Installing the Remote Display (Optional)

To install the optional Remote Display see "Installing the Remote Display (Optional)" on page 40.

Installing the Remote Pulser (Optional)

To install the optional remote pulser see “Installing the Remote Pulser (Optional)” on page 43.

RS-232 Peripheral Equipment Requirements

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

1. Peripheral equipment must be UL approved.
2. The equipment must have an EIA standard RS-232C or RS-232D communications protocol.
3. The equipment must NOT be installed over or in a hazardous location.
4. Maximum cable length is 50 feet (15.24 m).
5. Serial parameters
 - Baud: 9600
 - Parity: none
 - Stop bits: 1
 - Data bits: 8

Note: for a list of serial commands, contact Veeder-Root directly.

Pulse Output for EMR4

RANGE OF VALUES ALLOWED FOR SET PULSES/VOL

- Minimum: 0.0
- Maximum: 99,999

HARDWARE SIGNALS

POUT-1 and POUT-2

- POUT-1 and POUT-2 are open collector outputs with an internal pull-up resistor (2.4 K Ω). The output voltage can be set to either 5, 12, or 24 volts using the pulse output voltage rotary switch (see Figure 42).
- Typical duty cycle: variable length square wave
- Minimum period: 1.072 ms
- Maximum frequency: 933 Hz
- Minimum lag time: 460 ms (if within flow rates)

WIRE SIZE AND/OR DISTANCE LIMITATIONS

POUT-1, POUT-2, SP1, and SP2

- Wire size 16 - 24 AWG,
- 5V out length 250 ft. (76.2 m)
- 12V out length 500 ft. (152.4 m)
- 24V out length 1000 ft. (304.8 m)
- Maximum frequency 933 Hz

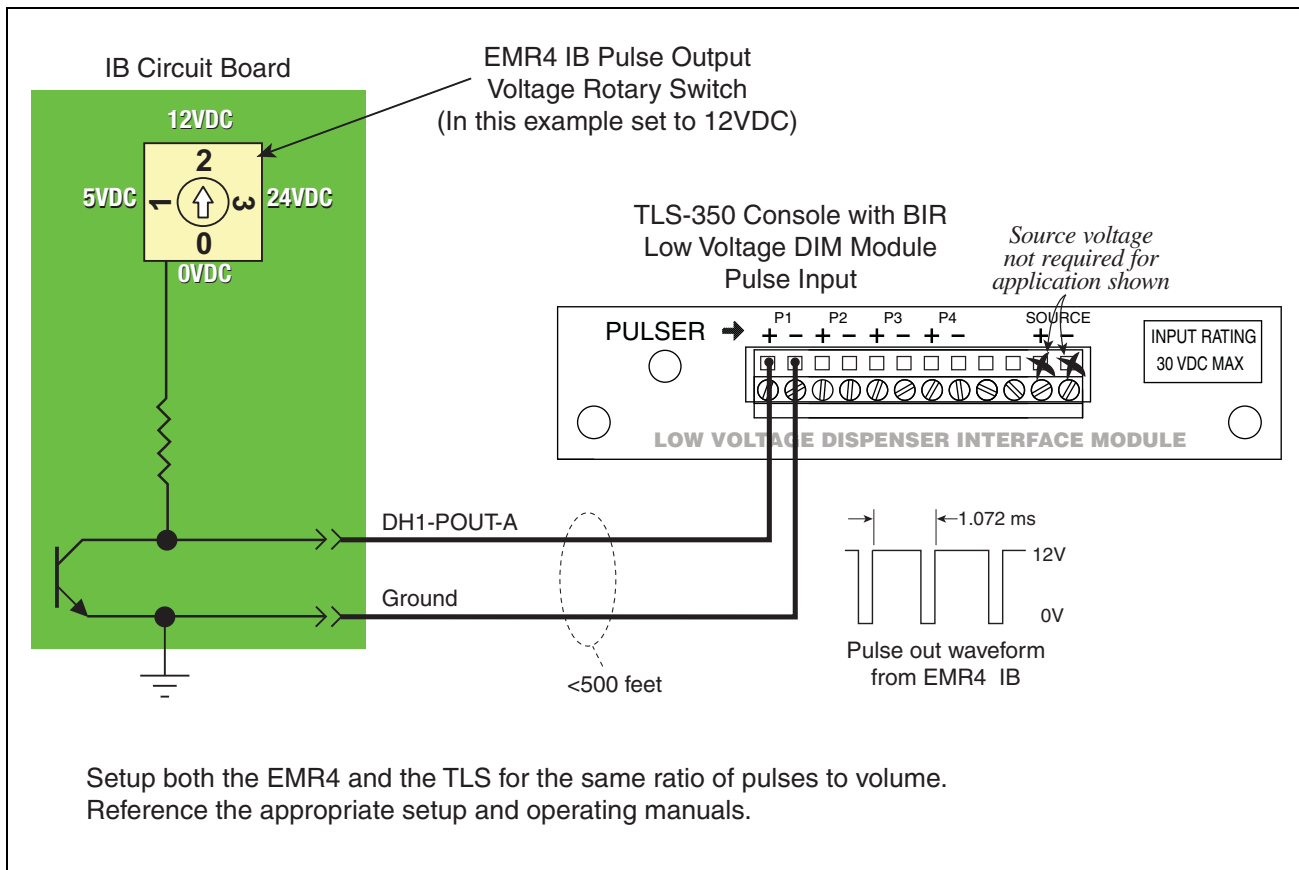


Figure 42. Wiring Pulse Output To A TLS-350 Console

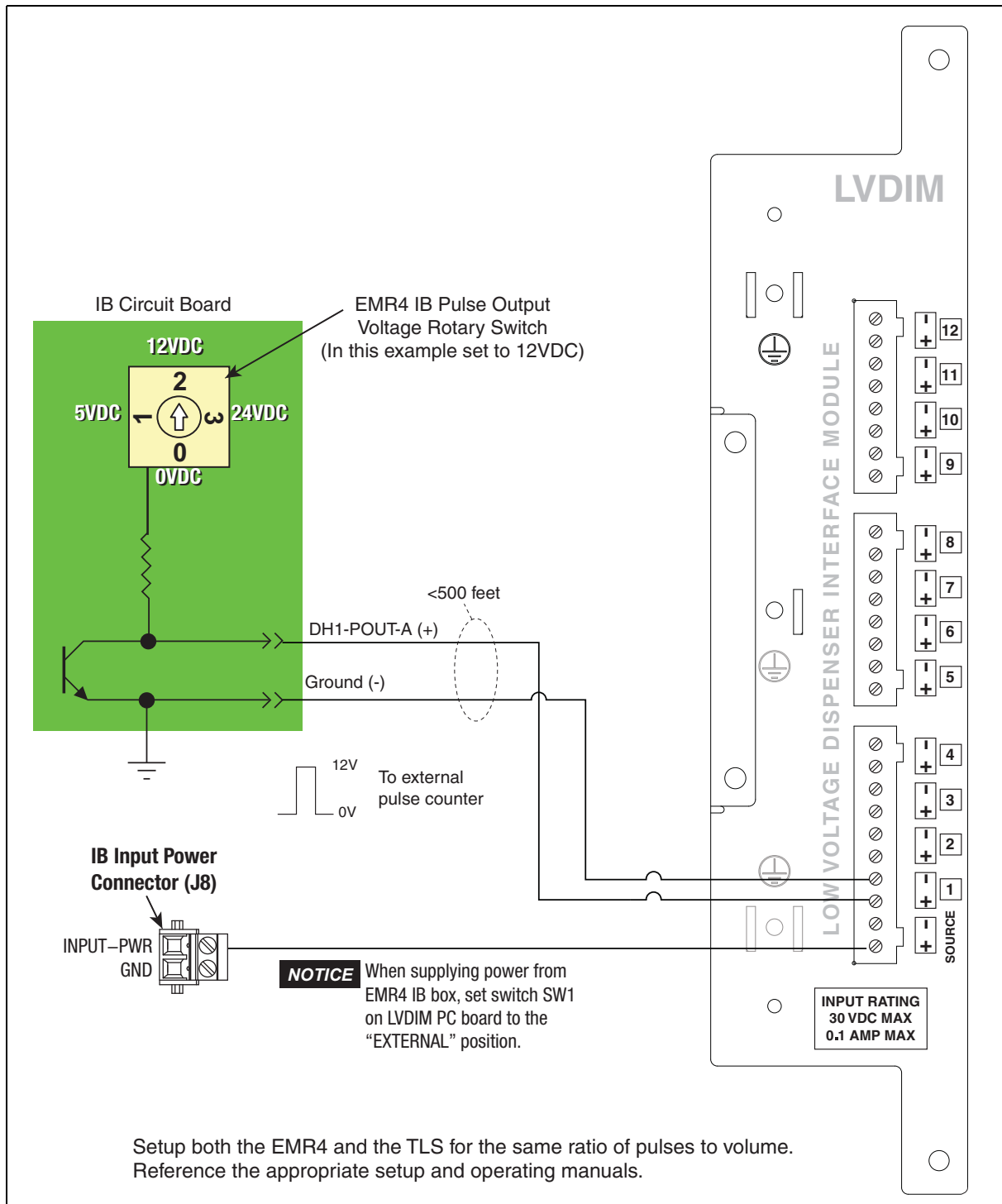


Figure 43. Wiring Pulse Output To A TLS-450/TLS4 Console

PULSE OUTPUT LIMITS

<u>EMR4 Setting</u>	<u>Maximum Fueling Rate</u>
0.1 pulse/gallon	450,000 gpm
1.0 pulse/gallon	45,000 gpm
10 pulses/gallon	4,500 gpm
100 pulses/gallon	450 gpm
1,000 pulses/gallon	45 gpm

Limits are dependent on the time it takes the EMR4 to send pulses. In this example, a gallon is used to represent a unit of volume and gpm is gallons-per-minute.

The EMR4 has a maximum pulse rate of 750 pulses per second or 45,000 pulses per minute. At high fueling rates, the EMR4 will need extra time to send out all of the required pulses. Use the following examples as a guide to setting the correct pulse-to-unit-volume ratio on the EMR4. Reference the EMR4 Setup And Operation Manual, 577014-350, to enter a value under the SET PULSES/VOL menu.

Example of a correct setting:

Set the PULSES/VOL value to 10 pulses per gallon and deliver 1,600 gallons at a fueling rate of 800 gpm. The actual delivery takes 2 minutes and the EMR4 can transmit 16,000 pulses within the 2 minute time frame.

Example of an incorrect setting:

Set the PULSES/VOL value to 100 pulses per gallon. Deliver 3,200 gallons at a fueling rate of 800 gpm. The actual delivery takes 4 minutes while the EMR4 takes (320,000 pulses/45,000 pulses per minute) 7 minutes to process the delivery data. It takes the EMR4 three additional minutes to transmit the last 140,000 pulses! Consider both the flow rate and the time it takes to send all of the pulses prior to setting the PULSES/VOL value.

CAUTION: The EMR4 system does not provide volume pulses in real time. There is an unspecified delay in the time it takes the IB to process volume data provided by the display head.

EMR4 – Legal Disclaimer Notice

PRODUCT SPECIFICATIONS ARE SUBJECT TO CHANGE WITHOUT NOTICE.

VEEDER-ROOT COMPANY, ITS AFFILIATES AND EMPLOYEES, AND ALL PERSONS ACTING ON ITS OR THEIR OWN BEHALF (COLLECTIVELY) DISCLAIM ANY AND ALL LIABILITY FOR ANY ERRORS, INACCURACIES OR INCOMPLETENESS CONTAINED HEREIN.

VEEDER-ROOT'S EMR4 PRODUCT IS NOT APPROVED FOR USE AS A COMPONENT THAT PROVIDES LIQUID ADDITIVES TO AN AIRCRAFT FUELING SYSTEM WHERE THE ABSENCE OF SUCH ADDITIVES CAN REASONABLY BE EXPECTED TO RESULT IN SIGNIFICANT INJURY TO PERSONS, PROPERTY AND THE ENVIRONMENT. CUSTOMERS USING VEEDER-ROOT PRODUCTS NOT EXPRESSLY INDICATED FOR USE IN SUCH APPLICATIONS DO SO ENTIRELY AT THEIR OWN RISK AND AGREE TO FULLY INDEMNIFY VEEDER-ROOT FOR ANY DAMAGE ARISING OR RESULTING FROM SUCH USE.

EMR4 Inhibitors - Provisions for Sealing

The EMR4 uses a wire with a W & M seal that prohibits tampering with the weights and measures sensitive set-up and calibration values stored in the Display Head. Once the wire seal is installed, a physical alteration to the Display Head is required to gain access to the parameters that control the metrological parameters called C&C (configuration and calibration). If the seal is broken, and power applied, the user may enter the C&C mode.

In the C&C mode, metrological parameters are adjusted and calibration of the meter is performed. When in the C&C mode, the EMR4 will not perform a delivery.

Mechanical

The Display Head cover is secured with four bolts that have holes drilled through their heads. A sealing wire is passed through the holes in the C&C bolt and at least one other bolt and secured with a W & M seal (see Figure 44). This wire sealing method is the same method used to physically seal mechanical registers whereupon removing the cover destroys the seal.

The extended keypad is sealed by rivets and cannot be opened without destruction of the rivets. The keypad is affixed to the register housing by means of a fastener that is attached from the inside of the housing. Removing the optional keypad can not be accomplished without breaking the same seal that secures the Display Head cover.

The Interconnect Box (IB) cover is secured to the IB enclosure by 4 Torx screws and a wire with a W & M seal. The sealing holes are located in both the enclosure box and the cover (see Figure 45). Removing the cover will destroy the seal.

Electronic

The EMR4 is protected from any adjustments of metrological parameters by means of the C&C switch located inside the Display Head. During normal operation, there are two terminal positions that must be electrically connected on the terminal block of the Display Head, YEL(+) and YEL (GND) (C&C SW terminals). The C&C switch is protected and sealed by the cover of the Display Head housing. Two possible C&C hardware configurations are used in the EMR4.

INTERNAL CORNER SWITCH

This is a normally open switch with a mounting bracket installed in the corner position of the register housing. When the cover bolt is inserted to secure the cover, it passes through the switch assembly and closes the normally open switch. Conversely when the bolt is removed the switch opens and C&C access is allowed. When using the C&C switch assembly, the sealing wire must pass through the bolt used to mount the corner switch assembly.

REMOTE DISPLAY - FRONT COVER SWITCH

The switch is installed on the front panel of the Remote Display. The heads of the two hex head screws have been drilled through for the sealing wire. To prevent unauthorized switch activation after C&C parameters are entered and the switch is set to setup mode, the switch's cover is replaced and sealing wire is threaded through the switch cover and the heads of the two hex head screws and secured with a W & M seal (see Figure 46).

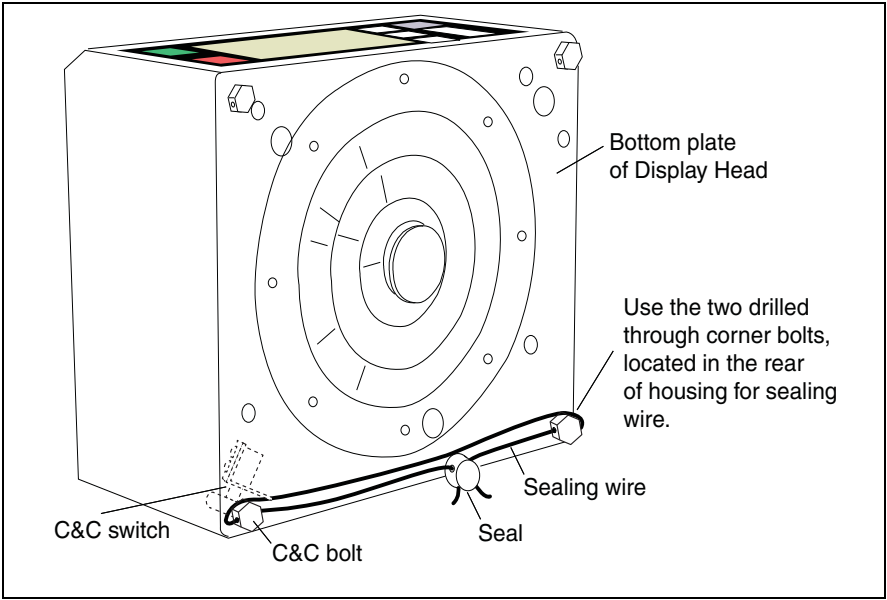


Figure 44. Display Head Sealing

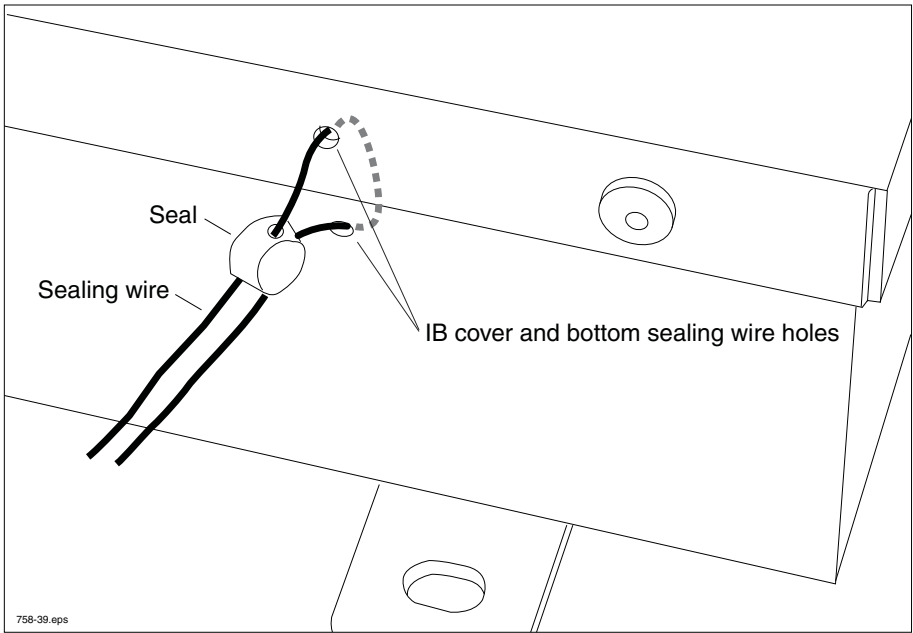


Figure 45. IB Sealing

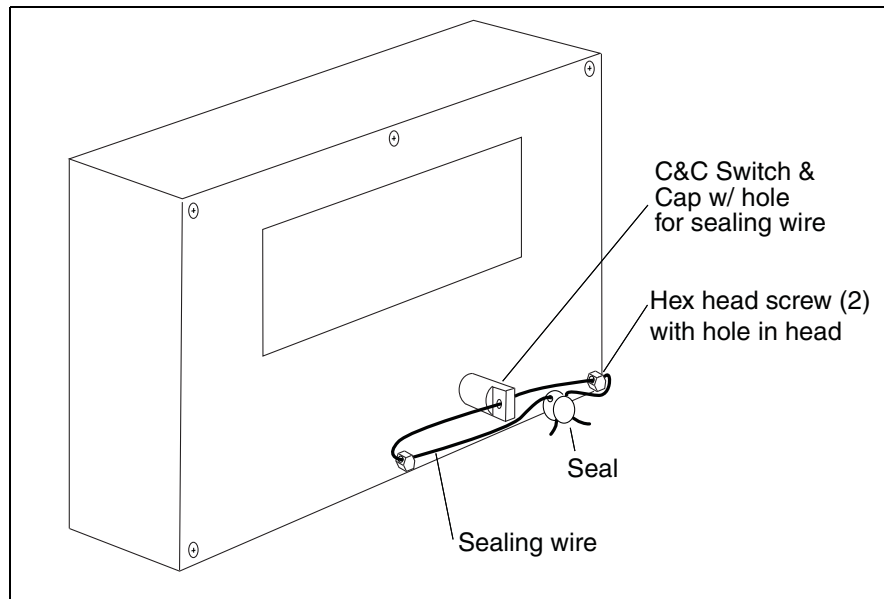


Figure 46. Remote Display Head Sealing

Temperature Probe

The temperature probe used by the EMR4 system for performing volume correction is connected to the two TP positions of the terminal block located in the Display Head that is sealed by the mechanical method described above. The temperature probe cable passes through the wall of the housing by way of one of two openings provided. Strain relief for this cable is provided by a compression fitting called a cord grip. If the temperature probe cable becomes disconnected, the system will display an error message and terminate the current delivery.

Appendix A: EMR4 Safety Instructions & System Specifications

1. ATEX approved EMR4 systems are marked with the following information defining its limits for safe use.
 - This equipment must be installed according to the applicable installation document. For UL/cUL installations use Control Drawing number 331940-021 and for ATEX installations use Descriptive System Document number 331940-022. For IECEx installations use Descriptive System Document number 331940-022.
 - Defined per certification DEMKO 17 ATEX 1889X or IECEx UL 17.0054X.
2. Refer to the site preparation procedures in this manual for general instructions on safe installation, use, and replacement.
3. The EMR4 system does require periodic calibration. Follow the calibration procedures outlined in the Veeder-Root EMR4 Setup and Operation manual (P/N 577014-350).
4. The EMR4 system is not serviceable. If a failure occurs, the unit should be replaced in accordance with the requirements of this manual.


Special Conditions for Safe Use

- For ambient temperatures below -10°C and above +60°C use field wiring suitable for both minimum and maximum ambient temperature.
- All installations must be made in accordance with the accompanying Descriptive System Documentation.
- The devices have not been evaluated for use across a boundary wall.
- The display head, remote display head, thermoprobe, pulse encoder, corner switch and optional keypad all contain aluminum. Care must be taken to avoid ignition hazards due to impact or friction.

General Overview Of The ATEX Directive

ASSOCIATED APPARATUS

The Veeder-Root EMR4 Interconnect Box (IB) is installed in an indoor, non hazardous area. The IB has barriers that protect the linked apparatus by an **[Exia]** intrinsically safe mode of protection and are suitable to control apparatus installed into areas that are likely to become hazardous in the presence of concentrations of gases, vapours or mists formed by group **IIA** dangerous substances. The symbols on the nameplate have the following meaning:

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

All ATEX models of the **EMR4 IB** are in compliance with Directive **2014/34/EU (ATEX)**.


A sample EMR4 IB has been evaluated and tested by **UL International Demko A/S**, Borupvang 5A, 2750 Ballerup, Denmark Tel.+45 44 85 65 65, info.dk@ul.com, www.ul.com and approved by the issue of the EC type certificates:

DEMKO 17 ATEX 1889X or IECEx UL 17.0054X

EMR4 Interconnect Box

INTRINSICALLY SAFE APPARATUS

The Veeder-Root EMR4 Display Head is an intrinsically safe apparatus, marked **Ex ia**, suitable for installation into areas that are likely to become hazardous in the presence of concentrations of gases, vapours or mists formed by group **IIA** dangerous substances. The temperature class of the devices is **T4** (surfaces temperatures lower than 135°C). The symbols on the nameplate have the following meaning:

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

All ATEX models of the **EMR4 DH** are in compliance with Directive **2014/34/EU (ATEX)**.


A sample EMR4 DH has been evaluated and tested by **UL International Demko A/S**, Borupvang 5A, 2750 Ballerup, Denmark Tel.+45 44 85 65 65, info.dk@ul.com, www.ul.com and approved by the issue of the EC type certificates:

DEMKO 17 ATEX 1889X or IECEx UL 17.0054X

EMR4 Display Head

EMR4 Remote Pulser + Encoder

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

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

In addition to certified intrinsically safe apparatus, Veeder-Root also provides simple apparatus that comply with the requirements of EN 60079-11, Clause 5.7. These devices include; Thermoprobe, Emergency Stop Switch, Corner Switch and the Optional Keypad. Figures showing these devices may contain devices that are outside the scope of this ATEX Certificate.

EMR4 System Specifications

COMPONENT LOCATION

The EMR4 system should be located on a fuel delivery vehicle as shown in Figure 1 on page 5 or in a fueling depot as shown in Figure 36 on page 44.

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

- Altitude up to 2000m.
- Temperature range - see Table A-1.
- A maximum relative humidity of 95% RH (non-condensing) at temperatures shown in Table A-1.
- A supply voltage fluctuation not exceeding 28 Vdc.
- Pollution Degree Category 2, Installation Category II.
- Vibration: MIL-STD-810G, Method 514.6; Table 514.6 C-VI Category 4
- Shock: MIL-STD-810G, Method 516.6; 20G, 11ms, 1/2-Sine

NOTICE **EMR4 IB units are not suitable for external locations and must be installed within the interior of buildings or the cab of the fuel delivery vehicle.**

Ensure that the EMR4 IB is located where neither the unit itself nor its associated cabling will be damaged by doors, furniture, barrows, etc. - depot installs or nearby equipment - vehicle installs.

Consider the ease of routing wiring, ducting and cables to the EMR4 IB.

Check that the mounting surface material is strong enough to support the EMR4 IB.

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

Overall dimensions and the weight of the various system components are as shown in Table A-1 and Table A-2:

Table A-1. System Component Information

System	Operating Temperature Range	Height	Width	Depth	Weight	Descriptive System Document
EMR4 IB	$-25^{\circ} \leq T_a \leq 40^{\circ} \text{C}$	254mm (10 in.)	215.9mm (8.5 in.)	80.9mm (3.185 in.)	7.6 lbs (3430 g)	331940-022
EMR4 Display Head	$-40^{\circ} \leq T_a \leq 60^{\circ} \text{C}$	129.6mm (5.1 in.)	241.3mm (9.5 in.) - w/o optional keypad 330.2mm (13 in.) - w/optional keypad	215.9mm (8.5 in.)	11 lbs (4990 g)	
Optional Keypad	$-40^{\circ} \leq T_a \leq 60^{\circ} \text{C}$	117mm (4.6 in.)	92mm (3.6 in.)	59mm (2.3 in.)	1 lb (454 g)	

To allow for maintenance ensure that the EMR4 IB is in an accessible area, even when the unit's doors are open. Ensure that all relevant subcontractors and other personnel are aware of the selected location.

Table A-2. Remote Pulser Information

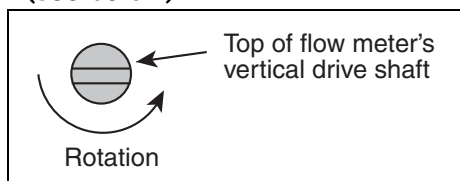
Operating Temperature Range	Shaft Length	Shaft Diameter	Housing Diameter	Housing Depth	Weight	Descriptive System Document
$-25^{\circ} \leq T_a \leq 70^{\circ} \text{C}$ ($-13^{\circ} \leq T_a \leq 158^{\circ} \text{F}$)	11.5mm (0.45 in.)	6.4mm (0.250 in.)	101.6mm (4 in.)	62mm (2.44 in.)	1.4 lbs (652 g)	331940-022

Appendix B: Installing/Replacing Pulse Encoder Kit

1. Remove the four cover bolts of the Display Head and lift off the cover. Put the cover and bolts aside.

Locate the V-R Installation Bracket With Encoder kit (P/N 845900-015). Refer to Figure B-1 to locate the pulse encoder, retaining nut and washer and mounting bracket in the EMR4.

NOTICE Veeder-Root recommends that the EMR4 Meter Register is driven in the counter-clockwise (CCW) rotation. When looking down at the top of the flow meter vertical drive shaft it should be turning CCW (see below).



NOTE: The flow meter's drive shaft end view may vary depending on the flow meter type.

2. Using the four 6-32 x 0.25, T15 screws, attach the encoder bracket to the Display Head base as shown in Figure B-1. Attach the pulse encoder to the bracket using the retaining nut and washer as shown.

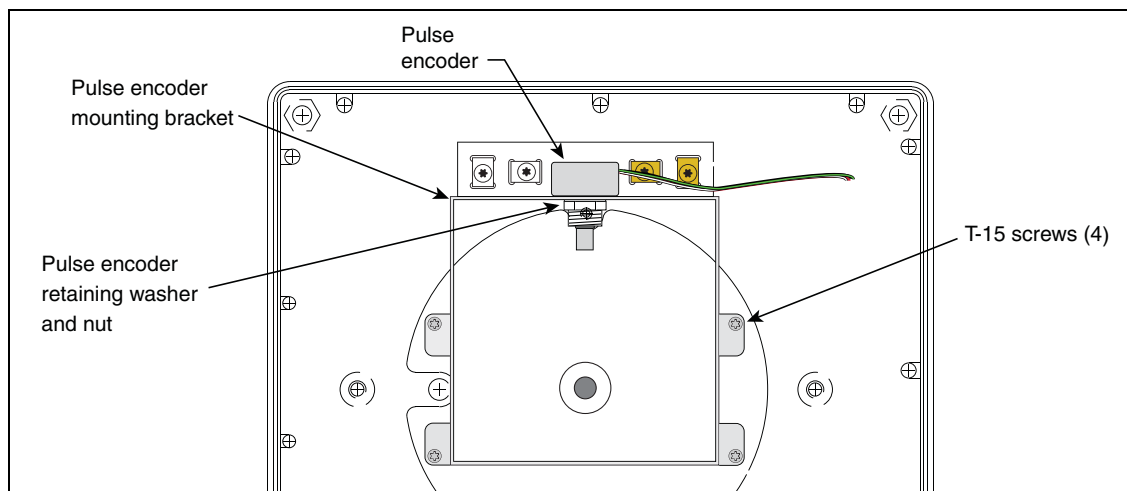
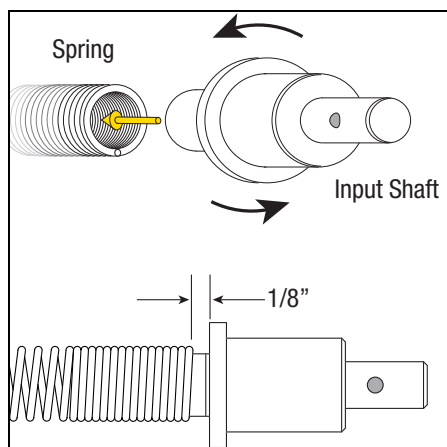


Figure B-1. Attach Encoder Mounting Bracket to Display Head Base

3. Locate the Encoder Spring and Input Shaft from the kit. With the encoder spring in your left hand and the input shaft in your right, orient the input shaft as shown in Figure B-2, then rotate the input shaft in a counter-clockwise direction as you 'screw' it into the spring until the flange on the input shaft is about 1/8" from the end of the spring.



NOTE: The Input Shaft's appearance may vary depending on the flow meter type.

Figure B-2. Screwing Input Shaft CCW Into Encoder Spring

4. With the Encoder Spring/Input Shaft assembly in one hand, push the open spring end onto the pulse encoder's shaft. Work the spring onto the shaft until it is about 1/8" from the pulse encoder (Figure B-3).

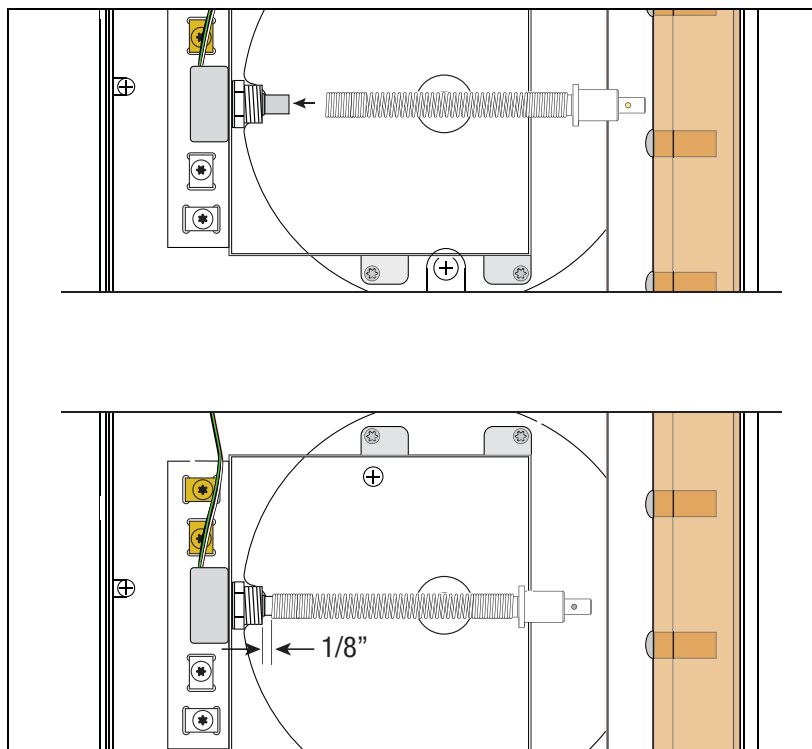
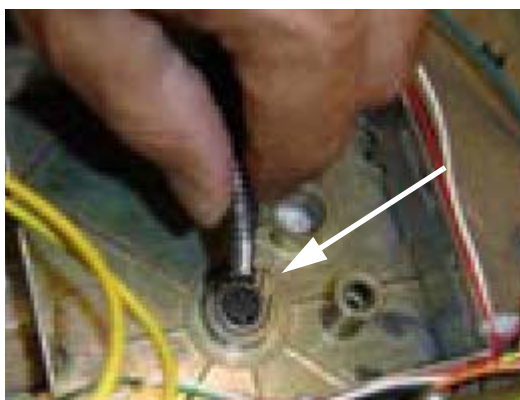


Figure B-3. Pushing Encoder Spring Onto Pulse Encoder Shaft

5. Place the thin washer from the kit onto the input shaft against the underside of the flange on the input shaft and then CAREFULLY bend the spring to insert the end of the input shaft into the center hole on the bottom of the Display Head as shown below.



6. From the underside of the Display Head, insert the groove pin from the kit into the hole in the input shaft to secure it in base of the unit (Figure B-4).

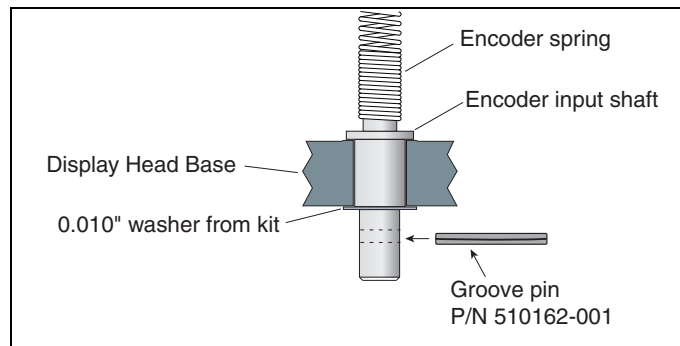


Figure B-4. Securing Encoder Input Shaft In Display Head Base

7. Connect pulse encoder wires to display assembly terminal block as shown in Figure B-5.

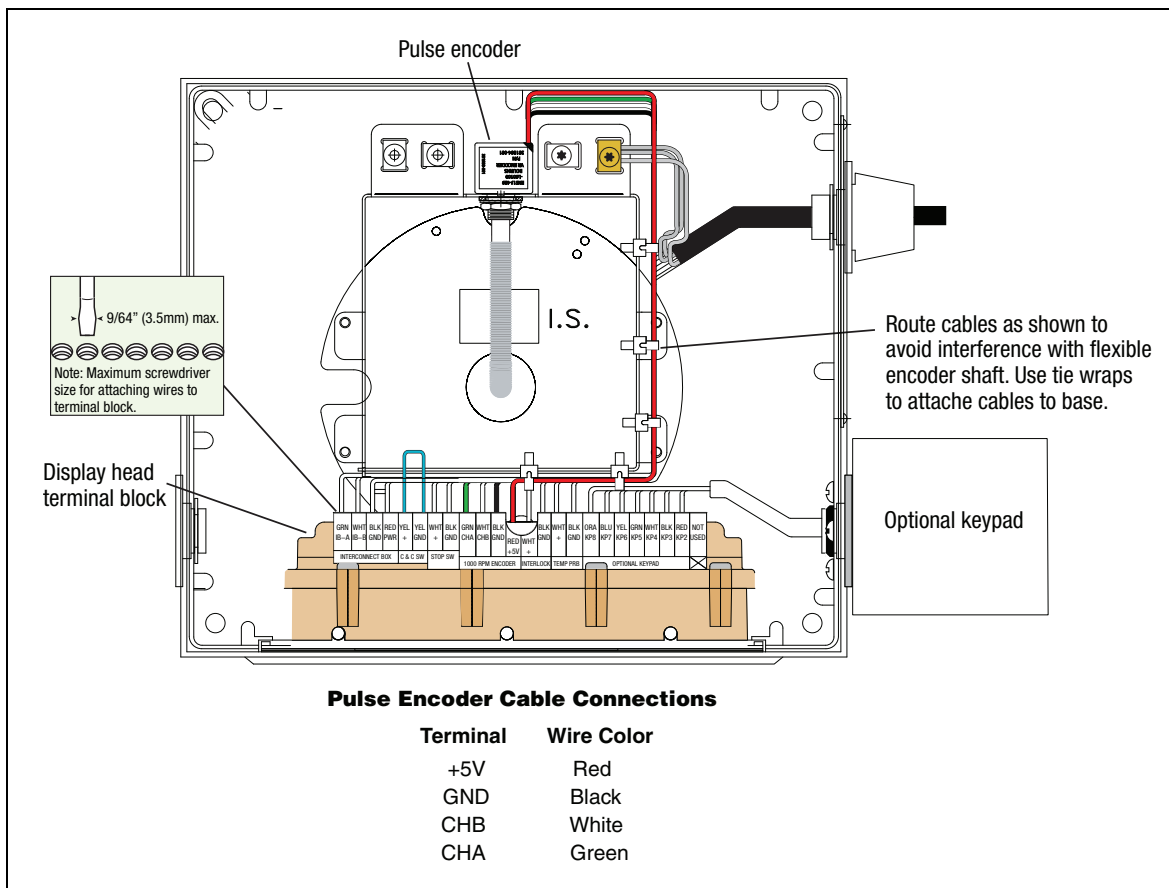


Figure B-5. Connecting Pulse Encoder Wiring To Display Assembly Terminal Block

