

# EMR4

## Technical Installation Guide

# Notice

---

Veeder-Root makes no warranty of any kind with regard to this publication, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose.

**Veeder-Root shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this publication.**

Veeder-Root reserves the right to change system options or features, or the information contained in this publication.

This publication contains proprietary information which is protected by copyright. All rights reserved. No part of this publication may be photocopied, reproduced, or translated to another language without the prior written consent of Veeder-Root.

Contact Technical Support for additional troubleshooting information at 800-323-1799.

## **DAMAGE CLAIMS / LOST EQUIPMENT**

Thoroughly examine all components and units as soon as they are received. If any cartons are damaged or missing, write a complete and detailed description of the damage or shortage on the face of the freight bill. The carrier's agent must verify the inspection and sign the description. Refuse only the damaged product, not the entire shipment.

Veeder-Root must be notified of any damages and/or shortages within 30 days of receipt of the shipment, as stated in our Terms and Conditions.

## **VEEDER-ROOT'S PREFERRED CARRIER**

1. Contact Veeder-Root Customer Service at 800-873-3313 with the specific part numbers and quantities that were missing or received damaged.
2. Fax signed Bill of Lading (BOL) to Veeder-Root Customer Service at 800-234-5350.
3. Veeder-Root will file the claim with the carrier and replace the damaged/missing product at no charge to the customer. Customer Service will work with production facility to have the replacement product shipped as soon as possible.

## **CUSTOMER'S PREFERRED CARRIER**

1. It is the customer's responsibility to file a claim with their carrier.
2. Customer may submit a replacement purchase order. Customer is responsible for all charges and freight associated with replacement order. Customer Service will work with production facility to have the replacement product shipped as soon as possible.
3. If "lost" equipment is delivered at a later date and is not needed, Veeder-Root will allow a Return to Stock without a restocking fee.
4. Veeder-Root will NOT be responsible for any compensation when a customer chooses their own carrier.

## **RETURN SHIPPING**

For the parts return procedure, please follow the appropriate instructions in the EMR Products General Returned Goods Policy pages in the EMR4 Products price list. Veeder-Root will not accept any return product without a Return Goods Authorization (RGA) number clearly printed on the outside of the package.

<b>Safety Information</b>	
Safety Warnings .....	2
Special Conditions for Safe Use .....	2
<b>EMR4 Truck Installation</b>	
Installing The Interconnection Box (IB) .....	4
Input Power – Critical Ground Connection .....	4
2-Stage Solenoid Valve Connections .....	8
Valve Operation With The EMR4 .....	8
3-Way Safety Valve for Truck LP Gas Systems .....	9
Installing The 3-way Valve.....	9
Solenoid Valves.....	12
Wiring The Display Head .....	14
C&C Mode Switch .....	16
Installing Optional Keypad Kit - Right or Left Side .....	16
Installing The Remote Display (Optional) .....	16
Installing The Remote Pulser (Optional) .....	19
Pulse Encoder Specifications .....	19
<b>EMR4 Terminal &amp; Fueling Depot Installation</b>	
Wiring The Display Head .....	21
Installing The Interconnect Box (IB) .....	22
National Electrical Code Compliance .....	22
Grounding.....	22
Wire Type for Metallic or PVC Conduit.....	23
Wire Length .....	23
Mounting and Wiring the IB Unit.....	23
Solenoid Valves.....	23
Power Conditioning Requirements .....	26
Wire Size And/or Distance Limitations .....	26
Pulse Output Limits .....	29
EMR4 – Legal Disclaimer Notice .....	29
<b>EMR4 System Specifications</b>	
System Power .....	30
Component Location .....	30
<b>Appendix A: EMR4 Safety Instructions &amp; System Specifications</b>	

## Figures

Figure 1.	Example EMR4 truck Installation With 2 Display Heads And Optional Remote Pulser .....	3
Figure 2.	IB Physical Dimensions (Shown With Cover Removed) .....	6
Figure 3.	EMR4 IB Box Wiring Connections .....	7
Figure 4.	2-Stage Solenoid Valve .....	8
Figure 5.	Connecting 3-Way Valve To Neptune Meter - Truck LP Gas Installations .....	10
Figure 6.	Connecting 3-Way Valve To L.C./TCS Meter - Truck LP Gas Installations .....	11
Figure 7.	Connecting 3-Way Valve To The Interconnect Box .....	12
Figure 8.	Example Wiring Connections For DC And AC Solenoid Valves .....	13
Figure 9.	Display Head Cable Connections .....	15
Figure 10.	Remote Display Assembly .....	17












Figure 11.	Remote Display Connections (Rear Cover Removed)	18
Figure 12.	Wiring Connections In Remote Pulser (Top Cover Removed)	19
Figure 13.	Example Terminal Fueling Depot Installation With 2 Display Heads And Optional Remote Pulser	20
Figure 14.	Display Head Cable Connections	22
Figure 15.	EMR4 IB Box Wiring Connections	24
Figure 16.	Example Terminal Wiring Connections For DC And AC Solenoid Valves	25
Figure 17.	Digi-Key Power Supply Wiring Diagram	26
Figure 18.	Wiring Pulse Output To A TLS-350 Console	27
Figure 19.	Wiring Pulse Output To A TLS-450/TLS4 Console	28

## Tables


Table 1.	2-Stage Solenoid Wiring	8
Table 2.	Remote Display (84559X-00X) Components	16
Table 3.	System Component Dimensions	30
Table 4.	Remote Pulser Dimensions	31
Table A-1.	System Component Information	A-3
Table A-2.	Remote Pulser Information	A-3


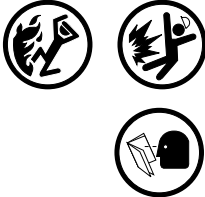
# Safety Information

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

 <p><b>EXPLOSIVE</b> Fuels and their vapors are extremely explosive if ignited.</p>	 <p><b>FLAMMABLE</b> Fuels and their vapors are extremely flammable.</p>
 <p><b>TURN POWER OFF</b> 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><b>WARNING</b> Indicates a hazardous situation which, if not avoided, could result in death or serious injury.</p>
 <p><b>NOTICE</b> Alerts the user to practices not related to physical injury.</p>	 <p><b>CAUTION</b> Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.</p>
 <p><b>INJURY</b> Careless or improper handling of materials can result in bodily injury.</p>	 <p><b>GLOVES</b> Wear gloves to protect hands from irritation or injury.</p>
 <p><b>WEAR EYE PROTECTION</b> 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><b>NO OPEN FLAMES</b> Open flames from matches, lighters, welding torches, etc. can ignite fuels and their vapors.</p>
 <p><b>READ ALL RELATED MANUALS</b> 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**

 **Who is allowed to work on this equipment: Only trained or authorized individuals knowledgeable in the related procedures should install, inspect, maintain, or service this equipment.**

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

- 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.

# 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.

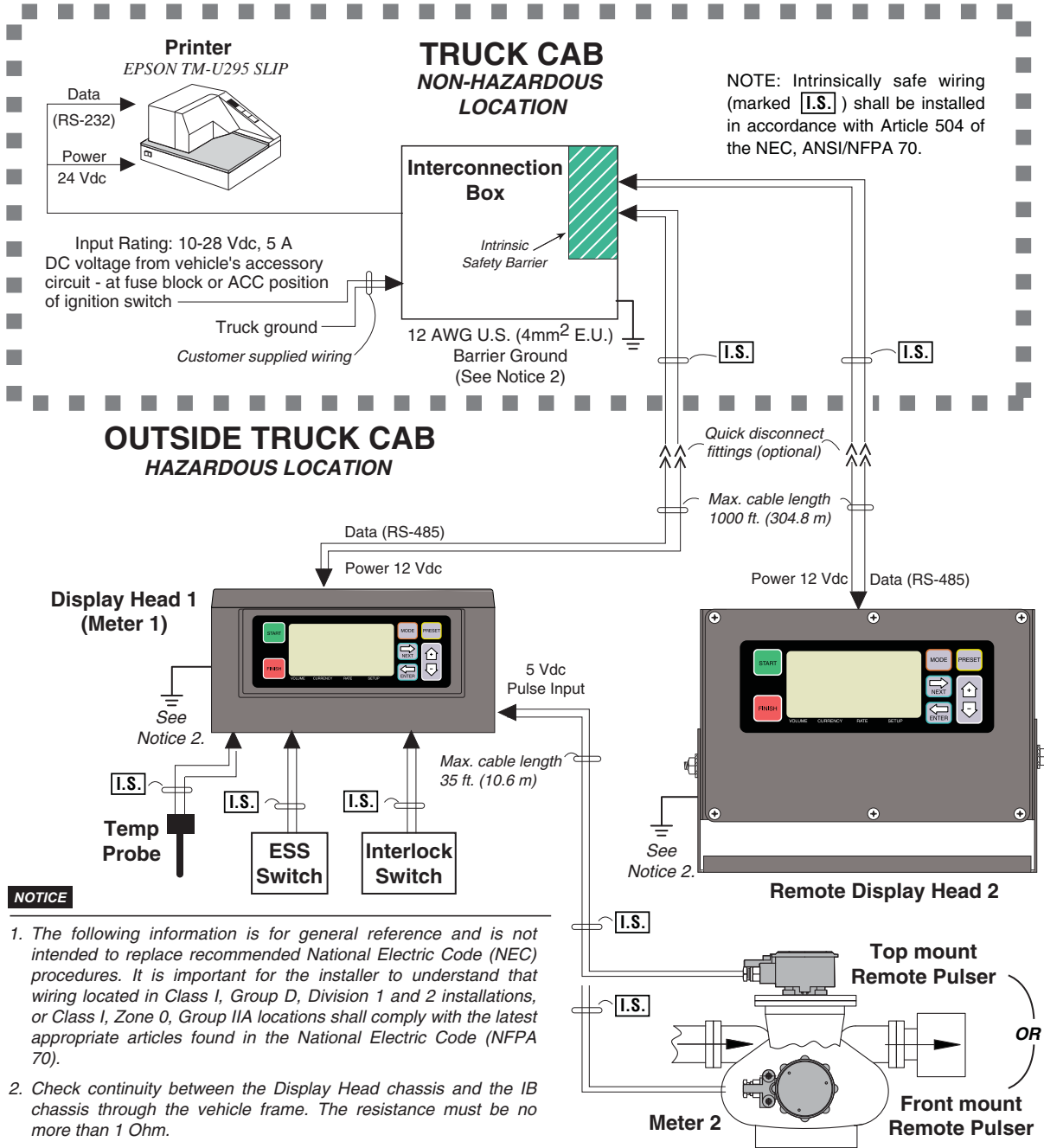


Figure 1. Example EMR4 truck Installation With 2 Display Heads And Optional Remote Pulser

---

## Installing The Interconnection Box (IB)

---

**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.

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 Interconnection Box (IB) are shown in Figure 2. 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 3 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.
3. 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).
  4. Refer to Figure 3 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 3, 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.

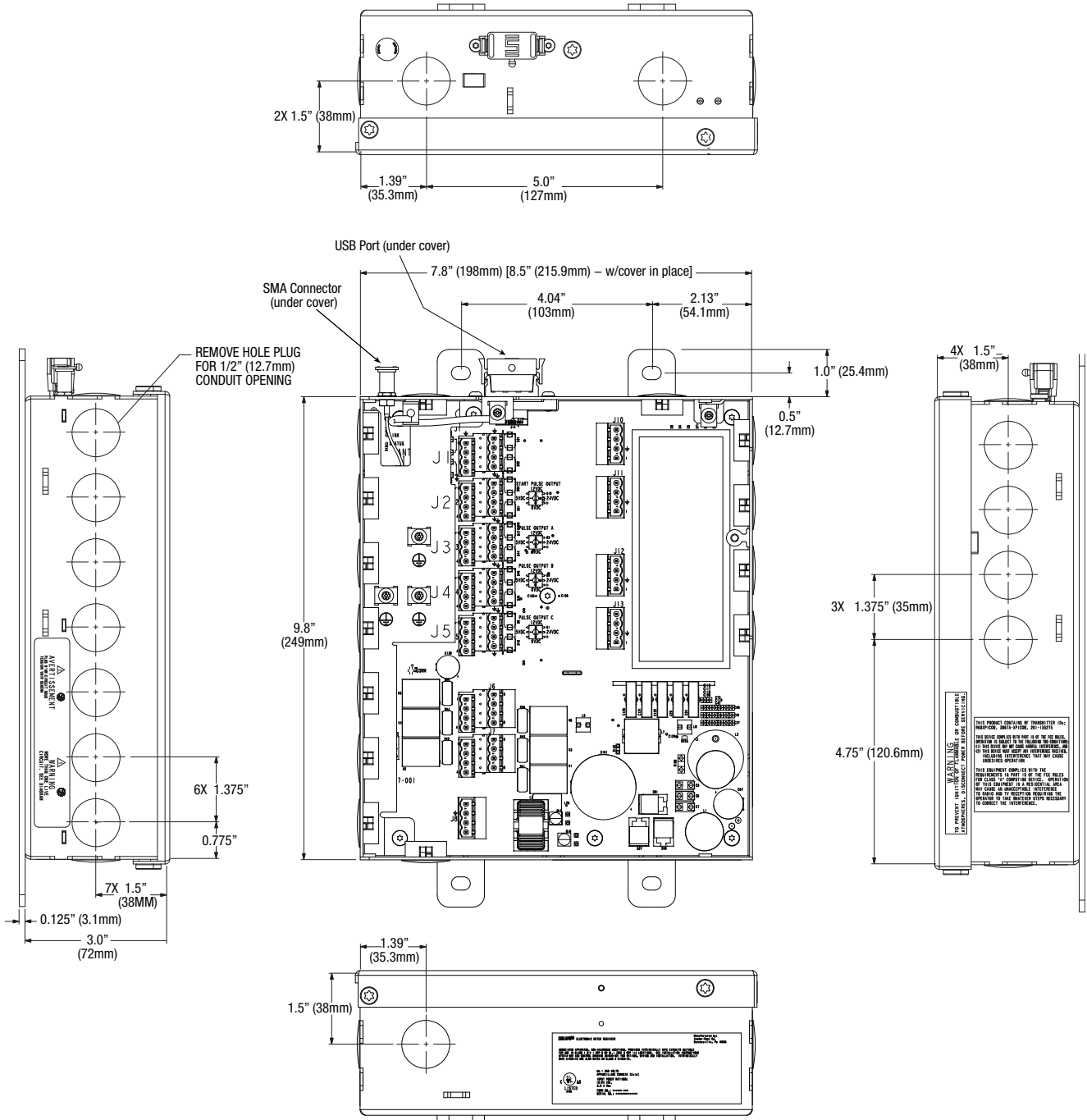


Figure 2. IB Physical Dimensions (Shown With Cover Removed)

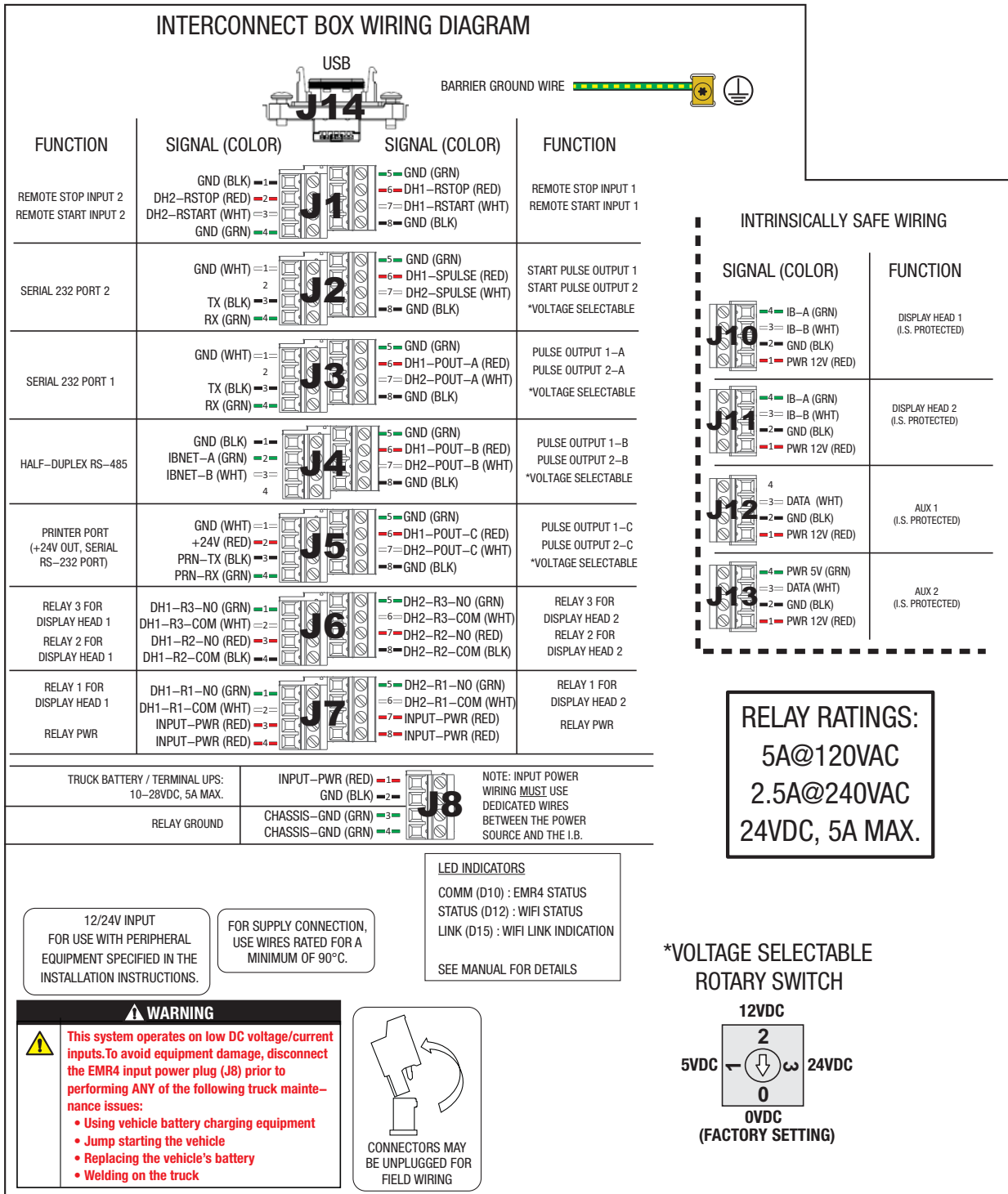


Figure 3. EMR4 IB Box Wiring Connections

**2-STAGE SOLENOID VALVE CONNECTIONS**

A 2-stage solenoid flow valve is shown in Figure 4 and wiring connections in Table 1.

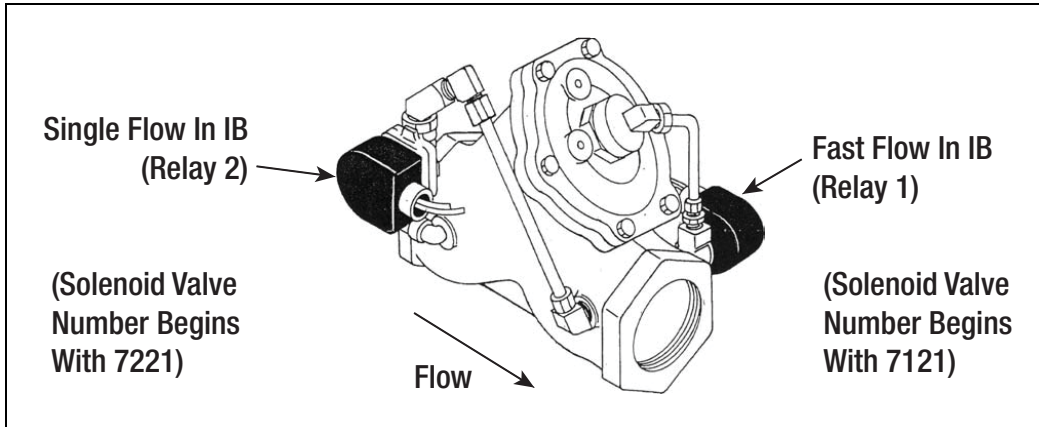


Figure 4. 2-Stage Solenoid Valve

Table 1. 2-Stage Solenoid Wiring

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

<b>⚠ WARNING</b>	
	<p>The Three-Way Safety Valve is installed and operated in the highly combustible environment of an LPG tank.</p> <p><b>FAILURE TO COMPLY WITH THE FOLLOWING WARNINGS AND SAFETY PRECAUTIONS COULD CAUSE DAMAGE TO PROPERTY, ENVIRONMENT, RESULTING IN SERIOUS INJURY OR DEATH.</b></p> <ol style="list-style-type: none"> <li>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.</li> <li>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.</li> <li>3. LPG tanks must be depressurized (drained) and free of liquid and combustible vapors before work begins.</li> <li>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.</li> </ol>

## 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 5. *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 5). 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 5).

**CAUTION**



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

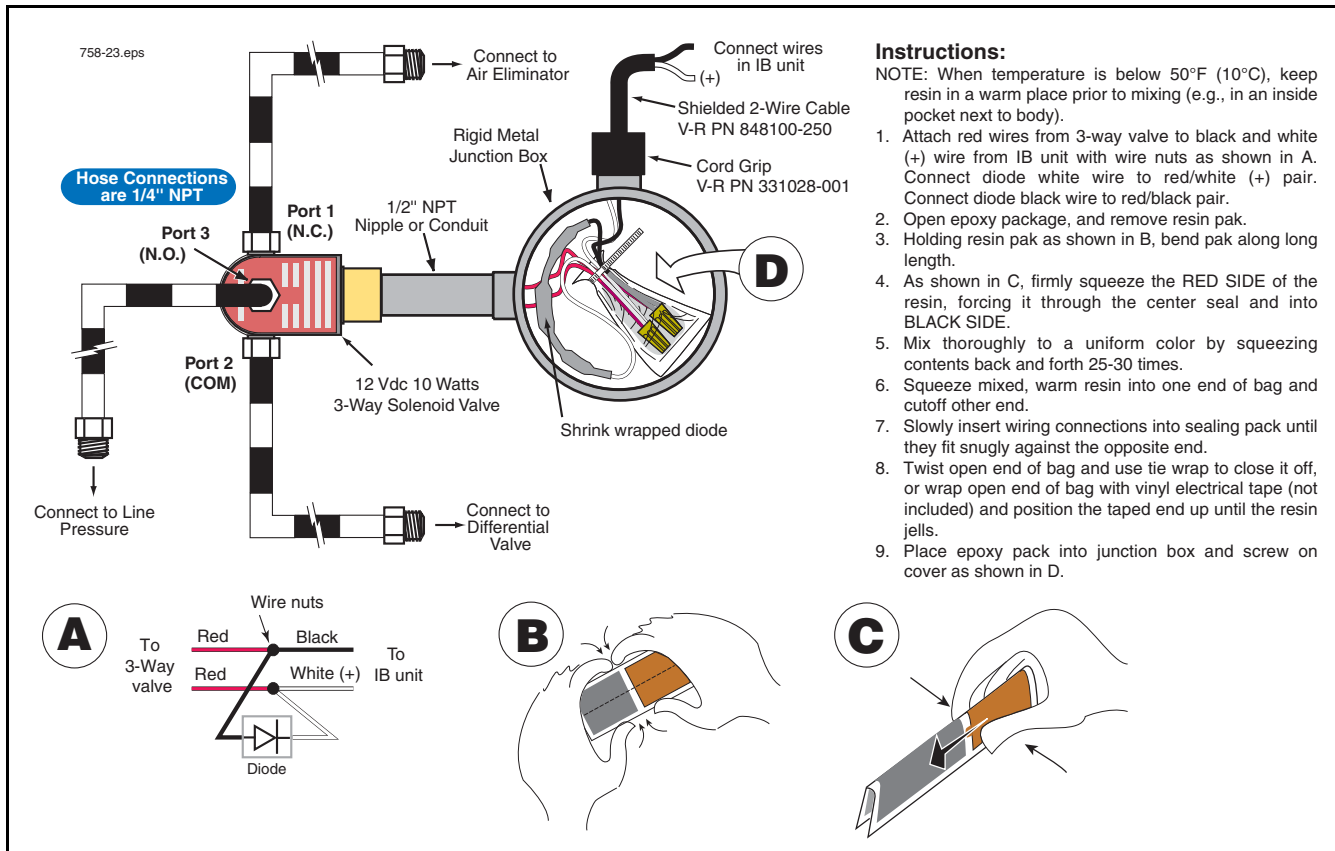


Figure 5. Connecting 3-Way Valve To Neptune Meter - Truck LP Gas Installations

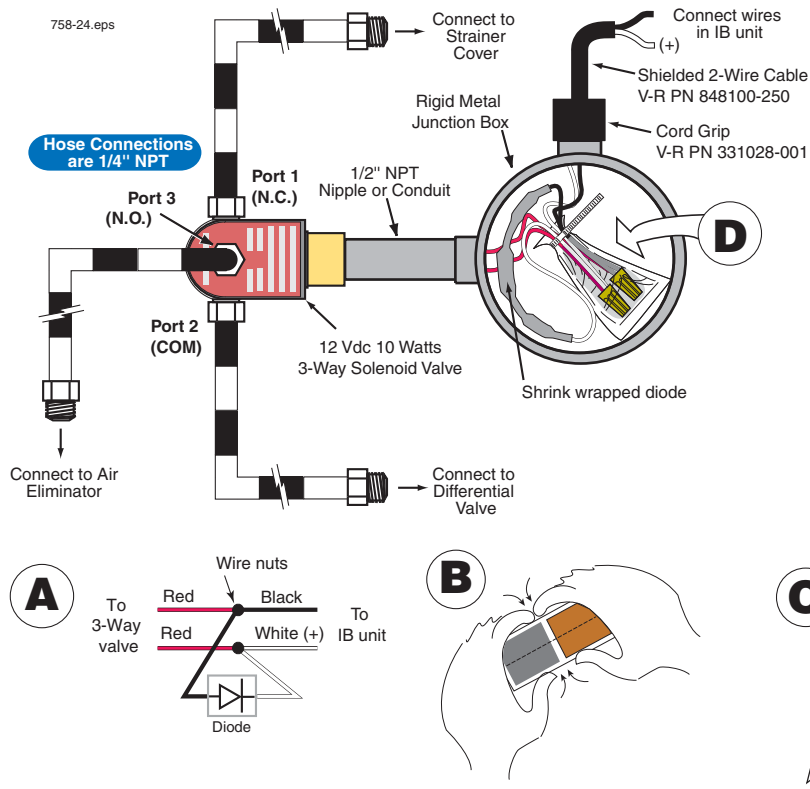
- Tighten the cable bushing nuts on the cord grip to ensure a watertight seal at the cable's entry.
- Remove the protective closures from the 3-way valve ports.

Neptune meters:

Connect a hose from line pressure to port 3 (normally open port) of the 3-way valve (see Figure 5). 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 6). 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 6. 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 7.

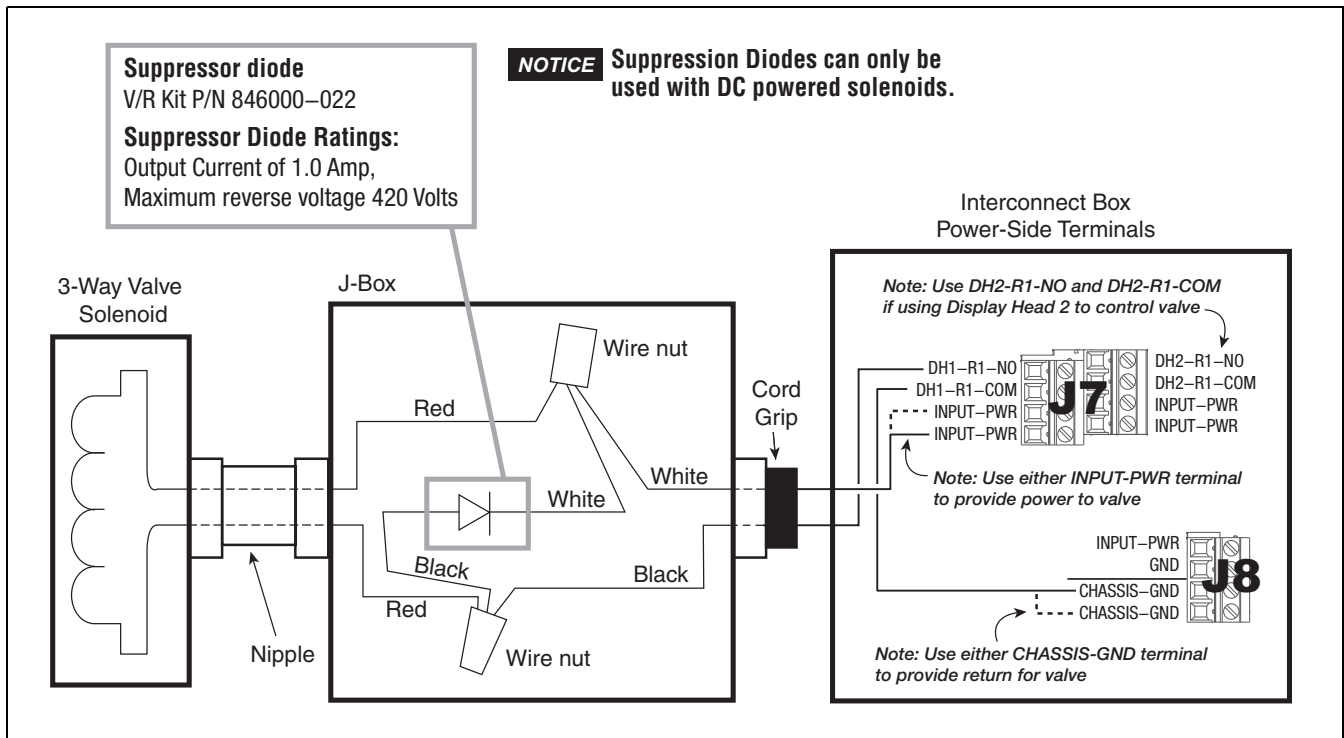


Figure 7. Connecting 3-Way Valve To The Interconnect Box

### SOLENOID VALVES

Figure 8 illustrates wiring examples when connecting DC or AC solenoid valves to the IB box.

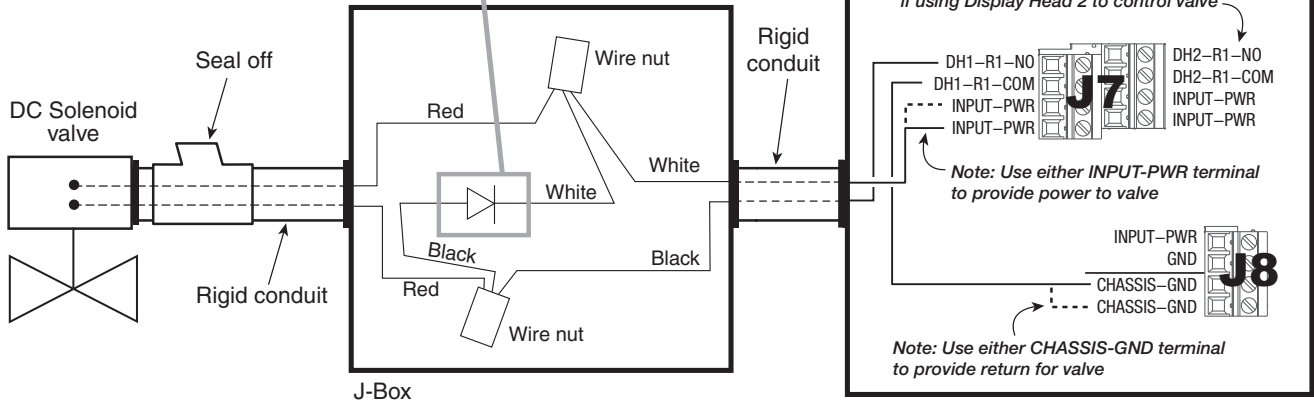


### DC Solenoid Wiring

**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

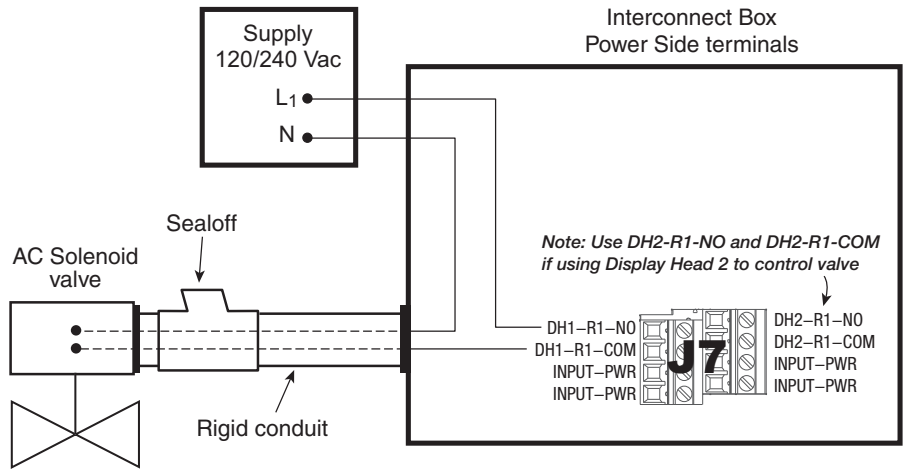


Figure 8. Example Wiring Connections For DC And AC Solenoid Valves

---

## 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 9. 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 9. 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 9. 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.

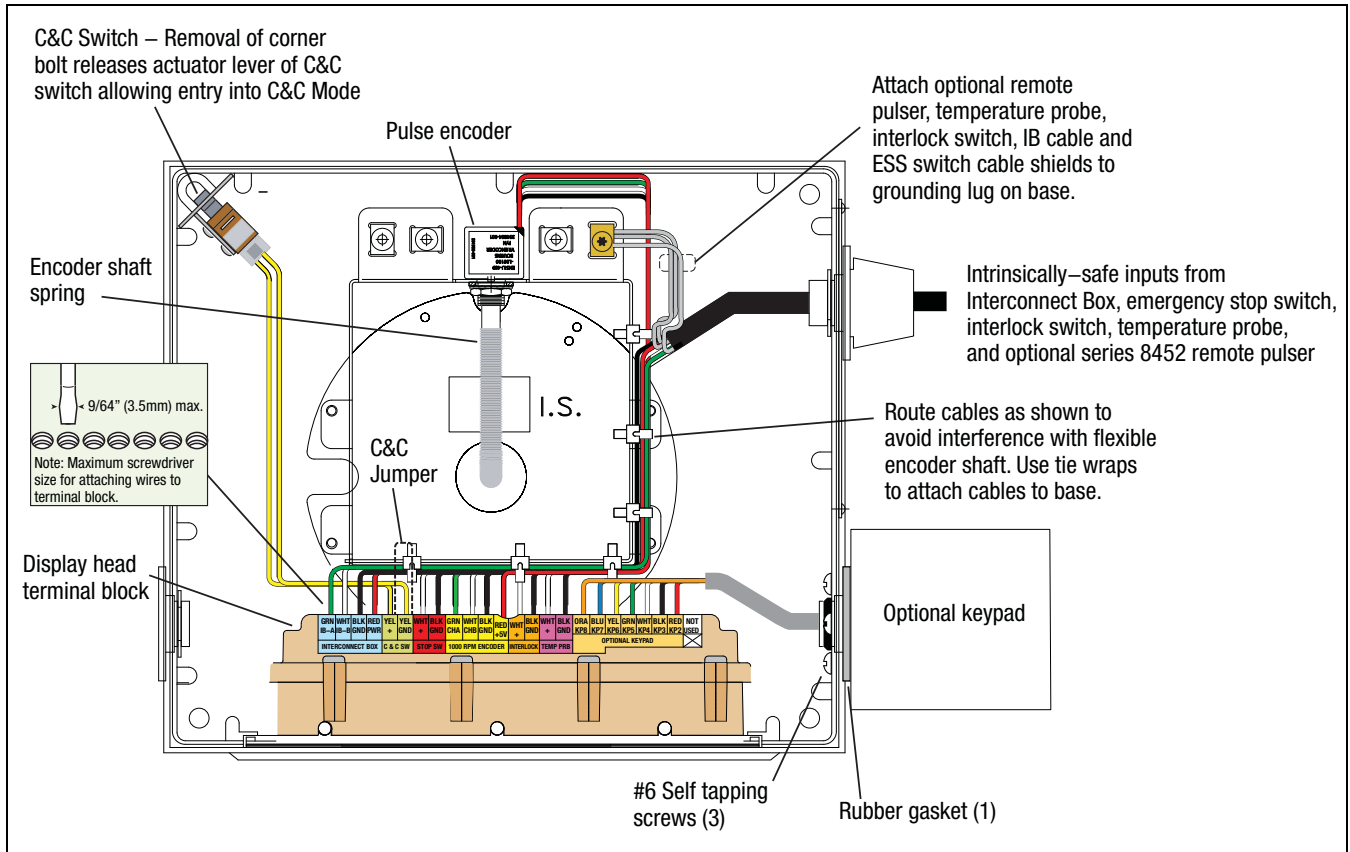


Figure 9. Display Head Cable Connections

## 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 Figure9). 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

Figure9 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 Figure9. The screws are self-tapping. The user may want to pre-tap the holes using the screw to ease installation.

## Installing The Remote Display (Optional)

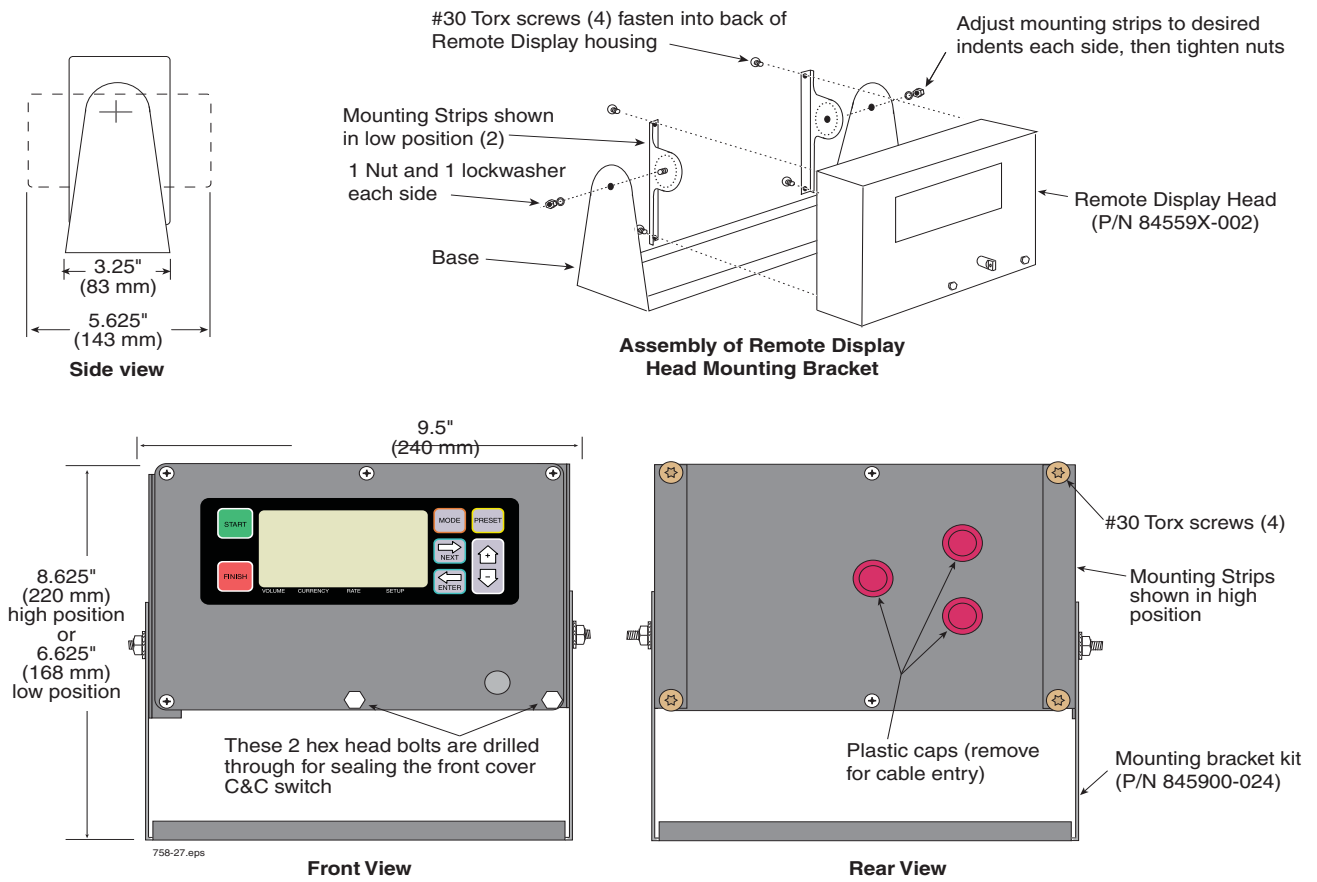
The Remote Display consists of the items listed in Table 2:

**Table 2. 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 10 shows the Remote Display assembly and Figure 11 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 14) for the meter mounted Display Head, connect the Remote Display to the Interconnect Box. Wiring connections at the Remote Display are shown in Figure 11. 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 10. Remote Display Assembly**

Figure 11 displays the wiring connections to a remote display.

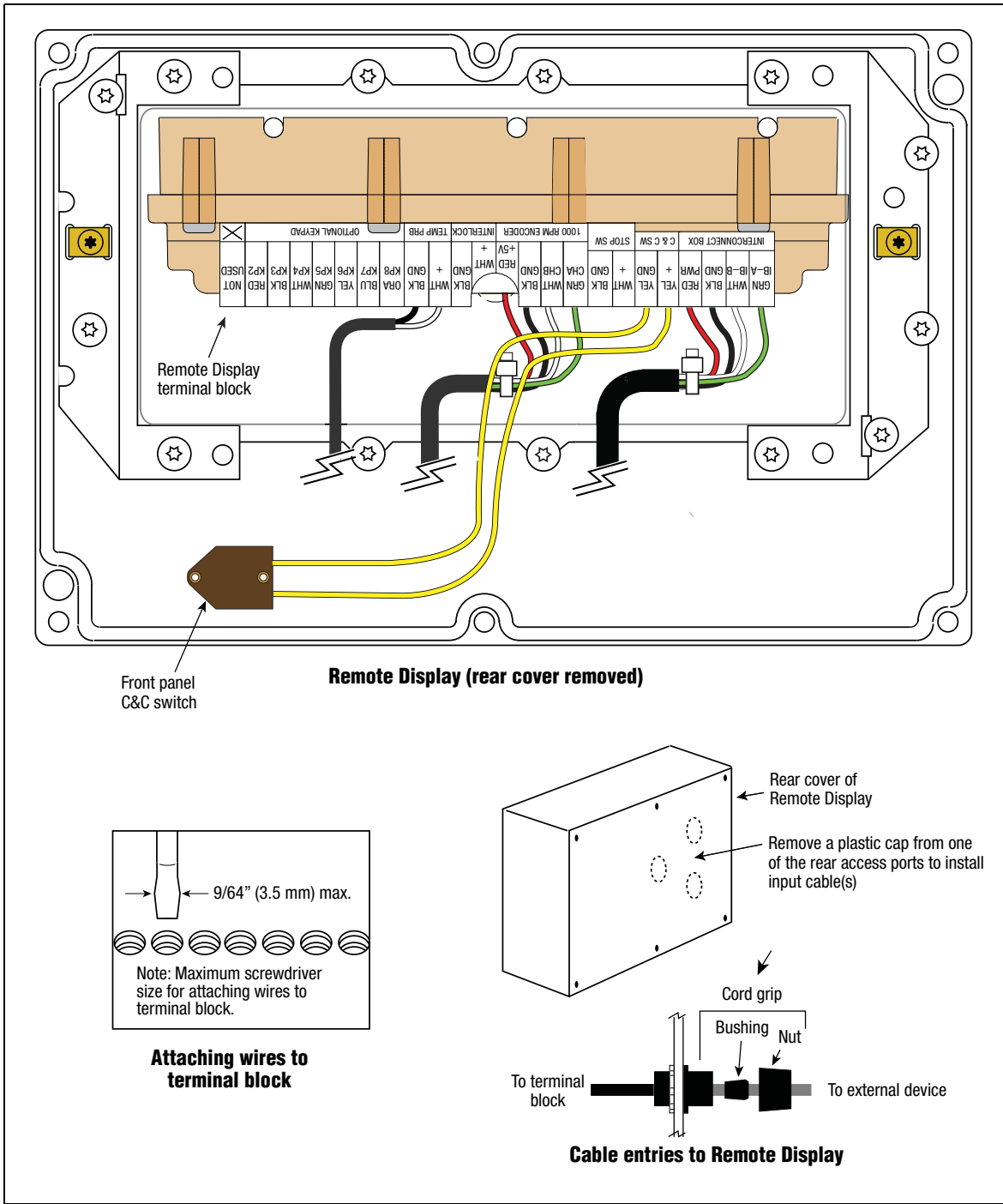
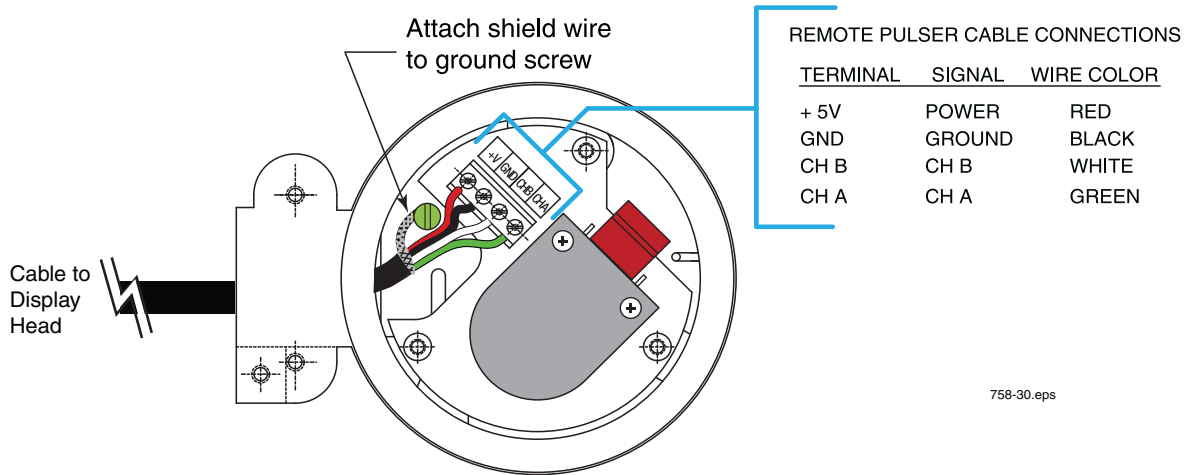


Figure 11. Remote Display Connections (Rear Cover Removed)

**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 12. 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 13 shows an example dual Display Head installation.

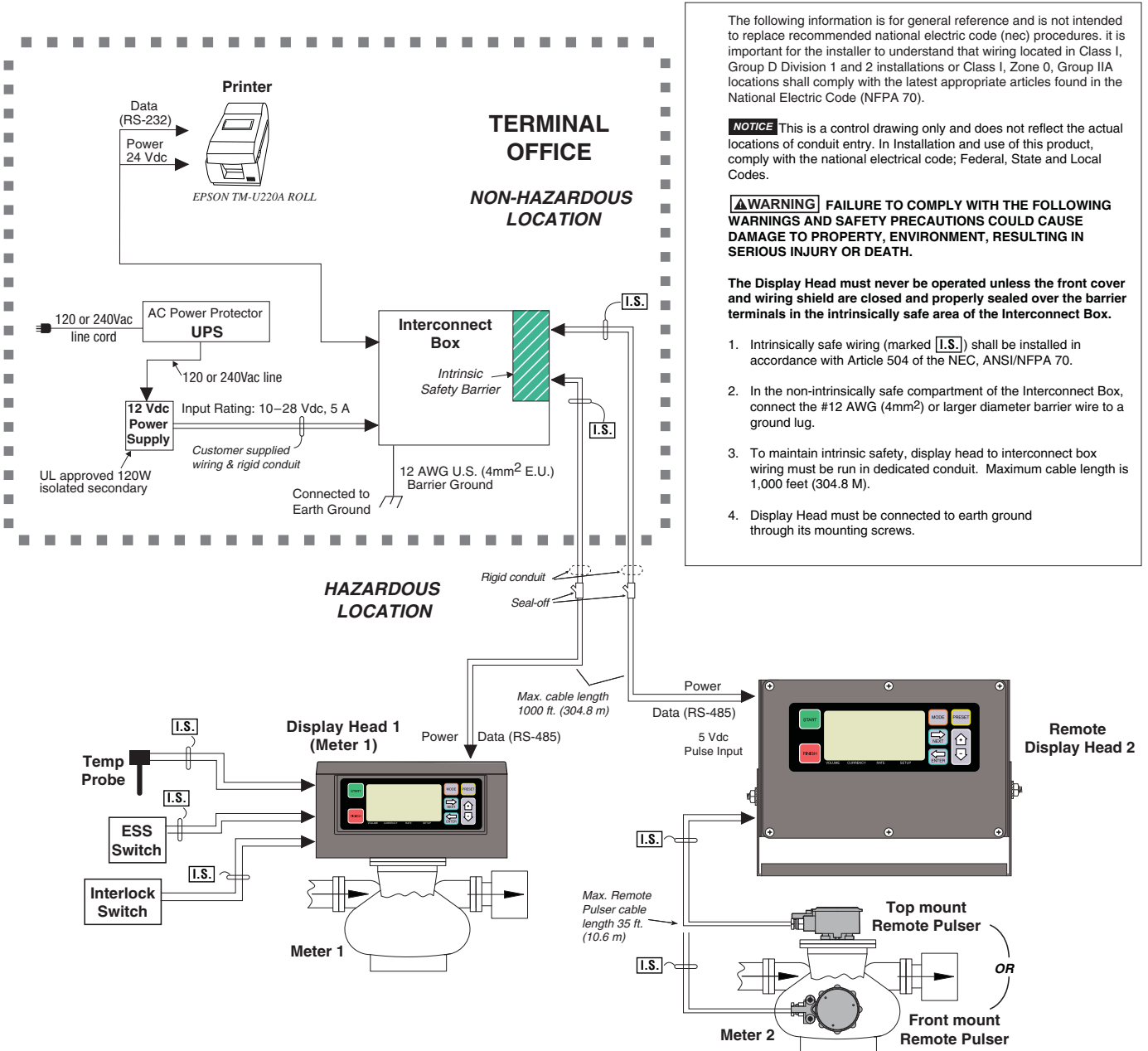


Figure 13. Example Terminal Fueling Depot Installation With 2 Display Heads And Optional Remote Pulser



## **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 14. 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 14.

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 14. 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).

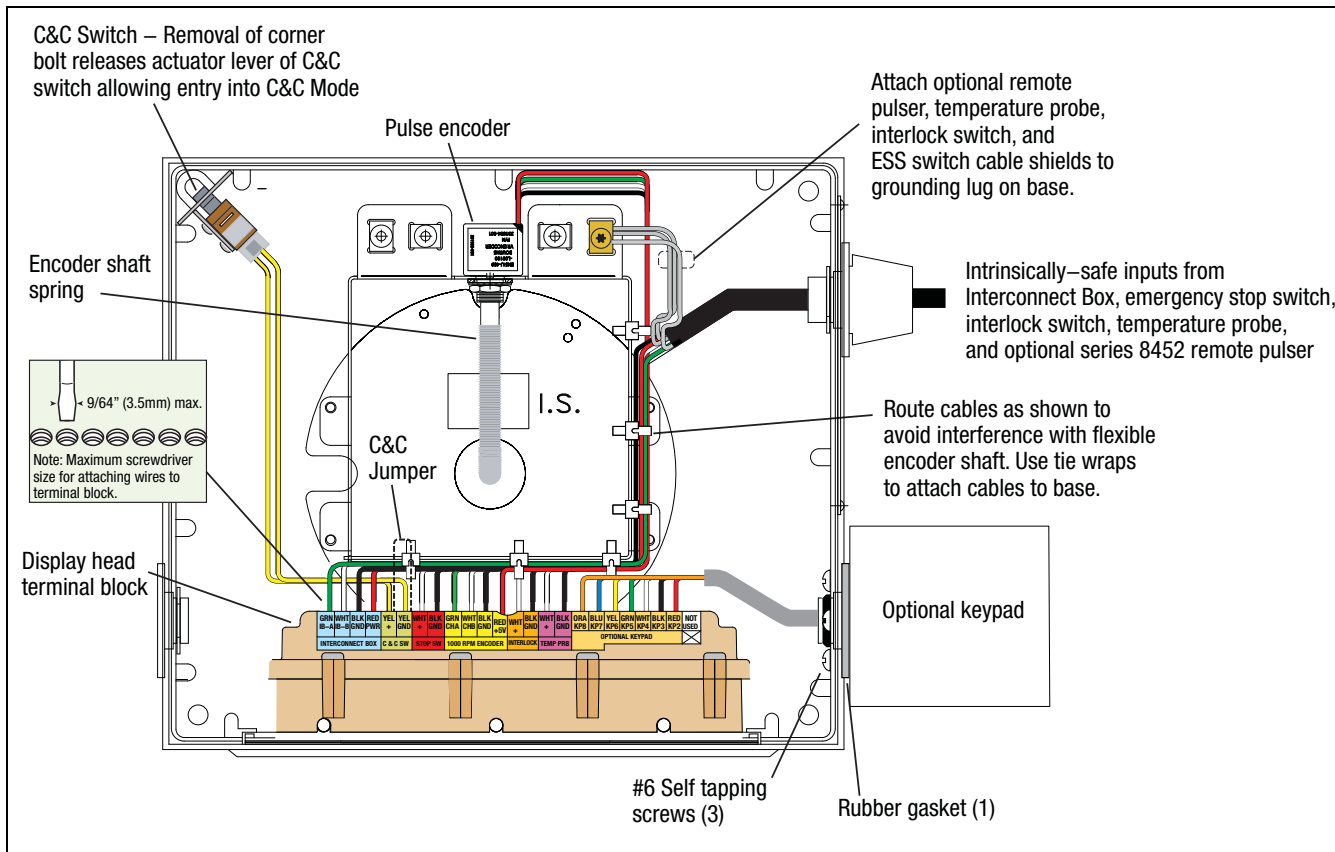


Figure 14. Display Head Cable Connections

**Installing The Interconnect Box (IB)**

**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 2 on page 6. 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 15 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 16 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.

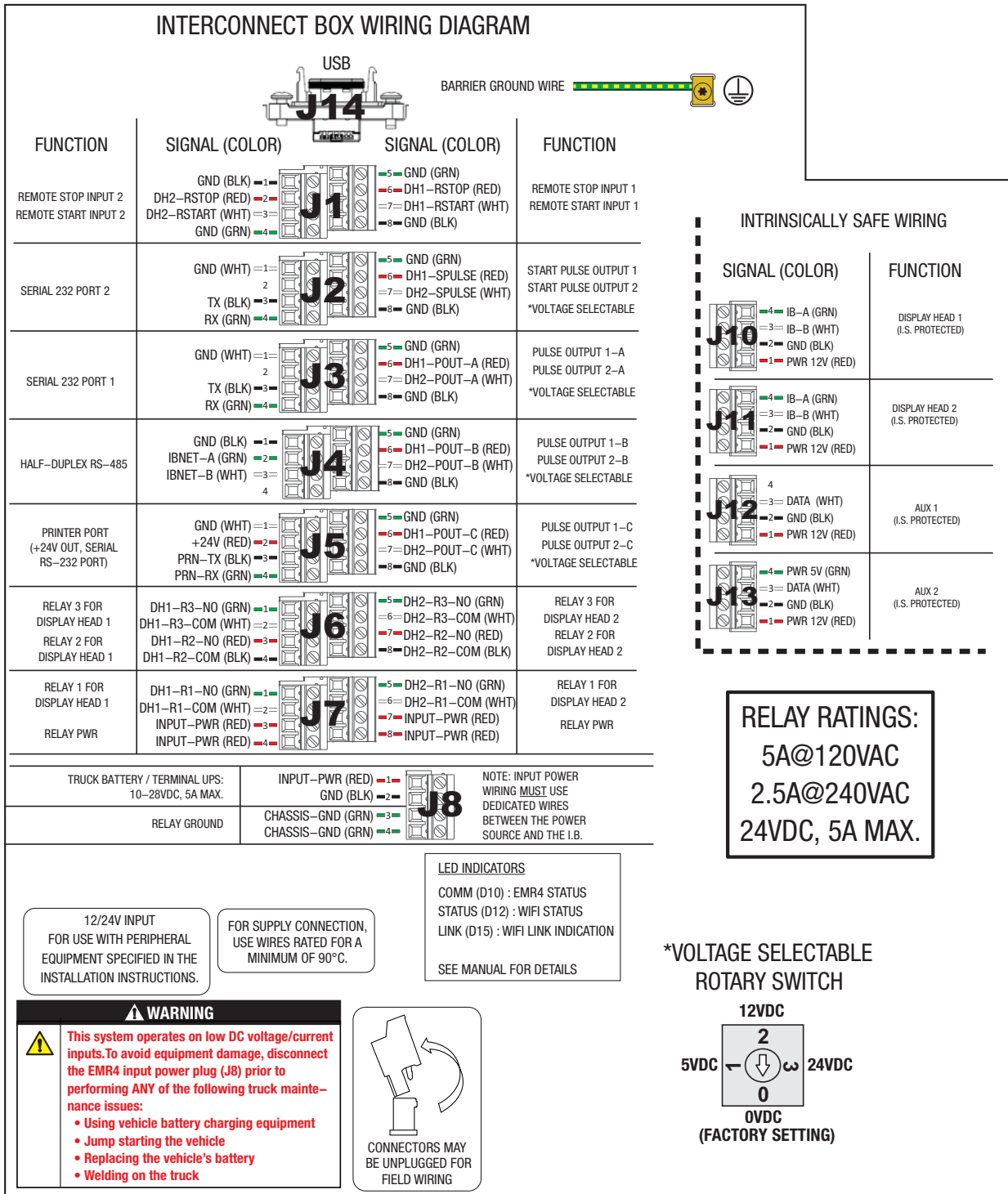
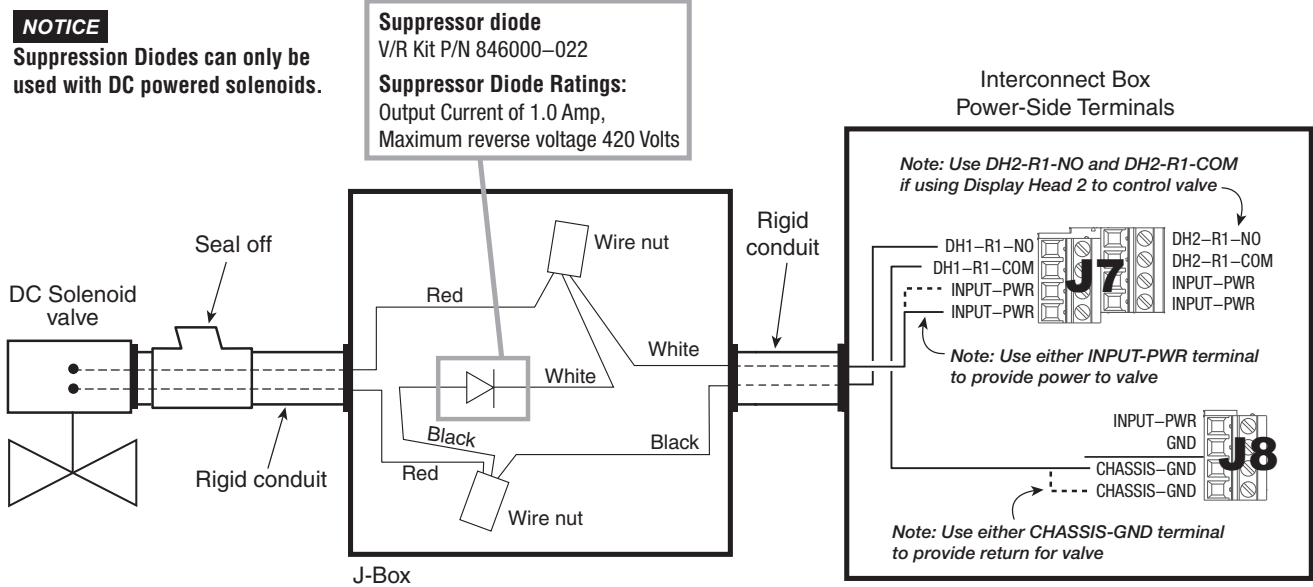


Figure 15. EMR4 IB Box Wiring Connections

**DC Solenoid Wiring**



**AC Solenoid Wiring**

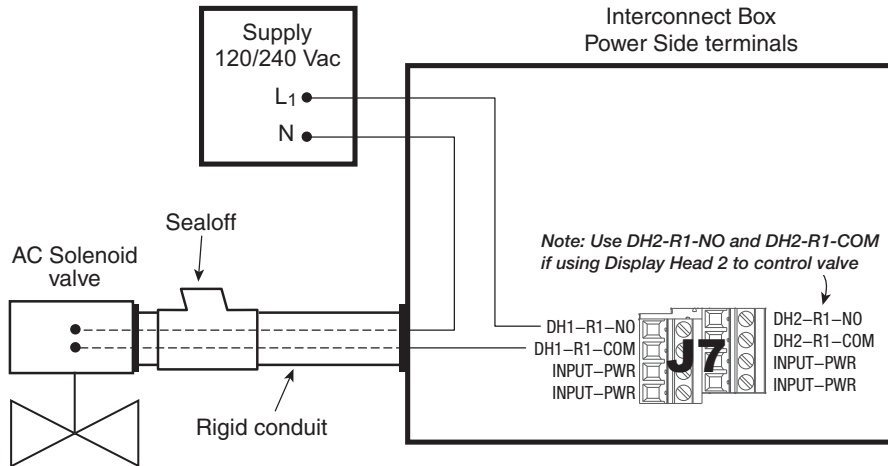


Figure 16. Example Terminal Wiring Connections For DC And AC Solenoid Valves

## 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](http://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 17 for connection wiring diagram) To order, visit their website at [www.digikey.com](http://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](http://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.

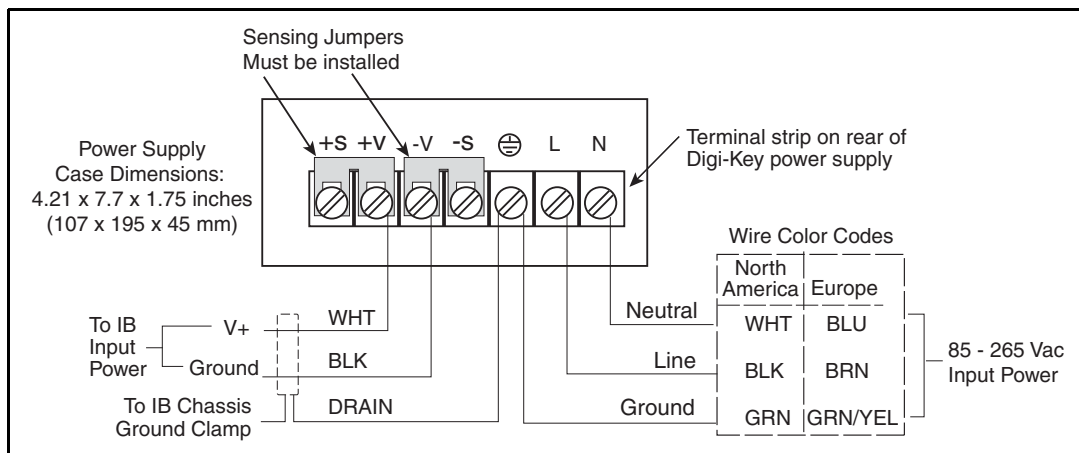


Figure 17. Digi-Key Power Supply Wiring Diagram

## 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

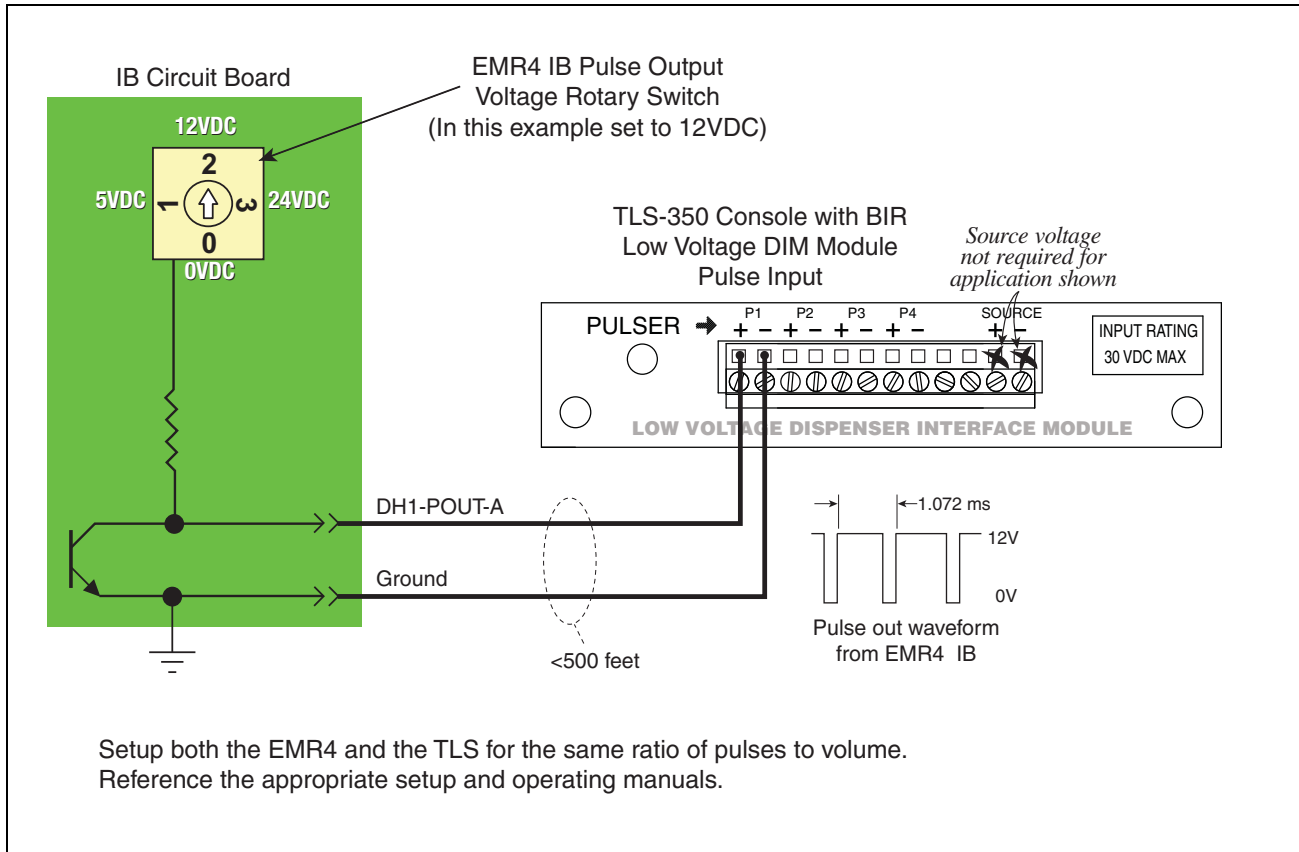
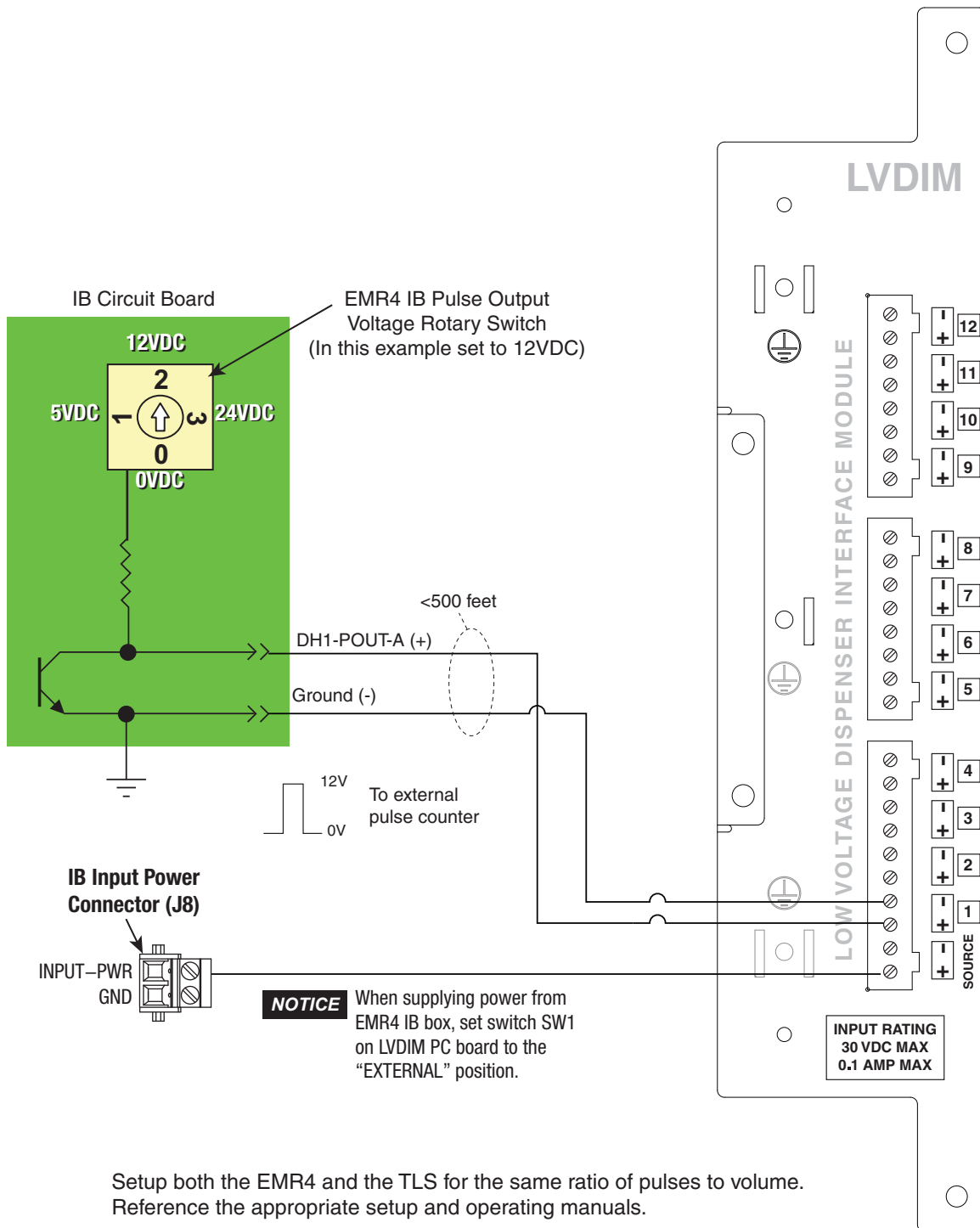


Figure 18. Wiring Pulse Output To A TLS-350 Console



Setup both the EMR4 and the TLS for the same ratio of pulses to volume. Reference the appropriate setup and operating manuals.

Figure 19. Wiring Pulse Output To A TLS-450/TLS4 Console



**PULSE OUTPUT LIMITS**

<b>EMR4 Setting</b>	<b>Maximum Fueling Rate</b>
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.

**NOTICE** 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 System Specifications

## System Power

10 - 28 Vdc, fused @ 5 A.

## Component Location

The EMR4 system should be located on a fuel delivery vehicle as shown in Figure 1 or in a fueling depot as shown in Figure 13 on page 20.

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

- Altitude up to 2000m.
- Temperature range - see Table 3.
- A maximum relative humidity of 95% RH (non-condensing) at temperatures shown in Table 3.
- 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 deliver 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 EMR4 IB 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 3 and Table 4:

**Table 3. System Component Dimensions**

System	Operating Temperature Range	Height	Width	Depth	Weight	Descriptive System Document
EMR4 IB	-25° ≤ Ta ≤ 40°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° ≤ Ta ≤ 60°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° ≤ Ta ≤ 60°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 4. Remote Pulser Dimensions**

<b>Operating Temperature Range</b>	<b>Shaft Length</b>	<b>Shaft Diameter</b>	<b>Housing Diameter</b>	<b>Housing Depth</b>	<b>Weight</b>	<b>Descriptive System Document</b>
-25° ≤ Ta ≤ 70°C (-13° ≤ Ta ≤ 158°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 A: EMR4 Safety Instructions & System Specifications

- 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.
- Refer to the site preparation procedures in this manual for general instructions on safe installation, use, and replacement.
- 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).
- 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:

<b>Ex</b>	Device suitable to be installed in potentially explosive areas
<b>II</b>	Group II: for installations in areas other than mines and related surface equipment
<b>(I)</b>	Category 1: suitable to control apparatus installed into Zone 0, Zone 1 or Zone 2 hazardous areas
<b>G</b>	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](mailto:info.dk@ul.com), [www.ul.com](http://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

**NOTICE IT IS AN INTRINSICALLY SAFE APPARATUS WHEN IT IS INSTALLED FOLLOWING THE MANUFACTURER'S INSTRUCTIONS IN THE MANUAL.**

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:

<b>Ex</b>	Device suitable to be installed in potentially explosive areas
<b>II</b>	Group II: for installations in areas other than mines and related surface equipment

<b>I</b>	Category 1: suitable for installation in Zone 0, Zone 1 or Zone 2 hazardous areas
<b>G</b>	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](mailto:info.dk@ul.com), [www.ul.com](http://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**.

<b>CE</b> <sub>1180</sub>	Equipment marking is compliant with requirements in the CE Marking Directive.
---------------------------	---

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 3 or in a fueling depot as shown in Figure 13 on page 20.

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° ≤ Ta ≤ 40°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° ≤ Ta ≤ 60°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° ≤ Ta ≤ 60°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 Pulsar Information**

Operating Temperature Range	Shaft Length	Shaft Diameter	Housing Diameter	Housing Depth	Weight	Descriptive System Document
-25° ≤ Ta ≤ 70°C (-13° ≤ Ta ≤ 158°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

