



**RED SEAL
MEASUREMENT**

M-614(I)
RML2000

Neptune RML2000 Mass Flowmeter Installation Manual



IMPORTANT: To ensure proper installation of this product, thoroughly review the information in this revision of the manual. Information is subject to change as new features are implemented. Failure to follow instructions may result in system malfunction.



www.redsealmeasurement.com

WARNINGS, CAUTIONS AND NOTES

Throughout this manual you will see **WARNINGS, CAUTIONS** and **NOTES**. They are here for your benefit and warrant attention. By paying careful attention to them you can prevent injury and possible equipment damage.

Below are examples:

WARNINGS: **INFORM THE READER OF POSSIBLE BODILY INJURY IF PROCEDURES ARE NOT FOLLOWED EXACTLY.**

CAUTIONS: **Alert the reader to possible equipment damage if procedures are not followed correctly.**

NOTES: **Inform the reader of a general rule for a procedure or of exception to such a rule.**

NOTICE

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This equipment is intended for use in Class I, Division 2, Groups A, B, C and D or non-hazardous locations only.

WARNING - Explosion hazard; substitution of components may impair suitability for Class I, Division 2.

WARNING - Explosion hazard; do not disconnect equipment unless power has been switched off or the area is known to be non-hazardous.

Hazardous area approval only valid when connected to an isolated source such as a truck battery.

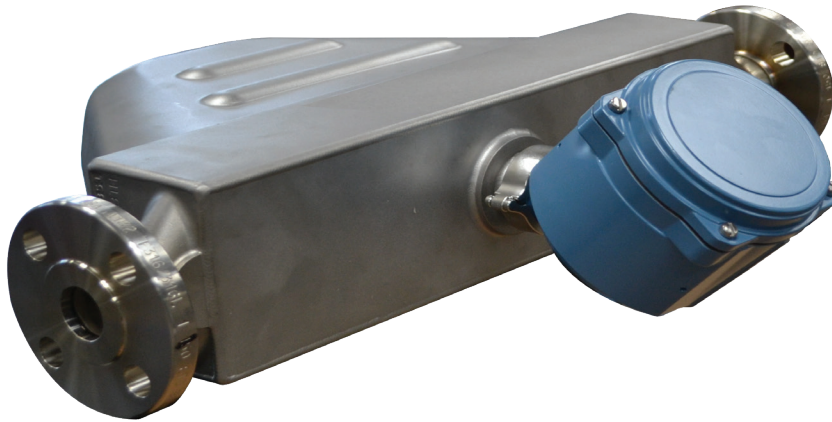
Power and input & output (I/O) wiring must be in accordance with Class I, Division 2 wiring methods, Article 501-4 (b), or the National Electrical Code, NFPA 70 for installations in the U.S., or as specified in Section 18-1J2 of the Canadian Electrical Code for installations within Canada, and in accordance with the authority having jurisdiction.



Caution - This electronic device is sensitive to damage from ESD (electrostatic discharge). Observe the following precautions when servicing this device.

1. **Always use a static-dissipative wrist strap. Connect the strap to a grounded, conductive surface or to the metal chassis of the equipment under repair. Use only wrist straps that incorporate a resistor for user safety. The resistance between the user and ground should be between 800K ohms to 10M ohms. Do not wear a wrist strap around exposed electrical hazards of more than 250 volts.**
2. **If a wrist strap is not available, ground yourself before touching electronics by touching the metal chassis of the equipment or another grounded surface. Repeat frequently while working.**
3. **If available, use a static-dissipative work mat. Connect the mat to ground and the wrist strap to the mat.**
4. **Avoid contacting the connectors or any exposed electronic component.**
5. **Work away from materials that may contribute to the generation of static electricity, such as synthetic carpeting.**
6. **Minimize your movements to avoid building up static charge.**
7. **Avoid working on electronics in areas with very low humidity.**
8. **Do not work on electronics during periods of lightning activity.**
9. **Do not ship or store this device near strong electrostatic, electromagnetic, magnetic, or radioactive fields.**

Amended Procedures for New Electronics



ProLink Update

The current versions of Neptune RML Series meters (both Modbus and Pulse Output options) require ProLink 3 for zeroing and configuration. ProLink 3 is compatible with all earlier releases of RML electronics, and will be the version used and supported by Red Seal Measurement for all RML Series meters.

ProLink 3 can be downloaded at www.redsealmeasurement.com/prolink.

The password to access the download link is **NeptuneRML**.

If previous versions of ProLink have been installed on a computer, they must be fully uninstalled before installing ProLink 3.

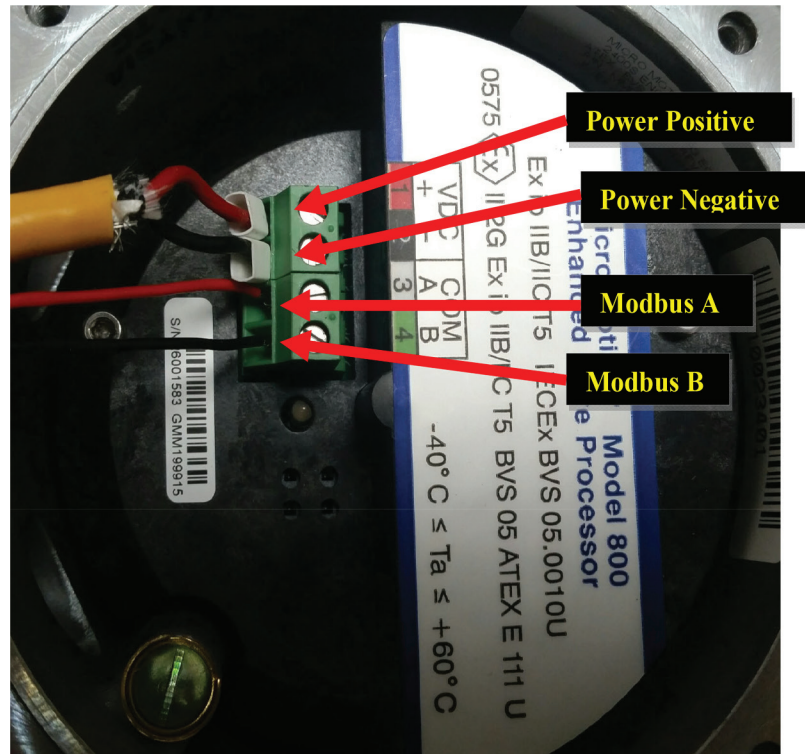
If you have any questions, please contact Red Seal Measurement Customer Service at support@red-sealmeasurement.com, or (800) 833-3357.

Installation and Zeroing

1. Power and Data Connections

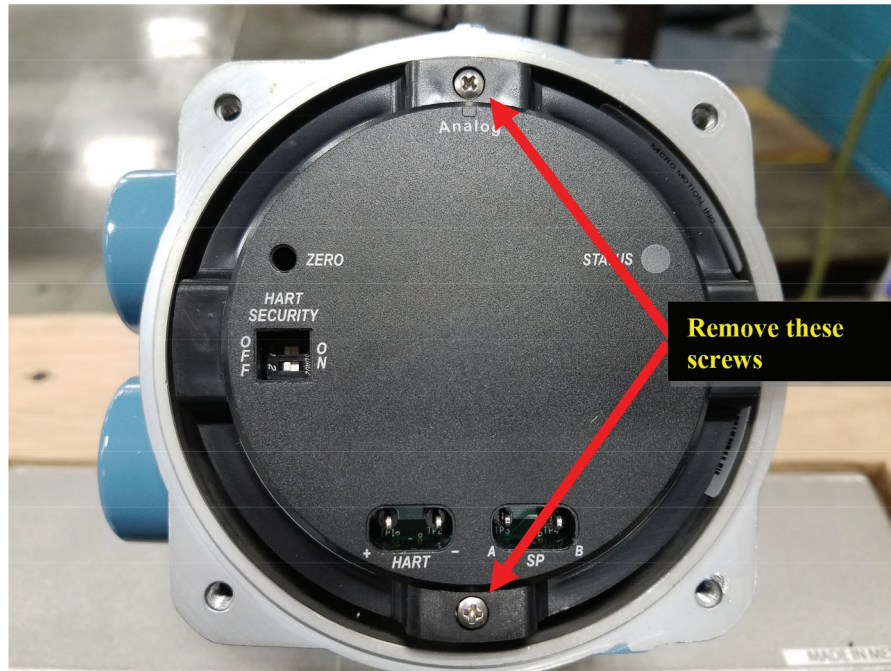
1.2. Modbus Units (800 Series Core Processor)

Remove the four screws that attach the housing cover and remove the cover. Make connections to the core processor as shown below.

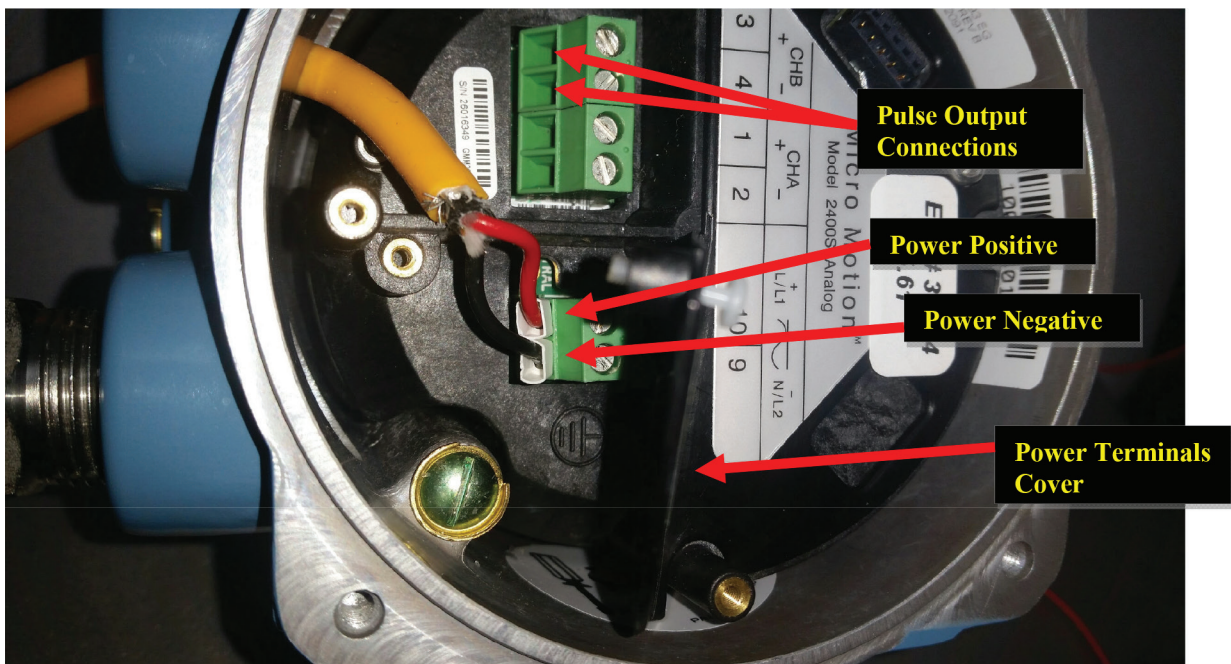


1.2. Pulse Output Units (2400S Core Processor)

Remove the four screws that attach the housing cover and remove the cover. The 2400s requires the upper disc to be removed before power or pulse connections can be made to the electronics. Loosen the two Philips screws on the disc and pull disc straight up.



There is a plastic cover over the power terminals on the processor. Loosen the retaining screw and flip the cover up to expose the power terminals. Connect power leads. Connect the pulse output wiring to terminals 3 and 4 (channel B) on the terminal strip adjacent to the power connection. Reinstall the upper disc.



2. Zeroing the meter

Before performing the zeroing procedure:

1. Power the meter for at least 30 minutes to warm up the electronics.
2. Circulate product thru the meter for 5 – 10 minutes to remove vapor and allow meter to reach a steady temperature.
3. Close the valve downstream of the meter first, vapor return line valve second, and finally close the valve upstream of the meter. All three should be closed as quickly as possible, to assure the meter is completely filled with LPG.
4. Disengage the truck PTO.

2.1 Modbus Units

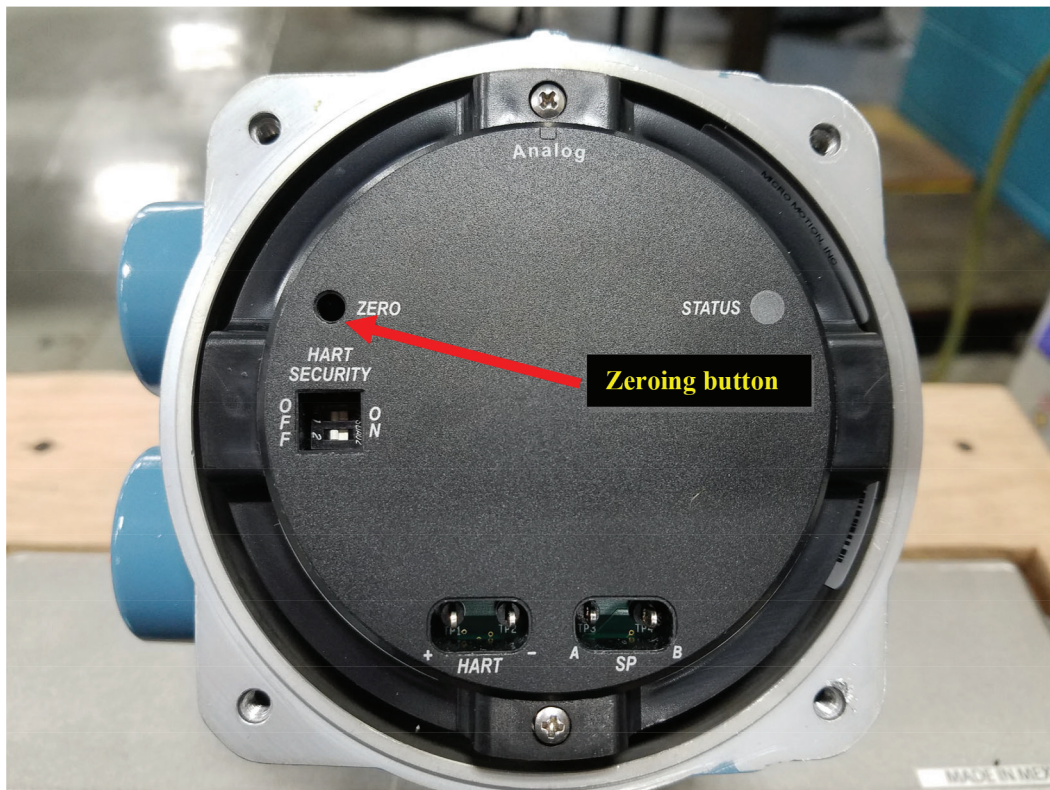
Using ProLink 3:

1. Power up the meter, allow to stabilize for approx. 20 minutes. Run process fluid through meter until temperature equalizes. Shut off flow and ensure it is completely stopped.
2. Attach temporary RS485 connection to SP terminals on user interface module (see section II above). Establish a connection in ProLink 3.
3. In ProLink 3: “Device Tools” > “Calibration” > “Zero Verification and Calibration”.
4. Perform Auto Zero, or select other options as desired.
5. LED on user interface module turns red during calibration, and turns green afterward for a good zero. If it remains red, calibration is unsuccessful and troubleshooting must be done.

2.2 Pulse Output Units

Using the “Zero” button:

1. Remove the four screws that secure the cover of the electronics housing. Remove the cover.
 2. Power up the meter, allow to stabilize for approximately 20 minutes. Run process fluid through meter until temperature equalizes. Shut off flow and ensure it is completely stopped.
 3. Press the zero button with a pointed tool and hold it until the status LED on the user interface module flashes yellow. (See picture below for location of button.)
 4. If the status LED shows solid green or solid yellow, the zero was successful. If it is red, the zero is not successful and should be repeated.
- (Note that the zeroing time cannot be changed when using the zero button; if a different time is desired, you must use ProLink).



2.2 Pulse Output Units (continued)

Using ProLink 3:

To communicate with the unit via the ProLink 3 configuration program, connect the RS-485 adapter to the A & B terminals of the service port (labeled SP). Then follow the instructions for “Using ProLink 3” in Section 2, Modbus Units.

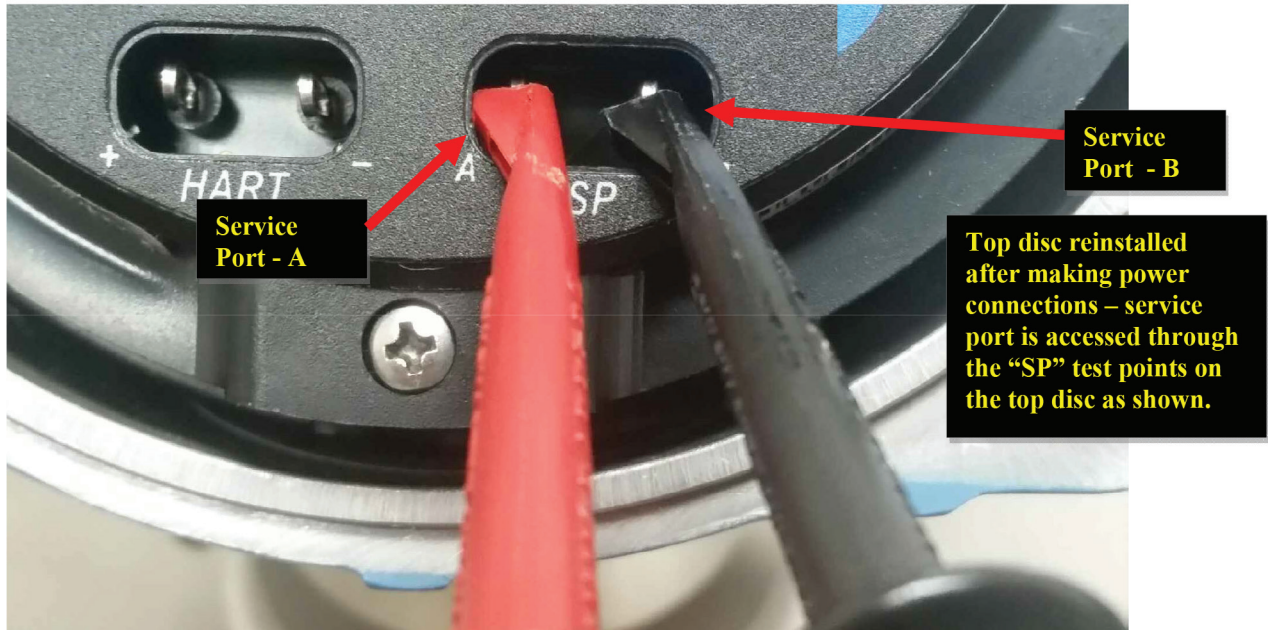


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1. FUNCTIONAL OVERVIEW

The RML2000 Coriolis metering system for LP gas delivery trucks consists of two main elements:

- The RML2000 Coriolis mass meter complete with vapor release and differential valve
- The E4000 Electronic Register system

The Coriolis meter is a true mass flow meter in that it directly measures the mass flow rate of the product passing through the sensor. The sensor consists of a vibrating U-tube arrangement, which tends to flex under the action of fluid flow. The degree of flexing of the tube is measured and is directly proportional to the mass flow rate. The Coriolis meter vibration frequency is related to the density of the product in the tubes. The combination of a direct mass and density reading allows the meter electronics to calculate the gross volume of propane delivered through the meter. The resultant volume measurement is highly accurate and the meter has the operational advantage compared to traditional volumetric meters of having no moving parts.

The E4000 electronic register system automates delivery and invoicing operations for deliveries of LPG, distillate fuels and other commercially distributed liquids from flowmeters on bulk delivery trucks. The register displays the delivered volume on the flowmeter at the rear of the truck as is traditional with mechanical registers in this application. Electronic temperature compensation allows deliveries to be made in gross or net volumes according to local practice. A printer in the cab provides a simple volume delivery ticket or, using the E4000's pricing capability, a complete priced invoice as a record of the transaction. Tickets are time and date stamped for security. An end of shift report can be conveniently generated to totalize the day's deliveries by product. This allows administrative staff to reconcile individual tickets with the shift as a whole. Delivery data is held for up to 100 deliveries in battery-backed memory. (Battery life is approximately 10 years.)

The driver controls the E4000 from a push button panel on the front of the register. This allows yes/no type decisions to be made and numerical values to be entered that are associated with delivery functions. The buttons are used to navigate menus that appear on the display screen, guiding the user to perform the required function. This interactive approach makes the register easy to operate by inexperienced personnel.

The E4000 can control a security valve to prevent fraudulent LPG deliveries being made without the register recording them. The solenoid valve is used with the LPG meter's existing differential valve to prevent flow. For both LPG, an optional driver-programmable 2-stage preset valve allows the delivered amount to be set at a predetermined volume or monetary amount, subject to volume measurement resolution.

The E4000 adapts mechanically to Neptune and other manufacturers' tank truck flowmeters. Temperature compensation is achieved via an RTD probe installed in the flowmeter that directly contacts the delivered product and measures its temperature. The ability to accept an electrical pulse input allows the E4000 to work with the RML2000 mass flowmeter.

The E4000 is designed to interface with the latest mobile computing products. Mobile computers bring customer database and delivery information from the office onto the truck. The register updates the customer record as deliveries are made during the shift. Formatted tickets can be printed that include customer information that has been downloaded from the computer. At the end of the shift, captured delivery information is carried back to the office in the computer to be downloaded to the main customer accounts database.

The E4000 features a calibrated pulse output which can be used to interface with remote meter displays and/or remote control truck delivery systems.

2. SPECIFICATIONS AND APPROVALS

2.1 RML2000 Specifications

Device Type:

- 1" Coriolis Mass Flow Transducer

Wetted Parts:

- 316L Stainless Steel

Sensor Housing:

- 304L Stainless Steel

Line Size:

- 2" (51mm)

Flowrate:

- NCWM Approved Volumetric Flowrate 8-82 GPM

Weight:

- 28lb (13kg)

Operating Temperature Range:

- -40 – 150°F (-40 – 65°C)

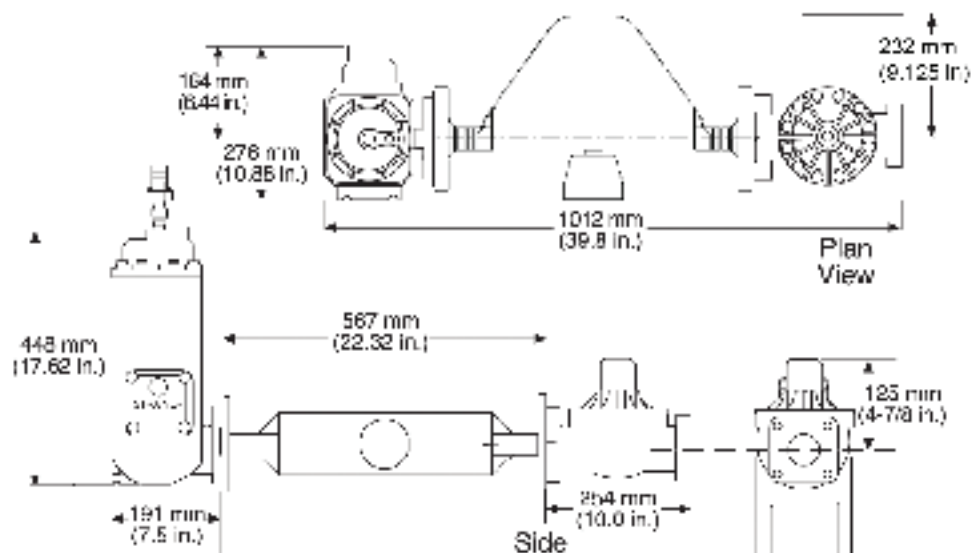
Pressure Rating:

- 350psi (24bar)

Power:

- 12 to 24vDC (19Volts supplied from E4000 Junction Box).
- If power to puck drops below 9-10 Volts, pulses will stop during flow. Pulse output will restart once 12 volts is reached and the puck has completed the 20-40 second recovery period.

Dimensions:



2.2. E4000 Specifications

Display

- 143 x 19 mm text area
- 2 lines, 20 characters per line
- 8.3 x 5.9 mm character area

Power Rating (supply from isolating or battery source)

- 9-16 VDC, 14.6 VDC nominal
- 0.25 Amps (0.63 Amps with optional display heater)

Relay Rating

- Number of Relays: 2
- Type: Normally open
- Contact Style: Form C contacts
- Contact Ratings: 230 VAC @ 3 amps
30 VDC @ 3 amps

LPG Single-Stage Valve (3/8" NPT)

- 0.8 Amp
- 12 VDC
- 9.5 Watts

LPG Dual-Stage Valve

- | | |
|------------------|---------------|
| • High Flow 3/8" | Low Flow 3/8" |
| • 0.8 Amp | 0.8 Amp |
| • 12 VDC | 12 VDC |
| • 9.5 Watts | 10 Watts |

RTD Temperature Probe

- Platinum
- 4 wire
- Resistance at 32 F, 100 Ohms +/- 0.12%

Pulse Input

- Number of inputs: one
- Configurations supported: single input, single, dual or quad channel (menu selectable)
- Input Impedance: 10K Ohms nominal to common
- Trigger levels:
 - Logic on: 3 to 30 VDC
 - Logic off: 0 to 1 VDC

Communication to Printer and Computer

- RS232

Power to Electronics Module

- 19 Volts

Printer

- Epson TM-U295 Dot Matrix (Can also be used with Blaster printer)
- Ticket Type: Blank / Pre-Printed up to 3 ply
- Ticket Size: 102 mm x 257 mm (4 x 10")
- Power: 24 VDC +/- 2.4 VDC
- Ribbon: Epson ERC—27

Size

- 9.0 in x 8.9 in x 6.3 in (229 mm x 227 mm x 161 mm)

Weight

- 5.4 lbs (2.45 kg)

Operating Temperature Range

- 0 °F to 131 °F (-18 °C to 55 °C)
- -40 °F to 104 °F (-40 °C to 40 °C) with optional display heater

Enclosure Rating

- NEMA 3R, NEMA 4

Meter Performance

- **Accuracy:** ±0.1% of rate
- **Repeatability:** ±0.05% of rate

2.3. Custody Transfer Approval

NTEP Approval to NIST Handbook 44 and NCWM Publication 14

- E4000 – Certificate 02-105
- RML2000 – Certificate 06-009

2.4. Safety Approvals**E4000:**

UL Suitable for use in Class 1, Division 2, Group A, B, C and D or non-Hazardous locations only.

The E4000 Electronic Register is UL approved when installed and operated in accordance with this manual. Modifications to the unit or deviations from specified usage may invalidate the UL certification.

RML2000:

CSA (C/US) suitable for use in Class I, Division 2, Group A, B, C and D or non-Hazardous locations only. Evaluated to applicable CSA and ANSI/UL standards for use in Canada and the US.

3. SYSTEM COMPONENTS

3.1. RML2000 Coriolis Mass Flowmeter

The Coriolis meter is mounted in a similar position to a traditional volumetric meter at the rear of the truck. The meter is connected in line via 2" 300 lb pressure rated flanges to the vapor release and differential valve.

The meter is constructed from stainless steel and consists of a double U-tube arrangement enclosed in a rectangular case. The drive coil, used to vibrate the tubes, and the sensor coils which measure the flexing of the tubes under flow conditions, are mounted inside the box.

The instrument electronics are enclosed within the small junction box at the top of the meter. Power and communication connections to the register are made here. The only means of communicating directly to the Coriolis meter is to connect a computer to these same terminals. The computer is only required to "zero" the meter as part of the calibration process, to be discussed later in this manual.

Once the junction box lid is closed, there are no operator controls on the meter; all functions are performed at the E4000 register head.

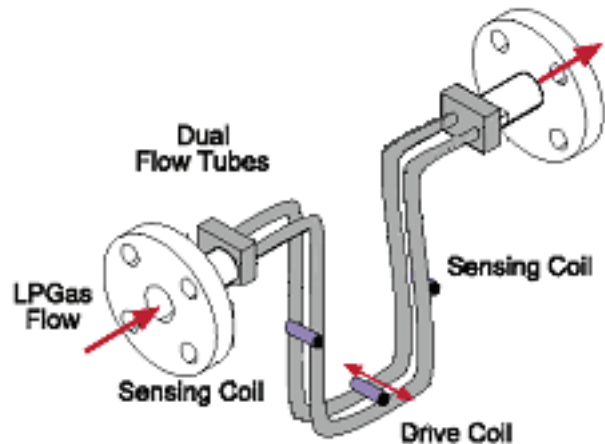


Figure 3-1. RML2000 Tube Configuration

3.2. E4000 Register Head

The E4000 electronic register is designed and field proven to withstand the harsh environment on tank trucks. The enclosure is plastic with a NEMA 3 rating.

The E4000 can be mounted directly on the positive displacement flowmeter so that the mechanical drive of the meter rotates an optical pulse encoder mounted in the register. Alternately, the register can be mounted wherever required when receiving a pulse output from a meter. Counting the pulses indicates the amount of product measured by the flowmeter during a delivery. An optional temperature compensation kit can be added to the base unit.



Figure 3-2. E4000 Register Head

An operator communicates with the register via an LCD screen and a 4 button control panel. Internally mounted relays operate electrical solenoid valves to control the flow of product. Delivery ticket information is transmitted through the power/data cable from the rear of the register to a cab mounted junction box, then to the ticket printer or hand-held computer.

Power and data connections are made to terminal strips inside the register and junction box. Configuration parameters are programmed into the register manually by the buttons or from an external computer using the E4000 configuration program.

An internal calibration switch is positioned inside the register to allow access to the Weights and Measures configuration menu, and is mechanically sealed on the outside of the register.

3.3. Display

The 2x20 character LCD display is primarily intended to show the volume of product being delivered. The two-line display configuration also allows two parameters to be shown simultaneously, such as delivered volume and price during delivery or net and gross volume during calibration. The display is also the method by which the E4000 communicates instructions to operators as they navigate through the software menus.

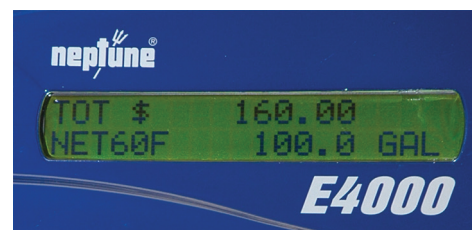


Figure 3-3. LCD Display

3.4. Keypad

The 4 button keypad is the method used to enter configuration data and select function options for the E4000 register.

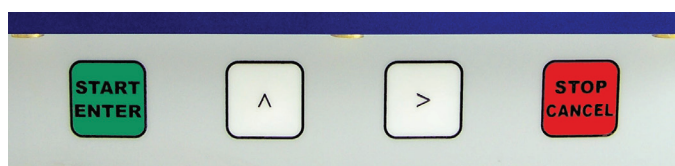


Figure 3-4. E4000 Keypad

START/ENTER	Confirms/accepts selected option on display
^	Increments the displayed character through the available character set
>	Moves cursor to the right .
STOP/CANCEL	Terminates delivery or exits current selection.

Pressing the up arrow on the control panel will scroll the selected character through a complete ASCII character set (upper and lower case letters, all numerals and symbols). A space character is also included in the character set. It is the fifth character after the lowercase z and is located between the right facing arrow and the exclamation point:

→ , [space], !

Access the Weights and Measures functions by depressing the internal switch beneath the seal screw on the side of the register and pressing the > button simultaneously.

3.5. Electronic Temperature Compensation (Optional)

A temperature probe is available as an option for electronic temperature correction of the delivered volume of product. This correction is mandatory for some products under Weights and Measures legislation in certain states and countries. The probe is a 100 ohm RTD. The E4000 measures the product temperature during delivery and uses the approved API volume correction table for the product at that temperature. The resulting calculation when applied to the gross volume gives a net volume corrected to 60 °F or 15 °C depending on the chosen units or product (505 LPG/510 LPG).

The use of electronic temperature correction has been shown to reduce the amount of unmeasured product by approximately 1% versus mechanical ATC. For fluids without a recognized correction table, approved formulas or expansion factors are used to calculate net volume. The RTD probe can be installed in a Neptune meter, replacing the mechanical ATC bellows, or in the strainer cover.

3.6. Valve control

Red Seal provides an optional single stage solenoid valve (figure 3-4) to control the opening and closing of the differential valve on LPG meters. The valve is opened only when the E4000 is powered and the start button has been pressed to commence a delivery. The valve will close whenever the stop button is pressed during a delivery or power is lost to the register.

Dual stage valves are also available for making preset deliveries of LPG. The E4000 has 2 relays which control the two-stage shut off either by volume or monetary amount. The first stage reduces flow by 90% to slowly bring delivered volume up to the preset amount. The second stage shuts off flow when the preset amount is reached without hydraulic shock to the delivery system.

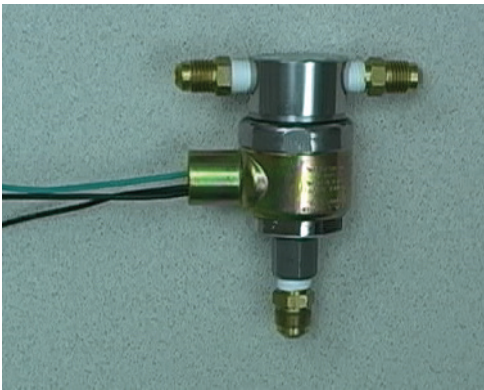


Figure 3-5. Single Stage LPG Valve



Figure 3-6. Dual Stage LPG Valve

Caution: All valves supplied with the E4000 (security valves and dual-stage preset) are wired with an in-line TVS (transient voltage suppressor) to protect the E4000 from harmful voltage spikes. If an E4000 is installed on another manufacturer's meter with a different solenoid valve (or a Neptune meter using another manufacturer's valve), an appropriate TVS must be installed. Contact customer service for details.

3.7. Junction Box

The junction box, located in the vehicle cab, houses a PC board and serves as the connection point for the E4000 peripherals mounted in the cab. The power to the E4000 and printer is distributed from here. Data passes through the junction box on its way to the printer. The RS232 data link from the E4000 to any peripheral-computing device such as a Hand held or Laptop is made here. The same RS232 connector is used for downloading the E4000 configuration parameters from a laptop using the E4000 Configuration Program.

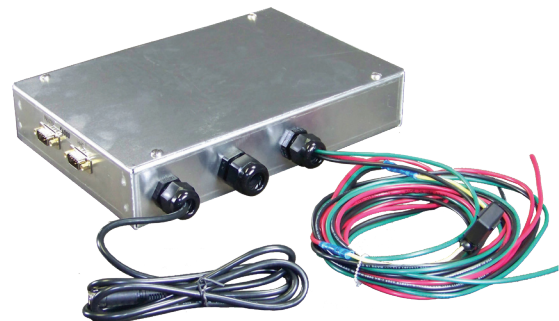


Figure 3-7. Junction Box

3.7. Printer

The E4000 printer is an Epson TM-U295 single feed style dot-matrix printer which uses a standard 4-1/8" wide truck meter delivery ticket , Neptune or Veeder Root. The printer is intended for internal use only and should be mounted in the cab of the truck. A data cable is supplied with the printer kit. The printer power cable comes with the Junction Box. The junction box steps up truck voltage from 12V to 24V to power the printer. The E4000 can also be used with a Blaster printer or an EPSON TM-U220D roll printer.



Figure 3-8. Printer

3.8 Mobile Computer

The E4000 has been specifically designed to operate with a mobile computer such as a laptop, hand-held or PDA. The computer plugs directly into the 9-pin RS-232 serial connector on the junction box that is not occupied by the printer.

There are two modes of operation with an external computer:

1. The computer is running the E4000 Configuration Program and is temporarily connected to the junction box to change non metrological parameters and update stand alone pricing.
2. The computer has fuel delivery application software running and carries customer account information required by the driver during a shift. The computer interacts digitally with the E4000, extracts volume data and uses this to calculate the customer invoice and update the account records. The mobile computer updates the company database when returned to the office at the end of the shift.

4. INSTALLATION

4.1. Introduction

Before attempting to install an RML2000/E4000 system, read this manual! To simplify installation and reduce the time required, follow the directions provided in this document. Each installation will vary depending on the layout and overall condition of the truck, the fluid being measured, and the installer's experience with electronic registers and flowmeters.

WARNING: LPG systems should be installed in accordance with national standards ref: NFPA 58. Power, input and output (I/O) wiring must be in accordance with Class I, Division 2 wiring methods Article 501-4(b) of the National Electrical Code, NFPA 70 for installations in the U.S., or as specified in Section 18-1J2 of the Canadian Electrical Code for installations within Canada and in accordance with the authority having jurisdiction.

4.2. Check Parts

Before commencing installation, unpack the entire contents of the E4000 packaging. Lay out the parts as they would be installed on the truck. This will highlight any missing or incorrectly ordered/supplied parts. Verifying that all the necessary parts are available in advance will reduce the truck downtime and avoid any wasted truck preparation work.

4.3. Truck Preparation

Before commencing the installation:

Check that the condition of the truck battery is within the E4000 specifications.

Disconnect the battery.

Close the manual supply valves and bleed down the meter.

Disconnect the pressure line from the top of the differential valve.

Warning: Pressure must be completely relieved before proceeding.

4.4. Installing the RML2000 Mass Flowmeter

The unit must be mounted using the approved bracket available from Red Seal (or a similarly fabricated bracket that will hold the unit securely, place no stress on the meter, and transmit minimal vibration). The four bolts securing the clamps which hold the meter should be torqued to 55-65 ft-lbs. The bolts attaching the top plate (for mounting the register) should be torqued to 15-17 ft-lbs.

The unit should be mounted horizontally so that the electronics module faces outward (figure 4-1).

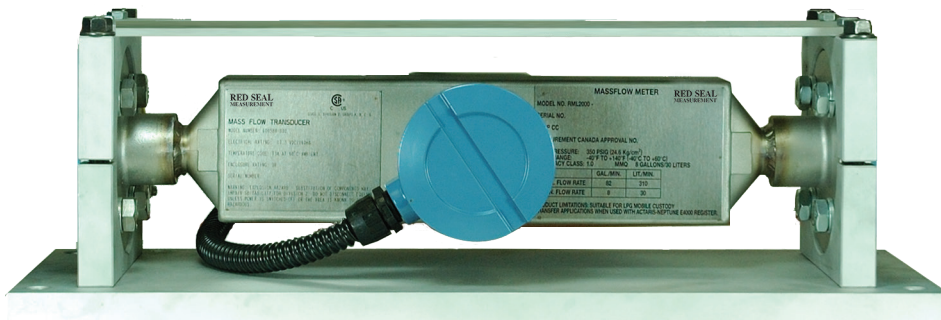


Figure 4-1. RML2000 in Bracket

The meter may be mounted for either left or right handed flow; however, the flow of liquid through the meter must always be in the direction indicated by the arrow on the meter housing. (Left to right flow when the unit is viewed with the nameplate on the right.)

Isolate the meter with valves upstream, downstream, and in the vapor return line, as close to the meter as practicable. The valves are required to ensure the meter remains filled with propane during the “zeroing” procedure. (see section 5).

Use flexible hose (min. length 8”) for connections to both the inlet and outlet of the meter to eliminate stress on the meter due to misalignment of piping. (See Figure 4-2, tank to meter inlet, and Figure 4-3, differential valve to hose reel.).

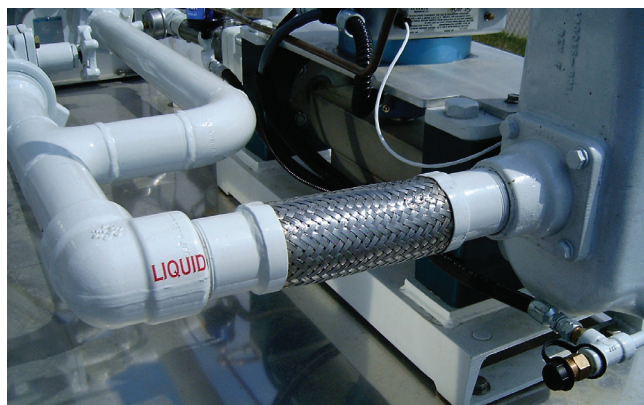


Figure 4-2. Flexible Hose at Inlet



Figure 4-3. Flexible Hose at Outlet

4.5. Installing a Retrofit RML2000 Mass Flowmeter

The installation procedure for a retrofit RML2000 is essentially the same as for a new installation. The vapor release and differential valve from a previous Neptune 2” 4D-MT meter can be reused. If the prior installation used mechanical temperature compensation, the installer will be required to replace the strainer cover with one that accommodates the E4000 thermowell. (See section 4.7, Installing the RTD). The 80 mesh strainer can be replaced with 16 mesh. (80 mesh is acceptable but will result in reduced flow and more frequent cleaning,)

4.6. Positioning the E4000 Register Head

The RML2000 bracket supplied by Red Seal provides a mounting plate with pre-drilled holes for the E4000 (figure 4-4). If this bracket is not used, the installer will be required to manufacture a custom fixture to secure the register. When considering a position for the bracket, ensure that the register controls will be easily and safely accessible by a driver. Also, the RTD probe cable must reach to the vapor release strainer cover as discussed in Section 4.8, Wiring the RTD.



Figure 4-4. E4000 Mounted on Bracket

4.7 Installing the RTD

E4000 registers equipped with an RTD (figure 4-5) are supplied with a ½" NPT male threaded thermowell. The RTD can be installed in the available dual-port strainer cover (figure 4-6). To ensure good conductivity to the RTD, fill the thermowell with anti-freeze or mineral oil before inserting the probe.

Note: If replacing the strainer cover, this is a good time to check the strainer and clean if necessary.

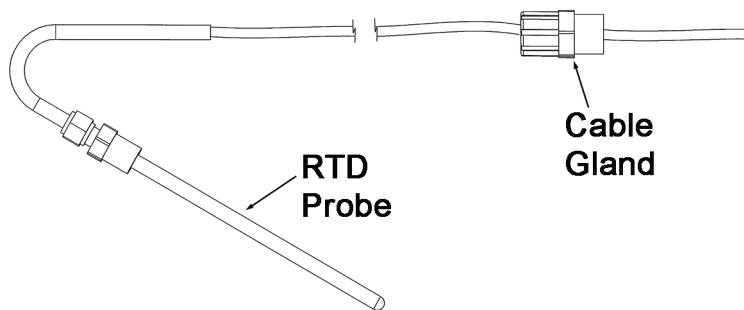


Figure 4-5. RTD



Figure 4-6. Dual-Port Strainer

4.8 Wiring the RTD

The RTD is a 4 wire shielded probe. There is a cable entry port specifically for the RTD on the side of the E4000. Run the cable through this port and connect the wires to the RTD terminals 6, 7, 8 and 12 as shown in figure 4-13. If mounting the RTD in the strainer cover ensure enough slack to allow the strainer cover to be removed for servicing. Secure the RTD cable with the cable gland supplied.

The lock washer supplied with the RTD cable gland can be discarded.

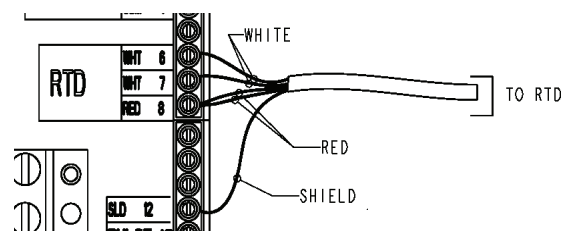


Figure 4-7. RTD Wiring

4.9 Installing the Single Stage LPG Solenoid Valve

Mount the solenoid valve to the E4000 mounting plate using the bracket provided. Mount the valve with the ports configured as shown in figure 4-8. Connect the COM port of the solenoid valve to the top of the differential valve. Pipe the NO or Normally Open port to pump pressure at the drain plug on either the vapor eliminator or the meter connector. Pipe the NC or Normally Closed port to the vent line check valve on top of the vapor eliminator. Figure 4-9 shows the completed plumbing.

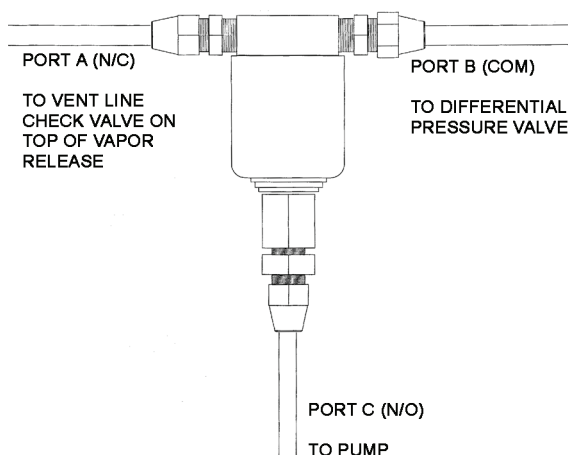


Figure 4-8. Solenoid Valve

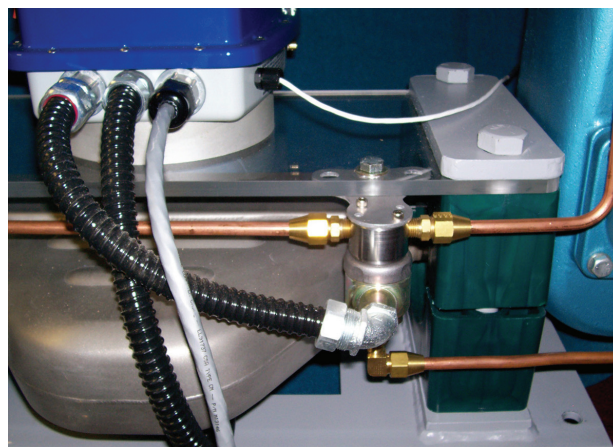


Figure 4-9. Valve Wiring and Plumbing

4.10 Wiring the Single Stage LPG Solenoid Valve

Install a straight conduit nipple, supplied with the valve kit, in the threaded electrical opening of the LPG solenoid valve. Teflon tape should be used on the threads of the conduit nipple to make a watertight seal. Run the two black wires from the solenoid valve through the factory supplied conduit, into the register using the conduit hub at the left side of the rear of the register. The green ground wire is not required and can be cut off. Teflon tape should be applied to the threads of the 90 degree conduit nipple before it is inserted in the conduit hub. *The following connections will be made after the power/data cable is installed in the E4000 register (section 4-14).*

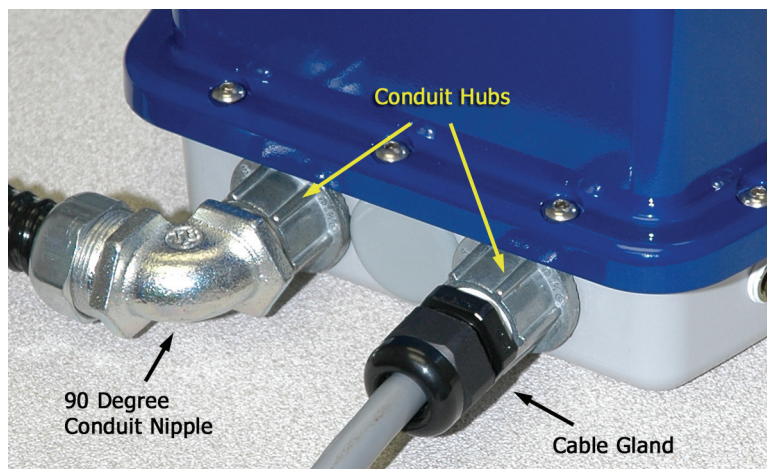


Figure 4-10. Conduit Fittings

Connect the white wire to terminal 23 and the black wire to terminal 24 on the register's POWER 12 VDC terminal strip (figure 4-13).

Connect the orange wire to terminal 18 (PRESET), and the blue/black wire from the twisted pair to either black wire from the solenoid valve (there is no required polarity for the solenoid valve) and secured with the supplied wire nut. The other black wire from the solenoid valve should be connected to terminal 19 (PRESET).

No wires will be connected to terminals 20, 21, and 22 (PRE-WARN). NOTE: The solenoid valve used must feature a transient voltage suppressor. Check for the TVS to have been previously installed, by Red Seal, under a section of heat shrink tubing where the two black wires enter the solenoid valve. If the TVS is not present, contact the factory for additional wiring instructions.

4.11 Installing the Dual-Stage LPG Valve

Install the LPG solenoid valve (first stage) per section 4.10.

Remove the drain plugs from the dual-stage LPG differential valve (figure 4-11). Verify that the threads on the valve body are clean and undamaged.

Apply a pipe sealer (approved for LPG service) to the NPT threads on the 90 degree elbows. Caution: Make sure that sealant does not enter tubing as this may damage the solenoid valve. Install the two 90 degree elbows in the differential valve body. Install the tubing/solenoid valve assembly, aligning the elbows as shown. Securely tighten the tube fittings.

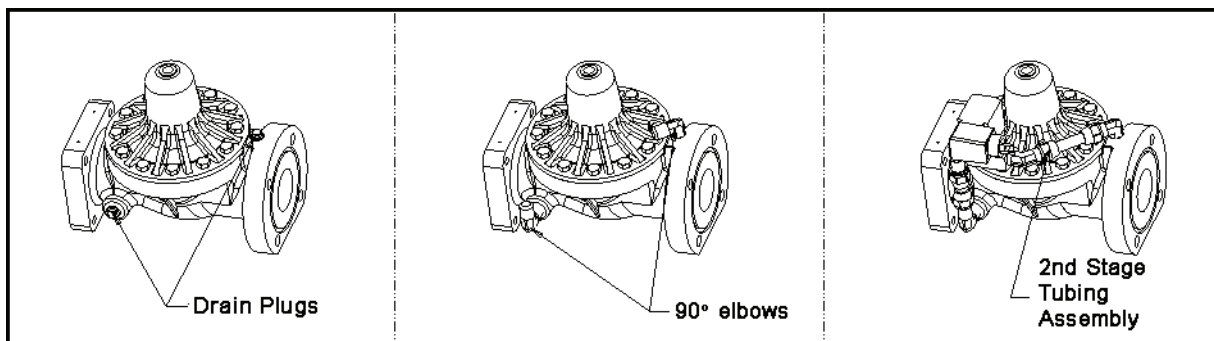


Figure 4-11. LPG Dual-Stage Valve Assembly

4.12 Wiring the Dual Stage LPG Valve

Install two straight conduit nipples, supplied with the valve kit, in the threaded electrical opening of each solenoid valve. Teflon tape should be used on the threads of the conduit nipples to make a watertight seal. Run the two black wires from the main valve through the factory supplied conduit, into the register using the conduit hub at the left side of the rear of the register. Teflon tape should be applied to the threads of the 90 degree conduit nipple before it is inserted in the conduit hub.

Remove the center hole plug from the E4000 register base and install the supplied 90 degree conduit nipple in the center port at the rear of the register. A supplied rubber gasket should be installed over the

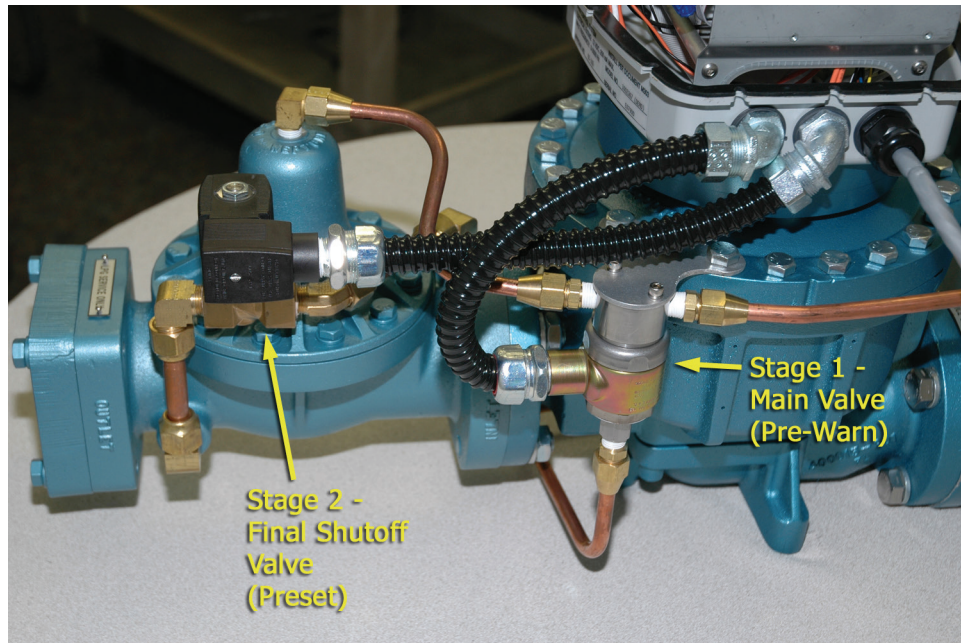


Figure 4-12. Dual Stage Valve Wiring Conduits

threads of the 90 degree conduit nipple before it is inserted in the port of the register. Run the two orange wires from the shutdown valve through the factory supplied conduit and into the register through the center port (figure 4-12).

The following connections will be made after the power/data cable is installed in the E4000 register (section 4-14).

Connect the white wire to terminal 23 and the black wire to terminal 24 on the register's POWER 12 VDC terminal strip (figure 4-15).

Connect the orange wire to terminal 21 (PRE-WARN), and the blue/black wire to one of the orange wires from the shutoff valve and one of the black wires from the main valve. Secure all three wires with the supplied wire nut.

The remaining orange wire from the LPG shutdown solenoid valve should be connected to terminal 19 (PRESET), and the remaining black wire from the main valve should be connected to terminal 22 (PRE-WARN).

Connect a jumper wire from terminal 18 (PRESET) to terminal 20 (PRE-WARN).

CAUTION: Both the main solenoid valve and the shutdown valve must feature a transient voltage suppressor. Valves supplied by Red Seal have a TVS installed under a section of heat shrink tubing where the two wires enter. If using a valve from another manufacturer, the appropriate TVS must be installed. Operating without a TVS could result in damage to the E4000.

4.13 Installing the Junction Box and Printer

Select a suitable location in the cab to position the junction box so that the two RS-232 ports are easily accessible and the junction box cover can be removed for service (figure 4-13). Route the 40 ft. power/data cable from the E4000 register head at the rear of the truck before permanently fixing the junction box. Route the cable away from sharp edges, drive train components, hot exhaust components, or other sources of potential damage. It is recommended that the cable be run through liquid-tight conduit for protection.

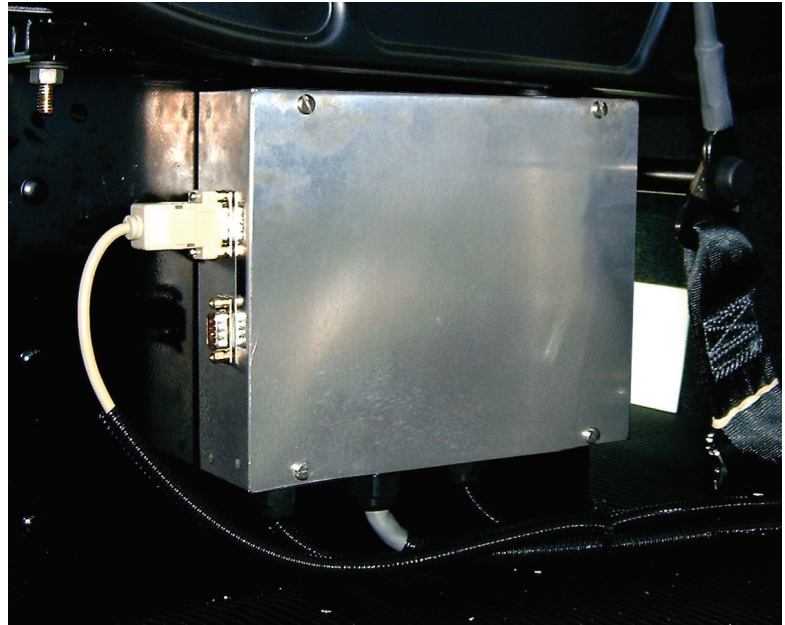


Figure 4-13. Junction Box Installation

The junction box dimensions are 10.5" x 7". Select a suitable location, orient the box, and mark and drill the bolt holes in the mounting surface. The mounting holes are accessible from inside the box. Route the power and data cables to the junction box. Secure excess cable to prevent damage.

4.14 Wiring the E4000 Register Head

The supplied 40 ft. power/data cable connects the E4000 and the cab mounted junction box.

Run the power/data cable the length of the truck from the flowmeter to the cab and into the area selected for the junction box. Automotive conduit is recommended to protect the cable from the environment. Secure the cable to the truck frame or existing truck wiring using cable ties. Route to avoid moving body parts, (drive shaft, etc) and sources of high temperature.

Some drilling may be required to pass through plating at the back of the truck and through bulkheads into the cab. Placing grommets or watertight fittings on any holes to prevent cable damage is required.

The power/data cable should pass through the right side port of the E4000 register as viewed from the rear (figure 4-17).

Make the connections as shown in the wiring diagrams for the E4000 register (figure 4-14, single-stage valve or figure 4-15, dual-stage valve). The colors of the wires are shown in the diagram for identification purposes. The numbers correspond to the E4000 terminal strip position to which the wire is connected. See figure 4-16 for an example of proper wire routing and connection.

Caution: The drain (shield) wire should be cut off on the register end to prevent interference with power or data lines. The drain wire is connected at the junction box end only.

Caution: Factory supplied plastic cable glands and metal liquid tight connectors prevent moisture from entering the E4000 Register. Rubber gaskets should be installed over the threads of the conduit hubs so that they are on the outside of the register base. Teflon tape should be used to seal the plastic cable gland and metal conduit nipple where they are inserted into the conduit

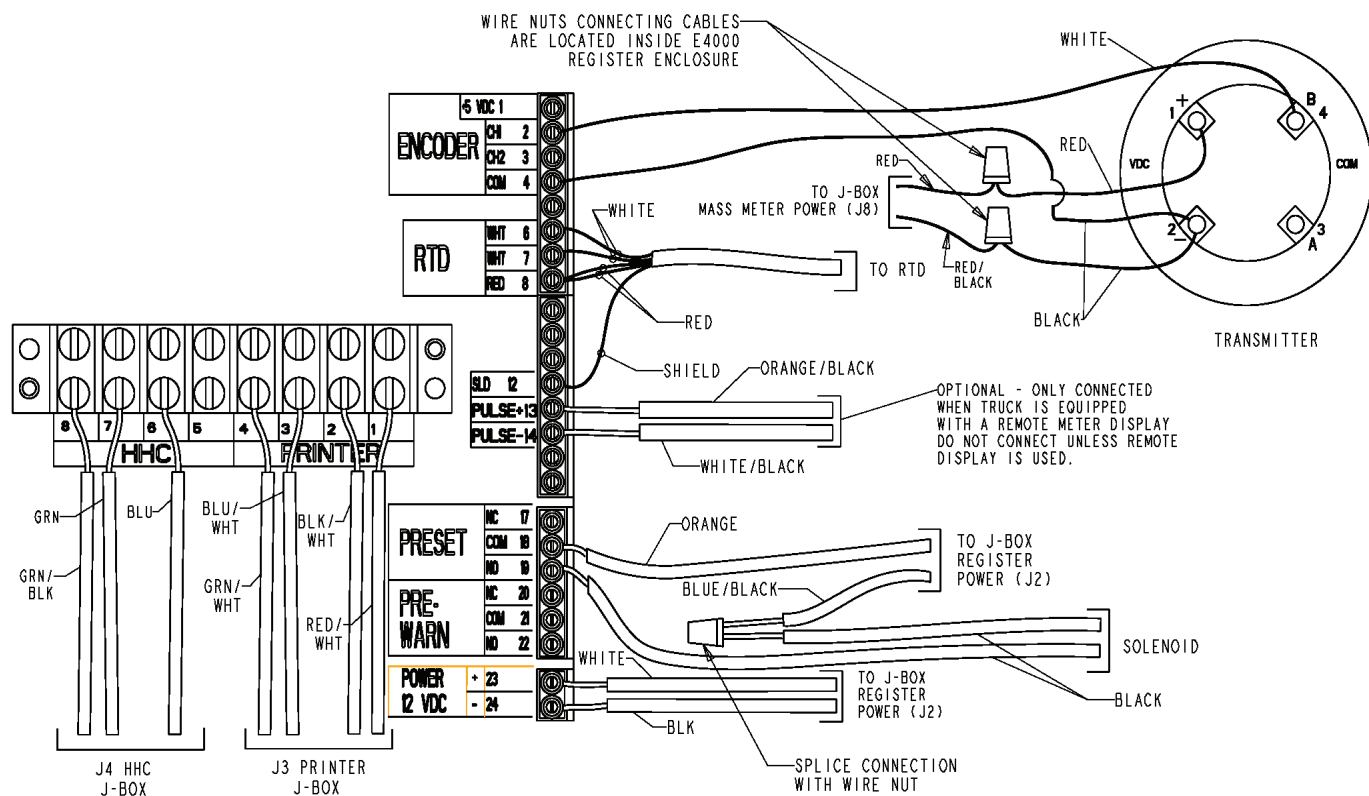


Figure 4-14. Register Wiring for LPG, RML2000 Mass Flow Meter, Single Stage Valve

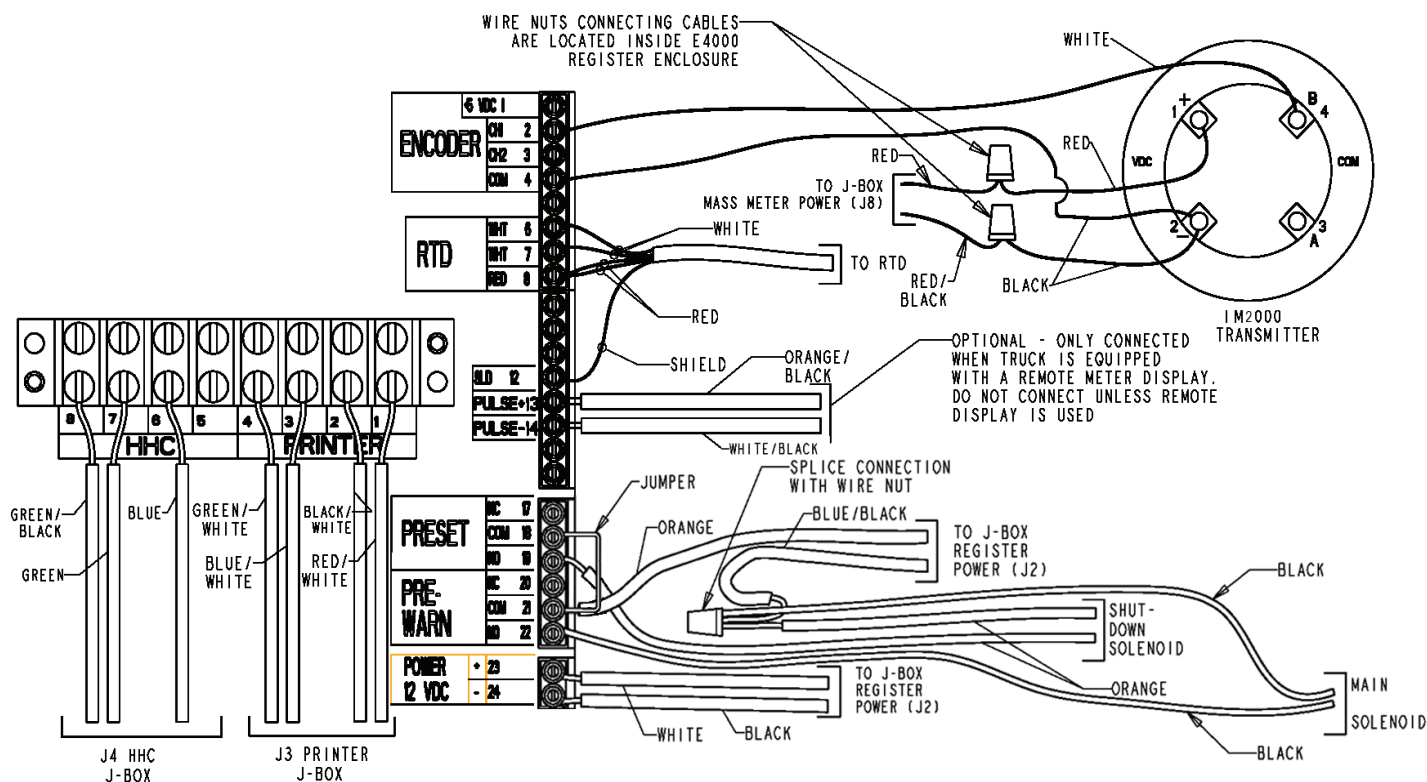


Figure 4-15. Register Wiring for LPG, RML2000 Mass Flow Meter, Dual Stage Valve

hubs. Also, the factory supplied hole plug should be installed in the center port at the rear of the E4000, and must be installed with the step on the inside washer facing the hole in the register base. This will center the hole plug correctly and ensure it will not leak.

If the E4000 is equipped with a heated display, the leads from the display heater will be preinstalled at the 12 volt terminals. If the wires are disconnected during the installation process, reinstall the red display wire to terminal 24 and white to terminal 23. The ferrule containing both white and red wires attaches to terminal 16 (figure 4-18).

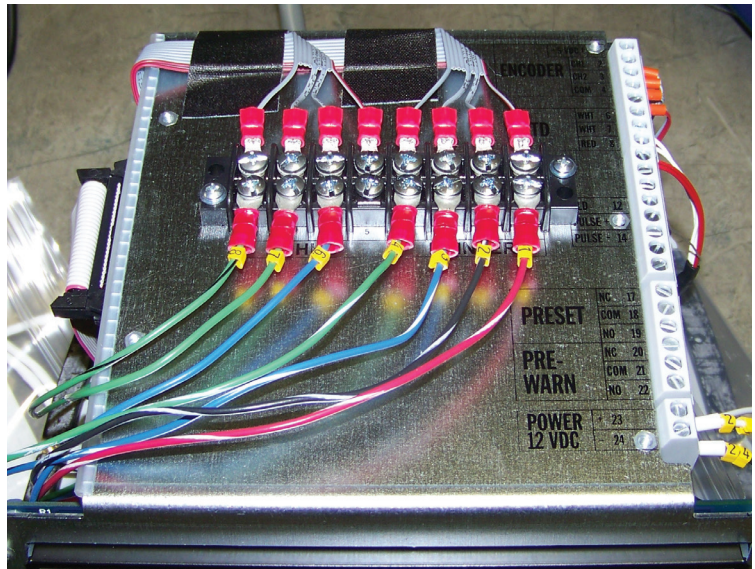


Figure 4-16. Register Terminals



Figure 4-17. E4000 Wiring Ports

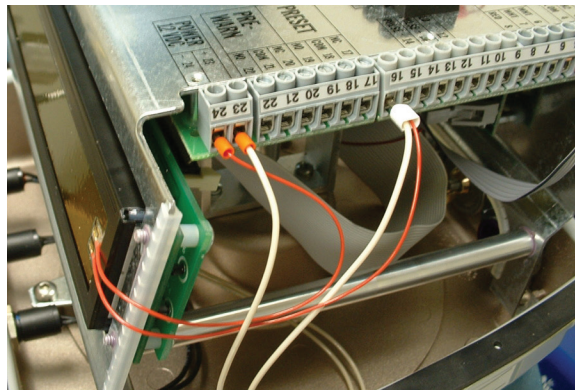


Figure 4-18. Heated Display Connections
(other wires omitted for clarity)

4.15 Wiring the Junction Box

The data/power cable should pass through the center port in the junction box. The printer power cable should pass through the left port, and the truck power cable should pass through the right port. Factory supplied cable strain relievers are required to prevent damage to cables as they enter the junction box. Make the connections as shown in the wiring diagram (figure 4-19) for the junction box.

Terminal block J8 is specifically for powering the RML2000. The red wire should be connected to the +19 VDC terminal of this block, and the red/black wire to common. *Do not use the printer power terminals to power the RML2000.*

Always complete the HHC DATA wiring, even if you are not using a hand-held computer, because this is also required to communicate with the register when using the E4000 configuration program. *Note: Terminal 5 of the HHC block and the SHIELD terminals on the HHC and POWER blocks are not used.*

Connect the drain (shield) wire to the SHIELD terminal of the PRINTER DATA terminal block. The length of the shield wire should be such that it cannot contact the metal junction box or lid.

Do not replace the E4000 cover or the junction box lid at this point.

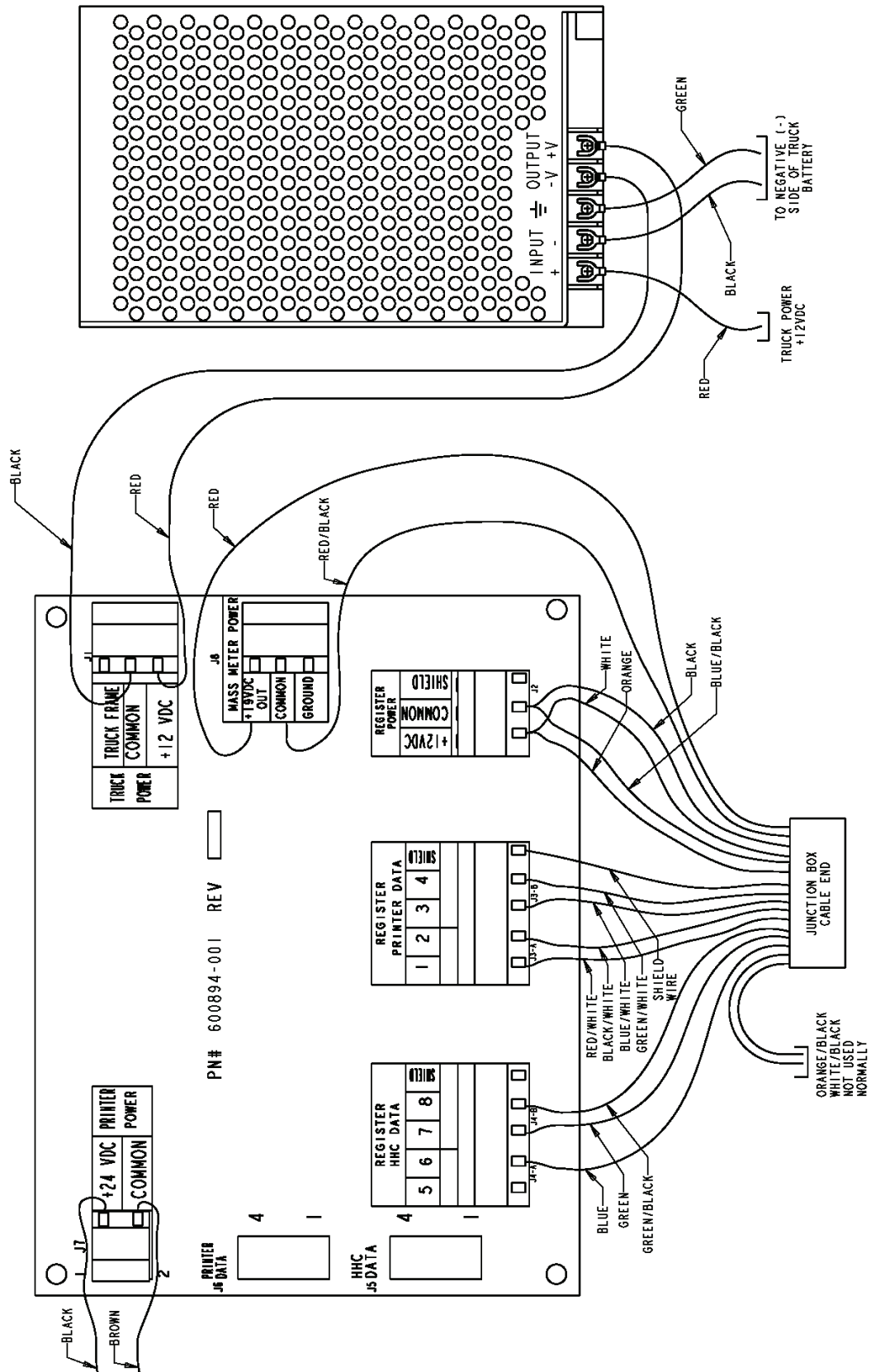


Figure 4-19. E4000 Junction Box Wiring Diagram, LPG, RML2000 Mass Flow Meter

4.15 Wiring the RML2000 Meter to the E4000 Register

Caution: The RML2000 transmitter electronics are susceptible to damage from electrostatic discharge. Make sure you are grounded to the truck frame before making the following connections.

Using the RML2000 cable kit, insert the leads from the 4-conductor power/encoder cable into the RML2000 transmitter housing and connect to the terminals as follows:

Red wire: Positive terminal (+)
Black wires: Negative terminal (-)
White wire: Terminal B

(Caution: always make the connections to the transmitter first, then connect the E4000.)

Using the conduit and conduit connectors provided, run the cable from the transmitter housing to the register via the center hole at the rear of the E4000. The straight connector screws into the meter transmitter housing and the 90-degree elbow to the rear of the E4000. Take care to ensure water-tight seals between the conduit and the enclosures by repeating the method described in “Wiring the E4000 and Junction Box” above

Inside the E4000, connect the 4-conductor cable as shown in figure 4-14 or 4-15:

White wire: Encoder terminal 2
One black: Encoder terminal 4
Red wire: Connect to red wire from junction box with wire nut
Other black: Connect to red/black wire from junction box with wire nut



Figure 4-20. Transmitter Connections

4.16 Installing the Printer

The Epson TM-U295 printer is available with the E4000. Find a suitable location in the cab for the printer. End user requirements may vary but a commercially available stand is recommended to secure the printer. Bolt the printer stand to a sturdy section of the cab floor and attach the printer with Velcro strips (figure 4-21). Remove the printer's rubber feet to get maximum holding force from the Velcro.

Data and power cables are supplied with the printer kit and junction box. The printer power cable is prewired to the printer power terminal of the junction box as shown in figure 18. Plug the power connector into the round DC24V port as marked on the rear of the printer. The 9-pin connector on the printer data cable plugs into the printer data socket provided on the junction box. Attach the 25-pin end of the data cable to the RS-232 socket on the rear of the printer. (Note: To ensure proper operation, use only the cable supplied with the printer.)

In the E4000 software under Supervisor>Com Ports>Printer>Handshaking, set Handshaking to "Hardware". All of the DIP switches on the bottom of the printer should be off (figure 4-22). (This is for software EA.01.05.E and later versions.)



Figure 4-21. Printer Installation

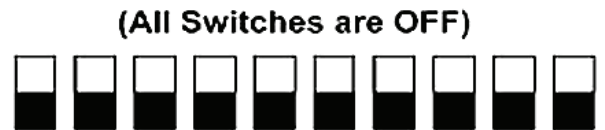


Figure 4-22. Printer DIP Switches

4.17 Connecting Power to the Junction Box

The junction box for the E4000 Electronic Register includes a voltage regulator to ensure that the unit receives clean power within the appropriate voltage range. The box comes prewired for printer power and truck power connections, and has an in-line 5A fuse on the power input (figure 4-24). The E4000 junction box includes three wires for connecting to truck power (figure 4-25).

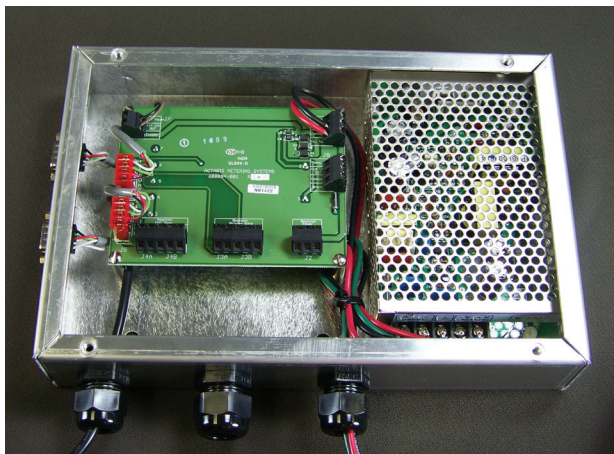


Figure 4-23. Junction Box (Voltage Regulator on Right)

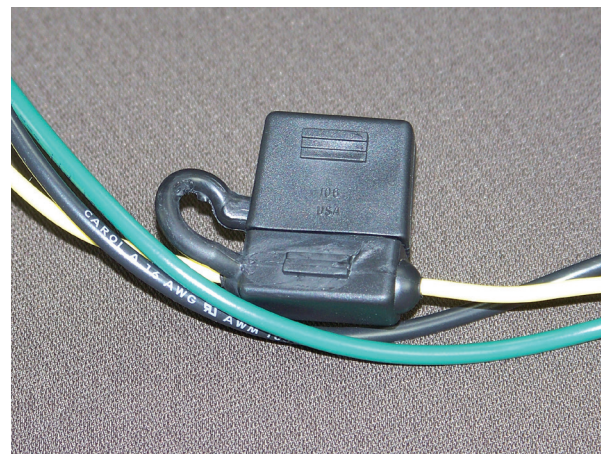


Figure 4-24. In-line 5A Fuse Holder

RED (TRUCK POWER +12 VDC): Attach to a switched accessory circuit on the truck fuse panel or use the supplied self-stripping power tap to connect to a switched accessory line (below).

BLACK (TRUCK POWER COMMON): Attach to the negative terminal of the battery, and verify that the resistance from the terminal connection to the negative terminal of the battery is less than 1 ohm (measured with power to the E4000 system switched off).

GREEN (TRUCK FRAME): Attach to the negative terminal of the battery, and verify that the resistance from the terminal connection to the negative terminal of the battery is less than 1 ohm (measured with power to the E4000 system switched off).

Caution: The E4000 system will not function reliably unless two separate grounds of less than 1 ohm are used.



Figure 4-25. Junction Box Cables - Printer on Left, Truck Power on Right



Figure 4-26. Crimp Lugs and Power Tap

Provided with the kit are crimp lugs that can be attached to the ends of the black and green junction box power wires, and a self-stripping tap connector that can be used to tap the red wire into an existing truck power wire (figure 4-26). **Make sure that the wire being tapped is a switched accessory line.** To use the tap connector, place the unstripped end of the junction box power wire into the side with the closed end, then slip the power wire from the truck into the other side. Use pliers to drive the metal tap through the wires and flush with the surface, then close the hinged cover until it snaps into place (figure 4-27).

With all connections completed turn the ignition switch to the ON position. The E4000 will power up as indicated by the LCD back light illuminating. Replace the E4000 register cover taking care to position the cover gasket correctly.

Check that the printer power light is illuminated. Replace the junction box cover. To configure and calibrate the E4000 before it enters service refer to Section 5 of this manual.

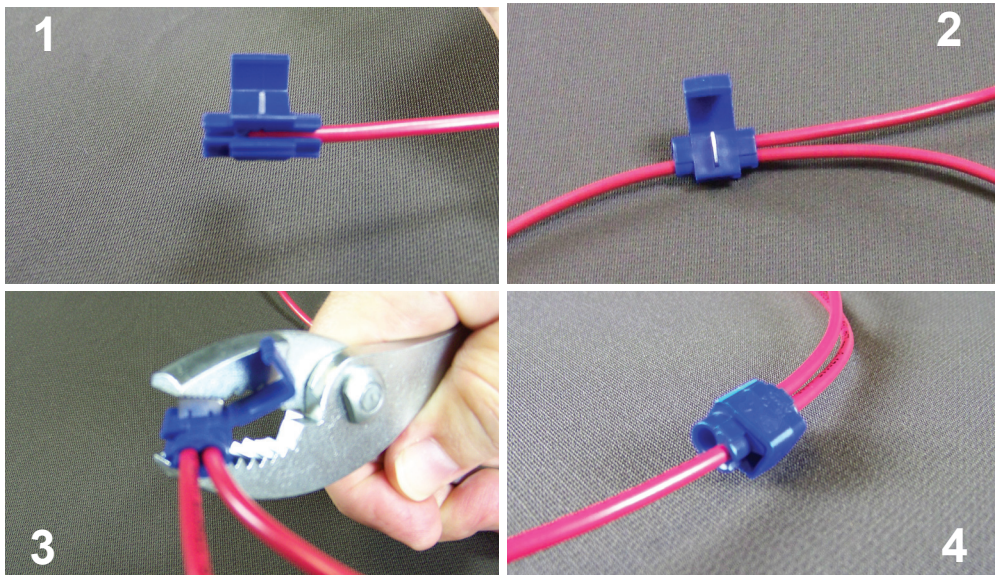


Figure 4-27. Using the Self-Stripping Power Tap.

4.15 Connecting a Mobile Computer

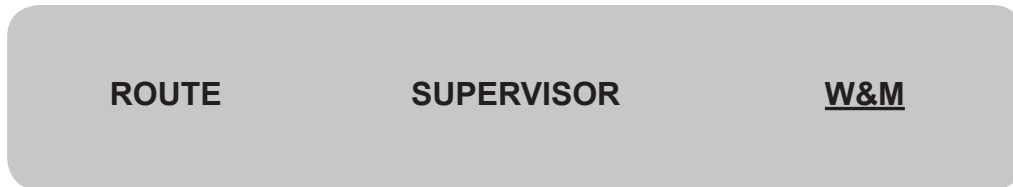
To operate with the E4000, a mobile computer plugs into a 9 pin serial connector on the junction box. Red Seal has prepared a communications protocol document specifying how a computer can interface directly to the register. The protocol allows the external computer to extract data and control the operation of the register from a position in the cab. Application developers wishing to interface their product to the E4000 should contact Red Seal directly.

5. START UP AND CALIBRATION

This procedure applies to E4000 firmware version EA.01.08E and later. The firmware version of the E4000 can be determined by viewing the display during the first 5 seconds after powering up the register (the version will be shown in the lower left corner of the display), or by printing a calibration report. To calibrate E4000s with earlier firmware versions, contact the factory.

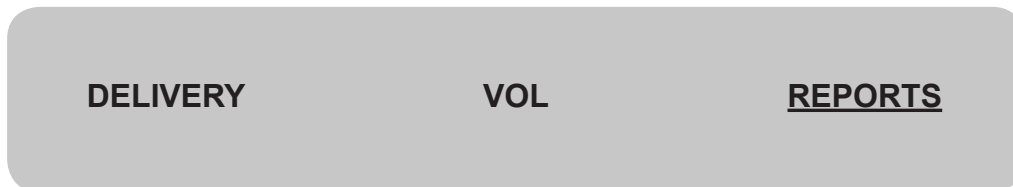
5.1 E4000 Command Menu Overview

The E4000 will turn on automatically on power up. This is indicated by the LCD display illuminating, followed by a screen test operation and a display of the software version. The screen will stop at the root software menu in the following condition:



5.1.1 Route Mode

The Route Mode is the menu selection the operator uses to make deliveries from the meter, print out reports that record what deliveries were made and how the register is calibrated, and access the volume of product on the truck.



Register functions carried out in Route Mode are as follows:

- Select 1 of 10 possible programmed products. priced or unpriced
- Display delivered volume and print delivery ticket or priced invoice
- Make deliveries
- Print End-of-Shift Report to record number of deliveries made and total volume of each product delivered.
- Report current cumulative totalizer value
- Print Calibration Report to show the K-Factors and temperature compensation parameters set for each programmed product
- Enter, edit, and access the onboard volume

5.1.2 Supervisor Mode

The Supervisor Mode is the menu selection that allows an operations supervisor to set up password protected parameters within the E4000 that dictate how the register is operated.



Register functions carried out in Supervisor Mode are as follows:

- Program prices, taxes and discounts for up to 10 individually named products
- Set the time and date for the E4000, printed on delivery, end-of-shift and calibration reports.
- Program the register flow control parameters
- With no valve control (E4000 relays do not operate a valve)
- With non-preset valve control (LPG security solenoid valve)
- With preset valve control (2 stage shut off valve)
- Configure the communication ports for the printer and mobile computer connection
- Allow multiple deliveries (disable 3 minute timeout to print ticket)
- Edit delivery ticket number, supervisor password, truck number
- Program a miscellaneous fee

Note: Complete software details are listed in the E4000 Software Manual

5.1.3 W&M Mode (Weights and Measures Mode)

The W&M Mode is the menu selection allowing a technician to calibrate the E4000 to the flowmeter it will operate with. The Weights and Measures menu is only accessible via a physically sealed internal calibration switch positioned on the side of the register. Remove the drilled fillister-head screw and use a paper clip, small Allen wrench, or similar item to depress the switch.

VOLUME

**CALIBRATION
TEMP**

MISC

Register functions carried out in W&M Mode are as follows

- Assign product name to each of a possible 10 products
- Add temperature compensation to each product, if required
- Enter meter K-Factor manually, if known
- Calculate meter K-Factor automatically using calibration prover volume
- Calibrate temperature probe in field to known thermometer standard
- Input meter and E4000 serial number to be printed on reports
- Select units, gal/°F or liters/ °C, and resolution of the display
- Select type of input pulse to match internal encoder or external device.

Note: Complete software details are listed in the E4000 Software Manual.

Note: See Section 5.4 for Calibrating E4000 Volumetric K-factor

Note: Always follow proper calibration procedures to avoid influencing results.

- *Recommend wet down test and discard results.*
- *Follow with 3 tests to determine repeatability.*
- *If repeatable, (within required specs) add results of the tests to get the average and put that value in to adjust the k-factor. Then run verification test.*
- *If meter not repeatable, correct issues with installation, accessories, meter issues or vapor issues before proceeding to item 2 above.*

5.2 Configuring the E4000

1. At the root menu, remove the seal screw and firmly depress the Calibration switch. Press the [>] button simultaneously using an allen key or stiff wire to enter the W&M mode indicated by flashing W&M. Press [Enter] to continue.

ROUTE

SUPERVISOR

W&M

2. Select MISC from the calibration menu [Enter]

VOLUME

**CALIBRATION
TEMP**

MISC

3. Use the push buttons [>] [^] to enter the Meter Serial Number [Enter]

**METER SN
FA0516**

4. Use the push buttons [>] [^] to enter the Register Serial Number [Enter]

**REGISTER SN
E516EA**

5. Select the correct volume units according to local standards. [Enter]

**UNITS
VOLUME**

GALLONS

6. Select the correct temperature units according to local standards. [Enter]

**TEMPERATURE SCALE
Deg_C**

Deg_F

7. Select the required display resolution for the volume units. [Enter]

VOLUME RESOLUTION	0.01	0.1
0.001		

8. Select the type of input pulses to be counted. [Enter]

NOTE: For a mechanical positive displacement meter, set PULSE TYPE to QUAD. For a mass flow meter, set to SINGLE.

PULSE TYPE	DUAL	QUAD
SINGLE		

9. Set PRINTER STATUS CHECK to ON.

PRINTER	STATUS	CHECK
OFF		ON

10. Set RTD ACTIVE to NO.

RTD ACTIVE?	
NO	YES

5.3 Configuring and Zeroing the RML2000

1. Configure the E4000 Electronic Register, using the W&M Calibration menu, for the RML meter -- select "SINGLE" pulse type and "596" starting K-Factor (if meter was previously calibrated, use the existing K-Factor. Also, enter the meter serial number (omit first two letters), register serial number, units of measurement, temperature scale (C or F), 505 LPG product class, name the products if desired, etc. It is recommended to use the E4000 configuration program and connect thru the HHC port on the junction box to confirm the correct wiring of the system. It may be necessary, when downloading, to change the setup, under PC Comm, to agree with your computer's COM port setting.

2. Check the E4000 junction box, located in the cab of truck, to assure the system is receiving 12-14 VDC at "TRUCK POWER +12VDC" when the system is powered up, and "TRUCK POWER COMMON" and "TRUCK FRAME" are two separate connections which each have less than 1 ohm resistance (with truck power off) from the terminal connection to the negative terminal of the battery.

3. Check the voltage at terminals 1 (+) and 2 (-) of the meter transmitter to assure the meter is receiving 24 volts, +/-1 volt. See Figure 5.1.

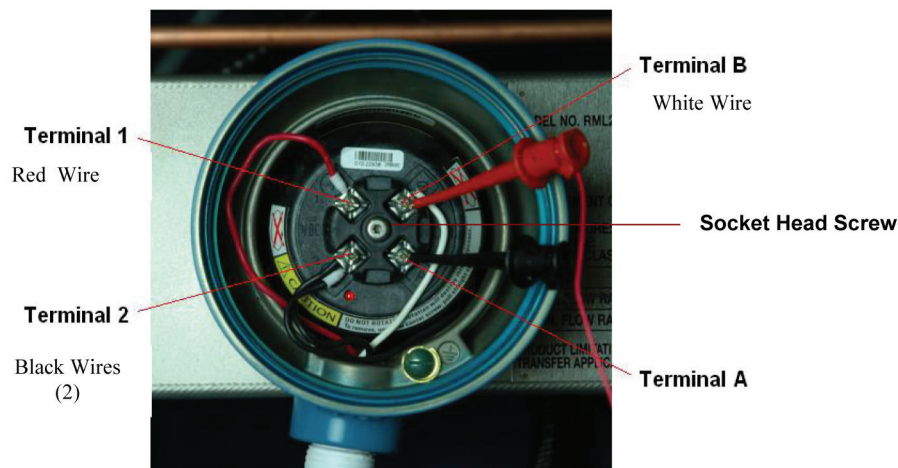


FIGURE 5.1

4. Connect the RS-485 Adapter Kit, P/N 600324-000, from your computer to the meter transmitter. See Figure 5.2. Attach the red clip to terminal B, and black clip to terminal A of the meter transmitter (figure 5.1). *** Do not connect clips to terminals 1 and 2 or damage will occur to the hardware ***

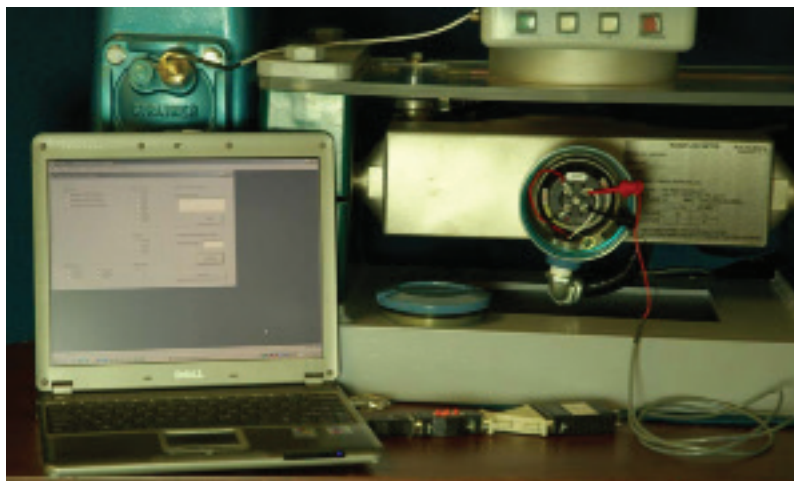


FIGURE 5.2

5. Launch Prolink, click on *Connection*, then *Connect to Device*. Verify the following settings (see Figure 5.3):

- Protocol - Modbus RTU (8-Bit)
- Baud Rate - 9600
- Parity - None
- Stop Bits - 1
- Address/Tag - 1.
- Com Port - the communications port your computer is using to communicate with the meter.

To determine your computer's Com Port setting:

- right click *My Computer*
- click *Properties*
- click *Hardware*
- click *Device Manager*
- double click on *Ports*

If you are using your computer's RS232 port, the Com Port will be specified under "Communications Port"; if you are using the USB port, it will be listed as "ATEN USB to Serial Bridge".

Prolink will only work with communication ports 1-4. If the port is not in this range, try a different port connector on your computer, or reassign the existing port as follows:

- Right click on the port description.
- Click *Properties*.
- Click *Port Settings*.
- Click *Advanced*.
- Click the down arrow next to the com port # and select a port (1- 4) that is not in use.

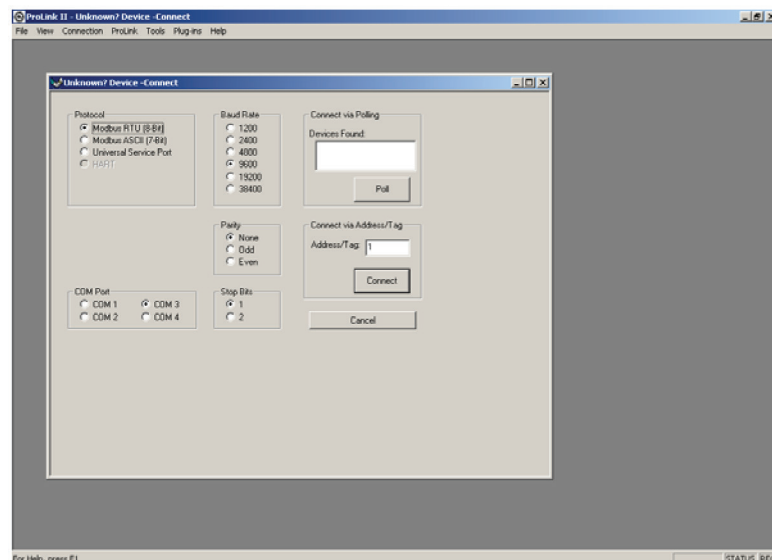


FIGURE 5.3

6. Power down the meter/E4000; wait 10 seconds, then power up again by starting the truck (the truck engine must be running from this point on). Within 3-8 seconds after powering up the meter, click on *Connect*, and the Process Variables (See Figure 5.4) screen should appear. If you receive the message "Modbus Server not found", you likely have not specified the correct Com Port, and if you receive the message "Failed to establish connection with the requested device", you either did not power the system down then back on again and click on *Connect* within 3-8 seconds, or there is a problem with the wiring connecting the computer to the puck. If the Process Variables window is displayed, and the *Transmitter in Fault* and *Prolink/Transmitter Com Error* lights are both green, you have successfully connected. Minimize the Process Variables window.

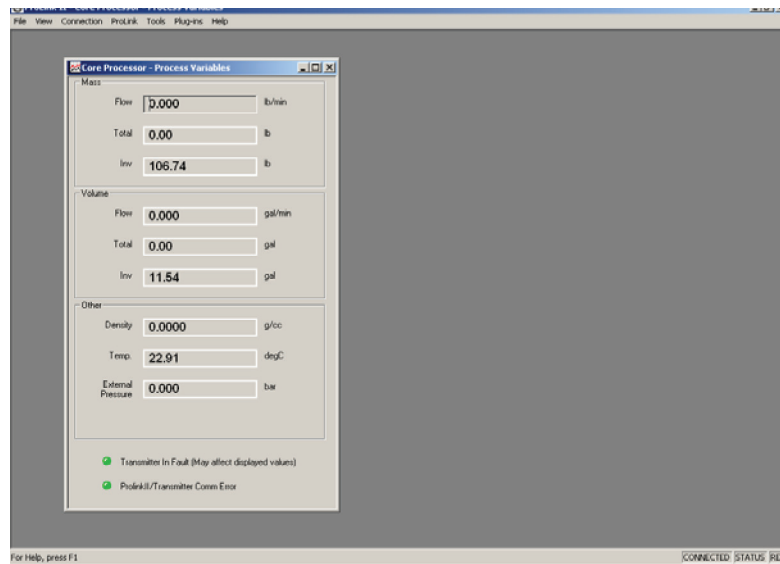


FIGURE 5.4

7. Click on *ProLink*, then *Configuration*. Check the meter configuration to assure agreement with Red Seal specifications. NOTE: The meters should have been configured exactly as specified below when received from Red Seal Measurement. If it is not, the configuration must be corrected before the meter will operate correctly.

The meters should be configured as indicated in yellow in the tab screenshots. Values and units at the bottom of tab screenshots are to be entered in designated areas. (If any values are incorrect and must be changed, click *Apply*, or the changes will not take effect):

Flow Tab

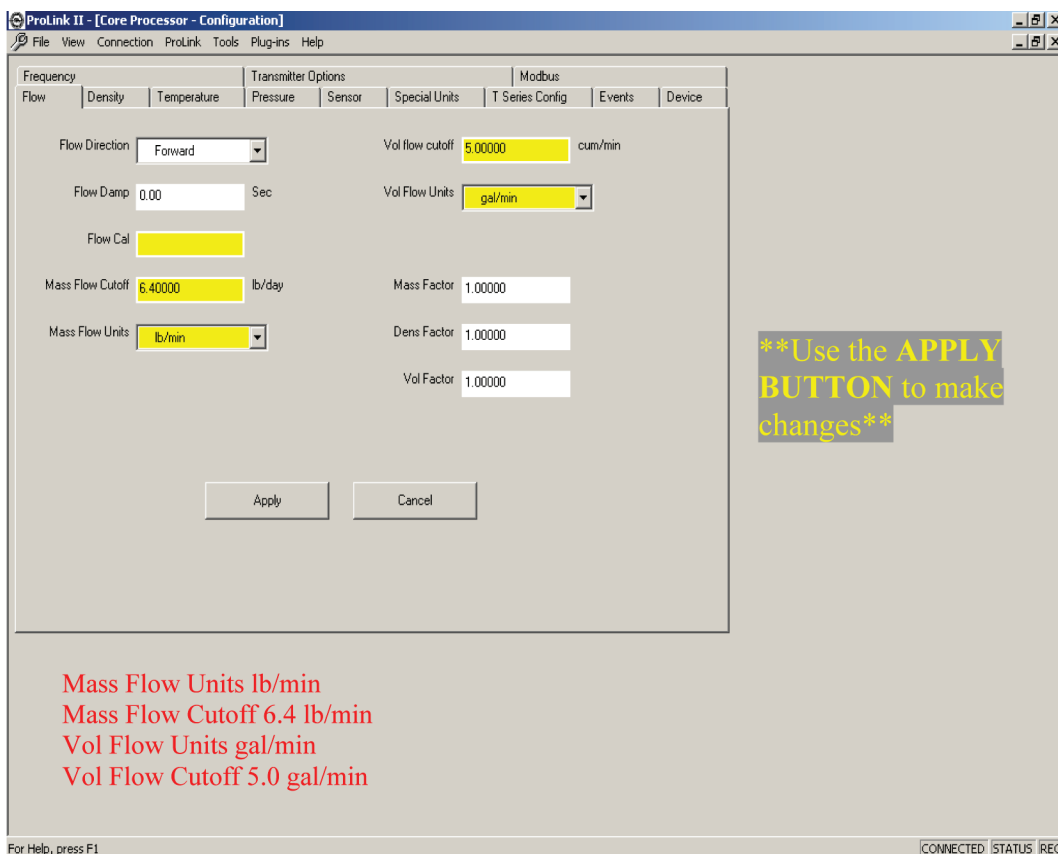


FIGURE 5.5

Density Tab

ProLink II - [Core Processor - Configuration]

File View Connection ProLink Tools Plug-ins Help

Frequency Density Temperature Pressure Sensor Special Units T Series Config Events Device

Dens Units **g/cc**

Dens Damping 0.00 Sec

Slug High Limit 5.00000 g/cc

Slug Low Limit 0.40000 g/cc

Slug Duration 0.00 Sec

Low Density Cutoff 0.200 deg API

K1 **uSec**

K2 **uSec**

FD 0.00000

D1 0.00000 g/cc

D2 1.00000 g/cc

Temp Coeff (DT) **uSec**

Apply Cancel

****Use the APPLY BUTTON to make changes****

Dens Units g/cc
 Slug High Limit 5.0 g/cc
 Slug Low Limit 0.4 g/cc
 Low Density Cutoff 0.20 g/cc

For Help, press F1

CONNECTED STATUS REC

FIGURE 5.6

Frequency Tab

ProLink II - [Core Processor - Configuration]

File View Connection ProLink Tools Plug-ins Help

Flow Density Temperature Pressure Sensor Special Units T Series Config Events Device

Frequency Transmitter Options Modbus

TV is **Vol Flow**

Freq Factor 1,000.00000 Hz

Rate Factor 100.00000 lb/min

Freq Pulse Width 0.10000 Sec

Fixed Frequency Level 0.00 Hz

Apply Cancel

****Use the APPLY BUTTON to make changes****

TV is Vol Flow
 Freq Factor 1000.0 Hz
 Rate Factor 100.0 gal/min
 Freq Pulse Width 0.1 Sec

For Help, press F1

CONNECTED STATUS REC

FIGURE 5.7

Transmitter Options Tab

Note: This is a secure area. To access, go to your desktop, right click on the Prolink icon, then click *Properties*. Under shortcut, add a space, then “–Secure” at the end of the target file name (after .exe”).

Example: “...G700.exe” –Secure

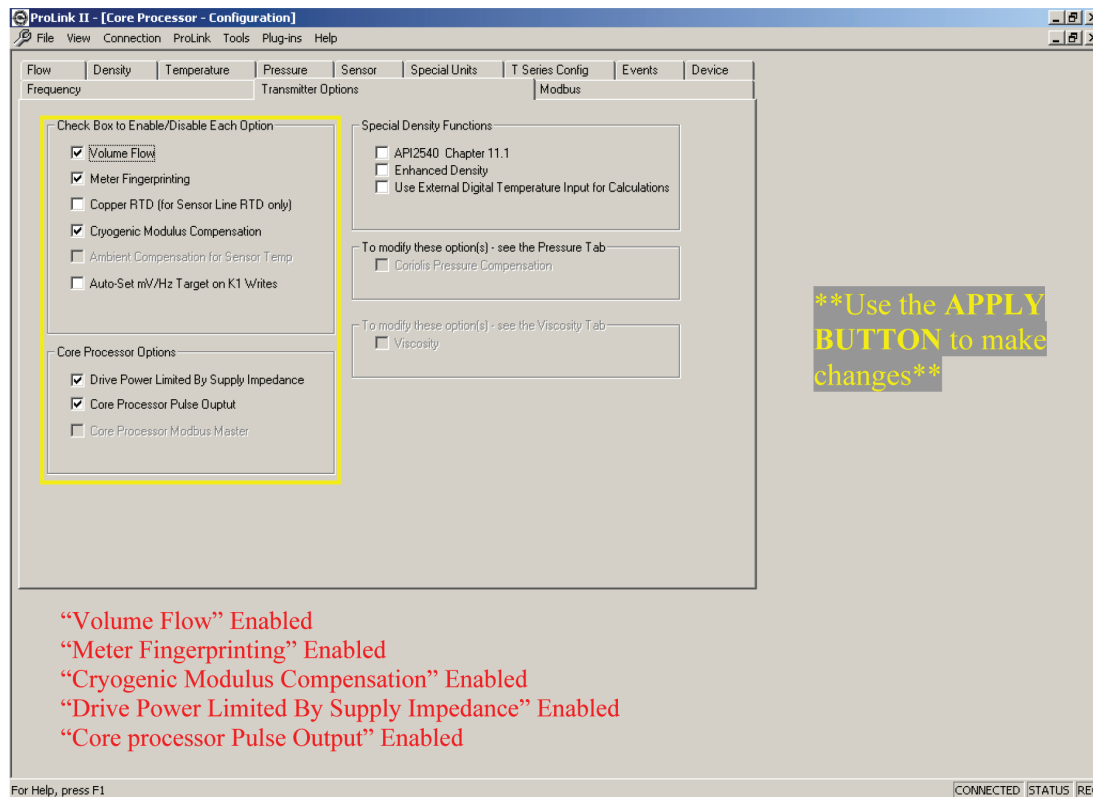


FIGURE 5.8

8. While in *Prolink*, and *Configuration*, under the *Flow* tab, temporarily change the mass and volume flow cutoffs to zero, and click *Apply*.

9. After the meter has been powered up for at least 30 minutes to warm up the electronics, circulate product thru the meter for 5-10 minutes to remove vapor and allow meter to reach a steady temperature. Close the valve downstream of the meter first, then the vapor return line valve, and finally close the valve upstream of the meter. All three should be closed as quickly as possible to ensure the meter is completely filled with LPG. See Figure 5.9. Disengage the truck PTO.



FIGURE 5.9

10. Click *Prolink*, then *Calibration - Zero Calibration* (see Figure 5.10).

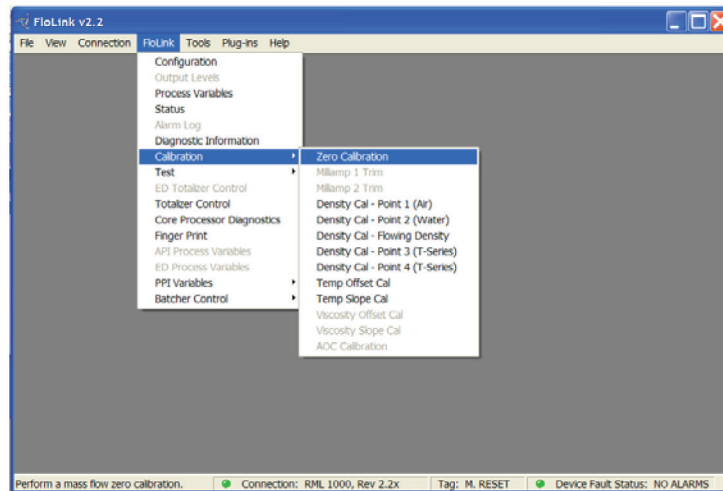


FIGURE 5.10

11. In the *Flow Calibration* screen, set the Zero Time for 40 seconds, and click *Apply*. With truck engine still running and the truck PTO disengaged, click *Zero* and *OK* at the "... Proceed?" message. After 40 seconds, if the zeroing procedure is successful, the status box will indicate all green lights. If there are any red lights, the procedure was not successful, and must be repeated. When successful, click *Done* (see Figure 5.11).

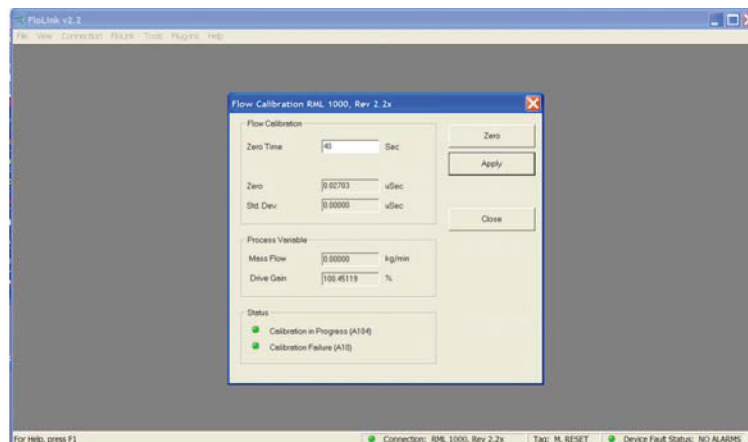


FIGURE 5.11

12. Click *Prolink*, then *Process Variables*. The flow rates should be low and evenly distributed around zero. It will take approximately one minute before the readings appear and stabilize. Observe them for at least 3 minutes. The Mass Flow readings should vary no more than ± 0.2 lb/min, and the Volume Flow readings should vary no more than $\pm .05$ gal/min. It is very important that the readings are evenly distributed around zero. If readings are either all positive or all negative, the zero is not acceptable. If readings seem within tolerance, click *Prolink*, then *Totalizer Control*, and *Reset All Totals*. Now view the Process Variables, and watch the Volume Total for 5 minutes to assure the reading is not greater than $\pm .25$ gal after 5 minutes. The smaller the number, the better the Zero, but it cannot exceed $\pm .25$ gal in 5 minutes (see Figure 5). Note: Always verify that the temperature indicated in the Process Variables window is reasonable when servicing an RML2000. If it is not, please consult factory for NF#RF08-01.

13. If the readings are acceptable, return to *Prolink, Configuration*, and under the *Flow* tab, change the mass and vol flow cutoffs back to the original values (6.4000 lb/min Mass Flow Cutoff and 5.00000 gal/min Vol Flow Cutoff). Note: This is very important. Failure to do this can result in the meter advancing the E4000 totalizer, even though there is no flow through the meter.

14. Power down the system and disconnect the hardware from the meter transmitter to exit the Modbus mode, and enter the pulsed output mode. Note: Until you exit the Modbus mode, no pulses will be sent from the meter to the E4000 Electronic Register, and therefore no gallonage will be shown on the E4000 when pumping through the meter.

15. The zeroing operation is now complete, and when the system is powered back up, it will have a pulsed output to the E4000. Open the valves, and calibrate the meter K factor using the E4000 Electronic Register.

16. To ensure that you have successfully zeroed the meter, it is very important to test the meter at both a high flow and low flow (82 GAL max. and 8 GAL min. for the RML2000). *Note: While filling the volumetric prover, do not allow the meter flow rate to decrease to less than 5 GPM, or the test results will not be accurate.* If there is no more than the allowed W&M spread (usually 1% maximum) between high and low flow, the zero is acceptable. If greater than 1%, the meter should be zeroed again.

5.4 Calibrating the E4000 Volumetric K-Factor

Before calibration, see Section 5.3 for the RML2000 zeroing procedure.

NOTE: Software versions 08 and higher permit W&M inspectors to check calibration by viewing both the gross and net volumes for the last delivery, without breaking the seal to enter the W&M menus. If the ^ or > buttons are pressed after the delivery ticket is printed, but before the cancel button is pressed to return to the SELECT PRODUCT screen, the screen will display both the gross and net volumes. If calibration is required, it is recommended that a shift report be printed before and after the calibration procedure, in order to reconcile the customer's inventory. The shift reports will show the totalizer readings at the start and completion of the calibration process. Any quantity pumped through the meter during the calibration process will be added to the register totalizer reading.

To print a shift report:

1. From the NEPTUNE root menu, press either > or ^ on the four button front panel, until ROUTE is flashing, then press the START/ENTER button.

ROUTE

SUPERVISOR

W&M

2. Press > or ^ until REPORTS is flashing, then press the START/ENTER button.



3. Press > or ^ until SHIFT is flashing, then press the START/ENTER button.



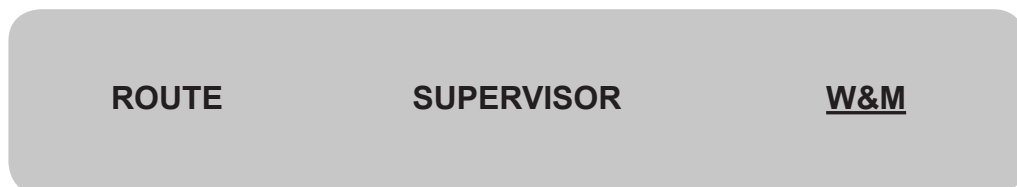
4. Press the START/ENTER button when the display reads "PRINT END_OF_SHIFT REPORT?"



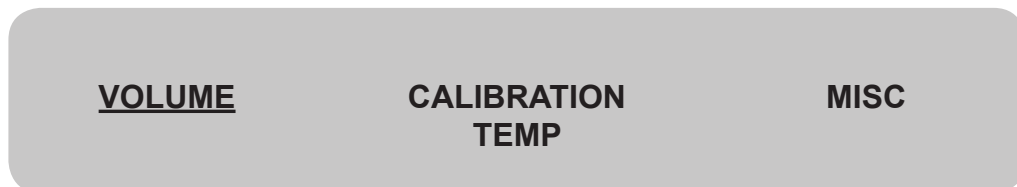
5. The end of shift report will now print.

To Calibrate the Volumetric K-Factor:

1. Depress the Calibration switch and press the [>] button simultaneously to enter the W&M mode. When W&M is flashing, press [Enter] to continue.



2. Select VOL to enter the volume calibration menu, and press [Enter].



3. Select [^] the desired product code for the fluid to be calibrated 0-9, and press [Enter].

SELECT PRODUCT CODE
0-9

4. Assign a name to the product code selected.
Scroll [>] [^] through the characters to enter the name, and then press [Enter].

PRODUCT NAME
PROPANE

5. Select [^] the required product class for temperature compensation
None, 505 LPG (US), 510 LPG (Canada), then press [Enter].

PRODUCT CLASS
505 LPG

6. Select the method of calibration to be used:
If the K-Factor is known and is being re-entered manually select MANUAL, press [Enter], and follow steps 7 and 8. If the K-Factor is not yet known select AUTO, then press [Enter] to skip to step 9.
Starting K-Factors* of 123 pulses/unit are programmed at the factory for Product 0.

CALIBRATION METHOD
MANUAL **AUTO**

*** Note: Any product programmed with a K-Factor of 999999 cannot be selected for delivery in route mode, and you cannot perform an AUTO calibration without first doing a MANUAL calibration to change the K-factor from 999999 to a starting K-factor of around 123.**

7. Use [>] [^] to enter the known K-Factor, and press [Enter].
To calculate a new K-factor: **NEW = OLD x REGISTER READING / CORRECTED PROVER READING**

ENTER K-FACTOR
XXXXXX/UNIT

8. Verify the K-Factor is entered correctly, and press [Enter].

K-FACTOR CORRECT?
XXXXXX/UNIT

Auto-calibration using an approved volumetric prover

9. To prepare for the calibration tests first wet down and zero the prover. If the register controls flow, press [Enter] to open the solenoid valve. Open the prover manual valve to allow fluid into the prover.

AUTO CALIBRATION START FLOW

10. As the fluid flows into the prover the register displays gross and net volume to allow the tester to monitor the operation of the meter.

GROSS	XXXXXXXX
NET	XXXXXXXX

11. When the prover is full, drain the prover down and zero it.

12. Press [Cancel] twice to return to CALIBRATION METHOD.

CALIBRATION METHOD
MANUAL **AUTO**

13. To perform a calibration test run, select AUTO, and press [Enter].

AUTO CALIBRATION START FLOW

14. Press [Enter], and open the prover manual valve to allow fluid into the prover. As fluid flows gross and net volumes are displayed as before.

GROSS	XXXXXXX
NET	XXXXXXX

Note: Pressing [Stop/Cancel] at any time during the AUTO CALIBRATION procedure will close the solenoid valve, if equipped, and flow cannot continue until [Enter] is pressed to re-open the solenoid valve. Pressing [Stop/Cancel] twice will terminate the AUTO CALIBRATION procedure.

TEMPERATURE	XXX.X/UNIT
RATE	XXXX.X/UNIT

15. By pressing [>] or [^] the display can be toggled to show the instantaneous RTD temperature and the flowrate through the meter. Press [>] or [^] to go back to step 14.

When the prover reaches the calibrated volume close the manual valve. Wait at least 5 seconds after closing the manual prover valve, and press [Enter]. The display changes to:

**FLOW STOPPED
CONTINUE?**

Press [Enter] to continue.

16. Measured gross and net volumes are displayed to allow tester verification against calculated prover uncompensated and compensated volumes.

GROSS	XXXXXXX
NET	XXXXXXX

Press [Enter] to calculate a new K-Factor.

17. Gross volume as measured by register is displayed. If the volume is incorrect, calculate the gross volume * of the prover do not put this in yet. Press [ENTER] and run a second and a third test. This is done to establish repeatability. If repeatability is established, on the third test enter the average calculated gross volume of the prover to calculate the new K-factor. Press [ENTER] to continue. If not repeatable, correct potential issues with installation, accessories, meter, register or vapor in the line. Once issues are corrected go back to step 9 again.

**ENTER PROVER VOLUME
XXXX.XXX UNITS**

***Note: For LPG, corrections must be made for the difference in temperature of the product as it passed through the meter and the temperature of the product as it occupies the prover, along with a correction for the thermal expansion of the prover based on it's temperature, and also a correction of the prover volume based on pressure effects, when calculating the Gross(uncompensated) volume of the prover. (Reference Tables 1, 2, & 3 of National Conference on Weights and Measures, Course 305.)**

18. Verify that the prover volume was entered correctly and press [Enter].

**PROVER VOL CORRECT?
XXXX.XXX UNITS**

19. The new K-Factor is calculated and displayed
Press [Enter] to verify the new K-Factor and return the display to step 12.

**K-FACTOR CORRECT
XXXXXX/UNIT**

Note: Any product programmed with a K-Factor of 999999 cannot be selected for delivery in route.

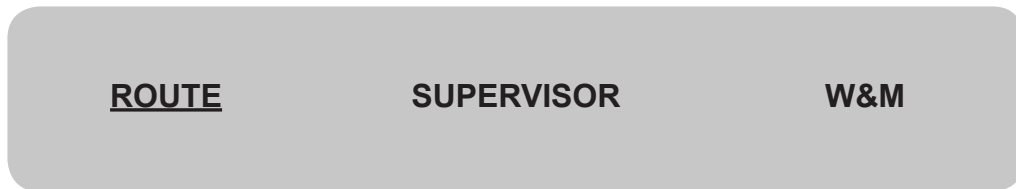
20. A second run should be performed to check the accuracy of the new K-Factor and the temperature compensated (Net) volume. Drain and zero the prover once more. To check the accuracy of the new K-Factor, return to the auto calibration process, and repeat steps 12- 17.

21. If the accuracy is acceptable, press [Stop/Cancel] six times to exit the calibration menu, or once to repeat steps 12- 17 if further test runs are necessary.

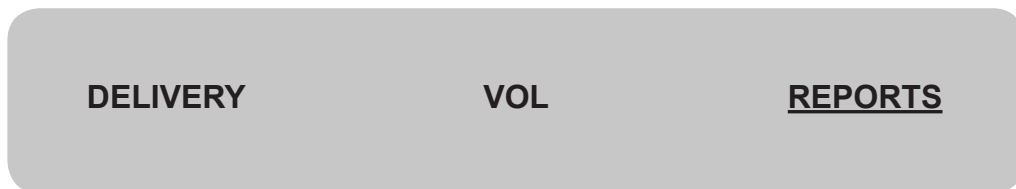
5.5 Printing a Calibration Report

Note: Insert 4 ½"x 11" paper into the printer

1. From the NEPTUNE root menu, press either of the white buttons > or ^, on the four button front panel, until "ROUTE" is flashing, then press the green START/ENTER button.



2. Press > or ^ until "REPORTS" is flashing, then press the START/ENTER button.



3. Press or until "CALIBRATION" is flashing, then press the START/ENTER button.



4. Press the START/ENTER button when the display reads "PRINT-END-OF SHIFT REPORT?"



5. Press [Cancel] three times to return to the root menu.

CONSULT YOUR LOCAL WEIGHTS AND MEASURES REPRESENTATIVE FOR GUIDELINES ON SEALING THIS UNIT.

6. INSTALLATION CHECKLISTS

Junction Box

- ___ Mount the Junction Box in cab oriented so that the two RS232 ports are easily accessible, and Jbox cover can be easily removed to access terminal connections.
- ___ Route power/data cable thru center port, printer power cable thru left port (RS232 connector side), and truck power cable thru right port.
- ___ Tighten three plastic cable glands to prevent pulling cables from JBox.
- ___ Check wire color connections as shown in the wiring diagram and tighten all terminal connections.
- ___ Connect the shield wire to the REGISTER PRINTER DATA terminal connection.
Do not allow the bare shield wire to contact the metal junction box.
- ___ Attach "TRUCK POWER +12 VDC" to a switched accessory circuit on the truck fuse panel, using a 16 AWG cable with an in-line 5 amp fuse.
- ___ Attach TRUCK POWER COMMON to the negative terminal of the battery, using a 16 AWG cable, and verify that the resistance from the terminal connection to the negative terminal of the battery is less than 1 ohm (measured with power to the E4000 system switched off).
- ___ Attach TRUCK FRAME connection as a separate wire (not same wire as TRUCK POWER COMMON) to the negative terminal of the battery, using a 16 AWG cable, and verify that the resistance from the terminal connection to the negative terminal of the battery is less than 1 ohm (measured with power to the E4000 system switched off).

Register

- ___ Attach to meter and tighten all connections (Section 4.5)
- ___ Install and wire RTD, if equipped (Sections 4.6 & 4.7, LPG).
- ___ Install rubber gaskets on the plastic cable gland and metal liquid tight connector so that the gaskets are positioned on the outside of the register.
- ___ Route power/data cable thru right side port at rear of register (looking from the rear), and tighten the plastic cable gland to compress the rubber gasket.
- ___ Route valve cable (if equipped with valve) thru the left side port (nameplate side), and tighten the metal liquid tight connector to compress the rubber gasket.
- ___ Check the hole plug in the center port for correct installation and tighten.
- ___ Cut and remove the shield wire from the power/data cable to within 1 inch of where the cable enters the register base. **Cut the shield wire on the register end of the cable only, not on the Jbox end**.
- ___ Route the wires for the HHC and PRINTER around the left side (from front of register) and connect to the terminal strip on top of register (See Figure 4-13).
- ___ Route the appropriate wires across to the right side of the register and connect to the terminal strip on the side.
- ___ Check wire color connections (See Figure 4-13) and tighten all connections.
- ___ Check the voltage across terminals 23 and 24 and verify it is 12-14 VDC.
- ___ Check to be sure the display ribbon cable connectors are attached securely.

Printer

- ___ Set DIP switches all to OFF (See Figure 4-20).
- ___ Install printer ribbon.
- ___ Mount the printer in the cab.
- ___ Plug the printer power connector into the round DC24V port on back of printer.
- ___ Plug the 9-pin connector on the printer data cable plug into the RS-232 socket on the rear of the printer.

LPG Solenoid Valve, If equipped

- ___ Check to be certain there is a transient voltage suppressor installed in the valve, under a section of heatshrink, where the two black wires enter the valve.
- ___ Check that port A (N/C) of the valve is connected to the vent line check valve of the vapor release.
- ___ Check that port B (Common) of the valve is connected to the top of the meter differential valve.
- ___ Check that port C (N/O) of the valve is connected to line pressure.

System

- ___ Check to see that the E4000 LCD Display turns on automatically when the truck ignition is ON.
- ___ Configure the E4000.
- ___ Set the BATCH mode in the Supervisor menu to program the correct valve operation.
- ___ Set the COM PORTS mode in the SUPERVISOR menu, for the PRINTER, to BAUD RATE - 9600, PARITY - NONE, and HANDSHAKING - HARDWARE.
- ___ Verify printer wiring is correct by printing a calibration report.
- ___ Verify HHC wiring is correct by using the Neptune E4000 Configuration Software to download a configuration from a computer to the E4000.
- ___ Pump product thru the meter and verify the E4000 operates correctly.
- ___ Zero the RML 2000.
- ___ Calibrate the system.

E4000 Serial No. _____

Date Installed _____

Installed By _____

Checked By _____

7. E4000 INITIALIZATION PROCEDURE

Occasionally, the E4000 will need to be reinitialized in order to reset the configuration to the factory defaults. This may be done to clear corrupted data or to restart the system after a firmware update. If instructed by a procedure or Red Seal personnel to reinitialize the unit, follow this procedure.

1. Record all calibration, configuration, and product/system data. The calibration data can be recorded by prompting the E4000 to print a calibration report.
 - a. Select ROUTE and press the START button.
 - b. Select CALIBRATION, press the START button. The display will read "PRINT CALIB REPORT?"
Insert a blank piece of paper 11 inches long and at least 4 inches wide. Press the red STOP button. After printing, remove the report and verify that it printed correctly. Press the STOP button to get back to the Main Menu.
Configuration data can also be accessed by entering the W&M mode. (See section 5.2, Configuring the E4000.) If the system has locked up, you will not have access to any of the calibration, configuration, or product/system data. It is recommended that you record all of this information when the system is first installed and set up.
2. Turn off the power to the E4000 system.
3. Remove the W&M seal screw located on the lower left side of the register base. Firmly depress the calibration switch using an Allen wrench or stiff wire. With the switch depressed, press the **Λ** button and the red Stop button at the same time. While all three are pressed, turn on the power to the E4000 system. This may require two people.
4. The register should come on and the display will indicate "Initializing Unit" for approximately 3 seconds. Go to the root menu.
5. All of the original factory programmed defaults have now been restored, and the E4000 system should be operating correctly. If equipped with automatic temperature compensation, the RTD must now be recalibrated.
 - a. Remove the RTD from the temperature compensator or strainer cover thermowell, and place the RTD into an ice bath.
 - b. At the root menu, go into the W&M mode (press three buttons at same time).
 - c. Display should now indicate Calibrate. Press START. The display will read "CAL RTD 100 OHM". Insert the RTD in the ice bath for 60 seconds. Press START button. Display will read "Calibrating" and start counting up. When it stops counting, press the STOP button.
 - d. The display should now be at the root menu. To check the RTD calibration, press the calibration switch and the > button until W&M is flashing. Press the START button.
 - e. The display will indicate the current temperature of the RTD. If it is still in the ice bath, it should read approximately 32 degrees.
 - f. Press the START button. The display will now show the temperature of the RTD and will change as the RTD is removed from the ice bath and reaches ambient temperature.
 - g. The RTD calibration is now complete. Press the red STOP button and the display will go back to the calibration menu. Press the STOP button again and the display will go to the root menu.
6. Re-enter the configuration data.
 - a. Press the calibration switch firmly and simultaneously press the > button until W&M is flashing. Press the START button.
 - b. Select MISC in the CALIBRATION menu. Press START.
 - c. Enter the meter serial number by pressing the > button once so that the first digit begins flashing, then the **Λ** button to advance to the next digit. Do the same until all digits are correct. Press the START button.
 - d. Enter the register serial number using the same procedure as in Step C.

- e. Select Gallons for the UNITS VOLUME by pressing the > button until GALLONS flashes. Press START.
 - f. Select "Deg F" for the TEMPERATURE SCALE. Press START.
 - g. Select "0.1" for the VOLUME RESOLUTION. Press START.
 - h. Select "Quad" for the PULSE TYPE. Press START.
 - i. The display will return to the Calibration menu. Configuration is now complete.
7. Re-enter the calibration data (See the Manual)
- a. Select VOL in the CALIBRATION menu. Press Start.
 - b. Select the ten product codes (0-9) and enter the product names and classes as recorded on the calibration report. Select "Manual" as the calibration method under each product to enter the K-Factor. K-Factors only have to be entered to three decimal places. Any digits beyond three decimal places are insignificant and will not affect the accuracy of the meter.
 - c. As each product is entered, the display returns to the Calibration menu. You must select VOL and press the START button. "Select Product Code" will be displayed. Press the > button once and the digit will begin flashing. Press the Δ button to choose the next product code. Then press START.
 - d. It is recommended that you now select ROUTE in the root menu, press START, select REPORTS and press START. Then select Calibration and again press START. Press the START button again to print the new calibration report. You should then compare it to the original report to assure all of the information is identical. Press the STOP button three times to return to the root menu.
8. Re-enter the product/system data.
- a. Select SUPERVISOR in the root menu. Press START.
 - b. Enter the Password 2000. Press START.
 - c. Follow the instructions in the manual to enter the Product Data, Time & Date, Batch, Com Ports, and Misc (next ticket number, supervisor password, multi-deliveries and truck number).
 - d. The product/system data is now entered, and you can return from the supervisor menu to the root menu by pressing the STOP button.
9. The E4000 initialization procedure is now complete, and the system is ready to make deliveries. Select ROUTE in the root menu, then DELIVERY to begin.

8. INTRODUCTION TO RESPONSIBLE RECYCLING (R2)

Purpose

This information is provided to help you properly manage used and end-of-life E4000 R2 Focus Materials, also known as FMs. FMs are materials in end-of-life electronic equipment that warrant greater care during recycling, refurbishing, materials recovery, energy recovery, incineration, and/or disposal due to their toxicity or other potential adverse worker health and safety, public health, or environmental effects that can arise if the materials are managed without safeguards.

The following are R2 Focus Materials:

1. Items containing polychlorinated biphenyls (PCB's)
2. Items containing mercury
3. Cathode Ray Tubes (CRT's) and CRT glass
4. Batteries
5. Whole and shredded circuit boards, except for whole and shredded circuit boards that do not contain lead solder, and have undergone safe and effective mechanical processing, or manual dismantling, to remove mercury and batteries.

The term recycling means the equipment is disassembled and the components – such as plastic, glass, and metals – are recovered and used to manufacture new products. Some organizations are involved in both reuse and recycling while others focus on one activity.

This manual is intended to present only general guidelines for recycling options. You may find it necessary or desirable to depart from these guidelines for convenience, to enhance productivity or safety in your organization's working environment, or in order to comply with local, state, and federal guidelines.

Options

What should be done with old electronic products? Electronic equipment should NOT be disposed of with regular garbage. Nonfunctioning electronic devices should be recycled by an organization equipped to handle them. A first step in properly managing electronic products at the end of their useful life is to look in your yellow pages under Computer Dealers-Used and Recycled; Environmental and Ecological Services; Recycling Equipment and Services; Scrap Metals; Waste Disposal-Hazardous; or Waste Disposal, Reduction and Recycling. Organizations that can provide recycling companies: International Association of Electronic Recyclers (IAER) at www.iaer.org and National Recycling Coalition (NRC) at www.nrc-recycle.org/Programs/electronics/index/htm.

Federal, state, and local regulations are subject to revision, so be sure to keep in touch with all agencies that regulate the disposal of this material so you will know if the regulations change. In the Other Resources section of this manual below, we have listed web site links to the 10 Federal Waste Management Regional Offices, the current State Waste Management Organizations, State Recycling Business Directories, and manufacturers and retailers who have committed to collecting, reusing, or recycling old electronics.

Other resources

<http://www.epa.gov/epahome/regions.htm> [the ten U.S. EPA Regional Offices]

http://www.astswmo.org/resources_stateagencylinks.htm [the State Waste Management Links]

<http://www.epa.gov/osw/conserve/rrr/rmd/bizasst/bizdir.htm> [Recycling Business Directories by State]

<http://www.epa.gov/epawaste/partnerships/plugin/partners.htm> [manufacturers and retailers who have committed to collecting, reusing, or recycling old electronics]

Materials that must be properly disposed of:

- Printed circuit boards and components, which contain silver, gold, tin, and copper
- Transformers, which contain, internally and externally, copper, lead, gold, and tin
- Small lithium battery [.4 g of lithium content]
- Metallic lead on wires, component leads, and printed circuit boards (in form of solder)

Materials that should be recycled:**Non-Hazardous Wastes & Materials – Recycling is encouraged**

- Valox resin housing and Valox resin base
- Lexan housing clear lens

9. POWER/DATA CABLE WIRE COLOR CONVERSION CHART

The power/data cable used for connecting the E4000 to the junction box was changed in 2009. The current cable contains individual wires insted of twisted pairs, and the identifying colors for the wires are different. Use the chart below to match the old twisted pair colors to those referenced in this manual.

WIRE MARKERS E4000 END	BELDEN CABLE WIRE COLORS	CAROL BRAND CABLE WIRE COLORS	WIRE MARKERS JUNCTION BOX END
1	BROWN }	RED/WHITE	1
2	BLACK }	BLACK/WHITE	2
3	YELLOW }	BLUE/WHITE	3
4	BLACK }	GREEN/WHITE	4
5	BLUE }		
6	BLACK }	BLUE	6
7	GREEN }	GREEN	7
8	BLACK }	GREEN/BLACK	8
13	RED }	ORANGE/BLACK	13
14	GREEN }	WHITE/BLACK	14
18	ORANGE }	ORANGE	+12V
	BLACK }	BLUE/BLACK	-COM
23	WHITE }	WHITE	+12V
24	BLACK }	BLACK	-COM
	RED }	RED	+24V
	BLACK }	RED/BLACK	COM
	RED }		
	WHITE }		



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