RED SEAL
MEASUREMENT

E1000
Electronic Register
for LPG Dispensers

Operation and Maintenance Manual

**ATTENTION - OBSERVE
PRECAUTIONS FOR
HANDLING ELECTROSTATIC
SENSITIVE DEVICES.**

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

Electronic devices with exposed connectors are highly susceptible to damage by electrostatic discharge (ESD). Anyone performing field service on Red Seal Measurement electronic devices must observe the following precautions.

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 electricval 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 compent.
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.

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I. Overview

Product Description

The E1000 is an electronic liquid flow register, designed for the LP Gas market, that can be mounted on the Neptune 4D LPG meter line.

Features:
- Battery operated (model E1000-B)
- 1" high, 6 digit display (resetable totalizer)
- 3/8" high, 8 digit non-resetable totalizer
- Low temperature LCD
- Units in gallons, liters or barrels (or blank)
- Low battery indicator
- Sleep mode
- NEMA 4X enclosure
- Meter mount
- Intrinsically safe protection (Class I, Division I, Group D - Ex ia T4)
- Ambient temperature range -30° to 50° C
- 0-100 Hz input pulse frequency
- 2 to 4 years without battery change, depending on usage
- 5 to 10 years with battery change and preventive maintenance

The register will count input pulses and represent them as a volume flow and total measured volume, according to the configured K factor selected. There are six different configuration menus.

Package Contents

Hardware kit includes:
- 3 seal wires
- 1 cap for configuration push button
- 2 hex bolts 1/4" x 1"
- 2 drilled hex bolts 1/4 x 1"
- 4 lock washers

Register Specifications

Physical

- Size 225 mm x 160 mm x 140 mm (8.85 in. X 6.3 in. X 5.5 in.)
- Weight 2.95 kg (6.5 lbs)
- Operating temperature: 1. non-hazardous installation, -25 to 70°C (-13 to 158°F)
                            2. hazardous installation, -30 to 50°C (-22 to 122°F)
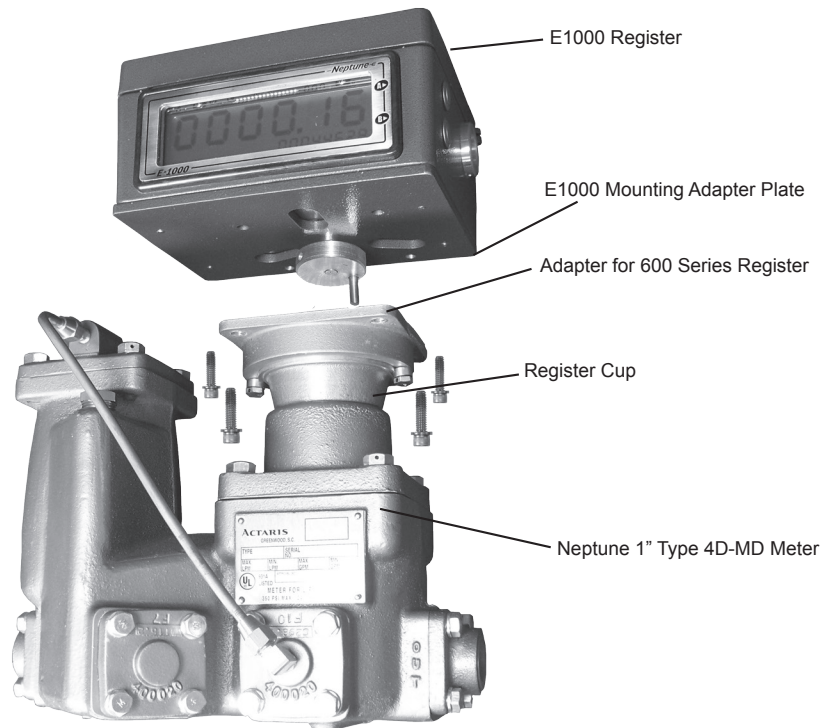- Enclosure rating NEMA 4x

Electrical

- Power rating (lithium D type battery 17AH): 3.6 VDC
- 2 year battery life
- Pulse input:
        Quadrature
        100 Hz period period
        Duty cycle 50/50 (+- 10%)
        Amplitude 5 to 20 volts
        Lo - 30 µH (negligible)
   Co - 3000 pF (negligible)
        Po - 0.05 W

II. Installation

Mechanical Installation

To install the E1000 on the 4D-MD meter, place the register onto the 600 series adapter and attach it with the 1/4" x 1" hexagonal bolts, placing the two drilled hexagonal bolts on opposite corners of the adapter. Place the register on the register cup, making sure that the transmission is engaged correctly, and attach it with the screws.
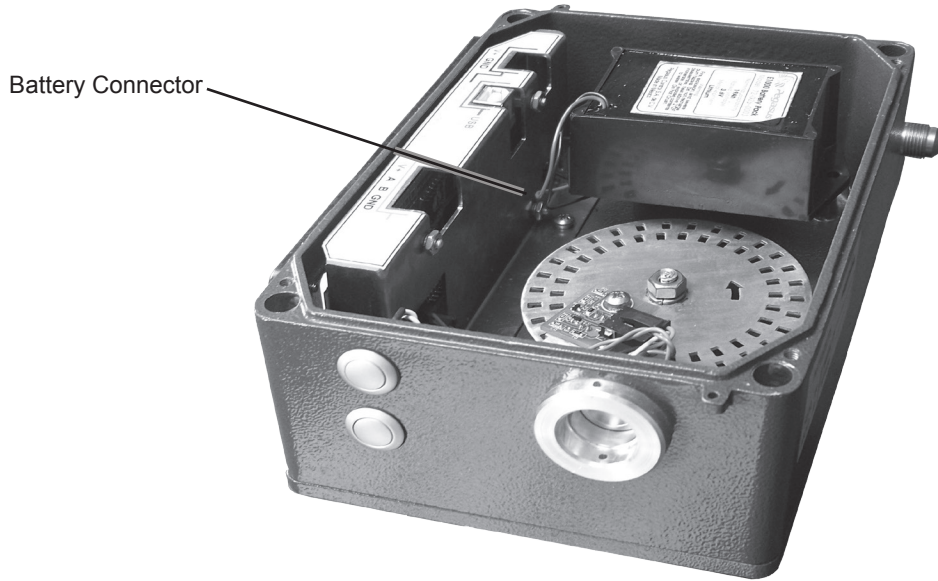

E1000 Register

E1000 Mounting Adapter Plate

Adapter for 600 Series Register

Register Cup

Neptune 1" Type 4D-MD Meter

Electrical Installation

Open the register by removing the four screws from the top cover.
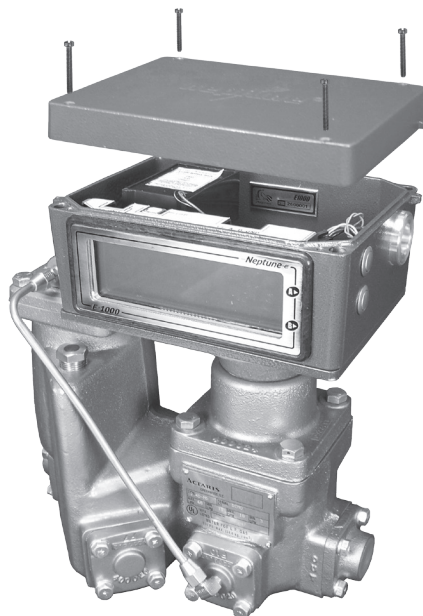
Connect the E1000 battery as shown. The red wire on the connector will be at the bottom. This will turn the equipment on.

Battery Connector

Security Seals

After configuring the register, it is necessary to install and seal the configuration button cap. The seal wire should go through the seal tabs of the box and cover from bottom to the top first and then it should go through the pushbutton mounting and the button cap drill holes from top to bottom.
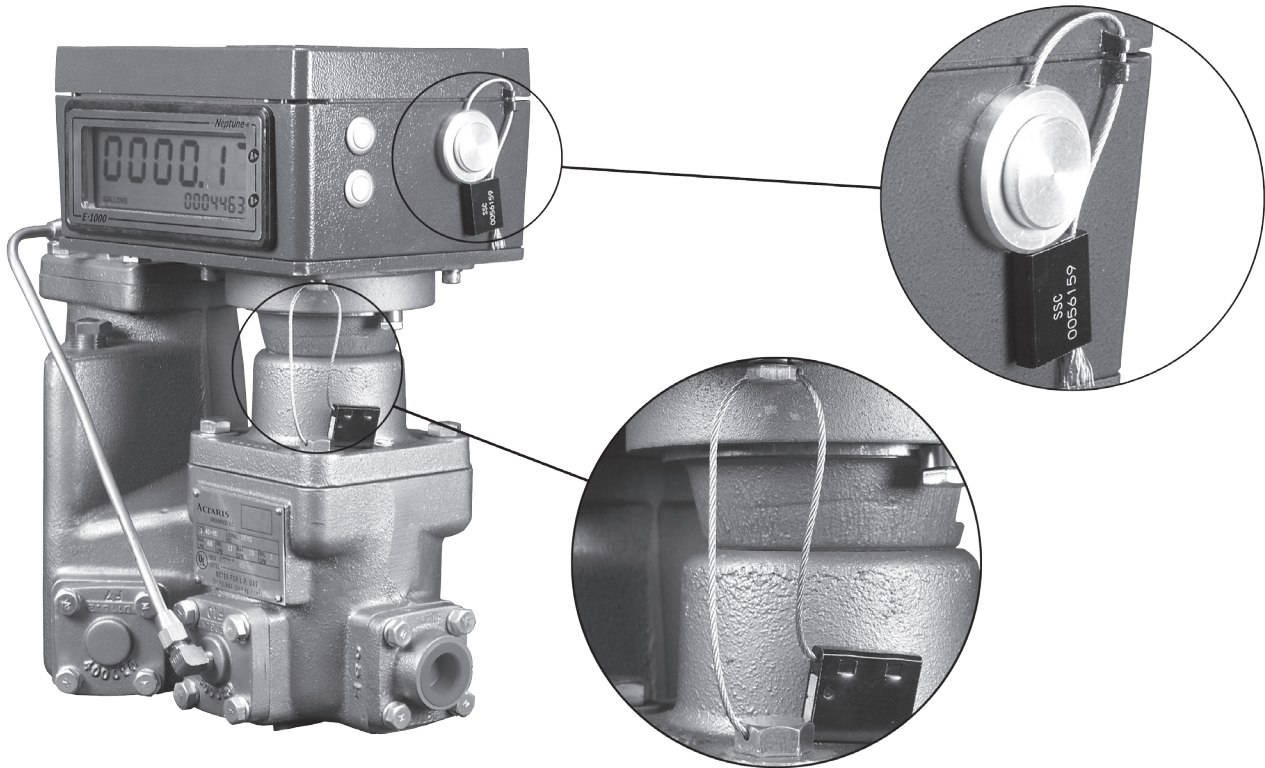
To place the seal on the adapter, insert the wire through the two drilled holes on the hexagonal screws surrounding the adapter and seal. Insert another seal wire through the remaining hole (on the other side) of the box and cover of the register.

Seal Wire (user supplied)
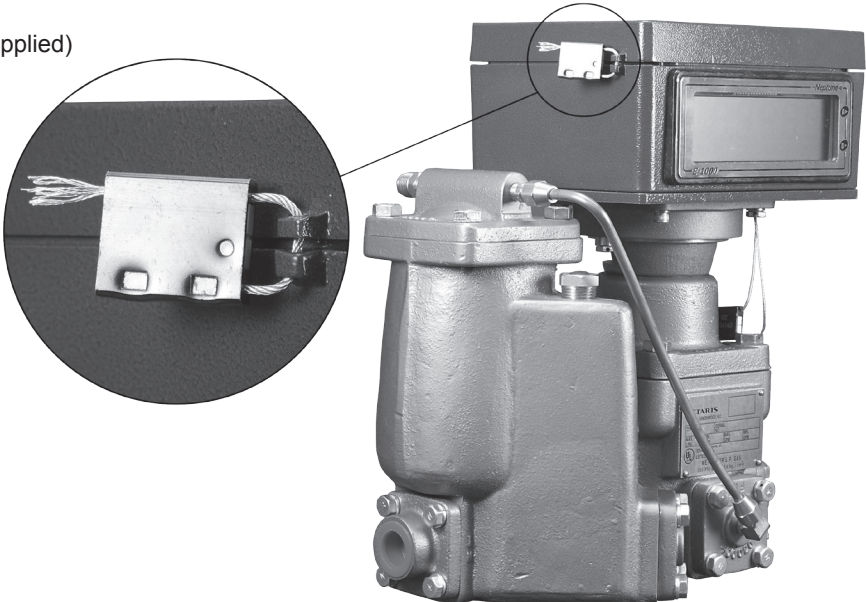
III. Operation (Delivery Mode)

1. User interface

- a. Labels area
- b. Measurement and flow rate digits
- c. Non resettable totalizer digits
- d. User buttons (A upper button and B lower button)
- e. Configuration button

2. Sleep Mode

In order to save power, the E1000 will enter a sleep mode when not in use. When in the sleep mode, no information will be visible on the display.

In the delivery mode, the E1000 will enter the sleep mode after approximately 30 seconds without operator input or product flow (pulse input). In the configuration mode, the time will be approximately 2 minutes.

The register will wake up automatically when flow (pulse input) is detected. It will assume that a new delivery has started, reset the resetable totalizer, and indicate the delivered quantity. The E1000 always wakes up in the delivery mode. It is also possible to wake up the register by pressing one of the three user buttons, A, B, or C. In this case, the quantity from the last delivery will be displayed. As always, the quantity will be reset when the A button is pressed or pulses start.

3. Measurement

The register will count input pulses and represent them as a volume flow and total measured volume according to the configured K factor.

Measurement formula: $Vm = N/K$

Vm = measured volume   N = number of pulses
K = number of pulses per one unit of measurement (K factor)

Note: The K factor is a 4 digit number with decimal point, so its value can go from 0.001 to 9999.

4. Reset to zero

There are two ways for the register to be set to zero in the measurement digits:
- Press and release button "A" when there is no flow and the delivery time-out has expired.
- Detection of flow after there has been no flow for at least the measurement time out. (See Configuration, section 5.)

5. Flow rate

a. To view flow rate during a delivery, press the B button. If there is no flow the register will switch back to the measurement display.
b. When the B button is pressed, the display will show the flow rate, to two decimal places, in the resettable totalizer area, and show the "RATE" label.

Flow Rate: *Measured volume / time = flow (in measured volume per minute)*

IV. Configuration Modes

1. In order to access the configuration menu, flow through the meter must be stopped and the time-out period elapsed.
2. Remove the security cap from the configuration button.
3. Press the configuration button to enter the configuration mode.
4. The version number of the currently installed firmware will be displayed.
5. Press the configuration button again to enter menu 1. Each further press of the button will save the currently displayed value and advance to the next configuration screen.
6. The "CONFIG" label will be flashing in all menus. The current menu parameter is indicated by a number from 1 to 7 (except for screen 4, Self Calibration)

1. K Factor

In this menu you can modify the K factor. This K factor converts pulses to measurement units. The factor can have a maximum value of 9999 and a minimum value of 0.001.

To select the digit to change, press the 'B' button. The active digit (as shown below) will be flashing. The A button will increment the selected digit with each press in the following sequence: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9. Note: Use preceeding zeroes in place of digits not used.
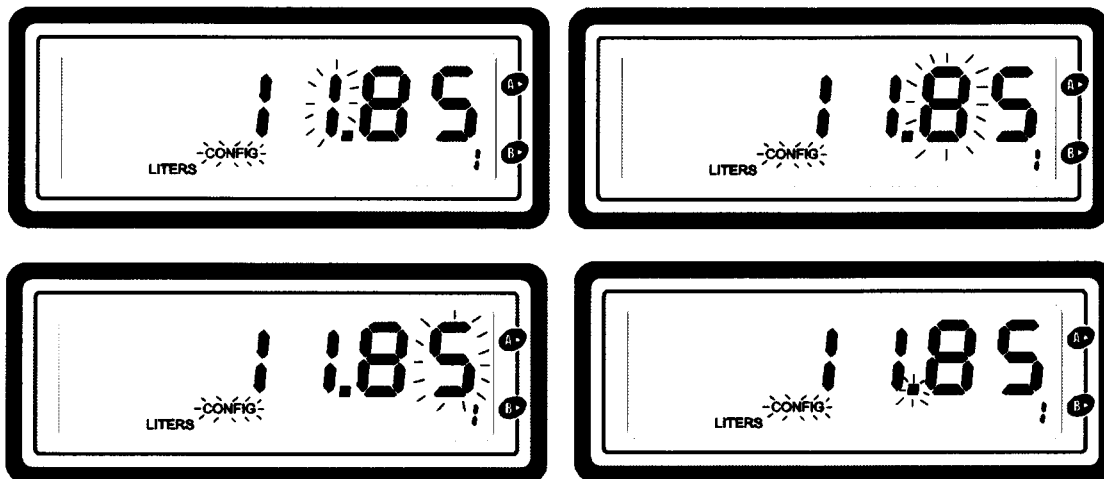
To select the decimal point position, first enter the desired K factor using the procedure above. After entering the K factor, press the B button once more. This is the first decimal point position, no decimal. This is incicated by no flashing digit and no decimal on screen. Pressing B will increment the decimal point position from left to right with each press, starting at the right of the leftmost digit.

To manually calculate a new K factor:
1. Record the current K factor (Kold)
2. Run a delivery through the E1000 and a reference system (prover, another register, etc.)
3. Use the following equation to determine adjusted K factor
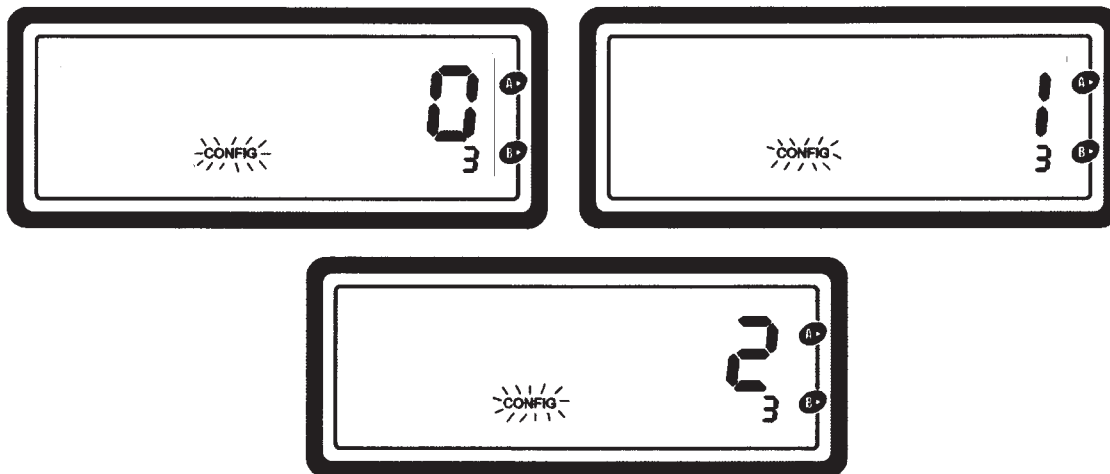
$$Knew = Ve1000/Vref \times Kold$$

2. Measurement Unit Label

In menu 2 you can select three different unit labels by pressing the A button. These are LITERS, GALLONS, BARRELS and no label.
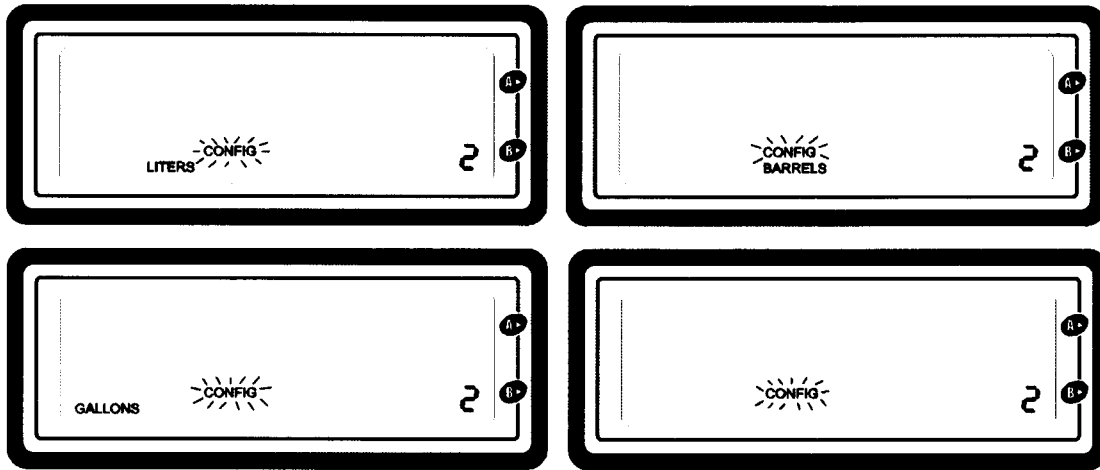
3. Decimal point position

Menu 3 allows you to set the decimal point position. Configuration can be set to zero, one or two decimal places. Press the A button to change the decimal point position.

4. Self Calibration Mode

The self calibration mode automatically adjusts the K factor according to a reference measurement.
- Start delivery while the register is in configuration menu 4 (autocalibration mode). Menu 4 is indicated by the non-resettable totalizer appearing in the bottom right corner and the "CONFIG" label flashing. The delivered amount should also be run through a reference system (another register, mass flow meter, etc.) Measured amount will be added to non resettable totalizer.
- After flow stops, wait for the first digit to begin flashing and the non-resettable totalizer to be replaced by "4" in the bottom right corner. Then input the measured reference by pressing A or B to switch between digits.
- The register will automatically calculate the new K factor when the C button (internal button) is pressed.

5. Delivery time out

The delivery time out is set in menu 5. This time is set in seconds and it is the neccesary time after flow has stopped for the register to consider that the delivery is finished. If flow stops and continues before this time has expired, measurement will still be added to the value which is still on the screen. You can configure this value from 4 to 9999 seconds. To change the digit position, press the B button. The A button will increment the selected digit by one with each press. Note: during the delivery time-out period, the manual reset button A may be disabled depending on the setting of menu #6, Reset Button Enable/Disable. When the zero button is disabled, setting the time out value arbitrarily high will force a long wait before totals can be reset.


6. Reset Button Enable/Disable

Menu 6 enables or disables the ability to reset the register total using the manual reset (A or Zero) button. If this function is enabled (En on the display), there is a 4 second delay after delivery when any button press will be ignored. After 4 seconds, pushing the button once ends the current operation (regardless of the configured timeout), but leaves the existing total visible on the screen. Any new flow will set this total to zero and start counting. Pushing the button twice will reset the display to zero if no product is flowing.
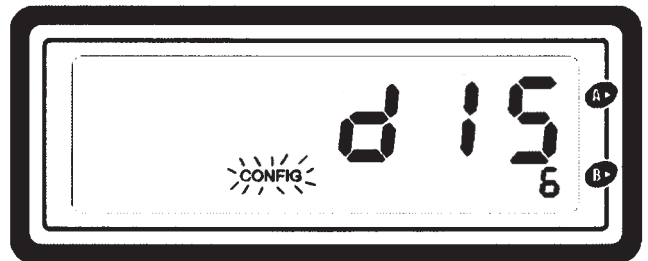
7. Turning direction

In menu 6 you can set the turning direction that the register will use to measure. You can set the direction to '0' (clockwise) or '1' (counterclockwise). To select turning direction press the 'A' button. The register will not indicate a negative quantity.
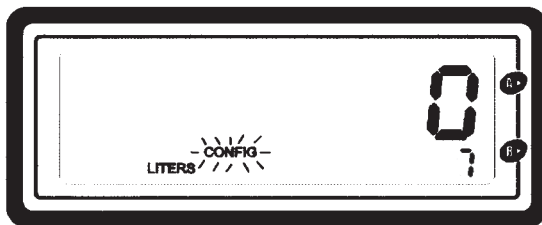
V. Miscellaneous

1. Low battery indicator

When the battery is low, the display will show a label marked "BAT", this is an indicator that the battery should be replaced soon. (See instructions for battery replacement)

2. Power save mode

After approximately 30 seconds without use in delivery mode or 2 minutes in the configuration menu, the register will go to power save mode. In this mode the register will turn the display off to save energy. Pressing any of the buttons or starting flow through the meter will turn the register back to operating mode. It will assusme that a new delivery has started, reset the resetable totalizer, and indicate the delivered quantity. The E1000 always wakes up in the delivery mode. It is also possible to wake up the register by pressing one of the three user buttons, A, B, or C. In this case, the quantity from the last delivery will be displayed. As always, the quantity will be reset when the A button is pressed or pulses start.

3. Alarms

Error reports for: problems with K-factors, pulse inputs, stored configuration parameters, non resettable total, etc. Error will be displayed by an "Err" message and a number in the non resettable totalizer, alternating with the totalizer value.

| Error	Description
Err1	Measurement error (one input channel measurement has reached a higher than 5% difference from the other)
Err2	Corrupted K factor
Err3	Corrupted decimal place
Err4	Corrupted measurement unit label
Err5	Corrupted non-resettable totalizer
Err6	Corrupted memory page
Err7	Corrupted firmware (reprogram CPU)

4. Factory reset

Factory reset can be achieved by simultaneously pressing the A, B and configuration buttons for more than 10 seconds. After 10 seconds, the entire display will start flashing approximatley once per second. After simultaneously releasing the three buttons, the register will restart with factory or "out-of-the-box" configuration.

Factory reset values are:
- K factor: 115
- Decimal place: 1 decimal
- Measurement units: gallons
- Reset time: 5 seconds
- Reset and no reset totalizer: back to zero
- Turning direction: 1 (Neptune meter)
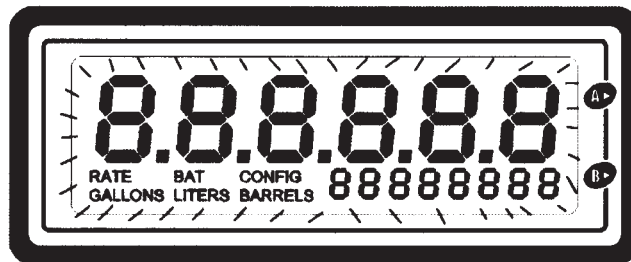
VI. Firmware Update

1. Connect the E1000 register to a PC with the USB cable. Open the register by removing the four screws from the top cover and plug the USB cable into the USB connector on the E1000. Connect the other end of the cable to the PC USB port.


2. Install the application "SetupE1000BootLoader.msi" (available from the manufacturer or distributor) on your PC following the installer's instructions.
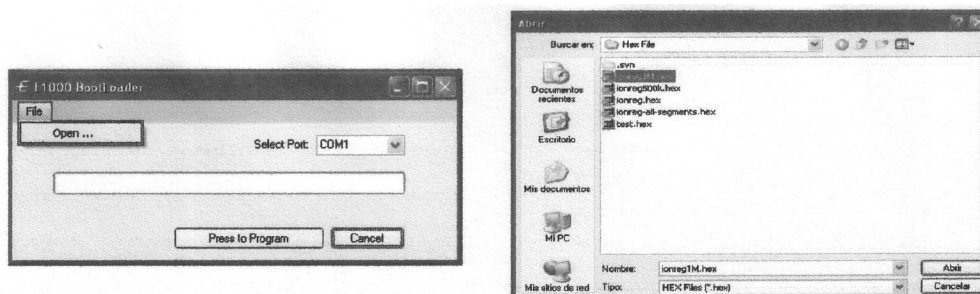
3. When installation is finished, open the E1000 Boot Loader by double clicking the shortcut icon added on the PC desktop.
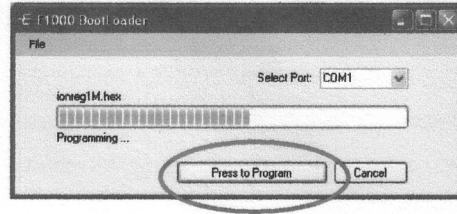

4. Select the serial port where you plugged the register (serial port is a virtual serial port which is installed when the register is connected to the PC via the USB cable).
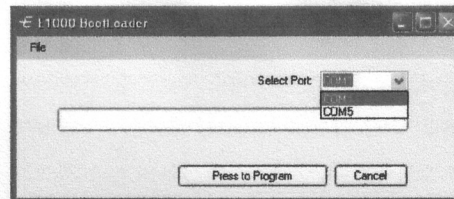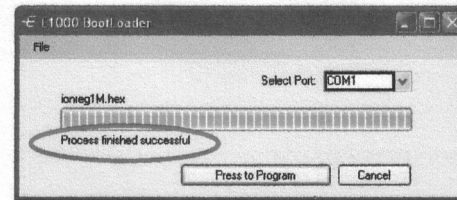

5. Click "File" then "Open" and select the programming file ending in ".hex".

6. Click the "Press to Program" button to start the programming.

7. When the programming is finished you will see "Process finished successfully."

8. Close the dialog box, unplug the cable from the register, and replace the cover with the four screws before operating the register.

VII. Maintenance and Repair

1. General Maintenance

Keep the register free of dust and grease. Make scheduled inspections to check main pieces for corrosion, moisture, or loose parts. Make sure that the wire seals are always in place. To maintain the acrylic screen in optimal condition, scratches can be removed with automotive polish.
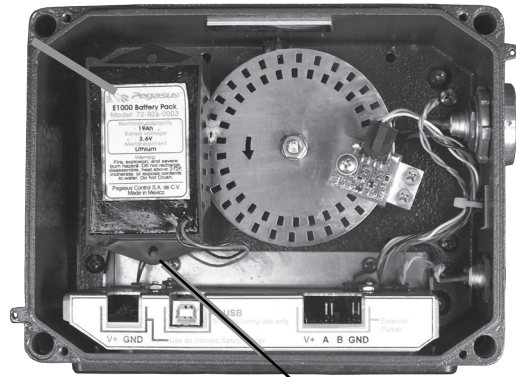
Acrylic Screen

2. Battery Replacement

When the "bat" indicator appears on the display, the battery must be replaced. For this the register must be uninstalled so that the battery replacement can be made in a non-hazardous area.

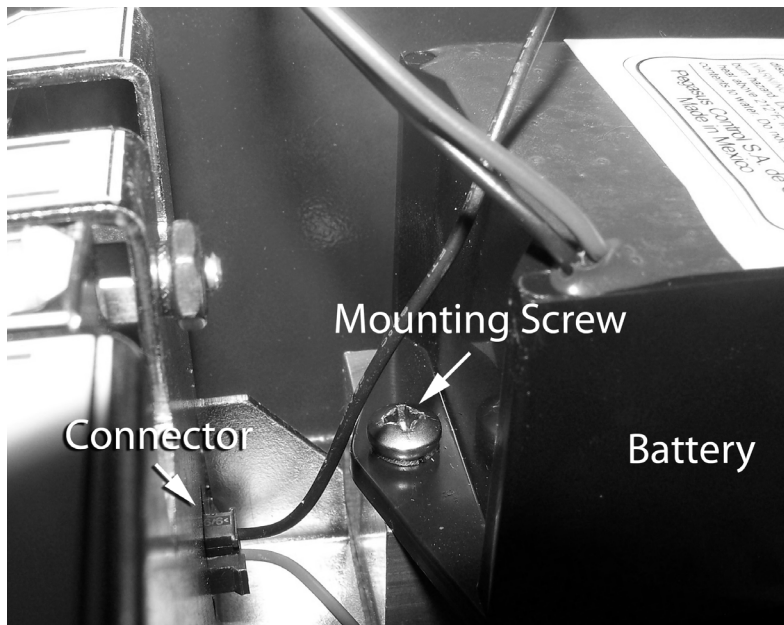1. Cut the seal wire and remove the security cap on the configuration button.
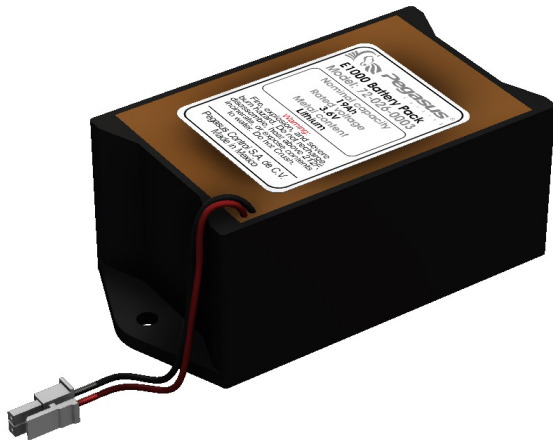
**E1000 Battery
P/N 601016-000**

Battery Connector

2. Remove the four top cover screws (9/64" hex or flat-head) and retain them.

3. Remove the top cover plate.

4. Using a small Phillips-head screwdriver, remove the mounting screws on either end of the battery and retain them.

5. Lift the battery partially out of the case and unplug the battery by depressing the latch on the side of the connector. (With the battery out of the way, this can be done by hand. If you have difficulty, you can use needle-nose pliers.)
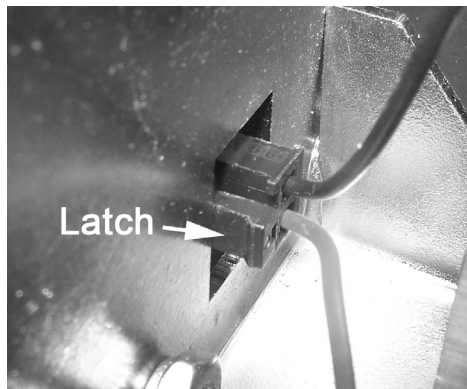
6. Remove the battery. **Warning: Take care not to puncture the battery case. Always dispose of lithium batteries properly.**

7. Install the new battery. This is easiest if the battery connection is made before screwing the battery to the mounting block. The connector should be oriented so that the latch is facing the inside of the case, with the red wire on the bottom.

8. Reattach the battery to the mounting block with the Phillips head screws.

9. Replace cover.

3. Transmission Service or Replacement

The E1000 transmission must be inspected every time the battery is changed. The transmission must not be obstructed by excess oxide or foreign material.

To disassemble the transmission for servicing, cleaning, or replacement, loosen the hex set screw of the transmission shaft drive connection and remove it from the shaft. Remove the four screws and lock washers that attach the adapter mounting plate. Remove the hexagonal machine screw nut and the lock washer that attach the optical disc, then remove the disc. Remove the transmission. To reassemble, place the optical disc in position, then the transmission. Use some Viper Lube synthetic grease (Loctite 36781) or similar on each side of the ball bearing to prevent corrosion. Attach the optical disc. Reattach the adapter plate and install the cover. The disc cannot be installed after the transmission is assembled. The arrow on the optical disc must point counter-clockwise.

E1000 TRANSMISSION
P/N 601010-008

Optical Encoder Disc

O-Ring

Optical Sensor Transmission

Mounting Adapter Plate

Transmission Shaft Drive Connection
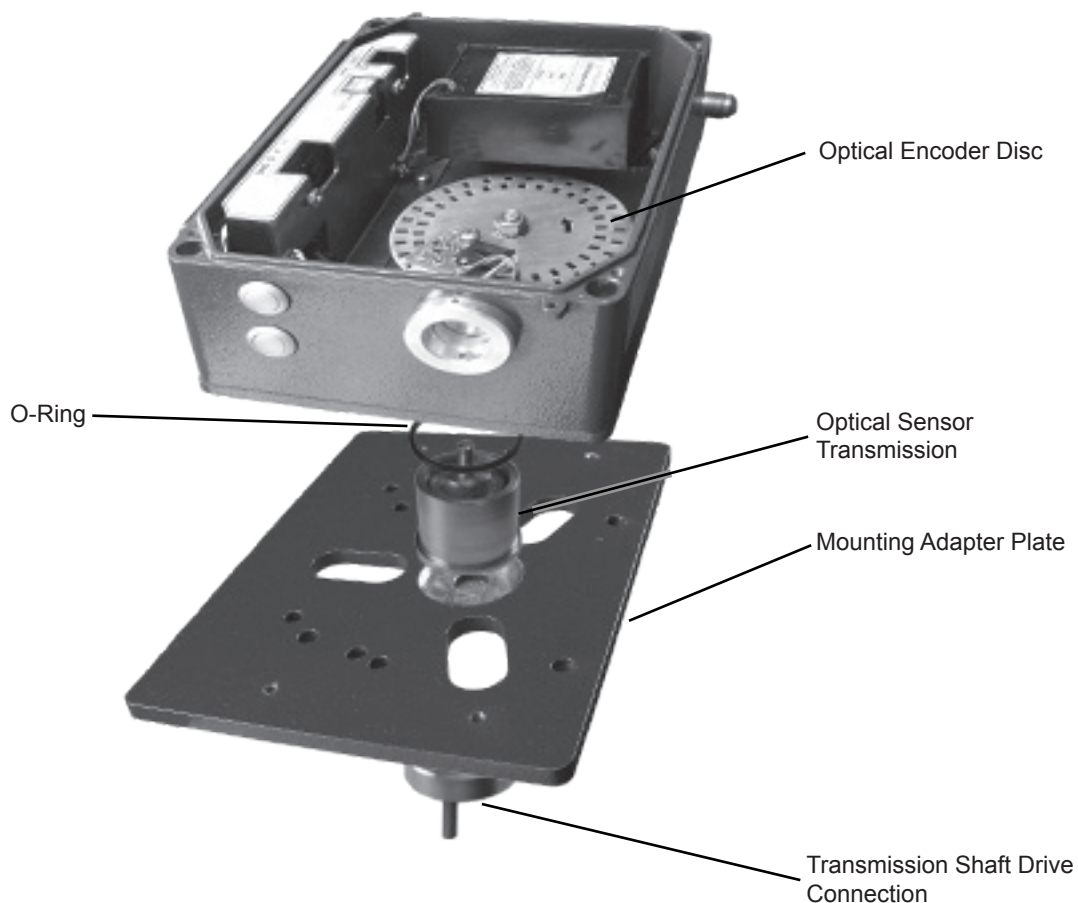
4. Display Window Replacement

Remove the screw located on the upper left. Using a flat screwdriver remove the metal frame. Beneath the metal frame you will find 3 more screws. Remove them and carefully remove the window and the adhesive that holds it in place. To install the new window, remove the protective cover from the adhesive and affix it to the new frame. Then replace the 3 screws on the bottom and upper right. Replace the metal frame with the adhesive and reinstall the last screw on the upper left corner.
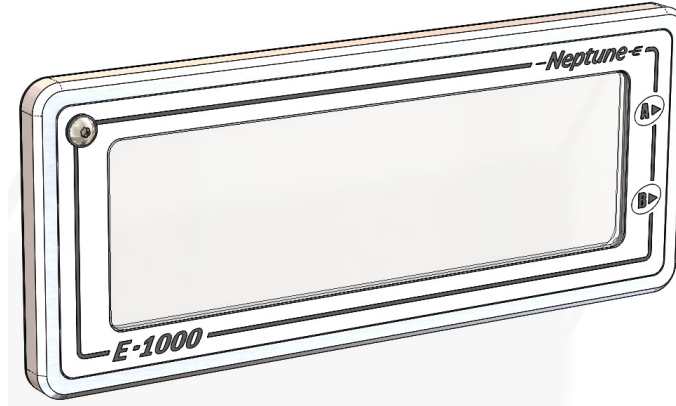
E1000 DISPLAY WINDOW
P/N 601010-003

5. CPU/Display Replacement

Disconnect all harnesses that are connected to the CPU/Display assembly (battery, button 1, button 2, configuration button, and encoder sensor harness) by pressing the levers on the connectors and pulling the harness. Remove the two screws located on the display stand, then remove the bracket and board from the equipment. Remove the 4 screws that hold the board. Replace the card and put back the 4 screws, being careful not to overtighten them. Place the stand with the CPU inside the equipment and hold it with 2 screws. Connect the wiring harnesses – button 1 (yellow harness) on the upper left connector, button 2 (orange harness) on the lower left connector, sensor harness at the middle connector, and configuration button (purple harness) at the right side connector.
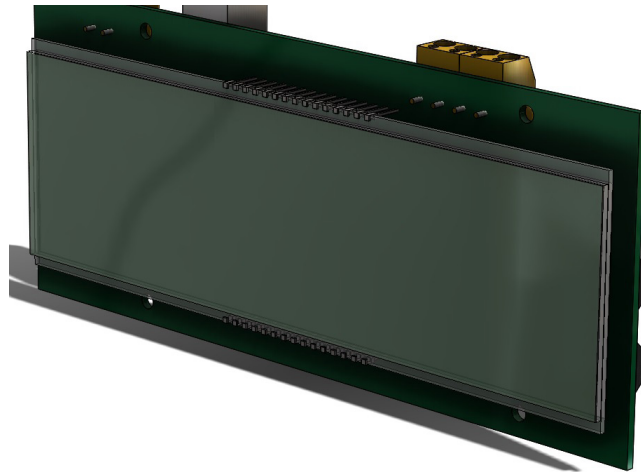
E1000 CPU/DISPLAY
P/N 601010-001

6. Encoder Sensor Replacement

Remove the two screws that hold the encoder, Remove the encoder´s harness by pressing the connector lever on each side of the harness. Then replace the encoder and put the encoder´s harness in its original location, ensuring that the colors black, blue, yellow and orange are at the top of the encoder. Place the sensor and tighten the screws.
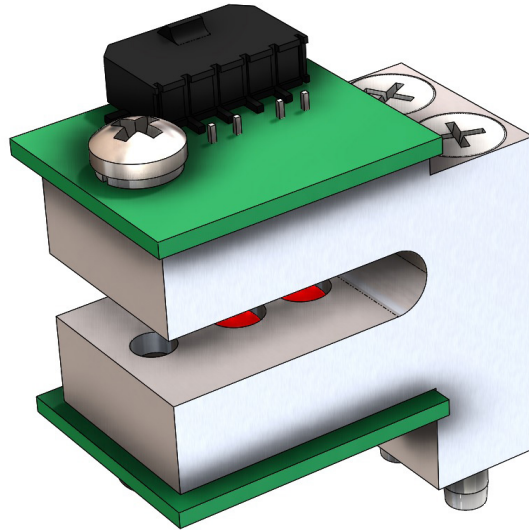
E1000 ENCODER SENSOR
P/N 601010-002

7. Encoder Connector Replacement

Remove the encoder harness by pressing the connector lever on each side of the harness. Replace the damaged encoder with a new one and reposition the harness again, making sure that the connector with black/blue/yellow/orange wires is at the top of the encoder. Connect to the middle of the three connectors on the left side of the CPU card.
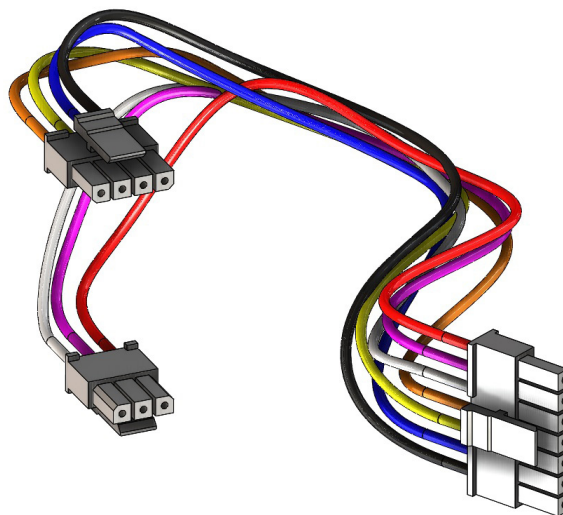
E1000 ENCODER CONNECTOR
P/N 601010-007

8. Button 1 (Zero Button) Replacement

Press the connector lever and pull the harness. Loosen the nut holding the button to the equipment. Remove the old button and cable assembly. Place the new button into the case and affix it with the nut. Reinstall the button harness on the CPU upper left connector, making sure that the orientation of the lever coincides with the notch in the connector on the CPU board.
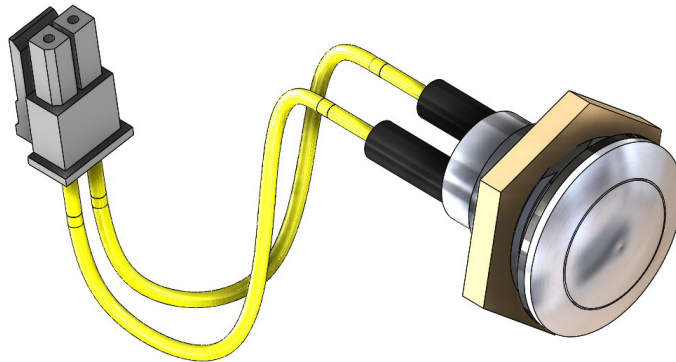
E1000 BUTTON 1
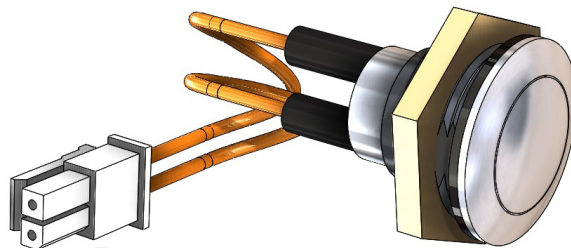**P/N 601010-005**

9. Button 2 (Rate Button) Replacement

Press the connector lever and pull the harness. Loosen the nut holding the button to the equipment. Remove the old button and cable assembly. Place the new button into the case and affix it with the nut. Reinstall the button harness on the CPU lower left connector, making sure that the orientation of the lever matches the notch in the connector on the CPU board.

E1000 BUTTON 2
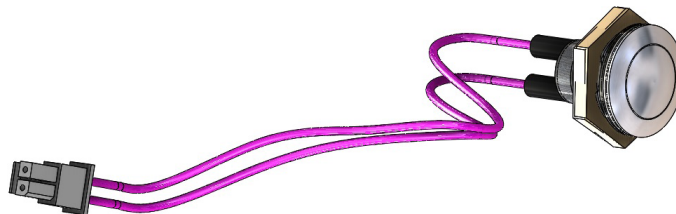**P/N 601010-006**

10. Configuration Button Replacement

Press the connector lever and pull the harness. Loosen the nut holding the button to the equipment. Remove the old button and cable assembly. Place the new button into the case and affix it with the nut. Reinstall the button harness on the CPU right side connector, making sure that the orientation of the lever matches the notch in the connector on the CPU board.
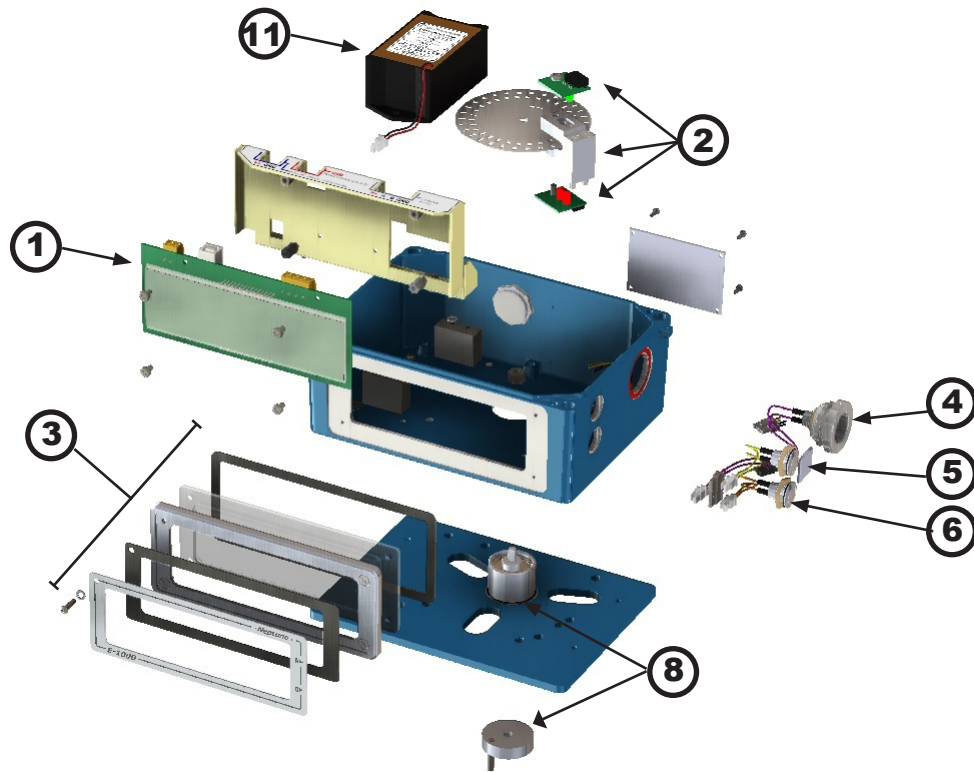

E1000 CONFIGURATION BUTTON
P/N 601010-006

VIII. Service Parts

1. **601010-001 – CPU/Display**
2. **601010-002 – Encoder**
3. **601010-003 – Display Window**
4. **601010-004 – Configuration Button and Connector**
5. **601010-005 – Button 1 and Connector (Zero)**
6. **601010-006 – Button 2 and Connector (Rate)**
7. **601010-007 – Encoder Wiring Harness (not shown)**
8. **601010-008 – Transmission**
9. **601015-000 – Accessory Kit (2 Sealing Wires, 4 Bolts, 4 Lock Washers, Config Cap)**
10. **601015-001 – Sealing Wire (not shown)**
11. **601016-000 – Battery Pack**

IX. Troubleshooting

Problem	Most common causes	Solution
Blank display	Battery not connected or wrongly connected	Connect the battery
	Low battery (2.5V minimum voltage in pulser, Black and Orange cable on the pulser harness)	Change the battery (See page 15: Battery replacement)
	External power supply voltage incorrect (12VDCmin, 30VDCmax)	Check the voltage of power supply
	CPU has a problem	Change the CPU (See page 18: CPU replacement)
Register not counting	No Flow	Check that the valves are open and product is flowing
	Turning direction is incorrect	Change the turning direction setting
	The pulser harness disconnected or has a bad connection	Check the continuity of each wire of the pulser harness
		Connect the pulser harness correctly
	The pulser harness is damaged	Change the pulser harness (See page 19: Encoder sensor replacement)
	Pulser not receiving the appropriate voltage (2.5V minimum voltage in pulser, Black and Orange cable on the pulser harness)	Check that the battery is wired correctly; change the battery. (See page 19: Battery replacement)
	The pulser does not work (2.5V minimum voltage in pulser, Black and Orange cable on the pulser harness, the pulser harness not have problems)	Change the Encoder (See page 19: Encoder sensor replacement)
Unable to access configuration mode	Product is flowing	Stop flow through the meter
	Not completed the necessary time pressing the button to enter the menu	Press the button the time that is configured as a "Delivery time out" (5 sec at the factory settings)
	Button or button wiring harness is disconnected	Check and reconnect the button wiring harness
	Button or button wiring harness is damaged	Change the button or button wiring harness (See page 20: Button 1 or 2 replacement)
	The CPU is damaged	Change the CPU (See page 18: CPU replacement)
A or B buttons do not work	Button or button wiring harness is disconnected	Check and connect the button harness
	Button is damaged	Change the button (See page 20: Button 1 or 2 replacement)
	The CPU is damaged	Change the CPU (See page 18: CPU replacement)
Inaccurate registration	Pulser not receiving the appropriate voltage (2.5V min).	Change the battery.
	The equipment has not been calibrated	Calibrate equipment
Display shows Err7	Corrupted firmware	Reprogram CPU

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