ELECTRONIC DIGITAL FLOW METER

OPERATION AND
SERVICE GUIDE
O-2175
AUGUST 1994

GENERAL INFORMATION

This manual will assist you in operating and maintaining your meter. It is designed and written with you in mind. Please take a few moments to acquaint yourself with the information contained here.

If you need assistance, contact the dealer from whom you purchased your meter.

If You Measure In Liters!
This manual commonly refers to "gallons." If your meter is factory calibrated in liters, consider all references to "gallons" apply equally to "liters." The model number of your meter specifies "GM" for gallon Factory Calibration and "LM" for liter Factory Calibration.

NOTE: If your meter is factory calibrated in gallons, you can field calibrate in liters, and vise-versa.

This symbol is used throughout the manual to call your attention to safety messages.

Warnings alert you to the potential for personal injury.

Cautions call your attention to practices or procedures which may damage your meter.

Notes give you information that can improve efficiency of operations.

It is your responsibility to make sure that all operators have access to adequate instructions about safe operating and maintenance procedures.

Read Me!

For your safety, review the major warnings and cautions below before operating your meter.

1. This meter is approved to handle only fluids which are compatible with the meter's housing material.
2. When metering flammable liquids, observe precautions against fire or explosion.
3. When handling hazardous liquids, always follow the liquid manufacturer's safety precautions.
4. Always dispose of used cleaning solvents in a safe manner according to the solvent manufacturer's instructions.
5. During meter removal, liquid may spill. Follow the liquid manufacturer's safety precautions to clean up minor spills.
6. Do not blow compressed air through the meter.
7. Do not submerge the meter.
8. Do not allow liquids to dry inside the meter.
9. Do not use a wrench to install plastic meters. Hand tighten only.
10. For best results, always verify calibration before use.

INTRODUCTION

Your Electronic Digital Meter (EDM) is designed for measuring liquids. The meter translates pulse data from the turbine into calibrated flow units shown on the meter's readout. Field replaceable batteries provide power.

All meters are tested and factory calibrated before shipping.

This manual refers to One Inch meters. Refer to the Specifications Section at the end of this manual.

BEFORE INSTALLATION

Upon receipt, examine your meter for visible damage. Remove protective plugs and caps for a thorough inspection. If any items are damaged or missing, contact your distributor. To ensure your warranty is registered, complete and return the enclosed warranty card.

Make sure the meter model meets your specific needs. Refer to the Specification Section and confirm the following:

1. Your flow rate is within the limits of your model.
2. Your liquid is compatible with your meter's material.
3. Your system's pressure does not exceed the meter's maximum pressure rating.

QUICK START

If your installation is relatively simple and you have installed our EDM meters before, you may use this section to quickly install and operate your meter. This section is especially helpful to those measuring thin viscosity fluids dispensed through a hose and nozzle.

If you complete this section and encounter difficulties, please refer to other sections, as necessary.

NOTE: To accommodate different installations, the faceplate can be rotated 180 degrees. To do this, remove the four corner screws from the face of the meter and lift the computer assembly from the turbine. Rotate the computer assembly 180 degrees. Place on the turbine ensuring the gasket or O-ring is fully seated. Secure the four screws.

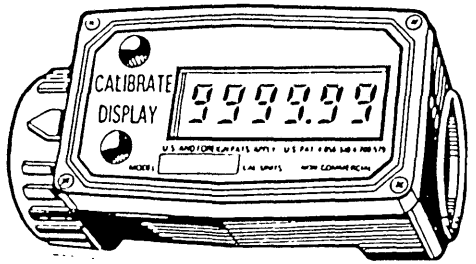
Connections

1. To protect against leakage, make sure all threads are sealed with two or three turns of Teflon® tape or a sealing compound compatible with the liquid being metered. (Figure 1)

Figure 1

2. Make sure the Teflon® tape or sealing compound does not interfere with flow.
3. Make sure the arrow on the outlet is pointing in the direction of the flow. (Figure 2)

Figure 2



4. Tighten the meter onto the fittings. Use a wrench only on metal meters. Hand tighten plastic meters.

CAUTION: Using a wrench on plastic meters could damage the meter.

Verify Meter Accuracy

Before using, you should check the meter's accuracy and verify calibration.

1. Make sure there is no air in the system by starting the flow until it runs steadily. Then, stop the flow using a valve or nozzle.
2. If desired, hold down DISPLAY for three seconds to zero the meter's Batch Total. When zeros appear, release the button.
3. Meter an exact known volume into an accurate container. For best results, meter with one continuous full stream.
4. Check the readout. If the amount metered is accurate, field calibration is not necessary. If not, refer to the Calibration Section for further instructions.

Using the Meter

The meter turns on automatically when fluid flow starts and, to conserve power, turns off automatically a few minutes after flow stops.

The meter can also be turned on manually by pressing and releasing the DISPLAY button.

If you wish to know the exact volume measured with each use, use the Batch Total function. You can zero the Batch Total before measuring and monitor volume as it flows through the meter, just like the gas pump at the service station as you fill up your tank.

To zero the Batch Total, make sure the meter is on. Hold down the DISPLAY button for three seconds until zeros appear. Release the button, start the flow, and watch the volume on the readout.

NOTE: If LOCKED appears on the readout, the Cumulative Total is displayed. It cannot be manually zeroed. To select the Batch Total, press and release DISPLAY until LOCKED does not appear on the bottom line.

If the numbers in the readout are dim or fading, the batteries need replacement. Refer to the Maintenance Section for more details.

INSTALLATION

Review the Before Installation and Quick Start Sections above. Also consider the following recommendations, especially if you are installing your meter in a piping system. These suggestions will help maximize performance of your meter.

The meter can be mounted either vertically or horizontally. It should be field calibrated in the same orientation in which it is mounted.

Avoid installing the meter in electrically "noisy" environments. If installed within six inches (15.2cm) of large motors, relays, vehicle ignition systems, or transformers, the meter's accuracy can be adversely affected.

To avoid pulsation or swirl, use the following recommendations.

For One Inch Meters, install with

- 20 inches (51cm) of straight pipe upstream and
- 5 inches (13cm) of straight pipe downstream.

Flow straightening vanes installed upstream from the meter can reduce the upstream pipe length.

Flow control valves upstream from the meter and within the straight pipe distances given above can adversely effect meter accuracy. This is especially true when measuring liquids with low vapor pressures such as fuels, oils, and solvents.

If cavitation effects meter accuracy, a flow control valve on the downstream side of the meter can provide a back pressure of 5 to 50 PSI (0.3 to 3.4 bar) to minimize the problem.

Foreign material in liquid can clog the meter's rotor. If the problem affects meter accuracy or material coats the rotor, install screens to filter the incoming flow.

- For One Inch or Two Inch Meters use a 350 micron or .015 inch screen.

For maximum accuracy, the velocity profile of the flow entering the meter must be uniform throughout the cross section of the pipe.

OPERATIONS

All meter operations are reflected in the readout on the face of the meter.

The readout contains three lines of information. They are generally defined as follows:

- the top line identifies the calibration curve,
- the middle line reflects flow information, and
- the bottom line shows information from the totalizer.

The words or "flags" that display on the top and bottom line further identify specific information.

Turn On
The meter is on when any display is present. It turns on automatically when liquid flows through the meter. It can be turned on manually by pressing and releasing the DISPLAY button.

Turn Off
The meter turns off automatically approximately four minutes after flow stops. When the meter is off, the readout is blank.

Batch and Cumulative Totals
Total flags are displayed on the bottom line. There are two types of totals: Batch Total and Cumulative Total.

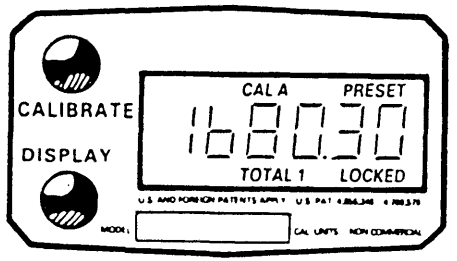
A Batch Total indicates flow during a single use. It is the total liquid metered since the last manual clearing of this total. For example, the Batch Total indicates when you have metered 20 gallons of diesel into your truck's tank (like the pump at the gas station).

Batch Total is labeled with TOTAL followed by a number. On most models this is TOTAL 2.

The Cumulative Total is the total of all liquid measured since the meter's power supply was connected. At your first use, the Cumulative Total is not zero because of calibration at the factory.

The Cumulative Total is labeled with TOTAL followed by a number and **always** flagged with the word LOCKED indicating that this total is locked and cannot be manually zeroed. (Figure 3)

Figure 3



Select Totals
To change between totals, press and release DISPLAY.

NOTE: Generally, readout displays change when buttons are **released**.

Clear Batch Total
Make sure the Batch Total is displayed. To clear, press and hold DISPLAY for three seconds or until the readout changes to zeros.

Clear Cumulative Total
Cumulative Totals are zeroed only when batteries are removed or go dead or when the Cumulative Total reaches the maximum value of 999,999.

Calibration Curves
Calibration Curve information is shown on the top line of the readout. There are two types of calibration curves: Field Calibration and Factory Calibration.

A Field Calibration Curve is set by the user. It can be changed or modified at any time using procedures given in the Calibration Section.

If a Field Calibration has not been completed, the meter uses the Factory Calibration.

A Factory Calibration Curve is "preset" by the manufacturer and stored permanently in the meter's computer. Factory Calibration curves display PRESET on the top line.

Select Calibration Curves

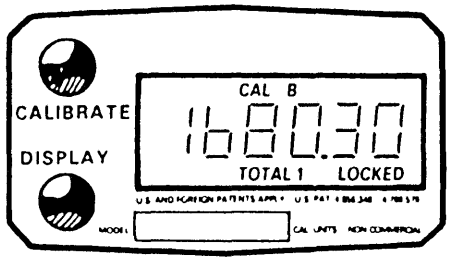
To change between a Field Calibration curve and a Factory Calibration curve, hold CALIBRATE down while pressing and releasing DISPLAY. When the desired calibration curve appears, release both buttons.

NOTE: In this case, the CALIBRATE button acts like a "Shift" key on a typewriter, shifting the operations of the DISPLAY button to change the top line of the readout.

Field Calibration is labeled with CAL followed by a letter. On most models this is CAL B.

Factory Calibration is CAL followed by a letter and **always** flagged with the word PRESET. In most models, Factory Calibration appears as CAL A PRESET. (Figure 4)

Figure 4



Flow Rate Feature

All models include a Rate of Flow display, as opposed to the usual flow volume.

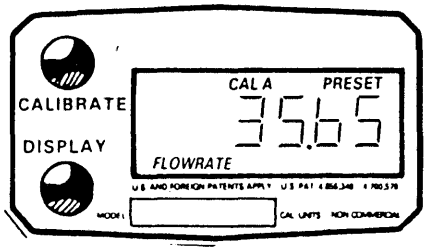
When this feature is activated, the word FLOWRATE displays to the left on the bottom line.

When FLOWRATE is displayed, the numbers on the middle line reflect the rate of flow, for example, the current gallons per minute (GPM) or liters per minute (LPM).

Display FLOWRATE

To use this feature, press and release DISPLAY until FLOWRATE appears to the left of the bottom line. (Figure 5)

Figure 5



Propeller

Any time liquid flows through the meter, a small propeller displays on the left of the bottom line.

"NO" Flag

The NO flag displays on the left of the top line when particular conditions have not been met during calibration procedures. Full definition of this flag is given in the Calibration Section.

While the NO flag displays, normal flow does not register on the meter. To resume normal flow counting, either exit Calibration mode or complete a successful Field Calibration as detailed in the Calibration Section.

Normal Precautions

Check the following items frequently to insure proper operation and measurement.

1. Make sure there are no leaks in the connections. To seal leaks, remove and inspect the meter and replace the Teflon® tape or sealant. Refer to the Troubleshooting Section.

2. A dim or fading readout indicates loss of power. To restore power, replace the batteries and check for corrosion on the battery terminals. Refer to the Maintenance Section.

3. Verify meter accuracy before use. To do this, measure a known quantity of liquid into a calibration container and compare the volume measured against the readout. If necessary, field calibrate the meter. Refer to the Calibration Section.

4. To ensure accurate measurement, remove all air from the system before use. To purge the system of air:

   a. Open the discharge valve or nozzle and allow fluid to completely fill the system. Make sure the stream is full and steady and no air is present.

   b. Close the discharge valve or nozzle. Leave the system on.

   c. Start normal operations. If necessary, zero the Batch Total.

⚠ !!! WARNING !!!

If handling hazardous liquids, always follow the liquid manufacturer's safety precautions. Wear protective clothing such as goggles, gloves, and respirators as instructed.

⚠ !!! WARNING !!!

When metering flammable liquids, observe precautions against fire or explosion. Do not meter in the presence of any source of ignition including running or hot engines, lighted cigarettes, or gas or electric heaters.

CALIBRATION

The two types of calibration are Field Calibration and Factory Calibration. These are defined in the Operations Section directly above. This section deals with the Field Calibration specifics and procedures. It also gives more specific information about Factory Calibration.

Field Calibration is necessary when Factory Calibration accuracy is not acceptable.

Factory Calibration is completed with thin viscosity liquid. If you are dispensing liquid which has a different uniform viscosity, a one-point Field Calibration can improve meter accuracy.

Up to five points can be calibrated on each calibration curve. This "multi-point" Field Calibration improves accuracy when operating characteristics (usually flow rate) are not uniform, for example, if you plan to measure a flow rate which varies from 5 GPM to 25 GPM.

Calibration Container

The desired calibration container should be uniformly dependable and constructed with a graduated neck. The container's volume indicator should be clearly and precisely marked. It is helpful if the container's material allows a window through which the level of liquid can be viewed. The factory has designed a calibration container for calibrations of five gallon or five liter quantities recommended for Low Flow and One Inch Meters.

Before Beginning Field Calibration

For successful Field Calibration, please review the following before beginning.

For most accurate results, dispense at full flow. Quickly start and stop a full flow as many times as necessary to reach the exact designated volume. Do not "choke" or "trickle" the flow to reach the exact volume.

Use an accurate calibration container.

Meet the meter's minimum requirements for calibration volume.

- One Inch Meters require 5 gallons or 5 liters of minimum volume.

Meet the meter's minimum requirements for flow rate.

- One Inch minimum calibration flow rate is 3 GPM (12 LPM).

If the meter's minimum volume and flow rate requirements are not met during the Field Calibration procedures, the meter blinks "NO" when you try to exit Calibration Mode and you must calibrate again.

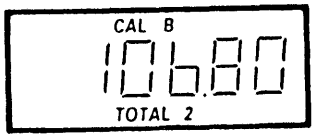
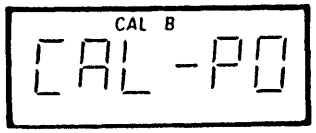
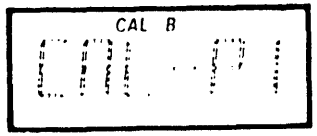
Use the correct button sequence during the calibration procedure.

Install your meter on your system according to the Installation instructions given earlier in this manual.

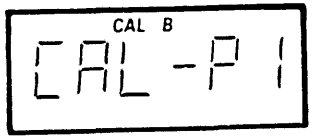
Immediately prior to calibration, purge the system of air by turning on the system and dispensing until the flow stream is full and steady. Stop the flow, but leave the system running.

Calibration Procedure

These Field Calibration procedures are recommended when the Factory Calibration is not appropriate for your measurement needs.

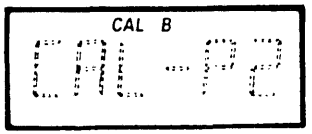
Your Action	Troubleshooting
1. Select the Field Calibration curve you wish to calibrate. Hold down CALIBRATE while you press and release DISPLAY until a CAL displays without the PRESET flag. 	
2. Enter Calibration mode by holding down CALIBRATE. Then hold down DISPLAY for approximately three seconds until CAL-P0 appears on the readout. 	*If CAL-P0 does not appear after a few seconds, you're probably in a Factory Calibration curve. Try Step 1. Remember, PRESET denotes a Factory Calibration curve which you cannot calibrate.*
3. Release both buttons. CAL-P1 blinks on the readout. 	*If you wish to exit Calibration Mode now, hold down CALIBRATE and press and release DISPLAY once. You will return to the normal readout and the old calibration curve information is retained in your meter.*

4. To calibrate the first or only point, press and release CALIBRATE. CAL-P1 stops blinking and remains on the readout.



5. Dispense five units (gallons or liters) into a calibration container using a full flow technique. When the calibration container is full, quickly stop the flow.

6. Press and release CALIBRATE or [illegible] to complete calibration of the first point. The meter responds by blinking CAL-P2.



If you are doing a one-point calibration curve, you are finished with the calibration procedure and need to continue with Step 7 below.

The blinking CAL-P2 indicates the meter is prompting you for the second point in this curve. If you want to calibrate additional points, return to Step 4 above and calibrate up to five points. Use a different flow rate with each calibration point. After the fifth point is accepted, the meter automatically returns to normal operations.

7. To accept this one calibration point and return to normal operations, hold down CALIBRATE while you press and release DISPLAY once.

   If the calibration was completed successfully, the meter will return to the normal display with a TOTAL flag on the bottom line.

If NO is blinking on the left side of the top line, the calibration point was not accepted by the computer. Try again starting with Step 2 above. Increase flow rate or volume as necessary. Make sure to use the correct button sequence.

If the readout flashes NO and you do not wish to try again, go back to Step 2 above and continue to the exit option in Step 3.

Factory Calibration

Factory Calibration curves are set at the factory for measuring liquids in gallons or liters and always display PRESET on the readout. This calibration is permanently stored in the meter's computer and provides calibration information for the meter unless Field Calibration is completed.

MAINTENANCE

During daily use, these meters are virtually maintenance-free.

It is important, however, that the meters be kept free of liquids when not in use for extended periods of time to prevent drying of liquids on the internal components. If liquids have dried and caked on the rotor, see the Cleaning instructions below.

Beware of a dim or fading readout. This condition indicates potential battery failure. See the Battery instructions below.

Batteries

Your meter is equipped with field replaceable lithium batteries which provide power for approximately 2,000 hours of actual use. Replacement batteries can be ordered from the factory.

If the meter's readout should become dim or blank, it is an indication that the batteries should be replaced.

When batteries are disconnected or fail, the Batch and Cumulative Totals return to zero.

Factory and Field Calibrations are *not* lost when batteries are replaced or power is lost. They are saved in the meter's computer and are available after new batteries are installed. You do not need to repeat Field Calibration.

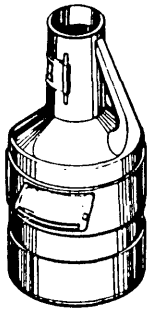
Check the batteries and terminals at least every year to ensure proper operation. It is strongly recommended that terminals be cleaned annually.

NOTE: Batteries can be replaced without removing the meter from the hose or pipe.

To replace batteries or clean terminals:

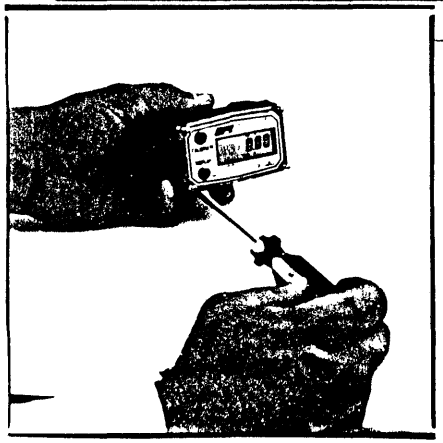
1. Remove the corner screws from the face of the meter and lift the computer assembly from the turbine.
2. Remove the batteries. (Figure 7)

Figure 7



3. If necessary, clean any corrosion from the battery terminals.
4. Place the batteries in position, ensuring the positive posts are positioned correctly. (Figure 8)

Figure 8



When the batteries are installed correctly, the computer powers on automatically. Check the readout to make sure normal meter functions have resumed before assembling again. If necessary, seat the batteries again.

5. Place the computer assembly on the turbine. Make sure the gasket or O-ring is fully seated to avoid moisture damage. Secure with the four screws.

o Remove

⚠ !!! WARNING !!!

During meter removal, liquid may spill. Follow the liquid manufacturer's safety precautions for clean up of minor spills.

1. Ensure all liquid is drained from the meter. This could include draining the hose, meter, nozzle, or pipe.
2. Wearing protective clothing as necessary, loosen both ends of the meter. Use a wrench only on the meter's flat metal surfaces.

CAUTION: Using a wrench on plastic meters could damage the meter.

3. If the meter is not immediately installed again, cap the hose end or pipe to prevent spills.

To Clean

During use, the meter should be kept full of liquid to ensure that drying does not occur inside the meter. If drying or caking should occur, the rotor will stick or drag, affecting accuracy. In this circumstance, cleaning is required.

To determine if the rotor is stuck or dragging, gently blow air through the meter and listen for the quiet whir of the rotor.

CAUTION: Never blow compressed air through the meter. It could damage the rotor.

To clean a stuck or dragging rotor, follow the procedures below.

1. Remove the meter from the hose or pipe following the directions above.
2. Apply a penetrating lubricant such as WD-40 or a recommended cleaning solvent on the turbine's rotor, shaft, and bearings. Allow it to soak for 10 to 15 minutes.

CAUTION: Do not submerge the meter.

3. Carefully remove residue from the rotor using a soft brush or small probe such as a screwdriver. Be careful not to damage the rotor and support.

⚠ !!! WARNING !!!

Follow the liquid manufacturer's instructions for the disposal of contaminated cleaning solvents.

4. When the rotor turns freely, install it again following the Installation instructions given earlier in this manual.

To Store

After thoroughly cleaning the meter, store it in a dry location.

SYMPTOM	PROBABLE CAUSE	CORRECTIVE ACTION
A. METER IS NOT ACCURATE	1. Field Calibration not performed properly	Field calibrate again or select Factory Calibration.
	2. Factory Calibration not suitable for liquid being measured	Perform a Field Calibration according to Calibration Section.
	3. Meter operated below minimum flow rate	Increase flow rate. See Specifications Section
	4. Meter partially clogged with dried liquid	Remove meter. Clean carefully with WD-40 or similar penetrating lubricant. Make sure rotor spins freely.
	5 Turbine bearings partially clogged with dried liquid	Remove meter. Lubricate bearings with WD-40 or similar penetrating lubricant through small holes in turbine supports. Make sure rotor spins freely.
	6. Teflon® tape or other material wrapped around rotor	Remove meter. Clear material from rotor Make sure rotor spins freely.
	7. Installed too close to fittings	Install correctly. See Installation Section
	8. Installed too close to motors or electrically "noisy" environment	Install correctly. See Installation Section
B. READOUT FADED OR BLANK	1. Batteries weak, dead, or not connected	Remove computer and replace batteries Install computer again, making sure that the gasket or O-ring seals evenly around the computer and turbine housing.
	2. Computer defective	Contact the factory.
C. NORMAL FLOW RATE BUT METER DOES NOT COUNT (Meter comes on when DISPLAY button pushed.)	1. Field Calibration not performed correctly	Field Calibrate again or select Factory Calibration.
	2. Rotor stuck or damaged	Remove meter. Lubricate turbine bearings with WD-40 or similar penetrating lubricant through small holes in turbine supports. Make sure rotor spins freely. If rotor cannot be loosened, contact the factory.
	3. Teflon® tape or other material wrapped around rotor.	Remove meter. Clear material from rotor Make sure rotor spins freely.
	4. Computer defective	Contact the factory.

SYMPTOM	PROBABLE CAUSE	CORRECTIVE ACTION
D REDUCED FLOW RATE AND METER DOES NOT COUNT (Meter comes on when DISPLAY button pushed)	1. Meter clogged with dried liquids	Remove meter. Clean carefully with WD-40 or similar penetrating lubricant. Make sure rotor spins freely.
E CANNOT GET METER INTO FIELD CALIBRATION	1. Factory Calibration (PRESET) curve active	Hold down CALIBRATE and push and release DISPLAY until PRESET flag goes off. Proceed with calibration according to the Calibration Section
	2 Button push sequence incorrect	Make sure PRESET flag on readout is off. Make sure CALIBRATE is held down *before* DISPLAY is pushed. Hold for three seconds. Readout will then show CAL-P0. Release both buttons. Computer face will then blink CAL-P1. Proceed with calibration according to Calibration Section.
	3 Computer circuit board delective	Replace computer. Contact the factory.
F COMPUTER BLINKS "NO" AFTER FIELD CALIBRATION	1 Calibration sample too small	Try again and dispense minimum volume of 5 units. See Calibration Section.
	2 Flow rate too low	Try again and increase flow rate to minimum calibration rate. See Calibration Section.
	3 Button push sequence incorrect	Make sure PRESET flag on readout is off. Make sure CALIBRATE is held down *before* DISPLAY is pushed Hold for three seconds. Readout will then show CAL-P0. Release both buttons. Computer face will then blink CAL-P1. Proceed with calibration according to Calibration Section.
	4. Rotor not spinning freely	Remove meter. Clean carefully with WD-40 or similar penetrating lubricant. Make sure rotor spins freely.
G. METER CONNECTIONS LEAK	1. Meter installed without thread sealant	Remove meter. Wrap male connections with 3 to 4 wraps of Teflon® tape or compatible sealing compound. Install again.
	2. Connecting threads damaged	Remove meter and inspect threads. Replace damaged connections. If meter threads are damaged, contact the factory.
	3. Meter housing cracked	Inspect housing for cracks. If cracks present, contact the factory.

TROUBLESHOOTING

SPECIFICATIONS

The following specifications apply to all models and materials.

Power Source:
Two lithium batteries which provide power for approximately 2,000 hours of actual use.

Operating Temperature:
+14 to +140 degrees F (-10 to +60 degrees C).

Storage Temperature:
-40 to +150 degrees F (-40 to +70 degrees C).

Accuracy:
Factory Calibration with non-viscous liquids to ±1.5%.
Field Calibration with non-viscous liquids to ±1.0%.

Wetted Parts:
In all models, wetted parts include the retainer rings, shaft, bearings, signal generators, and rotor. These parts are always the same materials.

Signal Generators:	Ferrite
Shaft:	Tungsten Carbide
Bearings:	Ceramic
Retainer Rings:	Stainless Steel

The following specifications are dependent upon housing materials.

Pressure Rating:

Aluminum:	300 PSIG (20.7 bar).
Nylon:	150 PSIG (10.3 bar).
Stainless Steel:	800 PSIG (55.1 bar).

Recommended Chemicals:
Aluminum is recommended for use with petroleum products.
Nylon is recommended for use with water or non-aggressive chemicals.
Stainless Steel is recommended for use with water and chemicals compatible with stainless steel.

U.S. Measurement

Model Family	One Inch
Units*	Gallons
Flow Range in GPM	3 to 50
Threads*	NPT
Inlet and Outlet	1 inch
Internal Diameter	1 inch
Design Type	Turbine
Readout Totals	
Minimum	.01
Maximum	999,999
Pressure Drop at Maximum Flow Rate	5 PSIG at 50 GPM.
Dimensions	
Width	4 inch
Height	2.5 inch
Depth	2 inch

Metric Measurement

Model Family	One Inch
Units*	Liters
Flow Range in LPM	10 to 190
Threads*	ISO
Inlet and Outlet	1 inch
Internal Diameter	1 inch
Design Type	Turbine
Readout Totals	
Minimum	.01
Maximum	999,999
Pressure Drop at Maximum Flow Rate	.35 bar at 190 LPM.
Dimensions	
Width	10.2 cm
Height	6.4cm
Depth	5.1cm

*Models are also available in liter measurement with NPT threads.

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WESTERN 213-588-0801 FAX: 213-588-6826