LIQUIDYNAMICS™

LD250 ELECTRONIC DIGITAL METER

Instruction & Parts Manual

Model LD250

This manual contains important warnings and information. READ AND KEEP FOR REFERENCE.

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Index:

Technical Specifications:

Measurement System:	Oval Gears
Resolution (Nominal):	0.0053 quarts/pulse
Flow Rate Range:	0.25 to 8 GPM
Operating Pressure, Max.:	1,000 PSI
Burst Pressure:	2,900 PSI
Storage Temperature Range:	-4° F – 158° F
Storage Maximum Humidity:	95% Relative Humidity, Non Condensing
Operating Temperature Range:	14° F – 122° F
Pressure Drop @ 4 GPM, SAE 10W @ 68° F:	5 PSI
Allowable Viscosity Range:	5 – 5000 cps
Accuracy (from 1 – 4 GPM):	+/- 1% after Calibration
Reproducibility (typical):	+/- 0.3%
Display Screen:	LCD w/ 5 digit Batch Total, 6 digit Cumulative Total
Power Supply:	2 ea. 1.5 V Alkaline batteries, size AAA
Battery Life:	18 – 36 Months
Weight:	1.1 lb
Reed Switch:	Max Current – 100 mA
Ingress Protection Rating:	IP65

⚠ WARNING

Do Not Use This Meter With Flammable Or Explosive Fluids.

⚠ WARNING

This Meter Has a Maximum Working Pressure of 1.000 PSI. Exceeding This Pressure May Cause Bodily Injury.

Introduction:

The Liquidynamics model LD250 electronic digital meter features a field replaceable electronic module, high contrast LCD with extended temperature range, AAA batteries and a broad range of display capability. The meter uses oval gear technology to measure fluid passing through the measurement chamber to a high degree of accuracy and can be used to measure engine oil, gear oil, hydraulic fluid, transmission fluid, 100% antifreeze and similar fluids.

The die cast aluminum housing is rated to 1,000 PSI working pressure, has a 1/2" NPT inlet and outlet and is supplied with a rubber shock protector. If necessary, the electronic module can be easily replaced in the field without removing the control handle from the fluid plumbing.

LCD Display (Figure 1)

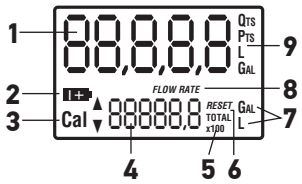


Figure 1

1. Batch Total register (5 digit with floating decimal, from 0.1 to 99999), indicates volume dispensed since the reset button was last depressed.
2. Indicates state of battery charge
3. Indicates when meter is in the calibration mode
4. Total register (6 digit with floating decimal, from 0.1 to 999999). This can indicate two types of totals;
   a. Cumulative total that cannot be reset (Total)
   b. Cumulative total that can be reset (Reset Total)
5. Indicates Total multiplication factor (x10 or x100)
6. Indicates type of total (Total or Reset Total)
7. Indicates unit of measurement for Total registers (Total and Reset Total), either Liters or Gallons
8. Indicates if meter is in Flow Rate mode
9. Indicates unit of measurement being used for Batch Total, Qts = Quarts, Pts = Pints, L = Liters, Gal = Gallons

User Buttons

The meter has two push buttons, "RESET" and "CAL" which have two primary functions when used individually and several secondary functions when used together.

Primary function

- RESET button – used to reset the "BATCH" total (upper register) and the RESET TOTAL (lower register)
- CAL button – used to enter calibration mode

Secondary function

- When both buttons are pressed simultaneously – used to enter the configuration mode to allow setting of units of measurement

Installation Notes

- The meter has 1/2" NPTF threaded connections at the inlet and outlet and may be installed in any orientation in either a fixed in-line installation or in a portable dispensing installation.
- The meter does not have a preferred direction of flow, therefore either fitting can be used as an inlet or outlet
- This meter is intended for use with "clean" fluids, an inlet filter with adequate filtering capacity should be used to ensure that no solid particles will enter the metering chamber and cause the gears to jam.
- Use an appropriate pressure rated thread sealant to ensure leak free installation
- When the meter is installed in an in-line installation, be sure to allow sufficient room for access to the battery housing for battery replacement
- The rubber shock protector is an integral part of the meter and should always be installed and kept in good condition

Normal Daily Use

The only operations required for normal daily use are the "Batch" total register reset and/or the "Reset Total" register reset. Below are the two typical operating LCD displays; Figure 2 shows the "Batch Total" and resettable cumulative register "RESET TOTAL". Figure 3 shows the "Batch" total and non-resettable cumulative register "TOTAL".

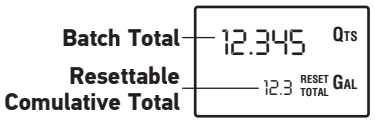


Figure 2

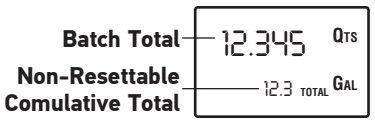


Figure 3

- The "Batch" total in the upper part of the display indicates the quantity dispensed since the last time the RESET button was depressed (typically reset after each dispensing operation).
- The "RESET TOTAL" register in the lower part of the display indicates the quantity dispensed since the last time the "RESET TOTAL" was reset. The "RESET TOTAL" cannot be reset until the "BATCH" total has been reset, however the "BATCH" total can always be reset without resetting the "RESET TOTAL". The unit of measurement of the two TOTALS can be the same as the "BATCH" or different depending on user settings.
- The non-resettable cumulative "TOTAL" can never be reset, it accumulates the amount of fluid dispensed for the life of the meter

- The registers of the two totals "RESET TOTAL" and "TOTAL" share the same digits of the display, therefore the two totals are never visible at the same time, but will always be displayed alternately. The meter is programmed to show these totals as follows:
  a. The cumulative, non-resettable "TOTAL" is shown during meter standby
  b. The cumulative, resettable "RESET TOTAL" is shown for a few seconds after a "BATCH" total reset, during the entire dispensing operation and for a few seconds after the end of a dispensing operation
  c. After a few seconds of the "RESET TOTAL" being displayed as outlined in 'b' above, the meter switches to standby and the display shows the cumulative, non-resettable "TOTAL"

NOTE

6 digits are available for "TOTALS" plus the two icons 'x10' and 'x100'. The 'x10' icon appears as the total register exceeds 999999, in this case the next indication will be 100000x10. The "TOTAL" register will then proceed to count up to 999999x10 beyond which the next indication will be 100000x100. The register will then continue to count up to 999999x100.

Dispensing Operation:

During the dispensing operation (count), the "BATCH" and cumulative, resettable total "RESET TOTAL" are displayed at the same time (Figure 4)

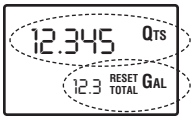


Figure 4

NOTE

If one of the buttons (RESET or CAL) are accidently pressed during the dispensing operation, this will have no effect

A few seconds after the dispense operation has ended, the lower register switches from "RESET TOTAL" to "TOTAL" i.e.; the word 'RESET' above the word 'TOTAL' disappears and the cumulative, resettable total count is replaced by the cumulative, non-resettable total count. This configuration is called "standby" and will remain this way until the meter is once again operated.

Batch Total Reset

The "Batch" total can be reset by pressing the "RESET" button when the meter is in the standby mode i.e.; the meter is in the standby mode when the LCD display shows the word "TOTAL" (Figure 5)

Figure 5

After pressing the "RESET" button, the LCD displays all characters on the screen (Figure 6) for a short period and then displays the "Batch" total and resettable cumulative total "RESET TOTAL"(Figure 7)

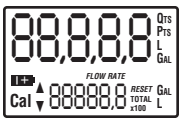


Figure 6

Figure 7

After a few seconds, the resettable cumulative total "RESET TOTAL" is replaced by the non-resettable cumulative total "TOTAL" (Figure 8)

Figure 8

Resetting the Cumulative "RESET TOTAL"

The cumulative total "RESET TOTAL" operation can only be performed after resetting the "BATCH" total register. The "RESET TOTAL" can be reset by pressing the "RESET" button for several seconds while the LCD display shows "RESET TOTAL" (Figure 9)

Figure 9

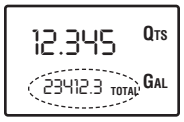


Figure 10

– Steps for resetting "RESET TOTAL"

- Meter must be in "standby" mode i.e.; with "TOTAL" displayed (Figure 10)
- Press the "RESET" button momentarily – "Batch" total is reset (Figure 11)
- While the LCD shows "RESET TOTAL" (Figure 12), press the "RESET" button again for 1 to 2 seconds
- The LCD momentarily displays all segments, followed by a display of active segments and then displays the reset (0.0) of the "RESET TOTAL" (Figure 13)

Figure 11

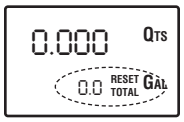


Figure 12

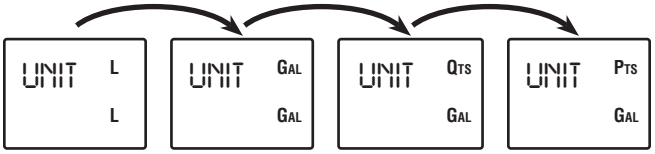


Figure 13

Units of Measure:

The user has the ability to select from the following combinations of "BATCH" total and cumulative total units of measure to be displayed on the LCD

Selection #	"BATCH" Register Units of Measurement	"TOTALS" Register Units of Measurement
1	Liters	Liters
2	Gallons (Gal)	Gallons (Gal)
3	Quarts (Qts)	Gallons (Gal)
4	Pints (Pts)	Gallons (Gal)

To choose between the above 4 possible choices:

- Wait for the meter to be in the "standby" mode (Figure 10)
- Then simultaneously press the "RESET" and "CAL" buttons, keep the buttons depressed until the word "UNIT" appears on the LCD display together with the unit of measurement set at that time (Figure 13, *in this example Liters/Liters*)
- With every momentary press of the "RESET" button, the selections 1 through 4 are scrolled through (Figure 12), stop at the selection that you would like to use currently.
- By pressing the "CAL" button for several seconds the new settings will be stored, the meter will then initiate a start cycle and will then be ready to dispense in the newly selected units.

NOTE

The "RESET TOTAL" and "TOTAL" registers will be automatically changed to the new unit of measurement

NOTE

No new calibration is required after changing the "Unit of Measurement," the meter calculates the conversion internally.

Calibration:

The LD250 meter is supplied with a factory calibration that ensures precise measurement in most operating conditions. However, if operating close to extreme conditions, such as with fluids close to acceptable range extremes (such as low viscosity antifreeze or high viscosity gear oil) or when operating in extreme flow rate conditions (close to minimum or maximum acceptable ranges) a field calibration may be required to better match the meter operating conditions.

Introduction

A multiplication factor, commonly referred to as a "K" factor, is applied by the electronic module to convert the electrical pulses received during metering to allow the appropriate display on the LCD.

A factory set default "K" factor of 1.000 is programmed into the electronics, which ensures precise metering during normal operating conditions. A user "K" factor may be programmed by the operator during field calibration if desired. The factory "K" factor is retained in memory if the operator would like to return to the factory setting.

Why Calibrate?

- In order to display the current calibration factor being used
- To return to the factory calibration (Factory "K" Factor) after a previous calibration by the user
- The user can change the calibration factor using one of two calibration procedures:
  - Field calibration by means of a dispensing operation
  - Calibration factor modified by directly changing the "K" factor

NOTE

In the Calibration mode, the "BATCH" and "TOTAL" dispensed quantities displayed on the LCD have different meanings, depending on the calibration procedure chosen.

When in the calibration mode the meter cannot be used for normal dispensing operations. When in the calibration mode, the "TOTALS" are not increased.

NOTE

The LD250 meter features a non-volatile memory that maintains data concerning calibration and "TOTAL" dispensed quantities stored indefinitely, even in the case of power loss or during battery change out.

Display of Current Calibration Factor and Restoration of Factory Calibration Factor

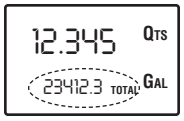


Figure 14

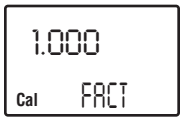


Figure 15

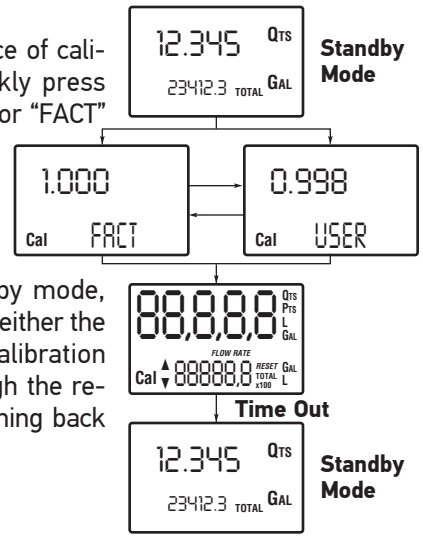
Figure 16

When the meter is in normal standby mode (Figure 14) a momentary press of the "CAL" button displays the current calibration factor being used. If no calibration has ever been performed, or the factory setting has been restored after previous calibrations, the LCD will display 1.000 as in (Figure 15). The word "FACT" (abbreviation for "Factory") shows that the factory calibration factor is being used.

On the other hand, if a calibration has been done by the user, the LCD display will show the current calibration factor being used, i.e.; 0.998 as in this example, (Figure 16). The word "USER" indicates that a calibration factor set by the user is being used.

To confirm the choice of calibration factor, quickly press "CAL" while "USER" or "FACT" is being displayed.

The flow Chart to the right shows the display logic starting from the standby mode, sequencing through either the "FACT" or "USER" calibration option, going through the restart cycle and finishing back in the standby mode.



NOTE

When the "FACTORY" calibration factor is confirmed, the old "USER" calibration factor is deleted from memory.

In-Field Calibration

This procedure calls for the fluid to be dispensed into a graduated container under actual operating conditions.

NOTE

For Correct Meter calibration Be Aware Of The Following

1. When the Factory calibration factor is confirmed, the old user calibration factor is deleted.
2. Use an accurate measurement container with a capacity of not less than 5 quarts, preferably 5 gallons, with an accurate graduated scale.
3. Ensure that calibration dispensing is done at a constant flow rate equivalent to that used during normal dispensing operations until the calibration container is full.
4. Do not reduce the flow rate when reaching the graduated area of the container during the final stages of

sample container filling. The correct method consists of making short top-ups at the normal flow rate.

5. After dispensing, wait a few minutes to make sure any air bubbles are eliminated from the sample container, only read (use) the actual level at the end of this process (after the level has dropped due to air being eliminated).
6. Carefully follow the procedure indicated below

In-Field Calibration Procedure, with Fluid Dispensing

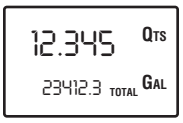


Figure 17

1. Meter in normal standby mode (Figure 17)
2. Depress "CAL" button for several seconds, the meter enters calibration mode, "CAL" is displayed along with the calibration factor in use (instead of the batch total), (Figure 18). The words "FACT" or "USER" indicate which of the two factors (factory or user) is currently in use. Note that this calibration factor will be the one used during field calibration.

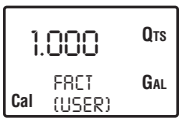


Figure 18

3. Depress "RESET" for several seconds, the meter shows "CAL" and the batch total at 0.000. The meter is now ready to perform an in-field calibration, (Figure 19).

Figure 19

4. Start dispensing fluid into the measurement (calibration) container . Dispensing can be interrupted and started again as necessary (Figure 20). Continue dispensing until the level of the fluid in the measurement (calibration) container reaches the graduated scale area. There is no need to reach a preset quantity (Figure 21).

Figure 20

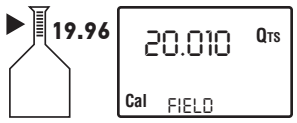


Figure 21

5. Momentarily depress the "RESET" button, this tells the meter that the calibration dispensing operation is finished. Make sure that the dispensing operation has been completed correctly prior to completing this operation.

   To calibrate the meter, the value indicated on the meter "Batch" total (example 20.010, Figure 22) must be forced to the real (actual) value dispensed as indicated on the graduated scale on the measurement (calibration) container. In the bottom left part of the LCD display, an arrow appears (up or down) showing the direction (increase or decrease) of the value displayed when following operations described in step 6 or 7.

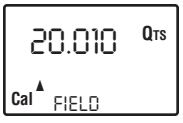


Figure 22

6. Momentarily depress the "RESET" button to change the direction of the arrow (Figure 23). This operation can be repeated to alternate the direction of the arrow.

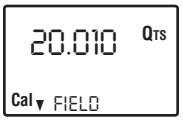


Figure 23

7. A momentary press of the "CAL" button will increment the amount shown in the Batch total by one unit.

   A continuous press of the "CAL" button will increase the speed of unit change. If the desired value is exceeded, change the direction of the arrow as outlined in step 6, (Figure 24). The Batch total changes in the direction indicated by the arrow.

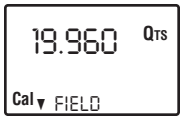


Figure 24

8. Before performing this next operation make sure that the "Indicated" value on the meter is the same as the "Real" (actual) value dispensed into the measurement (calibration) container(Figure 25).

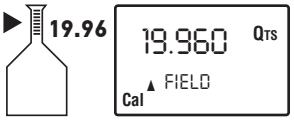


Figure 25

   Depress the "RESET" button for several seconds to let the meter know that the calibration procedure has been completed (Figure 26).

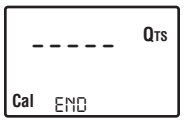


Figure 26

   The meter will now calculate the new "USER" calibration factor ('K' Factor), this calculation may take a few seconds, depending on the correction to be made.

NOTE

If this operation is performed after step #5, without changing the indicated value, the "USER" calibration factor ('K' Factor) would be the same as the "FACTORY" calibration factor ('K' Factor).

9. At the end of the calculation, the new "USER" calibration factor ('K' Factor) is shown on the LCD display (Figure 27) for a few seconds, after which the "restart" cycle is repeated and then returns to the "standby" condition.

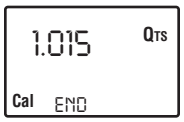


Figure 27

10. The meter stores the new calibration factor ('K' Factor) and is ready to begin a new dispensing operation using this new calibration factor ('K' Factor) that has just been calculated.

Direct Modification of 'K' Factor

If during normal meter operation it shows a repeated percentage error, this can be corrected by modifying the current calibration factor ('K' factor) by the same percentage. In this case, the percentage correction of the "USER" calibration factor ('K' Factor) can be calculated as follows:

$$\text{New Cal. Factor} = (\text{Old Cal. Factor}) \times \left(\frac{100 - \%\ \text{Error}}{100}\right)$$

Example:
Error percentage found: -0.9%
Current calibration factor: 1.000

$$\text{New USER Calibration Factor: } 1.000 \times \left(\frac{100 + 0.9}{100}\right) = 1.00 \times 1.009 = 1.009$$

If the meter indicates less than the real (actual) amount dispensed (negative error), the new calibration factor must be higher than the old one, as shown in the example. The opposite applies if the meter shows more than the real (actual) amount dispensed (positive error).

Steps for Direct Modification of Calibration Factor

1. Meter in normal standby mode (Figure 28)

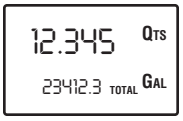


Figure 28

2. Depress "CAL" button for several seconds, the meter enters calibration mode, "CAL" is displayed along with the calibration factor in use (instead of the batch total), (Figure 29). The words "FACT" or "USER" indicate which of the two factors (factory or user) is currently in use.

Figure 29

3. Depress "RESET" for several seconds, the meter shows "CAL" and the batch total at 0.000. The meter is now ready to perform an in-field calibration, (Figure 30).

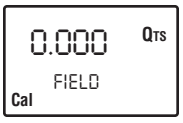


Figure 30

4. Depress "RESET" again for several seconds to enter the "Direct" change of the calibration factor. The word "DIRECT" appears together with the currently used calibration factor, (Figure 31). In the bottom left of the LCD display, an arrow appears (upwards or downwards) showing the direction (increase or decrease) of the value displayed when following operations described in step 5 or 6.

Figure 31

5. Momentarily depress the "RESET" button to change the direction of the arrow (Figure 32). This operation can be repeated to alternate the direction of the arrow.

Figure 32

6. A momentary press of the "CAL" button will increment the amount shown in the calibration factor by one unit, (Figure 33)

Figure 33

A continuous press of the "CAL" button will increase the speed of unit change. If the desired value is exceeded, change the direction of the arrow as outlined in step 5. The calibration factor changes in the direction indicated by the arrow.

7. Depress the "RESET" button for several seconds to let the meter know that the calibration procedure has been completed (Figure 34). Before performing this operation, make sure that the indicated calibration factor is the correct (desired) factor.

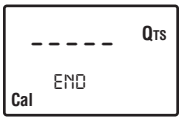


Figure 34

8. The meter now calculates the new calibration factor ('K' Factor) and then displays the new calibration factor ('K' Factor) for a few seconds (Figure 35) after which the "restart" cycle is repeated to return to the "standby" condition. The meter stores the new calibration factor ('K' Factor) and is ready to begin a new dispensing operation using this new calibration factor ('K' Factor) that has just been changed (Figure 36).

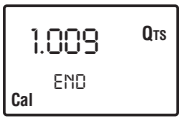


Figure 35

Figure 36

Maintenance:

The meter has been designed to require a minimum of maintenance, as follows:

- Battery Replacement – Necessary when the batteries have run down
- Cleaning Measurement Chamber – This may be necessary due to the presence of solid particles due to a lack of filtering.

Battery Replacement

NOTE

This meter should be installed in a position that will allow the batteries to be replaced without removing it from the system.

The model LD250 meter has two low-battery alarm levels

- When the battery charge falls below the first level, the "Battery" icon (Figure 37) on the LCD is illuminated. In this case, the meter will continue to operate normally, but the "Battery" icon warns the user that it is ADVISABLE to change the batteries.

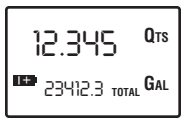


Figure 37

- If meter operation continues without changing the batteries, the second battery alarm will be reached, which will prevent further operation. In this case the battery icon starts to flash (Figure 38) and it is the only icon that remains visible on the LCD.

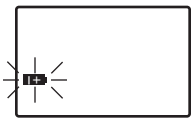


Figure 38

NOTE

The LD250 meter will display the same "RESET TOTAL", "TOTAL" and "BATCH" totals indicated prior to battery change. After changing batteries the meter does not need to be calibrated again.

Note

Gear w/o magnet holes to be oriented away from electronic module in gear pocket farthest from battery housing. (Figure 39, Ref. #4)

Note

Gear w/magnets to be oriented w/magnets toward electronic module and located in gear pocket next to battery housing. (Figure 39, Ref. #5)

Note

Correct battery orientation is molded into shock protector. (Figure 39, Ref. #6)

Cleaning Measurement Chamber

NOTE

The measurement chamber can be cleaned without removing the meter from the line or from the dispensing nozzle.

⚠ WARNING

Make sure that there is no pressure in the system and the pump has been turned off and meter is isolated prior to disassembling the meter.

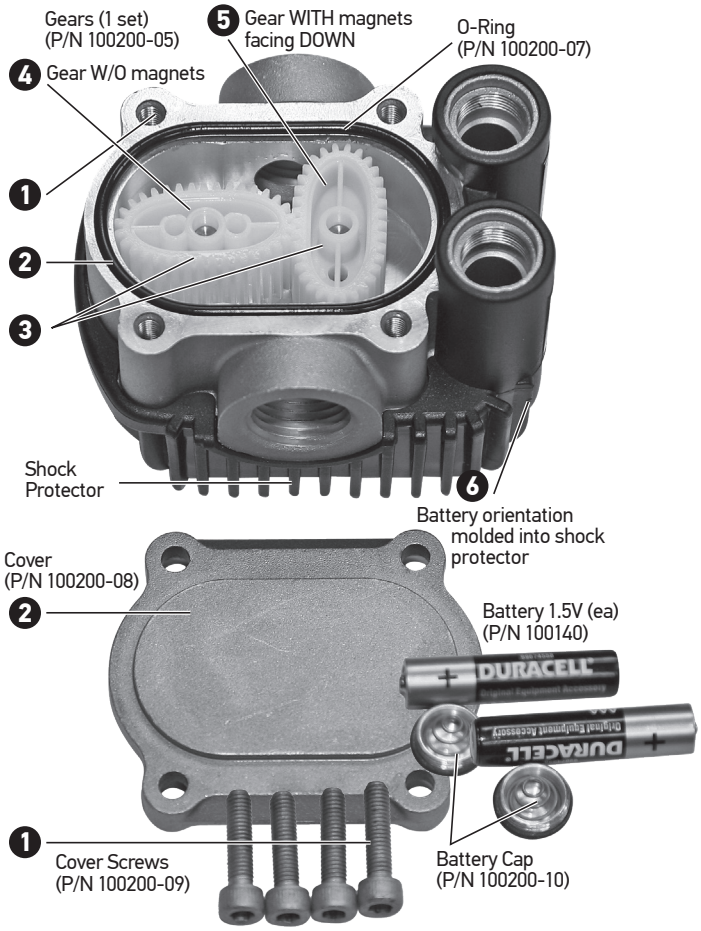
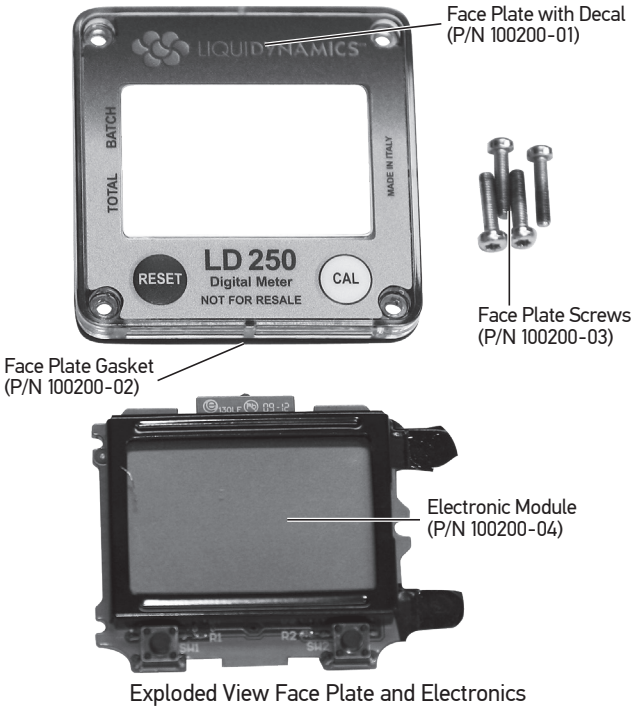


Figure 39 – Exploded View and Cleaning Reference



Exploded View Face Plate and Electronics

To clean the measurement chamber, proceed as follows; (Figure 39)

1. Loosen the four cover retention screws. (Ref. #1)
2. Remove the cover and seal. (Ref. #2)
3. Remove the oval gears. (Ref. #3)
4. Clean as necessary using a brush or small screw driver, being careful not to damage the body or gears.
5. Reassemble the meter by performing the disassembly operation in reverse

NOTE

Only one of the two gears incorporates magnets. This gear must be assembled in the position marked "MAGNET." The gear with the magnets need to be placed with the magnets on the bottom (electronics side of the cavity).

⚠ CAUTION

Place the second gear (without magnets) at 90° to the first gear (with magnets) and with the holes visible from the cover side. Make sure the gears are turning freely prior to closing the cover.

Troubleshooting:

Problem	Possible Cause	Corrective Action
LCD, No Indication	Bad battery contact	Check Battery contact
Metering Error	Incorrect K factor	Check K factor in accordance with calibration instructions
	The meter is operating outside Minimum or maximum flow rates	Increase or reduce flow rate to stay within specified flow range
	Meter is operating outside minimum or maximum viscosity range	Work within operating specifications
Reduced or no flow	Gears are jammed	Clean the measurement chamber
	Inlet screen plugged	Clean inlet screen
Meter does not count but flow OK	Incorrect installation of gears after cleaning	Repeat assembly procedure correctly
	Possible electronic problem	Contact Liquidynamics

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