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I. Remote Display maintenance

A. Becoming acquainted with Remote Display: General

Remote Display is a digital remote display system of the amount of fluid dispensed and measured by an electronic meter featuring an oval-gear measurement system or a turbine/impeller.

The transmission of electric pulses from meter to Remote Display is carried out through a simple 2-wire cable.

Below is the logic connection diagram:

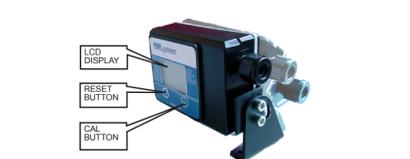


* possible connection only for the remote display versions equipped with output " Pulse Transmitter" (or " Pulse Out")
The user can choose between two different operating modes:
- Normal Mode: Mode with display of Partial and Total dispensed quantities
- Flow Rate Mode: Mode with display of Flow Rate as well as Partial dispensed quantity.

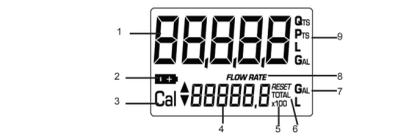
The Remote Display features a non-volatile memory for storing the dispensing data, even in the event of a complete power break for long periods.

Main components:

1) LCD display



The "LCD" of the RD features two numerical registers and various indications displayed to the user only when the applicable function so requires



- Legend:
1. Partial register (6 figures with moving comma: 0.000 + 99999), indicating volume dispensed from when the RESET button was last pressed;
2. Indication of battery charge;
3. Indication of calibration mode;
4. Totals register (6 figures with moving comma 0.0+999999 x10 / x100), that can indicate two types of Total:
4.1. General Total that cannot be reset (TOTAL)
4.2. Resettable total (Reset TOTAL)
5. Indication of total multiplication factor (x10 / x100)
6. Indication of type of total (TOTAL / Reset TOTAL);
7. Indication of unit of measurement of Totals:
L=Litres
Gal=Gallons
Qts=Quarts
Pts=Pints
8. Indication of Flow Rate mode
9. Indication of unit of measurement of Partial:

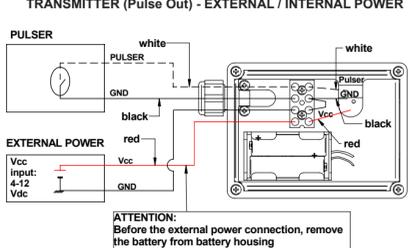
2) User Buttons
The meter features two buttons (RESET and CAL) which individually perform two main functions and, together, other secondary functions.
The main functions performed are:
- for the RESET key, resetting the partial register and Reset Total
- for the CAL key, entering instrument calibration mode
Used together, the two keys permit entering configuration mode where the desired unit of measurement can be set.

3) Battery Housing
The Remote Display is powered by two standard 1.5 V (size AA) batteries.
The batteries are inside the Remote Display (see photo chapter 1).

B. Installation

The Remote Display has been specifically designed for stationary installation. The display is fitted with a bracket that allows its rotation for best reading inclination.
To connect the pulser, loosen the 4 fixing screws of the rear lid, open the lid and insert the cable into the cable gland. The two electrical wires of the cable must be connected to a terminal (see photo) with two screws. Close the lid, ensuring that the o-ring is placed properly to guarantee a perfect seal.
Below are the connection diagrams, models without Pulse Transmitter and with Pulse Transmitter, featuring the two power options by means of battery or external power supply.

REMOTE DISPLAY CONNECTION DIAGRAM WITHOUT PULSE TRANSMITTER (Pulse Out) - EXTERNAL / INTERNAL POWER

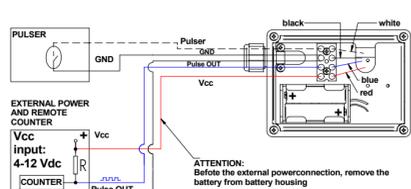


ATTENTION: Before the external power connection, remove the battery from battery housing

To return to "Normal" mode, press the CAL key again.
If one of the two keys RESET or CAL is accidentally pressed during the count, this will have no effect.

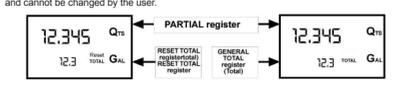
IMPORTANT: Even though in this mode they are not displayed, both the Reset Total and the General Total (Total) increase. Their value can be checked after dispensing has terminated, returning to "Normal" mode, by quickly pressing CAL.

REMOTE DISPLAY CONNECTION DIAGRAM WITH PULSE TRANSMITTER (Pulse Out) - EXTERNAL / INTERNAL POWER



C. Daily use

METER is delivered ready for use. No commissioning operations are required even after long storage periods. The only operations that need to be done for daily use are Partial and/or Reset Total resetting. Below are the two typical normal operation displays. One display page shows the Partial and Reset Total registers. The other shows the partial and general total. Switchover from Reset Total to general total display is automatic and tied to phases and times that are factory set and cannot be changed by the user.



The PARTIAL REGISTER positioned in the top part of the display indicates the quantity dispensed since the RESET key was last pressed
The RESET Total register, positioned in the lower part of the display, indicates the quantity dispensed since the last RESET Total resetting. The RESET Total cannot be reset until the Partial has been reset, while vice versa, the Partial can always be reset without resetting the RESET Total. The unit of measurement of the two Totals can be the same as the Partial or else different according to the factory or user settings.
The General TOTAL register (Total) can never be reset by the user. It continues to rise for the entire operating life of the meter.

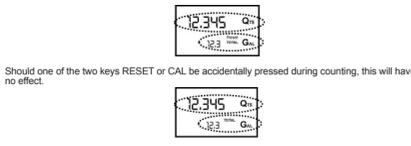
The register of the two totals (Reset Total and Total) share the same area and digits of the display. For this reason, the two totals will never be visible at the same time, but will always be displayed alternately.

The meter is programmed to show one or the other of the two totals at very precise times:
- The General Total (Total) is shown during Meter standby
- The Reset Total is shown:
- At the end of a Partial reset for a certain time (a few seconds)
- During the entire dispensing stage
- For a few seconds after the end of dispensing. Once this short time has expired, Meter switches to standby and lower register display switches to General Total

NOTE:
6 digits are available for Totals, plus two icons x10 /x100. The increment sequence is the following:
0.0 - 99999.9 - 999999 - 100000 x10 - 999999 x10 - 100000 x100 - 999999 x100

C.1. Dispensing in Normal mode

This is default dispensing during which, while the count is made, the Partial and Reset Total are displayed at the same time.

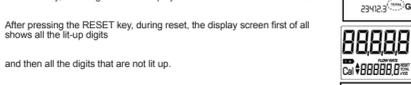


Should one of the two keys RESET or CAL be accidentally pressed during counting, this will have no effect.

A few seconds after dispensing has ended, on the lower register, the display switches from Reset Total to General Total: the word RESET above the word TOTAL disappears, and the Reset Total is replaced by the General Total. This situation is called STANDBY and remains stable until the user operates the meter again

C.1.1. Resetting the Partial Register

The Partial Register can be reset by pressing the RESET key when the meter is in Standby, meaning when the display screen shows the word "TOTAL".



After pressing the RESET key, during reset, the display screen first of all shows all the lit-up digits and then all the digits that are not lit up.

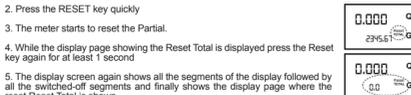


At the end of the process, a display page is first of all shown with the reset Partial and the Reset Total

and, after a few moments, the Reset Total is replaced by the NON resettable Total (Total).

C.1.2. Resetting the Reset Total

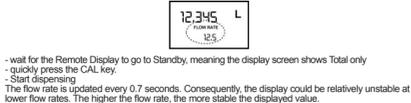
The Reset Total resetting operation can only be performed after resetting the Partial register. The Reset Total can in fact be reset by pressing the RESET key at length while the display screen shows RESET TOTAL as on the following display page:



Schematically, the steps to be taken are:
1. Wait for the display to show normal standby display page (with Total only displayed).
2. Press the RESET key quickly
3. The meter starts to reset the Partial.
4. While the display page showing the Reset Total is displayed press the Reset key again for at least 1 second
5. The display screen again shows all the segments of the display followed by all the switched-off segments and finally shows the display page where the reset Total is shown.

C.2. Dispensing with Flow Rate Mode display

It is possible to dispense fluids, displaying at the same time:
- the dispensed partial
- the Flow Rate in [Partial Unit / minute] as shown on the following display page:
Procedure for entering this mode:



- wait for the Remote Display to go to Standby, meaning the display screen shows Total only - quickly press the CAL key - Start dispensing
The flow rate is updated every 0.7 seconds. Consequently, the display could be relatively unstable at lower flow rates. The higher the flow rate, the more stable the displayed value.

IMPORTANT: The flow rate is measured with reference to the unit of measurement of the Partial.

IMPORTANT: Even though in this mode they are not displayed, both the Reset Total and the General Total (Total) increase. Their value can be checked after dispensing has terminated, returning to "Normal" mode, by quickly pressing CAL.

C.2.1. Partial reset

To reset the Partial Register, finish dispensing and wait for the Remote Display to show a Flow Rate of 0.0 as indicated in the illustration

then quickly press RESET
Unlike Normal mode, in this case during reset, you do not pass through the stages where the display segments are first lit up and then switched off, but rather the reset partial register is immediately displayed.

D. Calibration

D.1. Definitions

Calibration factor or "K Factor": this is the multiplication factor applied by the system to the electrical pulses received, to transform these into measured fluid units
- Factory K Factor: Factory-set default factor. It is equal to 1,000.

This calibration factor ensures utmost precision in the following operating conditions:

Fluid: motor oil type 10W40
Temperature: 20°C
Flow rate: 5-25 litres/min

Even after any changes have been made by the user, the factory K factor can be restored by means of a simple procedure:
- User K Factor: Customized calibration factor, meaning modified by calibration.

D.2. Why calibrate

METER is supplied with a factory calibration that ensures precise measuring in most operating conditions.

Nevertheless, when operating close to extreme conditions, such as for instance:
- with fluids close to acceptable range extremes (such as low-viscosity antifreeze or high-viscosity oils for gearboxes)
- in extreme flow rate conditions (close to minimum or maximum acceptable values) on the-spot calibration may be required to suit the real conditions in which the meter is required to operate.

The General TOTAL register (Total) can never be reset by the user. It continues to rise for the entire operating life of the meter.

D.3. Calibration Procedure

METER permits making quick and precise electronic calibration by changing the Calibration Factor (K FACTOR).
Two procedures are available for changing the Calibration Factor:
1. In-Field Calibration, performed by means of a dispensing operation
2. Direct Calibration, performed by directly changing the calibration factor

The calibration phases can be entered (by keeping the CAL key pressed for a long time) to display the currently used calibration factor.
- Return to factory calibration (Factory K Factor) after a previous calibration by the user
- Change the calibration factor using one of the two previously indicated procedures.

In calibration mode, the partial and total dispensed quantities indicated on the display screen take on different meanings according to the calibration procedure phase.

In calibration mode, the METER can not be used for normal dispensing operations. In "Calibration" mode, the totals are not increased.

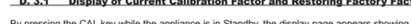
IMPORTANT: The METER features a non-volatile memory that keeps the data concerning calibration and total dispensed quantity stored for an indefinite time, even in the case of a long power break; after changing the batteries, calibration need not be repeated.

D.3.1. Display of Current Calibration Factor and Restoring Factory Factor

By pressing the CAL key while the appliance is in Standby, the display page appears showing the current calibration factor used.

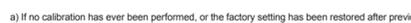
Two cases can occur:

a) If no calibration has ever been performed, or the factory setting has been restored after previous calibrations, the following display page will appear:



The word "Fric" abbreviation for "factory" shows that the factory calibration factor is being used

b) If, on the other hand, calibrations have been made by the user, the display page will appear showing the currently used calibration factor (i in our example 0.998).



The word "user" indicates a calibration factor set by the user is being used.

The flow chart alongside shows the switch-over logic from one display page to another

In this condition, the Reset key permits switching from User factor to Factory factor.

To confirm the choice of calibration factor, quickly press CAL while "User" or "Fric" are displayed.

After the restart cycle, the meter uses the calibration factor that has just been confirmed

IMPORTANT: When the Factory Factor is confirmed, the old User Factor is deleted from the memory

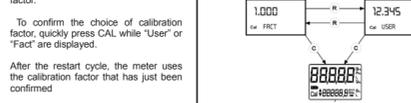


LEGEND:
R=K long RESET
R short RESET
C=C long CAL
C short CAL
Time Out

1. Wait for the display to show normal standby display page (with Total only displayed).
2. Press the RESET key quickly
3. The meter starts to reset the Partial.
4. While the display page showing the Reset Total is displayed press the Reset key again for at least 1 second
5. The display screen again shows all the segments of the display followed by all the switched-off segments and finally shows the display page where the reset Total is shown.

C.2. Dispensing with Flow Rate Mode display

It is possible to dispense fluids, displaying at the same time:
- the dispensed partial
- the Flow Rate in [Partial Unit / minute] as shown on the following display page:
Procedure for entering this mode:



- wait for the Remote Display to go to Standby, meaning the display screen shows Total only - quickly press the CAL key - Start dispensing
The flow rate is updated every 0.7 seconds. Consequently, the display could be relatively unstable at lower flow rates. The higher the flow rate, the more stable the displayed value.

IMPORTANT: The flow rate is measured with reference to the unit of measurement of the Partial.

IMPORTANT: Even though in this mode they are not displayed, both the Reset Total and the General Total (Total) increase. Their value can be checked after dispensing has terminated, returning to "Normal" mode, by quickly pressing CAL.

D.3.2. In Field Calibration

This procedure calls for the fluid to be dispensed into a graduated sample container in real operating conditions (flow rate, viscosity, etc.) requiring maximum precision.

IMPORTANT: For correct METER calibration, it is most important to:
- completely eliminate air from the system before calibrating;
- use a precise Sample Container with a capacity of not less than 5 litres, featuring an accurate graduated indicator;
- ensure calibration dispensing is done at a constant flow rate equivalent to that of normal use, until the container is full;
- not reduce the flow rate to reach the graduated area of the container during the final dispensing stage (the correct method during the final stages of sample container filling consists in making short top-ups at normal operation flow rate);
- after dispensing, wait a few minutes to make sure any air bubbles are eliminated from the sample container; only read the Real value at the end of this stage, during which the level in the container could drop;
- Carefully follow the procedure indicated below.

E. Configuration of unit of measurement

The METER features a menu with which the user can select the main measurement unit, Quarts (Qts), Pints (Pts), Litres (L), Gallons (Gal).

The combination of the unit of measurement of the Partial register and that of the Totals is predefined according to the following table:

Table with 3 columns: Combination no., Unit of Measurement Partial Register, Unit of Measurement Totals Register. Rows show combinations for Litres (L), Gallons (Gal), Quarts (Qts), and Pints (Pts).

F. Pulse Transmitter (Puls OUT)

The meter does not count, but the flow rate is correct

When the flow rate is correct, the flow rate is correct

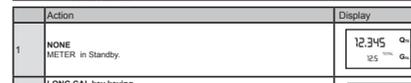
When the flow rate is correct, the flow rate is correct

When the flow rate is correct, the flow rate is correct

When the flow rate is correct, the flow rate is correct

When the flow rate is correct, the flow rate is correct

D.3.2.1. Sequence of operations to be performed for correct in-field calibration:



1. NONE METER in Standby. Display: 12.345 L, 29345.7 G.

2. LONG CAL key keying. The METER enters calibration mode, shows <<CAL>> and displays the calibration factor in use instead of partial. The words "Fric" and "USER" indicate which of the two factors (factory or user) is currently in use. IMPORTANT: This factor is that which the instrument also uses for field calibration measurement operations.

3. LONG RESET key keying. The METER shows "CAL" and the partial at zero. The meter is ready to perform in-field calibration.

DISPENSING INTO SAMPLE CONTAINER. Without pressing any key, start dispensing into the sample container.

Dispensing can be interrupted and started again at will. Continue dispensing until the level of the fluid in the sample container has reached the graduated area. There is no need to reach a preset quantity.

4. SHORT RESET key keying. The METER is informed that the calibration dispensing operation is finished. Make sure dispensing is correctly finished before performing this operation. To calibrate the METER, the value indicated by the partial totaliser (example 9.800) must be forced to the real value marked on the graduated sample container. In the bottom left part of the display an arrow appears (upwards or downwards), that shows the direction (increase or decrease) of the value change displayed when the following operations 5 or 7 are performed.

5. SHORT RESET key keying. The arrow changes direction. The operation can be repeated to alternate the direction of the arrow.

6. SHORTLONG CAL key keying. The indicated value changes in the direction indicated by the arrow one unit for every short CAL key keying. If the CAL key is kept pressed, the speed increase rises by continuously pressing the key pressed. If the desired value is exceeded, repeat the operations from point (6).

7. LONG RESET key keying. The METER is informed that the calibration procedure is finished. Before performing this operation, make sure the INDICATED value is the same as the REAL value.

8. NO OPERATION. At the end of the calculation, the new USER K FACTOR is shown for a few seconds, after which the reset cycle is repeated to finally achieve standby condition. IMPORTANT: From now on, the indicated factor will become the calibration factor used by the meter and will continue to remain such even after a battery change.

9. NO OPERATION. The METER stores the new user calibration factor and is ready to begin dispensing, using the USER K FACTOR that has just been calculated.

10. NO OPERATION. The METER stores the new user calibration factor and is ready to begin dispensing, using the USER K FACTOR that has just been calculated.

D.3. Direct Modification of K Factor

This procedure is especially useful to correct a "mean error" obtainable on the basis of several performed dispensing operations. If normal METER operation shows a mean percentage error, this can be corrected by applying to the currently used calibration factor a correction of the same percentage. In this case, the percentage correction of the USER K FACTOR must be calculated by the operator in the following way:

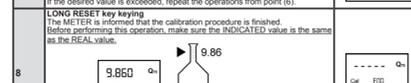
New cal. Factor = Old Cal Factor * (100 - %E) / 100

Example: Error percentage found 5% - 0.9% CURRENT calibration factor New USER K FACTOR

1.000 * [(100 - (- 0.9))/100] = 1.000 * [(100 + 0.9)/100] = 1.009

If the meter indicates less than the real dispensed value (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 dispensed value (positive error).

Direct procedure calibration:



1. NONE METER in Standby. Display: 12.345 L, 29345.7 G.

2. LONG CAL KEY KEYING. METER enters calibration mode, shows "CAL" and displays the calibration factor being used instead of the partial. The words "Fric" and "User" indicate which of the two factors (factory or user) is currently being used.

3. LONG RESET KEY KEYING. The METER shows "CAL" and the zero partial total. METER is ready to perform in-field calibration by dispensing - see previous paragraph.

4. LONG RESET KEY KEYING. We now go on to direct change of the calibration factor: the word "Direct" appears together with the currently used calibration factor.

5. SHORT RESET KEY KEYING. Changes the direction of the arrow. The operation can be repeated to alternate the direction of the arrow.

6. SHORTLONG CAL KEY KEYING. The indicated value changes in the direction indicated by the arrow one unit for every short CAL key keying. If the CAL key is kept pressed, the speed increase rises by continuously pressing the key pressed. If the desired value is exceeded, repeat the operations from point (5).

7. LONG RESET KEY KEYING. The METER is informed that the calibration procedure is finished. Before performing this operation, make sure the INDICATED value is that issued.

8. NO OPERATION. At the end of the calculation, the new USER K FACTOR is shown for a few seconds, after which the reset cycle is repeated to finally achieve standby condition. IMPORTANT: From now on, the indicated factor will become the calibration factor used by the meter and will continue to remain such even after a battery change.

9. NO OPERATION. The METER stores the new user calibration factor and is ready to begin dispensing, using the USER K FACTOR that has just been changed.

E. Configuration of unit of measurement

The METER features a menu with which the user can select the main measurement unit, Quarts (Qts), Pints (Pts), Litres (L), Gallons (Gal).

The combination of the unit of measurement of the Partial register and that of the Totals is predefined according to the following table:

Table with 3 columns: Combination no., Unit of Measurement Partial Register, Unit of Measurement Totals Register. Rows show combinations for Litres (L), Gallons (Gal), Quarts (Qts), and Pints (Pts).

F. Pulse Transmitter (Puls OUT)

The meter does not count, but the flow rate is correct

When the flow rate is correct, the flow rate is correct

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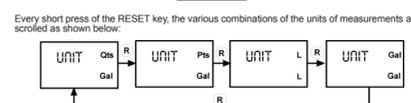
When the flow rate is correct, the flow rate is correct

To choose between the 4 available combinations: Wait for the METER to go to Standby



* then press the CAL and RESET keys together. Keep these pressed until the word "UNIT" appears on the screen together with the unit of measurement set at that time (in this example Litres / Litres)

Every short press of the RESET key, the various combinations of the units of measurements are scrolled as below:



By pressing the CAL key at length, the new settings will be stored, the METER will pass through the start cycle and will then be ready to dispense in the set units.

IMPORTANT: The Reset Total and Total registers will be automatically changed to the new unit of measurement.

NO new calibration is required after changing the Unit of Measurement.

F. Pulse Transmitter (Puls OUT)

In some models an outlet of "NPN-Open Collector" type is available. This outlet issues a certain number of pulses by Unit of measurement of the partial quantity dispensed. The number of pulses can be selected amongst 7 proposed options (1, 2, 5, 10, 20, 50, 100)