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A HOW K600/3 WORKS: GENERAL

K600 – meter and pulser versions - represents a family of meters developed to satisfy a wide range of requirements for the control, measurement, dispensing and transfer of lubricating oils and fuels. Its measurement principle is based on elliptical gears that provide high accuracy over a wide range of flow rates together with reduced loss of head. The fluid passing through the instrument turns the gears whose rotation transfers constant "fluid units". The exact measurement of the fluid dispensed is carried out by counting the rotations of the gears and, thus, the "fluid units" transferred. The magnetic coupling, consisting of magnets installed in the gears and a magnetic switch located outside the measuring chamber, guarantees the seal of the measuring chamber and ensures the transmission of the impulses generated by the rotation of the gears to the microprocessor.

The meter housing is manufactured of extruded aluminum and is furnished with external guides for a practical and simple installation. The various models are differentiated by the length of the housing, which is related to their ability to function at higher flow rates.

The meter body is made of die-cast aluminum and fitted with connections for the installation of threaded flanges, suitable for any type of tubing.

At the inlet opening, a filtering disk of stainless steel mesh is installed, which can be accessed from the outside by removing the flange close to the flow inlet side.

A.1 METER VERSION

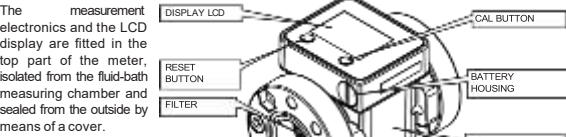
The user can choose between two different operating modes:

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 METER 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 METER features two numerical registers and various indications displayed to the user only when the applicable function so requires.

Key:

1. Partial register (5 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. Total 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
8. Indication of Flow Rate
9. Indication of unit of measurement of Partial: Qts=Quarts Pts=Pints L=Litres Gal=Gallons

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

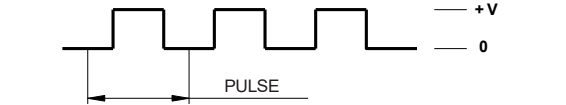
The METER is powered by two standard type 1.5 V batteries (size N).

The battery housing is closed by a threaded watertight cap that can be easily removed for quick battery change.

A.2 PULSER VERSION

The PULSER version is a pulse emitter (reed bulb) which translates the magnetic field variations generated by gear rotation into electric pulses to be sent to an external receiver. The receiver is to be connected according to the enclosed diagram. The pulser does not need any independent electric power supply, as it is directly powered by the receiver connection.

The issued pulse type is represented by a square wave generated by the voltage variation - see the following diagram:



The device calibration is carried out by means of the external pulser receiver.

A.3 MEASURING CHAMBER

The measuring chamber is located in the lower part of the instrument. It is fitted with connections for the installation of threaded flanges at inlet and outlet. The cover on the bottom part provides access to the measurement mechanism for any cleaning operations.

Inside the measuring chamber are the oval gears which, on turning, generate electrical pulses which are processed by the microprocessor-controlled electronic board.

By applying a suitable calibration factor (meaning a "weight" associated with each pulse), the microprocessor – on-board on meter versions and remote on pulser versions - translates the pulses generated by the fluid volume rotation expressed in the set units of measurement, displayed on the partial and total registers of the LCD.

All K600/23 meters are factory set with a calibration factor called FACTORY K FACTOR which is set according to the used fluid (diesel fuel or oil of SAE10 W40 type), for optimal measurement performance.

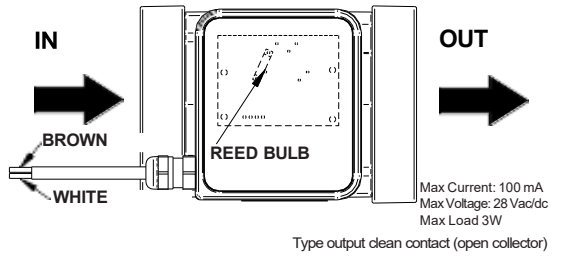
Calibration settings can be changed following the instructions in this manual, but you can return to the factory calibration at any time.

B INSTALLATION

K600 METER or PULSER features a 1 inch or 3/4 inch inlet and outlet, depending on the fluid for which they were calibrated, threaded and perpendicular. It is designed for fixed in-line installation. Make sure the threaded connections do not interfere with the inside of the measuring chamber causing the gears to seize.

Do not use any conical connectors which may damage the meter body or the connection flange. Only the Pulser version must be connected by means of 2 cables according to the electrical features in the diagram.

IMPORTANT: CARRY OUT INSTALLATION BY PLACING THE SUCTION FILTER.



C DAILY USE

C.1 PULSER VERSION

The pulser version of K600/3 meter when properly connected to the pulse receiver, does not need any start/stop operation.

C.2 METER VERSION

K600 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 Resettable Total register 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 Resettable Total register, positioned in the lower part of the display, indicates the quantity dispensed since the last Resettable 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: 10000 x 10 –> 999999 x 10 –> 10000 x 100 –> 999999 x 100

C.2.1 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 Resettable Total to General Total: the word RESET above the word TOTAL disappears, and the Reset Total is replaced by the General Total.

The situation is called STANDBY and remains stable until the user operates the meter again.

C.2.2 Partial reset

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».

The situation is called STANDBY and remains stable until the user operates the meter again.

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.2.3 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 Reset Total is shown.

C.2.4 Dispensing in Flow Rate Mode

It is possible to dispense, 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 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.

WARNING: The flow rate is measured with reference to the unit of measurement of the Partial. For this reason, in case of the unit of measurement of the Partial and Total being different, as in the example shown below, it should be remembered that the indicated flow rate relates to the unit of measurement of the partial. In the example shown, the flow rate is expressed in Qts/min.

The word "Gal" remaining alongside the flow rate refers to the register of the Totals (Reset or NON Reset) which are again displayed when exiting from the flow rate reading mode.

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

Warning: 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.

To reset the Partial Register, finish dispensing and wait for the meter 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 (ONLY METER VERSIONS)

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:

version for oil: Fluid motor oil type SAE 10W40

version for diesel fuel

Temperature: 20°C

Flow rate: 6-60 litres/min

Fluid motor oil type SAE 10W40

Temperature: 20°C

Flow rate: 6-60 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

K600 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.

D.3 Calibration procedure

K600 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.

1. In calibration mode, the partial and total dispensed quantities indicated on the display screen take on different meanings according to the calibration procedure phase.
2. In calibration mode, the METER cannot be used for normal dispensing operations.
3. In "Calibration" mode, the totals are not increased.

ATTENTION

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 "Fact" abbreviation for "factory" shows that the factory calibration factor is being used

If, on the other hand, calibrations have been made by the user, the display page will appear showing the currently used calibration factor (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 switchover 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 "Fact" 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

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.

ATTENTION

- 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.

D.3.2.1 In-field calibration procedure

OPERATION	DISPLAY
1 NONE METER in normal mode, not in counting mode.	12.345 L FACT
2 LONG CAL KEY KEYING The METER enters calibration mode, shows «CAL» and displays the calibration factor in use instead of partial. The words "Fact" and "USER" indicate which of the two factors (factory or user) is currently in use. Important:	1.000 L FACT
3 LONG RESET KEY KEYING The METER shows "CAL" and the zero partial total. The meter is ready to perform in-field calibration	0.000 L FACT
DISPENSING INTO SAMPLE CONTAINER Without pressing any button, start dispensing into the sample container.	8.800 L FACT
4 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.	Indicated value Real value
5 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 register (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 and downwards), that shows the direction (increase or decrease) of the USER K FACTOR value change when the operations 6 or 7 are performed.	9.800 L FACT
6 SHORT RESET KEY KEYING Changes the direction of the arrow. The operation can be repeated as many times as you wish	9.800 L FACT
7 SHORT/LONG CAL KEY KEYING The indicated value changes in the direction indicated by the arrow - one unit for every short CAL key keying - continually if the CAL key is kept pressed. (for the first 5 units slowly and then quickly) If the desired value is exceeded, repeat the operations from point (6).	9.800 L FACT
8 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	9.800 L FACT
9 NO OPERATION After the end of the calculation, the new USER K FACTOR is shown for a few seconds, after which the restart cycle is repeated to finally achieve standby condition.	1.015 L FACT
10 NO OPERATION METER stores the new calibration factor and is ready for dispensing, applying the newly defined USER K FACTOR.	0.000 L FACT

D.3.3 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:

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

Example:

Error percentage found 5% -0.9 %

CURRENT calibration factor 1,000

New USER K FACTOR $1,000 \times \left(\frac{100}{100 - (-0.9)} \right) = 1,009$

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).

OPERATION	DISPAY CONFIGURATION
1 NONE METER in normal mode, not in counting mode.	12.345 L FACT
2 LONG CAL KEY KEYING METER enters calibration mode, shows «CAL» and displays the calibration factor being used instead of the partial. The words "Fact" and "User" indicate which of the two factors (factory or user) is currently being used.	1.000 L FACT
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	0.000 L FACT
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. In the bottom left part of the display, an arrow appears (upwards or downwards) defining the direction (increase or decrease) of change of the displayed value when subsequent operations 5 and 6 are performed.	1.000 L FACT
5 SHORT RESET KEY KEYING Changes the direction of the arrow. The operation can be repeated to alternate the direction of the arrow	1.000 L FACT
6 SHORT/LONG CAL KEY KEYING The indicated value changes in the direction indicated by the arrow - one unit for every short CAL key keying - continually if the CAL key is kept pressed. The speed increases if the CAL key is kept pressed. If the desired value is exceeded, repeat the operations from point (5)	1.000 L FACT
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 required.	1.000 L FACT
8 NO OPERATION At the end of the calculation, the new USER K FACTOR is shown for a few seconds, after which the restart 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	1.000 L FACT
9 NO OPERATION METER stores the new calibration factor and is ready for dispensing, applying the newly defined USER K FACTOR.	0.000 L FACT

E METER CONFIGURATION

METER is fitted with a menu by which the user can select the main unit of measurement, Quarts (Qts), Pints (Pts), Litres (L), Gallons (Gal). The combination between the unit of measurement of the Partial Register and that of the Totals is set according to the following table:

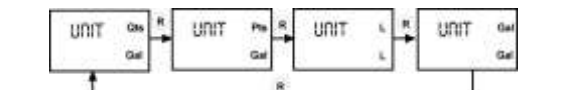
Combination no.	Unit of Measurement Partial Register	Unit of Measurement Totals Register
1	Litres (L)	Litres (L)
2	Gallons (Gal)	Gallons (Gal)
3	Quarts (Qts)	Gallons (Gal)
4	Pints (Pts)	Gallons (Gal)

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 shown 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.

ATTENTION

The Resettable 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 MAINTENANCE

The METER has been designed to require a minimum amount of maintenance.

- The only maintenance jobs required are:
- Battery change – necessary when batteries have run down (ONLY FOR METER VERSIONS)
- Cleaning the measuring chamber. This may be necessary due to the particular nature of the dispensed fluids or due to the presence of solid particles following bad filtering.

1 Changing the batteries

The METER is complete with 2 x 1.5 V. alkaline batteries SIZE N.

The METER features two low-battery alarm levels:

1) When the battery charge falls below the first level on the LCD, the fixed battery symbol appears.

In this condition, the METER continues to operate correctly, but the fixed icon warns the user that it is time to change the batteries.

2) If meter operation continues without changing the batteries, the second battery alarm level will be reached which will prevent operation. In this condition the battery icon starts to flash and is the only one to remain visible on the LCD.

ATTENTION

Do not discard the old batteries into the environment. Refer to local disposal regulations.

- To change the batteries, with reference to the spare parts list positions, proceed as follows:
- Press RESET to update all the totals
 - Unscrew the battery cap (pos.8)
 - Remove the old batteries
 - Place the new batteries in the same position as the old ones, making sure the positive pole is positioned as indicated on the cover (pos.9)
 - Re-lighten the battery cap, making sure the seal (pos.1) are correctly positioned.
 - The METER will switch on automatically and normal operation can be resumed.

The METER will display the same Reset Total, the same Total and the same Partial indicated before the batteries were changed.

After changing the batteries and, subsequently, every time there is a power break, the METER will start again and use the same calibration factor used when the break occurred. The meter does not therefore need calibrating again.

2 Cleaning the MEASURING CHAMBER

The K600 measuring chamber can be cleaned without removing the instrument from the line on which it is fitted. Make sure the gears are turning freely before closing the cover.

ATTENTION

Always make sure that the liquid has drained from the meter before cleaning.

To clean the chamber, proceed as follows (with reference to the exploded diagram positions):

- Loosen the four retention screws of the lower cover (pos. 7).
- Remove the cover (pos. 7) and the seal (pos. 8).
- Remove the oval gears.
- Clean where necessary. For this operation, use a brush or pointed object such as a small screwdriver.
- Be careful not to damage the body of the gears.
- To reassemble the instrument, perform the operations in the opposite sequence.

ATTENTION

Perform the assembly diagram to reassemble the gears.

ATTENTION

Only one of the two gears, modularly coupled as shown in the picture aside, features magnets. Observe the position of the gear with magnets, as shown in the figure. Fit the second gear (without magnets) with axis greater than 90° compared to the first gear.

3. Cleaning the filter

The filter cleaning interval is to be defined depending on the impurities contained in the fluid. To perform this operation, remove the device from the line on which it is installed, as the filter is placed between the meter body and tube connection flange.

ATTENTION

Always make sure that the liquid has drained from the meter before cleaning.

To clean the filter, proceed as follows (with reference to the exploded diagram positions):

- To access the filtering disk of the K600/3, loosen the 2 fixing screws of the connection flange at the inlet. Remove both flanges if it is necessary for the system.
- Remove the meter from the line, being careful to remove also the gaskets between the flanges and threaded connections of K600.
- Slide out the filter (pos. 9)
- Clean the filter with compressed air.
- Carry out the reverse procedure to reassemble the filter.

G MALFUNCTIONS

G.1 Electronic malfunctions

Problem	Possible Cause	Remedial Action
LCD: no indications	Bad battery contact	Check battery contacts
Not enough measurement precision	Wrong K FACTOR	With reference to paragraph H, check the K FACTOR
The meter does not count, but the flow rate is correct	The meter works below minimum acceptable flow rate	Increase the flow rate until an acceptable flow rate range has been achieved
	Possible electronic board problems	Contact your dealer

G.2 Mechanical malfunctions

Problem	Possible Cause	Remedial Action
Reduced or zero flow rate	Gears blocked	Clean the measuring chamber
The meter does not count, but the flow rate is correct	Incorrect installation of gears after cleaning	Repeat the reassembly procedure
Inaccuracy	Incorrect calibration of pulser version	Calibrate the device with the pulser receiver
	working flow-rate outside the flow-rate range	reduce or increase the flow-rate to return to the indicated flow-rate range.
High loss of head	dirty filter	Clean the filter
	Braked gears	clean the measuring chamber
It does not count	Wrong gear installation	check the position of the gear with magnet.
	faulty bulb	change the bulb

H TECHNICAL SPECIFICATIONS

		K600/3 (oil)		K600/3 (diesel fuel)	
		Meter	Pulser	Meter	Pulser
Resolution	L/pulse	36	35	33.5	33.5
	Gal/pulse	132.5	132.5	127	127
Flow-rate range	L/min	6 + 60	10 + 100		
Operating pressure	bar	70	30		
Bursting pressure	bar	140	60		
Measurement system		Elliptical gears			
Storage temperature	°C	-20 + +70			
Storage humidity	H.R.	95%			

