

INDEX

- A. **Becoming acquainted with METER: General information**
- B. **Installation**
- C. **Daily use**
 - C.1. Dispensing in Normal mode
 - C.1.1 Azzeramento del Parziale
 - C.1.2 Resetting the Reset Total
- D. **Calibration**
 - D.1 Definitions
 - D.2 Why calibrate
 - D.3 Calibration Procedure
 - D.3.1 Display of Current Calibration Factor and Restoring Factory Factor
 - D.3.2 In Field Calibration
 - D.3.2.1 Sequence of operations to be performed for correct in-field calibration:
 - D.3.3 Direct Modification of K Factor
- E. **Meter Configuration**
- F. **Maintenance**
- G. **Malfunctions**
- H. **Technical Details**
- I. **Spare parts**

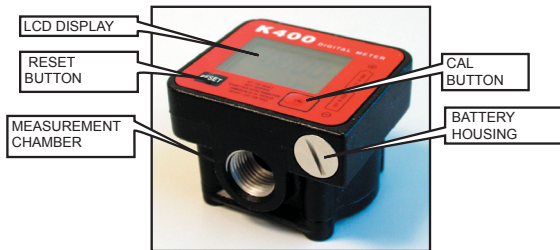
A. Becoming acquainted with METER: General information

METER is an electronic digital meter featuring an oval-gear measurement system, designed for easy and precise measuring of oils and other liquids compatible with the component materials.

The fluid, by flowing through the appliance, rotates the gears which, during their rotation, transfer, "volume units" of fluid. The exact measurement of the dispensed fluid is done by counting the number of rotations made by the gears and consequently the number of transferred "volume units". The magnetic coupling, between the magnets installed in the gears and a magnetic switch outside the measurement chamber, ensures measurement chamber sealing and ensures transmission of the pulses generated by gear rotation to the electronic board microprocessor.

In the dispensing mode (Normal Mode), the partial and the total amounts are shown in two different registers of the LCD.

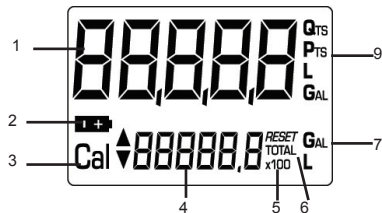
The METER features a non-volatile memory for storing the dispensing data, even in the event of a complete power break for long periods.



The measurement electronics and the LCD display are fitted in the top part of the meter, isolated from the fluid-bath measurement chamber and sealed from the outside by means of a cover.

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



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. 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
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) **Measurement Chamber**

The measurement chamber is located in the lower part of the instrument.

It features a threaded inlet and outlet.

The cover on the bottom part provides access to the measurement mechanism for any cleaning operations.

Inside the measurement 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 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 the meters are factory set with a calibration factor called FACTORY K FACTOR equal to 1,000.

For best meter performance - adapting this to the intrinsic characteristics of the fluid to be measured - the instrument can be "calibrated".

It is possible to return to factory calibration at any time.

4) **Battery Housing**

The METER is powered by two standard type 1.5 V batteries (size 1N).

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

B. Installation

The METER features a ½ inch inlet and outlet, threaded and perpendicular, and has been designed to be installed in any position, both as fixed in-line installation and as moving installation on a dispensing nozzle.

Make sure the threaded connections do not interfere with the inside of the measurement chamber causing the gears to seize.

METER does not have a fixed direction of flow and both inlets can be used as inlet and outlet.

Make sure a filter with adequate filtering capacity is always fitted either at meter inlet or at the entrance of the line on which the meter is fitted. If solid particles enter the measurement chamber, the gears could seize.

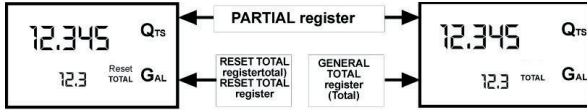
C. Daily use

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 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 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 x 10 / x100.

The increment sequence is the following:

0.0 → 99999.9 → 99999 → 100000 x 10 → 999999 x 10 → 100000 x 100 → 999999 x 100

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 Azzeramento del Parziale

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 Reset Total is shown.

D. Calibration

D1. 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.

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 cannot 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 "Fact" 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 (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





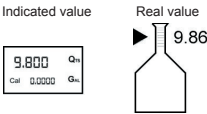




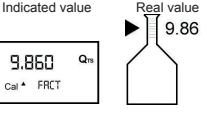
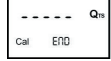


This procedure calls for the fluid to be dispensed into a graduated sample container in real operating conditions (flow rate, viscosity, etc.) requiring maximum precision.

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.**

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

	Action	Display
1	NONE METER in Standby.	
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: 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.	
4	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. 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 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 and downwards), that shows the direction (increase or decrease) of the value change displayed when the following operations 6 or 7 are performed.	
6	SHORT RESET key keying The arrow changes direction. The operation can be repeated to alternate the direction of the arrow.	
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. The speed increase rises by keeping the key pressed. If the desired value is exceeded, repeat the operations from point (6).	
8	LONG RESET key keying The METER is informed that the calibration procedure is finished. <u>Before performing this operation, make sure the INDICATED value is the same as the REAL value.</u>  The METER calculates the new USER K FACTOR ; this calculation could require a few seconds, depending on the correction to be made.	
9	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	
10	NO OPERATION The METER stores the new work calibration factor and is ready to begin dispensing, using the USER K FACTOR that has just been calculated.	

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:

$$\text{New cal. Factor} = \text{Old Cal Factor} * \left(\frac{100 - E\%}{100} \right)$$

Example:
 Error percentage found E% - 0.9 %
 CURRENT calibration factor 1.000
 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).

	Action	Display Configuraton
1	NONE METER in Standby.	
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.	
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. 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 or 6 are performed.	
5	SHORT RESET KEY KEYING Changes the direction of the arrow. The operation can be repeated to alternate the direction of the arrow.	
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 increase rises by keeping 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. <u>Before performing this operation, make sure the INDICATED value is that required.</u>	
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	
9	NO OPERATION The METER stores the new work calibration factor and is ready to begin dispensing, using the USER K FACTOR that has just been changed.	

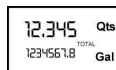
E. Measurement Units configuration

Some models are provided with a menu through which the user can select the main measurement unit, Quarts (Qts), Pints (Pts), Litres (Lit), 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:

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)

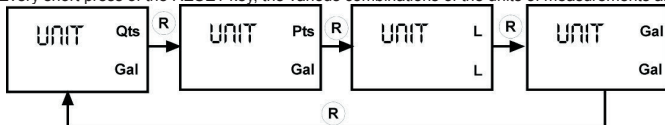
To choose between the 4 available combinations:

* 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.

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. Maintenance

The METER has been designed to require a minimum amount of maintenance.
The only maintenance jobs required are:

- Battery change – necessary when the batteries have run down
- Cleaning the measurement 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 1N.

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.

IMPORTANT

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, proceed as follows:

- Press RESET to update all the totals
- Unscrew the battery cap (pos.10)
- 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-tighten the battery cap, making sure the seal (pos.11) 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 METER measurement chamber can be cleaned without removing the instrument from the line or from the dispensing nozzle on which it is fitted.

IMPORTANT

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

To clean the chamber, proceed as follows (with reference to the spare parts list positions):

- Loosen the four cover retention screws (pos. 15)
- Remove the cover (pos. 14) and the seal (pos. 13)
- 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 or the gears.

- To reassemble the instrument, perform the operations in the opposite sequence.

IMPORTANT

Only one of the two gears features magnets. This must be fitted in the position marked "MAGNET" (see drawing). Once the gear has been fitted, the magnets must be visible before closing the cover.

Fit the second gear (without magnets) with axis greater than 90° compared to the first gear, and with the holes visible from the cover side.

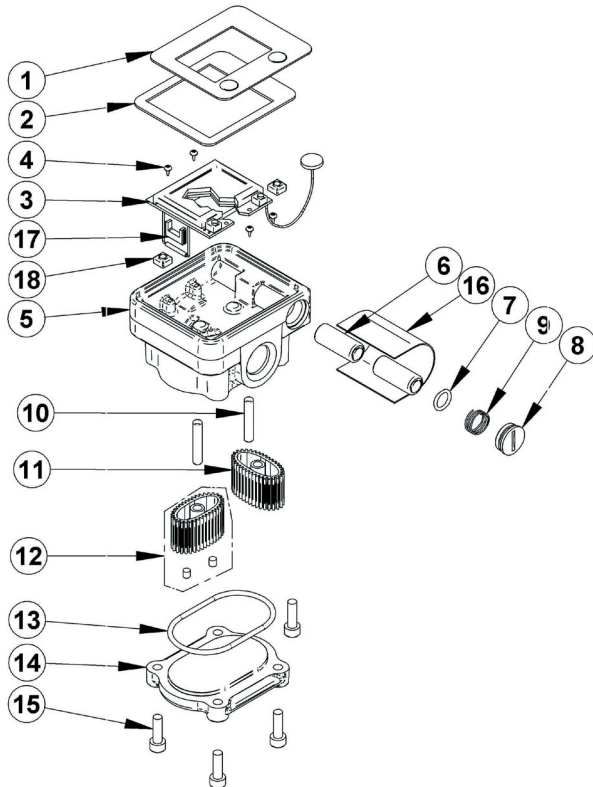
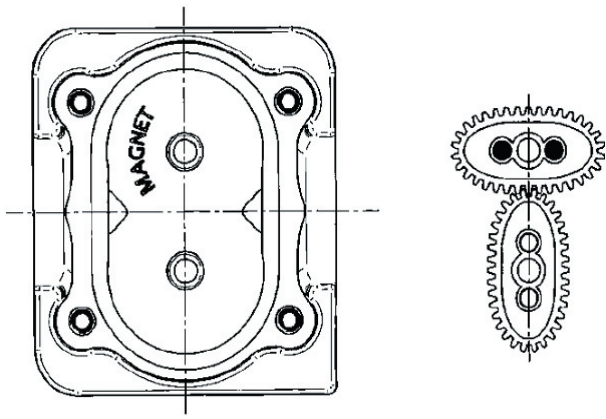
Make sure the gears are turning freely before closing the cover.

G. Malfunctions

Problem	Possible cause	Remedial Action
LCD: indications dull	Battery low	See paragraph H- Maintenance-replace battery
Not enough measurement precision	Wrong K FACTOR	With reference to paragraph F, check the calibration factor
	The meter works out of flow rate nominal range.	Reenter at flow rate nominal range
Reduced or zero flow rate	Gears blocked	Clean the measurement chamber
Indication Err 1 flashing	The data in the electronic board memory have been damaged	Not repairable
Indication Err 2 temporary	Temporary error during data reading (possible at change battery)	The board will restart automatically to restore correct working
The meter does not count, but the flow rate is correct	Incorrect installation of gears after cleaning	Repeat the reassembly procedure
	Possible electronic board problems	Contact your dealer

H. Technical Details

Measurement system		Oval gears	
Resolution	(nominal)	0.005	(Litres/pulse)
Flow Rate	(Range)	1+25	(Litres/minute)
Operating pressure	(Max)	70	(Bar)
Bursting pressure	(Min)	140	(Bar)
Storage temperature	(Range)	-20 + + 70	(°C)
Storage humidity	(Max)	95	(% RH)
Operating temperature	(Max)	60	(°C)
Flow resistance	(at 15 l/min with oil SAE10W at 20°C)	1.3	(Bar)
Viscosity	(Range)	5+5000	(mPas)
Precision	(between 5 and 25 l/min)	±1 of value indicated after calibration	(%)
Reproducibility	(Typical)	±0.3	(%)
Screen	Liquid crystals LCD Featuring: - 5-figure partial - 6-figure Reset Total plus x10 / x100 - 6-figure non reset Total plus x10 / x100		
Power supply	2x1.5 V alkaline batteries size 1N		
Battery life	14,000+100,000 h		
Weight	0.375 kg (including batteries)		



Posiz.	Descrizione componente	Quant.
1	NAME PLATE CAL	1
2	SELF-STICKER	1
3	LITERS ELECTRONIC BOARD	1
4	SCREW D.2.2x4.5	4
5	HOUSING GAS	1
6	BATTERY 1.5V N SIZE	2
7	O-RING 2043	1
8	BATTERY PLUG + O-RING	1
9	CONIC SPRING	1
10	OVAL GEAR PIVOT	2
11	MEASURING CHAMBER OVAL GEAR	1
12	OVAL GEAR WITH MAGNET	1
13	O-RING 3206	1
14	COVER	1
15	SCREW D.5x16	4
16	BATTERY PROTECTION	1
17	SPACER FOR BULBS	1
18	SPACER FOR KEY	2

DICHIARAZIONE DI CONFORMITA'
In accordo con la direttiva:
89/336/CEE (compatibilità elettromagnetica) e successive modifiche

PIUSI S.p.A. - 46029 Suzzara (Mantova) Italy
dichiara che il seguente modello di contaltri

K400

a cui la presente dichiarazione si riferisce, rispetta la applicabili normative indicate nel seguito:
Normative europee: EN 61000-6-1; EN 61000-6-3; EN 55014-1-2000; EN55014-2-97

Suzzara li 01/01/2004

il Presidente. Otto Varini

DECLARATION OF CONFORMITY
In conformance with the directives
89/336/CEE (compatibilità elettromagnetica) e successive modifiche

PIUSI S.p.A. - 46029 Suzzara (Mantova) Italy
declares that the followinf meter

K400

To witch this declaration refers, conforms to the following applicable regulations:
European Regulations: EN 61000-6-1; EN 61000-6-3; EN 55014-1-2000; EN55014-2-97

Suzzara li 01/01/2004

the President Otto Varini