PROGRAMMING INSTRUCTIONS

Electronic Oil Meters
1/2″ - 2″

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ISTEC
Flow Measurement & Control

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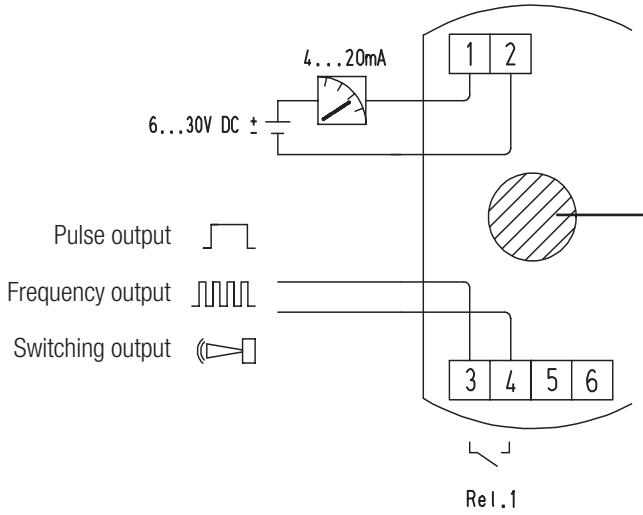
Electrical connections

Our different output functions are available:
- Pulser for volume pulses with programmable pulse value (for external totaliser)
- Analogue current output 4...20 mA corresponding to flow rate
- Frequency output 0...100 Hz corresponding to flow rate
- Switching function (limiting value switch) specified by programmable upper and lower flow rates

Except for the analogue output function, any two of the remaining three functions can always be used simultaneously.
This results in two types of connection; the desired one must be set in the Parameter Menu.

- 1 potential-free digital output (Rel.1), freely parameterisable to one of the three functions mentioned below.
- passive current output, 4…20 mA (Analog), used to power the meter at the same time.

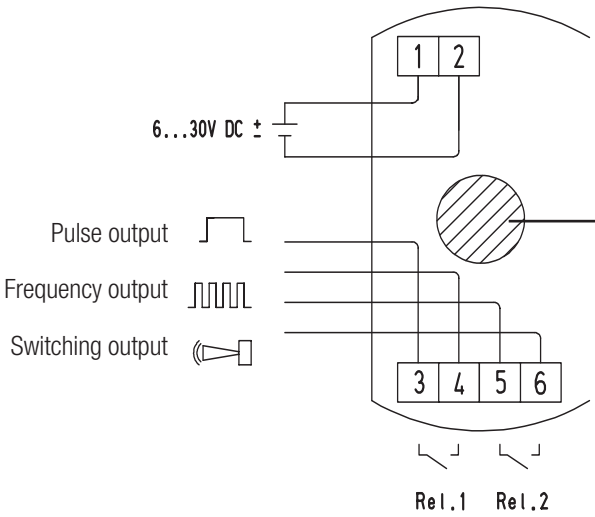


Current Output
Resistance R_L : (U-5)V/0,0215 [Ω]
Exemple 24 V : (24-5)/0,0215 = 883 Ω

Sensor area!
No cables, wires or other installation material must be present in this area. This can lead to incorrect measurements and damage to the meter.

Solid state relay
$R_{ON} \leq 100\ \Omega$, $R_{OFF} \geq 10\ M\Omega$
$U_{max} \leq 48$ V AC/DC, $I_{max} \leq 50$ mA

- Choose any two (2), programmed as followes:.



Sensor area!
No cables, wires or other installation material must be present in this area. This can lead to incorrect measurements and damage to the meter.

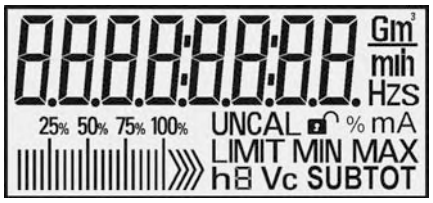
Solid state relay
$R_{ON} \leq 100\ \Omega$, $R_{OFF} \geq 10\ M\Omega$
$U_{max} \leq 48$ V AC/DC, $I_{max} \leq 50$ mA

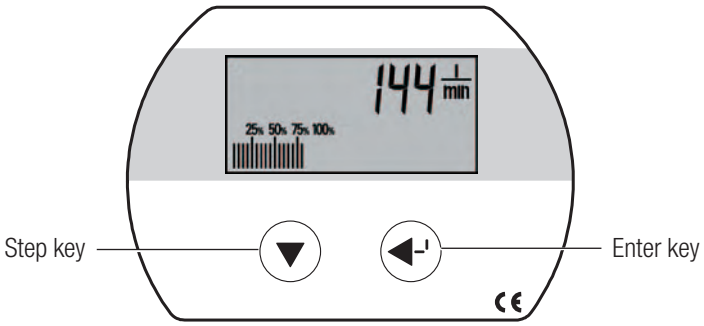
Factory setting: 2 digital outputs
Output 1: Rel.1 – Volume pulses: 250 ms, 1 Ltr/pulse (DN40-50: 10 Ltr/pulse)
Output 2: Rel.2 – Limiting value switch: Limit min = Q_{min}, Limit max = Q_{max}, Hysteresis 1%

Setting the display
The display can be rotated 360° in 90° steps during installation to improve readability.

Data preservation
All data are saved periodically, and every time a key is pressed, in a non-volatile memory (EEPROM). This means that the last value is saved even if the power supply is interrupted.

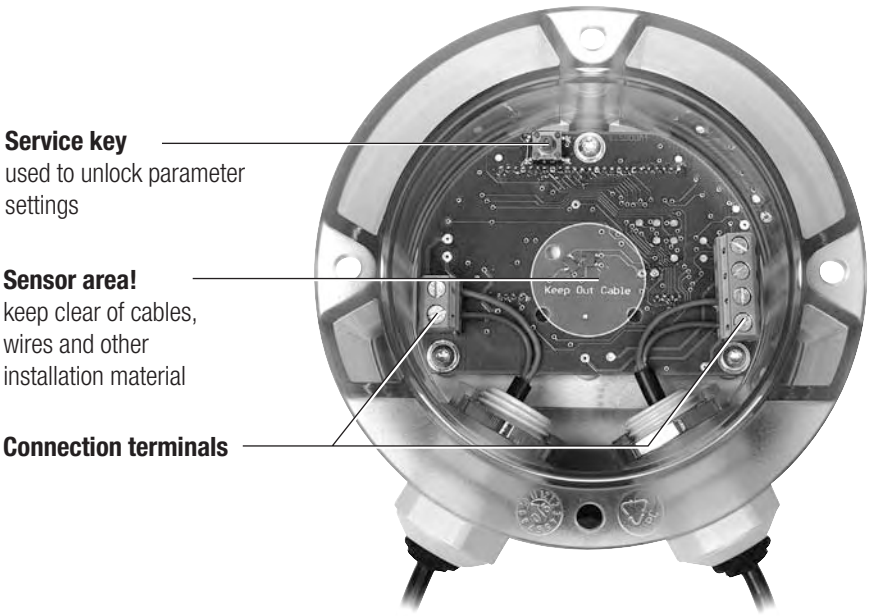
Operating notes
The 7-segment display can show 8-digit measured values with a decimal point or text messages using letters in a special presentation mode. Units of measurement and additional items of information are shown with symbols or index indicators. The references to these in the text are shown in square brackets, e.g. [LIMIT MAX]





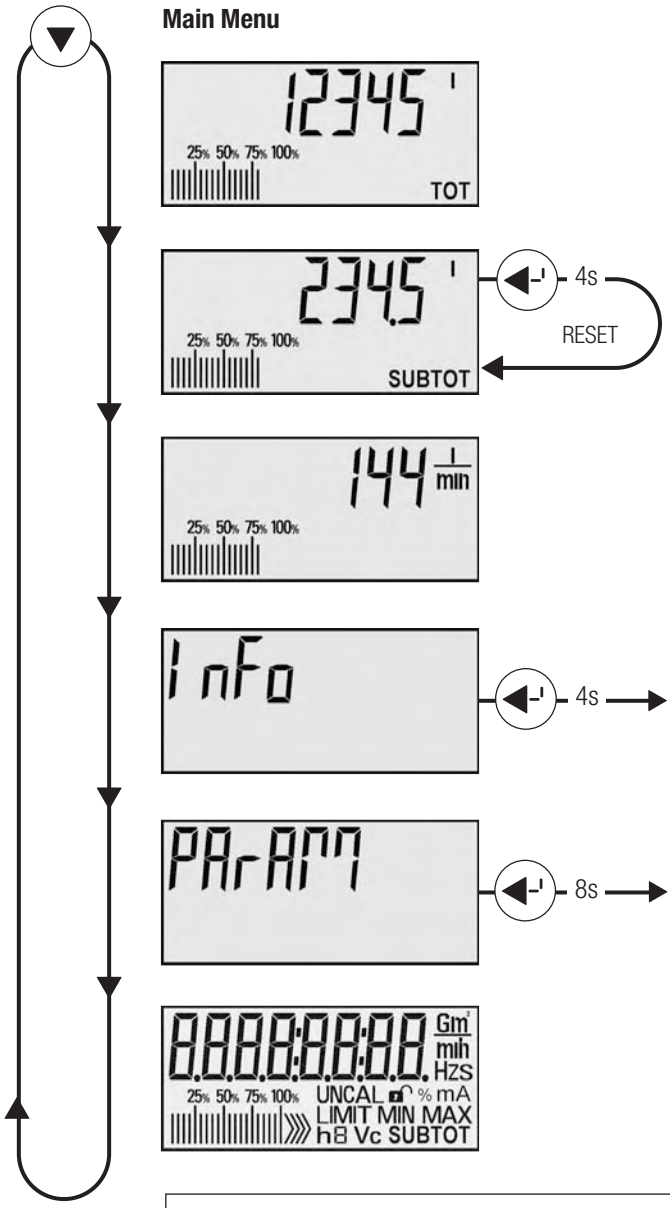
To operate, use the Step key (triangle) and the Enter key (hooked arrow).

The display data and parameters are split into three menu groups:
- Main Menu: displays measured data, accesses other menus, tests display segments and displays error messages (if present).
- Information Menu: displays additional information about the meter and operating status
- Parameter Menu: displays parameter settings for the display and output signals. To set these parameters, the device must be unlocked with the Service key. This is located in the connections compartment and is only accessible after the display module has been opened or unscrewed.



Operation and Programming

Main Menu: displays most important measured data, accesses other menus, tests display
The standard display of the Main Menu is the total volume. Use the Step key to go to the measured value for the resettable volume or the flow rate and other menu items, as follows:



Total volume [TOT] cannot be reset
Standard display adopted by the meter after a time-out. The flow indicator bar corresponds to the meter measuring range. It shows the flow rate by means of graduation marks, in steps of 5 per cent up to Q_{max}.

Subtotal volume [SUBTOT] can be reset
Reset: press the Enter key for **4 seconds**.
Reset must be enabled in the Parameter Menu. The flow indicator bar corresponds to the meter measuring range.It shows the flow rate by means of graduation marks, in steps of 5 per cent up to Q_{max}.

Current flow rate
Besides being displayed numerically, this value is also shown in the display by a bar with graduation marks, each mark representing 5% of the maximum permitted flow rate.

Entry portal for the Information Menu
Display additional information about the device and operating status (For details, see next page).
To access: press the Enter key for **4 seconds**.
Time-out: 60 seconds

Entry portal for the Parameter Menu
Display and settings for device and operating parameters for display and outputs (for details, see page 21).
To access: press the Enter key for **8 seconds**.
Time-Out: 60 seconds

Display test
All the segments are shown for 2 seconds for monitoring. This test is also performed after switching on the unit.

Device errors
If a device error is detected during the periodic self-test, this message is briefly shown on the display every 2 seconds. Measuring accuracy is impaired.
CAUTION! Meter may supply incorrect values.
The Information Menu gives more information on the error.

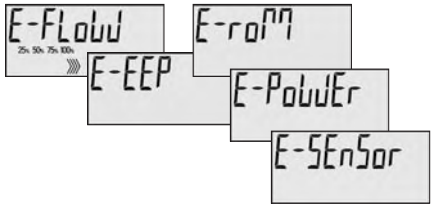
The value diplayed in "subtotal volume" [SUBTOT] can be reset to zero by pressing the Enter key for about 4 seconds, unless this function has been disabled in the Parameter Menu.
If a meter error is present, the [ERROR] warning appears on the display every 2 seconds. Details about the error are shown in the Information Menu.

Information Menu: display additional information about meter and operating status

Select the [INFO] item from the Main Menu and then press the Enter key for approx. 4 seconds to enter the Information Menu. Use the Step key to view the following additional information about the meter and the operating status:

Information Menu

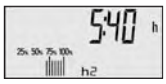
This is only shown when an error has been detected. CAUTION! Meter may supply incorrect measured values



Error status [E- . . .]
[E-FLOW] flow overload
[E-EEP] data error in EEPROM
[E-ROM] data error in ROM
[E-POWER] error in power supply
[E-SENSOR] signal error
For details, see "Error messages" page 29.

Hours in operation [H0]
Total hours in operation for the meter in HH:MM format

Hours in operation [H1]
Hours in operation (HH:MM) in the optimal flow range, Q_{min} - Q_N



Hours in operation [H2]
Hours in operation (HH:MM) in the upper flow range, Q_N - Q_{max}

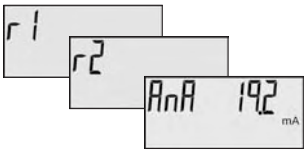
Hours in operation [H3]
Hours in operation (HH:MM) above Q_{max}

Duration [H4]
Duration (HH:MM) since last recorded flow

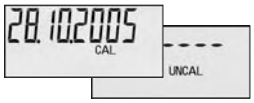
Peak flow rate [MAX Q]
Maximum value of flow rate since starting operation

Nominal size DN15 … DN50
[CAL] calibrated nominal size of the flow sensor

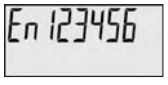
Measuring chamber volume [VC]
[CAL] calibrated volume of the flow sensor



Status display for outputs
2 relay outputs
1 analogue current output
Details on next page



Calibration date [DD.MM.YYYY]
[CAL] calibrated in factory
[UNCAL] delivered in uncalibrated state (spare part)



Serial number of electronics module [EN]
Consecutive number to identify the hardware

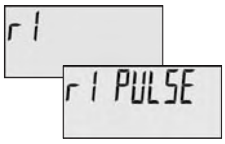
Firmware Version [FW]
Version number of electronics module firmware

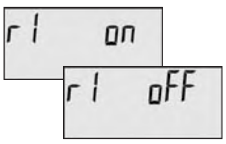
Main Menu

Information Menu - Detailed view, outputs

Status of RELAY 1
Only the function that is enabled in the parameter setting is shown

volume pulses or **frequency signal** or **limiting value switch**





Status of pulse output [R1]
[PULSE] appears as long as the pulse signal is present at the output

Status of frequency output [R1 . . . Hz]
displays the current flow output frequency

Status of limiting value switch [R1 . . .]
displays the current relay status
[ON] switch closed
[OFF] switch open

(With very fast pulse trains "PULSE" will be displayed continuously)

Only the second output enabled in the "Output selection" parameter setting is shown (relay 2 or analogue)

Status of RELAY 2
Function as for relay, 1 see above

Status of pulse output [R2]

Status of frequency output [R2 . . . Hz]

Status of limiting value switch [R2 . . .]

or
ANALOG status display

Status of current output [ANA ...mA]
Displays the current value of the current output

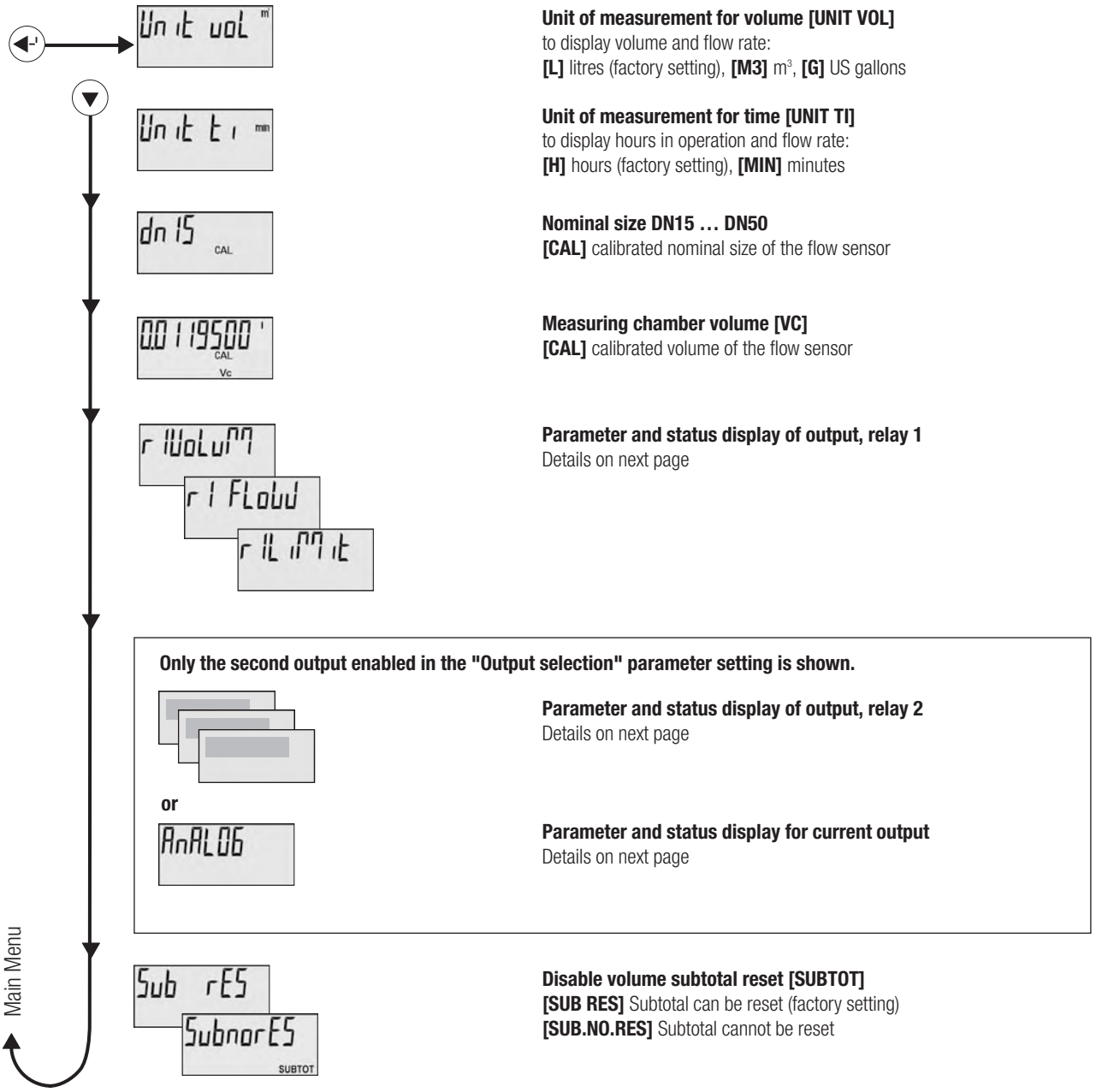
Main Menu

If both keys are pressed at the same time, or if no key is pressed for 60 seconds, the device returns to the standard display.

Parameter Menu: show parameter settings for display and output signals
Select the [PARAMETER] item from the Main Menu and press the Enter key for approx. 8 seconds to enter the Parameter Menu.

The menu structure for reading out parameters is shown below. Use the Step key to display all the parameters that are set. Submenus are available for the relay and power output menus; to enter them, press the Enter key.

Parameter Menu



Unit of measurement for volume [UNIT VOL]
to display volume and flow rate:
[L] litres (factory setting), **[M3]** m^3, **[G]** US gallons

Unit of measurement for time [UNIT TI]
to display hours in operation and flow rate:
[H] hours (factory setting), **[MIN]** minutes

Nominal size DN15 … DN50
[CAL] calibrated nominal size of the flow sensor

Measuring chamber volume [VC]
[CAL] calibrated volume of the flow sensor

Parameter and status display of output, relay 1
Details on next page

Parameter and status display of output, relay 2
Details on next page

Parameter and status display for current output
Details on next page

Disable volume subtotal reset [SUBTOT]
[SUB RES] Subtotal can be reset (factory setting)
[SUB.NO.RES] Subtotal cannot be reset

If both keys are pressed at the same time, or if no key is pressed within 15 minutes, the device returns to the standard display.

Parameter Menu - detailed view of outputs

Parameter display, RELAY 1

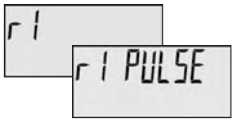
Only the function enabled in the "Output selection" parameter setting is shown.

volume pulses (page 27) or **frequency signal** (page 27) or **limiting value switch** (page 28)

pulse width of volume pulses in ms

pulse value of one volume pulse
[LPP] in litres per pulse for volume unit [L] or [m³]
[PPG] pulses per US gallon for volume unit [G]

pulse indication
[PULSE] appears as long as the pulse signal is present at the output



(With a very fast pulse train, "PULSE" may be displayed continuously.)

lower flow rate value for frequency output Q1 for f1

lower frequency of frequency output f1 for Q1

upper flow rate value of frequency output Q2 for f2

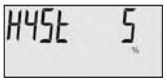
upper frequency of frequency output f2 for Q2

current frequency output
frequency for flow rate in Hz

lower flow rate limiting value
Limit Q_{min}

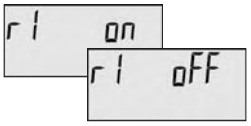
upper flow rate limiting value
Limit Q_{max}

hysteresis [HYST]
in percent of limiting values



Working position of contacts
[ACT ON] closed at limiting value
[ACT OFF] open at limiting value

current position of contact
[ON] contact closed
[OFF] contact open



Only the second output enabled in the "Output selection" parameter setting appears (relay 2 or analog)

Parameter display, RELAY 2

Only the function that is enabled in the parameter setting is shown:
volume pulses or **frequency signal** or **limiting value switch** (for details see relay 1)

or ANALOG parameter display

lower flow rate value
Q_{min} for 4mA

upper flow rate value
Q_{max} for 20mA

Attenuation of current output [DAMP]
[1] no damping **[10]** high damping

Current output in case of an error [ERR...]
[HIGH] 21,5mA, **[LOW]** 3,5mA, **[OFF]** no output

current status of current output [ANA]
displays the current value of the current output

Main Menu

If both keys are pressed at the same time, or if no key is pressed within 15 minutes, the device returns to the standard display.

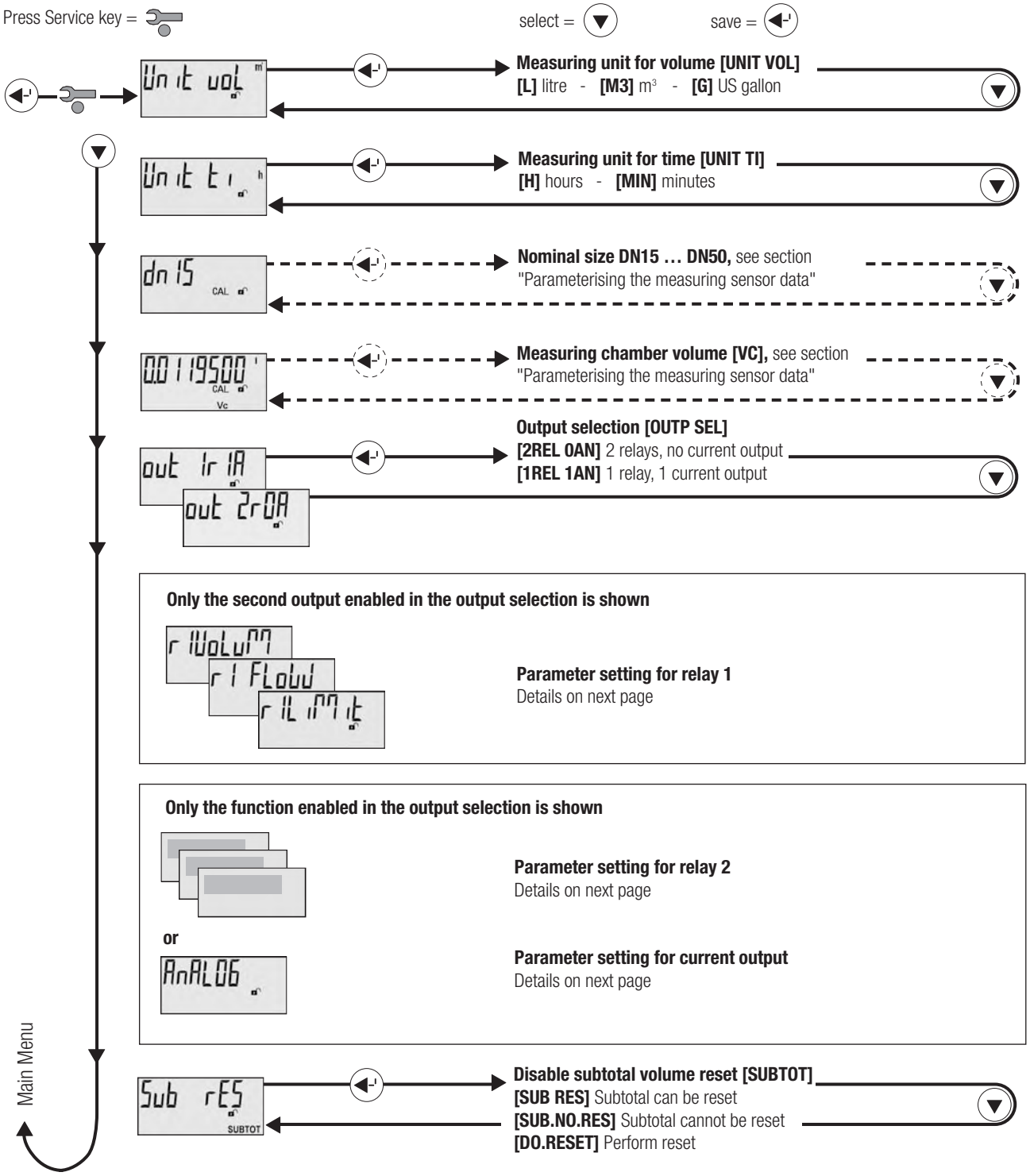
Parameter setting

In order to set the parameters, the device must first be unlocked with the Service key. This puts the device into Edit mode.

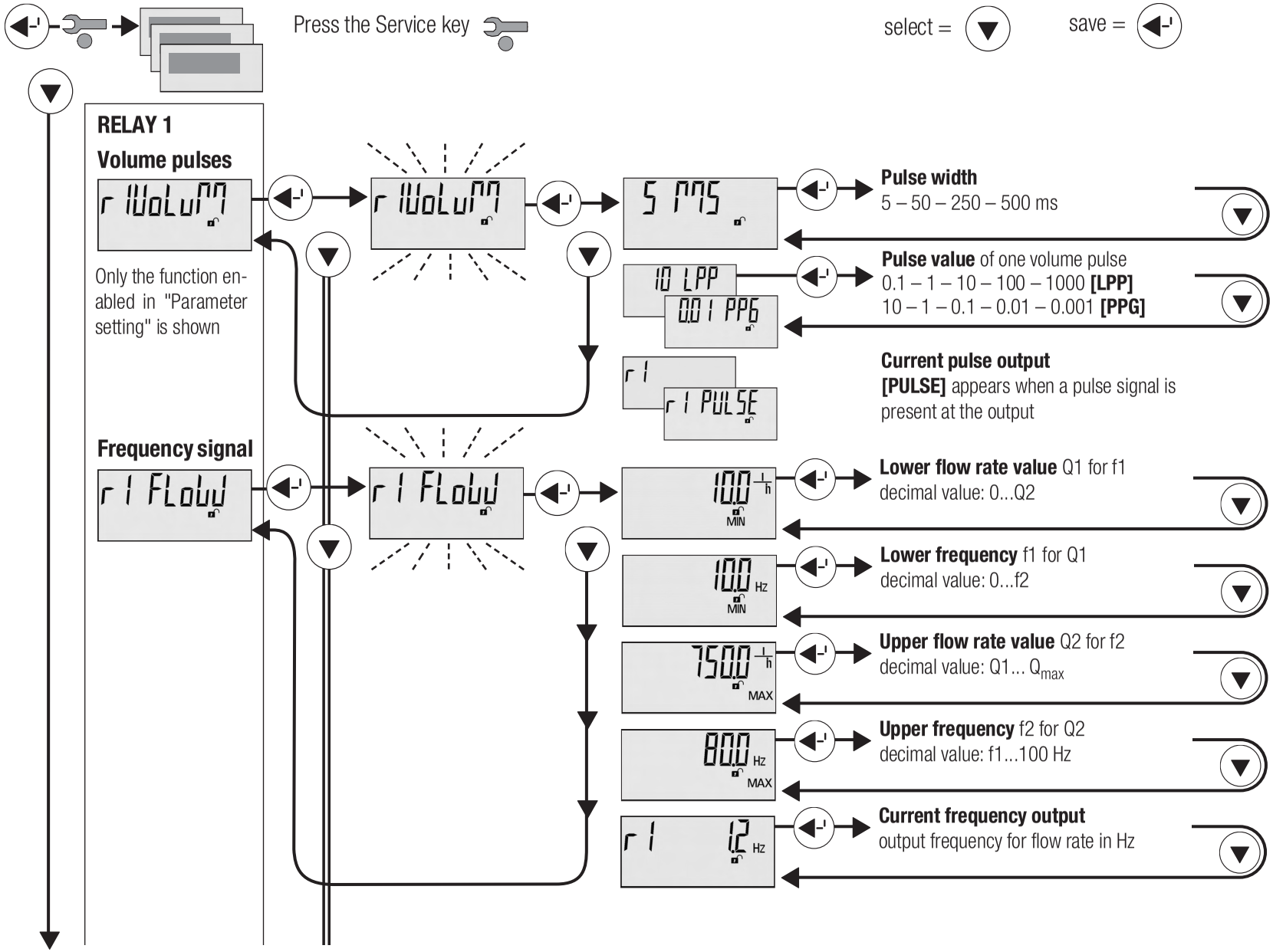
This is located in the connections compartment and is only accessible after the display module has been opened or unscrewed. The power supply must not be interrupted when this is done.

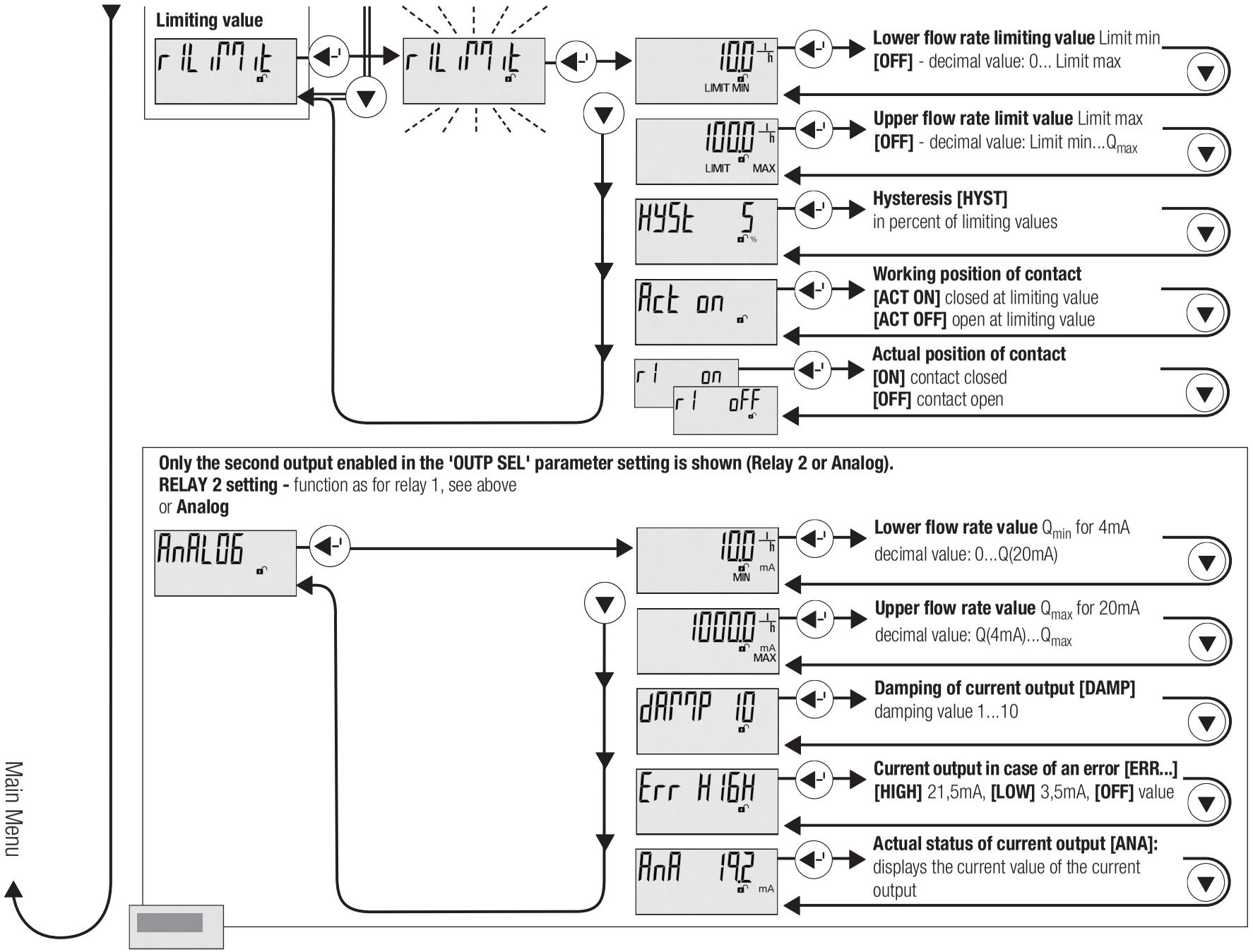
This unlocking procedure is only possible within the Parameter Menu and is done by pressing the Service key. Once the parameter setting is enabled, symbol 🔓 will be shown in addition to all the displays. On exiting the Parameter Menu, the Edit mode is automatically discontinued.

Parameter Menu



Parameter Menu - set outputs




Limiting value
LIMIT MIN
LIMIT MAX
HYST 5 %
Act on
r1 on
r1 oFF
Lower flow rate limiting value Limit min
[OFF] - decimal value: 0... Limit max
Upper flow rate limit value Limit max
[OFF] - decimal value: Limit min...Qmax
Hysteresis [HYST]
in percent of limiting values
Working position of contact
[ACT ON] closed at limiting value
[ACT OFF] open at limiting value
Actual position of contact
[ON] contact closed
[OFF] contact open
Only the second output enabled in the 'OUTP SEL' parameter setting is shown (Relay 2 or Analog).
RELAY 2 setting - function as for relay 1, see above
or Analog
AnALOG
MIN mA
MAX mA
dAMP 10
Err HIGH
AnA 19.2 mA
Lower flow rate value Qmin for 4mA
decimal value: 0...Q(20mA)
Upper flow rate value Qmax for 20mA
decimal value: Q(4mA)...Qmax
Damping of current output [DAMP]
damping value 1...10
Current output in case of an error [ERR...]
[HIGH] 21,5mA, [LOW] 3,5mA, [OFF] value
Actual status of current output [ANA]:
displays the current value of the current output
Main Menu

In order to set the individual parameters, the relevant menu item in the Parameter Menu must be found, as above. Press the Enter key to enable editing. The value to be set starts flashing and may be changed.

Selections are available for most of the menu items. Use the Step key to select a desired value and press the Enter key to save it. A saved value no longer flashes.

If discrete numerical values are to be entered as individual digits (e.g. flow rate values), proceed from the smallest decimal place to the largest. The digit to be set will flash. Use the Step key to select the value (0-9) and press the Enter key to accept. Then set the next higher decimal place. The number of decimal places is fixed. For litres and gallons, one decimal place is specified; four decimal places are specified for m^3.

For the limiting value settings, the function of the upper or lower limiting value switch can be disabled if necessary. To do this, an "OFF" selection is also offered when the lowest decimal value for the flow limit is entered.

If no key is pressed within 15 minutes, the device returns to the standard display and the Edit mode is discontinued. Any entries that have not been completed by pressing the Enter key are rejected.

Parameterising the display

In order to set the parameters, the device must be unlocked with the Service key. See the section on Parameter setting, page 23.

Setting the unit of measurement for volume [UNIT VOL]
Possible settings and subsequent parameters derived from them are as follows:
- litre [UNIT LIT]: pulse value in litres per pulse [LPP], flow in [l/time]
- cubic metres [UNIT M3]: pulse value in litres per pulse [LPP], flow in [m^3/time]
- US gallons [UNIT USG]: pulse value in pulses per gallon [PPG], flow in [gal./time]

The set unit of measurement is shown as an index.

Setting the unit of measurement for time [UNIT TI]
Possible settings and subsequent parameters derived from them are as follows:
- hour [UNIT TI h]: flow rate in [Volume/h]
- minute [UNIT TI min]: flow rate in [Volume/min]

The set unit of measurement is shown as an index.

Parameterising the flow sensor data

In order to guarantee accurate measurement, the electronics on the flow sensor require adjustment. During calibration in the factory, the data for nominal size and the exact measuring chamber volume are entered for this purpose. These parameters cannot usually be changed again. They are displayed with the index [CAL] to document the calibrated condition of the instrument.

If the measurement transducer has to be replaced, it is possible to enter these two parameters manually in order to "marry" a new measurement transducer with the flow sensor. For spare parts for which the nominal size or measuring chamber volume can be changed, this is shown by the [UNCAL] index.

In order to set the parameters, the device must be unlocked with the Service key. See the section on Parameter setting, page 23.

CAUTION: the settings for the nominal size or the measuring chamber volume can be changed within a maximum time window of 7 days after the first change, and a maximum of 4 changes can be made. After the time window has expired or after the fifth change to these two parameters, NO FURTHER CHANGES ARE POSSIBLE.

Programming the outputs

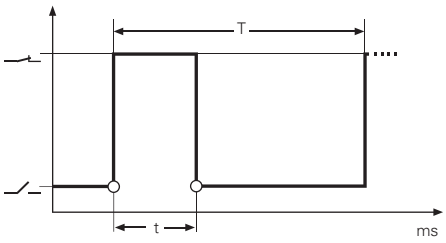
In order to set the parameters, the device must be unlocked with the Service key. See the section on Parameter setting, page 23.

The outputs to be used must be enabled in the 'Output selection [OUTP SEL] in the Parameter Menu.

Only enabled outputs can be parameterised. The following alternatives are possible:
- 2 relay outputs (factory setting) or
- 1 relay output and 1 current output

Pulse output for summing the flow volume (totaliser)

Parameter Menu: volume function [R1VOLUM]



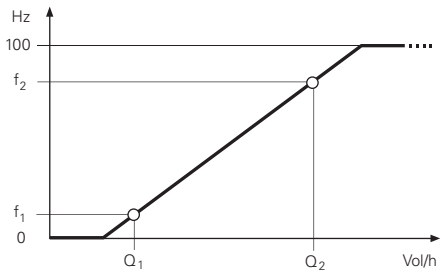
Parameters that can be set:
Pulse width (t): 5 – 50 – **250** – 500 ms
=> The pulse width determines the smallest possible pulse value.

Pulse value for litres, m^3 [LPP]: 0,1 – **1** – 10 – 100 – 1000 m^3 or Ltr/pulse
Pulse value for US gallons [PPG]: 10 – **1** – 0.1 – 0.01 – 0.001 Pulses/USG
(Factory setting: 250 ms, 1 Ltr/pulse; DN40-50: 10 Ltr/pulse)
=> Based on the pulse width shown above, only those values are offered that can also display the maximum possible flow rate. If a lower pulse value is required other than those, a smaller pulse width must be selected.

Signal behaviour:
When the pulse value is reached, the solid state relay is closed for the duration of the set pulse width.

Frequency output depicting flow rate

Parameter Menu: flow rate function [R1 FLOW]



Parameters that can be set:
Frequency range and proportionality of the signal over the desired flow rate measurement range $Q_1 ... Q_2$

Lower flow rate [MIN]:	$Q_1 \geq 0$	(factory setting: Q_{min})
Lower frequency [Hz]:	$f_1 \geq 0$	(factory setting: 10 Hz)
Upper flow rate [MAX]:	$Q_2 \leq Q_{max.}$	(factory setting: Q_N)
Upper frequency [Hz]:	$f_2 \leq 100$ Hz	(factory setting: 80 Hz)

=> The upper frequency must be larger than the lower frequency.
The upper flow rate value must be larger than the lower flow rate value.
Q_{min}, Q_N and Q_{max} are dependent on the nominal size of the meter.

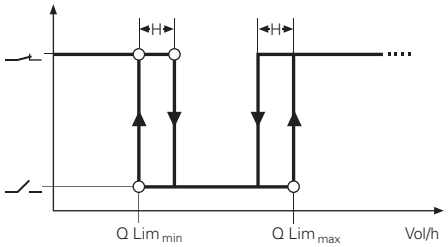
Signal behaviour:
a) Value falls below the set lower flow rate value Q_1:
- proportional decrease to 0 Hz, which is then maintained.

b) Value exceeds set upper flow rate value Q_2:
- proportional increase to 100 Hz, which is then maintained.

No provision is made for error signals.

Switching output to signal a limiting value (Limit)

Parameter Menu: limiting value output [R1LIMIT]



Parameters that can be set:

Lower flow rate limiting value [LIMIT MIN]: [OFF] or Q $Lim_{min} \geq 0$
(factory setting: Q_{min})

Upper flow rate limiting value [LIMIT MAX]: [OFF] or Q $Lim_{max} \leq Q_{max.}$
(factory setting: Q_N)

=> The upper flow rate limiting value must be larger than the lower flow rate limiting value. Q_{min} and Q_{max} are dependent on the nominal size.

Hysteresis [HYST] (H): 0…10% of Q Lim
(factory setting: 1%)

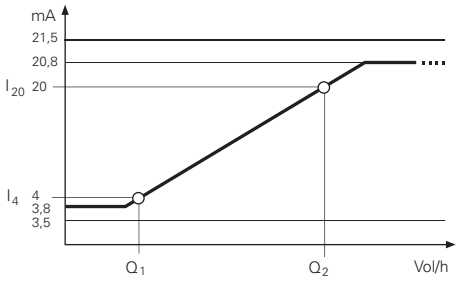
Working position of the semiconductor switch: **active on** – active off

Signal behaviour:

a) For a flow rate lying between the lower and upper flow rate limiting values, the semiconductor switch is open in the "active on" working position. In the "active off" working position, it is closed.
b) If the upper flow rate limiting value is reached or exceeded, the contact switches to the closed position. It switches back again as soon as the value falls below the upper flow rate limiting value by the hysteresis amount.
c) If the lower flow rate limiting value is reached or if the value falls below this limit, the contact switches to the closed position. It switches back again as soon as the lower flow rate limiting value is exceeded by the amount of the hysteresis.

Analogue current output (4…20mA) depicting flow rate

Parameter Menu: analogue output [ANALOG]



Parameters that can be set:

Proportionality of the signal over a flow rate-range Q_1 to Q_2
flow rate at 4mA [MIN mA] (I_4): $Q_1 \geq 0$
(factory setting: 0)
flow rate at 20mA [MAX mA] (I_{20}): $Q_2 \leq Q_{max.}$
(factory setting: Q_N)

=> The upper flow rate value must be larger than the lower flow rate value. Q_{min}, Q_N and Q_{max} are dependent on the nominal size.

Damping of the signal on rapidly changing measured values
Damping value [DAMP] **1** (none) …10 (maximum)

=> The higher the damping, the larger the relative error.

Signal level when a relevant meter error occurs
Error behaviour [ERR …]: HIGH (21,5mA), LOW (3,5mA), **OFF**

Signal behaviour:

a) Value falls below the set lower flow rate value Q_1:
   • proportional decrease to 3.8mA which is then maintained.
b) Value exceeds set upper flow rate value Q_2:
   • proportional increase to 20.8mA which is then maintained.
c) Error signal for measurement-relevant meter error (sensor, ROM, supply voltage, etc.):
   • For HIGH error behaviour: output 21.5mA
   • For LOW error behaviour: output 3.5mA
   • For OFF error behaviour: no error signal, continued output of computed value.

Error messages

The electronics perform a self-test about every 5 minutes. If an error is detected which impairs the reliability or accuracy of the measurement, the [ERROR] warning will appear every 2 seconds on the display.

The error is shown in detail in the Information Menu:

[E-FLOW] maximum permitted flow rate (Qmax) exceeded
The meter is mechanically overloaded and is no longer measuring accurately.
Action: reduce the flow rate or use the next higher nominal size.

[E-POWER] supply voltage is too low
Faulty data processing, meter supplies incorrect measured values.
Action: check the voltage supply and eliminate the cause of the error (if applicable).

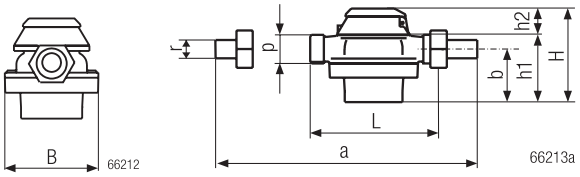
[E-EEP] error when reading or saving data to EEPROM, faulty data backup.
Totaliser value may be incorrect.
Action: measurement transducer must be replaced. Please contact the supplier.

[E-ROM] error when reading data from the ROM
Faulty data processing, meter supplies incorrect measured values.
Action: measurement transducer must be replaced. Please contact the supplier.

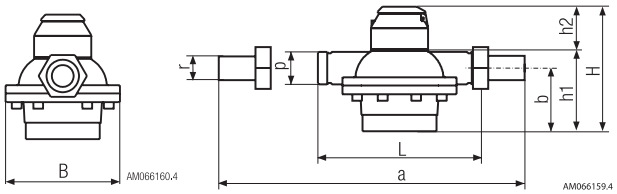
[E-SENSOR] signal error from flow sensor to measurement transducer
Meter supplies incorrect measured values.
Action: measurement transducer must be replaced. Please contact the supplier.

Dimensional drawings

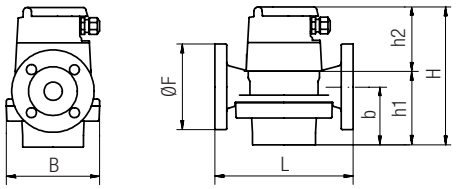
DN15, 20, 25: with threaded ends



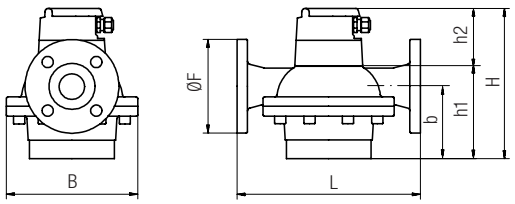
DN40: with threaded ends



DN15, 20, 25: with flanges (DIN 2501/SN 21843)



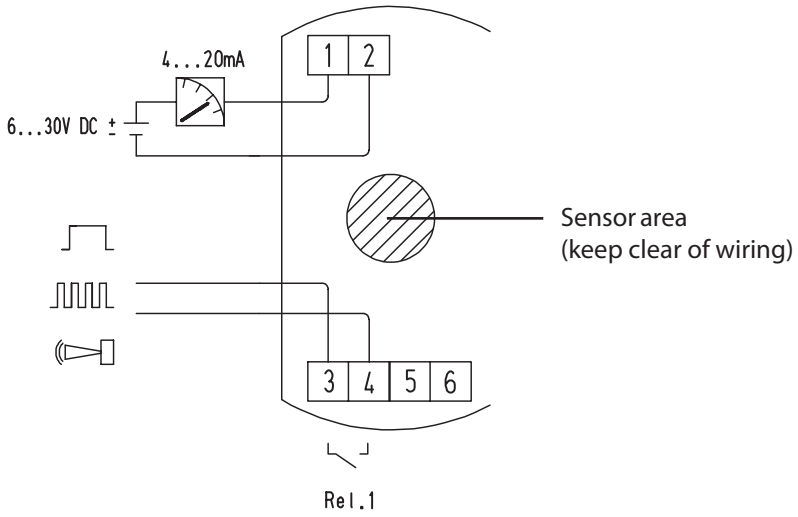
DN40, 50: with flanges (DIN 2501/SN 21843)



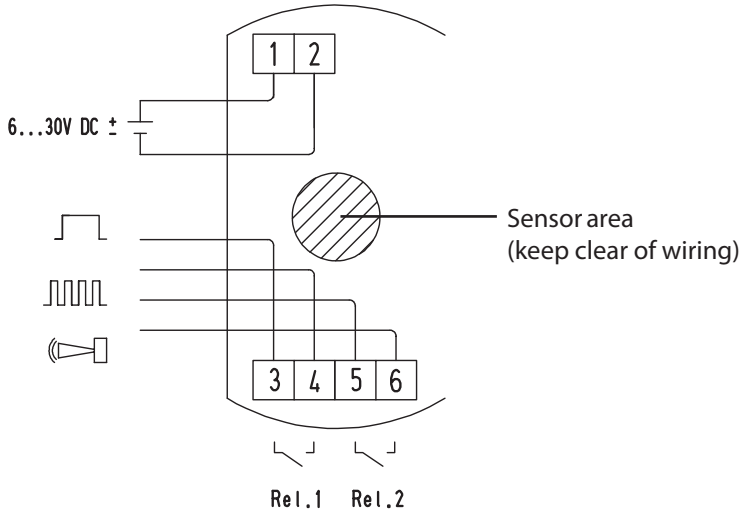
Nominal size	L	B	a	Ø F	b	h1	h2	p	r
DN15	165	105	260	95	45	65	90	G ¾”	G ½”
DN20	165	105	260	105	54	74	90	G 1”	G ¾”
DN25	190	130	305	115	77	101	90	G 1¼”	G 1”
DN40	300	210	440	150	116	153	90	G 2”	G 1½”
DN50	350	280	–	165	166	209	90	–	–

Diemnsions in mm

1 Analogue Output
1 Digital Output



2 Digital Outputs



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