Electromagnetic flowmeters of the type series

FLONEX FXx11x

and

FLONET FH30xx

Meter control instructions

Contents

1. BASIC INFORMATION 4
2. ASSOCIATED DOCUMENTATION 4
3. METER COMMISSIONING 4
4. METER ENERGISING 5
4.1. Initial display status 5
4.2. Basic screen 5
4.3. Front panel and control buttons 5
4.3.1. Display unit 5
4.3.2. Control button functions 5
5. FLOWMETER CONTROL 6
5.1. Manual control 6
5.1.1. Basic screen 6
5.1.2. Error and diagnostic messages 7
5.1.3. User password 7
5.1.4. Main menu 8
5.1.4.1. Language 11
5.1.4.2. Display data 11
5.1.4.2.1. Display data 12
5.1.4.2.1.1 Volume Q+ a Q− 12
5.1.4.2.1.2 Time and date 12
5.1.4.2.1.3 Working time and error time 12
5.1.4.2.1.4 Excitation current 12
5.1.4.2.1.5 Flow rate per cent 12
5.1.4.2.1.6 Last error 13
5.1.4.2.1.7 No display 13
5.1.4.2.2. Flow rate units 13
5.1.4.2.3. Volume units 14
5.1.4.2.4. Backlighting time 15
5.1.4.2.5. 100% 15
5.1.4.3. Current output 16
5.1.4.3.1. Output for Q−… Q+ 16
5.1.4.3.2. Output for 0 ... |Q| 17
5.1.4.3.3. Fixed current 4–20 mA 18
5.1.4.4. Output functions 18
5.1.4.4.1. Frequency for Q+ 19
5.1.4.4.2. Frequency for Q− 19
5.1.4.4.3. Frequency for |Q| 19
5.1.4.4.4. Pulses for Q+ 20
5.1.4.4.5. Pulses for Q− 23
5.1.4.4.6. Pulses for |Q| 23

5.1.4.4.7. Constantly closed 23
5.1.4.4.8. Q > Qlim 23
5.1.4.4.9. IQI > Qlim 24
5.1.4.4.10. No error 24
5.1.4.5. Serial line 24
5.1.4.6. Date setting 25
5.1.4.7. Time setting 25
5.1.4.8. Volume resetting 26
5.1.4.9. Number of samples 26
5.1.4.10. Suppressed flow rate 26
5.1.4.11. Zero setting 28
5.1.4.12. Manufacturing data 28
5.1.4.13. Production setting 29
5.1.4.14. Simulation mode 29
5.2. Remote meter control using program FLOSET 4.0 30
5.2.1. Flowmeter connection to a communication line 30
5.2.2. Program FLOSET 4.0 installation and operational start 31
6. **DOCUMENTATION AND STANDARDS 33**

1. BASIC INFORMATION

Electromagnetic flowmeters of the type series FLONET FH30xx (for normal operating environment) and FLONEX FXx11x (for explosive atmospheres) are meters intended for bi-directional measurement of volume flow rates of conductive liquids in a fully flooded piping. The flow velocity range is 0.025 – 10m/s and the minimum conductivity of the measured fluid is 10 µS/cm, for de-mineralized water 20 µS/cm.

This manual contains a detailed description of the meter commissioning procedure and instructions for meter control on the user level.

The flowmeters are supplied verified as to their functions, calibrated and with the output parameters set according to the order number specifications and other customer requirements (if any).
Instructions regarding the order number specifications can be found in the meter manuals supplied with the products:

- Es90678K Electromagnetic flowmeter FLONET FH30xx – section 15
- Es90…. K Electromagnetic flowmeter for application in explosive atmospheres FLONEX FXx11x – section 15

Information on the meter parameter setting is included in the delivery note of every flowmeter.

Provided the meter is installed on site in observance of all instructions and directions in the manual, it will be ready for immediate operational start.

2. ASSOCIATED DOCUMENTATION

Es 90684K/a	Communication interface RS-485 MODBUS RTU Electromagnetic flowmeters FLONET FH30xx and FLONEX FXx11x
Es 90678K/a	Electromagnetic flowmeters FLONET FH30xx
Es 90675K	Electromagnetic flowmeters for application in explosive atmospheres FLONEX FXx11x

3. METER COMMISSIONING

Prior to connecting the meter to its power source make sure that:

- The power grid supply voltage is the same as that specified on the meter rating plate;
- The power grid is provided with suitable protection devices;
- All terminals and electric contact elements have been properly tightened;
- The connecting cables are:
  - intact,
  - connected to the correct terminals on both the meter and the plant control system sides,
  - secured against incidental pulling out of the bushings, and
- The required meter interconnection and grounding to the reference potential have been properly done.

Apart from examination of the electric connections prior to the meter operational start, it is also important to check:

- The meter protection covers;
- The meter installation details with respect to the co-operating technology; and
- The operational conditions of the meter.

The meter sensor shall be fully flooded with the measured liquid.

More detailed description of the required initial inspection procedure is included in the flowmeter manual.

4. METER ENERGISING

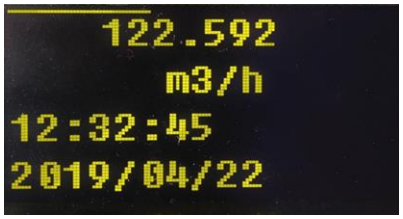
4.1. Initial display status

Upon connecting the power supply to the meter, all its modules will undergo an initialization procedure. Following the display unit test, the basic screen format will appear on the display including information on:

- Current volume flow rate measured by the meter
  (if an error is indicated, its code is shown next to the flow rate figure)
- Aggregate flow volume passed through the meter in the positive direction
- Aggregate flow rate passed through the meter in the negative direction

Shown in the top section of the display will be a bar chart relating the current volume flow rate to the specified maximum flow rate.

4.2. Basic screen



A volume value at the main screen in positive and negative direction is displayed by the version of a flow meter, when it is intended for billing purpose.

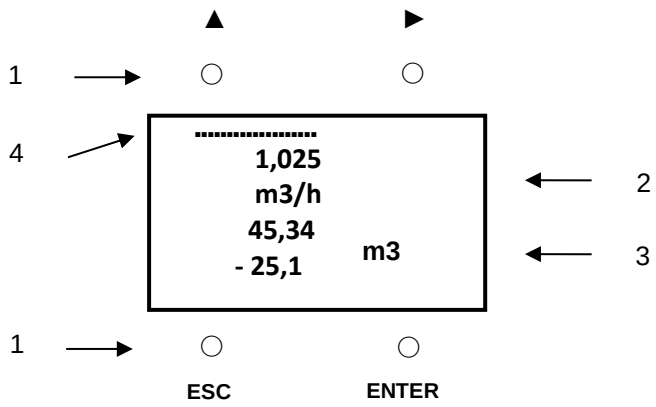
4.3. Front panel and control buttons

4.3.1. Display unit

The flowmeter includes a color OLED display of 128x64 pixels providing visual information to the user on all measured quantities, meter parameter settings and important operational information. The display control is facilitated by four optical buttons (optical reflex sensors).

4.3.2. Control button functions

Button positions with respect to the display unit



Explanation:
1 … optical buttons (optical reflex sensors)

2 … current /instantaneous flow rate
3 … selected item from MENU – DISPLAY, or error message
4 … current/instantaneous flor rate – bar graph

Control button functions
Buttons ▲, ►, **ENTER** are activated by a short touch with a finger.
Button **ESC** is activated by either a short (0.3s) or longer touch (> 2s).

▲	Move in a menu to the text item upwards Cyclic functions: setting numeric values 0–9 (towards higher values) Change in sign +/−
►	Move in a menu to the next item downwards Cursor position control in setting numeric values
ENTER	Confirmation of selected operation
ESC	Departure from current operation to the previous menu item with no change
ESC 2 s	Finger touch longer than 2s: return to the basic screen

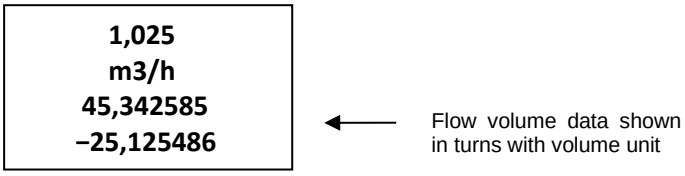
Actuated (by a finger touch) can be just one button at a time while the remaining buttons shall be left uncovered. For repeated button actuation remove the finger and touch the button again.

5. FLOWMETER CONTROL

5.1. Manual control

Manual meter control and selection of menu items using optical buttons do not require any special skills; these functions are intuitive and user friendly.

5.1.1. Basic screen



Basic screen always shows information on current / instantaneous flow rate (lines 1 and 2).
The remaining two lines are reserved for supplementary data the user may select from the menu **Display**.
The meter is supplied with these two lines pre-set to show the aggregate flow volumes passed through the meter sensor in the positive and negative directions. The volume figure alternates with the selected volume unit.

A volume value at the main screen in positive and negative direction is displayed always in unit m3/h by the version of a flow meter, when it is intended for billing purpose (units in m3/h isn't possible to change from any user).

Should the flowmeter identify a condition that might adversely affect the meter functions, next to the magnitude of the instantaneous flow rate on line 1 will appear the respective error code. In cases of a major error that might significantly affect the measurement precision, displayed in the data field reserved for the flow rate data is a zero. This applies to situations such as ADC failure, open or short-circuited excitation, not fully flooded piping, strong electromagnetic interference and others.

5.1.2. Error and diagnostic messages

Error code	Description
E00	No error
E01	ADC overflow condition
E02	Fast flow-rate changes
E03	Memory write or read error CRC (counted value is different from downloaded value)
E04	Another electronic unit error
E05	Warning: zero flow rate calibration impossible
E06	Low excitation current
E07	Short-circuited coils
E08	Information: calibration in progress
E09	Empty piping
E10	OUT1 error
E11	OUT2 error
E12	Information: IOUT outside permitted range
E13	Incorrect time setting
E14	Q4 exceeded
E15	Record of switching on the device

As long as you move in the control or parameter-setting menus, the display remains in the active mode (backlighted).
The backlighting time can be set in the menu item **Backlighting time**. Deactivated display will automatically be activated upon touching any control button.

5.1.3. User password

To enter Main menu from Basic screen, actuate the **ESC 2 s** button and specify your user password.

The initial user password is pre-set in production at 0000.

The user password can only be changed using the FLOSET 4.0 program via communication line RS-485 MODBUS RTU.

Should no control button (▲, ►, **ESC, ENTER**) be actuated during the recent three minutes, or should the specified backlighting time elapse before that, the display will return automatically to the Basic screen format.

5.1.4. Main menu

There are only four lines shown on the flowmeter display. Upon the first call on Main menu, the following items will appear with the **Language** item highlighted.

Flow simulation
Language
Displayed data
Current output

The highlighted item can be selected using the **ENTER** command.
Return to Basic screen: **ESC 2 s**

Use buttons ► and ▲ to scroll in the menu.

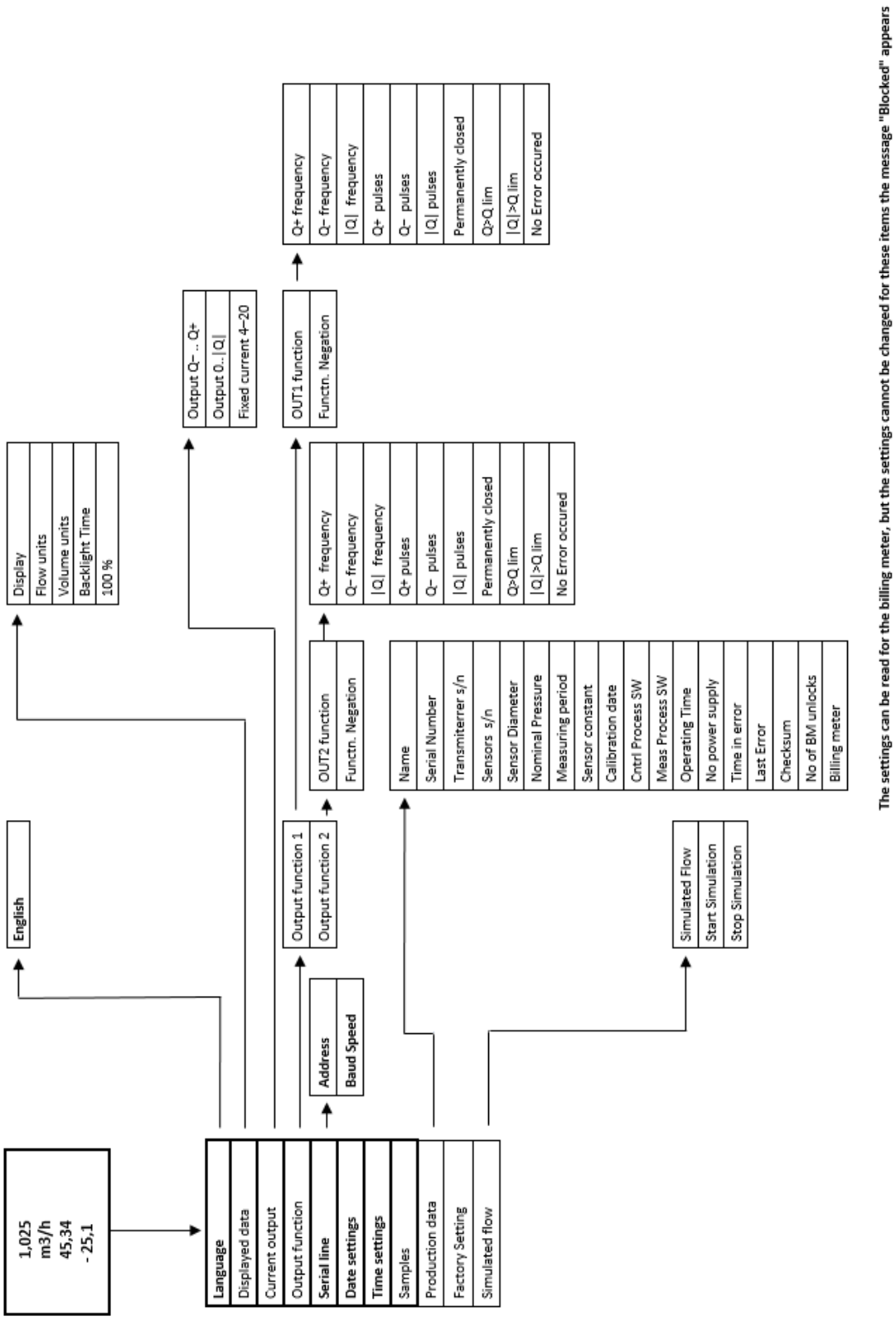
To move upward in the menu, use button ▲

Language
Displayed data
Current output
Output function
Serial line
Date settings
Time settings
Samples
Production data
Factory Setting
Simulated flow

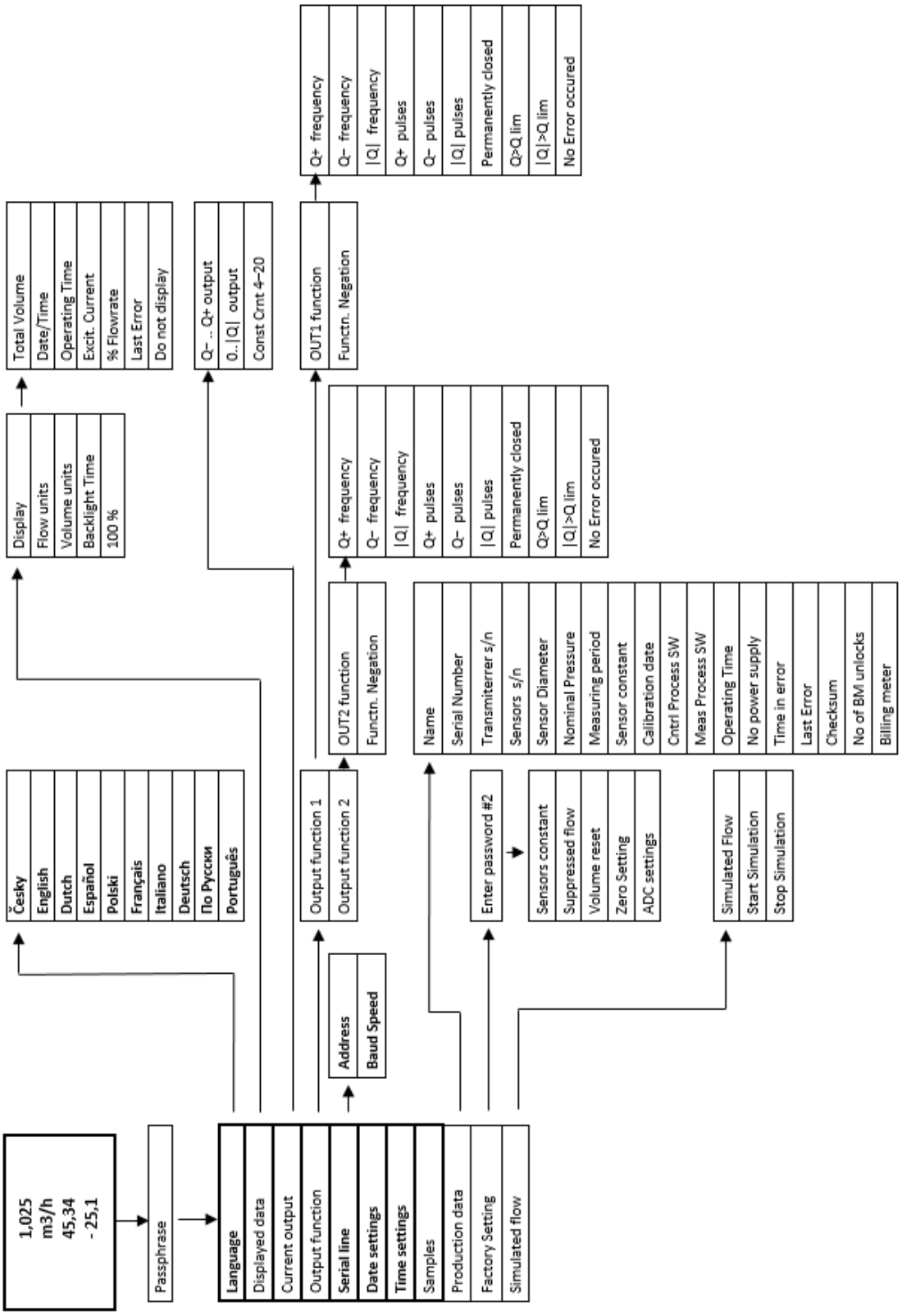
To move downward in the menu, use button ►

The manufacturer supplies the flowmeter verified as to its functions, calibrated and with parameters set according to the customer's order. When installed in the user's technology in observance of the requirements specified in the product manual, the flowmeter is ready for immediate operational start. In cases where the user requires an accelerated procedure for the meter commissioning and the meter parameter setting with respect to the given operational conditions and the co-operating higher-level (plant) control system, it suffices to set the parameters shown in bold print in the above list of the Main menu items.

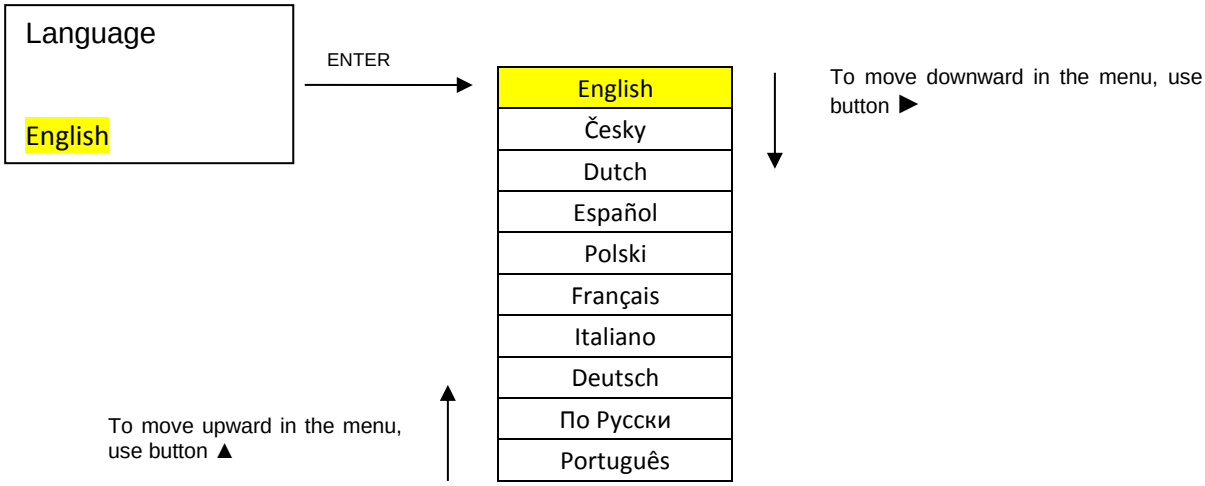
Control menu structure of flow meters FLONEX FXx11x and FLONET FH30xx in version of a technology meters



Control menu structure of flow meters FLONEX FXx11x a FLONET FH30xx by flow meters in version for billing purpose



5.1.4.1. Language

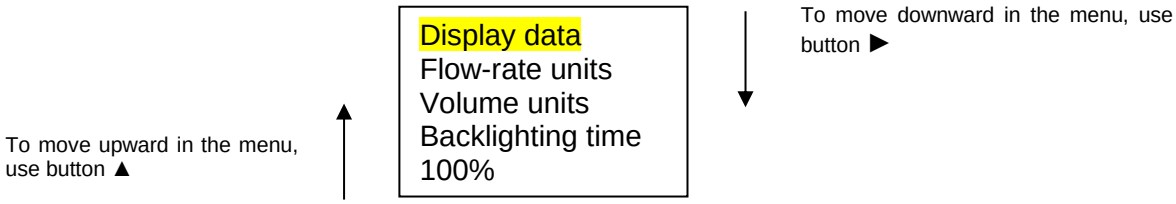


The item selected by buttons ► and ▲ will be highlighted. Confirm the selection by **ENTER** whereby the display will return to the previous item on the Main menu.

Return to Basic screen: **ESC 2 s**

The item selection procedure can be interrupted at any time by actuating button **ESC** with no effect on the original setting. The display will then return to the previous screen format with item **Language** highlighted. The interrupt function of the **ESC** button applies to all parameter setting procedures.

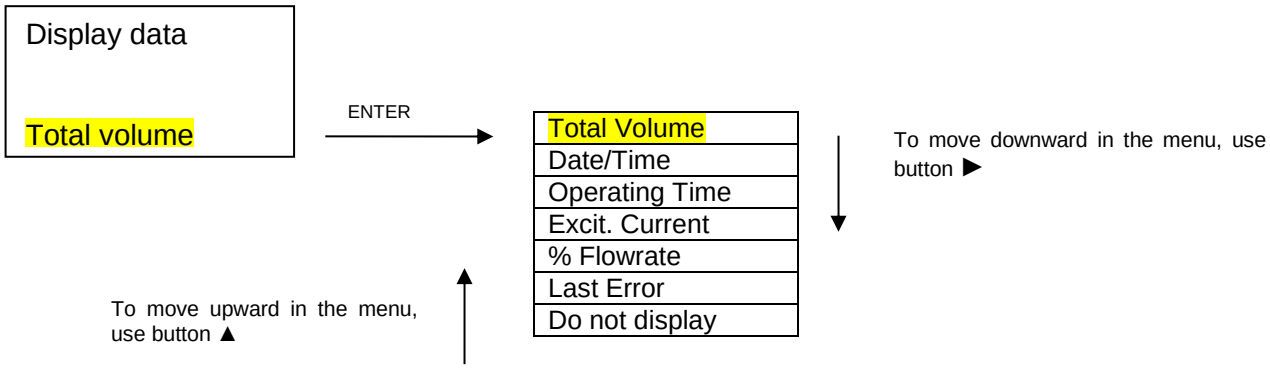
5.1.4.2. Display data



The selected item will be highlighted and can be open using **ENTER**.

5.1.4.2.1. Display data

Upon selecting the **Display data** item, the user may pick out supplementary data to be shown on the display lines 3 and 4. In Basic screen, these appear under the data on current/instantaneous flow rate. The initial setting consists of the data on the aggregate flow volume passed through the meter sensor in the positive and negative directions.



The item selected by buttons ► and ▲ will be highlighted (in yellow). Confirm the selection by **ENTER**, the display will then return to the previous menu item. The selected item will appear on line four in Basic screen. Displayed can only be one item at a time.

Upon selecting the **No display** item, Basic screen will only show the instantaneous flow rate data (line 1 … flow rate, line 2 … flow rate units).

5.1.4.2.1.1 Volume Q+ a Q−

Alternated (cyclic) display of current flow volume and the selected volume unit:

- Display line 3: aggregate flow volume passed through the meter in positive direction
- Display line 4: aggregate flow volume passed through the meter in negative direction

5.1.4.2.1.2 Date Time

Display line 3: time
Display line 4: date

5.1.4.2.1.3 Working time and error time

Display line 3: measurement down time due to meter error (Error time)
Display line 4: aggregate operating time (Working time) including Error time

5.1.4.2.1.4 Excitation current

Display line 3: current flowing through the sensor excitation coils (typically 200mA)
Display line 4: resistance of the fluid between the measuring electrodes (kΩ). This information is used to check the condition of fully flooded piping.

5.1.4.2.1.5 Flow rate per cent

Display line 3: measured flow rate in per cent of the maximum flow rate
Display line 4: the character of %

5.1.4.2.1.6 Last error

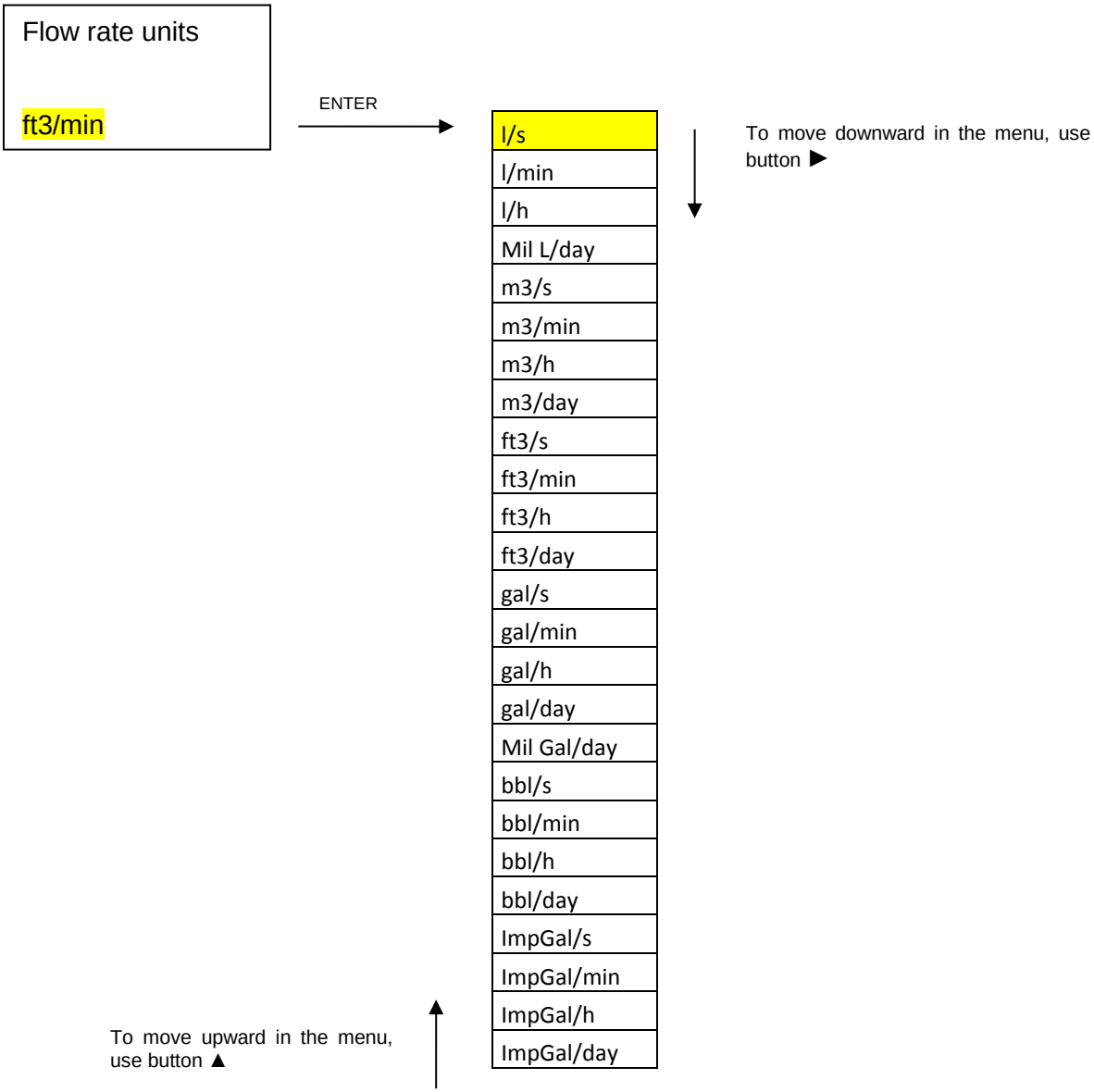
Cyclic display of the error code and error description vs. time and date of the error incidence:

- Display line 3: error code (Exx) / time
- Display line 4: error description / date

5.1.4.2.1.7 No display

Display line 3: empty
Display line 4: empty

5.1.4.2.2. Flow rate units

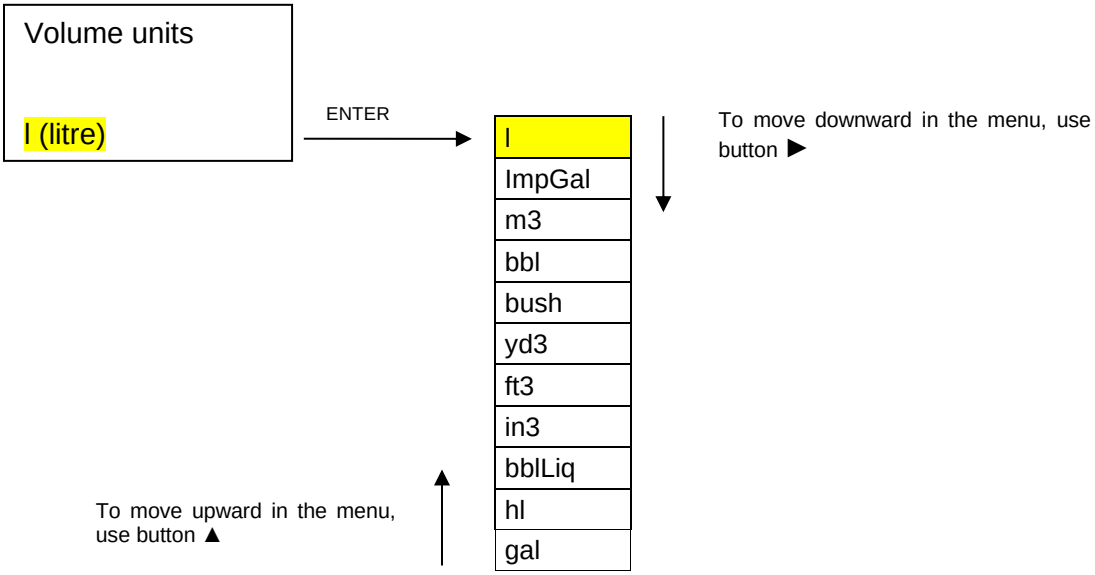


The item selected by buttons ► and ▲ will be highlighted (in yellow). Confirm the selection by **ENTER** whereby the menu will return to the previous item (**Flow rate units**).
The selected flow-rate unit will appear on line 2 in the Basic screen.
Return to Main menu: **1 x ESC**
Return to Basic screen: **ESC 2 s**

Conversion of various fluid volume units to liters

Unit designation	Name	Volume in liters
l	liter	1.00000
hl	hectoliter	100.00000
m3	cubic meter	1,000.00000
Mil L	million liters	1,000,000.00000
ft3	cubic foot	28.31685
gal	US gallon	3.78540
MilGal	million US gallons	3,785,412.00000
bbl	US barrel	158.98729
ImpGal	UK gallon	4.54609
bush	bushel	35.23907
yd3	cubic yard	764.55487
in3	cubic inch	0.01638
bblLiq	US barrel liquid	119.240471

5.1.4.2.3. Volume units



The item selected by buttons ► and ▲ will be highlighted (in yellow). Confirm the selection by **ENTER** whereby the menu will return to the previous item (**Volume units**).
The selected fluid volume unit will appear in Basic screen.
Return to Main menu: **1x ESC**
Return to Basic screen: **ESC 2 s**

5.1.4.2.4. Backlighting time

Backlighting time s **000**

Setting range: 0 to 999s
Value 0 is reserved for unlimited backlighting time.

The flashing underline marker shows the digital position ready to be set.
Set the display backlighting time using buttons ► and ▲ and confirm the setting by actuating the **ENTER** button. The display will return to the previous menu item (**Backlighting time**).

Return to Main menu: **1 x ESC**
Return to Basic screen: **ESC 2 s**

To actuate the "sleeping" display, depress any of the four control buttons.

5.1.4.2.5. 100%

By selecting the **100%** item, the user may define the flow rate to which the instantaneous flow rates will be related (in per cent); the same applies to the bar graph display.

100% l/s +1.000000E+01

The flashing underline marker shows the digital position ready to be set.
Using buttons ► and ▲, set the flow-rate value in liters per second corresponding to the intended maximum (100%) flow rate. Use button ► to move the position marker, and button ▲ to set the numeric value 0 to 9. Confirm the setting by depressing the **ENTER** button. The display will then return to the previous menu item (**100%**).

Return to Main menu: **1 x ESC**
Return to Basic screen: **ESC 2 s**

The maximum flow rate value shall always be set in liters per second irrespective of the currently used flow rate unit. The flow rate value set as 100% shall not, in consideration of the meter sensor size, correspond to the fluid flow velocity in excess of 10 meters per second. It is recommended to set the maximum flow rate corresponding to the fluid flow velocity between 3 and 5 m/s.

Volume flow rates in liters per second corresponding to various flow rate units

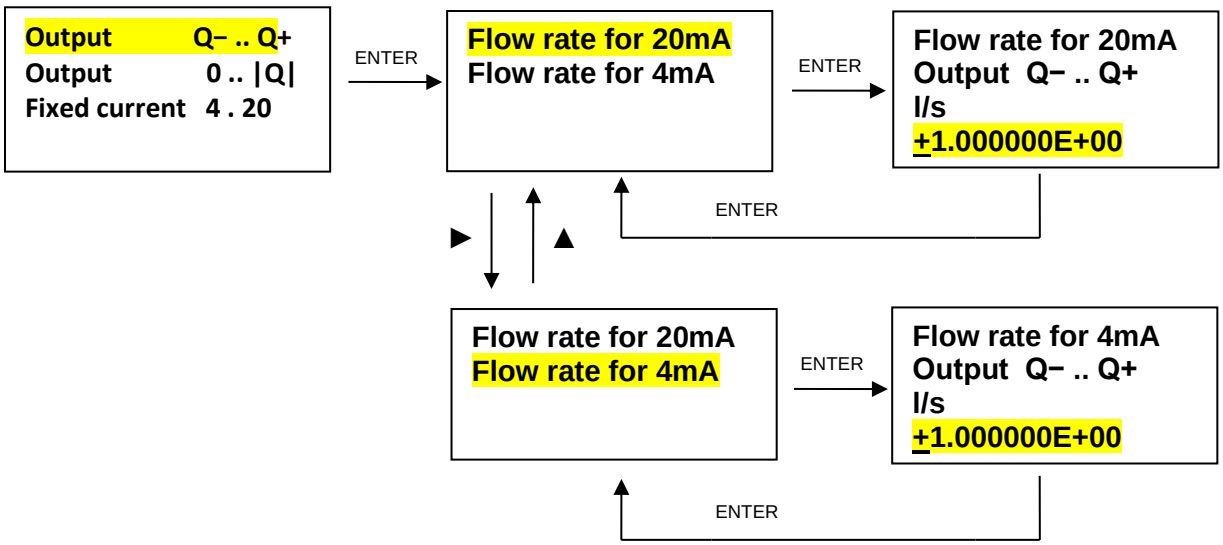
Unit	(liters per sec.)

l/s	1.000000E+00
l/min	1.666667E-02
l/h	2.777778E-04
Mil L/day	1.157407E+01
m^3/s	1.000000E+03
m^3/min	1.666667E+01
m^3/h	2.777778E-01
m^3/day	1.157407E-02
ft^3/s	2.831685E+01
ft^3/min	4.719474E-01
ft^3/h	7.865791E-03
ft^3/day	3.277413E-04
gal/s	3.785412E+00
gal/min	6.309020E-02
gal/h	1.051503E-03
gal/day	4.381264E-05
Mil Gal/day	4.381264E+01
bbl/s	1.589873E+02
bbl/min	2.649788E+00
bbl/h	4.416314E-02
bbl/day	1.840131E-03
ImpGal/s	4.546090E+00
ImpGal/min	7.576817E-02
ImpGal/h	1.262803E-03
ImpGal/day	5.261678E-05

Example:
A user has selected for display of instantaneous flow rate values the unit of **m^3/hour** and wishes to set the 100% flow rate value at 150 m^3/hour.
The above table gives the conversion coefficient between 1 m^3/hour and liters per second 2.777778E-01.
The value to be set as the menu item **100%** therefore is:
150 x 2.777778E-01 = **4.1666666E+01 (l/s)**.

5.1.4.3. Current output
(passive, current)

5.1.4.3.1. Output for Q−… Q+

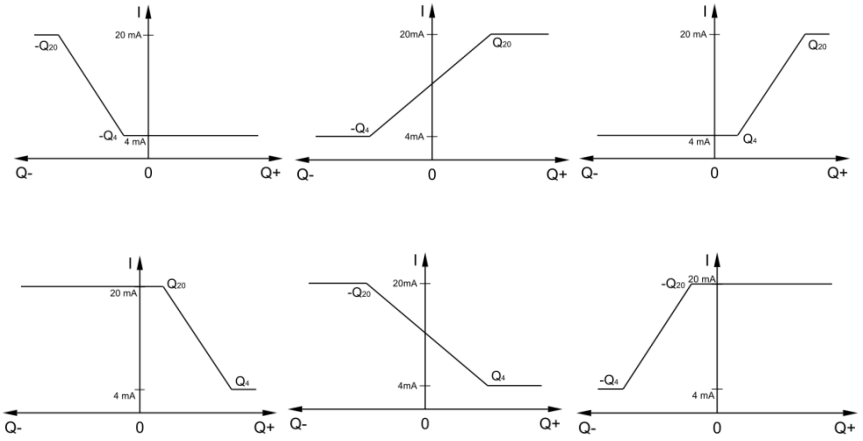


The flashing underline marker shows the digital position ready to be set.
Using buttons ► and ▲, set the flow-rate value in liters per second corresponding to current values 4 and 20mA. Confirm the setting by depressing the **ENTER** button. The display will then return to the previous menu item (**Flow rate for 20mA / Flow rate for 4mA**).
Return to Main menu: **2 x ESC**
Return to Basic screen: **ESC 2 s**

The flow rate values set for current levels 4 or 20mA shall always be in liters per second.

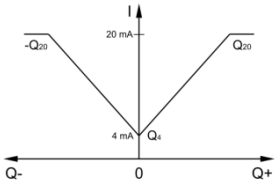
The values of flow rate for currents 4 and 20mA can be both positive and negative, and each such value can be greater or smaller than the other. Theoretically there can be up to six different relationships between the output current (IOUT) and the flow rate (Q).

Output current for flow rate ranging from Q− to Q+



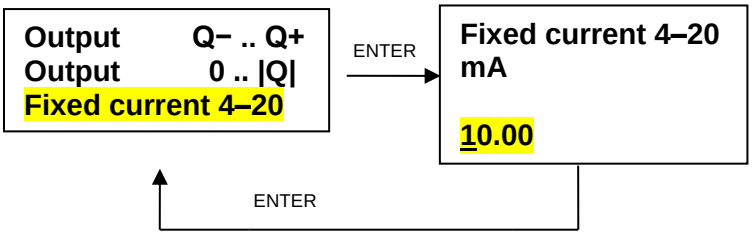
5.1.4.3.2. Output for 0 ... |Q|

Current for |Q|



The setting procedure is essentially the same as that described for **Current output Q− ... Q+**. The only value to be set here is the flow rate corresponding to output current 20mA.

5.1.4.3.3. Fixed current 4–20 mA

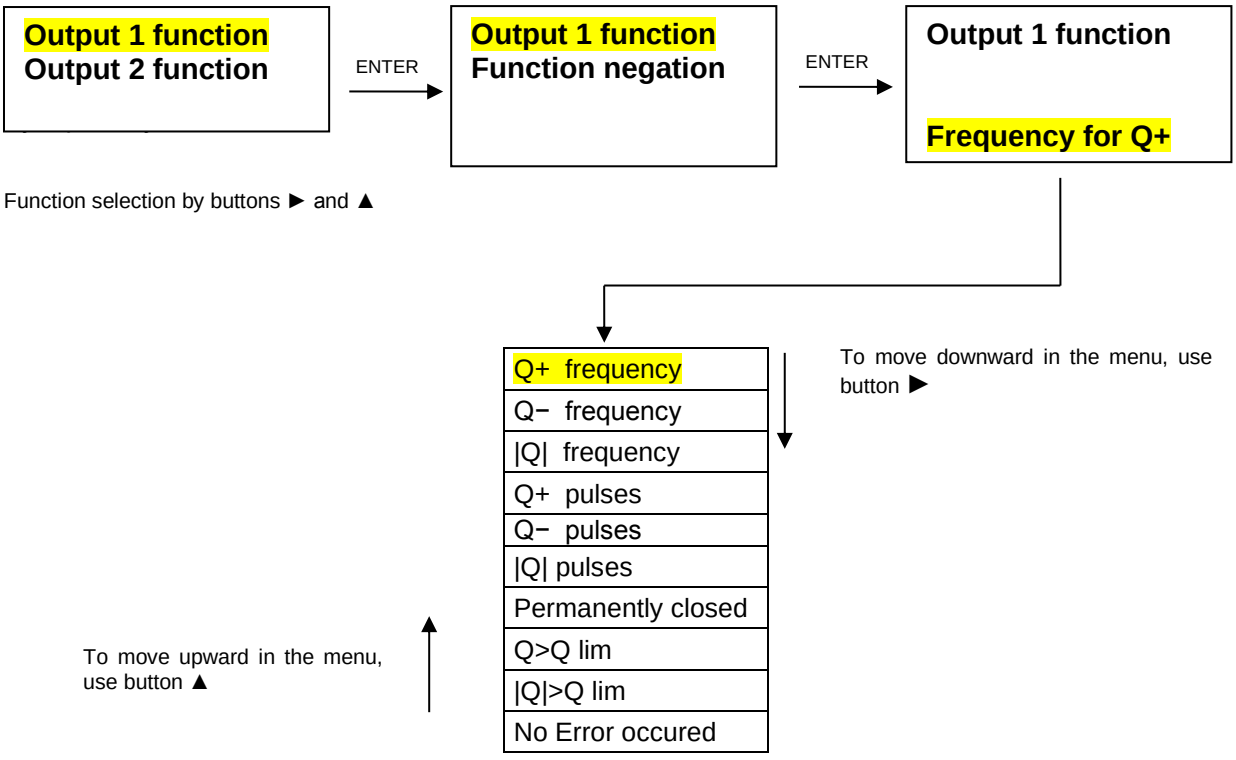


The flashing underline marker shows the digital position ready to be set.
Using buttons ► and ▲, set the highlighted current value in the range of 4 to 20mA. Confirm the setting by depressing the **ENTER** button. The display will return to the previous menu item (**Fixed current 4–20**).
From that moment on the current output is operated in the mode of fixed current. Return to the measuring mode via setting the function of current output.
Return to Main menu: **1 x ESC**
Return to Basic screen: **ESC 2 s**

The value of fixed current can only be set within the range of 4.00 to 20.00mA. Values outside this range will not be accepted; in that case, upon depressing button **ENTER**, the display will remain in the mode of current setting and will not return to menu item **Fixed current 4–20**.

5.1.4.4. Output functions
(passive, open collector)

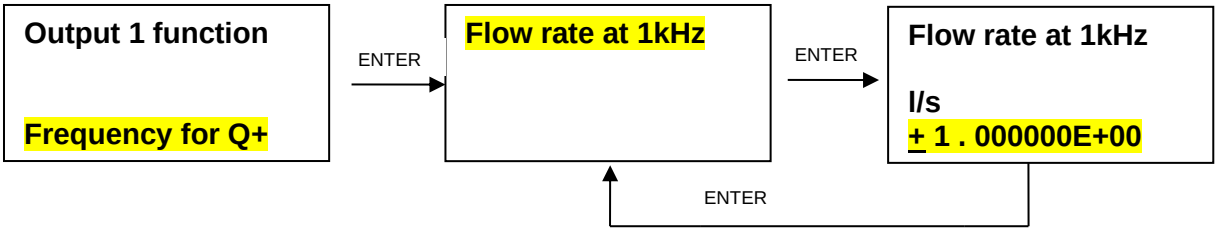
The parameter setting procedures for **Output 1 functions** and **Output 2 functions** are the same.



The function selected by buttons ► and ▲ will appear backlighted in yellow on the last display line. Confirm the selected by **ENTER**.

Upon selection of item **Function negation** the output signal will change sign. The other functions of the multi-function output will remain as they are.

5.1.4.4.1. Frequency for Q+



Using buttons ► and ▲, set the flow rate in liters per second corresponding to the output frequency of 1kHz. Confirm the set value by **ENTER**. The display will return to the previous menu item (**Flow rate at 1kHz**).
Return to Main menu: **3 x ESC**
Return to Basic screen: **ESC 2 s**

The flow rate value Q+ for 1kHz shall always be set in liters per second. Conversion of the volume flow rate in liters per second to flow rates in other units is described above in the procedure for setting the **100%** value.

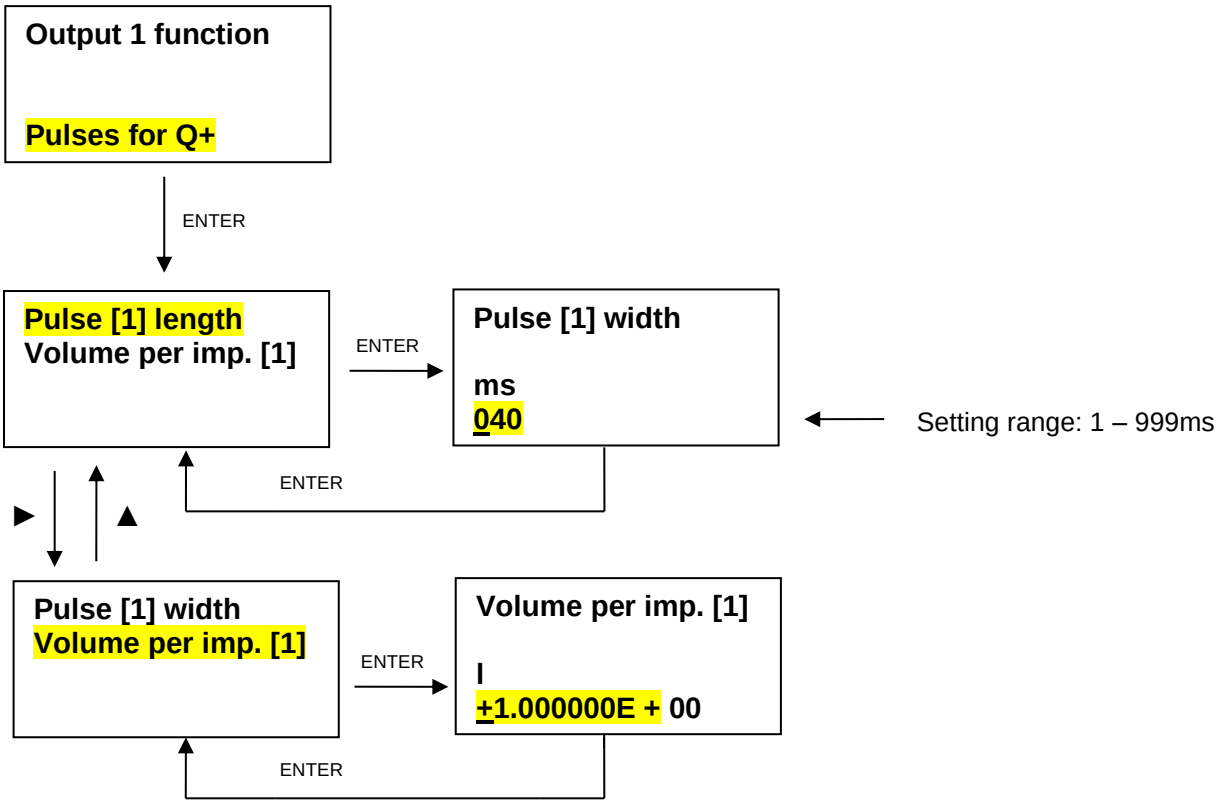
5.1.4.4.2. Frequency for Q−

See the procedure for setting the frequency for Q+.

5.1.4.4.3. Frequency for |Q|

See the procedure for setting the frequency for Q+.

5.1.4.4.4. Pulses for Q+



Using buttons ► and ▲, set the required pulse parameters.

Confirm the setting by **ENTER**. The display will return to the previous menu item **Pulse width / Volume per pulse**.

Return to Main menu: **3 x ESC**
Return to Basic screen: **ESC 2 s**

Pulse number determination

The values of fluid volume per pulse (the pulse number) shall always be specified in liters per second.
The limiting conditions for pulse output parameters:

- The maximum frequency of pulse output: f_{max} = 100Hz
- The idle period between pulses ***M*** shall be equal to or wider than the pulse width ***P***. Breaching this condition will result in an error message (E10, E11).

For pulse width it holds:

$P + M = T \qquad f = \frac{1}{T}$

$M \geq P$

In selecting the pulse number, the following conditions shall be met:

$$Qmax \leq 3.6 \times V \times fmax \qquad (m3/h,\ l/imp,\ imp/s)$$

Where:

Q … fluid flow rate		(m^3/hour)
V … fluid volume per pulse		(l)
P … pulse width		(s)
f … pulse output frequency		(Hz)
T … cycle length		(s)

Volume **V** per pulse is usually selected from the options shown in the following table:

V (l)							
0.001	0.01	0.1	1	10	100	1,000	10,000

In cases of electronic determination of the fluid volume passed through the sensor, the pulse width is recommended to be set at P_{min}= 5ms, which meets the condition for f_{max} at the pulse output equal to 100Hz. In cases of electro-mechanical counters, P_{min} is usually set at 50ms, corresponding to the maximum frequency at the pulse output of 10Hz.

Example:
Assume that a user specified for their flowmeter of DN100 the maximum operating flow rate:
Q_{max} = 150 m^3/h (Q_{max} = 41.66 l/s … v = 5.3 m/s)

For the fluid volume corresponding to one pulse (of length 5ms, f_{max} 100Hz) it holds:

$$V \geq \frac{Q_{max}}{3.6 \times f_{max}} \qquad \text{(liters/pulse, m3/h, Hz)}$$

$$V \geq 0.416 \qquad \text{(liters/pulse)}$$

By selecting the next higher pulse number from the above table (1 liter per pulse) the user will make sure that the pulse output frequency will not exceed (for the specified Q_{max} of 150 m^3/hour) the value of 100Hz and, at the same time, verify the selection of the pulse length (5ms). The user may choose the ***V*** values other than those from the basic selection in the above table, e.g. 0.5 liters/pulse.

Should the volume flow rate and the aggregate volume passed through the meter be given in units outside the SI system (e.g. US gallons), the fluid volume per pulse should be converted to liters using the table in section 5.1.4.2.2. The parameter of fluid volume per pulse shall then be determined with respect to the maximum frequency at the pulse output and the type of measuring system used.

Pulse numbers for various maximum frequencies at the pulse output
f max = 100, 50, 10 and 5 Hz

The volume per pulse parameters are selected from a decimal series; the maximum flow rate Q_4 corresponds to fluid flow velocity v = 10m/s.

DN	NPS	Q_4 (v = 10 m/s)		Pulse number (l/pulse)											
				for fmax =100 Hz			for fmax =50 Hz			for fmax =10 Hz			for fmax =5 Hz		
		(m3/h)	(l/s)	pulse volume V (l/imp)	f pulse for Q4 f (Hz)	pulse width Pmax (ms)	pulse volume V (l/imp)	f pulse for Q4 f (Hz)	pulse width Pmax (ms)	pulse volume V (l/imp)	f pulse for Q4 f (Hz)	pulse width Pmax (ms)	pulse volume V (l/imp)	f pulse for Q4 f (Hz)	pulse width Pmax (ms)
15	½"	6,5	1,8	0,1	18,00	27	0,1	18,00	27	1	1,80	277	1	1,80	277
20	¾"	12	3,33	0,1	33,30	15	0,1	33,30	15	1	3,33	150	1	3,33	150
25	1"	18	5	0,1	50,00	10	0,1	50,00	10	1	5,00	100	1	5,00	100
32	1 ¼"	30	8,33	0,1	83,30	6	1	8,33	60	1	8,33	60	10	0,83	600
40	1 ½"	45	12,5	1	12,50	40	1	12,50	40	10	1,25	400	10	1,25	400
50	2"	72	20	1	20,00	25	1	20,00	25	10	2,00	250	10	2,00	250
65	2 ½"	120	33,33	1	33,33	15	1	33,33	15	10	3,33	150	10	3,33	150
80	3"	180	50	1	50,00	10	1	50,00	10	10	5,00	100	10	5,00	100
100	4"	280	77,77	1	77,77	6	10	7,78	64	10	7,78	64	100	0,78	642
125	5"	430	119,44	10	11,94	41	10	11,94	41	100	1,19	418	100	1,19	418
150	6"	650	180,55	10	18,06	27	10	18,06	27	100	1,81	276	100	1,81	276
200	8"	1 150	319,44	10	31,94	15	10	31,94	15	100	3,19	156	100	3,19	156
250	10"	1 800	500	10	50,00	10	10	50,00	10	100	5,00	100	100	5,00	100
300	12"	2 520	700	10	70,00	7	100	7,00	71	100	7,00	71	1000	0,70	714
350	14"	3 500	972	10	97,20	5	100	9,72	51	100	9,72	51	1000	0,97	514
400	16"	4 500	1250	100	12,50	40	100	12,50	40	1000	1,25	400	1000	1,25	400
500	20"	7 200	2 000	100	20,00	25	100	20,00	25	1000	2,00	250	1000	2,00	250
600	24"	10 000	2 778	100	27,78	17	100	27,78	17	1000	2,78	179	1000	2,78	179
700	-	14 000	3 889	100	38,89	12	100	38,89	12	1000	3,89	128	1000	3,89	128
800	-	18 000	5 000	100	50,00	10	100	50,00	10	1000	5,00	100	1000	5,00	100
900	-	23 000	6 389	100	63,89	7	1000	6,39	78	1000	6,39	78	10 000	0,64	782
1000	-	28 000	7 778	100	77,78	6	1000	7,78	64	1000	7,78	64	10 000	0,78	642
1200	-	40 000	11 111	1000	11,11	45	1000	11,11	45	10 000	1,11	450	10 000	1,11	450

5.1.4.4.5. Pulses for Q−

See the procedure for setting the pulse parameters for Q+

5.1.4.4.6. Pulses for |Q|

See the procedure for setting the pulse parameters for Q+

5.1.4.4.7. Constantly closed

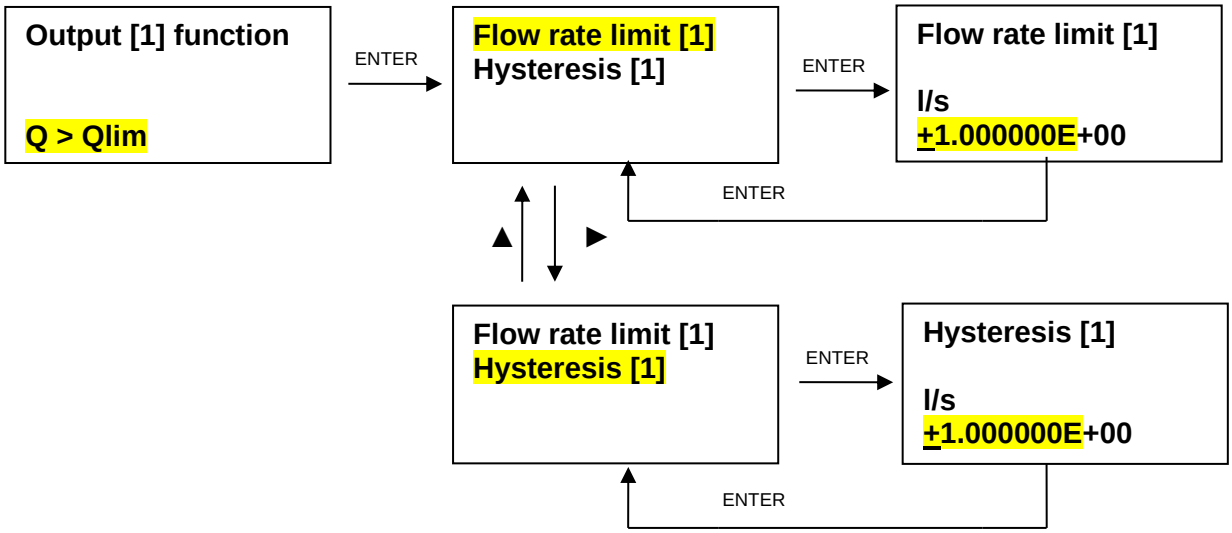
Output [1] function

Constantly closed

Upon confirming by **ENTER** the selection of the menu item **Constantly closed**, **Output 1** will be set at the **ON** status. At the same time, the display will return to the menu item Output 1 function / Function negation.

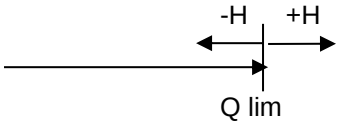
Upon selecting the **Function negation** mode, the output signal will be negated (**Output 1** will be constantly open – disconnected).

5.1.4.4.8. Q > Qlim



Using buttons ► and ▲, set the required values of flow rate limit and hysteresis.

Hysteresis (H) is assumed to be symmetric with respect to the flow rate limit value.



Confirm the setting by **ENTER** whereby the display will return to the previous menu item (**Flow rate limit [1] / Hysteresis [1].**

Return to Main menu: **3 x ESC**
Return to Basic screen: **ESC 2 s**

The flow rate limit value shall always be set in liters per second. Conversion of volume flow rates in various units to flow rate in liters per second is described above in the procedure for setting the **100%** value.

5.1.4.4.9. IQI > Qlim

The parameter setting procedure is essentially the same as that for Q > Qlim.

5.1.4.4.10. No error

Output [1] function

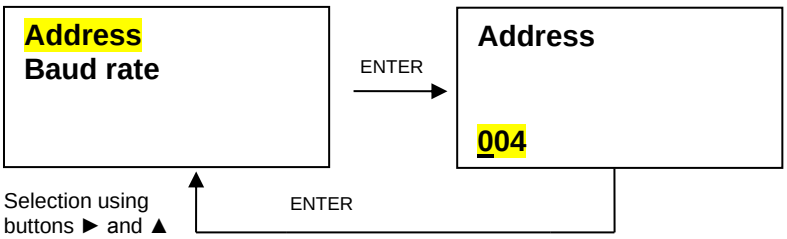
No error

Upon confirming by **ENTER** the selection of the menu item **No error**, **Output 1** will be ready for reporting a flowmeter error. **In the error-free condition Output 1 will be open (disconnected).**
A correct function selection will be confirmed by return of the display to the previous menu item.

Upon selecting the **Function negation** mode, the output signal will be negated (in the error-free condition **Output 1** will be constantly closed).

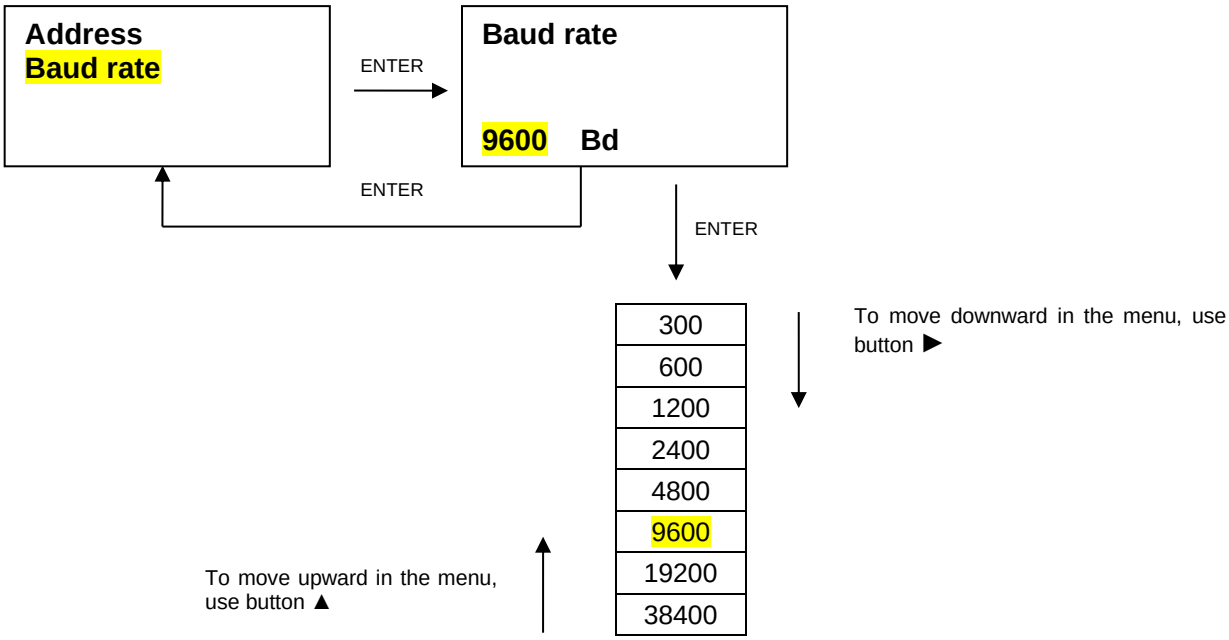
Return to Main menu: **2 x ESC**
Return to Basic screen: **ESC 2 s**

5.1.4.5. Serial line



Using buttons ▲ and ►, select in the yellow highlighted field the flowmeter address for interconnection to the communication network.
Confirm the selection by **ENTER** whereby the display will return to the previous menu item.
Return to Main menu: **1 x ESC**.

The meter address can only be selected from the range of 1 to 247. Other address values will be rejected.
The initial flowmeter address is 4.



The initial Baud rate setting for communication on a serial line is 9600 Baud.
Use buttons ► and ▲ to select another data communication speed. Confirm the alternative selection by **ENTER** whereby the display will return to the previous menu item (**Address / Baud rate**).
Return to Main menu: **1 x ESC**.
Return to Basic screen: **ESC 2 s**

5.1.4.6. Date setting

Date setting
Date YYYY/MM/DD

2018/09/22

Date format
YYYY/MM/DD
year/month/day

Using buttons ► and ▲ set the current calendar date. Confirm the selection by **ENTER** whereby the display will return to the previous menu item (**Date setting**).
Return to Basic screen: **ESC 2 s**

5.1.4.7. Time setting

Time setting
Time HH:MM:SS

20:17:22

Time format – mode 24
HH/MM/SS
hour/minute/second
Using buttons ► and ▲ set the current time. Confirm the selection by **ENTER** whereby the display will return to the previous menu item (**Time setting**).
Return to Basic screen: **ESC 2 s**

5.1.4.8. Volume resetting

The counters of the aggregate fluid volume quantities passed through the meter sensor in both positive and negative directions can be simultaneously reset by depressing button **ENTER**. Execution of the resetting operation will be signaled by a short flashing of the highlighted menu item **Volume resetting**.

5.1.4.9. Number of samples

Number of samples **100**

Using buttons ▲ and ►, set in the highlighted field the number of measurements used for calculation of the floating averages as input data for the determination of:

- current output,
- frequency and pulse outputs (OUT1 and OUT2), and
- visualization of the instantaneous flow rate values on the meter display.

Setting range: 1 − 254
The minimum number of samples depends on the excitation frequency; it is determined automatically.
Confirm the setting by **ENTER** whereby the display will return to the previous menu item (**Number of samples**).
Return to Basic screen: **ESC 2 s**

5.1.4.10. Suppressed flow rate

Suppressed flow rate **l/s** **+1.000000E+00**

Here the value set by buttons ► and ▲ defines a zone of flow rate symmetric with respect to zero where all outputs (current, OUT1 and OUT2 outputs, and the magnitude of instantaneous flow rate shown on the meter display) indicate zero flow rate.
Any flow rate values greater than **Suppressed flow rate** will be correctly measured and indicated.
Return to Basic screen: **ESC 2 s**

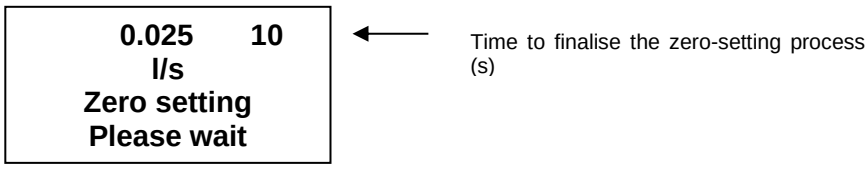
The suppressed flow rate value shall always be set in liters per second. Conversion of volume flow rates in various units to flow rate in liters per second is described above in the procedure for setting the **100%** value.
The initial setting of the suppressed flow rate has been done by the manufacturer according to the order number specification.

Flow rates for various sensor sizes

DN	NPS	(l/s)	
		Q_1 v = 0,025 m/s	Q_4 v = 10 m/s
15	½“	0,0036	1,8
20	¾“	0,0067	3,33
25	1“	0,0100	5
32	1 ¼“	0,0167	8,33
40	1 ½“	0,0250	12,5
50	2“	0,0400	20
65	2 ½“	0,0667	33,33
80	3“	0,1000	50
100	4“	0,1556	77,77
125	5	0,2389	119,44
150	6“	0,3611	180,55
200	8“	0,6389	319,44
250	10“	1,0000	500
300	12“	1,4000	700
350	14“	1,9444	972
400	16“	2,5000	1250
500	20“	4,0000	2 000
600	24“	5,5556	2 778
700		7,7778	3 889
800		10,0000	5 000
900		12,7778	6 389
1000		15,5556	7 778
1200		22,2222	11 111

5.1.4.11. Zero setting

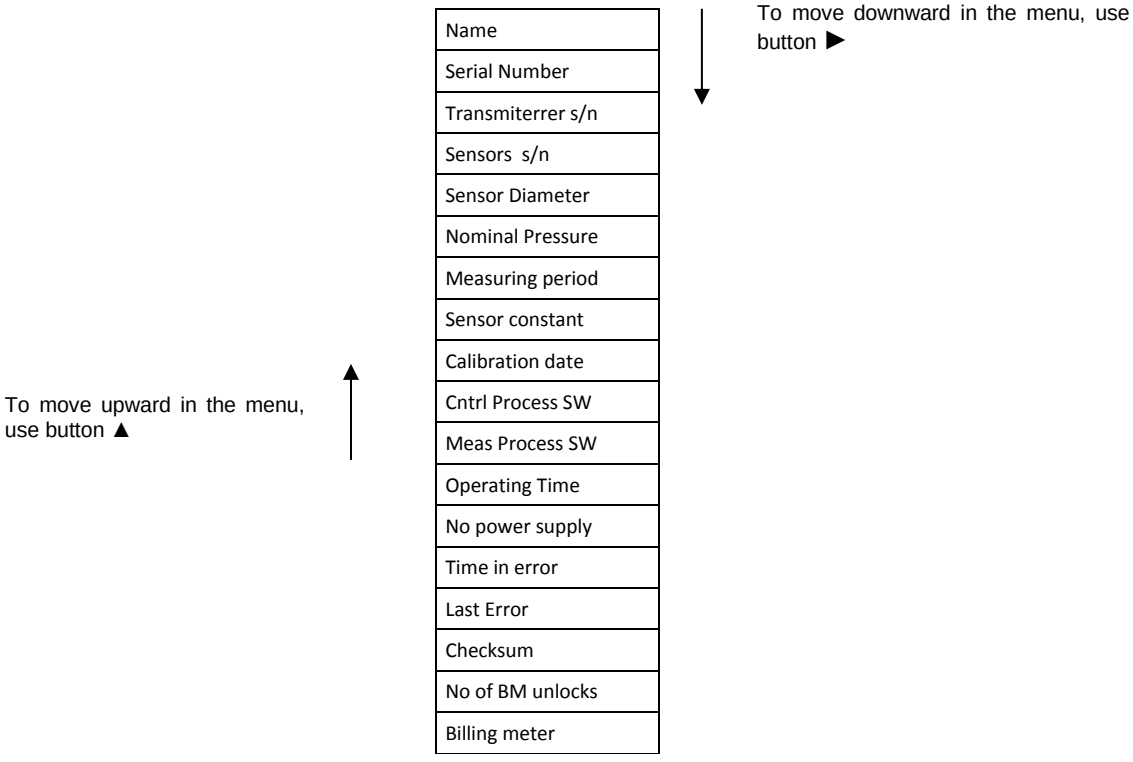
Zero setting is always required prior to the meter calibration and within the meter commissioning procedure. During the zero setting process the meter sensor shall be fully flooded with the measured fluid and the fluid shall be at absolute standstill.
Using buttons ► and ▲, select the item Zero setting on Main menu. Confirmation of the selection by **ENTER** will actuate the flowmeter zero setting process. The commencement of the zero-setting process will also be confirmed by a notice on the meter display.
The time to finalizing the zero-setting process will be indicated in the top right-hand corner of the display.



Upon completion of the zero-setting process, the display will return to Basic screen.
Part of the zero-setting process is optimization of the meter excitation circuit parameters, which in specific cases may result in a change in the excitation frequency.

5.1.4.12. Production data

The flowmeter manufacturing data are specified and written in the meter software during the meter production process. The user may only read and not modify such data in any way.



The menu item selected by buttons ► and ▲ will be highlighted in yellow. Confirm the selection (for reading only) by button **ENTER**.

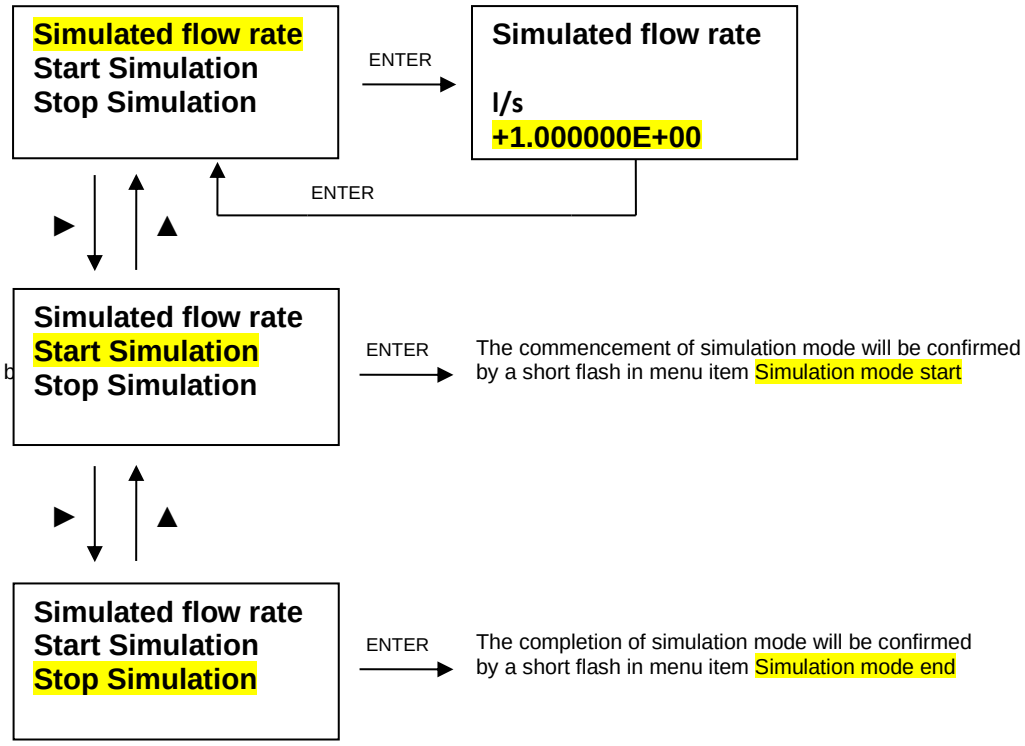
Return to previous menu item: **ENTER**
Return to Main menu: **1 x ESC**
Return to Basic screen: **ESC 2 s**

5.1.4.13. Production setting

The menu item P**roduction setting** is not accessible to the user. Data and information intended for the manufacturer only are protected by a password. This arrangement concerns:

- Sensor constant
- ADC setting

5.1.4.14. Simulation mode



Upon confirming the selection of item **Simulated flow rate** by **ENTER**, a window will open for setting the value of simulated flow rate in liters per second. Regarding conversion of volume flow rate in various units to flow rate in l/s, see the procedure for setting **100%**.
Confirm the set flow-rate value by **ENTER** whereby the display will return to the previous menu item (**Simulation flow rate**).
Select the command **Simulation mode start** and confirm by **ENTER.** The commencement of the simulation procedure will be confirmed by a short flash of the **Simulation mode start** field.

All outputs (analog, OUT1 and OUT2 outputs and the figure on the instantaneous flow rate line on the display) will be set at the value corresponding to the simulated flow rate. Next to the value of the simulated flow rate on line 1 of Basic screen will appear the text message **SIM**.

Return to Main menu: **1 x ESC**.

Upon return from Main screen to item **Simulation flow rate**, use button **ENTER** to discontinue the simulation mode. Termination of the simulation mode will be confirmed by a short flash of the **Simulation mode end** field.
All outputs (analog, OUT1 and OUT2 outputs and the figure on the instantaneous flow rate line on the display) will return to the status existing prior to the commencement of the simulation mode procedure.

5.2. Remote meter control using program FLOSET 4.0

Flowmeters of the type series FLONET FXx11x and FLONET FH30xx are provided with digital interfaces RS-485 MODBUS RTU and HART®.
Remote control of flowmeters FLONET FXx11x and FLONET FH30xx is facilitated by the serial communication interface RS-485 MODBUS RTU.
Across such interfaces the meter can be connected as subordinated equipment to a computer (a personal, notebook or tablet computer) with Windows XP or a higher OS upgrade (Linux, iOS) and JAVA 8u40 or a higher upgrade thereof installed. The remote control mode of operation further requires installation of the following software:

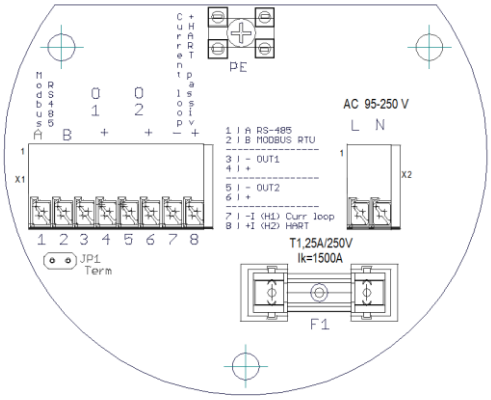
- Configuration program FLOSET 4.0, and
- File *.floc related to the flowmeter type concerned.

Using these software tools, the user may set parameters and read the values of all meter variables as with the manual meter control mode.

Program **FLOSET 4.0** and file ***.floc** associated with the given meter type are not included in the basic scope of deliverables.
A complete software package (on a CD) for remote meter control including the USB/RS-485 convertor complete with connecting cables can be supplied on request.

5.2.1. Flowmeter connection to a communication line

- The terminals of the RS-485 communication interface are located on the meter terminal board. Prior to connecting the communication line, turn off the meter power supply.



FH30xx/FXx11x	Bar conductor
1	A
2	B
PE	Shielding

- Line termination resistor: 120Ω connected to the terminals marked **Term**.
- Recommended line cable: Type A according to standard ČSN EN 61158-2 (a twisted pair of conductors, shielding on 90% area).

If the communication line is short and is to be used for the purposes of parameter setting prior to the meter on-site installation, it is not necessary that the cable meet the requirements of standard ČSN EN 61158-2, and no line termination resistor needs be used.

- The control PC shall be connected to the communication line by means of a USB/RS-485 convertor.

The USB/RS-485 convertor including the connecting cables can be supplied on request.

- Connect the flowmeter to its power supply grid.
- Turn on the PC and find the USB input to which the communication line is connected (using the PS equipment administrator function).
- Run program FLOSET 4.0, select and open the *.flo file associated with the given flowmeter type.

More detailed instructions regarding application of the RS-485 MODBUS RTU communication interface can be found in the manual
Es 90664K Communication interface RS-485 MODBUS RTU
Electromagnetic flowmeters FLONEX FXx11x and FLONET FH30xx

5.2.2. Program FLOSET 4.0 installation and operational start

Installed on the PC shall be OS JAVA 8u40 or a higher upgrade of the same.
Upon starting the configuration program FLOSET 4.0, displayed on the computer monitor will be the initial window including the **Open Project** field.

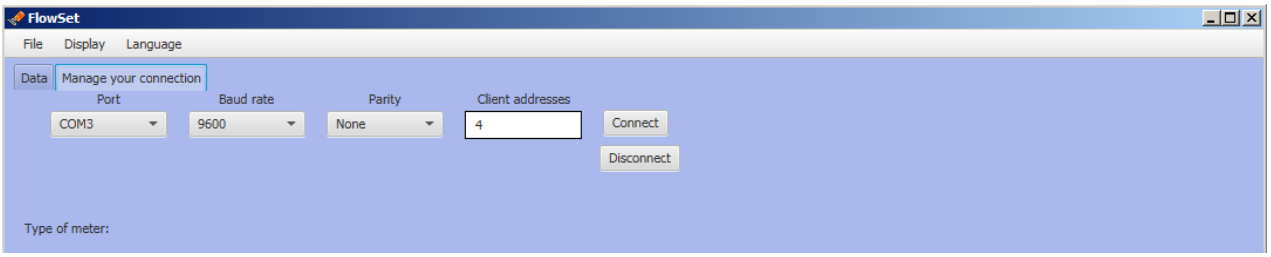
The window header will include items:
File → Open / Close
Display → Complete screen
Language → The user language

Located at the top right-hand corner of the screen will be software buttons with the standard functions: **Minimise**, **Maximise** and **Close**.

A click on the **Open Project** field will call forth an address directory with file names including the suffix *.flo (such as Flonex.flo). Select the file related to the given flowmeter.

Upon the project opening, displayed will be a strip with bookmarks **Data** and **Connection administration**.

Bookmark Connection administration



Fill in the white fields as follows:

Port: The port number can be found using the standard computer OS tools. The initial (production) setting of the port number is 4.

- **Baud rate**: 9,600 Baud (the production setting)
  At the very first communication start, the PC will set the data transfer velocity at 9,600 Baud.
  With a meter that was connected to the RS-485 MODBUS RTU serial communication line earlier, the current communication parameters need be read from the meter manually and the PC parameters needed for communication set accordingly. Observance of this procedure will eliminate any difficulties in establishing communication between the PC and a subordinated flowmeter.
- **Parity:** None
  In serial communication, flowmeters of the type series FLONEX FXx11x and FLONET FH30xx do not apply any parity checks.
- **Client address:** 4 (This is the initial/production setting of the flowmeter address for the purposes of RS-485 MODBUS RTU serial communication)

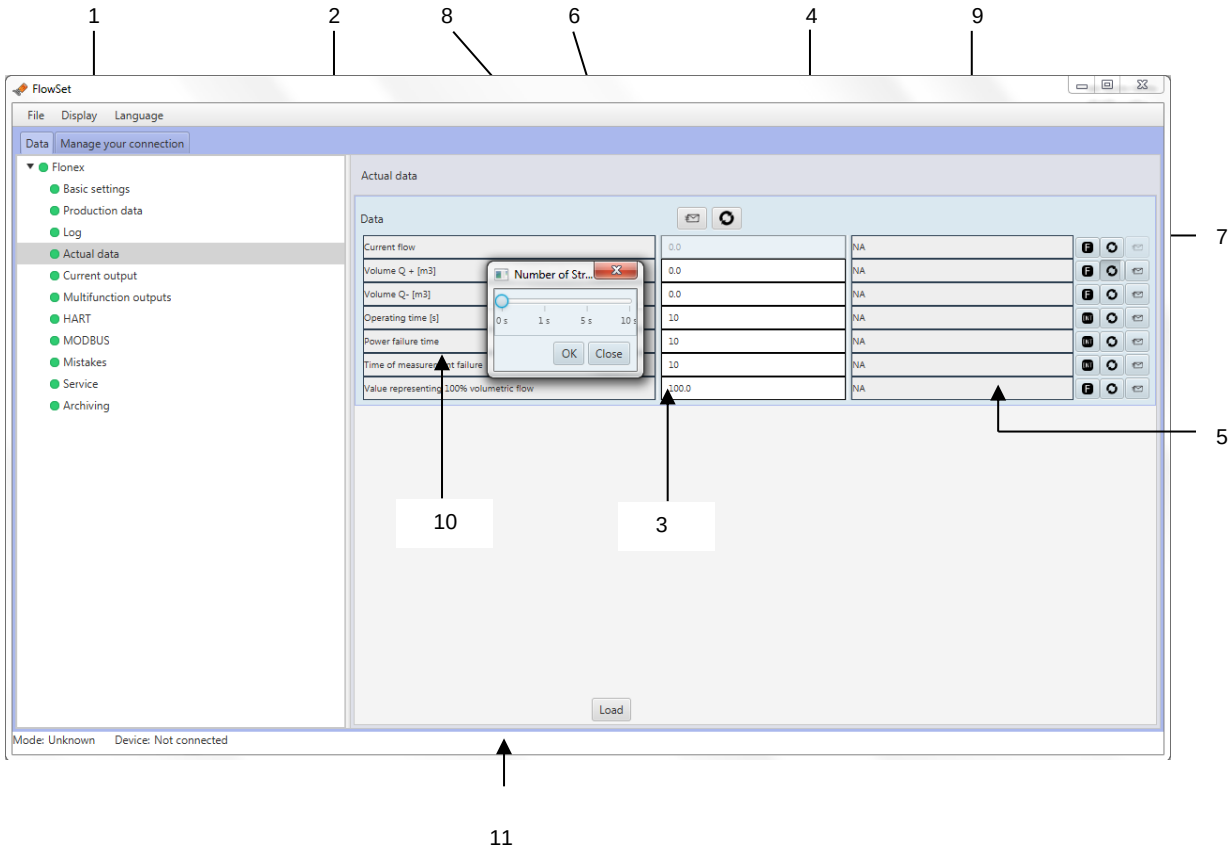
To activate / disactivate the communication line, use buttons **Connect/Disconnect.**

The flowmeter shall be energized.

As confirmation of a successful communication connection, the flowmeter type designation and the meter ID will appear in red in the field for **Meter type**. Should the connection attempt fail, red label

reading **Failed connection** will be shown on that line. At the same time, button ✕ will flash in red in the top right-hand corner of the screen.

Bookmark Data



The Data file includes a list of items where selection of any of these will open a table including a detailed description of the item and the current setting of the relevant parameters. If required, the set parameter values can be modified here.

1 The bookmark column includes the following items:

- Initial setting
- Manufacturing data
- Log
- Current data
- Current output
- Multifunction outputs
- HART
- MODBUS
- Errors
- Service
- Data archiving

The FLOSET 4.0 program has been designed to support different types of flowmeter manufactured by the company ELIS PLZEŇ a. s. It may happen that some function names referred to in the program are not identical with messages appearing in abbreviated form on the meter display. Nevertheless, the functions are always easy to identify and understand.
Apart from functions accessible to the user in the manual meter control mode, program FLOSET 4.0 working via the RS-485 MODBUS RTU communication interface makes also possible:

- Setting the user passwords;
- Reading of the historical flow-rate data (the hourly, daily and monthly flow-rate values)

Use buttons ▲,▼ in the header of the Log table to select the required archived data from specific operation periods.

- Setting the data archiving parameters (Log, Archiving)
- Reading the initial parameter setting (Service)
- Deleting the archived data (Service)

2 Variable name

3 Setting of a new variable value. If the field is backlighted, a modification is permitted.

4 Data read from the flowmeter (upon depressing button)

5 Button for one-off flowmeter data reading (data on one display line only).

6 Depress button above the table to read and transfer to program FLOSET 4.0 a complete group of variables.

7 A click on the envelope button will result in one-off writing of new data into the flowmeter. This write command will be limited to data on a single display line.

8 Button above the block of variables may be used to write new data for a complete group of variables into the flowmeter.

9 Symbols assigned to variables:

- F the float-type of variable
- S a string variable
- I the integer-type of variable
- E the enum-type of variable
- The clock-face symbol: the date-and-time variable

This button is reserved for manufacturing and service operations only. The user may only work with the backlighted item. Use the button to open **Item editor**. Through the backlighted item it is possible to set values to be written into the flowmeter just as with item 3.
To end the data setting procedure use button **Store** whereby the system will rewrite the variable value in the table and store the new value in the flowmeter, or button **Close** whereby the procedure will be discontinued and no data changed.

10 A click on button will cause a narrow empty bar to appear right of the button. A click on this bar will open a dialogue window where the user may define the cycle period for repeated flowmeter data reading.
This is possible for a single variable only, not with the button associated with reading data from a complete table.

11 At the bottom of the open window there is a software button **READ** making possible reading all variables in a table.

6. DOCUMENTATION AND STANDARDS

Es 90664K/a **RS-485 MODBUS RTU communication interface**
Electromagnetic flowmeters FLONEX FXx11x and FLONET FH30xx

Es 90679K **FLOSET 4.0 Configuration Program**

Manufacturer's address:

ELIS PLZEŇ a. s.
Luční 425/15,
301 00 Plzeň
Czech Republic
Telephone: +420/377 517 711
Fax: +420/377 517 722
E-mail: sales@elis.cz
http://www.elis.cz

Issue 1