

**AFLQWT**



**TECHNOLOGICAL MAGNETIC  
FLOW METER**

# **AFLOWT MFT**

**OPERATION MANUAL  
PART II**



**ISO 9001:2015**

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This manual covers "AFLOWT MFT" Technological Magnetic Flowmeter, gives the instructions for its proper use.

Due to continuous improvement of product policy, actual flowmeter's specifications may differ from the data specified in this manual. However, this will not affect the metrological characteristics and functionality.

#### LIST OF ABBREVIATIONS

ER - Error  
MFT - Technological Magnetic flowmeter  
PC - Personal computer.

NOTE. Words in the text marked in bold, for example, **FLOW DATA**, correspond to the items displayed on the Flowmeter's screen.

# 1. CONTROLLING THE FLOWMETER





MFT's operation in various modes can be controlled from the keyboard via the menu designed on the model of nested menus and windows, or from a PC either via serial RS-485 interface, or via Ethernet or HART.


## 1.1. Keyboard



The keyboard has four buttons, functionality and description of which are given in Appendix A. The keyboard keys are activated by placing a finger (or an object) over a photosensitive cell.

The keyboard allows you to do the following:

- Navigate around the hierarchical menu and windows
- Efficiently control indication on the LCD display
- Enter configuration data.

Use ,  buttons to scroll up or down the lists of options and to select a menu item (setting). To go to a lower level menu (window) or activate a menu item (setting), place the cursor  $\rightarrow$  () against the required item (setting) and press button .

Press button  to return to a parent window (menu).

To abort the present activity and revert to the previous menu without saving changes, press button . Pressing button  allows you to save a new value in the memory. In both cases, press the button several times until the Device exits the mode.

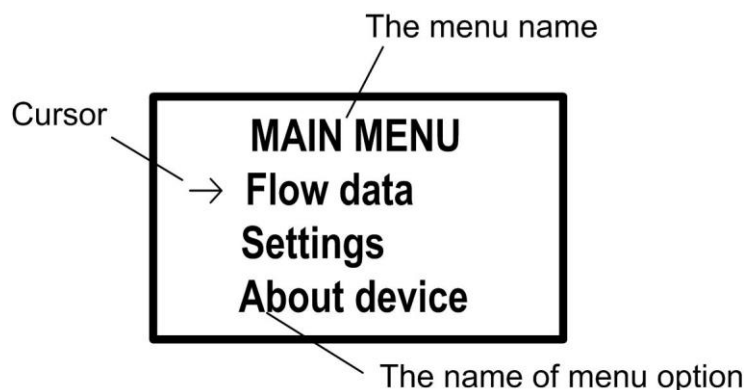
NOTE: After "pressing" a button, move a finger (or an object) apart from the keyboard by a few centimeters.

## 1.2. Display system

1.2.1. To control the flowmeter from the keyboard of the Calculation module, use the hierarchical menu (see Appendix B) consisting of the main menu, submenus and windows which give access to the lists of menu functions and options. The main menu is the same in all modes. However, the functions of submenus and windows will change depending on the mode selected.

1.2.2. The menu window (Fig.1) contains:

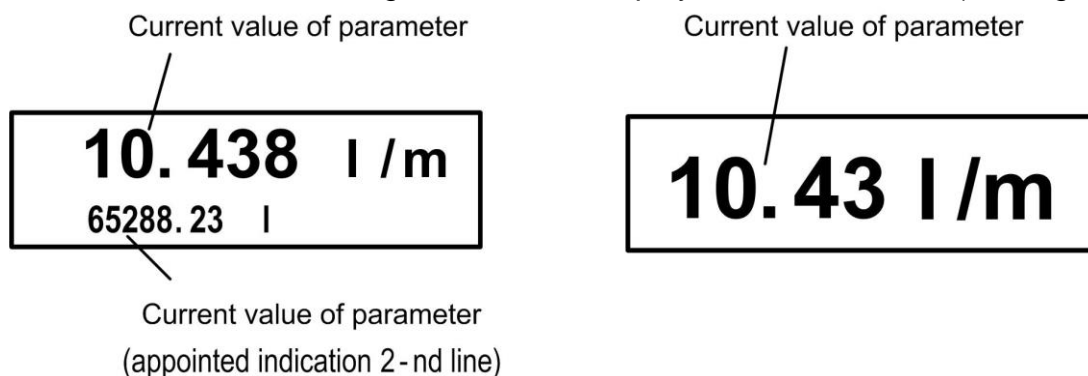
- Menu (window) name fixed in the first line
- Menu option (setting) names which can be moved up or down
- Cursor against one of the menu options (settings).



**Fig.1. Main menu.**

Number of displayed lines (menu items, list options) cannot exceed 3 at a time.


1.2.3. Current values of parameters being measured are displayed in **FLOW DATA** menu window (see Fig.B.1, Appendix B). In addition, you may choose the font of greater size to display measured values (see Fig.2).




**a) two-line window**

**b) single-line window**

**Fig.2. Windows indicating measurement results in enlarged size**

The single-line enlarged indication window is opened by pressing button  from a two-line enlarged indication mode, the single-line indication function allows you to only view the current value of flow rate.

To return to the two-line enlarged indication mode, press button . The two-line mode is restored automatically, if no button is pressed for more than two minutes.

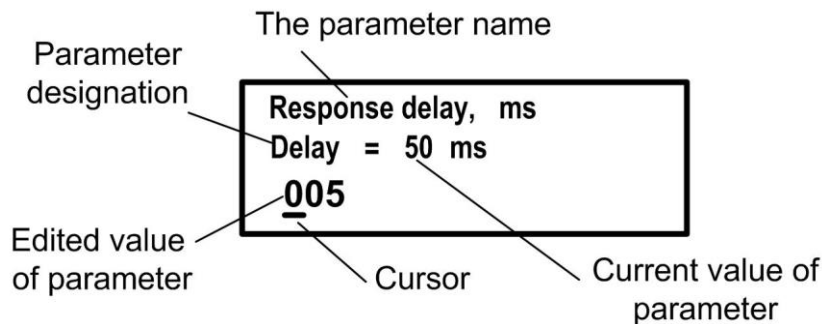
**CAUTION!** The two-line enlarged indication mode is automatically restored regardless of the active mode.

When the enlarged indication window is opened upon a command from the keyboard, the first line shows, in large font, the current value of measured parameter activated in **FLOW DATA** menu.

When the enlarged indication window is opened automatically, the first line shows the current value of measured parameter selected by the user.

In both cases, the second line shows the current value of another parameter selected by the user.

- 1.2.4. Most of the configuration settings are entered from the special-purpose window which is opened after the menu option containing the name of the corresponding setting is recalled (see Fig.3). The window contains:
- In the first line – parameter name and symbol of the measurement unit
  - In the second line – parameter identifier, its current value and symbol of the measurement unit
  - In the third line – parameter value to be edited and cursor under a digit (when editing is accessible).



**Fig.3. Configuration setting (parameter) editing window.**

- 1.2.5. The cursor points to the selected menu item, parameter name or digit of the number being edited. Image and location of the cursor depend on the type of data being displayed and status of the menu item (setting) against the cursor.

In the menu window, the cursor is placed:



- Against the first menu line (setting) – after opening the main menu or a submenu, or scrolling through a list of options
- Against the second menu line (setting) – after scrolling through a list of options
- Against the third menu line (setting) – after scrolling through a list of options.





Cursor images:



- → – When there is an access to a lower level menu (window)
- ► – When the parameter can be adjusted
- ■ – When no actions are possible, or going to enlarged indication window is the only action accessible
- ─ – When a number (with the cursor under a digit) is editable.

## 1.3. Entering values of configuration settings

### 1.3.1. Entering numerical values





If the cursor ─ is placed under a digit, this means that the value can be modified. It is modified digit by digit with buttons , .

Pressing button  () once will increase (decrease) the digit marked by the cursor by one. To move the cursor to another digit, press buttons , .

To record a numeric value into the memory, press button  (with the cursor located in the rightmost digit position), to exit the mode without saving changes, press button  (with the cursor located before the numeric value).

#### 1.3.2. Entering values selected from a list

If the cursor is transformed into triangle brackets ◀ ▶ enclosing a value of the parameter, this means that the list of selectable parameter values is activated.

Press  or  to cycle through the list. Button  is used to enter the value into the memory, press  to cancel the operation.

## 1.4. Entering password

1.4.1. To get access to the configuration settings available in **SERVICE** mode, you will need to enter a password – a three-digit number ranged from 001 to 999. The default password is **123**.

1.4.2. The password can be entered in **Settings / Enter password** menu (see Fig.B.2 in Appendix B). On entering the mode, the first line is: **Password = 0**. After this menu line is activated, **0** is replaced by **000** and the cursor **\_** appears under the leftmost digit. Use buttons in the same order as for entering numeric values (see section 1.3.1).

1.4.3. If the password is correct, the Device takes you to **SETTINGS** menu. If you fail to enter a correct password, the first menu line turns back to **Password = 0**.

**SETTINGS** menu will appear without entering a password (**Settings / Enter password / Enter without pass.**), but in this case configuration settings cannot be edited.

1.4.4. You can set the Device to a new password in **Settings / Enter password / SETTINGS / Password** menu (see Fig.B.2 of Appendix B).

1.4.5. **SETTINGS** menu can be accessed from **CALIBR** mode without entering a password and with all configuration settings being fully editable.

## 2. START-UP CONFIGURATION

### 2.1. Setting flow rate measurement cutoffs

2.1.1. The flowmeter allows you to set cutoffs (thresholds) for suppressing flow rate measurement: Up Flow cutoffs (**On decr.**) and Down Flow cutoffs (**On incr.**).

The **Up Flow Cutoff** and **Down Flow Cutoff** are the flow rate thresholds below which (on increasing or decreasing the flow rate value respectively) totalizing, pulse generating and outputting of current signal are stopped. The flow rate value is displayed as zero. For the reverse (bidirectional) flow, the cutoffs trigger both for positive and for negative flow directions. The flow direction signal also changes according to the preset cutoffs.

2.1.2. To modify Up Flow and Down Flow cutoff values, enter **SETTINGS / Measure settings / User settings / Dead zones / On decrease (On increase)** menu and perform operations specified in section 1.3.1.

### 2.2. Performance settings

The Flowrate signal filter (see Table 1) and Automatic flowrate setup module may be included in signal processing. To enable this function, select **Filter select** option in **User settings / Performance settings** menu.

Table 1

Filter	Interference Suppression Factor, db	Batching time, s
1 (3 lag elements)	49	0.21
2 (5 lag elements)	85	0.33
3 (6 lag elements)	93	0.38

Enabling additional filter **Add. filter – yes** in the same menu increases flow rate fixing time by approximately 0.16 s.

Additionally, the device allows you to adjust filter depth in the **Performance settings** menu by specifying **Kfilt. flow** parameter. Approximate duration of a transient process is specified in Table 2.

Table 2

Value	10	9	8	7	6	5	4	3	2	1	0
Time, s	16.2	8.1	4.02	2.01	1	0.5	0.24	0.12	0.05	0.02	0

NOTE. All data on filter fixing time are given for reference only.

### 2.3. "Pipeline filling" settings

The flowmeter is capable of controlling the pipeline filling by measuring resistance of a channel with use of the additional electrodes installed in the flow sensor's vertical plane.

To correctly measure the channel resistance and, therefore, the pipeline filling, it is necessary to perform flowmeter's calibration. To do



this, you must enter medium reference resistance into the device's memory. Select option **Run calibr. – Start** in the **Measure settings / User settings / Empty pipe settings** menu. The device uses this reference (standard) resistance **Rstd** to calculate the pipeline filling.

To evaluate a signal related to resistance of medium against the "resistance out of range" criterion, select **CORcutoff** value from the same menu. To evaluate the resistance against the "empty pipe" criterion, select **EP cutoff**. For each of these parameters, it is necessary to specify the cutoffs as percentages of **Rstd** (the minimal value is 0), and the response time in seconds. Then, the resistance signal is set.

If the resistance value goes beyond the range, the device generates alarm messages **Empty pipe** and **Rmeas overf**. These parameters are of a different kind from the above since such options as "save" or "don't save" can be set for triggering **EP cutoff**. If the "don't save" option is selected, the device will display zero flow rate value.

Additionally, filter resistance constant **K cond. filter** can be configured in the range from 0 (filter is off) to 10; the constant will affect measurement speed and accuracy.

## 2.4. Low frequency interference compensation

When operating the device in chemically aggressive media, there is a high probability of polarization of the electrodes. When the polarization interference is high, it is recommended to turn on the low frequency compensation filter **Suppress noise – "on"** in **USER SETTINGS** menu.

## 2.5. Setting a calculation of mass flow and mass

To enable calculation of the mass flow and the mass of the controlled fluid is made in the menu **SETTINGS / Measure settings / User settings / Mass calculation**. For the **Calc. mass** is set to **on**. In this menu, you can also set the average value of the density  $\rho$  (kg/m<sup>3</sup>) of the controlled fluid.

After you enable this function in the flow meter indicates additional menu commands and parameters (Appendix B). The mass increase of the controlled fluid begins from the moment you enable calculation of the mass with zero values.

**CAUTION!** The error in determining the mass flow rate and mass are not normalized.

## 2.6. Setting display parameters



To select the parameters to be displayed in the first and second lines of enlarged indication window, go to **SETTINGS / Display** menu. Options are given in Table 3.

**Table 3**

Number of line	Parameter	Indication	Meaning of displayed information
First line	<b>Flow</b>	<b>no</b> <b>Q*</b> <b>Qm*</b>	- no indication - current flow rate value - current mass flow rate value
First line	<b>Total volume / mass</b>	<b>no</b> <b>V+*</b> <b>V-*</b> <b>ΣV*</b> <b>M+*</b> <b>M-*</b> <b>ΣM*</b>	- no indication - value of accumulated volume for direct flow - value of accumulated volume for reverse flow - the algebraic sum of volumes considering flow direction - value of accumulated mass for direct flow - value of accumulated mass for reverse flow - the algebraic sum of mass considering flow direction
Second line	<b>Empty string</b>	<b>no</b> <b>yes*</b>	- according to the value selected for the second line - no indication (empty line)
Second line	<b>Flow</b>	<b>no</b> <b>Q*</b> <b>Qm*</b>	- no indication - current flow rate value - current mass flow rate value
Second line	<b>Total volume / mass</b>	<b>no</b> <b>V+*</b> <b>V-*</b> <b>ΣV*</b> <b>M+*</b> <b>M-*</b> <b>ΣM*</b>	- no indication - value of accumulated volume for direct flow - value of accumulated volume for reverse flow - the algebraic sum of volumes considering flow direction - value of accumulated mass for direct flow - value of accumulated mass for reverse flow - the algebraic sum of mass considering flow direction
Second line	<b>Work time</b>	<b>no</b> <b>yes*</b>	- no value is indicated - the flowmeter operation time is indicated
Second line	<b>Percent flow</b>	<b>no</b> <b>yes*</b>	- no indication - current flow rate value is displayed as a percentage of the specified maximum value **
Second line	<b>Errors</b>	<b>no</b> <b>yes*</b>	- no indication - fault or alarm message
Second line	<b>R measured</b>	<b>no</b> <b>yes*</b>	- no indication - actual value of medium resistance
Second line	<b>Vuser</b>	<b>no</b> <b>Vd</b> <b>Md</b>	- no indication - actual value of measured dose volume - actual value of measured dose mass

\* - once a value for the parameter in the line has been selected, "no" value is automatically set for other options.

\*\* - maximum flow rate value corresponding to 100% is set in **SETTINGS / Display / Set 100% flow** menu.

After transition to the enlarged indication window upon pressing button  from **Flow data** menu, the measurement value of the parameter activated in this menu is displayed in the first line. The measurement value of the parameter set by the user is indicated in the second line. If button  is pressed once again, the actual flow rate value is displayed in full-screen size.

## 2.7. Batcher settings




2.7.1. Batcher is activated regardless of other measurement or logging processes.

The batching can be performed in one of two ways:

- Batching of the set dose value
- Batching in the "start-stop" mode.

The batching process is started by the operator either from the keyboard or by a control signal. At the end of batching, the actual value of the volume (mass) of the measured dose and the time of dose intake is determined.

2.7.2. When batching a given dose value, its volume value is set by selecting one of the dose numbers **D1 ... D8**, and the mass value – one of the dose numbers **D9 ... D16** (**Doses list** menu), the values of which are entered in the flowmeter in advance.




To select one of the dose numbers, it is necessary to activate **FLOW DATA / Batcher / Dose number** and in the appeared triangle brackets ◀ ▶ use the buttons ,  to select the desired number. After then press the button . At the same time in the set line **Vset. (Mset.)** an indication of the volume (mass) of the given dose will appear.

Enter the values for the doses **D1 ... D16** before the start of the dosing process is performed in the **MEASURE SETTING / User settings / Batcher settings / Doses list** menu.

Stopping the batching process is performed automatically after the set dose value, or at the command of the operator from the keyboard or by a control signal.




2.7.3. For batching in the "start-stop" mode, it is necessary to set the dose number with a zero volume value. The dosing process is started and stopped by the operator from the keyboard or by a control signal.

2.7.4. To start the batching process, it is necessary to do the following:

- Select and activate **FLOW DATA / Batcher / Batching** menu option
- Using buttons , , select the "start" value in the triangle brackets and press button .

When the user counter starts, the previously accumulated values are zeroed, and then new **Vcur. (Mcur.)** and **Tdos.** values start to change.

To stop the batching process:

- Activate **FLOW DATA / Batcher / Batching** menu option
- Using buttons ,  select the "stop" value in the triangle brackets and press button .

## 2.8. HART setting

If the HART interface is used, it is configured in the **Settings / HART settings** menu. A network address of the flowmeter, the current signal characteristics, the lower and upper limits of the measured flow rate are set in the interface settings. In addition, the keyboard of the flowmeter can be used to switch on the test mode of the interface when entering the test value of the flow rate.

## 2.9. Operation procedure

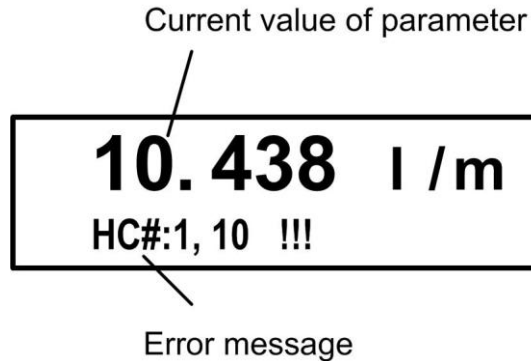
After putting into operation, the flowmeter continuously works in the automatic mode.

After the flowmeter is energized, the information about the device and the software version is indicated on the display. At the completion of self-test, **FLOW DATA** menu appears. If the keyboard is not operated for two minutes, the display will show the enlarged indication window displaying the parameter selected for this purpose in the **DISPLAY SETTINGS / First line** menu.

The measurement results and status of the Device is read from the universal outputs via serial interface RS-485, HART, or from local (industrial type) network, if the Ethernet (Profibus) module is installed.




### 3. TROUBLESHOOTING

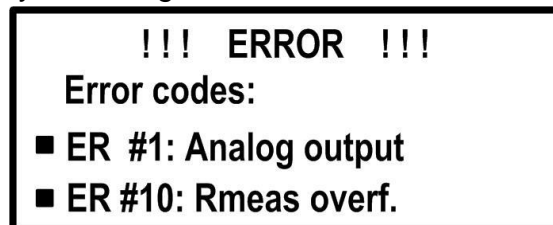
3.1. Faults and error situations (ER) detected by the flowmeter are displayed as an error message in the second line of the enlarged indication window (see Fig.4):



**Fig.4. Indication window containing ER message.**

An error message is displayed in the second line immediately after the situation has been detected and regardless of the parameter selected to be displayed in the second line of enlarged indication window.

To identify the fault or ER type, press button . In the corresponding window (see Fig.5), you can view the fault code (ER) and its description. When several faults are detected at the same time, error codes and descriptions are displayed as a list. Use buttons ,  to cycle through the list.



**Fig.5. Window containing Error codes and their descriptions.**

For the list of faults and alarm situations detected by the flowmeter see Table 4.

3.2. In case of failure or an alarm situation check the following:

- Flowmeter and secondary power source input voltage is present and conforms to the specifications
- Power circuits are reliably connected
- Liquid is present and running through the pipeline
- No air collection at the flowmeter's location is present
- Values of KP, cutoffs and other configuration settings are set correctly (change if necessary).

If all of the requirements listed above are met, contact the manufacturer for the information about the device's operability.





**Table 4**

ER code, message on the display	Event description
<b>ER #1: Analog output</b>	Current output error
<b>ER #2: Sign. overflow</b>	Input signal level exceeds the allowed value for several measurement cycles
<b>ER #3: Wrong KP1</b>	Invalid KP value, output 1
<b>ER #4: Wrong KP2</b>	Invalid KP value, output 2
<b>ER #5: Stab. overflow</b>	Input signal level exceeds the allowed value over a long time
<b>ER #6: Q &gt; Qmax</b>	Current flow rate value exceeds maximum
<b>ER #7: Measure error</b>	Reference resistance measurement failure, firmware fault
<b>ER #8: Init. error</b>	Working mode without initialization
<b>ER #9: Empty pipe</b>	Resistance exceeds the preset value (empty pipe)
<b>ER #10: Rmeas overf.</b>	Resistance value is beyond the specified range
<b>ER #11: Q out range</b>	Flow rate value is beyond the specified range
<b>ER #12: Q &lt; Qmin</b>	Current flow rate is below the preset operation range value
<b>ER #13: Q &gt; Qmax</b>	Current flow rate exceeds the preset operation range value
<b>ER #14: Amplify. overflow</b>	The signal level at the input of the amplifier is above the allowed
<b>ER #15: tins &gt; tcrit.v.</b>	The temperature value inside the flowmeter electronics block exceeds the critical value (+ 85 °C)

3.3. "AFLOWT MFT" flowmeter should only be repaired by authorized dealers or by the manufacturer.

## APPENDIX A. Controlling the flowmeter












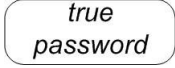

**Table A.1. Functions and Identification of Keyboard Keys (Buttons)**

Graphical symbol	Function
	<ol style="list-style-type: none"> <li>1. When selecting menu item, parameter – navigating up the list.</li> <li>2. When setting a character value – navigating up the list of character values.</li> <li>3. When setting a numeric value – moving cursor to the left along digit positions.</li> </ol>
	<ol style="list-style-type: none"> <li>1. When selecting menu item, parameter – navigating down the list.</li> <li>2. When setting a character value – navigating down the list of character values.</li> <li>3. When setting a numeric value – moving cursor to the right along digit positions.</li> </ol>
	<ol style="list-style-type: none"> <li>1. Transition to the selected menu/ window of lower level.</li> <li>2. When setting numeric values – moving cursor to the right along digit positions.</li> <li>3. When performing an operation – entering the selected value (when the cursor is located under the rightmost digit of a number).</li> </ol>
	<ol style="list-style-type: none"> <li>1. Exit to the menu/ window of higher level.</li> <li>2. When setting numeric values – moving cursor to the left along digit positions.</li> <li>3. Cancelling an operation, entering modified parameter value, command; exiting to the menu/ window of higher level (when the cursor is located before the number).</li> </ol>

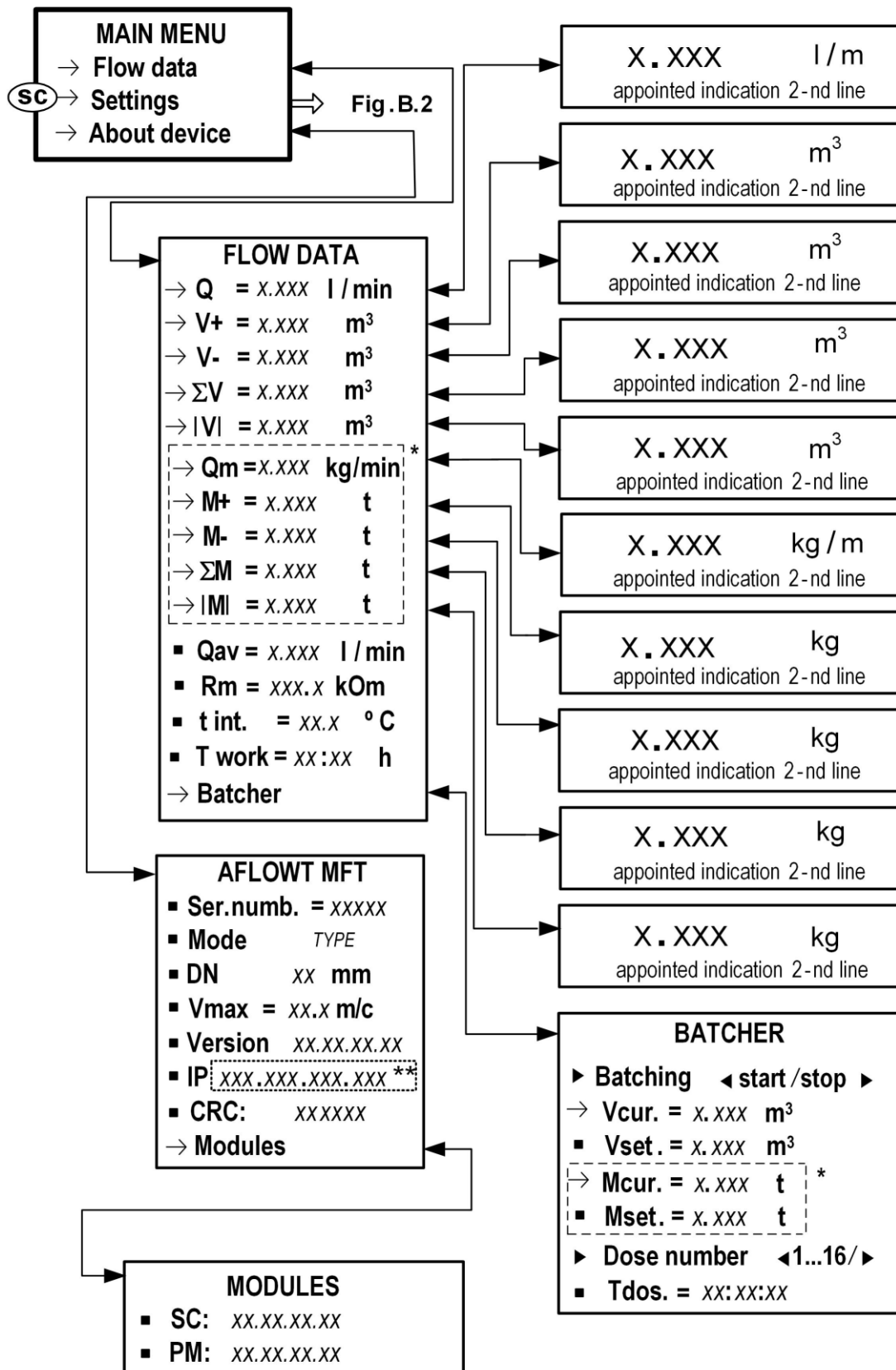
## APPENDIX B. Display system

1. Menu and window system and relationships between them are shown in Figs.B.1-B.7. Notation used in these figures is shown in Table B.1.

**Table B.1**

Element type	Application
<b>FLOW DATA</b>	Menu/ window name
<b>Reference</b>	Name of menu item, command or setting.
<b>x,xxxx</b>	Uneditable value, or editing is accessible in the other window.
	Numeric value editable digit-by-digit.
	Menu line or parameter value, indicated upon certain conditions.
<i>message</i>	Value defined by the flowmeter. Displayed words represent the setting essence meaning.
◀ <i>frequency</i> ▶	User-defined value selected from the list. Words within angle brackets represent the essence meaning or possible values of a setting.
◀ <i>start / stop</i> ▶	User-defined value selected it from the list. Words within angle brackets represent possible values.
	Window or menu (submenu) option is only displayed in the <b>SERVICE</b> mode.
	Window or menu (submenu) option is only displayed in the <b>CALIBR</b> mode.
	Window or menu (submenu) option is only displayed in the <b>SERVICE</b> and <b>CALIBR</b> modes.
Symbol  containing mode representation is missing	Window or menu (submenu) option is displayed in all modes: <b>WORK, SERVICE, CALIBR.</b>
	Modification is possible only in the <b>SERVICE</b> mode.
	Modification is possible only in the <b>CALIBR</b> mode.
	Modification is possible only in <b>SERVICE</b> and <b>CALIBR</b> modes.
Symbol  containing mode representation is missing	Modification is possible in all modes: <b>WORK, SERVICE, CALIBR.</b>
	Transition between windows.
	Condition of the transition between windows.
 <b>Fig.B.2</b>	Indicator of the transition to another figure.

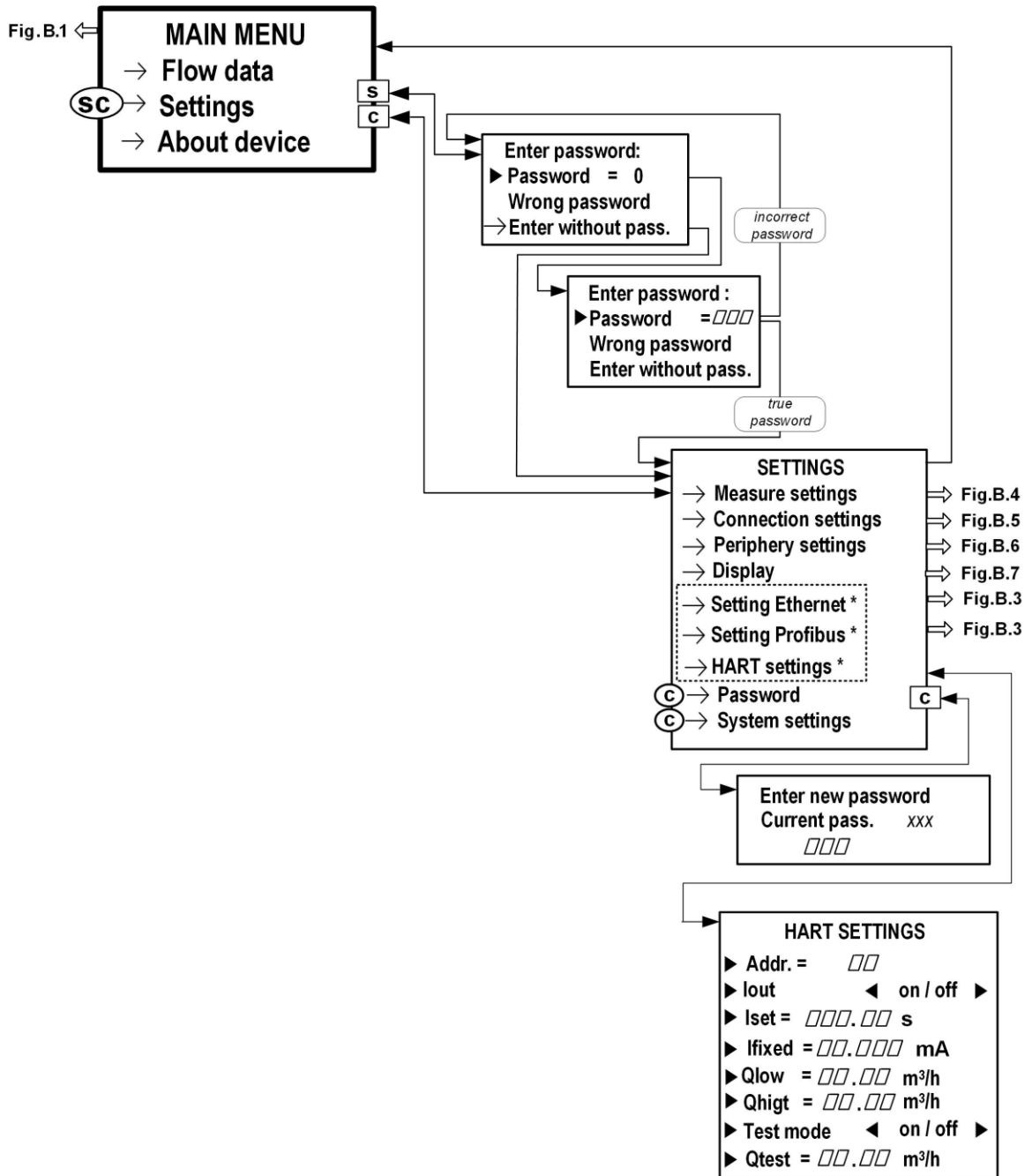




\* - displayed when set the **Calculation of the mass** – on

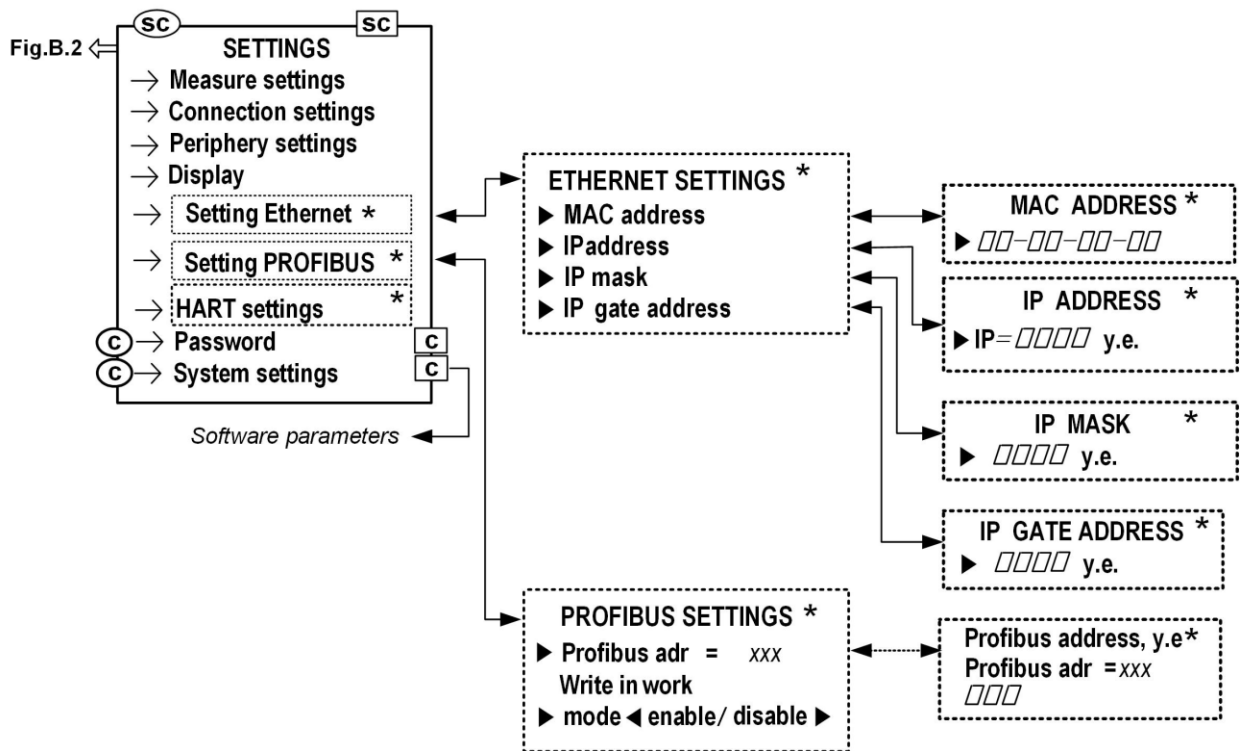
\*\* - displayed if the Ethernet module is installed

**Fig.B.1. MAIN MENU, “Flow data”, “Batcher” and “About device” menus**



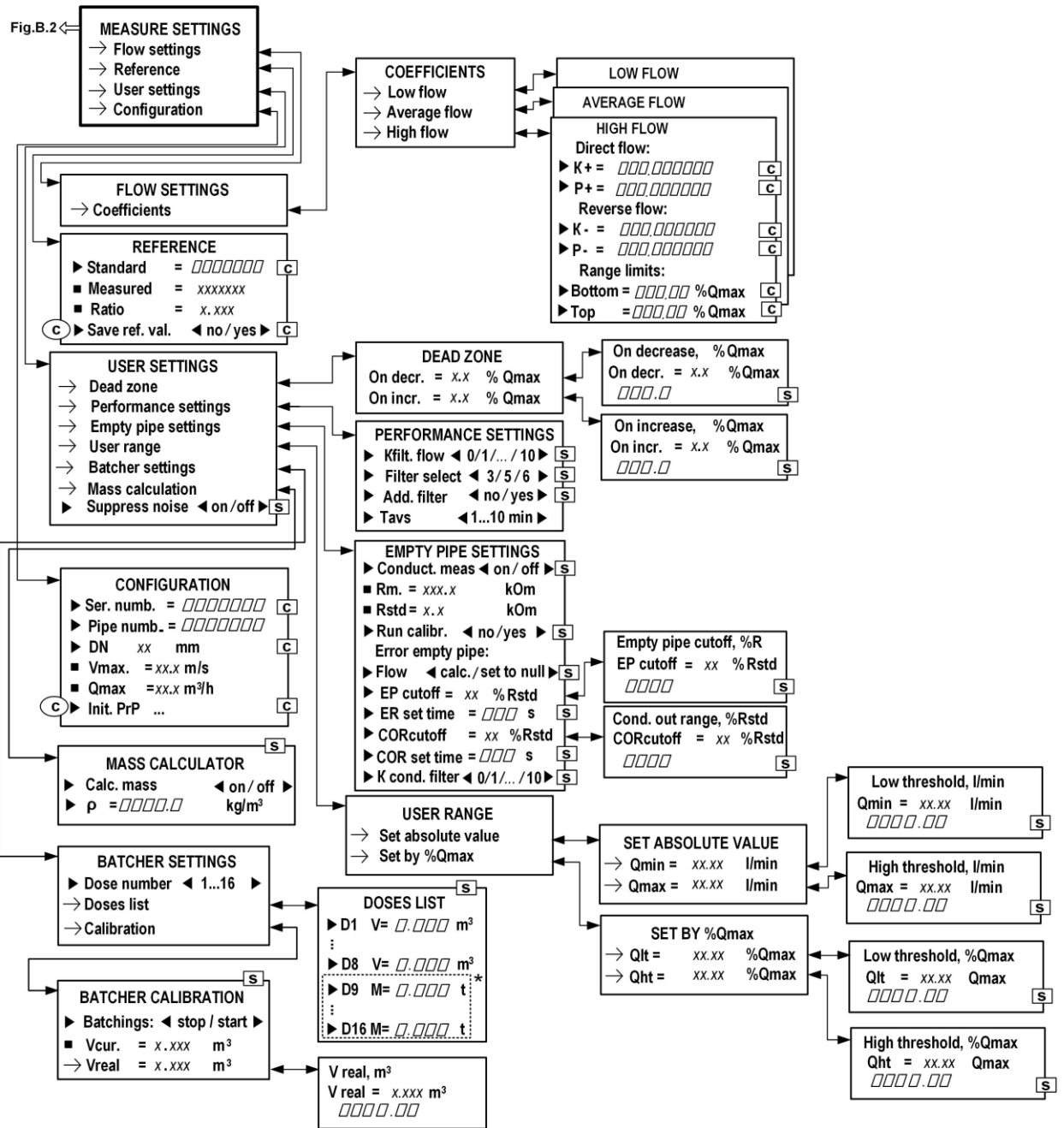
\* - displayed if an appropriate module is installed

Fig.B.2. MAIN MENU, “HART settings” and “Enter password” menu



\* - displayed if an appropriate module is installed

Fig.B.3. "ETHERNET SETTINGS", "PROFIBUS SETTINGS" menus and lower level menus (windows)



\* - displayed when set the **Calculation of the mass** – on

Fig.B.4. MEASURE SETTINGS menu and lower level menus (windows)

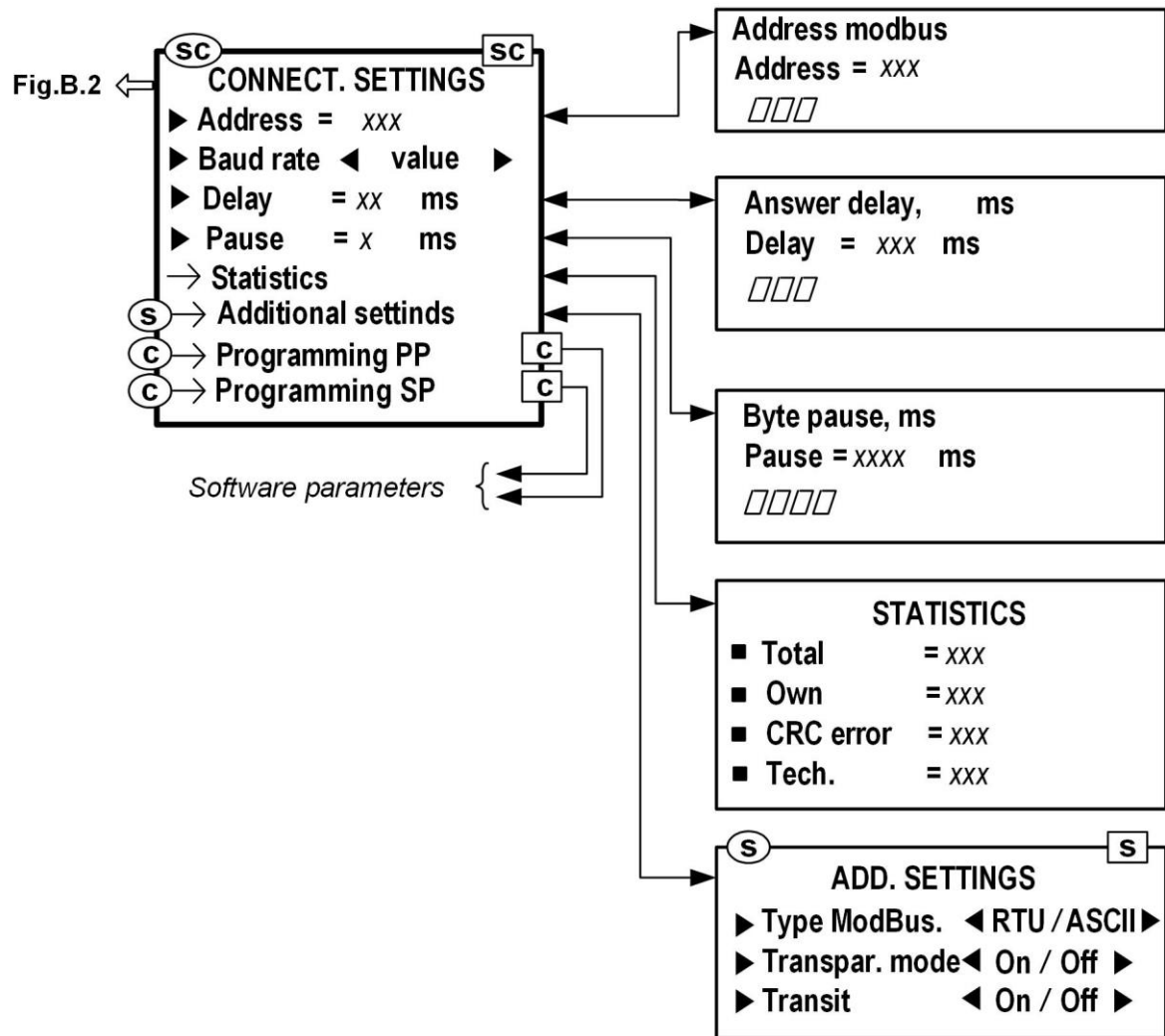
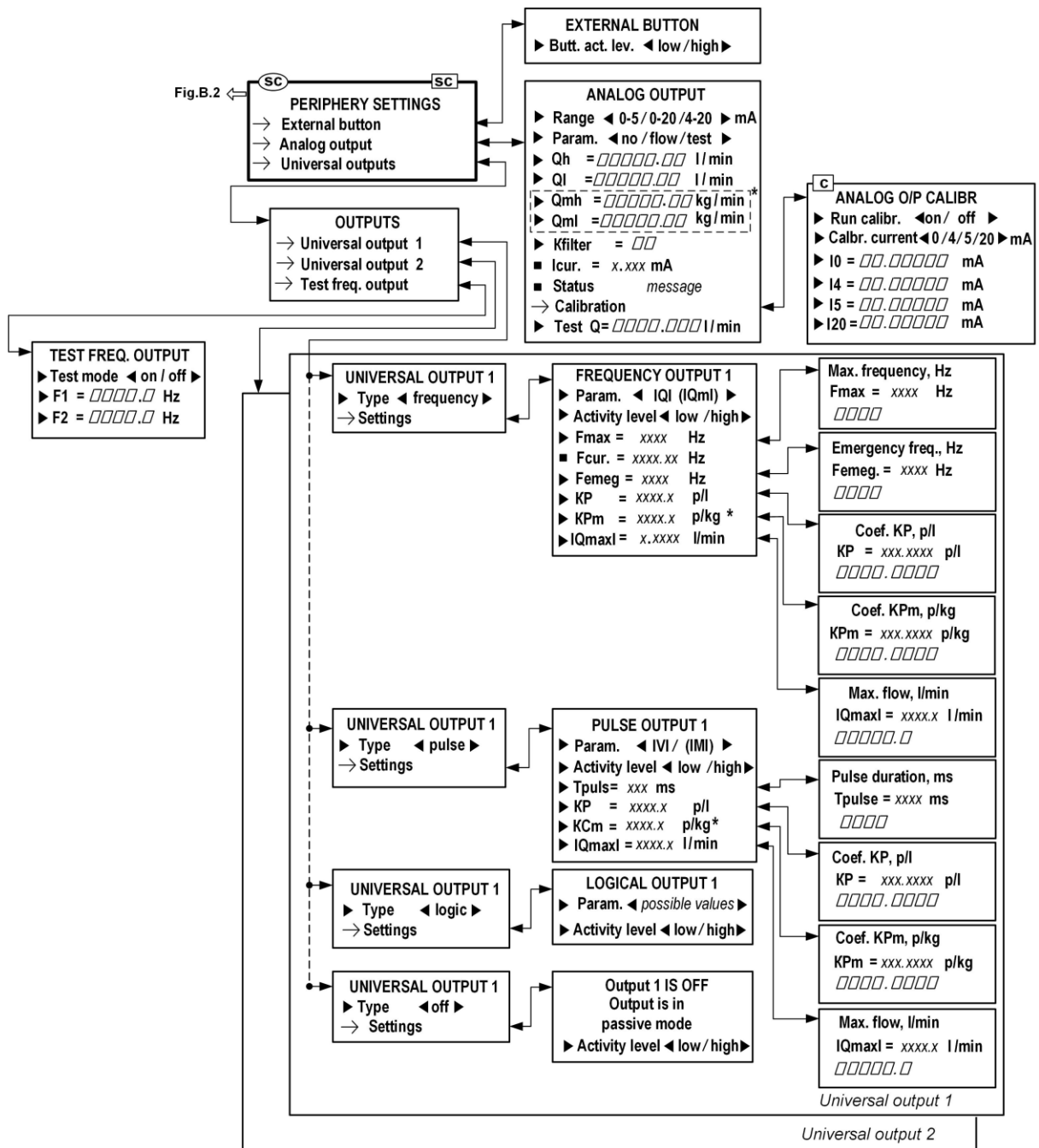
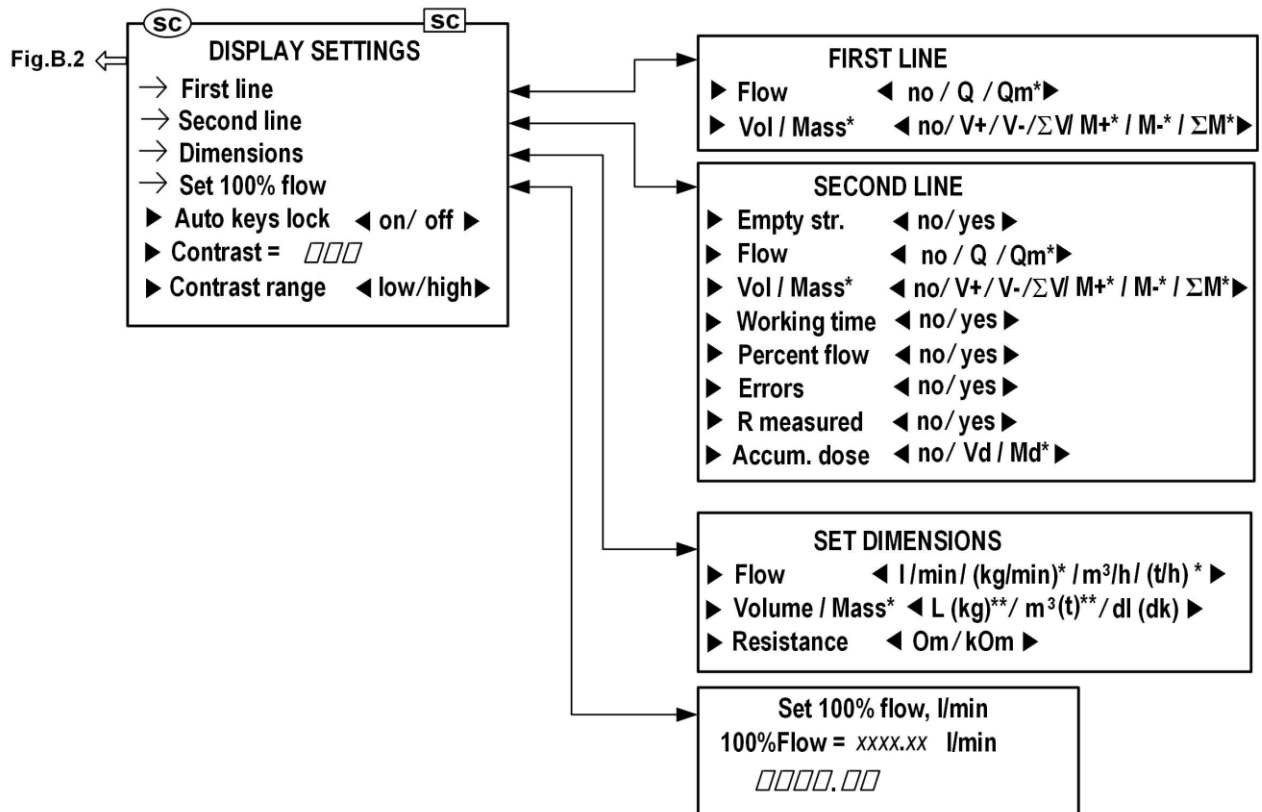


Fig.B.5. "CONNECT. SETTINGS" menu and lower level menus (windows)



\* - displayed when set the **Calculation of the mass** – on

**Fig.B.6. "PERIPHERY SETTINGS" menu and lower level menus (windows)**



\* - possible appointment when set the **Calculation of the mass – on**  
 \*\* - displayed when set the **Calculation of the mass – on**

Fig.B.7. "DISPLAY SETTINGS" menu and lower level menus (windows)