

AFLOWT



ULTRASONIC LEVEL GAUGE
AFLOWT LV

VERSION
LV-2xx

**OPERATION MANUAL
PART II**



9001:2008

Saint-Petersburg, Russia

TABLE OF CONTENTS

	Page
INTRODUCTION	3
1. CONTROLLING LEVEL GAUGE	4
1.1. Controlling indication.....	4
1.2. Entering Commands and configuration settings	6
2. PREPARING FOR OPERATION.....	8
2.1. Date and Time Correction	8
2.2. Setting Transition to "Daylight Saving" / "Standard" Time Mode.....	8
2.3. Setting KC factor	8
2.4. Entering Volume/Level characteristic of a tank	9
3. OPERATION	10
3.1. Displaying measured parameters	10
3.2. Viewing data logs and status logs.....	10
4. TROUBLESHOOTING	12
APPENDIX A. Functions and Identification of Keyboard Keys (Buttons)	14
APPENDIX B. Display System.....	15
APPENDIX C. Displayed Parameters	23
APPENDIX E. Status Words and Troubleshooting	31

This manual covers ultrasonic level gauges "AFLOWT LV" of LV-2xx models and contains information about their operation and design.

Due to continuous improvements of the level gauges its' actual characteristics may differ from data specified in this manual. However, this will not affect the metrological characteristics and functionality.

LIST OF ABBREVIATIONS

AS	- Acoustic system
BMD	- Digital Measuring Block;
DS	- Universal output
ER	- Error
FA	- Failure
KC	- Scale factor
Param.ut	- Upper threshold of an output parameter
Param.lt	- Lower threshold of an output parameter
RTD	- Resistance temperature detector (temperature sensor)
USS	- Ultrasonic signal.

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

1. CONTROLLING LEVEL GAUGE

In all modes, the level gauge can be controlled from BMD keyboard or PC via serial interfaces RS-232, RS-485, or Ethernet.

To control the level gauge via BMD keyboard you can use the hierarchical menu system (see Appendix B), comprising the Main menu, submenus and windows containing lists of commands and options.

1.1. Controlling indication

1.1.1. The contents and structure of the main menu (Fig.1) is constant. Number and contents of submenus and windows as well as settings available for modification depend on the Level gauge's operating mode.

1.1.2. Keyboard of BMD has eighteen buttons, functionality and description of which are given in Appendix C.

The keyboard lets you do the following:

- Navigate through the hierarchical system of menu items and windows
- Quickly control indication on the display
- Input configuration data
- View status logs and data logs.

1.1.3. The display shows the menu (window) name which is fixed in the first row of the LCD indicator, and menu items (options) which can move up or down (see Fig.1).

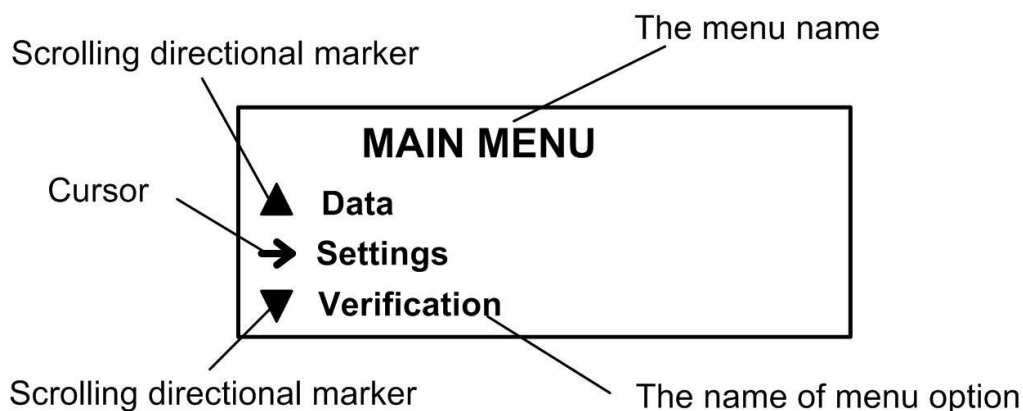






Fig. 1. Main menu


1.1.4. Cursor is used to indicate a selected menu item, option, digit of a number or a substring being edited. Cursor appearance and position depend on user's possibility to modify data indicated in the current row. Your options:




- ➔ - to navigate to a submenu (window)
- ▶ - to modify a setting or command (state) shown in this row
- - it is impossible to modify a setting (for some settings, there is a possibility to zoom indication in)
- - to modify a digit underlined by the blinking cursor
- ◀ ▶ - to modify the value inside angled brackets.


- 1.1.5. Number of rows (menu items, list options) indicated on the display cannot exceed 3 at a time. Scroll direction indicators may therefore be shown at the beginning of the first and the last rows of menu items (or options). These indicators are triangles (see Fig.1) with vertexes showing the directions where the cursor can navigate through rows (menu items, and settings).



Buttons ,  are used to scroll the list up or down to select a menu item (setting).

When you press the button  for the first time the cursor moves one row up and stops between the scrolling directional markers. Further pressings of  button will initiate scrolling. Menu items (settings) are moved upwards, while the cursor and scrolling directional markers are fixed on the screen. When the last menu item (setting) is reached, the cursor moves to the last row and stops in the place of the lower scroll marker.




The procedure of scrolling in the opposite direction (with button ) is similar.

- 1.1.6. If you need to go to a submenu (subordinate window) or activate a menu item (setting), set the required menu item (setting) and cursor  () in the same line and press button .

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

To leave the item without saving changes, you need to press button , while pressing button  will save a new value in the memory.

- 1.1.7. Several menus (windows) which have similar contents but different ownership can be subsequently displayed in one menu (window). Menu (window) ownership is indicated by the sequential number of output, number of a record in the menu (window) name line in the special-purpose log or by specifying the log record logging range.

Symbol  positioned to the left of menu (window) name and sequential number indicates the possibility to scroll through option-related menus (windows). To go to the menu (window) of another type use buttons , .

- 1.1.8. Registered signals that fall inside the preset measurement range can be displayed in graphical form. Signals are displayed in **Signal view** window (**Settings** / **Object settings**) according to the time of registration (see Fig.2).

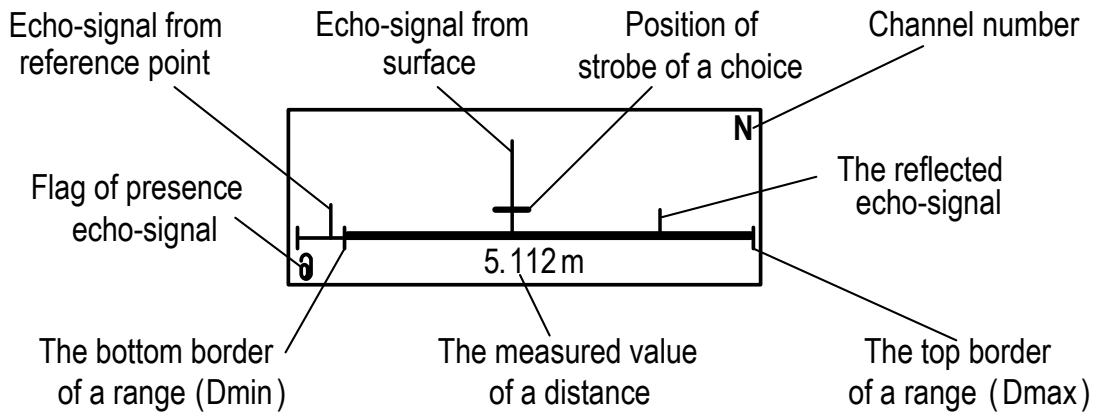









Fig. 2. Signal view window.









Window **Signal view** allows you to select the wanted signal manually. When you press button  in the **Signal view** window the selection marker (strobe of a choice) starts blinking and you can move it using buttons , . While in the moving mode, the selection marker (strobe of a choice) is positioned at the desired signal. After pressing button , the tracing mode is activated, and marker stops blinking.





1.1.9. You may choose the font of greater size to display settings and measurable values. The window with zoomed indication opens after selecting the name of a parameter and pressing button .



1.2. Entering Commands and configuration settings

1.2.1. To modify the value of a setting or a command, you need to open the appropriate menu (window), match the required line of the list with the cursor that looks like  and press button . You can set a new value either digit by digit (numeric value) or by selecting it from a list.





1.2.2. Setting a numeric value digit by digit.







To change a numeric value digit by digit, press button , after which cursor  will transform to a blinking cursor  positioned under the first digit of a numeric value, or digit by digit setting window will open with a similar blinking cursor  under the first digit of a number. To modify an existing value, you need either to enter a new setting value using buttons  ...  or to change a number digit by digit using buttons , .

If button  () is pressed once, the digit marked by cursor will be increased (decreased) by one. To move the cursor to another digit, you need to press buttons , .

Press button  to enter the setting value, and to cancel entering (to return to a previous value) press button .









1.2.3. Entering a setting value, a command or an identifier by selecting from a list.

If the value of setting (command, identifier) is selected from a list, press button , then, the cursor  will transform into triangle brackets   enclosing the value (command, identifier) which now can be modified.

Buttons ,  or ,  allows you to navigate through values. By pressing button  you enter the assigned numeric setting value while pressing button  you cancel entering the value (return back to previous value).

2. PREPARING FOR OPERATION

2.1. Date and Time Correction

To adjust date and time, select and activate **Settings / System settings / TIME SETTINGS / Date (Time)**, then using buttons ,  set the cursor **-** to **day, month, year (hours, minutes, seconds)** positions sequentially. Buttons ... or ,  allows you to modify a selected value in each position. Press button  to enter a setting value, and to cancel entering (to return to previous value) press button .

2.2. Setting Transition to "Daylight Saving" / "Standard" Time Mode

- 2.2.1. The level gauge is capable of setting the device clock to "Daylight Saving" / "Standard" time automatically. The user can:
- Set the device clock transition mode
 - Turn off the device clock transition functionality.

Two device clock transition modes are provided: standard and user-defined.

In standard mode, the transition to "daylight saving" time takes place at 2:00:00 a.m. of the last Sunday of March the clock being put one hour forward, and to "standard" time at 3:00:00 a.m. of the last Sunday of October the clock being put one hour back. In user-defined mode, the user can set the transition time. In case the transition functionality is turned off the device clock keep time countdown according to "standard" time only.

- 2.2.2. To set the transition mode, you need to activate option **Settings / System settings / TIME SETTINGS / Time mode change / Mode** and select one of the following: **standard** or **user-defined**.



In the Standard mode, you may see the date and time of automatic transitions to "daylight saving" and "standard" time in **Daylight saving time** and **Standard time** windows, respectively.

In the User-defined mode, you can set time of transition to "daylight saving" and "winter" time in **Daylight saving time** и **Standard time** windows, respectively, following instructions in p.1.2.2.

If **Mode** setting is set to **no change** then **Daylight saving time** and **Standard time** menu items become unavailable.

2.3. Setting KC factor

- 2.3.1. To calculate **KC** factor enter menu **Settings / Periphery setting / UNIVERS. OUTPUT X / Setup / FREQUENCY OUTPUT X /**

KC factor is calculated on the base of **Param.ut**, **Param.lt**, and **Fmax** values that are entered from the same menu according to the instructions given in section 1.2. After that, using buttons ,  set **KC**

calcul. menu item against cursor ► and press button ◀. On pressing button ◀, ellipsis at the end of “**KC calcul.**” string becomes enclosed in triangular brackets.

To start the calculation procedure, you need to press ▲ button and then, after dots within the triangle brackets are substituted with the ◀ **start** word – ▲ button. Then, **start** message is substituted with dots once again, and the calculated **KC** value is displayed in the upper line.

The calculated **KC** value can be modified only in downward direction. The value is set according to the instructions given in section 1.2.

2.4. Entering Volume/Level characteristic of a tank

Volume/Level characteristic is the dependence of volume on the liquid level for a certain tank. It is entered into the device by points. Values of level and corresponding volume are specified for each point. Total amount of points cannot exceed 32. Volume/Level characteristic values shall be entered one after another in the ascending order. The first point shall correspond to the zero level.






To enter volume\level characteristic, open menu **Settings / Object settings / OBJ. SETTINGS chan. X / HV-function**. Then enter sequentially: values of liquid level **H** and volume **V** for each point. Use buttons ◀, ▶ to move between points. Parameter values are set and entered as described in section 1.2.

3. OPERATION

3.1. Displaying measured parameters

The user can operate the level gauge from keyboard and display, or from a PC via RS-232 / RS-485 or Ethernet interfaces.

3.1.1. After powering on the level gauge, the BMD display shows the device-related information. **MAIN MENU** is displayed on completing self test procedure.

3.1.2. To display measured values, open menu **DATA channel X**. Use buttons ,  to select the required channel number, buttons ,  are used to select the required parameter. To switch to zoomed indication of a parameter, put the cursor against the parameter name and press button .





The set of displayed parameters being measured is determined by the number of channels and by the measurement mode specified in the window **Settings / Configuration / CONFIG. chan. X / Calc. mode**. User can modify the set of displayed parameters being measured for each channel using window **Settings / Configuration / CONFIG. chan. X / Indication settings / INDICATION chan. X** and by setting **yes** or **no** value in the corresponding line.

3.1.3. Besides the setting name, channel number, measurement units and the parameter value, zoomed indication window contains the sign-position code of the current channel status word. The full channel status word (see Appendix E, table E.1) is displayed in window **Status logs / Current status / CURR. STAT. chan. X**.

To define the type of alarm situation which arose in the given measurement channel and is displayed as the "x" sign in the measured parameter zoomed indication window, you need to open window **Status logs / Current status / CURR. STAT. chan. X / ER** of the corresponding channel. Besides the ER type name, this window shows the ER start time and duration.

3.1.4. After putting into operation the level gauge works in the automatic mode.

3.2. Viewing data logs and status logs


3.2.1. To view log records select the log type **Data logs / View data logs / Channel 1 (2) / Hourly log (Daily log, Interval log)**. Then select the required log range using buttons ,  and view logged values pressing buttons , .

Inside logs, the last row of the window contains option **Record search**. After activating this option, you move to the window **LOG RECORD SEARCH** and the cursor is set in the line displaying the log range.

To find a record activate the line and enter the required log range. If the entered range is present in the log you can move to this (or the

nearest) range by pressing button . If it is not present the last row will display words **No search conducted**.

3.2.2. To view records in status logs select the status logs type **Error logs (Failure log, Mode log, User log)**. The procedure to view status logs records is the same as for records in data logs.

The last records line in each status logs contains words **Curr. record**. Activate this line, enter the required record number and press button  to navigate to this record quickly. If the record with this number does not exist, the display will show the last record.

4. TROUBLESHOOTING

4.1. The level gauge functionality is characterized to the fullest extent by values of setting parameters and displaying of measured values.

Besides this you can (if necessary) control signal levels on control outputs using an oscilloscope.

4.2. The level gauge has the automatic monitoring functionality which displays device's status words that register emergency situations, failures and faults.

Current device state is displayed as status words in windows

Status logs / Current status / CURR. STAT. chan. 1 (2):

- **ER** – measuring channel alarm situations (ER) status word
- **DS** – universal and analog outputs status word
- **FL** – failures status word.

Also, the ER status word is displayed in windows with zoomed indication containing current values of measured parameters.

Status word is displayed as a sign-position code – a combination of characters " - " и " × ". Character " - " indicates “no-event” situation, while character " × " shows that the event has occurred.

Status word contents, possible causes of some faults and ER, and troubleshooting methods are described in Appendix D.

To define the type of an ER displayed in the windows with zoomed indication, open window **Status logs / Current status / CURR. STAT. chan. 1 (2) / ER**. Besides the ER type name, this window shows the ER start time and duration.

4.3. An ER is an event characterized by mismatch of measured values and level gauge metrological characteristics, or by impossibility of measurements due to violation of measurement conditions. An ER is registered when its duration is equal to or exceeds 1 second.

The BMD processes ER as follows: when the ER occurrence condition is met character " × " shows in the certain place of the status word, and upon completion the ER start time, end time and duration are recorded to the status log ER. In addition to ER, power interruptions are also recorded to the status log.

Depending on an ER type BMD may respond by stopping USS velocity adjustment, stopping level measurements and dead time accumulation. Dead time value starts recording when level measurement is stopped.

4.4. When an acoustic system (AS) has a reference reflector and the signal from the latter disappears the ER **no ref.** is recorded to the status word for the measuring channel, speed adjustment stops while level measurement continues using the latest USS speed value.

When an AS is equipped with RTD (resistance temperature detector) and the latter faults, ER **no temp.** is recorded to the status word for the measuring channel, speed adjustment stops while level measurement continues using the latest USS velocity value.

On termination of an ER situation, **no ref.** and **no temp.** are resolved, and velocity adjustment is resumed. Events related to the termination of velocity adjustment are recorded to the status log.

- 4.5. When USS disappears the ER **no signal** is recorded to the status word for the measurement channel, zero level value is displayed and the dead time counter starts. USS failure is recorded to the ER status log, and the dead time value is increased by the USS failure duration value.

When special test signal from the piezoelectric converter disappears, ER situations **no trans.** and **no signal** are registered sequentially in the status word for the measuring channel. Piezoelectric converter failure is recorded to the ER status log.

- 4.6. When measured distance value exceeds base value the ER **Level err.** is registered in the status word and zero level value is displayed. Distance measurement continues, and the event **Level err.** is recorded to the ER status log.

If measured parameter goes beyond the range borders defined when setting the frequency output then the corresponding error (see Table E.1). Measurements still continue.

- 4.7. In case of failure or an ER first of all check the following:

Level gauge and secondary power source input voltage is present and conforms to the specifications;










- Power circuits are reliably connected
- Liquid is present in the tank
- The USS channel has no foreign objects.

If all the requirements listed above are met contact the service centre (regional dealer) or manufacturer for the information on the device's operability.

- 4.8. "AFLOWT LV" Level gauge should be repaired by authorized dealers or by the manufacturer.

APPENDIX A. Functions and Identification of Keyboard Keys (Buttons)

Table A.1.












Identification	Function
	<ol style="list-style-type: none"> 1. When selecting menu item, parameter, log record, value from the list – scrolling up the list. 2. When setting a numeric value – incrementing digit value by one.
	<ol style="list-style-type: none"> 1. When selecting menu item, parameter, log record, value from the list – scrolling down the list. 2. When setting a numeric value – decrementing digit value by one.
	<ol style="list-style-type: none"> 1. When setting numeric values digit-by-digit – moving the cursor along the digit positions in the left direction. 2. When viewing log records – decrementing number of a record. 3. When searching similar menus (windows) – transition to the menu (window) with less sequential number or to the previous log interval. 4. When selecting menu item, parameter, log record, value from the list – scrolling up the list.
	<ol style="list-style-type: none"> 1. When setting numeric values digit-by-digit – moving the cursor along the digit positions in the right direction. 2. When viewing log records – incrementing the number of a record. 3. When searching similar menus (windows) – transition to the menu (window) with greater sequential number or to the next log range. 4. When selecting menu item, parameter, log record, value from the list – scrolling down the list.
	<ol style="list-style-type: none"> 1. Transition to the selected menu (window) of lower level. 2. Activation of a menu item (parameter): allowing access to changing a parameter (setting) value, command or to execution of an action. 3. Executing an operation, entering set parameter value, command.
	<ol style="list-style-type: none"> 1. Exit to the menu (window) of higher level. 2. Exiting active state: forbidding access to changing a parameter (setting) value, command or to execution of an action. 3. Cancelling an operation, entering modified parameter value, command; going to the menu (window) of higher level.
	<ol style="list-style-type: none"> 1. Entering a numeric value of a configuration parameter.
	<ol style="list-style-type: none"> 1. Moving the cursor to the fractional part of a number.
	<ol style="list-style-type: none"> 1. Negative sign of parameter value.

APPENDIX B. Display System

Menu and window system and relationships between them are shown in Figs. B1-B7. Notation used in these figures is shown in table B1.

List of settings, number of displayed digits and possible values of displayed parameters can be found in Appendix C.

Table B.1.

View of an element	Function
SETTINGS	Menu name
Mean level	Menu item, command or setting (parameter) name.
X. XXX	Numeric value of a setting cannot be edited, or editing is performed in another window.
	Numeric parameter value editable digit-by-digit.
name	Value is set by the device. Displayed words represent the essence of a setting.
<command>	The value of a setting is use-specified by selecting it from the list. Words within angle brackets represent the essence meaning or possible values of a setting.
	Window or menu item (setting) is displayed only in the SETUP mode.
	Window or menu item (setting) is displayed in modes SERVICE and SETUP.
Icon  representing the mode is missing	Window or menu item (setting) is displayed in all modes: OPERATION, SERVICE, SETUP
	Setting (settings) modification or transition to the lower level window is possible only in THE SETUP mode.
	Setting (settings) modification or transition to the lower level window is possible only in SERVICE and SETUP modes.
Icon  representing the mode is missing	Setting (settings) modification is possible in all modes: OPERATION, SERVICE, SETUP
	Zoomed indication and entering parameter value window.
	Zoomed indication window.
	Transition between windows.
 Fig. B. 1.	Symbol indicating transition to another figure.

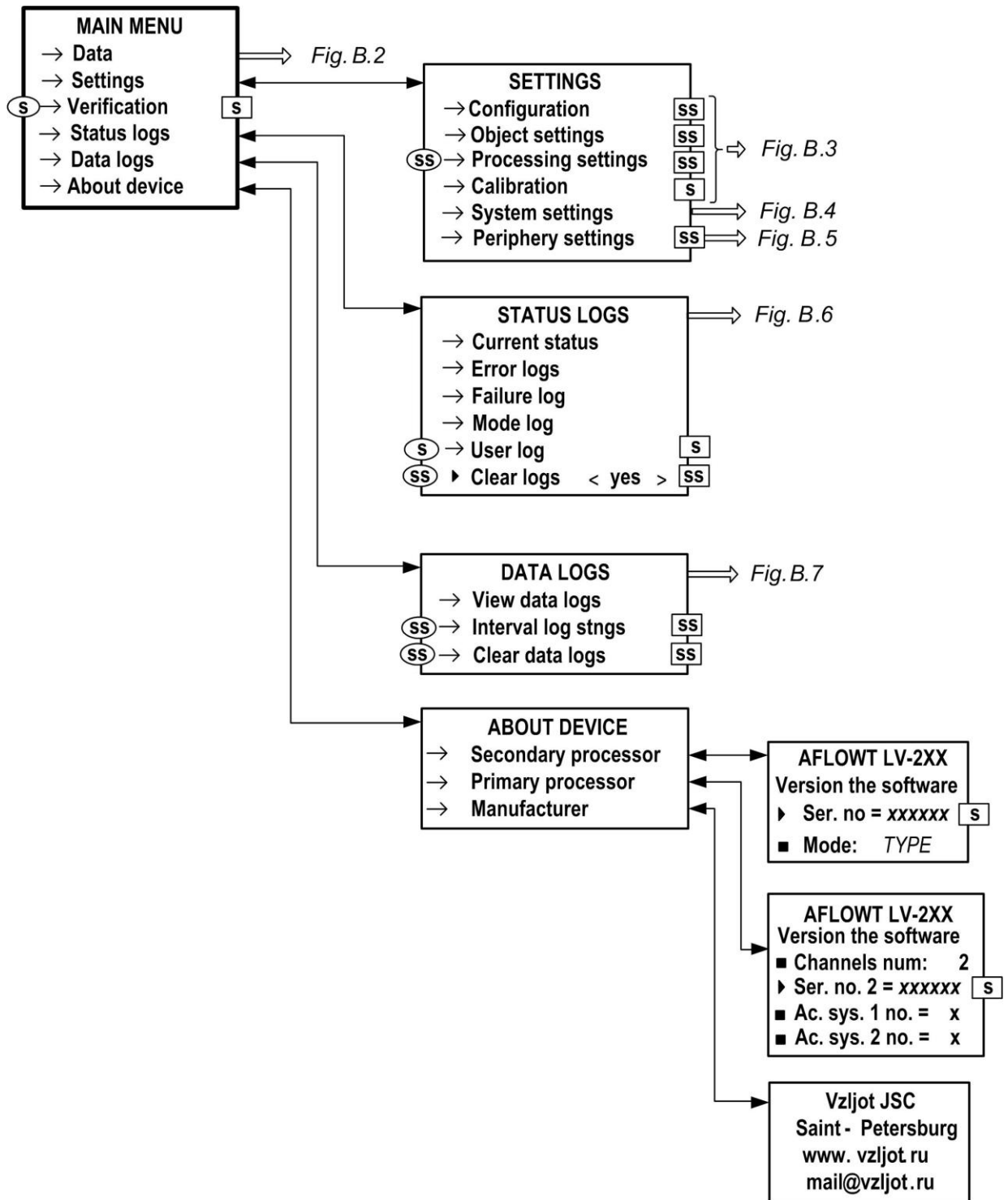
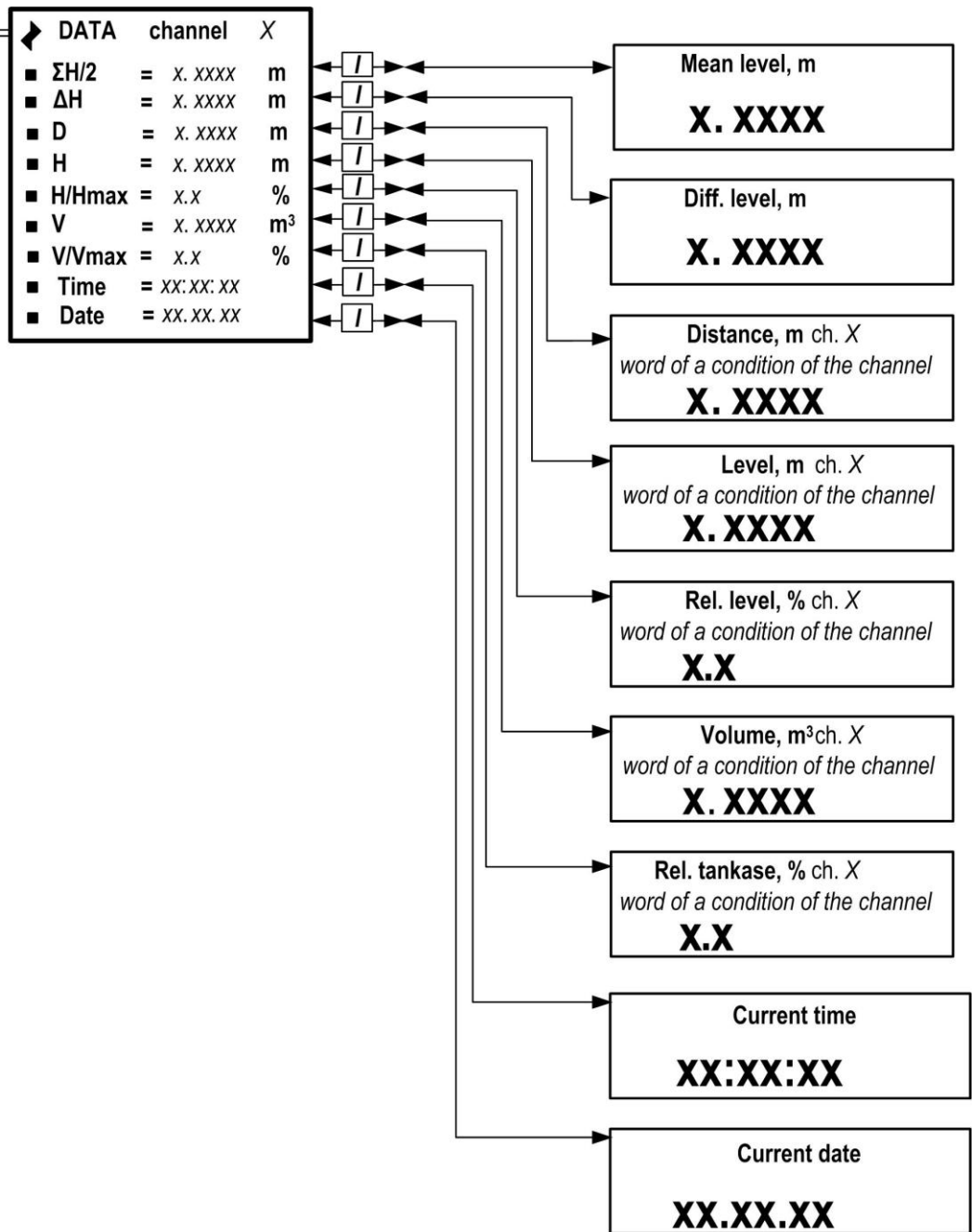


Fig. B.1. MAIN MENU

Fig. B.1 ←



* - set of displayed parameters depends on the operation mode set in menu **CONFIG. chan. X** and configuration of menu settings indication in menu **INDICATION chan. X** (see table C.2).

Fig. B.2. Menu DATA

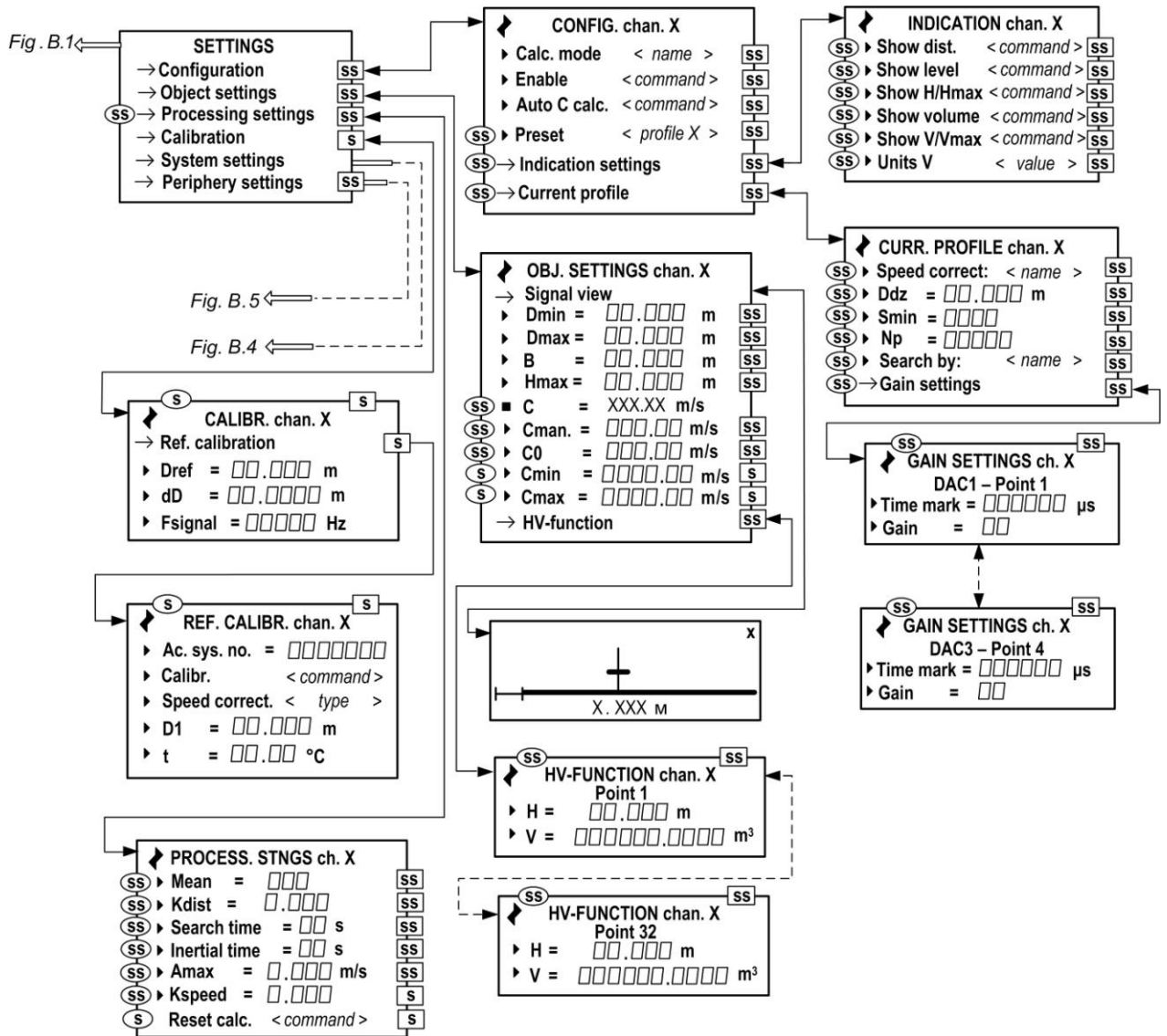
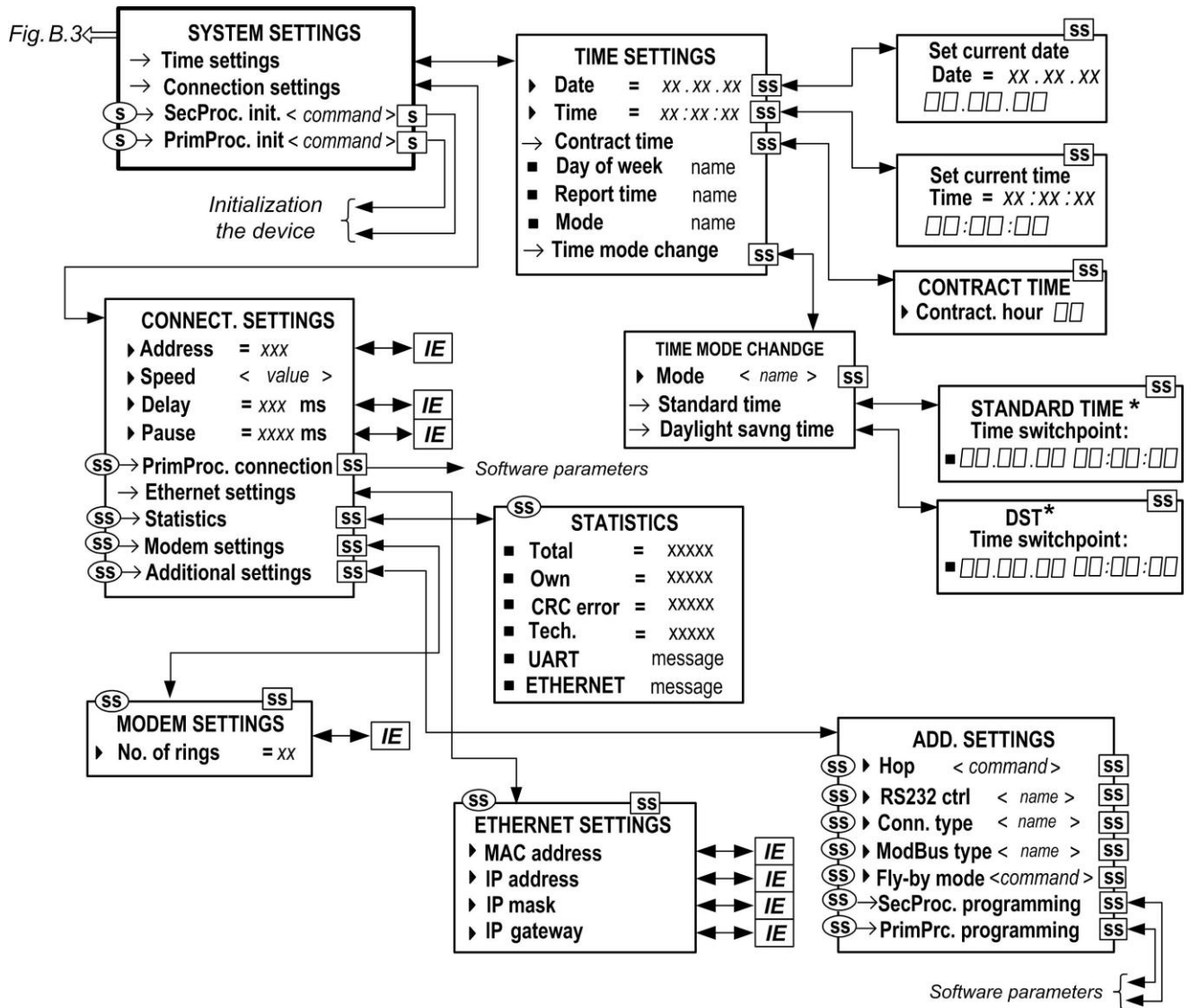


Fig. B.3. Menu **SETTINGS** and Windows Configuration, Object settings, Processing settings and Calibration



* - not displayed in case **Mode** setting is assigned **no change** value.

Fig. B.4. Menu **SYSTEM SETTINGS**

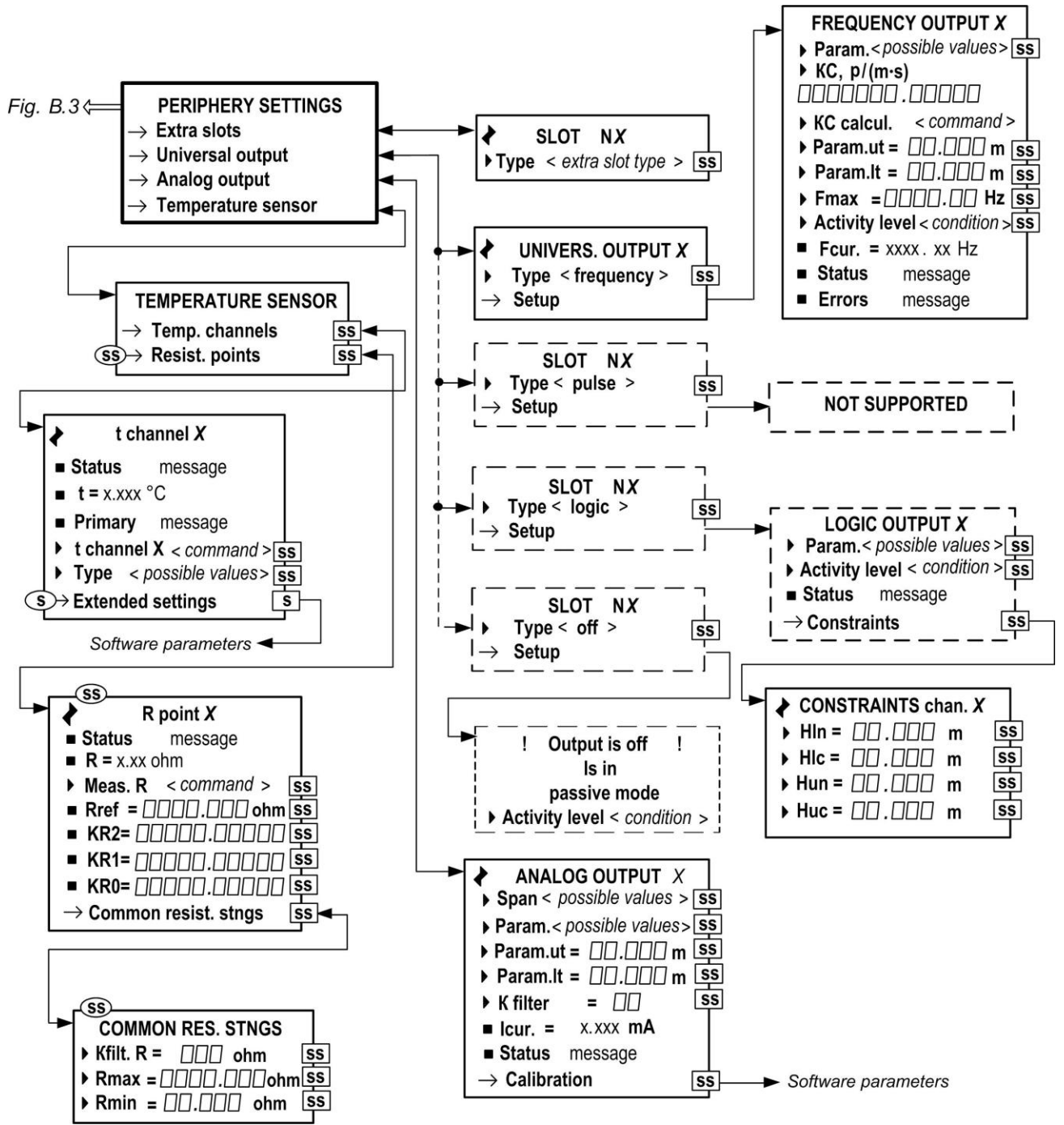


Fig. B.5. Menu PERIPHERY SETTING

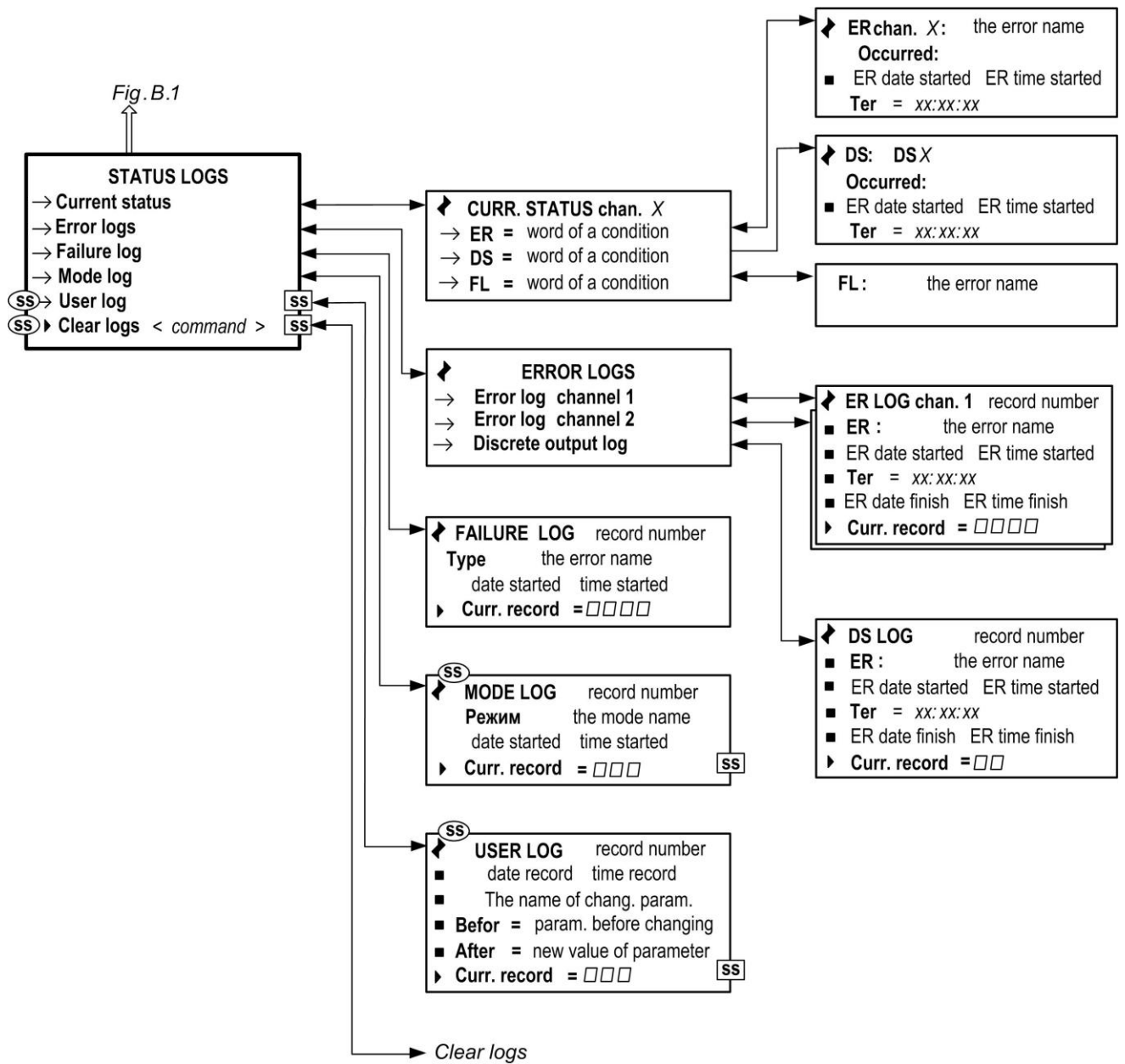


Fig. B.6. Menu STATUS LOGS

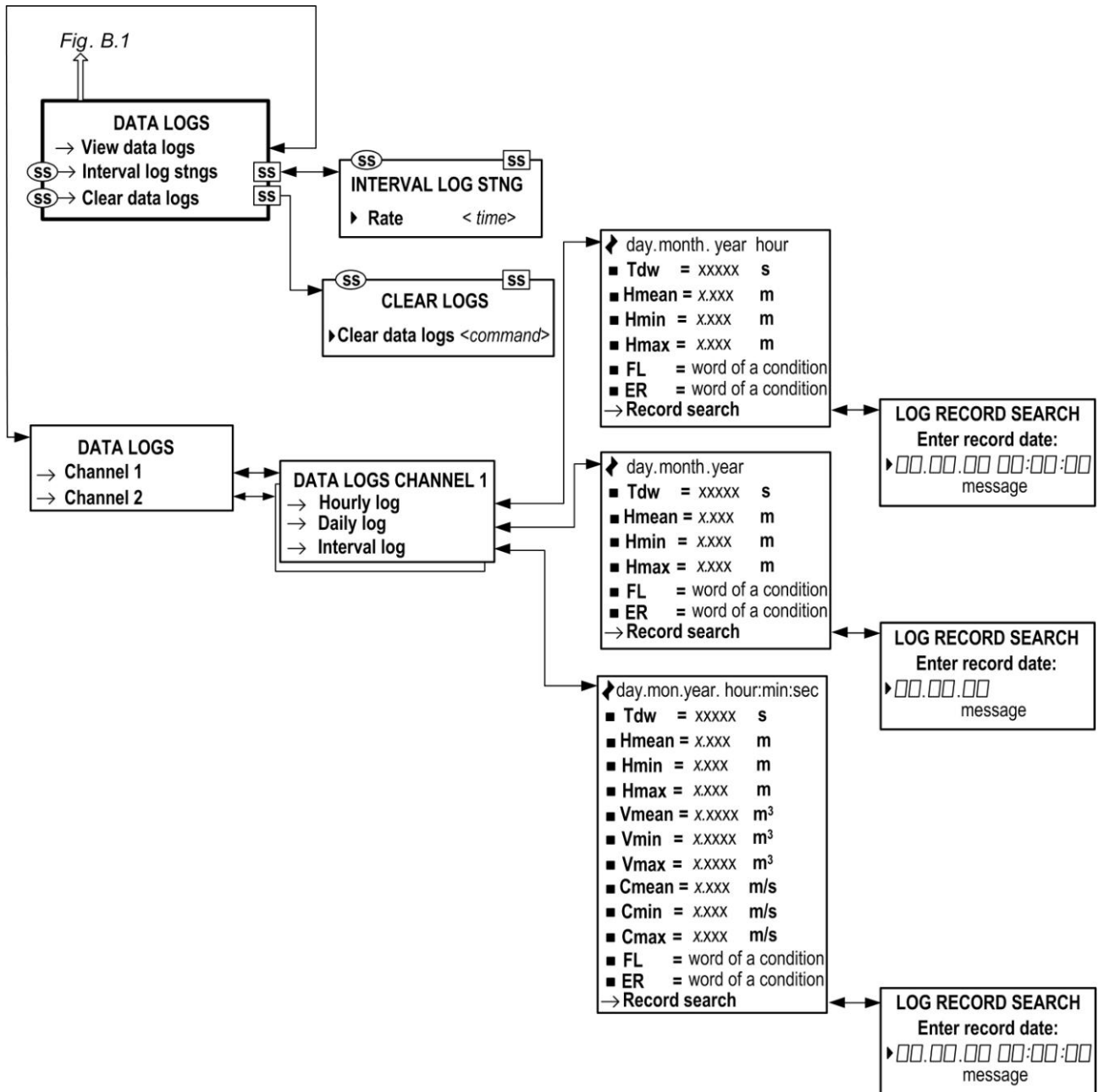


Fig. B.7. Menu DATA LOGS

APPENDIX C. Displayed Parameters

Table C.1. Menu DATA (Fig.B.2)

Representation of the parameter being displayed	Parameter Name, measurement units	Number of displayed digits, representation form		Notes
		integer part	fractional part	
DATA				
$\Sigma H/2$	Average current level value averaged over two channels, m	2	3	Note 1
ΔH	Current difference of level between two measuring channels (considering the sign), m	2	3	Note 2
D	Current distance to media interface, m	2	3	
H	Current value of liquid level, m	2	3	
H/Hmax	Current value of filled level, %	3	1	
V	Current value of liquid volume in a tank, m ³ (l)	6	4	
V/Vmax	Current value of filled volume, %	3	1	
Time	Current time (level gauge time)	XX:XX:XX		
Date	Current date (level gauge date)	XX.XX.XX		

NOTES:

1. Displayed if specified in menu **SETTINGS / CONFIG. chan X / Calc. mode**, value < **mean** >.
2. Displayed if specified, in menu **SETTINGS / CONFIG. chan X / Calc. mode**, value < **diff.**>.

Table B.2. Menu Configuration, Object settings, Processing settings and Calibration (Fig.B.3)

Representation of the parameter being displayed	Parameter Name, units of measurement	Allowed values	Notes
1	2	3	4
Configuration / CONFIG. chan. X			
Calc. mode	Two-channel level gauge operation mode	diff.; mean 2-chan.	
Enable	Inclusion of measurements	yes; no	
Auto C calc.	Auto correction of ultrasound velocity	dis.; en.	
Preset	Preset of a profile of the channel	profile 1...8	
INDICATION chan. X			
Show dist.	Distance indication	yes; no	
Show level	Level indication	yes; no	
Show H/Hmax	Indication of the relation of current level to the maximum level	yes; no	
Show volume	Volume indication	yes; no	
Show V/Vmax	Indication of the relation of current volume to the maximum volume	yes; no	
Units V	Choice of a units of measure of volume	liter; m³	
CURR. PROFILE chan. X			
Speed correct	Ultrasound velocity value correction type	t °C; ref.	
Ddz	Minimal value of the distance being measured (dead zone), m	0-30	
Smin	Minimal Sensitivity	0-4095	
Np	Number of cycles in sounding pulse	1-36	
Search by:	Search criterion for efficient echo-signal	max(D*A); max(D); max(D); max(A)	
GAIN SETTING ch. X			
DAC1 (3) – Point 1(2,3,4)	Representation of adjustment profile point		
Time mark	Time of amplifying, μ s	0-200000	
Gain	Amplification parameter	0-255	
Object settings / OBJ. SETTINGS chan. X			
Signal view	Graphical representation of signals on the display		
Dmin	Minimal value of distance measuring range, m	0,2-30	
Dmax	Maximum value of distance measurement range, m	0,2-30	
B	Measurement base value, m	0,2-30	
Hmax	Maximum value of liquid level, m	0-30	
C	Measured ultrasound velocity, m/s		
Cman	Ultrasound velocity value entered during manual correction, m/s	100-1500	
C0	Speed of ultrasound at 0°C, m/s	100-1500	
Cmin	Minimal velocity of ultrasound in the gas medium of a tank, m/s	0-2000	
Cmax	Maximum ultrasound velocity in the gas medium of a tank, m/s	0-2000	

Cont. of Table C.2

1	2	3	4
HV-function chan. X (point 1...32)			
H	Level value in the point of volume-level tank characteristic, m	0-30	
V	Volume value in the point of volume-level characteristic of the tank, m ³ (l)	0-999999,875	
Processing settings / PROCESS. STNGS ch. X			
Mean	Time interval for averaging distance	1-128	
Kdist	Distance filter factor	0-0,999	
Search time	USS search time, s	1-60	
Inertial time	USS lag time, s	1-60	
Amax	Maximum speed of level change, m/s	0,005-5	
Kspeed	Factor for USS velocity filter	0-0,999	
Calibration / CALIBR. chan. X			
Dref	Distance to the reference reflector, m	0-15	Passport val.
dD	Zero offset, m	0-1	Passport val.
Fsignal	Signal operating frequency, Hz	20000-85000	
Ref. calibration / REF. CALIBR. chan. X			
Ac. sys. no.	AS Serial No	0-9999999	
Calibr.	Command for distance calibration	Stop; Start	
Speed correct.	Ultrasound velocity correction type	t °C; ref.	
D1	Calibration distance, m	0-15	
t	Temperature value for calibration by reference reflector, °C	0-99,99	

Table C.3. Menu SYSTEM SETTINGS (Fig.B.4)

Representation of the parameter being displayed	Parameter Name, measurement units	Allowed values, representation form	Notes
1	2	3	4
TIME SETTINGS			
Date	Current level gauge date	XX.XX.XX (dd.mm.yy)	
Time	Current level gauge time	XX:XX:XX (hh:mm:ss)	
Contract time	Time set by agreement, hours	0-23	
Day of week	Current level gauge week day	Su, Mo, Tu, We, Th, Fr, Sa	
Report time	Level gauge time type	std.; DST	
Mode	Mode of transition to "Daylight Saving" and "Standard" time	no change; standard; user-defined	
Time mode change	Date and time of transition to "Daylight Saving" and "Standard" time	XX.XX.XX XX:XX:XX	

Cont. of Table C.3

1	2	3	4
CONNECT. SETTINGS			
Address	Level gauge address in the RS-interface network	1-247	
Speed	Transfer speed in the RS-interface network, Baud	1200; 2400; 4800; 9600; 19200	
Delay	Lag for response via interface, ms	0-125	
Pause	Idle time between sending bytes, ms	1-1000	
ETHERNET SETTINGS			
MAC address	MAC address	00-00-000 (99-99-999)	
IP address	IP address	000-999	
IP mask	IP mask	000-999	
IP gateway	Gateway IP address	000-999	
STATISTICS			
Total	Total amount of requests to all devices in the network	0-65535	
Own	Number of requests to a certain level gauge	0-65535	
CRC Error	Number of errors during data exchange (own requests)	0-65535	
Tech.	Number of correct pass-through requests	0-65535	
UART	Connection status	no; yes	
ETHERNET	Connection status	no; yes	
MODEM SETTINGS			
No. of rings	Number of calls to establish modem connection	0-31	
ADD. SETTINGS			
Hop	Transit mode	off; on	
RS232 ctrl	Control mode	no; bidir.; unidir.	
Conn. type	RS-232 cable diagram	direct; modem	
ModBus type	ModBus Protocol Type	RTU; ASCII	
Fly-by mode	Communication mode	off; on	

Table C.4. Menu PERIPHERY SETTING (Fig.B.5)

Representation of the parameter being displayed	Parameter Name, measurement units	Allowed values, representation form	Notes
1	2	3	4
Extra slots / SLOT N X			
Type	Type of the module installed in the slot	Empty Universal o/p Analog Discrete TF-module Ethernet	
Universal output / UNIVERS. OUTPUT X			
Type	Universal output operation mode	off; logic; pulse; frequency; missing	
LOGIC OUTPUT X			
Param.	Output function (parameter identifier)	see. table C.5	
Activity level	Level of output voltage in the presence of signal (logical 1)	low; high	
Status	Output status	intact; faulty	
CONSTRAINTS chan. X			
Hln	Lower normal level setpoint, m	0-30	
Hlc	Lower critical level setpoint, m	0-30	
Hun	Upper normal level setpoint, m	0-30	
Huc	Upper critical level setpoint, m	0-30	
FREQUENCY OUTPUT X			
Param.	Output function (measured parameter identifier)	see. table C.5	
KC calcul.	Output conversion factor, pulse/(m·s)	5-5000000	
Papam. ut	Upper level of measured parameter, m	0-99,999	
Param. lt	Lower level of measured parameter, m	0-99,999	
Fmax	Maximum output frequency, Hz	0-3000	
Activity level	Level of output voltage in the presence of signal (logical 1)	low; high	
Fcur	Current frequency value, Hz	0-3000	
State	Output status	intact; faulty	
Errors	Output operation characteristic	no errors; F > Fmax; pulse>norm; yes sett.viol.	
ANALOG OUTPUT X			
Span	Output operation range, mA	0-5; 0-20; 4-20	
Param.	Output function (parameter identifier)	see. table C.5	
Papam. ut	Upper level of measured parameter, m	0-99.999	
Param. lt	Lower level of measured parameter, m	0-99.999	
K filter	Filtration factor of current output	0-40	
Icur.	Current value of current, mA	0-20	
Status	Output operation characteristic	no errors; value > UT; value < LT	

Cont. of Table C.4

1	2	3	4
TEMPERATURE SENSOR / t channel X			
Status	Temperature channel status	OK; Off; Error	
t	Current temperature value, °C	- 50 ÷ 180	
Message	Failure cause message	No errors; Input range err.; Output range err.; Off; Primary error	
t channel	Temperature channel connection	on; off	
Type	RTD sensor characteristic	Pt500/1.3910; Pt500/1.3850; Pt1000/1.3910; Pt1000/1.3850	
TEMPERATURE SENSOR / R point X			
Status	Current state of RTD input	Normal; R<Rmin; R>Rmax; Off; Fail	
R	Current value of RTD resistance, Ohm	50-2000	
Meas. R	RTD connection	on; off	
Rref	Reference resistance, Ohm	50-1000	
KR2	Calibration factor	0.000000- 999999.999999	
KR1	Calibration factor	0.000000- 999999.999999	
KR0	Calibration factor	0.000000- 999999.999999	
R point X / COMMON RES. STNGS			
Kfilt. R	Adjustment filter constant	0-255	
Rmax	Maximum resistance, Ohm	100-2000	
Rmin	Minimal resistance, Ohm	0-50	

Table C.5. Possible values for analog, frequency and logical outputs

Name of the parameter	Identification in the line Param.	Possibility to set the function for the output		
		analog	universal	
			frequency	logical
Output closed	no	x	x	x
Current value of liquid level in channel 1	H1	x	x	
Current value of distance in channel 1	D1	x	x	
Current value of liquid level in channel 2	H2	x	x	
Current value of distance in channel 2	D2	x	x	
Average current level value averaged over two channels	$\Sigma H/2$	x	x	
Current difference of level between two measuring channels	ΔH	x	x	
No USS in channel 1	no signal 1			x
Liquid level in channel 1 is below lower normal value	H1<Hln 1			x
Liquid level in channel 1 is below lower critical value	H1<Hlc 1			x
Liquid level in channel 1 is over upper normal value	H1> Hun 1			x
Liquid level in channel 1 higher than higher critical value	H1> Huc 1			x
No USS in channel 2	no signal 2			x
Liquid level in channel 2 is below lower normal value	H2<Hln 2			x
Liquid level in channel 2 is below lower critical value	H2<Hlc 2			x
Liquid level in channel 2 is over upper normal value	H2> Hun 2			x
Liquid level in channel 2 is over upper critical value	H2> Huc 2			x

Table C.6. Menu STATUS LOGS (Fig.B.6)

Representation of the parameter being displayed	Parameter Name, measurement units	Range of Values, representation form	Notes
All Windows			
Ter	Event duration	XX:XX:XX (hh:mm:ss)	
-	Data of event start or end	XX.XX.XX (dd.mm.yy)	
-	Time of event start or end	XX:XX:XX (hh:mm:ss)	
Curr. record	Sequential number of the record to be searched after entering a new value	1-1000*	

* - Maximum number of records depends on the type of log

Table C.7. Menu DATA LOGS (Fig.B.7)

Representation of the parameter being displayed	Parameter Name, measurement units	Range of values, representation form	Notes
DATA LOGS			
Tdw	Dead time:		
	- hourly log, s	0-3600	
	- daily log	XX:XX (hh:mm)	
	- interval log	XX:XX:XX (hh:mm:ss)	
Hmean	Arithmetic average value of level for the logging interval, m		
Hmin	Minimal level for the logging interval, m		
Hmax	Maximum level for the logging interval, m		
Vmean	Arithmetical average value of volume for the logging interval, m ³ (l)		
Vmin	Minimal volume, m ³ (l)		
Vmax	Maximum volume, m ³ (l)		
Cmean	Arithmetical average value of ultrasound velocity for the logging interval, m/s		
Cmin	Minimal ultrasound velocity, m/s		
Cmax	Maximum ultrasound velocity, m/s		
FL	Status word of failures	4 character places	
ER	ER status word	13 character places	
INTERVAL LOG STING			
Rate	Interval log range (logging range), mm:ss	5 seconds - 24 hours	

APPENDIX E. Status Words and Troubleshooting

Status word is displayed in menu **DATA** in zoomed parameter indication mode and in window **Current status** of menu **STATUS LOGS**. When an event occurs, the status word shows, character "x" in the corresponding position, and when it doesn't occur – character " - ". Positions in status words are numbered **from right to left**.

Table E.1. Word of a condition ER (measuring channel status word)

Number of the position	View of indication	ER Description
1	no power	No power
2	no signal	USS not present in measuring channel
3	no trans.	PEP or communication cable fault
4	no temp.	Resistance temperature detector signal loss
5	no ref.	Reference reflector signal loss in the measuring channel
6	Level err.	Level error
7	F > Fmax	Maximum frequency is exceeded
8	I > Imax	Level exceeds the current output upper threshold
9	I < Imin	Level lower than the current output lower threshold
10	H < Hln	Level in the measuring channel is below lower normal value
11	H < Hlc	Level in the measuring channel is below lower critical value
12	H > Hun	Level in the measuring channel is above upper normal value
13	H > Huc	Level in the measuring channel is above upper critical value

Table E.2. Word of a condition DS (status word of universal outputs)

Number of the position	View of indication	Event description
1	DS0	ER or failure on the universal output 0
2	DS1	ER or failure on the universal output 1
3	DS2	ER or failure on the universal output 2
4	DS3	ER or failure on the universal output 3
5	DS4	ER or failure on the universal output 4
6	DS5	ER or failure on the universal output 5
7	DS6	ER or failure on the universal output 6
8	DS7	ER or failure on the universal output 7
9	DS8	ER or failure on the universal output 8
10	I1 < I1 min	Level lower than the current output 1 lower threshold
11	I1 > I1 max	Level exceeds the current output 1 upper threshold
12	I2 < I2 min	Level lower than the current output 2 lower threshold
13	I2 > I2 max	Level exceeds the current output 2 upper threshold

NOTE.

The following events DS are registered in the status word of universal outputs:

- Level value is beyond the set lower or upper limit (in the frequency mode)
- Frequency corresponding to the current level exceeds the maximum allowed value (in the frequency operation mode)
- Output failure.

Table E.3. Word of a condition of FL (failures status word)

Number of the position	View of indication	Event description
1	Conn. fail.	Failure of connection with the transducer
2	Clock fail.	The level gauge clock failure
3	FRAM fail.	External RAM failure
4	FLASH fail.	Nonvolatile memory failure

Table E.4. Faults, failures, alarm situations and troubleshooting

External manifestations of fault, failure or ER	Probable cause	Troubleshooting method
1	2	3
1. Display failure	1. SPS fault. 2. Fuse burned out. 3. Cable breakdown, contact loss.	1. Replace secondary power supply. 2. Replace the fuse. 3. Check cable integrity and connection reliability.
2. no signal	1. Incorrect configuration of the Device. 2. AS incorrect installation, obstacles preventing the USS propagation. 3. Loss of connection between AS and BMD. 4. PEP fault. 5. BMD failure.	1. Check current profile and measurement range setting correctness. 2. Make sure the AS is installed correctly and there are no obstacles hindering the USS propagation. 3. Check the communication line between the AS and BMD with a testing device. 4. Check the channel performance with another PEP. 5. Contact the Service Center.
3. no trans.	1. Loss of connection between AS and BMD. 2. Fault or failure of PEP.	1. Check the communication line between the AS and BMD with a testing device. 2. Check the channel performance with another PEP.
4. no temp.	1. Temperature module configured incorrectly, wrong speed correction method. 2. Loss of connection between RTD and BMD. 3. RTD fault.	1. Make sure that the parameters are set correctly. 2. Check the communication line between BMD and RTD with a testing device. 3. Check the channel performance with another RTD.

Cont. of Table E.4

1	2	3
5. no ref.	1. Incorrect configuration of the Device. 2. Absence of the reference reflector, foreign items in the AS cross-section hindering USS propagation	1. Check that the current profile is set properly 2. Make sure that reference reflector is present, and there are no obstacles in the AS cross-section for USS propagation.
6. Level err.	1. Device base is set improperly. 2. The device has tuned to re-reflection.	1. Make sure that the base is set correctly. 2. Check that the measurement range and signal search algorithm are set correctly. Select the desired signal in the Signal view window.
7. F > Fmax	Current pulse frequency exceeds the maximum allowable value in the frequency operation mode of the pulse output.	Make sure that the frequency output parameters are set correctly.
8. I < I_{max}	Actual current value on the current output exceeds the maximum allowed value.	Make sure that the current output parameters are set correctly.
9. I < I_{max}	Actual current value on the current output is lower than the minimal possible value.	Make sure that the current output parameters are set correctly.
10. I₁ < I_{1 min} I₂ < I_{2 min}	Actual current value on the current output is lower than the minimal possible value.	Make sure that the current output parameters are set correctly.
11. I₁ > I_{1 max} I₂ > I_{2 max}	Actual current value on the current output exceeds the maximum allowed value.	Make sure that the current output parameters are set correctly.
12. Count. fail.	Transducer failure.	1. Initialize the device.* 2. Contact the Service Center.
13. Clock fail.	The level gauge clock failure	1. Initialize the device.* 2. Contact the Service Center.
14. FRAM fail.	External RAM failure.	Contact the Service Center.
15. FLASH fail.	Nonvolatile memory failure.	Contact the Service Center.

* - During level gauge's initialization the logs are cleared.