

BC-3 BC-3N

version 1.31



BC-3(N)

Batch controller

OPERATING MANUAL

Version: 190319EN



This operating manual is also available in soft copy on CD-ROM.

metronic



Safety Information

! To ensure the dispenser is installed and used safely, follow all instructions stated in this Manual.

Incorrect installation of dispenser may cause hazard to health or life of the user.

The device has been manufactured according to the requirements of relevant EU directives.

The device must not be installed in atmosphere liable to explosion.

Manufacturer's Information

! The Manufacturer reserves the right to modify some functions of the device.



The device meets EMC requirements (electromagnetic compatibility of industrial equipment) set-forth in the Directive 2004/108/EEC.




Table of contents

1	General information	6
1.1	Application and operation of the device	6
1.2	Signalling LEDs.....	7
1.3	Keyboard use	7
1.4	Device versions.....	7
2	Device operation.....	8
2.1	Logging in.....	8
2.1.1	Change of password.....	8
2.1.2	Retrieval of ADMIN password.....	8
2.2	Result display; navigation between screens.....	8
2.2.1	Summary screens.....	10
2.2.2	Measurement screens	10
2.2.3	Additional screens	11
2.3	Metering	12
2.4	Failures	14
2.5	Alarms.....	14
2.6	Totaliser Resetting	15
2.7	Resetting minimum, maximum and average values.....	16
2.8	Archiving	16
2.8.1	Creating new file of main archive.....	16
2.8.2	Start/ stop/ resume archiving.....	17
2.8.3	Browsing of main archive.....	18
2.9	Logs	19
2.9.1	Event Log	19
2.9.2	Log of Authorised Operations	19
2.9.3	Metering log.....	20
2.9.4	Calibration Log	20
2.9.5	Log of settings	20
2.10	Transfer of files using USB mass storage devices.....	20
2.11	Serial transfer RS485.....	21
2.12	Ethernet Port.....	21
2.13	New software	22
2.14	Observation of RS485 port	22



2.15	Language change	22
3	Mechanical assembly	23
4	Electric connections	24
4.1	Galvanic isolation	24
4.2	Description of terminals of panel-type device	24
4.3	Description of terminals of on-wall mounted device	25
4.4	Power connection	27
4.5	Connection of measurement transducers	27
4.6	Connection of receivers to relay outputs	28
4.7	Connection of RS-485 data transmission line	29
4.8	USB port	29
4.9	Ethernet Port	29
5	Device settings	30
5.1	Displaying the results	30
5.1.1	Summary screens	30
5.1.2	Measurement screens	31
5.1.3	Additional screens	31
5.1.4	LCD display	31
5.2	Dispensers	32
5.3	Measuring inputs	34
5.4	Failures of measurement transducers	35
5.5	Alarms	35
5.6	Relay outputs	35
5.7	Totalisers	36
5.8	Beginning of a month	36
5.9	Main archive	36
5.10	Totaliser Archive	37
5.11	RS-485 Port	37
5.12	Ethernet Port	38
5.13	Description of the device	38
5.14	Change to DST and v.v.	38
5.15	Admin Menu	38
5.15.1	Protected operations	38
5.15.2	Users and access rights	39
5.15.3	Log-out after	40

5.15.4	Minimum password length	40
5.16	Import and recording of settings.....	40
5.17	Restoring factory settings	40
6	Technical data	41
7	Complete delivery and accessories	44
7.1	Content of BC-3	44
7.2	Content of BC-3N.....	44
7.3	Accessories.....	44
8	Entity launching the product on European Union market.....	45
9	Modbus RTU / Modbus TCP protocol 	49
9.1	Serial port RS485 settings for Modbus RTU	49
9.2	Ethernet port settings for Modbus TCP	49
9.3	Readout of current results and totalisers.....	50
9.3.1	Registers' addresses for current results	50
9.3.2	Registers' addresses for relay outputs readout	50
9.3.3	Registers' addresses for totalisers.....	51
9.4	Reading out archive	51
9.4.1	Mapa rejestrów do odczytu archiwum głównego	53
9.4.2	Registers' addresses to which recording is possible	54
9.4.3	Readout and settings of clock.....	54
9.4.4	Registers' addresses of clock	54
9.5	Function 08 (Diagnostics).....	55

The sections of the Manual marked with  symbol are available only in electronic version of this document on CD ROM supplied along with the dispenser.

1 General information

1.1 Application and operation of the device

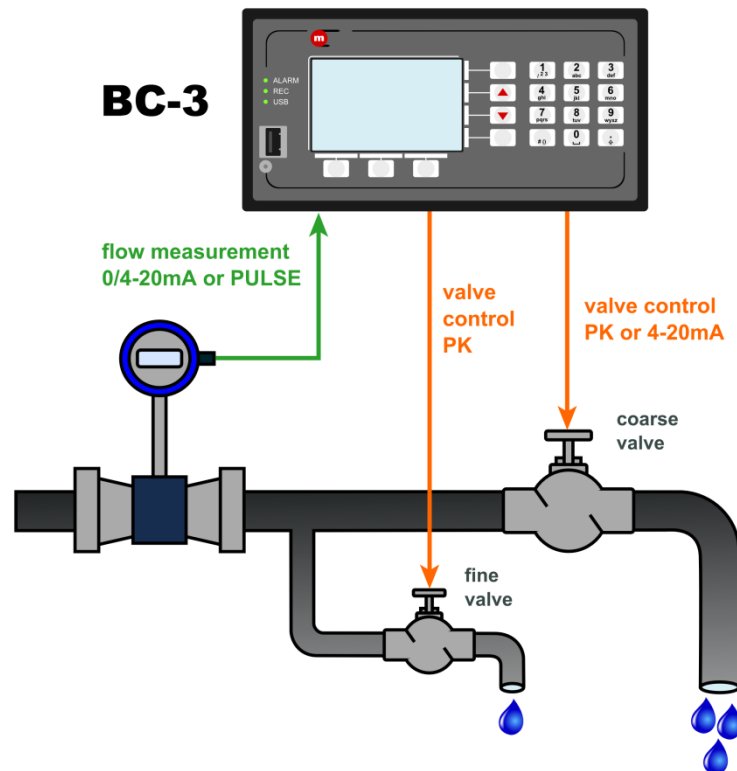


Fig. 1.1 Principle of BC-3 batch controller operation

Principles of BC-3 dispenser operation are shown in Fig. 1.1. The device works together with flow meter and enables metering the set amount of medium by control of the valve (s).

BC-3 (BC-3N) dispenser has five measuring inputs to measure flow rate or other parameters, four relay outputs to control the valves and alarm system and two 4-20mA current outputs to control the valves. The dispenser enables performance of three metering operations (A, B and C dispensers) at the same time. Metering process may be activated in either mode:

- individual mode – each of the dispensers A, B or C is switched on separately by the user,
- sequential mode – once dispenser "A" has been switched on, two other units (B & C) are automatically switched on upon the set time delay.

The device may work with flow meter of any type (e.g. ultrasonic, vortex, electromagnetic) using:

- 4-20mA or 0-20mA output signal proportional to actual flow rate,
- pulse output with constant weight per pulse,
- frequency output proportional to actual flow rate.

Each metering may be either a one- or two-stage process. In case relay outputs are used to control, two valves are being controlled: main (coarse) valve, which operates at the beginning of metering process only and fine adjustment valve, which operates all the time; in such a case two relay outputs are used. On the other hand, when current output is



used to control, only one valve is being controlled, and the value of the current defines opening/ closing grade of the valve.

Two totalisers may be configured for each IN1 ... IN5 input and each dispenser. The totalisers, which serve measuring inputs, count all the time, while those serving dispensers count only when metering process is ON.

User's interface comprises:

- LCD TFT display,
- keyboard with 19 keys,
- three two-colour LEDs.

Measurement results are saved in internal non-volatile 2 GB memory; local access to saved data is provided through USB port arranged at front panel.


Remote communication with the device is possible through ports:

- RS485 - using either protocol ASCII or Modbus RTU,
- Ethernet - using protocol Modbus TCP; additionally, WWW server is available.

1.2 Signalling LEDs

LED	Function
ALARM	Green colour means one of the users is logged-in the device. Operation with active "RS-485 monitor" function is described in Sec. 2.14 LED blinks in red when unacknowledged messages of alarms/ transducer faults are present. LED lights in red continuously, when alarm/ fault threshold has been overrun and acknowledged.
REC	Green - means recording is ON. Red - means recording fault.
USB	Continuous orange - means communication between external USB memory and the device has been established. Blinking orange - means data exchange between the device and the mass storage device is in progress.

1.3 Keyboard use

The functions of the three bottom and four side keys are indicated by pictograms displayed on the device screen. The functions of remaining 12 keys are like those of mobile phone. E.g. pressing 3x  key enters „B” / „b” when writing down a text message, and pressing it twice when writing down a number - enters „2”.

1.4 Device versions

BC-3	-	Panel enclosure
	N	Enclosure for on-wall mounting
	0	Without 4-20mA outputs
	1	One 4-20mA output
	2	Two 4-20mA outputs

The device is available in three language versions (see Sec. 2.15):

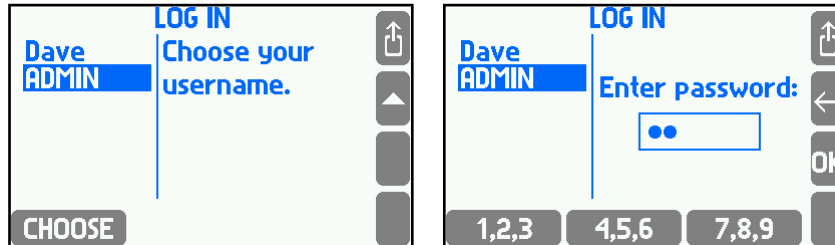
- PL,
- EN,
- DE.


2 Device operation

2.1 Logging in

Logging-in is required to perform any protected command (see Sec. 5.15.1).

To log-in to the device: enter Main menu (click ) and select Log in option. Then, select appropriate user name from the list.



Once the use of the device has been over, click  → Main menu → Log out to log-out. Automatic log-out will occur once the user has failed to perform any activity on the device within the set time.

If any not logged-in user attempts to perform any protected command on the device, he/she will be prompted to log-in in the foregoing manner, and, once the command in question has been completed, he/she will be automatically logged-out.

Note!

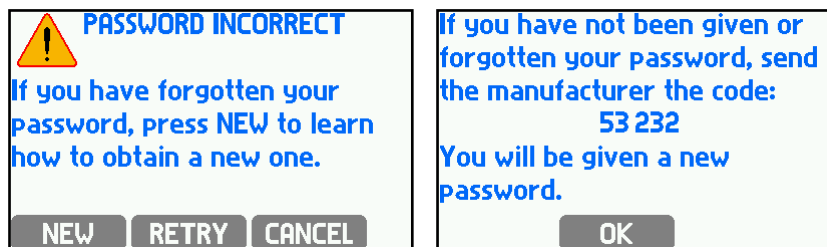
ADMIN is a default user with the highest access rights to the device. Default password to ADMIN account is „1”.

2.1.1 Change of password

The user (incl. ADMIN), once logged-in, may change his/her password; to do this - click: Main menu → Change password. Moreover, password of each user may be changed by ADMIN (see Sec. 5.15.2).

2.1.2 Retrieval of ADMIN password

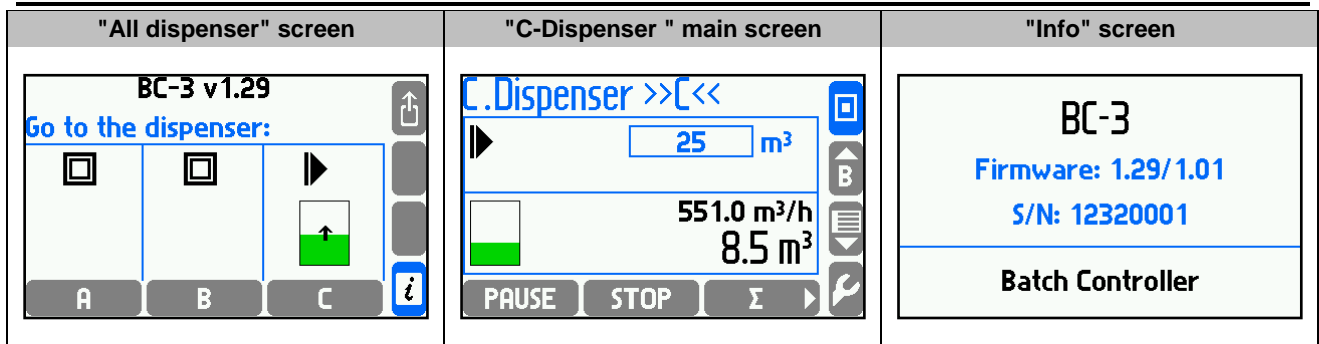
Lost/ forgotten ADMIN password may be retrieved. To do this - contact the manufacturer and quote five-digit code number displayed on the device screen.



New ADMIN password will be created on that basis. Upon logging-in using this password, change it to the new one (see Sec. 2.1.1).

2.2 Result display; navigation between screens

Measurement results are displayed in screens. Use the keys to navigate between screens. Display of some screens may be disabled - details see Sec. 5.1.



General rules of navigation are given in Fig. 2.2. Fig. 2.1 shows navigation within the group of measurement screens.

Use and keys to move between individual tables within the group of summary screens.

Upon entry of the option to display measurement screens for other measuring input, first displayed screen is the screen configured as the default one (see Sec. 5.1.2).

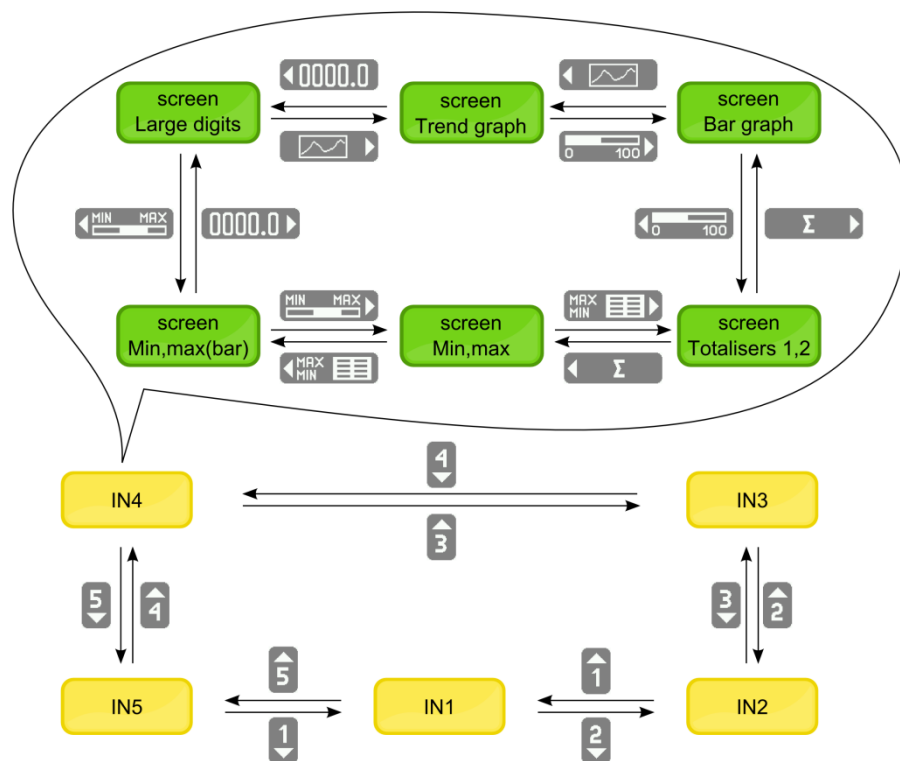


Fig. 2.1 Navigation within the group of measurement screens (assuming display of all screens is enabled)

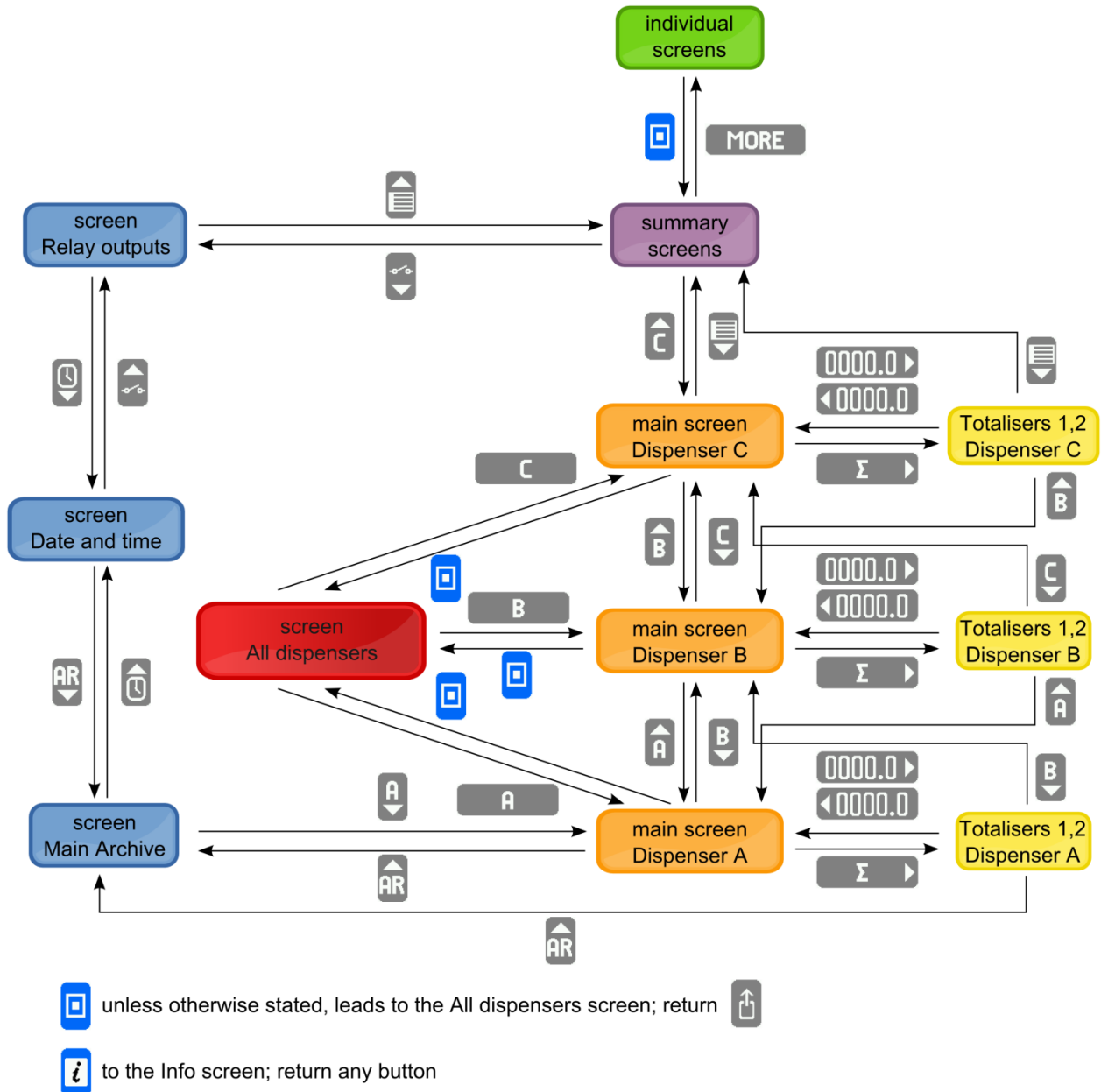


Fig. 2.2 Navigation between screens (assuming display of all screens is enabled)

2.2.1 Summary screens

Summary screens have form of table and their content is configured by the user.

Description		
IN1	169.5	kg/h
Σ_1 IN1	0 000 000 009	kg
IN3	550.8	m ³ /h
Σ_1 IN3	0 000 034 887	dm ³

Description example		
IN2	23.9	kg/h
Σ_1 IN1	0000000010	kg
IN4	997.22	kg/h

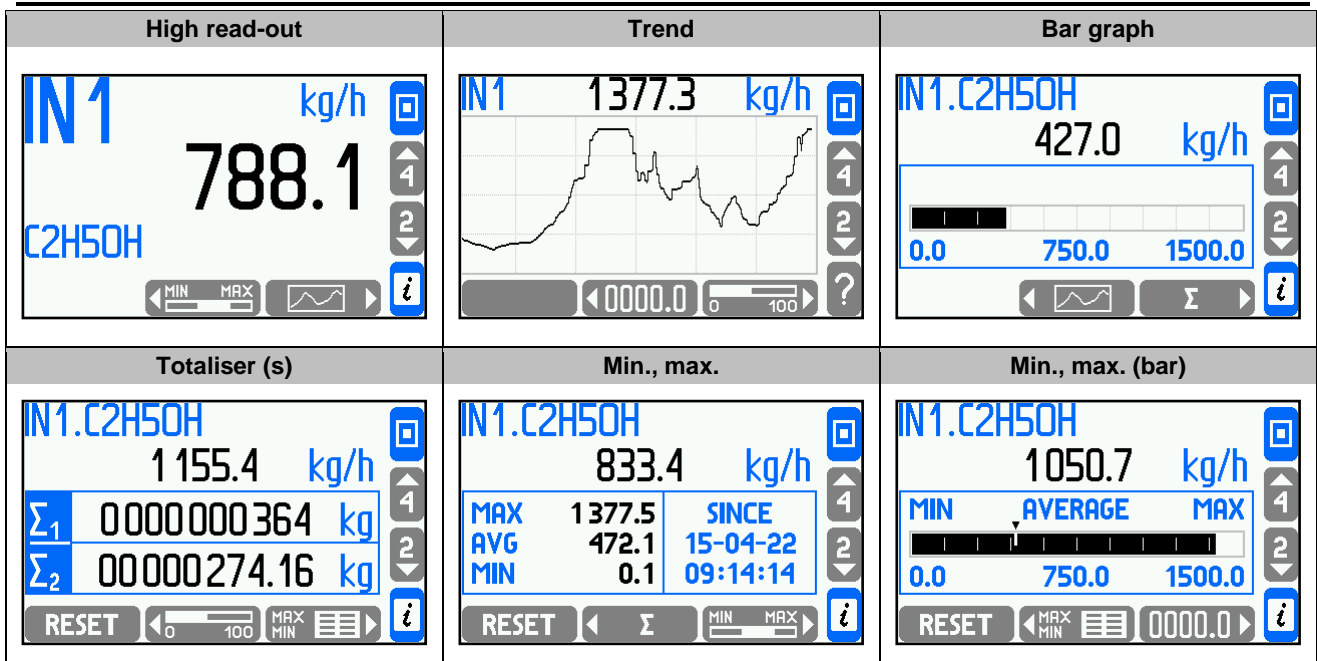
Table 3		
A	997.19	kg/h
Σ_1 C	0 000 000 034	m ³
B	STOP	kg/h
IN2	23.9	kg/h

2.2.2 Measurement screens

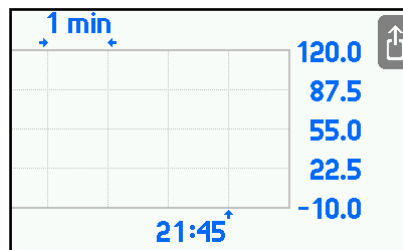
Measurement screen, unlike summary screen, refers always to a single measurement result only.



BC-3, BC-3N

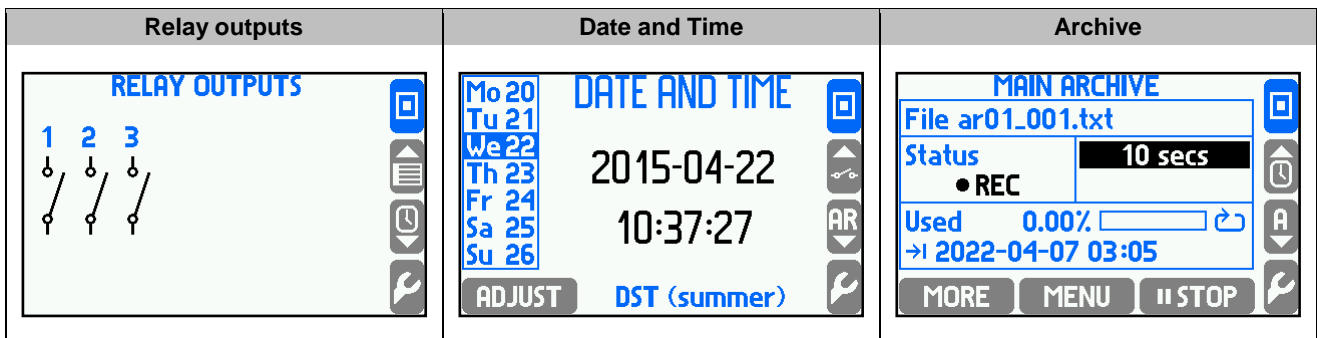


Click **?** key in TREND screen to display scale (range) of the TREND, bar graph and Min., max. (bar) screen.



Function of **ARCHIVE** key in "Trend" screen is described in Sec. 2.8.3, of **RESET** key in "Totaliser(s)" screen and in totaliser screens for individual dispensers - in Sec. 2.6, and of **RESET** key in "Min., max" and "Min., max (bar)" screens - in Sec. 2.7.

2.2.3 Additional screens



Relay output screen shows the status (OPEN/CLOSE) of all four relay outputs.

Click **ADJUST** key in Date and time screen to set/ change the current date and time.

Archive screen shows basic information about main archive:

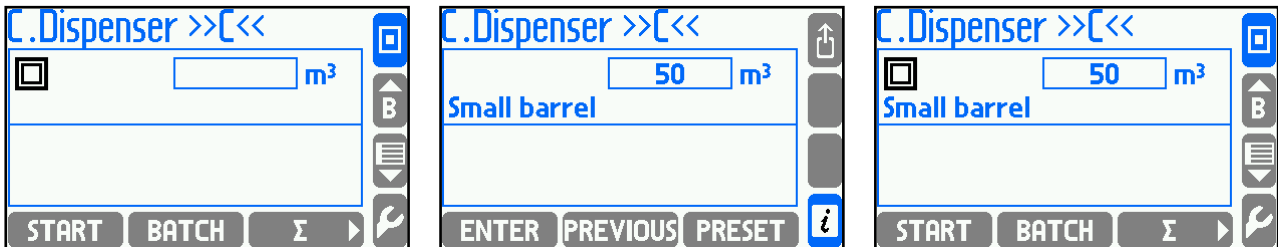
- name of current file of main archive,
- recording status REC / STOP / NO FILE of the archive,

- recording interval
- estimated day/time of archive file fill-up.

Functions of bottom keys in ARCHIVE screen are described in w Sec .2.8.

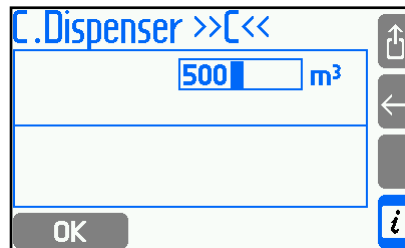
2.3 Metering

Dispenser settings are described in Sec. 5.2.

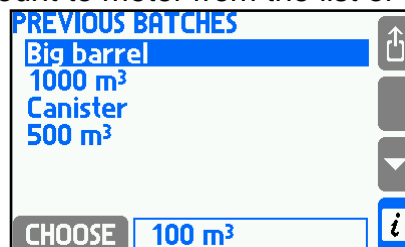


To start metering: first enter the amount of medium to meter. Click **BATCH** and select any of the following options:

- **ENTER** : manual entry of desired value:



- **PREVIOUS** : selection of the amount to meter from the list of entries recently made:



- **PRESET** : selection of the amount to meter from the list prepared during device setting (if the list is blank, following message is displayed):



Now, metering may start.

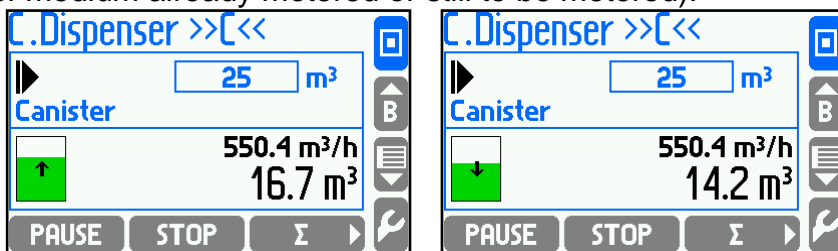
To start metering in individual mode of control - click **START**.

Once the metering in individual mode of control has started, the screen showing the following information is displayed on the device screen:

- the amount of medium set to meter
- the measured flow rate,

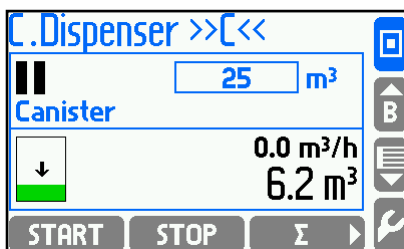


- the metering status in a numeric and graphic form (subject to the configuration, either the amount of medium already metered or still to be metered).

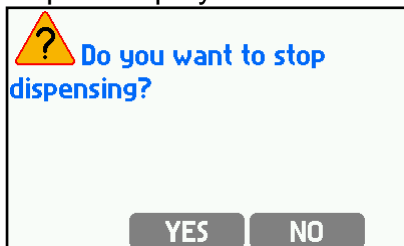


At any time during the metering process the user may:

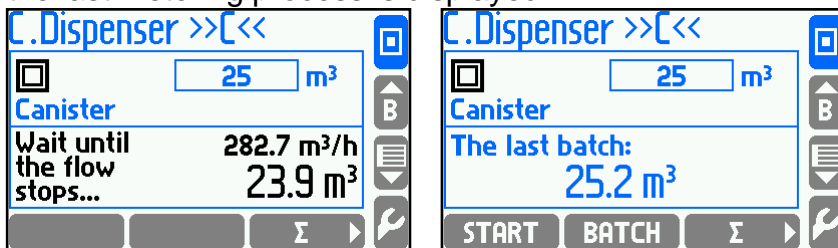
- temporarily interrupt metering by clicking **PAUSE** key (to resume metering - click **START** key):



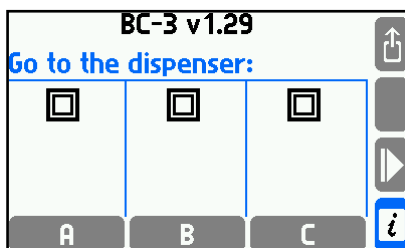
- switch off the metering by clicking **STOP** key. To prevent incidental switch-off of the metering process, following prompt is displayed:



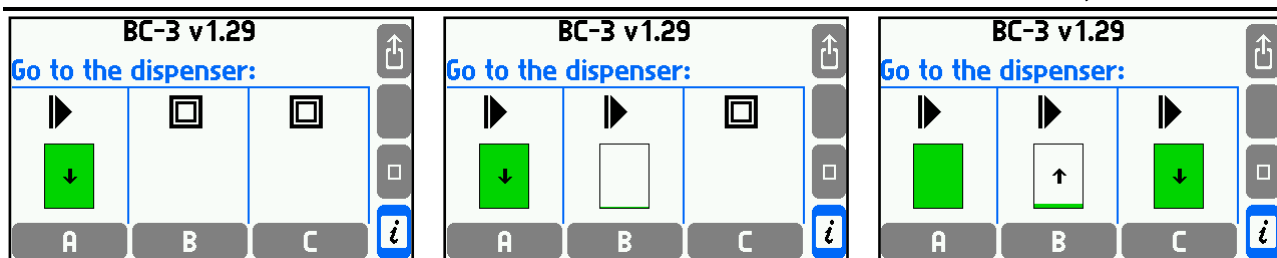
Once the metering has been stopped (either automatically or manually by the user), the dispenser waits for flow cut-off and subsequently, the amount of medium actually metered during the last metering process is displayed:



To start metering in a sequential mode - click  key on ALL DISPENSERS screen.

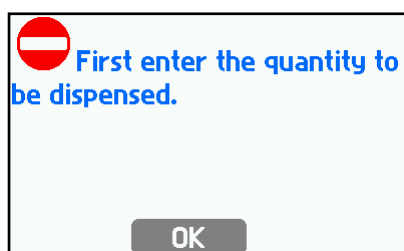


Dispensers A, B and C turn on one-by-one (if switched on) after time delay of $t(A \rightarrow B)$ and $t(B \rightarrow C)$.



More information about a given metering process (amount of medium set to meter, measured flow rate, metering status shown in a numeric form) is available in main screen of the given dispenser.

To start metering in this mode, the amount of medium to be metered has to be set for each activated dispenser; otherwise, metering does not start and the following message is displayed:



To interrupt temporarily metering by selected A, B or C dispenser - enter main screen of respective dispenser (click **PAUSE** key). It does not affect the operation of other dispensers. To resume metering - click **START** key (in the same manner as in individual mode of metering).

To stop metering in emergency conditions:

- click **STOP** in main screen of respective dispenser
- click in ALL DISPENSERS screen.

Once clicked, all metering processes are interrupted. To avoid incidental interruption, a warning message is displayed.

In either mode of operation (individual or sequential metering), if measuring error occurs during metering on measuring input, in which flow rate through a given dispenser is being measured, metering is stopped in emergency mode.

2.4 Failures

Device behaviour in case of failure occurrence is described in Sec. 5.4.

Failure symbols:

- -||- failure of 4-20mA transducer, loop current below 3.6 mA;
- -E- failure of 0/4-20mA transducer, loop current above 22 mA;
- -R- value out of the range;
- -W- waiting;
- -C- error of internal communication in the device.

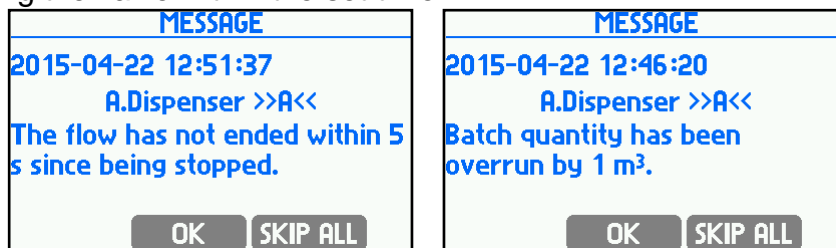
Failure symbols are displayed instead of measurement results for all channels concerned.

2.5 Alarms

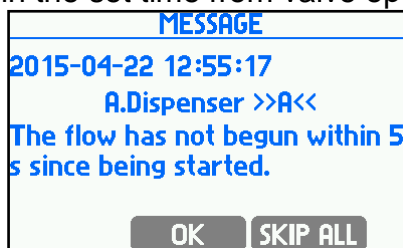
Alarm settings are described in Sec. 5.5.

"Alarm condition" means:

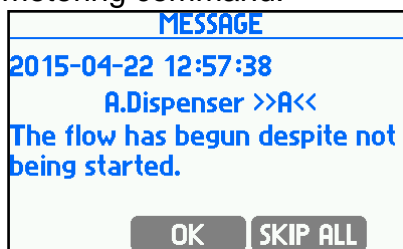
- the set amount to be metered/ the amount at which metering was temporarily interrupted (Pause) has been overrun by the set value or the flow has not stopped in spite of closing the valve within the set time:



- the flow has not started within the set time from valve opening:



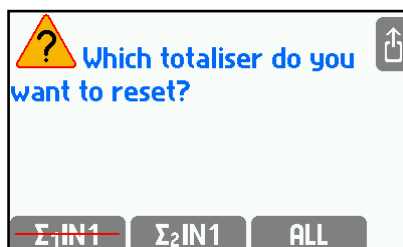
- the flow has started without metering command:



Click **OK** or **SKIP ALL** to acknowledge one or all alarms, respectively. In addition to the message displayed on the device screen, alarms may modify the status of selected relay output.

2.6 Totaliser Resetting

Totalisers serving the given: (i) measuring input are reset in Totaliser(s) screen, and (ii) dispenser - in Totaliser(s) screen for the respective dispenser. To reset the totaliser: click **RESET** key, and subsequently, select the totaliser to reset.

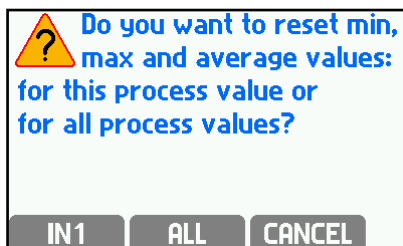


Only totalisers set as Resettable may be reset. Non-resettable totaliser is indicated with a crossed-out symbol.

Totaliser resetting may be a protected operation (see Sec. 5.15.1).

2.7 Resetting minimum, maximum and average values

Click **RESET** in "Min,max" or "Min,max(bar)" measurement screen for the given measuring input to resume monitoring minimum, maximum and average value of the given or all measurement result (s).



Resetting minimum, maximum and average values may be a protected operation (see Sec. 5.15.1).

2.8 Archiving

There are two available archives in the device:

- archive of actual values (main archive - configuration is described in Sec. 5.9,
- totaliser archive - see Sec. 5.10.

Recording to main archive occurs with the set frequency. The user can create next file in the archive manually (or files may be created automatically) and stop/ resume recording. Main archive may be browsed on the device screen.


Recording to totaliser archive occurs to one file (new file is created automatically only once the previous one has been deleted from the device memory - see Sec. 2.10) and cannot be interrupted. Totaliser archive may not be browsed on the device screen.

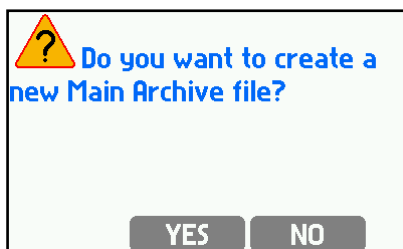
Functions to serve main archive are available in ARCHIVE and TREND screens and in main menu of the device: Main Menu → Archive commands (if there is not current archive file in the device, only the function of creating new archive file is available).

Archiving commands may be protected commands (see Sec. 5.15.1).

2.8.1 Creating new file of main archive

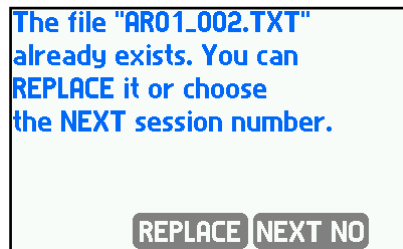
To create new file of main archive:

- select  → Main menu → Archiving commands → New file,
- click **MENU** in ARCHIVE screen and select New file in the group of functions of Archiving commands.
- If there is not current archive file in the device - click **•REC** .



The names of subsequent main archive files are unique: *ar[adr]_[number].txt*, np. *ar01_001.txt* (*adr* – device address in RS485 network, *number* – consecutive number of created record).

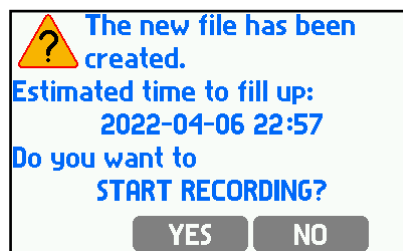
If there is another file of the same name already saved in the device memory (which may occur in case of execution of Restore factory settings function) - click **REPLACE** to replace the existing file with the new one or **NEXT NO** - to create new archive file with consecutive number.



Subject to the settings, the device may also create automatically subsequent archive files. Details - see Sec. 5.9. In such a case, existing files of the same names are automatically overwritten.

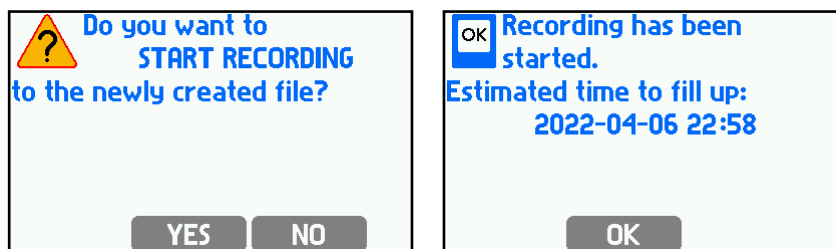
2.8.2 Start/ stop/ resume archiving

Once new archive file has been created, the device asks whether to start recording to the new archive file:



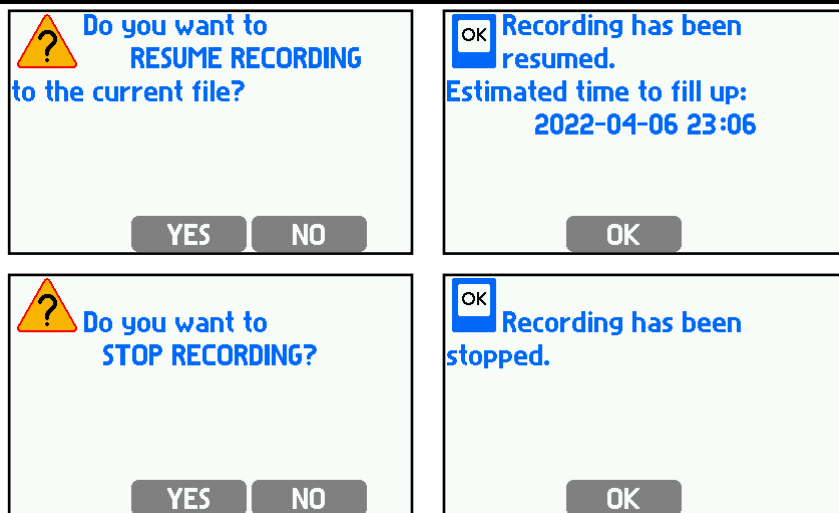
Recording to new file may also start at a later time. To do this click:

- → Main menu → Archiving commands → Start recording,
- **MENU** in "Archive" screen, and next, Start recording in the group of functions of Archiving commands,
- **•REC** in "Archive" screen.



In addition, recording may be stopped/ resumed at any time. To do this click:

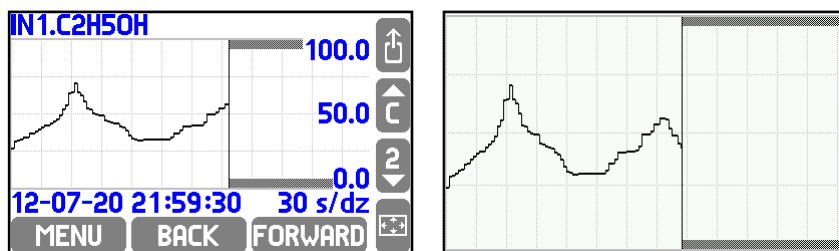
- → Main menu → Archiving commands → Stop recording / Resume recording,
- **MENU** in "Archive" screen, and next, Stop recording/ Resume recording in the group of functions of Archiving commands,
- **||STOP** / **•REC** in "Archive" screen.



2.8.3 Browsing of main archive

Main archive (only data from current archive file) may be browsed on the device screen. To do this click:

- → Main menu → Archiving commands → Browse,
- **MENU** in "Archive" screen, and next, Browse in the group of functions of Archiving commands,
- **ARCHIVE** in "Trend" screen.



Click to display full screen graph (without scale and key symbols); click any key to return to default display. Click arrow keys (e.g. ,) to move between archives of individual results. Click **BACK** or **FORWARD** key to display previous and next results, respectively.

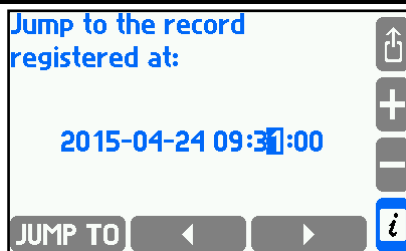
Click **MENU** key to select any of the following options:

- display data table (click **TABLE** key); navigation through data in the table is the same as in case of data shown on a graph:

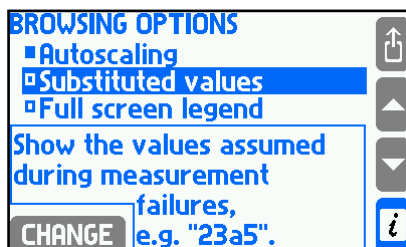
IN1.C2H5OH		
12-07-20 21:59:30	26.7	
12-07-20 21:59:33	31.1	
12-07-20 21:59:36	31.8	
12-07-20 21:59:39	32.7	
12-07-20 21:59:42	33.9	
12-07-20 21:59:45	34.3	

MENU BACK FORWARD

- search the record saved at the particular time (click **JUMP TO** key):



- move to configuration of browsing option (filled square means the selected option):



- Autoscaling – the device automatically adjusts graph scale in case the values fall beyond bar graph range,
- Substituted values – select this option to have emergency results displayed on the graph
- Full screen legend – axis descriptions are also displayed during full screen graphic presentation of the results recorded in the archive.

2.9 Logs

2.9.1 Event Log

The following events are recorded in the Event Log:

- power supply on and off,
- change of the settings,
- date or time changes,
- resetting of maximum, minimum and average values,
- resetting of totalisers,
- occurrence of failures on selected measuring inputs (see Sec. 5.4).

Date and time of each event is recorded along with this event. Last 500 events may be browsed on the screen. To do this click: → Main menu → Audit trail → Event Log. The record is also available in form of a file; additional information - see Sec. 2.10.

2.9.2 Log of Authorised Operations


Log of Authorised Operations includes those operations from the group of protected commands, performance of which requires authorization at the moment of execution. Details of protected operations are provided in Sec. 5.15.1.

The operation date and time and the name of the user, who performed the operation are recorded. Last 500 authorized operations may be browsed on the screen. To do this click: → Main menu → Audit trail → Authorization Log. The record is also available in form of a file. Additional information - see Sec. 2.10.

2.9.3 Metering log

Entries to metering log include:

- start of metering,
- automatic stop of metering,
- stop of flow – end of metering,
- interruption of metering (pause),
- resuming of metering,
- manual stop of metering by operator,
- start of flow without metering command,
- emergency stop of metering when measurement is missing,
- no flow after elapsing of the set time from switch-on,
- flow still present after elapsing of the set time from switch-off,
- overrunning the amount to be metered / the amount at which metering was stopped by the set value.

Each entry is accompanied by date and time and indication of the dispenser concerned (A, B or C). Last 500 entries may be browsed on the device screen:  → Main menu → Audit trail → Batch Log. The record is also available in form of a file. Additional information - see Sec. 2.10.

2.9.4 Calibration Log

The Calibration Log comprises all calibration procedures carried out by service people and the manufacturer. Each record features the following information:

- calibration time and date,
- calibration carried out by... (service or manufacturer),
- operations performed (calibration of analog inputs or deletion of entire previous calibration).

Information of last 50 calibration procedures is available on the device screen. The record is not available in form of a file.

2.9.5 Log of settings

Log of settings comprises information of changes in device settings. The record is not available to browse on the device screen, it is only available in form of a file. Additional information is provided in Sec. 2.10.

2.10 Transfer of files using USB mass storage devices

Archive and log files are saved in internal data memory. The table below shows the list of files saved in internal data memory; *adr* - means address of the device in RS485 network, *number* – consecutive number of created record.

File name	File type
ar[adr]_[number].txt	Main archive
artot[adr].txt	Totaliser archive
e_log[adr].txt	Event Log
a_log[adr].txt	Log of Authorised Operations
b_log[adr].txt	Metering log
s_log.dat	Log of settings

The user may select:

- the command → Main menu → Copy files → Current archives, which causes the files of current main archive and totaliser archive as well as the files of event log, log of authorized operations and metering are copied to USB mass storage device.
- the command → Main menu → Copy files → Choose a file, and click key to select desired file from the displayed list, and then Copy, Move or Remove the selected file; log files may be deleted/ transferred only by the Service.

Note!

To delete/ transfer current file of main archive, the recording process has to be stopped.

Note!

Upon deletion/ transfer of totaliser archive file, new file will be automatically created.

Note!

Any file saved in USB mass storage device with the same name will be overwritten by the new one.

During these operations, USB mass storage device (pen-drive) must remain inserted to USB port of the device. Files are copied to main directory on USB mass storage device.

Copy/transfer/ deletion of files from internal memory may be protected operation (see Sec. 5.15.1).

2.11 Serial transfer RS485

The device has RS485 interface. Communication may use either ASCII or Modbus RTU protocol. Details - see Sec. 9.

2.12 Ethernet Port

The device is provided with Ethernet port. Modbus TCP protocol is used to communicate (details - see Sec. 9). In addition, WWW server to be connected through an internet browser is available. To establish such communication - enter IP address of the dispenser to the address bar of the browser.

WWW server enables viewing of the current results, totalisers, and statuses of dispensers and relay outputs. Data are presented also in form of a graph (TREND tag).

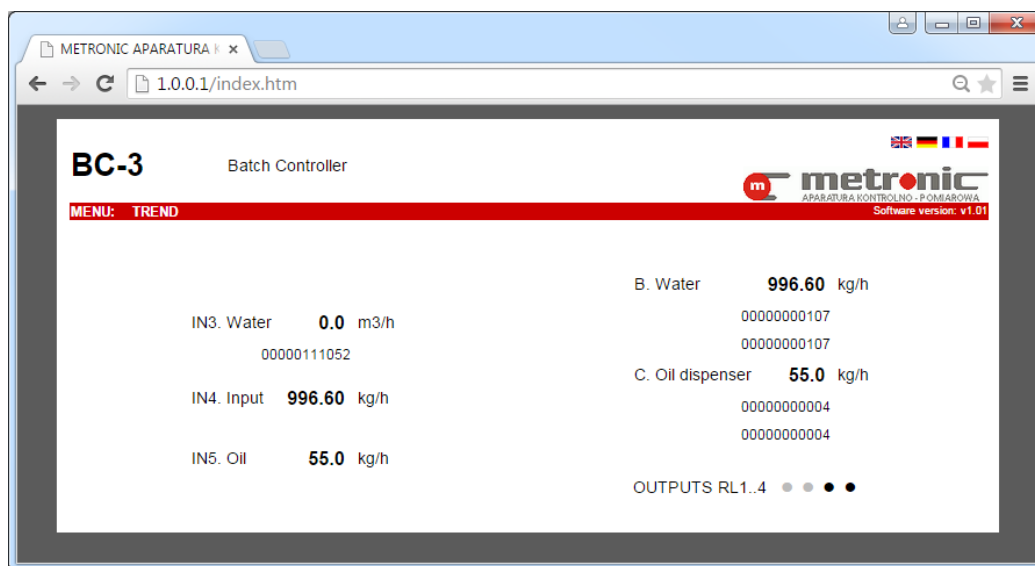



Fig. 2.3 View of WWW server in dispenser

Note!

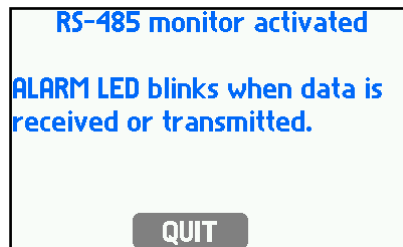
The site has been tested in the following internet browsers: Internet Explorer 8, Opera, Mozilla Firefox, Chrome and Safari.

2.13 New software

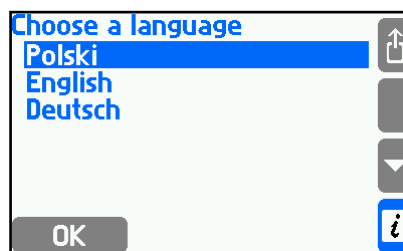
Click  → Main menu → Firmware and licences to check currently used software version and serial number of the device. The user logged-in as ADMIN may also up-grade device firmware to the most current version. To do this: insert USB mass storage device with respective file saved in main directory into USB port of the device and select Load and install option. Once the list of available files has been displayed, select the file with appropriate software. Software up-grade takes approx. 1 min. and does not cause loss of any settings, log contents or saved data.

2.14 Observation of RS485 port

Function RS-485 monitor is a service function. Once activated, ALARM LED blinks when data exchange occurs through RS485 port. Click **ZAKONCZ** to disable this function.

**2.15 Language change**

The language used may be changed at any time. Use Change the language function to do this. Select desired language from the list and click **OK** to confirm.



3 Mechanical assembly

The BC3 batch controller is suitable for panel mounting.

- Enclosure dimensions: 96 mm x 192 mm x 63.5 mm
- Depth of mounting along with connectors: approx. 72 mm
- Dimensions of panel cut-out: 186 ^{+1,1} mm X 92 ^{+0,6} mm

After fitting the device in the panel, install snap fasteners on its side walls and then tighten the set screws.

The enclosure of BC-3N dispenser is suitable for on-wall mounting.

- Device dimensions: 217 mm X 257 mm X 125 mm (without cable glands)
 247 mm X 257 mm X 125 mm (with cable glands)

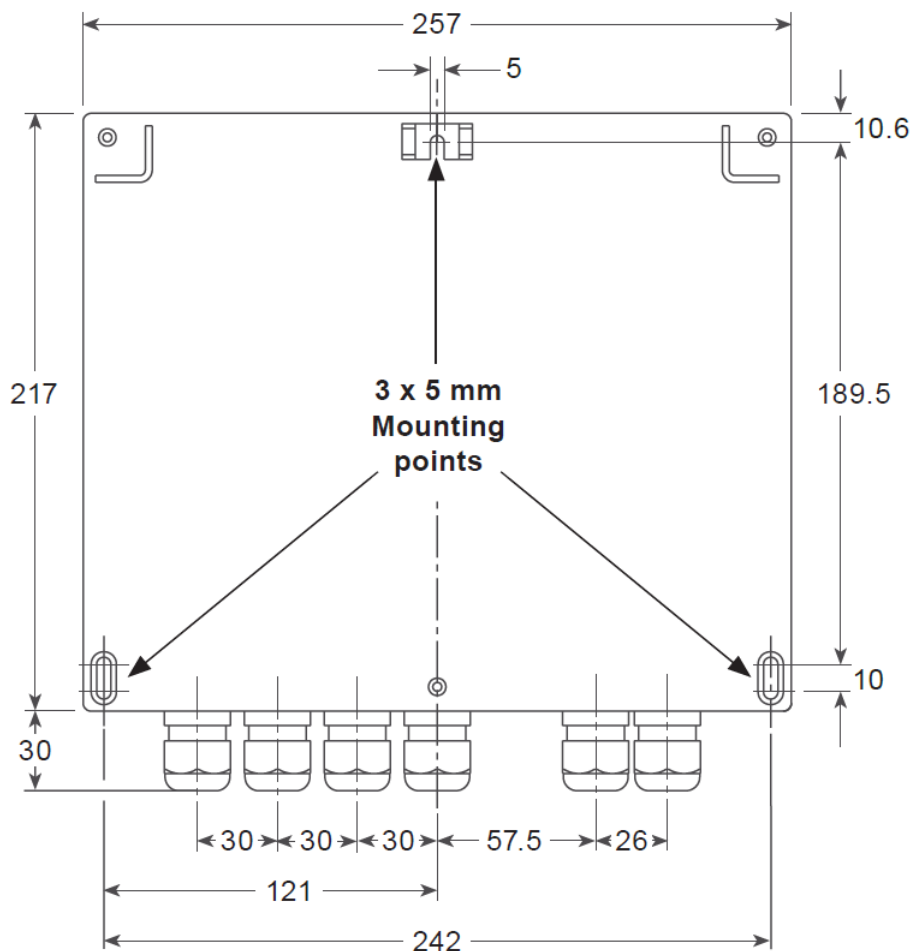


Fig. 3.1 On-wall mounting of dispenser

Install the batch controller in the place protected from exposure to direct heat generated by other equipment and if possible and practicable, located away from the sources of strong interferences (such like e.g. inverters, contactors, etc.).

4 Electric connections

4.1 Galvanic isolation

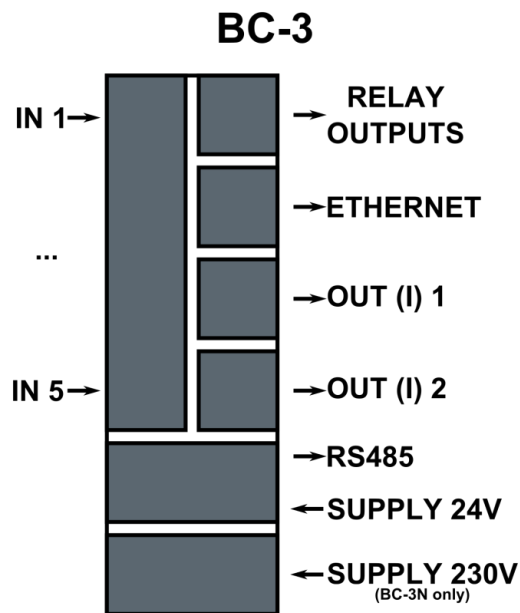


Fig. 4.1 Galvanic isolation in BC-3(N)

4.2 Description of terminals of panel-type device

All electrical circuits in BC-3 dispenser are led out to dividable screw terminal strips located in the rear panel of the device. Wires of cross-section area of up-to 1.5 mm² may be connected to the terminal strips. Insulation should be removed from wire ends at the length of 8-10 mm.

Terminal block no.	BC-3 – description of terminals		
1	+	0/4-20mA	IN 1 (I)
2	I+		
3	I-		
4	+	0/4-20mA	IN 2 (I)
5	I+		
6	I-		
7	+	0/4-20mA	IN 3 (I / PULSE)
8	I+		
9	I-		
10	F+	PULS	
11	F-		
12	+	0/4-20mA	IN 4 (I / PULSE)
13	I+		
14	I-		
15	F+	PULS	
16	F-		



BC-3, BC-3N

17	+	0/4-20mA	IN 5 (I / PULSE)
18	I+		
19	I-		
20	F+	PULSE	
21	F-		
22	+	ANALOG OUTPUT 4-20mA no. 1 (option)	
23	I+		
24	I-		
25	+	ANALOG OUTPUT 4-20mA no. 2 (option)	
26	I+		
27	I-		
28	RL1	RELAY OUTPUT 60V/0.1A (RL1)	
29			
30	RL2	RELAY OUTPUT 60V/0.1A (RL2)	
31			
32	RL3	RELAY OUTPUT 60V/0,1A (RL3)	
33			
34	RL4	RELAY OUTPUT 60V/0,1A (RL4)	
35			
36	+	RS485 SERIAL PORT	
37	T+		
38	A+		
39	B-		
40	T-		
41	G		
42	⏚	POWER SUPPLY 24 V DC/AC	
43	+~		
44	--		

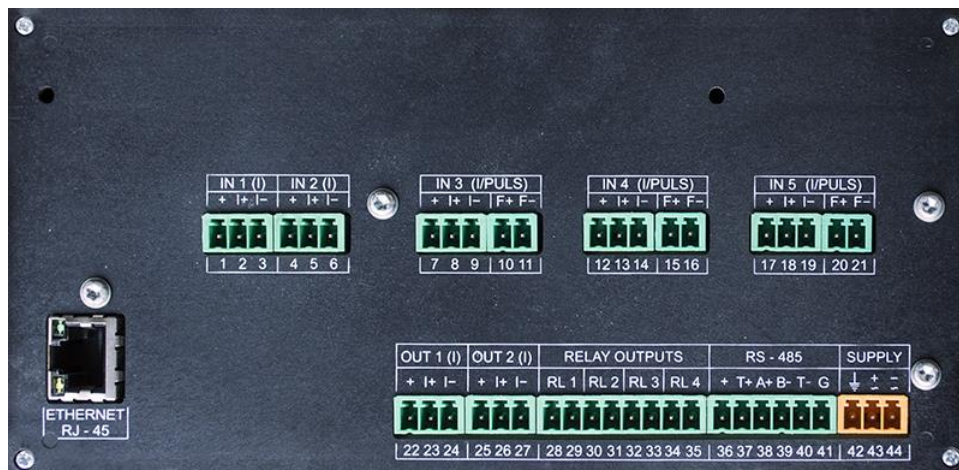


Fig. 4.1 Rear panel of BC-3 dispenser

4.3 Description of terminals of on-wall mounted device

Electric circuits in BC-3N dispenser are led out to terminal strip located in front panel of the device. Wires of cross-section area of 0.2 mm² to 1.5 mm² may be connected to the terminal strip. It is recommended to use wires of possibly small cross section area



BC-3, BC-3N

because quite many of them have to pass through cable glands. Insulation should be removed from wire ends at the length of 8-10 mm.

Terminal block no.	BC-3N – description of terminals		
28	+	0/4-20mA	IN 1 (I)
29	I+		
30	I-		
31	+	0/4-20mA	IN 2 (I)
32	I+		
33	I-		
34	+	0/4-20mA	IN 3 (I / PULSE)
35	I+		
36	I-		
37	F+	PULSE	
38	F-		
39	+	0/4-20mA	
40	I+		
41	I-		
42	F+	PULSE	
43	F-		
44	+	0/4-20mA	IN 5 (I / PULSE)
45	I+		
46	I-		
47	F+	PULSE	
48	F-		
49	+	ANALOG OUTPUT 4-20mA no. 1 (option)	
50	I+		
51	I-		
52	+	ANALOG OUTPUT 4-20mA no. 2 (option)	
53	I+		
54	I-		
55	RL1	RELAY OUTPUT 60V/0.1A (RL1)	
56			
57	RL2	RELAY OUTPUT 60V/0.1A (RL2)	
58			
59	RL3	RELAY OUTPUT 60V/0,1A (RL3)	
60			
61	RL4	RELAY OUTPUT 60V/0,1A (RL4)	
62			
63	+	RS485 SERIAL PORT	
64	T+		
65	A+		
66	B-		
67	T-		
68	G		



69	\perp	POWER SUPPLY 24 V DC/AC
70	+~	
71	~	
L	POWER SUPPLY 230 VAC	
N		
PE		



Fig. 4.2 Connectors of BC-3N device

4.4 Power connection

Subject to the version, the device may be supplied with:

- 24 VDC or AC of any polarity,
- 230 VAC – only device in enclosure suitable for on-wall mounting.

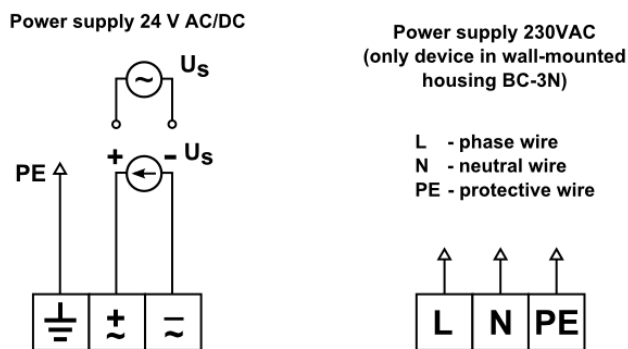


Fig. 4.3 Connection of power supply to the device

4.5 Connection of measurement transducers

Measurement transducers with 4-20mA loop-powered outputs may be connected to IN1 and IN2 inputs, while the transducers with 0/4-20mA or PULSE-type outputs should be connected to three other inputs IN3, IN4 and IN5.

Input	0/4-20mA	PULSE
IN1	+	-
IN2	+	-
IN3	+	+
IN4	+	+
IN5	+	+

0/4-20mA active transducer	0/4-20mA transducer supplied from external power supply	0/4-20mA transducer supplied from the device	transducer with passive contact/ OC / NAMUR output

Subject to the configuration of internal jumpers in the device, PULSE-type input may be connected with transducer with

- output of passive contact-type or OC transistor (factory settings),
- active voltage output – high impedance output > 10kΩ,
- NAMUR standard output.

Additional low-pass filter, particularly recommended for signals generated by the contact, may be connected (factory settings: filter disconnected).

Note!

Prior to the change of factory settings of PULSE input, please contact the manufacturer.

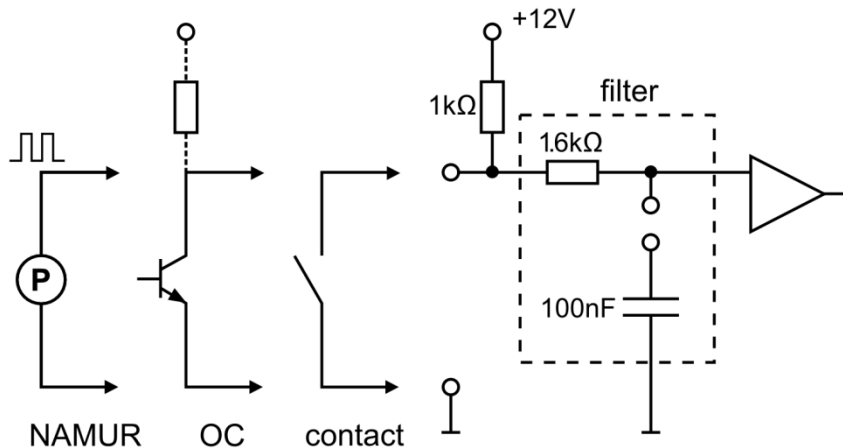


Fig. 4.4 Signal forming circuit for PULSE inputs

4.6 Connection of receivers to relay outputs

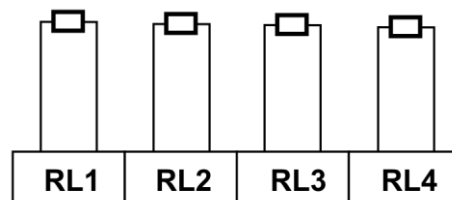


Fig. 4.5 Connection of receivers to relay outputs

4.7 Connection of RS-485 data transmission line

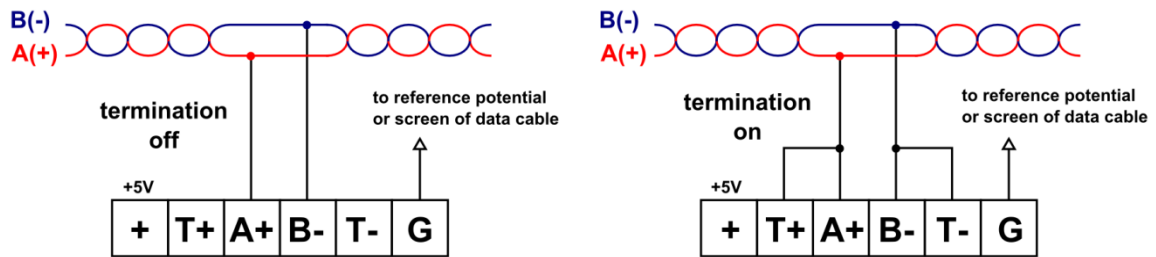


Fig. 4.6 Connection of the device to RS-485 serial bus

4.8 USB port

USB port of “A”- type is located in the front panel of the device. The port enables connection of external mass storage device (USB flash drive).

4.9 Ethernet Port

Ethernet (100Base-T) port is located in the rear panel of the device. Connection of the port is compliant with EIA/TIA-568A/B. A wire of 8 twisted conductors ended with RJ-45 plug may be connected to this port.

5 Device settings

Set up the device prior to commencement of its use. Settings may be made in either way:


- selecting appropriate option in menu:  → Main menu → Settings and Main menu → Administrative data using keyboard
- using USB mass storage device with saved file with settings: Main menu → Load or save settings (details - see Sec. 5.16).

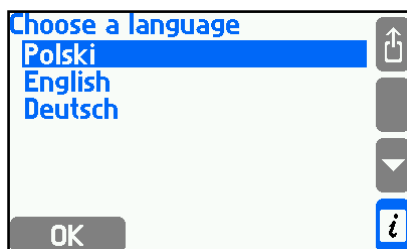
Menu Settings comprises following parameter sub-groups:

- Display (Sec. 5.1),
- Dispensers (Sec. 5.2),
- Inputs (Sec. 5.3),
- Sensors failures (Sec. 5.4),
- Alarms (Sec. 5.5),
- Relay outputs (Sec. 5.6),
- Totalisers (Sec. 5.7),
- Nominal month beginning (Sec. 5.8),
- Main Archive (Sec. 5.9),
- Totaliser Archive (Sec. 5.10),
- RS-485 port (Sec. 5.11),
- Ethernet port (Sec. 5.12),
- Device tag... (Sec. 5.13),
- DST (Sec. 5.14).

Menu Administrative data comprises:

- Protected commands (Sec. 5.15.1),
- Users and entitlements (Sec. 5.15.2),
- Log out after (Sec. 5.15.3),
- Min pass length (Sec. 5.15.4).

To switch-on the brand new device - enter Language selection screen, select desired language and click  to confirm). The language may be changed at a later time (see Sec. 2.15).



5.1 Displaying the results

5.1.1 Summary screens

Summary screens allow to display three (Print → Large) or five (Print → Small) measurement results on the device screen at the same time. The user may configure up-to 6 tables; each table row is to be configured individually. First, select the input (IN1, IN2, IN3,

IN4, IN5) or dispenser (A, B, C) to display, and, then, current value (Curr value) or either totaliser (Σ_1 , Σ_2) to display. This line may be also left blank. Display of summary screens may be disabled.

Summary screens

- Visible → Yes (Yes, No)
- Table X
 - Print → Large (Large, Small)
 - Row X → Empty ()
 - Table tag...

5.1.2 Measurement screens

Measurement screens are to be configured individually for each input. Setting a given screen as a Primary one means this screen will be first to display upon entry to display a screen group for other input.

Individual screens

- IN X [Input]
 - Large digits → Primary (Primary, Visible, Hidden)
 - Trend graph → Visible (Primary, Visible, Hidden)
 - Bar graph → Visible (Primary, Visible, Hidden)
 - Totalisers 1,2 → Visible (Primary, Visible, Hidden)
 - Min,max → Visible (Primary, Visible, Hidden)
 - Min,max (bar) → Visible (Primary, Visible, Hidden)

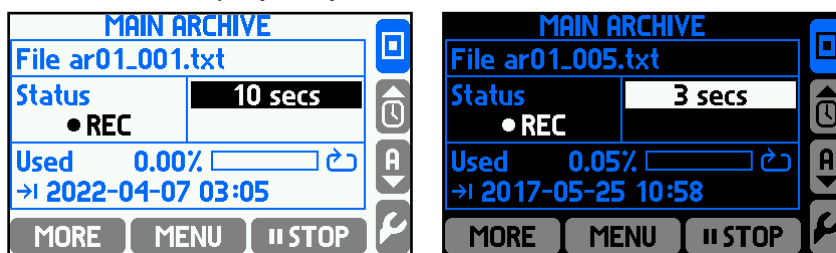
5.1.3 Additional screens

Special screens

- Relay outputs → Visible (Visible, Hidden)
- Date and time → Visible (Visible, Hidden)
- Main Archive → Visible (Visible, Hidden)

5.1.4 LCD display

Background colour of the display may be White or Black.

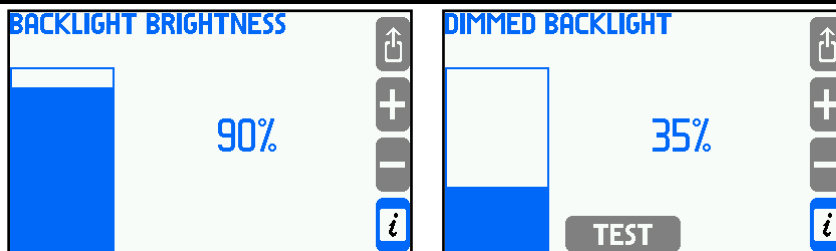


Display illumination may either automatically turn off after elapsing certain time from the last use of any key or may remain switched-on permanently. Backlight brightness and

Dimmed backlight may be adjusted with 5% step using and keys. Effect of Backlight brightness change are noticeable immediately, while of "Dimmed backlight" change - upon clicking key.

LCD display

- Background colour → White (White, Black)
- Backlight → 3 mins (1 mins, 2 mins, 3 mins, 5 mins, 7 mins, 10 mins, Still ON)
- Backlight brightness
- Dimmed backlight



5.2 Dispensers

Dispensers may be switched on:

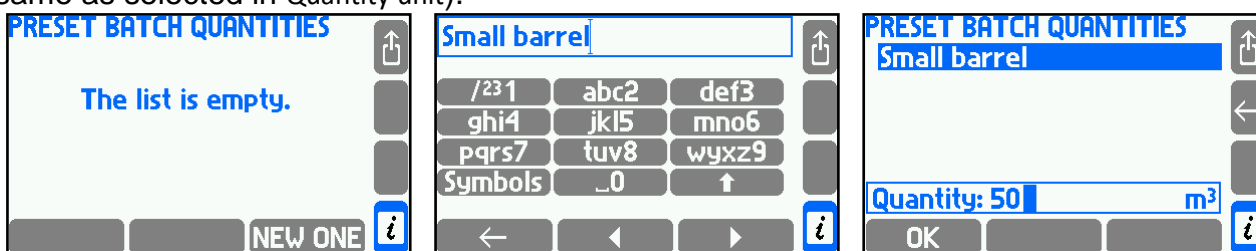
- individually – each dispenser is switched on by the user separately,
- sequentially – all dispensers are switched on simultaneously and start to operate with delay of t (A→B) and t (B→C).

To configure respective dispenser (A, B or C), specify: (i) whether valve (s) is (are) to be controlled by RL relay output or 4-20mA current output, (ii) which measurement input is to be used to measure flow rate, and (iii) which flow rate measurement units are to be used.

X.[Dispenser >>X<<]

- Mode → RL outputs(s) (Off, RL outputs(s), 4-20mA output)
- Preset batch quantities
- Flow measured at → IN1 (IN1, IN2, IN3, IN4, IN5)
- Unit → kg/h (g/s, kg/s, kg/h, t/h, dm³/s, m³/s, dm³/h, m³/h)
- Quantity unit → kg (kg, t, dm³, m³)
- Coarse-fine mode → No (No, Yes)

Optionally, the list of amounts to be metered may be preset (up-to 10 values) so that the user may select the desired amount to be metered from the list instead of its manual entry (see Sec. 2.3). To add new item to the list, click **NEW ONE** and select the name of the item (e.g. „Small barrel”) and the corresponding amount (measurement unit will be set the same as selected in Quantity unit).



If Mode → RL outputs(s):

- Coarse-fine mode → No is selected: set the relay output to control valve operation:
Control → RL1 (RL1, RL2, RL3, RL4)
- Coarse-fine mode → Yes: two valves (Coarse and Fine), each controlled by separate relay output are used to meter; set the time at which slower metering should start before the end of the process and the relay outputs to open main (coarse) valve (only at the metering beginning) and fine valve:
Threshold = 0 [Quantity unit]
Coarse → RL1 (RL1, RL2, RL3, RL4)
Fine → RL1 (RL1, RL2, RL3, RL4)



Upon selection of Mode → 4-20mA output:

- Coarse-fine mode → No: set the current output to control valve operation, current values corresponding to opening and closing the valve and whether the current changes should be stepwise or stepless (in case of stepless changes - specify the change rate in mA/s):

Valve → OUT1 (OUT1, OUT2)

Open = 4.00 mA

Closed = 20.00 mA

Curr changes → In leaps (In leaps, Enter...)

- Coarse-fine mode → Yes: set (i) the time at which slower metering should start before the end of the process, (ii) the relay output to control valve operation, (iii) current values corresponding to quick filling (at the beginning of metering) and fine (final) filling, and to closing the valve, and (iv) whether the current changes should be stepwise or stepless (in case of stepless changes - specify the change rate in mA/s):

Threshold = 0 [Quantity unit]

Valve → OUT1 (OUT1, OUT2)

Coarse = 20.00 mA

Fine = 16.00 mA

Closed = 4.00 mA

Curr changes → In leaps (In leaps, Enter...)

Other settings comprise:

Learning → No (No, Yes)

Tag...

Total format → 0000.0 (00000, 0000.0, 000.00, 00.000, 0.0000)

Count → Up (Up, Down)

The setting Learning → Yes causes the dispenser saves and considers when metering, the error occurred during the last metering (quantity overrun arising from discrete nature of measurement). It results in gradual increase of metering accuracy.

The settings below are mainly intended for the user's information:

- Tag... is a textual description of the dispenser; default dispenser is Dispenser >>X<<.,
- Total format is a resolution of indication of medium amount when metering,
- Count → Up means that when metering, the amount of the medium being metered is counted up from 0 to the set quantity, and the amount already metered is displayed on the device screen,
- Count → Down means that when metering, the amount of the medium being metered is counted down from the set quantity to 0, and the amount remaining to be metered is displayed on the device screen,

To configure the dispensers to operate in sequential mode of start-up, at least A and B dispensers have to be turned on; otherwise, the option of selecting start-up mode is not available in the menu.

A.[Dispenser >>A<<]

B.[Dispenser >>B<<]

C.[Dispenser >>C<<]

Launching mode

Start → Sequential (Individual, Sequential)

t (A→B) = ...

t (B→C) = ...



- $t(A \rightarrow B)$ time between start-up of A and B dispensers (from 0s to 600s),
- $t(B \rightarrow C)$ time between start-up of B and C dispensers (from 0s to 600s).

No additional options have to be set up if individual mode of start up has been selected.

5.3 Measuring inputs

For each of five measuring inputs select flow rate or other parameter to measure and its measurement unit (for Measurement \rightarrow Flow - select it from the list, for Measurement \rightarrow Other - enter desired measurement unit). Only transducers with 4-20mA or 0-20mA loop-powered outputs (Mode \rightarrow 4-20mA or Mode \rightarrow 0-20mA) may be connected to IN1 and IN2 inputs, and transducers with current output (Mode \rightarrow 4-20mA, Mode \rightarrow 0-20mA) or with binary output (Mode \rightarrow Frequency, Mode \rightarrow Pulse) may be connected to IN3, IN4, IN5 inputs.

INX.[Input]

Measurement \rightarrow Flow (Off, Flow, Other)

Mode \rightarrow 4-20mA (4-20mA, 0-20mA, Frequency, Pulse)

Unit \rightarrow kg/h (g/s, kg/s, kg/h, t/h, dm³/s, m³/s, dm³/h, m³/h)

When selecting Mode \rightarrow 4-20mA or Mode \rightarrow 0-20mA - specify the current range i.e the values corresponding to maximum and minimum current values (i.e. 0 mA and 20 mA or 4 mA and 20 mA, respectively). The measured value may be digitally filtered using one - pole low-pass filter with time constant specified in Filter item. When flow rate is measured, Cutoff function may be enabled, which means once the measured value has fallen below the set threshold, indication of the actual value is replaced with zero.

If a given measuring input is to be used to measure flow rate when metering, due to the algorithm of dispenser operation, cut-off value other than zero should be set.

4 mA = 0 kg/h

20 mA = 100 kg/h

Cutoff = 1 kg/h

Filter \rightarrow Off (Off, 2 sec, 5 secs, 10 secs, 20 secs, 30 secs, 1 mins, 2 mins, 3 mins, 5 mins)

Fail value \rightarrow None (None, Last result, Enter)

The current above 22 mA or below 3.6 mA (only for 4-20mA version) is considered by the device as a failure of measurement transducer. In such a case, the actual result may be replaced with a constant value or the last properly measured value. If Fail value \rightarrow None, the current below 3.6 mA is indicated by a $-||-$ symbol, and above 22 mA - by a $-E-$ symbol on the display.

If Mode \rightarrow Frequency is selected, enter two values from transducer characteristic (frequencies and corresponding measured values).

0 Hz = 0 [Unit]

1 Hz = 0 [Unit]

Mode \rightarrow Pulse is not available if the measured value is other than the flow rate. For this mode, set constant weight per pulse (specify the weight corresponding to the set number of pulses).

10 pulses = 100 kg

The settings below are mainly intended for the user's information:

- Tag... is a textual description of the input; default input is an Input.
- Format is a resolution of result presentation in the measurement screen,



- Graph 100% and Graph 0% define Y-axis scaling on Trend screen and the range of bar graphs on Bar graph and Min,max (bar) screens (see Sec. 2.2.2).

Tag...

Format → 0000.0 (00000, 0000.0, 000.00, 00.000, 0.0000)

Graph 100% = 100 kg/h

Graph 0% = 0 kg/h

5.4 Failures of measurement transducers

Failure of measurement transducer may be reported by a message displayed on the device display and may also modify the status of selected relay output. Failure occurrence may be recorded in the Event Log (either failure beginning or end only or both).

INX.[Input]

Alarm → Message only (None, Message only, RL1, RL2, RL3, RL4)

Event → None (None, Both, Failure, Recovery)

5.5 Alarms

"Alarm condition" means:

- Overrun i.e. excess of the set amount by the set value (Only surplus) or keeping the flow on continue in-spite of closing the valve within the set time (Only delay):

Overrun

Detect → Yes (No, Only surplus, Only delay, Yes)

Surplus = 0 kg

Delay = 5 s

Alarm → Message only (Message only, RL1, RL2, RL3, RL4)

- Missing flow i.e. the flow has not started within the set time (Delay) from opening the valve:

Missing flow

Detect → Yes (No, Yes)

Delay = 5 s

Alarm → Message only (Message only, RL1, RL2, RL3, RL4)

- Flow when STOP i.e. the flow has started without release of metering command:

Flow when STOP

Detect → Yes (No, Yes)

Alarm → Message only (Message only, RL1, RL2, RL3, RL4)

Alarms are indicated by messages displayed on the device screen and may also modify the status of selected relay output.

5.6 Relay outputs

Output RL1 [Non-latched]

Active → Closed (Closed, Open)

Output RL2 [Latched]

Active → Closed (Closed, Open, Pulsing)

Output RL3

Output RL4

In case the relay output has been used in previous settings: (i) to control valve operation, or (ii) to signal alarms or measurement transducer failure, it is identified as Non-



latched or Latched, respectively (in the latter case, the output status remains active until acknowledgement by the user of failure or overrun message). Other relay outputs are disabled. Set active status for each enabled output (Closed, Open, Pulsing – are reserved for signal outputs only).

5.7 Totalisers

INX.[Input]

Totaliser Σ1

Mode → Unresettable (Off, Unresettable, Resettable, Hourly, Daily, Monthly)

Quantity unit → kg (kg, t, dm³, m³)

Format → 0000.0 (00000, 0000.0, 000.00, 00.000, 0.0000)

Totaliser Σ2

X.[Dispenser >>X<<]

Totaliser Σ1

Mode → Unresettable (Off, Unresettable, Resettable, Hourly, Daily, Monthly)

Quantity unit → kg (kg, t, dm³, m³)

Format → 0000.0 (00000, 0000.0, 000.00, 00.000, 0.0000)

Totaliser Σ2

Two totalisers may be configured for each flow rate measuring input and for each dispenser: Totaliser Σ1 and Totaliser Σ2. Each totaliser may be:

- Unresettable – impossible to reset using keyboard; no automatic resetting,
- Resettable – resetting possible using keyboard (see Sec. 2.6),
- Hourly reset – automatic resetting every full hour,
- Daily reset – automatic resetting at any full hour set in the group of settings Nominal month beginning (see Sec. 5.8),
- Monthly reset – automatic resetting at the same day of each month and at the same full hour set in the group of settings Nominal month beginning (see Sec. 5.8).

Select measurement unit and resolution of indications for each totaliser (Format parameter does not have any effect on counting accuracy and may be changed at any time without any impact on a counted value).

5.8 Beginning of a month

Day = 00 (Enter 1...28, The last one)

Hour = 00

Settings from the group of Nominal month beginning are important for totalisers (see Sec. 5.7).

5.9 Main archive

Rec interval → 3 secs (PAUSE, 3 secs, 4 secs, 5 secs, 6 secs, 10 secs, 12 secs, 15 secs, 20 secs, 30 secs, 1 min, 2 mins, 3 mins, 4 mins, 5 mins, 6 mins, 10 mins, 12 mins, 15 mins, 20 mins, 30 mins, 1 h, 2 h, 3 h, 4 h, 6 h, 8 h, 12 h, 24 h)

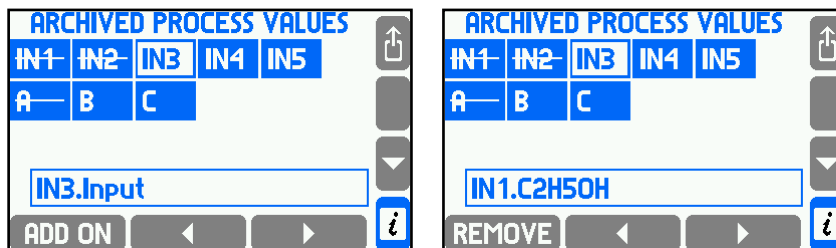
Archived process values

Mode → Overwrite (Overwrite, One file, Successive files)

File size → Entire memory (Entire memory, 2 MB, 4 MB, 8 MB, 16 MB, 32 MB, 64 MB, 128 MB, 256 MB, 24H, Week, Month)

Restore previous settings

Select interval of data recording to file and define data to record (in default setting all results are recorded). Select Archived process values. Use keys to select inputs/ dispensers one by one from the list of archived values and click **ADD ON** or **REMOVE** to add or delete the selected item, respectively. Crossed-out value means non-configured (disabled) input or dispenser.



Mode and File size options are used to manage organization of files with archived data in the device memory. Once the data file has reached the size set in File size option, the device behaviour depends on Mode setting:

- Mode → Overwrite: the oldest records are overwritten with the newest data,
- Mode → One file: recording stops,
- Mode → Successive files: next archive file of the set size is automatically created

5.10 Totaliser Archive

Interval of data recording to archive file is fixed (every 15 min.). Select Archived totalisers.

Use keys to select totalisers one by one from the list of archived totalisers and click **ADD ON** or **REMOVE** key to add or delete the selected totaliser. Crossed-out value means the given totaliser is disabled.



5.11 RS-485 Port

Protocol → ASCII (ASCII, Modbus RTU)

Device ID = 1

Baud rate → 115200 (2400, 4800, 9600, 19200, 38400, 57600, 115200)

Parity → EVEN (EVEN, ODD, NONE)

CRC7 check → No (No, Yes)

Min delay → 50 ms (10 ms, 20 ms, 30 ms, 50 ms, 70 ms, 100 ms, 150 ms, 200 ms, 300 ms, 400 ms)

Max delay → 1500 ms (500 ms, 600 ms, 700 ms, 800 ms, 1000 ms, 1200 ms, 1500 ms, 2000 ms)

Communication is established using ASCII or Modbus RTU protocol (selectable in Protocol option). Details, including maps of Modbus RTU protocol logs are provided in Sec.9. The address (set within the range of 0 to 99) identifies the device in network and must be unique. Baud rate and Parity values should be set the same as in PC or controller, which is a network master. Min delay means minimum time between receiving a request and sending a response.



CRC7 check and Max delay refer to communication using ASCII protocol only. Setting CRC7 check → No means the device does not check whether CRC code in received data packages is correct (the device always attaches CRC code to data package sent). If the device fails to send a response within Max delay time, it sends a code of non-readiness instead.

Read-out of data through the RS-485 port has no effect on communication through Ethernet port and v.v.

5.12 Ethernet Port

The dispenser may work in industrial Ethernet network. Communication is made using Modbus TCP protocol (details, including maps of Modbus TCP protocol logs are provided in Sec. 9).

IP → 1.0.0.1

Port = 502

Mask → 255.255.255.0

Gate → 1.0.0.1

DHCP server → Off (Off, On)

Timeout = 60 secs

Set IP address, subnetwork mask and default gate parameters in compliance with the network in which the dispenser will operate. Switch the DHCP server off. It is recommended to set the port at 502 as it is the port dedicated to Modbus TCP. Connection timeout defines maximum time without data exchange between the master device and the dispenser. Once this time has elapsed, the connection is automatically interrupted (it is deemed inactive due to e.g. emergency switch off of the master device, etc.)

Read-out of measurement data through and the number of clients connected (max. 4) to Ethernet port have no effect on communication through RS-485 port and vice versa.

5.13 Description of the device

Description of the device is displayed:

- during device start-up on its screen,
- in Info screen (see Sec. 2.2),
- in WWW server (see Sec. 2.12).

5.14 Change to DST and v.v.

The device automatically changes standard time to Daylight Saving Time and v.v. at the last Sunday of October and of March, respectively.

5.15 Admin Menu

The group of Administrative data functions is available to ADMIN user only.

5.15.1 Protected operations

Select the operations with access to be password-protected (so selected commands will be executable only upon logging-in).

Protected commands

Archiving commands → No (Yes, No)

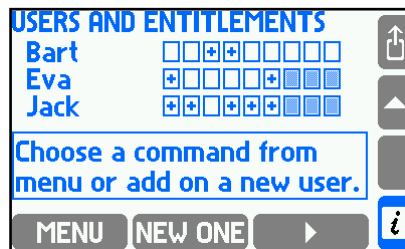
Copy files → No (Yes, No)

Resetting min,max → No (Yes, No)

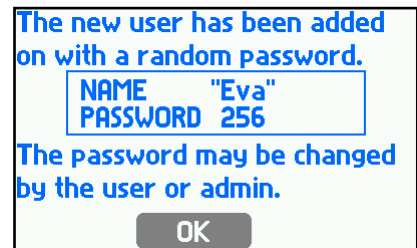
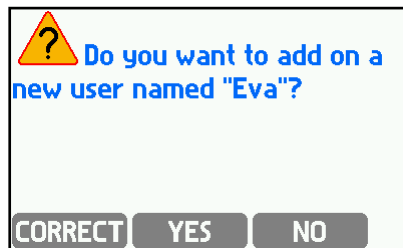
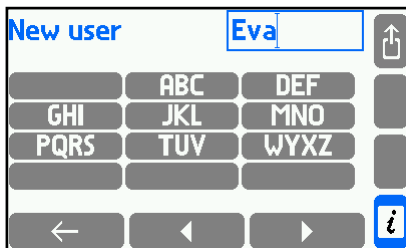
- Adjusting clock → No (Yes, No)
- Resetting totalisers → No (Yes, No)
- Main settings → No (Yes, No)
- Alarm settings → No (Yes, No)
- Screen settings → No (Yes, No)
- Archiving settings → No (Yes, No)

Enabling password protection for any group in Alarm settings, Screen settings OR Archiving settings results in automatic password protection of Main settings, while disabling password protection for Main settings results in automatic disabling of password protection for Alarm settings, Screen settings and Archiving settings.

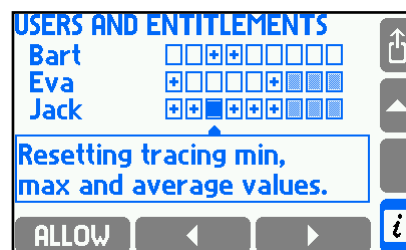
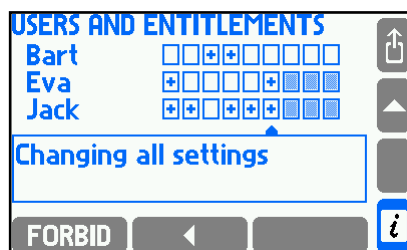
5.15.2 Users and access rights



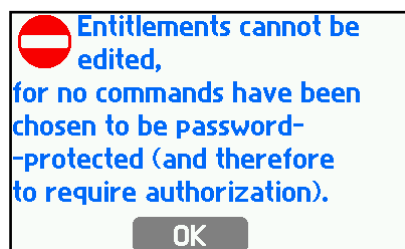
To add new user - place cursor in the user list, click **NEW ONE**, and enter the user name.



Next, select protected operations, which should be accessible to the given user. To add/ delete the access rights - use arrow keys to place cursor in appropriate box in the table (the list of operations comprised in the column in which cursor is placed is displayed below the table) and click **ALLOW** or **FORBID**.

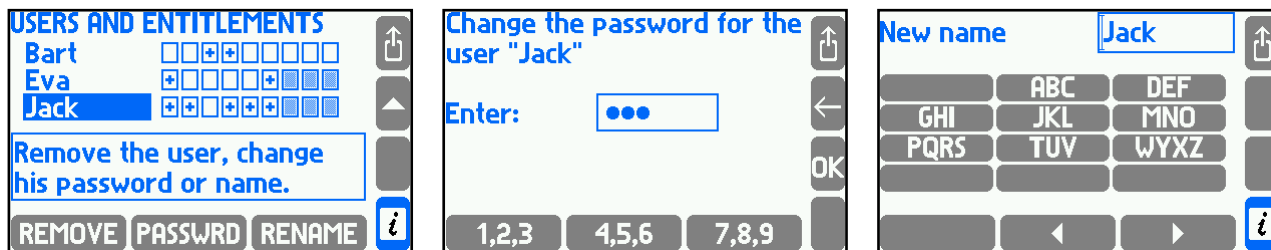


Only the operations, which require authorization are displayed in the table. If no operation requires authorization, following message is displayed:



„+” sign means the given user is authorized to perform respective operation.

Click **MENU** to change password (**PASSWRD**), user name (**RENAME**) or delete selected user (**REMOVE**). Only ADMIN user is authorized to perform these operations.



5.15.3 Log-out after

Set the time elapsing from the last operation performed on the device after which the user will be automatically logged-out (30 secs, 1 mins, 2 mins, 3 mins, 5 mins, 10 mins).

5.15.4 Minimum password length

Set minimum length of password for new created users: 3 digs, 4 digs, 5 digs (the change has no effect on passwords of existing users).

5.16 Import and recording of settings

The device settings may be:

- imported from the file saved in USB mass storage device to the dispenser → Main menu → Load or save settings → Load; Import of new settings requires to stop archiving;
- saved in main directory of USB mass storage device → Main menu → Load or save settings → Save; two files are recorded: *SETT_[adr].txt* and *SETT_[adr].ust* (where *adr* – address of the device in RS485 network). Any file of the same name already saved in USB mass storage device will be overwritten.

USB mass storage device (USB flash drive) has to remain inserted into USB port during performance of these operations.

5.17 Restoring factory settings

Select → Main menu → Restore factory settings to restore factory settings without possibility to restore. All totalisers and entries to the logs (except of calibration log) are cleared after saving of log files on SD card. SD card is not cleared. Once the factory settings have been restored, the device starts operation from Language Selection screen.

**6 Technical data**

User interface, front panel	
Display type	LCD TFT color, 272 x 480 pixels
Readout field size	43.8 mm x 77.4 mm
LED indication	3 two-color LEDs, red-orange-green
Keyboard	19 membrane buttons
Inputs organization	
2 x I:	IN1, IN2
3 x I / PULSE:	IN3, IN4, IN5
0/4-20mA type analog inputs	
Signal type	0-20mA or 4-20mA
Transmitter connection	Passive transmitter (supplied from measuring loop) or active converter
Input resistance	100 Ω \pm 10%
Transmitters supply	24 V DC / max 22 mA
A/D converter resolution	18 bits
Accuracy (Ta = 20 °C)	\pm 0,1% of the range (typical \pm 0,05% of the range)
Temperature drift	Max \pm 50 ppm / °C
Galvanic isolation between inputs	No, common potential GND for all inputs
Galvanic isolation to supply voltage	400 VAC
Signal type	0-20mA or 4-20mA
PULSE type inputs (pulse/frequency)	
Maximum input voltage	\pm 28 VDC
Galvanic isolation between inputs	No, common potential GND for all inputs
Galvanic isolation to supply voltage	400 VAC
Functions	Pulse counting Frequency measurement
Measuring range	0,001 Hz to 10 kHz (0,001 Hz to 1 kHz with connected filtering capacitor)
Minimum pulse width	20 μ s 0.5 ms, with filtrating capacitor
Accuracy (Ta = 20 °C)	0,02%
Configuration: OC / contact (default)	
Voltage(OC)	12 V
Current (contact)	12 mA
On / off threshold	2,7 V / 2,4 V
Configuration: input voltage	
Input resistance	>10 k Ω
On / off threshold	2,7 V / 2,4 V
Voltage (open)	12 V
NAMUR configuration	
High impedance state	0,4 mA – 1 mA
Low impedance state	2,2 mA – 6,5 mA
4-20 mA analog outputs (optional)	
Number of outputs	No, 1 or 2
Output signal	4-20mA
Maximum voltage between I+ and I-	28 VDC
Loop resistance (for Ucc = 24 V)	0 .. 500 Ω
Converter resolution D/A	16 bits
Accuracy	0,5% of the range
Current loop supply	External or from internal unit supply 24 V DC / 22 mA
Galvanic isolation to supply voltage	400 VAC



Binary outputs	
Number of outputs	4, mutually separated
Outputs type	Semiconductor relays
Maximum load current	100 mA DC/AC
Maximum voltage	60 V DC/AC
Galvanic isolation	400 VAC
RS485 serial port	
Maximum load	32 receivers / transmitters
Maximum line length	1200 m
Maximum differential voltage A(+) – B(-)	-8 V ... +13 V
Maximum total voltage A(+) – „ground“ or B(-) – „ground“	-7 .. +12 V
Transmitter minimum output signal	1,5 V (at R ₀ = 54 Ω)
Receiver minimum sensitivity	200 mV / RWE = 12 kΩ
Minimum impedance of data transmission line	27 Ω
Internal terminating resistor	Yes, activated by short-circuit pins on terminal block
Short circuit/ thermal protection	Yes
Transmission protocol	ASCII Modbus RTU
Baud rate	1.2, 2.4, 4.8, 9.6, 19.2, 38.4, 57.6, 115.2 kbps
Parity control	Even, Odd, None
Frame	1 start bit, 8 data bits, 1 stop bit
Galvanic isolation	No
Ethernet port	
Transmission protocol	Modbus TCP, ICMP (ping), DHCP server, http server
Interface	10BaseT Ethernet
Data buffer	300 B
Number of open connections (simultaneously)	4
Connector type	RJ-45
LED signaling	2 (build in RJ-45 socket)
USB port	
Socket type	A type, according to USB standard
Version	USB 1.1
Socket protection class	IP-54
Data format	FAT16
Read/write signaling	Red/green/yellow LED on front panel
Archiving, internal data memory	
Memory capacity	2 GB (nonvolatile memory)
Recording format	FAT16 (within a limited scope)
Recording indication	Green-red USB LED on the front panel
BC-3 and BC-3N power supply	
Supply voltage	24 VAC (+5% / -10%) or 24 VDC (15 .. 30 VDC)
Maximum power consumption	6 VA / 6 W
BC-3N power supply	
Supply voltage	100 – 240 VAC 50/60Hz
Maximum power consumption	16 VA
BC-3 casing - dimensions	
Casing type	For panel surface, nonflammable plastic material „Noryl“
Dimensions (height x width x depth)	96 mm x 192 mm x 63,5 mm
Housing depth with terminals (without extra space for cables)	ca. 72 mm
Panel cut-out dimensions	186 ^{+1,1} mm X 92 ^{+0,6} mm
Panel maximum thickness	5 mm



BC-3, BC-3N

Weight	ca. 0,7 kg
Protection class from the front panel	IP-54
Protection class from the rear panel	IP-30
BC-3N casing - dimensions	
Casing type	Wall mounting, ABS
Dimensions (height x width x depth)	217 mm X 257 mm X 125 mm (without cable glands) 247 mm X 257 mm X 125 mm (with cable glands)
Weight	ca. 2,1 kg
Protection class	IP-54
Wire connection	
BC-3	Screw type terminal blocks, max. cable diameter 1,5 mm ²
BC-3N	Spring type terminal blocks, cable diameter 0,2 mm ² – 1,5 mm ² Screw type terminal block, cable diameter 0,2 mm ² – 1,5 mm ²
Climate conditions	
Ambient temperature	0 .. +40 °C
Relative humidity	0 .. 75% (without steam condensation)
Storage temperature	-20 .. +80 °C

7 Complete delivery and accessories

7.1 Content of BC-3

- Batch controller BC-3 1 pc.
- Terminal blocks 1 set
- Fixing clamps 4 pcs.
- Printed operating manual – short version 1 pc.
- CD 1 pc.
- Warranty 1 pc.
- Calibration card 1 pc.
- Cartoon package 1 pc.

7.2 Content of BC-3N

- Batch controller BC-3N 1 pc.
- Printed operating manual – short version 1 pc.
- CD 1 pc.
- Warranty 1 pc.
- Calibration card 1 pc.
- Cartoon package 1 pc.

7.3 Accessories

- Converter RS485 <-> USB with galvanic isolation CONV485USB-I
- Converter RS485 <-> USB without galvanic isolation CONV485USB
- Converter RS485 <-> Ethernet CONV485E
- Software for data processing and visualization
- Software for setup configuration
- Power supply transformer, manufactured by Breve PSS 10 VA, 230 V AC / 24 V AC
- Power supply transformer, manufactured by Breve PSS 30 VA, 230 V AC / 24 V AC



8 Entity launching the product on European Union market

Manufacturer: METRONIC AKP s.c.
st. Żmujdzka 3
PL 31- 426 Kraków, Poland
Tel.: (+48) 12 312 16 80
www.metronic.pl

Vendor:



Notes:



Notes:



Notes:

9 Modbus RTU / Modbus TCP protocol

Modbus RTU / Modbus TCP protocol in batch controller BC-3 allows:

- readout of current results,
- readout of relay outputs state,
- readout of archived data,
- clock readout and setting.

The document contains the full map device registers with a description.

There are four Modbus function implemented:

- 03 – Read Holding Registers – for reading current results, totalisers, relays outputs state and archived data,
- 04 – Read Input Registers – for reading current results, totalisers, relays outputs state and archived data,
- 08 – Diagnostics – diagnostics function,
- 10 – Write Multiple Registers – function for writing to one or multiple registers.

Modbus RTU is available at RS-485 port and Modbus TCP is available at Ethernet port.

9.1 Serial port RS485 settings for Modbus RTU

NOTE!!!

Mode **Modbus RTU** and other transmission parameters should be set according to the parameters of the master system.

- Mode: Modbus RTU
- Address: 01 (01, .. , 99)
- Baud rate: 9600 (2400, .. , 115,2k)
- Parity EVEN (NONE, ODD, EVEN)
- Response delay (min): 50ms (10, 20, 30, 50, 70, 100, 150, 200, 300, 400 ms)

Transmission parameters do not allow to set maximum time („Response delay (max):”) because in Modbus RTU mode response to a command is sent immediately. The maximum delay is not more than few ms.

According to MODBUS standard in RTU mode a frame (transmitted information) is as follows:

Start	Address	Function	Data	CRC control	End
T1 ... T4	1 bytes	1 bytes	n bytes	2 bytes	T1 ... T4

Information transmitted from the master computer to the device is a query whereas the device sends a response.

9.2 Ethernet port settings for Modbus TCP

- Address IP
- Port (typically 502)
- Mask (e.g. 255.255.255.0)
- Gate (e.g. 1.0.0.1)
- DHCP server (off for normal operation)
- Timeout (typically 60 s)



NOTE!!!

Using port 502 is recommended, since it is registered for Modbus TCP.

According to MODBUS standard in TCP/IP mode, the frame is as follows:

MBAP Header	Function	Data
7 bytes	1 bytes	n bytes

Information transmitted from the master computer to the device is a query whereas the device sends a response.

9.3 Readout of current results and totalisers

Readout function (03 – Read Holding registers, 04 – Read Input Registers) has a form:

Function (1B)	Initial address (2B)	Number of registers (2B)
---------------	----------------------	--------------------------

Function – 04 HEX or 03 HEX – process values and totalisers readout.

Initial address – an address of a device from which data are to be sent.

Number of registers – two-byte registers for readout.

In response the device transmits a sequence of characters in form of:

Function (1B)	Number of bytes (1B)	Data sequence (nB)
---------------	----------------------	--------------------

Function – acknowledge, in case of error 80 HEX value is added on to the command code.

Error codes possible for the device are:

- 01 HEX – incorrect function (in case of diagnostics also impermissible subfunction),
- 02 HEX – incorrect initial address,
- 03 HEX – incorrect number of points.

Queries are not confirmed by a response in case of:

- parity error,
- CRC errors,
- address error.

Number of bytes – n bytes transmitted in response (but not number of registers).

Data sequence – n bytes of register contents.

9.3.1 Registers' addresses for current results

Current results are available in single floating point format, according to IEEE-754 standard for 32-bit numbers (4 bytes).

Registers' addresses (hex)	Registers' addresses (hex)	Description
0080, 0081	128, 129	Current value input IN1
0082, 0083	130, 131	Current value input IN2
0084, 0085	132, 133	Current value input IN3
0086, 0087	134, 135	Current value input IN4
0088, 0089	136, 137	Current value input IN5
008A, 008B	138, 139	Current value dispenser A
008C, 008D	140, 141	Current value dispenser B
008E, 008F	142, 143	Current value dispenser C

9.3.2 Registers' addresses for relay outputs readout

Registers' addresses (hex)	Registers' addresses (hex)	Description	Format
----------------------------	----------------------------	-------------	--------



0300	768	State RL1	integer
0301	769	State RL2	integer
0302	770	State RL3	integer
0303	771	State RL4	integer

Value „1” – relay closed

Value „0” – relay open

9.3.3 Registers' addresses for totalisers

Totalisers are available in two formats: in special integer format (4 bytes) and in double floating point format, according to IEEE-754 standard for 64-bit numbers (8 bytes).

NOTE!!!

Totalisers values in Modbus registers are updated every 2 sec.

Registers' addresses (hex)	Registers' addresses (hex)	Description	Format
0400 ... 0403	1024 ... 1027	Totaliser 1 input IN1	floating point double
0404 ... 0407	1028 ... 1031	Totaliser 2 input IN1	floating point double
0408 ... 040B	1032 ... 1035	Totaliser 1 input IN2	floating point double
040C ... 040F	1036 ... 1039	Totaliser 2 input IN2	floating point double
0410 ... 0413	1040 ... 1043	Totaliser 1 input IN3	floating point double
0414 ... 0417	1044 ... 1047	Totaliser 2 input IN3	floating point double
0418 ... 041B	1048 ... 1051	Totaliser 1 input IN4	floating point double
041C ... 041F	1052 ... 1055	Totaliser 2 input IN4	floating point double
0420 ... 0423	1056 ... 1059	Totaliser 1 input IN5	floating point double
0424 ... 0427	1060 ... 1063	Totaliser 2 input IN5	floating point double
0428 ... 042B	1064 ... 1067	Totaliser 1 dispenser A	floating point double
042C ... 042F	1068 ... 1071	Totaliser 2 dispenser A	floating point double
0430 ... 0433	1072 ... 1075	Totaliser 1 dispenser B	floating point double
0434 ... 0437	1076 ... 1079	Totaliser 2 dispenser B	floating point double
0438 ... 043B	1080 ... 1083	Totaliser 1 dispenser C	floating point double
043C ... 043F	1084 ... 1087	Totaliser 2 dispenser C	floating point double

Registers' addresses (hex)	Registers' addresses (hex)	Description	Format
0600 ... 0601	1536 ... 1537	Totaliser 1 input IN1	integer
0602 ... 0603	1538 ... 1539	Totaliser 2 input IN1	integer
0604 ... 0605	1540 ... 1541	Totaliser 1 input IN2	integer
0606 ... 0607	1542 ... 1543	Totaliser 2 input IN2	integer
0608 ... 0609	1544 ... 1545	Totaliser 1 input IN3	integer
060A ... 060B	1546 ... 1547	Totaliser 2 input IN3	integer
060C ... 060D	1548 ... 1549	Totaliser 1 input IN4	integer
060E ... 060F	1550 ... 1551	Totaliser 2 input IN4	integer
0610 ... 0611	1552 ... 1553	Totaliser 1 input IN5	integer
0612 ... 0613	1554 ... 1555	Totaliser 2 input IN5	integer
0614 ... 0615	1556 ... 1557	Totaliser 1 dispenser A	integer
0616 ... 0617	1558 ... 1559	Totaliser 2 dispenser A	integer
0618 ... 0619	1560 ... 1561	Totaliser 1 dispenser B	integer
061A ... 061B	1562 ... 1563	Totaliser 2 dispenser B	integer
061C ... 061D	1564 ... 1565	Totaliser 1 dispenser C	integer
061E ... 061F	1566 ... 1567	Totaliser 2 dispenser C	integer

9.4 Reading out archive

Readout of main archive is to read the file stored in the internal memory of the device using the Modbus functions. Three functions are used to readout archive: 04 (Read Input Registers) or 03 (Read Holding Registers) and 10 (Write Multiple Registers).

The modification of values, required to readout archives, is possible by function 10 (Write Multiple Registers):



- step (see section 9.4.1 – register 0200),
- time (see section 9.4.1 – registers 0201, 0202 and 0203),
- number (see section 9.4.1 – registers 0204 and 0205).

Record function (query) has a form:

Function (1B)	Initial address (2B)	Number of registers = N (2B)	Number of data bytes (1B)	Data to record (N x 2B)
------------------	-------------------------	---------------------------------	---------------------------------	----------------------------

Function – 10 HEX – record to one or several registers.

Initial address – an address of first register.

Number of registers – two-byte registers for record.

Number of data bytes – number of bytes which will be recorded.

Data to record – data bytes which will be record to specified registers.

In response the device transmits a sequence of characters in form of:

Function (1B)	Initial address (2B)	Number of registers (2B)
---------------	-------------------------	-----------------------------

Function – acknowledge, in case of error 80 HEX value is added on to the command code.

Error codes possible for the device are:

- 01 HEX – incorrect function (in case of diagnostics also impermissible subfunction),
- 02 HEX – incorrect initial address,
- 03 HEX – incorrect number of points.

Queries are not confirmed by a response in case of:

- parity error,
- CRC errors,
- address error.

Initial address – an address of first register contenting recorded data.

Number of registers – number of registers contenting recorded data.

NOTE!!!

It's possible to record just one field (step, number or time) in single 10 query.

Queries containing more than one field or any field partially (ex. only 0204 register) will be rejected with error code 02.

Algorithm to readout archive of current results:

- to readout an archive of current results is useful 04 function (or 03 function).
- registers 0100...0116 contain general information,
- registers 0206...02FF contain one record or one headline.
- every readout query containing registers 0204 or 0205 causes move on to consecutive record (number of record is increased by value of register 0200, default 1, can be substituted by input of new value using 10 function) or to consecutive headline.
- after readout of registers 0204 and 0205, new record or next headline will be available at registers 0206...02FF,
- readout of last headline or last record causes move on to first record.
- to move on to selected headline, record selected number to registers 0204 and 0205 is required,
- to move on to selected record, it's required to record selected number or time of record to proper register (0204, 0205 – number of record, 0201...0203 – time of record) using an 10 function.



9.4.1 Mapa rejestrów do odczytu archiwum głównego

Registers' addresses HEX	Registers' addresses DEC	Format	Description
General information			
0100, 0101	256, 257	Ulong	Number of available records
0102, 0103	258, 259	Ulong	Number of saved records
0104, 0105	260, 261	Ulong	Fill, number of records saved since indicator of memory space usage was reset.
0106, 0107	262, 263	Ulong	Last saved record, consecutive number of last saved record.
0108, 0109, 010A	264, 265, 266	Time	Time of highest record
010B, 010C, 010D	267, 268, 269	Time	Time of lowest record
010E, 010F, 0110	270, 271, 272	Time	Time of memory space usage indicator reset
0111, 0112, 0113	273, 274, 275	Time	Expected time of end of memory space. Values of 0x00 denote that archive is fulfilled. Values of 0xFF denote that expected time won't be in 21st century
0114	276	Uint	Status: 0 – correct value 1 – channel off 2 – failure 3 – open circuit 0/4-20mA 4 – exceeding calculation range 5 – exceeding in 0/4-20mA circuit 6 – lack of measurement results -F- -II- -R- -E-
0115	277	Uint	Size of record in bytes (without end of line characters)
0116	278	Uint	Size of headline
Record or headline			
0200	512	Uint	Step, number of records to move on after every readout. Don't concern headline readout.
0201, 0202, 0203	513, 514, 515	Time	Time of record save. If there's no record in registers 0206...02FF, then value in this field is random.
0204, 0205	516, 517	Ulong	Points which record or which headline's is currently available in registers 0206...02FF: 0xFFFFFFFF – no data in registers 0206...02FF, 0...0x7FFFFFFFF – consecutive records, Up from 0x80000000 – number of headline NOTE!!! For example, line 3 is 0x80000002
0206	518	2 x char	Record or headline in string form ended by null digit . There are two ASCII chars in each register (first one is on the highest bytes). Late, unused registers are filled by zero digits. String doesn't contain end of line characters.
...		...	
02FF	767	2 x char	

Table formats:

Uint – unsigned integer saved in one register (2bytes),

Ulong – unsigned integer saved in two registers (4 bytes), in first register are saved lowest 16 bites of them,

Time – consecutive:

- Year (High byte of first register),
- Month (Low byte of first register),
- Day (High byte of second register),
- Hour (Low byte of second register),
- Minutes (High byte of third register),
- Seconds (Low byte of third register).

Char – one char on one byte.

NOTE!!!

For instance, for 4 byte number ABCD:



CD – low 16 bits (low byte),
AB – high 16 bits (high byte).

9.4.2 Registers' addresses to which recording is possible

Registers' addresses HEX	Registers' addresses DEC	Format	Description
0200	512	Uint	Step, number of records to move on after every readout. Don't concern headline readout.
0201, 0202, 0203	513, 514, 515	Time	Time of record save. If there's no record in registers 0206...02FF, then value in this field is random .
0204, 0205	516, 517	Ulong	Points which record or which headline is currently shared in registers 0206...02FF: 0xFFFFFFFF – no data in registers 0206...02FF, 0...0x7FFFFFFF – consecutive records Up from 0x80000000 – number of headline NOTE!!! For example, line 3 is 0x80000002

Table formats:

Uint – unsigned integer saved in one register (2bytes),

Ulong – unsigned integer saved in two registers (4 bytes), in first register are saved lowest 16 bites of them,

Time – consecutive:

- Year (High byte of first register),
- Month (Low byte of first register),
- Day (High byte of second register),
- Hour(Low byte of second register),
- Minutes (High byte of third register),
- Seconds (Low byte of third register).

Char – one char on one byte.

NOTE!!!

For instance, for 4 byte number ABCD:

CD – low 16 bits (low byte),

AB – high 16 bits (high byte).

9.4.3 Readout and settings of clock

Current time is read by 04 or 03 command.

To modify clock's settings user should use 10 command. This command have to contain strictly all three registers. In another time will be rejected with error code 02.

9.4.4 Registers' addresses of clock

Registers' addresses HEX	Registers' addresses DEC	Format	Description	
			High byte	Low byte
0020	32	Time	Year	Month
0021	33	Time	Day	Hour
0022	34	Time	Minute	Second

NOTE!!!

For instance, for 2 byte number AB:

B – low 8 bits (low byte),

A – high 8 bits (high byte).



Year, month, Day, hour, minute, second should be entered in HEX system. In the following table is an example for date 2009-12-25 and time 15:40:00:

Registers' addresses HEX	Registers' addresses DEC	Number
0020	32	090C
0021	33	190F
0022	34	2800

9.5 Function 08 (Diagnostics)

Device accepts only one diagnostics command – return of received control data (“echo”).

Diagnostics function (query) has a form:

Function (1B)	Subfunction (2B)	Data (2B)
---------------	------------------	-----------

Function – 08 HEX – diagnostics.

Subfunction – only 0000 HEX – return of received data.

Data – two bytes of data in any value.

In response, the device transmits a sequence of characters in form of:

Function (1B)	Subfunction (2B)	Data (2B)
---------------	------------------	-----------

Funkcja – potwierdzenie zwrotne, w przypadku błędu do wartości kodu rozkazu dodana jest wartość 80 HEX.

Function – acknowledge, in case of error 80 HEX value is added on to the command code.

Error codes possible for the device are:

- 01 HEX – incorrect function (in case of diagnostics also impermissible subfunction),
- 02 HEX – incorrect initial address,
- 03 HEX – incorrect number of points.

Queries are not confirmed by a response in case of:

- parity error,
- CRC errors,
- address error.

Subfunction – acknowledgement.

Data – return of two received bytes of data.