

USER MANUAL

-  IP65
Protection rate
-  Memory up to
104 thousand records
-  Clock
-  Alarms



AR236.B



AR232.B

-  USB
-  Bluetooth
-  Software
-  Data protection

BATTERY - POWERED RECORDERS OF HUMIDITY AND/OR TEMPERATURE



*Thank you for choosing our product.
 This manual will enable proper handling, secure
 operating and full use of the recorder's capabilities.
 Before assembling and starting the device please read
 and understand this manual.*

If you have any additional questions, please contact our technical consultant.

TABLE OF CONTENTS

1. RULES OF SAFE USE	3
2. GENERAL CHARACTERISTICS OF RECORDERS.....	3
3. CONTENT OF THE SET.....	4
4. TECHNICAL DATA.....	4
5. DIMENSIONS OF HOUSING AND DESCRIPTION OF EXTERNAL ELEMENTS.....	6
6. DESCRIPTION OF THE FUNCTIONS OF THE BUTTONS AND LCD DISPLAY.....	7
7. CONNECTING TO A COMPUTER AND INSTALLING USB DRIVERS	8
8. SOFTWARE INSTALLATION.....	8
9. SETTING CONFIGURATION PARAMETERS.....	8
9.1. INTERNAL CLOCK OPTIONS.....	9
9.2. RECORDING OPTIONS.....	9
9.3. DISPLAY AND MEASUREMENTS OPTIONS.....	10
9.4. BUTTONS' FUNCTIONS AND ACCESS OPTIONS.....	11
9.4.1. HANDLING BLUETOOTH RADIO COMMUNICATION (BLE).....	12
9.5. ALARMS' CONFIGURATION.....	12
10. CREATING AND REVIEWING RECORDED MEASUREMENTS AND EVENTS.....	14
11. SIGNALING MESSAGES AND ERRORS.....	14
12. IMPORTANT EXPLOITATION REMARKS. TROUBLESHOOTING.....	15
13. BATTERY REPLACEMENT.....	16
14. USER'S NOTES.....	16



Special attention should be paid to texts marked with this sign

The manufacturer reserves the right to make changes to the design and software of the device without any deterioration of technical parameters (some functions may not be available in older versions). Upgrading to the latest firmware version may require reconfiguration of the device.

1. RULES OF SAFE USE



Before using the device, carefully read this manual and ensure proper working conditions, in accordance with technical data (chapter 4, humidity, temperature, etc.), also do not expose the recorder and measurement probe to direct and strong influence of thermal radiation.

The device has been designed to provide an adequate level of resistance to most of the disturbances that can occur in working environments. However, in environments with an unknown level of interference, it is recommended to use the following measures to prevent any possible disruption of the device's operation:

- a) avoid routing the measuring probe in the immediate vicinity and parallel to the power and supply lines
- b) avoid proximity of devices with radio communication, high power, with phase or group power control and other devices generating large electromagnetic, conducted and radiated interference
- c) ground or neutralize the metal rails on which the rail devices are mounted

Before starting working with the device, remove the protective foil of the LCD display.

2. GENERAL CHARACTERISTICS OF THE RECORDERS

- registration of humidity and/or temperature of air or other neutral gases with display of measurements
- available models: **AR236.B** (relative humidity and temperature measurement), **AR232.B** (temperature measurement)
- configurable architecture enabling use in many fields and applications (for industrial, office and residential environments, inside and outside buildings, e.g. warehousing, production, transport, food sector, pharmacy, medicine, gardening, laboratories and others)
- saving data in a standard text file located in the internal memory of the recorder in the FAT system with the option of reading through the USB interface and available software and editing in any spreadsheet such as Microsoft Excel or OpenOffice Calc
- high quality and accuracy digital relative humidity (%RH) and/or temperature (°C/°F) sensor with a protective filter (measuring probe integrated with the casing or external one on the cable)
- tight casing (IP65 protection level) ensures high operational reliability due to high resistance against penetration of water and dust and harmful condensation of steam inside the device
- portable casing with a handle for easy mounting on vertical and horizontal surfaces (after using an additional table base or other user's solutions)
- two-line readable LCD display with icons and measuring units, showing measured values, operating and memory status of the device, battery level and other diagnostic messages
- the possibility of presenting current measurements (relative humidity and/or temperature), calculated values (dew/frost point [°C/°F] and absolute humidity [g/m³]), measurement statistics (maximum, minimum, average) and clock, available HOLD function (stopping measurements)
- power supply from durable AA lithium battery with easy replacement
- long working time on a new battery - up to 15 years, depending on the recording interval, device operating temperature, presence and method of alarm signalling and Bluetooth Low Energy radio communication status (BLE)
- internal clock with the possibility of precise correction of real time counting
- F button for quick selection of one of the programmed functions: date and time display, memory status, measurement statistics, measured or calculated values, START/STOP button blocking, alarm memory clearing, switching on/off the Bluetooth wireless communication (BLE, optional equipment)
- programmable function of START/STOP button: measurement refresh only, start/stop or pause/resume of recording (with or without HOLD function), presentation of memory status (recording method, number of occupied memory and how long will it be enough for)
- a wide range of ways to start recording (continuous, limited by date and time, periodic daily, only during an alarm or manually controlled with the START/STOP button)
- recording in endless mode (when the memory is full, the oldest archives are deleted) or until the memory is full (registration is stopped), total capacity up to 104/94 thousand (AR232.B/AR236.B) records
- programmable archive file size for endless record (number of records)
- included free software (for Windows 7/8/10) enabling reading and graphical or text presentation of recorded results (ARSOFT-LOG) and configuration and copying of device parameters (ARSOFT-CFG), updates available on the website
- free application for mobile devices (smartphone or tablet) to read measurements via the Bluetooth Low Energy interface (MyAmbience for *Android* to be downloaded from Google Play and for *iOS* from the App Store, for *SHT31 Smart Gadget* from Sensirion, English version)

- the ability to copy archival and configuration files directly via the computer's USB port
- programmable password protection for access against unauthorized reading, copying and modification of archival and configuration data
- checksum allowing to detect unauthorized modification of the archive
- the possibility of differentiating archives from many recorders through individual assignment of an identification number (ID)
- programmable types of alarms for humidity and temperature (below or above the threshold with hysteresis, inside band or out of band), intensity, alarm memory and time of insensitivity after resetting alarms memory
- alarm signalling with pulsating LED diodes and sounds (built-in low-volume buzzer)
- programmable displayed values (measurement values, calculated values, statistics or clock), recording and alarms options, and other configuration parameters, such as zero calibration of the measured quantity, type of thermometric scale (Celsius [°C] or Fahrenheit [°F]), indications resolution, identification number (ID), state of the BLE interface, etc.
- saving in archives files the data and events, such as measured or calculated values, USB connection/disconnection, start/stop or pause /resume of recording, low battery level, parameter configuration, etc., with order numbers, time stamps and check sum
- temperature compensation of humidity (for AR236.B) and high long-term stability of measurements
- dew/frost point (°C /°F) and absolute humidity (g/m³) calculated on the base of the measurement of the relative humidity (%RH) and sensor's temperature (°C/°F) for constant atmospheric pressure of 1013hPa (for AR236.B)
- intuitive operation, easy configuration and clear signalling of device operation states
- available accessories (you can also buy it through the online store *apar.sklep.pl*):
 - 3.6V lithium battery type AA (R6), 2450mAh, (e.g. SAFT type LS14500)
 - table base (standing)

NOTE:



- before working with the recorder, read this user manual, perform the operations described in chapters 7 and 8, and then set the operating parameters correctly (chapter 9)
- by default, the recorder is configured for the presentation of the relative humidity (%RH) and / or sensor temperature (°C) with data recording off, the F button starts the date and time view, the START/STOP button only refreshes the measurement with the memory status display (recording mode, the amount occupied and how long it will be enough for)
- for humidity and temperature recorder AR236.B it is recommended to periodically check and/or calibrate the device in accordance with the requirements applicable at the place of use or every 12 months

3. CONTENT OF THE SET

- recorder with 3.6V AA lithium battery (e.g. SAFT type LS14500)
- USB cable (A - micro B) for connection to a computer, length 1.5 m
- user's manual, warranty card
- non-obligatory CD with drivers and software (Windows 7/8/10, also available on the website *www.apar.pl* in the *Download* → *Software* section)

4. TECHNICAL DATA

Measuring probe (integrated with the casing or on a 1.5 m long cable, do not pour water over it)		AR236.B	sensor SHT31 from Sensirion, ABS cover (gap width 1mm) and stainless steel mesh (mesh size 0.15mm)
		AR232.B	a digital sensor placed in a stainless steel tube
Measuring range for the probe (other than the nominal operating condition, in the table below)	- humidity	AR236.B	0 ÷ 100 % RH (does not apply to AR232.B)
	- temperature		-30 ÷ 80 °C (for each version of AR236.B and AR232.B/1), -50 ÷ 120 °C (AR232.B/2 - with probe on the wire)
Measurement accuracy	- humidity	AR236.B	typically ±2 %RH (maximum ±2.5 %RH in the range 0 ÷ 90 % RH and ± 3.5 %RH in the range 90÷100 %RH)
	- temperature	AR236.B	typically ±0.3 °C (maximum ±0.4 °C)
		AR232.B	±0.5 °C in the range -10 ÷ 85 °C, ±0.5 ÷ 2 °C in the remaining range

Measuring resolution	0.1 %RH/°C, for displaying, programmable 0.1 or 1
Hysteresis (not applicable to AR232.B)	± 0.8 % RH
Long-term stability (3)	<0.25 %RH/year (does not apply to AR232.B)
Response time (63%)	8s (airflow required> 3.6 km/h, 1m/s)
Measurement update period	5s (on battery power and always for Bluetooth communication) or 1s (after connecting to the computer's USB port)
Working environment	air and neutral gases, dust-free (for AR236.B)
Communication interface for a computer	USB (micro B connector), drivers for Windows 7/8/10
Bluetooth Low Energy radio interface (optional)	BLE, version 4.2, range (depending on the type of obstacles, the relative location and used mobile equipment) < 9m
Data memory (4MB, internal, non-volatile, FLASH type, FAT file system)	up to 94/104 thousand (AR236.B/AR232.B) records in endless (circular) mode or until memory is full
Data recording interval (1)	programmable from 5s to 8 hours, every 5s
Real time clock (RTC)	quartz, date (yyyy: mm: dd), time (hh: mm: ss), includes leap years, with the correction of time counting
Optical and audio signalling	LCD display, 2 LED red alarm diodes, buzzer (low volume, for working in silent environment)
LCD display (without backlight)	2 lines of 4 digits, 7-segment, 8 mm high, signalling icons and measurement units
Power supply (lithium battery)	3.6V size AA (R6), 2450mAh, e.g. SAFT type LS14500
Working time of a new battery (2)	up to 15 years (at 20 ÷ 30°C), battery level indication
Nominal operating conditions	-20 ÷ 70°C, <100% RH (without condensation)
Casing	portable, ABS material, light grey color
Protection level	IP65 for housing, IP41 for measuring probe (for AR236.B)
Casing dimensions (details in chapter 5)	77x111x32 mm (without probe and hanging holder)
Operating position	any position or sensor cover down when the probe is exposed to direct contact with water
Weight	~ 150g (with battery and probe integrated with the casing)

Notes:

- (1) - registration is always held (pause) during connection to the computer's USB port
- (2) - estimated working time depends on the data recording interval, alarm and Bluetooth (BLE) status and operating temperature:
- a) up to 15 years (recording interval >30min, alarms and BLE always off, operating temperature 20 ÷ 30°C)
 - b) at least 8 years (recording interval >25s, alarms and BLE always off, 20 ÷ 30°C)
 - c) 16 months (recording interval >25s, BLE **or** alarms every 1s with sound signalling continuously present, 20÷30°C)
 - d) 22 months (5 s recording interval, alarms and BLE always off, 20÷30°C)
 - e) 10 months (5 s recording interval, BLE **or** alarms every 1s with sound signalling continuously present, 20 ÷ 30°C)
 - f) 6 months (5 s recording interval, BLE **and** alarms every 1s with sound signalling continuously present, 20÷30°C)
 - g) for alarms occurring sporadically and with the signaling set every 5s, the above times will be significantly longer
 - h) at temperatures around -20° C and +70°C, the above times will be shortened by about 25 ÷ 30% (depending on the type of battery)
 - i) it is possible to use a USB power adaptor (AC power adaptor or powerbank, with the battery continuously present and functioning as a back-up power supply), however it may cause disturbances in the device operation due to the reduction of resistance to harmful external factors at the installation site, such as water, dust, surges in the power grid, etc.
- (3) - for humidity and temperature recorder AR236.B it is recommended to periodically check and/or calibrate the device in accordance with the requirements applicable at the place of use or every 1 year

5. DIMENSIONS OF CASING AND DESCRIPTION OF EXTERNAL ELEMENTS

a) casing dimensions in the standard version (integrated measuring probe, AR236.B/1, AR232.B/1)

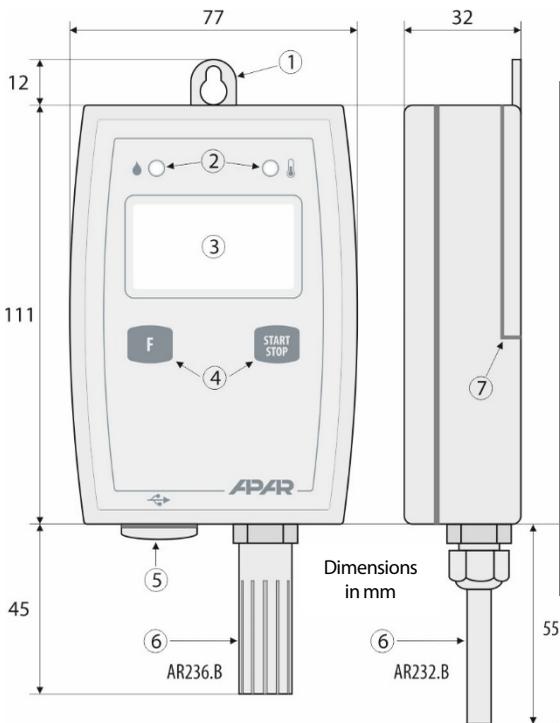


Table 5. Items Description

Item	Description
①	hanging holder to hang on hook/screw
②	alarm LED diodes for relative humidity (%RH, ●) and sensor temperature (°C/°F, ↓), description in chapter 9.5
③	LCD display, chapter 6b
④	function keys, description in chapter 6
⑤	socket cover for USB for communication with the computer and the power supply adaptor (note 2h in chapter 4), details in chapter 7 and 12
⑥	measuring probe (integrated with the casing or on cable, description in point b)
⑦	battery cover with handle ①, battery replacement procedure is described in chapter 13

Fig.5.1. Front view

Fig.5.2. Side view

b) dimensions for measuring probes on the cable (versions AR236.B/2 and AR232.B/2)

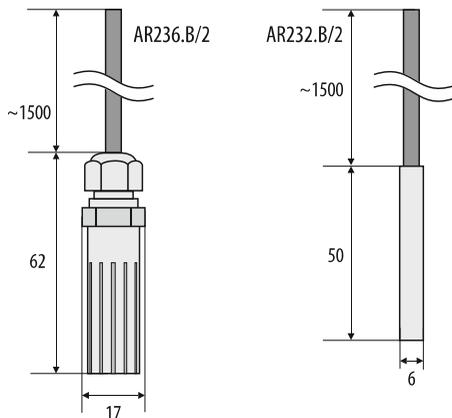


Fig.5.3. View of the measuring probes on the cable

NOTE:



- to unscrew the USB cover you can use a small coin or other item, e.g. a flat screwdriver with a width tip of about 10mm, taking care not to lose this cover
- obtaining a high IP65 tightness class requires correct mounting of the battery cover and the USB cover with rubber gaskets and o-rings provided in the set
- don't unscrew the USB cover, when condensation on the device is possible (e.g. after taking out from the fridge). Wait until the recorder reach ambient temperature, to avoid potential malfunction. If necessary, during this time, recordings can be stopped by programmed START/STOP key (chapter 6).

6. DESCRIPTION OF THE FUNCTIONS OF THE BUTTONS AND LCD DISPLAY

a) functions of the F and START/STOP buttons

Key	Description and the method of marking in the content of the manual
	F - starting the function programmed with the parameter F button function (chapter 9.4), default setting: date and time view
	START/STOP - starting the function programmed with the parameter START/STOP button function (ch.9.4), default: refreshing the measurement with displaying the memory status
 + 	F and START/STOP (simultaneously): - display Device status : firmware version, time, memory status (upper row, chapter 9.4, note 1), battery voltage [V], MAC address for BLE (4 digits) - deleting statistics and alarm memory (after holding time 4-9s), chapter 9.4, note 5

b) functions of LCD display elements

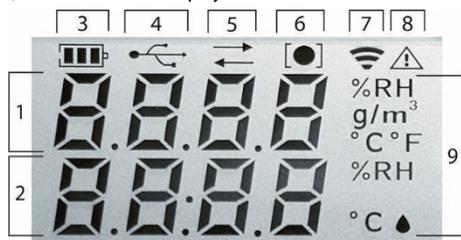


Fig.6. View of all segments of the display

Item	Description [and the method of marking in the content of the manual]		
1, 2	upper and lower row for presentation (in 7-segment code) of measured values or time (description in chapter 9.3) and other messages and errors (chapter 11)		
3	[BAT] - battery level icon		
4	[USB] - icon of connecting to a USB port of a computer or power supply adaptor		
5	[TX / RX] - icon of the USB transmission and recording/reading of the recorder's memory		
6	[●]	saving the archive file is active	[REC] - registration status icon (missing, in progress or pause), registration options are described in chapter 9.2
	[]	pause (pausing the archive recording)	
7		Bluetooth module turned on and ready to be connected to a mobile device	[BLE] - status icon for Bluetooth wireless interface, description in chapter 9.4.1, if there is no icon - BLE module turned off or absent, possible signal level indication:  (weak but within range),  (medium),  (strong)
		the level of the Bluetooth radio signal from the connected mobile device	
8	[NOTE] message and error icon (it always appears together with other icons and codes)	[] + 	recording pause after using the START/STOP key , chapter 9.4
		 + [] + 	recording pause after connecting to the computer's USB port
		[] + Star Error + 	recording pause due to memory error (e.g., full)
		 + 	very low battery level (description of replacement in chapter 13)
		Prob Error or ---- + 	lack of communication with the measuring probe (damage/missing sensor or interruption of electrical connections, see ch. 11)
		 + BLE Error + 	error of the Bluetooth module, additional description in chap.11
9	measuring units of displayed values (display options are described in chapter 9.3)	%RH	relative humidity
		g/m3	absolute humidity
		°C or °F	temperature (Celsius or Fahrenheit scale)
		°C or °F and 	dew/frost point temperature

7. CONNECTING TO A COMPUTER AND INSTALLING USB DRIVERS

Connecting the recorder to the computer's USB port is necessary in order to configure device parameters and to download files with registered data. Access to the USB socket of the recorder is protected by a protective cap, which must be unscrewed before connecting and screwed back again after disconnecting the USB cable.

The supplied ARSOFT series support software for Windows is described in the further part of the manual.

After the first connection, Windows (7/8/10) will detect the recorder under the name **Composite device USB or AR23x (AR236 or AR232)** and will request the installation of virtual COM serial port drivers (MODBUS-RTU protocol, used by the ARSOFT software). In the device manager or the add new hardware creator, you must manually indicate the location containing the drivers (CD-ROM, **DRIVERS** catalogue or downloaded from the website www.apar.pl).

In Windows 8/10 systems, you can use the automatic driver software download from the Windows Update site. In Windows 7, from the **Device Manager** level, the manual installation is as follows:

1. right-click on the AR23x position **and** select **Update Driver Software**, and then **Browse My Computer for Driver Software**
2. use the **Browse** button to indicate on the disk the location (**DRIVERS** folder) containing the drivers and click **Next**
3. installation of the virtual COM port **USB serial device**, press the **Close** button
4. additionally, in the **Disc drives** branch, the system detects and installs **APAR AR23x USB Device**

After the installation is completed, the recorder appears in the system as a removable disk with a capacity of approximately 4MB with the AR23x label and a virtual COMx serial port (x-port number: 1, 2..). The serial port uses the MODBUS-RTU protocol.

In the internal memory (removable disk) a text configuration file is visible: *AR23x.B.cfg* or *AR23x.BT.cfg* (for the version with Bluetooth), an additional description in Chapter 9.

NOTE:

- do not disconnect the device from the computer before the installation of the drivers is completed
- connection of the recorder to the USB port of the computer stops the recording until the cable is disconnected and blocks a preview of the memory status available from the device's buttons level (with the message **Stop BUSY**)

8. SOFTWARE INSTALLATION

Provided CD-ROM contains in the **SOFTWARE** folder an installation set of free software for operating the recorder (via the USB port). This set includes the following applications (for Windows 7/8/10):

Name	Description of the program
ARSOFT-CFG (parameters configuration)	- displaying current measurement data as well as date and time, - configuration of the real time clock (RTC) and other parameters such as options for registration, display, alarms, function keys, access, etc. (chapter 9), - creating configuration files on the disk containing the current parameters' settings for re-use (backup or duplication of configuration)
ARSOFT-LOG (reading archives)	archiving on a computer disk and graphic or text presentation of recorded results with the possibility of printing, input data are downloaded from a text file with the extension <i>csv</i> created in the recorder in the internal memory (chapter 10)

The **latest** versions of the above programs are also available on the website (www.apar.pl Download →Software section). Detailed descriptions of the above mentioned applications can be found in the installation folders. To ensure trouble-free recorder operation, you should not use many ARSOFT applications at the same time.

9. SETTING CONFIGURATION PARAMETERS

All configuration parameters of the recorder are contained in the non-volatile internal memory (FLASH type) in the text file *AR23x.B.cfg* (where x is 6 or 2) or *AR23x.BT.cfg* (for the version with Bluetooth).

Programming takes place via the USB port and the ARSOFT-CFG computer program:

- connect the recorder to the computer port and run the ARSOFT-CFG application
- when the connection is established, in the program window, the current measured values, battery voltage are displayed as well as internal time and date of the recorder, presence of the transmission is indicated by the [TX / RX] icon of the display

- setting and viewing device parameters is available in the parameter configuration window
- new parameter values must be confirmed with the **Submit changes** button
- the program allows you to synchronize time and date with your computer
- the current configuration can be saved to a file or set with values read from the file
- the recorder updates the configuration file with the extension *cfg* after disconnection from the computer's USB port (on condition that the battery voltage > 3.1V)

NOTE: 

- before disconnecting the device from the computer, use the **Disconnect** button
- in the absence of a response:
 - check and correctly set the COM port number in the **Edit device configuration** window
 - make sure that the serial port drivers have been installed correctly (chapter 7)
 - disconnect for a few seconds and reconnect the recorder to the USB port
 - restart the ARSOFT-CFG and/or the computer
 - take out the battery from the recorder for a few seconds (as described in chapter 13)

To set the default parameter configuration, use the ARSOFT-CFG program. Default password can be restored by taking out the battery and putting it again while pressing the buttons **F** and **START/STOP** continuously until the appearance of a message **PRSS FESB**, and then set the clock.

9.1. INTERNAL CLOCK OPTIONS

The time and date of the internal clock are used as timestamps for recording with the possibility of presenting on the LCD display and in the ARSOFT-CFG program. In addition, if there is a need, a precise adjustment of the time counting speed is available (when the clock is in a hurry or late). Discharging and replacement or lack of battery causes the clock to be reset and requires setting time and date again after the power is restored.

Table 9.1. Parameters of the internal time clock

Parameter	Range of parameter variability
Date (dd: mm: yyyy)	01.01.2018 ÷ 31.12.2099
Time (hh: mm: ss)	00:00:00 ÷ 23:59:59
Correction of time counting	-10.0 ÷ 10.0 seconds/day - decrease or increase the speed of time counting

9.2. RECORDING OPTIONS

Data archiving takes place in a text file with the extension *csv* in the internal memory, a detailed description of the recording format can be found in chapter 10. The recording can be done in endless mode (when the memory is full, the oldest archives are deleted) or until the memory is full (the message **Stop Error**, then the archive files should be copied for further analysis and then the space should be released to re-registration). **Data recording interval** and **Type of archive saving** and other recording options should be adapted to the needs of the application.

Table 9.2. Configuration parameters regarding the recording options

Parameter	Range of parameter variability and description	Default settings
Data recording interval	every 5s to 8 hours (1), also included in the memory status presentation (ch. 9.4.)	2 min
Recording type (2) (chapter 10)	disabled	recording is permanently off
	continuous	recording is permanently on
	 limited by date and time	active recording in the scope of Date and Time defined by the parameters Recording start time and Recording end time
	 periodic daily (hourly)	recording active in hours from-to defined by the parameters Recording start time and Recording end time
	only during an alarm	recording active only during the occurrence of any of the alarms (chapter 9.6)

Recording start time	Date: 01.01.2018 ÷ 31.12.2099, Time: 00:00:00 ÷ 23:59:59, active parameter when Recording type = limited by date and time or periodic daily		2018.01.01 00:00:00
Recording end time	Date: 01.01.2018 ÷ 31.12.2099, Time: 00:00:00 ÷ 23:59:59, active parameter when Recording type = limited by date and time or cyclical daily		2018.01.01 23:59:55
Type of archive saving (also used in memory status presentation, chapter 9.4)	circular (endless)	when the memory is full, the oldest archives are deleted (according to the parameter Maximum size of archive files)	<i>circular (endless)</i>
	until the memory is full	recording is stopped, total capacity is approx. 94/104 thousand (AR236.B/AR232.B) records (measurements and other events)	
Maximum size of archive files for circular record (3)	2 MB	2 files, each with a capacity of ~47/52 th. records (AR236.B/AR232.B)	1 MB (4 files)
	1 MB	4 files, each with a capacity of ~24/26 th. records (AR236.B/AR232.B)	
	0.5 MB	8 files, each with a capacity of ~12/13 th. records (as above)	
	0.25 MB	16 files, each with a capacity of ~ 6/6.5 thousand records (as above)	
Archive identification number (ID)	0 ÷ 999	the device number used in the archive file name and records (csv) to distinguish archives from multiple recorders, should be set before the recording begins	0
1-st channel logged value	absolute humidity (g/m3)	selection of the first measured or calculated value (g/m3) to be recorded in the archive file (description of the record in chapter 10)	<i>relative humidity (%RH)</i>
	relative humidity (%RH)		
	sensor's temperature (°C/°F)		
2-nd channel logged value	relative humidity (%RH)	selection of the second measured or calculated value (dew/frost point) to be saved in the archive file (description of the record in chapter 10)	<i>sensor's temperature (°C)</i>
	dew/frost point temperature (°C/°F)		
	sensor's temperature (°C/°F)		

- Notes:** (1) - the recording interval is counted from the moment of disconnection from the computer's USB port
(2) - the device does not record data in the file when it is connected to the computer's USB port
(3) - parameter **does not** apply when **Recording type = periodic daily** (new files are created every day with size depending on the number of records saved, i.e. from the **Data recording interval**)

9.3. DISPLAY AND MEASUREMENTS OPTIONS

Due to the very low power consumption, the LCD display is always on, providing a lot of useful information about the operating status of the device. It is possible to configure the type of displayed values. If there is a discrepancy between the indications and the actual measured values, it is possible to calibrate the measurements with the parameters **Offset for the humidity** and **Offset for the sensor's temperature**.

Table 9.3. Configuration parameters for display and measurements options

Parameter	Range of parameter variability and description	Default settings	
Value for the upper display	absolute humidity (g/m3) (1)	Selection of values for continuous presentation on the top and bottom line of the LCD display. Measurement statistics are presented in the following way: 3-digit value + symbol ■ = maximum, ■ = minimum, ■ = average)	<i>relative humidity (%RH)</i> or <i>sensor's temperature (°C/°F)</i> for AR232.B
	relative humidity (%RH) (1)		
	maximum humidity (%RH) (1)		
	minimum humidity (%RH) (1)		
	average humidity (%RH) (1)		
	sensor temperature (°C/°F)		
	maximum sensor temperature (°C/°F)		
	minimum sensor temperature (°C/°F)		
	average sensor temperature (°C/°F)		
alternately humidity (%RH) and sensor temperature (°C/°F) (1)			

Value for the lower display	relative humidity (%RH)	(1)		sensor's temperature (°C) or time (hh:mm) for AR232.B
	maximum humidity (%RH)	(1)		
	minimum humidity (%RH)	(1)		
	average humidity (%RH)	(1)		
	dew point / frost temperature (°C / °F)	(1)		
	sensor temperature (°C/°F)			
	maximum sensor temperature (°C/°F)			
	minimum sensor temperature (°C/°F)			
	average sensor temperature (°C/°F)			
	alternately humidity (%RH) and sensor temperature (°C/°F)	(1)		
time (hh:mm)				
Resolution of humidity indications (1)	1%RH or g/m3	selection of the display resolution of humidity and/or temperature on the LCD display and in the ARSOFT-CFG program (recording in the archive file always takes place at a resolution of 0.1)	0.1 % RH	
	0.1% H or g/m3			
Resolution of temperature indications	1 (°C/°F)		0.1 °C	
	0.1 (°C/°F)			
Temperature scale type	Celsius (°C)	selection of the scale for temperature (also applies to recording in the archive file)	Celsius (°C)	
	Fahrenheit (°F)			
Offset for the humidity (1)	-5.0 ÷ 5.0 (%RH)	zero calibration for the measured relative humidity and temperature of the sensor (also applies to the recording in the archive file)	0.0 %RH	
Offset for the sensor's temperature	-5.0 ÷ 5.0 (°C/°F)		0.0 °C	

Notes: (1) - the parameter or value does not appear in AR232.B

9.4. BUTTONS' FUNCTIONS AND ACCESS OPTIONS

Table 9.4. Configuration parameters regarding button functions and access options

Parameter	Range of parameter variability and description		Default settings
F button function	display date (dd.mm) and time (hh:mm)		display date (dd.mm) and time (hh:mm)
	display the memory status (the way of recording, the amount occupied memory and how long it will be enough for) (1)		
	display statistics of measurements (maximum, minimum, average), %RH (6), °C/°F (2)		
	display absolute humidity and dew/frost point, g/m3, °C or °F and \blacklozenge (6)		
	display relative humidity and sensor's temperature, %RH, °C/°F (6)		
	START/STOP button lock (indicated by the message bl.oe on / off)		
	clear the alarm memory (indicated by the message RL AL CLR , chapter 9.5)		
Bluetooth turn on/off (with the message BLE BBBB / off , chapters 9.4.1 and 11)			
START/STOP button function (always with memory status display (1))	measurement refresh only		measurement refresh only
	start/stop of recording (continuous/disabled) , signalling with LCD icon [●] or lack (4)		
	pause/resume of recording , indicated by icons [] + \triangle (pause) or [●]		
	pause/resume of measurements and recording (HOLD function) (3) , [] + \triangle / [●]		
Measurement statistics and alarm clearing by the START button	disabled	deleted only with pressing F+START/STOP after hold time 4-9s (5)	enabled
	enabled	additionally deleted with pressing F+START/STOP after holding time 4-9s (5)	

Access protection to archive data and configuration parameters via USB port	disabled - data disk available, password for ARSOFT-CFG and LOG disabled	<i>disabled</i>	
	full - disk not available for exploration, password for ARSOFT-CFG and LOG enabled		
	for files only - disk not available, password for ARSOFT-CFG and LOG disabled		
Data access password	0 ÷ 9999	used for configuration in ARSOFT-CFG and for reading archives in ARSOFT-LOG, depending on the Access protection parameter	1111
Bluetooth	off	status of the (optional) Bluetooth module indicated by the [BLE] icon (detailed description in the table in chapter 6, point b and in ch. 9.4.1)	<i>off</i>
	on		

Notes:

(1) - memory status is presented in the following format:

- upper row: the **method of recording** (symbol = infinite, no symbol = until the memory is full, chapter 9.2), **amount of occupied** memory [%]
- bottom row: **how long is it enough for** (symbol = hours, = days, = months, time calculated on the basis of parameter **Data recording interval** and the amount of available memory, non-archive and additional files catalogues' structures reduce the capacity), for an circular (endless) record it is always the maximum value

(2) - statistics are presented according to the description of the parameter **Value for the upper** and **lower display** (ch. 9.3)

(3) - presentation format of the **HOLD** function (stopping the measurements): 3-digit value + symbol and LCD icons

(4) - the function automatically changes the **Recording type** parameter to the **disabled** or **continuous** value (Table 9.2)

(5) - deleting statistics and alarm memory with the **F+START/STOP** buttons is indicated by the message **SEARCH CLEAR**

(6) - the parameter or value does not appear in AR232.B

9.4.1. HANDLING BLUETOOTH RADIO COMMUNICATION (BLE)

Bluetooth wireless communication (BLE) enables remote reading of the current measured values and the recorder's battery level with the use of a mobile device (smartphone or tablet) with Android or iOS system and an available application. This functionality can be useful and convenient when the recorder is placed out of the user's reach (e.g. in a different room, outside or in a cold room, fridge, warmer or oven), while providing access to measurement data without disturbing the climatic conditions at the place of assembly, which could happen if the door is opened in order to read the display indications.

Activation of the (optional) BLE interface requires the **Bluetooth** parameter to be set to **on** value or programming the **F button function** with the **Bluetooth turn on/off** value, chapter 9.4. The recorder is visible under the name *Smart Humigadget* and can be connected to any compatible device within the BLE range, without a password.

To save battery, it is recommended to provide good range with a connected mobile device and turn off the module when Bluetooth communication is not used (the effect of BLE on battery life is given in chapter 4, note 2).

The free application *Sensirion MyAmbience* (English version) for mobile devices can be downloaded from Google Play (for Android) and from the App Store (for iOS). The application is dedicated to devices such as *Smart Gadget* with Sensirion humidity and temperature sensors. The program allows you to establish connections with several recorders at the same time (maximum 5, depending on the type of mobile equipment), while the recorder currently connected to one mobile device is not visible to others (until disconnection). In order to add recorders to the *Smart Gadgets* list, you can use the *Add new device* option and give your own names (*Gadget name*). For the device selected at the moment, the measurements are presented in the form of a board (*Dashboard*) or a graph (*Plot*) with additional archiving in the memory of the smartphone/tablet. The devices of the AR23x.B series do not support the function of setting the recording interval (*Logging interval*) and synchronization of archived data (*Sync now*) offered by the application. In addition, for AR232.B humidity (*HUMIDITY*) always takes the value of *0%RH*. For uninterrupted transmission, data update takes place every 5s. In case of connection problems, check the Bluetooth settings in the devices and/or restart the *MyAmbience* application.

9.5. ALARMS' CONFIGURATION

The recorder allows signalling the current alarms and alarms stored for relative humidity and sensor's temperature with short LED diode flashes and optionally with pulsating sounds, repeated every 1s or 5s. Programmable alarm characteristics are presented in the table below. **Alarms memory** can be useful for detecting exceeding that has occurred in the past. In addition, it is possible to set the **Insensitivity time** (postponement of alarm checking) after resetting the alarm memory, which allows stabilization of measurements and prevention of premature alarms after placing the device in the target place (e.g. in a cold room) or just disable alarms for defined time using buttons. The alarm memory can be reset by

pressing the **F** and **START** buttons (chapter 9.4) and additionally always after connecting to the computer's USB port (the alarm resets with initialization of insensitivity time are then carried out).

It should be remembered that active alarms increase battery consumption, therefore it is recommended to use this functionality only when it is actually needed. The influence of alarms on the battery life is given in chapter 4 (note 2), assuming that they are continuously active and signalled with high intensity (parameter **Alarms interval** = 1s). In practice, for less frequent alarms and **Alarms interval** = 5s this effect will be lower and may even be negligible.

Table 9.5. Configuration parameters regarding alarm configuration

Parameter	Range of parameter variability and description	Default settings
	<p>Off</p> <p>alarms are permanently off</p>	
<p>Alarm type for relative humidity (1)</p> <p>and</p> <p>Alarm type for sensor's temperature</p>	<p>Inverted (below threshold)</p> <p>Fig.9.5.1 Characteristics of the <i>Inverted</i> type alarm</p>	<p><i>Off</i> (for humidity)</p> <p>and</p> <p><i>Off</i> (for temperature)</p>
	<p>Direct (above threshold)</p> <p>Fig. 9.5.2. Characteristics of the <i>Direct</i> type alarm</p>	
	<p>Inside of the band</p> <p>Fig. 9.5.3. Characteristics of an <i>Inside of the band</i> alarm</p>	
	<p>Outside of the band</p> <p>Fig. 9.5.4. Characteristics of an <i>Outside of the band</i> alarm</p>	
Alarm value for humidity (%RH) (1)	0.0 ÷ 100.0 %RH	50.0 %RH
Hysteresis for humidity alarm (%RH) (1)	0 ÷ 100.0 %RH	2.0 %RH
Alarm value for temperature (°C/°F)	-50.0 ÷ 250.0 °C/°F (applies to sensor temperature)	25.0 °C
Hysteresis for temperature alarm (°C/°F)	0 ÷ 230.0 °C/°F (applies to sensor's temperature)	1.0 °C

Sound signalling of any alarm		disabled	control with the built-in buzzer (pulsing sounds at low volume level, for operation in a quiet environment)	<i>disabled</i>
		enabled		
Alarms interval (intensity)	1s (intensive)	alarm indication period (applies to LED and buzzer) when battery powered (for USB communication always 1s)		<i>every 5s (battery saving)</i>
	5s (battery power saving)			
Alarm memory		disabled	delete using the F and START buttons (chapter 9.4) or after connecting to the computer's USB port (continuous deleting)	<i>disabled</i>
		enabled		
Insensitivity time after clearing the alarm memory		0 ÷ 120 min	postponing alarm checking after resetting the alarm memory, 0 = off (alarms are signalled on an ongoing basis)	<i>0 min (off)</i>

Notes: (1) - the parameter or value does not appear in AR232.B

10. CREATING AND REVIEWING RECORDED MEASUREMENTS AND EVENTS

In order to archive data, the recorder creates text files with the extension *csv* in the internal memory.

Subsequent, new archive files (*csv*) are created in the following situations:

- when the new recording starts (e.g. when the **Recording type** parameter = **periodic daily (hourly)**, new files are created daily, chapter 9.2)
- when the memory is full with simultaneous deletion of the oldest archives (provided that the parameter **Type of archive saving** = **circular (endless)**, in the recording options)
- after changing the time and/or date (chapter 9.1) and other parameters such as: **Archive identification number (ID)**, **1-st or 2-nd channel logged value** (table 9.2), **Temperature scale type** (chapter 9.3)
- after replacing the battery (only if the recording is on, additionally set the time and date, chapter 9.1)

The file name contains the device type (AR23x.B or.BT), **Archive identification number (ID)** and the date and time of creation, e.g. "AR236.B_1_2018-01-01_10-57-16.csv" (AR236.B, ID = 1, date = 2018-01-01, time = 10:57:16).

The format of a single data record is as follows: "event sequence number; date; time; event identifier; argument 1;

argument 2; check sum". Sample record for humidity and temperature measurement:

"20;2018-05-09;13:46:30;5;40,4;26,3;IEM1", where argument 1 = 40.4 %RH, argument 2 = 26.3 °C.

Types and identifiers of recorded events:

- measurement (event **5 ID**)
- connection to the USB port (event **0**, "USB; CONNECTED")
- disconnection from the USB port (event **1**, "USB; DISCONNECT")
- loading a new configuration (event **3**, "NEW; ON-LINE" from ARSOFT-CFG or "NEW; OFF-LINE" from the file *AR23x.B.cfg/AR23x.BT.cfg*)
- creation of a new "**csv**" file (event **4**, "ID; xxxx", where xxxx - **Archive identification number (ID)** of the device)
- low battery voltage, below 3.1 V (event **6**, "LVBAT; x, xx", where x.xx - battery voltage [V])
- pause (holding) of recording with the **STOP** button (event **10**, "REC; PAUSED")
- resuming the recording with the **START** button (event **11**, "REC; RESUMED")

For graphic or text presentation and printout of recorded results, you can import data into the ARSOFT-LOG program via the computer's USB port. If the recorder disk is not available (parameter **Access protection** = **full** or **for files only**, chapter 9.4), enable in the program *Options* and use the "**Unprotect and load via USB**" button, and then follow the instruction manual. ARSOFT-LOG additionally allows you to detect unauthorized modification of the archive by verifying the check sum. Alternatively, *csv* files can be opened in any spreadsheet (e.g. OpenOffice Calc, Microsoft Excel), as well as in various word processors (Windows WordPad, Notepad ++, etc.).

11. SIGNALING MESSAGES AND ERRORS

The messages appearing on the LCD display are temporary (with a duration of 4-9 seconds) or continuous. To shorten the presentation time or delete the message, use the **F** and/or **START/STOP** buttons.

Table 11. A cumulative list of possible messages, symbols and errors presented on the LCD display

Code	Message or symbol description
	symbols used in the presentation of the memory status and the HOLD function (chapter 9.4, notes 1 and 3)
	blocking the memory status view due to the connection of the recorder to the computer's USB port

	symbols used in the presentation of measurement statistics (maximum, minimum and average, chapter 9.3)
	measurement statistics and alarm memory deleted using the F+START/STOP buttons (chapter 9.4, note 4)
	alarm memory deleted using the F button, chapter 9.4, F button function
	lock of the START/STOP button is on () or off () , chapter 9.4, F button function
	default password restored with F+START/STOP buttons during power up (chapter 9)
	memory error, e.g. due to filling up or too many files and folders (> 110) or damage to the FAT file system, requiring cleaning or formatting the recorder disk with a computer (via USB port), if the problem persists, please send the device back to the service for the purpose of repair
	sensor's error: no communication with the measuring probe (damage/missing sensor or interruption of electrical connections), if the problem persists, the device should be sent back to the service for repair
	Bluetooth interface (BLE) on (- last 4 characters of the MAC address) or off () , chapters 9.4 and 9.4.1, F button function
	potential error of the Bluetooth module (additionally indicated by the [BLE] and [NOTE] icons, chapter 6, point b): remove the battery for at least 10s, if the problem persists, contact the technical support for additional instructions and/or send the device back to the service for repair

12. IMPORTANT EXPLOITATION REMARKS. TROUBLESHOOTING



To ensure trouble-free and optimal use of the recorder, read this instruction manual carefully. The description of messages and errors reported by the device is included in chapter 11.

In order to reduce the power consumption and achieve the longest possible working time without replacing the batteries, the following recommendations must be observed (estimated working times are given in chapter 4, note 2):

- set the highest possible values of the **Data recording interval** parameter (recommended > 1 min, chapter 9.2)
- turn off the alarms when they are not needed or set **Alarms interval** to 5s (chapter 9.5, when the buzzer is on every 1s, it additionally increases the power consumption by approx. 15%)
- provide a good range with a connected mobile device and turn off Bluetooth communication (BLE) when it is not used (chapter 9.4.1)
- delete unnecessary files in the internal memory before starting the new recording (and check clock settings)

After removing the protective cover, there is also the option of powering up via the USB port (power supply adaptor or powerbank, and the battery must be continuously present, because it works as a back-up power supply), however it may cause disturbances in the device operation due to reduced resistance to harmful external factors at the installation site, such as water, dust, power grid surges, etc.

In addition, to ensure trouble-free operation and continuous operation, it is advisable to follow the following instructions:

- do not disconnect the device from the computer's USB port before the completion of the installation of the drivers and during the communication with the ARSOFT-CFG and LOG programs, as well as when operating the recorder's disk (copying/deleting files, etc.), which is indicated by the [TX/RX] icon on the LCD display, moreover, do not use many ARSOFT applications at the same time
 - do not fill up the memory with your own files and folders because they reduce the capacity for recording data
 - store in external memories (USB, computer disks, etc.) a copy of the current configuration file (*AR23x.B.cfg/AR23x.BT.cfg*) to restore the configuration in case of problems or to duplicate settings
 - don't unscrew the USB cover, when condensation on the device is possible (e.g. after taking out from the fridge). Wait until the recorder reach ambient temperature, to avoid potential malfunction. If necessary, during this time, recordings can be stopped by programmed START/STOP key (chapter 6)
 - replace the battery with a new one as soon as the device starts to indicate a low voltage level (< 3.1V), chapter 13
- Turned off LCD display may indicate complete discharging, incorrect installation or lack of battery. In this case, open the battery cover and check the correctness of the installation and voltage.

The discharging and replacement or absence of battery causes the clock to be reset and requires the time and date to be set again after the power supply is restored (chapters 9 and 9.1), the other configuration parameters remain unchanged.

13. BATTERY REPLACEMENT

In order to replace the battery, prepare a Phillips screwdriver and perform the following actions on the table:

- unscrew 2 screws and disassemble the battery cover (at the back of the casing at the top, Fig.13), being careful not to lose screws and rubber sealing o-rings, loosely mounted in the screw sockets under the cover
- replace the battery with a new one of the appropriate type (3.6V, AA, chapter 4) with polarity in the holder
- screw the battery cover in place with the 2 screws (with properly installed o-rings)

NOTE: 

- when the battery is replaced, the real-time clock (RTC) is reset and needs to be set again using the ARSOFT-CFG program, the other parameters remain unchanged
- obtaining a high degree of IP65 protection requires correct mounting of the battery cover and a USB plug with rubber gaskets included in the set

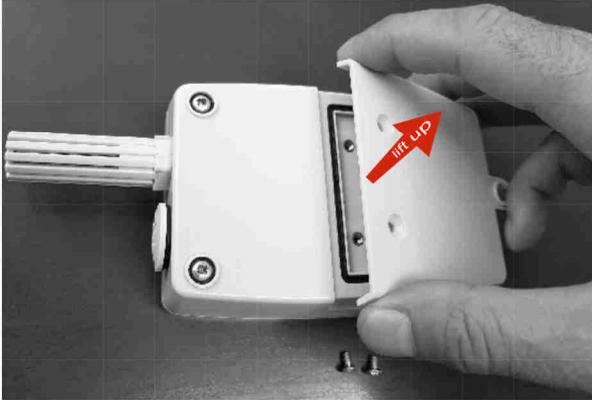


Fig.13. Opening the battery cover

14. USER'S NOTES
