USER INSTRUCTION

DATA RECORDER

AR234

Thank you for choosing our product.

This instruction is intended to facilitate correct operation, safe use, and taking full advantage of the recorder's functionalities.

Before you start the device, please read and understand this instruction.

In the event of any additional questions, please contact our technical adviser.

CONTENTS

⚠ Please pay particular attention to fragments marked with this sign.

The manufacturer reserves its rights to modify the design and software of the device without deteriorating its technical parameters.

1. INSTALLATION GUIDELINES ⚠

The device is designed so as to ensure an appropriate level of immunity to most interferences that may occur in industrial environments. In environments of unknown level of interferences, it is recommended to implement the following measures so as to prevent potential interference with the operation of the device:

- use shielded sensor, and signal cables, whereby the earthing of the shield should be single-point and located as close to the device as possible;
- avoid running measurement (signal) cables in the direct vicinity of and parallel to power and supply cables;
- it is recommended to use twisted pair signal cables;
- in the case of sensing resistors in 3-wire connections, use identical wires;
- avoid proximity of remotely controlled devices, electromagnetic meters, high power loads, loads with phase or group power control, and other devices that cause high impulse disturbances;
- ground or zero metal rails on which rail-mounted devices are installed.

Make sure to remove the protective film from the LCD display before the first use of the device.

2. GENERAL CHARACTERISTICS OF THE RECORDER

- recording of data from the measurement input and the internal temperature sensor;
- 1 universal measurement input (thermoresistance, thermocouple, and analog) and integrated digital temperature sensor;
- data recording in a standard text file located in the internal memory of the recorder or on an SD/MMC card in the FAT system, with the possibility to read through the USB interface;
- portable housing suitable for wall installation;
- battery power supply with the possibility that the user changes the battery;
- LCD display that shows the measured values, messages, and errors;
- long operation time with a new battery (up to 5 years, depending on the recording interval, the presence of an SD card, the operating temperature of the device, and the mode of operation of the display);
- possibility to transfer archived and configuration data on an SD card;
- internal real time clock with a battery backup power supply;
- compensation of line resistance for resistance sensors (automatic or permanent);
- compensation of thermocouple cold tip temperature (automatic or permanent);
- free software included that enables configuration of the parameters of the device and presentation of the recorded results in a graphic form or as text; possibility to update from a website;
- high, low, within band, and outside of band alarm; signaling with an LED;
- programmable type of input, range of indications, recording interval, start and end of recording, and other configuration parameters, such as zero and sensitivity calibration, SD/MMC card options, LCD display options, and identification number (ID);
- possibility to prevent unauthorized change of the recorder's parameters from the SD/MMC card and transfer of archived data from the internal memory onto an SD/MMC card (authorization of the card or free access is required);
- parameter configuration methods:
  - through a USB outlet and software (Windows Vista/7/8/10);
  - from a configuration file recorded on an SD/MMC card;
- a checksum that enables detecting unauthorized modifications of the archive;
- possibility to differentiate archives from many recorders of the same type by assigning individual identification (ID) numbers;
- recording of data until the memory is full, full memory signalization;
- possibility to update the recorder's software;
- high temperature stability of measurements, accuracy, and immunity to interferences;

- protection against incorrect battery polarity;
- available accessories:
    - a lithium battery, 3.6 V, type AA (R6), 2450 mAh (e.g. SAFT LS14500);
    - an SD memory card (2 GB);
    - SD/MMC card reader;
    - a stabilized power supply, 5 V/150 mA;

NOTE: ⚠️
- before you start working with the recorder, read this instruction, perform the actions described in chapters 7 and 8, and then properly connect the sensor or the input signal and configure the parameters (chapter 9);
- recording is performed only in a predefined interval (Start and Stop parameters, Table 9, chapter 9).

3. CONTENTS OF THE SET

- a recorder with a 3.6 V AA lithium battery;
- a USB (A4 – mini B) cable for connecting the device to a computer, 2 m long;
- a CD with the drivers and the software (Windows XP/Vista/7/8/10)
- a user instruction;
- a warranty card.

4. TECHNICAL DATA

A universal input (programmable):		**measurement range**		
- Pt100 (RTD, 3- or 2-wire)		-200	÷	850	°C
- Ni100 (RTD, 3- or 2-wire)		-50	÷	170	°C
- thermocouple J		-40	÷	800	°C
- thermocouple K		-40	÷	1200	°C
- thermocouple S		-40	÷	1600	°C
- thermocouple B		300	÷	1800	°C
- thermocouple R		-40	÷	1600	°C
- thermocouple T		-25	÷	350	°C
- thermocouple E		-25	÷	680	°C
- thermocouple N		-35	÷	1300	°C
- current (R_{in} = 110 Ω)		0/4	÷	20	mA
- voltage (R_{in} = 110 kΩ)		0	÷	10	V
- voltage (R_{in} > 2 M Ω)		0	÷	60	mV
- resistance (3- or 2-wire)		0	÷	700	Ω
Number of measurement inputs		1			
Resistance of leads (RTD, Ω)		R_d < 25 Ω (for each line)			
Resistance input current (RTD, Ω)		~480 µA (impulse)			
Processing errors (at ambient temperature of 25 °C):					
- basic	- for RTD, mA, V, mV, Ω	0.1% of the measurement range ±1 digit			
	- for thermocouples	0.2% of the measurement range ±1 digit			

- additional for thermocouples	<2 °C (temperature of cold tips)
- additional from ambient temperature changes	< 0.005% of the input range /°C
An integrated temperature sensor (measurement range: -20 ÷ 70 °C)	Accuracy: ±0.5°C (in the range of -10 ÷ 70 °C) ±0.5 ÷ 1.5 °C (in the remaining range)
Resolution of measured temperature	0.1 °C
Communication interface for work with a computer	USB, drivers compatible with Windows XP/Vista/7/8/10
Measurement and data recording interval	programmable 10 s to 24 hours
Data storage memory (non-volatile):	
- internal	4MB, FLASH, file system FAT12, recording of up to 80,000 measurements
- external SD/MMC card (connection with an ejector)	FAT16, FAT32, maximum size 2 GB, recommended size ≤ 1GB and FAT16 (recording up to 19 million measurements)
Real time clock (RTC)	quartz, date, time, takes leap years into account)
Optical signaling	an LCD display, 3 LED's: "READ/WRITE", "Status", 1 alarm
An LCD display	7-segment, 4 digits, 10 mm high
Power supply (lithium battery)	3.6 V type AA (R6), 2,450 mAh, (e.g. SAFT LS14500)
Time of operation with a new battery (1)	up to 5 years (in temperatures 20 ÷ 30 °C)
Rated operating conditions	-20 to 70 °C, <100% RH (no condensation)
Operating environment	air and neutral gases, no dust
Housing (wall-mounting)	material ABS UL94-V0, white
Protection rating	IP20 (no protection against ingress of water and condensation)
Enclosure dimensions	80 x 80 x 25 mm
Operating position	any
Weight	approx. 100 g (with a battery)
Electromagnetic compatibility (EMC)	immunity: according to the PN-EN 61000-6-2:2002(U) standard
	emissivity: according to the PN-EN 61000-6-3:2002(U) standard

(1)
– operation time depends on the measurement period, the presence of an SD/MMC card, the operation mode of the LCD display, and the ambient temperature:
  – 5 years (recording period > 10 min., recording in internal memory, data copied only through the USB, LCD in the economy mode, 20-30 °C)
  – 20 months (measurement period > 10 min., recording in internal memory, data copied only through the USB, LCD in the continuous mode, 20-30 °C)
  – 7 months (measurement period 10 s, internal memory, data copied only through the USB, 20-30 °C)
  – 1.5 year (measurement period > 10 min., recording on an SD/MMC card, LCD in the economy mode, 20-30 °C)
  – 4 months (measurement period 10 s, recording on an SD/MMC card, 20-30 °C)
– an unused SD/MMC card installed in the socket also reduces the operating time of a battery
– it takes about 2 min. to transfer the entire content of the internal memory (4 MB) onto an SD/MMC card and it consumes about 1-2 mAh of the battery's capacity (tested on SanDisk and Kingston memory cards)
– by using an accessory power supply device, the operating time of a new battery can be extended to about 8 years

5. HOUSING DIMENSIONS, DESCRIPTION OF CONNECTIONS AND EXTERNAL ELEMENTS

LCD display

internal temperature marker

°C

A
LED - alarm
measurement connection

80

12

80

25
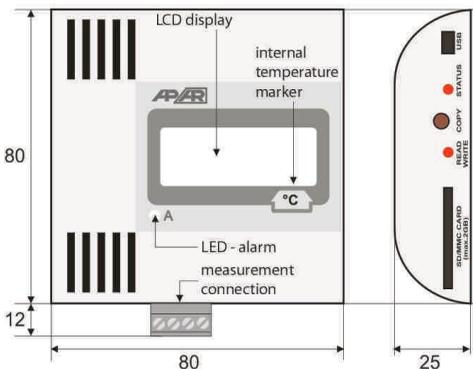
an USB connection for communication with a computer and for a power supply device

a LED - operating status (messages and errors)

a button for copying configuration and measurement data and for updating the LCD display

a LED - recording/reading of the internal memory or SD/MMC card

a slot for an SD/MMC card with an ejector (push-out type) (max. 2 GB)

Dimensions in mm

In the case of wall-mounted installation, in order to make mounting holes, the back wall of the housing can be uninstalled (chapter 14) and used as a template.

6. MEASUREMENT CONNECTOR DESCRIPTION AND THE ELECTRICAL CONNECTIONS

a) numbering of connections and method of connecting sensors and measurement signals
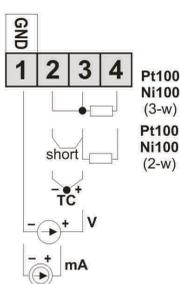
Terminals	Description
2-3-4	input Pt100, Ni100, resistance (2- and 3-wire)
2-3	thermocouple input TC (J, K, S, B, R, T, E, N) and voltage input 0÷60 mV
1-2	current input 0/4÷20 mA
1-3	voltage input 0÷10 V

b) connection of a 2- and 3-wire transducer (Iout - output current, Uout - output voltage)
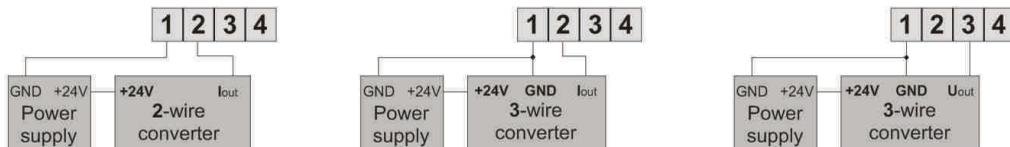
7. CONNECTING TO A COMPUTER AND INSTALLATION OF DRIVERS

After the first connection, the Windows (XP/Vista/7/8/10) system detects the recorder named "**APAR USB DEVICE**" and demands installation of drivers. In the find new device wizard, **manually** indicate the location of the drivers on a CD-ROM, the **DRIVERS** catalog).

In the Windows XP system, the installation procedure is the following:

1. Choose the option "**No, not this time**" and press the "**Continue**" button.

2. Choose "**Install from a list or a specific location (advanced)**" and press the "**Continue**" button

3. Select "**Find the best driver in those locations**" and the selection field "**Include this location in the search:**," press

the "**View**" button, in the dialog box select the *DRIVERS* folder, press the "**Continue**" button, when the warning "**Installing a device**" appears, press "**Continue anyway**."

4. The virtual COM port "**CDC USB to UART**" is installed; press "**Finish**."

5. The system then detects and installs the "**Mass storage device**" -> "**ATMEL MASS STORAGE USB Device**" -> "**Disk drive**."

After the installation is completed, the recorded is listed in the system as a virtual COMx port (x-port number: 1, 2, ...) and two exchangeable disks: internal memory 4 MB with the AR234 label and SD/MMC memory (available after the card is put in the "SD/MMC CARD" slot). In the internal memory the configuration text file *AR234.cfg* can be seen (chapter 9).

NOTE: ⚠️

Do not disconnect the device from the computer before the installation of drives is completed and whenever the device is connected again to the USB port when disks are being detected (when the **[READ/WRITE]** LCD is on; see chapter 5).

8. INSTALLATION OF SOFTWARE

In the "**SOFTWARE**" folder of the CD-ROM that is provided with the device there is a free software installation set for the recorder. The set contains the following applications:

- **ARSOFT-CFG WZ1** - display of current measurement data, battery voltage, and date and time;
  - configuration of the real time clock (**RTC**) and other parameters, such as type of measurement input, ranges of indications, recording options, alarms, display, access options etc. (chapter 9), the software requires communication with the recorder via the USB port - **on-line configuration**
- **ARSOFT-WZ3** - presentation, in a graphic form or as text, of results, with the possibility to print; input data is uploaded one time from a "csv" text file created in the internal memory in the recorder or on an SD/MMC card (chapter 11)

The latest versions of the aforementioned programs are also available at the website (www.apar.pl). The detailed descriptions of the aforementioned applications can be found in the installation folders.

9. SETTING OF THE CONFIGURATION PARAMETERS

All the configuration parameters of the recorder are stored in the non-volatile FLASH internal memory in a text file: "*AR234.cfg*."

When the device is switched on for the first time, an error message may be shown in the display due to the lack of a sensor or the fact that the sensor that is connected is not one that is factory-programmed. In such an event, the proper sensor or analog signal must be connected and the configuration must be programmed.

There are parameter configuration methods:

1. Use the USB port and the ARSOFT-CFG WZ1 software (**on-line configuration**):
- connect the recorder to a computer port and to start the ARSOFT-CFG WZ1 application
- after the connection has been established, the current measured values, the battery voltage, and the internal time and date of the recorder are displayed in the software's window; the "**STATUS**" LED indicates the presence of transmission
- setting and viewing of the device parameters is possible in the parameter configuration window
- new parameter values must be approved with the *Approve changes* button
- the software enables synchronization of the time and the date with the computer
- the current configuration can be saved in a file or set using values read from a file
- the recorder updates the "cfg" configuration file after it is disconnected from the USB port of the computer (provided that battery voltage > 3 V)

NOTE: ⚠️

- before disconnecting the device from a computer, press the ***Disconnect device*** button
- in the event of no response:
    - in the ***Software options***, check the number of the COM port
    - make sure that the serial port drivers have been installed correctly (chapter 7)
    - disconnect for a few seconds and then reconnect the recorder to the USB port
    - restart the computer
    - take the battery out of the recorder for a few seconds (as described in chapter 12)

In the event of indications different than the actual value of the input signal, the zero and the sensitivity of a sensor can be tuned: parameters 11: ***calO*** (zero) and 12: ***calG*** (sensitivity).

Table 9. List of configuration parameters

No.	Name	Description of parameter	User settings
0	***RTC*** **(1)**	internal real time clock (chapter 9.1)	
		RECORDING OPTIONS (chapter 9.2)	
1	***Start***	recording start time	
2	***Stop***	recording end time	
3	***MPer***	data recording interval	
4	***SDest***	selection of memory to save archive files (to record data)	
		CONFIGURATION OF THE MEASUREMENT INPUT (chapter 9.3)	
5	***inp***	type of measurement input	
6	***rrtd***	total resistance of leads for 2-wire RTD sensors and 700 Ω	
7	***cjte***	temperature of cold thermocouple tips	
8	***dot***	position of the point/resolution	
9	***rbot***	bottom of the indication range (start of the scale) for 0 mA, 4 mA, 0 V, 0 mV, and 0 Ω	
10	***rtop***	top of the indication range (end of the scale) for 20 mA, 10 V, 60 mV, and 700 Ω	
11	***calO***	calibration of the zero	
12	***calG***	calibration of the inclination	
		ACCESS OPTIONS (chapter 9.4)	
13	***bloc***	block of the "**COPY**" button	
14	***Pass***	card authorization password	
15	***Prot***	SD card authorization demand	
16	***ID*** **(1)**	identification number, ID (recorded in the csv archive file)	
		DISPLAY OPTIONS (chapter 9.5)	
17	***LCDmod***	operation mode of the display	
18	***LCDupd***	interval of display update in the continuous mode	
19	***LCDch***	value to be displayed	
		CONFIGURATION OF ALARMS (chapter 9.6)	
20	***AHigh***	high alarm for the measured value	
21	***Alow***	low alarm for the measured value	

Notes: (1) – parameter accessible only from the level of ARSOFT-CFG WZ1 (on-line configuration)

9.1. TIME AND DATE

The current time and date are used as time stamps for recording. Their review and modification are possible **only** from the level of the ARSOFT-CFG WZ1 software (item 1 of chapter 9).

Table 9.1. Parameters of the real time clock (**RTC**)

Parameter	Range of variability of the parameter
Time (hh:mm:ss)	*00:00:00 ÷ 23:59:59*
Date (dd:mm:yyyy)	*01.06.2008 ÷ 31.12.2099*

9.2. RECORDING OPTIONS

Data is archived in a text file with a "*csv*" extension in the internal memory, on an SD/MMC card; a detailed description of the storage format is given in chapter 11. Recording to a file is performed only when the current time (**RTC**) is within a range defined by recording parameters 1:**Start** and 2:**Stop** (Table 9.2). Recording is continued until the memory becomes full and is then stopped and the **FULL** message is displayed repeatedly. The archive files must then be transferred or copied for further analysis so as to free up space in the memory for new recording. Selection of the memory for recording is determined by parameter 4:**SDest**.

Table 9.2. Configuration parameters pertaining to the recording option

Parameter	Range of variability of the parameter and description		Company settings
1:**Start**: recording start time (1)	date: *01.06.2008 ÷ 31.12.2099*, time: *00:00:00 ÷ 23:59:59*		*2008.06.01 00:00:00*
2:**Stop**: recording end time (1)	date: *01.06.2008 ÷ 31.12.2099*, time: *00:00:00 ÷ 23:59:59*		*2008.06.01 00:00:00*
3:**MPer** (2)	data recording interval: *10 s ÷ 24 hrs*, increment 10 s		10 s
4:**SDest** the memory where the archive files (**csv**) are to be recorded (3)	*internal*	The **csv** files are created only in the internal memory	***auto*** automatic selection
	auto	archive files (csv) are created only on an SD/MMC card or in the internal memory when there is no card	

Notes: (1) - the device does not record data in a file when it is connected to the computer's USB port

(2) - the recording interval is counted from the moment the device is disconnected from the USB port

(3) - it is possible to demand authorization of the SD card (chapter 9.4, parameter 15:**Prot**)

9.3. CONFIGURATION OF THE MEASUREMENT INPUT

Table 9.3. Configuration parameters of the measurement input

Parameter	Range of variability of the parameter and description		Company settings
5: **inp** type of input	*Pt100*	thermoresistance sensor (RTD) Pt100 (-200 ÷ 850 °C)	*Pt100*
	Ni100	thermoresistance sensor (RTD) Ni100 (-50 ÷ 170 °C)	
	J (Fe-CuNi)	thermoelectric sensor (thermocouple) type J (-40 to 800 °C)	
	K (NiCr-NiAl)	thermoelectric sensor (thermocouple) type K (-40 to 1200 °C)	
	S (PtRh 10-Pt)	thermoelectric sensor (thermocouple) type S (-40 to 1600 °C)	
	B (PtRh30PtRh6)	thermoelectric sensor (thermocouple) type B (-300 to 1800 °C)	
	R (PtRh13-Pt)	thermoelectric sensor (thermocouple) type R (-40 to 1600 °C)	
	T (Cu-CuNi)	thermoelectric sensor (thermocouple) type T (-25 to 350 °C)	

	E *(NiCr-CuNi)*	thermoelectric sensor (thermocouple) type E (-25 to 820 °C)	
	N *(NiCrSi-NiSi)*	thermoelectric sensor (thermocouple) type N (-35 to 1300 °C)	
	4-20 mA	current signal 4...20 mA	
	0-20 mA	current signal 0...20 mA	
	0-10 V	voltage signal 0...10 V	
	0-60 mV	voltage signal 0...60 mV	
	0-700 Ohm	resistance signal 0..700 Ω	
6: **rrtd** line resistance (1)	**0 ÷ 50.00** Ω	total resistance of leads for 2-wire RTD sensors and 700 Ω	**0.00** Ω
7: **cjte** temp. of cold thermocouple tips	**-20 ÷ 70.0**°C **0** = automat.	automatic (0°C) or constant compensation of temperature of the reference junction of thermocouples	**0**°C automat.
8:**dot** position of the point/resolution	**0**	no point **(2)** or 1°C for temperature	**0** (0.0/0.1 °C)
	1	0.0 **(2)** or resolution 0.1 °C for temperature	
	2	0.00 **(2)**	
	3	0.000 **(2)**	
9: **rbot** bottom of the indication range	**-1999 ÷ 9999** units (2) – indication for 0 mA, 4 mA, 0 V, 0 mV, 0 Ω - start of the input scale		**0.0** °C
10: **rtop** top of the indication range	**-1999 ÷ 9999** units (2) – indication for 20 mA, 10 V, 60 mV, 700 Ω - end of the input scale		**100.0** °C
11: **calO** calibration of the zero	zero offset: **-50.0 ÷ 50.0** °C or **-500 ÷ 500** units (2)		**0.0** °C
12: **calG** calibration of the inclination	sensitivity (gain): **85.0 ÷ 115.0** %		**100.0** %

Notes: (1) – in the case of 3-wire sensors, there is automatic line resistance compensation and parameter 6:**rrtd** **must be equal to** *0.00* Ω

(2) – applies to analog inputs (mA, V, mV, Ω)

9.4. ACCESS AND IDENTIFICATION OPTIONS

Table 9.4. Configuration parameters concerning the access and identification options

Parameter	Range of variability of the parameter and description		Company settings
13:**bloc**	block of the "**COPY**" button: *off* or *on*		*off*
14:**Pass**	card authorization password: **0 ÷ 9999**		*1111*
15:**Prot** SD card authorization demand (1)	*off*	SD card authorization demand is off	*off*
	on	saving to an archive is possible only on a card that contains the AR234.cfg configuration file with a conforming password (14:**Pass**)	
16:**ID** (identification number)	**0 ÷ 9999**	an individual device number entered into the initial records in the archive file (csv) in order to distinguish archives from different recorders of the same type	*0*

Notes: (1) - this function prevents unintended off-line configuration or transfer from an archive from the internal memory onto an SD card put in the recorder by accident or by unauthorized persons.

9.5. DISPLAY OPTIONS

The display can work in one of the following two modes: economic (when parameter 17**LCDmod**=**economic**, Table 9.5) or continuous (**LCDmod**=**continuous**). In the economy mode, the display is switched on for several seconds after each measurement is performed in the recording mode or manually after the "**COPY**" button is pressed. This mode operation reduces the use of the battery to a minimum, thus extending the time of operation of the recorder without the need to change the battery.

In the continuous mode, the display is switched on all the time and is updated after one of the following causes takes place:

- a measurement and a recording was performed in the recording mode (in accordance with parameter 3:**MPer**, chapter 9.2, Table 9.2)
- a measurement was performed in accordance with the display update interval (18:**LCDupd**)
- a measurement was performed after the "**COPY**" button was pressed

The display update period (parameter 18:**LCDupd**) makes it possible to perform measurements also when the recording is switched off. In order to reduce the use of the battery, it is recommended to set this parameter to a value greater than 1 min.

Table 9.5. Display options configuration parameters

Parameter	Range of variability of the parameter and description	Default settings
17:**LCDmod** (1)	display operation mode: **economy** or **continuous**	**econom.**
18:**LCDupd** (1)	interval of display update in the continuous mode: **10 s** - **24 hrs**, 10 s increment	**2 minutes**
19:**LCDch** value to be displayed	**measurement and internal temperature**	**measurement and int. temp.**
	measurement only	

9.6. CONFIGURATION OF THE ALARM OUTPUT

When the measured values are displayed, the recorder also enables signaling of alarm conditions with brief flashes of the "LED-alarm" diode occurring every second. The characteristics and the values of the alarm thresholds for the measured value are defined by the low alarm (parameter 21:**Alow**) and the high alarm (20:**AHigh**), see Table 9.6.

In order to obtain the low, high, or outside of band alarm, the low alarm must be set for a value that is **smaller** than the high alarm value - Fig. 9.6.1. An alarm occurs in a preset band when the value of the low alarm is **higher** than the value of the high alarm - Fig. 9.6.2.

Table 9.6. Configuration parameters of the alarm output

Parameter	Range of variability of the parameter and description	Company settings
20:**AHigh** high alarm for the measured value	**-199.9 ÷ 1800** ℃ or **-1999 ÷ 18000** units (1)	**18000**℃
21:**Alow** low alarm for the measured value	**-199.9 ÷ 1800** ℃ or **-1999 ÷ 18000** units (1)	**-199.9** ℃

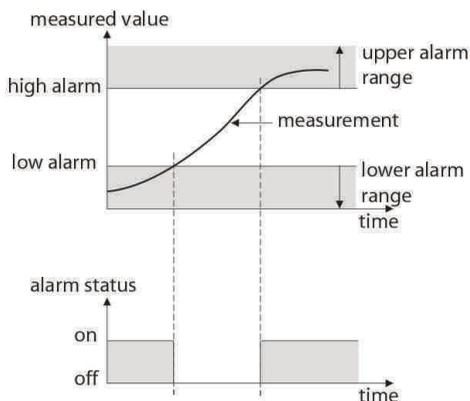**Notes: (1)** – applies to analog inputs (mA, V, mV, Ω)

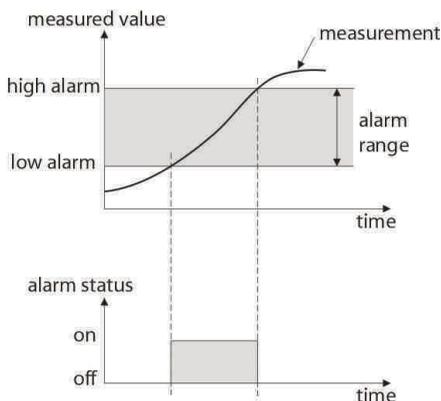Fig. 9.6.1. High, low, or outside of the band alarm

Fig. 9.6.2. Alarm within the band

10. USE AND FUNCTIONS OF THE SD/MMC CARD

Use of an SD/MMC card may be particularly suitable to transfer data in the event of stationary (wall) installation of the recorder and when the size of the internal memory is not sufficient to record the required number of measurements.

A card that is properly installed in the "**SD/MMC CARD**" slot has the following functions:

– storage of files with saved data in the course of recording
– off-line configuration of the parameters of the device (from the **AR234.cfg** configuration file after the "**COPY**" button has been pressed, see chapter 9)
– transfer of "**csv**" archive files from the internal memory onto the card (this is done after the "**COPY**" button has been pressed and the authorization has been successful or when the authorization demand is switched off; during the operation, the "**STATUS**" LED is illuminated; the time is up to 2 min. for 4 MB of data).

NOTE: ⚠️

– transfer of "**csv**" files from the internal memory onto an SD/MMC card takes place **SIMULTANEOUSLY** with off-line configuration; consequently, an appropriate "**cfg**" file must be present (or absent when parameter 15:*Prot*=*off*) so as to avoid undesirable reconfiguration of the recorder
– in order to extend the operation of the battery, it is recommended to use SD/MMC cards of reputable brands (e.g. SanDisk, Kingston, or GoodRam) formatted in the FAT16 file system
– **in the case of cards larger than 2 GB there is a risk that the device may lag, which requires taking out the battery for a short time**

11. VIEWING RECORDED MEASUREMENTS AND EVENTS

In order to archive data, the recorder creates a text file with the "csv" extension in the internal memory or on an SD/MMC card. The file name contains the device type (AR234), the identification number 16:*ID*, and the date and time of creation of the file, e.g. „AR234_1_2009-11-30_10-57-16.csv". The format of a single data record is the following: "sequential number of the event;date;time;identifier of the event;measurement;internal temperature;checksum", an example record for measurement in the AR234: "30;2009-11-09;16:34:58;5;149,5;26,2;8BE2", where the measurement =149,5 and the internal temperature=26,2 °C. The types and the identifiers of the recorded events are:

– measurement (identifier of event **5**)
– connection to the USB port (**0**, "USB;CONNECTED")

- disconnection from the USB port (**1**, "USB;DISCONNEC")
- loading of new configuration parameters (**3**, "NEW;ON-LINE" or "NEW;OFF-LINE")
- creation of a new "**csv**" file (**4**, "ID;xxxx", where xxxx - value of parameter 16:**ID** of the device)
- low battery voltage, below 3.35 V (**6**, "LVBAT;x.xx", where x.xx - battery voltage [V])

To make a presentation of recorded results in a graphic form or as a text, and to print them, the ARSOFT-WZ3 software must be used; the software also enabled detecting unauthorized modifications of the archive. As an alternative, "csv" files can be edited in spreadsheet software (OpenOffice Calc, Microsoft Excel, etc.) and in text editors (Windows WordPad, Notepad++, etc.).

NOTE: ⚠️

If the SD/MMC card is installed or removed in the course of recording, a new "csv" file is created where the sequential numbers of events are continued from the previous file.

12. MESSAGE AND ERROR SIGNALING

a) measurement errors indicated on the LCD display and in the "csv" file in the measured value field:

Code	Possible causes of error
▄▄▄▄ "19999"	− the measurement range of the sensor is exceeded from the top − the sensor is broken − the sensor that is connected is different than the one that is set in the configuration (chapter 9.3, parameter 5:**inp**)
▄▄▄▄ "-19999"	− the measurement range of the sensor is exceeded from the bottom − the sensor is broken − the sensor that is connected is different than the one that is set in the configuration (chapter 9.3, parameter 5:**inp**)

b) other elements indicated by the LED's on the side of the housing and on the LCD display

LED	Description of message
READ/ WRITE	− writing to/reading from the internal memory or the SD/MMC card (also during recording of a measurement) − recording is active (a short flash every 10 seconds)
STATUS	transmission through the virtual COM port (used in ARSOFT-CFG WZ1, item 1 of chapter 9)
	copying of the configuration file from the SD/MMC card to the recorder and transfer of files with recorded data onto the card after the **"COPY"** button is pressed (chapter 10
	full memory that prevents saving recorded data in an archive file - a quick flash during attempted recording of measurement and the **FULL**
	too low battery voltage (less than 3.35 V) - short flash every 10 seconds when recording is active and the **LbAt** message on the display (also a record is created in the archive file, chapter 11)

13. IMPORTANT COMMENTS PERTAINING TO OPERATION ⚠️

Please read this instruction carefully in order to ensure problem-free and optimized operation of the recorder.
In order to ensure the longest possible operating time of the battery without the need to change it, make sure to:
- set the longest possible value of the measurement and recording interval (recommended > 10 min., 3:**MPer**, Table 9.2)
- use an SD/MMC card only when this is actually necessary; otherwise, use the internal memory
- use the display in the economy mode (parameter 17:**LCDmod**); when the continuous mode is required, the

display update interval should be as long as possible (recommended >1 min., parameter 18:*LCDupd*)

- switching off alarms when they are not needed (the low and high alarm should be set on the ends of the measurement range, chapter 9.6, Table 9.6, parameters 20:*AHigh*, 21:*ALow*)
- delete unnecessary files from the internal memory or the SD card before new recording starts

If one of the following conditions is met:

- the measurement and recording interval is shorter than 10 min.;
- an SD/MMC card is used
- when the display is used in the continuous mode (with frequent update of the measured values), consider using an accessory display that can extend the life of the battery to approx. 8 years.

Moreover, it is recommended to comply with the following advice:

- do not disconnect the device from the computer in the course of communication via the USB interface, which is indicated by the "**READ/WRITE"** and in the ARSOFT-CFG WZ1 software. USB communication is present when mass memory is supported (internal memory or the SD/MMC card) and during operation of the ARSOFT-CFG WZ1 software.
- keep a copy of the current configuration file (*AR234.cfg*) in external memory (SD/MMC card, computer disk, etc.) for the purpose of archiving and future off-line configuration.

If the recorder does not respond, the battery can be taken out for a short time and its charging level can be checked (if the voltage is less than 3.3 V, the battery should be replaced with a new one).

14. CHANGING THE BATTERY

In order to change the battery, use a flat screwdriver and perform the following actions:

- remove the back wall of the housing (as shown in Figure 14.1)
- carefully take out the control board of the recorder from the housing (Figure 14.2)
- replace the battery with a new one of appropriate type (chapter 4), observing the polarity in the holder
- reassemble the device by putting the board and the back wall in their places

NOTE: ⚠

When the battery is replaced, the real time clock (RTC) is reset to zero and must be set again using the ARSOFT-CFG WZ1 software; other elements remain unchanged.
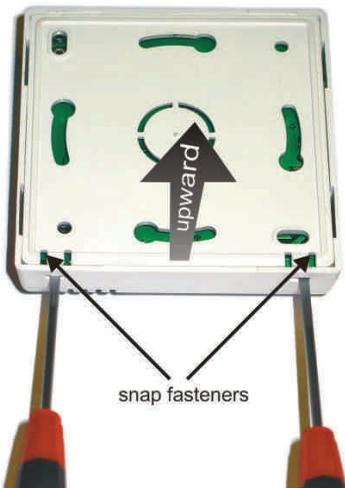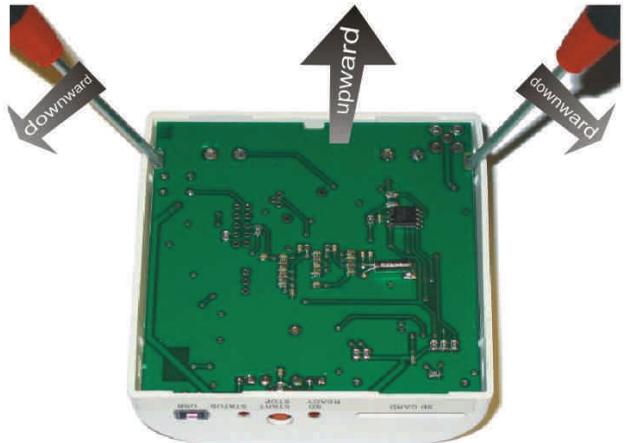

Fig. 14.1. Removal of the back wall

Fig. 14.2. Removal of the control board