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USER MANUAL

TEMPERATURE AND HUMIDITY RECORDER
AR236

TEMPERATURE RECORDER
AR232

CE

Rev. 1.1.0
2010-02-16

Thank you for choosing our product.
This user manual contains information about proper and safe operation of the recorder.
Read and understand this user manual before installation and operation of the recorder.
If you have any questions, consult a technician.

TABLE OF CONTENTS

Pay particular attention to texts marked with this sign

1 . OVERVIEW OF THE RECORDER

- **AR236** - measure and record the humidity and temperature of air or other neutral gases
  AR232 - measure and record the temperature of air or other neutral gases
- record data in a text file in internal memory of the recorder or on SD/MMC card in the FAT file system with a possibility to read via USB
- high quality digital sensor of:
  - relative humidity and temperature (AR236)
  - temperature (AR232)
- mobile casing with an option to install on wall
- battery-powered with the possibility to replace battery by the user
- LCD display for viewing output data or messages and errors
- long operation time on a new battery (up to 5 years, depending on the measurement period, whether SD/MMC card was used and operation mode of the LCD display)
- possibility to store archived data and configuration data on an SD/MMC card
- protection against unauthorized copying and changing of data
- battery-supported internal real time clock
- included software to adjust the device parameters and produce graphical or textual representation of recorded data
- temperature compensation of humidity measurement (AR236)
- high measurement stability over long periods of time
- ways to adjust parameters:
  - via USB interface and a computer program (Windows 2000/XP/Vista/7)
  - using a configuration file stored on an SD/MMC card
- checksum to detect unauthorized changes in the archive
- uniquely identifying multiple recorders of the same type by assigning unique identifier (ID) to each of them
- low and high value alerts, in-band and out-of-band alert, LED indicators
- programmable measurement period, start and end point of recording and other configuration parameters: measured signal zero adjustment, “COPY” button lock, authorization request for SD/MMC card, disable writing data to SD/MMC card, operation mode of LCD display, alerts, identification number (ID)
- option to prevent unauthorized modification of recorder parameters from SD/MMC card and moving archived data from internal storage to an SD/MMC card (card authorization or free access required)
- protection against improper placement of batteries
- high accuracy level and resistance to interferences
- possibility to update recorder's firmware
- available accessories:
  - lithium battery 3.6V, type AA (R6), 2450mAh (SAFT LS14500)
  - SD memory card (1GB)
  - SD/MMC card reader
  - USB cable (A4 – miniA4)
  - stabilized AC adapter 5V/150mA

NOTE: 

- read this user manual and follow the procedures described in sections 5, 6 and 7 before using this recorder.
- data is recorded only within defined period of time (parameters Start and Stop, Table 1, section 7)

2. CONTENTS OF THE SET

After unpacking the recorder, verify that you have the following items:
- recorder with a lithium battery 3.6V, type AA
- 2-meter long USB cable (A4 – miniA4) to connect to a computer
- CD with drivers and software
- user manual
- warranty

3. GENERAL SPECIFICATION

Sensor.....interior
Measurement range
- humidity ..... 0 ÷ 100 %RH
- temperature..... -30 ÷ 80 °C

Measurement accuracy
- humidity (AR236).....±3 %RH (20 ÷ 80 %RH)
  ±3 ÷ 5 %RH (in the remaining measurement range)
- temperature
  - AR236.....±0,5°C (20 ÷ 30°C)
    ±0,5 ÷ 1,8°C (in the remaining measurement range)
  - AR232.....±0,5°C (-10 ÷ 80°C),
    ±0,5 ÷ 1,7°C (in the remaining measurement range)

Measurement resolution..... 0,1 %RH i 0,1 °C
Hysteresis (AR236)..... ±1% RH
Long-lasting stability (AR236)..... <0,5% RH/year
Response time (63%)..... 10s (@ air flow > 1m/s)
Measurement and writing period..... programmable, 10s do 24h
Operating environment ..... air and neutral gases
Communication interface..... USB (to communicate with computer), drivers compatible with Windows 2000/ XP/Vista/7 OS

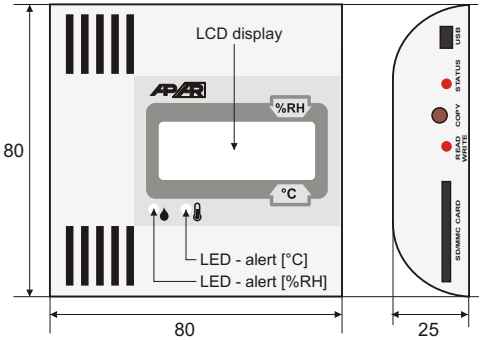
Storage (non-volatile)
- interior ..... 4MB FLASH memory, file system FAT12, record up to 75,000 measurements (up to 80,000 for AR232)
- exterior ..... SD/MMC card, recommended capacity ≤ 1 GB and FAT16 max. capacity 2GB
  - supported file systems.....FAT12, FAT16, FAT32
  - card connector.....push-out type

Real-time clock (RTC).....quartz, date (yyyy:mm:dd), time (hh:mm:ss), remembers about leap year
Optical indication.....LED diodes: "READ/WRITE", "STATUS", 1 or 2 alerts
LCD display (7 segments)..... number of digits: 3, digits height 10 mm
Power..... lithium battery 3.6 V type AA (R6), 2450 mAh, (SAFT LS14500)
Working time on new battery (1) .....up to 5 years (in ambient temperature 20 ÷ 30 °C)
Nominal operation environment.....-20 ÷ 70 °C, <100 %RH (without condensation)
Protection level.....IP20
Casing.....on-wall, material ABS UL94-V0, white
Casing dimensions.....80 x 80 x 25 mm
Working position.....any
Weight.....~97g (with battery)

(1) - working time depends on measurement period, whether SD/MMC card is used, working mode of LCD display and working temperature:
- 5 years (measurement period > 10 min., data recorded in internal storage, copying data only via USB, LCD in economic mode, 20÷30 °C), 20 months with LCD display constantly enabled
- 7 months (measurement period 10 s, internal memory, copying data only via USB, 25 °C)
- 1.5 years (measurement period > 10 min., data recorded on SD/MMC card, LCD display in economic mode, 20÷30 °C)
- 4 months (measurement period 10 s, data recorded on SD/MMC card, 20÷30 °C)

- unused card left in card slot also wears out the batteries
- moving the contents of full internal storage (4 MB) to an SD/MMC card takes about 2 min. and uses about 1÷2 mAh of the battery power (tests run on SanDisk and Kingston cards)
- LCD display running in constant mode and with refresh rate of the measured quantity > 1 min. uses about 80 mAh/month (3.3% of battery power per month)
- when optional adapter is used, new battery working time may be extended up to about 8 years (20÷30°C)

4. CASING DIMENSIONS AND EXTERNAL PARTS IDENTIFICATION



USB connector to communicate with computer and to connect the adapter

LED diode - operating status (messages and errors)

button to copy configuration data and measurement results and update the LCD display

LED diode - read/write to internal storage or SD/MMC

SD/MMC card slot (push-out) (max. 2 GB)

Dimensions [mm]

To install the recorder on a wall, you can remove the back cover (section 14) and use it to mark points in which to make holes in the wall.

5. CONNECTING TO THE COMPUTER AND DRIVER INSTALLATION

After connecting the recorder to the computer, operating system (Windows 2000/XP/Vista/7) will detect the recorder as "**APAR USB DEVICE**" and will ask you to install the drivers. Using the wizard to add new devices browse for the drivers on the CD shipped with the recorder (DRIVERS directory).
Installation procedure for Windows XP:

1. Select "**No, not this time**" and click "**Next**"
2. Choose "**Install from a list or a specific location (Advanced)**" and click "**Next**"
3. Select "**Search for the best driver in these locations**" radio button and "**Include this location in the search:**" box. Click "**Browse**", find **DRIVERS** directory, click "**Next**" and in the "**Hardware Installation**" warning dialog box click "**Continue Anyway**"
4. After the virtual COM port named "**CDC USB to UART"** has been installed, click "**Finish**"
5. Next the OS will detect and install "**Mass storage device**" -> "**ATMEL MASS STORAGE USB Device**" -> "**Disc drive**"

After finishing the installation, the recorder is present in the system as a virtual COMx port (where x is the number of the port) and two removable discs: internal 4 MB memory labeled AR236 (or AR232) and SD/MMC storage (available after inserting a card into the "**SD/MMC CARD**" slot). In internal memory is available a configuration text file AR236.cfg or AR232.cfg (section 7).

NOTE: ⚠
Do not disconnect the device from the computer while installing drivers or when detecting the discs after connecting the recorder to the USB interface (**READ/WRITE** indicator illuminated).

6. SOFTWARE INSTALLATION

The CD shipped with recorder contains a setup package ("SOFTWARE" directory) of free software to operate the recorder. The package consists of the following applications:

- ARSOFT-WZ1 - show the current temperature and humidity (AR236) readouts, battery voltage, date and time, real-time clock (**RTC**) configuration, adjustment of other parameters, such as the beginning and end of recording, period of measurement and writing etc. (see section 7). The program requires communication with the recorder (on-line configuration)
- ARSOFT-WZ3 - graphical or textual representation of recorded data and an option to print it. Input is taken all at once from a „**csv**" file created in internal memory of the recorder or on an SD/MMC card
- ARSOFT-WZ4 - create on disk a configuration file with the extension „**cfg**" which may be used to configure the recorder with an SD/MMC card and the "**COPY**" button. In this type of configuration you cannot change **RTC** and **ID** parameters. The program does not communicate with the recorder (off-line configuration)

Newest versions of these programs can be downloaded from our website at www.apar.pl. Refer to documents in installation folders for details about these applications.

7. PARAMETERS ADJUSTEMENT

Configuration activities may be performed in the following ways:

1. Using USB interface and computer program ARSOFT-WZ1 (on-line):
- connect the recorder to the USB port of computer and run the application
- after connection, the program shows current measurement data, battery voltage and internal time and date of the recorder. "**STATUS**" LED indicator indicates that the transmission is running
- parameters that may be adjusted in the configuration window are presented in table 1
- every change must be confirmed by clicking "**Accept**"
- the program allows to synchronize date and time with the computer
- current configuration values may be stored in a file or restored from a file
- the recorder will update the configuration file (**cfg**) after disconnecting from computer USB (unless battery voltage is < 2.7 V)

NOTE:
- before disconnecting the device from computer, click "**Disconnect the device**"
- when there is no response:
  - make sure the drivers have been installed properly
  - disconnect the recorder from the USB interface and reconnect it after a few seconds
  - restart the computer
  - remove for a few seconds battery from the recorder (section 14)

2. . Using configuration file created by ARSOFT-WZ4 (off-line):
- run the application and in the "**Device**" box enter the name of the device (**AR232** or **AR236**)
- adjust parameters showed according to the table 1 (except for **RTC** and **ID**)
- current configuration may also be created via changing values from an existing file
- save the created configuration in a file (**AR236.cfg** or **AR232.cfg**) and store it on an SD/MMC card (using the card reader)
- insert the card in the "**SD/MMC CARD"** slot and press "**COPY**"; while copying the "**STATUS**" indicator will be illuminated
- when the "**STATUS**" LED turns off, remove the card from the slot

NOTE:
- for the off-line configuration to be successfully completed, parameters for data protection from unauthorized copying and changing should be set as follows: **bloc=disabled**, **Prot=disabled** or when **Prot=enabled** the **Pass** parameter value in the SD/MMC card file should match the value of the **Pass** parameter in the recorder
- pressing "**COPY"** button and successful authorization of the card triggers also the action to move archive „**csv**" files onto this card

Table 1. Configuration parameters

#	Name	Description	Value and value range	Settings: factory	Settings: custom
0	**RTC**	internal time of the recorder (1)	**2008.06.01 ÷ 2099.12.31**, **hh:mm:ss**	08.06.01	
1	**Start**	recording start point (2)	**2008.06.01 ÷ 2099.12.31**, **hh:mm:ss**	08.06.01	
2	**Stop**	recording end point (2)	**2008.06.01 ÷ 2099.12.31**, **hh:mm:ss**	08.06.01	
3	**MPer**	measure.and record.period (3)	**10s ÷ 24h**, interval 10s	10 min	
4	**SDest**	measurement output storage	**internal** or **auto** (SD/MMC when present)	auto	
5	**dot**	measurement resolution	**0** = 1°C and 1%RH, **1** = 0,1°C and 0,1%RH	1=0,1	
6	**coHum**	zero offset for humidity (5)	**-5.0 ÷ 5.0** %RH (AR236 only)	0 %RH	
7	**coTem**	zero offset for temperature (5)	**-2.0 ÷ 2.0** °C	0 °C	
8	**bloc**	"**COPY"** button lock	**enabled** or **disabled**	disabled	
9	**Pass**	card authorization password	**0 ÷ 9999**	1111	
10	**Prot**	card authorization request (6)	**enabled** or **disabled**	disabled	
11	**ID**	identification number (7)	**0 ÷ 9999**	0	

				Settings	
#	**Name**	**Description**	**Value and value range**	**factory**	**custom**
12	**LCDmod**	display operating mode (4)	**economic** or **constant**	econ.	
13	**LCDupd**	display update time in constant mode (4)	**10s** ÷ **24h**, interval 10s	2min	
14	**AHiHum**	high alert for humidity (8)	**0** ÷ **100.0** %RH (AR236 only)	100%RH	
15	**ALoHum**	low alert for humidity (8)	**0** ÷ **100.0** %RH (AR236 only)	0 %RH	
16	**AHiTem**	high alert for temperature (8)	**-40.0** ÷ **100.0** °C	100 °C	
17	**ALoTem**	low alert for temperature (8)	**-40.0** ÷ **100.0** °C	-40 °C	

Notes:
- (1) - parameter available only in ARSOFT-WZ1
- (2) - when connected to the USB interface of computer, the device does not record data in a file
- (3) - the measurement and recording period start with disconnection from USB
- (4) - see section 11 for details about operating modes of the display
- (5) - parameters enabling offset for measurement (eg. in case discrepancies between real and measured values are detected)
- (6) - when **Prot=enabled** only SD/MMC cards containing a configuration file with password (**Pass**) matching the password in recorder will be supported. This prevents unauthorized removal of archive „**csv**" files stored in internal storage and changing configuration parameters of the recorder. For **Prot=disabled** all SD/MMC cards are supported.
- (7) - parameter available only in ARSOFT-WZ1 application. It is used to identify files with data created by many different recorders of the same type
- (8) - see section 10 for details about alert configuration

8. OPERATION AND FEATURES OF SD/MMC CARD

SD/MMC card to store data may be particularly useful for stationary (on-wall) installations of the recorder and when the amount of measurement data to be stored exceeds the capacity of the internal storage. Properly installed card in the "**SD/MMC CARD**" slot has the following features:

- store files with values written to the files during recording
- off-line parameter configuration (using a configuration file **AR236.cfg** or **AR232.cfg** with "**COPY**" button, see section 7)
- move archive **„csv"** files from internal storage onto the card (the action may be performed by pressing "**COPY**" button and authorizing or when authorization request is disabled; during the operation "**STATUS**" indicator is illuminated; timing for 4 MB of data - up to 2 min.)

NOTE: 

- the action of moving **„csv"** files from internal storage to SD/MMC card is performed **CONCURRENTLY** with off-line configuration. Thus, to avoid undesired recorder reconfiguration, make sure that on the card exists appropriate "**.cfg**" file (or the file does not exist if **Prot=disabled**)
- use only branded SD/MMC cards (e.g. SanDisk or Kingston) formatted using FAT 16 file system for maximum battery durability
- **cards with capacity over 2 GB may cause device suspension, which requires removing batteries for a while**

9. VIEWING RECORDED MEASUREMENTS AND EVENTS

In order to perform data synchronization, recorder creates in internal storage or on an SD/MMC card a text file with "**.csv**" extension. Writing to the file is performed only, when current time (RTC) is within the time range defined by 1:**Start** and 2:**Stop** recording parameters (see section 7, table 1). The filename consists of the device type (AR236 or AR232), 11:**ID** and date and time when the file was created, e.g.: "AR236_1_2009-08-30_10-57-16.csv". Records are written in the following format: "ordinal number of the event;date;time;event identification number;argument 1;argument 2,checksum". Example record for humidity and temperature measurement performed by AR236:
“30;2009-01-09;16:34:58;5;49,5;26,2;8BE2,” where humidity=49,5 % RH, temperature=26,2 °C.
Types and identification numbers of recorded events:

- temperature and humidity measurement (event identification number: **5**, %RH and °C for AR236 or °C for AR232)
- connection using the USB interface (**0**, "USB;CONNECTED")
- disconnection from the USB interface (**1**, "USB;DISCONNEC")
- load new configuration parameters (**3**, "NEW;ON-LINE" or "NEW;OFF-LINE")
- create new „**csv**" file (**4**, “ID;xxxx”, where xxxx is the 11:**ID** parameter of the device)
- low battery voltage, below 3.15 V (**6**, "LVBAT;x.xx", where x.xx is battery voltage [V])

Use ARSOFT-WZ3 application to produce and print graphical or textual representation of the output. Moreover, the application also enables detection of unauthorized changes of the archive. Alternatively the „**csv**" files may be edited with spreadsheet software, such as Microsoft Excel or OpenOffice Calc, as well as word processors (e.g. Windows WordPad or Notepad++).

NOTE:

- if while performing recording an SD/MMC card is installed or removed, new „**csv**" file is created with numbering of events being continued from the previous file.

10. ALERT CONFIGURATION

While displaying measured values, the recorder allows also signal alert statuses indicated by short one-second blinks of LED diodes. Properties and alert threshold values for humidity (AR236 only) or temperature are defined by: low alert (15:**ALoHum**, 17:**ALoTem** parameters) and high alert (14:**AHiHum**, 16:**AHiTem**). See section 7, Table 1.
To acquire low alert, high alert or out-of-band alert, set low alert value that is **lower** than the value of high alert - Fig. 1. Alert in a certain band enables when low alert value is **higher** than high alert's - Fig. 2.

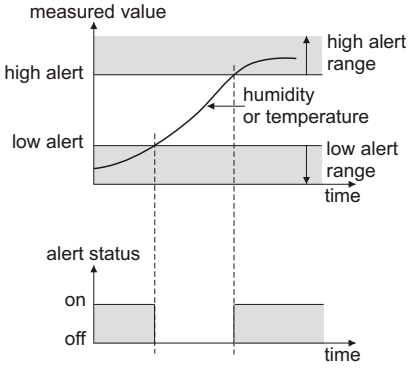


Fig. 1. High alert, low alert or out-of-band alert

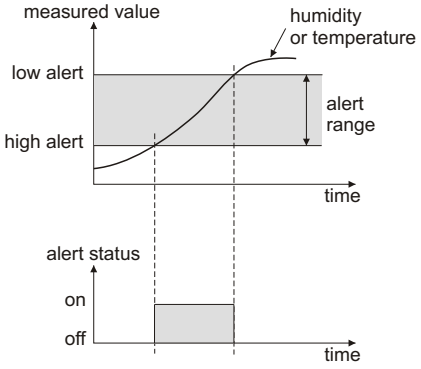


Fig. 2. Alert in band

11. LCD DISPLAY OPERATION MODES

The display can be set within one of two operating modes: economic (12:**LCDmod** = economic) or constant (**LCDmod** = constant). In economic mode the display turns on for a few seconds after performing every measurement while recording or can be enabled manually by pressing the "**COPY**" button. This operating mode ensures the lowest energy consumption, which allows longer recorder operation without battery replacement.
In constant mode, the display is constantly on and updated in the following conditions:
- measurement and write operation occurred during recording (according to 3:**MPer** parameter, see section 7, Table 1)
- measurement occurred according to the display update period (13:**LCDupd**)
- measurement triggered by pressing the „**COPY**" button

The display update period (13:**LCDupd** parameter) allows perform measurements also when recording is turned off. Set this parameter value over 1 min. to minimize battery energy consumption.

12. MEASSAGES AND ERRORS — LED INDICATORS

Two LED indicators localized on one side of the recorder indicate the occurrence of the following events:
READ/WRITE : - read/write to internal storage or SD/MMC
STATUS: - transmission via virtual COM port (used by ARSOFT-WZ1 application, see section 7, pt 1)
- copy configuration file from SD/MMC to recorder and move files with recorded data to a card by pressing the „**COPY"** button (see section 8)
- storage used to save recorded data in an archive file is full - short blink while trying to save the data and the FULL message on the display
- battery voltage too low (below 3.15 V) - short blink during measurement output recording and the LbAt message on the display (additionally a record is created in the archive file, section 9)

13. IMPORTANT OPERATIONAL NOTES

Read this user manual carefully to ensure easy usage of the product. For maximum durability of batteries make sure that:
- measurement and recording period parameters are set to the highest possible value (above 10 min. is recommended, parameter 3:**MPer**, Table 1)
- SD/MMC card is used only when necessary. Otherwise use internal memory
- the display is working in economic mode (parameter 12:**LCDmod**). If constant mode is required, update period should be set to the highest possible value (above 1 min. recommended, parameter 13:**LCDupd**)
- alerts are turned off when not in use (high and low alerts should be set at bounds of the measurement range, section 7, table 1, parameters 14:**AHiHum**,15:**ALoHum**, 16:**AHiTem**, 17:**ALoTem**)
- unnecessary files are removed from the internal memory and SD card before recording starts

In the following conditions:
- measurement and recording periods are much shorter than 10 min
- SD/MMC card is in use
- the display works in the constant mode (with measured results frequently updated)

consider using optional AC adapter, which may extend durability of batteries up to about 8 years.
Another important thing to note is that you must not disconnect the device from the computer while communicating over USB interface - this is signaled by illumination of **READ/WRITE** and **STATUS** LED indicators. USB communication can be defined as the act of working with mass memory device (internal SD/MMC card) or running ARSOFT-WZ1 application.
When response from the recorder seems to be suspended remove battery for a while and check its voltage. If that voltage is less then 3,3V then replace the battery for a new one of a proper type.

14. BATTERY REPLACEMENT

To replace batteries, you will need two screwdrivers. Perform the following procedure:

- remove the back cover (Fig. 1)
- carefully remove the circuit board (Fig. 2)
- replace battery with a new one of correct type (section 3) - make sure the battery is placed correctly in the slot
- put the circuit board back in place and close the back cover

NOTE: ⚠

During battery replacement the real-time clock (RTC) is cleared and needs to be reset with ARSOFT-WZ1 application. The other parameters remain unchanged.

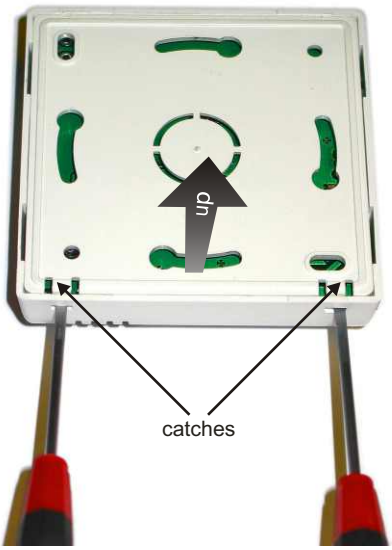


Fig.1. Removing back cover

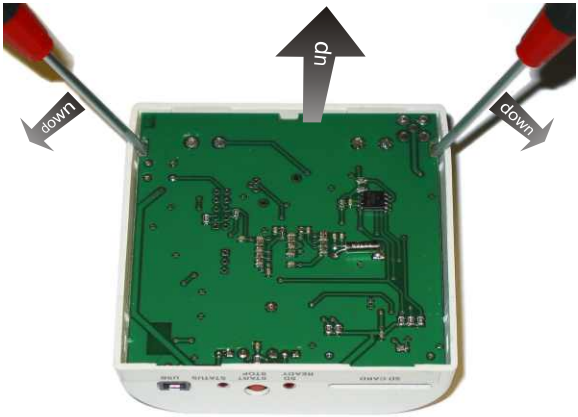


Fig.2. Removing circuit board