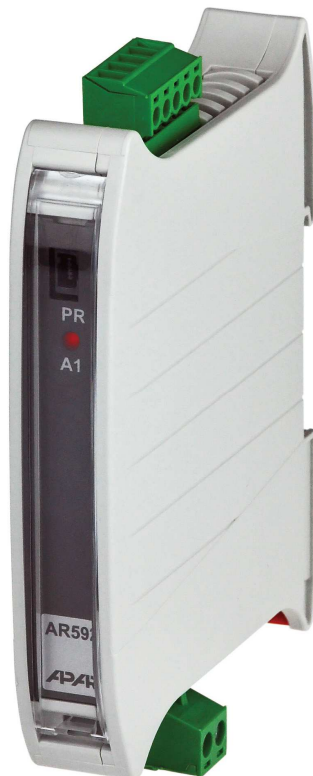# USER INSTRUCTION

UNIVERSAL TRANSDUCER
AR592

Thank you for choosing our product.
These instructions will facilitate operating the device and enable safe use of the device at its full capacity.
Prior to the installation and startup of the device, please become familiar with these instructions.
In the event of any additional questions, please contact our technical adviser.

CONTENTS

⚠ Please pay particular attention to the text marked with this sign.

The manufacturer reserves the right to make changes to the design and the programming of the device without any deterioration of the technical parameters (some functions may not be available in older versions).

1. SAFETY PRINCIPLES ⚠

- before you start to use the device, become familiar with the present instructions;
- in order to avoid electrocution or damage to the device, its mechanical and electrical installation must be performed by qualified staff;
- before switching on the power supply, make sure that all cables and wires are properly connected;
- before making any modifications to the wire and cable connections, switch off the device's power supply;
- ensure proper operating conditions compliant with the technical specification of the device (power supply voltage, humidity, temperature - see chapter 5).

2. 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:

- do not supply the device from the same lines as high-power equipment without using appropriate power line filters;
- use cable shields on power supply cables, sensor cables, and signal cables, whereby the earthing of the shield should be single-point and located as close to the device as possible;
- avoid running instrument (signal) cables in the direct vicinity of and parallel to power distribution and power 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 locating remotely controlled, electromagnetic meters, and high-power loads, loads with phase or group power control, and other devices producing large impulse interferences close to one another;
- ground or zero metal rails on which rail-mounted devices are installed.

3. GENERAL CHARACTERISTICS OF THE TRANSDUCER

- linear processing of measured temperature or another physical value transformed into a standard current signal;
- high accuracy, long-term stability, and immunity to interferences;
- universal input:
  - thermoresistance... Pt100, Ni100, Pt500, Pt1000
  - thermocouple ....J, K, S, B, R, T, E, N
  - analog .... 0/4÷20 mA, 0÷10 V, 0÷60 mV, resistance 0÷2,500 ohm
- current output 4÷20 mA (2-wire with supply in the current loop), proportional to the measured value
- galvanic isolation (input/output)
- narrow enclosure for installation on the TS35 rail (DIN rail)
- scope of processing, input type, and other parameters configured with an AR950 programmer or an AR956 programming set
- LED signaling of exceeded processing range or sensor error
- high accuracy and immunity to interferences;

NOTE: ⚠️

- **before starting to work with the meter, you must become familiar with this using instruction, properly prepare the electrical system and the mechanical system, and correctly configure the parameters.**
- **if the characteristics of the transducer are configured with the AR956 programmer, the transmission parameters that can be set in the options of the ARSOFT-CFG software are the following:**
    - **COM port number: assigned by the Windows system after installation of the AR956 controller, available in the "Device Manager" in the "Ports (COM and LPT)" group; see "Quick start programmer AR956"**
    - **transmission speed: 2,400 bit/s**
    - **MODBUS address = 1**

A detailed description of the configuration parameters of the transducer can be found in chapter 9.

4. CONTENTS OF THE SET

- ■ a transducer with a set of connections;
- ■ operating instructions;
- ■ a warranty card.

5. TECHNICAL DATA

1 universal programmable input	measurement range
- Pt100 (RTD, 3- or 2-wire)	-200 ÷ 850 °C
- Ni100 (RTD, 3- or 2-wire)	-50 ÷ 170 °C
- Pt500 (RTD, 3- or 2-wire)	-200 ÷ 850 °C
- Pt1000 (RTD, 3- or 2-wire)	-200 ÷ 850 °C
- thermocouple J (Fe-CuNi)	-40 ÷ 800 °C
- thermocouple K (NiCr-NiAl)	-40 ÷ 1,200 °C
- thermocouple S (PtRh 10-Pt)	-40 ÷ 1,600 °C
- thermocouple B (PtRh30PtRh6)	300 ÷ 1,800 °C
- thermocouple R (PtRh13-Pt)	-40 ÷ 1,600 °C
- thermocouple T (Cu-CuNi)	-25 ÷ 350 °C
- thermocouple E (NiCr-CuNi)	-25 ÷ 740 °C
- thermocouple N (NiCrSi-NiSi)	-35 ÷ 1,300 °C
- current $(R_{in} = 110\,\Omega)$	0/4 ÷ 20 mA
- voltage $(R_{in} = 100\,k\Omega)$	0 ÷ 10 V
- voltage $(R_{in} > 5\,M\Omega)$	0 ÷ 60 mV
- resistance (3- or 2-wire)	0 ÷ 2,500 Ω
Permissible feed resistance (RTD, Ω)	$R_d < 30\,\Omega$ (for each line)
Resistance input current (RTD, Ω)	180 ÷ 250 µA
Processing range for the output	any (programmable in the measurement range of the input), factory 0÷500 °C

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		< 0.01% of the input range /°C
Resolution of measured temperature		programmable, 0.1 °C or 1 °C
Resolution of analog input (programmable)		-1999 ÷ 9999 (parameters 3: `Abot` , 4: `Atop`)
Analog output	- current 4 ÷ 20 mA	maximum resolution 2.6 mV
		load resistance Ro < 500 Ω
	- basic error of the output	< 0.1% of the output range
Response time (10 ÷ 90%)		240 ÷ 1,600 ms (programmable with parameter 1: `F ilt`); factory 360 ms
Signaling of alarms, messages, and errors		red LED diode (A1) and output signals (3.8 mA or 21 mA)
Power supply (Usup)		10 ÷ 36 V DC
Operating temperature range		0 ÷ 65 °C
Relative humidity range		0-90 °C (no condensation)
Protection rating		IP20
Operating position		any
Weight		approx. 70 g
Separation (in/out)		1.5 kV, 50 Hz, 1 min.
Electromagnetic compatibility (EMC)		immunity: according to the PN-EN 61000-6-2:2002(U) standard
		emissivity: according to the PN-EN 61000-6-4:2002(U) standard
Transmission parameters for the AR956 programmer		2,400 bit/s, address MODBUS = 1

NOTE: ⚠

Measurements performed by the transducer when supplied from the AR956 programmer are not reliable. The AR956 programmer is intended only to supply the transducer during configuration of parameters using the ARSoft-CFG software. During normal operation, the transducer should be supplied in the standard manner.

6. ENCLOSURE DIMENSIONS AND INSTALLATION DATA

|	
Enclosure type	rail-mounted
Material	polycarbonate, ABS UL94V-0
Enclosure dimensions	79 x 101 x 17.5 mm
Fixing methods	on a 35 mm DIN rail
Conductor cross-sections	2.5 mm^2 (supply, outputs), 1.5 mm^2 (inputs)
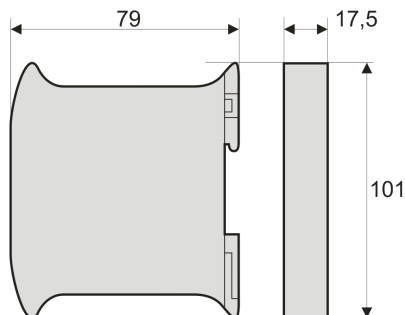
7. DESCRIPTION OF TERMINAL STRIPS AND ELECTRICAL CONNECTIONS

Table 7. Numbering and description of terminal strips.

Terminals	Description
1-2-3	input Pt100, Ni100, Pt500, Pt1000, resistance, (2- and 3-wire)
2-3	thermocouple input TC (J, K, S, B, R, T, E, N) and voltage input 0÷60 mV
3-5	current input 0/4÷20 mA
4-5	voltage input 0÷10 V
6	analog output 4÷20 mA
7	supply input +Usup
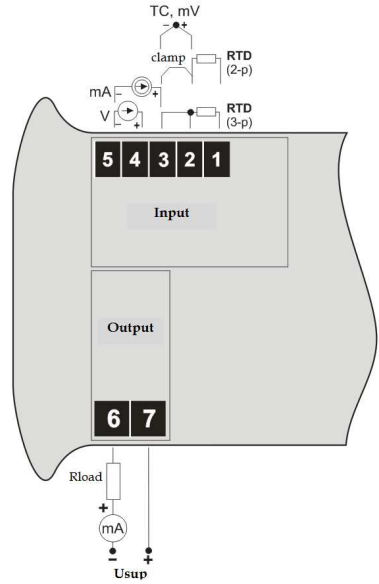
Usup - power supply voltage
Rload - load resistance of the measuring device
(mA) - measuring device (miliammeter)

8. LOCATION AND DESCRIPTION OF ELEMENTS OF THE FRONT PANEL

Table 8. Description of the elements of the front panel.

Symbol	Description
PR	programming outlet (for AR956 and AR950)
A1	LED signaling of exceeded processing range or sensor error

NOTE: ⚠️
Connecting other devices than the AR950 or AR956 programmer to the PR socket may result in damage to the connected device and the AR592 transducer.

9. SETTING OF THE CONFIGURATION PARAMETERS

All the configuration parameters of the device are stored in the non-volatile internal memory.

When the device is switched on for the first time, an error may occur 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 a situation, the appropriate sensor or analog signal should be connected

or the parameter configuration must be performed.

Methods of parameter configuration via the PR socket (accessible by opening the transparent front cover):

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1. Use the AR956 programmer and the ARSOFT-CFG software to:
– connect the device to a computer port and to start and configure the ARSOFT-CFG application
– after the connection has been established, the current measured value is displayed in the window of the software
– 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 current configuration can be saved in a file or set using values read from a file

NOTE: ⚠️

– before disconnecting the device from a computer, press the ***Disconnect device*** button (ARSOFT-CFG)
– in the event of no response:
  – in the ***Program options*** check the configuration of the port and the ***MODBUS address of the device*** (transmission speed 2,400 bit/s, MODBUS address=1)
  – make sure that the serial port drivers in the computer have been properly installed for the AR956 programmer
  – disconnect for a few seconds and then reconnect the AR956 programmer
  – restart the computer
  – if the AR955 programmer is used instead of the AR956 programmer, connect the power supply voltage to the transducer (put it in the current loop)

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2. Use the autonomous AR950 programmer to:
– connect the power supply voltage to the transducer;
– use the cable included in the set to connect the AR950 programmer to the device being configured (an AR5xx series transducer);
– the programmer can be connected both before the power supply is switched on and during operation of the device;
– enter the configuration parameters programming mode by pressing (for about 2 s) the **CONF** button until the $\boxed{\text{ConF}}$ message briefly appears on the display and then the mnemonic name of the first parameter is displayed ($\boxed{\text{inP}}$); by pressing the ▲ button, you can move to the next parameter, and by pressing the ▼ button - to the previous parameter ($\boxed{\text{inP}} \leftrightarrow \boxed{\text{FiLt}} \leftrightarrow \boxed{\text{dot}} \leftrightarrow$...); a list of configuration parameters can be found in the user instruction of the device being configured;
– in order to change or view the value of the current parameter, press SET (edition of the parameter);
– by using ▲ or ▼, you can change the value of the current parameter;
– by pressing SET again, you can save the edited value and return to the parameter name display (e.g. $\boxed{\text{FiLt}}$);
– in the parameter edition mode, by pressing **ESC** for a short time, you can cancel the changes and return to the parameter name display mode;
– you can exit the configuration parameters programming mode by pressing the **ESC** button for a long time (approx. 1 s); otherwise, the mode is switched off after approx. 2 minutes;
– in the normal mode, the measured value is displayed;

Detailed information can be found in the user instruction of the AR950 programmer.

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 7: $\boxed{\text{cALo}}$ (zero) and 8: $\boxed{\text{cALg}}$ (sensitivity).

In order to restore the default settings, use the file with the default configuration in the ARSOFT-CFG software.

NOTE: ⚠️

The transmission parameters for the AR956 programmer in the ARSOFT-CFG software are the following: 2400 bit/s, address MODBUS = 1

Table 10. List of configuration parameters

| Parameter	Range of variability of the parameter and description		Default settings
0: `inP` Type of measurement input	`Pt 100`	thermoresistance sensor (RTD) Pt100 (-200 ÷ 850°C)	`Pt 100`
	`ni100`	thermoresistance sensor (RTD) Ni100 (-50 ÷ 170°C)	
	`Pt500`	thermoresistance sensor (RTD) Pt500 (-200 ÷ 850°C)	
	`Pt 1000`	thermoresistance sensor (RTD) Pt1000 (-200 ÷ 850°C)	
	`tc-J`	thermoelectric sensor (thermocouple) type J (-40 ÷ 800°C)	
	`tc-h`	thermoelectric sensor (thermocouple) type K (-40 ÷ 1,200°C)	
	`tc-S`	thermoelectric sensor (thermocouple) type S (-40 ÷ 1,600°C)	
	`tc-b`	thermoelectric sensor (thermocouple) type B (-300 ÷ 1,800°C)	
	`tc-r`	thermoelectric sensor (thermocouple) type R (-40 ÷ 1,600°C)	
	`tc-t`	thermoelectric sensor (thermocouple) type T (-25 ÷ 350°C)	
	`tc-E`	thermoelectric sensor (thermocouple) type E (-25 ÷ 740°C)	
	`tc-n`	thermoelectric sensor (thermocouple) type N (-35 ÷ 1,300°C)	
	`4-20`	current signal 4 ÷ 20 mA	
	`0-20`	current signal 0 ÷ 20 mA	
	`0-10`	voltage signal 0 ÷ 10 V	
	`0-60`	voltage signal 0 ÷ 60 mV	
	`rES`	resistance signal 0 ÷ 2,500 Ω	
1: `Flt` filtration **(3)**	`1÷ 10`	digital filtration of measurements (response time)	`4`
2: `dot` position of the point/resolution**(2)**	`0`	no point or 1°C resolution for temperature	`1` (0.1 °C)
	`1`	`0.0` or resolution 0.1 °C for temperature	
3: `Abot` start of input scale **(1)**	`-1999 ÷ 9999`	indication for 0/4mA, 0V, 0Ω on the input - start of input scale	`0.0` °C
4: `AtoP` end of input scale **(1)**	`-1999 ÷ 9999`	indication for 20 mA, 10 V, 60 mV, 2,500 Ω on the input - end of the input scale	`500.0` °C
5. `rbot` start of analog output scale	in the measurement range of the specific input		`0.0` °C
6. `toP1` end of analog output scale	in the measurement range of the specific input		`500.0` °C
7: `cALo` calibration of the zero	zero offset for measurements: `-100.0 ÷ 100.0` °C or `-1000 ÷ 1000` units (**1**)		`0.0` °C
8: `cALG` gain	`-85.0÷ 115.0` %	calibration of inclination (sensitivity) for measurements	`100.0` %

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

(2) – applies only to display of data in the connected programmer (AR950, AR956),

(3) – for `Flt`=`1`, the response time is approx. 0.135 s; for `Flt`=`10` - approx. 1.5 s. Higher degree of filtration means a more smooth measured value and a longer response time, which is recommended in the case of turbulent measurements (e.g. water temperature in a boiler).

10. OUTPUT CONFIGURATION

The output signal is proportional to the signal measured in the range set by
parameters 5: `rbot` and 6: `rtoP`. The principle of operation of the analog output is shown in the drawing below.
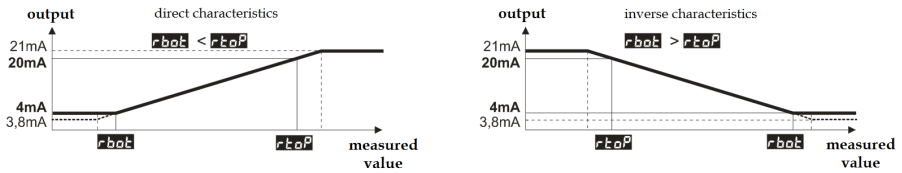
11. SIGNALING OF MEASUREMENT ERRORS

The transducer detects the following measurement errors:
- exceeded processing range, from the bottom or from the top;
- connected sensor or input signal other than the one set in the configuration parameters;
- defective sensor circuit.

Methods of signalization of measurement errors:
- blinking of diode **A1**

12. CONNECTING THE CONTROLLER TO A COMPUTER AND AVAILABLE SOFTWARE

It may be useful (or necessary) to connect the transducer to a computer in order to configure parameters, which also enables copying the setting to other transducers of the same type.
As a standard, the transducers are equipped with a **PR** port, which enables connecting to a computer using an AR956 programmer. Attention should be paid to the configuration of transmission parameters in the options of the ARSOFT-CFG software. The transmission parameters should be of the following values: Speed = 2,400 bit/s, MODBUS address = 1.
The following applications are available (on a CD supplied with the AR956 programmer or to be downloaded from the Internet at ***www.apar.pl***, *Download* section, for operating systems Windows Vista/7/8/10):

Name	Software description
ARSOFT-CFG (free)	- display of current measurement data from the connected device - configuration of the type of measurement input, the indication range, the alarm options, the display, etc. - creation of a disk with a "cfg" extension, containing the current configuration of the parameters to be used again (duplication of configuration) - the software requires communication with the device via the **PR** port (AR956 or AR955)

The detailed descriptions of the aforementioned applications can be found in the installation folders.

NOTE:

Before a connection is established, make sure that the MODBUS address and the transmission speed in the options of the ARSOFT software are the same as the settings of the device. Moreover, in the ARSOFT software options, set the number of the COM serial port in use (in the case of the RS956 or AR955 programmer it is the number assigned by the operating system during installation of the drivers).