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USER INSTRUCTION

TEMPERATURE CALIBRATOR

AR915

Version 1.1.0
2015-06-12

Thank you for choosing our product.
This instruction is intended to facilitate correct operation, safe use, and taking full advantage of the calibrator'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 the text marked with this sign.

1. PRINCIPLES OF SAFE USE

- **before you start to use the device, become familiar with the present instructions;**
- ensure proper operating conditions, as specified in the user's technical data (humidity, temperature)

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:

- avoid running instrument (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;

2.GENERAL CHARACTERISTICS OF THE CALIBRATOR

- the purpose of the device is to measure and simulate temperature sensors
- **universal input/output** (programmed from the keyboard)**:**
  - thermoresistant...Pt100, Ni100, for measurements, automatic detection of a 2- or 3-wire connection of the sensor with line resistance compensation
  - thermocouples...J, K, S, B, R, T, E, N, automatic or constant compensation of reference joint temperature
  - linear…….. voltage (mV), resistance
- an ergonomic manual housing of small size and weight, with rubber anti-slip side grips
- simple and reliable laboratory banana connectors
- a clearly visible LCD display and a functional keyboard
- battery (2 x 1.5 V) or rechargeable battery (2 x 1.2 V NiMH) power supply, AA type
- long operation on a fully charged set of batteries
- automatic power supply cutoff at low battery charging level
- automatic shutdown after a preset idle time
- possibility to test measurement devices and temperature sensors
- diagnostic functions facilitating detections such defects in tested circuits as:
  - lack of excessive value of current polarizing a resistance sensor (in a simulation)
  - short circuits in a voltage signal measurement circuit (in a simulation of thermocouples and mV)
  - short circuits or interruptions in sensor circuits (in measurements)
- quick and simple readout:
  - type of sensor set
  - working direction (input/output)
  - battery charging level
  - current polarizing a resistance sensor (in a simulation)
  - type of detected connection in a resistance sensor (2- and 3-wire)
  - reference joint temperature in a thermocouple sensor (in a simulation and in measurements)
- programmable range and step of output signal changes and other configuration parameters, such as: resolution of indications, calibration of the zero point and the gain of the measured or set signal, keyboard block, automatic device shutdown delay, etc.
- settings in °C ,Ω, mV
- programmable password protection of configuration parameters
- high resistance to interferences present in industrial environments
- protection against incorrect battery polarity

NOTE:
After the calibrator is switched on in the measurement mode, an error signal may be shown in the display that indicates that no sensor or a sensor different than the factory-defined sensor in the configuration parameter is connected to the device. If this happens, connect the proper sensor or set the correct parameter 0: SEnP (chapter 6, Table 1)

3. TECHNICAL DATA

Operation mode (set from the keyboard)..... input (measurement) or output (simulation)
Universal input/output (programmable with the parameter 0: StYP), measurement and settings range:

RTD :
- Pt100 (3- or 2-wire)....-100 ÷ 850 °C (factory setting of the sensor)
- Ni100 (3- or 2-wire)..... -50 ÷ 170 °C
- Pt100, Ni100, for measurements, automatic detection of a 2- or 3-wire connection of the sensor with line resistance compensation, automatic for 3-wire version, constant for 2-wire version (parameter 1: rtd)

Thermocouple:
- 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 ..... -50 ÷ 750 °C
- thermocouple N ..... -80 ÷ 1300 °C
- compensation of cold thermocouple end temperature, automatic or constant (programmable with parameters 2: 2: cJtY and 3: cJtE, see chapter 6, Table 1)

Line:
- voltage ..... -5 ÷ 55 mV
- resistance ..... .10 ÷ 540 Ω(measurement)
  0 ÷ 1,000/Ip [Ω]≤ 3,200 Ω(setting)
  Ip - output polarizing current [mA]

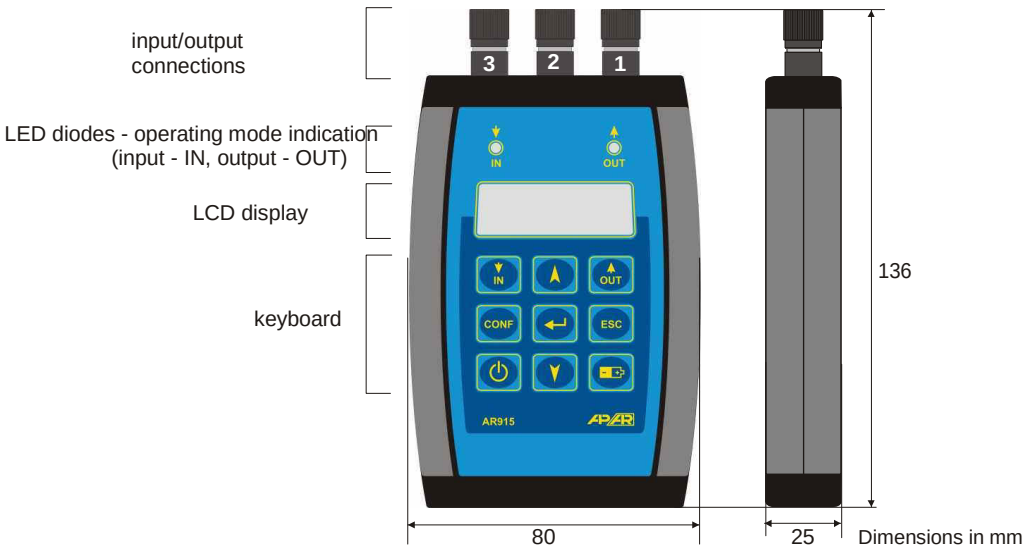
Leads resistance for RTD ..... Rd < 25 Ω(for each line)
Resistance input current (RTD, Ω)..... ~250 μA (for measurements)
Output polarizing current Ip RTD, Ω.....100 ÷ 1,900 μA (input current in resistance simulations) **(1)**
Basic processing error (at ambient temperature equal to 25 °C)
- measurement: - Pt100, -5÷55 mV, 10÷540 Ω.....≤ 0.2% of sensor range ±1 digit
  - Ni100, all thermocouples……..≤ 0.3% of sensor range ±1 digit
- setting (simulation):- Pt100, Ni100..... … ≤ 2 °C for Ip > 200 μA and ≤ 3 °C for Ip < 200 μA
  - J, K, E, N, 55 mV, 0÷3.2 kΩ ..... … ≤ 0.2% for sensor range and ≤ 1.5 Ωfor 0÷3.2 kΩ
  - S, B, R, T..... ….≤ 0.3% of sensor range

Additional error for setting Pt100,Ni100, 0÷3,2kΩ… ≤ 2,5°C or ≤1Ω (nonlinearity)
Additional error for thermocouple inputs ..... ….≤ 2 °C (present only in automatic compensation of cold tip temperature)
Additional error from temperature changes..... ….≤ 0.01% of the sensor range/°C
Resolution of indications..... … 0.1 °C or 1 °C (programmable with parameter 6: dot)
Resolution of settings in simulations..... …… 0.5 ÷ 200.0 °C, set with parameter 9: StEP, default value 1°C
Response time for measurements (10÷90%)... …… 0.7 ÷ 2.3 s, set with parameter 5: FiLt, default value 1.3 s
LCD display (7-segment, 4 digits)
- range of indications ..... ….. -1999 ÷ 9999
- digit height ..... ….. 10 mm

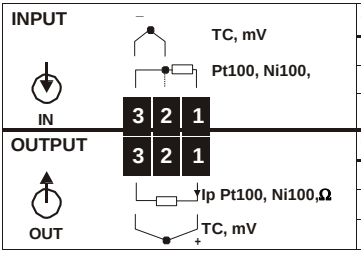
Power supply (regular or rechargeable batteries) 2 x 1.5 V (2 x 1.2 V NiMH), type AA (LR6) **(2)**
Operation time.....…..300 ÷ 400 hours(with rechargeable batteries 2 x 1.2 V/2,5 Ah)
Operating temperature range .....…..0 ÷ 50 °C
Relative humidity range ..... …. 0 ÷ 90 % (no condensation)
Housing ..... …. manual, ABS material
Dimensions..... ….136 x 80 x 25 mm
Protection rating..... … IP43
Operating position ..... … any
Weight..... …~130 g (w/o batteries), ~165 g (w/ batteries)
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

(1) - simulation of resistance (RTD, Ω)does not work for multiplexed inputs (pulse IP current)
(2) - when replacing the batteries, pay attention to the polarity shown in the battery compartment

4. DIMENSIONS OF THE HOUSING AND DESCRIPTION OF CONNECTIONS AND EXTERNAL ELEMENTS



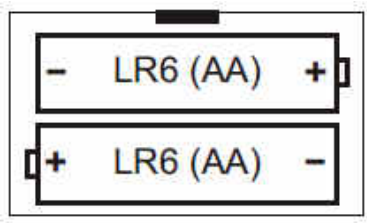
DESCRIPTION OF CONNECTIONS



termin	description
1-2-3	input Pt100, Ni100, Pt500, Pt1000, resistance, 3-wire
1-3	input Pt100, Ni100, Pt500, Pt1000, resistance, 2-wire
2-3	thermocouple input (J, K, S, B, R, T, E, N) and 0÷55 mV

termin	description
1-3	output Pt100, Ni100, resistance
1-3	thermocouple output (J, K, S, B, R, T, E, N) and 0÷55 mV
Ip - resistance output polarizing current in simulations	

BATTERY INSTALLATION METHOD



View from the bottom of the device after the cover is opened

5. BUTTON FUNCTIONS

Button	Function
	- switches the calibrator on/off (press for more than 1 second)
IN or OUT	- sets the operating mode: input - IN (measurement) or output - OUT (simulation)
CONF	- accesses the parameter configuration mode (press for more than 2 seconds in the measured/set value display mode), - shows the type of sensor set (in the measured/set value display mode)
	- edits the current parameter in the configuration mode (display of the parameter value), - approves the edited parameter value, (in the text, it is designated as **SET**),
	- increases the set value by the preset step (parameter 9:StEP, chapter 6) in simulations - increases the parameter value in the configuration mode, (in the text, it is designated as ▲), - moves to the next parameter,
	- decreases the set value (parameter 10:SEt, chapter6) by the preset step in simulations - decreases the parameter value in the configuration mode, (in the text, it is designated as ▼), moves to the previous parameter,
ESC	- cancels the change of the edited parameter (and displays the parameter name again) - returns to the measured/set value display mode (must be pressed for more than 1 second)
+	- changes the set value (10:SEt) to the upper limit of the range of the simulated sensor or to the value of parameter 8:LiHi (the lower of the two values)
+	- changes the set value (10:SEt) to the lower limit of the range of the simulated sensor or to the value of parameter 7:LiLo (higher of the values)
	- shows the battery voltage:- 0 % - voltage < 2.2 V (low level), - 100 % - voltage > 2.6 V (high level)
+ ESC	- shows the current polarizing a resistance sensor in a simulation in [µA] - type of detected connection for a resistance sensor (2- and 3-wire) in measurements - reference joint temperature for a thermocouple sensor (in simulations and in
+	- shows the calibrator software version

6. PROGRAMMING OF CONFIGURATION PARAMETERS

- press the **CONF** button until (approx. 2 s) the display shows the following temporary message: CONF or CODE (if password protection is set, i.e. parameter 15:PROt=on),
- if password protection is on, the display shows 0000 with the 1st digit blinking; use keys ▼ and ▲ to enter the password (default parameter 16:PASS=1111), to move to the successive positions and to approve the entered code, use the **SET** key,
- after you enter the configuration menu, the mnemonic name of the first parameter is displayed (SEnP),
- by pressing the ▲ button, you can move to the next parameter, and by pressing the ▼ button - to the previous parameter (SEnP↔rrtd↔cJtY...), a list of the configuration parameters is presented in Table 1.
- 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.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 **ESC** for a long time, or automatically after approx.2 minutes of idle condition,
- in the normal mode, the measured or set value is displayed,
- in the event of a difference between the measured/set value and the actual one, it is possible to tune the zero point and the sensitivity to the specific sensors - parameters 11: cALo (zero point) and 12: cALG (sensitivity).

Table 1.Configuration parameters

Parameter name change - ▲ or ▼				Parameter name readout/saving - SET, Parameter value change - ▲ or ▼	Settings	
No.	Name	Description of parameter		Parameter value and range of variability	default	user's
0	SEnP	type of sensor (input and output)	RTD	Pt= Pt100, ni= Ni100	Pt	
			Resistance	rES= 10÷540 Ω-IN or 0÷3200 Ω (max)-OUT		
			Thermocouple	tc-J=J, tc-K= K, tc-S= S, tc-b= B, tc-r= R, tc-t= T, tc-E= E, tc-n= N		
			Voltage	uSS= -5÷55 mV		
1	rrtd	total resistance of 2 lines for the input Pt, ni and rES		00÷ 5000 Ω (line resistance compensation for a 2-wire connection in measurements	000 Ω	
2	cJtY	type of compensation of temperature of cold tips		Auto= automatic, conS= constant (defined by parameter 3: cJtE)	Auto	
3	cJtE	temperature of cold tips		00÷ 500°C (applies to thermocouples for cJtY= conS)	250 °C	
4	FndE	calibrator operation mode		in= measurement (input), out= simulation (output)	in	
5	FiLt	filtration rate (1)		4÷ 15	8	
6	dot	resolution of indications (2)		0= 1 °C, 1= 0.1 °C	1= 0.1 °C	
7	LoLo	lower setting limit for SEt		-200 ÷ 3200	-200 °C	
8	HiLi	upper setting limit for SEt		-200 ÷ 3200	3200	
9	StEP	value change step SEt		0.5÷ 2000	10°C	
10	SEt	set value		in the range of the sensor or LoLo÷ HiLi	1000 °C	
11	cALo	zero point offset		-500÷ 500°C	00 °C	
12	cALG	gain (sensitivity)		-850÷ 1150%,	1000 %	
13	bLoc	keyboard keys lock **IN**, **OUT** and 10:SEt		oFF= no lock, inou= lock **IN** and **OUT** SEt= lock **SET**, ALL= lock **IN**,**OUT**, SEt	oFF	
14	PASS	password (3)		0÷ 9999	1111	
15	Prot	password protection (3)		oFF= off, on= on	oFF	
16	toFF	auto-off delay (4)		0÷ 240 min (0- function not active)	0	

Notes: (1) - for FiLt=4 the response time is approx.0.7 s, for FiLt=15 - approx. 2.3 s. A higher filtration rate means a smoother measurement value and a longer response time. The parameter also applies to measurements of the current polarizing the (thermo)resistance output (in the simulation mode).

(2) - does not apply to the resistance sensor (SEnP=rES) and the voltage sensor (SEnP=uSS) for which the resolution is equal to, respectively:0.1Ω and 0.01 mV,

(3) - when Prot=oFF, access to the parameter configuration does not require a password,

(4) - this is the time from the last use of any button

7. SETTING OUTPUT SIGNAL VALUES

By pushing ▼ or ▲ in the simulation mode (OUT), you can change the set value by the preset step (parameter 9:StEP). By pressing **SET** and ▲ at the same time, you set the output to the lower of the following values: the upper limit of the simulated sensor or the value of parameter 8:LiHi; by pressing **SET** + ▼ at the same time, you set the output to the higher of the following values: the lower limit of the simulated sensor or the value of parameter 7:LiLo. Also, the output signal can be set in the parameter programming mode (parameter 10:SEt).

8. LIST OF MESSAGES AND ERRORS

- ‾‾‾‾.....upper segments of the display - the upper limit of the sensor range is exceeded or the sensor is defective,
- ____.....lower segments of the display - the lower limit of the sensor range is exceeded or the sensor is defective,
- ConF... the parameter configuration mode is entered,
- CodE... the mode for entering the password for access to the configuration parameters is entered,
- Err..... an incorrect password for access to the configuration parameters was entered,
- ----..... initiation of the operating mode (input/output),
- E-iH..... the value of the current polarizing the output of the (thermo)resistance sensor is exceeded (Ip > 1.5 mA)
- E-iP.....reverse polarization of the output of the (thermo)resistance sector (wrong connection to the terminals),
- 200.0... blinking set value - no current polarizing the output of the (thermo)resistance sensor, (Ip < 25 μA)
- E-rL..... a short circuit in the output of the thermocouple sensor or the voltage sensor,
- PoFF... the calibrator was switched off (manually or automatically due to low battery voltage),
- LbAt.....battery voltage too low (replace batteries with new ones).

9. USER'S NOTES