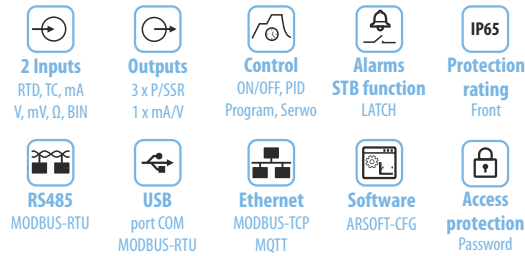


# AR653.B

# APAR

## Universal controller with two row display

### Two channel process controller with autotuning PID parameters functions



Bargraph  
8-segment

- control and monitoring of temperature and other physical values (humidity, pressure, flow rate, level, speed, etc.) processed to a standard electrical signal
- configurable architecture enabling use in many fields and applications (industrial, heating, food, energy, etc.)
- 2 universal measuring input (resistance thermometers, thermocouple, analogue 0/4÷20mA, 0÷10V, 0÷60mV, 0÷2,5kΩ) with mathematical functions (difference, sum, average, greater or lesser of the measurements) available independently for displaying and controlling control/alarm outputs
- 2 function buttons (F i SET) and digital input (BIN) for quick selection operating mode of controller, separately programmable: start/stop of control, manual/ automatic mode for outputs, step change of the set point value SP (day / night, with separate control parameters), keyboard lock, resetting errors and alarms STB (LATCH), unconditional preview of measured values from inputs 1 and 2
- 3 control/alarm outputs ON/OFF type (two-state P/SSR) with independent functionalities and control algorithms (setpoints defined by the parameter or taken from the measurement input 1/2):
  - ON-OFF with hysteresis (characteristics for heating and cooling, band alarms in range, out of range and with deviation for 3-position control)
  - PID (choice of 3 separate sets of parameters, gain scheduling for SP setpoint taken from measurement input 1 or 2), advanced functions of automatic selection of PID smart logic parameters
  - programmed control characteristic (process controller with timer, up to 6 sections, including 3 ramping sections - inclination for heating/cooling or for cooling/defrosting, 3 setpoints SP with ON-OFF or PID control, selection of the auxiliary output and its status, displaying remaining time for the entire section or after exceeding SP, etc.)
  - thermostat/ safety controller STB (alarm state open or closed, can be used as LATCH alarm memory e.g. when exceeds a threshold or a band)
  - ability to control a three-way mixing valve with an actuator (step control, Servo) with two contact inputs (open - close)
  - manual mode (open control loop) with initial value of control signal (MV) taken from current automatic mode or programmed by user
  - direct or inverse copy of the output 1 state (applies to outputs 2 and 3, can be used e.g. to implement DPDT changeover relay or to take over the function of the damaged P1)
  - limiting maximum level of output signal (power), also includes associated mA/V analog output
  - analog output 0/4÷20mA lub 0/2÷10V for control or retransmission of measurements and set values:
  - getting control parameters from any associated two state output (1, 2, 3), both in automatic and manual mode
  - shockless (soft) switching of the output signal, e.g. after changing manual/automatic mode or control start/stop
  - correction (calibration) of range of changes of output signal (offset for end values to obtain non-standard ranges e.g. 2÷16mA or 1÷9V)
- wide range of supply voltages (18÷265 Vac / 22÷350 Vdc) and built-in power supply for supplying on-site transducers 24Vdc/50mA
- readable LED display with adjustable brightness, typical units of measurement and signaling work status (messages, errors, etc.):
  - white color - measured value PV (upper row), units and symbols of status of outputs and serial transmissions (1, 2, 3, °C, %, %RH, mA, A, mV, V, m, . or none)
  - red, bottom row - selectable setpoints SP or 8-segment bargraph for MV (control signal), PV (measurement), output signal mA/V or none)
- optional RS485 serial interface, protocol MODBUS-RTU for reading measurements and parameter configuration
- optional Ethernet interface, protocol MODBUS-TCP i MQTT (for internet of things IoT/M2M, a cloud and mobile applications), possibility of data exchange via the Internet
- USB interface (micro USB port, standard equipment, for parameter programming, viewing measurements and updating firmware)
- automatic or fixed line resistance compensation for resistive sensors and temperature of cold thermocouple ends
- programmable type of input, indication range (for analog inputs), control options, alarms, display, communication, access, and other configuration parameters
- access to configuration parameters protected with a user password or without protection
- methods for configuring parameters:
  - via membrane keyboard IP65 located on the front panel
  - via USB, RS485 or Ethernet and freeware ARsoft-CFG (for Windows 7/10) or user application (using protocols MODBUS-RTU i TCP)
- free software ARSOFT-CFG (download from [www.apar.pl](http://www.apar.pl)) enabling the preview of measured value and quick configuration single or ready parameter sets previously saved on a computer for re-use, e.g. in other controllers of the same type (duplicate configuration)
- panel housing, IP65 from the front (after using an additional accessory gasket or other sealing), IP54 without a gasket
- modern technical solutions, intuitive and clear operation, high accuracy and long-term stability as well as resistance to interference
- optional to choose from (in the way of ordering): control outputs for SSR, analog output 0/2÷10V (instead 0/4÷20mA) and RS485 and Ethernet interface (RJ45 connector)

#### Contents of set:

- controller with handles mounting
- user manual and warranty card

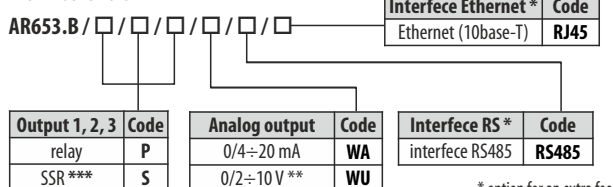
#### Available accessories:

- gasket for IP65 tightness from the front,
- USB cable (A - micro B) for connection with a computer, length 1.5 m

## TECHNICAL DATA

<b>Number of measuring inputs</b>	2 universals (resistance thermometer RTD, thermocouple, analog mA/V/Ω)		
<b>Universal input</b> (programmable, 17 types, conversion A/C 18 bits), measuring ranges			
- Pt100 (RTD, 3- or 2-wire)	-200 ÷ 850 °C	- thermocouple R (TC, PtRh13-Pt)	-40 ÷ 1600 °C
- Pt500 (RTD, 3- or 2-wire)	-200 ÷ 620 °C	- thermocouple T (TC, Cu-CuNi)	-25 ÷ 350 °C
- Pt1000 (RTD, 3- or 2-wire)	-200 ÷ 520 °C	- thermocouple E (TC, NiCr-CuNi)	-25 ÷ 820 °C
- Ni100 (RTD, 3- or 2-wire)	-50 ÷ 170 °C	- thermocouple N (TC, NiCrSi-NiSi)	-35 ÷ 1300 °C
- thermocouple J (TC, Fe-CuNi)	-40 ÷ 800 °C	- current (mA, Rwe = 50 Ω)	0/4 ÷ 20 mA
- thermocouple K (TC, NiCr-NiAl)	-40 ÷ 1200 °C	- voltage (V, Rwe = 110 kΩ)	0 ÷ 10 V
- thermocouple S (TC, PtRh 10-Pt)	-40 ÷ 1600 °C	- voltage (mV, Rwe > 2 MΩ)	0 ÷ 60 mV
- thermocouple B (TC, PtRh30PtRh6)	300 ÷ 1800 °C	- resistance (R, 3- or 2-wire)	0 ÷ 2500 Ω
<b>Response time for measurements</b> (0÷90%)	0,5 ÷ 5 s (programmable, default ~1,0 s)		
<b>Resistance of leads</b> (RTD, R)	Rd < 25 Ω (for each line), compensation of line resistance		
<b>Resistive input current</b> (RTD, R)	400 µA (Pt100, Ni100), 200 µA (Pt500, Pt1000, 2500 Ω)		
<b>Processing errors</b> (at 25°C ambient temperature):			
- basic	- for RTD, mA, V, mV, R	0,1 % of the measurement range ±1 digi	
	- for thermocouple	0,2 % of the measurement range ±1 digi	
- additional for thermocouples	< 2 °C (compensation of temperature of cold ends)		
- additional from ambient temp. changes	< 0,004 % of the input range /°C		
<b>Indication range</b> (programmable)	total-1999÷9999 (maximum range of indications for analog inputs)		
<b>Display resolution / dot position</b>	programmable, 9 ÷ 9999, for thermometric inputs 0,1 °C or 1 °C		
<b>Outputs P/SSR</b> (3 separate)	- relay P1÷P3	8A/250Vac (for res.), 1 x SPDT, 2 x SPST-NO, standard for outputs 1 i 2	
	- SSR1÷SSR3 (option)	transistor type NPN OC, 11V, current < 23mA, standard for outputs 3	
<b>Analogue output</b> (mA or V, without separation from input)	- current (standard)	0/4 ÷ 20 mA, load Ro < 1 kΩ, max resolution 1,4 µA, 14 bit, active	
	- voltage (option)	0/2 ÷ 10 V, load Io < 3,7mA (Ro > 2,7 kΩ), max resolution 0,7mV, 14 bit	
	- errors (at 25°C)	basic < 0,1 % output range, additional < 0,004 % /°C	
<b>Digital input BIN</b> (2-state)	contact or voltage < 24V, active level: short circuit or < 0,8V		
<b>Power</b> (Usup, universal, comply with the standards 24Vac/dc and 230Vac)	18 ÷ 265 Vac, < 3VA (alternating voltage, 50/60Hz) 22 ÷ 350 Vdc, < 4W (napięcie stałe)		
<b>Power supply for object transducers</b>	24Vdc/50mA		
<b>Communication interfaces</b>	- USB (micro type B, standard)	drivers for the Windows 7/8/10 (virtual serial port COM, communication with computer, MODBUS-RTU protocol, Slave)	
(independent, they can be used simultaneously)	- RS485 (option)	MODBUS-RTU protocol (Slave), bitrate 2,4÷115,2 kbit/s, programmable sign format (8N1, 8E1, 8o1, 8N2), galvanic separation	
	- Ethernet (option)	RJ45 connector, 10base-T, protocols TCP/IP: MODBUS-TCP (Server), MQTT (client, v.3.1.1), DHCP (client, ICMP (ping), galvanic separation	
<b>Display</b> (LED with brightness adjustment, signaling status of outputs and measuring units)	top row: white color, 7-segment, height digit 13 mm bottom row: red color, 7-segment, height digit 10,5 mm		
<b>Rated operating conditions</b>	0 ÷ 50°C, < 90%RH (no condensation) air and neutral gases, no dust		
<b>Protection rating</b>	front IP65 (with gasket) or IP54 (without gasket), IP20 from the side of connectors		
<b>Electromagnetic compatibility</b>	immunity: according to the PN-EN 61000-6-2, emission: PN-EN 61000-6-4		
<b>Safety requirements according to PN-EN 61010-1</b>	overvoltage category: II pollution degree: 2 voltage to the ground (earth): 300 V for power supply and output relay circuits 50 V for other inputs/outputs circuits and communication interfaces insulation resistance > 20 MΩ height above sea level < 2000 m		

## How to order



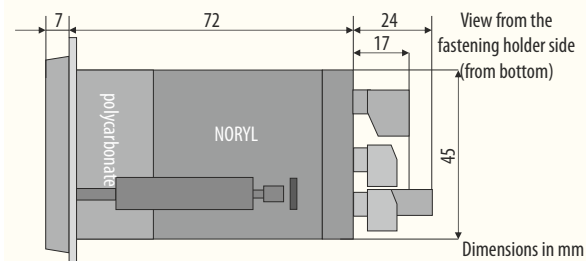
## Order examples (standard execution):

### AR653.B / P / P / S / WA

AR653.B, 1 and 2 relay outputs, output 3 for control SSR (NPN-OC), analog output 0/4 ÷ 20 mA (active), without RS485 and Ethernet interfaces

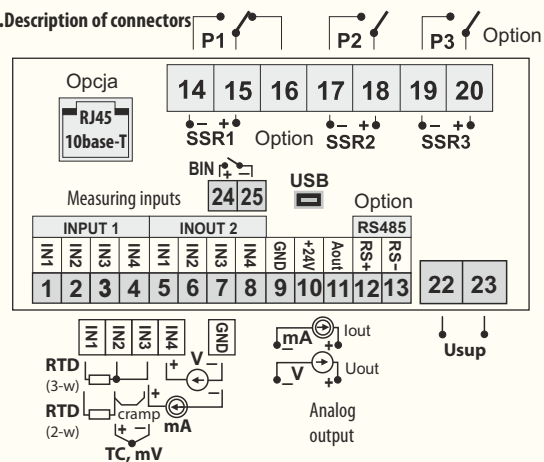
## INSTALLATION DATA

<b>Fixing methods</b>	panel, with handles on the side of the housing
<b>Dimensions and weight</b>	96 × 48 × 79 mm (without connectors), ~200 g
<b>Panel windows</b>	92 × 46 mm
<b>Material</b>	self-extinguishing NORLYL 94V-0, polycarbonate
<b>Cable cross-sections</b> (separable connectors)	2.5mm <sup>2</sup> (power supply and outputs P/SSR), 1.5mm <sup>2</sup> (others)



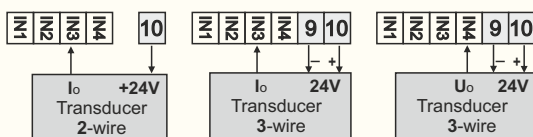
## TERMINAL STRIPS, ELECTRICAL CONNECTIONS

### 1. Description of connectors

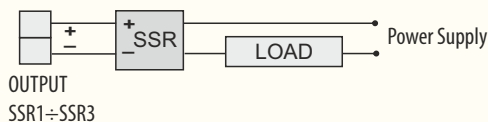


### 2. Connection of a 2- and 3-wire transducer

(Io - current, Uo - voltage output)



### 3. Connection of a SSR type relay to regulator's control output



### 4. Galvanic separation of circuits

