

VR660 / A200R

Programmable Modular Controller System

consisting of
1-channel top-hat rail controller modules (VR660) and a display and operating unit (A200R)

Application

The VR660 top-hat rail controller permits the design of autarkic, freely programmable control system. The number of channels used always corresponds exactly to the number of control circuits. The A200R display and operating module serves commissioning, visualising and parameterising of the controllers on site and also facilitates the safety-oriented management of the whole control system.

The CB-Manager configuration software enables user-friendly commissioning, visualising and parameterising of the entire controller system.

A system consists of 1 to max. 32 universal VR660 1-channel temperature controllers, the A200R display unit as well as the CB-Manager configuration and service software.

The VR660 temperature controllers communicate via a common bus interface with the separate A200R display and operating unit. The system is accessed via A200R or the CB-Manager configuration software.

VR660 temperature controllers also work independently without A200R. In this case, the controllers are accessed via the CB-Manager configuration software.

Features / Benefits

- Fast, harmonic-free PDPI control algorithm
- The system may be extended at any time (modular design)
- Very easy exchange of individual modules
- Space-saving as compared with conventional temperature controllers
- Less installation work
- Price advantage
- Two-state or three-state controller
- Fixed setpoint control / setpoint profile
- Second setpoint
- Setpoint ramp adjustable
- Heating loop monitoring

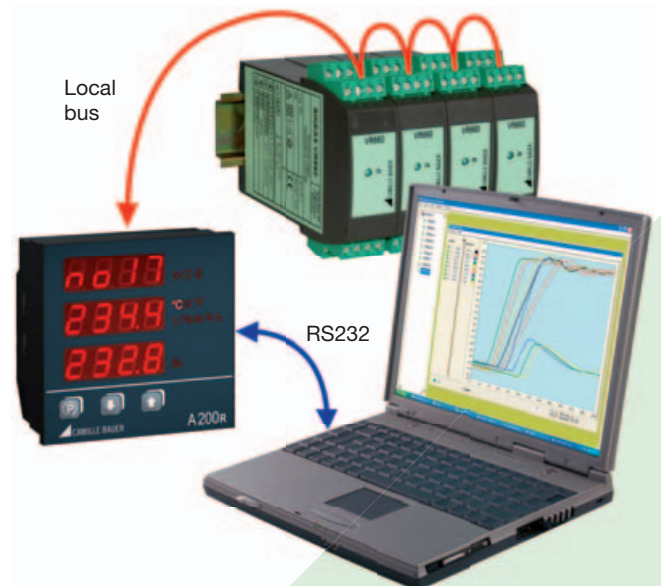


Table 1:

Sensor	Measuring range	
Voltage input	- 1 ... 1	V
RTD Pt 100 ... 1000	- 200 ... 850	°C
RTD Ni 100	- 60 ... 250	°C
TC Type B	0 ... 1820	°C
TC Type E	- 270 ... 1000	°C
TC Type J	- 210 ... 1200	°C
TC Type K	- 270 ... 1372	°C
TC Type L	- 200 ... 900	°C
TC Type N	- 270 ... 1300	°C
TC Type R	- 50 ... 1769	°C
TC Type S	- 50 ... 1769	°C
TC Type T	- 270 ... 400	°C
TC Type U	- 200 ... 600	°C
TC Type C: W5Re / W26Re	0 ... 2315	°C
TC Type D: W3Re / W25Re	0 ... 2315	°C

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VR660



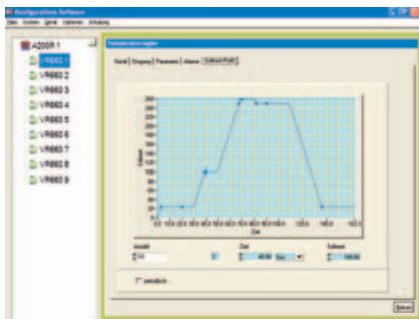
VR660 is a universal 1-channel temperature controller for top-hat rail mounting. Several independent temperature controllers may be used in a control cabinet. All of them have a common serial bus interface to the separate A200R display and operating unit to visualise and set the individual temperature controllers. The controllers work independently, also without A200R – in which case they may be configured via the bus interface.

A200R



A200R serves the visualisation of measured values, parameterising and the construction as well as monitoring of small bus systems. A200R permits indirect access to connected devices via the integrated RS232 interface. Using the CB-Manager configuration software, A200R and any connected device may be configured.

CB-Manager



The configuration software offers free access to A200R (bus master) and thus to the temperature controllers or direct access to the temperature controllers. Parameters may be read by the devices or stored in the devices. Device data can also be stored in files or read by files. The software serves visualising, commissioning and servicing of the devices.

PDPI control properties

The PDPI control properties were particularly developed for temperature control paths. PDPI unites the advantages of both PD and PID control properties while avoiding their disadvantages. The dynamic properties correspond to PD properties and the additional integral part completely settles the remaining control deviation typical to PD properties. This achieves very fast and harmonic-free start-up, since the controller strongly reacts to large initial setpoint deviation. PDPI control properties are distinguished by the fact that only one controller setting settles both the effects of interference and setpoint changes without harmonic and pendulation.

Two-state controller

A two-state controller activates a final controlling element with ON and OFF signals respectively. The control algorithm is such that the actual value adjusts itself to the setpoint without harmonic.

Three-state controller

A three-state controller is employed if a process requires three control statuses. There are processes which need to be heated, but also cooled at times. The three control statuses are HEATING, OFF, COOLING.

Fixed setpoint control

In fixed setpoint control, the setpoint is adjusted to a permanent value at the controller. Fixed setpoint controllers settle interference and are thus designed with favourable interference properties.

Setpoint profile

The setpoint is automatically specified in accordance with a time-dependent profile stored in the controller.

Second setpoint

Conservation of energy is achieved by specifying a lower setpoint during production intervals. This second setpoint is activated via the binary input.

Setpoint ramp

The specification of a gradient achieves gentle heating or cooling of materials sensitive to temperatures. The temperature change up to the setpoint is adjusted in relation to time.

Heating loop monitoring

The heating circuit is monitored without any additional hardware. When the heater is on 100%, the controller determines the rise in temperature and indicates a heating loop error if it occurs.

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Technical data VR660

Measuring input \rightarrow

Temperature with resistance thermometer

Measuring range limits:	See Table 1, $\Delta R \geq 10 \Omega$
Types of sensor resistors:	Type Pt 100 (IEC 60 751) also Pt 50 ... 1000 Type Ni 100 (DIN 43 760) also Ni 50 ... 1000
Wiring:	Two, three or four-wire connection
Measuring current:	0.2 mA
Lead resistance:	$\leq 30 \Omega$ per lead, may be set or calibrated in two-lead measurement

Temperature with thermocouple

Measuring range limits:	See Table 1, $\Delta U \geq 2 \text{ mV}$
Thermocouples:	Type B: Pt30Rh-Pt6Rh (IEC 584) Type E: NiCr-CuNi (IEC 584) Type J: Fe-CuNi (IEC 584) Type K: NiCr-Ni (IEC 584) Type L: Fe-CuNi (DIN43710) Type N: NiCrSi-NiSi (IEC 584) Type R: Pt13Rh-Pt (IEC 584) Type S: Pt10Rh-Pt (IEC 584) Type T: Cu-CuNi (IEC 584) Type U: Cu-CuNi (DIN43710) Type W5 Re/W26 Re (ASTM) Type W3 Re/W25 Re (E 988-90)

Cold junction compensation

Internal:	With installed Pt 100
External:	Via cold junction thermostat - 30 ... 90°C

Voltage input - 1 ... 1 V

Resistance measurement: 0 ... 5 k Ω

Gain/offset adjustment with A200R or CB-Manager

Binary input \rightarrow

Contact input: Galvanic connection to the output, common negative connection.

Active:	< 5 k Ω
Inactive:	> 200 k Ω , leakage current < 0.1 mA
No-load voltage:	< 25 V
Short-circuit current:	3 mA

Function	Signal at binary input
Start and stop autotuning	Impulse
Online / offline	Permanent signal
Second setpoint	Permanent signal
Feed forward control	Permanent signal
Limit value alarm suppression	Permanent signal
Start and stop setpoint profile	Impulse

Duration of impulse: Min. 100 ms; the minimum time between the start and stop autotuning impulse amounts to two output cycles.

The function of the binary input may be inverted.

Outputs \rightarrow

4 digital outputs, galvanically connected, common negative connection.

Suitable for common semiconductor relays (SSR) or dig. PLC inputs (EN 61131 Types 1 and 3)

Active:	$\geq 15 \text{ V DC}$ at $I \leq 15 \text{ mA}$, short-circuit proof
Inactive:	< 1 V, < 0.1 mA
Non-load voltage:	< 25 V
Output 1:	Heating
Output 2:	Cooling
Output 3:	Alarme
Output 4:	Alarme
Output cycle:	Heating/cooling 0.5 ... 300 s
Effective direction:	Invertible

Accuracy (according to EN/IEC 60 770-1)

Reference conditions:

Ambient temperature:	23 °C
Power:	24 V DC $\pm 10\%$
Settings:	Pt100, 3-lead, 0 ... 600 °C, cycle time 1 s
Reference value:	Span
Basic accuracy:	Under reference conditions $\leq \pm 0.5 \text{ K}$
TC type K, E, J, T, N, L, U	$\leq \pm 0.5 \text{ K}$, meas. value > - 100 °C
TC type R, S	$\leq \pm 2.5 \text{ K}$
TC type B	$\leq \pm 2.5 \text{ K}$, meas. value > 300 °C
TC type C, D	$\leq \pm 2.0 \text{ K}$

Additional error (additive)

Cold junction compensation:	$\pm 3 \text{ K}$
Ambient temperature:	Type 0.1% + 0.1 K per 10 °C
Long-term drift:	$\pm 0.1\%$
Common-mode/series mode effect:	$\pm 0.2\%$

Control properties

Control types and control parameters:

2-state PDPI controller:	Heating or cooling	Pb 1	proportional band
		Tv 1	rate time
		Tn 1	reset time
		Tc	output cycle time
3-state PDPI controller:	Heating	Pb 1	proportional band
		Tv 1	rate time
		Tn 1	reset time
	Cooling	Pb 2	proportional band
		Tv 2	rate time
		Tn 2	reset time
	Tc	output cycle time	
	dbnd	dead band	

Autotuning

Determination of the optimum PDPI control parameters in any operating mode:

- Around setpoint (decrease or increase is adjustable)
- When increasing or decreasing temperature

Activation: Binary input or via A200R or CB-Manager

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Regulated ratio

Regulated ratio limits, regulated ratio in case of an error or regulated ratio in case of interference may be set.

Setpoints

Setpoint, second setpoint: Activation by binary input or CB-Manager

Setpoint limits: Min./max. value

Ramp function to limit the temperature change (increase and decrease).

Set point profile

Number of values: 10 time and setpoint values, repeatable

Activation: Start control, binary input or via A200R or CB-Manager

Limit values and monitoring

Limit values: Number 2, absolute or relative switching limits

Sensor breakage and short-circuit monitoring

Heating loop monitoring: Error in active heating (100%) and falling temperatures and vice versa

Thermocouple polarity reversal: At start and end of measuring range > or < 0°C possible

Interruption of communication with A200R

Error signal: Monitoring errors or exceeded limit values may be allocated individually or in a combined fashion to the two alarm outputs.

Limit value alarm suppression:

- Activation upon start-up or by binary input
- At autotuning

Power H $\rightarrow \bigcirc$

Table 1: Nominal voltages and tolerances

Nominal voltage U_N	Tolerance
24 ... 230 V DC/AC, 45 ... 400 Hz	$\pm 15\%$

Power consumption: $\leq 3 \text{ W}$ or $\leq 5 \text{ VA}$

A voltage of > 125 V DC requires an external fuse in the power circuit.

LED

Green LED: Power On. LED flashes if the device is addressed by A200R or CB-Manager.

Bus connection $\leftarrow \rightleftrightarrow$

Interface: RS-485
 Bus distance: Max. 40 m

Installation

Design: Housing P16/23
 For dimensions see the "Dimensional sketch" section

Housing material: Lexan 940 (polycarbonate)
 Combustibility class V-0 according to UL 94, self-extinguishing, not dripping, free of halogen

Assembly: For snap-on fastening on top-hat rail (35 x 15 mm or 35 x 7.5 mm) according to EN 50 022

Operating position: As required

Electric terminals: Screw terminals with indirect wire clamping, für 0.14 mm² to 2.5 mm²

Weight: 0.1 kg

Galvanic isolation
 All circuits (measuring input/output/power/bus) are galvanically isolated

Regulations

Electromagnetic compatibility: EN 61000-6-2 / 61000-6-4

Ingress protection (according to IEC 529 or EN 60 529): Housing IP 40
 terminals IP 20

Electric design: According to IEC or EN 61010

Operating voltage: < 300 V between all insulated circuits

Degree of pollution: 2

Overvoltage category according to IEC 664: II for all circuits

Double insulation: Between all insulated circuits

Test voltage: 2.3 kVrms, 50 Hz

Environmental tests: EN 60068-2-1/-2/-3/-6/-27

Ambient conditions

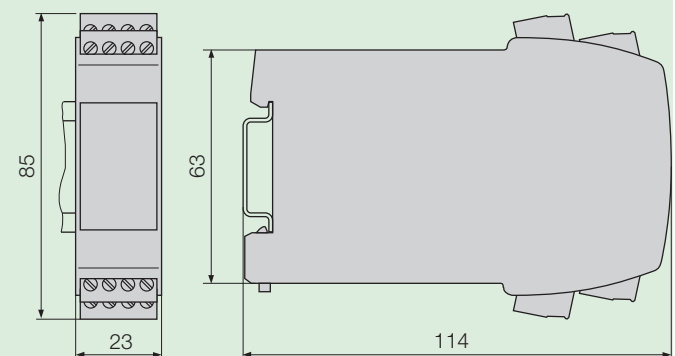
Operating temperature: – 25 to + 55 °C

Storage temperature: – 40 to + 70 °C

Relative humidity, annual average: $\leq 75\%$, no dew

Functional range: Indoors up to 2000 m above sea level

Dimensions, dimensional sketch



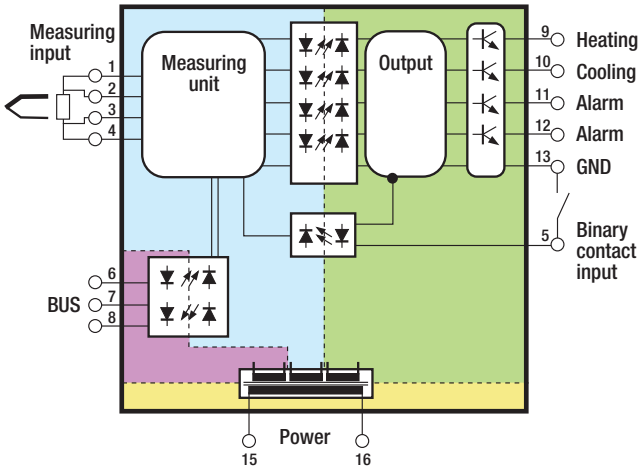
VR660 in mounting rail housing P16/23 St on top-hat rail (35 x 15 mm or 35 x 7.5 mm, according to EN 50 022) snapped on, plug-in screw terminal.

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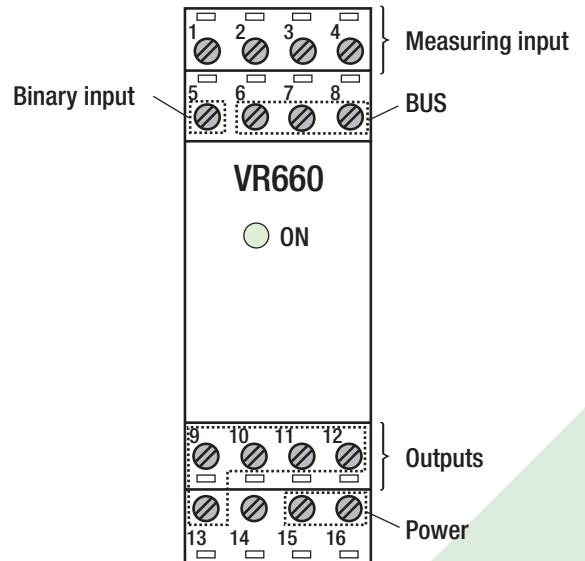
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Design

Block diagram

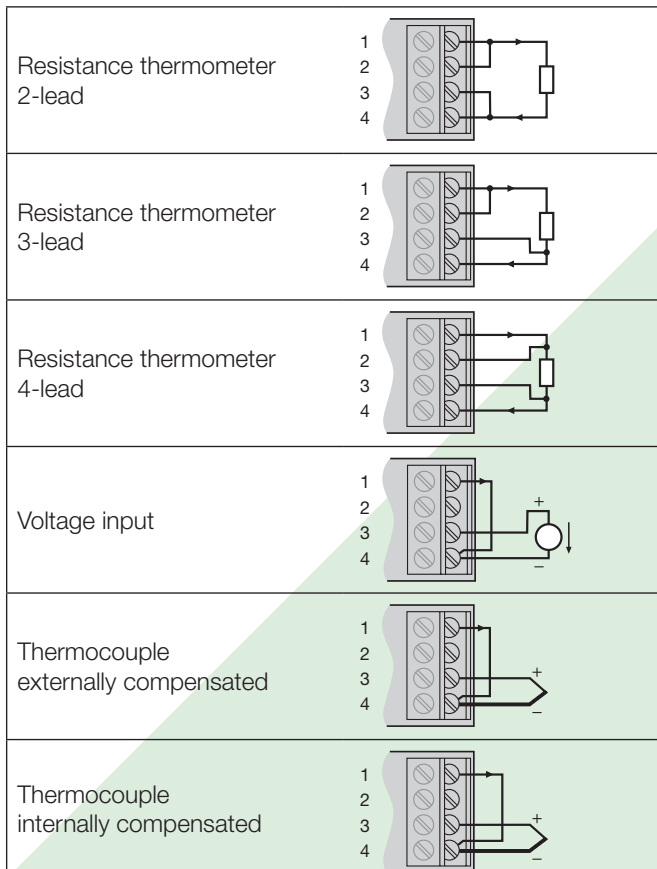


Terminal assignment

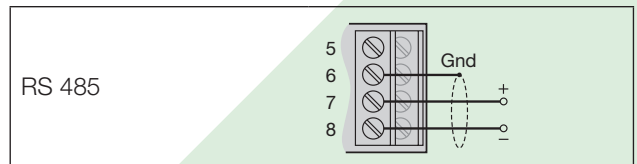


Electric connections

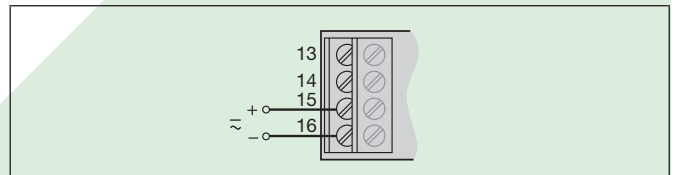
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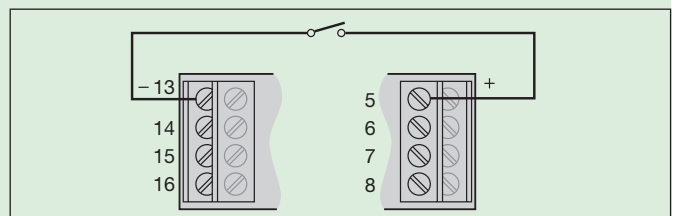
Bus connection



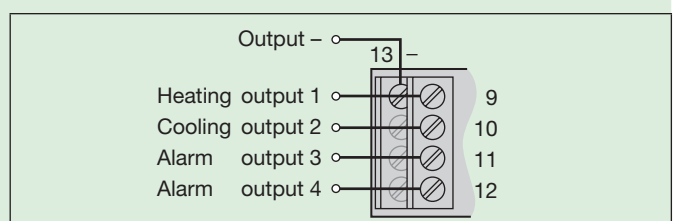
Power



Binary input



Outputs



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Technical Data A200R

Display

LED 7 segment display: Height 14 mm, colour red
 Brightness: Adjustable

Power

Nominal voltage: 24 – 230 V AC/DC, 45 ... 400 Hz
 Tolerance: ± 15%
 Power consumption: 3 W / 5 VA

In case of a voltage > 125 V DC, the power circuit must have an external fuse.

Bus connection

Interface: RS-485
 Number of controllers: Max. 32
 Bus distance: Max. 40 m
 Terminating resistor: Can be connected
 Bus cycle time: 1 s, adjustable

PC connection

Interface RS-232

Functions

Visualising:

- Cyclical acquisition and display of process data (actual value setpoint, regulated ratio, status) of all connected devices

Commissioning, service, parameterising:

- Automatic system recognition and address allocation
- System pre-engineering
- Entry of device parameters
- Copying of configurations
- Start/stop of control, autotuning, setpoint profile, lead calibration of single or several devices
- Exchange of devices (incl. transfer of parameters)

Access authorisation: May be set by CB-Manager

Installation

Dimensions: See dimensional sketch
 Housing material: ABS, combustibility class V-0 according to UL98, self-extinguishing, not dripping, free of halogen
 Assembly: Installation in control panel
 Connections: Power, bus connection: Cage clamps, cross section single-wire and fine-wire: 0.5 - 1.5 mm²
 PC connection: 9-pole D-Sub female
 Weight: 0.3 kg

Galvanic isolation: All circuits (power/bus/PC connection) are galvanically isolated

Regulations

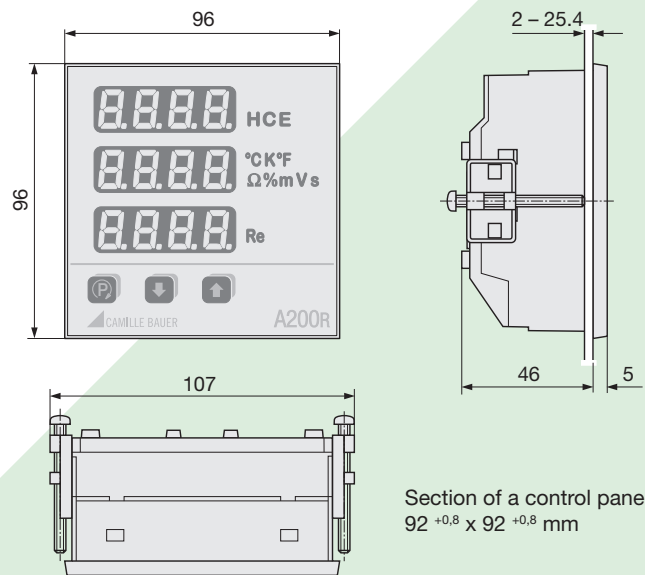
Electromagnetic compatibility: EN 61000-6-2/61000-6-4
 Ingress protection: EN 60029, front IP 66, terminals IP20

Safety: IEC or EN 61010
 Operating voltage: < 300 V between all insulated circuits
 Degree of pollution: 2
 Overvoltage category according to IEC 664: II
 Double insulation: Between all insulated circuits
 Test voltage: 2.3 kVrms, 50 Hz
 Environmental tests: EN 60068-2-1/-2/-3/-6/-27

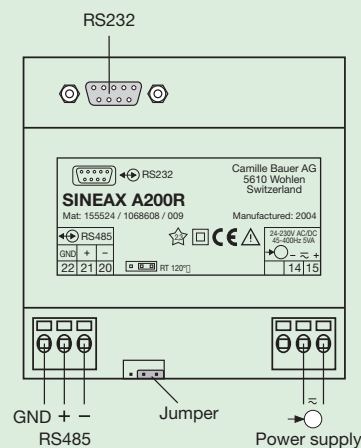
Ambient conditions

Operating temperature: – 25 ... 55 °C
 Storage temperature: – 25 ... 70 °C
 Relative humidity, annual average: ≤ 75%, no dew
 Functional range: Indoors up to 2000 m above sea level

Dimensional sketch



Terminal assignment

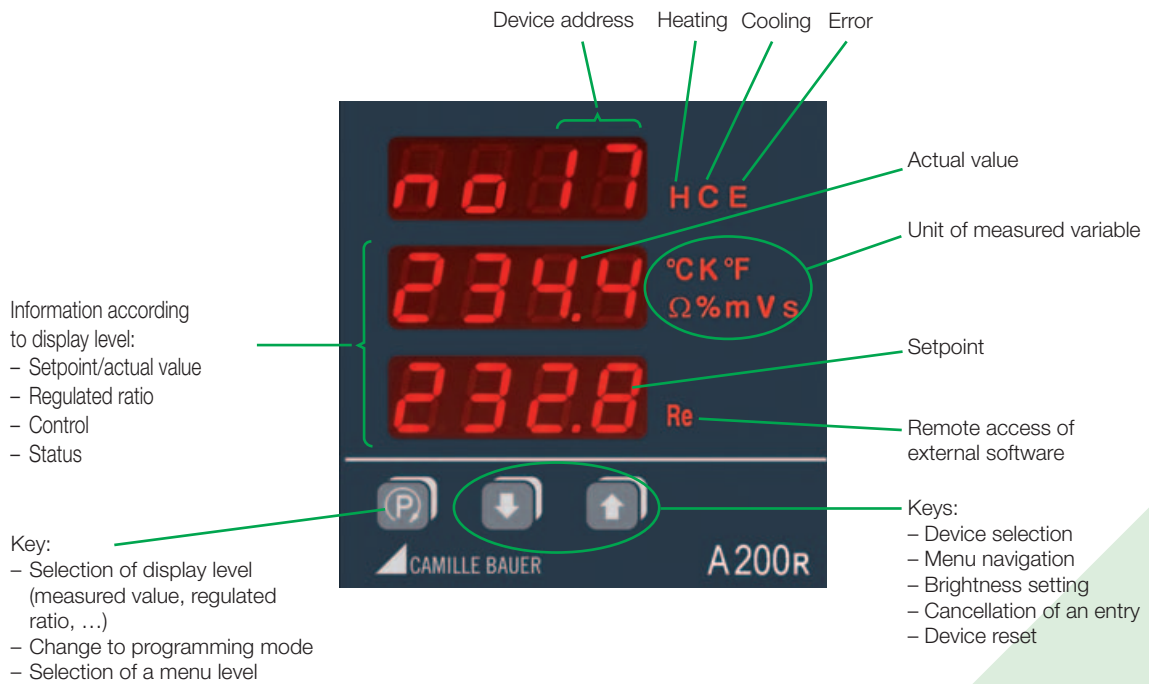


The jumper serves the connection of the terminating resistor to the RS 485 interface.

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Overview of display and operating elements



Technical data CB-Manager Software

Operating system:	Windows XP
Required memory:	Approx. 20 MB
Interface to A200R:	RS-232
Interface to VR660:	RS-485, e.g. by RS-232/RS-485 converter

Accessories and spare parts

Description	Order No.
Programming cable RS232, 9 pole, D-Sub, male/female	980 179
Top-hat rail adapter (A200R)	154 055
Software and documentation CD	156 027

Scope of delivery VR660

- 1 VR660
- 1 Safety Instructions
- 1 Software and documentation CD (incl. CB-Manager)

Scope of delivery A200R

- 1 A200R
- 1 Bracket
- 1 Safety Instructions
- 1 Overview of menu structure

Details for ordering

VR660	Order No. 155 516
A200R	Order No. 155 524

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