Operating Manual RS200

1. Description

The RS200 Electronic Control Unit is a transistor servo-controller for DC-motors with permanent-magnets . The RS200 electronic unit enables motor driving and braking in one direction of rotation (two-quadrant operation). Braking operation operates as short-circuit braking.

The RS200 servo-controller operates as analogue speed controller with a subordinated current control. The pulse-width operating mode of the electronic control unit enables high efficiency to be achieved, resulting in a compact design. A filter is integrated for conformance to the applicable EMC standards and the design includes electromagnetically screened construction. Through these precautions and the use of screened cable, EN55011 Cl. B is achieved. A main- fuse to isolate the mains is also provided on the circuit board.

The RS200 Electronic Control Unit only needs one supply voltage to operate in a wide supply voltage range. From this voltage all auxiliary voltages are derived . These auxiliary voltages are also available at the terminals to supply the external controls and the actual-value sensors.

The user has the free choice of feeding back the instantaneous speed either with a direct voltage tachogenerator, a single or dual-channel incremental encoder or the motor EMF proportional to the speed with compensation of the current-dependent armature voltage drop (IxR). The user selects the required operating mode with DC tachogenerator, encoder or IxR by setting the short-circuit jumper on the operator's jumper strip. For applications with lower requirements (higher than 500 rpm) on the accuracy of speed control, a speed setting largely independent of the load without DC tachogenerator or incremental encoder is provided with the EMF control. This EMF control is economical and space-saving. For speeds in the range higher than 50 rpm , we recommend speed feedback with our incremental encoders RE30 and RE56. The widest speed control range with the best control quality is obtained when using the DC tachogenerators TG11 and TG52. Depending on the project, it may be possible to use the MG2 actual-value sensor.

Customised settings are made with potentiometers. The setting for the peak motor current and the desired speed can be made with a potentiometer on the electronic-board as well as externally. Here, the internal potentiometers define the maximum values for the current and speed. The electronic control unit and the motor can be protected against overload through the independent setting of the continuous motor current. The continuous current setting enables the motor to accelerate and brake with the set maximum current, but the i^2t function present controls the motor current to the set continuous current depending on the load. This means that a high torque is available for brief acceleration and braking processes. The heatsink temperature is monitored for the maximum figure of 80ºC and the motor current is automatically reduced if this is exceeded. If required, the speed set value can be provided using an adjustable ramp for soft running up and down to protect the drive. The closed-loop gain of the speed control and the level of the actual speed value can be matched through appropriate potentiometers to different drive applications .

The state of the servo-controller is indicated by an LED indicator and an additional digital output signal . An appropriate signal is available on the card connection to drive an external ballast circuit if required.

The electronic control unit is connected with a 16-pole screw “phoenix-style” connector (available as an accessory). Depending on the project, the RS200 Electronic Control Unit can also be supplied with a 32-pole plug connector conforming to DIN41612, making it suitable for 19" rack technology.

The control unit can be directly mounted with its heatsink on a external mounting surface using four M3 screws. A bracket, available as an accessory, enables space-saving perpendicular mounting (vertical and horizontal). With the screwed-on TS35 mounting base, this bracket also permits fitting to a TS35 mounting rail (DIN rail).

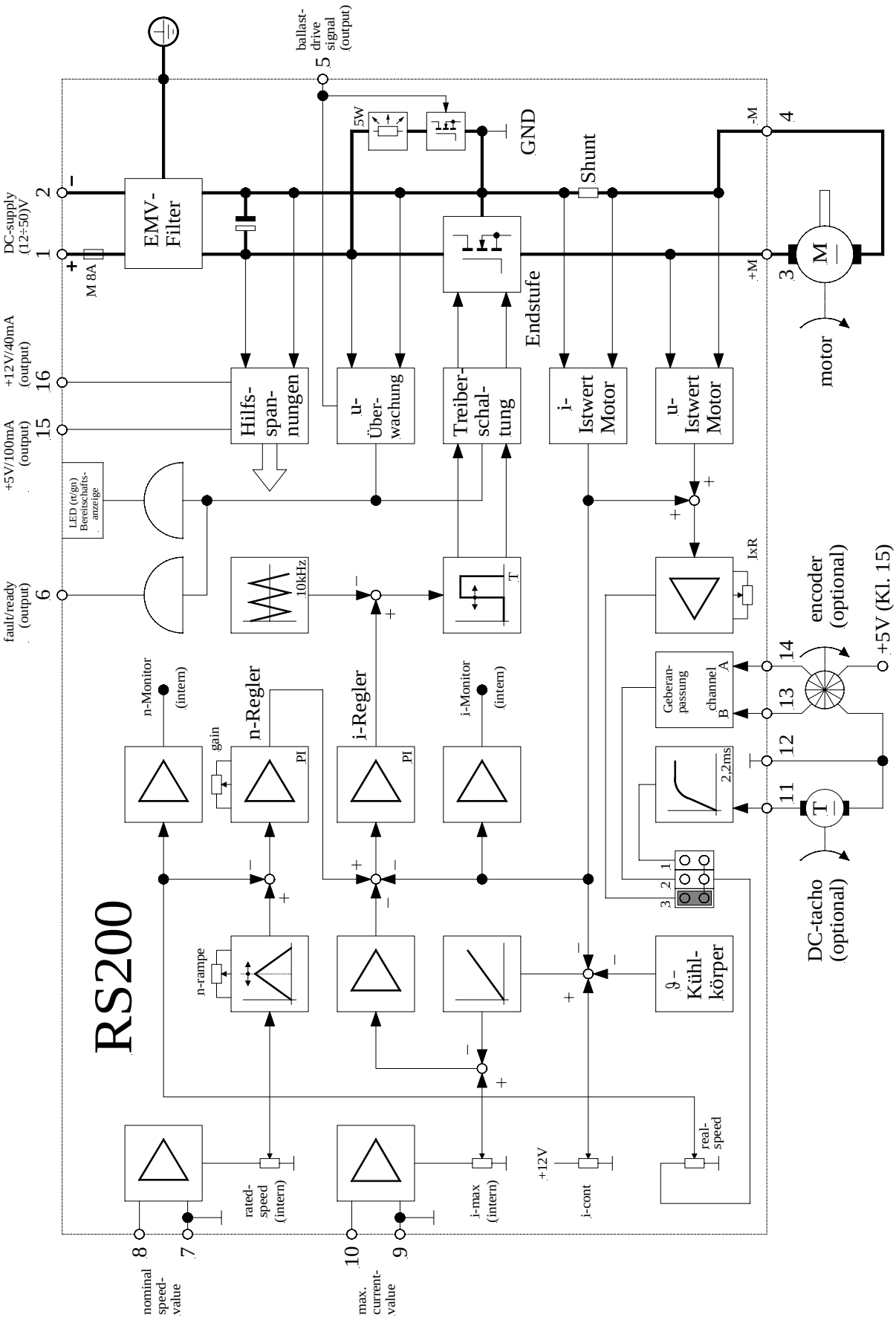
The versatile mounting and easy external operation makes the RS200 servo-controller suitable for application in higher level open-loop and closed-loop controllers for positioning and other duties. The screen printing provided as standard on the RS200 cover with designation of the terminals and controls is helpful during first-run and servicing.

It is essential to provide matching to the connected motor before the RS200 Electronic Control Unit is switched on for the first time. In particular the rated current (i cont) and the maximum speed should be set suitable for the drive (see Settings).

2. Technical data

Supply voltage:	12V ≤ U ≤ 50V with maximum 5% residual ripple
Under and overvoltage detection:	For 10V > U >60V
Auxiliary voltages:	+5V/100mA and +12V/40mA
Ballast circuit:	5Watt effective for 54V < U < 57V, externally expandable
Maximum continuous current:	0 < I < 7A adjustable
Maximum current:	0 < I < 15A adjustable
Fuse:	8A (medium blow) fitted
DC tachogenerator voltage:	0 to +60V
Incremental encoder:	5V supply through existing auxiliary voltage and automatic evaluation of 1 or 2-channel rectangular signals
Recommended operating range:	- with EMF controller minimum speed: 500 rpm - with incremental encoder (e.g. RE30) minimum speed: 50 rpm - with tachogenerator (e.g. TG11) minimum speed: 5 rpm
Control precision:	*Speed regulation from 0 to 80% of the torque* - with IxR controller 10% - with incremental encoder (e.g. RE30) 1% - with tachogenerator (e.g. TG11) 1%
Max. speed:	6000 rpm
Speed set value ramp:	From about 0÷10 s adjustable
Proportional speed closed-loop gain	$0 < P_n < 9$ adjustable
Heatsink temperature:	Maximum 80°C, thereafter automatic current matching
Radio frequency suppression:	Conforming to EN55011 Class B
Protection:	IP00
Ambient temperature:	$0 \leq \vartheta \leq 40°C$
Dimensions:	(163 x 100 x 28)mm

3. Block diagram



4. Connection

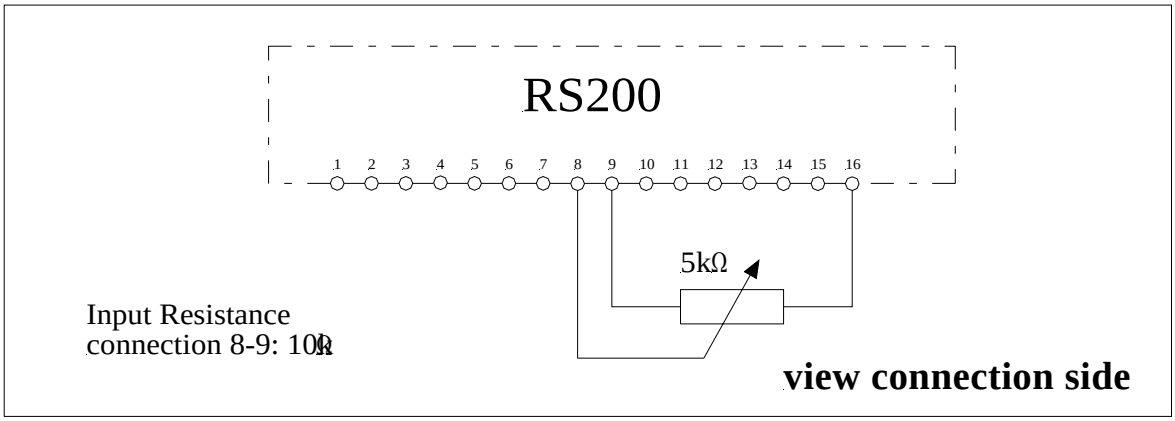
Connection is provided as standard via the following 16-pole screw connectors which are not included with the control unit:

RIA:	Type 249	Order no. 312491 16
Phoenix:	**Type MSTB 2,5/16-ST-5,08**	**Dunker order no.: SNR 24392.57153**
Wieland:	Type 8213 B/16	Order no. 25.340.1653.0
Weidmüller:	Type BLZ 5.08/16 SN OR	Order no. 152786

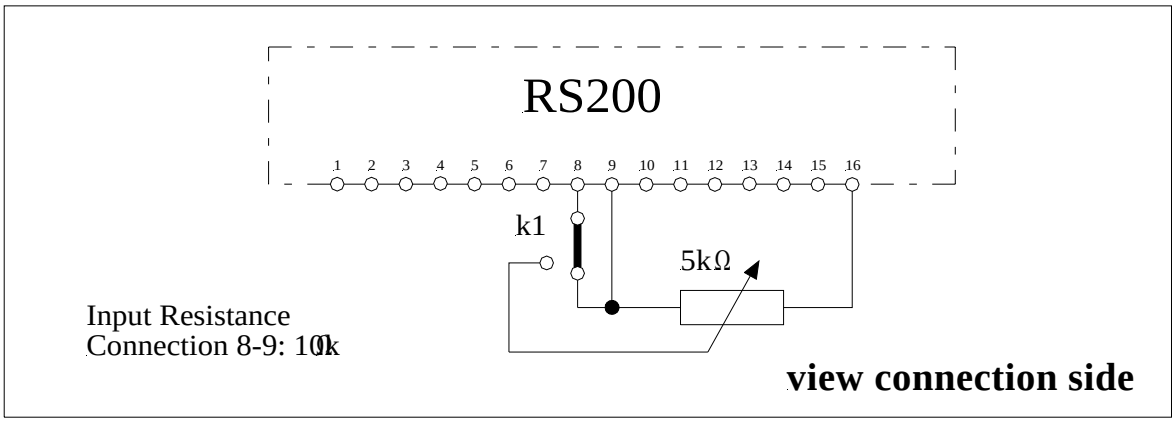
Connection	Designation	Remark
1	*+DC supply*	12V ≤ U ≤ 50V with maximum 5% residual ripple Under and overvoltage detection for 10V > U >60V
2	*-DC supply*	
3	*+Motor*	External polarity reversal only with motor at standstill
4	*-Motor*	
5	*Control signal for external ballast circuit*	-10V or +10V (HIGH/LOW)
6	*Fault/ready*	0 or +10V (HIGH/LOW)
7	*GND*	For fault/ready
8	*Set speed*	0 to +10V
9	*GND*	For set speed and maximum current
10	*Maximum current*	0 to +10V
11	*DC tachogenerator*	Ensure correct polarity
12	*GND*	For DC tachogenerator and incremental encoder
13	*Incremental encoder (Channel A)*	RE30 or RE56
14	*Incremental encoder (Channel B)*	RE30 or RE56
15	*+5V*	Current maximum 100 mA
16	*+12V*	Current maximum 40 mA
2 solder tags	*Earth connection*	For screening and earthing
on card	*Current and speed monitor*	-10V to +10V

5. Connection examples

5.1 Desired speed value set via an external potentiometer

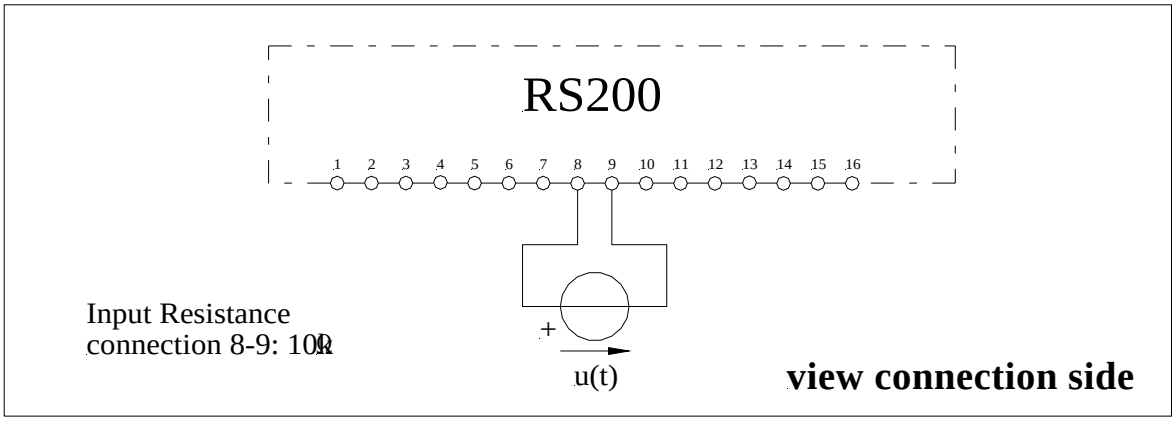


5.2 Desired speed value set via an external potentiometer and START/STOP switchover

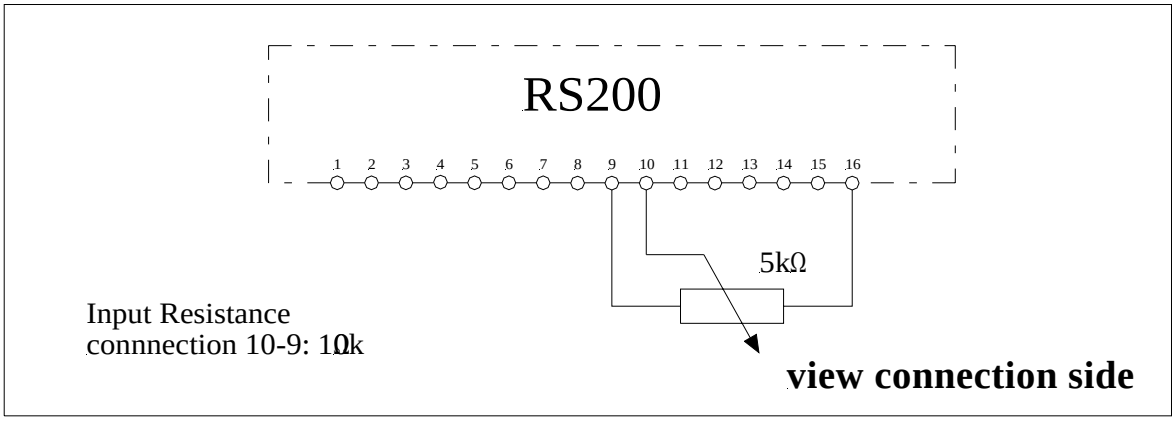


The external voltage-free relay contact k1 must be designed for 10 mA maximum. When the relay contact short circuits Terminals 8 and 9, this corresponds to a motor stop.

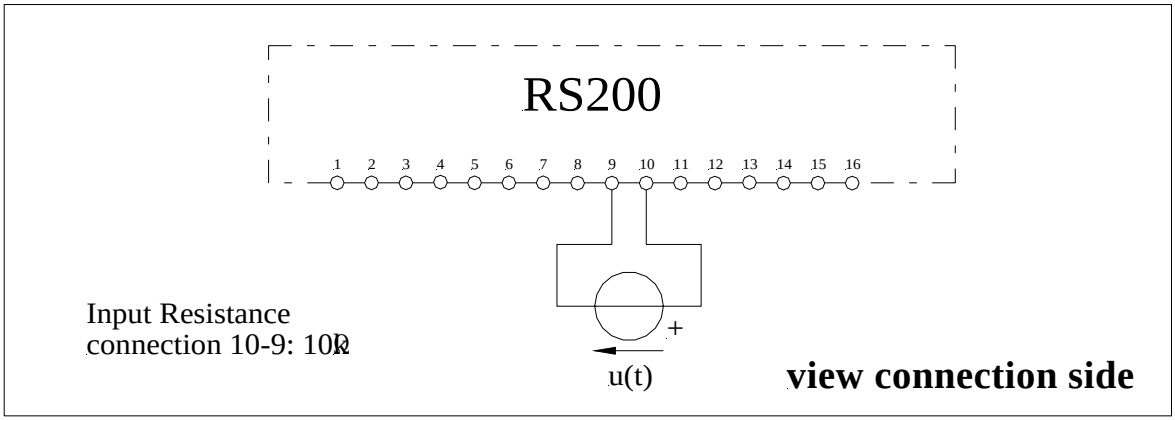
5.3 Desired speed value set via an external control voltage



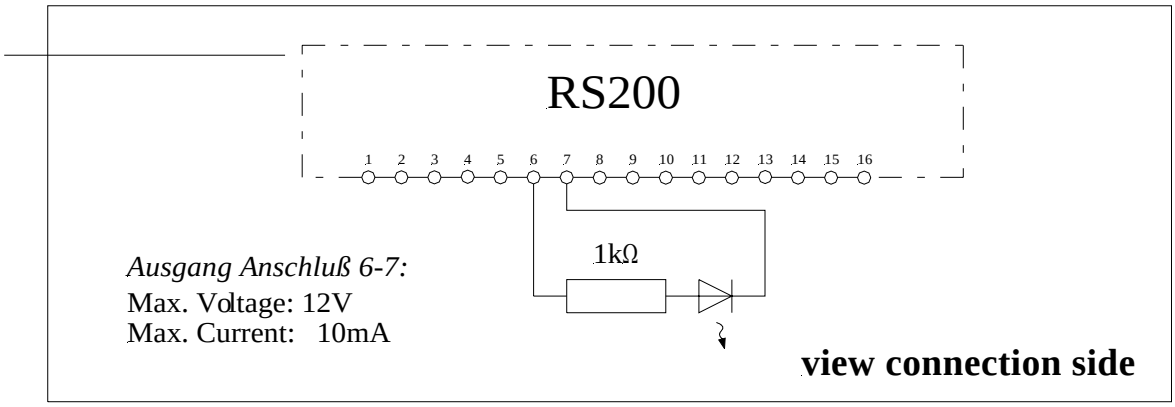
5.4 Current limit via external potentiometer



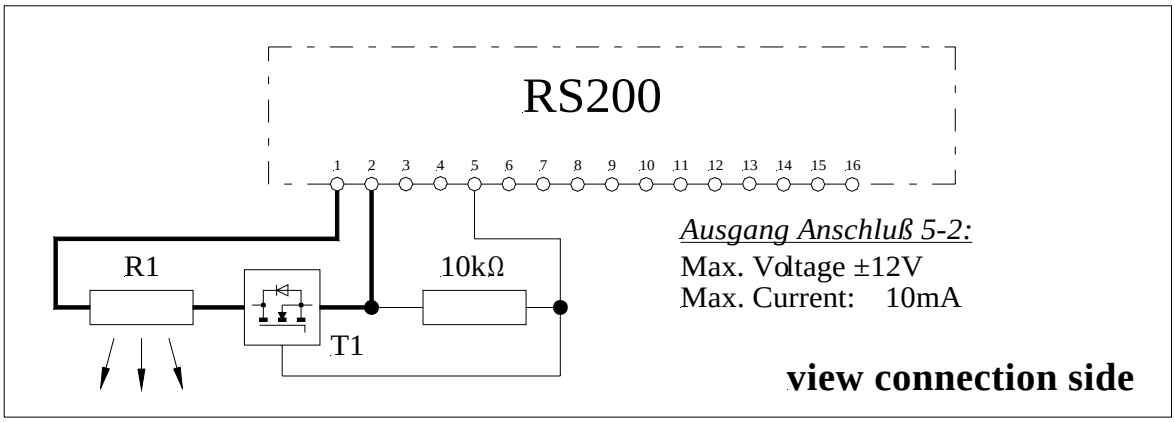
5.5 Current limit via an external control voltage



5.6 Wiring of the fault/ready output

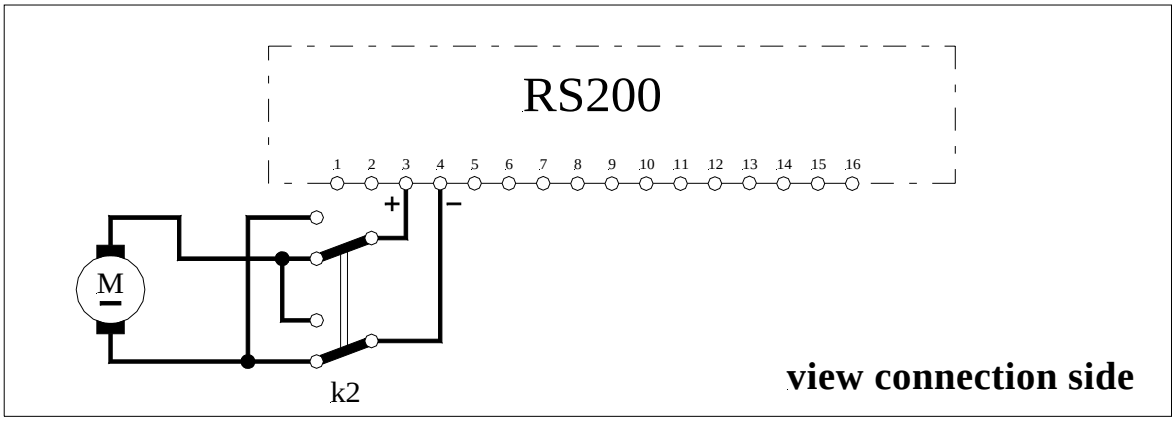


5.7 Connection of an external ballast circuit



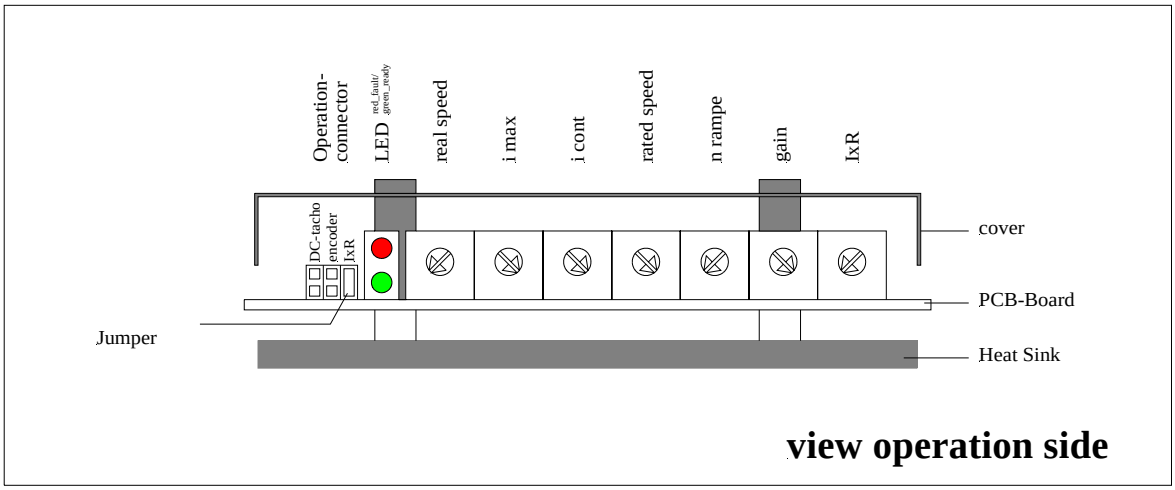
An N-channel MOS-FET with a drain/source voltage of at least 100V must be selected for transistor T1.

5.8 Circuit for reversal of direction of drive rotation



The voltage-free contacts on the external relay or contactor must be designed for a switching capacity of at least 15 A.
Reversal of the direction of rotation must always take place with the motor stationary. With a closed-loop control with DC tachogenerator the polarity of the tachogenerator must also be reversed with auxiliary connections on k2.

6. Potentiometer settings



The positions shown for the potentiometers and the short-circuit jumper correspond to the positions on delivery, i.e. maximum speed in the EMF control mode. The function of the potentiometer is described in the following:

Potentiometer *real speed:* This potentiometer is used as a voltage divider for the voltage of the speed feedback used (instantaneous speed value). This makes matching possible to the tachogenerator and actual-value sensor voltages. Turning from the left to the right causes the speed to increase.

Potentiometer *i max:* This potentiometer is used for setting the peak current. Rotation from the right to the left causes the maximum motor current to change from 15A to 0A irrespective of the continuous current as set with the potentiometer *i cont*. The setting *i max* at the *right end stop* means that no motor current can flow. This potentiometer sets the maximum value for the current value defined externally through Terminal 10.

Potentiometer *i cont:* This potentiometer is used for setting the continuous motor current. Normally, this current should not be set greater than the rated current quoted on the nameplate of the motor to be connected. The matching can be carried out with a blocked motor or by using a motor inductor and an ammeter (20A range) in the motor line. Turning from the right to the left causes a change of the continuous motor current from 7A to 0A.

Potentiometer *rated speed:* This potentiometer is used for setting the motor speed (set-value potentiometer). Turning from the left to the right causes an increase in the speed from zero to the maximum figure. This potentiometer sets the maximum value for the speed value defined externally through Terminal 8.

Potentiometer *n ramp:* This potentiometer is used for setting a motor speed ramp from 0 to 10 s. This provides a speed setting for soft running up and down to protect the drive. Turning from the left to the right causes the slope of the ramp to increase. Turning to the left end-stop means no ramp setting.

Potentiometer *gain:* This potentiometer is used for setting the proportional gain of the closed-loop speed control. The value can be adjusted between 9 and 1. The setting is correct when the motor operates without vibration and without a whistling sound. At the right end-stop the gain is set to the maximum value.

Potentiometer *IxR:* This potentiometer compensates the current-dependent voltage drop (IxR) in the motor with EMF control. The setting of this potentiometer must be carried out with the motor under load such that the speed difference between idling and fully loaded is little as possible. At the right end-stop this setting corresponds to the maximum value.

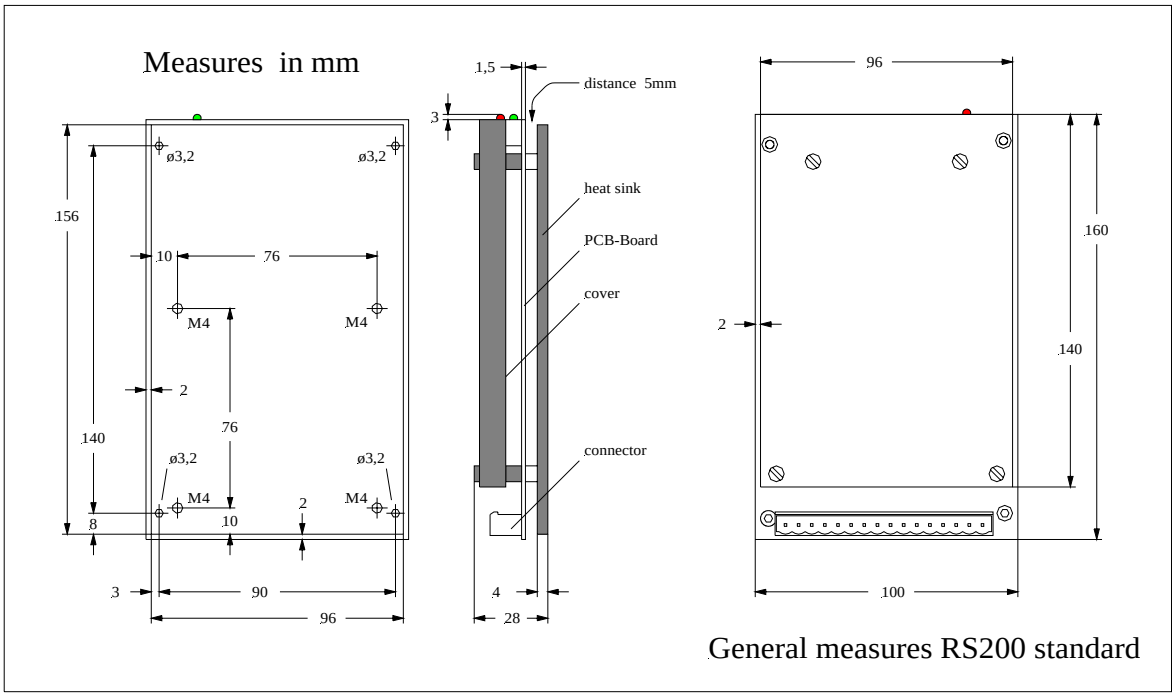
7. Commissioning

When wiring, the wire cross-sections as required by VDE must be used. The wire routing must separate the signal leads from the motor and supply lines as far as possible. To avoid interference on the tachogenerator, signal and encoder leads, twisted pairs and screened versions of these leads are practicable as are screened versions of the motor lines. The screens must be connected **at one end** to the solder tags provided for this purpose. In addition, the earth connection can be joined to these solder tags if no adequate earth connection is possible via the heatsink. Here it should be ensured that no earth loops are created, i.e. no current should flow in the screen.

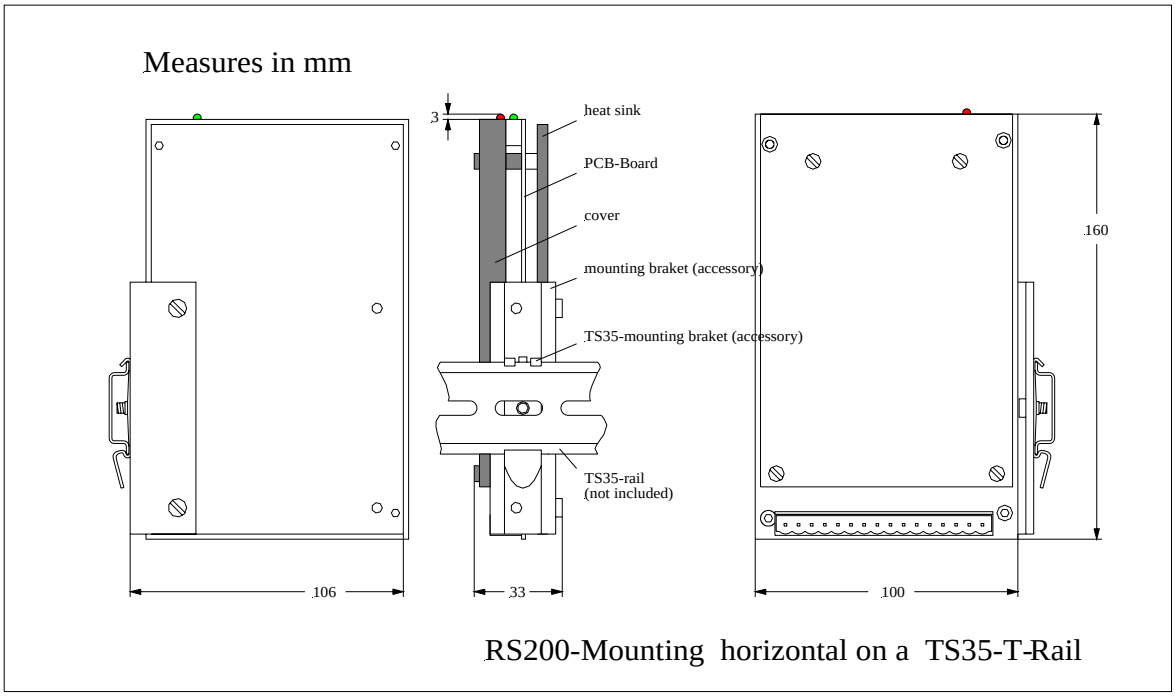
The short-circuit jumper on the operator's jumper strip must be set according to the required application. For setting the maximum motor current and the continuous motor current the details given under the potentiometer settings *i max* and *i cont* should be followed. When setting the motor speed, the details on the potentiometer setting *rated speed* should be followed. In addition, the potentiometer *real speed* provides matching of the speed range.

External setting of the speed and current is possible via Terminals 8 and 10. A setting of 0 to 10V enables a linear adjustment on the control card up to the set maximum values *rated speed* and *i max*. The corresponding GND is terminal 9.

8. Mechanical data

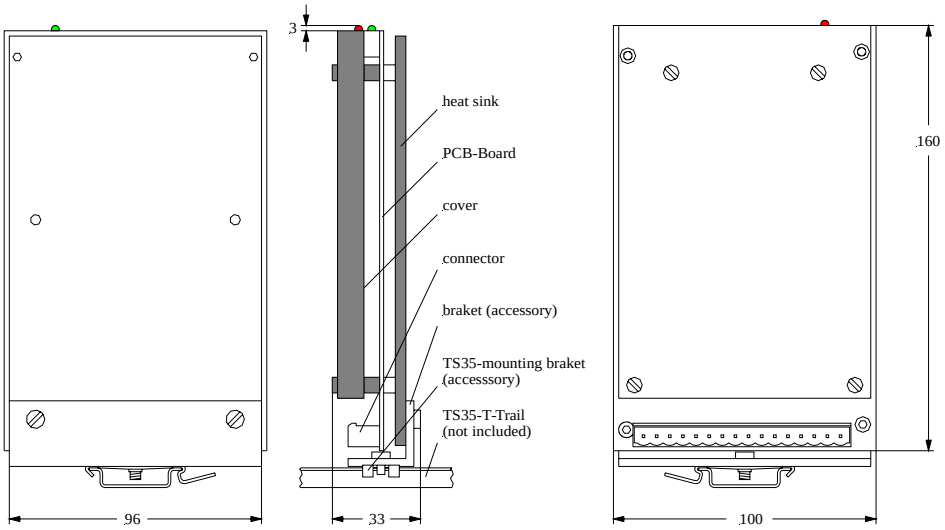


General measures RS200 standard



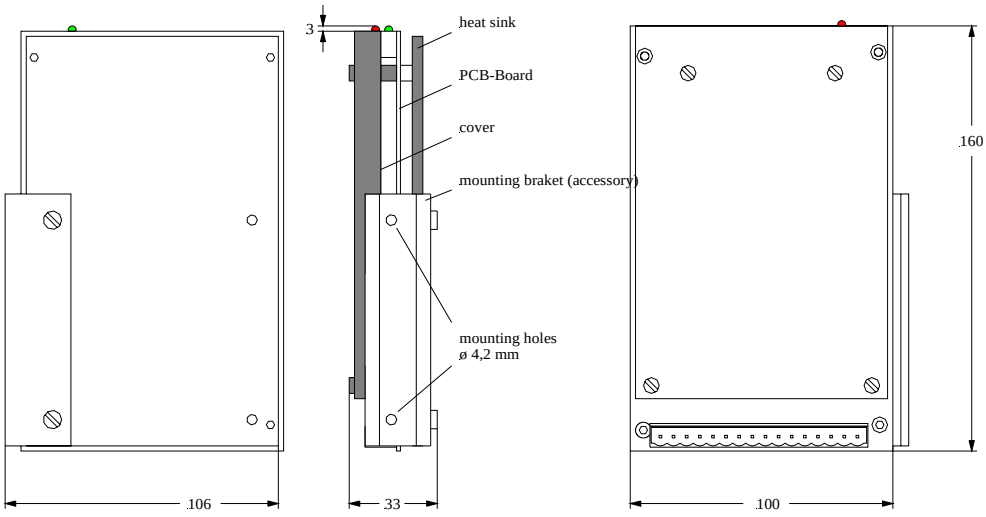
RS200-Mounting horizontal on a TS35-T-Rail

meausure in mm



RS200-Mounting vertical on TS35-rail

measure in mm



RS200-mounting vertical with braket