



User Manual

DC brush motor controller

RS Stock No.: 717550

1. Product designation

Controller 717550 is an electronic device to operate and control DC brush motors with a maximum voltage of 24VDC and power under 500W. The controller is designed to control torque, speed, direction, and the smooth start and stop of brush motors. The motor control is carried out by both internal regulators included in the design of the device and external ones, connected additionally. 717550 provides a motor overload protection function with regulation of the maximum permissible current supplied to the motor.

The controller performs the following functions:

- start and stop a DC brush motor with a button on the front panel or with an external signal;
- change of rotation direction of the motor by a button on the front panel or by an external signal;
- motor speed control;
- motor torque control;
- setting the value of acceleration and deceleration;
- protection of the motor against an overload with adjustment of peak current;
- indication of errors and operating modes of the controller;
- emergency stop function "HARD STOP" - the motor stops in case of opening of the electrical circuit of the protective circuit;
- control of the external electromagnetic motor brake;
- temperature protection of power stages;
- temperature protection of the brake circuit.

2. Technical characteristics

2.1. Main characteristics

Table 1. Technical characteristics.

Power supply U_{sup}	12...24 VDC, stabilized
Permissible supply voltage range	10...30 VDC
Maximum motor power	500 W
Max. operation motor current	20 A
Hardware short-circuit protection	30 A, response time - 15 μ s
Adjustable phase current limitation	0.2 - 20 A, response time -5 s
Current consumption	< 100 mA at a supply voltage of 24VDC
Maximum current of the built-in power supply +5V	50 mA
Permissible working current of the brake connected to terminals BR+ / BR-	1 A

2.2. Dimensions

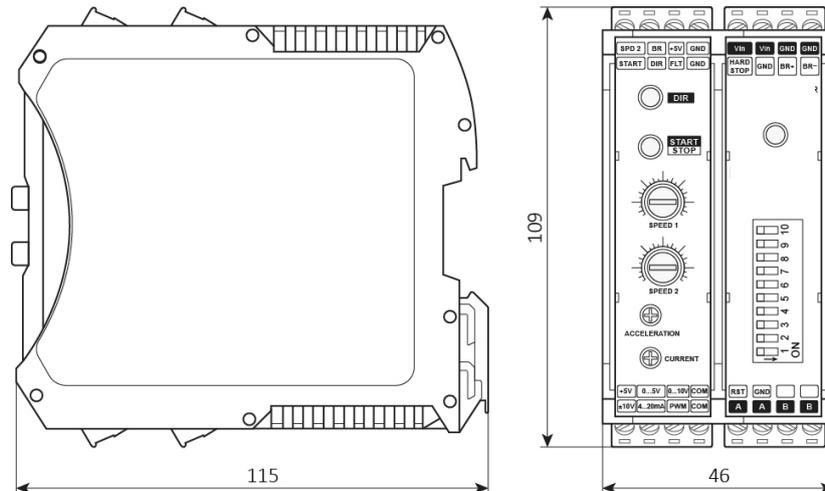


Fig. 1. Dimensions of 717550

2.3. Environmental conditions

- Ambient environment: non-corrosive, non-explosive,
- Humidity: 90% RH or less upon condition +25°C
- Condensation and freezing: none
- Pressure: 650...800 mm of mercury.
- Ambient Temperature: 0...+40°C

2.4. Protection functions

Current protection:

- The controller has hardware protection against short circuits - 30A, response time - 15 μ s;
- The controller provides for adjustable limitation of the motor current. The limitation is set by the user within 0.2 – 20 A using a potentiometer on the front panel. The response time of the limitation is 5s. Then an emergency stop (HARD STOP) is performed.

Mechanical protection:

- An emergency stop of the motor is provided in case of opening the electric protective circuit HARD STOP.

Temperature protection:

- output stage temperature rise
- brake circuit temperature rise

3. Control modes

The controller 717550 provides control of the motor speed or torque.

3.1. Motor speed control modes

- internal potentiometer;
- external potentiometer with full resistance: 10 kOhm;
- analog signal 0 - 10 V;
- analog signal -10 - +10 V;
- analog signal 4 - 20 mA;
- PWM signal. PWM frequency: 16 kHz, 3.3 V.

Speed feedback is not provided.

3.2. Motor torque control modes

- internal potentiometer;
- external potentiometer with full resistance: 10 kOhm;
- analog signal 0 - 10 V;
- analog signal -10 +10 V;
- analog signal 4 - 20 mA;
- PWM signal. PWM frequency: 16 kHz, 3.3 V.

Torque stabilization without speed control, by instantaneous motor current.

The control mode and the type of control signal are selected using microswitches on the front panel of the controller (refer to section 6).

4. Construction

717550 is designed as a circuit plate with electronic elements, installed on a plate and covered with a case, indicating and control elements, and connection terminals on the board:

- Plastic housing designed for installation on a DIN rail.
- Circuit board with electronic components.
- Screw terminals for connecting wires: control lines, power supply, and motor.
- Front panel with controls and graphic symbols.

Front panel control elements:

- status LED;
- "START" button;
- "DIR" button;
- main speed setting potentiometer;
- second speed setting potentiometer;
- current setting potentiometer;
- acceleration setting potentiometer;
- microswitches group for selecting the logic of the "Start" and "DIR" input signals (level- or edge-triggered), selecting the control mode (speed or torque control), selecting the stop mode with open or closed motor terminals, BRAKE signal inversion, and automatic brake application function.

5. Assembly and connection

Please, learn this manual carefully before connecting and assembling.

Please, wire just when the power is off. Do not attempt to change wiring while the power is ON.

Set the required operating mode, type, and logic of control signals using microswitches SW1 – SW10 in accordance with section 6.1.

Installation must be performed by qualified personnel. The controller is designed for installation on a standard DIN rail 35 mm wide.

Attention: When connecting, observe the polarity of the power supply. Failure to observe the polarity, as well as exceeding the supply voltage, may damage the unit.

Please, provide a reliable contact at the connection terminals. During wiring, please observe the polarity and wire management.

Connection order:

- 1) Make sure the power supply is turned off. Please, wire just when the power is off.
- 2) Connect the motor to the controller terminals A and B.
- 3) If necessary, connect external control circuits to the terminals: external speed or torque controller (potentiometer, analog signal source -10...+10V, 0...+10V, 4...20mA or PWM signal); external control signals "HARD STOP", "START/STOP", "DIR", "BR", "SPD2" to the corresponding terminals.
- 4) Connect the device to a power supply. The thickness of the connecting wires must correspond to the current consumed by the motor.
- 5) Use the control elements to pre-set working parameters by setting the speed, acceleration, and current potentiometers to the middle positions.
- 6) Turn the power on, check the operation, and perform fine-tuning using the control elements.

6. Operation

If necessary, before starting work, configure the controller operating parameters (control mode, speed, acceleration, current limitation) according to section 6.1.

During operation, the controller monitors abnormal situations. In case of error or alarm, the controller indicates the code with LED flashing – refer to section 6.7.

6.1. Setting up the controller and connecting control signals

There is a group of microswitches SW1...SW10 on the front panel of the controller. These switches are intended for selecting the logic of start and reverse signals (triggering by level or by edge), selecting the control mode (speed or torque control), selecting the stop mode (with open or closed motor terminals), selecting brake polarity, and the automatic brake application function.

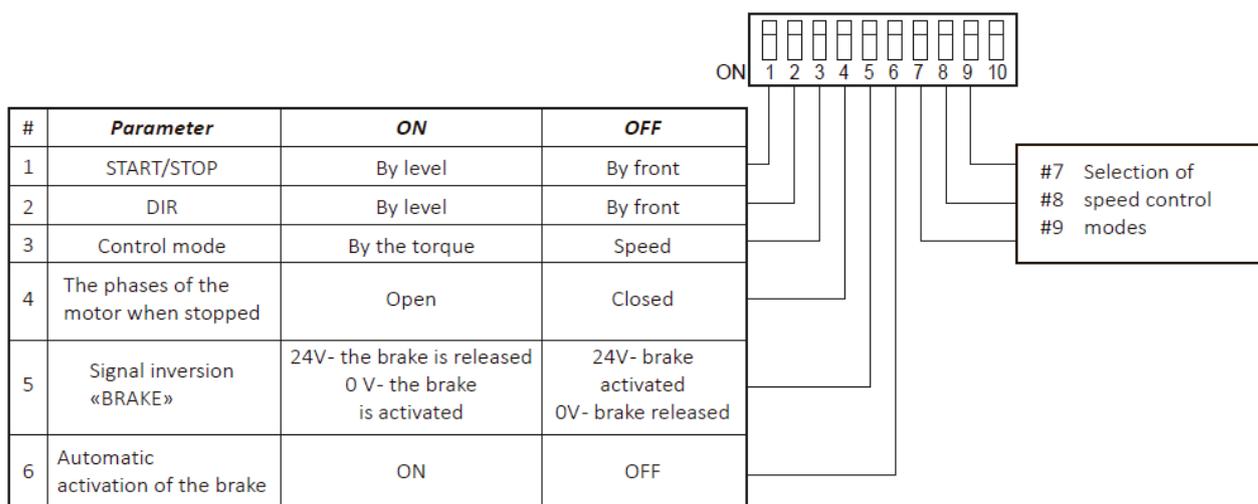


Fig. 2. Purpose of microswitches SW1 – SW10

An example of connecting the controller with control from a built-in potentiometer is carried out according to the diagram in Fig. 3.

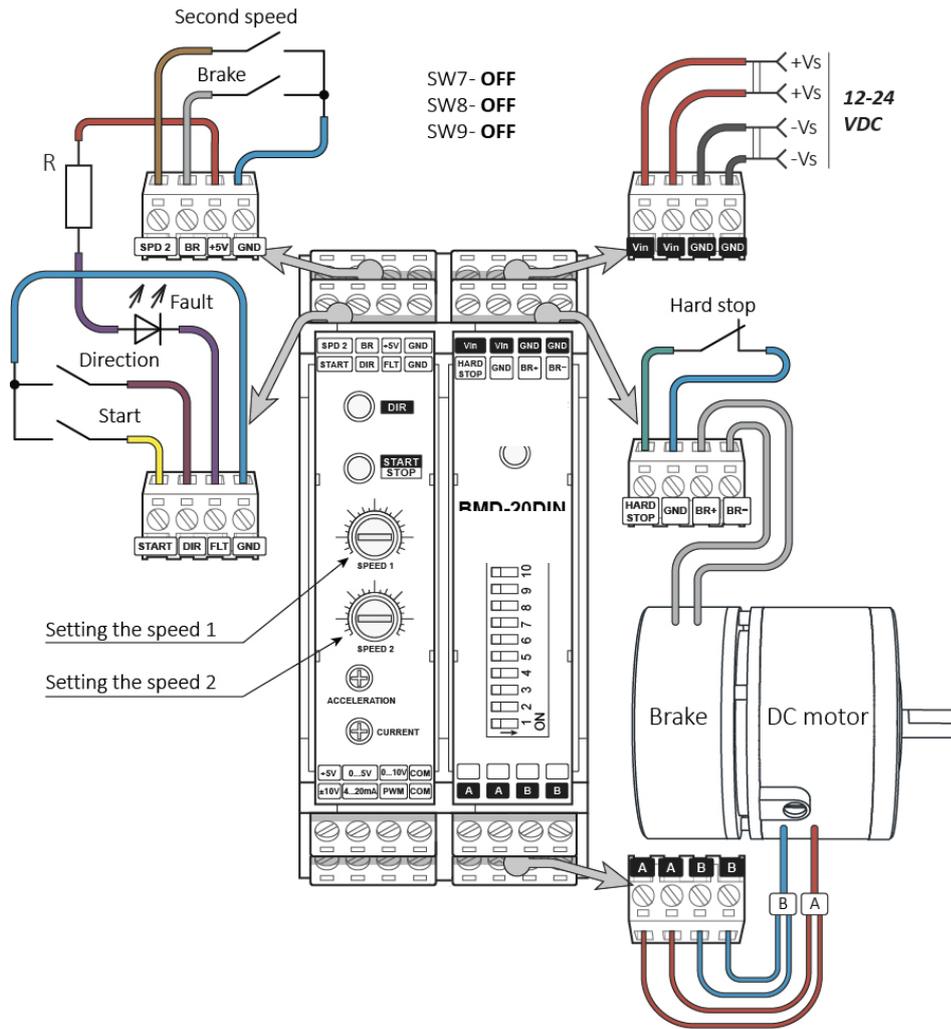


Fig. 3. Connection diagram for control with the built-in potentiometer

The control signal type is set with the microswitches SW7, SW8, and SW9. Set the desired position of the microswitches and, if necessary, connect the external control signal according to the diagram in Fig. 4.

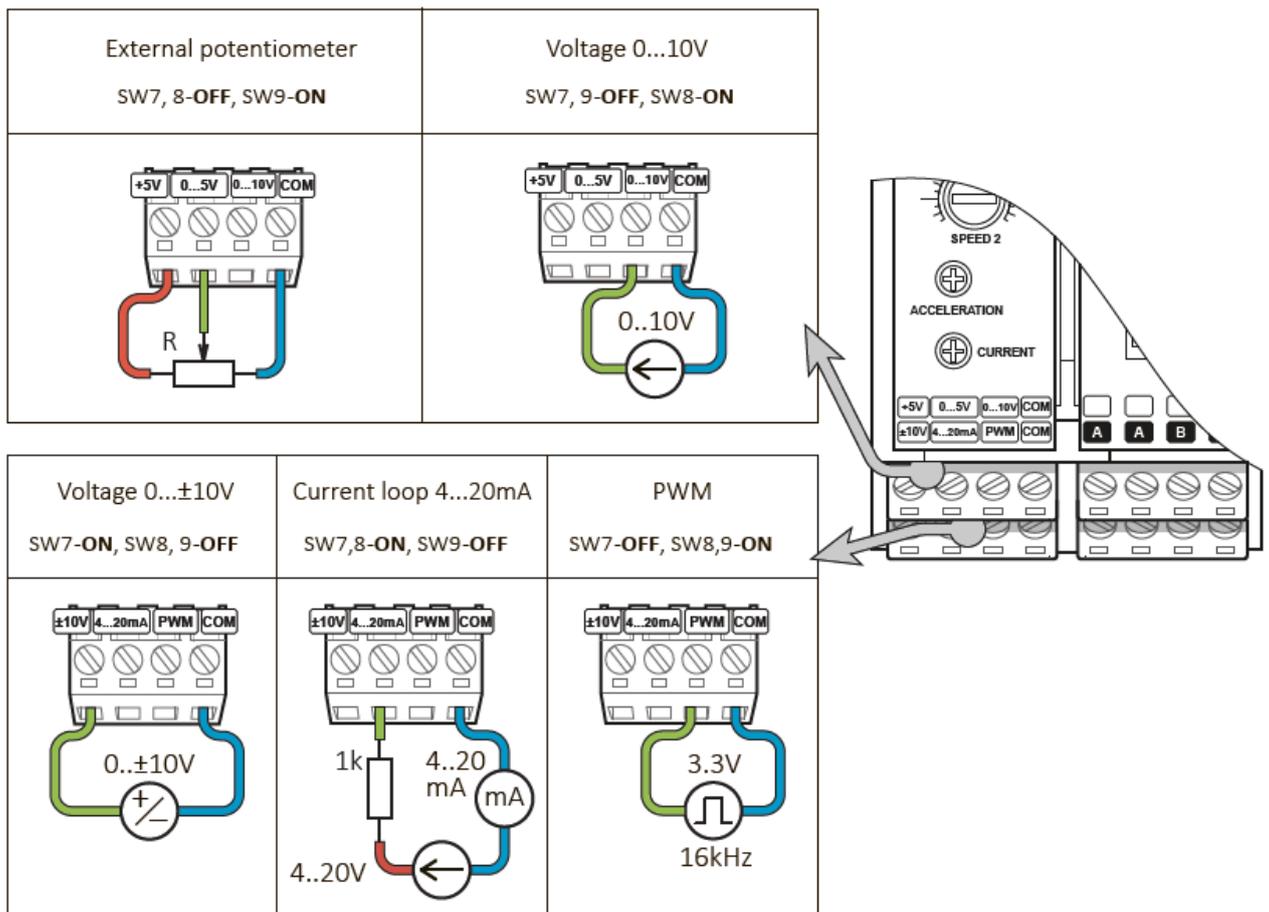


Fig. 4. Connecting external speed and torque control signals

6.1.1. Selecting the operating mode - speed or torque control

Regulation of motor speed or torque with the controller 717550 is carried out with an analog signal. The control mode is selected using the SW3 microswitch on the front panel of the controller: SW3 = OFF - speed control, SW3 = ON - torque control.

Speed control mode (SW3 = OFF).

In the speed control mode, when the motor starts, voltage is supplied to the windings, the value of which depends on the speed control signal. The type of the signal is selected with microswitches SW7, SW8, and SW9. Speed feedback and stabilization are not provided.

Select the speed setting signal type according to the diagram in Fig. 4:

- Internal potentiometer;
- External potentiometer with impedance: 10 kOhm;
- Analog signal 0 - 10 V;
- Analog signal -10 - +10 V;
- Analog signal 4 - 20 mA;
- PWM signal.

Built-in potentiometer. When controlling the speed with the built-in potentiometer "SPEED 1", no additional connections of the control signal are required. The extreme clockwise position

corresponds to the maximum motor speed. The extreme counterclockwise position corresponds to stopping the motor.

A feature of the built-in potentiometer speed control mode is the ability to set two speed values and switch between them by shorting the "SPD 2" input to the "GND" terminal. The second speed is set using the built-in "SPEED 2" potentiometer.

External potentiometer. In case of controlling the speed with an external potentiometer, the maximum speed will correspond to the extreme position of the potentiometer, at which a voltage of 4.3 V is applied to the input "0..5V". Stopping the motor will correspond to the potentiometer position, at which a voltage of 0 V is applied to the input "0..5V". External potentiometer parameters: 10 kOhm.

Analog signal 0...10 V. In case of applying an external analog signal 0...10 V to the "0..10V" input, the maximum speed corresponds to a signal level of 10 V. Motor stop corresponds to a level of 0 V. Dead zone is 0...100 mV

Analog signal 4...20 mA. When controlling the speed with an external current signal 4...20 mA, the maximum speed corresponds to a signal level of 20 mA. The motor stops at a signal level of 4 mA.

Analog signal -10...+10 V. When controlling the speed with a -10...+10 V analog signal, the motor stops at a signal level of 0 V. The maximum speed in the forward direction corresponds to the signal level +10 V. The maximum speed in the reverse direction corresponds to the signal level -10 V. The Dead zone is 5%.

PWM signal. When controlling the speed with a PWM signal (16 kHz, 3.3V), the signal is applied to the "PWM" input. The minimum start speed corresponds to a duty cycle of 2%. The maximum speed corresponds to a duty cycle of 100%. A duty cycle of 0% corresponds to the motor stop.

Torque control mode (SW3 = ON).

In torque control mode, voltage is applied to the windings when the motor starts. The voltage increases until the current reaches the set value. The maximum permissible motor voltage is limited by the built-in SPEED2 potentiometer.

Select the torque setting signal type according to the diagram in Fig. 4:

- internal potentiometer;
- external potentiometer with impedance: 10 kOhm;
- analog signal 0 - 10 V
- analog signal -10 - +10 V
- analog signal 4 - 20 mA
- PWM signal.

Built-in potentiometer. When controlling the torque with the built-in potentiometer "SPEED 1", no additional connections of the control signal are required. The extreme clockwise position corresponds to the maximum motor torque and motor current of 20A. The extreme counterclockwise position corresponds to the minimum torque and motor current 0A.

External potentiometer. In case of controlling the torque with an external potentiometer, the maximum torque and motor current will correspond to the extreme position of the potentiometer, at which a voltage of 4,3 V is applied to the "0..5V" input. The minimum torque and motor current 0A corresponds to the potentiometer position, at which a voltage of 0 V is applied to the "0..5V" input. External potentiometer parameters: 10 kOhm.

Analog signal 0...10 V. In case of applying an external analog signal 0...10 V to the "0..10V" input, the maximum torque and motor current 20A corresponds to a signal level of 10 V. The

minimum torque and motor current 0A corresponds to a level of 0 V. The signal level of 0...200 mV is a dead zone.

Analog signal 4...20 mA. When controlling the torque with an external current signal 4...20 mA, the maximum torque and current 20A corresponds to a signal level of 20 mA. The minimum torque and motor current 0A corresponds to a signal level of 4 mA.

Analog signal -10...+10 V. When controlling the torque with a -10...+10 V analog signal, the minimum torque and motor current 0A corresponds to a signal level of 0 V. The maximum torque and current value is 20A, and movement in the forward direction corresponds to the level of +10V. The maximum torque and current value 20A, and movement in the reverse direction corresponds to the level of -10V. Dead zone is 5%.

PWM signal. When controlling the torque with a PWM signal (16 kHz, 3.3V), the minimum motor torque corresponds to a duty cycle of 0%. The maximum torque corresponds to a duty cycle of 100%.

6.1.2. Setting the motor acceleration

Use the built-in potentiometer "ACCELERATION" to set the acceleration and deceleration time. The extreme counterclockwise position corresponds to the maximum acceleration time (minimum acceleration). The extreme clockwise position corresponds to the minimum acceleration time (maximum acceleration). The acceleration time to maximum speed varies in the range from 0.5 to 5 seconds.

Note: if, as a result of acceleration, the controller switches to the alarm state with the error code #2, it is necessary to increase the acceleration time.

In the torque control mode, the acceleration potentiometer changes only the deceleration time. When setting smooth deceleration, when the motor stops, the current regulation function is disabled, and a smooth reduction of the PWM level on the motor from the current value to zero is carried out.

6.1.3. Setting the peak current limit

The internal potentiometer "CURRENT" is used to set the peak power supplied to the motor. The extreme clockwise position corresponds to a motor current limit of 20 A, counterclockwise to a current limit of 0.2 A. When the limit is reached, if the current does not decrease within 5 seconds, an emergency stop of the motor (HARD_STOP) is performed. The controller displays the HARD_STOP error.

6.1.4. Motor stop method

By default, the controller uses the stop mode with the rotor closed on itself. Stopping with the rotor closed on itself allows the motor to stop rotating in a short period of time. It is possible to use the stop mode with the motor rotor open, the so-called "stop mode with open motor terminals". The mode is switched on by the switch SW4 on the front panel: SW4 = ON - stop with open terminals, SW4 = OFF - stop with closed terminals.

6.2. Motor rotation control

After switching on the supply voltage, the device is ready for operation. The LED located on the board is continuously green.

Start/stop and reverse of the motor are carried out by external signals or by pressing buttons on the front panel of the controller. The buttons are activated when released, and external signals can be configured to be activated according to the front or level of the signal.

The logic for processing the control signals "START and "DIR" can be configured by a user. The control signals are processed by a front or by a level, depending on the position of the microswitches SW1 (START signal) and SW2 (DIR) on the front panel (see the diagram in Fig. 2).

The OFF position of the microswitch determines the processing of the corresponding signal by a front, the ON position - by the signal level.

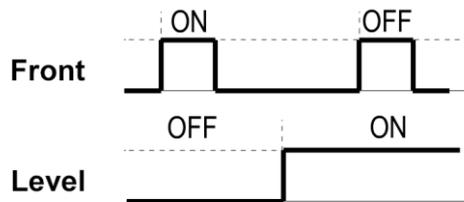


Fig. 5. Control signals START and DIR - front and level types

6.2.1. Motor start/stop

The motor is started and stopped by the "START/STOP" button on the front panel of the controller or by an external signal, when the line connected to the "START" terminal is closed to the signal ground GND.

The START/STOP button on the front panel is active only when the START input is configured for front-triggered signal processing (SW1=OFF). The button is activated when released.

6.2.2. Motor direction

The motor rotation direction is changed by the "DIR" button on the front panel of the controller or by an external signal, when the line connected to the "DIR" terminal is closed to the GND signal ground.

The DIR button on the front panel is active only when the DIR input is configured for front-triggered signal processing (SW2=OFF). The button is activated when released.

In the -10...+10V control mode, the DIR button and the external DIR signal are not active. In this case, the direction of rotation is changed by changing the polarity of the voltage.

6.3. Alarm signal FAULT

If the errors described in Section 6.7 are detected, the FAULT output signal is triggered. The FLT output operates as follows: when an error occurs, the open-collector transistor switches the output to GND. Examples of connecting the error output signal are shown in Figures 6 and 7.

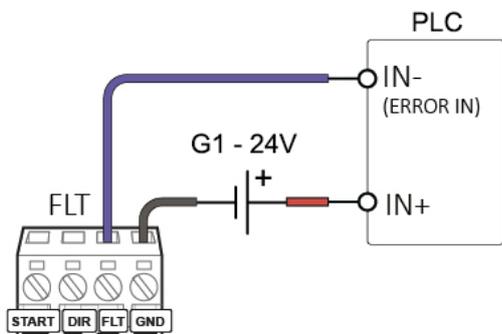


Fig. 6. Example of connection to an external PLC

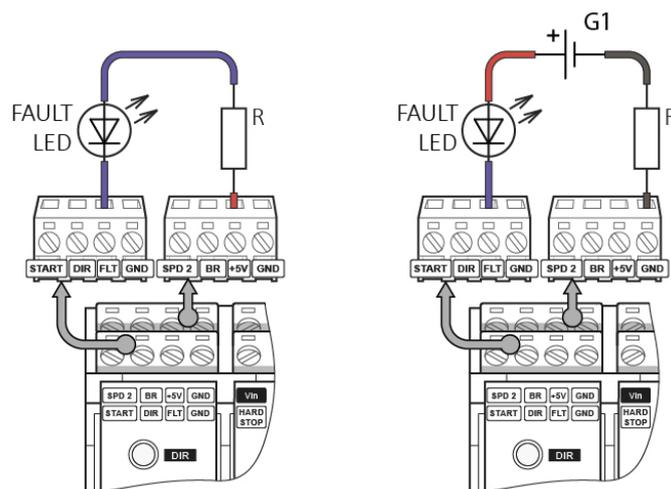


Fig. 7. Examples of connecting the indicator LED

6.4. Emergency stop

The "HARD STOP" signal is used for the emergency stop of the motor. Operation is permitted when the HARD_STOP contact is closed to the GND signal ground. If the contact is disconnected, the controller switches to the emergency mode, the motor stops abruptly, and the corresponding error is indicated (refer to section 6.7).

Exit from the emergency mode is performed by switching off and then on the supply voltage.

6.5. Brake control

The controller provides control of a motor electromagnetic brake.

Brake type. A normally closed brake holds the motor shaft when there is no voltage on the windings; to release the rotor of the electric motor, it is necessary to apply supply voltage to the electric brake. A normally open brake operates according to reverse logic: when voltage is applied to the brake windings, the shaft is fixed; when the voltage is removed, the shaft rotates freely. The brake type is selected using microswitch SW5 on the front panel: SW5 = OFF - normally closed brake, SW5 = ON - normally open brake.

Brake control is provided via a discrete "BR" signal, as well as automatic brake activation. The control method is selected using microswitch SW6 on the front panel: SW6 = OFF - brake control via the external "BR" signal, SW6 = ON - automatic brake activation.

When controlling the brake using the external signal "BR" (SW6 = OFF), voltage is applied or removed from the output terminals "BR+" and "BR-" depending on the brake type (SW5) and the state of the "BR" signal.

Table 2. Brake control logic using external signal "BR" (SW6 = OFF).

Brake inversion (SW5)	Signal «BR»	State of the brake output BR+\BR-
OFF	OFF	Usup
OFF	ON	0
ON	OFF	0
ON	ON	Usup

In automatic brake control mode (SW6 = ON), the brake is automatically applied when the motor stops and released when the motor starts. In automatic brake control mode (SW6 = ON), the "BR" signal is inactive.

Table 3. Control logic for automatic brake application (SW6 = ON).

Brake inversion (SW5)	Motor state	State of the brake output BR+\BR-
OFF	OFF (stop)	0
OFF	ON (run)	U _{sup}
ON	OFF (stop)	U _{sup}
ON	ON (run)	0

6.6. Second speed

The controller can turn on a preset second speed. The second speed value is adjusted using the "SPEED 2" potentiometer. The second speed is turned on by closing the SPD2 contact to the GND signal ground. The function is only available in the speed control mode with the built-in potentiometer regulation (SW7=OFF, SW8=OFF, SW9=OFF).

6.7. Indication of operating modes and errors

The LED indicator on the front panel displays the controller state.

After applying the supply voltage in the normal mode:

- When the motor is off, the indicator lights up green constantly.
- When the motor is on, the indicator flashes green for a period of approximately 1 second.

If the red LED lights up and remains lit during operation, this means that the maximum speed has been reached and further speed increase is impossible.

If an error is detected, the indicator displays the error code with a series of red flashes (Table 4).

Table 4. Status indication.

Error code	Indication	Description
0	Green on	Normal operation (motor stop)
0	Green flashing	Normal operation (motor run)
0	Red on, no flashes	Normal operation (motor runs at maximum possible speed)
1	Single red flashes	Out of range of the internal 12V converter voltage
2	A series of 2 red flashes	Short circuit in the phase or motor current increases to 30A
3	A series of 3 red flashes	Overheating of the internal braking circuit
4	A series of 4 red flashes	Overheating of the power keys
5	A series of 5 red flashes	Emergency stop of the motor (HARD_STOP)
6	A series of 6 red flashes	Test firmware version

Note: If a short circuit of the motor phases occurs or its current exceeds 30A for 15 μ s, the controller switches to emergency mode with the motor switched off and LED indication.



7. Delivery in complete sets

DC brush motor controller 717550

1 pcs

8. Manufacturer information

RS Components adheres to the line of continuous development and reserves the right to make changes and improvements in the design and software of the product without prior notice.

The information contained in this manual is subject to change at any time and without prior notice.

9. Warranty

Any repairs or modifications are performed by the manufacturer or an authorized company. The manufacturer guarantees the failure-free operation of the controller for 12 months from the date of sale when the operation conditions are satisfied.

The manufacturer's sales department address:



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RS Components GmbH, Mainzer Landstrasse 180, 60327 Frankfurt/Main, Germany, rs-online.com