

# Motor Controllers

## AC Semiconductor Motor Controller

### Types RSE 22 25 - C., RSE 4. 25 - C., RSE 60 25 - C.

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- Soft starting and stopping of 3-phase squirrel cage motors
- Rated operational voltage: Up to 600 VACrms, 50/60 Hz
- Rated operational current: 25 AAC 53 b
- Potential-free control input
- LED-indications for power supply, ramping, bypassing relays and overheating
- Self protection against overheating
- Optional relay output for end of ramp and overheating alarm, optional wrong phase sequence LED indication (-C10)
- Transient overvoltage protection built-in
- Integral bypassing of semiconductors

## Product Description

Compact easy-to-use AC semiconductor motor controller. With this controller 3-phase motors with nominal load currents up to 25 A can be soft-started and/or soft-

stopped. Starting and stopping time as well as initial torque can be independently adjusted by built-in potentiometers.

## Ordering Key

**RSE 40 25 -C 1X**

Solid State Relay \_\_\_\_\_  
 Motor controller \_\_\_\_\_  
 E-line housing \_\_\_\_\_  
 Rated operational voltage \_\_\_\_\_  
 Rated operational current \_\_\_\_\_  
 Control voltage \_\_\_\_\_  
 Control relay (option) \_\_\_\_\_  
 Shape of ramp \_\_\_\_\_

## Type Selection

Type	Rated operational voltage $U_e$	Rated operational current $I_e$	Control voltage $U_c$	Control relay
<b>RSE:</b>	22: 127/220 VACrms, 50/60 Hz	25: 25 A	-C: 24 to 110 VAC/DC & 110 to 480 VAC	Blank: No relay mounted
<b>E-series,</b>	40: 230/400 VACrms, 50/60 Hz			1: 2 control relays mounted
<b>motor controller</b>	48: 277/480 VACrms, 50/60 Hz			
	60: 346/600 VACrms, 50/60 Hz			

## Selection Guide

Rated operational current $I_e$	Motor Rating 5.5 kW/10 HP	11 kW/15 HP	15 kW/20 HP	18.5 kW/25 HP
25 AAC 53b	RSE2225-C RSE2225-C10	RSE4025-C RSE4025-C10	RSE4825-C RSE4825-C10	RSE6025-C RSE6025-C10

## Input Specifications (Control Input)

Control voltage $U_c$ A1-A2:	24 - 110 VAC/DC $\pm 15\%$ , approx. 12 mA
A1-A3:	110 - 480 VAC $\pm 15\%$ , approx. 5 mA
Rated insulation voltage	630 V rms Overvoltage cat. III (IEC 60664)
Dielectric strength Dielectric voltage Rated impulse withstand volt.	2 kVAC (rms) 4 kV (1.2/50 $\mu$ s)

## Output Specifications

Utilization category	AC-53b Integral bypassing of semiconductors
Overload current profile (overload relay trip class)	25 A: AC-53b: 4-3: 120

## Supply Specifications

Power supply	Overvoltage cat. III (IEC 60664)
Rated operational volt. (U <sub>e</sub> ) through terminals L1-L2-L3	(IEC 60038)
22	127/220 VAC rms $\pm 15\%$ 50/60 Hz -5/+5 Hz
40	230/400 VAC rms $\pm 15\%$ 50/60 Hz -5/+5 Hz
48	277/480 VAC rms $\pm 15\%$ 50/60 Hz -5/+5 Hz
60	346/600 VAC rms $\pm 15\%$ 50/60 Hz -5/+5 Hz
Voltage interruption	$\leq 40$ ms
Dielectric voltage	2 kV (rms)
Rated impulse withstand volt.	4 kV (1.2/50 $\mu$ s)
Rated operational power supplied from	5 VA L1-L2

## Mode of Operation

This motor controller is intended to be used to softstart/ stop 3-phase squirrel cage induction motors and thereby reduce the stress or wear on gear and belt/chain drives and to give smooth operation of machines. Soft starting and or stopping is achieved by controlling the motor voltage. During running operation the semiconductor is bypassed by an internal electro-mechanical relay.

The initial torque can be adjusted from 5 to 50% of the nominal torque.

The soft-start time can be adjusted from 0.5 to 10 s and 0.5 to 20 s for the soft-stop respectively.

A green LED indicates supply. The yellow LED is flashing during the ramping up or down. After the ramping when the semiconductors are bypassed the yellow LED lights constantly. The red LED is flashing when the frequency is different from L1-L2-L3 (only in -C10). If the softstarter is overheated the red LED is turned on constantly.

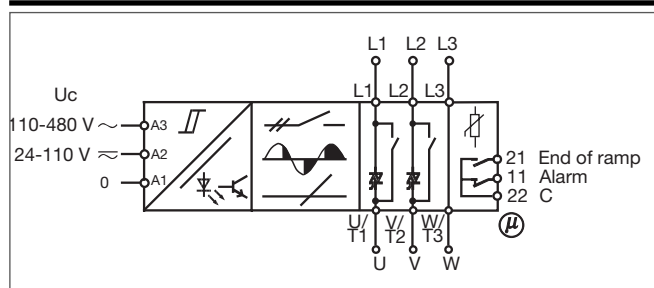
### Alarm handling:

Over temperature: The RSE will not start if the heatsink has an internal temperature which is exceeding approx 100°C. When over temperature occurs while the softstarter is not ramping (1) or while the bypass Relays are activated (2) the following will happen:

- 1) The softstarter will not ramp up and alarm relay is deactivated (contact open) - Reset takes place when the temperature drops below the critical level and only if the supply is interrupted and reapplied.
- 2) The alarm relay will deactivate (open) to indicate fault and when the softstarter is not ramping the softstarter will react as described in 1).

Sequence: By wrong sequence at connection of the power the RSE will start normally but the alarm relay will not activate. (Contacts open).

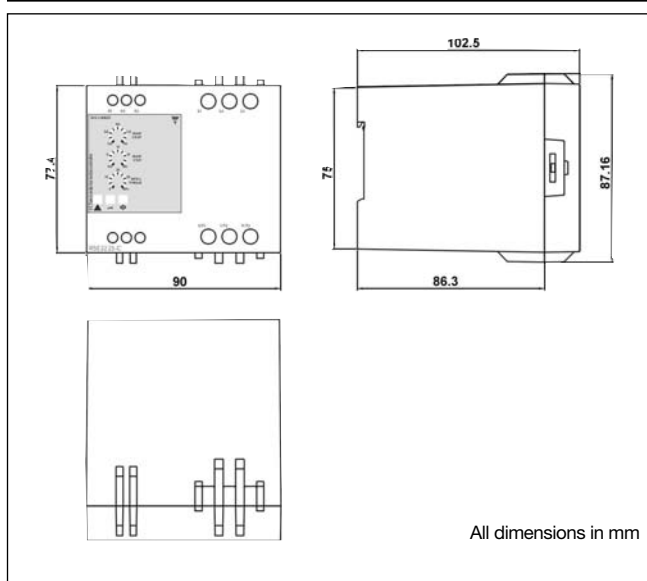
## Functional Diagram



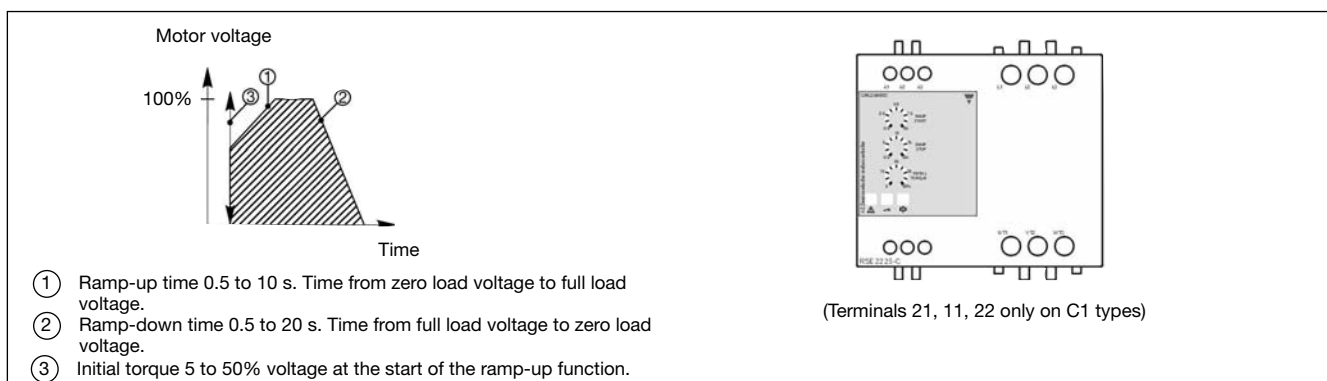
## General Specifications

Accuracy	
Ramp up	10 $\pm 10\%$ on max. $\leq 0.5$ s on min.
Ramp down	20 $\pm 10\%$ on max. $\leq 0.5$ s on min.
Initial torque	50% $\pm 5\%$ on max. $< 5\%$ on min.
EMC Immunity	Electromagnetic Compatibility acc. to EN 50 082-2
Indication for	
Power supply ON	LED, green
Ramping	LED, yellow (flashing)
Bypassing relay	LED, yellow (constant ON)
Wrong phase sequence	LED, red (flashing)
Overheated	LED, red (constant ON)
Environment	
Degree of protection	IP 20
Pollution degree	3
Operating temperature	-20° to +50°C (-4° to +122°F)
Storage temperature	-50° to +85°C (-58° to +185°F)
Terminals	Screw with captive wire clamp
Control terminals nominal	2.5 mm <sup>2</sup> , AVG 14
Min.	0.5 mm <sup>2</sup> , AWG 20
Mounting torque max.	0.6 Nm
Power terminals nominal	10 mm <sup>2</sup> , or 2 x 6 mm <sup>2</sup>
Min.	AWG 6 or 2 x AWG 10
Mounting torque max.	1 mm <sup>2</sup> , AWG 16
Approval	UL (listed), CSA
CE-marking	Yes

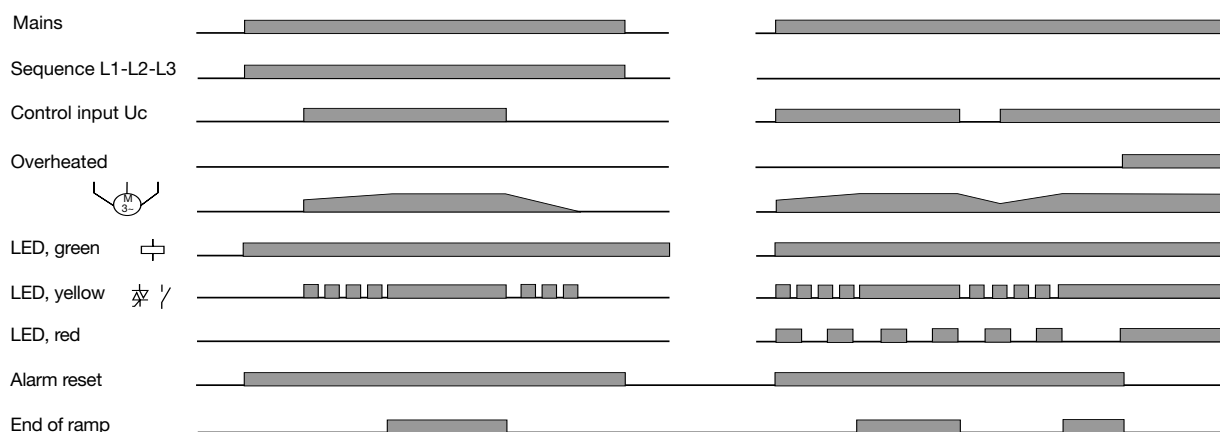
## Dimensions



## Operation Diagram 1



## Operation Diagrams 2 and 3



## Time between Rampings

Ramp time [sec.]	1	2	5	7	10
I ramp [A]					
150	4 min	8 min	20 min	N/A	N/A
125	3 min	6 min	14 min	19 min	N/A
100	2 min	4 min	9 min	12 min	18 min
75	1 min	2 min	5 min	7 min	10 min
50	27 sec	53 sec	2 min	3 min	4 min
25	7 sec	13 sec	33 sec	47 sec	67 sec

To prevent the semiconductors from overheating, a certain time between ramping should be allowed. The time between rampings depends on the motor current during ramping and ramp time (see table).

**Note:**  
Table is valid for ambient temperature 25°C. For higher ambient temperature add 5%/°C to values in the table. The shaded areas in the table are for blocked rotor. Do not repeat rampings with blocked rotor.

## Housing Specifications

Housing material	PC/ABS Blend
Colour	Light grey
Terminal block	PBTP
Colour	Black
Bottom clips	POM
Colour	Black
Diode cover	PC
Colour	Grey Transparent
Front knob	PC
Colour	Black

## Semiconductor Data

Rated operational current	I <sup>2</sup> t for fusing t = 1 - 10 ms	I <sub>TSM</sub>	dI/dt
25 A	1250 A <sup>2</sup> s	500 Ap	100 A/μs



Applications

Changing from Direct ON Line start to soft start (Line controlled soft-start) (Fig. 1)

Changing a Direct On Line start into a soft start is very simple with the RSE soft-starting relay:

- 1) Cut the cable to the motor and insert the RSE relay.
- 2) Connect control input to two of the incoming lines. Set initial torque to minimum and ramp up and down to maximum.
- 3) Power up again - adjust the start torque so the motor starts turning immediately after power is applied, and adjust ramp time to the appropriate value.

When C1 is operated, the motor controller will perform soft-start of the motor. When C1 is switched off, the motor will stop, the motor controller will reset and after 0.5 s a new soft-start can be performed.

Please note that the controller does not insulate the motor from the mains. Contactor C1 is therefore needed as a service switch for the motor.

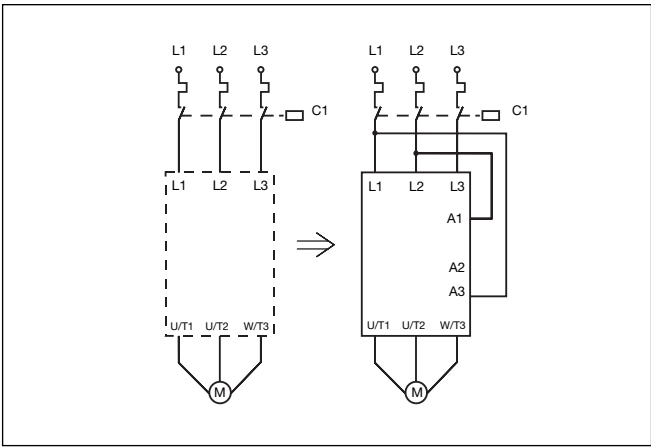


Fig. 1

Soft-start and soft-stop (Fig. 2)

When S1 is closed, soft-start of the motor will be performed according to the setting of the ramp-up potentiometer and the setting of the initial torque potentiometer. When S1 is opened, soft-stop will be performed according to the setting of the ramp-down potentiometer.

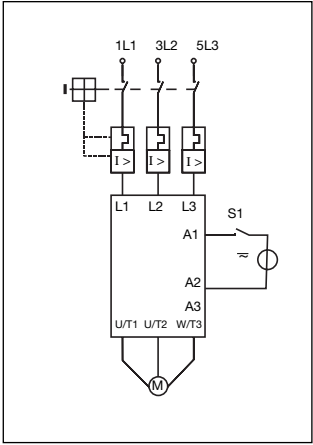


Fig. 2

Fusing Considerations

The motor controller provides by-passing of the semiconductors during running operation. Therefore the semiconductors can only be damaged by short-circuit currents during ramp-up and ramp-down function.

A 3-phase induction motor with correctly installed and adjusted overload protection does not short totally between lines or directly to earth as some other types of loads, eg heater bands. In a failing motor there will always be some part of a winding to limit the fault current. If the motor is installed in an environment where the supply to the motor cannot be damaged, the short circuit protection can be considered to be acceptable if the controller is protected by a 3-pole thermal-magnetic overload relay.

Recommended thermal-magnetic overload relay Selection Chart

Thermal-magnetic overload relay and motor controller

Motor full load current (AACrms)	12-16	16-20	20-25
Overload relay type :GV 2- Manufacturer : Telemecanique	M 16 M 20	M 20 M 21	M 22
Overload relay type: MS 325- Manufacturer : ABB	12.5 16	20	25
Motor protection circuit breaker type KTA3-25- Manufacturer : Allan Bradley/Sprecher + Schuh	16	20	25
Motor controller type : 127/220 V mains 230/400 V mains 277/488 V mains 347/600 V mains	RSE 22 25 - C RSE 40 25 - C RSE 48 25 - C RSE 60 25 - C		