Motor Controllers
AC Semiconductor Motor Controller
Type RSE..-CR1

- **Soft starting and stopping of 3-phase squirrel cage motors**
- **Ramp selector setting for Pump or Compressor motors**
- **Initial Torque setting with kick-start option**
- **Rated operational current: 25 AAC 53 b**
- **Rated operational voltage: Up to 600 VAC, 50/60 Hz**
- **Potential-free control input**
- **LED- indications for power supply, ramping, bypassing relays, phase sequence and overheating.**
- **Integral over-temperature protection**
- **Auxiliary relays for end of ramp, over-temperature and phase sequence alarms**
- **Built-in transient over-voltage protection**

Product Description

The RSE-CR1 is an AC semiconductor controller specifically designed to switch pump and compressor motors using start and stop ramps matched to the application. Initial torque is user adjustable with optional kick-start to allow matching of the start conditions with the motor load. The start ramp can be adjusted to last up to 20 s. Two stop ramps can be selected: pump or compressor. The pump setting produces an immediate drop in load voltage down to the level of the initial torque setting, followed by a gradual ramp down lasting up to 20 s. The compressor ramp down option drops the voltage immediately to zero, but this drop can be delayed by maintaining full load voltage for up to 20 s.

Ordering Key

RSE 40 25 - C R 1

- **Integral Motor Controller**
- **Rated operational voltage**
- **Rated operational current**
- **Control voltage**
- **Ramp selector**
- **Ramp version number**

Type Selection

Type	Rated operational voltage U_e	Rated operational current I_e	Control voltage U_c
RSE: Integral, motor controller	22: 127/220 VAC, 50/60 Hz 40: 230/400 VAC, 50/60 Hz 48: 277/480 VAC, 50/60 Hz 60: 346/600 VAC, 50/60 Hz	25: 25 AAC 53b	C: 24 to 110 VAC/DC & 110 to 480 VAC

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-CR1**	**RSE4025-CR1**	**RSE4825-CR1**	**RSE6025-CR1**

Control input specification

	Control terminals A1 - A2	Control terminals A1 - A3
Control supply voltage Uc	24 - 110 VAC/DC ± 15%	110 - 480 VAC ± 15%
Control supply current	approx. 12 mA	approx. 5 mA
Rated frequency for AC	50-60 Hz ± 10%	50-60 Hz ± 10%
Rated insulation voltage	630 V rms Overvoltage cat. III (IEC 60664)	630 V rms Overvoltage cat. III (IEC 60664)
Dielectric strength Dielectric voltage Rated impulse withstand volt.	 2 kVAC (rms) 4 kV (1.2/50 µs)	 2 kVAC (rms) 4 kV (1.2/50 µs)

Supply Specifications

Overvoltage cat.III IEC (60664)	220 V	400 V	480 V	600 V
Operating supply voltage Uc through L1, L2, L3	127/220 VACrms ± 15%	230/400 VACrms ± 15%	277/480 VACrms ± 15%	346/600 VACrms ± 15%
Rated frequency	50-60 Hz ± 10%	50-60 Hz ± 10%	50-60 Hz ± 10%	50-60 Hz ± 10%

Output Specifications

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

Mode of Operation

General

This motor controller is intended to softstart / stop 3-phase squirrel cage induction motors, especially in pump and compressor systems. Three user-adjusted potentiometers are provided to enable matching of the ramp profiles to the specific load. This device can also be used in other applications with similar load characteristics.

Starting

During motor starting this motor controller can provide a gradual ramp up with a maximum duration of 20 s; this is user adjusted with the Ramp Start potentiometer. The Initial Torque potentiometer can be adjusted from 5 to 50% of maximum torque (at full load voltage) to match the load inertia. For loads with high inertia, a kick-start can be user selected to supply full voltage to the load for 200 ms. After the kick-start is performed, the voltage is dropped according to the initial torque % setting and ramp up occurs. When the starting ramp is completed, the bypass relays and end of ramp relay (normally open) are activated.

Stopping

This motor controller is equipped with specific settings for PUMP and COMPRESSOR applications, although it can also be utilised in other applications. The PUMP scale on the Ramp Stop potentiometer allows a ramp down with maximum duration of 20 ms (user adjusted). At the beginning of the downward ramp the full load voltage is immediately reduced to the level of the initial torque setting to cause an immediate deceleration of the PUMP system. The voltage is thereafter reduced gradually to zero to provide a smooth deceleration and therefore minimise vibration and potential leakage in the system under pressure. The COMPRESSOR setting provides an immediate total reduction of voltage to zero. This stopping ramp can also be delayed by up to 20 s to allow the system to continue running until a new control signal is applied. This will help avoid unnecessary stop-start sequences that can damage the COMPRESSOR system.

Alarm Relays

Over-temperature Alarm

- If over-temperature is detected on the internal heatsink (>100ºC approx.) when the motor controller is not ramping, the device will not start, ramp up will not occur and the alarm relay (Normally Closed) contact will open.
- When the temperature drops below the critical level, reset will only take place if the supply is interrupted and re-applied.
- If over-temperature is detected on the internal heatsink (>100ºC approx.) when the bypass relays are activated, the alarm relay (Normally Closed) contact will open to indicate fault.

Wrong phase sequence alarm

- At connection of power the motor controller will start normally
- The alarm relay (Normally Closed) contact opens

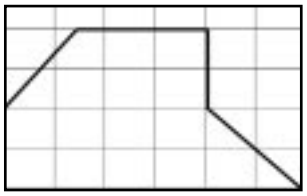
General Specifications

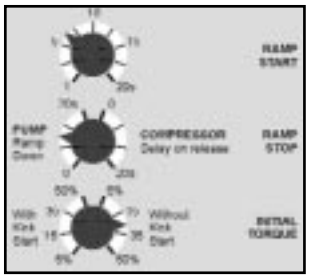
Accuracy	
Ramp up	20 ±10% on max. ≤ 0.5 s on min.
Ramp down	20 ±10% on max. ≤ 0.5 s on min.
Initial torque	50% ±5% on max. < 5% on min.
Indication for	
Power supply ON	LED, green
Ramping	LED, yellow (flashing)
Bypassing relays	LED, yellow (constant ON)
Wrong phase sequence	LED, red (flashing)
Overheated	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	Self lifting screw terminals
Control terminals nominal	2.5 mm^2, AWG 14
Min.	0.5 mm^2, AWG 20
Mounting torque max.	0.6 Nm
Power terminals nominal	10 mm^2, or 2 x 6 mm^2 AWG 6 or 2 x AWG 10
Min.	1 mm^2, AWG 16
Mounting torque max.	2.0 Nm
Approvals	UL, CSA
CE-marking	Yes
EMC Immunity	EN 50 082-2
Electrostatic discharge (ESD)	IEC 61000-4-2, IEC 60947-4-2, IEC 60801-2
Radio Frequency Electromagnetic fields	IEC 61000-4-3 IEC 60947-4-2 ENV 50140
Radio Frequency common mode	IEC 61000-4-6 IEC 60947-4-2 ENV 50141
Simulation of GSM signals 900 Mhz	ENV 50204
Burst / Fast transients	IEC 61000-4-4
Surge	IEC 61000-4-5
Wire Conducted Emission	EN 55011* CISPR 11 IEC 60947-4-2

* For AC mains: 150kHz - 30MHz

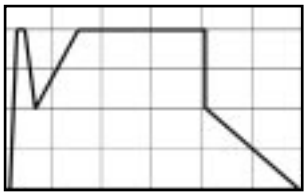
Ramp Adjustments

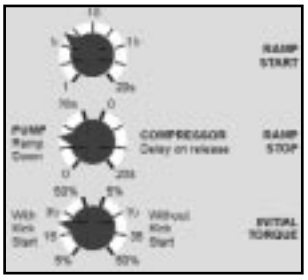
Pump without kickstart



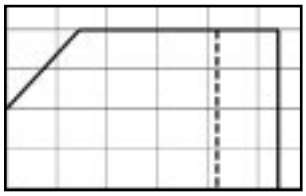


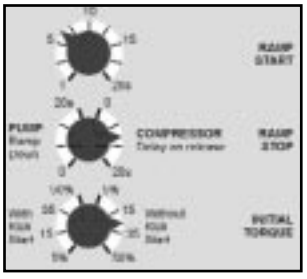
Pump with kickstart



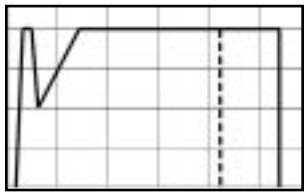


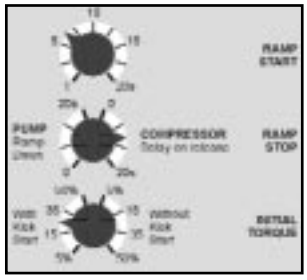
Compressor without kickstart with delay on release



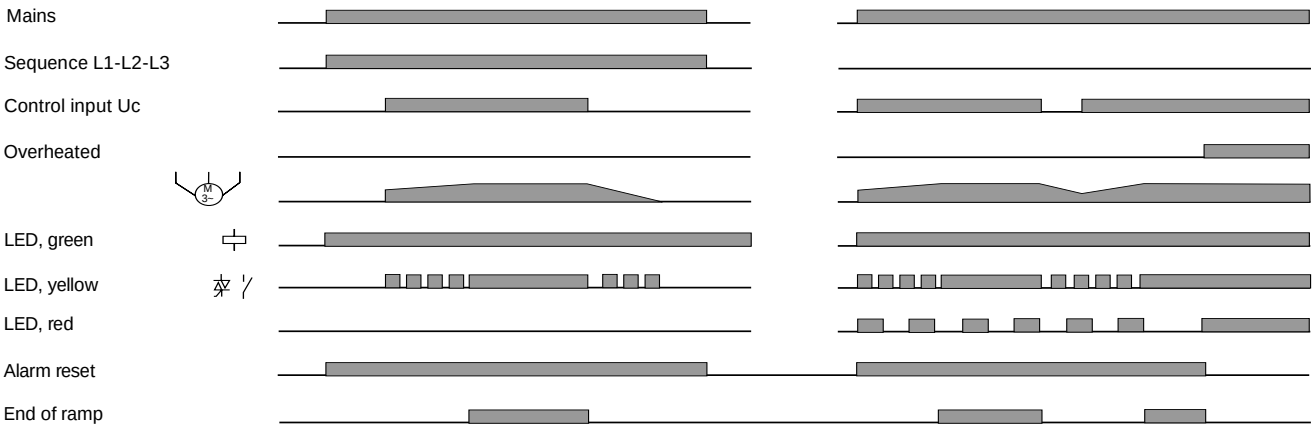


Compressor with kickstart and delay on release

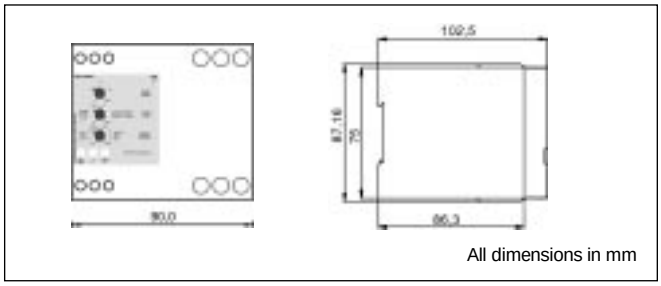




Operation Diagrams



Dimensions



All dimensions in mm

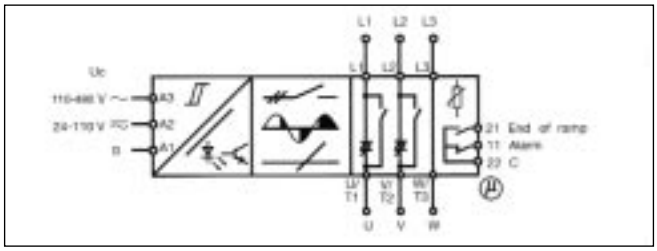
Housing Specifications

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

Semiconductor Data

Rated operational current	I^2t for fusing t = 1 - 10 ms	I_{TSM}	dI/dt
25 A	1250 A^2s	500 Ap	100 A/µs

Functional Diagram



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.

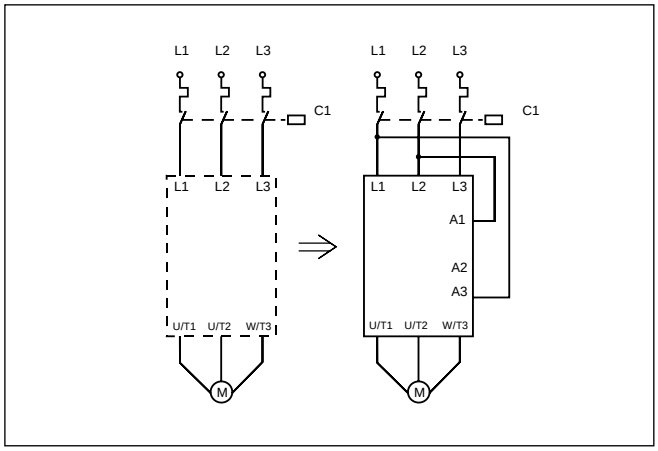


Fig. 1

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.

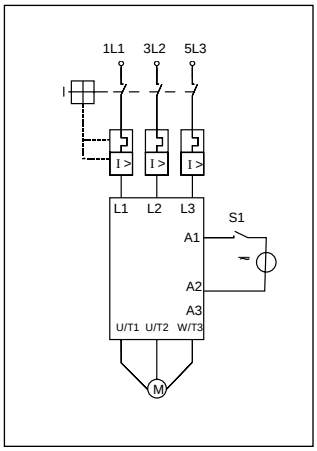


Fig. 2

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.

Recommended fusing
Ferraz 6.900 CP gRC 14.5140

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 - CR1 RSE 40 25 - CR1 RSE 48 25 - CR1 RSE 60 25 - CR1		