

Lodam Compressor Protection Modules

Technical manual

Version 3.0



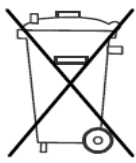
SE-B1, B2, B3, B4

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1. Read this first

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Disposing of the parts of the controller:

INFORMATION FOR USERS ON THE CORRECT HANDLING OF WASTE ELECTRICAL AND ELECTRONIC EQUIPMENT (WEEE)

In reference to European Union directive 2002/96/EC issued on 27 January 2003 and the related national legislation, please note that:

1. WEEE cannot be disposed of as municipal waste and such waste must be collected and disposed of separately;
2. The public or private waste collection systems defined by local legislation must be used. In addition, the equipment can be returned to the distributor at the end of its working life when buying new equipment;
3. The equipment may contain hazardous substances: the improper use or incorrect disposal of such may have negative effects on human health and on the environment;
4. The symbol (crossed-out wheeled bin) shown on the product or on the packaging and on the instruction sheet indicates that the equipment has been introduced onto the market after 13 August 2005 and that it must be disposed of separately;
5. In the event of illegal disposal of electrical and electronic waste, the penalties are specified by local waste disposal legislation.

1.1. Reading instructions

The following symbols are used to draw the reader's attention to different warning levels.



Important information.



Danger!! General danger.



Danger of electrical current or voltage.

1.2. User manual



Before installation the user should be thoroughly familiarized with this user manual, especially with purposes, installation and operation.

Special care should be taken when installing and connecting external equipment (PTC sensor, high voltage etc) and handling the modules correctly according to protection against ESD.



Installation of the SE-B1/SE-B2/SE-B3/SE-B4 must be performed by authorized personnel only. All warranties are excluded in case installation is performed by unauthorized personnel or in case the SE-B1/SE-B2/SE-B3/SE-B4 has not been correctly installed.

1.3. Safety



The SE-B1/SE-B2/SE-B3/SE-B4 is a protection device and not a safety component according to the Machinery Directive and can not be used in "medical" or "life support" equipment.

Before plant commissioning the service technician shall ensure that personal safety requirements are met in conformity with the Machinery Directive on the basis of safety estimations.



Electrical plant failures are to be immediately solved, even though no immediate danger exists; the SE-B1/SE-B2/SE-B3/SE-B4 and motor must be without power.

2. General

The protection devices SE-B1, SE-B2, SE-B3 and SE-B4. Hereafter SE-Bx are used for protection of the motor against overheating by monitoring motor temperature by means of PTC-sensors mounted in the motors windings.

Further, other temperatures can be monitored by for example mounting PTC-sensors in the discharge outlet of a compressor, for monitoring the oil temperature or the temperature in vessels.

In other areas where PTC-sensors are installed, they can also be monitored by a SE-Bx protection module. Due to their fast reaction time, good accuracy and built-in relay they can be a good solution instead of a separate controller. They can also be used as switch relays.

A SE-Bx is default wired up for lockout in case of an overheat situation, but can also be used as a thermostat/switch relay via the cool down period of the media surrounding the PTC-sensor.

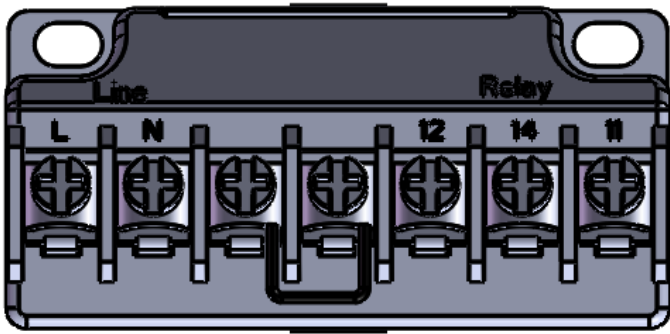
3. Definitions

Product range

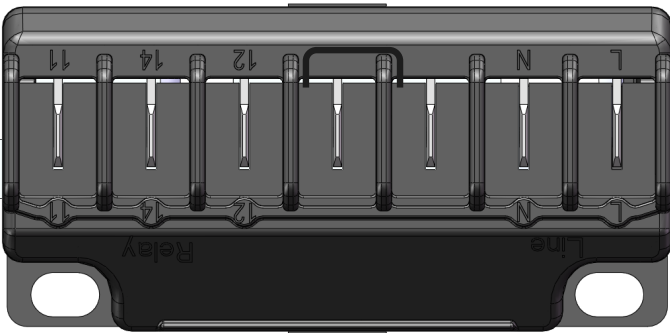
Definitions	
HW	Hardware/electronics
NC	Normally Closed (relay)
NO	Normally Open (relay)
PTC	Positive Temperature Coefficient (sensor element)
SE-Bx	A SE-B1, SE-B2, SE-B3 or SE-B4 compressor protection module

4. How to

Use the SE-Bx in lockout mode



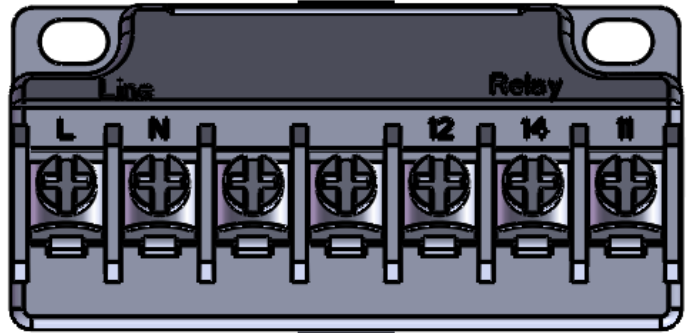
SE-B1/SE-B2/SE-B3



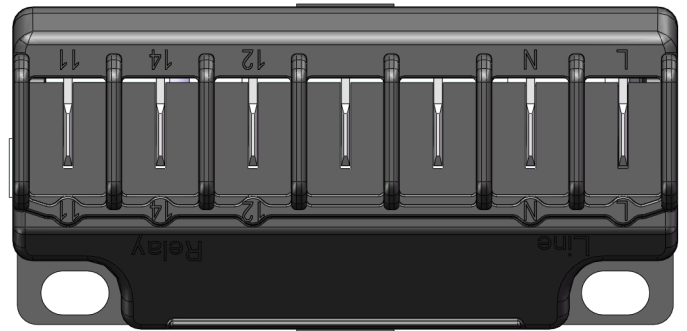
SE-B4

The wire jumper is default mounted in the two unnamed terminals – located between terminals N and 12. In this mode a fault condition will need a manual reset to release the relay.

Use the SE-Bx in restart / hysteresis mode



SE-B1/SE-B2/SE-B3



SE-B4

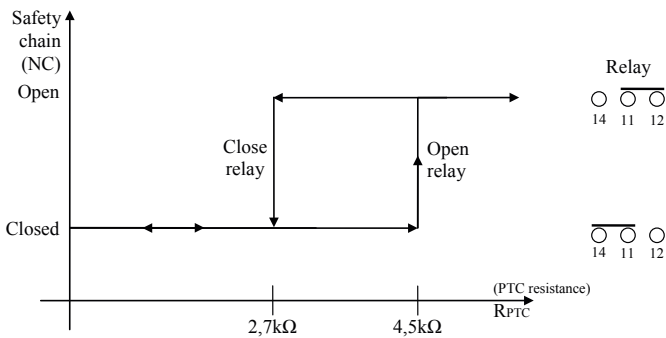
The wire jumper between the two unnamed terminals is removed.

After an overheat condition, the relay is energized again as soon as the resistance is below the lower threshold level of 2.7 kOhm. There is no timer function in the SE-Bx.

5. Functions

The SE-Bx is a motor protection module. By monitoring the resistance in a PTC sensor, it will open its relay when the resistance of the PTC sensor increases above the limit as shown below.

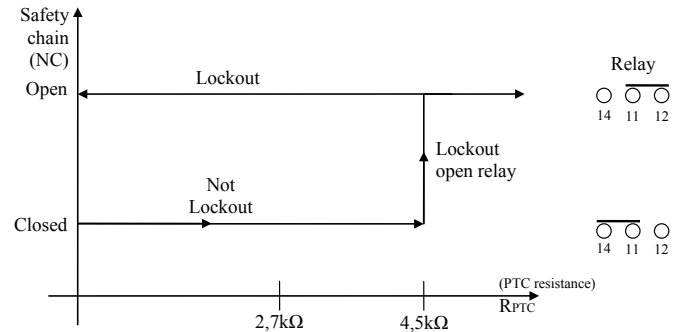
The PTC-sensor could for example be according to DIN 44081/82. The resistance of these PTC-sensors are not linear, but gives a steep rise in resistance when the threshold temperature of the PTC-sensor is reached. This is detected by the protective device and the relay is released and thereby cutting the control power as shown on the diagram below.



Since the increase in resistance is so steep, from 1 up to 9 PTC-sensors can be coupled in series without raising the actual temperature threshold more than a few degrees Celsius.

Default there is a restart blocking wire jumper to prevent a motor from being started too soon after having been overheated. A manual reset must be done by removing power from the module for minimum 5 seconds and then applying it again.

If the restart blocking wire jumper is removed, the relay behaves like on the following diagram.

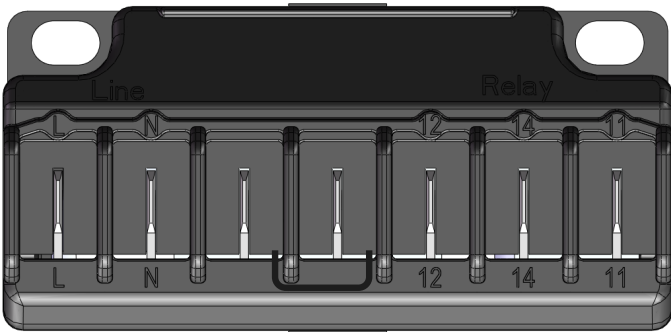
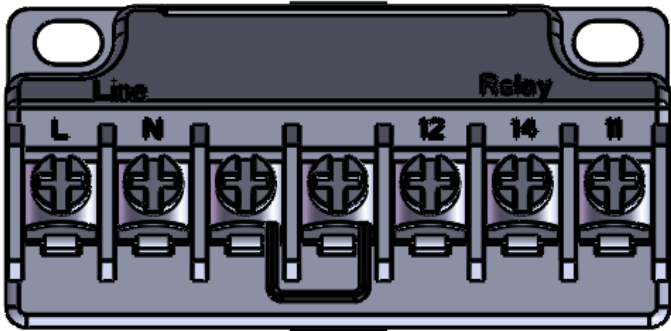


In this mode, there is a hysteresis from 2,7kOhm to 4,5 kOhm. When the resistance in the PTC-sensors increases above 4,5 kOhm, the relay is released. The relay is released as long as the resistance is above 2,7 kOhm. When the resistance comes below 2,7 kOhm, the relay is energized.

This hysteresis can be used for applications where the media where the PTC-sensors are mounted has such a large temperature inertia that this hysteresis is sufficient.

6. Examples of application use

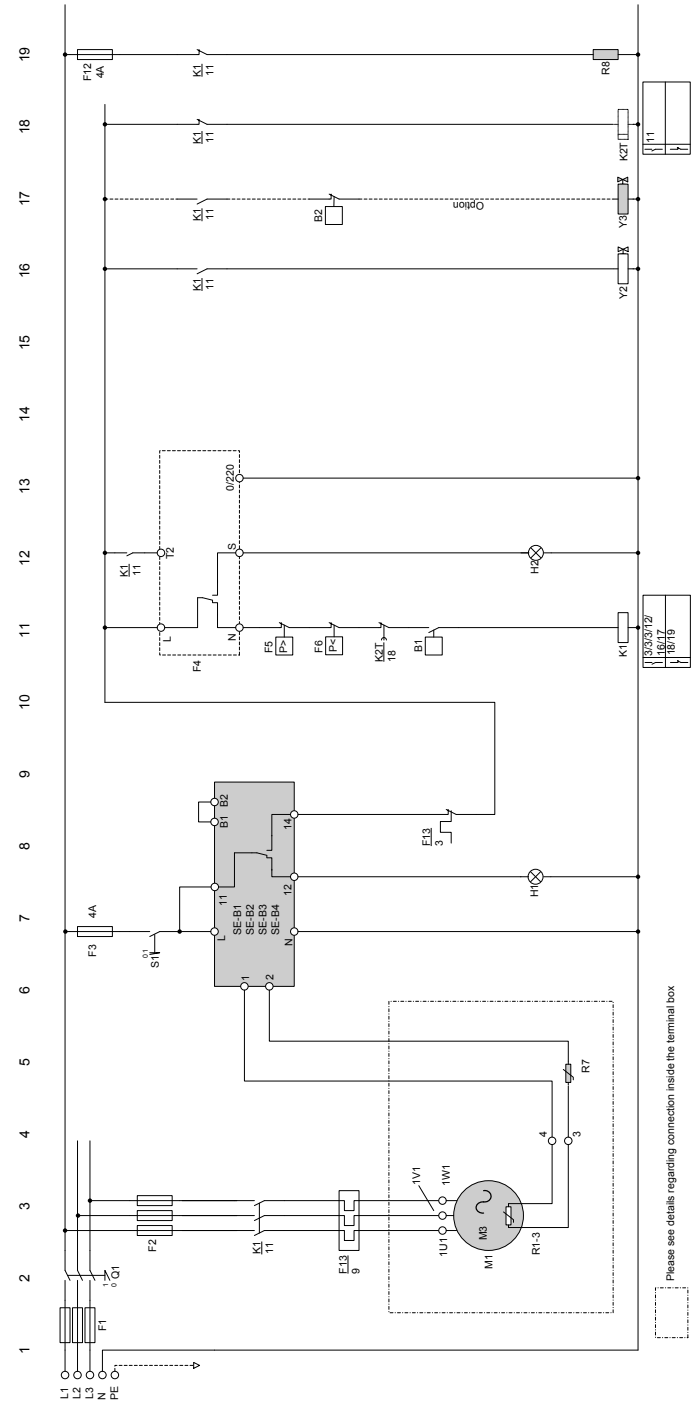
6.1. Connections



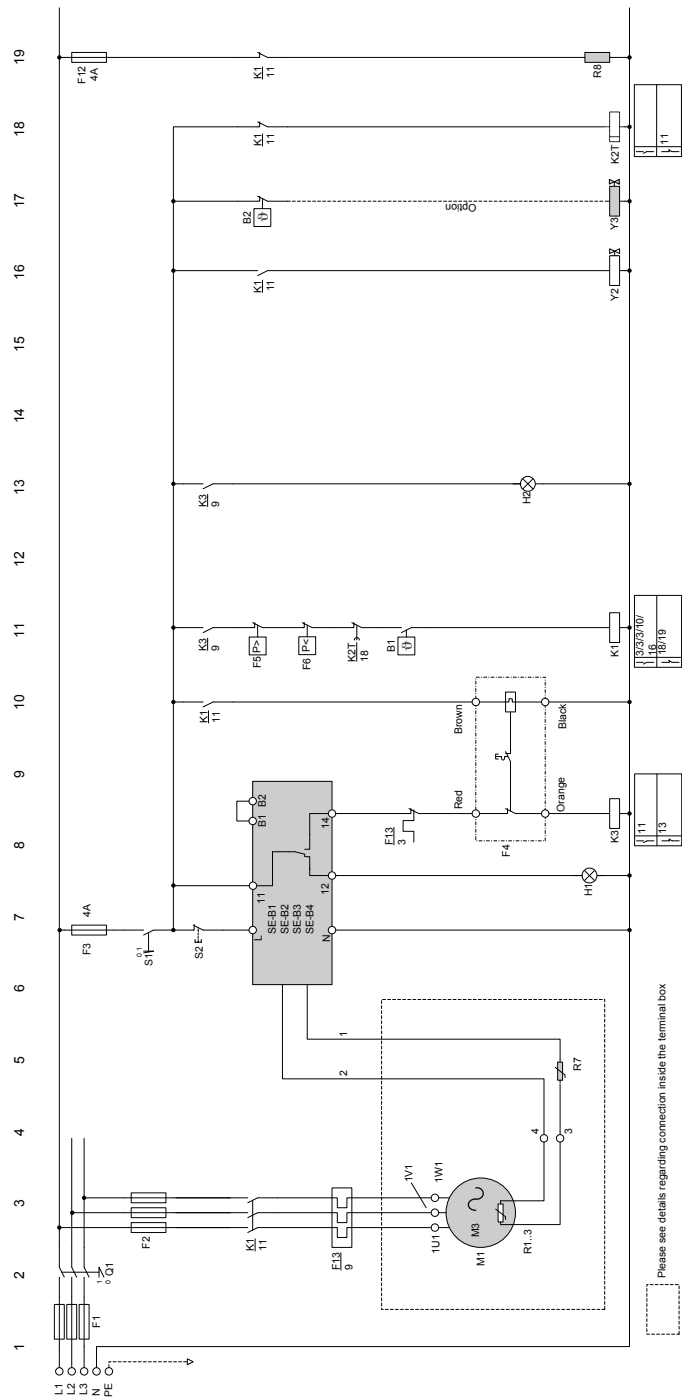
Terminal	Description
L	Power supply
N	Neutral
11	Relay common
12	Relay NO – Error condition
14	Relay NC – Ok condition
Unnamed	Lockout wire jumper

Compressor protection module with a direct starting compressor

Method 1:

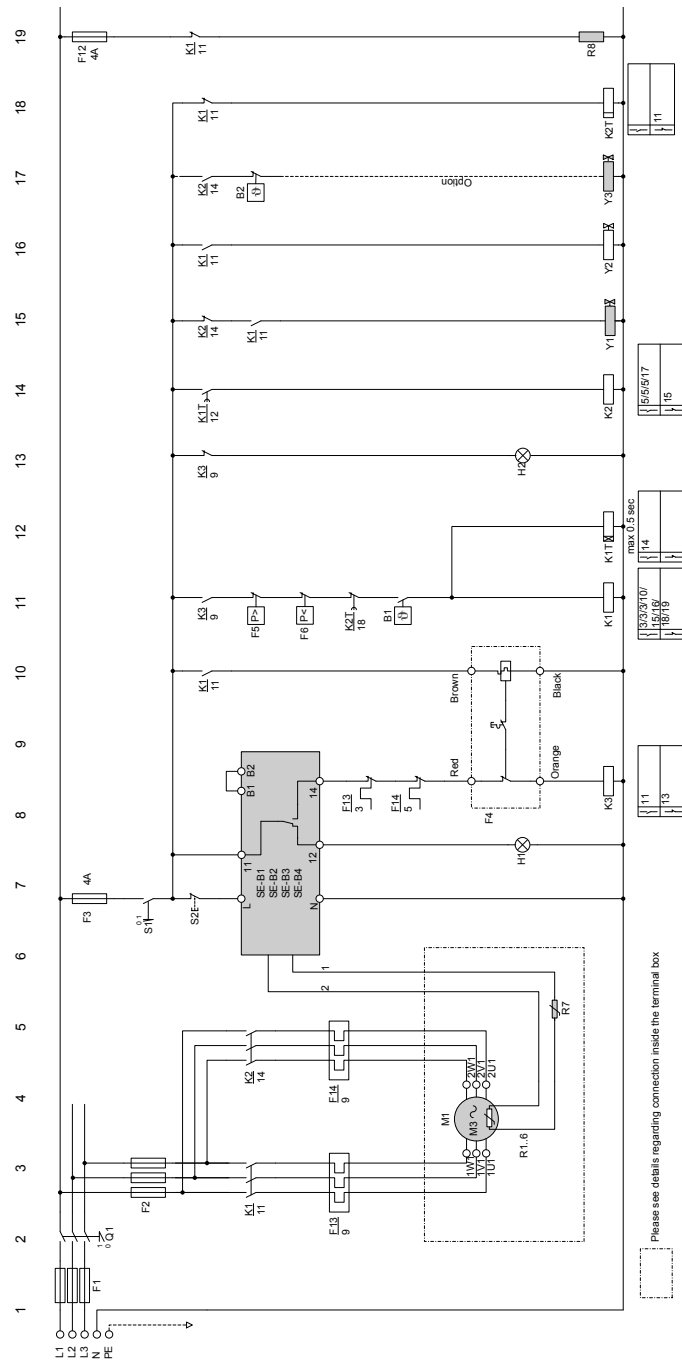


Method 2:

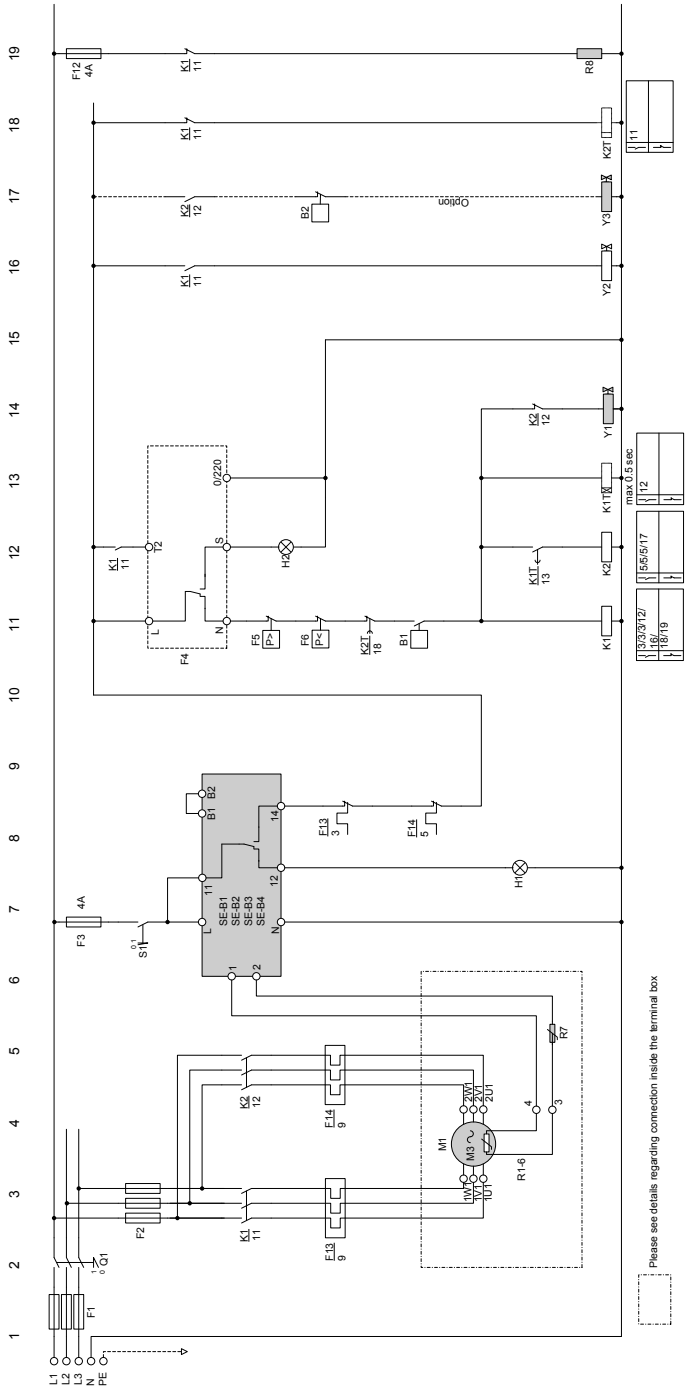


Compressor protection module with a part winding compressor.

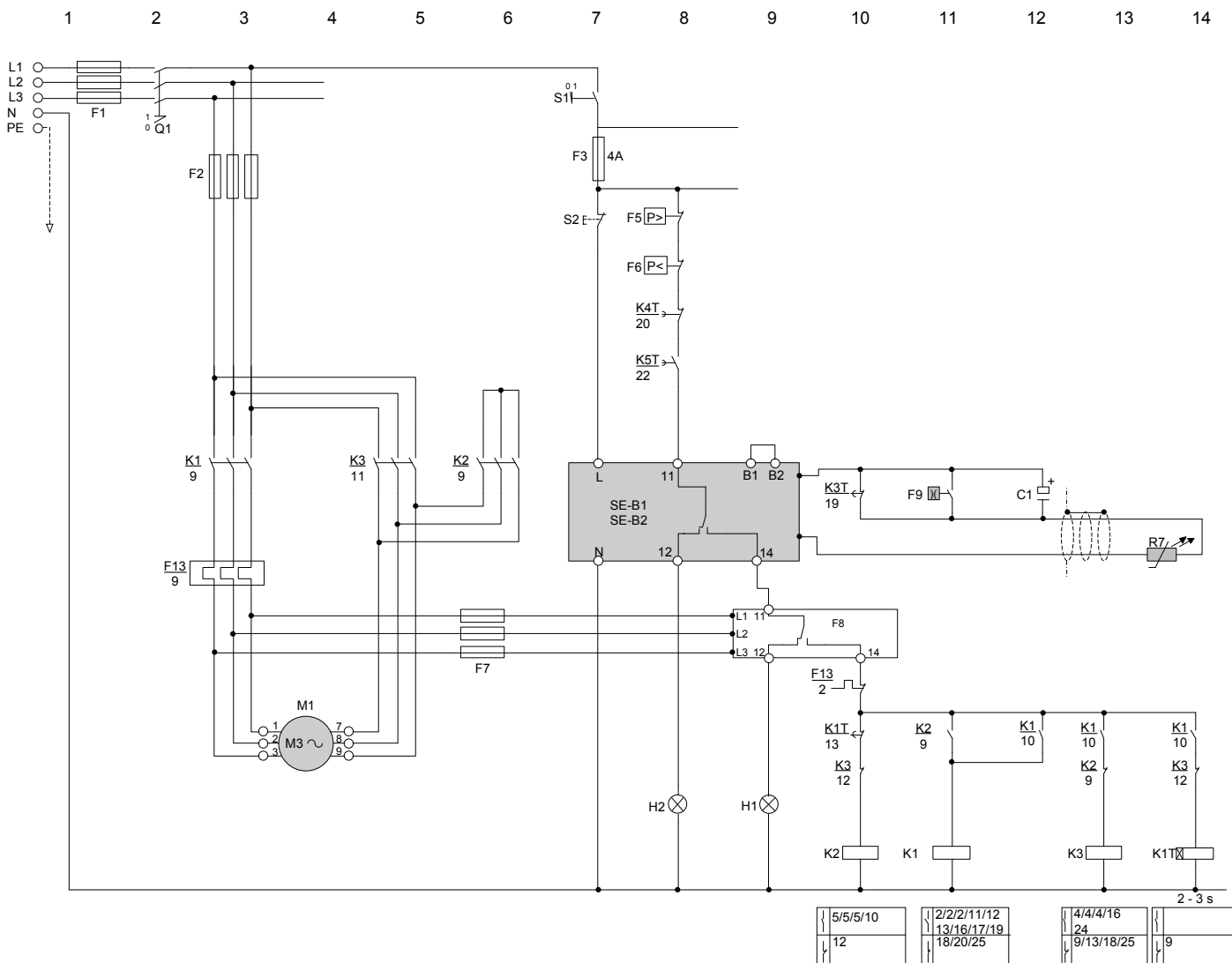
Method 1:



Method 2:



Oil flow monitoring using the SE-B1/SE-B2/SE-B3/SE-B4 module:



Using the C1 electrolytic capacitor together with an additional time delay K3T will allow a temporary bridging of the monitoring function.

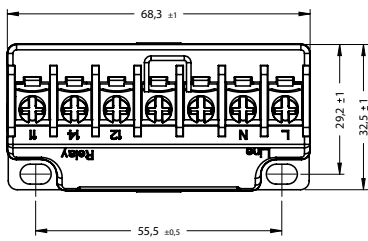
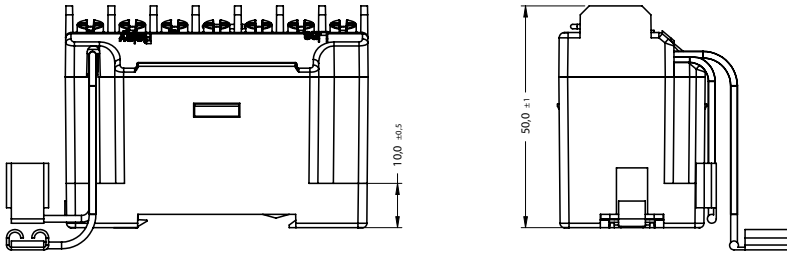
Please note: The C1 electrolytic capacitor will be destroyed if mounted with wrong polarity! Measure the polarity off the two leads and connect the C1 according to the drawing.

Legend for the schematic diagrams	
B1/B2	Control unit
C1	Electrolytic capacitor
F1	Main fuse
F2	Compressor fuse
F3	Control circuit fuse
F4	Differential oil pressure switch
F5	High pressure limiter
F6	Low pressure limiter
F7	Control circuit switch
F8	Phase sequence control relay
F9	Oil flow switch
F12	Fuse for the crank case heater
F13/F14	Thermal motor overload relay
H1	Signal light "Over temperature"
H2	Signal light "Oil pressure/flow fault"
K1/K2/K3	Motor contactors
K1T	Time relay for part winding operation 2-3 s
K2T	Time relay Start-up delay
K3T	Time relay oil flow monitoring 10-20 s
K4T	Time relay pause time 300 s
K5T	Time relay oil level monitoring 120 s
M1	Compressor
Q1	Main switch
R1..3	PTC sensors in motor windings
R1..6	PTC sensors in part winding motor windings
R7	PTC sensor in cylinder head/discharge gas temperature sensor
R8	Crank case heater
S1	Control switch
Y1	Solenoid valve (Start unloading)
Y2	Solenoid valve (Liquid line)
Y3	Solenoid valve (Capacity control – Expansion valve)

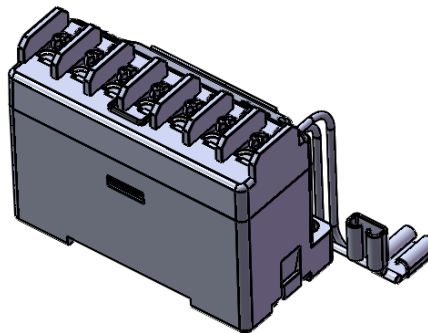
7. Technical data

Technical specifications				
Description	SE-B1	SE-B2	SE-B3	SE-B4
Supply voltage	230 VAC; +10% ~ -15%, 50/60 Hz 2VA 24 VAC; +10% ~ -15%, 50/60 Hz 2VA 24 VDC; +20% ~ -20%, 50/60 Hz 1W 24 VDC version: no galvanic isolation		115 - 230 VAC; +10% ~ -15% 50/60 Hz 2VA	230 VAC; +10% ~ -15%, 50/60 Hz, 2VA 24 VAC; +10% ~ -15%, 50/60 Hz, 2VA
Permitted ambient temperature	-30°C – +70°C		-30°C – +60°C	
Relative humidity	Max. 95% RH non-condensing Electronic circuit board is coated			
Air pressure	660 hPA to 1060 hPA			
PTC sensor cable length	120 mm	350 mm		
Relay	24 VAC/VDC versions Switch voltage 24 VAC/VDC Continuous current max 10 mA (gold plated contacts). If current limit is exceeded, gold plating will be destroyed and current limit is then like the other versions listed below All versions Switch voltage 250 VAC. Continuous current max 2.5A Switching capacity 300 VA, C300 (pilot type use according to UL508)			
Fuse required	Max. 4A, fast-blow			
Enclosure class	Terminals IP00			
Field wiring markings	Wire type (Cu only, 14 – 20 AWG) Use 60°C copper conductors only			
Terminal torque rating	6 lb-in." / 0.7 Nm or equivalent			Spade connection 6.3 mm * 0.8 mm / 1/4"
Type of sensor	PTC according to DIN 44081/44082			
Number of sensors	1 to 9 in series			
Max total resistance, R25 total	< 1.8 kΩ			
RTrig	4.5 kΩ ff15%			
RReset	2.7 kΩ ff15%			
Reset	Interrupt supply power for min. 5 seconds			
Weight	150g; 24 VDC version: 90g			
Dimensions	68.3 mm (w) * 32.5 mm (d) * 50 mm (h)			
Mounting	35 mm snap-in or mounting with screws			
Housing material	PA66 - GF			
UL file number	E334756			
Terminal wire range	Cu 60°C only, 20-14 AWG / 0.5 mm ² - 2,0 mm ²			

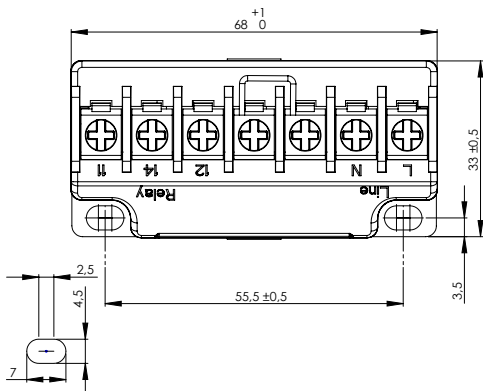
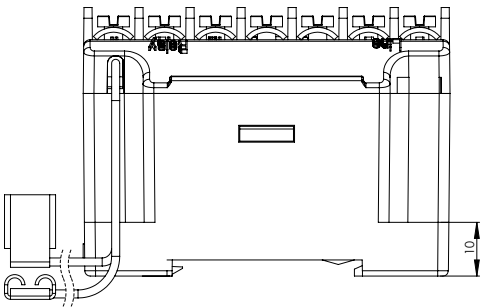
8. Drawings



Shown without wire



SE-B1/SE-B2/SE-B3



SE-B4

Mounting is for standard rail 35 mm according to DIN EN 60715.

9. Standards

The product is manufactured according to the following standards.

- RoHS 2002/95/EC
- Low voltage 206/95/EC
- 61010-1 Safety requirement for electrical equipment for measurement and control
- EMC 2004/108/EC
- 61000-6-x Generic EMC

The following standards have been used

- EN 61010-1
Safety requirement for electrical equipment for measurement and control
- EN 61000-6-1
Immunity for domicile, profession and light industry
- EN 61000-6-3
Emission for domicile, profession and light industry
- UL 508
UL file number E334756

10. Trouble shooting

Check if there is power to the unit according to specification.

If the power is ok:

- Turn off the power for 5 seconds and see if the relay is energized after power on again.

If not, turn off all the power to avoid risk of injury!

- Unmount one of the cables to the PTC element in the motor
- If the measured resistance is above $4.5\text{ k}\Omega$ $\pm 5\%$, the temperature of the PTC-sensor is above the threshold limit and the relay has been released to protect the motor or installation.
- If the measured resistance is more than $1\text{ M}\Omega$, there is a broken connection to the PTC-sensor and the relay will not be engaged.
- If the measured resistance is close to $0\ \Omega$, there is a short circuit on the PTC-sensor cables and there is no overheat protection!
- If power and resistance is ok, the protection module may be defect and needs replacement.

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Innovative and energy saving climate control

When it comes to climate control Lodam is one of the most experienced you can turn to. For more than four decades we have developed, produced and implemented electronic solutions dedicated to optimising applications like:

- Compressors
- Condensing units
- Heat pumps
- Air conditioning
- Refrigerated truck and trailer
- Reefer containers

We know the importance of reliable, energy-efficient operation – and constantly push technological boundaries to bring you the most innovative and forward-thinking solutions.

As part of the BITZER Group we are backed by one of the world's leading players in the refrigeration and air conditioning industry. This alliance provides us with extensive network and application knowhow and allows us to stay at the forefront of climate control innovation. And to help ensure comfortable surroundings for humans and reliable protection of valuable goods anywhere in the world.

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