Lodam
BY BITZER GROUP

Lodam Compressor Protection Module

Technical manual

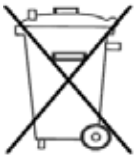
Version 3.0

SE-G1

Contents

1. Read this first

The contents of this manual are subject to change without notice. Lodam electronics holds the copyright to this user's manual. The user shall follow any instructions given in this user manual entirely and not only partly. Any non-following of this user manual result in exclusion of all warranties, guarantees, and liabilities.



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.

Importan information.

Danger!! General danger.

Danger!! High voltage. 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-G1 must be performed by authorized personnel only. All warranties are excluded in case installation is performed by unauthorized personnel or in case the SE-G1 has not been correctly installed.

1.3. Safety

The SE-G1 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-G1 and motor must be without power.

2. General

The protection device SE-G1 is used for protection of scroll compressors equipped with softstarters. Its relay is used in the safety chain for the compressor and will open in case of a failure.

Different scenarios can threaten the lifetime of the compressor where the SE-G1 can protect:

- Overheating: The SE-G1 will protect against overheating by monitoring motor temperature by means of PTC-sensors mounted in the motors windings or in the hotgas. In case of overheating, the module will lock out and open the relay.
- Wrong rotation direction: The SE-G1 monitors the rotation direction of the phases at compressor start and will lock out and open the relay in case of wrong rotation direction.
- Phase failure: If a phase is missing at start up, SE-G1 opens the relay for 6 minutes. After this period a start is allowed again. Only a number of retries are allowed before a permanent lock out is performed.

The SE-G1 first starts monitoring of the phases 5 seconds after start-up to allow the system with the softstarter to become stable.

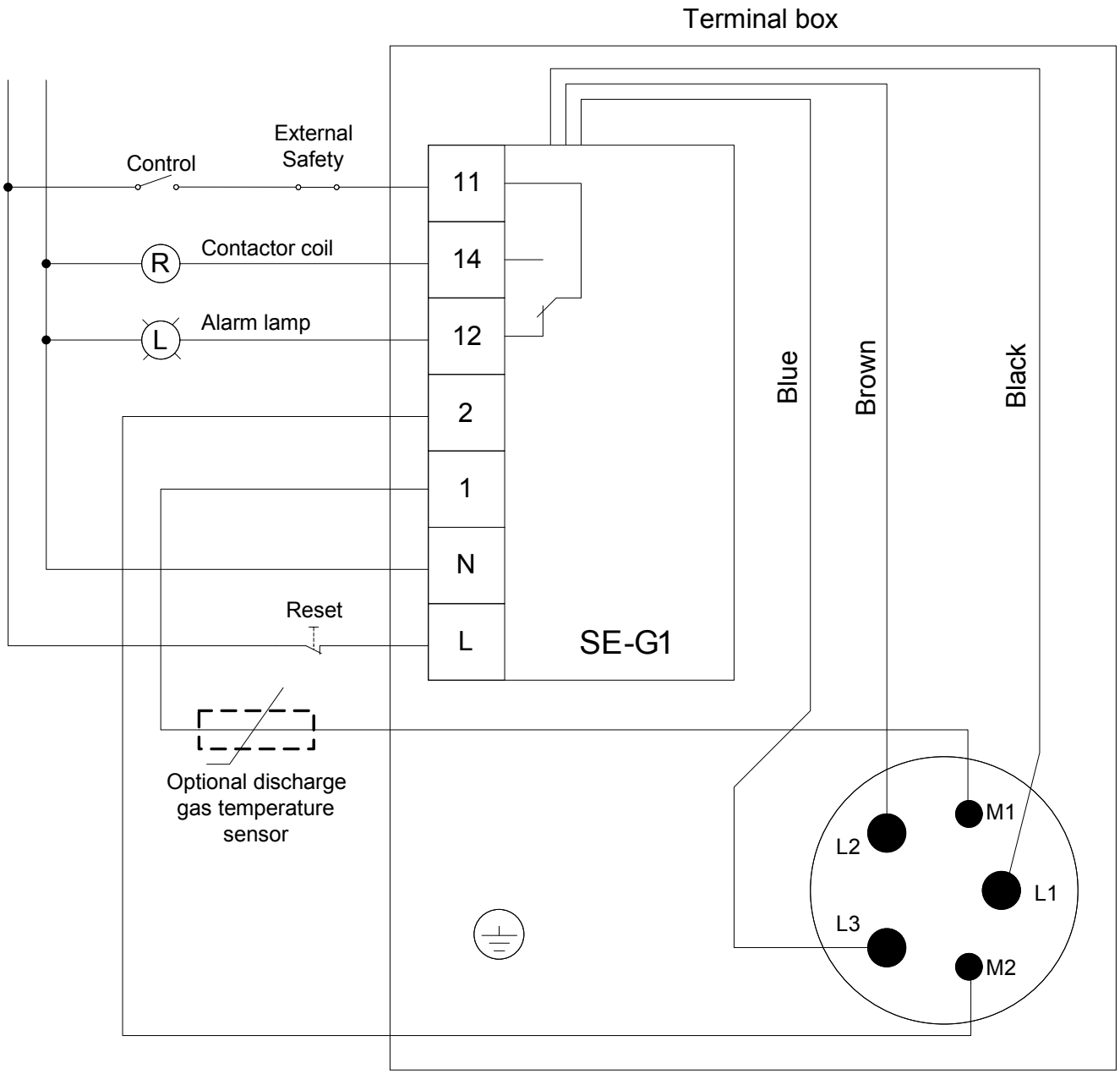
3. Definitions

Product range

Definitions	
ESD	Electro Static Discharge
HW	Hardware/electronics
NC	Normally Closed (relay)
NO	Normally Open (relay)
PTC	Positive Temperature Coefficient (sensor element)

4. How to...

Use the SE-G1 with a Scroll compressor



5. Functions

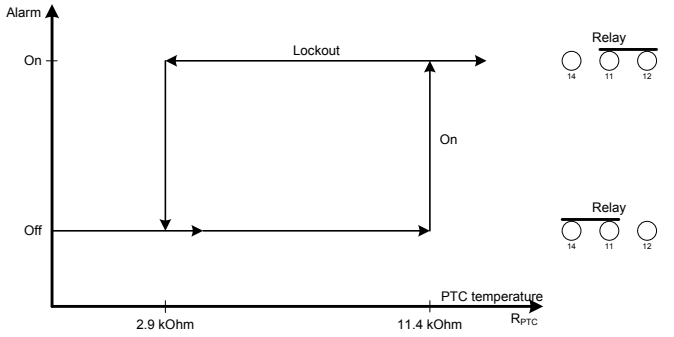
The SE-G1 has several monitoring functions which are listed in the following.

5.1. Temperature monitoring

One of the functions of the SE-G1 is to work as 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 is not linear but give a well-defined 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.

There is a restart blocking function 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.

When power is turned on to the SE-G1 module, the PTC resistance is measured:

- If the measured PTC resistance is below 2,9 kΩ: The relay is energized immediately
- If the measured PTC resistance is between 2,9 kΩ and 11,4 kΩ: The relay is first energized when the resistance is below 2,9 kΩ - i.e.the compressor has cooled down.
- If the measured PTC resistance is above 11,4 kΩ: The relay is not energized and the module is locked and must be powered off to be released.

5.2. Rotation direction monitoring

The SE-G1 waits 5 seconds after compressor start for the softstarter and then the 3 phases for the compressor are monitored for 5 to 10 seconds against wrong rotation direction (wrong phase sequence). In case of a wrong rotation direction, the relay is immediately de-energized and the SE-G1 locks.

A manual reset must be done by removing power from the module for minimum 5 seconds and then applying it again.

When the compressor is stopped, a pressure difference in the compressor can make it turn backwards and thereby generating a false phase sequence. Therefore the detection of phase sequence is disabled the first 10 seconds after a compressor stop to avoid a false alarm condition.

5.3. Phase failure monitoring

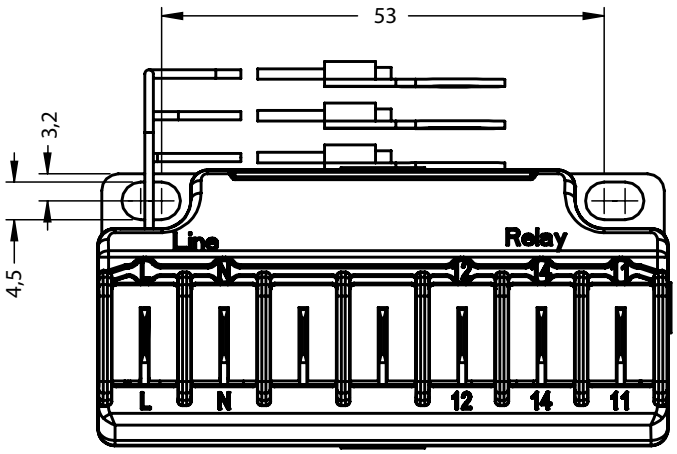
Phase failure monitoring waits for the softstarter and is started 5 seconds after compressor start. In case of a phase loss during the first 5 to 10 seconds of monitoring the SE-G1 de-energizes the relay and thereby breaks the security chain.

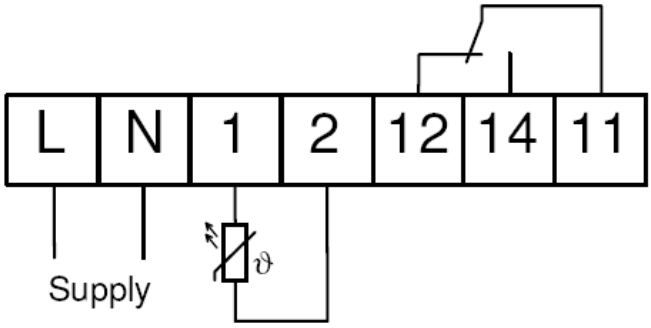
If the module is in the locked state, a manual reset must be done by removing power from the module for minimum 5 seconds and then applying it again.

The count of the 4 events in sequence is reset when start is detected with no “phase loss”.

6. Examples of application use

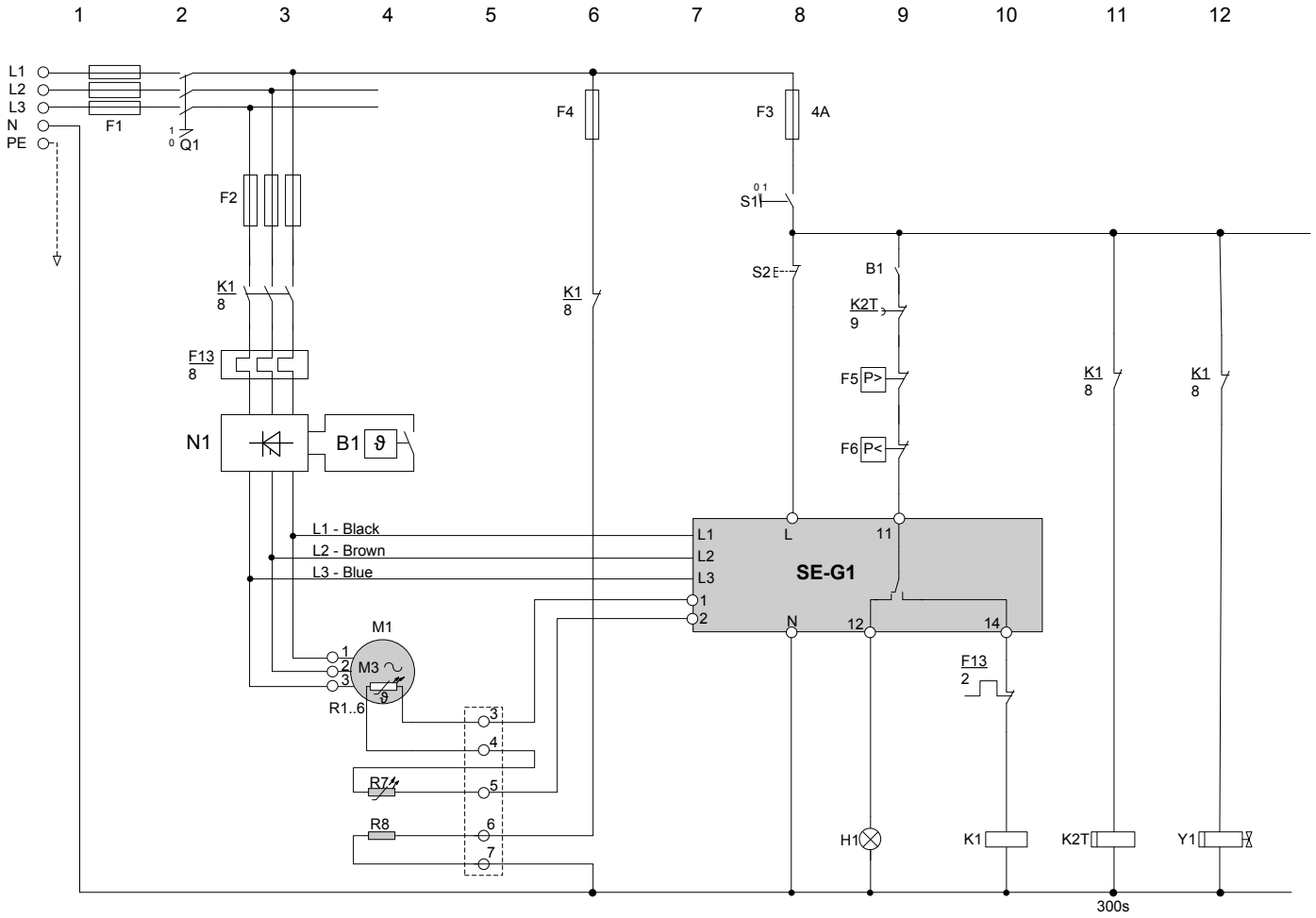
6.1. Connection





Terminal	Description
L	Power supply
N	Neutral
Unnamed	PTC element – two wires
11	Relay common
12	Relay NO – Error condition
14	Relay NC – Ok condition

6.2. Compressor with soft starter



6.3. Legend for the schematic diagrams

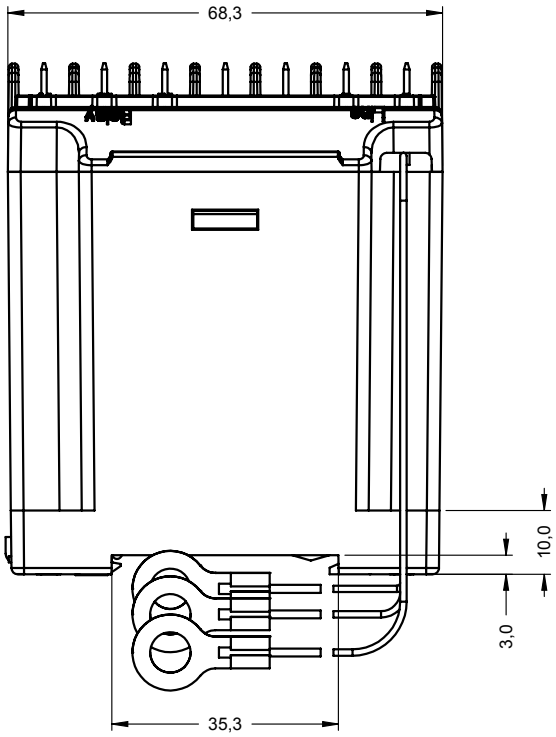
Legend	
B1	Control unit
F1	Main fuse
F2	Compressor fuse
F3	Control circuit fuse
F4	Oil heater fuse
F5	High pressure limiter
F6	Low pressure limiter
F13	Thermal motor overload relay
H1	Signal light “Compressor fault”
K1	Motor contactor
K2T	Time relay Short cycling delay
M1	Compressor
N3	Soft starter (ramp up time < 2s)
Q1	Main switch
R1-6	PTC sensors in motor windings
R7	PTC Discharge gas temperature sensor
R8	Oil heater
S1	Control switch
S2	Manual reset
Y1	Liquid Line Solenoid Valve

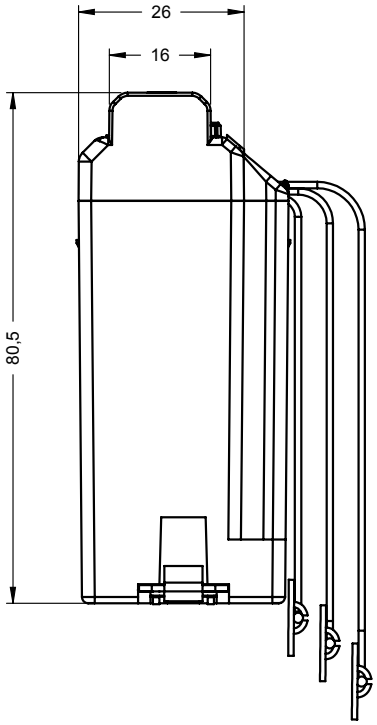
6.4. Technical data

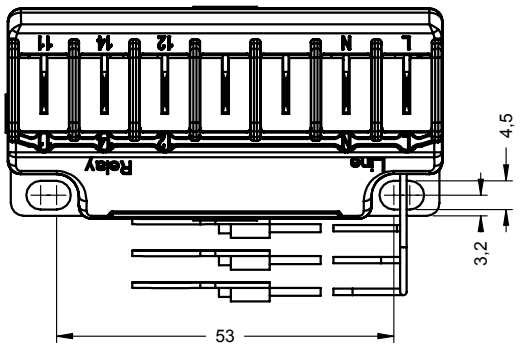
Technical specifications	
Operation voltage	110-277 VAC, 50-60Hz, 3VA
Motor voltage	200...600V +/- 10%, 50/60 Hz
Permitted ambient temp.	-30°C ~ +60°C
Relay	Switch voltage 250V ~ Continuous current max. 2.5A Swiching capacity 300VA, C300
Relative humidity	5% - 95%RH, non condensing
L1, L2 and L3 cable	Length 300 mm Connector Ring connector for 1/4” stud L1 – Black L2 – Brown L3 – Blue
PTC measuring circuit	Sensor type: Thermistors according to DIN 44081/82, thermistor type: 1 - 9 in series R total < 1,8 kΩ Switching point: Relay off > 11,4 kΩ +/- 5% Relay on < 2,9 kΩ +/- 5%
Fuse required	4A quick blow
Enclosure class	Terminals IP00
Terminals	Spade connectors 6,3 mm * 0,8 mm / 1/4”
Field wiring markings	Use 60°C copper conductors only

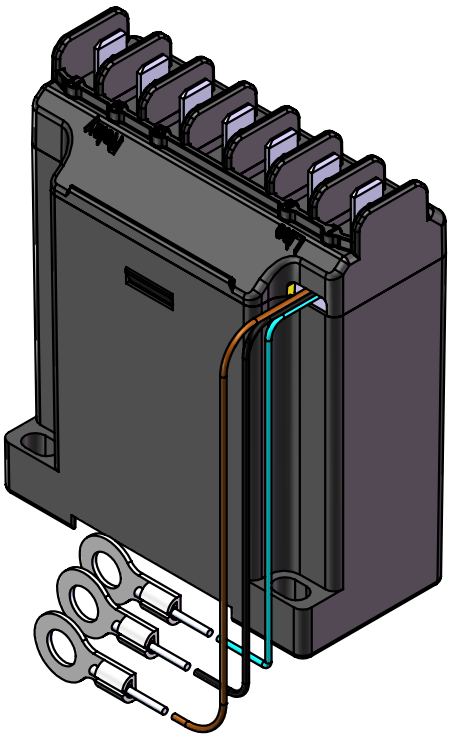
7. Drawings

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









8. 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 domicil, profession and light industry
- EN 61000-6-3 Emission for domicil, profession and light industry
- UL 508
- UL file number: E334756

9. 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 11,4 kΩ ffl5%, 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 MΩ, there is a broken connection to the PTC-sensor and the relay will not be engaged.
- If the measured resistance is close to 0 Ω, there is a short circuit on the PTC-sensor cables and there is no overheat protection!
- If all three phases are within range and resistance is below 2.9 kΩ ffl5%, the protection module may be defect and needs replacement.

10. Index

11. Notes

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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