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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.

- i Important 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

<table>
<thead>
<tr>
<th>Definitions</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESD</td>
<td>Electro Static Discharge</td>
</tr>
<tr>
<td>HW</td>
<td>Hardware/electronics</td>
</tr>
<tr>
<td>NC</td>
<td>Normally Closed (relay)</td>
</tr>
<tr>
<td>NO</td>
<td>Normally Open (relay)</td>
</tr>
<tr>
<td>PTC</td>
<td>Positive Temperature Coefficient (sensor element)</td>
</tr>
</tbody>
</table>
4. How to...

Use the SE-G1 with a Scroll compressor

Terminal box

Control

Contactor coil

Alarm lamp

External Safety

Reset

Optional discharge gas temperature sensor

SE-G1

Terminal box

Blue

Brown

Black

11

14

12

2

1

N

L

L1

M1

L2

M2

L3
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”.

[Diagram of temperature monitoring]
6. Examples of application use

6.1. Connection

<table>
<thead>
<tr>
<th>Terminal</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>L</td>
<td>Power supply</td>
</tr>
<tr>
<td>N</td>
<td>Neutral</td>
</tr>
<tr>
<td>Unnamed</td>
<td>PTC element – two wires</td>
</tr>
<tr>
<td>11</td>
<td>Relay common</td>
</tr>
<tr>
<td>12</td>
<td>Relay NO – Error condition</td>
</tr>
<tr>
<td>14</td>
<td>Relay NC – Ok condition</td>
</tr>
</tbody>
</table>
6.2. Compressor with soft starter
### Legend for the schematic diagrams

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1</td>
<td>Control unit</td>
</tr>
<tr>
<td>F1</td>
<td>Main fuse</td>
</tr>
<tr>
<td>F2</td>
<td>Compressor fuse</td>
</tr>
<tr>
<td>F3</td>
<td>Control circuit fuse</td>
</tr>
<tr>
<td>F4</td>
<td>Oil heater fuse</td>
</tr>
<tr>
<td>F5</td>
<td>High pressure limiter</td>
</tr>
<tr>
<td>F6</td>
<td>Low pressure limiter</td>
</tr>
<tr>
<td>F13</td>
<td>Thermal motor overload relay</td>
</tr>
<tr>
<td>H1</td>
<td>Signal light “Compressor fault”</td>
</tr>
<tr>
<td>K1</td>
<td>Motor contactor</td>
</tr>
<tr>
<td>K2T</td>
<td>Time relay Short cycling delay</td>
</tr>
<tr>
<td>M1</td>
<td>Compressor</td>
</tr>
<tr>
<td>N3</td>
<td>Soft starter (ramp up time &lt; 2s)</td>
</tr>
<tr>
<td>Q1</td>
<td>Main switch</td>
</tr>
<tr>
<td>R1-6</td>
<td>PTC sensors in motor windings</td>
</tr>
<tr>
<td>R7</td>
<td>PTC Discharge gas temperature sensor</td>
</tr>
<tr>
<td>R8</td>
<td>Oil heater</td>
</tr>
<tr>
<td>S1</td>
<td>Control switch</td>
</tr>
<tr>
<td>S2</td>
<td>Manual reset</td>
</tr>
<tr>
<td>Y1</td>
<td>Liquid Line Solenoid Valve</td>
</tr>
</tbody>
</table>
### 6.4. Technical data

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