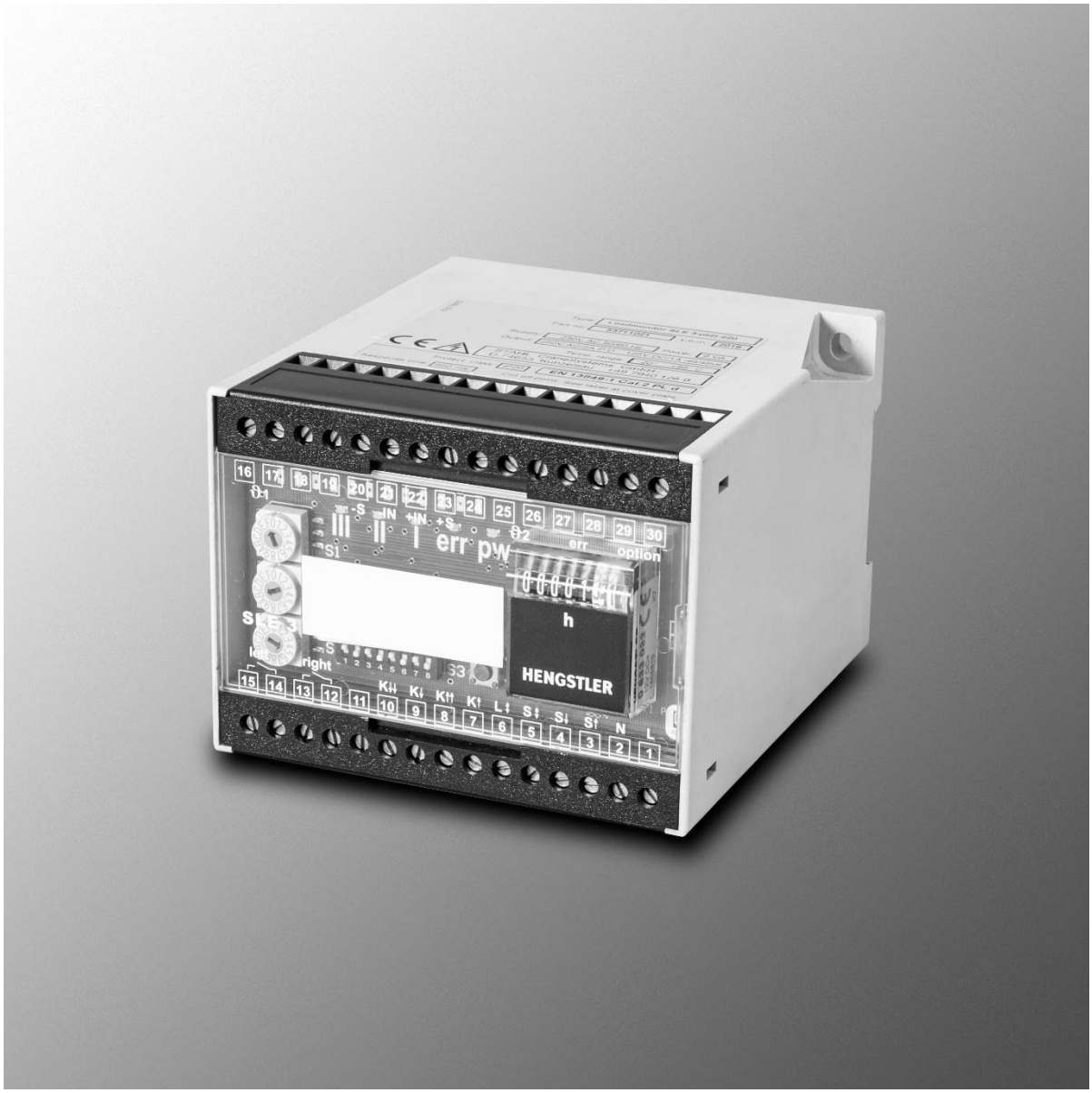

SLE 3

Electronic Control Unit SLE 3

EN

Operation Manual

Before installing hoist, fill in the information below.
Refer to the Hoist and Motor data plates.

Model No. _____

Serial No. _____

Purchase Date _____

Voltage _____

Rated Load _____

Follow all instructions and warnings for inspecting, maintaining and operating this product.

The use of any hoist presents some risk of personal injury or property damage. That risk is greatly increased if proper instructions and warnings are not followed. Before using this hoist, each operator should become thoroughly familiar with all warnings, instructions and recommendations in this manual. Retain this manual for future reference and use.

Forward this manual to operator. Failure to operate equipment as directed in manual may cause injury.

Yale® HOISTS

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Contents

1 General information

1.1 General information on these operating instructions

These operating instructions serve as safety manual in the sense of the safety standards for functional safety of the **SLE 3** electronic control unit for the manufacturer's hoists. They are aimed at the manufacturers, operators, commissioning engineers and service personnel of hoists.

They contain requirements and information on intended use of the safety-based control unit.

They must be available to the technical personnel of the machine manufacturer or machine operator during the complete period of use and be followed at all times for assembly, electrical installation, configuration, commissioning, maintenance and diagnosis.
The safety instructions must be followed.
The chapter "Safety instructions" in the original operating instructions for the hoist contains further requirements, and the chapter "Electrical installations" provides further information and explanations, which must also be followed.

1.2 Contents of the operating instructions

These operating instructions contain information on the following subjects:

- Safety instructions
- Product and functional description
- Installation
- Commissioning and settings
- Testing
- Maintenance
- Error and warning messages, faults
- Decommissioning
- Technical data
- Approvals

The necessary expertise needed for planning and use of protective devices is **not** given or imparted in the operating instructions.

1.3 Approvals / Test marks

See chapter ***"Technical data"***.

1.4 Disclaimer / Loss of warranty

The fundamental requirement for safe operation and achievement of the specified product properties and performance features is:

- compliance with the operating instructions.

Non-compliance will lead to a loss of liability and the warranty for the device and hoist.

1.5 Symbols

The safety instructions in the manual are subdivided according to the severity of the hazard and the likelihood of it occurring.
The measures described to avoid the hazards must be followed.

⚠ DANGER

This symbol warns of a direct danger to the health and life of people.
Disregarding these warnings will lead to severe injuries, possibly also death.

⚠ WARNING

This symbol warns of possibly dangerous situations for the health and life of people.
Disregarding these warnings can lead to severe injuries, possibly also death.

⚠ CAUTION

This symbol warns of possibly dangerous situations for the health of people.
Disregarding these warnings can lead to injuries.

ATTENTION

This symbol warns of property and environmental damage.

Specific symbols:

Warning of electrical voltage
Covers such as hoods and lids marked with this symbol may only be opened by "electrically skilled persons or competent persons".

Touching live parts can lead directly to death.

Warning of a suspended load
Any lingering of people under a suspended load is prohibited.
There is a danger of injury and death!

Warning of hand injuries
Danger of crush and cut injuries to the hands and fingers. The personal protective equipment required for the specified activity should be worn to avoid injuries.

Requirements / Recommendation
Especially important information and tips for use of the product.

1.6 Target group

ATTENTION

All work for installation and troubleshooting must be carried out by an **electrically skilled person**, commissioning and maintenance by a **competent person**.

Electrically skilled person
An electrically skilled person is a person who on account of his technical training has knowledge of and experience with electrical systems and, knowing the applicable standards and regulations, is able to assess the work assigned to him and identify and avert possible dangers.
The electrically skilled person must be familiar with operation of the product and trained in this.

Definition of a competent person
A competent person is a person who on account of his vocational training, vocational experience and recent vocational activity has the necessary technical knowledge to test the equipment.
This person must be able to assess the safety of the system in dependence on the case of use. Competent persons authorised to carry out certain maintenance work on our products are the manufacturer's service technicians and trained technicians with certificate.

1.7 Warranty claims

⚠ WARNING

Prerequisite for trouble-free operation of the device and fulfilment of warranty claims is compliance with the operating instructions.

- Read the operating instructions before you work with the device.
- Always only use the device for its intended purpose. Pay attention to the contents in the sections "Technical data", "Intended use" and "Misuse", particularly to the conditions for transport, storage, installation, commissioning and operation.
- These operating instructions only describe the basic functions of the device.
- Do not open the enclosure to make unauthorised changes to the device.
- Always switch off the power supply when carrying out maintenance work (e.g. replacement of the device).

1.8 Misuse

⚠ WARNING

They device may **only** be used according to the instructions and information in this manual.

1.9 Commissioning / Operation / Documentation

⚠ WARNING

The **SLE 3** only achieves its safety function when it has been programmed accordingly. The commissioning of a hoist must be documented. This documentation must also contain the overload cut-off point. The signature of the **qualified person** and the operator is needed after commissioning (section ***"Commissioning and testing"***).

1.10 Standards and directives

ATTENTION

Hoists in which SLE control equipment is installed are subject to the following directives

- Machinery Directive 2006/42/EC and
- EMC Directive 2014/30/EU

The SLE 3 was built in accordance with the following valid European standards and regulations:

- IEC / EN 60204-32 – "Safety of machinery – Electrical equipment of machines – Part 32: Requirements for hoisting machines"
- EN 14492-2 – "Cranes – Power driven winches and hoists – Part 2: Power driven hoists"
- DIN EN ISO 13849-1 – "Safety of machinery – Safety-related parts of control systems – Part 1: General principles for design"

1.11 Intended use

ATTENTION

The SLE 3

- may only be used for control of a manually controlled single hoist from the manufacturer.
- is intended for industrial installations and may only be used in accordance with the information in the technical documentation and the information on the rating plate.
- contains a safety-related overload cut-off that can, with due regard to the corresponding standards specifically applicable to the machines / systems, be used for the above-mentioned machines and systems in conjunction with a load sensor (see chapter "Load sensor" for specification) up to category 2, PL d, according to DIN EN ISO 13849-1.
- is a configurable device that only performs the safety functions after setting of the safety-related parameter "Overload cut-off point"; this parameter may only be changed by a **competent person**.
- is used in the control equipment as a central safety device for overload protection.
- is used in the hoist control equipment to actuate the motor.
- monitors the temperature of the motor by means of a thermistor (PTC).

ATTENTION

- The circuit diagrams and schematic circuit diagrams delivered with the hoist must be observed and implemented in control equipment built by the customer.
- When integrating the control equipment delivered by the manufacturer in a general control system or higher-level PLC, the product standards for hoists and the technical specifications regarding the functionality, signal sequence and timing of the device must be followed.
- The plant manufacturer is responsible for the overall system.

All faults and warnings that are indicated must be corrected immediately. If this is not possible, the device, and therefore also the hoist it controls, must be taken out of service until the fault has been corrected.

⚠ CAUTION

Any other use of the device or changes to the device itself, also during assembly and installation, will lead to the loss of all warranty claims against the manufacturer.

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2 General safety instructions

⚠ WARNING

You must follow the safety instructions:

- National and international directives and regulations must be followed for assembly, commissioning, operation and period tests, in particular the Machinery Directive 2006/42/EC, safety rules and country-specific safety regulations.
- The manufacturer and operator of the machine / system must coordinate and observe all applicable safety regulations with the responsible authorities on their own responsibility.
- Detailed instructions for commissioning and tests are described in chapter ***5***.

2.1 Installation requirements

⚠ WARNING

For applications with the device, observe the following guidelines on electrical installation.

- Switch cabinet assembly, protection at least IP54.
- Implement wiring according to EN 60204-32.
- The load sensor cable must be shielded. Connect the shield to earth potential. Observe the information in the chapter "Installation".
- The fuse may not exceed the value in the table "Technical data".

NOTICE

Sensor cables must be installed separately of main power cables, e.g. in spatially separate ducts or bundles.

2.1.1 Protective conductor

⚠ WARNING

With a missing protective conductor, an electric shock hazard exists. Material damage, severe injuries or death can result.

➢ Connect the external protective earth system (PE) close to the terminals of the phase conductor using a protective conductor for each mains connection.

Without a protective earth connection, malfunctions can arise during operation. The protective earth connection facilitates protective equipotential bonding for protection against electric shocks, as well as functional equipotential bonding for the avoidance of electrical interference effects on electronic systems.

2.2 Residual risks

⚠ WARNING

Unexpected start-up:

- Is prevented after the power supply is restored.
- The actuation control must also ensure this.

Physical injuries, e.g. crushing, severed limbs or even death.
The safety instructions are to be followed and applied!

⚠ WARNING

Direct contact with the power supply:
Deadly touch voltages can arise:

- from faulty wiring
- from not disconnecting the power supply when working on the control equipment

Physical injuries can remain, e.g. ventricular fibrillation, skin burns.

- The electrically skilled person must take this into consideration and take suitable precautions.

⚠ WARNING

Failure of one of the downstream power elements

- Downstream power elements are not monitored by the **SLE 3**.
- Failure is to be prevented by the designer of the control equipment by suitable choice.
- In the event of failure the operator must have the power element replaced immediately by a **competent person**.

3 Product and functional description

3.1 Description

The **SLE 3** is an electronic control unit for hoists. The device can be used to control pole-changing or frequency-controlled drives. It contains a safety-related overload cut-off for hoists in conjunction with a load sensor. It is a configurable system that only performs the overload protection function after parameterisation and storage of the safety-relevant parameter (overload cut-off point) in that the lifting movement is switched off safely.

The device also carries out other, non-safety related control and monitoring functions:

- Temperature monitoring for hoist and travel motors
- Display of system states via signalling relays
- Control of the lifting movements with motor management
- Counting of operating time

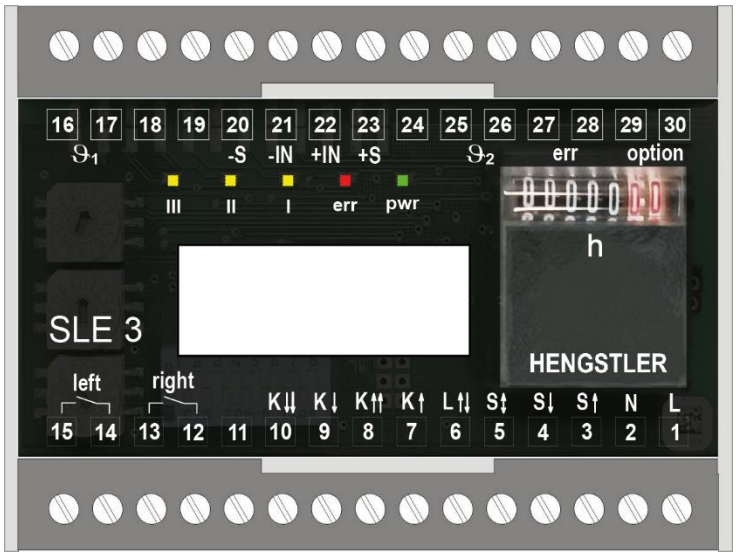
3.2 Load sensor

ATTENTION

The **SLE 3** processes signals from passive DMS load sensors (see technical data).
The load sensor is a safety-relevant component. Due to this, only load sensors approved by the manufacturer may be used. In the event of a defective load sensor, a sensor of the same type must always be ordered and fitted. The load sensors are specified by the manufacturer appropriately for the respective hoist and load and assigned internally.
Pay attention to the chapter "Device and sensor replacement" when replacing a load sensor.

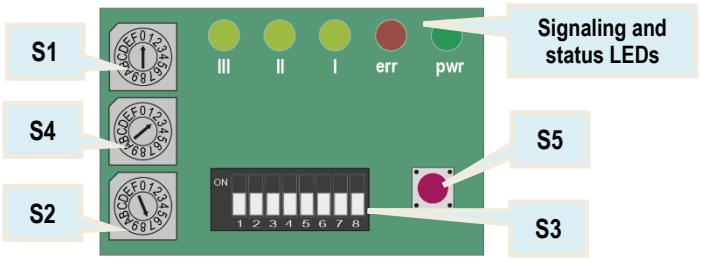
Fitting an unapproved load sensor will cancel the warranty and approval of the device!

3.3 Front view



S1: Selector switch motor management
S4: Setting cut-off point, rough
S2: Setting cut-off point, fine
S3: DIP switch: to activate the testing bay functions, relay operation and motor management
S5: Enter button: e.g. crane test

Display board



⚠ WARNING

The setting of the stored cut-off point may only be changed by a qualified person. Unauthorized changes will void the warranty!

3.4 Block diagram SLE 3

Legend

Supply
1: Power supply **L**
2: Power supply reference point **N**

Actuation
3: Safety input lift **S↑**
4: Safety input lower **S↓**
5: Input fast **S↕↕**

Relay outputs hoist
6: Switching voltage of the relay **L↑↓**
7: Safety output lift slowly **K↑**
8: Safety output lift fast **K↑↑**
9: Safety output lower slowly **K↓**
10: Safety output lower fast **K↓↓**

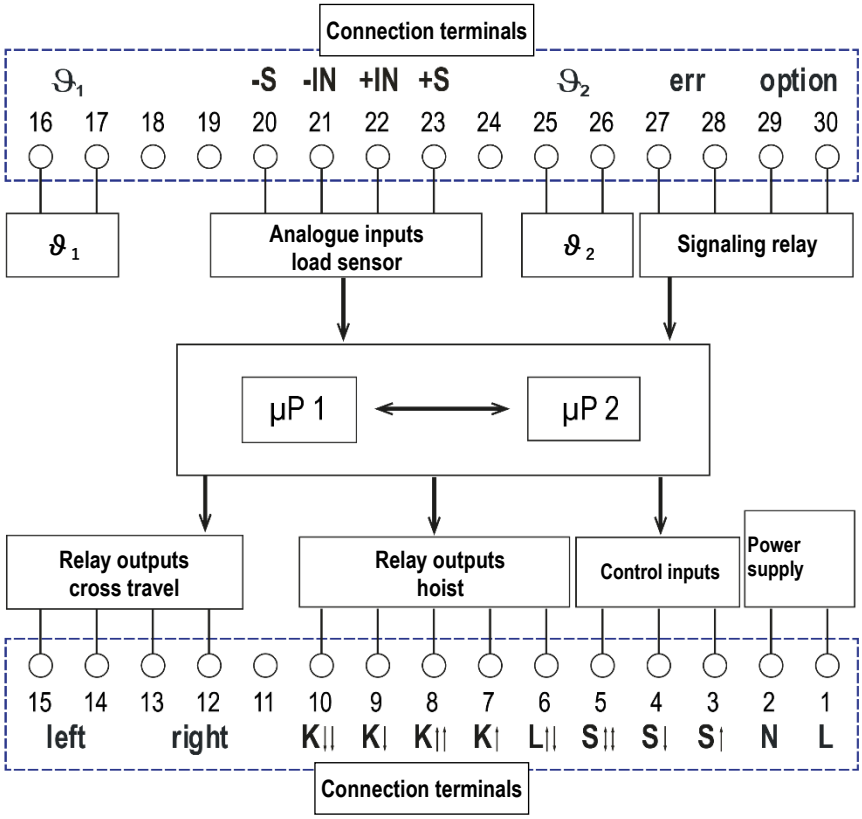
Relay outputs cross travel
12...15 Relay outputs to switch off the travel motors if temperature too high **left / right**

ϑ1
16, **17**: Thermistor input hoist motor **ϑ1**

ϑ2
25, **26**: Thermistor input travel motor **ϑ2**

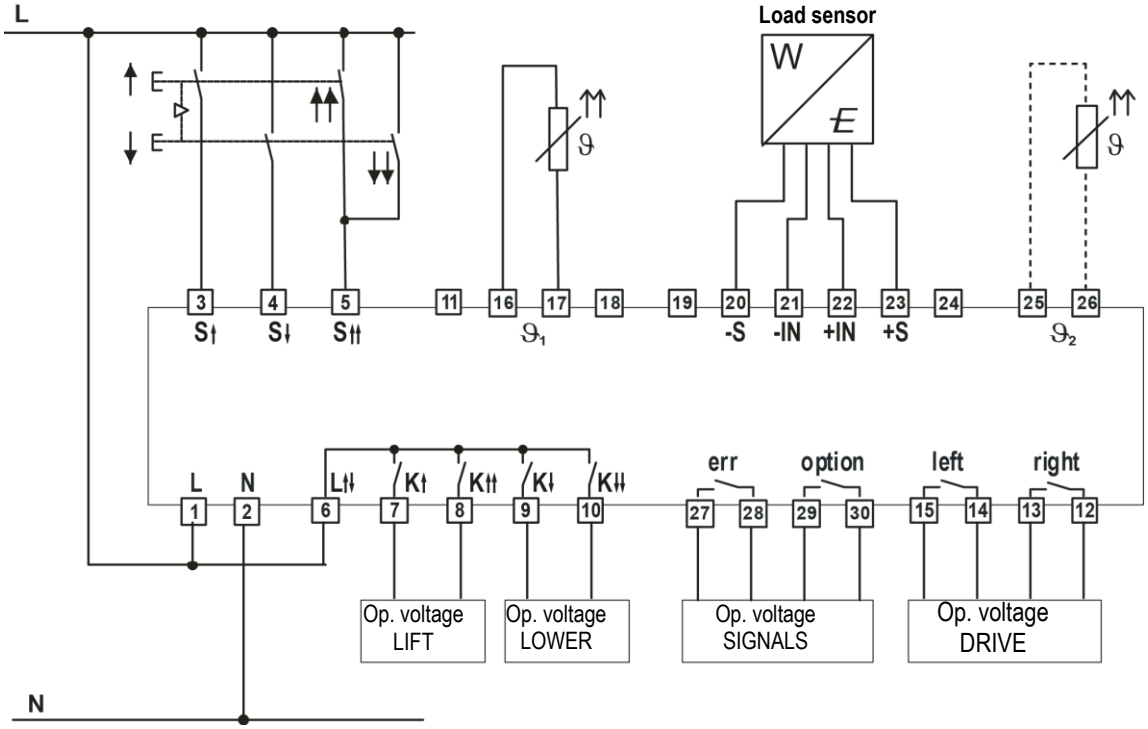
Signaling relay
27, **28**: Signaling relay **err**

29, **30**: Signaling relay **option**



Analogue inputs load sensor
20: Ground DMS supply **–S**
21, **22**: Load sensor input **–IN / +IN**
23: DMS power supply **+S**

3.5 Schematic circuit diagram



3.6 Safety functions

3.6.1 Overload cut-off

The overload cut-off is designed according to Performance Level d, Category 2 in accordance with DIN EN ISO 13849-1.
As shown in the schematic circuit diagram, the DMS load sensor is supplied with power (10 VDC) via the connections +S and -S. The load-proportional signal voltage ("load signal") of the DMS sensor is connected at the connections +IN and -IN (mV).

The overload cut-off switches off in the following cases:

- If the signal voltage between the connections IN+ and IN- exceeds the cut-off threshold setting while **S↑** is active, the **SLE 3** detects "**overload**" and switches the outputs **K↑ and K↑↑** off. The outputs are blocked until no overload is detected any more.

- If the signal voltage between the connections IN+ and IN- exceeds the cut-off threshold setting while the outputs **K↓** and **K↓↓** are active or when stationary, the **SLE 3** detects "**overload**" after a time of 800 ms and blocks the outputs **K↑** and **K↑↑** until no overload is detected any more.

As a result of internal filter functions, the maximum response time of the cut-off when lifting a load from the ground is 500 ms. For the total response time, the elasticity of the crane system must also be taken into consideration.

"**Overload**" is acknowledged when the load on the hooks drops below 82.5 % of the maximum lifting capacity and the safety input **S↓** is active for a time of at least 2 seconds.

Switching of the outputs K↓ and K↓↓ is possible when an overload has been detected!

3.6.2 Sensor errors

The load signal (+IN/-IN) from the DMS sensor is processed internally in the SLE 3 on two channels and monitored permanently.
The following three types of sensor errors are detected

- broken cable
- short circuit
- differential error between the internal measuring amplifiers in the device – internal error.

NOTICE

See chapter "Error messages" on error diagnosis and correction.

In all three cases of sensor errors the output relays **K**↑ and **K**↑↑ are switched off in dependence on the actuation of the safety inputs **S**↑ and **S**↕↕ and indicated as error code by the device LEDs.

The maximum response time for cut-off of the outputs is:

- when input **S**↑ active = 850 ms
- when input **S**↑ not active = 1950 ms

A sensor error is acknowledged when:

- the cause of the error no longer exists **and**
- the sensor signal is within the function limits **and**
- lift **S**↑ is not actuated.

⚠ WARNING

It remains possible to carry out the downwards movement (switching of the outputs K↓ and K↓↓) in the case of an overload or sensor error so that a suspended load can be put down if necessary!

3.7 Control and monitoring functions

3.7.1 Actuation

The safety inputs **S**↑, **S**↓ and the input **S**↕↕ are read in in relation to **N**.
S↑ and **S**↓ are kept in the device on two channels in both controllers and evaluated according to Category 2 Performance Level d.

Actuation of **S**↕↕ is only recognised if the corresponding direction **S**↑ or **S**↓ is active at the same time.

If **S**↑ or **S**↓ is actuated from idle state, the **SLE 3** switches the respective safety output **K**↑ or **K**↓ after a maximum delay time of 300 ms.

3.7.2 Relay outputs

The relay outputs switch the voltage connected to **L↑↓** through to the downstream actuators (e.g. contactor). The control voltage at L↑↓ must correspond to the power supply at **L**.

The safety outputs **K↑** and **K↑↑** are actuated by a safe internal circuit according to Category 2 Performance Level d. This circuit switches the safety outputs **K↑** and **K↑↑** off in the case of an error or overload.

The safety outputs **K↓** and **K↓↓** are also actuated by a safe internal circuit according to Category 2 Performance Level d.
This circuit switches the safety outputs **K↓** and **K↓↓** off in the event of an error (e.g. excessively high temperature at the hoist motor).

The safety output **K↑↑** or **K↓↓** is only active in conjunction with the safety output **K↑** or **K↓** respectively.

3.7.3 Motor management

The term motor management relates to the off-times for the lifting and lowering movements.
The off-times for the **example** of lifting are explained below:

Starting at slow speed t_a:

If **S↑** and **S↕↕** are actuated together, **K↑** is switched on first. At the end of the off-time t_a, **K↑↑** is switched on.

Stopping at slow speed t_b:

If **K↑** and **K↑↑** are active, the output **K↑↑** is switched off first at the end of actuation of **S↑** and **S↕↕**. After the deceleration time t_b has passed, **K↑** is no longer actuated either.

Off-time for slow (t_s) and fast (t_f) speed:

If **S↑** or **S↕↕** becomes inactive, **K↑** and **K↑↑** are also no longer actuated. If **S↑** or **S↕↕** is switched on again directly afterwards, **K↑** or **K↑** and **K↑↑** is only actuated again at the end of the off-time for the slow t_s or fast t_f speed.

Off-time for reversal of direction t_r:

When the actuation reverses direction, the hoist is first stopped and the corresponding safety output is actuated at the end of the off-time t_r.

The length of the follow-up and off-times is set with the switch S1 and the DIP switch S3_1.

⚠ WARNING

Changes to the settings of S1 and S3_1 may only be carried out by a qualified person!

Motor management table

This table shows the relationship between the settings and times:

Motor type	S1		S3	ts	tf	tr	ta	tb
				[ms]	[ms]	[ms]	[ms]	[ms]
Unknown		**0**		**600**	**1250**	**1250**	**500**	**500**
12/2H33		**1**		**250**	**500**	**500**	**0**	**250**
12/2H42		**2**		**250**	**500**	**500**	**0**	**250**
12/2H62		**3**		**250**	**500**	**500**	**0**	**250**
12/2H71		**4**		**400**	**750**	**750**	**300**	**300**
12/2H72		**5**		**400**	**750**	**750**	**300**	**300**
12/2H73		**6**		**400**	**750**	**750**	**400**	**400**
12/2H91 12/2H92		**7**		**600**	**1250**	**1250**	**500**	**500**
Ex-Motor A-xxx		**A**		**500**	**500**	**500**	**0**	**0**
Frequency-controlled		**F**		**0**	**0**	**0**	**0**	**0**

Motor management parameters for motors from Yale and third-party motors

- **F** = Setting for operation with a frequency inverter
- In setting **8 … E**, the highest setting, as in item **7**, is retained

Operation with frequency inverter

When working with a frequency inverter, the switch **S1** is set to **"F"** and the switch **S3_1** to **"on"**.

3.7.4 Operating time counter

The operating time counter integrated in SLE counts the total number of hours of operation in which the hoist motor is actuated.

3.7.5 Temperature monitoring for hoist and travel motors

Thermistor input ϑ1

The temperature of the hoist motor is monitored by default. When the motor thermistor (input **ϑ1**) is actuated, an error is indicated by the device LEDs and all lifting movements (outputs **K↓**, **K↓↓** and **K↑**, **K↑↑**,) are blocked.

The load can only be moved again after cooling of the hoist motor.

Thermistor input ϑ2

The travel motor thermistor (PTC) is connected to input **ϑ2** (if two or more travel motors, for all). When a travel motor thermistor responds, the **SLE 3** switches the relay outputs **left/right** off and reports this via the device LED (as warning) that the travel motor(s) can no longer be actuated.
When the motor has cooled down, the error is acknowledged automatically by the **SLE 3** and **left/right** is switched on again.

- All thermistors must correspond to the specifications of DIN 44080.
- All thermistors can be replaced with resistors of ~300 Ω if the motors used do not have thermistors.
  ATTENTION: The hoist or cross travel motor is then no longer protected against overheating.
  Please observe the chapter "Technical data"!

If there is no thermistor connected to **ϑ2**, the warning signal can be suppressed by switching the slide switch **S3_2** on.
The relay outputs **left/right** are switched irrespective of this.

3.7.6 Signaling relays

⚠ CAUTION

The signalling relays **"err"** and "**option**" are used to output error messages and may **not** be used for safety-relevant functions.

The signalling relays may only be parameterised by an **electrically skilled person**.

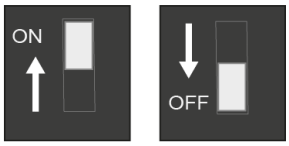
Both relays can be parameterised as normally-closed or normally-open contacts:

Relay	Normally-open	Normally-closed
option	S3_7 off	S3_7 on
err	S3_6 off	S3_6 on

err is switched in every error state that stops a **lifting movement**.

option is freely parameterisable. Parameterisation is dependent on the switch position S3:

DIP switch:



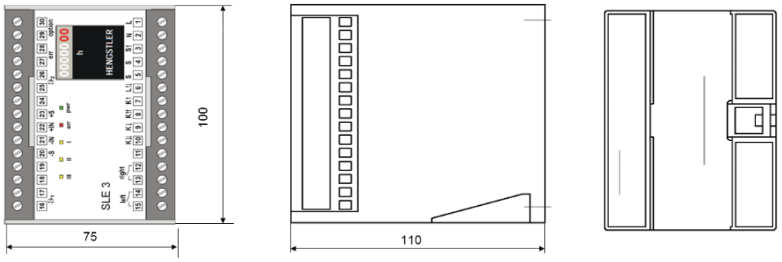
Switch S3_3	Switch S3_4	Switch S3_5	The option relay
0	0	0	does not switch
1	0	0	switches on overload
0	1	0	switches on overheating
1	1	0	switches on sensor error
0	0	1	switches on all errors that prohibit lifting and lowering
1	0	1	Switch-off pulse on overload: option relay switches off for 500 ms and then on again
0	1	1	switches at 95 % of nominal load
1	1	1	not used

The settings are made during initial commissioning in the factory.

4 Installation

4.1 Dimensions

- 100 × 110 × 75 mm (W × H × D)



4.2 Attachment possibilities

- Snap-on attachment on 35 mm top hat rail (EN 50022-35)
- Screw attachment enclosure bottom (M4) using pull-out sliders

4.3 Cable connection

See section ***"Technical data"***.

4.4 Cables

Install sensor cables (load sensor, temperature sensor) and power lines separately of each other. (Example: Installation in different ducts or spatially separate bundles)
The lengths of the cables for sensors and digital control signals may not exceed the maximum values specified in the chapter "Technical data".

4.5 Mounting

Mounting in a switch cabinet, at least IP 54.

5 Commissioning, tests, settings and maintenance

⚠ WARNING

Commissioning, testing, setting and maintenance work may only be carried out by a qualified person in accordance with this manual.
The manual for the hoist contain further safety instructions and information on the electrical equipment, which must also be observed.

5.1 Commissioning and regular tests

ATTENTION

The commissioning engineer must have all necessary information on the plant and the device available to him.
The test must extend to perfect interaction of the device with the controls of the hoist, the safe state and assembly according to state work regulations and equipment-specific safety rules (directives, product standards, BG rules/information).
The test results are to be documented in writing in a report, which is to be signed by the tester. The report is to be kept at the installation site of the machine/plant.

There are the following types of tests:

a) Tests before initial commissioning and after changes (acceptance tests)
A test must be carried out before initial commissioning of the **SLE 3** and after changes to the **SLE 3** or components or units involved in the safety function.
A change is considered as all changes to the circuit, the control system, the configuration and the parameters of the **SLE 3** and components or units involved in the safety function. The aim of the tests is to establish that the requirements regarding the hoist are fulfilled when using the **SLE 3** and that the components and units involved in the safety function work perfectly in interaction with the **SLE 3**. The type of use / attachment of the **SLE 3** and the follow-up of the plant must also be tested.
Acceptance test: overload cut-off:
Lifting of a **test load** of 110 % of the maximum lifting capacity. The device must detect the overload and switch off the lifting movement at the latest after the load has been lifted completely from the floor. According to DIN EN 14492-2, an overload may not be lifted further than a distance of the maximum nominal lifting speed multiplied by 1 s.

b) Regular tests
The purpose of regular testing is to systematically uncover and correct safety shortcomings (e.g. in the case of changes or manipulations) in the protective devices of the plant after commissioning. According to § 3, par. 3 of the Industrial Safety Regulation, the type, scope and times must be determined and stipulated by the user on an equipment-specific basis. A test period of at least once a year has proven to be appropriate. The test intervals can also be shorter in the case of multi-shift operation, heavy duty or unfavourable environmental conditions or due to national regulations.
This test also includes testing of the overload cut-off point with a test load of 110 % of the maximum lifting capacity, safety testing for perfect functioning of the **SLE 3**, inspection of the components, correct and proper attachment of the **SLE 3** and testing of the interaction of the **SLE 3** with the components and units involved in the safety function. The test also includes checking whether the specified limit value for the follow-up is not exceeded.

5.2 Change to the cut-off point

ATTENTION

If, when lifting the test load during initial commissioning, an overload is not detected or the maximum lifting capacity cannot be lifted, a new cut-off point must be saved in the device.
This change may only be made by an electrically skilled person with the help of the **testing bay function**. The permissible setting range must be observed here.

Permissible setting range of the overload cut-off point:

Overload cut-off points between 12 and 30 mV can be set with the SLE 3. This corresponds to a HEX switch setting from the minimum value: S4 = 4 and S2= B (minimum value) to the maximum value: S4 = C and S2 = 2.

ATTENTION

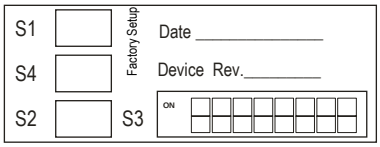
If the sensor value at 110 % of the maximum lifting capacity is greater or smaller than the permissible range and a load sensor fault can be ruled out, a larger or smaller load sensor must be used.

5.3 Settings

5.3.1 Testing bay function

⚠ WARNING

The testing bay function involves the setting and saving of an overload cut-off point in the SLE 3. Errors in the activation sequence or when saving a new overload cut-off point can lead to dangerous situations up to falling of the load. The testing bay function may therefore **only** be used by **an electrical qualified person.**

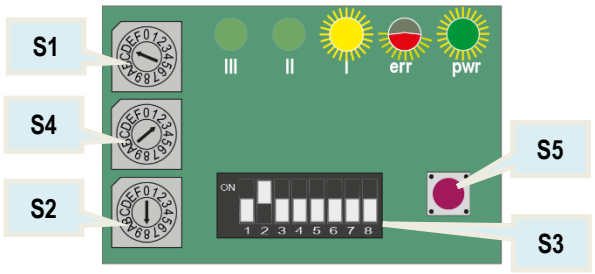


Label on the inside of the front panel

Changes to the cut-off point must be documented in this manual in the section *"Documentation of changes to the cut-off point"* and in the crane logbook, stating the reason, and signed by the setter and operator. The new cut-off point must also be noted on the label in the cover (see figure).

Preparations for activation of the testing bay function:
The following preparations should be made or organized before activating the testing bay function:

- Get a test load of 110 % of the maximum lifting capacity ready.
- Get a load weighing the maximum lifting capacity ready.
- Carefully take off the front panel (device cover) of the SLE 3 with the help of a screwdriver and put in a safe place.

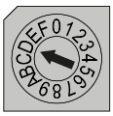


5.3.2 Activating the testing bay function

The testing bay function can only be activated in stationary state and with no overload on the hook.

Note the position of the switch S1.

The following 3 steps (2., 3. and 4.) must be carried out in the order described within a maximum of 16 seconds otherwise the test bench function cannot be activated or fully completed.

1. Hex switch start settings:	S1 ≠ D (note position) S4 = 4 S2 = B				
2. Set **S3** DIP switch **8** to "**On**". Lifting / Lowering is blocked					
3. Set **S1** on **D**					
	III	II	I	err	pwr
4. Press **S5** until all LEDs light up permanently	☀	☀	☀	☀	☀
5. Set **S3** DIP switch **8** to "**OFF**". The red and all yellow LEDs flash: The testing bay function is now active for 30 minutes. Lifting / Lowering is enabled	☀	☀	☀	☀	☀
6. Correct the offset of the load sensor: → No load on the hook → Press the button **S5** until the red LED stops flashing	☀	☀	☀	○	☀
7. Set S4 = C, S2 = F	☀	○	○	○	☀
8. Lift 110% overload at slow speed and simultaneously turn **S4** to the left until **II** and "**err**" light up	○	☀	○	☀	☀
9. Turn **S4** one switch position to the right and put down the overload	☀	☀	☀	○	☀
10. Lift 110% overload at slow speed and simultaneously turn **S2** to the left until **II** and "**err**" light up	○	☀	○	☀	☀
11. Put down the 110% overload	☀	☀	☀	○	☀
12. Test the cut-off point found. Lift 110% overload again. The load may not be picked up from the floor completely. **II** and "**err**" light up	○	☀	○	☀	☀
13. Put down the 110% overload	☀	☀	☀	○	☀
14. Lift the maximum lifting capacity	☀	☀	☀	○	☀
15. Lower the maximum lifting capacity	☀	☀	☀	○	☀
16. Save the new overload cut-off point by pressing the button **S5** until the 3 yellow LEDs stop flashing. Saving is indicated by fast flashing					
17. Set **S1** back to the previously noted switch position, note the changes and confirm the settings by signing on the enclosure cover.					
18. Restart the device.					

After the crane test, the device cover must be applied to the SLE 3 again until it audible snaps in place. The device's electronics are thus protected from dust and foreign objects.

5.4 Crane test

⚠ WARNING

When commissioning a hoist, a so-called crane test must be carried out according to manual. To enable this test, the function "Crane test", which increases the overload cut-off point, can be activated.
The function "Crane test" may only be activated by a qualified person in the presence of a crane expert for the purposes of carrying out the test.

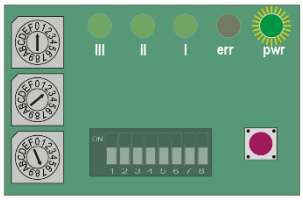
The crane runway and crane bridge are tested with a load of 125 %. To enable this test, the function "Crane test" can be activated. After activation of the function, the cut-off point is set on 137.5 % of the maximum lifting capacity for 30 minutes. (125 % + 10 %)

5.4.1 Activation of the function "Crane test":

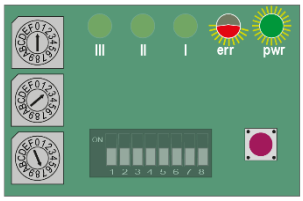
The crane test can only be activated in stationary state and with no overload on the hook. The DIP switches S3 must correspond to the setting shown in the enclosure cover.

Preparation:
Carefully take off the front panel of the SLE 3 (transparent enclosure cover) with the help of a screwdriver.

Activation procedure:
The following steps must be carried out within a time of **12 seconds**; the function "Crane test" is then active:



1. Press the button **S5** for longer than **3 seconds** and then let it go again



2. After a **pause** of **1 second**, press the button **S5** again for longer than **3 seconds** until the red LED begins to flash.

If an error occurs during the activation procedure for the crane test, the red LED flashes three times. After this error indication, the crane test can be activated again.

5.4.2 Deactivation of the crane test

The function "Crane test" is deactivated by:

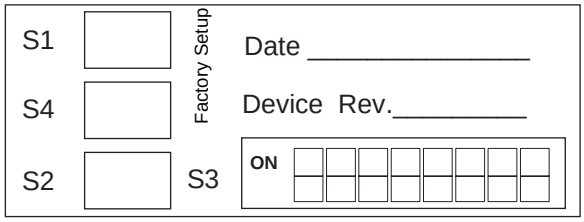
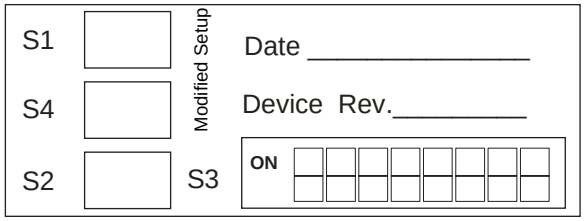
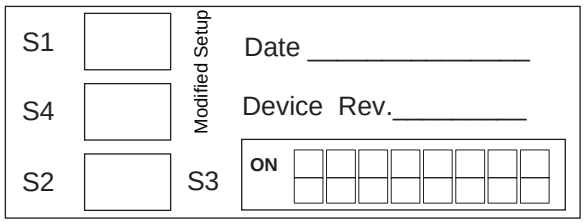
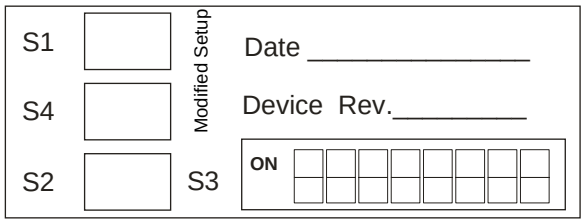
- restarting the device
- pressing the button S5 until the red LED goes out

After the crane test, the device cover must be applied to the SLE 3 again until it audible snaps in place. The device's electronics are thus protected from dust and foreign objects.

5.5 Documentation of changes to the cut-off point

⚠ WARNING

After testing of the new cut-off point, it must be documented in the cover of the device, in the following table and in the crane logbook with signatures and confirmed.
Failure to document a change in the cut-off point will lead to immediate loss of the warranty and is grossly negligent.

Setting	Reason for change	Operator's signature	Service technician's signature
			
			
			
			

NOTICE

There is a page with a table as shown above at the end of these operating instructions. This page can be taken out (or copied) and used to document changes to the settings of the SLE 3 in the test book.

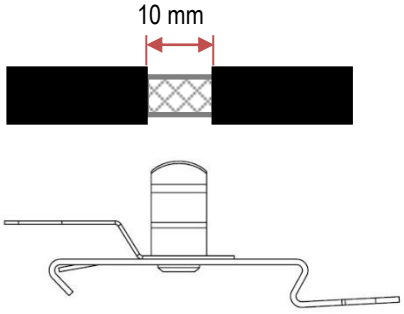
5.6 Device or sensor replacement

ATTENTION

When replacing a device and/or sensor, the original state of the installation as on delivery of the hoist must be restored. This means in particular that all cables must be installed exactly and reconnected and earthed exactly as specified ex works.

The sensor cable, delivered in a length of 5 m, must be shortened accordingly. Correct earthing of the cable shield at the shield clamp is particularly important.

Earthing cable shield:



⚠ WARNING

After replacement of a device or load sensor by a **competent person**, the commissioning procedure (see the chapter "Commissioning and testing") must be repeated completely and the reading of the operating time counter of the replaced device must be recorded in the crane logbook.

5.7 Maintenance

All screw terminals must be checked for tightness during every maintenance assignment, at the latest **annually**, and tightened if necessary.

5.8 Wear parts

ATTENTION

The **SLE 3** does not have any wear parts. If a device is defective, it must be replaced with an equivalent one. Here it must be ensured that the device has the following properties:

- equal or higher-order hardware version
- equal or higher-order software version
- equal or higher-order temperature range of application

These properties are to be found on the rating plate of the respective device.
(See chapter "Technical data")
The device can be procured directly from the manufacturer or one of his sales partners.
The chapter "Device and sensor replacement" must be followed for installation.

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6 Error and warning messages, faults

⚠ WARNING

Testing of the electrical installation may only be carried out by an **electrical qualified person**.
Changes to the overload cut-off point or a device replacement may only be carried out by a **qualified person**.

6.1 Operation

The detailed description of errors is to be found in the "Service instructions of the manual".

Internal tests are carried out when the power supply is switched on. The LEDs "pwr", "err", "I", "II", "III" light up during this test.
The **SLE 3** is ready for operation when only the LED "pwr" is still on.

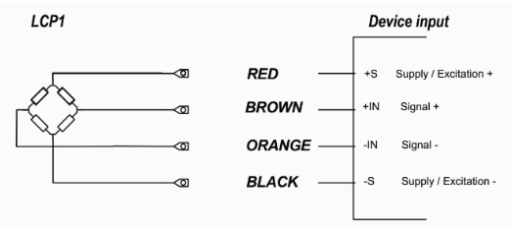
Symbols
○ LED is off ✳ LED flashes ✳ LED lights up

III	II	I	err	pwr	Cause	Consequence	Correction
○	○	○	○	✳	Device is ready for operation		

6 Error and warning messages, faults

6.2 Error state indicators

The **SLE 3** constantly carries out internal tests and tests on the connected sensors and monitors the plausibility of external and internal switch states. If the **SLE 3** detects a problem, an error or error state is set and lifting or lifting and lowering is blocked.
The possible errors and their indication are described in the following table and must be corrected before further operation is possible.

III	II	I	err	pwr	Cause	Consquence	Correction
○	○	☀	☀	☀	**Sensor error:** Broken cable, short circuit	Lifting blocked	• Check load sensor connection: screw terminals for tightness (-S, -IN, +IN, +S), correct wire assignment per circuit diagram  • Measure sensor supply voltage (+S / -S): set point value 9.5…10.5 V • Measure the output voltage of the connected sensor (-IN / -S, +IN / -S): value approx. 5 V • Load sensor test: To do this, disconnect the output signals S+ (brown terminal +IN [22]) and S- (orange terminal -IN [21]) of the connected sensor from the SLE 3. UB+ (red terminal +S [23]) and UB- (black terminal -S [20]) remain connected to the SLE 3. Switch on the SLE 3. Then measure the voltage difference between the brown (S+) and orange (S-) sensor cable with a multimeter. S+ (brown) is used as the signal and S- (orange) is used as the reference point. Adjust the measuring range to mV DC. ➢ The nominal value with the sensor unloaded is between -7 mV and +7 mV. ➢ If the measured value is outside of this tolerance, then the sensor must be replaced. **Note:** The multimeter must support the millivolt [mV] voltage range.
○	☀	○	☀	☀	**Overload**	Lifting blocked	• Put down the overload and reduce the load • Correct the cut-off threshold (during commissioning, with test load)
○	☀	☀	☀	☀	**Overheating 1 or thermistor error**	Lifting and lowering blocked	• Let the motor cool down →the error state is acknowledged automatically • Check the wiring of the thermistor • Check the thermistor resistance with the motor cold: – If the measured resistance is 150...750Ω, the thermistor input is defective and the device must be replaced. – If the resistance is greater or smaller, the thermistor is defective and the motor must be replaced.
☀	○	○	☀	☀	Offset correction error	Lifting blocked	• Existing device: check the load sensor → see above • New device: carry out offset calibration • If the error occurs in testing bay mode, then check the load sensor wiring

					Lifting and lowering actuated at the same time	Lifting and lowering blocked	• Error in the wiring. • Check the control cables to the terminals 3, 4 and 5 at the SLE
					Internal error	Lifting blocked	• Check the voltage at terminal 6 • Restart the device • If the error occurs again after a restart, the device must be replaced
					No power supply available, device fuse defective	Device does not work	• Check the power supply of the device

6.3 Warning messages

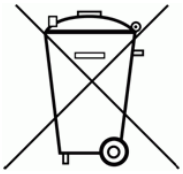
A warning detected and indicated by the device does not lead to any restrictions in the lifting movements. The warning is indicated by three LED indicators (flashing) on the front side. A warning can lead to impairment of the travel motion.

III	II	I	err	pwr	Cause	Correction
					Crane test mode is active. Test load for the crane test can now be lifted.	• The crane test mode can be deactivated by restarting the device or pressing the button S5.
					Error occurred while activating the testing bay function or the crane test.	Revert the settings to the Hex and DIP switches and start activation from the beginning again.
					**Overheating 2 or thermistor error**	• Let the motor cool down →the error state is acknowledged automatically • Check the wiring of the thermistor • Check the thermistor resistance with the motor cold: – If the measured resistance is 150...750Ω, the thermistor input is defective and the device must be replaced. – If the resistance is greater or smaller, the thermistor is defective and the motor must be replaced.
					Overload cut-off point. Setting was manipulated.	• Set the overload cut-off point on the smallest-possible value.
					The set overload cut-off point is greater than the greatest-possible cut-off point.	• Set the overload cut-off point on the smallest-possible value.
					The set overload cut-off point is smaller than the smallest-possible cut-off point.	• Set the overload cut-off point on the smallest-possible value.
					Testing bay mode active: offset correction not carried out	• Carry out sensor offset correction
					Testing bay mode active: offset correction carried out	

ATTENTION

If an error cannot be corrected, the service department of the manufacturer or one of his sales partners must be contacted.

7 Decommissioning



The operator is responsible for decommissioning of the plant and thus of the SLE 3.

Electronic components and electric and electronic scrap are special waste.
Country-specific environmental laws must be obeyed when disposing of the device.
The local authorities will provide relevant information.

The SLE 3 does not have any batteries or rechargeable batteries.

8 Technical data

Supply		
Voltage variants	AC voltage: 24 V 50 / 60 Hz 42 V 50 / 60 Hz 48 V 50 / 60 Hz 110/120 V 50 / 60 Hz 230 V 50 / 60 Hz	DC voltage: 24 V DC Residual ripple: ±5 %
Voltage tolerance	90 … 115 %	
Power consumption at rated voltage	9 VA	
Fuse protection control current circuit	6.3 A, slow blow	
Actuation		
Galvanic isolation	Yes	
Signal level input inactive	< 40 %	of the supply
Signal level input active	> 70 %	
Relay outputs		
Control relays per DIN EN ISO 13849-1, Cat. 2	4	
Utilization category - EN 60947-5-1,	AC15: 250 V / 2 A (inductive load cos φ=0.7), 5 A (resistive load) DC13: 30 V / 2 A At +70 °C (optional) AC15: 250 V / 1.5 A (inductive load cos φ=0.7), 3 A (resistive load)	
Signaling relays / Temperature monitoring relay	4, volt-free	
Utilization category - EN 60947-5-1,	AC15: 250 V / 2 A (inductive load cos φ=0.7), 5 A (resistive load) DC13: 30 V / 2 A At +70 °C (optional) AC15: 250 V / 1.5 A (inductive load cos φ=0.7), 3 A (resistive load)	
Inputs load sensor		
Load sensor type	Passive DMS sensor, full bridge	
Supply DMS sensor **+S**	10 V DC ± 5 %	
-S	0 V DC	
Load signal input **+IN**	2 mV / V,	
-IN	350 Ω	
Measurement range	0...20 mV	
Max. error of measurement at 25 °C referred to the smallest-possible cut-off point	±3 %	
Overload cut-off point	Parameterizable	
PTC inputs ϑ1 / ϑ2		
Maximum total initial resistance	Max. 1500 Ω (IEC / EN 60947-8)	
Pick-up resistance	2800 … 3500 Ω	
Maximum release resistance:	1650 Ω	
Environmental conditions		
Insulation strength	Clearances and creepage distances per IEC / EN 60664 Rated insulation voltage 250 V AC Pollution degree 2 Protection class II Overvoltage categories III	

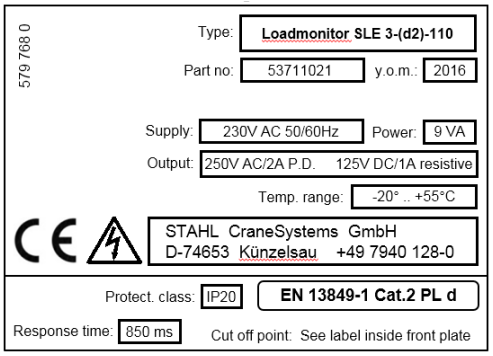
Impact, vibrations	EN 60068-2-27 10 g – 11 ms EN 60068-2-6 3 mm at 2...9 Hz; 0.5 g at 9...200 Hz
EMC	EN 61000-6-2-7 Immunity for devices intended to perform functions in safety-related systems (functional safety) at industrial sites EN 61000-6-3 Emission standard for residential, commercial and light-industrial environments
Temperature range operation	-20 °C ... +55 °C (standard) -20 °C ... +70 °C (optional)
Storage	-40 °C ... +80 °C
Dimensions	100 × 110 × 75 mm (W × H × D)
Protection	IP20, EN 60529
Connection terminals	30 box terminals with captive plus-minus screws Per box terminal: 1 × 4 mm^2 solid or 1 × 2.5 mm^2 stranded wire with wire ferrules or 2 × 1.5 mm^2 stranded wire, with wire ferrules Tightening torque of the screw terminals 0.5 Nm
Attachment	Top hat rail EN 50022
Weight	0.5 kg
Mounting position	Horizontal, vertical
Maximum cable length - Digital control signals - Temperature inputs - Sensor inputs (shielded)	 100 m 50 m 5 m
Safety parameter values per DIN EN ISO 13849-1	
SLE 3	
Performance level	d
PFH	5.28 E-07
MTTFd	100 years
DC	84 %
Category	2
Response time	850 ms
Requirements for sensors:	
Performance level	c
PFH	< 1.08 E-06
MTTFd	>= 100 years
Category	1
Requirements for the contactor:	
Performance level	c
PFH	< 1.32 E-06
B10d	> 1,300,000 (assumed cycles/year: 150,000)
Category	1

8 Technical data

8.1 Rating plates

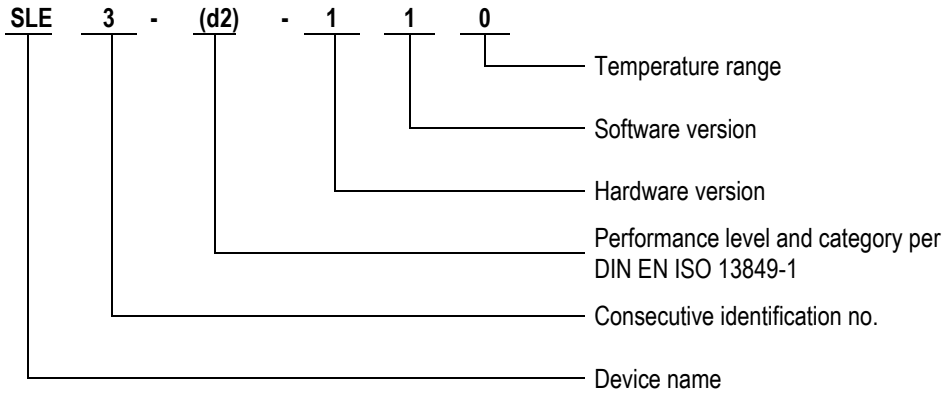
The type designation is to be found on the rating plate. The hardware and software versions are also to be found on the rating plate.

Rating plate for countries without UL and CSA approval requirement:
Example:



Rating plate for countries with UL and CSA approval requirement:
There is currently not yet UL/CSA approval for the SLE 3.

8.2 Type designation



Changes to the SLE 3 device setting – Serial number: ....

Setting	Reason for change	Operator's signature	Service technician's signature
Factory Setup S1 ☐ Date ____________ S4 ☐ Device Rev.________ S2 ☐ S3 ON ☐☐☐☐☐☐☐☐			
Modified Setup S1 ☐ Date ____________ S4 ☐ Device Rev.________ S2 ☐ S3 ON ☐☐☐☐☐☐☐☐			
Modified Setup S1 ☐ Date ____________ S4 ☐ Device Rev.________ S2 ☐ S3 ON ☐☐☐☐☐☐☐☐			
Modified Setup S1 ☐ Date ____________ S4 ☐ Device Rev.________ S2 ☐ S3 ON ☐☐☐☐☐☐☐☐			
Modified Setup S1 ☐ Date ____________ S4 ☐ Device Rev.________ S2 ☐ S3 ON ☐☐☐☐☐☐☐☐			
Modified Setup S1 ☐ Date ____________ S4 ☐ Device Rev.________ S2 ☐ S3 ON ☐☐☐☐☐☐☐☐			
Modified Setup S1 ☐ Date ____________ S4 ☐ Device Rev.________ S2 ☐ S3 ON ☐☐☐☐☐☐☐☐			

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Notes

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CM COFFING HOISTS BUDGIT Hoists CHESTER HOIST Yale HOISTS SHAW-BOX

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GERMANY: Ph: +49 7940 128-0 • Fax: +49 7940 55665 • www.stahlcranes.com