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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09.2019
8.2 Type designation
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 General information

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 General information

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:

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 EN 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 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.
2 General safety instructions

2.1 Installation requirements

### 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.

### 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 General safety instructions

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  Product and functional description

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
2: Power supply reference point

Actuation
3: Safety input lift
4: Safety input lower
5: Input fast

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

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

Signaling relay
27, 28: Signaling relay
29, 30: Signaling relay

Analogue inputs load sensor
20: Ground DMS supply
21, 22: Load sensor input
23: DMS power supply
3 Product and functional description

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 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 out-
puts $K^↓$ 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 $L_{\uparrow \downarrow}$ through to the downstream actuators (e.g. contactor). The control voltage at $L_{\uparrow \downarrow}$ must correspond to the power supply at $L$.

The safety outputs $K_{\uparrow}$ and $K_{\uparrow\uparrow}$ are actuated by a safe internal circuit according to Category 2 Performance Level d. This circuit switches the safety outputs $K_{\uparrow}$ and $K_{\uparrow\uparrow}$ off in the case of an error or overload.

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

The safety output $K_{\uparrow\uparrow}$ or $K_{\downarrow\downarrow}$ is only active in conjunction with the safety output $K_{\uparrow}$ or $K_{\downarrow}$ 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 $S_{\uparrow}$ and $S_{\uparrow\uparrow}$ are actuated together, $K_{\uparrow}$ is switched on first. At the end of the off-time $t_a$, $K_{\uparrow\uparrow}$ is switched on.

**Stopping at slow speed $t_b$:**

If $K_{\uparrow}$ and $K_{\uparrow\uparrow}$ are active, the output $K_{\uparrow\uparrow}$ is switched off first at the end of actuation of $S_{\uparrow}$ and $S_{\uparrow\uparrow}$. After the deceleration time $t_b$ has passed, $K_{\uparrow}$ is no longer actuated either.

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

If $S_{\uparrow}$ or $S_{\uparrow\uparrow}$ becomes inactive, $K_{\uparrow}$ and $K_{\uparrow\uparrow}$ are also no longer actuated. If $S_{\uparrow}$ or $S_{\uparrow\uparrow}$ is switched on again directly afterwards, $K_{\uparrow}$ or $K_{\uparrow\uparrow}$ and $K_{\uparrow\uparrow}$ 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 $S_1$ and the DIP switch $S_{3\_1}$.

⚠️ **WARNING**

Changes to the settings of $S_1$ and $S_{3\_1}$ may only be carried out by a qualified person!
Product and functional description

Motor management table

This table shows the relationship between the settings and times:

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

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 S1**
The temperature of the hoist motor is monitored by default. When the motor thermistor (input S1) 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 S2**
The travel motor thermistor (PTC) is connected to input S2 (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 S2, 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:

<table>
<thead>
<tr>
<th>Relay</th>
<th>Normally-open</th>
<th>Normally-closed</th>
</tr>
</thead>
<tbody>
<tr>
<td>option</td>
<td>S3_7 off</td>
<td>S3_7 on</td>
</tr>
<tr>
<td>err</td>
<td>S3_6 off</td>
<td>S3_6 on</td>
</tr>
</tbody>
</table>

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

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

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

The settings are made during initial commissioning in the factory.
4 Installation

4.1 Dimensions

- 100 x 110 x 75 mm (W x H x 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:

1. 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.

2. 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.

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 first 3 steps must be carried out in the order described within a maximum time of 16 seconds, otherwise the testing bay function cannot be activated or not finished completely.

1. Set S3 DIP switch 8 to "On". Lifting / Lowering is blocked

2. Set S1 on D

3. Press S5 until all LEDs light up permanently

4. 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

5. Correct the offset of the load sensor:
   → No load on the hook → Press the button S5 until the red LED stops flashing

6. Set S4 = C, S2 = F

7. Lift 110 % overload at slow speed and simultaneously turn S4 to the left until II and "err" light up

8. Turn S4 one switch position to the right and put down the overload

9. Lift 110 % overload at slow speed and simultaneously turn S2 to the left until II and "err" light up

10. Put down the 110 % overload

11. 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

12. Put down the 110 % overload

13. Lift the maximum lifting capacity

14. Lower the maximum lifting capacity

15. 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

16. Set S1 back to the previously noted switch position, note the changes and confirm the settings by signing on the enclosure cover.

17. Restart the device.

When the crane test is finished, put the front panel (device cover) back on to the SLE 3 to protect the electronic components against dust and foreign bodies.
5 Commissioning, tests, settings and maintenance

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

As soon as the crane test is finished, put the front panel (device cover) back on to the SLE 3 to protect the electronic components against dust and foreign bodies.
## 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.

<table>
<thead>
<tr>
<th>Setting</th>
<th>Reason for change</th>
<th>Operator's signature</th>
<th>Service technician's signature</th>
</tr>
</thead>
<tbody>
<tr>
<td>S1</td>
<td>Date _____________</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S4</td>
<td>Device Rev._________</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S2 S3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S1</td>
<td>Date _____________</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S4</td>
<td>Device Rev._________</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S2 S3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S1</td>
<td>Date _____________</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S4</td>
<td>Device Rev._________</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S2 S3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S1</td>
<td>Date _____________</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S4</td>
<td>Device Rev._________</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S2 S3</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**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 Commissioning, tests, settings and maintenance

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:

![Earthing cable shield](image)

**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.
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

<table>
<thead>
<tr>
<th>III</th>
<th>II</th>
<th>I</th>
<th>err</th>
<th>pwr</th>
<th>Cause</th>
<th>Consequence</th>
<th>Correction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>🌟</td>
<td>Device is ready for operation</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

09.2019
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.

<table>
<thead>
<tr>
<th>III</th>
<th>II</th>
<th>I</th>
<th>err</th>
<th>pwr</th>
<th>Cause</th>
<th>Consequence</th>
<th>Correction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>red</td>
<td></td>
<td>Sensor error: Broken cable, short circuit</td>
<td>Lifting blocked</td>
<td>• Check load sensor connection: screw terminals for tightness (-S, -IN, +IN, +S), correct wire assignment per circuit diagram</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Overload</td>
<td>Lifting blocked</td>
<td>• Put down the overload and reduce the load</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Overheating 1 or thermistor error</td>
<td>Lifting and lowering blocked</td>
<td>• Let the motor cool down → the error state is acknowledged automatically</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Offset correction error</td>
<td>Lifting blocked</td>
<td>• Existing device: check the load sensor → see above</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Lifting and lowering actuated at the same time</td>
<td>Lifting and lowering blocked</td>
<td>• New device: carry out offset calibration</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Internal error</td>
<td>Lifting and lowering blocked</td>
<td>• Error in the wiring</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>No power supply available, device fuse defective</td>
<td>Device does not work</td>
<td>• Check the voltage at terminal 6</td>
</tr>
</tbody>
</table>

![Diagram of device input connections](image)

- 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
- Measure the sensor values at the disconnected sensor: set point values:
  - between wires RED / BLACK: 350 ... 400 Ω
  - between wires BROWN / ORANGE: 346 ... 356 Ω

• Measure the output voltage of the sensor (-IN / -S, +IN / -S):
  - value approx. 5 V
• Measure the sensor values at the disconnected sensor: set point values:
  - between wires RED / BLACK: 350 ... 400 Ω
  - between wires BROWN / ORANGE: 346 ... 356 Ω

- Measure the input resistance of the thermistor:
  - If the measured resistance is 150...750Ω, the thermistor 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.

• Check the wiring of the thermistor
• Check the wiring of the thermistor resistance with the motor cold:
  - If the measured resistance is 150...750Ω, the thermistor 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.
6. Error and warning messages, faults

### 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.

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

**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.
### Technical data

#### Supply

<table>
<thead>
<tr>
<th>Voltage variants</th>
<th>AC voltage:</th>
<th>DC voltage:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>24 V 50 / 60 Hz</td>
<td>24 V DC</td>
</tr>
<tr>
<td></td>
<td>42 V 50 / 60 Hz</td>
<td></td>
</tr>
<tr>
<td></td>
<td>48 V 50 / 60 Hz</td>
<td>Residual ripple: ±5 %</td>
</tr>
<tr>
<td></td>
<td>110/120 V 50 / 60 Hz</td>
<td></td>
</tr>
<tr>
<td></td>
<td>230 V 50 / 60 Hz</td>
<td></td>
</tr>
<tr>
<td>Voltage tolerance</td>
<td>90 … 115 %</td>
<td></td>
</tr>
<tr>
<td>Power consumption at rated voltage</td>
<td>9 VA</td>
<td></td>
</tr>
<tr>
<td>Fuse protection control current circuit</td>
<td>6.3 A, slow blow</td>
<td></td>
</tr>
</tbody>
</table>

#### Actuation

<table>
<thead>
<tr>
<th>Galvanic isolation</th>
<th>Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Signal level input inactive</td>
<td>&lt; 40 % of the supply</td>
</tr>
<tr>
<td>Signal level input active</td>
<td>&gt; 70 %</td>
</tr>
</tbody>
</table>

#### Relay outputs

**Control relays** per EN 13849-1, Cat. 2

<table>
<thead>
<tr>
<th>Utilization category</th>
<th>AC15: 250 V / 2 A (inductive load cos ϕ=0.7), 5 A (resistive load)</th>
</tr>
</thead>
<tbody>
<tr>
<td>- EN 60947-5-1,</td>
<td>DC13: 30 V / 2 A</td>
</tr>
<tr>
<td></td>
<td>At +70 °C (optional)</td>
</tr>
<tr>
<td></td>
<td>AC15: 250 V / 1.5 A (inductive load cos ϕ=0.7), 3 A (resistive load)</td>
</tr>
</tbody>
</table>

**Signaling relays / Temperature monitoring relay** 4, volt-free

<table>
<thead>
<tr>
<th>Utilization category</th>
<th>AC15: 250 V / 2 A (inductive load cos ϕ=0.7), 5 A (resistive load)</th>
</tr>
</thead>
<tbody>
<tr>
<td>- EN 60947-5-1,</td>
<td>DC13: 30 V / 2 A</td>
</tr>
<tr>
<td></td>
<td>At +70 °C (optional)</td>
</tr>
<tr>
<td></td>
<td>AC15: 250 V / 1.5 A (inductive load cos ϕ=0.7), 3 A (resistive load)</td>
</tr>
</tbody>
</table>

#### Inputs load sensor

<table>
<thead>
<tr>
<th>Load sensor type</th>
<th>Passive DMS sensor, full bridge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply DMS sensor</td>
<td>+S 10 V DC ± 5 %</td>
</tr>
<tr>
<td>-S 0 V DC</td>
<td></td>
</tr>
<tr>
<td>Load signal input</td>
<td>+IN 2 mV / V,</td>
</tr>
<tr>
<td>-IN 350 Ω</td>
<td></td>
</tr>
<tr>
<td>Measurement range</td>
<td>0...20 mV</td>
</tr>
<tr>
<td>Max. error of measurement at 25 °C referred to the smallest-possible cut-off point</td>
<td>±3 %</td>
</tr>
<tr>
<td>Overload cut-off point</td>
<td>Parameterizable</td>
</tr>
</tbody>
</table>

#### PTC inputs 91 / 92

| Maximum total initial resistance | Max. 1500 Ω (IEC / EN 60947-8) |
| Pick-up resistance              | 2800 ... 3500 Ω                  |
| Maximum release resistance:     | 1650 Ω                           |

#### Environmental conditions

<table>
<thead>
<tr>
<th>Insulation strength</th>
<th>Clearances and creepage distances per IEC / EN 60664</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated insulation voltage 250 V AC</td>
<td></td>
</tr>
<tr>
<td>Pollution degree 2</td>
<td></td>
</tr>
<tr>
<td>Protection class II</td>
<td></td>
</tr>
<tr>
<td>Overvoltage categories III</td>
<td></td>
</tr>
</tbody>
</table>
### 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 x 110 x 75 mm (W x H x D)

### Protection

IP20, EN 60529

### Connection terminals

30 box terminals with captive plus-minus screws  
Per box terminal: 1 x 4 mm² solid or 1 x 2.5 mm² stranded wire with wire ferrules  
or 2 x 1.5 mm² 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: 100 m  
- Temperature inputs: 50 m  
- Sensor inputs (shielded): 5 m

### Safety parameter values per ISO 13849-1

<table>
<thead>
<tr>
<th>SLE 3</th>
<th>Performance level</th>
<th>d</th>
</tr>
</thead>
<tbody>
<tr>
<td>PFH</td>
<td>5.28 E-07</td>
<td></td>
</tr>
<tr>
<td>MTTFd</td>
<td>100 years</td>
<td></td>
</tr>
<tr>
<td>DC</td>
<td>84 %</td>
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<tr>
<td>Response time</td>
<td>850 ms</td>
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### Requirements for sensors:

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<thead>
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<th>Performance level</th>
<th>c</th>
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<tbody>
<tr>
<td>PFH</td>
<td>&lt; 1.08 E-06</td>
</tr>
<tr>
<td>MTTFd</td>
<td>&gt;= 100 years</td>
</tr>
<tr>
<td>Category</td>
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### Requirements for the contactor:

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<thead>
<tr>
<th>Performance level</th>
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<tbody>
<tr>
<td>PFH</td>
<td>&lt; 1.32 E-06</td>
</tr>
<tr>
<td>B10d</td>
<td>&gt; 1,300,000 (assumed cycles/year: 150,000)</td>
</tr>
<tr>
<td>Category</td>
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</table>
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

Temperature range
Software version
Hardware version
Performance level and category per ISO 13849-1
Consecutive identification no.
Device name
Changes to the SLE 3 device setting  –  Serial number: ....................................................

<table>
<thead>
<tr>
<th>Setting</th>
<th>Reason for change</th>
<th>Operator's signature</th>
<th>Service technician's signature</th>
</tr>
</thead>
<tbody>
<tr>
<td>S1</td>
<td>Date ______________</td>
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<tr>
<td>S4</td>
<td>Device Rev. ______</td>
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<tr>
<td>S2</td>
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<tr>
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Annex

Notes