

Curve sensor control unit LCG3

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Read this manual before
installing or commissioning
the product and keep it at
hand for later reference!

EU Declaration of Conformity in accordance with Directive 2014/35/EU, Annex IV

The manufacturer hereby declares under its sole responsibility conformity of the product described below with all relevant harmonization legislation of the European Union at the time of placing on the market.

Designation: Curve sensor control unit

Type: LCG3

Item number: 5351-xxxxxxx

Furthermore, the following directives and standards were applied in the respective applicable areas:

2011/65/EU: RoHS II

2014/30/EU: Electromagnetic Compatibility

2014/35/EU: Low Voltage Directive

EN 50155:2021

Walldorf, 15.12.2024

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UK Declaration of Conformity pursuant to the Electrical Equipment (Safety) Regulations 2016 No. 1101, Annex IV

The manufacturer hereby declares under its sole responsibility conformity of the product described below with all relevant harmonization legislation of the United Kingdom at the time of placing on the market.

Designation: Curve sensor control unit

Type: LCG3

Item number: 5351-xxxxxxx

Furthermore, the following regulations and standards were applied in the respective applicable areas:

Electromagnetic Compatibility Ordinance 2016 No. 1091

Electrical Equipment (Safety) Regulations 2016 No. 1101

The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012 No. 3032

EN 50155:2021

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Warranty

The instructions contain no statements regarding the warranty or liability for defects. That information can be found in our General Terms of Payment and Delivery.

Training

We conduct detailed training in order to enable maximum safety and efficiency. We recommend taking advantage of this training. For further information, contact your authorized SKF dealer or the manufacturer.

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Safety alerts, visual presentation, and layout

While reading these instructions, you will encounter various symbols, illustrations, and text layouts intended to help you navigate and understand the instructions. Their meaning is explained below.

Safety alerts:

Activities that present specific hazards (to life and limb or possible damage to property) are indicated by safety alerts. Always be sure to follow the instructions given in the safety alerts.

DANGER

These safety alerts indicate an imminent danger. Ignoring them will result in death or serious injury

WARNING

These safety alerts indicate potentially imminent danger. Ignoring them could result in death or serious injury

CAUTION

These safety alerts indicate potentially imminent danger. Ignoring them could result in minor injury

NOTICE

These safety alerts indicate a potentially harmful situation. Ignoring them could result in damage to property or malfunctions

Illustrations:

The illustrations used depict a specific product. For other products, they may have the function of a diagram only. This does not alter the basic workings and operation of the product.

Text layout:

- **First-order bulleted lists:** Items on a bulleted list start with a solid black dot and an indent.
 - **Second-order bulleted lists:** If there is a further listing of subitems, the second-order bulleted list is used.
- 1 **Legend:** A legend explains the numbered contents of an illustration, presented as a numbered list. Items in a legend start with a number (with no dot) and an indent.
 - **Second-order legend:** In some cases, the numbered contents of an image represent more than just one object. A second-order legend is then used.
- 1. **Instruction steps:** These indicate a chronological sequence of instruction steps. The numbers of the steps are in bold and are followed by a period. If a new activity follows, the numbering starts again at “1.”
 - **Second-order instruction steps:** In some cases, it is necessary to divide up a step into a few substeps. A sequence of second-order instruction steps is then used.

1 Safety instructions

1.1 General safety instructions

- Putting the products into operation or operating them without having read the instructions is prohibited. The operator must ensure that the instructions are read and understood by all persons tasked with working on the product or who supervise or instruct such persons. Retain the instructions for further use.
- The product may only be used in awareness of the potential dangers, in proper technical condition, and according to the information in this manual.
- Any faults that could affect safety must be remedied according to responsibility. The supervisor must be notified immediately in case of malfunctions outside one's individual scope of responsibility.
- Unauthorized modifications and changes can have an unpredictable effect on safety and operation. Unauthorized modifications and changes are therefore prohibited. Only original SKF spare parts and SKF accessories may be used.
- Any unclear points regarding proper condition or correct assembly/operation must be clarified. Operation is prohibited until issues have been clarified.
- The components used must be suitable for the intended use and the applicable operating conditions, e.g. max. operating pressure and ambient temperature range, and must not be subjected to torsion, shear, or bending.

1.2 General electrical safety instructions

- Electrical devices must be kept in proper condition. This must be ensured by periodic inspections in accordance with the relevant applicable standards and technical rules. The type, frequency, and scope of the inspections must be determined in accordance with the risk assessment to be carried out by the operator. Work on electrical components may be performed only by qualified electricians. Connect the electrical power only in accordance with the valid terminal diagram and in observance of the relevant regulations and the local electrical supply conditions.
- Work on electrical components may be performed only in a voltage-free state and using tools suitable for electrical work. Do not touch cables or electrical components with wet or moist hands.
- Fuses must not be bridged. Always replace defective fuses with fuses of the same type.
- Ensure proper connection of the protective conductor for products with protection class I. Observe the specified enclosure rating.
- The operator must implement appropriate measures to protect vulnerable electrical devices from the effects of lightning during use. The electrical device is not furnished with a grounding system for the dissipation of the respective electric charge and does not have the voltage strength necessary to withstand the effects of lightning.

1.3 General behaviour when handling the product

- Familiarize yourself with the functions and operation of the product. The specified assembly and operating steps and their sequences must be observed.
- Keep unauthorized persons away.
- Wear personal protective equipment always.
- Precautionary operational measures and instructions for the respective work must be observed.
- In addition to these Instructions, general statutory regulations for accident prevention and environmental protection must be observed.
- Precautionary operational measures and instructions for the respective work must be observed. Uncertainty seriously endangers safety.
- Safety-related protective and safety equipment must not be removed, modified or affected otherwise in its function and is to be checked at regular intervals for completeness and function.
- If protective and safety equipment has to be dismantled, it must be reassembled immediately after finishing the work, and then checked for correct function.
- Remedy occurring faults in the frame of responsibilities. Immediately inform your superior in the case of faults beyond your competence.
- Never use parts of the centralized lubrication system or of the machine as standing or climbing aids.

1.4 Persons authorized to use the product

Operator

A person who is qualified by training, knowledge and experience to carry out the functions and activities related to normal operation. This includes avoiding possible hazards that may arise during operation.

Specialist in electrics

Person with appropriate professional education, knowledge and experience to detect and avoid the hazards that may arise from electricity.

Specialist in mechanics

Person with appropriate professional education, knowledge and experience to detect and avoid the hazards that may arise during transport, installation, start-up, operation, maintenance, repair and disassembly.

1.5 Foreseeable misuse

Any usage of the product other than as specified in this manual is strictly prohibited. Particularly prohibited are:

- Use of non-specified consumables, contaminated lubricants, or lubricants with air inclusions.
- Use of C3 versions in areas with aggressive, corrosive substances (e.g., high salt load).

- Use of plastic parts in areas with high exposure to ozone, UV light, or ionizing radiation.
- Use to supply, convey, or store hazardous substances and mixtures as defined in the CLP Regulation (EC 1272/2008) or GHS with acute oral, dermal, or inhalation toxicity or substances and mixtures that are marked with hazard pictograms GHS01-GHS06 and GHS08.
- Use to supply, convey, or store Group 1 fluids classified as hazards as defined in the Pressure Equipment Directive (2014/68/EU) Article 13 (1) a).
- Use to supply, convey, or store gases, liquefied gases, dissolved gases, vapors, or fluids whose vapor pressure exceeds normal atmospheric pressure (1013 mbar) by more than 0.5 bar at their maximum permissible operating temperature.
- Use in an explosion protection zone.
- Use without proper securing against excessively high pressures, in the case of pressurized products.
- Use outside of the technical data and limits specified in this manual.

1.6 Painting plastic components and seals

The painting of any plastic components and seals of the products described is prohibited. Completely mask or remove plastic components before painting the main machine.

1.7 Safety markings on the product

No safety markings on the product

NOTE

In accordance with the results of the workstation risk assessment, additional labels (e.g., warnings, safety signs, prohibition signs, or labels in accordance with CLP/GHS) are to be attached by the operator if necessary.

1.8 Note on the type plate

The type plate provides important data such as the type designation, order number, and sometimes regulatory characteristics. To avoid loss of this data in case the type plate becomes illegible, it should be entered in the manual.

1.9 Emergency shutdown

This is done by a course of action to be defined by the operator.

1.10 Assembly, maintenance, fault, repair

Prior to the start of this work, all relevant persons must be notified of it. At a minimum, the following safety measures must be taken before any work is done:

- Unauthorized persons must be kept away
- Mark and secure the work area
- Cover adjacent live parts
- Dry any wet, slippery surfaces or cover them appropriately
- Cover hot or cold surfaces appropriately

Where applicable:

- Depressurize
- Isolate, lock and tag out
- Check to ensure live voltage is no longer present
- Ground and short-circuit.

The product should be protected as much as possible from humidity, dust, and vibration, and should be installed so that it is easily accessible. Ensure an adequate distance from sources of heat or cold. Any visual monitoring devices present, such as pressure gauges, min./max. markings, or oil level gauges must be clearly visible. Observe the mounting position requirements.

Drill required holes only on non-critical, non-load-bearing parts of the operator's infrastructure. Use existing holes where possible. Avoid chafe points. Immobilize any moving or detached parts during the work. Adhere to the specified torques.

If guards or safety devices need to be removed, they must be reinstalled immediately following conclusion of work and then checked for proper function.

Check new parts for compliance with the intended use before using them.

Avoid mixing up or incorrectly assembling disassembled parts. Label parts. Clean any dirty parts.

2 Overview

2.1 Application

The LCG3 curve sensor control unit is used for wheel flange lubrication in rail vehicles with a compressed air supply (SKF lubrication systems EasyRail Compact, EasyRail Low Pressure, EasyRail High Pressure).

2.1.1 SKF EasyRail Compact

The oil+air technology is the most widespread solution on the market. The lubricant is metered in the pump, and the compressed air acts as the transport medium. The compressed air draws the lubricant into streaks along the tube wall and conveys it to the spray nozzle.

2.1.2 SKF EasyRail Low Pressure

The system does not have a pump, but instead has a reservoir that is pressurized with compressed air. This keeps the lubricant line to the nozzles under slight pressure at all times (subject to the availability of the compressed air). The lubricant is metered directly in the spray nozzle and is expelled with the compressed air.

2.1.3 SKF EasyRail High Pressure

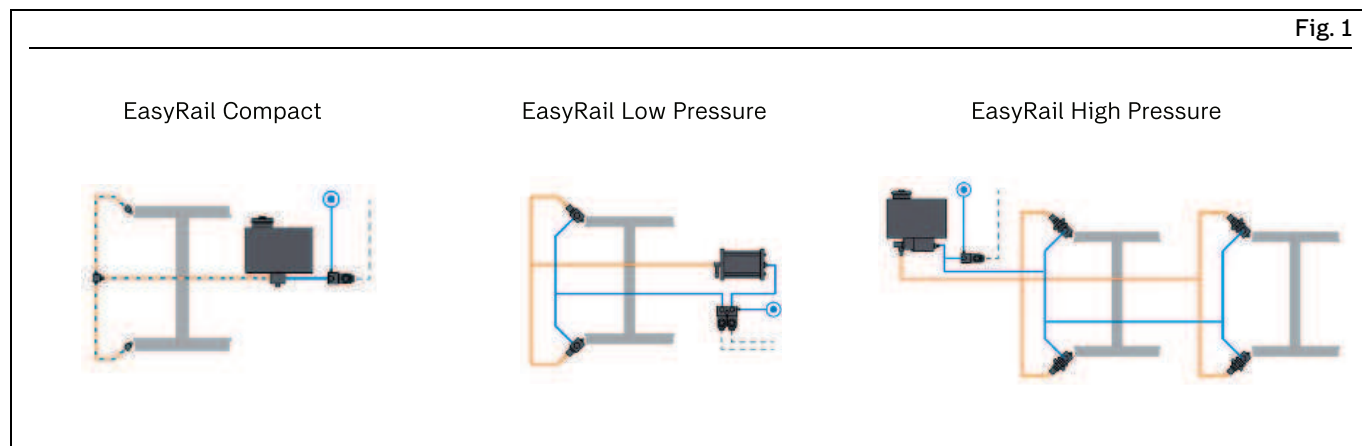
This technology uses a pneumatic pump that can generate high pressures up to 100 bar as needed. It is especially useful for applications with long lubrication lines or multiple connected nozzles. The system withstands harsh environments, including extreme temperatures, dust, snow, and ice. The lubricant is metered directly in the spray nozzle and is expelled by compressed air.

2.2 Operating mode

The curve sensor control unit can control the lubrication of the wheels on each side of the rail vehicle using three operating modes.

2.2.1 Operating mode A

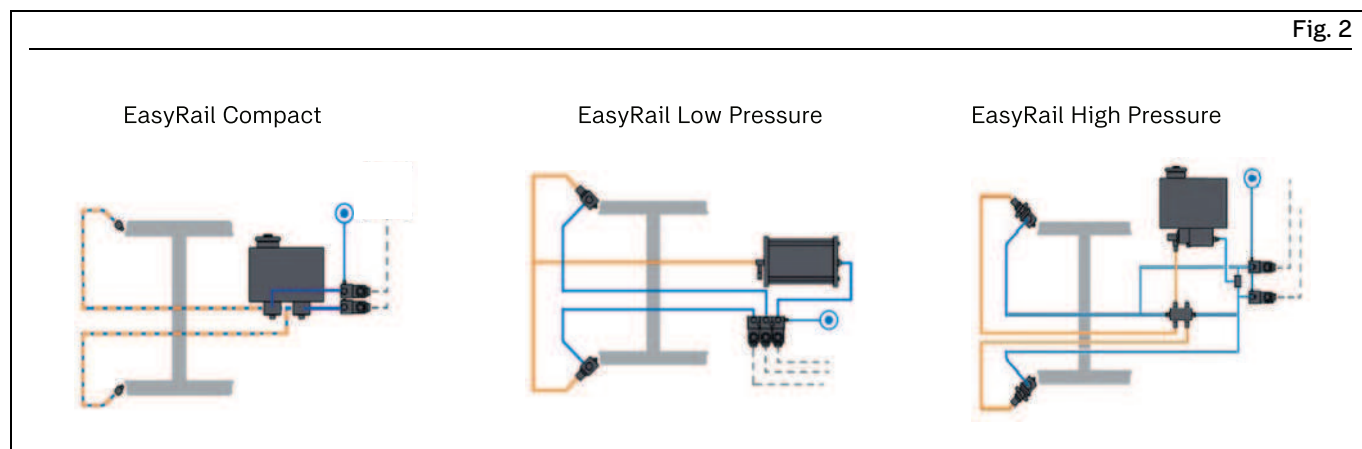
The wheels on both sides of the rail vehicle are lubricated at the same time.



Operating mode A

2.2.2 Operating mode B

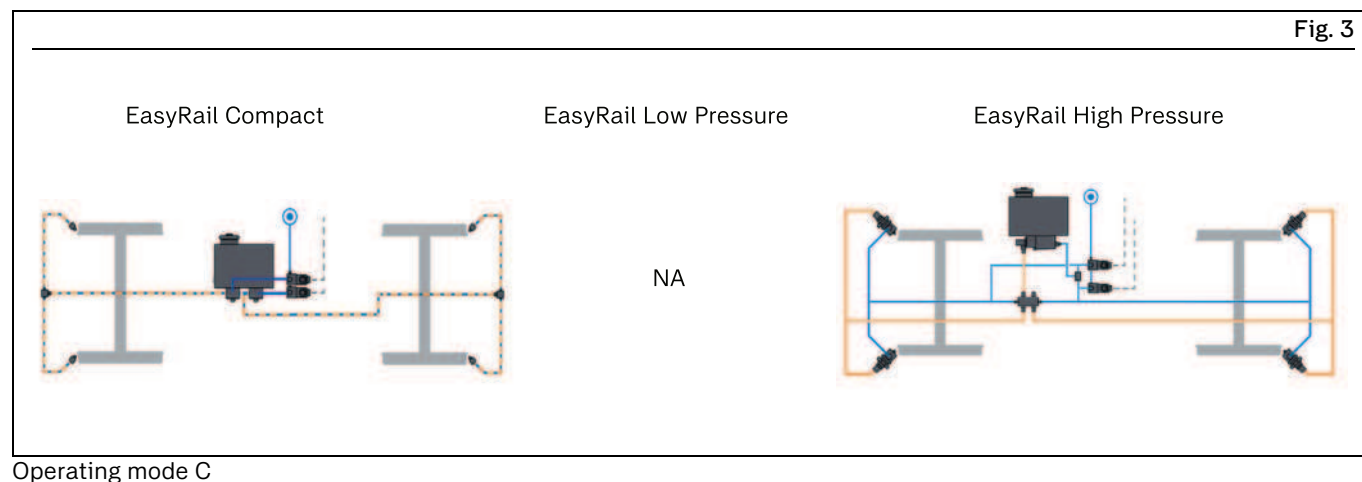
The left-side wheel is lubricated independently from right-side wheel.



Operating mode B

2.2.3 Operating mode C

According to the driving direction the wheels of the leading axle will be lubricated.



2.3 Designs

The LCG3 is available in two operating voltage designs. The exterior difference between these two designs is to be found in the housing structure and its dimensions. There are versions with a built-in display or with a portable display. The functions of the units are identical.

Table 1

LCG3 - Type identification mode

LCG3 - X 0 0 - X 0 0

Operating voltage

A = 24 VDC

B = 110 VDC

Software version

Display

D = with built-in display

X = with portable display

Mechanical version

3 Function

3.1 Operating modes

NOTE

In the following, we describe EasyRail mode B, which is when two valves (R and L) are activated, so that the left wheel is lubricated independently of the right wheel.

The valves of the lubrication system can be activated according to three submodes:

- time-dependent
- curve-dependent
- time and curve-dependent

3.1.1 Enable signal

In the three submodes, the vehicle control must apply an enable signal (switching contact **FG** closed) before spraying cycles can be triggered.

The enable contact **FG** can open depending on usage, such as when the speed falls below a specified minimum, when the vehicle is stationary, or during a braking or sanding procedure.

3.1.2 Time-dependent control

3.1.2.1 Lead time

When the operating voltage of the curve sensor control unit is switched on, a random number generator specifies a lead time in seconds between the set value of the pause time (tp) and the set value of the spray period time T. This is done in order to better distribute the lubricant along the rail network.

If all spray enable conditions are met, the operational sequence begins with this lead time; once this lead time has elapsed, the first time-dependent spray process is performed and the spray period starts according to the preselected time.

3.1.2.2 Spray process

At the start of the spray process, an initial spraying cycle is triggered for valve R. Immediately after that, a second spraying cycle is triggered for valve L.

Spraying cycles consists of a spray time (ts) and a pause time (tp). Both of these times are set by the operator (→ section 7.3.3 and 7.3.4) and are the same for both valves.

After the second spraying cycle, a spray period time (T) begins. There is no lubrication during this time. This time is likewise set by the operator (→ section 7.3.5).

At the end of the spray period time, the spray process is complete and a new spray process begins.

Spray process:

Valve R spraying cycle (ts + tp) + valve L spraying cycle (ts + tp) + period time (T).

NOTE

With time-dependent control, the wheels on both sides of the rail vehicle are lubricated evenly, regardless of whether the rail vehicle is traveling in a straight line or on a curve.

3.1.2.3 Spray enable

If the enable contact **FG** is opened during an ongoing spraying cycle (tp + ts), then that cycle will still be carried out to completion. The spray process is then stopped.

If the enable contact **FG** is opened within the spray period time, the spray period time is stopped and no more spraying cycles are started.

When the switching contact **FG** is closed again, first a lead time elapses. After that time, a new spray process begins.

3.1.3 Curve-dependent lubrication

3.1.3.1 Spray process

The curve sensor integrated into the LCG3 detects the curve direction while the rail vehicle is traveling through a curve and outputs a corresponding signal once a user-definable angular velocity is reached. The control evaluates the signal and, if the spray enable conditions are met, it triggers spraying cycles via the valve R or L, whichever is responsible for the wheels on the outer side of the curve.

Spraying cycles consists of a spray time (ts) and a pause time (tp). Both of these times are set by the operator and are the same for both valves.

Spraying cycles keep being triggered as long as the curve direction signal remains active.

NOTE

With curve-dependent control, the wheels are not lubricated on either side of the rail vehicle when traveling on straight sections of track.

3.1.3.2 Spray enable

If the enable contact **FG** is opened during an ongoing spray cycle (tp + ts), then that cycle will still be carried out to completion. The spray process is then stopped.

When the enable contact **FG** is closed again, spraying cycles are triggered when the curve direction signal is active.

3.1.4 Time- and curve-dependent control

With this operating mode, the operational sequence starts when all the spray enable conditions are met. It starts with a lead time (→ section 3.1.2.1).

When traveling on straight sections of track, control of lubrication is time-dependent (→ section 3.1.2) and when traveling around curves, it is curve-dependent (→ section 3.1.3).

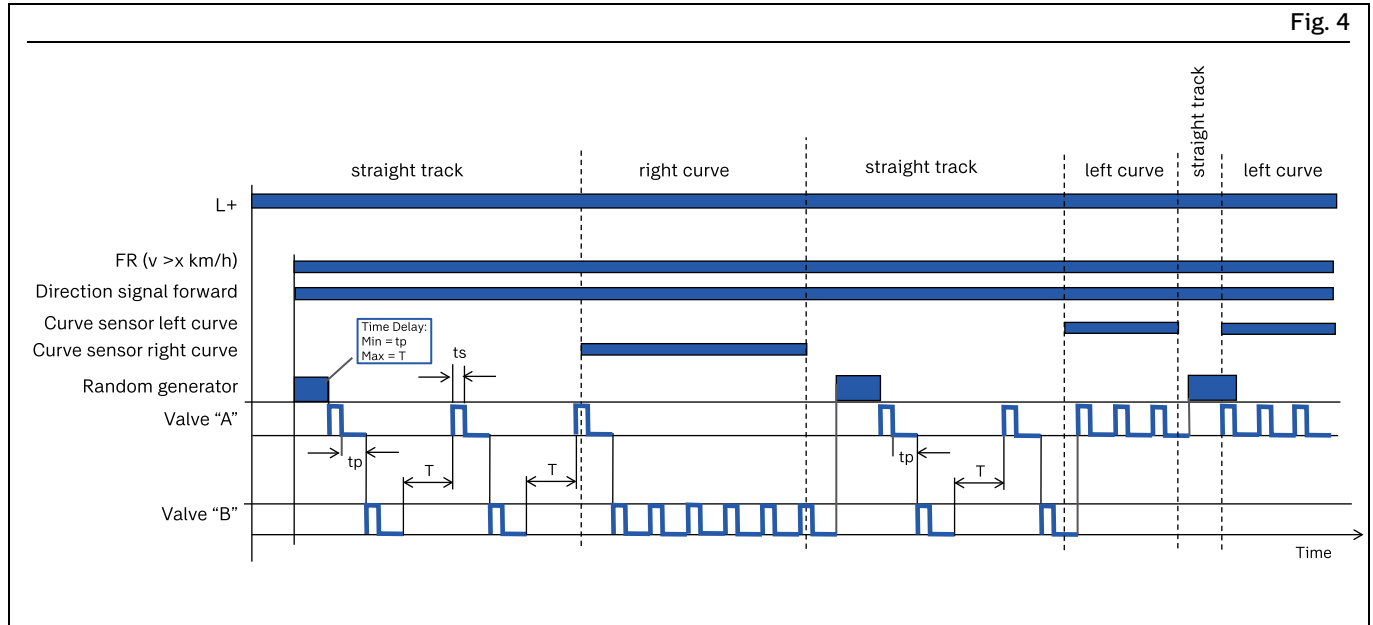
3.1.4.1 Curve detected during a time-dependent spray process

- If the lead time is elapsing, the lead time is stopped and the curve-dependent spraying cycles are triggered.
- If the time-dependent spraying cycle is being carried out, it is carried out to completion. Then the curve-dependent spraying cycles are triggered.

- If the spray period time is elapsing, it is interrupted. The curve-dependent spraying cycles are triggered.

3.1.4.2 Curve no longer detected during a curve-dependent spray process

- The active curve-dependent spraying cycle is carried out to completion. After that, the lead time is specified by a random number generator. At the end of this lead time, the time-dependent spray process is triggered.



LCG3 operational sequence

4 Technical data

Table 2

General technical data for LCG3



24 V DC version with display



24 V DC version without display



110 V DC version without display

Housing

Material	Aluminum		
Weight	1.5 kg	1.5 kg	2 kg
Fixing screws	DIN EN ISO-M6-8.8 (4×)		
Protection class according to DIN EN 60529	IP65		
Mounting position	Vertical, cable glands pointing downwards		
Threaded hole for cable gland	1 × M25×1,5 2 × M20×1,5	1 × M25×1,5 2 × M20×1,5	1 × M25×1,5 2 × M20×1,5

Ambient conditions

Temperature class acc. to: DIN EN 50155: 2008-03	T1
Ambient temperature	-25 °C to +70 °C
Air humidity acc. to DIN EN 50125-1:2014	Corresponding to temperature class T1
Altitude/air pressure acc. to DIN EN 50125-1:2014	Class A2 (up to 1000 m)
Shock and vibration according to DIN EN 61373:2011-04	Cat. 1 Class A

Electrical connection

Connection type	Push-in terminals
Conductor cross-section flexible without/with ferrule	0,08 ... 2,5 mm ² / 28 ... 12 AWG
Stripping length of conductors	Note (conductor cross-section): 12 AWG: THHN, THWN 7 ... 9 mm

Table 3

LCG3 functional characteristics



24 V DC version with display



24 V DC version without display



110 V DC version without display

Curve sensor setting range	0.1 ... 5°/s (dps) – in increments of 0.25
Spray period time T for time-dependent spraying	1 ... 999 s
Spray pause time tp	1 ... 15 s
Spray time ts	1 ... 10 s
Master password	0337
Default password	5555

Table 4

Electrical characteristics for LCG3



24 V DC version with display



24 V DC version without display



110 V DC version without display

Power supply L+/M

Nominal voltage UN	DC 24 V	DC 72 V ... DC 110 V
Minimum voltage	$0.7 \times UN$	$0.7 \times UN$
Rated voltage	$1.15 \times UN$	$1.15 \times UN$
Maximum voltage	$1.25 \times UN$	$1.25 \times UN$
Standby current consumption @ 1.15 UN (without output load)	approx. 20 mA	approx. 23 mA
Rated connected load (depends on output load)	approx. 0.5 W + output load	approx. 3 W + output load
Device protection	Yes	Yes
Reverse voltage protection	Yes	Yes
Back-up fuse for line protection	min. T 1 A, max. T 6 A	min. T 1 A, max. T 2 A

Outputs A1, A2

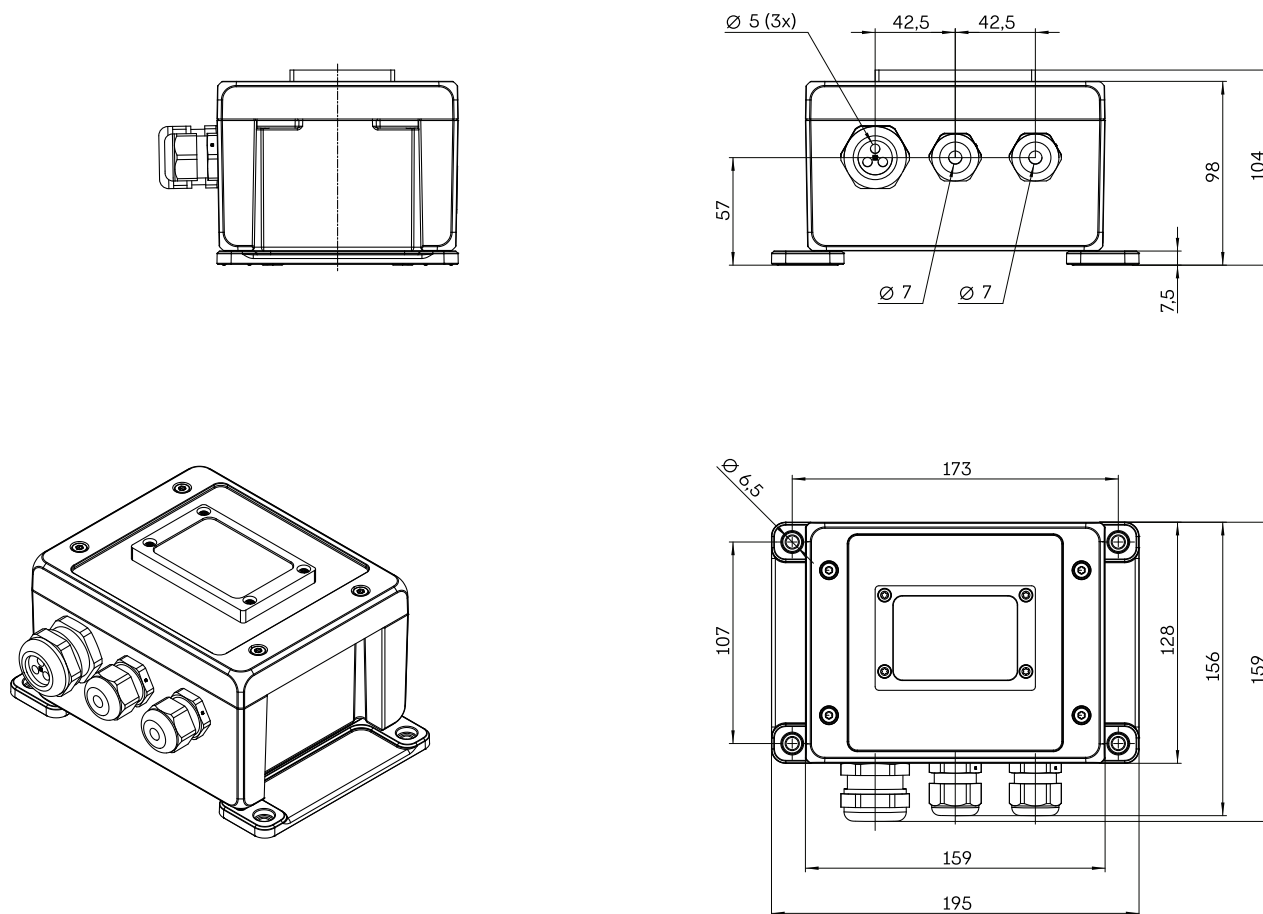
Switching output	Solid state switch, high-side	Solid state switch, high-side
Output voltage UA	Operating voltage minus voltage drop (UA = UB - UF)	Operating voltage minus voltage drop (UA = UB - UF)
Voltage drop UF	approx. 70 mV @ IL = 0.66 A	$\leq 3 \text{ V @ IL} = 0.2 \text{ A}$
Max. output current	0.66 A	0.22 A
Max. output load	16 W	16 W
Overload protection	Yes	Yes
Short-circuit protection	Yes	Yes

Inputs FG, VR, DK

Input voltage	DC 24 V	DC 72 V... DC 110 V
Input current	approx. 8 mA	approx. 2.7 mA to 4.2 mA
Input impedance	approx. 3.3 kΩ	26 kΩ
Signal "1" level	$\geq 12 \text{ V}$	$\geq 30 \text{ V}$
Signal "0" level	$\leq 3 \text{ V}$	$\leq 2.5 \text{ V}$

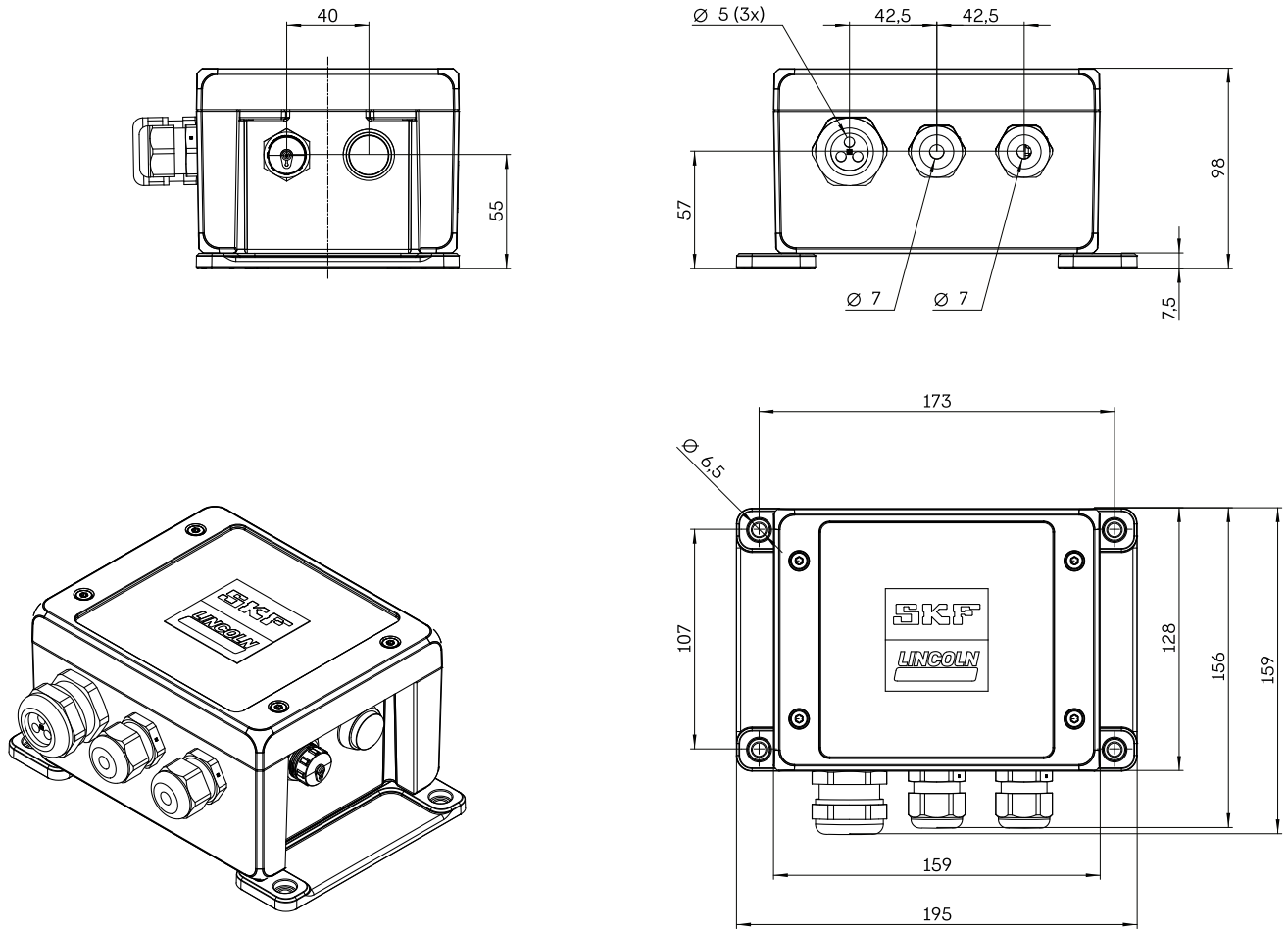
4.1 Curve sensor dimensions

Fig. 5



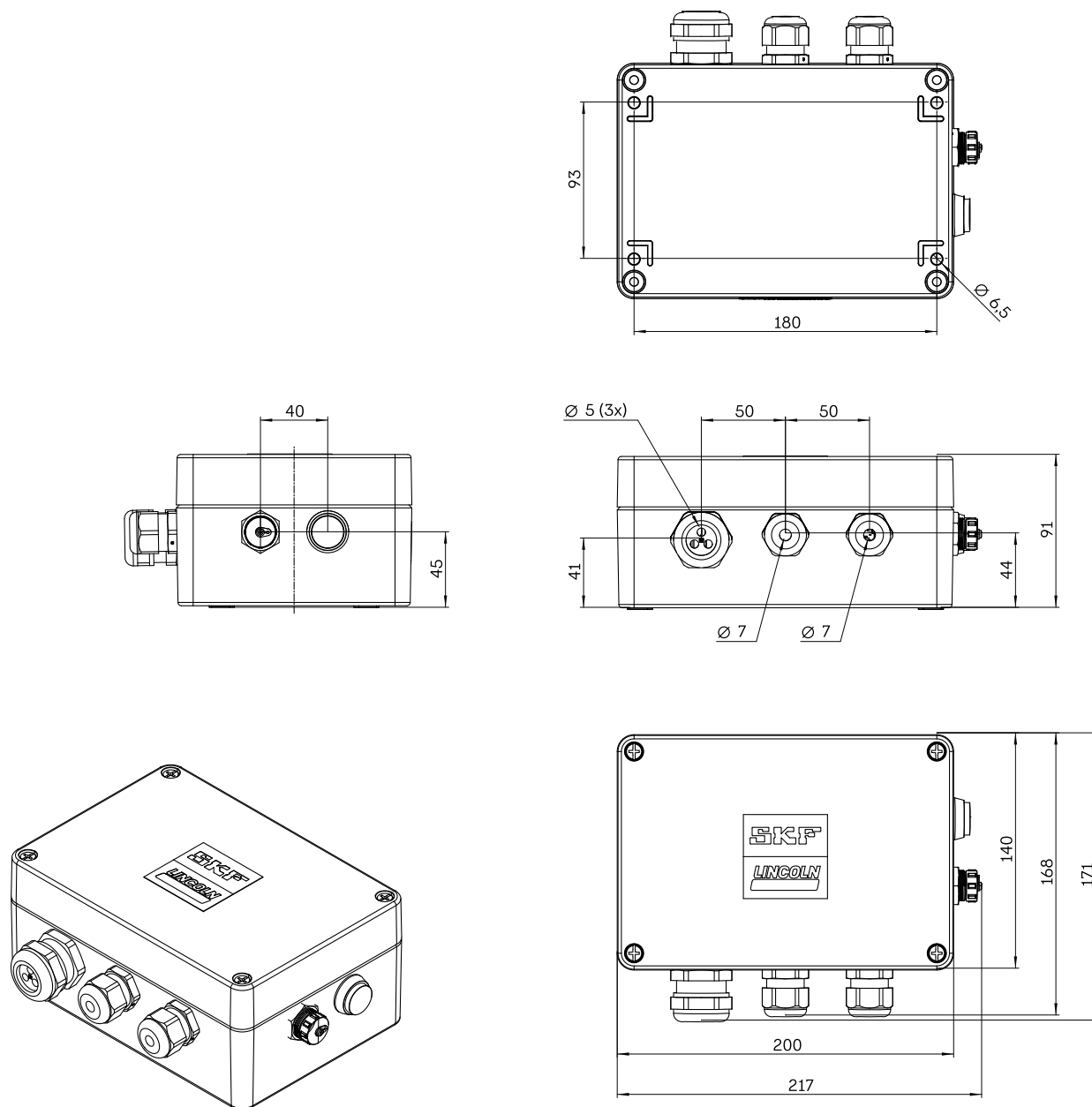
Dimensions of curve sensor, 24 V DC version with display

Fig. 6



Dimensions of curve sensor, 24 V DC version without display

Fig. 7



Dimensions of curve sensor, 110 V DC version without display

5 Delivery, returns, storage

5.1 Delivery

After receipt of the shipment, it must be inspected for any shipping damage and for completeness according to the shipping documents. Immediately inform the transport carrier of any shipping damage. The packaging material must be preserved until any discrepancies are resolved.

5.2 Return shipment

Before return shipment, all contaminated parts must be cleaned. If this is not possible or practical, e.g. if it would impede fault detection in the case of complaints, the medium used must always be specified. In the case of products contaminated with hazardous substances as defined by GHS or CLP regulations, the safety data sheet (SDS) must be sent with the product and the packaging must be labelled in accordance with GHS/CLP. There are no restrictions for land, air, or sea transport. The choice of packaging should be based on the specific product and the stresses to be expected during transport (e.g., necessary anti-corrosion measures in the case of shipment by sea). In the case of wooden packaging, the applicable import regulations and the IPPC standards must be observed. Required certificates must be included in the shipping documents. The following information, as a minimum, must be marked on the packaging of return shipments.



Marking of return shipments

5.3 Storage

The following conditions apply to storage:

- Dry, low-dust, vibration-free, in closed rooms
- No corrosive, aggressive substances at the storage location (e.g., UV rays, ozone)
- Protected against animals (insects, rodents)
- If possible, keep in the original product packaging
- Protected from nearby sources of heat or cold
- In the case of large temperature fluctuations or high humidity, take appropriate measures (e.g., heating) to prevent the condensation of water
- Before usage, check products for damage that may have occurred during storage. This applies in particular to parts made of plastic (due to embrittlement).

5.4 Storage temperature range

For parts not filled with lubricant, the permitted storage temperature is the same as the permitted ambient temperature range (see "Technical data").

6 Assembly

6.1 General

Only qualified technical personnel may install, operate, maintain and repair the curve sensor control units of the LCG3 series. Qualified technical personnel are persons who have been trained, assigned, and instructed by the owner-operator of the final product into which the product described here is incorporated. Such persons are familiar with the relevant standards, rules, accident prevention regulations, and operating conditions as a result of their training, experience, and instruction. They are qualified to carry out the required activities and in doing so recognize and avoid potential hazards.

The definition of qualified personnel and the prohibition against employing non-qualified personnel are laid down in DIN VDE 0105 and IEC 364.

Before assembling the curve sensor control units, the packaging material and any shipping braces must be removed.

6.2 Setup and attachment

The curve sensor control unit should be installed in a place protected from contamination, water splashes, and vibrations. It should be easily accessible so that all further installation work can be performed without difficulty and the control unit can be configured easily later. Avoid installation on vibrating walls or parts.

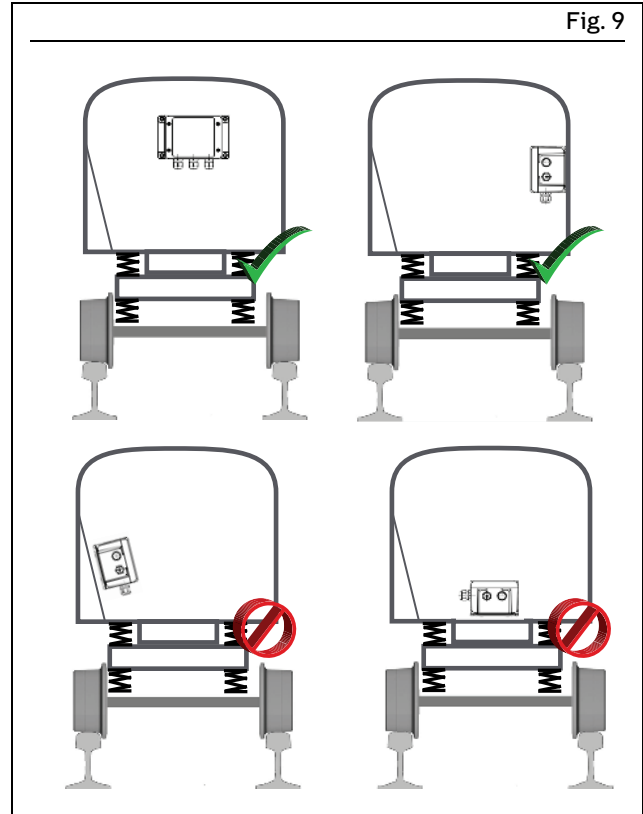
6.2.1 Installation location pursuant to DIN EN 61373, Appendix C

- Within the vehicle body or within a rooftop or substructure cabinet fastened on the vehicle body, if the unit has an integrated display. Units that do not have a display do not need to be installed in any protective housing.
- Do not fasten it to the bogie!

6.2.2 Mounting position

- In any direction on a vertical wall
- Cable glands vertical pointing downwards
- Horizontal installation is also possible if curve-dependent spraying is not to be performed

Fig. 9



LCG3 mounting position

Assembly holes must be drilled according to the drawings (section 4.1).

In addition, design specifications and conditions of the railway vehicle manufacturer must be observed.

During installation and especially when drilling, always pay attention to the following:

- Ensure sufficient clearance under the device for subsequent laying of electrical lines. The minimum bending radii of the lines according to the manufacturer's specifications must be observed while doing so.
- Also ensure enough space around the pushbutton DK for it to be pressed by hand and for connection of the portable display.
- Existing supply lines must not be damaged by the installation work.
- Other units must not be damaged by the installation work.
- The product must not be installed within range of moving parts
- The product must be installed at an adequate distance from sources of heat

6.3 Installing the curve sensor control units of the LCG3 series

The curve sensor control unit must be mounted by the customer, who must also select the appropriate mounting hardware.

6.3.1 24 V DC control unit

With this version, the unit remains closed and the 4 lugs on the side with the holes (diameter 6.5 mm) can be used for mounting.

1. Assembly holes must be drilled on the mounting location according to the relevant illustrations (Fig. 5 or Fig. 6, respectively). Deburr and prime the assembly holes
2. Pass fixing screws through the fixing holes in the control unit's housing and mounting location. If necessary, gently tighten the washers and self-locking nuts
3. Align the control unit housing

NOTICE



Tightening torque

Make sure that torque is adequate when installing the curve sensor control unit!

4. Securely tighten the hexagon socket screws

6.3.2 110 VAC control unit

With this version, you must first unscrew the cover of the unit in order to reach the mounting holes (diameter 6.5 mm).

1. Assembly holes must be drilled on the installation location according to the relevant illustrations (Fig. 7). Deburr and prime the assembly holes
2. Unscrew the cover screws (4×) on the cover of the curve sensor control unit using a screwdriver (Phillips) and remove the cover. The cover is attached to the housing by a grounding cable and should therefore be set down carefully, or securely hung up somewhere.

CAUTION



Electrostatic charge and discharge (ESD)

The curve sensor control units contain electronic components that can be destroyed by accidental electrostatic charge or discharge (ESD). To prevent possible damage due to ESD, hands and any tools must be discharged on a bare grounded position on the railway vehicle prior to performing any work in the area of the printed circuit board. Conductors or component connections within the device must not be touched under any circumstances

3. Pass fixing screws through the fixing holes in the control unit's housing and mounting location. If necessary, gently tighten the washers and self-locking nuts
4. Align the control unit housing

NOTICE



Tightening torque

Make sure that torque is adequate when installing the curve sensor control unit!

5. Securely tighten the hexagon socket screws
6. Screw the cover on the curve sensor control unit again
– Tightening torque: 5 Nm ±0.5 Nm

6.4 Electrical connection

⚠ WARNING



Electric shock

Work on electrical components may be performed only by qualified electricians.



At a minimum, the following safety measures must be taken before any work on electrical components is done:

- Isolate, lock and tag out
- Check to ensure the absence of voltage
- Ground and short-circuit the product
- Cover any live parts in the surrounding area

⚠ CAUTION



Electric shock

The available mains voltage (supply voltage) must be in accordance with the specifications on the type plate of the curve sensor control unit. The LCG3 control units contain a device protection. The customer must install line protection that is suitable for the conductor cross-section and length, the power consumption of the control unit, and possible short-circuit current. Incorrect sizing may result in bodily injury and property damage.

Observe the following instructions for a safe connection:

- The electrical connection must comply with the specifications of the standards of the DIN VDE 0100 series or the standards of the IEC 60364 series, as applicable.
- The rules for railway applications pursuant to DIN EN 50343 must be observed during installation of the electrical lines.
- Connect the electrical lines in such a way that no mechanical forces are transferred to the product.
- Flexible electrical installation pipes as well as cables and lines must be laid in such a way that fluids flow away from the screw unions.

NOTICE



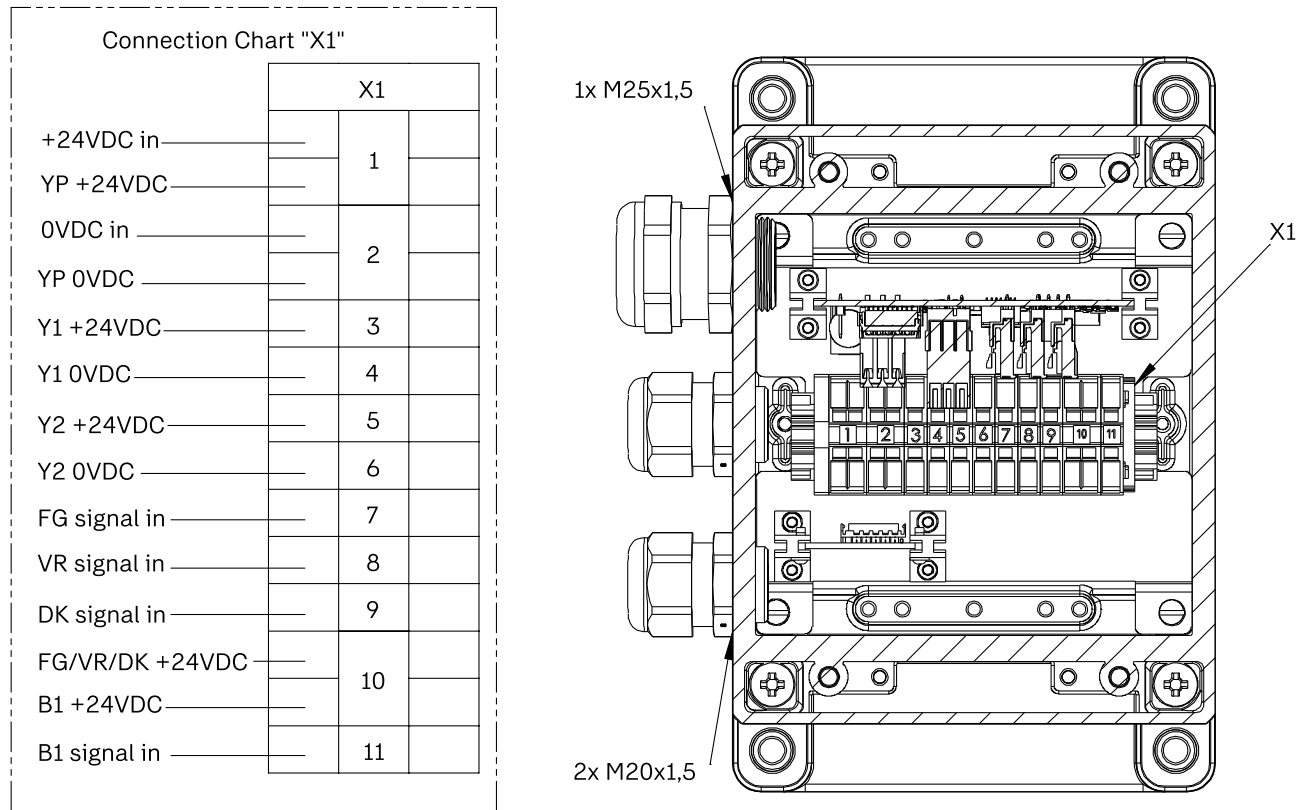
Interference fields

When establishing the curve sensor control unit's electrical connection, ensure that appropriate measures prevent interference between signals due to inductive, capacitive or electro-magnetic couplings. Shielded cables must be used in places where electrical interference fields can distort signal transmissions despite separate laying of cables.

The rules and empirical values for "EMC-compliant" cabling must be taken into consideration.

6.4.1 Control unit 24 V DC with built-in display

Fig. 10



Electrical connection – 24 V DC with built-in display

Table 5

Electrical connection – 24 V DC with built-in display

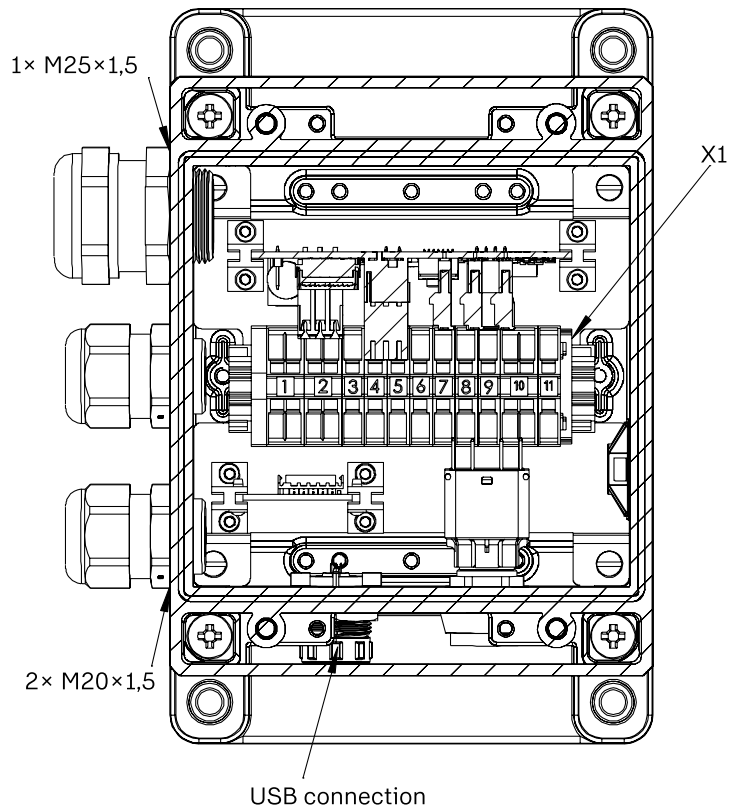
Designation	Description	Function
YP	Electromagnetic valve P	Pressurization of the reservoir*)
Y1	Electromagnetic valve 1	Y1 is the valve for the nozzle on the left wheel in the direction of travel
Y2	Electromagnetic valve 2	Y2 is the valve for the nozzle on the right wheel in the direction of travel
FG	Switching contact on vehicle for spray enable	e.g., switching signal for vehicle speed $v > 5$ km/h.
VR	Direction of travel input (used only for operation in two directions of travel)	Switchover to direction of travel 2 Direction of travel 1 (VR = OFF), Direction of travel 2 (VR = ON)
DK	Pushbutton on the control unit	Manual triggering for spraying cycle (additional lubrication) or line filling
B1	Connection for later applications	

*) When the control unit is used in the "EasyRail Low Pressure" system

6.4.2 24 V DC control unit with USB port for a portable display

Fig. 11

Connection Chart "X1"		
	X1	
+24VDC in	1	
YP +24VDC	2	
0VDC in	3	
YP 0VDC	4	
Y1 +24VDC	5	
Y1 0VDC	6	
Y2 +24VDC	7	
Y2 0VDC	8	
FG signal in	9	
VR signal in	10	
DK signal in	11	
FG/VR/DK +24VDC		
B1 +24VDC		
B1 signal in		



Electrical connection – 24 V DC with portable display (USB port)

Table 6

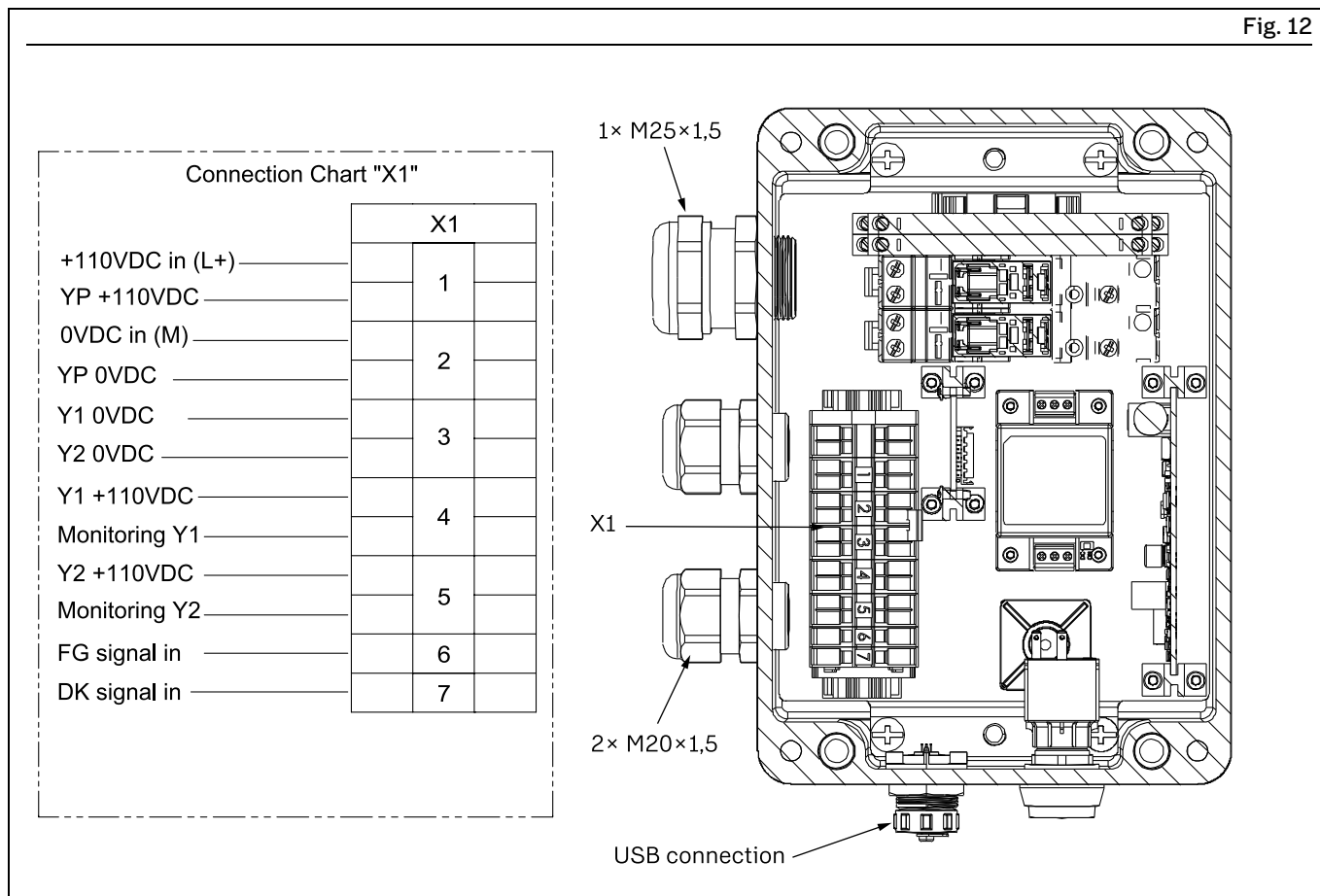
Electrical connection – 24 V DC with portable display

Designation	Description	Function
YP	Electromagnetic valve P	Pressurization of the reservoir*)
Y1	Electromagnetic valve 1	Y1 is the valve for the nozzle on the left wheel in the direction of travel
Y2	Electromagnetic valve 2	Y2 is the valve for the nozzle on the right wheel in the direction of travel
FG	Switching contact on vehicle for spray enable	e.g., switching signal for vehicle speed $v > 5$ km/h.
VR	Direction of travel input (used only for operation in two directions of travel)	Switchover to direction of travel 2 Direction of travel 1 (VR = OFF), Direction of travel 2 (VR = ON)
DK	Pushbutton on the control unit	Manual triggering for spraying cycle (additional lubrication) or line filling
B1	Connection for later applications	

*) When the control unit is used in the "EasyRail Low Pressure" system

6.4.3 110 V DC control unit with USB port for a portable display

Fig. 12



Electrical connection – 110 V DC with portable display (USB port)

Table 7

Electrical connection – 110 V DC with portable display

Designation	Description	Function
YP	Electromagnetic valve P	Pressurization of the reservoir*)
Y1	Electromagnetic valve 1	Y1 is the valve for the nozzle on the left wheel in the direction of travel
Y2	Electromagnetic valve 2	Y2 is the valve for the nozzle on the right wheel in the direction of travel
FG	Switching contact on vehicle for spray enable	e.g., switching signal for vehicle speed $v > 5$ km/h.
DK	Pushbutton on the control unit	Manual triggering for spraying cycle (additional lubrication) or line filling

*) When the control unit is used in the "EasyRail Low Pressure" system

7 First start-up

7.1 Commissioning

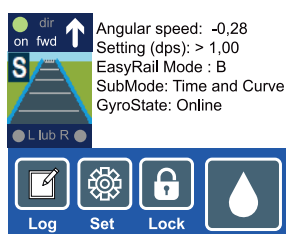
When commissioning, first fill the lubricant reservoir and the lubricant lines. To do so, follow the instructions in the system description.

You can also do a test drive with the factory settings so you can check the settings, especially those of the curve sensor. The correct setting depends on the route profile and the question of how fast the vehicle moves through the curves.

7.2 Program structure

Below you can see an overview of the program structure of the control unit and its possible functions and setting options. For details, see the relevant sections.

Table 8



This menu is for activating the screensaver.

Info This shows general information for the control unit (e.g., name, item number) and also the hardware and software specifications.

View Settings This is used for displaying the current operating mode and its parameters.

Change Settings This is used for changing the operating mode and its parameters.

Set Password This is used for changing the device password.

Error Display of errors that have occurred.

Warning Display of warnings that have occurred.

Thermometer icon Display of the current device temperature.

Clock icon Display of the total operating values of the control unit

Info Display of operating information received

Program structure of the control unit

7.3 Setting parameters

7.3.1 Modifying settings

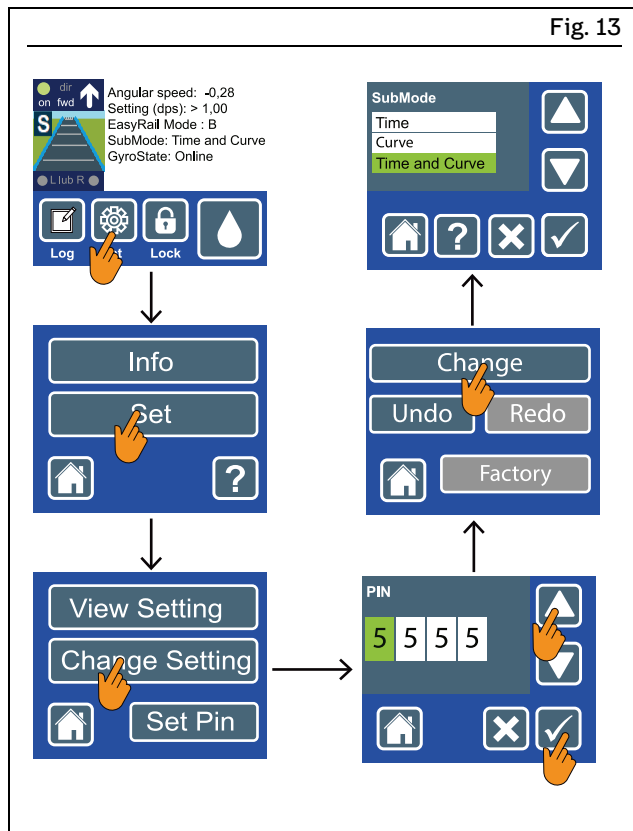
To modify the parameters, proceed as follows:

1. Press “Set”, and then on the next screen, again press “Set” and then “Change Settings”.
2. Enter the 4 digit device password and confirm it with the “checkmark” icon.

NOTE

If you have entered the wrong device password, the 4 digits will be shown in red. In that case, enter the password again with the correct digits.

The device password that was set at the factory can be found in section 4.



Modifying settings

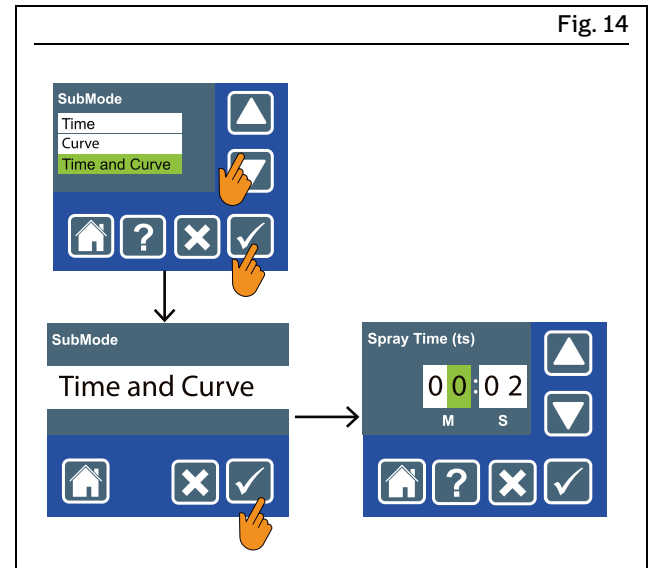
3. Press “Change”. The first parameter to be set is displayed.

A total of five parameters are set.

- The operating mode (SubMode)
- The spray time (Spray Time)
- The pause time (Pause Time)
- The spray period time (Hold Time)
- The angular velocity (Angular speed)

7.3.2 Selecting the SubMode

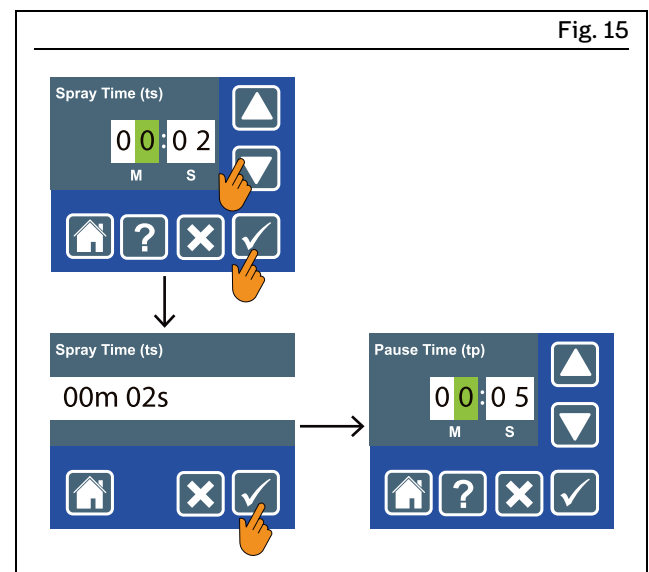
1. Select the operating mode and confirm your selection by pressing the “checkmark” icon. The set value will then be displayed again.
 2. Confirm it by pressing the “checkmark” icon. The next parameter is displayed.
- Factory setting: Time and Curve



Selecting the SubMode

7.3.3 Setting the spray time

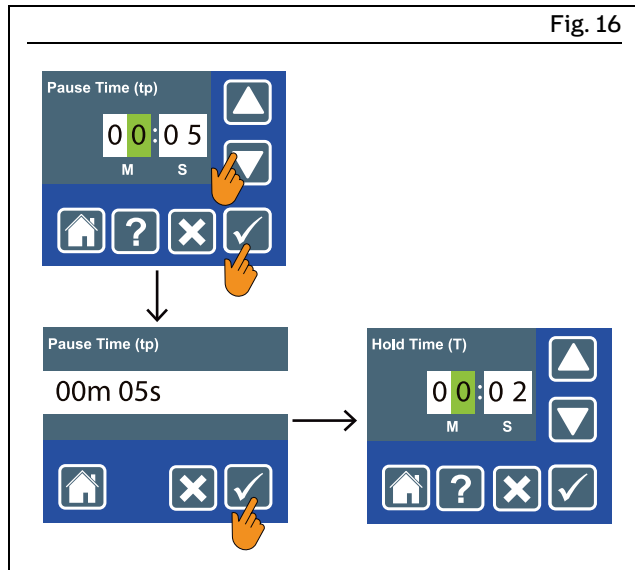
1. Enter the spray time (ts) and confirm each digit by pressing the “checkmark” icon. The set value will then be displayed again.
 2. Confirm it by pressing the “checkmark” icon. The next parameter is displayed.
- Factory setting: 2 s
 - Setting range: min. 1 s, max. 10 s



Setting the spray time

7.3.4 Setting the pause time

1. Enter the pause time (tp) and confirm each digit by pressing the “checkmark” icon. The set value will then be displayed again.
 2. Confirm it by pressing the “checkmark” icon. The next parameter is displayed.
- Factory setting: 5 s
 - Setting range: min. 1 s, max. 15 s

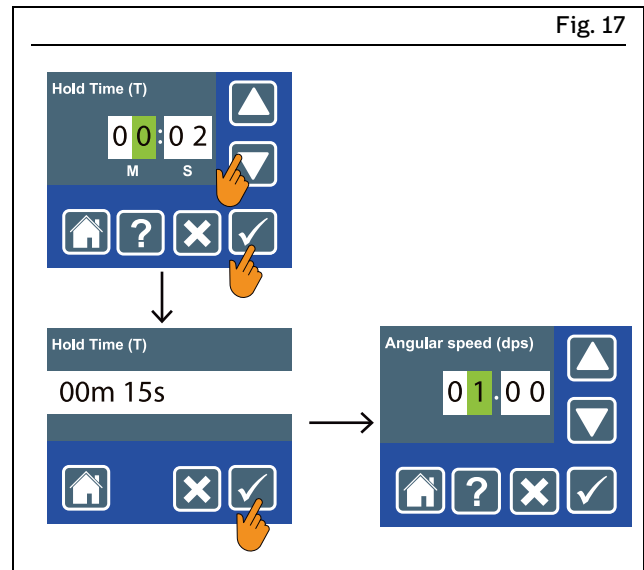


Setting the pause time

7.3.5 Setting the spray period time

1. Enter the spray period (T) time and confirm each digit by pressing the “checkmark” icon. The set value will then be displayed again.
2. Confirm it by pressing the “checkmark” icon. The next parameter is displayed.

- Factory setting: 5 min
- Setting range: min. 1 s, max. 15 min



Setting the spray period time

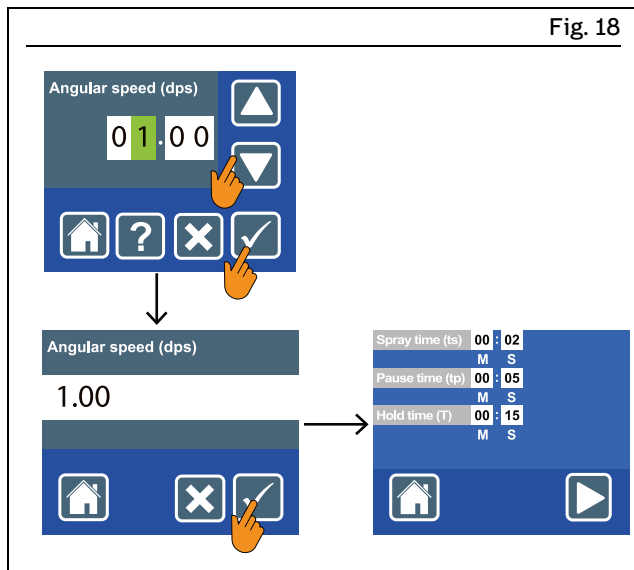
7.3.6 Setting the curve sensor sensitivity

The procedure for determining curve sensor sensitivity is identical in all relevant operating modes. For commissioning, the curve sensor sensitivity can be set to 01.00 dps. A test drive with varying settings is recommended to determine whether there is a sensitivity more suitable for the existing route profile. The curve sensor sensitivity is set in increments of 0.25 dps each.

1. Enter the curve sensor sensitivity and confirm by pressing the “checkmark” icon. The set value will then be displayed again.
2. Confirm it by pressing the “checkmark” icon. An overview of the parameters is displayed.

- Factory setting: 1 dps
- Setting range: 1 – 5°/s (dps)

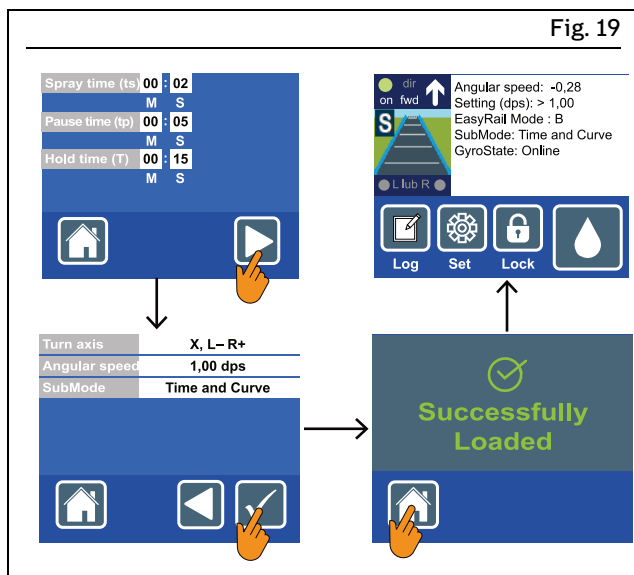
Fig. 18



Setting the curve sensor sensitivity

7.3.7 Overview of the parameters

1. All the set values for the curve sensor will be displayed again. Confirm them by pressing the “checkmark” icon. “Successfully Loaded” will appear on the display.



Overview of parameters

7.4 Changing the control unit password

NOTE

The master password supplied with the curve sensor control unit cannot be changed. Only the specific control unit password can be changed. The control unit password that was set at the factory and the master password can be found in section 4.

Proceed as follows to change the control unit password:

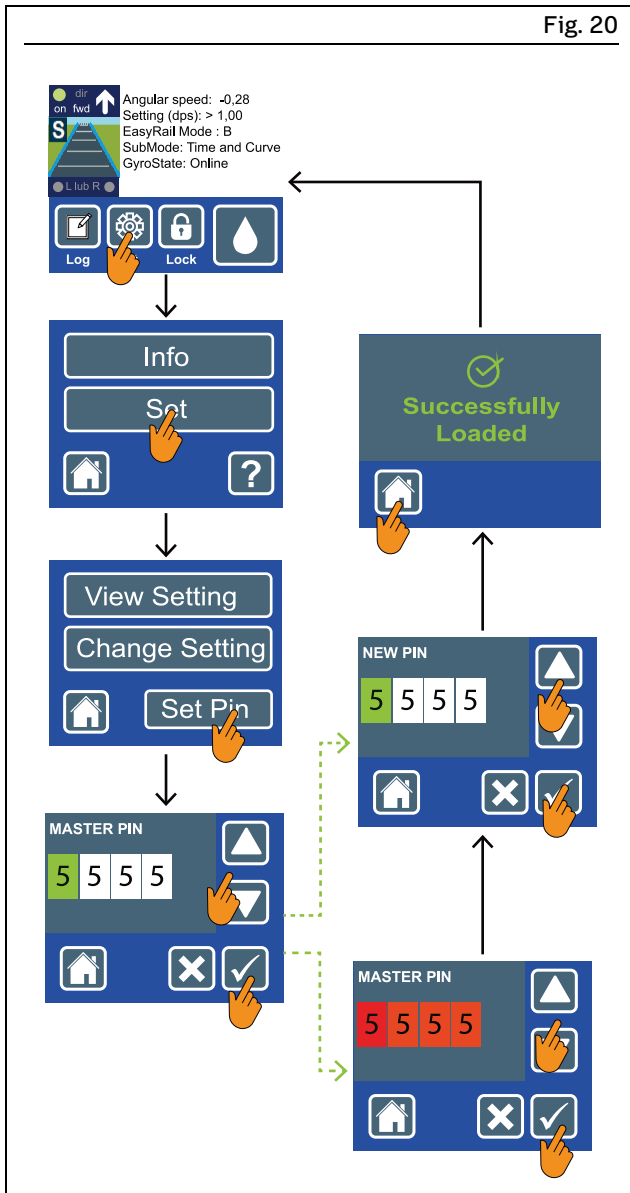
1. Press “Set”, and then on the next screen, again press “Set” and then “Set PIN”.
2. Enter the master password and confirm each digit by pressing the “checkmark” icon.

NOTE

If you have entered the wrong master password, the 4 digits will be shown in red. In that case, enter the password again with the correct digits.

3. After successfully entering the master password, enter the new 4 digit control unit password. You then see “Successfully Loaded” on the display.
4. Press the “house” icon to go to the start display.

Fig. 20



Changing the control unit password

7.5 Undo/redo

Undo reverses the last changes. Redo restores the last changes. If no settings have been changed since the curve sensor was delivered, undo/redo are not possible.

NOTE

Undo/redo will also change the device password. Make sure you know both the previous and current device password. Otherwise you will only be able to make modifications on the curve sensor by entering the master password and setting a new device password.

To execute undo/redo, proceed as follows:

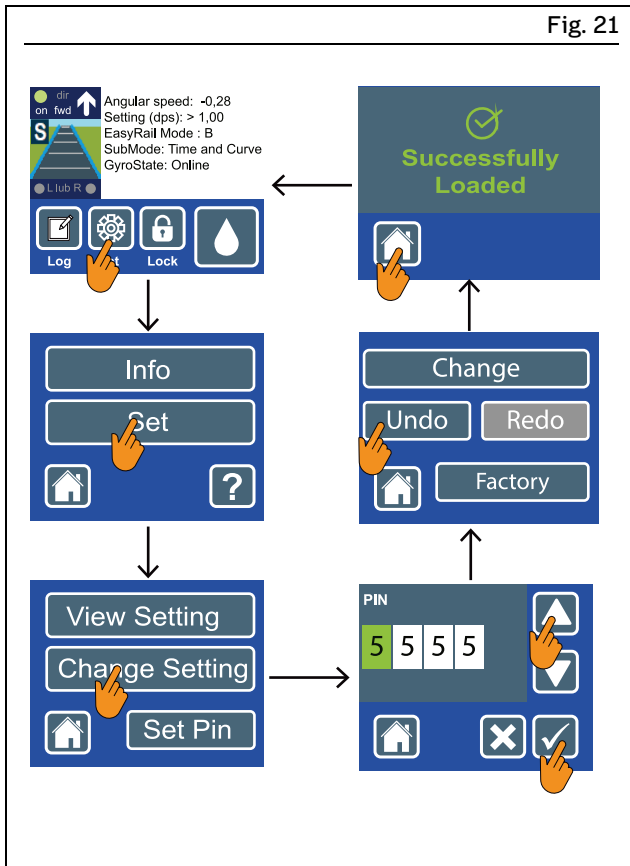
1. Press "Set", and then on the next screen, again press "Set" and then "Change Settings".
2. Enter the current device password and confirm each digit by pressing the "checkmark" icon.

NOTE

If you have entered the wrong device password, the 4 digits will be shown in red. In that case, enter the password again with the correct digits. The device password that was set at the factory can be found in section 4.

3. Press "Undo" or "Redo" to execute the respective function. If one of the functions is not possible, it will be grayed out on the display screen.
4. "Successfully Loaded" will appear on the display. Press the "house" icon to go back to the start display.

Fig. 21



Undo/redo, using Undo as an example

7.6 Factory settings

This restores the factory settings, meaning the settings that applied when the curve sensor was delivered.

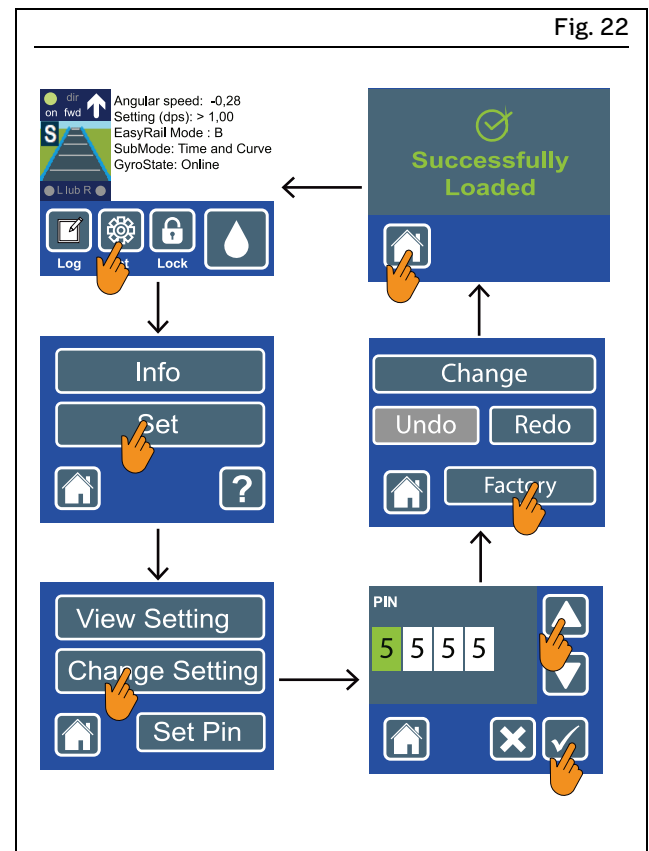
NOTE

Resetting to the factory settings also means resetting the device password. Make sure that you know either device password set at the factory or the master password. Otherwise you will not be able to make any more modifications on the control unit. The passwords can be found in section 4.

To restore the factory settings, proceed as follows:

1. Press "Set" and then on the next screen, again press "Set" and then "Change Settings".
2. Enter the current device password and confirm each digit by pressing the checkmark icon.
If you have entered the wrong device password, the 4 digits will be shown in red. In that case, enter the password again with the correct digits.
3. After entering the curve sensor device password successfully, press "Factory".
The factory settings will be loaded and "Successfully Loaded" will appear on the display.
4. Press the "house" icon to go to the start display.

Fig. 22



Restoring factory settings

8 Operation

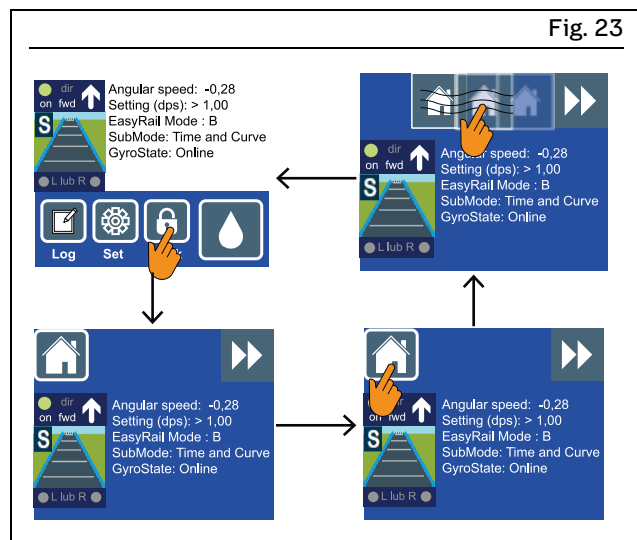
8.1.1 Screensaver

NOTE

The screensaver is activated after 2 minutes without any user action on the control unit.

To activate and exit the screensaver, proceed as described in the example:

1. Press the “Lock” icon to activate the screensaver manually
2. Push the “house” icon to the right onto the “double arrow” icon which appears. The screen then exits the screensaver.

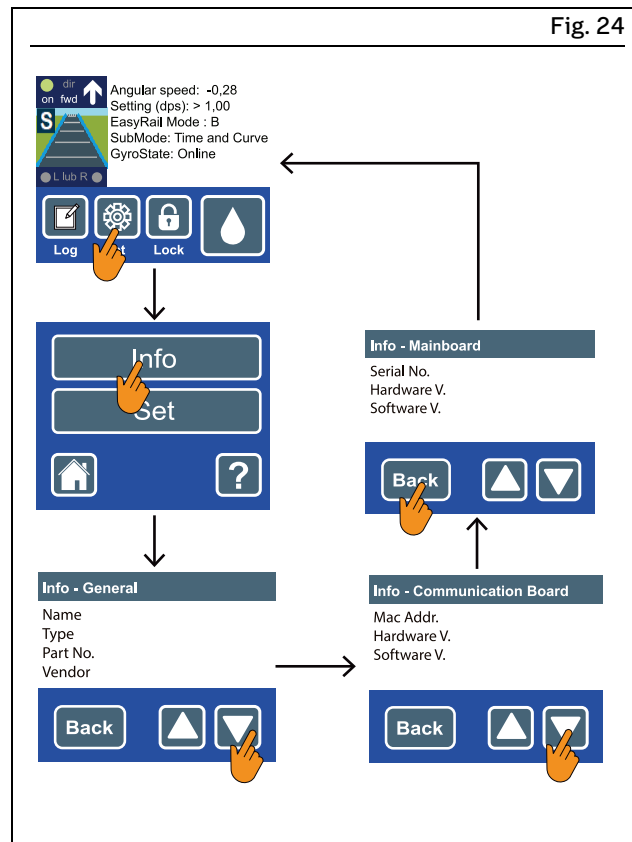


8.1.2 Displaying device information

The Info menu item shows general information about the curve sensor and its hardware and software.

To display this, proceed as follows:

1. Press “Set”, and then on the next screen, press “Info”.
2. Use the arrow keys to scroll through the 3 screens.
3. Press the “Back” icon to go back to the start display.



8.2 Displaying operating data

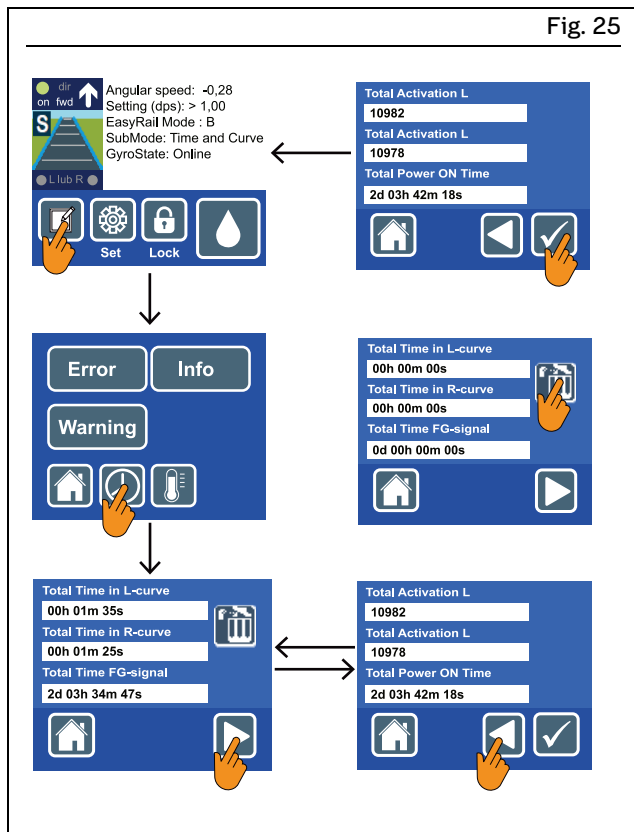
The Log menu item displays counters for various totals since commissioning or since the last reset to zero.

The following data is displayed:

- Total time in L-curve: Total time in left curves
- Total time in R-curve: Total time in right curves
- Total Time FG-signal: Total time of the enable signal
- Total Activation L: Total number of times that the spray nozzle was activated on the left wheel in the direction of travel
- Total Activation R: Total number of times that the spray nozzle was activated on the right wheel in the direction of travel
- Total Power ON Time: Total time when voltage was applied to the device

To display this, proceed as follows:

1. Press the “Log” icon, and then on the next screen, press the “clock” icon.
2. Use the arrow keys to scroll through the 2 screens.
3. Press the “house” icon to go to the start display.



Displaying operating data

4. Press and drag the trashcan icon to reset the operating data to zero

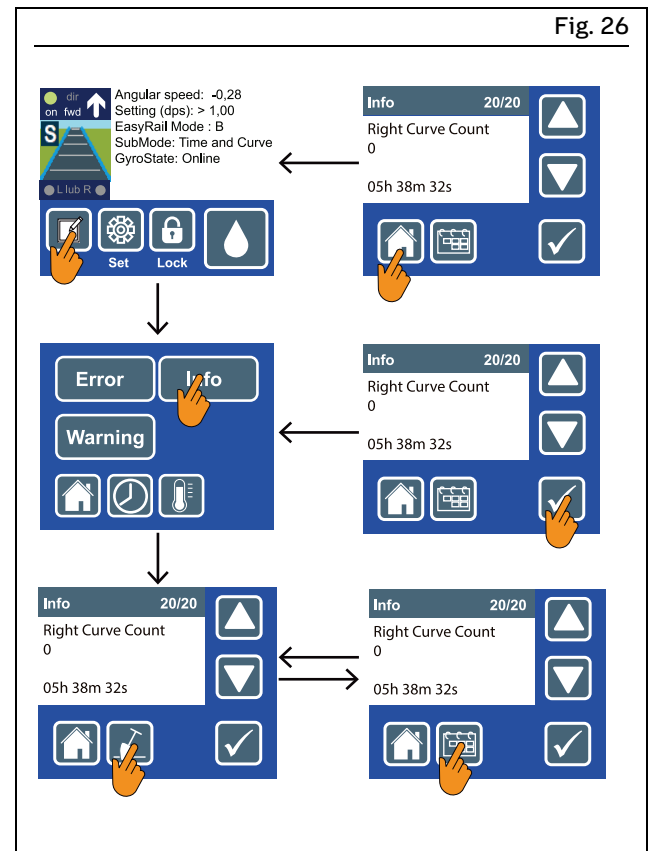
8.3 Displaying information

Operating information can be displayed during the spray process.

NOTE

The curve sensor control unit saves the last 200 items of information. After that, the oldest data record will be overwritten by the newest data record.

1. Press the Log icon, and then on the next screen, press Info.
2. By pressing the shovel icon and then the calendar icon that appears next, you can toggle between displaying the date and time of the last Info and displaying when the last Info occurred within the total operating hours of the curve sensor control unit.
3. Press the arrow keys to display more data records.
4. Press the checkmark icon to return to the Log menu, or press the house icon to go back to the start display.



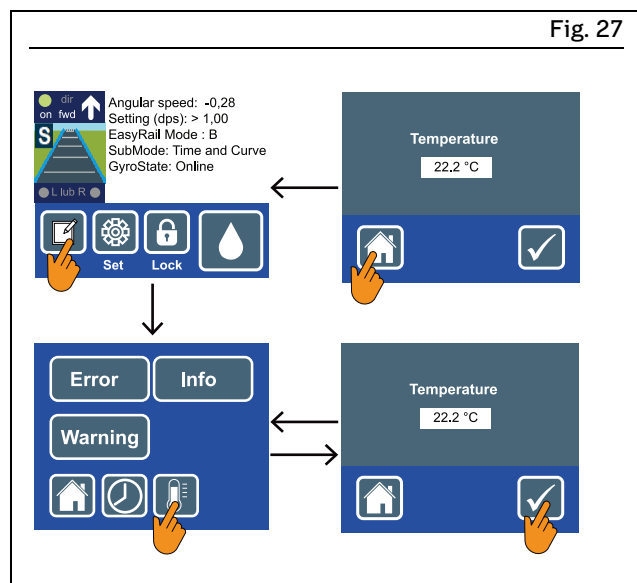
Displaying information

8.3.1 Displaying device temperature

1. Press the “Log” icon, and then on the next screen, press the “thermometer” icon.

The current curve sensor temperature is displayed.

2. Press the “checkmark” icon to return to the Log menu, or press the “house” icon to go back to the start display.



Displaying device temperature

8.4 Additional lubrication

The operator can use the curve sensor control unit to trigger additional lubrication. There are two ways of doing this:

- On the display screen
- With a pushbutton (if present)

8.4.1 Triggering additional lubrication on the display screen

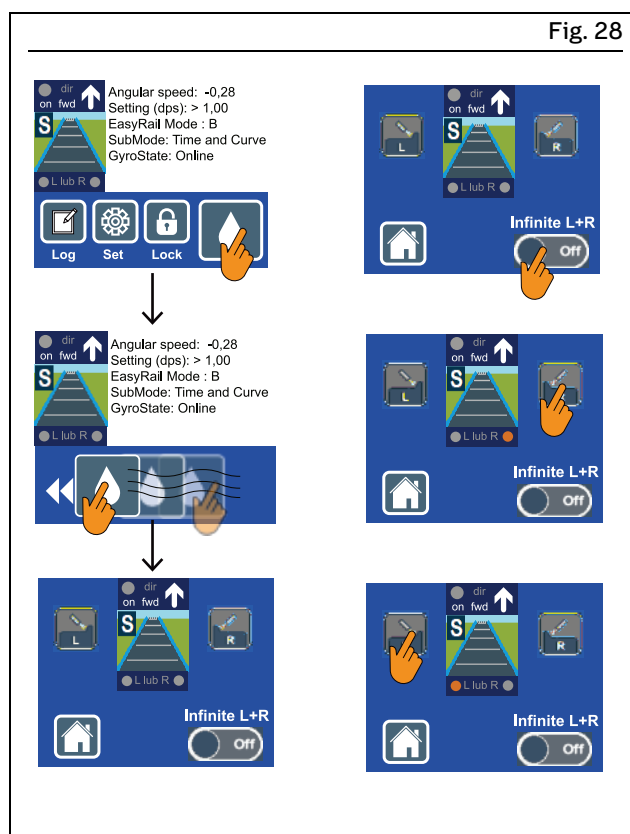
To trigger additional lubrication, proceed as follows:

1. Push the “drop” icon to the left onto the “double arrow” icon which appears.
2. Press the icon for “Left lubrication” or the icon for “Right lubrication” to trigger a single lubrication cycle on the wheels on the left or right side, respectively. The corresponding control line turns red at the same time.
3. Push the “Infinite L+R” button to **Off**. **On** is shown. Spraying cycles are triggered continuously on the wheels on the left side and then on the right side.

NOTE

In the case of additional lubrication, there is no spray period time between the spraying cycles.

4. Push the “Infinite L+R” button to **On** to stop the spraying cycles. **Off** is shown.



Triggering additional lubrication

8.4.2 Triggering additional lubrication using a pushbutton

1. Press the pushbutton once for less than 3 seconds to trigger two spraying cycles, one on the wheel on the left side and one on the right side
2. Press for longer than 3 seconds to trigger continuous spraying cycles on the wheels on the left side and then on the right side.

NOTE

In the case of additional lubrication, there is no spray period time between the spraying cycles.

3. Press the pushbutton again to stop the spraying cycles.

9 Maintenance

CAUTION



Electric shock

Performing work on products that have not been de-energized may result in serious injury or death.

Assembly, maintenance, and repair work may only be performed by qualified technical personnel on products that have been de-energized.

The supply voltage must be switched off before opening any of the product's components.

If necessary, a protective earth connection must be established prior to starting work.

NOTICE



Electrostatic charge and discharge

The curve sensor control units contain electronic components that can be destroyed by accidental electrostatic charge or discharge (ESD). To prevent possible damage due to ESD, hands and any tools must be discharged on a bare grounded position on the railway vehicle prior to performing any work in the area of the printed circuit board. Conductors or component connections within the device must not be touched under any circumstances

SKF products are low-maintenance. However, you should inspect the following items at regular intervals to ensure proper function.

- No visible damage
- Housing securely affixed to the wall
- Cover tightly closed
- All cables securely attached
- Secure hold on strain relief for cables / cable harnesses
- Corrosion or traces of fire
- Functional check using pushbutton DK with visual control of the spray pattern at the position to be sprayed on the wheel flange or the rail head, respectively

10 Faults, causes, and remedies

10.1 Displaying warnings

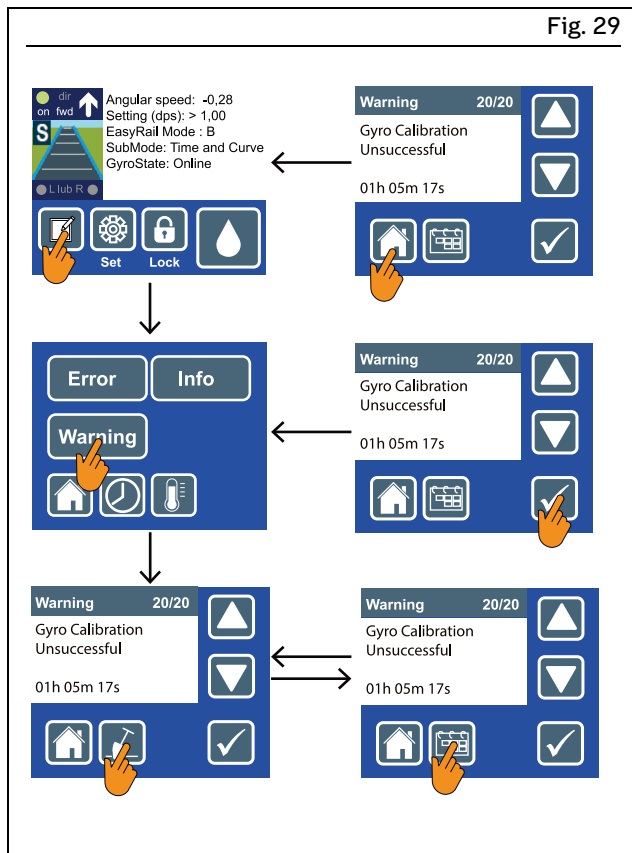
Warnings can be displayed during the spray process.

NOTE

The curve sensor control unit saves the last 200 warnings. After that, the oldest data record will be overwritten by the newest data record.

1. Press the Log icon, and then on the next screen, press Info.
- The data record for the last warning will be displayed.
2. By pressing the shovel icon and then the calendar icon that appears next, you can toggle between displaying the date and time of the last warning and displaying when the last warning occurred within the total operating hours of the curve sensor control unit.
 3. Press the arrow keys to display more data records.
 4. Press the checkmark icon to return to the Log menu, or press the house icon to go back to the start display.

Fig. 29



Displaying warnings

10.2 Displaying errors

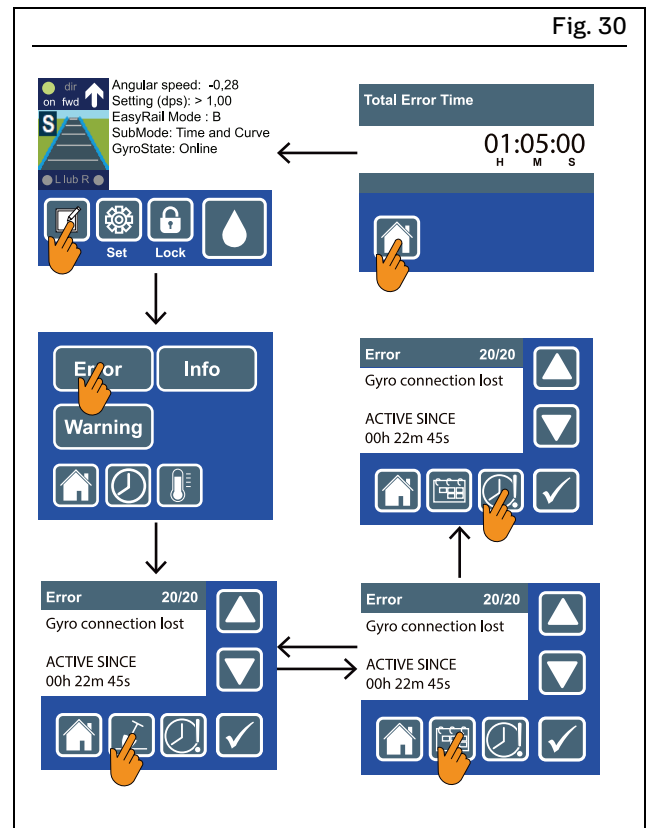
Error messages can be displayed during the spray process.

NOTE

The curve sensor control unit saves the last 100 errors. After that, the oldest data record will be overwritten by the newest data record.

1. Press the Log icon, and then on the next screen, press Error.
- The data record for the last error will be displayed.
2. By pressing the shovel icon and then the calendar icon that appears next, you can toggle between displaying the date and time of the last error and displaying when the last error occurred within the total operating hours of the pump.
- Press the arrow keys to display more data records.
3. Press the clock icon with exclamation mark to display the total time of curve sensor control unit errors.
 4. Press the house icon to go back to the start display.

Fig. 30



Displaying errors

10.3 General

The following table provides an overview of possible malfunctions and their causes. If you cannot remedy the malfunction, the curve sensor control unit needs to be replaced; you may also contact the Service department of SKF Lubrication Systems Germany GmbH.

NOTICE**Electrostatic charge and discharge**

The curve sensor control units contain electronic components that can be destroyed by accidental electrostatic charge or discharge (ESD). To prevent possible damage due to ESD, hands and any tools must be discharged on a bare grounded position on the railway vehicle prior to performing any work in the area of the printed circuit board. Conductors or component connections within the device must not be touched under any circumstances

CAUTION**Electric shock**

Performing work on products that have not been de-energized may result in serious injury or death.

Assembly, maintenance, and repair work may only be performed by qualified technical personnel on products that have been de-energized.

The supply voltage must be switched off before opening any of the product's components.

If necessary, a protective earth connection must be established prior to starting work.

Dismantling of individual parts of the product is not permitted and voids any claims.

Table 9**Fault table**

Fault	Possible cause	Remedy
No spraying cycle occurs when pushbutton DK is actuated	Curve sensor control unit is without operating voltage	Check voltage connection, replacing back-up fuses (line protection) if necessary
No spraying cycle occurs when pushbutton DK is actuated. Operating voltage is connected.	- Valve connection faulty - Valve defective - Short circuit in the valve electrical circuit - Pushbutton defective - Curve sensor control unit faulty	- Check valve connection - Replace valve - Eliminate short circuit - Check pushbutton and replace if necessary - Replace curve sensor control unit
The control unit does not always respond to actuation of pushbutton DK .	The spray pause time T_p after the last spray time is not yet elapsed	Wait for the end of the spray pause time t_P and press the pushbutton DK once again
A spraying cycle occurs when pushbutton DK is actuated but no lubricant discharges from the spray nozzle.	- Lubricant lines are not sufficiently wetted with lubricant. - Lubricant supply exhausted - Compressed air missing	- Wet lubricant lines with lubricant. - Top up the lubricant - Supply compressed air
Curve-dependent spraying is not performed.	- Curve-dependent control was not preselected - The curve sensor's sensitivity is set too low - Vehicle is traveling too slowly for the set curve sensor sensitivity or the curve radius is too large	- Check the setting of the control unit and correct if necessary - Increase the sensitivity of the curve sensor - Readjust the sensitivity
Time-dependent spraying is not performed	Time-dependent control was not preselected	Check the setting of the control unit and correct if necessary

Table 9

Fault table

Fault	Possible cause	Remedy
	• Spray enable signal is not activated at input FG	• Check whether the spray enable signal on input FG is functioning properly

11 Shutdown, disposal

11.1 Temporary shutdown

Temporary shutdowns should be done by a course of action to be defined by the operator.

11.2 Permanent shutdown, disassembly

Permanent shutdown and disassembly of the product must be planned properly by the operator and conducted in compliance with all applicable laws and regulations.

11.3 Disposal

The waste producer/operator must dispose of the various types of waste in accordance with the applicable laws and regulations of the country in question.

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