SCHAEFFLER

Lubricator CONCEPT4

User manual

I. Revision history & Imprint

I.I Revision history

The present user manual is translated from the original user manual. The original user manual was created in german language.

This user manual is only valid for

Product:

Product designation:	CONCEPT4 (C4)
Product revision:	---

User manual:

Date of creation:	11.2020
Revision of the manual:	0

I.II Imprint of the manufacturer, distribution and service

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I.III Table of contents

1. General information about this manual

This user manual contains all necessary information to use the Lubrication device safely and as intended. In the event that supplementary sheets are attached to these instructions, the information and data contained in the supplementary sheets are valid and replace the corresponding information in this user manual. Any contradictory information contained in this user manual thus becomes invalid.
If you have any questions regarding special applications, please contact Schaeffler Technologies AG & Co. KG (chapter I.II).
The actual and factual operator must ensure and guarantee that these instructions, including any supplementary sheets, have been read and understood by all persons responsible for the installation, operation or maintenance of the Lubrication device.
Therefore, keep these instructions in a suitable place, ideally in an easily accessible place, in the surrounding area of the Lubrication device.
Inform your colleagues who work in the local area of the machine about safety instructions so that nobody gets hurt.
This manual was written in German, all other language versions are translations of this manual.

1.1 Signal words

The following signal words are used in this manual to draw your attention to possible dangers, prohibitions and other important information:

DANGER	This signal word points you to an immediate and threatening risk of serious injury or death.
WARNING	This signal word indicates a potentially imminent danger which can result in serious injury or even death.
CAUTION	This signal word indicates a potentially imminent danger that can result in minor to severe injuries.
NOTICE	This signal word indicates a potentially imminent danger which can result in damage to property.
INFORMATION	This signal word refers to practical application tips or particularly important information when using the Lubrication device.

1.2 Warning symbols

The following warning symbols are used in this user manual to alert you to hazards, prohibitions and important information:

		
General warning sign	Electricity hazard	Flammable material

1.3 Structure of the safety instructions

The safety instructions in this user manual are structured according to the following system:

	**CAUTION** **The text explains the consequences of disregarding the reference.** ■ The text shows what to do as an instruction.

1.4 Symbols for information

The following information symbols are used in the text and instructions in this manual:

● Requests you to take action

➲ Shows the consequences of an action

ⓘ Additional information about the action

2. Safety

All persons working with the Lubrication device must follow these operating instructions, in particular the safety instructions and the rules and regulations applicable at the place of use. Generally applicable legal regulations and other rules as well as the relevant rules and regulations for accident prevention (e.g. Personal Protective Equipment (PPE)) and environmental protection must be observed.

2.1 EC/EU Directive

Within the scope of the EC/EU Directive, (re)commissioning of a machine on which the Lubrication device has been installed and/or fitted is prohibited until it has been clearly established that the machine complies with the provisions of the applicable Directive.
An EC/EU declaration of conformity for the Lubrication device can be found in the appendix (chapter 11.2).

2.2 Hazards

In order to avoid danger to the user or damage to the machine on which the Lubrication device is used, the Lubrication device may only be used for its intended purpose (chapter 2.5) and in a technically safe condition.
Always inform yourself about the general safety instructions (chapter 2) before starting to work.

2.3 Staff

Only qualified staff who has read and understood this manual may work with the Lubrication device. Local and/or company regulations apply accordingly.

2.4 Reasonably predictable misuse

Any use of the Lubrication device which exceeds the maximum permissible technical data is generally considered to be improper and therefore prohibited.

2.5 Usage for the intended purpose

The following points must be observed for the intended purpose of using the Lubrication device:

+ The Lubrication device is exclusively approved for industrial use.
+ The Lubrication device may be used exclusively in accordance with the technical data (chapter 3.4).
+ Unauthorized structural alterations to the Lubrication device are not permitted.
+ Read the user manual and act accordingly.
+ During operation of the Lubrication device, a visual inspection of the Lubrication device as well as of the lubrication point must be carried out regularly. Any anomalies must be eliminated immediately and the cause rectified.
+ Refilling the cartridge is only allowed when using the refillable cartridge system with filling adapter.
+ The Lubrication device may not be opened or disassembled.
+ Only lubricants approved by the manufacturer may be used.
+ Relevant regulations and rules on work safety, accident prevention and environmental protection must be observed.
+ Work and activities with and on the Lubrication device are only permitted with appropriate authorisation (chapter 2.3).

All other uses than the aforementioned intended usage or the disregard of one of the above points shall be deemed improper usage. In this case no liability and/or warranty is assumed.

2.6 Warranty and Liability

If the following items are disregarded, all warranty and liability claims for personal injury and/or damage to property are excluded:

+ Non-observance of the instructions for transport and storage;
+ misuse;
+ Improper or unperformed maintenance or repair work;
+ Improper assembly / disassembly or improper operation;
+ Operation of the Lubrication device with defective protective devices and devices;
+ Operation of the Lubrication device without lubricant;
+ Operation of the Lubrication device with non-approved lubricant;
+ Operation of heavily contaminated Lubrication device;
+ Modifications or alterations which may be carried out without the written permission of Schaeffler Technologies AG & Co. KG have taken place;
+ Opening and/or partial or complete disassembly of the Lubrication device.

2.7 General safety instructions

The following safety instructions are given for the Lubrication device:

DANGER

Damaged or incorrect electrical connections or unauthorized live components lead to serious injuries or even death.

- Have all electrical connection work carried out by qualified personnel only.
- Replace damaged cables or plugs immediately.

NOTICE

Loose or overloaded screw connections can cause damage to the Lubrication device.

- Mount and check all screw connections with the permissible torques specified for this purpose. Use a calibrated torque wrench.

WARNING

Lubricants are flammable.

- In case of fire, do not use a water jet to extinguish the fire.
- In case of fire, use only suitable extinguishing agents such as powder, foam and carbon dioxide.
- Observe the relevant safety instructions of the lubricant manufacturer on the safety data sheet of the lubricant used.

CAUTION

Lubricants can cause skin irritations.

- Avoid direct skin contact.

NOTICE

Lubricants can contaminate soil and water.

- Use and dispose lubricants properly.

3. Description of function

3.1 General information

The Lubrication device is designed as an extremely compact double piston pump for autonomous operation with grease as the lubricant. The pistons run force-controlled and counter-rotating. The Lubrication device has four lubrication outlets, see chapter 5.1. The outlets are secured by an integrated non-return valve. Approx. 0.16 cm³ of lubricant is pumped during each dispensing operation.
The present Lubrication device has to be integrated into an external control (e.g. PLC). The Lubrication device has an electrical interface with which you can control and command the Lubrication device. Furthermore, the Lubrication device enables remote monitoring by output signals in order to be able to query the status and possible error messages (e.g. empty cartridge). By means of various input signals processed by the microelectronics, the Lubrication device is controlled to supply the lubrication point with the ideal amount of lubricant.

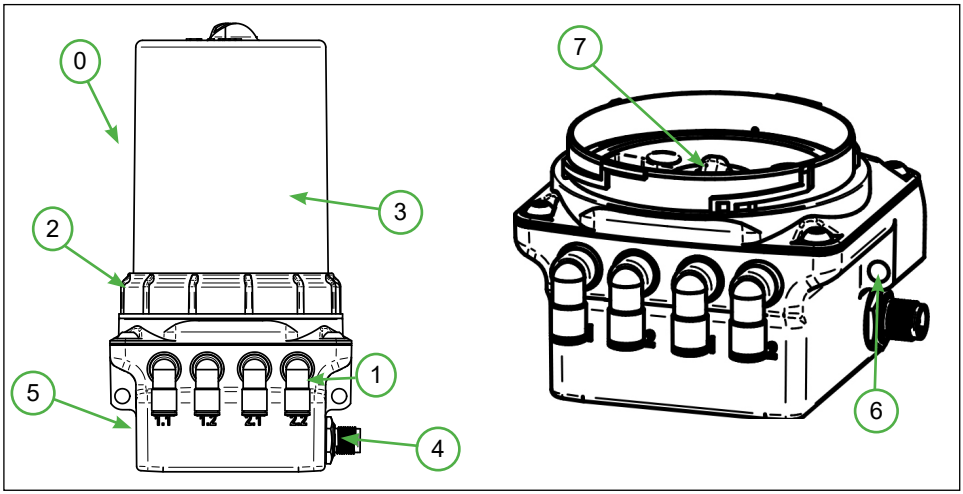


Fig. 1: Overview CONCEPT4

Nr.	Description
0	CONCEPT4 (C4)
1	Lubricant outlet, outlets (different versions possible)
2	Retaining ring
3	Upper Housing
4	M12x1 electrical interface
5	Nameplate with designation, CE mark and serial number
6	Through hole for assembly
7	Lubricant inlet with thread for cartridge

3.2 Nameplate and designation

The nameplate of the Lubrication device is visibly attached to the side of the pump itself. There the CE mark and the serial number of the Lubrication device are visible. Refer to chapter 3, Fig.1 for the location of the nameplate and serial number.

3.3 Scope of delivery

The scope of delivery includes the Lubrication device and the user manual. For accessories see TPI252.

3.4 Technical data

Housing			
Dimensions without housing		111 x 56,5 x 108 (B x H x T)	mm
Dimensions with housing for 400ml cartridge		111 x 200 x 108 (B x H x T)	
Weight (without cartridge)	appx.	1300	g
Mounting options		holes for screw M6	
Mounting position		upright	
Material		Zinc die-cast / PA 6.6 GF30 / POM	
Material outlet		Nickel-plated brass	
Operating temperature		-15 ... +60*	°C
Lubricant and hydrauilcs			
Cartridge volume		400	ml
Lubricant characteristics		grease up to NLGI class 2 (3**)	
Number of outlets		4	
Hydraulic connection		via PA-Tube	
Number of lubrication points per outlet		up to 4 in conjunction with distributor* up to 14 in conjunction with progressive distributor*	
max. pressure		70 (-10%/+15%)	bar
Steady state pressure		70	bar
Grease delivery	per stroke	0,16 (-5%)	cm³
Electrics			
Operating voltage		24 (+/- 5%)	V
Protection		0,75 (slow blow)	A
Protection class		IP 54	
Current consumption		I_{max} < 0,3 $I_{quiescent}$ < 0,025	A
Further information on electrics can be found in chapter 7 and 8!			

* The stated value depends on the specific application and may vary considerably in individual cases depending on the lubricant used and other conditions.
** Taking into account the max. tube length. See calculation in TPI252 (page 8-10); Pressure P_{max}=70bar

4. Transport and storage

4.1 Packaging

The Lubrication device is delivered in an outer packaging (cardboard box) and - depending on the scope of delivery with a lubricant cartridge and other accessories - in the same package. To protect them from moisture and dirt, they are also packed in PE films.
Dispose the packaging materials at the designated disposal points in compliance with the relevant national and company regulations.
After receiving the Lubrication device, check the delivery note for completeness and correctness.
Any missing parts or damage must be reported immediately to the forwarding agent, the insurance company or Schaeffler Technologies AG & Co. KG in writing.

4.2 Transport

NOTICE

Hard shocks, e.g. due to falling or setting down too hard, can damage the Lubrication device.

- Do not throw the Lubrication device.
- When using lifting equipment, only use hoists and load handling attachments in perfect condition and with sufficient load capacity.
- The permissible lifting weight of the lifting device must not be exceeded.

4.3 Storage

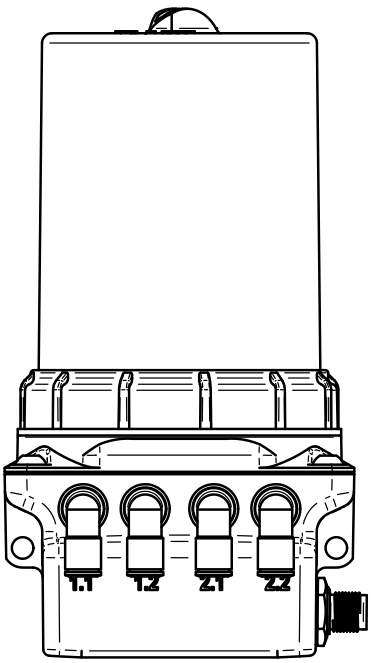
Store the Lubrication device in its original packaging in a vertical position in a dry, frost-free environment at an ambient temperature of +5°C to +30°C. The maximum storage time in unopened condition is 2 years.

The so-called "First-In-First-Out-Principle" (FiFo) is recommended for storage logistics.

5. Variants

The Lubricant device is designed as a compact lubrication unit for supplying several lubrication points. Depending on the specific application, the Lubrication device can also reliably and cleanly supply a limited number of lubrication points with lubricant. In this case, parts of the system accessories from the manufacturer (e.g. progressive distributors or lubrication gears) can be connected to the Lubrication device in order to extend the number of lubrication points beyond the number of outlets. The outlets of pump body (PB) 1 are marked on the housing with 1.1 and 1.2, the outlets of pump body 2 with 2.1 and 2.2.

5.1 C4-2P-24VDC



Number of pump bodies	2
Number of outlets	4
Differences in dosing volume per pump body possible	yes

With the C4-2P-24VDC, each possible outlet is operated individually. One outlet is supplied with 0.16cm³ lubricant per stroke. The outlets are supplied with lubricant one after the other.
The C4-2P-24VDC allows you to set dosing volume differences from outlets 1.1 and 1.2 to outlets 2.1 and 2.2 by individually controlling the two pump bodies. An explanation of the different control signals can be found in chapter 8.2.

6. Mounting

6.1 Preparations

Before starting to work, inform yourself in detail about the Lubrication device using this user manual; in particular about the general safety instructions (chapter 2.7). Prepare the installation site carefully.

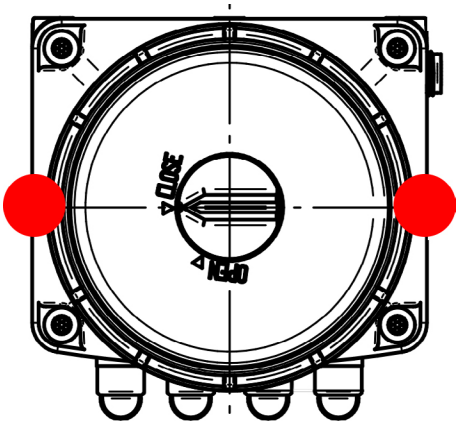
NOTICE

Pressurised air can damage the seals of the Lubrication device and can transport dirt and foreign matter into the Lubrication device or the lubricant.

- Do not use pressurised air.
- Make sure that there is no coarse dirt in the mounting area.

6.2 Mounting

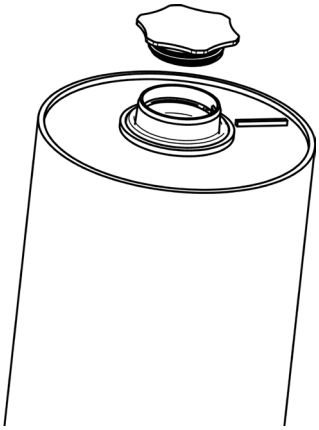
1. Condition as delivered
The Lubrication device is delivered in a cardboard box. Depending on the version ordered, further accessories such as a lubricant cartridge or additional tube connection parts are included.



2. Remove the upper housing from the power unit of the Lubrication device.

- Turn the retaining ring counterclockwise in order to remove the upper housing.
- Remove the upper housing from the power unit.

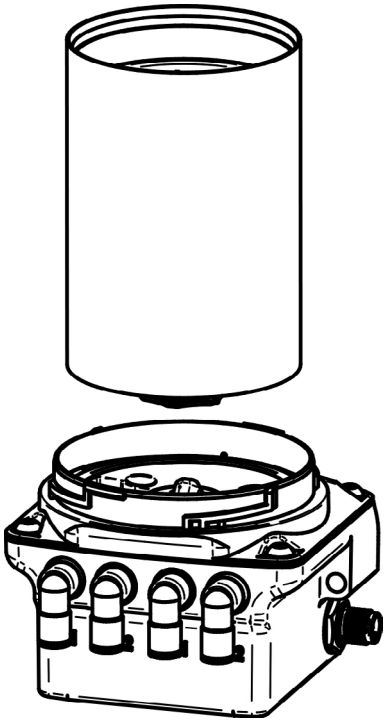
ⓘ Loosen the retaining ring at the marked positions.
ⓘ Make sure that no dirt, water or foreign bodies enters the lubricant inlet.



3. Unscrewing the cartridge cap.

- Turn the cap on the lubricant cartridge counterclockwise and pull it off.

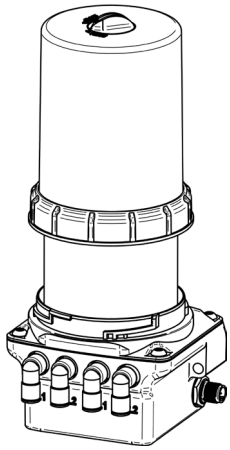
ⓘ Pay attention to cleanliness when carrying out the work. It is imperative that dirt and foreign bodies do not enter the cartridge.



4. Mounting the lubricant cartridge

- Place the full lubricant cartridge on the Lubrication device.
- Turn the lubricant cartridge clockwise onto the Lubrication device.

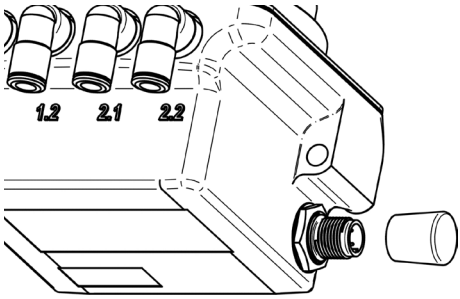
ⓘ The end position is reached after two full rotations when the label of the lubricant cartridge is aligned with the front label of the Lubrication device.



5. Assembling the upper housing on the power unit of the Lubrication device.

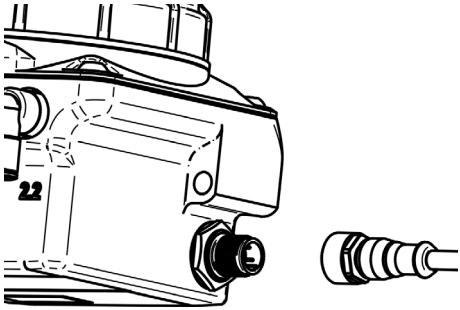
- Place the dismantled upper housing on the Lubrication device and press it onto the power unit.
- Fasten the upper housing to the power unit by turning the retaining ring clockwise.

ⓘ The retaining ring must snap into place when turning and be completely tightened.



6. Remove the protective cap on the side of the Lubrication device.

- Remove the black protective cap from the side of the electrical M12x1 interface.



7. Connect the electrical interface

- Connect the Lubrication device to the external power supply or controller via the M12x1 interface on the side of the Lubrication device using a suitable connecting cable.

ⓘ Depending on the application, both connection cables with straight or angled sockets can be used.
ⓘ Please refer to chapter 8.1 for the condition of the connection cable.

DANGER

Defective or faulty electrical connections or unauthorized live components can lead to serious injuries or even death.

- Have all electrical connection work carried out by qualified personnel only.
- Replace damaged cables or plugs immediately.
- Before carrying out any electrical installation work, observe the five safety rules of electrical engineering:
  - Unlocking
  - Secure against unintentional restarting.
  - Check that there is no voltage.
  - Ground and short-circuit.
  - Cover adjacent live parts.

6.3 Commissioning

Mount the Lubrication device carefully according to the steps described in chapter 6.2. Depending on the scope of delivery, you must also carry out the following additional measures for the first-time commissioning:

1. Mechanical fastening
Fix the Lubrication device mechanically. Pay particular attention to the maximum tightening torques permissible for the M5 female threads!

2. Electrical connection
Connect the Lubrication device to the external controller (PLC) via the M12x1 interface using a suitable cable.

3. Check the assembly
Make sure that the Lubrication device is properly and completely assembled. In particular, the battery must be inserted and a lubricant cartridge must be fitted.

4. Execute 12 seconds signal
Execute the 12 seconds control signal. The detailed description can be found in chapter 8.2.4. The Lubrication device performs a certain number of strokes and transports the lubricant from the cartridge to the outlet.

5. Hydraulic connection
Connect the consumer hydraulically to the Lubrication device. If you connect tubes to the Lubrication device, make sure that the tubes and connectors are installed tightly, cleanly and correctly.

ⓘ Ideally, use tubes prefilled with the appropriate lubricant!

6. Check the settings on Lubrication device
Check the basic settings of the Lubrication device with the required values required for the lubrication point and adjust them if necessary. Changes must be made in the PLC program.

7. Operation and settings

7.1 General information

What you should know about operating and setting the Lubrication device:

✓For operation, the Lubrication device must be integrated into a control system (PLC) and must be commanded and controlled via the PLC, see chapter 7 and chapter 8. The Lubrication device delivers one or more strokes (one stroke = 0.16 cm^3) depending on the signals of the external control (PLC). Depending on the internal status of the Lubrication device (e.g. cartridge empty), different output signals are issued by the Lubrication device.

✓The Lubrication device signals a Pre-Warning when the cartridge has a remaining filling quantity of approx. 80 cm^3 and thus indicates that the cartridge will be empty soon.

✓The disposable interchangeable cartridge 400ml lubricant guarantees a controlled and constant quality of the lubricant and is filled without air bubble inclusions. The Lubrication device allows a high supply security of the lubrication point and prevents failures. The Lubrication device in its present version is designed exclusively for the lubricant grease.

✓The Lubrication device cannot be used in the present version without a lubricant cartridge.

✓If you have any questions about your application and the correct settings for Lubrication device, please contact the manufacturer (chapter I.II).

●Make sure that your PLC program is correct for your application and that the lubrication point is supplied with the correct amount of lubricant per time unit.
If this is the case, you can operate the Lubrication device.
If this is not the case, change your PLC program accordingly.

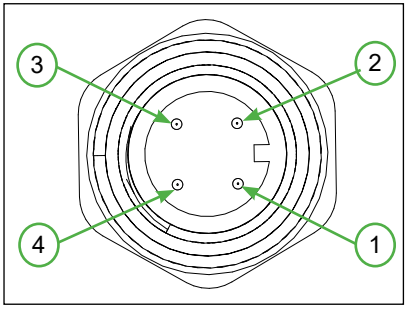
ⓘ To use the Lubrication device, it first has to be properly mounted and installed. The installation is very simple and described in detail in chapter 6.2.

ⓘ If you order a special version of the Lubrication device from the factory, the information on the supplement sheet is decisive for you!

8. Input and output signals - External control (PLC)

The Lubrication device operates as a pulse-controlled lubrication system only if unalterable input signals (high level) are transmitted from the PLC to the Lubrication device via PIN 2 in a defined sequence. The Lubrication device signals the respective status to the PLC via high/low levels, which can be tapped off at PIN 4, and thus enables comprehensive control or, by suitable programming of the PLC, differentiated evaluation of the different statuses. For the integration of the Lubrication device into an external control, one input and one output must be provided on the control side.

8.1 Pin assignment - External control (PLC)



PIN assignment (PLC)		
PIN	**Assignment**	**Colour**
1	+24 V DC	brown
2	Input Signal PLC→C4	white
3	Ground	blue
4	Output Signal C4→PLC	black
Type: M12x1 female connector; 4-pin, A-coded		

For the electrical connection to an external control (PLC) of a system, the Lubrication device has a 4-pin interface, which is designed as a plug connection with the standard industrial M12x1 connection.

ⓘ The Lubrication device can be switched off completely by switching off the supply voltage. After reapplying the supply voltage, the Lubrication device checks itself automatically (Duration self check approx. 2s) but only operates after receiving an input signal from the PLC.

ⓘ To operate the Lubrication device via an external controller (PLC), a program corresponding to the communication protocol must be created in the PLC.

ⓘ The output signal at PIN 4 can be tapped for further processing (e.g. indicator light or external control). The maximum permissible output current must not exceed I_{max} < 20mA. No inductive load (e.g. relay) may be connected!

ⓘ After a longer standstill of the Lubrication device the manual execution of the "Quick-Check" is recommended. You can use for example the 12 seconds control signal to trigger a certain number of donations via the PLC (chapter 8.2).

8.2 Input signals - External control (PLC)

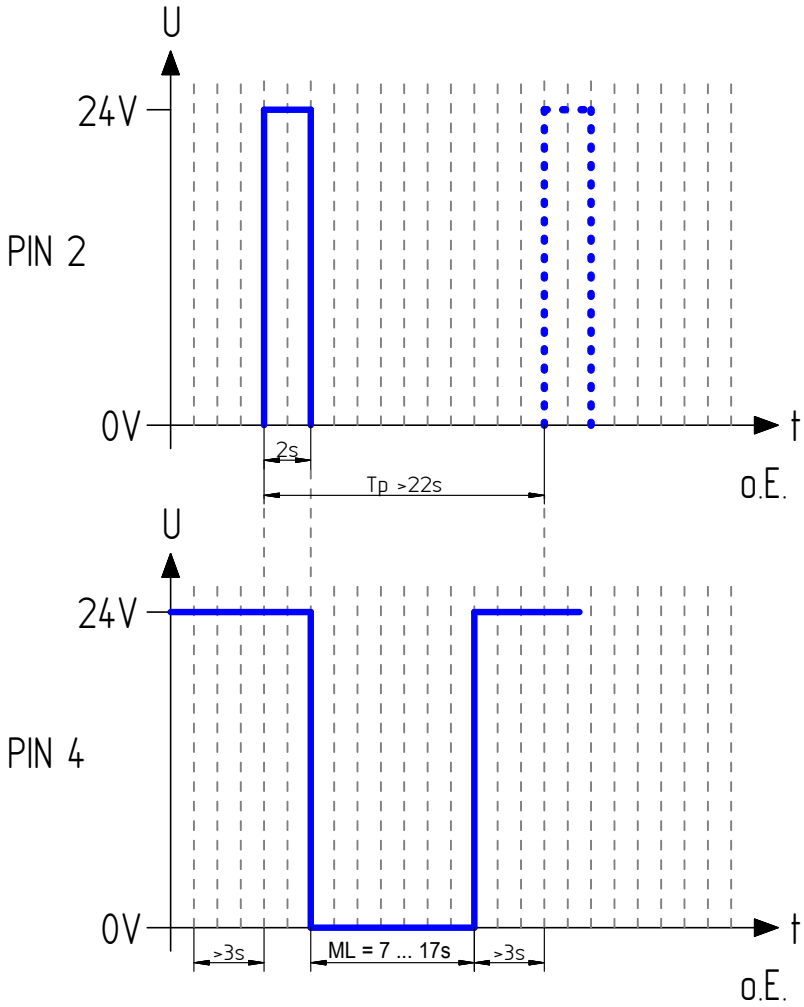
The Lubrication device provides the following unalterably defined control signals (input signals), which must be transmitted from the PLC to the Lubrication device via PIN 2 of the electrical M12x1 interface as high level (+24 V DC).
The control signals must be generated as high level (+24 V) by the external controller (PLC) over certain times with a tolerance of +/- 0.1 seconds.

Signal length in seconds	Description	Function	Detail
2 high	Signal 2 Seconds	1 Stroke PB1	8.2.1
5 high	Signal 5 Seconds	1 Stroke PB2	8.2.2
8 high	Signal 8 Seconds	1 Stroke PB1 and PB2	8.2.3
12 high	Signal 12 Seconds	FIL-Function	8.2.4
14 high	Signal 14 Seconds	Error acknowledgement	8.2.5

ⓘ The Lubrication device only processes the control signals listed in the table up to a maximum length of 14 seconds. If a high level (+24 V DC) is present outside the tolerances, the Lubrication device does not react. If a high level (+24 V DC) is applied to PIN 2 of the electrical interface for longer than 15 seconds the Lubrication device will not react.

8.2.1 Control signal 2 seconds

The control signal 2 seconds triggers a single dispensing process. After a specified pause time, this control signal can be repeated or another control signal can be sent. The Lubrication device reacts only in a certain operating state to control signals at PIN 2. The operating states are output by the Lubrication device via PIN 4 as a high/low level and must be tapped and processed accordingly in the PLC.



Tp: Pause time
ML: Motor running time

Description:

✓The Lubrication device is properly connected to an external controller via the electrical interface and connected to the power supply.

●The Lubrication device sends a permanent output signal (high level) to PIN 4, which indicates to the external control (PLC) that it is ready for operation. This output signal must be permanently and continuously present for >3 seconds. Control by the external controller is only possible if this condition is present.
●The control signal 2 seconds with a signal length of 2 (1.9 ... 2.1) seconds high level can be sent from the external control (PLC) to the Lubrication device.
●Immediately after the control signal drops, the motor run (ML) of the Lubrication device starts and 0.16 cm³ lubricant is conveyed to the outlet. Simultaneously with the start of the motor run (ML), the Lubrication device sends a low level output signal to the external controller (PLC) as confirmation for the duration of the motor run (ML).
●The motor running time (ML) depends on various conditions, including the counterpressure present or built up in the hydraulic system and the temperature. With the Lubrication device, the motor running time (ML) is 7...17 seconds.
●At the end of an error-free and successful motor run (ML), the output signal at Lubrication device changes from a low level to a high level.

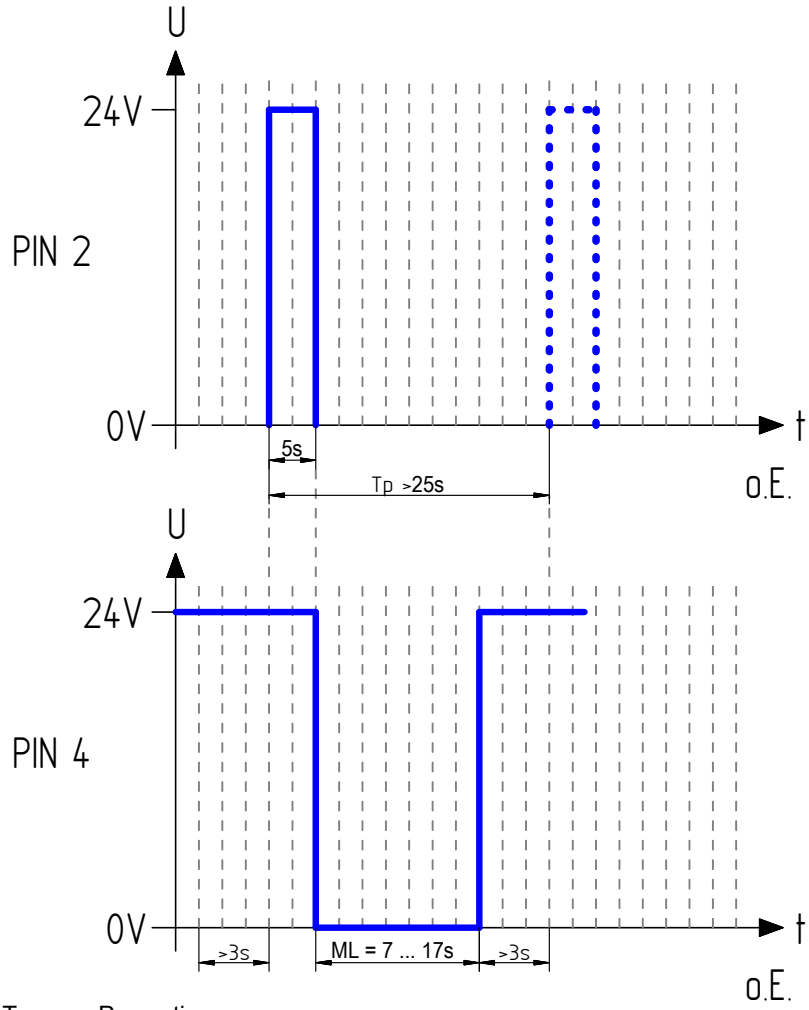
ⓘ A possible next control signal can be sent from the external controller (PLC) at the earliest >3 seconds after the end of the error-free and successful motor run. In the meantime, the Lubrication device does not process any control signals.

ⓘ In order to ensure a reliable and unambiguous recognition of the control signal, a pause must be observed. For the control signal 2 seconds, the Lubrication device requires a pause time (Tp) of at least 22 seconds between two identical or different control signals.

ⓘ If the integrated microelectronics of the Lubrication device has detected an error during or immediately after the end of the motor run (ML), this is transmitted to the external controller (PLC) by the corresponding output signal (chapter 8.3).

8.2.2 Control signal 5 seconds

The 5 second control signal triggers a single dispensing operation on pump body 2. After a certain pause time, this control signal can be repeated or another control signal can be sent.
The Lubrication device reacts only in a certain operating state to control signals at PIN 2. The operating states are output by the Lubrication device via PIN 4 as a high/low level and must be tapped and processed accordingly in the PLC.



Tp: Pause time
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Description:

✓The Lubrication device is properly connected to an external controller via the electrical interface and connected to the power supply.

●The Lubrication device sends a permanent output signal (high level) to PIN 4, which indicates to the external control (PLC) that it is ready for operation. This output signal must be permanently and continuously present for >3 seconds. Control by the external controller is only possible if this condition is present.
●The control signal 2 seconds with a signal length of 5 (4.9 ... 5.1) seconds high level can be sent from the external control (PLC) to the Lubrication device.
●Immediately after the control signal drops, the motor run (ML) of the Lubrication device starts and 0.16 cm³ lubricant is conveyed to the outlet. Simultaneously with the start of the motor run (ML), the Lubrication device sends a low level output signal to the external controller (PLC) as confirmation for the duration of the motor run (ML).
●The motor running time (ML) depends on various conditions, including the counterpressure present or built up in the hydraulic system and the temperature. With the Lubrication device, the motor running time (ML) is 7...17 seconds.
●At the end of an error-free and successful motor run (ML), the output signal at Lubrication device changes from a low level to a high level.

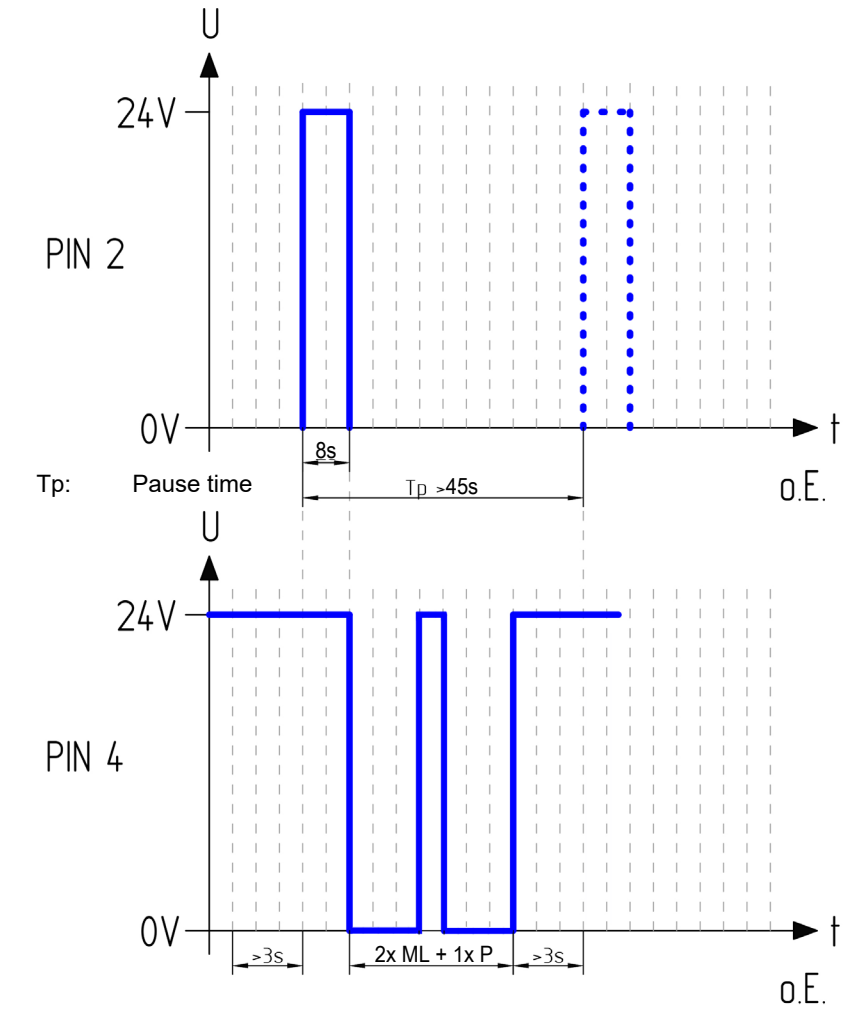
ⓘ A possible next control signal can be sent from the external controller (PLC) at the earliest >3 seconds after the end of the error-free and successful motor run. In the meantime, the Lubrication device does not process any control signals.

ⓘ In order to ensure a reliable and unambiguous recognition of the control signal, a pause must be observed. For the control signal 5 seconds, the Lubrication device requires a pause time (Tp) of at least 25 seconds between two identical or different control signals.

ⓘ If the integrated microelectronics of the Lubrication device has detected an error during or immediately after the end of the motor run (ML), this is transmitted to the external controller (PLC) by the corresponding output signal (chapter 8.3).

8.2.3 Control signal 8 seconds

The 8 second control signal triggers a single dispensing operation at pump body 1 and pump body 2. After a certain pause time, this control signal can be repeated or another control signal can be sent.
The Lubrication device reacts only in a certain operating state to control signals at PIN 2. The operating states are output by the Lubrication device via PIN 4 as a high/low level and must be tapped and processed accordingly in the PLC.



Tp: Pause time

P: Pause
ML: Motor running time

Description:

✓The Lubrication device is properly connected to an external controller via the electrical interface and connected to the power supply.

●The Lubrication device sends a permanent output signal (high level) to PIN 4, which indicates to the external control (PLC) that it is ready for operation. This output signal must be permanently and continuously present for >3 seconds. Control by the external controller is only possible if this condition is present.
●The control signal 2 seconds with a signal length of 8 (7.9 ... 8.1) seconds high level can be sent from the external control (PLC) to the Lubrication device.
●Immediately after the control signal drops, the motor run (ML) of the Lubrication device starts and 0.16 cm^3 lubricant is conveyed to the outlet. Simultaneously with the start of the motor run (ML), the Lubrication device sends a low level output signal to the external controller (PLC) as confirmation for the duration of the motor run (ML).
●The motor running time (ML) depends on various conditions, including the counterpressure present or built up in the hydraulic system and the temperature. With the Lubrication device, the motor running time (ML) is 7...17 seconds.
●At the end of the first error-free and successful motor run (ML), the output signal at the Lubrication device changes from a low level to a high level for a short pause time P = 2 seconds.
●At the end of the second error-free and successful motor run (ML), the output signal at Lubrication device changes from a low level to a high level.

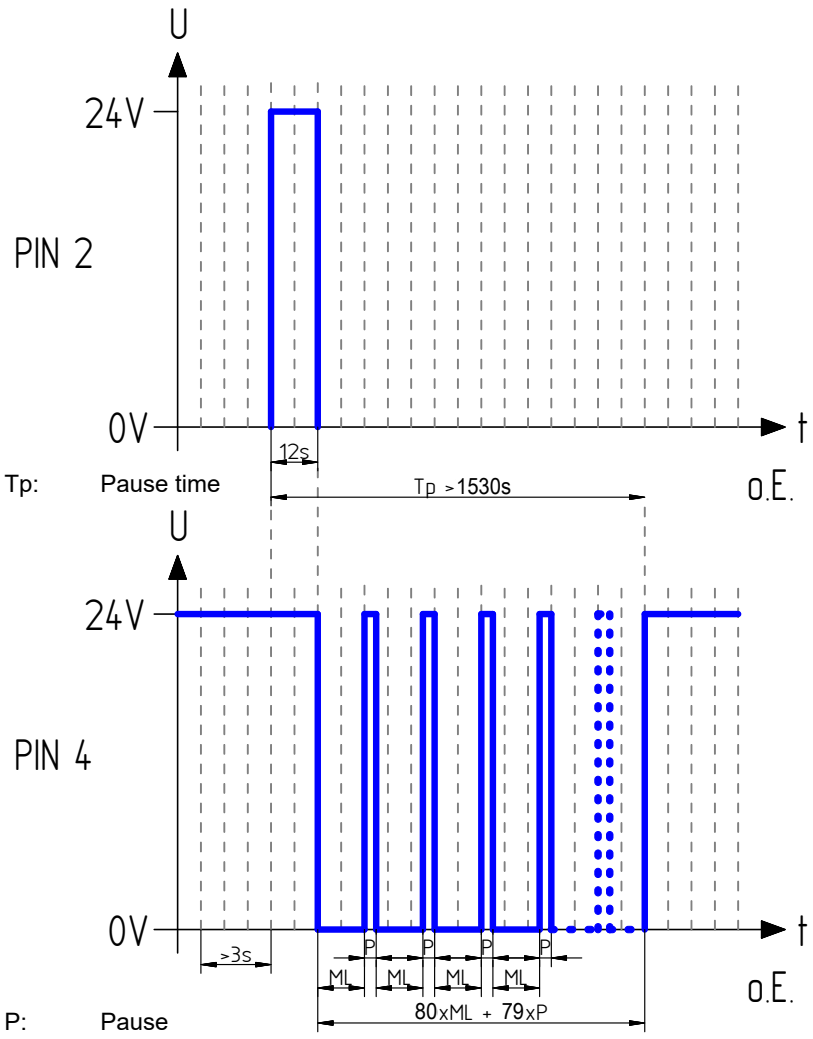
ⓘ A possible next control signal can be sent from the external controller (PLC) at the earliest >3 seconds after the end of the error-free and successful motor run. In the meantime, the Lubrication device does not process any control signals.

ⓘ In order to ensure a reliable and unambiguous recognition of the control signal, a pause must be observed. For the control signal 8 seconds, the Lubrication device requires a pause time (Tp) of at least 47 seconds between two identical or different control signals.

ⓘ If the integrated microelectronics of the Lubrication device has detected an error during or immediately after the end of the motor run (ML), this is transmitted to the external controller (PLC) by the corresponding output signal (chapter 8.3).

8.2.4 Control signal 12 seconds

The control signal for 12 seconds triggers the FIL function by the external control. A total of 40 dispensing operations per pump body are carried out automatically one after the other. After a certain pause time, this control signal can be repeated or another control signal can be sent. The Lubrication device reacts only in a certain operating state to control signals at PIN 2. The operating states are output by the Lubrication device via PIN 4 as high/low levels and must be tapped and processed accordingly in the PLC.



Description:

✓The Lubrication device is properly connected to an external controller via the electrical interface and connected to the power supply.

●The Lubrication device sends a permanent output signal (high level) to PIN 4, which indicates to the external control (PLC) that it is ready for operation. This output signal must be permanently and continuously present for >3 seconds. Control by the external controller is only possible if this condition is present.
●The control signal 2 seconds with a signal length of 12 (11.9 ... 12.1) seconds high level can be sent from the external control (PLC) to the Lubrication device.
●Immediately after the control signal drops, the motor run (ML) of the Lubrication device starts and 0.16 cm³ lubricant is conveyed to the outlet. Simultaneously with the start of the motor run (ML), the Lubrication device sends a low level output signal to the external controller (PLC) as confirmation for the duration of the motor run (ML).
●The motor running time (ML) depends on various conditions, including the counterpressure present or built up in the hydraulic system and the temperature. With the Lubrication device, the motor running time (ML) is 7...17 seconds.
●At the end of each error-free and successful motor run (ML), the output signal at the Lubrication device changes from a low level to a high level for a short pause time P = 2 seconds.
●A total of 40 engine runs and donations per both pump bodys will take place immediately one after the other. 40 x 0,16cm³ x 2 PB = 12,8 cm³ lubricant is conveyed from the cartridge to the outlet.

ⓘ A possible next control signal can be sent from the external controller (PLC) at the earliest >3 seconds after the end of the error-free and successful motor run. In the meantime, the Lubrication device does not process any control signals.

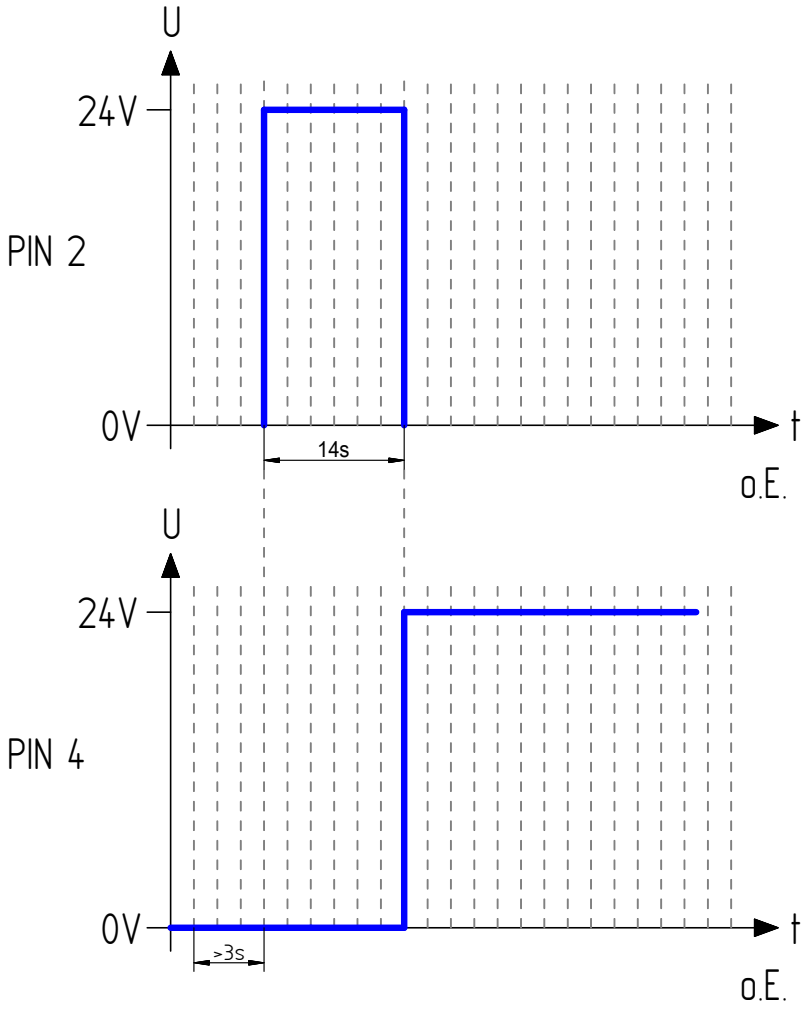
ⓘ In order to ensure a reliable and unambiguous recognition of the control signal, a pause must be observed. For the control signal 12 seconds, the Lubrication device has a pause time (Tp) between two identical or different control signals of at least 1533 ($Tp=ML_{max}$x80 strokes+Px79 strokes+signal length+3s) seconds = approx. 25.5 min.

ⓘ If the integrated microelectronics of the Lubrication device has detected an error during or immediately after the end of the motor run (ML), it is transmitted to the external controller (PLC) by the corresponding output signal (chapter 8.3).

ⓘ The FIL function can be terminated by sending the control signal 14 seconds, see chapter 8.2.5, during the pause time P after successful completion of any motor run. Furthermore, the FIL function can be terminated by disconnecting the power supply during the pause time P after successful completion of any motor run.

8.2.5 Control signal 14 seconds

The control signal 14 seconds is used to acknowledge error messages. It is the only control signal that the Lubrication device can process when a low level output signal is sent. Irrespective of the basic possibility of remote acknowledgment of an error, it is essential to identify and eliminate the cause when an error message is present. Furthermore, the 14 seconds control signal can be used to interrupt the FIL function.



Description:

✓The Lubrication device is properly connected to an external controller via the electrical interface and connected to the power supply.
✓There is an error at the Lubrication device.

●The Lubrication device sends a permanent output signal (low level) to PIN 4, which indicates an error to the external controller (PLC). This output signal must be permanently and continuously present for >3 seconds.
●The control signal 14 seconds with a signal length of 14 (13.9 ... 14.1) seconds high level can be sent from the external control (PLC) to the Lubrication device. The control signal is sent to the Lubrication device by the external control (PLC).
●At the end of the control signal, the integrated microelectronics of the Lubrication device will automatically check itself:

+If this internal check is **successful**, the output signal at the Lubrication device changes from a low level to a high level; the error is thus acknowledged and the Lubrication device is ready for operation again.
- If this internal check is **not successful**, the Lubrication device continues to send a low level output signal. The error is still present. For further measures in this case: Chapter 8.3.5.

ⓘ A possible next control signal can be sent from the external controller (PLC) at the earliest >3 seconds after the end of the error-free and successful motor run. In the meantime, the Lubrication device does not process any control signals.

ⓘ Regardless of the principle of remote acknowledgement of an error, it is essential to identify and eliminate the cause when an error message is present.

ⓘ Alternatively, the 14 second signal can be used to terminate the FIL function. In this case, the control signal must be sent 14 seconds after the motor has run successfully and without errors during the pause time P. As soon as the lubricator receives a signal during this pause time P, no further motor running is started.

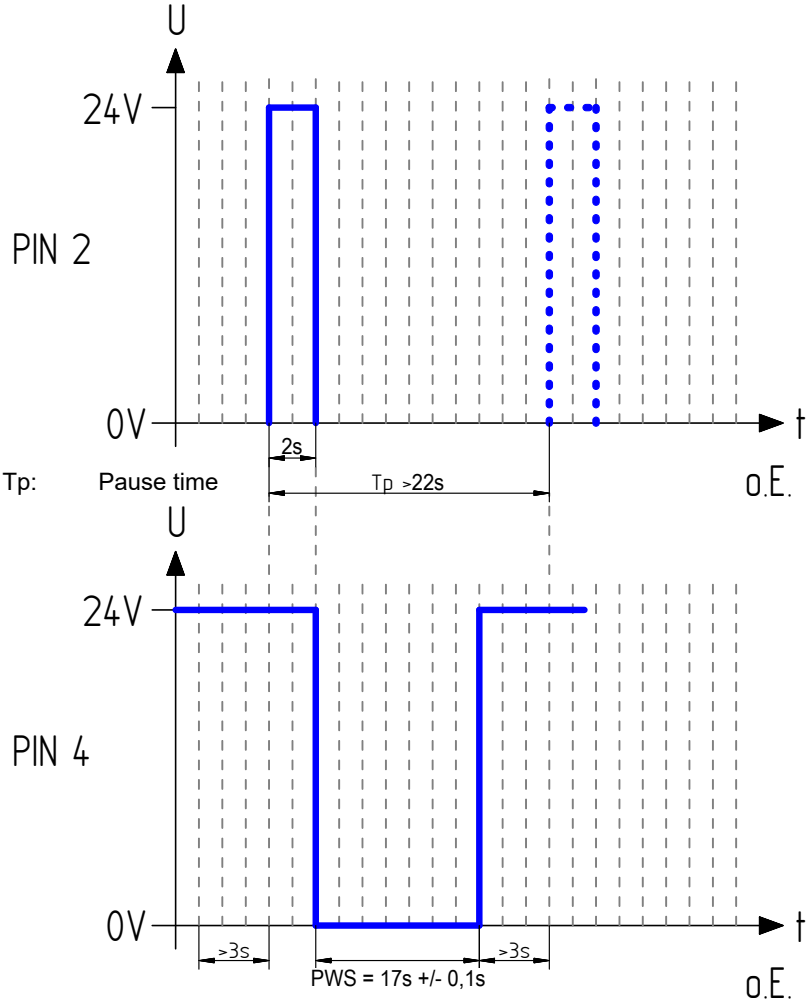
8.3 Output signals - External control (PLC)

Description	Output signal (PIN 4)	Detail
Ready for operation	high, permanent	Chap. 8
Receiving control signal	high, permanent	Chap. 8
Dispensing process	low, 7...17 seconds	Chap. 8
Filling Level Pre-Warning	low, 17 +/- 0,1 seconds	Chap. 8.3.1
Cartridge empty	0,5Hz-square wave signal, permanent	Chap. 8.3.2
Error	low, permanent	

If an output signal as low level (0V) is permanently present at PIN 4 for longer than 30s, there is an error at the Lubrication device. The only thing that can be determined by the signaling is that there is an error at the Lubrication device. The cause must be determined and eliminated by the operator. Chapters 8.3.3, 8.3.4 and 8.3.5 provide a procedure and possible causes for the pump error message.

8.3.1 Filling Level Pre-Warning

The Lubrication device is equipped with a sensor system that monitors the filling level of the lubricant cartridge. After reaching a remaining filling level of approx. 80 cm^3 in the cartridge, the Lubrication device signals an Pre-Warning. The Pre-Warning Signal (PWS) is transmitted to the external control (PLC). For this purpose, a separate, unique output signal is provided, which can be easily and reliably detected by the external control (PLC).



PWS: Pre-Warning Signal

Description:

The description of the Filling Level Pre-Warning is based on the example of the 2s input signal, which triggers a single dispensing process at pump body 1.The output signal of the Filling Level Pre-Warning is identical for all input signals.

✓The Lubrication device is properly connected to an external controller via the electrical interface and connected to the power supply.
✓ The remaining filling level of the cartridge is in the range of approx. 80 cm^3.

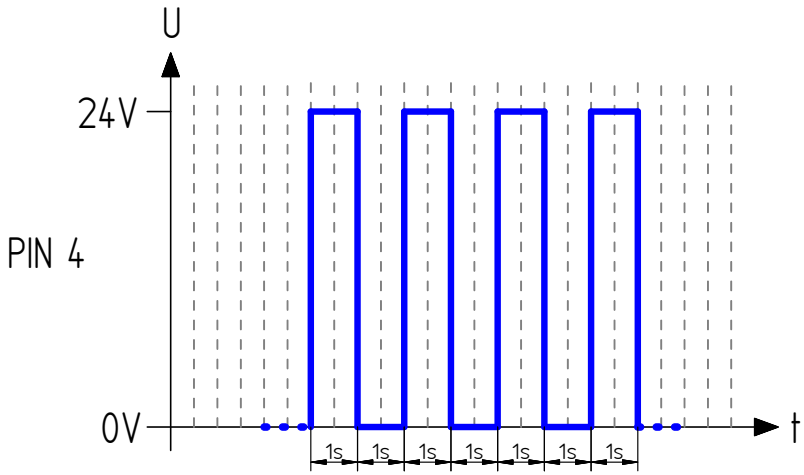
●The Pre-Warning Signal can only occur in addition to a donation.
●The filling level of the cartridge has fallen below a remaining filling level of approx. 80 cm^3 and a dispensing process is triggered by one of the input signals.
●Immediately after the control signal drops, the motor run (ML) of the Lubrication device starts and 0.16 cm^3 lubricant is conveyed to the outlet. Simultaneously with the start of the motor run (ML), the Lubrication device sends a low level output signal to the external controller (PLC) as confirmation. When the Filling Level Pre-Warning is activated, the low level signal has a defined length of 17s +/- 0.1s and is not coupled to the duration of the motor run.

ⓘ A Filling Level Pre-Warning is only permissible after three directly consecutive output signals with a defined length of 17s +/- 0.1s have been detected with the PLC after appropriate activation.

ⓘ The Pre-Warning Signal is a purely informative signal. The Lubrication device continues to work normally until the empty state of the cartridge is detected.

8.3.2 Empty level

The Lubrication device is equipped with a sensor system which detects the empty level of the lubricant cartridge. **After reaching the empty level, the Lubrication device no longer delivers lubricant.** This ensures that no air enters the Lubrication device or the lubricant lines. The empty state message is transmitted to the external control (PLC). For this purpose, a separate, unique output signal is provided, which can be easily and reliably detected by the external control (PLC).



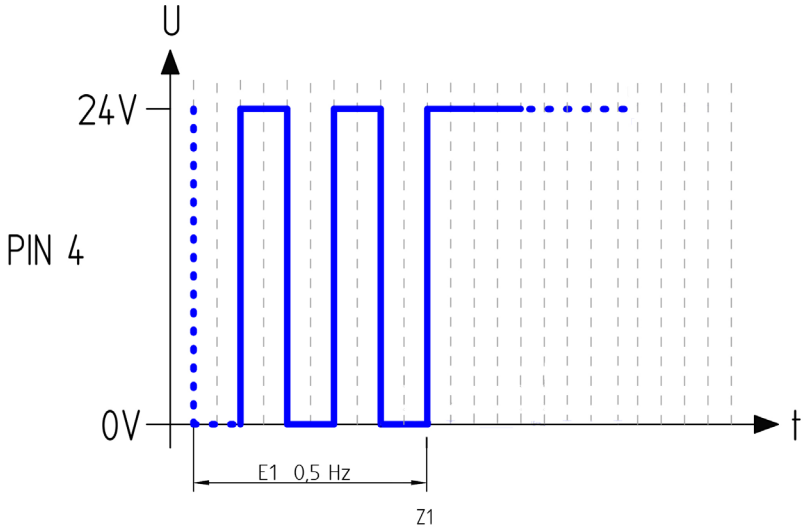
Description:

✓The Lubrication device is properly connected to an external controller via the electrical interface and connected to the power supply.

●The Empty state signal can only occur immediately after a donation.
●The Empty state signal must and cannot be acknowledged and stays present until the cartridge is changed. Remedial action is described in chapter 9.2.
At the same time as removing the cartridge, the Lubrication device sends a permanent low level (0 V) as output signal to PIN 4.

ⓘ The Lubrication device does not process control signals until all errors have been eliminated.

The transition of the output signals when changing a cartridge on the Lubrication device is shown and described below:



Z1: Removing the empty cartridge/the upper housing

Description:

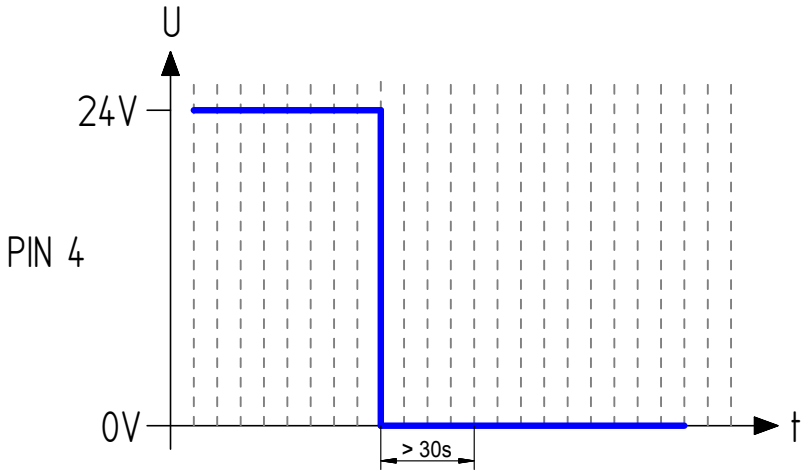
✓The Lubrication device is properly connected to an external controller via the electrical interface and connected to the power supply.

●The empty state of the cartridge occurred after a donation, the output signal of the Lubrication device is initially the 0.5Hz square wave signal (empty state signal) (0/+24 V).
●Z1 indicates the time of removal of the empty cartridge. The output signal of the Lubrication device now changes from a 0.5Hz square wave signal to a permanent high signal (0V).
●The lubrication device is again in operational condition and processes the known control signals.

ⓘ The Lubrication device does not process control signals until all errors have been eliminated.

8.3.3 Error Overload

The Error Overload signals a hydraulic overload during a dispensing process, i.e. the maximum pressure is exceeded.



Description:

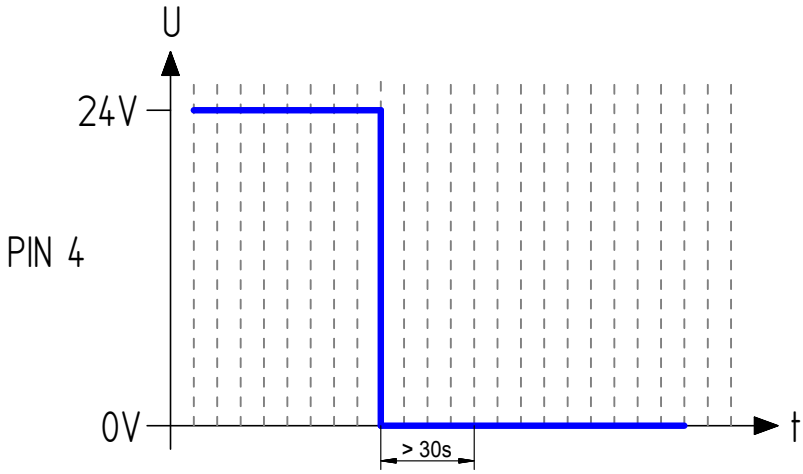
✓The Lubrication device is properly connected to an external controller via the electrical interface and connected to the power supply.
✓The Lubrication device has been successfully controlled by the external control (PLC) immediately before the occurrence of the overload error and has (attempted to perform) performed a dispensing operation.

●When the maximum permissible pressure is reached during or after a donation, the Lubrication device sends a permanent output signal as low level (0 V) to PIN 4 for external control (PLC).
●The error E2 (overload) must be acknowledged with the control signal 14 seconds (chapter 8.2.5) after elimination of the cause(s).

ⓘ The Lubrication device does not process control signals until all errors have been eliminated.

8.3.4 Error Under- or Overvoltage

Error Under- or Overvoltage indicates that the Lubrication device power supply is not within the specified parameters.



Description:

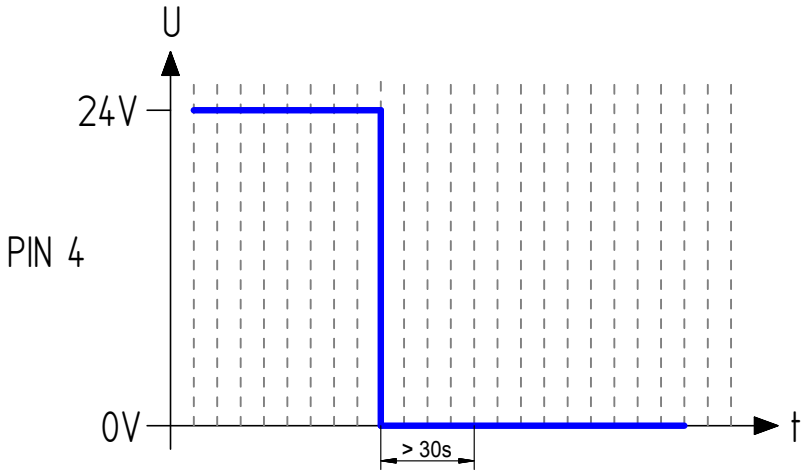
✓The Lubrication device is properly connected to an external controller via the electrical interface and connected to the power supply.

●If the supply voltage is too low, the Lubrication device sends a permanent output signal as low level (0 V) to PIN 4 for external control (PLC).
●Check the supply voltage and compare it with the parameters given in the Lubrication device technical data.
●Error Under- or Overvoltage must be acknowledged with the control signal 14 seconds (chapter 8.2.5) after elimination of the cause(s).

ⓘ The Lubrication device does not process control signals until all errors have been eliminated.

8.3.5 Critical error

The Critical Error indicates that the integrated microelectronics has detected a critical error and that the Lubrication device is not operating within the valid parameters. The cause can be mechanical, electronic or any other influencing variable.



Description:

✓The Lubrication device is properly connected to an external controller via the electrical interface and connected to the power supply.

●In an (internal) diagnosis, the critical (exception) error has been detected.
●The critical error **cannot** be corrected by you on site and **cannot** be acknowledged by you on the Lubrication device!
●Remove the Lubrication device with the lubricant cartridge screwed on and return the complete lubrication system to the manufacturer with a detailed description of the fault. The address of the manufacturer is given in chapter I.II.

ⓘ Do not open the Lubrication device without authorization! Observe the relevant notes and regulations in these instructions for proper use (section 2.5) and warranty (section 2.6)!

9. Maintencance and disposal

- Before starting any maintenance work, inform yourself about the general safety instructions (see Chapter 2) and observe the relevant local and operational safety regulations.
- Do not deactivate any protective device without authorization!

9.1 Maintenance schedule

The following maintenance schedule must be observed for the Lubrication device:

Maintenance	Commis-sioning	After 500 hours or after 3 months	Every year	If required
Cleaning	x	x	x	x*
Visual check	x	x	x	x*
Cartridge change	x		x**	x*

* Depending on operating conditions and lubricant consumption
** Recommendation after 2 years at the latest

9.1.1 Visual check

- Check the entire lubrication system (Lubrication device and any connected accessories including tubes and distributors) for external damage (e.g. loose or loosened tubes) by a thorough and conscientious visual inspection.
- Check the condition of the lubrication point for correct supply of lubricant.
- Replace damaged or defective parts immediately to ensure permanent lubrication.
- Check the filling level of the cartridge on the Lubrication device.
- Check possible error messages on the Lubrication device and remedy the causes accordingly.

9.1.2 Cleaning

- Clean the Lubrication device from dirt using suitable cleaning agents (e.g. absorbent towels, cloths).

NOTICE

Compressed air can damage the seals of the Lubrication device as well as transport dirt and foreign bodies into the Lubrication device or the lubricant.

- Do not use compressed air to clean the Lubrication device.

9.1.3 Recommssioning

- Reinstall all safety devices and make sure that no tools remain in the danger area.
- Check that the Lubrication device is turned on.
- Carry out a "Quick Check" (test run) using the control signal 8 seconds (chapter 8.2.3).

9.2 Cartridge change

NOTICE

A used lubricant cartridge must not be replaced on the Lubrication device, as the integrated stroke counter of the Lubrication device is automatically reset by the cartridge sensor after a cartridge has been removed.

- Only use full lubricant cartridges.

NOTICE

Only use original lubricant cartridges or the refillable cartridge system with filling adapter with lubricant approved by the manufacturer.

- Observe the maximum shelf life of lubricant filled in cartridges.

NOTICE

Refilling of empty or opened lubricant cartridges is only possible when using the refillable cartridge system with filling adapter.

NOTICE

Make sure you use the same lubricant in the new cartridge that is already in use.

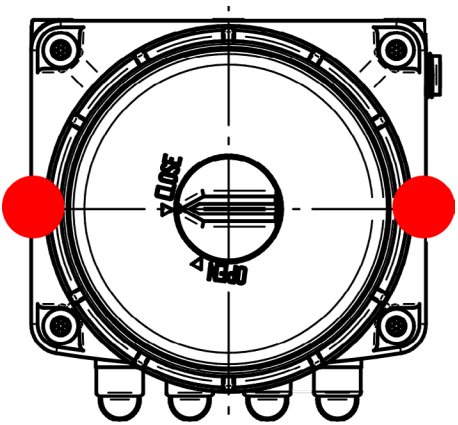
- Compare the data on the lubricant cartridge.

NOTICE

Only replace the cartridge if you also have a replacement cartridge at hand and can replace the emptied cartridge directly on site.

Changing the lubricant cartridge is very easy with the Lubrication device and takes place in five steps.
The cartridge only needs to be changed when it is empty or when the lubricant has exceeded its service life time. A cartridge can be changed during normal operation of the Lubrication device. Apart from changing the cartridge, no further measures are necessary!

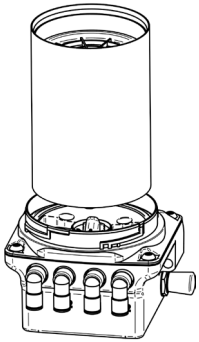
✓The Lubrication device has an empty level or the service life time of the lubricant has been exceeded.



1. Remove the upper housing from the power unit of the Lubrication device.

- Turn the retaining ring counterclockwise in order to remove the upper housing.
- Remove the upper housing from the power unit.

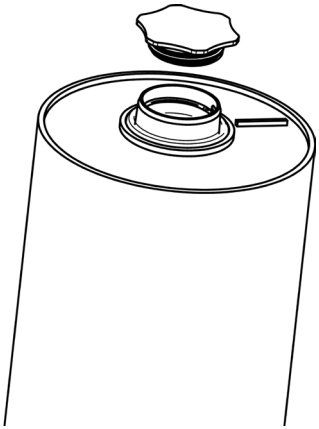
ⓘ Loosen the retaining ring at the marked positions.
ⓘ Make sure that no dirt, water or foreign bodies enters the lubricant inlet.



2. Remove the empty cartridge.

- Turn the lubricant cartridge counterclockwise, detach it from the Lubrication device and dispose it.

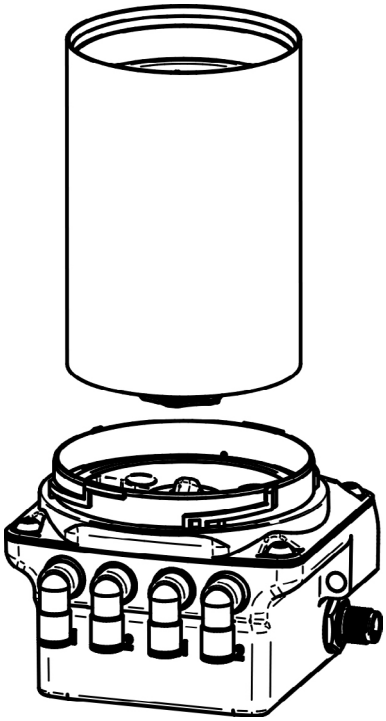
ⓘ Pay attention to cleanliness when carrying out the work. It is imperative that dirt and foreign bodies do not enter the cartridge.



3. Unscrewing the cartridge cap.

- Turn the cap on the new lubricant cartridge counterclockwise and pull it off.

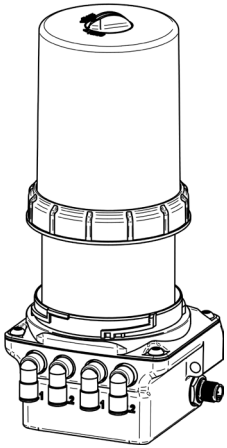
ⓘ Pay attention to cleanliness when carrying out the work. It is imperative that dirt and foreign bodies do not enter the cartridge.



4. Mounting the lubricant cartridge

- Place the full lubricant cartridge on the Lubrication device.
- Turn the lubricant cartridge clockwise onto the Lubrication device.

ⓘ The end position is reached after two full rotations when the label of the lubricant cartridge is aligned with the front label of the Lubrication device.



5. Assembling the upper housing on the power unit of the Lubrication device.

- Place the dismantled upper housing on the Lubrication device and press it onto the power unit.
- Fasten the upper housing to the power unit by turning the retaining ring clockwise.

ⓘ The retaining ring must snap into place when turning and be completely tightened.

- Carry out the work as described above.

➲ If the return signal indicated an error before the cartridge was changed, the display goes out. A separate acknowledgment is not necessary.

ⓘ If an empty cartridge has been reached during a dispensing cycle (pumping), this is automatically interrupted and continued automatically after completion of the work.

9.3 Disposal

- When disposing the Lubrication device, empty or opened cartridges, observe the relevant national regulations in force.
- When disposing the Lubrication device, observe the relevant safety data sheets and disposal instructions for the individual components.

ⓘ The refilling of empty lubricant cartridges is only possible when using the refillable cartridge system with filling adapter.

10. Lubricants / Tube lengths

10.1 Lubricants

Either use the original cartridges with arcanol grease developed and produced exclusively for the Lubrication device by the manufacturer Schaeffler Technologies AG & Co. KG or the refillable cartridge system with filling adapter.

NOTICE

The lubricant used in each case differs according to the application. The respective designation can be found on the label of the cartridge.

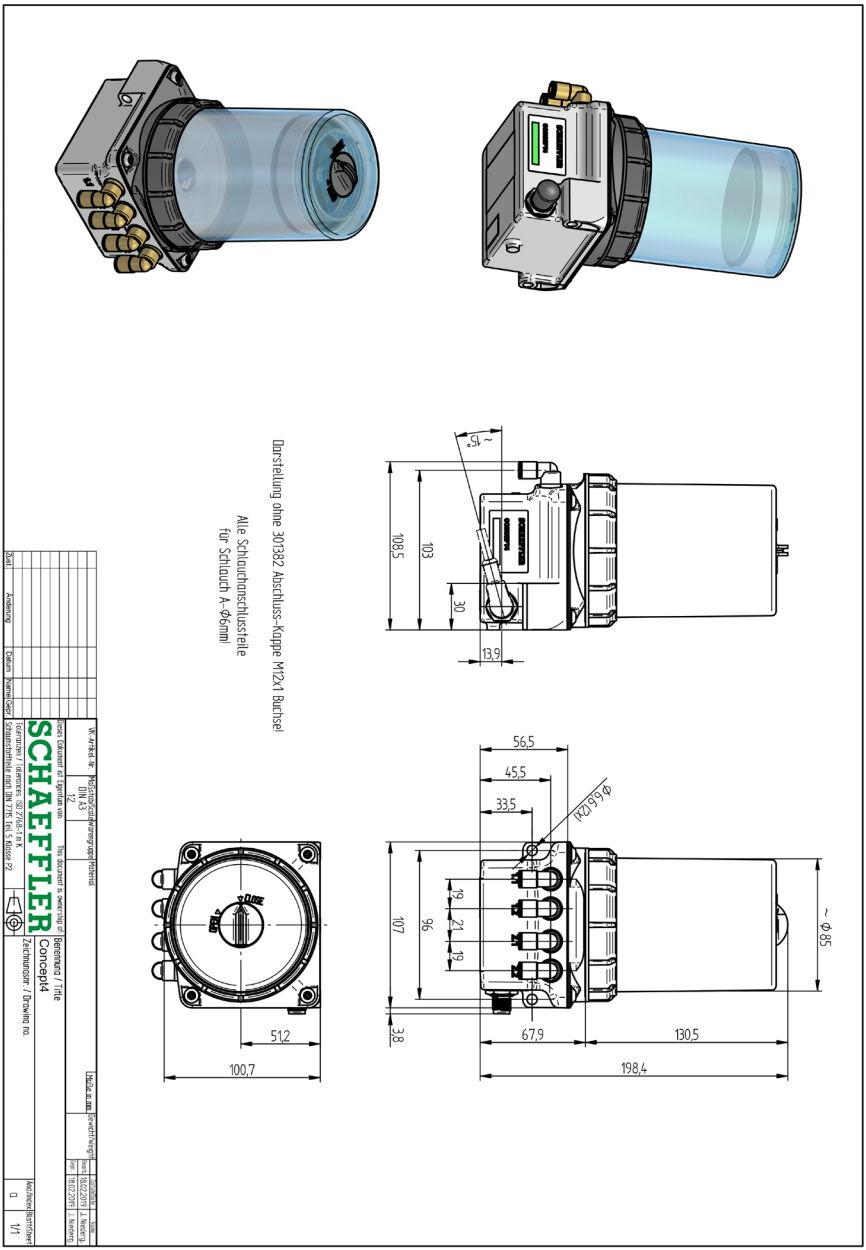
Further information on lubricants, documentation and safety data sheets can be obtained directly from the manufacturer Schaeffler Technologies AG & Co. KG.

10.2 Tube lengths

The maximum possible tube lengths must be determined according to TPI252.

11. Appendix

11.1 Dimension sheet and installation dimensions



11.2 EC/EU Declaration of conformity

SCHAEFFLER

en

EU Conformity Declaration

within the meaning of Machinery Directive 2006/42/EC of 17 May 2006

within the meaning of the EC Directive Electromagnetic Compatibility 2014/30/EU

The manufacturer:	Schaeffler Technologies AG & Co.KG Georg-Schäfer-Str. 30 D-97421 Schweinfurt

hereby declares that, based on its design and type and also on its marketed version, the product specified below complies with the relevant safety and health requirements of the following EU directives: Machinery Directive 2006/42/EC and EMC Directive 2004/108/EC. Any changes made to the product that have not been agreed to by the manufacturer will cause this declaration to lose its validity.

The manufacturer bears sole responsibility for issuing this conformity declaration.

Product designation:	Lubrication system
Product name:	CONCEPT4 as well as C4
Type:	C4-1P-24VDC, C4-2P-24V and F-xxxxxx.ARCALUB (F-number with 6-digit numerical code in customer-specific design)

Applicable harmonized standards:

EN 12100:2011-03	Safety of Machinery
EN 61000-6-2, EN 61000-6-4	Electromagnetic Compatibility (EMC)

Name and address of the person authorized to compile the technical documents:

Schaeffler Technologies AG & Co. KG
Georg-Schäfer-Str. 30
D-97421 Schweinfurt

Peter Schuster
Head of Mechatronics

Place, date:
Schweinfurt, 03/30/2020

This declaration certifies compliance with the directives specified above; however, it does not involve any guarantee of specific features. The safety information in the operating instructions must be followed.

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