

Aerosol Monitor  
AM1000

Minimum Quantity  
Lubrication Systems

Operating Manual  
Version 1



# Imprint

The Operating Manual is a part of the scope of delivery of a SKF aerosol monitor AM1000.

The manual has been edited in conformity with applicable standards and rules for technical documentation.

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## Editor

Dipl.-Ing. J. Schwartz

# Contents

Contents .....	1	8 Operation.....	14
1 Information Concerning the EC Declaration of Conformity and the Manufacturer's Declaration .....	2	8.1 Autonomous Operation .....	14
2 Notes to the Instructions .....	3	8.2 Operation with Connection to the Bus System of a SKF LUBRILEAN® Digital Super MQL System.....	15
3 Field of Application .....	4	9 Maintenance .....	16
4 Safety Instructions .....	4	10 Failures.....	16
4.1 Using the Aerosol Monitor .....	4	11 Decommissioning .....	18
4.2 Personnel .....	5	12 Service .....	18
4.3 Working on the Aerosol Monitor .....	5	13 Technical data .....	19
5 Transport, Delivery, Storage .....	6		
6 Design and Function .....	6		
6.1 System Design.....	6		
6.2 Method of Operation.....	7		
6.3 Operation Modes .....	7		
6.3.1 Autonomous Operation with Teach Function .....	7		
6.3.2 Operation with Connection to the Bus System of a SKF LUBRILEAN® Digital Super MQL System.....	7		
6.4 Functions.....	7		
6.4.1 Laser longlife function .....	7		
7 Installation.....	8		
7.1 Configuration.....	9		
7.2 Installation .....	10		
7.3 Connecting the Aerosol Lines .....	11		
7.4 Electrical Connection.....	12		
7.4.1 Supply Voltage and Analog Current Signal .....	12		
7.4.2 Bus Connection / Teach Adapter .....	12		

# 1 Information Concerning the EC Declaration of Conformity and the Manufacturer's Declaration

For the product designated below:

## **Aerosol Monitor AM1000**

we herewith certify that it complies with the pertinent safety requirements set forth in the following Council Directive(s) for the harmonisation of the laws of the Member States...

- **Electromagnetic compatibility 89/336/EEC**

### **Notes**

- (a) This declaration certifies the conformity with the directives listed, but does not entail an express assurance of properties.
- (b) The safety instructions listed in the documents that come with the product are to be observed.
- (c) Putting the certified products into operation is only allowed after it has been ensured that the machine, the vehicle or any other unit in which the product has been installed complies with the regulations and requirements of the applicable directives.
- (d) Operating the products on a non-standard mains voltage, or ignoring installation instructions can have an effect on the EMC properties and/or the electrical safety.

We further declare that the above-mentioned product:

- has been designed for installation in a machine / for assembly with other machines into a machine in accordance with the **EC machinery directive 98/37/EC, Annex II B**. Commissioning is not admissible until evidence has been provided that the machine in which this part is installed or to which this part is connected, complies with the regulations set forth in the EC directive 98/37/EC.
- with reference to the **EC directive 97/23/EC concerning apparatus subjected to pressure** this product must only be used as intended and in accordance with the notes in the documentation. The following must therefore be observed in particular:

SKF products are not suited for use in connection with fluids of group I (hazardous fluids), definition in accordance with article 2 paragraph 2 of the Directive 67/548/EEC dtd. 27th June, 1967; and are not approved for application with such.

SKF products are not designed and not approved for any utilization in conjunction with gases, liquified gases, gases dissolved under pressure, vapours, and liquids whose vapour pressure at the maximum permissible temperature is more than 0.5 bars above the normal atmospheric pressure (1013 mbars).

When used as intended, the products supplied by us do not reach the limit values listed in the article 3 paragraph 1, sections 1.1 to 1.3 and paragraph 2 of the directive 97/23/EC. They are thus not subject to the requirements of Appendix I of the Directive. Consequently, they do not obtain a CE mark with respect to the Directive 97/23/EG. They are classified by us to come under article 3 paragraph 3 of the directive.

SKF products must only be employed in accordance with their intended use. Using the products or putting them into operation in a hazardous area according to ATEX Directive 94/9/EG with a gas atmosphere or a dust atmosphere is not permitted.

If required, you may request the declaration of conformity or manufacturer's declaration for this product from our central contact address.

## 2 Notes to the Instructions

The aerosol monitor has been built according to the generally recognized technical standards. It complies with the valid occupational safety and accident prevention regulations. Still hazards may be involved in their use, which can lead to injury of operators or other persons or damage to the machine or other property. To ensure trouble-free operation and prevent hazard, we kindly ask you to read the present manual carefully and observe the notes contained in it.

Use the table of contents to locate the desired information promptly and successfully.

Please take note of the symbol shown below. It calls attention to special situations:



**Texts marked by this icon point out specific hazards or identify work that has to be carried out with particular care.**

These instructions are a part of the unit. They must be handed over to the new user when the unit is sold.

## 3 Field of Application



**All products from SKF LUBRICATION SYSTEMS GERMANY AG may only be used as intended and only according to the specifications in the Operating Instructions that belong to the units.**

**We particularly want to point out that any hazardous materials - in particular substances that are classified as dangerous according to EG RL 67/548/EWG Article 2, Paragraph 2 - may only be filled in SKF products and conveyed and/or distributed with these products after written authorization from SKF LUBRICATION SYSTEMS GERMANY AG has been obtained.**

**No SKF product is approved for being used in conjunction with hot gases, liquified gases, gases dissolved under pressure, vapours and liquids whose vapour pressure at the maximum permissible temperature is more than 0.5 bars above the normal atmospheric pressure (1013 mbars).**

**Apart from the particularly identified products, no product produced by SKF is approved for utilization in hazardous areas.**

The aerosol monitor is a measuring sensor used for continuously monitoring the aerosol flow of minimum quantity lubrication systems (MQL systems). Although it has specifically been developed for utilization in conjunction with the SKF LUBRILEAN® Digital Super MQL system, it may as well be used independently of this system.

Other use or use beyond this purpose is considered unintended. SKF will not accept liability for damages resulting from such unintended use.

## 4 Safety Instructions

Please observe the following safety instructions in order to ensure a troublefree functioning of the aerosol monitor and to avoid damages.

### 4.1 Using the Aerosol Monitor

The aerosol monitor may only be used as intended, when it is in a technically faultless state, in a safety- and hazard-conscious way and when the Operating Instructions are observed. Especially errors that could affect safety must be resolved without delay. Contact a SKF service centre (see Chapter 12, page 18) for this purpose.

The aerosol monitor is intended to be used in conjunction with a minimum quantity lubrication system (MQL system). All safety instructions listed in the Operating Instructions of the MQL system must therefore be observed when the aerosol monitor is used within the MQL system.

The aerosol monitor employs a class-1 laser which does not represent any risk when the unit is used as intended. However, do not look into the laser beam, and do not insert strongly reflecting objects into the aerosol channel.

Unauthorized modification of the aerosol monitor and using unapproved spare parts and auxiliaries are not permitted, and would lead to losing the warranty.

Units that can no longer be used must be made unusable and disposed of properly.

## 4.2 Personnel

The installation, electrical connection and all interventions such as repairs, component replacement, etc. may be carried out only by adequately qualified and instructed personnel.



**There can be significant damage and injuries when the aerosol monitor is connected improperly.**

Qualified personnel has been trained, instructed and specifically ordered by the owner to perform the work. Due to their training, experience and instruction, these persons are familiar with the applicable standards, regulations accident prevention regulations, and operating conditions. They are authorized to carry out the necessary activities, and are able to recognize and avoid possible hazards. The definition for qualified personnel and the prohibition of the employment of non-qualified personnel are stipulated by DIN VDE 0105 or IEC 364.

## 4.3 Working on the Aerosol Monitor

The aerosol monitor is installed in the aerosol line of an MQL system. Any work that is carried out during the installation on the aerosol monitor, for example, thus requires the safety instructions in the Operating Instructions of the MQL system to be observed.



### **CAUTION DANGER OF LIFE**

**Prior to starting any installation, service or repair work, the corresponding experts must disconnect the power to the system. Working on MQL systems that are not de-energized may lead to personal injuries.**



**Prior to starting any installation, service or repair work, the MQL system must be separated from the compressed air supply. Working on systems under pressure could lead to personal injuries.**

## 5 Transport, Delivery, Storage

The aerosol monitor is packed in commercial standard packing according to the requirement of the destination country and of DIN ISO 9001.

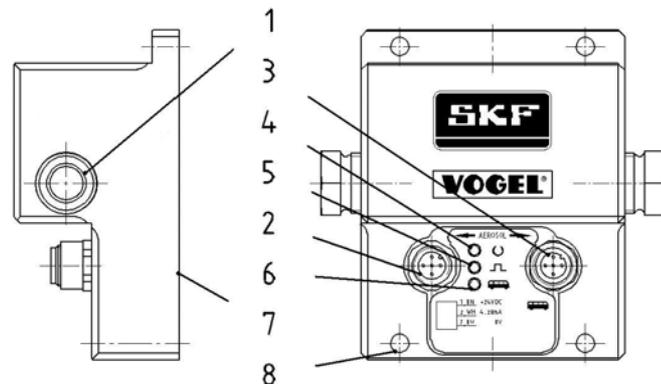
There are no limitations for road, air or sea transport.

Upon receiving the package, please check the items for possible damage, and ensure the package is complete by checking the supply papers. Keep the packaging material until any and all problems have been clarified.

Generally, units should be stored in dry and dust-free environment. The storage temperatures can be found in the specifications.

## 6 Design and Function

### 6.1 System Design



**Fig. 1. Design of the aerosol monitor**

1. **Connections for aerosol lines**
2. **Connection for supply voltage and analog signal**
3. **Connection for bus link or teach adapter**
4. **LED indicator for operating voltage**
5. **LED indicator for signals**
6. **LED indicator for bus communication**
7. **Bottom lid (access to DIP switches)**
8. **Boreholes for fixture**

## 6.2 Method of Operation

The aerosol monitor is a scattered-light monitor that is installed in the aerosol line between aerosol generator and lubrication point of an MQL system. There it measures the density of the aerosol produced by the MQL system.

In the SKF terminology, the term aerosol in minimum quantity lubrication technique stands for air mixed with finest lubricant droplets. The aerosol density is the quantity of the oil contained in the aerosol, related to the air flow.

The aerosol monitor supplies a measured analog signal that can be employed for controlling the aerosol production. If the oil content in the aerosol drops at a constant air flow, the aerosol density and, consequently, the measured signal drop, too. The measured signal remains constant if air stream and aerosol-oil throughput change equally. Thus, the measured signal represents the concentration of the oil in the air that flows along the monitor, not for the absolute oil quantity contained in the air stream.

## 6.3 Operation Modes

### 6.3.1 Autonomous Operation with Teach Function

The aerosol monitor can also be used in stand-alone mode, i.e. without a connection to a SKF LUBRILEAN® Digital Super MQL system. To be able to use the full range of the measured signal in this case, you can define a measurement range whose highest and/or lowest value correspond to the highest and the lowest value, respectively, of the measured signal (teaching).

### 6.3.2 Operation with Connection to the Bus System of a SKF LUBRILEAN® Digital Super MQL System

The aerosol monitor features a bus interface via which the monitor can be connected to the bus system of a SKF LUBRILEAN® Digital Super MQL system. This provides the MQL system with information, such as the aerosol-oil volume flow, that permit the aerosol generation to be optimized.

## 6.4 Functions

### 6.4.1 Laser longlife function

The laser is switched off automatically when the aerosol monitor detects that aerosol does not flow through the measuring chamber and the signal approaches zero. Next, the aerosol monitor checks at 10-second intervals whether there is aerosol in the line. The laser is switched back on as soon as aerosol flows through the measuring chamber.

**Note:**

This function is particularly suitable for slow processes to which a signal delay of up to 10 seconds is not relevant.

## 7 Installation

Use the following flow chart to carry out installation and commissioning of the aerosol monitor:

- Configuration
- Erection
- Connecting the aerosol lines
- Electrical connection and settings



**Installation work may only be carried out on the previously de-energized and de-pressurized MQL system.**



**The aerosol monitor may only be installed and connected by properly qualified and instructed personnel. The safety instructions in the Operating Instructions of the aerosol monitor and the MQL system are to be observed.**

## 7.1 Configuration

The unit must be configured via DIP switches on the board if it is to be connected to the internal bus system of the LUBRILEAN® Digital Super MQL system.

De-energize the unit, screw off the bottom lid, and remove the seal.

Use the following table to select the configuration required for your application. Additional notes and explanations can also be found in Chapter 7.4.2, page 12.

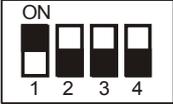
Carefully install seal and bottom lid after you have set the DIP switches.

Please note, that the configuration of the related control unit of the LUBRILEAN® Digital Super also have to be adjusted. Please refer to the related Operating Instructions and/or contact a SKF service centre to find the necessary settings.



**Fig. 2. View on the DIP switches. Bottom lid removed.**

**Table 1. Configuration of the DIP switches**

Illustration	DIP No.	Status	Default ex factory	Action	Setting
	1	ON OFF	X	Bus termination	active inactive
	2	ON OFF	X	Target system for bus data	2nd control unit in UFD20-02x 1st control unit in UFD20-02x or UFD10-02x
	3	ON OFF	X	not used	- -
	4	ON OFF	X	Laser longlife function	active inactive

## 7.2 Installation

The aerosol monitor should be installed on a vertical surface such that the aerosol lines run horizontally.

The location of the monitor must remain the same during operation.

The aerosol monitor should be installed such that it is protected against humidity and vibration, and easily accessible so that any further installation is possible without any problems. All visual indicators should be clearly visible, all control elements easily accessible.

Do not install the monitor in the vicinity of a heat source. Ebenfalls ungeeignet ist ein Ort, der schnellen und starken Temperaturschwankungen ausgesetzt ist.

We recommend to install the monitor directly on the machine housing. Die Einbaumaßen sind den entsprechenden Kundenzeichnungen zu entnehmen.



Fig. 3. Aerosol monitor with installed lines

### 7.3 Connecting the Aerosol Lines



**Prior to installing the aerosol lines to the aerosol monitor you must depressurize the MQL system.**

Aerosol monitor features screwed connections for hoses  $\text{Ø } 12 \times 1$  (outside  $\text{Ø} \times$  wall thickness).

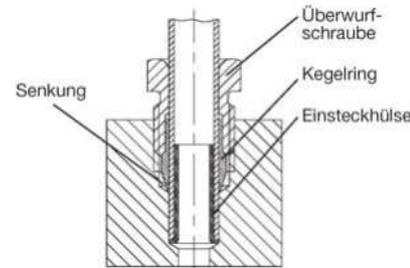


**Only pneumatic hoses which are resistant to the lubricants used and will withstand an operating pressure of least 10 bars may be used.**

The aerosol monitor is installed in the aerosol line, between MQL system and lubrication point. This may require the hose to be separated. Use the screwed fittings to connect the hoses (Fig. 4).

We recommend using transparent hoses, which should be screened against the ambient light at a length of approximately 20 cm before and after the aerosol monitor in order to ensure an optimum signal response of the monitor. Sufficient screening can be achieved by an additional hose sheath, for example.

Guidelines and recommendations for laying the aerosol lines can be found in the Operating Instructions of the related MQL system. Please contact a SKF service centre if you have any other questions when you install your MQL system (see Chapter 12, page 18).



**Fig. 4. Threaded hose coupling**

1. Shift the union screw and the tapered ring onto the pipe end as shown in the figure.
2. Guide the pipe end into the hollow until it hits the stop.
3. Tighten the union screw manually. Continue turning it by a maximum of  $1 \frac{1}{2}$  revolutions.

## 7.4 Electrical Connection



**The electrical connection of MQL system and aerosol monitor may only be established by appropriately qualified and instructed specialist staff. Comply with the notes in this operating manual.**

Please refer to the installation drawing and/or the leaflet of the aerosol monitor for recommended accessories for the electrical connection.

### 7.4.1 Supply Voltage and Analog Current Signal

The left-hand connector of the aerosol monitor (male connector) is provided for connecting the operating voltage and the analog signal output.

The pin assignments are listed in the table below.

The aerosol monitor is operational and the operating voltage LED is ON as soon as the supply voltage is applied.

Contact	Used for	Male connector* <sup>1</sup>	Wire colours* <sup>2</sup>
Pin 1	+ 24 VDC		Brown
Pin 2	4..20 mA		White
Pin 3	0 V (GND)		Blue
Pin 4	-		Black
Pin 5	-		Yellow-green

**Table 2. Pin assignments for operating voltage and analog signal**

\*<sup>1</sup> View onto the connector

\*<sup>2</sup>When using a pre-fabricated M12x1 cable

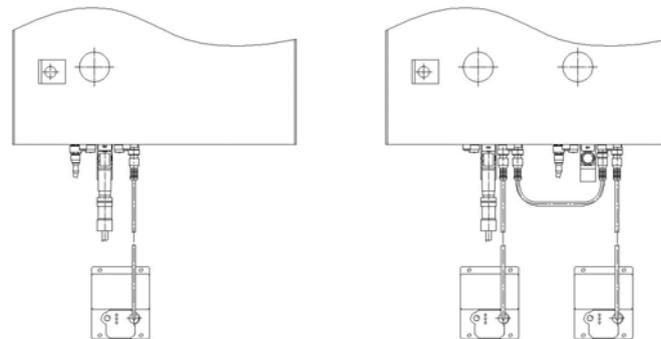
### 7.4.2 Bus Connection / Teach Adapter

The right-hand connector of the monitor (female connector) is provided for connecting the bus link to the SKF LUBRILEAN® Digital Super MQL system or the teach adapter.

Connect the bus cable (accessory) to establish the link to the SKF LUBRILEAN® Digital Super MQL system.

When using the UFD20-02x, you must connect an aerosol monitor with a control unit of the MQL system. A common bus is established, since the control units of the MQL system are already interconnected with each other (Fig. 5).

The line is always terminated at the end of the bus. The left-hand picture (Fig. 5) thus requires the line termination in the LUBRILEAN® Digital Super control unit and in the aerosol monitor to be activated.



**Fig. 5. SKF LUBRILEAN® Digital Super MQL systems with connected aerosol monitor  
left: UFD10-02x, right: UFD20-02x**

In the right-hand picture, the termination resistors in the LUBRILEAN® Digital Super control units are to be deactivated, and the ones in the aerosol monitors are to be activated.

The termination resistor of the aerosol monitor is activated via a DIP switch at the bottom of the monitor (see Chapter 7.1, page 9).

The teach adapter (accessory) can be connected to the right-hand connector of the aerosol monitor. The adapter can be used for adjusting the monitoring range of the aerosol monitor.

To connect the teach adapter you must remove the screwed lid on the right-hand connector. Once you have completed the teaching process, remove the teach adapter and reinstall the lid.

A bus line connected to the right-hand connector must be removed during the teach process, and be reconnected after teaching has been completed.

## 8 Operation

### Note:

The colour of the signal LED shows the range of the measuring range the current aerosol density is in:

- 0 – 25 % signal LED is OFF.
- >25 - 50 % signal LED lights white
- >50 - 75 % signal LED lights green
- >75 % signal LED lights blue

The aerosol monitor can be used in two different modes:

- Autonomous operation
- Operation with connection to the bus system of a SKF LUBRILEAN® Digital Super MQL system

### 8.1 Autonomous Operation

When the aerosol monitor is used in autonomous mode, an analog current signal (4...20 mA) is available that is related to the actual analog density. This signal can be used, for example, to generate a warning message when the measured values deviate from the specified reference values.

To be able to use the complete measuring range of 4 – 20 mA, we recommend the setting of limit values of the aerosol density in the aerosol monitor. This process is known as "Teaching". To carry out teaching, connect the teach adapter (accessory) to the right-hand connector of the aerosol monitor, and carry out teaching according to the instructions in Table 3.

**Table 3. Teaching the analog signal**

Action	Prerequisite	Operation	LED response	
			with successful teach-in	with faulty teach-in
Setting the maximum value (high teach)	Aerosol flows at the maximum set analog density	Press the button on the teach adapter 2x in short succession	Signal LED blinks 4x blue	Signal LED blinks 6x red
Setting the minimum value (low teach)	Aerosol flows at the minimum permitted analog density	Press the button on the teach adapter 1x long (approximately 1s), until the signal LED lights green	Signal LED blinks 3x green	Signal LED blinks 6x red
Resetting the values to the factory setting	None	Press the button on the teach adapter until signal LED and bus LED light up. Release the button.	Signal LED blinks 4x blue and BUS LED blinks 4x white	Signal LED blinks 6x red



Figure 6. Aerosol monitor with teach adapter

## 8.2 Operation with Connection to the Bus System of a SKF LUBRILEAN® Digital Super MQL System

When the aerosol monitor is connected to the bus system of a SKF LUBRILEAN® Digital Super MQL system, the measured values are transferred via the bus link to the control unit of the MQL system where they are processed to yield additional characteristic variables (see Table 4).

The MQL system transfers these variables to the control system of the machine tool. Comparing the measured results with the previously determined reference values enables the user to determine and assess significant deviations.

Operation with the BUS system requires a software version 17 or higher at the control unit of the SKF LUBRILEAN® Digital Super MQL system. Please contact a SKF service centre for software updates.

Table 4. MQL parameters in bus communication

Parameter	Value range
Air volume flow	0...600 NI/min
Aerosol-oil volume flow	0...65355 [without unit]
Aerosol density	0...1000 [without unit]

## 9 Maintenance



**Maintenance work may only be carried out by adequately qualified and instructed specialist staff.**

**Maintenance work may only be carried out on an MQL system that was de-energized before by competent specialist staff. Working on an energized system may lead to personal injuries.**

The aerosol monitor requires little service. However, in order to ensure faultless functioning and to prevent dangers from arising, check all connections and joints regularly.

**Any work not described in these Instructions may only be carried out by authorized SKF service personnel.**

SKF LUBRICATION SYSTEMS GERMANY AG does not assume any responsibility for damages that are caused by improper maintenance on the aerosol monitor or MQL system.

## 10 Failures

Faultless functioning of the aerosol monitor requires the following prerequisites to exist:

- The system has been connected correctly.
- The bus link has been installed properly.
- The MQL system has properly been configured and is equipped with the correct software.
- The machine tool is switched on.

Provided that there are no malfunctions in the system itself, any other faults can usually be eliminated quickly.

Table 5 gives an overview of various problems you can eliminate yourself. You should contact us if the problem cannot be rectified by taking the measures described here.

When using the unit with a SKF LUBRILEAN® Digital Super MQL system, faults different to the listed error messages of the control unit are not due to faults of the aerosol monitor. Please refer to the Operating Instructions of the SKF LUBRILEAN® Digital Super MQL system for details.

**Table 5. Possible faults when using the aerosol monitor**

Fault	Possible cause	Remedial action
Autonomous operation or operation with connection to the bus system of a SKF LUBRILEAN® Digital Super MQL system		
Analog value always 4 mA	No aerosol	Check the MQL system
	No sensible teach setting (aerosol density high teach < low teach)	Reset the teach values to the factory setting (see Chapter 8.1, page 14)
<b>Operation with connection to the bus System of a SKF LUBRILEAN® Digital Super MQL system</b> <b>The control unit of the LUBRILEAN® Digital Super shows the following error codes</b>		
BUS LED doesn't glow	Software of the control unit of the SKF LUBRILEAN® Digital Super MQL system does not correspond with version 17 or higher	Update the software version
E 50	The aerosol monitor is not recognized by the control unit of the UFD10-02x or by the 1st control unit of the UFD20-02x	Check the bus cable connections Check whether DIP switch 8 in the control unit of the DigitalSuper is ON. If not, set it to ON. Check whether DIP switch 2 in the aerosol monitor is OFF. If not, set it to OFF.
E 60	The aerosol monitor is not recognized by the 2nd control unit of the UFD20-02x.	Check the bus cable connections Check whether the PROFIBUS address in the 1st system of the UFD20-02x is ≠ 0. Check whether the PROFIBUS address in the 2nd system of the UFD20-02x is ≠ 0. Check whether DIP switch 8 in the 2nd control unit of the UFD20-02x is ON. If not, set it to ON. Check whether DIP switch 2 in the aerosol monitor is ON. If not, set it to ON.

## 11 Decommissioning

When decommissioning the aerosol monitor and disposing of it you must always observe the legal provisions for disposing of components that contain lubricants.

Upon request, SKF takes the unit back for disposal and will charge you for the incurring costs.

## 12 Service

Please contact our sales offices or our international representatives if you have any questions or problems.

You can find a list of the current addresses on the Internet at:

- [www.skf.com/schmierung](http://www.skf.com/schmierung)

## 13 Technical data

**Table 6. Technical data**

Designation	Unit	Value
Fluid	-	Aerosol for MQL
Operating pressure, aerosol	bar	4 ... 10
Connection for aerosol line	-	for hose Ø12x1
Ambient temperature	°C	+ 10 ... + 60
Protection rating to DIN EN 60529	-	IP 54
Operating voltage	V DC	24 ± 25%
Current consumption		
idle	mA	max. 60
under load	mA	max. 80
Analog signal	mA	4 ... 20
Load for analog current signal	Ω	max. 400

Operation with the BUS system requires a software version 17 or higher at the control unit of the SKF LUBRILEAN® Digital Super MQL system. Please contact a SKF service centre for software updates.













SKF Lubrication Systems Germany AG

Motzener Straße 35/37  
12277 Berlin

Postfach: 970444, 12704 Berlin

Telefon: (+ +49) 30-7 20 02-0

Fax: (+ +49) 30-7 20 02-111

E-Mail: [lubrication-germany@skf.com](mailto:lubrication-germany@skf.com)

WWW: [www.skf.com/schmierung](http://www.skf.com/schmierung)

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