ORIGINAL OPERATING INSTRUCTIONS

SMART COLLECTOR

SYSTEM MANUAL
INSTALLATION MANUAL
MAINTENANCE MANUAL

EN | V1.07 | DCL 356

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1 DOCUMENT HISTORY

Material number	Version	Edition	Description/changes
-	1.01	11/2022	First edition
-	1.02	01/2023	Foam body, PLC connection, temperature range, dashboard, fault indicator, system overview display
-	1.03	09/2023	• Adaptation Brief description (ExternalLink: Kurzbeschreibung) • Adaptation of designations/drawings (ExternalLink: Baugruppenübersicht) • Adaptation/addition of current collectorExternalLink: Baugruppenübersicht) • Addition of UPS and thermal sensor (ExternalLink: Baugruppenübersicht) • Description Main unit connection PLC and load output (chapterExternalLink: Main-Unit Anbindung SPS und Last-Ausgang) • X4 interface (chapter ExternalLink: X4 Schnittstelle) • Router (chapter ExternalLink: Router) • Power supply router (chapter ExternalLink: Schema Kabelanschluss) • Dashboard software version 1.3 (chapterExternalLink: 7 Bedienung • Addition delete error (chapter ExternalLink: Störungsanzeige) • Spare parts (chapter ExternalLink: Ersatzteile)
-	1.04	11/2023	Addition UL note
-	1.05	09/2025	• Nomenclature adaptation • Addition of voltage transformer • Addition of ampere specification for reading heads and thermal sensor • Addition of cable types and lengths
-	1.06	11/2025	• Adjustment technical data Main-Unit
-	1.07	02/2026	Operation chapter removed

2 GENERAL

2.1 About these instructions

These operating instructions enable the safe and efficient handling of our VAHLE products. This document is an integral part of the installation and must be kept accessible to operating and maintenance personnel in the immediate vicinity. The basic requirement for safe working is compliance with all specified safety instructions and instructions. This documentation does not give instructions for operating the plant/machine in which our system is integrated. In addition, the local accident prevention regulations and general safety regulations for the use of the system apply. Diagrams are for basic understanding and may deviate from the actual version.

2.2 Symbols

Safety instructions in this manual are identified by symbols. Each safety instruction begins with a signal word that indicates the severity of the hazard. The various types of warnings and safety instructions and their structure are explained below.



DANGER!

The source of the hazard is described here.

This combination of a symbol and a signal word indicates an immediately dangerous situation that will result in death or serious injury unless avoided.

► The actions to prevent the hazard are identified here.



DANGER!

The source of an electrical hazard is described here.

This combination of a symbol and a signal word indicates an immediately dangerous situation related to electricity that will result in death or serious injury unless avoided.

► The actions to prevent the hazard are identified here.



WARNING!

The source of the hazard is described here.

This combination of a symbol and a signal word indicates a potentially dangerous situation that may result in death or serious injury unless avoided.

► The actions to prevent the hazard are identified here.



CAUTION!

The source of the hazard is described here.

This combination of a symbol and a signal word indicates a potentially dangerous situation that may result in light or moderate injury unless avoided.

► The actions to prevent the hazard are identified here.



NOTICE!

The source of the hazard is described here.

This combination of a symbol and a signal word indicates a potentially dangerous situation that may result in property or environmental damage unless avoided.

► The actions to prevent the hazard are identified here.



NOTICE!

This indicates a reference to another place in this text or another document.

This combination of a symbol and a signal word indicates a reference to another place in this text or in a different document.

► The places in the text or references to other documents are identified here.



TIPS AND RECOMMENDATIONS!

► Simple tips and recommendations from our long years of experience are provided here.

2.3 Copyright protection

The contents of this manual are protected by copyright. Their use is permitted within the scope of the use of the installation. No further use is permitted without the written permission of the manufacturer. This manual may not be copied, given to any third party, reproduced in any form or by any means, including, but not limited to, exploitation and/or communication of the contents without the written permission of the manufacturer, except for internal purposes.

2.4 Disclaimer

The information in this document has been compiled in consideration of applicable standards and regulations, accepted rules of engineering, as well as our years of knowledge and experience.

The manufacturer shall not be liable for damages resulting from:

- Failure to observe the technical documentation
- Uses other than the intended use
- Use by personnel without the required training
- Unauthorized modifications or technical changes
- Use of non-approved spare parts or accessories

The actual scope of delivery may vary from the descriptions and images in this document in case of custom versions, the selection of additional order options, or due to latest technical changes.

The obligations agreed in the supply contract, the general terms and conditions and the terms and conditions of delivery, and the laws and regulations applicable at the time the contract was signed all apply.

We reserve the right to make technical changes to improve the usability and for further development.

2.5 Customer service

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Country of origin: Germany

2.6 Warranty

2.6.1 Warranty terms and conditions

The information in this document has been compiled in consideration of applicable standards and regulations, accepted rules of engineering, as well as our accumulated years of knowledge and experience.

The warranty period and the scope of the warranty are defined in the terms of the contract and the general terms and conditions of delivery of Vahle GmbH & Co. KG.

Our general terms of warranty and delivery are published on our website. www.vahle.de



⚠ WARNING!

No liability in case of unauthorized changes, modifications, or accessories!

Changes or modifications to the delivered product require the permission of the manufacturer. Genuine spare parts and manufacturer-approved accessories provide safety. The use of non-approved parts voids any liability of the manufacturer.

► Always consult the manufacturer first!

The warranty immediately expires in particular f one or several of the following situations arise(s):

- If the product is modified in whole or in part without permission of Vahle.
- If the operator independently performs repairs during the warranty period or has repairs performed by third parties.
- If the product has been handled or maintained inappropriately.
- If parts are used that are not original parts approved by Vahle.
- If the information in this documentation is not observed.
- If in this context applicable directives and standards are not complied.

3 SAFETY INSTRUCTIONS

3.1 Safety

This section gives an overview of all important safety aspects relating to the protection of personnel as well as the safe use and fault-free operation. Other, task-specific safety instructions can be found in the sections on the individual phases of the product's life.



DANGER!

Failure to observe the safety instructions may result in risks to life and health!

3.2 Intended use

In principle, the Smart Collector can be used in all rail-guided systems with moving consumers that are electrified by means of conductor rails. It features a special sensor system that detects the movements of the individual current collectors in the power and grounding rails. This movement data is aggregated with the position data. Anomalies in the overall system can be registered and reported at an early stage thanks to defined threshold and limit values set in the software and the corresponding logic.

3.3 General risks

The following section describes residual risks that arise even if the product is used as intended. Observe the safety instructions listed here in the other sections of these instructions to reduce the risk of injuries or damage to property and equipment and to avoid dangerous situations.

Do not change or modify the system inappropriately!



WARNING!

Risk of death from improper replacement or removal!

Errors during the removal or replacement of components may cause life-threatening situations or significant property damage

► Observe the safety instructions before beginning any removal work.

3.3.1 Danger from electrical energy

Perform the following safety work in accordance with VDE 0105-100 (this work must be carried out by a qualified electrician, see section "2 Safety").

Disconnect

Required isolating distances must be established.

Secure against re-switching

During work, a prohibition sign must be attached reliably on switching handles or drives of switches, control units, pressure and sensing devices, safety parts, circuit breakers that have been used to unlock a system part or that can be used to connect electricity. If this is not possible, then the clearly associated prohibition sign must be nearby. Existing mechanical interlocking devices against restart must be used for manually operated switches.

Determine that the system is de-energized

Absence of voltage is to be determined at or as close as possible to the work site at all poles. Absence of voltage must be checked with a voltage tester immediately before and after use.

Grounding and short-circuiting

Parts on which work will be performed at the work place must first be grounded and then short circuited. Grounding and short-circuiting must be visible from the workplace. Deviating from the above, it is permitted to ground and short-circuit near the work place if this is required due to the local conditions or for safety reasons. Devices for grounding and short-circuiting must always first be connected with the grounding system or the ground electrode and afterwards with the parts to be grounded. Grounding and short circuiting may be waived in certain low-voltage systems (see VDE 0100-100).

Cover or block adjacent live parts

Before starting work, check whether it is appropriate to make adjacent parts voltage-free.



DANGER!

Danger of death due to electrical current!

Contact with live parts can result in life-threatening injuries.

► Make sure that the relevant components are not live or under voltage, and that there is no unauthorized approximation.

The use of strong magnets can result in hazards due to:

- Electromagnetic fields
- Crushing injuries



DANGER!

Magnets can affect the functionality of pacemakers and implanted defibrillators.

A magnetic pulse could put the pacemaker into a different mode. A defibrillator may cease to function under certain circumstances.

► Ensure sufficient distance from magnets if you are the wearer of such a device. If necessary, warn the wearers of such devices.



Fig. 3-1 Warning sign: “No entry for people with pacemakers or defibrillator implants.”



⚠ WARNING!

Risk of crushing injuries due to magnetic forces

Accidents, serious injuries, damage to property

► It is important to ensure that no body parts get between the magnet and magnetic material.



NOTICE!

Hazard from magnetic fields and forces for devices

Destruction or damage

► Make sure that you do not bring (sensitive) electronic devices such as smartphones, tablets etc. into the direct vicinity of the magnets.

► Magnetic data carriers such as memory cards, credit cards, etc. can be destroyed or damaged!

Note that the additional safeguards are the responsibility of the operating company. If required, refer to relevant standards or the DGUV documents (German social accident insurance), such as DGUV Regulation 103-013, “Electromagnetic Fields”.

Specifications for the shipping of magnets



TIPS AND RECOMMENDATIONS!

Information on the shipping of magnets by air

When shipping magnets, the applicable regulations for stray magnetic fields during air transport must be observed (IATA Dangerous Goods Regulations). These regulations also apply to built-in magnets.

3.4 Responsibilities of the operating company

Definition of the operating company

The owner is listed in the order confirmation and has the following owner obligations:

Owner obligations

The system is put to commercial use. The owner of the system is therefore subject to laws and regulations on workplace health and safety. In addition to the safety instructions in this document, the safety, accident prevention, and environmental regulations for the system's field of application must be followed. The following applies in particular:

- The owner ensures protection against electric shock (contact protection).
- The owner must inform himself about applicable workplace health and safety regulations and conduct a risk assessment for additional hazards that may arise from the special operating conditions at the installation site. These must be implemented as facility instructions for the operation of the system.
- Over the entire time, the owner has to verify that the instructions drafted by him for the operation of the system conform to the current state of applicable regulations and adapt the instructions as necessary.
- The owner must clearly define responsibilities for the installation, operation, maintenance, and cleaning of the system.
- The owner must ensure that all employees who handle the system have read and understood the operating instructions. The owner is also required to provide training periodically and instruct personnel about the risks.

The owner is also responsible for ensuring that the system is always in good technical condition. The following therefore applies:

- The owner must ensure that the maintenance intervals described in this documentation are observed.
- Control and safety devices provided by the owner for the operation of the system must be checked for completeness and functional safety.
- The owner must ensure that assembly and installation comply with EN 60204.
- The owner must ensure that all components are de-energized in the event of an emergency off. This applies in particular to the parallel busbar.

3.5 Personnel requirements

3.5.1 Qualifications

The tasks described in this manual present various requirements to the qualifications of the persons performing them.



⚠ WARNING!

Hazard in case of insufficient qualification of personnel!

Insufficiently qualified persons are unable to judge the risks when working on the system, which puts them and others at risk of severe or fatal injuries.

- ► All work must be performed by qualified personnel only.
- ► Insufficiently qualified personnel must stay out of the work area.

Operator

The operator has been instructed by the owner about the tasks assigned to him and the risks of inappropriate actions. An operator may perform tasks that go beyond normal operation only if this is indicated in the instructions and the owner has expressly assigned him with such a task.

Electrically qualified person (see VDE 0105-100)

Due to their professional training, knowledge, experience, and knowledge of the relevant standards and regulations, professional electricians are able to carry out work on electrical installations and to independently recognize and avoid possible hazards. The professional electrician has been specifically trained for his/her professional working environment and is conversant with the relevant standards and regulations.

Qualified personnel

Qualified personnel are able, based on their technical training, knowledge, experience, and familiarity with applicable regulations, to perform the assigned tasks and independently detect and avoid potential hazards.

Instructed personnel

The instructed person has been instructed by the owner about the assigned tasks and the risks of inappropriate actions. Such persons must also have read and understood these safety instructions and observe them during their work.

This may need to be confirmed by the customer/user with a signature.

3.6 Personal protective equipment

Every person who is instructed to work on the system or in the vicinity of the system (support personnel) must wear personal protective clothing/equipment for the suitable type of their work. Personal protective equipment has the purpose of protecting personnel against hazards to their health and safety at work. The owner is responsible for ensuring that protective equipment is worn.

Personal protective equipment is described below:



Safety shoes

Safety shoes protect against falling parts as well as against slipping.



Protective goggles

Protective goggles protect against flying particles and liquid sprays.



Helmet

Helmets protect against falling or flying parts and materials.



Gloves

Gloves protect hands against chafing and abrasion, cuts and punctures, as well as against contact with hot surfaces.



Protective work clothes

Work clothing is close fitting and resistant to tearing, with close-fitting sleeves and without any projecting parts. It is designed to protect against being caught by moving parts of machinery. However, it must not reduce mobility. Do not wear rings, necklaces, or other jewelry. Long hair must be covered (cap, hat, hairnet, or similar). Fall-arrest equipment, face protection, and hearing protection according to DGUV Regulation 112-189.



Hearing protection

To protect against severe and permanent hearing loss.



Breathing protection

To protect against severe and chronic conditions of the airways.

3.7 Safety devices



WARNING!

Danger from non-functional safety devices!

Non-functional or disabled safety devices cause a risk of severe injuries or even death.

► Before beginning any work, verify that all safety devices are functional and installed properly.

► Never disable or override safety devices.

In addition to locally applicable safety regulations, the following safety instructions must be observed.

The following accident prevention regulations (UVV; Germany) and the new Accident Prevention Regulations – Principles of Prevention (DGUV Regulation 1; Germany) must always be observed.

3.8 Conduct in case of danger or accident

Precautions:

- Have first-aid equipment (first-aid kit, blankets, etc.) and fire extinguisher ready.
- Maintain free access for emergency services vehicles.

Conduct in case of accident:

- Secure site of accident and call first-aid personnel.
- Alert emergency services.
- Provide first aid.

3.9 Signage

The following symbols and instruction signs are located in the work area. They relate to the immediate environment in which they are installed.



DANGER!

Danger of death due to electrical current!

Contact with live parts can result in life-threatening injuries.

► Make sure that the relevant components are not live or under voltage, and that there is no unauthorized approximation.



WARNING!

Danger from illegible signs!

Over time, labels and signs can get dirty or can become unreadable in other ways, which means that the dangers are not identified and that operating instructions cannot be followed.

► Always keep all safety, warning, and operating instructions in a legible condition.



NOTICE!

Follow instructions!

Only use the designated product after this documentation has been completely read and understood.

4 TECHNICAL DATA

Conformity	
CE	

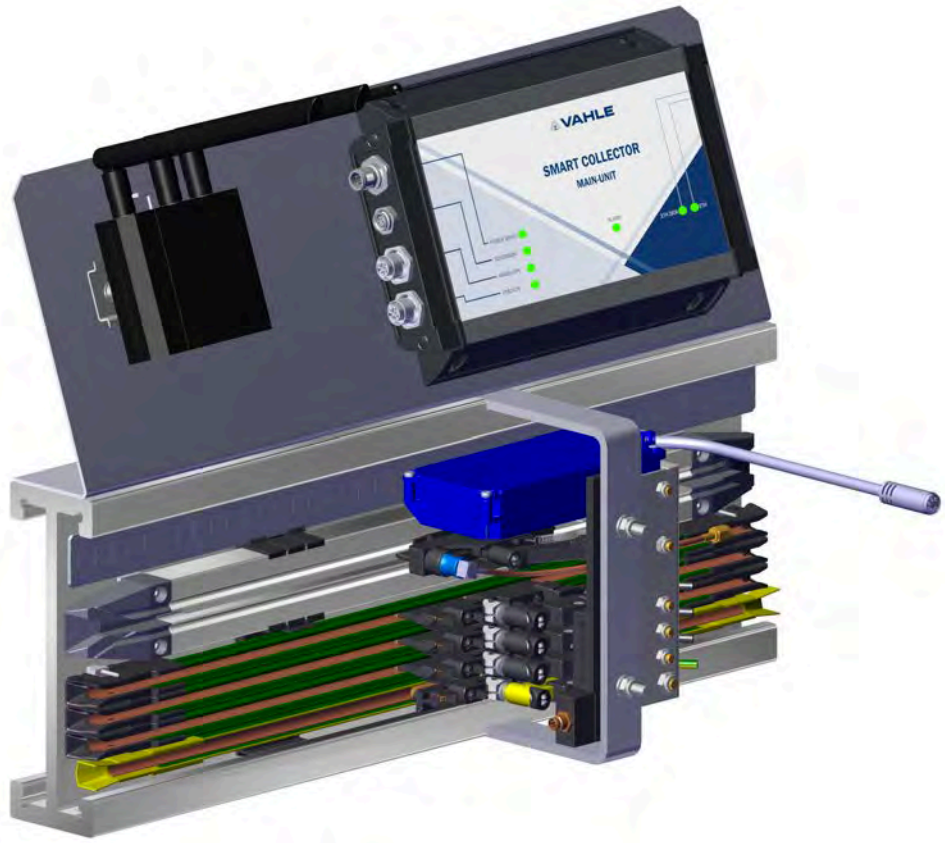
EMC	
Interference emissions	EN 61000-6-4:2007+A1:2011
Interference immunity	EN 61000-6-2:2005

Ambient conditions		
Operating temperature transport/storage	[°C]	-25 to +55
Operating temperature operation	[°C]	+10 to +40(1)
Max. humidity transport/storage	[%]	5 to 95, non-condensing
Max. air humidity during operation	[%]	5 to 85, non-condensing

(1) Systems with temperatures < 10 °C on request.

5 LAYOUT AND FUNCTION

5.1 System overview



5.2 Brief system description

In principle, the Smart Collector can be used in all rail-guided systems with moving consumers that are electrified by means of conductor rails. It features a special sensor system that detects the movements of the individual current collectors in the power and grounding rails. This movement data is aggregated with the position data. Anomalies in the overall system can be registered and reported at an early stage thanks to defined threshold and limit values set in the software and the corresponding logic. Predictive maintenance is possible.

Systems can currently be equipped with a phase spacing of 14, 18 and 26 mm, other systems available on request.

The Smart Collector system essentially comprises the following components:

Current collector with sensors

3D sensors record the movement data of the current collector during running operation. Functionality of the current collector is not affected in any way. These data are transmitted to the main unit for analysis.

Positioning system

For position query purposes, the existing system is extended with a reading head. Compatible positioning systems are APOS Optic and APOS Magnetic. Other systems can be integrated on request.



Router

If the main unit detects reproducible anomalies, a message is sent to our certified data center via the connected router. There is no continuous transmission.

Main unit

The measurement data are processed and evaluated in real time directly in the main unit. The flexible system features variable interfaces and is compatible with a number of positioning and data transmission systems (on request).

Interface

The analyzed measurement data is visualized using software and enables the allows the operating company to continuously monitor the status on an ongoing basis as well as offering various service options, which can be called up digitally using any end device.

Thermosensor

The thermal sensor enables the localization of thermal hotspots. In conjunction with the existing 3D unit, which determines movement data of the current collector arms, system availability can now be increased by a further measure.

UPS

With the optional UPS (Uninterruptible Power Supply), the Smart Collector System can bridge short periods of no power so that the Main Unit does not shut down during operation.

Server

The data center is certified as follows:

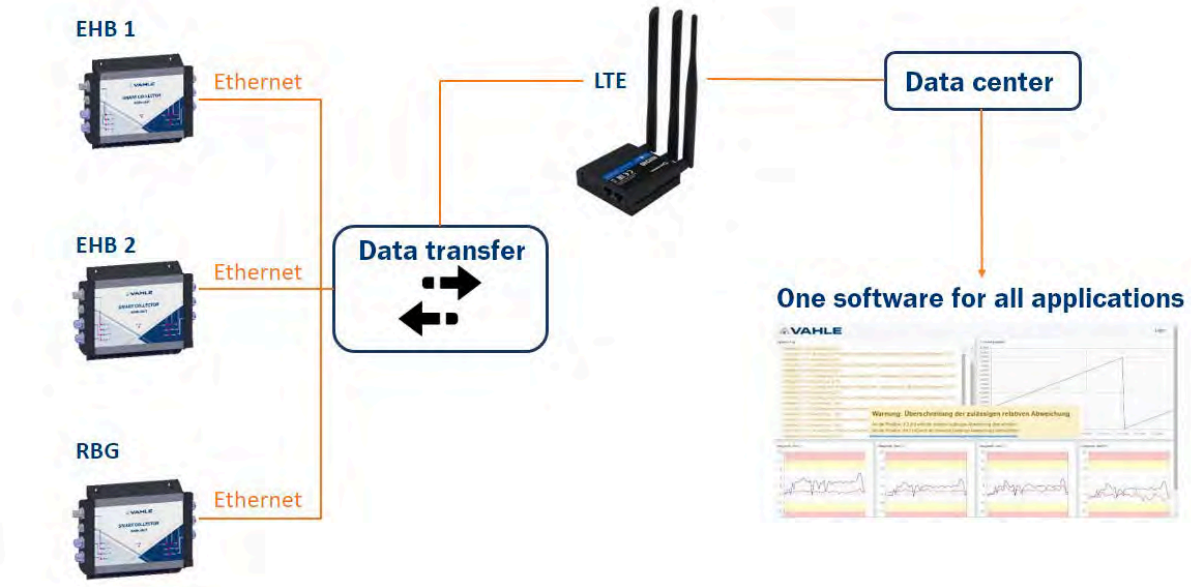
- DIN EN 50600
- ISO 9001
- ISO 27001
- ISO 50001
- PCI DSS
- Tier3 based on TIA 942:2010 - Appendix G

For fail-safety purposes, the virtual machines are replicated on a server at a second data center every 5 minutes.

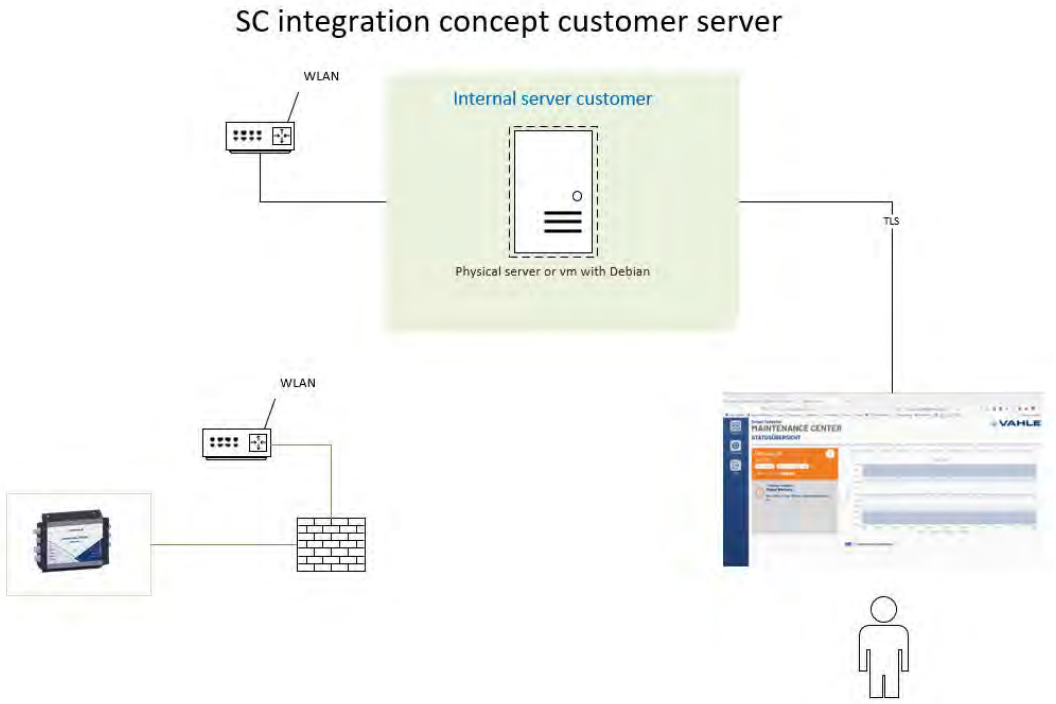
- TÜV Level 3
- PCI DSS
- ISO 27001

5.3 Schematic diagram

5.3.1 Online concept



5.3.2 On-premise concept customer server



5.4 Assembly overview

5.4.1 Current collector

NOTICE!

Following prior project planning, it is possible in principle to equip the current collector with a sensor unit for any number of pins and assignments. In general, the phases L1, L2 and L3 as well as PE(VP) are monitored via the sensor unit of the Motion Detector. Usually, the collector brushes or the current collectors wear out. For spare parts, please refer to the operating instructions for the conductor rail system.

Overview of motion detectors (current collector, magnetic sensor) for systems with 14 mm phase distance

Current collector type	Ident-No. Motion Detector	Current collector set	Connection cable
KDS	10030304	0142277	0.5 m
KDS	10032488	0144293/..-C	0.5 m
KUFR	10030652	0144474	0.5 m
KESR	10032232	0142937	none
KESL	10032233	0143539	none

Overview of motion detectors (current collector, magnetic sensor) for systems with 18 mm phase distance

Current collector type	Ident-No. Motion Detector	Current collector set	Connection cable
KES	10033948	10034250	none
KESR	10033952	0157221	none
KESL	10033951	0157191	none
KDS	10033953	0155080	0.5 m

Overview of motion detectors (current collector, magnetic sensor) for systems with 26 mm phase distance

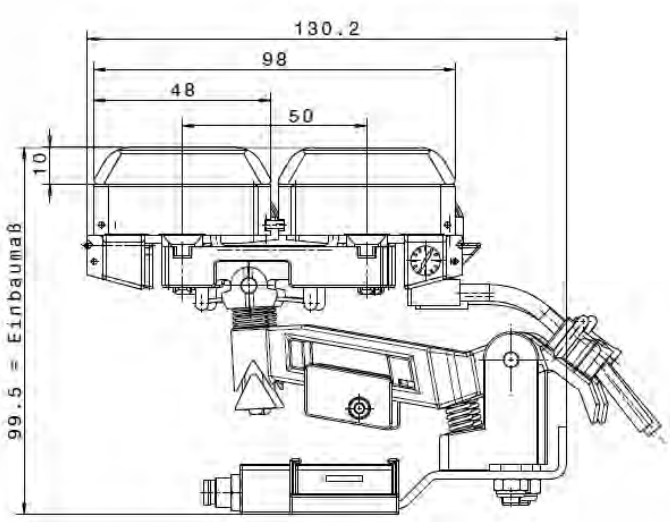
Current collector type	Ident-No. Motion Detector	Current collector set	Connection cable
KUF	10033947	10034249	none

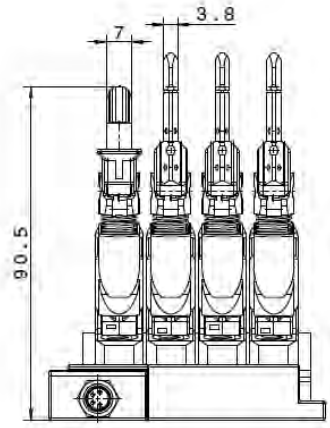
5.4.2 Current collector with sensors - 14 mm phase spacing

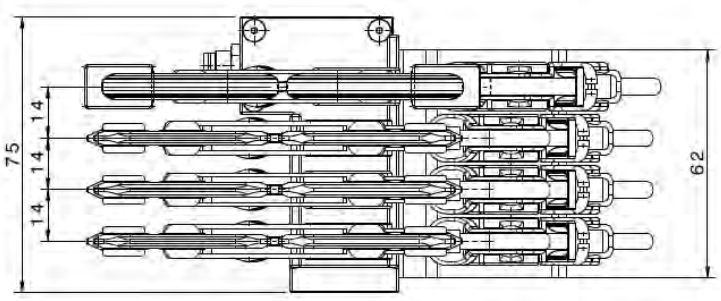
5.4.2.1 Motion Detector KDS2/40



SC-MD-1-4-KDS-4-14-VP-0,5-4	
Ident. No.	10030304
max. current: 1 connection cable [A]	25
2 connection cables [A]	40
Phase spacing [mm]	14
Installation dimension [mm]	99.5
Stroke [mm]	± 15
Lateral tolerance [mm]	± 15
Contact pressure [N]	Approx. 3.5 per carbon brush
Connection cable	0.5 m of highly flexible cable included in delivery. 2.5 mm ^{2} type WFLA 2.5
PE on no. 4 (other configuration possible)	
PE moves forward when folding into the conductor rail	



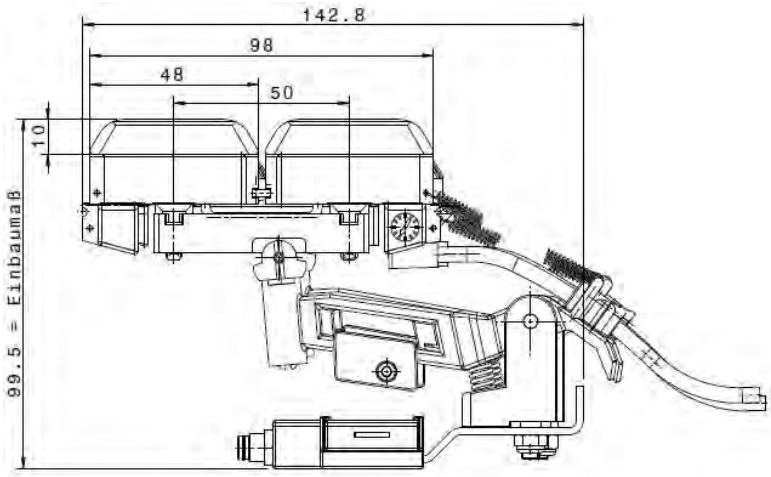


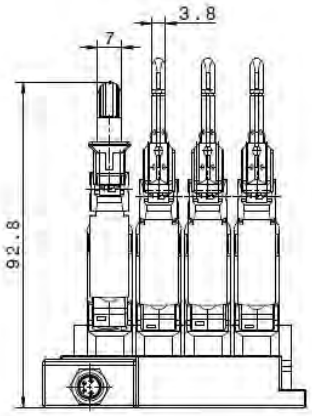


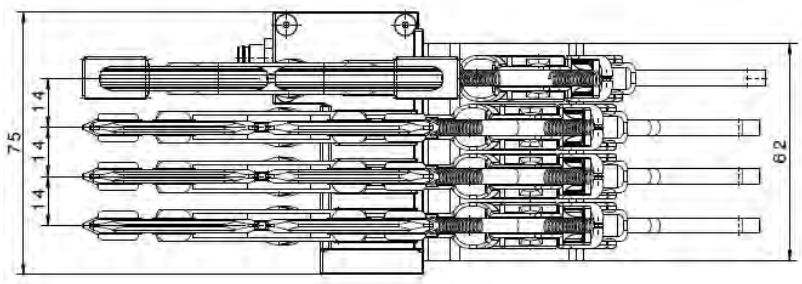
5.4.2.2 Motion Detector KUFR2/40



SC-MD-1-4-KUFR-4-14-VP-0,5-4	
Ident. No.	10030652
Reversing operation	
max. current: 1 connection cable [A] 2 connection cables [A]	 25 40
Phase spacing [mm]	14
Installation dimension [mm]	99.5
Stroke [mm]	± 15
Lateral tolerance [mm]	± 15
Contact pressure [N]	Approx. 3.5 per carbon brush
Connection cable	0.5 m of highly flexible cable included in delivery. 2.5 mm ^{2} type WFLA 2.5
PE on no. 4 (other configuration possible)	
PE moves forward when folding into the conductor rail	



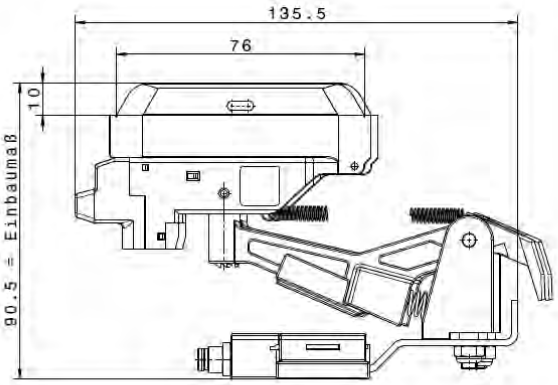


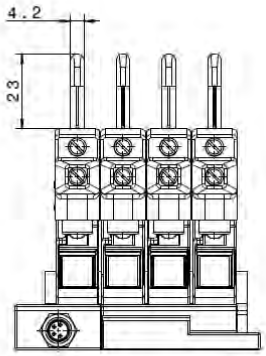


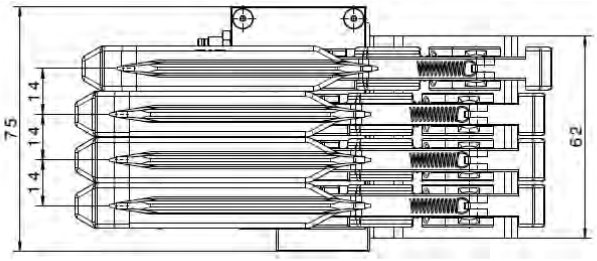
5.4.2.3 Motion Detector KESR



SC-MD-1-4-KESR-S-4-14-HS-0,0-4		
Ident. No.		10032232
Reversing operation		
Max. current	[A]	32 - 55
Installation dimension [mm]		90.5
Phase spacing	[mm]	14
Stroke	[mm]	± 15
Lateral tolerance	[mm]	± 15
Contact pressure	[N]	Approx. 7 per carbon brush
PE on no. 4 (other configuration possible)		
PE moves forward when folding into the conductor system		



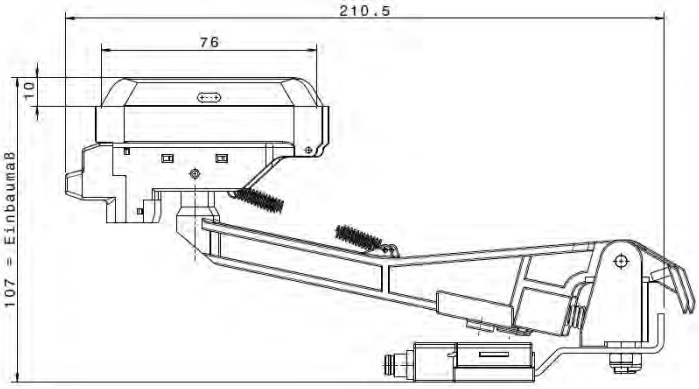


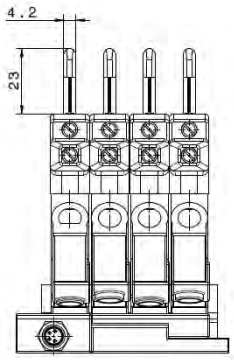


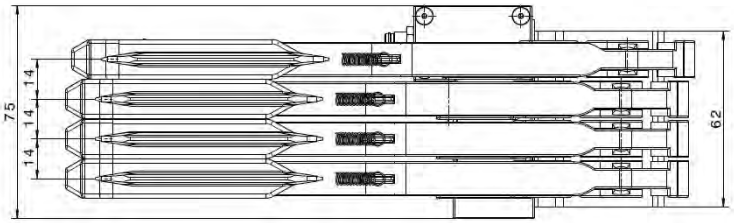
5.4.2.4 Motion Detector KESL



SC-MD-1-4-KESL-S-4-14-HS-0,0-4		
Ident. No.		10032233
Reversing operation		
Max. current	[A]	32 - 55
Installation dimension [mm]		107
Phase spacing	[mm]	14
Stroke	[mm]	+30/-20
Lateral tolerance	[mm]	± 30
Contact pressure	[N]	Approx. 7 per carbon brush
PE on no. 4 (other configuration possible)		
PE moves forward when folding into the conductor system		





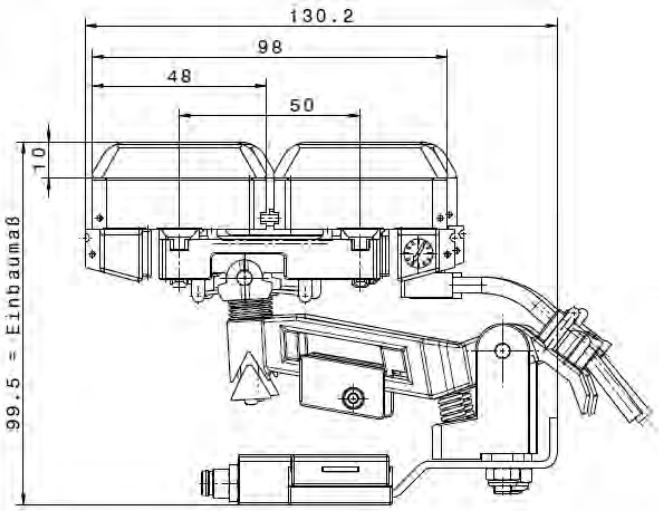


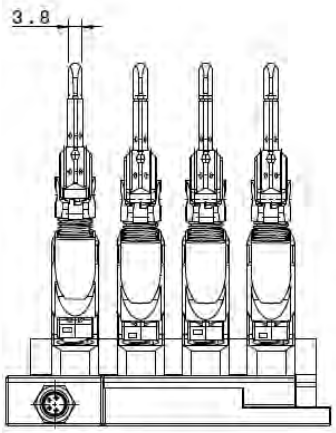
5.4.3 Current collector with sensors - 18 mm phase spacing

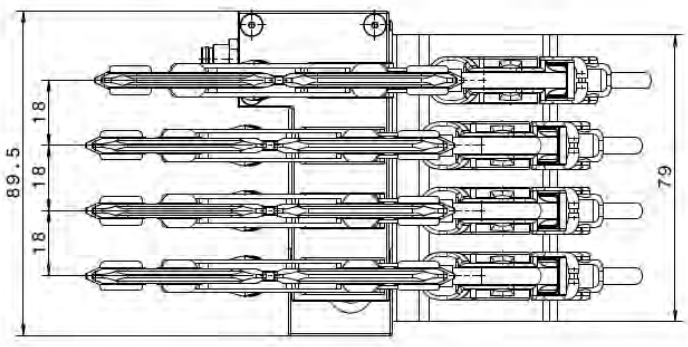
5.4.3.1 Motion Detector KDS2/40



SC-MD-1-4-KDS-4-18-HS-0,5-4	
Ident. No.	10033953
max. current: 1 connection cable [A] 2 connection cables [A]	 25 40
Phase spacing [mm]	18
Installation dimension [mm]	99.5
Stroke [mm]	± 15
Lateral tolerance [mm]	± 15
Contact pressure [N]	Approx. 3.5 per carbon brush
Connection cable	0.5 m of highly flexible cable included in delivery. 2.5 mm ^{2} type WFLA 2.5
PE on no. 4 (other configuration possible)	
PE moves forward when folding into the conductor rail	



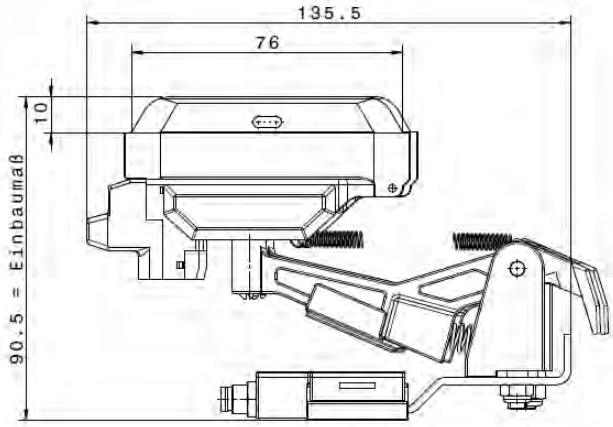


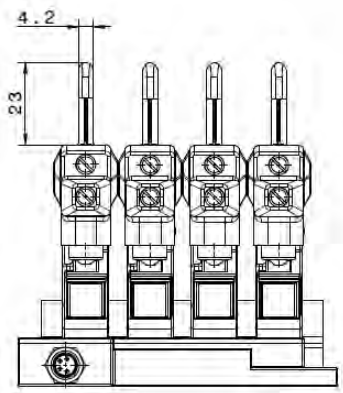


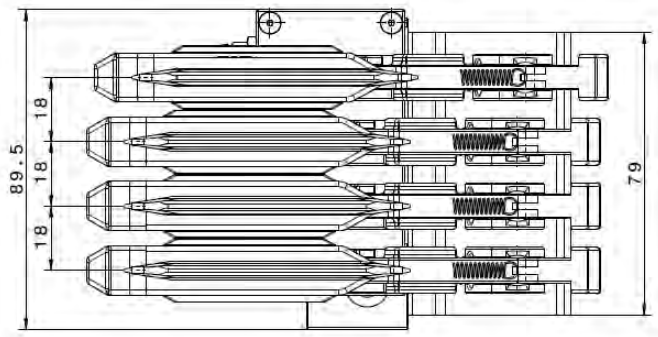
5.4.3.2 Motion Detector KESR



SC-MD-1-4-KESR-S-4-18-HS-0,0-4		
Ident. No.		10033952
Reversing operation		
Max. current	[A]	32 - 55
Installation dimension [mm]		90.5
Phase spacing	[mm]	18
Stroke	[mm]	± 15
Lateral tolerance	[mm]	± 15
Contact pressure	[N]	Approx. 7 per carbon brush
PE on no. 4 (other configuration possible)		
PE moves forward when folding into the conductor system		



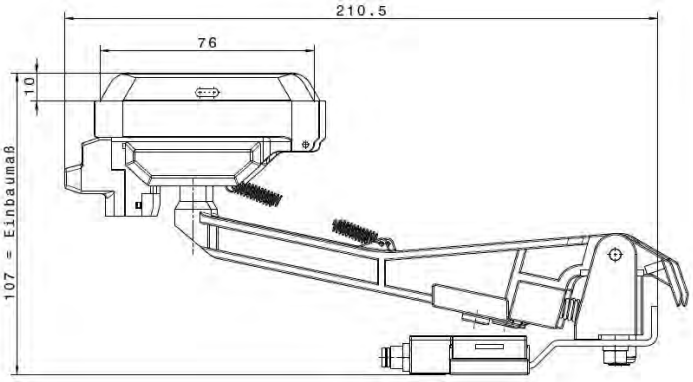


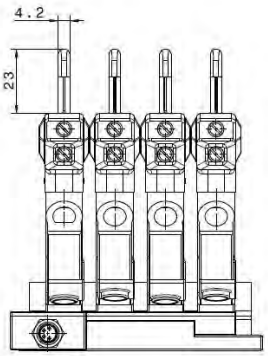


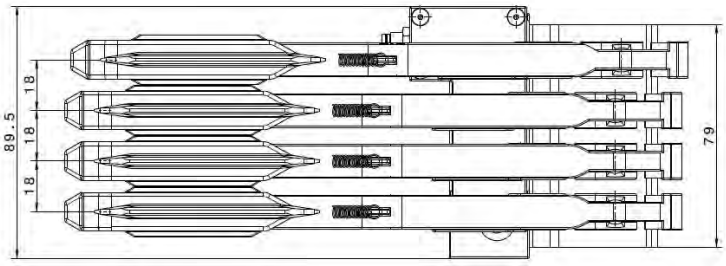
5.4.3.3 Motion Detector KESL



SC-MD-1-4-KESL-S-4-18-HS-0,0-4		
Ident. No.		10033951
Reversing operation		
Max. current	[A]	32 - 55
Installation dimension [mm]		107
Phase spacing	[mm]	18
Stroke	[mm]	+30/-20
Lateral tolerance	[mm]	± 30
Contact pressure	[N]	Approx. 7 per carbon brush
PE on no. 4 (other configuration possible)		
PE moves forward when folding into the conductor system		



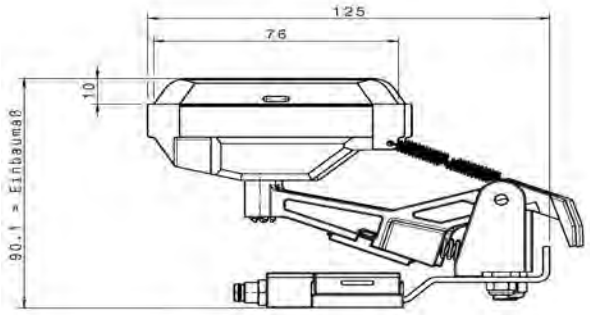


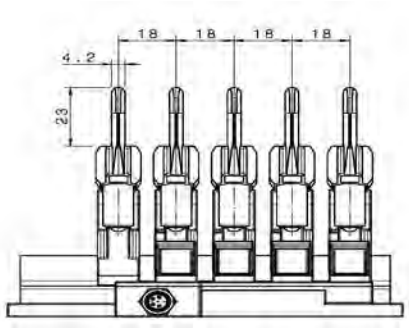


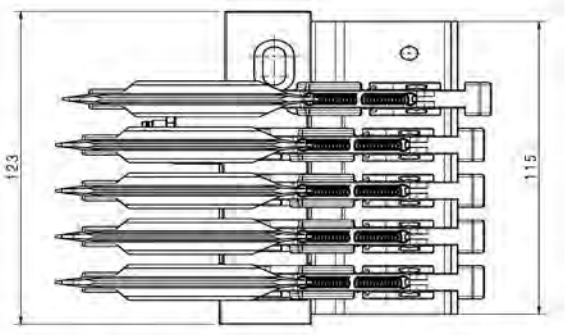
5.4.3.4 KES



SC-MD-1-4-KES-F-4-18-HS-0,0-4	
Ident. No.	10033948
max. current: 1 connection cable [A] 2 connection cables [A]	 25 40
Phase spacing [mm]	18
Installation dimension [mm]	90.5
Stroke [mm]	± 15
Lateral tolerance [mm]	± 15
Contact pressure [N]	Approx. 3.5 per carbon brush
PE on no. 4 (other configuration possible)	
PE moves forward when folding into the conductor rail	





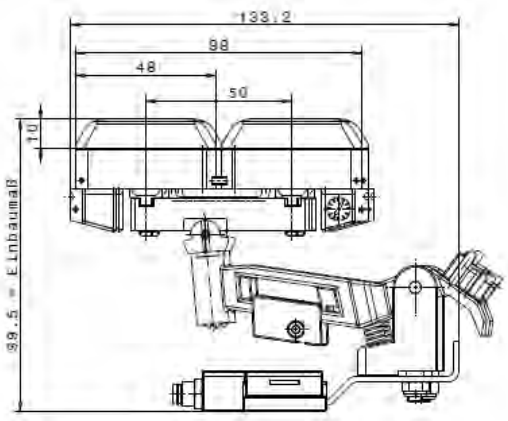


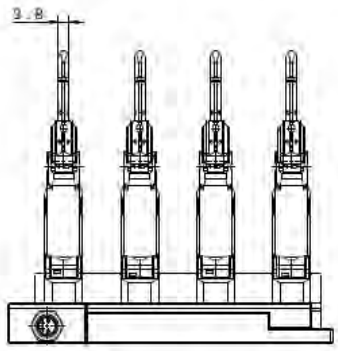
5.4.4 Current collector with sensors - 26 mm phase spacing

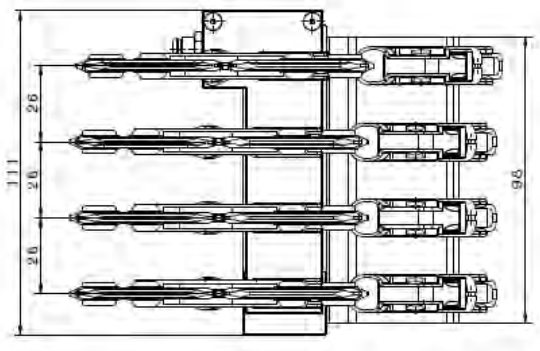
5.4.4.1 Motion Detector KUF



SC-MD-1-4-KUF-4-26-HS-0,0-4	
Ident. No.	10033947
max. current: 1 connection cable [A] 2 connection cables [A]	 25 40
Phase spacing [mm]	26
Installation dimension [mm]	99.5
Stroke [mm]	± 15
Lateral tolerance [mm]	± 15
Contact pressure [N]	Approx. 3.5 per carbon brush
PE on no. 4 (other configuration possible)	
PE moves forward when folding into the conductor rail	





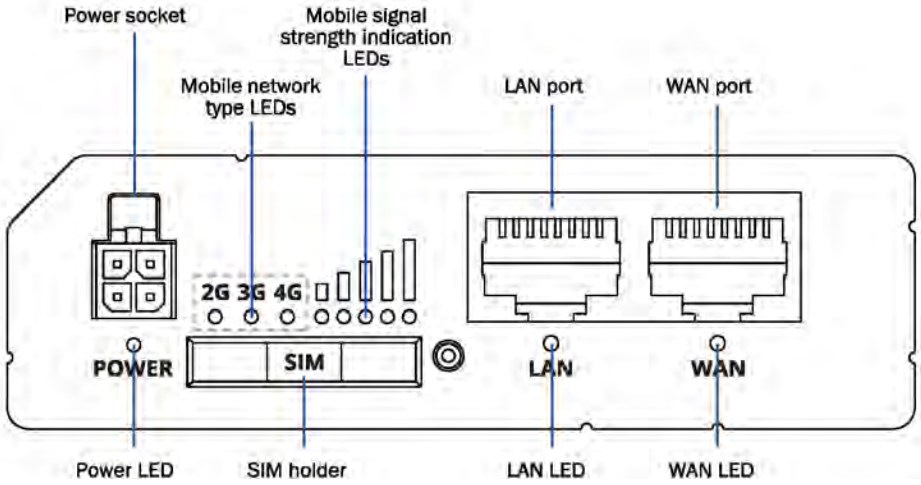


5.4.5 Router for online concept

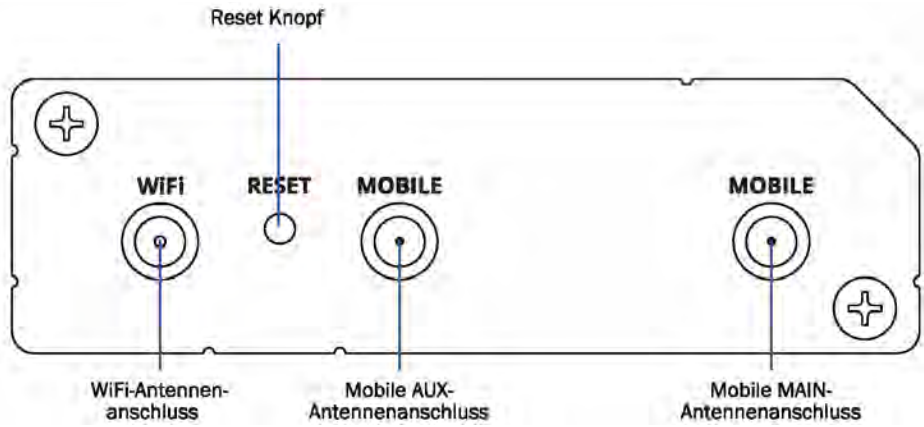


SC-IR-RUT240/241-EU-LTE-SET+V	
Ident. No.	10030638
Dimensions [mm]	83 x 25 x 74 (without antennas extended)
Weight [kg]	0.135
Supply voltage [VDC]	9 - 30
Power consumption [mA]	270
Operating temperature [°C]	-40 to +75
Max. humidity at ambient temperature 10 °C to 40 °C	10% to 90%, non-condensing
Protection class	IP 30
Including SIM card and 230V power adapter	

Front view



Rear view



5.4.6 Main unit

The main unit provides the intelligence. It records the sensor data, bundles, synchronizes and processes them and forwards the data belonging to an error through an appropriate data transmission system.

The main unit uses an open interface (Ethernet) to which a wide variety of data transmission systems can be connected.

The open interface (ETHERNET) offers customers additional connection options, for example to an ACCESS POINT via the customer network



SC-MU-MAINUNIT		
Dimensions	[mm]	255x153x36
Material housing		Aluminum coated
Attachment		173.4x137.2, 4x M4
Weight	[kg]	1.125
Voltage supply	[V DC]	24
Voltage tolerance	[%]	+/- 20
Power consumption	[mA]	200 with a load of 500
Protection class		IP54

NOTICE!

Deep discharge of the main unit

► The main unit must be installed no later than four weeks after delivery to prevent deep discharge of the built-in batteries.

5.4.6.1 Displays

LED	Labeling	Function
LED1	POWER 24VDC	Connectivity, 24VDC
LED2	3D-SENSOR	Connectivity, 3D sensor + data transfer
LED3	RS485/PLC	Connectivity, additional sensors
LED4	POSITION	Connectivity, positioning system + data transfer
LED5	ALARM	Alarm LED (visual error indicator)
LED6	ETH DATA	Data transfer, Ethernet
LED7	ETH	Connectivity, Ethernet + network quality

5.4.6.2 Interfaces



Connection	Function
X1	Supply, 24 V DC/1 A
X2	Sensor connection, RS 485, 5 volts (motion detector)
X3	Sensor connection, RS 485, 24 volts + 2x PLC signal
X4	Positioning systems RS 485 or SSI
X5	Data transmission, Ethernet 100 Mbit

The connections of the main unit are described in greater detail below.

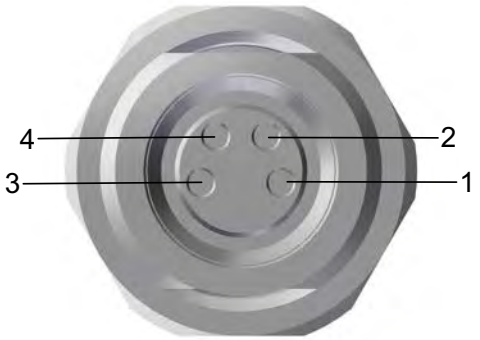
X1 - supply, 24 V DC



Type	Description
Connection X1	M12, A-coded, 4-pin
Mating cycles	> 100
Contact	Au (gold)

Pin	Function	Comment
1	GND	Supply ground
2	+24V	Supply voltage, +24VDC
3	+24V	Supply voltage, +24VDC
4	GND	Supply ground

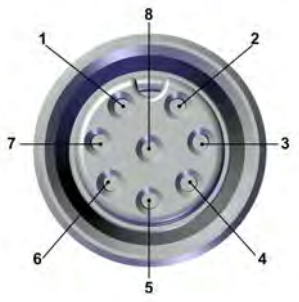
X2 - Motion Detector sensor connection



Type	Description
Connection X2	M8, A-coded, 4-socket
Mating cycles	> 100
Contact	Au (gold)

Pin	Function	Comment
1	+5V	Supply voltage, +5VDC
2	RS 485 A	Data line A
3	RS 485 B	Data line B
4	GND	Supply ground

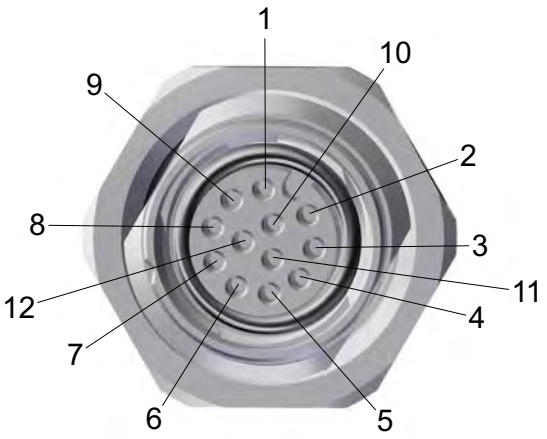
X3 - Sensor connection, RS 485, 24 volts + 2x PLC signal



Type	Description
Connection X3	M12, A-coded, 8-socket
Mating cycles	> 100
Contact	Au (gold)

Pin	Function	Comment
1	RS 485 B	Data line B
2		Low power contact A
3		High power contact A
4		High power contact B
5	RS 485 A	Data line A
6		Low power contact B
7	GND	Supply ground
8	+24V	Supply voltage, +24VDC

X4 - Data transmission, Positioning system RS 485 or SSI



Type	Description
Connection X4	M12, A-coded, 12-socket
Mating cycles	> 100
Contact	Au (gold)

Pin	Function	Comment
1	GND	Supply ground
2	SSI Out data - / RS 485 A	SSI data line output - / RS 485 data line A
3	SSI In clock -	SSI clock line input -
4	SSI Out data + / RS 485 B	SSI data line output + / RS 485 data line B
5	SSI Out clock +	SSI clock line output +
6	SSI In clock +	SSI clock line input +
7	GND	Supply ground
8	SSI In data -	SSI data line input -
9	+24V	Supply voltage, +24VDC
10	SSI In data +	SSI data line input +
11	SSI Out clock -	SSI clock line output -
12	+24V	Supply voltage, +24VDC

X5 - Data transmission, Ethernet 100 Mbit



Type	Description
Connection X5	M12, D-coded, 4-socket
Mating cycles	> 100
Contact	Au (gold)

Pin	Function	Comment
1	TD+	Transmit +
2	RD+	Receive +
3	TD-	Transmit -
4	RD-	Receive -

5.4.7 Main unit connection cables

5.4.7.1 Connection cable, 24 VDC



SC-AL-PWR	
Number of pins	4-pin
PUR halogen-free	
black-gray RAL 7021	
Free cable end, straight M12 socket	
Coding: A	

Color	Function
Black	GND
Brown	GND
White	24 VDC
Blue	24 VDC

Type	Length [m]	Ident. No.
SC-AL-PWR-3,0	3.0	10030314
SC-AL-PWR-5,0	5.0	10034778
SC-AL-PWR-10,0	10.0	10037154
SC-AL-PWR-KIT-ST-5,0	5.0	10038032*

*loose enclosed plug, straight M12 coding: APush-lock spring connection

5.4.7.2 Connection cable, Motion Detector



SC-VL-MD	
Number of pins	4-pin
PUR halogen-free	
black-gray RAL 7021	
Straight M8 plug, straight M8 socket	

Type	Length [m]	Ident. No.
SC-VL-MD-0,3	0.3	10030315
SC-VL-MD-0,6	0.6	10030316
SC-VL-MD-1,5	1.5	10030317
SC-VL-MD-3,0	3.0	10035809
SC-VL-MD-KIT-ST-5,0	5.0	10038036*

*loose enclosed plug, straight M8 coding: APush-lock spring connection



SC-VL-MD	
Number of pins	4-pin
PUR halogen-free	
black-gray RAL 7021	
Straight M8 plug, angled M8 socket	

Type	Length [m]	Ident. No.
SC-VL-MD-3.0-WINKELSTECKER	3.0	10036412
SC-VL-MD-KIT-RA-5,0	5.0	10038037*

*loose enclosed plug, straight M8 coding: APush-lock spring connection

5.4.7.3 Connection line, router



SC-VL-IR	
Number of pins	4-pin
Ethernet CAT5 (100 MBit/s) PUR halogen-free Water blue RAL 5021, shielded	

Type	Length [m]	Ident. No.
SC-VL-IR-0,5	0.5	10030318
SC-VL-IR-1,0	1	10030319
SC-VL-IR-2,0	2	10030320
SC-VL-IR-10,0	10	10037290

5.4.7.4 Adapter, positioning systems



SC-AD-POS	
Number of pins	12-pin
Connection of APOSM reading heads supported with SSI or RS485 interface.	

NOTICE!

If positioning systems from other manufacturers are to be used, it may be necessary to configure a different adapter due to the different pin assignment.

Type	Length [m]	Ident. No.
SC-AD-POS-1.5-SSI-APOS-MAGNETIC	1.5	10030321
SC-AD-POS-1.5-RS485-APOS-OPTIC	1.5	10030322

5.4.7.5 Connecting cable thermosensor



SC-AD-TS-TERABEE	
Number of pins	5-pin
Connection of the Terabee Ind Thermal 90 sensor (10033963) to the Smart Collector main unit is possible.	

Type	Length [m]	Ident. No.
SC-AD-TS-TERABEE-1,5	1.5	10033299
SC-AD-TS-TERABEE-3,0	3.0	10035811
SC-AD-TS-TERABEE-5,0	5.0	10037291
SC-AD-TS-KIT-ST-5.0-TERABEE	5.0	10038039*

*loose enclosed socket, straight M12 coding: APush-lock spring connection



SC-AD-TS-TERABEE	
Number of pins	5-pin
Connection of the Terabee Ind Thermal 90 sensor (10033963) to the Smart Collector main unit is possible.	

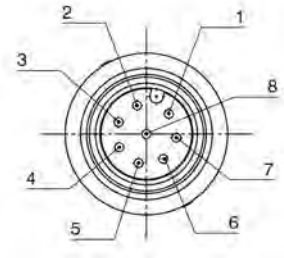
Type	Length [m]	Ident. No.
SC-AD-TS-TS-TERABEE-1.5-WIN-KELSTECKER	1.5	10035454
SC-AD-TS-TS-TERABEE-3.0-WIN-KELSTECKER	3.0	10036113
SC-AD-TS-KIT-RA-5.0-TERABEE	5.0	10038040*

*loose enclosed plug, straight M12 coding: A compliant termination

5.4.8 Main unit connection PLC and load output

Connecting cable RS485/PLC

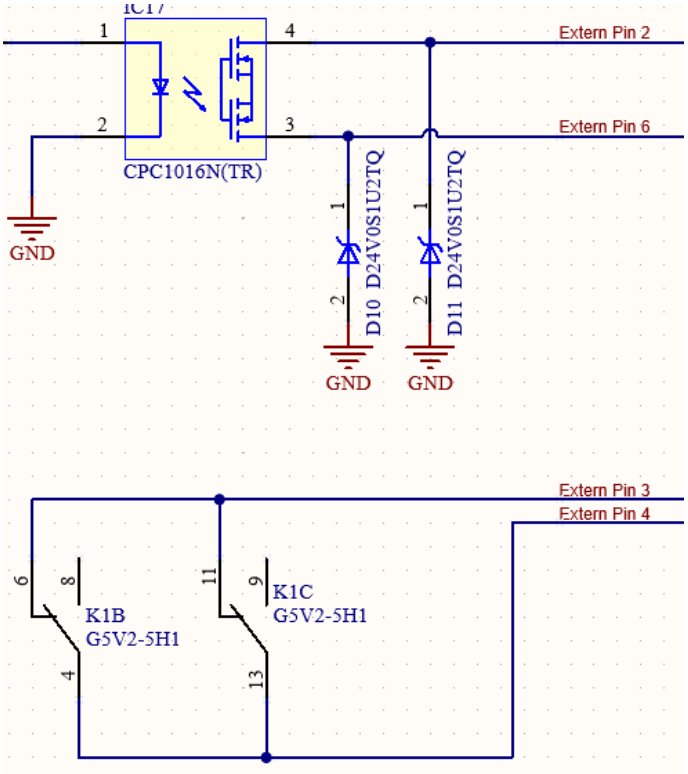




SC-AL-PLC/RS485	
Number of pins	8-pin
PUR halogen-free	
Black-gray RAL 7021	
Straight M12 plug, on free cable end	
Coding: A	

Strand	Color	Function
1	white	RS 485 B (n.c.)
2	Brown	Low Power Contact A (PLC)
3	green	High power contact A
4	Yellow	High power contact B
5	Gray	RS 485 A (n.c.)
6	Pink	Low Power Contact B (PLC)
7	Blue	GND (n.c.)
8	Red	24 VDC (n.c.)

Type	Length [m]	Ident. No.
SC-AL-PLC/RS485-1.5	1.5	10033298
SC-AL-PLC/RS485-3.0	3.0	10035810
SC-AL-PLC/RS485-5.0	5.0	10032460



The 8-pin connector is assigned as follows:

Connections 1 and 5 are data communication connections that are not currently in use.

The high-power output (connections 3 and 4) is designed as a potential-free switch with a maximum permissible voltage of 24 volts (AC/DC) and a maximum permissible current of 1A. Internally, it is implemented using a mechanical relay and is therefore not bounce-free. Connection with digital inputs is therefore not recommended.

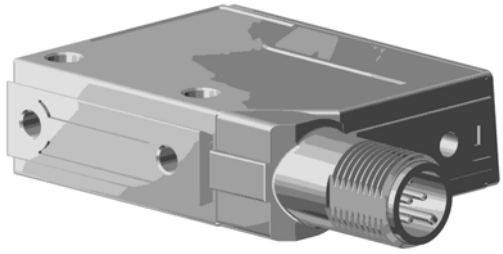
The low-power output (connections 2 and 6) is implemented by a solid-state relay and is therefore bounce-free and suitable for connecting digital inputs (e.g., PLC). However, due to the ESD diodes, it is not potential-free. The maximum permissible voltage is 24 volts (AC/DC) and the maximum permissible current is 50 mA.

Connection 8 supplies 24 volts at 50 mA and can be used externally.

Connection 7 is the corresponding GND connection.

5.4.9 Positioning systems

5.4.9.1 Leuze BPS 8 SM 102-01



SC-POS-LEUZE-BPS8SM102-01	
Ident. No.	10032456
Dimensions [mm]	48x40.3x15
Weight [g]	70
Voltage supply [V DC]	4.9 - 5.4
Power consumption max. [mA]	250
Depth of field (distance to code strip) [mm]	80 - 140
Travel speed max. [m/s]	4
Interface	RS 232
Protection class	IP67
Attention: BPS 8 positioning system only works in combination with the Leuze MA 8-01 modular connection unit. 5.4.9.2 Leuze MA 8-01	

5.4.9.2 Leuze MA 8-01



SC-PS-LEUZE-MA8-01-ANSCHLUSSEINHEIT	
Ident.-No.	10032457
Dimension [mm]	86x32x25
Weight [g]	70
Power supply [V DC]	10 - 30
Traversingspeed,,max. [m/s]	4
Protection class	IP67

5.4.9.3 Leuze connecting line



SC-VL-PS-LEUZE-BPS8	
Number of pins	5-pin
PUR halogen-free	
Black-gray RAL 7021	
Straight M8 plug, straight M12 socket	
Coding: A	

Type	Length [m]	Ident. No.
SC-VL-PS-0.3-LEUZE-BPS8	0.3	10032458
SC-VL-PS-1.5-LEUZE-BPS8	1.5	10036065

5.4.9.4 Leuze adapter



SC-AD-POS-1,5-RS485-LEUZE-BPS8	
Ident.-No.	10032455
Lenght [m]	1,5
Connection of the BPS 8 SM 102-01 (10032456) to the main unit possible.	

5.4.9.5 Pepperl und Fuchs PXV100 F200 R4 V19



LK-PXV100-F200-R4-V19	
Ident. No.	10035863
Dimensions [mm]	70x70x50
Weight [g]	160
Voltage supply [V DC]	15 - 30
Power consumption max. [mA]	200
Depth of field (distance to code strip) [mm]	50 - 150
Travel speed max. [m/s]	8
Interface	RS 485
Protection class	IP67

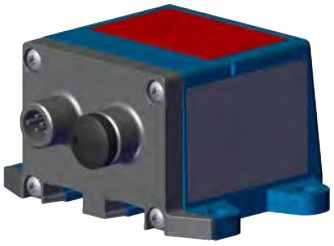
5.4.9.6 Pepperl und Fuchs adapter



SC-AD-POS-RS485-PundF-PXV100
Connection of the PXV100-F200-R4-V19 (10035863) to the main unit is possible.

Type	Length [m]	Ident. No.
SC-AD-POS-1,5-RS485-PundF-PXV100	1.5	10032471
SC-AD-POS-3,0-RS485-PundF-PXV100	3.0	10037220
SC-AD-POS-5,0-RS485-PundF-PXV100	5.0	10033931
SC-AD-POS-KIT-ST-5,0-RS485-PundF-PXV100	5.0	10038041

5.4.9.7 Sick sensor



SC-POS-Sick-OLM1001201S03+V	
Ident. No.	10035033
Dimensions [mm]	65x45x42
Weight [g]	215
Voltage supply [V DC]	10 - 30
Power consumption max. [mA]	230
Depth of field (distance to code strip) [mm]	82 - 120
Travel speed max. [m/s]	7
Interface	SSI
Protection class	IP65

5.4.9.8 Sick adapter



SC-AD-POS-SSI-SICK-OLM100-1201S03
Connection of the OLM100-1201S03 (10035033) to the main unit is possible.

Type	Length [m]	Ident. No.
SC-AD-POS-1.5-SSI-SICK-OLM100-1201S03	1.5	10035031
SC-AD-POS-5.0-SSI-SICK-OLM100-1201S03	5.0	10035037

5.4.10 Thermosensor

The Terabee Ind Thermal 90 thermal sensor adds a component to the Smart Collector to obtain busbar temperature data. The sensor is mounted on the busbars and records temperature data during travel. Possible hotspots are thus localized at an early stage.

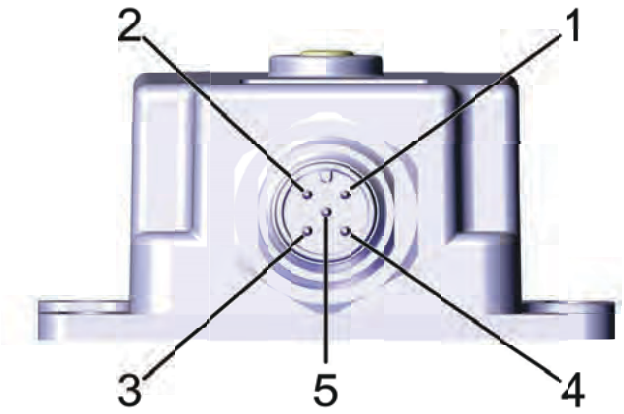
At an early stage, the sensor can detect assembly errors or defects, e.g. at transitions or poorly contacted joints of the rails.

In conjunction with the existing 3D unit, which determines movement data of the current collector arms, system availability can now be increased by a further measure.



SC-TS-TERABEE-IND-Thermal-90+V	
Ident.-No.	10033963
Dimensions [mm]	95 x 57 x 27
Mounting	4x Screw M4
Weight [g]	75
Powersupply [V DC]	12 bis 24
Protection class	IP 65
Operating temperature [°C]	- 10 bis + 65
Sensor measurement method	Infrarot
Sensor resolution	32x32 Pixel
Sensor field of view	90°x 90°
Frame rate [Hz]	7
Interface	RS485
Protocol	Modbus
Measurement accuracy	± 5 °C below 100 °C, ± 5 % above 100 °C

5.4.10.1 Interface

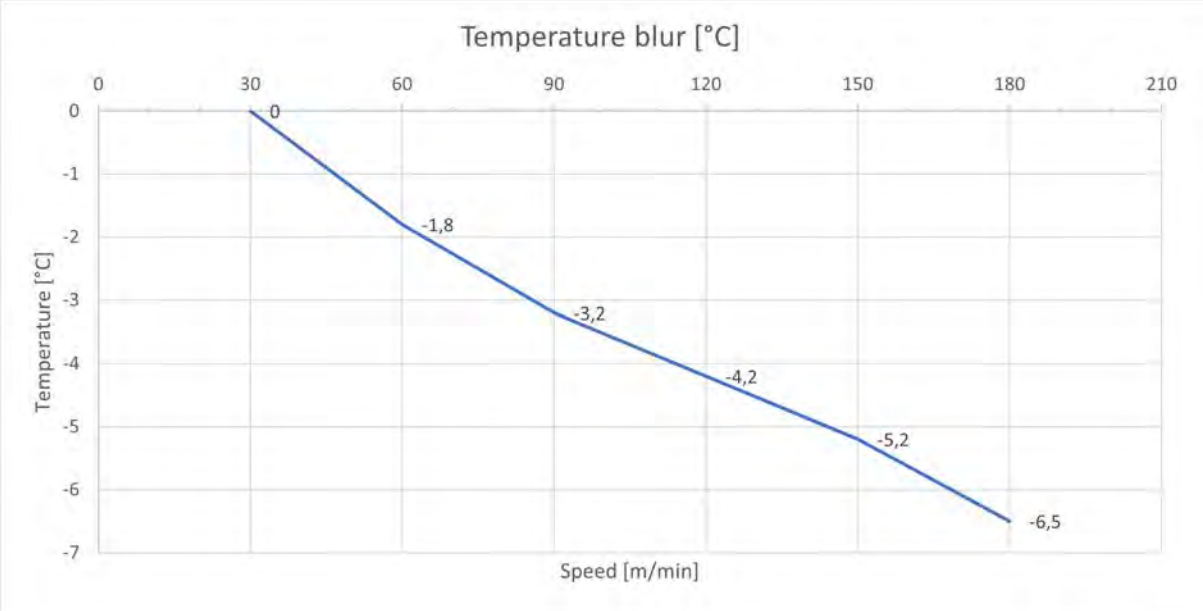


Pin	Function	Comment
1	+VDD	Power supply 12 VDC to 24 VDC
2	GND	Supply ground
3	NO/NC	PNP/NPN Connection (not used in SC)
4	TX/RX +	RS 485 +
5	TX/RX -	RS 485 -

5.4.10.2 Measurement accuracies

The Thermosensor has the following measuring accuracies:

Temperature blur



Position blur forward

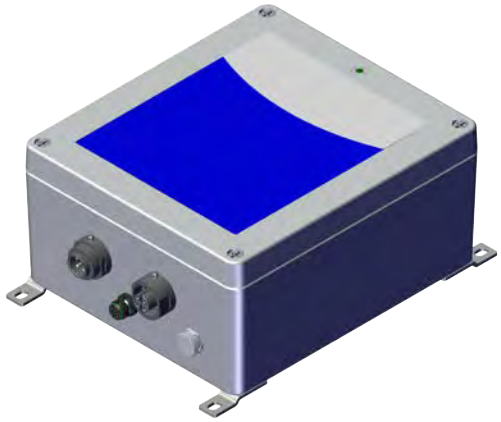


Position blur backward



5.4.11 UPS

With the optional UPS (uninterruptible power supply), the Smart Collector System can bridge short power outages so that the main unit is not shut down during operation. This is advantageous, for example, in skid systems where the return path of the vehicle often operates without power. When the Smart Collector funnels back into the conductor bar, monitoring of the rail system resumes immediately.



SC-USV-BICKER-UPSI-2406IP-24U+V	
Ident. No.	10033962
Dimensions [mm]	210 x 232 x 110
Weight [kg]	3.69
Protection class	IP 65
Operating temperature [°C]	-20 to 75
Input voltage [VDC]	24 (22.8 to 30)
Input current, max. [A]	7.5
Output voltage [VDC]	24 to 23.3 (depending on the load)
Output current, nominal [A]	6
Charging time (0 to 100%) [min]	Approx. 5
Bridging time [min]	Min. 15
Input and output lines	3 x 2.5 mm², length 3 meters, open end

5.4.11.1 Terminal box

The terminal box is required to connect the UPS to the main unit electrically.



ES-AKSC1-PH3X3L2,5-PE1X3L2,5-M16/M16	
Ident. No.	10034055
Dimensions [mm]	160 x 80 x 85
Weight [g]	465
Connection	3 x 2.5 mm² three-wire terminals 1 x 2.5 mm² three-wire protective earth terminal
Cable gland	2 x M16x1.5 right and left

5.4.11.2 24V voltage transformer

If the vehicle does not have its own 24V power supply, the required voltage can be drawn from the conductor rail via a current collector and converted to 24V using a voltage transformer.



400V/24V VOLTAGE TRANSFORMER		
Ident. No.		10036127
Dimensions	[mm]	280 x 200 x 140
Input voltage	[V AC]	180 - 550
Output voltage	[V DC]	24

6 COMMISSIONING

6.1 Safety instructions for commissioning



DANGER!

Before beginning any work, ensure that the system is free of voltage and remains so for the duration of the work. Observe the safety instructions in the section 3 Safety instructions!



WARNING!

Risk of injury in case of improper operation!

Improper operation may result in serious injury or property damage.

- ► Observe the safety instructions from section “3 Safety instructions.”
- ► Are all acceptance reports available? (initial startup)
- ► Are there no people in the danger zones?
- ► Was the assembly performed completely according to instructions?
- ► Have excess materials, tools and auxiliary devices been cleared from the danger zones?
- ► Has the electrical system been powered up by an authorized electrically trained person (see section “3.5 Personnel requirements”)



WARNING!

Danger to unauthorized persons!

Unauthorized persons who do not meet the requirements described here do not know the dangers in the respective work area.

- ► Keep unauthorized persons away from the work area.
- ► If in doubt, speak to people and expel them from the work area.
- ► Interrupt the work as long as the unauthorized persons are in the work area.



WARNING!

Hazard in case of insufficient qualification of personnel!

Insufficiently qualified persons are unable to judge the risks when working on the system, which puts them and others at risk if severe or fatal injuries.

- ► All work must be performed by qualified personnel only
- ► Insufficiently qualified personnel must stay out of the work area



⚠ WARNING!

Risk of injury from falling parts!

In case of improper use (faulty assembly, misuse, failure to perform maintenance, etc.), there is a risk of parts falling down.

- ► Wear a helmet
- ► Perform regular maintenance

6.2 Installation information



NOTICE!

Instructions for correct installation of the Smart Collector

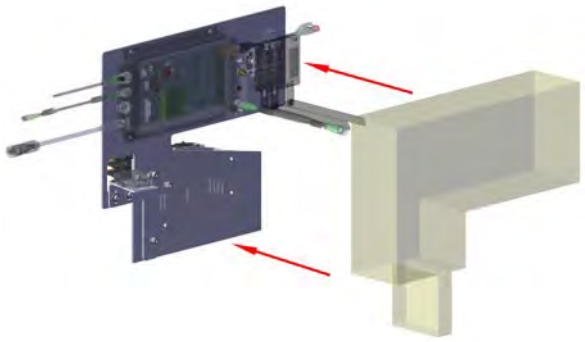
- ► Ensure that the movement of the current collector arms and connection cables on the current collector assembly is not restricted by the additional components.
- ► The specified values for stroke and deflection for the respective current collector must be observed.
- ► Observe the system limits. Collisions with any existing components must be ruled out.
- ► Position the router antennas away from metal panels if possible.

Notes on power supply

- ► The power supply for the main unit and the router is designed for 24 VDC at 1 A.
- ► Two 24-volt connections and a ground are therefore required on the vehicle. Special solutions can be planned (e.g. connection box with power supply unit as an additional component).

6.3 Assembly preparation

Foam body



NOTICE!

Test run before installing the Smart Collector!

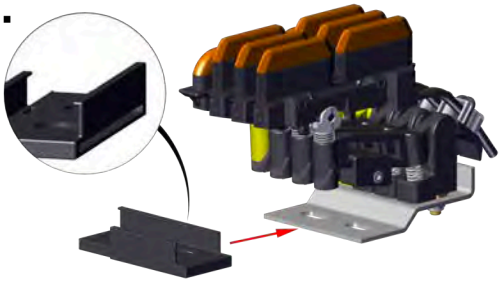
Before installing the system, a test run using a foam body must be performed to ensure that the Smart Collector does not collide with the environment.

- ► The foam body is installed by the customer according to VAHLE specifications at the location where the Smart Collector system components are to be mounted.
- ► Attachment is done using adhesive tape or a similar method.
- ► Correct installation, clearance verification, and approval are the responsibility of the customer.

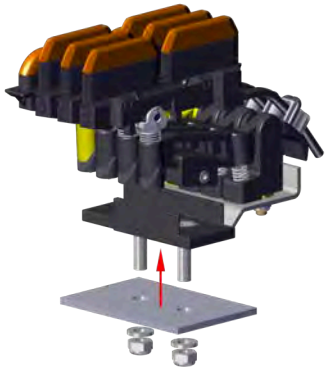
6.4 Installation

6.4.1 Motion detector

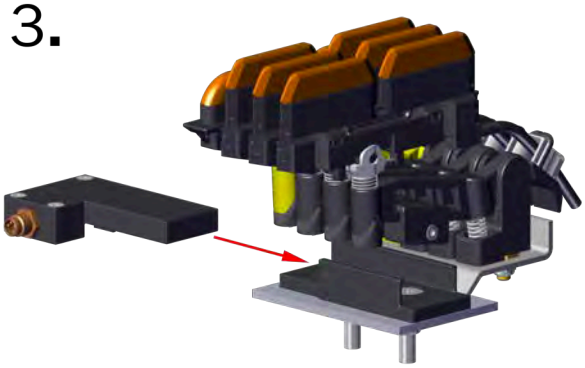
1.



2.



3.



Installation of current collector assembly with 3D unit

Prerequisites:

✓ The installation instructions for the current collector must be observed.

✓ The sheet metal/mechanical components on the customer vehicle must always be completely filled behind the 3D unit, otherwise incorrect sensor values may be output.

Required tools:

⚒ Torx TX20

⚒ Open-end wrench, 10 mm

Installation steps:

1. Push the retaining plate onto the current collector base plate.
2. Fasten the retaining plate and the current collector assembly to the sheet metal/mechanical components of the customer vehicle with 2 special screws M6x25 SF.
3. Clip the 3D unit into the retaining plate.

NOTICE!

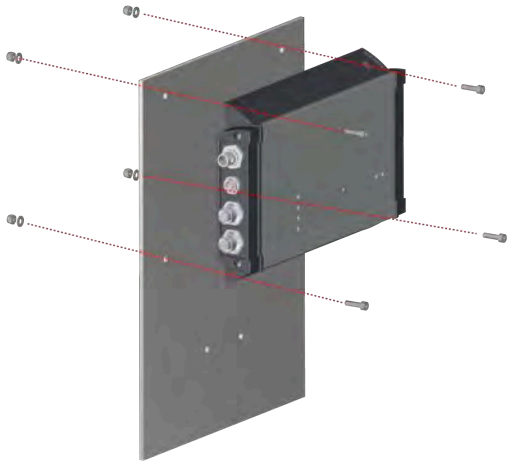
► The fastening level for the current collector must be aligned parallel to the EMS travel profile.

► The fastening level must be designed in such a way that the current collectors can be positioned at the pivot point of the bogie.

► Installation dimension is the horizontal distance between contact surface and fastening level on the vehicle.

► The current collector must be aligned centrally and vertically to the conductor rail.

6.4.2 Main unit



Installing the main unit

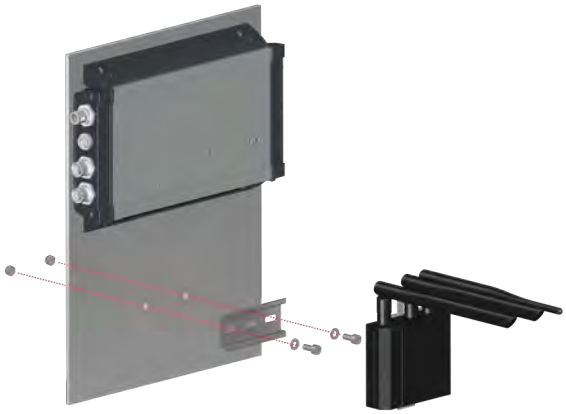
Required tools:

- ⚒ Hexagon socket, 3 A/F
- ⚒ Open-end wrench, 7 A/F

Installation steps:

1. Fasten the main unit to the metal plate provided or to the customer vehicle with four M4 screws.

6.4.3 Router



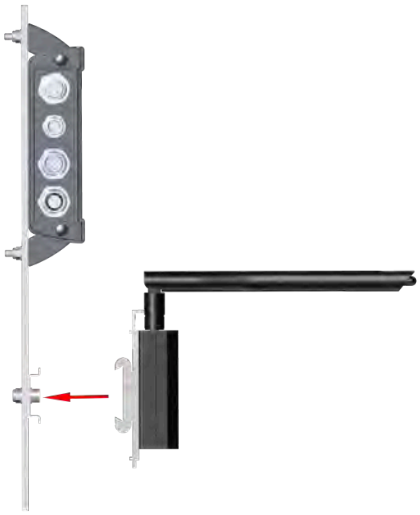
Installing the top-hat rail

Required tools:

- ⚒ Hexagon socket SW4
- ⚒ Open-end wrench, 8 A/F

Installation steps:

1. Fasten the top-hat rail to the metal plate provided or to the customer vehicle with two M5 screws.



Installing the router

Installation steps:

1. Clamp the router onto the top-hat rail.

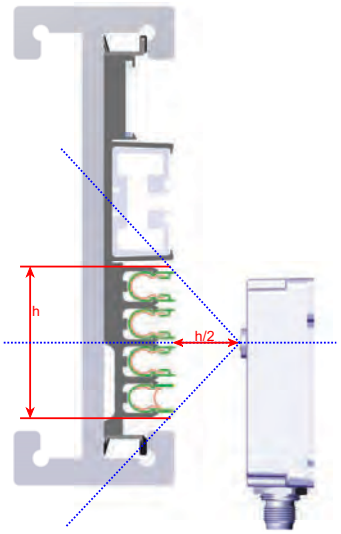
6.4.4 Positioning system



NOTICE!

► A customized fastening solution must be planned for the positioning system (e.g. mounting bracket directly on the current collector or mounting bracket on the vehicle, depending on the space available and the position sensor used)

6.4.5 Thermosensor



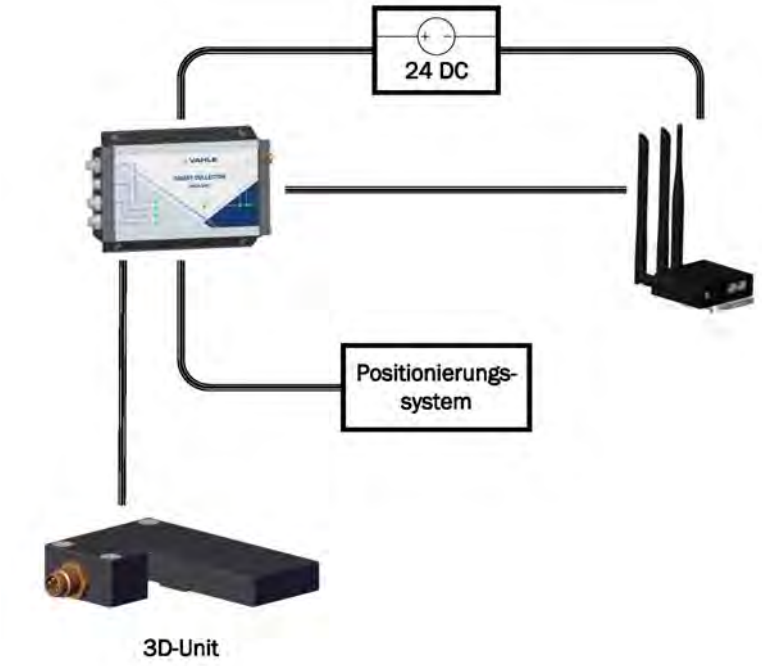
Installation of the thermosensor/alignment

Installation steps::

1. Mount the sensor at a distance h/2 from the target.
2. Place the sensor centrally in front of the target (blue line).

If vertical alignment and distance cannot be realized exactly, a readjustment can be made with the parameter Coverage/Image area in the Dashboard. However, the image area to be adjusted must then be calculated.

6.4.6 Cable connection diagram



Wiring

Installation steps:

1. Connect the main unit to the 3D unit on the current collector assembly.
2. Connect the main unit to the positioning system (an adapter may be required).
3. Connect the main unit to the industrial router.
4. Connect the main unit to the power supply.
5. Connect the industrial router to the power supply (230 V) using the supplied power supply unit. Alternatively, a customer-side connection to the 24V power supply can be made.

6.4.7 UPS with junction box

Installation UPS

Installation steps:

1. Mount the UPS on the vehicle.

Installation Terminal box

Installation steps:

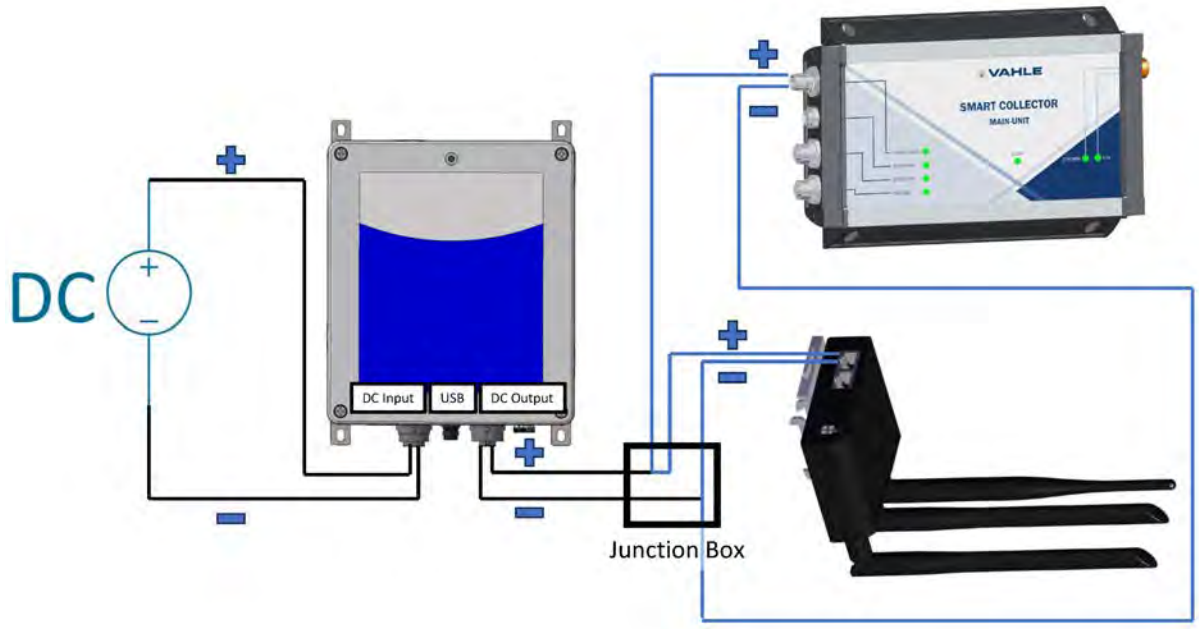
1. Mount the junction box on the vehicle.

NOTICE!

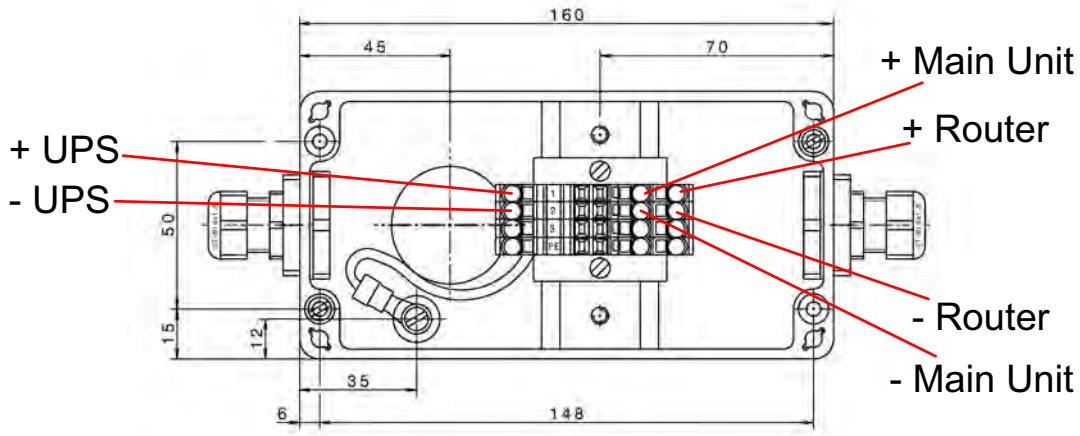
Connection UPS and junction box

► The connection is made according to chapter 6.4.7.1 Connection.

6.4.7.1 Connection



Junction Box



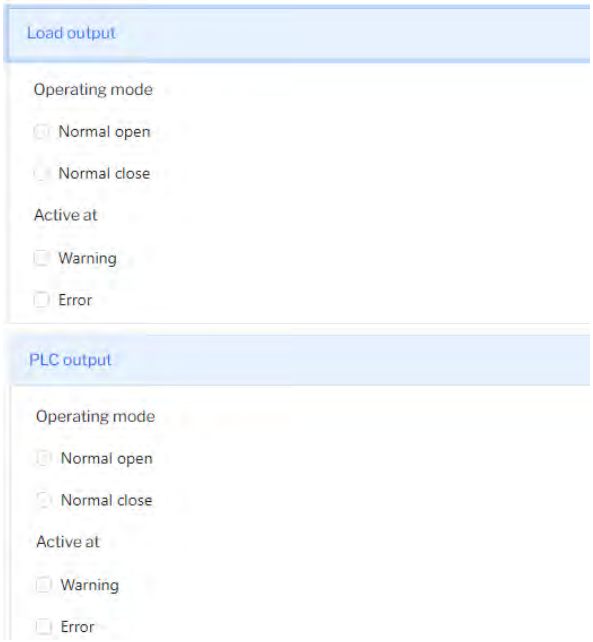
6.5 Condition after the installation



WARNING!

The responsible assembly manager must check the system for the following parts or situations after assembly and issue and sign an acceptance certificate!

- ► Check the general functionality of the system.
- ► Clearances of the line transitions and transfers.
- ► Open spaces and interfering edges.
- ► Random sample checking of tightening torques.
- ► Correct connection and routing of the cables.
- ► Have all required parts been installed safely and according to instructions.



NOTICE!

PLC/load output: normally closed/ normally open contact

On the Smart Collector, a normally open contact is installed for the PLC output (2,6) and a normally closed contact for the load output (3,4). The corresponding settings in the software for this are shown, but they can be adjusted:

- If an application requires that the e.g. PLC does not expect a normally open contact but a normally closed contact, the function can be simulated on the software side.
- The following must be observed for this software-side inversion: As soon as the Smart Collector is shut down or switched off, both outputs fall back to their hardware-side function. This means that the PLC output is always open when the Smart Collector is de-energized and the load output is always closed, regardless of what has been defined in the operating mode.
- **Recommendation:** Configure the software setting identical to the hardware setting.
- Configuration software see: ExternalLink: dashboard

6.6 Decommissioning

Switch off the system and secure it against restarting. Disconnect the entire power supply from the system physically.

7 MALFUNCTIONS

7.1 Safety information about malfunctions



⚠ WARNING!

Risk of injury in case of improper troubleshooting!

Improper troubleshooting may cause serious injuries or property damage.

- ► Ensure sufficient installation space before beginning any work.
- ► Switch off power supply, verify that the system is free of voltage, and secure against switching back on.

7.2 Procedure in the event of malfunction

General principle:

- In the event of malfunctions that pose an immediate hazard to persons or property, immediately activate the safety devices.
- Determine the cause of the fault.
- Notify the person in charge at the place of operation.



NOTICE!

The inspection and maintenance tasks listed in the technical documentation must be performed and documented regularly:

(location, spare part, task performed, date, name of inspector).

- ► Only persons with the required training, qualification and authorization may perform troubleshooting work on the system.

7.3 Fault indication

Warning/error display dashboard

If there are warnings or errors on the Smart Collector, they can be displayed in the Dashboard. To login to the dashboard, see ExternalLink: Login Dashboard.

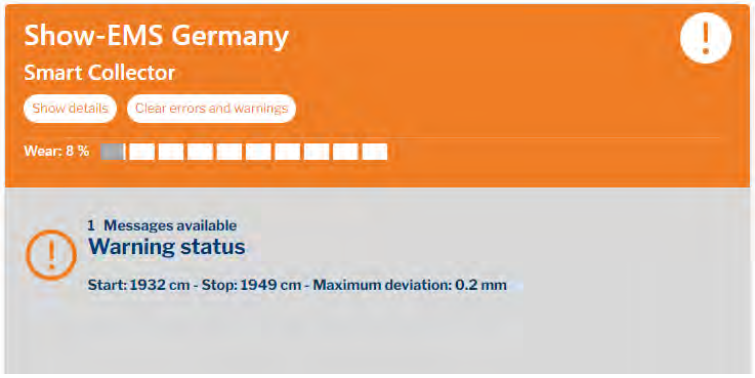


Fig. 7-1 Example warning

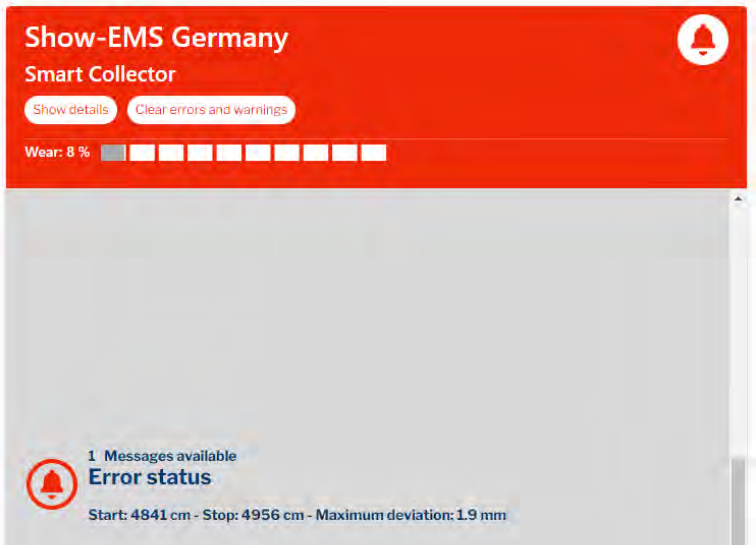


Fig. 7-2 Example error

Clear error

Prerequisites:

✓ The displayed errors have been corrected.

Work steps::

1. Click the Clear Errors and Warnings button to reset the error display.

If the errors are displayed again, the system continues to detect abnormalities in the track.

8 MAINTENANCE

The main aim of this section is to maintain the system's target condition and operational capability. By avoiding malfunctions and unplanned downtimes, regular maintenance can increase the utilization rate. Efficient planning of maintenance work and material is a prerequisite. In order to carry out safe maintenance by appropriately trained personnel, the following instructions must be observed:



DANGER!

Danger of death due to electrical current!

Contact with live parts can result in life-threatening injuries.

► Make sure that the relevant components are not live or under voltage, and that there is no unauthorized approximation.



NOTICE!

The inspection and maintenance work listed in the technical documentation must be performed and documented regularly

(location, spare part, task performed, date, name of inspector)

► System fault elimination may only be carried out by trained, qualified, and authorized persons.

Date	Name	Maintenance/servicing work	Instructions given by	Signature

8.1 Safety information about repairs



DANGER!

Before beginning any work, ensure that the system is free of voltage and remains so for the duration of the work. Observe the safety instructions in the section 3 Safety instructions!



WARNING!

Risk of injury due to improperly performed maintenance work!

Improper maintenance can result in serious personal injury or property damage.

- ► Ensure that there is sufficient clearance before starting work.
- ► Pay attention to order and cleanliness in the workplace!
- ► Follow the procedure according to3.3.1 Danger from electrical energy before starting work.



WARNING!

Danger due to insufficiently qualified persons!

Insufficiently qualified persons cannot assess the risks involved in operating the system and expose themselves and others to the risk of serious or fatal injuries.

- ► Have all work performed only by persons qualified for the task.
- ► Inadequately qualified persons should be kept away from the work area.



CAUTION!

Tripping hazard due to protruding parts

There is a tripping hazard during the work.

- ► Watch out for steps and holes in the floor when walking inside the work area and the danger zone. There must be no loose objects in the work area.

8.2 Return/repair

TIPS AND RECOMMENDATIONS!

Information about the procedure for repairs

The procedure for repairs during and after the warranty period is identical.

If a module is defective, then it must be sent to VAHLE for repairs. Contact the VAHLE customer service (see section “2.5 Customer service”).

To ensure the quickest possible repair, **the following information is always required**:

- **Customer name and address**
- **Designation of the system in which the module is installed**
- **Name of a contact (in case of any questions)**
- **Module designation and serial number**
- **Description of the fault (What are the symptoms? Under what circumstances does the fault occur?)**

A template for the repair document can be found under: „12 Repair note“.

8.3 Maintenance

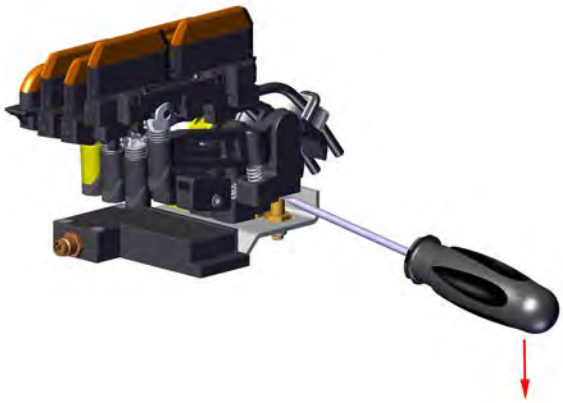
NOTICE!

► The standard replacement interval for individual current collectors is three replacements of the carbon brushes.

► Observe the safety information and instructions in the operating instructions that apply for your system.

8.3.1 Replacement current collector arm

Replacing on KSDS2/40 and KUFR2/40



Removing the current collector arm

Prerequisites:

✓ Ensure that the system is disconnected from power and remains so for the duration of the work.

Required tools:

⚒ Hexagon socket 2.5 A/F

Work steps:

1. Detach the current collector arm that needs to be replaced from the base plate.
2. Remove the screw and nut from the magnet holder.
3. Remove the magnet holder and magnet.



Installing the current collector arm

Prerequisites:

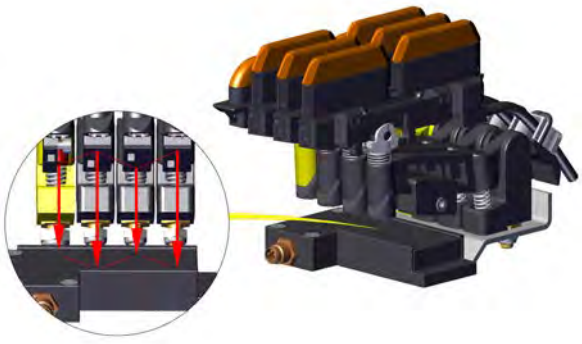
✓ Ensure that the system is disconnected from power and remains so for the duration of the work.

Required tools:

⚒ Hexagon socket 2.5 A/F

Work steps:

1. Insert the magnet holder into the new current collector arm as shown.
2. Fasten the screw and nut of the magnet holder. Tighten the screw by hand.
3. Attach the current collector arm to the base plate.



⚠ CAUTION!

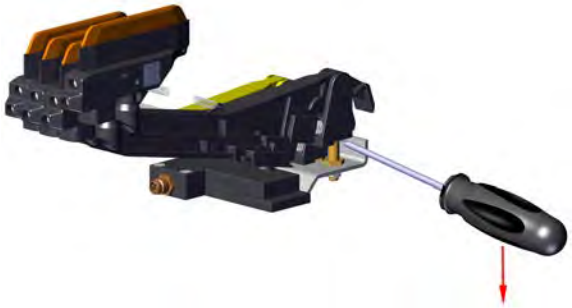
Risk of mix-up

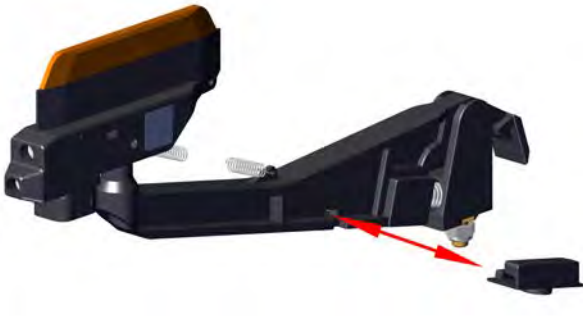
Always replace the current collector arms one at a time to prevent mix-ups.

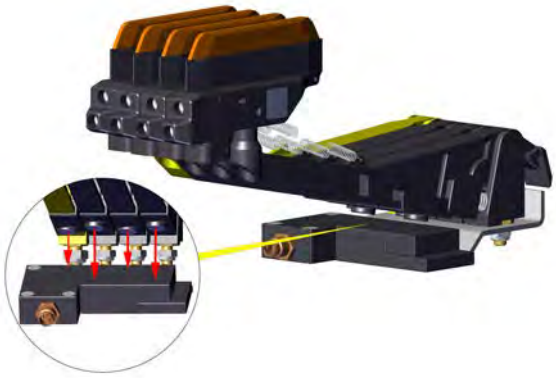
► The magnet holders are different and may not be used for current collector arms in a different position.

► The position of the magnet on the current collector arm must correspond to the marking on the 3D unit as shown.

Replacing on KESL







Removing the current collector arm

Prerequisites:

✓ Ensure that the system is disconnected from power and remains so for the duration of the work.

Work steps:

1. Detach the current collector arm that needs to be replaced from the base plate.
2. Remove the magnet holder.

Installing the current collector arm

Prerequisites:

✓ Ensure that the system is disconnected from power and remains so for the duration of the work.

Work steps:

1. Insert the magnet holder into the new current collector arm as shown.
2. Attach the current collector arm to the base plate.

⚠ CAUTION!

Risk of mix-up

Always replace the current collector arms one at a time to prevent mix-ups.

► The magnet holders are different and may not be used for current collector arms in a different position.

► The position of the magnet on the current collector arm must correspond to the marking on the 3D unit as shown.

Replacing on KESR

Replacing the current collector arm on the KESR must be carried out in the same manner as on the KESL. However, there is no risk of mix-ups with KESR, as all of the magnet holders are of the same design.

8.4 Spare parts

NOTICE!

Spare parts

- ► If there is a defect in the sensor system of the motion detector, it must be replaced completely.
- ► For other spare parts see 5.4 Assembly overview.

Overview of motion detectors (current collector, magnetic sensor) for systems with 14 mm phase distance

Current collector type	Ident-No. Motion Detector	Current collector set	Connection cable
KDS	10030304	0142277	0.5 m
KDS	10032488	0144293/..-C	0.5 m
KUFR	10030652	0144474	0.5 m
KESR	10032232	0142937	none
KESL	10032233	0143539	none

Overview of motion detectors (current collector, magnetic sensor) for systems with 18 mm phase distance

Current collector type	Ident-No. Motion Detector	Current collector set	Connection cable
KES	10033948	10034250	none
KESR	10033952	0157221	none
KESL	10033951	0157191	none
KDS	10033953	0155080	0.5 m

Overview of motion detectors (current collector, magnetic sensor) for systems with 26 mm phase distance

Current collector type	Ident-No. Motion Detector	Current collector set	Connection cable
KUF	10033947	10034249	none

9 TRANSPORT AND STORAGE

9.1 Safety instructions for transport and storage



NOTICE!

Damage due to improper transport or storage. Improper transport or storage may cause significant property damage!

- ► Storage temperature: -20 °C to +70 °C
- ► Storage location: Indoors, dry, no exposure to chemicals.
- ► Do not expose to direct sunlight.
- ► Exercise caution and observe the symbols on the packaging while unloading the pieces at delivery or during transport on the facilities.

9.2 Transport inspection

Check the delivery for completeness and transport damage upon receipt!

If any external damage is found:

- Refuse delivery or accept delivery only conditionally.
- Note the scope of the damage in the transport documents or on the carrier's delivery note.



NOTICE!

The delivery may be damaged during transport!

Report all defects as soon as they are found. Claims for damages can only be made during the applicable period.

- ► Document and report the defects found.

10 DISASSEMBLY AND DISPOSAL

10.1 Preparation for disassembly

- Switch off the system and secure it against switching back on.
- Physically disconnect the entire power supply from the system.
- Loosen and remove all screws.



DANGER!

Danger of death due to electrical current!

Contact with live parts can result in life-threatening injuries.

► Make sure that the relevant components are not live or under voltage, and that there is no unauthorized approximation.

10.1.1 Disassembly

During disassembly, always observe the information in section 3.3.1 .



WARNING!

Risk of death from improper replacement or removal!

Errors during the removal or replacement of components may cause life-threatening situations or significant property damage

► Observe the safety instructions before beginning any removal work.



CAUTION!

All accessories must be checked for wear.

Only defect-free parts may be reused.

► Use only genuine VAHLE spare parts.

10.2 Disposal

General

Current national regulations on site are decisive for disposing of/recycling components, machines and systems.

NOTICE!

Dangers from incorrect disposal/operator's responsibility

Risk of environmental damage/loss of valuable raw materials

- ► Incorrect disposal can lead to environmental damage.
- ► **Electronic waste is hazardous waste!**
- ► The most current, valid guidelines, laws and regulations of the respective economic area or country in which components are disposed of/recycled apply.
- ► The product operator is responsible for proper disposal/recycling.
- ► Old electrical devices contain valuable raw materials. **These must not be disposed of in residual waste!**

Disposal instructions

Individual product parts to be disposed of must be separated, depending on their nature. Currently valid local regulations must be observed.
Overview of parts / subassemblies that must be disposed of separately:

- Electronic waste (circuit boards)
- Batteries and accumulators
- Plastic
- Sheet metal
- Copper
- Aluminum

Information about the WEEE Directive (2021/19/EU)

The WEEE Directive does **not** apply to the products described **because the products fall under the exception under Article 2 "Scope."** Products described are used in large industrial tools, stationary large systems and mobile machines that are not intended for road traffic and are made available and designed exclusively for professional use (B2B).

Manufacturer's obligation to provide information

(according to ElektroG, Germany)

Options for returning, disposing of and recycling old devices

- The most current, valid guidelines, laws and regulations apply locally.
- The operator, as a professional user of the products, is responsible for properly disposing of or recycling (old) products.
- Contact a recycling or disposal company specializing in electronic waste.

Note on data protection

- The operator or his employees must ensure compliance with data protection on their **own responsibility**.
- Personal data present on the assembly to be disposed of or stored in the assembly must be removed by the operator or securely and permanently deleted -> **operator's own responsibility**.
  - **Data on the assembly**: stickers, labels, etc.
  - **Data stored in the assembly / device**: electronically stored data, etc.

Meaning of the symbol "crossed-out garbage can with black bars"

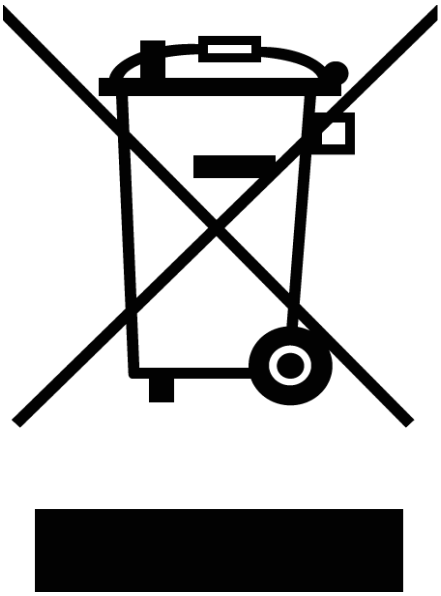


Fig. 10-1 Symbol

- Symbol according to WEEE Directive 2012/19/EU or ElektroG (Germany)
- The symbol is attached to the name plate where possible. Otherwise, the symbol can be found on the product packaging.
- Meaning of the symbol:
  - Symbol for the separate collection of electrical and electronic equipment
  -> The product must not be disposed of as unsorted waste,
  but must be taken to separate collection points for disposal/recycling.
  -> The black bar under the symbol indicates that after August 13, 2005,
  the product was placed on the market

11 PROTECTIVE MEASURES

11.1 EU conformity declaration

VAHLE

EU Declaration of conformity

Paul Vahle GmbH & Co. KG, Westicker Str. 52, D-59174 Kamen (Germany)

We herewith declare that the products specified hereafter conform to the relevant EU regulations. This declaration will be void when amendments not approved by us will be made to the products.

Product Group	**86**
Product	**vMonitoring**
Type	**Smart Collector** **KESL, KESR, KUFR2/40, KDS2/40**
Relevant EU Regulation:	
Electromagnetic compatibility	**2014 / 30 / EU**
Low voltage	**2014 / 35 / EU**
Placement of CE-marking	**2022**

The following harmonized standards respectively other technical norms and Specifications have been applied:

EN 60204-1:	**2018**
EN 60204-32:	**2008**
EN 61000-6-2:	**2005 /AC:2005**
EN 61000-6-4:	**2007 + A1:2011**
EN ISO 12100:	**2010**

This declaration is not an assurance of properties.
The safety hints mentioned in the product documentation must be followed.

Kamen, 25.10.2022

i.V. Michael Heitmann

Michael Heitmann

Director Quality Management

Paul Vahle GmbH & Co. KG · Postfach 1720 · D-59172 Kamen · Tel. 02307/704-0 · Fax 02307/704-444 · eMail: info@vahle.de

11.2 UKCA

VAHLE

UKCA - Declaration of conformity

Paul Vahle GmbH & Co. KG, Westicker Str. 52, D-59174 Kamen (Germany)

We herewith declare that the products specified hereafter conform to the relevant UK regulations. This declaration will be void when amendments not approved by us.

Product Group	**86**
Product	**vMonitoring**
Type	**Smart Collector** **KESL, KESR, KUFR2/40, KDS2/40**
Relevant UK Regulation:	
Electromagnetic compatibility	**Electromagnetic Compatibility Regulations 2016 (S.I. 2016/1091)**
Low voltage	**Electrical Equipment (Safety) Regulation 2016**
First CE / UKCA - marking	**2022 /2022**

The following harmonized standards respectively other technical norms and Specifications have been applied:

EN 60204-1:	**2018**
EN 60204-32:	**2008**
EN 61000-6-2:	**2005 /AC:2005**
EN 61000-6-4:	**2007 / A1:2011**
EN ISO 12100:	**2010**

This declaration is not an assurance of properties.
The safety hints mentioned in the product documentation must be followed.

Kamen, 25.10.2022

i.V. Michael Heitmann

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Director Quality Management

Paul Vahle GmbH & Co. KG · Postfach 1720 · D-59172 Kamen · Tel. 02307/704-0 · Fax 02307/704-444 · eMail: info@vahle.de

11.3 UL

NOTICE!

UL certification

The electronic components of the Smart Collector System must be electrified with a 24 V power supply. UL certification is not required by law for systems that are operated with low voltage, among other things. The Smart Collector System is therefore not UL certified.

12 REPAIR NOTE

Repair tickets |EN V1.01

Receiver (Possibly after consultation with customer service)	Company Address ZIP code, city Country	Paul Vahle GmbH & Co. KG Westicker Str. 52 59174, Kamen Germany
Sender / customer	Company: Address: ZIP code, city: Country:	
Contact Person (on site)	Mr./Mrs: Phone: E-Mail:	Country code / Area code / Telephone number / Extension
Guarantee		Yes ☐ No ☐
System (Location / name)		
Product	Type: S-No.:	
Configuration (product)	FW-Version: Parameter:	
Fault description Error pattern? Under what circumstances does the error occur? Other abnormalities? When does the error occur? Student / Temporary?		
Notice		The General Terms and Conditions (GTC) of Paul Vahle GmbH & Co. KG apply. The terms and conditions are accepted with order confirmation.
Contract award **Signature, Date**		_____,_____

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13 DATA SHEETS

13.1 Router

TELTONIKA | Networks

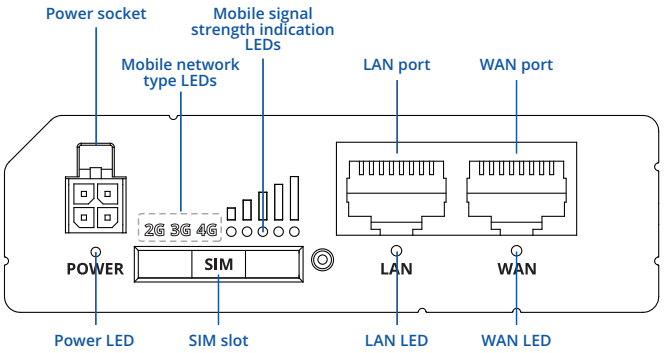
RUT241



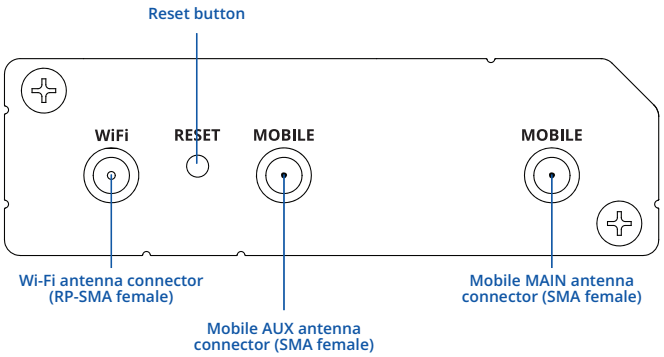
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HARDWARE

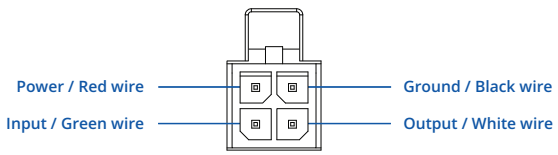
FRONT VIEW



BACK VIEW



POWER SOCKET PINOUT



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FEATURES

MOBILE	
Mobile module	4G (LTE) – Cat 4 up to 150 Mbps, 3G – Up to 42 Mbps, 2G – Up to 236.8 kbps
3GPP Release	Release 10/11 depending on the hardware version
Status	Signal strength (RSSI), SINR, RSRP, RSRQ, EC/IO, RSCP, Bytes sent/received, connected band, IMSI, ICCID
SMS	SMS status, SMS configuration, send/read SMS via HTTP POST/GET, EMAIL to SMS, SMS to EMAIL, SMS to HTTP, SMS to SMS, scheduled SMS, SMS autoreply, SMPP
USSD	Supports sending and reading Unstructured Supplementary Service Data messages
Black/White list	Operator black/white list
Multiple PDN	Possibility to use different PDNs for multiple network access and services
Band management	Band lock, Used band status display
APN	Auto APN
Bridge	Direct connection (bridge) between mobile ISP and device on LAN
Passthrough	Router assigns its mobile WAN IP address to another device on LAN
WIRELESS	
Wireless mode	IEEE 802.11b/g/n, Access Point (AP), Station (STA)
Wi-Fi security	WPA2-Enterprise - PEAP, WPA2-PSK, WEP, WPA-EAP, WPA-PSK; AES-CCMP, TKIP, Auto Cipher modes, client separation
SSID/ESSID	SSID stealth mode and access control based on MAC address
Wi-Fi users	Up to 50 simultaneous connections
Wireless Connectivity Features	Fast roaming (802.11r), Relayd
Wireless MAC filter	Whitelist, blacklist
Wireless QR code generator	Once scanned, a user will automatically enter your network without needing to input login information
NETWORK	
Hotspot	Captive portal (Hotspot), internal/external Radius server, SMS authorization, internal/external landing page, walled garden, user scripts, URL parameters, user groups, individual user or group limitations, user management, 9 default customizable themes and option to upload and download customised hotspot themes
Routing	Static routing, Dynamic routing (BGP, OSPF v2, RIP v1/v2, EIGRP, NHRP), Policy based routing
Network protocols	TCP, UDP, IPv4, IPv6, ICMP, NTP, DNS, HTTP, HTTPS, SFTP, FTP, SMTP, SSL/TLS, ARP, VRRP, PPP, PPPoE, UPNP, SSH, DHCP, Telnet, SMPP, SMNP, MQTT, Wake On Lan (WOL)
VoIP passthrough support	H.323 and SIP-alg protocol NAT helpers, allowing proper routing of VoIP packets
Connection monitoring	Ping Reboot, Wget Reboot, Periodic Reboot, LCP and ICMP for link inspection
Firewall	Port forward, traffic rules, custom rules
Firewall status page	View all your Firewall statistics, rules, and rule counters
Ports management	View device ports, enable and disable each of them, turn auto-configuration on or off, change their transmission speed, and so on
Network topology	Visual representation of your network, showing which devices are connected to which other devices
Hotspot	Captive portal (Hotspot), internal/external Radius server, SMS authorization, internal/external landing page, walled garden, user scripts, URL parameters, user groups, individual user or group limitations, user management, 9 default customizable themes and option to upload and download customised hotspot themes
DHCP	Static and dynamic IP allocation, DHCP Relay
QoS / Smart Queue Management (SQM)	Traffic priority queuing by source/destination, service, protocol or port, WMM, 802.11e
DDNS	Supported >25 service providers, others can be configured manually
Network backup	Wi-Fi WAN, Mobile, VRRP, Wired options, each of which can be used as an automatic Failover
Load balancing	Balance Internet traffic over multiple WAN connections
SSHFS	Possibility to mount remote file system via SSH protocol
ETHERNET	
WAN	1 x WAN port 10/100 Mbps, compliance IEEE 802.3, IEEE 802.3u standards, supports auto MDI/MDIX
LAN	1 x LAN port, 10/100 Mbps, compliance with IEEE 802.3, IEEE 802.3u standards, supports auto MDI/MDIX
DLMS	
DLMS Support	DLMS - standard protocol for utility meter data exchange

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SECURITY

Authentication	Pre-shared key, digital certificates, X.509 certificates, TACACS+, Radius, IP & Login attempts block
Firewall	Pre-configured firewall rules can be enabled via WebUI, unlimited firewall configuration via CLI; DMZ; NAT; NAT-T
Attack prevention	DDOS prevention (SYN flood protection, SSH attack prevention, HTTP/HTTPS attack prevention), port scan prevention (SYN-FIN, SYN-RST, X-mas, NULL flags, FIN scan attacks)
VLAN	Port and tag-based VLAN separation
Mobile quota control	Mobile data limit, customizable period, start time, warning limit, phone number
WEB filter	Blacklist for blocking out unwanted websites, Whitelist for specifying allowed sites only
Access control	Flexible access control of SSH, Web interface, CLI and Telnet

VPN

OpenVPN	Multiple clients and a server can run simultaneously, 27 encryption methods
OpenVPN Encryption	DES-CBC 64, RC2-CBC 128, DES-EDE-CBC 128, DES-EDE3-CBC 192, DESX-CBC 192, BF-CBC 128, RC2-40-CBC 40, CAST5-CBC 128, RC2-64-CBC 64, AES-128-CBC 128, AES-128-CFB 128, AES-128-CFB1 128, AES-128-CFB8 128, AES-128-OFB 128, AES-128-GCM 128, AES-192-CFB 192, AES-192-CFB1 192, AES-192-CFB8 192, AES-192-OFB 192, AES-192-CBC 192, AES-192-GCM 192, AES-256-GCM 256, AES-256-CFB 256, AES-256-CFB1 256, AES-256-CFB8 256, AES-256-OFB 256, AES-256-CBC 256
IPsec	IKEv1, IKEv2, with 14 encryption methods for IPsec (3DES, DES, AES128, AES192, AES256, AES128GCM8, AES192GCM8, AES256GCM8, AES128GCM12, AES192GCM12, AES256GCM12, AES128GCM16, AES192GCM16, AES256GCM16)
GRE	GRE tunnel, GRE tunnel over IPsec support
PPTP, L2TP	Client/Server instances can run simultaneously, L2TPv3, L2TP over IPsec support
Stunnel	Proxy designed to add TLS encryption functionality to existing clients and servers without any changes in the program's code
DMVPN	Method of building scalable IPsec VPNs
SSTP	SSTP client instance support
ZeroTier	ZeroTier VPN client support
WireGuard	WireGuard VPN client and server support
Tinc	Tinc offers encryption, authentication and compression in it's tunnels. Client and server support

OPC UA

Supported modes	Client, Server (planned)
Supported connection types	TCP

MODBUS TCP SLAVE

ID range	Respond to one ID in range [1;255] or any
Allow Remote Access	Allow access through WAN
Custom registers	MODBUS TCP custom register block requests, which read/write to a file inside the router, and can be used to extend MODBUS TCP Slave functionality

MODBUS TCP MASTER

Supported functions	01, 02, 03, 04, 05, 06, 15, 16
Supported data formats	8-bit: INT, UINT; 16-bit: INT, UINT (MSB or LSB first); 32-bit: float, INT, UINT (ABCD (big-endian), DCBA (little-endian), CDAB, BADC)

DATA TO SERVER

Protocol	HTTP(S), MQTT, Azure MQTT, Kinesis
Data to server	Extract parameters from multiple sources and different protocols, and send them all to a single server

MQTT GATEWAY

MQTT Gateway	Allows sending commands and receiving data from MODBUS Master through MQTT broker

DNP3

Supported modes	TCP Master, DNP3 Outstation

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MONITORING & MANAGEMENT

WEB UI	HTTP/HTTPS, status, configuration, FW update, CLI, troubleshoot, event log, system log, kernel log
FOTA	Firmware update from server, automatic notification
SSH	SSH (v1, v2)
SMS	SMS status, SMS configuration, send/read SMS via HTTP POST/GET
Call	Reboot, Status, Mobile data on/off, Output on/off, answer/hang-up with a timer, Wi-Fi on/off
TR-069	OpenACS, EasyCwmp, ACSLite, tGem, LibreACS, GenieACS, FreeACS, LibCWMP, Friendly tech, AVSystem
MQTT	MQTT Broker, MQTT publisher
SNMP	SNMP (v1, v2, v3), SNMP Trap
JSON-RPC	Management API over HTTP/HTTPS
MODBUS	MODBUS TCP status/control
RMS	Teltonika Remote Management System (RMS)

IoT PLATFORMS

Cloud of Things	Allows monitoring of: Device data, Mobile data, Network info, Availability
ThingWorx	Allows monitoring of: WAN Type, WAN IP, Mobile Operator Name, Mobile Signal Strength, Mobile Network Type
Cumulocity	Allows monitoring of: Device Model, Revision and Serial Number, WAN Type and IP, Mobile Cell ID, ICCID, IMEI, Connection Type, Operator, Signal Strength
Azure IoT Hub	Can send device IP, Number of bytes send/received, Temperature, PIN count to Azure IoT Hub server, Mobile connection state, Network link state, IMEI, ICCID, Model, Manufacturer, Serial, Revision, IMSI, SIM State, PIN state, GSM signal, WCDMA RSCP, WCDMA EC/IO, LTE RSRP, LTE SINR, LTE RSRQ, CELL ID, Operator, Operator number, Connection type

SYSTEM CHARACTERISTICS

CPU	Mediatek, 580 MHz, MIPS 24KEc
RAM	128 MB, DDR2
FLASH storage	16 MB, SPI Flash

FIRMWARE / CONFIGURATION

WEB UI	Update FW from file, check FW on server, configuration profiles, configuration backup
FOTA	Update FW
RMS	Update FW/configuration for multiple devices at once
Keep settings	Update FW without losing current configuration

FIRMWARE CUSTOMIZATION

Operating system	RutOS (OpenWrt based Linux OS)
Supported languages	Busybox shell, Lua, C, C++
Development tools	SDK package with build environment provided
GPL customization	You can now create your own custom firmware and web page application, with some examples to make the creation process easier; and brand our firmware by changing colours, logos, and so on to fit your or your clients' needs

INPUT / OUTPUT

Input	1 x Digital Input, 0 - 6 V detected as logic low, 8 - 30 V detected as logic high
Output	1 x Digital Output, Open collector output, max output 30 V, 300 mA
Events	Email, RMS, SMS
I/O juggler	Allows to set certain I/O conditions to initiate event

POWER

Connector	4-pin industrial DC power socket
Input voltage range	9 – 30 VDC, reverse polarity protection; surge protection >31 VDC 10us max
PoE (passive)	Passive PoE over spare pairs. Possibility to power up through LAN1 port, not compatible with IEEE802.3af, 802.3at and 802.3bt standards, Mode B, 9 - 30 VDC
Power consumption	< 6.5 W Max

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PHYSICAL INTERFACES

Ethernet	2 x RJ45 ports, 10/100 Mbps
I/O's	1 x Digital Input, 1 x Digital Output on 4-pin power connector
Status LEDs	3 x Connection type status LEDs, 5 x Connection strength LEDs, 2 x LAN status LEDs, 1 x Power LED
SIM	1 x SIM slot (Mini SIM – 2FF), 1.8 V/3 V, external SIM holder
Power	1 x 4-pin power connector
Antennas	2 x SMA for LTE, 1 x RP-SMA for Wi-Fi antenna connectors
Reset	Reboot/User default reset/Factory reset button

PHYSICAL SPECIFICATION

Casing material	Aluminium housing, plastic panels
Dimensions (W x H x D)	83 x 25 x 74 mm
Weight	125 g
Mounting options	Bottom and sideways DIN rail mounting slots

OPERATING ENVIRONMENT

Operating temperature	-40 °C to 75 °C
Operating humidity	10% to 90% non-condensing
Ingress Protection Rating	IP30

REGULATORY & TYPE APPROVALS

Regulatory	CE, UKCA, ANRT, Kenya, ICASA, FCC, IC, PTCRB, NOM, RCM, KC, Giteki, IMDA, E-mark, CB, UL/CSA Safety, RoHS, REACH
Operator	AT&T, Verizon, T-Mobile, Uscellular

EMI IMMUNITY

Standards	EN 55032:2015 + A11:2020 EN 55035:2017 + A11:2020 EN IEC 61000-3-2:2019 EN 61000-3-3:2013 + A1:2019 EN 301 489-1 V2.2.3 EN 301 489-17 V3.2.4 Final Draft EN 301 489-52 V1.2.0
ESD	EN 61000-4-2:2009
Radiated Immunity	EN IEC 61000-4-3:2020
EFT	EN 61000-4-4:2012
Surge Immunity (AC Mains Power Port)	EN 61000-4-5:2014 + A1:2017
CS	EN 61000-4-6:2014
DIP	EN 61000-4-11:2020

RF

Standards	EN 300 328 V2.2.2 EN 301 511 V12.5.1 EN 301 908-1 V15.2.1 EN 301 908-2 V13.1.1 EN 301 908-13 V13.2.1

SAFETY

Standards	CE: EN IEC 62368-1:2020 + A11:2020, EN IEC 62311:2020, EN 50665:2017 RCM: AS/NZS 62368.1:2022 CB: IEC 62368-1:2018 UL/CSA Safety: UL 62368-1, Ed. 3 dated December 13, 20, CAN/CSA C22.2 No. 62368-1:19

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STANDARD PACKAGE*

- Router RUT241
- 9 W PSU
- 2 x LTE antennas (swivel, SMA male)
- 1 x Wi-Fi antenna (swivel, RP-SMA male)
- Ethernet cable (1.5 m)
- SIM Adapter kit
- QSG (Quick Start Guide)
- Packaging box



ROUTER RUT241



9 W PSU



2 X LTE ANTENNAS (SWIVEL, SMA MALE)



1 X WI-FI ANTENNA (SWIVEL, RP-SMA MALE)



ETHERNET CABLE (1.5 M)



SIM ADAPTER KIT



QSG

* Standard package contents may differ based on standard order codes.

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CLASSIFICATION CODES

HS Code: 851762
HTS: 8517.62.00

For more information on all available packaging options – please contact us directly.

AVAILABLE VERSIONS

HARDWARE VERSION	SUPPORTED FREQUENCIES	STANDARD ORDER CODE / PACKAGE CONTAINS
RUT241 *0**** Europe1, The Middle East, Africa, Thailand	**4G (LTE-FDD):** B1, B3, B7, B8, B20, B28A **3G:** B1, B8 **2G:** B3, B8	RUT241000000 / Standard package with EU PSU RUT241001000 / Standard package with UK PSU RUT241004000 / Standard package with Power cable with 4-way screw terminal RUT241002030 / Mass packing code
RUT241 *1**** Europe1, The Middle East, Africa	**4G (LTE-FDD):** B1, B3, B5, B7, B8, B20 **4G (LTE-TDD):** B40 **3G:** B1, B5, B8 **2G:** B3, B8	RUT241010000 / Standard package with EU PSU RUT241011000 / Standard package with UK PSU RUT241012030 / Mass packing code
RUT241 *3**** Global1	**4G (LTE-FDD):** B1, B2, B3, B4, B5, B7, B8, B12, B13, B18, B19, B20, B25, B26, B28 **4G (LTE-TDD):** B38, B39, B40, B41 **3G:** B1, B2, B4, B5, B6, B8, B19 **2G:** B2, B3, B5, B8	RUT241030000 / Standard package with EU PSU RUT241034000 / Standard package with Power cable with 4-way screw terminal RUT241033000 / Standard package with Universal PSU RUT241038000 / Standard package with US PSU RUT241032030 / Mass packing code
RUT241 *6**** Australia, New Zealand, Taiwan	**4G (LTE-FDD):** B1, B3, B5, B7, B8, B28 **4G (LTE-TDD):** B40 **3G:** B1,B5, B8 **2G:** B3, B5, B8	RUT241065000 / Standard package with AU PSU RUT241063000 / Standard package with Universal PSU RUT241062030 / Mass packing code
RUT241 *7**** Latin America	**4G (LTE-FDD):** B1, B2, B3, B4, B5, B7, B8, B28 **4G (LTE-TDD):** B40 **3G:** B1, B2, B4, B5, B8 **2G:** B2, B3, B5, B8	RUT241070000 / Standard package with EU PSU RUT241073000 / Standard package with Universal PSU RUT241075000 / Standard package with AU PSU RUT241072030 / Mass packing code
RUT241 *8**** Japan	**4G (LTE-FDD):** B1, B3, B8, B18, B19, B26 **4G (LTE-TDD):** B41 **3G:** B1, B6, B8, B19	RUT241087000 / Standard package with JP PSU RUT241082030 / Mass packing code
RUT241 *9**** North America2	**4G (LTE-FDD):** B2, B4, B5, B12, B13, B14, B66, B71 **3G:** B2, B4, B5	RUT241098000 / Standard package with US PSU RUT241092030 / Mass packing code

The price and lead-times for region (operator) specific versions may vary. For more information please contact us.

1 - Regional availability - excluding Russia & Belarus
2 - For more detailed information about certified carriers, visit our Wiki page

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RUT241 SPATIAL MEASUREMENTS & WEIGHT

MAIN MEASUREMENTS

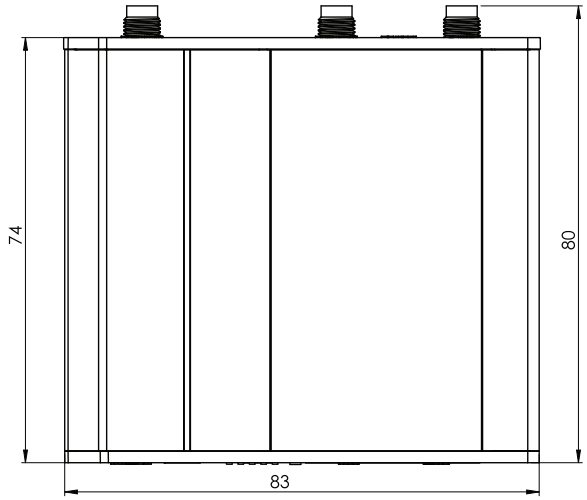
W x H x D dimensions for RUT241:

Device housing*:	83 x 25 x 74 mm
Box:	173 x 71 x 148 mm

*Housing measurements are presented without antenna connectors and screws; for measurements of other device elements look to the sections below.

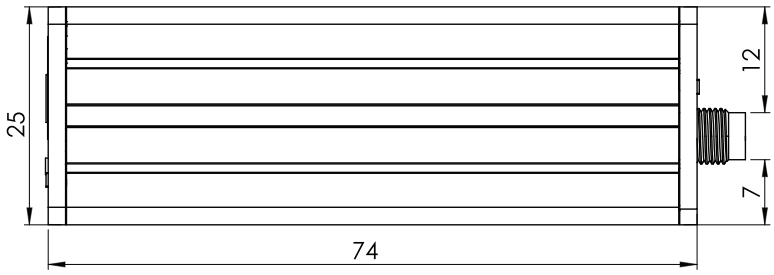
TOP VIEW

The figure below depicts the measurements of RUT241 and its components as seen from the top:



RIGHT VIEW

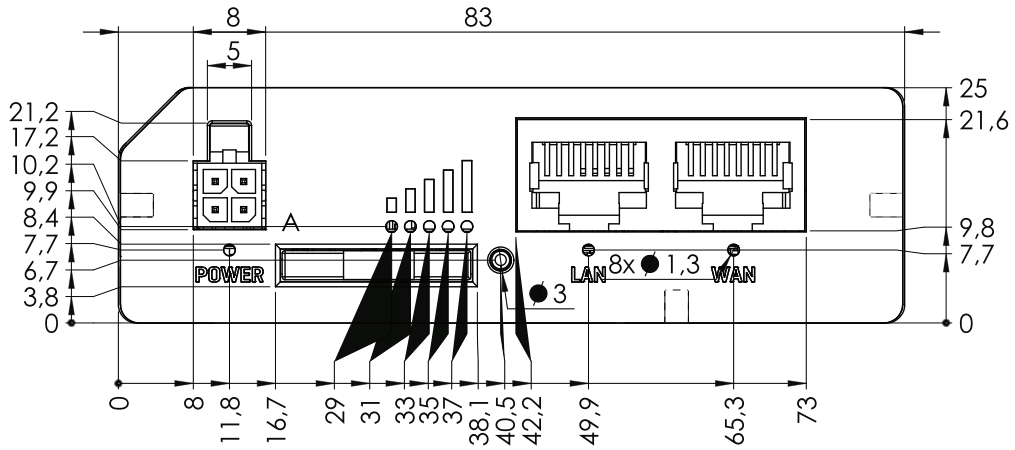
The figure below depicts the measurements of RUT241 and its components as seen from the right side:



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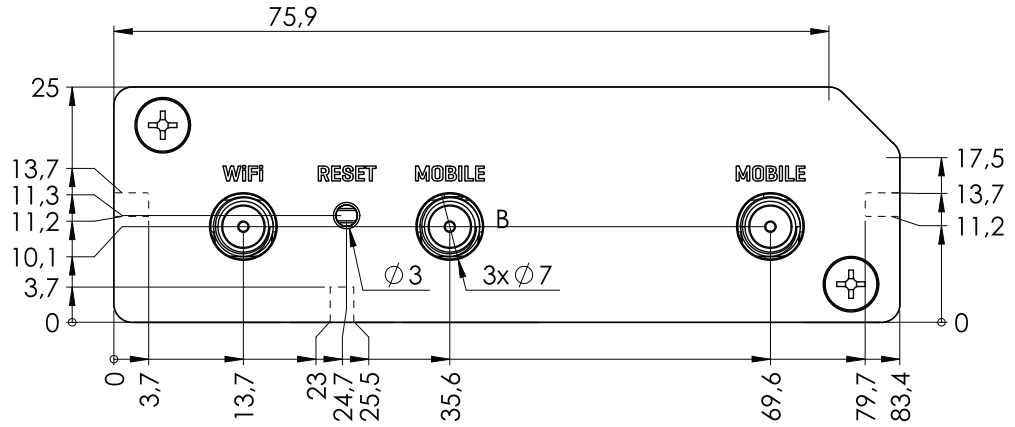
FRONT VIEW

The figure below depicts the measurements of RUT241 and its components as seen from the front panel side:



REAR VIEW

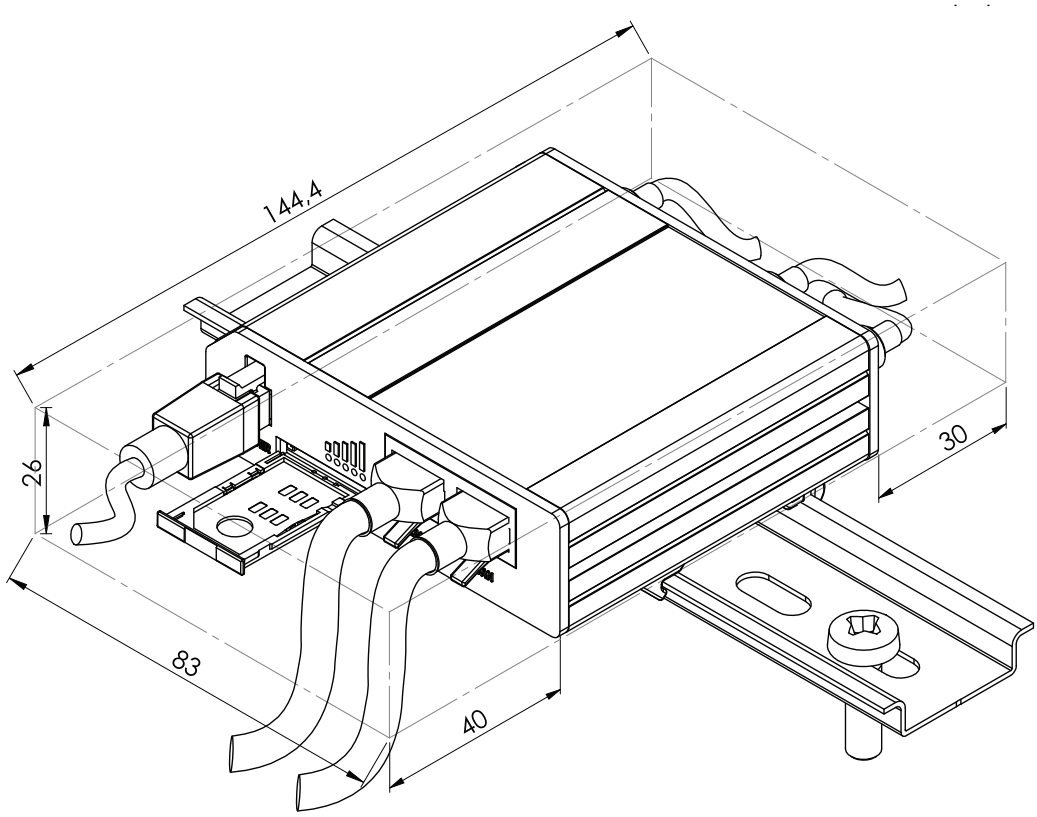
The figure below depicts the measurements of RUT241 and its components as seen from the back panel side:



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MOUNTING SPACE REQUIREMENTS

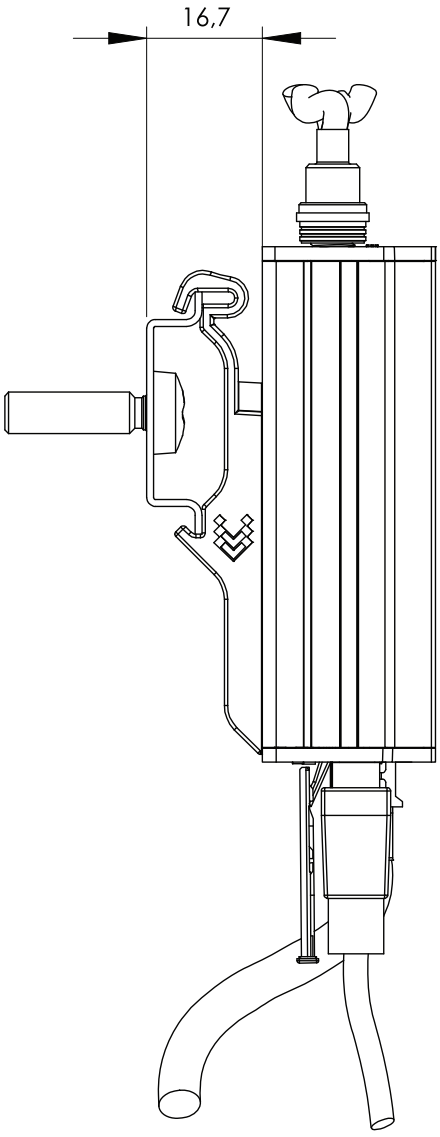
The figure below depicts an approximation of the device's dimensions when cables and antennas are attached:



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DIN RAIL

The scheme below depicts protrusion measurements of an attached DIN Rail:



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