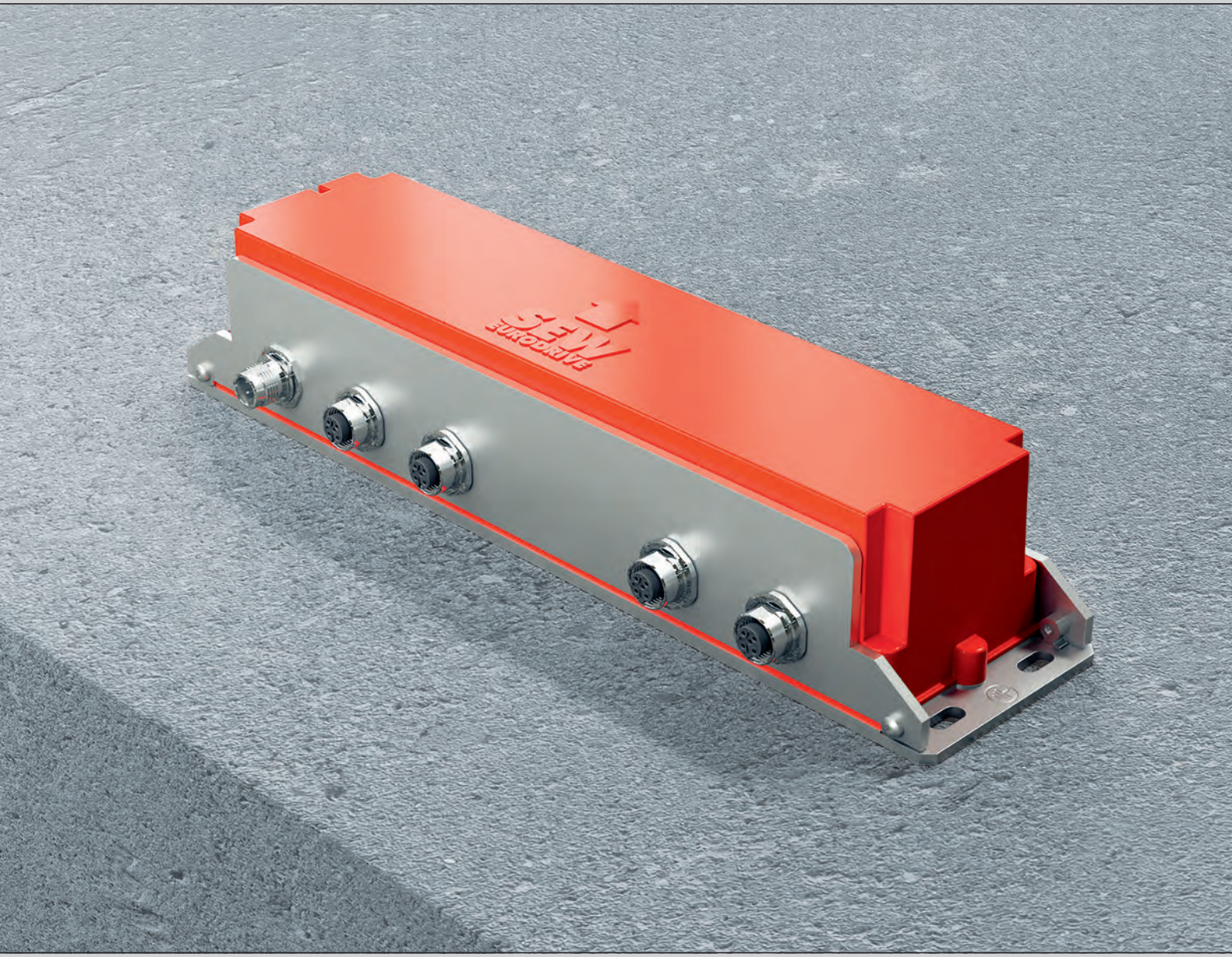
SEW EURODRIVE

Assembly and operating instructions



MAXOLUTION® system solution

Sensor module

MAXO-MS/M/SM-GIP/2, MAXO-MS/M/SM-IP/2

Edition 05/2025

31982107/EN

Table of contents

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1 General information

1.1 About this documentation

The documentation at hand is the original.

This documentation is an integral part of the product. The documentation is intended for all employees who perform work on the product.

Make sure this documentation is accessible and legible. Ensure that persons responsible for the systems and their operation as well as persons who work on the product independently have read through the documentation carefully and understood it. If you are unclear about any of the information in this documentation or if you require further information, contact SEW-EURODRIVE.

1.2 Other applicable documentation

Observe the corresponding documentation for all additional components.

1.3 Structure of the safety notes

1.3.1 Meaning of signal words

The following table shows the graduation and meaning of the signal words in the safety notes.

Signal word	Meaning	Consequences if not observed
⚠ **DANGER**	Imminent danger	Death or severe injuries
⚠ **WARNING**	Possibly dangerous situation	Death or severe injuries
⚠ **CAUTION**	Possibly dangerous situation	Minor injuries
NOTICE	Possible damage to property	Damage to the product or its environment
INFORMATION	Useful information or tip: Simplifies handling of the product.	

1.3.2 Structure of section-related safety notes

Section-related safety notes do not apply to a specific action but to several actions pertaining to one subject. The hazard symbols used either indicate a general hazard or a specific hazard.

This is the formal structure of a safety note for a specific section:

SIGNAL WORD

Type and source of hazard.

Possible consequence(s) if disregarded.

- Measure(s) to prevent the hazard.

1.3.3 Structure of embedded safety notes

Embedded safety notes are directly integrated into the instructions just before the description of the dangerous step.

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This is the formal structure of an embedded safety note:

⚠ **SIGNAL WORD!** Type and source of danger. Possible consequence(s) if disregarded. Measure(s) to prevent danger.

1.4 Decimal separator in numerical values

In this document, a period is used to indicate the decimal separator.

Example: 30.5 kg

1.5 Rights to claim under limited warranty

Read the information in this documentation. This is essential for fault-free operation and fulfillment of any rights to claim under limited warranty. Read the documentation before you start working with the product.

1.6 Product names and trademarks

The product names mentioned in this documentation are trademarks or registered trademarks of the respective titleholders.

1.6.1 Trademark of Beckhoff Automation GmbH

EtherCAT® is a registered trademark and patented technology, licensed by Beckhoff Automation GmbH, Germany.

1.7 Copyright notice

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2 Safety notes

2.1 Preliminary information

The following general safety notes serve the purpose of preventing injury to persons and damage to property. They primarily apply to the use of products described in this documentation. If you use additional components, also observe the relevant warning and safety notes.

2.2 Duties of the user

As the user, you must ensure that the basic safety notes are observed and complied with. Make sure that persons responsible for the machinery and its operation as well as persons who work on the device independently have read through the documentation carefully and understood it.

As the user, you must ensure that all of the work listed in the following is carried out only by qualified specialists:

- Setup and installation
- Installation and connection
- Startup
- Maintenance and repairs
- Shutdown
- Disassembly

Ensure that the persons who work on the product pay attention to the following regulations, conditions, documentation, and information:

- The national and regional regulations governing safety and the prevention of accidents
- Product safety label on the product
- All other associated project planning documents, installation and startup instructions, as well as connection and wiring diagrams
- Do not assemble, install, or operate damaged products
- All system-specific specifications and regulations

Ensure that systems in which the product is installed are equipped with additional monitoring and protection devices. Observe the applicable safety regulations and legislation governing technical work equipment and accident prevention regulations.

2.3 Target group

Specialist for mechanical work

Any mechanical work may be performed only by adequately qualified specialists. Specialists in the context of this documentation are persons who are familiar with the design, mechanical installation, troubleshooting, and maintenance of the product, and who possess the following qualifications:

- Qualifications in the field of mechanics in accordance with the national regulations
- Familiarity with this documentation

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Specialist for electrotechnical work

Any electrotechnical work may be performed only by electrically skilled persons with a suitable education. Electrically skilled persons in the context of this documentation are persons who are familiar with electrical installation, startup, troubleshooting, and maintenance of the product, and who possess the following qualifications:

- Qualifications in the field of electrical engineering in accordance with the national regulations
- Familiarity with this documentation

Additional qualifications

In addition to that, these persons must be familiar with the valid safety regulations and laws, as well as with the requirements of the standards, directives, and laws specified in this documentation.

The persons must have the express authorization of the company to operate, program, parameterize, label, and ground devices, systems, and circuits in accordance with the standards of safety technology.

Instructed persons

All work in the areas of transport, storage, installation, operation and waste disposal may only be carried out by persons who are trained and instructed appropriately. These instructions must enable the persons to carry out the required activities and work steps safely and in accordance with regulations.

2.4 Designated use

The product consists of a unit with the following sensors, which are used for track guidance:

- 2 acceleration sensors for the X, Y, and Z axes (optional)
- 2 rotation rate sensors for the X and Z axes (optional)
- 1 inductive track guidance
- 1 read head for RFID transponders

Moreover, the product is equipped with a connection for the power supply and communication interfaces:

- 2 EtherCAT® interfaces (IN and OUT)
- 2 CAN interfaces
- DC 24 V supply

The product is designed for installation in mobile electrical systems or machines, especially for automated guided vehicles.

In case of installation in electrical systems or machines, startup of the product is prohibited until it is determined that the machine meets the requirements stipulated in the local laws and directives. For Europe, Machinery Directive 2006/42/EC as well as the EMC Directive 2014/30/EU apply. Observe EN 60204-1 (Safety of machinery - electrical equipment of machines). The product meets the requirements stipulated in the Low Voltage Directive 2014/35/EU.

Technical data and information on the connection conditions are provided on the nameplate and in chapter "Technical data" in the documentation. Always comply with the data and conditions.

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Observe the following restrictions:

- Do not open the product.

  Safe and fault-free operation can no longer be ensured if you open the product. In case of service, send your product back to SEW-EURODRIVE. Your rights to claim under limited warranty become void if you open the product.

- Do not make any changes to the product.

  Your rights to claim under limited warranty become void if you make changes to the product.

Unintended or improper use of the product may result in severe injury to persons and damage to property.

2.5 Network security and access protection

A bus system makes it possible to adapt electronic drive technology components to the particulars of the machinery within wide limits. There is a risk that a change of parameters that cannot be detected externally may result in unexpected but not uncontrolled system behavior and may have a negative impact on operational safety, system availability, or data security.

Ensure that unauthorized access is prevented, especially with respect to Ethernet-based networked systems and engineering interfaces.

2.6 Transport

Inspect the shipment for damage as soon as you receive the delivery. Inform the shipping company immediately about any damage. If the product is damaged, it must not be assembled, installed or started up.

When you return the product, pack it into a suitable box.

Observe the information on climatic conditions in chapter "Technical data" of the documentation.

2.7 Installation/assembly

When installed in an automated guided vehicle system, adjacent or attached components must not result in exceeding the permitted operating temperature of the device.

Protect the product from strong mechanical strain. The product and its mounting parts must never protrude into the path of persons or vehicles. Electrical components must not be mechanically damaged or destroyed.

2.7.1 Restrictions of use

The following applications are prohibited unless the device is explicitly designed for such use:

- Use in potentially explosive areas.
- Use in areas exposed to harmful oils, acids, gases, vapors, dust, and radiation.
- Operation in applications with impermissibly high mechanical vibration and shock loads in excess of the regulations stipulated in EN 61800-5-1.
- Operation at an elevation of more than 2000 m above sea level.

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2.8 Electrical installation

The preventive measures and protection devices must comply with the applicable regulations (e.g. EN 60204-1 or EN 61800-5-1).

2.9 Startup and operation

Damaged products

Never install damaged products. Submit any complaint to the shipping company immediately in the event of transportation damage. Do not start up damaged products.

2.10 Inspection/maintenance

Never open the device. Only SEW-EURODRIVE may repair the device.

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3 Device structure

3.1 Type designation

MAXO	MAXOLUTION® system solution	
-		
MS	Mobile system	
/		
M	Module	
/		
SM	Sensor module	
-		
	Design with the following combination options:	
	G	Acceleration and rotation rate sensor (optional)
	I	Inductive
	P	RFID

3.2 Part numbers

Designation	Part number
MAXO-MS/M/SM-GIP/2	28320034
MAXO-MS/M/SM-IP/2	28314107

3.3 Short designation

The following short designations are used in this documentation:

Designation	Short designation
Sensor module	Device
Automated guided vehicle	Vehicle

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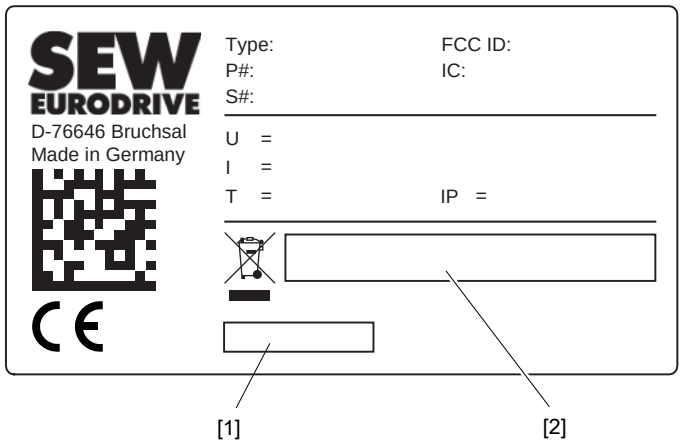
3.4 Nameplate



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[1] Product designation
[2] Version

Depending on the device design, the following information is listed on the main nameplate:

Value	Specification
Type	Type designation
P#	Part number (for customer-specific products)
S#	Production number
FCC ID IC	Radio approval for USA/Canada
U	Voltage
I	Current
T	Ambient temperature
IP	Degree of protection

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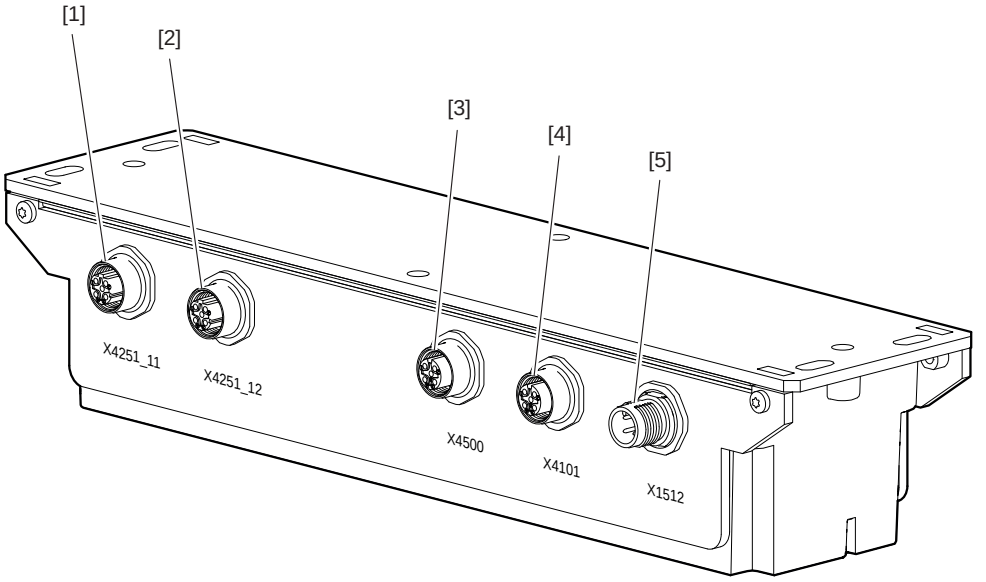
3.5 Device overview



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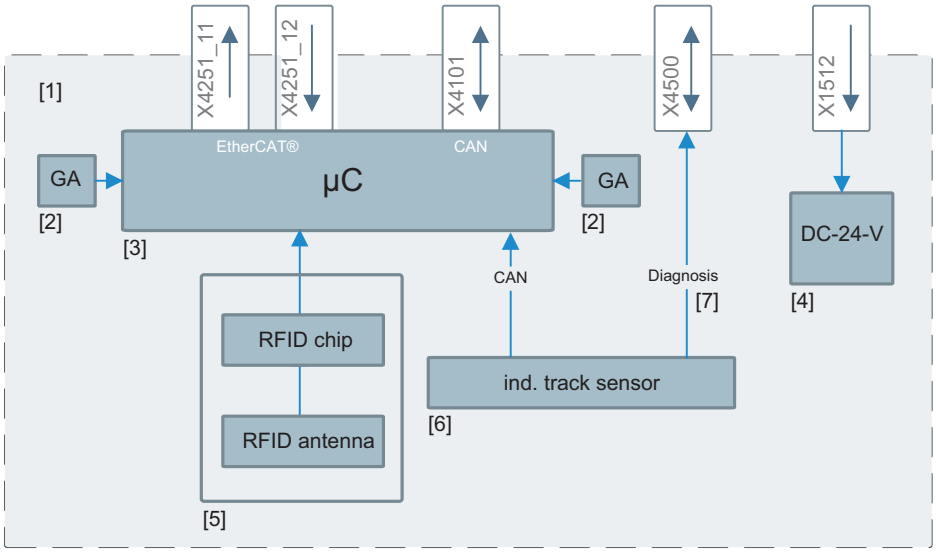
[1]	X4251_11	EtherCAT® interface (OUT)
[2]	X4251_12	EtherCAT® interface (IN)
[3]	X4500	Diagnostic interface of inductive track guidance
[4]	X4101	CAN interface (diagnostics)
[5]	X1512	Interface for power supply

For further information, refer to chapter "Electrical installation" (→ 🗎 24).

3.6 Operating principle

The following figure shows the block diagram of the sensor module:



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The sensor module is used in a mobile assistant. It consists mainly of the following components:

[1] Communication interfaces
[2] Rotation rate and acceleration sensors (optional)
[3] Microcontroller
[4] Power supply
[5] Read head and antenna for detection of RFID transponders
[6] Inductive track guidance
[7] Diagnostics and programming of inductive track guidance

Inductive track guidance [6] detects the deviation of the vehicle from the specified track on the MOVITRANS® line cable. Optionally, odometry data is collected by the rotation rate sensor and acceleration sensors at the same time.

The data of the inductive track guidance is transmitted to the microcontroller [3] via CAN for evaluation. Another CAN female plug connector X4101 is connected to the microcontroller and can be used for diagnostics or programming of the device.

X4500 can be used to diagnose and program inductive track guidance.

The data of the RFID transponders is collected and read [5] and transmitted serially to the microcontroller for referencing.

The sensor module transmits the sensor data to a higher-level controller where it is compared and evaluated.

The sensor module has 2 EtherCAT® interfaces (X4251_11 and X4251_12) for integration into an EtherCAT® topology and as a prerequisite for communication with a higher-level controller.

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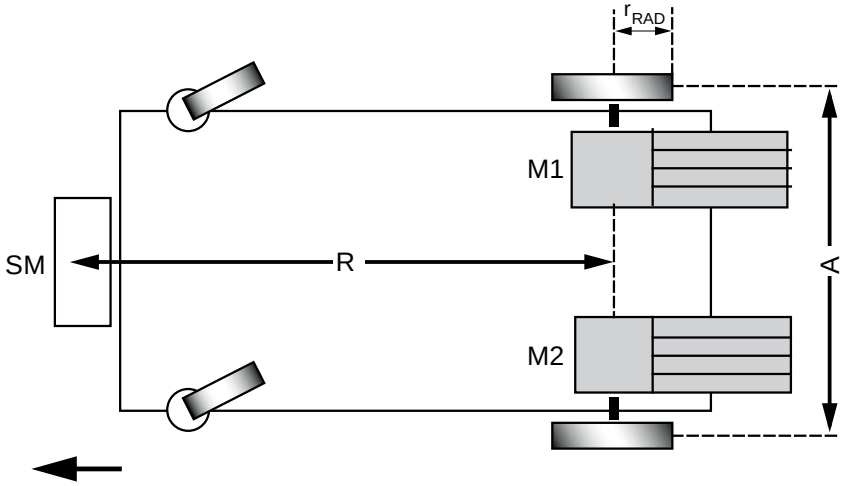
4 Mechanical installation

4.1 Track and vehicle geometry

4.1.1 Distance designation

The following figure shows the vehicle from below (in the direction of travel) with the designation of the distances:



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SM Sensor module
R Distance R between the sensor module (SM) and the steered axis
M Motor
A Distance of the two drive wheels
r_{RAD} Tire radius

These parameters are required for configuring the sensor module. They also apply to slightly different vehicle designs with swivel wheel suspension.

An advantage of vehicles with swivel wheel suspension is that they run more smoothly during operation.

4.1.2 Distance between the sensor module and the steered axis

The distance R between the sensor module and the steered drive axis must be at least as large as the result calculated using the following formula:

$$R_{min} = \sqrt{(1.6 \frac{s^2}{m} \times A)} \times v_{max}$$

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v_{max} Maximum travel speed in m/s

INFORMATION

This condition also applies to vehicle designs with swivel wheel suspension.

4.1.3 Minimum permitted curve radius

The smallest possible curve radius $r_{Curve,min}$ that can be traveled at v_{max} is calculated using the actual distance R:

$$r_{Curve,min} = \frac{R^2}{0.08\,m}$$

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4.1.4 Speed reduction in tight curves

For curve radii $r_K < r_{Curve,min}$, the travel speed in the curve must be reduced in accordance with v_{max}:

$$v_{Curve,max} = \frac{r_K}{r_{Curve,min}} \cdot v_{max}$$

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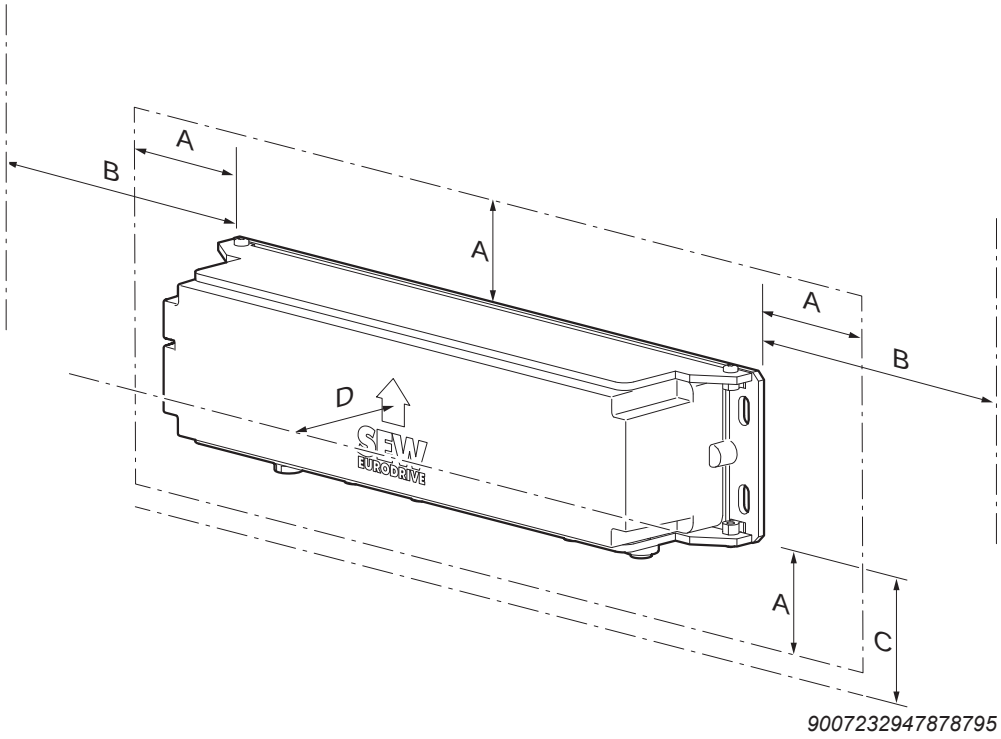
4.2 Minimum clearances

SEW-EURODRIVE recommends observing the following clearances when mounting the device:



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The following table lists the minimum clearances:

Clearance	Function	Clearance
A	Distance to metallic components. This way, you can avoid a reduction of the range when reading an RFID transponder.	≥ 50 mm
B	Distance to metallic components. Metallic components prevent the sensor technology from functioning correctly.	≥ 125 mm
C	Space for cable entry and plug connectors	≥ 60 mm
D	Distance to floor to avoid collisions with obstacles and to ensure proper operation of the sensor technology	≥ 25 mm

4.3 Travel direction

It is important that you align the sensor module correctly in reference to the direction of travel. To help you do this, an arrow is printed on the top of the housing to indicate the direction of travel.

The sensor module must always be in front of the steered axis. This means a track point is crossed first by the sensor module and then by the steered axis.

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INFORMATION

Reverse travel is not possible.

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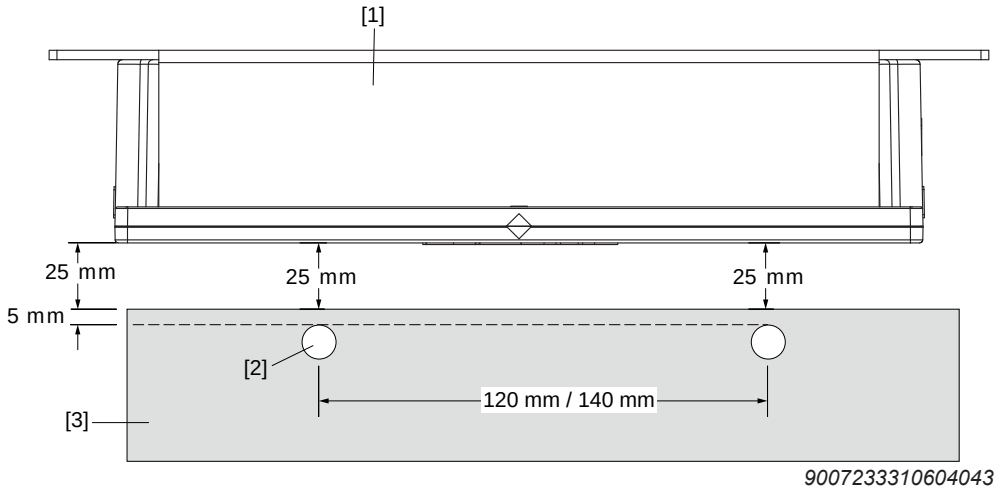
4.4 Project planning notes on inductive track guidance

4.4.1 Distances for line cable routing

Inductive track guidance is used with line cables (round or wedge-shaped) that are routed at a distance of 140 mm or 120 mm.

The following figure shows the distances that must be observed when mounting the sensor module using a round line cable as an example:



[1] Sensor module
[2] Line cable (round design)
[3] Hall floor

Install the sensor module [1] in such a way that the distance between the hall floor [3] and the bottom of the housing is 25 mm. This value applies when the line cable [2] is routed so that the top edge of the cable is 5 mm below the surface of the hall floor.

When routing the line cable, ensure that the distance between the top edge of the line cable and the surface of the hall floor is kept constant along the entire track. Before routing the line cable, determine the precise thickness of the surface covering above the line cable. Avoid lateral deviations when routing the line cable because the track-guided vehicle follows the routed line cable exactly.

A constant height must be maintained between the sensor module and the line cable. Deviations of ±3 mm in the height from the measuring system to the line cable pair leads to a track deviation of ±2 mm.

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4.4.2 Permitted deviation of the track guidance

Depending on the line cable distance and the active sensor system (at the edge or in the middle), the following permitted track deviations are possible:

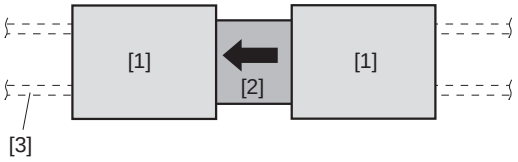
Position of the active sensor system		At the edge		In the middle	
Line cable distance		140 mm	120 mm	140 mm	120 mm
Permitted track deviation	Toward the outside	± 40 mm	± 20 mm	± 65 mm	± 55 mm
	Toward the inside		+ 40 mm		

The specified track deviations assume that the measuring coil is positioned precisely above the line cable. If that is not the case, correct recording is no longer guaranteed.

With a line cable distance of < 120 mm, only the sensor system in the middle is permitted due to the deviation.

4.4.3 Distance to pick-ups

The following figure shows the installation of the sensor module between 2 flat MOVITRANS® pick-ups:



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[1] MOVITRANS® pick-ups
[2] Sensor module
[3] Line cable

Observe the following notes during installation:

The MOVITRANS® pick-ups may be installed before and/or after the sensor module, taking the minimum clearances into account (see "Minimum clearances" (→ 🗎 17)).

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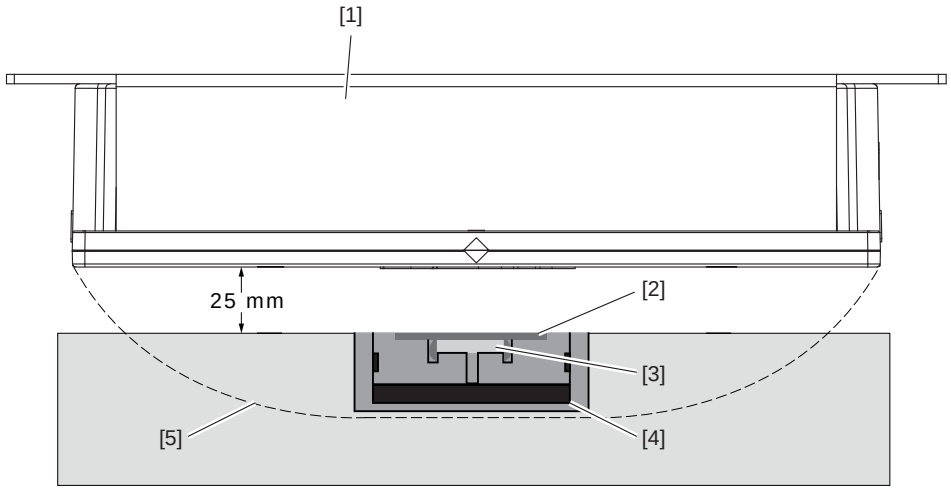
4.5 Project planning notes, RFID system

The following figure shows the sensor module, the components for installing the transponder and the required distance to the hall floor:



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[1] Sensor module
[2] Closing plug for assembly sleeve
[3] Transponder
[4] Assembly sleeve for transponder
[5] Read field of the RFID transponder

The RFID system operates at a frequency of 13.56 Mhz according to ISO 15693. The range of the system is influenced by various factors that must be taken into account during project planning:

Distance

Keep a sufficient distance to metallic objects (see "Minimum clearances" (→ 🗎 17)) and liquids.

Reduced reading range in the outer area

Due to the physical characteristics of the antenna, the full reading range is not achieved in the outer area.

Therefore, make sure that the transponder is passed in the center of the sensor module.

Transponder type

The coupling between the RFID antenna and the RFID transponder depends on the shape and surface of the RFID transponder. This ensures different travel speeds with each transponder type.

That is why SEW-EURODRIVE recommends the following transponder components:

Transponder component (type)	Part number
Transponder (IQC22-22-T9)	11744928
Assembly sleeve	11746467
Closing plug for sleeve (W4299 1-25.5-PP-BK)	01146572

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INFORMATION

Faulty reading of transponders

✓ At a distance of 25 mm, safe reading of the transponder (IQC22-22-T9) is guaranteed for speeds of up to 2 m/s if the following conditions are met:

- Correct installation of the recommended transponder components.
- Transponder is passed in the center of the antenna.

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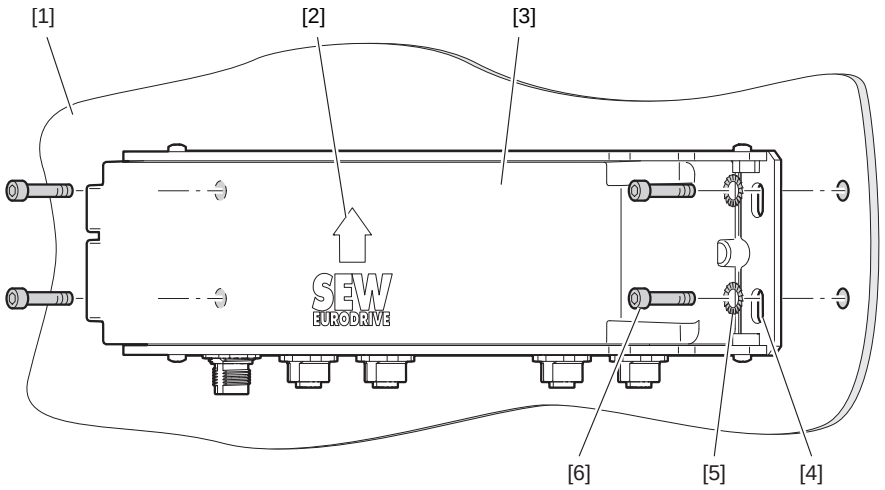
4.6 Mounting the device

The device has 2 slotted holes [4] on both sides. You can mount the device [3] using the slotted holes [4] and 4 cap screws [6].

- Use screws [6] of suitable length to mount the device [3].
- Use tooth lock washers [5] and washers, if necessary. This allows for a low-impedance contact between the device [3] and the screw fitting so that the device is connected to the equipotential bonding of the vehicle.



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[1] Mounting plate for mounting the sensor module to the bottom of the vehicle

[2] The arrow points in the direction of travel when mounted correctly.

[3] Sensor module

[4] Slotted hole (4 pieces)

[5] Tooth lock washer (4 pieces) with washers, if necessary

[6] Cap screw M5 (4 pieces)

Tightening torque 5.8 – 6.8 Nm, strength class 8.8

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5 Electrical installation

5.1 Electrical connections

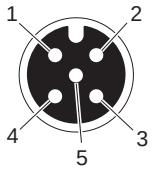
5.1.1 Representation of connections

The wiring diagrams show the contact end of the connections.

5.1.2 X4101: CAN bus – system bus

Function
Internal CAN bus (system bus) – output

Connection type
M12, 5-pin, female, A-coded

Connection diagram


No.	Name	Function
1	CAN_SHLD	Shield/equipotential bonding
2	+24 V	DC 24 V output
3	GND	Reference potential
4	CAN_H	CAN data cable (high)
5	CAN_L	CAN data cable (low)

5.1.3 X4251_11/12: EtherCAT®/SBus^{PLUS} interface

Function
EtherCAT®/SBus^{PLUS}

Connection type
Connection M12, 4-pin, female, D-coded

Connection diagram


No.	Name	Function
1	TX+	Transmit line (+)
2	RX+	Receive line (+)

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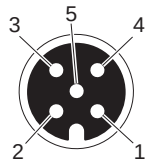
No.	Name	Function
3	TX-	Transmit line (-)
4	RX-	Receive line (-)

5.1.4 X4500: Diagnostic interface

Function
Diagnostic interface

Connection type
Connection M12, 5-pin, female, A-coded

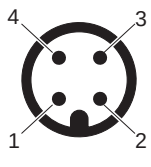
Connection diagram


No.	Name	Function
1	5 V	Programming voltage
2	PGC	Clock
3	0V24	0V24 reference potential
4	PGD	Data
5	MCLRN	Master Clear/Reset

5.1.5 X1512: DC 24 V supply

Function
DC 24 V device supply input

Connection type
Connection M12, 4-pin, male, A-coded

Connection diagram


No.	Name	Function
1	+24V	DC 24 V supply
2	n.c.	Not assigned
3	0V24	0V24 reference potential
4	n.c.	Not assigned

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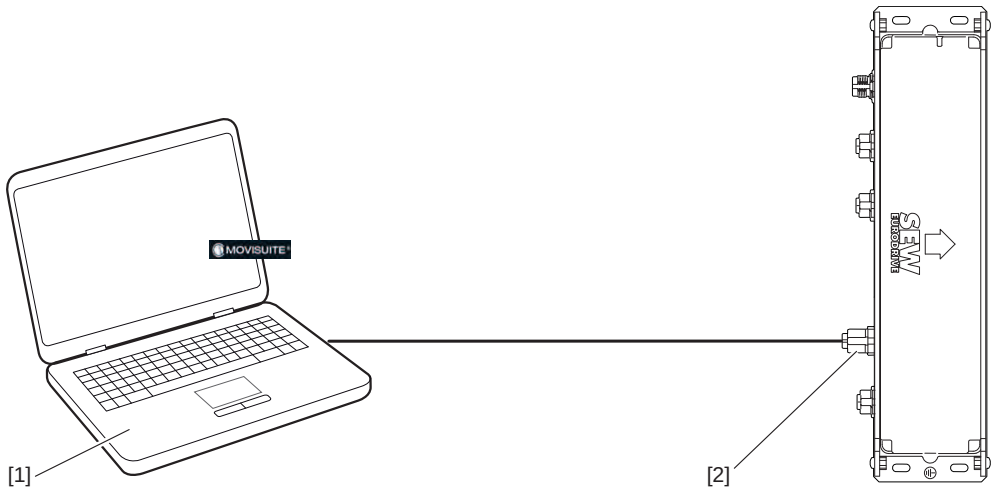
6 Startup

6.1 Connecting an engineering PC via EtherCAT®/SBus^{PLUS}

A direct connection via the EtherCAT®/SBus^{PLUS} interface allows the sensor module to be started up in advance in the network without an EtherCAT® master.



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No.	Meaning
[1]	Engineering PC with MOVISUITE®
[2]	4251_12: EtherCAT®/SBus^{PLUS} interface (IN)

INFORMATION

SEW-EURODRIVE does not offer prefabricated cables for this type of plug connector.

SEW-EURODRIVE recommends using industrial Ethernet cables/EtherCAT® CAT 5e, 4-core cables for this connection.

6.2 Configuring the communication and creating a project

✓ The engineering PC is connected to the sensor module via the EtherCAT®/SBus^{PLUS} interface.

1. Open the MOVISUITE® engineering software on the engineering PC.

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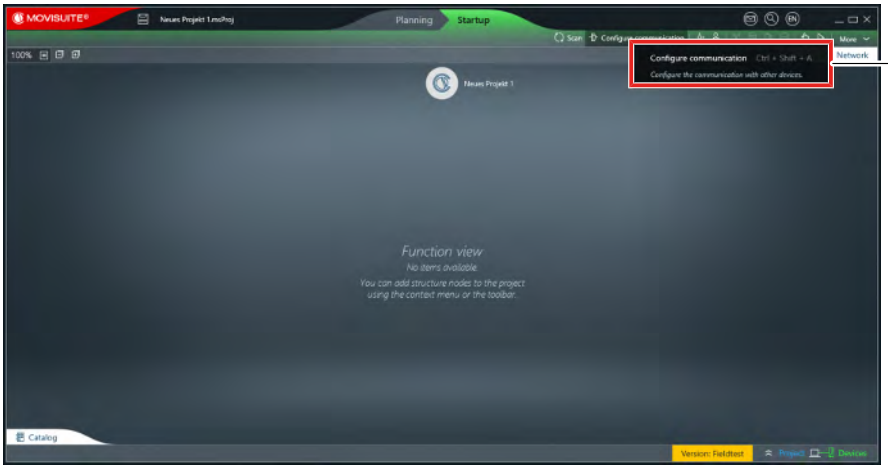
2. Click the [Configure communication] button [1].



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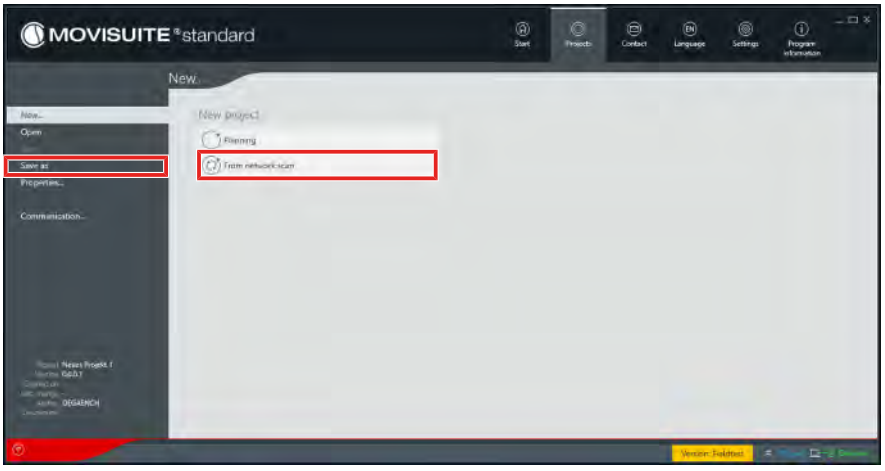
3. Create a new project based on a network scan.



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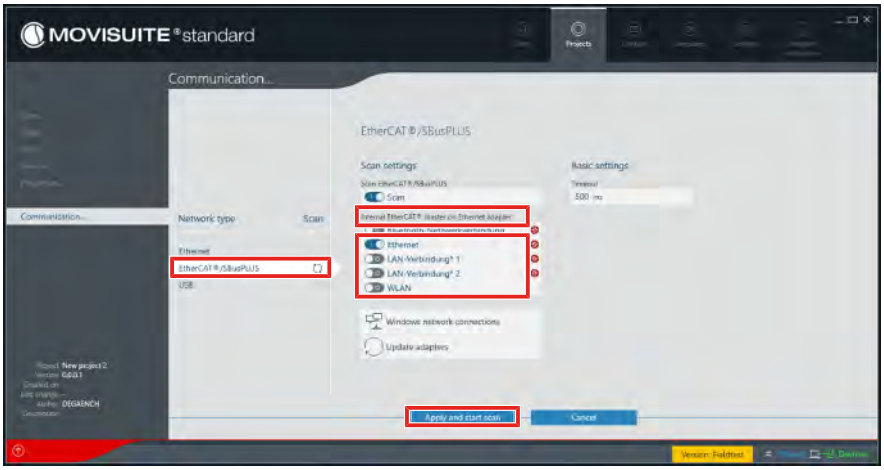
6.3 Selecting and scanning the EtherCAT®/SBus^{PLUS} network

1. Select the network type EtherCAT®/SBus^{PLUS} in the MOVISUITE® engineering software.



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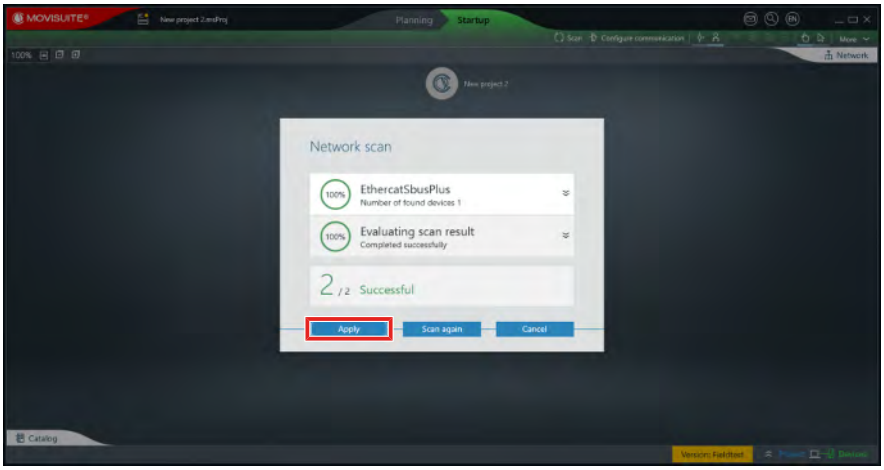
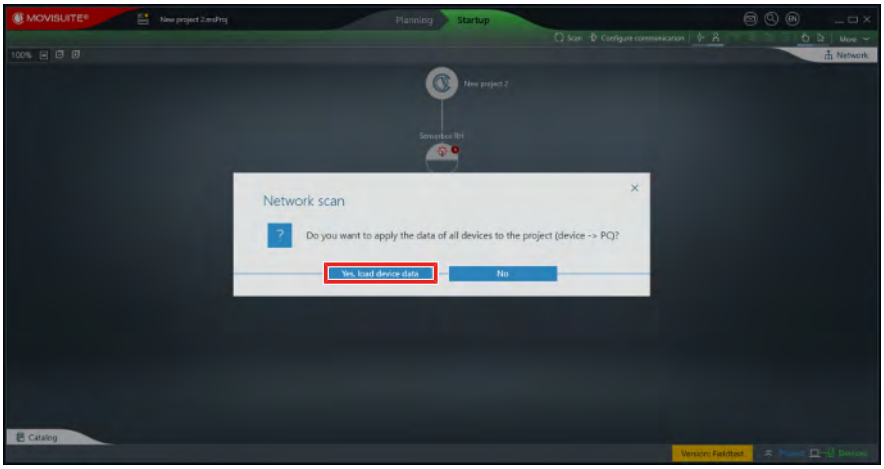
2. Perform the network scan using the active LAN connection of the engineering PC.
3. Click [Apply and start scan].
   ⇨ The sensor module is recognized during the network scan.
4. Accept the result of the network scan.



34673313675

⇨ The sensor module is transferred to the new project.

5. Transfer the device data from the sensor module to the engineering PC.



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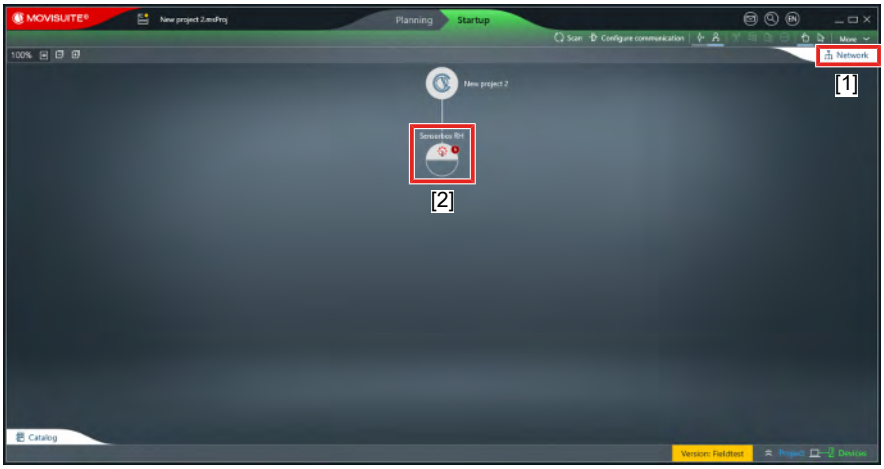
⇨ You have now met all requirements for displaying the sensor module configuration and changing it if required, as described in the following chapter.

6.4 Displaying and changing the configuration

1. In click on the network icon on the (top right) toolbar [1].



34681408139

2. Double-click the device icon [2].

   ⇨ Important data of the sensor module as network station and the software version are displayed in a table.

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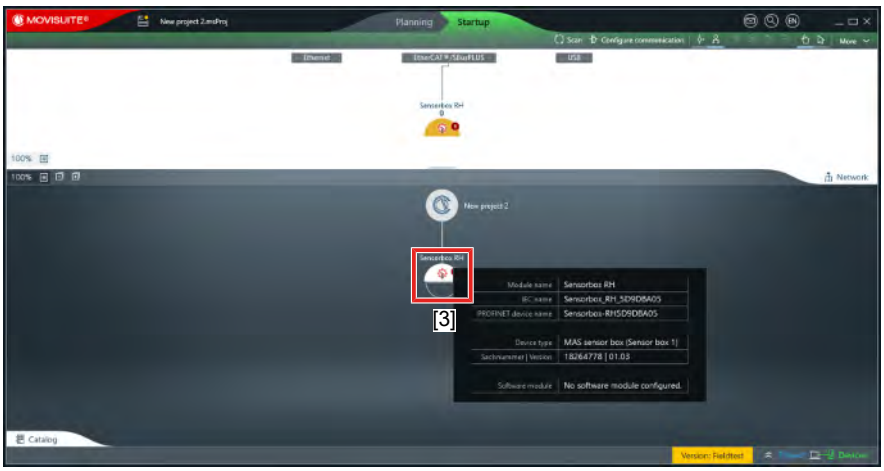
3. Double-click the device icon [3].



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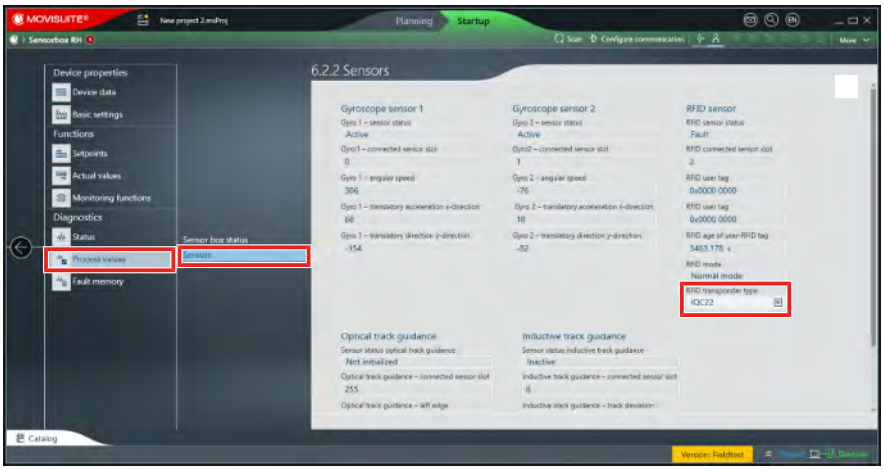
⇨ The configuration settings are displayed.

4. To check the sensor settings and adjust them if necessary, select [Device settings] > [Process values] > [Sensors].



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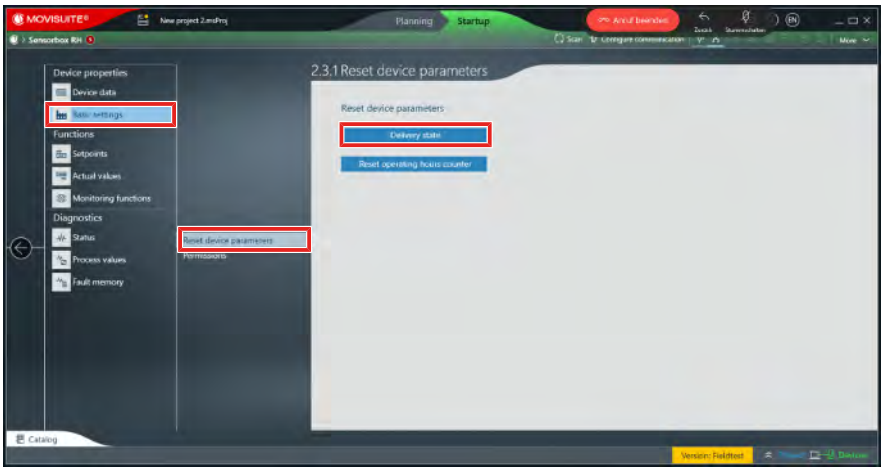
5. Make sure all types are set for the "IQC22" RFID transponder.

6.5 Resetting the device parameters to delivery state

1. Select [Device properties] > [Basic settings] > [Reset device parameters].



34682380555

2. Click on the [Delivery state] button.

⇨ All parameters and non-volatile values of the sensor module (e.g. transponder type) are reset to the delivery state.

7 Service

7.1 Waste disposal

Dispose of the product and all parts separately in accordance with their material structure and the national regulations. Put the product through a recycling process or contact a specialist waste disposal company. If possible, divide the product into the following categories:

- Iron, steel or cast iron
- Stainless steel
- Magnets
- Aluminum
- Copper
- Electronic parts
- Plastics

The following materials are hazardous to health and the environment. These materials must be collected and disposed of separately:

- Oil and grease

  Collect used oil and grease separately according to type. Ensure that the used oil is not mixed with solvent. Dispose of used oil and grease correctly.
- Screens
- Capacitors

Waste disposal according to WEEE Directive 2012/19/EU

This product and its accessories may fall within the scope of the country-specific application of the WEEE Directive. Dispose of the product and its accessories according to the national regulations of your country.

For further information, contact the responsible SEW-EURODRIVE branch or an authorized partner of SEW-EURODRIVE.

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Return Information – **MAXO**LUTION®

Project identification / Projektidentifikation

Proj. number	Proj. name SEW-EURODRIVE	Proj. name customer	

Serial number, unit / Seriennummer, Gerät

SO# ☐☐ ☐☐☐☐☐☐☐☐☐☐ ☐☐☐☐ ☐☐

Customer reference / Kundenreferenz _____

Local contact for inquiries / Ansprechpartner vor Ort für Rückfragen _____

Phone / Telefon _____ **E-mail /** E-Mail _____

System data / Daten zu Anlage

Location description / Textangabe Ort _____

Vehicle number / Fahrzeugnummer _____

E-plan reference / E-Plan Referenz _____

Components / Komponente ☐ **Stationary /** Stationär ☐ **Mobile /** Mobil

Application / Applikation _____

Identification unit description / Identifikation Gerätebezeichnung _____

Failure description / Fehlerbeschreibung

Date / Datum MMDD20YY **Time /** Uhrzeit ☐☐ : ☐☐ h

Location of failure / Ort des Fehlers _____

Failure appearance (description / external conditions / repeatability) / Ausfallbild (Fehlererscheinung / äußere Umstände / Reproduzierbarkeit)

_____

Unit display and LED status indication / Geräteanzeige und LED Statusanzeige **State of diagnostic system /** Statusanzeige Diagnosesystem

_____ _____

_____ _____

_____ _____

Failure characteristics / Fehlercharakteristik

☐ **One-time /** Einmalig

☐ **Repeated /** Wiederholt **How often and where /** Wie oft und wo _____

☐ **At same place /** An gleicher Stelle ☐ **At this product /** Bei diesem Produkt ☐ **At this product type /** Bei diesem Produkttyp

Failure occurence (Please save log files for detailed analysis!) / Auftreten des Fehlers (Ggf. Logfile für Analyse nötig, bitte speichern!)

☐ **Power up /** Einschalten ☐ **Boot process /** Bootprozess ☐ **Running mode /** Im Betrieb

Elimination of error / Fehlerbeseitigung durch ☐ **Reset /** Quittieren ☐ **Reboot /** Neustart ☐ **Replace /** Austausch

Replacement new SO# / Bei Replacement neu SO#

SO# ☐☐ ☐☐☐☐☐☐☐☐☐☐ ☐☐☐☐ ☐☐

Supposed failure / customers failure diagnostic / Fehlervermutung / Eigendiagnose

_____

Attachments / Anlagen ☐ **Marked layout plan / Mark position at layout plan (see reverse)** Markiertes Layout / Position im Layoutplan markieren (s. Rückseite) ☐ **Other /** Anders

Return to / Rücksendung an

_____

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8 Technical data

8.1 General

General information	
Ambient temperature	+5 °C – +40 °C (non-condensing; no condensation)
Storage temperature and transportation	-25 °C – +70 °C
Climate class (EN 60721-3-3)	3K3
Voltage supply	DC 24 V
Max. power/current consumption	12 W/0.5 A
Mass	620 g
Degree of protection	IP54 (in accordance with EN 60529)
Installation altitude (industry standard)	≤ 2000 m

8.2 Track guidance

Track guidance	
Tolerance	±2 mm
Resolution	0.2 mm
Frequency	25 kHz – 50 kHz
Sensing range	±65 mm

8.3 Rotation rate and acceleration sensors (optional)

Rotation rate and acceleration sensors				
	Rotation rate sensor		**Acceleration sensors (g = 9.81 m/s²)**	
Measuring axis	**Ω_X**	**Ω_Z**	**$a_{x,y}$**	**a_z**
Measuring range	±300°/s		±6 g	
Digital resolution	16 bits		16 bits	
Measuring accuracy (nominal)	100 LSB per °/s		5000 LSB per g	
Measuring tolerance	±3%		±3%	
Offset of controller	±2°/s	±3°/s	50 mg	55 mg
Noise	±0.1°/s		4 mg	6 mg

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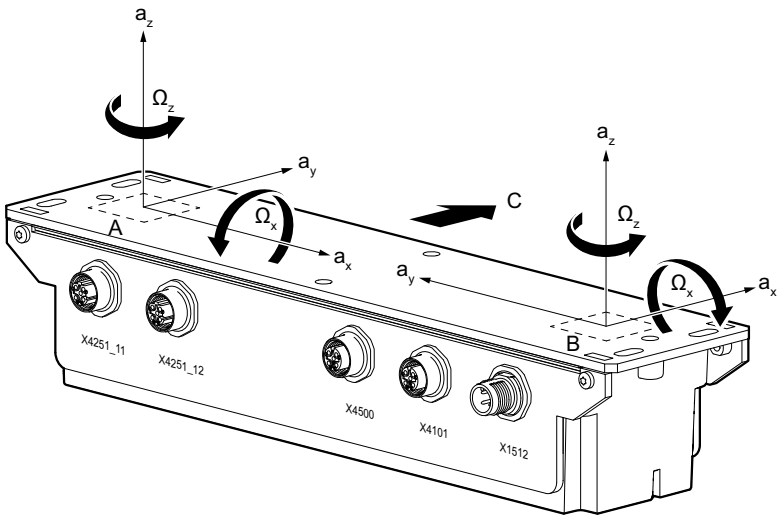
Sensor value		Acceleration in g	Rotation rate in °/s
LSB	Hex		
30000	7530_{hex}	+6	+300
0	0	0	0
-30000	$8AD0_{hex}$	-6	-300

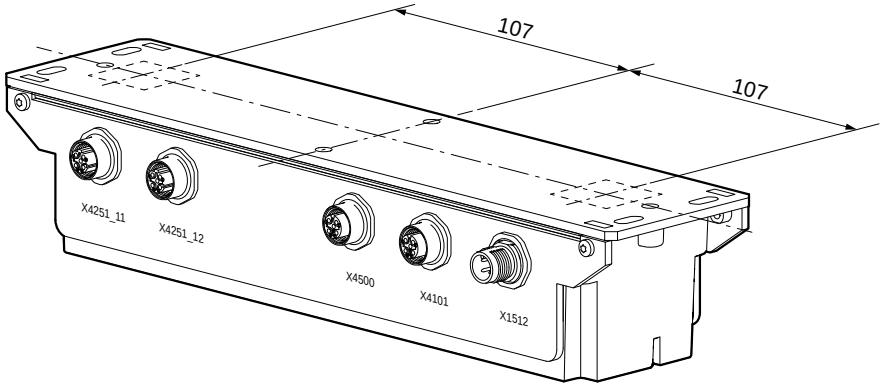
8.3.1 Orientation of the axes



55971218059

[A] Position of the 1st rotation rate and acceleration sensor
[B] Position of the 2nd rotation rate and acceleration sensor
[C] Direction of travel
[$a_{x, y, z}$] Measuring axes of the acceleration sensors
[$\Omega_{z, x}$] Measuring axes of the rotation rate sensors

8.3.2 Distance between the sensors



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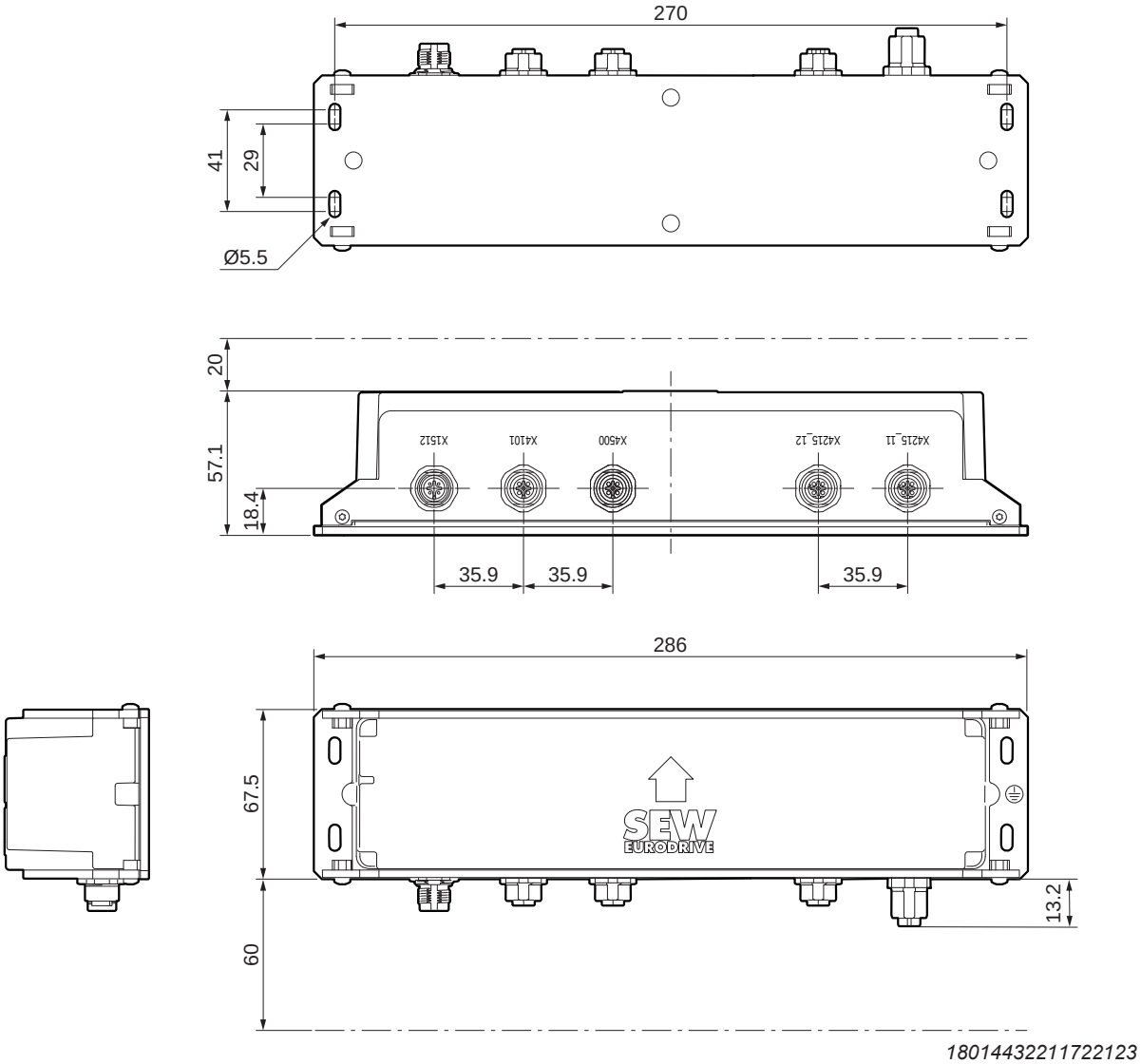
8.4 Read head for RFID transponder

Read head for RFID transponder		
Operating frequency		13.56 MHz
Transmission rate		26 kBit/s
Sensing range	Read distance	0 – 48 mm (ensures safe reading of transponder IQC22-22-T9 with up to 2 m/s)
	Width	Max. 220 mm
Conformity with standard		ISO/IEC 15693

8.5 Dimension sheet



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9 Appendix

9.1 Process output data (PO)

Controller → sensor module

9.1.1 Overview

PO	Source	Name	Size	Index
PO1	Control word 1 (low)	System control word	8 bits	8850.2
	Control word 1 (high)	System control word	8 bits	
PO2	Control word 2	Reserved	16 bits	8850.6

9.1.2 Control word 1

Word	Bit	Function	Description
PO1	0	Reset of system errors	By setting this bit, the controller can initiate a reset of a non-self-acknowledging error.
	…	…	…
	8 + 9	Switching of the sensor system for inductive track guidance	b00: Middle sensor system active b10: Left sensor system active. b01: Middle sensor system active. b11: Right sensor system active.
	…	…	…
	12 – 15	Block address RFID read head Logical block address (for safety mode memory mapping)	The block address determines the address to be read in the transponder's memory. The block address is a logical address (range of values: 0 – 15), whereby the logical block size has been defined with 8 bytes. The physical addresses in the transponder depend on the transponder type because they have different memory mappings/block sizes.

9.1.3 Control word 2

Word	Bit	Function	Description
PO2	0 – 15	Not used	Set to "0"

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9.2 Process input data (PI)

Sensor module → controller

9.2.1 PI: MAXO-MS/M/SM-GIP/2

PI	Source	Name	Size	Index
PI1	System sequence control of the sensor module	Status word	2 × 16 bits	8850.1
PI2				
PI3	Rotation rate and acceleration sensor 1	Angular speed around Z-axis	16 bits	8850.181
PI4		Angular speed around X-axis	16 bits	8850.182
PI5		Translational acceleration of the X-axis	16 bits	8850.183
PI6		Translational acceleration of the Y-axis	16 bits	8850.184
PI7		Translational acceleration of the Z-axis	16 bits	8850.185
PI8	Rotation rate and acceleration sensor 2	Angular speed around Z-axis	16 bits	8850.201
PI9		Angular speed around X-axis	16 bits	8850.202
PI10		Translational acceleration of the X-axis	16 bits	8850.203
PI11		Translational acceleration of the Y-axis	16 bits	8850.204
PI12		Translational acceleration of the Z-axis	16 bits	8850.205
PI13	RFID reader	ID (low word) of the RFID transponder	3 × 16 bits	8850.41
PI14		ID (middle word) of the RFID transponder		
PI15		ID (high word) of the RFID transponder		
PI16	Inductive track guidance	Deviation track center point	16 bits	8850.91

The maximum assignment of the process input data (PI) is 16. This enables the operation of a standard profile on the process data interface.

9.2.2 PI: MAXO-MS/M/SM-IP/2

PI	Source	Name	Size	Index
PI1	System sequence control of the sensor module	Status word	2 × 16 bits	8850.1
PI2				

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PI	Source	Name	Size	Index
PI03	RFID reader	ID (low word) of the RFID transponder	3 × 16 bits	8850.41
PI04		ID (middle word) of the RFID transponder		
PI05		ID (high word) of the RFID transponder		
PI06	Inductive track guidance	Deviation track center point	16 bits	8850.91
PI07 – PI16	...	...	16 bits	...

The maximum assignment of the process input data (PI) is 16. This enables the operation of a standard profile on the process data interface.

9.2.3 Status word

Word	Bit	Function	Description
PI1	0 – 3	Status word (low), 16 bits	Status of sensor at slot 0
	4 – 7		Status of sensor at slot 1
	8 – 11		Status of sensor at slot 2
	12 – 15		Status of sensor at slot 3
PI2	0 – 3	Status word (high), 16 bits	Status of sensor at slot 4
	4 – 7		Status of sensor at slot 5
	8 – 11		Status of sensor at slot 6
	12 – 15		Status of sensor at slot 7

9.2.4 Status of the sensors

Status	Description
cssUninitialized = 0	Uninitialized (initial state).
cssStopped = 1	Sensor stopped. (Sensor was detected, but is not providing any valid data).
cssRunning = 2	Sensor is ready for operation and is providing valid data.
cssCalibration = 3	Sensor is being calibrated and is not providing any valid data.
cssError = 4	Sensor defective (invalid sensor data).
cssInactive = 5	Sensor inactive (e.g. with RFID reader – no sensor detected).
cssBooting = 6	Sensor is still booting.
cssActiveLeft = 7	Especially for inductive track guidance: Left track guidance antenna active.

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Status	Description
cssActiveRight = 8	Especially for inductive track guidance: Right track guidance antenna active.
cssInactiveL = 9	Especially for inductive track guidance: Line cable inactive and to the left.
cssInactiveR = 10	Especially for inductive track guidance: Line cable inactive and to the right.

9.2.5 Data types and units

x: Determined by the position in the dynamic process data image.

Rotation rate and acceleration sensor

PI	Name	Description	Data type	Unit
PIx	Rotation rate and acceleration sensor	Angular speed around Z-axis	int16	100 LSB per °/s
PIx+1		Angular speed around X-axis	int16	100 LSB per °/s
PIx+2		Translational acceleration of the X-axis	int16	5000 LSB per g
PIx+3		Translational acceleration of the Y-axis	int16	
PIx+4		Translational acceleration of the Z-axis	int16	

The sensor values are retrieved after 2 ms at the latest.

RFID reader

PI	Name	Description	Data type	Unit
PIx	RFID reader	ID (low word) of the RFID transponder Bit 0 – bit 15	uint16	–
PIx+1		ID (middle word) of the RFID transponder Bit 16 – bit 31	uint16	
PIx+2		ID (high word) of the RFID transponder Bit 32 – bit 47	uint16	

Inductive track guidance

PI	Name	Description	Data type	Unit
PIx	Inductive track guidance	Deviation from track center point	int16	0.2 mm

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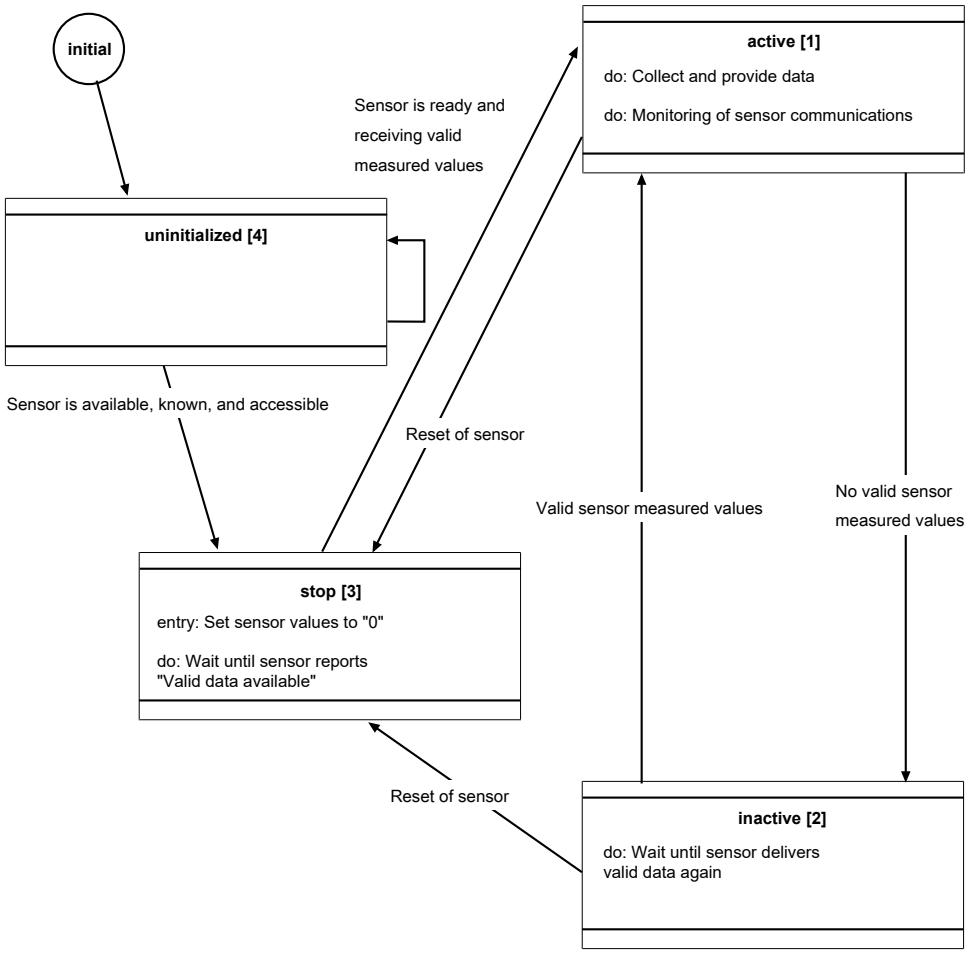
The sensor module converts the SBus^{PLUS}protocol into a CAN protocol with a MOVILINK®profile. Here, the sensor module acts as a gateway and uses the Data-stream-App-Service parameter service for protocol implementation.

9.3 Functional principle of the sensors

9.3.1 Rotation rate and acceleration sensor (optional)

Operating states

The status (see "Status of the sensors" (→ 🗎 39)) allows the user to detect the following operating states of the sensor:



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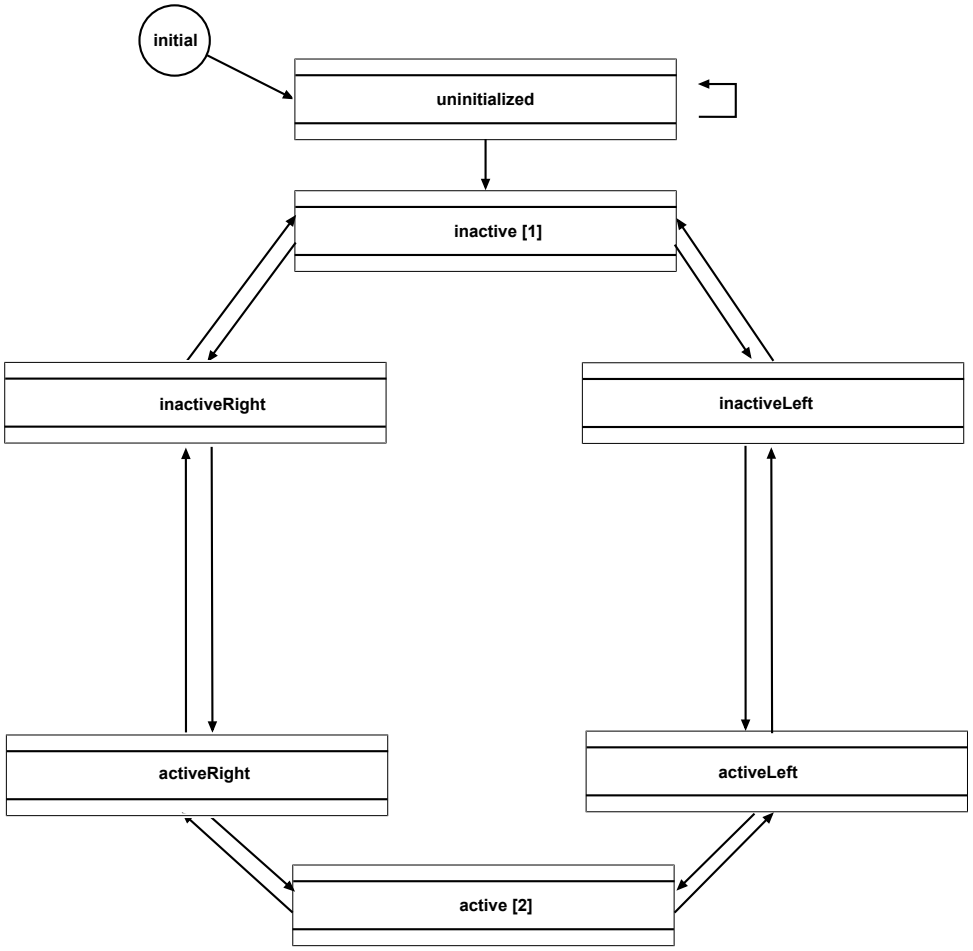
[1] Sensor is in operating mode and is providing valid sensor measured values.
[2] Sensor is inactive or in this state due to an error. The sensor measured values are not updated.
[3] Sensor has stopped and is not providing any valid data.
[4] Sensor was not yet detected.

The sensor has a parameter that allows the user to trigger a reset.

9.3.2 Inductive track guidance

Operating states

The status (see "Status of the sensors" (→ 🗎 39)) allows the user to detect the following operating states of the sensor:



36299456011

[1] No line cable detected.
[2] Line cable detected.

9.3.3 Read head for RFID transponder

The sensor makes it possible to read out a transponder and to output its data as process data (max. 3 process data words with 2 bytes each) in "normal mode".

After initialization of the sensor, the firmware of the sensor module cyclically reads out the data of the transponder (user RFID tag) near the RFID antenna. The last detected user RFID tag is transferred via the process data at a repeat rate of 1 ms and stored in index 8850.41.

If no transponder is near the RFID antenna, the time of the last read value can be read out from index 8850.46.

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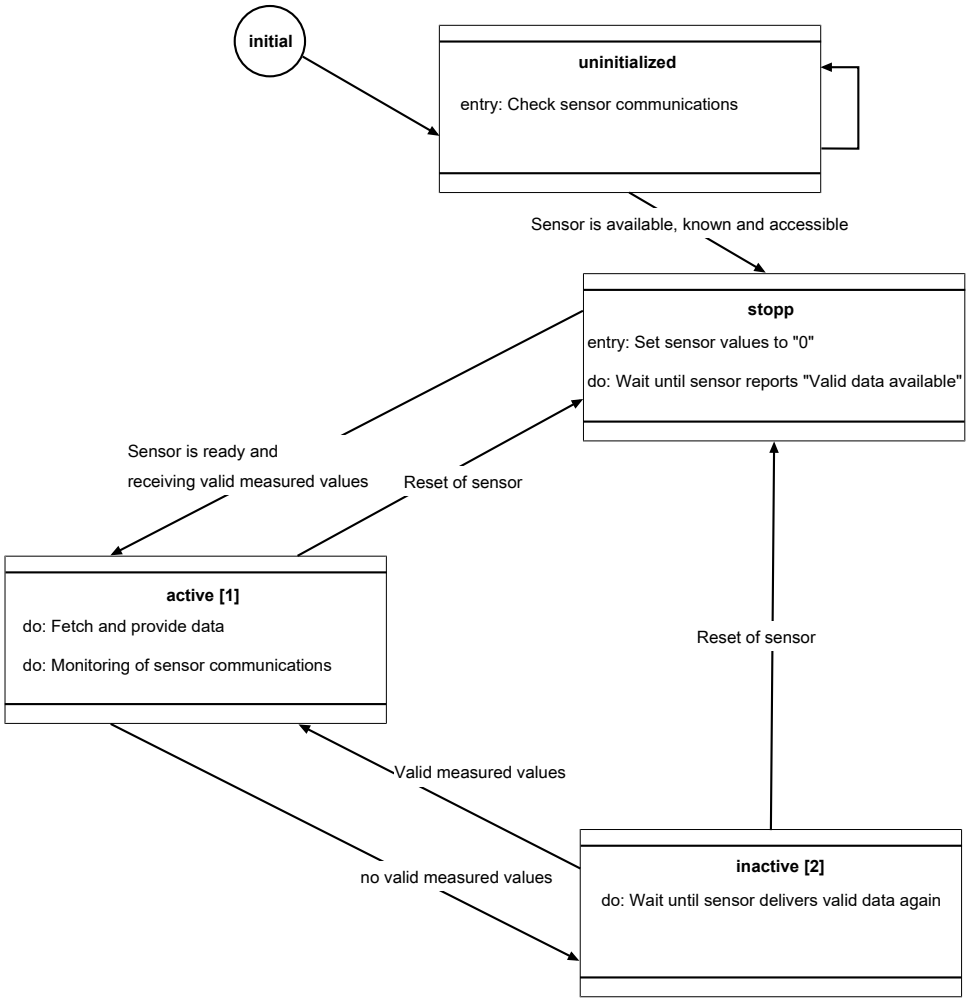
Operating states

The status (see "Status of the sensors" (→ 🗎 39)) allows the user to detect the following operating states of the sensor:



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[1] Transponder within range of the sensor.
→ The sensor measured values (user RFID tag) are updated.

[2] No transponder within range of the sensor.
→ The sensor measured values (user RFID tag) are not updated and the last valid value is retained.

Operating modes

Normal mode

In "normal mode", the user RFID tag is provided as follows:

- 1 process data word (48 bits) or 3 process data words (with 2 bytes each)
- Parameter (index 8850.41) with index array (2 × 4 bytes)

When reading out the recommended transponder type IQC22-22-T9 (manufacturer: Pepperl+Fuchs), the following values apply:

Physical block size	Logical block size	What is read out?	How long is the read time?
4 bytes	8 bytes	2 x physical block size	9 ms

Normal mode – memory mapping

Index

In this operating mode, the value in the transponder is read from address X (block X with max. 8 bytes) and transferred to the process data (max. 4 bytes).

The operating mode (index 8850.47) shows how the data is read out from the transponder. You can change the operating mode in the control word. To do so, use the block address according to the following logic table:

Block address	Operating mode
= 0	Normal mode
≠ 0	Normal mode – memory mapping

User RFID tag

The user writes the user RFID tag to the transponder during system configuration. It is a 32-bit value with the following value range:

Value	Function
0x0	In delivery state, the transponder is preassigned the value "0" (uninitialized).
0x1 – 0xFFFF FFFF	Freely addressable values that are written to the transponder by the user when the system is started up.

UID tag

The UID tag (index 8850.43) is a unique 64-bit value with which each transponder is delivered from the manufacturer. The user can read out the UID tag via the parameter interface. It is not possible to read this tag out via the process data.

Setting the transponder type

The user can set the transponder type via index 8850.50. The value is stored in the non-volatile memory. This setting is required because the transponder types are addressed via different communication commands.

Duration for reading out the transponder

Without transponder	5 ms
With transponder	8 ms

The time was measured between the start of the reading task and the receipt of the measured value via the interface.

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10 Approvals

10.1 USA/Canada

SEW-EURODRIVE GmbH & Co. KG

Sensor module	MAXO-MS/M/SM-GIP/2, MAXO-MS/M/SM-IP/2
FCC ID:	VEB-28320034
IC:	7177A-28320034

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment

This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions:

(1) This device may not cause harmful interference, and

(2) this device must accept any interference received, including interference that may cause undesired operation.

FCC Radiation Exposure Statement:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance of 20 cm between the radiator and your body.

Caution:

Changes or modifications not expressively approved by SEW-EURODRIVE void the user's authority to operate the equipment.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes :

(1) l'appareil ne doit pas produire de brouillage, et

(2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Radiation Exposure Statement (RSS-102)

This equipment complies with Canada radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20 cm between the radiator and your body.

Déclaration d'exposition aux radiations (RSS-102)

Cet équipement est conforme Canada limites d'exposition aux radiations dans un environnement non contrôlé. Cet équipement doit être installé et utilisé à distance minimum de 20 cm entre le radiateur et votre corps.

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10.2 Europe

The device is authorized for the following countries:

- Austria
- Belgium
- Bulgaria
- Croatia
- Cyprus
- Czech Republic
- Denmark
- Estonia
- Finland
- France
- Germany
- Greece
- Hungary
- Iceland
- Ireland
- Italy
- Latvia
- Liechtenstein
- Lithuania
- Luxembourg
- Malta
- Netherlands
- Norway
- Poland
- Portugal
- Romania
- Sweden
- Switzerland
- Slovakia
- Slovenia
- Spain
- Turkey
- United Kingdom

Additional national regulations apply for compliance with the RE 2014/53/EU directive (RED – Radio Equipment Directive). At the time this document was created, there were no restrictions regarding startup for any of the member states mentioned above or requirements to be fulfilled for permission of use according to article 10 paragraph 10 of directive 2014/53/EU.

SEW-EURODRIVE GmbH & Co KG hereby declares that the device complies with the basic requirements and other relevant regulations of the 2014/53/EU directive.

10.2.1 Declaration of conformity

The latest declaration of conformity is available on the SEW-EURODRIVE website.

Do the following:

1. Call up the SEW-EURODRIVE website at https://www.sew-eurodrive.de/. If necessary, you can change the view using the country and language selection.
2. Select [Online Support] > [Data & documents] > [Documentation].
3. Enter "Sensor module" in the search field and click on [Find].

⇨ The declaration of conformity is available in section [Quality documentation] for download.

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11 MAXOLUTION® Competence Center

Germany		
Bruchsal	SEW-EURODRIVE GmbH & Co KG Ernst-Blickle-Straße 42 76646 Bruchsal	Tel. +49 7251 75-0 Fax +49 7251 75-1970 http://www.sew-eurodrive.de maxolution@sew-eurodrive.de
Kirchheim	SEW-EURODRIVE GmbH & Co KG Domagkstraße 5 85551 Kirchheim (München)	Tel. +49 89 909551-21 Fax +49 89 909551-50 dtc-sued@sew-eurodrive.de
Australia		
Melbourne	SEW-EURODRIVE PTY. LTD. 27 Beverage Drive Tullamarine, Victoria 3043	Tel. +61 3 9933-1000 Fax +61 3 9933-1003 http://www.sew-eurodrive.com.au enquires@sew-eurodrive.com.au
Brazil		
São Paulo	SEW-EURODRIVE Brasil Ltda. Estrada Municipal José Rubim, 205 – Rodovia Santos Dumont Km 49 Indaiatuba – 13347-510 – SP	Tel. +55 19 3835-8000 sew@sew.com.br
China		
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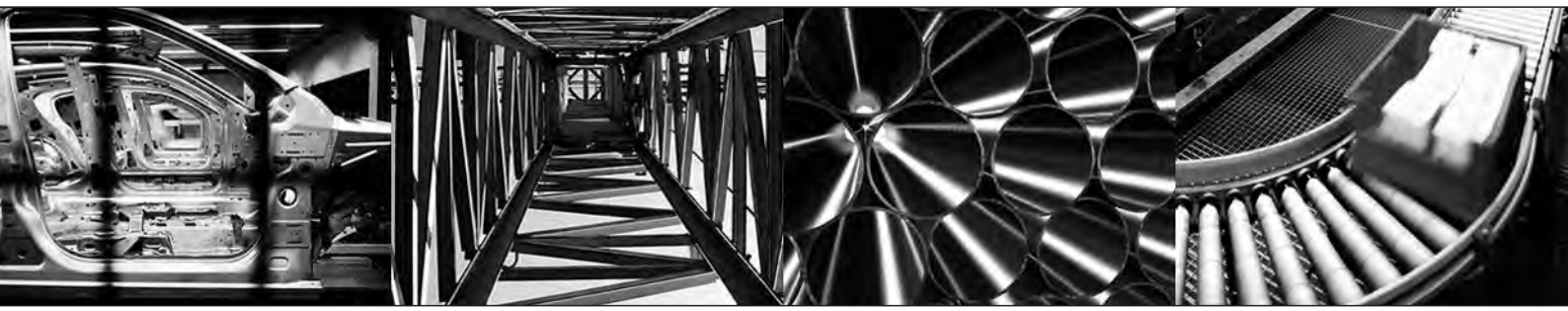

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