MWC25M-L2M-B20 Series

Parameterization of Radar Sensors with CAN SAE J1939 Interface

Manual

CE SAE J1939

Your automation, our passion.

PEPPERL+FUCHS

With regard to the supply of products, the current issue of the following document is applicable: The General Terms of Delivery for Products and Services of the Electrical Industry, published by the Central Association of the Electrical Industry (Zentralverband Elektrotechnik und Elektroindustrie (ZVEI) e.V.) in its most recent version as well as the supplementary clause: "Expanded reservation of proprietorship"

Worldwide

Pepperl+Fuchs Group

Lilienthalstr. 200

68307 Mannheim

Germany

Phone: +49 621 776 - 0

E-mail: info@de.pepperl-fuchs.com

North American Headquarters

Pepperl+Fuchs Inc.

1600 Enterprise Parkway

Twinsburg, Ohio 44087

USA

Phone: +1 330 425-3555

E-mail: sales@us.pepperl-fuchs.com

Asia Headquarters

Pepperl+Fuchs Pte. Ltd.

P+F Building

18 Ayer Rajah Crescent

Singapore 139942

Phone: +65 6779-9091

E-mail: sales@sg.pepperl-fuchs.com

https://www.pepperl-fuchs.com

2025-01

2025-01

1 Introduction

1.1 Content of this Document

This document contains information required to use the product in the relevant phases of the product life cycle. This may include information on the following:

- Product identification
- Delivery, transport, and storage
- Mounting and installation
- Commissioning and operation
- Maintenance and repair
- Troubleshooting
- Dismounting
- Disposal

Note

For full information on the product, refer to the further documentation on the Internet at www.pepperl-fuchs.com.

Note

For specific device information such as the year of construction, scan the QR code on the device. As an alternative, enter the serial number in the serial number search at www.pepperl-fuchs.com.

The documentation comprises the following parts:

- This document
- Datasheet

In addition, the documentation may comprise the following parts, if applicable:

- EU-type examination certificate
- EU declaration of conformity
- Attestation of conformity
- Certificates
- Control drawings
- Instruction manual
- Functional safety manual
- Other documents

1.2 Target Group, Personnel

Responsibility for planning, assembly, commissioning, operation, maintenance, and dismounting lies with the plant operator.

Only appropriately trained and qualified personnel may carry out mounting, installation, commissioning, operation, maintenance, and dismounting of the product. The personnel must have read and understood the instruction manual and the further documentation.

Prior to using the product make yourself familiar with it. Read the document carefully.

2025-01

1.3 Symbols Used

This document contains symbols for the identification of warning messages and of informative messages.

Warning Messages

You will find warning messages, whenever dangers may arise from your actions. It is mandatory that you observe these warning messages for your personal safety and in order to avoid property damage.

Depending on the risk level, the warning messages are displayed in descending order as follows:

Danger!

This symbol indicates an imminent danger.

Non-observance will result in personal injury or death.

Warning!

This symbol indicates a possible fault or danger.

Non-observance may cause personal injury or serious property damage.

Caution!

This symbol indicates a possible fault.

Non-observance could interrupt the device and any connected systems and plants, or result in their complete failure.

Informative Symbols

Note

This symbol brings important information to your attention.

Action

This symbol indicates a paragraph with instructions. You are prompted to perform an action or a sequence of actions.

1.4 Intended Use

Radar sensors in the MWC25M-L2M-B20 series emit electromagnetic waves (radar waves) that are reflected by an object and received again by the radar sensor to detect objects and measure their distance from the sensor and their relative velocities.

The radar sensor operates according to the frequency-modulated continuous wave (FMCW) method at 122 GHz, in the ISM band approved for industrial use. It emits a continuous radar signal that is varied in frequency within the bandwidth. This method enables the sensor to reliably detect the distance and velocity of static and moving objects. When measuring velocity, the radar sensor detects the velocity of an object only in the radial direction, without measuring tangential velocities or velocity components.

Note

Radar sensors in the MWC25M-L2M-B20 series are only approved in the countries listed in the relevant declaration of conformity for the radar sensor. These can be found online at www.pepperl-fuchs.com on the respective product page for the sensor version of the MWC25M-L2M-B20 series.

Only operate the device in countries in which approval has been granted. If the device is operated in other countries, it may interfere with protected frequency ranges.

The operator is responsible for complying with country-specific laws.

Note

Radar waves of the sensor are not hazardous according to the following standards:

- EN 62368-1 Tests for "Electrical safety"
- EN 62311 Tests for "Health"
- ETSI EN 305550-1
- FCC/CFR. 47 Part 15
- The maximum emitted power does not exceed the approved limits according to ETSI and FCC.

According to these standards/regulations, radar sensors in the MWC25M-L2M-B20 series are within the permissible limits and the radar waves are not damaging.

Caution!

Health hazards caused by high-frequency electromagnetic radiation

The radar sensor is designed for operation in accordance with ETSI EN 305550. During operation, the exposure limits defined in EN 62311 must be observed. To limit human exposure to electromagnetic fields, adequate safety distances must be maintained for both short-term and long-term work in the radiation range of the antenna. The minimum distance between the antenna and the human body during continuous operation is 20 cm. Country-specific special issuesthat must be taken into account when operating the device can be found in the declaration of conformity.

Radar sensors in the MWC25M-L2M-B20 series are standard sensors (standard components) without an independent safety certificate and are therefore not a safety component as defined in the EU Machinery Directive 2006/42/EC. However, under certain parameterization requirements and in combination with a higher-layer safety control unit, the sensor can be used up to a maximum of category 2 PL c in accordance with ISO 13849. The detailed description in the "Safety Application Report" document must be taken into account.

Only operate the device as described in these instructions to ensure the correct functioning of the device and the connected systems. The protection of operating personnel and the plant is guaranteed only if the device is operated in accordance with its intended use.

The operator is responsible for complying with all local safety regulations.

Only use recommended original accessories.

2025-01

1.5 General Safety Information

Caution!

Health hazards caused by high-frequency electromagnetic radiation

The radar sensor is designed for operation in accordance with ETSI EN 305550. During operation, the exposure limits defined in EN 62311 must be observed. To limit human exposure to electromagnetic fields, adequate safety distances must be maintained for both short-term and long-term work in the radiation range of the antenna. The minimum distance between the antenna and the human body during continuous operation is 20 cm. Country-specific special issuesthat must be taken into account when operating the device can be found in the declaration of conformity.

Responsibility for planning, assembly, commissioning, operation, maintenance, and dismounting lies with the plant operator.

Installation and commissioning of all devices may be performed only by trained and qualified personnel.

The device is only approved for appropriate and intended use. Ignoring these instructions will void any warranty and absolve the manufacturer from any liability.

If serious faults occur, stop using the device. Secure the device against inadvertent operation. In the event of repairs, return the device to your local Pepperl+Fuchs representative or sales office.

Note

Disposal

Electronic waste is dangerous. When disposing of the equipment, observe the current statutory requirements in the relevant country of use and local regulations.

1.6 Declaration of Conformity

This product was developed and manufactured in line with the applicable European standards and directives.

Note

A declaration of conformity can be requested from the manufacturer.

The product manufacturer, Pepperl+Fuchs Group, 68307 Mannheim, Germany, has a certified quality assurance system that conforms to ISO 9001.

ISO**9001**

1.7 Declaration of Conformity FCC, Canada

The product manufacturer, Pepperl+Fuchs Group, 68307 Mannheim, Germany, has a certified quality assurance system that conforms to ISO 9001.

This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s) and complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference.
2. This device must accept any interference received, including interference that may cause undesired operation of the device.area.

Note

- Operation on board of an aircraft and or / on board of a satellite is prohibited.
- Canada-specific regulation: The device should not point >30° elevation toward the sky in normal operation.
- Règlement spécifique au Canada : L'appareil ne doit pas être orienté vers le ciel à plus de 30° d'élévation en opération normale.
- Changes or modifications made to this equipment not expressly approved by Pepperl & Fuchs may void the FCC authorization to operate this equipment.
- 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 their own expense.

Radiofrequency Radiation Exposure Information:

- This equipment complies with FCC and ISED 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. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.
- Cet équipement est conforme aux limites d'exposition aux rayonnements ISED établies pour un environnement non contrôlé. Cet équipement doit être installé et utilisé avec un minimum de 20 cm de distance entre la source de rayonnement et votre corps. Ce transmetteur ne doit pas être place au même endroit ou utilise simultanément avec un autre transmetteur ou antenne.

FCC ID: IRE-MWL2A

IC ID: 7037A-MWL2A

HVIN/PMN: MWL2A

2 Product Description

2.1 Use and Application

The MWC25M-L2M-B20 series radar sensor with J1939 interface for medium distances up to 25 m detection range is optimized for use in industrial applications. Its compact cubic L2 series housing is proven in many industrial areas due to its high robustness.

The radar sensor has a J1939 interface. Parameter Group Numbers (PGNs) enable you to directly parameterize the radar sensor optimally for your application. You can parameterize the measurement mode, the foreground and background suppression, and the minimum and maximum velocity suppression. Many other parameters, such as filter mode, filter strength and sampling rate, can also be configured. Alternatively, parameterization with extended functionality can be carried out using the PACTware FTD (Field Device Tool) framework program and a DTM (Device Type Manager). This makes it possible to use various evaluation and filter settings for distance and velocity data.

The radar sensor operates according to the frequency-modulated continuous wave (FMCW) method at 122 GHz, in the ISM band approved for industrial use. It emits a continuous radar signal that is varied in frequency within the bandwidth. This method enables the sensor to reliably detect the distance and velocity of static and moving objects. When measuring velocity, the radar sensor detects the velocity of an object only in the radial direction, without measuring tangential velocities or velocity components.

You can parameterize the radar sensor in two ways. Either via the CAN bus directly with the CAN-specific parameters described in the manual or via DTM and an FTD framework program.

Typically, radar sensors are used in a wide range of applications, including:

- Distance measurement (between 2 vehicles, in the crane arm, between 2 cranes, etc.)
- Velocity measurement (of trains, on AGVs, etc.)
- Area monitoring/anti-collision monitoring (for front and rear of vehicles, etc.)
- Fill level measurement (silos, agricultural tanks, etc.)
- Height control (scissor lift table, working platforms, fork on forklifts, detection of building roofs for trucks, etc.)

Advantages of radar sensors in the MWC25M-L2M-B20 series:

- Measuring distance and velocity, and detecting direction of movement in a device
- Can be used for safety applications up to PL c in combination with a diagnostics-enabled controller (e.g., PLC); see "Safety Application Report"
- Reliable measurements in harsh environments and fast applications
- J1939 interface for service and process data, and for parameterization
- Increased EMC strength
- Tried and tested VariKont cubic housing design
- Flexible mounting

Parameterization Via PACTware DC and DTM

Parameterization via PACTware DC and DTM allows convenient and comprehensive parameterization of the sensor due to the graphical interface of the DTM. The DTM (Device Type Manager, a kind of "device driver") displays the parameters clearly and graphically, by subject, in menu items. Furthermore, the measured distances, status changes, and individual radar reflections are visualized. Analysis and observation functions allow you to record and evaluate your situations.

As an FTD frame application, we recommend using "PACTware 5.0" software or higher as the user interface. The PACTware software package includes the PACTware DC (DC Direct Connect) version for quickly and easily establishing a connection between PACTware and the sensor.

The latest available versions of the individual software components required, such as PACTware 5.0 or higher, CAN-COM-DTM, and device DTM, can be found at www.pepperl-fuchs.com, on the product page in the "Software" section.

As a convenient solution, we offer the "CAN Parameterization Tool," which contains PACTware, PACTware DC, the device driver for the CAN/USB converter-SUBD9, and the DTM for J1939 communication. We recommend using this software package for easy commissioning and parameterization of the sensor. The latest available versions of the individual software components required, such as the "CAN Parameterization Tool" and the device DTM, can be found online at www.pepperl-fuchs.com, on the product page for the MWC25M-L2M-B20 series.

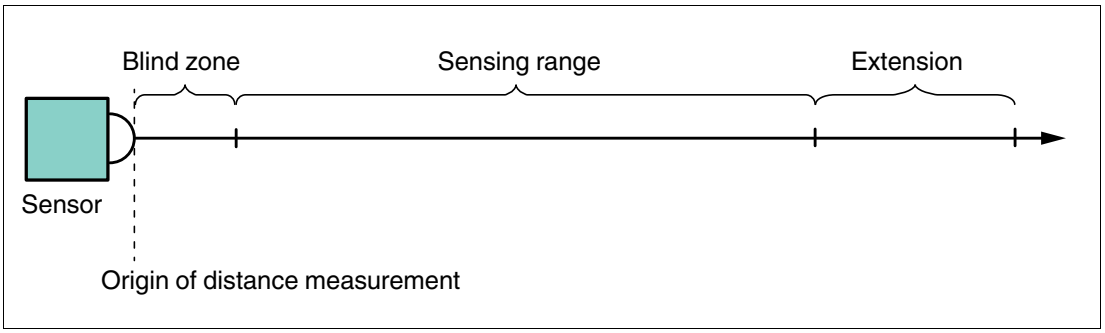
Availability of a DBC file

A DBC file (database container) is available for integrating and parameterizing the radar sensor.

The DBC data format is a CAN network description and enables the definition of attributes and the assignment of these attributes to the elements of the network. A DBC file is an ASCII-based translation file that is used to identify, scale, and define data transmitted within a controller area network (CAN) frame. These files are the de facto standard for exchanging J1939 descriptions. It helps to translate the raw data transferred in a CAN frame into meaningful values and information.

2025-01

2.2 Measurement Characteristics



The sensor has the following measuring ranges:

- Dead band:
  - Objects are not detected in the dead band. This area should remain free to ensure reliable distance and velocity measurement of objects in the sensing range.
  - If objects are placed in the sensor's dead band, false reflections may occur in the sensing range, causing incorrect distance values to be output.
  - Placing materials that absorb radar waves to a limited extent is possible in the dead band, for example, mounting behind a plastic wall or thin glass pane. This may, however, limit the measuring range.
- Sensing range:
  - Objects can be detected in the sensing range if the cross-section of an object is sufficient for radar reflections and the alignment is suitable for reflecting radar signals. The maximum range of the sensing range is guaranteed under all ambient conditions specified in the datasheet.
  - This range is the adjustment range accepted by the firmware. Readings related to distances outside the sensing range, however, are not guaranteed measurement situations. Depending on the ambient conditions, the validity of the measured values is not guaranteed. This range is used at the customer's own risk.
  - Measuring different materials and their object alignment with the sensor. For details, see see chapter 3on the reflectivity of materials.
  - In the case of objects with a very large radar cross-section in the near range, the physical properties may cause false reflections to occur for a short time if the readings are not sufficiently filtered.
- Extension:
  - The measurement range extension specifies the sensor's operating reserve when using the sensor under typical ambient conditions.

2.3 Safety Applications

Radar sensors in the MWC25M-L2M-B20 series can be used in safety applications under certain circumstances, taking into account certain aspects up to PL c in combination with a diagnostics-enabled controller (e.g., PLC).

A "Safety Application Report" explains an example of a use case. You can download the application report from www.pepperl-fuchs.com, on the product page for your MWC25M-L2M-B20 series radar sensor.

If you are interested in using MWC25M-L2M-B20 series radar sensors for safety applications, contact an application specialist at Pepperl+Fuchs to discuss and review your use case.

2.4 Indicators

The radar sensor has multi-color LEDs, each with three colors, for displaying operating and status information.

Two LEDs with the same meaning are arranged diagonally on the device to ensure better visibility in an application environment.

Figure 2.1

SENSOR LED (yellow) Object in the evaluation area

STATUS LED (green/red) CANJ1939 status indicator: green LED is run LED, red LED is error LED

Note

The STATUS LED (green/red) can also light up green and red successively at the same flashing frequency to indicate the states in the following tables.

SENSOR LED (yellow)

LED status	Description
On	Object detected in the evaluation area
Off	No object detected in the evaluation area

Table 2.1

STATUS LED (green)

LED status	Description
On	The device is in the state "Operational"
Off	The device is in the reset state or there is no electric power supply
Rapid flashing	The device is active in "address claiming" state and is waiting for an address to be assigned (flashing frequency 10 Hz).
One short flash	The device is in "Power Saving Mode", no PGNs are sent (flashing frequency 1 Hz).

Table 2.2

STATUS LED (red)

LED status	Description
On	The device is in the state "CAN Bus Off"
Off	The device is operating without errors
Rapid flashing	The "address claiming" failed, no address has been assigned to the device and it does not participate in bus communication (flashing frequency 10 Hz).
One short flash	The CAN controller error counter has reached or exceeded its warning limit (flashing frequency 1 Hz)

Table 2.3

2.5 Supported J1939 Functions

The device has a standardized J1939 interface to SAE J1939-21 and SAE J1939-81 specifications. Usable objects of object directory OV are listed in this manual.

The address is assigned with "Address Claiming" at start-up. The start value is 128. If the claim is unsuccessful, the address is incremented and the "Claiming Process" is restarted.

The standard transfer speed is 250 kBit/s. A parameter can also be used to set 500 kBit/s. SAE J1939 only allows these two transmission speeds.

Note

A DBC file (database container) is available for integrating and parameterizing the radar sensor. You can download it from www.pepperl-fuchs.com, on the product page for the MWC25M-L2M-B20 series.

Note

This device does not have an internal terminator. If required, this can be implemented externally via a T-piece at the end of the bus (120 ohms).

Available J1939 Functions

- Address Claiming
- Command address
- Proprietary B PGN (Parameter Group Numbers) (see chapter 6.2.1)
- CAM11/CAM21 PGN
- CEM PGN

Vendor-specific properties and functions

- Save and restore functions via parameters
- Address Claiming
- Status and fault indication
- Operating hours
- Application-specific tag, function tag, location tag

The radar sensor of the MWC25-L2M-B20 series supports "cyclic operation" mode. The distance and velocity values are sent cyclically every 100 ms (10 Hz) via the bus.

2.6 Accessories

Various accessories are available.

2.6.1 Connection Accessories

Various connecting cables and cordsets are available for connecting the sensors of the MWC25M-L2M-B20 series. You will find details online at **www.pepperl-fuchs.com** on the product page for the relevant sensor or on the relevant datasheet.

Note

For mounting, connection, and commissioning, the following product information is available online at **www.pepperl-fuchs.com** on the product page for the relevant sensor: datasheet, quick reference guide, manual. The relevant DTM contains comprehensive context-related help texts.

2.6.2 Parameterization Aids

Note

A DBC file (database container) is available for integrating and parameterizing the radar sensor. You can download it from www.pepperl-fuchs.com, on the product page for the MWC25M-L2M-B20 series.

The following parameterization aids are required for parameterization via the DTM:

Designation	Description
CAN Parameterization Tool	Software package for simple commissioning and parameterization of the sensor, consisting of: • PACTware/PACTware DC • DTM for CAN communication • VCI driver for the CAN/USB converter-SUBD9 Visit www.pepperl-fuchs.com and access the product page for the relevant sensor in the MWC25M-L2M-B20 series
DTM for MWC25M-L2M-B20 series	DTM (Device Type Manager)—device description and graphic user interface for radar sensor parameterization, integration into the system environment Visit www.pepperl-fuchs.com and access the product page for the relevant sensor in the MWC25M-L2M-B20 series
PACTware (5.0 or higher)	FDT frame application for operating IODDs and DTMs. Includes the PACTware and PACTware DC versions. Compared to PACTware, the PACTware DC has a "plugin" for quickly and easily establishing connections between sensor and PACTware. Visit www.pepperl-fuchs.com and access the product pages for software in the "Products" section.
DTM for J1939 communication	Device Type Manager—Software for operating the CAN/USB converter-SUBD9 via FDT frame application Not required when installing the "CAN Parameterization Tool." Visit www.pepperl-fuchs.com and access the product pages for software in the "Products" section.
CAN/USB configuration kit	Configuration kit for communications between FDT frame application and radar sensor Includes the following components: • CAN/USB converter-SUBD9 • Power supply for CAN/USB converter-SUBD9 • Connection cable and adapter cable for components The CAN Parameterization Tool contains both VCI drivers for the CAN/USB converter-SUBD9 and the DTM for CAN communication for CAN communication with PACTware/PACTwareDC.

Table 2.4

3 Reflectivity of Materials

3.1 Reflectivity and Typical Radar Cross-Sections

Microwaves behave similarly to light due to their short wavelength, e.g., 12 mm at 24 GHz or 2.45 mm at 122 GHz. There are therefore the same effects such as diffraction, total reflection, deflection, interference, and some others. Many properties of radar sensors can only be understood when these effects are taken into account. In applications with radar sensors, it is assumed that an emitted wave is diffusely scattered by an object such that at least a certain part of the wave is reflected back to the point of emission. The strength of this reflection (amplitude strength) is highly dependent on the material and properties of the object.

The radar cross-section is a measure of an object's ability to reflect radar signals. Its value depends on various factors such as the size, shape, and material of the target object. Bigger objects with a smooth surface usually have a larger radar cross-section and are therefore more easily detected by the radar.

The following table shows typical values for the resulting radar cross-section of a radar sensor.

Radar Target/Target Object	Radar Cross-Section [m^2]
Ship (container ship, passenger ship)	> 1000
Truck	200
Car	100
Radar corner reflector (metal) 10 cm side length	70
Radar corner reflector (metal) 5 cm side length	5
Tree (large)	1
Human	0.5 ... 1
Bird	0.01

Table 3.1

A human target object therefore is evidently a poor radar target compared to a reflecting object made of metal. This affects the distance measurement of different materials due to the smaller radar cross-section. The properties of other radar targets or target objects will become clearer when the dependencies of materials are considered in the following chapter.

3.2 Dependency of Materials

Radar waves propagate freely in space in a vacuum. When the waves hit an object, the signal changes due to the influence of the object's properties. Depending on the materials, the radar waves are completely or partially absorbed or reflected. There is also penetration of various substances.

Material	Absorption	Reflection	Penetration
Metal	None	Total reflection with straight incidence With oblique incidence, refraction and partial reflection are possible	None
Wood	Medium to high (depending on humidity)	Low	Low
Water	Very high	Depending on the angle of incidence, partial or total reflection is possible	None, due to absorption
Foams	Low	Low	Very low
Plastics	Low to high (depending on the thickness and type of plastic)	Low to high (depending on the thickness and type of plastic)	Low to high (depending on the thickness and type of plastic)
Glass	Low to high (depending on the thickness of the glass)	Low to high (depending on the thickness of the glass)	Low to high (depending on the thickness of the glass)
Clothing	Medium to high (depending on humidity)	Low	Low
Rain	Low	Low	Very good
Humans	Medium	Medium	Low
Ice	Very high	Depending on the angle of incidence, partial or total reflection is possible	None, due to absorption

Table 3.2

In summary , absorbent materials constitute poorer radar targets. Although they generate a reflection due to the so-called "matter jump," most of the energy of the radar wave is absorbed.

4 Installation

4.1 Safety Information

Caution!

Risk of short circuit

Carrying out work while the system is energized may result in damage to the device.

- Always disconnect the supply voltage before carrying out work on the device.
- Only connect the device to the supply voltage once all work has been completed.

4.2 Preparation

Unpacking the Device

1. Check the packaging and contents for damage.

   ↳ In the event of damage, inform the shipping company and notify the supplier.

2. Check the package contents against your order and the shipping documents to ensure that all items are present and correct.

   ↳ Should you have any questions, direct them to Pepperl+Fuchs.

3. Retain the original packaging in case the device is to be stored or shipped again at a later date.

4.3 Connection

Note

Use a shielded 5-wire sensor connection cable to connect the sensor to a J1939 bus. Pay attention to the pin assignment as the standard pin assignment (A-coded M12 plug) differs from the pin assignment in the J1939 specification.

Wiring Diagram

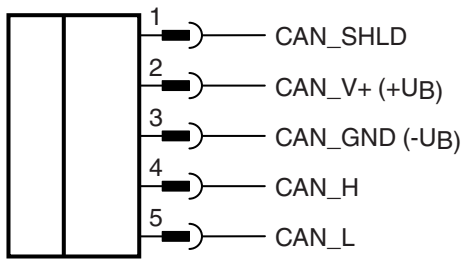


Figure 4.1

Applying Supply Voltage for a Sensor with V15 Connector Plug

To supply voltage to the sensor, proceed as follows:

1. Insert the prepared connection cable into the connector plug provided for this purpose on the sensor.
2. Screw the union nut onto the connector plug as far as it will go. This ensures that the power cable cannot be pulled out inadvertently.
3. Connect the supply voltage to the cables provided for this purpose and switch it on.

↳ The sensor is now ready for operation.

Applying Supply Voltage to a Sensor with a Fixed Cable and Plug

To supply voltage to the sensor, proceed as follows:

1. Connect the prepared connection cable to the plug of the sensor connection cable.
2. If present, secure the plug connection with the securing elements provided.
3. Connect the supply voltage to the cables provided for this purpose and switch it on.

↳ The sensor is now ready for operation.

4.4 Mounting and Alignment

Mounting

When mounting, observe the following points:

- Mount the sensor so that no foreign objects are in the sensing range.
- Note the dead band in which objects cannot be detected. If there are objects in the dead band, false reflections may occur. Thin materials with low absorption can be placed in the dead band after extensive testing (e.g., sensor behind a plastic wall, glass).

Alignment

When aligning the radar sensor, the beam direction of the radar wave is often crucial in determining how well the wave is reflected by an object. If object detection parameters are not configured in advance, the radar sensor will detect the object closest to it and reference its measured values to this object. You can use the parameterization options to configure different measurement modes for which object should be referenced.

If the radar sensor does not measure against a reference object, the sensors can be mounted in any alignment, observing the influencing factors of objects in the dead band. The radar wave spreads perpendicular to the radome (radar dome = lens). The opening angle and characteristic response curve of the radar beam can be found in the relevant datasheet for your radar sensor.

Note

In stationary applications, achieving the full performance of the radar sensor requires good alignment and mounting of the radar sensor and the reflector or reference object. In mobile applications, the following information must be taken into account in the system's design.

Planar reflecting object

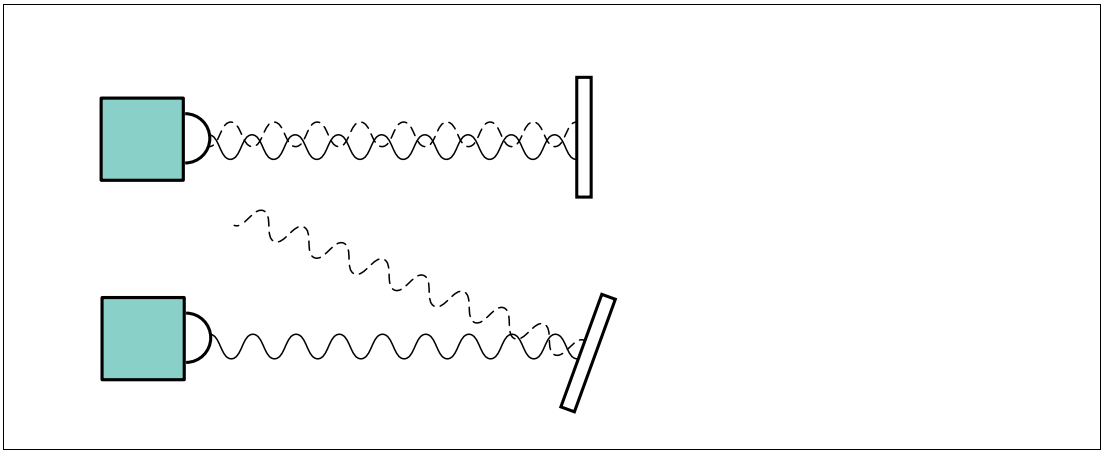


Figure 4.2

When using a planar surface as the reflecting object, the maximum signal strength is reflected if the radar wave hits the reflecting object at a right angle.

When using an inclined surface and with total reflection of the radar wave, the inclination angle of the reflective object must be smaller than the opening angle of the sensor. If the reflected object is tilted too much, the reflected radar signal will be reflected away from the radar sensor and no object will be detected in the sensing range.

Curved reflecting object

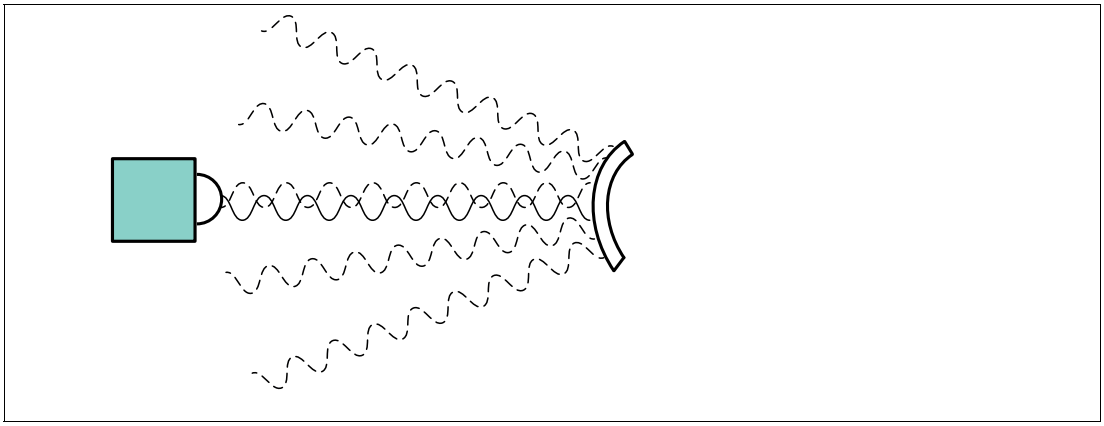


Figure 4.3

When using a curved surface (e.g., cylindrical objects) as the reflecting object, align the radar sensor with the center of the reflecting object. After hitting the reflecting object, in this scenario the main part of the radar signal is scattered in different directions.

Distances to objects with these geometric properties are identifiable and measurable, but the strength of the detectable signal is lower than that of planar reflecting objects.

5 Cybersecurity Information

To ensure cybersecure operation and to protect the device, implement the following measures.

Security Context

The device is designed for use in an industrial CAN bus network, such as in applications in the field of Mobile Equipment.

Protect the device and the application against unauthorized access.

Lock the device to prevent hardware tampering. Ensure that only authorized users have access.

Ensure that only well-known and trusted nodes are connected to the network.

Maintenance and Management

Check the website regularly for security advisories publications and subscribe to the RSS feed: https://www.pepperl-fuchs.com/cybersecurity.

Decommissioning

The device stores adjustable parameters and operating data.

Reset the device to factory setting.

Disposal

The device stores certain operating data permanently.

To delete data, you have to physically destroy the device.

2025-01

6 Commissioning

6.1 Commissioning via PACTwareDC and DTM

Note

Various software components, adapters, and cables are required as parameterization aids for the parameterization of J1939 radar sensor. See chapter 2.6.2

The various software components can be downloaded from www.pepperl-fuchs.com, on the respective MWC25M-L2M-B20 series product page. The software can be downloaded in compressed form as a ZIP file. After unzipping, we recommend installation using the appropriate MSI file.

We recommend installing the "CAN Parameterization Tool" for easy installation and commissioning.

Make sure that you have these available for commissioning the sensor via PACTwareDC and DTM.

Installing Software Components

Certain software components will need to be installed to communicate with the sensor via J1939 using "PACTware" software and the associated DTM (Device Type Manager). Proceed as follows:

1. Preferably install the "CAN Parameterization Tool."

   ↳ PACTware, PACTware DC, the driver, and the DTM for CAN communication are installed automatically. If a PACTware version is installed separately, you must install the driver and DTM for CAN communication separately.

2. Restart your computer to start the newly installed drivers.
3. Install the DTM for the MWC25M-L2M-B20 sensors.

Note

For the CAN/USB converter-SUBD9 to work, the compatible VCI driver must be installed first. This is done automatically when you install the "CAN Parameterization Tool." If you want to install software components outside this package individually, ensure that the VCI driver is installed before connecting the CAN/USB converter-SUBD9 and then restart your computer.

Establish connection between sensor, CAN/USB converter, and PC

1. Connect the sensor to input 1 of the T-distributor for the CAN/USB converter-SUBD9 using a 5-pin connection cable.
2. Connect the power supply to input 2 of the T-distributor for the CAN/USB converter-SUBD9 using the adapter cable (2.10 mm DC coupling to 4-pin M12 plug).
3. Make sure that the terminator on the T-distributor is activated.
4. Connect the T-distributor to the SUBD9 plug on the CAN/USB converter-SUBD9.
5. Connect the USB cable of the CAN/USB converter-SUBD9 to a USB port on your work PC or laptop.
6. Connect the power supply of the CAN/USB converter-SUBD9 to the electric power supply.

Note

Before establishing a connection between PACTwareDC and the sensor, check whether the CAN communication between the sensor and the work computer via CAN/USB converter-SUBD9 is working. You can check this by seeing if the "USB" LED is lit green on the CAN/USB converter-SUBD9.

If this is not the case, check:

- whether the correct CAN-USB driver (VCI driver) is installed for the CAN/USB converter-SUBD9.
- whether the electric power supply for the CAN/USB converter-SUBD9 is switched on and all cordsets are connected correctly.
- whether the terminator integrated in the T-distributor is activated.

Establishing a Connection between PACTwareDC and the Sensor

1. Start PACTware DC on your work computer.

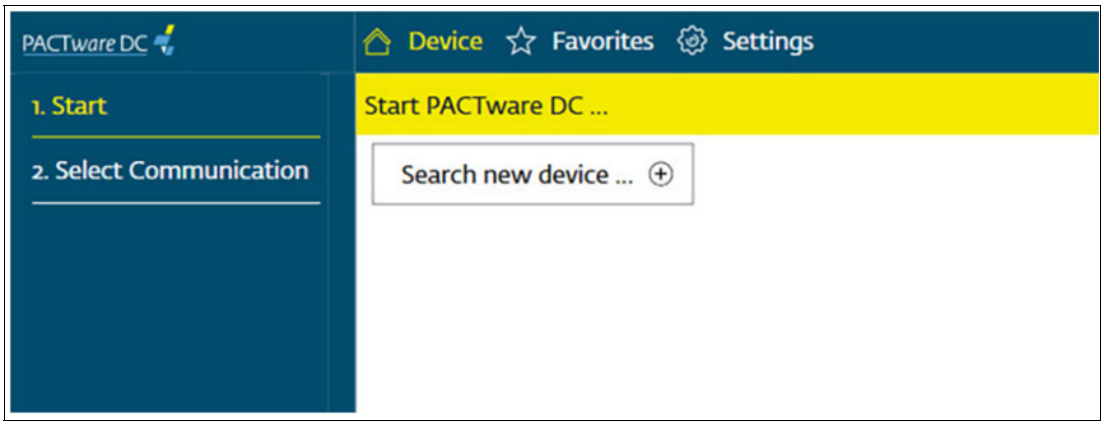


Figure 6.1

2. First click on "Device," followed by "Search new device..."

↳ PACTwareDC first retrieves the DTM for J1939 communication with the CAN/USB converter-SUBD9.

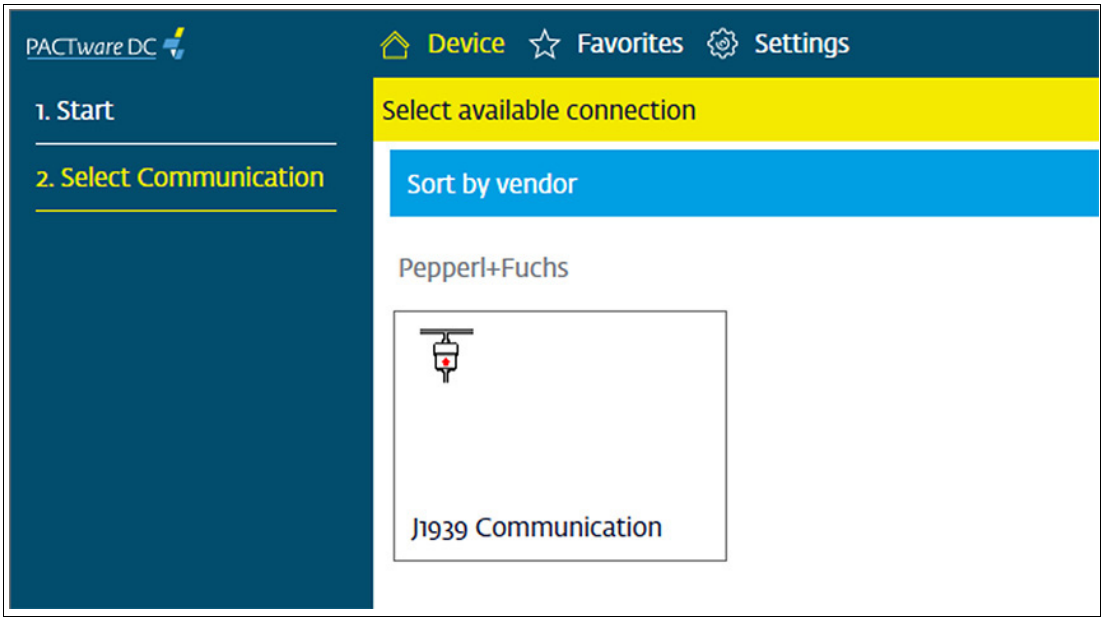


Figure 6.2

3. Click on "J1939 Communication" to perform a scan of the connected J1939 devices.

   ↳ PACTwareDC finds connected devices.

   ↳ If there is only one device on the bus, the connection to the device is established automatically. Continue with step 5.

   ↳ If there are more devices on the bus, you must select a device using the following steps.

4. If there are 2 or more devices on the bus, switch to the "Device list." Here you can read communication parameters such as "Identity" and the assigned address (address claiming) of the sensors from the table.

5. Read the number of the device you want in the "Identity" column.

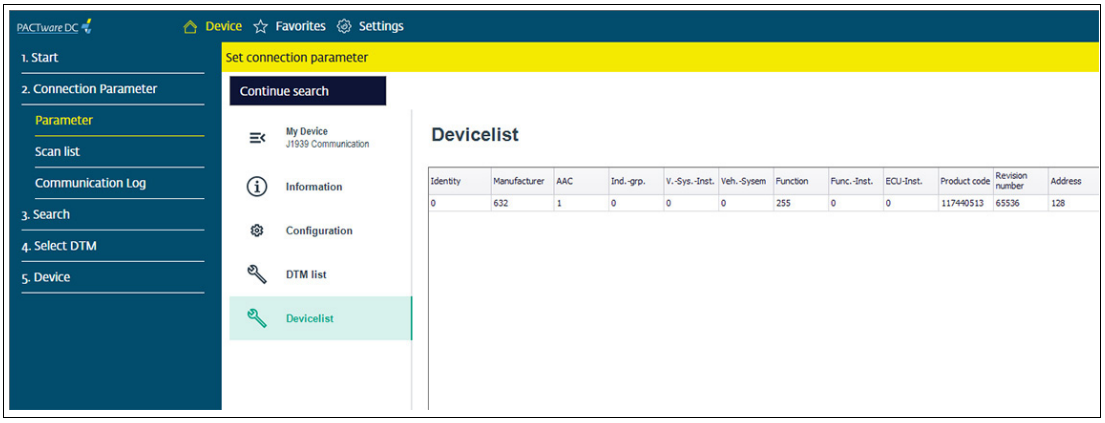


Figure 6.3

6. Switch to the "DTM list" display.

7. Write the corresponding "Identity" number from the device list of the sensor in the field provided.

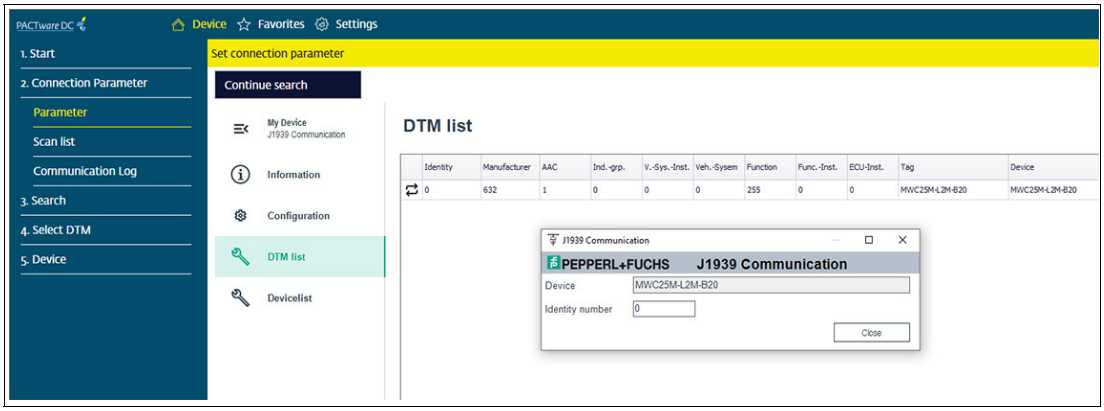


Figure 6.4

↳ PACTwareDC establishes a connection to the sensor, allowing you to then access the sensor.

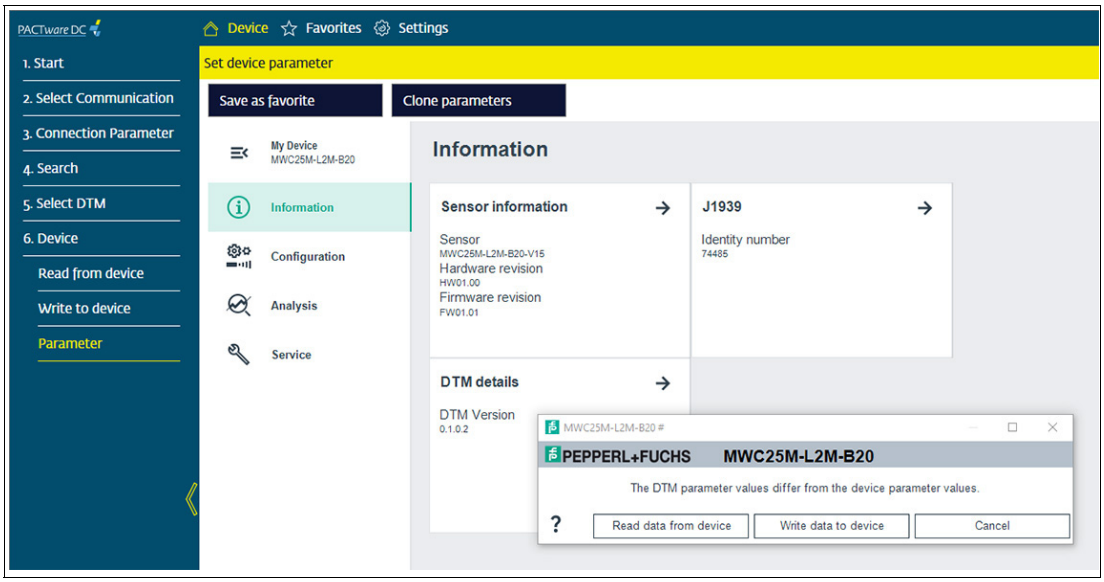


Figure 6.5

8. To set the baud rate, select the "Connection Parameter" menu item and then the "Configuration" display. Check the setting or set the baud rate to 250 kbit/s or 500 kbit/s.

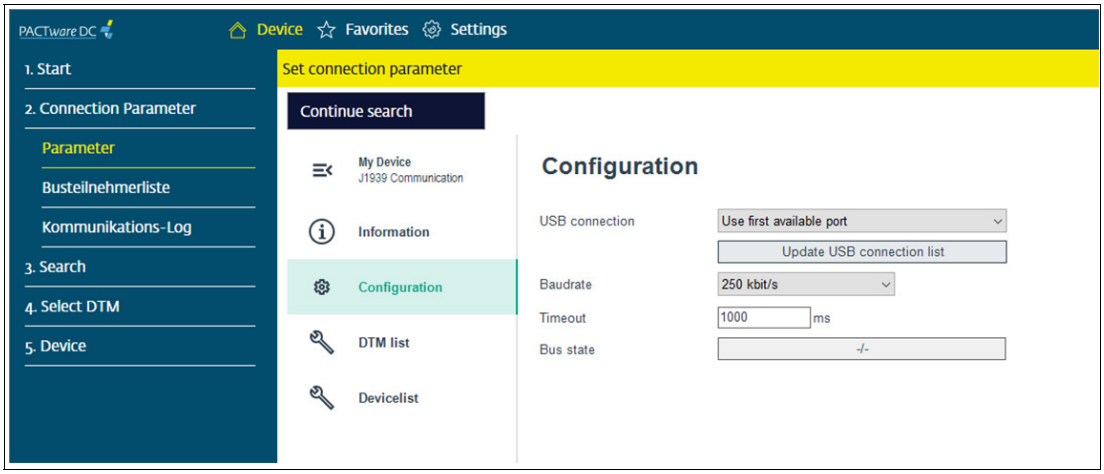


Figure 6.6

6.2 Commissioning via CAN Engineering Tool

Note

Before commissioning the sensor on a CAN bus, check whether the communication parameters of the sensor match your J1939 network. A transmission rate of 250 kbit/s is preset at the factory.

Basic commissioning steps

1. Connect the sensor to the CAN bus and ensure a 24 V DC electric power supply. An extended operating voltage range is possible. Information on this can be found in the datasheet for your MWC25M-L2M-B20 series radar sensor.
2. If necessary, change the communication parameters of the sensor using a suitable CAN Engineering Tool.
3. For correct communication, make sure that a terminator and at least one other device are connected to the CAN bus. A monitoring tool is sufficient for this purpose.

   ↳ The status LED flashes quickly "green" while the sensor attempts to obtain an address from the network management NM of the J1939 network using "Address Claiming." If the address claiming process is successful, the status LED briefly lights up "green." If no address could be defined for the sensor via "Address Claiming," the status LED repeatedly lights up briefly "red." If the sensor has a valid address, process data is immediately exchanged cyclically in the J1939 network. Parameters can be written and read.

   ↳ If communication conditions are incorrect, the status LED flashes "red" and the sensor is in the "Error-passive" state.

Note

The following sections describe basic parameterization settings for commissioning, operation, diagnostics, and restoring to the factory settings.

6.2.1 Processing the Process Data

After successful "Address Claiming," the sensor sends process data immediately. By default, PGN 0xFF00 is enabled and the process data is sent as follows:

Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
Status Register	Distance byte 0	Distance byte 1	Signal quality byte 0	8-bit counter	Velocity byte 0	Velocity byte 1	

Table 6.1

You can select the following objects via predefined PGNs:

- Distance
- Velocity
- Signal quality
- 8-bit counter
- Manufacturer status register

The sensor has the following predefined PGNs:

PGN	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
FF00	Status Reg	Distance byte 0	Distance byte 1	Signal quality byte 0	8-bit counter	Velocity byte 0	Velocity byte 1	
FF01	Status Reg	Distance byte 0	Distance byte 1					
FF02	Status Reg	Distance byte 0	Distance byte 1	Signal quality byte 0				
FF03	Status Reg	Velocity byte 0	Velocity byte 1					
FF04	Status Reg	Velocity byte 0	Velocity byte 1	Signal quality byte 0				

Table 6.2

6.2.2 Changing the Device Address

After switching on the sensor, it always initially starts with address 128. An "address claiming" process begins with the network management of the J1939 network. An address is then assigned to the sensor; this address is not stored persistently. This means that a new address claiming process with start address 128 is carried out each time the system is restarted.

The PGN "Commanded Address" 0xFED8 is also supported. The parameterization tool or your controller must support the J1939 "Broadcast Announcement Message" (BAM) transport protocol for this purpose. In this process, the sensor can be assigned a different address if a fixed address should be specified for the sensor.

1. Prepare the "Commanded Address Message" by typing the following entries in byte 1 - 8:
   - Byte 1 - 7: J1939 NAME of sensor
   - Byte 8: New address to be assigned to the sensor
2. Send the prepared "Commanded Address Message" to global address 255.

↳ There are 2 ways to process the message in the J1939 network:

↳ Command is accepted: The sensor initiates "Address Claiming" to claim the new address.

↳ Command is ignored: If the sensor cannot accept the new address, "Address Claiming" is performed with the new address as the start address.

Note

If the "Commanded Address" is in the "preferred" range and a "claim fail" occurs, the sensor goes to address 254. The standard "Address Claiming" process takes place in the "dynamic" area (Address +1).

6.2.3 Writing Parameters

The sensor offers the PGN CAM11/CAM21 from the CiA510 specification for writing parameters. These parameter groups are extensions of the J1939 protocol, which make it possible to use classic CANopen services such as SDOs and emergency messages in J1939 networks. The specification tunnels CANopen SDO messages via a PGN standardized by SAE.

6.2.4 Transfer Rate

See object directory "0x2003:2" when using CAM 11/21 (CANopen Application Message).

Alternatively, you can also set the baud rate via PACTware in the communication DTM baud rate, see chapter 6.1.

Note

After changing the parameter, the power supply must be switched off and on again (power cycle).

6.2.5 Evaluate Error Messages

The sensor offers the PGN CEM from specification CiA-510 for displaying error messages. This parameter group is an extension of the J1939 protocol, which makes it possible to display and use classic emergency messages in J1939 networks. Device-specific and communication errors are displayed.

If a sensor error occurs. it sends a PGN "CEM" when sending is enabled. The PGN of "CEM" is 0xFC68. CEM implements the CANopen emergency messages in J1939. The "Suspect Parameter Numbers" (SPNs) are shown in the following table. CEM implements the so-called CANopen emergency messages in J1939.

Each emergency message is only sent once, even if the error persists. It consists of an "Emergency Error Code," "Error Register," and additional manufacturer-specific information.

If the error no longer exists, the emergency message is sent once more with error code 0x0000. The manufacturer-specific information shows which error has disappeared.

Byte 0	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
FC68	Emergency error code Byte 0	Emergency error code Byte 1	Error register	Manufacturer specific error code Byte 0	Manufacturer specific error code Byte 1	Manufacturer specific error code Byte 2	Manufacturer specific error code Byte 3	Manufacturer specific error code Byte 4

Table 6.3

6.2.6 Restoring the Factory Defaults

You can restore the sensor's factory defaults using index 0x5011 "Restore default parameters":

1. 1. Write the signature 0x64616F6C ("daol" corresponds to "load" backward) to object 0x5011:1 of the sensor.
2. Switch the voltage supply to the sensor off and then on again (power cycle).

↳ The sensor's factory settings are now restored.

7 Parameterization and Analysis Using PACTware and DTM via J1939

7.1 Overview

The parameters of the sensors are device-specific. In the DTM (Device Type Manager), these parameters are described in a well-structured way and partly supported with graphics. The DTM can be imported into various engineering tools from different system providers, DTM support provided. The sensor can then be parameterized or diagnosed using the appropriate tool (e.g., PACTware). The DTM menus are outlined below on the basis of the "PACTware" FTD frame application being used.

For simple and comprehensive parameterization of the sensor via J1939 and analysis of the sensor behavior, the DTM (Device Type Manager) described below offers you a wide range of options.

In addition to configuring the sensor, you can use the **Analysis** and **Observation** menus to display and record the sensor behavior during operation to adapt it in the best way possible to your application.

Note

The following screenshots from the DTM in the PACTware frame application are described for all versions of the MWC25-L2M-B20 series using the example of the MWC25M-L2M-B20-V15 sensor.

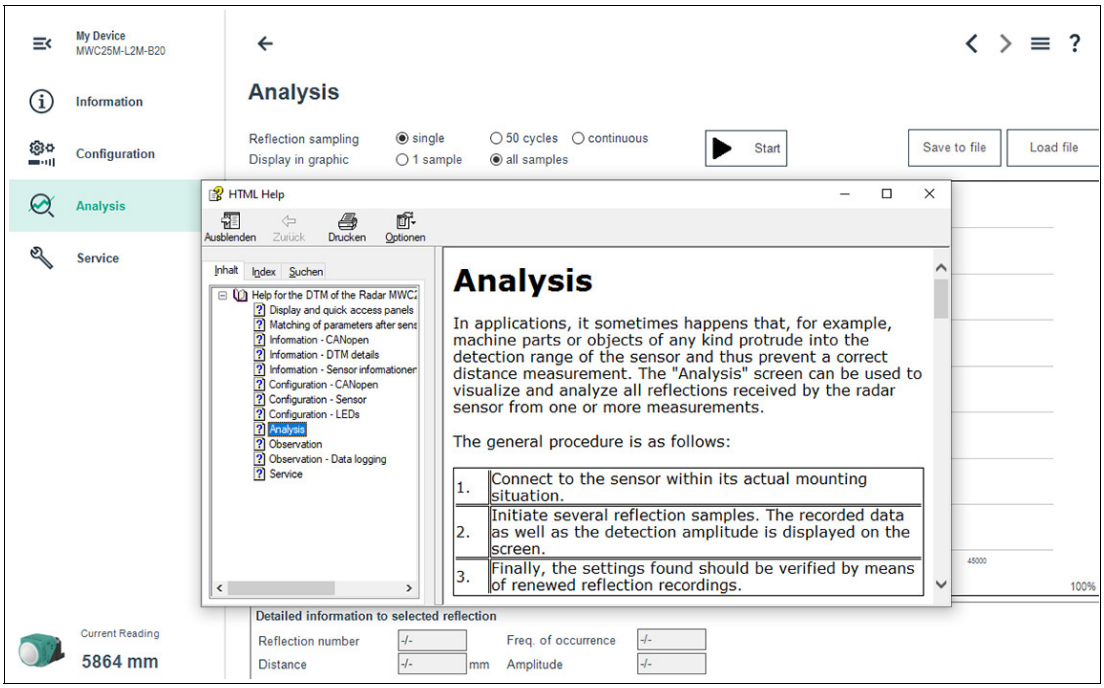


Figure 7.1

Context-Related Help Texts Via F1

In the DTM, you can access context-related help texts by clicking on the "?" icon in the displayed menu or by clicking on the required parameter and then pressing the F1 key. A display will then open showing information about the adjustment options of the relevant menu and its parameters.

You can also call up the DTM help using "Open manual," see figure below.

Basic DTM Operating Functions

Below are a few basic operating functions for the DTM in the PACTware environment.

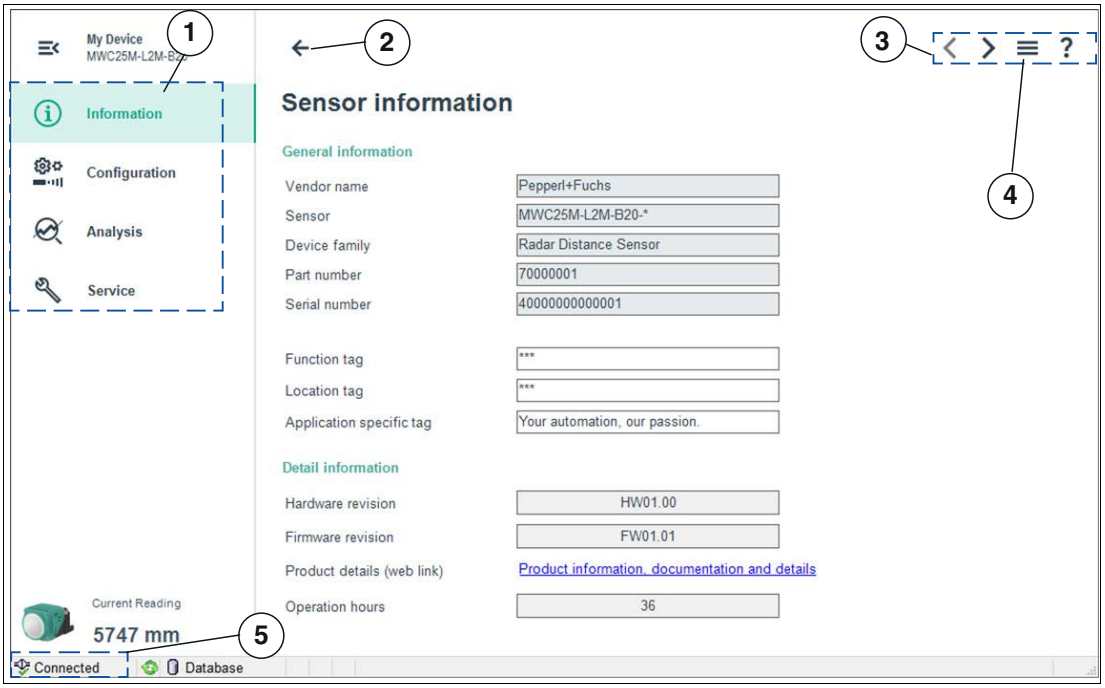


Figure 7.2

1 Basic menu structure of the DTM. When a menu is selected, clickable tile icons for submenus are displayed on the right, or information or control buttons are displayed directly.

2 Navigation return from the submenu to the menu

3 Navigation to switch between the submenus and parameter handling

4 Manage parameter data, display DTM help via "Open manual"

5 Status indicator: radar sensor connection to DTM

7.2 Menu Item Information

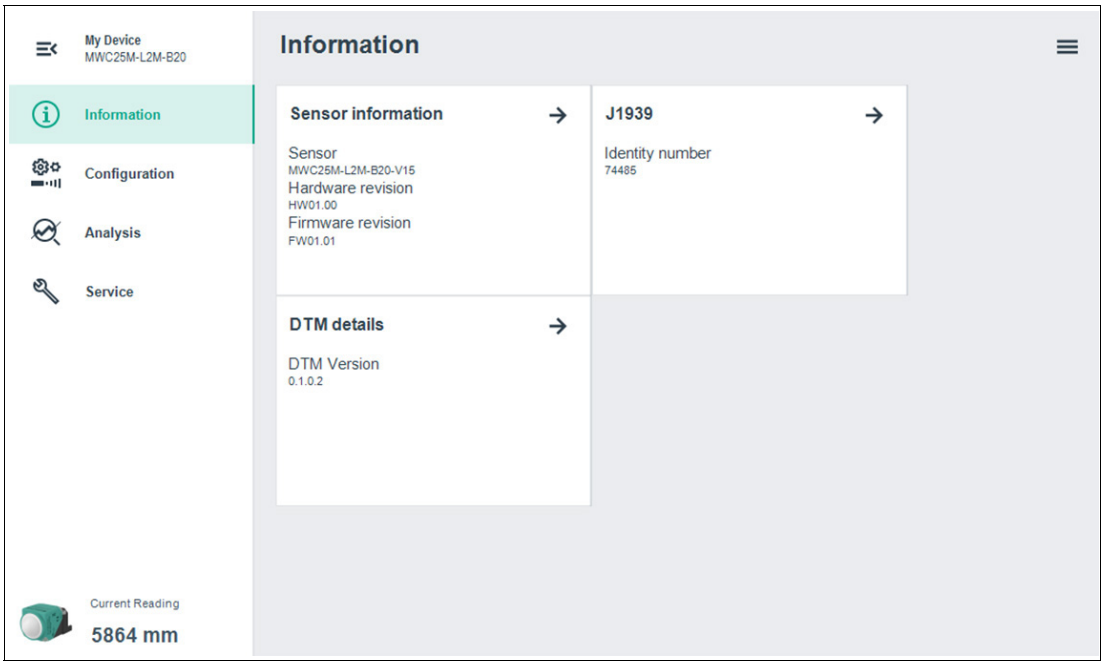


Figure 7.3

In the **Information** menu item, information on the sensor, product-specific J1939 information, and DTM details can be accessed via the respective submenus.

- In the Sensor information submenu
  - hard-coded vendor and device information is displayed, as is the number of operating hours. These are read-only fields.
  - You can input application-specific tags to identify and mark your sensor in the system environment. Text information (string) can be input in the "User tag" and "Application-specific tag" fields.
  - Detailed information about the hardware and software versions of the device, a link to the product-specific website, and the operating hours are listed.
- In submenu J1939
  - J1939 identification information such as vendor ID, product code, etc., and the node ID are displayed.
- In the DTM details submenu
  - The DTM version and the creation date are displayed.

7.3 Menu Item Configuration

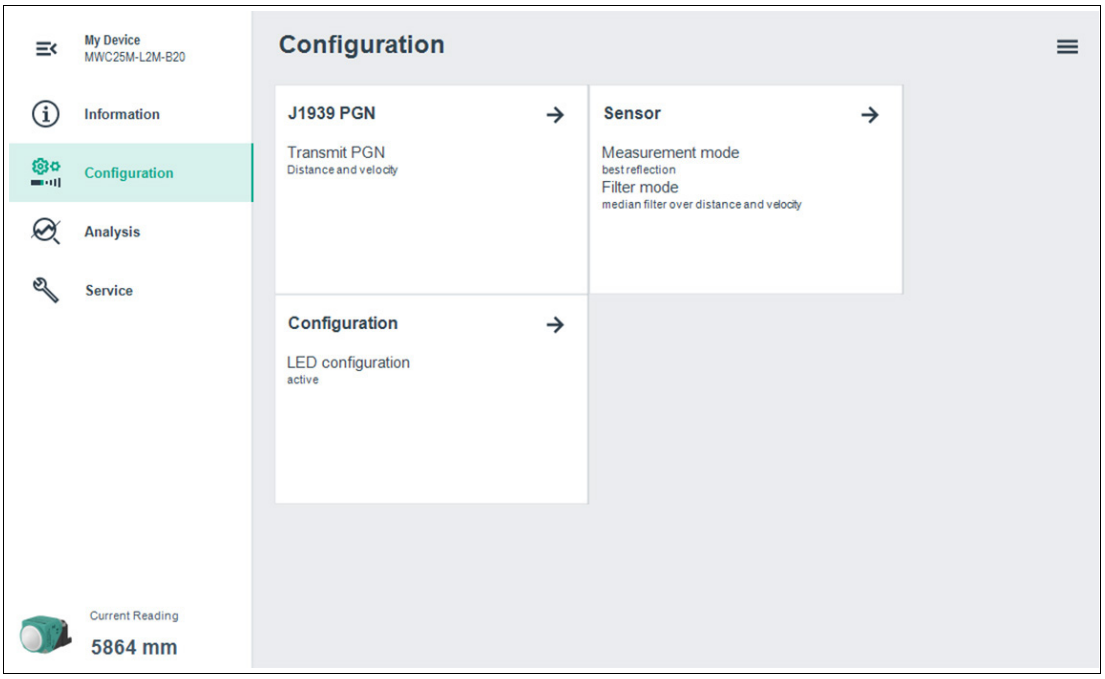


Figure 7.4

The **Configuration** menu item can be used to parameterize the sensor via the respective submenus.

Submenu J1939 PGN

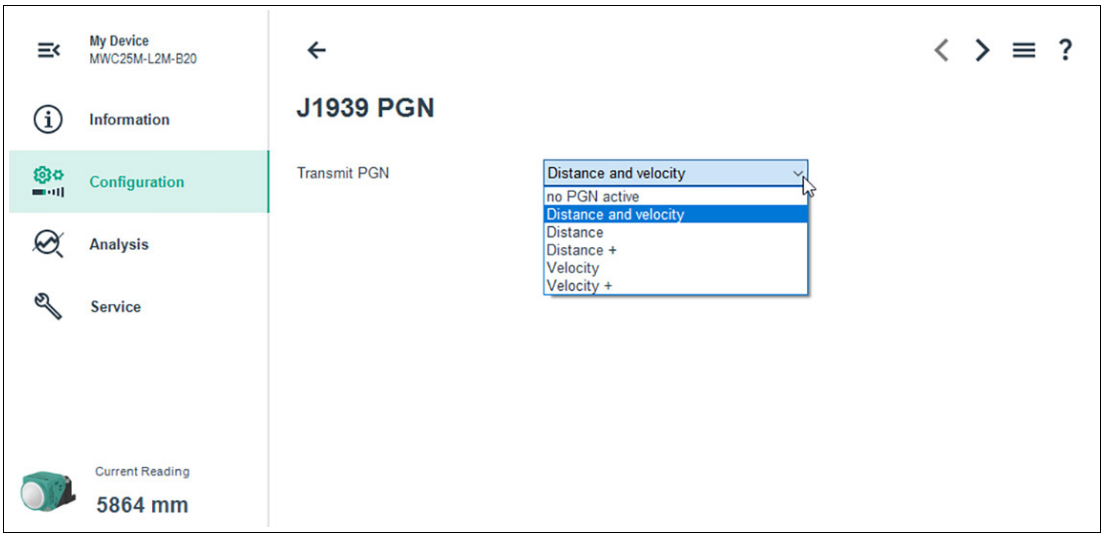


Figure 7.5

In the **J1939 PGN** submenu, you can set the PGNs of the sensor you wish to transfer.

Submenu Sensor

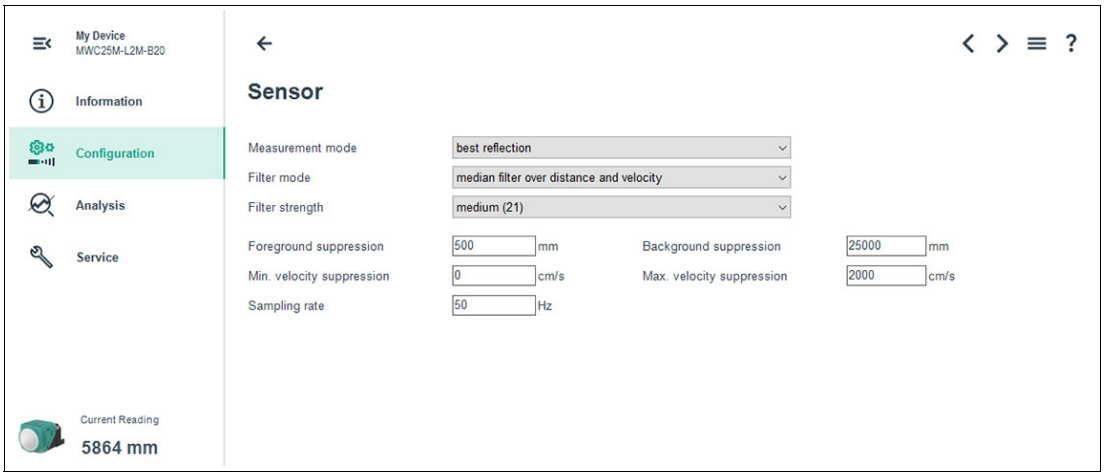


Figure 7.6

In the **Sensor** submenu, you can parameterize the behavior during radar measurement and its evaluation.

Submenu LED Configuration

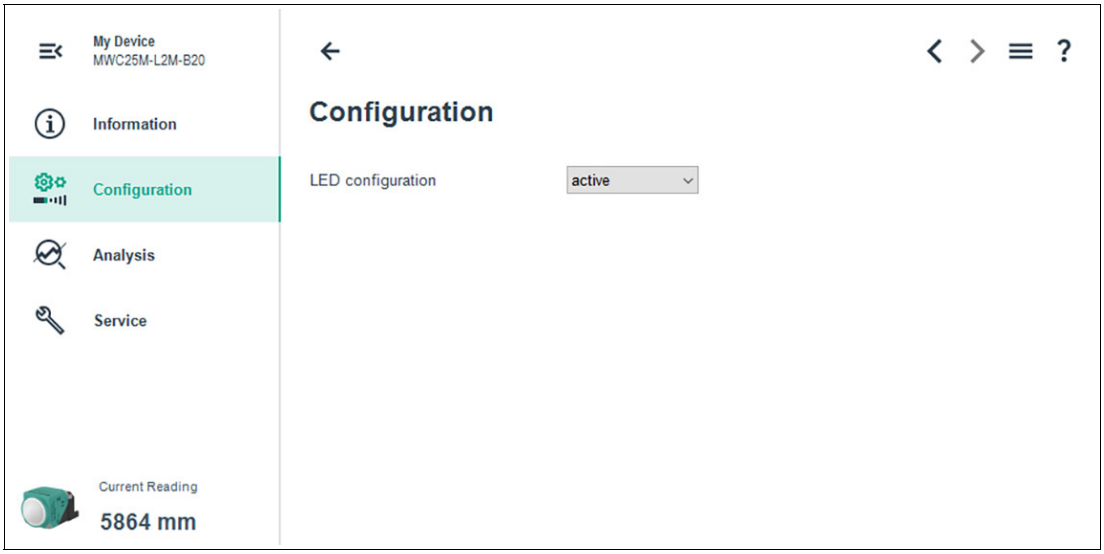


Figure 7.7

In the **LED configuration** submenu, you can enable or disable the sensor's sensor LED and status LED.

7.4 Menu Item Analysis

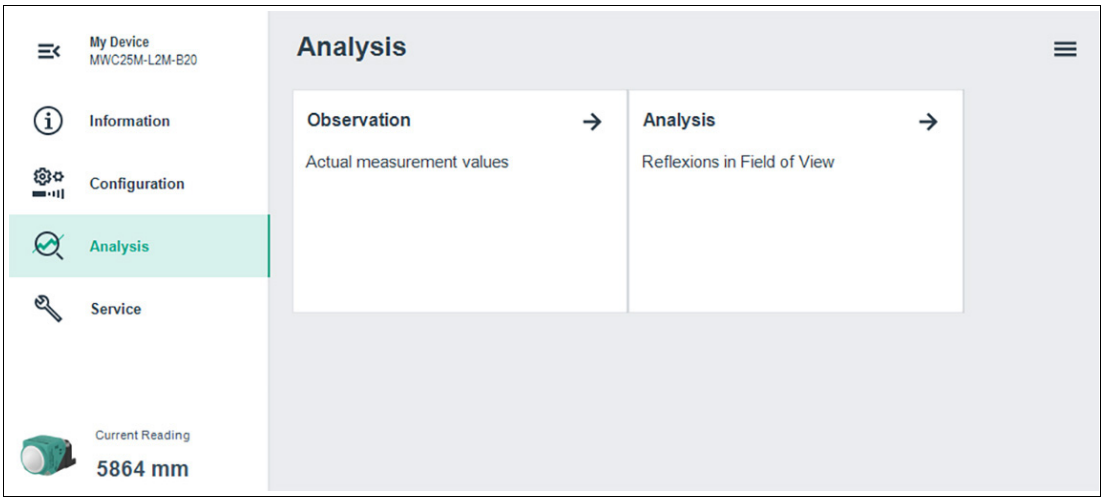


Figure 7.8

In the **Analysis** menu item, you can select between the Observation and Analysis submenus.

- Submenu Observation
  For tracking and recording measured values and corresponding behavior.
- Submenu Analysis
  For visualizing and analyzing all reflections received by the radar sensor.

7.4.1 Submenu Analysis

To better detect the reflections located in the sensor's detection field, all the reflections of one or more measurements received by the radar sensor can be visualized and analyzed in the Analysis submenu item.

The general procedure is as follows:

1. You must first establish a connection to one of the sensors integrated into the application environment.
2. It is a good idea to take multiple reflection samples.

   ↳ The corresponding data will then be shown in the display.
3. Finally, verify the detected settings by taking fresh reflection samples.

   ↳ The detected settings can be saved to/loaded from a file.

Menu Description

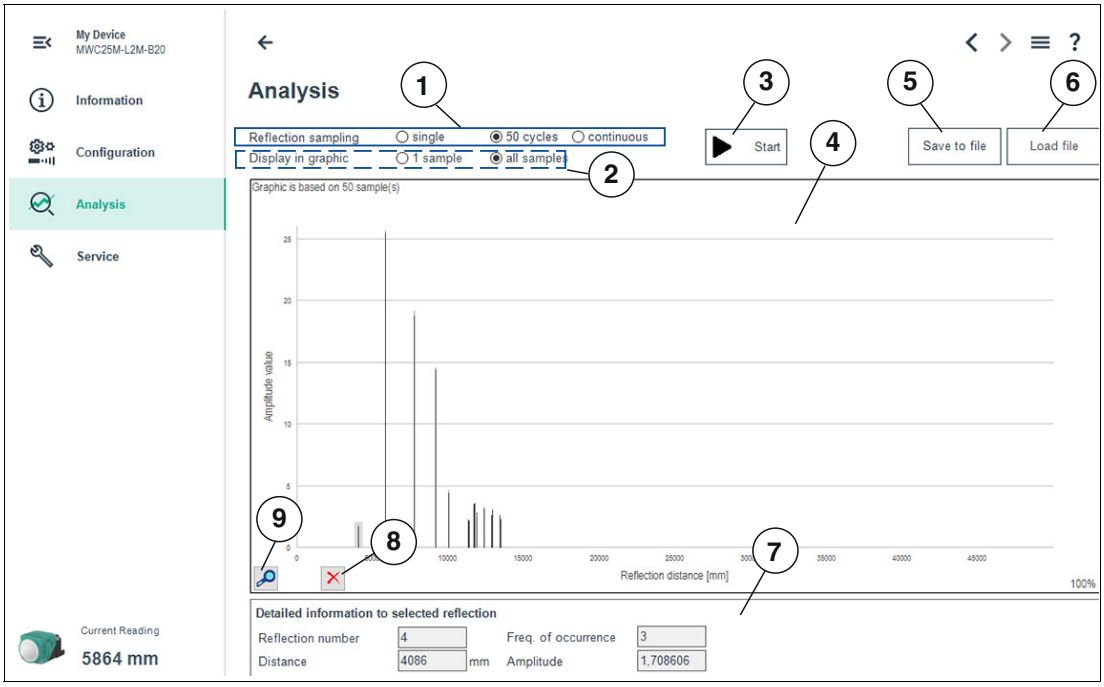


Figure 7.9

No.	Name	Explanation
1	Reflection (echo) sampling	In the "Reflection sampling" area, you can choose whether to record a single sample, 50 cycles, or continuous samples. Using the continuous display also provides you with an alignment aid. You can use the displayed amplitude of the evaluated reflecting object to check whether the sensor is optimally aligned with the object. You will know this has worked when slightly varying the alignment no longer increases the displayed reflection amplitude. **Note:** For information about alignment and the amplitude height of reflections, see also the "Reflectiveness of Materials" (see chapter 3) chapter.
2	Display in graphic	You can use the "Display in graphic" area to set whether all of the sampled reflecting objects are shown together or only the most recently sampled object image is shown.
3	Start	The "Start" button is used to start and stop reflection sampling. After reflection sampling has started, the button changes to "Stop." • In the case of "single" reflection sampling, reflection sampling stops after one measurement. • In the case of "50 cycles" reflection sampling, reflection sampling automatically stops after 50 measurements. You can stop it at any time by pressing the button again. • In the case of "continuous" reflection sampling, reflections will continue to be sampled until you press the button again.
4	Display area	The sampled object reflections are displayed in the form of thin columns during and after completion of sampling. The counter in the upper left corner indicates the number of reflection samples that the current graphic is based on.
5	Save to file	You can save the reflection sample as a .CSV file, .XML file, or .TXT file by pressing the "Save to file" button. In addition to this data, sensor settings (parameter values) will also be saved. This means it is possible to evaluate recorded data later "offline."
6	Load file	You can load previously saved reflection samples to the DTM by pressing the "Load file" button, allowing you to assess or evaluate the samples. **Note:** You can only load a saved file when disconnected from the sensor.
7	Detailed information on selected reflection	Clicking on one of the object reflection columns shown in the graphic displays detailed information about the selected reflection below the graphic.
8	Clear reflection sampling	You can use the "Clear reflection sampling" button to clear the display area and restore it to its original state.
9	Rescale diagram	You can use the "Rescale diagram" (magnifying glass) button to enlarge the view along the x-axis up to 5-fold in 100 % increments. If magnification is set to more than 100 %, the displayed area can be shifted along the x-axis (by scrolling) to be able to obtain a magnified view of sections of the entire sample area. To do so, right-click on the x-axis, keep it pressed and move left or right with the mouse.

Table 7.1

7.4.2 Submenu Observation

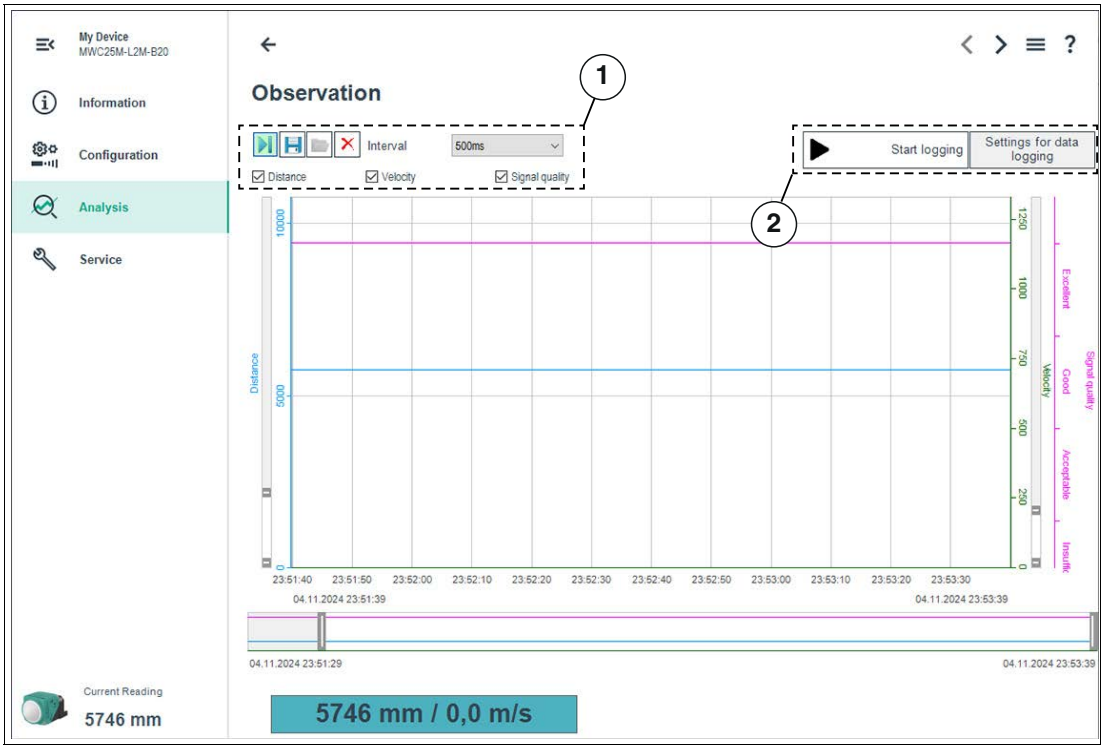


Figure 7.10

You can use the **Observation** submenu item to track and record the data from the radar sensor over time, and the corresponding behavior of the signal quality of the measured object. You can choose from the "Visual observation" (1) or "Event-driven data logging" (2) application focuses.

Visual Observation

The visual observation functions (1) allow you to observe, during commissioning for example, whether the data of the sensor behave as intended.

When you first access the **Observation** menu item in the DTM, automatic recording of data will start in the graphic. From this point in time, recording will run continuously in the background. The data display works using the so-called follow-mode principle . It will always track the current measured value and make sure it visible is visible in the display using the zoom settings for the X-axis. You can save the data displayed in this trend graphic in a file in various file formats for evaluation at a later stage.

Placing the check mark in front of the available measured variables or output statuses selects which data will appear in the graphic.

Event-Driven Data Logging

Event-driven data logging functions (2) allow you, for cause analysis, for example, to monitor the sensor logic in such a way that an event occurring sporadically is recorded in a file. You can specify the recording conditions from predefined trigger criteria such as changing the status of the switching output or a change to the value of the distance measurement. The DTM function then observes the sensor and writes the measured variables and output statuses to a file if the event occurs.

Note

If the DTM is closed while data is being recorded, recording automatically stops. Values recorded up to this point in time will remain in the corresponding file.

Menu Description

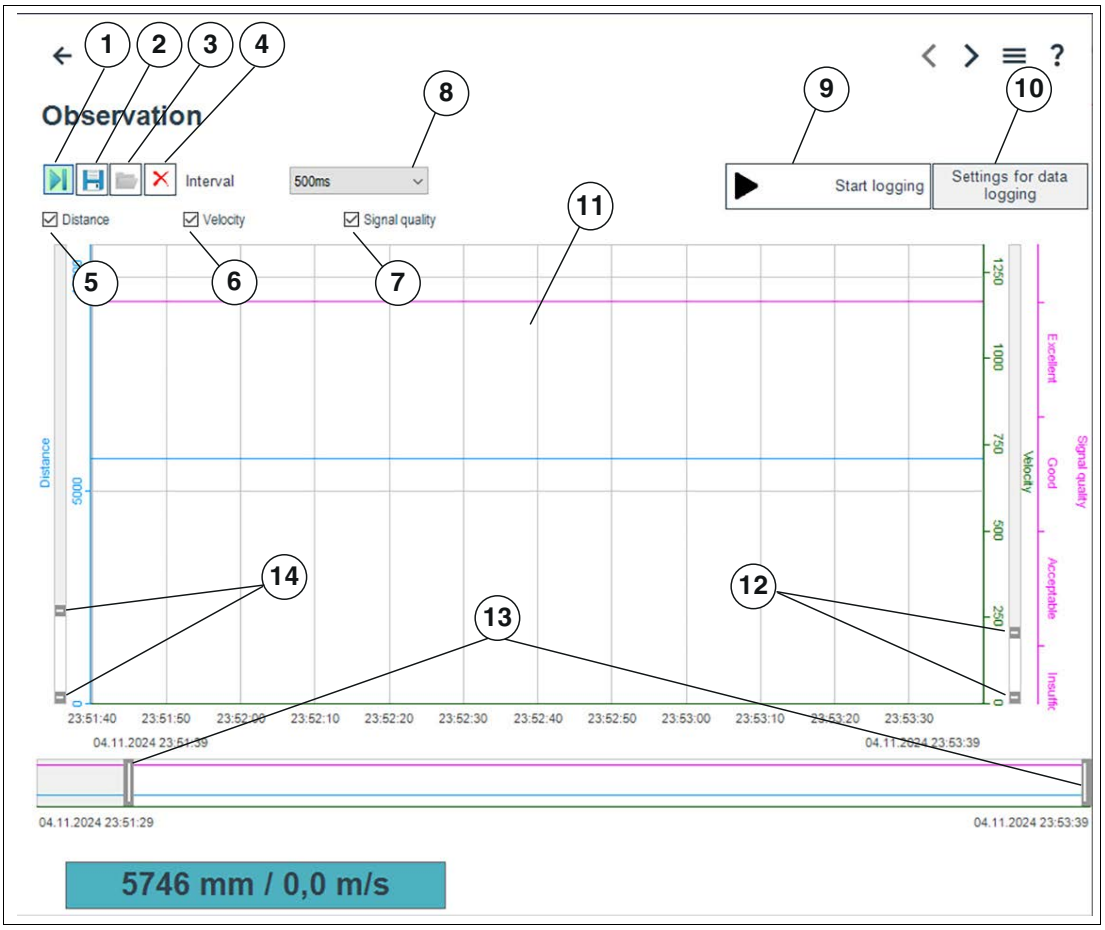


Figure 7.11

No.	Name	Explanation
1	Follow mode on/off	If follow mode is "On," data is displayed in accordance with the current rescale setting of the x-axis. The data is visible in the display. If follow mode is "Off," the data stops being continuously displayed. When follow mode is restarted, data recorded in the background in the meantime is added to the graphic.
2	Save trend data	**Only for visual observation** You can save data recorded via follow mode in one of three available file formats (.csv, .xml or .txt) by pressing the "Save trend data" button. In addition to this data, sensor settings (parameter values) will also be saved. This means it is possible to evaluate recorded data later "offline."
3	Load data	You can load the saved trend data (visual observation) or logging data (event-driven data logging) into the DTM again by pressing the "Load data" button to assess or evaluate the data. Files with recorded data combined with the parameter settings can be very useful for discussing issues with our experts. **Note:** You can only load a saved file when disconnected from the sensor.
4	Delete	Pressing the "Delete" button allows you to delete all data in the display area (10). All data recorded up to this point is discarded and the display is cleared. Recording automatically restarts from scratch.
5, 6, 7	Data displayed	Clicking the relevant checkbox enables or disables the presentation of distance data, velocity data, and the signal quality of the reflection amplitude in the display area, where lines are displayed in the colors shown in the legend.
8	Interval	You can use the "Interval" selection function to specify the time interval at which data is recorded in the graphic. There are several fixed intervals available between 100 ms and 1 hour.
9	Start logging	**Only for event-driven data logging** You can use the "Start recording" button to start and end event-driven recording of data in a file (data logging).
10	Settings for data logging	**Only for event-driven data logging** You can use the "Settings for data logging" button to specify events for data recording and the name of the log file via a menu.
11	Display area	In the display area, the "Distance," "Velocity," and "Signal quality" checkboxes can be used to display selected measured variables and output statuses in the form of line diagrams.
12 13 14	Axis scaling	You can limit the desired value range with the shift keys of the axes (left/right x-axis, y-axis). You can move the value range to be displayed by clicking a move icon with the left mouse button and holding it down.

Table 7.2

Scaling the X-Axis and Navigating to Significant Data

Each axis has a value range. This can be limited up and down (left and right x-axes and left and right (y-axis), to get to the desiredreadings.

To do this, you must left-click the shift icon of an axis and hold it down. You can move the corresponding shift symbol to the left/right or up/down by holding down the mouse button.

Data Logging Setting

Pressing the "Settings for data logging" button opens the menu displayed below.

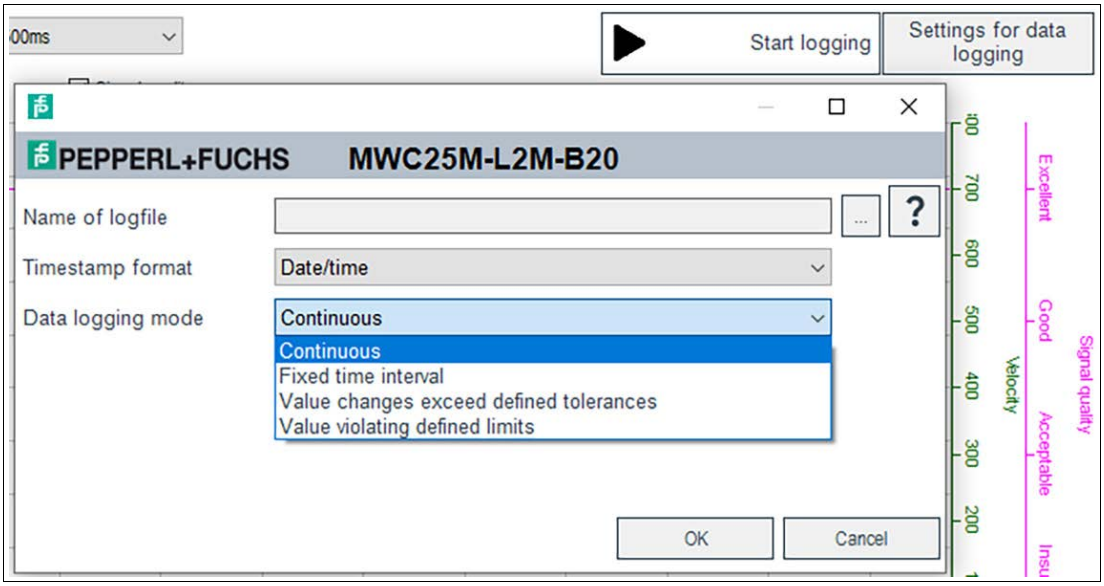


Figure 7.12

You can use the "Name of log file" field to set the file path and file name for the logging data.

You can select "Data logging mode" to set the events that trigger automatic data logging. You need to press the OK button at the end to save the setting.

Data can be recorded either on a continuous or event-driven basis. For event-driven recording, the amount of data to be recorded before and after the event is independently defined via two parameters.

The following recording modes are available:

- Continuous
  Data is continuously recorded and saved in the file. Data is sequentially recorded, but is not necessarily consistent. Individual data may not be recorded depending on the sensor's repeat measurement rate, data transmission rate, the computer capacity and operating system tasks.
- Fixed time interval
  Data is recorded at fixed time intervals. The time interval can be selected in fixed increments between 500 ms and 2 hours.
- Value changes exceed defined tolerances
  Data recording is triggered by changes to data that exceed the specified tolerance limits. The reference value is the distance value determined during the previous measurement. The permissible tolerances can be specified either as an absolute value, i.e., in mm, or as a percentage, relative to the previous measurement. If this tolerance limit is exceeded from one measurement to the next, data recording is triggered.
- Value violating defined limits
  Data is recorded if specified, absolute limit values are exceeded. The distance value in mm and the value at the sensor analog output (if physically present on the sensor) are available as reference values. In addition, the "Trigger" parameter can be used to determine whether data recording is to take place once per instance of the limit value being exceeded or for the complete duration.

7.5 Menu Item Service

Figure 7.13

In the **Service** menu item, you can restore the sensor to its factory settings.

Clicking the "Reset to factory defaults" button will restore the sensor to its factory settings. All previous parameter changes are lost as a result. After the voltage supply has been switched off and on again (power cycle), the sensor re-initializes on the bus with its factory defaults.

Note

The baud rate and operating hours are not restored to the factory settings.

Use the "Product Website" button to go to the product area information page (landing page) for the MWC25M-L2M-B20 series.

8 Parameterization via J1939

8.1 J1939 Object Directory

J1939 Parameter Communication

This section contains the basic information required for the data exchange via J1939. Data is exchanged with the sensor via objects. These objects and their permissible functions are listed in the following object directory. The device-specific object directory contains all parameters and process data for the sensor.

Object List

The parameters and process data are described in detail in this manual as individual objects and are listed in tables. An entry in the object list is identified via a 16-bit index and an 8-bit sub-index.

The following object list only lists the 16-bit index objects; the subindices are then described in the respective object descriptions. Access to device parameters and process data, such as input signals and output signals, device functions, and network variables, is provided via the assignment within the object list in standardized form over the J1939 network.

Note

The supported J1939 objects are listed below. Detailed information about these can be found in the DBC file.

Supported Objects

Object	Description
0x2000	Process Data: Distance value, velocity value, signal quality, 8-bit counter, 16-bit counter
0x2001	Operating Hours
0x2003	Baud Rate
0x2010	Identification and Info
0x4000	Measurement Configuration
0x4001	LED Configuration
0x4100	Reflections array list
0x5008	Manufacturer device name
0x5009	Manufacturer hardware version
0x500A	Manufacturer hardware version
0x5011	Restore default parameters
0x5018	Device recognition (identity object)
0x5800	PGN transfer/Configuration of the PGNs

Table 8.1

8.2 Object 0x2000 Process Data

Note

These objects can be found in the PGNs.

Index	Sub-index	Designation	Data Type	Attribute	Default Value	Meaning
0x2000	0x00	Highest sub-index supported	unsigned8	ro	0x06	
	0x01	Distance	unsigned16	ro	Assigned to the mapping object 0x1A00 by default	Distance value to the measured object in mm 16-bit distance of 500 ... 50,000 mm Resolution: 1 mm Object in dead band (300 ... 500 mm) = 0x0000 No object detected = 0x7FFF
	0x02	Velocity	integer16		Assigned to the mapping object 0x1A00 by default	Relative velocity to the measured object in cm/s 16-bit velocity value of -8000 cm/s ... +8000 cm/s "-" means object approaching *+" means object moving away Resolution: 1 cm/s (0.01 m/s) 0x7FFF = object in dead band 0x7FFF = No object detected
	0x03	Signal Quality	unsigned8	ro	Assigned to the mapping object 0x1A00 by default	Signal quality of the radar signal reflected by the object. Possible values: 0x00 = no object detected 0x01 = insufficient signal quality ... 0x14 = excellent signal quality
	0x05	Cyclic counter 8 bit	unsigned8	ro	Assigned to the mapping object 0x1A00 by default	8-bit counter Cyclic counter increases after each measuring cycle, skips the zero (zero still no process data update) Possible values: 0x01 ... 0xFF(1 ... 255)

Table 8.2

8.3 Object 0x2001 Operating Hours

Index	Subindex	Designation	Data Type	Attribute	Default Value
0x2001	0x00	Operating hours	unsigned 32	ro	0x00000000 Value changes over time Value in full hours, n+1 is incrementally counted upward each time power is resupplied.

Table 8.3

8.4 Object 0x2003 baud rate

Index	Subindex	Designation	Data Type	Attribute	Default Value
0x2003	0x02	Baud Rate	unsigned 8	rw	0x01 (250 kBaud) Auto baud rate is not supported. Possible values: 0x01 = 250 kBaud 0x02 = 500 kBaud

Table 8.4

8.5 Object 0x2010 Identification and Info

Index	Subin-dex	Designation	Data Type	Attri-bute	Default Value	Meaning
0x2010	0x00	Highest subin-dex supported	unsigned8	ro	0x09	
	0x01	Vendor name	string	ro	Pepperl+Fuchs	Vendor name
	0x02	Vendor text	string	ro	www.pepperl-fuchs.com	Website
	0x03	Product ID	string	ro	70134318-xxxxxx	Item number
	0x04	Product text	string	ro	Radar distance sensor	Product text
	0x05	Serial number	string	ro	Individually for each device	Serial number of the device
	0x06	Application-specific tag	string	rw	Your automation, our passion	Application-specific tag = free text
	0x07	Function tag	string	rw	***	Function tag = free text
	0x08	Location tag	string	rw	***	Location tag = free text
	0x09	Unique prod-uct ID	string	ro	https://pefu.de/<serialnumber>	Link to the device-specific product page

Table 8.5

8.6 Object 0x4000 Measurement Configuration

Index	Subindex	Designation	Data Type	Attribute	Default Value	Meaning
0x4000	0x00	Highest subindex supported	unsigned 8	ro	0x09	
	0x01	Measurement mode	unsigned 8	rw	0x00	Sets the measurement mode for the radar sensor The possible settings are: 0x00 = closest distance 0x01 = best reflection 0x02 = fastest velocity
	0x02	Measurement rate	unsigned 16	rw	50	Sets the sampling rate in Hz in "Operational mode" Possible values: 1, 2, ... 200 [Hz]
	0x03	Filter mode	unsigned 8	rw	0x01	Sets the filter operating mode. Possible values: 0x00 = no filter 0x01 = Medianfilter by distance 0x02 = Medianfilter by speed 0x03 = Medianfilter by speed and distance You can set the filter strength of the "Median Filter" in subindex 0x04.
	0x04	Filter strength	unsigned 8	rw	0x02	Sets the filter strength for the "Median Filter". Possible values: 0x00 = very low (3) 0x01 = low (11) 0x02 = medium (21) 0x03 = high (51) 0x04 = very high (101)

Table 8.6

The median filter belongs to the subset of nonlinear filters. This filter is often used to eliminate outliers in signal processing. N readings (see object 0x4000, sub 0x04 filter strength) are stored in a sorted field and only the value at the middle position of the field is used. When a new reading is transferred to the Median Filter, the oldest reading is replaced with the new one and the list is re-sorted.

Index	Subindex	Designation	Data Type	Attribute	Default Value	Meaning
0x4000	0x05	Event configuration	unsigned8	rw	0x00 (disabled)	Allows you to configure an event that triggers an emergency message. Possible values: 0x00 = disabled 0x01 = "No object" triggers the emergency message
	0x06	Foreground suppression	unsigned16	rw	500	Foreground suppression: Distance value in mm for suppressing objects in the front sensing range. Possible values: 300 ... 49,999 [mm]
	0x07	Background suppression	unsigned16	rw	25,000	Background suppression: Distance value in mm for suppressing objects in the back sensing range. Possible values: 301 ... 50,000 [mm] Objects at distances greater than this value are not detected.
	0x08	Minimum velocity suppression	unsigned16	rw	0	Minimum velocity suppression: Absolute velocity value in cm/s for suppressing objects below this value. Possible values: 0 ... 7999 [cm/s]
	0x09	Maximum velocity suppression	unsigned16	rw	2000	Maximum velocity suppression: Absolute velocity value in cm/s for suppressing objects above this value. Possible values: 1 ... 8000 [cm/s]

Table 8.7

8.7 Object 0x4001 LED Configuration

Index	Subindex	Designation	Data Type	Attribute	Default Value	Meaning
0x4001	0x00	Highest subindex supported	unsigned 8	ro	0x01	
	0x01	LED configuration	bool	rw	0x00	Sets whether all LED indicators on the sensor are enabled or disabled. Possible values: 0x00 = all LEDs enabled 0x01 = all LEDs disabled

Table 8.8

8.8 Object 0x4100 Reflection Array List

This object contains up to ten reflections from objects. All reflections are output without the influence of filters or suppressions.

Each reflection indicates the following values:

- Distance in mm
- Velocity in cm/s
- Amplitude in digits

Note

If a reflection stops being detected or an extra reflection is detected while reading the sensor data, the following objects will move forward or backward. This may cause inconsistent data to appear when reading. The use of object 0x4100 is only recommended if all object reflections are read after a measurement before the next measurement starts.

We recommend using object 0x4100, Sub 0x1F instead. This object guarantees consistent reading of all reflections.

Index	Subin-dex	Designation	Data Type	Attri-bute	Default Value	Meaning
0x4100	0x00	Highest subin-dex supported	unsigned8	ro	0x31	
	0x01	Reflection 1 Distance	real32	ro	-	Contains the distance value of the first reflection in mm
	0x02	Reflection 1 Velocity	real32	ro	-	Contains the velocity value of the first reflection in cm/s
	0x03	Reflection 1 Amplitude	real32	ro	-	Contains the amplitude value of the first reflection in digits

Table 8.9

Index	Subin-dex	Designation	Data Type	Attri-bute	Default Value	Meaning
0x4100	0x04	Reflection 2 Distance	real32	ro	-	Contains the distance value of the second reflection in mm
	0x05	Reflection 2 Velocity	real32	ro	-	Contains the velocity value of the second reflection in cm/s
	0x06	Reflection 2 Amplitude	real32	ro	-	Contains the amplitude value of the second reflection in digits

Table 8.10

Index	Subin-dex	Designation	Data Type	Attri-bute	Default Value	Meaning
0x4100	0x07	Reflection 3 Distance	real32	ro	-	Contains the distance value of the third reflection in mm
	0x08	Reflection 3 Velocity	real32	ro	-	Contains the velocity value of the third reflection in cm/s
	0x09	Reflection 3 Amplitude	real32	ro	-	Contains the amplitude value of the third reflection in digits

Table 8.11

Index	Subin-dex	Designation	Data Type	Attri-bute	Default Value	Meaning
0x4100	0x0A	Reflection 4 Distance	real32	ro	-	Contains the distance value of the fourth reflection in mm
	0x0B	Reflection 4 Velocity	real32	ro	-	Contains the velocity value of the fourth reflection in cm/s
	0x0C	Reflection 4 Amplitude	real32	ro	-	Contains the amplitude value of the fourth reflection in dig-its

Table 8.12

Index	Subin-dex	Designation	Data Type	Attri-bute	Default Value	Meaning
0x4100	0x0D	Reflection 5 Distance	real32	ro	-	Contains the distance value of the fifth reflection in mm
	0x0E	Reflection 5 Velocity	real32	ro	-	Contains the velocity value of the fifth reflection in cm/s
	0x0F	Reflection 5 Amplitude	real32	ro	-	Contains the amplitude value of the fifth reflection in digits

Table 8.13

Index	Subin-dex	Designation	Data Type	Attri-bute	Default Value	Meaning
0x4100	0x10	Reflection 6 Distance	real32	ro	-	Contains the distance value of the sixth reflection in mm
	0x11	Reflection 6 Velocity	real32	ro	-	Contains the velocity value of the sixth reflection in cm/s
	0x12	Reflection 6 Amplitude	real32	ro	-	Contains the amplitude value of the sixth reflection in digits

Table 8.14

Index	Subin-dex	Designation	Data Type	Attri-bute	Default Value	Meaning
0x4100	0x13	Reflection 7 Distance	real32	ro	-	Contains the distance value of the seventh reflection in mm
	0x14	Reflection 7 Velocity	real32	ro	-	Contains the velocity value of the seventh reflection in cm/s
	0x15	Reflection 7 Amplitude	real32	ro	-	Contains the amplitude value of the seventh reflection in digits

Table 8.15

Index	Subindex	Designation	Data Type	Attribute	Default Value	Meaning
0x4100	0x16	Reflection 8 Distance	real32	ro	-	Contains the distance value of the eighth reflection in mm
	0x17	Reflection 8 Velocity	real32	ro	-	Contains the velocity value of the eighth reflection in cm/s
	0x18	Reflection 8 Amplitude	real32	ro	-	Contains the amplitude value of the eighth reflection in digits

Table 8.16

Index	Subindex	Designation	Data Type	Attribute	Default Value	Meaning
0x4100	0x19	Reflection 9 Distance	real32	ro	-	Contains the distance value of the ninth reflection in mm
	0x1A	Reflection 9 Velocity	real32	ro	-	Contains the velocity value of the ninth reflection in cm/s
	0x1B	Reflection 9 Amplitude	real32	ro	-	Contains the amplitude value of the ninth reflection in digits

Table 8.17

Index	Subindex	Designation	Data Type	Attribute	Default Value	Meaning
0x4100	0x1C	Reflection 10 Distance	real32	ro	-	Contains the distance value of the tenth reflection in mm
	0x1D	Reflection 10 Velocity	real32	ro	-	Contains the velocity value of the tenth reflection in cm/s
	0x1E	Reflection 10 Amplitude	real32	ro	-	Contains the amplitude value of the tenth reflection in digits

Table 8.18

Index	Subindex	Designation	Data Type	Attribute	Default Value	Meaning
0x4100	0x1F	Get All	array8	ro		Contains all reflections at once. You need to convert the values from "Bytes" to the "Float" data type.

Table 8.19

8.9 Object 0x5008 Manufacturer Device Name

Index	Subindex	Designation	Data Type	Attribute	Default Value
0x5008	0x00	Manufacturer Device Name	visible string[1]	ro	MWC25M-L2M-B20-*

Table 8.20

1. ASCII string, variable length

8.10 Object 0x5009 Manufacturer Hardware Version

Index	Subindex	Designation	Data Type	Attribute	Default Value
0x5009	0x00	Manufacturer Hardware Version	visible string	ro	HW01.00 Value may vary

Table 8.21

8.11 Object 0x500A Manufacturer Software Version

Index	Subindex	Designation	Data Type	Attribute	Default Value
0x500A	0x00	Manufacturer Software Version	visible string	ro	FW01.00 Value may vary

Table 8.22

8.12 Object 0x5011 Restore Default Parameters

Index	Subindex	Designation	Data Type	Attribute	Default Value
0x5011	0x01	Restore all default parameters	unsigned 32	rw	0x01/1 Re

Table 8.23

To reset to the default parameters, write the signature "0x64616F6C" ("daol" corresponds to "load" backward) into object 0x5011:1.

The factory settings are restored after the sensor is switched off and on again (power cycle). It affects all objects of 0x2000 ... 0x6FFF.

Note

The baud rate and operating hours are not restored to the factory settings.

8.13 Object 0x5018 Device ID (Identify Object)

Index	Subindex	Designation	Data Type	Attribute	Default Value
0x5018	0x01	Vendor ID	unsigned 32	ro	632 = Pepperl+Fuchs
	0x02	Product Code	unsigned 32	ro	Byte 1: Product groups code = 0x07000001 = Radar products Byte 2: Sequential number
	0x03	Revision Number	unsigned 32	ro	Version number for protocol stack J1939 The value may vary.
	0x04	Identity Number	unsigned 32	ro	Unique serial number of the device. It is identical to the "Identity Number" in the J1939 name.

Table 8.24

8.14 Object 0x5800 PGN Transfer/Configuration of PGNs

Index	Subin-dex	Designa-tion	Data Type	Attribute	Default Value	Meaning
0x5800	0x01	PGN Configu-ration	unsigned 32	rw	0b0000'0001 (PGN 0XFF00)	Object for activating/deactivating PGNs The PGNs are set via a binary matrix: • 0000'0000 no PGN active • 0000'0001 0xFF00 • 0000'0010 0xFF01 • 0000'0011 0xFF01 0xFF00 • 0000'0100 0xFF02 • 0000'0101 0xFF02 0xFF00 • 0000'0110 0xFF02 0xFF01 • 0000'1000 0xFF03 • 0000'1001 0xFF03 0xFF00 • 0000'1010 0xFF03 0xFF01 • 0000'1011 0xFF03 0xFF01 0xFF00 • 0000'1011 0xFF03 0xFF02 0xFF01 0xFF00 • 0001'0000 0xFF04 • 0001'0001 0xFF04 0xFF00 • 0001'0010 0xFF04 0xFF01 • 0001'0100 0xFF04 0xFF02 • 0001'1000 0xFF04 0xFF03 • 0001'1001 0xFF04 0xFF03 0xFF00 • 0001'1010 0xFF04 0xFF03 0xFF01 • 0001'1100 0xFF04 0xFF03 0xFF02 • 0001'1101 0xFF04 0xFF03 0xFF02 0xFF00 • 0001'1110 0xFF04 0xFF03 0xFF02 0xFF01 • 0001'1111 0xFF04 0xFF03 0xFF02 0xFF01 0xFF00

The values 0000'0000 are the binary representation.

A "1" at the respective position determines which PGN should be active. A "0" at the respective position means that this PGN is deactivated.

In the following figure, the "X" is the position for the respective PGN.

0000'000**X** >> 0xFF00

0000'00**X**0 >> 0xFF01

0000'0**X**00 >> 0xFF02

0000'**X**000 >> 0xFF03

000**X**'0000 >> 0xFF04

If, for example, for the 2nd entry (0000'00**X**0) a "1" is set at the position of the "X," PGN 0xFF01 is active.

In binary form, this then looks as follows: 0000'00**1**0.

If you now want 0xFF01 and 0xFF04 to be active simultaneously, you write a "1" at position 0000'00**X**0 and at position 000**X**'0000.

In binary form, this then looks as follows: 000**1**'00**1**0

2025-01

9 Maintenance and Repair

9.1 Maintenance Work

The sensor itself is maintenance-free. For this reason, it is not necessary to carry out regular adjustments or maintenance work on the sensor itself.

However, check that the sensor and connector are tight within the scope of routine maintenance intervals. You may also want to check that the connection cable is installed and intact.

9.2 Cleaning

Cleaning is only necessary in applications where the radome (lens) of the sensors is exposed to heavy dirt or build-up.

In general, the following applies as far as cleaning is concerned:

- Only use water without chemicals
- Only use a soft cloth
- No abrasive cleaning, scratching, or scrubbing

2025-01

10 Troubleshooting

10.1 What to Do in Case of Fault

In case of fault, use the following checklist to determine whether a fault in the sensor can be remedied.

If none of the information provided in the checklist solves the problem, contact Pepperl+Fuchs via your sales office with any queries. If possible, have the model number and firmware version of the sensor to hand.

Checklist

Error	Cause	Remedy
Green LED not lit up	The voltage supply is switched off.	Check whether there is a reason why the voltage supply is switched off (installation or maintenance work, etc.). Switch on the voltage supply if appropriate.
	The plug is not connected to the connector on the sensor.	Connect the plug to the sensor and tighten the union nut by hand.
	Faulty wiring in the splitter or switch cabinet.	Check the wiring carefully and repair any faults. Pay attention to the pin assignment as the standard assignment (A-coded M12 plug) is different from the pin assignment of the CAN specification.
	Supply cable to the sensor is damaged.	Replace the damaged cable.
	LEDs have been disabled in the parameter settings	Check the parameter settings under object 0x4001. The LEDs are disabled when parameterizing 0x01.
No CAN connection to the device	The sensor's communication port is not connected to the CAN bus or, in the case of parameterization, to the CAN/USB converter-SUBD9.	Ensure that the communication port of the sensor is connected to the CAN bus/CAN/USB converter-SUBD9 and that a 5-pin cable has been used.
	No power supply	Check whether there is a reason for the absence of the voltage supply (installation or maintenance work, etc.). Switch on the voltage supply. Make sure that the correct pins are connected for CAN communication. (Pinout differs from standard pinout)
The target object is not detected, even though the sensor is OK	There may be an obstruction in the vicinity of the sensor	Check that the sensor is correctly aligned. Check the sensor parameterization and, if necessary, change the measurement mode. Information about various objects in the sensing range is provided by the object reflection list 0x4100 or in PACTware DTM in the "Reflections in Field of View" evaluation under the "Analysis" main menu.

Your automation, our passion.

Explosion Protection

- Intrinsic Safety Barriers
- Signal Conditioners
- FieldConnex® Fieldbus
- Remote I/O Systems
- Electrical Ex Equipment
- Purge and Pressurization
- Industrial HMI
- Mobile Computing and Communications
- HART Interface Solutions
- Surge Protection
- Wireless Solutions
- Level Measurement

Industrial Sensors

- Proximity Sensors
- Photoelectric Sensors
- Industrial Vision
- Ultrasonic Sensors
- Rotary Encoders
- Positioning Systems
- Inclination and Acceleration Sensors
- Fieldbus Modules
- AS-Interface
- Identification Systems
- Displays and Signal Processing
- Connectivity

Pepperl+Fuchs Quality
Download our latest policy here:

www.pepperl-fuchs.com/quality

PEPPERL+FUCHS

www.pepperl-fuchs.com

/ DOCT-9594