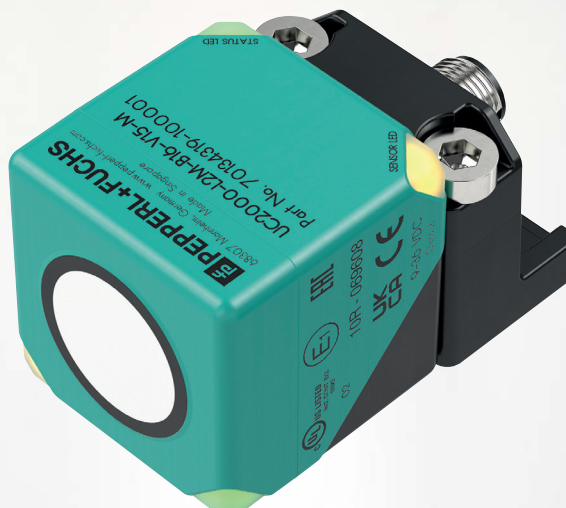


UC*-L2M-B16 Series

Parameterization of Ultrasonic Sensors with CANopen Interface

Manual



CANopen

Your automation, our passion.

 **PEPPERL+FUCHS**

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1	Introduction	6
1.1	Content of this Document	6
1.2	Target Group, Personnel	6
1.3	Symbols Used	6
1.4	Intended Use	7
1.5	General Safety Notes.....	8
1.6	Declaration of Conformity.....	8
2	Product Description	9
2.1	Use and Application	9
2.2	Indicators.....	10
2.3	Supported CANopen Functions	12
2.4	Accessories.....	12
2.4.1	Connection Accessories	12
2.4.2	Parameterization Aids	13
3	Installation.....	14
3.1	Safety Information	14
3.2	Preparation	14
3.3	Connection	14
4	Cybersecurity Information.....	16
5	Commissioning.....	17
5.1	Commissioning via PACTwareDC and DTM.....	17
5.2	Commissioning via CANopen Engineering Tool.....	19
5.2.1	Change Transmission Rate and Node ID	20
5.2.2	Enable Processing of the Process Data.....	20
5.2.3	Restoring Factory Default Settings	21
5.2.4	Evaluate Error Messages.....	21
6	Parameterization and Analysis Using PACTware and DTM via CANopen	22
6.1	Overview	22
6.2	Sensor Information Menu Item	23
6.3	Output Configuration Menu Item.....	24
6.4	Sensor Configuration Menu Item	24
6.5	Analysis & Echo Suppression Menu Item	27
6.6	Observation Menu Item	34

6.7	Service Menu Item	38
6.8	Menu Item Information	39
7	Parameterization Using the CANopen Engineering Tool with CANopen Objects..	40
7.1	CANopen Overview	40
7.2	CANopen Object Directory OV	41
7.3	Object 0x1000 Device Type	42
7.4	Object 0x1001 Error Register	43
7.5	Object 0x1002 Manufacturer Status Register	43
7.6	Object 0x1003 Predefined Error Field	43
7.7	Object 0x1005 SYNC Identifier	44
7.8	Object 0x1008 Vendor Device Name	44
7.9	Object 0x1009 Vendor Hardware Version	44
7.10	Object 0x100A Vendor Software Version	44
7.11	Object 0x1010 Save Parameters	44
7.12	Object 0x1011 Restore Factory Parameters	45
7.13	Object 0x1014 COB ID Emergency	45
7.14	Object 0x1015 Inhibit Time Emergency	45
7.15	Object 0x1017 Producer Heartbeat Time	45
7.16	Object 0x1018 Device ID (Identify Object)	46
7.17	Object 0x1020 Check Configuration	46
7.18	Object 0x1200 Server SDO Parameter (Default SDO)	46
7.19	Object 0x1400 1. RxPDO Input Data	46
7.20	Object 0x1600 Receive PDO Mapping 1. RxPDO	47
7.21	Object 0x2000 1. TxPDO Process Data	47
7.22	Object 0x2001 Operating Hours	48
7.23	Object 0x2010 Identification and Information	49
7.24	Object 0x2011 EMCY Configuration	49
7.25	Object 0x2020 Ultrasound Synchronization Mode	49
7.26	Object 0x2021 Ultrasonic Sensor with Sync Feature	50
7.27	Object 0x2022 Synchronization Object for Ultrasonic Synchronization	50
7.28	Object 0x4000 Measurement Configuration	51

7.29 Object 0x4001 Echo Suppression Configuration 52

7.30 Object 0x4002 Evaluation Configuration..... 55

7.31 Object 0x4003 Temperature Compensation Configuration 57

7.32 Object 0x4100 Echo Field Information 58

7.33 Object 0x4101 Switching Threshold Values 59

8 Synchronizing Multiple Sensors 60

9 Maintenance and Repair 62

9.1 Maintenance Work 62

9.2 Cleaning..... 62

10 Troubleshooting 63

10.1 What to Do in Case of Fault 63

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/device-information.

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.

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.



Tip

This symbol brings an useful tip to your attention.



Example

This symbol provides an example of the issue described.



Action

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

1.4 Intended Use

The UC*-L2M-B16 series ultrasonic sensors use ultrasonic pulses to detect objects. The sensor emits ultrasound, which is reflected by the object and received again by the sensor. The measured sound propagation time is used to determine the distance to the object (pulse-echo principle). Objects in the following forms can be detected: solid, granular, powder, or liquid. The color and surface structure of the objects are irrelevant. Gases cannot be detected.



Note

UC*-L2M-B16 series ultrasonic sensors are not safety components within the meaning of the EC Machinery Directive 2006/42/EC. They must not be used for the purposes of avoiding risk to individuals or parts of the body.

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.

1.5 General Safety Notes

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.



ISO9001

2 Product Description

2.1 Use and Application

The UC*-L2M-B16 series ultrasonic sensors use ultrasonic pulses to detect objects. The sensor emits ultrasound, which is reflected by the object and received again by the sensor. The measured sound propagation time is used to determine the distance to the object (pulse-echo principle). Objects in the following forms can be detected: solid, granular, powder, or liquid. The color and surface structure of the objects are irrelevant. Gases cannot be detected. The device has a standardized CANopen interface according to the CiA 301 specification.

You can parameterize the ultrasonic sensor in two ways. Either via a CANopen Engineering Tool or via DTM and an FTD frame application.

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

- Sag monitoring on packaging and metal processing machines
- To measure diameter of roll material (e.g., film, paper, metal sheet)
- To detect fill levels in tanks and silos
- To prevent collisions with self-propelled or controlled machines
- Height control of booms for crop sprayers
- To detect containers on refuse collection vehicles
- To detect objects or to measure fill levels on conveyor belts
- To detect pallets on forklifts
- For area monitoring on barrier systems
- To detect PCBs when feeding them to SMD placement machines

The L2M cubic housing design can be programmed and adapted to various applications via CAN. You can program the limits, the output modes, the output type, and the sound beam width via the CAN interface. Many other parameters can be set, such as filter options, echo suppression, synchronization settings, etc. This provides you with various adjustment options for programming, which you can use individually depending on your application.

The advantages of the UC*-L2M-B16 series ultrasonic sensors are:

- Tried and tested VariKont cubic housing design
- CANopen interface for service and process data, and for parameterization
- E1 approval
- Increased EMC strength
- Excellent immunity to background noise such as compressed air
- Can be self-synchronized to prevent cross-talk between several adjacently mounted ultrasonic sensors
- Programmable echo suppression

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 echoes are visualized. Analysis and observation functions allow you to record and evaluate your situations.

As FTD frame application, we recommend using the "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 and 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 "CANopen Parameterization Tool", which contains PACTware, PACTware DC, the device driver for the CAN/USB converter-SUBD9, and the DTM for CANopen 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 "CANopen Parameterization Tool" and the device DTM, can be found at www.pepperl-fuchs.com, on the product page for the UC*-L2M-B16 series.

Parameterization Using the CANopen Engineering Tool

You can carry out parameterization directly via the CANopen object directory using a CANopen Engineering Tool with LSS Manager functionality of your choice. CANopen Engineering Tools for configuration and parameterization are available from various suppliers. An EDS configuration file is available for easy integration and parameterization of the ultrasonic sensor. This can be found at www.pepperl-fuchs.com on the product page for the UC*-L2M-B16 series.

2.2 Indicators

The ultrasonic sensor has multicolor 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.

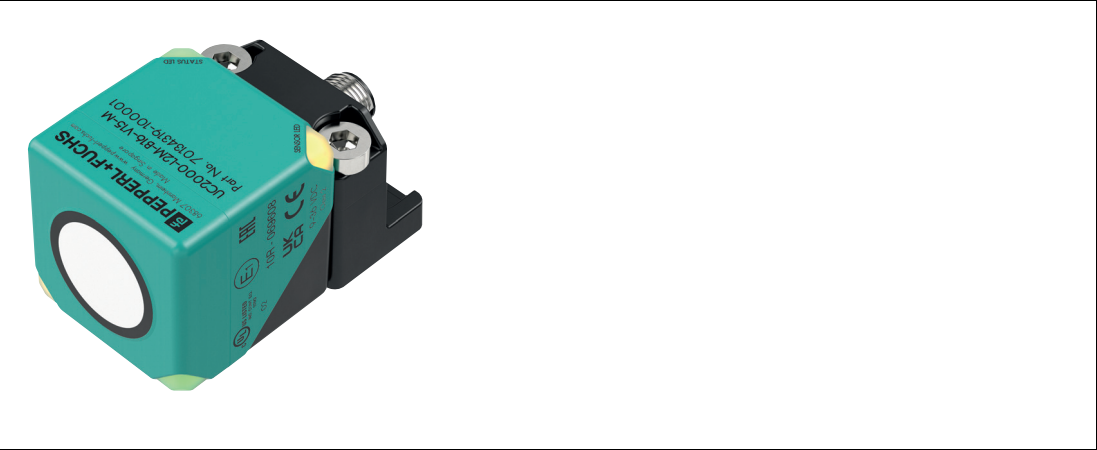


Figure 2.1

SENSOR LED Object in the evaluation area
(yellow)

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



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	LSS configuration state is active (flashing frequency 10 Hz)
Flashing	The device is in the "Pre-Operational" NMT state. (Flashing frequency 2.5 Hz)
One short flash	The device is in the NMT state "Stopped"
Three short flashes	A software download is running on the device

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 "LSS-Node-ID" is not configured. CANopen is not initialized
Flashing	General error, invalid configuration on the device
One short flash	The CAN controller error counter has reached or exceeded its warning limit

Table 2.3

2.3 Supported CANopen Functions

The device has a standardized CANopen interface in accordance with the CiA301 specification. All usable CANopen objects of the object directory are listed in this manual.

Additional functions (sound beam width, echo suppression, etc.) can be configured. You can set the node ID and baud rate via LSS.

You can set the transmission speed in increments of 125 kbit/s up to 1 Mbit/s, according to CiA 102, Table 1 and CiA 301 5.4, Table 1. We support transmission speeds of 125, 250, 500, 800, and 1000 kbit/s. The maximum cable length for 1 Mbit/s must be 30 m.



Note

An EDS configuration file is available for easy integration and parameterization of the ultrasonic sensor. You can download it from www.pepperl-fuchs.com, on the product page for the UC*-L2M-B16 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 CANopen Functions

- Process data objects (PDO) – (dynamic configuration)
- Service data object (SDO)
- Heartbeat monitoring mechanism
- Layer settings service (LSS) for setting the node ID and baud rate
- Save and recovery function (store and load parameter field)
- Error messages by emergency object (EMCY)
 - Error register
 - Vendor-specific status register (manufacturer status register)
 - Error list (pre-defined error field)
- Status and fault indicator (status LED according to CiA 303-3)

Vendor-specific properties and functions

- Operating hours
- Application-specific tag, function tag, location tag
- Synchronization function for CANopen sensors

The UC*-L2M-B16 series ultrasonic sensors support the following modes of operation:

- Cyclic operation: The distance value is sent cyclically (regularly, adjustable interval) via the bus.
- SYNC operation: The distance value is sent after receiving a synchronization message (SYNC). The position value is sent every n SYNCs ($n = 1 \dots 240$). The sensor accepts synchronous modes 00-F0h and event-driven modes FEh and FFh.

2.4 Accessories

Various accessories are available.

2.4.1 Connection Accessories

Various connection cables and cordsets are available for connecting the sensors of the UC*-L2M-B16 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 and manual. The relevant DTM contains comprehensive context-related help texts.

2.4.2 Parameterization Aids

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

Designation	Description
CANopen Parameterization Tool	Software package for simple commissioning and parameterization of the sensor, consisting of: - PACTware/PACTware DC - DTM for CANopen communication - VCI driver for the CAN/USB converter-SUBD9 Visit www.pepperl-fuchs.com and see the product page for the relevant UC*-L2M-B16 series sensor
DTM for UC*-L2M-B16	DTM (Device Type Manager)—device description and graphic user interface for ultrasonic sensor parameterization, integration into the system environment Visit www.pepperl-fuchs.com and see the product page for the relevant UC*-L2M-B16 series sensor
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 CANopen communication	Device Type Manager—software for operating the CAN/USB converter-SUBD9 via FDT frame application Not required when installing the "CANopen 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 ultrasonic sensor. Includes the following components: - CAN/USB converter-SUBD9 - Power supply for CAN/USB converter-SUBD9 - Connection cable and adapter cable for components The CANopen Parameterization Tool contains both VCI drivers for the CAN/USB converter-SUBD9 and the DTM for CANopen communication for CAN communication with PACTware/PACTwareDC.

Table 2.4

3 Installation

3.1 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.
-

3.2 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.

3.3

Connection

**Note**

Use a shielded 5-wire sensor connection cable to connect the sensor to a CANopen bus, because the pinout of the CANopen specification differs from the standard pinout.

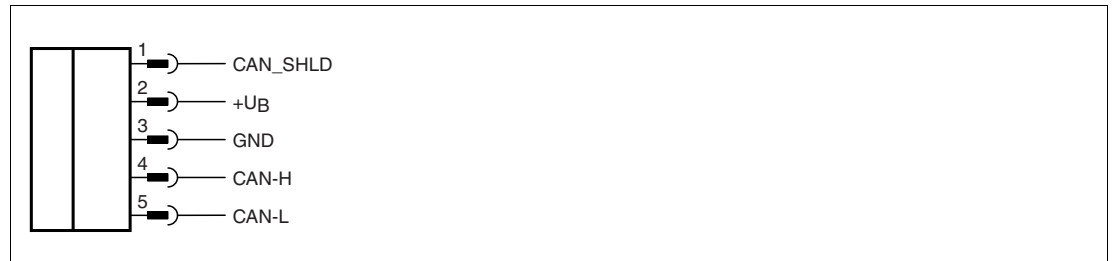
Wiring Diagram

Figure 3.1

**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. Now 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 Fixed Cable with 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. Now connect the supply voltage to the cables provided for this purpose and switch it on.
- ↳ The sensor is now ready for operation.

4 Cybersecurity Information

Security Context

The device is designed for use in an industrial CAN bus network , such as in mobile equipment, tanks and silos, and packaging and metal-processing machines. The plant operator must ensure that the device is physically protected against unauthorized access. It must also be ensured that only well-known and trusted nodes are connected to the CAN bus network.

Decommissioning

Only adjustable parameter data are permanently saved. Parameter data can be deleted by restoring factory settings, but operating time data cannot be deleted. In case of doubt, the device must be physically destroyed to ensure these data are also destroyed.

5 Commissioning

5.1 Commissioning via PACTwareDC and DTM



Note

Various software components, adapters, and cables are required as parameterization aids for the parameterization of a CANopen ultrasonic sensor see chapter 2.4.2.

The various software components can be downloaded from www.pepperl-fuchs.com, on the respective UC*-L2M-B16 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 "CANopen 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 CANopen using "PACTware" software and the associated DTM (Device Type Manager). Proceed as follows:

1. Preferably install the "CANopen Parameterization Tool."



Note

After installing the "CANopen Parameterization Tool", the computer must be restarted.

↳ 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. Install the DTM for the UC*-L2M-B16 sensors.



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

1. Connect the sensor to the T-distributor for the CAN/USB converter-SUBD9 at input 1 using a 5-pin connection cable.
2. Connect the power supply to the T-distributor for the CAN/USB converter-SUBD9 at input 2 using the adapter cable (2.10 mm DC cable socket to 4-pin M12 plug).



Caution!

Malfunctions may occur

The switch for the terminal resistor may only be actuated as long as the T-piece is not connected to the SUBD9 connector on the CAN/USB converter SUBD9.

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 and tighten.
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 lights up green on the CAN/USB converter-SUBD9.

If this is not the case, check:

- whether the correct CAN-USB driver is installed for 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.

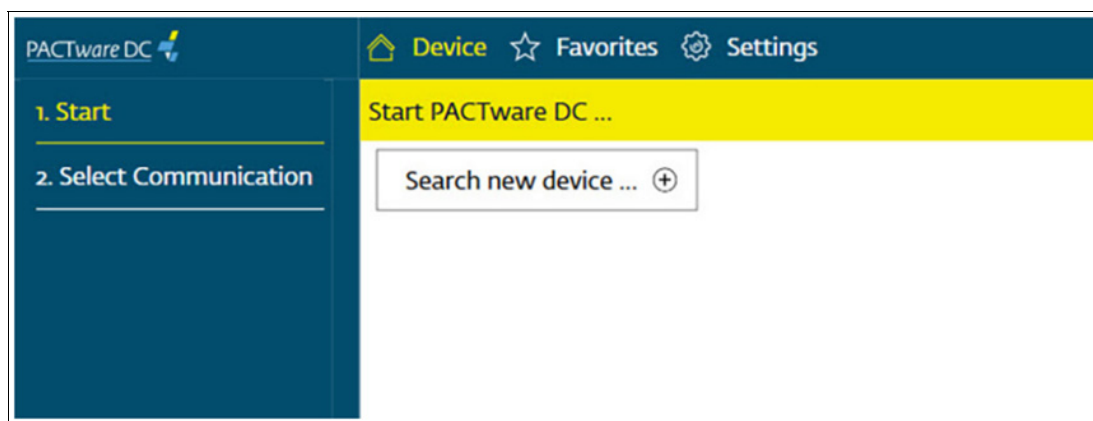


Figure 5.1

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

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

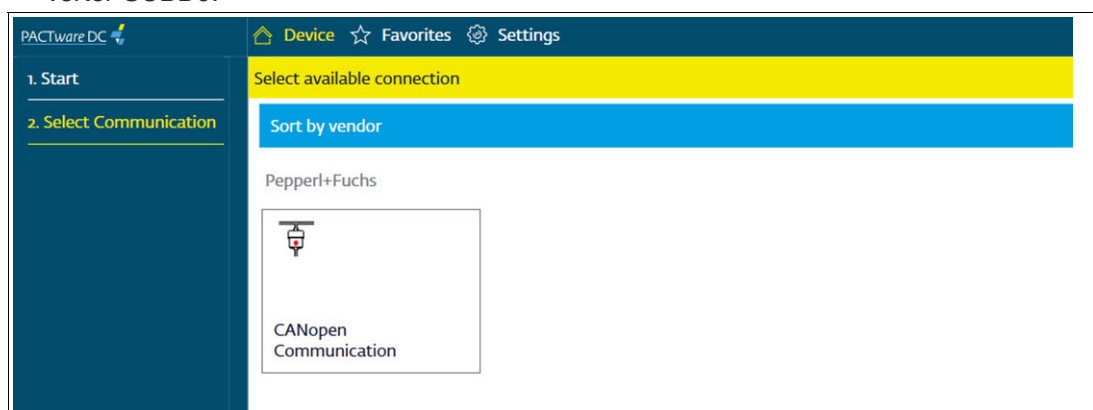


Figure 5.2

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

↳ PACTwareDC finds connected devices.

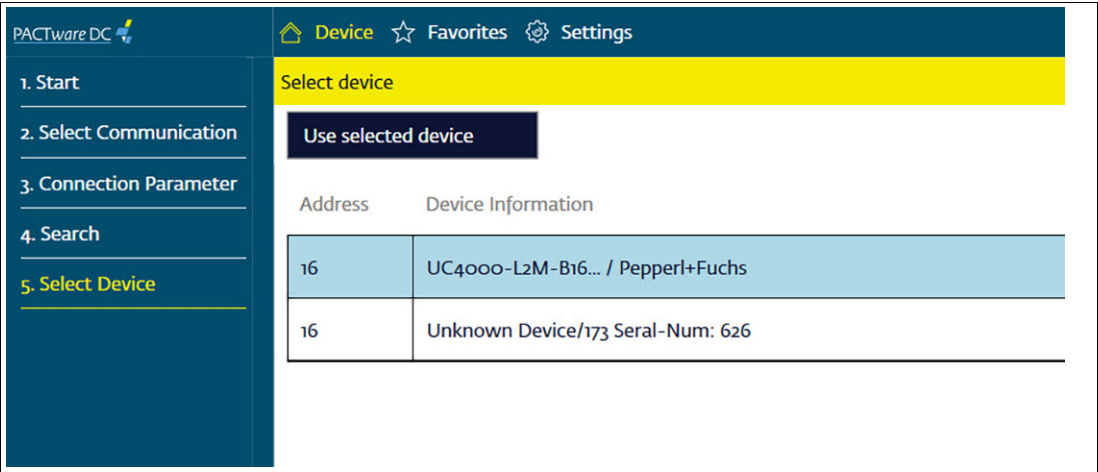


Figure 5.3

4. Now select the desired device by double-clicking.
- ↳ PACTwareDC establishes a connection to the sensor, allowing you to then access the sensor.

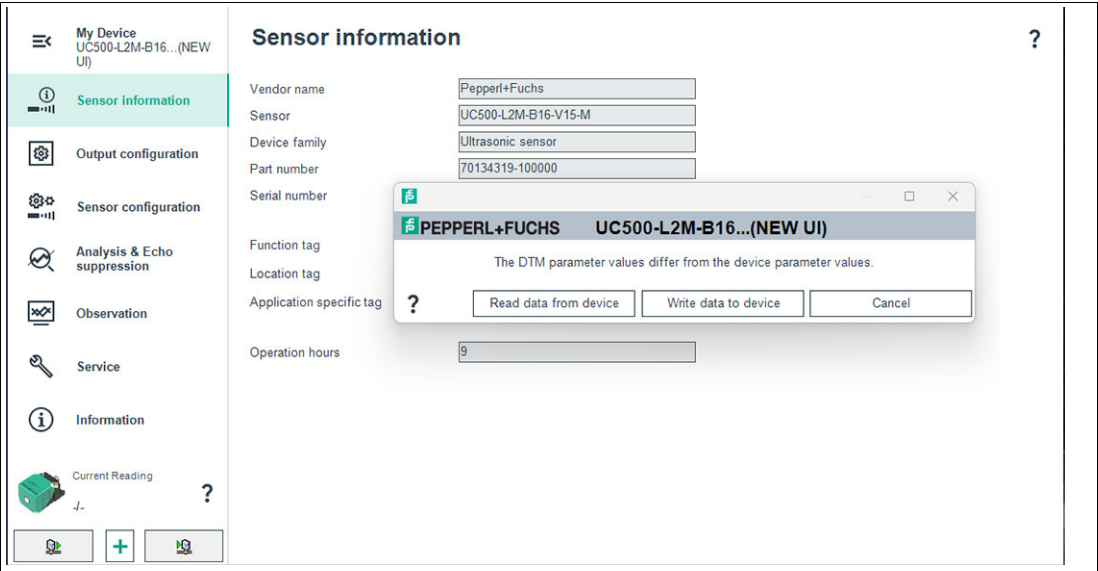


Figure 5.4

5.2 Commissioning via CANopen Engineering Tool



Note

Before commissioning the sensor on a CAN bus, check whether the communication parameters of the sensor match your CANopen network. The factory default settings are a transmission rate of 250 kbit/s and a node ID of 16. If the node ID is already assigned or not desired and a different transmission rate is required, you can change these settings.



Basic Commissioning Steps

1. Connect the sensor to the CAN bus and ensure a 24 V DC electric power supply.
2. If necessary, change the communication parameters of the sensor using a suitable CANopen 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 also sufficient.
 - ↳ The green LED flashes and the sensor is in the "Pre-operational" state. The sensor sends the heartbeat message with the CAN identifier 0x700+Node-ID (default 0x710). You can now parameterize the sensor using service data objects (SDOs).
 - ↳ If communication conditions are faulty, the red LED flashes, and the sensor is in the "Error-passive" state.



Note

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

5.2.1 Change Transmission Rate and Node ID



Change the transmission rate (baud rate) and the node ID using the following steps:

1. The sensor can be found by the vendor ID and product code, e.g., UC500-L2M-B16-V15-M (see datasheet) using a classic LSS scan. If the sensor has node ID 255, an LSS fast scan can also be used. This is shown by the rapid flashing of the status LED.
2. If the sensor is found, set it in LSS configuration mode either with the "Switch state selective" service or all devices with the "Switch state global configuration" service.
3. Now set the required node ID and baud rate.
4. Save the new values as persistent objects using the "Store configuration" service.
5. Send an NMT reset command to the sensor to activate the node ID.
 - ↳ The baud rate will be active after a successful "Activate bit timing" LSS service.

5.2.2 Enable Processing of the Process Data

To enable the sensor to send/receive process data, you must set the sensor to the Operational state using an NMT Main Device in accordance with CiA 301.

The mapping of the process data is specified in the respective TPDO Mapping Parameter. Here, the available objects are coded in the various subindices. The process data sequence corresponds to the subindices sequence.

By default, the process data are mapped as follows:

Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
Distance byte 0 LSB	Distance byte 1 MSB	Signal quality byte 0	8-bit counter				

Table 5.1

The mapping in TPDO1 is dynamic and you can change it. The following objects can be mapped.

- Distance
- Signal Quality
- 8-Bit Counter
- 16-Bit Counter
- Status Register
- Error Register
- Vendor Status Register
- Operating Hours



Note

Please note the following aspects when changing the mapping entries of TPDO1 (subindices of 0x1A00). The coding describes the index, subindex, and size in bits. For object index 0x2000 subindex 0x01, which is 16 bits (0x10), 0x20000110 must be written. For object 0x2010:2, which is also 8 bits, the next subindex 0x20100208 must be written.

To change the mapping, perform the following steps:

1. Disable TPDO1 by setting the "Invalid Bit" to 0x1800:1 COB ID (writing 0x80000190).
2. Disable the current mapping by writing a 0 to 0x1A00:0.
3. Change the mapping entries (subindices of 0x1A00) as required and note the above.
4. Enable mapping by writing the number of required mapping entries to 0x1A00:0. For example, you must enter a "3" for three objects.
5. Enable TPDO1 by resetting the "Invalid Bit" to 0x1800:1 COB ID (writing 0x190).

5.2.3 Restoring Factory Default Settings



You can restore the sensor's factory settings using index 0x1011 "Restore default parameters":

1. Write the signature "load" 0x64616F6C in object 0x1011:1 of the sensor.
2. Switch off the voltage supply to the sensor and then switch it on again (power cycle).
3. Alternatively, you can also trigger a NMT Node Reset .

↳ The sensor's factory settings are now restored.

5.2.4 Evaluate Error Messages

If an error occurs in the sensor, it sends a CANopen emergency message (EMCY). The COB ID of the emergency message can be changed to object 0x1014. The value 0x80 + node ID (0x90) is stored by default.

Each emergency message can only be sent once, even if the error persists. It consists of an "Error code" and additional vendor-specific information.

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

The error register (object 0x1001) is updated for each emergency message according to the error category that occurs/disappears. You can call up a history of the emergency messages that have occurred using index 0x1003.

6 Parameterization and Analysis Using PACTware and DTM via CANopen

6.1 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, providing they support DTM. 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 CANopen and analysis of the sensor behavior, the DTM (Device Type Manager) described below offers you a wide range of options.

In addition to sensor parameterization, you can use the **Analysis & Echo Suppression** and **Observation** menus to display and record sensor logic in operation so as 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 UC*-L2M-B16 series using the example of the UC2000-L2M-B16-V15-M sensor. Individual sensors in the product family differ, e.g., in terms of their detection range. Consequently, the DTMs of the respective product versions may differ from the following screenshots.

Context-Related Help Texts via F1

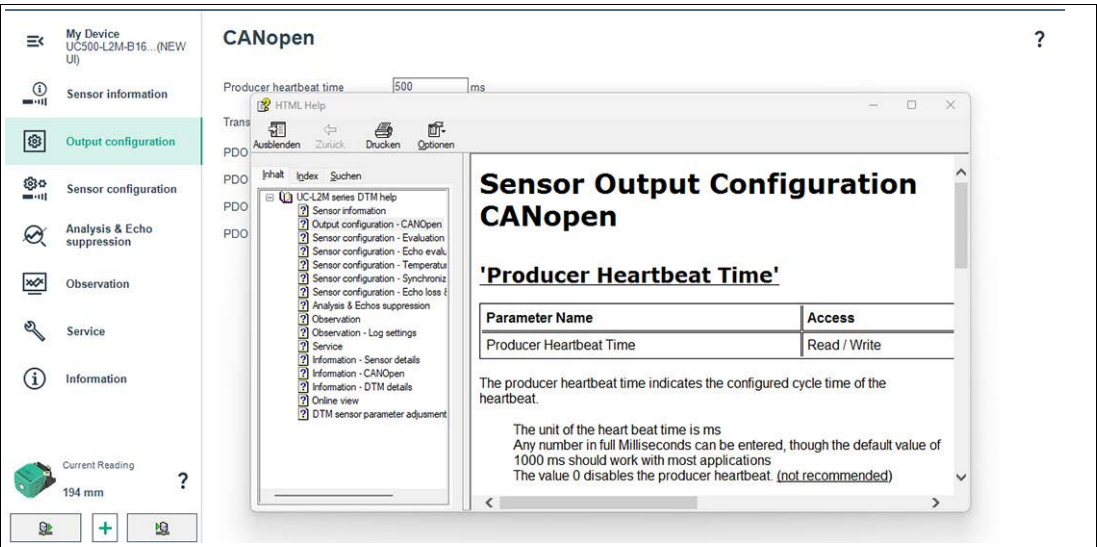


Figure 6.1

In the DTM, you can access context-related help texts by clicking on the "?" symbol 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.

6.2 Sensor Information Menu Item

My Device
UC500-L2M-B16...(NEW UI)

Sensor information

Output configuration

Sensor configuration

Analysis & Echo suppression

Observation

Service

Information

Current Reading
195 mm

Sensor information

Vendor name

Sensor

Device family

Part number

Serial number

Function tag

Location tag

Application specific tag

Operation hours

Pepperl+Fuchs

UC500-L2M-B16-V15-M

Ultrasonic sensor

70134319-100000

40000131814164

Your automation, our passion.

9

Figure 6.2

In the **Sensor information** menu item,

- 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 (strings) can be input in the "Function tag", "Location tag", and "Application specific tag" fields.

6.3 Output Configuration Menu Item

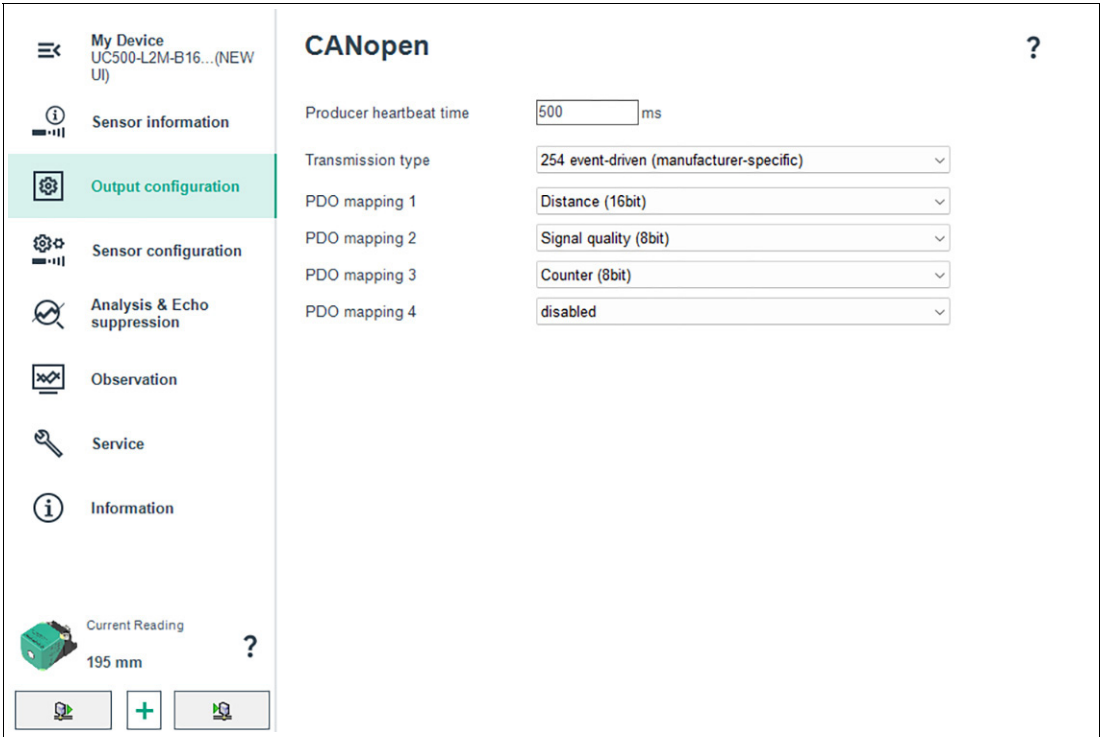


Figure 6.3
In the **Output configuration** menu item, it is possible to set the sensor's PDO mapping.

6.4 **Sensor Configuration Menu Item**
Overview of the Sensor Configuration Menu Item

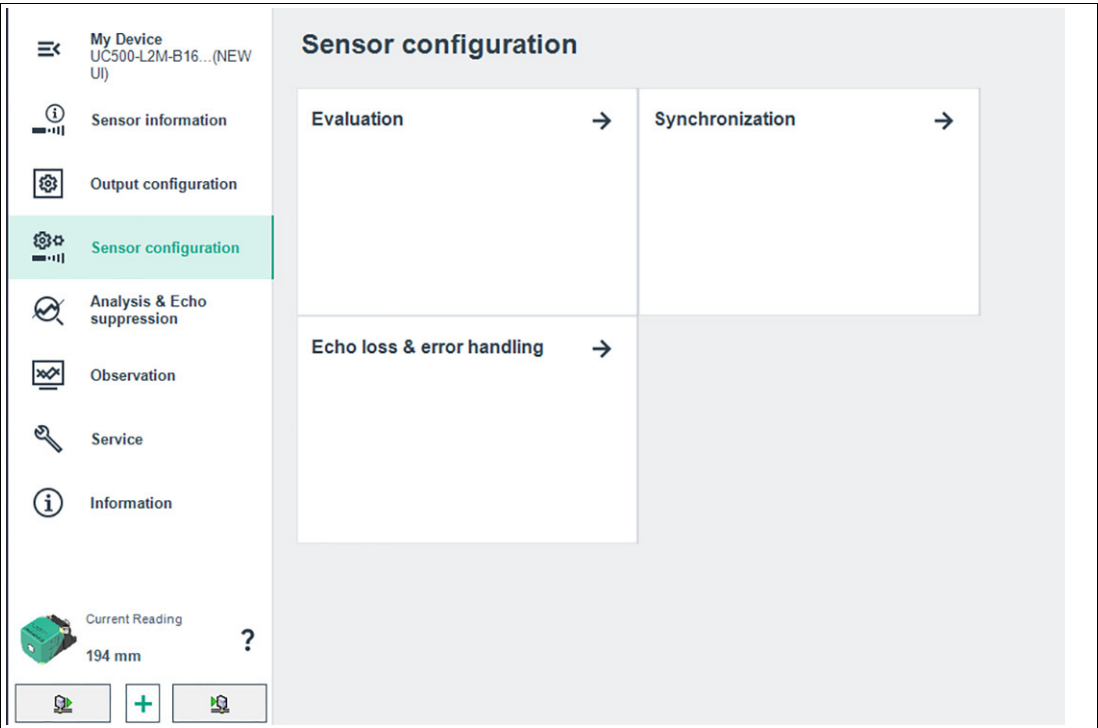


Figure 6.4
The **Sensor Configuration** menu item consists of three tabs

- Evaluation (with reduced and advanced view)
- Synchronization
- Dealing with echo loss and troubleshooting

Evaluation Tab (Advanced View)

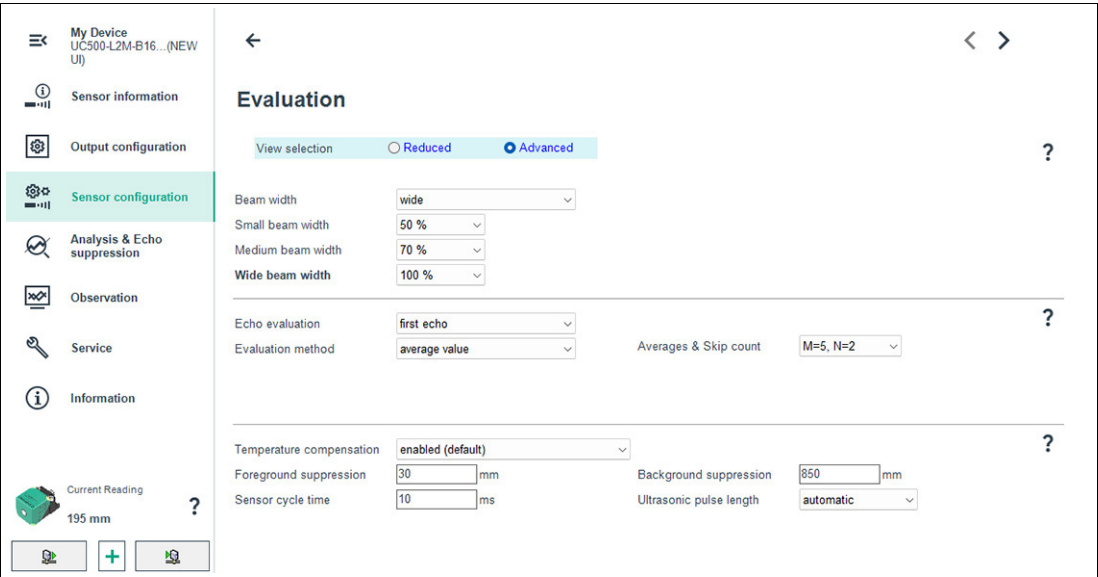
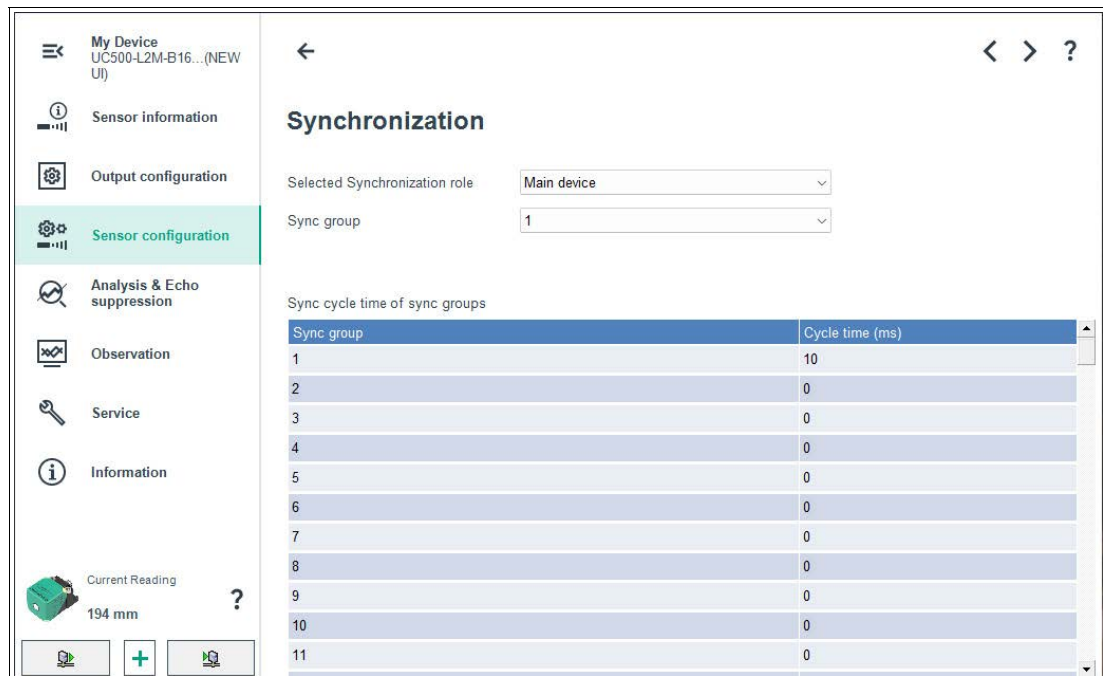


Figure 6.5

In the **Analysis** tab, you can set the functions that impact behavior during sensor measurement. You can choose between a reduced view for basic settings and an advanced view for output logic expert settings.

Synchronization Tab



In the Synchronization tab, you can set the desired synchronization type if you want to suppress cross-talk when operating multiple UC*-L2M-B16 sensors.

You can choose between two synchronization roles for the sensor:

- **Main Device:** The sensor works as a generator of the ultrasound synchronization signal (object 0x1801 US-Sync-TPDO) for all other UC*-L2M-B16 sensors.
- **Secondary Device:** The sensor is a secondary sensor and waits for an ultrasound synchronization signal to be received from a Main Device before starting measurement.

Details of the individual synchronization modes can be found in the chapter "Synchronizing Multiple Sensors."

Echo Loss and Error Handling Tab

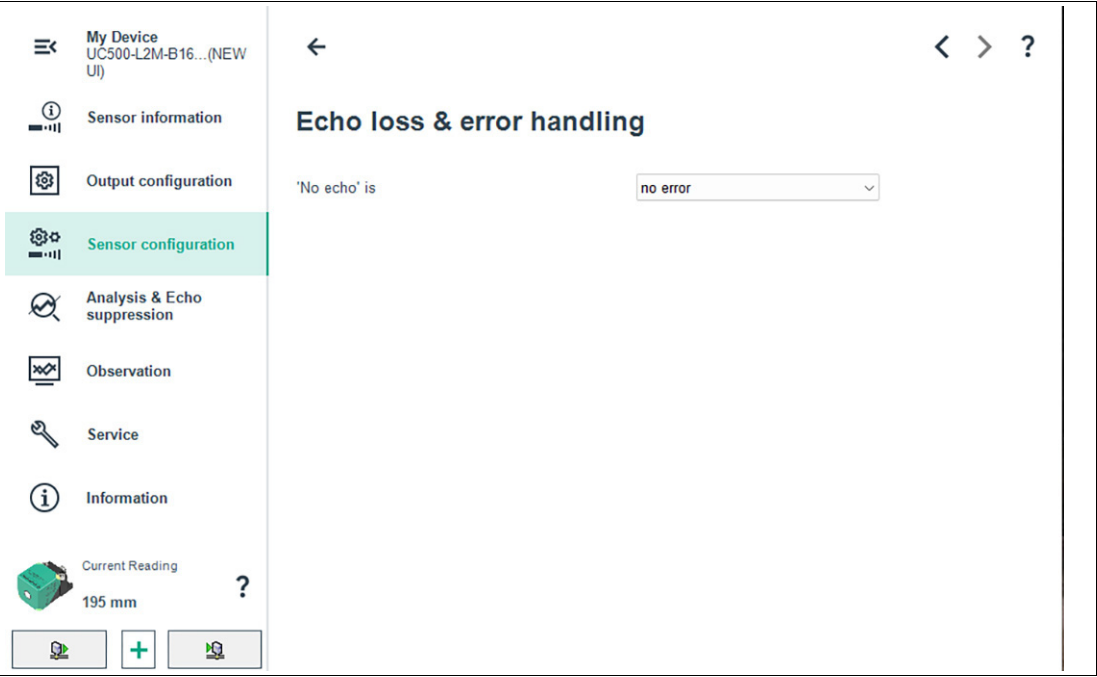


Figure 6.6
In the **Echo Loss and Error Handling** tab, you can adjust the evaluation of echo loss and the error output logic in the process data.

6.5 Analysis & Echo Suppression Menu Item

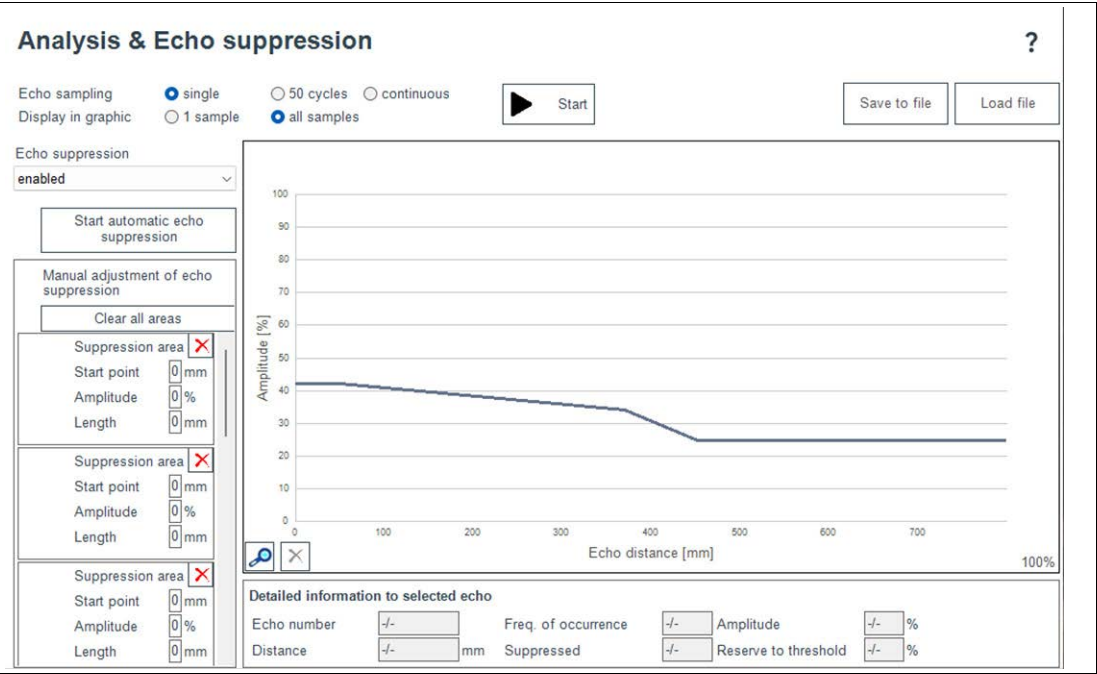


Figure 6.7
In some applications, machine parts or support bars within a tank obstruct the sensing area, preventing proper distance or level measurement. Using the **Analysis & Echo Suppression** menu item, you can visualize and analyze all echoes received by the ultrasonic sensor from one or a series of measurements, as well as suppress the disruptive objects in the sensing area.

2025-12



The general procedure is as follows:

1. You must first establish a connection to a sensor built into the application environment.
2. Ideally carry out multiple echo samples.
 - ↳ The corresponding data will then be shown in the display together with the switching threshold of the sensor (blue line).
3. Start automatic echo suppression. If necessary, you can correct the suppression areas. Alternatively, you can also manually set the suppression areas.
4. Finally, verify the detected settings by taking new echo samples.
 - ↳ The detected settings can be saved to/loaded from a file.

Menu Description

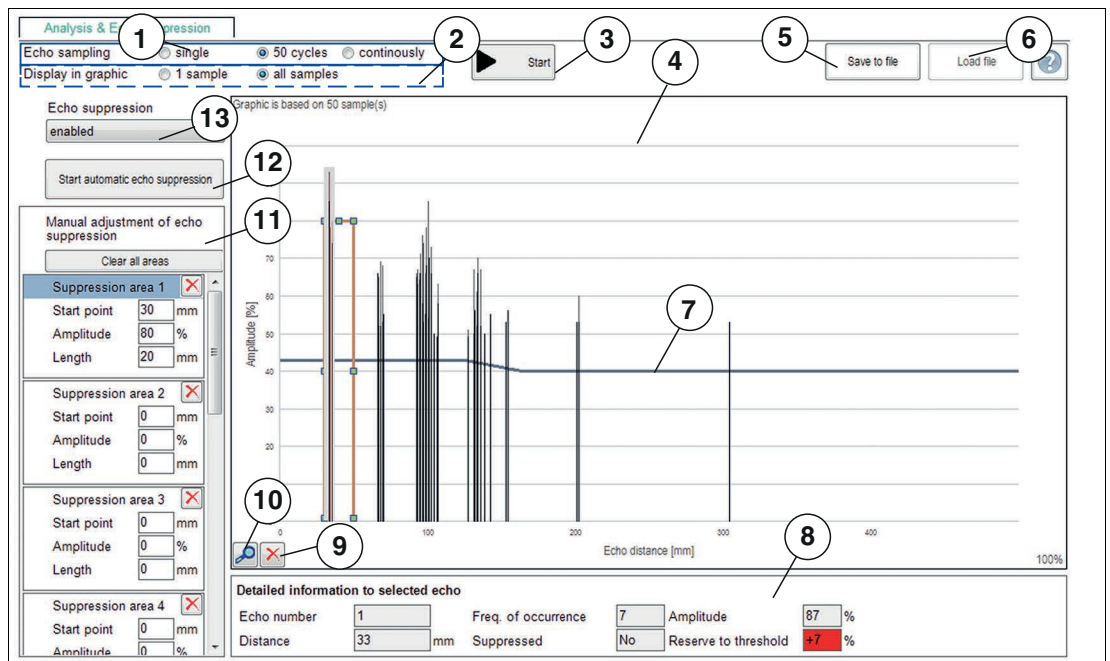


Figure 6.8

No.	Name	Explanation
1	Echo sampling	In the "Echo sampling" area, you can choose whether to record a single value, 50 values, or continuous data. Using the continuous display also provides you with an alignment aid. You can use the displayed amplitude of the evaluated echo to check whether the sensor is optimally aligned to the object. This is the case when a slight variation in the alignment no longer results in an increase in the displayed echo amplitude.
2	Display in graph	You can use the "Display in graph" area to set whether all of the gathered recorded echoes are shown or only the last recorded echo image. The former is recommended if you want to set suppression areas in an application; the latter in order to verify detected suppression areas.
3	Start	The "Start" button is used to start and stop echo sampling. After echo sampling has started, the button changes to "Stop." - In the case of "individual" echo sampling, echo sampling stops after one measurement. - In the case of "50 values" echo sampling, echo sampling automatically stops after 50 measurements. You can stop it at any time by pressing the button. - In the case of "continuous" echo sampling, echoes will continue to be sampled until you press the button again.
4	Display area	The sampled echoes are displayed in the form of thin columns during and after completion of echo sampling. The counter in the upper left corner indicates the number of echo samples the current graphic is based on.
5	Save to file	You can save the echo sample, including set suppression areas, 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."

No.	Name	Explanation
6	Load file	You can load previously saved echo samples to the DTM by pressing the "Load file" button, allowing you to assess or evaluate the samples. Note: A saved file can only be loaded when the connection to the sensor is disconnected.
7	Sensor switching threshold (blue line)	In addition to the recorded echoes, the switching threshold of the sensor will also be displayed as a "blue line." Echoes for which amplitude exceeds this threshold can be evaluated by the sensor. Echoes below the switching threshold are in effect suppressed and are discounted by the sensor during evaluation.
8	Details of the selected echo	If you click on one of the echo columns shown in the graph, detailed information about the selected echo will be displayed below the graph. Note: More information on this can be found in the following section, "Details about sampled echoes."
9	Clear echo sample	You can use the "Clear echo sample" button to clear the display area and restore to the original state.
10	Rescale diagram	You can use the "Rescale diagram" (magnifying glass) button to enlarge the view in the x direction up to 5-fold in 100 % increments. If magnification is set to more than 100 %, the displayed area can be shifted in the x direction (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.
11	Manually adjusting the suppression areas	The area allows you to manually set individual suppression areas. 10 areas can be individually customized as well as deleted individually or all at once. Each suppression area is defined by three parameters: "Start point", "Amplitude" and "Length". • The mm value entered for "Start point" specifies where the suppression area starts on the x-axis of the graph. • The % value for "Amplitude" specifies the height of the suppression area in keeping with the scale of the y-axis. • The mm value entered for "Length" specifies the length of the suppression area measured from the respective start point. Individual areas can be cleared by either pressing the relevant button with the red "X" or by going directly to the graph and clicking on the framed area and pressing the "Del" button on the keyboard. It is necessary to clear a single area, for example, if the echo from the target object is also contained in the echo sample and was also suppressed by automatically setting the suppression areas. All areas can be cleared by pressing the "Clear all areas" button.
12	Start automatic echo suppression	Automatic echo suppression is a quick and simple, one-click option to suppress all previously sampled echoes. You must first take a sample of the echoes with the sensor installed and then press the "Start automatic echo suppression" button. The recorded echoes are then suppressed by setting the individual suppression areas based on algorithms.
13	Echo suppression activated/not activated	The "Echo suppression activated/not activated" parameter switches echo suppression in the sensor on or off and shows or hides the echo suppression display in the menu.

Table 6.1

Details about sampled echoes

Using an echo sample with manual echo suppression as an example, the following sets out the graphic elements of information in the display area.

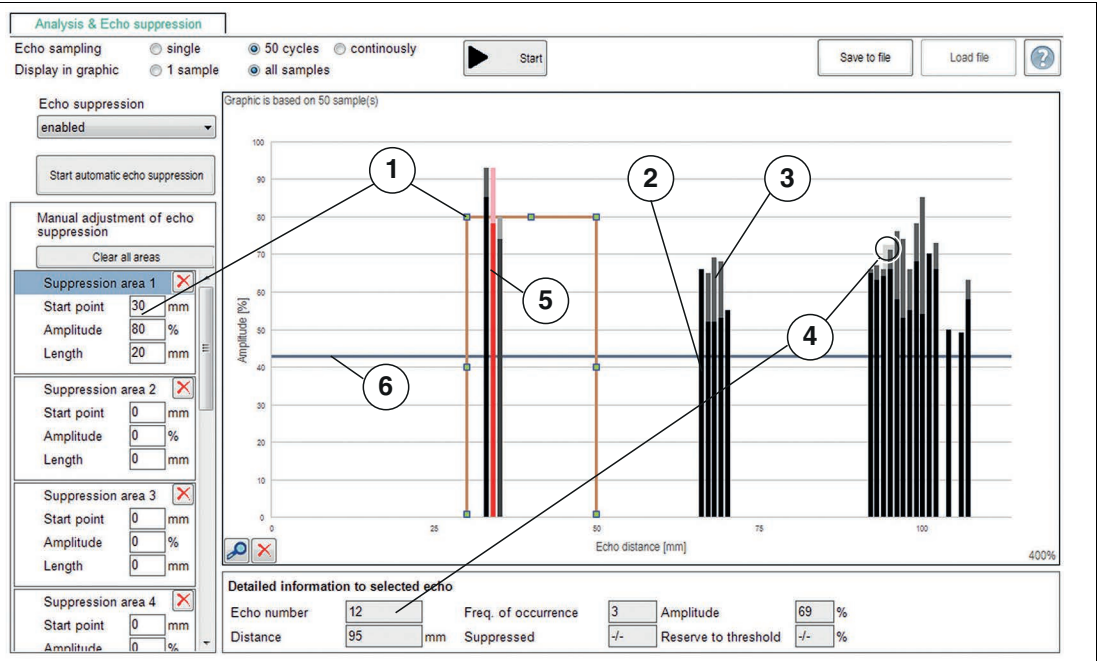


Figure 6.9

No.	Name	Explanation
1	Suppression area	A rectangle indicates the specified suppression area.
2	Black part of the column	If multiple echo samples are shown in the graph, the black part of each column shows the amplitude that each of the recorded echoes reached from this distance.
3	Gray part of the column	The gray part of the column, above the black part, shows the variance in the strength of amplitude of all echoes from this distance.
4	Details of the selected echo	Clicking on a column from the echo sample displays the following detailed information in the "Details of the selected echo" area: • Echo number: The echo number is a consecutive number that numbers the echoes shown in the graph from left to right. • Frequency of occurrence: The value of the frequency of occurrence indicates how often the selected echo occurs in the currently displayed number of echo samples. • Amplitude: The strength of the amplitudes of the selected echo is displayed as a % value • Distance: The distance indicates the distance corresponding to the displayed echo value measured from the sensor surface in mm. Note: The displayed distance value always refers to the runtime measured by the sensor after the relevant echo was taken. This does not mean that an object has to be physically present in each of these distances. For example, if an object is located close to the sensor, so-called multiple echoes may occur. This involves reflecting the sound pulse of a measurement back and forth several times between the sensor and the object. The sensor treats each echo reflected from the object as a separate echo and provides it accordingly. These multiple echoes can be identified in the graph as echoes at x-fold the actual object distance. • Suppressed: When indicating suppression (yes/no), the displays shows whether the selected echo exceeds or falls below the switching threshold. If the echo amplitude exceeds the switching threshold, the echo is "not suppressed", but can be evaluated by the sensor. If the echo amplitude is lower than the switching threshold, the echo is "suppressed." • Reserve for threshold: The threshold reserve value indicates how reliably an echo is detected or suppressed. This value is shaded by traffic light colors so that evaluation can be carried out easily.
5	Red column	The evaluated echo of the last recorded echo samples is displayed in the graph as a red column. This specific representation makes it possible to subsequently verify the effectiveness of set suppression areas because the evaluated echo can be easily distinguished from the rest.
6	Sensor switching threshold (blue line)	In the graph, a "blue line" indicates the switching threshold of the sensor alongside the recorded echoes. Echoes for which amplitude exceeds this threshold can be evaluated by the sensor. Echoes below the switching threshold are in effect suppressed and will be discounted.

Table 6.2

Application Information for Echo Suppression

In order to be able to suppress echoes, you first have to set the "Echo suppression" parameter to "enabled", provided that the parameter is not already set accordingly in the connected sensor. The "Start automatic echo suppression" button as well as the parameter values of the available suppression areas 1–10 are then displayed in the DTM.

Ideally, echo suppression areas should be based on a variety of echo samples (at least 50) because the echo amplitude can vary from measurement to measurement depending on the ambient conditions.

Obtaining sampled echoes from the original sensor mounting location in the plant is mandatory before starting targeted echo suppression.

Automatic Echo Suppression

If the echo from the target object is also contained in the echo samples, this will be suppressed through automatic echo suppression. This may occur, for example, when echo samples are taken in a partially-filled tank because then the echo from the surface of the liquid is also included in the echo samples.

The same applies in the case where samples are carried out in an empty tank because the echo from the base of the tank in most cases should still be identified as "Tank empty", even after echo suppression.

In these cases, a manual correction must be carried out to the corresponding suppression area to eliminate the relevant echo from the suppression (see section on "Manual echo suppression").

If there are an extremely large number of "echo blocks" in the echo samples, the 10 available suppression areas for algorithm-based automatic suppression may not be sufficient to suppress all of the sampled echoes. In this case, it is necessary to carry out manual adjustments to the individual suppression areas (see section on "Manual echo suppression").

Manual Echo Suppression

Each of the 10 suppression areas is specified via the "Start point", "Amplitude", and "Length" parameters (see section on "Menu description"). Each area can be modified or deleted individually or all at once.

To reliably suppress echoes under varying ambient conditions (for example fluctuations of air temperature or air humidity), we recommend selecting a suppression area that is larger than the echo or echo block to be suppressed. Specifically, this means that the amplitude value of the suppression area should be set at least 10 % higher than the largest echo amplitude to be suppressed. However, it must not be set too high, otherwise the detectable echo (e.g., of a fill level) would also no longer be detected. For indoor applications, the lateral boundaries of the suppression area should be set to +/- 5 % and for outdoor applications to +/- 10 % of the relevant echo distances, which should be suppressed with the area.

Example

In terms of the following echo sample, the echo labeled with the red arrow should be suppressed. The echo labeled with the green arrow comes from the object that is to be detected (e.g., the level surface).

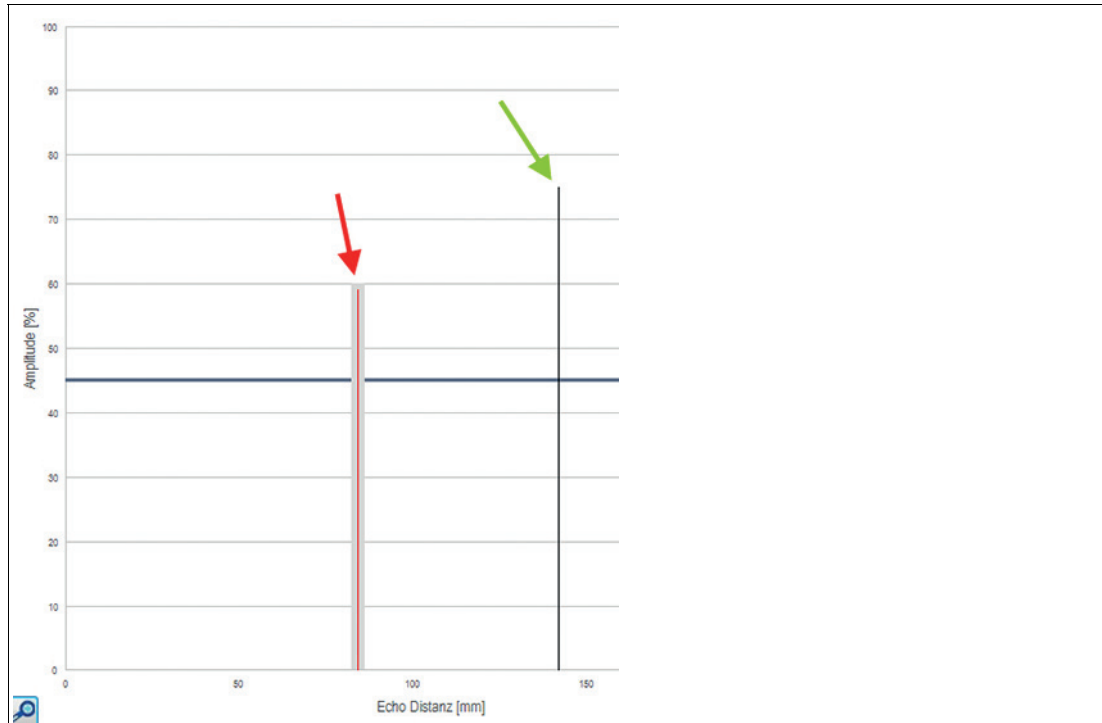


Figure 6.10

The echo to be suppressed has an amplitude of 59 % at a distance of 84 mm. To suppress the echo correctly and with reserve, for an indoor application the parameters for the suppression area should be set as follows (the corresponding values for an outdoor environment are shown in parentheses):

- Start point: 80 mm (75 mm)
- Amplitude: 69 % (69 %)
- Length: 8 mm (18 mm)

The graph with set suppression area for an indoor application is as follows:

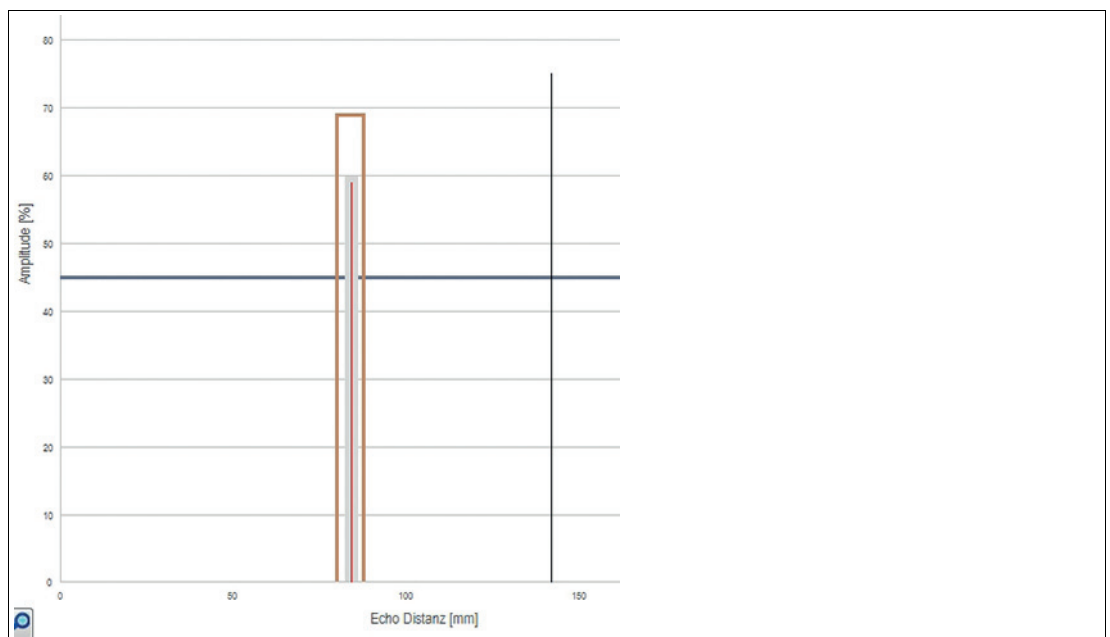


Figure 6.11



Note

The boundaries of suppression areas can also be adjusted directly within the graph by left-clicking and dragging with the mouse.



Note

The amplitude difference between unwanted echoes and echoes from the desired target is critical to proper echo suppression performance.

With echoes from target objects that reflect well, unwanted echoes in the peripheral areas can be suppressed very successfully without impairing function because the echo amplitudes of the unwanted echoes are not too high in this case.

On the other hand, unwanted echoes in the center of the sound beam usually create an echo, which is situated in approximately the same amplitude range as the echo of the object to be detected. For this reason it is not usually possible to suppress unwanted echoes with normal reflective properties in the center of the sound beam.

6.6 Observation Menu Item

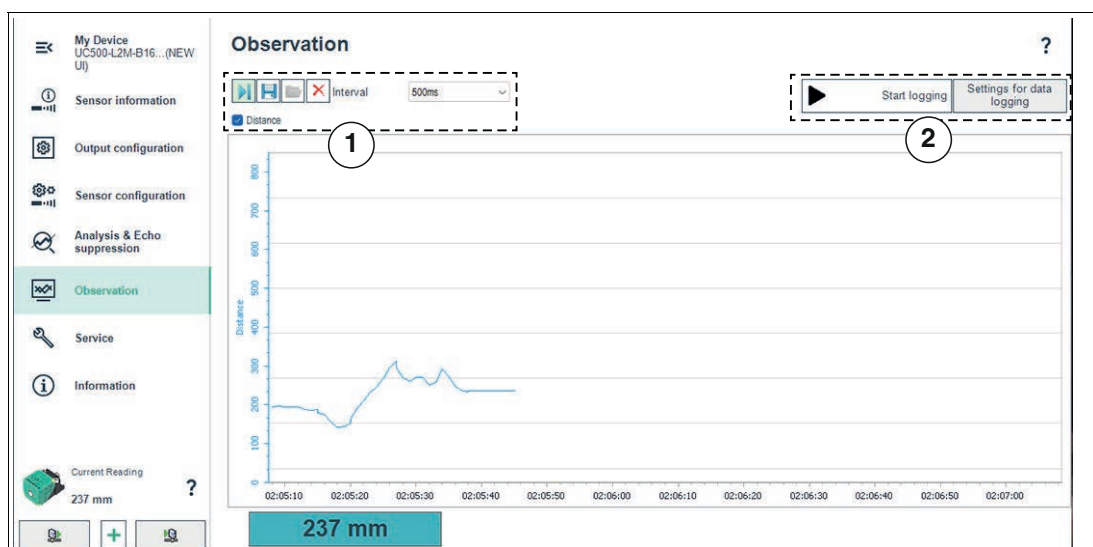


Figure 6.12

You can use the **Observation** menu item to track and record data from the ultrasonic sensor over time and the corresponding switching and analog output logic. 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 data and switching characteristics 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 according to the "follow-mode" principle. It will always track the current measured value in accordance with the rescale settings in the x-axis and make sure it is visible in the display. 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 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 a change in the status of the switching output and a change in 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 an 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

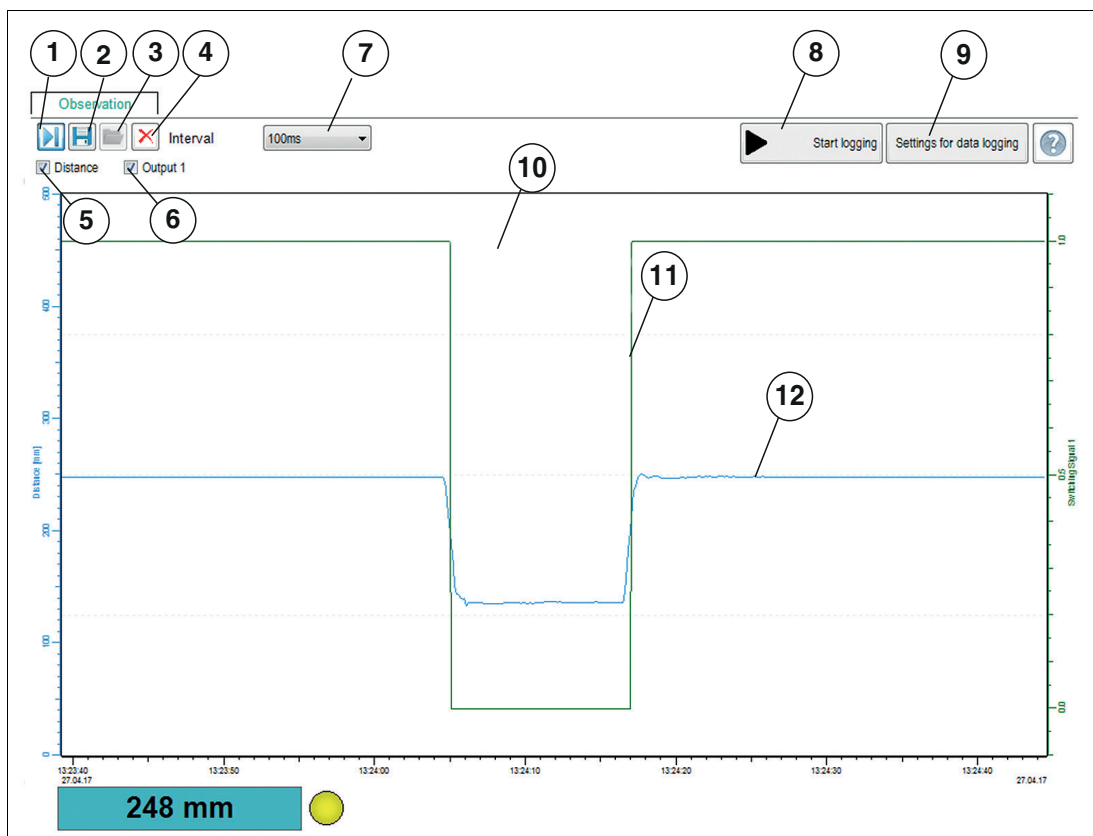


Figure 6.13

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 measured value 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 the beginning.
5	Distance	By clicking the check box, you can enable or disable the display of distance values in the display area in the form of a blue line.
6	Output	By clicking the check box, you can enable or disable the display of the output status (0/1) in the display area in the form of a green line. The analog output value is displayed in the diagram for an analog output.

No.	Name	Explanation
7	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.
8	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).
9	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.
10	Display area	In the display area, the "Distance" and "Output" check boxes can be used to display selected measured variables and output statuses in the form of line diagrams.
11	Output logic (green line)	The green line indicates the logical status of the output (right y-axis) for the switch point set in the Output configuration menu item. The analog output value is displayed (likewise right y-axis) for a sensor with analog output.
12	Distance value line (blue line)	The blue line shows the distance value measured from the sensor (left y-axis).

Table 6.3

Scaling the X-Axis and Navigating to Significant Data

You can use the left and right mouse buttons to rescale the displayed area in the x direction or move the display to focus on the required data.

To do so, you will need to move the cursor over the x-axis until the cursor becomes a hand icon. Then hold down the required mouse button and move the hand icon left or right along the x-axis.

- Both mouse buttons: Moves the display area to the left or right.
- Right mouse button: Rescales the x-axis from the right and retains left time value.
- Left mouse button: Rescales the x-axis from the left and retains right time value.

Data Logging Setting

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

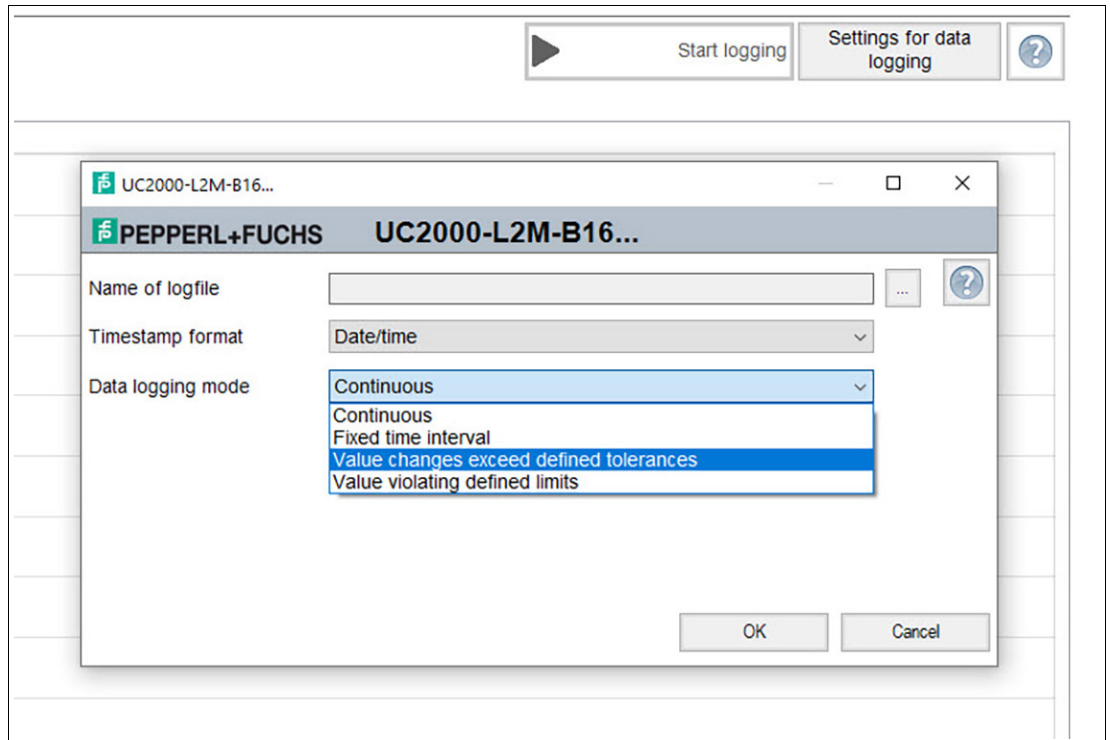


Figure 6.14

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. Press the OK button at the end to save the setting.

Measured 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, 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.
- **Change of switching output state**
Data is recorded in the event of a change of status of a sensor switching output. A further parameter is used to define with what type of status change data should be recorded. You can choose status changes to "Closed", "Open", or "In both directions." If the sensor has more than one switching output, but only one should be used as a trigger for recording data, the other parameters need to be set to "Ignore."
- **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 when 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.



1. Use the "Name of log file" field to set the file path and file name for logging data. To do so, click on the "..." button.
2. Use the "Data logging mode" option to set the events that should trigger automatic recording of data. Press the "OK" button at the end to save the setting.

6.7 Service Menu Item

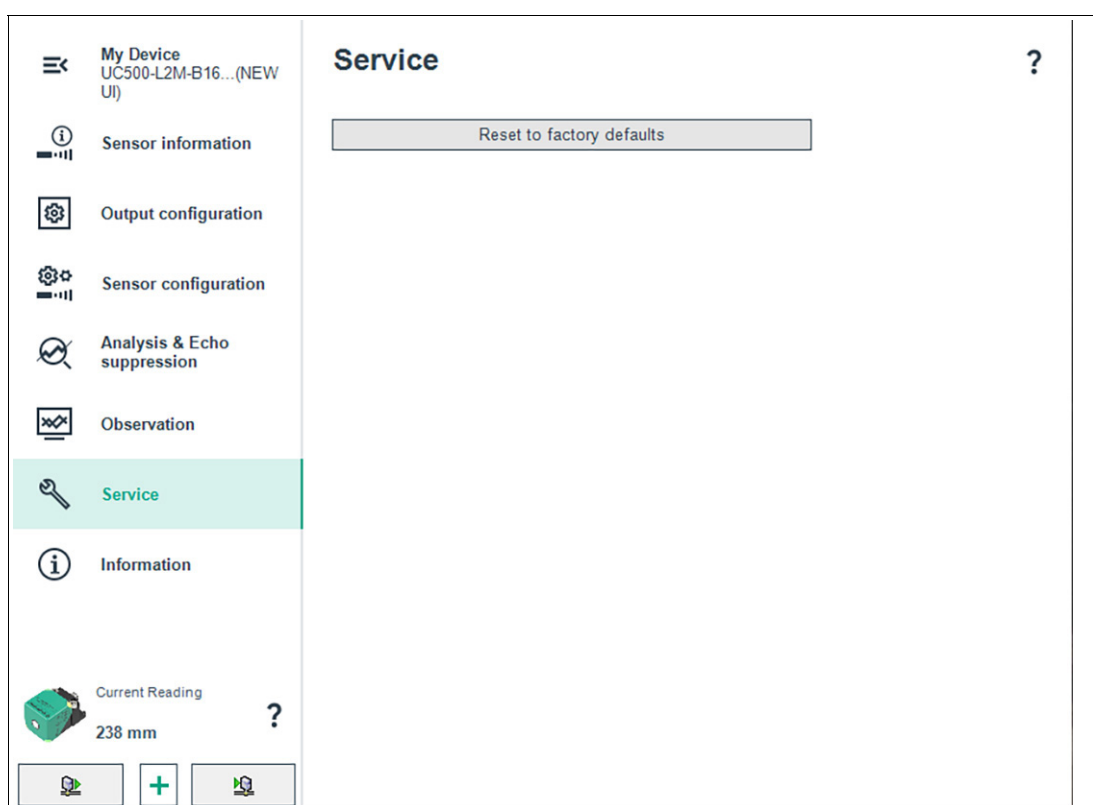


Figure 6.15

In the **Service** menu item, you have the option of restoring the sensor to factory settings.

Activating the switch resets the sensor to the state in which it was delivered. All previous parameter changes are lost as a result.

6.8 Menu Item Information

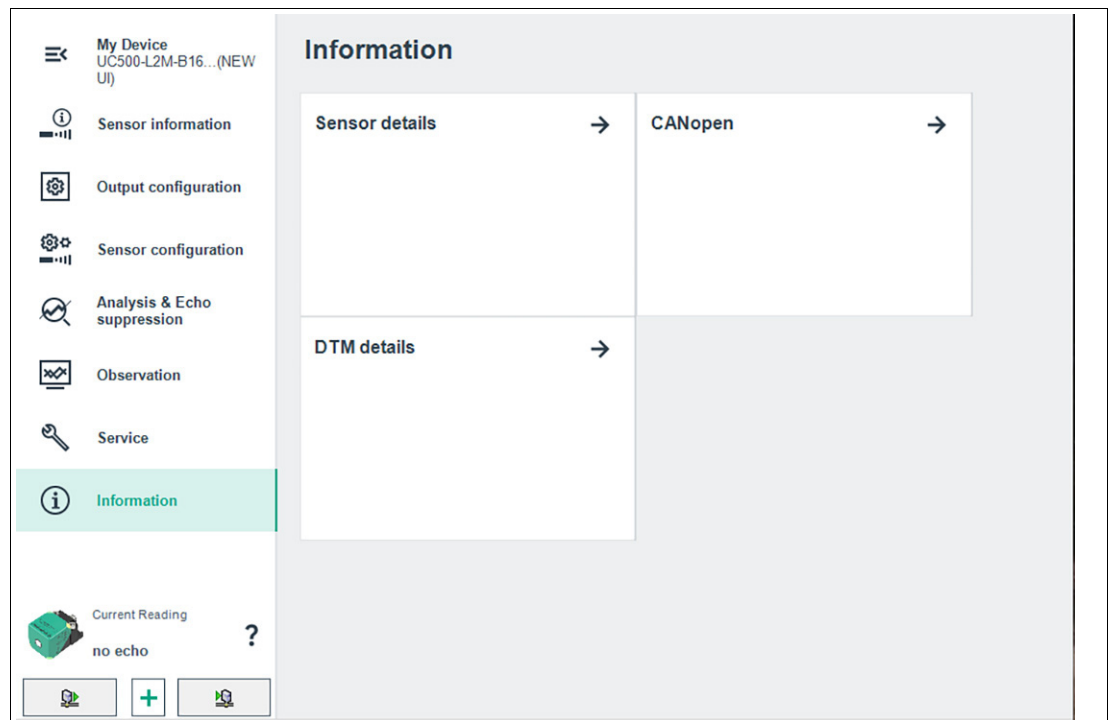


Figure 6.16

The **Information** menu item consists of three tabs

- **Sensor details:** Information about the hardware and software version
- **CANopen:** Information on CANopen identification, such as vendor ID, product code, etc., and the node ID (not equal to 0 for series devices).
- **DTM details:** Information on DTM version

7 Parameterization Using the CANopen Engineering Tool with CANopen Objects

7.1 CANopen Overview

What Is CANopen?

CANopen is a multimaster-compliant fieldbus system based on the CAN (**C**ontroller **A**rea **N**etwork).

Devices on the CANopen fieldbus communicate via message identifiers rather than via addresses. This allows all devices to access the fieldbus at any time. Fieldbus access is according to the CSMA/CA principle (**C**arrier **S**ense **M**ultiple **A**ccess/**C**ollision **A**voidance).

Collision Avoidance means that the dominant signal "0" overwrites the recessive signal "1" in the event of simultaneous access. The node that sends the "1" detects this and aborts the data transfer. As a result, messages with a lower identifier have higher priority, and messages with higher priority are not interrupted by these procedures.

Each device intercepts the fieldbus and can send messages whenever the fieldbus is free. The device with the highest priority, i.e., the lowest identifier, receives the access right. Devices with a lower priority interrupt the data transfer and make a further access attempt once the fieldbus becomes free. However, this also means that there is no guaranteed transmission time for a message and that it is better to avoid excessive bus loading.

In CANopen, the CAN identifier is encoded in a COB-ID (Communication Object Identifier). This object type also contains information about whether the message is active or other CAN frame-specific options. The CAN identifier for a CANopen message consists of the function code and the node ID number.

The function code describes the message type:

- **Message with service data (SDO)**
For parameterization of object directory entries
 - Any length
 - Transmission "on request"
 - SDOs of a device are combined in the object directory
- **Message with process data (PDO)**
For transmitting real-time data
 - Maximum 8 bytes long
 - Cyclical or event-controlled transmission
 - Distinction between send (max. 512) and receive PDOs (max. 512)
 - In the CAN, PDOs occupy their own identifier
- **Messages for network management (NMT)**
For controlling the state machine of the CANopen device and for monitoring the network nodes
- Further objects such as synchronization object (SYNC) and error messages (EMCY).

The most important attributes of the process data objects (PDOs) and service data objects (SDOs) are shown in the table below:

Process Data Objects (PDOs)	Service data objects (SDOs)
Are used for real-time data exchange	Permit access to the object directory; each SDO establishes a point-to-point service communication channel.
Typically messages with higher priority	Messages with lower priority
Synchronous and asynchronous data transfer	Typically asynchronous data transfer
Cyclical and acyclical transmission	Typically acyclical transmission
Data of the PDOs can be configured via SDOs	Use of the data field is dictated by the CMS (CAN Message Specification) Multiplexed Domain Protocol.
Preformatted data field	Access to an entry in the device object directory via index and subindex.

Table 7.1

Additional Information

CAN in Automation (CiA)

International Users and Manufacturers Group e.V.

Kontumazgarten 3

90429 Nuremberg, Germany

<http://www.can-cia.org/>

References: CAN Application Layer for industrial applications CAL-based communication profile for industrial systems

- CiA Draft Standard 301
- CiA Draft Standard 305 Layer Setting Services

7.2 CANopen Object Directory OV



Note

CANopen Parameter Communication

This section contains the information required for the data exchange via CANopen. Data is exchanged with the sensor via objects. These objects and their respective permissible functions are defined in the following SDO directory.

The sensor supports the identifier format 2.0A (11-bit identifier) according to the CAN specification. The extended 29-bit identifier is not supported.

The device-specific object directory OV contains all parameters and process data for the sensor. The object directory has two defined areas.

- 0x1000 ... 0x1FFF Communication segment: Predefined CANopen objects as specified in CiA301
- 0x2000 ... 0xFFFF Manufacturer segment: manufacturer-specific CANopen objects



Note

PDO mapping is not possible for most CANopen objects. For CANopen objects for which mapping is enabled, this is explicitly mentioned in the relevant sections of the CANopen objects.

The sensor is described in general terms in the 0x1000 area up to and including object 0x1FFF. The device ID, the name of the vendor, and the communication parameters are listed here. The 2nd area starting with object 0x2000 covers the specific functionality of the sensor.

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

Supported Objects

Object	Description
0x1000	Device Type
0x1001	Error Register
0x1002	Vendor Status Register
0x1003	Predefined Error Field, Maximum of 32 Entries
0x1005	SYNC Identifier
0x1008	Vendor Device Name
0x1009	Vendor Hardware Version
0x100A	Vendor Software Version
0x1010	Save Parameters
0x1011	Restore Factory Parameters
0x1014	COB-ID Emergency
0x1015	Inhibit Time Emergency
0x1017	Producer Heartbeat Time
0x1018	Device ID (Identify Object)
0x1020	Check Configuration
0x1200	Server SDO Parameter (Default SDO)
0x1400	1.RxPDO Input Data
0x1600	Receive PDO Mapping 1. RxPDO
0x1801	Ultrasound Synchronization
0x2000	Process Data: Distance Value, Signal Quality, Counter 1, Counter 2, Status Register
0x2001	Operating Hours
0x2010	Identification and Information
0x2011	EMCY Configuration
0x2020	Ultrasound Synchronization Mode
0x2021	Ultrasound Synchronization Encoder
0x2022	Synchronization Object for Ultrasound Synchronization
0x4000	Configuration of Measurements
0x4001	Configuration of Echo Suppression
0x4002	Evaluation Configuration
0x4003	Temperature Compensation Configuration
0x4100	Echo Field Information
0x4101	Switching Threshold Information

Table 7.2

7.3 Object 0x1000 Device Type

Index	Subindex	Designation	Data Type	Attribute	Default Value
0x1000	0x00	Device Type	unsigned32 ¹	ro (= read only)	0x0

Table 7.3

1. Data type without prefix, 32 bit

7.4 Object 0x1001 Error Register

Index	Subindex	Designation	Data type	Attribute	Default value
0x1001	0x00	Error Register	unsigned8	ro	0x0

Table 7.4

The 8-bit data of the error register describes errors as follows:

Bit							
7	6	5	4	3	2	1	0
0	Reserved	Reserved	Communication errors	Reserved	Reserved	Reserved	Generic error not specified in more detail ¹

Table 7.5

1. Flag is set for every error message

7.5 Object 0x1002 Manufacturer Status Register

Index	Subindex	Designation	Data Type	Attribute	Default Value
0x1002	0x00	Manufacturer status register	unsigned 32	ro	0

Table 7.6

The 32-bit data of the status register is structured as follows:

Bit							
32 ... 7	6	5	4	3	2	1	0
Reserved	Signal fault: In the event of noise or unexpected signal.	Warning message: "No detected object." Only if parameterized.	Overtemperature	Undervoltage	Hardware error	No reading yet	No error

Table 7.7

7.6 Object 0x1003 Predefined Error Field

Index	Subindex	Designation	Data type	Attribute	Default value
0x1003	0x00	Predefined Error Field (Indicates the number of errors that occurred)	unsigned 32	rw	0
	0x01	Most Recent Error	unsigned 32	ro	No error
	...		unsigned 32	ro	
	0x20	Oldest Error	unsigned 32	ro	No error

Table 7.8

7.7 Object 0x1005 SYNC Identifier

Index	Subindex	Designation	Data type	Attribute	Default value
0x1005	0x00	COB-ID SYNC Message	unsigned32	rw (= read/write)	0x00000080

Table 7.9

The 32-bit data of the identifier in the SYNC message describes the synchronization as follows:

Bit			
31	30	29	10 ... 0
Has no meaning	0 ¹	0	Identifier 0x80 = 128 _{dec}

Table 7.10

1. Always 0, since sensor is only for SYNC consumers, not SYNC producers

7.8 Object 0x1008 Vendor Device Name

Index	Subindex	Designation	Data type	Attribute	Default value
0x1008	0x00	Vendor Device Name	visible string ¹	ro	e.g., UC4000-L2M-B16-*

Table 7.11

1. ASCII string, variable length

7.9 Object 0x1009 Vendor Hardware Version

Vendor hardware version

Index	Subindex	Designation	Data type	Attribute	Default value
0x1009	0x00	Vendor Hardware Version	visible string	ro	1.0

Table 7.12

7.10 Object 0x100A Vendor Software Version

Index	Subindex	Designation	Data type	Attribute	Default value
0x100A	0x00	Vendor Software Version	visible string	ro	1.0.0

Table 7.13

7.11 Object 0x1010 Save Parameters

Index	Subindex	Designation	Data Type	Attribute	Default Value
0x1010	0x01	Save all parameters	unsigned 32	ro	0x00000002

Table 7.14

7.12 Object 0x1011 Restore Factory Parameters

Index	Subindex	Designation	Data Type	Attribute	Default Value
0x1011	0x01	Restore Default Parameters	unsigned 32	rw	0x00000001

Table 7.15

To restore factory parameters, write the specific code "0x64616f6c" in parameter 0x1011. After switching the ultrasonic sensor off and on again, factory settings will be restored. The node ID is not reset during this process.

7.13 Object 0x1014 COB ID Emergency

Index	Subindex	Designation	Data Type	Attribute	Default Value
0x1014	0x00	COB-ID emergency	unsigned32	rw	NODEID + 0x80

Table 7.16

7.14 Object 0x1015 Inhibit Time Emergency

Index	Subindex	Designation	Data type	Attribute	Default value
0x1015	0x00	Inhibit Time Emergency (As a Multiple of 100 µs)	unsigned16	rw	0x0

Table 7.17

7.15 Object 0x1017 Producer Heartbeat Time

Index	Subindex	Designation	Data Type	Attribute	Default Value
0x1017	0x00	Producer Heartbeat Time ¹	unsigned16	rw	0

Table 7.18

1. Time span [ms] between two sent heartbeat messages

7.16 Object 0x1018 Device ID (Identify Object)

Index	Subindex	Designation	Data type	Attribute	Default value
0x1018	0x00	Number of Subsequent Parameters	unsigned8	ro	0x4
	0x01	Vendor Identifier	unsigned32	ro	0xAD
	0x02	Device Identifier	unsigned32	ro	For UC500: 0x03 00 00 01 For UC2000: 0x03 00 00 02 For UC4000: 0x03 00 00 03
	0x03	Version Number	unsigned32	ro	0x001 00 00
	0x04	CANopen Serial Number = P+F Serial Number	unsigned32	ro	Individual

Table 7.19

7.17 Object 0x1020 Check Configuration

Index	Subindex	Designation	Data type	Attribute	Default value
0x1010	0x00	Configuration Date	unsigned 32	rw	0x00000000

Table 7.20

7.18 Object 0x1200 Server SDO Parameter (Default SDO)

Index	Subindex	Designation	Data type	Attribute	Default value
0x1200	0x00	Number of Subsequent Parameters	unsigned8	ro	0x02
	0x01	COB ID Client to Server	unsigned32	ro	NODEID + 0x600
	0x02	COB ID Server to Client	unsigned32	ro	NODEID + 0x580

Table 7.21

7.19 Object 0x1400 1. RxPDO Input Data

Index	Subindex	Designation	Data Type	Attribute	Default Value
0x1400	0x00	Number of Subsequent Parameters	unsigned8	ro	0x02
	0x01	COB ID Used By RPDO	unsigned32	rw	NODEID + 0x200
	0x02	Transmission Type	unsigned8	rw	0xFE

Table 7.22

COB ID: Bit			
31	30	29 ... 11	10 ... 0
PDO present: 0 = currently present 1 = not present	RTR access: 0 = permitted 1 = not permitted	...	CAN identifier ¹

Table 7.23

1. Cannot be changed when PDO is currently present

7.20 Object 0x1600 Receive PDO Mapping 1. RxPDO

Index	Subindex	Designation	Data type	Attribute	Default value	Meaning
0x1600	0x01	Mapping of Input Data	unsigned32	rw	0x20220008	Input data MSB Data = 0x2022, byte 0x01 Meaning: Index 0x2022 Sub-index: 0 (trigger US sync) 8-bit length

Table 7.24

7.21 Object 0x2000 1. TxPDO Process Data



Note

PDO mapping is possible for this CANopen object.

Index	Subindex	Designation	Data Type	Attribute	Default Value	Meaning
0x2000	0x01	Measured value	unsigned16	ro	16-bit distance of 0 ... 16000 mm Measured value: 0 ... 3E80 Error substitute value 0x7FFC = if no object is detected, no valid measured value	Distance value to the measurement object measured in mm
	0x02	Signal Quality	unsigned8	ro	Signal quality 3 ... 0 Possible values: 3 = excellent 2 = good 1 = acceptable 0 = insufficient	Signal quality of the ultrasonic signal
	0x03	Cyclic Counter 16 Bit	unsigned16	ro	Cyclic counter increases after each measuring cycle, skips the zero (zero still no process data update)	Counter 1: Cyclic counter, increases after each measuring cycle Counter 1 consists of counter 2 and another byte.
	0x04	Cyclic Counter 8 Bit	unsigned8	ro	Cyclic counter increases after each measuring cycle, skips the zero (zero still no process data update)	Counter 2: Cyclic counter, increases after each measuring cycle
	0x05	Status Register	unsigned8	ro	Copy of object 0x1002, but only 8-bit value	Copy of object 0x1002, cyclic counter

Table 7.25

The 32-bit data of the status register is structured as follows:

Bit							
32 ... 7	6	5	4	3	2	1	0
Reserved	Signal fault: In the event of noise or unexpected signal.	Warning message: "No detected object." Only if parameterized.	Overtemperature	Undervoltage	Hardware error	No reading yet	No error

Table 7.26

7.22 Object 0x2001 Operating Hours

Index	Subindex	Designation	Data type	Attribute	Default value
0x2001	0x00	Operating Hours	unsigned 32	ro	0x00000000 Value changes over time

Table 7.27

7.23 Object 0x2010 Identification and Information

Index	Subindex	Designation	Data type	Attribute	Default value	Meaning
0x2010	0x01	Vendor Name	string	ro	Pepperl+Fuchs	Vendor Name
	0x02	Vendor Text	string	ro	www.pepperl-fuchs.com	Website
	0x03	Product ID	string	ro	70134319-*	Item number
	0x04	Product Text	string	ro	Ultrasonic 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	Free text
	0x07	Function Tag	string	rw	***	Free text
	0x08	Location Tag	string	rw	***	Free text
	0x09	Unique Product ID	string	ro	<a href="https://pefu.de/<serialnumber>">https://pefu.de/<serialnumber>	Link to product info

Table 7.28

7.24 Object 0x2011 EMCY Configuration

Index	Subindex	Designation	Data type	Attribute	Default value	Meaning
0x2011	0x01	No Target	Boolean	ro	1	If "No object detected" is an error, an EMCY message is sent.
	0x02	Signal Error	Boolean	ro	1	If there is a signal error, an EMCY message is sent.

Table 7.29

7.25 Object 0x2020 Ultrasound Synchronization Mode

Index	Subindex	Designation	Data type	Attribute	Default value	Meaning
0x2020	0x01	Sync Mode	unsigned8	rw	0	0 = deactivated 1 = Main Device 2 = Secondary Device
	0x02	Sync ID	unsigned8	rw	1	Specifies the sync group to which the sensor should belong
	0x03	Cycle Time	unsigned16	rw	sensor-specific	Specifies the cycle time of the device when the synchronization mode is set to "deactivated."

Table 7.30

7.26 Object 0x2021 Ultrasonic Sensor with Sync Feature

Index	Subindex	Designation	Data type	Attribute	Default value	Meaning
0x2021	0x00	Synchronization device	unsigned8	rw	127	Number of sync groups
	0x01	Synchronization device	unsigned8	rw	0 = deactivated	Cycle time of sync group 1
	0x02	Synchronization device	unsigned8	rw	0 = deactivated	Cycle time of sync group 2
	...		...		...	

Table 7.31

The subindices 1... 127 correspond to those sync groups whose parameter value corresponds to the cycle time of the respective sync group. The default value of a subindex is 0 = deactivated. Only subindices with a value not equal to 0 are active sync groups.

For example:

Subindex 0x05 = sync group 5 >> value in subindex 5 = cycle time of sync group 5

7.27 Object 0x2022 Synchronization Object for Ultrasonic Synchronization

Index	Subindex	Designation	Data type	Attribute	Default value	Meaning
0x2022	0x00	Trigger Synchronization	unsigned8	rw	0 (sync deactivated)	Contains the current value for ultrasound synchronization. Is changed automatically. WARNING: If synchronization is activated, this value must not be changed manually, otherwise the synchronization will be interrupted.

Table 7.32

7.28 Object 0x4000 Measurement Configuration

Index	Sub-index	Designation	Data type	Attribute	Default value	Meaning
0x4000	0x01	Measurement Config: Beam Width	unsigned8	rw	Factory setting is 0x02 = wide sound beam The possible settings are: 0x00 = narrow sound beam 0x01 = medium sound beam 0x02 = wide sound beam	Setting of the sound beam width
	0x02	Measurement Config: Small Beam Width	unsigned8	rw	Factory setting = 50 Possible values: 10, 20, 30, 40, 50, 60, 70, 80, 90, 100	Definition of a narrow sound beam in %.
	0x03	Measurement Config: Medium Beam Width	unsigned8	rw	Factory setting = 70 Possible values: 10, 20, 30, 40, 50, 60, 70, 80, 90, 100	Definition of a medium sound beam in %.
	0x04	Measurement Config: Wide Beam Width	unsigned8	rw	Factory setting = 100 Possible values: 10, 20, 30, 40, 50, 60, 70, 80, 90, 100	Definition of a wide sound beam in %.

Table 7.33

Index	Sub-index	Designation	Data type	Attribute	Default value	Meaning
0x4000	0x05	Measurement Config: Ultrasonic Pulse Length	unsigned8	rw	Factory setting = 0x00 (automatic) Possible values: 0x00 = automatic 0x01 = short 0x02 = long	Setting the pulse length of the ultrasonic signal
	0x06	Measurement Config: Foreground Suppression	unsigned8	rw	Factory setting = dead band – 5 mm Possible values: (Dead band – 5 mm) ... End of adjustment range	Foreground suppression: Echoes from distances smaller than the set value are suppressed
	0x07	Measurement Config: Background Suppression	unsigned16	rw	Factory setting = end of adjustment range Possible values: Start of adjustment range ... End of sensing range	Background suppression: Echoes from distances greater than the set value are suppressed

Table 7.34

7.29 Object 0x4001 Echo Suppression Configuration

Index	Subindex	Designation	Data type	Attribute	Default value	Meaning
0x4001	0x01	Echo Suppression: Echo Suppression Config	unsigned16	rw	Factory setting is 0x00 = activated Possible values: 0x00 = activated 0x01 = deactivated	Setting of configurable echo suppression
	0x02	Echo Suppression: Area 1 Start	unsigned16	rw	Factory setting = 0 Possible values: 0 ... End of adjustment range	Start distance value from which echoes are suppressed (mm)
	0x03	Echo Suppression: Area 1 Amplitude	unsigned8	rw	Factory setting = 0 Possible values: 0 ... 100	Amplitude value up to which echoes are suppressed (%)
	0x04	Echo Suppression: Area 1 Length	unsigned16	rw	Factory setting = 0 Possible values: 0 ... End of adjustment range	Width of echo suppression in mm, from start distance value to right

Table 7.35

Index	Subindex	Designation	Data type	Attribute	Default value	Meaning
0x4001	0x05	Echo Suppression: Area 2 Start	unsigned16	rw	Factory setting: 0 Possible values: 0 ... End of adjustment range	Start distance value from which echoes are suppressed (mm)
	0x06	Echo Suppression: Area 2 Amplitude	unsigned8	rw	Factory setting: 0 Possible values: 0 ... 100	Amplitude value up to which echoes are suppressed (%)
	0x07	Echo Suppression: Area 2 Length	unsigned16	rw	Factory setting: 0 Possible values: 0 ... End of adjustment range	Width of echo suppression in mm, from start distance value to right

Table 7.36

Index	Subindex	Designation	Data type	Attribute	Default value	Meaning
0x4001	0x08	Echo Suppression: Area 3 Start	unsigned16	rw	Factory setting: 0 Possible values: 0 ... End of adjustment range	Start distance value from which echoes are suppressed (mm)
	0x09	Echo Suppression: Area 3 Amplitude	unsigned8	rw	Factory setting: 0 Possible values: 0 ... 100	Amplitude value up to which echoes are suppressed (%)
	0x0A	Echo Suppression: Area 3 Length	unsigned16	rw	Factory setting: 0 Possible values: 0 ... End of adjustment range	Width of echo suppression in mm, from start distance value to right

Table 7.37

Index	Subindex	Designation	Data type	Attribute	Default value	Meaning
0x4001	0x0B	Echo Suppression: Area 4 Start	unsigned16	rw	Factory setting: 0 Possible values: 0 ... End of adjustment range	Start distance value from which echoes are suppressed (mm)
	0x0C	Echo Suppression: Area 4 Amplitude	unsigned8	rw	Factory setting: 0 Possible values: 0 ... 100	Amplitude value up to which echoes are suppressed (%)
	0x0D	Echo Suppression: Area 4 Length	unsigned16	rw	Factory setting: 0 Possible values: 0 ... End of adjustment range	Width of echo suppression in mm, from start distance value to right

Table 7.38

Index	Subindex	Designation	Data type	Attribute	Default value	Meaning
0x4001	0x0E	Echo Suppression: Area 5 Start	unsigned16	rw	Factory setting: 0 Possible values: 0 ... End of adjustment range	Start distance value from which echoes are suppressed (mm)
	0x0F	Echo Suppression: Area 5 Amplitude	unsigned8	rw	Factory setting: 0 Possible values: 0 ... 100	Amplitude value up to which echoes are suppressed (%)
	0x10	Echo Suppression: Area 5 Length	unsigned16	rw	Factory setting: 0 Possible values: 0 ... End of adjustment range	Width of echo suppression in mm, from start distance value to right

Table 7.39

Index	Subindex	Designation	Data type	Attribute	Default value	Meaning
0x4001	0x11	Echo Suppression: Area 6 Start	unsigned16	rw	Factory setting: 0 Possible values: 0 ... End of adjustment range	Start distance value from which echoes are suppressed (mm)
	0x12	Echo Suppression: Area 6 Amplitude	unsigned8	rw	Factory setting: 0 Possible values: 0 ... 100	Amplitude value up to which echoes are suppressed (%)
	0x13	Echo Suppression: Area 6 Length	unsigned16	rw	Factory setting: 0 Possible values: 0 ... End of adjustment range	Width of echo suppression in mm, from start distance value to right

Table 7.40

Index	Subindex	Designation	Data type	Attribute	Default value	Meaning
0x4001	0x14	Echo Suppression: Area 7 Start	unsigned16	rw	Factory setting: 0 Possible values: 0 ... End of adjustment range	Start distance value from which echoes are suppressed (mm)
	0x15	Echo Suppression: Area 7 Amplitude	unsigned8	rw	Factory setting: 0 Possible values: 0 ... 100	Amplitude value up to which echoes are suppressed (%)
	0x16	Echo Suppression: Area 8 Length	unsigned16	rw	Factory setting: 0 Possible values: 0 ... End of adjustment range	Width of echo suppression in mm, from start distance value to right

Table 7.41

Index	Subindex	Designation	Data type	Attribute	Default value	Meaning
0x4001	0x17	Echo Suppression: Area 8 Start	unsigned16	rw	Factory setting: 0 Possible values: 0 ... End of adjustment range	Start distance value from which echoes are suppressed (mm)
	0x18	Echo Suppression: Area 8 Amplitude	unsigned8	rw	Factory setting: 0 Possible values: 0 ... 100	Amplitude value up to which echoes are suppressed (%)
	0x19	Echo Suppression: Area 8 Length	unsigned16	rw	Factory setting: 0 Possible values: 0 ... End of adjustment range	Width of echo suppression in mm, from start distance value to right

Table 7.42

Index	Subindex	Designation	Data type	Attribute	Default value	Meaning
0x4001	0x1A	Echo Suppression: Area 9 Start	unsigned16	rw	Factory setting: 0 Possible values: 0 ... End of adjustment range	Start distance value from which echoes are suppressed (mm)
	0x1B	Echo Suppression: Area 9 Amplitude	unsigned8	rw	Factory setting: 0 Possible values: 0 ... 100	Amplitude value up to which echoes are suppressed (%)
	0x1C	Echo Suppression: Area 9 Length	unsigned16	rw	Factory setting: 0 Possible values: 0 ... End of adjustment range	Width of echo suppression in mm, from start distance value to right

Table 7.43

Index	Subindex	Designation	Data type	Attribute	Default value	Meaning
0x4001	0x1D	Echo Suppression: Area 10 Start	unsigned16	rw	Factory setting: 0 Possible values: 0 ... End of adjustment range	Start distance value from which echoes are suppressed (mm)
	0x1E	Echo Suppression: Area 10 Amplitude	unsigned8	rw	Factory setting: 0 Possible values: 0 ... 100	Amplitude value up to which echoes are suppressed (%)
	0x1F	Echo Suppression: Area 10 Length	unsigned16	rw	Factory setting: 0 Possible values: 0 ... End of adjustment range	Width of echo suppression in mm, from start distance value to right

Table 7.44

7.30 Object 0x4002 Evaluation Configuration

Index	Subindex	Designation	Data type	Attribute	Default value	Meaning
0x4002	0x01	Eval Config: Echo Evaluation	unsigned8	rw	Factory setting is 0x00 = first echo Possible values: 0x00 = first echo 0x01 = strongest echo	Setting of the echo relevant to the distance value
	0x02	Eval Config: No Echo Is Error	unsigned8	rw	Factory setting is 0x00 = no Possible values: 0x00 = no 0x01 = yes	Setting whether no echo should be considered and output as an error (yes) or considered as OK (no).
	0x03	Eval Config: Eval Method	unsigned8	rw	Factory setting is 0x01 = arithmetic average Possible values: 0x00 = none 0x01 = arithmetic average 0x02 = low-pass filter	Setting the echo value determination used. With "Low-pass filter," short-term fluctuations in the distance value are suppressed.

Table 7.45

Index	Subindex	Designation	Data type	Attribute	Default value	Meaning
0x4002	0x04	Eval Config: Arithmetic Average	unsigned8	rw	Factory setting = 0x07 -> M = 5 N = 2 Possible values: 0x00 -> M = 2 N = 0 0x01 -> M = 3 N = 0 0x02 -> M = 3 N = 1 0x03 -> M = 4 N = 0 0x04 -> M = 4 N = 1 0x05 -> M = 5 N = 0 0x06 -> M = 5 N = 1 0x07 -> M = 5 N = 2 0x08 -> M = 6 N = 0 0x09 -> M = 6 N = 1 0x0A -> M = 6 N = 2 0x0B -> M = 7 N = 0 0x0C -> M = 7 N = 1 0x0D -> M = 7 N = 2 0x0E -> M = 7 N = 3 0x0F -> M = 8 N = 0 0x10 -> M = 8 N = 1 0x11 -> M = 8 N = 2 0x12 -> M = 8 N = 3	You can use this parameter to control the depths of the average determination. M defines the total number of measurements used for average determination. N also defines the number of measurements from the number M that are not taken into account for average determination. These are the value/values with the greatest error from the measurement result most recently determined. The current measurement result is calculated arithmetically from the remaining data.

Table 7.46

Index	Subindex	Designation	Data type	Attribute	Default value	Meaning
0x4002	0x05	Eval Config: Low Pass Weight	unsigned8	rw	Factory setting = 75 Possible values: 1 ... 99	This parameter determines how much weighting in percentage terms the result of the previous measurement is given in the current evaluation. The following formula applies: $\text{ResN} = (\text{ResN-1} \times W + \text{Meas} \times (100 - W)) / 100$ N = value of 1 ... 99 Res = result W = "weighting of previous measurement" factor Meas = current measured value
	0x06	Eval Config: Low Pass Deviation	unsigned8	rw	Factory setting = 10 Possible values: 10 ... 50	Together with the "Hold-up time" parameter, you can use this parameter to define an acceptance filter. This is used to hide short-term faults so that the measurement result does not change. The "Allowed error from previous measurement" parameter defines the value by which the new measured value may deviate at most from the previous measurement result. Only data with allowed errors will be included in the calculation of the new measurement result. If the error is exceeded, the data are ignored until the set hold-up time has elapsed.
	0x07	Eval Config: Low Pass Skip Time	unsigned16	rw	Factory setting = 0 Possible values: 0 ... 60000	Low-pass jump time in ms.

Table 7.47

7.31 Object 0x4003 Temperature Compensation Configuration



Note

PDO mapping is possible for this CANopen object.

Index	Subindex	Designation	Data Type	Attribute	Default Value	Meaning
0x4003	0x01	Temperature Compensation: Compensation Config	unsigned8	rw	Factory setting is 0x01 = activated Possible values: 0x00 = disabled 0x01 = activated	The speed of sound and subsequently an ultrasonic sensor's accuracy is affected by changes in ambient temperature. By using the "Temperature compensation" parameter, you can switch the sensor's integral automatic temperature compensation off and on. When this parameter is enabled, the distance value is calculated taking into account the ambient temperature continuously measured by the sensor. This method automatically corrects measuring errors resulting from a changing ambient temperature and therefore greatly improves the measurement accuracy of the sensor. If disabled, the distance value is calculated on the basis of the temperature value provided by the "Operating temperature" parameter.
	0x02	Temperature Compensation: Operating Temperature	integer8	rw	Factory setting = 25 Possible values: -40 °C ... 100	Setting operating temperature in °C

Table 7.48

7.32 Object 0x4100 Echo Field Information

Index	Subindex	Designation	Data Type	Attribute	Default Value	Meaning
0x4100	0x00	Echo Array Information	octet_string	ro	0	The echo array information contains distance and amplitude information for the measurement result and for up to 32 individual echo signals.

Table 7.49

You can use this parameter to read out the raw data of the measurement. The data is structured and read out at once to ensure consistency and is rewritten for each measuring cycle.

Data name	Value Range	Unit	Data Type	Meaning
Number of echoes	0 ... 32	–	unsigned8	
Index of the selected echo	-1 = No echo selected 0 ... 31	–	signed8	
Distance value	<min-1> = echo in dead band <min> ... <max> <max+1> = no echo	mm	unsigned16	<min> is the "start of the setting range accepted by the firmware". <max> is the "end of the setting range accepted by the firmware". <min-1> is the distance when an object below <min> is detected but the distance could not be determined. <max+1> is the distance if no object is detected but this does not trigger an error.
Amplitude	0 ... 100	%	unsigned8	
Signal level	0 ... 100	%	unsigned8	
Error	0x00 = no error 0x01 = error	–	unsigned8	- No echo error - Interference echo - etc.
Echo field	See the following table for the "Echo" data type	–	unsigned8 [0 ... 32]	0 ... 32 entries of the "Echo" data type (see next table) This value is dynamic.

Table 7.50

"Echo" data type

Data name	Value Range	Unit	Data Type	Meaning
Echo distance value	<min-1> = echo in dead band <min> ... <max>	mm	unsigned16	These are actually measured echoes so that <max+1> will not occur. A placeholder echo with <min-1> is added for detection below <min>.
Echo amplitude	0 ... 100	%	unsigned8	
Echo quality	0 = not sufficient 1 = acceptable 2 = good 3 = excellent	–	unsigned8	No position determination possible
Echo suppressed	0x00 = not suppressed 0x01 = suppressed	–	unsigned8	

Table 7.51

The maximum data length is $7 + 32 * 5 = 167$ bytes.

7.33 Object 0x4101 Switching Threshold Values

Index	Subindex	Designation	Data Type	Attribute	Default Value	Meaning
0x4100	0x00	Threshold Information	unsigned16	ro	0	Contains the switching threshold values saved for each distance

Table 7.52

8 Synchronizing Multiple Sensors

In applications where multiple ultrasonic sensors are operated in close proximity to each other, we must prevent cross-talk between them. Otherwise, this can result in individual devices providing incorrect measurements.

Synchronizing devices is the easiest way to solve this problem. This can be done directly between the synchronized sensors without intervention from a separate CAN device.

Whether and in which role the sensor is synchronized can be defined via the DTM or the CANopen objects. The various synchronization options are explained below.

Defining Synchronization Role via the DTM

Via the "Sensor configuration" menu item and the "Synchronization" tab, you can make some settings in the "Selected synchronization role" parameter, see chapter 6.4.

- **Disabled:** Synchronization is inactive (factory setting)
- **Main Device:** When "Main Device" is selected, the sensor acts as a sync device, defines the sync groups and their cycle times, and triggers a synchronous measurement.
- **Secondary Device:** If "Secondary Device" is selected, you must define the sync group of the sensor and the node ID of the sync device. As a "Secondary Device", the sensor waits for a sync signal before starting a measurement.
- **Sync Group:** The sync group determines in which sync mode the sensors are operated. If a sync group has cycle time 0, this group is inactive.

Define the synchronization role via the CANopen object 0x2020 "Ultrasound synchronization mode"

You can make some settings in subindex 0x01 using the CANopen object 0x2020 "Synchronization mode", see chapter 7.25.

- **Disabled:** Synchronization is inactive (factory setting)
- **Main Device:** When "Main Device" is selected, the sensor acts as a sync device, defines the sync groups and their cycle times, and triggers a synchronous measurement.
- **Secondary Device:** If "Secondary Device" is selected, you must define the sync group of the sensor and the node ID of the sync device. As a "Secondary Device", the sensor waits for a sync signal before starting a measurement.
- **Sync Group:** The sync group determines in which sync mode the sensors are operated. If a sync group has cycle time 0, this group is inactive.

Define Synchronization Modes

The two synchronization modes "Common Mode" and "Multiplex Mode" are available for operating multiple ultrasonic sensors of the UC*-L2M-B16 series. The mode for an ultrasonic sensor is selected by assigning it to a sync group or by setting its cycle time. You can set this either via the DTM in the relevant menu item, see "Synchronization Tab" on page 25, or via the CANopen object 0x2020, see chapter 7.25.

- **Common Mode**
All sensors in the same sync group start their measurement simultaneously once they have been triggered by the Main Device. This mode is suitable for area monitoring, because all sensors transmit and receive simultaneously. Reflected echoes from adjacent sensors can also be detected and processed in this way.
- **Multiplex Mode**
All sync groups whose cycle time is not 0 are triggered by the Main Device one after the other. If, for example, only one sensor is assigned to each sync group, the following measurement only starts once the cycle time set for this sync group has expired. This prevents cross-talk between the sensors' measurement operations. This mode is suitable for distance detection of sensors mounted in close proximity to each other. It is possible to combine several sync groups with multiple sensors per sync group.

Define Cycle Time

The cycle time determines the time interval at which a synchronized measurement of all sensors in this sync group is triggered. If a sync group has cycle time 0, this group is inactive. Theoretically, you can enter any value in ms. However, it must be noted that synchronization only functions reliably if the cycle time entered is greater than or equal to the maximum single measuring cycle time of the sensors synchronized in the sync group.

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 in which the transducer surface is exposed to dirt or build-up.

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

- Only with water without chemicals
- Without pressure/high pressure
- Only by using a soft cloth
- No abrasive cleaning, scratching, or scrubbing

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 ready.

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 applicable.
Green LED not lit up	The plug is not connected to the connector on the sensor.	Connect the plug to the sensor and tighten the union nut by hand.
Green LED not lit up	Faulty wiring in the splitter or switch cabinet.	Check the wiring carefully and repair any faults.
Green LED not lit up	Supply cable to the sensor is damaged.	Replace the damaged cable.
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.	Make sure that the sensor's communication port is connected to the CAN bus/CAN/USB converter-SUBD9.
No CAN connection to the device	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)
No CAN connection to the device	Incorrect node ID or incorrect transmission rate set.	See chapter 5.2.1
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 sensor parameterization and, if necessary, change the sound beam width.
The target object is not detected even though the sensor is OK	The object absorbs sound.	The target object consists of a sound-absorbing material and therefore cannot reflect enough sound.
The target object is not detected even though the sensor is OK	The object does not emit a usable echo	The target object does not reflect enough sound (too small) for the sensor to detect Or the sound is reflected almost completely away from the object (angle too large) Or it is too close to the sensor (within the dead band, see datasheet)
The target object is not detected even though the sensor is OK	The object is too far away from the sensor.	The target object is outside the detection range, see datasheet.

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