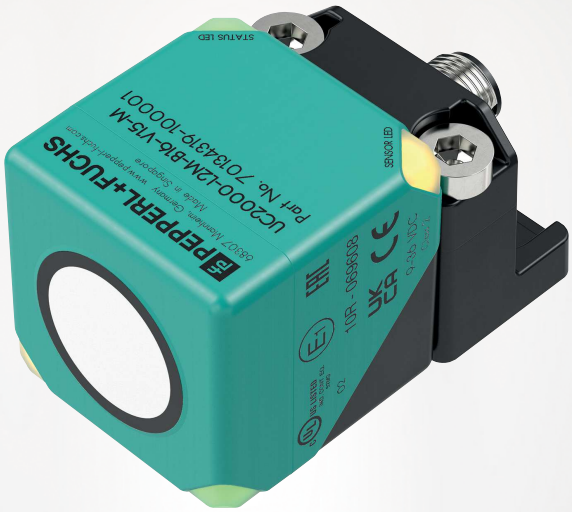
# UC***-L2M Series

# Parameterization of Ultrasonic Sensors with CANopen Interface

**Manual**

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# 1 Introduction

## 1.1 Content of this Document

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

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

**Note**

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

**Note**

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

The documentation comprises the following parts:

- This document
- Datasheet

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

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

## 1.2 Target Group, Personnel

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

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

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

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## 1.3 Symbols Used

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

### Warning Messages

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

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

**Danger!**

This symbol indicates an imminent danger.

Non-observance will result in personal injury or death.

**Warning!**

This symbol indicates a possible fault or danger.

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

**Caution!**

This symbol indicates a possible fault.

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

### Informative Symbols

**Note**

This symbol brings important information to your attention.

### Action

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

## 1.4 Intended Use

The UC***-L2M 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 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.

Always operate the device as described in these instructions to ensure that the device and connected systems function correctly. 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.

ISO**9001**

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# 2 Product Description

## 2.1 Use and Application

The UC***-L2M 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 control 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 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 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 or higher, CAN-COM-DTM, and device DTM, can be found at www.pepperl-fuchs.com, on the product page in the "Software" section.

As a convenient solution, we offer the "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 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 series.

## 2.2 Indicators

The ultrasonic sensor has multi-color LEDs, each with three colors, for displaying operating and status information. Two LEDs with the same meaning are arranged diagonally on the device to ensure better visibility in an application environment.

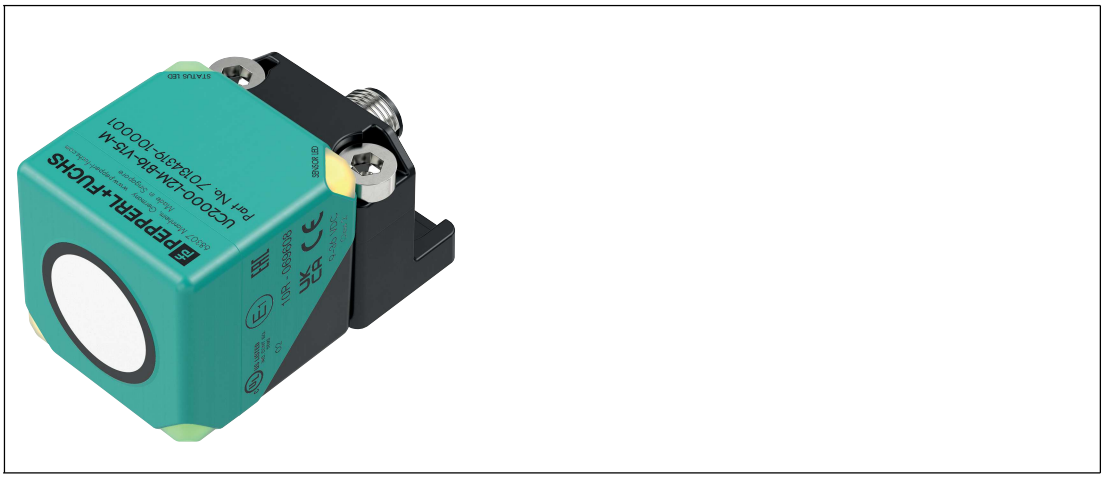


Figure 2.1

**SENSOR LED (yellow)** Object in the evaluation area

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

#### 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 OV 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 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 counter
- Application-specific tag, function tag, location tag
- Synchronization function for CANopen sensors

The UC***-L2M 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...240). The sensor accepts synchronous modes 00-F0h and event-driven modes FEh and FFh.

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## 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 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, commissioning instructions, 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:<br>• PACTware/PACTware DC<br>• DTM for CANopen communication<br>• VCI driver for the CAN/USB converter-SUBD9<br>Visit www.pepperl-fuchs.com and access 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<br>Visit www.pepperl-fuchs.com and access 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 "plug-in" for quickly and easily establishing connections between sensor and PACTware.<br>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<br>Not required when installing the "CANopen Parameterization Tool."<br>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.<br>Includes the following components:<br>• CAN/USB Converter-SUBD9<br>• Power supply for CAN/USB converter-SUBD9<br>• Connection cable and adapter cable for components<br>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.

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## 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

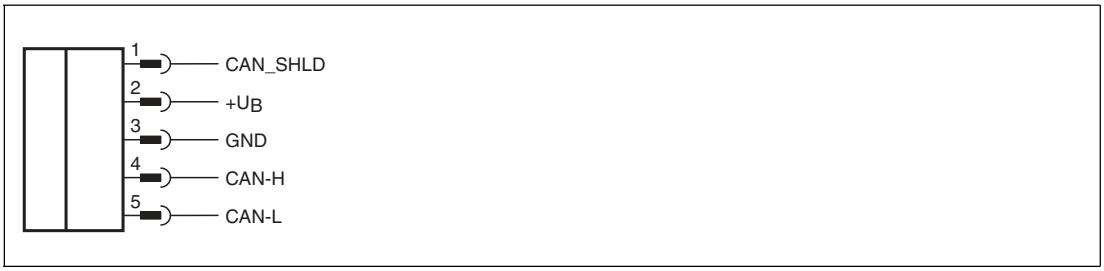


Figure 3.1

### 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.

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# 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 sensorsee chapter 2.4.2.

The various software components can be downloaded from www.pepperl-fuchs.com, on the UC***-L2M 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."

   ↳ 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-piece for the CAN/USB converter-SUBD9 using a 5-pin connection cable.
2. Connect the power supply to the T-piece for the CAN/USB converter-SUBD9.
3. Connect the T-piece to the SUBD9 plug on the CAN/USB converter-SUBD9.
4. Make sure that the terminator on the T-piece is activated.
5. Connect the USB cable of the CAN/USB converter-SUBD9 to a USB connection on your work PC/laptop computer.
6. Connect the power supply of the CAN/USB converter-SUBD9 to the electric power supply.

**Note**

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

## Establishing a Connection between PACTwareDC and the Sensor

1. Start PACTware DC on your work computer.

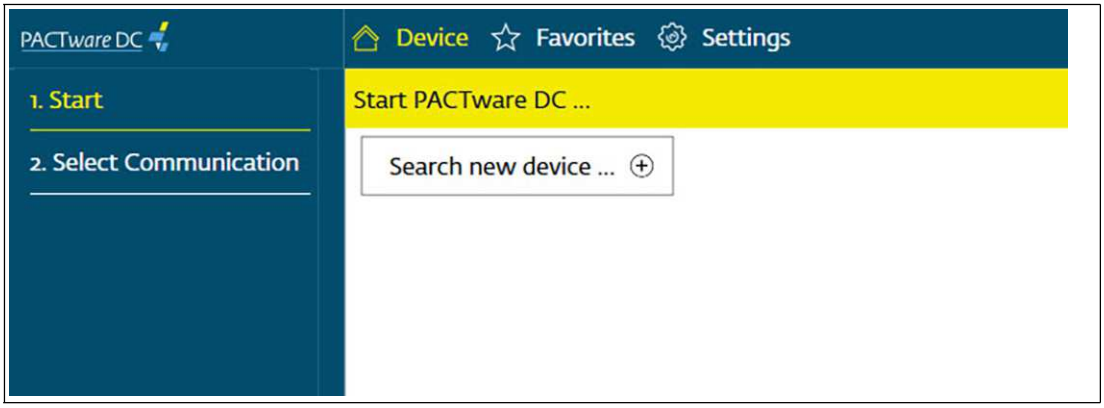


Figure 5.1

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

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

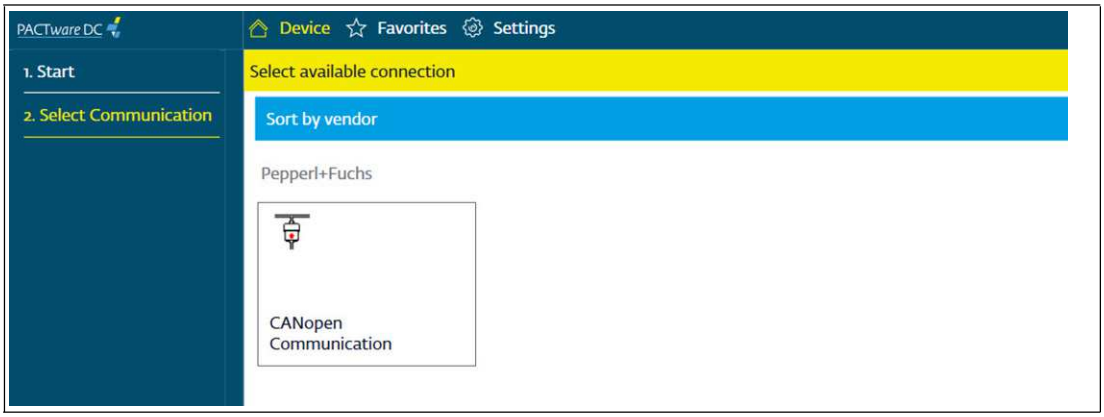


Figure 5.2

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

↳ PACTwareDC finds connected devices.

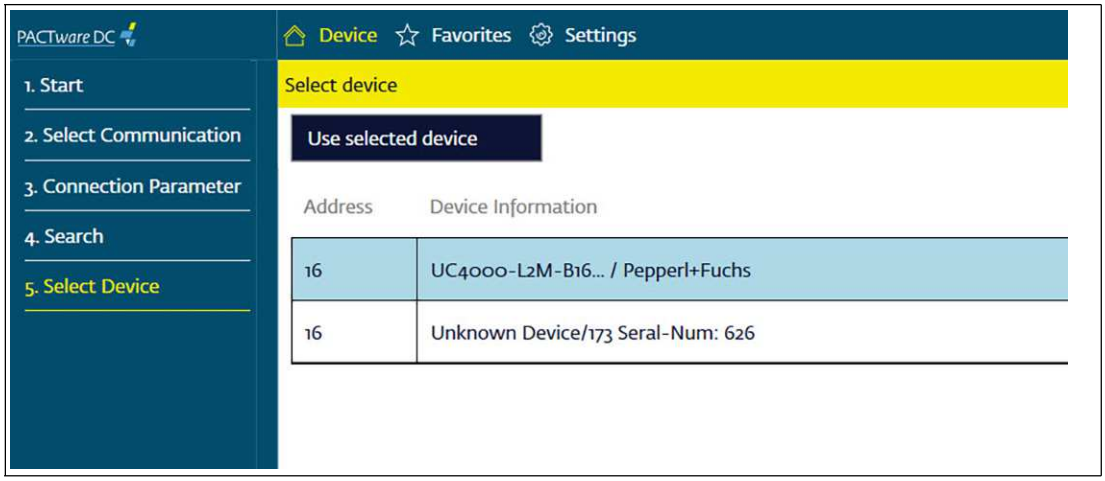


Figure 5.3

4. Now select the desired device by double-clicking.

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

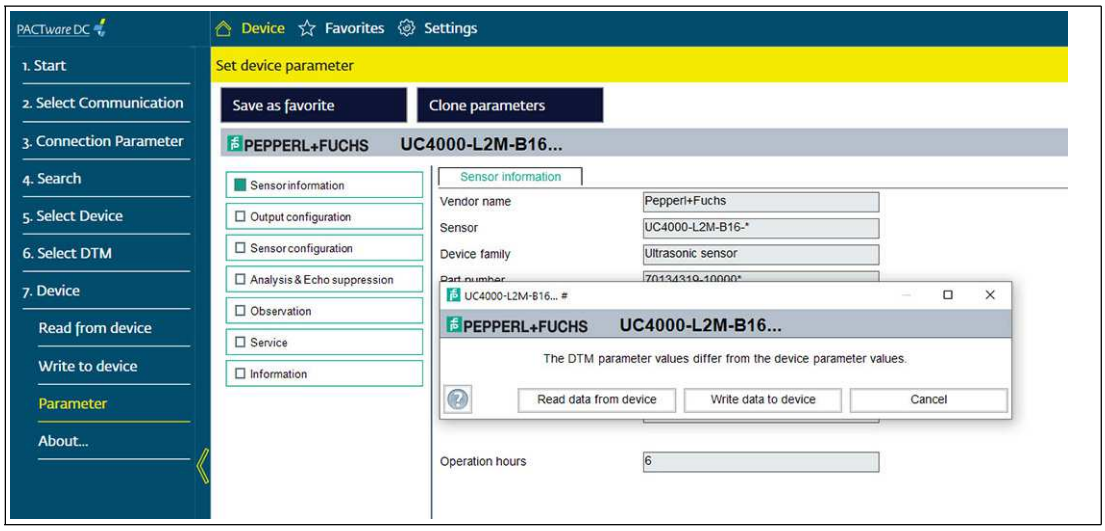


Figure 5.4

## 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, diagnosis, 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.

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## 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.

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# 6 Parameterization and Analysis Using PACTware and DTM via CANopen

## 6.1 Overview

The sensor parameters are different for each device. 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 logic, 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 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

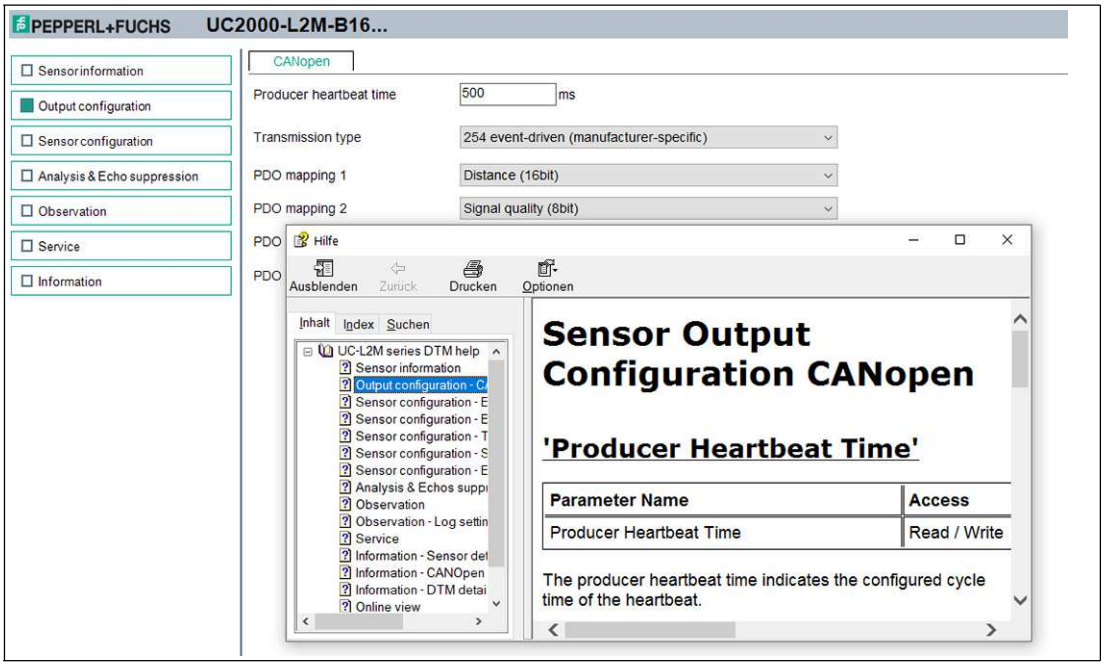


Figure 6.1

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

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## 6.2 Sensor Information Menu Item

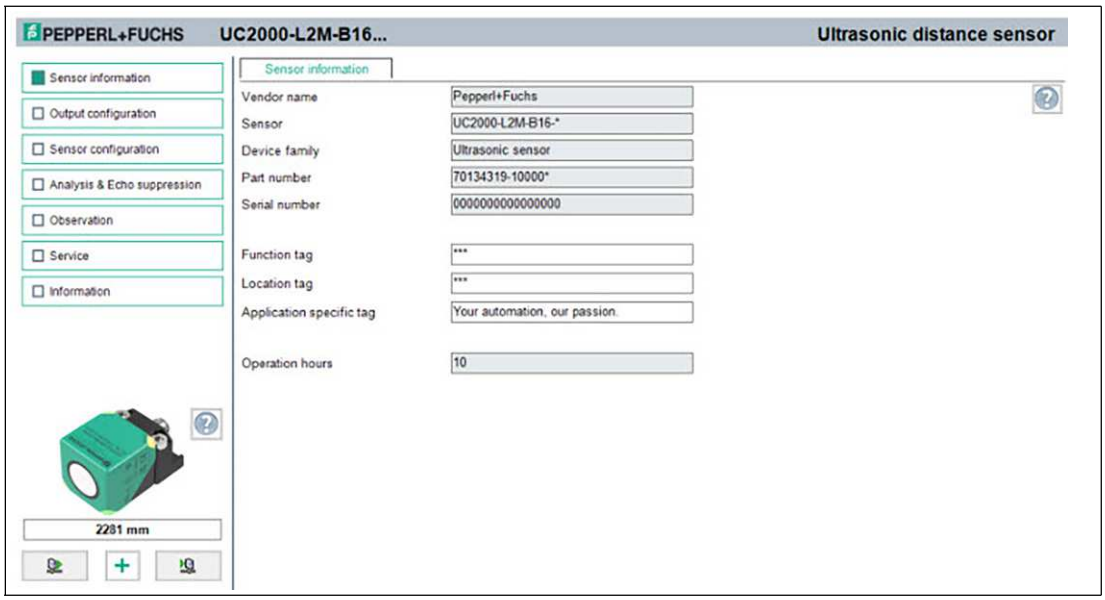



Figure 6.2

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 (string) can be input in the "User tag" and "Application-specific tag" fields.

## 6.3 Output Configuration Menu Item

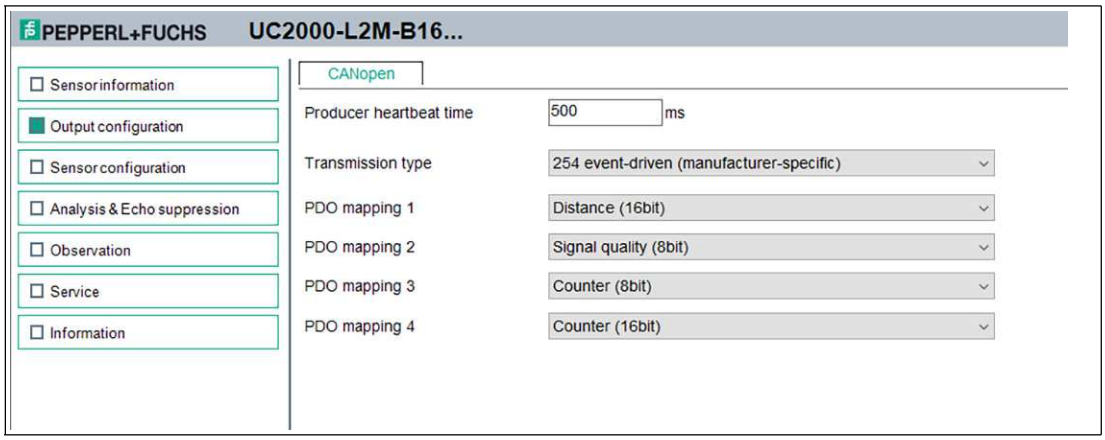



Figure 6.3

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

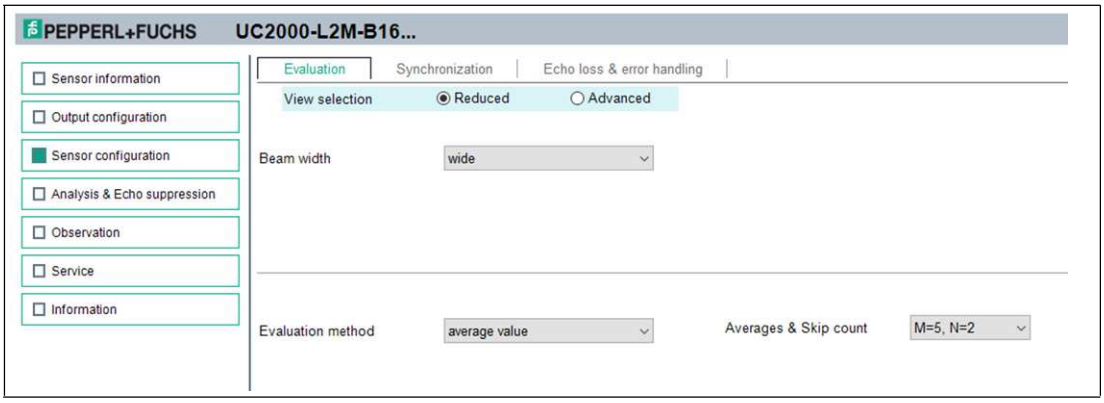



Figure 6.4

The **Sensor configuration** menu item consists of four tabs

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

## Evaluation Tab (Advanced View)

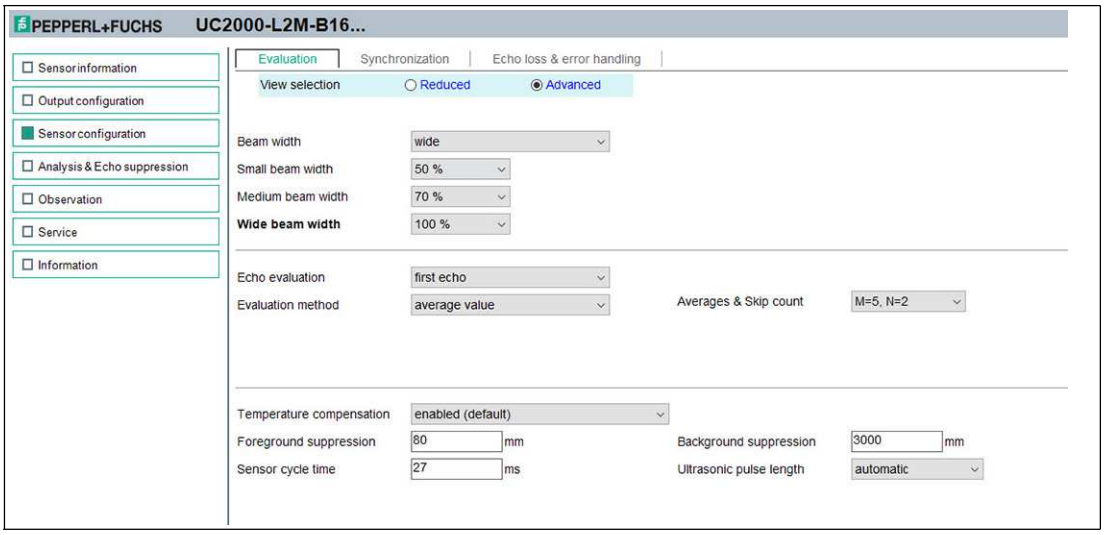
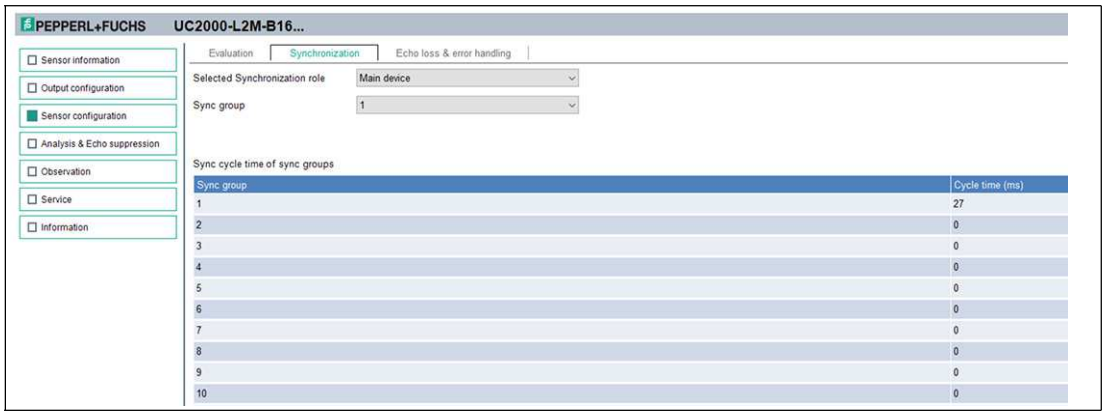



Figure 6.5

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 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 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."

## Dealing With Echo Loss And Troubleshooting Tab

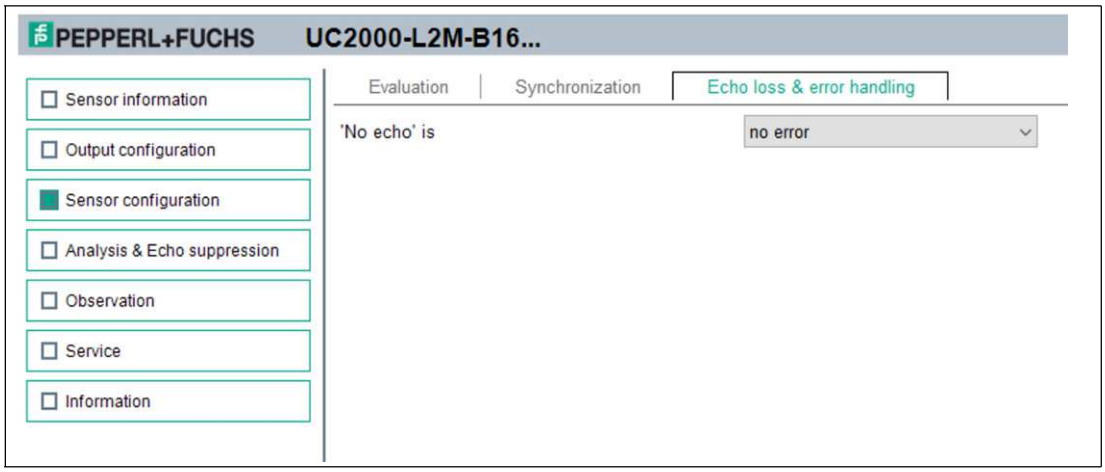



Figure 6.6

In the **Dealing with echo loss and troubleshooting** 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

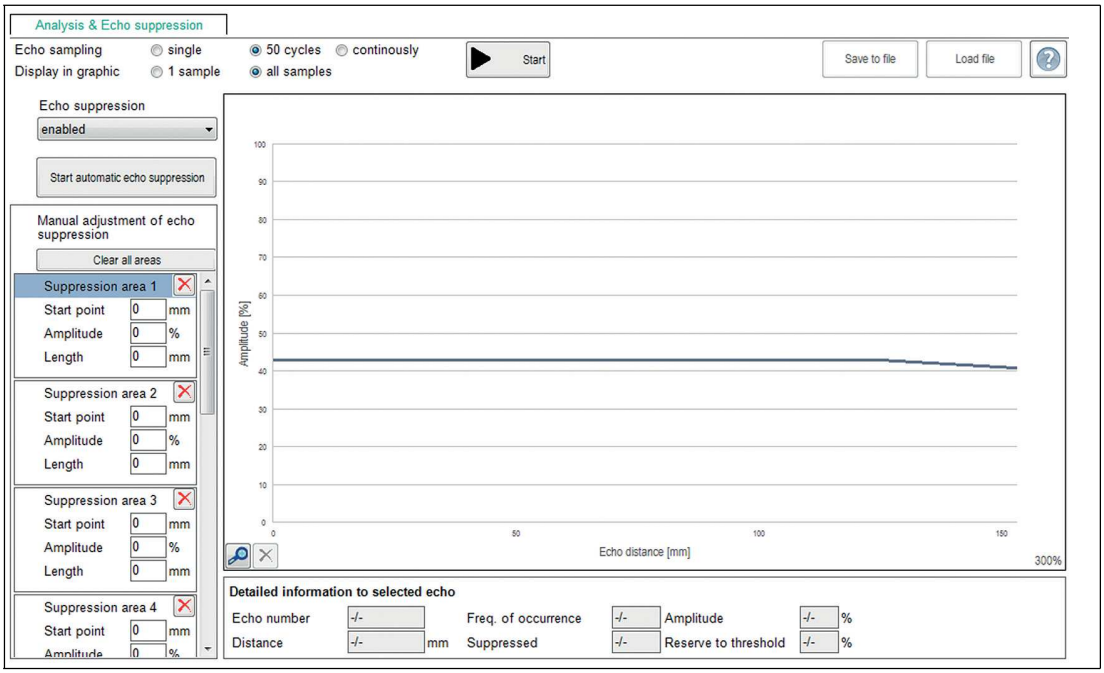



Figure 6.7

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 option, 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.

### 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 fresh echo samples.

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

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## Menu Description

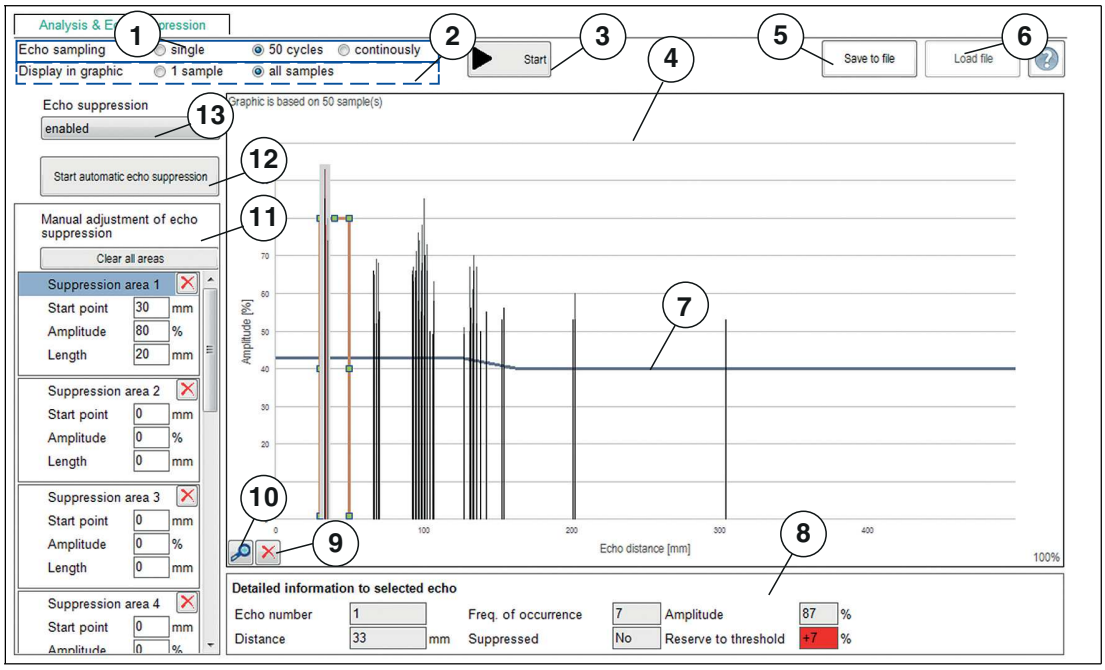


Figure 6.8

| No. | Name | Description |
|---|---|---|
| 1 | Echo sampling | In the "Echo sampling" area, you can choose whether to record a single value, 50 values or continuous data.<br>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. You will know this has worked when slightly varying the alignment no longer increases the displayed echo amplitude. |
| 2 | Display in graphic | You can use the "Display in graphic" 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."<br>• In the case of "individual" echo sampling, echo sampling stops after one measurement.<br>• 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.<br>• 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.<br>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 | Description |
|---|---|---|
| 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.<br>**Note:** You can only load a saved file if disconnected from the sensor. |
| 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 | Clicking on one of the echo columns shown in the graphic displays detailed information about the selected echo below the graphic.<br>**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 along the x-axis 5-fold in 100 % increments.<br>If magnification is set to more than 100 %, the displayed area of the x-axis can be shifted (by scrolling) to be able to obtain a magnified view of sections of the entire sample area.<br>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 determined by three parameters: "Start point," "Amplitude," and "Length."<br>• The mm value entered for "Start point" specifies where the suppression area starts on the X-axis of the graph.<br>• The % value for "Amplitude" specifies the height of the suppression area in keeping with the scale of the Y-axis.<br>• The mm value entered for "Length" specifies the length of the suppression area measured from the respective start point.<br>Individual areas can be cleared by either pressing the relevant button with the red "X" or by going directly to the graphic 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.<br>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.<br>You must first take a sample of the echoes in the sensor's installed state 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.

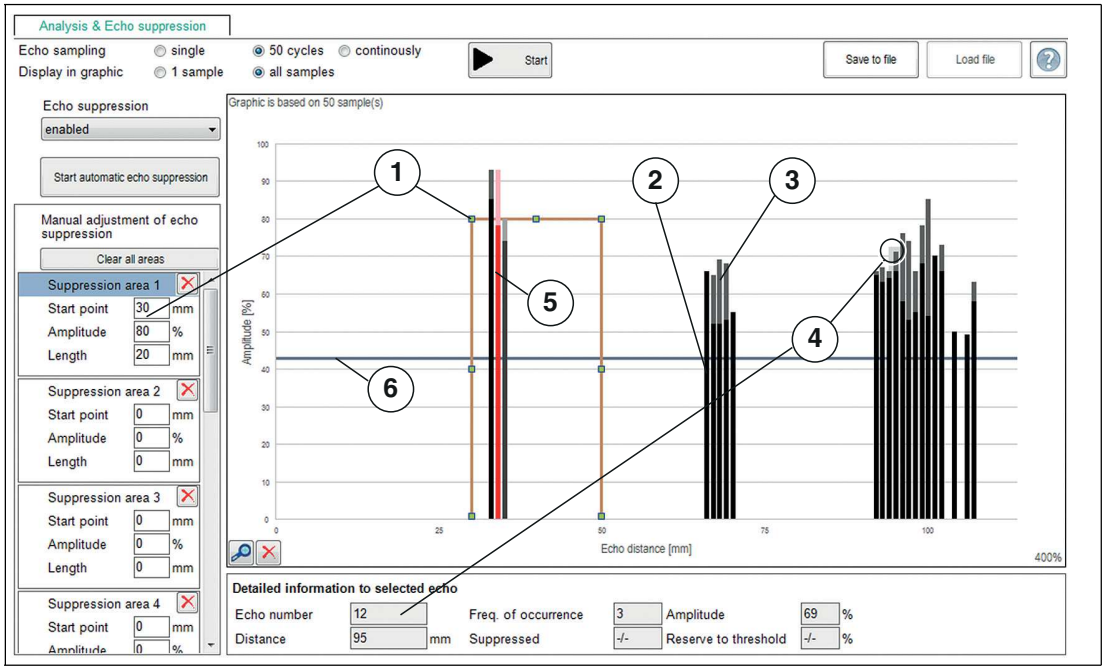


Figure 6.9

| No. | Name | Description |
|---|---|---|
| 1 | Suppression area | A rectangle indicates the specified suppression area. |
| 2 | Black part of the column | If multiple echo samples are shown in the graphic, the black part of each column shows the amplitude which 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:<br>• Echo number: The echo number is a consecutive number which numbers the echoes shown in the graphic from left to right.<br>• 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.<br>• Amplitude: The strength of the amplitudes of the selected echo is displayed as a % value<br>• 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 sees each fresh echo reflected from the object as its own echo and provides it accordingly. These multiple echoes can be identified in the graphic as echoes in the x-times actual object distance.<br>• 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."<br>• Reserve to 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 graphic as a red column.<br>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 graphic, 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").

A lot of "Echo blocks" in the echo samples may lead to the 10 available suppression areas not being sufficient for algorithm-based automatic suppression to really suppress all recorded 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 which 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, the amplitude value should not be set so high that the echo to detect (e.g., a fill level) is no longer recognized. 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 echo comes from the object that is to be detected (e.g., the level surface).

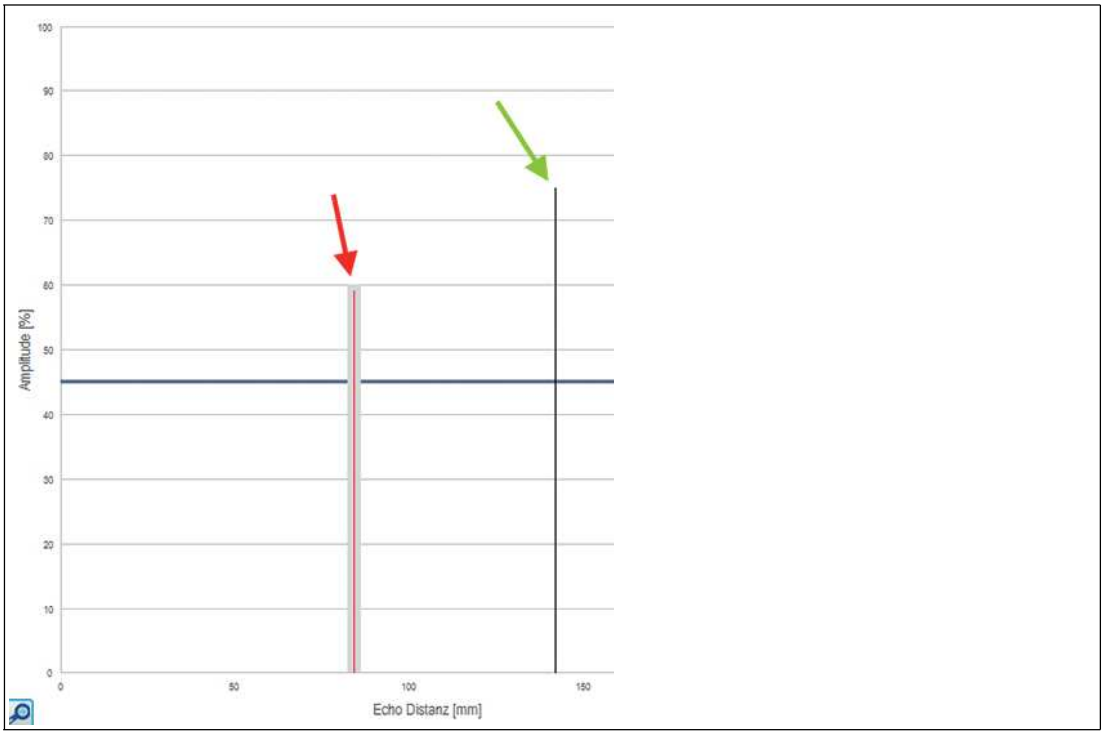


Figure 6.10

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 (in brackets are the corresponding values for an outdoor environment):

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

The graphic with set suppression area for an interior application is as follows:

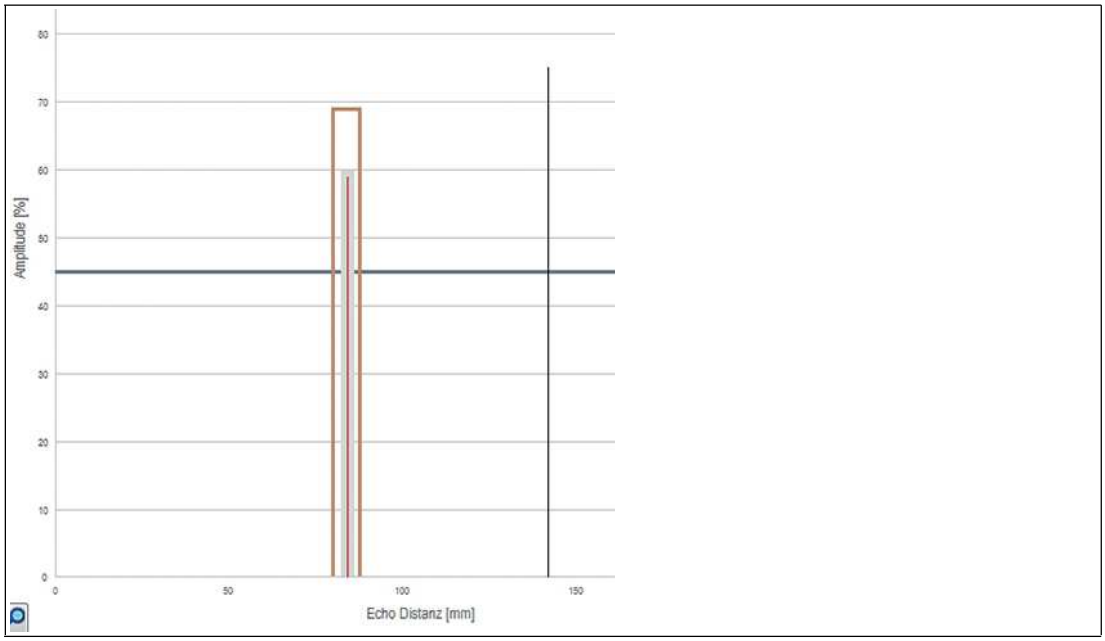


Figure 6.11

**Note**

The boundaries of suppression areas can also be adjusted directly within the graphic 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 which 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

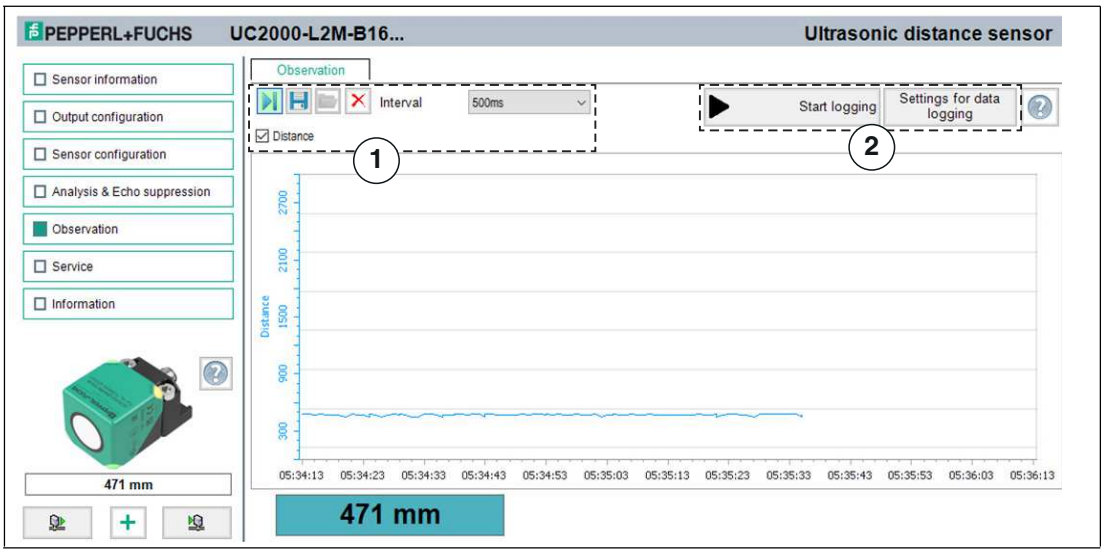


Figure 6.12

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 changing the status of the switching output or a change to the value of the distance measurement. The DTM function then observes the sensor and writes the measured variables and output statuses to a file if 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

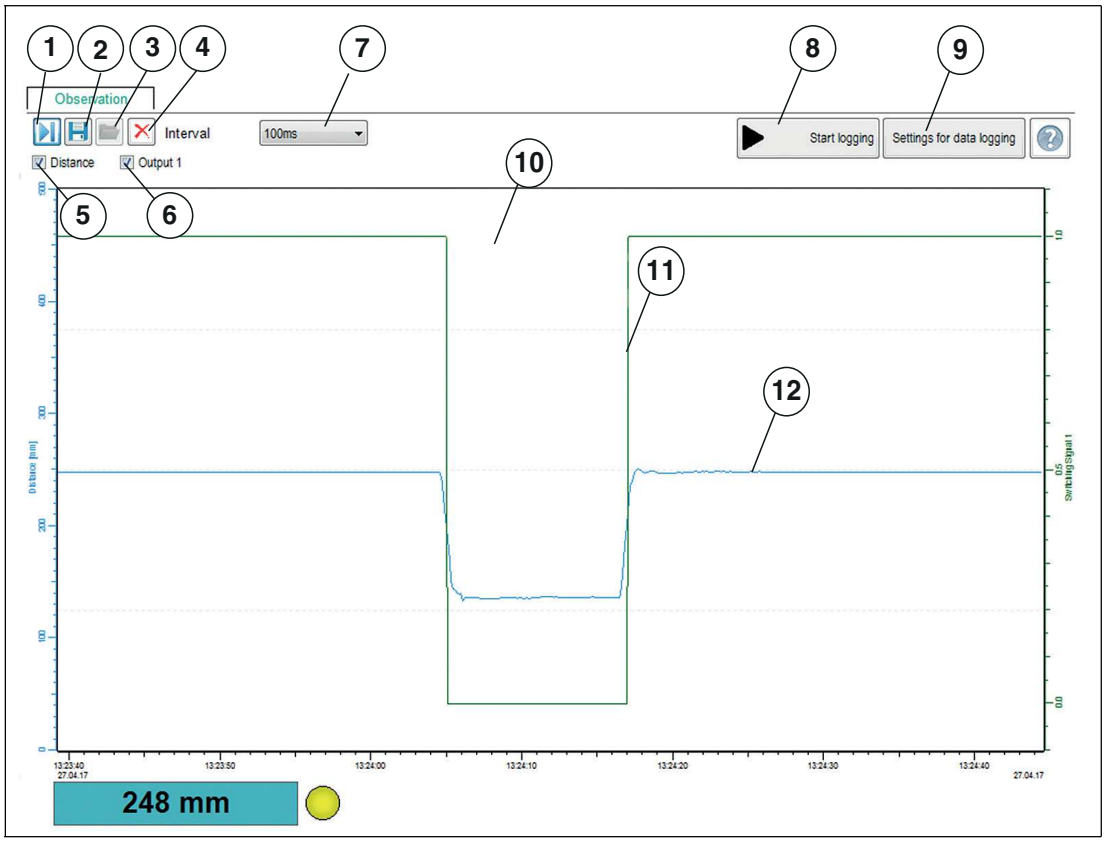


Figure 6.13

| No. | Name | Description |
|---|---|---|
| 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**<br>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.<br>Files with recorded data combined with the parameter settings can be very useful for discussing issues with our experts.<br>**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).<br>All data recorded up to this point is discarded and the display is cleared. Recording automatically restarts from scratch. |
| 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. |

| No. | Name | Description |
|---|---|---|
| 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.<br>The analog output value is displayed in the diagram for an analog output. |
| 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 recording | **Only for event-driven data logging**<br>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**<br>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.<br>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.

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## Data Logging Setting

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

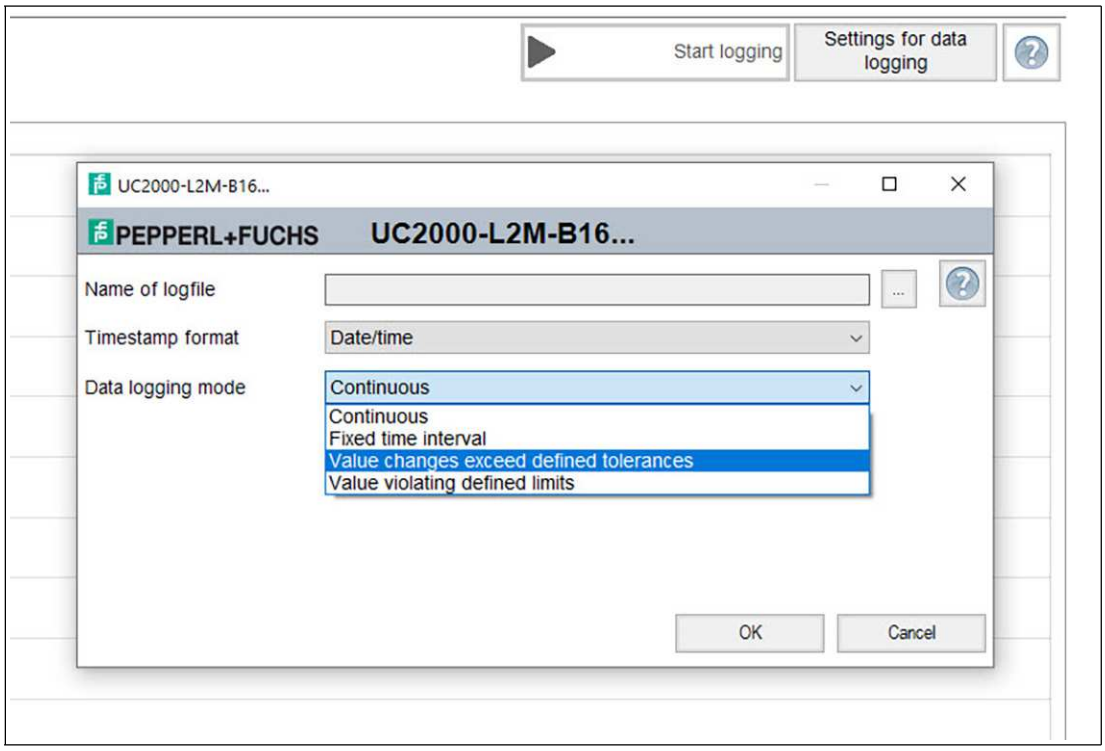


Figure 6.14

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

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

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 outside the set limits
  Data is recorded if specified, absolute limit values are exceeded. The distance value in mm and the value at the sensor analog output (if physically present on the sensor) are available as reference values. In addition, the "Trigger" parameter can be used to determine whether data recording is to take place once per instance of the limit value being exceeded or for the complete duration.

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. You need to press the "OK" button at the end to save the setting.

## 6.7 Service Menu Item

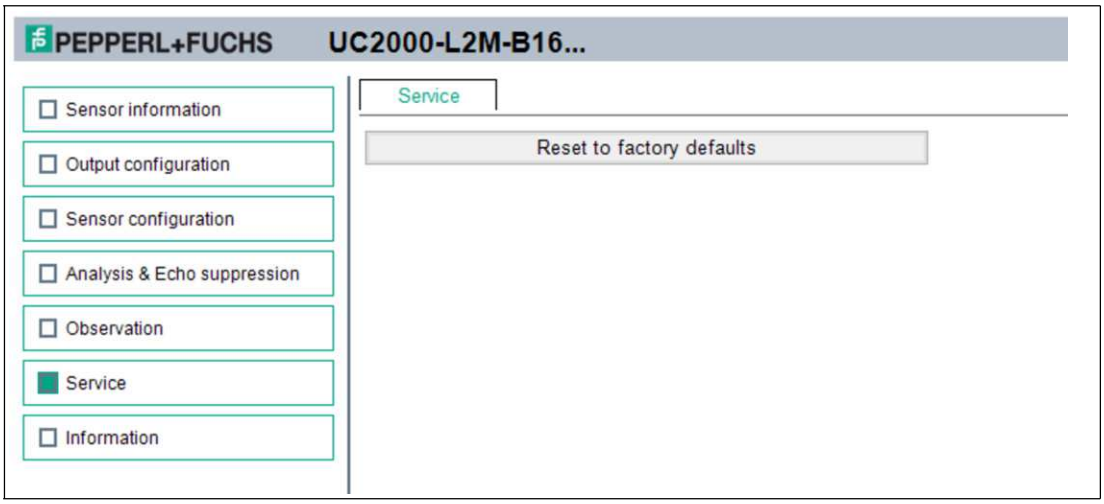


Figure 6.15

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 Information Menu Item

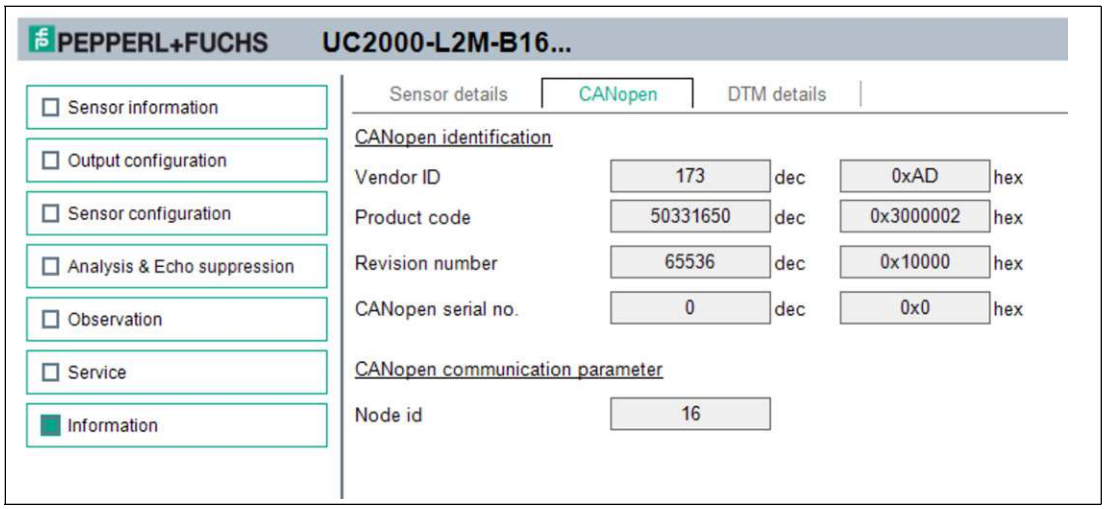


Figure 6.16

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.

Any device can receive the messages. An acceptance filter ensures that messages are received only by the intended devices. Data is transferred via message telegrams. Message telegrams consist of a COB ID (**C**ommunication **Ob**ject **Id**entifier) and a maximum of 8 subsequent bytes. The COB ID dictates the priority of the messages. The COB ID is made up 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).

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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 assembles 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 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 ... 0xFFF 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.

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### 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 (= **r**ead **o**nly) | 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 | Communi-cation 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 Vendor Status Register

| Index | Subindex | Designation | Data type | Attribute | Default value |
|---|---|---|---|---|---|
| 0x1002 | 0x00 | Vendor Status Register | unsigned 32 | ro | 0 |

Table 7.6

## 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 7.7

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## 7.7 Object 0x1005 SYNC Identifier

| Index | Subindex | Designation | Data type | Attribute | Default value |
|---|---|---|---|---|---|
| 0x1005 | 0x00 | COB-ID SYNC Message | unsigned32 | rw (= **r**ead/**w**rite) | 0x00000080 |

Table 7.8

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<br>0x80 = $128_{dec}$ |

Table 7.9

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 7.10

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 Hard-ware Version | visible string | ro | 1.0 |

Table 7.11

## 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 7.12

## 7.11 Object 0x1010 Save Parameters

| Index | Subindex | Designation | Data type | Attribute | Default value |
|---|---|---|---|---|---|
| 0x1011 | 0x01 | Save All Parame-ters | unsigned 32 | ro | 0x00000002 |

Table 7.13

## 7.12 Object 0x1011 Restore Factory Parameters

| Index | Subindex | Designation | Data type | Attribute | Default value |
|---|---|---|---|---|---|
| 0x1010 | 0x01 | Restore Default Parameters | unsigned 32 | rw | 0x00000001 |

Table 7.14

To restore factory parameters, write the specific code "0x64616f6c" in parameter 0x1010. After switching the ultrasonic sensor off and on again, factory settings will be restored.

## 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 7.15

## 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 7.16

## 7.15 Object 0x1017 Producer Heartbeat Time

| Index | Subindex | Designation | Data type | Attribute | Default value |
|---|---|---|---|---|---|
| 0x1017 | 0x00 | Producer Heartbeat Time[1] | unsigned16 | rw | 500 |

Table 7.17

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<br>For UC2000: 0x03 00 00 02<br>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 7.18

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## 7.17 Object 0x1020 Check Configuration

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

Table 7.19

## 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 7.20

## 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 7.21

| COB ID: Bit | | | |
|---|---|---|---|
| 31 | 30 | 29 ... 11 | 10 ... 0 |
| PDO present:<br>0 = currently present<br>1 = not present | RTR access:<br>0 = permitted<br>1 = not permitted | ... | CAN identifier[1] |

Table 7.22

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**<br>MSB<br>Data = 0x2022, byte 0x01<br>Meaning: Index 0x2022 Subindex: 0 (trigger US sync) 8-bit length |

Table 7.23

## 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<br>Measured value: 0 ... 3E80<br>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<br>Possible values:<br>3 = excellent<br>2 = good<br>1 = acceptable<br>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<br>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 7.24

## 7.22 Object 0x2001 Operating Hours

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

Table 7.25

## 7.23 Object 0x2010 Identification and Information

| Index | Subin-dex | Designation | Data type | Attri-bute | 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 Prod-uct ID | string | ro | https://pefu.de/<serialnumber> | Link to product info |

Table 7.26

## 7.24 Object 0x2011 EMCY Configuration

| Index | Subin-dex | Designation | Data type | Attri-bute | 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 7.27

## 7.25 Object 0x2020 Ultrasound Synchronization Mode

| Index | Subin-dex | Designation | Data type | Attri-bute | Default value | Meaning |
|---|---|---|---|---|---|---|
| 0x2020 | 0x01 | Sync Mode | unsigned8 | rw | 0 | 0 = deactivated<br>1 = Main Device<br>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 synchro-nization mode is set to "deac-tivated." |

Table 7.28

## 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 7.29

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 7.30

## 7.28 Object 0x4000 Measurement Configuration

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

Table 7.31

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

Table 7.32

## 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<br>Possible values:<br>0x00 = activated<br>0x01 = deactivated | Setting of configurable echo suppression |
| | 0x02 | Echo Suppression: Area 1 Start | unsigned16 | rw | Factory setting = 0<br>Possible values:<br>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<br>Possible values:<br>0 ... 100 | Amplitude value up to which echoes are suppressed (%) |
| | 0x04 | Echo Suppression: Area 1 Length | unsigned16 | rw | Factory setting = 0<br>Possible values:<br>0 ... End of adjustment range | Width of echo suppression in mm, from start distance value to right |

Table 7.33

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

Table 7.34

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

Table 7.35

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| Index | Subin-dex | Designation | Data type | Attri-bute | Default value | Meaning |
|---|---|---|---|---|---|---|
| 0x4001 | 0x0B | Echo Sup-pression: Area 4 Start | unsigned16 | rw | Factory setting: 0<br>Possible values:<br>0 ... End of adjust-ment range | Start distance value from which echoes are sup-pressed (mm) |
| | 0x0C | Echo Sup-pression: Area 4 Amplitude | unsigned8 | rw | Factory setting: 0<br>Possible values:<br>0 ... 100 | Amplitude value up to which echoes are suppressed (%) |
| | 0x0D | Echo Sup-pression: Area 4 Length | unsigned16 | rw | Factory setting: 0<br>Possible values:<br>0 ... End of adjust-ment range | Width of echo suppression in mm, from start distance value to right |

Table 7.36

| Index | Subin-dex | Designation | Data type | Attri-bute | Default value | Meaning |
|---|---|---|---|---|---|---|
| 0x4001 | 0x0E | Echo Sup-pression: Area 5 Start | unsigned16 | rw | Factory setting: 0<br>Possible values:<br>0 ... End of adjust-ment range | Start distance value from which echoes are sup-pressed (mm) |
| | 0x0F | Echo Sup-pression: Area 5 Amplitude | unsigned8 | rw | Factory setting: 0<br>Possible values:<br>0 ... 100 | Amplitude value up to which echoes are suppressed (%) |
| | 0x10 | Echo Sup-pression: Area 5 Length | unsigned16 | rw | Factory setting: 0<br>Possible values:<br>0 ... End of adjust-ment range | Width of echo suppression in mm, from start distance value to right |

Table 7.37

| Index | Subin-dex | Designation | Data type | Attri-bute | Default value | Meaning |
|---|---|---|---|---|---|---|
| 0x4001 | 0x11 | Echo Sup-pression: Area 6 Start | unsigned16 | rw | Factory setting: 0<br>Possible values:<br>0 ... End of adjust-ment range | Start distance value from which echoes are sup-pressed (mm) |
| | 0x12 | Echo Sup-pression: Area 6 Amplitude | unsigned8 | rw | Factory setting: 0<br>Possible values:<br>0 ... 100 | Amplitude value up to which echoes are suppressed (%) |
| | 0x13 | Echo Sup-pression: Area 6 Length | unsigned16 | rw | Factory setting: 0<br>Possible values:<br>0 ... End of adjust-ment 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 | 0x14 | Echo Suppression: Area 7 Start | unsigned16 | rw | Factory setting: 0<br>Possible values:<br>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<br>Possible values:<br>0 ... 100 | Amplitude value up to which echoes are suppressed (%) |
| | 0x16 | Echo Suppression: Area 8 Length | unsigned16 | rw | Factory setting: 0<br>Possible values:<br>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 | 0x17 | Echo Suppression: Area 8 Start | unsigned16 | rw | Factory setting: 0<br>Possible values:<br>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<br>Possible values:<br>0 ... 100 | Amplitude value up to which echoes are suppressed (%) |
| | 0x19 | Echo Suppression: Area 8 Length | unsigned16 | rw | Factory setting: 0<br>Possible values:<br>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 | 0x1A | Echo Suppression: Area 9 Start | unsigned16 | rw | Factory setting: 0<br>Possible values:<br>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<br>Possible values:<br>0 ... 100 | Amplitude value up to which echoes are suppressed (%) |
| | 0x1C | Echo Suppression: Area 9 Length | unsigned16 | rw | Factory setting: 0<br>Possible values:<br>0 ... End of adjustment range | Width of echo suppression in mm, from start distance value to right |

Table 7.41

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| Index | Subin-dex | Designation | Data type | Attri-bute | Default value | Meaning |
|---|---|---|---|---|---|---|
| 0x4001 | 0x1D | Echo Sup-pression: Area 10 Start | unsigned16 | rw | Factory setting: 0<br>Possible values:<br>0 ... End of adjust-ment range | Start distance value from which echoes are sup-pressed (mm) |
| | 0x1E | Echo Sup-pression: Area 10 Amplitude | unsigned8 | rw | Factory setting: 0<br>Possible values:<br>0 ... 100 | Amplitude value up to which echoes are suppressed (%) |
| | 0x1F | Echo Sup-pression: Area 10 Length | unsigned16 | rw | Factory setting: 0<br>Possible values:<br>0 ... End of adjust-ment range | Width of echo suppression in mm, from start distance value to right |

Table 7.42

## 7.30 Object 0x4002 Evaluation Configuration

| Index | Subin-dex | Designation | Data type | Attri-bute | Default value | Meaning |
|---|---|---|---|---|---|---|
| 0x4002 | 0x01 | Eval Config: Echo Evalua-tion | unsigned8 | rw | Factory setting is 0x00 = first echo<br>Possible values:<br>0x00 = first echo<br>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<br>Possible values:<br>0x00 = no<br>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<br>Possible values:<br>0x00 = none<br>0x01 = arithmetic average<br>0x02 = low-pass fil-ter | Setting the echo value deter-mination used.<br>With "Low-pass filter," short-term fluctuations in the dis-tance value are suppressed. |

Table 7.43

| Index | Subin-dex | Designation | Data type | Attri-bute | Default value | Meaning |
|---|---|---|---|---|---|---|
| 0x4002 | 0x04 | Eval Config: Arithmetic Average | unsigned8 | rw | Factory setting = 0x07 -> M = 5 N = 2<br>Possible values:<br>0x00 -> M = 2 N = 0<br>0x01 -> M = 3 N = 0<br>0x02 -> M = 3 N = 1<br>0x03 -> M = 4 N = 0<br>0x04 -> M = 4 N = 1<br>0x05 -> M = 5 N = 0<br>0x06 -> M = 5 N = 1<br>0x07 -> M = 5 N = 2<br>0x08 -> M = 6 N = 0<br>0x09 -> M = 6 N = 1<br>0x0A -> M = 6 N = 2<br>0x0B -> M = 7 N = 0<br>0x0C -> M = 7 N = 1<br>0x0D -> M = 7 N = 2<br>0x0E -> M = 7 N = 3<br>0x0F -> M = 8 N = 0<br>0x10 -> M = 8 N = 1<br>0x11 -> M = 8 N = 2<br>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 measure-ments from the number M that are not taken into account for average determination. These are the value/values with the greatest error from the measure-ment result most recently deter-mined. The current measurement result is calculated arithmetically from the remaining data. |

Table 7.44

| Index | Subin-dex | Designation | Data type | Attri-bute | Default value | Meaning |
|---|---|---|---|---|---|---|
| 0x4002 | 0x05 | Eval Config: Low Pass Weight | unsigned8 | rw | Factory setting = 75<br>Possible values:<br>1 ... 99 | This parameter determines how much weighting in percentage terms the result of the previous measurement is given in the current evaluation.<br>The following formula applies:<br>ResN = (ResN-1 x W + Meas x (100 - W)) / 100<br>N = value of 1 ... 99<br>Res = result<br>W = "weighting of previous measurement" factor<br>Meas = current measured value |
| | 0x06 | Eval Config: Low Pass Deviation | unsigned8 | rw | Factory setting = 10<br>Possible values:<br>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.<br>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.<br>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<br>Possible values:<br>0 ... 60000 | Low-pass jump time in ms. |

Table 7.45

## 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 0x00 = activated<br>Possible values:<br>0x00 = deactivated<br>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.<br>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<br>Possible values:<br>-40 ... 100 | Setting operating temperature in °C |

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## 7.32 Object 0x4100 Echo Field Information

| Index | Subin-dex | Designation | Data type | Attri-bute | 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 7.47

## 7.33 Object 0x4101 Switching Threshold Values

| Index | Subin-dex | Designation | Data type | Attri-bute | Default value | Meaning |
|---|---|---|---|---|---|---|
| 0x4100 | 0x00 | Threshold Information | unsigned16 | ro | 0 | Contains the switching threshold values saved for each distance |

Table 7.48

# 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 "Mutliplex Mode" are available for operating multiple ultrasonic sensors of the UC***-L2M 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.

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## Define Cycle Time

The cycle time determines the 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

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# 10 Troubleshooting

## 10.1 What to Do in Case of a Fault

In case of a fault, use the following checklist to determine whether a fault with 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. Have details of the model number and firmware version of the sensor ready if possible.

**Checklist**

| Error | Cause | Remedy |
|---|---|---|
| Green LED not lit up | The voltage supply is switched off. | Check whether there is a reason why the voltage supply is switched off (installation or maintenance work, etc.). Switch on the voltage supply if appropriate. |
| 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 voltage supply | Check whether there is a reason for the absence of the voltage supply (installation or maintenance work, etc.). Switch on the voltage supply.<br>Make sure that the correct pins are connected for CAN communication. (Pinout differs from standard pinout) |
| The target object is not detected, even though the sensor is OK | There may be an obstruction in the vicinity of the sensor | Check that the sensor is correctly aligned. Check sensor parameterization and, if necessary, change the sound beam width. |

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