MICRO-EPSILON


Operating Instructions

# RS422 Extension terminal, EtherCAT

optoNCDT 1302
optoNCDT 1402
optoNCDT 1420
optoNCDT 1700
optoNCDT 2200
optoNCDT 2300

optoCONTROL 2500
optoCONTROL 2600

RS422 extension terminal

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# Contents

# 1. Safety

The handling of the system assumes knowledge of the operating instructions.

## 1.1 Symbols used

The following symbols are used in these operating instructions.

| | |
|---|---|
| ⚠ CAUTION | Indicates a hazardous situation which, if not avoided, may result in minor or moderate injury. |
| NOTICE | Indicates a situation that may result in property damage if not avoided. |
| ➔ | Indicates a user action. |
| i | Indicates a tip for users. |
| `Measure` | Indicates hardware or a software button/menu. |

## 1.2 Warnings

⚠ CAUTION

Connect the electrical components of the RS422 extension terminal only when the terminal is disconnected from the power supply.

> Risk of injury

> Damage to and destruction of the RS422 extension terminal

Connect the power supply in accordance with the safety regulations for electrical equipment.

> Risk of injury

> Damage to and destruction of the RS422 extension terminal

The supply voltage must not exceed the specified limits

> Risk of injury

> Damage to and destruction of the RS422 extension terminal

NOTICE

Avoid shocks and impacts to the RS422 extension terminal.

> Damage to and destruction of the RS422 extension terminal

Connect the sensors/systems only when the RS422 extension terminal is not bearing any voltage.

> Damage to and destruction of the RS422 extension terminal

## 1.3 Notes on CE Marking

The following apply for the RS422 extension terminal:

- EU Directive 2014/30/EU
- EU Directive 2011/65/EU, “RoHS“ category 11

Products which carry the CE mark satisfy the requirements of the EU directives cited and the European standards (EN) listed therein. The EU Declaration of Conformity is available to the responsible authorities according to EU Directive, article 10, at:

MICRO-Epsilon Optronic GmbH
Lessingstraße 14
01465 Langebrück / Germany

The RS422 extension terminal is designed for use in industrial environments and meets the requirements.

## 1.4 Proper Use

- The RS422 extension terminal is designed for industrial use in production automation and machine monitoring. It is used to connect Micro-Epsilon sensors/systems in EtherCAT networks.
- The RS422 extension terminal may only be operated within the limits specified in the technical data, see Chap. 2.2.
- The RS422 extension terminal must be used in such a way that no persons are endangered or machines and other material goods are damaged in the event of malfunction or total failure of the RS422 extension terminal.
- Take additional precautions for safety and damage prevention in case of safety-related applications.

## 1.5 Proper Environment

- Protection class IP 30
- Operating temperature: 0 ... 50 °C
- Storage temperature: -20 ... +70 °C
- Humidity: 95 %, non-condensing
- Ambient pressure: Atmospheric pressure

# 2. Functional Principle, Technical Data

## 2.1 Functional Principle

The RS422 extension terminal integrates a maximum of 2 Micro-Epsilon sensors/systems in a real-time Ethernet field bus.

Sensors and systems supported:

- optoNCDT 1302
- optoNCDT 1402, 1420
- optoNCDT 1700
- optoNCDT 2200 / optoNCDT 2220
- optoNCDT 2300
- optoCONTROL 2500
- optoCONTROL 2600

Properties:

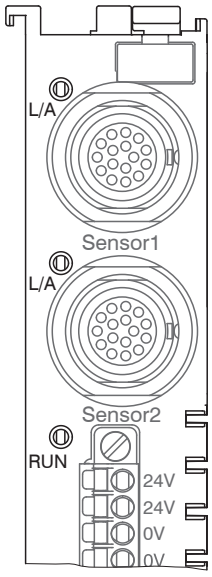
- Extension terminal for Beckhoff system
- Operation as a slave
- Connection of 2 sensors via RS422 or EtherCAT

The parameters for all inputs and outputs to the RS422 extension terminal and its connected sensors/systems via the Beckhoff TwinCAT® System Manager or other EtherCAT masters. For details, see www.Beckhoff.com. etc.

## 2.2 Technical Data

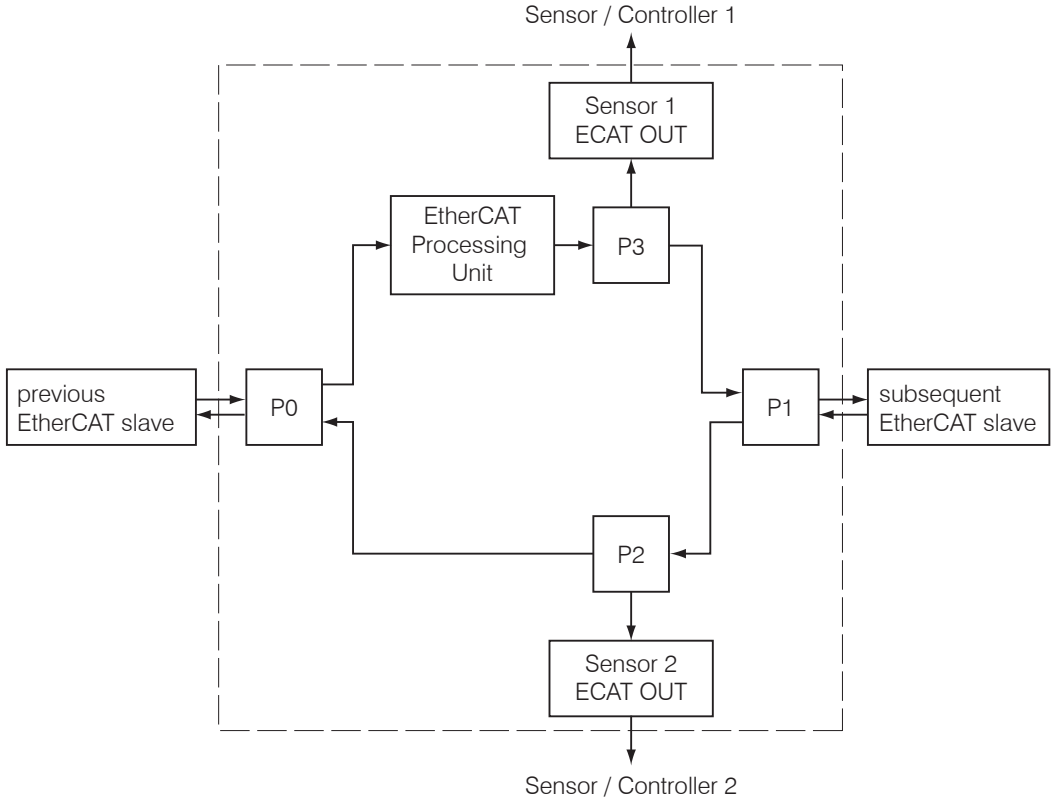
| | |
|---|---|
| Measuring frequencies | 0.312 ... 10 kHz (for RS422)<br>100 kHz (for EtherCAT) |
| Baud rates | 9600 Baud ... 1.5 MBaud |
| Connectors | 2x push-pull sockets for the sensors |
| Outputs/inputs: | 2x E-bus<br>2x sensor female connectors, 16-pin (power supply, laser on/off, sync in, RS422, EtherCat)<br>1x terminal block (Laser On/Off, 24 V, 0V, 2x PE) |
| Resolution | 16 Bit |
| Conversion time | 100 µs |
| Minimum cycle time per distributed clock | 100 µs |
| Power supply for the electronics | 24 VDC ±15%, protected against polarity reversal, supply of the connected sensors via the RS422 extension terminal |
| Power consumption from the E-Bus | typically 180 mA |
| Bit width in the process image | Outputs: 2x 16 bit |
| Configuration | via TwinCAT System Manager |
| Weight | 115 g |
| Operating temperature | 0 °C to 50 °C |
| Storage temperature | -20 °C to 70 °C |
| Relative humidity | 95%, no condensation |
| Dimensions | approximately 27 mm x 100 mm x 70 mm<br>(lined up in a row of width: 24 mm) |
| Installation | on 35 mm mounting rail as per EN 50022 |
| Protection class | IP 30 |

## 2.3 LEDs




| LED | Color | Meaning | |
|---|---|---|---|
| L/A | green | Indicate the link status to the sensors. | |
| | | off | No sensor connected through EtherCAT or no sensor detected through RS422 |
| | | on | Sensor connected through EtherCAT or sensor detected through RS422 |
| | | flashing | Sensor connected through EtherCAT and data transmission is on |
| RUN | green | Indicates the operating state of the terminal. | |
| | | off | INIT status |
| | | flashing | PRE-OP status |
| | | single flash | SAFE-OP status |
| | | on | OP status |

## 2.4 EtherCAT Port Division



# 3. Delivery

## 3.1 Unpacking

The delivery includes:

- 1 RS422 extension terminal
- 1 assembly Instructions
- 1 spring terminal block
- 1 CD-ROM with instruction manual

➡ Carefully remove the components of the measuring system from the packaging and ensure that the goods are forwarded in such a way that no damage can occur.

➡ Check the delivery for completeness and shipping damage immediately after unpacking.

➡ If there is damage or parts are missing, immediately contact the manufacturer or supplier.

## 3.2 Storage

Storage temperature: -20 ... +70 °C

Humidity: 95 % (no condensation)

# 4. Assembly and Installation

i Ensure careful handling during installation and operation. The RS422 extension terminal must be installed when disconnected from the power supply.

## 4.1 Assembly

➡ Attach the RS422 extension terminal to a DIN rail, type TS35.

➡ Observe the minimum bending radii of the connection cables.

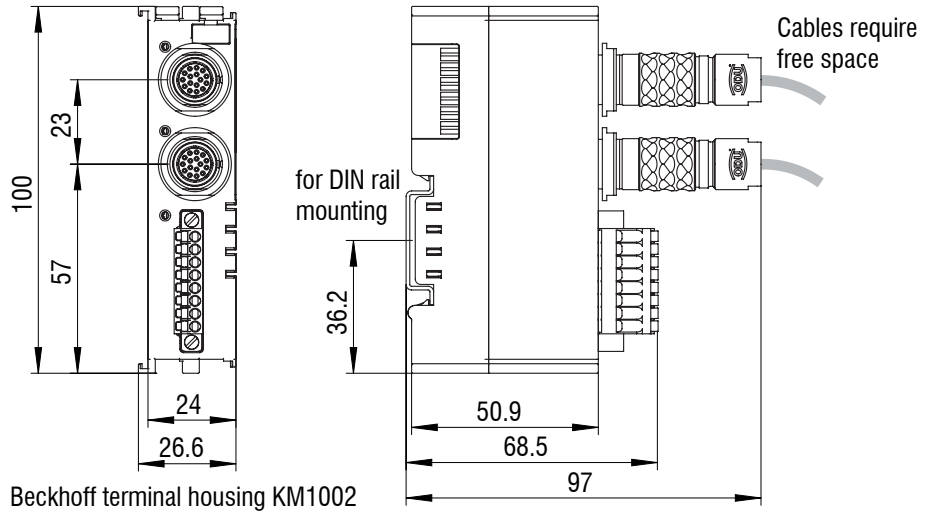



*Fig. 1 Dimensional drawing of the RS422 extension terminal, dimensions in mm*

## 4.2 Installation

Make sure that the individual modules are latched securely into the DIN rail. The bus must be connected with the bus end terminal.

i Connect the sensors/systems only when the RS422 extension terminal is not bearing any voltage.

The sensors/systems connected to the RS422 extension terminal are powered by the field supply.

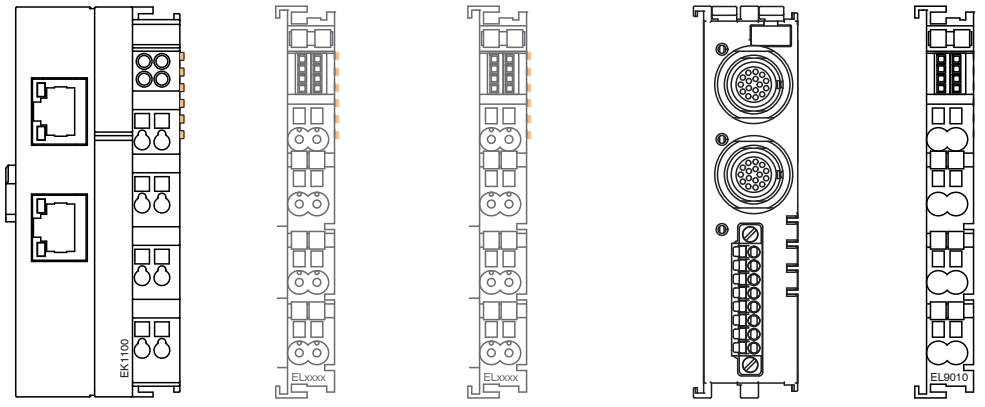



*Fig. 2 Sample configuration of EtherCAT with output and input terminals*

**NOTICE**

Damage of extension terminal by balancing current. Connect the extension terminal (PE terminal) to the protective earth connection of mains power.

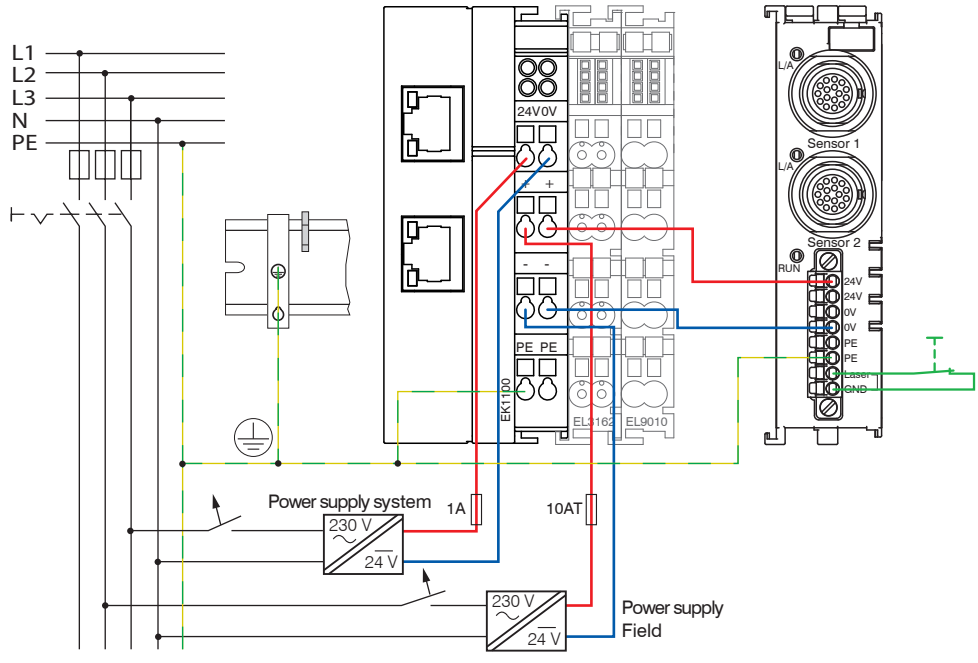



*Fig. 3 Example circuit for the system and field supply*

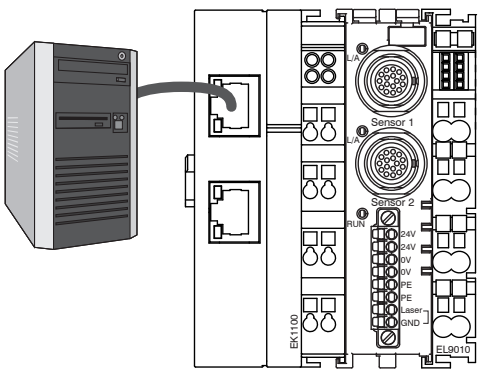
Use separate power supplies for the system supply and field supply.

Do not connect the protective earth connection PE of RS422 extension terminal with the supply ground of system respectively field supply. As a result, the bus communication is disrupted or the RS422 extension terminal damaged.

➡ Connect the `Laser` and `GND` inputs to the RS422 extension terminal in order to switch on the laser beam of the connected sensors, see Fig. 3.

A connection of the input to `GND` using a button or a transistor (NPN - Open Collector) is sufficient for starting. The laser beam of the sensors that are connected to the RS422 extension terminal is switched off when the inputs are open.

➡ Connect the EtherCAT bus coupler to a PC. Use a LAN cable with RJ-45 connectors for this.



# 5. Operation

## 5.1 EtherCAT Configuration with Beckhoff TwinCAT© Manager

### 5.1.1 Slave Information File

The Beckhoff TwinCAT Manager, for example, can be used as EtherCAT© master on the PC.

➡ Copy the slave information file `RS422klemme_V2.xml` from the enclosed CD to the directory
\\TwinCAT\IO\EtherCAT (if TwinCAT© Version ≤ 3.0 is used)
\\TwinCAT\3.1\IO\EtherCAT (if TwinCAT© Version ≥ 3.1 is used.

EtherCAT® slave information files are XML files that specify the properties of the slave device for the EtherCAT® Master and they contain information on the communication objects to be supported. You will find the latest program routine at: www.micro-epsilon.com/download/software/RS422-klemme-EtherCAT-XML.zip

➡ Start the TwinCAT© System Manager program.

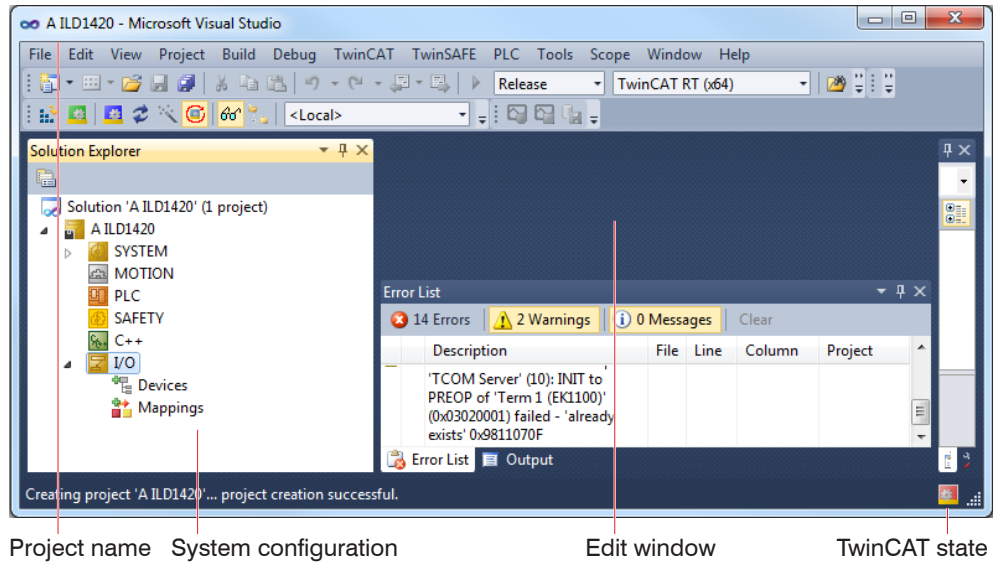



*Fig. 4 TwinCAT System Manager program interface*

### 5.1.2 Set Up Interface

For the RS422 extension terminal can communicate with the interface card, the driver of the interface card must be replaced by a driver from Beckhoff. Proceed as follows.

➡ In the `TwinCAT` menu bar, select the `Show Real Time Ethernet Compatible Devices...` entry.

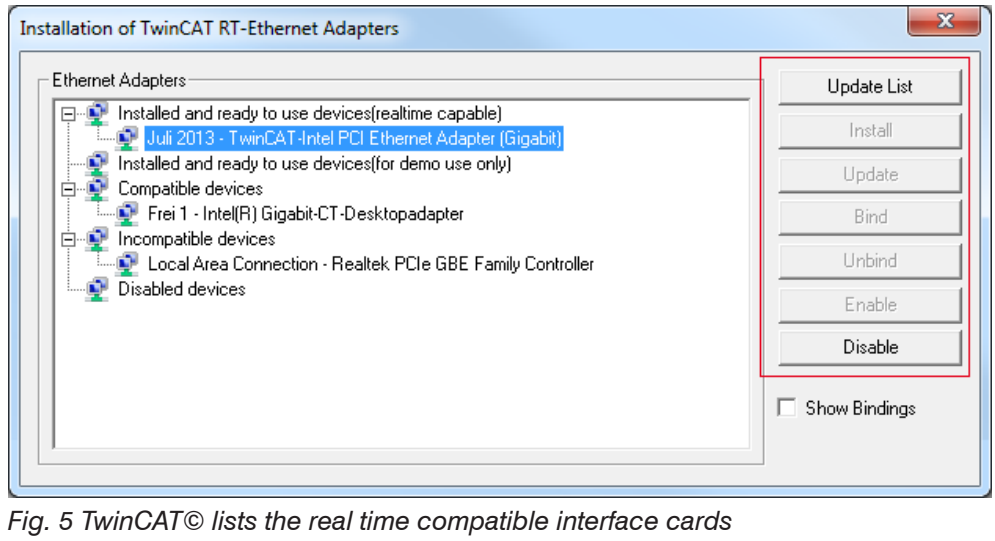



*Fig. 5 TwinCAT© lists the real time compatible interface cards*

➡ Mark the adapter provided for the connection.

If the driver of the interface card needs an update, the TwinCAT System Manager © enables the `Install` button. If necessary, follow the installation instructions.

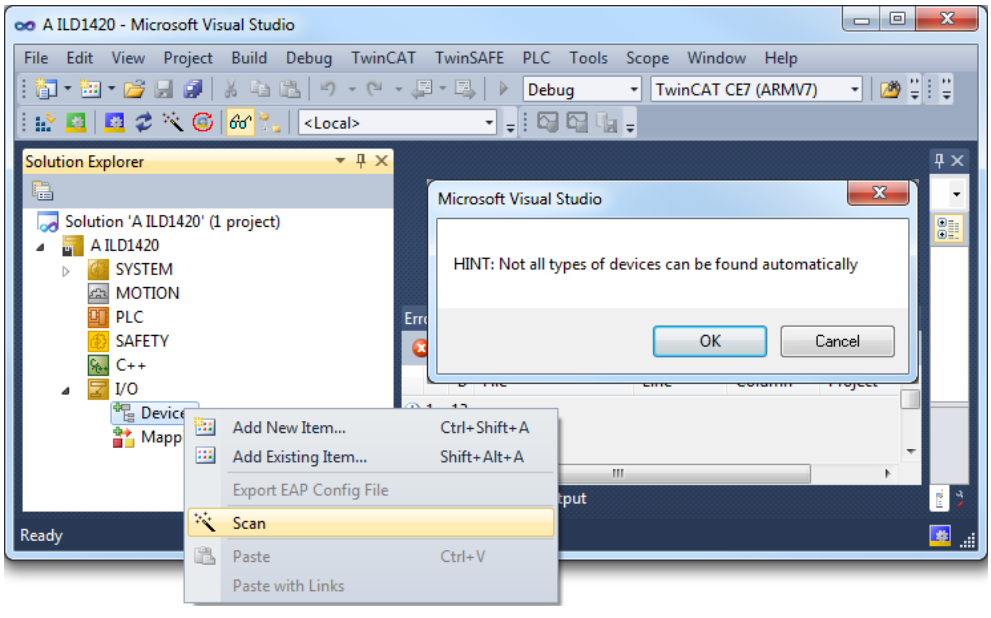
If the operating system displays  a warning about the "Windows Logo Certification", see illustration below, click on `Continue Anyway`.

➨ Click the `Enable` button to complete the installation procedure.

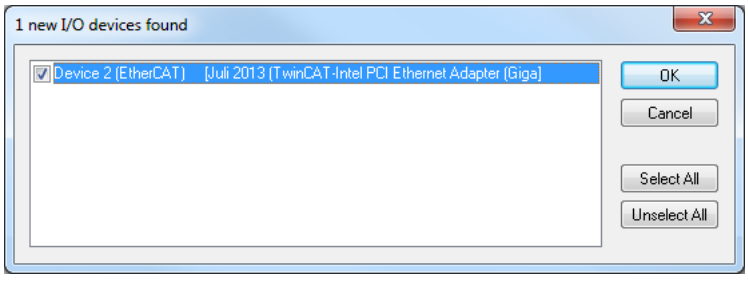
### 5.1.3 Integrate the RS422 extension terminal

➨ Select the `Devices tab`, then `Scan`.

➨ Confirm with `OK`.

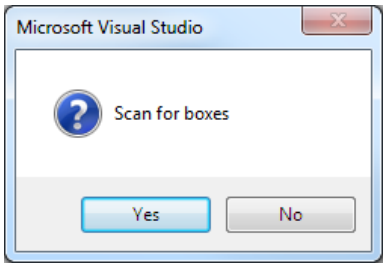



➨ Select a network card on which you wish to search for EtherCAT® Slaves.




➨ Confirm with `OK`.

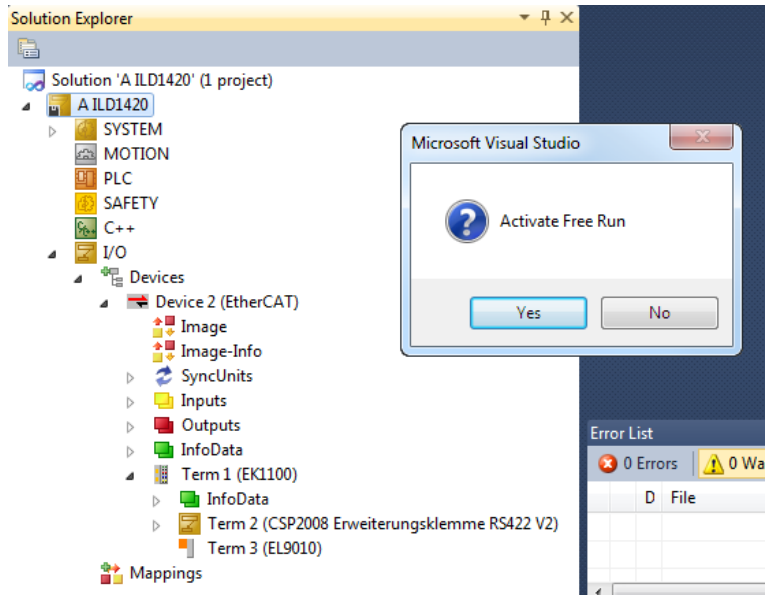
The `Scan for boxes` (EtherCAT® Slaves) window will appear.



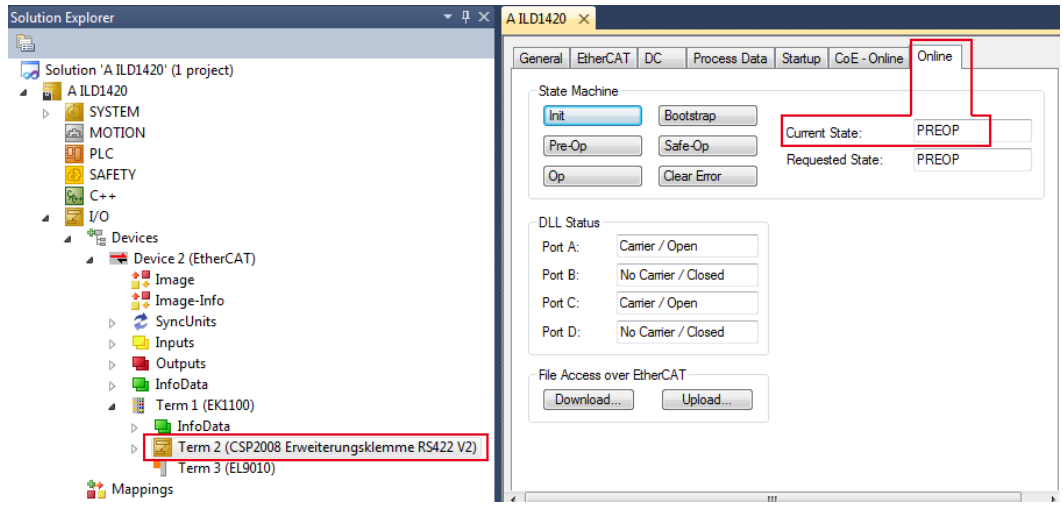

➨ Confirm with `Yes`.

The RS422 extension terminal is now listed in the system configuration.

➨ Acknowledge the `Activate free run` window with `Yes`.



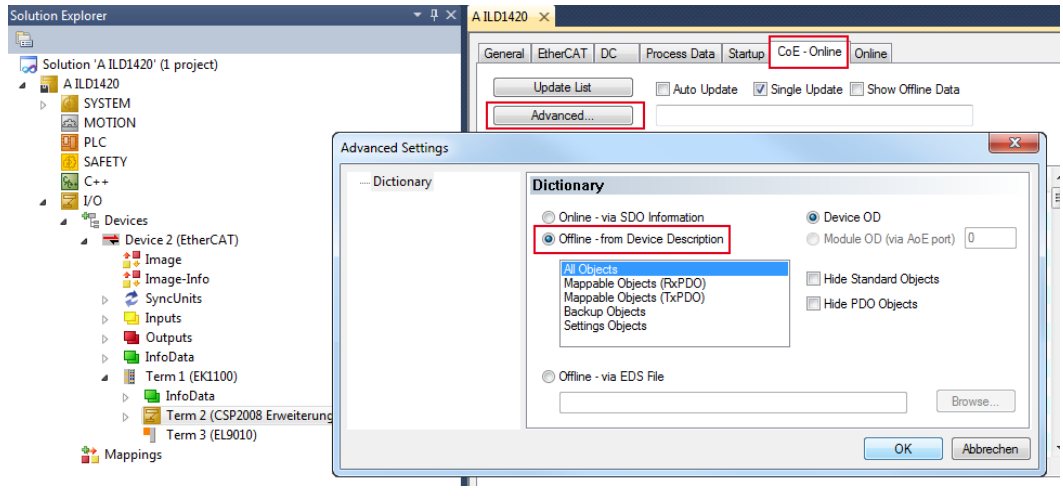

➡ Double-click the `Term 2 (CSP2008 Erweiterungsklemme RS422 V2)` item and change to the `Online` tab in the edit window.




The current status on the "online" side should at least indicate "PREOP, SAFEOP or OP". In the event of `ERR PREOP`, the cause will be shown in the message window.

In order to correctly configure the Synchron manager, it is first necessary to read the object directory of the RS422 extension terminal:

➡ Go to the `CoE - Online` tab and click the `Advanced` button.



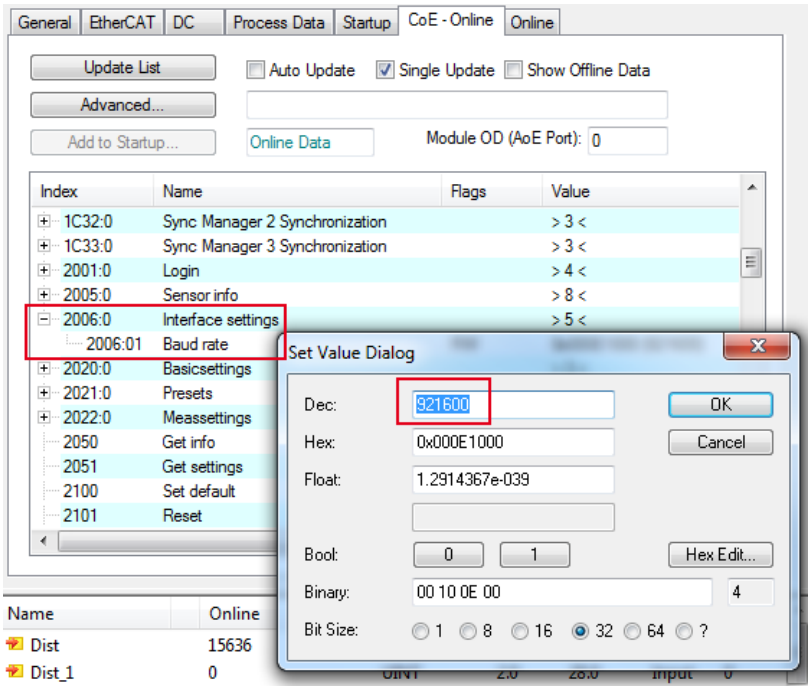

➡ Select `Offline - from Device Description` and `All Objects` and click on the `OK` button.

➡ In the `TwinCAT` menu, select the `Restart TwinCAT (Config Mode)` command.

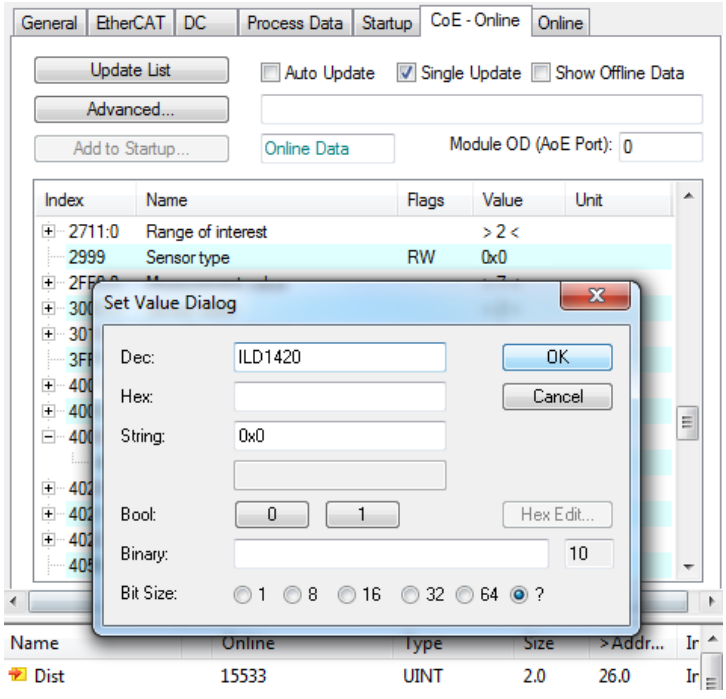
### 5.1.4 Configure sensor and system

The following configuration was performed with a type ILD1420 sensor.

➡ Select object 2006:01 and set the baud rate for your sensor. Confirm the dialog with `OK`. The ILD1420 sensor works with a baud rate of 921600 Baud.



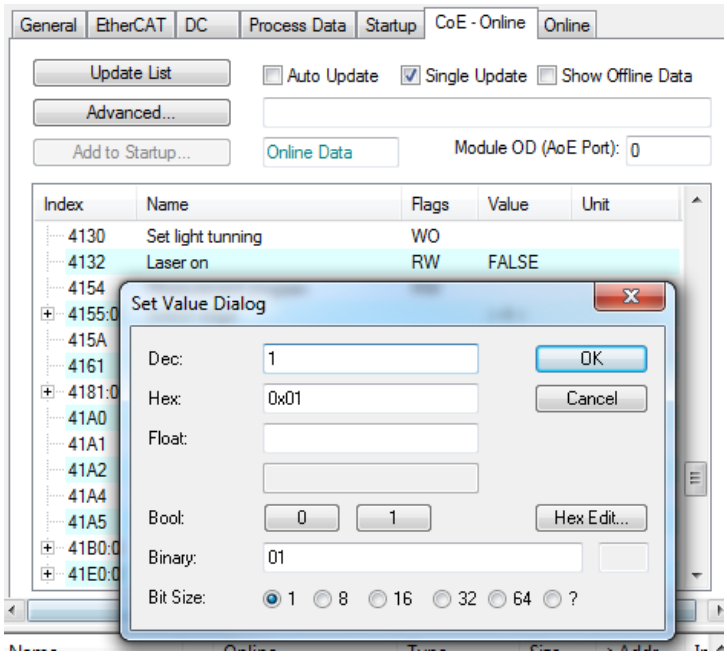

➡ Select Object 2999 `Sensor type` and set the sensor used. Confirm the dialog with `OK`. In this example, a sensor of type `ILD1420` is used.



- Select Object 2132 `Laser on` and switch on the laser in the sensor. Confirm the dialog with `OK`.

`0` = Laser off

`1` = Laser on.




Basic settings are completed by entering the previous baud rate, type of sensor and laser activation objects. Object 3000:01 should have a value of 16 or higher with a proper connection status. Object 2FF0 01 shows measurements.

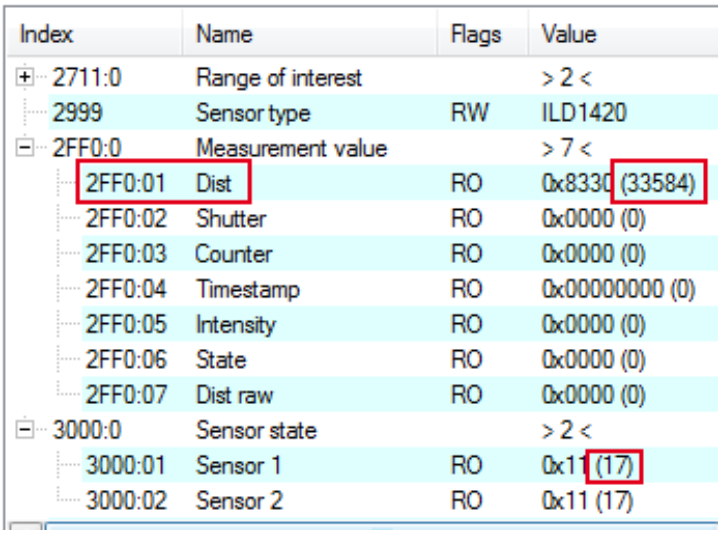



*Fig. 6 Detail of the CoE-object directory using an ILD1420 sensor*

Repeat the action in objects 4006, 4132 and 4999, if you are running two sensors/systems on the RS422 extension terminal.

The PDO assignments can be read from the device on the `Process data` side:

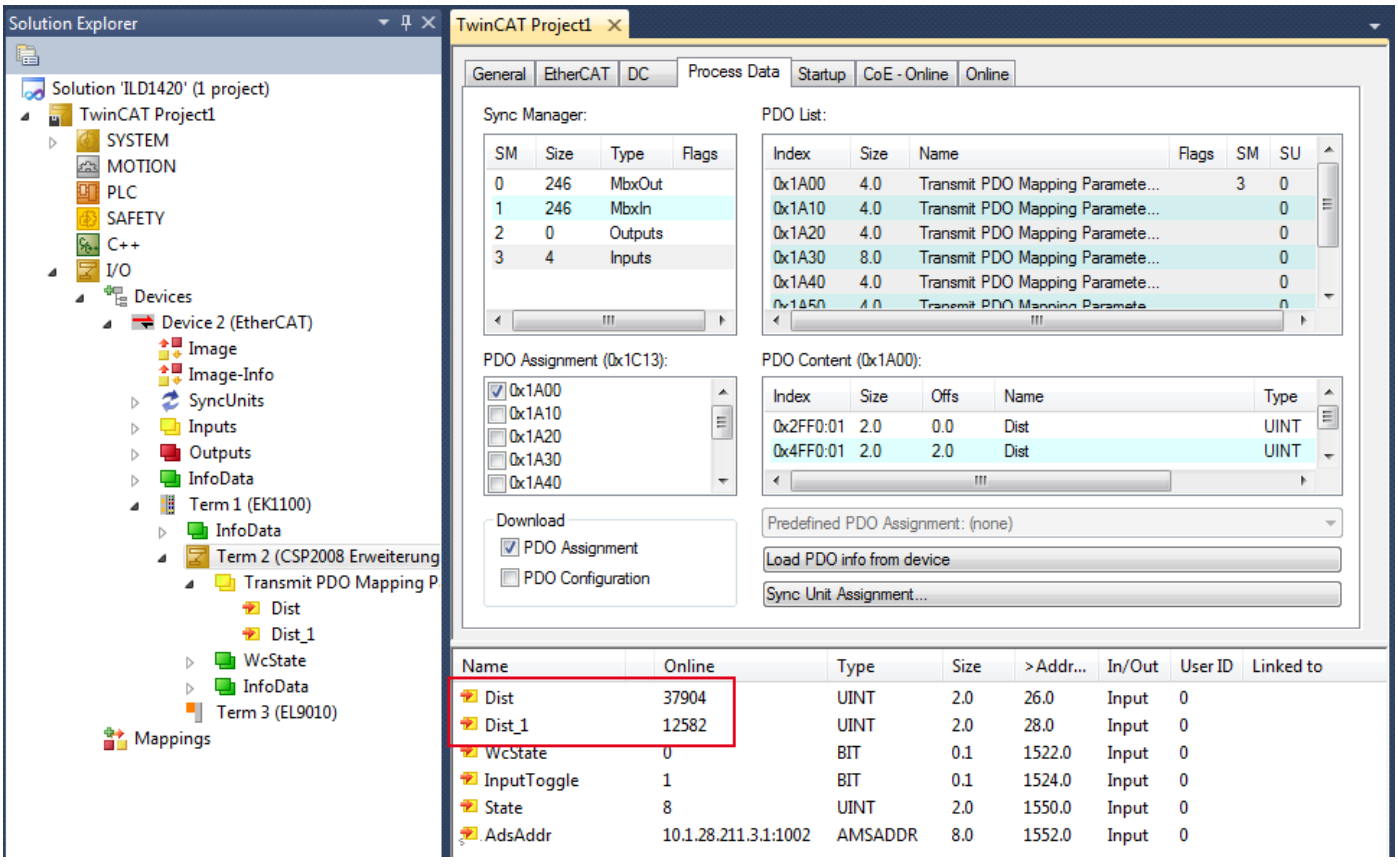



*Fig. 7 Process data of the RS422 extension terminal when programming was finished*

➡ In the `TwinCAT` menu, select `Reload Devices`.

The variables `Dist` and `Dist_1` contain the measurements of the connected sensors.

Configuration is now complete.

| Sensor and system | | ILD1302 | ILD1402 | ILD1420 | ILD1700 | ILD2200 | ODC2500 | ODC2600 | ILD2300 |
|---|---|---|---|---|---|---|---|---|---|
| Interface type, controller | | --- | | | | | RS422 | | EtherCAT |
| Objects RS422 extension terminal | | | | | | | | | |
| 2006, 4006 | Baud rate RS422 extension terminal | 115200 | | 921600 | 115200 | 691200 | | | --- |
| 2999, 4999 | Sensor type ILD | 1302 | 1402 | 1420 | 1700 | 2200 | ODC2500 | ODC2600 | --- |
| 2132, 4132 | Laser on | 1 | 1 | 1 | 1 | 1 | --- | --- | 3010 Laser on 1 |
| 21B0: 1, 41B0: 1 | Data output sensor/system | 1 | 1 | --- | 2 | --- | --- | --- | --- |

*Fig. 8 Summary of elementary object settings*

The above illustration, see Fig. 8, illustrates examples of object settings for the individual sensors/systems. The entire object list of the individual sensors/systems, can be found in the object reference.

## 5.2 Object Reference

### 5.2.1 CoE Object Directory

The CoE object directory (CANopen over EtherCAT) contains all a sensor's configuration data, see Fig. 6. The objects in the CoE object directory can be called with the SDO services. Each object is addressed based on a 16-bit index.

### 5.2.2 Standard Objects

| Overview | |
|---|---|
| Index (h) | Name |
| 1000 | Device type |
| 1001 | Error register |
| 1008 | Device name (manufacturer) |
| 1009 | Hardware version |
| 100A | Software version |
| 1018 | Identity (device) |
| 1029 | Error behavior |

**Object 1000h: Device type**

| | | | | | |
|---|---|---|---|---|---|
| 1000 | VAR | Device type | 0x00000000 | Unsigned32 | r |

Supplies information about the device profile and the device type used.

**Object 1008h: Manufacturer's device name**

| | | | | | |
|---|---|---|---|---|---|
| 1008 | VAR | Device name | RS422 Kle... | String | r |

**Object 1009h: Hardware version**

| | | | | | |
|---|---|---|---|---|---|
| 1009 | VAR | Hardware version | HW Vx.x | String | r |

**Object 100Ah: Software version**

| | | | | | |
|---|---|---|---|---|---|
| 100A | VAR | Software version | SW Vx.x.x | String | r |

**Object 1018h: Device identification**

| 1018 | RECORD | Identity | Value | Data type | Access |
|---|---|---|---|---|---|
| Sub-indices | | | | | |
| 0 | VAR | Number of entries | 4 | Unsigned8 | r |
| 1 | VAR | Vendor ID | 0x00000607 | Unsigned32 | r |
| 2 | VAR | Product code | 0x00000001 | Unsigned32 | r |
| 3 | VAR | Revision number | 0x00000001 | Unsigned32 | r |
| 4 | VAR | Serial number | 0x00000001 | Unsigned32 | r |

The article number is defined in the product number, the serial number of the sensor is defined in serial number.

### 5.2.3 Sensor objects

An RS422 extension terminal can address a maximum of two sensors. The following object allocation applies:

- Sensor 1: Object 2005h to 2FF0h
- Sensor 2: Object 4005h to 4FF0h

### 5.2.4 ILD1302

**Overview of objects**

| Index (h) | | Name | Description |
|---|---|---|---|
| Sensor 1 | Sensor 2 | | |
| 2005 | 4005 | Sensor info | Sensor information (other) |
| 2006 | 4006 | Interface settings | Baud rate extension terminal |
| 2050 | 4050 | Get info | Query sensor information |
| 2051 | 4051 | Get settings | Selection of the sensor |
| 2100 | 4100 | Set default | Reset to factory setting |
| 2101 | 4101 | Reset | Reboot sensor |
| 2132 | 4132 | Laser on | Switch on laser light source |
| 2181 | 4181 | Average | Averaging setting |
| 21A0 | 41A0 | Data on | Switch measurement output on/off |
| 21A1 | 41A1 | Output mode | Digital/analog data output characteristics |
| 21A2 | 41A2 | Output time | Update digital/analog output value |
| 21A4 | 41A4 | ASCII output | Measurement data format |
| 21B0 | 41B0 | Digital interface | Measurement output and baud rate sensor |
| 2400 | 4400 | Synchronize/trigger | Synchronizing, triggering, operating mode |
| 24A0 | 44A0 | Key lock | Button lock |
| 24C0 | 44C0 | Enable flash for mastering | Release/lock flash writing |
| 24E0 | 44E0 | Analog output scale | Scaling of the analog output |
| 24E1 | 44E1 | Reset analog output scale | Resets analog scaling |
| 2502 | 4502 | Set peak searching | Selection of the peak in the video signal |
| 2550 | 4550 | Set threshold | Video signal search threshold |
| 2999 | 4999 | Sensor type | Specify sensor type |
| 2FF0 | 4FF0 | Measurement value | Reading out the measurements |
| 3000 | | Sensor state | Connection status |

For a description of the individual commands, also see Chapter "Serial interface RS422" in the sensor instructions.

**2005 Sensor info**

**Object 2005h: Sensor information**

| 2005 | RECORD | Sensor info | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| Sub-indices | | | | | |
| 0 | VAR | Number of entries | 8 | Unsigned8 | r |
| 1 | VAR | Sensor name | ILD1302 | String | r |
| 2 | VAR | Measuring range | 10 | String | r |
| 3 | VAR | Software version | 1.004.1 | String | r |
| 4 | VAR | Hardware version | 1.52 | String | r |
| 5 | VAR | Serial No. | 1012034 | String | r |
| 6 | VAR | Option no | 0 | String | r |
| 7 | VAR | Calibration date | 11/0120 | String | r |
| 8 | VAR | Article no | 4120153 | String | r |

### 2006 Interface settings

**Object 2006h: Baud rate extension terminal**

| 2006 | RECORD | Interface settings | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| Sub-indices | | | | | |
| 0 | VAR | Number of entries | 5 | Unsigned8 | r |
| 1 | VAR | Baud rate | 115200 | Unsigned32 | rw |

The baud rate in object 2006:01 determines the baud rate of the RS422 extension terminal. The baud rate of the sensor is defined in object 21B0: 02. The two baud rates must match.

### 2050 Get Info

**Object 2050h: Query sensor information**

| 2050 | RECORD | Get info | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| | | | | Boolean | w |

Causes the terminal to retrieve the infostring from the sensor.

### 2051 Get settings

**Object 2051h: Query sensor settings**

| 2051 | RECORD | Get settings | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| | | | | Boolean | w |

Causes the Terminal to send the GetSettings command to the sensor and to store the received sensor settings in the 2005h objects.

### 2100 Set Default

**Object 2100h: Call up factory setting**

| 2100 | RECORD | Set default | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| | | | | Boolean | w |

After calling up the factory default, the current output is activated as the output channel in object 21B0:01. Set object 21B0:01 to RS422.

### 2101 Reset

**Object 2101h: Initialize sensor (boot)**

| 2101 | RECORD | Reset | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| | | | | Boolean | w |

### 2132 Laser On

**Object 2132h: Switch on laser light source**

| 2132 | RECORD | Laser on | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| | | | x | Boolean | rw |

x = 0 : Laser off
x = 1 : Laser on.

### 2181 Average

**Object 2181h: Averaging**

| 2181 | RECORD | Average | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| Sub-indices | | | | | |
| 0 | VAR | Number of entries | 2 | Unsigned8 | r |
| 1 | VAR | Average type | x | Int16 | rw |
| 2 | VAR | Number of values | y | Int16 | rw |

X = 0: moving average — Moving average over 1 to 128 measurement
X = 1: Median — median of 3, 5, 7 or 9 measurements

i The averaging type Median requires a valid number of values in the object 2181:02.

### 21A0 Data On

**Object 21A0h: Switch measurement output on/off**

| 21A0 | RECORD | Data on | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| | | | x | Boolean | rw |

x = 0 : Data output off
x = 1 : Data output on

The output channel (output type) must also be set to the digital output, otherwise the measurement data cannot be received from the sensor.

### 21A1 Output Mode

**Object 21A1h: Digital/analog data output characteristics**

| 21A1 | RECORD | Output mode | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| | | | x | Int8 | rw |

x = 0 : Continuous
x = 1 : Time-controlled
x = 2 : Triggering

### 21A2 Output Time

**Object 21A2h: Update digital/analog output value**

| 21A2 | RECORD | Output time | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| | | | x | Unsigned16 | rw |

x = 1 … 65535 [ms]

### 21A4 RS422 Format

**Object 21A4h: Measurement data format**

| 21A4 | RECORD | RS422 format | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| | | | x | Boolean | rw |

x = 0 : Binary format
x = 1 : ASCII characters

### 21B0 Digital Interfaces

**Object 21B0h: Measurement output and baud rate sensor**

| 21B0 | RECORD | Digital interfaces | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| Sub-indices | | | | | |
| 0 | VAR | Number of entries | 2 | Unsigned8 | r |
| 1 | VAR | Output device | x | Unsigned32 | rw |
| 2 | VAR | Baud rate | y | Unsigned32 | rw |

x = 0 : Current (4 .. .20 mA)
x = 1 : RS422

y = 0 : 115200 Baud
y = 1 : 57600 Baud
y = 2 : 38400 Baud
y = 3 : 19200 Baud
y = 4 : 9600 Baud

### 2400 Teaching, triggering

**Object 2400h: Switching input function**

| 2400 | RECORD | Synchronize, trigger | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| Sub-indices | | | | | |
| 0 | VAR | Number of entries | 2 | Unsigned8 | r |
| 1 | VAR | Operation mode | x | Unsigned8 | rw |
| 2 | VAR | Reserved | | | |

x = 0 : External input operates as teach conductor
x = 1: External input acts as input for the trigger-controlled data output

### 24A0 Key Lock

**Object 24A0h: Button lock**

| 24A0 | RECORD | Key lock | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| | | | x | Boolean | rw |

x = 0 : Release button
x = 1 : Button locked
x = 2 : The button is locked automatically 5 minutes after switching on the sensor

### 24C0 Enable Flash

**Object 24C0h: Release/lock flash writing**

| 24C0 | RECORD | Enable flash | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| | | | x | Boolean | rw |

x = 0 : Store settings in the RAM
x = 1 : Store settings in the FLASH

### 24E0 Analog Output Scale

**Object 24E0h: Scaling of the analog output**

| 24E0 | RECORD | Analog output scaling | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| Sub-indices | | | | | |
| 0 | VAR | Number of entries | 2 | Unsigned8 | r |
| 1 | VAR | Start value | x | Float | rw |
| 2 | VAR | End value | y | Float | rw |

x = 0 : 0.0 to 16368.0
y = 1 : 0.0 to 16368.0

The teaching process requires a valid measuring signal. The teaching process is terminated at „no target“, „target not evaluated“, „to close to the sensor“ - beyond SMR“ or „to far from the sensor - beyond EMR“.

The minimum distance between the scaling values is 10 % of the measuring range.

### 24E1 Reset Analog Output scale

**Objekt 24E1: Resets analog scaling**

| 24E1 | RECORD | Reset analog scaling | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| | | | | Boolean | w |

### 2502 Set peak searching

**Object 2502h: Selection of the peak in the video signal**

| 2502 | RECORD | Set peak searching | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| | | | x | Int8 | rw |

x = 0 : Peak with global maximum
x = 1 : first peak, reading direction pixel 0 to pixel 127, left to right
x = 2 : last peak, reading direction pixel 0 to pixel 127, left to right

**2550 Set Threshold**

**Object 2550h: Video signal search threshold**

| 2550 | RECORD | Set threshold | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| | | | x | Int8 | rw |

x = 0 : Less than standard
x = 1: Standard
x = 2 : higher than standard
x = 3 : highest

**2999 Sensor Type**

**Object 2999h: Specify sensor type**

| 2999 | RECORD | Sensor type | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| | | | ILD1302 | String | rw |

**2FF0 Measurement Value**

**Object 2FF0h: Reading out the measurements**

| 2FF0 | RECORD | Measured value | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| Sub-indices | | | | | |
| 0 | VAR | Number of entries | 1 | Unsigned8 | r |
| 1 | VAR | Measurement sensor 1 | | Unsigned16 | r |

The output values are issued as unsigned digital values (raw values).

| Digital value | Use |
|---|---|
| 0 ... 39 | Reserve start of measuring range |
| 40 ... 4055 | Measuring range |
| 4056 ... 4095 | Reserve end of measuring range |
| 16370 ... 16383 | Error codes |

Calculation of a measurement (in mm) from the digital value, reference value start of measuring range

$$x\,[mm] = (digital_{OUT} * \frac{1.02}{4096} - 0.01) * MR\,[mm]$$

Example: MB = 10 mm, digital value = 2048, measurement = 5 mm

Digital error codes are output like measurements.
The range of values for error codes: 16370 ... 16384 ($digital_{OUT}$)

16370 No object recognizable
16372 too close to the sensor
16374 too far from the sensor
16376 Target cannot be evaluated
16380 Target is moving towards sensor
16382 Target is moving away from sensor

**3000 Sensor State**

**Object 3000h: Connection status**

| 3000 | RECORD | Sensor state | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| Sub-indices | | | | | |
| 0 | VAR | Number of entries | 2 | Unsigned8 | r |
| 1 | VAR | Sensor 1 | x | Unsigned8 | r |
| 2 | VAR | Sensor 2 | x | Unsigned8 | r |

x = 0 : No RS422 extension terminal
x = 1 : Terminal starts synchronization phase
x = 2 : Terminal in synchronization phase 1
x = 3 : Terminal in synchronization phase 2
x = 4 : Terminal in synchronization phase 3
x = 5 : unknown type of sensor
x = 6 : unknown baud rate
x = 7 : Error during serial initialization
x = 8 : Sensor time-out
x = 16 : Sensor communication ok
x = 17 : Measurement reception ok

### 5.2.5 ILD1402

**Overview of objects**

| Index (h) | | Name | Description |
|---|---|---|---|
| Sensor 1 | Sensor 2 | | |
| 2005 | 4005 | Sensor info | Sensor information (other) |
| 2006 | 4006 | Interface settings | Baud rate extension terminal |
| 2050 | 4050 | Get info | Query sensor information |
| 2051 | 4051 | Get settings | Selection of the sensor |
| 2100 | 4100 | Set default | Reset to factory setting |
| 2101 | 4101 | Reset | Reboot sensor |
| 2132 | 4132 | Laser on | Switch on laser light source |
| 2181 | 4181 | Average | Averaging setting |
| 21A0 | 41A0 | Data on | Switch measurement output on/off |
| 21A1 | 41A1 | Output mode | Digital/analog data output characteristics |
| 21A2 | 41A2 | Output time | Update digital/analog output value |
| 21A4 | 41A4 | ASCII output | Measurement data format |
| 21A5 | 41A5 | Hold last value | Sensor behavior in event of error |
| 21B0 | 41B0 | Digital interface | Measurement output and baud rate sensor |
| 2250 | 4250 | Measuring rate | Measuring rate |
| 2400 | 4400 | Synchronize/trigger | Synchronizing, triggering, operating mode |
| 24A0 | 44A0 | Key lock | Button lock |
| 24C0 | 44C0 | Enable flash for mastering | Release/lock flash writing |
| 24E0 | 44E0 | Analog output scale | Scaling of the analog output |
| 24E1 | 44E1 | Reset analog output scale | Resets analog scaling |
| 2502 | 4502 | Set peak searching | Selection of the peak in the video signal |
| 2550 | 4550 | Set threshold | Video signal search threshold |
| 2999 | 4999 | Sensor type | Specify sensor type |
| 2FF0 | 4FF0 | Measurement value | Reading out the measurements |
| 3000 | | Sensor state | Connection status |

For a description of the individual commands, also see Chapter "Serial interface RS422" in the sensor instructions.

**2005 Sensor info**

**Object 2005h: Sensor information**

| 2005 | RECORD | Sensor info | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| Sub-indices | | | | | |
| 0 | VAR | Number of entries | 8 | Unsigned8 | r |
| 1 | VAR | Sensor name | ILD1402 | String | r |
| 2 | VAR | Measuring range | 10 | String | r |
| 3 | VAR | Software version | 1.004.1 | String | r |
| 4 | VAR | Hardware version | 1.52 | String | r |
| 5 | VAR | Serial No. | 1012054 | String | r |
| 6 | VAR | Option no | 0 | String | r |
| 7 | VAR | Calibration date | 11/01/20 | String | r |
| 8 | VAR | Article no | 4120152 | String | r |

### 2006 Interface settings

**Object 2006h: Baud rate extension terminal**

| 2006 | RECORD | Interface settings | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| Sub-indices | | | | | |
| 0 | VAR | Number of entries | 5 | Unsigned8 | r |
| 1 | VAR | Baud rate | 115200 | Unsigned32 | rw |

The baud rate in object 2006:01 determines the baud rate of the RS422 extension terminal. The baud rate of the sensor is defined in object 21B0: 02. The two baud rates must match.

### 2050 Get Info

**Object 2050h: Query sensor information**

| 2050 | RECORD | Get info | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| | | | | Boolean | w |

Causes the terminal to retrieve the infostring from the sensor.

### 2051 Get settings

**Object 2051h: Query sensor settings**

| 2051 | RECORD | Get settings | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| | | | | Boolean | w |

Causes the terminal to send the GetSettings command to the sensor and to store the received sensor settings in the 2005h objects.

### 2100 Set Default

**Object 2100h: Call up factory setting**

| 2100 | RECORD | Set default | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| | | | | Boolean | w |

After calling up the factory default the current output is activated as the output channel in object 21B0:01. Set object 21B0:01 to RS422.

### 2101 Reset

**Object 2101h: Initialize sensor (boot)**

| 2101 | RECORD | Reset | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| | | | | Boolean | w |

### 2132 Laser On

**Object 2132h: Switch on laser light source**

| 2132 | RECORD | Laser on | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| | | | x | Boolean | rw |

x = 0 : Laser off
x = 1 : Laser on.

### 2181 Average

**Object 2181h: Averaging**

| 2181 | RECORD | Average | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| Sub-indices | | | | | |
| 0 | VAR | Number of entries | 2 | Unsigned8 | r |
| 1 | VAR | Average type | x | Int16 | rw |
| 2 | VAR | Number of values | y | Int16 | rw |

X = 0: moving average — Moving average over 1 to 128 measurement values
X = 1: Median — Median of 3, 5, 7 or 9 measurements

The averaging type Median requires a valid number of values in the object 2181:02.

### 21A0 Data On

**Object 21A0h: Switch measurement output on/off**

| 21A0 | RECORD | Data on | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| | | | x | Boolean | rw |

x = 0 : Data output off
x = 1 : Data output on

The output channel (output type) must also be set to the digital output, otherwise the measurement data cannot be received from the sensor.

### 21A1 Output Mode

**Object 21A1h: Digital/analog data output characteristics**

| 21A1 | RECORD | Output mode | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| | | | x | Int8 | rw |

x = 0 : Continuous
x = 1 : Time-controlled
x = 2 : Triggering

### 21A2 Output Time

**Object 21A2h: Update digital/analog output value**

| 21A2 | RECORD | Output time | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| | | | x | Unsigned16 | rw |

x = 1 … 65535 [ms]

### 21A4 RS422 Format

**Object 21A4h: Measurement data format**

| 21A4 | RECORD | RS422 format | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| | | | x | Boolean | rw |

x = 0 : Binary format
x = 1 : ASCII characters

### 21A5 Hold Last Value

**Object 21A5h: Retain measurement**

| 21A5 | RECORD | Hold last value | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| | | | x | Unsigned8 | rw |

x = 0 : Hold last measurement
x = 1 : Output error signal
x = 2 ... 99 : Hold last measurement for 2 ... 99 images or measuring cycles

The command only affects the analog output.

### 21B0 Digital Interfaces

**Object 21B0h: Measurement output and baud rate sensor**

| 21B0 | RECORD | Digital interfaces | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| Sub-indices | | | | | |
| 0 | VAR | Number of entries | 2 | Unsigned8 | r |
| 1 | VAR | Output device | x | Unsigned32 | rw |
| 2 | VAR | Baud rate | y | Unsigned32 | rw |

x = 0 : Current (4 .. .20 mA)
x = 1 : RS422

y = 0 : 115200 Baud
y = 1 : 57600 Baud
y = 2 : 38400 Baud
y = 3 : 19200 Baud
y = 4 : 9600 Baud

### 2250 Measuring Rate

**Object 2250h: Set measuring rate**

| 2250 | RECORD | Measuring rate | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| Sub-indices | | | | | |
| 0 | VAR | Number of entries | 2 | Unsigned8 | r |
| 1 | VAR | Reserved | | | |
| 2 | VAR | Measuring rate | x | Int8 | rw |

x = 0 : 1.5 kHz
x = 1 : 1.0 kHz
x = 2 : 750 Hz
x = 3 : 375 Hz
x = 4 : 50 Hz

### 2400 Teaching, triggering

**Object 2400h: Switching input function**

| 2400 | RECORD | Synchronize, trigger | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| Sub-indices | | | | | |
| 0 | VAR | Number of entries | 2 | Unsigned8 | r |
| 1 | VAR | Operation mode | x | Unsigned8 | rw |
| 2 | VAR | Reserved | | | |

x = 0 : External input operates as teach conductor
x = 1 : External input acts as input for the trigger-controlled data output

### 24A0 Key Lock

**Object 24A0h: Button lock**

| 24A0 | RECORD | Key lock | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| | | | x | Boolean | rw |

x = 0 : Release button
x = 1 : Button locked
x = 2 : The button is locked automatically 5 minutes after switching on the sensor

### 24C0 Enable Flash

**Object 24C0h: Release/lock flash writing**

| 24C0 | RECORD | Enable flash | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| | | | x | Boolean | rw |

x = 0 : Store settings in the RAM
x = 1 : Store settings in the FLASH

### 24E0 Analog Output Scale

**Object 24E0h: Scaling of the analog output**

| 24E0 | RECORD | Analog output scaling | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| Sub-indices | | | | | |
| 0 | VAR | Number of entries | 2 | Unsigned8 | r |
| 1 | VAR | Start value | x | Float | rw |
| 2 | VAR | End value | y | Float | rw |

x = 0 : 0.0 to 16368.0
y = 1 : 0.0 to 16368.0

The teaching process requires a valid measuring signal. The teaching process is terminated at „no target“, „target not evaluated“, „to close to the sensor“ - beyond SMR“ or „to far from the sensor - beyond EMR“.

The minimum distance between the scaling values is 10 % of the measuring range.

### 24E1 Reset Analog Output scale

**Objekt 24E1: Resets analog scaling**

| 24E1 | RECORD | Reset analog scaling | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| | | | | Boolean | w |

### 2502 Set peak searching

**Object 2502h: Selection of the peak in the video signal**

| 2502 | RECORD | Set peak searching | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| | | | x | Int8 | rw |

x = 0 : Peak with global maximum
x = 1 : first peak, reading direction pixel 0 to pixel 127, left to right
x = 2 : last peak, reading direction pixel 0 to pixel 127, left to right

### 2550 Set Threshold

**Object 2550h: Video signal search threshold**

| 2550 | RECORD | Set threshold | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| | | | x | Int8 | rw |

x = 0 : Less than standard
x = 1 : Standard
x = 2 : higher than standard
x = 3 : highest

### 2999 Sensor Type

**Object 2999h: Specify sensor type**

| 2999 | RECORD | Sensor type | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| | | | ILD1402 | String | rw |

### 2FF0 Measurement Value

**Object 2FF0h: Reading out the measurements**

| 2FF0 | RECORD | Measured value | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| Sub-indices | | | | | |
| 0 | VAR | Number of entries | 1 | Unsigned8 | r |
| 1 | VAR | Measurement sensor 1 | | Unsigned16 | r |

The output values are issued as unsigned digital values (raw values).

| Digital value | Use |
|---|---|
| 0 ... 39 | Reserve measuring range start |
| 40 ... 4055 | Drawings |
| 4056 ... 4095 | Reserve measuring range end |
| 16370 ... 16383 | Error codes |

Calculation of a measurement (in mm) from the digital value, reference value start of measuring range

$$x\,[mm] = (digital_{OUT} * \frac{1.02}{16368} - 0.01) * MR\,[mm]$$

Example: MR = 10 mm, digital value = 8184, measurement = 5 mm

Digital error codes are output like measurements.
The range of values for error codes: 16370 ... 16384 ($digital_{OUT}$)

| | | | |
|---|---|---|---|
| 16370 | No object recognizable | 16376 | Target cannot be evaluated |
| 16372 | too close to the sensor | 16380 | Target is moving towards sensor |
| 16374 | too far from the sensor | 16382 | Target is moving away from sensor |

### 3000 Sensor State

**Object 3000h: Connection status**

| 3000 | RECORD | Sensor state | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| Sub-indices | | | | | |
| 0 | VAR | Number of entries | 2 | Unsigned8 | r |
| 1 | VAR | Sensor 1 | x | Unsigned8 | r |
| 2 | VAR | Sensor 2 | x | Unsigned8 | r |

x = 0 : No RS422 extension terminal
x = 1 : Terminal starts synchronization phase
x = 2 : Terminal in synchronization phase 1
x = 3 : Terminal in synchronization phase 2
x = 4 : Terminal in synchronization phase 3
x = 5 : unknown type of sensor
x = 6 : unknown baud rate
x = 7 : Error during serial initialization
x = 8 : Sensor timeout
x = 16 : Sensor communication ok
x = 17 : Measurement reception ok

### 5.2.6 ILD1420

**Overview of objects**

| Index (h) | | Name | Description |
|---|---|---|---|
| Sensor 1 | Sensor 2 | | |
| 2001 | 4001 | Login | User level |
| 2005 | 4005 | Sensor info | Sensor information (other) |
| 2006 | 4006 | Interface settings | Baud rate extension terminal |
| 2020 | 4020 | Basic settings | Load/store device settings |
| 2021 | 4021 | Presets | Load preset |
| 2022 | 4022 | Measurement settings | Load/store measurement settings |
| 2050 | 4050 | Get info | Query sensor information |
| 2100 | 4100 | Set default | Reset to factory setting |
| 2101 | 4101 | Reset | Reboot sensor |
| 2107 | 4107 | Reset counter | Reset measurement counter |
| 2132 | 4132 | Laser on | Switch on laser light source |
| 215A | 415A | Targetmode | Select measurement mode |
| 2161 | 4181 | Peak position | Peak selection in the video signal |
| 2181 | 4181 | Averaging | Measurement averaging |
| 21A5 | 41A5 | Hold last value | Behavior of the analog output |
| 21B0 | 41B0 | Digital interface | Baud rate sensor |
| 21E0 | 41E0 | Zeroing, mastering | Set output to zero or master value |
| 2250 | 4250 | Measuring rate | Measurement frequency |
| 24A1 | 42A1 | Keyfunc | Key function |
| 24A2 | 42A2 | Advanced keylock | Activate/lock key |
| 2711 | 4711 | Range of interest | Evaluation range |
| 2999 | 4999 | Sensor type | Specify sensor type |
| 2FF0 | 4FF0 | Measurement value | Reading out the measurements |
| 3000 | | Sensor state | Connection status |

For a description of the individual commands, also see Chapter “Serial interface RS422” in the sensor instructions.

**2001 Login**

**Object 2001h: Login**

| 2001 | RECORD | Login | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| Sub-indices | | | | | |
| 0 | VAR | Anzahl Einträge | 4 | Unsigned8 | ro |
| 1 | VAR | Actual user | x | Unsigned8 | ro |
| 2 | VAR | Login | ****** | String | wo |
| 3 | VAR | Logout | FALSE | BOOL | wo |
| 4 | VAR | Default user | x | Unsigned8 | rw |

**2005 Sensor info**

**Object 2005h: Sensor information (other)**

| 2005 | RECORD | Sensor info | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| Sub-indices | | | | | |
| 0 | VAR | Number of entries | 8 | Unsigned8 | r |
| 1 | VAR | Sensor name | ILD1420 | String | r |
| 2 | VAR | Measuring range | 10.00mm | String | r |
| 3 | VAR | Software version | xxx.xx | String | r |
| 4 | VAR | Hardware version | xxx | String | r |
| 5 | VAR | Serial No. | xxxxxxxx | String | r |
| 6 | VAR | Option no | 0xx | String | r |
| 7 | VAR | Calibration date | | String | r |
| 8 | VAR | Article no | 4120212 | String | r |

**2006 Interface settings**

**Object 2006h: Baud rate extension terminal**

| 2006 | RECORD | Interface settings | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| Sub-indices | | | | | |
| 0 | VAR | Number of entries | 5 | Unsigned8 | r |
| 1 | VAR | Baud rate | 921600 | Unsigned32 | rw |

The baud rate in object 2006:01 determines the baud rate of the RS422 extension terminal. The baud rate of the sensor is defined in object 21B0: 02. The two baud rates must match.

**2020 Basic settings**

**Object 2020h: Device settings**

| 2020 | RECORD | Basic settings | Value/Parameter | Data type | Access |
|---|---|---|---|---|---|
| Sub-indices | | | | | |
| 0 | VAR | Number of entries | 3 | Unsigned8 | ro |
| 1 | VAR | Read | | BOOL | wo |
| 2 | VAR | Store | | BOOL | wo |
| 3 | VAR | Set default | | BOOL | wo |

- Read: Loads the stored device settings.
- Store: Saves the current device settings.
- Set default: Resets the device settings on factory setting.

**2021 Presets**

**Objekt 2021h: Load presets**

| 2021 | RECORD | Presets | Value/Parameter | Data type | Access |
|---|---|---|---|---|---|
| Sub-indices | | | | | |
| 0 | VAR | Number of entries | 3 | Unsigned8 | ro |
| 1 | VAR | Mode | x | Unsigned8 | rw |
| 2 | VAR | List | | String | ro |
| 3 | VAR | Named read | | String | wo |

x = 0 : STATIC
x = 1 : BALANCED
x = 2 : DYNAMIC

- List: Listing of all saved measurement settings, see object 2022.
- Named read: Loads a measurement setting from „List“ / sub-indice 2, see object 2022.

**2022 Measurement settings**

**Object 2022h: Messeinstellungen laden/speichern**

| 2022 | RECORD | Meassettings | Value/parameter | Data typ3 | Access |
|---|---|---|---|---|---|
| Sub-indices | | | | | |
| 0 | VAR | Number of entries | 7 | Unsigned8 | ro |
| 1 | VAR | Current | | String | ro |
| 2 | VAR | Named read | | String | wo |
| 3 | VAR | Named store | | String | wo |
| 4 | VAR | Named delete | | String | wo |
| 5 | VAR | Initial meassettings | | String | rw |
| 6 | VAR | List | | String | ro |
| 7 | VAR | Set default | | BOOL | wo |

- Current: contains the current measurement settings (MEASSETTINGS CURRENT).
- Named read: Loads a measurement setting from „List“ / sub-indice 6, (MEASSETTINGS READ).
- Named store: Saves the current measurement setting. Assign a name or a number (MEASSETTINGS STORE).
- Named delete: Deletes a measurement setting from „List“ / sub-indice 6, (MEASSETTINGS DELETE).
- Initial meassettings: Measurement setting, which is loaded first at a reset of the sensor (MEASSETTINGS INITIAL).
- List: Listing of all saved measurement settings (MEASSETTINGS LIST).
- Set default: Corresponds to the SETDEFAULT MEASSETTINGS command.

**2050 Get Info**

**Object 2050h: Query sensor information**

| 2050 | RECORD | Get info | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| | | | | Boolean | w |

Causes the terminal to retrieve the infostring from the sensor.

**2100 Set Default**

**Object 2100h: Call up factory setting**

| 2100 | RECORD | Set default | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| | | | | Boolean | w |

Resets the sensor on factory setting.

**2101 Reset**

**Object 2101h: Initialize sensor (boot)**

| 2101 | RECORD | Reset | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| | | | | Boolean | w |

**2107 Reset Counter**

**Object 2107h: Reset counter**

| 2107 | RECORD | Reset Counter | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| Sub-indice | | | | | |
| 0 | VAR | Number of entries | 2 | Unsigned8 | ro |
| 1 | VAR | Reset counter | x | Bool | wo |
| 2 | VAR | Reset meas counter | x | Bool | wo |

### 2132 Laser On

**Object 2132h: Switch on laser light source**

| 2132 | RECORD | Laser on | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| | | | x | Boolean | rw |

x = 0 : Laser off
x = 1 : Laser on

### 215A Targetmode

**Object 215Ah: Measurement mode**

| 215A | RECORD | Targetmode | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| | | | x | Unsigned16 | rw |

x = 0 : Standard, suitable for materials, e.g. made of ceramics, metal, plastics or wood
x = 1 : Multisurface, suitable for materials with changing surfaces, e.g. PCB or hybrid materials
x = 2 : Penetration, suitable for materials with strong penetration depth of the laser light

### 2161 Peak Position

**Object 2161h: Peak selection in the vide osignal**

| 2161 | RECORD | Peak position | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| | | | x | Unsigned8 | rw |

x = 0 : DISTA, output of peak with highest amplitude (standard)
x = 1 : DIST1, output of first peak
x = 2 : DISTL, output of last peak

### 2181 Average

**Object 2181h: Averaging**

| 2181 | RECORD | Average | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| Sub-indices | | | | | |
| 0 | VAR | Number of entries | 2 | Unsigned8 | ro |
| 1 | VAR | Average type | x | Signed8 | rw |
| 2 | VAR | Number of values | y | Unsigned16 | rw |

| | |
|---|---|
| x = 0 : keine Mittelung | y |
| x = 1 : gleitend | moving average over 2 / 4 / 8 to 128 measurements |
| x = 2 : Rekursiv | recursive average over 1 to 32768 measurements |
| x = 3 : Median | median of 3, 5, 7 or 9 measurements |

### 21A5 Hold last Value

**Object 21A5h: Error handling**

| 21A5 | RECORD | Hold last value | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| | | | x | Unsigned16 | rw |

x = 0 : Output error signal
x = 1 : Hold last measurement

### 21B0 Digital Interface

**Object 21B0h: Baud rate sensor**

| 21B0 | RECORD | Interface settings | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| Sub-indices | | | | | |
| 0 | VAR | Number of entries | 2 | Unsigned8 | ro |
| 2 | VAR | Baudrate | x | Unsigned32 | rw |

x = 9600|19200|56000|115200|128000|230400|256000|460800|691200|921600|1000000 Baud

The baud rate in object 21B0:02 determines the baud rate of the sensor. The baud rate of the RS422 extension terminal is defined in object 2006: 01. The two baud rates must match.

### 21E0 Zeroing, Mastering

**Object 21E0h: Zeroing, mastering**

| 21E0 | RECORD | Zeroing, mastering | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| Sub-indices | | | | | |
| 0 | VAR | Number of entries | 4 | Unsigned8 | ro |
| 1 | VAR | Reserved | | | |
| 2 | VAR | Master value | | Int16 | rw |
| 3 | VAR | Zeroing/mastering active | x | Bool | ro |
| 4 | VAR | Mastering/reset mastering | y | Bool | wo |

x = 0 : Setting of masters and mid-point cancelled

x = 1 : Master value/mid-point set

y = 0 : Cancel setting of master value and mid-point

y = 1 : Setting master value and the mid-point

### 2250 Measuring Rate

**Object 2250h: Measuring rate**

| 2250 | RECORD | Measuring rate | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| Sub indices | | | | | |
| 0 | VAR | Number of entries | 5 | Unsigned8 | ro |
| 5 | VAR | Manual measuring rate | x | float | rw |

x = 0.250, 0.500, 1, 2 or 4 kHz

### 24A1 Keyfunc

**Object 24A1h: key function**

| 24A1 | RECORD | Keyfunc | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| | | | x | Unsigned16 | rw |

x = 0 : none x = 2 : Teaching

x = 1 : Mastering

### 24A2 Advanced Keylock

**Object 24A2h: Advanced keylock**

| 24A2 | RECORD | Advanced keylock | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| Sub-indices | | | | | |
| 0 | VAR | Number of entries | 2 | Unsigned8 | ro |
| 1 | VAR | Mode | x | Unsigned8 | rw |
| 2 | VAR | Delay | y | Unsigned16 | rw |

x = 0 : none y = 0 ... 60 [min]

x = 1 : active

x = 2 : automatic

### 2711 Range of Interest

**Object 2711h: Evaluation range**

| 2711 | RECORD | Range of interest | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| Sub-indices | | | | | |
| 0 | VAR | Number of entries | 2 | Unsigned8 | ro |
| 1 | VAR | Start of range | | Unsigned16 | rw |
| 2 | VAR | End of range | | Unsigned16 | rw |

### 2999 Sensor Type

**Object 2999h: Specify sensor type**

| 2999 | RECORD | Sensor type | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| | | | ILD1420 | String | rw |

### 2FF0 Measurement Value

**Object 2FF0h: Reading out the measurements**

| 2FF0 | RECORD | Measurement value | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| Sub-indeces | | | | | |
| 0 | VAR | Number of entries | 7 | Unsigned8 | ro |
| 1 | VAR | Dist | | Unsigned16 | ro |
| 2 | VAR | Shutter | | Unsigned16 | ro |
| 3 | VAR | Counter | | Unsigned16 | ro |
| 4 | VAR | Timestamp | | Unsigned32 | ro |
| 5 | VAR | Intensity | | Unsigned16 | ro |
| 6 | VAR | State | | Unsigned16 | ro |
| 7 | VAR | Dist raw | | Unsigned16 | ro |

The output values are issued as unsigned digital values (raw values). 16 resp. 18 bits per value are being transmitted. Subsequently you can find a compilation of output values and the conversion of the digital value.

| Value | Length | Variables | Value range | Formula |
|---|---|---|---|---|
| Distance (without mastering) | 16 bits | x = digital value | [0; <643] SMR reserve<br>[643; 64877] measuring range<br>[>64877; 65520] EMR reserve | $d\ [mm] = \frac{1}{100}\left(\frac{102}{65520}\ x - 1\right) * MR\ [mm]$ |
| | | MR = measuring range [mm] | {10/25/50} | |
| | | d = distance [mm] | [-0,01MR; 1,01MR] | |
| Distance (with mastering) | 18 bits | x = digital value | | The output range is also coded with 64235 values at 18 bit and shifted with the master value. The reserves at SMR and EMR are coded with 643 values each.<br>$d\ [mm] = \frac{1}{100}\left(\frac{102}{65520}\ x - 51\right) * MR\ [mm]$ |
| | | MR = measuring range [mm] | {10/25/50} | |
| | | MP = master position [mm] | [0; MR] | |
| | | MV = master value [mm] | [0; 2MR] | |
| | | d = distance [mm] | | |
| | | MV < MP - 0.5MR: | [-0.5MR + MV; MR - MP+ MV] | |
| | | MV ≥ MP - 0.5MR: | [-MP + MV; MR - MP+ MV] | |
| Exposure time | 18 bits | x = digital value | [1; 262143] | $ET\ [\mu s] = \frac{1}{10}\ x$ |
| | | ET = exposure time [µs] | [0.1; 26214.3] | |
| Intensity | 16 bits | x = digital value | [0; 65472] | $I\ [\%] = \frac{25}{16368}\ x$ |
| | | I = intensity [%] | [0; 100] | |

| | | | | |
|---|---|---|---|---|
| Sensor status | 18 bits | x = digital value | [0; 242143] | Bit 0 (LSB): peak starts before ROI |
| | | Bit encoding | [0; 1] | Bit 1: peak ends after ROI |
| | | | | Bit 2: no peak found |
| | | SMR = Start of measuring range | | Bit 5: distance before SMR (extended) |
| | | EMR = End of measuring range | | Bit 6: distance after EMR (extended) |
| | | | | Bit 15: measuring value is triggered |
| | | | | Bit 16, 17: status LED;<br>- 00 – off 10 – red<br>- 01 – green 11 – yellow |
| Measurement counter | 18 bits | x = digital value | [0; 262143] | |

| | | | | |
|---|---|---|---|---|
| Time stamp | 2 words, at 16 bit | x = digital value Lo<br>y = digital value Hi | [0; 65535]<br>[0; 65535] | $t\ [ms] = \frac{1}{100}\ (65536y + x)$ |
| | | t = time stamp [ms] | [0; 11h55m49.67s] | |
| Non-linear-ized focus | 18 bits | x = digital value | [0; 262143] | $NF\ [\%] = \frac{100}{262143}\ x$ |
| | | NF = focus | [0; 100] | |
| Video raw signal | 16 bits | 512 pixel | [0; 65535] | |

Additional information transmitted in the distance value

| Distance value | Description |
|---|---|
| 262075 | data amount to big for selected baud rate |
| 262076 | no peak available |
| 262077 | peak before the measurement range (MR) |
| 262078 | peak behind the measurement range (MR) |
| 262080 | measurement value can not be calculated |
| 262081 | peak is to large |
| 262082 | Laser is off |

**3000 Sensor State**

**Object 3000h: Connection status**

| 3000 | RECORD | Sensor state | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| Sub-indices | | | | | |
| 0 | VAR | Number of entries | 2 | Unsigned8 | r |
| 1 | VAR | Sensor 1 | x | Unsigned8 | r |
| 2 | VAR | Sensor 2 | x | Unsigned8 | r |

x = 0 : No RS422 extension terminal
x = 1 : Terminal starts synchronization phase
x = 2 : Terminal in synchronization phase 1
x = 3 : Terminal in synchronization phase 2
x = 4 : Terminal in synchronization phase 3
x = 5 : unknown type of sensor
x = 6 : unknown baud rate
x = 7 : Error during serial initialization
x = 8 : Sensor timeout
x = 16 : Sensor communication ok
x = 17 : Measurement reception ok

### 5.2.7 ILD1700

**Overview of objects**

| Index (h) | | Name | Description |
|---|---|---|---|
| Sensor 1 | Sensor 2 | | |
| 2005 | 4005 | Sensor info | Sensor information (other) |
| 2006 | 4006 | Interface settings | Baud rate extension terminal |
| 2050 | 4050 | Get info | Query sensor information |
| 2051 | 4051 | Get settings | Selection of the sensor |
| 2100 | 4100 | Set default | Reset to factory setting |
| 2101 | 4101 | Reset | Reboot sensor |
| 2132 | 4132 | Laser on | Switch on laser light source |
| 2181 | 4181 | Average | Averaging setting |
| 21A0 | 41A0 | Data on | Switch measurement output on/off |
| 21A4 | 41A4 | ASCII output | Measurement data format |
| 21A5 | 41A5 | Hold last value | Sensor behavior in event of error |
| 21B0 | 41B0 | Digital interface | Measurement output and baud rate sensor |
| 21E0 | 41E0 | Zeroing | Setting masters and the mid-point |
| 2200 | 4200 | Set limits | Set limit values |
| 2201 | 4201 | Set limits F1 | Assign switch outputs |
| 2250 | 4250 | Measuring rate | Measuring rate |
| 2400 | 4400 | Synchronize/trigger | Synchronizing, triggering, operating mode |
| 24A0 | 44A0 | Key lock | Button lock |
| 24C0 | 44C0 | Enable flash for mastering | Release/lock flash writing |
| 2999 | 4999 | Sensor type | Specify sensor type |
| 2FF0 | 4FF0 | Measurement value | Reading out the measurements |
| 3000 | | Sensor state | Connection status |

For a description of the individual commands, also see Chapter "RS422 serial port" in the sensor instructions.

**2005 Sensor info**

**Object 2005h: Sensor information**

| 2005 | RECORD | Sensor info | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| Sub-indices | | | | | |
| 0 | VAR | Number of entries | 8 | Unsigned8 | r |
| 1 | VAR | Sensor name | ILD1700 | String | r |
| 2 | VAR | Measuring range | 200 | String | r |
| 3 | VAR | Software version | 5,047 | String | r |
| 4 | VAR | Hardware version | 1.52 | String | r |
| 5 | VAR | Serial No. | 706102 | String | r |
| 6 | VAR | Option no | 0 | String | r |
| 7 | VAR | Calibration date | 11/10/20 | String | r |
| 8 | VAR | Article no | 4120092 | String | r |

### 2006 Interface settings

**Object 2006h: Baud rate extension terminal**

| 2006 | RECORD | Interface settings | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| Sub-indices | | | | | |
| 0 | VAR | Number of entries | 5 | Unsigned8 | r |
| 1 | VAR | Baud rate | 115200 | Unsigned32 | rw |

The baud rate in object 2006:01 determines the baud rate of the RS422 extension terminal. The baud rate of the sensor is defined in object 21B0: 02. The two baud rates must match.

### 2050 Get Info

**Object 2050h: Query sensor information**

| 2050 | RECORD | Get info | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| | | | | Boolean | w |

Causes the terminal to retrieve the infostring from the sensor.

### 2051 Get settings

**Object 2051h: Query sensor settings**

| 2051 | RECORD | Get settings | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| | | | | Boolean | w |

Causes the Terminal to send the GetSettings command to the sensor and to store the received sensor settings in the 2005h objects.

### 2100 Set Default

**Object 2100h: Call up factory setting**

| 2100 | RECORD | Set default | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| | | | | Boolean | w |

After calling up the factory default the current output is activated as the output channel in object 21B0:01. Set object 21B0:01 on RS422, see Object 21B0.

### 2101 Reset

**Object 2101h: Initialize sensor (boot)**

| 2101 | RECORD | Reset | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| | | | | Boolean | w |

### 2132 Laser On

**Object 2132h: Switch on laser light source**

| 2132 | RECORD | Laser on | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| | | | x | Boolean | rw |

x = 0 : Laser off
x = 1 : Laser on.

### 2181 Average

**Object 2181h: Averaging**

| 2181 | RECORD | Average | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| Sub-indices | | | | | |
| 0 | VAR | Number of entries | 2 | Unsigned8 | r |
| 1 | VAR | Average type | x | Int16 | rw |
| 2 | VAR | Number of values | y | Int16 | rw |

x = 0 : recursive average — Recursive average of 1 to 32768 measurements
x = 1 : moving average — moving average of 1 to 128 measurements
x = 2 : Median — median of 3, 5, 7 or 9 measurements

The averaging number applies only for the moving and the recursive average.

| Averaging number | 1 | 2 | 4 | 8 | 16 | 32 | 64 | 128 | 256 | 512 | 1024 | 2048 | 4096 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| y | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |

| Averaging number | 8192 | 16384 | 32768 |
|---|---|---|---|
| y | 13 | 14 | 15 |

### 21A0 Data On

**Object 21A0h: Switch measurement output on/off**

| 21A0 | RECORD | Data on | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| | | | x | Boolean | rw |

x = 0 : Data output off
x = 1 : Data output on

### 21A4 RS422 Format

**Object 21A4h: Measurement data format**

| 21A4 | RECORD | RS422 format | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| | | | x | Boolean | rw |

x = 0 : Binary format
x = 1 : ASCII characters

### 21A5 Hold Last Value

**Object 21A5h: Retain measurement**

| 21A5 | RECORD | Hold last value | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| | | | x | Unsigned8 | rw |

x = 0 : Output error signal
x = 1 : Hold last measurement

The command only affects the analog output.

### 21B0 Digital Interfaces

**Object 21B0h: Measurement output and baud rate sensor**

| 21B0 | RECORD | Digital interfaces | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| Sub-indices | | | | | |
| 0 | VAR | Number of entries | 2 | Unsigned8 | r |
| 1 | VAR | Output device | x | Unsigned32 | rw |
| 2 | VAR | Baud rate | y | Unsigned32 | rw |

x = 0 : Current (4 .. .20 mA)
x = 1 : voltage (0 ... 10 V)
x = 2 : RS422

y = 0 : 115200 Baud
y = 1 : 57600 Baud
y = 2 : 19200 Baud
y = 3 : 9600 Baud

### 21E0 zeroing, mastering

**Object 21E0h: Zeroing, mastering/**

| 21E0 | RECORD | Zeroing, mastering | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| Sub-indices | | | | | |
| 0 | VAR | Number of entries | 4 | Unsigned8 | r |
| 1 | VAR | Reserved | | | |
| 2 | VAR | Master value | | Int16 | rw |
| 3 | VAR | Zeroing/mastering active | x | Boolean | r |
| 4 | VAR | Mastering/reset mastering | y | Boolean | w |

x = 0 : Setting of masters and mid-point cancelled
x = 1 : Masters/mid-point set

y = 0 : Cancel setting of masters and mid-point
y = 1 : Setting masters and the mid-point

### 2200 Limit Values

**Object 2200h: Set limit values**

| 2200 | RECORD | Limit values | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| Sub-indices | | | | | |
| 0 | VAR | Number of entries | 4 | Unsigned8 | r |
| 1 | VAR | Upper limit | | Int16 | rw |
| 2 | VAR | Lower limit | | Int16 | rw |
| 3 | VAR | Upper hysteresis | | Int16 | rw |
| 4 | VAR | Lower hysteresis | | Int16 | rw |

### 2201 Set limits F1

**Object 2201h: Assign switch outputs**

| 2201 | RECORD | Set limits F1 | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| | | | x | Int16 | rw |

x = 0 : Upper limit switch output 2, lower limit switch output 1
x = 1 : Upper limit switch output 1, lower limit switch output 2

### 2250 Measuring Rate

**Object 2250h: Set measuring rate**

| 2250 | RECORD | Measuring rate | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| Sub-indices | | | | | |
| 0 | VAR | Number of entries | 2 | Unsigned8 | r |
| 1 | VAR | Reserved | | | |
| 2 | VAR | Measuring rate | x | Int8 | rw |

x = 0 : 2.5 kHz
x = 1 : 1.25 kHz
x = 2 : 625 Hz
x = 3 : 312.5 Hz

### 2400 Synchronize, trigger

**Object 2400h: Synchronizing, triggering, operating mode**

| 2400 | RECORD | Synchronize, trigger | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| Sub-indices | | | | | |
| 0 | VAR | Number of entries | 2 | Unsigned8 | r |
| 1 | VAR | Operation mode | x | Unsigned8 | rw |
| 2 | VAR | Synchronous/trigger | y | Unsigned8 | rw |

x = 0 : Sync/error
x = 1 : Sync/switch
x = 2 : Trigger/error
x = 3 : Trigger/switch

for x = 0/1
y = 0 : Master synchronous off
y = 1 : Master synchronous on
y = 2 : Slave
y = 3 : Master synchronous alternating

For x = 2/3
y = 0 : Flank positive
y = 1 : Flank negative
y = 2 > level high
y = 3 > level low

### 24A0 Key Lock

**Object 24A0h: Button lock**

| 24A0 | RECORD | Key lock | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| | | | x | Boolean | rw |

x = 0 : Unlock keyboard
x = 1 : Keyboard locked

### 24C0 Enable Flash for Mastering

**Object 24C0h: Release/lock flash writing**

| 24C0 | RECORD | Enable flash mastering | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| | | | x | Boolean | rw |

x = 0 : Flash writing locked
x = 1 : Flash writing released

### 2999 Sensor Type

**Object 2999h: Specify sensor type**

| 2999 | RECORD | Sensor type | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| | | | ILD1700 | String | rw |

### 2FF0 Measurement Value

**Object 2FF0h: Reading out the measurements**

| 2FF0 | RECORD | Measured value | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| Sub-indices | | | | | |
| 0 | VAR | Number of entries | 1 | Unsigned8 | r |
| 1 | VAR | Measurement sensor 1 | | Unsigned16 | r |

The output values are issued as unsigned digital values (raw values).

| Digital value | Use |
|---|---|
| 0 ... 160 | Reserve measuring range start |
| 161 ... 16207 | Drawings |
| 16208 ... 16367 | Reserve measuring range end |
| 16370 ... 16383 | Error codes |

Calculation of a measurement (in mm) from the digital value, reference value start of measuring range

$$x\,[mm] = (digital_{OUT} * \frac{1{,}02}{16368} - 0{,}01) * MB\,[mm]$$

Example: MB = 10 mm, digital value = 8184, measurement = 5 mm

Digital error codes are output like measurements.
The range of values for error codes: 16370 ... 16383 ($digital_{OUT}$)

16370 No object recognizable
16372 too close to the sensor
16374 too far from the sensor
16376 Target cannot be evaluated
16378 external laser off
16380 Trigger mode, pulses coming too quickly

### 3000 Sensor State

**Object 3000h: Connection status**

| 3000 | RECORD | Sensor state | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| Sub-indices | | | | | |
| 0 | VAR | Number of entries | 2 | Unsigned8 | r |
| 1 | VAR | Sensor 1 | x | Unsigned8 | r |
| 2 | VAR | Sensor 2 | x | Unsigned8 | r |

x = 0 : No RS422 extension terminal
x = 1 : Terminal starts synchronization phase
x = 2 : Terminal in synchronization phase 1
x = 3 : Terminal in synchronization phase 2
x = 4 : Terminal in synchronization phase 3
x = 5 : unknown type of sensor
x = 6 : unknown baud rate
x = 7 : Error during serial initialization
x = 8 : Sensor timeout
x = 16 : Sensor communication ok
x = 17 : Measurement reception ok

### 5.2.8 ILD2200

**Overview of objects**

| Index (h) | | Name | Description |
|---|---|---|---|
| Sensor 1 | Sensor 2 | | |
| 2005 | 4005 | Sensor info | Sensor information (other) |
| 2006 | 4006 | Interface settings | Baud rate extension terminal |
| 2050 | 4050 | Get info | Query sensor information |
| 2051 | 4051 | Get settings | Selection of the sensor |
| 2101 | 4101 | Reset | Reboot sensor |
| 2132 | 4132 | Laser on | Switch on laser light source |
| 2181 | 4181 | Average | Averaging setting |
| 21A0 | 41A0 | Data on | Switch measurement output on/off |
| 21E0 | 41E0 | Zeroing | Setting masters and the mid-point |
| 24A0 | 44A0 | Key lock | Button lock |
| 2999 | 4999 | Sensor type | Specify sensor type |
| 2FF0 | 4FF0 | Measurement value | Reading out the measurements |
| 3000 | | Sensor state | Connection status |

For a description of the individual commands, also see Chapter "RS422 serial port" in the sensor instructions.

**2005 Sensor info**

**Object 2005h: Sensor information**

| 2005 | RECORD | Sensor info | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| Sub-indices | | | | | |
| 0 | VAR | Number of entries | 8 | Unsigned8 | r |
| 1 | VAR | Sensor name | ILD2200 | String | r |
| 2 | VAR | Measuring range | 20 | String | r |
| 3 | VAR | Software version | | String | r |
| 4 | VAR | Hardware version | | String | r |
| 5 | VAR | Serial No. | 01110576 | String | r |
| 6 | VAR | Option no | 0006 | String | r |
| 7 | VAR | Calibration date | | String | r |
| 8 | VAR | Article no | | String | r |

**2006 Interface settings**

**Object 2006h: Baud rate extension terminal**

| 2006 | RECORD | Interface settings | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| Sub-indices | | | | | |
| 0 | VAR | Number of entries | 5 | Unsigned8 | r |
| 1 | VAR | Baud rate | 691200 | Unsigned32 | rw |

The baud rate in object 2006:01 determines the baud rate of the RS422 extension terminal. The baud rate of the sensor is defined in object 21B0: 02. The two baud rates must match.

**2050 Get Info**

**Object 2050h: Query sensor information**

| 2050 | RECORD | Get info | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| | | | | Boolean | w |

Causes the terminal to retrieve the infostring from the sensor.

**2051 Get settings**

**Object 2051h: Query sensor settings**

| 2051 | RECORD | Get settings | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| | | | | Boolean | w |

Causes the Terminal to send the GetSettings command to the sensor and to store the received sensor settings in the 2005h objects.

**2101 Reset**

**Object 2101h: Initialize sensor (boot)**

| 2101 | RECORD | Reset | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| | | | | Boolean | w |

**2132 Laser On**

**Object 2132h: Switch on laser light source**

| 2132 | RECORD | Laser on | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| | | | x | Boolean | rw |

x = 0 : Laser off
x = 1 : Laser on.

**2181 Average**

**Object 2181h: Averaging**

| 2181 | RECORD | Average | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| Sub-indices | | | | | |
| 0 | VAR | Number of entries | 2 | Unsigned8 | r |
| 1 | VAR | Average type | x | Int16 | rw |
| 2 | VAR | Number of values | y | Int16 | rw |

| | |
|---|---|
| x = 0 : recursive average | Recursive average of 1 to 32768 measurements |
| x = 1 : moving average | moving average of 1 to 128 measurements |
| x = 2 : Median | median of 3, 5, 7 or 9 measurements |

The averaging number applies only for the moving and the recursive average.

| Averaging number | 1 | 2 | 4 | 8 | 16 | 32 | 64 | 128 | 256 | 512 | 1024 | 2048 | 4096 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| y | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |

| Averaging number | 8192 | 16384 | 32768 |
|---|---|---|---|
| y | 13 | 14 | 15 |

**21A0 Data On**

**Object 21A0h: Switch measurement output on/off**

| 21A0 | RECORD | Data on | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| | | | x | Boolean | rw |

x = 0 : Data output off
x = 1 : Data output on

### 21E0 zeroing, mastering

**Object 21E0h: Zeroing, mastering/**

| 21E0 | RECORD | Zeroing, mastering | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| Sub-indices | | | | | |
| 0 | VAR | Number of entries | 4 | Unsigned8 | r |
| 1 | VAR | Reserved | | | |
| 2 | VAR | Master value | | Int16 | rw |
| 3 | VAR | Zeroing/mastering active | x | Boolean | r |
| 4 | VAR | Mastering/reset mastering | y | Boolean | w |

x = 0 : Setting of masters and mid-point cancelled
x = 1 : Masters/mid-point set

y = 0 : Cancel setting of masters and mid-point
y = 1 : Setting masters and the mid-point

### 24A0 Key Lock

**Object 24A0h: Button lock**

| 24A0 | RECORD | Key lock | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| | | | x | Boolean | rw |

x = 0 : Unlock keyboard
x = 1 : Keyboard locked

### 2999 Sensor Type

**Object 2999h: Specify sensor type**

| 2999 | RECORD | Sensor type | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| | | | ILD2200 | String | rw |

### 2FF0 Measurement Value

**Object 2FF0h: Reading out the measurements**

| 2FF0 | RECORD | Measured value | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| Sub-indices | | | | | |
| 0 | VAR | Number of entries | 1 | Unsigned8 | r |
| 1 | VAR | Measurement sensor 1 | | Unsigned16 | r |

The output values are issued as unsigned digital values (raw values).

| Digital value | Use |
|---|---|
| 0 ... 642 | Reserve measuring range start |
| 643 ... 64876 | Measurement range |
| 64877 ... 65519 | Reserve measuring range end |
| 65520 ... 65535 | Error codes |

Calculation of a measurement (in mm) from the digital value, reference value mid-point of measuring range

$$x\,[mm] = \left(digital_{OUT} * \frac{1{,}02}{65520} - 0{,}51\right) * Messbereich\,[mm]$$

Example: MB = 10 mm, digital value = 643, measurement = -4.99989 mm

Digital error codes are output like measurements.
The range of values for error codes: 65520 ... 65535 ($digital_{OUT}$)

65522 No object recognizable
65524 too close to the sensor
65526 too far from the sensor
65528 Target cannot be evaluated
65530 external laser off

### 3000 Sensor State

**Object 3000h: Connection status**

| 3000 | RECORD | Sensor state | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| Sub-indices | | | | | |
| 0 | VAR | Number of entries | 2 | Unsigned8 | r |
| 1 | VAR | Sensor 1 | x | Unsigned8 | r |
| 2 | VAR | Sensor 2 | x | Unsigned8 | r |

x = 0 : No RS422 extension terminal
x = 1 : Terminal starts synchronization phase
x = 2 : Terminal in synchronization phase 1
x = 3 : Terminal in synchronization phase 2
x = 4 : Terminal in synchronization phase 3
x = 5 : unknown type of sensor
x = 6 : unknown baud rate
x = 7 : Error during serial initialization
x = 8 : Sensor timeout
x = 16 : Sensor communication ok
x = 17 : Measurement reception ok

### 5.2.9 ILD2300

#### 3010 Laser On

**Object 3010h: Switch on laser light source**

| 3010 | RECORD | Laser On | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| Sub-indices | | | | | |
| 0 | VAR | Number of entries | 2 | Unsigned8 | r |
| 1 | VAR | Sensor 1 | x | Boolean | rw |
| 2 | VAR | Sensor 2 | y | Boolean | rw |

x, y = 0 : Laser off
x, y = 1 : Laser on

Activates the laser with EtherCAT sensors connected.

### 5.2.10 ODC2500

The optoCONTROL 2500 is shipped ex works with RS232 as active interface.

- Before using the RS422 extension terminal for the very first time, switch the interface in the optoCONTROL 2500 to RS422.
- Start the TwinCAT Manager
- In the Actions menu, select the command: Reload the configuration.
- Select object 2006:01 and set the baud rate to 691200.
- Select object 2999 sensor type and set the sensor used to ODC2500.

**Overview of objects**

| Index (h) | | Name | Description |
|---|---|---|---|
| Sensor 1 | Sensor 2 | | |
| 2005 | 4005 | Sensor info | Sensor information (other) |
| 2006 | 4006 | Interface settings | Baud rate extension terminal |
| 2050 | 4050 | Get info | Query controller information |
| 2101 | 4101 | Reset | Reboot sensor |
| 2154 | 4154 | measuring program | Change measuring program |
| 2155 | 4155 | Switch edge | Change the edge |
| 21A0 | 41A0 | Data on | Switch measurement output on/off |
| 2600 | 4600 | Edit option data | Write options data in RAM |
| 2601 | 4601 | Edit program data | Measuring program data in RAM |
| 2604 | 4604 | Save option data | Save options data in Flash |
| 2605 | 4605 | Save program data | Save measuring program data in Flash |
| 2606 | 4606 | Read statistic | Read min - max values |
| 2607 | 4607 | Reset statistic | Read min - max values with reset |
| 2999 | 4999 | Sensor type | Specify sensor type |
| 2FF0 | 4FF0 | Measurement value | Reading out the measurements |
| 3000 | | Sensor state | Connection status |

For a description of the individual commands, see also the instructions for the Controller in Chapter

**2005 Controller-Info**

**Object 2005h: Sensor information**

| 2005 | RECORD | Sensor info | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| Sub-indices | | | | | |
| 0 | VAR | Number of entries | 8 | Unsigned8 | r |
| 1 | VAR | Sensor name | ODC2500 | String | r |
| 2 | VAR | Measuring range | 34 | String | r |
| 3 | VAR | Software version | 1021 | String | r |
| 4 | VAR | Hardware version | | String | r |
| 5 | VAR | Serial No. | 1011423 | String | r |
| 6 | VAR | Option no | 0 | String | r |
| 7 | VAR | Calibration date | | String | r |
| 8 | VAR | Article no | | String | r |

### 2006 Interface settings

**Object 2006h: Baud rate extension terminal**

| 2006 | RECORD | Interface settings | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| Sub-indices | | | | | |
| 0 | VAR | Number of entries | 5 | Unsigned8 | r |
| 1 | VAR | Baud rate | 691200 | Unsigned32 | rw |

The baud rate in object 2006:01 determines the baud rate of the RS422 extension terminal.

### 2050 Get Info

**Object 2050h: Query controller information**

| 2050 | RECORD | Get info | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| | | | | Boolean | w |

Causes the terminal to retrieve the infostring from the controller.

### 2101 Reset

**Object 2101h: Initialize controller (boot)**

| 2101 | RECORD | Reset | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| | | | | Boolean | w |

### 2154 Measuring Program

**Object 2154h: Selection of measuring program**

| 2154 | RECORD | measuring program | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| | | | x | Int8 | rw |

x = 0 : EDGEHL
x = 1 : EDGELH
x = 2 : DIA
x = 3 : GAP
x = 4 : SEG_2_4
x = 5 : 2-SEG
x = 6 : USER1
x = 7 : USER2 [1]
x = 8 : USER3 [1]
x = 9 : USER4 [1]

1) Presupposes that appropriate programs are installed in the controller.

### 2155 Switch Edge

**Objekt 2155h: Change the edge**

| 2155 | RECORD | Switch edge | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| Sub-indices | | | | | |
| 0 | VAR | Number of entries | 4 | Unsigned8 | r |
| 1 | VAR | Front edge 1 | x | Unsigned16 | rw |
| 2 | VAR | Front edge 2 | x | Unsigned16 | rw |
| 3 | VAR | Rear edge 1 | x | Unsigned16 | rw |
| 4 | VAR | Rear edge 2 | x | Unsigned16 | rw |

x = 0 ... 80

### 21A0 Data On

**Object 21A0h: Switch measurement output on/off**

| 21A0 | RECORD | Data on | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| | | | x | Boolean | rw |

x = 0 : Data output off
x = 1 : Data output on

**2600 Edit option data**

**Object 2600h: Write options data in RAM**

| 2600 | RECORD | Edit option data | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| | | | | Int8[44] | w |

For a description of the command, see also the instructions for the Controller in Chapter ”Commands”.

**2601 Edit program data**

**Object 2601h: Write measuring program data RAM**

| 2601 | RECORD | Edit program data | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| | | | | Int8[82] | w |

For a description of the command, see also the instructions for the Controller in Chapter ”Commands”.

**2604 Save option data**

**Object 2604h: Save options data in Flash**

| 2604 | RECORD | Save option data | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| | | | | Boolean | w |

For a description of the command, see also the instructions for the Controller in Chapter ”Commands”.

**2605 Save program data**

**Object 2605h: Save measuring program data in Flash**

| 2605 | RECORD | Edit measuring program | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| | | | | Boolean | w |

For a description of the command, see also the instructions for the Controller in Chapter ”Commands”.

**2606 Read Statistic**

**Object 2606h: Read min - max values**

| 2606 | RECORD | Read statistic | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| Sub-indices | | | | | |
| 0 | VAR | Number of entries | 2 | Unsigned8 | r |
| 1 | VAR | Min value | | Int32 | rw |
| 2 | VAR | Max value | | Int32 | rw |

Min/Max[mm] = Min/Max[0...65519] * 40.824 / 65519 - 0.4204872

The optoCONTROL 2500 provides a min value and a max value to the object.

**2607 Reset Statistic**

**Object 2607h: Read min-max values, statistics in the sensor are reset**

| 2607 | RECORD | Reset statistic | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| Sub-indices | | | | | |
| 0 | VAR | Number of entries | 2 | Unsigned8 | r |
| 1 | VAR | Min value | | Int32 | rw |
| 2 | VAR | Max value | | Int32 | rw |

Min/Max[mm] = Min/Max[0...65519] * 40.824 / 65519 - 0.4204872

The optoCONTROL 2500 provides a min value and a max value to the object. Then the memory for the min value and the max value is set to zero in the optoCONTROL 2500.

**2999 Sensor Type**

**Object 2999h: Specify sensor type**

| 2999 | RECORD | Sensor type | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| | | | ODC2500 | String | rw |

### 2FF0 Measurement Value

**Object 2FF0h: Read out the measurements**

| 2FF0 | RECORD | Measured value | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| Sub-indices | | | | | |
| 0 | VAR | Number of entries | 1 | Unsigned8 | r |
| 1 | VAR | Measurement sensor 1 | | Unsigned16 | r |

Calculation of a measurement (in mm) from the digital value

$$x\,[mm] = digital_{OUT} * \frac{34{,}4386}{65519} - 0{,}2221$$

Digital error codes are output like measurements.

| | |
|---|---|
| 65521 | No flank |
| 65522 | At the beginning of the image |
| 65523 | At the end of the image |
| 65524 | Dark-light flank |
| 65525 | Light-dark flank |
| 65526 | Min. number of flanks |
| 65527 | Maximum number of flanks |
| 65528 | No valid measuring program |
| 65529 | Segment 1st edge > = 2nd edge |
| 65530 | Segment number of edges < last edge |
| 65531 | No valid measurement distance |
| 65533 | Laser switched off |
| 65534 | No valid float number |
| 65535 | DMA Setup error |

### 3000 Sensor State

**Object 3000h: Connection status**

| 3000 | RECORD | Sensor state | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| Sub-indices | | | | | |
| 0 | VAR | Number of entries | 2 | Unsigned8 | r |
| 1 | VAR | Sensor 1 | x | Unsigned8 | r |
| 2 | VAR | Sensor 2 | x | Unsigned8 | r |

x = 0 : No RS422 extension terminal
x = 1 : Terminal starts synchronization phase
x = 2 : Terminal in synchronization phase 1
x = 3 : Terminal in synchronization phase 2
x = 4 : Terminal in synchronization phase 3
x = 5 : unknown type of sensor
x = 6 : unknown baud rate
x = 7 : Error during serial initialization
x = 8 : Sensor timeout
x = 16 : Sensor communication ok
x = 17 : Measurement reception ok

### 5.2.11 ODC2600

The optoCONTROL 2600 is shipped ex works with RS232 as active interface.

- Before using the RS422 extension terminal for the very first time, switch the interface in the optoCONTROL 2600 to RS422.
- Start the TwinCAT Manager
- In the Actions menu, select the command: Reload the configuration.
- Select object 2006:01 and set the baud rate to 691200.
- Select the Object 2999 sensor type and set the sensor used to ODC 2600.

**Overview of objects**

| Index (h) | | Name | Description |
|---|---|---|---|
| Sensor 1 | Sensor 2 | | |
| 2005 | 4005 | Sensor info | Sensor information (other) |
| 2006 | 4006 | Interface settings | Baud rate extension terminal |
| 2050 | 4050 | Get info | Query controller information |
| 2101 | 4101 | Reset | Reboot sensor |
| 2130 | 4132 | Set light tuning | Flexible edge detection threshold |
| 2154 | 4154 | measuring program | Change measuring program |
| 2155 | 4155 | Switch edge | Change the edge |
| 21A0 | 41A0 | Data on | Switch measurement output on/off |
| 2401 | 4401 | Trigger mode reset | Stop triggering |
| 2402 | 4402 | trigger mode trigger | Enable trigger-controlled output |
| 2600 | 4600 | Edit option data | Write options data in RAM |
| 2601 | 4601 | Edit program data | Measuring program data in RAM |
| 2604 | 4604 | Save option data | Save options data in Flash |
| 2605 | 4605 | Save program data | Save measuring program data in Flash |
| 2606 | 4606 | Read statistic | Read min - max values |
| 2607 | 4607 | Reset statistic | Read min - max values with reset |
| 2999 | 4999 | Sensor type | Specify sensor type |
| 2FF0 | 4FF0 | Measurement value | Reading out the measurements |
| 3000 | | Sensor state | Connection status |

For a description of the individual commands, see also the instructions for the Controller in Chapter ”Control commands”.

**2005 Controller-Info**

**Object 2005h: Sensor information**

| 2005 | RECORD | Sensor info | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| Sub-indices | | | | | |
| 0 | VAR | Number of entries | 8 | Unsigned8 | r |
| 1 | VAR | Sensor name | ODC2600 | String | r |
| 2 | VAR | Measuring range | 40 | String | r |
| 3 | VAR | Software version | 1013 | String | r |
| 4 | VAR | Hardware version | | String | r |
| 5 | VAR | Serial No. | 0311050 | String | r |
| 6 | VAR | Option no | 0 | String | r |
| 7 | VAR | Calibration date | | String | r |
| 8 | VAR | Article no | 4321004 | String | r |

### 2006 Interface settings

**Object 2006h: Baud rate extension terminal**

| 2006 | RECORD | Interface settings | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| Sub-indices | | | | | |
| 0 | VAR | Number of entries | 5 | Unsigned8 | r |
| 1 | VAR | Baud rate | 691200 | Unsigned32 | rw |

The baud rate in object 2006:01 determines the baud rate of the RS422 extension terminal.

### 2050 Get Info

**Object 2050h: Query controller information**

| 2050 | RECORD | Get info | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| | | | | Boolean | w |

Causes the terminal to retrieve the infostring from the controller.

### 2101 Reset

**Object 2101h: Initialize controller (boot)**

| 2101 | RECORD | Reset | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| | | | | Boolean | w |

### 2130 Set Light Tuning

**Object 2130h: Light reference for flexible edge detection threshold**

| 2130 | RECORD | Set light tuning | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| | | | x | Boolean | w |

x = 0 : Reset light reference, i.e. solid edge detection threshold
x = 1 : Activates light reference for flexible edge detection threshold

### 2154 Measuring Program

**Object 2154h: Selection of measuring program**

| 2154 | RECORD | Measuring program | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| | | | x | Int8 | rw |

x = 0 : EDGEHL
x = 1 : EDGELH
x = 2 : DIA
x = 3 : GAP
x = 4 : SEG_2_4
x = 5 : MULTISEG
x = 6 : USER1
x = 7 : USER2 [1]
x = 8 : USER3 [1]
x = 9 : USER4 [1]

1) Presuppose that appropriate programs are installed in the controller.

### 2155 Switch Edge

**Objekt 2155h: Change the edge**

| 2155 | RECORD | Switch edge | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| Sub-indices | | | | | |
| 0 | VAR | Number of entries | 4 | Unsigned8 | r |
| 1 | VAR | Front edge 1 | x | Unsigned16 | rw |
| 2 | VAR | Front edge 2 | x | Unsigned16 | rw |
| 3 | VAR | Rear edge 1 | x | Unsigned16 | rw |
| 4 | VAR | Rear edge 2 | x | Unsigned16 | rw |

x = 0 ... 80

**21A0 Data On**

**Object 21A0h: Switch measurement output on/off**

| 21A0 | RECORD | Data on | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| | | | x | Boolean | rw |

x = 0 : Data output off x = 1 : Data output on

**2401 Trigger mode reset**

**Object 2401h: Stop triggering**

| 2401 | RECORD | Trigger mode reset | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| | | | | Boolean | w |

**2402 Trigger Mode Trigger**

**Object 2402h: Start triggering**

| 2402 | RECORD | Trigger mode trigger | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| | | | | Boolean | w |

**2600 Edit option data**

**Object 2600h: Write options data in RAM**

| 2600 | RECORD | Edit option data | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| | | | | Int8[44] | w |

For a description of the command, see also the instructions for the Controller in Chapter ”Control Commands”.

**2601 Edit program data**

**Object 2601h: Write measuring program data in RAM**

| 2601 | RECORD | Edit program data | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| | | | | Int8[82] | w |

For a description of the command, see also the instructions for the Controller in Chapter ”Control Commands”.

**2604 Save option data**

**Object 2604h: Save options data in Flash**

| 2604 | RECORD | Save option data | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| | | | | Boolean | w |

For a description of the command, see also the instructions for the Controller in Chapter ”Control Commands”.

**2605 Save program data**

**Object 2605h: Save measuring program data in Flash**

| 2605 | RECORD | Edit measuring program | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| | | | | Boolean | w |

For a description of the command, see also the instructions for the Controller in Chapter ”Control Commands”.

**2606 Read Statistic**

**Object 2606h: Read min - max values**

| 2606 | RECORD | Read statistic | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| Sub-indices | | | | | |
| 0 | VAR | Number of entries | 2 | Unsigned8 | r |
| 1 | VAR | Min value | | Int32 | rw |
| 2 | VAR | Max value | | Int32 | rw |

Min/Max[mm] = Min/Max[0...65519] * 40.824 / 65519 - 0.4204872

The optoCONTROL 2600 provides a min value and a max value to the object.

### 2607 Reset Statistic

**Object 2607h: Read min-max values, statistics in the sensor are reset**

| 2607 | RECORD | Reset statistic | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| Sub-indices | | | | | |
| 0 | VAR | Number of entries | 2 | Unsigned8 | r |
| 1 | VAR | Min value | | Int32 | rw |
| 2 | VAR | Max value | | Int32 | rw |

Min/Max[mm] = Min/Max[0...65519] * 40.824 / 65519 - 0.4204872

The optoCONTROL 2600 provides a min value and a max value to the object. Then the memory for the min value and the max value is set to zero in the optoCONTROL 2600.

### 2999 Sensor Type

**Object 2999h: Specify sensor type**

| 2999 | RECORD | Sensor type | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| | | | ODC2600 | String | rw |

### 2FF0 Measurement Value

**Object 2FF0h: Read out the measurements**

| 2FF0 | RECORD | Measured value | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| Sub-indices | | | | | |
| 0 | VAR | Number of entries | 1 | Unsigned8 | r |
| 1 | VAR | Measurement sensor 1 | | Unsigned16 | r |

Calculation of a measurement (in mm) from the digital value

$$x\,[mm] = digital_{OUT} * \frac{40{,}824}{65519} - 0{,}4204872$$

Digital error codes are output like measurements.

| | | | |
|---|---|---|---|
| 65521 | No flank | 65528 | No valid measuring program |
| 65522 | At the beginning of the image | 65529 | Segment 1st edge > = 2nd edge |
| 65523 | At the end of the image | 65530 | Segment number of edges < last edge |
| 65524 | Dark-light flank | 65531 | No valid measurement distance |
| 65525 | Light-dark flank | 65533 | Laser switched off |
| 65526 | Min. number of flanks | 65534 | No valid float number |
| 65527 | Maximum number of flanks | 65535 | DMA Setup error |

### 3000 Sensor State

**Object 3000h: Connection status**

| 3000 | RECORD | Sensor state | Value/parameter | Data type | Access |
|---|---|---|---|---|---|
| Sub-indices | | | | | |
| 0 | VAR | Number of entries | 2 | Unsigned8 | r |
| 1 | VAR | Sensor 1 | x | Unsigned8 | r |
| 2 | VAR | Sensor 2 | x | Unsigned8 | r |

x = 0 : No RS422 extension terminal
x = 1 : Terminal starts synchronization phase
x = 2 : Terminal in synchronization phase 1
x = 3 : Terminal in synchronization phase 2
x = 4 : Terminal in synchronization phase 3
x = 5 : unknown type of sensor
x = 6 : unknown baud rate
x = 7 : Error during serial initialization
x = 8 : Sensor timeout
x = 16 : Sensor communication ok
x = 17 : Measurement reception ok

# 6. Synchronize Sensors

## 6.1 Introduction

The synchronization of connected sensors/controller among each other in the EtherCAT is realized via the Distributed Clock.

With it it is not necessary or possible to transmit the synchronous signals via the synchronous input or output of the sensor respectively of the controller.

Unlike the Ethernet the synchronization does not occur via external signals but about the clocks in the controllers. Using the EtherCAT this results in the synchronous modes

- Synchronization off (= `Free Run`) and
- Synchronization on (= `DC-Sychron`).

## 6.2 Simultaneous Synchronization

The following description explains the synchronization of two laser-optical optoNCDT 1700 displacement sensors.

➡ Connect both sensors to be synchronized to the RS422 extension terminal.

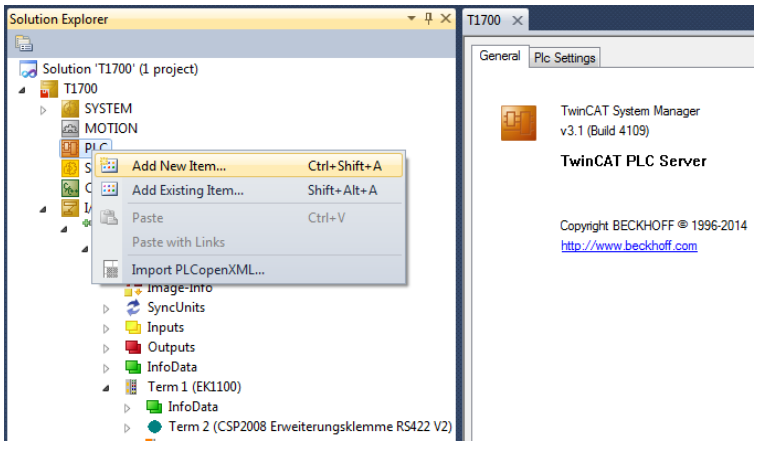
➡ Connect the EtherCAT coupler to a PC via a direct Ethernet connection (LAN) or Switch (Intranet). Use a LAN cable with RJ-45 connectors.

➡ Start the TwinCAT© System Manager program.

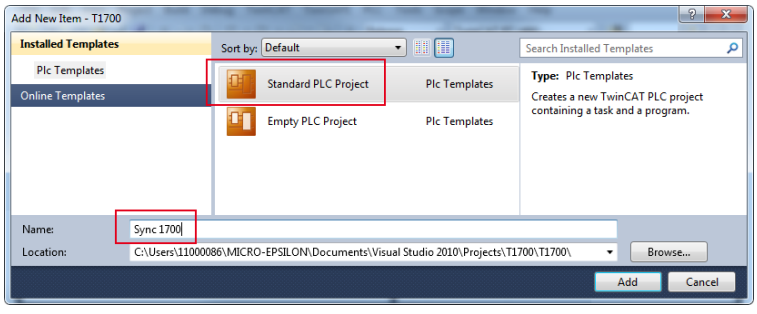
The RS422 extension terminal and the sensors are configured, see Chap. 5.1.4.

➡ In the `TwinCAT` menu, select the `Reset TwinCAT (Config Mode)` command.

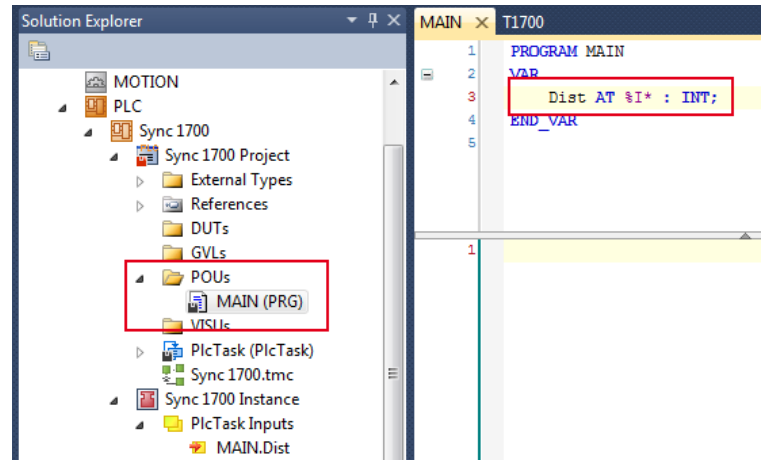
➡ Click on `PLC` with the right mouse button in the `System - Configuration`. Select `Add New Item`.



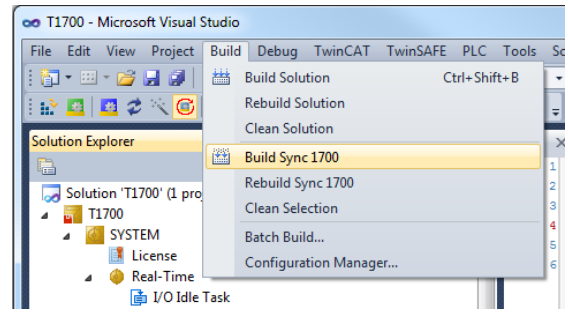

➡ Select `Standard PLC Project` and rename the project in the field `Name`.



- Click twice on `MAIN (PRG)` and start the editor.
- Add the variable `Dist` with the syntax `Dist AT %I* : INT;`.
- Add the variable `Dist_1` with the syntax `Dist_1 AT %I* : INT;`.

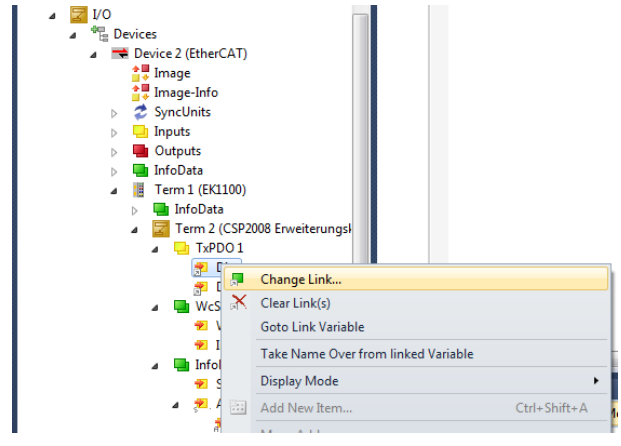



- Change to the `Build` menu and select the item `Build Sync1700`.

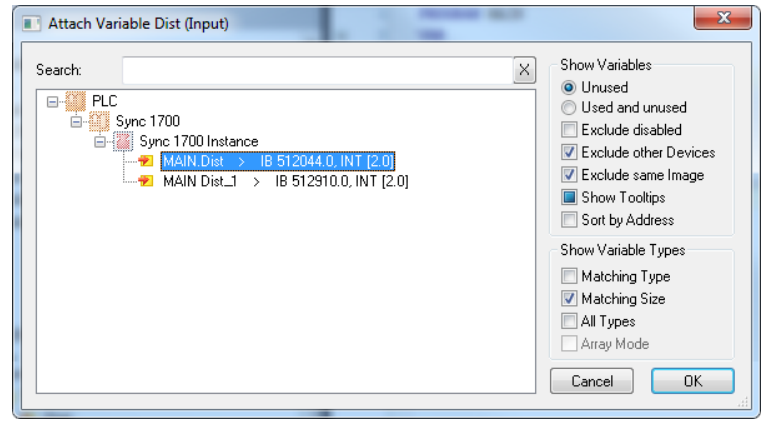



Link the `Dist` input with the variable `Dist`.

- Click on `TxPDO1 > Dist` with the right mouse button in the system configuration and select `Change Link`.

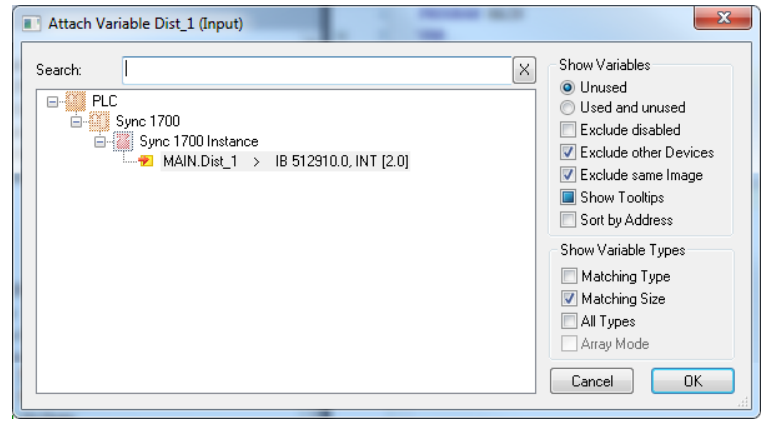



- Select the `MAIN. Dist > IB xxxxxx.0, INT [2.0]` item and quit with `OK`.



Link the `Dist_1` input with the variable `Dist_1`.

- Click on `TxPDO1 > Dist_1` with the right mouse button in the system configuration and select `Change Link`.
- Select the `MAIN. Dist_1 > IB xxxxxx.0, INT [2.0]` item and quit with `OK`.



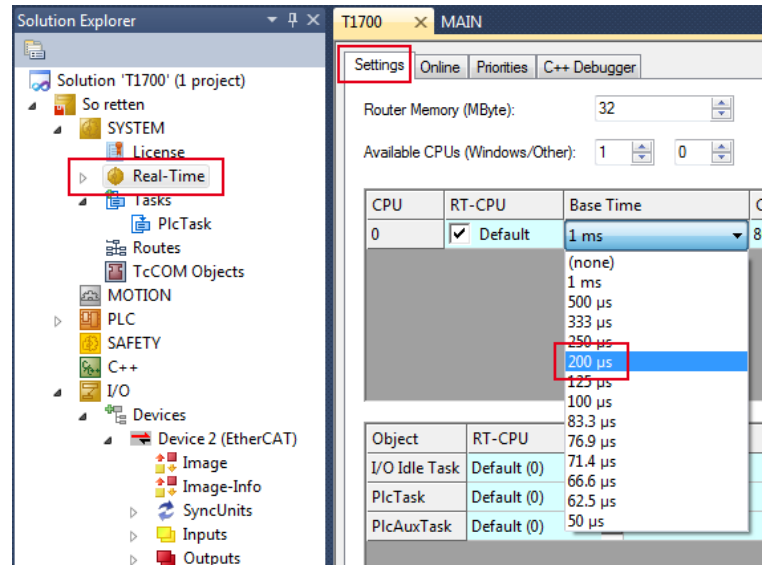

In the example, the ILD1700 operates with a measuring rate of 1.25 kHz. Using object 2250:2, the measuring rate can be changed if necessary, see Chap. 5.2.7. For synchronization, the sensor measuring rate and the synchronization rate or cycle time of the extension terminal must be compatible.

| Measuring rate [kHz] | Cycle time [µs] |
|---|---|
| 2.5 | 400 |
| 1.25 | 800 |
| 0.625 | 1600 |
| 0.3125 | 3200 |

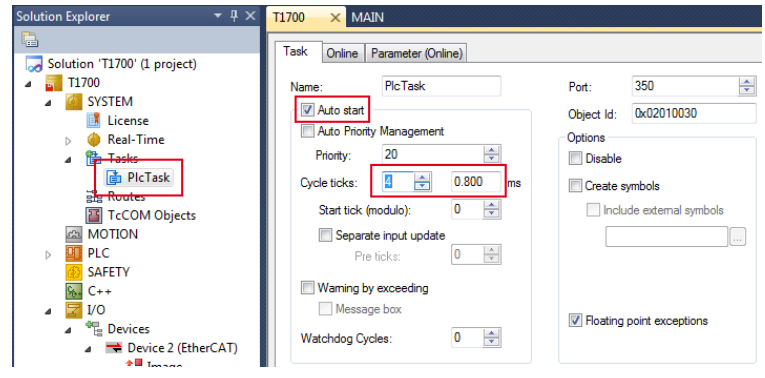
The cycle time of the PLC tasks should also correspond to the SYNC0 cycle time or a multiple of it.

Change the `Base Time` of the tasks.

- Double click on `Real-Time` and switch to the `Settings` tab.
- Choose a base time of `200 µs`.




- Click twice on `PlcTask` and activate the `Autostart` function.
- Set the synchronous time on `0.8 ms` in the `Cycle ticks` field.



- Select the RS422 extension terminal. Go to the `DC` tab and select `DC-Synchron` as operation mode.
- Click the `Advanced Settings` button.
- Enter the `cycle time` of the synchron pulses, e. g. 800 µs for an ILD1700 with a measuring rate of 1.25 kHz.

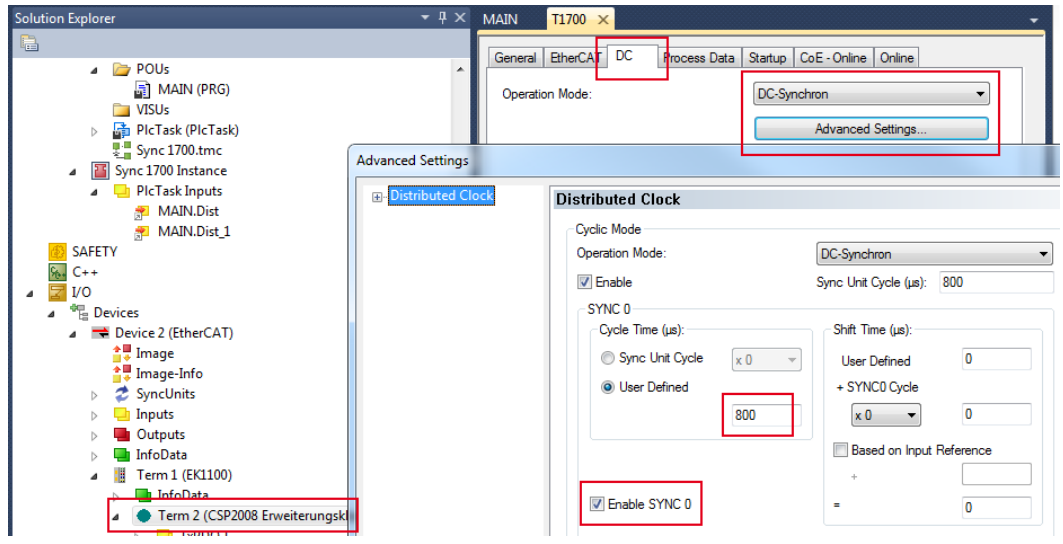



*Fig. 9 Cycle time for a simultaneous synchronization*

Activate the Configuration.

- Change to the `TwinCAT` menu and select `Activate Configuration`.

## 6.3 Alternating Synchronization

i With this type of synchronization, the two sensors measure alternately and it is intended e .g. for thickness measurement of transparent objects or a difference measurement on closely spaced measuring points.

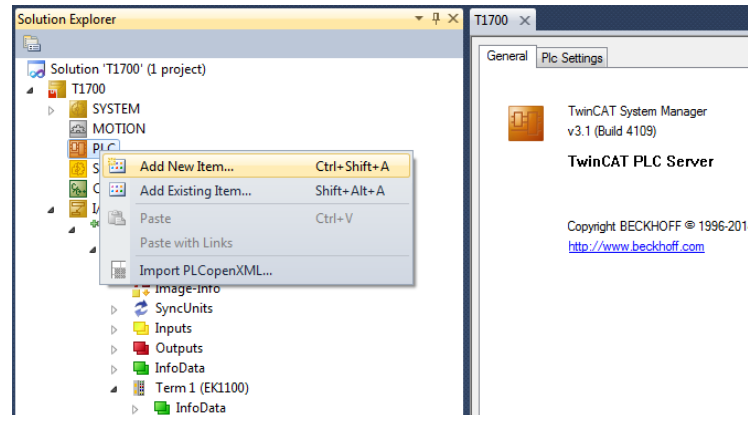
i Not all sensor models are suitable for alternating synchronization. The output rate of a sensor with alternating synchronization is halved; the total measuring rate is equal to the set measuring rate of one sensor.

The following description explains the alternating synchronization of two laser-optical optoNCDT 1700 displacement sensors.

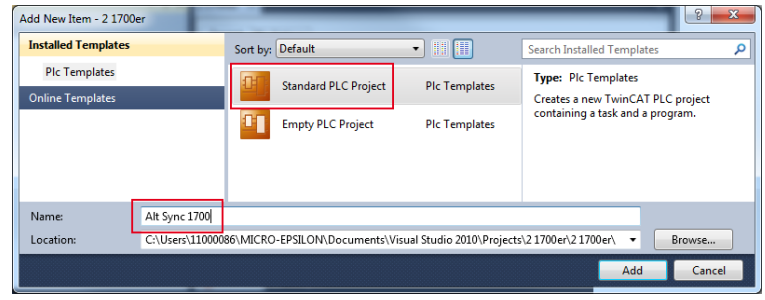
- Connect both sensors to be synchronized each at their own RS422 extension terminal.
- Connect the EtherCAT coupler to a PC via a direct Ethernet connection (LAN) or Switch (Intranet). Use a LAN cable with RJ-45 connectors.
- Start the TwinCAT© System Manager program.

The RS422 extension terminals and the sensors are configured, see Chap. 5.1.4.

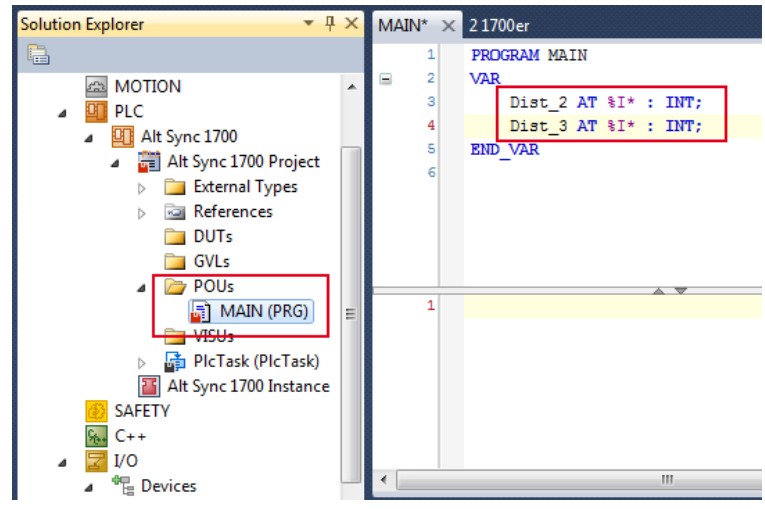
- In the `TwinCAT` menu, select the `Reset TwinCAT (Config Mode)` command.
- Click on `PLC` with the right mouse button in the `System - Configuration`. Select `Add New Item`.



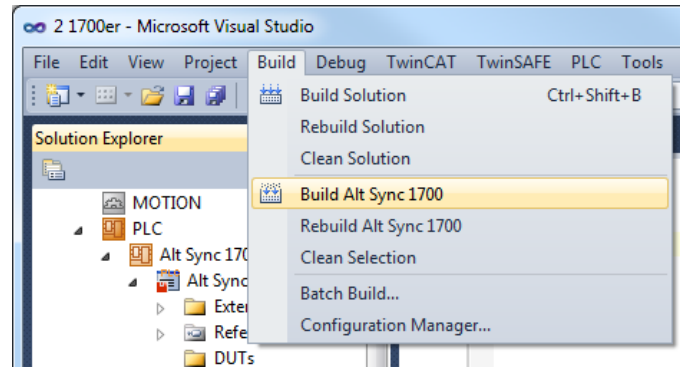
- Select `Standard PLC Project` and rename the project in the field `Name`.
- Confirm the entry with `Add`.




- Click twice on `MAIN (PRG)` and start the editor.
- Add the variable `Dist_2` with the syntax `Dist_2 AT %I* : INT;`.
- Add the variable `Dist_3` with the syntax `Dist_3 AT %I* : INT;`.

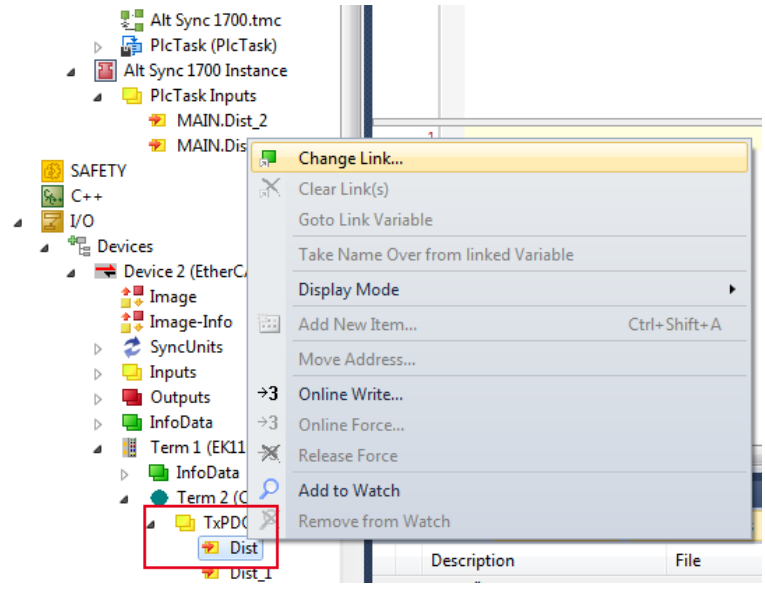



- Change to the `Build` menu and select the item `Build Sync1700`.

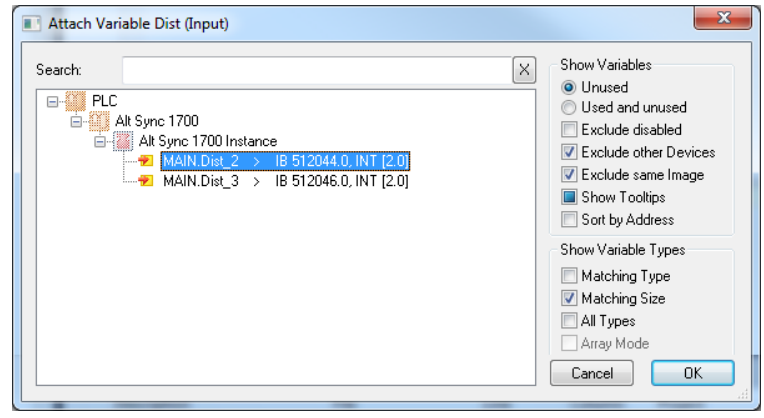



Link the `Dist` input of `Term 2` with the variable `Dist_2`.

- Click on `TxPDO1 > Dist` with the right mouse button in the system configuration and select `Change Link`.



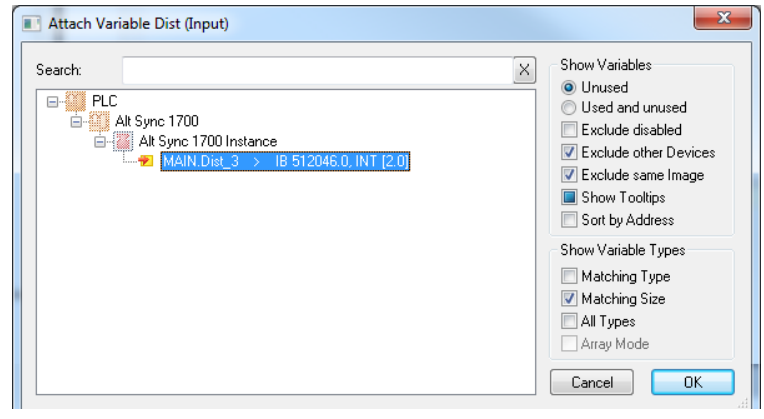
➡ Select the `MAIN. Dist_2 > IB xxxxxx.0, INT [2.0]` item and quit with `OK`.




Link the `Dist` input of `Term 3` with the variable `Dist_3`.

➡ Click on `TxPDO1 > Dist` with the right mouse button in the system configuration and select `Change Link`.

➡ Select the `MAIN. Dist_3 > IB xxxxxx.0, INT [2.0]` item and quit with `OK`.




In the example, the ILD1700 operates with a measuring rate of 2.5 kHz. Using object 2250:2, the measuring rate can be changed if necessary, see Chap. 5.2.7. For synchronization, the synchronization rate or cycle time of the extension terminal must be half the sensor measuring rate.

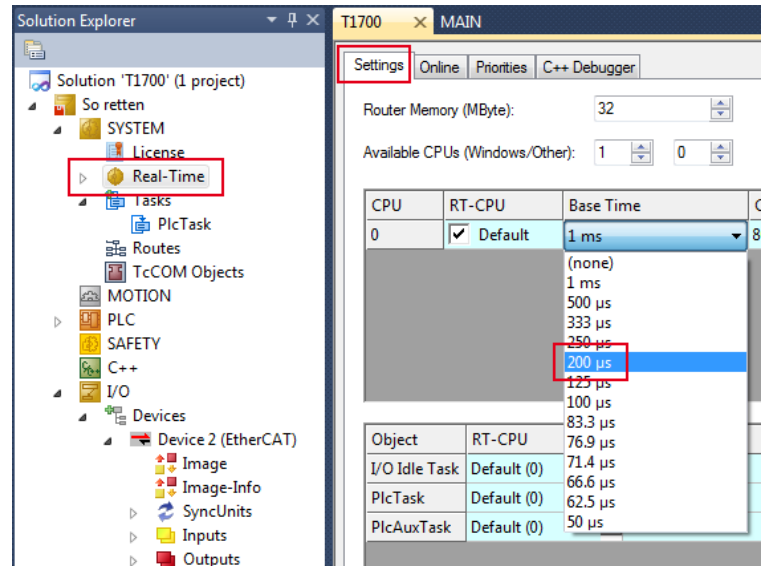
| Measuring rate [kHz] sensor | Cycle time [µs] extension terminal |
|---|---|
| 2.5 | 800 |
| 1.25 | 1600 |
| 0.625 | 3200 |
| 0.3125 | 6400 |

The cycle time of the PLC tasks should also correspond to the SYNC0 cycle time or a multiple of it.

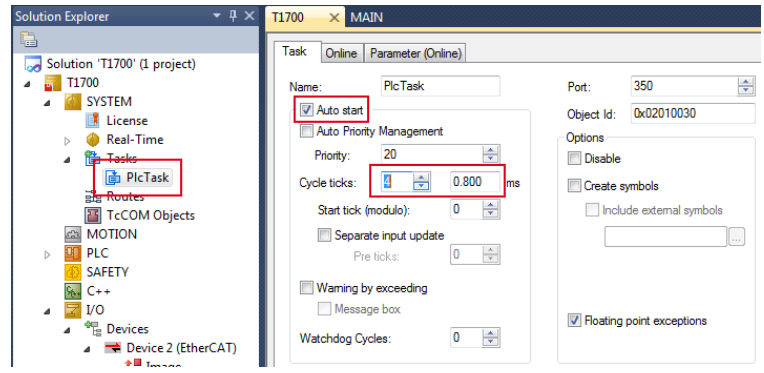
Change the `Base Time` of the tasks.

➡ Double click on `Real-Time` and switch to the `Settings` tab.

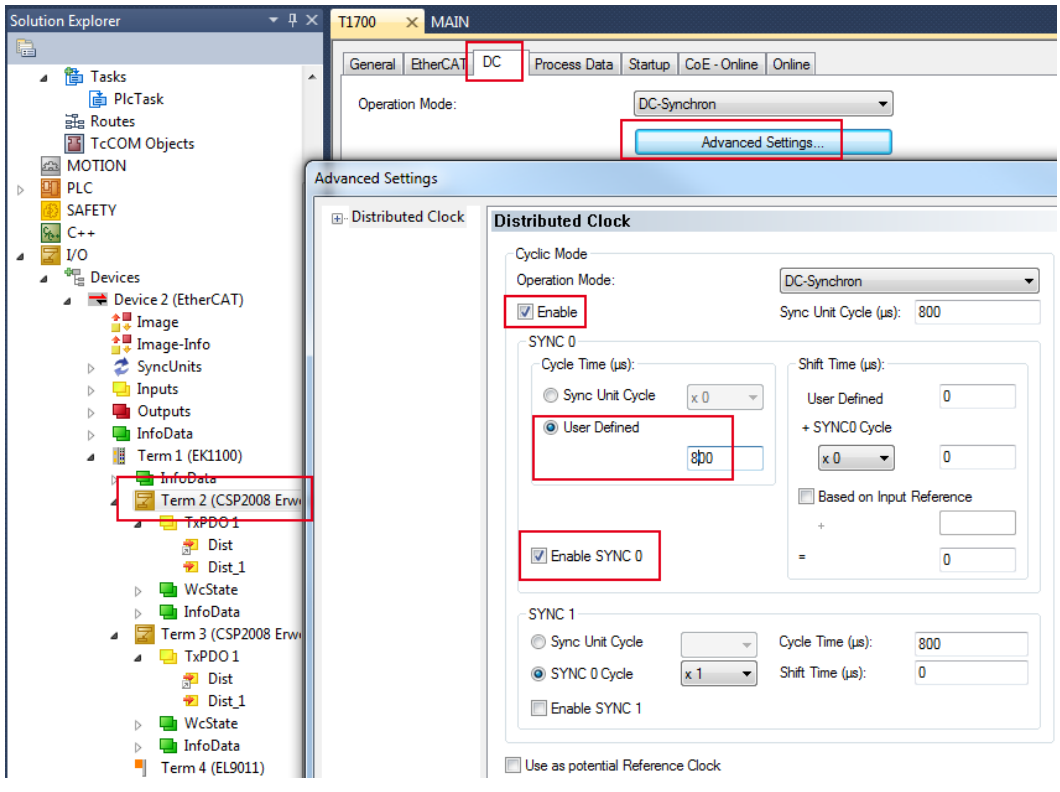
➡ Choose a base time of `200 µs`.



- Click twice on `PlcTask` and activate the `Auto-start` function.
- Set the synchronous time on `0.8 ms` in the `Cycle ticks` field.




- Select the `Term 2 (CSP2008 Erweiterungsklemme...` Go to the `DC` tab and select `DC-Synchron` as operation mode.
- Click the `Advanced Settings` button.
- Enter the `cycle time` of the synchron pulses, e. g. 800 µs for an ILD1700 with a measuring rate of 2.5 kHz.



➡ Select the `Term 3 (CSP2008 Erweiterungsklemme...`. Go to the `DC` tab and select `DC-Synchron` as operation mode.

➡ Click the `Advanced Settings` button.

➡ Enter the `cycle time` of the synchron pulses, e. g. 800 µs for an ILD1700 with a measuring rate of 2.5 kHz. Set the `shift time` to 400 µs.

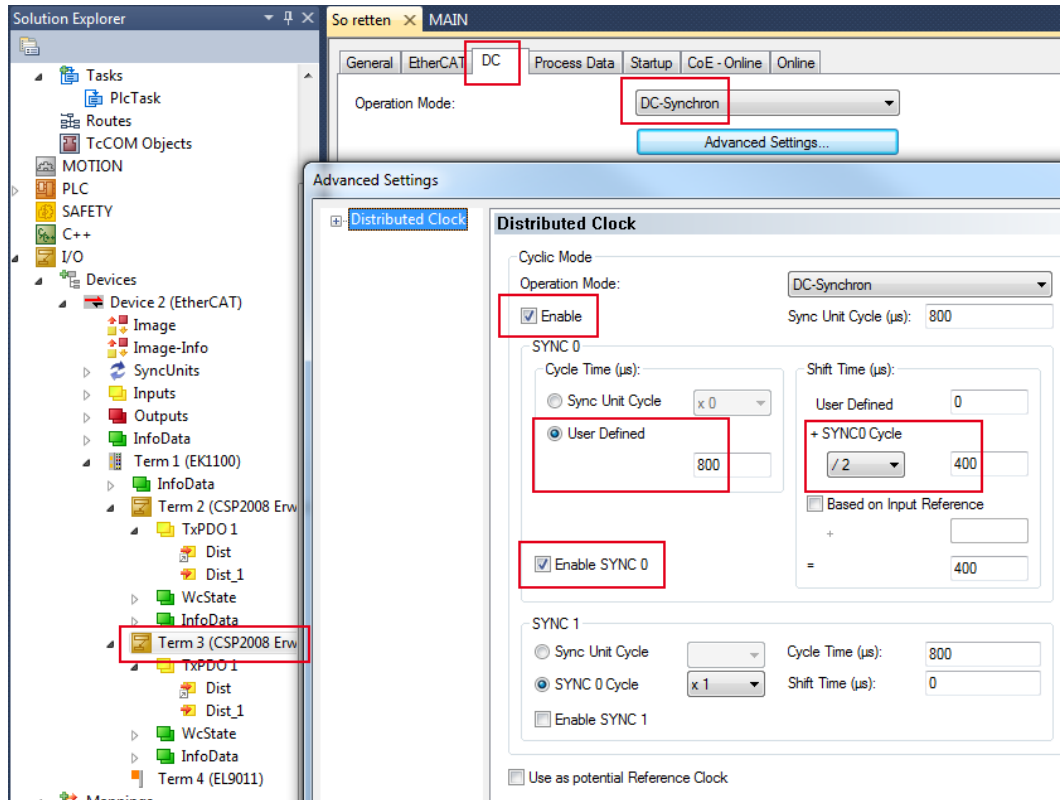



*Fig. 10 Cycle time and shift time for an alternating synchronization*

Activate the Configuration.

➡ Change to the `TwinCAT` menu and select `Activate Configuration`.

The following set shows the time shift for alternating synchronization using an ILD1700 with different measuring rates.

| Measuring rate individual sensor | Output rate individual sensor | SYNC0 Cycle Time | +SYNC0 Cycle | |
|---|---|---|---|---|
| 2.5 kHz | 1.25 kHz | 800 µs | /2 | 400 µs |
| 1.25 kHz | 0.6255 kHz | 1600 µs | /2 | 800 µs |
| 0.625 kHz | 0.31255 kHz | 3200 µs | /2 | 1600 µs |
| 0.3125 kHz | 0.156255 kHz | 6400 µs | /2 | 3200 µs |

*Fig. 11 Time shift ILD1700 with alternating synchronization*

# 7. Loading Project in Terminal, Saving

The following chapter describes how to save a project and to load it in the RS422 extension terminal(s).

This examples is based on the project of alternating synchronization, see Chap. 6.3.

Requirements:

- Both sensors to be synchronized are respectively connected to their specific RS244 extension terminal.
- The EtherCAT coupler is connected with a PC via a direct Ethernet connection (LAN) or Switch (Intranet).
- The TwinCAT© System Manager program runs with the alternating synchronization project, see Chap. 6.3.
- The extension terminals and sensors are configured, see Chap. 5.1.4.

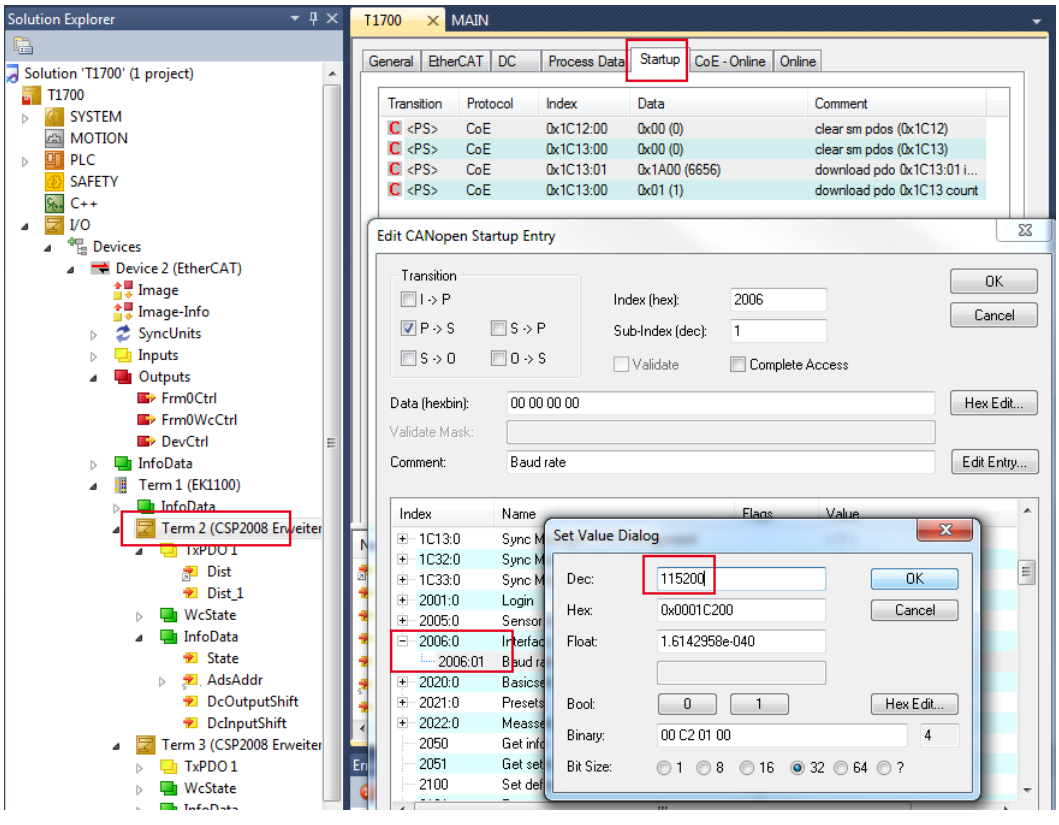
The status of the objects 2006h, 2999h and 2132h is volatile. As long as you do not switch off the RS422 extension terminal(s), the settings are retained after a restart of the TwinCAT Manager.

You can instruct the TwinCAT Manager to set these objects automatically to the desired values.

➡ Choose the `Restart TwinCAT (Config Mode)` command in the `TwinCAT` menu.

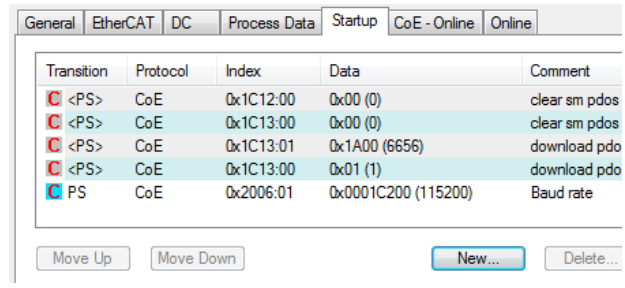
➡ Double-click on the `Term 2 (CSP2008 extension terminal RS422 V2)` entry and switch to the programming environment in the `Startup` tab and click on the `New...` button.

➡ Choose the 2006:01 object and set the baud rate for your sensor. The ILD1700 operates using a baud rate of 115200 bauds. Confirm the dialogs with `OK`.




Repeat these steps for the sensor type (Object 29999h) and the laser light source (object 2132h).

➡ Click the `New...` button and choose object 2999h.




The data type for the sensor is a string. However, in object 2999h it can be deposited only as hexa-decimal value.

String „ILD1700“

Hex- value: 49 4c 44 31 37 30 30 00

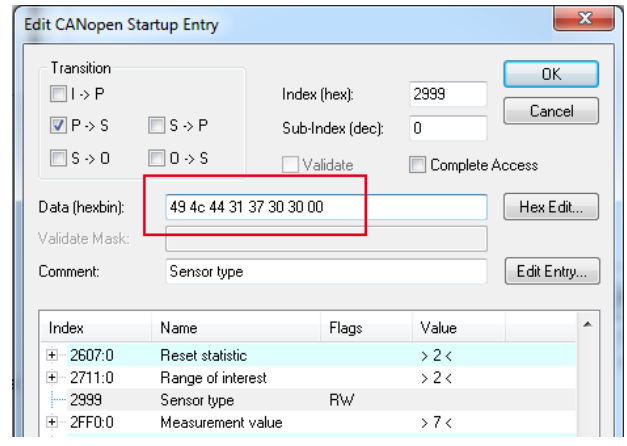



*Fig. 12 Dialog for the transition of the sensor type into object 2999h*

➡ Add the startup entry for the laser light source, object 2132h.

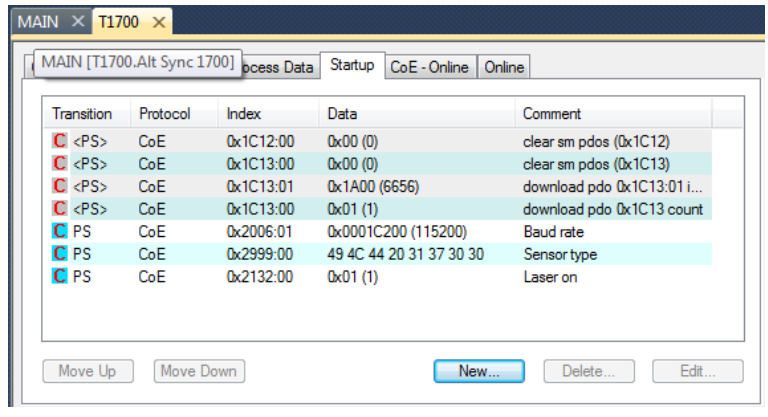



*Fig. 13 Startup entries for sensor configuration*

➡ Add the three startup entries also in terminal `Term 3 (CSP2008 extension terminal RS422 V2)`.

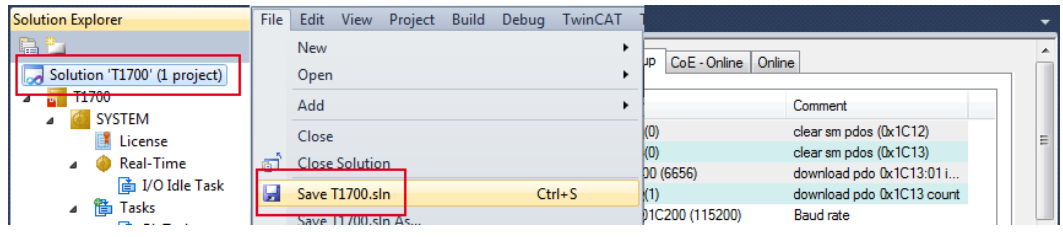
Activate the configuration.

➡ Switch to the `TwinCAT` menu and choose the `Activate Configuration` entry.

Save the configuration

➡ Switch to the system configuration and mark `Solution'T1700'(x xx)` at the beginning of the tree.

➡ Choose the `Save T1700.sln` entry in the `File` menu to save the project.



## 8. Warranty

All components of the device have been checked and tested for functionality at the factory. However, if defects occur despite our careful quality control, MICRO-EPSILON or your dealer must be notified immediately.
The liability for material defects is 12 months from delivery. Within this period, defective parts, except for wearing parts, will be repaired or replaced free of charge, if the device is returned to MICRO-EPSILON with shipping costs prepaid. Any damage that is caused by improper handling, the use of force or by repairs or modifications by third parties is not covered by the liability for material defects. Repairs are carried out exclusively by MICRO-EPSILON.
Further claims can not be made. Claims arising from the purchase contract remain unaffected. In particular, MICRO-EPSILON shall not be liable for any consequential, special, indirect or incidental damage. In the interest of further development, MICRO-EPSILON reserves the right to make design changes without notification.

For translations into other languages, the German version shall prevail.

## 9. Service, Repair

In the case of the RS422 extension terminal has a defect, please send the affected parts for repair or exchange. If the cause of a fault cannot be clearly identified, please send the entire measuring system to:

MICRO-EPSILON Optronic GmbH
Lessingstraße 14
01465 Langebrück, Germany
Telephone: + 49 35201/729 - 0
Fax: + 49 35201/729 - 90
optronic@micro-epsilon.de
www.micro-epsilon.com

## 10. Decommissioning and Disposal

➪ Disconnect all the cables on the RS422 extension terminal.

Incorrect disposal may cause harm to the environment.

➪ Dispose of the device, its components and accessories, as well as the packaging materials in compliance with the applicable country-specific waste treatment and disposal regulations of the region of use.

MICRO-EPSILON MESSTECHNIK GmbH & Co. KG
Königbacher Str. 15 · 94496 Ortenburg / Germany
Tel. +49 (0) 8542 / 168-0 · Fax +49 (0) 8542 / 168-90
info@micro-epsilon.de · www.micro-epsilon.com

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