MICRO-EPSILON

Instruction Manual

C-Box

Controller

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Certified acc. to DIN EN ISO 9001: 2008

Contents

1. Safety

The handling of the system assumes knowledge of the instruction manual.

1.1 Symbols Used

The following symbols are used in this instruction manual:

⚠ CAUTION	Indicates a hazardous situation which, if not avoided, may result in minor or moderate injury.
NOTICE	Indicates a situation which, if not avoided, may lead to property damage.
➪	Indicates a user action.
i	Indicates a user tip.

1.2 Warnings

⚠ CAUTION

The power supply and the display/output device must be connected in accordance with the safety regulations for electrical equipment.
> Danger of injury

> Damage to or destruction of the controller

NOTICE

The power supply may not exceed the specified limits.
> Damage to or destruction of the controller

Avoid shock and vibration to the controller.
> Damage to or destruction of the controller

1.3 Notes on CE Identification

The following applies to the C-Box measuring system:

- EU directive 2014/30/EC
- EU directive 2011/65/EC, “RoHS“ category 9

Products which carry the CE mark satisfy the requirements of the quoted EU directives and the European standards (EN) listed therein. The EC declaration of conformity is kept available according to EC regulation, article 10 by the authorities responsible at

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The system satisfies is designed for use in industry and satisfies the requirements.

1.4 Proper Use

- The C-Box is designed for industrial use in automated manufacturing and machine monitoring. It is used for
  - processing 2 digital input signals, e. g. thickness measurement
  - filtering of measurements
- The controller may only be operated within the limits specified in the technical data, see Chap. 2.2.

The system should only be used in such a way that in case of malfunction or failure personnel or machinery are not endangered.

Additional precautions for safety and damage prevention must be taken for safety-related applications.

1.5 Proper Environment

- Protection class: IP 40 (Only with sensor cable connected)
- Operating temperature: 5 to +50 °C (+41 to +122 °F)
- Storage temperature: 0 to +50 °C (+32 to +122 °F)
- Humidity: 5 - 95 % (non condensing)
- Ambient pressure: atmospheric pressure

i The protection class is limited to water (no penetrating liquids or similar).

2. Functional Principle, Technical Data

2.1 Functional Principle

The C-Box is used for processing two digital input signals.

Features:

- Processing of 2 input signals
- Programmable via Ethernet (web pages)
- Semi-automatic sensor detection for MICRO-EPSILON sensors with digital output
- Triggering
- Ethernet interface with TCP and UDP protocols
- USB interface
- D/A converter of the digital measurements, output via current and voltage interface

The C-Box is installed in a stable aluminium case.

Two digital sensors of the same series can be directly connected to the C-Box via RS422.

Both sensors are synchronized via the C-Box; the C-Box is the master.

The parameterization of all inputs and outputs on the C-Box is performed via a Web interface.

An internal time base also enables the calculation of measurement results of different measuring frequencies.

2.2 Technical Data

Sensors	**Series ILD23xx**
Measurement frequency	1,5 … 70 kHz
Connections	- 2 Sensor connector (HD-Sub, 15-pin), - 1x Ethernet (PC, 100 Mbit/s), - 1x USB 2.0, type B, max. 12 Mbit, - 1 plug-in terminal block 14-pin ▪ External power supply ▪ External laser on/off ▪ External trigger input ▪ 2 RS485 interfaces ▪ 1 analog output (1 x current or 1 x voltage)
Functions	Filter: average moving 2…512 / recursive 2…32768, Median 3,5,7,9
	Zero, mastering, synchronization
	- 1 external trigger input, HTL and TTL compatible (measurement output, edge) - Input voltage ▪ TTL ≤ 0.7 V / HTL ≤ 3.0 V > trigger not active ▪ TTL > 2.2 V / HTL > 8.0 V > trigger active - input current 3.0 mA max. - input frequency 100 kHz max.
	Scaling analog output

Sensors	**Series ILD23xx**
Analog output	- 1 current output: ▪ 4 – 20 mA - 1 voltage output parameterisable: ▪ Unipolar 0 – 5 V / Unipolar 0 – 10 V ▪ Bipolar ± 5 V / Bipolar ± 10 V - Tolerance of current and voltage output: 0.04 %
Laser switch off	- Switch resp. voltage input: ▪ switching input connected with > laser = on ▪ switching input open > laser = off ▪ input voltage < 3 V (HTL) > laser = on ▪ input voltage > 8 V (HTL) > laser = off
Firmware	Measurement configurations can be saved (max. 8) two languages (English, German), can be updated
LED	for successful connection controller/sensor, Ethernet
Power supply	- 13 – 30 VDC for full functionality, power consumption max. 200 mA without sensor - 10 – 13 VDC with reduced DA converter function, power consumption max. 200 mA without sensor, analog output 0 - 5 V or ± 5 V only - Reverse polarity protection - No galvanic isolation, all GND signals are connected internally and with the housing
Power consumption sensors	maximum two sensors from internal power supply
Weight	appr. 210 g

Sensors	Series ILD23xx
Case dimensions	appr. 103 x 39 x 106 mm
Protection class	IP 40
Operation temperature	5 °C up to 50 °C (+41 up to +122 °F)
Storage temperature	0 °C up to 50 °C (+32 up to +122 °F)
Relative air humidity	5 ... 95 %, non-condensing

3. Delivery

3.1 Supplied Items

1 C-Box

1 Instruction manual

1 Female terminal box, type WAGO 713-1107

➪ Check for completeness and transport damage immediately after unpacking.

➪ In case of damage or missing parts, please contact the supplier immediately.

3.2 Storage

Storage temperature: 0 ... +50 °C (+41 to +122 °F)

Humidity: 5 - 95 % (non-condensing)

4. Installation and Mounting

4.1 Dimensional Drawing

Pay attention to careful handling during the installation and operation.

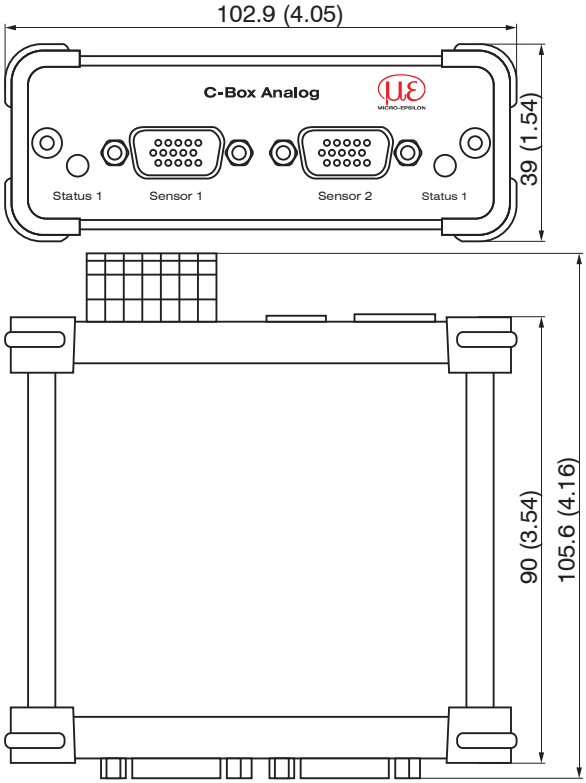


Fig. 1 Dimensions C-Box, dimensions in mm (inches), not to scale

4.2 Electrical Connections, LEDs

Pin	Signal
1	RS422 TxD-
2	RS422 TxD+
3	RS422 RxD-
4	RS422 RxD+
5	GND
6	RS422 TRG+
7	RS422 TRG-
8	5V CMOS output (reserve, do not connect)
9	Power supply +24V via power connection
10	Power supply +24V via power connection
11	Multifunction output TTL or HTL compatible
12	Laser on, HTL compatible
13	NC
14	NC
15	GND

Fig. 2 Pin assignment sensor connector (2), sensor 1 resp. sensor 2

LED color	Description
off	Sensor not connected
green	Sensor in measurement mode and within the measurement range
rot	Sensor in measurement mode and sensor outside the measurement range
orange	Sensor in setup mode (no measurement output)

Fig. 3 Description LED (1) for sensor 1 resp. sensor 2

Pin	Signal
1	Power connector for external power supply
2	GND
3	Screen
4	Laser on (HTL) [1]
5	Trigger in (HTL) or external synchronization
6	GND
7	RS422 RxD+ / RS485 A1
8	RS422 RxD- / RS485 B1
9	RS422 TxD+ / RS485 A2
10	RS422 TxD- / RS485 B2
11	Voltage analog output
12	GND analog
13	Current analog output
14	Screen

Fig. 4 Pin assignment 14-pin terminal block (4), type WAGO

LED color	Description
off	no power supply (power off)
green	Power on, data output on USB interface not active or data output on USB interface active and data communication error free
orange	Power on, data output on USB interface active, data communication faulty or disconnected
rot	Power on, data output on USB interface active, USB cable not connected or communication disconnected

Fig. 5 LED description for power and USB status (3)

1) The laser is activated when Laser on and GND are connected by a bridge.

4.3 Laser on

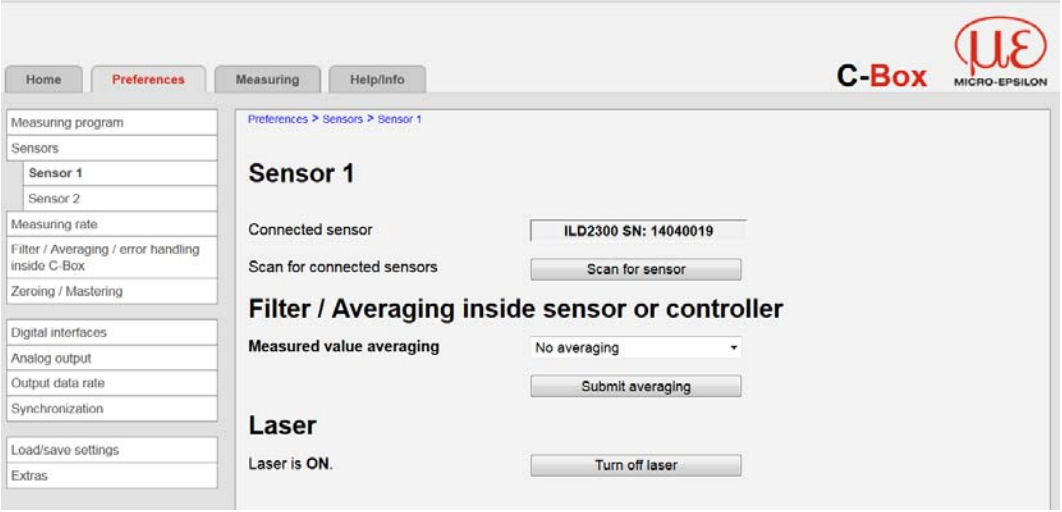


Fig. 6 View Preferences - Sensors - Laser

The measuring laser on the sensor is activated via an optocoupler input. This is advantageous if the sensor has to be switched off for maintenance or similar. Switching can be done with a transistor (for example open collector in an optocoupler) or a relay contact.

➔ Connect pin 4 `Laser` with pin 6 `GND` by a jumper.

i The laser is off unless pin 4 is electrically connected to pin 6.

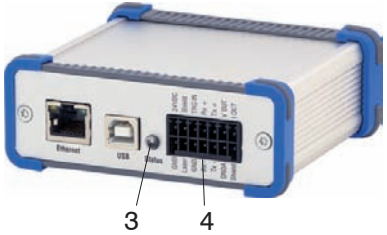


Fig. 7 Pin assignment 14-pin terminal block (4), type WAGO with view on pin `Laser`

Reaction time: Correct measuring data are sent by the sensor approximately 1 ms after the laser was switched on.

5. Operation

5.1 Getting Ready for Operation

The C-Box must be installed in accordance with the installation instructions, see Chap. 4. and connected to an automation unit, e.g. PLC, and the power supply in compliance with the connection instructions.

After switching on the operating voltage, the C-Box performs an initialization sequence and goes into the measurement operating mode afterwards.

The laser operation on optical sensors is only indicated at the sensor by an LED. If no measured values are transmitted, check whether the sensors are switched on and whether a target is in the measuring range of the sensor.

5.2 Installation of USB Driver

You will find the driver C-Box WinUSB under:

http://www.micro-epsilon.en/accessories/C-Box/index.html

- Connect C-Box to the usb port of your computer.
- Connect C-Box to power supply.
- Open Windows system control.
- Go to device manager.

You will see a device with a question mark (unknown device).

- Right mouse click on it.

A menu opens.

- Select `Properties`.
- Select `Drivers`.
- Select `Update driver`.
- Browse to the directory with the downloaded Win usb drivers.
- Click on `ok`.
- Wait until installation will finish.

If the installation is done properly, you will find C-Box in the device manager, see Fig. 8.

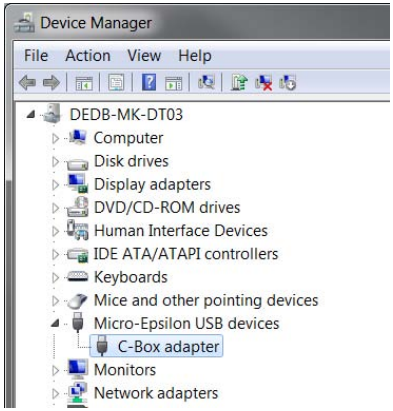


Fig. 8 View Device Manager after installing the USB driver

5.3 Operation Using Ethernet

Dynamic web pages are generated in the C-Box which contain the current settings of the C-Box and the peripherals. The operation is only possible while there is an Ethernet connection to the C-Box.

5.3.1 Requirements

You need a web browser (e.g. Mozilla Firefox or Internet Explorer) on a PC with a network connection. Decide about connecting the C-Box to a network or directly to a PC.

The C-Box is delivered as standard with a fixed IP address. If you do not require a static IP address, you can enable DHCP (Dynamic Host Configuration Protocol) as automatic IP address allocation. The controller will be assigned an IP address by the DHCP server, see Chap. 5.3.2.

If you have set your browser so that it accesses internet through a proxy server, please add the IP address of the controller to the IP addresses that should not be routed through the proxy server in the settings of the browser.

Parameter	Description
Address type	Static IP address (standard) or dynamic IP address (DHCP, Standard)
IP address	Static IP address of the controller (only active if no DHCP is selected).
Gateway	Gateway to the other subnets
Subnet mask	Subnet mask of the IP subnet

Fig. 9 Basic Ethernet settings

“Java” and “Javascript” must be activated and updated in the browser for the graphical display of the measurement and calculation results. The PC needs Java (Version 6, from update 12). Source: www.java.com > “JRE6 Update 12”.

5.3.2 Access via Ethernet

<table>
<tr><td colspan="2">Direct connection to PC, controller with static IP (Factory setting)</td><td>Network</td></tr>
<tr><td>PC with static IP</td><td>PC with DHCP</td><td>Controller with dynamic IP, PC with DHCP</td></tr>
<tr><td colspan="2">➡ Connect the C-Box („Ethernet“ female connector) with a PC via an Ethernet direct connection (LAN). Use a LAN cable with RJ-45 connectors for this.</td><td>➡ Connect the controller with a switch (Intranet). Use a LAN cable with RJ-45 connectors.</td></tr>
</table>

For a direct connection the controller needs a fixed IP address.

➡ Start the program SensorFinder.exe.

You will find this program on the delivered CD.

➡ Click the button `Find sensors`. Select the designated C-Box from the list. In order to change the address settings, click the button `Change IP-Address.`

- Address type: static IP-Address
- IP address: 169.254.168.150 [1]
- Gateway: 169.254.1.1
- Subnet mask: 255.255.0.0

➡ Click on the button `Change`, in order to transfer the changes to the C-Box.

➡ Click on the button `Start Browser` in order to connect the C-Box to your standard browser. Alternatively change the IP settings according to the settings of your PC (IP address ranges must fit together).

1) Requires, that the LAN connection on PC uses e.g. the following IP address: 169.254.168.1

Wait until Windows has established a network connection (Connection with limited connectivity).

➡ Start the program SensorFinder.exe.

You will find this program on the delivered CD.

➡ Click the button `Find sensors.` Select the designated C-Box from the list.

➡ Click the button `Start Browser` to connect the C-Box with your default browser.

➡ Enter the C-Box in the DHCP / register the controller in your IT department.

The sensor gets assigned an IP address from your DHCP server. You can check this IP address with the SensorFinder.exe program.

➡ Now start the SensorFinder.exe program.

You will find this program on the provided CD.

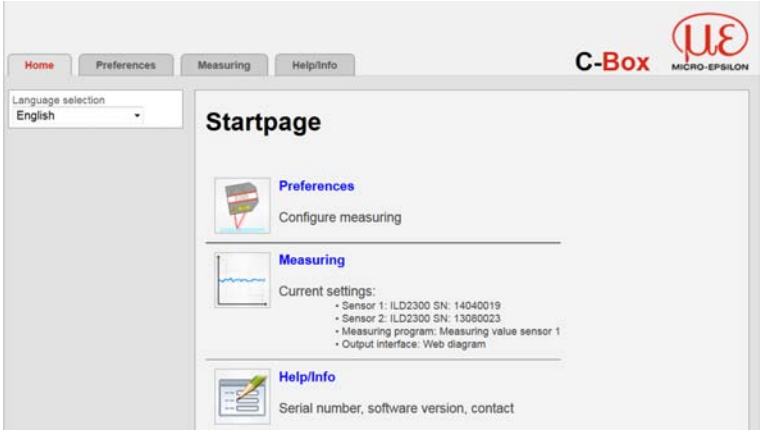
➡ Click the button Find sensors. Select the designated C-Box from the list.

➡ Click the button Start browser, to connect the C-Box with your default browser.

➡ Start a web browser on your PC. Type “„C-Box_serial number“ in the address bar of your browser.

Interactive web pages for programming the controller and peripherals are now shown in the web browser.

Parallel operation with keyboard and web browser is possible; the last setting applies. Do not forget to save your settings.



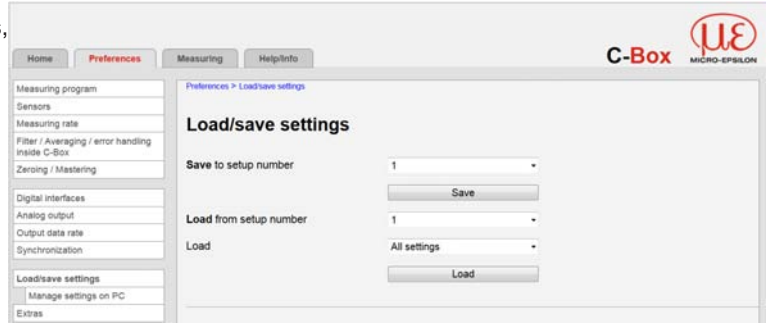
Use the upper navigation bar to access additional features (Preferences, Help/Info etc.).

All settings in the web page are applied immediately in the C-Box after clicking the button `Submit`.

Fig. 10 First interactive web page after calling the IP address

The appearance of the web pages can change depending on the functions and the peripherals. Each page contains descriptions of the parameters and thus tips to configure the web page.

You can access additional submenus, e.g. for measuring rates and triggers, through the navigation bar on the left side of a web page.



i When programming has been completed, please save all settings permanently in a set of parameters to ensure that these settings will be available when the C-Box is switched on the next time.

5.3.3 Measured Value Presentation with Web Browser

For graphical description of the measuring results “Javascript“ must be enabled and updated in the browser.

The control and display of the diagram are loaded as a Java program in the browser which continues to run there autonomously while the CSP2008 continues to operate independently of this.

➡ Start the demonstration diagram display (`Measurement`) in der horizontal navigation bar.

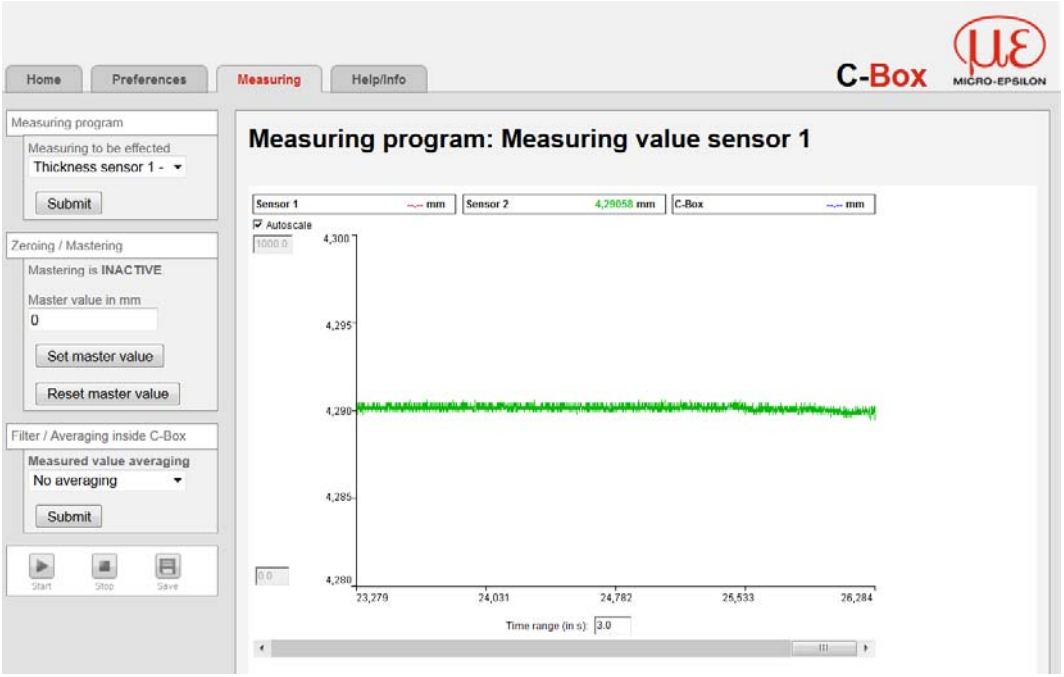


Fig. 11 Presentation of the measurement and calculation results

i By letting the diagram display run in a separate tab or browser window, you avoid having to restart the display every time.

➡ Click the `Start` button to begin displaying measurement results.

➡ Click the `Stop` button to stop displaying measurement results.

➡ Click `Save` button to save the previously accumulated measurement and calculation results in a CSV compatible file inclusive timing information.

With the menu item `Save` you can let save up to six results of sensor inputs or calculation functions with a variable number of decimal places as a frame in an Excel-compatible file without timing information.

A requirement for this is that the measurements to save for output via Ethernet, see Chap. 5.4.8.2, were defined.

As only one of both functions via Ethernet can be active, the demo cannot be started until a possible saving of the measurement values via Ethernet has been finished.

Each curve can be deactivated and activated using the associated checkbox (checkmark). In addition, the horizontal scrolling (slider) is possible in the diagram.

The `Show data channel checkbox` specifies which channels are displayed in the diagram.

Use the button `Mastering` to set the selected channel to zero, for example, for performing differential measurements.

➡ Go to the menu bar at the side indicated below `Zero setting / Mastering.`

➡ Set the master value to `0`.

You can do this also in the menu `Preferences - Zeroing / Mastering, see Chap.` 5.4.7.

The y-axis can be scaled manually or by using the `Autoscale` function.

The measuring values are stored with a dot as decimal mark if the language is set to English, otherwise a comma is used.

NOTICE

Only a limited number of measured values can be stored (about 2.000,000). The oldest values will be overwritten when more values are captured.

5.4 Operating Menu

5.4.1 General

It is only possible to operate the controller via the Web interface. The last setting applies. Do not forget to save.

Overview

Language selection	System / English / German
Measuring program	Measuring to be effected
Sensors	Sensor 1, Sensor 2 (Sensor selection, value averaging, laser)
Measuring rate	Display synchronization mode, selection of measuring rate
Filter/Averaging/Error handling in inside C-Box	Measured value averaging, Error handling in the case of no valid measured value
Zeroing / Mastering	Mastering active or inactive, master value in mm
Digital interfaces	Digital interfaces selection, Data selection, Ethernet settings, Settings RS422/USB
Analog output	Output signal, Output area, Scaling
Output data rate	Specifying measurement, interface reduction
Synchronization	Synchronization mode
Load/save settings	Save to setup number, Load from setup number, Load settings, Manage settings on PC
Extras	Language, Factory defaults, Reset of controller

5.4.2 Language Selection

Go to the Home menu > Language selection.

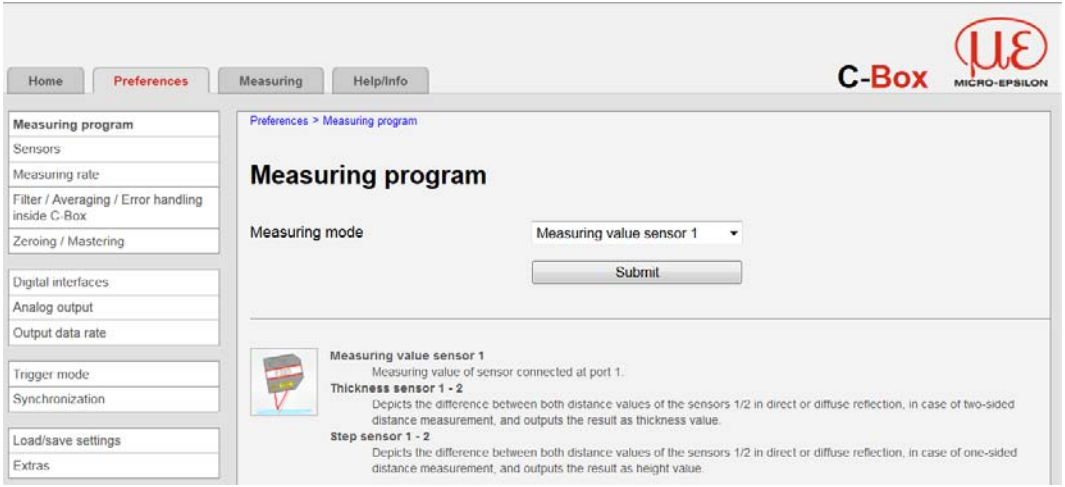
This menu item allows a change of the language of the interactive web pages.

Language selection	*System / English / German*	Language of the interactive websites

The language selection can be made also by the menu Preferences > Extras > Language, see Chap. 5.4.15.1.

5.4.3 Measuring Program

Go to the menu Preferences > Measuring program.



Fields with a grey background require a selection.

Value

Dark bordered fields require the specification of a value.

➡ Select the Measuring to be effected from following list:

Measuring program	*Measuring value sensor 1*	Measuring value of sensor connected at port 1.
	Thickness sensor 1 - 2	Calculates the thickness of the distance between the two sensors 1/2 in direct and diffuse reflection using the formula: C-Box value = A*DQ1 + B*DQ2
	Step sensor 1 - 2	Depicts the difference between both distance values of the sensors 1/2 in direct or diffuse reflection, in case of one-sided distance measurement, and outputs the result as height value.

i The selected measuring program is used as the standard measuring program on startup.

Fields with a grey background require a selection.

Value

Dark bordered fields require the specification of a value.

5.4.4 Sensors

Go to the menu `Preferences` > `Sensors`.

Sensors	*Sensor 1 / Sensor 2*	Sensor selection, value averaging, laser

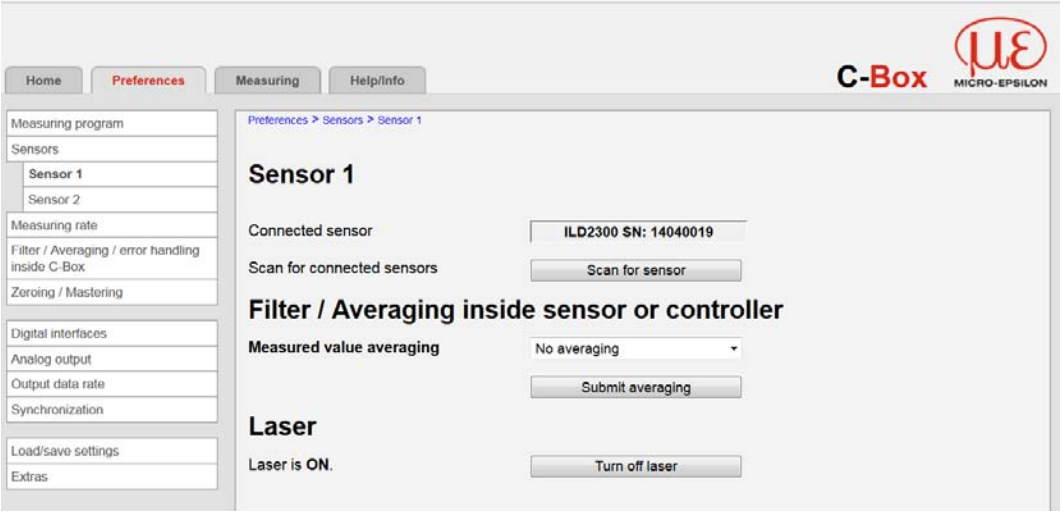


Fig. 12 View Preferences - Sensors

Fields with a grey background require a selection.

Value — Dark bordered fields require the specification of a value.

Sensors	Sensor 1, Sensor 2	Connected sensor	*Sensor name*

Selecting the connected sensor/controller. Sensors of the ILD2300 series are supported.
If no sensor is shown, it is possible to scan for connected devices.

A number of filter types for measurement values are available. Filtering lowers the noise of the measurement signal, which results in a better resolution. Filter width is used to specify the number of measurement values to which the filter applies.

Filter / Averaging inside sensor or controller	Measured value averaging	*No averaging*	Selection of the connected sensors/ controllers. Sensor series ILD 2300 are supported. If no sensor is performed, it is possible to search for sensors.	
		Moving average for N values / Recursive average for N values (1...32768) / Median filter for N values	Number of values for moving average	*2 / 4 / 8 / 16 / 32 / 64 / 128 / 256 / 512*
			Number of values for recursive average	
			Number of values for Median filter	
Laser	Laser is ON. / Laser is OFF.	ON / OFF	Software-supported activation/deactivation of the laser light source on the sensor.	

You will find further information and settings in the Chapter Filter / Averaging / Error handling in C-Box, see Chap. 5.4.6.

Fields with a grey background require a selection.

Value — Dark bordered fields require the specification of a value.

Moving average:

The selectable filter width N for successive measurement values is used to calculate and issue the arithmetic mean M_{gl}

$$M_{gl} = \frac{\sum_{k=1}^{N} MV(k)}{N}$$

MV = measured value,
N = averaging value,
k = continuous index (in the window)
M_{gl} = average value or output value

Each new measured value is added, and the first (oldest) value is removed from the averaging (from the window). This produces short response times for measurement jumps.

Example: N = 4

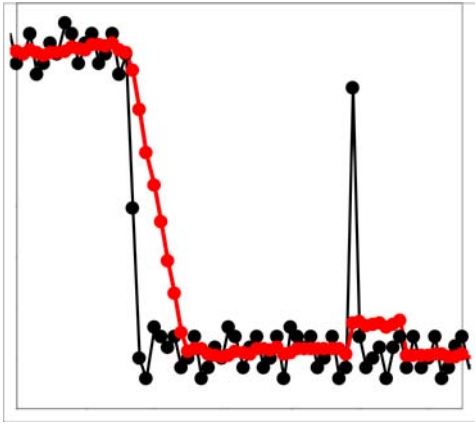
Measured values

... 0, 1, 2, 2, 1, 3 → $\frac{2, 2, 1, 3}{4} = M_{mov}(n)$

... 1, 2, 2, 1, 3, 4 → $\frac{2, 1, 3, 4}{4} = M_{gl}(n+1)$

Output value

Moving average in the controller C-Box allows only potentials of 2 for N. The highest averaging value is 1024.



Signal without averaging
Signal with averaging

Fig. 13 Moving average, N = 8

Application tips
- Smooths measured values
- The effect can be finely controlled in comparison with the recursive averaging.
- With uniform noise of the measured values
- without spikes
- At a slightly rough surface, in which the roughness should be eliminated.
- Also suitable for measured value jumps at relatively low settling time

Recursive average:

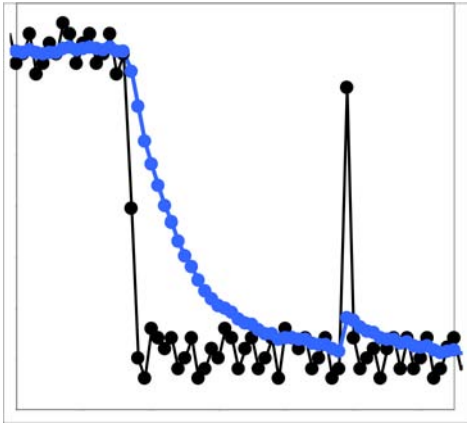
Formel:

$$M_{rec}(n) = \frac{MV_{(n)} + (N-1) \times M_{rec\,(n-1)}}{N}$$

MV = measured value,
N = averaging value, N = 1 ... 32768
n = measurement index
M_{rec} = average value or output value

Each new measurement value MV(n) is added, as a weighted value, to the (n-1)-fold of the previous averaging value.

Recursive averaging allows for very strong smoothing of the measurements, however it requires long response times for measurement jumps. The recursive average value shows low-pass behavior.



Signal without averaging
Signal with averaging

Fig. 14 Recursive average, N = 8

Application tips
- Permits a high degree of smoothing of the measurement values. However, it requires extremely long transient recovery times for measured value jumps (low-pass behavior)
- Permits a high degree of smoothing for noise without strong spikes
- For static measurements, to smooth signal noise
- For dynamic measurements on rough surfaces, to eliminate the roughness, e. g. roughness of paper
- For the elimination of structures, e. g. parts with uniform grooves, knurled rotary parts or roughly milled parts
- Unsuitable for highly dynamic measurements

Median:

The median is formed from a pre-selected filter width N for measurement values by re-arranging the incoming measurement values after each measurement is completed. Then the average value is issued as a median. If an even number is selected as filter width N, the two average measurement values are added and divided by two.

3, 5, 7 or 9 readings are taken into account. This means that individual interference pulses can be suppressed. However, smoothing of the measurement curves is not very strong.

Example: Median value from five measured values

... 0 1 ⌊2 4 5 1 3⌋ → Sorted measurement values: 1 2 [3] 4 5 $\quad$ $\text{Median}_{(n)} = 3$

... 1 2 ⌊4 5 1 3 5⌋ → Sorted measurement values: 1 3 [4] 5 5 $\quad$ $\text{Median}_{(n+1)} = 4$

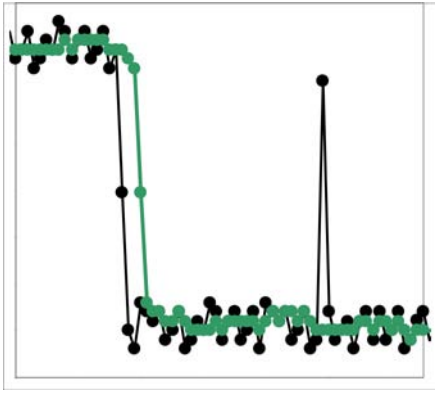


Fig. 15 Median, N = 7

Application tips

- The measurement value curve is not smoothed to a great extent, used to eliminate spikes
- Suppresses individual interference pulses
- In short, strong signal peaks (spikes)
- Also suitable for edge jumps (only minor influence)
- For rough, dusty or dirty environment, to eliminate dirt or roughness
- Further averaging can be used after the median filter

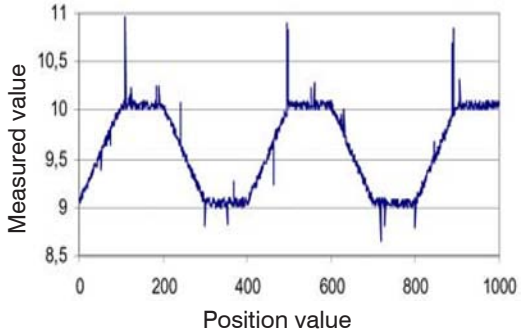


Fig. 16 Original profile

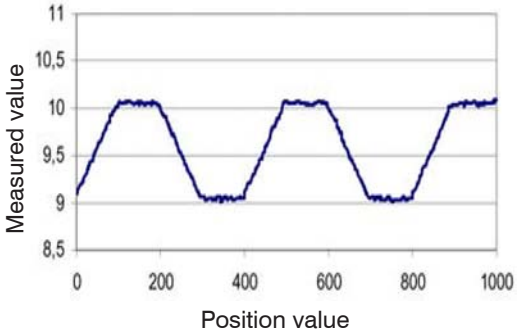
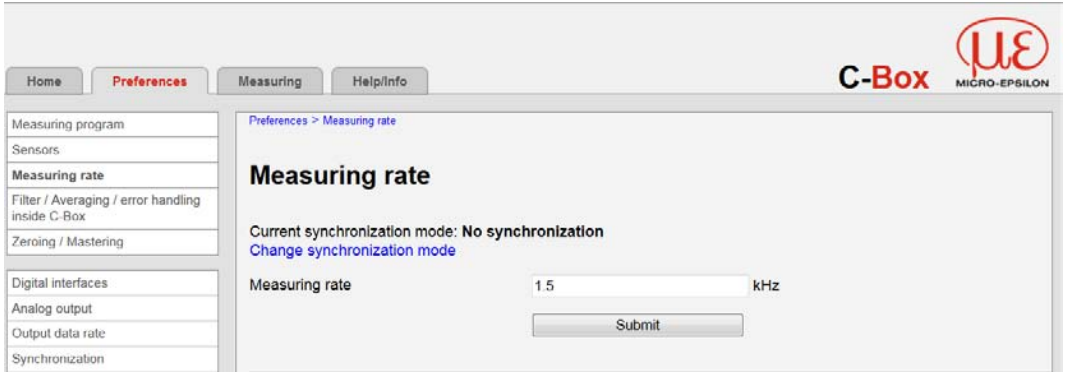


Fig. 17 Profile with Median, N = 9

5.4.5 Measuring Rate



Measuring rate	Current synchronization mode	*No synchronization*	Synchronization off. The measuring rate can be entered freely. Value range: from 0.4 to 80 kHz. Otherwise the available measuring rates are given by the connected sensors/ controllers.
		Internal synchronization	The C-Box is the time basis.
		External synchronisation	The synchronization signal is generated by an external signal source, e.g. function generator.
	Measuring rate	*Value*, see table below	kHz

Fields with a grey background require a selection.

Value — Dark bordered fields require the specification of a value.

In this view, you can change via the link `Change synchronization mode` into the view `Synchronization` and there change the synchronization mode, e.g. select between the modes `No synchronization`, `Internal synchronization` and `External Synchronization`.

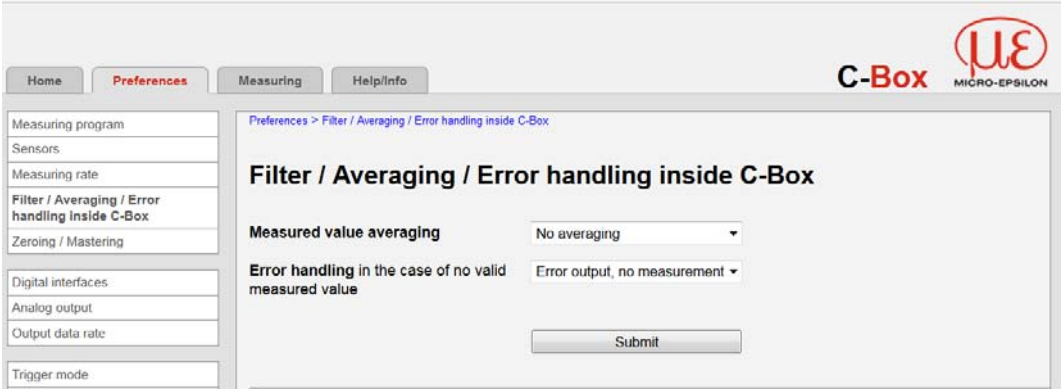
With synchronization off the measuring rate can be entered freely. Value range: from 0.4 to 80 kHz. Otherwise the available measuring rates are given by the connected sensors/controllers as enumerated in the table

Sensor / **Controller**	**Measuring rate**
ILD 2300	1.5/2.5/5/10/20/30/50 kHz. Please note that a measurement frequency of 50 kHz involves a reduction of the sensor measuring range.

Fig. 18 Preset measuring rate

5.4.6 Filter / Averaging / Error Handling inside C-Box

Go to the menu `Preferences` > `Filter / Averaging / Error handling inside C-Box`.



A number of filter types for measurement values are available. Filtering lowers the noise of the measurement signal, which results in a better resolution. Filter width is used to specify the number of measurement values to which the filter applies.

Filter / Averaging inside C-Box	Measured value averaging	*No averaging*		
		Moving average for N values / Recursive average for N values (1...32768) / Median filter for N values	Number of values for moving average	*2 / 4 / 8 / 16 / 32 / 64 / 128 / 256 / 512*
			Number of values for recursive average	
			Number of values for median filter	
	Error handling in the case of no valid measured value	*Error output, no measurement value*	An error value is output if no valid measured value can be determined. If this impedes further processing the last valid measured value can be kept for a number of measurement cycles, i.e. output repeatedly.	
		Hold last valid value		
		Hold last valid value forever		

You will find further information respectively adjustment possibilities in the Chap. Sensors, see Chap. 5.4.4.

Moving average:

The selectable filter width N for successive measurement values is used to calculate and issue the arithmetic mean Mgl. Each new measurement is added, and the first (oldest) measurement value is removed from the averaging, see Chap. 5.4.4.

Recursive average:

Each new measurement value MV(n) is added, as a weighted value, to the (n-1)-fold of the previous averaging value, see Chap. 5.4.4.

Fields with a grey background require a selection.

Value

Dark bordered fields require the specification of a value.

Median:

The median is formed from a pre-selected filter width N for measurement values by re-arranging the incoming measurement values after each measurement is completed. Then the average value is issued as a median. If an even number is selected as filter width N, the two average measurement values are added and divided by two, see Chap. 5.4.4.

5.4.7 Zeroing / Mastering

➡ Go to the menu `Preferences` > `Zeroing / Mastering`.

Zeroing / Mastering	Mastering is ACTIVE	*Reset master value*	Reset zero setting and mastering.
	Mastering is INACTIVE	*Set master value*	Activate zero setting and mastering. Value range for mastering: from -1024 to 1024 mm.
	Master value in mm	*Value*	

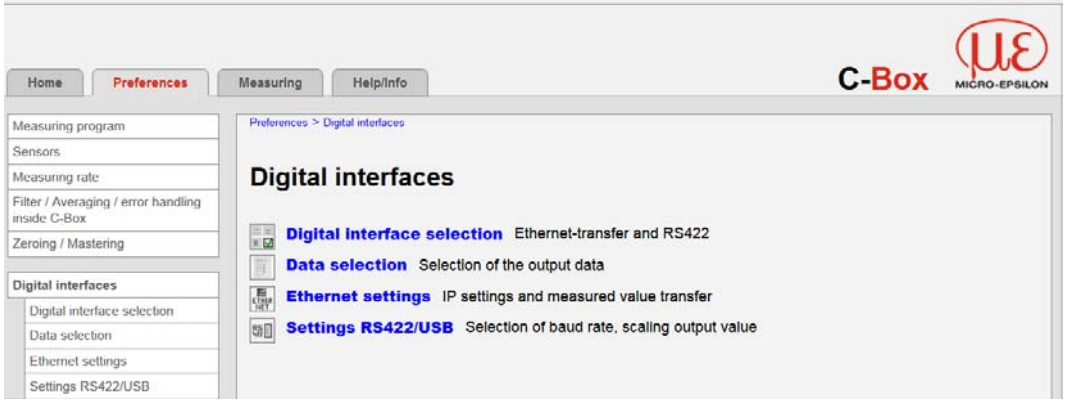
Fields with a grey background require a selection.

Value — Dark bordered fields require the specification of a value.

5.4.8 Digital Interfaces

5.4.8.1 Digital Interface Selection

Go to the menu `Preferences` > `Digital interfaces` > `Digital interface selection`.



Digital interfaces	Digital interface selection	Used interface for data output	*Disabled*	No measurement value transfer via digital interface.
			RS422	The measured values are transmitted via the RS422 and USB interface. The configuration is carried out via ASCII commands, see Chap. 5.4.8.4.
			USB	
			Ethernet data transfer	Ethernet allows a fast, not real-time capable data transmission (packet-based data transfer). The configuration of the measuring unit can be carried out by either a web-based user interface or ASCII commands or a terminal program, see Chap. 5.4.8.3.
			Web diagram	

i The Ethernet interface is recommended for a measured value output with subsequent analysis and without direct process control.
If a real-time measured value output is necessary for process control the RS422 port should be used.
If the sensor was configured via the Web interface the Ethernet connection should be disconnected physically afterwards.

Fields with a grey background require a selection.

Value — Dark bordered fields require the specification of a value.

5.4.8.2 Data Selection

Go to the menu `Preferences` > `Digital interfaces` > `Data selection`.

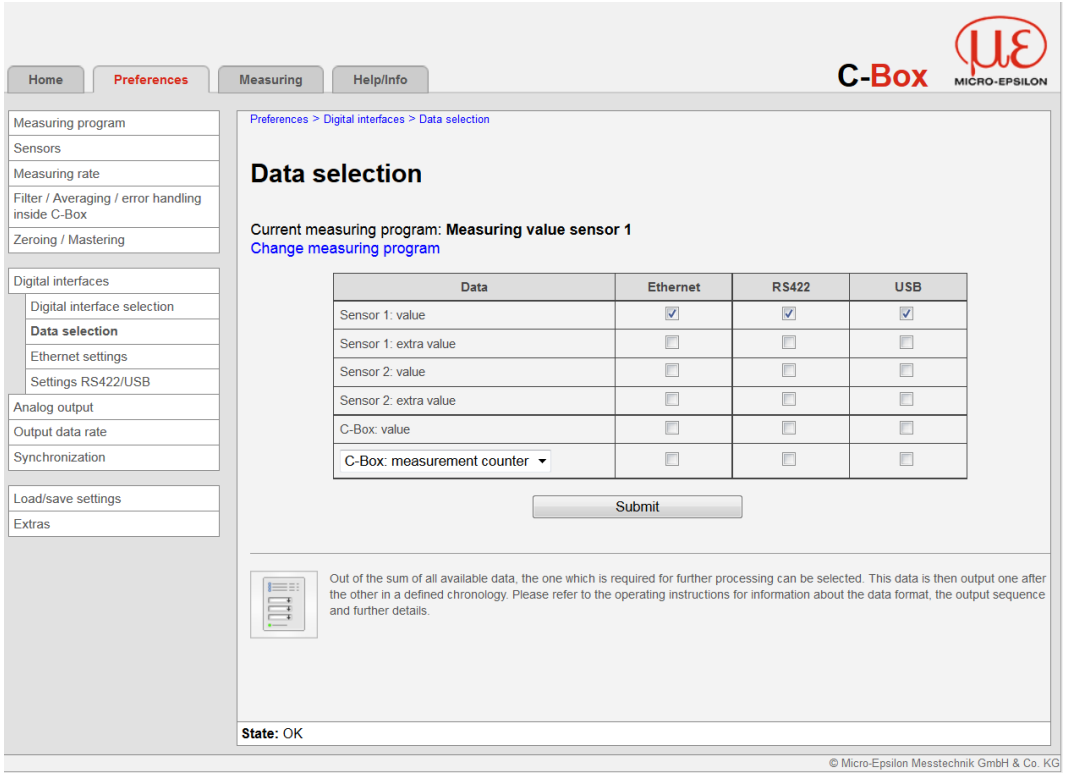


Fig. 19 View Digital interfaces - Data selection

Here the data can be selected, which should be transmitted over the digital interfaces.

Out of the sum of all available data, the one which is required for further processing can be selected. This data is then output one after the other in a defined chronology. You will find information about the data format, the output sequence and more details in the MEDAQLib documentation of MICRO-EPSILON.

In the figure above, the measuring program `Measuring value sensor 1, see` Fig. 19, is selected, that means only one sensor is connected to the C-Box.

Over the link `Change measuring program` you can operate a further sensor for the thickness or step measurement, see Chap. 5.4.3.

You can select following in the drop down menu, see Fig. 20:

`C-Box: measurement counter` and `C-Box: timestamp`. This means that in addition to measured value additional values are digitally displayed.

Condition for this function is the selection of the auxiliary value in the Web interface of the sensor.

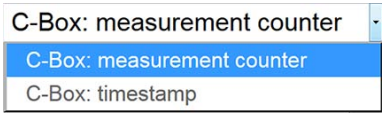


Fig. 20 View on drop down menu C-Box

The display and storage of additional values is not possible in the web diagram.

Please use the C-Box-Tool. You will find the C-Box-Tool on the MICRO-EPSILON website under http://www.micro-epsilon.de/accessories/C-Box/index.html.

5.4.8.3 Ethernet Settings

Go to the menu `Preferences` > `Digital Interfaces` > `Ethernet settings`.

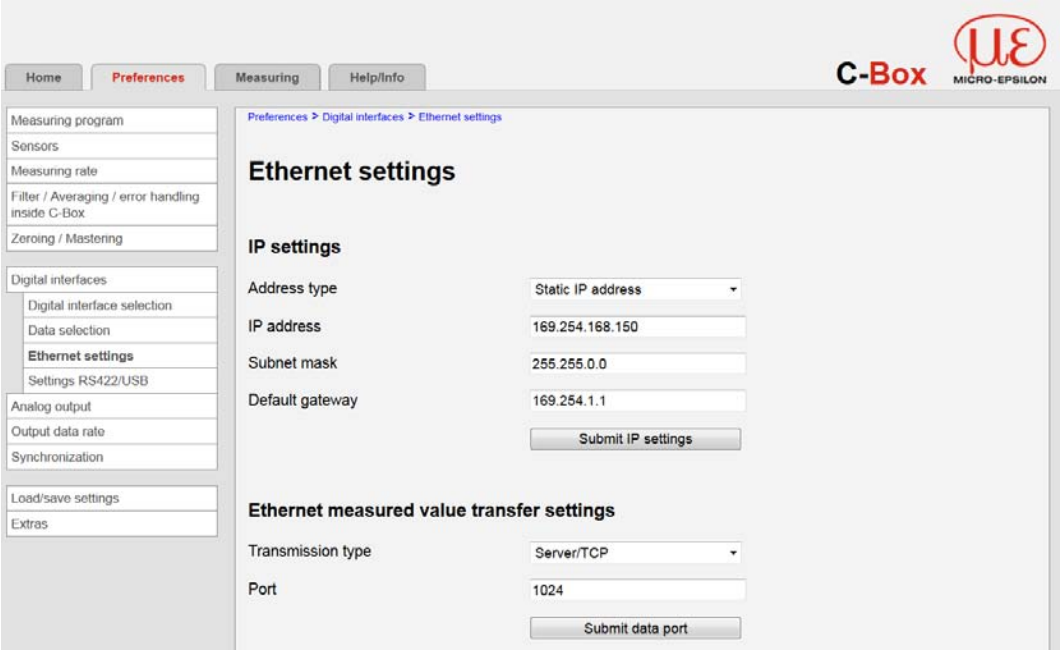


Fig. 21 View Ethernet settings

Ethernet settings	IP settings	Adress type	Static IP address / DHCP	
		IP address	*Value*	Values for IP address / Gateway / Subnet mask. Only with a static IP address
		Subnet mask	*Value*	
		Default gateway	*Value*	
	Ethernet measured value transfer settings	Transmission type	Server/TCP	The C-Box provides the measured values as a server (Transmission-type: Server/TCP).
		Port	*Value*	

A self-written program or a tool such as ICONNECT can be applied as a measured value client. You will find the documentation of the data format in the MEDAQLib documentation of MICRO-EPSILON, see Chap. 6.

Fields with a grey background require a selection.

Value

Dark bordered fields require the specification of a value.

5.4.8.4 Settings RS422/USB

Go to the menu `Preferences` > `Digital interfaces` > `Settings RS422/USB`.

RS422 interface parameter: 8 data bits
no partity
1 stop bit (8N1)

Settings RS422/USB	Baud rate (RS422 only)	*9.6 / 115.2 / 230.4 / 460.8 / 691.2 / 921.6 / 1500 / 2000 / 2500 / 3000 / 3500 / 4000 / 8000 kBps*		Set baud rate
		IP address	*Value*	Values for IP address / Gateway / Subnet mask. Only with a static IP address
	Scaling	*Standard scaling*		Standard scaling outputs the entire measuring range of the sensor/controller.
		Two-point scaling		ON/OFF scaling requires the indication of the start and the end of the measuring range, value range: from -1024 to 1024 mm. Note: minimum value must be smaller than maximum value. Valid for both RS422 and USB interface.

Fields with a grey background require a selection.

Value — Dark bordered fields require the specification of a value.

5.4.9 Analog Output

Go to the menu Preferences > Analog Output.

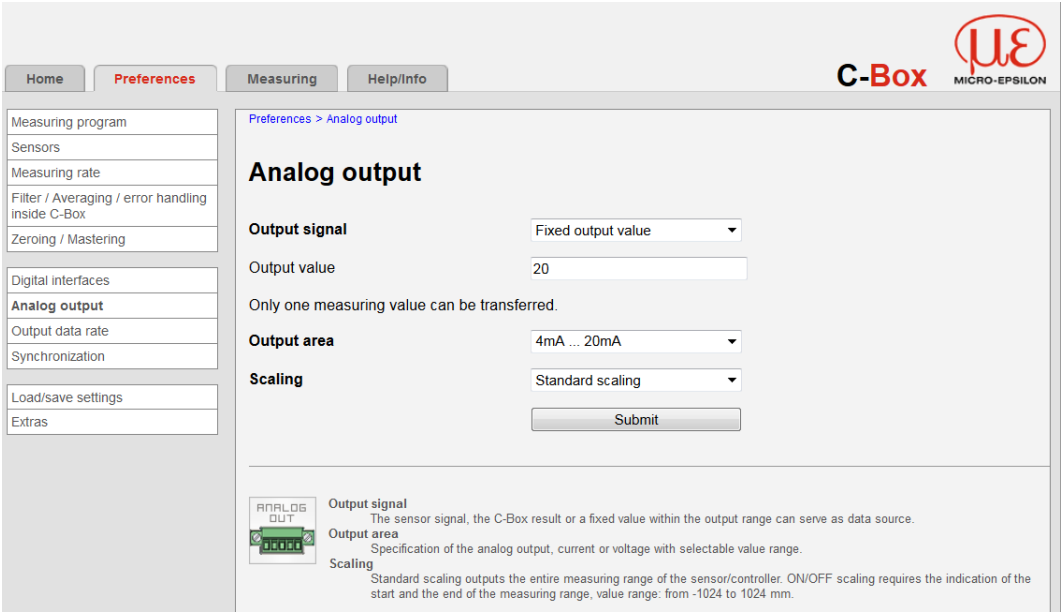


Fig. 22 View Preferences - Analog output

You can adjust the output signal, the output value and the scaling in this view. As soon as you have adjusted No averaging under the menu Filter / Averaging / error handling inside C-Box > Measured value averaging, see Chap. 5.4.6, you may select between Fixed output value, Sensor 1 value and Sensor 2 value in the menu Analog output > Output signal, see Fig. 23.

As soon as you have adjusted an averaging method or the median filter in the menu Filter / Averaging / error handling inside C-Box > Measured value averaging, you have to adjust the C-Box: value under Analog output > Output signal, see Fig. 23.

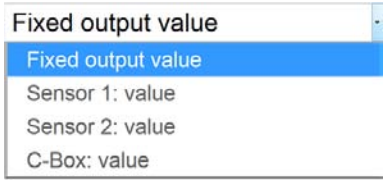


Fig. 23 Section drop down menu Analog output - Output signal

This also applies for the menu Sensors > Sensor 1 > Measured value averaging and Sensors > Sensor 2 > Measured value averaging, see Chap. 5.4.4.

You may select between analog output, current or voltage in the menu Preferences > Analog output > Output area, see Fig. 24.

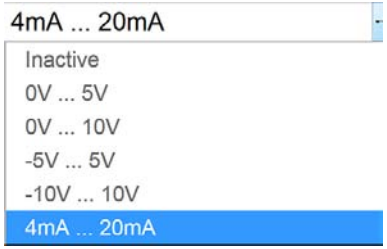


Fig. 24 Section drop down menu Analog output - Output area

You may select between Standard scaling or Two-point scaling in the menu Preferences > Analog output > Scaling, see Fig. 25.

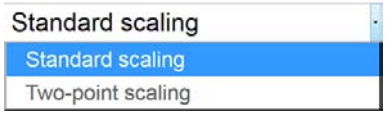


Fig. 25 Section drop down menu Analog output - Scaling

Analog output	Output signal [1]	*Fixed output value*	*Output value*	*Min to Max - value in V resp. mA*	The sensor signal, the C-Box result or a fixed value within the output range can serve as data source.
		Sensor 1: value			
		Sensor 2: value			
		C-Box: value			
	Output area	*Inactive / 0V ... 5V / 0V ... 10V / -5V ... 5V / -10V ... 10V / 4mA ... 20mA*			Specification of the analog output, current or voltage with selectable value range.
	Scaling	*Standard scaling*			Standard scaling outputs the entire measuring range of the sensor/controller.
		ON/OFF scaling			ON/OFF scaling requires the indication of the start and the end of the measuring range, value range: from -1024 to 1024 mm.
	Two-point scaling (displacement and factor)	Start of range in mm	*Value*		
		End of range in mm	*Value*		

1) Only one measured value can be transmitted.

Fields with a grey background require a selection.

Value

Dark bordered fields require the specification of a value.

5.4.10 Output Data Rate

Go to the menu `Preferences` > `Output data rate.`

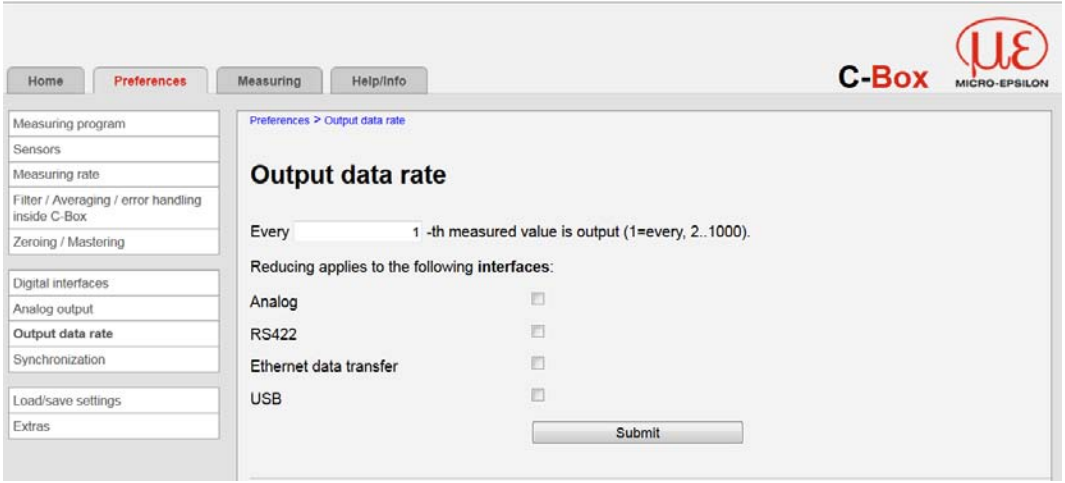
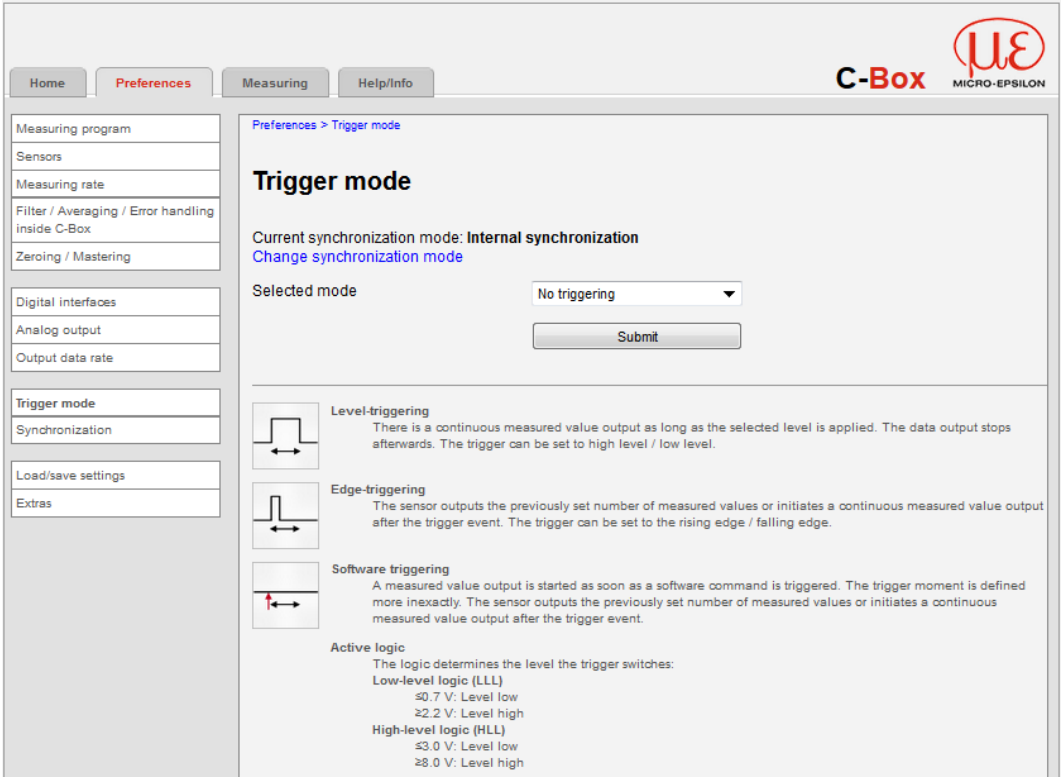


Fig. 26 View Preferences - Output data rate

As a result of reducing the output rate, only every n-th measured value is output. The other measured values are discarded. If an averaging for n values is requested, it has to be set separately, see Chap. 5.4.6.

5.4.11 Trigger Mode

Go to menu `Preferences` > `Trigger mode`.



Trigger mode	Current synchronization mode	*No synchronization*
		Internal synchronization
		External synchronization

You may select under `Change synchronization mode` among the 3 synchronization options, see Chap. 5.4.12.

Trigger mode	Selected mode	*No triggering*	
		Level-triggering	There is a continuous measured value output as long as the selected level is applied. The data output stops afterwards. The trigger can be set to high level / low level.
		Edge-triggering	The sensor outputs the previously set number of measured values or initiates a continuous measured value output after the trigger event. The trigger can be set to the rising edge / falling edge.
		Software triggering	A measured value output is started as soon as a software command is triggered. The trigger moment is defined more inexactly. The sensor outputs the previously set number of measured values or initiates a continuous measured value output after the trigger event.

Fields with a grey background require a selection.

Value

Dark bordered fields require the specification of a value.

Selected mode	No triggering				
	Level-triggering	Value output at	*Level high hoch*	*Active logic*	*High-level logic*
			Level low niedrig		*Low-level logic*
	Edge-triggering		*Raising edge*		*High-level logic*
			Falling edge		*Low-level logic*
	Software triggering	Number of measured values	*Value*		

Active logic

The logic determines the level the trigger switches:

Low-level logic (LLL)

≤0.7 V Level low

≥2.2 V Level high

High-level logic (LLL)

≤0.7 V Level low

≥8.0 V Level high

Anzahl der Messwerte

1...16382: Number of measured values to be output after a trigger event

16383: Start of an infinitely measured value output after a trigger event

0: Stop of the trigger or ending an infinitely measured value output

i For all measuring tasks level- or edge-triggering and external synchronization cannot be combined.

Fields with a grey background require a selection.

Value

Dark bordered fields require the specification of a value.

5.4.12 Synchronization

Go to the menu `Preferences` > `Synchronization.`

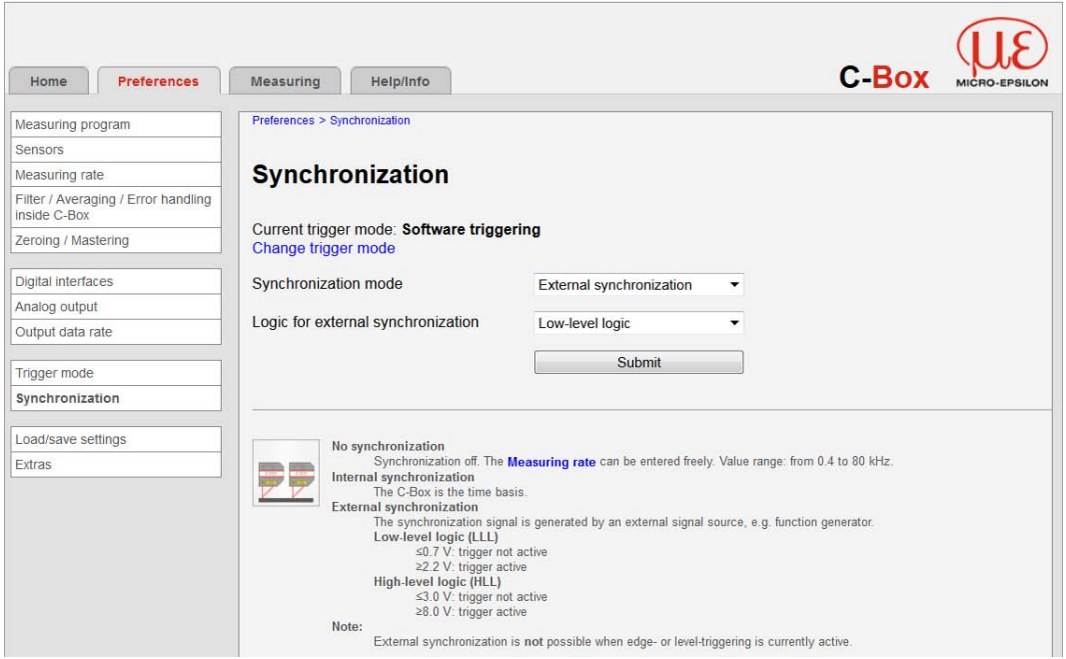


Fig. 27 View Preferences - Synchronization

All sensors can be synchronised from the controller. A synchronization between them of sensors of the same type is then no longer necessary. Sensors with different measuring ranges from the same series can be synchronized.

The C-Box operates as Master; the sensors operate as Slave. The small time offset of the measured value between individual sensors no longer applies. The controller only reacts to the edge of a synchronization signal.

Synchronization	Synchroniza-tion mode	*No synchronization*			Synchronisation off. The measuring rate can be en-tered freely. Value range: from 0.4 to 80 kHz.
		Internal synchronization			The C-Box is the time basis.
		External synchronization	*Low-level logic (LLL)*	≤0,7 V: Trigger not active ≥2,2 V: Trigger active	The synchroniza-tion signal is generated by an external signal source, e.g. func-tion generator.
			High-level logic (HLL)	≤3,0: Trigger not active ≥8,0 V: Trigger active	

In this view, the measuring rate can be changed via the link `Measuring rate`.

External synchronization is not possible when edge- or level-triggering is currently active.

You may select under `Change trigger mode` among the 4 trigger options, see Chap. 5.4.11.

Fields with a grey background re-quire a selection.

Value — Dark bordered fields require the specification of a value.

5.4.13 Load/Save Settings

Go to the menu `Preferences > Load/save settings.`

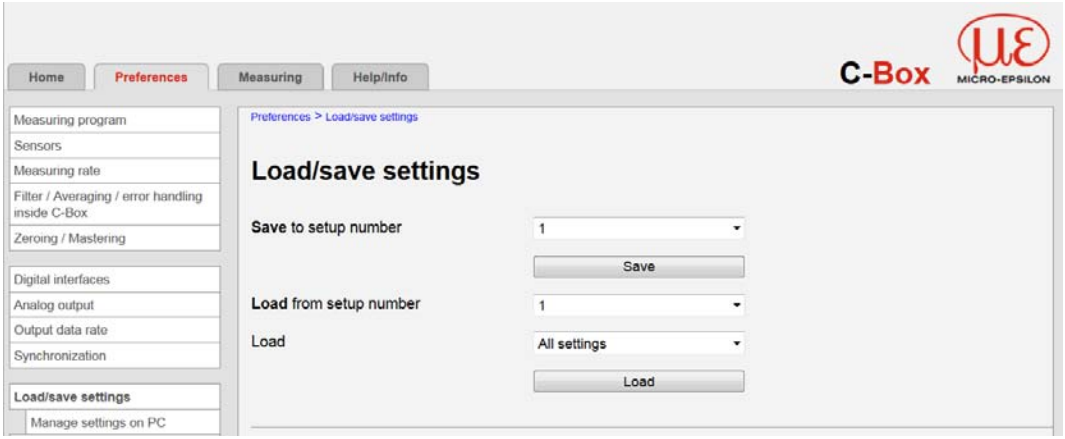


Fig. 28 View Preferences - Load/save settings

All settings on the controller, for example connected sensors and calculation functions can be saved permanently in application programs, so-called setups, in the controller and on an external PC.

i After the programming, all settings must be permanently stored under a setup no.(1 / 2 / 3 ... 8) in the controller, so that they are available again when the C-Box is switched on the next time.

Load/save settings	Save to setup number	*1 / 2 / 3 ... 8*	One click on the button saves the settings in the selected setup file.
	Load from setup number	*1/ 2 / 3 ... 8*	One click on the button loads the settings of the selected setup file.
	Load	*All settings*	All settings
		Interface settings only	Interface settings include network properties, such as the baud rate for the RS422 interface.
		Measuring settings only	Only measuring settings

Fields with a grey background require a selection.

Value

Dark bordered fields require the specification of a value.

5.4.14 Manage Settings on PC

Use this menu to save a backup copy of the controller data to a PC or to restore backed up setup files to the controller.

Save the controller settings, before exporting or importing data, see Chap. 5.4.13.

➡ Go to the menu `Preferences` > `Load/save settings > Manage settings on PC.`

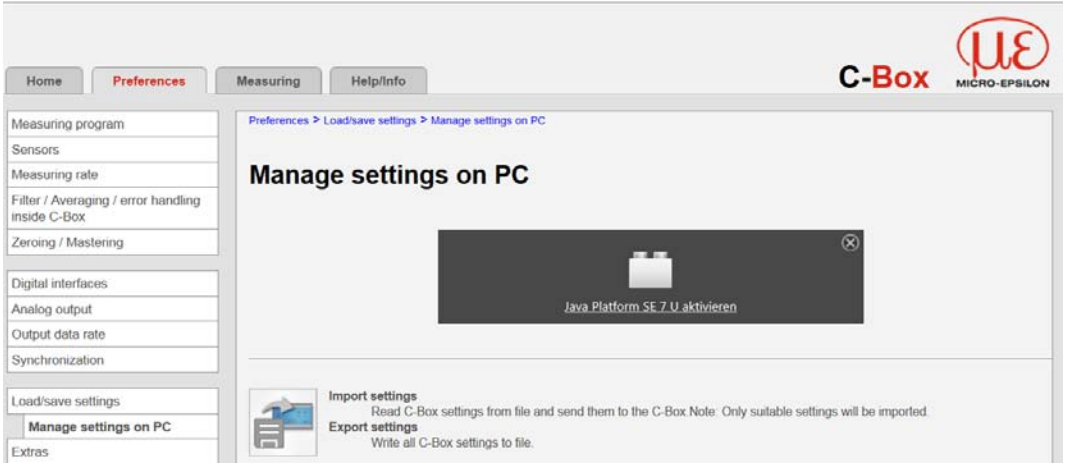


Fig. 29 View Preferences - Manage settings on PC

The link `Java Platform SE 7 U aktivieren` appears.
➡ Confirm with `Ausführen`.

The following Windows dialog opens:

Fig. 30 Windows dialog `Manage settings on PC`

Import settings

➡ If you want to load the settings, press the button `Import settings.`

The Windows dialog `Choose settings file....` opens:

➡ Select the suitable parameter set file (*.meo) and confirm with `Open`.

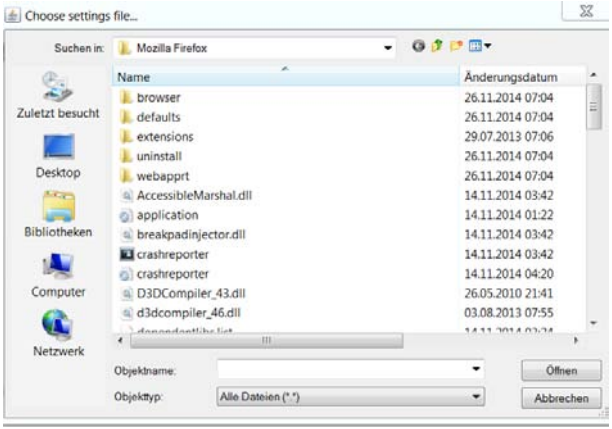


Fig. 31 Windows dialog `Choose settings file`

Settings of the C-Box are read from (*.meo) - file and sent to the C-Box.

Only suitable settings will be imported.
If you have selected the wrong file, you will get the advice: `Errors during import. Not all settings imported: Invalid settings file.`

Export settings

➡ If you want to export the settings, press the button `Export settings.`

Again the Windows dialog `Choose settings file` opens, see Fig. 31. `You can select their own` (*.meo) - file name.

➡ Save your settings by confirming with `Speichern`.

Now all settings of the C-Box are saved in this file and can be loaded at any time again.

5.4.15 Extras

5.4.15.1 Language

➡ Go to the menu `Preferences > Extras > Language.`

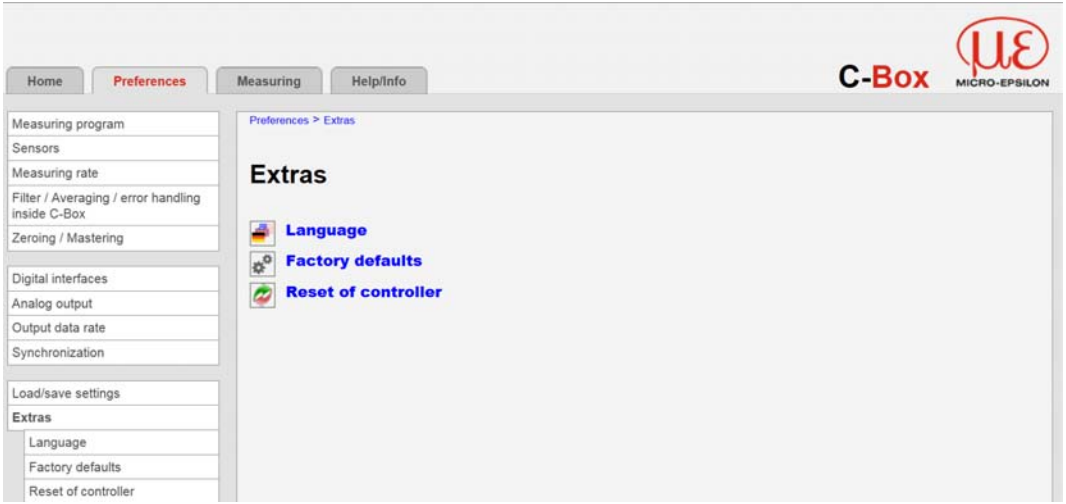


Fig. 32 View Preferences - Extras

The following menu selection is available:

Extras	Language	Language selection	*System*	Only applies for display in this web-based user interface.
			English	
			German	

The language selection can also be done via the menu `Home > Language selection, see Chap. 5.4.2`.

Fields with a grey background require a selection.

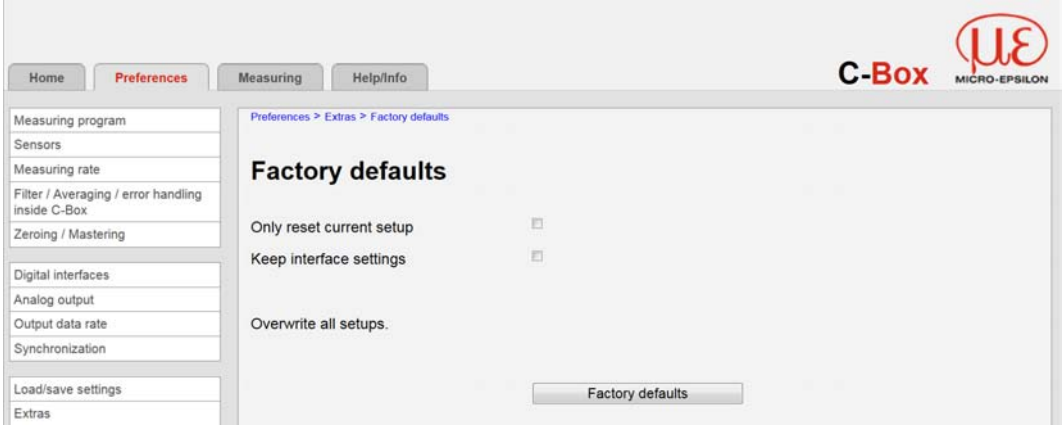
Value

Dark bordered fields require the specification of a value.

Factory defaults

The sensor is reset to the default setting. All setups are deleted and the default parameter loaded.

➡ Go to the menu `Preferences` > `Extras > Factory defaults.`



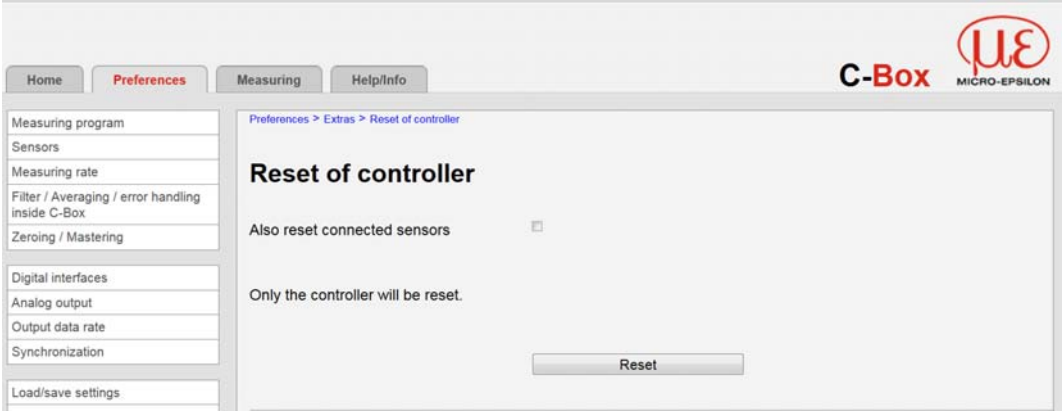
➡ Make the following selection with factory defaults:

Intention	Checkbox	Meaning
Only reset current setup Keep interface settings	☑ ☐	Only the current setup is deleted and the default parameters are loaded.
Only reset current setup Keep interface settings	☑ ☑	Current setup except interface settings is reset.
Only reset current setup Keep interface settings	☐ ☑	All setups are deleted and the default parameters are loaded. The settings for language, password and Ethernet remain unchanged.

➡ Confirm the selection by pressing the button `Factory defaults`.

5.4.15.2 Reset of Controller

Go to the menu `Preferences` > `Extras` > `Reset of controller`.



Make the following selection with reset of controller:

Intention	Checkbox	Meaning
Also reset connected sensors	☐	Only the controller will be reset.
Also reset connected sensors	☑	Controller and all connected sensors will be reset.

Confirm your selection by pressing the `Reset` button.

The button `Reset` performs a restart of then controller. The measuring will be interrupted, unsaved changes are lost.

5.4.16 Menu Measuring

Go to the menu `Measuring`.

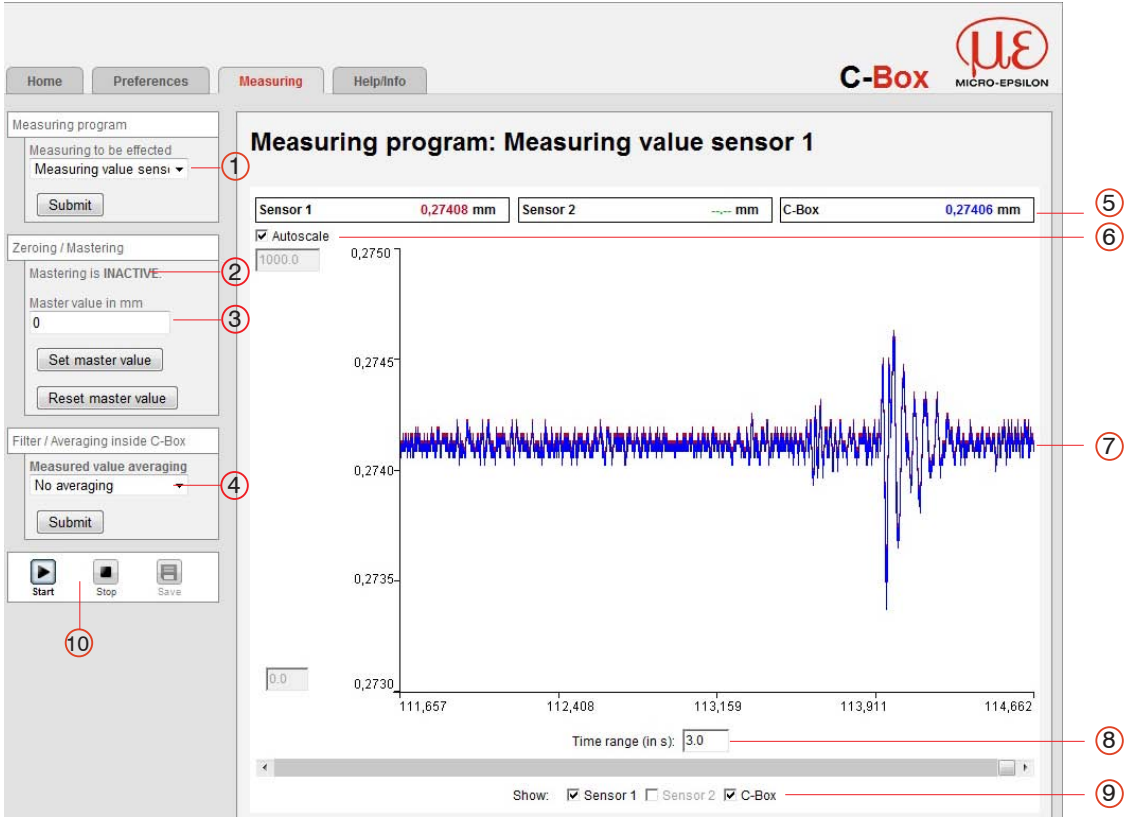


Fig. 33 View menu Measuring - Measuring program

The left window shows the following functions:

1	The Measuring to be effected, which you have already selected, see Chap. 5.4.3, is indicated. You can adjust the measuring program again and confirm with Submit. It is automatically updated in the submenu Measuring program, see Chap. 5.4.3.
2	Indicates whether Mastering is ACTIVE or INACTIVE, see Chap. 5.4.7. Here, you can set or reset the master value and confirm with Submit. It is automatically updated in the submenu Zeroing / Mastering, see Chap. 5.4.7.
3	The master value can be changed here, see Chap. 5.4.7.
4	Display which measured value averaging is selected, see Chap. 5.4.4. You can also change the measured value averaging here and confirm with Submit. The averaging method is automatically updated in the submenu Sensors under Filter / averaging in the sensor or controller, see Chap. 5.4.4. as in the submenu Filter / averaging / error handling inside C-Box, see Chap. 5.4.6.
5	Over the diagram the actual measured values of sensor 1, sensor 2 and C-Box are additionally shown.
6	The Mastering button resets the selected channel to zero, when 0 is entered in the field Master value in mm. Switch on Automatic scaling: ➡ Set the hook into the checkbox Automatic scaling. The two small boxes are now gray deposited. Switch off Automatic scaling: ➡ Take the hook from the checkbox Automatic scaling. Automatically the lowest and highest value of the scaling of the y axis in the before grey deposited small boxes appears. Die Y axis can be scaled manually.
7	Display of the graph measured value averaging
8	Small box time range (in s)

9	Die Checkbox Show data channel specifies which channels (sensor 1, sensor 2, C-Box) are displayed in the diagram.
10	Press the button Start to start the measured value display. Press the button Stop to stop the measured value display. After stopping you can save the measured value display by pressing the Save button. The Windows selection dialog for the file name and the memory place opens, in order to save the selected measured values into a *.meo-file.

The measuring values are stored with a dot as decimal mark if the language is set to English, otherwise a comma is used.

Only a limited number of measured values can be stored (about 2.000,000). The oldest values will be overwritten when more values are captured.

5.4.17 Help, Info Menu

This page contains information about the serial and version numbers and the MAC address of controller and the attached sensors and an address block.

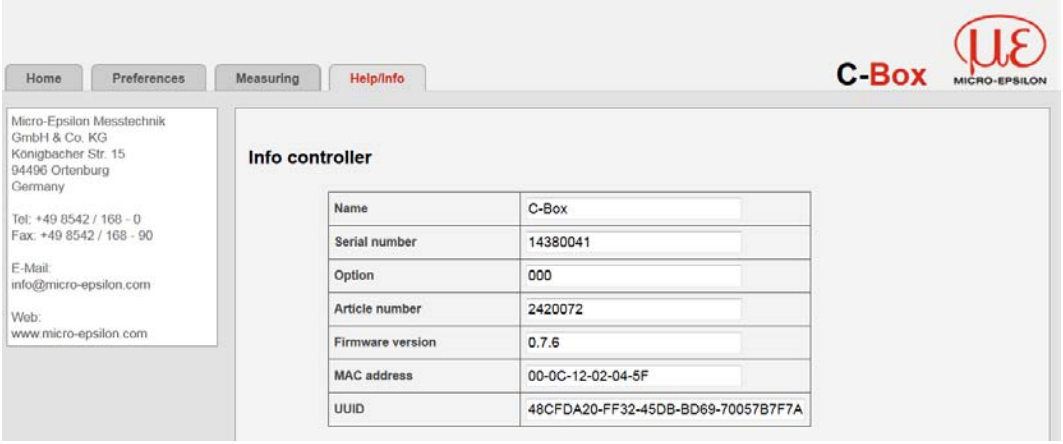
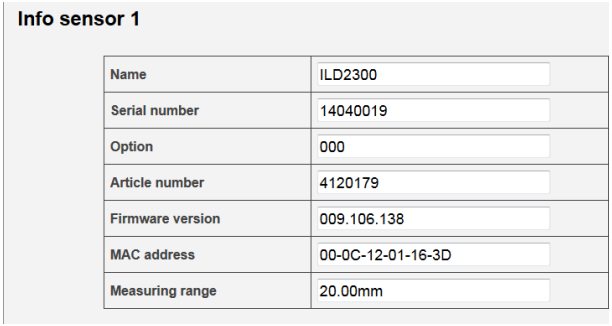


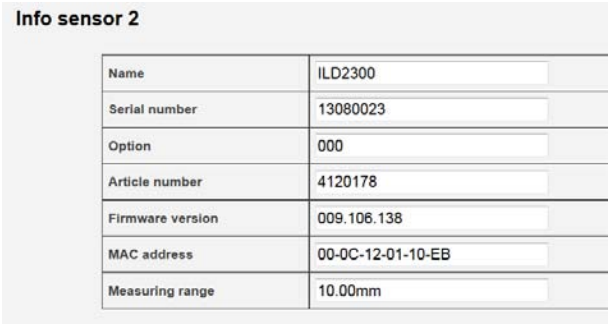
Fig. 34 Menu Help/Info - section 1 - Info controller



Info sensor 1

Name	ILD2300
Serial number	14040019
Option	000
Article number	4120179
Firmware version	009.106.138
MAC address	00-0C-12-01-16-3D
Measuring range	20.00mm

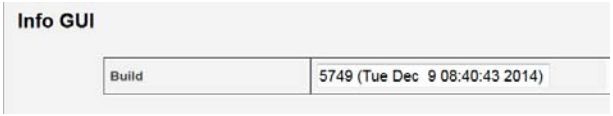
Fig. 35 Menu Help/Info - section 2 - Info sensor 1



Info sensor 2

Name	ILD2300
Serial number	13080023
Option	000
Article number	4120178
Firmware version	009.106.138
MAC address	00-0C-12-01-10-EB
Measuring range	10.00mm

Fig. 36 Menu Help/Info - section 3 - Info sensor 2



Info GUI

Build	5749 (Tue Dec 9 08:40:43 2014)

Fig. 37 Menu Help/Info - section 4 - Info GUI

6. Software Support with MEDAQLib

MEDAQLib offers you a documented driver DLL. Therewith you embed the C-Box, in combination with
- the PCI interface card IF 2008 or
- Ethernet card
- USB

into an existing or a customized PC software.

MEDAQLib
- contains a DLL, which can be imported into C, C++, VB, Delphi and many additional programs,
- makes data conversion for you,
- works independent of the used interface type,
- features by identical functions for the communication (commands),
- provides a consistent transmission format for all MICRO-EPSILON sensors.

For C/C++ programmers MEDAQLib contains an additional header file and a library file. You will find the latest driver / program routine at:

www.micro-epsilon.de/download

www.micro-epsilon.de/link/software/medaqlib

7. Warranty

All components of the device have been checked and tested for perfect function in the factory. In the unlikely event that errors should occur despite our thorough quality control, this should be reported immediately to MICRO-EPSILON.

The warranty period lasts 12 months following the day of shipment. Defective parts, except wear parts, will be repaired or replaced free of charge within this period if you return the device free of cost to MICRO-EPSILON. This warranty does not apply to damage resulting from abuse of the equipment and devices, from forceful handling or installation of the devices or from repair or modifications performed by third parties.

No other claims, except as warranted, are accepted. The terms of the purchasing contract apply in full. MICRO-EPSILON will specifically not be responsible for eventual consequential damages. MICRO-EPSILON always strives to supply the customers with the finest and most advanced equipment. Development and refinement is therefore performed continuously and the right to design changes without prior notice is accordingly reserved.

For translations in other languages, the data and statements in the German language operation manual are to be taken as authoritative.

8. Service, Repair

In the event of a defect on the C-Box:

- If possible, save the current C-Box settings in a parameter set, in order to load again the settings back into the C-Box after the repair.
- Please send us the C-Box for repair or exchange.

The opening of the C-Box is only subjected to the manufacturer. In the case of faults the cause of which is not clearly identifiable, the whole measuring system must be sent back to

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

9. Decommissioning, Disposal

➡ Disconnect all supply and output cables from the C-Box.

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.

Appendix

A 1 Accessories

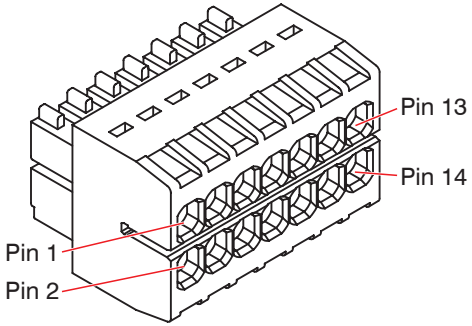


Fig. 38 Pin assignment 14-pin terminal box, type WAGO 713-1107

Female connector suitable for

- Conductor type solid/fine-stranded, cross section from 0.08 ... 1.5 mm² AWG 28 ... 16

- Conductor type fine-stranded (with insulated/uninsulated ferrule), cross section from 0.25 ... 1 mm² AWG 24 ... 18

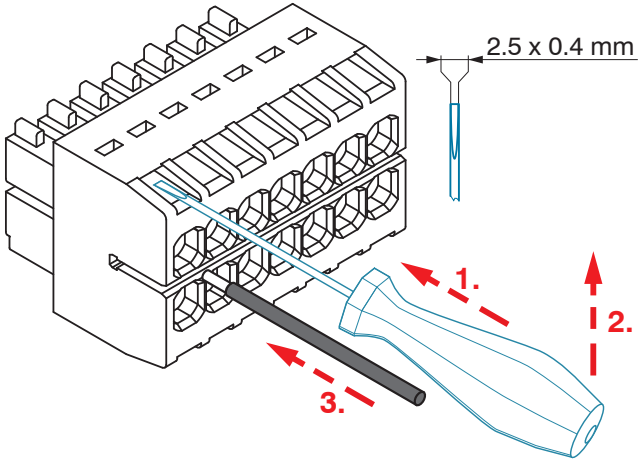


Fig. 39 Steps for wiring the cable clamp

Attach the female connector in bench vise as far as possible.

1. Guide the blade of the screwdriver into the operating slot.
Blade width 2.5 x 0.4 mm.

2. Lift the screwdriver slightly.

3 Move the connecting wire into the terminal.

4 Remove the screwdriver.

Interface and power supply cable to connect an ILD23xx to a C-Box,
cable length x = 3, 6, 9 or 25 m

Fig. 40 PC2300-3/C-Box/RJ45 power supply and interface cable

You can adjust settings to the sensor via the RJ45 Ethernet connector using the web interface or ASCII adjustments.

A 2 ASCII Communication with Sensor

A 2.1 General

The ASCII commands can be sent to the controller via the RS422 interface, USB or Ethernet. All commands, inputs and error messages are in English. A command always consists of the command name and zero or more parameters, which are separated by spaces and are completed with CR LF (corresponds \r\n).

The echo is always active, i. e.:

- With a command for setting parameters first the command name and afterwards OK respectively error and finally the prompt return as answer.
- With a command for reading parameters first the command name and afterwards the parameter value and finally the prompt return at answer.
- With a command with answer of several lines first the command name and in the next lines the parameters return as answer.

A 2.2 Interface Parameter RS422

- Baud rates: 115.200 (Default), 8.000.000, 4.000.000, 3.500.000, 3.000.000, 2.500.000, 2.000.000, 1.500.000, 921.600, 691.200, 460.800, 230.400, 9.600 Baud
- Parity: no
- Data bits: 8
- Stop bit: 1

A 2.3 Data Protocol

All values to be output at the same time are combined for transmission to a frame. A maximum of 6 values/ frames are possible. The measured values are transmitted via TCP/IP with 32 bit, via RS422 and USB with a maximum of 18 data bits

Structure of a measured value frame:

- Sensor 1 Value
- Sensor 1 Additional
- Sensor 2 Value
- Sensor 2 Additional
- C-Box Value
- C-Box Additional

With the Ethernet transmission a header and then a sequence of data frames is transmitted with each package.

The header consists of:
- Preamble (32 bits): MEAS
- Order number (32 bits)
- Serial number (32 bits)
- Flags1 (32 bits), already described
- Flags2 (32 bits), momentarily without function
- Bytes per frame (16 bits) / Number of frames in the package (16 bits)
- Frame counter (32 bits)

The data frames in the package is always complete (No frame can be distributed on several packages). Each frame consists of his selected measured values (up to six). Each measured value has again 32 bits.

The valid ranges for sensor and C-Box values are as follows:
- Via RS422/USB:
  - Sensor measured values and additional values depending on sensor (RS422 transmission), see also instruction manual optoNCDT 2300, Chapter 7.5 Data output.
  - C-Box measured values from 0 .. 131071, from 262073 … 262143 (18 bits) error values
  - C-Box additional values from 0 .. 262143 (18 bits)
- Via TCP/IP (Ethernet):
  - Sensor measured values and additional values depending on the sensor (RS422 transmission), see also instruction manual optoNCDT 2300, Chapter 7.5 Data output.
  - However, an additional Hi Byte (0x00) is transmitted to comply with 32 bits.
  - C-Box measured values from INT_MIN (-2147483648) to INT_MAX (2147483647)-11, INT_MAX-10 to INT_MAX are error values
  - C-Box additional values from INT_MIN to INT_MAX

Flag bit	Description	Flag bit	Description
0	Sensor 1 Value	4	C-Box Value
1	Sensor 1 Additional	5	C-Box Additional
2	Sensor 2 Value	6, 7	Typ Additional (00= Counter, 01= Timestamp)
3	Sensor 2 Additional	8 up to 31	0

Fig. 41 Description Flags 1 (Ethernet)

Flag bit	Description
0 up to 31	0

Fig. 42 Description Flags 2 (Ethernet)

Value	Interface	Value range
Sensor 1 Value, Sensor 2 Value, C-Box Value	RS422/USB	0 ... 262072
	Ethernet -INT_MAX ... INT_MAX -11	-2147483647 ... 2147483636
Sensor 1 Additional, Sensor 2 Additional, C-Box Additional	RS422/USB	0 ... 262143
	Ethernet: -INT_MAX ... INT_MAX	-2147483647 ... 2147483647

Fig. 43 Valid ranges (raw)

Value	Interface	Value range
Sensor 1 Value, Sensor 2 Value, C-Box Value	RS422/USB	262073 ... 262143
	Ethernet: INT_MAX -10 ... INT_MAX	2147483637 ... 2147483647

Fig. 44 Error ranges (raw)

Value	Interface	Calculation	Unit
C-Box Value	RS422/USB	$\text{Value} = \frac{\text{Digital} * (\text{C-Box Range Max} - \text{C-Box Range Min})}{131072.0} + \text{C-Box Range Min}$	[mm]
	Ethernet	$\text{Value} = \frac{\text{Digital}}{1.0e+006}$	[mm]
C-Box Additional (Timestamp)	RS422/USB	$\text{Value} = \frac{\text{Digital (Left shift by 8 bits)}}{1.0e+006}$	[s]
	Ethernet	$\text{Value} = \frac{\text{Digital (unsigned int)}}{1.0e+006}$	[s]
C-Box Additional (Counter)	RS422/USB	Digital	without
	Ethernet	Digital (unsigned int)	without

Fig. 45 Calculation of the values

During a restart or after a configuration change at the C-Box this initializes the sensors and the measuring restarts.

A 2.4 Commands Overview

Group	Chapter	Short info
A 2.5.1	Chap. A 2.5.1	Controller information
A 2.5.2	Chap. A 2.5.2	Search sensor
A 2.5.3	Chap. A 2.5.3	Sensor information
A 2.5.4	Chap. A 2.5.4	Read all settings
A 2.5.5	Chap. A 2.5.5	Language setting
A 2.5.6	Chap. A 2.5.6	Synchronization
A 2.5.7	Chap. A 2.5.7	Booting the controller
A 2.5.8	Chap. A 2.5.8	Triggerung
A 2.5.8.1	Chap. A 2.5.8.1	Trigger Selection
A 2.5.8.2	Chap. A 2.5.8.2	Trigger Level
A 2.5.8.3	Chap. A 2.5.8.3	Number of measuring values displayed
A 2.5.8.4	Chap. A 2.5.8.4	Software Trigger pulse
A 2.5.8.5	Chap. A 2.5.8.5	Trigger output all values
A 2.5.9	Chap. A 2.5.9	Ethernet
A 2.5.10	Chap. A 2.5.10	Setting the measured value server
A 2.5.11	Chap. A 2.5.11	Baudrate
A 2.5.12	Chap. A 2.5.12	Save parameter
A 2.5.13	Chap. A 2.5.13	Load parameter
A 2.5.14	Chap. A 2.5.14	Default settings
A 2.5.15	Chap. A 2.5.15	Measurement Mode
A 2.5.16	Chap. A 2.5.16	Measuring rate
A 2.5.17	Chap. A 2.5.17	Measured value averaging controller

A 2.5.18	Chap. A 2.5.18	Measured value averaging sensor
A 2.5.19	Chap. A 2.5.19	Setting masters / zero
A 2.5.20	Chap. A 2.5.20	Selection digital output
A 2.5.21	Chap. A 2.5.21	Output data rate
A 2.5.22	Chap. A 2.5.22	Scale output values
A 2.5.23	Chap. A 2.5.23	Error processing
A 2.5.24	Chap. A 2.5.24	Data selection for RS422
A 2.5.25	Chap. A 2.5.25	Data selection for USB
A 2.5.26	Chap. A 2.5.26	Data selection for Ethernet
A 2.5.27	Chap. A 2.5.27	Data selection of additional values
A 2.5.28	Chap. A 2.5.28	Data selection for analog output
A 2.5.29	Chap. A 2.5.29	Value range analog output
A 2.5.30	Chap. A 2.5.30	Analog output scaling
A 2.5.31	Chap. A 2.5.31	Send command to connected sensor
A 2.5.32	Chap. A 2.5.32	Laser off / laser on
A 2.5.33	Chap. A 2.5.33	Find C-Box
A 2.6	Chap. A 2.6	Error values via RS422/USB
A 2.7	Chap. A 2.7	Error values via Ethernet

A 2.5 Commands

A 2.5.1 Controller Information

```
GETINFO
```

Controller data are queried. Output as per example:

```
->GETINFO
Name:         C-Box
Serial:       10000001
Option:       000
Article:      2420072
MAC-Address:  00-0C-12-01-06-08
Version:      xxx.xxx.xxx.xx
->
```

A 2.5.2 Search Sensor

```
SCAN1
```

The controller looks for sensors connected to the socket sensor 1.

The `SCAN2` command causes the controller to look for sensors connected to the socket Sensor 2.

A 2.5.3 Sensor Information

```
GETINFO1
```

Provides information about the sensor connected to the socket Sensor 1.

Example of a response if a ILD2300 is connected:

```
->GETINFO1
Name: ILD2300
Serial: 11020009
Option: 001
Article: 2418004
MAC-Address: 00-0C-12-01-06-08
Version: 004.093.087.02
Measuring range: 20 mm
...
Imagetype: User
->
```

If the sensor was not recognized by the C-Box, the error `E39 no sensor found` is output.

The `GETINFO2` command provides information about the sensor connected to the socket Sensor 2.

A 2.5.4 Read All Settings

```
PRINT [ALL]
```

Print is used to output all query commands, for each line a response with command names in front.

In detail these are: SYNC, IPCONFIG, MEASTRANSFER, BAUDRATE, MEASMODE, MEASRATE, AVERAGE, AVERAGE1, AVERAGE2, MASTERMV, OUTPUT, OUTREDUCE, OUTSCALE_RS422_USB, OUTHOLD, OUT_RS422, OUT_USB, OUT_ETH, OUT_ADDITIONAL, ANALOGOUT, ANALOGRANGE, ANALOGSCALE, LASERPOW1, LASERPOW2, LANGUAGE

- ALL: Provides the response to GETINFO, GETINFO1 and GETINFO2 in several rows, the first row contains the command name

A 2.5.5 Language Setting

```
LANGUAGE BROWSER|ENGLISH|GERMAN
```

Language of indicated web pages.

- BROWSER means default language

A 2.5.6 Synchronization

```
SYNC NONE|INTERNAL|EXTERNAL [LLL | HLL]
```

- NONE: Sensors are not synchronized, the C-Box runs with its own clock and takes just available sensor values.
- INTERNAL: C-Box produces Sync impulse
- EXTERNAL: External Sync impulse is looped through to the sensors
  - In the case of external triggering it can still be switched between Low Level Logic (LLL) and High Level Logic (HLL).
  - Low Level Logic (0 ... 0,7 to 2,8 ... 30)
  - High Level Logic (0 ... 3 to 8 ... 30)

A 2.5.7 Booting the Controller

```
RESET [ALL]
```

The C-Box restarts.

- ALL: Also restart the sensors.

A 2.5.8 Triggering

A 2.5.8.1 Trigger Selection

```
TRIGGER NONE|EDGE|PULSE|SOFTWARE
```

Selection of trigger mode

- NONE: No triggering
- EDGE: Level triggering via TRG-IN (Measuring value output depends on TRIGGERCOUNT)
- PULSE: Gate triggering via TRG-IN (continuous measuring value output while TRG-In is inactive.)
- SOFTWARE: Triggering via the command TRIGGERSW (measuring value output depends on TRIGGER-COUNT)

Default = NONE

A 2.5.8.2 Trigger Level

```
TRIGGERLEVEL HIGH|LOW LLL|HLL
```

Sets the active level logic and the switching threshold for the trigger input.

- HIGH|LOW: active level logic
- LLL|HLL: Switching threshold
  - LLL = High level logic ==> LO = 0..0.7 Volt, HI = 8..30 Volt)
  - HLL = High level logic ==> LO = 0..3 Volt, HI = 8..30 Volt)

Default = HIGH LLL

A 2.5.8.3 Number of Measuring Values Displayed

```
TRIGGERCOUNT 0|1...16382|INFINITE|16383
```

Determines how many measuring values are output after a trigger event.

- 1...16382: Number of measuring values which are displayed after trigger event
- INFINITE|16383: Start the continuous measuring value output after a trigger event
- 0: Stops the continuous output of measuring values

Default = 1

A 2.5.8.4 Software Trigger Pulse

```
TRIGGERSW
```

Generating a software trigger. Is the trigger selection is not SOFTWARE, the error message „E43 triggermode SOFTWARE disabled“ is output.

If the command is resent with active measuring value output, the trigger is stopped and the measuring value output is finished.

A 2.5.8.5 Trigger Output all Values

```
OUT_ADDITIONAL C-BOXCOUNTER|C-BOXTIMESTAMP|TRG-IN
```

Setting the value to be output as an additional value of C-Box.

- C-BOXTIMESTAMP: Timestamp of C-Box
- C-BOXCOUNTER: Measuring value counter of C-Box
- TRG-IN: State by trigger input (0 = inactive, 1 = active)

When Ethernet data output the setting of OUT_ADDITIONAL (00 = Counter, 01 = Timestamp, 10 = TRG-IN) is output in Flags1 with Bit6+7.

Default = C-BOXCOUNTER

The new trigger function uses the same input as the Sync function, therefore only one of the two functions can be active:

If SYNC is set to EXTERNAL and the TRIGGER will be set to EDGE or PULSE, then an error is output.

If the TRIGGER is set to EDGE or PULSE and SYNC will be set to EXTERNAL, an error is output.

If SYNC is set to NONE or INTERNAL, the TRIGGER can be set to EDGE or PULSE.

If TRIGGER is set to NONE or SOFTWARE, the SYNC can be set to EXTERNAL.

A 2.5.9 Ethernet

```
IPCONFIG DHCP|STATIC [<IPAdresse> [<Netmask> [<Gateway>]]]
```

Set Ethernet interface.

- DHCP: IP address and gateway are automatically requested by DHCP. System looks for a LinkLocal address after appr. 30 minutes if no DHCP server is available.
- STATIC: Set IP address, net mask and gateway in format xxx.xxx.xxx.xxx

Values stay the same if no IP address, net mask, and/or gateway is typed in.

A 2.5.10 Setting the Measured Value Server

```
MEASTRANSFER SERVER/TCP [<PORT>]
```

In case of measured value output via Ethernet: currently only TCP server is provided.
- The port is freely selectable between 1024 and 65535.

A 2.5.11 Baudrate

```
BAUDRATE <Baudrate>
```

Setting the interface baudrate to the PC. Possible variants: 115.200 (Default), 8.000.000, 4.000.000, 3.500.000, 3.000.000, 2.500.000, 2.000.000, 1.500.000, 921.600, 691.200, 460.800, 230.400, 9.600 Baud

A 2.5.12 Save Parameter

```
STORE 1|2|3|4|5|6|7|8
```

Save the current parameter under the specified number in the flash. With the restart of the C-Box the last saved data record is always loaded.

A 2.5.13 Load Parameter

```
READ ALL|DEVICE|MEAS 1|2|3|4|5|6|7|8
```

Read the current parameter under the specified number in the flash. In addition, the size of the loaded data needs to be specified:
- ALL: All parameters are loaded.
- DEVICE: Only the standard device settings are loaded (interface parameter).
- MEAS: Only the measurement settings are loaded (all features for the measurement).

A 2.5.14 Default Settings

```
SETDEFAULT [ALL] [NODEVICE]
```
- Sets the default values (Reset to default setting).
- ALL: All setups are deleted and default parameters are loaded, otherwise, only the current setup will be deleted.
- NODEVICE: Settings of IP address and RS422 are kept temporarily.

A 2.5.15 Measurement Mode

```
MEASMODE SENSOR1VALUE|SENSOR12THICK|SENSOR12STEP
```

Set measurement mode, possible are:
- SENSOR1VALUE: Measured value of sensor 1.
- THICKSENSOR12: The measured values of sensor 1 and sensor 2 are subtracted from measuring range and both results are added together. If the mastering is active, both values are subtracted from the internal mastering offset.
- STEPSENSOR12: Difference from measured value of sensor 1 minus measured value of sensor 2.

A 2.5.16 Measuring Rate

```
MEASRATE x.xxx
```

Measuring rate in kHz with three decimal places.

Only measuring rates that support the measuring rates are permit. During deactivated synchronization values between 0.400 and 80.000 are permitted.

A 2.5.17 Measured Value Averaging Controller

```
AVERAGE NONE|MOVING|RECURSIVE|MEDIAN [<Averaging depth>]
```

Output averaging of the C-Box. The averaging value affects on the C-Box measured value on all interfaces and analog.
- MOVING: Moving average value (averaging depth 2, 4, 8, 16, 32, 64, 128, 256 and 512 possible).
- RECURSIVE: Recursive average value (averaging depth 2, 4, 8, ..., 32768)
- MEDIAN: Median (averaging depth 3, 5, 7 and 9 possible)

A 2.5.18 Measured Value Averaging Sensor

```
AVERAGE1 NONE|MOVING|RECURSIVE|MEDIAN [<Averaging depth>]
```

Averaging in the sensors. The averaging value always affects all to be output displacement and difference values.
- MOVING: Moving average value [1]
- RECURSIVE: Recursive average value [1]
- MEDIAN: Median [1]

The command `AVERAGE2 NONE|MOVING|RECURSIVE|MEDIAN [<Averaging depth>]` stops averaging the sensor connected to the socket Sensor 2.

1) Only those values are possible, which are supported by the sensor.

A 2.5.19 Setting Masters / Zero

```
MASTERMV NONE|MASTER <Master value>
```

Mastering the C-BOXVALUE.

- NONE: Terminates the mastering
- MASTER: Setting the current measured value as master value
  - Master value in millimeters (min: -1024.0 mm, max: 1024.0 mm)
  - In case of master value is 0, then the mastering function has the same functionality as the zero setting

A 2.5.20 Selection Digital Output

```
OUTPUT NONE|RS422|ETHERNET|HTTP|USB
```

Activates data output at the desired interface.

- NONE: No measured value output
- RS422: Output of measured values via RS422
- ETHERNET: Output of measured values via Ethernet
- HTTP: Output of measured values over the web page of the C-Box
- USB: Output of measured values via USB

A 2.5.21 Output Data Rate

```
OUTREDUCE <Output reduction> ([ANALOG] [RS422] [USB] [ETHERNET])|NONE
```

Reduces the measured value output for all available interfaces.

- 1: Output of every measured value
- 2 ... 1000: Output of each n-th measured value

A 2.5.22 Scale Output Values

```
OUTSCALE_RS422_USB STANDARD|(TWOPOINT <Minimum measured value> <Maximum mea-
sured value>)
```

Sets the scaling of the C-BOXVALUE via RS422 and USB.

The default scaling is for distance/level 0 to MR (Sensor 1) and for thickness measurement 0 to MR (Sensor1) + MR (Sensor2) (MR=Measuring range).

The minimum and maximum measured value must be indicated in millimeters. The available output range of the RS422/USB output is then spread between the minimum and maximum measured value. The minimum and maximum measured value must lie between -1024.0 and 1024.0 mm with 4 decimal places. The maximum value must be larger than the minimum value.

A 2.5.23 Error Processing

```
OUTHOLD NONE|0|<Number>
```

Setting the behavior of the measured value output in case of error for the C-Box measured value, not for the sensor values.

- NONE: No holding the last measured value, output of error value.
- 0: Infinite holding of the last measured value
- Number: Holding the last measured value on the number of measuring cycles; Then an error value (maximal 1024) is output.

A 2.5.24 Data Selection for RS422

```
OUT_RS422 NONE|([SENSOR1VALUE][SENSOR1ADDITIONAL][SENSOR2VALUE][SENSOR2ADDI-
TIONAL][C-BOXVALUE][C-BOXADDITIONAL])
```

Setting the values to be output via RS422.

- NONE: No output of a distance
- SENSOR1VALUE: Measured value of Sensor 1
- SENSOR1ADDITIONAL: Additional value of Sensor 1
- SENSOR2VALUE: Measured value of Sensor 2
- SENSOR2ADDITIONAL: Additional value of Sensor 2
- C-BOXVALUE: Calculated value of the C-Box
- C-BOXADDITIONAL: Additional value of the C-Box

A 2.5.25 Data Selection for USB

```
OUT_USB NONE|([SENSOR1VALUE][SENSOR1ADDITIONAL][SENSOR2VALUE][SENSOR2ADDITION-
AL][C-BOXVALUE][C-BOXADDITIONAL])
```

Setting the values to be output via USB.

- NONE: No output of a distance
- SENSOR1VALUE: Measured value of Sensor 1
- SENSOR1ADDITIONAL: Additional value of Sensor 1
- SENSOR2VALUE: Measured value of Sensor 2
- SENSOR2ADDITIONAL: Additional value of Sensor 2
- C-BOXVALUE: Calculated value of C-Box
- C-BOXADDITIONAL: Additional value of C-Box

A 2.5.26 Data Selection for Ethernet

```
OUT_ETH NONE|([SENSOR1VALUE][SENSOR1ADDITIONAL][SENSOR2VALUE][SENSOR2ADDITION-
AL][C-BOXVALUE][C-BOXADDITIONAL])
```

Setting the values to be output via Ethernet.

- NONE: No output of a distance
- SENSOR1VALUE: Measured value of Sensor 1
- SENSOR1ADDITIONAL: Additional value of Sensor 1
- SENSOR2VALUE: Measured value of Sensor 2
- SENSOR2ADDITIONAL: Additional value of Sensor 2
- C-BOXVALUE: Calculated value of C-Box
- C-BOXADDITIONAL: Additional value of C-Box

A 2.5.27 Data Selection of Additional Values

```
OUT_ADDITIONAL C-BOXCOUNTER|C-BOXTIMESTAMP
```

Setting the value to be output as additional value of the C-Box.

- C-BOXTIMESTAMP: Timestamp of C-Box
- C-BOXCOUNTER: Measurement counter of C-Box

A 2.5.28 Data Selection of Analog Output

```
ANALOGOUT SENSOR1VALUE|SENSOR2VALUE|C-BOXVALUE|FIXED [Value]
```

Selection of the signal to be output via the analog output.

- For FIXED the voltage/current value is indicated as four decimal places.

A 2.5.29 Value Range Analog Output

```
ANALOGRANGE NONE|0-5V|0-10V|-5-5V|-10-10V|4-20mA
```

- NONE: No analog output (inactive)
- 0 - 5 V: The analog output outputs a voltage from 0 up to 5 Volt.
- 0 - 10 V: The analog output outputs a voltage from 0 up to 10 Volt.
- -5 - 5 V: The analog output outputs a voltage from -5 up to 5 Volt.
- -10 - 10 V: The analog output outputs a voltage from -10 up to 10 Volt.
- 4 - 20 mA: The analog output outputs a current of 4 up to 20 milliamperes.

A 2.5.30 Analog Output Scaling

```
ANALOGSCALE STANDARD|(TWOPOINT <Minimum measured value> <Maximum measured val-
ue>)
```

Setting the scaling of analog output.

The default scaling is for displacements 0 - MR respectively - MR/2 up to MR/2 and for thickness measurement on 0 up to 2 MR (MR=Measuring range).

In case of minimum and maximum measured value is ‚0', the default scaling is used.

The minimum and maximum measured value is to output in millimeters. The available output range of the analog output is then spread between the minimum and maximum measured value. The minimum and maximum measured value must be between -1024.0 and 1024.0 mm with four decimal places.

The minimum and maximum measured value is processed with four decimal places.

A 2.5.31 Send Command to Connected Sensor

```
CHANNEL1 <Command for Sensor 1>
```

The command is enclosed in quotation marks and is sent and provided by the C-Box with a <CRLF> to the sensor connected to Sensor 1 socket. The response of the sensor is packaged and returned in quotation marks.

If no prompt comes, then up to 15000 ms is waited for the response and afterwards an error is returned.

If no sensor in the C-Box is recognized, immediately an error message returns.

Example of a channel communication, the echo in the sensor is switched off:

Command: `CHANNEL1 „LASERPOW“<CRLF>`

Response: `CHANNEL1 „LASERPOW FULL“<CRLF>->`

Command: `CHANNEL1 „LASERPOW FULL“<CRLF>`

Response: `CHANNEL1 „<CRLF>“<CRLF>->`

Command: `CHANNEL1 „GETINFO“<CRLF>`

Response: `CHANNEL1 „<CRLF><CRLF>Name:ILD2300<CRLF>Serial:1020004<CRLF>..
.“<CRLF>->`

The command `CHANNEL2` sends commands to the sensor connected to the Sensor 2 socket.

A 2.5.32 Laser off / Laser on

```
LASERPOW1 OFF|ON
```

Line for laser on/off. When the laser is enabled by a jumper between Laser on and GND, it can be switched via the `LASERPOW1 OFF / ON` command.

The `LASERPOW2` command operates analog and is addressed to the sensor connected to the Sensor 2 socket.

A 2.5.33 Find C-Box

Search the C-Box by using the Sensorfinder, see Chap. 5.3.2.

A 2.6 Error Values via RS422/USB

262073	RS422 scaling underflow
262074	RS422 scaling overflow
262075	Too much data for this baud rate
262079	Measure value cannot be calculated
262080	Measure value cannot be examined, global error

A 2.7 Error Values via Ethernet

7ffffff8	Measure value cannot be calculated
7ffffff7	Measure value cannot be examined, global error

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