MICRO-EPSILON

Operating Instructions

C-Box/2A

Controller for ILD 1420, ILD 1750 and ILD 2300 series

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Appendix

1. Safety

System operation 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.

1.2 Warnings

⚠ CAUTION

Connect the power supply and the display/output device according to the safety regulations for electrical equipment.
> Risk of injury

> Damage to or destruction of the controller

NOTICE

The supply voltage must not exceed the specified limits.
> Damage to or destruction of the controller

Avoid shocks and impacts to the controller.
> Damage to or destruction of the controller

1.3 Notes on CE Marking

The following apply to the C-Box/2A:

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

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

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The measuring system is designed for use in industrial environments and meets the requirements.

1.4 Intended Use

- The C-Box/2A 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 must only be operated within the limits specified in the technical data, see Chap. 2.2.
- The system 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 system.
- Take additional precautions for safety and damage prevention in case of 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/2A 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/2A is installed in a stable aluminium case.

Two digital sensors of the same series can be directly connected to the C-Box/2A via RS422.

Both sensors are synchronized via the C-Box/2A; the C-Box/2A is the master.

The parameterization of all inputs and outputs on the C-Box/2A 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

Model	C-Box/2A
Connections	- 2 Sensor connectors (HD-Sub, 15-pin), - 2 RS422 interfaces - 1x Ethernet (PC, 100 Mbit/s), - 1x USB 2.0, type B, max. 12 Mbit, - 1 plug-in terminal block 16-pin ▪ External power supply ▪ External laser on/off ▪ External trigger input ▪ 2 analog outputs (current or voltage) - 1 external multi function input - 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. - 2 switching outputs
Supported sensors	Sensors of the ILD 1420 series with a measuring rate of 0.25 ... 4 kHz, sensors of the ILD 1750 series with a measuring rate of 0.3 ... 7.5 kHz and sensors of the ILD 2300 series with a measuring rate of 1.5 … 49 kHz
Functions	Filter: average moving 2…512 / recursive 2…32768, Median 3,5,7,9
	Zero, mastering, synchronization
	Scaling analog outputs

Model	**C-Box/2A**
Analog output	- 1 current output per connected sensor ▪ 4 – 20 mA - 1 voltage output per connected sensor; programmable: ▪ 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 respectively 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

Model	C-Box/2A
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 Unpacking, Included in Delivery

1 C-Box/2A

1 Operating instructions

1 16-pin. female terminal box (cable clamp) with locking function type Weidmüller B2CF 3.50/16/180 SN BK BX

➡ 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.

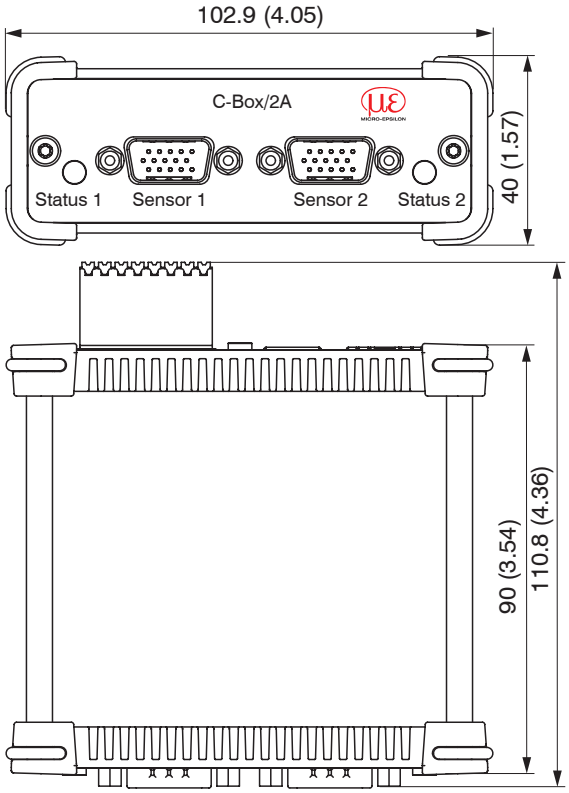
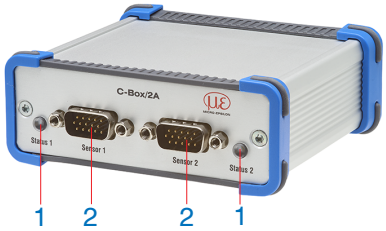


Fig. 1 Dimensions C-Box/2A, dimensions in mm (inches), not to scale

4.2 Electrical Connections, LEDs

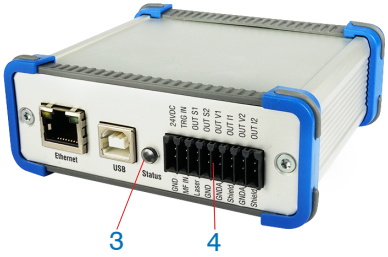


Pin	Signal
1	RS422 TxD-
2	RS422 TxD+
3	RS422 RxD-
4	RS422 RxD+
5	GND
6	RS422 TRG+
7	RS422 TRG-
8	5V CMOS output (reserve, do not connect)
9	Power supply +24 V via power connection
10	Power supply +24 V via power connection
11	Multfunction output TTL or HTL compatible
12	Laser on, HTL compatible
13	NC
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	Designation	Signal
1	24VDC	Power
2	GND	GND
3	TRG IN	Trigger in
4	MF IN	Multi function input
5	OUT S1	Switching output 1
6	Laser	Laser
7	OUT S2	Switching output 2
8	GND	GND
9	OUT V1	Measurement value voltage 1
10	GNDA	Analog GND1
11	OUT I1	Measurement value current 1
12	Shield	Schirm
13	OUT V2	Measurement value voltage 2
14	GNDA	Analog GND2
15	OUT I2	Measurement value current 2
16	Shield	Schirm

Fig. 4 Pin assignment 16-pin terminal block (4), type Phoenix

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)

4.3 Laser on

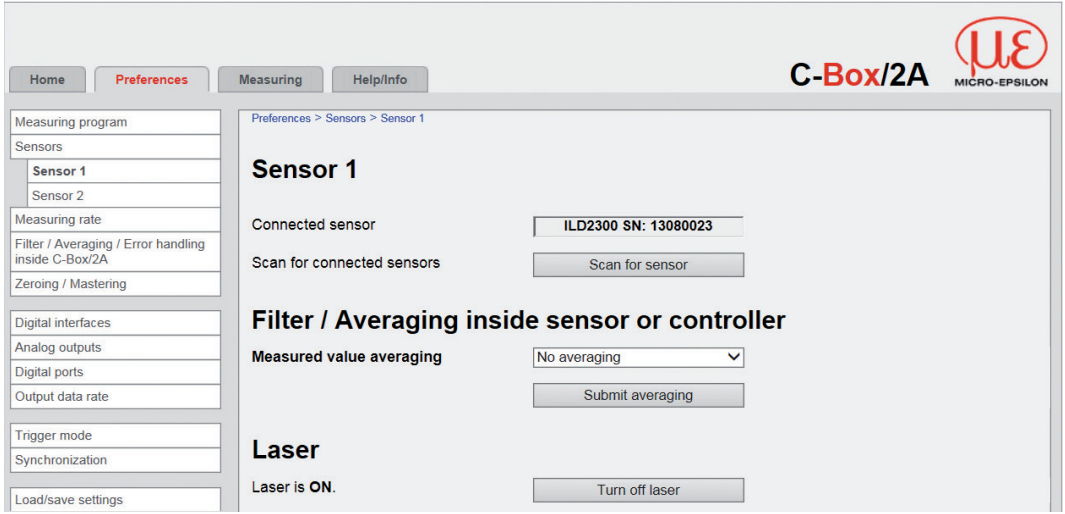


Fig. 6 View Preferences - Sensors - Laser

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 6 `Laser` with pin 8 `GND` by a jumper.

i The laser is off unless pin 6 is electrically connected to pin 8.

5. Operation

5.1 Getting Ready for Operation

The C-Box/2A 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/2A 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/2A WinUSB under:

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

- Connect C-Box/2A to the usb port of your computer.
- Connect C-Box/2A 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/2A in the device manager, see Fig. 7.

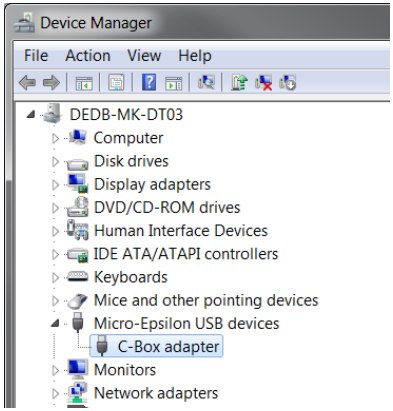


Fig. 7 View Device Manager after installing the USB driver

5.3 Software Update

The software can only be updated via USB.

- Download the USB driver from the homepage, see Chap. 5.2 and unpack it.
- Start the installation program.
- Search for the C-Box.
- Choose the update file.
- Start the installation.
- Wait until the installation is complete.

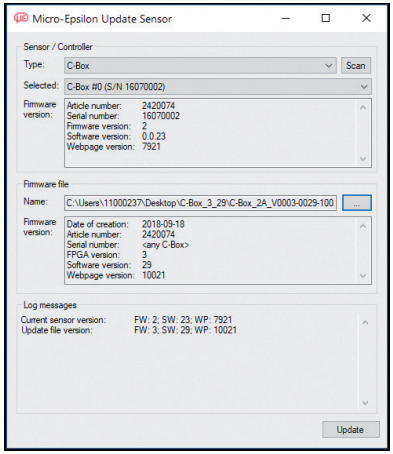


Fig. 8 View MICRO-Epsilon Update Sensor

5.4 Operation Using Ethernet

Dynamic web pages are generated in the C-Box/2A which contain the current settings of the C-Box/2A and the peripherals. The operation is only possible while there is an Ethernet connection to the C-Box/2A.

5.4.1 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/2A to a network or directly to a PC.

The C-Box/2A 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. 5.4.2.

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

5.4.2 Access via Ethernet

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

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

➡ Start the sensorFINDER, see Fig. 11.

You will find this program on the supplied CD.

➡ In the `Sensor Group` dropdown menu, select `Interfaces` and in the `Sensor Type` dropdown menu, select `C-Box`.

➡ Click the `Magnifier` button.

➡ Now select the C-Box/2A from the list, in order to change the address settings, click the `Configure sensor IP button`.

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

➡ Click the `Apply` button, in order to transmit the changes to the C-Box/2A.

➡ Click the `Open Website` button, in order to display the C-Box/2A on your standard browser. Alternatively, change the IP settings according to the settingson your PC (IP address ranges must match).

1) This assumes that the LAN connection on the PC uses the following IP address, for example: 169.254.168.1

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

➡ Start the sensorFINDER, see Fig. 11.

You will find this program on the supplied CD.

➡ In the `Sensor Group` dropdown menu, select `Interfaces` and in the `Sensor Type` dropdown menu, select `C-Box`.

➡ Click the `Magnifier` button.

➡ Now select the C-Box/2A from the list.

➡ Click the `Open Website` button, in order to display the C-Box/2A on your standard browser.

➡ Enter the C-Box/2A in the DHCP / register the C-Box/2A in your IT department.

The C-Box/2A is assigned an IP adress by your DHCP server. You can query this IP address by using sensorFINDER.exe.

➡ Start the sensorFINDER, see Fig. 11.

You will find this program on the supplied CD.

➡ In the `Sensor Group` dropdown menu, select `Interfaces` and in the `Sensor Type` dropdown menu, select `C-Box`.

➡ Click the `Magnifier` button.

➡ Now select the C-Box/2A from the list.

➡ Click the `Open Website` button, in order to display the C-Box/2A on your standard browser.

Interactive web pages for setting the C-Box/2A and peripherals are now shown in the web browser.

Parallel operation with web browser and ASCII commands is possible; the last setting applies. Do not forget to save.

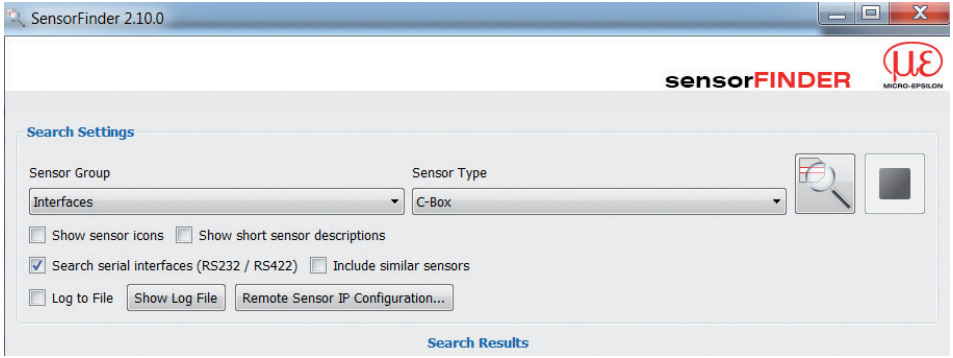
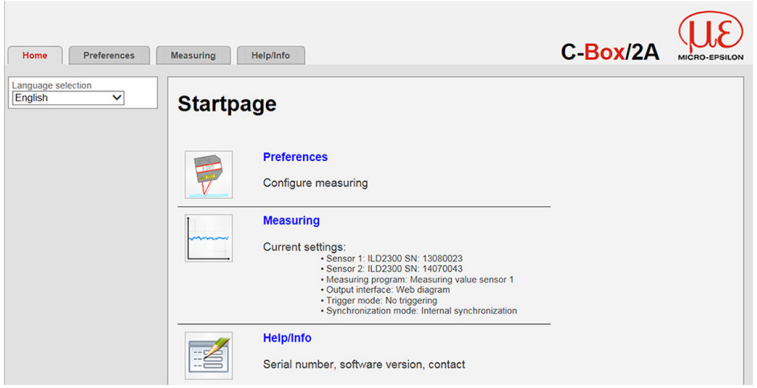


Fig. 10 sensorFINDER



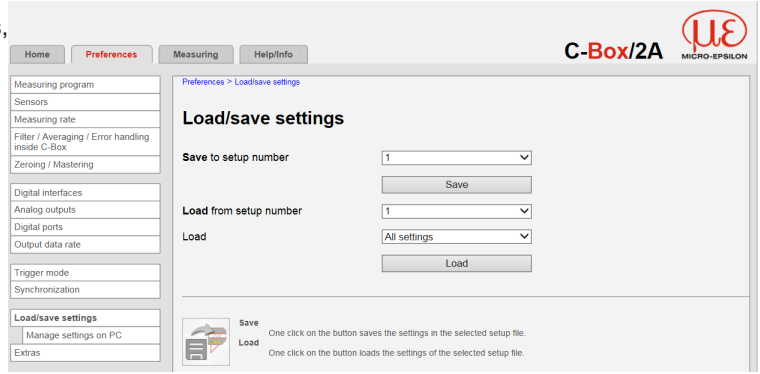
You can access additional features in the upper navigation bar (Preferences, Measuring and Help/Info).All settings in the web page are applied immediately in the C-Box/2A after clicking the button `Submit`.

Fig. 11 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/2A is switched on the next time.



5.4.3 Measured Value Presentation with Web Browser

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

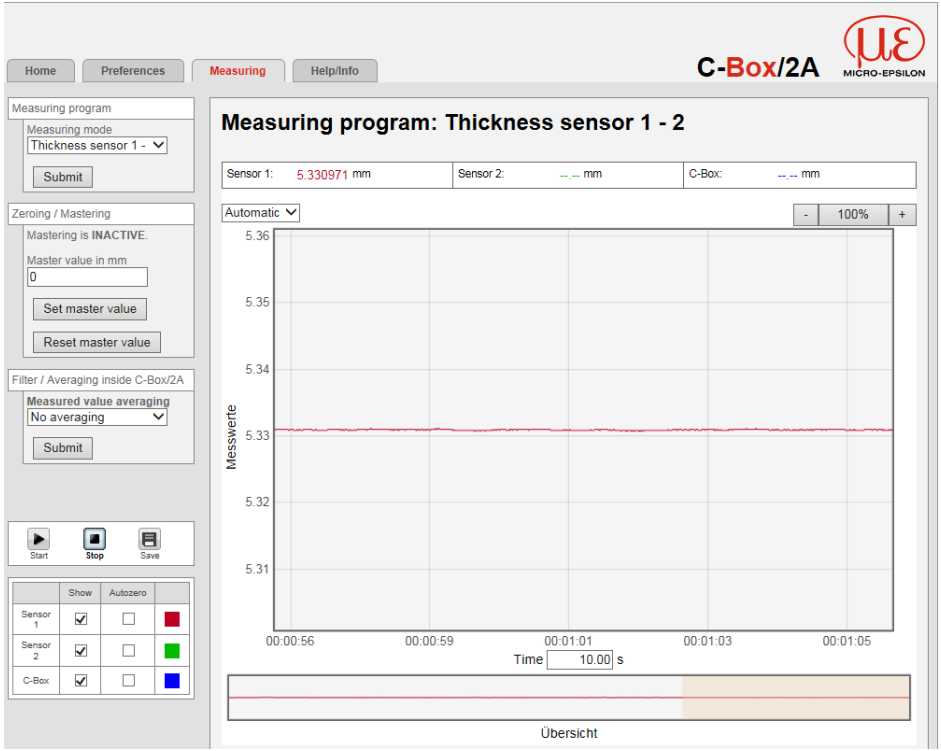


Fig. 12 Presentation of the measurement and calculation results

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.

The menu item Save stores the measured values after the measurement was stopped. The measured 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 50,000).

i The oldest values will be overwritten when more values are captured.

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 checkbox specifies which channels are displayed in the diagram.

The Autozero checkbox sets the selected channel to zero only in the diagram. This setting has to influence on the C-Box/2A or the sensors connected.

Use the Mastering button to set the measurement value from the C-Box/2A to the selected measurement value, for example, for performing differential measurements.

➡ Go to the menu bar at the side indicated below Zeroing / Mastering.

➡ Enter a master value (e.g. 0 for a differential measurement).

➡ Click the Set master value button.

➡ Click the Reset master value button to end mastering.

➡ 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. 5.5.7.

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

5.5 Operating Menu

5.5.1 General

It is only possible to operate the controller via a 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/2A	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 USB
Analog outputs	Output signal, Output area, Scaling
Digital, ports	Digital input, Digital outputs
Output data rate	Specifying measurement, reduction of measured values
Trigger mode	Selected mode
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

5.5.2 Language Selection

Go to the Home menu > Language selection.

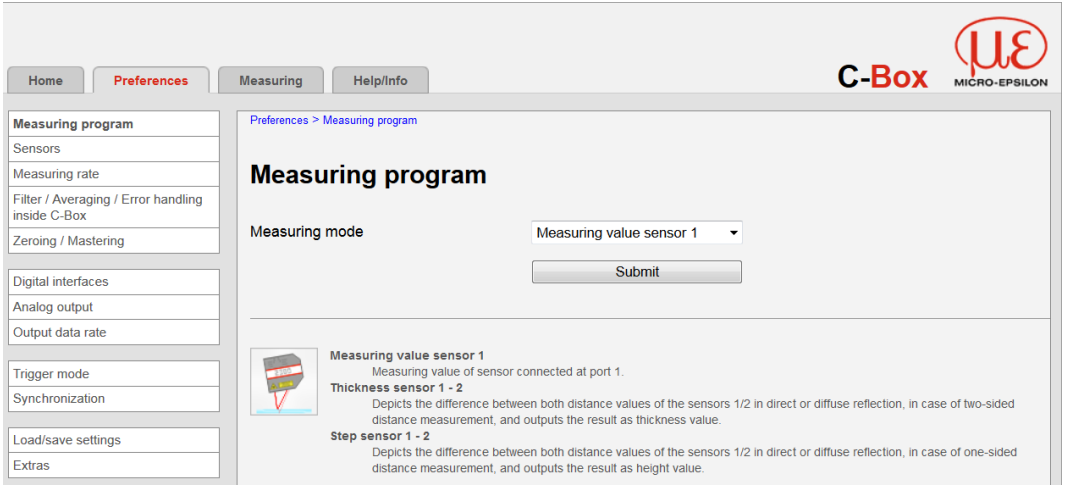
This menu item allows a change of the language of the interactive web pages.

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. 5.5.16.1.

5.5.3 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/2A 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.

5.5.4 Sensors

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

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

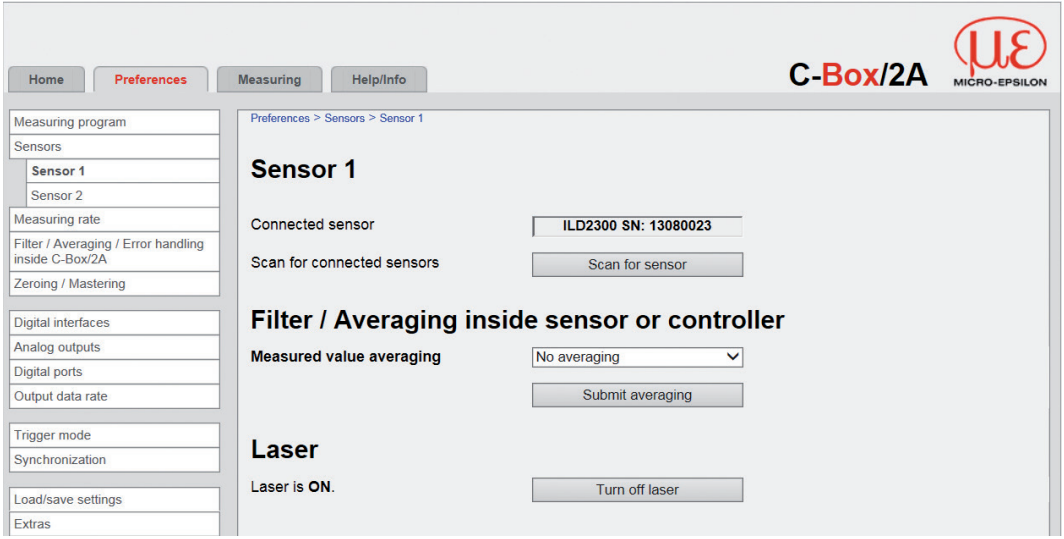


Fig. 13 View Preferences - Sensors

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 ILD 1420, ILD 1750 and ILD 2300 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 1420, ILD 1750 and 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 and 512*
			Number of values for recursive average	*2 / 4 / 8 / 16 / 32 / 64 / 128 / 256 / 512 / 1024 / 2048 / 4096 / 8192 / 16384 / 32768*
			Number of values for Median filter	3 / 5 / 7 / 9
Laser	Laser is ON. / Laser is OFF.	ON / OFF	Software-supported activation/deactivation of the laser light source on the sensor.	

Fields with a grey background require a selection.

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

You will find further information and settings in the Chapter Filter / Averaging / Error handling in C-Box/2A, see Chap. 5.5.6.

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

i Moving average in the controller C-Box/2A allows only potentials of 2 for N. The highest averaging value is 512.

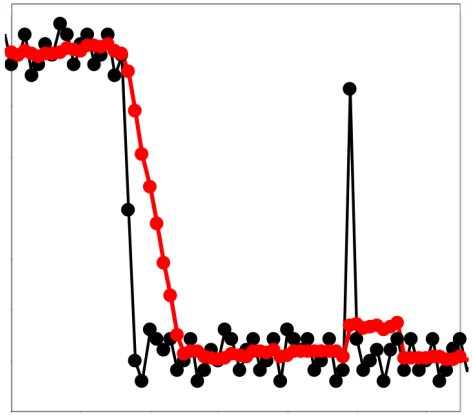


Fig. 14 Moving average, N = 8

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,

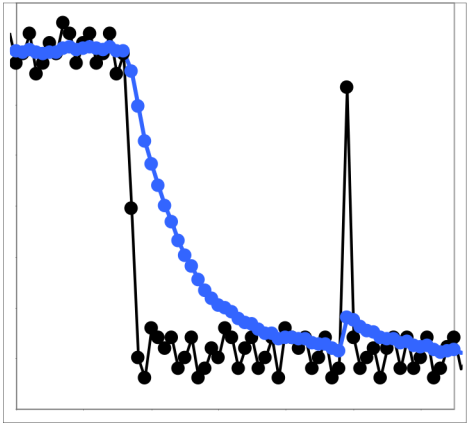
N = averaging value, N = 1 ... 32768

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. 15 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 (N = 3,5,7,9) for measurement values by re-arranging the incoming measurement values after each measurement is completed. Then the average value is issued as a median.

Die maximalen Mittelungszahlen der C-Box/2A sind:
- Median: 9
- Gleitend: 512
- Rekursiv: 32768

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 $\quad \text{Median}_{(n+1)} = 4$

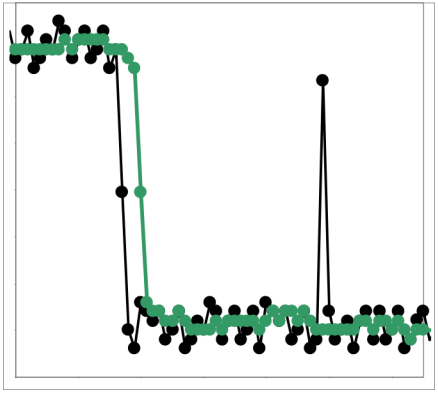


Fig. 16 Median, N = 7

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

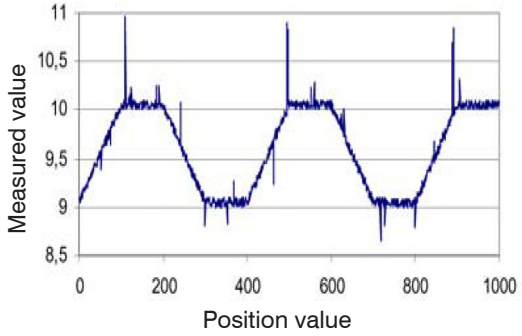


Fig. 17 Original profile

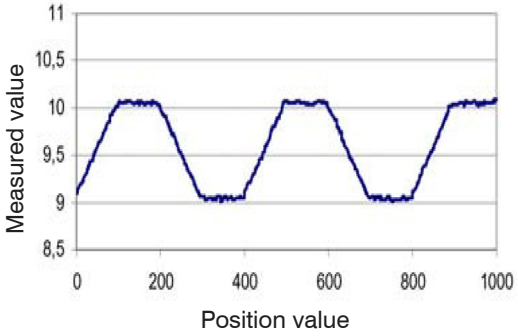
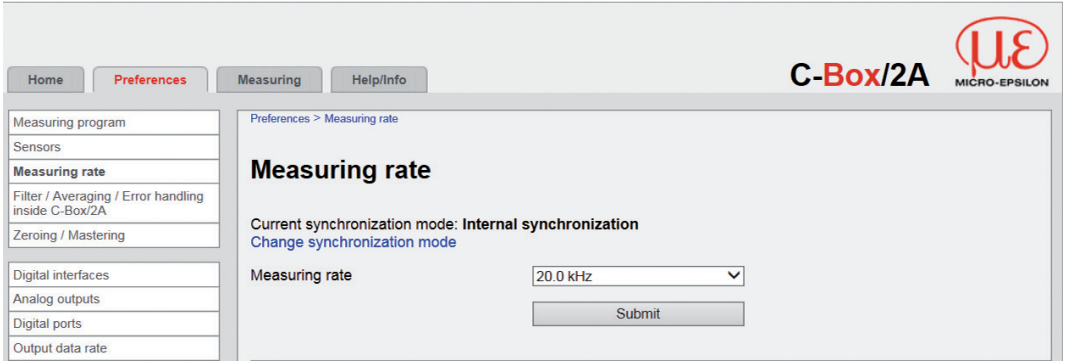


Fig. 18 Profile with Median, N = 9

5.5.5 Measuring Rate

Go to the menu `Preferences` > `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, see Fig. 19.
		Internal synchronization	The C-Box/2A is the time basis.
		External synchronisation	The synchronization signal is generated by an external signal source, e.g. function generator.
	Measuring rate	*Value*	kHz; , see also the following table

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`.

Fields with a grey background require a selection.

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

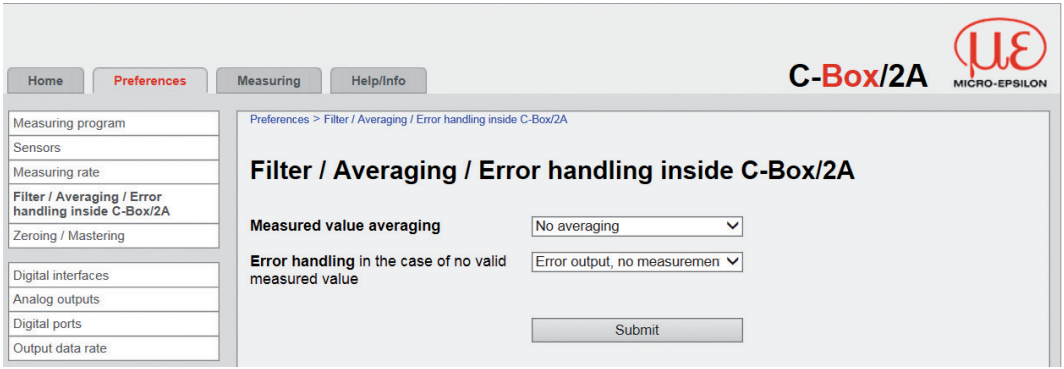
With synchronization off the measuring rate can be entered freely. Value range: from 0.4 to 80 kHz. Otherwise the available measuring rates are given by the connected sensors/controllers as enumerated in the table

Sensor / Controller	Measuring rate
ILD 1420	0.25 / 0.5 / 1 / 2 / 4 kHz
ILD 1750	0.3 ... 7.5 kHz (continuously adjustable) 7.5 kHz / 5 kHz / 2.5 kHz / 1.25 kHz / 625 Hz / 300 Hz (adjustable)
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. 19 Preset measuring rates

5.5.6 Filter / Averaging / Error Handling inside C-Box/2A

➡ Go to the menu `Preferences` > `Filter / Averaging / Error handling inside C-Box/2A`.



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/2A	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	*2/ 4 / 8 / 16 / 32 / 64 / 128 / 256 / 512 / 1024 / 2048 / 4096 / 8192 / 16384 / 32768*
			Number of values for median filter	*3 / 5 / 7 / 9*
	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. 5.5.4.

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. 5.5.4.

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. 5.5.4.

Fields with a grey background require a selection.

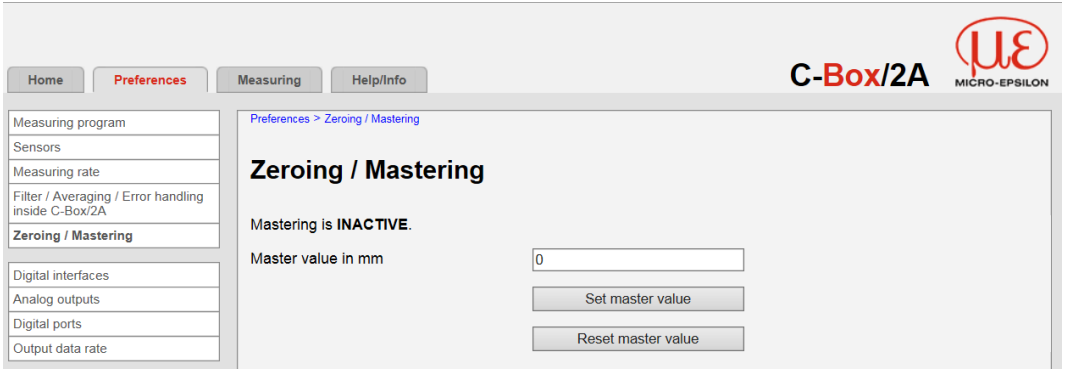
Value — Dark bordered fields require the specification of a value.

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, see Chap. 5.5.4.

5.5.7 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*	

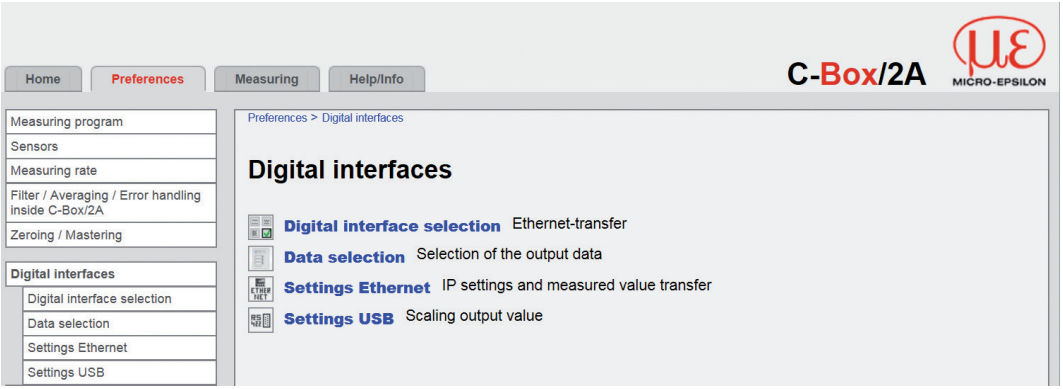
Fields with a grey background require a selection.

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

5.5.8 Digital Interfaces

5.5.8.1 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.
			USB	The interface with a low data rate for transmitting measured data values is provided by the USB interface. The configuration is carried out via ASCII commands, see Chap. A 2.4.24. USB Settings, see Chap. 5.5.8.4.
			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. A 2.4.25. Ethernet Settings, see Chap. 5.5.8.3.
			Web diagram	The measured data values are shown in the diagram on page Measuring, see Chap. 5.5.17.

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 analog interfaces should be used.

Fields with a grey background require a selection.

Value

Dark bordered fields require the specification of a value.

5.5.8.2 Data Selection

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

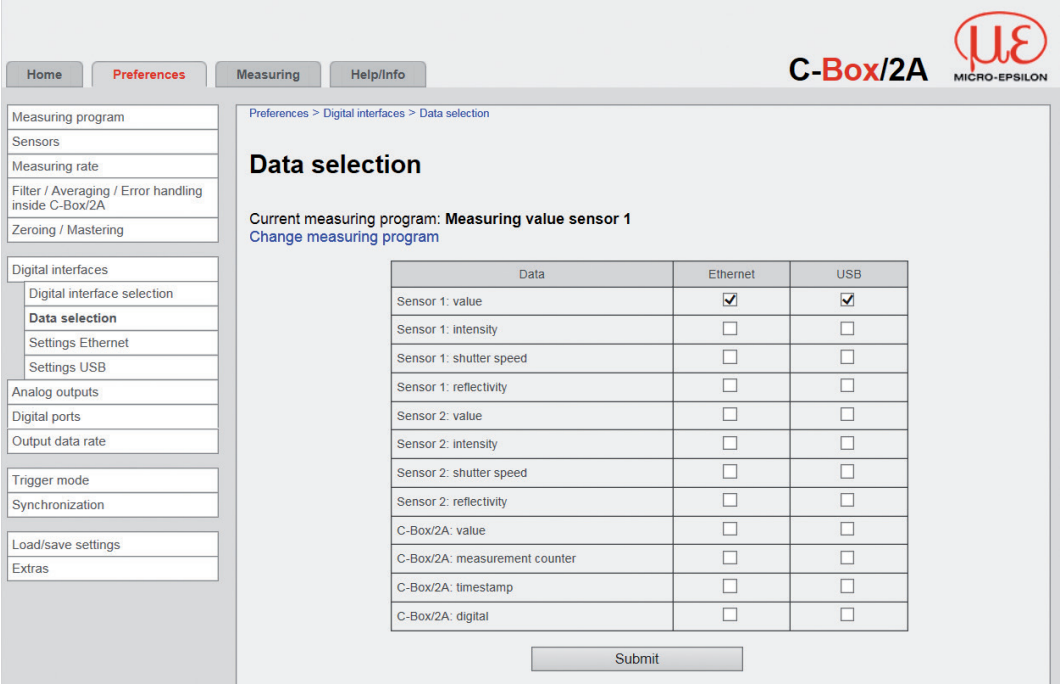


Fig. 20 View Digital interfaces - Data selection

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. 20`, is selected, that means only one sensor is connected to the C-Box/2A.

Over the link `Change measuring program` you can operate a further sensor for the thickness or step measurement, see Chap. 5.5.3.

Please use the C-Box/2A-Tool. You will find the C-Box/2A-Tool on the MICRO-EPSILON website under

https://www.micro-epsilon.de/accessories/C-Box-2A/

5.5.8.3 Ethernet Settings

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

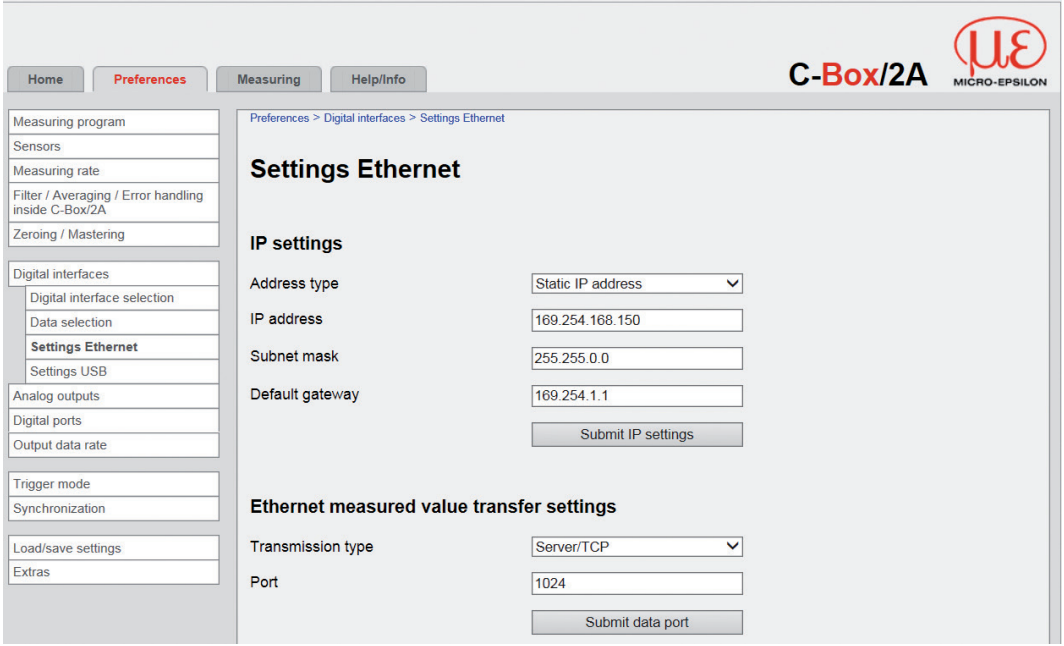


Fig. 21 View Ethernet settings

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/2A provides the measured values as a server (Transmission-type: Server/TCP).
		Port	*Value*	

A self-written program 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.

5.5.8.4 Settings USB

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

Settings USB	Scaling	*Standard scaling*	Standard scaling outputs the entire measuring range of the sensor/controller.
		Two-point scaling	Two-point 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.

Fields with a grey background require a selection.

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

5.5.9 Analog Outputs

Go to the menu `Preferences` > `Analog Outputs`.

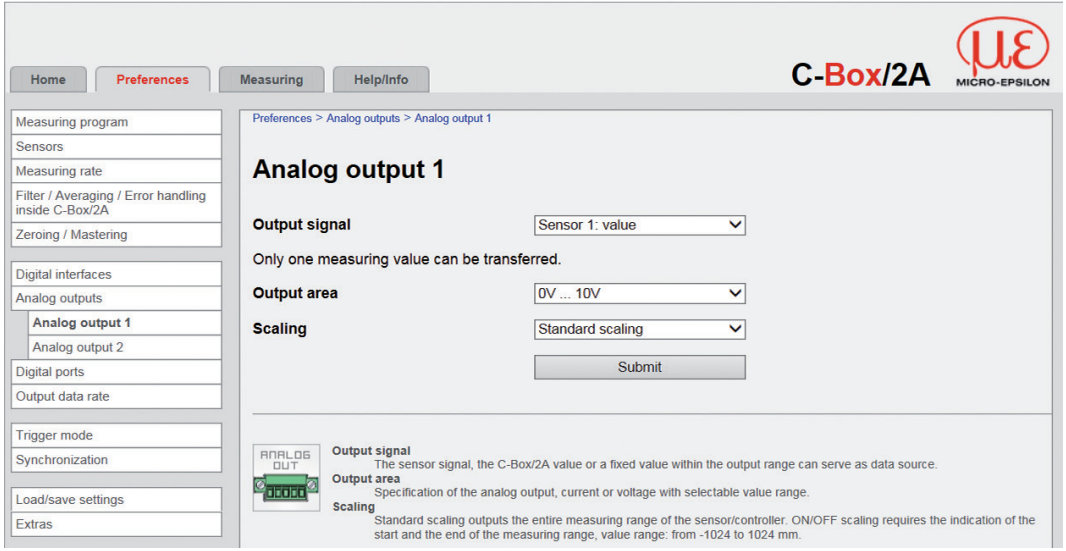


Fig. 22 View Preferences - Analog outputs

You can determine the output signal, the output area and the scaling in this view.

The output signal can be a sensor signal, see Fig. 22, the measurement value from C-Box/2A or a fixed value within the output area.

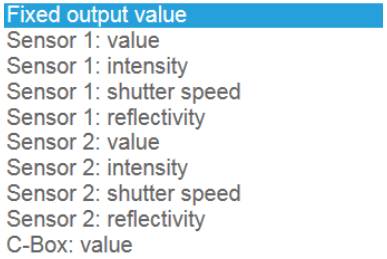


Fig. 23 Section drop down menu Analog output - Output signal

This also applies for the menu `Sensors` > `Sensor 1` > `Measured value averaging` and `Sensors` > `Sensor 2` > `Measured value averaging`, see Chap. 5.5.4.

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

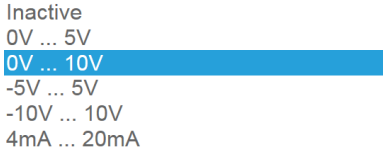


Fig. 24 Section drop down menu Analog output - Output area

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/2A result or a fixed value within the output range can serve as data source.
		Sensor 1/2: value			
		Sensor 1/2: intensity			
		Sensor 1/2: shutter speed			
		Sensor 1/2: reflectivity			
		C-Box/2A: 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.
		Two-point scaling			Two-point 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*		

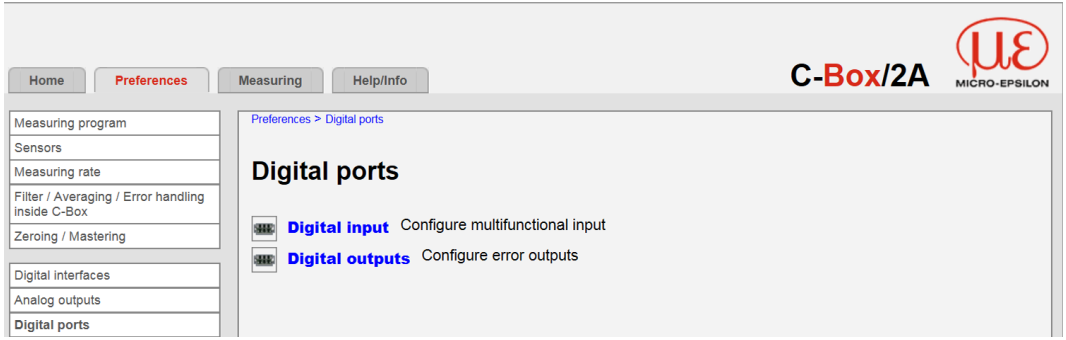
Fields with a grey background require a selection.

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

1) Only one measured value can be transmitted.

5.5.10 Digital Ports

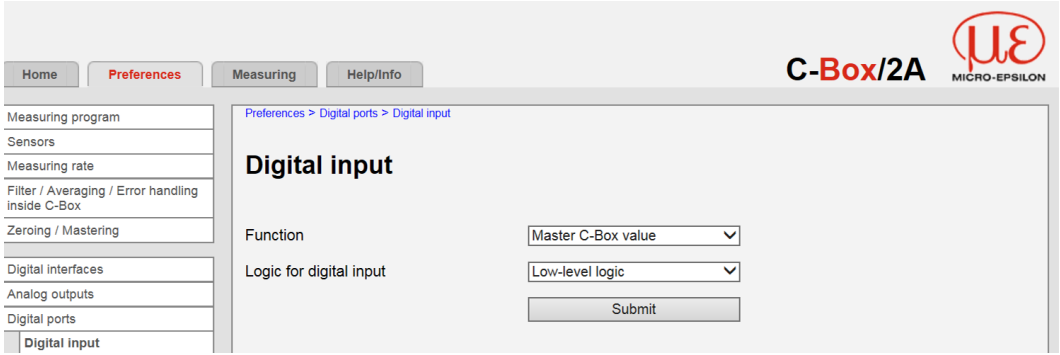
Go to the menu Preferences > Digital ports.



You can adjust the function input in the Digital input, see Chap. 5.5.10.1.

You can adjust the error outputs in the Digital outputs, see Chap. 5.5.10.2.

5.5.10.1 Digital Input



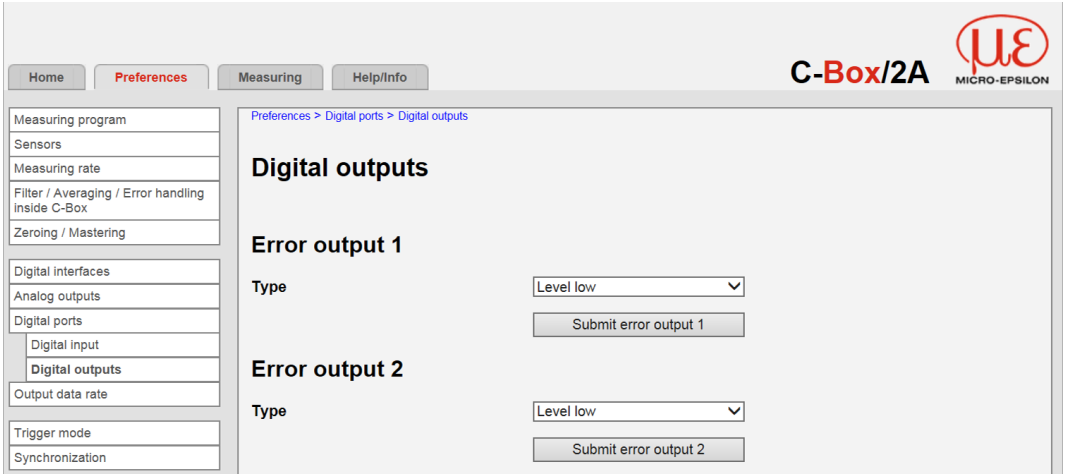
Digital input	Function	*Disabled*	The multifunctional input has no function.
		Master C-Box value	The multifunctional input is master impulse input for the C-Box.
		Forward to sensor 1	The multifunctional input is forwarded to the corresponding input of connected sensor 1.
		Forward to sensor 2	The multifunctional input is forwarded to the corresponding input of connected sensor 2.
		Forward to sensor 1 and 2	The multifunctional input is forwarded to the corresponding inputs of connected sensors 1 and 2.
	Logic for digital input	*Low-level logic*	
		High-level logic	

Fields with a grey background require a selection.

Value

Dark bordered fields require the specification of a value.

5.5.10.2 Digital Outputs



➡ Select the functions of the error outputs .

Digital outputs	Error output 1/2	Type	*Sensor 1/2: error output 1/2*	Outputs the chosen error output of the chosen sensor.
			Sensor 1/2: value	Outputs the range check result of measuring value / intensity value / shutter speed value / reflectivity value of chosen sensor. The allowed range is specified by the Upper- and Lower limit input fields.
			Sensor 1/2: intensity	
			Sensor 1/2: shutter speed	
			Sensor 1/2: reflectivity	
			C-Box/2A: value	Outputs the range check result of C-Box value. The allowed range is specified by the Upper- and Lower limit input fields.
			Level low	Error output is always low.
			Level high	Error output is always high.
			Submit error output 1 / 2	

Fields with a grey background require a selection.

Value

Dark bordered fields require the specification of a value.

5.5.11 Output Data Rate

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

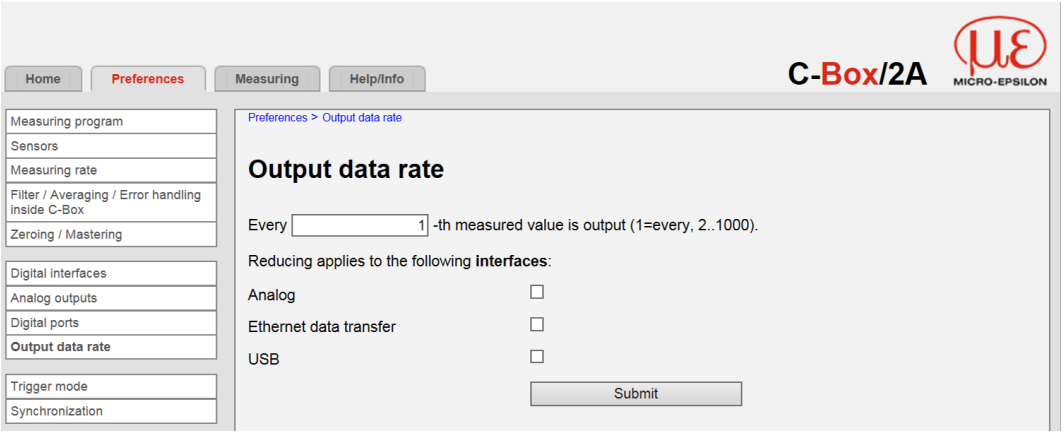
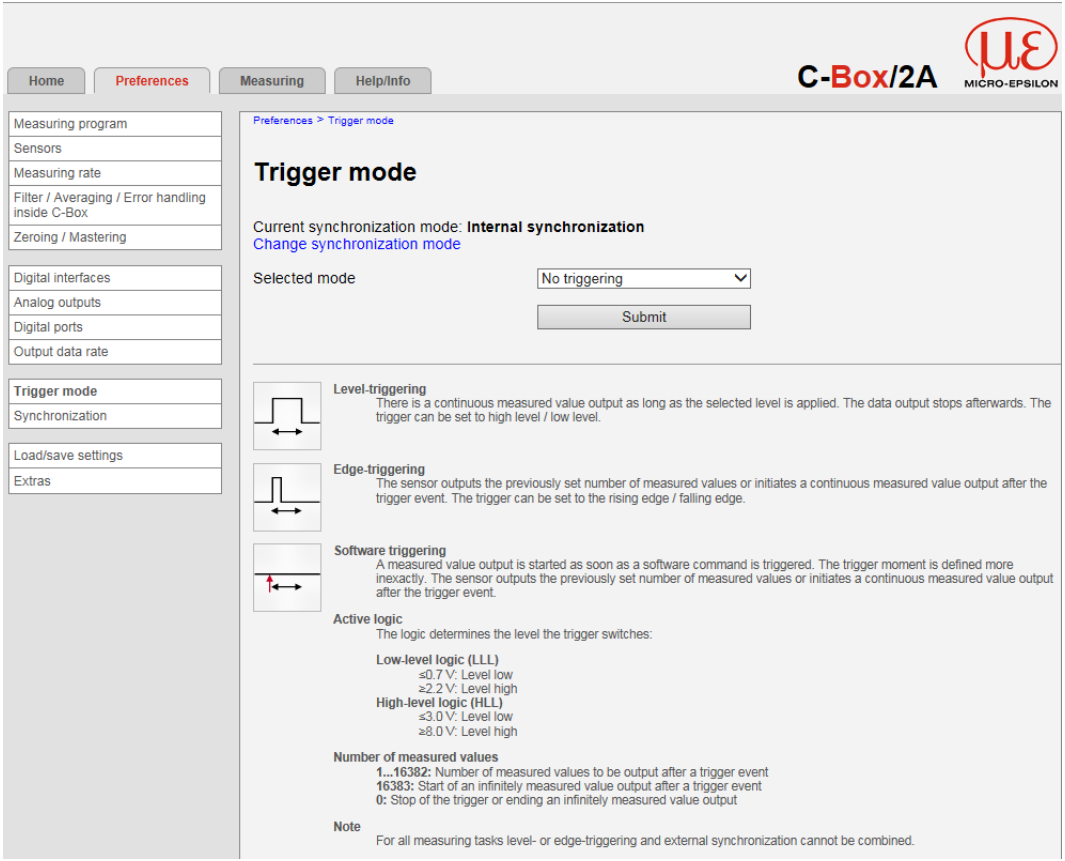


Fig. 26 View Preferences - Output data rate

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 is requested, it has to be set separately, see Chap. 5.5.6.

5.5.12 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. 5.5.13.

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 (HHL)*
			Level low niedrig		*Low-level logic(LLL)*
	Edge-triggering		*Raising edge*		*High-level logic (HHL)*
			Falling edge		*Low-level logic (LLL)*
	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

Number of measured values

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.

5.5.13 Synchronization

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

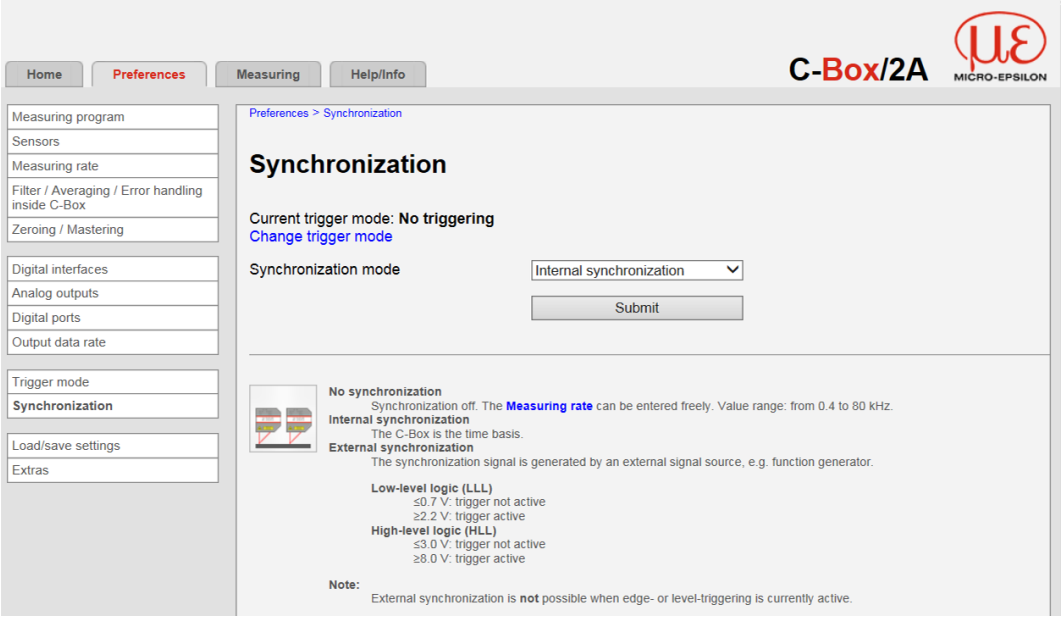


Fig. 27 View Preferences - Synchronization

All sensors can be synchronised from the C-Box/2A. 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/2A 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/2A 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, see Chap. 5.5.5`.

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. 5.5.12.

Fields with a grey background re-quire a selection.

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

5.5.14 Load/Save Settings

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

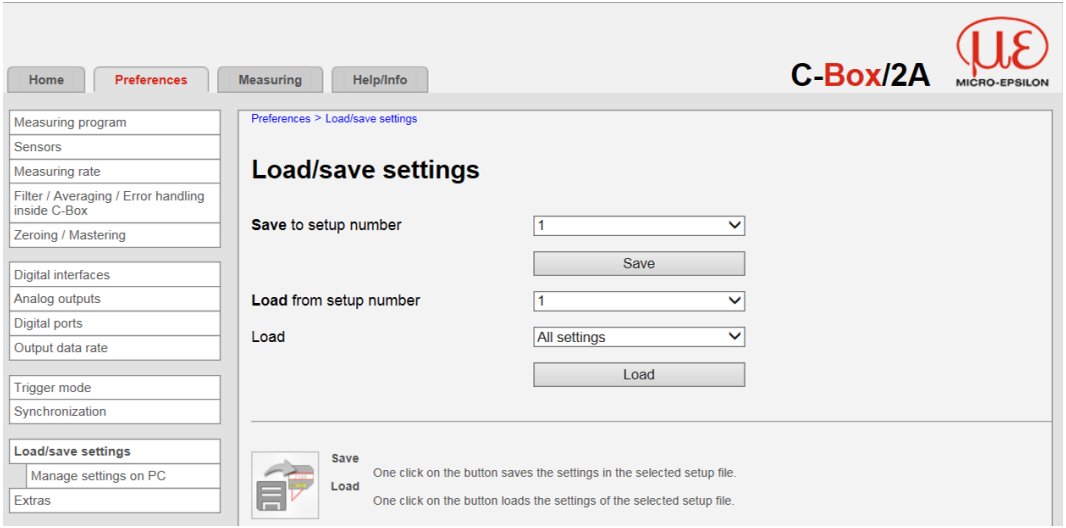


Fig. 28 View Preferences - Load/save settings

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.

i After the programming, store all settings permanently under a setup no.(1 / 2 / 3 ... 8) in the controller, so that they are available again when the C-Box/2A 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.
		Measuring settings only	Only measuring settings

Fields with a grey background require a selection.

Value

Dark bordered fields require the specification of a value.

5.5.15 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. 5.5.14.

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

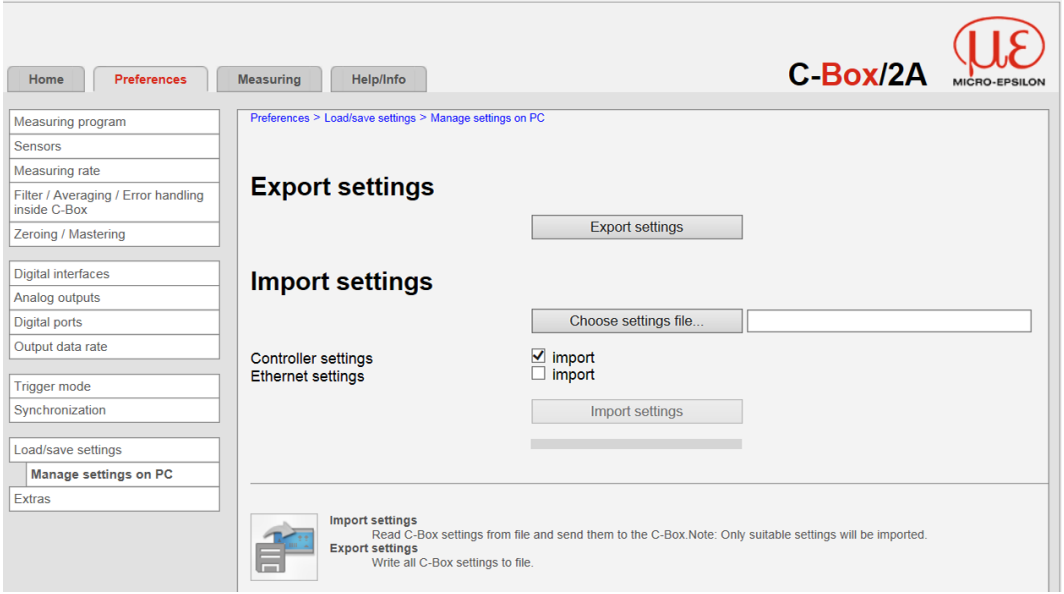


Fig. 29 View Preferences - Manage settings on PC

Export settings

➡ If you want to export the settings, press the button `Export settings, see Fig. 29`.

The Windows dialog `Öffnen von C-Box_2A_Settings` opens, see Fig. 30.

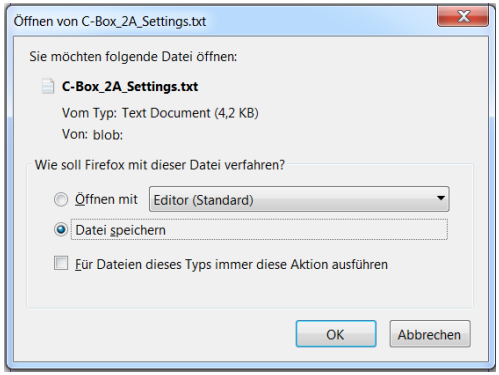


Fig. 30 Windows Dialog Öffnen von C-Box_2A_Settings

➡ Choose `Datei speichern.`

Select a path to save the file.

The current C-Box/2A settings are now saved in this file and can be loaded at any time again.

Import settings

➡ If you want to load respectively to import the settings, press the button `Choose settings file...` under `Import settings, see Fig. 29`.

The Windows dialog `Choose file to upload` opens, see Fig. 31 .

➡ Select a suitable parameter set file and confirm with `Öffnen`.

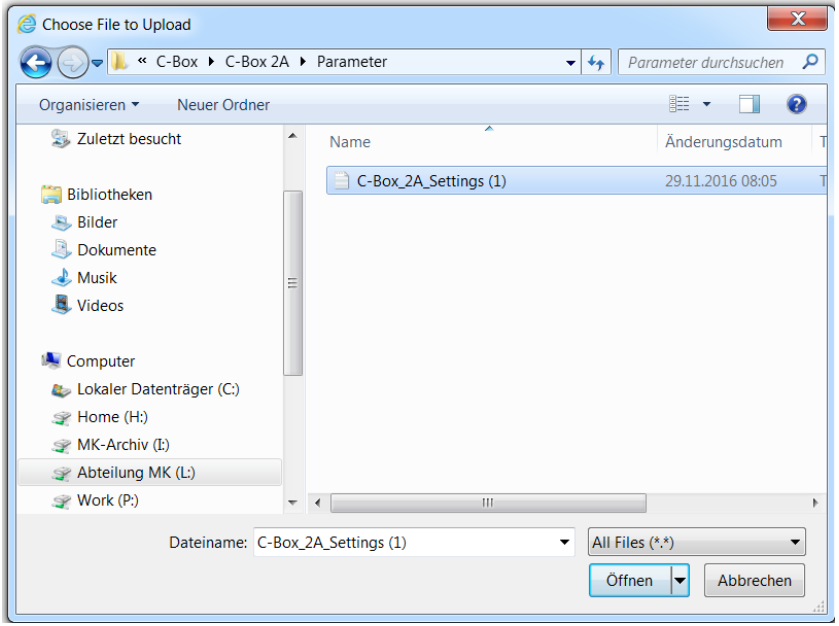


Fig. 31 Windows dialog `Choose file to upload`

Settings of the C-Box/2A are read from the parameter set file and sent to the C-Box/2A.

5.5.16 Extras

5.5.16.1 Language

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

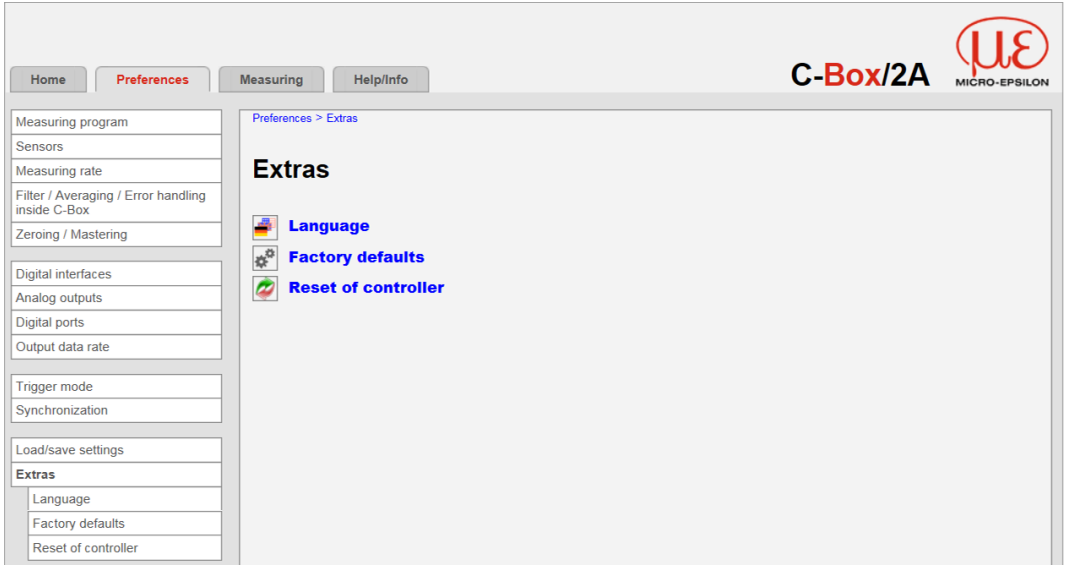


Fig. 32 View Preferences - Extras

Fields with a grey background require a selection.

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

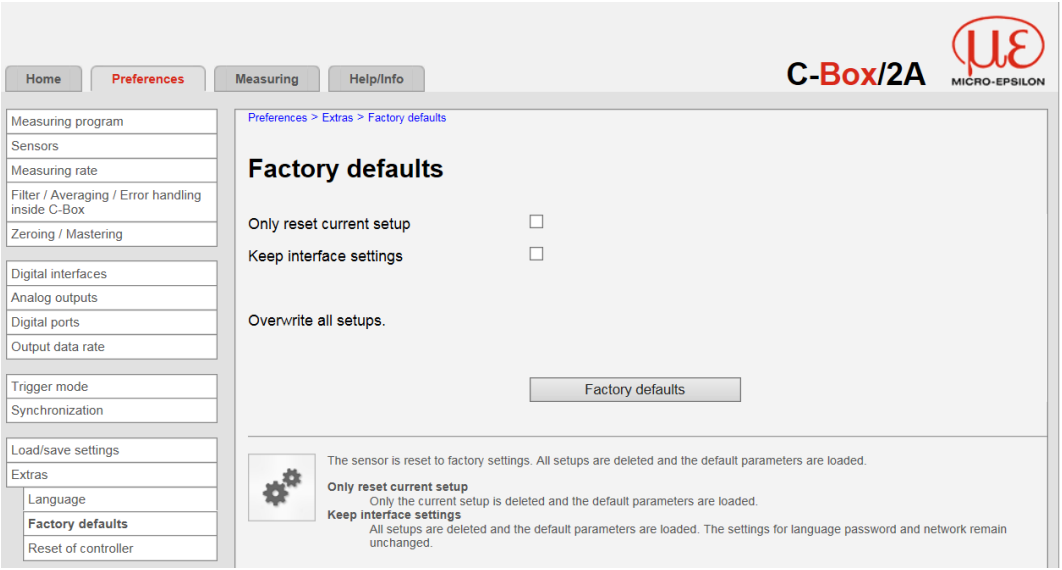
The following menu selection is available:

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. 5.5.2`.

5.5.16.2 Factory Defaults

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



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

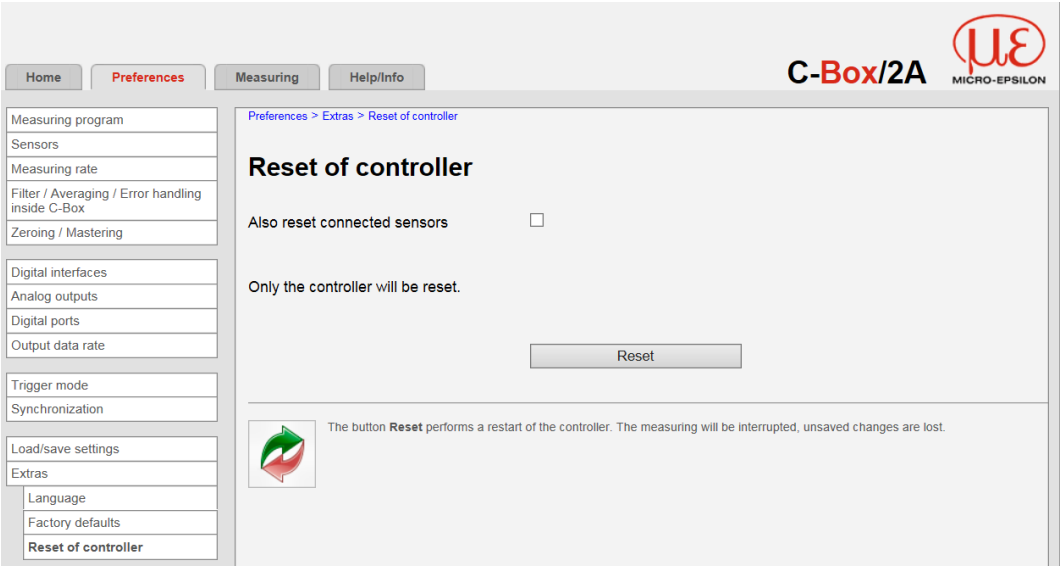
➡ Make the following selection with factory defaults:

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.
Overwrite all setups	☐ ☐	All setups are deleted and the interface parameters are reset.

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

5.5.16.3 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.

5.5.17 Menu Measuring

Go to the menu `Measuring`.

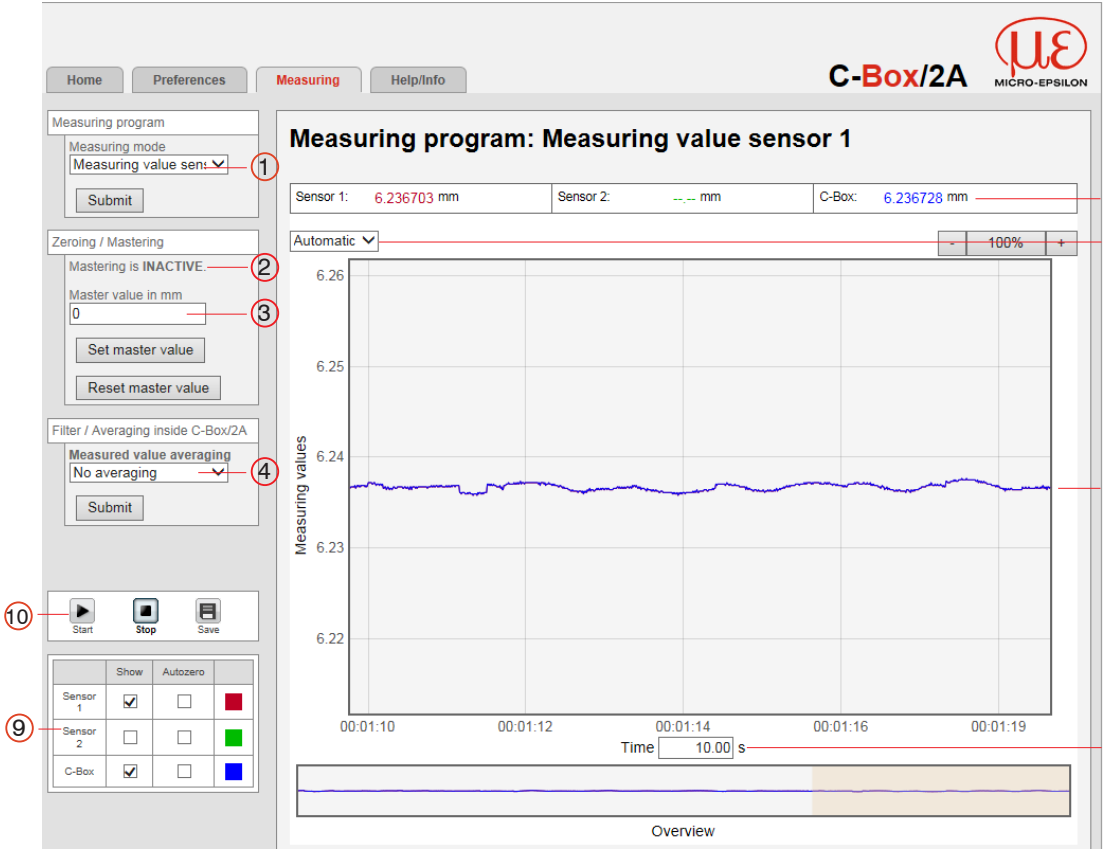


Fig. 33 View menu Measuring - Measuring program

The left window shows the following functions:

1	The Measuring to be effected, which you have already selected, see Chap. 5.5.3, is indicated. You can adjust the measuring program again and confirm with Submit. It is automatically updated in the submenu Measuring program, see Chap. 5.5.3.	
2	Indicates whether Mastering is ACTIVE or INACTIVE, see Chap. 5.5.7. Here, you can set or reset the master value and confirm with Submit. It is automatically updated in the submenu Zeroing / Mastering, siehe Kap. 5.5.7.	
3	The master value can be changed here, see Chap. 5.5.7. The Mastering button resets the selected channel to zero, when 0 is entered in the field Master value in mm.	
4	Shows which measured value averaging has been set in the C-Box/2A, see Chap. 5.5.6. The measured value averaging can also be changed. ➡ Confirm the new value with Submit. The corresponding setting in the submenu Filter/Averaging/Error handling inside the C-Box/2A is automatically updated.	
5	Over the diagram the actual measured values of sensor 1, sensor 2 and C-Box/2A are additionally shown.	
6	Switch on Automatic scaling of the y axis:	➡ Select Automatic from the drop-down menu.
	Switch on Manual scaling:	➡ Select Manual from the drop-down menu. Automatically the lowest and highest value of the scaling of the y axis appears. Die Y axis can be scaled manually.
7	Display of the measured values	
8	Currently displayed time range on the x-axis (in s).	
9	The checkbox Show specifies which channels (sensor 1, sensor 2, C-Box/2A) are displayed in the diagram. The Autozero checkbox sets the selected channel to zero 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 submit the measurement values to the PC by clicking 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 CSV file.	

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

i Only a limited number of measured values can be stored (about 50000). The oldest values will be overwritten when more values are captured.

5.5.18 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.

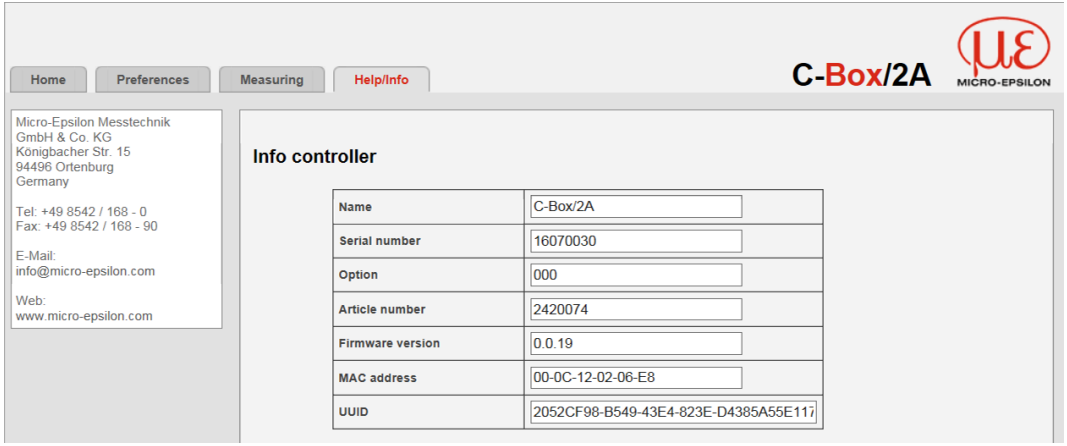
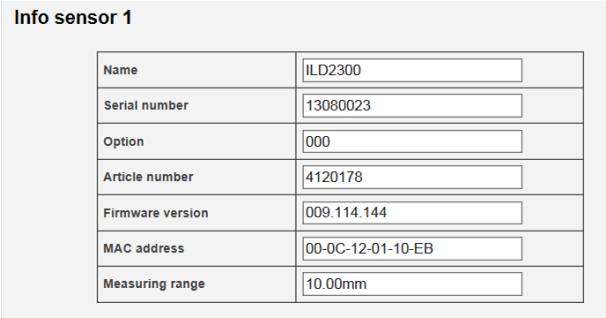


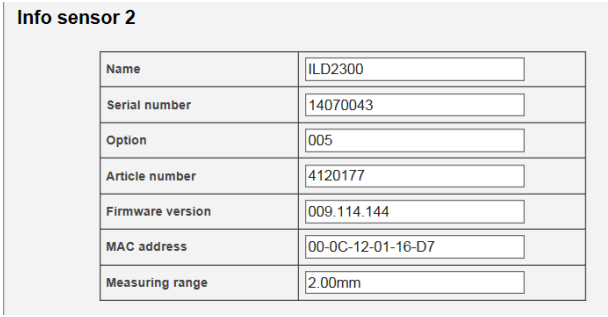
Fig. 34 Menu Help/Info - section 1 - Info controller



Info sensor 1

Name	ILD2300
Serial number	13080023
Option	000
Article number	4120178
Firmware version	009.114.144
MAC address	00-0C-12-01-10-EB
Measuring range	10.00mm

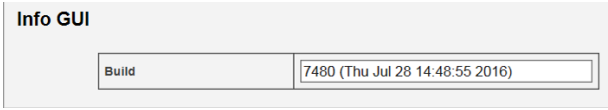
Fig. 35 Menu Help/Info - section 2 - Info sensor 1



Info sensor 2

Name	ILD2300
Serial number	14070043
Option	005
Article number	4120177
Firmware version	009.114.144
MAC address	00-0C-12-01-16-D7
Measuring range	2.00mm

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



Info GUI

Build	7480 (Thu Jul 28 14:48:55 2016)

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

6. Software Support with MEDAQLib

MEDAQLib (Micro-Epsilon Data Acquisition Library) offers you a documented driver DLL. Therewith you embed the C-Box/2A, in combination with

- 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:

https://www.micro-epsilon.com/download/

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

7. Liability for Material Defects

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.

8. Service, Repair

If the controller is defective:

If possible, save the current C-Box/2A settings in a parameter set on your PC, see Chap. 5.5.15, to reimport them into the C-Box/2A after the repair. The opening of the C-Box/2A is only subjected to the manufacturer. In the cause of a fault cannot be clearly identified, please send the entire measuring system 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

➡ Remove all supply and output cables from the C-Box/2A.

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

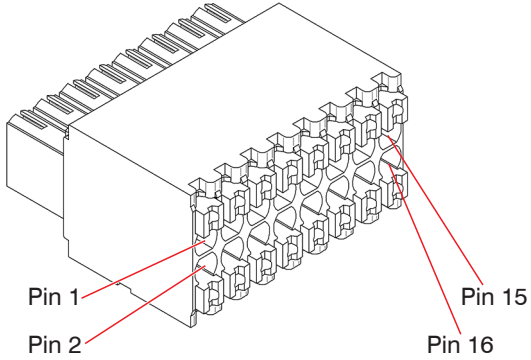


Fig. 38 Pin assignment 16-pin terminal box

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

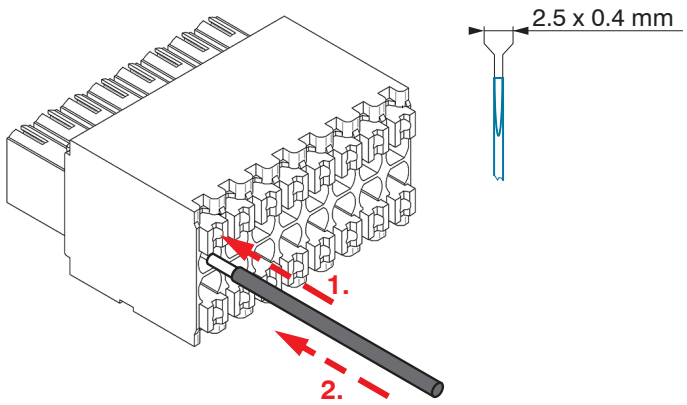
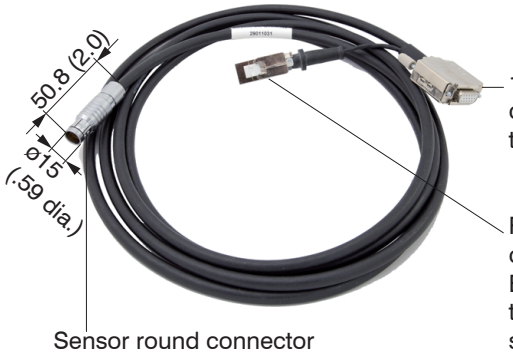


Fig. 39 Steps for wiring the cable clamp

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

1. Press the orange clamping lever inwards.
2. Insert the connecting wire into the terminal.
3. Release the operating slot.

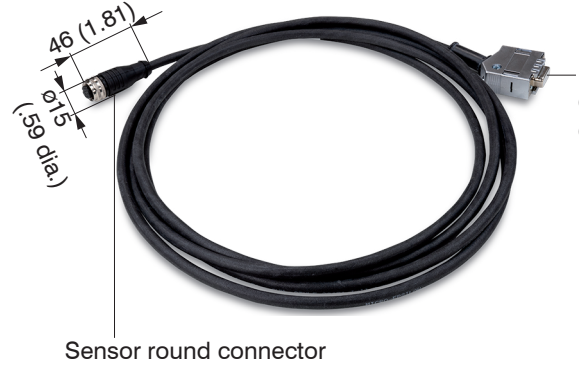
i Please use a screwdriver with a max. blade width of 2.5 x 0.4 mm.



Interface and power supply cable to connect an ILD23xx to a C-Box/2A,
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.



Interface and power supply cable to connect an ILD1420 to a C-Box/2A, cable length x = 3, 6, 9 or 10 m

Fig. 41 PCF1420-3/C-Box power supply and interface cable

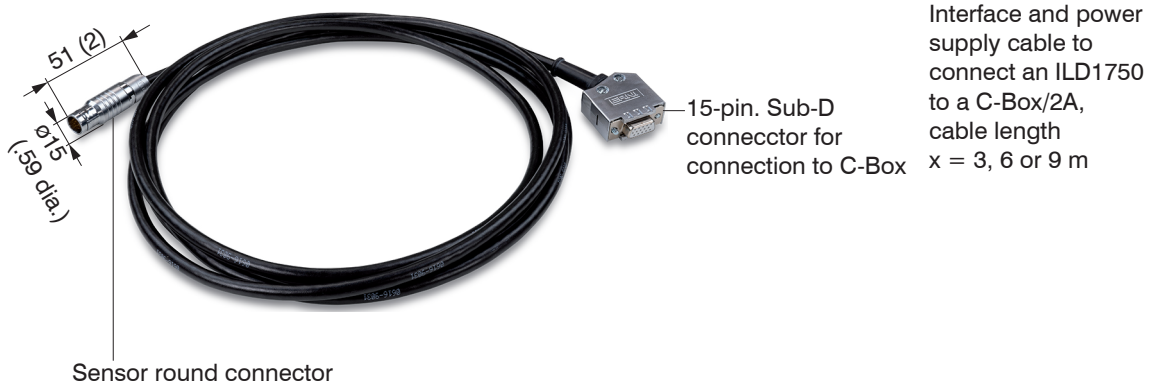


Fig. 42 PC1750-3/C-Box power supply and interface cable

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 Data Protocol

All values to be output at the same time are combined for transmission to a frame. A maximum of 12 values/ frames are possible. The measured values are transmitted via TCP/IP with 32 bit and USB with a maximum of 18 data bits

Structure of a measured value frame:

- Sensor 1 Value
- Sensor 1 Intensity
- Sensor 1 Shutter
- Sensor 1 Reflectivity
- Sensor 2 Value
- Sensor 2 Intensity
- Sensor 2 Shutter
- Sensor 2 Reflectivity
- C-Box Value
- C-Box Counter
- C-Box Timestamp
- C-Box Digital

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), see Fig. 43
- Flags2 (32 bits), see Fig. 44, 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 12). Each measured value has again 32 bits.

The valid ranges for sensor and C-Box/2A values are as follows:

- Via RS422/USB:
  - Sensor measured values and additional values depending on sensor, see also instruction manual optoNCDT 1750 and optoNCDT 2300.
  - C-Box measured values from 0 .. 131071, from 262073 … 262143 (18 bits) error values
  - C-Box Counter von 0 .. 262143 (18 bits)
  - C-Box Timestamp von 0 .. 262143 (18 bits)
  - C-Box Digital von 0 .. 262143 (18 bits)
- Via TCP/IP (Ethernet):
  - Sensor measured values and additional values depending on the sensor, see also instruction manual optoNCDT 1750 and optoNCDT 2300.
  - 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 Counter von INT_MIN bis INT_MAX
  - C-Box Timestamp von INT_MIN bis INT_MAX
  - C-Box Digital von INT_MIN bis INT_MAX

Flag 1 bits	Description		Flag 1 bits	Description
0	Sensor 1 Value		11	Sensor 2 Intensity
1	unused		12	Sensor 2 Shutter
2	Sensor 2 Value		13	Sensor 2 Reflectivity
3	unused		14	C-Box Counter
4	C-Box Value		15	C-Box Timestamp
5 to 7	unused		16	C-Box Digital
8	Sensor 1 Intensity		17 to 30	unused
9	Sensor 1 Shutter		30 to 31	01 (fixed value, to distinguish from C-Box, where it is 00)
10	Sensor 1 Reflectivity			

Fig. 43 Description Flags 1 (Ethernet)

Flag 2 bits	Description
0 up to 31	0

Fig. 44 Description Flags 2 (Ethernet)

Value	Interface	Value range
Sensor 1 Value, Sensor 2 Value, C-Box Value	USB	0 ... 262072
	Ethernet -INT_MAX ... INT_MAX -11	-2147483647 ... 2147483636
C-Box Counter, C-Box Timestamp, C-Box Digital	USB	0 ... 262143
	Ethernet: -INT_MAX ... INT_MAX	-2147483647 ... 2147483647

Fig. 45 Valid ranges (raw values)

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

Fig. 46 Error ranges (raw values)

Value	Interface	Calculation	Unit
C-Box Value	USB		[mm]
		$\text{Value} = \frac{\text{Digital} * (\text{C-Box Range Max} - \text{C-Box Range Min})}{131072.0} + \text{C-Box Range Min}$	
	Ethernet	$\text{Value} = \frac{\text{Digital}}{1.0e+006}$	[mm]
C-Box Time-stamp	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 Counter	USB	Digital	without
	Ethernet	Digital (unsigned int)	without
C-Box Digital	, see Fig. 48		

Fig. 47 Calculation of the values

C-Box Digital		
Bits	Description	
0	Trigger IN (TRG IN)	Connector input
1	Multi function input (MF IN)	Connector input
2	Laser-ON (Laser)	Connector input
3	Switching output S1 (OUT S1)	Connector output
4	Switching output S1 (OUT S2)	Connector output
5	Multi function output	Sensor1 output
6	Laser-ON	Sensor1 output
7	Switching input 1	Sensor1 input
8	Switching input 2	Sensor1 input
9	Multi function output	Sensor1 output
10	Laser-ON	Sensor2 output
11	Switching input 1	Sensor2 input
12	Switching input 2	Sensor2 input
13 bis 15 (bzw. 31)	reserved (0)	

Fig. 48 Description C-Box Digital

During a restart or after a configuration change at the C-Box/2A this initializes the sensors and the measuring restarts.

A 2.3 Commands Overview

Group	Chapter	Short info
A 2.4.1	Chap. A 2.4.1	Controller information
A 2.4.2	Chap. A 2.4.2	Search sensor
A 2.4.3	Chap. A 2.4.3	Sensor information
A 2.4.4	Chap. A 2.4.4	Read all settings
A 2.4.5	Chap. A 2.4.5	Language setting
A 2.4.6	Chap. A 2.4.6	Synchronization
A 2.4.7	Chap. A 2.4.7	Booting the controller
A 2.4.8	Chap. A 2.4.8	Triggerung
A 2.4.8.1	Chap. A 2.4.8.1	Trigger Selection
A 2.4.8.2	Chap. A 2.4.8.2	Trigger Level
A 2.4.8.3	Chap. A 2.4.8.3	Number of measuring values displayed
A 2.4.8.4	Chap. A 2.4.8.4	Software Trigger pulse
A 2.4.9	Chap. A 2.4.9	Ethernet
A 2.4.10	Chap. A 2.4.10	Setting the measured value server
A 2.4.11	Chap. A 2.4.11	Baudrate
A 2.4.12	Chap. A 2.4.12	Save parameter
A 2.4.13	Chap. A 2.4.13	Load parameter
A 2.4.14	Chap. A 2.4.14	Default settings
A 2.4.15	Chap. A 2.4.15	Measurement mode
A 2.4.16	Chap. A 2.4.16	Measuring rate
A 2.4.17	Chap. A 2.4.17	Measured value averaging controller
A 2.4.18	Chap. A 2.4.18	Measured value averaging sensor

Group	Chapter	Short info
A 2.4.19	Chap. A 2.4.19	Setting masters / zero
A 2.4.20	Chap. A 2.4.20	Selection digital output
A 2.4.21	Chap. A 2.4.21	Output data rate
A 2.4.22	Chap. A 2.4.22	Scale output values
A 2.4.23	Chap. A 2.4.23	Error processing
A 2.4.24	Chap. A 2.4.24	Data selection for USB
A 2.4.25	Chap. A 2.4.25	Data selection for Ethernet
A 2.4.26	Chap. A 2.4.26	Function selection multifunctional input
A 2.4.27	Chap. A 2.4.27	Activate error output, switching output 1
A 2.4.28	Chap. A 2.4.28	Activate error output, switching output 2
A 2.4.29	Chap. A 2.4.29	Limit values
A 2.4.30	Chap. A 2.4.30	Data selection
A 2.4.31	Chap. A 2.4.31	Output range
A 2.4.32	Chap. A 2.4.32	Two-point scaling
A 2.4.33	Chap. A 2.4.33	Send command to connected sensor
A 2.4.34	Chap. A 2.4.34	Laser off / laser on
A 2.4.35	Chap. A 2.4.35	Find C-Box/2A
A 2.5	Chap. A 2.5	Error values via USB
A 2.6	Chap. A 2.6	Error values via Ethernet

A 2.4 Commands

A 2.4.1 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 2.4.2 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 2.4.3 Sensor Information

```
GETINFO1
```

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

Example of a response if a ILD2300 [1] 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/2A, the error `E39 no sensor found` is output.

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

A 2.4.4 Read All Settings

```
PRINT [ALL]
```

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

- ALL: Provides further information

A 2.4.5 Language Setting

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

Language of indicated web pages.

- BROWSER means display language of the web browser.

Default = BROWSER

1) For the ILD 1420 and 1750 accordingly.

A 2.4.6 Synchronization

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

- NONE: Sensors are not synchronized, the C-Box/2A runs with its own clock and takes just available sensor values.
- INTERNAL: C-Box/2A 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)

Default = INTERNAL LLL

A 2.4.7 Booting the Controller

```
RESET [ALL]
```

The C-Box/2A restarts.

- ALL: Also restart the sensors.

A 2.4.8 Triggering

A 2.4.8.1 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 TRIGGERCOUNT)

Default = NONE

A 2.4.8.2 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 2.4.8.3 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 2.4.8.4 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 2.4.9 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.

Default = STATIC 169.254.168.150 255.255.0.0 169.254.1.1

A 2.4.10 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.

Default = SERVER/TCP 1024

A 2.4.11 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

Default = 115200

A 2.4.12 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/2A the last saved data record is always loaded.

A 2.4.13 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 2.4.14 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 are kept temporarily.

A 2.4.15 Measurement Mode

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

Set measurement mode, possible are:
- SENSOR1VALUE: Measured value of sensor 1.
- SENSOR12THICK: 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.
- SENSOR12STEP: Difference from measured value of sensor 1 minus measured value of sensor 2.

Default = SENSOR1VALUE

A 2.4.16 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 2.4.17 Measured Value Averaging Controller

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

Output averaging of the C-Box/2A. The averaging value affects on the C-Box/2A measured value on all interfaces and analog.
- NONE: Measured value averaging not active
- 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)

Default: NONE

A 2.4.18 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.

- NONE: Measured value averaging not active
- 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.

Default = NONE

A 2.4.19 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.

Default = NONE

A 2.4.20 Selection Digital Output

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

Activates data output at the desired interface.

- NONE: No measured value output
- ETHERNET: Output of measured values via Ethernet
- HTTP: Output of measured values over the web page of the C-Box/2A
- USB: Output of measured values via USB

Default = HTTP

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

A 2.4.21 Output Data Rate

```
OUTREDUCE <Output reduction> ([ANALOG] [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

Default = 1 NONE

A 2.4.22 Scale Output Values

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

Sets the scaling of the C-BOXVALUE via 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 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.

Default = STANDARD 0.0 50.0

A 2.4.23 Error Processing

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

Setting the behavior of the measured value output in case of error for the C-Box/2A 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.

Default = NONE

A 2.4.24 Data Selection for USB

```
OUT_USB NONE|([SENSOR1VALUE][SENSOR1INTENSITY][SENSOR1SHUTTER][SENSOR1REFLEC-
TIVITY][SENSOR2VALUE][SENSOR2INTENSITY][SENSOR2SHUTTER][SENSOR2REFLECTIVITY]
[C-BOXVALUE][C-BOXCOUNTER][C-BOXTIMESTAMP][C-BOXDIGITAL])
```

Setting the values to be output via USB.

- NONE: No output via USB
- SENSOR1VALUE: Measured value of Sensor 1
- SENSOR1INTENSITY: Intensity of Sensor 1
- SENSOR1SHUTTER: Shutter speed des Sensor 1
- SENSOR1REFLECTIVITY: Reflectivity of Sensor 1
- SENSOR2INTENSITY: Intensity of Sensor 2
- SENSOR2VALUE: Measured value of Sensor 2
- SENSOR2SHUTTER: Shutter speed des Sensor 2
- SENSOR2REFLECTIVITY: Reflectivity of Sensor 2
- C-BOXVALUE: Calculated value of C-Box
- C-BOXCOUNTER: Counter value of C-Box
- C-BOXTIMESTAMP: Timestamp of C-Box
- C-BOXDIGITAL: Digital inputs/outputs of C-Box

Default = SENSOR1VALUE

A 2.4.25 Data Selection for Ethernet

```
OUT_ETH NONE|([SENSOR1VALUE][SENSOR1INTENSITY][SENSOR1SHUTTER][SENSOR1REFLEC-
TIVITY][SENSOR2VALUE][SENSOR2INTENSITY][SENSOR2SHUTTER][SENSOR2REFLECTIVITY]
[C-BOXVALUE][C-BOXCOUNTER][C-BOXTIMESTAMP][C-BOXDIGITAL])
```

Setting the values to be output via Ethernet.

- NONE: No output via Ethernet
- SENSOR1VALUE: Measured value of Sensor 1
- SENSOR1INTENSITY: Intensity of Sensor 1
- SENSOR1SHUTTER: Shutter time of Sensor 1
- SENSOR1REFLECTIVITY: Reflectivity of Sensor 1
- SENSOR2VALUE: Measured value of Sensor 2
- SENSOR2INTENSITY: Intensity of Sensor 2
- SENSOR2SHUTTER: Shutter time of Sensor 2
- SENSOR2REFLECTIVITY: Reflectivity of Sensor 2
- C-BOXVALUE: Calculated value of C-Box
- C-BOXCOUNTER: Counter value of C-Box
- C-BOXTIMESTAMP: Timestamp of C-Box
- C-BOXDIGITAL: Digital inputs/outputs of C-Box

Default = SENSOR1VALUE

A 2.4.26 Function Selection Multifunctional Input

```
MFIFUNC NONE|MASTER|SENSOR1|SENSOR2|SENSOR12 LLL|HLL
```

Function of the multifunction input, either masters or output to one or both multifunction outputs (sensor).

- NONE: No function
- MASTER: C-Box Mastering
- SENSOR1: Multifunction output for sensor 1
- SENSOR2: Multifunction output for sensor 2
- SENSOR12: Multifunction output for sensor 1 and 2
- LLL: Low Level Logic input
- HLL: High Level Logic input

Default = NONE LLL

A 2.4.27 Activate Error Output, Switching Output 1

```
ERROROUT1 SENSOR1ERROROUT1|SENSOR1ERROROUT2|SENSOR2ERROROUT1|SENSOR2ERROROUT2|S
ENSOR1VALUE|SENSOR1INTENSITY|SENSOR1SHUTTER|SENSOR1REFLECTIVITY|SENSOR2VALUE|SE
NSOR2INTENSITY|SENSOR2SHUTTER|SENSOR2REFLECTIVITY|C-BOXVALUE|LOW|HIGH
```

Select the signal source for the switching output 1 (to the periphery).

The first four switches only one error output of the sensors.

The next nine monitoring values from the sensors or the C-Box.

The last two switch the output to a level by command.

Default = LOW

A 2.4.28 Activate Error Output, Switching Output 2

```
ERROROUT2 SENSOR1ERROROUT1|SENSOR1ERROROUT2|SENSOR2ERROROUT1|SENSOR2ERROROUT2|S
ENSOR1VALUE|SENSOR1INTENSITY|SENSOR1SHUTTER|SENSOR1REFLECTIVITY|SENSOR2VALUE|SE
NSOR2INTENSITY|SENSOR2SHUTTER|SENSOR2REFLECTIVITY|C-BOXVALUE|LOW|HIGH
```

Select the signal source for the switching output 2 (to the periphery).

The first four switches only one error output of the sensors.

The next nine monitoring values from the sensors or the C-Box.

The last two switch the output to a level by command.

Default = LOW

A 2.4.29 Limit Values

```
ERRORLIMIT1 <Lower Limit><Upper Limit>
```

If a measured value respectively calculated value is to be monitored using ERROROUT1, the limits can be set here.

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

```
ERRORLIMIT2 <Lower Limit><Lower limit>
```

If a measured value respectively calculated value is to be monitored using ERROROUT2, the limits can be set here.

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

Default = 0.0 0.0

A 2.4.30 Data Selection

```
ANALOGOUT1 SENSOR1VALUE|SENSOR1INTENSITY|SENSOR1SHUTTER|SENSOR1REFLECTIVITY|SEN
SOR2VALUE|SENSOR2INTENSITY|SENSOR2SHUTTER|SENSOR2REFLECTIVITY|C-BOXVALUE|FIXED
[Wert]
```

Selection of the signal to be output via the analog output1.

For FIXED, the voltage / current value is indicated with four decimal places.

```
ANALOGOUT2 SENSOR1VALUE|SENSOR1INTENSITY|SENSOR1SHUTTER|SENSOR1REFLECTIVITY|SEN
SOR2VALUE|SENSOR2INTENSITY|SENSOR2SHUTTER|SENSOR2REFLECTIVITY|C-BOXVALUE|FIXED
[Wert]
```

Selection of the signal to be output via the analog output2.

For FIXED, the voltage / current value is indicated with four decimal places.

Default = SENSOR1VALUE

A 2.4.31 Output Range

```
ANALOGRANGE1 NONE|0-5V|0-10V|-5-5V|-10-10V|4-20mA
```

- NONE: No analog output (inactive)
- 0 - 5 V: The analog output1 outputs a voltage of 0 to 5 Volt.
- 0 - 10 V: The analog output1 outputs a voltage of 0 to 10 Volt.
- -5 - 5 V: The analog output1 outputs a voltage of -5 to 5 Volt.
- -10 - 10 V: The analog output1 outputs a voltage of -10 to 10 Volt.
- 4 - 20 mA: The analog output1 outputs a current of 4 to 20 milliamperes.

```
ANALOGRANGE2 NONE|0-5V|0-10V|-5-5V|-10-10V|4-20mA
```

- NONE: No analog output (inactive)
- 0 - 5 V: The analog output2 outputs a voltage of 0 to 5 Volt.
- 0 - 10 V: The analog output2 outputs a voltage of 0 to 10 Volt.
- -5 - 5 V: The analog output2 outputs a voltage of -5 to 5 Volt.
- -10 - 10 V: The analog output2 outputs a voltage of -10 to 10 Volt.
- 4 - 20 mA: The analog output2 outputs a current of 4 to 20 milliamperes.

Default = 0-10V

A 2.4.32 Two-point Scaling

```
ANALOGSCALE1 STANDARD|(TWOPOINT <Minimum Measured Value> <Maximum Measured
Value>)
```

Setting the scaling of analog output1.

The standard scaling is for distances -MR/2 to MR/2, for thickness measurement 0 to 2 MR (MR = measuring range), for intensity 0 to 100 %

If the minimum and maximum measured value is ‚0', the standard scale is used.

The minimum and maximum measured value must be indicated in millimeters (distance/thickness) respectively % (intensity).

The available output range of the analog output is then divided between the minimum and maximum measured value. The minimum and maximum measured value must be between -1024.0 and 1024.0 mm, four decimal places.

```
ANALOGSCALE2 STANDARD|(TWOPOINT <Minimalum Measred Value> <Maximum Measured
Value>)
```

Setting the scaling of analog output2.

The standard scaling is for distances -MR/2 to MR/2, for thickness measurement 0 to 2 MR (MR = measuring range), for intensity 0 to 100 %.

If the minimum and maximum measured value is ‚0', the standard scale is used.

The minimum and maximum measured value must be indicated in millimeters (distance/thickness) respectively % (intensity).

The available output range of the analog output is then divided between the minimum and maximum measured value. The minimum and maximum measured value must be between -1024.0 and 1024.0 mm, four decimal places.

Default = STANDARD

A 2.4.33 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/2A 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/2A 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 2.4.34 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 2.4.35 Find C-Box/2A

Search the C-Box/2A by using the Sensorfinder, see Chap. 5.4.2.

A 2.5 Error Values via USB

262073	USB scaling underflow
262074	USB 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 2.6 Error Values via Ethernet

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

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