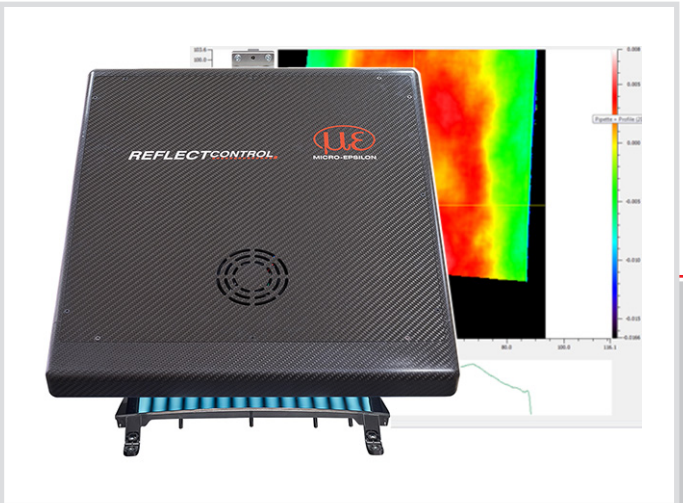
MICRO-EPSILON



Operating Instructions

reflectCONTROL Sensor

RCS130-160

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Contents

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.
Measurement	Indicates hardware or a software button/menu.

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 sensor and/or the controller

NOTICE

Avoid impacts and shocks to the system.

> Damage to or destruction of the system

Protect the cables against damage.

> Failure of the measuring device

1.3 Notes on Product Marking

1.3.1 CE Marking

The following apply to the reflectCONTROL Sensor RCS130-160 series:

- EU Directive 2014/30/EU
- EU Directive 2011/65/EU

Products which carry the CE mark satisfy the requirements of the EU directives cited and the relevant applicable harmonized European standards (EN). The measuring system is designed for use in industrial and laboratory applications.

The EU Declaration of Conformity and the technical documentation are available to the responsible authorities according to the EU Directives.

1.3.2 UKCA Marking

The following apply to the reflectCONTROL Sensor RCS130-160 series:

- SI 2016 No. 1091:2016-11-16 The Electromagnetic Compatibility Regulations 2016
- SI 2012 No. 3032:2012-12-07 The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012

Products which carry the UKCA mark satisfy the requirements of the directives cited and the relevant applicable standards. The sensor is designed for use in industrial environments.

The UKCA Declaration of Conformity and the technical documentation are available to the responsible authorities according to the UKCA Directives.

1.4 Intended Use

The measuring system is designed for use in an industrial environment.

It is used for non-contacting surface inspection of highly reflecting materials, quality monitoring and dimensional inspection.

The measuring system must only be operated within the limits specified in the technical data, see 2.4.

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

- Area between camera and target must not be soiled (for example water, abrasion, dust etc.).
- Temperature range:
  - Operation: 0 ... +40 °C (+32 ... +104 °F), (for 3D measurements: max. fluctuation of ±2 °C after referencing)
  - Storage: -10 ... +60 °C (+14 ...+140 °F)
- Humidity: 10 … 80 %, non-condensing (for 3D measurements: max. fluctuation of ±2 % after referencing)
- Ambient pressure: Atmospheric pressure
- Area between sensor and target must be free of water, abrasion, dust etc.

1.6 Software Security

The following important information must be observed for all application software based on reflectCONTROL. The modification of hardware or software components is essentially not permitted. Exceptions must be approved of in writing by Micro-Epsilon Messtechnik GmbH & Co. KG.

The automatic start of software components that do not originate from Micro-Epsilon Messtechnik GmbH & Co. KG and which run in the background of the measurement process is not permitted. During the use of virus scanners there may be limitations in system availability.

The integration of systems from Micro-Epsilon Messtechnik GmbH & Co. KG into networks must only be performed by qualified personnel. In doing so, the system operator is responsible for security on the network.

Micro-Epsilon Messtechnik GmbH & Co. KG shall accept no claims arising from non-observance of these safety instructions.

2. Functional Principle, Technical Data

2.1 Measuring Principle

The reflectCONTROL Sensor automatically inspects highly reflecting surfaces.

1 reflectCONTROL Sensor

2 Holder [1]

3 Supporting surface for the target/object [1]

Fig. 1 Full view of the measuring system

The reflectCONTROL Sensor operates according to the principle of phase measuring deflectometry. The measurement technique is particularly suitable for defect detection and measurement of flat reflecting surfaces. With deflectometry, the surface itself is not examined but its optically distorted or intensity weakening effect which shows itself in the mirror image of a pattern. In the process, a sine pattern is shown on a display and then the reflection of this pattern is recorded by a camera. A few images are recorded using a CCD camera between phase displacements of the displayed pattern and curvatures and intensity amplitudes over the entire surface are algorithmically determined using the data obtained.

For the 3D measurement, simultaneous image acquisition by two cameras from different directions is performed. The combined evaluation of the data of both cameras enables a stable 3D reconstruction of the target.

Referencing is required for the 3D reconstruction. The positions of the cameras, the screen and the imaging characteristics of the cameras are determined here using a special referencing mirror. The 3D reconstruction provides a point cloud with X/Y/Z coordinates.

1) Not included in delivery

2.2 Structure

The compact system contains all the necessary components for the measurement in one housing.

2.3 Requirements for the Target

The prerequisite for deflectometry is that the striped pattern can be recorded by the camera via the target. As flat and reflecting as possible surfaces are optimal. Convex curved targets (beams are scattered) may have to be examined from multiple measurement positions.

2.4 Technical Data

Model		**RCS130-160**
Measurement area Length x width (x * y) [1]	in reference plane	170 mm x 160 mm
Acquisition of measurement data		approx. 1.2 s … 6 s
Evaluation		approx. 2 s … 8 s
Resolution	x, y	100 µm
Planarity measurement error	z [2]	< 1 µm
Supply voltage		24V DC (must not exceed 26 V)
Power consumption		< 50 W
Interfaces and connections		1 x GigE Vision (RJ45), 1 x Ethernet (RJ45), power supply (3-pin Lemo connector)
Mounting		mechanically reproducible adapter flange
Temperature range	Storage	-10 ... +60 °C (+14 ...+140 °F)
	Operation [2]	0 °C … +40 °C (+32 °F ... +104 °F) (for 3D measurements: max. fluctuation of ±2 °C after referencing)
Humidity [2]		10 % … 80 %, non-condensing (for 3D measurements: max. fluctuation of ±2 % after referencing)
Design		carbon housing with controlled fan, design with integrated controller
Weight		< 7 kg

1) Size specifications refer to the reference plane. Trapezoidal measuring field - the medium width is specified. Exact dimensions, see Fig. 2.

2) Measured after referencing with a plane mirror (Ø 300 mm and a flatness of lambda/10) at a max. distance tolerance of ±0.1 mm. After referencing, a maximum temperature fluctuation of ± 2 °C and change of humidity of ±2 % are to be complied with.

3. Delivery

3.1 Unpacking/Included in Delivery

1 Measuring system

1 24V supply cable, open ends

1 Operating instructions

- Carefully remove the components of the measuring system from the packaging and ensure that the goods are forwarded in such a way that no damage can occur.
- Check the delivery for completeness and shipping damage immediately after unpacking.
- If there is damage or parts are missing, immediately contact the manufacturer or supplier.

3.2 Storage

Temperature range (storage): -10 ... +60 °C (+14 ...+140 °F)

Humidity: 10 % ... 80 % (non-condensing)

4. Installation and Assembly

4.1 Precautions

No sharp or heavy objects should be allowed to affect the cable sheath.

Avoid folding the cables. Check the plug-in connections for firm seating.

The measuring system is an optical system used to measure in the µm range.

Ensure careful handling during installation and operation.

4.2 RCS130-160 Dimensions, Measuring Window

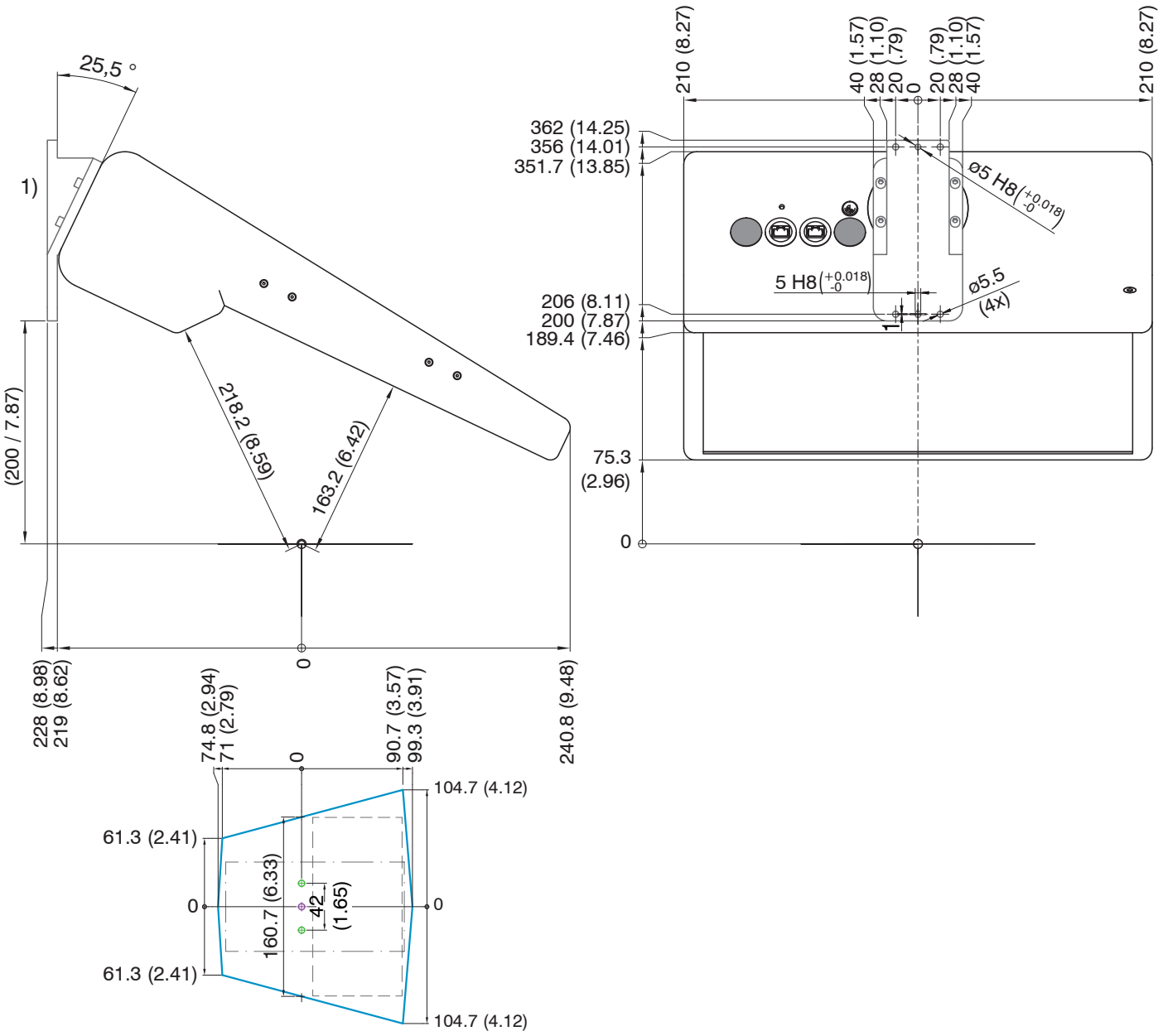


Fig. 2 Dimensional drawing of RCS130-160 measuring system with measuring window

Legend		
		Position of target/object
		Outer boundary of measuring field
		Piercing points of both cameras' main beams
		Zero point of the measuring field's coordinate system

1) Optionally available mounting adapter, see A 1

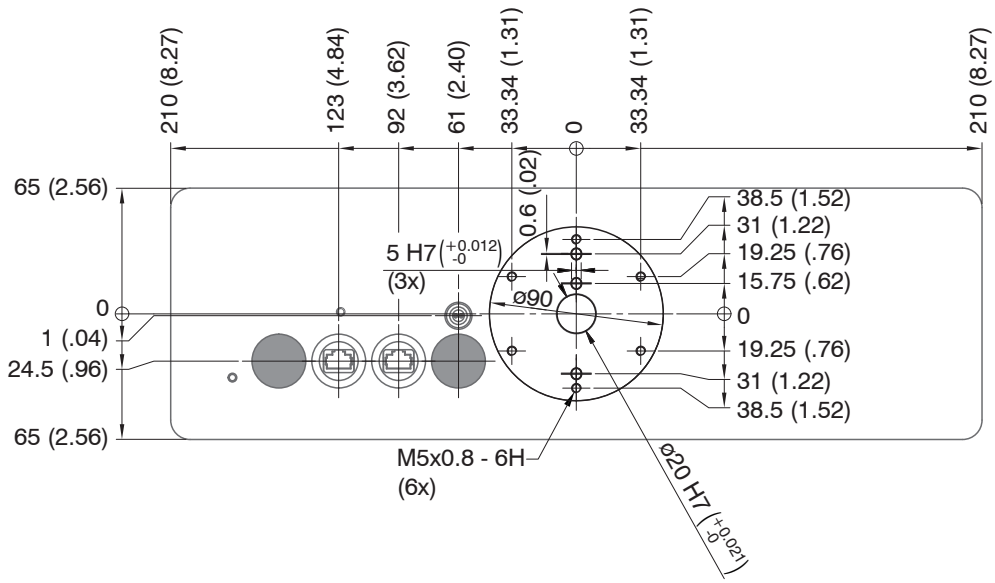
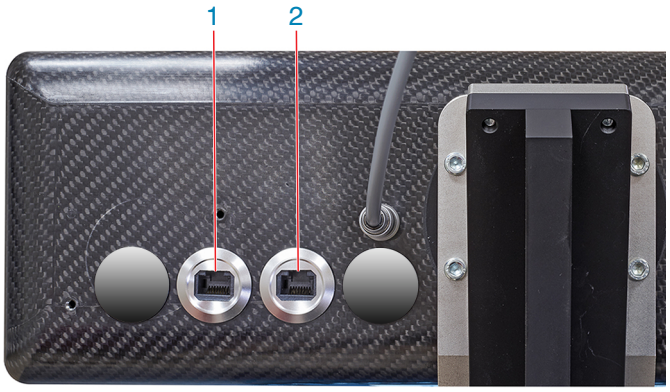


Fig. 3 Dimensional drawing of mounting bores

4.3 Electrical Connections, Interfaces

4.3.1 Interfaces

The measuring system has the following interfaces:



1 Ethernet diagnosis interface

2 GigE Vision
Parameter setting and process control

1000 Mbps,
RJ45 connection

Fig. 4 Rear view of RCS130-160 with interface connections

4.3.2 Connection Options

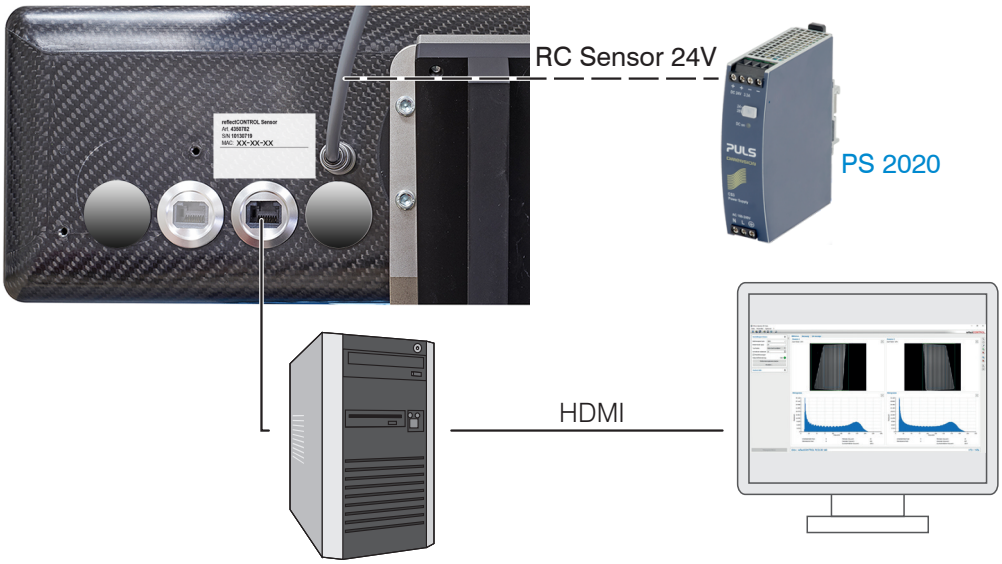
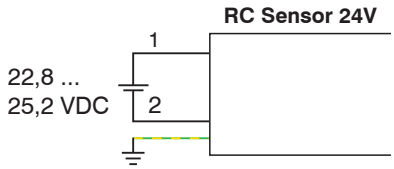


Fig. 5 Connection plan for standard operation

4.3.3 Supply Voltage

Nominal value: 24 V DC (22.8 ... 25.2 V, P < 60 W).

- Only turn on the power supply after wiring has been completed.
- Connect the inputs “1” and “2” at the sensor with a 24V power supply.



Cable RC Sensor 24V	Assignment
black (1)	+24 V
black (2)	Ground
yellow/green	PE

Fig. 6 Supply voltage connection

Use the power supply only for measuring devices; do not use it at the same time for drives or similar sources of impulse interference. MICRO-EPSILON recommends using the optionally available PS2020 power supply, for the sensor, see A 1.

5. Operation

5.1 General

The software is installed on the sensors at the factory. The user is not required to perform any installation. The sensor is accessed via GenICam/GigE Vision from Version 2.1.

The package includes a download link to the client software from Micro-Epsilon. This package consists of the `3DInspect` software and an SDK with corresponding sample programs.

`3DInspect` can be installed on Windows 8/10 (64-bit) computers and enables

- the setting of system parameters,
- the execution of measurements and
- the visualization of measurement results.

The measurement data generated can be exported in different standard formats.

5.2 Process to Turn On and Turn Off

5.2.1 Turning On

The system starts when the supply voltage is applied. The controller in the sensor starts the boot process.

The system will be operational after a startup time of approx. 60 sec.

It can then be connected to any compatible software via GigE Vision, e.g., `3DInspect` by Micro-Epsilon.

5.2.2 Turning Off

Turn off the system as follows:

➡ Disconnect the 24V power supply.

5.3 Positioning Target

The surface of the target must be in the depth of field range of the lenses both for the defect detection as well as for the 3D reconstruction. The tolerances for the vertical positioning are approx. 40 µm (-20 µm to +20 µm).

The dimensions of the measuring fields that the target must be located within can be found in the dimensional drawing, see Fig. 2.

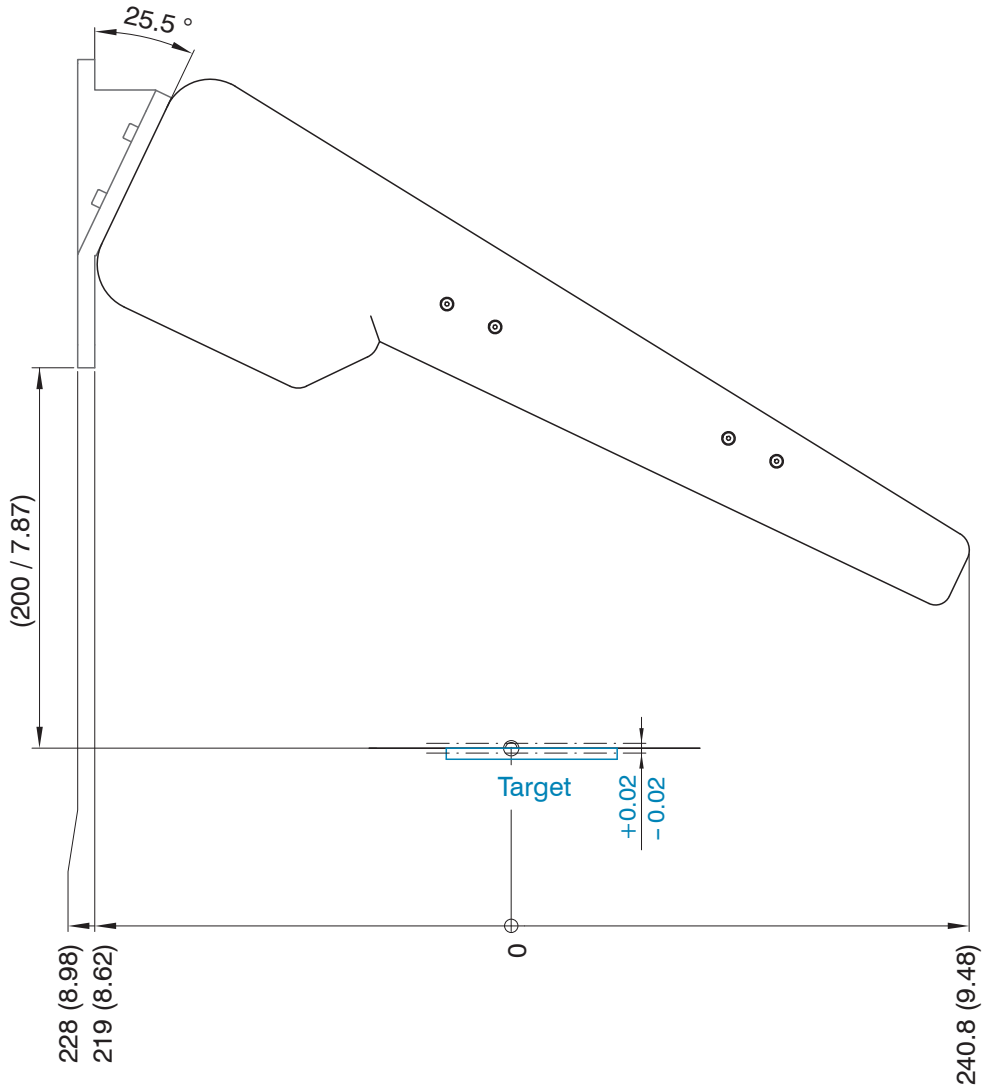


Fig. 7 Vertical tolerance field for the target surface

➡ Position the measuring system so that it is level.

5.4 Shading

Lateral scattered light on the target can cause measurement inaccuracies.

i Avoid scattered light, e.g. bright daylight, on the target.

Shade the measurement environment if required.

5.5 Measurement Procedure

Let the measurement equipment warm up for approx. 15 minutes, 120 minutes for high-precision measurements, before you perform any measurement. This prevents measurement inaccuracies.

The following table shows the most important steps of a measurement process:

Step 1	Positioning target		Chap. 5.3
Step 2	Basic settings, e.g. camera, striped pattern		
Step 3	Image acquisition		
Step 4	2D Data processing	3D Data processing	
	Result images: base intensity, amplitude, curvature	3D point cloud	
Step 5	Save results		

Fig. 8 Measurement process steps, software blocks

Place the target in the object plane for the measurement. Then, the camera (exposure time), the striped pattern and the number of images can be parametrized. Depending on the selected number of images, the image acquisition takes approx. 1 ... 2 s. The result images of the deflectometry are available after the data processing in 2D mode or 3D mode. The expected processing time is 1… 60 s which particularly depends on the `Binning`, `ReconstructionGridsize` and `Patterntype` parameters.

Details about setting the parameters are available in the software description.

Please refer to the appendix, see A 2, for details about the parameters.

6. Disclaimer

All components of the device have been checked and tested for functionality in the factory. However, should any defects occur despite careful quality control, these shall be reported immediately to MICRO-EPSILON or to your distributor / retailer.

MICRO-EPSILON undertakes no liability whatsoever for damage, loss or costs caused by or related in any way to the product, in particular consequential damage, e.g., due to

non-observance of these instructions/this manual,

improper use or improper handling (in particular due to improper installation, commissioning, operation and maintenance) of the product,

repairs or modifications by third parties,

the use of force or other handling by unqualified persons.

This limitation of liability also applies to defects resulting from normal wear and tear (e.g., to wearing parts) and in the event of non-compliance with the specified maintenance intervals (if applicable).

MICRO-EPSILON is exclusively responsible for repairs. It is not permitted to make unauthorized structural and / or technical modifications or alterations to the product. In the interest of further development, MICRO-EPSILON reserves the right to modify the design.

In addition, the General Terms of Business of MICRO-EPSILON shall apply, which can be accessed under Legal details | Micro-Epsilon https://www.micro-epsilon.com/impressum/.

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

7. Service, Repair

For any defect on the system:

- If possible, save the current system settings in a parameter set to reload them into the system after the repair.

If the cause of a fault cannot be clearly identified, please send the entire measuring system to:

MICRO-EPSILON MESSTECHNIK
GmbH & Co. KG
Koenigbacher Str. 15
94496 Ortenburg / Germany

Tel. +49 (0) 8542 / 168-0
Fax +49 (0) 8542 / 168-90
info@micro-epsilon.com
www.micro-epsilon.com

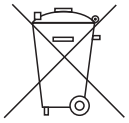
8. Decommissioning, Disposal

In order to avoid the release of environmentally harmful substances and to ensure the reuse of valuable raw materials, we draw your attention to the following regulations and obligations:

- Remove all cables from the sensor and/or controller.
- Dispose of the sensor and/or the controller, 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.
- You are obliged to comply with all relevant national laws and regulations.

For Germany / the EU, the following (disposal) instructions apply in particular:

- Waste equipment marked with a crossed garbage can must not be disposed of with normal industrial waste (e.g. residual waste can or the yellow recycling bin) and must be disposed of separately. This avoids hazards to the environment due to incorrect disposal and ensures proper recycling of the old appliances.



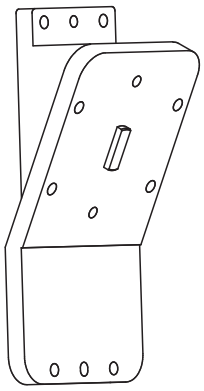
- A list of national laws and contacts in the EU member states can be found at https://ec.europa.eu/environment/topics/waste-and-recycling/waste-electrical-and-electronic-equipment-weee_en. Here you can inform yourself about the respective national

collection and return points.

- Old devices can also be returned for disposal to MICRO-EPSILON at the address given in the imprint at https://www.micro-epsilon.de/impressum/.
- We would like to point out that you are responsible for deleting the measurement-specific and personal data on the old devices to be disposed of.
- Under the registration number WEEE-Reg.-Nr. DE28605721, we are registered at the foundation Elektro-Altgeräte Register, Nordostpark 72, 90411 Nuremberg, as a manufacturer of electrical and/or electronic equipment.

Appendix

A 1 Optional Accessories

rC Sensor adapter		Mounting adapter from AlMg4.5Mn0.7 item 3007154
PS2020		Power supply for DIN rail installation; input 230 VAC, output 24 VDC/2.5 A

A 2 GenICam reflectCONTROL Parameters

Details about setting the parameters are available in the software description, see `3DInspect` operating instructions.

Parameter Description

Observe the notes below if you operate the sensor with a third party library for GenICam/GigE Vision:

- The library must support GigE Vision 2.1. In particular, `MultiPart` mode must be supported.
- Three sources are available to set the parameters of the sensor, see the `SourceSelector` description below. However, data are always transmitted using `StreamChannel 0`. Before starting data transmission with the `AcquisitionStart` command, the entry `Source0` must be selected as `SourceSelector`.
- The network card used should be configured as follows:
  - Jumbo frames: enable/use largest possible value
  - Interrupt moderation: enable
  - Interrupt moderation rate: adaptive
  - Receive buffer: use largest possible value
- The `Coord3D_C32f` pixel format is used for 3D measurements. If this pixel format is not supported by the library used, the `Mono16` pixel format can be used as an alternative. In that case, however, the resolution or measuring range is limited.
- The operating mode and sensor data transmitted are controlled using the parameter `ComponentEnable` and the associated selectors `SourceSelector`, `RegionSelector` and `ComponentSelector`, as well as via `TriggerMode` and `TriggerSoftware`. The following modes are possible, among others:
  - Setup operation (continuous transmission of raw images):
    - TriggerMode = Off
    - ComponentEnable [Source1][Region0][Intensity] = 1
    - ComponentEnable [Source2][Region0][Intensity] = 1
    - Set all other selector combinations for ComponentEnable to 0
  - Measurement mode 2D:
    - TriggerMode = On
    - ComponentEnable [Source1][Region0][Amplitude] = 1
    - ComponentEnable [Source1][Region0][Curvature] = 1
    - ComponentEnable [Source1][Region0][Base] = 1
    - ComponentEnable [Source2][Region0][Amplitude] = 1
    - ComponentEnable [Source2][Region0][Curvature] = 1
    - ComponentEnable [Source2][Region0][Base] = 1
    - Set all other selector combinations for ComponentEnable to 0
    - Trigger a measurement by "TriggerSoftware"
  - Measurement mode 3D:
    - TriggerMode = On
    - ComponentEnable [Source0][Scan3dExtraction0][Range] = 1
    - If you want a mask image for invalid points: ComponentEnable [Source0][Scan3dExtraction0] [Confidence] = 1
    - Set all other selector combinations for ComponentEnable to 0
    - Trigger a measurement by "`TriggerSoftware`"

Name	Locked	Description	Documentation Text
Device Control			
DeviceTemperatureSelector		Selects the location within the device, where the temperature will be measured.	Serves as a switch for the temperature sensor to be read out: DisplayController - temperature of the display controller
DeviceTemperature		Device temperature in degrees Celsius (C).	Temperature of the component selected in the DeviceTemperatureSelector.
DevicePOSTStatus		Shows the status of the Power-On-Self-Test. Possible values are: Success (no error has occurred), Warning (Sensor is not cofigurated correct), Error (a hardware error has occurred).	Status display for the Power-On-Self test. Possible states are Success (no error has occurred), Warning (Sensor is not configured correctly) and Error (a hardware error has occurred).
DevicePOSTStatusCode		Returns the status code for the Power-On-Self-Test.	Returns the status code for the Power-On-Self test. Possible codes are: # 0: Success: Sensor is ready for operation without restrictions # 1: Sensor hardware: Hardware error # 2: Loading calibration files: Error loading calibration files # 3: Loading display bending file: Error loading display bending file # 4: Sensor configuration: The calibration files do not match the cameras
DevicePOSTStatusMessage		Detailed message for DevicePOSTStatus	Detailed description of the DevicePOSTStatus
Image Format Control			
RegionSelector ([SourceSelector])		Selects the Region of interest to control.	Serves as a switch for the parameters to describe the measuring field. Note that this switch also depends on the SourceSelector. The following settings are possible: - Region0: Describes the measuring field of the cameras [Source1] or [Source2] - Scan3dExtraction0: Describes the 3D measuring field [Source0]
Width[SourceSelector][RegionSelector]	ja	Width of the image provided by the device (in pixels).	The width of the measuring field in pixels [Region0] or the number of points in x direction [Scan3dExtraction0]
Height[SourceSelector][RegionSelector]	ja	Height of the image provided by the device (in pixels).	The height of the measuring field in pixels [Region0] or the number of points in y direction [Scan3dExtraction0]
OffsetX[SourceSelector][RegionSelector]	ja	Horizontal offset from the origin to the region of interest (in pixels).	The offset of the measuring field in pixels [Region0]. This parameter has no effect on [Scan3dExtraction0].
OffsetY[SourceSelector][RegionSelector]	ja	Vertical offset from the origin to the region of interest (in pixels).	The offset of the measuring field in pixels [Region0]. This parameter has no effect on [Scan3dExtraction0].

Die mit „Locked“ markierten Parameter können bei aktiver Datenübertragung nicht geändert werden.

Name	Locked	Description	Documentation Text
PixelFormat[SourceSelector] [RegionSelector] [ComponentSelector]	ja	Format of the pixels provided by the device.	Indicates the pixel format used for the selected component. The pixel format Mono8 is available for the [Intensity], [Amplitude], [Curvature], [Base] and [Confidence] components. You can select Mono16 or Coord3D_C32f for the 3D data [Range].
BinningHorizontal	ja	Number of horizontal photo-sensitive cells to combine together. Decreasing the value does not change the image size. To get a full image after decreasing the binning, set the image size to the maximum value.	Note: BinningHorizontal and BinningVertical always have the same value
BinningVertical	ja	Number of vertical photo-sensitive cells to combine together. Decreasing the value does not change the image size. To get a full image after decreasing the binning, set the image size to the maximum value.	Note: BinningHorizontal and BinningVertical always have the same value
ComponentSelector ([Regionselector] [SourceSelector])		The ComponentSelector defines the various data components which are available on the device for streaming.	The following entries are available: - Intensity: Live camera image - Amplitude: Amplitude image - Curvature: Curvature image - Base: Image of base intensities - Range: 3D data - Confidence: Mask for invalid points in 3D data The following combinations of SourceSelector, RegionSelector and ComponentSelector are permitted: - [Source0][Scan3dExtraction0][Range] - [Source0][Scan3dExtraction0][Confidence] - [Source1/Source2][Region0][Intensity] - [Source1/Source2][Region0][Amplitude] - [Source1/Source2][Region0][Curvature] - [Source1/Source2][Region0][Base]
ComponentEnable [SourceSelector][Regionselector] [ComponentSelector]	ja	Controls if the selected component, which is defined by SourceSelector, RegionSelector and ComponentSelector, is active and streaming.	Describes the components to be transmitted. It is used in particular to distinguish between setup operation (live mode) and measurement mode. Setup operation is enabled, if only the [Intensity] components are enabled.
ImageScale[SourceSelector] [ComponentSelector]		2D Mode components only: Scale	Scaling factor for the gray values of the [Amplitude], [Curvature] and [Base] components
ImageOffset[SourceSelector] [ComponentSelector]		2D Mode components only: Offset	Offset for the gray values of the [Amplitude], [Curvature] and [Base] components

Die mit „Locked“ markierten Parameter können bei aktiver Datenübertragung nicht geändert werden.

Name	Locked	Description	Documentation Text
Acquisition Control			
ExposureTime		Sets the Exposure time in microseconds when ExposureMode is Timed and ExposureAuto is Off.	Exposure time of the cameras
PatternDisplay		Defines the pattern that is shown except during measurement.	Definition of the pattern displayed on the monitor: - Bright: Homogeneous white image with a brightness of 255 - Medium: Homogeneous gray images with a brightness of 127 - Dark: Homogeneous black image with a brightness of 0 - Pattern (standard): Measurement pattern (sine) Homogeneous images (in particular "Dark" or "Medium") can be used as screen saver during longer waiting periods. With successive measurements, you should maintain the "Pattern" setting to save time.
PatternBrightness		Defines the brightness of the display for PatternDisplay = Custom	Defines the brightness of the display for PatternDisplay = Custom
StripeDirectionLive		Defines the direction of the stripes shown in live mode.	Defines the direction of the stripes shown in live mode.
LightControl			
LightOperatingHours		Operating hours of the display controller.	Provides the operating hours of the display controller.

Die mit „Locked“ markierten Parameter können bei aktiver Datenübertragung nicht geändert werden.

Name	Locked	Description	Documentation Text
Measurement Control			
PatternWidth[PatternWidthSelector]		Width of sine stripes on monitor.	Width of sine stripes on monitor.
PatternWidth		Width of sine stripes on monitor.	Strip width of the sine pattern on the screen.
PatternCount		Number of different sine stripe images used for calculation.	The number of sine patterns and images to be recorded which are used for one measurement.
AmplitudeThreshold		3D mask generation	Only pixels whose amplitude value (before offset and scaling) is greater than this threshold value are used to calculate the result. This allows you to exclude unwanted pixels with a low degree of reflection (e.g., outside the measured object or near the edges).
PatternType		Selects the type of pattern projection.	Provides pre-defined options for setting the number of sine patterns and the images to be recorded that are used for one measurement: - HighSpeed: 4 - Balanced: 6 - HighPrecision: 12 - Custom: Choose a user-defined value for the number of sine patterns (see "PatternCount")
MinimumIntensityThreshold		Threshold to sort out underdriven pixels.	Threshold for filtering of underexposed pixels.
MaximumIntensityThreshold		Threshold to sort out overdriven pixels.	Threshold for filtering of overexposed pixels.
PatternSensitivity		Sets the bit depth of the camera images for improvement on dark areas. (Standard - 8 Bit / Enhanced - 12 Bit)	Sets the bit depth of the camera images for improvement on dark areas. (Standard - 8 Bit / Enhanced - 12 Bit)

Die mit „Locked“ markierten Parameter können bei aktiver Datenübertragung nicht geändert werden.

Name	Locked	Description	Documentation Text
Scan3dControl			
Scan3dExtractionMethod		Selects the method for extracting 3D from the input sensor data.	Defines the measurement modes: - Standard: Standard measurement mode - SensorReferencing: Is used to perform a reference measurement
Scan3dCoordinateSelector		Selects which Coordinate to retrieve data from.	Is used as switch for the selected 3D coordinate
Scan3dCoordinateScale [Scan3dCoordinateSelector]		Returns the Scale for the selected coordinate axis of the image included in the payload	Defines the resolution of the point cloud in x and y direction. If the Mono16 format is used, scaling can be defined additionally for the z coordinate.
Scan3dCoordinateOffset [Scan3dCoordinateSelector]		Returns the Offset for the selected coordinate axis of the image included in the payload.	Defines the offset of the point cloud in x and y direction. If the Mono16 format is used, the offset can be defined additionally for the z coordinate. The following formula can be used to transform the x and y indices into real world coordinates: Coord_real = Scan3dCoordinateOffset[Scan3dCoordinateSelector] + index * Scan3dCoordinateScale[Scan3dCoordinateSelector]
Scan3dInvalidDataFlag [Scan3dCoordinateSelector]		Specifies if a special value is available for identifying non valid 3d Coordinates	Indicates whether the scan3dInvalidDataValue parameter can be used to identify invalid points. The value is "true" if no mask is transmitted.
Scan3dInvalidDataValue [Scan3dCoordinateSelector]		Value which identifies non valid 3d Coordinates	If no mask is transmitted, this value defines the invalid points in the 3D data.
Advanced 3D Control			
TrendRemoval		Remove global trend from 3D data	To set a trend, a polynomial can be fitted to the surface using an approximation method. Subsequently, the fitted polynomial is substracted from the surface. The following settings are available: - None: No trend is fitted. - Plane: A trend in the form of a plane is created. - Custom: The polynomial degree is set manually (see TrendRemovalCustomX/TrendRemovalCustomY)
TrendRemovalCustomX		Set custom trend removal function degree in X	The polynomial degree in the x direction for the determination of a trend (see TrendRemoval)
TrendRemovalCustomY		Set custom trend removal function degree in Y	The polynomial degree in the Y direction for the determination of a trend (see TrendRemoval)

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Name	Locked	Description	Documentation Text
ReduceMask		Erosion of mask [pixel]	This parameter enables the 3D data erosion. This is how pixels at the edge can be hidden. Enabling this parameter is only necessary when it is not sufficient to hide undesired pixels with the "AmplitudeThreshold" parameter. The following entries are available: - None: Data are not eroded - 3x3: Data are eroded with a square structure mask with a size of 3x3 pixels. - 5x5: Data are eroded with a square structure mask with a size of 3x3 pixels. - 7x7: Data are eroded with a square structure mask with a size of 7x7 pixels.
ReconstructionGridSize		Reconstruction grid size [pixel]	Defines the grid size used in the sensor to calculate the 3D data in pixels. The "n" value means that every "nth" pixel of the raw data is used to calculate the 3D data. The higher this value, the lower the calculation time. This parameter has no effect on the scaling of the 3D coordinates.
ReconstructionHighResIteration		Activates a post-iteration for the reconstruction with full resolution. The quality of the reconstruction corresponds to a reconstruction with parameter "ReconstructionGridSize 1".	Activates a post-iteration for the reconstruction with full resolution. The quality of the reconstruction corresponds to a reconstruction with parameter "ReconstructionGridSize 1".
MultiAreaMode		Multiple areas: Mode	This parameter indicates whether the object to be measured consists of several independent areas: OneAreaMode: Measuring object consists of one contiguous area (normal case) MultiAreaMode: Measurement of several individual measuring objects, i.e. several contiguous areas
MinAreaSize		Minimum area size [pixel]	Defines the number of pixels required for the reconstruction of an area, i.e. smaller areas are ignored. This parameter only takes effect when the MultiAreaMode is enabled.
ReferencingActive		Specifies if the recently executed reference measurement is active.	Indicates whether a previously performed reference measurement is enabled, and thus whether the 3D point cloud is calculated relative to the reference measurement.

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Name	Locked	Description	Documentation Text
ReferencingBinning		Returns the binning factor used for the recently executed reference measurement.	Indicates which value was used for the BinningHorizontal or BinningVertical during the enabled reference measurement. This value must correspond to the current value for Binning in order to perform valid measurements.
ReferencingMode		Specifies the kind of referencing, i.e. if planar targets or nonplanar targets with known shape are used for referencing.	Defines the type of referencing. Referencing with flat and non-planar targets with known shape are possible. With non-planar targets, a description file for the target (shape, contour) is required. The correct type of referencing is to be set both when performing the reference measurement (Scan3dExtractionMethod "SensorReferencing") and during the application (Scan3dExtractionMethod "Default").
ReferencingContour		Specifies if the contour of the referencing target is displayed in the intensity images (i.e. live images of cameras)	Indicates wheter the contour of non-planar reference targets (ReferencingMode "Nonplanar") is displayed in the intensity images. Is used as positioning aid for the reference target when performing the reference measurement (Scan3dExtractionMethod "SensorReferencing"). Displaying the contour can also be used with (Scan3dExtractionMethod "Default") in order to position the measuring objects within the referencing area.
ReferencingTargetID		Identifier of referencing target (e.g. part number, serial number) in case of ReferencingMode "Nonplanar"	Description (e.g. part number, serial number) for non-planar reference target (ReferencingMode "Nonplanar"), whose description file (shape, contour) is stored in the sensor for the calculation of the referencing. Is used for a comparison with the description of the actually used target for the reference measurement.
ReferencingValid		Specifies if valid reference data are available	This parameter indicates whether valid reference data are available on the sensor in such a way that they can be used with an active reference (see "ReferencingActive" parameter).
PlaneMove		Specifies if stereo reconstruction is conducted with or without shifting the reference plane	Specifies whether the stereo reconstruction is performed with or without shifting the reference plane. Activating this option increases the accuracy if the target has a height offset parallel to the reference plane.

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Name	Locked	Description	Documentation Text
ReferencePlaneIterations		Number of maximum iterations for improving the reference plane position within the reconstruction process. This is useful for objects, which are not exact positioned in the reference plane.	Specifies the number of iterations used to optimize the reference plane during stereo reconstruction. Values > 1 increase the accuracy when the position of the measuring object deviates from the reference plane. However, values > 1 also increase the computing time.
ReferencePlaneExactness		Exactness for optimizing the reference plane within the reconstruction process in millimeter	Specifies the accuracy used for optimizing the reference plane during stereo reconstruction. The lower the value, the higher the computation time.
UnwrapPostProcessing		If the mode is activated, outliers in the unwrapped phase are corrected.	If the mode is activated, outliers in the unwrapped phase are corrected.

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Name	Locked	Description	Documentation Text
AnalogControl			
Gain		Controls the selected gain as an absolute physical value in dB	The gain with which the cameras in the sensor are operated.
Event Control			
EventFrameTriggerMissed		Returns the unique Identifier of the FrameTriggerMissed type of Event.	This event is triggered when a measurement is triggered although the most recent measurement has not yet been completed.
EventExposureEndData		Category that contains all the data features related to the ExposureEnd Event	This event is triggered when image acquisition for a measurement has been completed and calculation of the 3D results is started. The sensor or measuring object can now be moved to the next measuring position.
EventFrameStartData		Category that contains all the data features related to the FrameStart Event	This event is triggered when the measurement is started.
EventFrameEndData		Category that contains all the data features related to the FrameEnd Event	This event is triggered when the measurement is completed.
EventError		Returns the unique identifier of the Error type of Event.	This event is triggered when an error occurs during the measurement.
EventErrorCode		Returns the error code.	This parameter returns the defect type for a measuring error. The following error codes are possible: - 1: Error Sensor Hardware: An error occurred in a hardware component in the sensor. Contact Micro-Epsilon - 2: Error Sensor Acquisition: An error occurred during data acquisition in the sensor. Contact Micro-Epsilon - 3: Error 3D Reconstruction: The 3D reconstruction could not be calculated. # 4: Error 3D Resampling: The sampling of the 3D data was not successful. # 5: Error 3D Filter: An error occurred while applying the 3D filter operations # 6: Error Sensor referencing: An error occurred while performing the reference measurement # 7: Error reference data: The reference measurement data is invalid # 8: Error Apply Sensor referencing: Error while applying the reference measurement # 10: Error Sensor Configuration: The sensor is configured incorrectly.

Name	Locked	Description	Documentation Text
EventErrorMessage		Returns a detailed error message for the error.	In addition to the error type, an additional description of the measuring error is returned if necessary.
Source Control			
SourceSelector		Selects the source to control.	Is used as a switch for the data source to be configured: - Source0: Virtual source for 3D measured data - Source1: Camera 1 - Source2: Camera 2

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