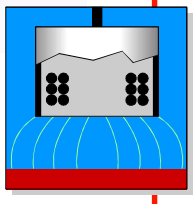
SENSORS & SYSTEMS

Authority in Displacement Measurement

MICRO-EPSILON

Non Contact Compact
Displacement Measuring System
on Eddy Current Principle



Instruction Manual
NLS3181

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CE

Zertificated acc. to DIN EN ISO 9001: 2000

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1. Safety

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

1.1 Symbols Used

The following symbols are used in this instruction manual:

DANGER! - imminent danger

WARNING! - potentially dangerous situation

IMPORTANT! - useful tips and information

1.2 Warnings

- Avoid banging and knocking the electronics / sensors
  ⇨ Damage to or destruction of the electronics / sensors

- Power supply must be connected in accordance with the safety regulations for electrical equipment
  ⇨ Danger of injury
  ⇨ Damage to or destruction of the sensor safety

- Protect the cables against damage
  ⇨ Failure of the measuring device

1.3 Notes on CE Identification

The following applies to NLS3181:

EU regulation 89/336/EEC

Products which carry the CE mark satisfy the requirements of the EU regulation EU 89/336/EEC 'Electromagnetic Compatibility' and the European standards (EN) isted therein.
The EU declaration of conformity is kept available according to EU regulation, article 10 by the authorities responsible at

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The NLS3181 is designed for use in industry and satisfy the requirements of the standards

- EN 50 081-2 RFI emission
- EN 61000-6-2 Immunity to interference

The system satisfy the requirements if they comply with the regulations described in the instruction manual for installation and operation.

1.4 Proper Use

- The NLS3181 is designed for use in industrial areas.
- It is used for machine supervision and for measuring and testing in process quality assurance.
- The system may only be used in such a way that does not endanger persons or cause damage to the machine due to malfunctions or total failure of the system.
- Additional precautions for safety and damage prevention must be taken for safety-related applications.

1.5 Proper Environment

- Protection class
  Sensor: IP 65
  Controller: IP 54
- Operating temperature
  Sensor and sensor cable: -50 to +150 °C (-58 to +302 °F)
  Controller: +10 to +65 °C (+50 to +149 °F)
- Humidity: 5 - 95 % (no condensation)
- Ambient pressure: atmospheric pressure
- Power supply: 24 VDC (9 ... 36 VDC)
- Storage temperature: -25 to +75 °C (-13 to +167 °F)

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2. System Description

2.1 Area of Application

The NLS3181 non-contact, compact displacement measuring systems are designed for industrial applications to measure the movement of injection needles.

2.2 Measuring Principle

The NLS3181 displacement measuring system operates without contact using eddy current technology. It is used for making measurements on targets made of ferromagnetic electrically conductive materials.

High-frequency alternating current flows through a coil cast in a sensor casing. The electromagnetic coil field induces eddy currents in the conductive target thus changing the ac resistance of the coil. This change in impedance is interpretted by demodulation electronics which generate an electrical signal proportional to the distance of the target from the sensor.

A patented electronic compensation technique reduces temperature-dependent measuring errors to a minimum.

2.3 Structure of the Complete Measuring System

The NLS3181 non-contact single channel displacement measuring system (Fig. 2.1) consists of:

- Sensor LS04
- Connecting cable C3/1
- Signal conditioning electronics (controller) built into a compact aluminium housing
- Power supply and output cable PC3/4

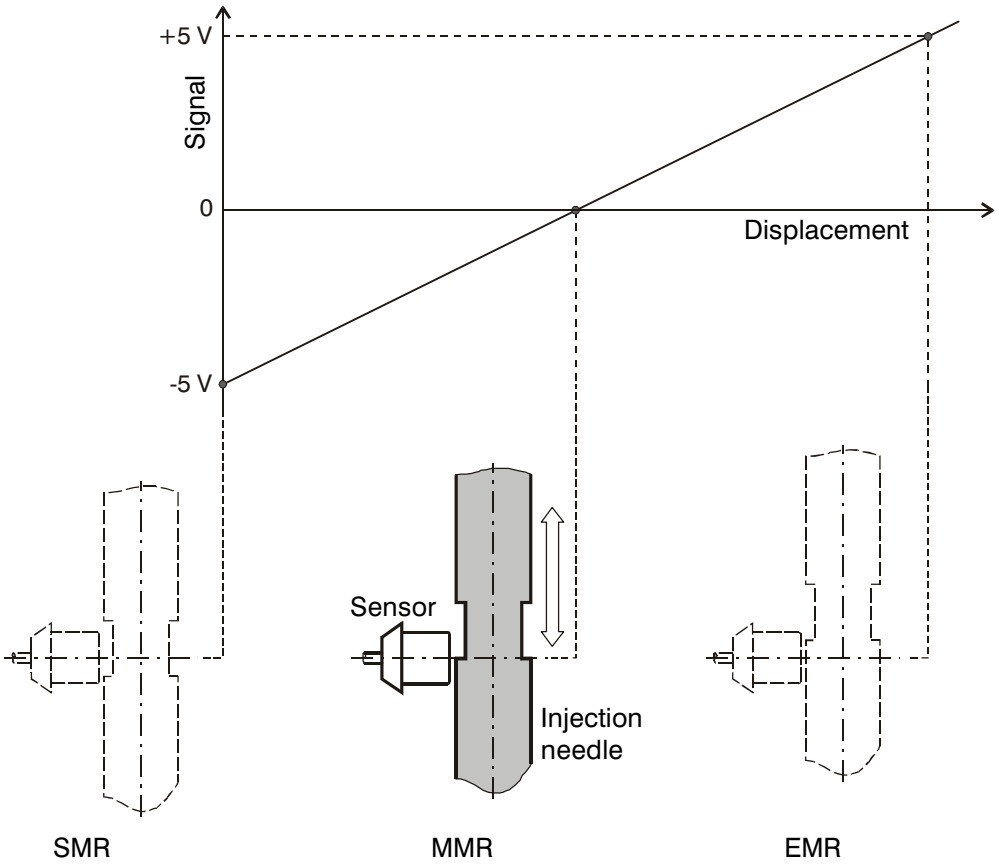
IMPORTANT!

The components are matched.

The allocation of the sensor and the controller determined by the serial number.

2.4 Glossary

SMR Start of measuring range. Minimum overlapping between sensor and the injection needle groove.
MMR Midrange
EMR End of measuring range. Maximum overlapping between sensor and the injection needle groove.



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3. Technical Data

Sensor model		LS04
Controller		NLS3181
Measuring range MR		0.4 mm (.016 ")
Start of measuring range SMR		-0.2 mm (.008 ")
End of measuring range EMR		+0.2 mm (.008 ")
Linearity		≤ ±1.5 % FSO
Resolution	static dynamic	0.05 µm (0.002 mils) 0.5 µm (0.02 mils)
Frequency response		100 kHz (-3 dB)
Repeatability	static	±0.05 % FSO
Operating temperature	Sensor +Cable Controller	+10 ... +150 °C (+50 ... +302 °F) +10 ... +65 °C (+50 ... +149 °F)
Storage temperature		-25 ... +75 °C (-13 ... +167 °F)
Temperature stability		≤±0.05 % FSO /°C (≤±0.03 % FSO /°F)
Protection class	Sensor + Cable	IP65
	Controller	IP54
Length sensor cable	Standard Extension	0.5 m (±15 %), 3 m (±15 %)
Material sensor cable		PTFE (teflon)
Signal output		-5 VDC ... +5 VDC
Power supply		+24 VDC (9 VDC ... 36 VDC)
Electromagnetic compatibility		acc. EN 50081-2 / EN 61000-6-2

The specified technical data apply for the reference material mild steel St37 DIN1.0116 at 20 °C.

FSO = Full Sale Output

4. Installation and Assembly

4.1 Precautions

No sharp or heavy objects should be allowed to affect the cable sheath of the sensor cable, the supply cable and of the output cable. All plug-in connections must be checked for firm seating before starting operation.

4.2 Sensor

Type designation: LS04

Construction: The front part of the sensor with encapsulated coil consists of electrically non-conducting materials.

Important: In the radial direction metal parts in the vicinity may behave similar to the measurement object, rendering the measurement result inaccurate.

Legend:
mm
(inches)

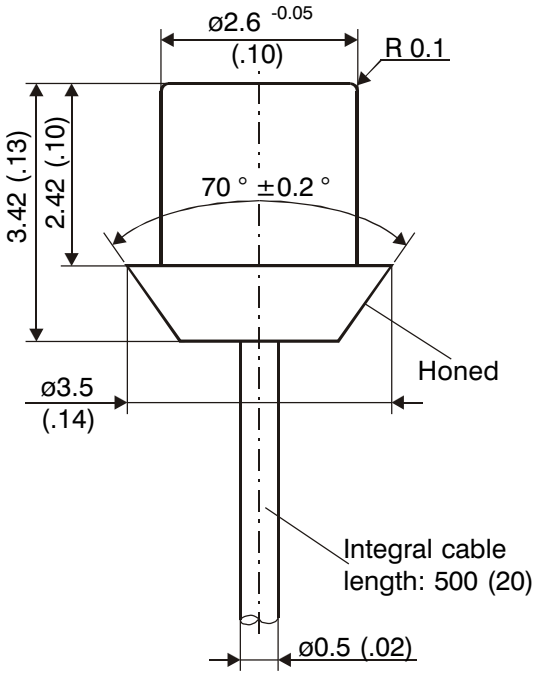

Fig. 4.1: Sensor Dimensions LS04 with integral cable

IMPORTANT!

The sensor needs to be bonded into the injection body for high pressure applications.

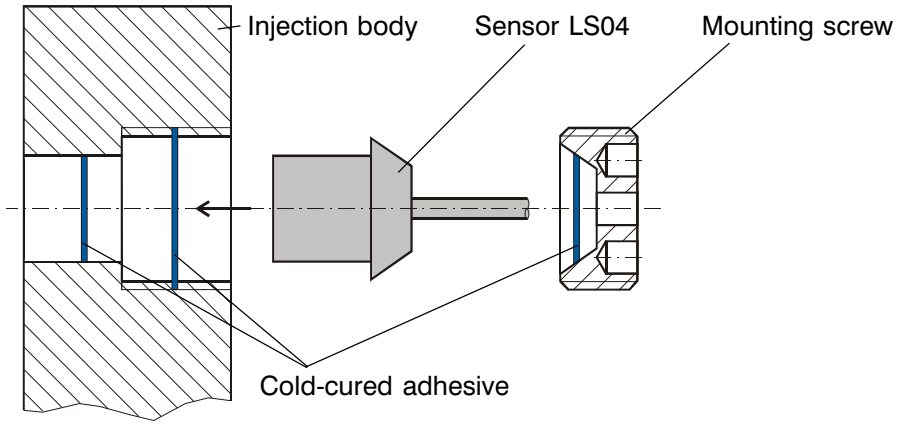

Fig. 4.2: Bonding the sensor into the injection body

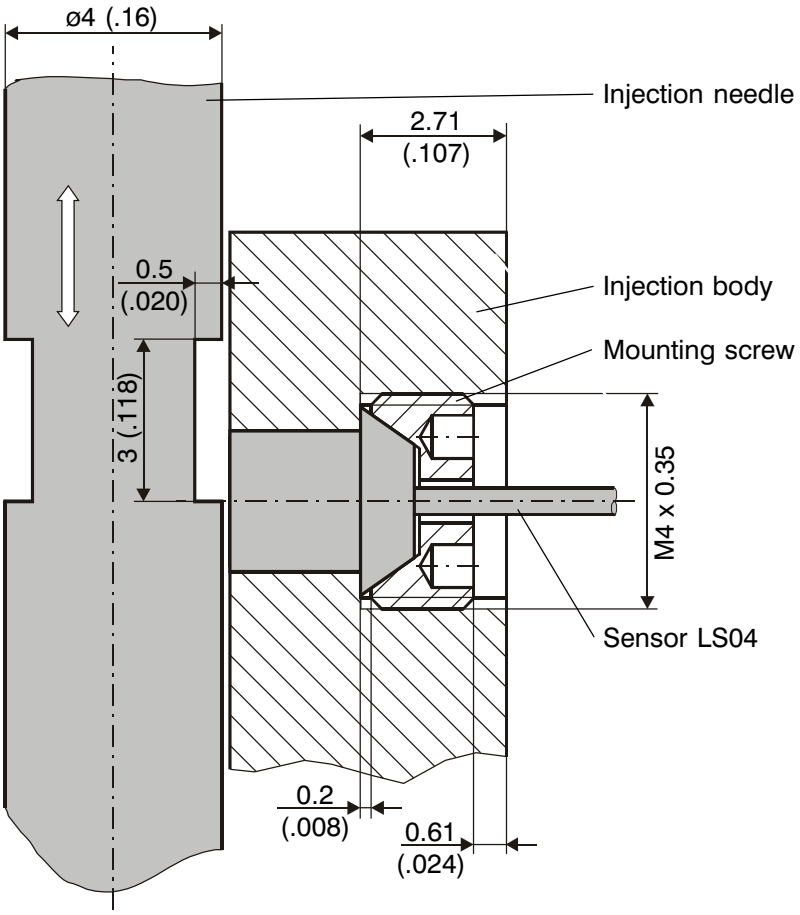

Fig. 4.3: Measuring against the injection needle

4.3 Sensor Cables

- Do not kink the cables - the minimum bending radius is 10 mm.
- Lay the cable such that no sharp-edged or heavy objects can affect the cable sheath.
- Make the connection between the sensor and controller using the integral sensor cable, the transition board and the sensor cable C3/1. Connect the sensor cable to the controller. Check the plugged connections for firm sea ting.

The integral sensor cable has a length of 0.5 m. The sensor cable extension C3/1 has a length of 3 m.

The cables of one type are tuned to the same capacitance at the factory. This may result in deviations in length of ±15 % in relation to the nominal length.

IMPORTANT!

The tuned cables may not be shortened because this changes the capacity and the adjustment of the measuring system!

The thicker cable end must be connected with the signal conditioning electronics.

IMPORTANT!

Transition board, both sides for soldering.
Dimensions: 16 x 10 x 1.5 (0.63 x 0.39 x 0.06)

Legend:
mm
(inches)

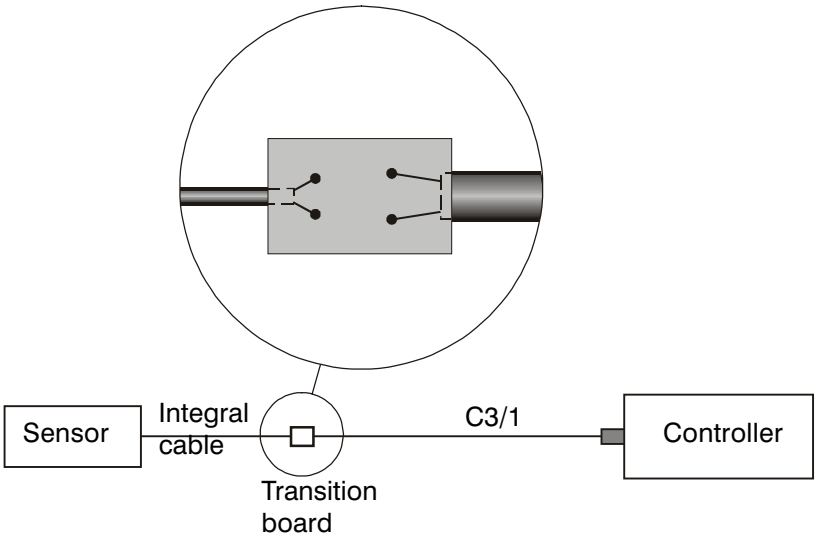

Fig. 4.4: Sensor connecting cables

4.4 Controller

The signal conditioning electronics (Fig. 4.5) are installed in an aluminium casing. The oscillator and demodulator electronics are on one board.

- The oscillator electronics feed the sensor with a frequency and amplitude stable ac voltage
- The demodulator electronics demodulate, linearise and amplify the distance-dependent measuring signal.

The signal conditioning electronics are already tuned to the delivered sensor with connecting cable at the factory.

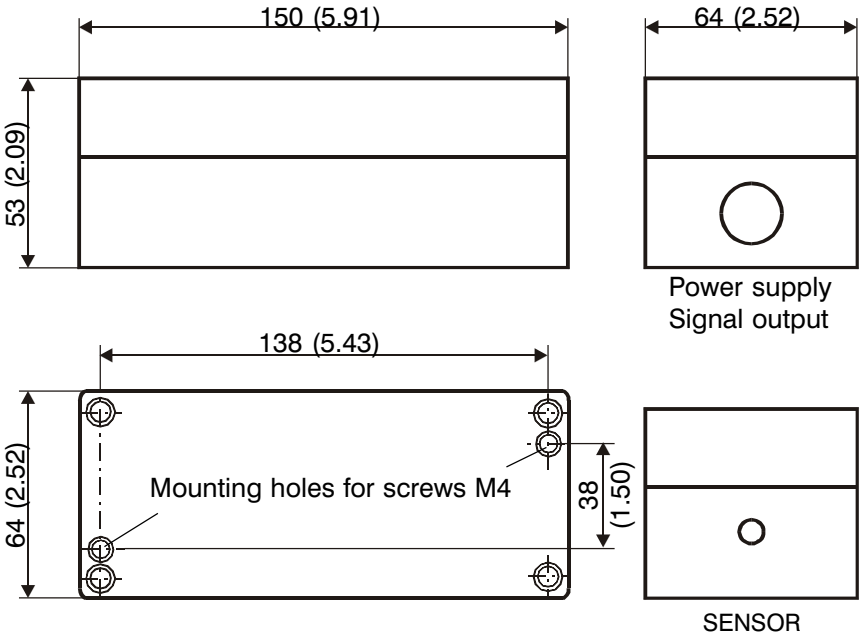

Fig. 4.5: Dimensional drawing controller NLS3181 with connecting elements

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4.6 System Adjustment

Measuring systems of the **NLS3181** must be calibrated by the user for his particular application before measuring (see chap. 5*.2 Calibration and Linearisation*). If possible use

- the actual sensor mounting and
- the actual target!

IMPORTANT!

If you cannot use the actual target, simulate the measuring environment as accurately as possible.

5. Operation

Checking the measuring system setup:

1) Is the sensor adjusted for the application (target material)?

2) Are the sensor, cable length and electronics aligned? (type and serial number)

3) Is the sensor connected?

4) Are the cable connections tight?

IMPORTANT!

Protect cables against pressure in pressurized rooms.

Connecting the measuring system setup:

- Set up the power supply for the electronics by
  - connecting the cable (PC3/4) or
  - a user assembled cable

  1) to the 8-pole built-in socket (Fig. 5.1) on the controller casing with the enclosed plug,
  2) to a 24 VDC power supply

Matching power supply units for the **controller** are available as accessories!

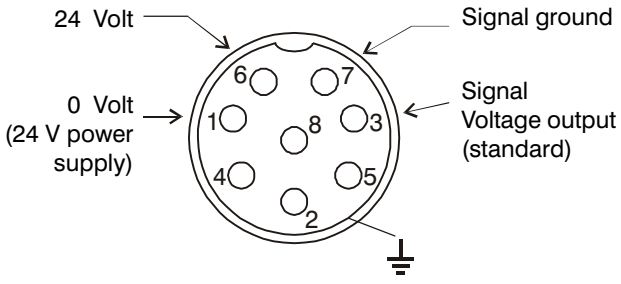

Fig. 5.1: Socket pin assignment and signal output for standard supply (+24 VDC)

- Measuring signal displays or recorders are also connected to the 8-pole built-in socket on the controller casing
- Switch on the power supply on the power supply unit
- Let the measuring setup warm up for about 15 minutes

The power supply and signal output are connected by the 8-pin built-in connector (DIN 45326). See the drawing and table for the pin assignment. The controller contains an 8-pin cable socket for the unser-side assembly of your own connecting cable.

- Take the 8-pin cable socket which is enclosed at the signal conditioning electronics
- A screened cable must be used!
- Outer screnning mesh surrounds all sable wires.
- Screen connected via connector housing to housing ground
- Recommended conductor cross-section 0.14 mm²

The EMC regulations are only satisfied under these basic conditions.
PC3/4 is a 3 m long, pre-assembled 4-wire power and output cable. It is supplied as an accessory.

Pin assignment and colour codes PC3/4

PIN	Cable colour	Assignment
1	grey	0 Volt
6	green	+24 Volt
3	white	signal voltage output
7	brown	0 Volt

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5.1 Control Elements

- Remove the cover from the controller by loosening the four screws in the cover

There are two trimmer potentiometers on the demodulator board (Fig. 5.2) for adjusting

- Zero and
- Gain

The trimmer potentiometers *Zero and Gain* have 24 turns! A slight click is audible at the end positions.

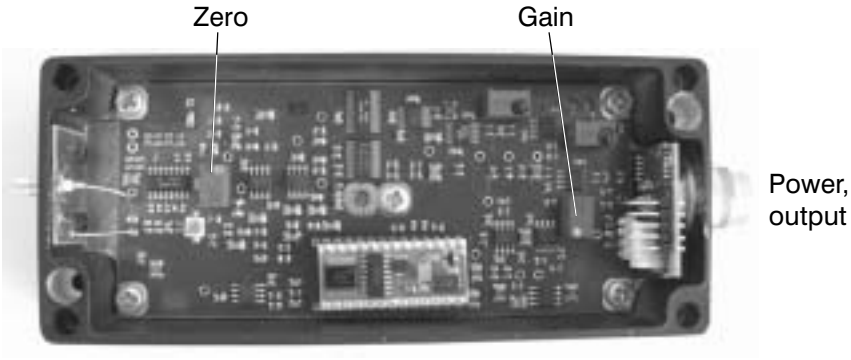

Fig. 5.2: Potentiometers on the demodulator board

The measuring signal can be adjusted in the range from -5 VDC to +5 VDC at a max. output current of 10 mA. The output is temporarily short-circuit-proof. The output impedance is less than 10 ohms.

5.2 Calibration

Every measuring channel must be calibrated for the installation environment and the target prior to measuring. The two trimmer potentiometers are set at two distance points by a reference norm for calibration.

- Turn the trimmer potentiometer with a screwdriver in a clockwise direction to effect a positive change in the output voltage
- Turn the trimmer potentiometer with a screwdriver in counterclockwise direction to effect a negative change in the output voltage
- Use the original measuring environment for calibration where possible. Simulate the measuring environment if this is not possible.

IMPORTANT!

The highest sensitivity over the whole range is achieved at a calibration to 10 V output voltage.

This gives the best signal/ noise ratio!

Step 1: Zero adjustment

- Set the target at the middle of measuring range to the sensor

  - The middle of measuring range corresponds to the measuring value of 0 V

- Set the output voltage to 0 V on the *Zero* potentiometer

Step 2: Gain adjustment

- Move the target to the end of measuring range (see Chap. 2.4)

- Set the output voltage on the *Gain* potentiometer to the value of the desired voltage for full range (+5 VDC or -5 VDC)

6. Eliminating Errors

No change in output signal

- Check supply voltage
- Check allocation of sensor type and cable length
- Check sensor and cable

7. Accessories

PS100/230/15	Built-in power supply unit Input 230 Vac Output ±15 Vdc; 500 mA
PC3D	Supply and output cable, 3 m long, plugs on both ends to fit DT110 electronics and PS1000 power supply units
PS1605	Built-in power supply unit Input 230 Vac Output 24 V; 600 mA Terminal strip connections
PC3	Supply and output cable, 3 m long, with one plug to fit DT110 electronics and cable spades for terminal connection

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8. Warranty

All components of the device have been checked and tested for perfect function in the factory.

In the unlikely event that errors should occur despite our thorough quality control, this should be reported immediately to MICRO-EPSILON.

The warranty period lasts 12 months following the day of shipment. Defective parts, except wear parts, will be repaired or replaced free of charge within this period if you return the device free of cost to MICRO-EPSILON.

This warranty does not apply to damage resulting from abuse of the equipment and devices, from forceful handling or installation of the devices or from repair or modifications performed by third parties.

No other claims, except as warranteed, are accepted. The terms of the purchasing contract apply in full.

MICRO-EPSILON will specifically not be responsible for eventual consequential damages.

MICRO-EPSILON always strives to supply the customers with the finest and most advanced equipment. Development and refinement is therefore performed continuously and the right to design changes without prior notice is accordingly reserved.

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

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