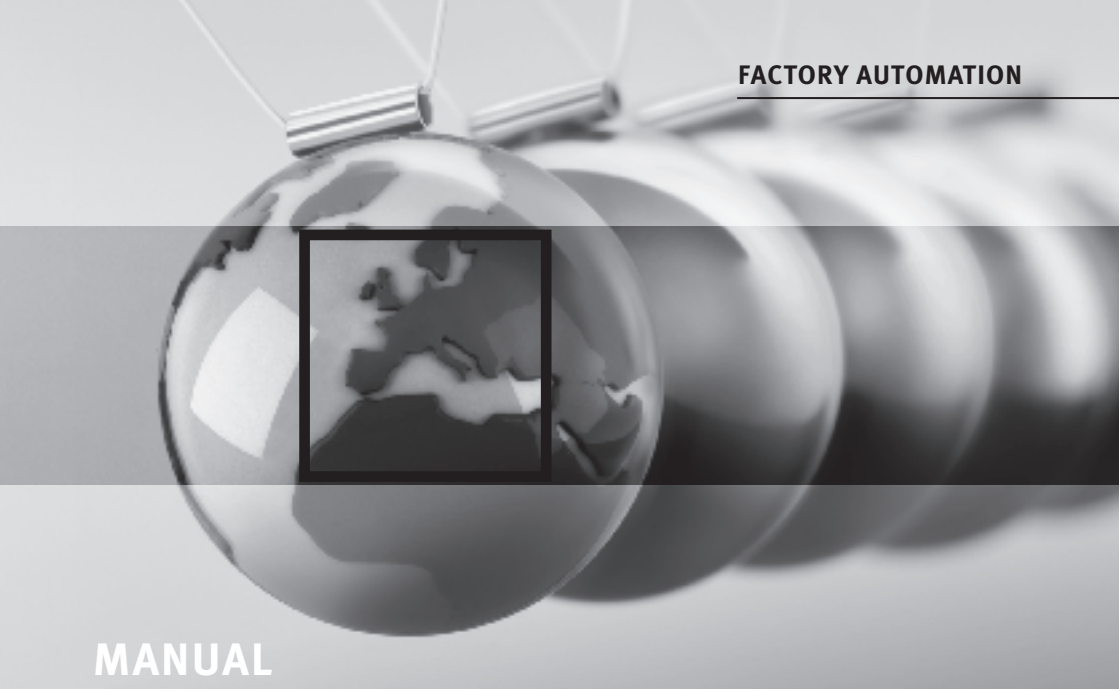
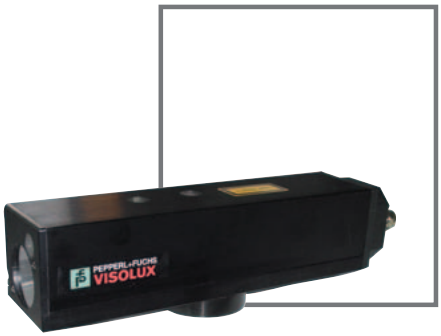


MANUAL

Distance Measurement Series EDM



CE

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SENSING YOUR NEEDS

With regard to the supply of products, the current issue of the following document is applicable:

The General Terms of Delivery for Products and Services of the Electrical Industry, published by the Central Association of the Electrical Industry (Zentralverband Elektrotechnik und Elektroindustrie (ZVEI) e.V.)

in its most recent version as well as the supplementary clause: "Expanded reservation of proprietorship"

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Date of issue 06/13/2007

PEPPERL+FUCHS

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1 Declaration of conformity

The EDM series have been developed and produced in accordance with the applicable european standards and directives.

Note

A corresponding declaration of conformity can be requested from the manufacturer.

Pepperl+Fuchs GmbH in D-68301 Mannheim possesses a certified quality assurance system in accordance with ISO 9001.

CE

ISO9001

2 General information

Warning

This symbol warns the user of possible danger. Failure to heed this warning can lead to personal injury or death and/or damage to equipment.

Attention

This symbol warns the user of a possible failure. Failure to heed this warning can lead to total failure of the equipment or any other connected equipment.

Note

This symbol gives the user important hints.

3 Safety

3.1 Intended use

The precise positioning of shelf stackers, transport trolleys, cranes and automatic handling equipment and the measuring of length in the woodworking industry, on concrete saws and in elevator design, calls for distance meters capable of accuracy to the millimetre over large distances and distance meters with a high measurement rate.

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Distance meters are widely used where previously angle coding units or electromechanical metering devices were used for measuring distances.

Improper use includes:

- using the EDM for the first time without having read the manual,
- The power supply for generating the supply voltage needs to be separated by a double insulation and a safety transformer according to DIN VDE 0551 (complies with IEC 742).
- using the equipment outside the specification without suitable protective measures,
- opening the equipment,
- pointing the unit directly at or measuring at the sun,
- removing the warning/machine labels.

With the radiation emission of a class 1 laser there is no cause for concern. This type of laser instrument can be operated by anyone.

Warning

In applications with shelf stacking equipment and transport trolleys it is essential that the relevant safety instructions be carefully followed.

Failure to observe this warning can result in fatal injury!

3.2 General safety information

Warning

Safety and correct functioning of the device cannot be guaranteed if any operation other than that described in this operating manual is performed.

The connection of the equipment and any maintenance work to be carried out with voltage applied to the equipment must only be performed by appropriately qualified electro-technical personnel.

In the case that a failure cannot be repaired, the device must be taken out of operation and protected against inadvertently being put back into operation.

Repair work may only be carried out by the manufacturer. Additions or modifications to the equipment are not allowed and void the warranty.

The responsibility for the observance to local safety standards lies with the operator.

The EDM must not be operated in areas where there is a risk of explosion without appropriate protective measures being adopted.

3.3 Functional safety/monitoring

The distance measuring devices of the EDM series function on a microprocessor basis. They are internally monitored for proper function and component failure, which are indicated by two LEDs: "diagnostic display" (InterBus-S, PROFIBUS-DP) and "control display".

More detailed information can be found in Chapter 7.

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4 Product description

4.1 General notes on the equipment

The precise positioning of shelf stackers, transport trolleys, cranes and automatic handling equipment and the measuring of length in the woodworking industry, on concrete saws and in elevator design, calls for distance meters capable of accuracy to the millimetre over large distances and distance meters with a high measurement rate. Distance meters are widely used where previously angle coding units or electromechanical metering devices were used for measuring distances The properties of these mechanical meters are very much influenced by ambient conditions such as temperature, and are subject to ageing and continuous wear.

In contrast, optoelectronic distance meters (EDM, electronic distance meters) operate virtually free of wear and are easy to install using an integrated laser pointer.

Further advantages include the short installation and commissioning times and the high level of reliability of an optoelectronic measuring system, in addition to the simplicity of replacement.

The EDM series covers three standard ranges: 50 m, 120 m and 240 m. The interfaces available are:

SSI (Synchronous Serial Interface),

IBS (InterBus-S),

PROFIBUS-DP

The optoelectronic distance meters in the EDM series meet the safety requirements of Laser Protection Class 1 (EN 60825). The lower level of laser radiation ensures that operation personnel are not exposed to any risk of injury.

4.2 Principe of measurement

The equipment works on the principle of pulse time measurement. Here, the time that elapses between the transmission of an invisible light pulse and the arrival of its reflection is measured by the unit. Because the speed of light is constant, this period of time equates to the distance between the source and the reflecting body. The light emitter and receiver are both located in the unit. For distance measurements, a reflector is required which must be set up opposite the unit. Compared to other distance measurement procedures, the pulse time procedure is particularly suited for high precision measurement over large distances because of its specific technical properties. Compared to other procedures, it is largely unaffected by ambient conditions and can thus be used in the rough, everyday conditions which obtain in industry, whilst maintaining a high level of accuracy.

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Note

Influence of temperature:

The speed of light depends on air temperature and air pressure. Within the working range of the EDM (10 °C ... 40°C) it can be calculated

with k_T = +1 ppm/°C

and k_P = -0,3 ppm/hPa.

Example:

At a distance of 100m the measured distance changes 0.1 mm/°C.

4.3 Illustration

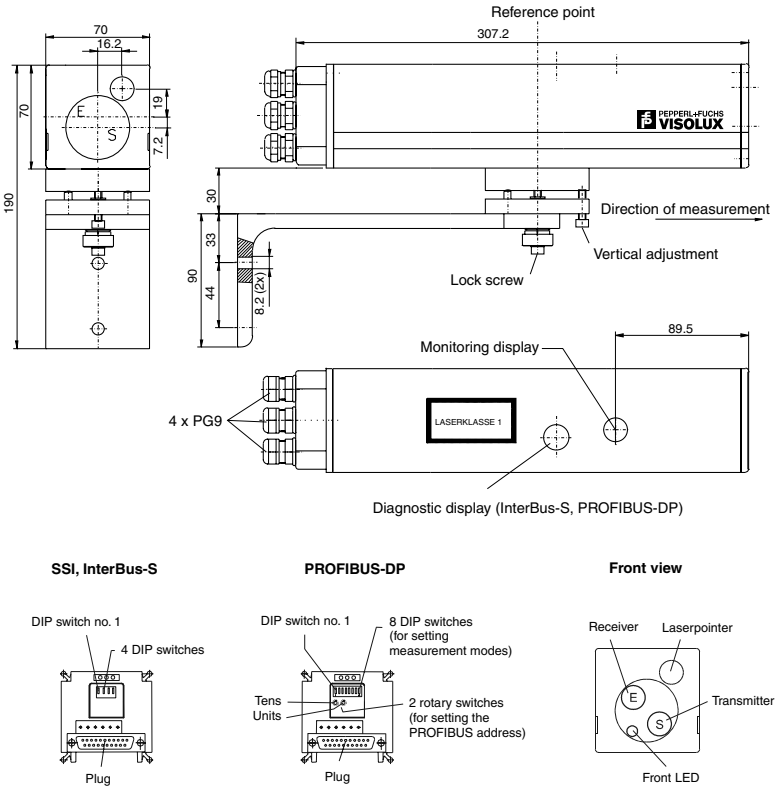

Figure 4.1 Series EDM equipment and dimensions

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5 Installation

5.1 Storage, transport, installation

Storage

The equipment should be stored in its original packing in a dry room. Always keep the housing cover closed in order to prevent moisture, dust or foreign bodies entering the equipment.

Note

If the equipment has been subjected to extreme temperature fluctuations during transport, it must be allowed to acclimatise (approx. 2 hours) before being installed and put into operation. Always avoid condensation forming in or on the unit as this could result in internal components being impaired or indeed irreparably damaged.

Transport

Care must be exercised when transporting the sensor. Always use the original packing plus additional packing when transporting it. Severe jolting should always be avoided.

Check that the contents are not damaged. In case of damage, notify the forwarding agent and inform the deliverer.

Check the contents of delivery with respect to your order and the delivery papers for:

- correct number of parts
- device type and version according to the name plate
- accessories
- manual(s)

Keep the original packaging in case the device must be repacked and stored or reshipped.

For any further questions please contact Pepperl+Fuchs GmbH.

Installation

The most important precondition for the proper functioning of the sensor is that it be correctly installed and stable, and properly aligned.

Note

<u>Do not</u> point the sensor directly at the sun. Always protect the sensor against direct and lengthy exposure to sunlight. Prevent the formation of condensation by avoiding exposing the sensor to large temperature fluctuations. Keep the sensor away from aggressive chemicals. Make sure that the glass of the EDM and the reflector is kept clean. Always use soft cloths and, if necessary, a proprietary glass cleaner.

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5.2 Installation notes

5.2.1 Pin allocation of the 14-pole screw terminal (X2, X3)

Pin	SSI	PROFIBUS-DP	InterBus-S
1			
2			
3			GND 2
4			DI2
5			/DI2
6			DO2
7			/DO2
8	CLK -	P (B)	DI1
9	CLK +	N (A)	/DI1
10	DATA -		DO1
11	DATA +		/DO1
12		P (B)	
13		N (A)	
14	GND (ISOL)	GND (ISOL)	GND 1

5.2.2 Pin allocation of the 4-pole screw terminal (X4)

Pin	SSI	PROFIBUS-DP	InterBus-S
1	+24V	+24V	+24V
2	+24V	+24V	+24V
3	0 V	0 V	0 V
4	0 V	0 V	0 V

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5.3 Description for the interfaces

5.3.1 General

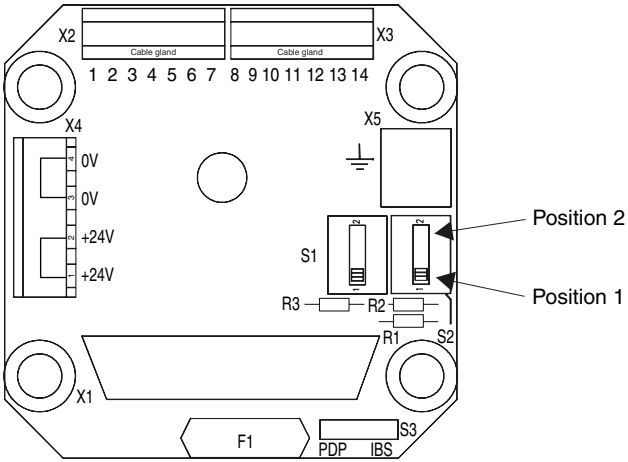

Figure 5.1 Plug cover for all interfaces

- The data transmission across all interfaces is serial.
- The value for 1 LSB is 0.1 mm.
- For each type of interface, the housing GND (screw terminal X5 on the plug cover) must be connected to the metal construction of the vehicle in order to suppress any electromagnetic interference.

5.3.2 SSI

A 100 Ω terminal resistor (0.5 W) must be connected between Data+ and Data- in the control unit if this resistor is not already integrated on the interface card. It is recommended to connect the screen on both sides.

You also have to make a connection between the screw terminal X5 and the metal construction of the vehicle.

Data telegram:

MSB																					LSB	SSI error

bit	bit	bit	bit	bit	bit	bit	bit	bit	bit	bit	bit	bit	bit	bit	bit	bit	bit	bit	bit	bit	bit	bit	bit	bit
G24	G23	G22	G21	G20	G19	G18	G17	G16	G15	G14	G13	G12	G11	G10	G9	G8	G7	G6	G5	G4	G3	G2	G1	
SSI-data																								

Gray-coding:

Error bit 1 = Target loss or no echo, 0 = OK
Bit G24 ... G1 SSI-Data, gray-coded

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1 start bit, 24 data bits in grey code and 1 error bit are transmitted. The error bit is set (high) as soon as the target is lost (laser beam no longer strikes the reflector). In this case, the front LED and the red LED on the monitoring display light up (see Section 6.3).

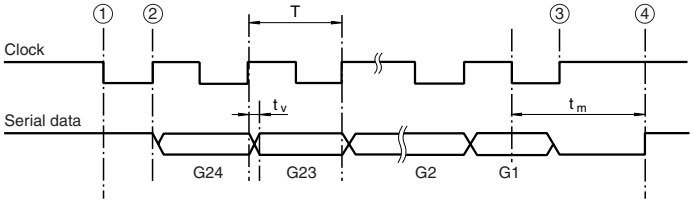

Figure 5.2 Gray-coding

5.3.3 PROFIBUS-DP

The respective last connection must be made with terminal resistors. In this case the switch S2 on the plug cover has to be brought into the position 1 (resistor combination on). In case that the slave is not the last connection on the bus, the switch S2 has to be brought into the position 2 (resistor combination off) (see Figure 5.1).

The shield must be connected at both ends (EDM and control unit). For this connection the screw terminal X5 is required in the lid. You also have to make a connection between the screw terminal X5 and the metal construction of the vehicle.

4 bytes are transmitted in binary (3 bytes measured value and one error byte). Bit 0 within the error byte will be used as error bit.

Data telegram:

low byte								middle byte								high byte								error byte							
0								1								2								3							
bit	bit	bit	bit	bit	bit	bit	bit	bit	bit	bit	bit	bit	bit	bit	bit	bit	bit	bit	bit	bit	bit	bit	bit	bit	bit	bit	bit	bit	bit	bit	bit
7							0	7							0	7							0	7							0
distance low								distance middle								distance high								error error: bit 0 = 1							

5.3.4 InterBus-S

If an InterBus connection is not the last in the chain, the RBST connection must be connected to the internal +5 V voltage. In this case the switch S1 on the plug cover has to be brought into the position 2. If an InterBus connection is the last in the chain, the switch S1 on the plug cover has to be brought into the position 1 (RBST internally connected to GND by a resistor) (see Figure 5.1).

The shield must be connected at both ends (EDM and control unit). For this connection the screw terminal X5 is required in the lid. You also have to make a connection between the screw terminal X5 and the metal construction of the vehicle.

Data telegram:

byte 0								byte 1								byte 2								byte 3							
bit	bit	bit	bit	bit	bit	bit	bit	bit	bit	bit	bit	bit	bit	bit	bit	bit	bit	bit	bit	bit	bit	bit	bit	bit	bit	bit	bit	bit	bit	bit	bit
7							0	7							0	7							0	7							0
distance low								distance middle								distance high								error							

4 bytes are transmitted in binary (3 bytes measured value and one error byte). Bit 0 within

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the error byte will be used as error bit. The EDM has the ident-code 32h (50d).

5.3.5 Advice on the operation of products in the EDM series in parallel with data transmission light beam systems

When products of the EDM series operate simultaneously on the same optical axis as Data Transmission Light Beam Systems, the advice given below should be followed to avoid mutual interference.

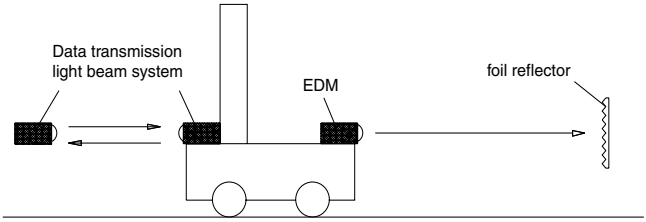

diagram 1

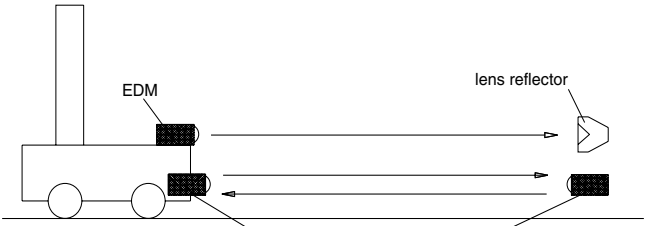

diagram 2

Figure 5.3 Arrangement of the products

1. Diagram 1 shows the recommended arrangement with Data Transmission System and Electronic Distance Measuring Systems on opposite sides of the vehicle. This means that the left hand Data Transmission unit should not receive any stray light from the EDM reflector. In most cases the vehicle shades the stray light, preventing problems. Therefore this arrangement is preferred.
2. When it is necessary to have Data Transmission and Distance Measuring Systems on the same side of the vehicle without the necessary spacing between them, it is possible to get crosstalk. This is because the foil reflector can reflect part of the tightly bundled EDM laser beam over a wide angle and a part of this stray reflected light can enter the receiver optic on the Data Transmission unit.

   Therefore we recommend an arrangement using a lens reflector, as shown in diagram 2.

   The minimum spacing (a) between Data Transmission and Distance Measuring light beams depends upon the operating range.

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Operating range	Spacing (a)
30 m	0.5 m
60 m	0.8 m
90 m	1.0 m
120 m	1.2 m
240 m	2.4 m

Additionally, the arrangement between Data Transmission System and Distance Measuring unit, as per diagram 2, should be configured so that the EDM light beam cannot strike any Data Transmission unit opposite.

If the vehicle sways during travel and thus loses contract with the lens reflector, then more triple reflectors can be installed according to requirements.

5.4 Reflector selection

Ranges	500 x 500**	1000 x 1000**	R140*
EDM-50	0.5 m ... 50 m	0.5 m ... 50 m	0.5 m ... 50 m
EDM-120	0.5 m ... 60 m	0.5 m ... 120 m	0.5 m ... 120 m
EDM-240	0.5 m ... 60 m	0.5 m ... 120 m	0.5 m ... 240 m***

* Operating range valid for inside use and good atmospheric conditions. If air is polluted, we recommend increasing number of reflectors. The distance measuring device should be sighted with the reflectors so that at close distance it aligns with one of them.

** Operating range on foil reflector is only for inside use. A range of 120 m can only be achieved if the reflector edge is 1 m long. It is not possible to increase the range by enlarging the foil surface. The more polluted the air, the more the operating range is reduced.

*** A range of 240 m can only be achieved by use of at least two pieces R140.

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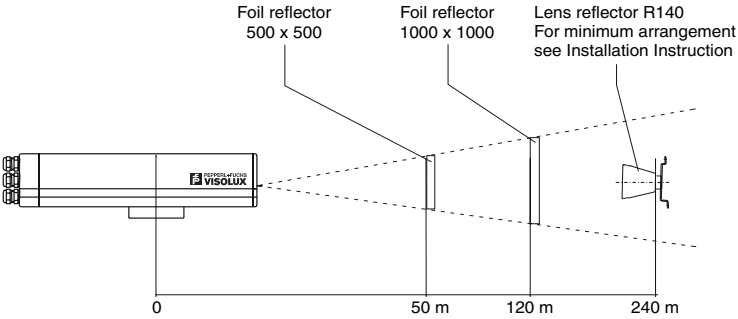
5.5 Reflector arrangement



Measurement beam diameter:	approx. 20 cm	approx. 35 cm	approx. 70 cm

Figure 5.4 Reflector arrangement (EDM side view)

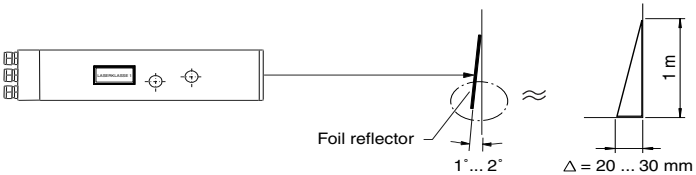


Figure 5.5 Arrangement of the foil reflector (EDM top view)
(with a 500 mm x 500 mm foil reflector, dimension Δ reduces to 10 ... 15 mm)

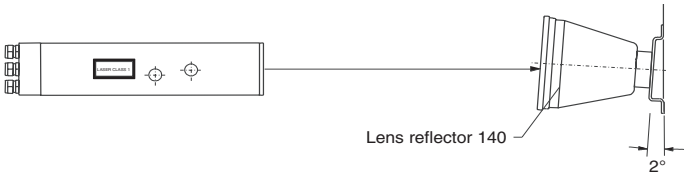


Figure 5.6 Arrangement of the lens reflector (EDM top view)
(When using the mounting bracket R 140, the required reflector tilt-angle is set automatically)

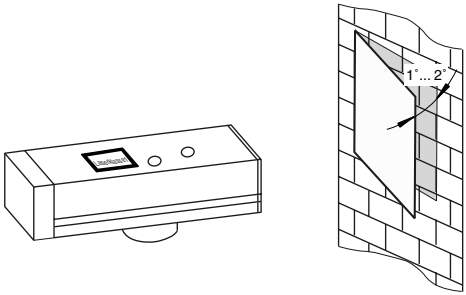


Figure 5.7 3-D view of the relationship between sensor orientation and reflector tilt angle orientation

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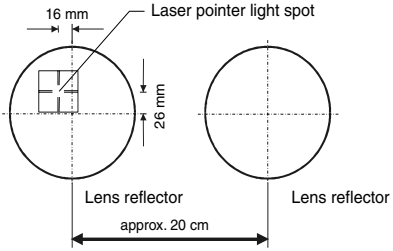

Figure 5.8 Minimal arrangement for distances from 120 m to 240 m (2x lens reflector R 140)

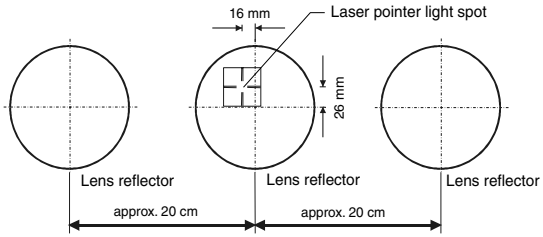

Figure 5.9 Recommended arrangement for horizontal beam adjustment because of uneven motion

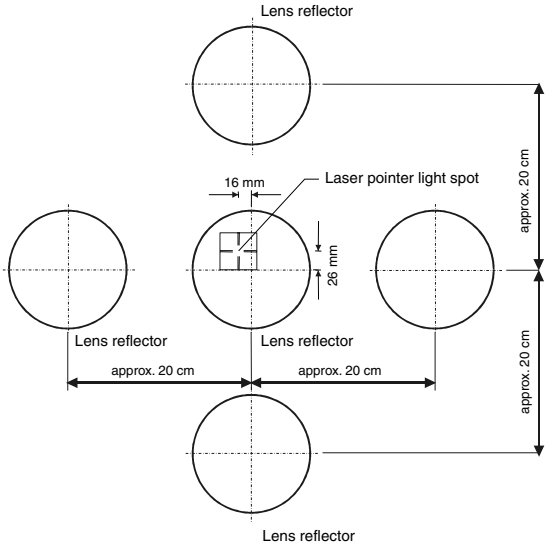

Figure 5.10 Recommended arrangement for horizontal and vertical beam adjustment because of rough surface and uneven motion

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5.6 Notes of alignment

When adjusting the unit, it should be remembered that the laser pointer is displaced laterally relative to the optical measurement system. The adjustment procedure applies for both types of reflector (foil and lens reflector) and must be carried out at **maximum** range.

Aim the unit so that the centre point of the laser pointer spot is horizontally 26mm and vertically 16mm away from the centre point of the reflector (see Figure 5.11). The adjustment as shown in Bild 5.11 assumes that the unit has been installed as shown above in Bild 5.4.

For a check of the alignment it is recommended to cover the reflector completely with white paper. Hence the laser pointer switches on. Now the Light beam position can be checked with a test run and adjusted if necessary.

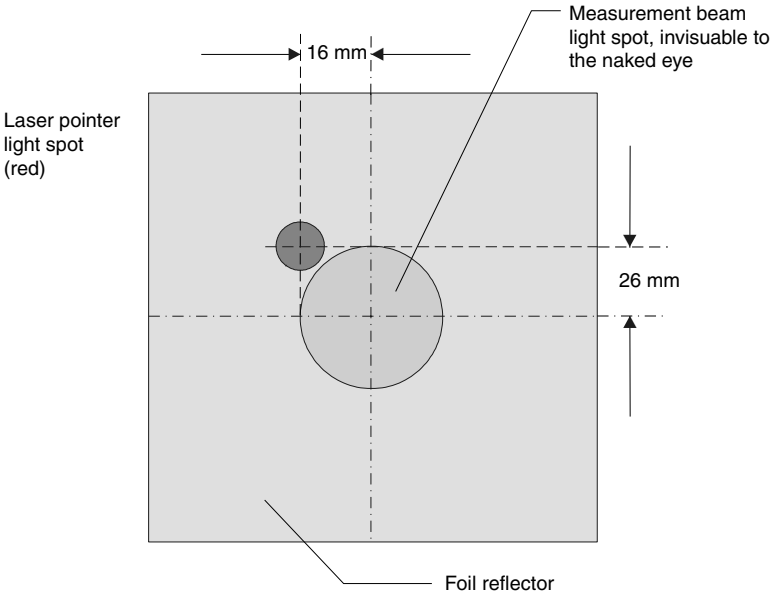

Figure 5.11 Foil reflector

6 Commissioning

6.1 Commissioning

After an approximate 10 second initialisation, the front red LED will go out provided that the EDM is aimed at a reflector.

In order to attain the specified accuracy, wait approximately 30 minutes for the EDM to warm up. It will then be ready for operation.

The sensor is tested and calibrated before leaving the factory. No further adjustment is

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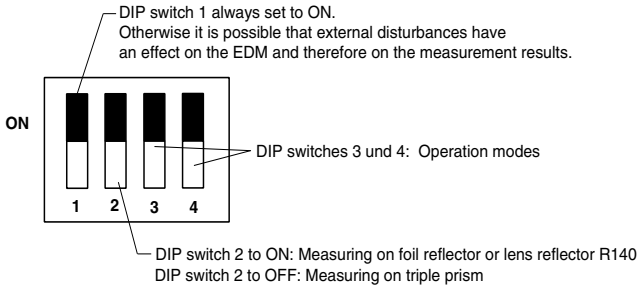
necessary before it is put into operation.

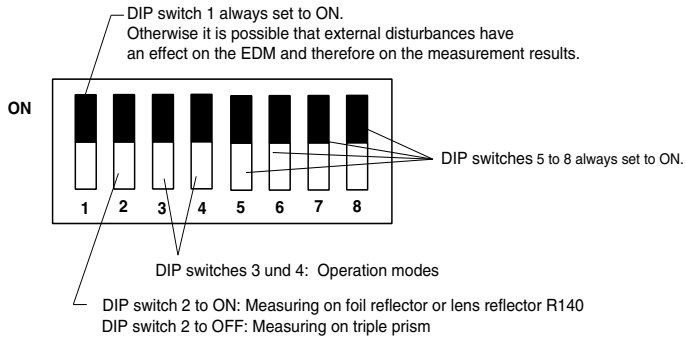
After removing the housing cover, the method of measurement can be selected using the four DIP switches (eight DIP switches on the PROFIBUS-DP).

On units with a PROFIBUS interface, DIP switches 5 to 8 always set to ON.

DIP switches - standard version



DIP switches - PROFIBUS-DP version



Note

The lens reflector R140 does not represent a triple prism!

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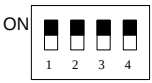
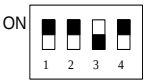
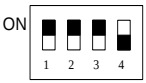
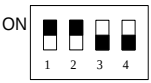
6.2 Operation modes

	Mode 0	Mode 1	Mode 2	Mode 3
				
Operation	Normal operation with **p**osition **r**eached **s**top (PRS) window in the control, typ. (3 mm ... 5 mm), will vary from one installation to another	For high travel speeds and short reaction times.	Normal operation with PRS window in the control (typ. 5 mm), will vary from one installation to another	Simulation of a PRS window only if this is not present in the control.
Depth of averaging	500 measurements with rapid target change 2000 measurements with slow target change	250 measurements	500 measurements	500 measurements with rapid target change 2000 measurements with slow target change
Data age	50 ms	25 ms	50 ms	50 ms
Repeat accuracy	± 0.5 mm, 1 Sigma	± 2.0 mm, 1 Sigma	± 1.5 mm, 1 Sigma	± 0.5 mm, 1 Sigma noise switch-off in the cause of static measurement

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6.3 LED display

Monitoring display

- Green LED lights up : Target (reflector) detected
- Red LED lights up : Target (reflector) not detected

All models include the monitoring display.

Diagnostic display PROFIBUS-DP

- Green outer LED : No function
- Green centre LED lights up : PROFIBUS successfully initialized
- Red LED No function

Diagnostic display InterBus-S

- Green outer LED lights up : InterBus successfully initialized
- Green centre LED lights up : Data is transfered on InterBus
- Red LED lights up InterBus not fitted or not initialized

Note

On units fitted with SSI interface, there is no diagnostic display!

Front LED

The front LED lights up as soon as power is applied to the unit. The LED will stay on whilst the unit is being initialized. It is extinguished after approximately 10 seconds (provided that the unit is aimed at a target). If the target is lost, the front LED will again light up during operation; it is switched together with the red LED of the monitoring display. In this case, the error bit is set after:

400 ms, if DIP switch 2 is set to ON (Foil reflector, Lense reflector, R140)

100 ms, if DIP switch 2 is set to OFF (Triple prism)

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7 Troubleshooting

Fault	Possible cause	Action
Red LED in the front windows stays on longer than 10 s.	• Target not detected • Dirty reflector or glass window • Exeeding measurement range	• Check adjustment (see Chapter 5.6)
Red control LED lights up	• Target not detected • Dirty reflector or glass window	• Check adjustment (see Chapter 5.6)
Red and grenn control LED light up	• Not ready for operation, unit possible defective	• Replace unit
Measurement error at close range	• Reflector is not tilted	• Tilt angle (see Chapter 5.5)
Measurement error increases with distance	• Laser is leaving the reflector	• Check adjustment
No LED lights up	• No power supply • Power supply poles transposed	• Check that housing cover is firmly fitted • Check wiring
Sporadic measurement jumps	• Electrostatic interference • GND loop	• Connect shield as in "Installation notes" • Connect housing to system GND
Measurement error at particular positions	• Loss of target, laser spot is leaving the reflector	• Check cource for very uneven surface, enlarge reflector if necessary
System oscillation	• Noise switch-off has unfavourable effect on regulation response	• Change measurement method
Shaking when position is reached	• Regulator intolerant of measurement noise	• Change measurement method
Large measurement errors	• Wrong target measured (galvanised or bright objects close by are detected as targets	• Paint or remove reflecting objects
Measurement is doubled	• Bit displacement during read-out	• Check software • Install data and power supply cables (for thyristor control) separatly • Check clock cables (Warning! Disconnect the motor if the cables are replaced)
Positioning error on the Y-axis heavy loads	• Residual vibration of the lifting platform	• Reduce brake action

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8 Technical data

Range	EDM-50 ...	0.5 m ... 50 m
	EDM-120 ...	0.5 m ... 120 m
	EDM-240 ...	0.5 m ... 240 m
Power supply	24 V DC ± 25% ≤ 8 VA (W)	
Laser class	1 (EN60825) optically safe	
Laser	Infrared 880 nm ± 30 nm	
	Spread (divergence) typically 2.5 mrad	
Interfaces	SSI, InterBus-S, PROFIBUS-DP	
Repeat accuracy	± 0.5 mm (1 Sigma) adjustable	
Absolute error	± 6 mm (0.5 m ... ≤ 3.2 m) ± 5 mm (> 3.2 m)	
Offset	± 5 mm (between two units)	
Influence of temperature	0.3 mm/K	
Refresh cycle of measured output	1000/s	
Read-out rate (max.)	3700/s (SSI)	
	Clock frequency 125 kHz ... 1 MHz	
	1000/s (InterBus-S)	
Transmission rate (max.)	1.5 MBit/s (PROFIBUS-DP)	
Maximum travel speed	10 m/s	
Temperature range	+10 °C ... +40 °C	
Storage temperature	-20 °C ... +75 °C	
Air humidity	95% (relative, no condensation)	
Type of protection	IP65 (when stored/operated with closed housing)	
Protection class	III (Rated voltage 50 V)	
EMV	EN 50082-2	
	EN 50081-1	
	EN 50082-1	
Initialisation time	approx. 10 s	
Weight	3 kg (incl. mounting bracket)	

Valid at 23 °C air temperature, 977 hPa, min. switch-on time 30 min.

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9 Ordering information

9.1 Distance Measurement Series EDM

Optoelectronic distance meter with SSI interface and laser pointer (Laser class 1))

EDM-50-SSI
EDM-120-SSI
EDM-240-SSI

Optoelectronic distance meter with InterBus-S interface and laser pointer (Laser class 1)

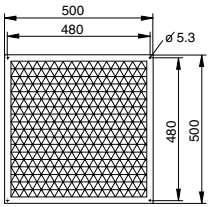
EDM-50-IBS
EDM-120-IBS
EDM-240-IBS

Optoelectronic distance meter with PROFIBUS interface and laser pointer (Laser class 1)

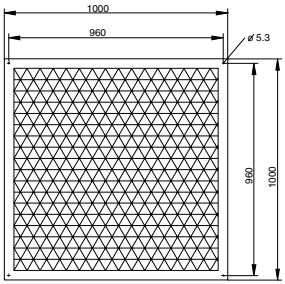
EDM-50-P
EDM-120-P
EDM-240-P

9.2 Accessories

Foil reflector 1 EDM (500 mm x 500 mm)



Foil reflector 2 EDM (1000 mm x 1000 mm)



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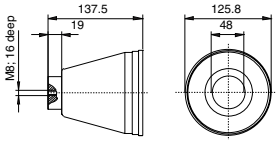
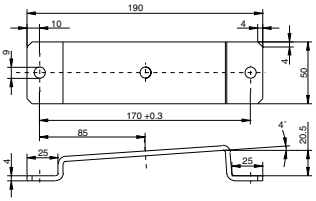
Retaining angle for lens reflector EDM

Lens reflector R140 EDM



Mounting bracket R140 EDM
(for lens reflector)



Deflection mirror EDM

9.3 Delivery comprises

Packaging
Optoelectronic distance meter (EDM), two-part
Mounting bracket
Manual (german/english)
Floppy disk with GSD file (only for PROFIBUS-DP version)

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