

MANUAL

# LS680-DA

Optical data coupler



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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## 1

# Introduction

## Congratulations

You have chosen a device manufactured by Pepperl+Fuchs. Pepperl+Fuchs develops, produces and distributes electronic sensors and interface modules for the market of automation technology on a worldwide scale.

Before you install this device and put it into operation, please read the operating instructions thoroughly. The instructions and notes contained in this operating manual will guide you step-by-step through the installation and commissioning to ensure the trouble-free usage of this product. This is useful to you, because with this you:

- support the safe operation of the device
- can utilize the device's entire range of functions
- reduce faulty operation and the associated errors
- reduce costs from downtime and incidental repairs
- increase the effectiveness and operating efficiency of your plant.

Store this operating manual somewhere safe in order to have it available for future work on the device.

After opening the packaging, please ensure that the device is intact and that the package is complete.

## Symbols used

The following symbols are used in this manual:

### Handling instructions

You will find handling instructions beside this symbol



### **Note!**

This symbol brings important information to your attention.

## Contact

If you have any questions about the device, its functions, or accessories, please contact us at:

Pepperl+Fuchs GmbH  
Lilienthalstraße 200  
68307 Mannheim  
Telephone: +49 621 776-4411  
Fax: +49 621 776-274411  
E-Mail: fa-info@pepperl-fuchs.com

## 1.1 Product documentation on the internet

You can view all the relevant documentation and additional information on your product at <http://www.pepperl-fuchs.com>. Simply enter the product name or model number in the **Product/Key word search** box and click **Search**.



Select your product from the list of search results. Click on the information you require in the product information list, e.g., **Technical documents**.



A list of all available documents is displayed.

## 2

## Declaration of conformity

This product was developed and manufactured under observance of the applicable European standards and guidelines.

**Note!**

A Declaration of Conformity can be requested from the manufacturer.

The product manufacturer, Pepperl+Fuchs GmbH, D-68307 Mannheim, has a certified quality assurance system that conforms to ISO 9001.



## 3 Safety

### 3.1 Symbols relevant to safety



#### ***Danger!***

This symbol indicates an imminent danger.

Non-observance will result in personal injury or death.



#### ***Warning!***

This symbol indicates a possible fault or danger.

Non-observance may cause personal injury or serious property damage.



#### ***Caution!***

This symbol indicates a possible fault.

Non-observance could interrupt devices and any connected facilities or systems, or result in their complete failure.

### 3.2 Intended use

The optical data coupler serves as an optical link between two Ethernet devices; typically one is mobile.

Always operate the device as described in these instructions to ensure that the device and connected systems function correctly. The protection of operating personnel and plant is only guaranteed if the device is operated in accordance with its intended use.

Only use recommended original accessories.

The operating company bears responsibility for observing locally applicable safety regulations.

Installation and commissioning of all devices must be performed by a trained professional only.

User modification and or repair are dangerous and will void the warranty and exclude the manufacturer from any liability. If serious faults occur, stop using the device. Secure the device against inadvertent operation. In the event of repairs, return the device to your local Pepperl+Fuchs representative or sales office.

### 3.3 General safety instructions

#### **Class 1M laser product**

This device is a class 1M laser product:



#### **Standards**

IEC 60825-1:2007 certified. Complies with 21 CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice No. 50, dated June 24, 2007.

Certifié cei 60825-1:2007. Conforme aux normes 21 CFR 1040.10 ET 1040.11 à l'exception des écarts conformément à la notice du laser N° 50, Datée du 24 JUIN 2007.

#### **LS680-DA-F2:**



#### **Warning!**

Visible red class 1M laser light

The laser light can be a nuisance especially in a dark environment. Do not point at people!

Do not observe with optical instruments such as magnifying glasses, microscopes, telescopes or binoculars!

Install the device so that the warning is clearly visible and readable.

Maintenance and repairs should only be carried out by authorized service personnel!



#### **Warning!**

Rayonnement laser visible produit laser classe 1M

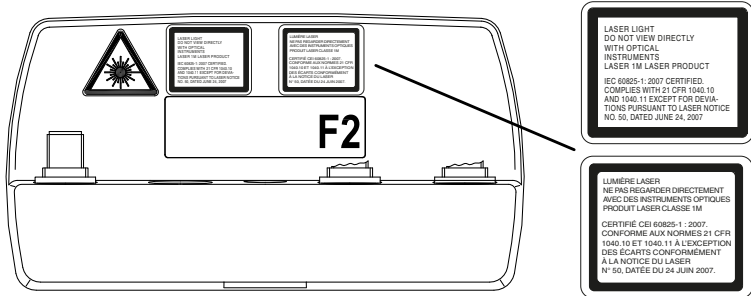
L'irradiation peut entraîner des irritations dans un environnement sombre. Ne pas orienter vers les personnes !

Ne pas regarder le rayon laser visible avec des instruments optiques comme les loupes, microscopes, télescopes ou jumelles !

L'appareil doit être installé de manière à ce que les mises en garde soient clairement visibles et lisibles.

L'entretien et les réparations doivent être réalisés exclusivement par le personnel de service autorisé !





LS680-DA-F1:



**Warning!**

Infrared class 1M laser light

Do not observe with optical instruments such as magnifying glasses, microscopes, telescopes or binoculars!

Install the device so that the warning is clearly visible and readable.

Maintenance and repairs should only be carried out by authorized service personnel!



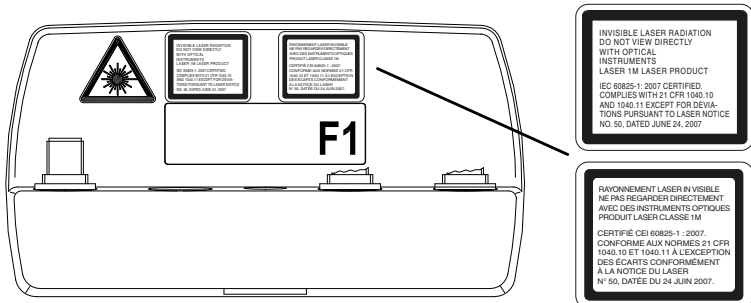
**Warning!**

Rayonnement laser invisible produit laser classe 1M

Ne pas regarder le rayon laser invisible avec des instruments optiques comme les loupes, microscopes, télescopes ou jumelles !

L'appareil doit être installé de manière à ce que les mises en garde soient clairement visibles et lisibles.

L'entretien et les réparations doivent être réalisés exclusivement par le personnel de service autorisé !



Only use recommended original accessories.

The operating company bears responsibility for observing locally applicable safety regulations.

Installation and commissioning of all devices must be performed by a trained professional only.

User modification and or repair are dangerous and will void the warranty and exclude the manufacturer from any liability. If serious faults occur, stop using the device. Secure the device against inadvertent operation. In the event of repairs, return the device to your local Pepperl+Fuchs representative or sales office.



**Caution!**

Controls or adjustments

Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure

## 4 Product Description

### 4.1 LS680-DA - Use and application

The optical data coupler serves as an optical link between two Ethernet devices; typically one is mobile. The opening angle is optimized for operations in high rack storage.

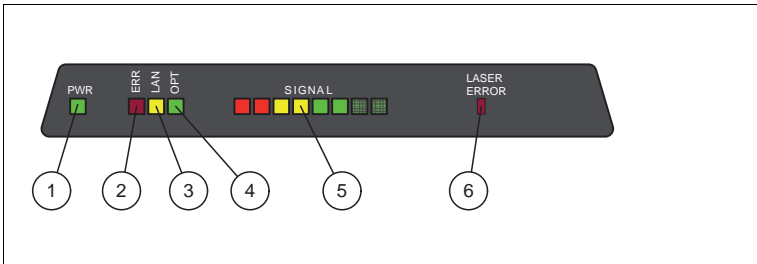
With the optical data coupler, devices with industrial Ethernet topologies, such as PROFINET, Ethernet/IP and other Ethernet protocols, can be connected. The physical transfer takes place protocol-free with 100 MBit/s full duplex. The connection to a number of modules must be implemented using switches that have been certified for use with the bus system in question. All layer 2 telegrams (IEEE 802.3 Clause 25) are physically transported. There is no saving of telegrams, so the transfer is not delayed at all.

Modules operating at a data rate of 10 MBit/s can be connected using a switch. Isochronous real-time systems can also be driven to a certain extent on account of the variable light propagation time.

The LS680 uses semiconductor lasers as optical transmitters. The dilation of the light beam and the use of return map blocks guarantee the harmlessness of the devices in accordance with laser class 1M. The transmitting beam must not be viewed with telescopes or binoculars from distances of less than 20 m. At longer distances, the limit values for laser class 1 are not exceeded, even when viewed through a telescope with a 50 mm aperture.



## 4.2 Displays and controls



①

### **PWR**

Lights up when the device is connected to the supply voltage.

②

### **ERR**

Status of the overall connection. Lights up if the signal is not strong enough to establish a connection (if misaligned or if the light beam is obstructed) and also when there is a fault on the optical channel, e.g., as a result of extraneous light. It must not illuminate under normal circumstances.

③

### **LAN**

Status of the cable connection. The LAN LED (yellow) indicates a physical connection to the next module on the cable. If it is not on, this indicates a connection problem. The LAN LED lights up permanently as long as no data is being transferred. Flashing of the LAN LED indicates the presence of data packets on the LAN.

④

### **OPT**

Status of the optical connection. The OPT LED flashes when the optical connection is stabilized through correct alignment.

⑤

### **SIGNAL**

Indicate the reception signal strength. Reaching the yellow area is sufficient to indicate error-free reception. If the alignment is correct, two green LEDs should light up at the nominal detection range. To avoid excessive bus loading due to transmission errors, data transfer is blocked below the yellow area.

⑥

### **LASER ERROR**

If the permitted internal temperature is exceeded, this LED will flash, although the transmission power is not reduced. If an internal activation error such as overcurrent is detected, the laser is switched off, and an attempt then made every second to resume normal operation. Meanwhile, the LASER ERROR LED lights up for 30 secs ... 60 secs, even if the process was unique, e.g., as the result of an EMC event.

### 4.3 Interfaces and connections

The device includes the following connections:

#### Power supply

There is an 4-pin M12 connector on the rear of the housing to connect the power supply and the alarm output. The following diagram shows the pin assignment:

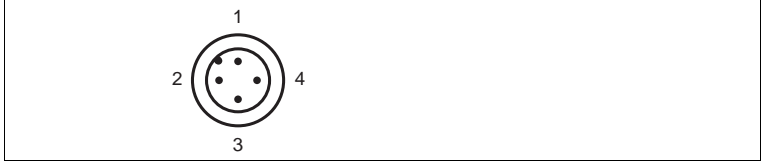
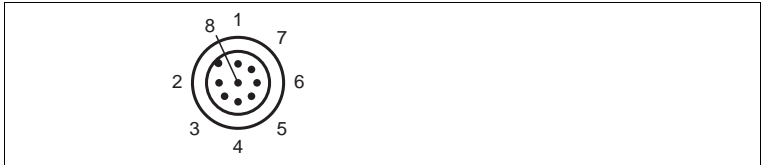


Figure 4.1 Power supply and alarm output connection layout

- 1 24 V power supply:
- 2 n.c.
- 3 Ground (GND)
- 4 Alarm

#### Service

The 8-pin M12 connector on the rear of the housing is for service purposes.



#### Network

There is a 4-pin D-coded M12 socket on the rear of the housing for connecting to the Profinet or Ethernet/IP network. The following diagram shows the pin assignment:

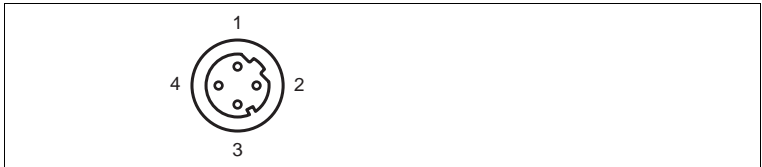


Figure 4.2 Network connection layout

- 1 Transmit Data (+)
- 2 Receive Data (+)
- 3 Transmit Data (-)
- 4 Receive Data (-)

#### 4.4 Delivery package

- LS680-DA
- Leaflet

#### 4.5 Accessories

##### 4.5.1 Mounting accessories

The following mounting accessories are available.

Designation	Description
OMH-LS610-01	Alignment/mounting aid
OMH-LS610-02	Direct mounting set (4 M4 threaded inserts)
Protective cap LS610 accessories	Additional fastening for transport and storage. A protective cap has already been placed onto the service connector .

##### 4.5.2 Connecting cable

The following female cordsets are available for selection:

Designation	Description
V1-G-2M-PVC	Female cordset, straight, M12, 4-pin, PVC cable, length: 2 m
V1-G-2M-PUR	Female cordset, straight, M12, 4-pin, PUR cable, length: 2 m
V1-M-5M-PVC	Female cordset, straight, M12, 4-pin, PVC cable, length: 5 m
V1-M-5M-PUR	Female cordset, straight, M12, 4-pin, PUR cable, length: 5 m
V1-W-2M-PVC	Female cordset, angled, M12, 4-pin, PVC cable, length: 2 m
V1-W-2M-PUR	Female cordset, angled, M12, 4-pin, PUR cable, length: 2 m
V1-W-5M-PVC	Female cordset, angled, M12, 4-pin, PVC cable, length: 5 m
V1-W-5M-PUR	Female cordset, angled, M12, 4-pin, PUR cable, length: 5 m

##### 4.5.3 Network connecting cable

The sensor is connected to the network using an M12 connector.

Designation	Description
V1SD-G-2M-PUR-ABG-V45-G	Patch cable M12 to RJ45, length: 2 m
V1SD-G-5M-PUR-ABG-V45-G	Patch cable M12 to RJ45, length: 5 m
V1SD-G-ABG-PG9	male connector, M12 D-coded, 4-pin for bus cable, field attachable

## 5 Installation

### 5.1 Preparation



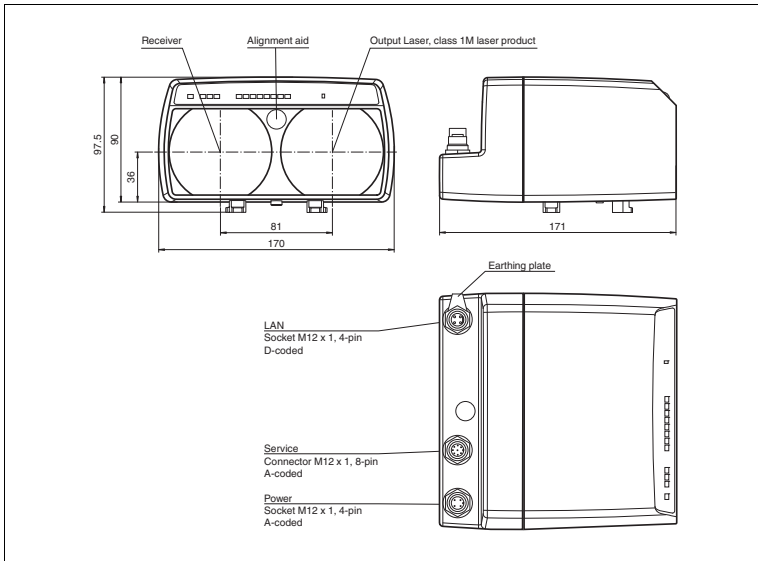
#### Unpacking the unit

1. Check that all package contents are present and undamaged.
  - ↳ If anything is damaged, inform the shipper and contact the supplier.
2. Check that all items are present and correct based on your order and the shipping documents.
  - ↳ If you have any questions, please contact Pepperl+Fuchs.
3. Keep the original packing material in case you need to store or ship the unit at a later time.

### 5.2 Mounting

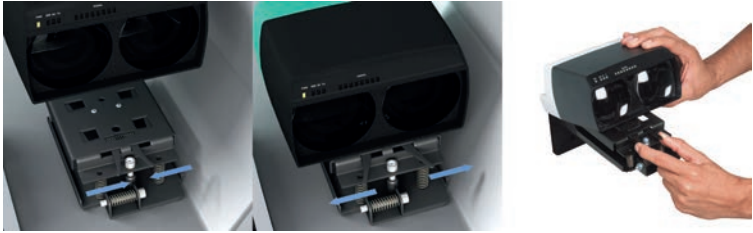
The device has two mounting holes as well as four retaining feet for easy installation. M4 inserts can also be pressed into these four feet. This allows existing adjustment and mounting options to be used. We also offer other mounting accessories to facilitate fast mounting and adjustment. See chapter 4.5.1

The following illustration shows all the relevant device dimensions in mm:



### Mounting on a P+F adjustment device

The mounting accessories (OMH-LS610-01) consist of a mounting bracket and an integral alignment device (in x and y axes). The required beam direction ( $\pm 90^\circ$  rotation) can be set using the mounting accessories, which are fastened to the mounting bracket using two M4 screws and the central M6 screw. The central screw is for securing the unit in place following adjustment and should not be tightened until the adjustment is finalized. To mount the optical data coupler, squeeze the two front levers together and place feet into the four openings in the adjustment device. The feet have to lock into place so that the levers can be released outwards as far as the stop; if necessary the optical data coupler has to be pressed down applying some force from the top to the center.



## 5.3

### Connection

#### Connecting the power supply

The device conforms to protection class III. This means that the power has to be supplied as a low protective voltage (PELV) and limited according to UL Class 2 (100 W). The power supply of the optical data coupler is a 18 V to 30 V DC. The dielectric test voltage (shield against power/GND) is 50 V maximum.

To supply power to the sensor, proceed as follows:

1. Plug the 4-pin M12 mating cordset into the connector on the rear of the housing.
2. Screw the cap nut as far as it will go over the connector. This ensures that the power cable cannot be inadvertently pulled out.
3. Now connect the supply voltage to the cable provided.

↳ The sensor is now ready for operation.





### Grounding / Shielding

This type of grounding is not protective grounding, it acts solely as a down conductor for cable-related faults and is not subject to any safety guidelines (e.g. personnel protection). Functional grounding of the shields is required to provide immunity to interference.

To ground the device, proceed as follows:

1. Make up a ground cable using a 6 mm flat connector with an adequate cross-section ( $\geq 1.5 \text{ mm}^2$ ).
2. Plug the flat connector onto the pre-mounted insertion prong on the device.
3. Connect the other end of the ground cable to adjacent metal components (e.g. mounting base, frame, etc.).

↳ The device is now grounded.



### Connecting the network

Both devices are connected to an M12 D-connector with the standard assignment for PROFINET or Ethernet/IP. The LS680 automatically locates transmit and receive lines (Auto-MDIX), so no crossover cable has to be used.

To connect the sensor to a network, proceed as follows:

1. Plug the 4-pin M12 mating cordset into the network connector on the rear of the housing.
2. Screw the cap nut as far as it will go over the connector. This ensures that the power cable cannot be inadvertently pulled out.
3. Now connect the network cable to the network connection provided for this purpose.

↳ The sensor is now ready for operation.



**Note!**

Data cables must conform CAT5. Do not use UTP (unshielded twisted pairs) for reasons of electrical immunity.

## 5.4

### Storage and transport

For storage and transport purposes, package the unit using shockproof packaging material and protect it against moisture. The best method of protection is to package the unit using the original packaging. Furthermore, ensure that the ambient conditions are within allowable range.

## 6 Commissioning

### 6.1 Adjustment

#### Alignment aid/ signal strength

An alignment LED, which can be seen from a long way off, is located on the front panel as an alignment aid. As soon as a receiver detects the transmitter light of the device opposite it, the flashing frequency of the alignment aid decreases. If the light goes out, this indicates that the devices are optimally aligned and sufficient signal strength is available. The bargraph display shows the receiving level. The optical data coupler is designed to ensure that an adequate level of received light is obtained over the entire transmitter. For technical reasons, however, the maximum received light is often not in the center of the spot. To ensure the best possible alignment, center the light spot horizontally and vertically with the other optical data coupler device. The drop-off in intensity at the edge of the spot is very pronounced, which makes the edges easy to locate.

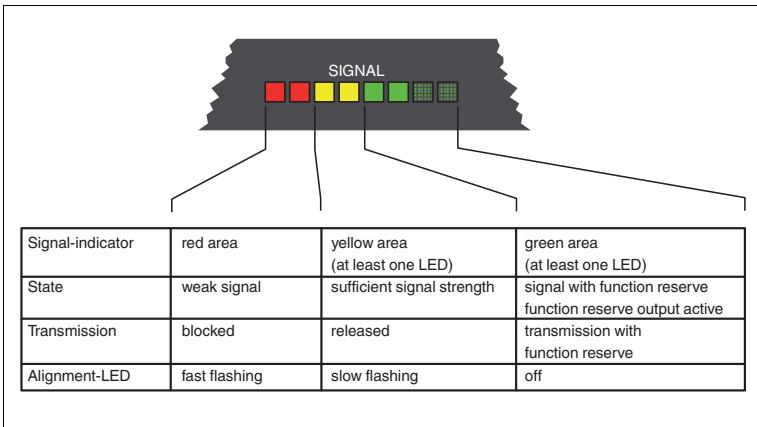
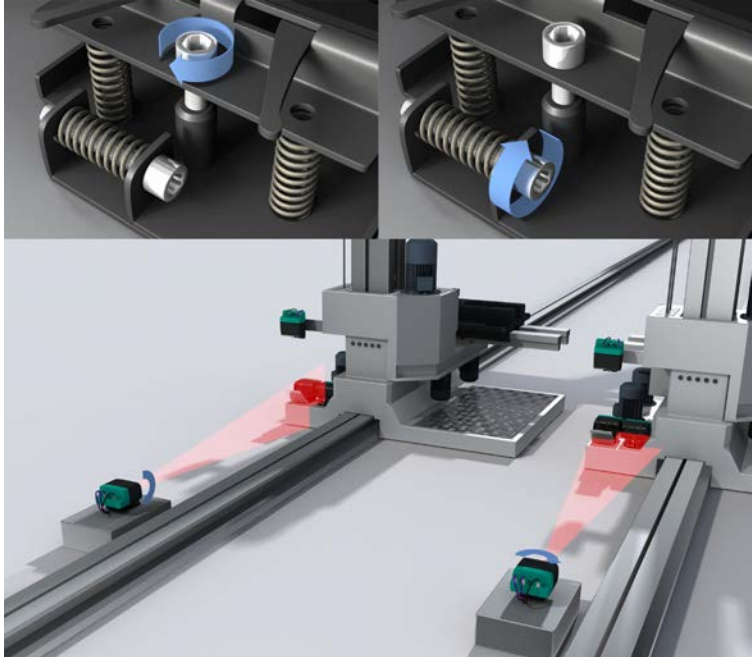


Figure 6.1 Explanation of display and operating state

In "high signal strength" mode (green zone), the received signal strength of the optical data coupler is sufficient for operational purposes. The optical data coupler should operate in the green zone within the nominal range (at least one green LED); if the received strength drops below this limit level, the alarm output is de-energized. Telegrams continue to be sent until the received strength drops below the level required for operational purposes (red LED only).

### Aligning using the adjustment alignment aid

The beam axis is aligned in the x and y direction using the two adjustment screws (hollow, 5 mm). This position is then fixed by tightening the central screw. Ethernet data communication is not needed for the alignment.



#### Alignment sequence

1. Place the adjustment alignment aid on the bracket in the required direction and tighten the two M4 nuts. Screw in the M6 central screw, but do not tighten it yet.
2. Place the optical data coupler in the adjustment alignment aid. Connect the power supply (Power).
3. Roughly align the device at a distance of around 3 - 5 m until both signal indicators lie in the green zone. Ensure that the optical data couplers are at the same height and are not offset.
4. Move both optical data couplers about 20 m apart and turn the adjustment screws Y until the alignment LED starts to flash slowly. Now turn the same screw in the opposite direction, counting the number of turns that the alignment LED remains off before it starts flashing again. Finally, turn the adjustment screw back (towards the middle) by half the number of turns. Perform the same procedure in the x direction.
5. Increase the distance to maximum. Adjust the device further if necessary.

6. We recommend to carry out the height adjustment before the lateral adjustment, as the height adjustment can mechanically modify the lateral position, but not the other way round.

↳ Once you have made the adjustments, tighten the central M6 screw to fix the position in the horizontal direction.

### Parallel light paths

If two transmission paths are installed next to each other without any optical separation, then the optical data couplers must be installed opposite in pairs to avoid cross-talk. A minimum distance 'a' between the beam axes is not required, provided that the adjacent pairs have the identical overall distance 'd.'

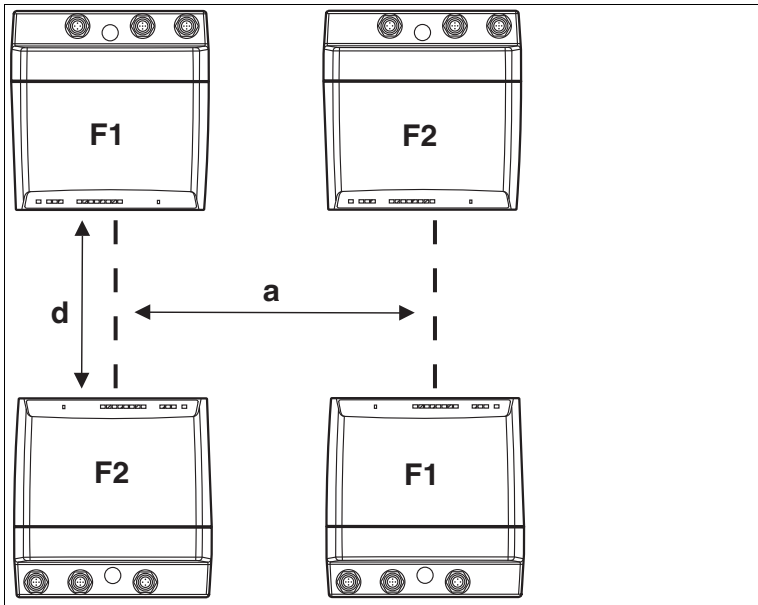
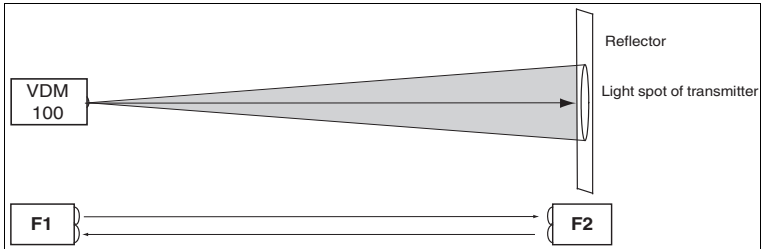


Figure 6.2 Parallel light paths

In such arrangements, disconnecting one side of an optical data coupler is not permitted. Similarly, the light beam must not be obstructed.

### Parallel arrangement with VDM100 distance measurement sensors

The optical data coupler and distance measurement sensors of the type VDM100 can be arranged in parallel. A minimum distance of the units is not required.



## 6.2 Topology

The optical data coupler does not contain any address routing logic (switch). This means that the distribution of the information must always be controlled by an external switch. The internal Ethernet adapter is permanently set to 100 MBit full duplex, as this is the only format that is converted for the optical transmission. Any adjustments required to connection modes must be made using the external switch. The pair of optical data couplers effectively replace a cable, the maximum cable lengths always relate to the distance from the ODC to the appropriate switch. The signal propagation time, on the other hand, depends on the physical distance between the two ODCs; it amounts to 3.3 ns for each meter of light path.

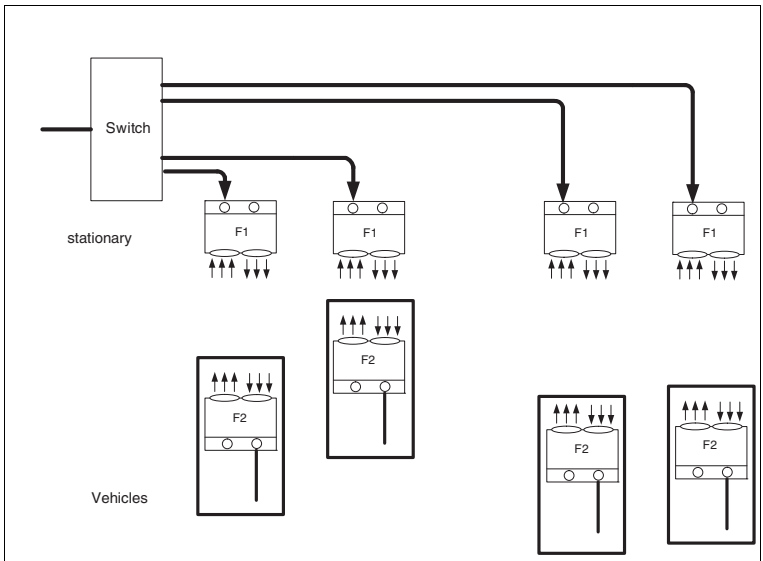


Figure 6.3 Topology

## 7 Maintenance and Repair

### 7.1 Maintenance

To get the best possible performance out of your device, keep the optical unit on the device clean and clean it when necessary.

Observe the following instructions when cleaning:

- Do not touch the optical unit with your fingers.
- Do not immerse the device in water. Do not spray the device with water or other fluids.
- Do not use a scouring agent to clean the surface of the device.
- Use a cotton or paper cloth moistened with water or isopropyl alcohol (not soaked).
- Remove any residual alcohol using a cotton or paper cloth moistened with distilled water (not soaked).
- Wipe the surface of the device dry using a lint-free cloth.

### 7.2 Repair

The devices must not be repaired, changed or manipulated. If there is a defect, the product must always be replaced with an original device.

## 8 Troubleshooting

### 8.1 What to do in the event of an error

Before requesting a service call, please check that the following actions have been taken:

- Test the equipment according to the following checklist.
- Telephone assistance from the Service Center in order to isolate the problem.

#### Checklist

Fault	Displays				Cause	Remedy
	PWR	ERR	LAN	OPT		
No display	off	off	off	off	The power supply is switched off or there is a wiring fault in the distributor or control cabinet.	Check whether there is a reason why it is switched off (installation or maintenance work etc.). Switch the power supply on if appropriate. Check the wiring carefully and repair any wiring faults.
No network connection	on		off		Network cable not connected or incorrectly connected	Check the connection to the next node; is the LAN LED also off on this node?
No optical communication	on	on		off	Receiving level too low, transfer blocked	Improve alignment or incorrect pairing; F1+F2 required
Bargraph not responsive despite precise alignment	on	off	on	on	Not an error; individual scaling deviation in the highest green signal strength	none
Bargraph full scale and data errors	on	on	on	on	Overload of the device	Move the device in horizontal or vertical direction by about 40 mm relative to the other device

- If none of the above solves the problem, contact the Service Center. Have the exact model number of the sensor ready if possible.

## 9

## Appendix

### 9.1

### Technical data

#### General specifications

Effective detection range	0 ... 150 m
Threshold detection range	180 m
Light source	laser diode
Light type device F1	modulated infrared light
Light type device F2	modulated visible red light
Laser nominal ratings	
Note	INVISIBLE LASER RADIATION , DO NOT VIEW DIRECTLY WITH OPTICAL INSTRUMENTS
Laser class	1M
Wave length device F1	785 nm
Wave length device F2	660 nm
Pulse length	8 ns
Repetition rate	62.5 MHz
Maximum optical power output	60 mW
Diameter of the light spot	1.5 m at a distance of 100 m
Angle of divergence	0.9 °
Ambient light limit	> 10000 Lux

#### Functional safety related parameters

MTTF <sub>d</sub>	58.6 a
Mission Time (T <sub>M</sub> )	10 a
Diagnostic Coverage (DC)	0 %

#### Indicators/operating means

Data flow indicator	LED green: OPTO-Link LED yellow: LAN-Link LED red: ERROR
Function indicator	Signal strength (8 LED: Red, yellow, green)



### Electrical specifications

Operating voltage	18 ... 30 V DC
No-load supply current	200 mA
Data rate	100 MBit/s (Fast Ethernet)

### Interface

Interface type	100 BASE-TX
----------------	-------------

### Output

Pre-fault indication output	1 PNP, inactive when falling short of the stability control , short-circuit protected, max. 200 mA
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### Compliance with standards and directives

Directive conformity	EMC Directive 2004/108/EC
Standard conformity	
Standards	EN 61000-6-2 , EN 61000-6-4 , EN 60825-1

### Approvals and certificates

UL approval	cULus Listed
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### Ambient conditions

Ambient temperature	-10 ... 50 °C (14 ... 122 °F)
Storage temperature	-20 ... 70 °C (-4 ... 158 °F)

### Mechanical specifications

Protection degree	IP65
Connection	4-pin, M12x1 connector, standard (supply) , 8-pin M12x1 connector, service , M12x1 socket, 4-pin, D-coded (LAN)
Material	
Housing	ABS / PC
Optical face	plastic
Mass	700 g

# FACTORY AUTOMATION – SENSING YOUR NEEDS



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