

Fibre optic isolating repeater

Series 9186



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1 General Information

1.1 Manufacturer

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1.2 Information about this Manual

ID no.:	918660330020
Publication code:	2023-10-20-HB00-III-en-02
Hardware version:	20 (type 9186/12); 12 (type 9186/.5)
Software version:	122 (type 9186/12); 130 (type 9186/.5)

The original manual is the German edition.
This is legally binding in all legal affairs.

1.3 Further Documents

- Data sheet
- Operating instructions
- National information and documents relating to use in hazardous areas
(see also chapter 1.4)

For documents in other languages, see r-stahl.com.

1.4 Conformity with Standards and Regulations

IECEX, ATEX, EU Declaration of Conformity and further national certificates and documents can be downloaded via the following link:

<https://r-stahl.com/en/global/support/downloads/>

Depending on the scope of validity, additional Ex-relevant information may be attached.

IECEX is also available at: <https://www.iecex.com/>

2 Explanation of Symbols

2.1 Symbols used in this Manual

Symbol	Meaning
	Tips and recommendations on the use of the device
	General hazard
	Explosive atmosphere hazard
	Laser radiation hazard





2.2 Warning Notes

Warning notes must be observed under all circumstances, in order to minimise the risk resulting from design engineering and operation. The warning notes have the following structure:

- Signalling word: DANGER, WARNING, CAUTION, NOTICE
- Type and source of danger/damage
- Consequences of danger
- Taking countermeasures to avoid the danger or damage

	DANGER
	Danger to persons Non-compliance with the instruction results in severe or fatal injuries to persons.
	WARNING
	Danger to persons Non-compliance with the instruction can result in severe or fatal injuries to persons.
	CAUTION
	Danger to persons Non-compliance with the instruction can result in light injuries to persons.
NOTICE	
Avoiding material damage Non-compliance with these instructions can result in material damage to the device and/or its surroundings.	

2.3 Symbols on the Device

Symbol	Meaning
 05594E00	CE marking according to the current applicable directive.
 02198E00	Electrical circuit certified for hazardous areas according to the marking.
 11048E00	Safety notes that must always be observed: For devices with this symbol, the corresponding data and/or the safety-relevant notes contained in this manual must be observed.
 20690E00	Marking according to WEEE Directive 2012/19/EU

3 Safety Notes

3.1 Storage of the Manual

- Read the manual carefully.
- Store the manual at the mounting location of the device.
- Observe applicable documents and operating instructions of the devices to be connected.

3.2 Personnel Qualification

Qualified specialist personnel are required to perform the activities described in this manual. This primarily applies to work in the following areas

- Project engineering
- Mounting/dismounting the device
- (Electrical) installation
- Commissioning
- Maintenance, repair, cleaning

Specialists who perform these activities must have a level of knowledge that meets applicable national standards and regulations.

Additional knowledge is required for any activity in hazardous areas!

R. STAHL recommends having a level of knowledge equal to that described in the following standards:

- IEC/EN 60079-14 (Electrical installations design, selection and erection)
- IEC/EN 60079-17 (Electrical installations inspection and maintenance)
- IEC/EN 60079-19 (Equipment repair, overhaul and reclamation)

3.3 Safe Use

Before mounting

- Read and observe the safety notes in this manual.
- Ensure that the contents of this manual are fully understood by the personnel in charge.
- Use the device in accordance with its intended and approved purpose only.
- Always consult R. STAHL Schaltgeräte GmbH if using the device under operating conditions which are not covered by the technical data.
- Make sure that the device is not damaged.
- We are not liable for damage caused by incorrect or unauthorised use of the device or by non-compliance with this manual.

For mounting and installation

- Have mounting and installation performed only by qualified and authorised persons (see chapter "Personnel qualification").
- The device is only to be installed in areas for which it is suited based on its marking.
- During installation and operation, observe the information (characteristic values and rated operating conditions) on the rating, data and information plates located on the device.
- Before installation, make sure that the device is not damaged.
- Only connect the device to equipment which does not carry voltages higher than 253 V AC (50 Hz).
- The safety characteristic values of the connected field devices must correspond to the specifications in the data sheet or in the EU Type Examination Certificate.
- The device's laser diode emits laser radiation. The laser beam is emitted at the emitting diode (TD-A, TD-B) or at the end of the fibre optic cable. According to IEC/EN 60825-1, the laser diode is assigned to the laser class 1M. In order to avoid eye injuries, do not look into the laser beam directly or with visual instruments (e.g. magnifiers, microscopes).
- Only connect the FO interface to Series 9186 devices.

Additionally for type 9186/12:

- For use in Zone 1 or Zone 2, install the device in a protective enclosure or cabinet that corresponds to a recognised type of protection according to IEC/EN 60079-0 and a degree of protection of at least IP54 according to IEC/EN 60529.
- For use in Zone 1 or Zone 2, affix an information plate to the enclosure (according to IEC/EN 60079-7): "Caution – Non-intrinsically safe circuits protected by internal IP30 cover".
- Only operate the device in environments not exceeding degree of pollution 2.
- Intrinsically safe devices of Zones 1, 0, 21 and 20 can be connected to the intrinsically safe signal circuits, even when used in Zone 2.
- Maintain a distance of at least 50 mm between intrinsically safe and non-intrinsically safe circuits.
- Electrical circuits with the "Ex i" type of protection may no longer be operated as electrical circuits with this type of protection after being operated with electrical circuits with other types of protection.
- Interconnecting multiple active pieces of equipment in a single intrinsically safe circuit can result in different safety characteristic values. This may jeopardise intrinsic safety.
- Observe the system certificate (PTB 04 ATEX 2089) and operating instructions for the Sub-D connector (94 900 02 22 0) if the RS485-IS interface is to be connected with other fieldbus devices to form a fieldbus system.
- Do not connect or disconnect any components at Ex e terminals 1 and 2 for the auxiliary power supply while the system is energised. After switching off the supply voltage, wait one minute before disconnecting the lines from the device.



Additionally for type 9186/.5:

- Install the device in Zone 2 or outside of hazardous areas.
- For use in Zone 2, install the device in a protective enclosure or cabinet that corresponds to a recognised type of protection according to IEC/EN 60079-0 and a degree of protection of at least IP54 according to IEC/EN 60529.
- Only operate the device in environments not exceeding degree of pollution 2.
- Only connect the FO interface to devices that correspond to the Ex op is type of protection. The devices connected to the fibre optic isolating repeater may be installed in Zone 2 or in safe areas.
- Only install the device in a de-energised state.


Commissioning, maintenance, repair

- Only have commissioning and repairs performed by qualified and authorised persons (see chapter "Personnel qualification").
- Before commissioning, make sure that the device is not damaged.
- Only perform maintenance work described in this manual.
- Repair work on the devices must be performed only by R. STAHL Schaltgeräte GmbH.
- The device contains components that can be damaged by electrostatic discharge. Before carrying out work on the device, discharge your body on earthed metal parts or put on an ESD wrist strap.

3.4 Modifications and Alterations

	DANGER
	<p>Explosion hazard due to modifications and alterations to the device! Non-compliance results in severe or fatal injuries.</p> <ul style="list-style-type: none"> • Do not modify or change the device.
	No liability or warranty for damage resulting from modifications and alterations.

4 Function and Device Design

	DANGER
	<p>Explosion hazard due to improper use! Non-compliance results in severe or fatal injuries.</p> <ul style="list-style-type: none"> • Use the device only according to the operating conditions described in this manual. • Use the device only for the intended purpose specified in this manual.

4.1 Function

Application range

The fibre optic isolating repeater is used to set up FO network structures in hazardous areas.

It enables asynchronous UART protocols such as PROFIBUS DP and Modbus signals to be transmitted over long distances.

Mode of operation

The signals are transmitted from an intrinsically safe RS485 interface according to PNO specification to an intrinsically safe optical interface (Ex op is).

4.2 Device Design

Type 9186/12

	#	Device element	Description
	Screw terminals		
	1, 2	Terminal	Not used
	3, 4	Terminals 3 + 4	Fault message contact
	21, 22	Terminals 5 + 6	Shield connection (equipotential bonding)
	RS485 interface		
	5	Sub-D, RS485	RS485 interface, data line
	Supply voltage status, RS485		
	6	Green LED	Supply voltage indicator
	7	Yellow LED	Data transmission indicator
	8	Green LED	Data reception indicator
	Port A status		
	9	Green LED	LED for excellent receive level
	10	Green LED	LED for good receive level
	11	Yellow LED	System reserve reached (fault message contact opened if both green LEDs are off)
	12	"ERR" LED, red	Inadequate receive level, fibre breakage at port A
	13	Connection of FO transmitter, port A (left)	FO transmitter port A, TD-A
	14	Connection of FO receiver, port A (left)	FO receiver port A, RD-A
	Port B status		
	15	Green LED	LED for excellent receive level
	16	Green LED	LED for good receive level
	17	Yellow LED	System reserve reached (fault message contact opened if both green LEDs are off)
	18	"ERR" LED, red	Inadequate receive level, fibre breakage at port B
	19	Connection of FO transmitter, port B (right)	FO transmitter port B, TD-B
	20	Connection of FO receiver, port B (right)	FO receiver port B, RD-B
Connection terminals X4 for supply voltage (auxiliary power)			
23	Terminal 2	0 V auxiliary power connection	
24	Terminal 1	+24 V auxiliary power connection	


Type 9186/5

#	Device element	Description
Screw terminals		
1	Terminal	+24 V auxiliary power connection
2	Terminal	0 V auxiliary power connection
3, 4	Terminals 3 + 4	Fault message contact
RS485 interface		
5	Sub-D, RS485	RS485 interface, data line
Supply voltage status, RS485		
6	Green LED	Supply voltage indicator
7	Yellow LED	Data transmission indicator
8	Green LED	Data reception indicator
Port A status		
9	Green LED	LED for excellent receive level
10	Green LED	LED for good receive level
11	Yellow LED	System reserve reached (fault message contact opened if both green LEDs are off)
12	"ERR" LED, red	Inadequate receive level, fibre breakage at port A
13	Connection of FO transmitter, port A (left)	FO transmitter port A, TD-A
14	Connection of FO receiver, port A (left)	FO receiver port A, RD-A
Port B status (only for type 9186/15-12-11)		
15	Green LED	LED for excellent receive level
16	Green LED	LED for good receive level
17	Yellow LED	System reserve reached (fault message contact opened if both green LEDs are off)
18	"ERR" LED, red	Inadequate receive level, fibre breakage at port B
19	Connection of FO transmitter, port B (right)	FO transmitter port B, TD-B
20	Connection of FO receiver, port B (right)	FO receiver port B, RD-B

5 Technical Data

Marking

Type designation 9186/..-1.-11

CE marking  0158

Explosion protection

Version	9186/12-11-11	9186/.5-12-11
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Global (IECEX)



Gas and dust



IECEX BVS 12.0081X
Ex e mb ib [ia op is Ga] IIC T4 Gb
[Ex ia Da] IIIC

IECEX BVS 13.0107X
Ex nA nC [op is T6 Ga] IIC T4 Gc
[Ex op is Da] IIIC

Europe (ATEX)

Gas and dust

BVS 06 ATEX E 145 X
 II 2 (1) G Ex e mb ib [ia op is Ga]
IIC T4 Gb
 II (1) D [Ex ia Da] IIIC

BVS 07 ATEX E 068 X
 II 3 (1) G Ex nA nC [op is T6 Ga]
IIC T4 Gc
 II (1) D [Ex op is Da] IIIC

Certifications and certificates

Certifications IECEX, ATEX, Brazil (INMETRO), Canada (cFM), USA (FM)

Ship certificates ABS, CCS, ClassNK, DNVGL, LR, RS

Further parameters

Installation In Zone 1 In Zone 2 and safe areas

Further information See relevant certificate and operating instructions

Safety data

Max. voltage U_o ± 3.7 V —

Max. current I_o 148 mA —

Max. power P_o 137 mW —

Safety-related maximum voltage U_m 253 V —

For RS485-IS connection

Max. connectable voltage U_i ± 4.2 V —

Internal capacitance C_i and inductance L_i negligible —

Ex i fault message contact

Max. connectable voltage U_i 24 V —

Max. connectable current I_i 600 mA —

Internal capacitance C_i and inductance L_i negligible —

Optical interface

Type of protection Ex op is IIC T6

Radiant power P_o 15 mW

Technical data

Version	9186/12-11-11	9186/5-12-11
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Electrical data

Auxiliary power		
Nominal voltage U_N	24 V DC	
Voltage range	18 to 31.2 V	
Residual ripple	< 3.6 V _{SS}	
Nominal current (at U_N)	67 mA	130 mA
Power consumption	≤ 2 W	3 W
Operation indication	Green "PWR" LED	
Polarity reversal protection	Yes	
Galvanic separation		
Test voltage		
According to standard	IEC/EN 60079-11	—
Between RS485 and auxiliary power	—	1.5 kV
Ex i RS485 to auxiliary power	1.5 kV	—
Fault message contact to auxiliary power	1.5 kV	—
Equipotential bonding to auxiliary power	1.5 kV	—
Ex i RS485 to fault message contact	500 V	—
Ex i RS485 to equipotential bonding	500 V	—
Fault message contact to equipotential bonding	500 V	—
Optical interface		
Protocols	Protocol-transparent for RS485 interface	
Network topologies	Ring structure, linear structure, point-to-point connection	
Redundancy	Automatic changeover in the event of a line fault	Automatic changeover in the event of a line fault (except for 9186/25-12-11)
Connection	ST [®] , BFOC/2.5 socket	
Wavelength	850 nm	
Transmission distance	≤ 2000 m	
Recommended optical fibres	G 50/125 multi-mode G 62.5/125 multi-mode	
	Integrated diagnostics function with alarm and automatic changeover to reserve path. Therefore increased availability	

Technical data

Version	9186/12-11-11	9186/5-12-11
Electrical interfaces		
Protocols	PROFIBUS DP, Modbus, HART over RS485, R. STAHL ServiceBus (IS1+)	
Version	RS485-IS (PNO)	RS485
Connection	Sub-D socket X1, 9-pin	
Transmission rate	1.2 kbps to 1.5 Mbps	9.6 kbps to 1.5 Mbps
Settings	Fixed transmission rates can be set or automatic identification (only for PROFIBUS DP)	
Bit refresh	Received bit is returned to its original form	
Cable length	Depends on transmission rate and cable according to PROFIBUS guideline	
Transmission method	2-wire, half-duplex	
End-of-line resistor	To be connected in external connector	
Data reception indication	Green "RD" LED ON	
Data transmission indication	Yellow "TD" LED ON	
Error control		
Auxiliary power failure	Fault message contact open	
Good receive level	Green and yellow "FO signal" LED, fault message contact closed	
Reduced receive level (-1.5 dBm)	Yellow "FO signal" LED, fault message contact open	
Fibre breakage or receive level too low (-3 dBm)	Red "FO ERR" LED, fault message contact open	
Switching capacity of fault message contact	See Ex i values	Max. 60 V DC, 42 V AC, 0.46 A
Electromagnetic compatibility	Tested in accordance with the following standards and regulations: IEC/EN 61326-1 For use in industrial areas	
Ambient conditions		
Ambient temperature	-20 to +65 °C	-20 to +60 °C
	Installation conditions influence the ambient temperature.	
Storage temperature	-40 to +85 °C	
Relative humidity (no condensation)	≤ 95%	
Use at the height of	< 2000 m	

Technical data

Version	9186/12-11-11	9186/5-12-11
Mechanical data		
Connection technology		
Auxiliary power	Spring clamp terminal, 0.2 to 1.5 mm ² (Ex e)	Screw terminal, 0.2 to 2.5 mm ² Green
Fault message contact	Screw terminal, 0.2 to 2.5 mm ² Blue (Ex i)	Screw terminal, 0.2 to 2.5 mm ² Green
Shield connection to equipotential bonding	Screw terminal, 0.2 to 2.5 mm ² Blue	Via DIN rail contact
Serial connection	Sub-D socket X1, 9-pin	
Shield	Via Sub-D socket terminal strip	
FO cable	BFOC/2.5 for optical fibre 50/125, 62.5/125	
Degree of protection		
Enclosure	IP30	
Auxiliary power terminals	IP20	IP30
Terminals	IP30	
Weight	Approx. 330 g	Approx. 200 g
Enclosure material	PA 6.6	
Fire resistance (UL-94)	V0	

Technical data

Version	9186/12-11-11	9186/5-12-11
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Mounting/installation

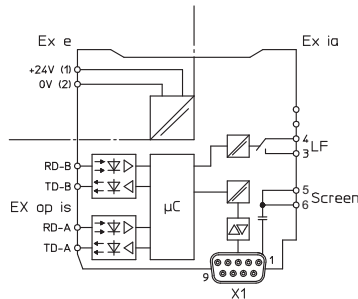
Installation conditions

Mounting type

Connection diagram

On DIN rail (NS 35/15; NS 35/7.5)

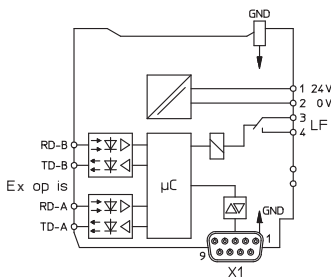
9186/12-...-



PIN	RS485-IS
8	A-
3	B+
6	ISP+
5	ISGND

05352E00

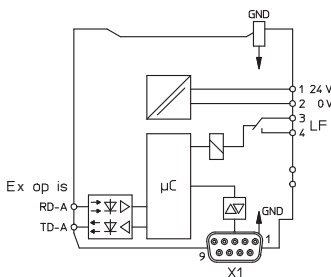
9186/15-...-



PIN	RS485
8	A-
3	B+
6	U+
5	GND

05354E00

9186/25-...-



PIN	RS485
8	A-
3	B+
6	U+
5	GND

06005E00

For further technical data, see r-stahl.com.

6 Project Engineering

NOTICE

An ambient temperature that is too high may cause failure of the devices installed in the cabinet.

Non-compliance can result in material damage.

- Install and set up the cabinet in such a way that all devices installed within it are always operated within their permissible temperature range.
-
- Only connect the FO interface to compatible interfaces of Series 9186 devices.

6.1 PROFIBUS



The data transmission lines and network components may cause signal delays. The bus parameters must therefore be adjusted using appropriate project engineering software. The defined maximum network reach must also be taken into account.

Operation in a linear structure

Calculate the min. slot time $T_{\text{slot_Init}}$ according to the following formula

$$T_{\text{slot_Init}} = a + b \times L + 2 \times N$$

where:

$T_{\text{slot_Init}}$: Min. slot time in bit times

N: Number of FO converters

L: Network reach in km

a, b: Length parameters (see table)

- Values a and b depend on the data rate and bus profile used (see table). Adapt the slot time $T_{\text{slot_Init}}$ accordingly in the system configuration.
- Ensure that the min. protocol processing time $\text{MIN } T_{\text{SDR}}$ is equal to at least 11 bit times ($\text{MIN } T_{\text{SDR}} \geq 11$).

Table: Project engineering parameters for linear structures

Data rate [kBps]	a		b
	DP	DP/FMS	
1500	161	991	15
500	111	371	5
187.5	71	371	1.875
93.75	71	211	0.9375
45.45	411	411	0.4545
19.2	71	76	0.192
9.6	71	71	0.096

Operation in a redundant ring

A ring structure is made up of at least three type 9186 devices.

Calculate the min. slot time T_{slot_Init} according to the following formula

$$T_{slot_Init} = a + b \times L + 44 \times N$$

where:

T_{slot_Init} : Min. slot time in bit times

N: Number of FO converters

L: Network reach in km

a, b: Length parameters (see table)

- Values a and b depend on the data rate and bus profile used (see table). Adapt the slot time T_{slot_Init} accordingly in the system configuration.
- Increase the RETRY LIMIT parameter by at least 3.
- Ensure that the min. protocol processing time $MIN T_{SDR}$ is equal to at least 11 bit times ($MIN T_{SDR} \geq 11$). This is the case as standard.

Table: Project engineering parameters for ring structures

Data rate [kBps]	a		b
	DP	DP/FMS	
1500	351	2011	30
500	251	771	10
187.5	171	771	3.75
93.75	171	451	1.875
45.45	851	851	0.909
19.2	171	181	0.384
9.6	171	171	0.192

Example:

Number of FO converters in the ring: 4

Speed: 1.5 MBps

Total installed length of the FO: 4 km

Slot time to be set: $T_{slot_Init} = a + b \times L + 44 \times N = 351 + 30 \times 4 + 44 \times 4 = 647$ bit

i	The slot time calculation only considers the optical network and the electrical connection of bus devices over an RS485 bus segment up to a maximum length of 20 m. Longer RS485 bus segments must also be accounted for by adding them to the FO cable length.
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6.2 Modbus/ServiceBus

i	Data transmission lines and network components may cause signal delays. If necessary, these must be taken into account when configuring the TIMEOUT times of the bus system used.
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Calculate the signal delay dT according to the following formula

$$dT = b \times L + 2 \times N$$

where:

Signal delay in bit times for a complete signal cycle

b: Length parameter (table)

L: Network reach in km

N: Number of fibre optic isolating repeaters

For the FO ring to function correctly, dT must be smaller than the shortest frame in bits.

Table: Correlation of data rate and length parameter b

Data rate	b
1.5 MBps	15
500 kBps	5.00
375 kBps	3.75
187.5 kBps	1.88
93.75 kBps	0.94
57.6 kBps	0.58
38.4 kBps	0.38
19.2 kBps	0.19
9.6 kBps	0.10
4.8 kBps	0.048
2.4 kBps	0.024
1.2 kBps	0.012

Modbus

For Modbus and similar UART protocols: At a minimum frame length of 44 bits, the maximum FO ring size is determined based on the number of devices and the transmission rate.

Table: FO ring size in Modbus operating mode (various data rates)

Number of devices	Data rate [kBps] of the FO ring size [km]										
	1.2	2.4	4.8	9.6	19.2	38.4	57.6	93.75	187.5	500	1500
2	Not permissible										
3	9.90	9.90	9.90	9.90	9.90	9.90	9.90	9.90	9.90	9.90	5.53
4	13.20	13.20	13.20	13.20	13.20	13.20	13.20	13.20	13.20	13.20	5.41
6	19.80	19.80	19.80	19.80	19.80	19.80	19.80	19.80	19.80	15.56	5.19
8	26.40	26.40	26.40	26.40	26.40	26.40	26.40	26.40	26.40	14.88	4.96
10	33.00	33.00	33.00	33.00	33.00	33.00	33.00	33.00	33.00	14.20	4.73
12	39.60	39.60	39.60	39.60	39.60	39.60	39.60	39.60	39.05	13.52	4.51
14	46.20	46.20	46.20	46.20	46.20	46.20	46.20	46.20	34.24	12.84	4.28
16	52.80	52.80	52.80	52.80	52.80	52.80	52.80	52.80	32.43	12.16	4.05
18	59.40	59.40	59.40	59.40	59.40	59.40	59.40	59.40	30.61	11.48	3.83
20	66.00	66.00	66.00	66.00	66.00	66.00	66.00	57.60	28.80	10.80	3.60
22	72.60	72.60	72.60	72.60	72.60	72.60	72.60	53.97	26.99	10.12	3.37
24	79.20	79.20	79.20	79.20	79.20	79.20	79.20	50.35	25.17	9.44	3.15
26	85.80	85.80	85.80	85.80	85.80	85.80	76.04	46.72	23.36	8.76	2.92
28	92.40	92.40	92.40	92.40	92.40	92.40	70.14	43.09	21.55	8.08	2.69
30	99.00	99.00	99.00	99.00	99.00	96.35	64.24	39.47	19.73	7.40	2.47
32	105.60	105.60	105.60	105.60	105.60	87.50	58.33	35.84	17.92	6.72	2.24

ServiceBus

The number of devices is limited to a maximum of 24 when operating in ServiceBus mode.

Table: Ring size in ServiceBus operating mode (9.6 kBps data rate)

Number of devices	Ring size [km]
2	Not permissible
3	9.90
4	13.20
6	19.80
8	26.40
10	33.00
12	39.60
14	46.20
16	52.80
18	59.40
20	66.00
22	68.75
24	33.33

6.3 PROFIsafe

i	Based on state-of-the-art technology, PROFIsafe devices and PROFIBUS standard devices can be operated simultaneously in one PROFIBUS network. This is commonly referred to as PROFIsafe in PROFIBUS (not to be confused with PROFIsafe in PROFINET). More information on this topic can be found in the relevant standards of PNO.
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PROFIsafe devices differ from standard PROFIBUS devices in that they assign 4 bytes of the possible payload range of a PROFIBUS frame for the additional PROFIsafe information (frame ID, CRC, etc.). This additional data is analysed by the master (F-Host).

When it comes to type 9186 fibre optic isolating repeaters, the PROFIBUS frames are transmitted transparently, irrespective of the content of the data. This enables all type 9186 to be operated in PROFIBUS networks with and without PROFIsafe devices. Note the watchdog monitoring which is configured for all PROFIsafe devices in the control system. With very large FO networks or in the case of radio transmission of PROFIBUS data, watchdog monitoring may be activated. In this case, the configured watchdog time must be adjusted correspondingly.


7 Transport and Storage

- Transport and store the device only in the original packaging.
- Store the device in a dry place (no condensation) free of vibrations.
- Do not drop the device.

8 Mounting and Installation

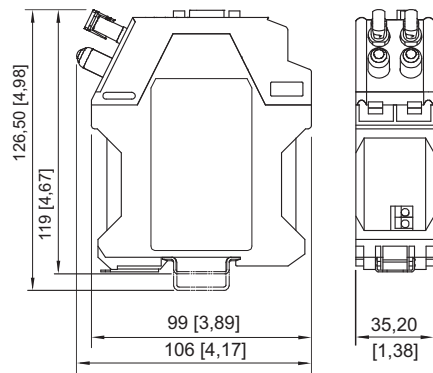
Type 9186/12 devices are approved for use in gas hazardous areas of Zones 1 and 2 and in safe areas.

Type 9186/.5 devices are approved for use in gas hazardous areas of Zone 2 and in safe areas.

	DANGER
	<p>Explosion hazard due to incorrect installation of the device! Non-compliance results in severe or fatal injuries.</p> <ul style="list-style-type: none"> • Carry out installation strictly according to the instructions and national safety and accident prevention regulations to maintain explosion protection. • Select and install the electrical device so that explosion protection is not affected due to external influences, i.e. pressure conditions, chemical, mechanical, thermal and electrical influences such as vibration, humidity and corrosion (see IEC/EN 60079-14). • The device must only be installed by trained qualified personnel who are familiar with the relevant standards.

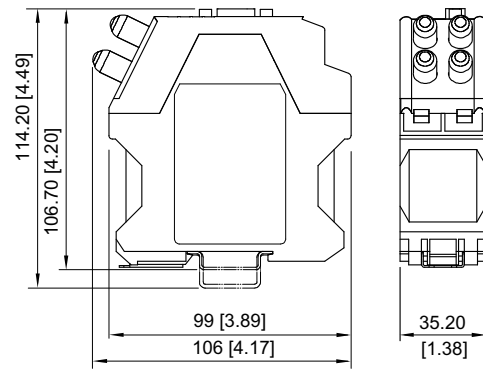
8.1 Dimensions/Fastening Dimensions

Dimensional drawings (all dimensions in mm [inch]) – Subject to change



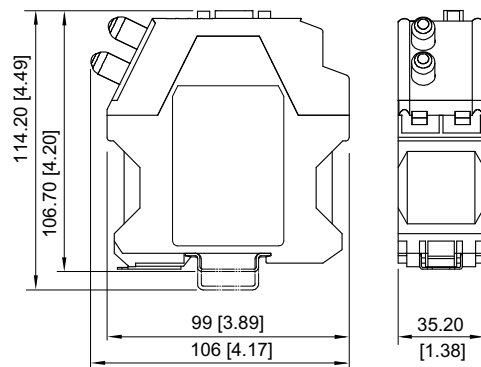
9186/12-11-11

06251E00



9186/15-12-11

11335E00



9186/25-12-11

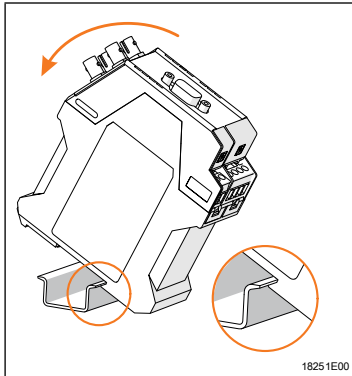
11328E00

8.2 Mounting/Dismounting, Operating Position

8.2.1 Mounting/Dismounting on DIN Rail

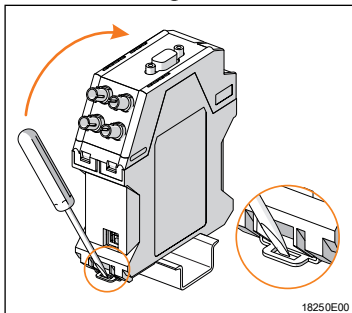
- Connect the mounting rail to the protective earth using an earthing terminal so that the module is earthed when attached to the mounting rail.

Mounting on DIN rail



- Position the device on the DIN rail. When doing so, position the cut-out in the enclosure on the outside edge of the DIN rail.
- Engage the device on the DIN rail.
- When swivelling the device onto the DIN rail, make sure that it is not set at an angle.

Dismounting



- Pull out the base bolt slightly using a screwdriver.
- Swivel out the device.

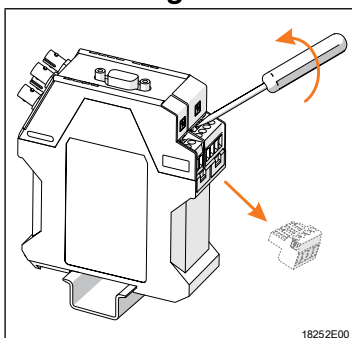
8.2.2 Mounting/Dismounting pluggable Terminals

All devices are equipped with pluggable terminals.

Mounting

- Insert the terminal into the device until the terminal engages.

Dismounting



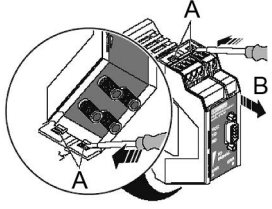
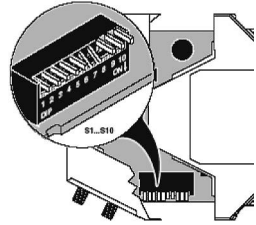
- Position the screwdriver behind the terminal.
- Push out the terminal.

8.3 Installation

i	Operation under difficult conditions, e.g. on ships in particular, requires additional measures to be taken for correct installation, depending on the operating location. Further information and instructions on this can be obtained on request from your designated sales contact.
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8.3.1 Opening and closing the Enclosure for Parameterisation


Opening the enclosure


 <p style="text-align: right; font-size: small;">11950E00</p>	<ul style="list-style-type: none"> • Make sure that appropriate protective measures have been taken to prevent electrostatic discharge. • Unlock the enclosure top using a screwdriver at the top and bottom (A). • Carefully pull out the PCB as far as it will go (B).
 <p style="text-align: right; font-size: small;">11951E00</p>	<ul style="list-style-type: none"> • Configure the DIP switches (see chapter 9.3).

Closing the enclosure

- Carefully insert the PCB into the enclosure until the upper and lower locking bars snap back into place in the enclosure.

8.3.2 Electrical Connections

	DANGER
	<p>Explosion hazard due to excessive voltage! Non-compliance results in severe or fatal injuries.</p> <ul style="list-style-type: none"> • Only connect the device to equipment with internal voltage U_m: Max. 253 V AC/50 Hz.


	DANGER
	<p>Explosion hazard due to incorrect safety characteristic values of the device or connected field devices! Non-compliance results in severe or fatal injuries.</p> <ul style="list-style-type: none"> • Check the safety characteristic values of the device and connected field devices according to the national installation guidelines.

NOTICE	
<p>Device failure due to electrostatically overcharged components! Non-compliance may lead to material damage.</p> <ul style="list-style-type: none"> • Before carrying out work on the device, discharge your body's own voltage on earthed metal parts or put on an ESD wrist strap. 	

8.3.3 Schematic Diagrams


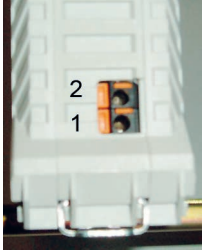
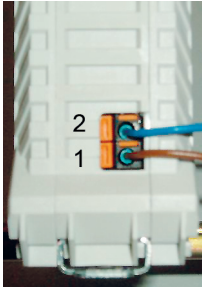
See device labelling or technical data.

8.3.4 Power Supply Connection

	DANGER
	<p>Explosion hazard with type 9186/12 due to live components when wiring connection lines! Non-compliance results in severe or fatal injuries.</p> <ul style="list-style-type: none"> • De-energise the device before connecting the auxiliary power (Ex e terminals 1 and 2). • Wait at least one minute after switching off the auxiliary power. • Disconnect cables from the device. • Only use insulating core end sleeves. • Insert the insulating sleeve of the core end sleeves into the corresponding opening of the connecting terminal in order to ensure a tight string length of at least 3 mm between the conducting parts of the cores for the auxiliary power supply. • Fit the outer diameter of the insulating sleeve (for cores with a cross section of up to 0.5 mm²) into the connection opening.


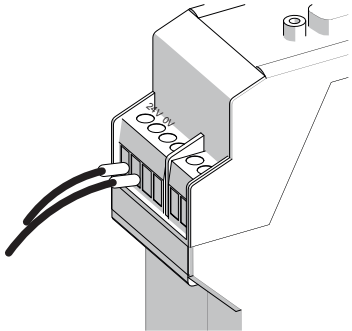
Preparing the power supply/auxiliary power connection for type 9186/12-11-11

- Use suitable tools to strip the cable for connecting the auxiliary power.
- Place the insulating core end sleeve onto the stripped core and secure it.

 <p>11948E00</p>	<ul style="list-style-type: none"> • Prepare the power supply cable with insulating core end sleeve.
 <p>11947E00</p>	<ul style="list-style-type: none"> • Connect the supply voltage to terminal 1 (24 V), lower, with the brown cable, and terminal 2 (0 V), upper, with the blue cable.
 <p>11949E00</p>	<ul style="list-style-type: none"> • Ensure that the insulating sleeve of the core end sleeves has been fully inserted into the corresponding opening of the connection terminal.




Preparing the power supply/auxiliary power connection for type 9186/.5-12-11

- Use suitable tools to strip the cable for connecting the auxiliary power.
- Place the insulating core end sleeve onto the stripped core and secure it.

 <p>11948E00</p>	<ul style="list-style-type: none"> • Prepare the power supply cable with insulating core end sleeve.
 <p>15685E00</p>	<ul style="list-style-type: none"> • Connect the power supply to terminal 1 (24 V) and terminal 2 (0 V). • Ensure that the insulating sleeve of the core end sleeves has been fully inserted into the corresponding opening of the connection terminal.

8.3.5 RS485 Data Line Connection

The fibre optic isolating repeater is designed to be connected to an RS485-IS interface. There is no provision for connection to an RS485 Ex i interface according to R. STAHL specifications.

	DANGER
	<p>Explosion hazard due to use of unapproved components! Non-compliance results in severe or fatal injuries.</p> <ul style="list-style-type: none"> • For connection to the RS485-IS interface, only use plug connectors that are approved for the RS485-IS interface. • Do NOT connect any non-intrinsically safe PROFIBUS signals to the RS485-IS interface.
	<p>Activate the termination in the terminating connector if the fibre optic isolating repeater is at the beginning or at the end of an electric PROFIBUS segment.</p>
	<p>Learn more details about project engineering in the operating instructions entitled "Project engineering, installation and commissioning of the RS485 fieldbus system from R. STAHL for safe and hazardous areas".</p>

Data rate and range for RS485-IS interface

Data rate [kBps]	Range for twisted pair cable, dia. 34 mm ² , RS485-IS, type A cable according to IEC 61158-2
< 93.75	≤ 1200 m
187.5	≤ 1000 m
500	≤ 400 m
1500	≤ 200 m

8.3.6 Equipotential Bonding Connection

The shield for the RS485 data line is capacitively placed over the 9-pin Sub-D connection on terminals 5 and 6 for the shield connection (see chapter 4.2).



- Attach the equipotential bonding to the device over both terminals.
Note the installation guidelines of IEC/EN 60079-14.

8.3.7 Fault Message Contact Connection

The fibre optic isolating repeaters are equipped with a potential-free switching contact which is used as an NC contact for error diagnosis (connection terminals 3 and 4, see chapter 4.2). This contact opens on the relevant module if:

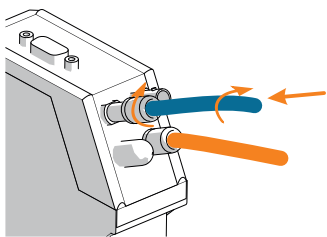
- The supply voltage fails,
- A break of the FO path has been detected,
- The value drops below the system reserve of the FO path,
- Connect the switching contact to an intrinsically safe digital input (for example Remote I/O IS1) to enable fault detection. Note the maximum electrical load of the contact (see the "Technical data" chapter).

8.3.8 FO Connection

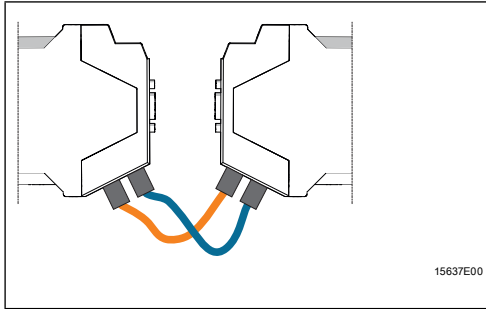
	<p style="text-align: center;">WARNING</p> <p>Hazard due to open connectors and plug connections! Non-compliance can result in severe injuries and material damage.</p> <ul style="list-style-type: none"> • Check connectors and plug connections for dirt, and clean them if necessary. • Remove the dust caps just before installing the fibre optic cables.
	<p style="text-align: center;">DANGER</p> <p>Laser radiation from laser diode! Non-compliance can result in severe eye injuries.</p> <ul style="list-style-type: none"> • During operation, do not look directly into the emitting diodes or into the fibre optic cables while using visual aids.

Connecting the FO cable

Standardised B-FOC (STR) connectors can be connected to the fibre optic isolating repeaters.


 <p style="text-align: right; font-size: small;">15641E00</p>	<ul style="list-style-type: none"> • Remove the protective caps. • Plug the FO cable into the plug connections of the transmit and receive channel. • Press the spring mechanism of the plug connector downwards. • Turn the connector a quarter rotation to the right to secure the connection. • Take measurements (for example dampening values of the fibre optic path) to check for proper connection.
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Coupling the fibre optic isolating repeater



- Take note of the fibre optic cable's signal direction.
- Connect the "TD" connection (transmitter) of module 1 to the "RD" connection (receiver) of module 2.
- Connect the "RD" connection (receiver) of module 1 to the "TD" connection (transmitter) of module 2.

9 Parameterisation and Commissioning

	DANGER
	<p>Explosion hazard due to incorrect installation! Non-compliance results in severe or fatal injuries.</p> <ul style="list-style-type: none"> • Check the device for proper installation before commissioning. • Comply with national regulations.

Before commissioning, ensure the following:

- The device has been installed according to regulations.
- The electrical lines are connected correctly.
- The device and connection lines show no signs of damage.
- The screws are securely fastened to the terminals.
Correct tightening torque: 0.5 to 0.6 Nm.

9.1 Replacing the Device

- When replacing this device with a device with an identical design, readjust the DIP switch if necessary.

9.2 Parameterisation

NOTICE

Device failure due to electrostatically overcharged components!

Non-compliance may lead to material damage.

- Before carrying out work on the device, discharge your body's own voltage on earthed metal parts or put on an ESD wrist strap.
- Attach protection against electrostatic charge.
- Do not remove the front shield during operation in a hazardous area.



The isolating repeater allows various bus protocols and operating modes to be transmitted.

The device characteristics must be configured by the user before commissioning. Configure DIP switches 1 to 10 according to the planned application (see chapter 9.2.1).

9.2.1 Setting the DIP Switches

Setting the data rate (DIP switches 1 4)

When the "PROFIBUS" operating mode is selected, the devices are equipped with automatic data rate identification (DIP switch 10 set to "ON"). The data rate can also be set in "PROFIBUS" operating mode, which markedly reduces the initialisation time of the whole system.

Specific setting for R. STAHL ServiceBus

For R. STAHL ServiceBus (for IS Wizard, IS1 download), Modbus or HART applications, the "RS485" operating mode must be selected. In this operating mode, the data rate must be set, as automatic data rate identification does not work in this case.

For R. STAHL ServiceBus, there is a special setting for DIP switches 1 to 4. This makes it possible to operating up to 24 9186 isolating repeaters in a ring.

If the R. STAHL ServiceBus protocol is used without this setting, the number of type 9186 isolating repeaters that can be connected in the ring structure is reduced to 12.

Transfer rate [kBps]	DIP switch (1 to 4)			
	1	2	3	4
1500	ON	ON	ON	ON
500	ON	ON	ON	OFF
375	ON	ON	OFF	ON
187.5	ON	ON	OFF	OFF
93.75	ON	OFF	ON	ON
57.6	ON	OFF	ON	OFF
45.45	ON	OFF	OFF	ON
38.4	ON	OFF	OFF	OFF
19.2	OFF	ON	ON	ON
9.6	OFF	ON	ON	OFF
4.8	OFF	ON	OFF	ON
2.4	OFF	ON	OFF	OFF
1.2	OFF	OFF	ON	ON
AUTO ^{*)}	OFF	OFF	ON	OFF
Reserved	OFF	OFF	OFF	ON
ServiceBus 9k6	OFF	OFF	OFF	OFF

^{*)} The "AUTO" switch position only applies to PROFIBUS

Setting the remaining functions (DIP switches 5 to 10)

	DIP switch (5 to 10)					
	5	6	7	8	9	10
ON	11 BIT ^{*)}	ECHO ON ^{*)}	INVERSE ^{*)}	REDUNDANCY ^{*)}	PORT B ON ^{*)}	PROFIBUS ^{*)}
OFF	10 BIT ^{*)}	ECHO OFF	STANDARD	OFF	OFF	RS485

^{*)} Standard setting upon delivery

DIP switch	Position	Function	Designation	Note
5	ON	11 bit character length ^{*)}	11 BIT	Transmission protocol with 11 bit character length. Only applicable if DIP switch 10 is set to RS485
	OFF	10 bit character length	10 BIT	Transmission protocol with 10 bit character length. Only applicable if DIP switch 10 is set to RS485
6	ON	Echo evaluation on ^{*)}	ECHO ON	Standard setting in redundant operation. Message contact opens if echo does not appear
	OFF	Echo evaluation off	ECHO OFF	For coupling to external devices that do not produce echo
7	ON	"Light on" during idle time ^{*)}	INV	<ul style="list-style-type: none"> Continuous measurement of received light energy Standard setting in redundant or ring operation
	OFF	"Light off" during idle time (for external coupler)	STANDARD	<ul style="list-style-type: none"> No performance evaluation (bar graph switched off) Automatically set to "Light on" in redundant/ring operation
8	ON	Operation in optical ring, or redundant operation	REDUNDANCY	<ul style="list-style-type: none"> Device in redundant operation Neutral position "Light on", data transmission at port A, or port B in case of error. The data is transmitted to ports A and B at the same time. An error message is sent in the event of a fibre breakage and communication continues over the intact half of the ring DIP switch 9 set to ON
	OFF	No redundant operation (optical lines or star connection)	OFF	Device either in star or linear operation, with inverse or normal light status. Data is sent to either port A or ports A and B depending on the setting of DIP switch 9
9	ON	Both FO interfaces (ports A and B) are active ^{*)}	NEXT	Operation as T-coupler
	OFF	FO interface B disconnected (only port A is active)		Operation as terminal device
10	ON	PROFIBUS operation ^{*)}	PROFIBUS	11 bit character length, automatic identification of data rate possible
	OFF	RS485 2-wire, depending on protocol	RS485	10/11 bit switchable character length, automatic identification of data rate not possible

^{*)} Standard setting upon delivery

10 Operation

10.1 Operation

When a line fault is detected, the output signal is identical to the input signal.

10.2 Indicators

The corresponding LEDs on the device indicate the operating state of the device (see also the "Function and device design" chapter).

LED	Colour	"ON" LED	"OFF" LED
"PWR" LED	Green	Ready for operation, no valid transfer rate identified (autobaud setting) (blinking green 1 Hz); Ready for operation, transfer rate identified or set (lights up green)	Device is not in operation, no power supply
"TD" LED	Green	Data transmission indicator	No data transmitted
"RD" LED	Green	Data reception indicator	No data received
"ERR" LED, port A	Red	Inadequate receive level, fibre breakage at port A	Receive level corresponding to the indication of the green/yellow LEDs of port A
"ERR" LED, port B	Red	Inadequate receive level, fibre breakage at port B	Receive level corresponding to the indication of the green/yellow LEDs of port B
Receive level LEDs, port A	Green/yellow	Yellow: System reserve receive level reached, fault message contact opened Green: Corresponding to the strength of the receive level (good/excellent), ascending from bottom to top	Receive level corresponding to the indication of the LEDs of port A
Receive level LEDs, port B	Green/yellow	Yellow: System reserve receive level reached, fault message contact opened Green: Corresponding to the strength of the receive level (good/excellent), ascending from bottom to top	Receive level corresponding to the indication of the LEDs of port B

10.3 Troubleshooting

For troubleshooting, refer to the following troubleshooting guide:

Error	Cause of error	Troubleshooting
"PWR" LED (green) is off	<ul style="list-style-type: none"> • Auxiliary power failure • Polarity reversal of the auxiliary power supply 	<ul style="list-style-type: none"> • Check the polarity of the auxiliary power supply. • Check the wiring of the auxiliary power supply.

If the error cannot be eliminated using the specified procedures:

- Contact R. STAHL Schaltgeräte GmbH.

For rapid processing, have the following information ready:

- Type and serial number of the device
- Purchase information
- Error description
- Intended purpose (especially input/output circuit)

11 Maintenance, Overhaul, Repair

11.1 Maintenance

- Consult the relevant national regulations to determine the type and extent of inspections.
- Tailor inspection intervals to the operating conditions.

At a minimum, check the following points during maintenance on the device:


- Whether the clamping screws holding the electrical lines fit securely
- Whether the device has cracks or other visible signs of damage
- Whether the permissible ambient temperatures are observed
- Whether it functions as intended

11.2 Maintenance

The device does not require regular maintenance.

i	Observe the relevant national regulations in the country of use.
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11.3 Repair

	DANGER
	<p>Explosion hazard due to improper repair! Non-compliance results in severe or fatal injuries.</p> <ul style="list-style-type: none"> • Repair work on the devices must be performed only by R. STAHL Schaltgeräte GmbH.

11.4 Returning the Device

- Only return or package the devices after consulting R. STAHL!
 Contact the responsible representative from R. STAHL.

R. STAHL's customer service is available to handle returns if repair or service is required.

- Contact customer service personally.

or

- Go to the r-stahl.com website.
- Under "Support" > "RMA" > select "RMA-REQUEST".
- Fill out the form and send it.
 You will automatically receive an RMA form via email. Please print this file off.
- Send the device along with the RMA form in the packaging to R. STAHL Schaltgeräte GmbH (refer to chapter 1.1 for the address).

12 Cleaning

- Devices located in hazardous areas may only be cleaned with a damp cloth to avoid electrostatic charge.
- When cleaning with a damp cloth, use water or mild, non-abrasive, non-scratching cleaning agents.
- Do not use abrasive cleaning agents or solvents.

13 Disposal

- Observe national, local and statutory regulations regarding disposal.
- Separate materials for recycling.
- Ensure environmentally friendly disposal of all components according to statutory regulations.

14 Accessories and Spare Parts

NOTICE

Malfunction or damage to the device due to the use of non-original components.
Non-compliance may lead to material damage.

- Use only original accessories and spare parts from R. STAHL Schaltgeräte GmbH.



For accessories and spare parts, see the data sheet on our homepage r-stahl.com.