



Fibre optic isolating repeater

Series 9186



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1 General Information

1.1 Manufacturer

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1.2 Information about the Manual

ID-No.:	918660330020
Publication Code:	2016-10-18-HB00-III-en-01
Hardware version:	20 (Type 9186/12); 12 (Type 9186/.5)
Software version:	122 (Type 9186/12); 130 (Type 9186/.5)

The original instructions are the English edition.
They are legally binding in all legal affairs.

1.3 Further Documents

- Data sheet 9186
- Product information 9186

For further languages, see www.stahl-ex.com.

1.4 Conformity with Standards and Regulations

See certificates and EU Declaration of Conformity: www.stahl-ex.com.
The device has IECEx approval. See IECEx homepage: <http://iecex.iec.ch/>
Further national certificates can be downloaded via the following link:
<http://www.r-stahl.com/downloads/certificates.html>.

EN 2 Explanation of the Symbols

2.1 Symbols used in this Manual

Symbol	Meaning
	Tips and recommendations on the use of the device
	General danger
	Danger due to explosive atmosphere
	Danger due to laser radiation




2.2 Warning Notes

Warnings must be observed under all circumstances, in order to minimize the risk due to construction 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 the instruction can result in material damage to the device and / or its environment.	

2.3 Symbols on the Device

Symbol	Meaning
 0158 0594E00	CE marking according to the currently applicable directive.
 02198E00	Electric circuit certified for hazardous areas according to the marking.
 11048E00	Safety instructions that must always be observed: For devices with this symbol, the corresponding data and/or the safety-relevant instructions contained in this manual must be observed!

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 tasks 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 tasks must have a level of knowledge that meets applicable national standards and regulations.

Additional knowledge is required for tasks 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 construction)
- IEC/EN 60079-17 (Inspection and maintenance of electrical installations)
- 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.
- Always consult with R. STAHL Schaltgeräte GmbH if using the device under operating conditions which are not covered by the technical data.
- We are not liable for damage caused by incorrect or unauthorised use of the device or by non-compliance with this manual.

For assembly and installation

- Have mounting and installation performed only by qualified and authorised persons (see "Personnel qualification" section).
- During installation and operation, observe the information (characteristic values and rated operating conditions) on the type plates, data plates and information signs located on the device.
- 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 laser diode of the fibre optic isolating repeater emits laser radiation. The laser beam is emitted through the emitting diode (TD-A, TD-B) or through the end of the fibre optic cable. According to EN 60825-1, the laser diode is assigned to the laser class 1M. In order to avoid eye injuries, do not view the laser beam directly with optical instruments (e.g. magnifiers, microscopes).

Additionally for Type 9186/12

- Install the device in Zones 1, 2, 21, 22 or outside of hazardous areas.
- When used in Zones 1, 2 or 22, the device must be built into an enclosure which corresponds to the requirements of IEC/EN 60079-7, IEC/EN 60079-15 or IEC/EN 60079-31.
- When used in Zones 2 and 22, the intrinsically safe devices of Zones 1, 0, 21 and 20 can be connected to the intrinsically safe signal circuits.
- Separate non-intrinsically safe circuits from intrinsically safe circuits.
- Electric circuits with the "Ex i" type of protection can no longer be operated as circuits with this protection type after being operated with circuits with other types of protection.
- Interconnecting several devices in a single intrinsically safe circuit can result in different safety characteristic values. This may impair 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 RS-485-IS interface is to be connected with other fieldbus devices to form a fieldbus system.
- Avoid making connections or disconnections at Ex e terminals 1 and 2 for 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 Zones 2, 22 or outside of hazardous areas.
- When used in Zones 2 or 22, the device must be built into an enclosure which corresponds to the requirements of IEC/EN 60079-15 or IEC/EN 60079-31.
- Only connect the FO interface with devices that correspond to the Ex op is type of protection. Devices connected with the fibre optic isolating repeater may be installed in Zones 2 or 22 or in the safe area.
- Only install the device in a de-energised state.


Commissioning, maintenance, repair

- Only have commissioning and repairs performed by qualified and authorised persons (see "Personnel qualification" section).
- Before commissioning, make sure that the device is not damaged.
- Only perform maintenance work described in this manual.

3.4 Modifications and Alterations

	<p style="text-align: center;">DANGER</p> <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 alter the device.
	<p>No liability or warranty for damage resulting from modifications and alterations.</p>

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">• The device may only be used 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 in hazardous areas to set up FO network structures.

It enables transfer of asynchronous UART protocols such as Profibus DP and Modbus signals over long distances.

Mode of operation

The signals are transmitted from an intrinsically safe RS-485-interface according to PNO specification to an intrinsically safe optical interface (Ex op is).

4.2 Device Design

Type 9186/12

#	#	Device component	Description
<p>09134E00</p> <p>15638E00</p>	Screw terminals		
	1,2	Terminal	not used
	3,4	Terminals 3 + 4	Fault message contact
	21,22	Terminals 5 + 6	Shield connection (equipotential bonding)
	RS-485 interface		
	5	Sub-D, RS-485	RS-485 interface, data line
	Supply voltage status, RS-485		
	6	Green LED	Indication for supply voltage
	7	Yellow LED	Indication for data sent
	8	Green LED	Indication for data received
	Port A status		
	9	Green LED	LED for very good transmission level
	10	Green LED	LED for good transmission level
	11	Yellow LED	System reserve reached (fault message contact opened if both green LEDs are off)
	12	Red LED "ERR A"	Insufficient reception level, fibre breakage port A
	13	Optical fibre connection transmitter Port A (left)	Optical fibre transmitter port A, TD-A
	14	Optical fibre connection receiver Port A (left)	Optical fibre receiver port A, RD-A
	Status Port B		
	15	Green LED	LED for very good transmission level
	16	Green LED	LED for good transmission level
	17	Yellow LED	System reserve reached (fault message contact opened if both green LEDs are off)
	18	Red LED "ERR B"	Insufficient reception level, fibre breakage port B
	19	Optical fibre connection transmitter Port B (right)	Optical fibre transmitter port B, TD-B
	20	Optical fibre connection receiver Port B (right)	Optical fibre receiver port B, RD-B
Connection terminal 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 component	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
RS-485 interface		
5	Sub-D, RS-485	RS-485 interface, data line
Supply voltage status, RS-485		
6	Green LED	Indication for supply voltage
7	Yellow LED	Indication for data sent
8	Green LED	Indication for data received
Port A status		
9	Green LED	LED for very good transmission level
10	Green LED	LED for good transmission level
11	Yellow LED	System reserve reached (fault message contact opened if both green LEDs are off)
12	Red LED "ERR A"	Insufficient reception level, fibre breakage port A
13	Optical fibre connection transmitter Port A (left)	Optical fibre transmitter port A, TD-A
14	Optical fibre connection receiver Port A (left)	Optical fibre receiver port A, RD-A
Port B status (only for type 9186/15-12-11)		
15	Green LED	LED for very good transmission level
16	Green LED	LED for good transmission level
17	Yellow LED	System reserve reached (fault message contact opened if both green LEDs are off)
18	Red LED "ERR B"	Insufficient reception level, fibre breakage port B
19	Optical fibre connection transmitter Port B (right)	Optical fibre transmitter port B, TD-B
20	Optical fibre connection receiver Port B (right)	Optical fibre receiver port B, RD-B

5 Technical Data

Marking

Type designation 9186/..-1.-11
 CE marking CE_{0158}

Explosion Protection

Version	9186/12-11-11	9186/5-12-11
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 Ex II 2 (1) G Ex e mb ib [ia op is Ga] IIC T4 Gb Ex II (1) D [Ex ia Da] IIIC	BVS 07 ATEX E 068 X Ex II 3 (1) G Ex nA nC [op is T6 Ga] IIC T4 Gc Ex II (1) D [Ex op is Da] IIIC
Certifications and certificates		
Certificates	IECEX, ATEX, Brazil (INMETRO), Canada (cFM), Kazakhstan (TR), Russia (TR), USA (FM), Belarus (TR)	
Ship approval	ABS, CCS, ClassNK, DNVGL, LR, RS	
Further parameters		
Installation	Zone 1	Zone 2 and in the safe area
Further information	see respective certificate and operating instructions	
Safety data		
Max. voltage U_o	$\pm 3.7 \text{ V}$	—
Max. current I_o	148 mA	—
Max. power P_o	137 mW	—
Safety-related maximum voltage U_m	253 V	—
For connection RS-485-IS		
Max. permissible voltage U_i	$\pm 4.2 \text{ V}$	—
Internal capacity C_i and inductivity L_i	negligible	—

Explosion Protection

Ex i fault-contact		
Max. permissible voltage U_i	24 V	-
Max. permissible current I_i	600 mA	-
Internal capacity C_i and inductivity 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 Vss	
Nominal current (at U_N)	67 mA	130 mA
Power input	≤ 2 W	3 W
Operation indication	LED green "PWR"	
Polarity reversal protection	yes	
Galvanic separation		
Test voltage		
acc. to standard	EN 60079-11	-
between RS-485 and power supply	-	1.5 kV
Ex i RS-485 to auxiliary power	1.5 kV	-
Error-contact to power supply	1.5 kV	-
PA to power supply	1.5 kV	-

Technical Data

Ex i RS-485 to fault message contact	500 V	-
Ex i RS-485 to equipotential bonding	500 V	-
Error contact to PA	500 V	-
Optical interface		
Protocols	protocol transparent for RS-485 interface	
Network topologies	Ring topology, line topology, point-to-point connection	
Redundancy	automatic switching in case of line fault	automatic switching in case of line fault (except 9186/25-12-11)
Connection	ST [®] , BFOC/2.5 connector	
Wavelength	850 nm	
Transmission distance	≤ 2000 m	
Recommended optical fibres	G 50 / 125 multi mode G 62.5 / 125 multi mode	
	Integrated diagnosis function with alarm and automatic switching to the backup path. This enables increased availability.	
Electrical interfaces		
Protocols	PROFIBUS DP, Modbus, HART over RS-485, ServiceBus R. STAHL (IS1+)	
Version	RS-485-IS (PNO)	RS-485
Connection	Sub-D socket X1, 9-pole	
Bit rate	1.2 kbps ... 1.5 Mbps	9.6 kbps ... 1.5 Mbps
Settings	You can select fixed baud rates or automatic baud rate detection (only for PROFIBUS DP).	
Bit refresh	Received bit is reset to the original form.	
Line length	According to PROFIBUS Guideline depends on bit rate and cable	
Transmission method	2-wire, half-duplex	
Terminating resistor	to be connected to an external plug	
Indication of data reception	LED green "RD" ON	
Indication of data transmission	LED yellow "TD" ON	

Technical Data

Fault control		
Power supply failure	Fault-contact is open	
Transmission level is good	LED green and yellow "FO signal", fault-contact is closed	
Transmission level reduced (-1,5 dBm)	LED yellow "FO signal", fault-contact is open	
Fibre breakage or transmission level is too low (-3 dBm)	LED red "FO ERR", fault-contact is open	
Switching capacity of fault-contact	see Ex i values	max. 60 V DC, 42 V AC, 0.46 A
Electromagnetic compatibility	Tested to the following standards and regulations: EN 61326-1 Use in industrial environment	
Ambient conditions		
Ambient temperature	-20 to +65 °C	-20 to +60 °C
	The installation conditions affect the ambient temperature.	
Storage temperature	-40 to +85 °C	
Relative humidity (no condensation)	≤ 95 %	
Use at the height of	< 2000 m	
Mechanical data		
Connectors		
Power supply	Spring clamp terminal, 0.2 ... 1.5 mm ² (Ex e)	Screw terminal, 0.2 ... 2.5 mm ² green
Fault-contact	Screw terminal, 0.2 ... 2.5 mm ² blue (Ex i)	Screw terminal, 0.2 ... 2.5 mm ² green
Screen connection to PA	Screw terminal, 0,2 ... 2,5 mm ² blue	via DIN rail contact
Serial connection	Sub-D socket X1, 9-pole	
Shield	Using sub-D socket terminal strip	
Fibre optic cable	BFOC/2.5 for fibre optics 50/125, 62.5/125	
Degree of protection		
Enclosure	IP30	
Terminals Powersupply	IP20	IP30
Terminals	IP30	
Weight	approx. 330 g	approx. 200 g
Enclosure material	PA 6.6	
Fire resistance (UL-94)	V0	

Technical Data

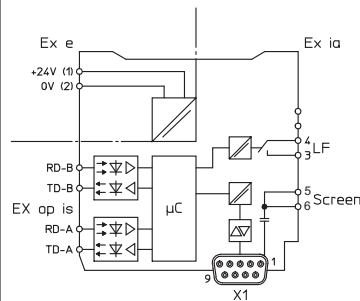
Mounting / Installation

Installation conditions

Mounting type on DIN rail (NS35/15; NS35/7.5)

Connection diagram

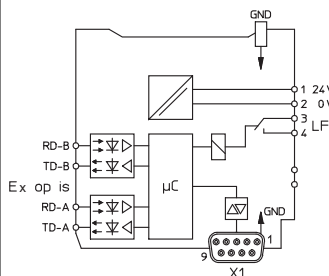
9186/12-...-



PIN	RS-485-IS
8	A-
3	B+
6	ISP+
5	ISGND

05352E00

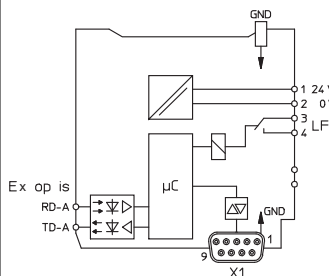
9186/15-...-



PIN	RS-485
8	A-
3	B+
6	U+
5	GND

05354E00

9186/25-...-



PIN	RS-485
8	A-
3	B+
6	U+
5	GND

06005E00

For further technical data, see www.stahl-ex.com.

6 Engineering

	DANGER
	<p>Explosion hazard due to too high temperature in the cabinet! Non-compliance results in severe or fatal injuries!</p> <ul style="list-style-type: none"> • Install and adjust the cabinet in such a way that it is always operated within the permissible temperature range.

6.1 PROFIBUS

i	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.
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Operating in linear structure

Calculate the minimum slot time $T_{SL\ min}$ according to the rule

$$T_{SL\ min} = a + b \times L + 2 \times N$$

where:

$T_{SL\ min}$: the minimum SLOT time in bit times

N: number of FO converters

L: Network reach in km

- Values a and b are dependent upon the data rate and bus profile used (see table). Adjust the slot time T_{SL} in the system configuration accordingly.
- Confirm that the minimum protocol processing time $MIN\ T_{SDR}$ amounts to at least 11 bit times ($MIN\ T_{SDR} \geq 11$).

Table: Programming 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

Operating in redundant ring

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

Calculate the minimum slot time $T_{SL\ min}$ according to the rule

$$T_{SL\ min} = a + b \times L + 2 \times N$$

where:

$T_{SL\ min}$: the minimum SLOT time in bit times

N: number of FO converters

L: Network reach in km

- Values a and b are dependent upon the data rate and bus profile used (see table). Adjust the slot time T_{SL} of the system configuration accordingly.
- Raise the RETRY LIMIT parameter by at least three.
- Confirm that the minimum protocol processing time $MIN T_{SDR}$ amounts 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	161	1971	15
500	211	731	5
187.5	131	731	1.875
93.75	131	411	0.9375
45.45	811	811	0.4545
19.2	131	141	0.192
9.6	131	131	0.096

Table: Ring size in PROFIBUS operating mode (various data rates)

Number of devices	Data rate (kbps) of the ring size [km]						
	9.6	19.2	45.45	93.75	187.50	500	1500
2	Not permitted						
3	9.90	9.90	9.90	9.90	9.90	9.90	5.20
4	13.20	13.20	13.20	13.20	13.20	13.20	5.07
6	19.80	19.80	19.80	19.80	19.80	14.40	4.80
8	26.40	26.40	26.40	26.40	26.40	13.60	4.53
10	33.00	33.00	33.00	33.00	33.00	12.80	4.27
12	39.60	39.60	39.60	39.60	39.60	12.00	4.00
14	46.20	46.20	46.20	46.20	29.87	11.20	3.73
16	52.80	52.80	52.80	52.80	27.73	10.40	3.47
18	59.40	59.40	59.40	51.20	25.60	9.60	3.20
20	66.00	66.00	66.00	46.93	23.47	8.80	2.93
22	72.60	72.60	72.60	42.67	21.33	8.00	2.67
24	79.20	79.20	79.20	38.40	19.20	7.20	2.40
26	85.80	85.80	70.41	34.13	17.07	6.40	2.13
28	92.40	92.40	61.61	29.87	14.93	5.60	1.87
30	99.00	99.00	52.81	25.60	12.80	4.80	1.60
32	105.60	105.60	44.00	21.33	10.67	4.00	1.33

- Note the maximum ring reach, which depends upon the data rate and number of devices in use according to the table.

Example:

- Number of FO converters in the ring: 6
- Speed: 500 kbps
- Permitted total reach: 14.4 km
- Total installed length of the FO: 9.98 km => O. K.

Slot time to be set: $T_{SL\ min} = a + b \times L + 2 \times N = 211 + 9.98 \times 5 + 2 \times 6 = 273$ bits

6.2 Modbus / ServiceBus

i	Data transmission lines and network components may cause signal delays. If necessary, these must be taken into account when adjusting the TIME-OUT times of the bus system used.
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Calculate the signal delay dT according to the rule
 $dT = b \times L + 2 \times N$

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 data rate.

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

Num-ber 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 permitted										
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 permitted
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 the state-of-the-art technology, PROFIsafe devices and PROFIBUS standard devices can be operated simultaneously in one PROFIBUS network. It 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 the PNO.
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The PROFIsafe devices differ from the standard PROFIBUS devices by assigning 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).

To the type 9186 fibre optic isolating repeater, the PROFIBUS frames are transmitted transparently, irrespective of the contents of the data. All type 9186 fibre optic isolating repeaters can consequently be operated in PROFIBUS networks with and without PROFIsafe devices.


Also note the Watchdog monitoring, configured for all PROFIsafe devices in the control system. In the event of very large fibre optic networks or radio transmission of PROFIBUS data, Watchdog monitoring can be triggered. 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) and vibration-free.
- Do not drop the device.

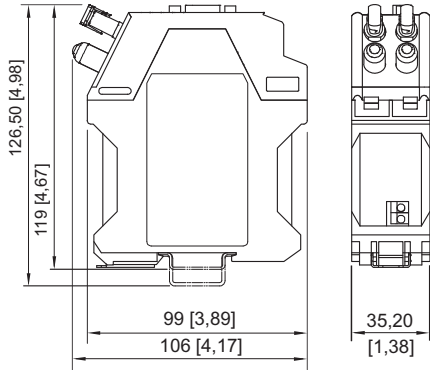
8 Mounting and Installation

The type 9186/12 device is approved for use in gas explosion hazardous areas of Zones 1 and 2 and dust explosion hazardous areas of Zones 21 and 22 and in safe areas. The type 9186/.5 device is approved for use in gas explosion hazardous areas of Zone 2 and dust explosion hazardous areas of Zone 22 as well as in safe areas.

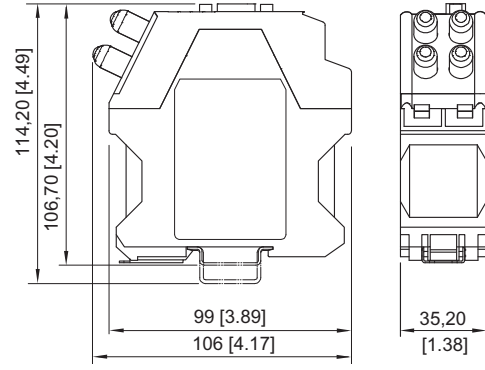
DANGER	
	<p>Explosion hazard due to installation without field enclosure! Non-compliance results in severe or fatal injuries!</p> <ul style="list-style-type: none"> • If used in Zone 1, the type 9186/12 device must be installed in an enclosure that meets the requirements of IEC/EN 60079-7. The enclosure cover bears the notice "Caution: Non-intrinsically safe circuits protected by internal IP-30 cover." • If used in Zone 2, the type 9186/12 and 9186/.5 devices must be installed in an enclosure that meets the requirements of IEC/EN 60079-15. • If used in Zone 21 and 22, the type 9186/12 device must be installed in an enclosure that meets the requirements of IEC/EN 60079-31. • If used in Zone 22, the type 9186/.5 device must be installed in an enclosure that meets the requirements of IEC/EN 60079-31.

8.1 Dimensions / Fastening Dimensions

Dimensional drawings (all dimensions in mm [inches]) – Subject to modifications



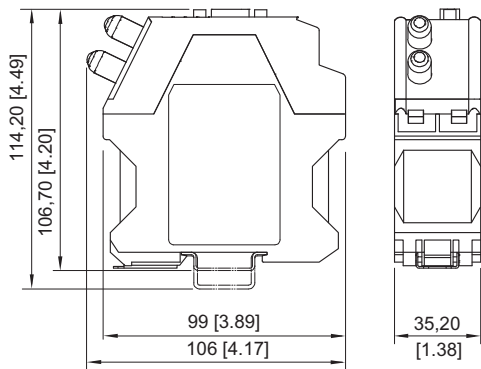
06251E00



11335E00

9186/12-11-11

9186/15-12-11



11328E00

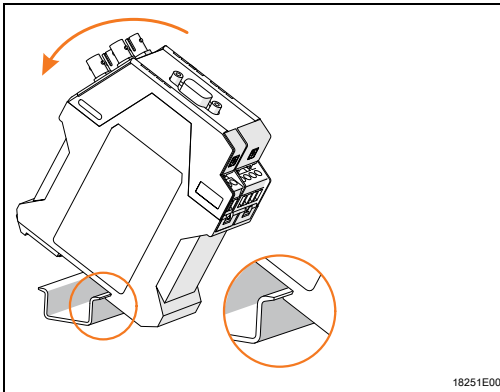
9186/25-12-11

8.2 Mounting / Dismounting, Operating Position

8.2.1 Mounting / Dismounting on Top Hat Rail

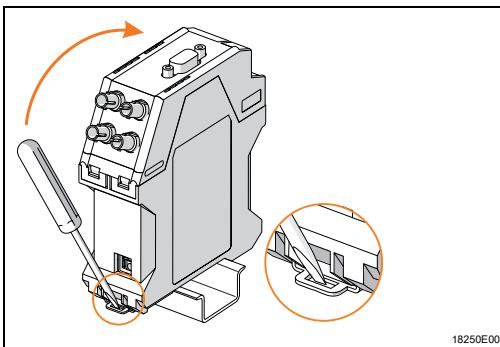
- Connect the mounting rails to the protective ground using an earthing terminal so that the module is earthed when attached to the mounting rail.

Mounting



- Position the device on the top hat rail. Position the cut-out of 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.

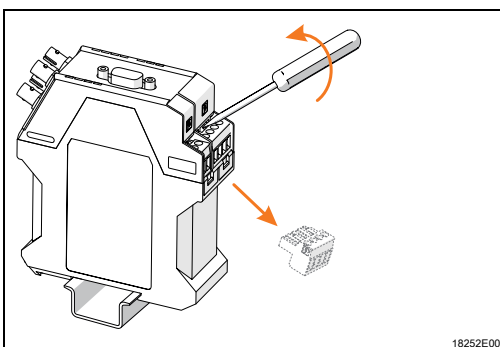
8.2.2 Mounting / Dismounting pluggable Terminals

All devices are equipped with pluggable terminals.

Mounting

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

Dismounting



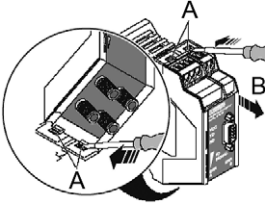
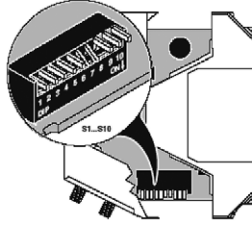
- Position the screwdriver behind the terminal.
- Push out the terminal.

8.3 Installation

i	<p>Operation under difficult conditions, such as, in particular, on ships, requires additional measures to be taken for correct installation, depending on the place of use. Further information and instructions on this can be obtained from your regional sales contact on request.</p>
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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 against electrostatic discharge. • Unlock the enclosure top using a screwdriver at the top and bottom (A). • Pull out the board carefully to the stop (B).
 <p style="text-align: right; font-size: small;">11951E00</p>	<ul style="list-style-type: none"> • Configure the DIP switch (see chapter "Setting the DIP switch").

Closing the enclosure

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


8.3.2 Electrical Connections

	<p style="text-align: center;">DANGER</p> <p>Explosion hazard caused by too high voltage! Non-compliance results in severe or fatal injuries.</p> <ul style="list-style-type: none"> • Connect the device only to equipment with internal voltage U_m: max. 253 V AC / 50 Hz. • Connect the device only to intrinsically safe terminals.
	<p style="text-align: center;">DANGER</p> <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 safety characteristic values of the device and connected field devices according to the national installation guidelines.
<p style="text-align: center;">NOTICE</p> <p>Device failure due to electrostatically overcharged components! Non-compliance can result in material damage!</p> <ul style="list-style-type: none"> • Before carrying out work on the device, the body's own voltage must be discharged on earthed metal parts or an ESD wrist strap must be put on. 	

8.3.3 Schematic Diagram


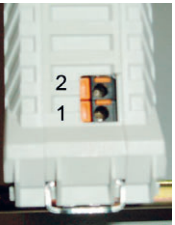
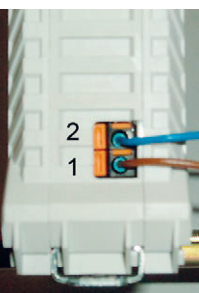
See device labelling or technical data.

8.3.4 Connection of Supply

	<p style="text-align: center;">DANGER</p> <p>Risk of explosion with type 9186/12 due to energised 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 auxiliary power (Ex e terminals 1 and 2). • Wait at least one minute after switching off the auxiliary power. • Disconnect lines from the device. • Only use insulated core end sleeves. • Insert the insulating sleeve of the core end sleeve into the corresponding opening of the connecting terminal in order to ensure a distance of at least 3 mm between the conducting parts of the core 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.
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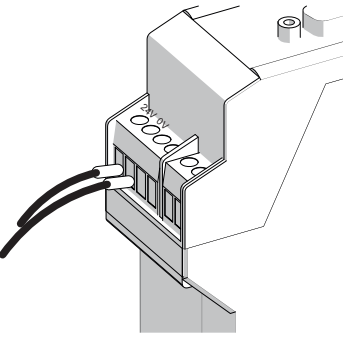
Preparing the supply / auxiliary power connection for type 9186/12-11-11

- 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 cable for power supply 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 sleeve has been inserted entirely into the corresponding opening of the connection terminal.




Preparing the 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 cable for power supply 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 sleeve has been inserted entirely into the corresponding opening of the connection terminal.

8.3.5 Connection of the RS-485 Data Line

The fibre optic isolating repeater is designed to be connected to a RS-485-IS interface. Connection to a RS-485 Ex i according to R. Stahl specification is not intended.

	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"> • Use only connectors that are certified for the RS-485-IS interface. • DO NOT connect any non-intrinsically safe PROFIBUS signals.
	<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 "Project engineering, installation and commissioning of the RS-485 fieldbus system from R. STAHL for safe and potentially explosive areas" operating instructions.</p>

Data rate and range for RS-485-IS interface

Data rate kBit/s	Range of twisted pair cables, \varnothing 34 mm ² , RS-485-IS, type A cable in accordance with IEC 61158-2
< 93.75	≤ 1200 m
187.5	≤ 1000 m
500	≤ 400 m
1500	≤ 200 m

8.3.6 Connection of Equipotential Bonding

The shield of the RS 485 data cable is fitted capacitively over the 9-pole Sub-D connection to the terminals 5, 6 for the shield connection (see chapter "Device design").



- Feed the equipotential bonding into the device over both terminals.
Note the installation guidelines of EN 60079-14.

8.3.7 Fault Message Contact Connection

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

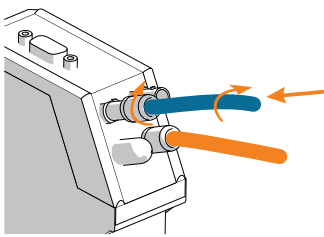
- There is power supply failure
- A break of the fibre optic line has been detected
- The system reserve of the fibre optic line is undershot
- Connect the switching contact to an intrinsically-safe digital input (for example Remote I/O IS1) to enable fault registration. Note the maximum electrical load of the contact (see "Technical data").

8.3.8 Optical Fibre Connection

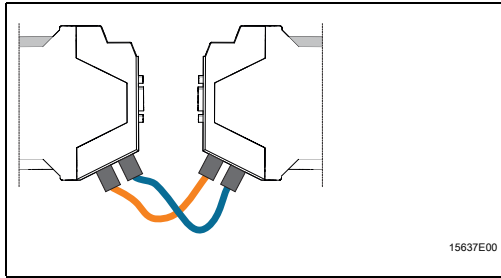
	WARNING
	<p>Danger due to open plugs and plug connections! Non-compliance results in minor injuries and material damage!</p> <ul style="list-style-type: none"> • Check connectors and plug connectors for contamination, clean if necessary. • Remove the dust covers just before the installation of the fibre optic cable.
	DANGER
	<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 cable while using optical aids.

Connecting the FO cable

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

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



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

9 Parameterization 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:

- Installation of the device according to regulations.
- Correct connection of the cables.
- No damage at the device and connection cables.
- Tight seat of the screws at the terminals.
Correct tightening torque: 0.5 ... 0.6 Nm.

9.1 Replacement of the Device

- If replacing by a device with identical design, readjust the DIP switch, if necessary.

9.2 Parameterizations

	DANGER
	<p>Explosion hazard due to uncovered, live components! Non-compliance results in severe or fatal injuries!</p> <ul style="list-style-type: none"> • Disconnect electric circuit from supply before beginning installation/parameterisation. • Secure the device against unauthorised switching.
NOTICE	
	<p>Device failure due to electrostatically overcharged components! Non-compliance can result in material damage!</p> <ul style="list-style-type: none"> • Before carrying out work on the device, the body's own voltage must be discharged on earthed metal parts or an ESD wrist strap must be put on.
	<p>The isolating repeater allows the transmission of various bus protocols and operating modes.</p> <p>The device characteristics must be configured by the user before commissioning. Configure DIP switches 1-10 according to planned application (see chapter "Setting the DIP switch").</p>

9.3 Setting the DIP Switches

Setting the data rate (DIP switches 1 to 4)

The devices are equipped with automatic data rate identification in "PROFIBUS" operating mode (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 "RS-485" operating mode must be selected. In this operating mode, the data must be set, as automatic data rate identification does not function in this case.

A special setting for DIP switches 1 to 4 is set for R. STAHL ServiceBus. It makes operation of up to 24 isolating repeaters possible in the ring. If the R. STAHL ServiceBus protocol is used without this setting, the number of type 9186 isolating repeaters that can be connected to the ring structure is reduced to 12.

Transfer rate in kbps	DIP switches (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

Setting the remaining functions (DIP switches 5 to 10)

	DIP switches					
	5	6	7	8	9	10
ON	11 BIT *)	ECHO ON *)	INVERS *)	REDUN- DANCY *)	PORT B ON *)	PROFIBUS *)
OFF	10 BIT	ECHO OFF	NORM	OFF	OFF	RS-485

*) Standard setting upon delivery. The switch position "AUTO" applies only for PROFIBUS.

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 on RS-485
	OFF	10 bit character length	10 BIT	Transmission protocol with 10 bit character length. Only applicable if DIP switch 10 is on RS-485
6	ON	Echo evaluation on ^{*)}	ECHO ON	Standard setting in redundancy operation. Signal contact opens if Echo does not appear.
	OFF	Echo evaluation off		For coupling to external devices that do not produce Echo.
7	ON	"Light on" during idle time ^{*)}	INV	Continuous measurement of received light energy. Standard setting in redundancy or ring operation.
	OFF	"Light off" during idle time (for external coupling)	NORM	No performance evaluation (bar graph turned off). Automatically set to "Light on" in redundancy / ring operation.
8	ON	Operation in optical ring or redundancy	REDUNDANCY	Device in redundancy operation. Neutral position "Light on", data transmission on port A, or port B in case of error. The data are transmitted to port A and B at the same time. A fault message is sent in the event of a fibre breakage and continues over the intact half-ring. DIP switch 9 to ON.
	OFF	No redundancy operation (optical linear or star connection)		Device optionally in star or linear operation, with inverse or standard light status. Data 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	RS-485 2-wire, depending on protocol	RS-485	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 Indications

The corresponding LEDs on the device indicate the operating conditions of the device and the line fault states (also refer to chapter "Function and Device Design").

LED	Colour	LED "ON"	LED "OFF"
"PWR" LED	Green	Operational readiness, no applicable transmission rate identified (Autobaud setting) (flashing green 1 Hz); operational readiness, transmission rate identified or set (lights up green)	Device is not in operation, power supply not available
"TD" LED	Green	Indication for data sent	No data transmission.
"RD" LED	Green	Indication for data received	No data received.
"ERR" LED, port A	Red	Insufficient reception level, fibre breakage port A	Reception level corresponding to the indication of the green / yellow LEDs of port A
"ERR" LED, port B	Red	Insufficient reception level, fibre breakage port B	Reception level corresponding to the indication of the green / yellow LEDs of port B
Reception level LEDs, port A	Green / yellow	Yellow: System reserve reception level reached, fault message contact opened Green: Corresponding to the strength of the reception level (good / very good), ascending from bottom to top	Reception level corresponding to the indication of the LEDs on port A
Reception level LEDs, port B	Green / yellow	Yellow: System reserve reception level reached, fault message contact opened Green: Corresponding to the strength of the reception level (good / very good), ascending from bottom to top	Transmission level corresponding to the indication of the LEDs on port B

10.3 Troubleshooting

Refer to the following troubleshooting chart during troubleshooting:

Error	Cause of error	Troubleshooting
"PWR" LED 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 mentioned procedures:

- Contact R. STAHL Schaltgeräte GmbH.

For fast processing, have the following information ready:

- Type and serial number of the device
- Purchase information
- Error description
- Intended use (in particular input / output wiring)

11 Maintenance and Repair

11.1 Maintenance


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

During maintenance of the device, check at least:


- whether the clamping screws holding the electric lines are securely seated,
- whether the device enclosure and / or protective enclosure have cracks or other visible signs of damage,
- whether the permissible ambient temperatures are observed,
- whether the device is used according to its designated use.

11.2 Maintenance

The device does not require regular maintenance.

	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 at R. STAHL for this.

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

	Only return or package the devices after contacting and consulting R. STAHL!
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- Contact customer service personally.

or

- Go to the www.stahl.com website.
- Select "Downloads" > Customer service > "RMA Request".
- Fill out the form.
Wait for confirmation. R. STAHL's customer service will contact you.
You will receive an RMA slip after speaking with customer service.
- Send the device along with the RMA slip in the packaging to
R. STAHL Schaltgeräte GmbH (refer to Section 1.1 for the address).

12 Cleaning

- To avoid electrostatic charging, the devices located in potentially explosive areas may only be cleaned using a damp cloth.
- When cleaning with a damp cloth, use water or mild, non-abrasive, non-scratching cleaning agents.
- Do not use aggressive detergents or solvents.

13 Disposal

- Observe national and local regulations and statutory regulation regarding disposal.
- Separate materials when sending it for recycling.
- Ensure environmentally friendly disposal of all components according to the statutory regulations.

14 Accessories and Spare Parts

NOTICE

Malfunction or damage to the device due to the use of non-original components.
Non-compliance can result in material damage.

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



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