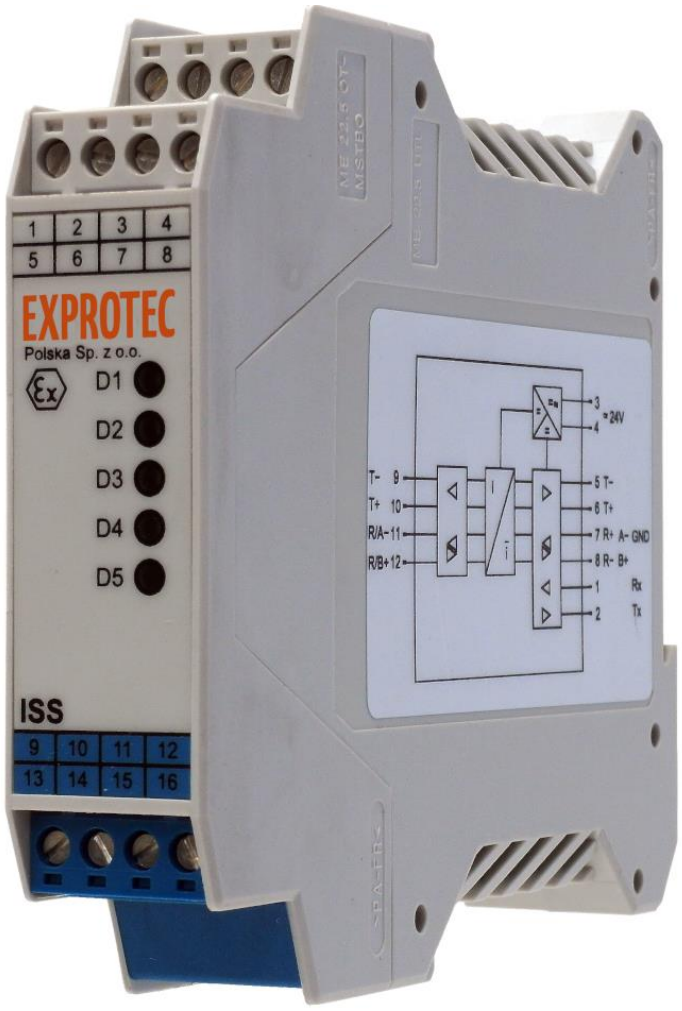
INTRINSICALLY SAFE SIGNAL SEPARATOR
TYPE ISS, ISS-1
USER MANUAL NO. BP/IO/04/16

EXPROTEC



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1. Introduction

This Operation Manual presents the ISS Intrinsically Safe Signals Separator as an accessory intended for installation in the main chambers of mining equipment in mine undergrounds – in areas at risk of methane and/or coal dust explosion as well as areas at risk of explosion gases. The unit has transmission channels with the "i_a" protection level which can be located in potentially explosive atmospheres without the need of switching off in case of methane concentrations exceeding allowable levels.

The ISS-1 Intrinsically Safe Signals Separator has been manufactured in compliance with good engineering practice in terms of safety and meets the requirements of the following standards: PN-EN IEC 60079-0: 2018-09, PN-EN 60079-11: 2012.

1.1 Copyright

1.2 Warranty conditions

The warranty conditions are in accordance with the contract "General Terms of Sale and Delivery" specified by the manufacturer.

Claims under warranty and/or liability for property damage or personal injury will not be honoured if arising from one or more of the following

- the use of the device was incompatible with its intended use;
- improper transport, storage, installation, connection, commissioning, incorrect maintenance, repair, disassembly or recycling;
- the notes in this manual have not been followed;
- unauthorised changes were made to the wiring of the device;
- improper control of wear parts;
- emergency situations have occurred due to contact with foreign objects or other emergency situations.

2. Type designation

ISS-1 – RS232, RS422 and RS485 serial interfaces barrier

3. Technical data

Table 1. Technical parameters

Design characteristics:		
Explosion protection designation	I (M1) [Ex ia Ma] I II (1)G [Ex ia Ga] IIC II (1)D [Ex ia Da] IIIC	
EU type examination certificate	TEXT 14 ATEX 0070U	—
Enclosure protection rating	IP20	—
Explosion protection type when installed in hazardous area for I M2 and II 2G	Ex d	
Installation location	mounting bracket: TH 35 / TS 35	—
Cross-section of the connected cable	0.25..2.5 (2x1.5)	mm²
Wire stripping length	9	mm
Max. terminal tightening torque	0.3	Nm
ISS-1 relay dimensions (h×w×d)	114 x 23 x 99	mm
ISS-1 relay ground	205	g

Electrical parameters:							
Voltage power supply	**Permissible supply voltage range**					**Current consump-tion**	**Input power**
	nominal	**min**	**max**	**min**	**max**		
V AC/DC	**V**	**V DC**	**V DC**	**V AC**	**V AC**	**mA**	**VA**
ISS-1	24-42	19.2	50.4	19.2	50.4	<70	<2

Operating conditions:		
Altitude above sea level	up to 1000	m
Ambient temperature	-20..+70	°C
Relative humidity at 20ºC	up to 95	%
Transport temperature	-20..+40	°C
Relative humidity for transport	up to 95	%
Mechanical exposures – frequency	10..500	Hz
Impact resistance	10	g
Vibration resistance (10...500 Hz)	5	g
Operating mode	continuous	—

Table 2. Intrinsically safe and technical parameters

Permissible parameters of circuits on the ISS-1 terminals:			
9, 10, 11, 12 (transmission circuit) Protection level "ia"	—	U_o = 3.7	V
	—	I_o = 130	mA
	—	P_o = 125	mW
	—	C_i = 5	uF
	—	L_i = (*)	mH
	—	U_i = 13	V
	—	I_i = 195	mA

Group I

L_0 [mH]	26	20	10	5	2	1	0.5	0.2	0.1	0.05	0.02
C_o [µF]	15	198	28	36	48	659	73	105	135	205	485

Group IIA

L_0 [mH]	20	10	5	2	1	0.5	0.2	0.1	0.05	0.02
C_o [µF]	11	198	26	36	45	566	79	105	155	335

Group IIB and III

L_0 [mH]	14	10	5	2	1	0.5	0.2	0.1	0.05	0.02
C_o [µF]	7	108	16	24	30	396	55	75	105	215

Group IIC

L_0 [mH]	1	0.5	0.2	0.1	0.05	0.02	0.01	0.005
C_o [µF]	0.6	2.18	4.5	7	10	18	29	53

~3-~4 (power supply)	Um = 250	V
	Un =24	V AC/DC
	Un =42	V AC/DC
1, 2, 7, (RS232 transmission)	Um = 250	V
	According to RS232 standard	
5, 6, 7, 8 (RS485 or RS422 transmission)	Um = 250	V
	According to RS485, RS422 standard	
Operation of the device		
Description		
Transmission rate RS422/RS485	1.2, 2.4, 4.8, 9.6, 14.4, 19.2, 38.4, 57.6, 93.75, 115.2, 187.5, 375, 500, 750 1000, 1500	kbps
Transmission range for RS422/485	<1500m to 9.6kbps <1100m to 93.750kbps <400m to 500kbps <100m to 1500kbps	
Transmission rate RS232	<15m to 115.2kbps	
HTL(5V) transmission speed	<300kbps	

4. Identification of hazards caused by the apparatus during its use

4.1 Introductory remarks

WARNING!
The safe operation of devices requires special training, knowledge and experience. Do not attempt to operate this equipment unless you are qualified to do so. Improper or careless handling can lead to a serious accident or death of the operator and/or other persons.

The device is designed to meet specific technical conditions and customer requirements.

WARNING!
Modification of equipment for which authorisation has not been granted or the use of repaired or other replacement parts which do not meet the manufacturer's technical conditions may result in serious risk or loss of guarantees, certifications or approvals.

If modifications of equipment are required, these must be carried out with the written permission of the manufacturer.

4.2 Hazards during equipment operation

Before starting up the equipment, make sure that this does not endanger the life and health of other workers.

WARNING!
Before starting the unit, make sure that the power cables are undamaged and properly screwed to the screw terminals.

It is forbidden to install makeshift connections. For safe operation, follow all procedures outlined in the safe use manual.

4.3 Special conditions for safe use

WARNING!
Special conditions for safe use: **– In potentially explosive atmospheres, the separator must be protected with an explosion protection solution of the type listed in EN 60079-0 with a protection degree of at least IP54.** **– Ambient temperature range: -20ºC ≤ Ta ≤+70ºC** **– When connecting the separator to a common bus with other devices, take into account the fact that currents and voltages sum up.** **– Installation shall be carried out with the required separation distances to the external terminals of the device in accordance with section 6.2.1** **PN-EN 60079-11.**

WARNING!
The device can be operated in mining plants, in workings classified as class "a", "b" or "c" methane explosion hazard and class "A" or "B" coal dust explosion hazard, only when installed in a flameproof enclosure of Ex d design.
The device can be operated in explosive gas atmospheres of zone 1 or 2 (G) only when installed in an enclosure with appropriate explosion protection.

5. Construction and principle of operation

5.1 Mechanical part

The relay control module type ISS (Fig. 1) consists of a printed circuit board and a ME 22.5 or ME 35 plastic enclosure by Phoenix Contact with IP20 protection.

The wires are connected to the screw terminals located on the sides of the enclosure. The separator is equipped with sockets and plugs without possibility of changing the connection order. To make improper connections impossible, the plugs and terminal blocks have coding inserts. Additionally, colour coding was applied (intrinsically safe circuit has a blue plug-socket, non-intrinsically safe circuit has a grey plug-socket), which facilitates proper connection. The relay enclosure is adapted for mounting on a TH 35 / TS 35 bus bar.

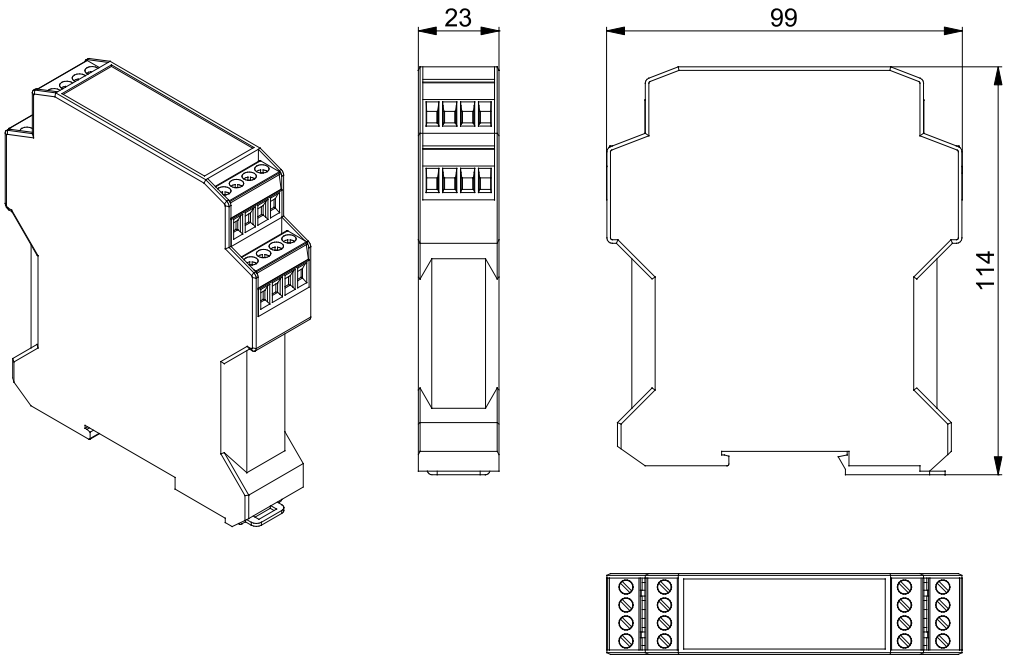

Fig. 1. General view of the ISS-1 relay

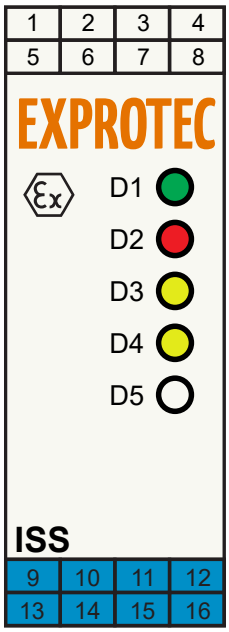

Fig. 2. View of the front and description of the ISS-1 relay

5.2 Electrical part

5.2.1 ISS-1

The presented device is designed to separate intrinsically safe RS422/RS485/HTL(5V) signals from non-intrinsically safe RS232/RS422/RS485/HTL(5V) signals. Transmission rate is regulated with the DIP-switch from 1.2 kbps to 1.5 Mbps. Terminal impedance is set with the DIP-switch to 200 Ω.

A view of the front and description of the ISS-1 relay is shown in Fig. 2.

ISS-1 is equipped with a single channel intrinsically safe RS422/RS485 serial interface with "i_a" protection. The intrinsically safe section is separated from the non-intrinsically safe section.

ISS-1 relay LED:

- D1 **– Power supply to the non-intrinsically safe section**,
- D2 **– Error in the unit, should be replaced,**
- D3 **– Transmission from the non-intrinsically safe section to the intrinsically safe section,**
- D4 **– Transmission from the intrinsically safe section to the non-intrinsically safe section,**
- D5 **– Not used.**

Table 3. Designation and description of ISS-1 contacts

Power circuit		
Sym.	**Description**	**Function**
~3	(+/-) DC, (~) AC	Power supply circuit, any polarity
~4	(-/+) DC, (~) AC	
Transmission		
Sym.	**Description**	**Function**
1	RX	RS232 signal reception
2	TX	RS232 signal transmission
5	ZS	RS422 Tx- differential output
6	YS	RS422 Tx+ differential output
7	AS/GND	RS485, RS422 Rx-/Tx2-, Ground to RS232 differential input
8	BS	RS485, RS422 Rx+/Tx2+ differential input
9	ZI	RS422 Tx- differential output
10	YI	RS422 Tx+ differential output
11	AI	RS485, RS422 Rx-/Tx2- differential input
12	BI	RS485, RS422 Rx+/Tx2+ differential input
13	NC	No terminals
14	NC	No terminals
15	NC	No terminals
16	NC	No terminals

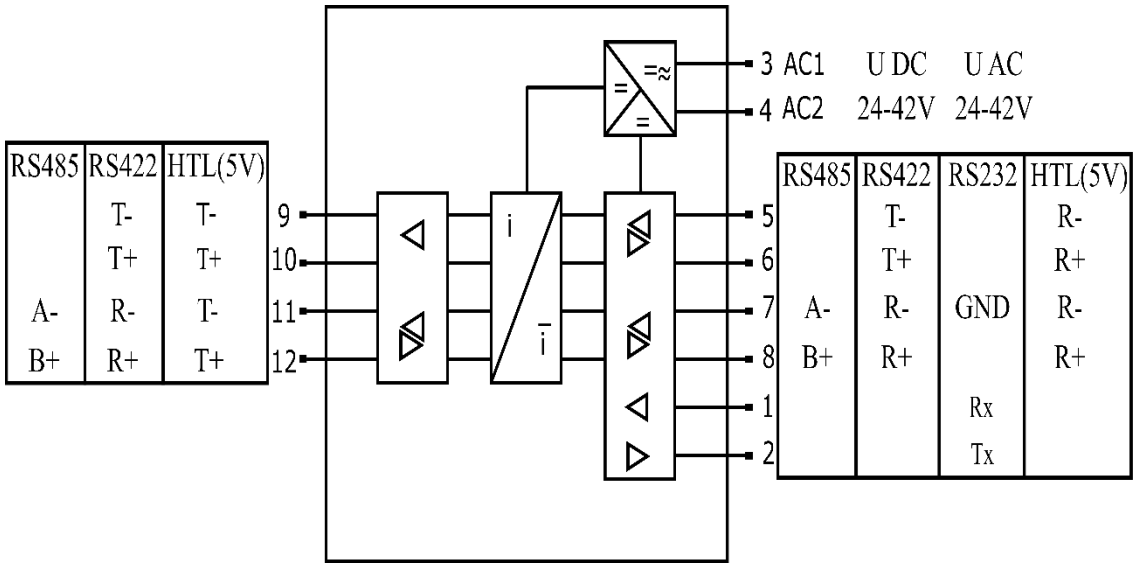

Fig. 3. Electrical diagram of the ISS-1 relay

5.2.2 Settings description

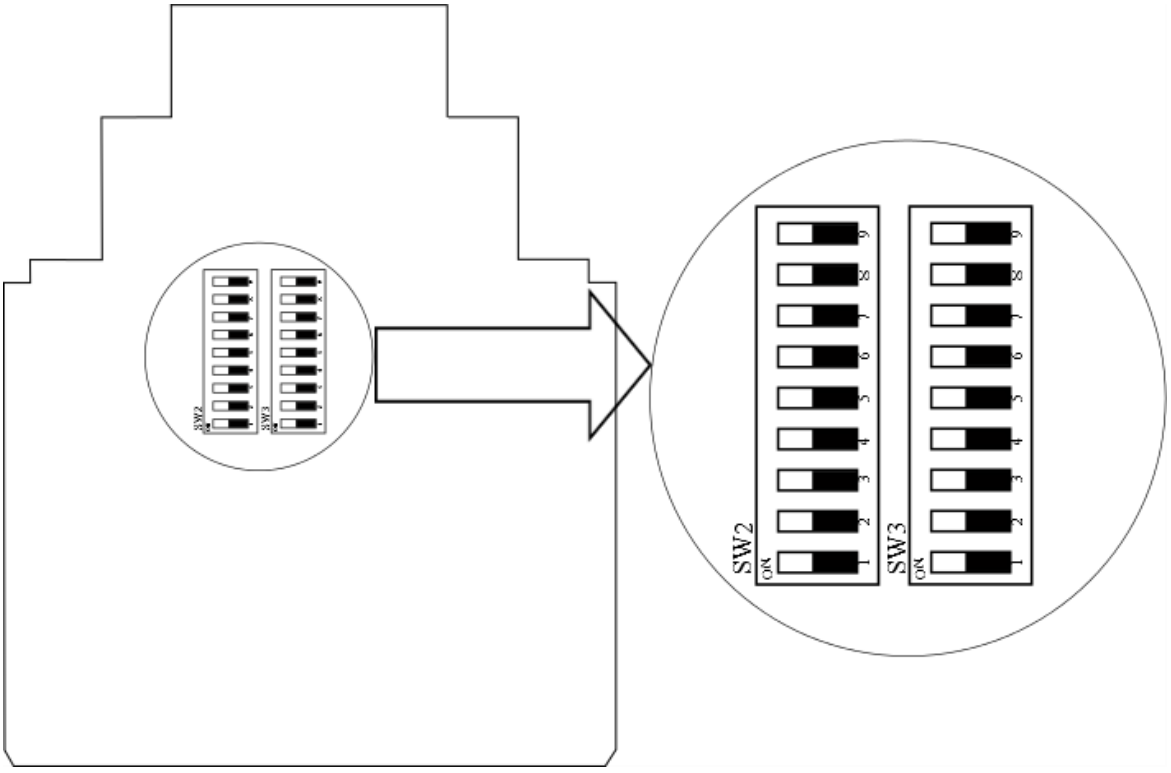

Fig. 4. View of the SW2 and SW3 switches.

- SW2 switch settings

Communication protocol for the non-intrinsically safe section	1	2	3	4	5
RS232	On	On	On	Off	Off
RS422	Off	Off	Off	On	On
RS485	Off	Off	Off	On	On
RS422 output two channels (HTL5V)	Off	Off	Off	On	On

Non-intrinsically safe section	**6**	**7**	**8**	**9**
Terminator RS422 RX/RS485	On	On	-	-
Terminator RS422 TX	-	-	On	On

- Settings for the type of communication

Communication protocol for the intrinsically safe section	**Communication protocol for the non-intrinsically safe section**	**SW3**	**SW3**		**SW3**		**SW1**
		1	**2**		**9**		**4**
RS422	RS232/RS422	Off	Off		Off		On
RS422	RS485	Off	On		Off		On
RS485	RS232/RS422	On	Off		Off		On
RS485	RS485	On	On		Off		On
RS422 output two channels (HTL5V)	RS422 input two channels (HTL5V)	Off	Off		On		Off

- SW3 switch settings

Transmission rate	**3**	**4**	**5**	**6**
1500000	Off	Off	Off	Off
1000000	Off	Off	Off	On
750000	Off	Off	On	Off
500000	Off	Off	On	On
375000	Off	On	Off	Off
187500	Off	On	Off	On
115200	Off	On	On	Off
93750	Off	On	On	On
57600	On	Off	Off	Off
38400	On	Off	Off	On
19200	On	Off	On	Off
14400	On	Off	On	On
9600	On	On	Off	Off
4800	On	On	Off	On
2400	On	On	On	Off
1200	On	On	On	On

Types of transmission	Number of bytes in transmission	7	8
7data, no parity, 1 stop	9	On	On
7data, no parity, 2 stop 7data, parity, 1 stop 7data, no parity, 1 stop 8data, no parity, 1 stop	10	On	Off
7data, parity, 2 stop 7data, no parity, 2 stop 8data, no parity, 2 stop 8data, parity, 1 stop 8data, no parity, 1 stop	11	Off	On
8data, parity, 2 stop 8data, no parity, 2 stop	12	Off	Off

- SW1 switch settings

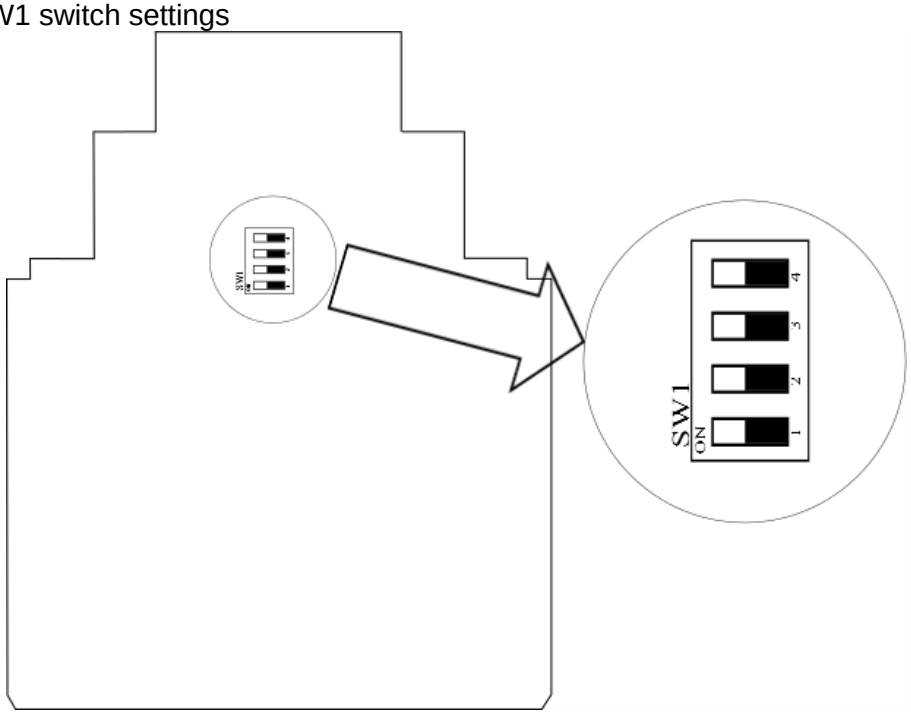

Fig. 5. SW1 switch view.

Intrinsically safe section	1	2	3	4
Terminator RS422 TX	-	-	On	-[1]
Terminator RS422 RX/RS485	On	On	-	

6. Marking

Each intrinsically safe device has a rating plate, made of a self-adhesive paper label, attached to the enclosure cover (from the outside) containing the following data: supervising unit number,

[1] See settings for the type of communication

manufacturer's name, device name, type, Ex symbol in a hexagon, explosion-proof design marking, intrinsically safe parameters, protection degree, factory number / year of manufacture.

7. Operation setup

7.1 Installation

The device should be mounted inside control cabinets and boxes. The permissible deviation from vertical should not exceed the value given in the technical data. Connect the power and control circuits according to the electrical documentation.

7.2 Protection against electric shock

WARNING!
The enclosure does not provide protection for live parts against direct contact

8. Storage and transport conditions

The unit must be stored in closed storage rooms at the temperature and relative humidity specified in the technical data, in an environment free from harmful vapours and corrosive gases. Transport in a horizontal or vertical position, secured against possible displacement.

9. Inspection and maintenance rules

During operation, ad hoc and periodic inspections should be carried out in order to ensure trouble-free operation of the device.

- **Ad hoc inspections:**
  Ad hoc inspections should be carried out when the installation location changes and when damaged components or subassemblies need to be replaced.
- **Periodic inspections:**
  Periodic inspections must be carried out at intervals of 6 to 12 months, depending on the operating conditions.

WARNING!
Observe the safety instructions before and during inspections and maintenance. Maintenance and repair work must be carried out by qualified personnel. This work may only be carried out when the supply voltage is switched off and protected against unauthorised switching on.

9.1 Inspections and Maintenance

The enclosure of the device together with plugs and connectors should be checked for mechanical damage. If damage is found, send the device to the manufacturer to eliminate the defect.

Inspect the electrical connections to detect any mechanical damage to the insulation of the wires connected to the terminals. If the insulation is damaged, replace the cable with a new one.

Check that the functionality of the device has not been damaged during operation. If a malfunction is found, send to the manufacturer for repair.

10. List of spare parts

The manufacturer does not provide spare parts. Any repairs or overhauls are performed solely by the manufacturer's service department.

11. List of standards and regulations

This equipment complies with the following standards and regulations:

Table 4. Standards and regulations

Directive/Standard	Description
Directive 2014/34/EU	Equipment and protective systems intended for use in potentially explosive atmospheres (ATEX)
PN-EN IEC 60079-0:2018-09 (EN IEC 60079-0:2018)	Explosive atmospheres – Part 0: Equipment. General requirements.
PN-EN 60079-11:2012 (EN 60079-11:2012)	Explosive atmospheres – Part 11: Equipment protection by intrinsic safety "i".
PN-EN 50303:2004 (EN 50303:2000)	Group I, category m1 equipment intended to remain functional in atmospheres endangered by firedamp and/or coal dust.

12. Disposal

After the end of its service life, the unit must be disposed of in accordance with the applicable environmental regulations.

In case of a lack of knowledge in the matter, local town or municipal office will provide all necessary information.

13. Orders and Service

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Replacement of enclosure components shall be performed by the manufacturer or a company authorised by the manufacturer.

The manufacturer shall not be responsible for the quality of the equipment in the event of repairs or replacement of components made by the customer themselves.

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EXPROTEC
protects the people
and the environment
by the
safety of
its components,
systems
and equipment