ATEST GAZ

User Manual

Warning Beacon / Warning Beacon with Sounder

HTT

Product code: PW-131-A-X

POD-073-ENG R02

ATEST GAZ

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Remarks and reservations

- Connection and operation of the device is allowed only after reading and understanding the contents of this document. Keep User's Manual with the device for future use.
- The manufacturer bears no responsibility for errors, damages and failures caused by improper selection of devices and cables, improper installation or failure to understand the contents of this document.
- Unauthorised repairs and modifications of the device are not allowed. The manufacturer bears no responsibility for the results of such interventions.
- Excessive mechanical, electrical or environmental exposure may result in damage to the device.
- Use of damaged or incomplete devices is not allowed.
- The design of the gas detection system for a protected facility may involve other requirements throughout all stages of the product life.

How to use this manual?

- Important parts of the text are marked as follows:

Pay special attention to information given in these fields.

- User's Manual consists of main text and appendices. Appendices are independent documents and can exist without User's Manual. Appendices have their own page numbering independent of User's Manual page numbering. These documents can also have their own tables of contents. All documents included in the User's Manual are marked in the bottom right corner with their name (symbol) and revision (issue number).

Table of contents

List of Tables

List of Figures

1 General information

1.1 Application

The Warning Beacon HTT of the PW-131 type is a device dedicated to optical and acoustic signalling of the presence of hazards in the particular industrial installation.

The device can be installed in hazardous areas.

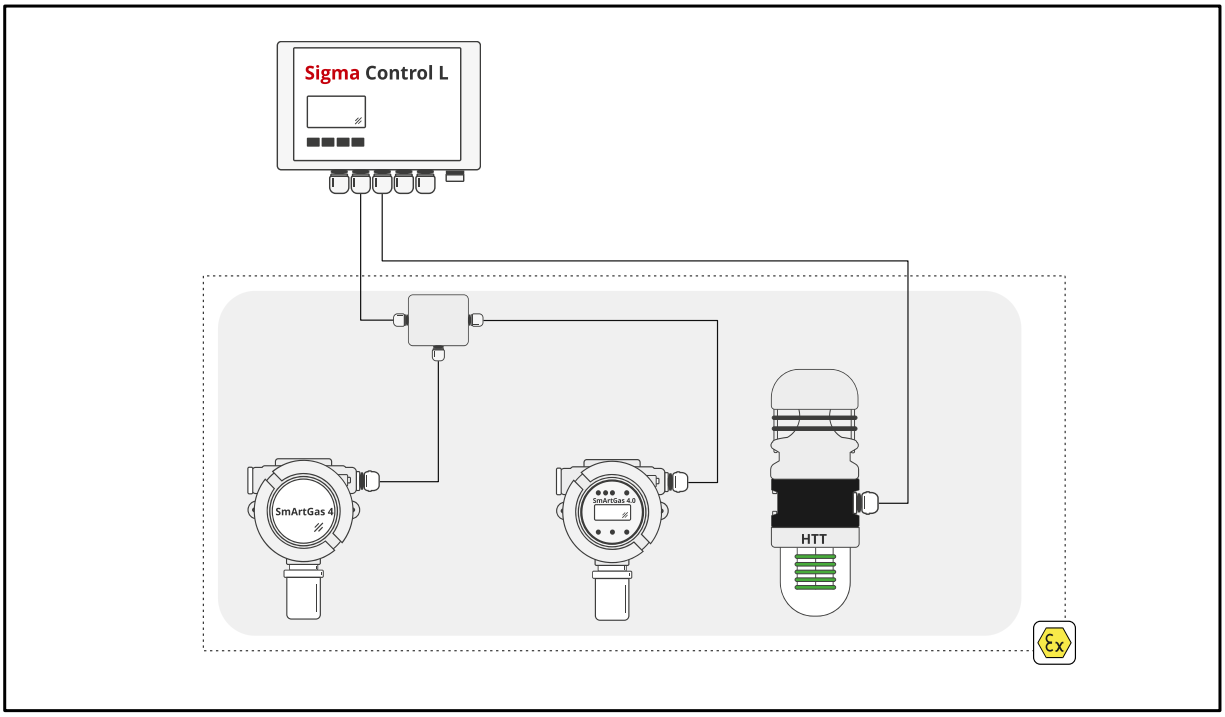


Figure 1: Location of the HTT in Gas Safety System

1.2 Specification of the device

- The warning beacon is designed for operation in areas with a potential hazard of gas explosion.
- Available as optical-acoustic, optical-only, or acoustic-only version (see Section 3).
- Enclosure made of stainless steel or aluminium.
- RGB LED-based optical module enabling configurable colour signalling.
- High-intensity red warning flash.
- Acoustic signalling with adjustable sound pressure level.
- Flexible configuration via voltage and digital control inputs.
- Integrated Bluetooth communication interface.
- Digital interface with possibility to connect multiple addressable devices to one system.

1.3 Marking of explosion protection

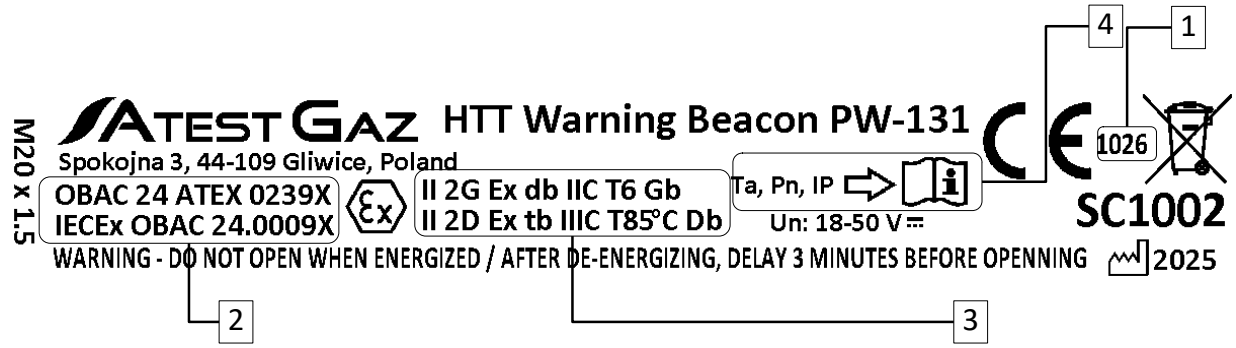


Figure 2: Information on the rating plate of the device

No.	Description
1	Number of the notified body responsible for supervision of the device
2	Numbers of ATEX and IECEx certificates issued for the device
3	Ex code for the device
4	Information about ambient temperature, power and ingress protection IP (see Section 8)

Table 1: Meaning of information provided on the rating plate

1.4 Additional information related to the explosion-proof protection of the device

- Do never allow deposition of contamination with the thickness more than 5 mm on the beacon surface.
- The actual ambient temperature should correspond to the ranges as declared in Table 8.
- The required position for the device operation is vertical, with glass globe down (see Figure 3).
- Defective flameproof joints must be replaced with new ones – no repairs are allowed.
- The cable inserted through the cable gland must be at least 3 meters[1] long.
- Equipment shouldn't be exposed to excessive vibrations that may lead to spontaneous loosening of bolts and cable glands.
- Explosion protection approval applies only to atmospheres with oxygen concentration ≤ 21%. Exceeding this value voids explosion protection.

1.5 Cable gland

The cable gland is replaceable element. To select spare ones please obey the following rules:

- ATEX certificate,
- degree of explosion protection (Ex code) – no worse than the device (see Table 8),
- operating temperature range (see Table 8),
- appropriate M20 x 1,5 mounting thread,
- nylon gasket to secure the enclosure pant (in the case of aluminum enclosures).

1 PN-EN 60079-14 standard requirement.

1.5.1 Replacement of cable gland

To replace/screw the cable gland:

- remove the gland from device (if it is screwed in),
- apply small amount of technical vaseline on the thread of the gland,
- screw in a new gland (remember to use the appropriate torque specified by the manufacturer).

1.6 Cables

When selecting cables, make sure that:

- thermal resistance of cables must comply requirements set forth in Table 8,
- the connection cable is of the appropriate length – see Section 1.4.

1.7 Power limitation

If the internal temperature exceeds approximately 75°C the device automatically limits output power to level 1 (approx. 50% of nominal power), reducing light intensity and sound level. This situation is signalled by the status lights (for details see section 5.1). Further temperature increase activates level 2 limitation (approx. 25% of nominal power).

2 Safety

All activities related to connecting detectors, signalling devices and other system components must be carried out while control unit's power supply is off.

Despite the power supply voltage for the Gas Safety System is off, dangerous voltage may persist across terminals of the control unit. Such a voltage may come from another system controlled by the same unit, for instance ventilation, that use one output pin of the control unit.

When performing repair, building and maintenance works, secure the device in a proper way.

The power supplying cable leading to the warning beacon must be reliably fixed down its route.

The device comprises a strong source of light. Do never turn your eyes directly towards the lamp and always keep a safe distance from it.

Do your best to mount the beacon at a location where the risk of its exposure to mechanical damage is minimized.

3 Device design

Dimension and enclosure of signaller shown Figure 3

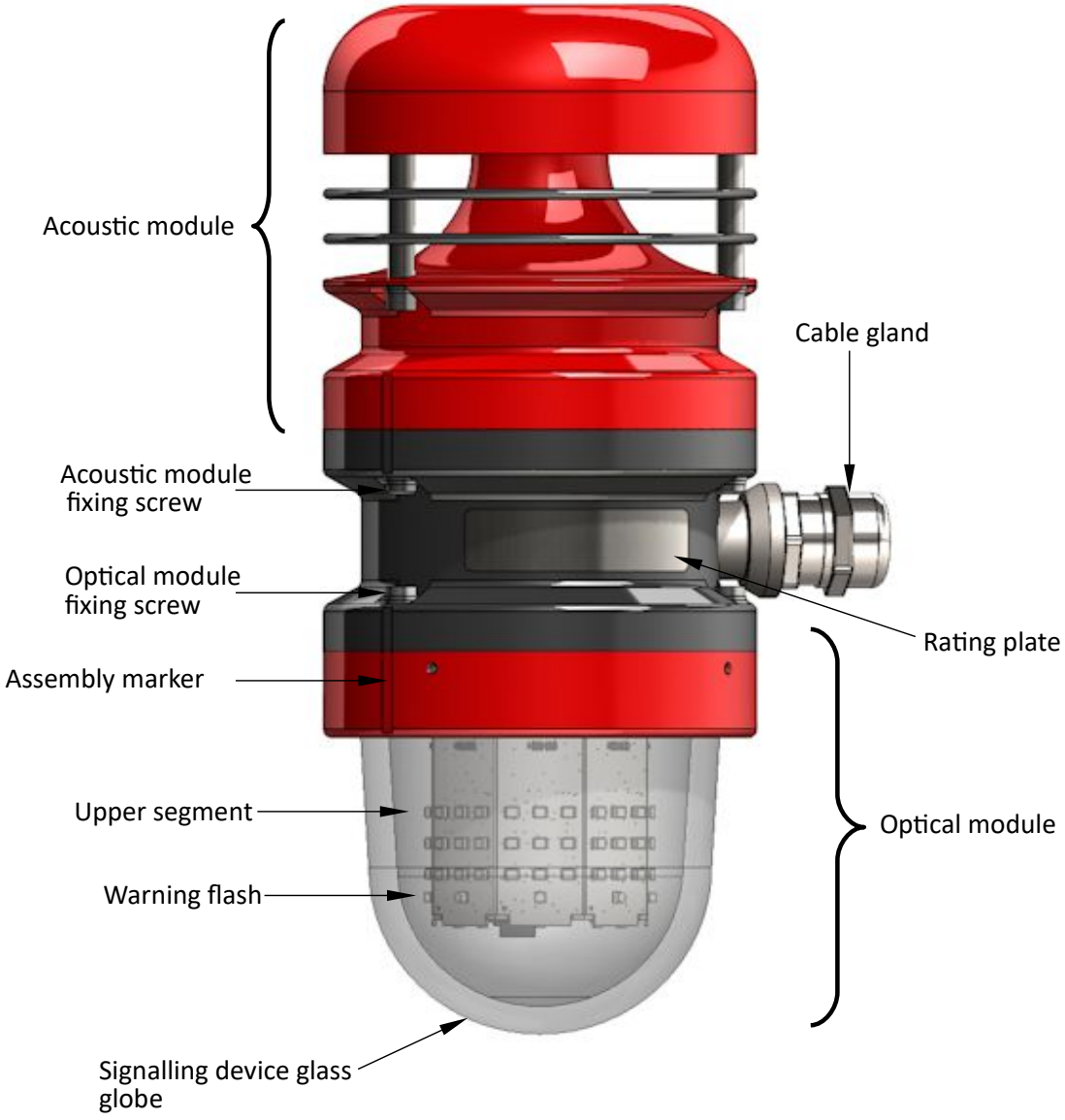


Figure 3: Warning beacon construction

Available versions of the warning beacon (product code fragments are given in brackets – for details, see Section 9):

- warning beacon with a sounder (B = RG.RF / 3RGB.RF, C = MT),
- optical warning beacon (B = RG.RF / 3RGB.RF, C = 0),
- acoustic warning beacon (B = 0, C = MT).

Warning beacon with a sounder

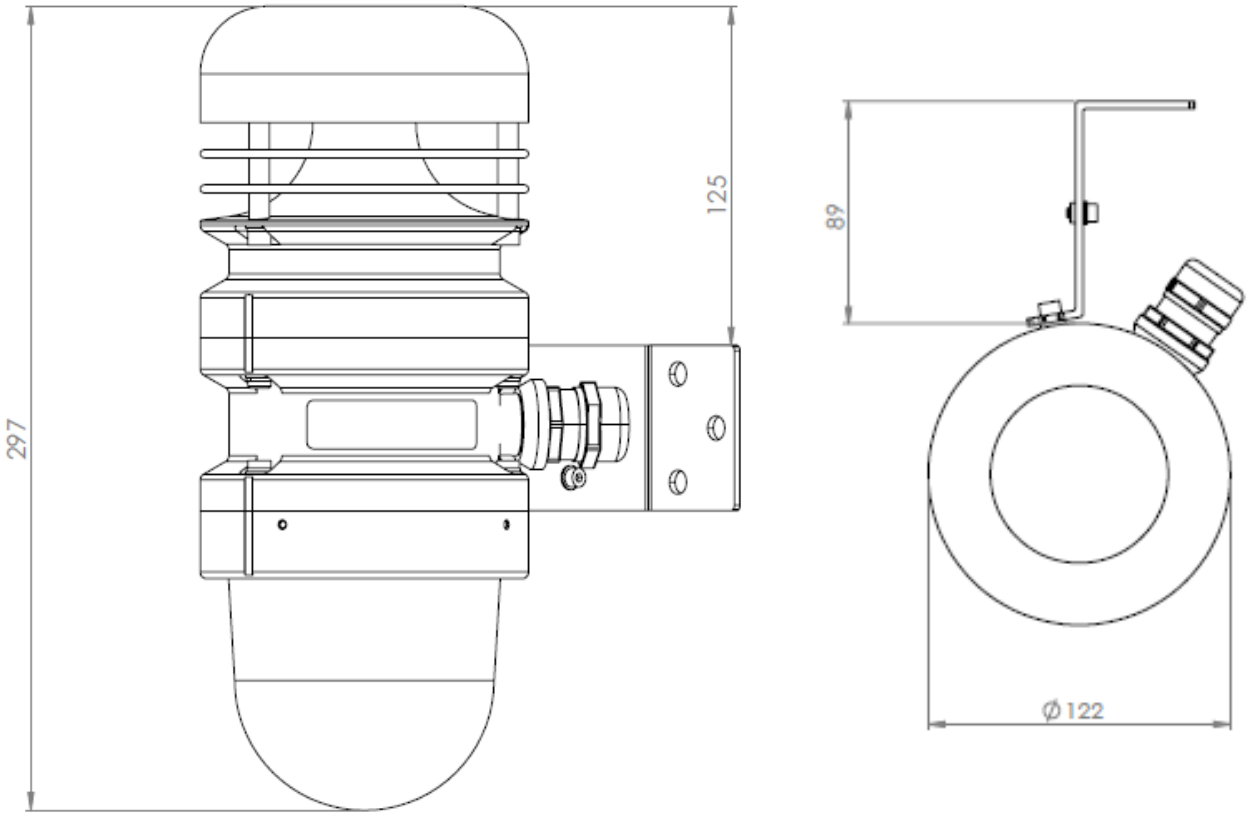


Figure 4: Overall dimensions of the optical – acoustic beacon

Optical warning beacon

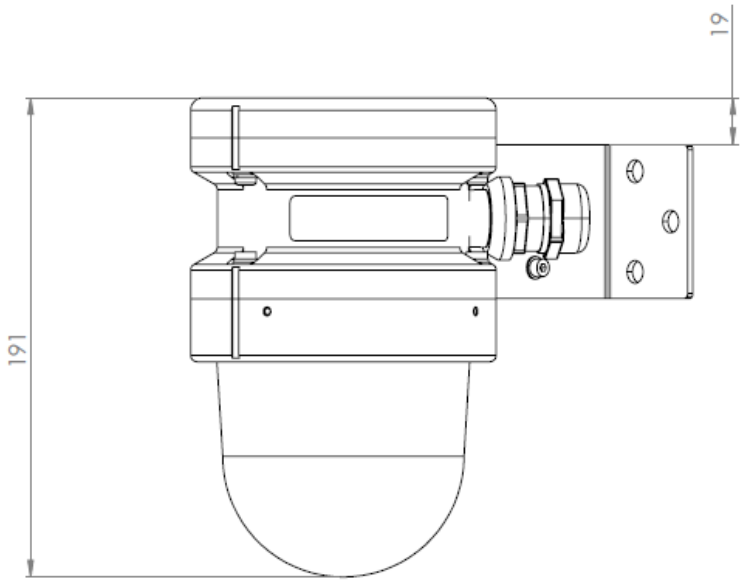


Figure 5: Overall dimensions of the optical beacon

Acoustic warning beacon

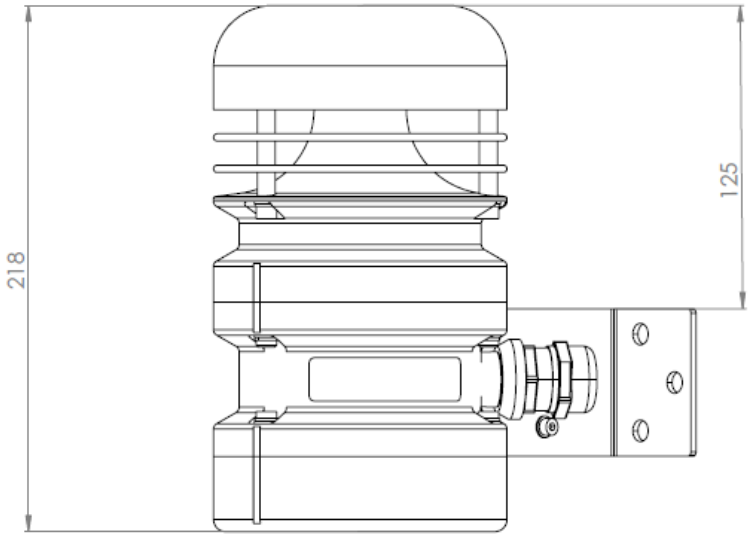


Figure 6: Overall dimensions of the acoustic beacon

4 Input-output interfaces

4.1 Electric interface

1	2	3	N	PE

Pin	Description
1	Control and signalling input 1
2	Control and signalling input 2
3	Control and signalling input 3
N	Neutral line
PE	Protective line

Figure 7: 230 V ~ control and power supply terminals

+1	+2	+3	-

Pin	Description
+1	Control and signalling input 1
+2	Control and signalling input 2
+3	Control and signalling input 3
-	Negative

Figure 8: 18-50 V ⎓ control and power supply terminals

B	A

Pin	Description
B	Signal line B
A	Signal line A

Figure 9: RS-485 communication interface

TETA	

Pin	Description
	Teta Bus power and communication line

Figure 10: Teta Bus interface

4.2 Bluetooth wireless interface (E=BT)

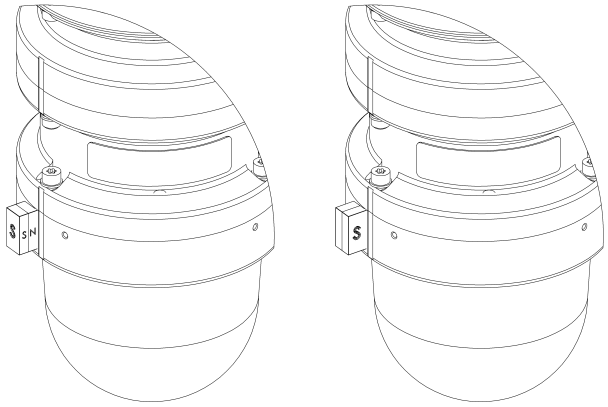
Wireless interface enables remote communications with beacon, by means of dedicated software (see details in Section 6.6).

The Bluetooth interface behaviour depends on the operation mode selected for the Bluetooth port upon configuration and position of the magnet. See possible options in Table 2 below.

Operation of the Bluetooth interface	Magnet in place	The beacon is seen on the list of devices with Bluetooth interface	The beacon can communicate via the Bluetooth interface
The beacon is seen and can communicate only with the permanent magnet in place	No	No	No
	Yes	Yes	Yes
The beacon is always seen and can communicate	-	Yes	Yes

Table 2: Operation modes of beacon with the Bluetooth interface

The picture below depicts how to mount the magnet.



Correct positioning of the magnet Incorrect magnet position

Figure 11: How to mount the magnet

After communication between the beacon and the control software is established, the magnet can be removed.

5 User interface

The device supports extensive configuration, including:

- continuous or flashing operation modes for optical segments,
- assignment of control inputs to individual segments,
- adjustable acoustic signalling parameters.

The device configuration – see Section 6.6.

5.1 Status indicators

At the base of the optical module, at the front of the device, there are two indicator lights that allow you to determine the status of the device.

Controls		Status description
Operation (green)		Slow, steady blinking – normal operation
		Fast, steady blinking – magnet detection
		Continuous signalling – active Bluetooth connection
Failure (yellow)		Continuous signalling – the device fault / incorrect configuration
		Slow, steady blinking – active power limitation

Table 3: Status indicator description

6 Lifetime cycle

6.1 Transportation

The device can be shipped in the same way as new equipment of that type. If the original package or another protecting means (e.g. corks) is unavailable the conveyed equipment must be secured against shocks, vibrations or moisture by means of adequate methods and material at the own responsibility of the sender.

6.2 Installation

6.2.1 Deployment of devices

Deployment of beacon must be determined by the system designer. Information can be found in the Guide – "Sigma Gas Safety System" (POD-070-ENG).

6.2.2 Mechanical mounting of devices

The hanger supplied with the device should be fixed to the wall using three bolts or M8 screws. The hanger should be mounted in such a way that the information on the signal's nameplate can be read.

The method of mounting the hanger is shown in the Figure 12.

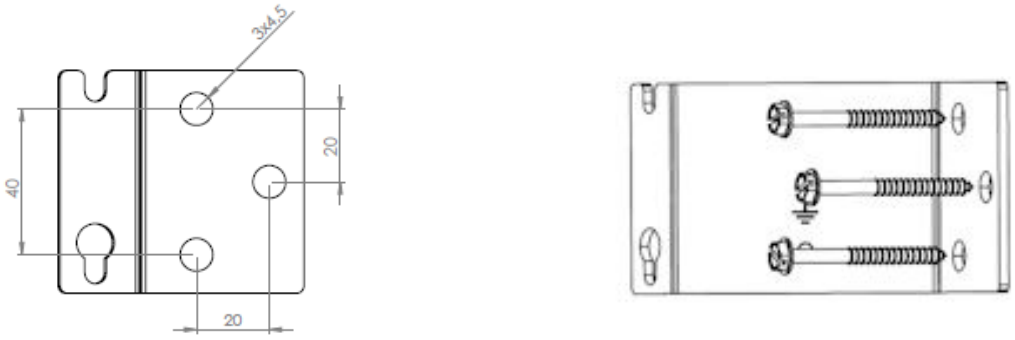


Figure 12: Dimensions and method of mounting the hanger

Figures 4, 5 and 6 show the minimum dimensions that must be maintained when installing the hanger.

The earthing line must be connected to the earthing terminal of the hanger in order to reduce risk of ignition due to electrostatic hazards. For a signal device powered by:

- 18 – 50 V – use a cable with a minimum cross-section of 1 mm² (if the signal device operates outside the Ex zone, it is not necessary to connect an earthing terminal),
- 230 V – use a cable with a cross-section specified by the installation designer.

The earthing terminal must be protected from corrosion (e. g. by applying a small amount of technical petroleum jelly).

Place the signal device on the hanger so that the glass cover is pointing vertically downwards (see Figure 3). In the case of an acoustic-only signal device, the acoustic part should be pointing vertically upwards (see Figure 6).

Tighten the screws securing the signal device.

6.2.3 Electric network

The applied flameproof cable glands allows to introduce cables with diameters of a specific range. The suggested cable types are included in the Guide – 'Sigma Gas Safety System' (POD-070-ENG).

To make electrical connections, obey the following order:

- make sure that the cables to be connected are isolated from any electrical circuits and potentials,
- make sure that no risk of explosion or fire may arise during installation.

6.2.3.1 Acoustic – optical beacon

The following steps describe how to install the signalling device.

- Unscrew the screws securing the acoustic signal device.(see Figure 13) use the No. 4 Allen socket wrench with a ball tip.

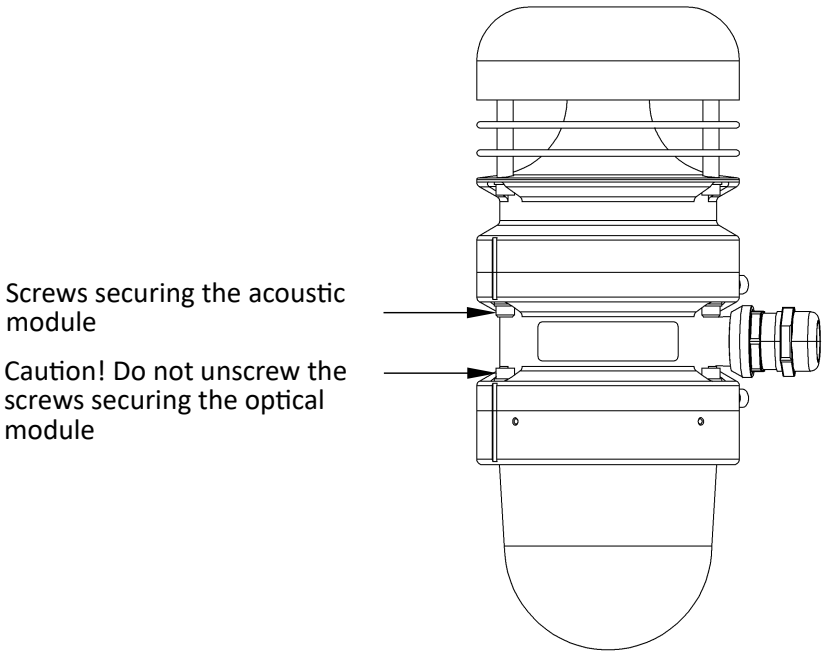


Figure 13: Securing screw

- Disconnect the cable connecting the acoustic signal device to the device's electronics.
- Untighten the cable gland.
- Peel insulation from conductor ends (see Appendix [2]) and thread the cable through the gland. To seal the passage use a suitable flexible sleeve for glands with adjustable diameter. For more details please refer to the manual POD-066-ENG 'Cable glands used in offered devices'.

Make sure that the cable outer diameter corresponds to the type of cable gland.

- arrange the cable correctly so that it is free of mechanical stress and water cannot penetrate into the detector down the cable – see Figure 14. Make sure that the cable is of the appropriate length (Section 1.4),

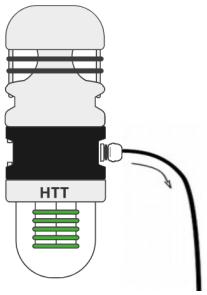
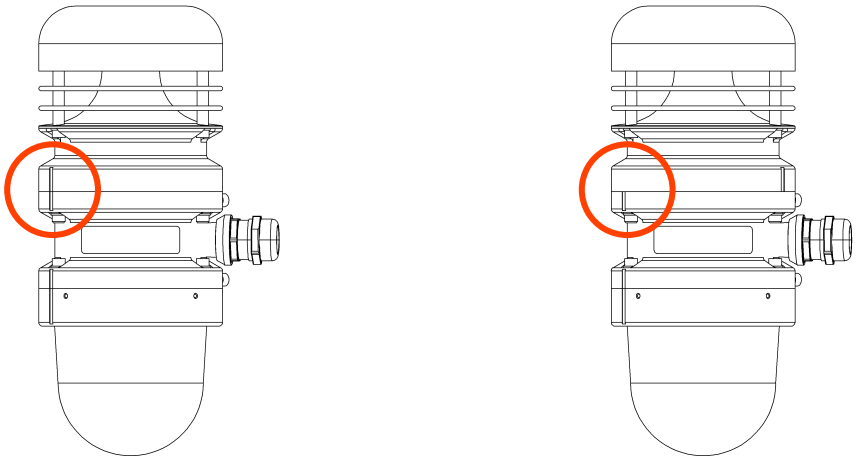


Figure 14: Correct routing of cables

- Connect the cable ends to the appropriate terminals on the terminal block.
- Tighten the cable gland.
- Plug the acoustic beacon into the connector, position it (so that the assembly marks are aligned – see Figure 15), tighten the screws securing the acoustic beacon (using a No. 4 Allen socket wrench with a ball tip).



Correct positioning of markers

Incorrect positioning of markers

Figure 15: Assembly markers

The cable shield must be insulated and slightly protrude from the cable gland inside the device. The shield most not be connected to the device body or inner appliances.

A detailed instruction how to prepare cables and how to connect them to the device is provided in Appendix [2].

Cable shields must be earthed at the end connected to the control unit.

It is a good practice to route control cables for devices as far as possible from power supply and/or hugh current cables, preferably in separate trays.

The electric circuits of the Gas Safety System is not intrinsically safe. Damage of any cable can lead to a danger.

If the connection was made with multi-core stranded cables (commonly known as a 'cord'), the bare ends of stranded cores must be secured with clamping sleeves.

In case of a need to connect two conductors a single terminal clamp of the device, the only allowed option is to secure them by means of a common clamping sleeve prior to make a connection.

It is not allowed to connect two cores to a single terminal unless these cores are embraced by a single cable lug.

Do not leave a spare length of a cable inside the device. Bare wires with worn insulation or entangled wires may create a danger of electric shock or equipment damage.

Do not leave disconnected cables inside the device.

Incorrect cable routing may lead to worsening of the device immunity to electromagnetic interferences.

Unused screw terminals must be tightened home.

6.2.3.2 Acoustic / optical beacon

In the case of an optical-only or acoustic-only beacon, proceed as described in section 6.2.3.1, with the difference that only the beacon cover is unscrewed (and not the acoustic beacon).

6.3 Connections

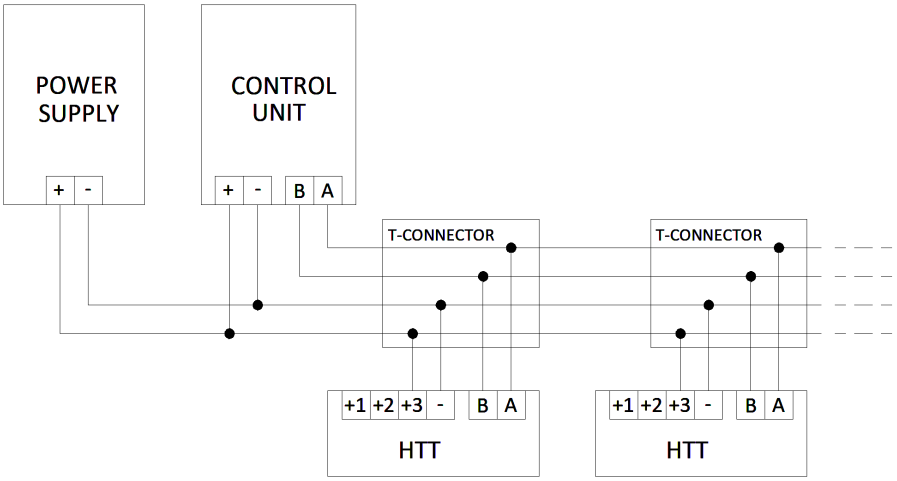


Figure 16: Connection of the device via digital interface (RS-485)

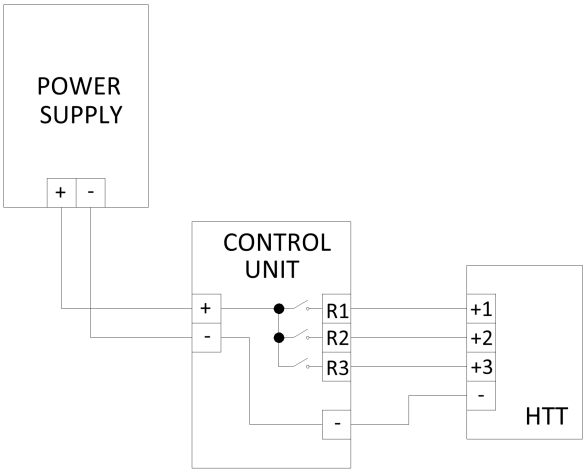


Figure 17: Connection of the device via 18 – 50 V control and power supply terminals

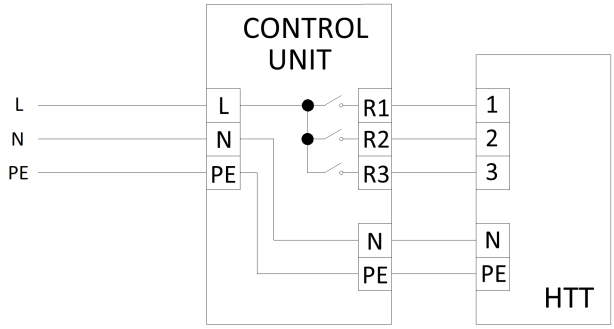


Figure 18: Connection of the device via 230 V control and power supply terminals

6.4 End of Line Monitoring

End of line resistor can be connected to the device, but this is not mandatory.

All 18 – 50 V control and power supply terminals have a blocking diode fitted in their supply input lines. An end of line monitoring resistor can be connected across any of "+1" and "–", "+2" and "–", or "+3" and "–". The resistor leads should be kept as short as possible.

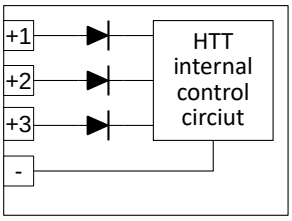


Figure 19: Blocking diodes in 18 – 50 V control and power supply terminals

If the end of line monitoring module use reverse voltage to supervise the line, it is possible to monitor and use only one of the three inputs at the same time. Due to the common "–", changing the polarity would prevent activation of a single input

If end of line monitoring module use voltage lower than input activation level, it is possible to supervise all three inputs at the same time.

6.5 Warning beacon as the part of an addressable gas detection system

HTT Warning Beacon can be connected as part of a Gas Detection System using digital communication interface via RS-485 standard. In this type of system, it is possible to connect multiple devices which, thanks to individual addressing, can operate independently.

When using the digital interface, it is possible to connect to the manufacturer's control unit Sigma NX Control H.

The connection should be made in accordance with the figures in Section 6.3.

6.6 Device configuration

Both optical and acoustic signalling are fully configurable by the user using dedicated software for Android devices. Among other things, you can configure:

- how to control the upper/middle/lower segment of the optical signalling device, flash and acoustics,
- the relay input number controlling a single segment, flash and acoustics,
- the operating mode of a single segment and flash,
- the delay time for switching on/off a single segment, flash and acoustics,
- the tones and volume of the acoustic signal,
- address, transmission protocol, frame size, parity and stop bit control method,
- Bluetooth communication parameters.

SNX Toolbox software can be downloaded from the manufacturer's website.

6.7 Troubleshooting

Information about the signal's operation is provided by status indicators – for details, see Section 5.1. Further information about error states is available in the SNX Toolbox application and in the device memory map (see Section 7).

6.8 Maintenance schedule

6.8.1 Scheduled inspections

The HTT signalling device is designed for use in potentially explosive atmospheres. Therefore, the following explosion protection maintenance activities must be performed:

- control the cable gland – correct tightening and no damage,
- control the overall condition of the signalling device – visual inspection of the coating (no chips, visible damage),
- control the cleanliness of the signalling device – do not allow a layer of dirt thicker than 5 mm to accumulate on the surface of the signal device.

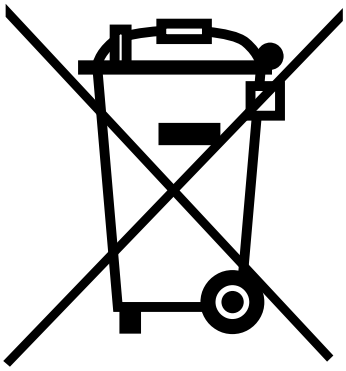
During the inspection, also control that the signal device is working properly (safety function test) – by activating the optical and acoustic signalling.

The minimum frequency of such inspections is specified in Table 8.

6.8.2 Maintenance

Remove dust and dirt from the beacon housing and glass globe with a moistened cloth as needed, depending on contamination of the ambient environment.

6.9 Utilization



This symbol on a product or on its packaging indicates that the product must not be disposed of with other household waste. Instead, it is the user's responsibility to ensure disposal of waste equipment by handing it over to a designated collection point for the recycling of waste electrical and electronic equipment. The proper recycling of your waste equipment at the time of disposal will help to conserve natural resources and ensure that it is recycled in a manner that protects human health and the environment. Information about relevant designated collection points can be obtained from the Local Authority, waste disposal companies and in the place of purchase. The equipment can also be returned to the manufacturer.

7 The memory map

This device can be controlled using the Modbus protocol if it is equipped with an RS-485 communication port. Its memory map is described below.

7.1 Device status

Type	Size [2B word]	Address (PLC base – first address 40001)	Bit	Bit description
Flags 40001 – 16..31 bits 40002 – 0..15 bits	2	40001	0	Status of contact input 1 (0 – inactive, 1 – active)
			1	Status of contact input 2 (0 – inactive, 1 – active)
			2	Status of contact input 3 (0 – inactive, 1 – active)
			3	Status of magnetic detector (0 – inactive, 1 – active)
			4	Status of the upper segment (0 – inactive, 1 – active)
			5	Status of the middle segment (0 – inactive, 1 – active)
			6	Status of the lower segment (0 – inactive, 1 – active)
			7	Status of flesh module (0 – inactive, 1 – active)
			8	Status of acoustic module (0 – inactive, 1 – active)
			9	First level of power limitation
			10	Second level of power limitation
			11..31	-

Table 4: The memory map – device status

7.2 The device failure

Type	Size [2B word]	Address (PLC base – first address 40001)	Bit	Bit description
Flags 40003 – 16..31 bits 40004 – 0..15 bits	2	40003	0	Incorrect parameters detected in configuration memory
			1	Incorrect checksum of configuration memory
			2	Incorrect checksum of program memory
			3..7	-
			8	Failure of the temperature conversion path
			9	Device supply voltage out of range
			10	Internal voltage 15 V out of range
			11..31	-

Table 5: The memory map – the device failure

7.3 The device detailed status

Description	Type	Size [2B word]	Address (PLC base – first address 40001)	Bit	Bit description
Input power voltage [0,1 V]	U16	1	40005	-	-
Peak power consumption [0,1 W]	U16	1	40006	-	-
Maximum power consumption [0,1 W]	U16	1	40007	-	-
Temperature [°C]	S16	1	40008	-	-

Table 6: The memory map – the device detailed status

7.4 Output control

Type	Size [2B word]	Address (PLC base – first address 40001)	Bit	Bit description
Flags	1	40101	0	The upper segment (0 – inactive, 1 – active)
			1	The middle segment (0 – inactive, 1 – active)
			2	The lower segment (0 – inactive, 1 – active)
			3	The flash module (0 – inactive, 1 – active)
			4	The acoustic module (0 – inactive, 1 – active)
			5..15	-

Table 7: The memory map – output control

8 Technical specification

Power supply • Voltage U_n • Power consumption P_n	 18 – 50 V ⎓ 230 V ~ Average: max 20 W, peak: max 36 W
Environment • Temperature • Humidity	 -40 – 50°C 0 – 100%
ATEX / IECEx • Certificate No.	 OBAC 24 ATEX 0239X / IECEx OBAC 24.0009X II 2G Ex dc IIC T6 Gb II 2D Ex tb IIIC T85°C Db
Additional requirements related to the ATEX / IECEx certificate • Thermal resistance required for cable gland • Thermal resistance required for cable	 -40°C < $T_{service}$ < 80°C, details see Section 1.5 -40°C < $T_{service}$ < 80°C, details see Section 1.6
IP	IP 65

Optical signalling
• Illuminance
  • All segments, 100% power configuration, yellow colour
 	
  • All segments, 100% power configuration, red colour
 	
  • Flash, 100% power configuration
 	
• Mode of operation
  • All segments
  • Flash
	RGB LED lamps
	
	Total luminous intensity typically 48 cd
	Luminous flux typically 400 lm
	
	Total luminous intensity typically 25 cd
	Luminous flux typically 260 lm
	
	Minimum momentary luminous intensity 420 cd
	Minimum effective luminous intensity 85 cd
	Minimum momentary luminous flux 2700 lm
	Minimum effective luminous flux 530 lm
	
	Continuous or modulated light (50% duty cycle)
	Configurable: single flash (10 – 50 ms), strobe 3 flashes/5 flashes

Acoustic signalling parameters • Sound intensity • Available tones	 Max 110 dB from 1 m 2200 Hz / 2000 Hz alternating (harmonic) 2500 Hz / 2000 Hz alternating (dissonant) Custom frequency in range 1800 – 4000 Hz at the customer's request
Digital communication parameters • RS-485 • Teta	 RS-485, Modbus ASCII, 19200 Bd, 7E1 Teta Bus
Parameters of control inputs • Deactivated • Activated	 0 – 1 V 18 – 50 V
Lifetime	15 years at conditions: • light segments at full power, maximum 20% operating duty or 25% power, 100% operating duty, • flash light: at full power, 100% operating duty, • acoustic: at full power, maximum 20% operating duty • ambient temperature < 40^{o}C
Parameters of wireless communication	Bluetooth 4.2
Protection class	I / III
Dimension	See Figure 4, 5, 6
Cable glands • Cable diameter range • External thread	 See section 9 See details in POD-066-ENG „Cable glands used in offered devices” M20 x 1,5
Acceptable cables	0,5 – 2,5 mm^2
Material	Body – see Section 9 Globe – glass
Painting	For aluminium enclosure only: epoxy paint, red and graphite, other colours from RAL palette at the customer’s request

Weight • Stainless steel • Aluminium	 Max 9 kg Max 4,5 kg
Mandatory periodic inspection	Once a year
Mounting	On the wall, mount the hanger using 3 bolts or M8 screws

Table 8: Technical specification

9 Product marking

PW-131-A- A - B - C - D - E - F - G

A **Enclosure material**	**AL**	Aluminium, epoxy paint
	SS	Stainless steel
B **Optics variant**	**0**	Without *(impossible when C = 0)*
	RG.RF	1 x red-green + red flash
	3RGB.RF	3 x RGB colour + red flash
C **Acoustic variant**	**0**	Without (impossible when *B = 0)*
	MT	Full (any MT tones – multi tone)
D **Interface**	**C.DC**	Voltage control 18-50 V DC
	C.AC230	Voltage control 230 V AC– *under development*
	C.485	Voltage control 18-50 V DC + RS-485 control
	Teta	Teta Bus – *under development*
E **Wireless interface**	**0**	Without *(only for DI = C.485)*
	BT	Bluetooth compatible
F **Number of cable entries**	**1**	1
	2	2 – *under development*
G **Cable gland**	**X**	See details in POD-066-ENG 'Cable glands used in offered devices'

Table 9: The device configuration

10 Appendices

[1] DEZG154-ENG – EU Declaration of Conformity – HTT

[2] PU-Z-015-ENG – Shielded cables applied for connecting detectors – preparation and installation

EU Declaration of Conformity

Atest Gaz A. M. Pachole sp. j. declares with full responsibility, that the product:

(Product description)	(Trade name)	(Type identifier or Product code)
Warning Beacon with Sounder	**HTT**	**PW-131**

complies with the following Directives and Standards:

- in relation to Directive 2014/34/EU – on the harmonisation of the laws of the Member States relating to equipment and protective systems intended for use in potentially explosive atmospheres:

Marking	Certificate no.	Standards	Notified body
Ex II 2G Ex db IIC T6 Gb II 2D Ex tb IIIC T85°C Db	OBAC 24 ATEX 0239X	EN 60079-0:2018 EN 60079-1:2014 EN 60079-31:2014	1461 The Institute for Research and Certification "OBAC" Ltd., Łabędzka 21, 44-121 Gliwice, Poland
CE 1026	FTZU 03 ATEX Q 004	EN ISO/IEC 80079-34:2020	1026 Physical-Technical Testing Institute, Pikartska 7, 716 07 Ostrava-Radvanice, Czech Republic

- in relation to Directive 2014/30/EU – on the harmonisation of the laws of the Member States relating to electromagnetic compatibility:
  - EN 50270:2015
- In relation to directive 2011/65/EU – on the restriction of the use of certain hazardous substances in electrical and electronic equipment
  - EN IEC 63000:2018

This declaration of conformity is issued under the sole responsibility of the manufacturer.

This EU Declaration of Conformity becomes not valid in case of product change or rebuild without manufacturer's permission.

Gliwice, 1.07.2025

(Name and Signature)

Co-owner
Małgorzata Pachole

Shielded cables applied for connecting detectors – preparation and installation

The cable shall be prepared in accordance with the following guidelines (see also 1):

- the cable external sheath shall be removed at the applicable length (see 1),
- the cable shield shall be cut right by the end of the external sheath,
- the cable shield shall be protected with isolation,
- at the ends of the cables, isolated clamp sleeve shall be placed,
- he conductive part of the clamp sleeve shall have applicable length (see 1).

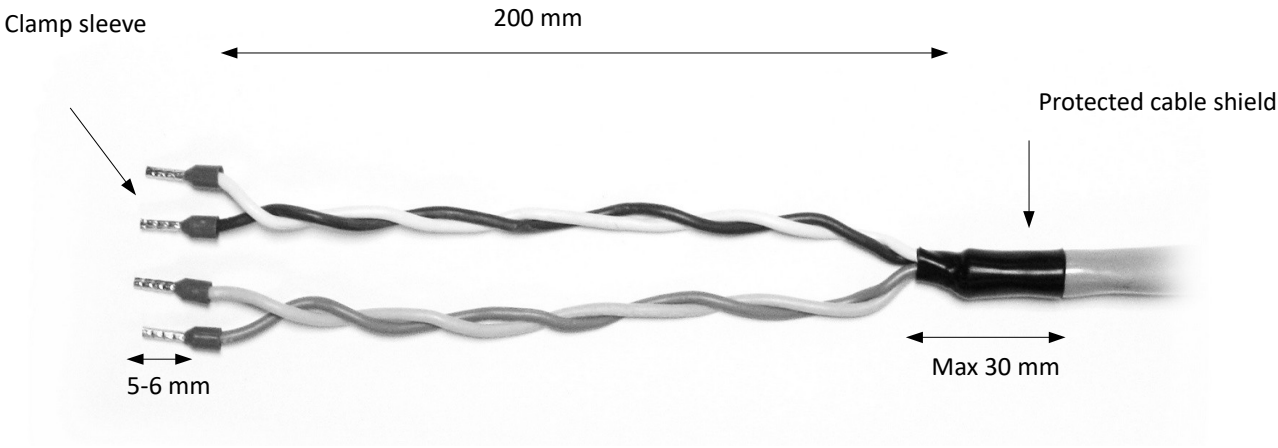


Figure 1: Cable preparation

For the systems with RS-485 interface, it is necessary to make sure that A and B transmission signals as well as + and – power supply were led with the use of the cables which belong to one pair.

The cable shall be placed in the detector as shown on figure 2. It is necessary to make sure that the shield protection is not located in the rubber element of the cable entry and that the smallest part of the cable external sheath was located inside the detector.

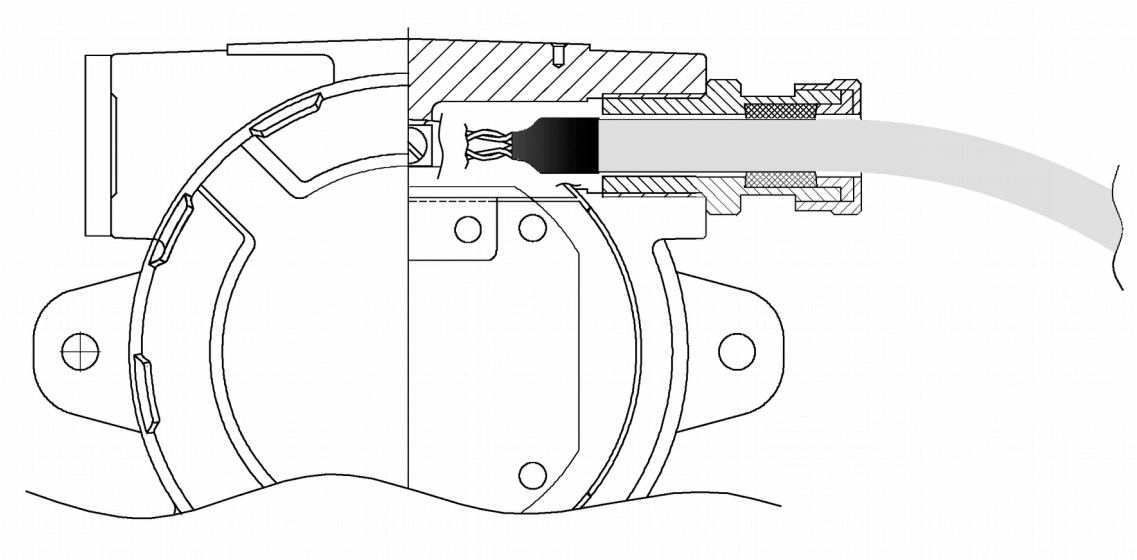


Figure 2: Placing cables in the detector

When laying the cable inside the detector enclosure, it must be remembered that:

- cables should be ordered,
- connecting cables should be kept as far away from the detector electronics as possible and routed as directly as possible to the crimp connection,
- it is necessary to minimize the amount of unnecessary conductor on the detector electronics. It is unacceptable to leave a reserve inside the detector.

Notes

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