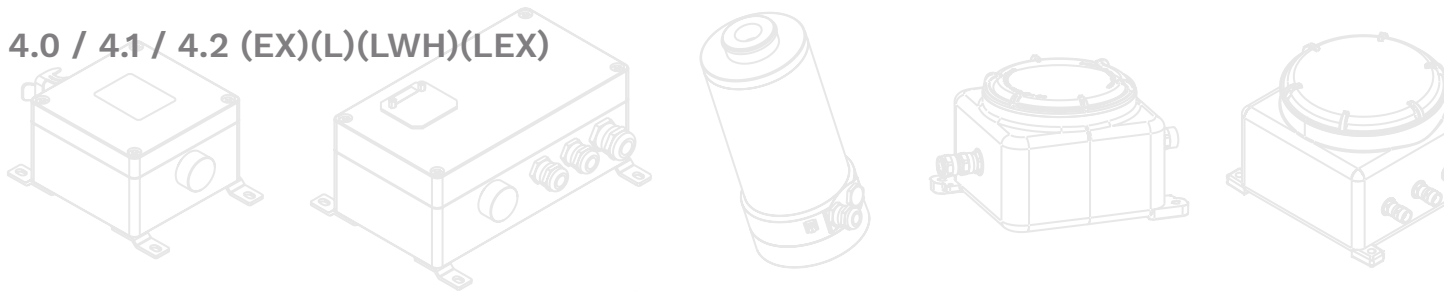


Operating instructions

FLAME SCANNER TYPE 4

4.0 / 4.1 / 4.2 (EX)(L)(LWH)(LEX)



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1 | General aspects

1.1 Introduction

These operating instructions are a helpful guide for ensuring the successful and safe operation of the Flame Scanner. They contain important information on how to operate the system safely, correctly and efficiently. Observing the operating instructions will help to prevent hazards, reduce costs of repair and downtimes and increase the reliability and life of the device.

All illustrations and drawings in these operating instructions are shown for illustration purposes and do not contain details for design.

The operating instructions always have to be accessible at the device. They have to be read and applied by each person who is required to work with/on the device:

- operation
- troubleshooting during operation
- servicing
- maintenance (upkeep, inspection, repair) and/or
- transport

This should be confirmed by the operating company in writing.

1.2 Warning notes

The following warning notes are used in these operating instructions:

DANGER

*This warning level indicates an imminent hazardous situation.
If the hazardous situation is not prevented, this will result in death or severe injury.
Follow the instructions that accompany this warning to prevent the risk of death and severe personal injury.*

WARNING

*This warning level indicates a potentially hazardous situation.
If the hazardous situation is not prevented, this may result in death or severe injury.
Follow the instructions that accompany this warning to prevent the potential risk of death and severe personal injury.*

CAUTION

*This warning level indicates a potentially hazardous situation.
If the hazardous situation is not prevented, this may result in slight or moderate injuries.
Follow the instructions that accompany this warning to prevent the injury of persons.*

CAUTION

*This warning level indicates potential damage to property.
If this situation is not prevented, it may result in damage to property.
Follow the instructions that accompany this warning to prevent damage to property.*

NOTICE

A notice indicates additional information that will make the handling of the device easier.

1.3 Copyright protection

These operating instructions have to be treated as confidential. They may only be used by authorised staff. Access by third parties may only be granted upon written agreement of BFI Automation.

All documents are protected in keeping with the German copyright law.

The disclosure and reproduction of documentation, in whole or in part, as well as the exploitation and communication of its content shall not be permitted unless expressly stated otherwise. Offenders are liable for prosecution and the payment of damages.

We reserve all rights to exercise industrial property rights.

1.4 Disposal information

The Flame Scanner is equipped with electrical and electronic components and must be disposed separate from household waste. Follow the local and actual regulations for waste disposal.



1.5 Warranty

Read these operating instructions carefully and in full before operating the Flame Scanner!

The manufacturer is not liable for damage or operating malfunctions that result from the operating instructions not being observed.

The operating company has to supplement the operating instructions with operating instructions on the basis of national regulations on accident prevention and environmental protection, including information on supervision and notification requirements with respect to special operating circumstances, e.g. regarding organisation of work, working processes and staff deployed.

The recognised technical rules for safe and professional working also have to be observed in addition to the operating instructions and the regulations on accident prevention applicable to the country and place of use.

The warranty shall become void, for example, in the event of:

- inappropriate use
- use of impermissible equipment
- incorrect connection
- prior works that are not part of the supplied product or service
- non-use of original spares and accessories
- conversion, if this has not been harmonised with BFI Automation
- non-performance of specified maintenance work
- Repair work on the device that is not carried out by BFI employees

NOTICE

It is recommended that the operator of the device concludes a service contract with BFI Automation. This guarantees that the device is regularly checked by our service staff and ensures that any required wearing and spare parts are available without long delivery periods.

1.6 Obligation of the operating company

The Flame Scanner may cause hazards if it is operated inappropriately or in an improper condition.

The operating company is under the obligation to operate the machine in proper state only. The operating company has to secure hazardous areas that exist between BFI devices and the customer's own equipment.

The operating company has to appoint and instruct responsible staff:

- Only deploy trained or instructed staff.
- Clearly set out the responsibilities of the staff with regard to operation, set-up, maintenance and repair.
- Regularly check that staff are safety conscious and aware of hazards and are observing the operating instructions.
- Before starting work, staff who are assigned to work with/on the device have to have read and understood the operating instructions, in particular the chapter on "Safety", as well as the relevant regulations.
- The operating instructions and relevant regulations have to be stored in such a way that they are accessible to operating and maintenance staff.
- Set out who will have responsibility for device operation and ensure that this person has the authority to overrule any unsafe instructions of third parties.

NOTICE

Generally valid legal and other binding regulations on accident prevention and environmental protection have to be observed and instructed, in addition to the operating instructions.

1.7 Liability disclaimer

All technical information, data and guidance on device operation that are contained within these operating instructions are, to the best of our knowledge, correct at the time of printing, taking into account our present understanding and experience.

We reserve the right to make technical changes with respect to the further development of the Flame Amplifier outlined in these operating instructions. No claims can be made based on the specifications, illustrations and descriptions of these operating instructions.

We shall not be liable for damage or operating malfunctions that result from operating errors, inappropriate repairs or the non-observance of the operating instructions. We expressly state that only original spare parts and accessories approved by us may be used. This also applies to the components of other manufacturers that have been used.

The installation or use of non-approved spare and accessory parts and any unauthorized retrofits and modifications are not permitted for safety reasons and exclude any liability by BFI Automation for consequential damages.

BFI Automation is liable for possible errors or omissions with the exclusion of additional claims entered into in the framework of the warranty obligations conceded to in the contract. Claims for damages, on whatever legal basis they may be, shall be excluded.

Translations into foreign languages are carried out in good faith. We cannot accept any liability for translation errors; this also applies where the translation has been carried out or has been commissioned by us. The original text alone shall be binding.

Descriptions and illustrations do not necessarily depict the delivered product or a possible spare parts order. Drawings and graphics are not to scale.

1.8 Declaration of conformity



EU Konformitätserklärung EC Declaration of Conformity

Produkt	Flammenüberwachungssystem 3000 (Fühler)		
<i>Product</i>	<i>Flame monitoring system 3000 (Scanner)</i>		
Typ	2.0x, 3.3x, 4.x, 7.x		
<i>Type</i>	<i>2.0x, 3.3x, 4.x, 7.x</i>		

Hiermit erklären wir, dass die bezeichneten Flammenfühler, in ihrer Konzipierung und Bauart sowie in der von uns in Verkehr gebrachten Ausführung, den grundlegenden Sicherheitsanforderungen folgender EU-Richtlinien entsprechen:

This is to confirm that the described flame scanner in there design and type of construction complies with the provisions of the Directive of the Council of the European Communities on the approximation of the laws of the member states relating to:

...

Anwendungsbereich <i>Field of application</i>	EU/2016/426		EU-Gasgeräteverordnung <i>EU Gas Appliances Regulation</i>
Richtlinien <i>Directives</i>	2014/34/EU		Explosionsschutzrichtlinie <i>Explosion protection directive</i>
	2014/30/EU		EMV Richtlinie <i>EMC directive</i>
	2011/65/EU		RoHS Richtlinie <i>RoHS directive</i>
Benannte Stelle <i>Notified body</i>	Kiwa Nederland B.V.	0063	
CE-Zertifikat vom <i>CE certificate from</i>	05.09.2024	CE0063DP1343	Baumusterprüfbescheinigung <i>Type examination certificate</i>
Gültig bis <i>Valid until</i>	05.09.2034		
Normen <i>Standards</i>	EN 298:2022 EN IEC 60079-0:2018; EN 60079-7:2015/ISH1:2016; EN IEC 60079-15:2019 EN 60079-31:2014 EN IEC 63000:2018		
Kennzeichnung ATEX <i>Identification ATEX</i>	ATEX Zone 1		Konformitätserklärung des Gehäuseherstellers <i>Declaration of conformity of housing manufacturer</i>
	ATEX Zone 2	TÜV 15 ATEX 7682 X	Ex II 3G Ex ec nC IIC T4 Gc / Ex ec IIC T4 Gc
	ATEX Zone 22		Ex II 3D Ex tc IIIC T100°C Dc
Ausgestellt durch <i>Issued by</i>	BFI Automation Mindermann GmbH		
Rechtsverbindliche Unterschrift <i>Legally binding signature</i>	 		
	Name	Funktion <i>Function</i>	Ort, Datum <i>Place, Date</i>
	Eberhard Röllecke	Prokurist <i>Authorized Officer</i>	Heiligenhaus, den 26.09.2024

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 info@flamონitec-bfi.com
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Vertretungsberechtigte Geschäftsführer / CEO: Thomas Bachmann, Michael Nocker
 Amtsgericht Wuppertal / District court Wuppertal: HRB 28942
 Ust.-IdNr. / VAT: DE 121 633 651
 Commerzbank . IBAN: DE76 3004 0000 0839 6327 00 . BIC: COBADEFF304
 Deutsche Bank . IBAN: DE14 3007 0010 0477 7348 00 . BIC: DEUTDE3304

1.9 Address of the manufacturer

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Tel.: +49 2056 98946-0
Fax: +49 2056 98946-42

E-Mail: info@bfi-automation.de
Internet: www.bfi-automation.com

2 | Safety

2.1 Intended use

The Flame Scanner shall be used exclusively to detect flames in combination with a suitable Flame Amplifier. The Flame Scanner and Flame Amplifier together constitute a complete flame amplifying system for burners with a random capacity and random fuels in single and multiple burner systems.

The Flame Amplifier renders available to the burner control the safety-oriented binary signals for "Flame ON/OFF".

On account of the continuous fully electronic self-test of its function, the Flame Scanner is approved for continuous operation.

WARNING

Danger when improperly used !

The device may cause hazards if it is not used as intended and/or for any other purposes.

The device has to be used only for the purposes for which it is intended.

The procedures described in the operating instructions have to be observed.

The manufacturer/supplier shall not be liable for damage resulting from use for non-intended purposes. The user/operating company alone shall bear the risk.

2.2 Requirements on persons

NOTICE

Work on/with the device may only be performed by persons authorized to do so based on their training and qualification. Furthermore, such persons have to have been commissioned by the operating company.

Do not allow any persons who are being apprenticed, educated, instructed or on a general training programme to work on the device without the constant supervision of an experienced person.

Persons who are under the influence of drugs, alcohol or medication that affects reactivity shall not be permitted to carry out work on the device.

Connection, set-up, maintenance and repair work may only be carried out by qualified specialist staff.

This device may cause hazards if it is operated inappropriately by untrained staff or if it is not used for its intended purpose.

Generally valid legal and other binding regulations on accident prevention and environmental protection in addition to basic health and safety requirements have to be observed. The operating company has to instruct its staff accordingly.

2.3 Safety instructions

The following instructions on accident prevention have to be observed when operating the Flame Scanner:

NOTICE

Only operate the device if it is in a proper state !

- Do not remove or disable safety devices.
- Check for externally noticeable damage and defects prior to using the device ! Immediately notify the appropriate authority/person of any changes that occur (including changes in operating performance). If necessary, stop and secure the device immediately.
- Allow only authorised specialist staff to carry out set-up and/or maintenance work.
- Replace worn or defective parts.
- Use suitable maintenance tools only.
- After repair work, refit all safety devices and carry out electrical and mechanical checks.
- Check the operating instructions for details of displays as well as switch-on and switch-off procedures.
- Prior to switching on the device, make sure that no-one can be endangered by the device !
- The operating instructions always have to be kept close to the device and be readily at hand.
- Any non-compliance with the safety instructions outlined in these operating instructions may lead to damage to property, personal injury or even death.

2.4 Safety devices

Check the safety equipment and locking devices on the device for safe operational condition.

Only operate the device if all safety devices are present and enabled. The operating company or operator of the Flame Scanner is responsible for the proper operation of the device.

NOTICE

The device has been fitted with warning and danger signs for the protection of operating staff. These signs have to be observed. Damaged or illegible signs have to be replaced immediately.

2.4.1 Safety devices

The Flame Scanner has been fitted with the following safety devices:

- Housing (protection against accidental contact)
- Flame-proof housing (optional)
- Earth connection of device (optional)
- Explosion protection barriers (optional)

2.5 Safety instructions in case of maintenance and troubleshooting

- Deadlines set or indicated in the operating instructions for repetitive checks / inspections shall have to be observed !
- Appropriate workshop equipment is essential for performing maintenance work.
- In conformity with the electrical regulations, work on the electrical equipment of the system may only be carried out by an electrical specialist or by trained staff under the direction and supervision of an electrical specialist.
- The adjustment, maintenance and inspection activities and deadlines stipulated by BFI Automation, including information on the replacement of parts / assemblies, have to be observed! These tasks may only be carried out by authorised specialist staff.
- Operating staff have to be informed before maintenance or other special work is carried out. A supervisor has to be appointed.
- Screw connections which have been loosened during maintenance and servicing work, have to be tightened.
- If maintenance and repairs require safety devices to be dismantled, these devices have to be remounted and checked as soon as the maintenance and repair work has been completed.
- Operating and auxiliary materials as well as exchanged parts have to be disposed of in a safe and eco-friendly way.
- Spare parts supplied by BFI Automation or approved of by BFI Automation only may be used.

2.5.1 Electrical / electronic devices

DANGER

Danger to life caused by electrical current!

Contact with live wires or components presents a danger to life!

Prior to any work on the electrical equipment, disconnect the flame amplifying system from the power supply network!

NOTICE

In keeping with the electrical regulations, work on electrical / electronic parts / components may only be carried out by electrical specialists.

Important rules of conduct:

- Check the device in regular intervals. Any defects or faults ascertained have to be corrected immediately. Switch off the device until the defects have been corrected.
- Equipment parts undergoing inspection, maintenance or repair work have to be made de-energised, if required. First check that the disconnected parts are no longer live, then short to earth. Also isolate neighbouring live parts
- If work is required on live parts, a second person has to be assigned who can disconnect the power supply in case of an emergency. Only use insulated tools!
- Fuses must not be repaired or bridged. Only use original fuses with the specified current!

2.5.2 Testing in keeping with the German Workplace Safety Ordinance

In case of the coupling or installation of devices from various manufacturers or suppliers, the operating company has to carry out a precise test, prior to start-up, in keeping with the German Workplace Safety Ordinance (BetrSichV) in force and the applicable electrical regulations.

In case of queries, please get in touch with BFI Automation.

2.5.3 Safety test

WARNING

In order to ensure correct operation, the Flame Scanners as well as Flame Amplifiers of all applications have to be tested several times by starting and stopping the burner several times. In all cases the flame relay has to be switched off reliably in case of an absent flame. Carry out this test whilst several neighbouring burners are started and stopped and different boiler outputs are used. This is an indispensable pre-requisite for a safe and correct operation of the device!

2.5.4 Specific conditions of use (IECEx)

WARNING

- The insulation of conductors must match with temperature requirements.
- The housing, especially the Harting plug and connector have to be installed impact-protected.
- The installation must be in accordance with IEC 60079-14.
- The equipment shall only be used in an area of at least pollution degree 2, as defined in IEC 60664-1.
- Transient protection shall be provided that is set at a level not exceeding 140 % of the peak rated voltage value at the supply terminals to the equipment.

3 | Technical data

3.1 General characteristic features

- Self-control to verify flawless function of the device
- Selective monitoring:
 - 4.0: for selective oil flame detection at oil/coaldust combined firing
 - 4.1: for selective coal dust flame detection at oil/coal dust combined firing
 - 4.2: for combustion chamber monitoring at gas /oil/ coaldust firings and for monitoring of fluidized-bed combustion and stoker-fired furnace
- Si sensor
- Fully electronic construction
- Spectral analyzing process
- Tested by the German Technical Inspection Association TÜV
- IECEx certified
- SIL 2

3.2 Electrical system, optical system, mechanical system

Spectral sensitivity	300 nm to 2700 nm
Angle of view Standard/Ex-de-housing With aperture OE-Converter housing/ Ex-d-housing	2,7° 1°, 2° or 2,7° 2,7° by sensor head
Lower limiting frequency 4.0 4.1 4.2	60 Hz 40 Hz 25 Hz
Self checking	fully electronic, once per second
Power supply	24 VDC
Current consumption Including heating	max. 200 mA max. 700 mA
Ambient temperature All housings (not EAC approved) Ex-de-housing (EAC approved)	-20 °C to +70 °C -40 °C to +60 °C

3.2 Electrical system, optical system, mechanical system

Electrical connection Standard/OE-Converter housing Ex-d-housing/Ex-de-housing/ OE-Converter housing WH	dustproof plug-type connector terminal blocks
Type of protection OE-Converter-/Ex-d-housing/ Ex-de-housing Standard housing	IP 66 IP 65
Cable length	max. 400 m
Sight port connection Standard/Ex-de-housing OE-Converter-/Ex-d-housing	1" female thread depending on SKL
Purge air Connection Volume Pressure	½" female thread 10 m³/h 0,02 bar over combustion chamber internal pressure
CE	CE0063
IECEX Zone 1 Ex-de-housing Ex-d-housing (GUB) Zone 2 Standard/OE-Converter housing	IECEX EPS 14.0042X IECEX INE 13.0069X IECEX TUR 15.0029X
ATEX Zone 1 Ex-de-housing Ex-d-housing (GUB) Zone 2 Standard/OE-Converter housing	EPS 14 ATEX 1 696 X INERIS 13ATEX0021X TÜV 15 ATEX 7682 X
EAC Zone 1 Ex-de-housing Ex-d-housing (GUB) Zone 2 Standard/OE-Converter housing	EAЭC RU-DE.BH02.B.00177/19 TC RU C-IT.BH02.B.00689/18 TC RU C-DE.ИМ43.B.00536

3.3 Weight

Standard housing	approx. 1,5 kg
OE-Converter housing	approx. 1,5 kg
OE-Converter housing WH	approx. 2,1 kg
Ex-de-housing	approx. 5 kg
Ex-d-housing (GUB01)	approx. 5 kg
Ex-d-housing (GUB03 FEAM)	approx. 15 kg

3.4 Adjustment controls - Sensitivity potentiometer

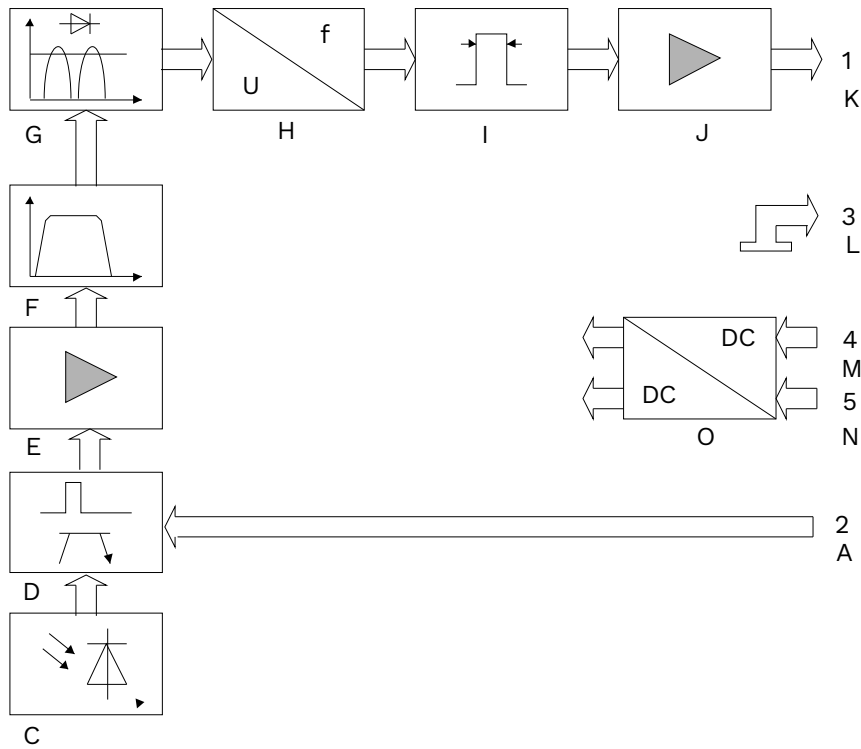
The potentiometer is used to set the amplification of the flame signal in the Flame Scanner. The Flame Scanner in the standard housing and in the Ex-de-housing cannot be adjusted during operation as the potentiometers are located behind the lens plate. Remove the yellow protective sticker on the lens plate for adjustment. To adjust the potentiometers on the Flame Scanners in the OE-Converter housing and in the Ex-d-housing, the cover of the housing must be removed. The Flame Scanner Type 4 has been fitted with two potentiometers. The PbS sensor (IR) for the spectral range 1050 - 2700 nm can be set via the inner potentiometer (near the centre of the circuit board). The outer potentiometer (near the edge of the circuit board) is used to set the Si sensor (UV) for the spectral range 300 - 1050 nm.

NOTICE

The following applies for both potentiometers: Increase of sensitivity by turning clockwise!

The potentiometers are set from 0 to 100 per cent by turning 24 (10 for Ex-housings) full turns. It is not possible to overturn the potentiometer.

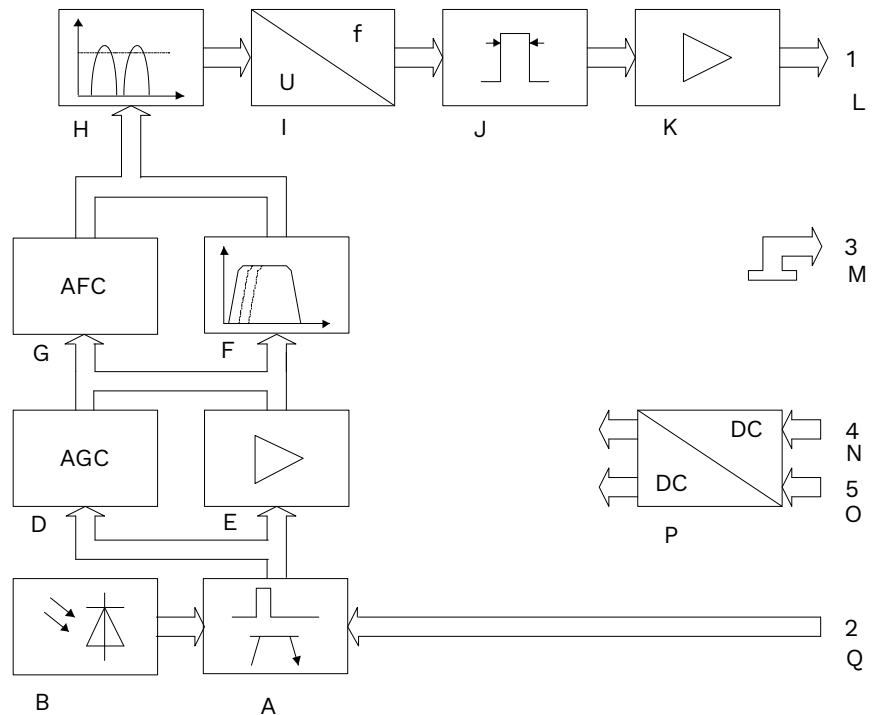
3.5 Device design - block diagram 4.0



1-5 pin no. at Harting plug
A shutter signal
C Si sensor
D electronic shutter
E preamplifier
F band pass
G full wave rectifier
H U/F-converter

I puls shaper
J power amplifier
K signal output
L signal ground
M supply voltage 24VDC (+)
N supply voltage 0VDC (-)
O galvanic isolation

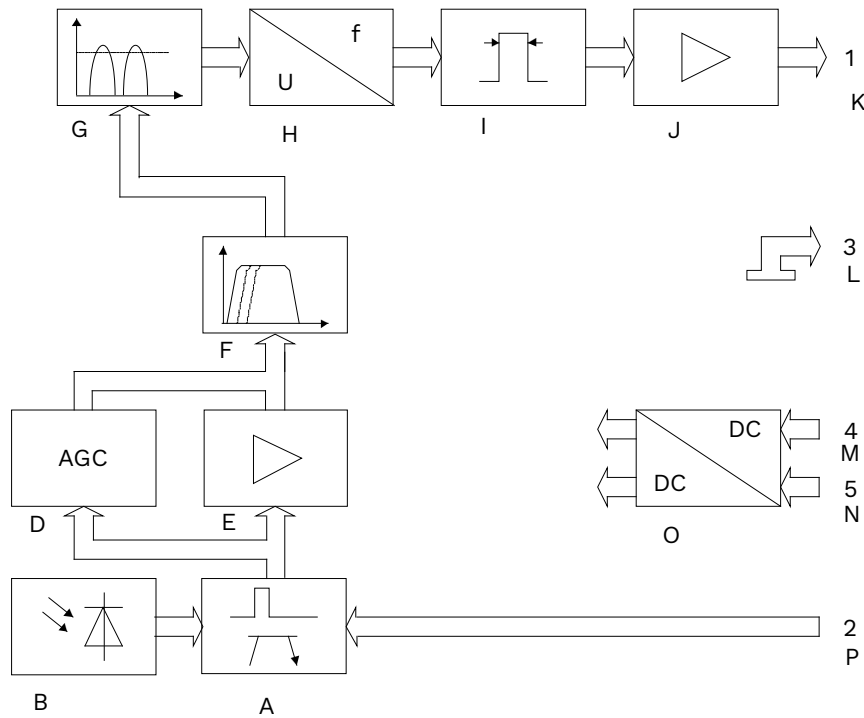
3.6 Device design - block diagram 4.1



1–5 pin no. at Harting plug
 A electronical shutter
 B Si sensor
 D AGC
 E preamplifier
 F band pass
 G AFC
 H full wave rectifier
 I U/F-converter
 J puls shaper

K power amplifier
 L signal output
 M signal ground
 N supply voltage 24VDC (+)
 O supply voltage 0VDC (-)
 P galvanic isolation
 Q shutter signal
 AGC automatic gain control
 AFC automatic frequency control

3.7 Device design - block diagram 4.2



1-5	Pin no. at Harting plug
A	electronical shutter
B	Si sensor
D	AGC
E	preamplifier
F	band pass
G	full wave rectifier
H	U/F-converter
I	puls shaper

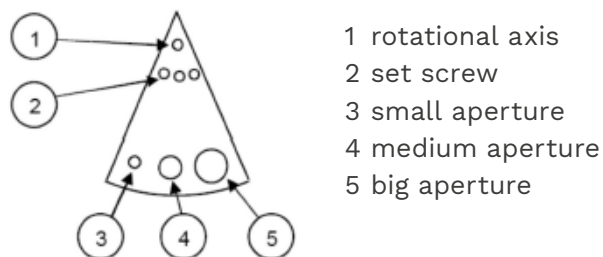
J	power amplifier
K	signal output
L	signal ground
M	supply voltage 24 V DC(+)
N	supply voltage 0 V DC(+)
O	galvanic isolation
P	shutter signal
AGC	automatic gain control

3.8 Optical aperture

The Flame Scanner in the standard housing and in the Ex-de-housing has been fitted with an optical aperture. The aperture permits a control of the radiation energy, which is picked up as flame signal by the semi-conductor sensor. It is used to fade out excessive radiation emitted by heavy oil flames, for example, by optical means. An overexcitation of the scanner electronics or a thermal overload of the scanners can be prevented.

Adjustment of the aperture

The unit has to be opened for the adjustment of the aperture. The aperture is located between the lens and the detector holding block. In order to be able to change the aperture setting, the rotational axis screw (1) has to be loosened first of all. Then loosen the set screw (2) until the aperture can be moved. Set the requested aperture (3-5) and lock the position with the set screw (2). Subsequently tighten the rotational axis screw (1) and close the device.



NOTICE

Flame Scanners in OE-Converter housings and Ex-d-housings are not equipped with an optical aperture.

4 | Installation and connection

4.1 Scope of delivery

- Flame Scanner Type 4
- Operating instructions
- Connection cable (optional)
- Harting cable box (optional)
- Ball flange (optional)
- 3-way-ball-valve (optional)
- Heating insulator (optional)
- Ex-housing (optional)
- Optical alignment device (optional)
- Fibre optic cable (optional)

Refer to the order papers for the exact scope of delivery and compare with the delivery note.

Checking for completeness

Check the entire delivery for completeness against the accompanying delivery note. Please refer to our terms of sale and delivery otherwise.

Report any damage

After arrival of the device and accessories, notify the shipping agent, the insurance company and BFI Automation immediately in case of any damage caused by transport or inadequate packaging. Take steps to minimise and prevent further damage.

Report the insurance case to the insurance company without delay and transmit the full claim documents at once in order to expedite the claims settlement (at the latest in sufficient time before the expiry of any periods of preclusion and/or limitation relating to the compensation claims against third parties).

NOTICE

All installation and connection work may be carried out by qualified and approved specialist staff only!

Observe the legal stipulations and adjustment instructions of the plant operator!

4.2 Packaging

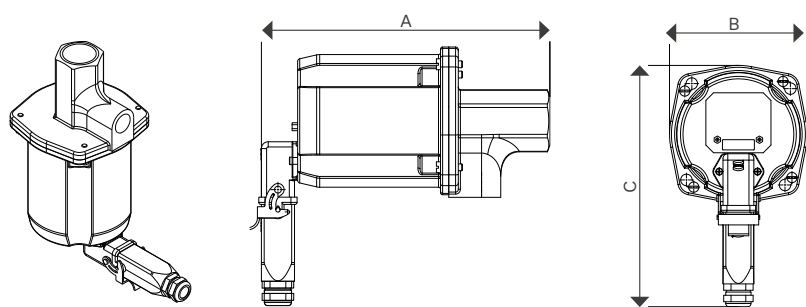
The Flame Scanner is shipped in different packaging materials.

The most frequently used packaging materials are cardboard and plastics (foils, foamed material).

NOTICE

Packaging has to be disposed of in an environmentally friendly way and in accordance with the relevant provisions on disposal.

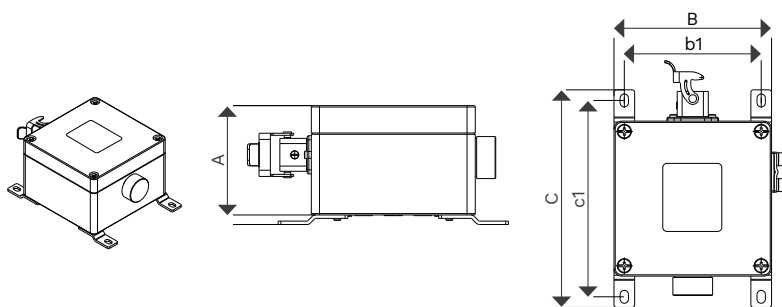
4.3 Space requirement - Housings



ATEX Zone 2

Standard housing

Length A:	235 mm
Width B:	108 mm
Height C:	190 mm
Weight:	1.5 kg
Type:	4.x

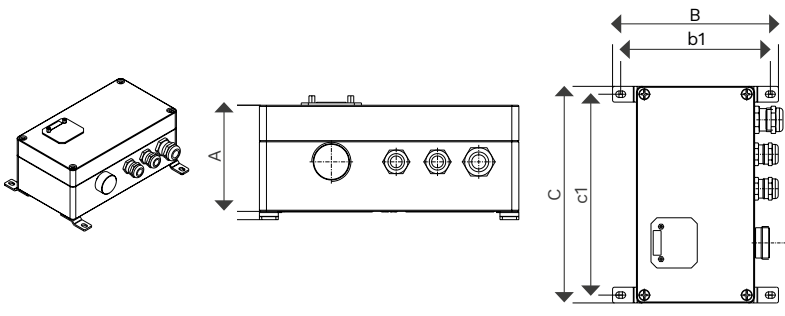
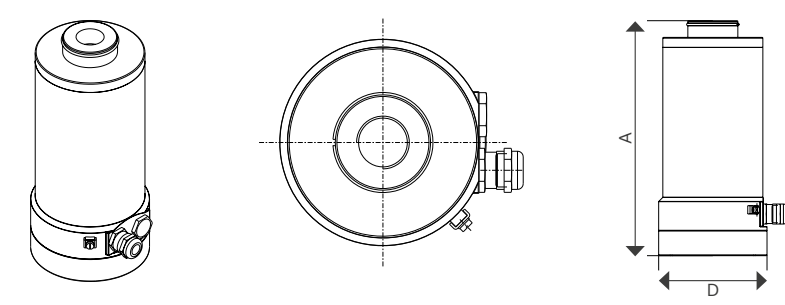
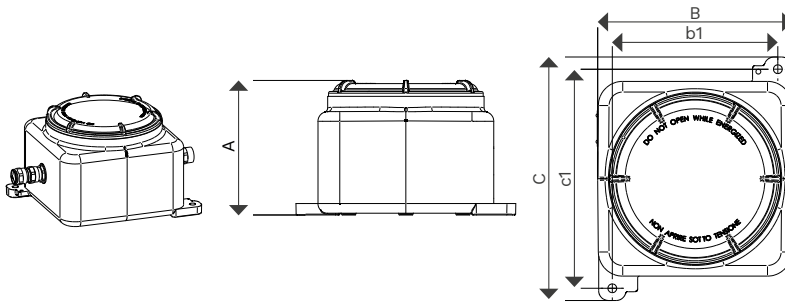
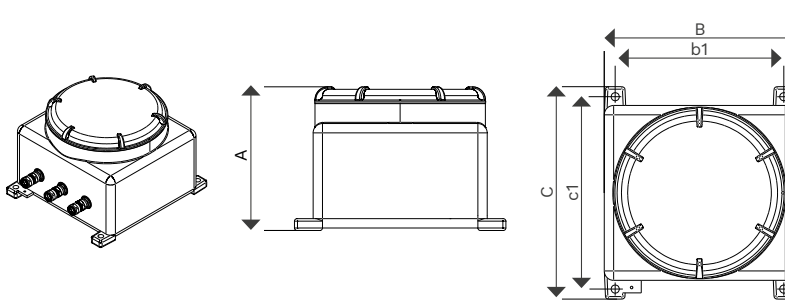


ATEX Zone 2

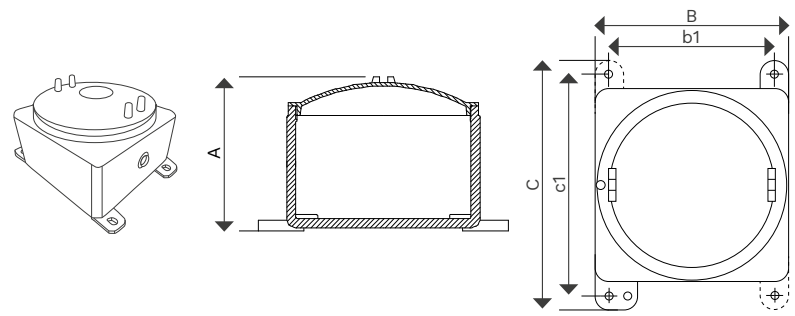
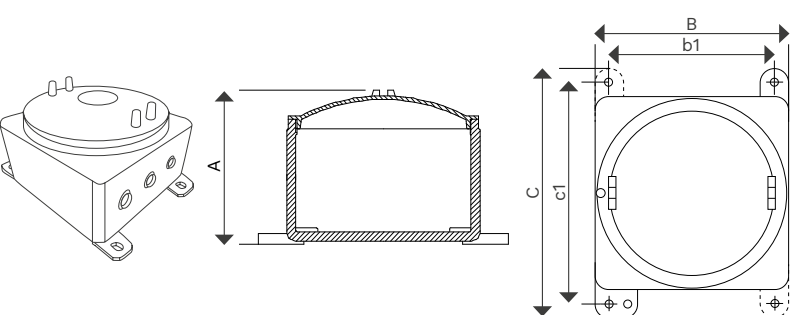
OE-Converter housing

Length A:	80 mm
Width B/b1:	122/106 mm
Height C/c1:	168.5/152mm
Weight:	1,5 kg
Type:	4.xL

4.3 Space requirement - Housings

	ATEX Zone 2 OE-Converter housing WH <table> <tr> <td>Length A:</td><td>91 mm</td></tr> <tr> <td>Width B/b1:</td><td>168/125 mm</td></tr> <tr> <td>Height C/c1:</td><td>220/204 mm</td></tr> <tr> <td>Weight:</td><td>2.1 kg</td></tr> <tr> <td>Type:</td><td>4.xLWH</td></tr> </table>	Length A:	91 mm	Width B/b1:	168/125 mm	Height C/c1:	220/204 mm	Weight:	2.1 kg	Type:	4.xLWH
Length A:	91 mm										
Width B/b1:	168/125 mm										
Height C/c1:	220/204 mm										
Weight:	2.1 kg										
Type:	4.xLWH										
	ATEX Zone 1 Ex-de-housing <table> <tr> <td>Length A:</td><td>290 mm</td></tr> <tr> <td>Ø D:</td><td>130 mm</td></tr> <tr> <td>Weight:</td><td>5 kg</td></tr> <tr> <td>Type:</td><td>4.xEX</td></tr> </table>	Length A:	290 mm	Ø D:	130 mm	Weight:	5 kg	Type:	4.xEX		
Length A:	290 mm										
Ø D:	130 mm										
Weight:	5 kg										
Type:	4.xEX										
	ATEX Zone 1 Ex-d-housing (GUB01) <table> <tr> <td>Length A:</td><td>153 mm</td></tr> <tr> <td>Width B/b1:</td><td>200/170 mm</td></tr> <tr> <td>Height C/c1:</td><td>250/225 mm</td></tr> <tr> <td>Weight:</td><td>5 kg</td></tr> <tr> <td>Type:</td><td>4.xLEX</td></tr> </table>	Length A:	153 mm	Width B/b1:	200/170 mm	Height C/c1:	250/225 mm	Weight:	5 kg	Type:	4.xLEX
Length A:	153 mm										
Width B/b1:	200/170 mm										
Height C/c1:	250/225 mm										
Weight:	5 kg										
Type:	4.xLEX										
	ATEX Zone 1 Ex-d-housing (GUB03) <table> <tr> <td>Length A:</td><td>231 mm</td></tr> <tr> <td>Width B/b1:</td><td>305/270 mm</td></tr> <tr> <td>Height C/c1:</td><td>336/308 mm</td></tr> <tr> <td>Weight:</td><td>15 kg</td></tr> <tr> <td>Type:</td><td>4.xLEX</td></tr> </table>	Length A:	231 mm	Width B/b1:	305/270 mm	Height C/c1:	336/308 mm	Weight:	15 kg	Type:	4.xLEX
Length A:	231 mm										
Width B/b1:	305/270 mm										
Height C/c1:	336/308 mm										
Weight:	15 kg										
Type:	4.xLEX										

4.3.1 Space requirement - Discontinued housings

	<table> <tr> <td colspan="2">ATEX Zone 1</td></tr> <tr> <td colspan="2">Ex-d-housing (GUB02)</td></tr> <tr> <td>Length A:</td><td>218 mm</td></tr> <tr> <td>Width B/b1:</td><td>232/196 mm</td></tr> <tr> <td>Height C/c1:</td><td>304/262 mm</td></tr> <tr> <td>Weight:</td><td>7.4 kg</td></tr> <tr> <td>Type:</td><td>4.x(LEX)(LAEX)</td></tr> </table>	ATEX Zone 1		Ex-d-housing (GUB02)		Length A:	218 mm	Width B/b1:	232/196 mm	Height C/c1:	304/262 mm	Weight:	7.4 kg	Type:	4.x(LEX)(LAEX)
ATEX Zone 1															
Ex-d-housing (GUB02)															
Length A:	218 mm														
Width B/b1:	232/196 mm														
Height C/c1:	304/262 mm														
Weight:	7.4 kg														
Type:	4.x(LEX)(LAEX)														
	<table> <tr> <td colspan="2">ATEX Zone 1</td></tr> <tr> <td colspan="2">Ex-d-housing (GUB03)</td></tr> <tr> <td>Length A:</td><td>218 mm</td></tr> <tr> <td>Width B/b1:</td><td>276/236 mm</td></tr> <tr> <td>Height C/c1:</td><td>356/318 mm</td></tr> <tr> <td>Weight:</td><td>10.4 kg</td></tr> <tr> <td>Type:</td><td>4.x(LEX)(LAEX)</td></tr> </table>	ATEX Zone 1		Ex-d-housing (GUB03)		Length A:	218 mm	Width B/b1:	276/236 mm	Height C/c1:	356/318 mm	Weight:	10.4 kg	Type:	4.x(LEX)(LAEX)
ATEX Zone 1															
Ex-d-housing (GUB03)															
Length A:	218 mm														
Width B/b1:	276/236 mm														
Height C/c1:	356/318 mm														
Weight:	10.4 kg														
Type:	4.x(LEX)(LAEX)														

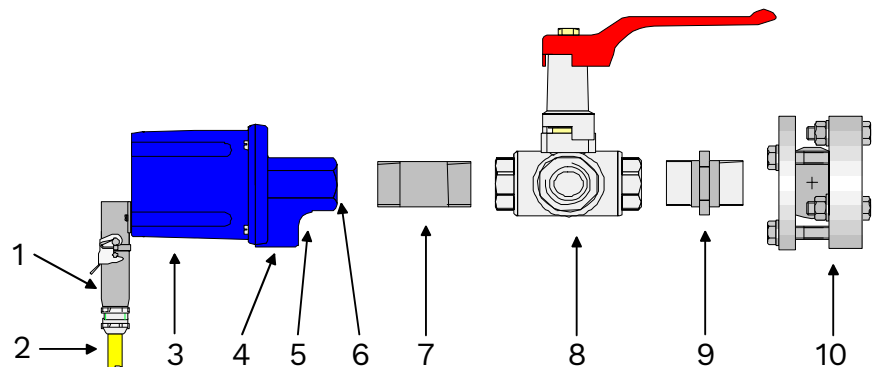
4.4.1 Installation - Standard housing

NOTICE

At a diameter of 1", the sighting tube should not be any longer than 50 cm. When doubling the length, double the diameter to 2"!

By using a ball-flange, the adjustment can be carried out easily ensuring that the ideal sighting point is set mechanically. The Flame Scanner is supplied complete with a rapid-installation flange. This flange ensures the unproblematic disassembly of the Flame Scanner. It has a purge air connection, the construction of which prevents the soiling of the lens system without the dust-laden purge air damaging the lens. If temperatures of over 50 degrees Celsius occur at the Flame Scanner despite the inflow of cooling air caused by the heat dissipation of the sighting tube, heating insulator has to be used. In case of pressurised combustion, an additional 3-way-ball-valve has to be fitted for protection. The exit of hot gas after removal of the scanner is prevented, ensuring further cooling and purging of the arrangement.

The entire mechanical peripheral system can be supplied by BFI Automation.

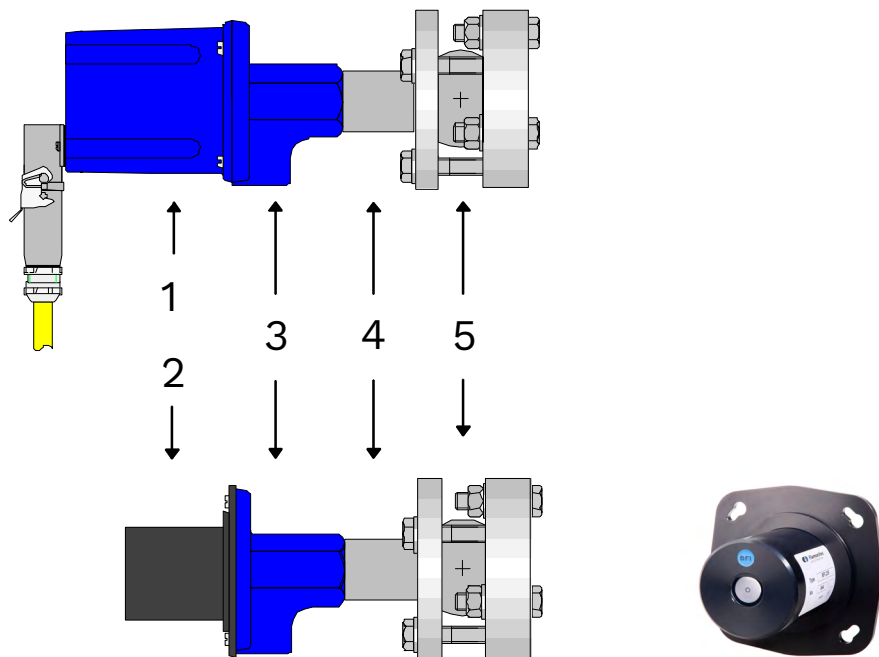


- | | |
|-----------------------------|----------------------|
| 1. Harting plug | 7. Heating insulator |
| 2. Special cable KW5 | 8. 3-way-ball-valve |
| 3. Flame Scanner | 9. Double nipple |
| 4. Purge air connection | 10. Swivel mount |
| 5. Purge air flange | |
| 6. Sighting tube connection | |

4.4.1 Installation - Standard housing

NOTICE

All installation and connection work may be carried out by qualified and approved specialist staff only! The legal regulations as well as adjustment instructions of the plant operator have to be observed!



- | | |
|----------------------------|---------------------|
| 1 Flame Scanner | 4 Heating insulator |
| 2 Optical alignment device | 5 Swivel mount |
| 3 Purge air flange | |

The Flame Scanner has been provided with oblong holes for easy installation on the purge air flange. The sighting tube connection has been provided with a G1" internal thread.

In order to ensure perfect flame amplifying, the correct and low-vibration position of the sighting tube relative to the flame is essential. The Flame Scanner has to be aligned in such a way that a perfect visual image is set. For this purpose use the optical adjusting device (available as an accessory) as shown in chapter 4.4.5. The best setting results when a large visual field is achieved.

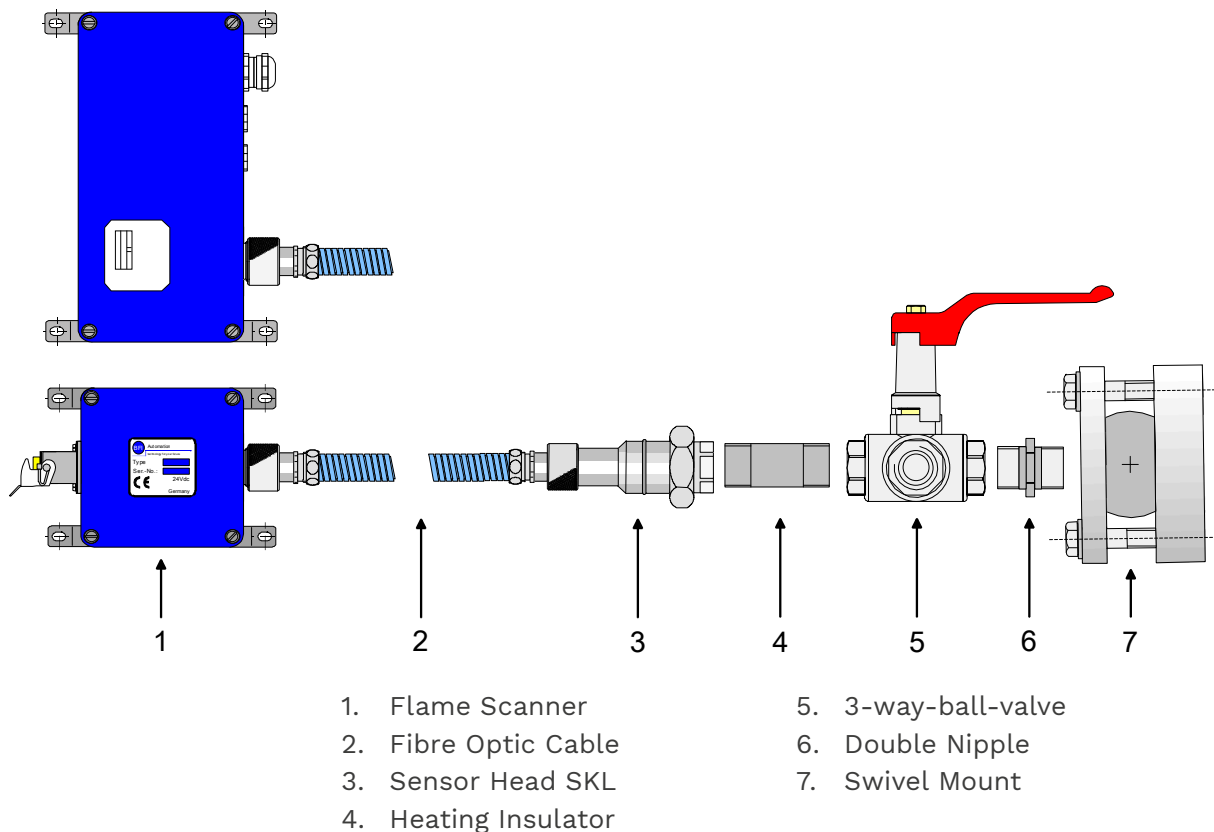
4.4.2 Installation - OE-converter housing

NOTICE

At a diameter of 1", the sighting tube should not be any longer than 50 cm. When doubling the length, double the diameter to 2"!

By using a Swivel Mount, the adjustment can be carried out easily ensuring that the ideal sighting point is set mechanically. Connection of the fibre optic cable by using the swivel nuts at both ends. If temperature of over 200 degrees Celsius occur at the Flame Scanner despite the inflow of cooling air caused by the heat dissipation of the sighting tube, heating insulator has to be used. In case of pressurised combustion, an additional 3-way-ball-valve has to be fitted for protection. The exit of hot gas after removal of the Sensor Head SKL is prevented, ensuring further cooling and purging of the arrangement.

The entire mechanical peripheral system can be supplied by BFI Automation.

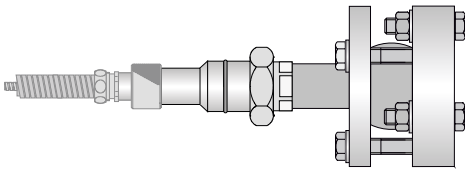


4.4.2 Installation - OE-converter housing

The sight port connection of the Sensor Head SKL is G 1" female thread.

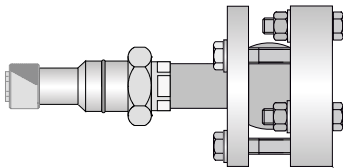
In order to ensure perfect flame amplifying, the correct and low-vibration position of the sighting tube relative to the flame is essential. The Sensor Head SKL has to be aligned in such a way that a perfect visual image is set. For this purpose use the Optical Alignment Device (available as an accessory) as shown in chapter 4.4.5.

Fibre Optic Cable



Remove the Fiber Optic Cable from the Scanner Head SKL, replace it with the optical alignment device and fix it with the hand nut.

Optical Alignment Device



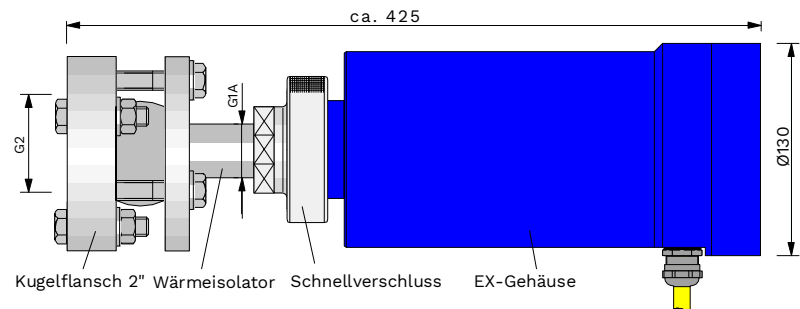
NOTICE

The enclosure may only be opened by a person authorised to do so when it is de-energised!

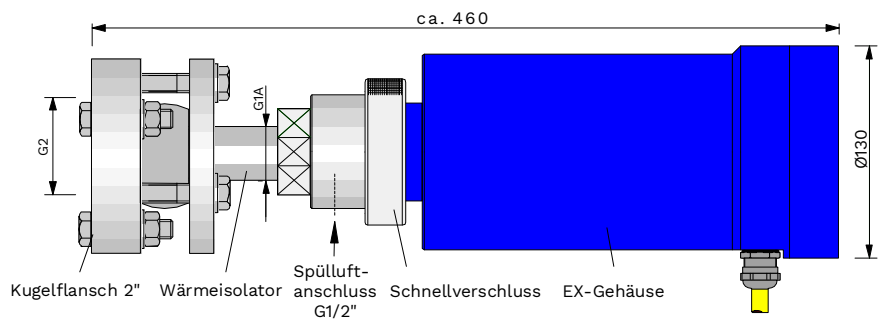
4.4.3 Installation - Ex-de-housing

Beside the above discribed peripheral also the following combinations are aviable. In addition the 3-way-ball-valve can be used.

Quick acting coupling



Quick acting coupling with purge air connector



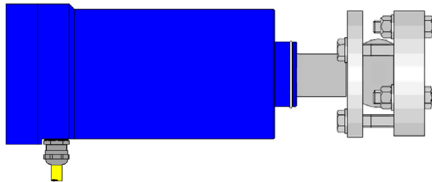
4.4.3 Installation - Ex-de-housing

For alignment of the visual axis of the Flame Scanner.

The circle insight the visor represents the detecting area of the sensor (see chapter 4.4.5).

With a swivel mount the visual axis can be aligned as shown below. The images in the upper line show a correct alignment. The images in the lower line show a misalignment of the visual axis of the Flame Scanner or a negative influence by burner internals.

Ex-housing



Remove the cover incl. Flame Scanner electronic, replace it with the optical alignment device and fix it with the screws.

Optical Alignment Device



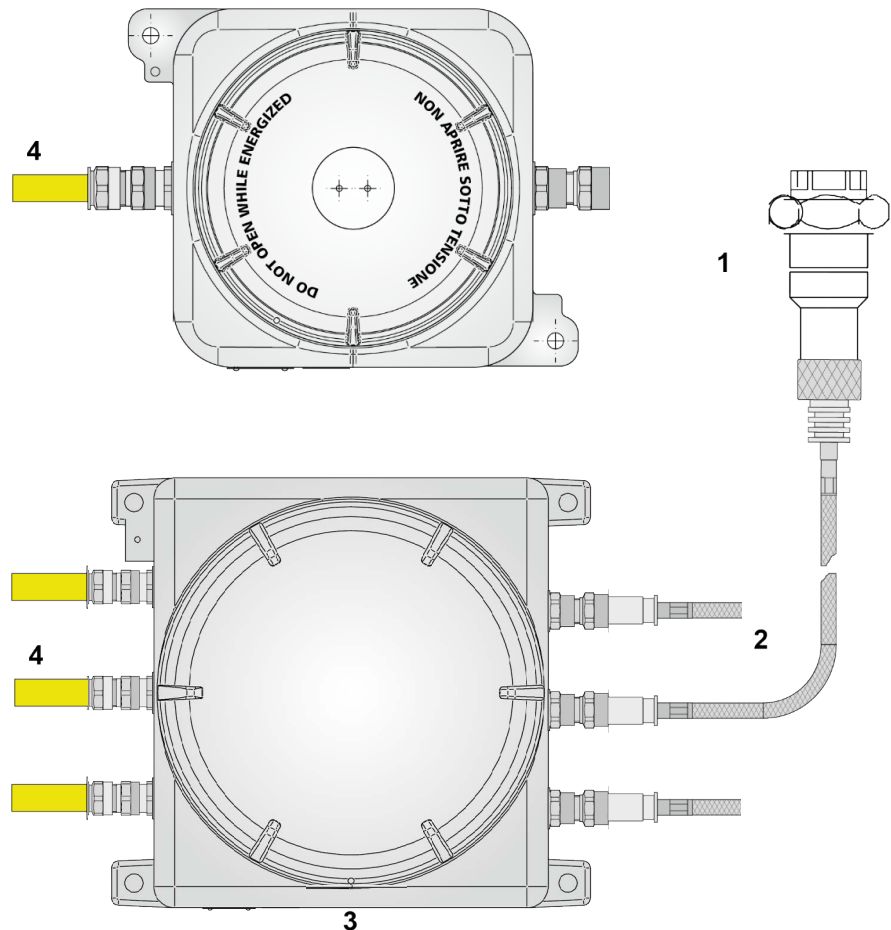
NOTICE

The enclosure may only be opened by a person authorised to do so when it is de-energised!

4.4.4 Installation - Ex-d-housing

The sighting tube connection has been provided with a G1" internal thread. In order to ensure perfect flame amplifying, the correct and low-vibration position of the sighting tube relative to the flame is essential.

The SKL-probe has to be aligned in such a way that a perfect visual image is set. For this purpose use the optical adjusting device as shown in chapter 4.4.5.



- 1. Sensor Head SKL
- 2. Fibre Optic Cable

- 3. Flame Scanner
- 4. Special Cable

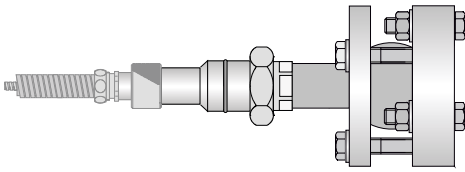
4.4.4 Installation - Ex-d-housing

For alignment of the visual axis of the Flame Scanner.

The circle insight the visor represents the detecting area of the sensor (see chapter 4.4.5).

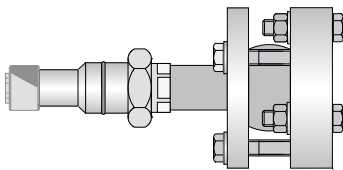
With a swivel mount the visual axis can be aligned as shown below. The images in the upper line show a correct alignment. The images in the lower line show a misalignment of the visual axis of the Flame Scanner or a negative influence by burner internals.

Fibre Optic Cable



Remove the cover incl. Flame Scanner electronic, replace it with the optical alignment device and fix it with the screws.

Optical Alignment Device



NOTICE

The enclosure may only be opened by a person authorised to do so when it is de-energised!

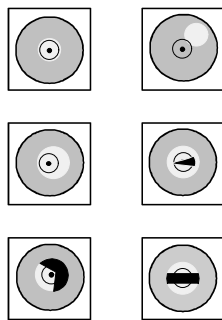
4.4.5 Vision images of the optical adjustment device

CAUTION

*Danger of injuring the eyes by infrared and ultraviolet radiation and penetrating gases when checking the flame visually !
Wear filtering protective glasses !*

Vision images of the optical adjustment device

correct wrong



NOTICE

The images appear mirror inverted in horizontal and vertical direction!

The length and the diameter of the sighting tube have a direct influence on the usable flame radiation as the visual angle of the lens system is defined. Without restriction of the visual range, the maximum length L of a sighting tube for conventional tube diameters D is as follows:

D:	1"	1.5"	2"
L:	0.5 m	0.8 m	1.1 m

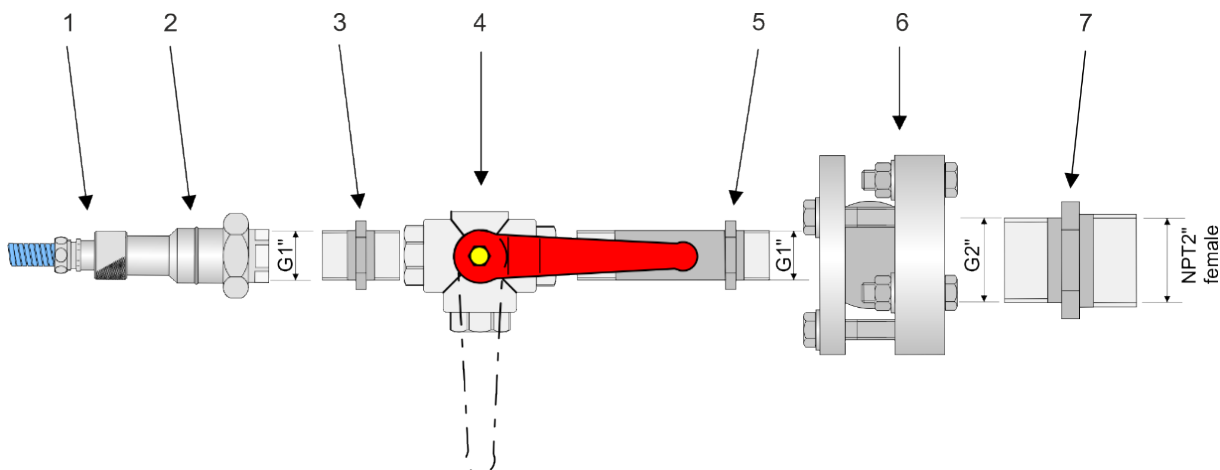
For this reason, the sighting tube should always be as short as possible. A diameter of 2" is recommended.

NOTICE

At a diameter of 1", the sighting tube should not be any longer than 50 cm. When doubling the length, double the diameter to 2"!

4.4.6 Mounting variant using accessories

By using a ball-flange, the adjustment can be carried out easily ensuring that the ideal sighting point is set mechanically. Connection of the fibre optic cable by using the swivel nuts at both ends. If temperature of over 100 degrees Celsius occur at the Flame Scanner despite the inflow of cooling air caused by the heat dissipation of the sighting tube, heating insulator has to be used. In case of pressurised combustion, an additional 3-way-ball-valve has to be fitted for protection. The exit of hot gas after removal of the SKL-probe is prevented, ensuring further cooling and purging of the arrangement. The entire mechanical peripheral system can be supplied by BFI Automation.



- | | |
|----------------------|------------------|
| 1. Fibre Optic Cable | 5. Double Nipple |
| 2. Sensor Head SKL | 6. Swivel Mount |
| 3. Double Nipple | 7. Double Nipple |
| 4. 3-way-ball-valve | |

4.4.7 Factory settings

DANGER

Danger to life caused by combustion or explosion!

In case of incorrect installation or adjustment, uncontrolled combustion or explosions may be caused!

Observe the adjustment instructions of the plant operator!

Adjustment work may be carried out only by qualified and approved specialist staff!

The sensitivity of the Flame Scanner has been factory set to 100% for each spectral range.

4.4.8 Adapting the Flame Scanner to the fuel

DANGER

Danger to life caused by combustion or explosion!

In case of incorrect installation or adjustment, uncontrolled combustion or explosions may be caused!

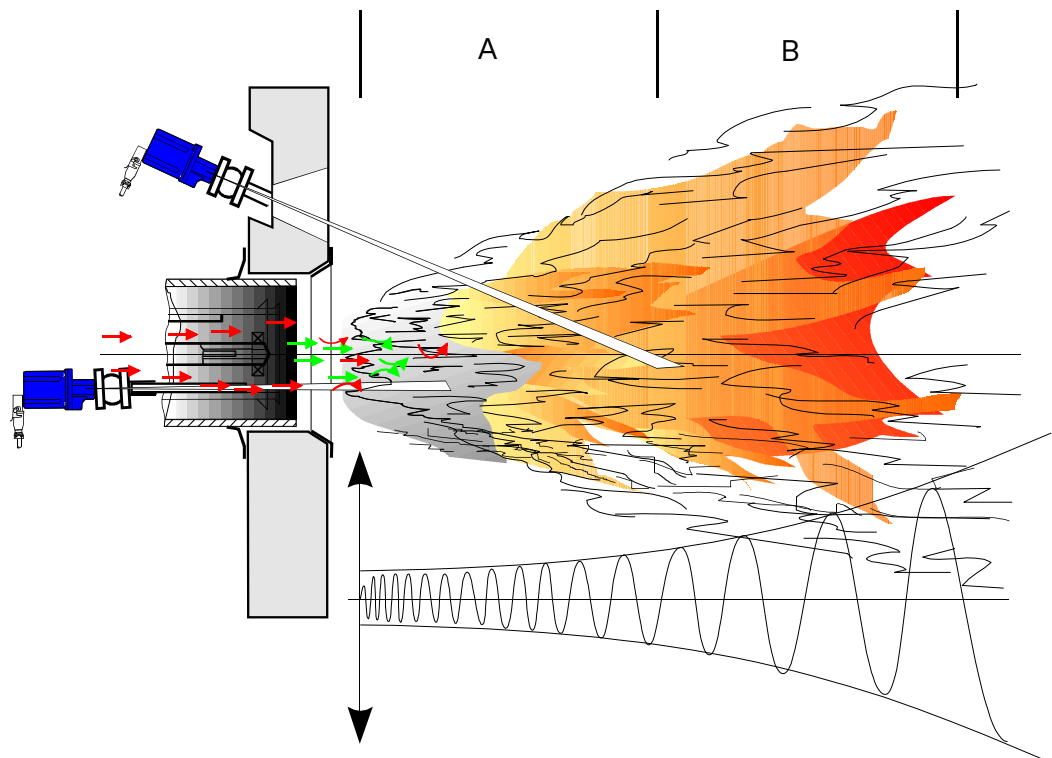
Observe the adjustment instructions of the plant operator!

Adjustment work may be carried out only by qualified and approved specialist staff!

NOTICE

All alignments and settings have to be carried out, when new spare parts have been fitted, the Flame Scanner has been moved or the flame image has been changed (by additional fuel, new burner, change in the burner / air register, for example) as well as during all first installations!

For selective burner amplifying, the device has to be installed in such a way that the primary combustion zone in all load ranges is inside the visual angle of the Flame Scanner. The sight axle has to cut through the first third of the flame (A) of the own burner if possible. The extension of the sight axle must not cut through the first third of the flame of other burners.



4.5 Connection

DANGER

Danger to life caused by electrical current!

The safety instructions and local safety regulations have to be observed during connection!

For connection data, please refer to the chapter titled "Technical data" as well as to the following terminal diagram.

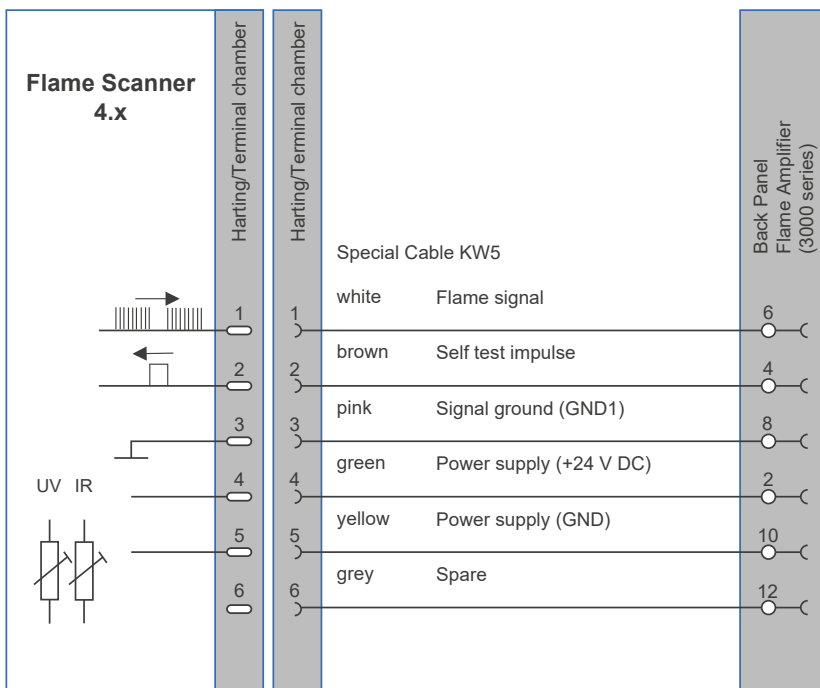
Ensure that the available supply voltage complies with the voltage indicated on the type plate.

Prior to connection, check the device and the connecting cables for visible damage.

4.5.1 Electrical connection

When using a heater, our KW6 cable must be used. The connection diagram is extended by terminals 7 and 8.

- 7 - Power supply (+24 V DC) blue
- 8 - Power supply (GND) red



NOTICE

Prior to the connection of the Flame Scanner, observe the separate operating instructions of the Flame Amplifier (System 3000)!

4.5.2 Laying the special cable KW5

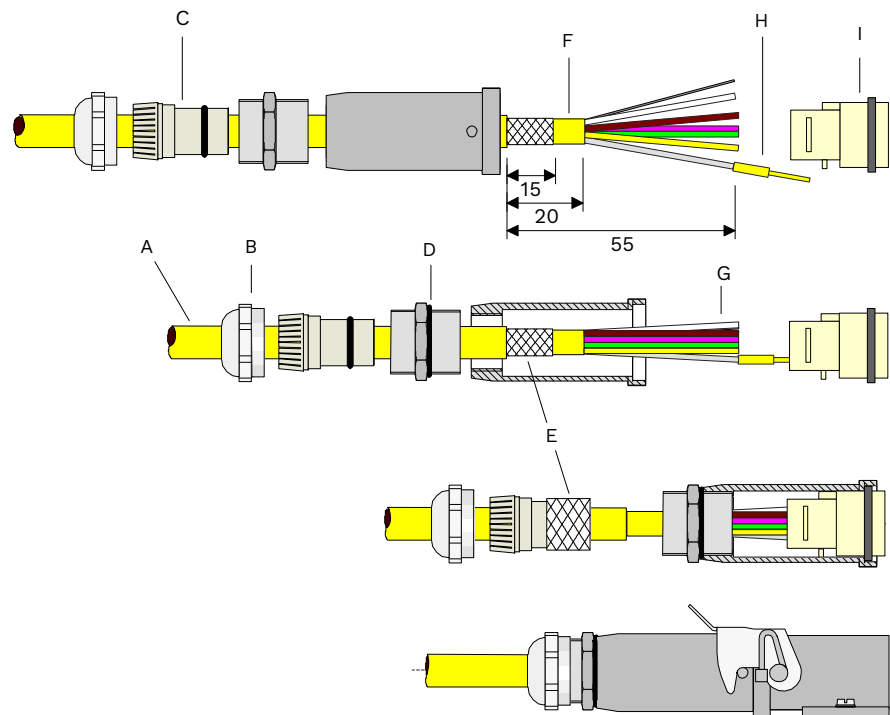
NOTICE

No contact chamber may remain bare!

All contact chambers in the contact insert have to be fitted with crimp contacts!

For this purpose use a suitable crimp tool!

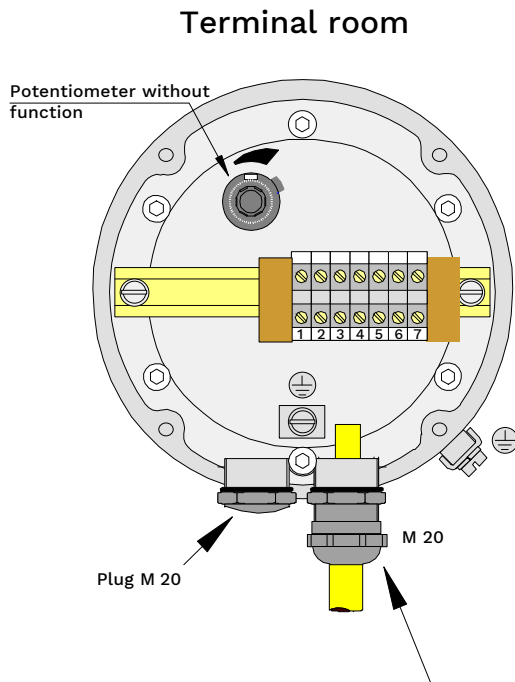
On the Flame Scanner side the external shielding is connected to the housing mass by means of a clamp connection located between the plastic insert the threaded part in the cable gland (not available in KW3 cable). The internal shielding is cut on the Flame Scanner side and is connected to the Flame Amplifier side along with the signal GND (see terminal diagram).



A external PUR shielding
B union joint
C plastic insert
D threaded part
E external shield

F internal PUR shielding
G individual wires
H crimp contact
I female contact

4.5.3 Laying the special cable for Ex-de-housing



The outer shielding has to be connected extensive on the scanner side by a clamping connection between the plastic insert and the inner threads of the M-screw connection to the housing ground. The inner shielding has to be cut off on the scanner side and connected to ground of the Flame Amplifier.

Outer shielding:

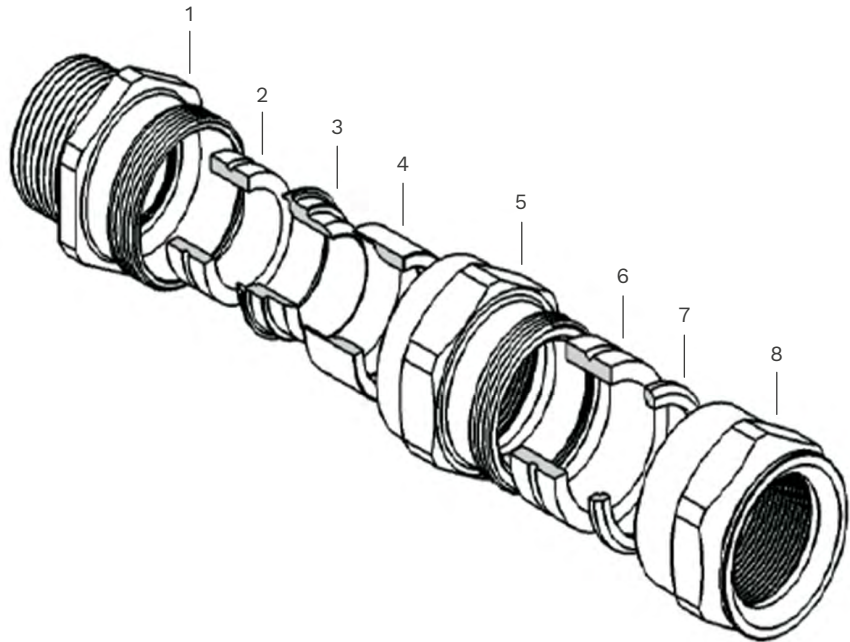
The outer shielding is only connected to the device via the cable gland. On the loose cable end the shielding should be cut off short.

Inner shielding:

The inner shielding has to be connected to ground of the Flame Amplifier side.

4.5.4 Mounting of the gland ADE4F (Type5) for Special Cable

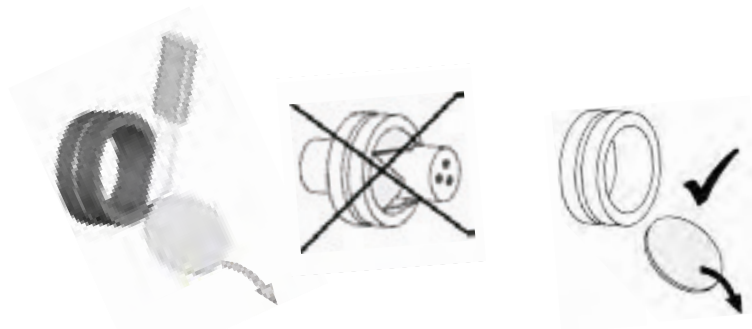
The base nut is already bonded and mounted to the Ex-housing.



- | | |
|-------------------------|-------------------------------|
| 1. Base nut | 5. Middle nut |
| 2. Sealing | 6. Sealing |
| 3. Shielding clamp base | 7. Pressure distribution ring |
| 4. Shielding clamp | 8. Top nut |

NOTICE

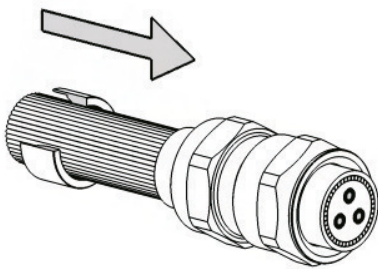
Both sealings (2 and 6) are closed and should be opened before mounting.



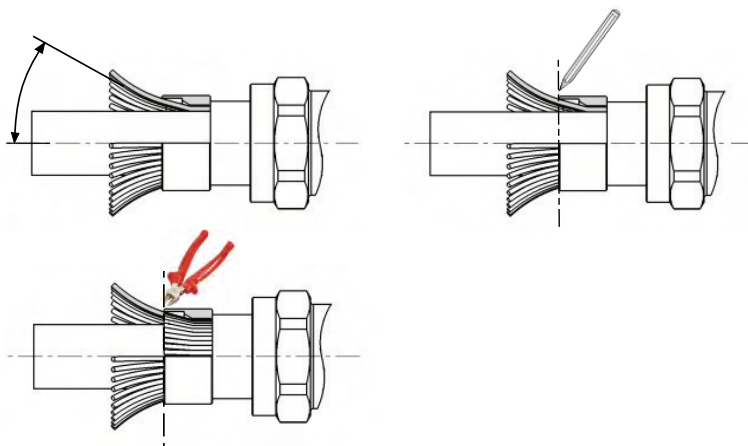
4.5.4 Mounting of the gland ADE4F (Type5) for Special Cable

Put on part numbers 5 – 8 to the cable. Then shorten the cable to the needed length and cut off the outer sheath.

Now put on the shielding clamp (4) to the cable and shorten the shielding, but leave some 2 cm of the shielding.

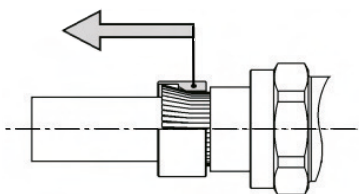


Fan out and cut the shielding in the shown way.

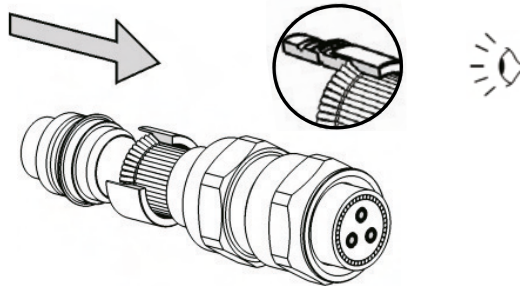


Put on the shielding clamp base and clamp the shielding.

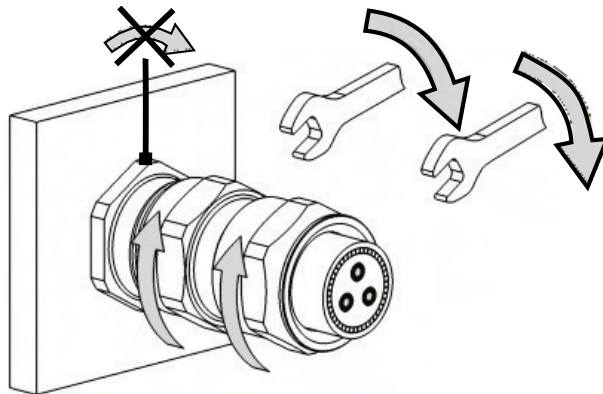
Take care that shielding, shielding clamp base and shielding clamp are mounted like the following picture shows.



4.5.4 Mounting of the gland ADE4F (Type5) for Special Cable



Now push the sealing (2) to the cable and put it to the base nut (1). Hand-tighten the middle nut and top nut in first step. At last pull tight first the middle nut with 12.5 Nm and then the top nut with the same torque.



Last but not least you can connect the wires to their terminals.

4.5.5 Mounting of the gland ADCS (Type6) for Fiber Optic Cable

CAUTION

The Fiber Optic Cable will turn around during the mounting to the Ex-housing. So it is highly recommended not to mount it to the Sensor Head SKL before this mounting has been done.



Firstly, the screw connection is screwed by hand with the base nut already fitted.

Not too tight because the small side of the Fiber Optic Cable (FOC) must still fit through.

Next step is to insert the small side of the FOC into the gland until the stop (Picture 1 und 2).



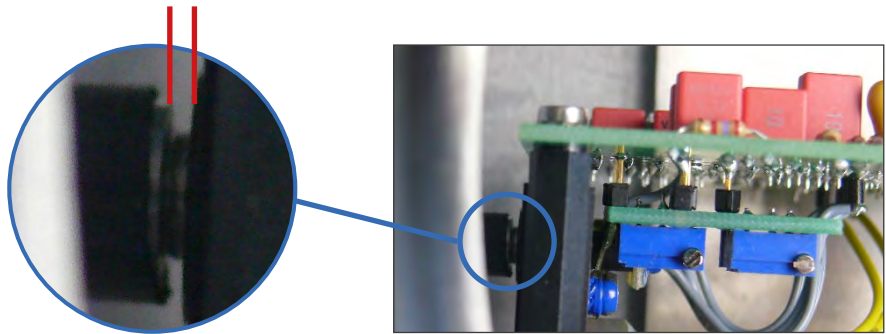
Picture 1



Picture 2

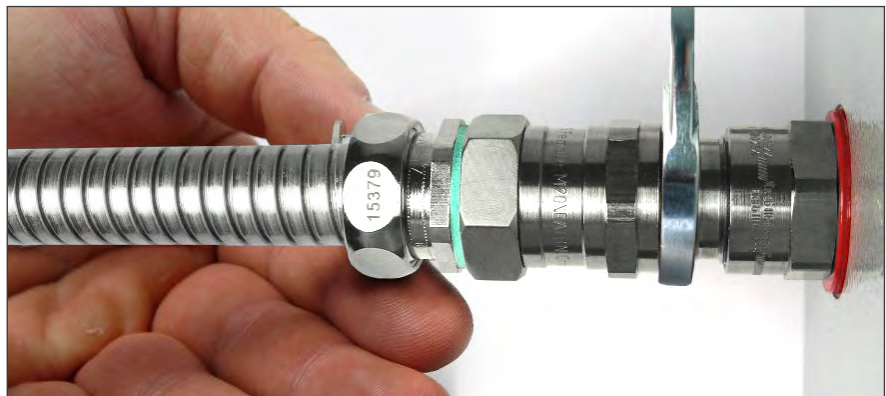
4.5.5 Mounting of the gland ADCS (Type6) for Fiber Optic Cable

Check the distance between the fibre optic cable and the sensor element (Picture 3). There should be a gap left of 2-3 mm.



Picture 3

Now the middle nut is to be tightened with 20 Nm torque. Please hold the top nut and FOC during this mounting. The position of the FOC should not be changed.



Picture 4

The top nut can now be tightened also with 20 Nm torque.

4.6 Storage

Do not unpack any packed Flame Scanners and accessories.

The following conditions apply to storage:

- Store in a dry place. Maximum relative humidity 60 %. In addition, It has to be assured that the floor in the storage area will remain dry through-out the storage period.
- Protect from direct sunlight. Storage temperature: 15 degrees to 25 degrees C (59 degrees to 77 degrees F).
- Store in a dustfree location.
- Avoid mechanical vibrations and damage.

5 | Description

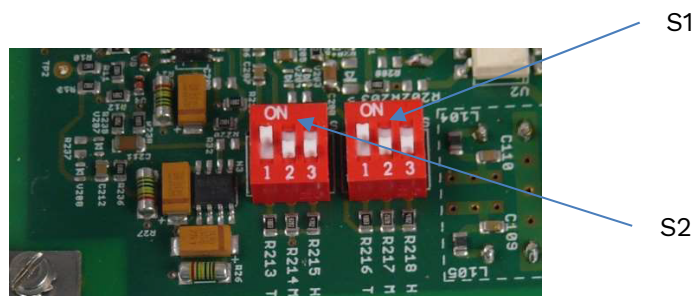
5.1 Functional description

The Flame Scanner Type 4 utilizes the well approved integral procedure of the flame radiation analysis. A silicon photo element senses the electro-magnetic radiation released during the combustion process from near ultraviolet to near infrared. The evaluation of the flame modulation resulting from the fuel oxydation with oxygen, permits a clear and separate identification of the typical flame signals from liquid fuels against coal firing signals. The radiation sensed by a photo element is immediately processed by a control circuit (AGC) optimizing the operating point of the Flame Scanner in relation with the fuel radiation. A precise shielding of the flicker frequencies smaller 60Hz, 40 Hz or 25 Hz achieves the suppression of background radiation due to adjacent burners or combustion chamber walls. An additional automatic frequency control (AFC) avoids unsteady signals, caused by either changing dust quality or by changing ignition zone on the burner load range. Furthermore this Flame Scanner provides the possibility to choose 3 different flame modulation characteristics and the size determination of the sight field. The remaining information is then sufficient to provide a precise flame evaluation. Further functional groups serve for the processing and forming of signals into standardized digital signals which are transmitted to the Flame Scanner.

This fully electronic Flame Scanner has no moveable mechanical parts. The photo element is non-ageing thus achieving that the sensitivity of the monitoring equipment remains unaffected even after years of service, maintenance is not necessary. This means that the user has a significantly enhanced usage of his entire firing equipment.

5.2 Frequency filter

The Flame Scanner Type 4 is equipped with an adjustable high pass filter. With the cut-off frequency of the high pass filter, the threshold of flicker frequency is defined which is used to form the flame signal processed. The adjustment of the cut-off frequency is performed using the DIP-switches S1 and S2. For this, the device must be opened.



f_G	S1			S2		
	S1.1	S1.2	S1.3	S2.1	S2.2	S2.3
30 Hz (T)	ON	OFF	OFF	ON	OFF	OFF
40 Hz (M)	OFF	ON	OFF	OFF	ON	OFF
70 Hz (H)	OFF	OFF	ON	OFF	OFF	ON
120 Hz	ON	ON	ON	ON	ON	ON

NOTICE

At least 1 DIP switch per group must be set to „ON“!

NOTICE

Default setting of high pass filter is 30 Hz.

6 | Operation of the Flame Scanner

NOTICE

For the operation of the Flame Scanner, please observe the separate operating instructions of the Flame Amplifier.

NOTICE

The Flame Scanner is intended for operation with a fibre optic cable. Observe the separate operating instructions for the fibre optic cable.

NOTICE

The response of the Flame Scanner depends on the burner configuration as well as on the air flow and the spectral characteristic (wave length).

6.1 Test of the Flame Scanner

NOTICE

Please also refer to the separate operating instructions of the Flame Amplifier!

In order to ensure correct operation, the Flame Scanners as well as Flame Amplifiers of all applications have to be tested several times by starting and stopping the burner several times. Carry out this test whilst several neighbouring burners are started and stopped and different boiler outputs are used. This is an indispensable pre-requisite for a safe and correct operation of the device!

6.2 Opening/closing the device

NOTICE

The Flame Scanner may only be opened / closed by qualified personnel!

7 | Maintenance, care and transport

The Flame Scanner requires no maintenance.
For cleaning, use a moist cloth to wipe the housing from the outside only.

NOTICE

Do not scratch the lens!

7.1 Forwarding instructions

NOTICE

Do not subject the appliance to heavy impacts during transport. Do not subject the appliance to any humidity!

8 | Failures

Problem	Display	Cause	Remedy
No flame-ON signal after the burner has been started	No analogue signal LED RF OFF LED RM OFF LED time I / time II OFF	Flame Amplifier is not operational	Check power supply Check fuse F101 (F 0.8 amps) Replace Flame Amplifier Check electrical connection
	Analogue signal < 25 % LED RF + RM OFF	Flame signal too low	Check Flame Scanner Check / set sensitivity
	Analogue signal 25 - 75 % LED RF OFF LED RM ON	Flame signal below the switch-ON threshold	Increase sensitivity Reduce switch-ON threshold
	Analogue signal 25 - 100 % LED RF ON LED RM OFF	Self-test error	Check / set switch-off times Check cable shield Replace Flame Scanner Replace Flame Amplifier Check installation including cable routes for EMC sources High voltage / radio
	Analogue signal 25 - 100 % LED RF + RM ON	Relay contact or wiring problem	Check fuse F102 (T 1 amp) Check electrical connection
Burner trips	Analogue signal falling below 25 %, switch OFF RF + RM.	No flame, weak flame signal	Check flame Check Flame Scanner Check Flame Scanner alignment, sight tube and lens Increase sensitivity setting Replace Flame Scanner Replace Flame Amplifier Check electrical connection
	Analogue signal > 25 % RF ON RM goes OFF	Self-test error	Check cable shield Check Flame Scanner cable for EMC interfering source

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