BFI Automation

Operating instructions

FLAME SCANNER TYPE 7

7.0 / 7.0/2 / 7.1 (EX)

Content

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

Flamonitec
BFI AUTOMATION

EU Konformitätserklärung
EC Declaration of Conformity

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

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 *Field of application*	EU/2016/426		EU-Gasgeräteverordnung *EU Gas Appliances Regulation*
Richtlinien *Directives*	2014/34/EU		Explosionsschutzrichtlinie *Explosion protection directive*
	2014/30/EU		EMV Richtlinie *EMC directive*
	2011/65/EU		RoHS Richtlinie *RoHS directive*
Benannte Stelle *Notified body*	Kiwa Nederland B.V.	0063	
CE-Zertifikat vom *CE certificate from*	05.09.2024	CE0063DP1343	Baumusterprüfbescheinigung *Type examination certificate*
Gültig bis *Valid until*	05.09.2034		
Normen *Standards*	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 *Identification ATEX*	ATEX Zone 1		Konformitätserklärung des Gehäuseherstellers *Declaration of conformity of housing manufacturer*
	ATEX Zone 2	TÜV 15 ATEX 7682 X	Ⓔ II 3G Ex ec nC IIC T4 Gc / Ex ec IIC T4 Gc
	ATEX Zone 22		Ⓔ II 3D Ex tc IIIC T100°C Dc

Ausgestellt durch
Issued by
BFI Automation Mindermann GmbH

Rechtsverbindliche Unterschrift
Legally binding signature

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Name	Funktion *Function*	Ort, Datum *Place, Date*
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1.9 Address of the manufacturer

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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 amplifiering 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 amplifiering 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
- Temperature difference method
- Monitoring of residual combustions
- Thermo couple sensors
- 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 With special lens	1050 nm bis 2700 nm 1050 nm bis 7000 nm
Angle of view With aperture	2,7° 1°, 2° or 2,7°
Self checking	fully electronic, once per second
Power supply	24 VDC
Current consumption Including heating	max. 200 mA max. 700 mA
Ambient temperature Standard housing (not EAC approved) Ex-de-housing (EAC approved)	 -20 °C to +70 °C -40 °C to +60 °C
Electrical connection Standard housing Ex-de-housing	 dustproof plug-type connector terminal blocks
Type of protection Standard housing Ex-de-housing	 IP 65 IP 66
Cable length	max. 400 m
Sight port connection	1" female thread

3.2 Electrical system, optical system, mechanical system

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 Zone 2 Standard housing	 IECEx EPS 14.0042X IECEx TUR 15.0029X
ATEX Zone 1 Ex-de-housing Zone 2 Standard housing	 EPS 14 ATEX 1 696 X TÜV 15 ATEX 7682 X
EAC Zone 1 Ex-de-housing Zone 2 Standard housing	 ЕАЭС RU-DE.ВН02.В.00177/19 ТС RU C-DE.ИМ43.В.00536

3.3 Weight

Standard housing	approx. 1,5 kg
Ex-de-housing	approx. 5 kg

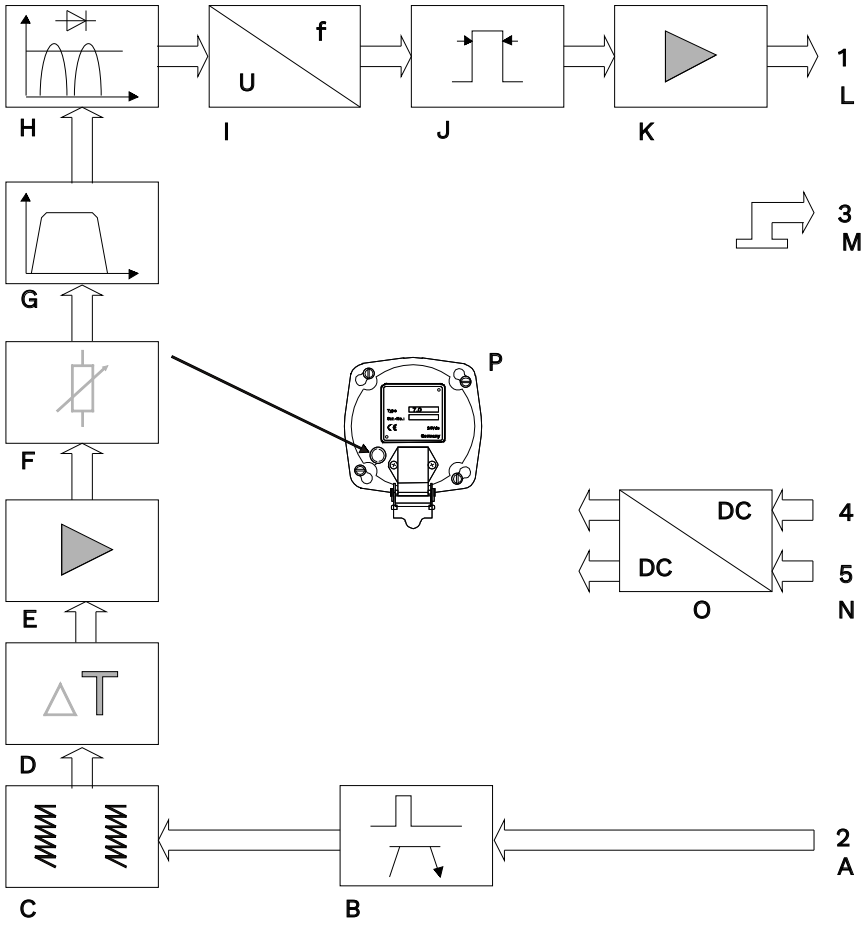
3.4 Adjustment controls - Sensitivity potentiometer

The potentiometer is used to set the amplification of the flame signal in the flame scanner. The adjustment can be carried out during the operation. The sensitivity potentiometer is located behind the cover screw next to the tag plate. The Flame Scanner Type 7 has been fitted with two potentiometers. The sensitivity for channel 2 (Ch 2) 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 sensitivity for channel 1 (Ch 1).

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



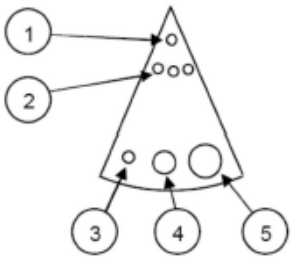
1–5	pin number in the Harting plug	I	U/F-converter
A	system shutter puls	J	pulse shaper
B	electronic shutter	K	output stage
C	sensor	L	signal output
D	temperature difference	M	signal GND
E	pre-amplifier	N	power supply
F	sensitivity setting	O	DC/DC converter
G	band pass	P	scanner with potentiometer
H	full-wave rectifier		

3.6 Optical aperture

The Flame Scanner in the standard housing and in the Ex-de-housinghas 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.



1 rotational axis
2 set screw
3 small aperture
4 medium aperture
5 big aperture

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 7
- 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)

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

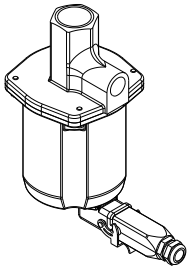
The Flame Scanner is shipped in different packaging materials.

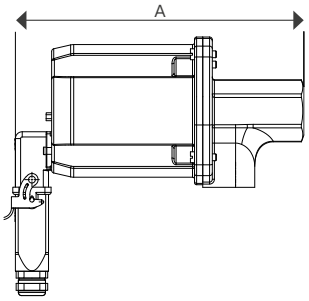
The most frequently used packaging materials are cardboard and plastics (foils, foamed material).

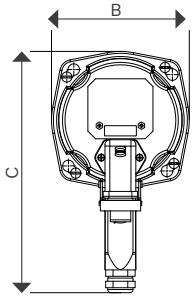
NOTICE

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

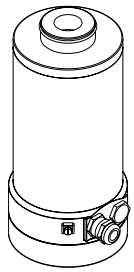
4.3 Space requirement - Housings

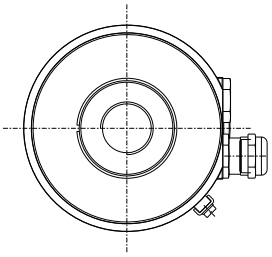


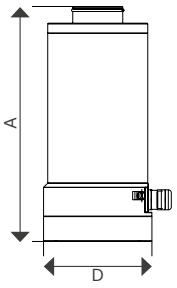




ATEX Zone 2	
Standard housing	
Length A:	235 mm
Width B:	108 mm
Height C:	190 mm
Weight:	1.5 kg
Type:	7.x







ATEX Zone 1	
Ex-de-housing	
Length A:	290 mm
Ø D:	130 mm
Weight:	5 kg
Type:	7.xEX

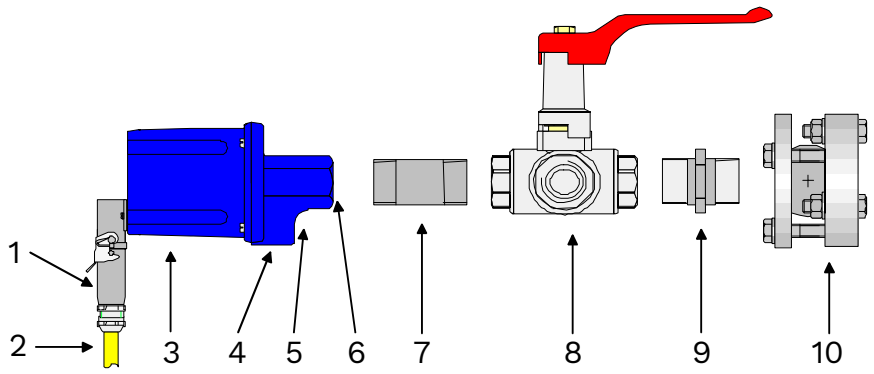
4.4.1 Installation - Standard housing

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.

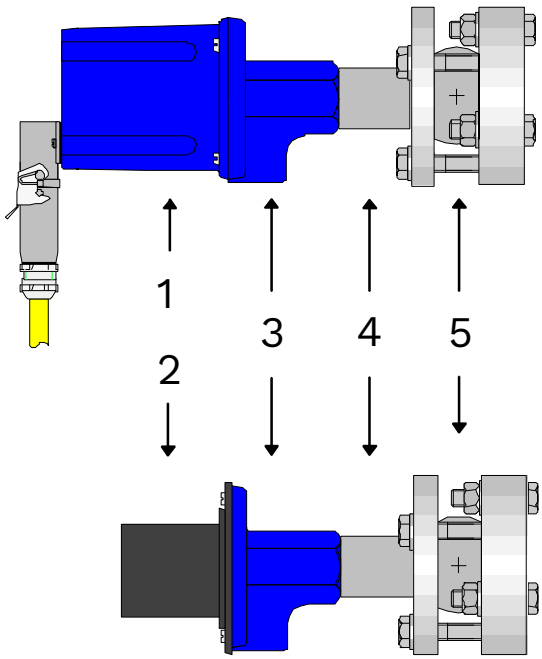


1. Harting plug
2. Special cable KW5
3. Flame Scanner
4. Purge air connection
5. Purge air flange
6. Sighting tube connection
7. Heating insulator
8. 3-way-ball-valve
9. Double nipple
10. Swivel mount

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!



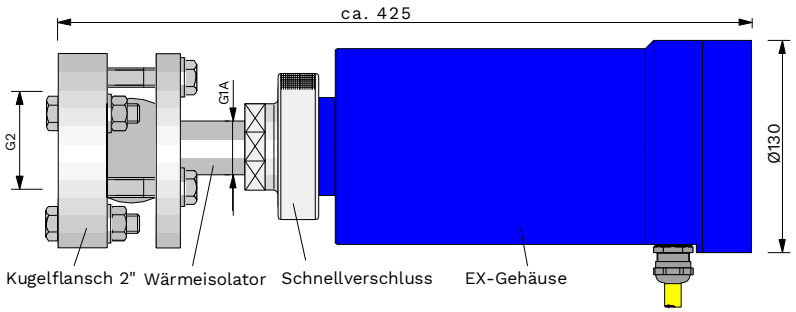
1 Flame Scanner
2 Optical alignment device
3 Purge air flange
4 Heating insulator
5 Swivel mount

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 amplifiering, 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 4.4.3. The best setting results when a large visual field is achieved.

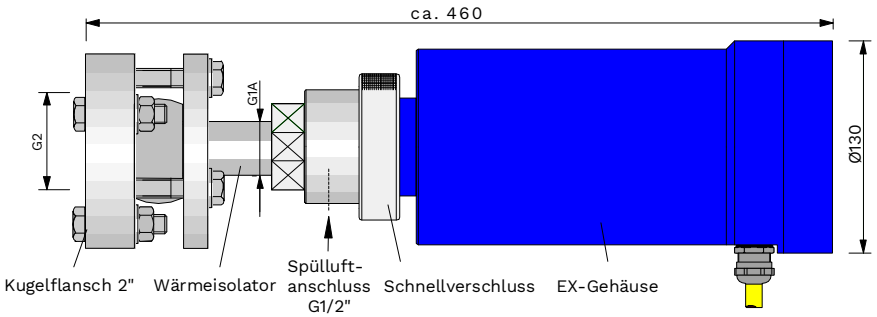
4.4.2 Installation - Ex-de-housing

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



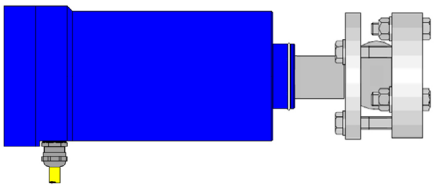
4.4.2 Installation - Ex-de-housing

For alignment of the visual axis of the Flame Scanner.

The circle insight the visor represents the detecting area of the sensor (see chapter 4.4.3).

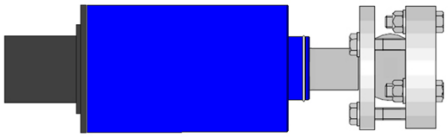
With a swivel mount the visual axis can be aligned as shown below. The images in the upper line show a correct alignment. The images in the lower line show a misalignment of the visual axis of the Flame Scanner or a negative influence by burner internals.

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

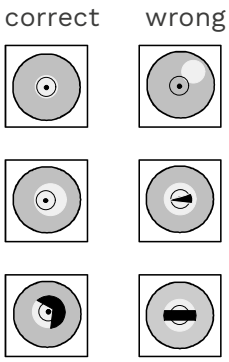
The enclosure may only be opened by a person authorised to do so when it is de-energised!

4.4.3 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



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.

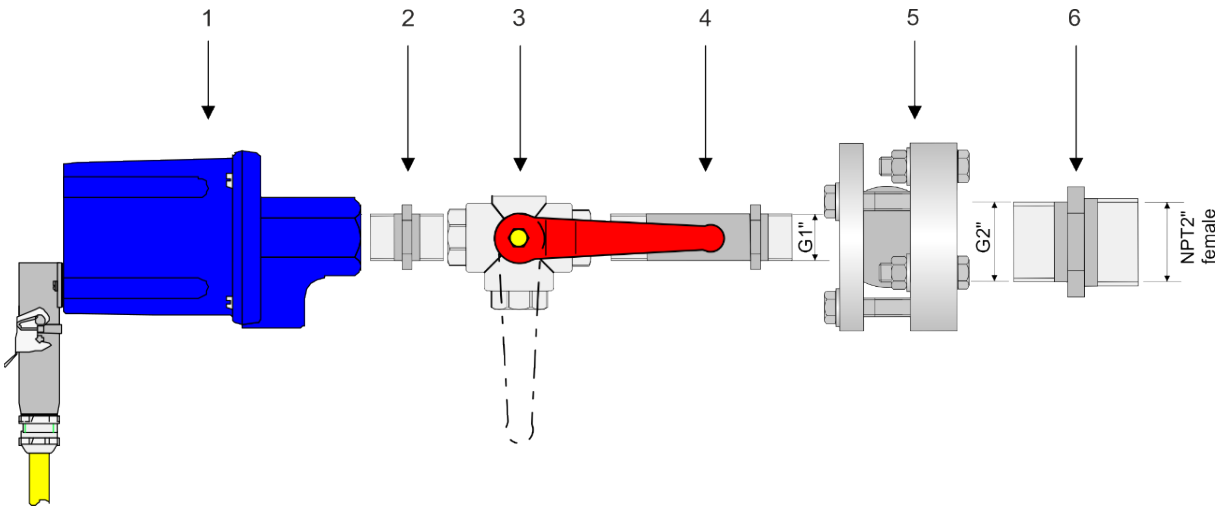
NOTICE

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"!

4.4.4 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. 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. Flame Scanner
2. Double Nipple
3. 3-way-ball-valve
4. Double Nipple
5. Swivel Mount
6. Double Nipple

4.4.5 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.

4.4.6 Adapting the Flame Scanner to the fuel

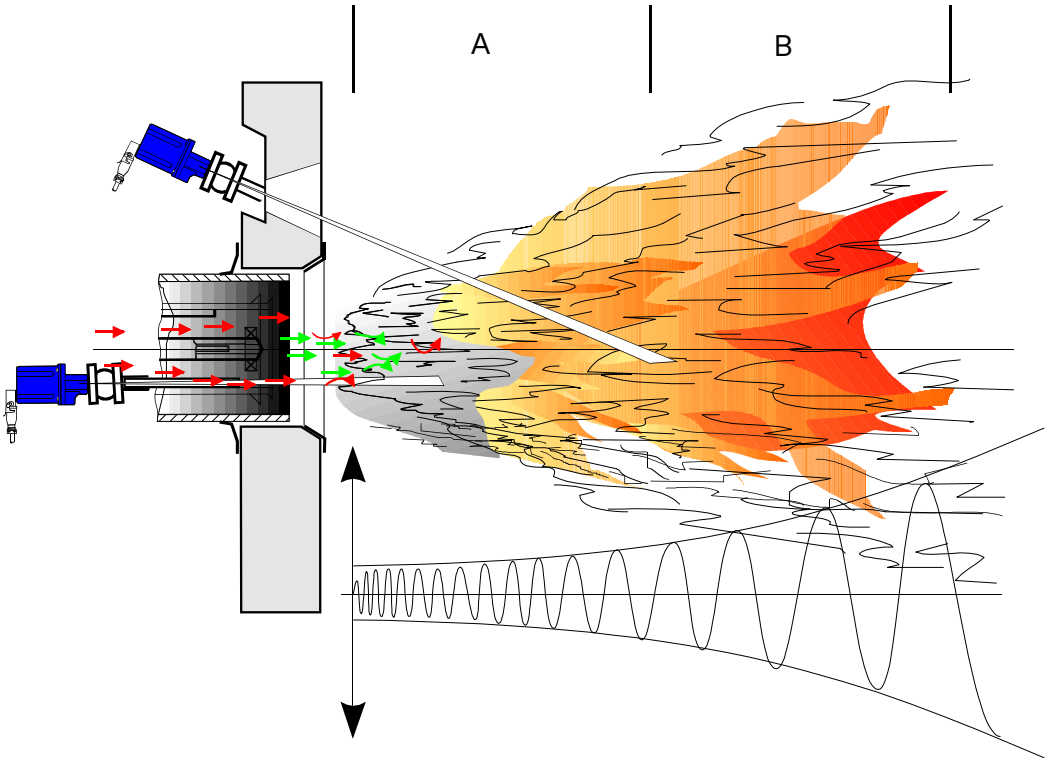
⚠ DANGER

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 amplifiering, 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

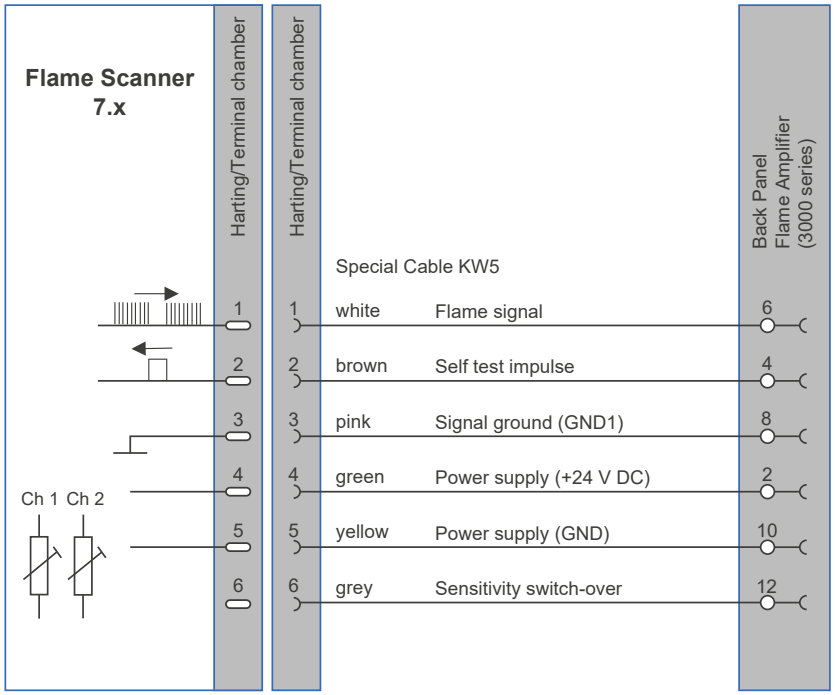
Danger to life caused by electrical current!
The safety instructions and local safety regulations have to be observed during connection!

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

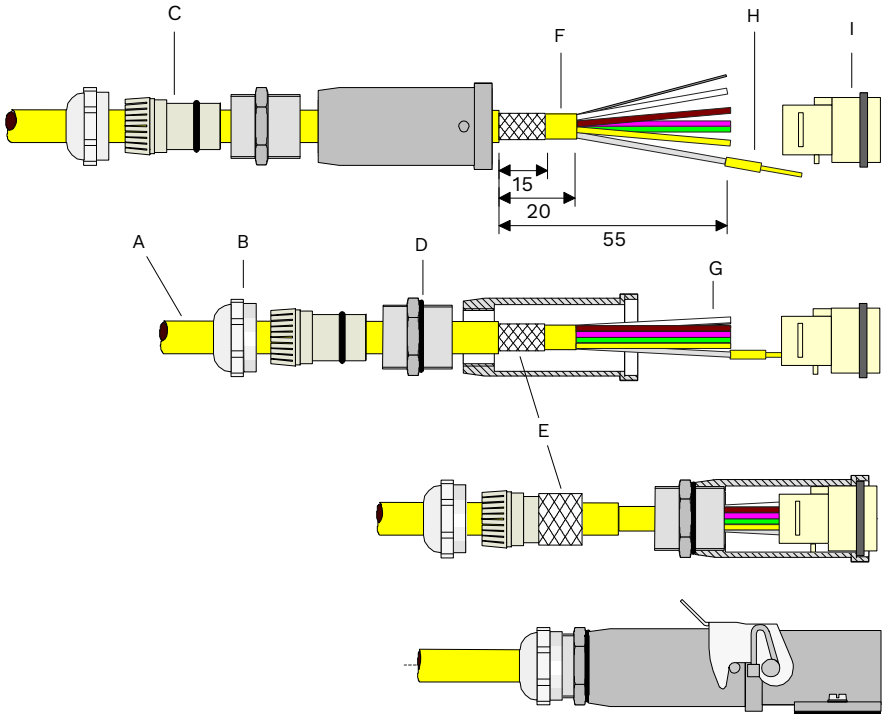
Prior to the connection of the Flame Scanner, observe the separate operating instructions of the Flame Amplifier (System 3000)!

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!

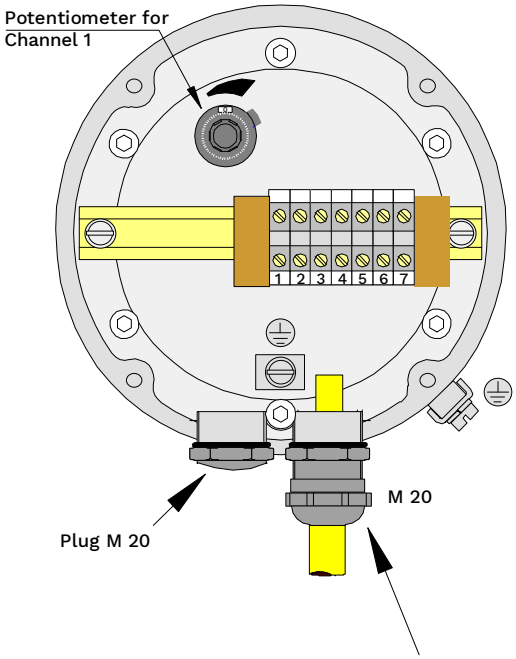
On the Flame Scanner side the external shielding is connected to the housing mass by means of a clamp connection located between the plastic insert the threaded part in the cable gland (not available in KW3 cable). The internal shielding is cut on the Flame Scanner side and is connected to the Flame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



A	external PUR shielding	F	internal PUR shielding
B	union joint	G	individual wires
C	plastic insert	H	crimp contact
D	threaded part	I	female contact
E	external shield		

4.5.3 Laying the special cable for Ex-de-housing

Terminal room



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.

4.6 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

In combination with a Flame Amplifier module of the 3000 line the Flame Scanner 7.x forms a complete flame monitoring system for meeting the safety requirements for steam generators.
The main field of application for this fully electronic Flame Scanner is flame detection at residue combustion processes of any kind, like plants for thermal treatment and energy recovery, for inst. with clarification sludge, pesticides, contaminated waste gas, tail gas, sour gas, furnace gas, tar oil, and pitch. The Flame Scanner 7.x can be used anywhere where combustion processes must be monitored in which flame radiation does not occur as continuous radiation bands or where reliable detection in the IR range is not possible due to reflection from the combustion chamber (hot brick lining, red-hot melt). Therefore, main places of application are combustion chambers, rotary kilns, melting furnaces, and grate firing installations.
The method developed by and patented to BFI Automation, i.e. to detect a flame by sensing the temperature re-circulation of its combustion gases, opens up completely new applications for safeguarding a firing plant. Monitoring for controlling fuels previously possible only by employing expensive parallel operation of UV and IR Flame Scanners, can now be replaced simply and offering a substantial increase of availability by Flame Scanner 7.x. Faulty opening due to absorption of flame radiation, caused by fuel composition or charging of additional media does no longer occur. Faulty light signals due to combustion chamber radiation are ruled out. The choice of the spectral range permits in addition the setting of a lowest flame temperature from which detection takes place.
For the first time, for inst., in plants for sulphur reclamation (Claus process) only H_2S combustion is monitored, also when the combustion chamber is quenched with steam. Addition of backup gas, required by the other optical flame monitoring systems can be dispensed with. Measurements with thermocouples subject to heavy wear and expensive can no longer limit the availability of the process.
The Flame Scanner is fully electronic, i.e. it has no mechanically moving parts. The photo element is not subject to any ageing, so that the sensitivity of the monitoring device remains unchanged even after many years of service. Maintenance work is not required.

5.1 Functional description

This results for the operator in a significant increase of safety and availability of the firing plant as a whole. The new solution for monitoring combustion processes of any kind is based on sensing and evaluating the difference of flame temperature and variation of the same at two predetermined points. The patented method is making use of the fact that combustion is maintained only when there is always sufficient energy fed back into the ignition zone in order to maintain combustion. Because of this, the recirculation of the combustion gases in the flame mantle is monitored by Flame Scanner 7.x. The result is a detection method which works reliably fully independent of fuel with any flame colour. The world-wide application, mainly in the petrochemical industry demonstrates that this principle permits flame monitoring systems far superior to conventional optical systems used so far.

As radiation sensors two thermoelement chains are used, vapour-deposited on a substrate, because these have linear sensitivity across the complete radiation emitted by the flames and therefore can be made selective for defined wave length ranges by filters. An optical system defines the two cones of view and preallocates temporarily the wave length range. Additional filters can further reduce the flame spectrum to be evaluated in order to pick up only the spectral lines of typical combustion products like, for inst., CO, CO_2, H_2S or H_2O. In this way application-oriented flame evaluation can be effected.

The Flame Scanner is directed towards the combustion so that the two thermoelement chains recognise along the flame points offset to each other. The Scanners are interconnected anti-parallel and, therefore, produce at the output the difference of the radiation power picked up. As the two measuring points in the flame are positioned close to each other the same emissivity applies to both allowing determining the temperature difference. The downstream amplifier cuts off variations with low frequency and processes flame signals only between 25 Hz and 1000 Hz, in order to concentrate on temperature movement. Faulty signal emission from the glowing brick lining is excluded because their absolute radiation is being shielded due to the anti-parallel connection of the thermoelement chains. Possible low-frequency modulation by stack gases is picked up by both elements and does not produce a difference signal of higher frequency which could be evaluated.

5.1 Functional description

NOTICE

In addition, a fuel-specific or load-dependent adjustment of the flame sensor can be made via the switchable sensitivity setting for sensor types 7.0/2.

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 align-ment, 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

BFI Automation

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