BFI Automation

Operating instructions

FLAME AMPLIFIER 3001X

3001(N)(DN)

Content

1 | General aspects

1.1 Introduction

These operating instructions are a helpful guide for ensuring the successful and safe operation of the Flame Amplifier. 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 Amplifier 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 Amplifier!

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 Amplifier 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

BFI Automation

EU Konformitätserklärung
EC Declaration of Conformity

Produkt *Product*	**Flammenüberwachungssystem 3000 (Flammenwächter)** *Flame monitoring system 3000 (Flame Amplifier)*
Typ *Type*	**3001N, 3001DN, 3016** *3001N, 3001DN, 3016*

Hiermit erklären wir, dass die bezeichneten Flammenwächter, 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 amplifier 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*	2014/35/EU		Niederspannungsrichtlinie *Low voltage 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-Zerifikat 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 60730-1:2016 EN IEC 63000:2018		
Kennzeichnung ATEX *Identification ATEX*	ATEX Zone 1		Konformitätserklärung des Gehäuseherstellers *Declaration of conformity of housing manufacturer*

Ausgestellt durch *Issued by*	BFI Automation GmbH		
Rechtsverbindliche Unterschrift *Legally binding signature*			
	Name	Funktion *Function*	Ort, Datum *Place, Date*
	Eberhard Röllecke	Prokurist *Authorized Officer*	Heiligenhaus, den 19.11.2025

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Ust.-IdNr. / VAT: DE 121 633 651

Commerzbank . IBAN: DE76 3004 0000 0839 6327 00 . BIC: COBADEFFXXX
Deutsche Bank . IBAN: DE14 3007 0010 0477 7348 00 . BIC: DEUTDEDD304

1.9 Address of the manufacturer

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2 | Safety

2.1 Intended use

The Flame Amplifier shall be used exclusively to detect flames in combination with a suitable Flame Scanner. 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 Amplifier 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 Amplifier:

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 Amplifier 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 on the Flame Amplifier

The Flame Amplifier 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 monitoring 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
- Short switch off time adjustable 0,5 s to 6 s
- Failure detection
- Relay output for sensitivity II active
- Two externally selectable and internally preselectable sensitivity levels
- Fully electronic construction
- Tested by Kiwa Nederland B.V.

3.2 Electrical system, optical system, mechanical system

Power supply	24 VDC
Current consumption	max. 300 mA
Preliminary fuse, built in	1 A, time lag
Ambient temperature	-40 °C to +85 °C
Intensity display	10-segments, LED bargraph
Intensity impuls display	(3001DN) 4-digit 7-segment display
Status displays	LED flame relay (yellow) LED failure diagnosis (red) LED sensitivity levels (green)
Failur display	coded upper 5 LEDs from bar graph for failure indication
Sensitivity switching	via external signal, 24V DC approx. 20 mA or DIP switch S1.1
Threshold value	selectable by a 16 step rotary switch in front
Interference light suppression	adjustable in 10 steps via rotary switch ILS in the front panel
Switch off time	selectable from 0,2 s to 6 s (see also note in chapter 5.5)

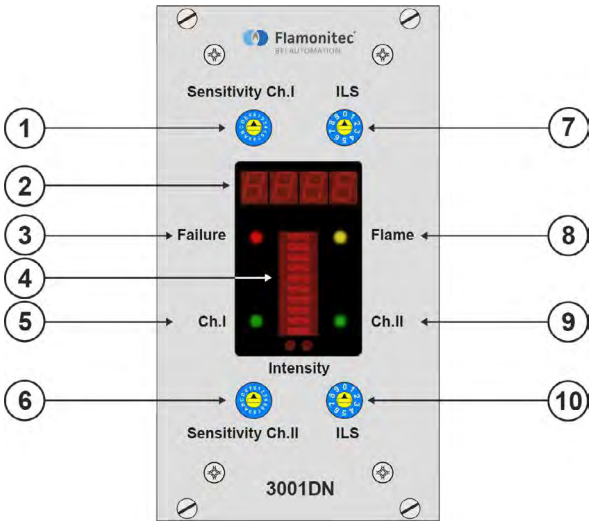
3.2 Electrical system, optical system, mechanical system

Design	in accord. with protection class III SELV
Current output	0/4 - 20 mA, max. load 800 Ω
Relay outputs	
Flame relay	each 2 potential free changeover contacts, internally fused with 1 A
Auxiliary circuit	max. switching voltage 48 V DC SELV / 1 A / 30 W ohmic load
Safety circuit	max. switching voltage 250 V AC / 1 A / 250 VA 300 V DC / 1 A / 30 W ohmic load
Signaling relay for	
Parameter channels	1 x 24 V DC / 50 mA max., ohmic load
Failure relay	1 x 24 V DC / 50 mA max., ohmic load
Type of protection	IP 00, in non-installed state

3.3 Weight

Standard housing	approx. 0,5 kg
Built-in rack	(see chapter 4.3.3)
Built-on rack	(see chapter 4.3.3)
Wall mounting housings	(see chapter 4.3.5)
EX-wall mounting housings	(see chapter 4.3.7)

3.4 Adjustment and display elements



1. Rotary switch - setting – sensitivity I
2. Intensity impuls display (3001DN)
3. LED display - failure
4. Intensity display

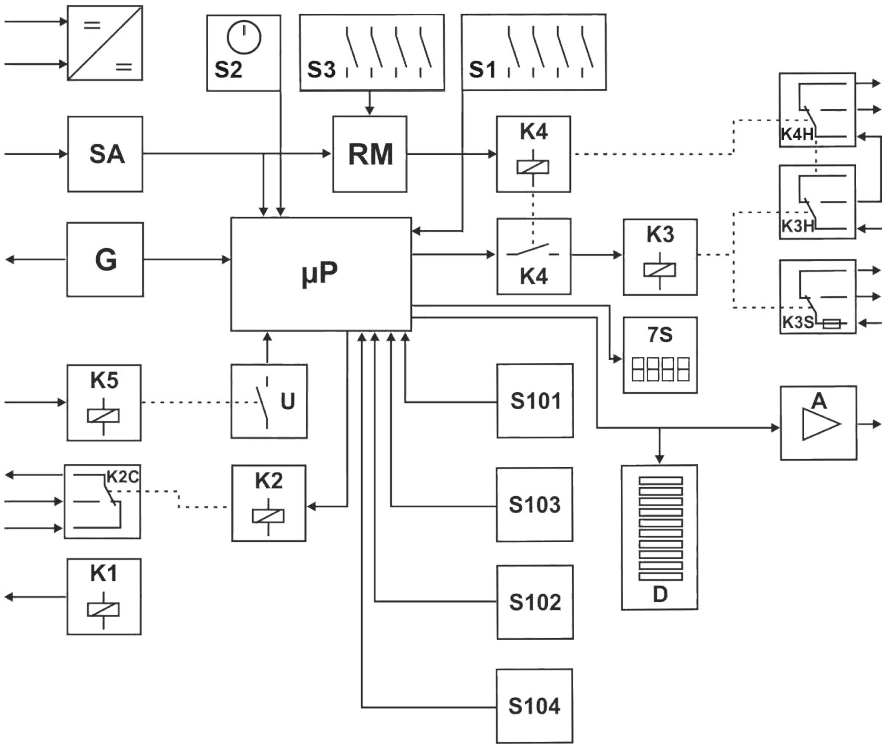
Light bar 0% bis 100% (3001N / 3001DN)

5. LED display – sensitivity I active
6. Rotary switch - setting – sensitivity II
7. Rotary switch - Interference light suppression I
8. LED display - flame relay active
9. LED display - sensitivity II active
10. Rotary switch - Interference light suppression II

3.5 Device design

The system slide-in module of the Flame Amplifier is based on a signal processor circuit with fail-safe self-monitoring system and has been approved for continous operation in keeping with European standard EN298 as well as TRD 411 - 414. Every failure of component part will cause the safe switching-OFF of the flame relay.
The Flame Scanner signal (see separate operating instructions of the Flame Scanner) reaches the sensitivity controllers in the form of a pulse telegram through a filter and pulse shaper stage. Subsequently the flame signal is distributed to two different function channels.
1 Monitor channel (RM)
2 Prozessor channel (µP)

3.5 Device design - block diagram



= / = DC / DC Converter
SA Signal processing
G Clock generator
RM Monitor channel
µP Evaluation channel
S101 Switch sensitivity I
S102 ILS I
S103 Switch sensitivity II
S104 ILS II
D Bargraph display
U Sensitivity switch
K1 Relay failure (optional)
K2 Relay sensitivity II
K3 Flame relay
K4 Safety relay
K5 Relay sensitivity
K2C Relay contact message sensitivity II
K3H Relay contact auxiliary circuit, message OFF
K4H Relay contact auxiliary circuit, message ON
K3S Relay contact safety circuit
A Output 0/4...20 mA
S7 7-Segment display
S3 Monitor channel switch
Switch-off time setting
1S, 2S, 3S, 4S
S2 Evaluation channel switch
Switch-off time setting
Sensitivity (0,5s - 6s)
S1 Switch
S11 Sensitivity switch
S12 Flame Scanner diagnosis
S13 Error Hold
S14 0/4 - 20mA setting

4 | Installation and connection

4.1 Scope of delivery

- Flame Amplifier 3001X
- Operating instructions
- Backpanel with screw terminal (optional)
- Pin connector (optional)
- 19" rack (optional)
- Wall mounting housings (optional)
- EX-wall mounting housings (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 Amplifier is shipped in different packagings.

The most frequently used packaging materials are cardboard and plastics (foils, foamed material). The packaging material also includes materials added to the packed goods as protection against moisture (e.g. bags with silicagel).

NOTICE

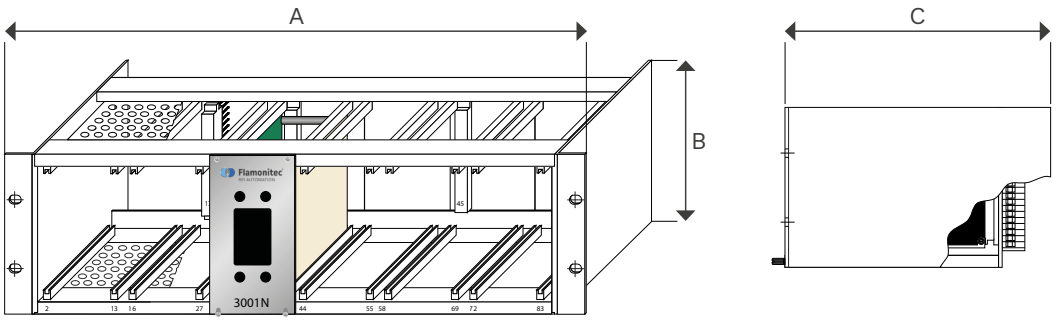
Packaging has to be disposed of in an environmentally friendly way and in accordance with the relevant provisions on disposal.

4.3 Mounting

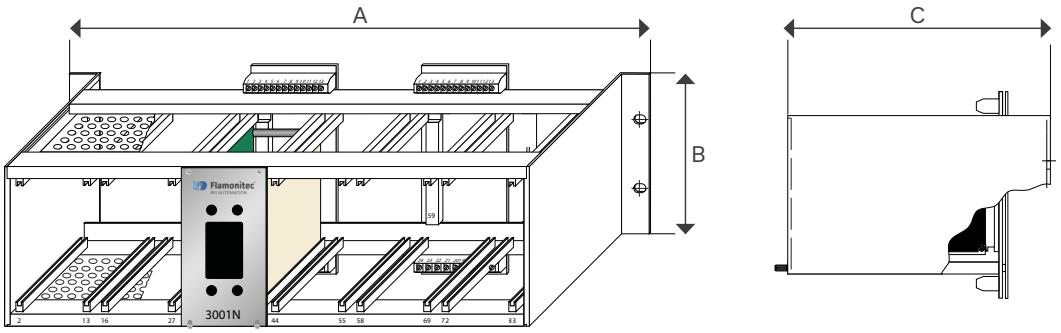
The following housing versions are available for the Flame Amplifier 3001N / 3001DN:

- Built-in rack
- Built-on rack
- Wall mounting housings for ATEX Zone 2
- EX-wall mounting housings for ATEX Zone 1

4.3.1 Built-in rack



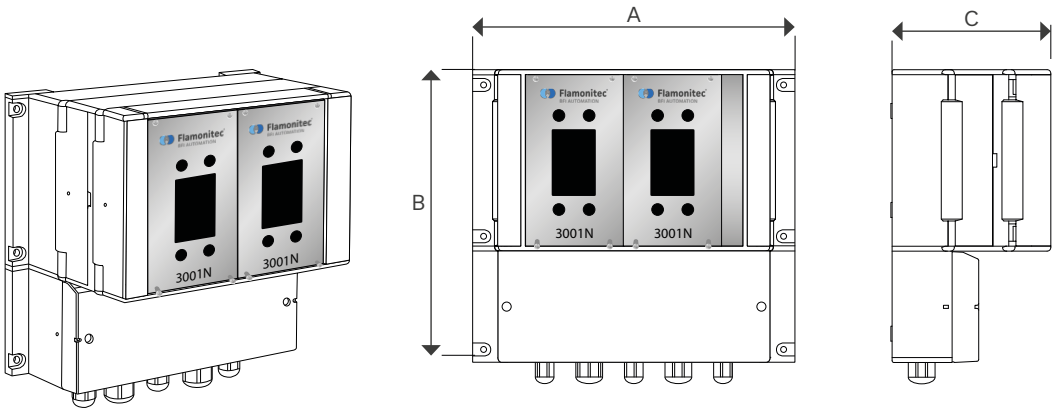
4.3.2 Built-on rack



4.3.3 Dimensions - Built-in and Built-on rack

Horizontal Pitch	Width A	Height B	Depth C	Weight
14 HP for 1 module	110.3 mm	132.5 mm	221.0 mm	approx. 0.54 kg
28 HP for 2 modules	181.4 mm	132.5 mm	221.0 mm	approx. 0.72 kg
42 HP for 3 modules	252.6 mm	132.5 mm	221.0 mm	approx. 0.87 kg
56 HP for 4 modules	323.7 mm	132.5 mm	221.0 mm	approx. 1.02 kg
84 HP for 6 modules	465.9 mm	132.5 mm	221.0 mm	approx. 1.8 kg

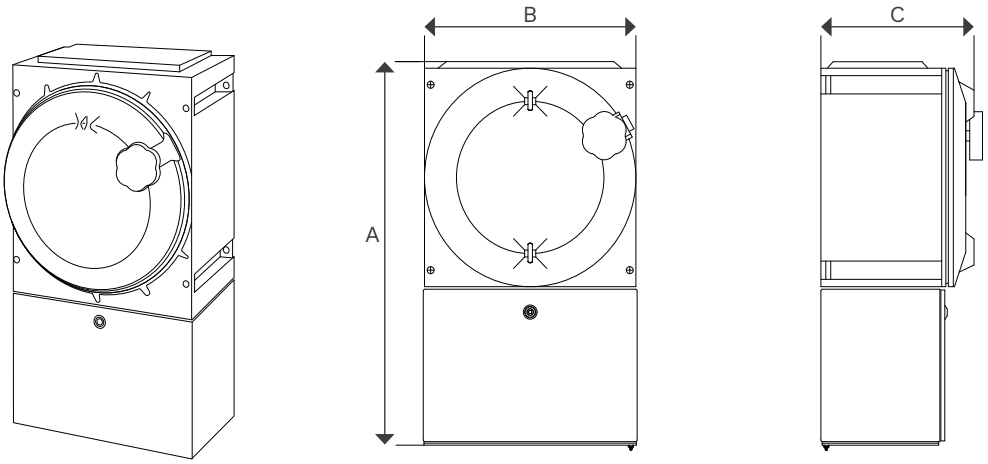
4.3.4 Wall mounting housings for ATEX Zone 2



4.3.5 Dimensions - Wall mounting housings

Horizontal Pitch	Width A	Height B	Depth C	Weight
20 HP for 2 modules	175.7 mm	236.7 mm	275.3 mm	approx. 1 kg
30 HP for 3 modules	226.5 mm	236.7 mm	275.3 mm	approx. 2 kg
49 HP for 4 modules	323.0 mm	236.7 mm	275.3 mm	approx. 3 kg

4.3.6 Ex-wall mounting housings



4.3.7 Dimensions - Ex-wall mounting housings

IP-Protection	Length A	Width B	Depth C	Weight
IP 55	860 mm	594 mm	410 mm	approx. 150 kg
IP 55	645 mm	325 mm	311 mm	approx. 37 kg
IP 65	755 mm	435 mm	311 mm	approx. 58 kg

4.4 Connection

⚠ DANGER

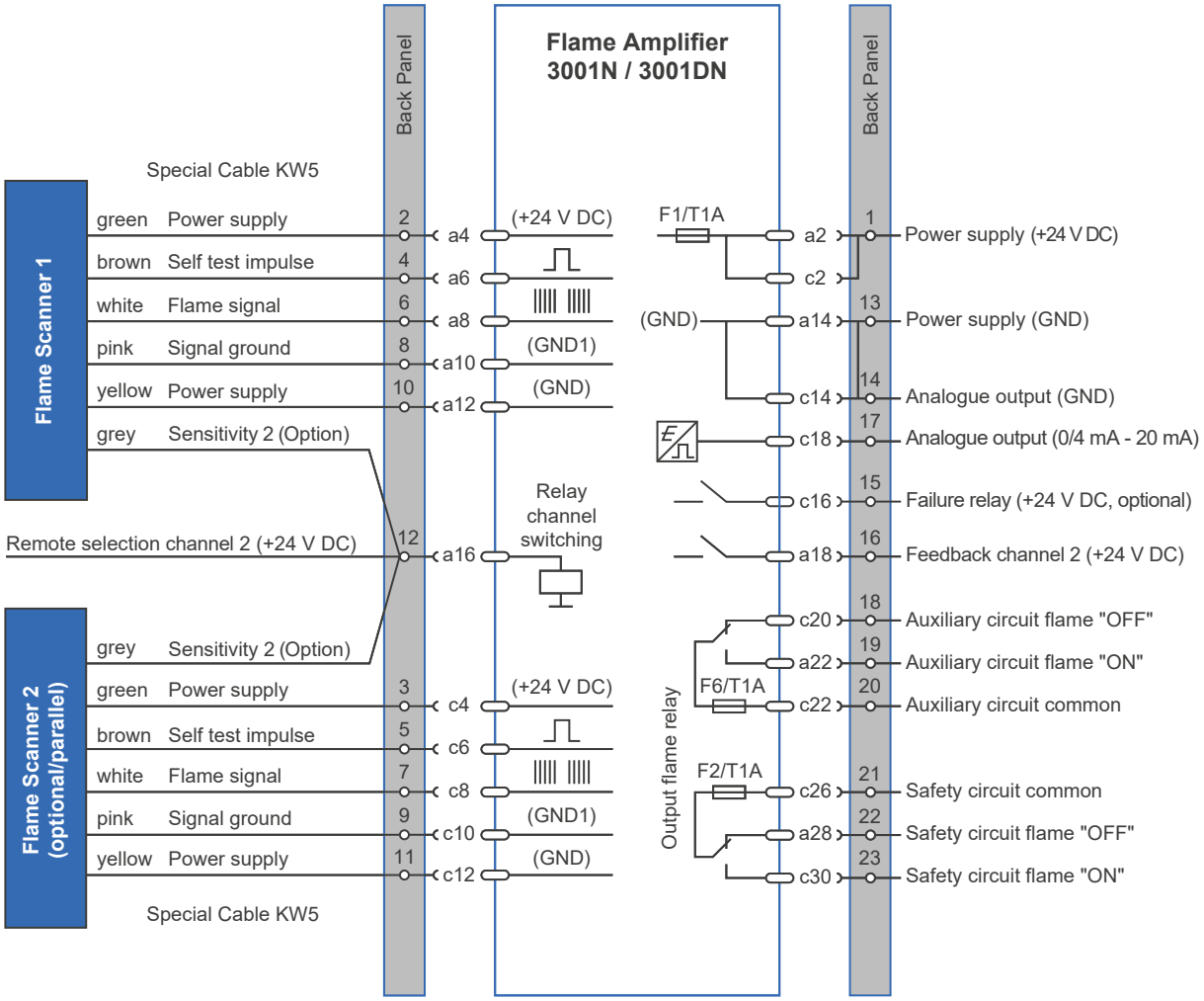
Danger to life caused by electrical current!
The safety instructions and local safety regulations have to be observed during connection!

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 (24 VDC).
Prior to connection, check the device and the connecting cables for visible damage.
Push the flame amplifier into the 19" rack and connect the connecting cable up to the rack.
Various connection possibilities are available:
· Back panel R (screw terminal on the rear)
· Back panel F (screw terminal on the front)
· Pin connector

NOTICE

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

4.5 Terminal diagram



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 Application

In combination with a BFI flame scanner, the Flame Amplifier 3001N / 3001DN offers a fail-safe flame monitoring system. Moreover, a malfunctioning channel has also been integrated, indicating Flame Scanner; Flame Amplifier or wiring errors.
The switch-off time is variably adjustable between 0.2 s and 6 s.

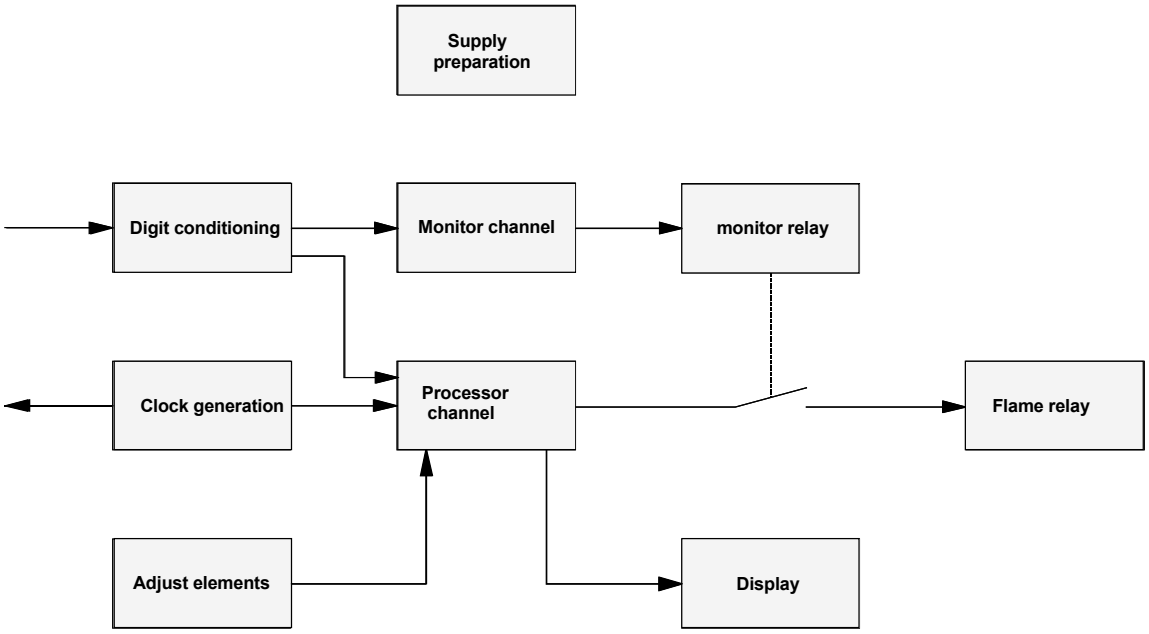
5.2 Front plate

The display of the current flame intensity is achieved via a 10 section bar graph display. The sensitivity level I or II is displayed via two LED's (green) A further LED (yellow) signals flame-on. Finally the error-LED (red) is situated on the front plate.

5.3 Function

The BFI flame monitoring system consists of one Flame Scanner (for instance type 2) which transmits, depending on the flame intensity information received, more or less pulses to the flame amplifier via the connection cable. The amplifier evaluates the pulse message and produces, depending on intensity, the flame-on or off signal. In addition to this the intensity evaluation is interrupted for 200ms per sec. for a selftest. In case of malfunction detection, the system switches off.
The below stated block diagram furnishes an overview of the functional groups in the Flame Amplifier 3001N / 3001DN.

5.3 Function



A self-test rate is generated. The pulses (or digits) supplied by the flame scanner are conditioned at first, to eliminate cable loss and interference. Subsequent to this, the signal path is split into two. An analogue monitoring channel ensures a safe switch-off in case of a failure of the parallel operating processor circuit. The flame relay is activated only if both, monitoring channels as well as the processor circuit, have recognised the flame-on signal.

5.4 Sensitivity adjustment

The unit can be sensitivity adjusted with the possibility to pre-select one of the two channels externally. The process control must furnish a predetermined signal for this purpose. The selected channel is displayed on the two green LED's at the front plate. At the same time the process control can receive a reinformation. It has to be taken into consideration that the time between channel selection and actual switch-over can be up to 1s.
Sensitivity adjustment is achieved by means of a 16-digit (hexadecimal) turn switch at the front plate.

5.4 Sensitivity adjustment

There is one turn-switch for each channel (the active sensitivity level has to be taken care of for the adjustment). The 0 position requires a stronger signal to activate the flame relay. The sensitivity can be increased beyond step 9 (A, B, C, D, E, F) up to switch position F. In this position a very weak signal is sufficient already to activate the flame relay. The sensitivity has to be chosen as such that during normal operation all bar graphs of the intensity indication are illuminated, whereas a flickering on the first bar must be recognisable. If the sensitivity is adjusted too high delays in switch-off could be the result and should therefore be avoided. A value between 4 and 6 is generally sufficient.

During the sensitivity adjustment it has to be borne in mind, that the switches are scanned only once per second, and an instant change is therefore not always possible.

The enclosed list features the connection between intensity and pulse rate.

Sensitivity adjustment	Flame-ON	Flame-OFF
0	502	403
1	354	281
2	305	240
3	246	194
4	206	159
5	176	136
6	132	100
7	120	89
8	102	77
9	84	59
A	71	53
B	68	47
C	56	42
D	43	30
E	33	18
F	27	12

5.5 Switch-Off time

The switch-off time is the time between flame failure and dropout of the flame relay. This time is adjustable by means of the switches (S2 and S3). The switches are situated on the main PCB, i.e. the plug-in unit has to be removed from the rack for this purpose. The selected adjustment should ensure a fast reaction without limiting the availability. The adjustment therefore depends on the time stable intensity level or whether there are severe fluctuations. In case of fluctuations a longer switch-off time has to be chosen to compensate short signal fall-outs in order to avoid an undesired switch-off. The adjustable switch-off times are listed below:

Channel 1	Channel 2	S2	S3	1	2	3	4
0,2 s	0,2 s	0	S3.1	ON	OFF	OFF	OFF
0,6 s	0,6 s	1	S3.1	ON	OFF	OFF	OFF
1 s	1 s	2	S3.1	ON	OFF	OFF	OFF
1 s	3 s	3	S3.2	OFF	ON	OFF	OFF
2 s	3 s	5	S3.2	OFF	ON	OFF	OFF
3 s	3 s	6	S3.2	OFF	ON	OFF	OFF
3 s	5 s	4	S3.3	OFF	OFF	ON	OFF
4 s	4 s	7	S3.3	OFF	OFF	ON	OFF
5 s	5 s	8	S3.3	OFF	OFF	ON	OFF
6 s	6 s	9	S3.4	OFF	OFF	OFF	ON

Tabele 5.5

NOTICE

- *Only one DIP switch may be set to "ON" at any one time*
- *One DIP switch must be set to "ON"*
- *If all DIP switches are set to "OFF", the appliance will switch off the flame relay*
- *If more than one DIP switch is set, unwanted times will occur*

5.6 Option unit

An additional jumper block with four DIP switches (S1.x) allows:

1. A manual selection of the sensitivity channel II
2. Flame Scanner diagnosis On/Off
3. Failure detection
4. The selection of the Intensity output signal 0/4 – 20mA

5.6.1 Choice of sensitivity level II

The sensitivity level can be chosen by DIP switch S1.1. Position OFF means that sensitivity level I is active. In position ON sensitivity level II is active.

NOTICE

Sensitivity level II can also be chosen by external signal from connection a16. See also chapter 4.7.3!

5.6.2 Flame sensor diagnosis

The flame sensor diagnosis can be switched on or off via DIP switch S1.2.

NOTICE

Switching off may be necessary if the amplitude setting of the flame sensor has been greatly reduced.

5.6.3 Failure detection

If an error is detected, it is displayed in coded form in the top 5 segments of the bar graph display, see Table 5.6.3. If there is for example no flame scanner connected to the flame amplifier, this will be indicated by the "failure" LED and the lightning of the uppermost bargraph. By connecting the flame scanner the failure indication will be turned off and the system will continue normal operation.

The following failures will be detected:

Bargraph (from top)	Abbreviation	Failure
1	FF (Flame signal fault)	Flame detected, but to small signal
2	FD (Flame scanner diagnostics)	No flame scanner connected or no data -> cable damaged
3	T >	Shutter period (to long)
4	T <	Shutter period (to short)
5	MP	Monitor- und Processor channel unequal

5.6.3 Failure detection

The second failure (FD) may also happen with a defect Flame Scanner or a wrong wiring. The failures 3 to 5 could not be solved or repaired on site please send them back for factory repair.

NOTICE

The Flame Amplifier 3001N / 3001DN is optionally available with a failure relay.

If there is no failure, the relay is energized. The supply voltage (24 V DC) is used as the output signal.
The presence of a failure causes the failure relay to drop out.
This must be taken into account when the relay contacts are queried by the control system.

There is also the option of galvanic decoupling of the relay contacts. For further information, see chapter 5.10.

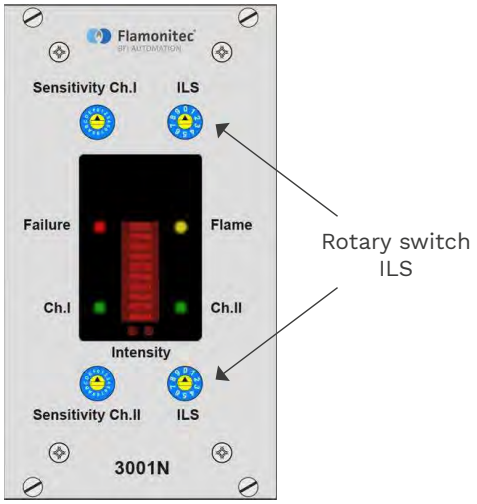
5.6.4 Current output

The current output which is dependent on the intensity could be selected in the range of 0 – 20 mA or 4 – 20mA by the Dip switch S1.4 which is the first on from the right hand side. In position OFF 4 – 20mA is selected. During the self checking period (200 ms per second) the current output will be hold on the value. The maximum shunt resistance will be 800W.

5.7 Interference light suppression ILS

With Interference light suppression, the potentially interfering ambient light component in the lower part of the flame signal is cut off from the incoming flame signalin 10 stages. The setting is made using the ILS rotaryswitch for each sensitivity level.
The following table shows the trigger values for the individual ILS switch positions:

5.7 Interference light suppression ILS



Position	Signal deduction
0	0
1	354
2	649
3	1003
4	1357
5	1652
6	2006
7	2360
8	2655
9	3009

5.8 Wiring

The 24 V DC power supply is internally protected by a 1 A fuse which is soldered on the PCB. The dimension of the fuse is of such a value that a flame scanner could be connected at the same line. A damage of the fuse is only expected by a defect of the system or by a wrong wiring. An additional possibility for a damage of the fuse might be transients on the power supply line which be suppressed by an internal EMC protection circuit. In those cases please send the flame amplifier back to our factory for a complete function check and for checking the EMC protection. Flame scanner and current output will be supplied with the same 24 V DC. If necessary a decoupling network between current output and BMS has to be used. All relay contacts are dry contacts.

5.9 Galvanic decoupling

The relais contacts of K1 and K2 are connected to internal power supply by factory. A galvanic decoupling for the in- and outputs of the DCS is possible. If the galvanic decoupling is necessary the jumper X2 and X3 can be plugged into the position "external".

5.9 Galvanic decoupling

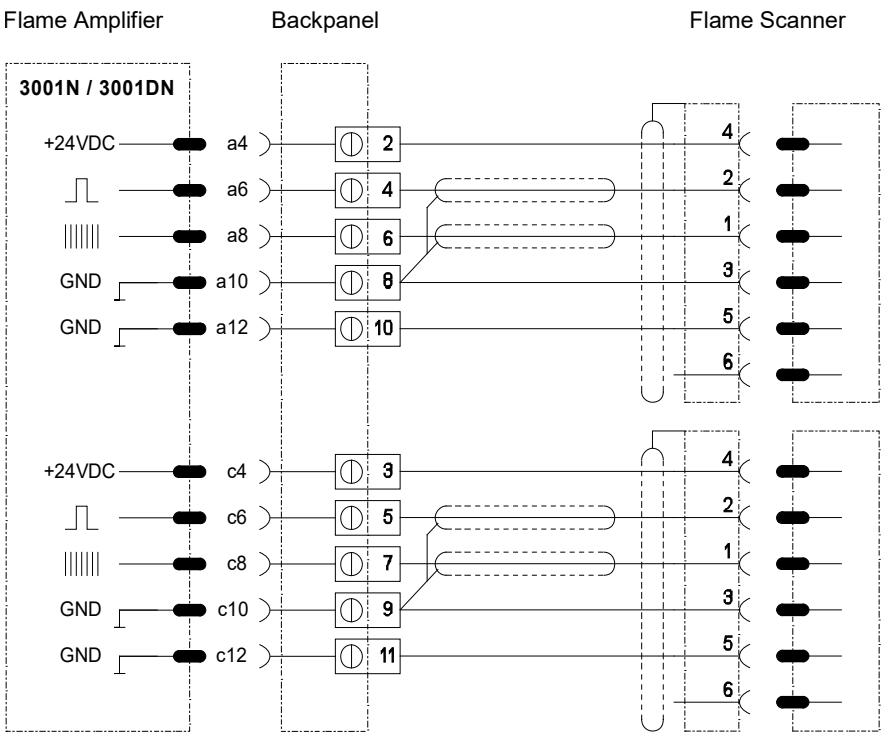
K1 = failure relay
K2 = signalling relay sensitivity II

NOTICE

By using the back panel 3001 the galvanic decoupling cannot be realized, cause the needed connectors a20 and a24 can't be reached.

5.10 Parallel connection of Flame Scanners

From auxiliary circuit and safety circuit, all three contacts of the relay (root, normally open and normally closed) are wired directly to the connector.The Flame Amplifier has been designed for the connection of two Flame Scanners in parallel operation. The pin connectors a4, a6, a8, a10 and a12 are used to connect a Flame Scanner. The pin connectors c4, c6, c8, 10 and c12 are used to connect the second Flame Scanner.



6 | Operation of the Flame Amplifier

NOTICE

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

NOTICE

Prior to initial operation, all regulations and adjustment parameters set up by the operating company of the burner have to be observed!

NOTICE

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

6.1 Connection of the Flame Amplifier

NOTICE

Prior to the connection of the Flame Scanner and a slide-in power supply unit to the Flame Amplifier, observe the separate operating instructions of the Flame Scanner and of the slide-in power supply unit!

NOTICE

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

6.2 Testing the Flame Amplifier

In order to ensure a correct operation, Flame Amplifier as well as Flame Scanner have to be tested several times in case of all applications by starting and stopping the burner several times (the flame relay has to be switched off reliably in all cases in which the flame is absent). 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!

6.3 Initial operation of the Flame Amplifier

The Flame Amplifier provides the Flame Scanner with operating voltage and the self test pulse, and ensures the evaluation of the Flame Scanner signals. All safety-related functions are carried out by the self-checking Flame Amplifier. After correct installation and wiring, the system is operational immediately. The respective status indicator (green LED) lights up at the slide-in power supply unit (optional, type 3002) and on the Flame Amplifier. The “Flame” indicator (yellow LED), “Failure” (red LED) as well as the bar graph indicator for the intensity are off.

After correct detection of the flame to be monitored, the “Flame” LED has to be lit. This LED has to be allocated to the "Flame on" and "Flame off" safety circuit. The safety circuit is connected by means of the pin connectors c28, a28 and c30. The flame intensity is displayed by a bargraph display. One bar represents 2.0 mA (0 - 20 mA) or 1.6 mA (4 - 20 mA).

NOTICE

The flame intensity indicator must be in the range between 50% and 100% !

If the output signal is lower than 50 %, monitoring may become instable. The flame relay is switched off at the chosen sensitivity (see table 5.4).

6.4 Factory setting of the Flame Amplifier

All sensitivity settings have set for both levels to the highest value (rotary switch = F).
The safety switch-OFF time has been set to 1 ms (S2=1).
The sensitivity level I is active (S1.1 is OFF).
The flame sensor diagnosis is active (S1.2 is OFF)
Failure detection (S1.3 is OFF).
The analogue output has been set to 4 - 20 mA (S1.4 is OFF).
ILS setting is 0 for both levels.
The monitor switch-off time is set to 950ms
(S3.1=ON, all others (S3.2-S3.4) are OFF)

7 | Maintenance, care and transport

The Flame Amplifier requires no maintenance.
For cleaning, use a moist cloth to wipe the front panel from the outside only.

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 “Flame” OFF LED sensitiveity I/II OFF	Flame Amplifier is not operational	Check power supply Check fuse F1 (T 1 A) Replace Flame Amplifier Check electrical connection
	1. bar is on (FF) LED “Flame” OFF	Flame signal too low	Check Flame Scanner Check / set sensitivity
	2. bar is on (FD)	Flame Scanner or cable defect	Check Flame Scanner Check cable
	3. bar is on	Clock cycle is too long	Send unit to the repair center
	4. bar is on	Clock cycle is too short	Send unit to the repair center
	5. bar is on (MP)	Monitor channel and process channel are unequal	Send unit to the repair center
	Analogue signal 25 - 100 % LED “Flame” ON	Relay contact or wiring problem	Check fuse F2 (T 1 A) 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

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