Original Operating Instructions
Compact Flame Controller

Type:	**CFC 2000 (Ex-Housing)**
Document No.:	**BA CFC2000 EX EN Rev.1**
	Software settings See
Document No.:	**HB CFC Com1 EN**

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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 compact flame controller. They contain important information on how to operate the controller 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 are not authoritative detailed designs.

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.

This work may involve, for example :

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

This should be confirmed by the operating company in writing.

NOTICE

The description of the Communication Software CFC Com1 you will find in the separate handbook HB CFC Com1 EN in its currently valid version.

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 an 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 an 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 operatint 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 detector 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 compact flame controller!

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

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 compact flame controller 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 compact flame controller 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

Dipl.-Ing. Kurt-Henry Mindermann GmbH

Eggerscheidter Strasse 57

D40883 Ratingen
Germany

Declaration of Conformity in Accordance with EC Directives

We hereby declare that in its design and construction and in the form brought into circulation by us, the flame control system designated below complies with the fundamental safety demands of the following EC Directives:

Low-voltage Directive 2006/95/EC

ATEX 95 Directive 94/9/EC

EMC Directive 2004/108/EC

This Declaration of Conformity is the result of an examination by BFI Automation in accordance with the European regulations.

Any modification to the system not approved by us will invalidate this declaration.

Description of the System:	Compact Flame Controller	
Device designation:	CFC 2000	
Directives:	2006/95/EC, formerly 73/23/EEC 94/9/EC (ATEX95), formerly ATEX 100a 2004/108/EC, formerly 89/336/EEC	
Applied standards:	EN 55022, EN 50082-2 EN 298 / EN 230 EN 50156-1 EN 60664-1 EN 60079-15 (Flame Scanner)	
Ex designation of the equipment:	Ex-housing PTB 03 ATEX 1051	CE 0032 Type 07-6152-9024 Ex II 2 G Ex d IIC T6 II 2 D IP 66 T 80°C
Date / Signature:	2009-07-16 *M. Thomas*	
Function of the signatory:	Authorized Officer	

1.9 Address of the manufacturer

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2 Safety

2.1 Intended use

The Compact Flame Controller CFC 2000 is intended exclusively for the monitoring of flames. The fields of application of this Compact Flame Controller are flame detections for selective and continuous burner monitoring in industrial steam generators, single and multi-burner furnaces.

⚠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 compact flame controller.

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 company is responsible for ensuring that the device is only operated in a proper state and that account is taken of all the appropriate safety requirements and provisions.
- 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

2.4.1 Fundamental aspects

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 compact flame controller 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.

2.4.2 Safety devices on the compact flame controller

The compact flame controller is equipped with the following safety devices:

- Housing (protection against accidental contact)
- Flame-proof housing (optional)
- Device earthing (explosion-proof housing)
- Explosion protection barrier (optional)
- Pressure barrier (optional)
- Locking device (optional)
- Purge air connection
- Heating insulator (optional)
- Self-test function

2.5 Safety instructions in case of maintenance and troubleshooting

2.5.1 Fundamental aspects

- 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.
- When working on the plug, the cable must be disconnected from the power supply.
- 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.

2.5.2 Electrical / electronic devices

⚠DANGER

Danger to life caused by electrical current!

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

Before working on electrical components, disconnect the compact flame controller from the mains power supply!

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 machine until the defects have been corrected.
- 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 !

2.5.3 Testing in keeping with the German Workplace Safety Ordinance (BetrSichV)

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.

2.5.4 Safety test prior to initial operation

⚠WARNING

Danger of injury and material damage if improperly used!

Improper use of the compact flame controller can lead to injury or even death and to material damage!

In order to ensure correct operation, the compact flame controller must be tested several times for all applications by starting and stopping the burner several times. In all cases the flame relay must switch off reliably in case if the flame is not detected. Carry out these tests whilst several neighbouring burners are started and stopped and different boiler outputs are used. This is an indispensable prerequisite for a safe and correct operation of the device!

3 Technical data

3.1 General characteristic features

- Flame scanner with integrated amplifier and flame relay
- Tested by the German Technical Inspection Association TÜV, approved by DIN DVGW
- For continuous, intermittent and 72-hours operation
- Type UV, UV1: For monitoring gas and oil-fired burners in the UV range
- Type IR (VIS-IR): For monitoring oil, coal and mixed-fuel burners
- Type IR1 (IR): For flames of all kinds (also residues, H2S and special gases)
- Type IR2: For monitoring gas and oil-fired burners in the IR range
- Two-channel flame monitoring system
- Sensitivity adjustable separately for both channels by software
- Analog output flame intensity 0(4) to 20 mA
- Flame analysis possibility by software
- LED status display for flame relay and flame intensity
- No additional wiring to external flame amplifiers
- Type of protection IP 65
- Suitable for safety related applications up to SIL 3 (according to IEC 61508)

3.2 Electrical system, Optical and Mechanical Data

Spectral sensitivity UV UV1 IR IR1 IR2	 270 to 420 nm 190 to 550 nm 300 to 1050 nm 1050 to 2700 nm 300 to 2700 nm
Angle of view	2.7 degrees
Self-monitoring	Fully electronic, 1 x per second
Operating voltage	24 V DC
Current consumption	approx. 200 mA
Prefuse	max. 1 A, slow blow
Design	in accord. with protection class III SELV
Ambient temperature	-20 degrees to +70 degrees C
Current output	0(4) to 20 mA (Ra<250 Ω) Current window variable by software
Fault output	24 V DC, short circuit-proof
Range changeover	External selection via 24 V DC signal
Flame relay	1 changeover contact, floating Wire breakage detection optional VDE 0110, class A max. 48 V switching voltage max. 1 A switching current max. 30 W switching power
Switching thresholds	programmable by software
Safety switch-off time	0.4 to 5 s, set at factory to 1 s
Sighting tube connection	1” internal thread ISO 228

Purge air connection	½“ internal thread ISO 228
Purge air volume	10 m³/h at standard conditions
Electrical connection Standard housing Ex-proof housing	 dust-tight Harting plug connector 3 m permanently connected cable
Housing dimension Standard with flange Ex-housing	 235 x 108 mm (l x ∅) 223 x 120 mm (l x ∅)
Ex-proof housing	IP 66, similar to NEMA 4 ATEX Zone 1 PTB 03 ATEX 1051 CE 0032 Type 07-6152-9024 II 2 G Ex d IIC T6 II 2 D IP 66 T 80°C
Approvals DIN-DVGW CE CSA UL GOST R	 NG-2530BN0176 CE0085BN0347 2171345 MH47747 POCC DE.AB28.B13063 No. 0605136
SIL	3

3.3 Weight

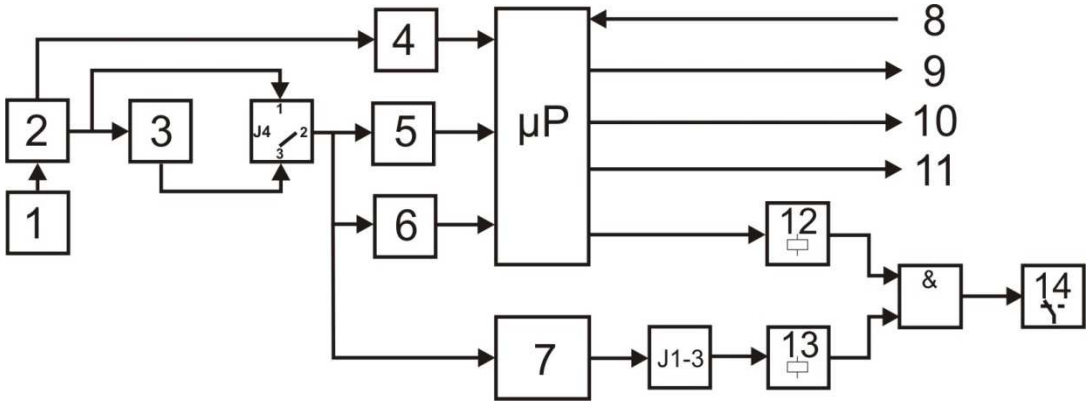
Ex-proof housing	4.0	kg

3.4 Dimensions

	Ex-housing	
Length	223	mm
Length with cable coupling	286	mm
Diameter	120	mm

(see chapter 4.6)

3.5 Device Design – block diagram of the Compact Flame Controller Type CFC2000



1	Sensor	10	Fault output
2	Pre-amplifier	11	Data output IRDA
3	Band-pass filter	12	Flame relay
4	DC voltage part	13	Monitor relay
5	Frequency part	14	Relay contact with fuse F3
6	Modulation part	J1-3	Monitor channel switch-off time
7	Monitor channel	J4	Frequency tap selection
8	Switchover to channel 2 (external)	µP	Microprocessor
9	Analog output 0(4) to 20 mA	&	AND logic

4 Transport, Installation and Connection

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!

4.1 Scope of delivery

- Compact Flame Controller CFC 2000
- Operating instructions CFC 2000
- Handbook CFC Com1
- Connecting cable (with ex-proof housing)
- Harting cable terminal box kit (not with ex-proof housing)

4.2 Accessories (optional)

- Power supply unit 230/115 V AC
- Power supply 5002
- 1" swivel mount with 2" flange disk
- 1” 3-way-ball-valve
- 1” heating insulator
- 1" pressure barrier 5 bar
- Optical alignment device
- Fiber optic cable
- Software CFC Com1 and data cable

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).

4.3 Packaging

The compact flame controller 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.

4.4 Forwarding instructions

NOTICE

Do not drop the device during transport and do not subject to heavy impacts. Do not subject the device to any humidity.

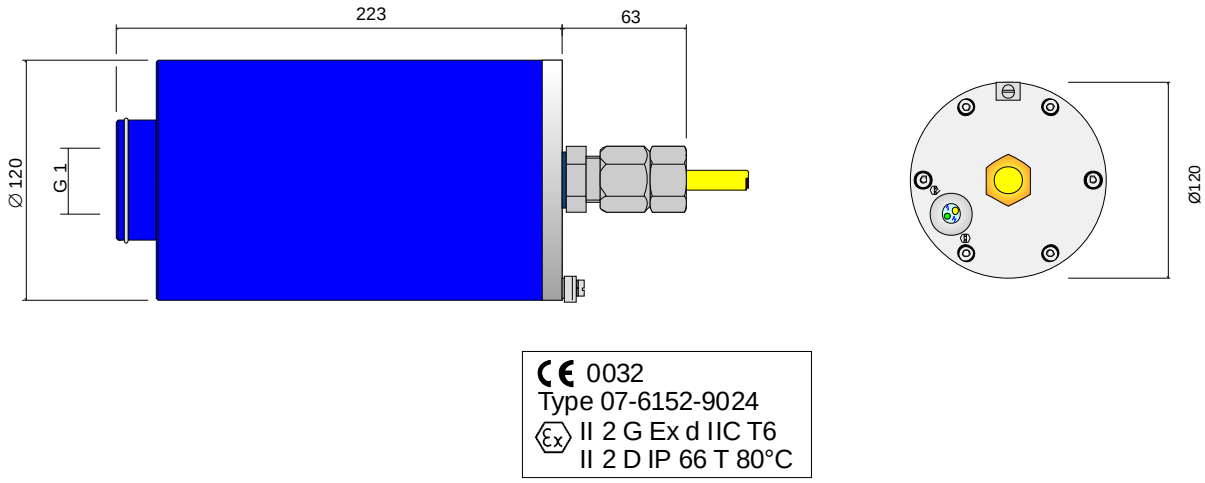
4.5 Weight of Compact Flame Controller

See chapter 3.3 *Technical data*.

4.6 Space requirement

See following illustration.

Explosion-proof housing

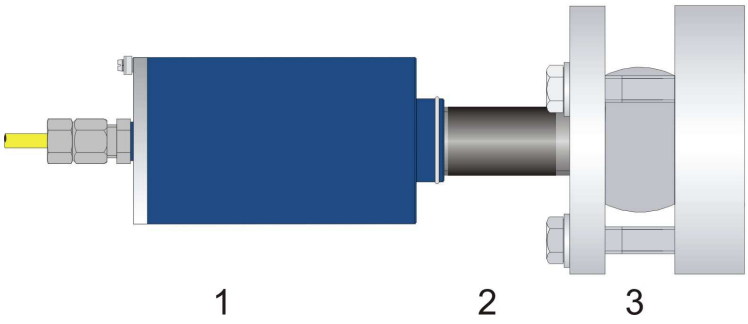


For usage in hazardous areas Zone 1
PTB 03 ATEX 1051

4.7 Installation

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 Compact Flame Controller
2 Heating insulator
3 Swivel mount

The sighting tube connection has a G1" internal pipe thread.

In order to ensure perfect flame monitoring, the correct and low-vibration position of the sighting tube relative to the flame is a significant pre-requisite. For selective burner monitoring, 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 compact flame controller. The sighting axis must, if possible, intersect the first third of the flame of the own burner. The extension of the sighting axis must not intersect the first third of the flame of other burners. Adjust the compact flame controller so that an optimum sighting is obtained.

⚠CAUTION

Risk of damage to the eyes from infrared and ultraviolet radiation and from escaping gases during visual flame monitoring!

Wear filtering protective goggles !

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 analysable 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

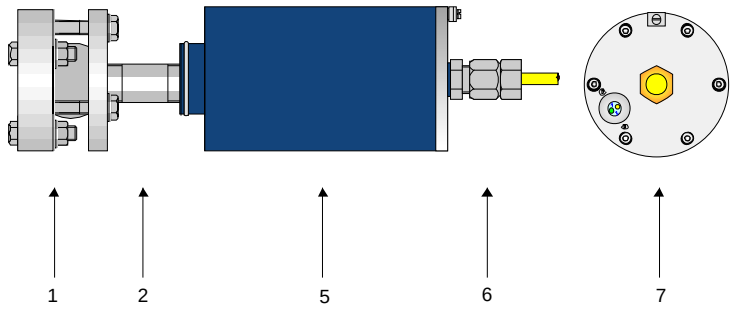
At a diameter of 1", the sighting tube should not be any longer than 50 cm. When doubling the length, double the diameter to 2" !

The use of a *ball flange* (optional, Part No.: 6590-9020-01) allows adjustments to be carried out easily in order to mechanically obtain the optimum observation point. The compact flame controller is supplied complete with a quick-installation flange. This guarantees quick and easy removal of the compact flame controller. It has a purge air connection whose special design prevents soiling of the lens without the possibly dust-laden purge air being able to damage the lens. If temperatures of over 50 °C occur at the compact flame controller caused by the heat dissipation of the sighting tube despite the inflow of cooling air, a *heat insulator* (optional, Part No.: B 512.1) must be employed. At pressurised firing installations, an additional *3-port shut-off device* (optional, Part No.: B 520) should be installed for the sake of safety. This prevents an escape of hot gases after the removal of the compact flame controller and provides additional cooling and purging of the installation.

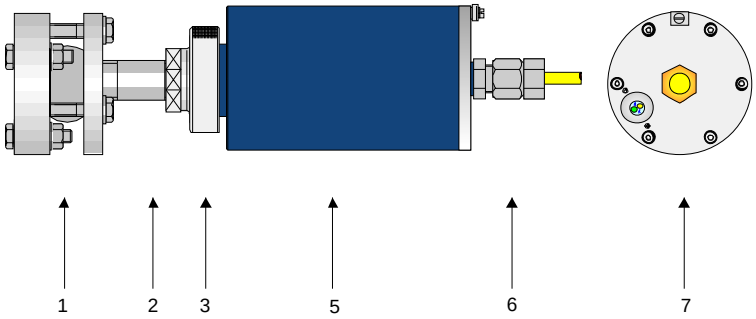
The entire mechanical peripheral system can be supplied by BFI Automation.

The assembly of the Ex-proof housing can be performed in three different ways:

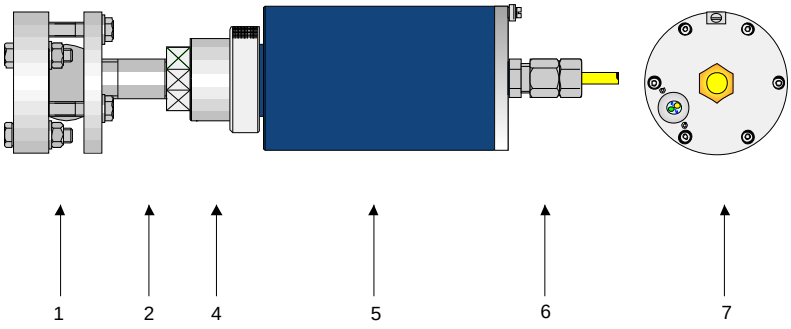
1. Standard



2. with quick release lock



3. with quick release lock and purge air connector



1	Swivel mount	5	EX-proof housing
2	Heating insulator	6	Cable coupling
3	Quick release lock	7	Back view
4	Quick release lock with purge air connector		

4.7.1 Works setting of the compact flame controller

DANGER

Danger to life caused by combustion or explosion !

Incorrect installation or adjustment may result in uncontrolled combustion or explosions!

Observe the adjustment instructions of the plant operator!

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

Compact flame controllers with variable sensitivity settings are set to the highest value at the manufacturer's works.

Compact flame controllers with variable frequency filters have a high signal sensitivity on account of the pre-set low-frequency harmonisation. Compact flame controllers with a variable shutter are set at the manufacturer's works to *Shutter open* which ensures maximum radiation sensitivity.

Devices with an additional changeover system must be actively controlled by means of an external 24 V DC signal.

4.7.2 Adaption of the compact flame controller to the firing installation

⚠DANGER

Danger to life caused by combustion or explosion !

Incorrect installation or adjustment may result in uncontrolled combustion or explosions!

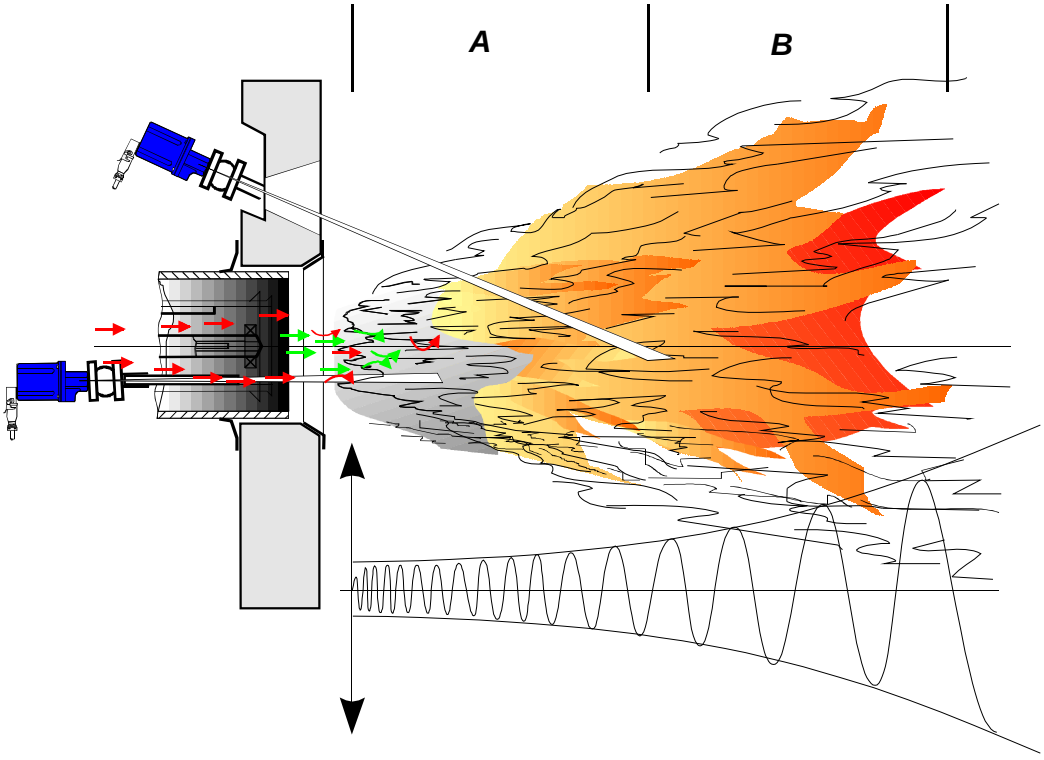
Observe the adjustment instructions of the plant operator!

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

NOTICE

All alignments and settings must be carried out, when new spare parts have been fitted, the compact flame controller has been moved or the flame image has been changed (e.g. due to additional fuels, new burners, changes in the burner/air registers) as well as during all initial installations!

For selective burner monitoring, the device must be installed in such a way that the primary combustion zone in all load ranges is within the visual angle of the compact flame controller. The sighting axis must, if possible, intersect the first third of the flame of the own burner. The extension of the sighting axis must not intersect the first third of the flame of other burners.



4.8 Connection

4.8.1 Electrical connection

⚠DANGER

Danger to life caused by electrical current!

Electrcal current may lead to injuries or to death!

The safety instructions and local safety regulations have to be observed during connection!
Have electrical connections made only by authorised specialist personnel!

For connection data, please refer to the chapter *Technical data* and 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.

For the contact assignment of the plug connector, refer to the following terminal diagram.

The output signal 0(4) to 20 mA for the flame intensity is not separate from the supply voltage so that the signal refers to the operating voltage ground. Should this result in problems, a corresponding isolating transformer can be supplied on request. The load of 250 ohm must on not account be exceeded.

After switching on the supply voltage, the device is immediately ready for operation.

4.8.2 Terminal diagram

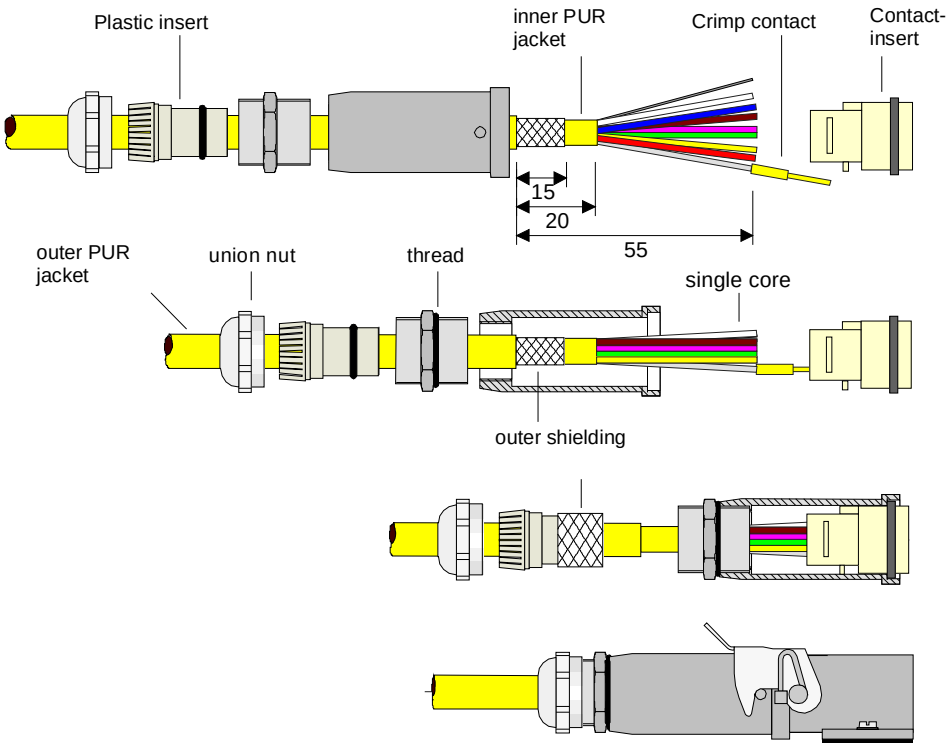
Connection of compact flame controller

Internal			External		
Contact	**Conductor colour**	**Function**	**Burner control**	**mA display**	**Power supply**
1	wh	Flame relay lead	x		
2	br	Flame relay Flame ON	x		
3	pk	Flame relay Flame OFF	x		
4	gn	Power supply +24V DC			+24V DC/200mA
5	ye	Power supply GND		-	GND
6	gr	Analog output + (0/4 to 20 mA)		+	
7	bl	Switchover to channel 2 (+24V DC ext.)	(x)		
8	rd	Fault output +24 VDC/100 mA	(x)		

Connection of compact flame controller with internal heating (optional)

Internal			External		
Contact	**Conductor colour**	**Function**	**Burner control**	**mA display**	**Power supply**
1 - 6 as for standard controller					
7	bl	Power supply to heater (+)			+24V DC / 500mA
8	rd	Power supply to heater (-)			GND

4.8.3 Laying special cable KW6



NOTICE

No contact chamber should be unloaded. All contact chambers have to be fitted with crimp contacts.

The outer shielding on the CFC-side is clamped extensive to the housing ground between the plastic insert and the thread of the gland.

The inner shielding has to be cut off on both ends.

4.9 Storage

Do not unpack the packed compact flame controller and accessories.

The following conditions apply to storage:

- Store in a dry place. Maximum relative humidity 60%. Ensure that the packages are not stored outdoors. In addition, It has to be assured that the floor in the storage area will remain dry throughout the storage period.
- Protect from direct sunlight. Storage temperature: 15 degrees to 25 degrees C (59 degrees to 77 degrees F).
- Store in a dust-free location.
- Avoid mechanical vibrations and damage.

5 Description

5.1 Type plate

The type plate is located on the device housing and contains the device type designation and the serial number.

5.2 Functional description

For flame radiation analysis the compact flame controller is using the integral method in the respective spectral range.

After pre-amplification, the undesirable unmodulated light portion is removed from the output signal of the wear-free detector. The subsequent sensitivity setting permist an attenuation of the signal for adaption to the firing conditions. The downstream bandpass ensures that only the typical flame radiation modulation of the primary combustion zone is evaluated. This allows extraneous light signals from neighbouring burners to be distinguished from the monitored flame.
Further function groups include i.a. the signal processing for the *dynamic monitor channel* that continuously monitors the fault-free state of the device.

A part of component defect results in the immediate switch-OFF of the flame relay that represents a floating changeover contact for processing in the burner controller.
The switching status is additionally indicated by a yellow LED on the rear side of the device behind the perspex panel.
For optimum adjustment of the compact flame controller, the flame intensity can be read off directly at the device by means of the pulsating green LED. A current output with 0(4) to 20 mA is available for visualisation or remote display.
The safety switch-OFF time that depends on the fuels to be monitored is set at the manufacturer's works to 1 second. Longer switch-OFF times can be set, if required.

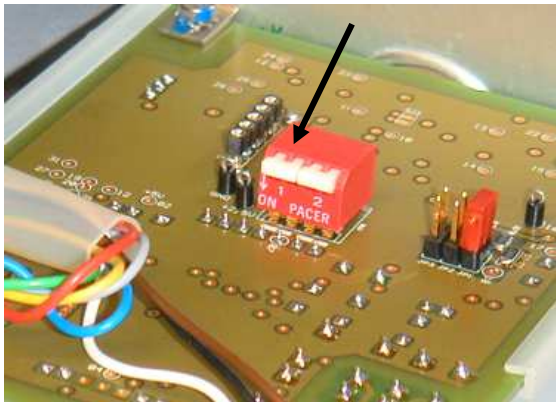
5.3 Hardware settings

The safety concept of the compact flame controller is based on two-channel signal processing.
The *evaluation channel* processes the flame signal under processor control so that the settings can be changed by the BFI software.
The *safety channel* is configured with SMD technology. Settings can only be changed on the printed circuit board.

5.3.1 The frequency filter

The CFC 2000 has a four-step frequency filter in the signal input. The evaluation of the flame signal by the software takes place only downstream of the frequency filter. Part of the extraneous light can therefore be filtered out before the evaluation by the software. The limit frequencies of the high-pass filter can be set as follows:

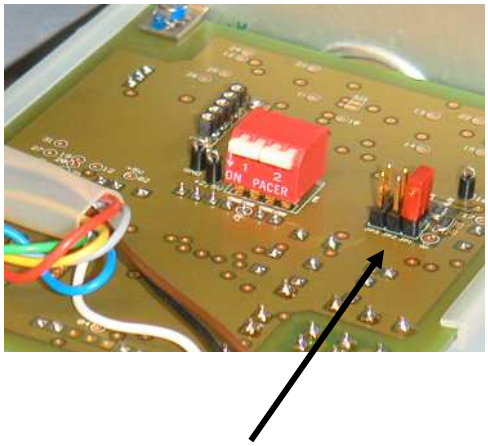
Filter frequency (Hz)	Switch 1	Switch 2
30	off	off
60	on	off
90	off	on
120	on	on



NOTICE

The setting at the dip switches should only be changed when an adjustment of the compact flame controller is no longer possible by software (see Handbook HB CFC Com1 EN).

5.3.2 Safety switch-OFF time of the safety channel



Jumper 1-3

The safety switch-OFF time of the safety channel (hardware) is set by means of a jumper. The settings are as follows:

Jumper 1 bridged: 1 second
Jumper 2 bridged: 3 seconds
Jumper 3 bridged: 5 seconds

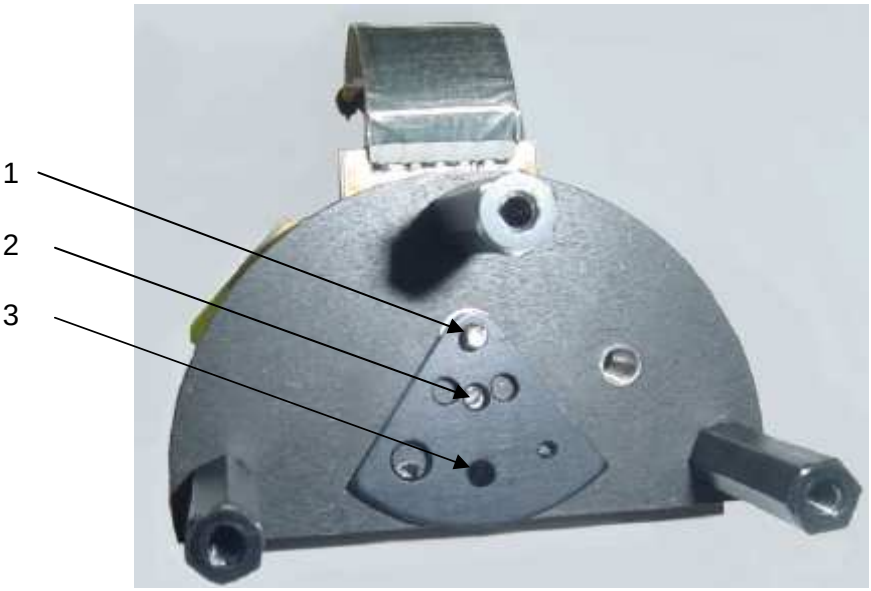
If a switch-OFF time of 2 seconds is required, the jumper must be inserted in position 2 (3 seconds) and the switch-OFF time of the evaluation channel set by software to 2 seconds (*see Handbook HB CFC Com1 EN*). The shorter switch-OFF time of the two channels always takes priority.

NOTICE

The safety switch-OFF time during operation (shut-off time) is also dependent on the software setting (see Handbook HB CFC Com1 EN)!

5.3.3 The optical shutter

On the CFC 2000 of the IR Series, the radiation on the sensor element (3) can be reduced by means of an optical shutter. The least radiation onto the element is obtained when the smallest hole is positioned in front of the sensor element. The shutter can be latched in 4 different positions.
The shutter is linked mechanically to the detector holder. To adjust the shutter, loosen the screws through the holes in the screen of the pre-amplifier. The upper screw (1) secures the shutter, the lower screw (2) centres the shutter.



6 Operation of the Compact Flame Controller

⚠WARNING

Danger of injury and material damage if improperly used!

Improper use of the compact flame controller can lead to injury or even death and to material damage!

Operation of the compact flame controller only by authorised and qualified special personnel!
Observe the operating instructions!

NOTICE

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

6.1 Test of the Compact Flame Controller

In order to ensure correct operation, the compact flame controller must be tested several times for all applications by starting and stopping the burner several times (the flame relay must reliably shut-down in all cases when there is no flame). Carry out these tests whilst several neighbouring burners are started and stopped and different boiler outputs are used. This is an indispensable prerequisite for a safe and correct operation of the device!

7 Care and Maintenance

The compact flame controller is maintenance-free.

For cleaning, use a moist cloth to wipe the housing from the outside only and clean the lens in regular intervals.

NOTICE

Take care not to scratch the lens!

8 Failures

Problem:	Display:	Cause:	Remedy:
No *Flame ON* signal after the burner was started	No mA output signal Yellow LED *OFF* Green LED *OFF* No data communication	Compact flame controller not functioning	Check voltage supply Replace compact flame controller Check electrical connection
	Flame signal (software) low Yellow LED *OFF*	Flame signal too low or below the starting threshold	Inspect compact flame controller Check flame, alignment, sighting tube and lens Check / set sensitivity and switching thresholds
	Flame signal (software) above the starting thresholds Yellow LED OFF Red LED ON (software)	Device or self-test fault	Check fault memory Possibly remove plug for 5 seconds then start the burner again Replace compact flame controller
	Flame signal (software) above the starting thresholds Yellow LED ON Green LED ON	Relay contact or wiring problem	Check fuse F3 in relay output circuit Check electrical connection

Problem:	Display:	Cause:	Remedy:
Burner fails	Flame signal (software) drops. Below the shut-off threshold, the flame relay switched off.	No flame, weak flame signal	Check flame Inspect compact flame controller Check alignment and lens Check sensitivity setting Check switching thresholds Replace compact flame controller Check electrical connection
	Flame signal above shut-off threshold Yellow LED OFF	Device or self-test fault	Check fault memory Possibly remove plug for 5 seconds then start the burner again Replace compact flame controller

9 Order data

The compact flame controller is available from BFI Automation GmbH under the following order data:

Compact flame controller ready for Ex-proof housing Zone 1	
Typ	**Material-No.**
CFC 2000 UV EX	S 520.3EXG
CFC 2000 UV1 EX	S 520.0EXG
CFC 2000 IR EX	S 520.4EXG
CFC 2000 IR1 EX	S 520.7EXG
CFC 2000 IR2 EX	S 520.6EXG

10 Accessories

Communication and software	
Typ	**Material-No.**
Software CFC Com1 and data cable	6040-4901-00
Data cable without software	6040-4810-10
Additional accessories	
Typ	**Material-No.**
Power supply 5002	G 652
Special cable KW6, yard good	6060-0680-00
Swivel mount 1“ with a 2“ flange plate	6590-9020-01
3-Way ballvalve 1“	B 520
Heating insulator 1“	B 512.1
Double nipple 2 x 1“ outer thread	B 500
Optical alignment device BFI 235-EX	P 106.EX
Quick release lock for Ex-proof housing with purge air connector G1/2“	6590-2352-12
Quick release lock for Ex-proof housing without purge air con-nector	6590-2351-12

More accessories you will find in our product catalog.

More information about BFI Automation and our products you find under:

Product catalog

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http://www.bfi-automation.de/download/bfi_pk_en_digi.pdf

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