Quick Reference for Endusers

F200K Compact Flame Scanner

Hardware version 2.0 to 2.3

Sensors and Systems for Combustion Engineering

LAMTEC
www.lamtec.de

Table of Contents

1 General Information

1.1 Validity of these Instructions

The devices correspond to the following directives and standards::

European Directives:

- 2014/30/EU (EMC Directive)
- 2014/35/EU (Low Voltage Directive)
- (EU) 2016/426 Gas Appliance Directive (GAR)
- 2014/68/EU (Pressure Equipment Directive)
- 2011/65/EU (RoHS2)
- 2015/863/EU (RoHS2)

Harmonised European Standards:

- DIN EN 298:2012-11
- DIN EN 60730-2-5: 2015-10
- DIN EN 746-2: 2011
- DIN EN 61508: 2011 part 2 (requirements SIL 3)
- DIN EN ISO 9001:2015 Quality Management Systems
- ISO/IEC 80079-34:2018 Potentially explosive areas - Quality Management System (QAR)

USA and Kanada:

- UL 372 – UL Listed

Product-Identification-Number: CE-0085 BO 0005

1.2 Purpose

In single-burner and multiple-burner furnaces, the flame scanner performs a high-safety monitoring of the burner flame. When the flame goes out, the safe control state' Flame' is reached.

It is mainly used in large-scale power plants, thermal power stations and chemical plants as well as for monitoring furnaces which are operated from.

– oil
– gas
– bio-mass
– dust coal
– chemicals and other waste products

2 Safety

2.1 For Your Safety

The following symbols are used in this document to draw the user's attention to important safety information. They are located at points where the information is required. It is essential that the safety information is observed and followed, and that applies particularly to the warnings.

⚠ DANGER!

This draws the user's attention to imminent danger. If it is not avoided, it will result in death or very serious injury. The plant including its surroundings could be damaged.

⚠ WARNING!

This draws the user's attention to the possibility of imminent danger. If it is not avoided, it may result in death or very serious injury. The plant including its surroundings could be damaged.

⚠ CAUTION!

This draws the user's attention to the possibility of imminent danger. If it is not avoided, it may result in minor injuries. The plant including its surroundings could be damaged.

NOTICE

This draws the user's attention to important additional information about the system or system components and offers further tips.

The safety information is incorporated into the instructions.

Thus, the operator is requested to:

1 Comply with the accident prevention regulations whenever work is being carried out.

2 Do everything possible within his control to prevent personal injury and damage to property.

2.2 How to Use the Information

The necessary data for correct mounting, wiring, installation, operation and maintenance of the device are to be taken from the relevant instructions for the burner or combustion in the official language of the country.

3 Product Description

3.1 Design

The compact flame scanner is composed of a cylindrical casing comprising an axial lightincidence aperture, a processing status indicator at the rear of the unit and operational controls which can be accessed by removing the cover.

The device is connected through an integrated standard plug and using a connection cable required for this with coupler.

4 Technical Data

4.1 Characteristics

The compact flame scanner is available in 2 basic versions, as well as an ex-proof enclosure type with several spectral varieties (IR/UV).

Design type	F200K1	F200K2
Sensitivity range	1 sensitivity range 6 levels	2 sensitivity range increased sensitivity in range II, can externally be switched over, 6 levels each
Frequency range	10 ...190 Hz	10/20/30 ... 190 Hz[1] can be adjusted on the device

[1] Special versions with regard to the lower limit frequencies are available on request

NOTICE

Signals lying in the mains frequency range or its multiples are suppressed for 50 Hz mains generally. For 60 Hz application, please indicate separately in your order form. The related stop ranges are changed in factory.
LAMTEC offers a version without mains frequency suppression for special applications. This design requires additional measures during installation. Please contact LAMTEC Support for further information. The compact flame scanner is accordingly marked by a rating plate.

Overlapping of the sensitivity ranges

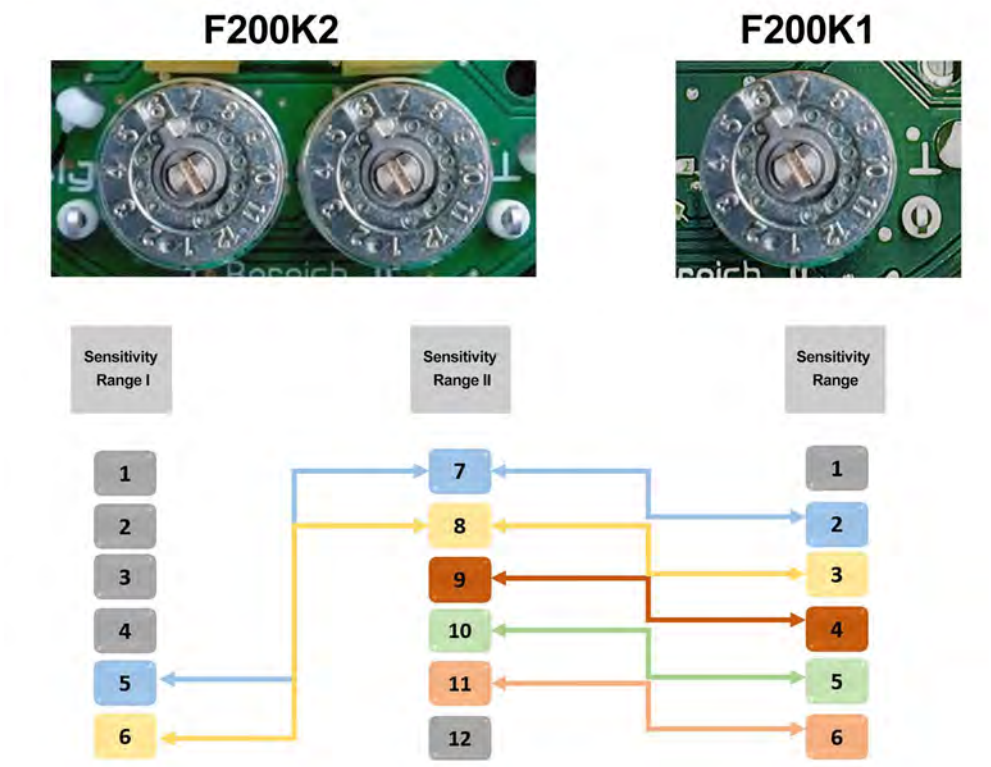

Fig. 4-1 Overlapping of the sensitivity ranges

4 Technical Data

4.2 Spectral Regions

Typ	Hazardous Area		Fiber-optic	Sensitiv-ity	Spectralrange [nm]	Application - Fuel type
	Ex-II	Ex				
F200K1 UV-2				+	210 ... 380	Oil, gas (special gasses such as refinery and blast furnace gases) and highly selective monitoring
F200K2 UV-2	X	X	X	++		
F200K2 UV-6	X	X	X	+++		
F200K1 IR-2				+	850 ... 1100	Monitoring of combustion chambers and combustion edges (coal, wood)
F200K2 IR-2				++		
F200K1 IR-1				+	1100 ... 2800	Oil, gas, wood, coal, furnaces with heavy flue gas recirculation, waste gases with yellowish colour without UV radiation and/or screening of the UV portions by vapour, dust etc.
F200K2 IR-1	X	X	**	++		

+++ very high ** in preparation
++ high
+ middle
O low
- very low

4 Technical Data

4.3 Operating conditions

Fig. 4-2 Compact flame scanner F200K V, F200K Ex-II V

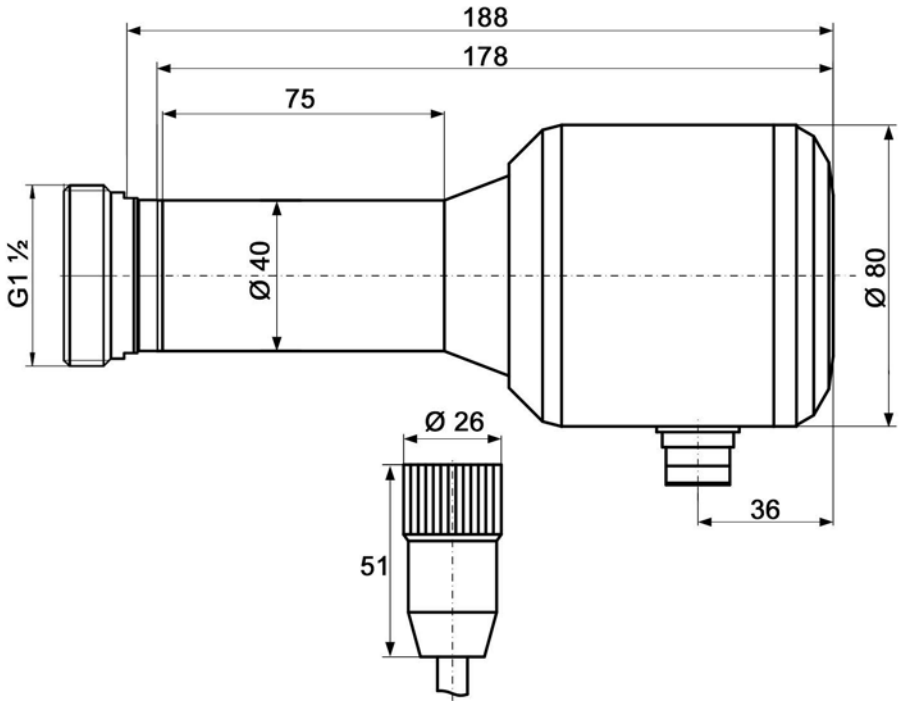

Fig. 4-3 Dimensional drawing compact flame scanner F200K V, F200K Ex-II V

NOTICE

Delivery without connecting cable!

Connection cable must be ordered separately, see order details.

4 Technical Data

Fig. 4-4 Compact flame scanner F200K, F200K Ex-II

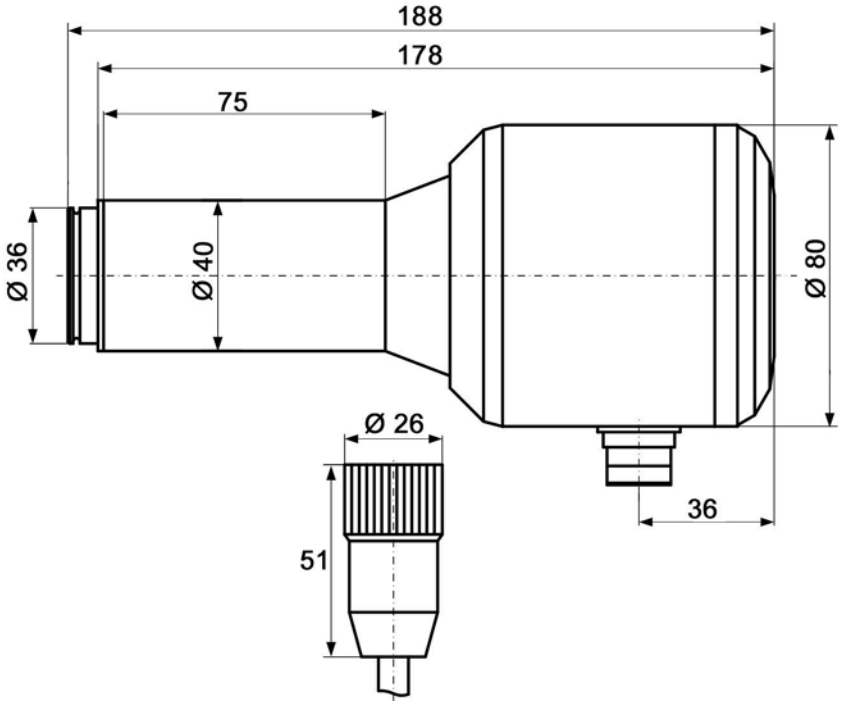

Fig. 4-5 Dimensional drawing compact flame scanner F200K, F200K Ex-II

NOTICE

Delivery without connecting cable!

Connection cable must be ordered separately, see order details.

Fig. 4-6 Compact flame scanner F200K Ex (for Ex zone 1, 21)

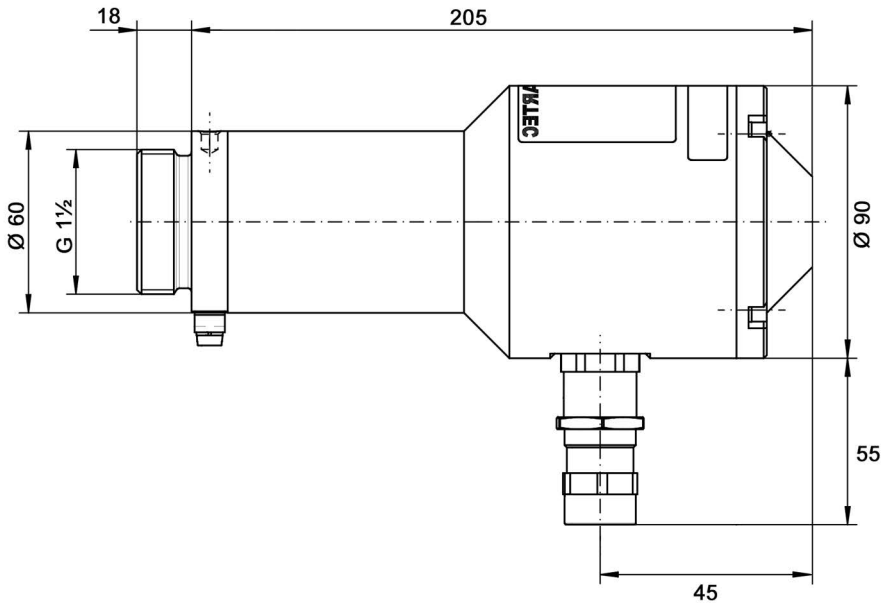

Fig. 4-7 Dimensional drawing compact flame scanner F200K Ex (for Ex zone 1, 21)

NOTICE

Delivery with connecting cable!

Available lengths 3/5/10 m | 9.84/16.40/32.81 ft, see order details.

4 Technical Data

Fig. 4-8 Compact flame scanner F200K Ex (for Ex-Zone 1, 21), with connection area

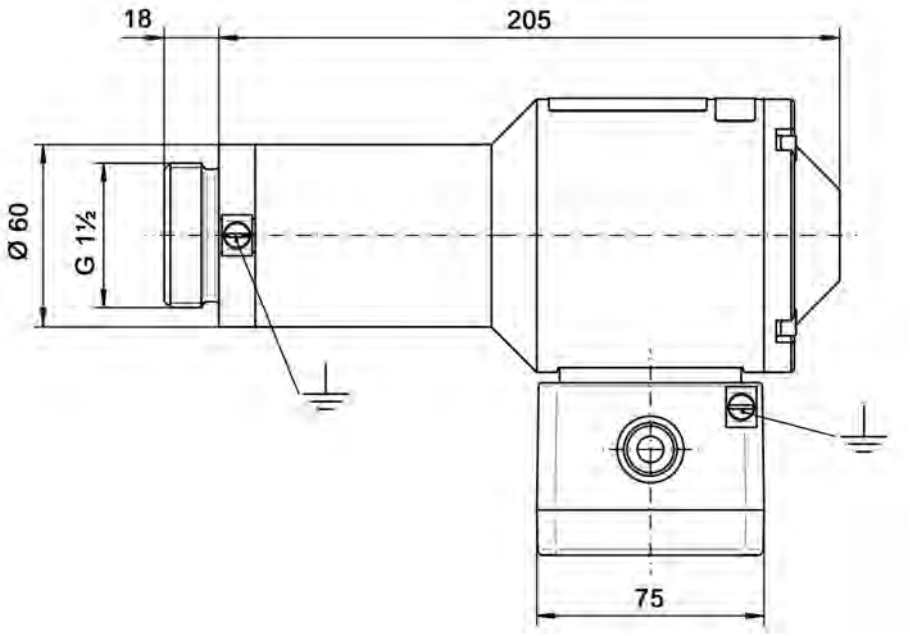

Fig. 4-9 Dimensional drawing compact flame scanner F200K Ex (for Ex zone 1, 21), with connection area

NOTICE

Delivery without connecting cable and without screwed cable gland!

The cable and screwed cable gland must be ordered separately.

4 Technical Data

F200K ... , F200K2 ..., Ex-II (for Ex zone 2, 22)

Dimensions Safe Area and Ex-II	
Material	Corrosion-resistant aluminium EN AW 6082 (seawater 2*; atmospheric condition 1*), nickel plated, varnished (F200K Ex-II)
Dimension Version V + S	Total length: 180 mm | 7.09" in; Diameter: 40/80 mm | 1.57/3.15" in with male thread G 1 ½, length 10 mm | 0.4" in / S (∅ 36)
Weight	0,60 kg | 1.32 lb
Tightening torque for brackets FV...	Hand-tight approx. 5 Nm

* Comparative evaluation from 1 (very good) to 6 (unsuitable)

F200K, F200K2 Ex (for Ex zone 1, 21)

Dimension	
Material	Corrosion-resistant aluminium EN AW 6082 (seawater 2*; atmospheric condition 1*), anodised
Dimension	Total length: 216 mm | 8.5" in Diameter: 60/90 mm | 2.36"/3.54" in
Weight	2 kg | 4.4 lb
Tightening torque for brackets FV...	Hand-tight approx. 5 Nm

* Comparative evaluation from 1 (very good) to 6 (unsuitable)

4 Technical Data

General technical data F200K for all variants/versions

Input parameters	
Auxiliary power	
Power supply voltage[1]	24 VDC ± 20 %, protection class III
Power consumption	≤ 4 W ≤ 380 mA (100 ms peak)
Switch ON current	28,8 V ≤ 750 mA (100 ms peak)

1 The product must not be transported, stored or operated outside the specified range. All promises regarding safety-relevant functions otherwise lose their validity.

Output Data	
Output contact flame signal	change-over contact (floating)
Permissible switching voltage [1]	max. 50 VDC, protection class II (250 VAC by main supply FN 20) min. 6 VAC/DC
Permissible switching current	max. 0,5 A at < 60 °C | +140 °F[2] 0,4 A at < 75 °C | +167 °F[2] min. 1 mA[2]
Switching capacity	min. 0,1 W max. 30 W
Internal fuses	2,5 A slow IEC or 3,5 A slow UL
Safety time 'FFDT'	t_{Voff} ≤ 1 s or ≤ 2 ... 4 s, (5 s on request) factory seting
Start-up delay	t_{Von} ≈ FFDT as of HW 2.3 applies to FFDT 3 s t_{Von} ≈ 2 s
Measuring output for intensity	
Output continuous current	4 (0) ... 20 mA, there is no insulation of potential towards the supply voltage
Maximum working resistance	200 Ω
Floating DC voltage	6,6 V
Basic error	±2 %

1 The product must not be transported, stored or operated outside the specified range.
If it is, any guarantees with regard to safety-related functions lose their validity.

2 Please note: Gold-plated relay contacts
The maximum load for inductive/capacitive loads (recurring current peaks during switching) is 100 mA. If this is exceeded, even briefly (current peaks), the specified minimum value of 10 mA can no longer be guaranteed. Provide external spark suppression.

Spectral radiation range and sight angle	
- F200K1 UV-2 and F200K2 UV-2(Ex)	210 ... 380 nm ca. 8°
- F200K2 UV-6 (Ex-II)	215 ... 360 nm ca. 10°
- F200K1 IR-2 and F200K2 IR-2(Ex)	850 … 1200 nm ca. 50°
- F200K1 IR-1 and F200K2 IR-1(Ex)	1200 ... 2800 nm ca. 60°

NOTICE

Range remote switch-over (F200K2 only) floating-contact, can be controlled by means of the supply voltage.

4 Technical Data

Cable length	
Maximum extension via the connection cable 3 m | 9,84 ft addition, at a supply voltage 20,5 V	Wire 0.5 mm^2 | 20 AWG → length: 50 m | 164 ft Wire 1.0 mm^2 | 18 AWG → length: 100 m | 328 ft Wire 2.5 mm^2 | 14 AWG → length: 250 m | 820 ft
Deviating cable lengths p. ex. (main criteria is the compliance to limitations of the supply voltage the compact flame scanner and thus the loss of voltage on the supply line)	Length: 150 m | 492 ft Wire: 0,5 mm^2 | 20 AWG 150 : 0.5 x 0.0131 +19.2= 23,13 V The supply voltage must be > 23,13 V.

NOTICE

Only a cross-section of 0.5 mm² | 20 AWG is possible for the **F200K Ex**.

Technical load capacity	
Operating mode	DB – continuous operation Intermittent operation 72 h Operation according to TRD604
Creepage distances and clearances	IEC 60730-1, ÜK III, VG 2
Interference susceptibility	IEC 60730-1, EN 61000-4
Emitted interference	DIN EN 55011/A1, Klasse B

Climatical conditions
Operating class temperature F200K

Sensor	IR-1	IR-2	UV-6, UV-2
-40 °C | -40 °F */**	x	x	x
-20 °C | -4 °F	x	x	x
+60 °C |+140 °F	x	x	x
+75 °C | +167 °F*		x	x

* for F200K … Ex … (see Ex approval)

** not valid for FFDT > 3 s

Operating Condition	
Relative humidity	0 ... 95 % non-condensing

Environmental Conditions		
Operation	permissible temperature range	- 40 ... +75 °C | -40 °F ... +167 °F
Transport	permissible temperature range	- 40 ... +75 °C | -40 °F ... +167 °F (type IR-1 +65 °C | +149 °F) (storage in closed cargo holds)
Storage	permissible temperature range	- 40 ... +75 °C | -40 °F ... +167 °F (type IR-1 +65 °C | +149 °F) (storage in closed spaces)
Degree of protection	DIN EN 60529:2000	IP66/67, IP66 (at F200K Ex), NEMA 4X in closed condition

4 Technical Data

Application in hazardous areas Ex zone 2, 22	**F200K .... Ex-II**
Device group/category of hazardous area	[Ex] II 3G, Zone 2, [Ex] II 3D, Zone 22
Certificate	IECEx IBE 15.0012X Class I Division 2 File-No. E488138
Marking	Ex ec nC IIC T6...T5 Gc X Ex tc IIIC T90°C Dc X Cl I Div2 Gr A T5
Standards	IEC 60079-0, EN 60079-0 ANSI/ISA-12.12.01, CAN/CSA C22.2 No. 213
Operating temperature range	
Ambient temperature	explosive gas atmospheres T5 -40°C | -40 °F ... Ta ... +75°C | +157 °F T6 -40°C | -40 °F ... Ta ... +65°C | +149 °F explosive dust atmospheres T90°C | 194 °F -40°C | -40 °F ... Ta ... +75°C | +157 °F
Additional Information	Follow the section "Special Points to Note When Using the Device in Explosion-proof Areas".

Application in hazardous areas Ex Zone 1, 21	**F200K .... Ex**
Device group/category of hazardous area	[Ex] II 2G, zone 1, [Ex] II 2D, zone 21
Certificate	IECEx EPS 14.0042X, EPS 14 ATEX 1 696 X
Marking	Ex db IIC T6...T5 Gb Ex tb IIIC T80°C, T95°C Db
Standards	IEC 60079-0 , EN 60079-0
Operating Temperature range	
Ambient temperature	T5 -40 °C | -40 °F ... Ta ... +75 °C | +157 °F (UV version) T6 -40 °C | -40 °F ... Ta ... +65 °C | +149 °F (UV version) T6 -40 °C | -40 °F ... Ta ... +60 °C | +140 °F (IR Version)

5 Instructions for Maintenance

5.1 Display and Operational Controls

Represented in chapter *6.1 Layout of the Operational Controls*.

5.1.1 Sensitivity Range - Indication

This display type only exists in the F200K2 execution type. The display shows the sensitivity ranges I or II activated by external selection. The range I (normal sensitivity) is mainly used for high flame intensities, whilst range II (higher sensitivity) is used for weaker flame intensities.

5.1.2 Operating State-Indication

The red LED shows the ’Flame OUT’ operating state. Whilst indicating 'Flame IN' the green LED pulses in intensity to indicate the self-monitoring operation of the system. The pulse frequency is the same as the self-monitoring cycle time (1.5 or 3.0 seconds). If the green LED does not pulse then this could be symptomatic of electromagnetic interference (EMC) or a defect of the compact flame scanner. (refer to chapters from *5.2.4 Fault on Flame Detection* to chapter *5.2.6 Faults During Operation* and chapter *5.3 Troubleshooting*).

5.2 Commissioning

5.2.1 General Information

5.2.1.1 'Flame Out' State

After switching on the power supply, the flame scanner is ready for operation after approximately 5 seconds. The following display has to be shown:

- Display ’Flame out’	’Red’ LED lights up
- Sensitivity range I or II	’Yellow’ LED lights depending on external pre-selection f. range I or II (for F200K2 only)

5.2.1.2 'Flame In' State

To check the monitoring parameters, install the compact flame scanner in the specified mounting place before starting the operation of the furnace. If the flame burns naturally, the display should change as follows:

’Red’ LED	Goes out
’Green’ LED	Lights up, changing its radiation intensity antivalently to the cycle rhythm of the self-monitoring system. Intensity indicator (lighting point) should reach 100 %.

5.2.1.3 Operating mode switchover

Two preselectable operating modes

The compact flame scanner F200K offers users two operating modes for selection. This makes it possible to select two different settings in the range of gain levels. The individual operating modes can be switched during operation.

5.2.2 Preparations

5.2.2.1 Checking the Compact Flame Scanner

The flame scanner can be checked for proper functionality without a flame being present.

1 Carry out the complete electrical installation of the flame scanner and connect it to thesupply voltage. A LAMTEC test emitter of the FFP30 type (IR + UV) can be used as an auxiliary means for flame simulation.

2 Simulation of flame radiation in front of the flame scanner's viewing port. This can be achieved using a lighter or any other type of a modulated-light source (do not use the mains frequency) having a sufficiently high intensity. For example the light from a lamp can be modulated by moving splayed fingers to and in front of the bulb.

The flame scanner will switch on its output contacts if the flame signal is simulated for a sufficient period of time. This is indicated by the extinction of the red LED and the pulsating light of the green LED. The 6-level intensity indicator illuminates.

If no flame signal is indicated despite apparent correct functionality then check the output contact (s. Kapitel *5.3 Troubleshooting*)

5.2.2.2 Optics

There are no special requirements for locking discs or similar components when using **IR-flame scanners**. Small accumulations of dirt due to dust and similar materials are generally not critical for flame detection.

In **UV- flame scanners**, the requirements for locking discs are more critical. Ensure that materials, such as quartz, that allow UV light to pass through freely are used. These materials are used in the LAMTEC UV adjustable holding devices (FH30, FV30, FH40 and FV40) Small accumulations of dust, water and other contaminants are much more likely to affect the performance of flame detection than when using an IR scanner.

⚠ WARNING!

When using an F200K without mains frequency suppression, it must be ensured that it is protected against the detection of mains frequency light. The mounting of the sight opening on the burner must meet the requirements of a tool mounting. Unintentional loosening of the F200K must be prevented.
Advice on this is available from LAMTEC support.

5.2.3 Checking the Flame Shut-down on Fault

⚠ WARNING!

Simulate a flame rupture or flame extinction by shunting off the fuel supply to the burner to be monitored by the flame scanner. Check that the signal for shutting-off the safety valve is triggered off within the period of T_S< 1 s (on safety period 'Operation' at t_VOff = 1 s) after extinction of the flame.

'Red' LED	lights
'Green' LED	dark

⚠ WARNING!

For the IR compact flame scanners of the F200K1(2) IR-1 and/or F200K1(2) IR-2 types, take into account the radiation effects characteristic of the combustion chamber. Consequently, switch-off tests should be carried out when the boiler has reached operating temperature. In particular, make sure that the sensitivity of the compact flame scanner is increased only to such a value required to safely and reliably monitor the flame throughout the operating range of the burner.

5.2.4 Fault on Flame Detection

Check this function according to chapter *5.2.2 Preparations -5.2.2.1 Checking the Compact Flame Scanner*.

5.2.4.1 1. Interference

Generally, interference becomes apparent by the fact that the intensity indicator of the device may indicate 100 %, but the green LED ('Flame in') does not light up. Or, the green LED lights up for a moment, but then it does not change its intensity according to the cycle rhythm and goes out again. This is a cycle synchronisation fault (signal in both evaluation channel present at the same time). This may chiefly be due to the interference emission of the ignition transformer during ignition.

– Check the shielding and FPE for proper connection to the F200K.
– Carry out a proper grounding of the ignition transformer.
– Check the cables for laying and if required untangle/separate them spatially.

5.2.4.2 2. Excessive Temperatures

Make sure that the maximum allowable ambient temperature of 60 °C is not exceeded at the installation site. In case where the temperature is expected to exceed the limit, take appropriate cooling measures (e.g. cooling air enclosure FS 50, FS 51or FS 56).

Make sure that the flame scanner casing does not heat up beyond this temperature value due to the impact of the heat radiated by the boiler. Overheating will result in a sensitivity loss in the first line, or will cause damage to the sensor elements and with it may result in a total failure of the system.

5.2.5 Faults During Ignition

Faults occurring during ignition may have several causes.

1 In case of additionally monitoring of pilot flame and main flame, the pilot flame may not sufficiently be detected.
   - Check the pilot flame for stable operation

2 Interference
Refer to chapter *5.2.4 Fault on Flame Detection*)

3 Defect in the device.

5.2.6 Faults During Operation

Faults occurring during operation may have 3 causes.

1 The main flame may not sufficiently be detected.
   – Check the main flame for stable operation - provide for visibility throughout the operating range

2 Interference

3 Defect in the device.

5.3 Troubleshooting

on apparently immaculate functioning according to the indicator elements

1 Check the output contact fuse and the contact
   – Disconnect the flame scanner from the supply voltage
   – Check the normally closed output contact at the 1st clamping point behind the flam scanner between the brown (BR) and the white (WH) connection wire (avoid low resistance continuity check - fuse 500 mA)
   – Connect the flame scanner to the supply voltage
   – Check with simulated flame between the brown (BR) and the green (GN) connectio wire

2 Check the supply voltage
   – Connect the flame scanner to the supply voltage
   – Check the supply voltage at the 1st clamping point behind the flame scanner betwee the red and the blue connection wire for compliance with the voltage limits (in particular the lower limit)
   – Repeat test with simulated flame

5 Instructions for Maintenance

5.4 Maintenance

5.4.1 General Information

Provisions shall be made to ensure that the light entry port of the flame sensor and the viewing port on the furnace, where the sensor is fitted, are regularly cleaned, i.e. at regular intervals, which depend on the operating conditions of the furnace. The compact flame scanner needs no maintenance. The operation of the flame scanner by physically shutting off the flame should be incorporated into the maintenance cycle for the device.

NOTICE

If it is necessary to clean the optics of fiber optic flame scanners, special care should be taken to clean the fiber optic surface. Damage to the surface can result in significant signal loss.

5.4.2 Instructions on Troubleshooting

⚠ **DANGER!**

The flame scanner is a safety device.
Any repair work or other changes to the device shall only be carried out by the manufacturer's specialist staff or by some other persons appointed by the manufacturer.
Any other person are not allowed to operate on parts inside the device.
In particular, this concerns the unauthorized exchange of the flame contact fuse.

6 Appendix

6.1 Layout of the Operational Controls

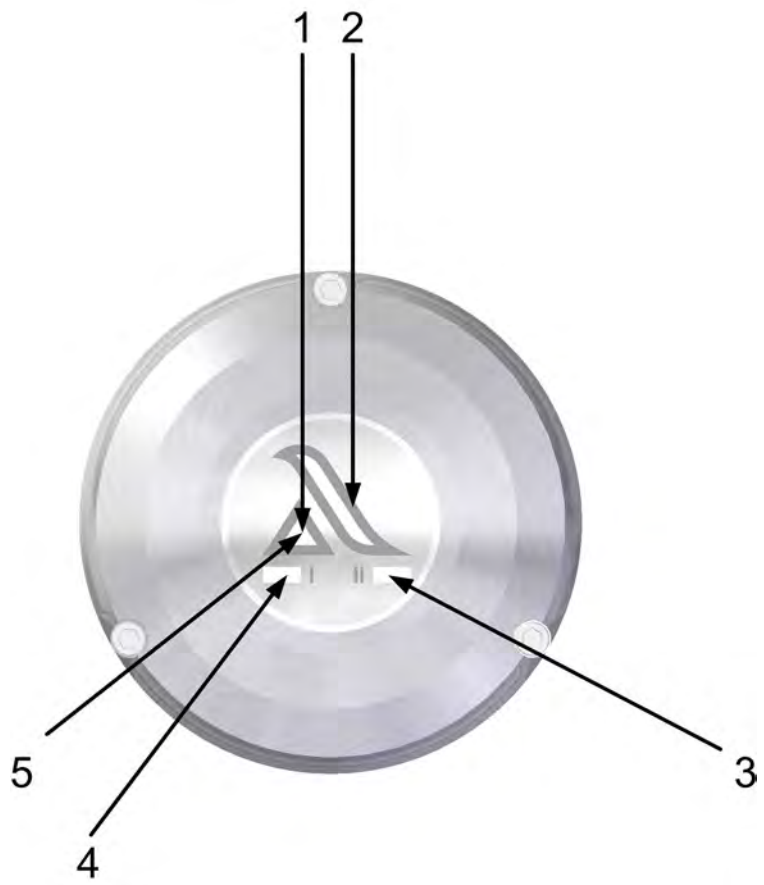

Fig. 6-1 Monitoring and control elements F200K2

1 **LED (green):** Indication, ’Flame in’ state

2 **Intensity indicator** for flame signal in the range 0 ... 100 %

3/4 **LED (yellow)**, only for F200K2, lights for active range.

5 **LED (red):** Indication, "Flame out state"

7 Accessories

7.1 Flame Scanner Testing Device

Fig. 7-1 Flame Scanner Testing Device FFP30

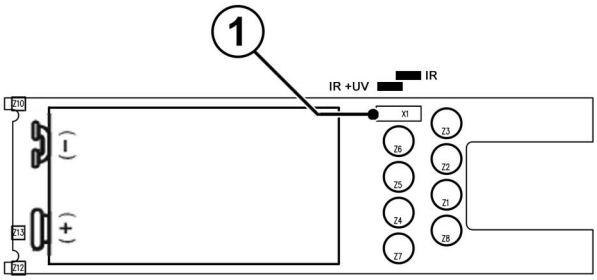

Fig. 7-2 1. (1) Positions of the internal jumper IR + UV

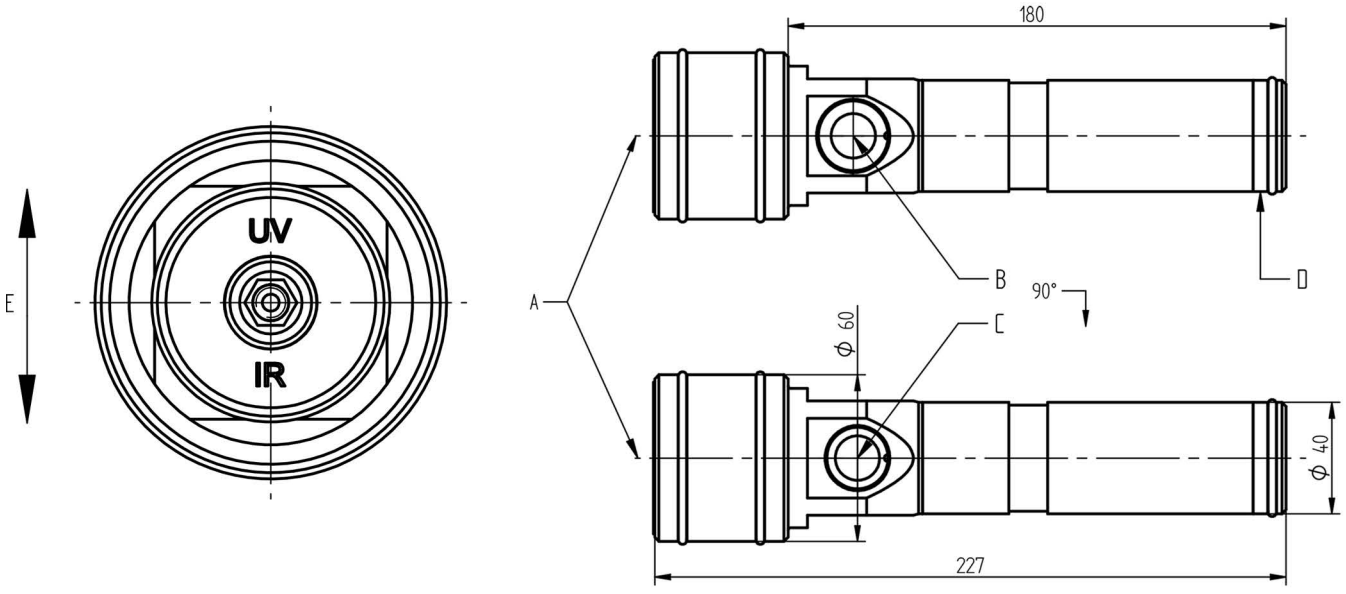

Fig. 7-3 Dimensional drawing FFP30

A	Threaded receptacle for F200K, F300K, FFS30
B	Plug-in receptacle for FFS08
C	Plug-in receptacle for FFS07
D	Changing battery (9 V, 500 mA - turn left to open housing)
E	Toggle switch

7 Accessories

Design	
Area of application	IR- and UV flame sensor Switching by means of toggle switch
Frequency range	Flame simulation by 4 frequency ranges
Power supply	alkaline battery 9 V, 500 mAh automatic switch-off by approx 5 min Battery life approx. 3 years
Housing	
Design	cylindrical aluminium housing
Montage	direct connection to: Threaded receptacle for F200K, F300K, FFS07, FFS30 Plug-in receptacle for FFS08, F200K
Environmental conditions	
Degree of protection	IP54
Level of protection	III
Weight	0.52 kg/1.15 lb

7 Accessories

The information in this publication is subject to technical changes.

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