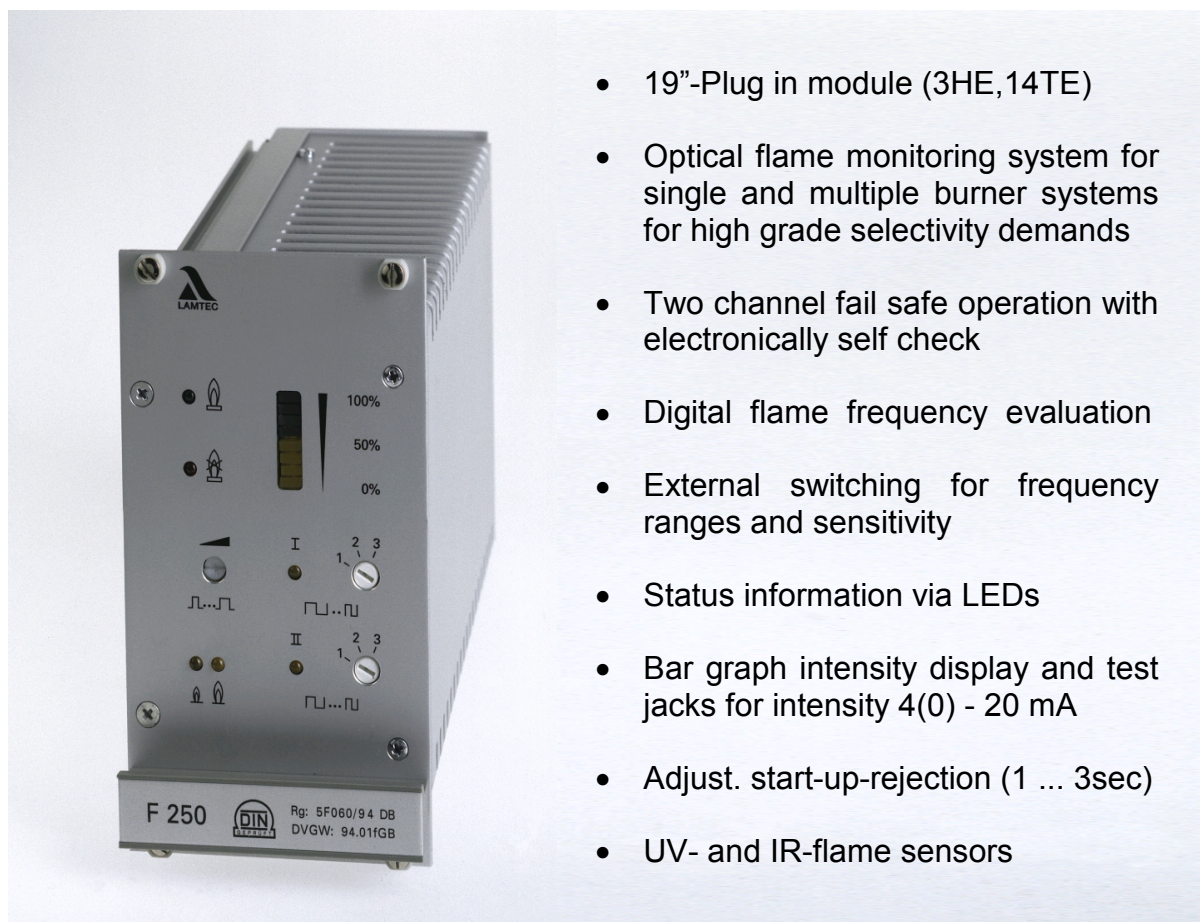


Technical Description

Flame Monitoring System F 250



- 19"-Plug in module (3HE,14TE)
- Optical flame monitoring system for single and multiple burner systems for high grade selectivity demands
- Two channel fail safe operation with electronically self check
- Digital flame frequency evaluation
- External switching for frequency ranges and sensitivity
- Status information via LEDs
- Bar graph intensity display and test jacks for intensity 4(0) - 20 mA
- Adjust. start-up-rejection (1 ... 3sec)
- UV- and IR-flame sensors

Prototype proofed

DIN EN 230 for oil operation
DIN EN 298 for gas operation
72-hours-TRD 604 operation

Registered numbers

DIN-CERTCO-Reg.-No.: **5F060/99**
DIN-DVGW -No. : **NG-2530AP1025**
Prod.-Ident-No.: **CE-0085AQ0813**

LAMTEC Leipzig GmbH & Co KG

Schlesierstr. 55, D-04299 Leipzig, Telefon (+49) 03 41 / 86 32 94 00, Telefax (+49) 03 41 / 86 32 94 10

LAMTEC Leipzig GmbH & Co KG	Technical Description Flame monitoring System F250 / FFS 05 ...	Ausgabe: 03/00 Blatt-Nr.: 2
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LAMTEC Leipzig GmbH & Co KG	Technical Description Flame monitoring System F250 / FFS 05 ...	Ausgabe: 03/00 Blatt-Nr.: 3
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0 Scope

This description informs about how to use the Flame Safeguard F 250 / FFS 05, FFS 05 Ex, FFS 05-1, FFS 05-1 Ex, FFS 05 UV1, FFS 05 UV1 Ex, FFS 05 UV2 and FFS 05 UV2 Ex resp.

1 Purpose

The Flame Safeguard monitors the burner operation of a furnace.

With multiburner installations the burner flame can be selectively acquired and transmitted, independent of the operating condition of the other burners directed to the same combustion chamber. flames, i.e. independently of the operating state of the adjacent burners in the same combustion chamber. In case of flame rupture a safe switching state is produced for the non-existing flame resulting in a cut-off of fuel supply to the defective burner.

This device is mainly utilized in large power stations, heating stations and chemical plants but also used for monitoring furnaces fired with

- oil
- gas
- pulverized coal
- wood dust and chips
- chemical and other waste products

The Flame Safeguard F 250/FFS 05 ... is designed to suit the high-duty operating conditions prevailing in such places. It provides for a high safety, availability and ease of servicing through

- a digital signal processing
- a dynamic self-checking and
- an appropriate number of checking and operational controls.

A potential-free, safe change-over contact is available at the outlet of the flame safeguard.

The two-channel design of the flame safeguard with dynamic electronic self-check and safety cut-out due to fault and the contacts connected in series by the two output relay meet, in addition to component testing, additional requirements on the design of safety devices according to DIN VDE 0116 and TRD 604 for a 72-hours-operation.

LAMTEC Leipzig GmbH & Co KG	Technical Description Flame monitoring System F250 / FFS 05 ...	Ausgabe: 03/00 Blatt-Nr.: 4
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2 Technical data

2.1 Parameters

Input values to the flame sensor

Flame radiation input values required to generate the "FLAME IN" message:

- Spectral radiation range = 260 ... 400 nm (FFS 05 UV1, FFS 05 UV1 Ex)
- Spectral radiation range = 210 ... 380 nm (FFS 05 UV2, FFS 05 UV2 Ex)
- Spectral radiation range = 850 ... 1200 nm (FFS 05-1, FFS 05-1 Ex)
- Spectral radiation range = 1200 ... 2800 nm (FFS 05, FFS 05 Ex)
- Pulse frequency ca. 10...200 Hz

Output values from the flame monitoring device

Output pin	Changeover
- Permissible switching voltage	max. 250 V AC; 30 V DC . min. 6 V AC/DC
- Permissible switching current	max. 0.5 A min. 1 mA
- Assigned fuse in device	0.5 A (TR 5-T/Wickmann)
- D.C. switching capacity	15 W max.
- A.C. switching capacity (cos φ : = 0.4)	50 VA max.
Safety period "operation"	$t_{\text{Voff}} \leq 1\text{s}$
Other safety periods, e.g. acc. to TRD 413, are adjusted internally	$t_{\text{Voff}} \leq 3\text{ s}$

Dynamic parameters

Self-check clock pulse	t_{pulse} abt. 1.5 s for safety period $t_{\text{Voff}} \leq 1\text{ s}$ t_{pulse} up to 4.5 s for safety period $t_{\text{Voff}} \leq 3\text{ s}$
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LAMTEC Leipzig GmbH & Co KG	Technical Description Flame monitoring System F250 / FFS 05 ...	Ausgabe: 03/00 Blatt-Nr.: 5
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2.2 Miscellaneous

Self-check principle

- Signals are processed via two separate transmission channels which are alternately polled
- To check for antivalence the two output levels are continuously compared one with another

Adjustment of parameters, furnace - monitoring device

A potential-free external contact at the flame safeguarded F 250 (plug-type connector X1 A 18/C18) to change over between two sensitivities of the flame sensor FFS 05 and FFS 05 Ex resp.

The current sensitivity is displayed at the front of the device through yellow LED (1.1 min., 1.2 max. see item 10).

Four signal transmission ranges can be preselected by two selector switches for two modes of operation of the flame safeguard F 250.

Transition from mode II to mode I is effected by closing one external contact, such as of a higher-ranking control. The active mode and the preselected transmission range are displayed.

Mode I		Mode II	
1	10 ... 190 Hz ¹⁾	1	55 ... 190 Hz ²⁾
2	20 ... 190 Hz ¹⁾	2	75 ... 190 Hz ²⁾
3	30 ... 190 Hz ¹⁾	3	110 ... 190 Hz ²⁾

¹⁾ the stop range being 45 ... 55 Hz and 90 ... 110 Hz ³⁾

²⁾ the stop range being 90 ... 110 Hz ³⁾

³⁾ this applies to devices with a 50 Hz mains frequency.

3 Structure (see section 11 - device structure)

The flame safeguard consists of :

a Flame Sensor FFS 05, ... which will alternatively be installed with the FS 19, FS 20, F 36 or FS 41 adjustable holding device, and a F 250 Flame Monitoring Device, which contains the functional units:

- FAD 15 Digital Evaluation Unit
- FSW 12 Switching Amplifier
- FVE 15 Supply Unit.

LAMTEC Leipzig GmbH & Co KG	Technical Description Flame monitoring System F250 / FFS 05 ...	Ausgabe: 03/00 Blatt-Nr.: 6
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Flame Sensor FFS 05, ...

The sensor circuit components are located on P.C.B.'s, which are accommodated in a cylinder. The latter is provided with an axial light entry port, which has a jet-proof cover. The flame sensor has an IP 65 enclosure.

F 250 Flame Monitoring Device

The module components are arranged on pc cards, which are electrically and mechanically connected with each other. They are specially suitable for being used in 19" sub-racks and casings. The F 250 flame monitoring device is supplied as plug-in unit (3 HE, 14 TE).

For accommodation sub-racks and casings for front panel installation and wall-mounting are available. The controls are arranged at the front. The device is connected from the rear via a plug-and-socket connector of the D type (see pin connection sheet 20) or via terminal strips when being installed in sub-racks (20 TE) or casings (see sheet 25) supplied as required.

Item 10 shows the layout of the controls.

4 Mode of operation (s. 9 basic wiring diagram)

The Flame Sensor FFS 05... converts the flame radiation pulses into electrical signals. These representative signals are routed to an electronic commutator, which alternately applies them to one of the independently working processing channels, where the signals are digitized. This reduces the initial signal quantity to the information "pulse period" (information carrier: pulse frequency of the flame radiation).

The F 250 Flame Monitoring Device with its functional units is electrically isolated and mounted separate from the flame sensor.

The FAD 15 Evaluation Unit regenerates the flame signals transmitted by the flame sensor and compares them with reference pulses to pick out for further processing those signals which are within a preselected frequency range, irrespective of their initial amplitude. Signal transmission is in two separate processing channels. The frequency ranges can be preset separately to match two different modes. Switch-over from mode II to mode I is effected by closing a potential-free contact 'Mode changeover' via the plug connector X 1 of the device. The frequency transmission range is preset at the front of the unit.

The current mode is displayed by a yellow LED and the preselected frequency range by a yellow LED at the front of the device. The frequency transmission ranges are adjusted by means of the switches at the front.

LAMTEC Leipzig GmbH & Co KG	Technical Description Flame monitoring System F250 / FFS 05 ...	Ausgabe: 03/00 Blatt-Nr.: 7
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The FSW 15 Switching Amplifier has two separate signal processing channels where the amplitude evaluation of the rectified flame frequency signals from the digital evaluation unit FAS 15 takes place.

Moreover, a third processing channel, which works independently of the two signal processing channels, activates a time switching in connection with a start suppression. This makes pickup times possible within a wide range in accordance with the technological specifications. The standard setting range is from 1 to 3 sec.

Moreover, an additional start suppression can be preselected, so that unwanted pulse rates occurring during the starting time will not be assessed. The settings are made on the rear side of the device (see page 17).

A safe monitoring of the non-equivalent switching states and the operate and turn-off delays are carried out at the output of the signal processing channels before the relay at the end of each signal processing channel can output generate the 'Flame In' state. Disturbances of non-equivalence operation and deviations from time lags beyond the admissible limits lead to an immediate switching-off of the standby position and the 'Flame Out' state.

Before the device is ready for flame monitoring again the 'Standby' state has to be provided at the plug-and-socket connector X1/A16, C16 by an external, potential-free contact (NO contact), for example. In case the interlocking of flame monitoring is carried out by a follow-up control (e.g. burner control) the contacts can be permanently bridged.

The FVE 15 Supply Unit has several functional units and connecting devices for

- 24 V DC auxiliary power
- system earth
- flame sensor
- the safe, external signal processing of the switching states 'Flame Out' or 'Flame In'
- setting up the standby state
- switching over from mode II to mode I
- external switch-over of two sensitivities (min, max-.)
- display of intensity and its measuring output.

The pc card covers functional units suitable for switching and overcurrent limitation of the 24 d.c. auxiliary energy supply, for non-reactive supply of the pc cards FAS 15 and FSW 15 with d.c. current voltage, for potential-separated d.c. working voltage generation and information signal transmission between the flame monitoring device F 250 and the flame sensor

FFS 05, ... and for the indication of intensity with measuring outlet.

LAMTEC Leipzig GmbH & Co KG	Technical Description Flame monitoring System F250 / FFS 05 ...	Ausgabe: 03/00 Blatt-Nr.: 8
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5 Operating conditions

Auxiliary energy, input

Voltage U_{H1}	24 V DC + 20 % - 15 %
Max. admiss. voltage dip U_{H1}	$\geq 0.85 U_{H1} / 0. \text{ to } 20 \text{ ms}$
Rated direct current I_{H1}	0.15 to 0.35 A (depending on function)
Assigned fuse in device	0.15 A (TR 5-T/Wickmann)

Output for supply of flame sensor FFS 05...

Voltage max. U_{H2}	26/40 V d.c.
Max. admiss. current drain I_{H2}	15 mA
Sustained short-circuit current drain I_K	20 mA

Measuring output of intensity

Output direct current	4 ... 20 mA
on request	0 ... 20 mA
Maximum burden	500 Ω
Floating d.c. voltage	18 to 28 V
Intrinsic error Output voltage	$\pm 2 \%$
on request	0 ... 10 V
Internal resistance	1 k Ω
Intrinsic error without load	$\pm 2 \%$

Mode change-over

Output X 1 A/C 20

Floating voltage	18 ... 28.8 V
Switching current	40 ... 60 mA

Setting up the readiness of operation

Output X1 A/C 16

Floating voltage	18 ... 28.8 V
Switching current	8 ... 10 mA
Min. admiss. closing time	0.1 s

External change-over of sensitivity (min., max.)

Output X1 A/C 18	
Floating voltage	18 ... 28.8 V
Switching current	8 ... 10 mA

LAMTEC Leipzig GmbH & Co KG	Technical Description Flame monitoring System F250 / FFS 05 ...	Ausgabe: 03/00 Blatt-Nr.: 10
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Transport (in original packing)

- Transport in closed holds
- Air temperature range - 40 ... + 70 °C
- max. temp.-to-moist. ratio 80 % at 35 °C

Approvals

Prototypes have been extensively tested by TÜV-Bayern-Sachsen test certificate FO 62 for oil burners and test certificate FGE 134 for gas burners.

DIN- DGWK registration no.:	5F060/99
DIN- DVGW test no.:	NG-2530AP1025
CE-no.:	CE-0085AQ0813

Wear parts none

6 Instructions on assembly and installation

6.1 Assembly

6.1.1 General

The radiation emitted by a flame contains a pulsating portion (flickering). This results from the processes, which occur during combustion. The pulse frequency at the root of the flame (near the burner head) is relatively high compared with the pulse frequency at the tip of the flame, i.e. there is a frequency decrease from the root to the tip of the flame.

Selective monitoring of burner flames in multiple-burner furnaces is based on this phenomenon. It requires proper positioning of the flame sensor to make sure that the sensor covers a predetermined observation point within the combustion chamber. We recommend the use of our FS 19, FS 20, FS 36 and FS 41 adjustable holding devices (see item13).

- The flame sensor must be positioned in such a way that it covers the root of the flame (high frequency) in the "FLAME IN" state.
- In the "FLAME OUT" state, the sensor may only detect the residual radiation, emitted by the other flames (low frequency).

By proper adjustment the flame monitoring device connected downstream from the sensor, is capable of distinguishing the signal states "IN" and "OUT".

Accurate positioning of the flame sensor is essential to obtain good selection quality.

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WARNING

Sensor cable routes must be separate from mains and control cables, as well as high voltage power cables and equipment (such as ignition cables and transformers, electrical motors, contactors). Parallel routing of sensor cables in mains cable trays is not permitted.

6.1.2 Flame Sensor FFS 05, ...

- Dimensions see item 12.2 dimensioned drawings
- Weight abt. 0.4 kg
- Cable type LiYCY stranded hook-up wire (blue, red, green, yellow, white)
or 5 x 1 x 0.5 mm² (AWG 20)

The FFS 05, ... come with an abt. 3 m long connecting cable . The connecting cable between flame sensor and flame monitoring device can be extended by up to 500 m. We recommend the use of a separate, five-core, shielded cable as a local extension line, which is to be connected to the sensor cable through the FG 21 "branch box".

The FFS 05, ... are to be mounted on the socket piece of the viewing port, through which the flame must be fully visible within the whole operating range of the furnace. The viewing port must be located in such way that the flame sensor covers the first third of the burner flame to be monitored (vicinity of the burner head). It should be taken into account that the longer the socket piece is, the more the range covered by the FFS 05... is restricted. The viewing port must be sealed with protective glass.

6.1.3 F250 Flame Monitoring Device

- Dimensions see item 12.1 dimensioned drawing

The flame monitoring device is mounted on a vibration-proof support. The place of installation should be easily accessible for an easy monitoring of the visual controls even during operation. When replacing a flame monitoring device make sure that the new device has an identical identification.

Make sure that the maximum admissible ambient temperature of 60°C is not exceeded on the erection site.

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6.2 Installation

6.2.1 External installation

The flame safeguard ready for operation delivers the "FLAME IN" and "FLAME OUT" state messages to a potential-free contact output. Further signal processing is effected by a control unit adapted to the respective furnace.

After each "FLAME OUT" message the "readiness for operation" signal is to be restored by momentarily bridging the ccontacts X1/A16 after C16. This can be rendered via a potential-free contact (NO contact) which is actuated by the control unit, when releasing the start-up or ignition instruction. In case the interlocking of the flame monitoring is carried out by a follow-up control (such as burner control), these contacts may constantly remain bridged.

When switching over from mode II to I a connection is made from X1/A20 to X1/C20 at the plug-and-socket connector of the flame monitoring device F 250. The external change-over of the sensitivity (min., max) is rendered by a connection from X1/A 10 to X1/C10 (potential-free contact).

For operational safety make sure when installing the output contacts, that the user carries out the interference suppression so that the contacts cannot be short-circuited by defective components of the suppressor.

6.2.2 Connecting the device

(see pin assignment sheet 20)

7 Instructions on commissioning and maintenance

7.1 Commissioning

7.1.1 General

The flame sensor is to be checked for proper positioning

Before the flame monitoring device is connected to the auxiliary energy check the connections of the terminal connector of the flame monitoring device in the rack according to the connection diagram.

7.1.2 Preparatory measures

The selector switches 7 and 9 for the transmission of the flame frequencies in the modes I at II have to be preset accordingly (1...4).

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7.1.3 "FLAME OUT" state

The flame safeguard is ready for operation about 10 s after auxiliary energy connection.

The following has to be display

- "FLAME OUT" red LED 2 light up
 - Mode II yellow LED 9 light up
 - Mode I yellow LED 7 light up
- when X1/A20 is connected with X1/C20

Frequency transmission range

	Mode I	Mode II
Setting 1	10 ... 190 Hz	55 ... 190 Hz
2	20 ... 190 Hz	75 ... 190 Hz
3	30 ... 190 Hz	110 ... 190 Hz

7.1.4 "FLAME IN" state

To check monitoring functions, install the flame sensor at the predetermined position, when the furnace is in operation.

When the flame burns properly, the display should change as follows:

- "FLAME OUT": LED (red) 2 goes out
- "FLAME IN": LED (green) 3 lights up changing the radiation intensity in cycles
- Mode II or LED (yellow) 9 lights up
- Mode I LED (yellow) 7 lights up
- Modes II and I as per presetting with transmission ranges 1 ... 3
- Intensity display LED line 4 green section lights up

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7.1.5 Flame failure switch-off test

A rupture or extinguishing of the flame is to be simulated. This may be effected by darkening the light entry port at the flame sensor. It must be checked that the 'extinguishing' of the flame during the time $T_s < 1 \text{ s}$ the signal for safety valve closing is released. The green LED 3 goes out, and the red LED 2 lights up. ('Flame in' state).

7.2 Maintenance

7.2.1 General

- 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 to be fit in, are regularly cleaned, i.e. at regular intervals, which depend on the operating conditions of the furnace.
- The F 250 Flame Monitoring Device needs no maintenance.
- The flame failure induced switch-off check is to be integrated into maintenance work.

7.2.2 Instructions on debugging

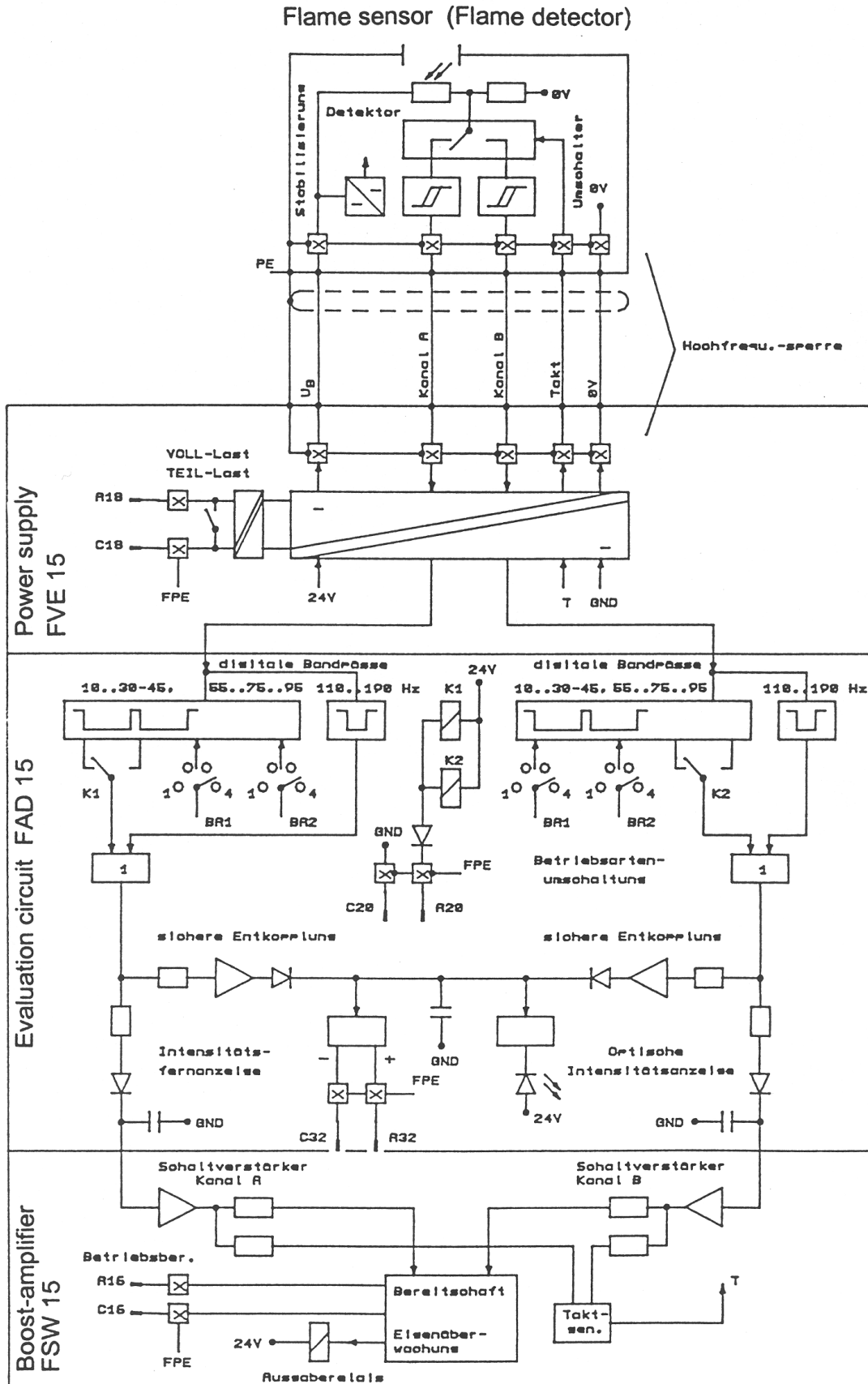
The flame safeguard is a safety device. Any repair work or other changes to the device shall only be effected by the manufacturer's specialist staff or by some other person appointed by the manufacturer. Any other person are not allowed to operate on parts inside the device.

8 Guarantee and delivery terms

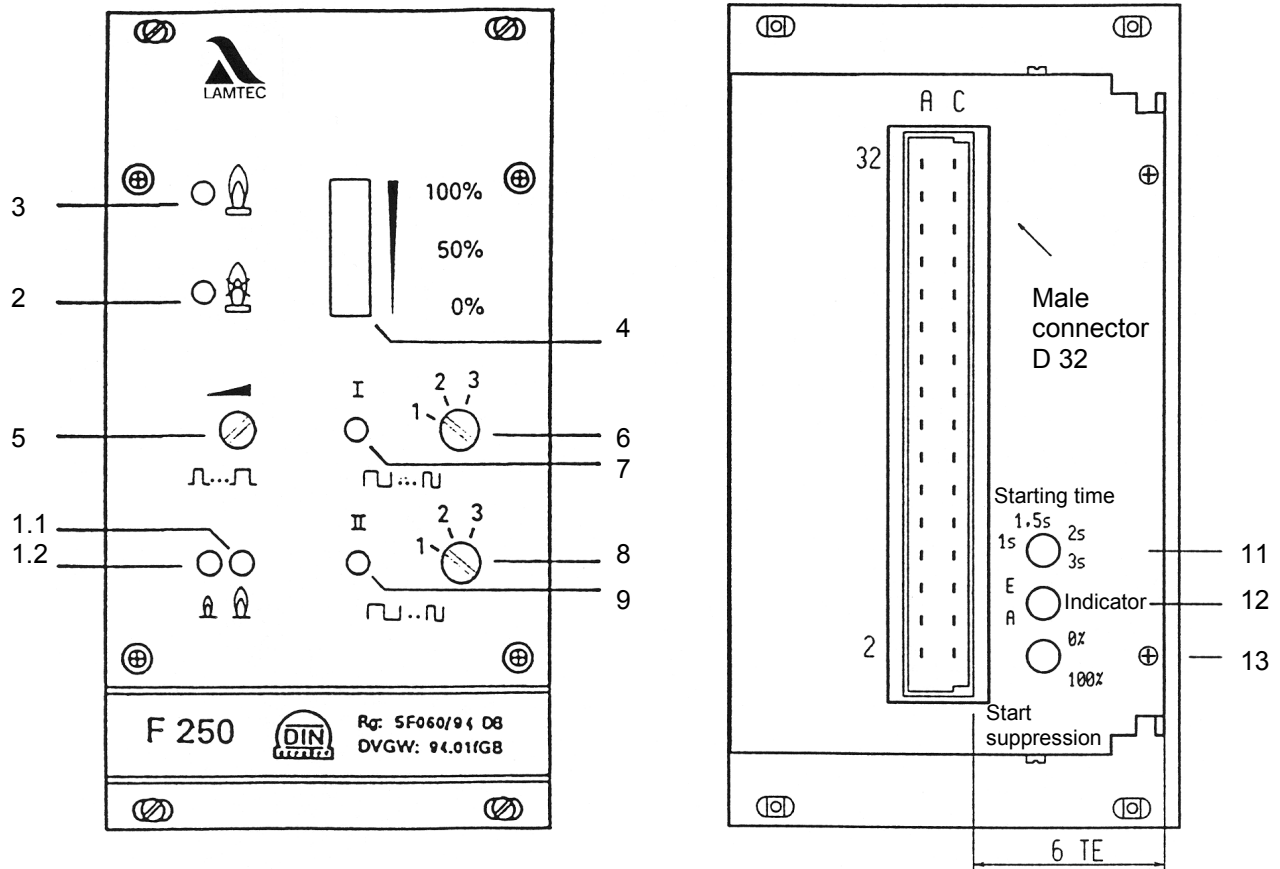
The manufacturer's conditions of guarantee shall apply. Any changes to and operations on components of the flame sensor or the monitoring device effected by unauthorized persons will result into refusal of claims under guarantee.

Delivery will comply with ordering details. The terms of deliveries and services of the Hartmann & Braun Leipzig GmbH, and the general terms of delivery for products and services made or rendered by companies of the electrical industry, shall apply.

9 Basic wiring diagram - Flame Safeguard F 250/FFS 05, ...

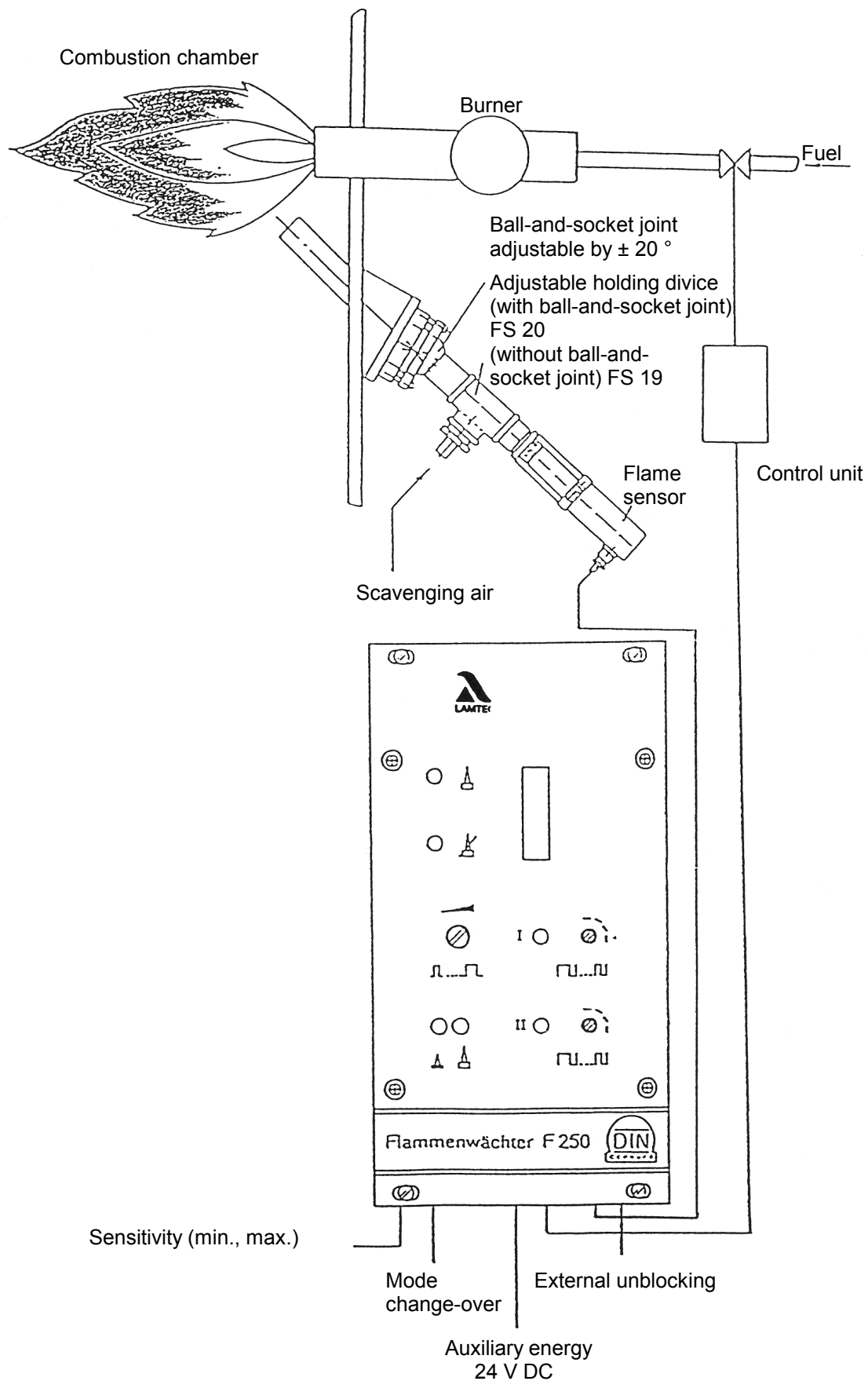


10 Controls



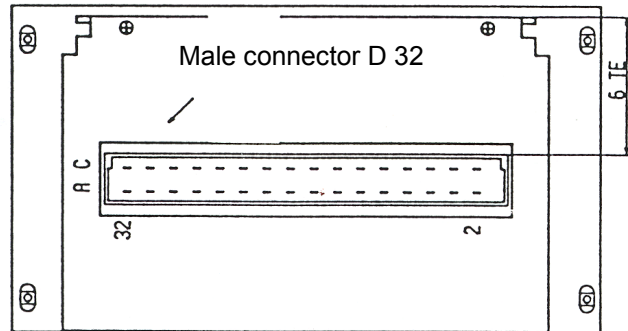
- 1.1 Sensitivity min.
- 1.2 Sensitivity max.
- 2 LED (red) Indication → → Flame out
- 3 LED (green) Indication → Readiness of operation → Flame in
- 4 Intensity display
- 5 Intensity adjustment
- 6 Frequency range adjusting device / Mode I (e.g. gas, pulv. coal, wood)
- 7 LED (yellow); Display / Mode I
- 8 Frequency range adjusting device / Mode II (e.g. oil)
- 9 LED (yellow); Display / Mode II
- 11 Starting time
- 12 Indicator (On/Off during starting time)
- 13 Start suppression

11 Device Structure - Flame Safeguard F 250/FFS 05, ...

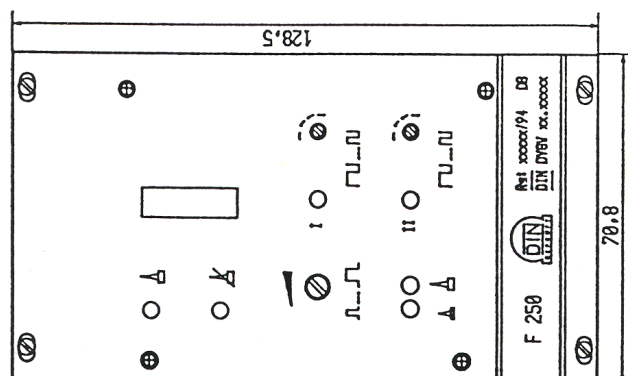
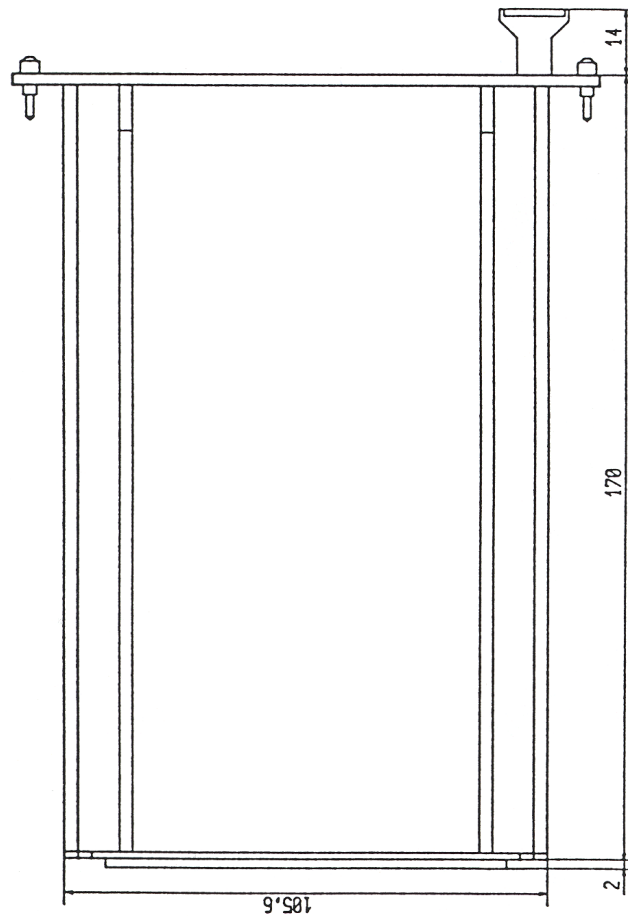


12 Dimensioned and Hook-up Drawings

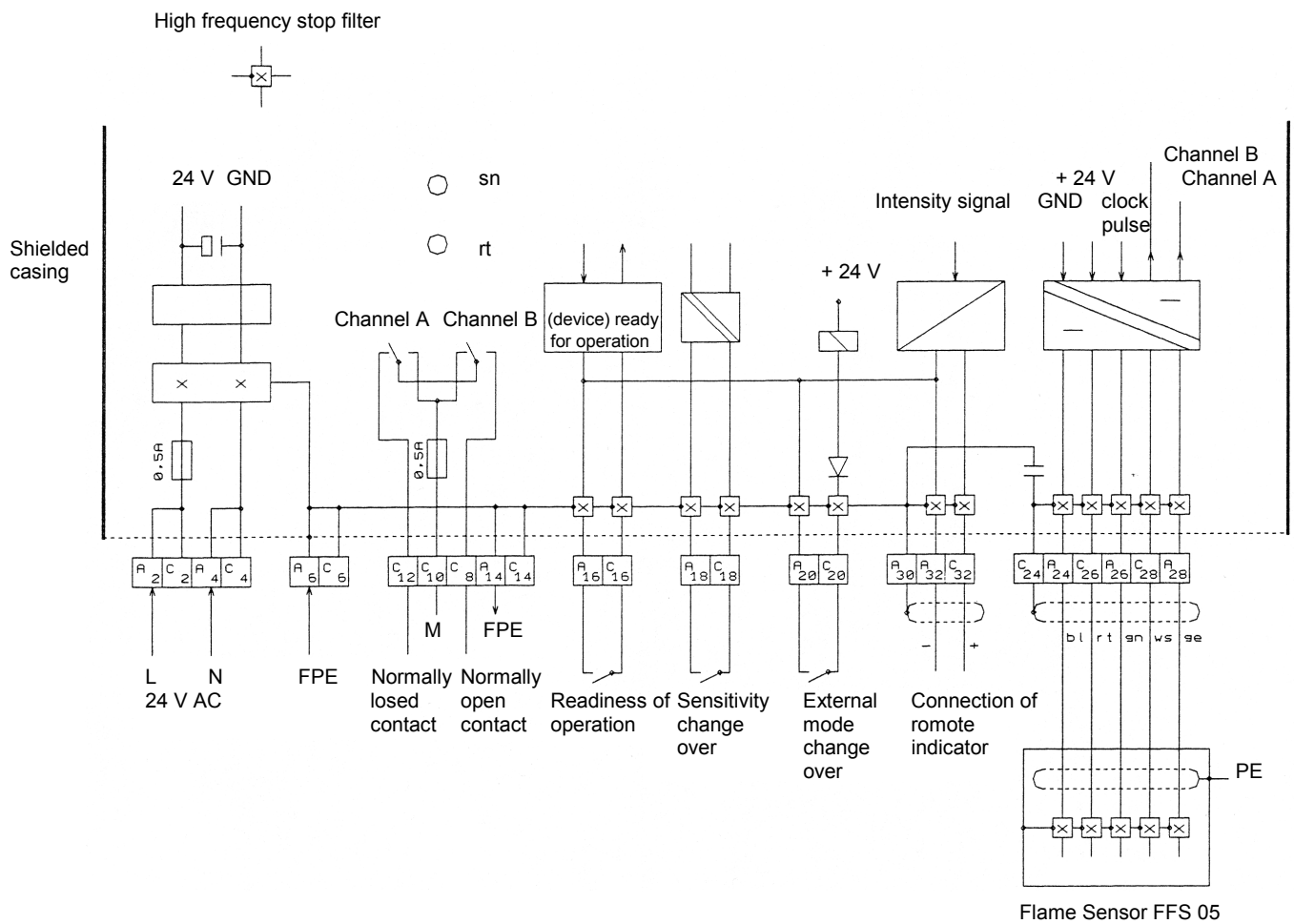
12.1 Flame Monitoring Device F 250



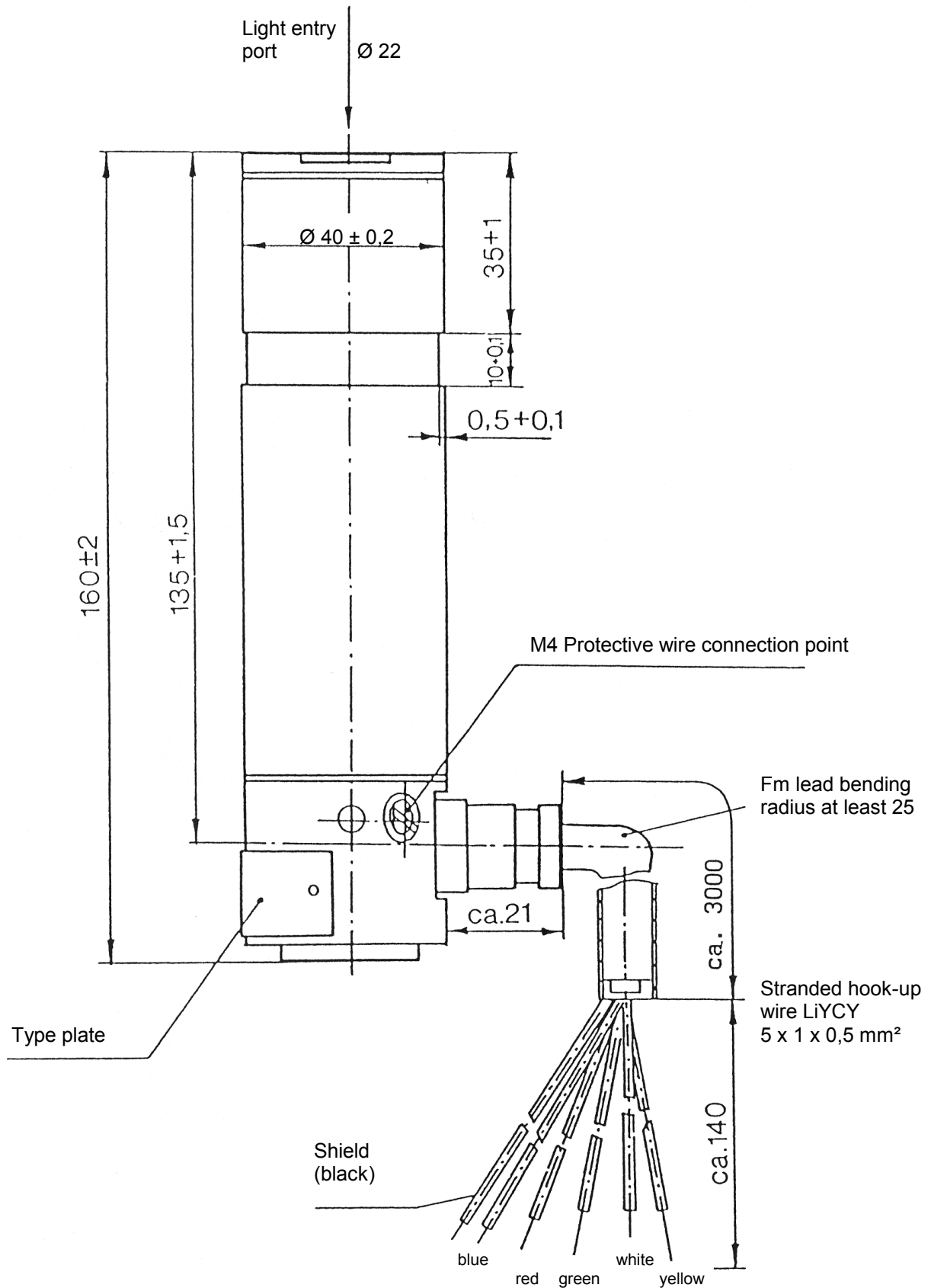
Complete mounted connector,
moved 6 TE from the edge,
180° turned around



Pin connections



12.2 Flame Sensor FFS 05,

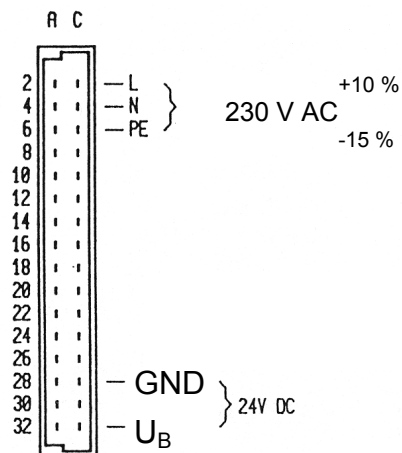


LAMTEC Leipzig GmbH & Co KG	Technical Description Flame monitoring System F250 / FFS 05 ...	Ausgabe: 03/00 Blatt-Nr.: 21
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13 Accessories

13.1 Power supply FN 01

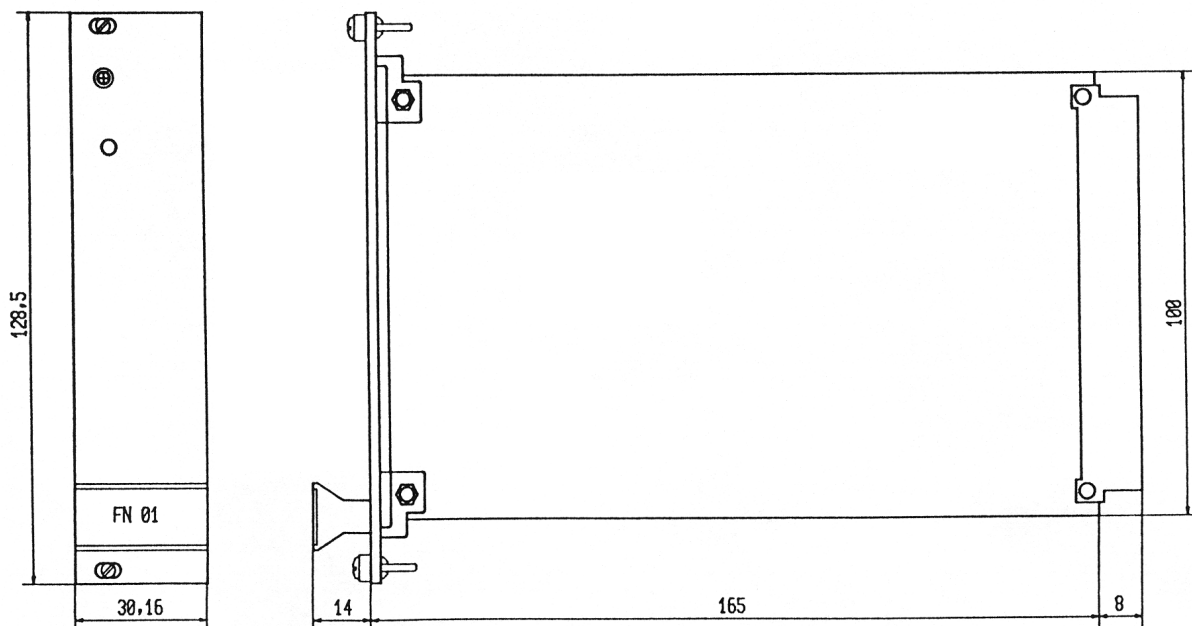
For the connection of the flame monitoring device F 250 to a mains a.c. voltage supply the FN 01 power has been provided. It is designed as 19 " plug-in unit and serves to supply the flame monitoring device F 250 with the necessary auxiliary energy. The electrical connection is either direct or via an existing printed back wiring (Sub-rack or wall-mounted casing, see 13.2.1).



Technical data

Mains a.c. voltage	230 V + 10 % - 15 %
Mains frequency	45 to 55 Hz
Power consumption	10 VA
Assigned fuse in device	0.1 A
Output d.c. voltage	22.5 to 25 V
Max. current drain	0.35 A
Type of operation	continuous

Application class acc. to flame
monitoring device F 250

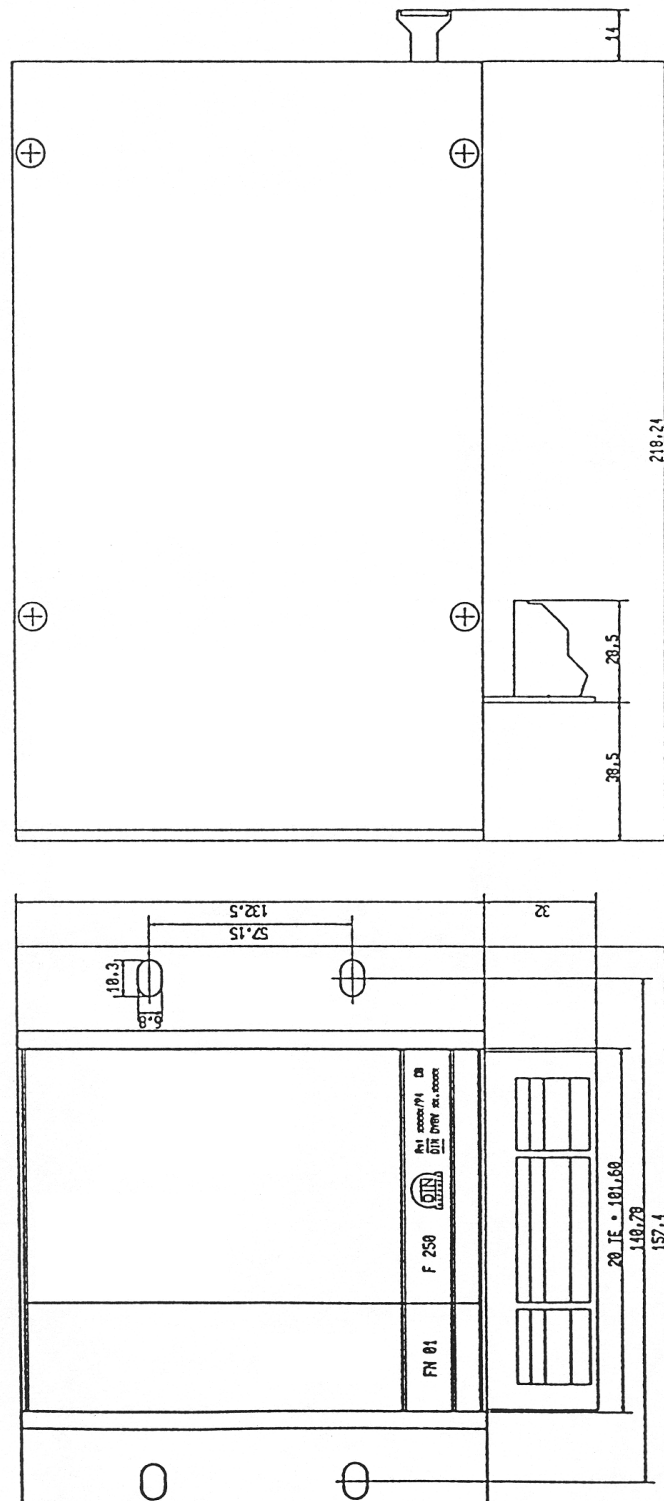


13.2 19" Casings

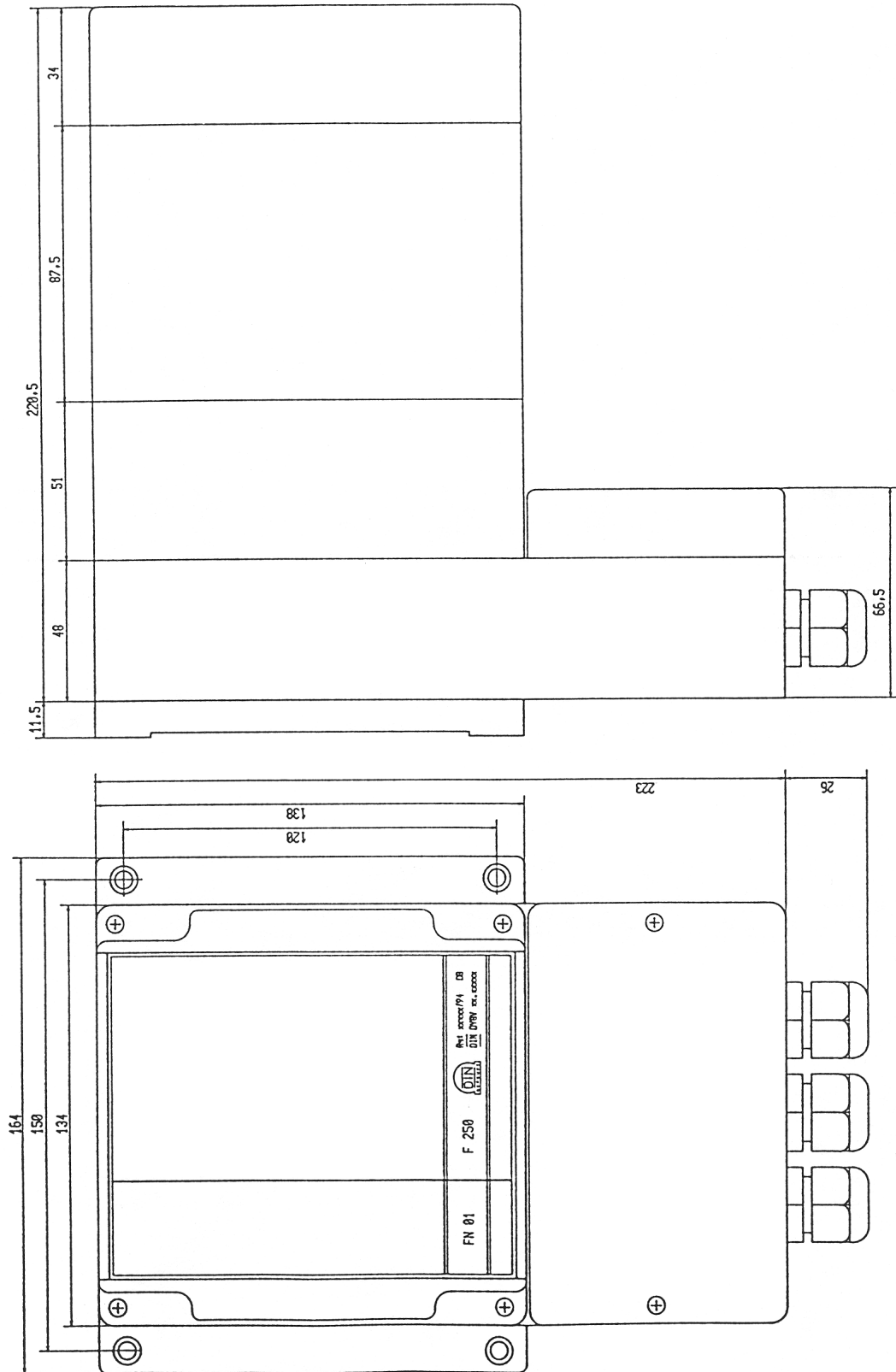
13.2.1 Sub-racks and wall-mounted casings (20 TE)

The delivery includes the back-wiring pc card FRV 15.

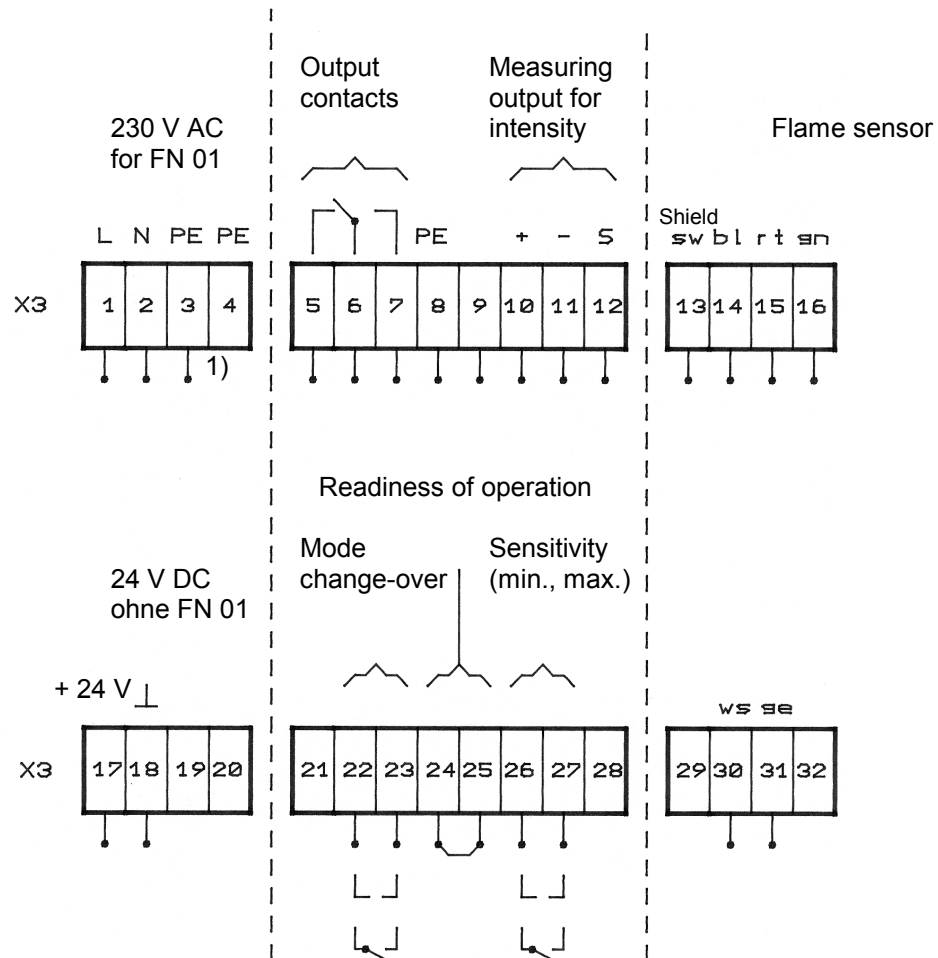
Sub-rack (20 TE)



Wall-mounted casings (20 TE) - Protective system IP 65



Pin connections of sub-racks and wall-mounted casings

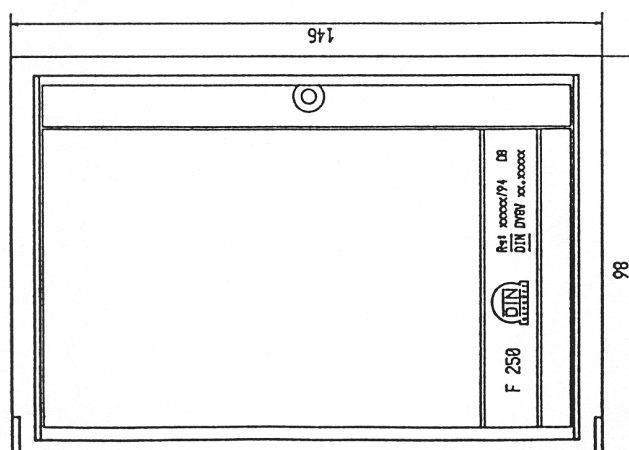
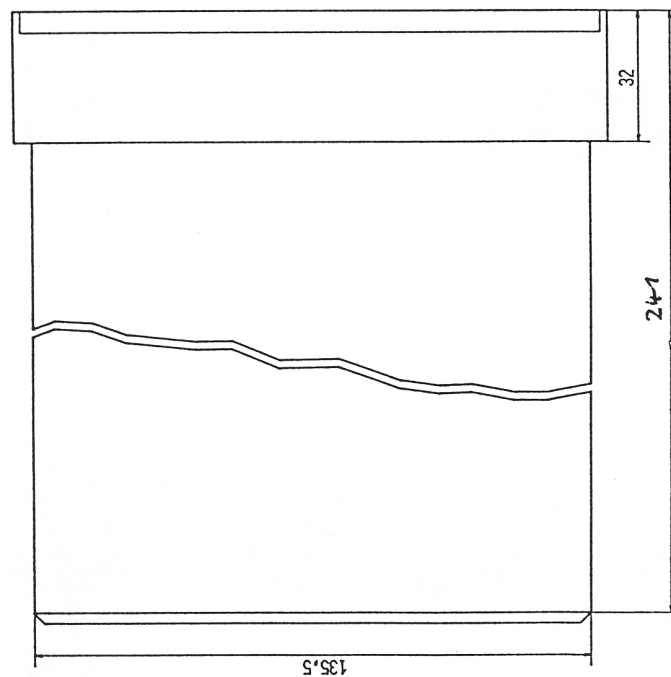
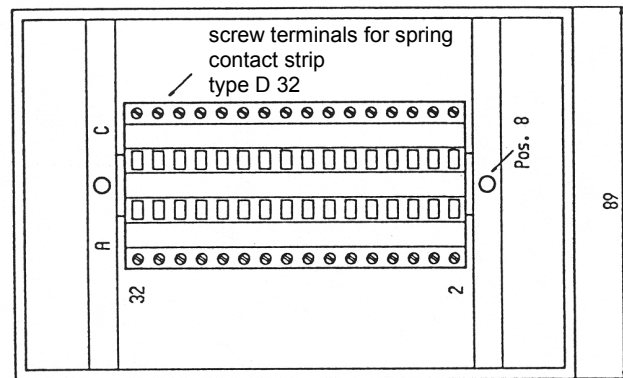


1) it's always necessary to connect ground clamp

Note: when connecting 230 V a.c. terminal 17 must not be wired.

13.2.2 Switch panel casing (16 TE)

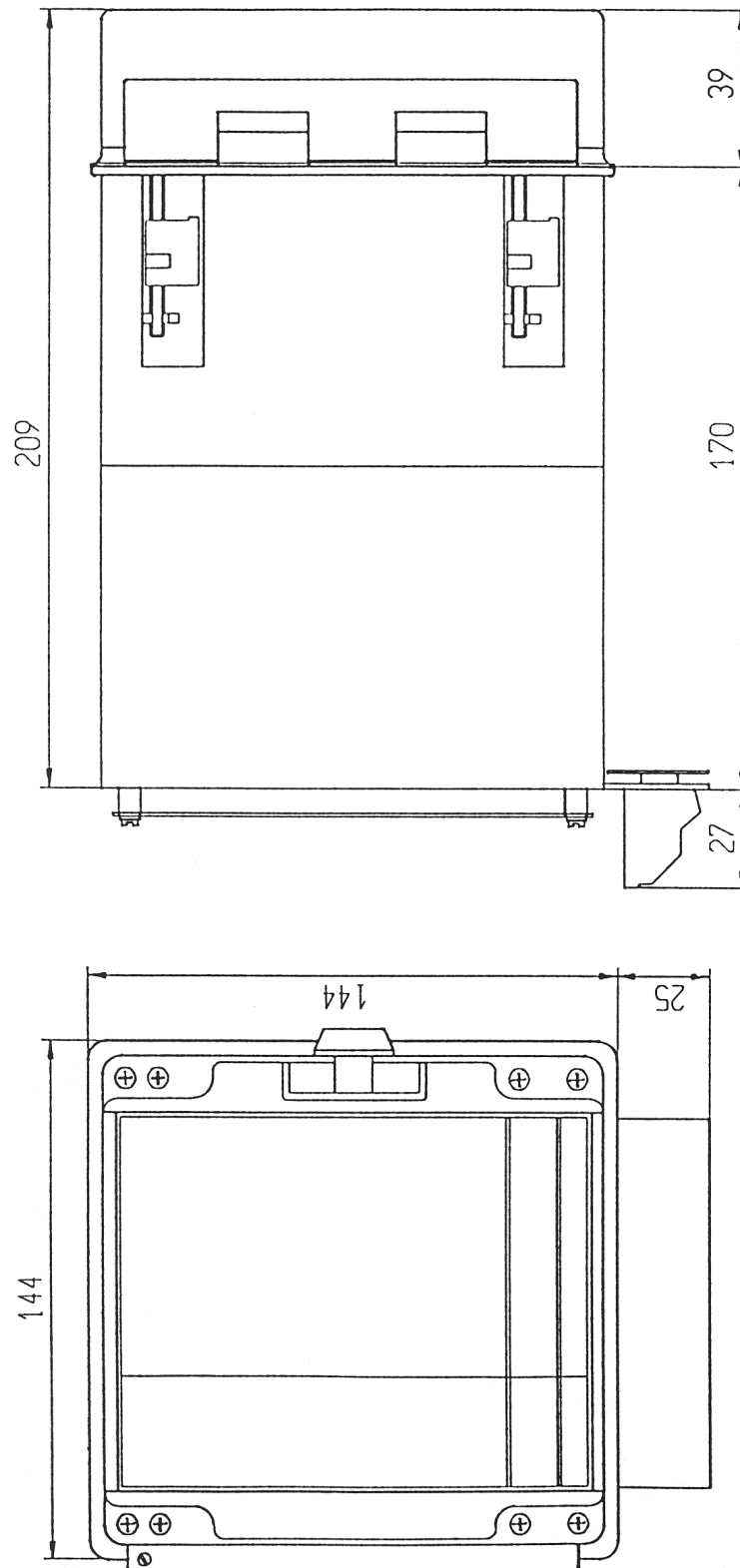
Control panel cutout: $92,0^{+0,8} \times 138,0^{+1,0}$ Protective system: IP 54 (Front door)
For connection diagram: see sheet 20 IP 20 (Connection area)



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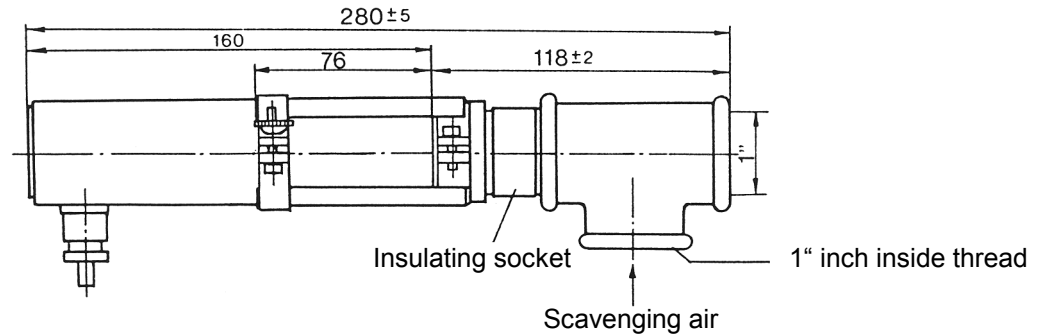
13.2.3 Switch panel casing (20 TE)

Control panel cutout: $137,0^{+1,0} \times 141,0^{+1,0}$ Protective system: IP 65 (Front door)
For connection diagram: see sheet 25 IP 20 (Connection area)

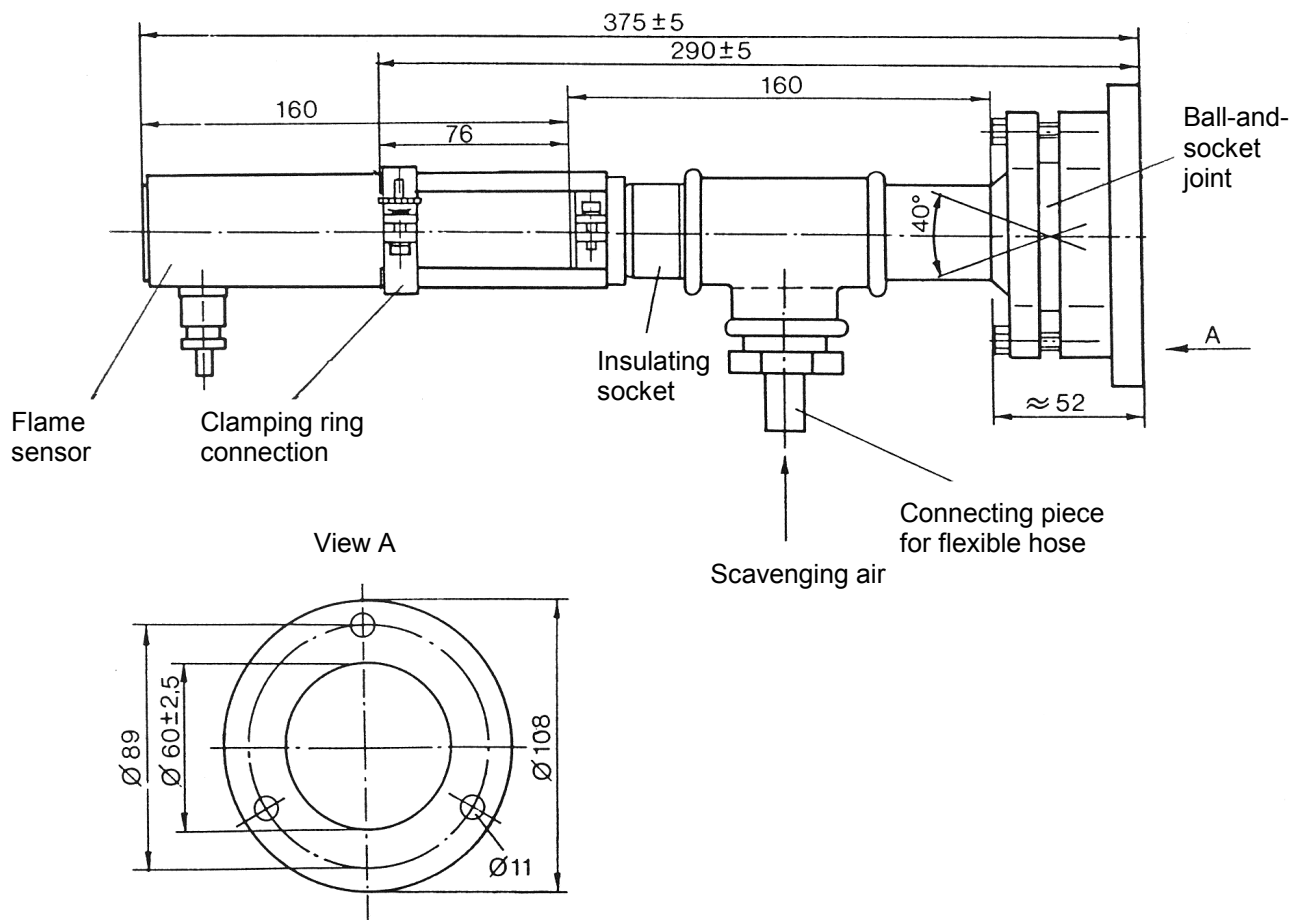


13.3 Adjusting device holder FS 19 and FS 20, FS 36 and FS 41

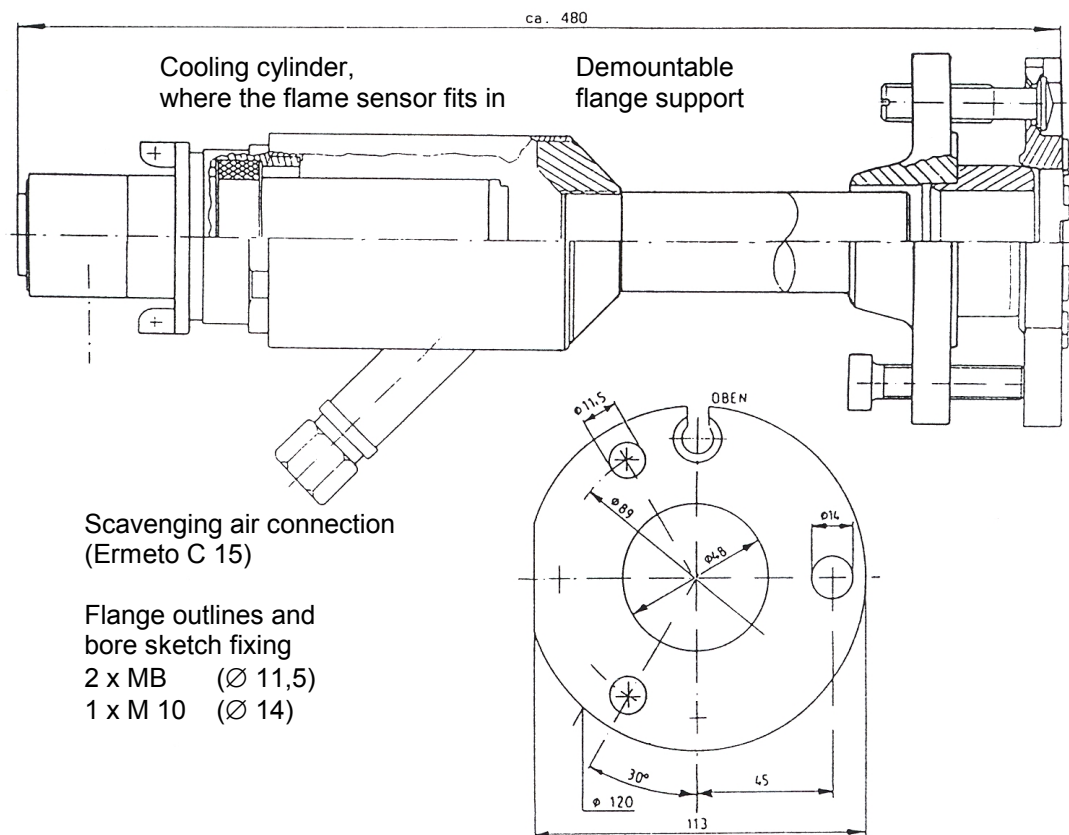
FS 19-3 (without adjusting ball-and-socket flange)



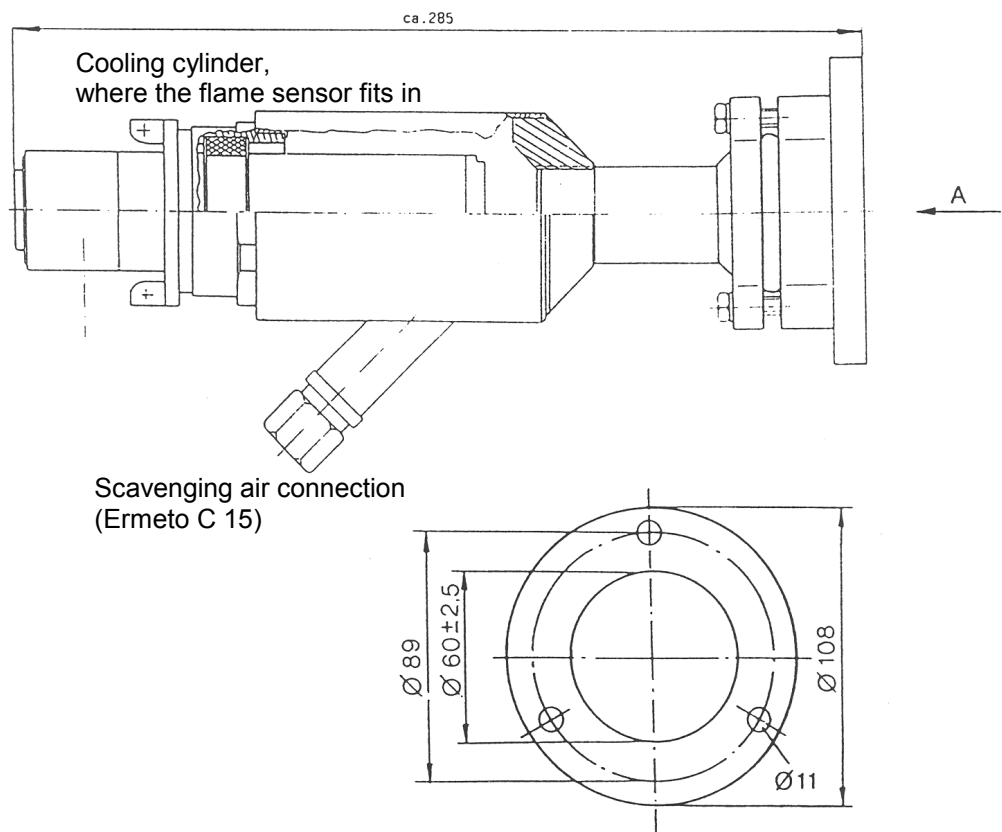
FS 20-1 (with adjusting ball-and-socket flange)



FS 36 (adjustable, demountable, with cooling air casing)

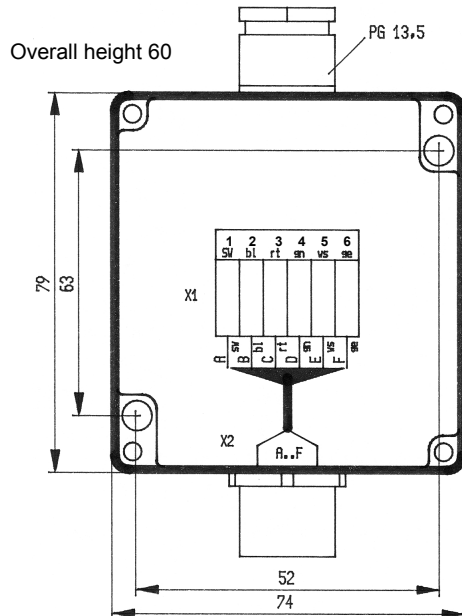


FS 41 (with adjusting ball-and-socket flange and cooling air casing)



13.4 Junction box

FG 21 (aluminium)



Weight: abt. 0.43 kgs

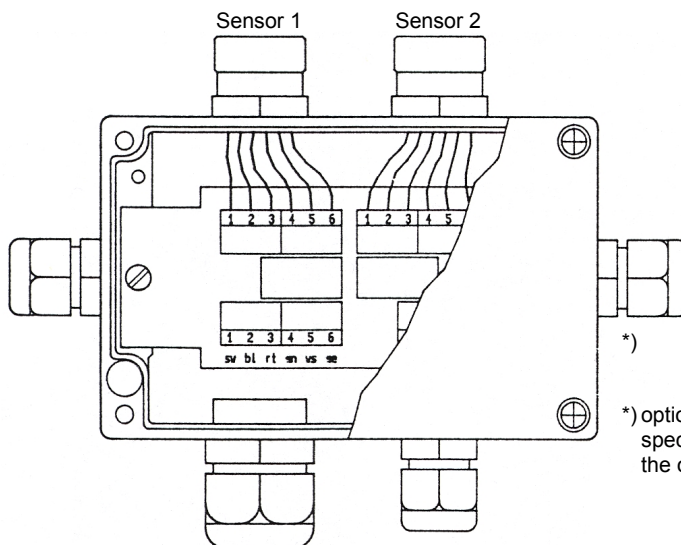
Enclosure type: IP 65

Field of application: -30°C / +90°C
relative air humidity
50% at 40°C
100% at 25°C
(for short periods only)

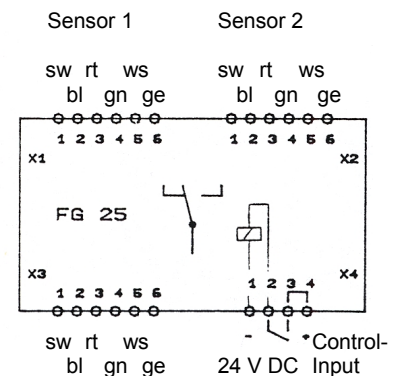
13.5 Sensor Switch Box FG 25 (Aluminium)

The Sensor Switch Box FG 25 can be used to operate two flame sensors on one flame monitoring device. The flame sensors can be selected and switched by external preselection (Control Input).

Provided standard connector for the flame sensors is the Coninvers-Connector PON/02. Screw terminals allow the connection to the flame monitoring device and for the 'Control Input'.



*) optional:
specify with
the order



Switched via control input
24 V DC \pm 20 % / 20 mA wired (x4/1+2)
or
24 V DC \pm 20 % / 20 mA wired (x4/1+4)
and isolated contact, wired (x4/2+3)

Weight: ca. 0,8 kg
Protective Enclosure: IP 65
Operating Condition: analogous FG 21

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Order information

- Connection box FG 21
- Sensor Switch Box FG 25

Remark: On purchasing the Connection Box or the Sensor Switch Box the corresponding Flame Sensor FFS 05 with connector for FG 21 respectively for FG 25 has to be used. The shipment for the explosion proof model generally does not include the connector.