



FM739

Gas Burner Controls

LFM1...

Series 03



Supplementary data sheet 7712

Gas burner controls for burners of small to medium capacity, with or without fan assistance, intermittent operation*.

* For reasons of safety (self-testing of flame supervision circuit, etc.), at least one controlled shut-down must take place every 24 hours.

Use

The plug-in type gas burner controls of the LFM1... range are used for automatic start-up and supervision of single- or two-stage gas burners with or without fan assistance. In addition, they are approved for use with forced draught gas or oil burners and burners of direct-fired air heaters (WLE to DIN 4794). Flame supervision can be provided either by an ionization current detector electrode or a UV detector type QRA...

For burners equipped with one fuel valve, there is a **burner control with a remote reset button** available (refer to LFM2.33 under "Programmed times").

Special features with regard to application

- Thanks to fully electronic programming, the pre-purge and safety times are reliably adhered to, even in the case of over- or undervoltages, after a power failure, or in the case of rapidly succeeding start-up operations, e. g. when rectifying faults
- The proper functioning of the flame supervision circuit is automatically tested during each start-up sequence
- The flame supervision circuit is insensitive to potential adverse effects of the ignition spark path on the ionization current, thus ensuring a fault-free start-up sequence
- The flame signal amplifier is designed such that ignition spark flashouts on the detector electrode or high voltage surges interspersed in the detector cable cannot have an adverse effect on the burner control's supervision functions

Mechanical design

The burner controls are of plug-in design. They can be fitted in any position on the burner, the boiler, in control panels or on any other type of panel. Their casing is made of impact-proof and heat-resistant plastic and accommodates the

- flame signal amplifier
- electronic programmers with their relays
- lock-out relay, and
- lock-out reset button with integrated fault indication lamp

In addition, the burner controls have a control output for the visual or audible remote lock-out connection.

For design of plug-in bases, refer to "Mounting the burner control".

Flame supervision with detector electrode

Flame supervision is achieved - using the conductivity and rectification effect of burning gases - by applying AC voltage to the detector electrode of heat-resistant material immersed in the flame. The current (ionization current) that flows in the presence of a flame generates the flame signal that is fed to the input of the flame signal amplifier. The latter is designed such that it responds only to the DC component of the flame signal. This ensures that a short-circuit between detector electrode and ground cannot simulate a flame signal (since in that case an AC signal would be generated).

Electrical connection of detector electrode

It is important to achieve practically loss-free signal transmission:

- The length of the detector electrode cable should not exceed 20 m
- The detector cable must not be laid in the same conduit as other conductors since line capacitance reduces the magnitude of the flame signal
- The insulation resistance between detector electrode and ground must be a minimum of 50 M Ω even after extensive periods of operation. Prerequisite for the latter is not only the use of high-grade heat-resistant insulation of the detector electrode cable, but also of the electrode itself (ceramic holder!)
- Soiled detector electrode holders support creepage currents that reduce the flame signal
- The burner (as the counter-electrode) must be earthed to comply with regulations, since otherwise no ionization current can flow. Often, earthing of the boiler alone is not sufficient!
- The live and neutral or middle conductor connections to terminals 10 and 2 of the burner control are not interchangeable. Incorrect connections will prevent generation of the flame signal!

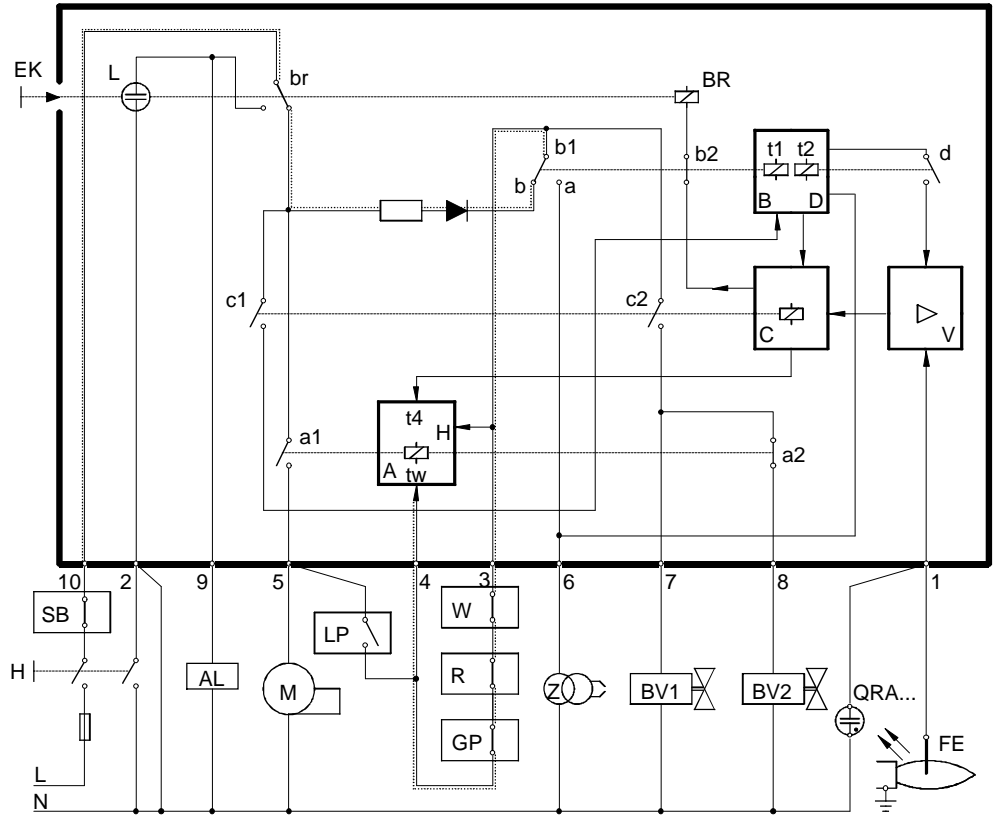
Functions

As soon as the temperature or pressure controller "R" of the heat producer closes its contact, thus also closing the start-up control loops across terminals 3 and 4 of the burner control, the latter switches on fan motor "M" after completion of the short waiting time "tw". Now, the air pressure monitor "LP" must close its contact within the period of time "t10", otherwise the burner control will go to lock-out. Upon completion of "t10", the specified pre-purge time "t1" commences. In the event of an air pressure failure during the pre-purge time or during the subsequent burner operating time, the burner control initiates a new start-up attempt.

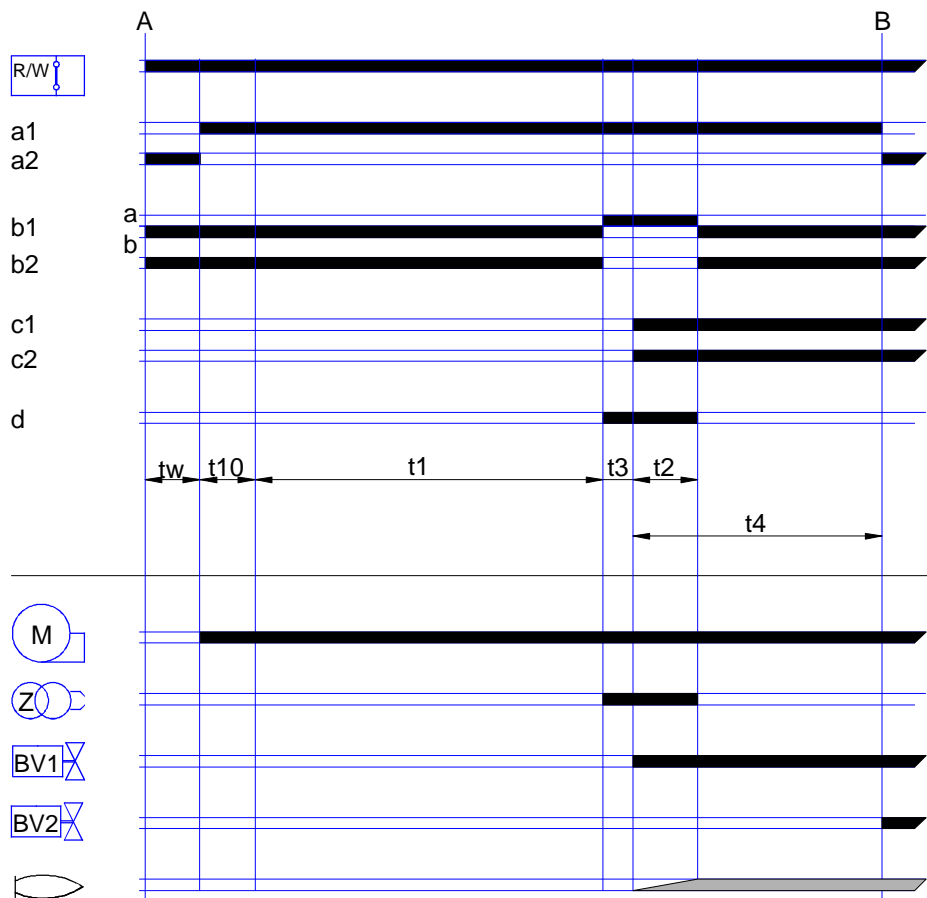
On completion of the pre-purge time "t1" and the short pre-ignition time "t3", fuel valve "BV1" opens and, at the same time, the supply voltage to the flame detector is reduced from the test value to the operating level. This means that the safety time "t2" commences, during which the burner must be ignited and the flame detector must deliver a flame signal to terminal 1. The ignition transformer remains in operation during the entire safety time, so that when the flame has been established at the start of the safety time, burner start-up is sustained by post-ignition for a period of time up to three or five seconds. If the flame signal is not present, however, the fuel valve will immediately close after the safety time has elapsed, the ignition transformer is switched off and lock-out initiated.

When the first stage has been correctly ignited, voltage is supplied to fuel valve "BV2" after an interval of about 12 seconds. Enabling of the second stage terminates the start-up sequence.

Internal diagram
(greatly simplified)



7433i06/0796



7433d02/0596

Legend

(for the entire data sheet)

a...	Relay contact designations
A	Electronic programmer for the waiting and interval time
AL	Lock-out warning (alarm)
B, D	Electronic programmer for the pre-purge and safety time
BR	Lock-out relay
BV...	Fuel valve
bv	Auxiliary contact in the gas valve for the closed position indication
C	Electronic programmer for the operating circuit
EK...	Illuminated lock-out reset button
FE	Ionization current detector electrode
GP	Gas pressure monitor
H	Mains isolator
L	Integrated lock-out warning lamp
LP	Air pressure monitor
LR	Load controller
M	Fan motor
QRA...	UV detector
R	Control thermostat or pressurestat
SB	Safety limit thermostat
SP	Auxiliary terminal
V	Flame signal amplifier
W	(Also STB): limit thermostat or pressurestat
Z	Ignition transformer
.....	Start control circuit (carries low voltage until "LP" closes)

Control program in the event of faults

- **After a mains failure:** repetition of start-up with unabridged program sequence.
- **Premature (faulty) flame signal**
 - During shut-down or during the waiting time: immediate lock-out when fan motor "M" is switched on
 - During the pre-purge time: immediate lock-out
- **Welded contact in the air pressure monitor** or contact of gas pressure monitor not closed: no start
Note: the ohmic resistance of the load connected to terminal 5 must be $< 2 \text{ k}\Omega$
- **No air pressure signal** at the beginning of the checked pre-purge time: lock-out on completion of "t10".
- **Air pressure failure** on completion of "t10": immediate shut-down of burner and new start attempt with lock-out if, on completion of "t10", there is no air pressure signal.
- **No ignition of burner:** lock-out on completion of safety time "t2".
- **Flame failure during operation:** immediate lock-out.
- **Flame does not extinguish** after the controlled shut-down: immediate lock-out with next start when fan motor is switched on.

Resetting the burner control

After each lock-out, the burner control can immediately be reset without obtaining a change in the program sequence. The changeover period "t10" for the air pressure signal may become somewhat shorter only after lock-out due to lack of air and resetting within less than approximately 60 seconds.

Connection examples

For burner controls in networks having an **earthed neutral conductor**.

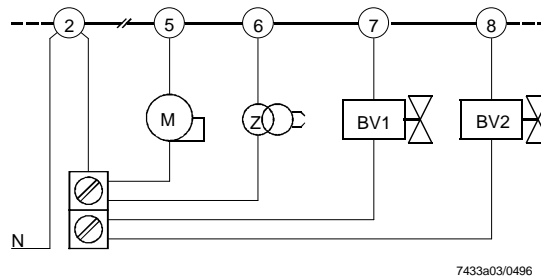
In networks **without** earthed neutral conductor and where ionization current monitoring is used, terminal 2 must be connected to the earth conductor via an RC unit; part number of RC unit: 4 668 9066 0.

Switches, fuses, earthing, etc., must be installed in compliance with local regulations. The following connection diagrams are intended to serve as principle diagrams only.

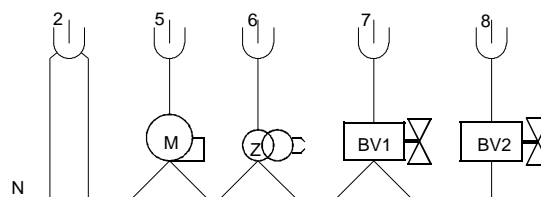
Further notes on the electrical installation

- Make certain that the maximum permissible current rating of the connection terminals will not be exceeded!
- **Room temperature controllers with thermal feedback** must be included in the control loop between terminals 3 and 4. The loading on these terminals caused by the feedback resistance must not exceed 8 Watts (at least 5 k Ω), however.
- The control outputs of the burner control must not receive any external mains voltage. Therefore, the burner control should never be plugged in when the proper functioning of the devices controlled by the burner control (gas valves and the like) is checked
- During shut-down and during the waiting time "tw", terminals 3 and 4 carry low voltage. An hours run meter, the thermal feedback of a room temperature controller or the like may be connected to these terminals only if the total loading does not exceed 8 Watts (resistance \geq 5 k Ω !)
- Connect the phase conductor to terminal **10** and the neutral conductor to terminal **2** (there will be no flame signal if these conductors are interchanged!)
- **Note:** for reasons of safety, it is **imperative** that the neutral conductor for the fan, the ignition transformer and the gas valves **will be taken from the neutral terminal block of the baseplate or directly from terminal 2:**

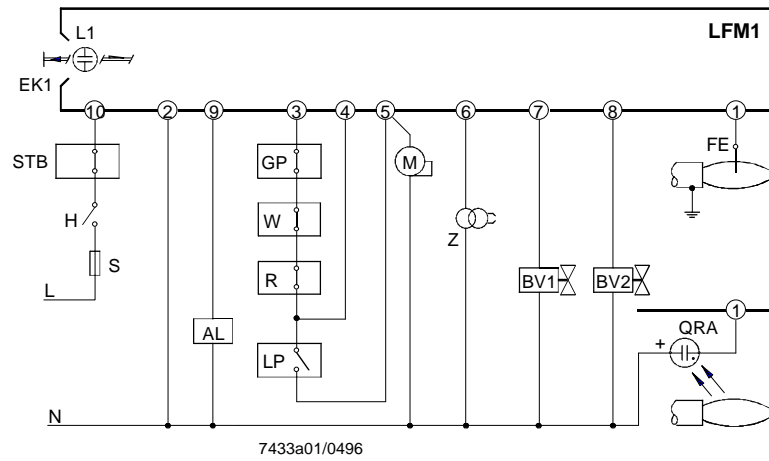
Correct connection of neutral conductor when using baseplate 4 104 9025 0 (refer to "Dimensions")



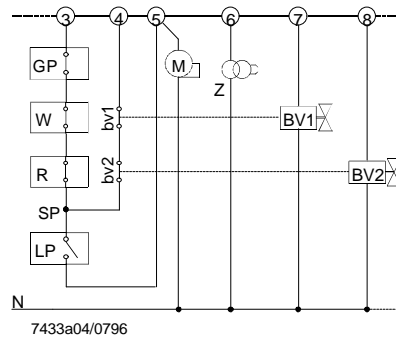
Correct looping of neutral conductor when using AMP quick connectors in conjunction with socket 4 408 2582 0 (refer to "Dimensions")



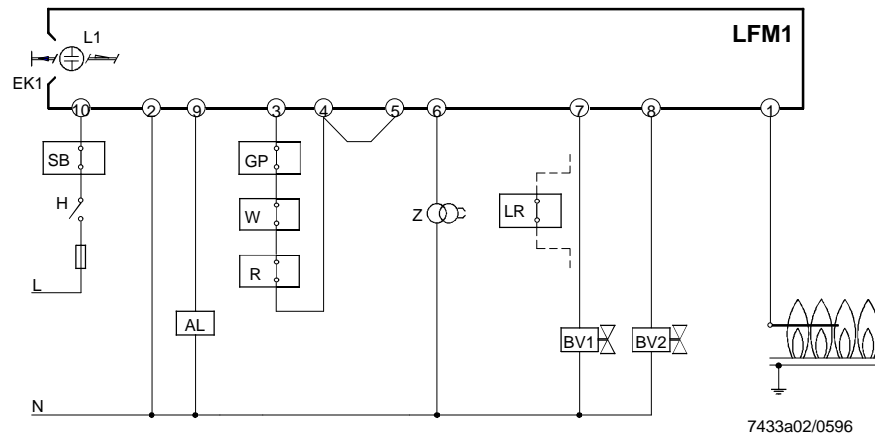
Forced draught burner



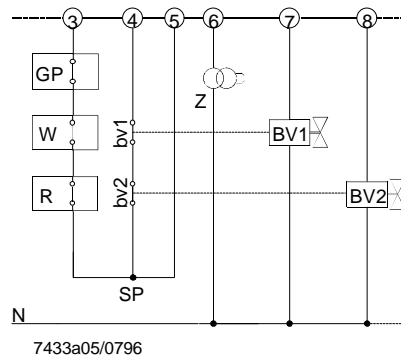
Connection example for the closed position check of the gas valves with auxiliary contacts "bv". Other connections as above.



Atmospheric burner (without auxiliary fan)



Closed position check of the gas valves with auxiliary contacts "bv" in the case of an atmospheric burner with no fan assistance. Other connections as above.



**Atmospheric burner
with auxiliary fan**

For atmospheric burners with fan assistance, connection example 7433a01 for forced draught burners is valid. If no air pressure monitor "LP" is present, an auxiliary contact of the fan contactor or an auxiliary contactor with an N. O. contact must be used to ensure that the loop between terminals 4 and 5 will be **open** during the shut-down period and during the period of time "tw", but automatically **closed** when the auxiliary fan starts.

**Measuring the
detector current**

Connect the measuring instrument between terminal 1 and the ionization current detector electrode (connect + pole to terminal 1). When measuring the UV detector current, connect a 100 μ F, AC 10...25 V condenser parallel to the measuring instrument.

**Functional check of
the burner control**

If the correct functioning of the burner control shall be checked with the control detached from the burner, terminal 5 must be loaded with an ohmic resistance of < 2 k Ω . This measure is also required when using the KF8796 test unit.

Warning notes

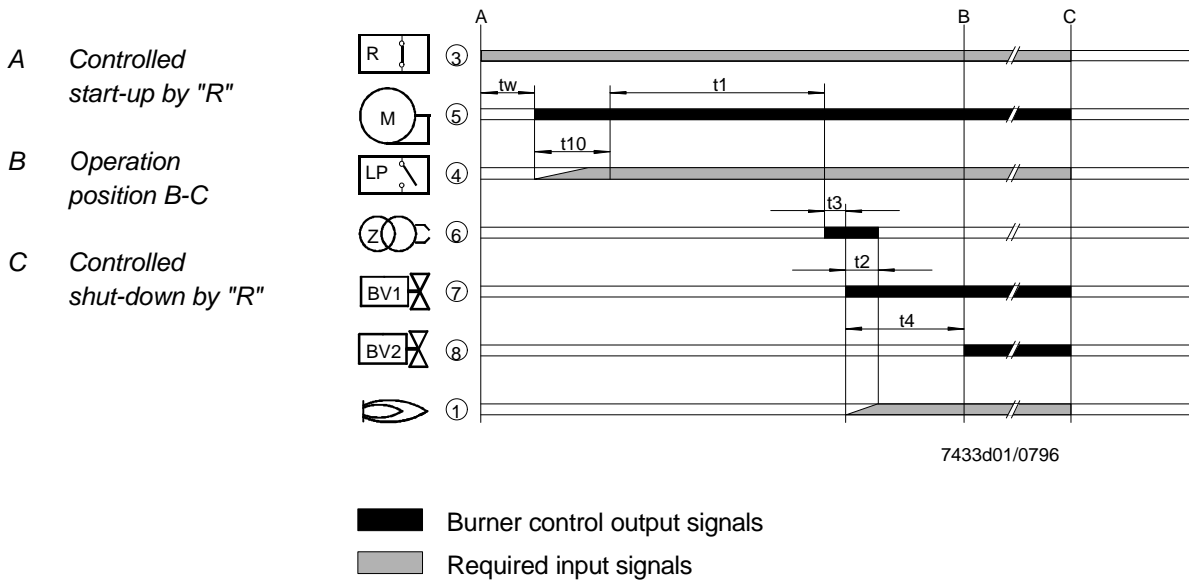
- In the geographical areas where DIN standards are in use, mounting and installation must be in compliance with the requirements of VDE, especially with DIN/VDE0100, 0550 and 0722!
- To protect the flame signal amplifier from electric overloads, both ignition and detector electrode must be located such that arcing over of the ignition spark to the detector electrode cannot occur.
- The electrical wiring within the gas devices must be made in compliance with national and local standards and regulations.
- The LFM1... is a safety device. It is therefore not permitted to open, interfere with or modify the unit!
- Check wiring carefully before putting the unit into operation!
- The LFM1... must be completely isolated from the mains before performing any work on it!
- Check all safety functions when putting the unit into operation or after having replaced a fuse!
- Ensure protection against electric shock on the unit and on all electrical connections by appropriate mounting!
- Make certain that no condensation water drips on the burner control, neither in operation nor while maintenance work is carried out.
- Electromagnetic emissions must be checked from an application point of view.

Programmed times	LFM1.25 ⁴⁾	LFM1.33 ⁵⁾	LFM1.35 ²⁾	LFM1.45 ⁵⁾	LFM1.63 ⁵⁾	LFM1.65 ⁵⁾	LFM2.33 ³⁾
Preferred use:							
F ⁴⁾	B	B	GB	NL	GB	D	
D	D					F	
F	F						
I	I						

tw	6 s	6 s	6 s	6 s	6 s	6 s	6 s
t1	< 30 s	30 s	30 s	30 s	60 s	60 s	30 s
t2	< 5 s	3 s	5 s	5 s	3 s	5 s	3 s
t3	0,5 s	0,5 s	0,5 s	0,5 s	0,5 s	0,5 s	0,5 s
t4	15 s	15 s	15 s	15 s	15 s	15 s	–
t10	3 - 7 s	6 - 15 s	6 - 15 s	6 - 15 s	3 - 10 s	3 - 10 s	6 - 15 s

- 2) For atmospheric burners
3) For burners with **one** fuel valve and with **remote reset** (connection of remote reset button between terminal 8 and neutral conductor)
4) For use with condensing boilers in France
5) For forced draught and atmospheric burners

Sequence diagram



Legend for the times

- t1 Checked pre-purge time
t2 Safety time
t3 Pre-ignition time
t4 Interval up to the time the second fuel valve is enabled
t10 Changeover period for the air pressure signal
tw Waiting time

Technical data

Operating voltage	AC 220 V -15 %...+10 %
LFM1.25, LFM1.33, LFM1.35, LFM1.63, LFM2.33	AC 240 V -15 %...+10 %*
LFM1.45, LFM1.65	
Mains frequency	50-60 Hz ±6 %
Power consumption	5 VA
Radio interference protection	N to VDE 0875
Max. permissible current rating of control outputs	
– Terminal 5	3 A (10 A during 1 s max.)
– Terminal 6 through 8	2 A
– Terminal 9	1 A
– Total	5 A
Required switching capacity of switching devices connected to terminals 3 and 4 and 4 and 5	depending on the loading of terminals 6 to 8, 1 A min., AC 250 V
Primary fuse	max. 10 AT
Degree of protection	IP40
Perm. ambient temperature	-20...+60 °C
Lowest permissible temperature during transport and storage	-50 °C
Perm. mounting position	optional
Relative humidity, climatic conditions and operating temperature	to IEC 721-2-1: widespread and extremely warm and dry, no condensation permitted during operation
Weight	
– Control without base	285 g
– Low base	75 g
– High base	110 g

* Perm. ambient temperature -10...+60 °C

Flame supervision

Detector currents (approx.)	Min. required	Max. possible
– With UV detector QRA...	75 µA	800 µA
– With ionization current detector electrode (FE)	3 µA	2 mA
Current with link across terminals 1 and 2 or across terminal 1 and ground		5 mA (AC)
Max. perm. length of detector cable (use a separate cable)		20 m

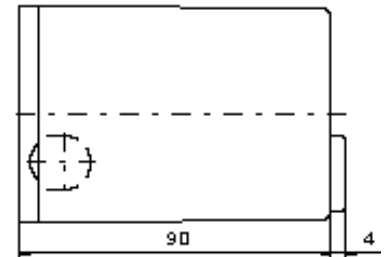
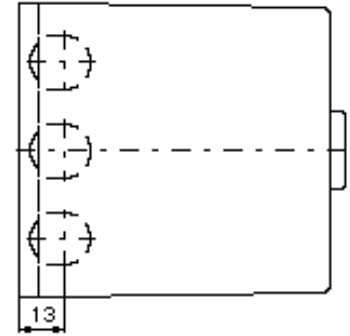
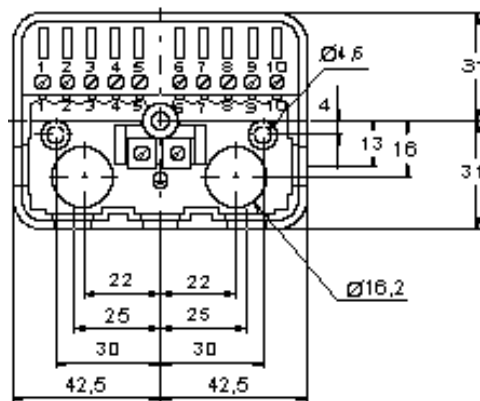
QRA2.../QRA10...

Refer to data sheet 7712

Mounting the burner control

Low plug-in base AGK 4 104 1345 0

Design: ten poles (screw terminals), with additional earth wire terminals. Cable entry either through the bottom of the base (two knock-out holes) from the front, right or left (total of five knock-out holes).



7433r01/0886

**High plug-in base
AGK 4 104 9025 0**

With removable front section (shaded area in dimension drawings)

Design: ten poles (screw terminals), and in addition:

- Two auxiliary terminals marked 11 and 12
- Two neutral conductor terminals, connected to terminal 2, the neutral conductor input
- Two earth terminals, with earthing lug for earthing the burner

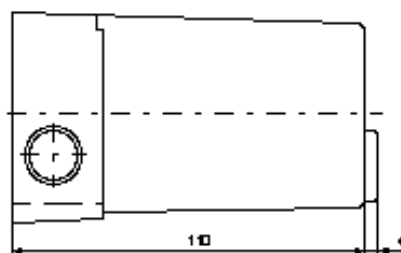
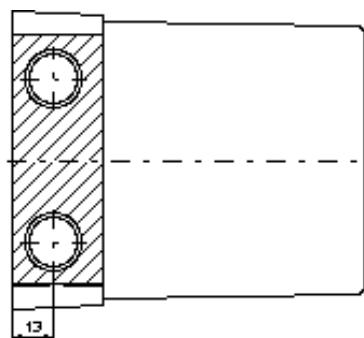
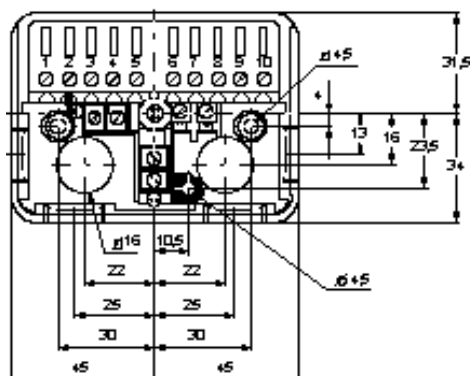
The following cable entries are available: two holes in the bottom of the base and four threaded knock-out holes Pg11 (one on the left, one on the right and two in the removable front section).

**High plug-in base
AGK 4 104 9169 0**

Same design as described above, but **without** removable front section, that is, the shaded area in the dimension drawing is **open**.

**Front section
AGK 4 104 9112 0**

Single item, for use with plug-in base 4 104 9169 0 (also suitable for use with AGK 4 104 9025 0, shaded area in the dimension drawing).



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