Gas Burner Controls

LFI7...

Series 03

ISO 9001

Gas burner controls for single-stage burners of small capacity in intermittent operation.
For safety reasons (self-testing of the flame supervision circuit, etc.), at least one controlled shutdown must take place every 24 hours.
The LFI7... and this data sheet are intended for use by OEMs that integrate the burner controls in their products!

Use

The burner controls of the LFI7... range are used for the automatic startup and supervision of single-stage forced draught gas burners.
Only for use (replacement) on existing plants:
– To DIN 4788 (Europe)
– To DIN 4788, or also
– For air heaters to DIN 4794

Program variants

LFI7.13	with control program for flash-steam generators
LFI7.33	with normal control program for heating plants, etc.
LFI7.35	with control program for forced draught or atmospheric gas burners

Mechanical design

The burner controls are of plug-in design, suitable for mounting in any orientation on the burner or boiler, as well as in control cabinets and on control panels. The housing is made of impact-proof and heat-resistant plastic and contains:

– The flame signal amplifier with its flame relay
– The electro-thermal timer that acts on a multiple snap-action switching system (ambient temperature-compensated)
– An electronic delayed action auxiliary relay, and
– The reset button with an integrated lockout warning lamp

The burner controls have a control output for optical and audible remote indication of faults.

For mechanical design of the base, refer to «Installing the burner control».

Flame supervision

Flame supervision - using the conductivity and rectification effect of burning gases - is ensured by the application of an a.c. voltage to a detector electrode of heat-resistant material immersed in the flame. The current (ionization current) which flows in the presence of the flame generates the flame signal which is fed to the input of the flame signal amplifier. The latter is designed such that it reacts only to the d.c. component of the flame signal. This ensures that a short-circuit between detector electrode and earth cannot simulate a flame signal (as in this case an a.c. signal would be generated).

The circuit of the flame signal amplifier is also so designed that brief arcing-over of the ignition spark to the detector electrode (or high voltage peaks entering the detector circuit) cannot impair the supervisory functions of the burner control.

The insensitivity of the flame supervision circuit to possible negative effects of the ignition sparks on the ionization current ensures optimum startup conditions.

Electrical connections of the detector electrode

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

- The detector connecting cable should not exceed 20 m in length
- The detector cable should not be laid in the same conduit with other conductors, as line capacitance may reduce the magnitute of the flame signal
- The insulation resistance between detector electrode and earth must remain above 50 MΩ even after long periods of operation. Prerequisite for the latter is not only the use of high-grade heat-resistant insulation for the detector cable, but also for the detector electrode itself (ceramic holder!)
- Soiled detector electrode holders encourage creepage currents, which reduce the magnitute of the flame signal
- The burner (as the counter-electrode) must, according to regulations, also be earthed, otherwise no ionization current can flow; earthing of the boiler alone is often insufficient!
- The line and neutral connections to terminals 1 and 2 of the burner control are not interchangeable. Incorrect line connection will prevent generation of the flame signal!

Functions

When the control thermostat or pressurestat «R» closes its contact, which supplies power to the burner control, the burner motor is switched on. However, the LFI7... begins to program the pre-purge time «t1» only when the air pressure monitor «LP» closes its contact.

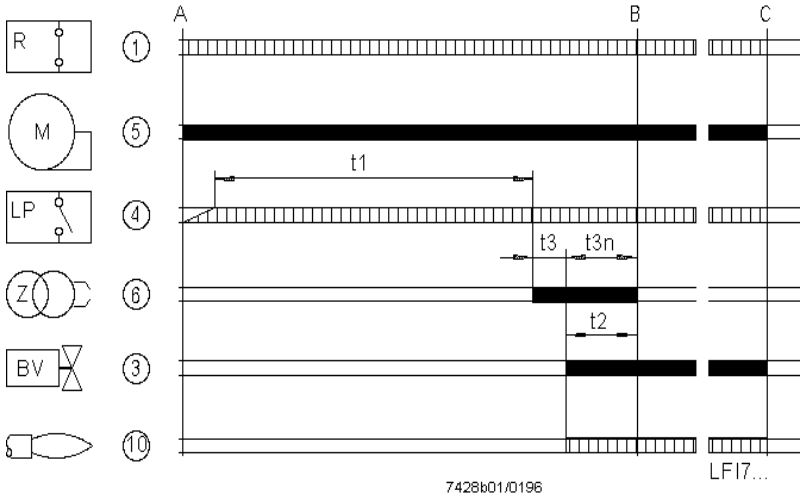
During the pre-purge time, the functioning of the flame signal amplifier is automatically checked by means of the flame relay test (energizing / de-energizing the relay). Lockout occurs if the test is unsuccessful.

On completion of the pre-purge time «t1» and the short pre-ignition time «t3», the gas valve is opened. This starts the safety time «t2», during which the burner must fire. If the flame supervision circuit has not registered a flame signal before the safety time is completed, the gas supply is immediately interrupted and lockout occurs shortly afterwards.

Because of the combination of electronic and thermal time control, the minimum and maximum switching times quoted below are reproduced with great accuracy - in spite of supply voltage variations, changes of ambient temperature or quick successions of shutdowns and restarts.

Switching times

				LFI7.13	LFI7.33	LFI7.35
A	**Startup** (control circuit closed by «R»)					
	t1	Pre-purge time	min.	8 s	30 s	30 s
	t2	Safety time	max.	3 s	3 s	5 s
	t3	Pre-ignition time	approx.	0.5 s	0.5 s	0.5 s
	t3n	Post-ignition time	max.	3 s	3 s	5 s
	--	Safety time with loss of flame	max.	1 s	1 s	1 s
B	**End of startup sequence** (B-C = heat generation)					
C	**Controlled shutdown by «R»**					



Control signals delivered by the burner control
Required incoming signals

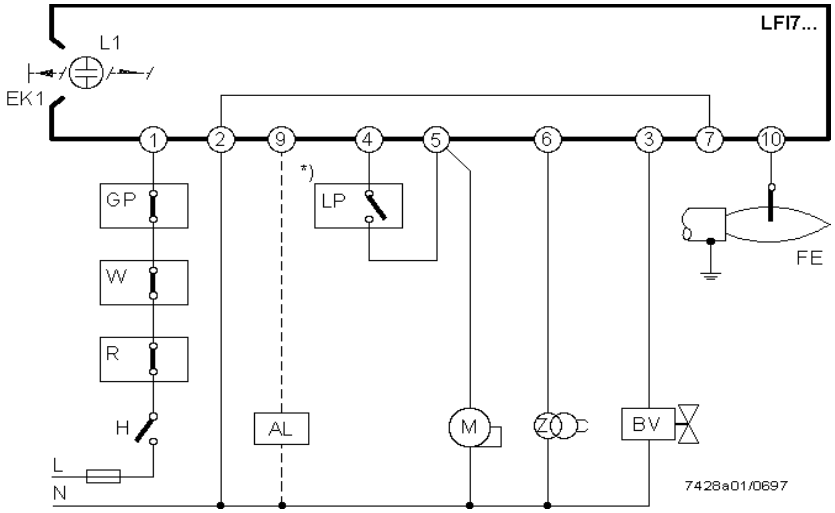
Control program in the event of fault

– **After a mains voltage failure**
  - During the pre-purge time: automatic restart
  - During a period of 30 to 40 seconds after the beginning of the pre-ignition time: automatic restart when the electro-thermal timer has retripped to its initial position (during retripping the fan remains energized)
  - During operation (on completion of the retrip time): automatic restart
– **On receipt of a premature flame signal (due to a fault!)** during the pre-purge time: no ignition; gas valve remains closed; lockout after about 40 to 50 seconds, or after about 20 seconds with burner control LFI7.13
– **No air pressure signal** after the start command or air pressure failure during the pre-purge time: interruption of startup sequence and continuous purging until fault is corrected
– On **air pressure failure** during the safety time and during burner operation: immediate interruption of the gas supply and continuous purging until fault is corrected
– **Burner fails to ignite:** gas valve turned off at the end of the safety time «t2», followed by lockout about 10 seconds later
– **Flame failure shortly after the end of the safety time:** gas valve shut down, followed by lockout about 10 seconds later
– **With flame failure during operation** (after at least 30 to 40 seconds of normal operation): restart attempt

The burner control can be reset earliest approx. 40 seconds after lockout.

Connection diagram

In combustion plant using networks **with unearthed neutral**.
In installations with **unearthed** neutral and ionization current supervision, terminal 2 must be connected to earth via a RC unit.
Part number of RC unit: 4 668 9066 0
Due to this measure, the supply voltage for the flame supervision is reduced and thus the detector current. For this reason, it must be ensured that optimum flame supervision conditions are obtained by carefully choosing the position of the detector electrode, etc.



*) Air pressure supervision not conforming to EN 298!

Notes on electrical installation

- Switches, fuse, earthing, etc., must be in compliance with local regulations
- External fuse max. 10 A, slow
- Line conductor must be connected to terminal **1** (otherwise no flame signal!)
- Other limiters or similar, the contacts of which must be closed from the start to at least the controlled shutdown, must be connected in series to «R»
- Do **not** use terminal 8 as an auxiliary terminal
- If there is **no air pressure supervision** (e.g. in the case of atmospheric burners, controlled by LFI7.35), terminal 4 must be connected directly to terminal 5

Flame supervision

- Flame detector cable length: max. 20 m. Detector cable must always be laid separately
- Earth the burner correctly! Earthing of the boiler only is often insufficient
- Measurement of detector current: connect instrument between terminal 10 and detector electrode: +pol to terminal 10. Measuring range: up to 150 µA

Technical data

Nominal voltage	AC 220 V -15 %...AC 240 V +10 %
Frequency	50 Hz -6 %...60 Hz +6 %
Power consumption	5 VA
Radio interference protection	N to VDE 0875
Max. permissible current loading of the control outputs	
- Terminal 5	4 A (locked rotor 20 A max.)
- Terminals 3 and 6	2 A
- Terminal 9	1 A
- Total	6 A
Perm. ambient temperature	
- Operation	-20...+60°C at AC 220 V -20...+50°C at AC 240 V
- Transport and storage	-50...+60°C

Required switching capacity of control devices and monitors	
- GP, LP, R, W (STB)	6 A, short-time 20 A
Fuse, external	10 A max., slow
Degree of protection	IP40
Mounting position	optional
Weight	
- Control without base	approx. 300 g
- Standard base	75 g
- Special base	110 g

Condensation, formation of ice and ingress of water are not permitted!

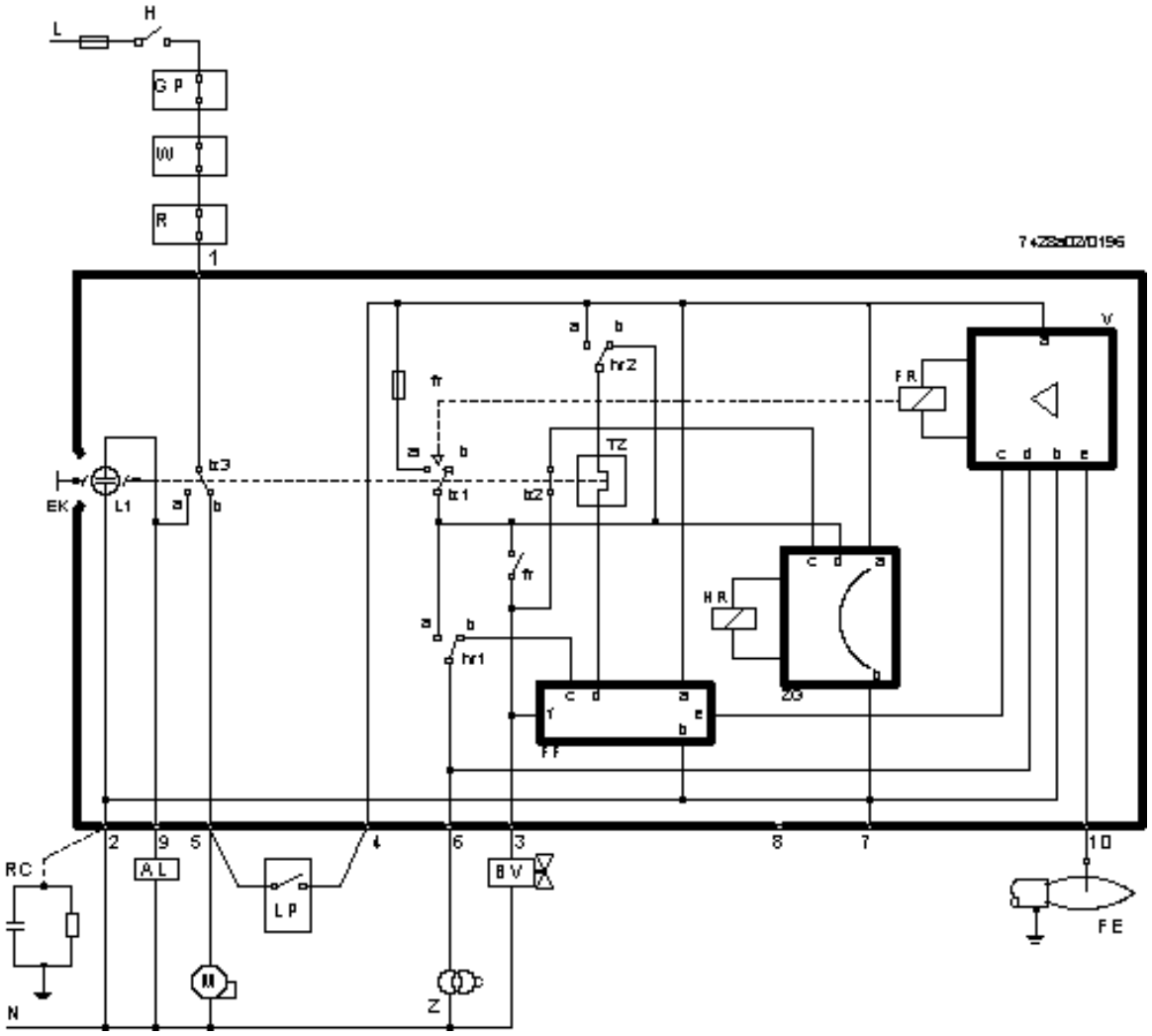
Flame rectification probe

Voltage across detector electrode and earth	mains voltage
Current with short-circuit between detector electrode and earth	< 0.5 mA
Min. ionization current required	2 µA
Min. ionization resistance required between detector electrode / connecting wire and earth	50 MΩ

Internal circuitry of burner control

(simplified)

LFI7...



Legend

ZG **Electronic timer with auxiliary relay HR**
«ZG» programs the first period of the pre-purge time (after air pressure signal) and the safety time
a, b Power supply
c If contact «tz2» at the input of «c» is closed and input «d» is not connected to the line conductor (rest position of electro-thermal timer «TZ»), auxiliary relay «HR» is energized after a delay of approx. 25 s (with LFI7.13 approx. 2 s)
d If «d» receives voltages via «tz1, a», the auxiliary relay has delayed drop-out = safety time!

FF **Flip-Flop**
The heating of the electro-thermal timer «TZ» is controlled via a thyristor in the «FF». The flip-flop also activates the flame signal amplifier «V», initiating at the same time the functional test of the flame relay
a, b Power supply
c If «HR» is energized, «FF» is triggered, thus connecting «d» to «b». At the same time, output «e» receives voltage
d Control output for «TZ»
e Control output for activation of the flame signal amplifier and for checking its functioning by means of a flame relay test of short duration (energizing / de-energizing of the relay)
f If mains voltage is present at input «f», the thyristor will be locked, thus interrupting the heating of «TZ»

TZ **Electro-thermal timer with contacts «tz...» (multiple snap-action system)**
«TZ» programs the second period of the pre-purge time and its contact «tz3» triggers lockout when, on completion of the safety time, the thyristor is not locked because there is no mains voltage present at input «f» of the flip-flop («fr» opened!)

V **Electronic flame signal amplifier with flame relay FR**
a, b Power supply
c Input for activation of the flame signal amplifier and checking its functioning by means of a flame relay test of short duration (energizing / de-energizing of the relay)
d Input for the forced energizing of the flame relay for the duration of the safety time
e Flame signal input

AL Lockout signal (alarm)
BV Fuel valve
EK1 Illuminated reset button
FE Ionization current detector electrode
GP Gas pressure monitor
H Mains isolator
L1 Built-in lockout warning lamp
LP Air pressure monitor
M Fan motor
R Control thermostat or pressurestat
W Also (STB): safety limit thermostat or pressure monitor
Z Ignition transformer

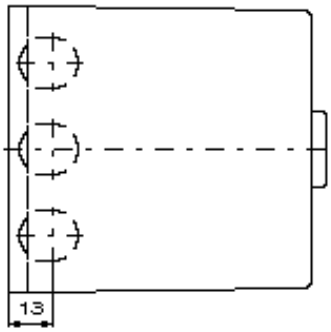
Warning notes

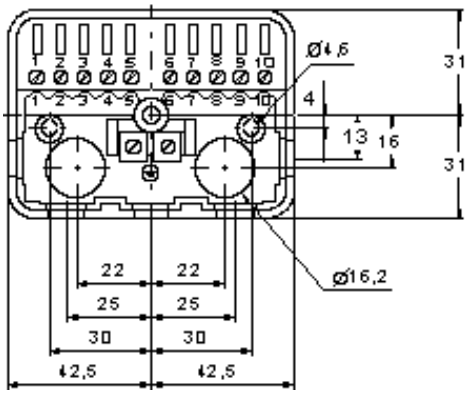
- **In the geographical areas where DIN standards are in use, the installation must be in compliance with VDE requirements, particularly with the standards DIN / VDE 0100 and 0722!**
- **All regulations and standards applicable to the particular application must be observed!**
- **Installation and commissioning work must always be carried out by qualified personnel!**
- **Condensation and ingress of humidity must be avoided!**
- **To protect the burner control from electric overload, both ignition and ionization electrode must be located such that arcing over of the ignition spark to the ionization electrode cannot occur!**
- **Observe the notes on the laying of detector cables!**
- **The electrical wiring must be in compliance with national and local standards and regulations!**
- **Ignition cable must always be laid separately, observing the greatest possible distance to other cables!**
- **The LFI7... 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 LFI7... 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 any fuses!**
- **Electromagnetic emissions must be checked from an application point of view!**

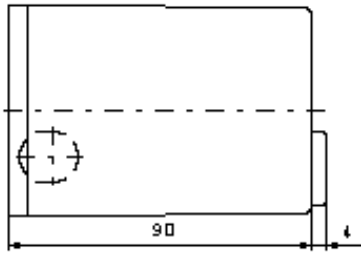
Installing the burner control

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).







7428m01/0297

High plug-in base
AGK 4 104 9025 0

With removable front (shaded area in dimension diagram)
Design: ten poles (screw terminals) and, in addition:
– Two auxiliary terminals with terminal markings 11 and 12
– Two neutral terminals, permanently connected to neutral input, terminal 2
– Two earth terminals with earthing lug for the burner

The following cable entries are available: two holes in the bottom of the base and four threaded knock-out holes for cable glands 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

Features as above, but **without** removable front section, i.e. shaded area in dimension drawing is **open.**

Front section
AGK 4 104 9112 0

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