



FM739

Burner Control

LFE1

Series 03



Supplementary data sheet 7712

The LFE1 is a burner control designed for use with forced draught gas and dual-fuel burners of any capacity (intermittent operation). For reasons of safety, at least one controlled shutdown must be carried out every 24 hours.

Use

The LFE1 burner control is designed for fully automatic control and supervision of single-stage, multi-stage and modulating gas or dual-fuel burners. Its firing program is suitable for both expanding flame and interrupted pilot type gas burners. Flame supervision can be achieved by means of an ionization current detector electrode or a UV detector. Used in conjunction with the control units of the VALVEGYR system (see data sheet 7696), the firing program of the LFE1 can be extended to include automatic proving of gas safety shut-off systems. All controls comply with the relevant European standards for gas and oil burners of any capacity. The LFE1 can operate the following burner plant components: fan motor, flue gas fan, air damper, ignition transformer, one to three fuel valves, load controller, and an external lockout warning device.

Mechanical design

The LFE1 burner control is of plug-in design and suitable for mounting in any position, directly on the burner, on a control panel or in a control cabinet. The spacious baseplate and the unit housing are manufactured from impact-proof and heat-resistant plastic. The synchronous motor driven sequence switch, the auxiliary relays, the electronic «detector current» amplifier and all other switching, control and adjusting elements are mounted on robust printed circuit boards and are, in respect of self-checking, included in the test circuit of the burner control. The LFE1 is secured to its baseplate by means of four screws; the unit cover is protected against tampering by two sealing screws (see «Dimensions»). A unit fuse protects the control contacts against overloading.

Mode of operation

Prerequisites for burner start-up

The burner will only start when:

- the burner control's sequence switch is in its start position
- the control unit is not in lockout position, e.g. in the case of a defective UV tube
- the contacts of all control and safety devices in the control loop connected between terminals 8 and 9 are closed
- the air pressure monitor is not indicating air pressure

Defects in the flame supervision circuit or in the burner control itself prevent start-up or lead to lockout during the start.

Caution

If the air damper is not operated by the burner control, terminals 20, 21 and 22 must be interconnected!

Program sequence on start-up

First, the fan motor is switched on via terminal 3, and the air damper actuator is started via terminal 22. As soon as the air damper has reached the fully open position, the burner control's sequence switch starts its run and the pre-purge time begins. The set minimum air pressure must be reached within 10 s (or 7 s with post-purge) and maintained until the control thermostat is satisfied; otherwise lockout occurs. A flame signal during the pre-purge time will also lead to lockout. On completion of the selected pre-purge time, the air damper receives a signal to close to the minimum air position. The control's sequence switch remains stationary during the air damper actuator's closing time. As soon as the signal contact for minimum air is actuated by the air damper actuator, the sequence switch starts again and continues with the burner firing sequence which cannot be influenced externally:

- Pre-ignition (3 s)
- Release of the 1st fuel valve at terminal 5 (the fuel valve for a pilot burner, which must be closed on completion of the 2nd safety time, must be connected to terminal 10)
- Programming of the set safety time. If no flame is established during this time, lockout occurs (always with interlocking of the burner control)
- Following an interval of 11 s after release of the 1st fuel valve, the 2nd fuel valve is released
- The pilot burner, if used and connected to terminal 10, is switched off
- The load controller is switched on following a further interval of 12 s. The burner has thus reached its operating position. From this point on, the load controller controls the burner output in that it increases or decreases the fuel throughput and air flow in response to the heat demand (ratio control). This can be achieved in a stepwise fashion, e.g. with thermostats, or continuously by means of a modulating controller

Loss of flame during burner operation leads to lockout.

Start-up with ignition spark supervision

The program sequence is principally the same as that without ignition spark supervision. Exceptions:

- If the flame signal amplifier does not receive an input signal during the **pre-ignition time** (from the UV detector) the burner control locks out before any gas is released, i.e. safety time $t_2 = 0$ s
- The safety time for the pilot burner can only be adjusted between 0...6 s (= t_{2z} in the sequence switch time diagram)

Program sequence following a controlled shutdown

Controlled shutdown occurs as soon as one of the control or monitoring devices in the control loop between terminals 8 and 9 opens its contacts. The fuel valves are closed immediately and the sequence switch is restarted for post-purging, if programmed. On completion of the post-purge time, the sequence switch has reached its start position again where it remains until the next switch-on command is given.

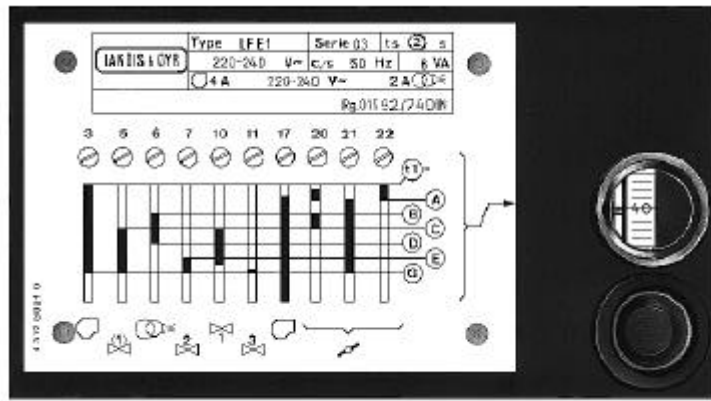
During the post-purge time, flame supervision is started again. Hence, any flame signal during this period of time leads to lockout.

Program sequence following lockout reset

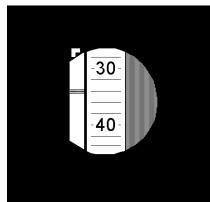
Following actuation of the built-in or remote reset button, the sequence switch will - providing the cause of lockout has been removed - run through to its start position. During this time, the only burner plant component that is operated is the fan motor connected to terminal 17. As - under normal circumstances - the control thermostat or pressurestat is still calling for heat, the sequence switch will commence with its burner firing sequence immediately it reaches the start position.

Program indicator

The program indicator gives the current state of the start-up sequence. The **letters** on the indicator disk correspond to those given on the adjacent sequence switch diagram; the **figures** indicate the remaining pre-purge time. In the event of lockout, the indicator disk stops immediately - thus giving the phase of operation during which lockout occurred.

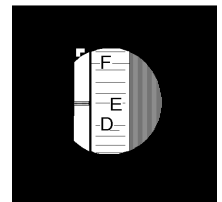


Reading the program indicator



← Remaining pre-purge time = approx. 35 seconds

Valve 2 at terminal 7 is opened →



Technical data Burner control LFE1

Nominal voltage	AC 220 V -15 %...240 V +10 % AC 100 V -15 %...110 V +10 %	Radio interference protection	N to VDE0875
Nominal frequency	50 Hz -6 %...60 Hz +6 %	Max. permissible loading of control outputs	
Built-in unit fuse	T6,3H250V to IEC127	- Each terminal	4 A
Fuse (external)	16 A max. slow	- Total	5 A
Power consumption		Degree of protection	IP40
- During start	9 VA	Mounting position	optional
- During operation	6 VA	Cable glands	Pg11
Environmental conditions		Weight	approx. 2 kg
- Transport	IEC721-3-2 class 2K2	Identification code to EN 298	F B L L B N
Climatic conditions		CE conformance	
Temperature	-50...+60 °C	According to the directives of the European Community	
Humidity	< 95 % r.h.	Electromagnetic compatibility EMC	89/336 EEC include. 92/31 EEC
Mechanical conditions	class 2M2	Gas appliance directive	90/396 EEC
- Operation	IEC721-3-3 class 3K5	Emissions	EN 50081-1
Climatic conditions		Immunity	EN 50082-2
Temperature	-20...+60 °C		
Humidity	< 95 % r.h.		

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

Flame detector circuit

Min. detector current in μ A	Ion. curr. det. electrode	UV detector
- At AC 100 V and AC 220 V	8	150
- At AC 110 V and AC 240 V	9	200
Max. possible detector μ A	approx. 100	approx. 650
Perm. cable length	20 m ¹⁾	20 m ¹⁾
Perm. ambient temperature	-	60 °C
Type of insulation	-	double insulation

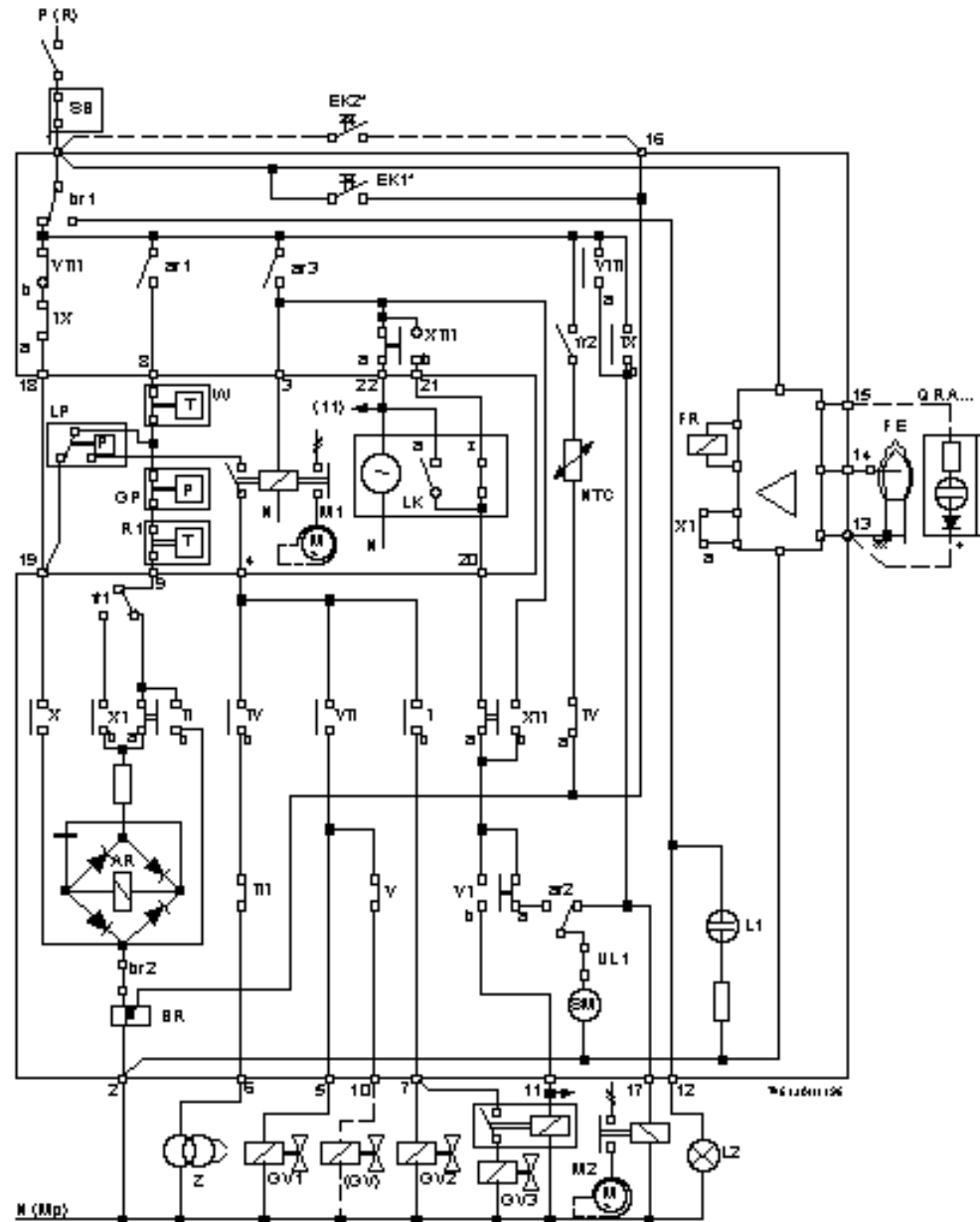
¹⁾ With longer distances, use **low capacitance** cable (e.g. single-core cable; totally 2 nF max.)

Type summary and ordering

Type reference	Mains voltage		Factory-settings of		
	ACV	(Hz)	t1 (s)	t2 (s)	t9 (s)
LFE1/8851	220...240	50	60	2	4
LFE1/8853	220...240	50	30	2	4
LFE1/8866	100...110	50	30	2	4
LFE1/8867	100...110	60	30	2	4
LFE1/8868	220...240	60	30	2	4
LFE1/8892	220...240	50	60	5	5

The burner control is delivered without baseplate. The latter must be ordered separately using the following type reference: **AGG41041713 (FE)**.

Basic diagram LFE1



When using UV detector QRA..., terminal 13 must be connected to earth!

Legend

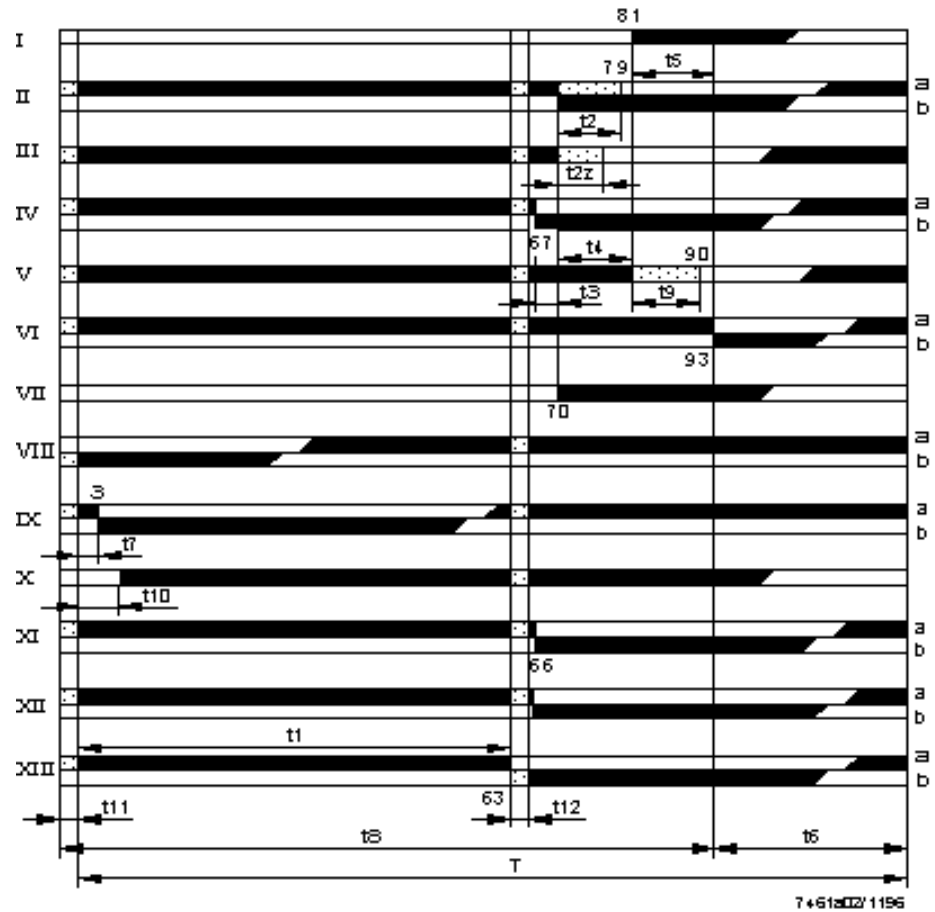
valid for the entire data sheet

AR	Load relay with contacts «ar...»	LP	Air pressure monitor
BR	Lockout relay with contacts «br...»	L1	Built-in lockout warning lamp
BS...	Selector	L2	Remote lockout warning lamp, external
c	Fan contactor with contacts «c...»	M...	Fan
d	Auxiliary relay with contacts «d...»	NTC	Lockout delay element
e	Thermal overload contact	OV...	Oil valve
EK1	Built-in lockout reset button	QRA...	UV detector
EK2	Remote lockout reset button	R, R1	Thermostat or pressurestat
FE	Flame electrode	R2	Load controller
FR	Flame relay with contacts «fr...»	RV	Control valve
FW	Flame supervision	SB	Safety limiter
GP	Gas pressure monitor	SM	Synchronous motor of sequence switch
GV...	Gas valve	SQ...	Air damper actuator (type reference)
(GV)	Gas valve for a pilot burner which is switched off after the 2nd safety time	UL1	Operating switch for the sequence switch motor (only accessible with unit cover removed)
H	Mains isolator	W	Temperature or pressure limiter
LF	UV detector QRA...	Z	Ignition transformer
LK	Air damper actuator with limit or auxiliary switches a = damper actuator runs to «On» (max. air position) z = damper actuator runs to «Off» (min. air position)		

Not shown: **built-in fuse** 6.3 A, slow, between terminal 1 and contact «br...»

* **Do not press EK for more than 10 seconds!**

Sequence switch time diagram



Switching times

(Factory-settings: on request)

T	120 s	Running time of sequence switch
t1	8...63 s	Pre-purge time, adjustable
t2	0...9 s	1st safety time (set to 0 s with ignition spark supervision)
t2z	0...6 s	Safety time for the pilot burner with program for ignition spark supervision
t3	3 s	Pre-ignition time (= safety time for ignition spark supervision)
t4	11 s	Interval between release of the 1st and the 2nd fuel valve
t5	12 s	Interval between release of the 2nd and the 3rd fuel valve, or the switching on of the load controller
t6	$T - (30 + t1)$	Post-purge time
t7	3 s	Delay time
t8	$t1 + 30 + t11 + t12$	Total start-up time
t9	0...9 s	2nd safety time (only for ignition with a pilot burner)
t10	10 s	Bridging time (time set for the air pressure check)
t11	optional	Opening or closing time of the air damper
t12	optional	Opening or closing time of the air damper

Max. perm. **after-burn time**
(from beginning of t6)

7 s

Special features

with regard to application

- Pre-purge time adjustable between 8 and 63 s
- Choice of operation with or without post-purge
- Fully automatic operation of air damper possible (with optional running time of the damper actuator)
- Air pressure check can be combined with a functional check of the air pressure monitor prior to each start
- Ignition (optional): direct ignition or with pilot burner, with or without ignition spark supervision
- 1st and 2nd safety times adjustable between 0 and 9 s
- Automatic testing of UV detector during burner off periods and during the purge periods
- Semi-automatic start and operation possible
- Built-in lockout warning lamp

with regard to mounting and installation

- Mounting location and orientation of the burner control are optional
- Large terminal compartment
- Additional terminals for earth and neutral connections (4 each), plus 4 auxiliary terminals
- Built-in unit fuse

with regard to commissioning and trouble shooting

- Continuous indication of the program sequence in the viewing window of the unit cover
- The motor of the sequence switch can be switched off (simplifies burner adjustment)
- Cam shaft can be rotated by hand
- Electric remote lockout reset facility

For setting instructions, please refer to «Setting facilities on the burner control».

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!**
- **The electrical wiring must comply with national and local standards.**
- **Check wiring carefully before putting the unit into operation!**
- **The LEC1 must be completely isolated from the mains before performing any work on it!**
- **The LEC1... is a safety device! The loosening of the sealing screws as well as any changes to the factory-settings must therefore be carried out by authorized persons only!**
- **Check all safety functions when putting the unit into operation or after having replaced any fuses!**
- **Ensure protection against electric shock hazard on the unit and at all electrical connections by appropriate mounting!**
- **Condensation and ingress of humidity must be avoided!**
- **Electromagnetic emissions must be checked from an application point of view!**

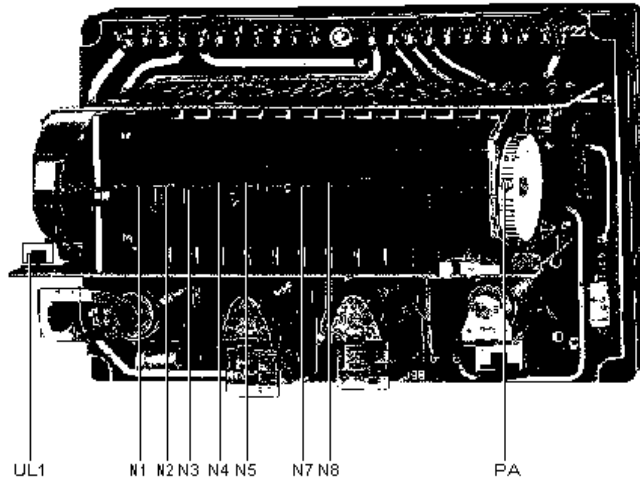
Setting facilities on the burner control

General

- Isolate the unit from the mains prior to making any settings
- Loosen all six retaining screws and remove the unit cover
- The switching cam numbering starts from the motor
- The cam shaft can be turned to any position by hand (direction of rotation clockwise as seen from the sequence switch motor)

Setting elements

UL1	ON/OFF switch for the sequence switch motor	N5	Cam 5, adjustable (2nd safety time)
N1	Cam 1, fixed	N7	Cam 7, fixed
N2, N3	Cams 2 and 3, adjustable (1st safety time)	N8	Cam 8, adjustable (pre-purge time)
N4	Cam 4, fixed	PA	Program indicator disk



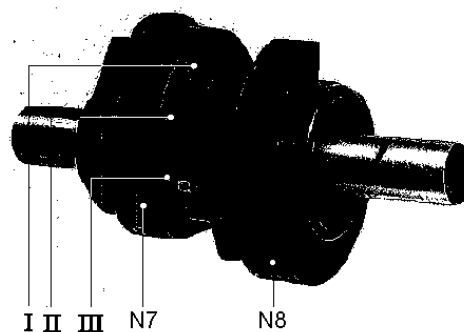
Important

This burner control is a safety device! The breaking of the sealing screws and changes to the factory-settings may only be undertaken by authorized staff!

Setting the pre-purge time

- Loosen the securing screw of the red cam N8
- Turn the cam shaft by hand until the required pre-purge time is indicated by the index mark (stamped on the sequence switch bracket) against the program indicator disk
- Hold the cam shaft firmly and rotate cam N8 until it actuates its contact
- Tighten the cam securing screw carefully and then check the adjusted time for accuracy. The set time is also visible through the viewing window when the burner control is in its start position

Adjustment of the setting mark of the red cam N8 to the time marks on the black cam N7 results in pre-purge times as shown in the following table.



Cam 8 adjusted to...

...cam 7, mark	I	t1 = 8 s
	II	18 s
	III	28 s
At stop		63 s
Factory-setting		approx. 30 s or 60 s

Setting the safety times

The settings are made by means of the red cams of the sequence switch. Their time marks serve as adjustment guides. On completion of the settings, the securing screws of the cams should be tightened carefully to prevent inadvertent readjustments.

1st safety time t_2

(Operation without ignition spark supervision)

- Loosen the securing screws of cams 2 and 3
- Hold cam 1 firmly and rotate cam 2 so that its setting mark aligns with the relevant time mark of cam 1 (see photo and table; intermediate settings possible). Secure cam 2
- Rotate cam 3 so that its setting mark is against the lower stop of cam 2. Secure cam 3
- Check the safety time setting. The new safety time is to be indicated on the plate (setting slot accessible from the bottom of the unit cover)



Cam 2 adjusted to...

...cam 1, time mark	I	$t_2 = 0$ s
	II	4.5 s
	III	9 s
Factory-setting		< 2 s

1st safety time t_{2z}

(Operation with ignition spark supervision)

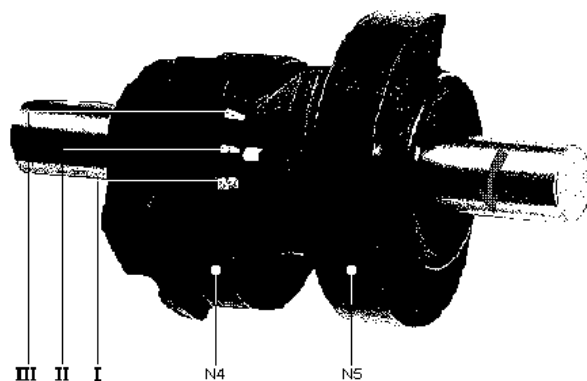
- Loosen the securing screw of cams 2 and 3
- Hold cam 1 firmly, set the setting mark of cam 2 to the lowest time mark of cam 1 and secure cam 2
- Hold cam 2 firmly, set the setting mark of cam 3 to the desired time and secure cam 3 (see photo and table)
- Check the set safety time

Cam 3 adjusted to...

...stop in the direction of the arrow	$t_{2z} = 0$ s
...stop in the other direction	6 s
Factory-setting	0 s

2nd safety time t_9

- Loosen the securing screw of cam 5. Set the setting mark of cam 5 to the relevant time mark of cam 4 (see photo and table; intermediate settings possible)

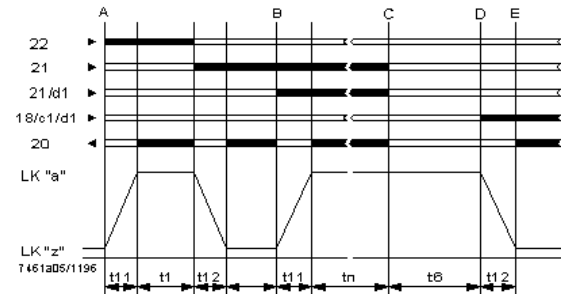
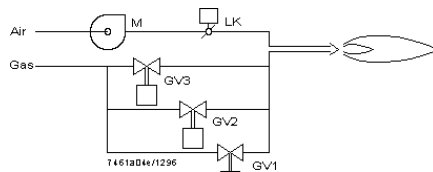
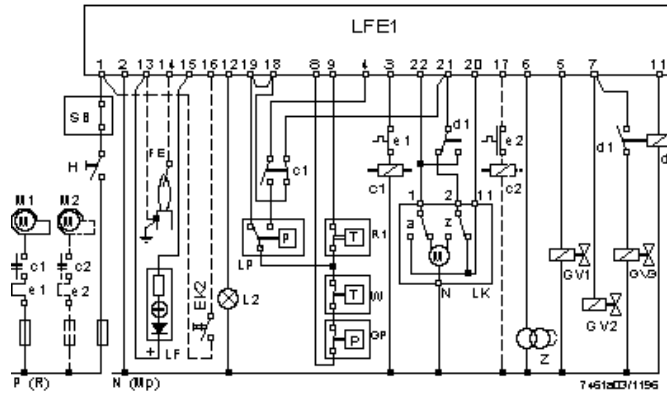


Cam 5 adjusted to...

...cam 4, time mark	I	$t_9 = 0$ s
	II	4.5 s
	III	9 s
Factory-setting		< 2 s

Connection examples

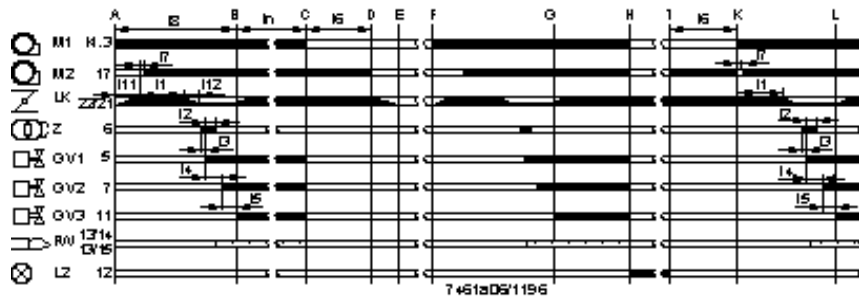
Connection diagram and sequence diagram for expanding flame burners



Important

Air damper control (detailed)

In the case of burners without air damper or with an air damper not controlled by the LFE1, terminals 20, 21 and 22 must be interconnected; circuit path 18-c1-21, by contrast, is not used!



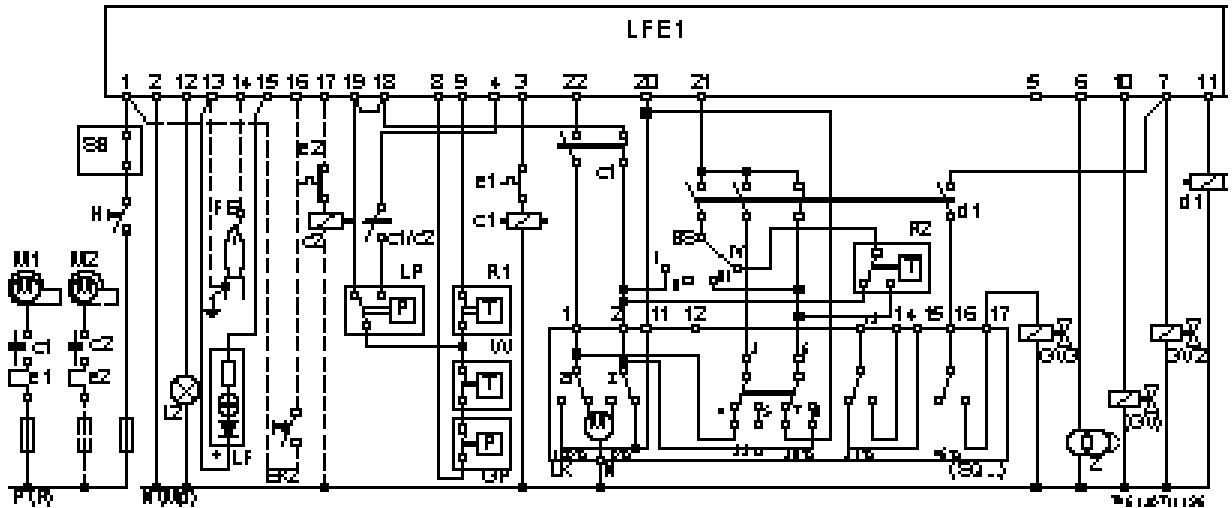
Checked air damper control by LFE1...; no load control. When using UV detector QRA..., terminal 13 must be connected to earth!

Legend for sequence diagram

A	Start	G-H	Burner run
A-B	Normal start-up	H	Flame failure
B-C	Burner run	H-I	Lockout
C	Controlled shutdown	I	Reset
C-D	Post-purge	I-K	Return to start position
D-E	Closing of air damper	K	Fresh start
E-F	Burner off	K-L	Start-up
F	Fresh start	L ▶	Burner run
F-G	Start-up		

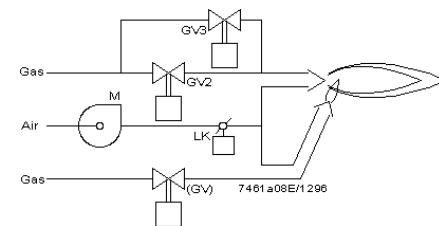
Connection diagram and sequence diagram for interrupted pilot burners

High/low control with checked air damper operation. When using the UV detector QRA..., terminal 13 must be connected to earth!

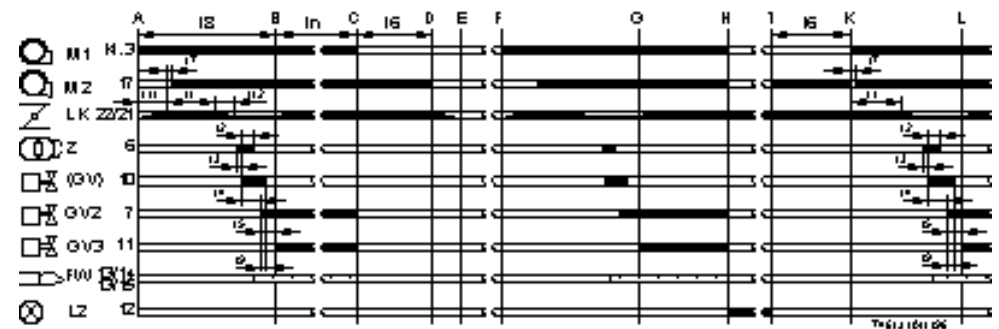
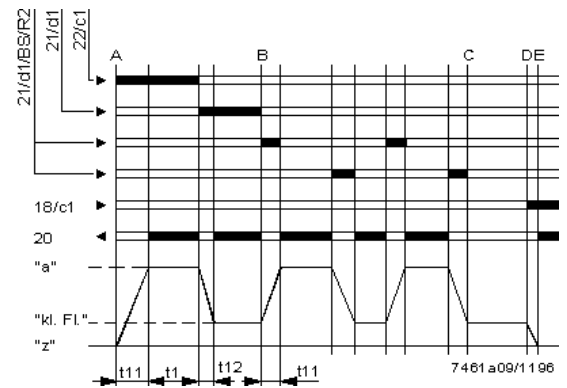


Selector BS

- I Full load
- II Stop
- III Part load
- IV Automatic control

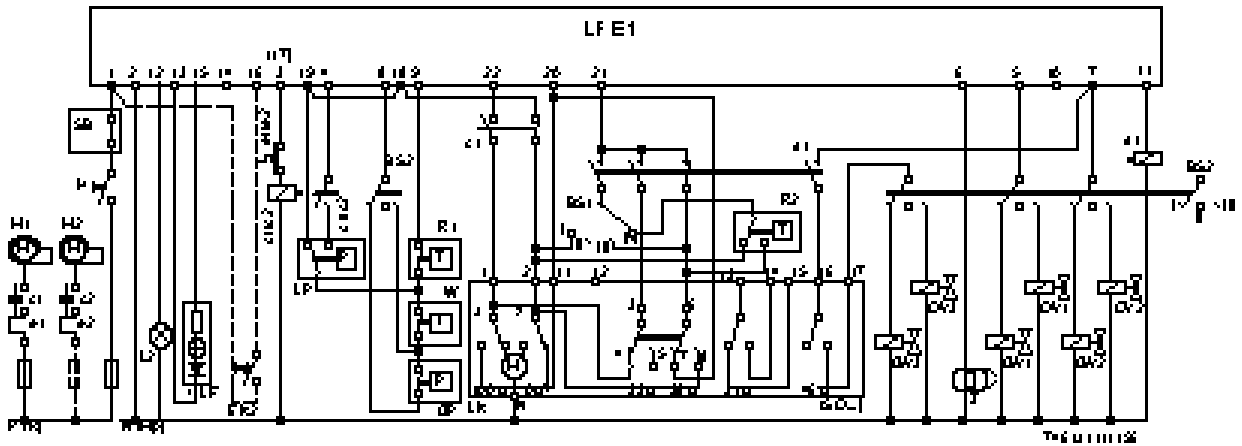


Air damper control (detailed)

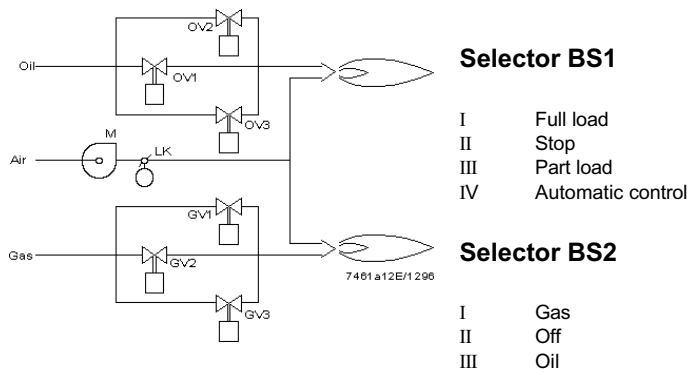


Burner control LFE for dual-fuel burners, firing gas or oil

A UV detector can supervise both oil and gas flames; the gas flame can, however, also be supervised with an ionization current detector electrode.



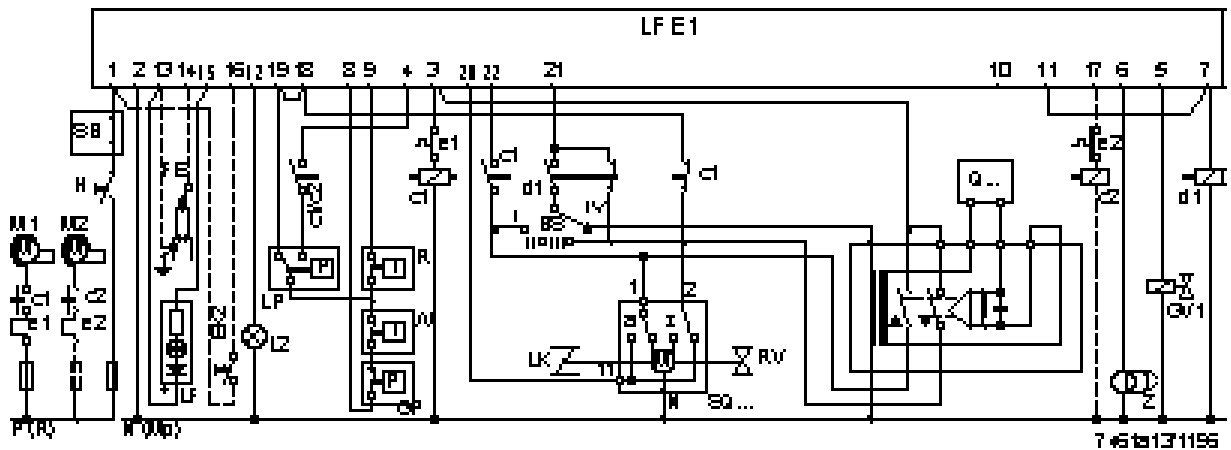
When using UV detector QRA..., terminal 13 must be connected to earth!



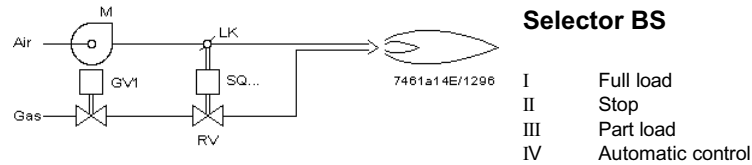
Connection diagram for modulating burner control with checked air damper operation

Modulating burners, which are designed for the continuous regulation of the burner output, require a temperature or pressure control system, in addition to the standard burner control equipment, for example:

- | | |
|--|--|
| 1 modulating controller, e.g. POLYGYR® RWF32 | 1 temperature or pressure detector with built-in setting unit QA.../QB... |
| 1 setting unit (required only for remote setting) FZA... | 1 actuator for the control of the air damper and fuel throughput (ratio control) SQ... |
| 1 auxiliary relay d1 | 1 control valve for the adjustment of the fuel throughput RV |
| 1 selector BS | |



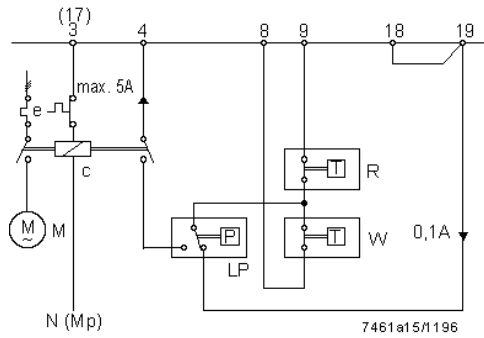
When using UV detector QRA..., terminal 13 must be connected to earth!



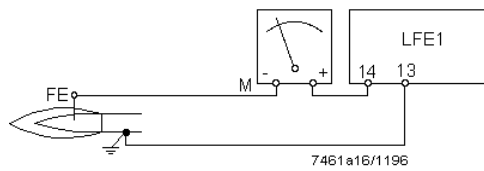
Air pressure monitor LP

The air pressure is permanently monitored from burner start to controlled shutdown. If the set air pressure is not achieved 10 s after start of the pre-purge time (7 s with the program for post-purge), or air pressure is lost any time thereafter, the control locks out.

With the air pressure monitor LP connected as shown in the diagram below, the switch is tested automatically for correct function before each start attempt; with an incorrect contact position, start is prevented.



Measurement circuit for ionization current



FE Detector electrode
M Microammeter

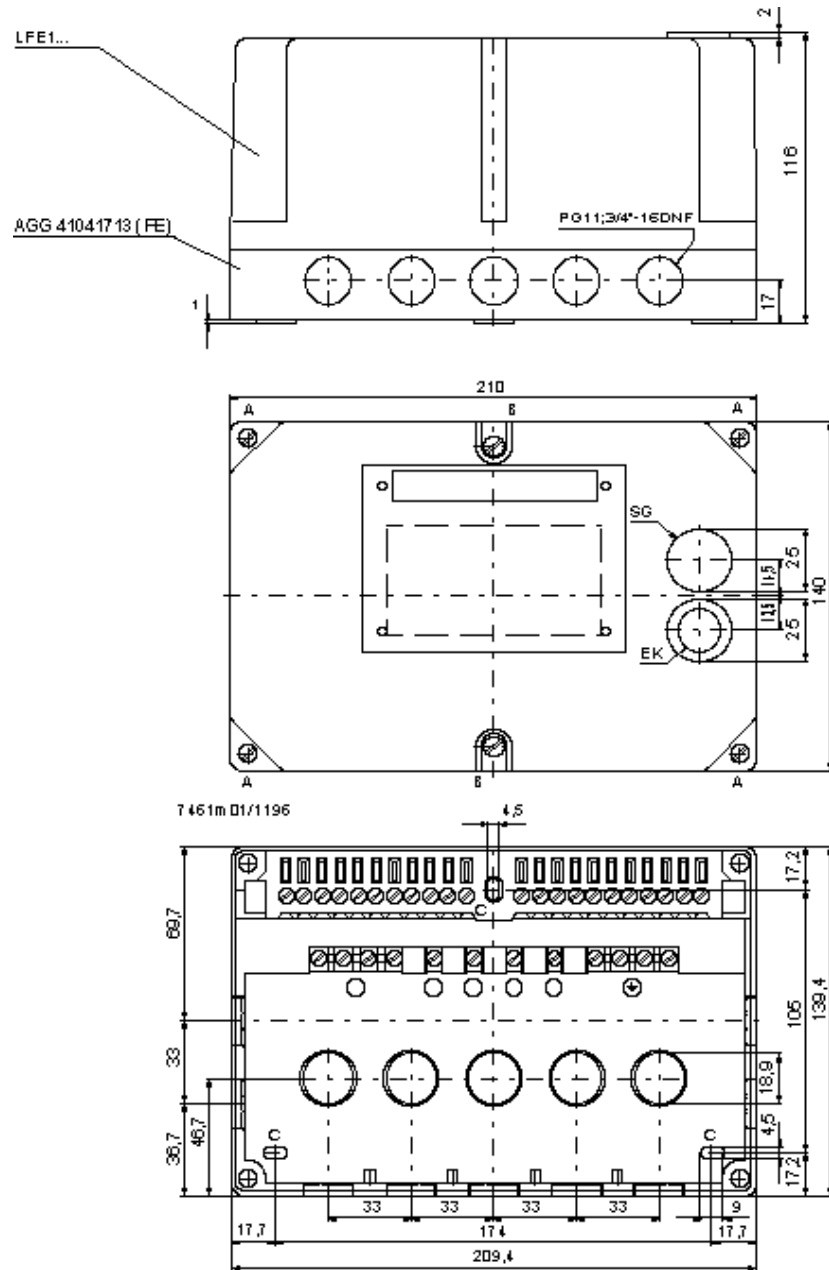
Note

Ignition can affect the ionization current!
(Possible remedy: interchange the transformer's primary connections)

Dimensions

Dimensions in mm

LFE1



Baseplate
AGG41041713
(FE)

Important

To remove the control from its baseplate, **only** loosen the four screws **A**
 To remove the unit cover, loosen the two screws **B** **also**
C: elongated holes for securing the baseplate
EK: reset button
SG: viewing window