



ISO 9001



Gas Burner Controls

LFL1...



Supplementary data sheet 7712

Gas burner controls for gas, oil or dual-fuel forced draught burners of medium to high capacity. Multistage or modulating burners in intermittent operation *) with air pressure for checked supervised air damper control.

The gas burner controls are tested to EN 298 and CE-certified in compliance with the directives for gas-fired appliances and electromagnetic compatibility.

The LFL1... and this data sheet are intended for use by OEMs that integrate the burner controls in their products.

*) For safety reasons, at least one controlled shutdown must take place every 24 hours!

Use

The burner controls of the LFL1... range are designed for the control and supervision of forced draught gas burners of both expanding flame and interrupted pilot construction of medium to high capacity. They are universally applicable and can be used for both multistage and modulating burners as well as for dual-fuel burners and for burners of stationary air heaters (WLE to DIN 4794).

The difference between series 01 and 02 lies in the duration of the safety time for the pilot burner of burners using pilot gas valves.

For **atmospheric burners of high capacity**, type LFL1.638 is available.

For burner controls used with burners in continuous operation, refer to data sheet 7785, types LGK16... .

Mechanical design

The burner controls are of plug-in design. Housing and plug-in baseplate consist of shock- and heat-resistant black plastic.

The lockout indicator, the fault signal lamp and the reset button are located in the viewing window of the unit. The burner control is supplied with an exchangeable unit fuse and a spare fuse.

Functions

With regard to standards

The following LFL1... features exceed the relevant standards, thus offering a high level of additional safety:

- Detector and extraneous light tests are restarted immediately after the tolerated after-burn time. This means that open or not fully closed fuel valves initiate a lockout immediately after this time has elapsed. The tests end only on completion of the pre-purge time of the next burner startup
- The correct functioning of the flame supervision circuit is automatically checked during each burner startup sequence
- The control contacts for the fuel release are checked for welding during the post-purge time
- A built-in unit fuse protects the control contacts against overloads

With regard to the control of the burner

- The units permit burner operation with or without post-purging
- Fan motors with a current draw of up to 4 A (starting current 20 A max.) can be directly connected
- Separate control outputs for OPEN, CLOSE and MIN of the air damper actuator
- Checked air damper control to ensure pre-purging with the nominal amount of air. Checked positions: CLOSED or MIN (low-flame position) at the start, OPEN at the beginning, and MIN on completion of the pre-purge time. In case the actuator does not drive the air damper to the required position, the burner startup sequence will be interrupted
- Functional test of the air pressure monitor before the startup and supervision of the air pressure from the beginning of the required pre-purge time until controlled shutdown occurs
- Separate control output for a pilot gas valve which is closed after the 2nd safety time has elapsed
- Two control outputs for the release of the 2nd and, if necessary, 3rd output stage (or load control)
- With burner controls of series **01** and expanding flame, it is possible to increase the safety time from 2.5 to 5 s by a very simple measure (refer to "Engineering Notes"), provided the longer safety time complies with the local safety regulations
- When load control is enabled, the control outputs for the air damper actuator are galvanically separated from the control section of the unit
- Connection facilities for remote lockout warning device, remote reset and remote emergency shutdown

With regard to flame supervision

Methods of flame supervision:

- a) With an ionization current detector electrode, in networks with earthed or unearthed neutral. For this supervision method, the flame supervision circuit is designed such that possible disturbances of the ionization current due to the ignition spark normally **cannot** have any influence on the establishment of the flame signal. A short-circuit between detector electrode and burner ground cannot simulate a flame signal
- b) With UV detectors of the QRA... range (gas and oil burners).
Refer to data sheet 7712
- c) With simultaneous use of ionization current detector electrode and UV detector (e.g. with interrupted pilot burners or gas-electrically ignited oil burners)

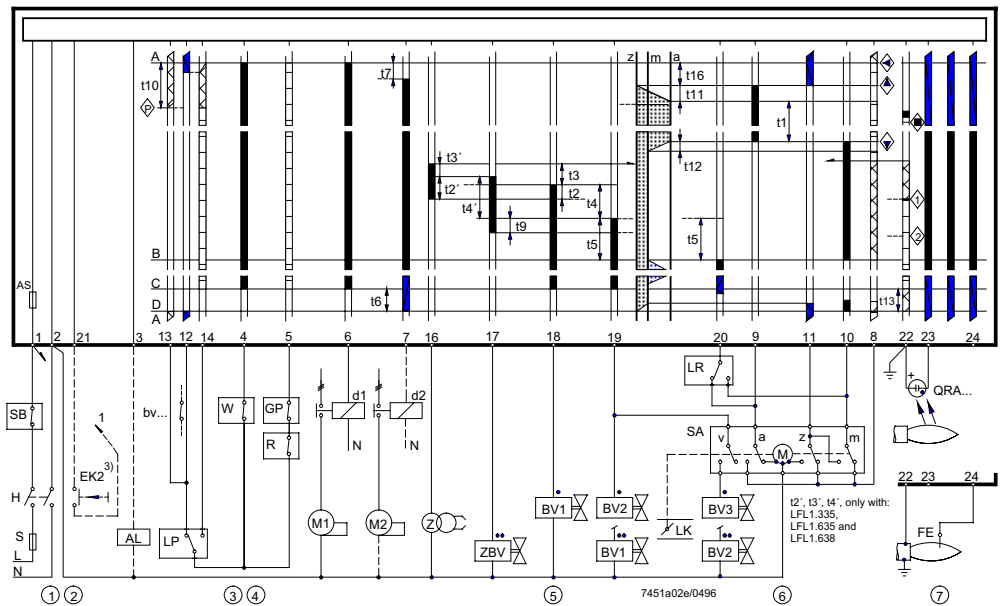
With regard to mounting and electrical installation

- Mounting location and position optional (degree of protection IP40)

Baseplate

- 24 connection terminals
- 2 auxiliary terminals, galvanically separated, with the markings «31» and «32»
- 3 earth terminals in the form of a latch for earthing the burner
- 3 neutral terminals, pre-wired to terminal 2, which is the neutral input
- 14 knockout entries for the cable entry by means of cable glands, 8 of which at the side and 6 in the bottom of the baseplate
- 6 lateral threaded knockout entries for cable entry glands Pg11

Connection diagram



- Control signals of burner control
- Permissible input signals
- Required input signals: if these signals are missing at the time marked by symbols or during the shaded phases, the burner control interrupts the startup sequence or initiates lockout. Legend for the symbols: see «Lockout indication»

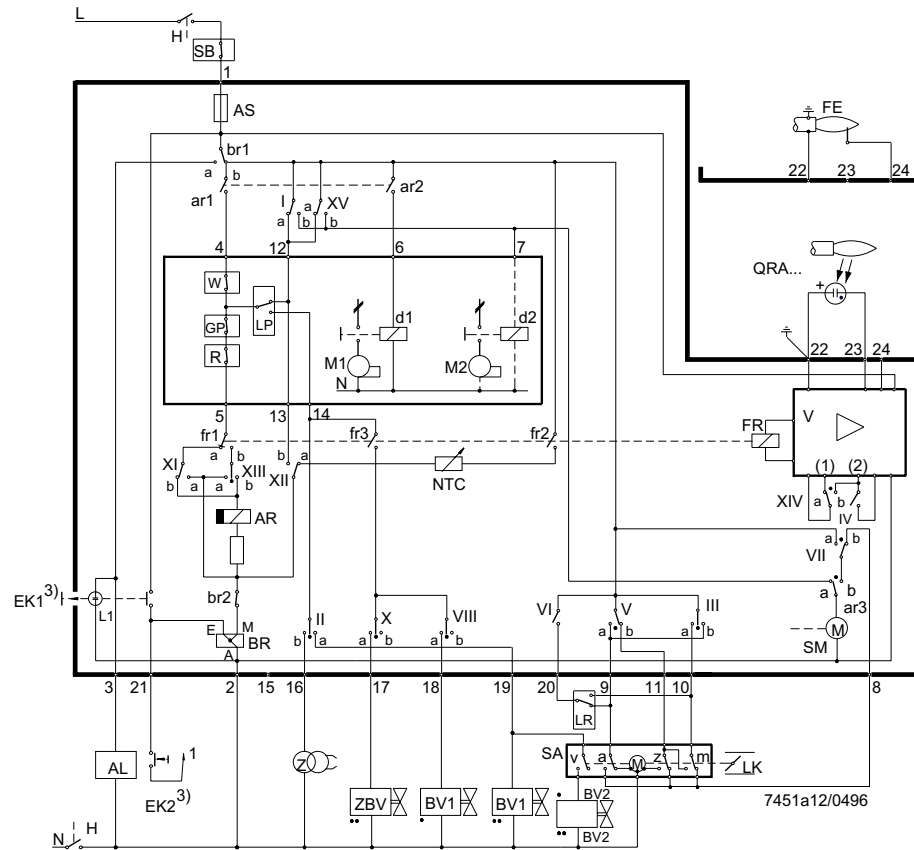
Engineering notes

Switches, fuses, earthing, etc., must be in compliance with the local regulations. For the connection of valves and other components, refer to the diagram provided by the burner manufacturer.

- ① **Phase and neutral** may not be interchanged!
Safety limit thermostats (manual reset, e.g. STB) have to be connected in the line.
- ② **Remote reset:** when button «EK2» is connected to terminal 3, only remote reset is possible; when connected to terminal 1, only emergency shutdown is possible.
- ③ **Required switching capacity** of the contacts between terminals 12 and 4 as well as between 4 and 14: depending on the load on terminals 16 ... 19.
- ④ **Air pressure supervision:** if the air pressure is not monitored by means of an air pressure monitor «LP», terminal 4 must be connected to terminal 12 and terminal 6 to terminal 14. Terminal 13 remains unused!
Control contacts of other devices in the burner installation are to be connected in series as follows:
To terminal 12: contacts which must be closed only during startup (otherwise no start).
To terminal 4 or 5: contacts which must be closed from startup to the controlled shutdown (otherwise no start or controlled shutdown).
To terminal 14: contacts which must be closed at the latest at the beginning of the pre-ignition time and which must remain closed until controlled shutdown occurs (otherwise lockout). This is valid for both long and short pre-ignition.
- ⑤
 - **Connection of fuel valves** with expanding flame burners. With two-stage burners, BV2 is connected instead of BV3.
 - Connection of fuel valves with interrupted pilot burners.
The direct connection of a fuel valve to terminal 20 is permitted only in
 - installations with a main shutoff valve on the mains side (safety valve) which is controlled by terminals 18 or 19, and
 - if two-stages valves are used, provided they **fully close** when the 1st stage - which is controlled by terminal 18 or 19 - is switched off.
- ⑥ For further examples of air damper control, refer to «Connection examples». In the case of air damper actuators without limit switch «z» for the CLOSED position of the damper, terminal 11 must be connected to terminal 10 (otherwise no burner start).
- ⑦ Simultaneous use of ionization and UV supervision is possible.

Connection diagram

LFL1...



For the connection of the safety valve, refer to the diagram provided by the burner manufacturer.

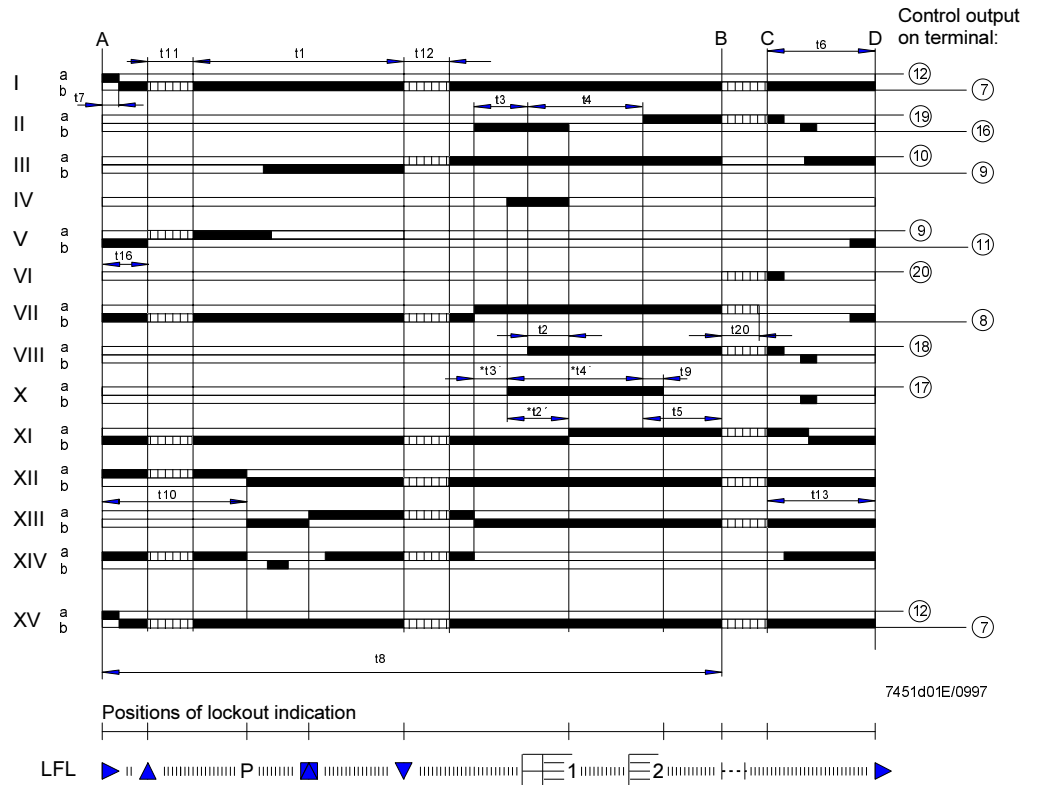
Legend

for the entire data sheet

a	Changeover limit switch for OPEN position of air damper	m	Auxiliary switch for the MIN position of the air damper
AL	Remote lockout warning device (alarm)	M...	Fan or burner motor
AR	Main relay (working relay) with contacts «ar...»	NTC	NTC resistor
AS	Unit fuse	QRA...	UV detector
BR	Lockout relay with contacts «br...»	R	Control thermostat or pressurestat
BV...	Fuel valve	RV	Continuously adjustable fuel valve
bv...	Control contact for the CLOSED position of gas valves	S	Fuse
d...	Contact or relay	SA	Air damper actuator
EK...	Lockout reset button	SB	Safety limiter (temperature, pressure, etc.)
FE	Ionization current detector electrode	SM	Synchronous motor of the sequence mechanism
FR	Flame relay with contacts «fr...»	v	In the actuator: auxiliary changeover switch for the release of fuel according to the air damper position
GP	Gas pressure monitor	V	Flame signal amplifier
H	Mains isolator	W	Limit thermostat or pressure monitor
L1	Fault signal lamp	z	In the actuator: limit switch for the CLOSED position of the air damper
L3	Operational readiness indication	Z	Ignition transformer
LK	Air damper	ZBV	Pilot gas valve
LP	Air pressure monitor		
LR	Load controller		

- Valid for expanding flame burners
- Valid for interrupted pilot burners
- (1) Input for the increase in operating voltage for the UV detector (detector test)
- (2) Input for forced energizing of the flame relay during functional test of the flame supervision circuit (contact XIV) and during safety time t2 (contact IV)
- 3) **Do not press EK for more than 10 seconds!**

Notes on the program sequence Sequence diagram



t2', t3', t4':

These times are valid **only** for the burner controls of **series 01**, i.e. LFL1.335, LFL1.635 and LFL1.638.

They do not apply to the units of series 02, as **cams X and VIII of these types switch simultaneously**.

Mode of operation

The diagrams above show both the connection circuit and the control program of the sequence mechanism.

- A** Start command (given by the control thermostat or pressurestat «R» of the installation)
- A-B** Startup sequence
- B-C** Burner operation (heat generation according to the control commands of load controller «LR»)
- C** Controlled shutdown through «R»
- C-D** Sequence mechanism runs into start position «A», post-purging

During burner off periods, only control outputs 11 and 12 are under voltage and the air damper is in its CLOSED position which is determined by limit switch «z» of the damper actuator. In order to carry out the detector and extraneous light test, the flame supervision circuit is under voltage, too (terminals 22/23 and 22/24).

Prerequisites for burner startup

- Burner control not interlocked in lockout position
- Air damper closed, limit switch «z» for the CLOSED position must supply voltage from terminal 11 to terminal 8
- The control contacts for the CLOSED position of fuel valves (BV...) or other contacts between terminal 12 and «LP» with similar control functions must be closed
- The N.C. contact of the air pressure monitor «LP» must be closed (LP test), that is, terminal 4 must be under voltage
- The contacts of the gas pressure monitor «GP» and of the limit thermostat or pressure monitor «W» must also be closed

Startup sequence

A

Start command by «R»

(«R» closes the control loop between terminals 4 and 5).

The sequence mechanism starts to run. At the same time, the fan motor receives voltage via terminal 6 (only pre-purging). After t_7 has elapsed, the fan motor or the flue gas fan also receives voltage via terminal 7 (pre- and post-purging).

On completion of t_{16} , the control command to open the air damper is given. During the actuator's running time, the sequence mechanism stops, as terminal 8 - via which the sequence mechanism is at first supplied with voltage - does not receive any voltage during this time. The sequence mechanism continues to run only after the air damper has fully opened.

t1

Pre-purge time with air damper fully open

During the pre-purge time, the correct functioning of the flame supervision circuit is tested (de-energizing of flame relay). The burner control goes into lockout position, if the relay does not function correctly.

Shortly after the beginning of the pre-purge time, the air pressure monitor must change over from terminal 13 to terminal 14, otherwise the burner control initiates lockout (start of air pressure check). At the same time, terminal 14 must be under voltage, as the ignition transformer and the fuel valves are supplied with voltage via this current path of the circuit.

After completion of the pre-purge time, the burner control drives the air damper via terminal 10 into the low-flame position which is determined by the changeover point of the auxiliary switch «m». During the running time, the sequence mechanism stops again. Shortly after that, the motor of the sequence mechanism is switched onto the control section of the burner control. That is why position signals to terminal 8 as of now do not affect the further startup of the burner (and the subsequent burner operation):

t5

Interval. After t_5 has elapsed, load controller «LR» is released via terminal 20.

With that, the startup sequence of the burner control ends. The sequence mechanism switches itself off, either immediately or after some so-called «idle steps»; these are steps without change of the contact positions, depending on the time variant.

Expanding flame burners

t3

Pre-ignition time, then release of fuel on terminal 18

t2

Safety time (start load)

On completion of the safety time, a flame signal must be present at input 22 of the flame signal amplifier. It must be continuously present until controlled shutdown takes place, otherwise the burner control goes into lockout position and interlocks itself in this position.

t4

Interval. On completion of t_4 , terminal 19 is under voltage. Thus the fuel valve at auxiliary switch «v» of the air damper actuator is supplied with voltage.

Interrupted pilot burners

t3

Pre-ignition time, then release of fuel for the pilot burner at terminal 17.

t3'

t2

1st safety time (pilot load)

On completion of the safety time, a flame signal must be present at input 22 of the flame signal amplifier. It must be continuously present until controlled shutdown takes place, otherwise the burner control goes into lockout position and interlocks itself in this position.

t4

Interval up to the release of the fuel valve at terminal 19 for the start load of the main burner.

t4'

t9

2nd safety time. On completion of the 2nd safety time, the main burner must have been ignited by the pilot burner, since terminal 17 becomes idle as soon as this time has elapsed, causing the closure of the pilot gas valve.

B

Operating position of burner

B-C

Burner operation

During burner operation, the load controller drives the air damper to the nominal load or low-flame position, depending on the demand for heat. The release of the nominal load is carried out by auxiliary switch «v» in the air damper actuator.

- C** **Controlled shutdown**
 During controlled shutdown, the fuel valves are immediately closed. At the same time, the sequence mechanism starts and programs the
- t6** **Post-purge time** (fan M2 at terminal 7).
 Shortly after the start of the post-purge time, terminal 10 receives voltage, so that the air damper is driven to the MIN position.
 The complete closing of the damper starts only shortly before the post-purge time has elapsed, initiated by the control signal on terminal 11, which also remains under voltage during the following burner off period.
- t13** **Permissible after-burn time.** During this time, the flame supervision circuit may still receive a flame signal without initiating burner lockout.
- D-A** **End of control program** (start position)
 As soon as the sequence mechanism has reset the control contacts into their start position - on completion of t6 - the detector and extraneous light test starts again. During the burner off period, a faulty flame signal of a few seconds only initiates lockout. Short ignition pulses of the UV tube, e.g. caused by cosmic radiation, do not initiate burner lockout.
- Times t2', t3' and t4' are only valid for burner controls of series 01.**

Warning notes

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- 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 flame signal amplifier from electric overloads, both ignition and detector electrode must be located such that the ignition spark cannot arc over to the detector electrode!
 - Ignition cables must always be laid separately, maintaining the greatest possible distance to the unit and other cables!
 - Observe the notes on the laying of detector cables (refer to «Technical data»)!
 - The electrical wiring must be made in compliance with national and local standards and regulations!
 - LFL1... are safety devices. It is therefore not permitted to open, interfere with or modify the units!
 - Check wiring carefully before putting the burner control into operation!
 - The LFL1... must be completely isolated from the mains before performing any work on it!
 - Check all safety functions when putting the burner control into operation or after performing service work!
 - Ensure protection against electric shock on the unit and on all electrical connections through appropriate mounting!
 - Electromagnetic emissions must be checked from an application point of view!
 - When used in connection with QRA..., terminal 22 must be earthed!
 - Supervision with both detector electrode and UV detector QRA... is possible, but for safety reasons, only one flame detector may be active at a time, with the exception of safety time t9. At the end of the 2nd safety time, one of the detectors must be inactive, that is, the detected flame must have extinguished, e.g. by shutting down the pilot valve at terminal 17!
 - UV detectors QRA... can be connected in parallel!

Control program under fault conditions and lock-out indication

In case of any disturbance, the sequence mechanism stops and with it the lockout indicator. The symbol above the reading mark of the indicator gives the type of disturbance:

- ◀ **No start**, e.g. because one contact is not closed (also refer to «Prerequisites for burner startup»). Lockout during or after control program sequence due to extraneous light (e.g. non-extinguished flames, leaking fuel valves, defects in the flame supervision circuit, etc.)
- ▲ **Interruption of startup sequence**, because the OPEN signal has not been delivered to terminal 8 by limit switch «a». Terminals 6, 7 and 14 remain under voltage until the fault has been corrected!
- P **Lockout**, because there is no air pressure indication at the beginning of air pressure control.
Every air pressure failure after this moment in time leads to lockout, too!
- **Lockout** due to a fault in the flame supervision circuit.
- ▼ **Interruption of startup sequence**, because the position signal for the low-flame position has not been delivered to terminal 8 by auxiliary switch «m». Terminals 6, 7 and 14 remain under voltage until the fault has been corrected!
- 1 **Lockout**, because no flame signal is present after completion of the (1st) safety time.
- 2 **Lockout**, because no flame signal has been received on completion of the 2nd safety time (flame signal of the main flame with interrupted pilot burners).
- | **Lockout**, because the flame signal has been lost during burner operation.

If lockout occurs at any other moment in time between the start and the pre-ignition which is not marked by a symbol, this is usually caused by a premature, i.e. faulty flame signal, e.g. caused by a self-igniting UV tube.

Lockout indication



LFL1..., series 01



LFL1..., series 02

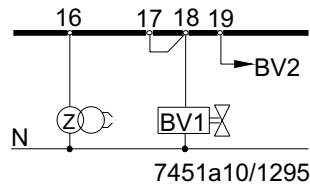
- a-b Startup sequence
- b-b' «Idle steps»
(without contact confirmation)
- b(b')-a Post-purge program

- Duration of safety time with expanding flame burners
- Duration of safety time with interrupted pilot burners

When lockout occurs, the burner control can immediately be reset. After resetting (as well as after correction of a fault which resulted in a controlled shutdown or after each mains failure), the sequence mechanism always returns to its start position, whereby **only** terminals 7, 9, 10 and 11 receive voltage in accordance with the control program. It is only then that the burner control begins with a new burner startup.

Connection examples

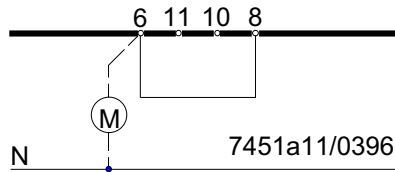
Doubling of safety time with expanding flame burners



Only when a burner control of **series 01** is used. Due to these circuit measures (connection of terminals 17 and 18), the pre-ignition time is reduced to 50 %.

Extension of the safety time is permitted only if this is in compliance with the standards of the respective country.

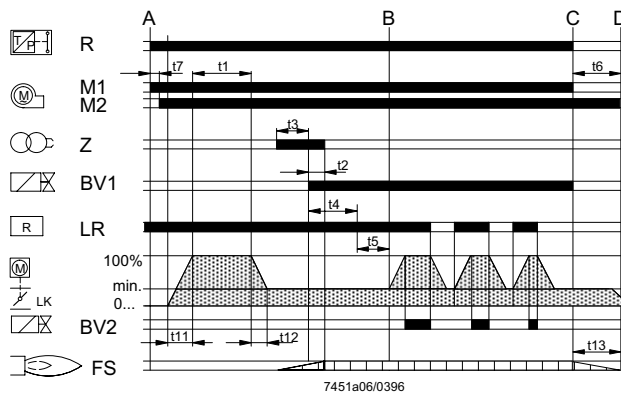
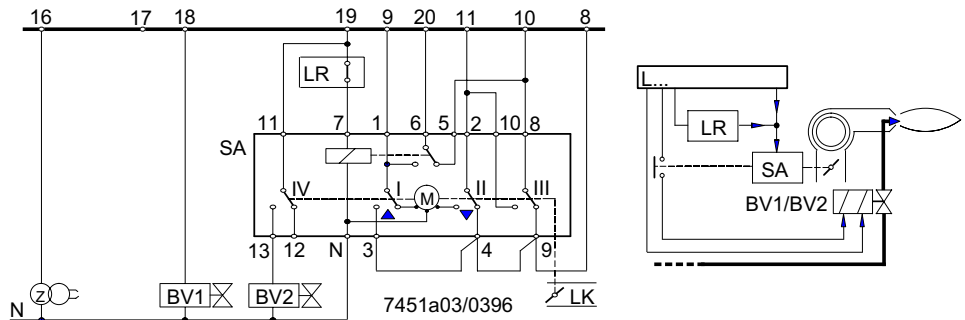
Burner without air damper



In case of burners without air damper (or with an air damper not controlled and supervised by the burner control unit), terminal 8 must be connected to terminal 6, as otherwise the burner control cannot carry out the burner startup.

Two-stage expanding flame burner

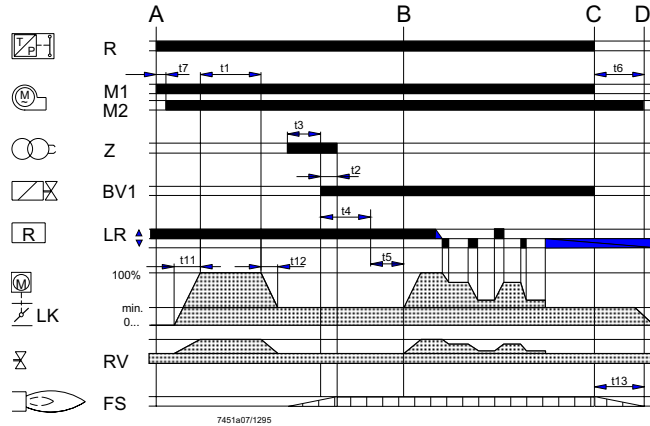
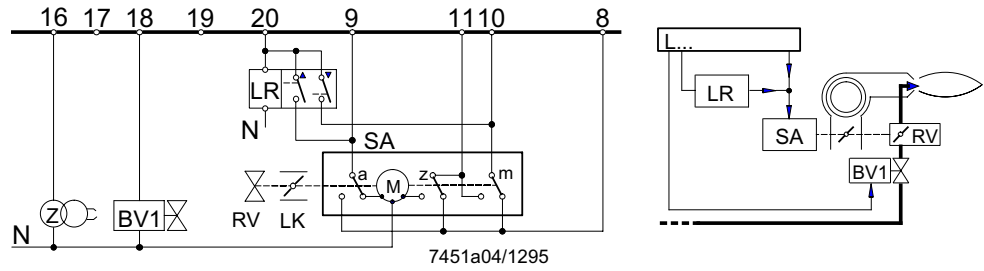
Load control with an ON/OFF controller. The air damper is closed during burner off periods.



Control of actuator «SA» according to the **single-wire control principle** (actuator «SA»: e.g. type SQN3... according to data sheet 7808). For other connections, refer to «Connection diagrams».

Modulating expanding flame burner

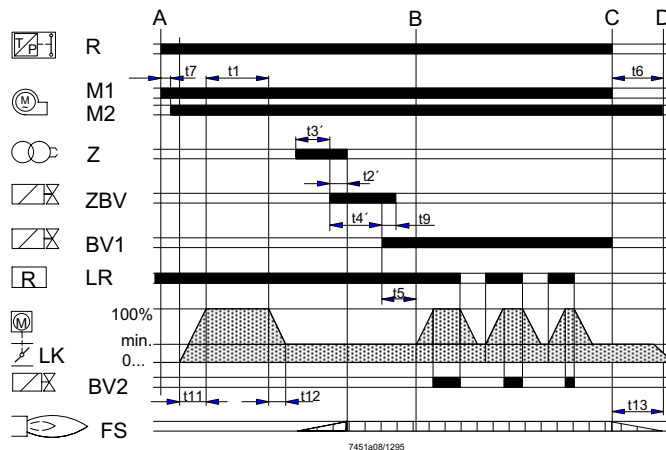
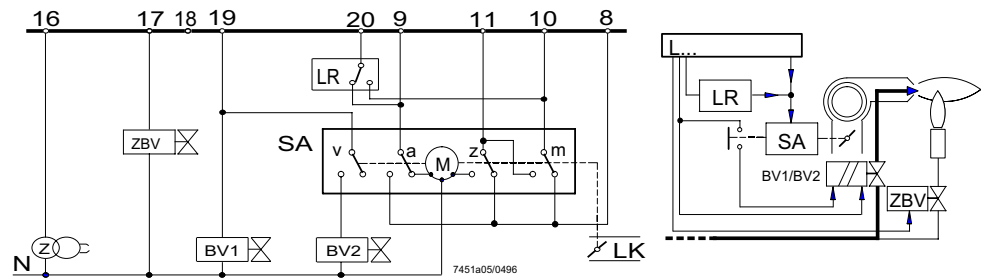
Load control with a modulating controller with galvanically separated control contacts for OPEN and CLOSED positions.



The air damper is closed during burner off periods. For other connections, refer to «Connection diagrams».

Two-stage interrupted pilot burner

Controlled and supervised by a burner control of series 01.



The air damper is closed during burner off periods. For other connections, refer to «Connection diagrams».

Technical data

Mains voltage	AC 220 V - 15 % ... 240 V + 10 % AC 100 V - 15 % ... 110 V + 10%	Required switching capacity of switching devices – Between terminals 4 and 5 1 A, AC 250 V – Between terminals 4 and 12 1 A, AC 250 V – Between terminals 4 and 14 depending on load on terminals 16 to 19, 1 A min., AC 250 V
Mains frequency	50 Hz - 6 % ... 60 Hz + 6 %	
Power consumption	3 VA	
Unit fuse, built-in	T6, 3H 250 V to IEC 127	Permissible mounting position optional Degree of protection IP40
Unit fuse, external	16 A max., slow	Weight – Burner control approx. 1000 g – Baseplate approx. 165 g
Radio interference protection	N to VDE 0875	
Permissible input current at terminal 1	5 A to VDE 0660 AC 3	
Perm. loading of control terminals	4 A to VDE 0660 AC 3	
Environmental conditions		CE conformity
- Transport	IEC 721-3-2	According to the directives of the European Community
Climatic conditions	class 2K2	Electromagnetic compatibility EMC
Temperature	-50...+70 °C	89/336 EEC incl. 92/31 EEC
Humidity	< 95 % r.h.	Gas appliance directive 90/396 EEC
Mechanical conditions	class 2M2	Emissions EN 50081-1
- Operation	IEC 721-3-3	Immunity EN 50082-2
Climatic conditions	class 3K5	
Temperature	-20...+60 °C	
Humidity	< 95 % r.h.	

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

Ionization current supervision

Voltage at detector electrode		Maximum permissible length of detector cable
– Operation	AC 330 V ± 10 %	– Normal cable, laid separately ²⁾ 80 m
– Test	AC 380 V ± 10 %	– Shielded cable, 140 m e.g. high frequency cable; shielding connected to terminal 22
Short-circuit current	0.5 mA max.	
Minimum ionization current required	6 µA	
Recom. range of measuring instrument	0 ... 50 µA	

UV supervision

Supply voltage		Weight
– Operation	AC 330 V ± 10 %	– QRA2 60 g
– Test	AC 380 V ± 10 %	– QRA10 450 g
Minimum detector current required ³⁾	70 µA	Identification code to EN298:
Maximum detector current		all types (except LFL1.148) FBLLXN
– Operation	680 µA	
– Test	1000 µA ¹⁾	
Max. perm. length of detector cable		
– Normal cable, laid separately ²⁾	100 m	
– Shielded cable, e.g. high frequency cable; shielding connected to terminal 22	200 m	

¹⁾ During the pre-purge time with increased test voltage: self-ignition and extraneous light test

²⁾ Laying in multi-core is **not** permitted

³⁾ For better reading, connect an electrolytic capacitor of 100 µF, DC 10 V, parallel to the measuring instrument, +pole of the instrument connected to terminal 23

Ordering

Available types

Switching times are given in seconds, in the burner startup sequence, valid for a frequency of 50 Hz. In case of 60 Hz, the times are reduced by approx. 20 %.

	LFL1.122 ¹⁾ Series 02	LFL1.133 ¹⁾ Series 02	LFL1.322 ¹⁾ Series 02	LFL1.333 ¹⁾ Series 02	LFL1.335 ¹⁾ Series 01
Preferred types for / in:					
	Flash steam generator	Flash steam generator	D (also for WLE) F	A D	GB
t1	10	9	36	31.5	37.5
t2	2	3	2	3	2.5
t2'	–	3	–	–	5
t3	4	3	4	6	5
t3'	–	–	–	–	2.5
t4	6	6	10	12	12.5
t4'	–	–	–	–	15
t5	4	3	10	12	12.5
t6	10	14.5	12	18	15
t7	2	3	2	3	2.5
t8	30	29	60	72	78
t9	2	3	2	3	5
t10	6	6	8	12	10
t11	optional				
t12	optional				
t16	4	3	4	6	5
t13	10	14.5	12	18	15
t20	32	60	–	27	22.5

	LFL1.622 ¹⁾ Series 02	LFL1.635 ¹⁾ Series 01	LFL1.638 Series 01
	F I	B NL ²⁾	Large atmospheric burner
t1	66	67.5	67.5
t2	2	2.5	2.5
t2'	–	5	5
t3	4	5	5
t3'	–	2.5	2.5
t4	10	12.5	12.5
t4'	–	15	15
t5	10	12.5	12.5
t6	12	15	15
t7	2	2.5	2.5
t8	96	105	105
t9	2	5	7.5
t10	8	10	10
t11	optional		
t12	optional		
t16	4	5	5
t13	12	15	15
t20	–	–	–

¹⁾ Available in 100...110 V, please add AC 110 V to type reference when ordering

²⁾ Reversed polarity protection according to Dutch installation standard: AGM30

Legend for the times

t1	Pre-purge time with air damper open
t2	Safety time
t2'	Safety time or 1st safety time with burners using pilot burners
t3	Pre-ignition time, short (ignition transformer on terminal 16)
t3'	Pre-ignition time, long (ignition transformer on terminal 15)
t4	Interval between start of t2 and release of valve at terminal 19
t4'	Interval between start of t2' and release of valve at terminal 19
t5	Interval between end of t4 and release of load controller or valve at terminal 20
t6	Post-purge time (with M2)
t7	Interval between start command and voltage on terminal 7 (start delay time for fan motor M2)
t8	Duration of startup (without t11 and t12)
t9	2nd safety time with burners using pilot burners
t10	Interval from startup to beginning of air pressure check without running time of air damper
t11	Running time of air damper into OPEN position
t12	Running time of air damper into low-flame position (MIN)
t13	Permissible after-burn time
t16	Interval until OPEN command for the air damper is given
t20	Interval until self-shutdown of the sequence mechanism after burner startup

