



FM739

Control Unit

LEC1...

Series 02



Control unit for double or multi-flame supervision of oil, gas or forced draught oil/gas burners of any fuel throughput (for continuous or intermittent operation).

Use

The LEC1... control unit is designed for the fully automatic start-up and supervision of those forced draught burners with which the flame supervision should or must be carried out by separate flame safeguards, e.g. with

- Dual supervision (of the main flame or of the pilot and main flame by means of **two** identical or different detectors).
- Supervision of forced draught oil/gas burners (with different types of detectors according to selected operating mode).
- Multi-flame supervision (i.e. central and simultaneous control of the start-up and supervision program for several burners, the flames of which, however, must be individually supervised by one or two flame safeguards each).

The following flame safeguards are available:

LAE10... for the supervision of oil burners with active selenium photocell sensor RAR... in intermittent operation.

LFE10... for the supervision by means of ionization field (gas burner) or with UV-detectors QRA... (gas, oil or dual fuel burners, with or without ignition spark supervision) in intermittent operation.

LFE50... for the supervision with UV-detectors QRA50.../51... (gas, oil or dual fuel burners) in intermittent or continuous operation.

All devices comply with the relevant European standards for oil, gas and forced draught burners of any fuel throughput.

The LEC1... can control the following burner plant components: fan motor, flue gas fan, air damper, ignition transformer, one to three fuel valves, the load controller and an external fault signaling device.

Construction of the Control Unit and the Flame Safeguards

The control unit LEC1... as well as the flame safeguards LAE10... and LFE10... are of plug-in design and are suitable for the mounting in any position at the burner, on control panels and in control cabinets. The spacious terminal bases and the housings are made of impact proof and heat-resistant plastic. The switching mechanism of the unit driven by a synchronous motor, its relays as well as all other switching, control and adjusting elements are mounted on solid printed circuit boards.

Operation

The following description of the mode of operation refers to the start-up and supervision of **one single** burner.

With **multi-flame supervision** all of the burners connected to the control unit are put into operation and supervised simultaneously in the same manner. A defect leading to a lock-out at one of the burners therefore results in the shutdown of all burners. The prerequisite for the immediate restart of the non-defective burners is the bridging of the flame safeguard of the defective burner by means of an operating switch. This switch must simultaneously interrupt all control lines to the ignition transformer and the fuel valves. For connection examples please refer to data sheet 7781.

Prerequisites for the burner start-up

The burner is started only if:

- the switching mechanism of the control unit is in its start position
- the control unit is not in lock-out position, e.g. with defective UV-tube
- the contacts of all the control and safety devices in the control loop between terminal 8 and 9 are closed
- the air pressure monitor does not indicate any air pressure

Defects in the flame safeguard or in the control unit prevent the start or lead to a lock-out during the start-up.

Important

If the air damper is not controlled by the control unit, terminal 20, 21 and 22 must be interconnected.

Program sequence during burner start-up

First the fan motor is switched on via terminal 3 and the air damper actuator is driven via terminal 22. As soon as the air damper has reached its fully open position, the switching mechanism of the unit starts its run - the prepurge time begins. The minimum air pressure set at the air pressure monitor must be reached within 10 s (or 7 s in operation with post-purge) and must be maintained until the controlled shutdown, otherwise lockout occurs. A flame signal during the prepurge time also leads to a lockout. On completion of the set prepurge time the air damper receives the control command to return to the minimum air position. During the air damper's closing time the switching mechanism remains stationary. As soon as the signal contact for the minimum butterfly position is operated by the air damper actuator, the switching mechanism starts again and now controls the program sequence which can no longer be influenced externally:

- Pre-ignition (3 s)
- Release of the 1st fuel valve via terminal 5 (the fuel valve of a pilot burner which must be closed on completion of the 2nd safety time must, however, 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 control unit)
- Following an interval of 11 s after the release of the 1st valve, the 2nd fuel valve is released
- The pilot burner, if connected to terminal 10, is switched off
- The load controller is switched on after a further interval of 12 s. Now the burner has reached its operating position. From now on the load controller controls the burner capacity by either increasing or decreasing the fuel throughput and the air volume depending on the heat demand (fuel/air ratio control). This can be carried out in stages, i.e. by means of thermostats or continuously (modulating) by using a continuous controller.

The loss of flame during operation always leads to burner lockout.

Burner start-up with ignition spark supervision

In principle the program sequence is the same as with burner start-up without ignition spark supervision. Exceptions:

- If the flame safeguard does not receive any input signal during the **short pre-ignition time** (UL2 on position «Short pre-ignition»), lockout occurs before any gas is released, i.e. safety time $t_2 = 0$ s.
- With ignition spark supervision the safety time for the pilot burner can only be adjusted between 0 ... 6 s (in the time diagram of the switching mechanism: t_{2z}).

Control program following a controlled shutdown

Controlled shutdown is carried out as soon as one control or supervision device in the control loop between terminal 8 and 9 open its contact, i.e. the fuel valves are closed immediately. The switching mechanism starts again and now programs the post-purge, if necessary. On completion of the post-purge time the switching mechanism has again reached its start position in which it remains until the next switching on command is received.

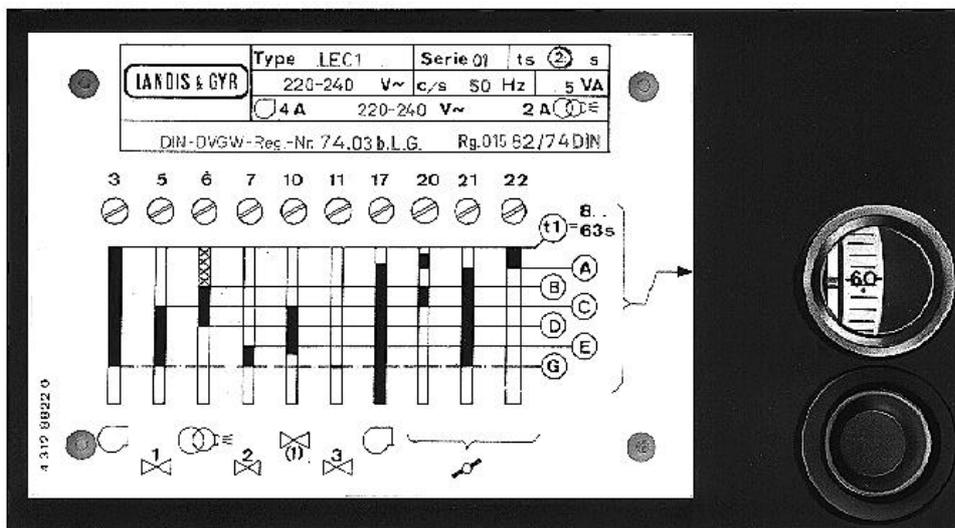
The flame supervision restarts again during the post-purge time; therefore every flame signal during this time leads to a lockout.

Control program following lockout reset

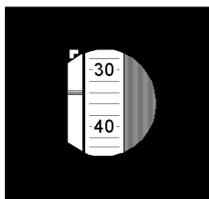
After actuation of the built-in or external reset button the switching mechanism runs through to its start position. The only burner plant component which is operated during this time is a fan motor connected to terminal 17. As the limit thermostat or pressurestat normally continues to call for heat, the unit immediately initiates a restart as soon as it has reached its start position.

Program Indicator

The program indicator continuously shows the respective phase of the burner start-up sequence. The **letters** correspond to those of the switching mechanism diagram next to the viewing window. The **figures** indicate the remaining pre-purge time. If lockout occurs the switching mechanism and the program indicator stop and by this means determine the operating phase during which the lockout occurred.

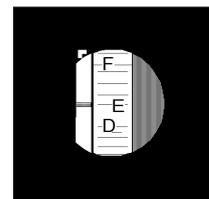


Reading the program indicator



← Remaining pre-purge time approx. 35 s

Valve 2 at terminal 7 is opened →



Technical Data Control unit LEC1

Mains voltage	AC 220 V -15%...AC 240 V +10% AC 100 V -15%...AC 110 V +10%	Radio interference protection	N according to VDE0875
Mains frequency	50 Hz -6%...60 Hz +6%	Max. permissible load on the control outputs	
Unit fuse, built-in	T6,3H250V	- per terminal	4 A
External fuse	10 A max., slow	- in total	5 A
Consumption		Degree of protection	IP40
- during start	8 VA	Mounting position	optional
- during operation	5 VA	Cable gland	Pg11
		Weight	approx. 2 kg
Identification code according to EN 298			
F B L L B N			
Environmental conditions:		CE-Conformity	
- Transport	IEC721-3-2	According to the directives of the European Community	
Climatic conditions	class 2K2	Electromagnetic compatibility EMC	
Temperature	-50...+60 °C	89/336 EWG includ. 92/31 EWG	
Humidity	< 95 % r.F.	Gas appliance directive 90/396 EWG	
Mechanical conditions	class 2M2	Interfering emissions EN 50081-1	
- Operation	IEC721-3-3	Immunity against disturbances EN 50082-2	
Climatic conditions	class 3K5		
Temperature	-20...+60 °C		
Humidity	< 95 % r.F.		

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

Flame supervision³⁾

	LFE10... Series 02 ionization field	LFE10... Series 02 UV-cell	LAE10... Series 02 selenium cell
Minimum required detector current in µA			
- with AC 100 V and AC 220 V	8	150	8 min.
- with AC 110 V and AC 240 V	9	200	8 min.
Max. possible detector current in µA	approx. 100	approx. 650	approx. 25

Detectors

Permissible connecting cable length	20 m ¹⁾	20 m ¹⁾	20 m ²⁾
Permissible ambient temperature	-	60°C	60°C

¹⁾ In case of larger distances use **low capacitance** cable, e.g. one-core cable (total 2 nF max.)

²⁾ Detector cables must always be laid separately, the selenium photocell RAR8 must be used in case of larger distances

³⁾ For information on LFE50... please refer to data sheet 7783

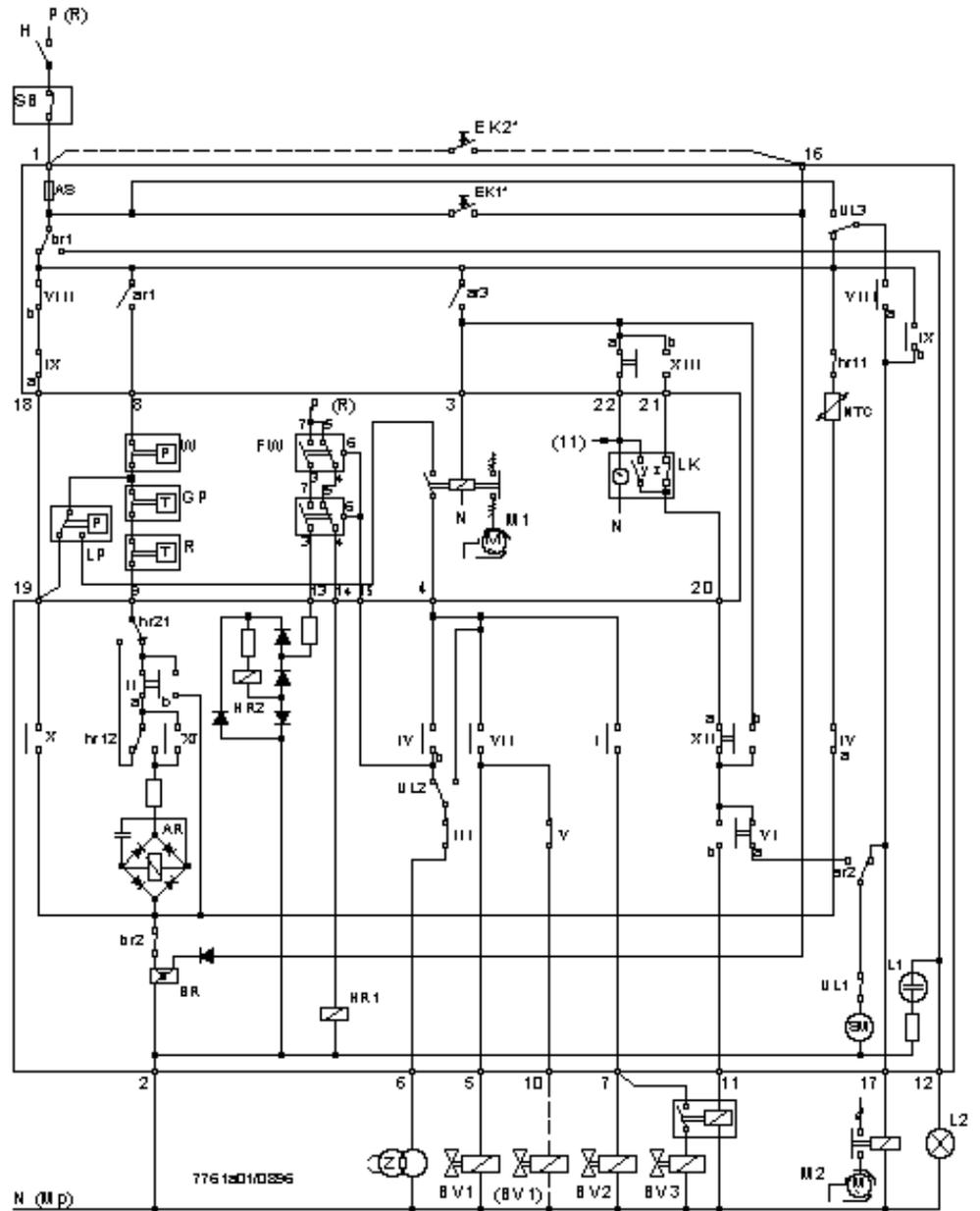
Type Summary and Ordering

Type/Ordering reference	Supply voltage (V)	Factory settings for			
		Hz	t1 (s)	t2 (s)	t9 (s)
LEC1/8851	AC 220...240	50	60	2	2
LEC1/8853	AC 220...240	50	30	2	2
LEC1/8866	AC 100...110	50	30	2	2
LEC1/8867	AC 100...110	60	30	2	2
LEC1/8868	AC 220...240	60	30	2	2
LEC1/8892	AC 220...240	50	60	5	5
LEC1/8906	AC 220...240	50	30	2	5

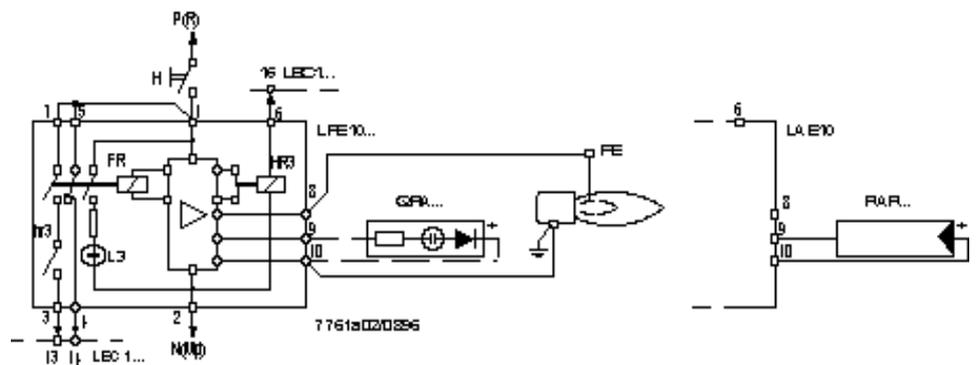
The control unit is delivered without terminal baseplate. The latter must be ordered separately using the following type reference: **AGG41041713 (EC)**

For flame safeguards **LAE10...** and **LFE10...** as well as the appropriate detectors, please refer to data sheet 7781.

Basic Diagram LEC1



LAE10... and LFE10...



Attention: When using the UV-detector QRA... terminal 10 must be connected to earth!

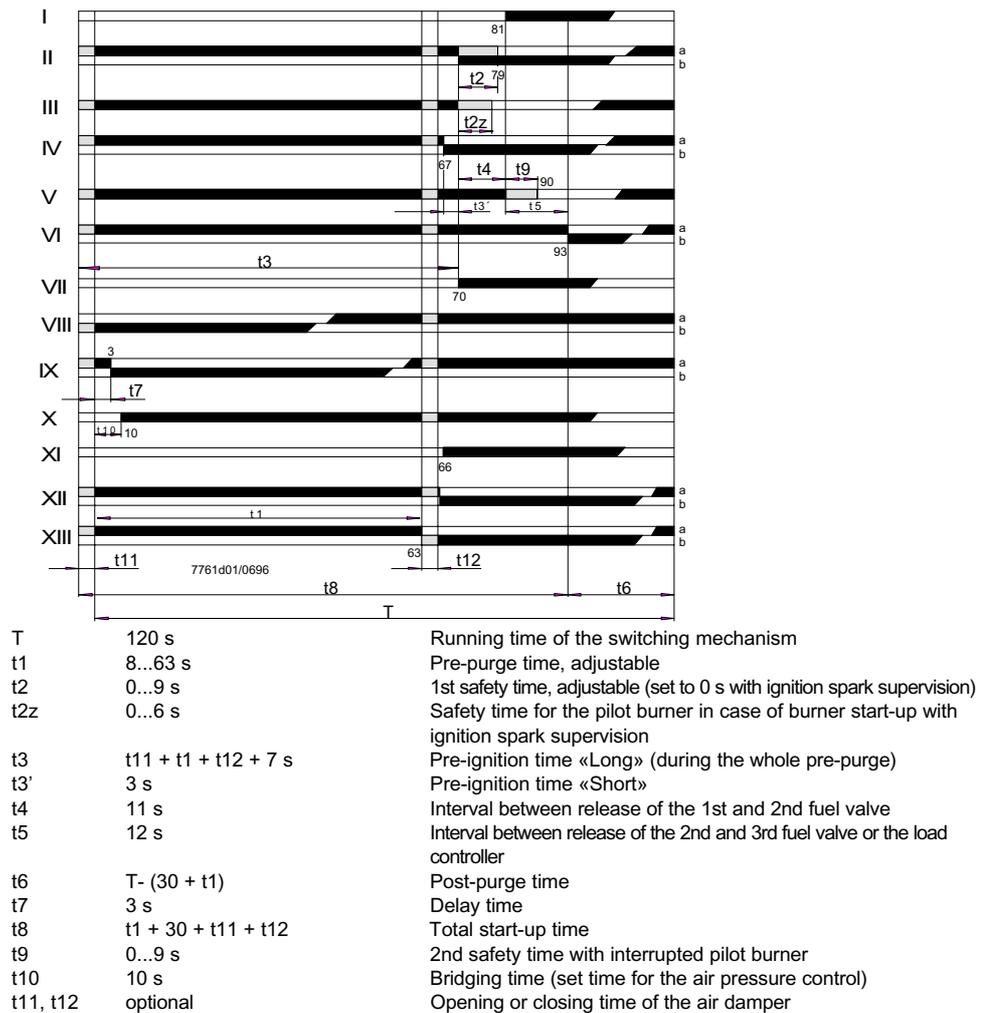
Legend

for the entire data sheet

AS	Unit fuse	L2	Lockout warning device, external
AR	Working relay with contacts «ar...»	L3	Signal lamp for the flame indication
BR	Lockout relay with contacts «br...»	LK	Air damper actuator with limit or auxiliary switches (see also «Connection examples») a = actuator runs into position «Open» (maximum air volume) z = actuator runs into position «Closed» (minimum air volume)
BS1	Operating switch	LP	Air pressure monitor
BS2	Operating mode selector switch	M...	Fan
BV...	Fuel valve	NTC	High-temperature conductor (delay unit)
(BV...)	Fuel valve for a pilot burner which is switched off on completion of the 2nd safety time	OV...	Oil valve
c...	Fan contactor with contacts «c...»	Q	Temperature or pressure detector
d...	Auxiliary relay with contacts «d...»	QRA...	UV-detector
e...	Thermal overload fuse	R...	Thermostat or pressurestat
EK1	Reset button at the unit	RAR...	Selenium photocell detector
EK2	Remote reset button	RV	Control valve
FE	Flame detector electrode	SB	Safety limiter
FR	Flame relay	SM	Synchronous motor of the switching mechanism
FW	Contacts of the flame safeguards LAE10..., LFE10... or LFE50...	SQ...	Type reference of air damper actuator
GP	Gas pressure monitor	UL1	Operating switch for motor of the switching mechanism
GV...	Gas valve	UL2	Changeover link for «Short/long pre-ignition time»
H	Main isolator	UL3	Changeover link for «STOP» or «Run» of the sequence mechanism after a lockout
HR1	Auxiliary relay with contacts «hr11 and hr12»	W	Limit thermostat or pressure monitor
HR2	Auxiliary relay with contact «hr21»	Z	Ignition transformer
HR3	Auxiliary relay for flame detector or flame simulation test		
L1	Lockout warning device, built-in		

* Do not press EK longer than 10 s

Time Diagram of the Switching Mechanism



T	120 s	Running time of the switching mechanism
t1	8...63 s	Pre-purge time, adjustable
t2	0...9 s	1st safety time, adjustable (set to 0 s with ignition spark supervision)
t2z	0...6 s	Safety time for the pilot burner in case of burner start-up with ignition spark supervision
t3	$t_{11} + t_1 + t_{12} + 7$ s	Pre-ignition time «Long» (during the whole pre-purge)
t3'	3 s	Pre-ignition time «Short»
t4	11 s	Interval between release of the 1st and 2nd fuel valve
t5	12 s	Interval between release of the 2nd and 3rd fuel valve or the load controller
t6	$T - (30 + t_1)$	Post-purge time
t7	3 s	Delay time
t8	$t_1 + 30 + t_{11} + t_{12}$	Total start-up time
t9	0...9 s	2nd safety time with interrupted pilot burner
t10	10 s	Bridging time (set time for the air pressure control)
t11, t12	optional	Opening or closing time of the air damper

Maximum permissible **after-burn time**
(counted as of the beginning of t6)

7 s

For the factory setting of the different types, please refer to the type summary.

Specific Features

The construction, control program and adjustment facilities of the unit allow its almost unlimited use in burner plants of any size and type of construction, be it expanding flame or interrupted pilot burners, permanently operating or any other special burners.

With respect to the application

- Pre-purge time adjustable between 8 and 63 s
- Operation at option with or without post-purge
- Fully automatic control of the air damper, with optional running time of the damper actuator
- Air pressure check can be combined with functional control of the air pressure monitor prior to the start
- Ignition at option: direct ignition, with pilot burner as well as with or without ignition spark supervision
- Pre-ignition time adjustable to «Long» (during the pre-purge time) or «Short» (3 s, e.g. for forced draught gas burners)
- 1st and 2nd safety time adjustable between 0 and 9 s
- Automatic test of flame safeguards and flame detectors during burner-off periods and the purge times (with lockout if a faulty flame signals occurs)
- Semi-automatic burner start and operation possible

With respect to mounting and installation

- Optional mounting location and position of the control unit
- Large space for connection in terminal base
- Additional 4 terminals each for earth and neutral conductors as well as 4 auxiliary terminals

With respect to commissioning and trouble shooting

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

For adjustment instructions please refer to «Adjustment facilities at the unit»

* It is, however, also possible to program the unit by means of a changeover link (UL3) in such a way that the programming mechanism does not stop in case of a lock-out, but that it runs through to the end of the program. The only component that remains under voltage during that time is a fan for the post-purge which is connected to terminal 17.

Warning Notes

- **In the area covered by DIN assembly and installation must comply with the requirements of the VDE, especially with the DIN/VDE standards 0100 and 0722!**
- **The electrical wiring must be made in accordance with national and local standards.**
- **LEC1... is a safety device! The loosening of the securing screws as well as any changing of the factory setting must therefore be carried out by authorized persons only!**
- **Check wiring carefully before putting the unit into operation!**
- **The LEC1 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!**
- **Ensure protection against contact at the unit and at all electrical connections by appropriate mounting!**
- **Electromagnetic emissions must be checked from an application point of view!**
- **Condensation and any influence of humidity must be avoided!**

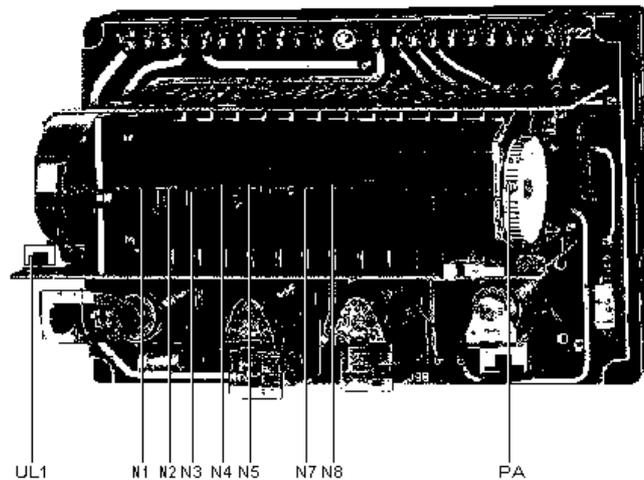
Adjustment Facilities at the Unit

General instructions

- Isolate the unit from the mains prior to any adjustment
- Loosen all 6 retaining screws and only remove the unit cover
- The numbering of the switching cams always starts from the motor
- The cam shaft can be turned into any position by hand (clockwise direction of rotation as seen from the motor)

Adjustment elements

UL1	ON/OFF switch for the motor of the switching mechanism	N5	Cam 5, adjustable (2nd safety time)
N1	Cam 1, fixed	N7	Cam 7, fixed
N2, N3	Cam 2 and 3, adjustable (1st safety time)	N8	Cam 8, adjustable (prepurge time)
N4	Cam 4, fixed	PA	Program indicator



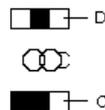
Important

LEC1... is a safety device! The loosening of the securing screws as well as any modification of the factory setting may therefore be carried out by authorized persons only!

On the rear side of the baseplate:

- UL2 Changeover link for «Short/long pre-ignition time», in position «Short pre-ignition» locked with varnish
- UL3 Changeover link for «STOP» of the control sequence following a lockout or «Restart». Only the fan for the post-purge connected to terminal 17 remains under voltage.

Adjustment of the pre-ignition time



- C** «Long pre-ignition time» (during the prepurge)
- D** «Short pre-ignition time» (3 s, factory setting)

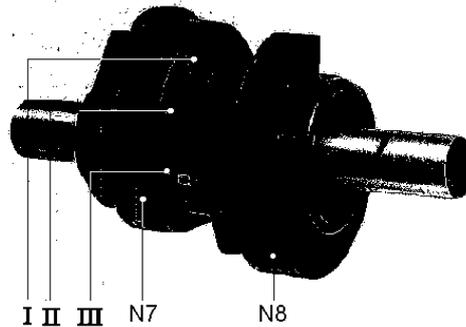
Loosen screw before carrying out the adjustment and tighten it carefully afterwards!

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Adjustment of the prepurge time

- Loosen the securing screw of the red cam 8
- Turn the cam shaft by hand until the required pre-purge time is indicated next to the index notch on the carrier of the switching mechanism
- Hold the cam shaft firmly and rotate cam 8 until the contact tappet operated by it just jumps out or the cam strikes this tappet
- Carefully tighten the securing screw of the cam and check the adjusted time for accuracy. The set time is also visible in the viewing window, if the unit is in its start position.

The adjustments of the mark of the red cam N8 to the graduation marks of the black cam N7 result in the prepurge times given in the following table.



Cam 8 adjusted to...		
...cam 7, graduation mark		
I		t1 = 8 s
II		18 s
III		28 s
Adjustment at stop		63 s
Factory setting		ca. 30 s or 60 s

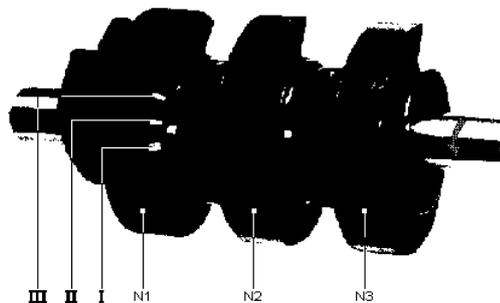
Adjustment of the safety times

The safety times are adjusted by setting the red cams of the switching mechanism. Their time marks serve as setting aid. After the adjustment the securing screws of the cams must be tightened very carefully to make any unintentional readjustment impossible.

1st safety time t2

(operation without ignition spark supervision)

- Loosen the securing screws of cams 2 and 3
- Hold cam 1 firmly and align the setting mark of cam 2 with the according time mark I of cam 1 (see picture and table, intermediate positions possible). Lock cam 2.
- Rotate cam 3 in such a way that its setting mark is set against the lower stop of cam 2. Lock cam 3.
- Check the adjusted safety time and set the new value on the rating plate of the unit cover (adjustment slot on the rear side of the cover).



Cam 2 adjusted to ...		
...cam 1, time mark		
I		t2 = 0 s
II		= 4,5 s
III		= 9 s
Factory setting		< 2 s

1st safety time t2z

(operation with ignition spark supervision)

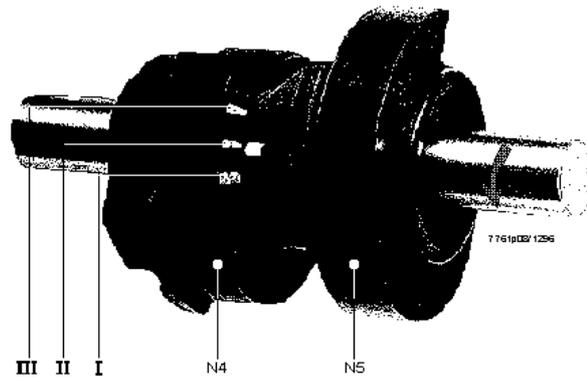
- Loosen the securing screws of cams 2 and 3
- Hold cam 1 firmly, set the setting mark of cam 2 to the time mark I of cam 1 and lock cam 2.
- Hold cam 2 firmly, set the setting mark of cam 3 to the required time and lock cam 3 (see photo and table).
- Check adjusted safety time

Cam 3 adjusted to...

...stop in the arrow direction	t2z = 0 s
...the other stop	6 s
Factory setting	0 s

2nd safety time t9

- Loosen the securing screw of cam 5 and align its setting mark to the according time marks of cam 4 (see photo and table, intermediate settings possible).

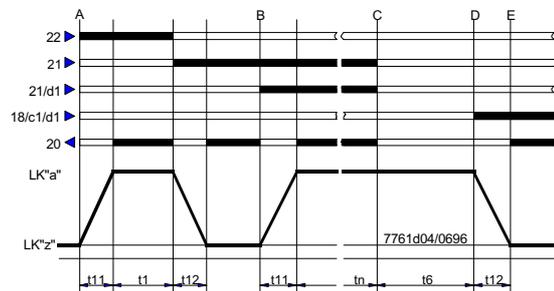
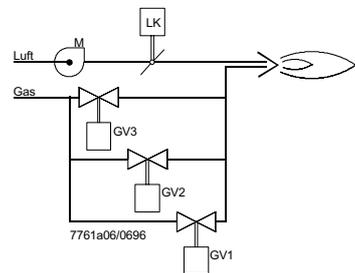
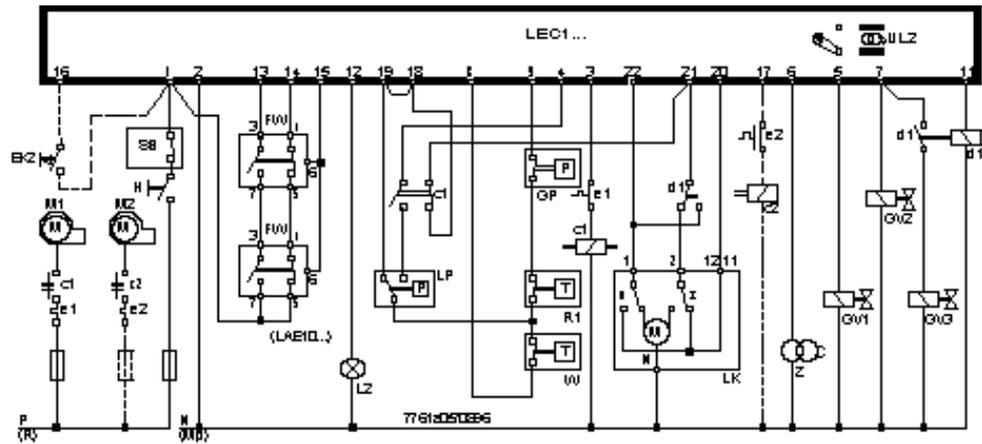


Cam 5 adjusted to

...cam 4, time mark I	t9 = 0 s
II	= 4,5 s
III	= 9 s
Factory setting	< 2 s

Double or multi-flame supervision of gas burners (expanding flame burner)

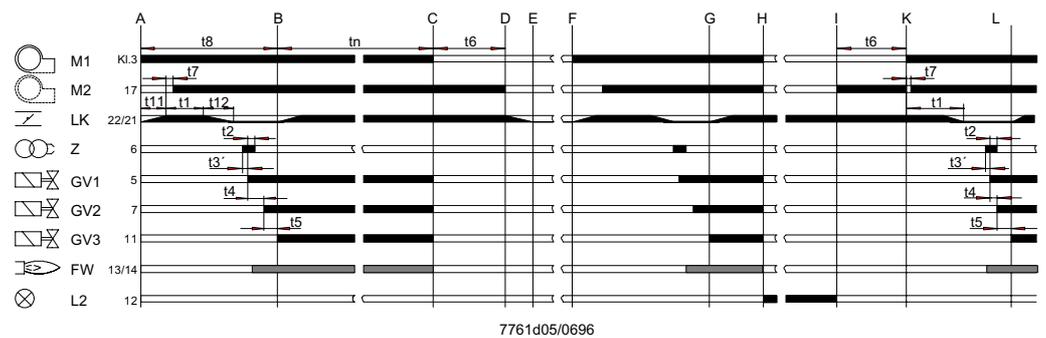
Start-up with short pre-ignition (3 s) and supervised air damper control. No load control. Necessary flame safeguards: **type LFE10...** with UV-detectors QRA... or ionization field.



Air damper control, detailed

Important

In case of burners without air damper or with an air damper not controlled by the control unit, terminals 20, 21 and 22 must be interconnected; the path 18-c1-21 of the circuit, however, must be omitted!



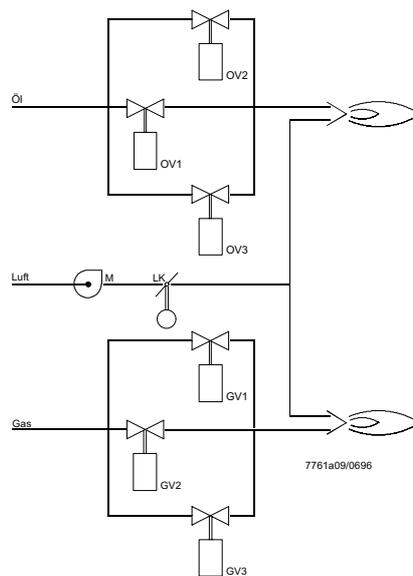
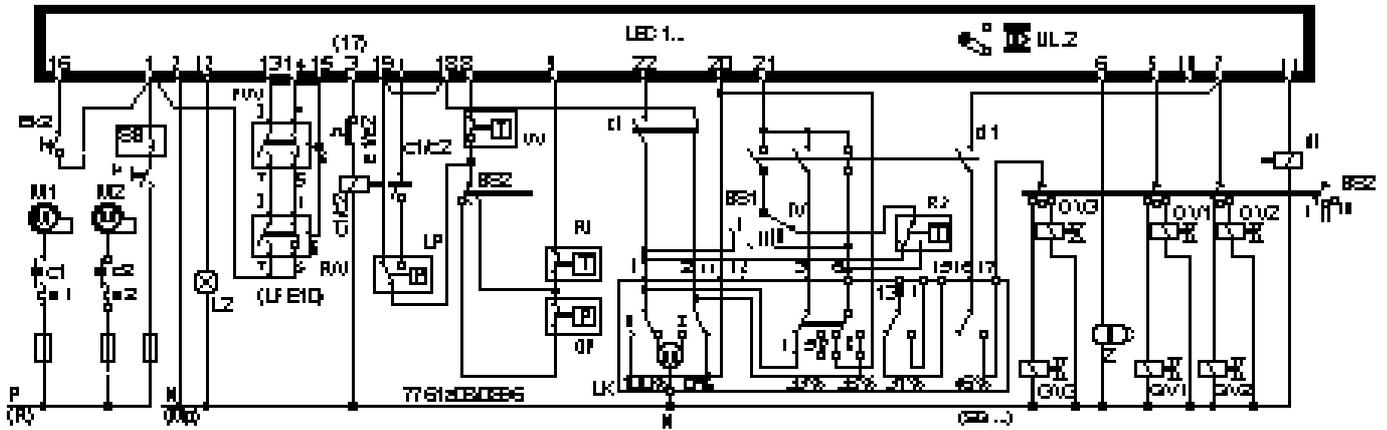
Legend

for the switching diagram

- | | | | |
|-----|---------------------------|-----|-------------------------|
| A | Start | G-H | Operation |
| A-B | Normal start-up | H | Loss of flame |
| B-C | Operation | H-I | Lockout |
| C | Controlled shutdown | I | Reset |
| C-D | Post-purge | I-K | Run into start position |
| D-E | Closing of the air damper | K | Restart |
| E-F | Burner off-period | K-L | Start-up |
| F | Restart | L | Operation |
| F-G | Start-up | | |

Double or multi-flame supervision of burners for selectable operation with oil or gas (expanding flame burner)

Start-up with short pre-ignition (3 s) and supervised air damper control. Control of the 2nd output stage via on/off controller (R2). Necessary flame safeguards: **type LFE10...** with UV-detectors QRA...



Operating switch BS1

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

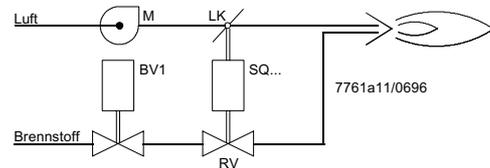
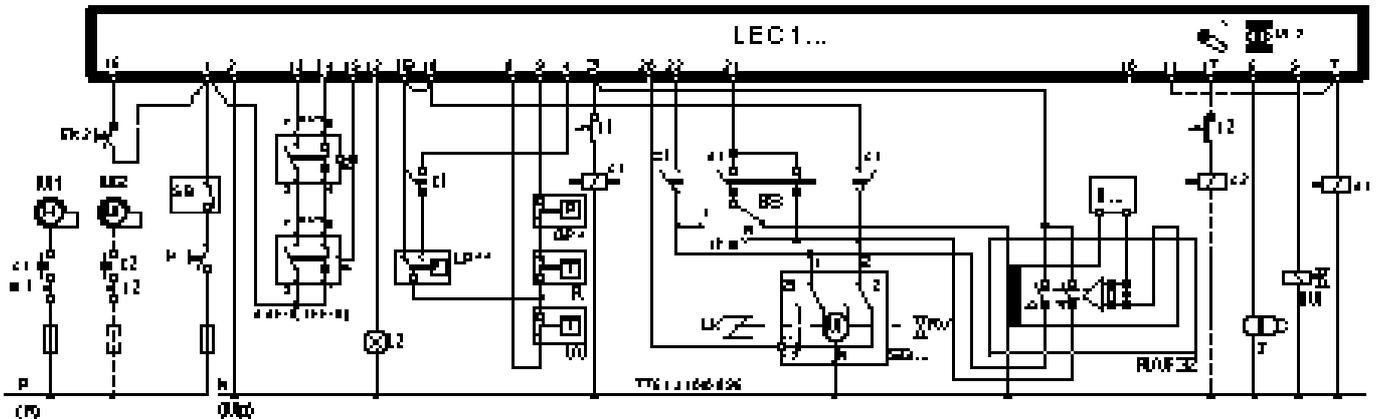
Operating mode selector switch BS2

- I Gas
- II Off
- III Oil

Double or multi-flame supervision of modulating burners

including supervised air damper control. Necessary flame safeguard:

- For oil: LAE10... with active selenium photocell detectors RAR...
- For gas: LFE10... with UV-detectors QRA... or ionization field
- For oil/gas: LFE10... with UV-detectors QRA...



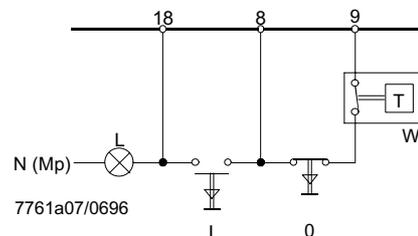
- Operating switch BS1**
- I Full load
 - II Stop
 - III Partial load
 - IV Automatic control

Burners that are designed for continuous adjustment of the burner capacity (modulating burners) require, in addition to the standard burner equipment, the devices of the temperature or pressure control circuit, e.g.

- 1 Continuous controller, e.g. POLYGYR® RWF32
- 1 Operating switch BS
- 1 Temperature or pressure detector QA.../QB...
- 1 Actuator for the control of the air damper and the fuel throughput (fuel/air ratio control) SQ...
- 1 Auxiliary relay d1
- 1 Control valve or similar for the adjustment of the fuel volume RV
- 1 Setting unit for remote setting, if necessary FZA...

* Omitted with oil burners
 ** Recommended for oil burners, if the oil pump is not coupled to the fan motor

Control for semi-automatic operating mode

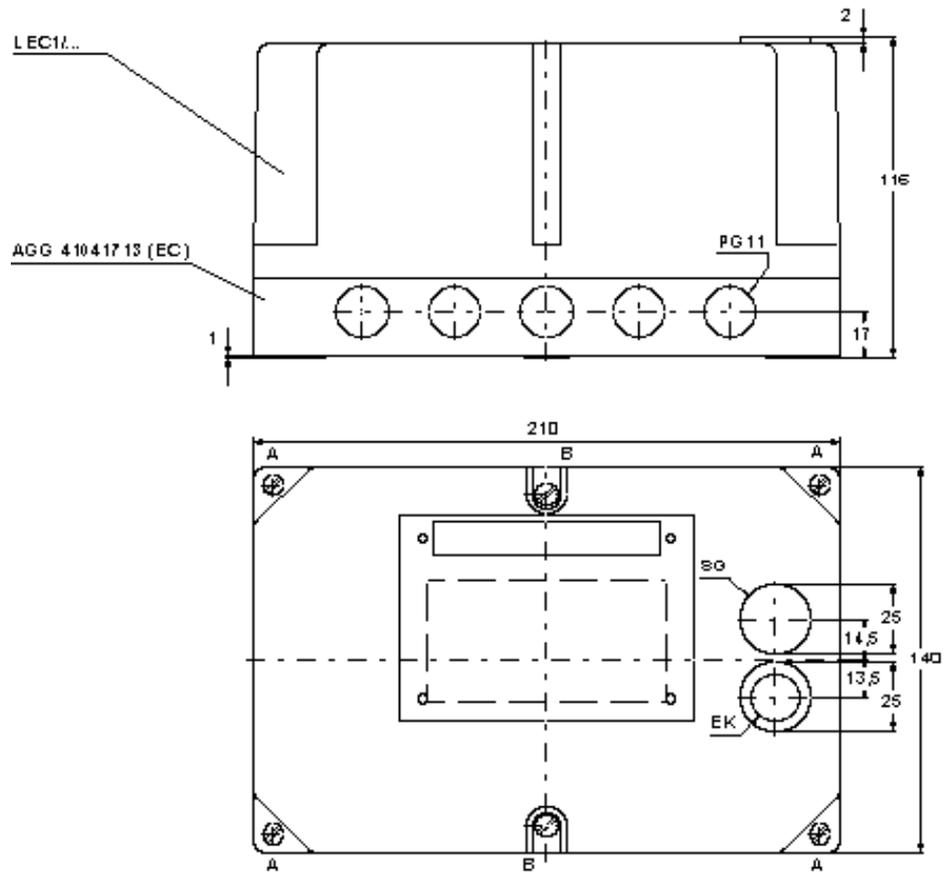


This circuit is used when fully automatic operation is not required due to certain reasons (e.g. with industrial burners). The burner is started by actuation of the impulse contact I; the burner is shut down by either pressing the circuit-breaking contact 0 or by operating the limit thermostat.

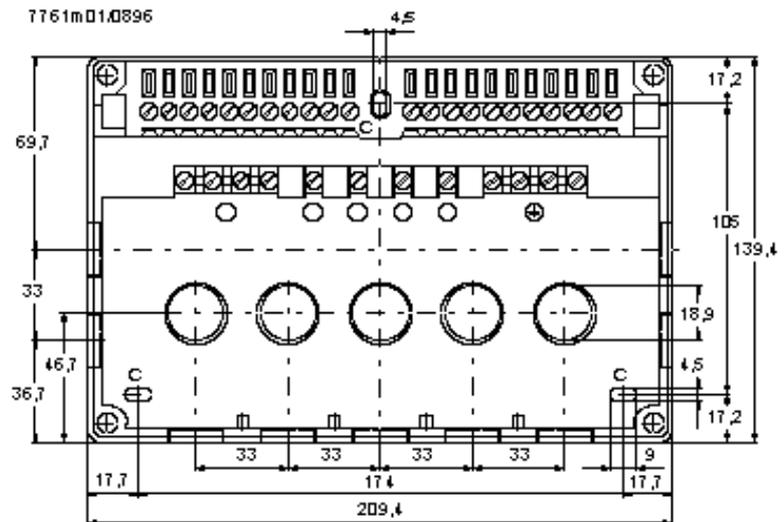
Dimensions

Dimensions in mm

LEC1



Baseplate AGG 41041713 (EC)



Important:

To remove the control unit from the plug-in baseplate, **only** the 4 screws **A** must be loosened. To remove the unit **cover** the 2 screws **B** also have to be loosened.

C: Elongated holes for fixing the baseplate.

EK: Reset button

SG: Viewing window