



ISO 9001



Control Units

LEC1...

Series 02

Control unit for double or multiflame supervision of oil, gas or forced draft oil / gas burners of any fuel throughput, suited for continuous or intermittent operation.

The LEC1... and this Data Sheet are intended for use by OEMs which integrate the control units in their products!

Use

The LEC1... is designed for the fully automatic startup and supervision of forced draft 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 **2** identical or different detectors.

Supervision of forced draft oil / gas burners

with different types of detectors depending on the selected operating mode.

Multiflame supervision

that is, central and simultaneous control of the startup and supervision sequence for several burners the flames of which must be individually supervised by one or 2 flame safeguards each.

The following flame safeguards are available:

LAE10...	For the supervision of oil burners with active selenium photocell detector RAR... in intermittent operation
LFE10...	For the supervision with ionization probe (gas burners) 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... / QRA51...(gas, oil or dual fuel burners) in intermittent or continuous operation

All units comply with the relevant European standards for oil, gas and forced draft 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 3 fuel valves, load controller and an external fault signaling device.

Design, control program and adjustment facilities of the control unit enable it to be used in combustion plants of any size and type, be it in connection with expanding flame or interrupted pilot burners, continuously operating burners or any other special burners.

Special features

- Prepurge time adjustable between 8 and 63 seconds
- Operation with or without postpurging
- Fully automatic control of air damper, irrespective of actuator running time
- Air pressure check can be combined with functional control of the air pressure monitor prior to startup
- Ignition: direct ignition or with pilot burner as well as with or without ignition spark supervision
- Preignition time adjustable to «Long» (during the prepurge time) or «Short» (3 seconds, e.g. for forced draft gas burners)
- 1st and 2nd safety time adjustable between 0 and 9 seconds
- Automatic test of flame safeguards and flame detectors during burner off periods and during the purging times (with lockout in the event of a faulty flame signal)
- Semiautomatic burner start and operation possible

Warning notes



To avoid injury to persons, damage to property or the environment, the following warning notes should be observed!

- Before performing any wiring changes in the connection area of the LEC1..., completely isolate the unit from the mains supply (all-polar disconnection)
- Ensure protection against electrical shock hazard by providing adequate protection for the unit's terminals
- Check wiring and all safety functions
- Press lockout reset button only manually without using any tools or pointed objects
- Fall or shock can adversely affect the safety functions. Such units may not be put into operation, even if they do not exhibit any damage
- Loosening of the fixing screws or any modification of the factory settings may therefore be carried out only by authorized staff!

Mounting notes

- Ensure that the relevant national safety regulations are complied with
- Locate ignition electrode and ionization probe such that the ignition spark cannot arc over to the ionization probe (risk of electric overloads)

Installation notes

- Installation work must be carried out by qualified staff
- Observe the permissible lengths of the detector cables (refer to «Technical data»)
- Always run the ignition cables separately while observing the greatest possible distances to the unit and to other cables
- 4 extra terminals for earth conductor, 4 extra terminals for neutral conductor, and 4 auxiliary terminals

Electrical connection of ionization probe and UV detector

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

- Never run the detector cable together with other cables
 - Line capacitance reduces the magnitude of the flame signal
 - Use a separate cable
- Insulation resistance
 - Must be a minimum of 50 MΩ between ionization probe and ground
 - Soiled detector holders reduce the insulation resistance, thus supporting creepage currents
- Earth the burner in compliance with the relevant regulations; earthing the boiler alone does not suffice
- Observe the polarity
Control units LEC... are able to detect wrong polarity of live and neutral conductors, in which case they initiate lockout at the end of «TSA»
- The ionization probe does not provide protection against electric shock hazard

Commissioning notes

- Commissioning and maintenance work must be carried out by qualified staff
- Continuous display of the program sequence in the viewing window:
It is 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 lockout, but that it runs to the end of the program. The only component that remains under voltage during that time is a fan for postpurging connected to terminal 17
- The motor of the switching mechanism can be switched off (simplifies burner adjustments)
- Cam shaft can be rotated manually
- Electric remote lockout reset facility
- For setting instructions, please refer to «Adjustment facilities on the unit»
- When commissioning the plant or when carrying out maintenance work, make the following checks:

	Safety check	Anticipated response
a)	Burner startup with flame detector darkened	Lockout at the end of «TSA»
b)	Burner startup with flame detector exposed to extraneous light	Lockout after no more than 40 seconds
c)	Burner operation with simulated loss of flame	Immediate lockout
d)	Burner startup with open-circuit of air pressure monitor (not with atmospheric burners)	Lockout at the end of the specified time «t10»
e)	Burner operation with simulated air pressure failure (not with atmospheric burners)	Immediate lockout

Disposal notes



The unit contains electric and electronic components and may not be disposed of as household garbage.

The local and currently valid laws must be observed.

Mechanical design

The control unit LEC1... as well as the flame safeguards LAE10... and LFE10... are of plug-in design and are suitable for mounting in any position at the burner, on control panels and in control cabinets.

The spacious terminal bases and 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 robust printed circuit boards.

Type summary and ordering

Type reference *	Supply voltage	Factory settings for			
		mains frequency	t1	TSA	t9
LEC1 / 8851	AC 220...240 V	50 Hz	60 s	2 s	2 s
LEC1 / 8853	AC 220...240 V	50 Hz	30 s	2 s	2 s
LEC1 / 8866	AC 100...110 V	50 Hz	30 s	2 s	2 s
LEC1 / 8867	AC 100...110 V	60 Hz	30 s	2 s	2 s
LEC1 / 8868	AC 220...240 V	60 Hz	30 s	2 s	2 s
LEC1 / 8892	AC 220...240 V	50 Hz	60 s	5 s	5 s
LEC1.1 / 8854	AC 220...240 V	50 Hz	17 s	2 s	2 s
LEC1 / 9500	AC 230 V	60 Hz	60 s	4.5 s	4.5 s
LEC1 / 9501	AC 100...110 V	50 Hz	60 s	4.5 s	4.5 s
LEC1 / 9502	AC 100...110 V	60 Hz	60 s	4.5 s	4.5 s
LEC1 / 9503	AC 230 V	50 Hz	60 s	4.5 s	4.5 s

The control unit is delivered without terminal base.

The latter must be ordered separately using the following part number:

AGG41041713 (EC)

For flame safeguards LAE10... and LFE10... and the associated flame detectors, refer to Data Sheet 7781.

* Type reference is given near the contacts

Technical data

General unit data	Mains voltage	AC 220 V -15 %...AC 240 V +10 % AC 100 V -15 %...AC 110 V +10 %		
	Mains frequency	50...60 Hz \pm 6 %		
	Unit fuse, built-in	T6.3H250V		
	External fuse	max. 10 A slow		
	Consumption			
	- during startup	8 VA		
	- during operation	5 VA		
	Permissible load on the control outputs			
	- per terminal	max. 4 A		
	- total	max. 5 A		
	Degree of protection	IP40		
	Mounting position	optional		
	Cable glands	Pg11		
	Weight	approx. 2 kg		
	Environmental conditions	Transport	IEC 721-3-2	
Climatic conditions		class 2K2		
Mechanical conditions		class 2M2		
Temperature		-50...+60 °C		
Humidity		< 95 % r.h.		
Operation		IEC 721-3-3		
Climatic conditions		class 3K5		
Mechanical conditions		class 3M2		
Temperature		-20...+60 °C		
Humidity		< 95 % r.h.		
		Condensation, formation of ice and ingress of water are not permitted!		
Standards	CE conformity	According to the directives of the European Community		
	Electromagnetic compatibility EMC	89 / 336 EEC incl. 92 / 31 EEC		
	Directive for gas appliances	90 / 396 EEC		
	Low voltage directive	73 / 23 EEC		
		Identification code to EN 298	F B L L B N	
Flame supervision ³⁾		LFE10... S 02 ionization path	LFE10... S 02 UV detector	LAE10... S 02 selenium cell
	Min. detector current required			
	- AC 100 V and AC 220 V	8 μ A	150 μ A	8 μ A
	- AC 110 V and AC 240 V	9 μ A	200 μ A	8 μ A
Max. possible detector current	approx. 100 μ A	approx. 650 μ A	approx. 25 μ A	
Detectors	Permissible connecting cable length	20 m ¹⁾	20 m ¹⁾	20 m ²⁾
	Permissible ambient temperature	---	60 °C	60 °C
Legend	<p>1) In case of longer distances use low capacitance cable, e.g. single-core cable (total 2 nF max.)</p> <p>2) Detector cables must always be laid separately, selenium photocell RAR8 must be used in case of longer distances</p> <p>3) For LFE50..., refer to Data Sheet 7783</p>			

The following description of the unit's function refers to the startup and supervision of one single burner.

With multiframe supervision, all burners connected to the control unit are put into operation and supervised simultaneously in the same manner.

A defect leading to lockout of one of the burners therefore results in the shutdown of all burners.

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, refer to Data Sheet 7781.

Prerequisites for burner startup

The burner starts only if:

- the unit's switching program is in the start position
- the control unit is not in the lockout position, e.g. due to a 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 startup or lead to a lockout during startup.



If the air damper is not controlled by the control unit, link terminals 20, 21 and 22.

Program sequence during burner startup

First, the fan motor is switched on via terminal 3 and the actuator is controlled via terminal 22. As soon as the air damper has reached its fully open position, the switching mechanism of the unit starts to run – the prepurge time commences. The minimum air pressure set on the pressure monitor must then be reached within 10 seconds (or within 7 seconds in operation with postpurging) and must be maintained until controlled shutdown occurs, otherwise lockout will take place. A flame signal during the prepurge time also leads to lockout. On completion of the set prepurge time, the air damper is given the control command to return to the minimum air position. During the air damper's closing time, the switching mechanism does not move.

As soon as the signal contact for the minimum throttling position is operated by the actuator, the switching mechanism starts again and now controls the program sequence which can no longer be influenced from outside.

- Preignition (3 seconds)
- 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)
- The set safety time elapses. If no flame is established during that period of time, lockout will be initiated (control unit will always lock itself)
- Following an interval of 11 seconds 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 seconds. 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 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 modulating controller

Loss of flame during operation always leads to lockout of the burner.

Burner startup with ignition spark supervision

In principle, the program sequence is the same as with burner startup without ignition spark supervision.

Exceptions:

- If the UV flame detector does not receive any input signal during the **short preignition time** (UL2 on position «Short preignition»), lockout occurs before any gas is released, i.e. safety time TSA = 0 seconds
- With ignition spark supervision, the safety time for the pilot burner can only be adjusted between 0 ... 6 seconds (in the time diagram of the switching mechanism: TSA')

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. In that case, the fuel valves are immediately closed.

The switching mechanism starts again and now programs postpurging, if required.

On completion of the postpurge time, the switching mechanism has again reached its start position in which it remains until the next switch on command is received.

The flame supervision restarts again during the postpurge time; therefore any flame signal during that period of time leads to a lockout.

Control program following lockout reset

After pressing the built-in or the external lockout reset button, the switching mechanism will return to its start position.

The only burner plant component that is operated during that period time is a fan motor connected to terminal 17.

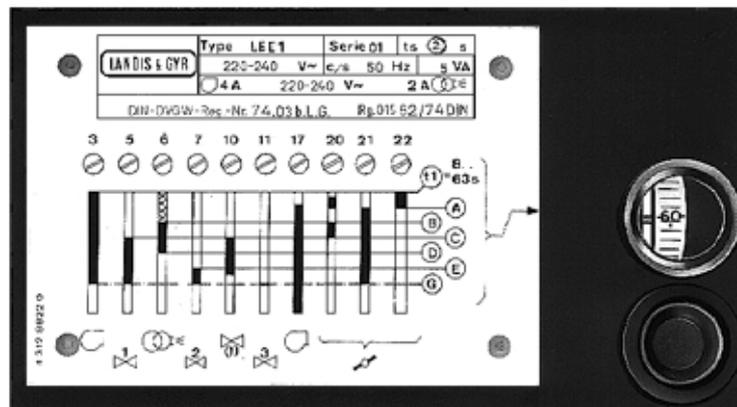
As the limit thermostat or pressurestat normally continues to call for heat, the unit immediately initiates a restart as soon as it has reached its start position.

Program indicator

The program indicator continuously shows the respective phase of the burner startup sequence.

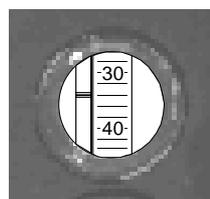
The letters correspond to those of the switching mechanism diagram next to the viewing window. The figures indicate the remaining prepurge time.

If lockout occurs, the switching mechanism and the program indicator stop, thus indicating the operating phase during which lockout occurred.



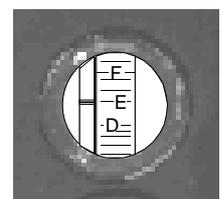
Reading the program indicator

Examples:



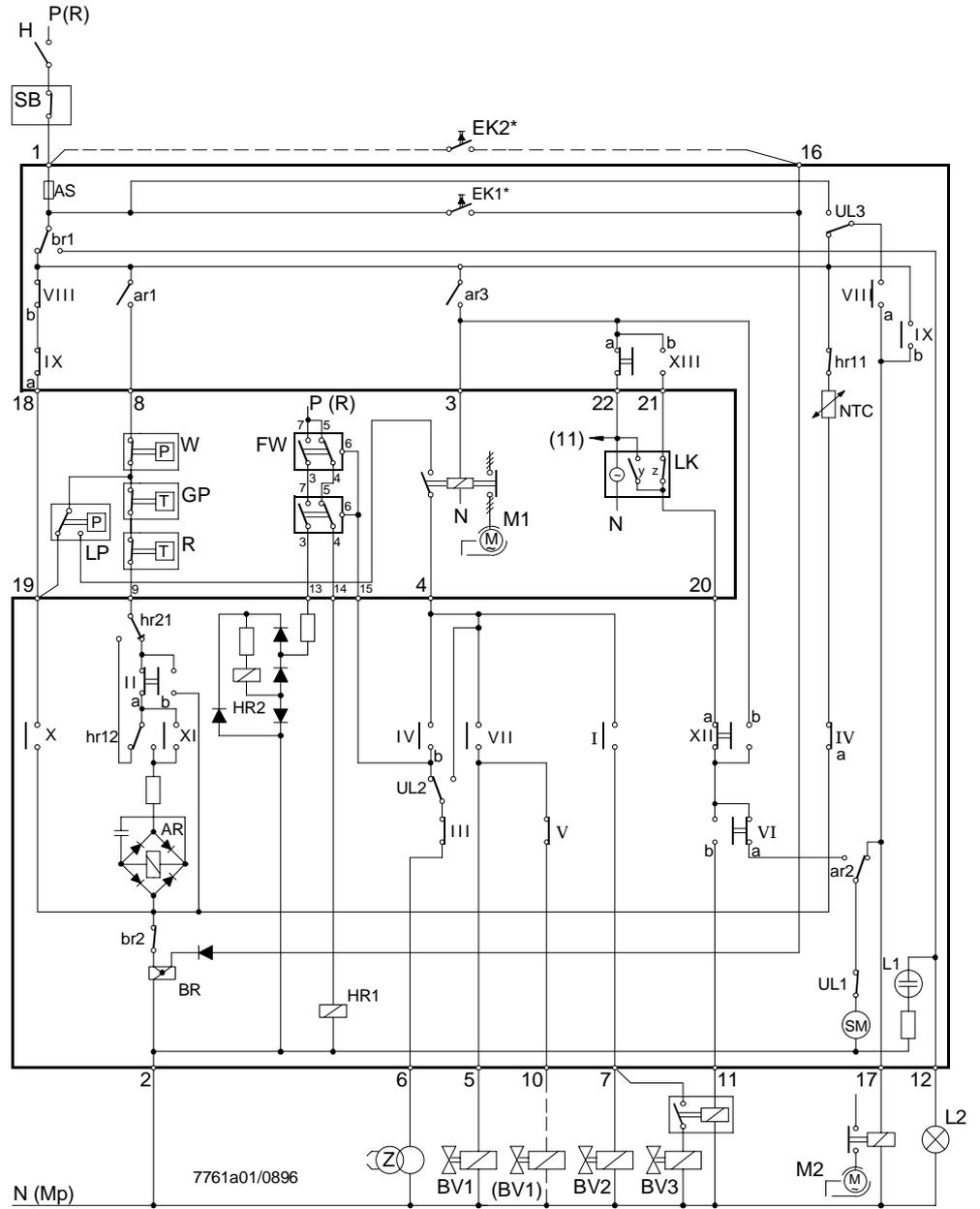
← Prepurge time will last another 35 seconds

Valve 2 at terminal 7 is opened →



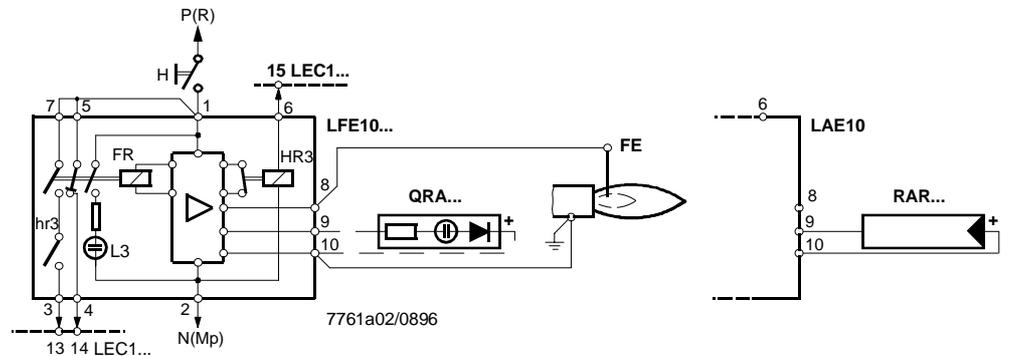
Basic diagram

LEC1...



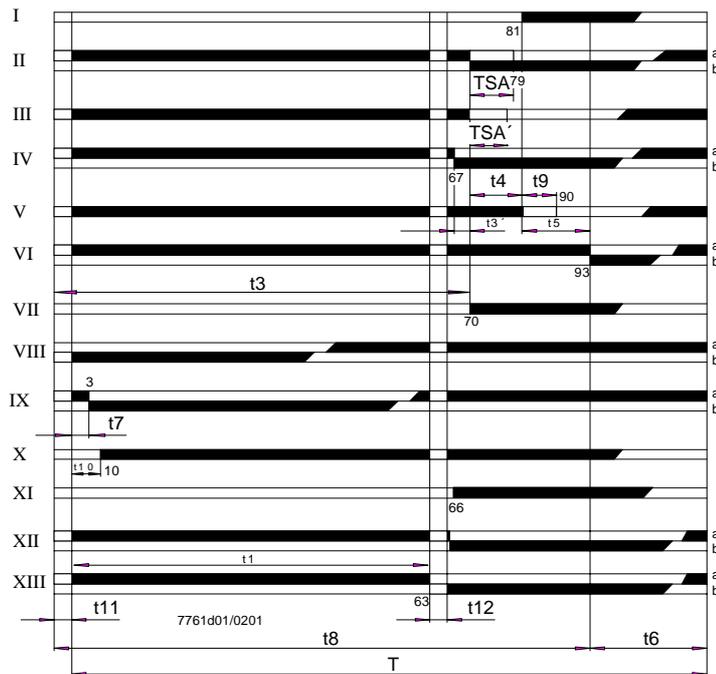
* Do not press EK... for more than 10 seconds!

LAE10... / LFE10...



When using UV detector QRA..., terminal 10 must be connected to earth!

Sequence diagram of switching mechanism



Legend

AS	Unit fuse	LK	Actuator with limit or auxiliary switches (refer so «Connection examples») a = actuator travels to the OPEN position (maximum air volume) z = actuator travels to the CLOSED position (minimum air volume)
AR	Load relay with contacts «ar...»	LP	Air pressure monitor
BR	Lockout relay with contacts «br...»	M...	Fan motor, fan
BV...	Fuel valve	NTC	Resistor with negative temperature coefficient
(BV...)	Fuel valve for a pilot burner that is switched off on completion of the 2 nd safety time	OV...	Oil valve
c...	Fan contactor with contacts «c...»	Q	Temperature or pressure sensor
d...	Auxiliary relay with contacts «d...»	QRA...	UV detector
e...	Thermal cutout	R...	Thermostat or pressurestat
EK1	Lockout reset button	RAR...	Selenium photocell detector
EK2	Remote lockout reset button	RV	Control valve
FE	Ionization probe	SB	Safety limiter
FR	Flame relay	SM	Synchronous motor of switching mechanism
FW	Contacts of flame safeguards LAE10..., LFE10... or LFE50...	SQ...	Type reference of air damper actuator
GP	Gas pressure monitor	UL1	Operating switch for motor of switching mechanism
GV...	Gas valve	UL2	Changeover link for «Short / long preignition time»
H	Main switch	UL3	Changeover link for «STOP» or «Run» of the sequence mechanism after lockout
HR1	Auxiliary relay with contacts «hr11 / 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 lamp, built-in		
L2	Lockout warning lamp, external		
L3	Signal lamp for flame indication		

Switching times

t1	8...63 s	Prepurge time	T	120 s	Running time of switching mechanism
t3	t11 + t1 + t12 + 7 s	Preignition time (during the whole prepurge)	TSA	0...9 s	Ignition safety time (setting = 0 s in the case of ignition spark supervision)
t3'	3 s	Short preignition time	TSA'	0...6 s	First safety time for the pilot burner in the case of startup with ignition spark supervision
t4	11 s	Interval between release of the 1 st and 2 nd fuel valve	t5	12 s	Interval between release of the 2 nd and 3 rd fuel valve or the load controller
t6	T - (30 + t1)	Postpurge time	t7	3 s	Delay time
t8	t1 + 30 + t11 + t12	Total startup time	t9	0...9 s	2 nd safety time with interrupted pilot burner
t10	10 s	Preset time for air pressure signal	t11	optional	Programmed opening time for actuator «SA»
Max. perm. afterburn time (from the beginning of the postpurge time)	7 s		t12	optional	Programmed closing time for actuator «SA»

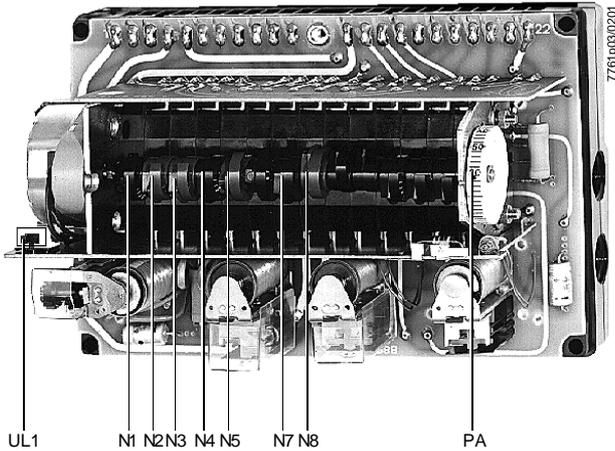
For the factory setting of the different types, please refer to «Type summary »

Adjustment facilities on the unit

General instructions

- Before making any adjustments, isolate the unit from the mains supply
- Loosen all 6 retaining screws and only remove the unit cover
- The numbering of the switching cams always starts from the motor
- The camshaft can be turned into any position by hand (clockwise direction of rotation as seen from the motor)

Setting elements

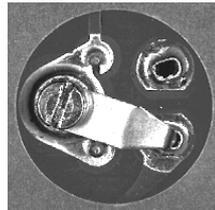


- UL1 ON / OFF switch for the motor of the switching mechanism
- N1 Cam 1, fixed
- N2, N3 Cam 2 and 3, adjustable (1st safety time)
- N4 Cam 4, fixed
- N5 Cam 5, adjustable (2nd safety time)
- N7 Cam 7, fixed
- N8 Cam 8, adjustable (prepurge time)
- PA Program indicator

On the rear side of the baseplate:

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

Adjusting the preignition time



□ — d



■ — c

7761p09/0696

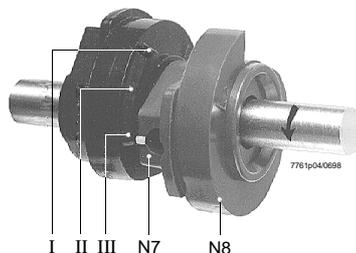
- C «Long preignition time» (during prepurging)
- D «Short preignition time» (3 s, factory setting)

Loosen screw before making the adjustment and tighten it carefully afterwards.

Adjusting the prepurge time

- Loosen the fixing screw of the red cam N8
- Turn camshaft manually until the required prepurge time is indicated next to the index notch on the carrier of the switching mechanism
- Hold camshaft firmly and rotate cam N8 until the contact tappet operated by it just jumps out or the cam strikes this tappet
- Carefully tighten the fixing 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

Adjustment of the mark of the red cam N8 to the graduation marks of the black cam N7 results in the prepurge times given in the following table.



Cam N8 adjusted to...

... Cam N7, graduation mark	I	t1 = 8 s
	II	18 s
	III	28 s
Adjustment at stop		63 s
Factory setting		approx. 30 s or 60 s

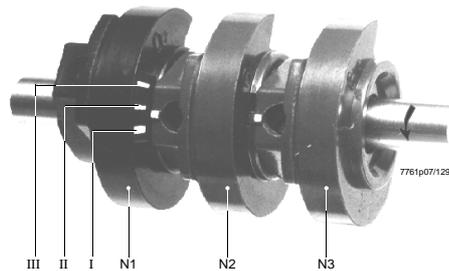
Adjusting the safety times

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

1st safety time TSA

(Operation with ignition spark supervision)

- Loosen the fixing screws of cams N2 and N3
- Hold cam N1 firmly and align the setting mark of cam N2 with the corresponding time mark I of cam N1 (see photo and table, intermediate positions possible). Lock cam N2
- Rotate cam N3 in such a way that its setting mark is set against the lower stop of cam N2. Lock cam N3
- Check the adjusted safety time and set the new value on the rating plate of the unit cover (adjustment slot at the rear of the cover)



Cam N2 adjusted to...

... cam N1, graduation mark	I	TSA = 0 s
	II	4.5 s
	III	9 s

Factory setting

< 2 s

1st safety time TSA'

(Operation with ignition spark supervision)

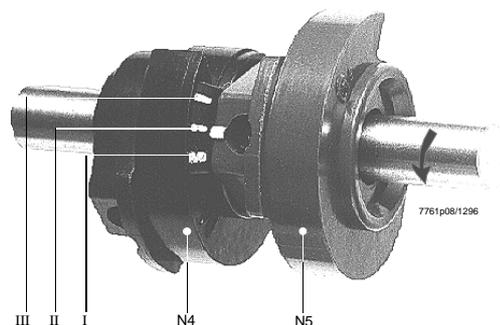
- Loosen the fixing screws of cams N2 and N3
- Hold cam N1 firmly, set the setting mark of cam N2 to the time mark I of cam N1 and lock cam N2
- Hold cam N2 firmly, set the setting mark of cam N3 to the required time and lock cam N3 (see photo and table)
- Check adjusted safety time

Cam N3 adjusted to...

... stop in the direction of the arrow	TSA' = 0 s
... the other stop	6 s
Factory setting	0 s

2nd safety time t9

- Loosen the fixing screw of cam N5 and align its setting mark to the corresponding time marks of cam N4 (see photo and table, intermediate positions possible)



Cam N5 adjusted to...

... Cam N4, graduation mark	I	t9 = 0 s
	II	4.5 s
	III	9 s

Factory setting

< 2 s

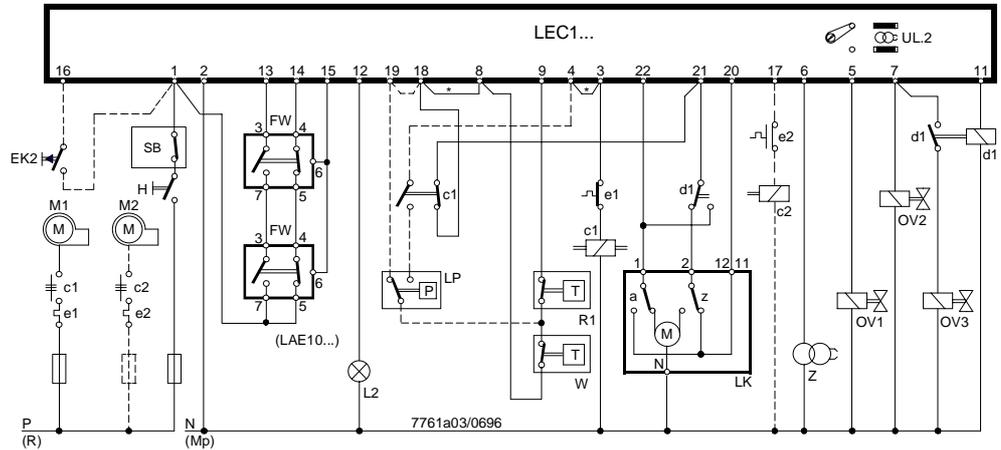
Connection examples and sequence diagrams

For connection examples for flame supervision with DETACTOGR® LFE50..., refer to Data Sheet 7783.

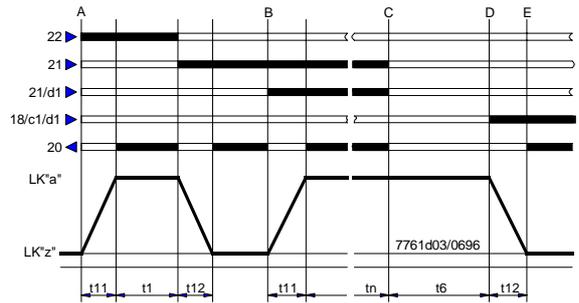
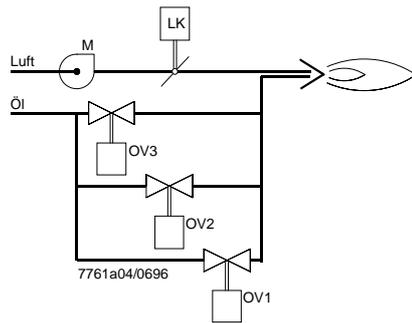
Double or multiflame supervision of oil burners

Startup with long preignition «t3» and checked actuator control.
Air pressure supervision from the start to controlled shutdown.
No load control.

Required type of flame safeguards: LAE10... with selenium photocell detector RAR...



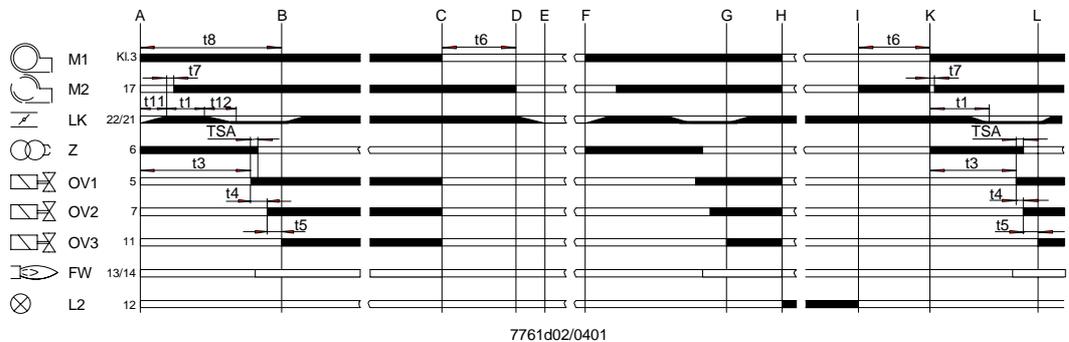
* Connection not required when using air pressure monitor «LP»



Air damper control, detailed

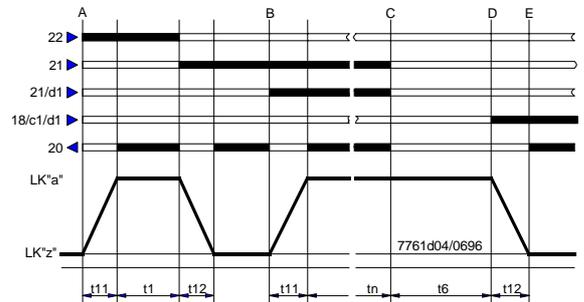
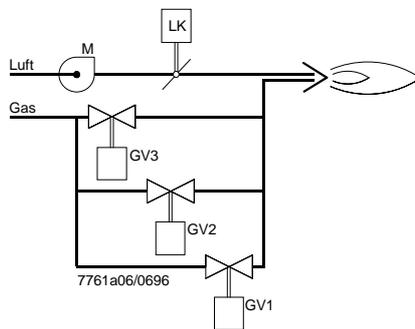
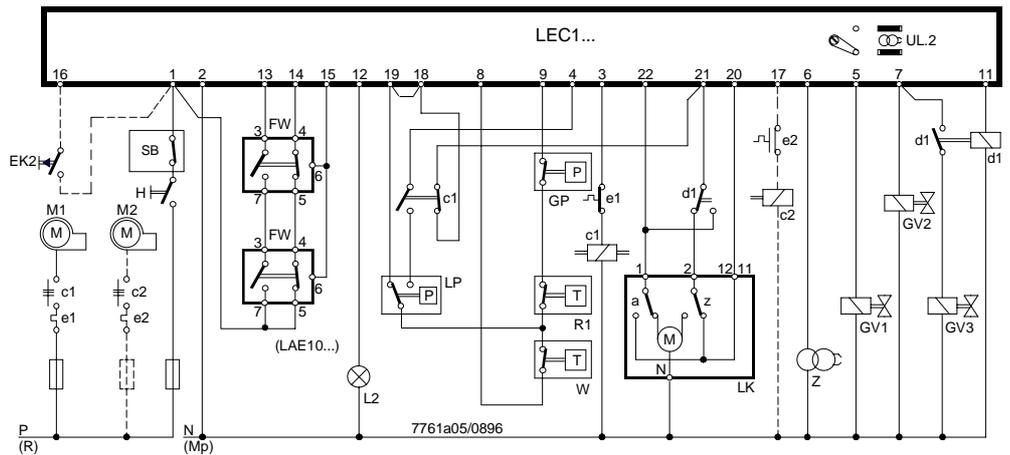


In the case of burners without air damper or with an air damper not controlled by the control unit, terminals 20, 21 and 22 must be interconnected; path 18-c1-21 of the circuit, however, is not required!



Double or multiflame supervision of gas burners (expanding flame burners)

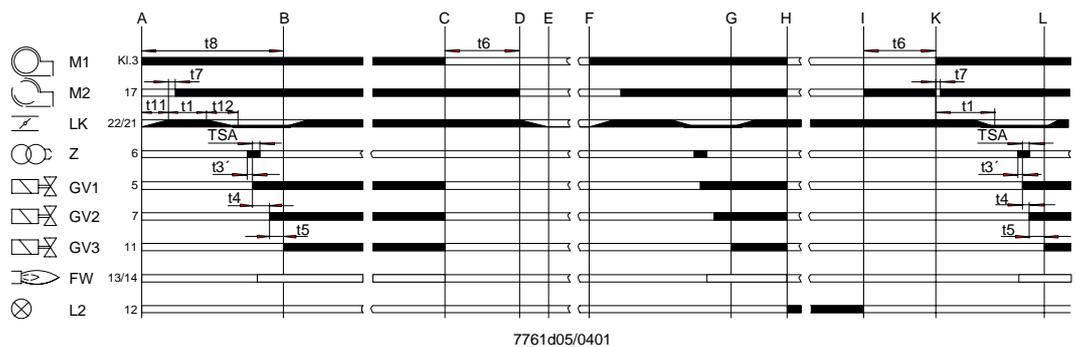
Startup with short preignition (3 seconds) and checked actuator control.
 Required type of flame safeguards: **LFE10...** with UV detectors QRA... or ionization probe.



Air damper control, detailed



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

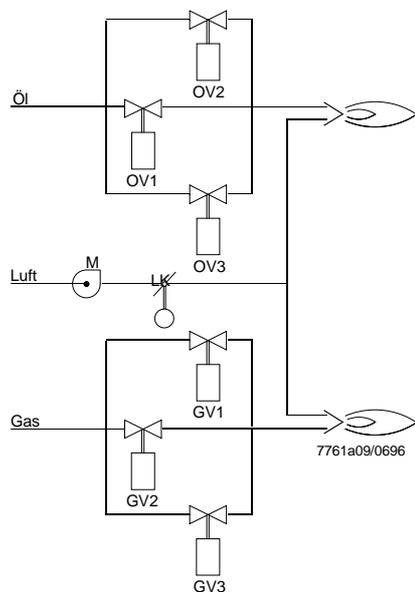
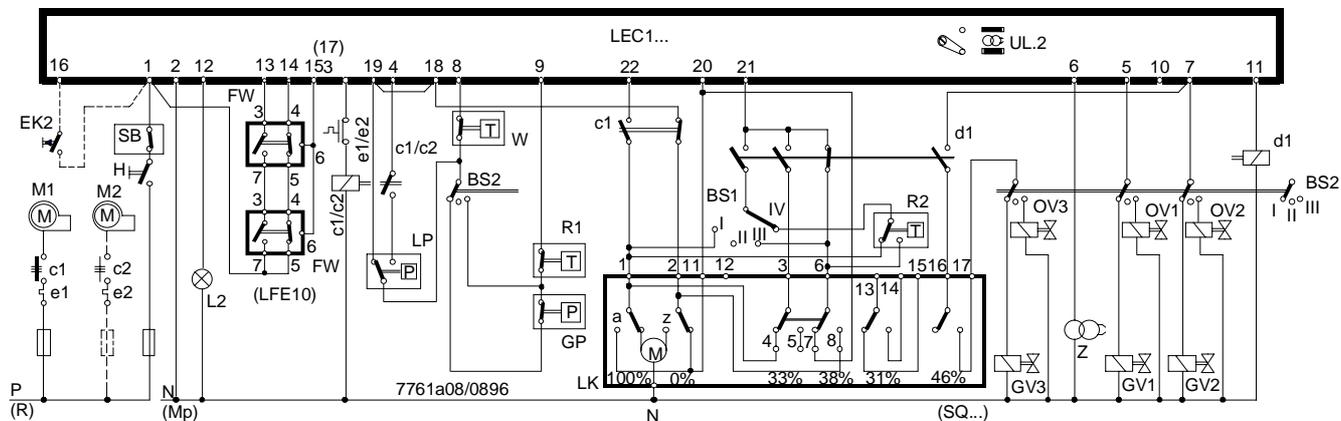


Legend for the switch-
 ing diagram

- | | | | |
|-----|---------------------------|-----|---------------|
| A | Startup | G-H | Operation |
| A-B | Normal startup | H | Loss of flame |
| B-C | Operation | H-I | Lockout |
| C | Controlled shutdown | I | Reset |
| C-D | Postpurgung | I-K | Home run |
| D-E | Closing of the air damper | K | Restart |
| E-F | Burner off period | K-L | Startup |
| F | Restart | L | Operation |
| F-G | Home run | | |

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

Startup with short preignition (3 seconds) and checked actuator control.
 Control of the 2nd output stage via on / off controller «R2».
 Required type of flame safeguards: LFE10... with UV detectors QRA...



Operating switch BS1

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

Operating mode selector BS2

- I Gas
- II Off
- III Oil

Double or multiflame supervision of modulating burners

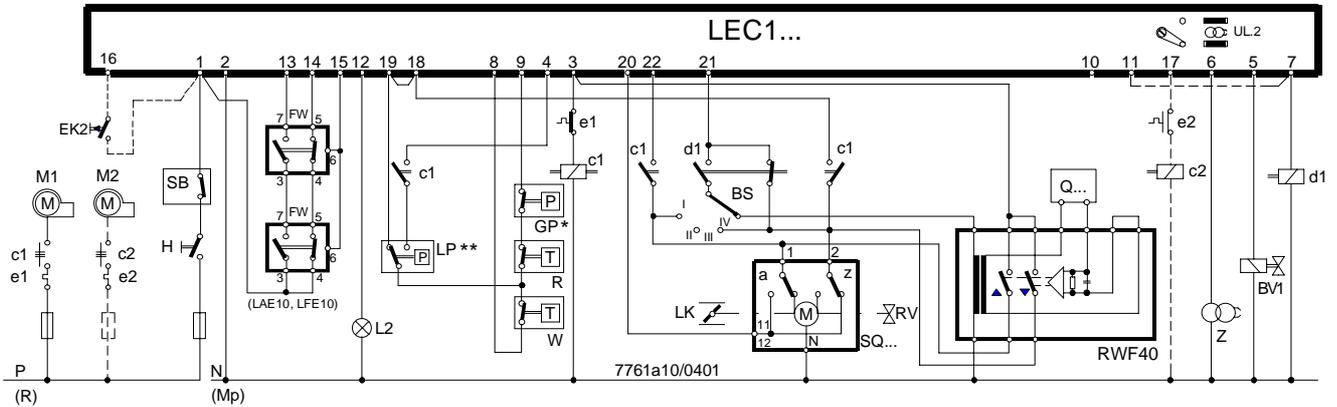
including checked actuator control.

Required type of flame safeguards:

For oil LAE10... with active selenium photocell detectors RAR...

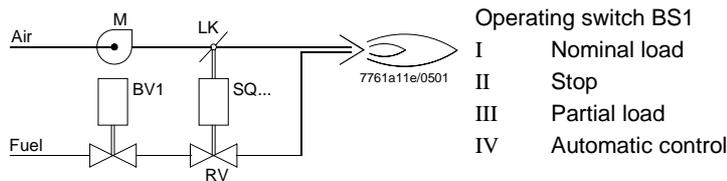
For gas LFE10... with UV detectors QRA... or ionization probe

For oil / gas LFE10... with UV detectors QRA...



* GP: not required with oil burners

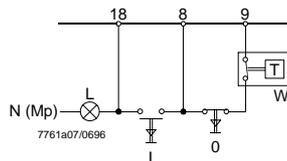
** LP: recommended for oil burners, if the oil pump is not coupled to the fan motor



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

- | | | |
|---|---|---------------|
| 1 | Modulating controller | RWF40... |
| 1 | Temperature or pressure sensor | QA... / QB... |
| 1 | Remote setting unit, if required | FZA... |
| 1 | Actuator for the control of the air damper and the fuel throughput (fuel / air ratio control) | SQ... |
| 1 | Auxiliary relay | d1 |
| 1 | Operating switch | BS |
| 1 | Control valve or similar for adjustment of the fuel throughput | RV |

Control for semiautomatic operating mode

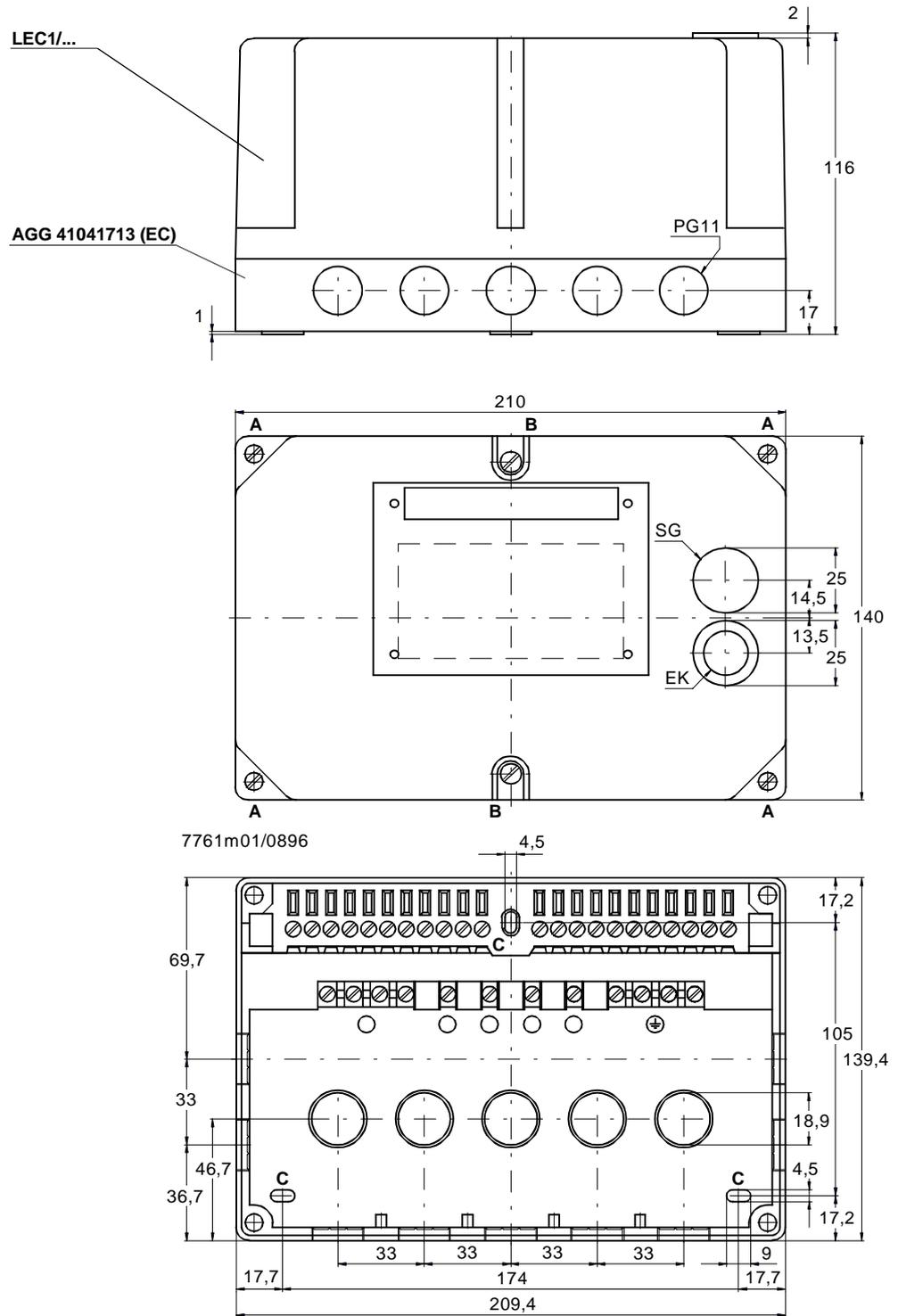


This circuit is used if, for certain reasons, fully automatic operation is not required (e.g. with industrial burners).

The burner is started up by actuating impulse contact I; the burner is shut down by either pressing circuit-breaking contact 0 or when the limit thermostat cuts out.

Dimensions

Dimensions in mm



To remove the control unit from the plug-in base, **only** the 4 screws **A** must be loosened.

To remove the unit **cover**, the 2 screws **B** must also be loosened.

C: elongated holes for fixing the baseplate.

EK: lockout reset button

SG: viewing window