



Burner Controls

LOK16... LGK16...

LOK16/LGK16 burner control

- For gas, oil or dual-fuel forced draft burners of medium to high capacity
- For multistage or modulating burners in continuous operation
- With air pressure supervision for checked air damper control.
- Flame supervision
 - LOK16: With silicon detector RAR9
 - LGK16: With QRA53/QRA55 UV flame detector / ionization electrode
- LOK16/LGK16 burner control for oil burners or gas burners in accordance with EN 298
- Suitable for use with air heaters (WLE)
- With self-checking flame signal amplifier

The LOK16/LGK16 and this Data Sheet are intended for use by OEMs which integrate the burner controls in their products.

The LOK16/LGK16 features a self-supervising flame supervision circuit.

The flame supervision circuit initiates the safety actions in the case of...

- ... premature or missing flame signal
- ... any kind of fault on the flame detector, the detector cables or the flame signal amplifier that could simulate a flame signal during burner operation

The LOK16/LGK16 can therefore be used in all oil-fired and gas-fired combustion plants where self-supervising flame supervision systems are either mandatory or recommended.

For example:

- Burners that operate continuously
- Burners in intermittent operation that, in the case of great heat demand, may operate continuously for more than 14 hours, e.g. in plant using boiler sequencing
- Burners that need to comply with the German TRD 411 and TRD 412 regulations for steam boilers
- Burners in plant where, for specific safety requirements, supervision of the burner by a self-checking flame supervision system seems advisable
- The control program and connection diagram of the LOK16/LGK16 are identical to those of the LAL2 and LFL1 burner controls (except for the LFL1.148). As a result, existing plants can also be equipped with the self-supervising LOK16/LGK16, provided that:
 - very good detector current values were measured in plants previously supervised by LFL1 burner controls, and
 - the flame detectors listed below are installed or can be retrofitted:

Flame supervision
when using LOK16

- Photocell detector RAR9

Flame supervision
when using LGK16

- QRA53/QRA55 UV flame detector
- Ionization probe
- QRA53/QRA55 UV flame detector and ionization probe together – e.g., for burners with pilot burner, also refer to data sheet N7712



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

Do not open, interfere with or modify the unit!

- All activities (mounting, installation and service work, etc.) must be performed by qualified staff
- Before making any wiring changes in the connection area, completely isolate the plant from mains supply (all-polar disconnection). Ensure that the plant cannot be inadvertently switched on again and that it is indeed dead. If not observed, there is a risk of electric shock hazard
- Ensure protection against electric shock hazard by providing adequate protection for the burner control's connection terminals
- Each time work has been carried out (mounting, installation, service work, etc.), check to ensure that wiring is in an orderly state and make the safety checks as described in *Commissioning notes*
- Press the lockout reset button only manually (applying a force of no more than 10 N) without using any tools or pointed objects
- **Do not press the lockout reset button on the unit or the remote reset button (input 21) for more than 10 seconds, since this would damage the lockout relay inside the unit**
- Fall or shock can adversely affect the safety functions. Such units must not be put into operation, even if they do not exhibit any damage
- In the case of flame supervision with a QRA53/QRA55 UV flame detector, it should be noted that sources of radiation such as halogen lamps, welding equipment, special lamps, ignition sparks, as well as X-rays and gamma radiation, can produce erroneous flame signals

Mounting notes

- Ensure that the relevant national safety regulations are complied with.
- Connect the earthing lug inside the AGM16/AGM17 plug-in base to burner ground using a screw with a lockwasher
- **An ignited UV tube is also a source of UV radiation.** If the flame is supervised by several flame detectors, all flame detectors must be placed in a way that ensures there is **no direct line of sight** between them. Failure to observe this information poses a risk of compromising the safety functions

Upgrading existing plant

When equipping existing plants with the LOK16 or LGK16, the plug-in base for LAL or LFL burner controls must be replaced with the corresponding AGM16/AGM17 plug-in base for the LOK16/LGK16.

Restart in the event of loss of flame

The LOK16 can be set to 'Restart in the event of loss of flame during operation' by removing a bridge (B) on its underside. In that case, the bridge must be cut off completely. It is essential to check whether this is permitted under the applicable national standards and regulations.



Note!

In applications involving air heaters (WLE), or in the case of oil burners with a maximum throughput of > 30 kW/h, removing wire link **B** is not permitted.

Installation notes

- Always run the high-voltage ignition cables separately, keeping as much distance as possible from the LOK16/LGK16 and other cables
- Neutral conductors must not be interchanged
- Install switches, fuses, earthing, etc., in compliance with local regulations
- Risk of damage to the switching contacts!
If the external primary fuse (Si) is blown due to overload or short-circuit at the terminals, the LOK16 / LGK16 must be replaced
- Make certain that the maximum permissible current rating of the connection terminals will not be exceeded
- The insulation of internal wiring that is exposed to the mains voltage must withstand the electrical stress occurring during correct use

Application notes



Note!

For use in applications in dual-fuel burners or oil burners, the oil supply must be equipped with two shutoff valves connected in series.

Observe the following:

EN 298, Section 7.101.3.3 *Prepurge time for oil burner control systems and the corresponding application standards.*

Electrical connection of flame detectors

It is important to achieve practically disturbance- 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
- Observe the permissible detector cable lengths; refer to chapter 'Technical data'
- It is not permitted to connect two QRA53/QRA55 UV flame detectors in parallel
- Terminal 22 must be connected to earth in connection with QRA53/QRA55 UV flame detectors
- The ionization probe is not protected against electric shock hazard
- Locate the ignition electrode and ionization probe such that the ignition spark cannot arc over to the ionization probe (risk of electrical overloads) and that it cannot adversely affect the supervision of ionization
- Supervision using an ionization probe and a QRA53/QRA55 UV flame detector is possible; however, for safety-related reasons, both flame detectors must not be active at the same time, except during the second safety time (t9). At the end of the second safety time (t9), one of the detected flames must be extinguished – e.g., by switching off the ignition valve at terminal 17

Commissioning notes

When commissioning the plant or when doing maintenance work, make the following safety checks:

	Safety check to be carried out	Anticipated response
a)	Burner startup with flame detector darkened	Non-volatile lockout at the end of the safety time (TSA)
b)	Burner startup with simulated flame	Non-volatile lockout within 40 seconds
c)	Burner operation with simulated loss of flame; for that purpose, darken the flame detector in operation and leave it in that state	For LOK16 with bridge cut: Restart followed by the non-volatile lockout at the end of the safety time (TSA) LGK16 and LOK16 with wire link closed: Immediate lockout
d)	Burner startup with response of air pressure switch	Start prevention or non-volatile lockout during the prepurge time (t1)
e)	Burner operation with simulated air pressure failure	Immediate lockout

Burner valves and other components must be connected according to the burner manufacturer's diagrams.

Standards and certificates



Applied directives:

- Low-voltage directive 2014/35/EC
- Directive for pressure devices 2014/68/EC
- Electromagnetic compatibility EMC (immunity) *) 2014/30/EC
2009/142/EC

Only LGK16:

- Gas Appliances Regulation (EU) (EU) 2016/426

*) The compliance with EMC emission requirements must be checked after the burner control is installed in equipment

Compliance with the regulations of the applied directives is verified by the adherence to the following standards / regulations:

- Automatic burner control systems for burners and appliances burning gaseous or liquid fuels DIN EN 298
- Only LGK16 DIN EN 13611
Safety and control devices for burners and appliances burning gaseous and/or liquid fuels – General requirements
- Automatic electrical controls for household and similar use Part 2-5: Particular requirements for automatic electrical burner control systems DIN EN 60730-2-5

The relevant valid edition of the standards can be found in the declaration of conformity!



Note on DIN EN 60335-2-102

Household and similar electrical appliances – Safety
Part 2-102: Particular requirements for gas, oil, and solid-fuel burning appliances having electrical connections. The electrical connections of the LOK16/LGK16 and the AGM16/AGM17 plug-in base comply with the requirements of EN 60335-2-102.



EAC Conformity mark (Eurasian Conformity mark)



UKCA conformity mark (UK compliance)



China RoHS

Hazardous substances table:

<http://www.siemens.com/download?A6V10883536>

Standards and certificates (cont'd)

Certified with AGM16/AGM17 plug-in base and flame detector:

Type									
LOK16.140Axx	---	---	●	●	●	---	---	●	---
LOK16.250Axx	---	---	●	●	●	---	---	●	---
LOK16.650Axx	---	---	●	●	●	---	---	●	---
LGK16.122Axx	●	●	●	---	---	●	●	---	●
LGK16.133A17	---	●	---	---	---	●	●	---	●
LGK16.133A27	●	●	●	---	---	●	●	---	●
LGK16.322Axx	●	●	●	---	---	●	●	---	●
LGK16.333Axx	●	●	●	---	---	●	●	---	●
LGK16.335Axx	●	●	●	---	---	●	●	---	●
LGK16.622Axx	●	●	●	---	---	●	●	---	●
LGK16.635Axx	●	●	●	---	---	●	●	---	●

Life cycle

The LOK16/LGK16 has a designed lifetime* of 250,000 burner startup cycles which, under normal operating conditions in heating mode, corresponds to approx. 10 years of service (starting from the date of manufacture on the type label).

This lifetime is based on the endurance tests specified in standard EN 298. A summary of the conditions has been published by the European Control Manufacturers Association (Afecor - www.afecor.org).

The designed lifetime is based on use of the LOK16/LGK16 according to the manufacturer's data sheet. After reaching the designed lifetime in terms of the number of burner startup cycles, or after the corresponding usage time, the LOK16/LGK16 must be replaced by authorized personnel.

* The designed lifetime is not the warranty time specified in the Terms of Delivery

Disposal notes

The LOK16/LGK16 contains electrical and electronic components and must not be disposed of together with domestic waste. Local and currently valid legislation must be observed.

Mechanical design

LGK16/LOK16	• Plug-in design • Exchangeable unit fuse (including spare fuse)
Housing	• Made of impact-proof and heat-resistant black plastic • Lockout reset button with viewing window; located behind it are: - The lockout warning lamp - The lockout indicator - coupled to the spindle of the sequence switch - visible in the transparent lockout reset button - uses easy-to-remember symbols to indicate the type of fault and the point in time lockout occurred

Type summary

The type references apply to the LOK16 without an AGM16 plug-in base or flame detector. For ordering information for the AGM16 plug-in base and other accessories, refer to chapter 'Accessories'.

Switching times are given in the order of the startup sequence and are valid for a mains frequency of 50 Hz. At a mains frequency of 60 Hz, the times are approximately 17% shorter. The type references apply to an LOK16 operating on 230 V AC, 50...60 Hz.

- * For an LOK16 operating on 100...110 V AC, 50...60 Hz, the last two digits of the type reference are 17 instead of 27.

LOK16

For flame supervision with a photocell detector RAR9 for oil burners

	Preferred use:			
	Flash-steam generators	Universal application	Medium- or heavy-oil burners	
Type	LOK16.140A27*	LOK16.250A27*	LOK16.650A27	
Article no.	BPZ:LOK16.140A27	BPZ:LOK16.250A27	BPZ:LOK16.650A27	Legend of times
t1	10 s	22 s	66 s	Prepurge time with air damper fully open
TSA	4 s	5 s	5 s	Safety time or first safety time
TSA'	---	---	---	Safety time with burners using a pilot burner
t3	2 s	2.5 s	2.5 s	Preignition time
t3'	From startup command (with air pressure supervision: from receipt of air pressure signal)			Long preignition time
t3n	10 s	15 s	15 s	Postignition time (ignition transformer connected to terminal 15)
t4	8 s	7.5 s	7.5 s	Interval between start of safety time and release of fuel valve at terminal 19
t4'	---	---	---	Interval between start of safety time and release of fuel valve at terminal 19
t5	4 s	7.5 s	7.5 s	Interval between end of interval (t4/t4') and release of load controller or fuel valve at terminal 20
t6	10 s	15 s	15 s	Postpurge time (identical to permissible afterburn time (t13))
t7	2 s	2.5 s	2.5 s	Switch-on delay of fan motor (M2)
t8	30 s	47 s	91 s	Startup duration without air damper running time
t9	---	---	---	Second safety time with burners using a pilot burner
t10	6 s	10 s	10 s	Interval from startup to the beginning of the air pressure check
t11	Optional			Air damper running time to the fully open position
t12	Optional			Air damper running time to the low-fire position
t13	10 s	15 s	15 s	Permissible afterburn time
t16	4 s	5 s	5 s	Interval from startup to the open command for the air damper
t20	32 s	34.5 s	12.5 s	Interval to self-shutdown of the sequence switch

Type summary (cont'd)

The type references apply to the LGK16 without an AGM17 plug-in base or flame detector. For ordering information for the AGM17 plug-in base and other accessories, refer to chapter 'Accessories'.

Switching times are given in the order of the startup sequence and are valid for a mains frequency of 50 Hz. At a mains frequency of 60 Hz, the times are approximately 17% shorter. The type references apply to an LGK16 operating on 230 V AC, 50...60 Hz.

* For an LGK16 operating on 100...110 V AC, 50...60 Hz, the last two digits of the type reference are 17 instead of 27.

LGK16

For flame supervision using a QRA53/QRA55 UV flame detector or ionization probe

Type	Preferred use:							
	Flash-steam generators	Also suited for direct-fired air heaters)						
Article no.	BPZ:LGK16.122A27	BPZ:LGK16.133A27	BPZ:LGK16.322A27	BPZ:LGK16.333A27	BPZ:LGK16.335A27	BPZ:LGK16.622A27	BPZ:LGK16.635A27	Key to the times
t1	10 s	9 s	35,5 s	31,5 s	37 s	65 s	66 s	Prepurge time with open air damper
TSA	2 s	3 s	2 s	3 s	2,5 s	2 s	2,5 s	Safety time or first safety time
TSA'	2 s	3 s	2 s	3 s	5 s	2 s	5 s	Safety time with burners using a pilot burner
t3	4 s	3 s	4 s	6 s	5 s	4 s	5 s	Preignition time
t3'	4 s	---	4 s	6 s	2,5 s	4 s	2,5 s	Long preignition time
t3n	---	---	---	---	---	---	---	Postignition time (ignition transformer connected to terminal 15)
t4	6 s	6 s	10 s	11,5 s	12,5 s	10 s	12,5 s	Interval between start of safety time and release of fuel valve at terminal 19
t4'	6 s	---	10 s	11,5 s	15 s	10 s	15 s	Interval between start of safety time and release of fuel valve at terminal 19
t5	4 s	3 s	10 s	11,5 s	12,5 s	10 s	12,5 s	Interval between end of interval (t4/t4') and release of load controller or fuel valve at terminal 20
t6	10 s	14,5 s	12 s	17 s	15 s	12 s	15 s	Postpurge time (also permissible afterburn time)
t7	2 s	3 s	2 s	3 s	2,5 s	2 s	2,5 s	Switch-on delay for fan motor
t8	30 s	29 s	65 s	69 s	74 s	95 s	103 s	Startup duration without air damper running time
t9	2 s	3 s	2 s	3 s	5 s	2 s	5 s	Second safety time with burners using a pilot burner
t10	6 s	6 s	8 s	11,5 s	10 s	8 s	10 s	Interval from startup to the beginning of the air pressure check
t11	Optional							Air damper running time to the OPEN position
t12	Optional							Air damper running time to the low-fire position
t13	10 s	14,5 s	12 s	17 s	15 s	12 s	15 s	Permissible afterburn time
t16	4 s	3 s	4 s	6 s	5 s	4 s	5 s	Interval from startup to the OPEN command for the air damper
t20	32 s	60 s	---	26 s	22 s	---	---	Interval until self-shutdown of the sequence switch

Accessories (to be ordered separately)

Oil burner control, without AGM16 plug-in base

For AC 230 V*	Control sequence and connection diagram like	Preferred use
LOK16.140A27*	LAL2.14	Flash-steam generators
LOK16.250A27*	LAL2.25	Universal application
LOK16.650A27	LAL2.65	Heavy-oil burners

* For an LOK16 operating on 100...110 V AC, 50...60 Hz, the last two digits of the type reference are 17 instead of 27.

Connection accessories for medium-capacity burner controls

Plug-in base **AGM16**

Article no.: **BPZ:AGM16**

- with Pg11 thread for cable entry glands

Plug-in base **AGM16.1**

Article no.: **BPZ:AGM16.1**

- with M16 thread for cable entry glands

see Data Sheet N7230.



Flame detectors

Photocell detectors **RAR9**

see Data Sheet N7713.



Accessories (to be ordered separately) (cont'd)

Gas burner control, without AGM17 plug-in base

For AC 230 V*	Control sequence and connection diagram like	Preferred use
LGK16.122A27*	LFL1.122	Flash-steam generators
LGK16.133A27	LFL1.133	Flash-steam generators
LGK16.322A27*	LFL1.322	Also suited for direct-fired air heaters
LGK16.333A27*	LFL1.333	
LGK16.335A27*	LFL1.335	
LGK16.622A27*	LFL1.622	
LGK16.635A27*	LFL1.635	

* For an LGK16 operating on 100...110 V AC, 50...60 Hz, the last two digits of the type reference are 17 instead of 27.

Connection accessories for medium-capacity burner controls

Plug-in base **AGM17**

Article no.: **BPZ:AGM17**

- with Pg11 thread for cable entry glands



Plug-in base **AGM17.1**

Article no.: **BPZ:AGM17.1**

- with M16 thread for cable entry glands

See Data Sheet N7230.

Flame detectors

QRA53/QRA55 UV flame detector

See Data Sheet N7712



Ionization probe

To be supplied by thirds.



Accessories (to be ordered separately) (cont'd)

Actuators

Actuator **SQN7**
Refer to Data Sheet N7804.



Actuator **SQN3/SQN4**
Refer to Data Sheet N7808.



Actuator **SQM40 / SQM41**
Refer to Data Sheet N7817.



Actuator **SQM5**
Refer to Data Sheet N7815.



Technical data

General unit data LOK16/LGK16

Mains voltage	AC 230 V -15% / +10% AC 100 V -15%...AC 110 V +10%
Mains frequency	50...60 Hz $\pm 6\%$
Unit fuse, built-in	T6,3H250V to DIN EN 60 127
Primary fuse (Si) (external)	Max. 16 A (slow)



Caution!

Risk of damage to the switching contacts!

If the external primary fuse (Si) is blown due to overload or short-circuit at the terminals, the LOK16 / LGK16 must be replaced.

Weight	Approx. 1000 g
Power consumption	Approx. 3.5 VA
Perm. mounting position	Optional
Degree of protection	IP40, (to be ensured through mounting) with the exception of the connection area (AGM16/AGM17 plug-in base)
Safety class	II
Perm. input current at terminal 1	Max. 5 A to VDE 0660 AC3
Perm. current load of control terminals	Max. 4 A to VDE 0660 AC3
Required switching capacity of switching devices	
• Between terminals 4 and 5, 4 and 12	1 A, AC 250 V
• Between terminals 4 and 14	depending on loading of terminals 15, 16, 18, 19 (LGK16: 16...19), min. 1 A, AC 250 V
Permissible length of the standard detector cable (laid separately)	Refer to chapter 'Technical data', section 'Flame supervision'
Capacity	
• Output on startup (without fan)	Optional (with ignition < 120 kW)
• Nominal output	Optional

Environmental conditions

Storage

Temperature range	-20...+60 °C
Humidity	<95% r.h.

Transport

Temperature range	-20...+60 °C
Humidity	<95% r.h.

Operation

Temperature range	-20...+60 °C
Humidity	<95% r.h.
Installation altitude	Max. 2,000 m above sea level



Caution!

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

If this is not observed, there is a risk of loss of safety functions and a risk of electric shock

Flame supervision

	LOK16	LGK16		
	Photocell detector RAR9	UV flame detector QRA5x.C QRA5x.E	UV flame detector QRA5x.D QRA5x.G	Ionization probe
Operating voltage (Terminal 23 or 24)	<DC 1 V $\pm$ 10%	AC 280 V $\pm$ 10% ¹⁾	AC 280 V $\pm$ 10% ¹⁾	AC 245 V $\pm$ 10% ¹⁾
Required detector current	Min. DC 6 μ A	Min. DC 35 μ A	Min. DC 120 μ A	Min. DC 12 μ A
Possible detector current	Max. DC 38 μ A	Max. DC 50 μ A	Max. DC 270 μ A	Max. DC 100 μ A
Short-circuit current	---	---	---	Approx. AC 300 μ A
Length of flame detector cable (laid separately)	Max. 100 m	²⁾	²⁾	Max. 60 m ³⁾

- 1) AC voltage, measured without detector current at a mains voltage of 230 V AC. Internal resistance of the measuring instrument: 10 M Ω . The shutter drive of the QRA53/QRA55 UV flame detector is connected to mains voltage.
- 2)
- Detector cable laid in a minimum distance of 5 cm from other mains carrying cable:
 - As a multiple cable **Max. 50 m**
 - With 5 single wires **Max. 70 m**
 - With a shielded 3-core control cable to terminals 3, 4, and 5 of the QRA53/QRA55 UV flame detector, and a standard mains cable to terminals 1 and 2 **Max. 15 m**
 - With two shielded single-core coaxial cables ($\leq$ 45 pF/m, e.g., RG 62) to terminals 3 and 4 of the QRA53/QRA55 UV flame detector and a standard mains cable to terminals 1, 2, and 5 **Max. 60 m**
 - If possible, shielding should be earthed at both ends
- 3) With low-capacitance routing of the detector cable to terminal 24 of the LOK16/LGK16 (particularly with respect to earthed conductors), longer distances are also possible

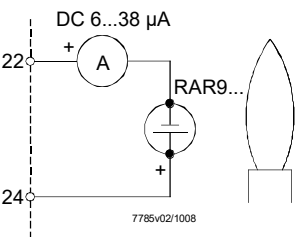
Detector current measurement

Measuring circuit for
detector current
measurement

LOK16 with RAR9
photocell detector

Connect the measuring instrument between the RAR9 photocell detector and terminal 22 (+pole to terminal 22).

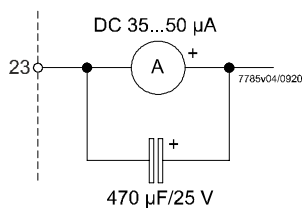
With RAR9 photocell detector



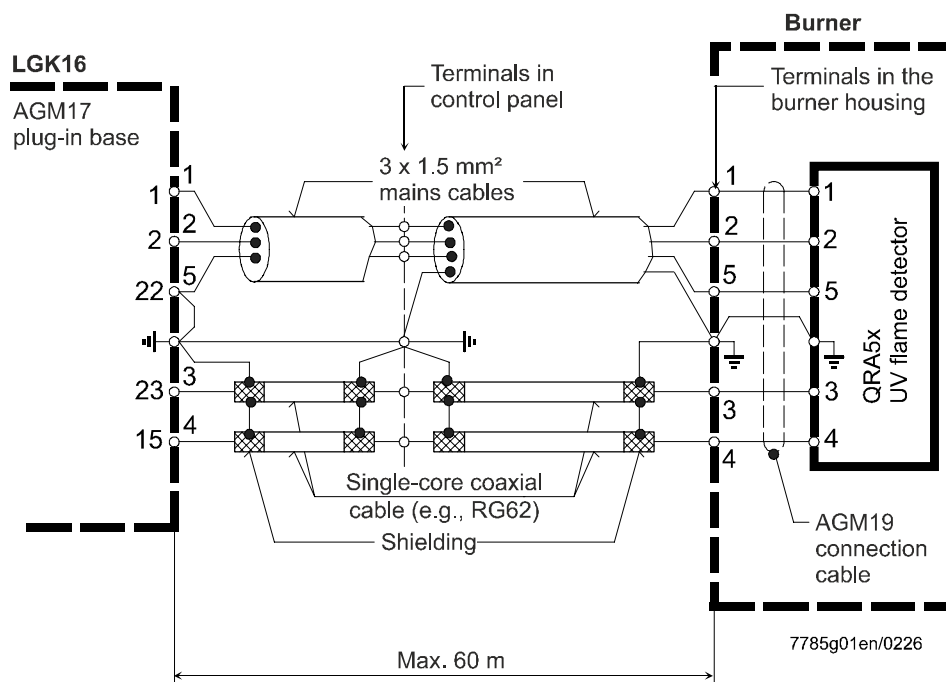
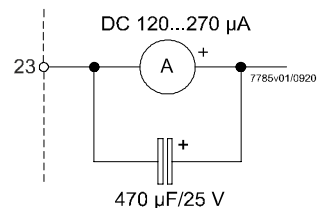
Detector current measurement (cont'd)

LGK16 with
QRA53/QRA55 UV
flame detector

With QRA5x.C/QRA5x.E
UV flame detector



With QRA5x.D/QRA5x.G
UV flame detector



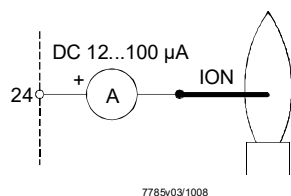
Legend

- A Ammeter
- AGM19 Connecting cable (2 m) with connector for QRA5x UV flame detector

LGK16 with ionization
probe

Connect the measuring instrument between terminal 24 and the ionization probe (+pole to terminal 24).

With ionization probe



Function

Principle of self-supervision

In contrast to conventional amplifiers, the signal delivered by the flame detector is processed dynamically rather than statically. It is converted into a sequence of control pulses and fed to the flame relay circuit. This circuit is designed in such a way that the flame relay can only be energized by a flame signal in the form described. If errors in the detector or in the detector cable cause a change in the pulses, the relay drops out and the LOK16/LGK16 initiates the prescribed safety measures. With UV supervision, it must also be ensured that self-ignition of the UV tube (e.g., due to aging) cannot simulate a flame signal. For this purpose, the incidence of UV radiation on the tube is periodically interrupted by a shutter. In addition to the self-supervising behavior, the flame signal circuit is subjected to a functional test during the prepurge time. If the function is incorrect, startup is aborted or a non-volatile lockout is initiated. Furthermore, if the mains voltage drops to a level where safe burner operation is no longer ensured, the burner will automatically shut down. After the mains voltage rises again, the LOK16/LGK16 initiates a restart; however, if the detector signals are only marginally above the minimum levels, such mains voltage fluctuations may also result in a non-volatile lockout.

Prerequisites for burner startup

- The LOK16/LGK16 is reset and in the start position (terminals 11 and 12 must be live)
- The air damper is closed. The end switch (z) for the CLOSED position must pass voltage from terminal 11 to terminal 8
- All control contacts between terminals 12 and 5 (limit thermostat, control thermostat, etc.) must be closed

A Start

When the control thermostat or pressurestat closes, the sequence switch of the LOK16/LGK16 starts. At the same time, the fan motor connected to terminal 6 (only prepurging) receives power and, on completion of switch-on delay time, the fan motor or flue gas fan at terminal 7 (pre- and postpurging) also receives power. On completion of interval (t16), the control command to open the air damper is given via terminal 9. During the running time of the motor, the sequence switch does not operate, as terminal 8, via which the motor of the sequence switch first receives power, is not live during that period of time. The sequence switch starts again and begins the prepurge time (t1) only after the air damper is fully open and end switch «a» has changed over to feed power to terminal 8.

t1 Prepurge time with air damper fully open (nominal amount of combustion air)

Shortly after the start of the prepurge time, the air pressure switch must change over, thereby interrupting the current path between terminals 4 and 13. Otherwise, the LOK16/LGK16 initiates a non-volatile lockout (start of air pressure check). At the same time, terminal 14 must be live since this current path is used to power the ignition transformer and the fuel valves.

t3' With the **LOK16**, an ignition transformer connected to terminal 15 is therefore switched on at this point in time (long preignition). If there is no air pressure switch, the ignition transformer receives power already with the start command. After the prepurge time has elapsed, the LOK16 drives the air damper to the low-fire position via terminal 10, as defined by the switching point of the auxiliary switch (m). During the positioning time, the sequence switch remains stopped until terminal 8 receives voltage from 'm'.

t5 Interval

After the interval (t5) has elapsed, terminal 20 is energized; at the same time, control outputs 9 to 11 and input 8 are now galvanically isolated from the control section of the LOK16/LGK16, thereby protecting it against backfeeding from the load control circuit. The LOK16/LGK16 startup program ends with the release of the load controller at terminal 20. The sequence switch switches itself automatically off, depending on the time variant used, either immediately or after some so-called *idle steps*, that is, without changing the contact positions.

Expanding flame burners with LOK16 or LGK16

t3 Short preignition time; followed by fuel release via terminal 18.

TSA Safety time (part load)

If no flame signal is present at the input of the flame signal amplifier by the end of the safety time, the LOK16/LGK16 initiates a non-volatile lockout.

Only with LOK16:

t3n Postignition time (provided the ignition transformer is connected to terminal 15).

t4 Interval until the fuel valve is released via terminal 19.

Interrupted pilot burner with **LGK16** (burners using a pilot burner)

t3 **Short preignition time**; followed by release of fuel for the pilot burner via terminal 17.
t3'



Note! (Only for LGK16)

For use in applications in dual-fuel burners or oil burners, the oil supply must be equipped with two shutoff valves connected in series.

Observe the following:

EN 298, Section 7.101.3.3 *Prepurge time for oil burner control systems and the corresponding application standards.*

TSA **First safety time** (ignition load)

TSA' On completion of the safety time latest, a flame signal must be present at the input of the flame signal amplifier, or else the burner control will initiate lockout.

t4 **Interval** until the fuel valve at terminal 19 is released (start load of the main burner). The safety time (TSA'),
t4' short preignition time (t3'), and interval (t4') are programmed only by the **LGK16.335** and **LGK16.635**.

t9 **Second safety time**

On completion of the safety time, the main burner must have been ignited by the pilot burner, since the pilot gas valve is closed on completion of second safety time (t9).

B **Operating position of the burner**

B - C **Burner operation** (generation of heat)

During burner operation, the load controller drives the air damper to the nominal load or low-fire position, depending on heat demand. Here, the nominal load is released by auxiliary switch (v) in the actuator.

C **Controlled shutdown by control thermostat or pressurestat**

In the case of controlled shutdown, the fuel valves are immediately closed and, at the same time, the sequence switch starts again to program the postpurge time (t6).

t6 **Postpurge time** (postpurging with fan motor (M2) at terminal 7).

Shortly after the start of the postpurge time, terminal 10 is energized again, causing the air damper to be driven to the MIN position. Full closing of the air damper does not begin until shortly before the end of the postpurge time, initiated by the control signal at terminal 11. During the subsequent operating pause, terminal 11 remains live.

t13 **Permissible afterburn time**

During permissible afterburn time (t13), the flame signal input may still receive a flame signal
→ No lockout

D - A **End of control sequence** (= start position)

When, on completion of postpurge time (t6), the sequence switch has reset the control contacts to their start positions, thereby switching itself off, the detector and flame simulation test is started again. During the operating pause, however, only a faulty flame signal lasting several seconds will result in a non-volatile lockout. Hence, short ignition pulses of the UV detector caused by cosmic radiation do not initiate lockout.

Control sequence in the event of fault and indication of lockout

In case of any disturbance, the supply of fuel will immediately be interrupted. At the same time, the sequence switch stops and thus the lockout indicator also.

The symbol appearing above the reading mark indicates the kind of fault:

◀	No start	• A contact is not closed; also refer to chapter 'Prerequisites for burner startup' • Extraneous light Non-volatile lockout during or after completion of the control program Example: - Flame not extinguished - Leaking fuel valves - Faulty flame supervision circuit
▲	Abortion of startup sequence	• No OPEN signal for end switch (a) at terminal 8 • Terminals 6, 7 and 14 and, in case LOK16 is used, terminal 15, also remain live until the fault is corrected.
P	Non-volatile lockout	• No air pressure indication at the beginning of the air pressure check • Loss of air pressure after air pressure check
■	Non-volatile lockout	• Due to a fault in the flame supervision circuit.
▼	Abortion of startup sequence,	• Auxiliary switch (m) has not delivered the positioning signal for the low-fire position to terminal 8. • Terminals 6, 7 and 14 and, in case LOK16 is used, terminal 15, also remain live until the fault is corrected.
1	Non-volatile lockout	• No flame signal has been received on completion of the (first) safety time.
2	Non-volatile lockout	Only with LGK16: • No flame signal has been received on completion of the second safety time (flame signal of the main flame with interrupted pilot burners).
I	Non-volatile lockout	• The flame signal has been lost during burner operation • Air pressure failure

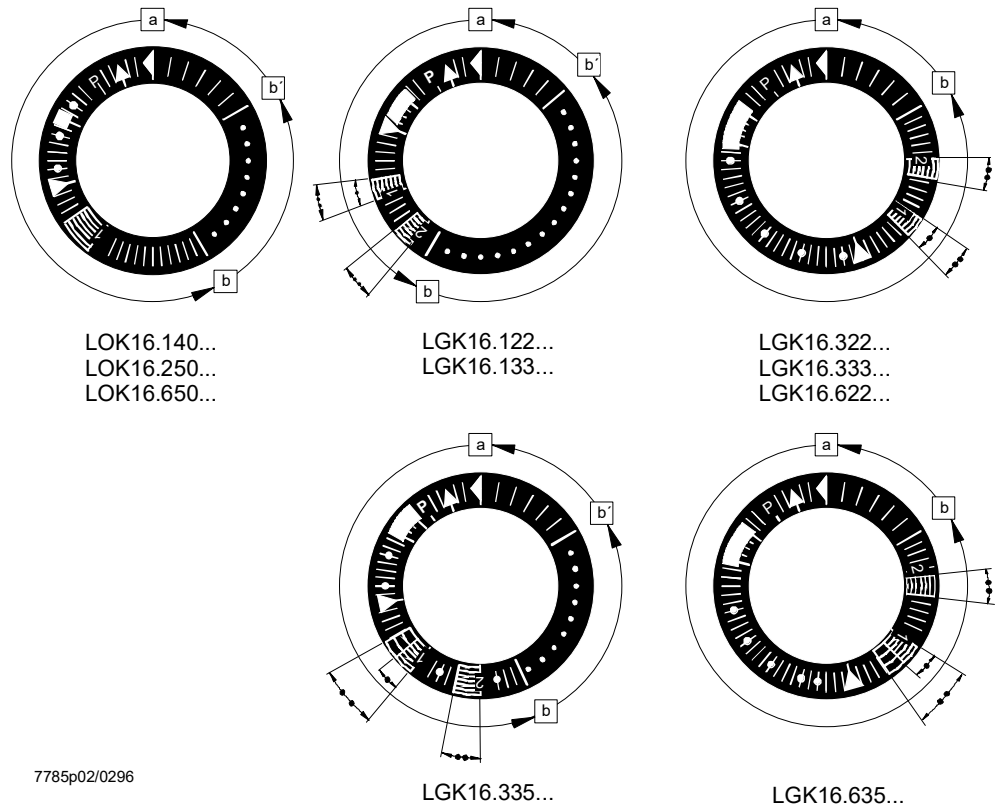
After the reset, the LOK16/LGK16 sequence switch first returns to the start position and then initiates a new burner startup.

If the non-volatile lockout is initiated at any other time between startup and preignition that is not indicated by a symbol, the usual cause is a premature flame signal – i.e., a faulty flame signal caused, for instance, by a self-igniting UV tube.

Only with LOK16:

- If the bridge (B) is cut off, the LOK16 programs a restart with the full, unshortened program sequence in the event of loss of flame during operation.

Lockout indication



a-b Startup sequence

b-b' With certain time variants:
Idle steps of the sequence switch up to the self-shutdown after burner startup
 (b' = operating position of the sequence switch)

b(b')-a Postpurge sequence after controlled shutdown.
 In start position (a), the sequence switch switches itself automatically off or immediately initiates another burner startup (e.g. after a fault has been corrected)

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

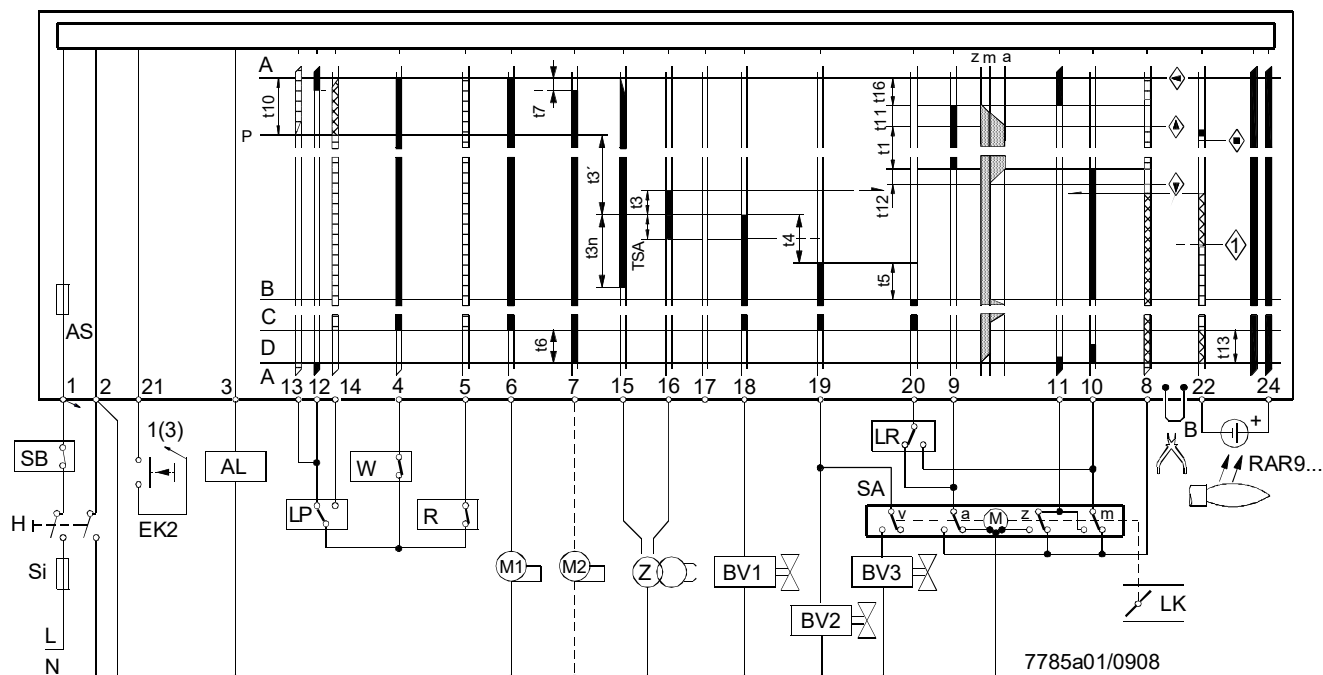
The LOK16/LGK16 can be reset immediately after a non-volatile lockout:
 → Do not press the lockout reset button for more than 10 seconds

The sequence switch always travels to the start position first
 → After resetting
 → After rectification of a fault that led to shutdown
 → After each power failure
 → During this period of time, power is only fed to terminals 7 and 9...11

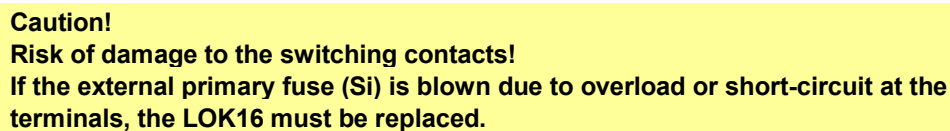
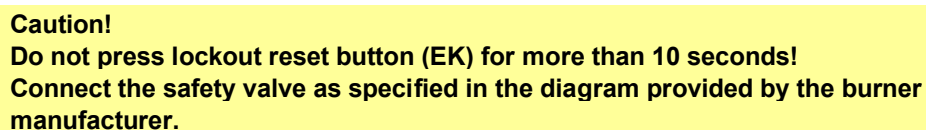
The LOK16/LGK16 then programs the burner restart.



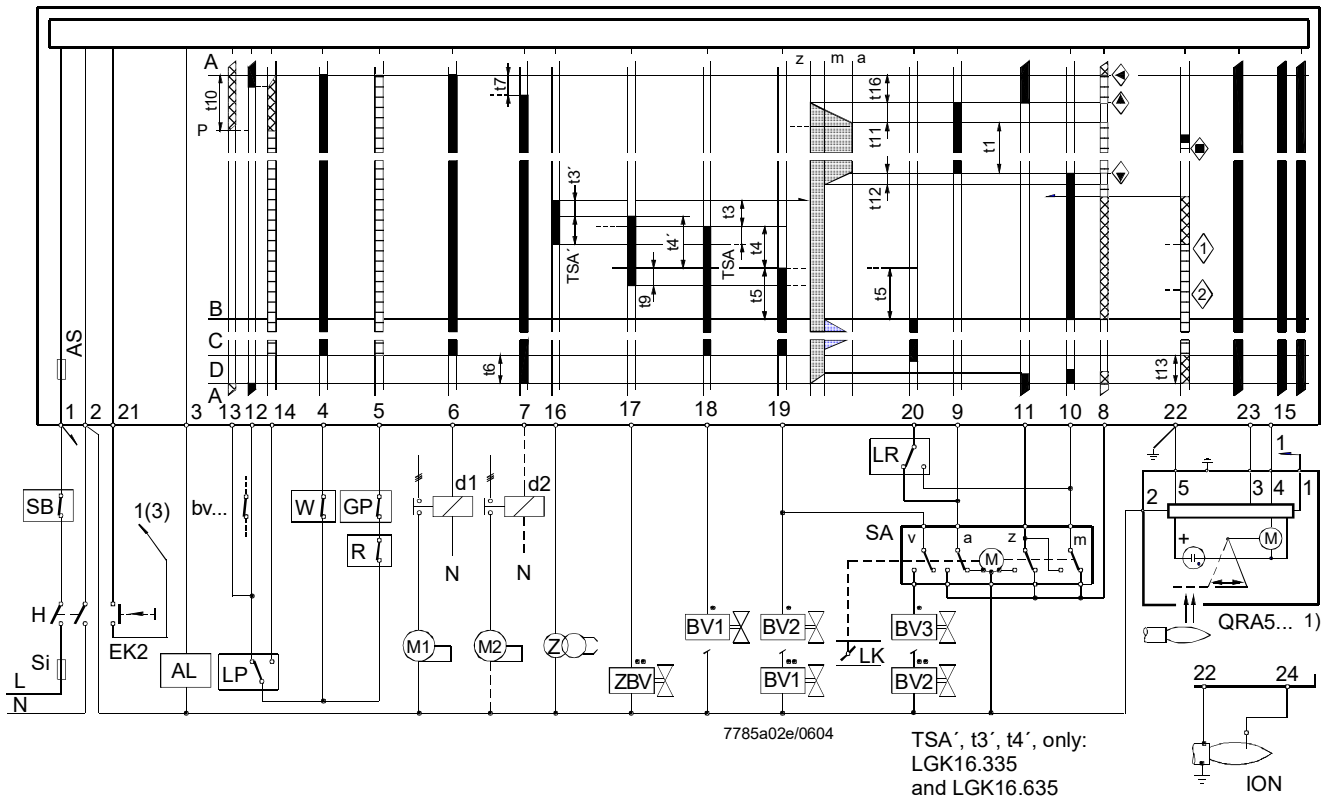
Note!
 Do not press the lockout reset button for more than 10 seconds.



Note!
In applications involving air heaters (WLE), or in the case of oil burners with a maximum throughput of > 30 kW/h, removing wire link **B** is not permitted.



LGK16



1) Terminal 22 must be connected to earth in connection with QRA53/QRA55 UV flame detectors.



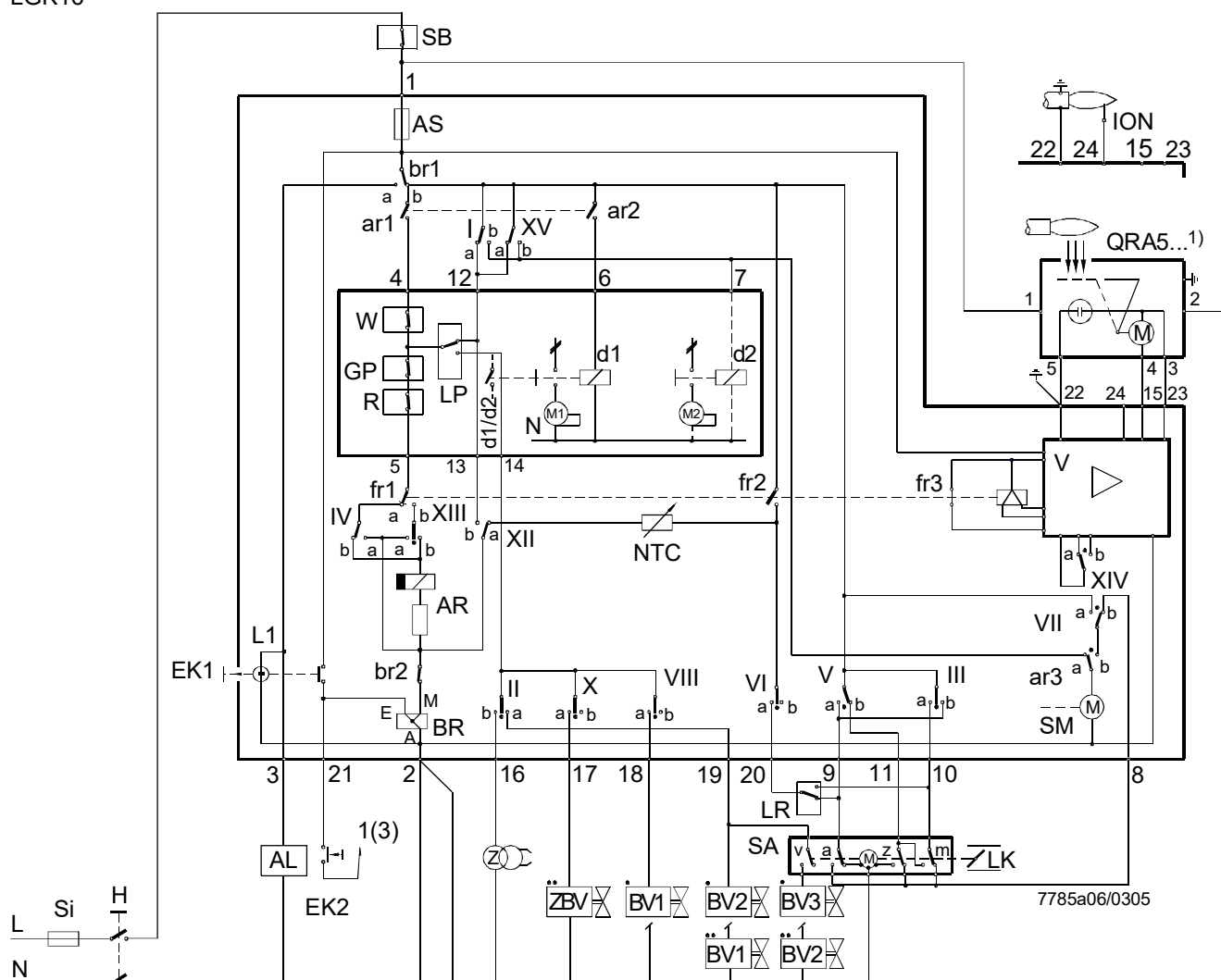
Caution!

Do not press lockout reset button (EK) for more than 10 seconds!
Connect the safety valve as specified in the diagram provided by the burner manufacturer.



Caution!

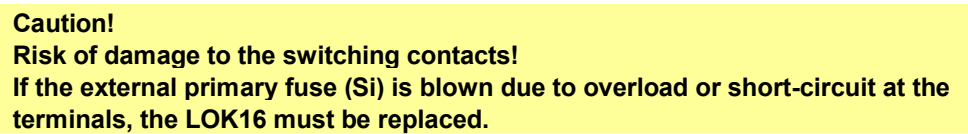
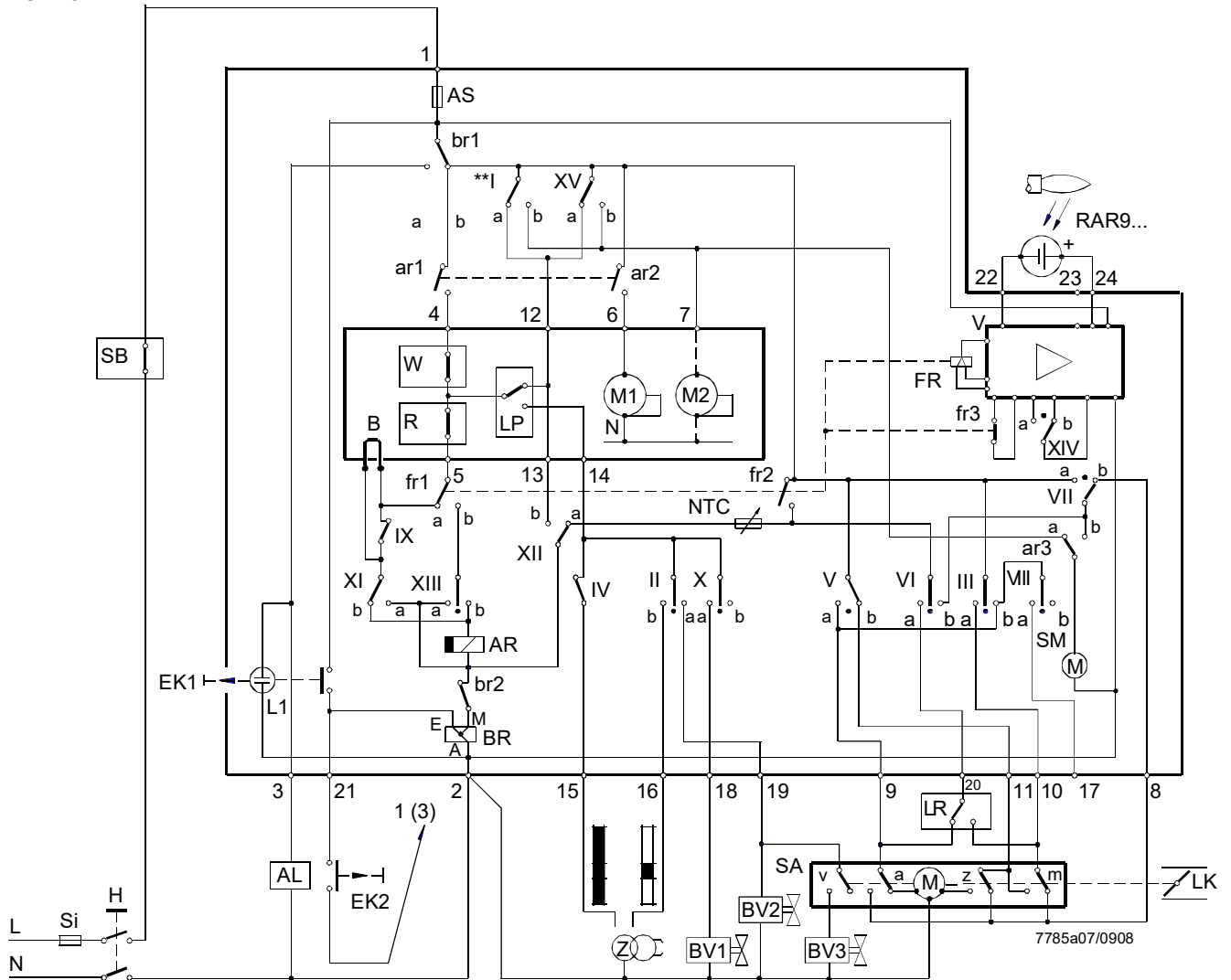
Risk of damage to the switching contacts!
If the external primary fuse (Si) is blown due to overload or short-circuit at the terminals, the LGK16 must be replaced.



Do not press lockout reset button (EK) for more than 10 seconds!

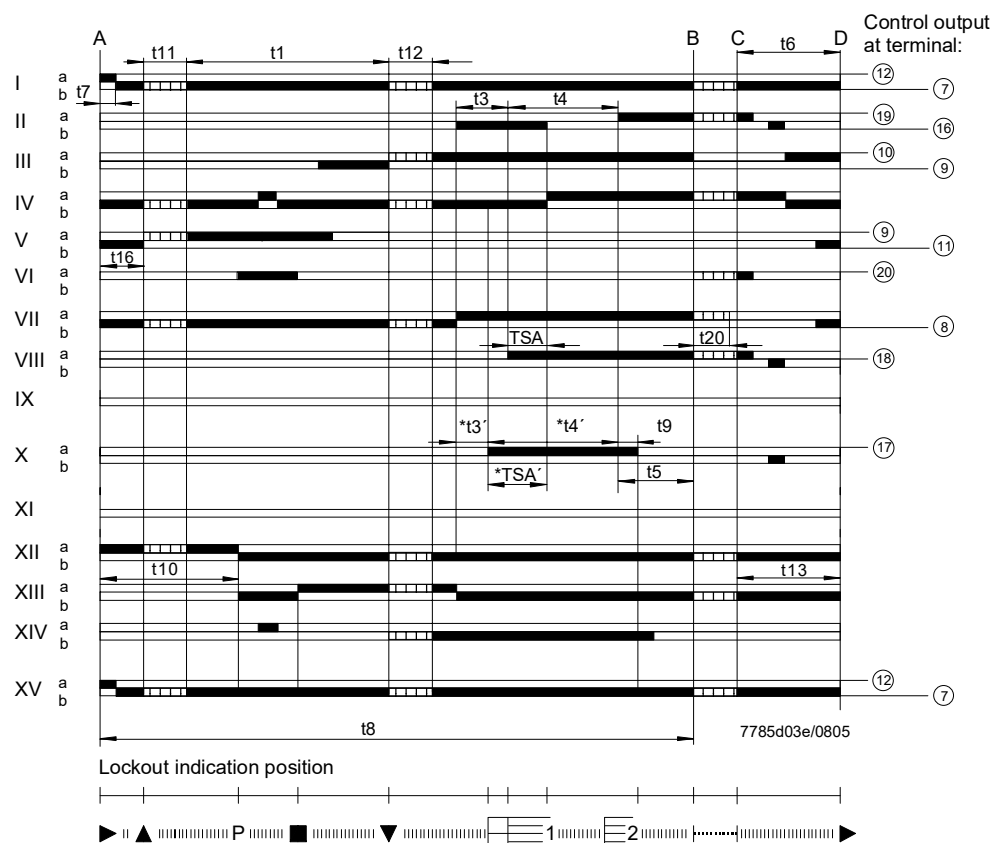


If the external primary fuse (Si) is blown due to overload or short-circuit at the terminals, the LGK16 must be replaced.



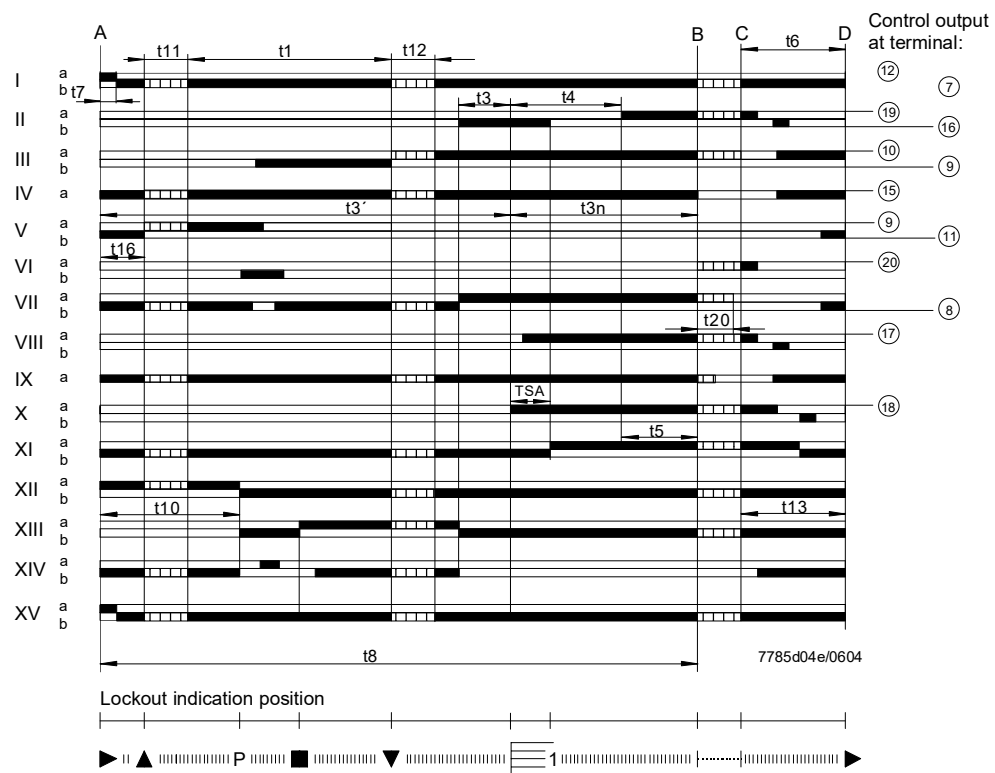
Program sequence

LGK16

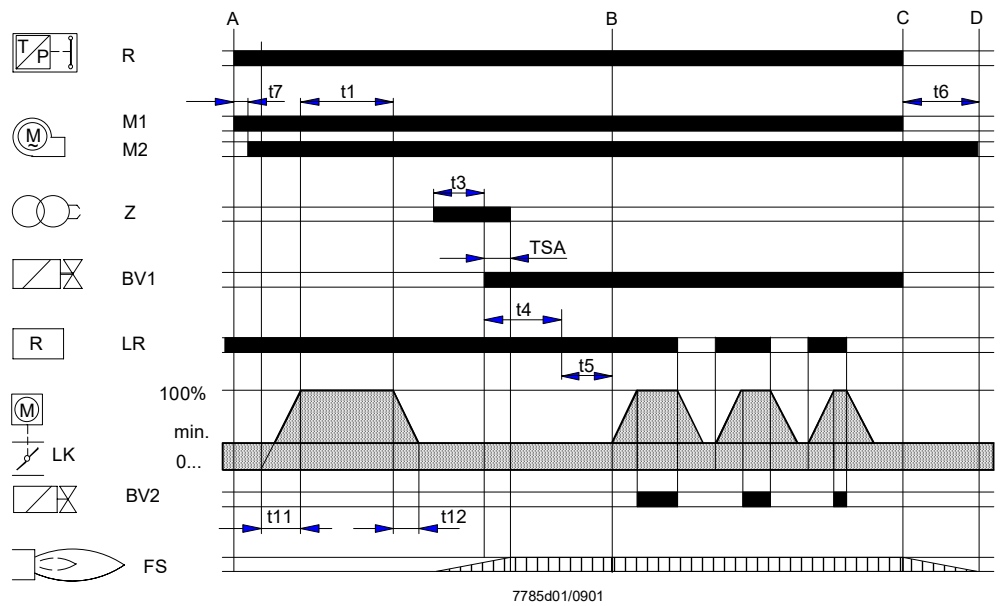


* The safety time (TSA'), long preignition time (t3'), and interval (t4') are programmed only by the LGK16.335 and LGK16.635.

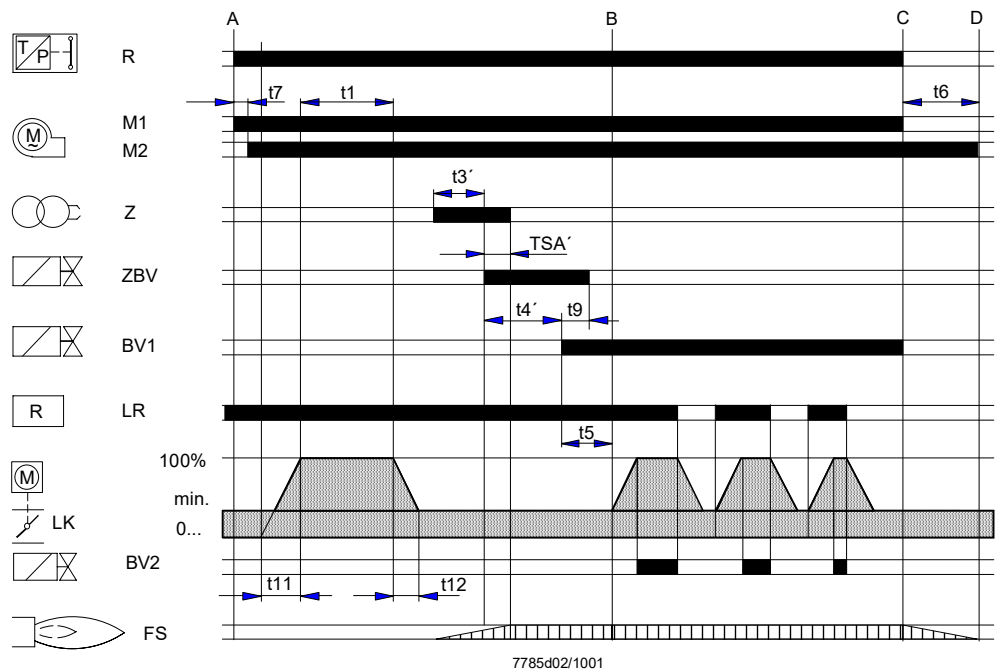
LOK16



Expanding flame burners (burners without a pilot burner), controlled and supervised by **LOK16** or **LGK16**. Air damper in low-fire position during burner off times (MIN).

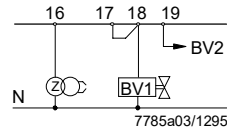


Interrupted pilot burners (burners with pilot burner), controlled and supervised by **LGK16.335** or **LGK16.635**, for example. The other **LGK16s** program the safety time (TSA), preignition time (t_3), interval (t_4), and second safety time (t_9) for the pilot burner.



Connection examples

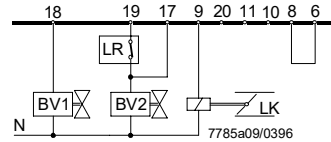
LGK16



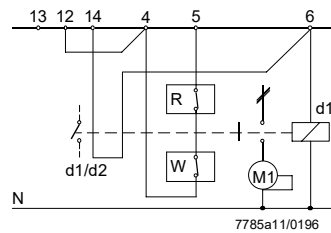
The safety time is doubled for single-pipe burners when using the **LGK16.335** and **LGK16.635**.

By connecting terminals 17 and 18, the safety time is doubled and the preignition time reduced by 50%. Before using this circuit, it must be ensured that the longer safety time is in compliance with national standards and regulations etc. and with the construction of the burner plant!

LOK16



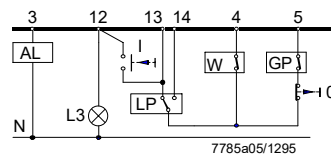
Control of the actuator during operation by feeding control signals to terminal 17



Wiring required for operation without air pressure supervision

If an auxiliary contact of the fan contactor is included in the circuit as shown in the diagram, ignition and fuel release are possible only when the contact is closed.

LOK16/LGK16

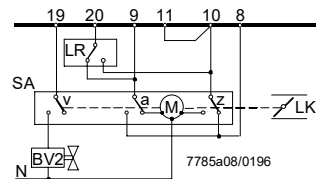


Semiautomatic startup

The burner is switched on manually by pressing button **I**. The LOK16/LGK16 then programs startup and flame supervision.

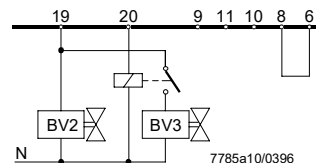
The burner is switched off manually by pressing button **0**, or automatically by the limit thermostat or pressure switch (W), or by gas pressure switch (GP). The signal lamp (L3) indicates when the LOK16/LGK16 is ready to start; it extinguishes shortly after the burner is switched on.

For the other connections, refer to chapter 'Connection diagrams'.



Connecting of actuators without end switch for the CLOSED position

Switch (Z) is set to low-fire



Control of a fuel valve from terminal 20 for burners without an air damper or with an air damper not controlled by the LOK16/LGK16

The relay is not required if the fuel valve at terminal 20 is installed hydraulically in series with a fuel valve actuated from terminal 18 or 19. For applications without an actuator, terminal 8 must be connected to terminal 6.

Legend

a	End switch for the OPEN position of the air damper
AL	Remote lockout warning device (alarm)
AR	Main relay (load relay) with «ar» contacts
AS	Unit fuse
B	Wire link (at the plug-in section of the LOK16/LGK16)
	Note! In applications involving air heaters (WLE), or in the case of oil burners with a maximum throughput of > 30 kW/h, removing wire link B is not permitted.
BR	Lockout relay with «br» contacts
BVx	Fuel valve
bv...	Auxiliary contact in the fuel-valve actuator for checking the closed position
d...	Contact or relay
EKx	Lockout reset button
ION	Ionization probe
FR	Flame relay with «fr» contacts
FS	Flame signal
GP	Gas pressure switch
H	Mains isolator
Lx	Lockout warning lamp
LK	Air damper
LP	Air pressure switch
LR	Load controller
m	Auxiliary changeover switch for the air damper's MIN position
Mx	Fan or burner motor
NTC	Resistor with negative temperature coefficient
QRA	UV flame detector
R	Control thermostat or pressurestat
RAR9	Photocell detector
SA	Actuator of air damper
SB	Safety limit thermostat
Si	External fuse
SM	Synchronous motor of sequence switch
v	In the actuator: Auxiliary changeover switch for release of fuel as a function of the air damper position
V	Flame signal amplifier
W	Limit thermostat or pressure switch
z	In the actuator: End switch for the air damper's fully closed position
Z	Ignition transformer
ZBV	Pilot valve
•	Valid for expanding flame burners
••	Valid for interrupted pilot burners with a pilot burner which is shut down after the main burner has ignited
A	Startup
B	Operating position
C	Controlled shutdown
D	End of control sequence
	Control signals of the LOK16/LGK16
	Permissible input signals
	Required input signals:
	If these signals are not present at the times marked by symbols or during the shaded periods, the LOK16/LGK16 interrupts startup or initiates a non-volatile lockout

Legend (cont'd)

Lockout position indication when there is no input signal (refer to chapter 'Control program in the event of faults'):

- ◀ No start
- ▲ Abortion of startup sequence
- ▼ Abortion of startup sequence
- Non-volatile lockout (fault in the flame supervision circuit)
- 1 Non-volatile lockout (no flame)
- 2 Non-volatile lockout (no flame)
- P Non-volatile lockout (no air pressure)

Time table

t1	Prepurge time with air damper fully open
TSA	Safety time or first safety time with burners using a pilot burner
TSA'	Safety time or first safety time with burners using a pilot burner
t3	Preignition time
t3'	Preignition time
t3n	Postignition time (ignition transformer connected to terminal 15)
t4	Interval between start of safety time (TSA/TSA') and release of fuel valve at terminal 19
t4'	Interval between start of safety time (TSA/TSA') and release of fuel valve at terminal 19
t5	Interval between end of interval (t4/t4') and release of load controller or fuel valve at terminal 20
t6	Postpurge time (identical with the permissible afterburn time (t13))
t7	Switch-on delay for fan motor M2
t8	Duration of startup sequence excluding running time (t11/t12)
t9	Second safety time with burners using a pilot burner
t10	Interval from the start to the beginning of the air pressure check
t11	Running time of air damper into the fully open position
t12	Running time of air damper into the low-fire position
t13	Permissible afterburn time
t16	Interval from the start to the OPEN command for the air damper
t20	Interval to the self-shutdown of the sequence switch
max.	Safety time in the event of loss of flame during operation

* The safety time (TSA'), long preignition time (t3'), and interval (t4') are programmed only by the LGK16.335 and LGK16.635.

Dimensions

Dimensions in mm

LOK16/LGK16


AGM16/AGM17 plug-in base

