SIEMENS

7781

ISO 9001

CE

LAE10
LFE10

Flame Safeguards

Series 02

Supplementary data sheets 7712 and 7713

Flame safeguards for burners with intermittent operation.
For safety reasons - self-test of flame supervision circuit, etc. - at least one controlled shutdown is required every 24 hours.
For flame supervision systems for continuous operation, refer to data sheet 7783.
The LAE10 is used for the supervision and indication of oil flames, the LFE10 for gas and oil flames.

The LAE10 / LFE10 and this data sheet are intended for use by OEMs which integrate the flame safeguards in their products.

Use

The **LAE10** is designed for the supervision of oil flames in connection with selenium photocell detectors RAR...
The **LFE10** is suited for the supervision of gas flames and luminous or blue-burning oil flames in connection with UV detectors QRA... or a flame rectification probe.

Both types of flame safeguards are used primarily in conjunction with the LEC1 burner control on the following applications:

– **Dual-supervision of burners**
  Supervision of the main flame or of the pilot and main flame by two identical or different types of flame detectors
– **Supervision of forced draught oil / gas burners**
  Supervision of the flame with different types of detectors, depending on the operating mode
– **Multi-flame supervision**
  Plants with several burners whose flames must be supervised individually by one or several detectors, whose startup and supervision, however, should or must be carried out centrally and simultaneously by only one burner control
– The flame safeguards can also be used in connection with other types of burner controls provided the given combination and selected circuitry do not impair the burner control's safety functions
– The flame safeguards are also used as **flame indication units** in combustion plant with manual startup

Warning notes

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

It is not permitted to open, interfere with or modify the units!

- Before performing any wiring changes in the connection area of the LAE10 / LFE10, the flame safeguard must be completely isolated from the mains supply!
- Check the wiring and all safety functions!

Engineering notes

- Ensure that the drop out delay time of relay «d» does not exceed 50 ms (also refer to «Connection examples»)!

Mounting notes

- The relevant national safety regulations must be complied with!
- Locate the ignition and detector electrodes such that the ignition spark cannot arc over to the detector electrode!
  → Risk of electric overloads
- Locate and adjust the flame detector such that only the flame to be supervised will be detected
- Protect the UV cell adequately against UV radiation emitted by
  – halogen lamps
  – welding equipment
  – special lamps
  – ignition sparks
  – high energy x-rays and gamma rays

Installation notes

- Installation and commissioning work may only be carried out by qualified staff!
- Observe the permissible lengths and shielding of the detector cables!
  → Refer to «Technical data»!
- Always run the ignition cables separate from the unit and other cables while observing the greatest possible distances!
- Before putting the flame safeguard into operation, check the wiring carefully!

Mechanical design

The **LAE10 / LFE10** are of plug-in design and consist of power section, flame signal amplifier, flame relay, an auxiliary relay for controlling the UV detector or the flame simulation test, and a flame indication lamp located in the unit cover behind a viewing window.
The electrical circuit is intrinsically safe in compliance with the relevant regulations and - in connection with LEC1 burner controls - is tested in respect of proper functioning each time the burner is started up.
The flame safeguards can be mounted in any position directly on the burner, in control panels, or on the front of a panel.
There are two types of plug-in bases available, designed for cable entry from the front, the side or below.
Two earth terminals provide looping facilities for the earth connections of other burner plant components such as ignition transformers (the flame safeguards themselves are double-insulated!).
The plug-in bases - like the housing - are made of impact-proof and heat-resistant plastic.
For illustrations of the bases and other notes, refer to «Base versions» and «Dimensions».

Special features

– **LAE10:**
  Automatic light simulation test by increasing the sensitivity of the amplifier during the burner off and purge times, as programmed by the LEC1 burner control
– **LFE10:**
  Automatic testing of the UV detector by increasing the operating voltage of the UV tube during the burner off and purge times, as programmed by the LEC1 burner control

Flame detectors

– **UV detector QRA...** (refer to data sheet 7712)
– **Selenium photocell detectors RAR7 and RAR8** (refer to data sheet 7713)
– **Flame rectification probe**
Flame supervision by making use of the electrical conductivity of the flame in conjunction with the rectifying effect is only possible with gas and blue-flame burners.
Since the flame signal amplifier responds only to the d.c. component of the flame signal (ionization current), a short-circuit across the detector electrodes cannot simulate a flame signal.

Technical data

CE conformity
According to the directives of the European Union
Electromagnetic compatibility EMC
89 / 336 EEC incl. 92 / 31 EEC
Directive for gas appliances 90 / 396 EEC
Low voltage directive 73 / 23 EEC

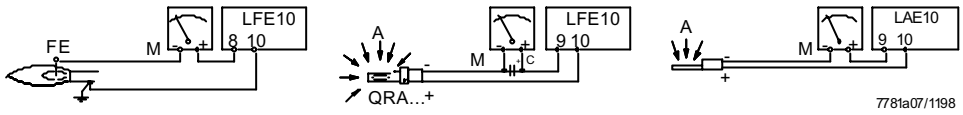
Environmental conditions
Transport IEC 721-3-2
Climatic conditions class 2K2
Temperature range -20...+60 °C
Humidity < 95 % r.h.
Mechanical conditions class 2M2
Operation IEC 721-3-3
Climatic conditions class 3K5
Temperature range -20...+60 °C
Humidity < 95 % r.h.
Condensation, formation of ice and ingress of water are not permitted!

Mains voltage AC 220 V -15 %...AC 240 V +10 %
AC 100 V -15 %...AC 110 V +10 %
Mains frequency 50...60 Hz ±6 %
Prefuse (external) max. 10 A (slow)
Power consumption 4.5 VA
Max. contact rating 2 A
Degree of protection IP 40
provided cable entry is in compliance with IP 40
Mounting orientation optional

	LAE10	LFE10	
Weight without plug-in base	305 g	395 g	
Weight with normal plug-in base	380 g	470 g	
Weight with high plug-in base	415 g	505 g	
Flame supervision	**Series 02**		
	LFE10	**LFE10**	**LAE10**
	Rectification probe	UV detector	Selenium cell
Required min. detector current in µA			
- At AC 100 V and AC 220 V	min. 8	150	8
- At AC 110 V and AC 240 V	min. 9	200	8
Max. possible detector current in µA			
- At AC 100...110 V and AC 220...240 V	approx. 100	approx. 650	approx. 25
Perm. length of connecting cables	20 m ¹)	20 m ¹)	20 m ²)

¹) In case of greater distances, use **low-capacitance** cable (total max. 2 nF), such as single-core RG62
²) Run detector cables separately, at least 5 cm away from other cables and, in case of greater distances, use selenium photocell detector RAR8

Measurement circuits



A Illumination of flame
C Electrolytic capacitor 100 µF, DC 10 V
FE Detector electrode
M Microammeter
QRA... UV detector

Ignition may affect the ionization current!
Remedy: exchange the connections on the primary side of the ignition transformer

Function

Basic mode of operation of the flame safeguards in connection with the LEC1 burner control

When used with the LEC1, the flame safeguard feeds the flame signal into the burner control's control program the same way as if the flame safeguard was a component of the burner control (same as with an oil or gas burner control).

In the event of non-ignition, loss of flame during burner operation, or faulty flame signal during burner off or purge times, the burner will always be shut down and the burner control will initiate lockout.

The switching functions needed to feed the flame signal into the burner control's control circuit are provided by flame relay «FR» of the flame safeguard and the two auxiliary relays «HR1» and «HR2» of the LEC1 burner control.

The LEC1 also delivers the program for the flame simulation test in connection with the LAE10, and the UV detector test with the LFE10.

The tests are controlled via the connecting line between terminal 15 of the burner control and terminal 6 of the respective flame safeguard.

Both tests
- start about 7 seconds after a controlled shutdown
- are continued during burner off times
- are continued during the ensuing pre-purge time
- end 3 seconds before the start of the safety time

Any flame signal detected during this test time, caused by
– extraneous light
– ageing UV detectors
– other defects of the flame supervision equipment,
leads to lockout with interlocking of the LEC1 burner control.

In the flame safeguard, the switching functions required are performed by auxiliary relay «HR3».

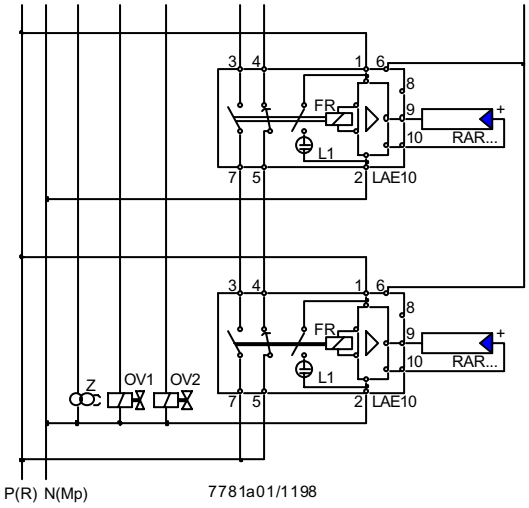
Since in the case of flame supervision with a flame rectification probe, it is not necessary to carry out a test, the connecting line between terminal 15 of the burner control and terminal 6 of the flame safeguard is not required here.

Instead, terminal 6 must be connected to the live wire.
For example: by making a connection to terminal 1, 5 or 7.

Any flame signal – be it a normal flame signal during operation or a faulty signal - is indicated by the indication lamp on the flame safeguard.

Mode of operation of the flame safeguards when used for dual-supervision

Dual-supervision (detailed connection diagram, e.g. for oil burners)

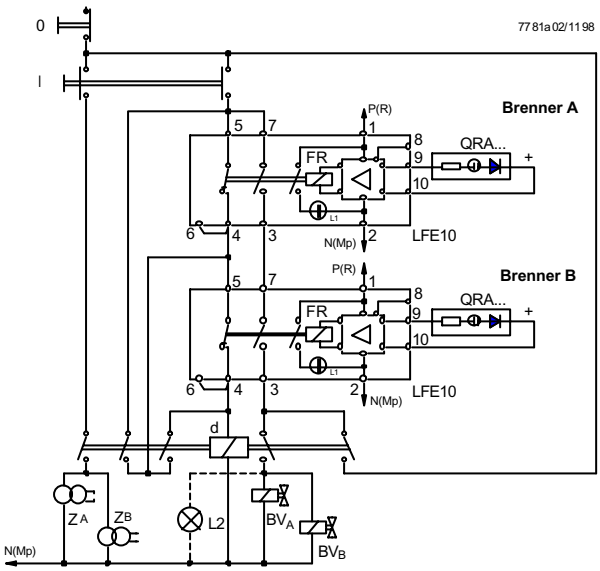


With this type of supervision, **one** flame is supervised by **two** independently operating flame safeguards, aimed at reducing the possibility of loss of flame during operation in case of a simultaneous failure of **both** flame safeguards to an "improbable coincidence".

With dual-supervision, the control contacts of the flame relays of both flame safeguards are connected in series so that loss of the flame signal of **either of the flame safeguards is sufficient** to cause lockout of the burner.
A faulty signal by only **one** of the two flame safeguards during burner off times or purge times also leads to lockout.

An ignited UV tube is a source of UV radiation!
In case of flame supervision by means of UV detectors, both detectors must be placed such that there is **no direct visual contact** between them.

Supervision of two manually controlled burners



Mode of operation of the flame safeguards when used for the supervision of two manually operated burners

With this type of supervision, too, the burner can be started only if the UV detector or flame simulation test has been successful.
This means that **neither** of the two flame safeguards may detect a flame signal during burner off times.
When the burner is started up, the detector test will automatically be interrupted.

When pressing button «I», relay «d» is energized via circuit path 4 - 5 of the flame relays, which is still closed, thus switching on the ignition of both burners.
At the same time, fuel is released.
The duration of the start pulse given by pressing button «I» should be limited by a time relay - in the sense of a **safety time.**

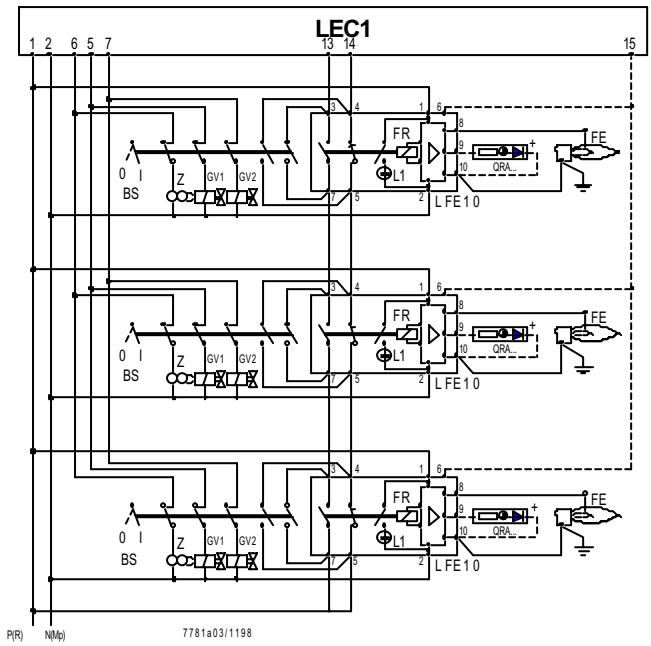
If the flame is established on **both** burners - indicated by the signal lamps of both flame safeguards - relay «d» is now maintained in its energized condition via circuit path 3 - 7 of the two flame relays.
When releasing button «I», ignition will be switched off, thus completing the startup sequence.

If the event of loss of flame on **one** of the burners, the respective flame relay is de-energized, thereby neutralizing the holding circuit for
relay «d».
This means that the fuel valves of **both** burners will immediately be shut.

The burners are switched off manually be pressing button «0», or - automatically - by the control / limit thermostat or pressurestat / pressure monitor in the phase wire connection.

In the case of flame supervision with flame rectification probes, terminal 6 of the flame safeguards must be connected directly to the phase wire since no detector test is required here.
For example: connection to terminal 1!

Detailed connection diagram (e.g. for gas burners)



Mode of operation of flame safeguards with multi-flame supervision

Like with dual-supervision, the control contacts of the flame relays of all flame safeguards must be connected in series.
A burner causes all other burners to go to lockout if
– the flame is not established during the safety time, or
– the flame is lost during operation

Correctly operating burners can be restarted only - after the burner control has been reset - when the faulty burner has been shut down.
In that case, the operating switch must not only bridge the control contacts of the respective flame safeguard, thus closing the control chain again, but must also break the phase wire connection to the ignition transformer and the fuel valves.

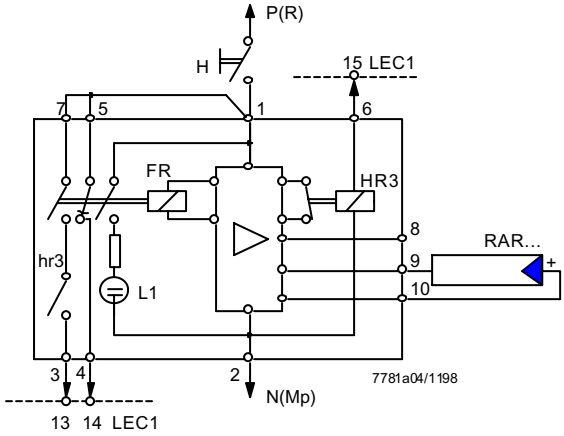
Likewise, after rectification of the fault, the burner can only be restarted in connection with the other burners, that is, only after all burners have previously been shut down.

Terminal 10 must be connected to earth also when using the UV detector QRA...

Legend

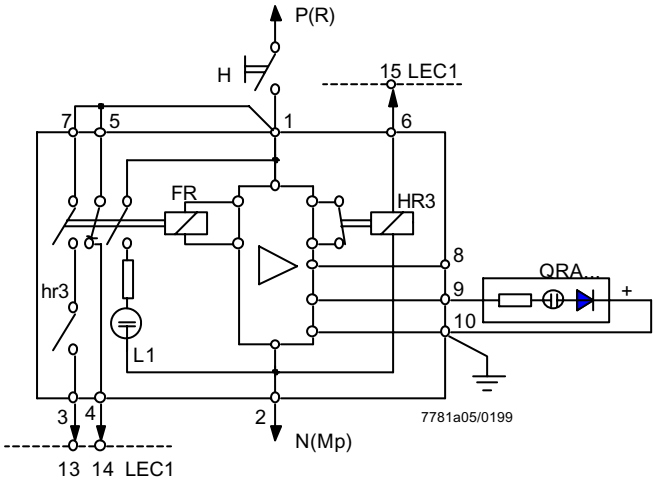
BS	Operating switch OFF / ON → Per burner		L1	Built-in signal lamp → Indication of flame
FE	Detector electrode for flame rectification		QRA...	UV detector
FR	Flame relay		Z	Ignition transformer
GV1/...2	Gas valves 1st and 2nd stage			

Basic circuit diagrams



LAE10

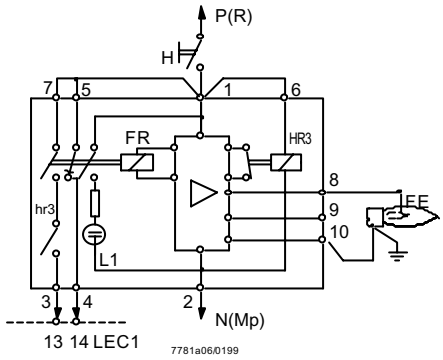
With selenium photocell detector RAR...



LFE10

With UV detector QRA...

Terminal 10 must be connected to earth!



LFE10

With flame rectification probe

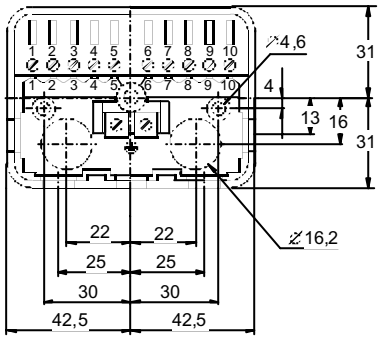
Legend	FE	Detector electrode for flame rectification	L1	Built-in signal lamp
	FR	Flame relay		→ Indication of flame
	H	Main isolator	QRA...	UV detector
	HR3	Auxiliary relay for UV detector or flame simulation test	RAR...	Selenium photocell detector

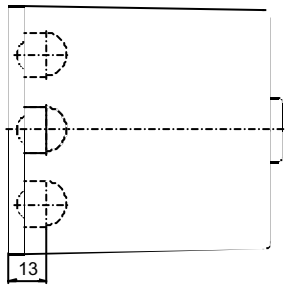
Dimensions

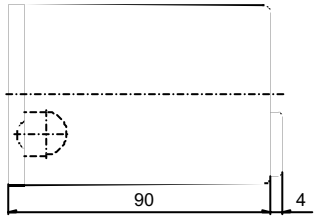
Dimensions in mm

Base versions

Low plug-in base, AGK 4 104 1345 0
Design features:
Ten-pole (screw terminals), with additional earth terminals.
Cable entry either through the bottom of the base
(two knock-out holes), the front, from the right or left side
(total of five cable entries).







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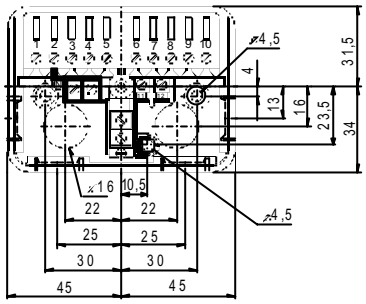
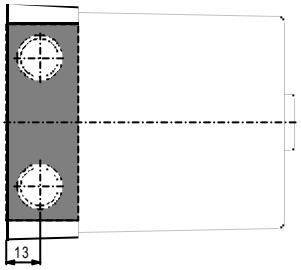
High plug-in base, AGK 4 104 9025 0
with removable front
(shaded area in the drawing)
Design features:
Ten-pole (screw terminals):
and
- two auxiliary terminals with markings 11 and 12
- two neutral terminals, wired to terminal 2 (neutral input)
- two earth terminals, with earthing lug for the burner

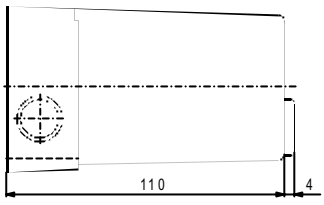
For cable entry:
two cable entries in the bottom of the base and four threaded knock-out holes for cable glands Pg11, one on the right, one on the left, **and in the removable front.**

High plug-in base, AGK 4 104 9169 0
Features as above, but without the removable front (shaded area in the drawing is **open**).

Front, AGK 4 104 9112 0
As a separate item, suited for use with plug-in base AGK 4 104 9169 0 (can also be used with AGK 4 104 9025 0, shaded area in the drawing).







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