

UV Flame Supervision System

**DEACTOgyR®
LFE50**

Series 02



The LFE50 is a self-checking UV flame supervision system designed for use with continuously operating burners or for burners running with no interruption for more than 24 hours.

Use

General application notes

One prerequisite for safe burner operation is a definitive flame signal, that is, a signal initiated by the burner flame alone. In the event of other influences or defects which simulate a flame signal, the flame supervision equipment must prevent any further burner operation.

In order to detect a simulated flame signal in time, burner controls program automatically a functional test of the flame supervision circuit following each controlled shutdown (at the beginning of the startup sequence latest). The protection given by this test is the more effective the more frequently the burner is started and the shorter the actual operating period. With burners controlled in intermittent operation, this protection is given to a high degree. With this form of burner operation, the standards specify at least one controlled shutdown each 24-hour period - thus ensuring a minimum test frequency.

Burners operating continuously must be monitored by self-checking flame supervision systems, such as DEACTOgyR.

Field of use

The self-checking flame supervision system DEACTOgyR, comprised of flame safeguard LFE50 and flame detector QRA50/51..., is designed for UV supervision. It can therefore be used for the supervision of oil burners with blue- or yellow-burning flames, for gas burners and dual-fuel burners. Automatic start-up and control of the burner is achieved using the control unit LEC1... (see data sheet 7761). The system is also suitable for use with manually operated burners.

Prerequisite for the use of the DEACTOgyR system is sufficiently high UV radiation intensity at the viewing point of the UV detector.

In combustion plants where heat generation must also be ensured in the event of failure of the flame supervision equipment, active redundancy circuitry can be easily achieved using two DEACTOgyR systems.

Mechanical design

Flame safeguard LFE50

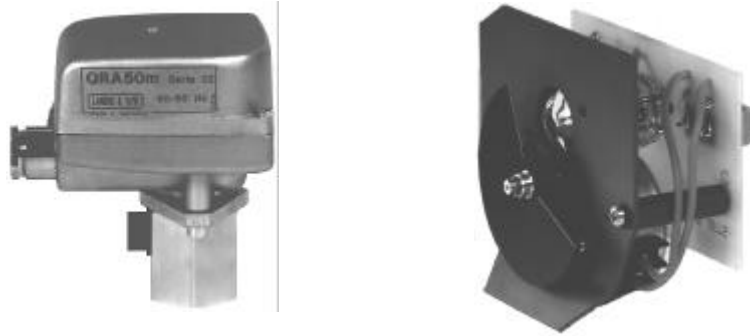
The flame safeguard is double-insulated and of plug-in design. It is suitable for mounting in any orientation into control cabinets or on control panels. Direct mounting on the burner is also permitted.

The unit housing, made from impact-proof and heat-resistant plastic, contains the power section, the self-checking electronic flame signal amplifier with its flame relay, and a flame indication lamp.

The plug and socket arrangement is designed such that erroneous plugging in of another type of unit into the baseplate is not possible. The spacious baseplate with four auxiliary terminals and four earth looping terminals facilitates the electrical installation.

UV detector QRA50M for mounting onto a viewing tube (frontal light entry)

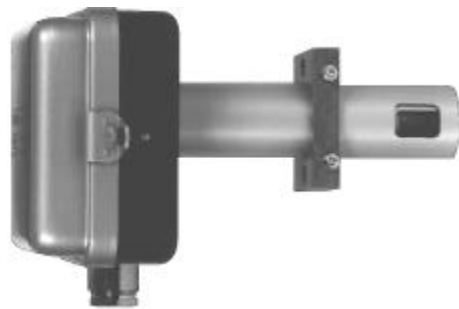
The injection die-cast alloy detector head is sealed with a quartz-glass lens. In addition to the plug-in UV cell, the detector head contains a rotating shutter which - for the purpose of continuous testing of the UV cells striking and extinction voltage performance - interrupts the UV radiation at the rate of three times per second. The shutter is driven by a synchronous motor which has proved suitable for continuous operation over many years.



The fixing of the detector onto the viewing tube is achieved by means of a mounting coupling with a 1 in. internal thread. A 3/8 in. tapping on the side of the coupling enables a cooling air conduit to be connected, provided dry, dust- and oil-free compressed air is available for this purpose.

UV detector QRA51M for burner mounting (lateral light entry)

The detector head, painted light grey/dark grey, is dust- and drip-proof. It has a flanged-on robust, aluminium tube with a radiation entry window for **lateral** viewing. In this tube rotates a cylindrical, slotted shutter which interrupts the incidence of UV radiation to the UV cell, which is mounted directly behind the radiation entry window, at a rate of about three times per second (continuous testing of the striking and quenching performance of the cell). The outer tube can be rotated through 180 ° by loosening two locking screws. A special clamping flange is supplied with the detector to ensure its vibration- and turning-proof fixing to the burner.



Mode of operation

The flame is supervised by the UV cell, which is permanently under voltage. The UV cell strikes and effects a current flow to the flame signal amplifier input when subjected to radiation from the 190...240 nm range of the flame spectrum. The flame signal is transmitted via the contacts of the flame relay at the amplifier output to the control circuit of the burner such that with flame failure, the fuel valves are immediately closed and all other necessary control commands are automatically initiated (burner lockout, lockout alarm signal, etc.). With a self-checking flame supervision system, it must be ensured that only the detector current emitted in the presence of a flame is actually amplified and used as the «flame on» supervision signal. All other currents not generated through flame radiation, e.g. current emission from a self-striking UV cell (caused by ageing) or from any other detector circuit defect which simulates a flame, must be differentiated against and not treated as a flame signal. Thus, the flame safeguard must be able to **differentiate clearly** between a true flame signal and an erroneous flame simulation signal.

For this purpose, the incident radiation at the UV cell is interrupted three times per second by a continuously rotating shutter. The shutter is so designed that it allows «light» and «dark» phases of practically equal length. Thus, the amplifier input does not receive a constant signal. The input signal is «cyclic».

This ensures that the flame relay is energized only if the following prerequisites are fulfilled:

- Flame is present
- The intensity of UV radiation at the viewing point of the detector must be such that the UV cell will strike regularly from the beginning to the end of the «light» phase
- The rotating shutter rotates at the determined speed so that the light and dark phases are given at the uniform rate of three times per second
- The electric and electronic components of the flame signal amplifier function correctly

Warnings

- **In the geographical areas where DIN standards are in use, the installation must be in compliance with VDE requirement, particularly with the standards DIN/VDE 0100 and 0722!**
- **The electrical wiring must comply with national and local standards!**
- **Check wiring carefully before putting the unit into operation!**
- **Ensure protection against electric shock hazard on the unit and at all electrical connections by appropriate mounting!**
- **The LFE50 is a safety device! The loosening of the sealing screws as well as any changes to the factory-settings must therefore be carried out by authorized staff only!**
- **Check all safety functions when putting the unit into operation or after having replaced any fuses!**
- **The LFE50 must be completely isolated from the mains before performing any work on it!**
- **Condensation and ingress of humidity must be avoided!**
- **Ignition cable must always be laid separately, observing the greatest possible distance to other cables!**
- **Electromagnetic emissions must be checked from an application point of view!**
- **To protect the burner control from electric overload, both ignition and ionization electrode must be located such that arcing over of the ignition spark to the ionization electrode cannot occur!**
- **Observe the notes for laying the detector cables (refer to «Technical data»)!**

Technical data

Flame safeguard

LFE50

Mains voltage	AC 220 V -15 %...240 V +10 % AC 100 V -15 %...110 V +15 %	External fuse	10 A max., slow
		Unit fuse	250 mA, slow; 5 x 20 mm
		Radio interference protection to VDE	no radio interference
Frequency	50...60 Hz ±6 %	Degree of protection	IP40
Operating voltage for		Mounting position	optional
- UV cell	250 V	Perm. contact loading	2 A max.
- Rotating shutter motor	63 V	Weight	approx. 1.5 kg
Power consumption	approx. 13 VA		
Environmental conditions		CE conformance	
- Transport	IEC721-3-2	According to the directives of the European Community	
Climatic conditions	class 2K2	Electromagnetic compatibility EMC	
Temperature	-50...+60 °C	89/336 EEC include. 92/31 EEC	
Humidity	< 95 % r.h.	Gas appliance directive	90/396 EEC
Mechanical conditions	class 2M2	Emissions	EN 50081-1
- Operation	IEC721-3-3	Immunity	EN 50082-2
Climatic conditions	class 3K5		
Temperature	-20...+60 °C		
Humidity	< 95 % r.h.		

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

UV detector

Degree of protection	QRA50M: IP54 QRA51M: IP40	Perm. cable lengths	
		- Using 5-core cable	(for terminals 9, 10, 17, 18 and earth) 30 m max.
Mounting position	optional	- Using 2-core cable	(for terminals 9 and 10 and 3-core cable for terminals 17, 18 and earth) 200 m max.
Perm. ambient temperature	-20...+50 °C		
Perm. storage temperature	-55...+50 °C		
Perm. pressure on the lens of the QRA50	500 mbar max.		
Weight of QRA50 / QRA51	approx. 0.75 kg		

Ordering

Flame safeguard

With baseplate	AC 220 V...240 V AC 100 V...110 V	LFE50 LFE50 - AC 110 V
UV detector for mounting onto a viewing tube, complete with flange		QRA50M¹⁾
UV detector for burner mounting (lateral viewing), complete with clamping flange		QRA51M¹⁾

Spare UV cell

- For QRA50M	4 502 4268 0
- For QRA51M	4 502 4065 7
Replacement fuse 250 mA, slow, 5 x 20 mm	4 519 1033 0

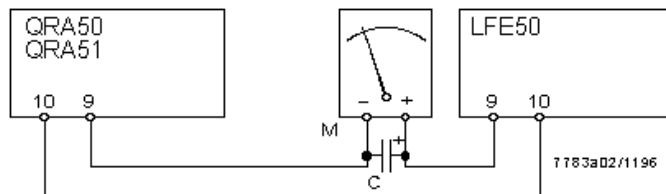
¹⁾ For all voltage variants

Prerequisites for reliable burner operation

Checking of UV radiation intensity at the detector's viewing point by measuring the detector current

Minimum detector current required with nominal voltage AC 220...240 V	70 μ A
Maximum possible detector current with nominal voltage AC 220...240 V	140 μ A
Internal resistance of measuring instrument «M»	5000 Ω max.
Capacitance of capacitor «C» (to facilitate reading)	470 μ F min./DC 25 V

Arrangement of units for measurement



This check of the UV radiation intensity, which also tests the striking performance of the UV cell, should be made not only during commissioning of the burner, but each time the UV cell has been changed.

This check is also recommended in the event of modifications being made which affect the original operating conditions of the burner, for example changes to the burner head, introduction of combustion additives into the fuel (possible impact on filter), or any other changes carried out, which may lead to a reduction of incidence of radiation at the UV cell.

Correct positioning of detector

The ignition spark is a source of intensive UV radiation. If the burner has a long pre-ignition time, the viewing tube of the detector should therefore be sited at the flame in such a way that the ignition spark lies outside the angle of incidence of UV radiation to the detector. If this is not observed, the burner control will lock out during the start-up sequence.

In the case of burner installations for which ignition spark proving is specified, the viewing tube must be so sited that the UV radiation of both the ignition sparks and the flame are detected equally well.

The discharge light of a UV cell may also be a source of UV radiation. In the case of burner supervision with two UV detectors, it must be ensured - through appropriate location of the cells - that they do not influence each other.

Warning

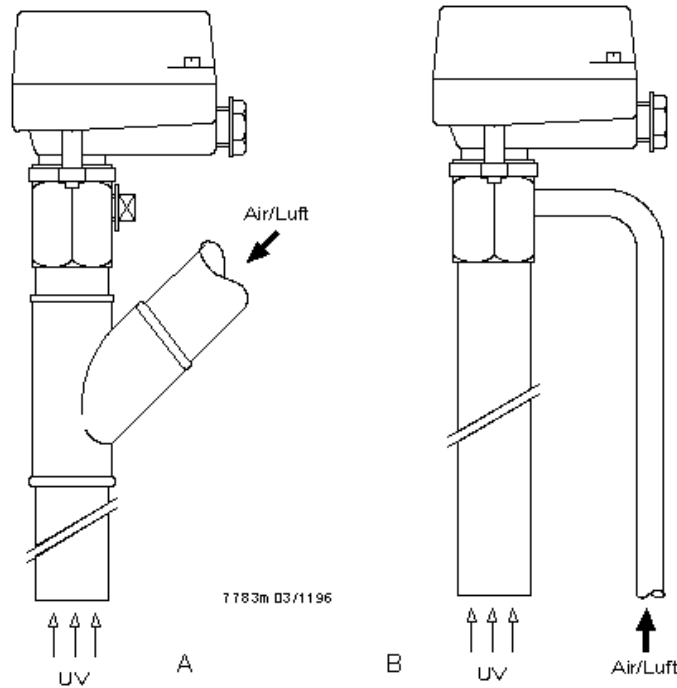
Powerful electron rays or X-rays may lead to faulty flame signals. This also applies to UV proportions in the light of halogen or gas discharge lamps.

The QRA5... must be installed and adjusted such that only the flame to be supervised will be detected.

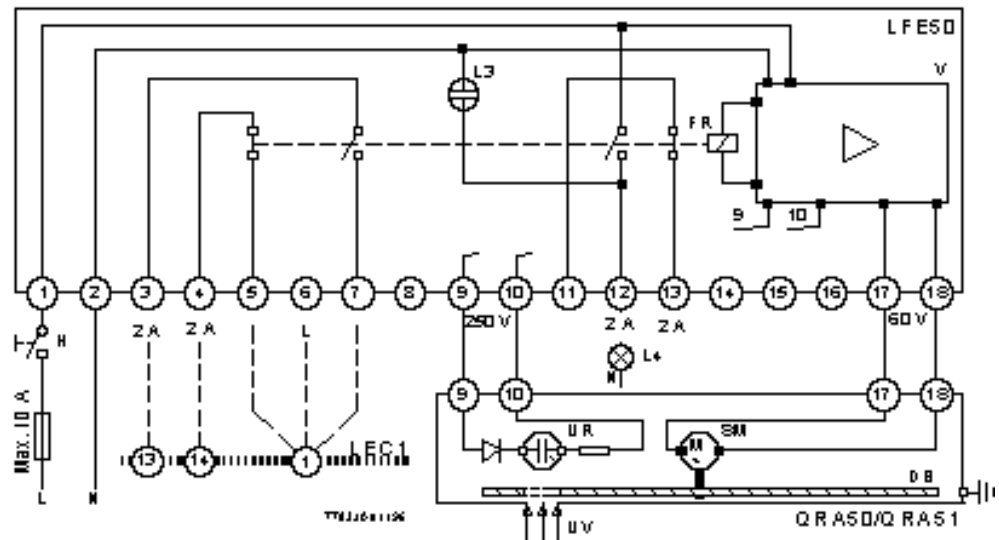
Protection of detector head against overtemperatures

The service life of a UV cell is reduced with increasing ambient temperature. Under continuous operating conditions, the ambient temperature should not exceed 50 °C. If the detector is mounted on a tube viewing into the combustion chamber, this temperature limit is often exceeded as a result of heat conduction. In this case, the UV cell's ambient temperature must be lowered by means of blowing cool air through the viewing tube into the combustion chamber (sketch A).

Lateral air entry at an angle of 90 ° to the viewing tube (sketch B) is permissible only if the cooling air is dry and absolutely dust- and oil-free. Otherwise, the sealing disk of the detector head will become soiled, thereby reducing the incidence of radiation at the UV cell - or even block it completely.



Basic circuit diagram

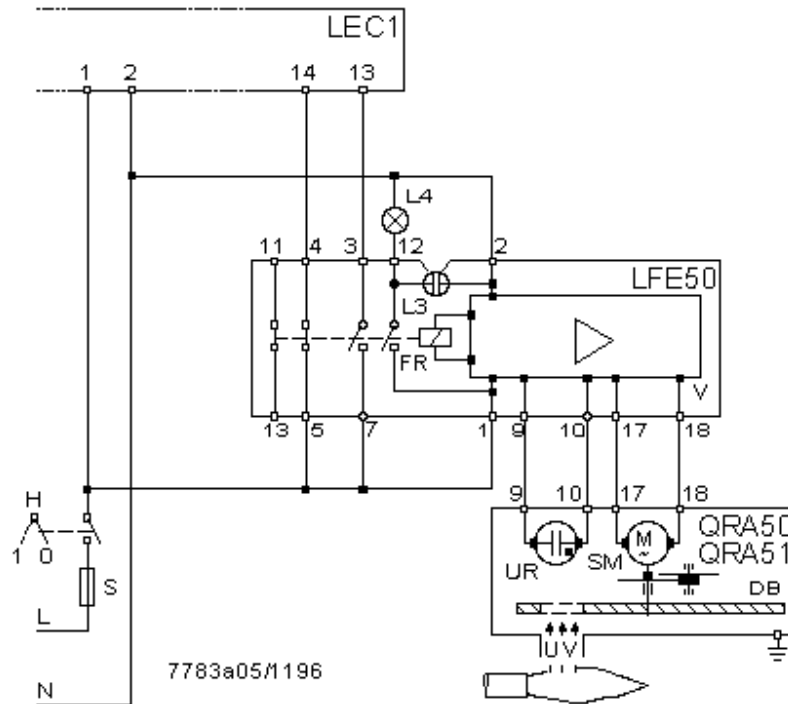


Legend

- | | | | |
|--------|-----------------------------------|----------|--|
| AL | Alarm | LEC1... | Control unit |
| BV... | Fuel valve | LFE10 | Flame safeguard (for intermittent operation) |
| C | Capacitor | LP | Air pressure monitor |
| DB | Rotating shutter | M... | Fan |
| FE | Detector electrode | QRA50/51 | UV detector |
| FR | Flame relay | S | Fuse |
| GP | Gas pressure monitor (or similar) | SM | Synchronous motor with reduction gearing |
| H | Mains isolator | UR | UV sensitive cell (UV detector) |
| HR... | Auxiliary relay | V | Flame signal amplifier |
| L1, L3 | Flame indication lamp (built-in) | W | Limit thermostat or pressure monitor |
| L4, L5 | Flame indication lamp (remote) | Z | Ignition transformer |

Connection examples

Flame supervision of an expanding flame burner with DETACTOGR

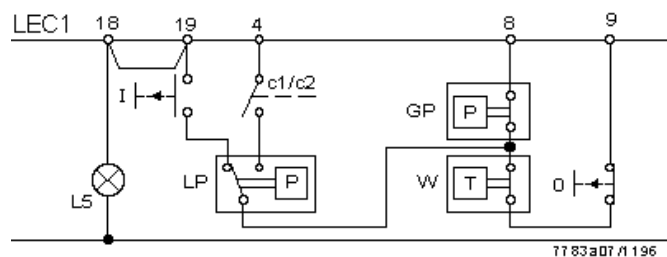


1. Automatic operation

A control unit type LEC1... is required to control the burner. Switching of the burner is achieved automatically by means of the heat generation plant's control thermostat or pressurestat.

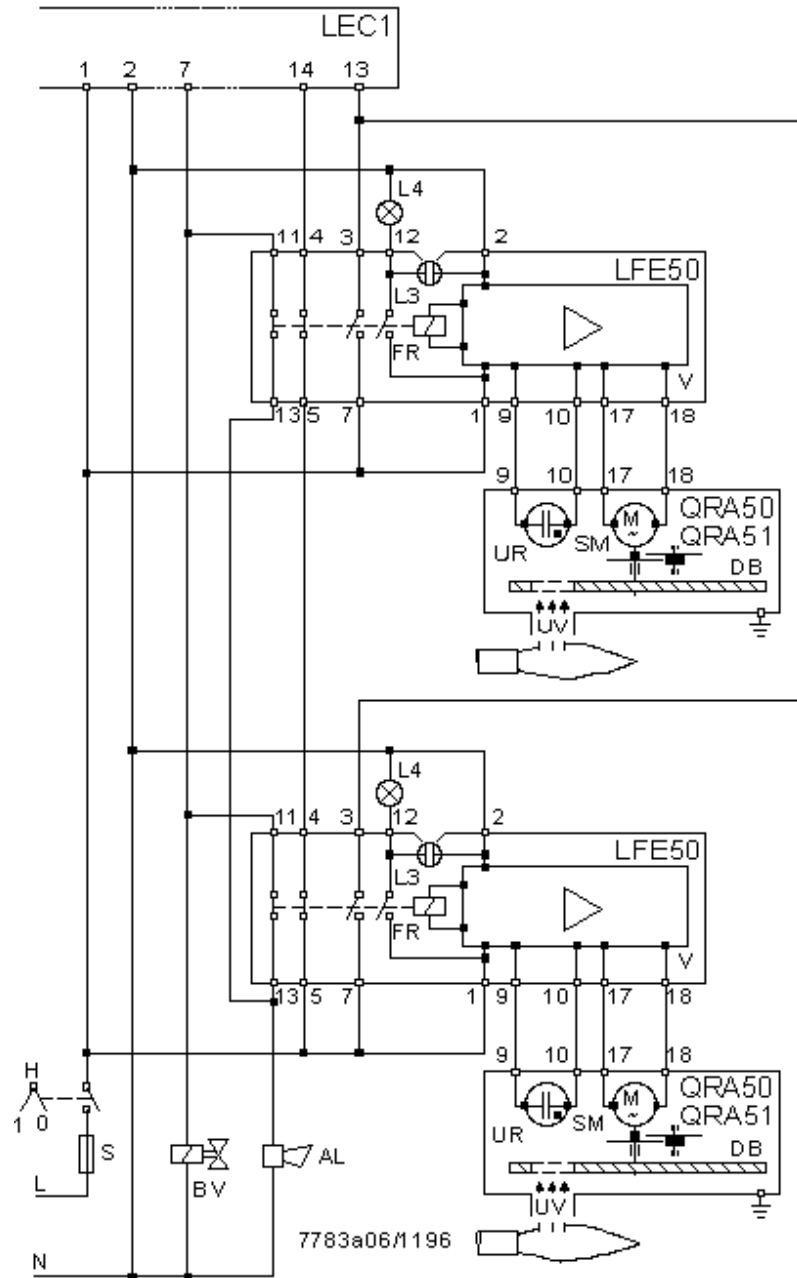
2. Semi-automatic operation

This form of operation differs from automatic operation only in that the burner is switched on manually (pushbutton «I») - providing signal lamp «L5» indicates that the control unit LEC1... is «ready to start». The burner can be shut down either manually (pushbutton «0») or automatically through a limiter in the control loop between terminals 8 and 9.



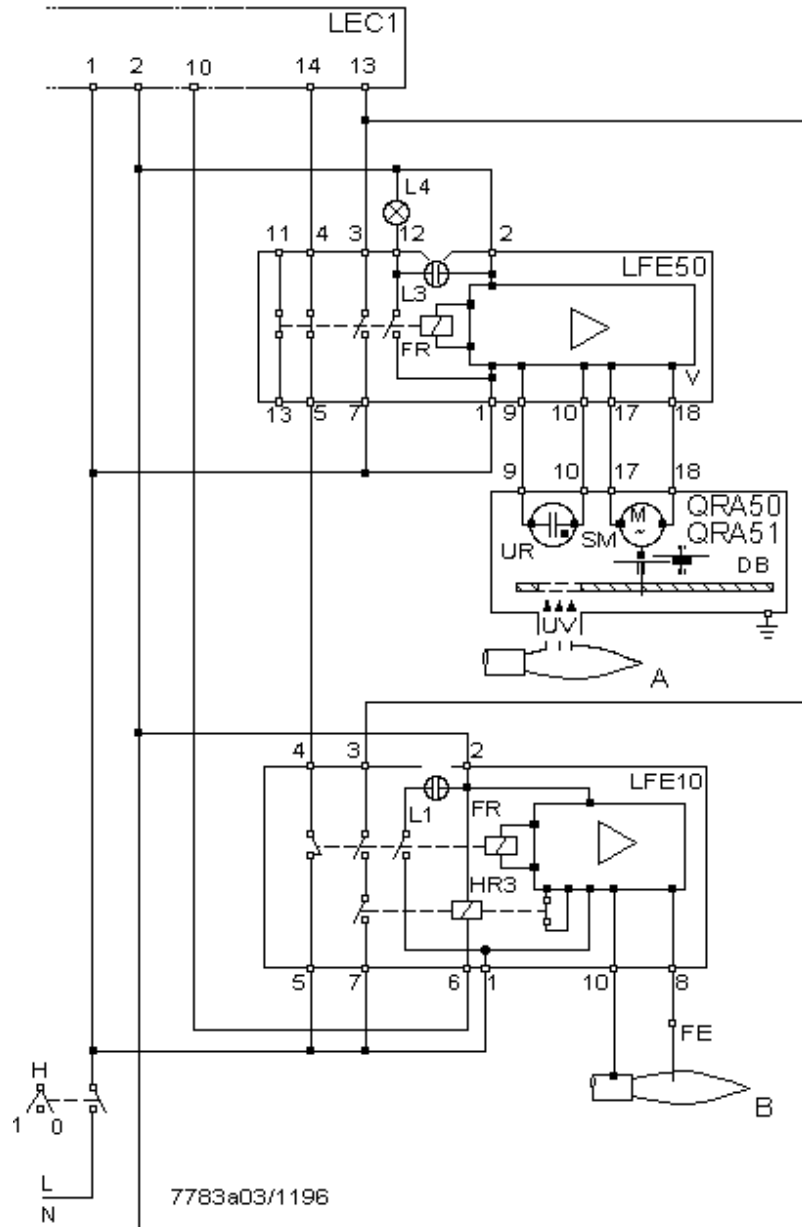
Connection examples for burner operation are given in data sheet 7761 for the control unit LEC1...

Supervision of an expanding flame burner with two self-checking flame supervision systems DETACTOGRYR in an active redundancy circuit



This circuit is used when burner operation must be maintained even in the event of a fault in the flame supervision circuit. With failure of a flame safeguard or a UV cell - signalled by a horn or similar - self-checking supervision is maintained by the second system. This allows the fault to be corrected without having to shut down the burner.

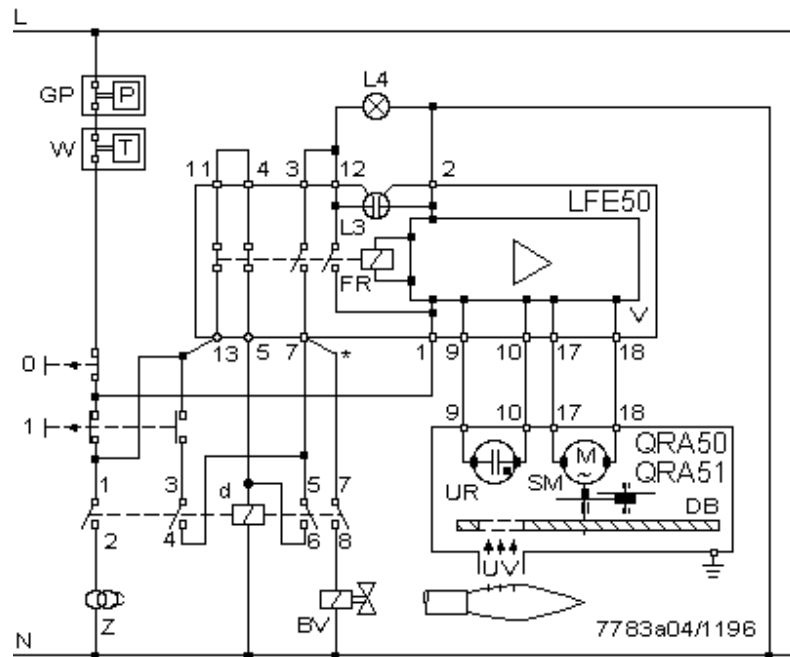
**Flame supervision of
the main flame (A) of
an interrupted pilot
burner with
DETACTOGR**



Supervision of the pilot burner (B) using an ionization detector electrode «FE» and a flame safeguard LFE10 (up to completion of the 2nd safety time).

Burner controlled with control unit LEC1..., as shown in data sheet 7761. This data sheet also contains information on the LFE10; further details are given in data sheet 7781.

Flame supervision of a manually operated single-stage burner with DETACTOGR



* If start-up shall be accomplished with **ignition spark supervision**, the UV detector must be installed such that it can detect the ignition spark and the flame equally well. In that case, the current path to the fuel valve must be connected to terminal 3 or 12 to make certain fuel will be released only after the flame safeguard has received an ignition spark signal (indicated by signal lamps L3 and L4). After the lamps have been lit, pushbutton «I» must be kept depressed until the burner has ignited. If the time of flame establishment shall be indicated also, flame safeguard LFE10 can be used (refer to data sheet 7781).

Actuation of pushbutton «I» switches the ignition transformer on. At the same time, relay «d» is energized and releases the fuel supply. The length of time during which pushbutton «I» may maintain its «start signal» should be limited by means of a time relay.

When the burner ignites, flame relay «FR» is energized, so that relay «d» is held in the energized position via current path 3-7 of the flame safeguard. The ignition transformer is switched off when pushbutton «I» is released. This completes the manual start-up sequence.

The burner is switched off manually by pressing pushbutton «0», or automatically by means of a monitor in the phase connection.

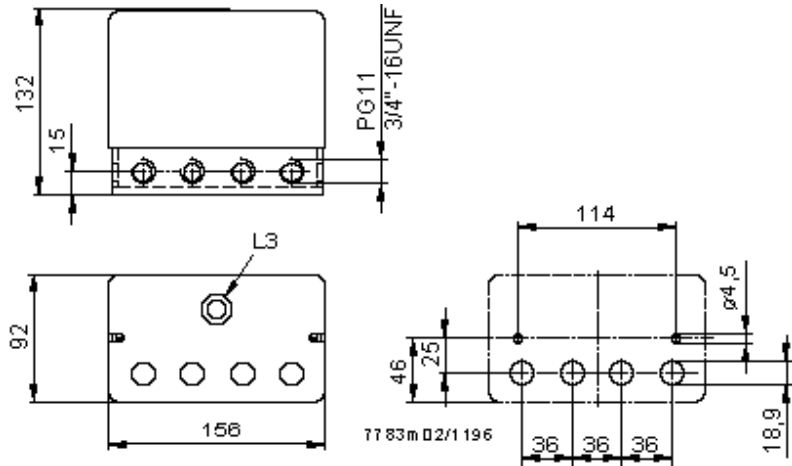
In the event of a flame failure or any other faults in the flame supervision circuit, the fuel supply is immediately interrupted. If such a fault occurs during a burner off period, neither ignition nor fuel release can be achieved.

Warning

The drop out delay time of relay «d» may not exceed 50 ms!

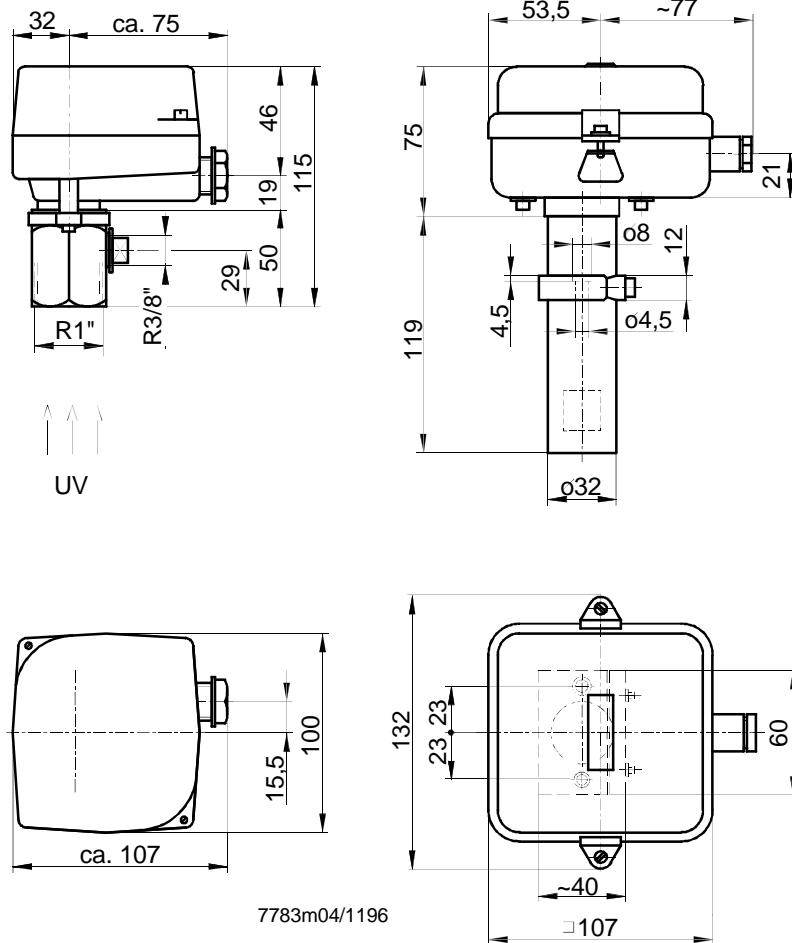
Dimensions

Dimensions in mm



Flame safeguard LFE50

(Baseplate 4 104 9023 0 is supplied with every LFE50; no separate order required)



UV detector QRA50...
(with mounting coupling)
for mounting onto
a viewing tube

UV detector QRA51...
for burner mounting