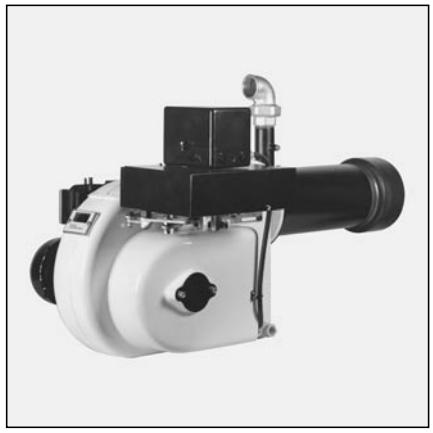
Operating instructions
for authorized experts

Gas burners
EK 3… G-ROA





Designs:
EN
TRD

09/2005 - Art. Nr. 13 019 529A

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General information

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General information
The ELCO EK3...G-ROA series of gas burners is designed for the combustion of natural gas.
Design and performance of the burners comply with the European Standard

EN 676
Installation, start-up and maintenance of the burner must be performed by a qualified expert in compliance with currently applicable guidelines and regulations.

DIN 4756
Gas-firing installations in heating systems

TRG I
Technical regulations for gas fittings

DIN EN 298
Gas burners, flame monitoring systems

EN 60335-1
Safety of electrical appliances for domestic use

Heat generator
The heat generator must meet the requirements for furnace loads stipulated in EN 676.

Thermal output kW	Furnace load kW/m³ min.	max.
12–24	1.2	1.7
24–70	0.95	1.63
70–190	0.92	1.51
190–480	0.97	1.53
480–1200	1.07	1.68
1200–2450	0.95	1.35
>2450	Standard does not apply. Observe manufacturer's recommandations	

Compare the performance data with the burner data. In case of discrepancies, contact the manufacturer.

Site of installation
The burner must not be operated in rooms with aggressive fumes (e .g. hairspray, tetrachloroethylene, carbon tetrachloride), dust-laden air or high atmospheric humidity (e .g. laundry rooms).
For supply of combustion air, ensure adequate ventilation of the heating room.

ELCO rejects all warranty claims for damage resulting from one of the following reasons:
- **Improper use**
- **Inexpert installation or maintenance by the purchaser or third persons, including the installation of parts other than genuine parts supplied by the manufacturer.**

Start-up
Initial start-up of the gas-firing installation must be performed by the installer, manufacturer, or by another expert designated by them.

Delivery and operating instructions
At the time of delivery at the latest, the company installing the gas burner must supply the user with a set of Operating and Service Instructions.
These should be kept in the room where the heating unit is installed.
The address and telephone number of the nearest service representative must be entered in the Instructions.

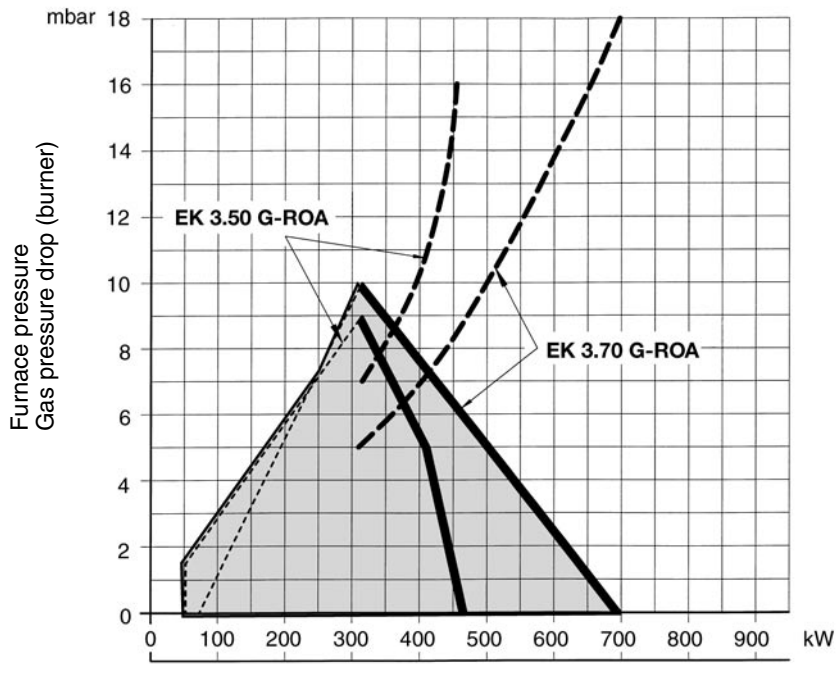
Note for the user
The system should be serviced by an expert at least once a year. To ensure maintenance at regular intervals, we recommend you to conclude a service contract.

Technical data

Brenner type		EK 3.50 G-ROA	EK 3.70 G-ROA
Technical data			
Thermal output	min.	59 kW	75 kW
Thermal output	max.	465 kW	700 kW
Gas type		Natural gas L+H*	Natural gas L+H*
Gas supply pressure		20-100 mbar**	20-100 mbar**
Regulation		modulating	modulating
Air regulation	suction side	Air cut-off valve	Air cut-off valve
Air regulation	pressure side	in burner head	in burner head
Control ratio	max.	30/100%	20/100%
Voltage		230/400 V, 50 Hz	230/400 V, 50 Hz
Power consumption		1.2 kW	1.2 kW
Weight approx.		48 kg	48 kg
Brenner equipment			
Electric motor	2800 min.$^{-1}$	0.9 kW	0.9 kW
Automatic burner control unit		LFL 1 / LGK 16	LFL 1 / LGK 16
Flame monitor		UV QRA 2 / QRA 53	UV QRA 2 / QRA 53
Ignition transformer		ZE 30/7,5	ZE 30/7,5
Ie. servomotor for air damper		EA 2	EA 2
Air pressure monitor		DL 50 A	DL 50 A

*Gas types CH I2H
DE I2ELL
AT I2H
NL I2L

** The minimum gas supply pressure required for burner operation must be calculated individually depending on the installation



Thermal output Q_F

Performance charts
The performance charts reflect the values approved during official homologation.

Determining the required thermal output

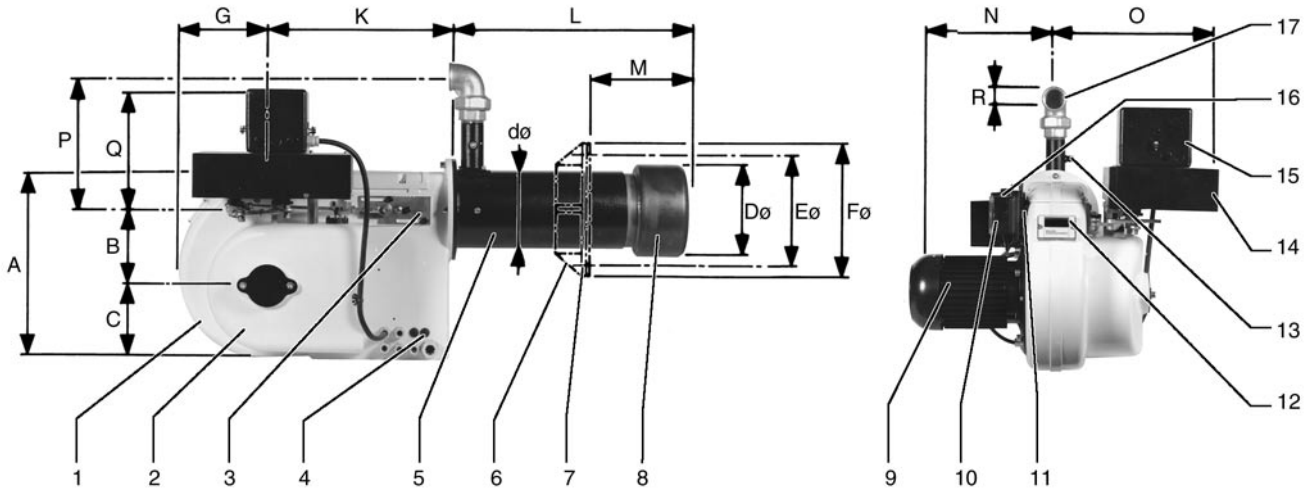
$$Q_F = \frac{Q_N}{\eta K}$$

Q_F = Thermal output (kW)
Q_N = Rated boiler capacity (kW)
ηK = Boiler efficiency (%)

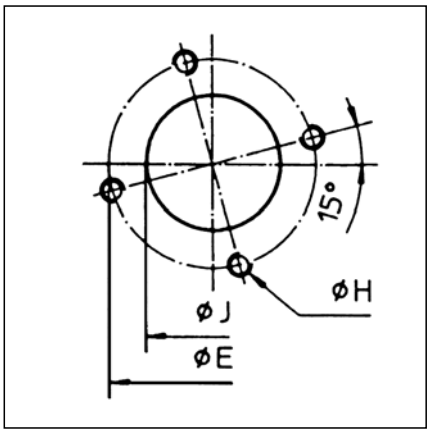
---- Gas pressure drop characteristics of burner head for natural gas
Hu_n = 9.9 kWh/m^3

Survey

Dimensions



1	Burner housing	6	Connecting flange	13	Connection piece for gas working pressure
2	Air suction box	7	Insulating p adding	14	Compound control
3	Scale, gas nozzle and baffle plate position	8	Flame cup	15	El. servomotor for compound control
4	Switch box with switch and connecting terminals	9	Electric motor	16	Ignition transformer
5	Burner tube	10	Control unit	17	Gas connection
		11	Air pressure monitor		
		12	Inspection glass		



Boreholes in boiler connecting plate

Key

EK	=	Manufacturer
3	=	Size
70	=	Performance rating
G	=	Natural gas
R	=	Modulating, with mechanical compound control
O	=	Optimized air speed
A	=	Burner control unit mounted on the burner

Burner type	Thermal output kW	A	B	C	dø	Dø	Eø*	Fø	Product-ID -No.
EK 3.50 G-ROA	170–530	370	146	156	125	149	190-220	252	CE-0085AQ0599
EK 3.70 G-ROA	270–710	370	146	156	159	190	240-300	333	CE-0085AQ0599

* oblong holes in connecting flange, diameter from to

Burner type	G	H	J	K	L	M	N	O	P	Q	R
EK 3.50 G-ROA	192	M10	160	370	485	120-300	305	320	280	240	R 1½”
EK 3.70 G-ROA	192	M12	200	370	485	120-300	305	320	280	240	R 1½”

Functional description

Starting function
As soon as the firing system demands heat, the burner is switched on automatically via a controller. The burner motor and the blower wheel start. The automatic burner control unit controls and monitors the start-up sequence.

A gas valve leakage test is carried out automatically every time the burner is started.

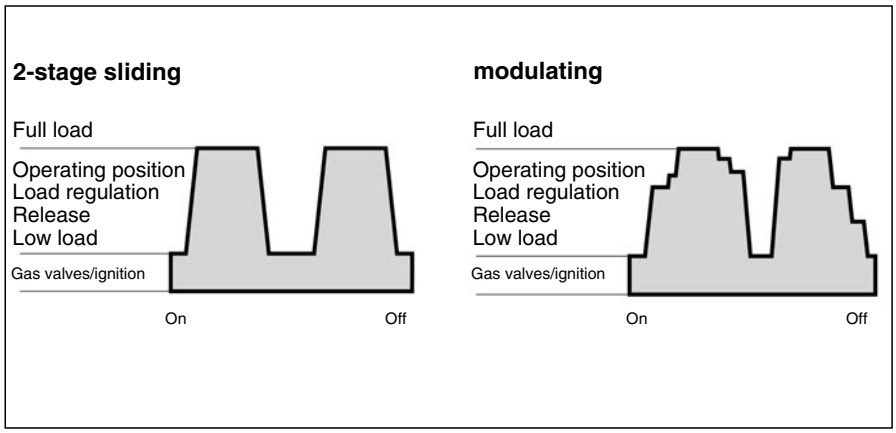
The air damper is **closed** when **the burner is not operating.**
The electric servomotor moves the closed air damper to the full-load position so that the burner prepurges the combustion chamber and the flue gas ducts with the prescribed quantity of air . Shortly after prepurging has started, the air failure monitor must switch over to its working position within a predetermined period of time, i.e. the set minimum air pressure must be reached and maintained until the burner is switched off. When the set prepurging time has elapsed, the air damper is moved to **low load** or **start load** in combination with the linear gas nozzle.

The electric burner control makes it possible **to start** the burner **at increased load** and then return to low load, which is advisable with some types of gas for safety reasons.
Preignition is then initiated and gas is released by the gas valves. Within the safety period of 3 seconds a regular, steady flame must be established. On completion of the safety time, a flame signal must be transmitted to the burner control unit via the flame monitoring circuit. This signal must be maintained until controlled shut down.
The start-up sequence of the burner is completed.

Operating function
After a regular flame has formed, the load control is activated, which means that the burner has reached its operating position. From now on the control unit automatically regulates the burner between low load and full load. Depending on heat requirements, the electric servomotor receives an OPEN or CLOSE command from the controller and then either increases or reduces the air and gas quantities.

This compound control system adjusts the linear gas nozzle and the linearized air damper and regulates the gas quantity in combination with the air.
Burner regulation is possible in two ways ; either **2-stage sliding or , if an appropriate controller is fitted, modulating**. With modulating control, the burner can operate at any level between low load and full load.
The burner is always switched off in the low load position. When the burner is idle, the air damper is always closed, thus preventing a cold air stream from passing through the combustion chamber, the heat exchanger and the flue ducts. This reduces the cooling loss of the burner to a minimum.

***Start load**
Burner control units with a safety period of 3 seconds:
Safety time = 33% of full load or 120 kW
Burner control units with a safety period of 2 seconds:
Safety time = 50% of full load or 120 kW



Compound control

Safety functions
A **fault shutdown** is effected :
- if a flame signal occurs during preventilation (extraneous light monitoring)
- if no flame has formed upon expiry of the safety period of 3 seconds after starting the burner (fuel release)
- if a flame failure occurs during operation
- if the blower pressure drops below the set safety pressure during operation

A fault shut down is indicated by the flashing lamp in the reset button. The sequence switch stops and indicates the type of malfunction (see Troubleshooting in Maintenance).
After rectifying the fault, press the reset button to release the shut down and to start the burner.

A **controlled shutdown** is effected :
- upon reaching the medium temperature or medium pressure
- if the gas pressure falls below the set safety pressure
- if the power supply fails

After restoring the operating conditions, the burner restarts automatically.

Burner functions

Compound control fuel/air
Gas fitting group
Functional diagram

Compound control fuel/air
The compound control system, which alters the gas and air quantities evenly and continuously, ensures that combustion values are maintained at almost identical levels across the entire control range.
Two-stage sliding control permits operation at either low or full load. These two load positions are reached gradually according to heat requirements, so that there is no sudden supply or cutoff of large amounts of fuel.
The modulating control system operates at any required level within the control range, depending on heat requirements.
The only difference between burners with two-stage sliding and burners with modulating control lies in the electric burner control, while mechanical regulation remains the same. The continuously variable and reversible electric servomotor moves the compound control segment according to the heat required.

This segment also controls the air damper and the air and fuel throughput in the burner head via the longitudinal adjustment lever.
To achieve an optimum ratio of air and fuel across the entire control range, the air damper must be positioned correctly via an adjust able steel segment and ball-bearing ratchet.

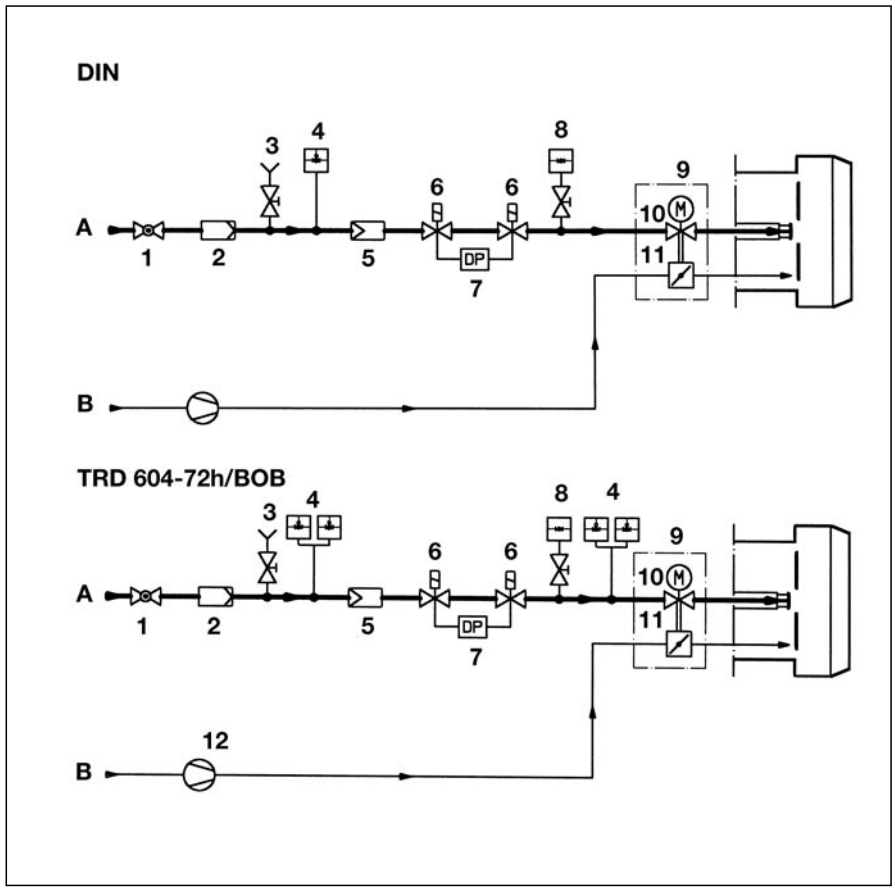
Linearization
Air regulation on the suction side is effected by the linearized air damper for all burner types.
This type of regulation allows the combustion air to be dispensed in line with the fuel quantity and thus ensures a wide adjustment range and a high combustion efficiency even at low loads.

Gas fittings group
The gas fittings group is determined according to customer-specific conditions.

Important criteria are:
- Burner capacity
- Furnace backpressure
- Gas pressure drop of the burner head
- Gas pressure drop of the gas fittings

The total gas pressure drop must always be smaller than the available gas flow pressure.

Important
Only gas fittings approved by official burner testing may be used.



Functional diagram
1 Gas shut-off valve
2 Gas filter
3 Test burner
4 Gas pressure monitor*
5 Gas pressure regulator
6 Gas valve
7 Valve leakage detector
8 Pressure gauge
9 Compound control segment
10 Gas regulator
11 Air regulator
12 Combustion air blower

* If the burner design complies with TRD 604-72h, the pressure monitors must either be tested for special design or two monitors must be installed.

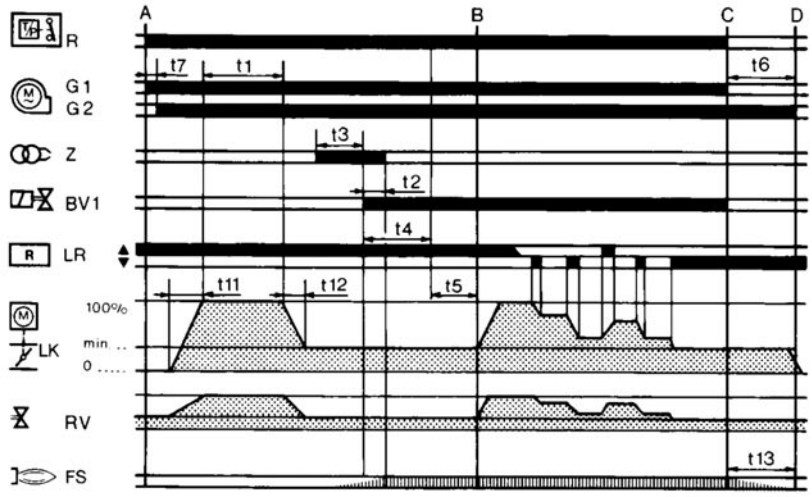
A Gas connection
B Combustion air inlet

Functional sequence of burner control units LFL 1.333 / LGK 16.333 Controller RWF 40



The **burner control units LFL 1.333** and **LGK 16.333** are designed for controlling and monitoring burners with multi-stage or modulating control systems.
For a detailed functional description of the burner control units, including technical dat a and planing information, refer to
LFL 1…-7451 D
LGK 16…7785 D

modulating



t1 Preventing time
t2 Safety time
t3 Preignition time
t4 Release of fuel valve BV
t5 Release of load controller LR
t11 Opening time of air damper
t12 Closing time of air damper

Functional diagram
LFL 1.333 / LGK 16.333
A = Start command
A–B = Interval for flame formation
B = Burner in operating position
B–C = Burner position (heat generation)
D = Controlled shutdown
G Blower motor
R Temperature or pressure controller
Z Ignition transformer
BV Fuel valve (s)
FS Flame signal
LK Air damper
LR Load controller
RV Continuously variable fuel valve (here gas control valve)

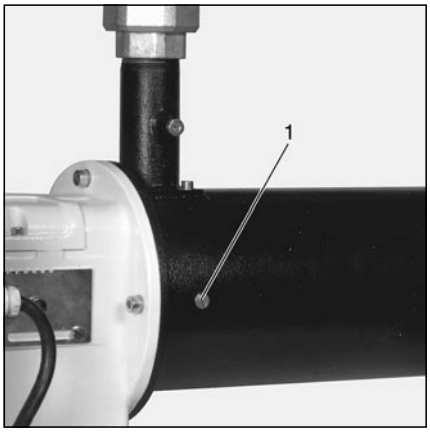


Burners with modulating control systems come equipped with the Universal Controller RWF 40 and its appropriate modules.
This controller has been designed specifically for use with burner installations, in particular for controlling the temperature or pressure of burners with continuously adjust able fuel throughput. The actual values (i .e. the resistance values) for temperature, pressure or furnace pressure are measured by means of a detector an a range connector.

The controller is adjusted to the control magnitude and the desired setting range by means of the range connector bridge on the detector side.
The set-point scale is mounted to the range connector. The unit itself is an integral part of the controller. It can be switched over to an external setting unit.

Technical documentation
RWF 40 Siemens 7865 / D

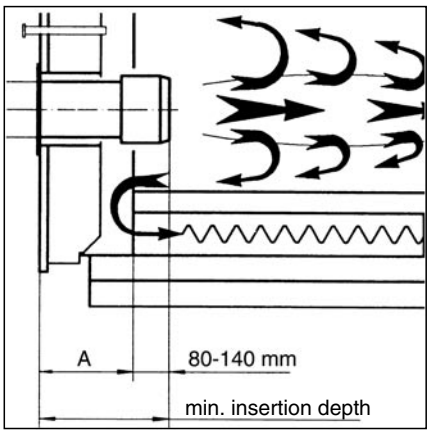
Mounting the burner to the heat generator
Electrical connection



Mounting the burner to the heat generator
To mount the burner to the heat generator, prep are the connecting plate according to the dimensions given on page 4.

- The movable clamping flange for connection is mounted at the front of the burner tube.
- Loosely attach the burner to the heat generator by means of the clamping flange
- Adjust the burner tube length in the furnace by inserting the burner
- First tighten the flange clamping screws, then the fixing screws.

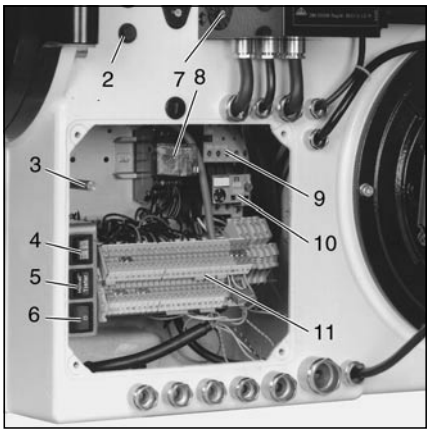
If necessary, release the screw **1** to displace the flame cup for correct adjustment of the burner head.



Burner tube insertion depth
In boilers with reverse furnaces, provide sufficient insertion depth of the burner tube to ensure troublefree operation.

A = Front of boiler to turning edge of second pass.

Boiler inspection glass cooling
To keep the boiler inspection glass cool and clean, a cooling line may be connected to connection **2** R1/4".
The cooling line can either be a hose or a copper pipe. A hose union is enclosed with the burner.
To connect a copper pipe, a suitable clamping ring connection is required.



2 Connection for inspection glass cooling
3 Lock nut
4 Switch Manual-Automatic
5 Pushbutton Higher/Lower
6 Service pushbutton
7 Burner control unit
8 Auxiliary relay
9 Motor contactor
10 Overload relay
11 Terminal strip

Electrical connection
Electric wiring of the burner and gas fittings must be carried out by an authorized electrician according to the enclosed wiring diagram.

For cable connection, ensure the following:

- Connect to terminal strip **11**
- Provide sufficient length of cable so that the burner and the boiler door can be opened
- Do not install the sensor lead in the multiconductor cable.

Caution!
The electric module can be removed for connection, replacement or adjustment of components.

Disassembling the electric module

- Set the main switch to Off, remove the fuse
- Release the lock nuts **3**
- Carefully remove the electric module.

Caution!
Never apply voltage to the electric module after disassembly.
After making the connections, check all system components for correct wiring.
Start the motor for a short time to check the sense of rotation.

Installation

Gas connection
For installation and start-up of the gas conduits and fittings, observe the applicable regulations of the supervisory authorities and institutions of your country.

Gas properties
Before installing the unit, ask your gas supply company for the following information:

1. Gas type (gas group I, II, III)
2. Calorific value Hun = kWh/m^3 (kJ/m^3)
3. Maximum CO_2 content of the flue gas
4. Gas supply pressure and static pressure

Checking the gas type
Before connecting the burner to the gas supply line, check whether the gas type and the burner type match (see type plate on the burner). The burner type and the gas type must coincide.

G = Natural gas

Gas supply pressure
To ensure optimum burner performance, a minimum gas supply pressure is required up stream of the burner gas fittings.

Minimum gas supply pressures

CH	I2H	G 20 = 20 mbar
DE	I2ELL	G 20 = 20 mbar
AT	I2H	G 20 = 20 mbar
NL	I2L	G 25 = 25 mbar

Observe the installation and mounting instructions of the components manufacturers (enclosed with the fittings).
The dimensions of the gas conduit depend on the throughput and the available pressure; the conduit must be installed so that the distance to the burner and the pressure drop are kept to a minimum.
When determining the nominal width DN of the gas fittings group, **consider the flue-gas side resistance of the heat exchanger as well as the gas pressure drop of the burner and the fittings group.**

Gas fittings group
The gas fittings group may be connected directly to the gas supply line. **The order and the direction of flow** (arrow on the housing) of the fittings **must be observed**. Remove dirt and foreign objects from the fittings and connection pieces prior to installation and start-up. **To ensure good start-up conditions, the distance between the burner and the gas shut-off valve must be kept to a minimum.**

Leakage test
The gas conduit upstream of the burner gas fittings group must be installed, tested for tightness, vented and certified by the installing comp any in accordance with applicable guide-lines. The tightness of the screw and flange connections must also be checked. The leakage test is to be carried out under pressure with approved foaming agents which do not cause corrosion. The results of the leakage tests performed on steam boilers also require certification.

Venting
Note. Before starting the burner or after repair work, the complete gas supply line and the gas fittings group must be vented to the out side (by means of a hose).

Never vent the gas conduit into the heating room or combustion chamber!

The test burner can be used for determining the presence of an inflammable mixture.

Support
The gas fittings group must be supported from below by means of the telescope support or a similar device after or even during installation (e.g. at the filter and/or valve).

Point of separation
To facilitate maintenance of the boiler (combustion chamber), a point of separation (flat sealing) should be provided for swivelling the boiler door.

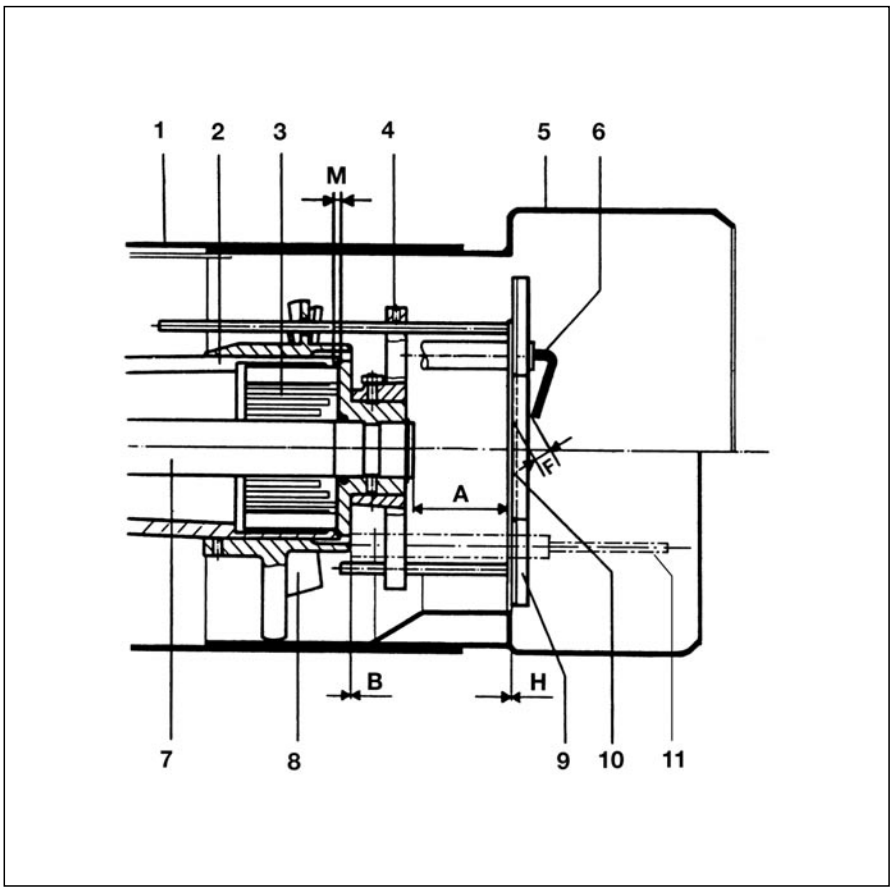
Burner head factory settings

Factory settings
The factory settings given below are standard values and refer to about 80% of the maximum burner capacity. Readjustment may be necessary depending on local circumstances, flue gas analysis and combustion behaviour.

The values are set from the **zero position**.

Zero position signifies:
- Scale value zero
- Dimensions **M** and **H** according to table

Important!
Check the settings by means of the table prior to start-up. To check, remove the nozzle assembly (see Servicing the Burner in Maintenance).



Burner head
1 Burner tube
2 Gas tube
3 Linearized gas nozzle
4 Electrode holder
5 Flame cup
6 Ignition electrode
7 Nozzle adjustment lever
8 Sleeve tube with swirl plate
9 Segment baffle plate
10 Perforated baffle plate
11 Ionisation probe (special construction)

Burner type	**Factory settings in mm**				
	A	B	F	H	M
	Baffle plate/ adjustment lever	Gas tube/ swirl plate	Electrode/ baffle plate	Baffle plate flame cup	Gas tube Gas nozzle
EK 3.50 G-ROA	35	0	3	0	8
EK 3.70 G-ROA	35	0	3	0	8

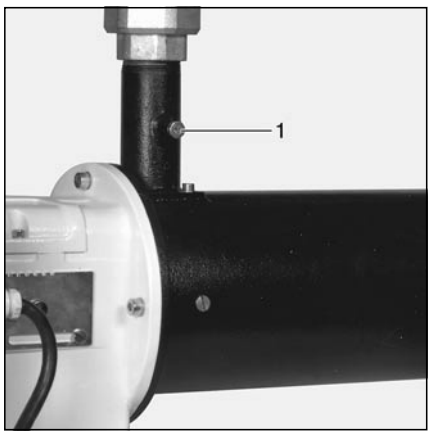
Gas pressure regulation

Start-up
The following checks must be performed before the system is first put into operation:

- Observe the operating instructions of the boiler manufacturer; the boiler must be installed ready for operation.
- Fill the heating system with sufficient water.
- Check the entire system for correct electric wiring of all component s and fittings.
- Check the sense of rotation of the blower motor.
- Check the settings of the temperature or pressure controllers, limiters, safety devices and electric limit switches.
- Ensure adequate gas supply pressure. The gas supply pressure must be between 20 mbar and 100 mbar. Higher connection pressures require additional gas fittings.
- Carry out a leakage test on the gas elements.
- Ensure unobstructed flue gas paths and adequate fresh air supply. Burner in starting position; air damper closed.
- Burner control unit reset and in start-up position.

Check the performance of the burner program sequence before fuel is first released. If gas is used, check the gas section as follows:

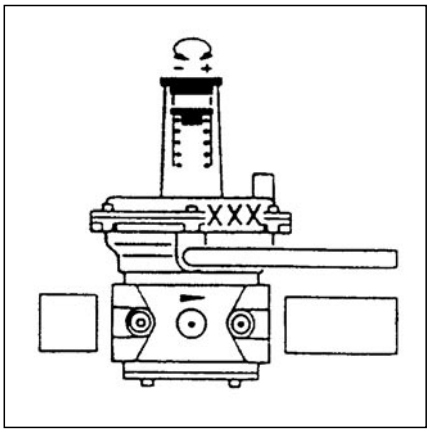
- Make sure that the gas shut-off valve of the valve group is closed.
- Bridge the gas pressure monitor (see wiring diagram).
- Start the burner and check for correct sequence of the start-up program:
  1. Blower
  2. Air damper in preventing position
  3. Air pressure check
  4. Air damper in low-load position
  5. Ignition sp ark
  6. Valves open
  7. Fault shut down after safety period (see burner control unit)
- Unlock (reset) the burner control unit, remove the bridge from the gas pressure monitor.



Start-up with gas

- Connect the measuring instruments for gas chamber pressure **1** and air pressure (connect to inspection glass cooling).
- Connect the measuring instruments for the flame monitoring current.
- Open the gas shut-off valve up stream of the valve group; check the gas pressure at the pressure gauge.
- Set the service switch to position **1**.
- Set the Manual/Automatic selector switch to Manual.

If applicable, wait for the leakage test of the gas valves to complete.
If the valves are leaky, the burner start-up sequence will stop.
The burner starts according to the burner start-up sequence.



Gas pressure regulation
The gas pressure is adjusted by changing the spring pressure which acts on the control diaphragm.

Thermal output
When calculating the thermal output, the calorific value of the individual gases must be taken into account.
If low-grade gas is used, for example, the gas pressure for high-grade gas must be multiplied by the factor 1.5 to achieve the required burner capacity.

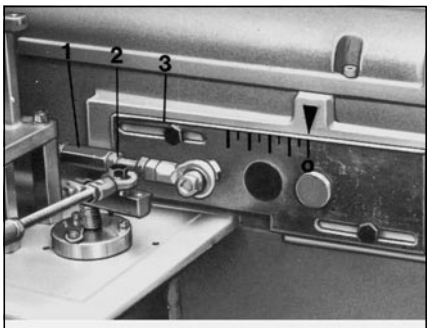
Note
The gas output pressure (gas control pressure) must always be lower than the gas entry pressure **but higher than the total pressure drop of the system.**

Adjustment sequence
Adjusting the gas throughput

Adjustment sequence
- Set the selector switch to “Manual”
- Use the service switch to switch on the burner
- Adjust the gas throughput (low load)
- Move the “Higher/Lower“ switch to full load
- Adjust the gas throughput (full load)
- Move the “Higher/Lower” switch to low load
- Gradually adjust the combustion air (suction side) to the gas throughput
- Switch off the burner
- Set the selector switch to “Auto”

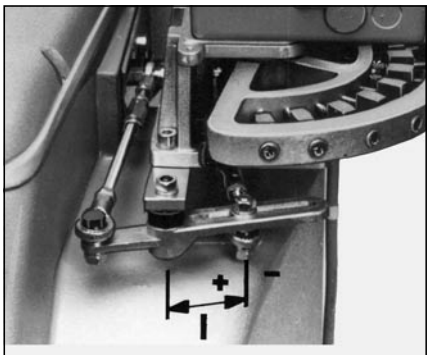
Adjusting the gas throughput
The gas throughput is adjusted by means of the gas control nozzle in the burner head. The nozzle can be opened and closed continuously by means of the longitudinal adjustment lever.

The gas throughput for low load must be 50%.



1 Turnbuckle sleeve
2 Counternut
3 Scale

Gas throughput for low load
- Burner in low-load position
- Release the counternut **2**
- Use the turnbuckle sleeve **1** to move the gas nozzle towards the open or closed position
- Tighten the counternut **2** after adjustment
- **Mark the low-load position on the scale 3**



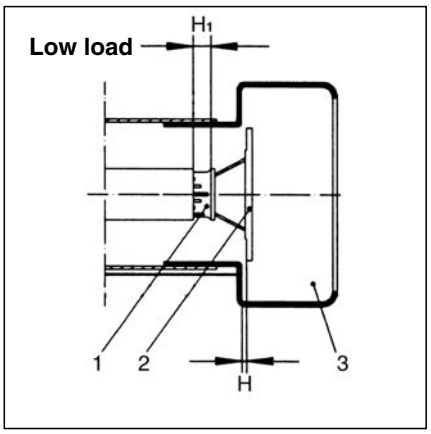
I Control path adjustment

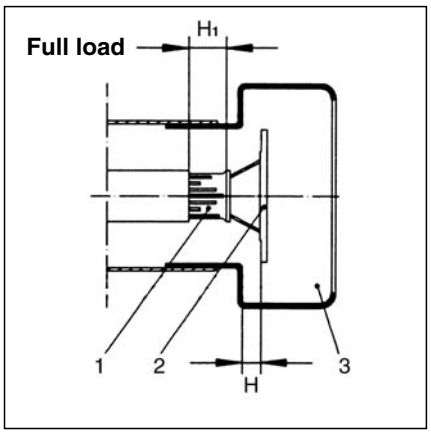
Gas throughput for full load
- Move the burner to full load
- Use the control path adjustment to move the gas nozzle towards the open (+) or closed (-) position
- After adjustment, move the burner to low load and **reset the low-load position as marked on the scale** (turnbuckle sleeve [1])

Combustion air

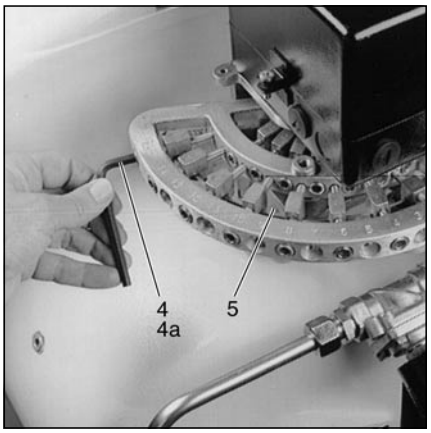
Combustion air (pressure side)
The distance **H** is given automatically by the control path **H1** of the gas nozzle.
Normally, the factory-set position of the baffle plate requires no further adjustment. If necessary, minor corrections can be made for optimum combustion

- by moving the baffle plate in the baffle plate holder
- and/or by moving the flame cup





1 Gas control nozzle
2 Baffle plate
3 Flame cup



4 Adjusting screws
5 Cam strip

Combustion air (suction side)
The combustion air on the suction side is set by means of the air damper which moves on an adjustable cam strip.

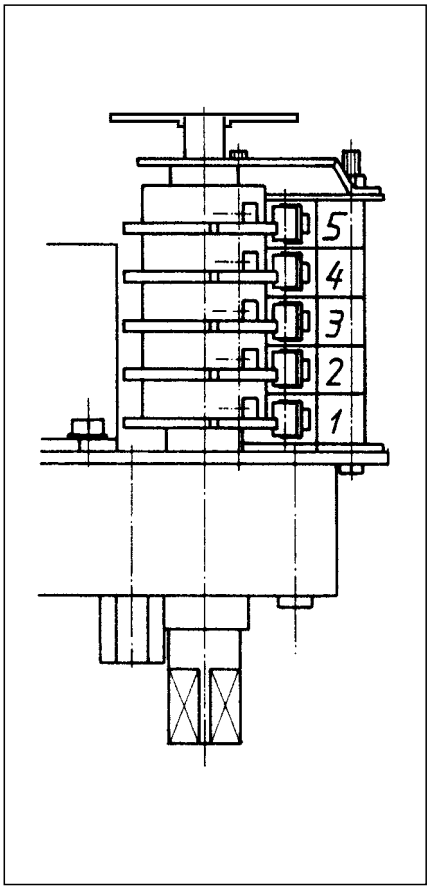
- Burner in full-load position (selector switch to “Manual”)
- Gradually move the “Higher/Lower” switch to low load and perform combustion and air quality measurements
- If necessary, readjust the cam strip 5. To do this, release the external hexagon socket screws **4** by ¼ turn and adjust the cam strip using the internal screws **4a** (5 mm hexagon socket screws)

Turn clockwise
= less air

Turn anti-clockwise
= more air

Make sure that the control curve of the cam strip rises evenly. The segment path should be fully utilized at each burner load level.
After adjustment, move the burner again to each load level from full load to low load and repeat the measurements.

Adjusting the limit switches at the electric servomotor



Limit switches
The limit switches are actuated by trip cams which are factory-set to standard values.

Note
Limit **switch 1** indicates that the **air damper** is **CLOSED** when the burner is idle; it is factory-set to scale position 0.
Limit switch **5** for preventilation can be adjusted according to individual system requirements in compliance with applicable regulations. The top switching point of this limit switch must always be set below the switching point for full load.
During preventilation, the air damper must be fully open for at least 20 seconds.

Normal construction

Limit switch 1
Air damper closed

Limit switch 2
Full load

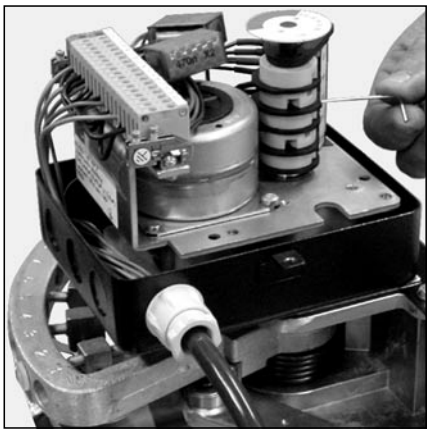
Limit switch 3
Low load

Limit switch 4
Start load

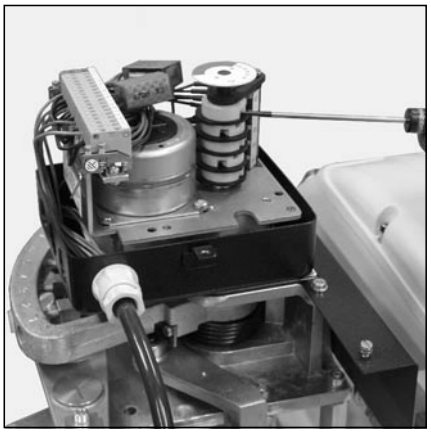
Limit switch 5
Preventilation

Construction without air damper closure
Limit switch 1
Low load

Limit switch 2
Full load



Adjusting the trip cams
If necessary, the trip cams can be readjusted during burner adjustment. To facilitate access to the locking screw, the complete cam can be adjusted after releasing the set screw with the Allen key incorporated in the servomotor.



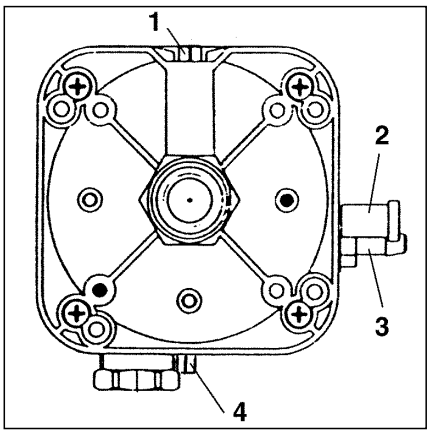
Adjustment is made by means of a screwdriver.

Air pressure monitor



Air pressure monitor
The air pressure monitor is used to monitor the pressure of blower burners and of ventilation and air-conditioning equipment.
The pressure monitor DL 50 A is suitable for making, breaking and switching a cont act when the actual pressure deviates from the preset values. It can be used as an over-pressure, negative pressure or differential pressure monitor for air and non-aggressive gases, but not for the gases described in the DVGW worksheet G 260/I.

Approvals
The pressure monitor complies with DIN 3398, Part 2, and is DIN-DVGW approved.
Other approvals in major gas consumption countries.



Determining the prepurging differential pressure and adjusting the differential pressure monitor
- Burner in preventing phase
- Measure pressure at measuring outlet **2**
- Measure vacuum at measuring point **3**
- Add up the measured pressures
- Set the scale to 90% of the calculated value

Control of switch function
The switch function be tested via testing key.
By activating this key, the actual differential pressure is being modified (pressure monitor switches, burner goes on fault position).

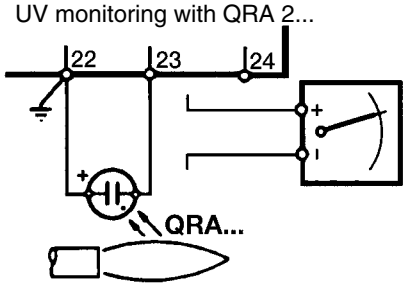
key 4 testing of fan negative pressure side

key 1 testing of fan pressure relief side*

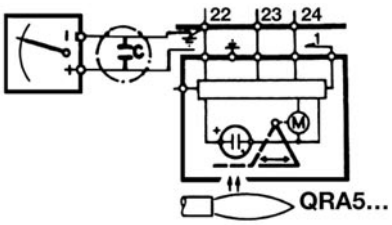
* According to circumstances due to the installation itself or its capacity, such testing may not be successfull.
As long as the testing of the negative pressure side results in a switch-off, the switch function is nevertheless guaranteed.

Flame monitoring, UV
Sensor current measurement

Burner control unit LFL 1…
UV monitoring with QRA 2...



Burner control unit LGK 16…
UV monitoring with QRA 5…



Flame monitoring with UV detector
This monitoring method uses the UV radiation of hot flame gases for obtaining the flame signal.
The radiation detector is a UV-sensitive tube which is constantly under voltage and which consists of two electrodes; the tube fires when it is exposed to light of the spectral range between 190... 270 nm, thus transmitting a current to the flame signal amplifier.
The UV tube does not react to afterglowing chamotte in the furnace, to sunlight, daylight or heating room illumination.
The tube has a service life of about 10,000 hours at ambient temperatures of up to 50 C; higher ambient temperatures will considerably reduce the tube life.
The tube is tested automatically in conjunction with the burner control unit during interruptions of operation and with increased supply volt age.
If the tube misfires, a lockout will be effected immediately at the next start.
Burners designed for continuous operation or intermittent operation at strong heat for more than 24 hours (e.g. multi-boiler cascade systems) or burners which are operated with steam boilers must be equipped with the burner control unit LGK 16... and the corresponding self-checking flame monitoring system (QRA 5...).
For a det ailed technical description, specifications and planning information, see burner control units
LFL 1... No. 7451 D
LGK 16... No. 7785 D

Measuring the UV current with QRA5
For precise measurement of UV currents, we recommend using the **test unit KF 8832.**
If you use a standard measuring instrument (microammeter) to measure the **UV current**, we recommend proceeding as shown in the illustration.
Integrate a capacitor C = 470 µF, 15 V (or higher electric strength) into the measuring connections.

Measuring instrument: 100 µA/Ri = 3 k

Connect the measuring instrument between the burner control unit and the UV flame detector QRA 5... (terminal 22 (-), terminal 5 (+).

Ensure correct polarity!

Aligning the UV detector QRA 5...
The fixing flange can be moved along the feeler tube and allows precise alignment of the detector window with the incident UV radiation.

Note
Terminal 22 must be earthed at all times!

Cleaning the detector
The UV detector window must be cleaned at regular intervals.
Keep the window free from dust.
If cleaning is unsuccessful, replace the UV tube.

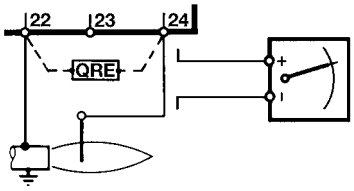
Burner control unit	Minimum	Maximum
Monitoring type *LFL 1… *LGK 16…	with UV 70 µA **	with UV 630 µA **
Recommended measuring range : UV monitoring 0–1000 µA		

Sensor currents
* See also specifications of burner control unit LFL 1.../LGK 16...
** See data on device KF 8832 for sensor current measurement

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Flame monitoring, ionization
Sensor current measurement

Ionization monitoring



Flame monitoring with ionization
Arrangement
The flame is monitored by applying an AC voltage to the detector electrode, which is made of heat resistant material and projects into the flame taking advantage of the conductivity and the rectifying effect of hot flame gases. The current that flows in the presence of a flame (ionization current) produces a flame signal, which is transmitted to the input of the flame signal amplifier. The latter is designed in such a way that it responds only to the DC component of the flame signal. This ensures that a short circuit between the detector electrode and earth cannot simulate a flame signal
(as in that case, AC would flow).
A microammeter is used for measuring (use the correct measuring range).
The microammeter is connected between the burner control unit and the ionization electrode. **Ensure correct polarity** (see connection examples for burner control units LFL 1.../LGK 16...).
For ionization monitoring, it is important that the signal is transmitted with virtually no loss. **The dectector lead must not be installed in a multi-conductor cable.**
Dirt on the detector electrode holder or a defective ceramic part of the electrode will favour the formation of leak currents which reduce the intensity of the flame signal.

The burner (as the opposed electrode) must be properly earthed because otherwise the ionization current cannot flow . In many cases, earthing of the boiler alone will not be sufficient.
When adjusting the burner for clean combustion, i.e. when increasing power from low load to full load, **the ionization current must be monitored ; it must not fall below the minimum monitoring current.**
A marked drop in ionization current indicates a lack of air or an excess of air, which must be counteracted by appropriate measures. A constant high ionization current indicates a steady flame and clean combustion.

Burner control unit	Minimum	Maximum
Monitoring type *LFL 1… *LGK 16…	6 µA 12 µA	– 100 µA
Recommended measuring range : Ionization monitoring : 0–150 µA		

Sensor currents
* See also specifications of burner control unit LFL 1.../LGK 16...

Troubleshooting

If a malfunction occurs, check first whether all requirements for proper operation have been met.

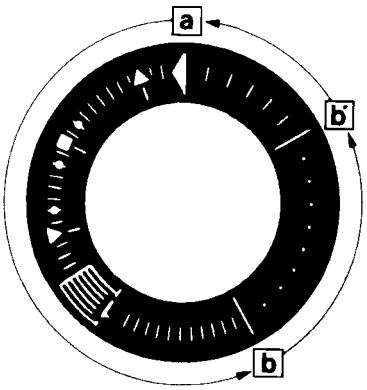
Check whether:
1. Fuel is available, gas is supplied, gas pressure is adequate, there is enough oil in the tank, and the fuel selector switch is set correctly.
2. The power supply works properly.
3. All control and safety features, e .g. temperature controller, safety limiter, low-water cutout, electric limit switches etc. work properly and are adjusted correctly.

If you find that the malfunction has not been caused by one of the above mentioned items, check the burner functions carefully.

Situation:
The burner is found out of action in the lockout mode. Reset the burner control unit with the reset button and start the burner.

Do not press the reset key for longer than 10 seconds.
Closely watch the subsequent start-up program.
The possible cause can be detected quickly by means of the lockout indicator on the burner control unit and by watching the sequence of the start-up and operating program.

Control program under fault conditions and lockout indication



LFL 1… / LGK 16…

a–b Start-up sequence

b–b' For some time variants : Idle steps of the sequence switch up to automatic shut down after burner start-up (b' = operating position of the sequence switch).

b(b')–a Post-venting sequence after controlled shut-down. In start position a the sequence switch is deactivated automatically or initiates another burner start-up immediately (e.g. after fault clearance)

● Duration of safety period for single-tube burners.

If a malfunction occurs, the fuel supply is always interrupted immediately.
Simultaneously, the sequence switch and the lockout indicator stop. The symbol above the reading mark indicates the type of malfunction:

◀ **No start** because the CLOSED signal has not been supplied to terminal 8 by the limit switch for air damper CLOSED; or because a cont act has not been closed between terminals 12 and 4 or 4 and 5 ; or because the cont act s of all control and safety unit s of the control loop are not closed (e.g. gas or air pressure monitor, temperature or pressure monitor, temperature or pressure controller).

▲ **Start aborted** because the OPEN signal from the limit switch for air damper OPEN has not been supplied to terminal 8. Check and adjust the corresponding limit switch (see page 11).

Ⓟ **Fault shut down** because the air pressure signal has not been received at the start of the air pressure check. Any air pressure failure after this point in time will also produce a fault shut down!

■ **Fault shut down** because of a defect in the flame monitoring circuit.

▼ **Start aborted** because the position signal for the air damper in low-load position has not been supplied by the limit switch to terminal 8. Check and adjust the corresponding limit switch for low load.

1 **Fault shut down** because no flame signal is present on completion of the **1st** safety time.

Any flame signal failure occurring after completion of the safety time will also produce a fault shut down!

2 **Fault shut down** because no flame signal is present on completion of the 2nd safety time (for interrupted pilot burners, the flame signal of the main flame **not** applicable for this burner type).

||| **Fault shut down** because the flame signal has failed or because an air pressure failure has occurred during burner operation.

◀ **Fault shut down** on completion of the control program sequence due to inadmissible stray light (e.g. flame not extinguished, leaky fuel valves), or due to a faulty flame signal (e.g. defective flame monitoring circuit). Also see flame monitoring.

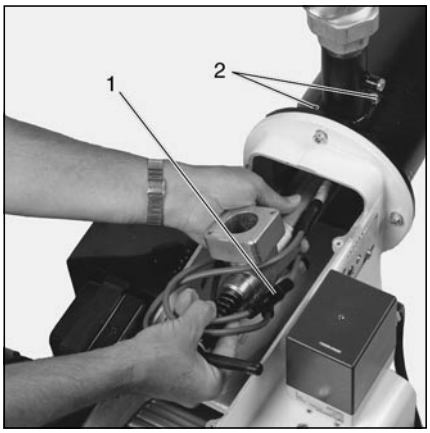
If a fault shut down occurs at any other point between start and preignition which is not marked by a symbol, the cause is usually a premature, i .e. faulty , flame signal.

Resetting of the control unit after a fault shut down can be effected immediately either externally or by pressing the reset key with the integrated lockout indication lamp.
After resetting (as well as after eliminating a malfunction which caused a shutdown, or after a power failure), the sequence switch will always returns to its starting position, supplying voltage to the terminals 7, 9, 10 and 11 only, as determined by the control program. Only then will the control unit initiate another start-up sequence of the burner.

Servicing the burner

Burner installations should be checked once a year. According to DIN 4755, 4756, to ensure the troublefree operation, performance, safety and efficiency of the installation, the user should have the installation checked once a year by a representative of the manufacturer or other qualified personnel.
The entire installation is to be tested for faultless performance, and defects are to be repaired without delay. It is expedient to carry out an inspection in addition.
Inspection should include the following items:

1. Disassemble the nozzle and check it. Clean the nozzle filter.
2. Check the ignition electrodes and the ignition spark ; readjust, if necessary.
3. Check the gas valves for tightness and cleanness.
4. Check all electrical connections.
5. Clean the UV flame detector.
6. Check the pressure monitors for proper adjustment and performance.
7. Check the control units for performance, adjustment and safety times.
8. Check the burner head setting. Check the flat O-ring seal between the gas and burner tube for tightness.
9. Inspect the boiler components and insulation and replace, if necessary. Check the boiler for cleanness.
10. Clean the burner inside and out side.
11. Check the combustion and make flue gas measurements:
    - Adjust fuel throughput
    - Heating room temperature (suction temperature)
    - Flue gas temperature
    - Furnace pressure/ pressure in the flue gas tube
    - CO_2/O_2 content
    - CO measurement, soot test
    - Measure the UV current
12. Enter the measured values in the test certificate.



Removing the gas tube
For replacement or adjustment of the baffle and ignition arrangement, the complete gas tube must be removed from the burner pipe. Proceed as follows:

- Disconnect the power supply ; set main switch to OFF.
- Close all shut-off valves upstream of the burner.
- Remove the cover from the housing.
- Disconnect the UV cell.
- Disconnect the ignition cables **1**.
- Release the fixing screws **2** of the gas tube, push the gas tube upwards and pull it off backwards.

Be careful with the baffle plate!
Before reassembly, check the seal and replace it, if necessary.

	Adresse	Service-Hotline
AT	**ELCO Austria GmbH** Aredstr.16-18 2544 Leobersdorf	0810-400010
BE	**ELCO Belgium n.v./s.a.** Pontbeeklaan-53 1731 Zellik	02-4631902
CH	**ELCOTHERM AG** Sarganserstrasse 100 7324 Vilters	0848 808 808
DE	**ELCO GmbH** Dreieichstr.10 64546 Mörfelden-Walldorf	0180-3526180
FR	**ELCO France** 18 rue des Buchillons 74106 Annemasse	0450877624
NL	**ELCO-Rendamax B.V.** Amsterdamsestraatweg 27 1410 AB Naarden	035-6957350

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