

–weishaupt–

manual

Installation and Operating Instructions



Certified for use in USA / Canada
Conforms to / à UL std 795 (R2013), UL std 295 (R2015) and UL std 296 (R2013)
Certified / certifié CSA std 3.4 (R2009)

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1 User instructions

1.1 Information for user

This installation and operating instruction is part of the equipment and must be kept at the installation at all time. As supplement to this document is the Installation and Operating Instructions for Combustion Manager W-FM 25.

1.1.1 Symbols

	indicates imminent hazardous situation, which if not avoided will result in death or serious injury
	indicates potential hazardous situation, which if not avoided could result in death or serious injury
	indicates potential hazardous situation, which if not avoided may result in minor or moderate injury
	important information
	requires direct action
	result of an action
	counting
	value range

1.1.2 Target group

This installation and operating instruction is designated for the user and qualified personnel only. It is to be placed at the installed equipment.

Only competent personnel may work on the appliance. Competent personnel, according to this operating manual, are persons who are familiar with the installation, mounting, setting and commissioning of the product and have the necessary qualifications and training.

1 User instructions

1.2 General Instructions

Any work on the burner or applicable interfaced products (controls) must be completed within the guidelines of the manufacturer's instructions and applicable local and national codes. Such work must only be undertaken by fully qualified and trained personnel, familiar with the products.

The operation of all safety devices including limit circuits, monitoring equipment and regulating equipment must be tested and correctly adjusted before the installation is left unattended.

IMPORTANT

Burners must have at least one shutdown every 24 hours of operation; otherwise the burner should be equipped with self-check flame sensing devices.

Installation

Standard Weishaupt burners are designed for indoor use only. For outdoor installations, contact your Weishaupt representative.

The installation of any Weishaupt product must be carried out by fully qualified and licensed personnel.

The personnel performing the work must be familiar with, and operate within the applicable local and national codes, such as CAN/CSA B149.1, 2, 3, CAN/CSA B139-00, NFPA 54/58, NFPA30/31 and all other applicable codes and standards to the satisfaction of the authority having jurisdiction. The installer is responsible for meeting all these requirements and codes.

Attention must also be given to the minimum clearance of related appliance to permit access for service and maintenance purposes and to the distance from combustible material as required by all applicable codes to ensure safe operation.

General information for gas operation

An independent vent to outside of the building, sized in accordance with the regulator manufacturer's instructions, shall be provided. Where there is more than one regulator at a location, each regulator shall have a separate vent to the outside.

Before being connected to the burner, the gas train shall be pressure tested using either air or an inert gas as ruled by applicable codes.

The gas manifold pressures listed for each gas or combination gas/oil burner are approximate figures obtained from tests on test boilers under ideal conditions. Manifold pressures are only to be used as a guide during start up. The only accurate method of determining the exact fuel throughput of the burner is by clocking the gas meter and applying the respective correction factors for pressure and temperature.

Maintenance and Services

Burner components such as combustion manager, stepping motors, gas valves, nozzle heads, etc are not user serviceable. Failure to heed this can cause property damage, severe personal injury or loss of life.

We recommend regular plant maintenance of all combustion equipment. It saves fuel and ensures good combustion. Excellent combustion quality is a pre-requisite for an environment-friendly operation.

The annual maintenance and inspection program should include inspection of electrodes, flame sensors, flame signal strength readings, inspection and testing of all safeties including air pressure switch, flange switch, gas pressure switches, interlocks, motor overloads, etc. Also the burner should be inspected for any mechanical damage. The flame tube should be inspected for warpage, damage, holes, etc. The mixing head and diffuser should be inspected for damage, missing bolts, etc. The head setting should be checked and oil nozzles should be inspected and replaced as required. Depending on the degree of contamination, the combustion air blower wheel, ignition electrodes, flame sensor and air intake should be cleaned as required.

The moving/rotating burner parts require no lubrication. Motor bearings damage, which is recognized and serviced quickly, prevents more extensive damage to the burner. Development of noise in the motor bearings should be investigated immediately.

2 Safety information

Dangers when using the equipment

Weishaupt products are manufactured in accordance with the relevant existing standards and guidelines, and the recognized safety laws. However, improper use of the equipment could endanger the life of the user or third party or result in damage to the plant.

To avoid unnecessary danger, the equipment must only be used:

- For its intended purpose;
- Under ideal safety conditions;
- With reference to all the information in the installation and operating instructions;
- In accordance with inspection and service work.

Faults, which could affect the safe operation of the burner, should be rectified at once.

Personnel training

Only competent personnel may work on the appliance. Competent personnel, according to this operating manual, are persons who are familiar with the installation, mounting, setting and commissioning of the product and have the necessary qualifications such as:

- Training, instruction or authorization to switch electrical circuits and electrical devices on and off, to ground them and to mark them in accordance with the safety standards.
- Training, instruction or authorization to carry out installation, alteration and maintenance work on gas installations in buildings and on site.

Organizational measures

- The necessary protective clothing should be worn by everyone working in the plant.
- All safety devices should be checked regularly.

Informal safety measures

- In addition to the Installation and Operating Instructions, local codes of practice should also be adhered to. Special attention should be given to the relevant installation and safety guidelines.
- All safety and danger notices should be kept in a legible condition.

Safety measures in normal operation

- Only use the equipment when all safety devices are fully functional.
- At least once a year, the equipment, including all safety devices, should be checked for signs of visible damage and to ensure that all safety devices are operating correctly.
- More frequent safety checks may be required depending on plant conditions.

Electrical safety

- Work on the electrical supply must be carried out only by a qualified technician.
- Electrical components should be checked during servicing. Loose connections and damaged cables should be fixed immediately.
- Control panel should be kept locked. Access should be limited to authorized personnel with the appropriate key or tool.
- Should it become necessary to carry out work on live parts, a second person should be present to switch off the main supply in case of an emergency.

Maintenance and fault rectification

- Necessary installation, service and inspection work should be carried out at the specified time.
- Inform the operator before beginning any service work.
- Prior to all service, inspection and repair works, electrically isolate the equipment and ensure the main switch cannot be accidentally switched back on. Cut off the fuel supply.
- If during servicing or testing, sealed joints have to be opened, these have to be thoroughly cleaned to ensure tight sealing when reassembling. Damaged seals must be replaced. Carry out a gas train leak test!
- Flame monitoring devices, limit controls, correcting elements and all the other safety devices must be commissioned by, and may only be replaced by the manufacturer or an authorized agent.
- Screwed connections, which have been loosened, must be re-tightened without cross threading.
- Following service work, all safety devices should be tested to ensure their correct and proper functions.

2 Safety information

Alteration to the equipment

- No alterations to the equipment are to be made without the approval of the manufacturer. All conversions require written permission from Weishaupt Corporation.
- Any parts not in perfect working condition should be replaced immediately.
- No additional components, which have not been tested for use with the equipment, may be installed.
- Use only genuine -weishaupt- replacement and connection parts.
- Parts from other manufacturers are not guaranteed to be suitable to meet the necessary operational and safety requirements.

Alterations to the combustion chamber

- No alterations, which hinder constructive predetermined flame formation, are to be made to the combustion chamber.

Cleaning of the equipment and water disposal

- All used materials should be handled and disposed correctly with due regards to the environment.

Noise levels

Dependent on site conditions, noise could be of a sufficient level to cause hearing damage. In this case, the operating personnel must be equipped with noise protection.

General information for gas operation

- When installing a gas combustion system, regulations and guidelines must be closely followed (e.g. Local Codes of Practice and Regulations).
- The subcontractor responsible for the installation or changes of the gas system must inform the gas supplier of the type and extent of the planned installation and the intended work. The subcontractor must ascertain that an adequate gas supply to the installation is ensured.
- Installations, alterations and maintenance work on gas systems in buildings and below ground must only be carried out by installers who have a contract with the gas supplier.
- The gas train must be subject to a preliminary and main test or the combined loading test and soundness test, according to the pressure range intended.
- The air or purge gas required for gas train test must be expelled from the gas train. Gas train must be completely purged and primed prior to starting burner.

Gas characteristics

The following information must be obtained from the gas supplier:

- Type of gas.
- Calorific value in BTU/cu-ft.
- Max. CO₂ content in the flue gas.
- Gas supply pressure.

Pipe thread connections

- Only tested and approved sealing material should be used. Please observe the prevailing user instructions.

Soundness test

- Brush connection points with foaming agents or similar, non-corroding materials.

Conversion to other gases

- When converting to another gas type, a conversion kit and re-commissioning are required.



IMPORTANT

Conversion to other gas types

The conversion from one gas to another will require:

1. Re-adjustment of the burner.
2. Possible change of parts in the combustion head.
3. Possible new gas train.

Contact Weishaupt prior to changing the type of gas.

3 Technical description

3.1 Permissible applications

Weishaupt gas burner WG20.../1-C ZM-LN is suitable for the following applications:

- Installation on heat exchanger.
- Warm water boiler .
- Steam boiler and hot water boiler.
- Intermittent and continuous operation.
- Hot air generator.

Any discrepancy from the above described applications requires written confirmation from Weishaupt Corporation.

To comply with specific NOx requirement, a minimum specific combustion chamber dimensions must be followed:

- The burner must **only** be operated with the type of gas indicated on the burner plate.
- The burner must **only** be operated under permissible ambient conditions.
- The burner must **not** be used outdoor. It is only suitable for indoor operation.
- The gas supply pressure must **not** exceed the rated gas pressure indicated on the rating plate.
- The burner must **not** be used outside of its capacity range.

Faults, which could affect the safe operation of the burner, should be rectified immediately.

3.2 Nomenclature

WG20N/1-C ZM-LN

W Type: Weishaupt burner
- G Fuel: Gas
20 Burner size
N N: Natural Gas
F: LPG
/1 Capacity range
-C Revision
ZM Version: sliding two stage or modulating
-LN Version: LowNOx

3.3 Basic functions

- Automatic power gas burner for sliding two stage or modulating operation;
- Electronic ratio controller for all actuators;
- Operation and control via the operating interface.

Combustion manager

- Controlling the sequence of operation;
- Flame monitoring;
- Communicating with the stepping motors.

Ionization electrode

Monitors the flame during all phases of operation. If the flame signal does not correspond to the sequence of operations, a safety lockout will be initiated.

Actuators

Stepping motors mounted on:

- Air damper;
- Gas butterfly valve.

These motors allow precise and direct regulation in conjunction with the electronic fuel – air ratio controller.

3 Technical description

3.3.1 Air supply

Air damper

The air damper actuator controls the amount of combustion air for optimum combustion. When the burner is in stand-by position, the air damper closes automatically.

Blower fan

The blower fan is driven by the burner motor. It supplies air through the air inlet via air damper to the mixing head.

Air pressure switch

In case of failed air supply, the air pressure switch initiates a safety lockout.

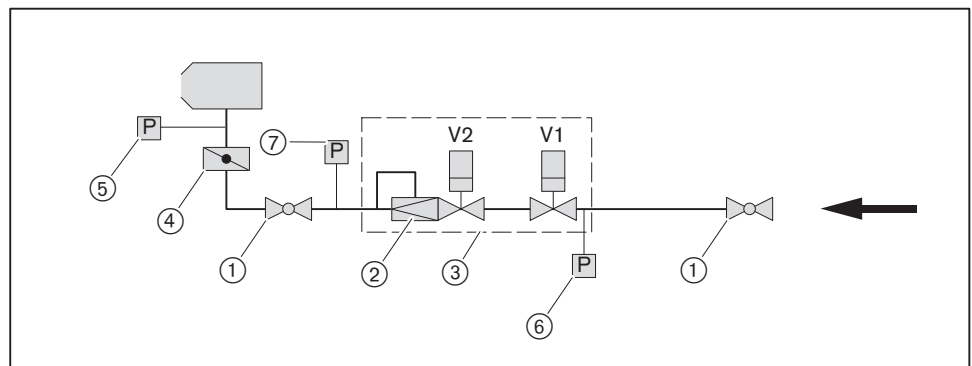
Mixing head

The air gap between the flame tube and the diffuser is adjusted depending on the burner maximum firing rate.

3.3.2 Gas supply

Gas train

Weishaupt gas and dual fuel burners are equipped as standard with dual safety gas valves, in single or double valve body configuration.



* This gas train configuration is for reference only. Actual gas train configuration may vary depending on applicable codes/ regulations

① Gas shut off valve

The gas shut off valves open and shut off the gas supply to the burner and/or pilot.

② Gas pressure regulator SKP25

The SKP25 is a motorized valve actuator with integrated pressure regulator. It opens and shuts the V2 valve according to the burner startup or shutdown sequence and it also regulates the gas pressure to the burner corresponding to the burner's firing rate.

③ Dual gas valves

The dual gas valves open and shut the gas supply to the burner and are controlled by the combustion manager.

④ Gas butterfly valve

The butterfly valve controls the amount of gas corresponding to the burner firing rate. The combustion manager controls the gas butterfly valve via dedicated stepping motor.

⑤ High gas pressure switch

A high gas pressure switch is connected to the safety interlock causing a lockout whenever the gas pressure is higher than the set point.

3 Technical description

3.3.2. Gas supply (cont.)

⑥ Low gas pressure switch

The low gas pressure switch monitors the gas supply pressure. With too low gas pressure, the burner start will be prevented.

⑦ Additional low gas pressure switch

The additional low gas pressure switch monitors the gas pressure downstream of the pressure regulator SKP25. For the burner start, the additional low gas pressure switch is bridged by a timer for max. 5 sec. If the gas pressure switch is closed when the time has elapsed, the V2 valve remains powered. If the output pressure drops below the setting point, the pressure switch opens and cuts the power supply to the V2 valve actuator. The V2 valve closes and the combustion manager initiates a lockout.

3.3.3 Electrical components

Combustion manager

The W-FM combustion manager is the main burner control unit. It controls the sequence of burner operations, monitors the flame and communicates with all related components in the system.

Operating interface

Via the operating interface, the operational related values and parameters of the combustion manager can be displayed and changed. It is connected to the main unit via a dedicated communication cable.

Burner motor

The burner motor drives the blower wheel. The combustion manager controls a motor starter to run the burner motor.

Ignition device

The electronic ignition device generates spark at the electrodes to ignite the fuel-air mixture during the ignition sequence.

Ionization electrode

The combustion manager monitors the flame signal via the ionization electrode. Should the flame signal becomes too weak, a safety shutdown will be initiated.

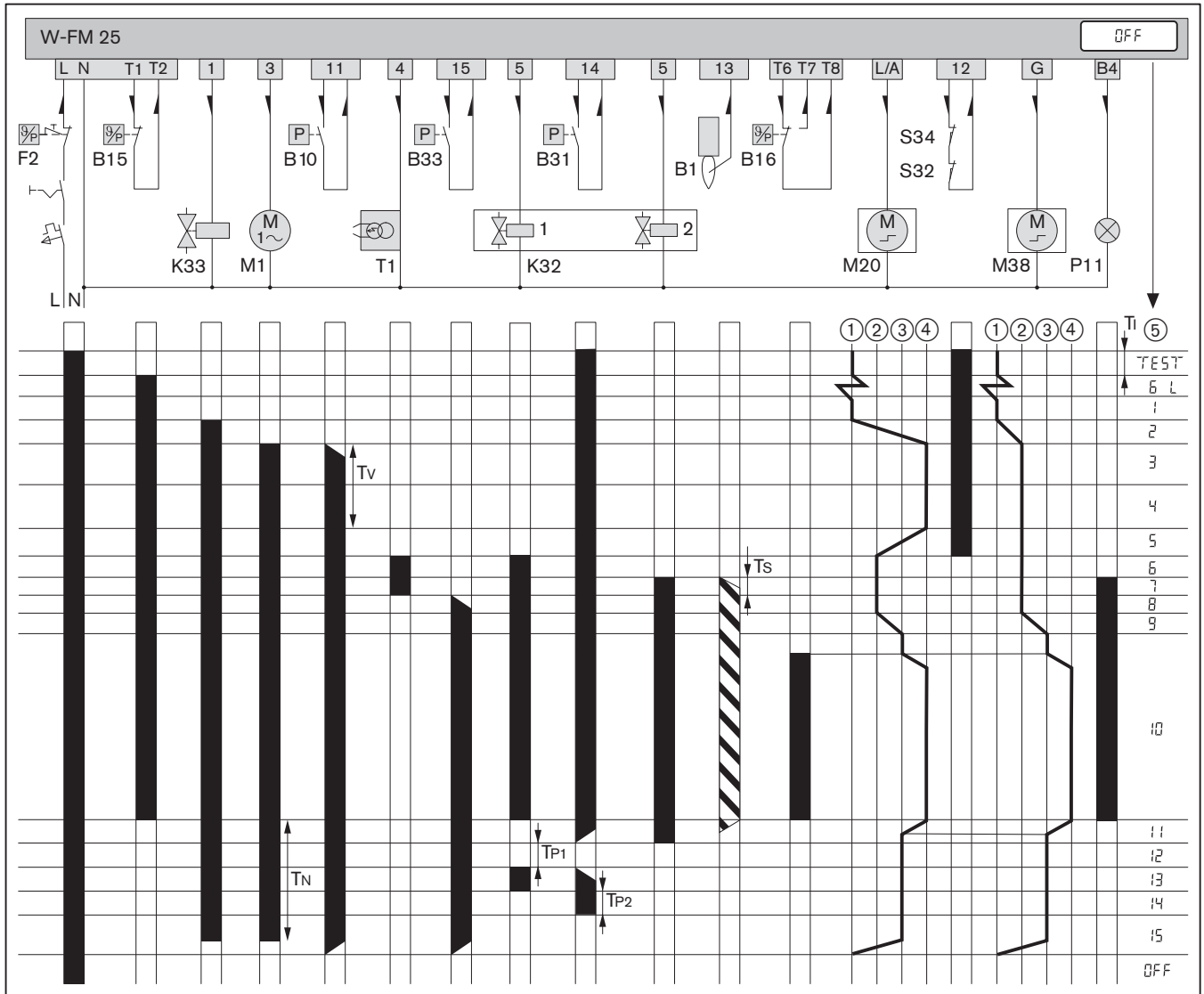
3 Technical description

3.3.4 Program sequence

The burner operating phases are shown on the display, as following:

Phase	Function
TEST	After the power supply is switched on, the combustion manager performs a self-test.
5 L	At call for heat, the air and gas stepping motors drive to the reference position.
1	The combustion manager monitors for extraneous light or flame.
2	The air damper stepping motor drives to pre-purge (operating point P_3). The gas butterfly stepping motor drives to ignition position (operating point P_4).
3	The pre-purge is started. The air pressure switch is checked and must be closed.
4	Pre-purge. The remaining pre-purge time is displayed.
5	The air damper stepping motor drives to ignition position (operating point P_4).
6	Gas valve V1 opens. The low gas pressure switch is checked and must be closed. Ignition spark starts.
7	Gas valve V2 opens. The gas is released. The safety time begins. The display shows the symbol  .
8	Flame stabilization. The high gas pressure switch is checked and must be closed.
9	The air damper and gas butterfly valve stepping motors drive to low fire.
10	The burner is in operation. Ready for modulation.
11... 14	Valves proving sequence is activated - optional, for special applications.
15	Following the post-purge, the burner motor is turned off. The air damper and gas butterfly valve are closed.
OFF	Stand-by, no call for heat.

3 Technical description



- B1 Ionization electrode
- B10 Air pressure switch
- B15 Temperature/pressure operating ctrl. (On/Off)
- B16 Temperature/pressure 2-stage or modulating ctrl.
- B31 Low gas pressure switch
- B33 High gas pressure switch
- F2 Temperature/pressure safety limit
- K32 Double gas valve
- K33 External valve LPG (optional)
- M1 Burner motor
- M20 Air damper stepping motor
- M38 Gas butterfly valve stepping motor
- P11 Burner status light (optional)
- T1 Ignition unit
- S32 Proof of Closure switch V2 (POC2)

- ① CLOSED position
- ② Ignition position
- ③ Low fire
- ④ High fire
- ⑤ Operating phase
- T_I Initialization time (test): 3 sec
- T_N Post-purge time: 2 sec
- T_{P1} 1. Test phase: 8 sec (proving V1 - optional)
- T_{P2} 2. Test phase: 16 sec (proving V2 - optional)
- T_V Pre-purge time: 60 sec
- T_S Safety time: 4 sec
- The device is energized
- Flame signal is present
- Current path
- S34 Proof of Closure switch V1 (POC1)

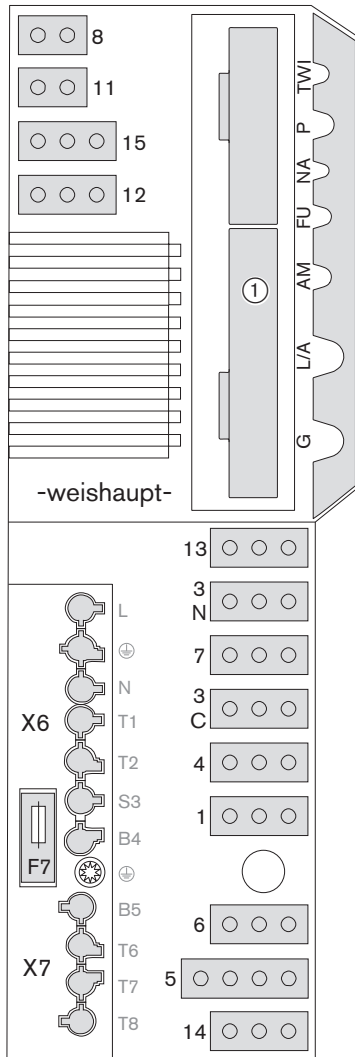


Operating phases 11 to 14 are only applicable if the valve proving system (VPS) is activated.

3 Technical description

3.3.5 Inputs and outputs

See the wiring diagram - Ch. 3.3.4



TWI	TWI Interface (VisionBox)
P	Not used
NA	Speed signal (Namur)
VSD	Variable speed drive
AM	Operating panel
L/A	Air damper stepping motor
G	Gas butterfly valve stepping motor

① Slot for analogue module EM3/3 or Fieldbus module EM3/2

1	External valve LPG (optional)
3C	Burner motor for continuous running blower
3N	Burner motor for normal blower operation
4	Ignition unit
5	Double gas valves
6	Not used
7	Bridging plug No. 7
8	Gas meter (impulse generator)
11	Air pressure switch
12	Gas valves Proof of Closure switches (POC)
13	Ionization electrode
14	Low gas pressure switch
15	High gas pressure switch

X6	7-pole connection plug (power supply, On/Off control, status signals)
X7	4-pole connection plug (2-stage or modulating control)
F7	Internal unit fuse, 6.3 AT

3 Technical description

3.4 Technical data

3.4.1 Electrical data

Burner control

Mains voltage / frequency	110 V / 60Hz
Power consumption - start	max 436 W
Power consumption - operation	max 336 W
Operating current	max 3 A
Internal fuse	6.3 AT
External fuse	15 AT

Burner motor ECK04/A-2/1

Mains voltage/ frequency	110 V, 60 Hz - 1~
Power	0.31 HP (0.23 kW)
Current	3.7 A @ 110 V
Speed	3,460 rpm
External fuse	10 AT

3.4.2 Ambient conditions

Operating temperature	5 ... 100° F (-15 ... +40° C)
Transport / storage temperature	-4 ... 158° F (-20 ... +70° C)
Relative humidity	max 80%, no condensation

3.4.3 Permissible fuels

- Natural gas
- Propane

3 Technical description

3.4.4 Capacity

Firing rate

Natural gas
Propane

119 ... 682 MBTU/H
119 ... 682 MBTU/H

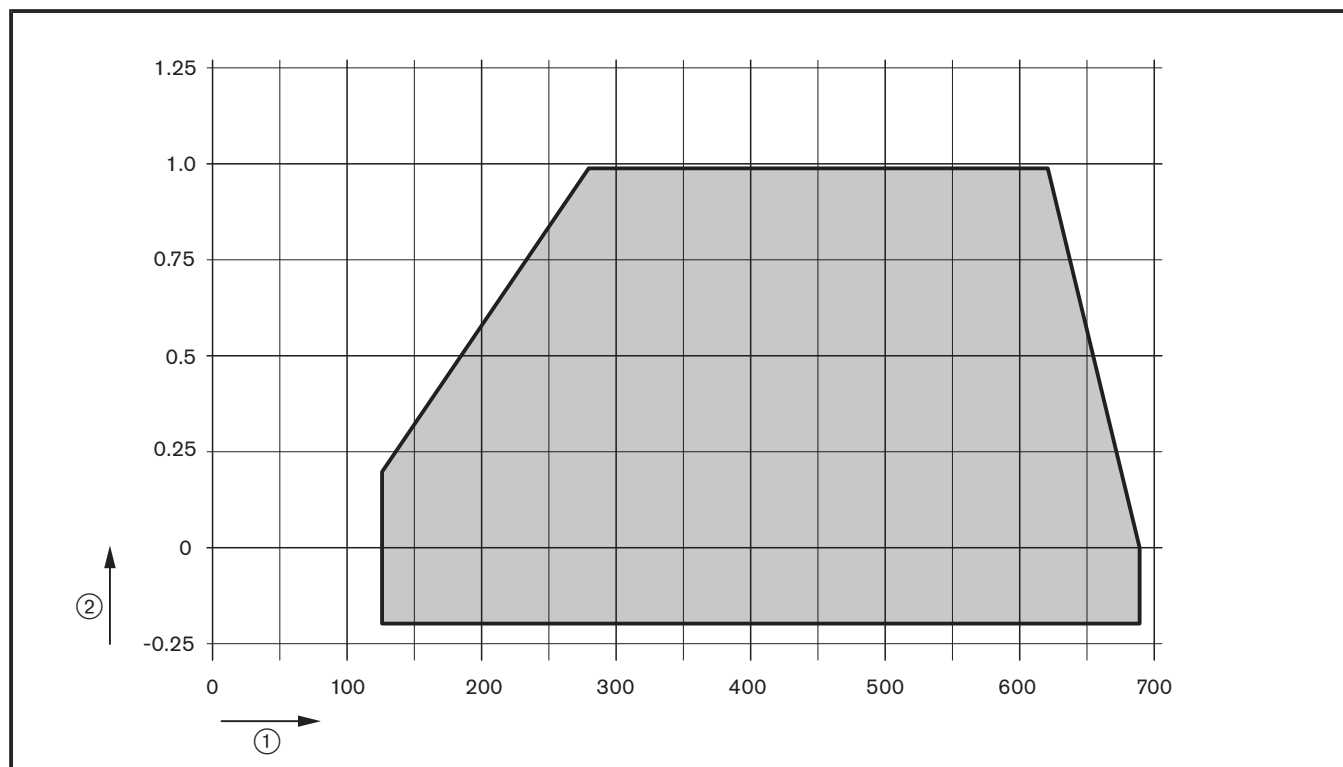
Combustion head

WG20-C

Capacity graph

The capacity graph is based on fuel with low calorific value and tested at sea level. Capacity reduction should be applied depending on the altitude of the installation: approx. 1% per 328 ft. (100 m) above sea level.

Capacity reduction might be required for burners with ducted air intake.

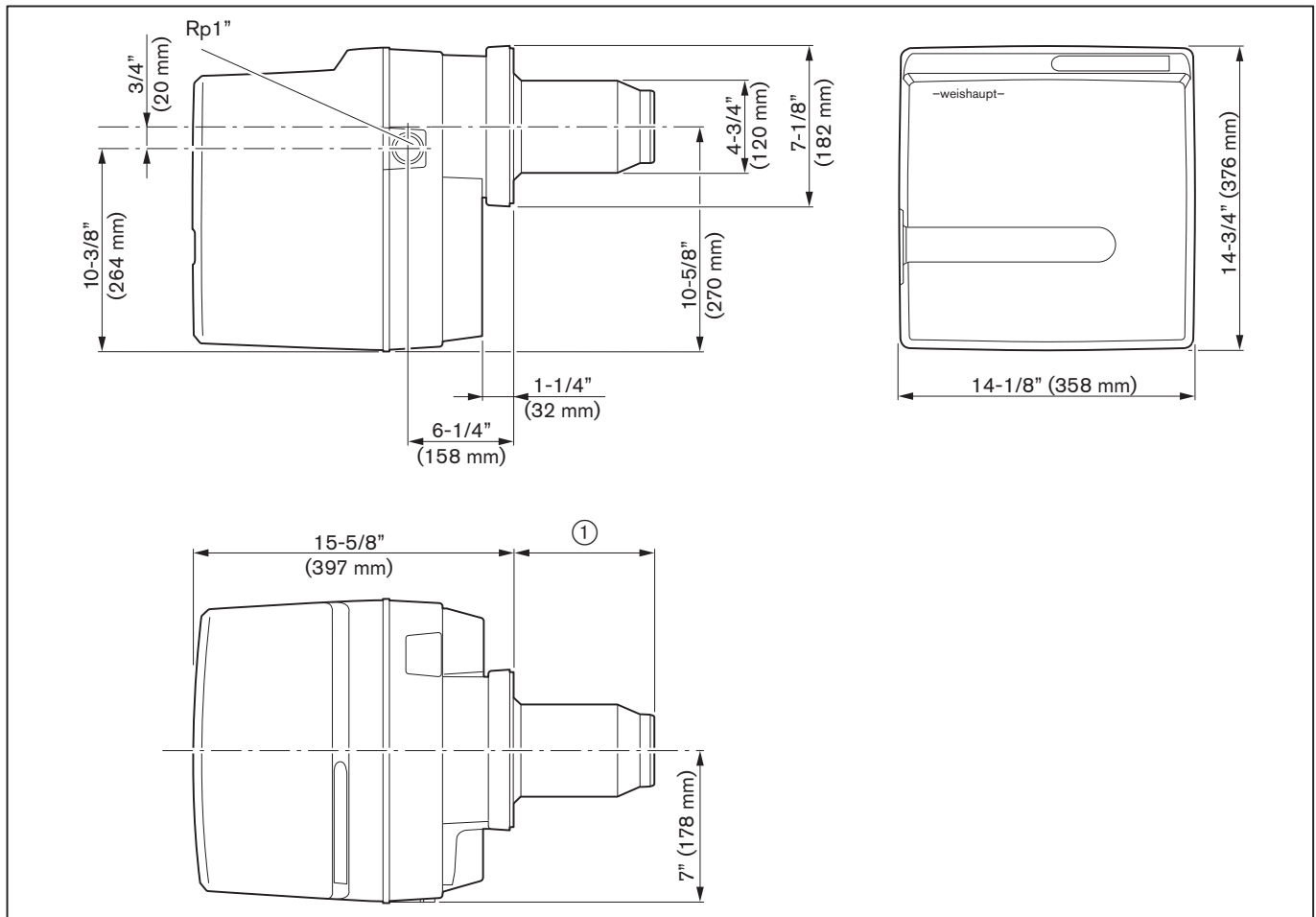


① Firing rate in MBTU/H

② Combustion chamber backpressure in "w.c.

3 Technical description

3.4.5 Dimensions



- ①
- 5-1/2" (140 mm) - without combustion head extension
 - 9-1/2" (240 mm) - with 3-7/8" (100 mm) combustion head extension
 - 13-3/8" (340 mm) - with 7-7/8" (200 mm) combustion head extension
 - 17-3/8" (440 mm) - with 11-3/4" (300 mm) combustion head extension

3.4.6 Weight

Approx. 61 lbs (28 kg).

4 Installation

4.1 Preparation prior to installation

Check burner's rating plate and capacity graph

- ▶ Check the burner type and rating.
- ▶ The burner rating must be within the operating range of the heating appliance. The ratings given on the burner plate are the minimum and maximum possible firing rates of the burner. See the capacity graph in chapter 3.4.4.

Check the installation space

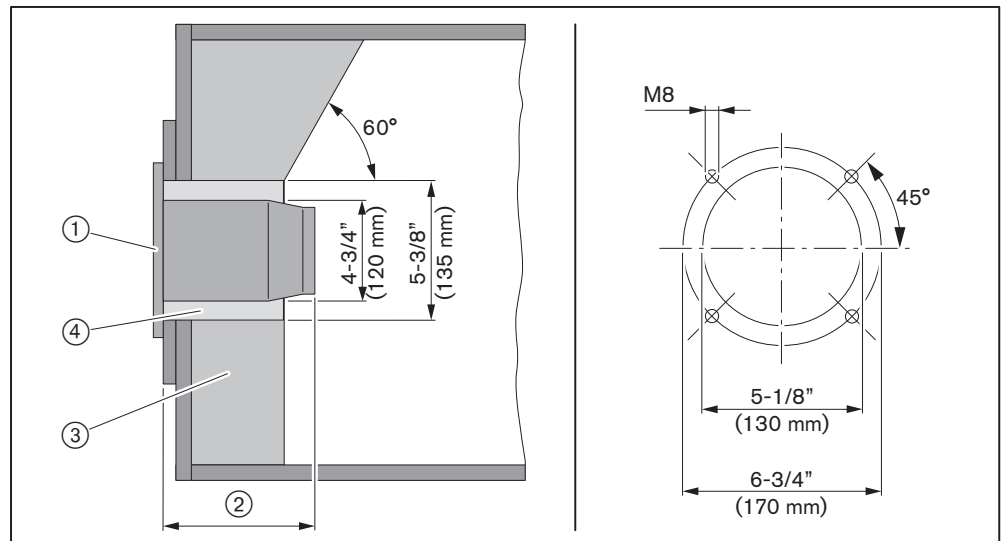
- ▶ Ensure sufficient space for the burner installation and maintenance.
- ▶ Ensure sufficient fresh air supply to the burner - if required, install air ducting.

Preparing the heating appliance

The refractory ③ must not protrude beyond the front edge of the combustion head. The refractory can take a conical shape (min 60°). Refractory may not be required on boilers with water-cooled fronts, unless the manufacturer gives other instructions.

The gap ④ between the flame tube and the refractory must be filled with resilient insulation material (do not make solid).

Heat exchangers with deep refractories or thick doors, or heat exchangers with reverse flame combustion chambers may require a combustion head extension. Head extensions of 3-7/8" (100 mm), 7-7/8" (200 mm) and 11-3/4" (300 mm) are available. The dimension ② changes accordingly with the used head extension.



- ① Boiler plate
- ② 5-1/2" (140 mm)
- ③ Refractory
- ④ Gap

4 Installation

4.2 Burner installation



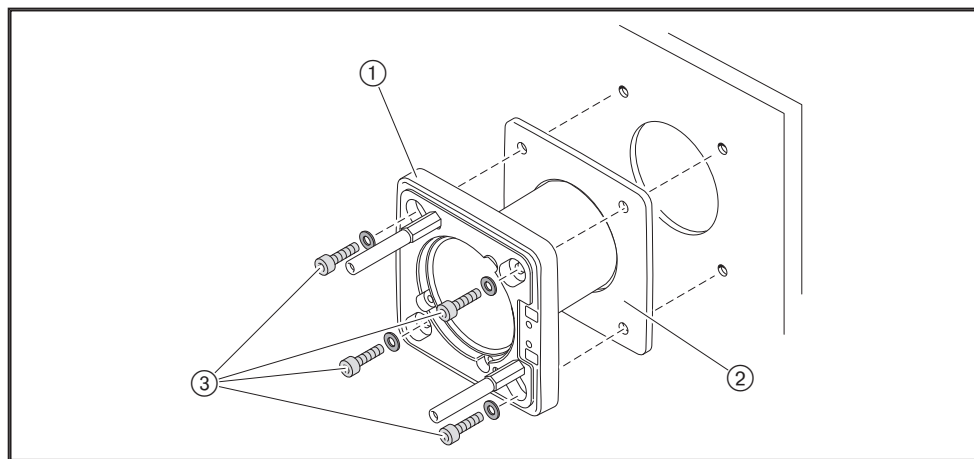
SWITCH OFF POWER FIRST!

- Prior to the installation, switch off the mains switch and the safety switch. Failure to comply could cause death or serious injury by electric shock.

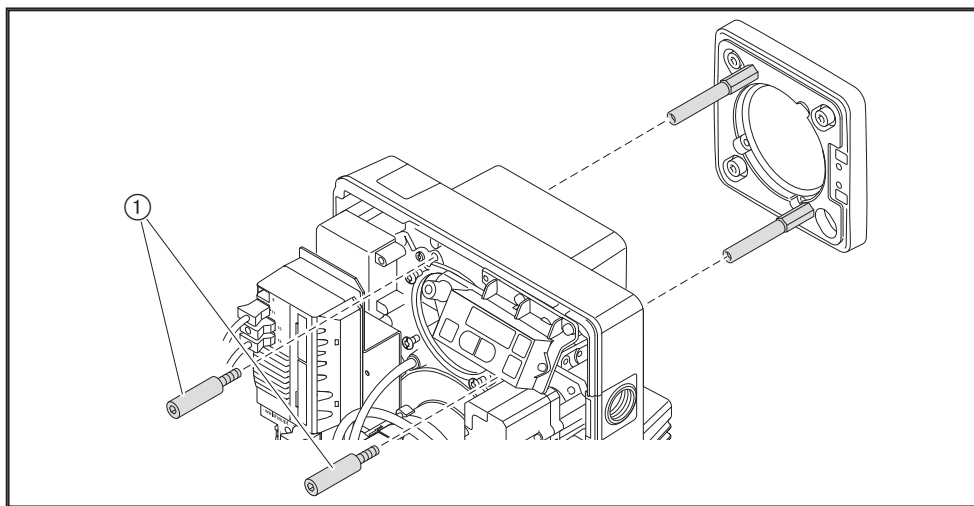


The burner in its standard version is designed for gas train connection from the right. For left side gas train connection, the burner must be installed rotated by 180° and additional conversion measures are required.

- Attach the flange gasket ② and the burner flange ① to the heat exchanger using screws ③.
- The gap between the flame tube and the refractory should be filled with flame-proof, resilient insulating material (do not make solid!).



- Install burner to the burner flange using screws ①.

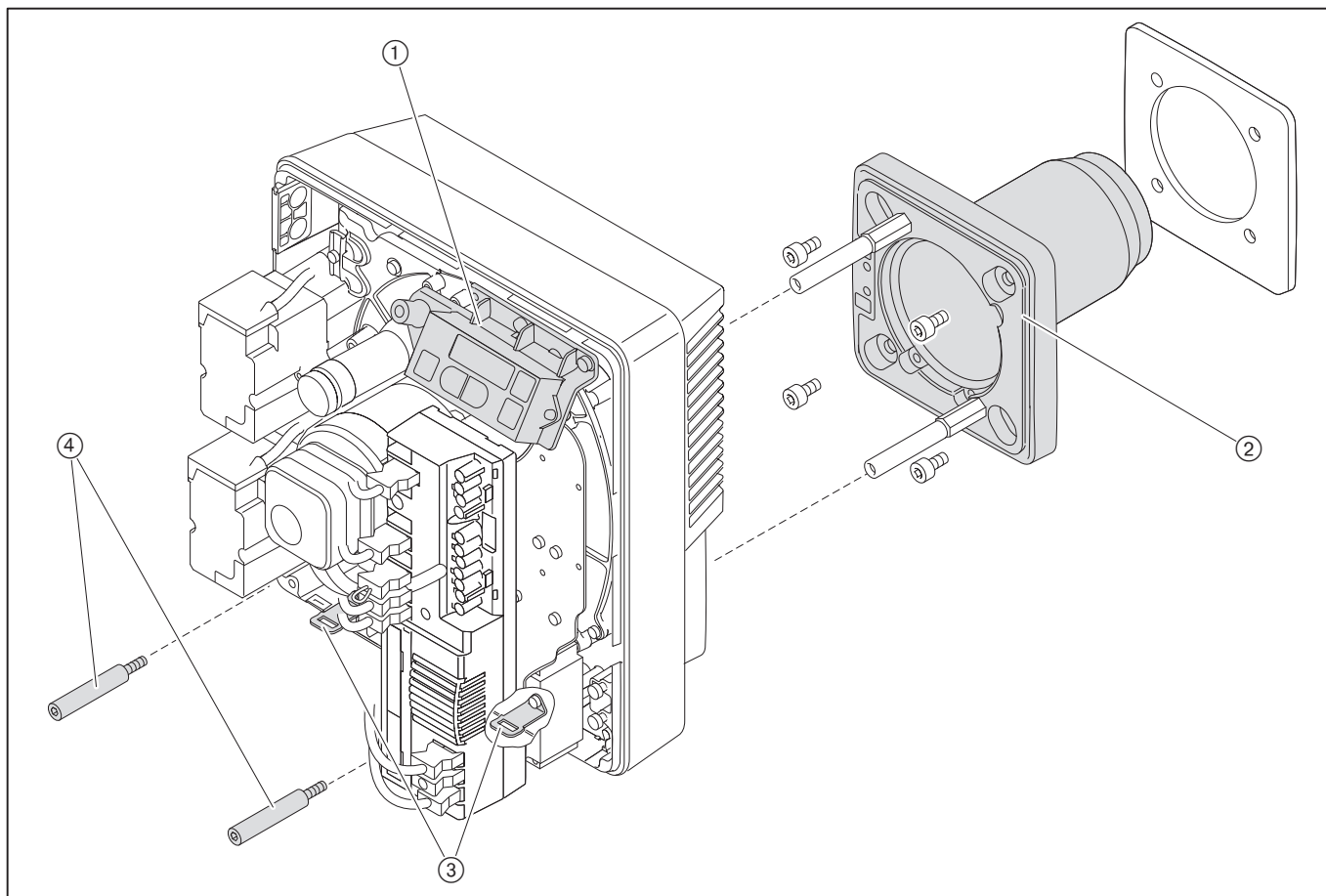


- Check the ignition and ionization electrodes' settings.
- Install the mixing head.

4 Installation

4.2.1 Rotate burner by 180°

- ▶ Install the operating interface ① on the opposite side of the burner's housing.
- ▶ Install the fixing bracket of the burner housing ③ on the opposite side of the burner's housing.
- ▶ Rotate the burner flange ② by 180° and installed it with the flange gasket.



- ▶ Rotate the burner by 180° and install screws 4 to the burner flange.
- ▶ The gap between the flame tube and the refractory should be filled with flame-proof, resilient insulating material (do not make solid!).
- ▶ Check the ignition and ionization electrodes' settings.
- ▶ Install the mixing head.

4 Installation

4.3 Gas supply



Risk of explosion!

Gas leaks can lead to the build up of explosive gas - air mixtures. With the presence of an ignition source, these could lead to an explosion.

To avoid accidents, please comply to the following safety information on the gas train installation:

- Observe the maximum permitted gas pressure feeding the gas train. Contact your local gas supplier to obtain the connection pressure of the gas supply. The connection pressure must not exceed the maximum pressure indicated on the burner rating plate.
- Before beginning of work, close all the relevant shut off devices and ensure that they cannot be accidentally reopened.
- Ensure the gas train components are correctly aligned and that all the joints are clean.
- Flange seals must be fitted correctly on the machined faces.
- Evenly tighten screws, diagonally opposite.
- Gas trains must be mounted stress free. Do **not** compensate misalignment by over tightening. Do not tighten or seal pipe thread connections on the mounted burner.
- The gas train must be fixed and supported securely. It must not be allowed to vibrate during operation. Supports suitable for the site should be fitted during installation.



IMPORTANT

Ensure that all gas train components are installed in the correct order and that the flow direction is correct for each component. Gas valves, actuators and gas pressure regulators must only be installed in the vertical (upright) position. The gas train should be supported in several places.

Additional installation notes:

In order to achieve better start conditions, the distance between the burner and the gas valves should be as short as possible. Observe gas train layout and flow direction.

4 Installation

4.4 Electrical connection



SWITCH OFF POWER FIRST!

Before the installation, switch off the main switch and the safety switch. Failure to comply could cause death, or serious injury by electric shock.

Burner specific wiring diagram

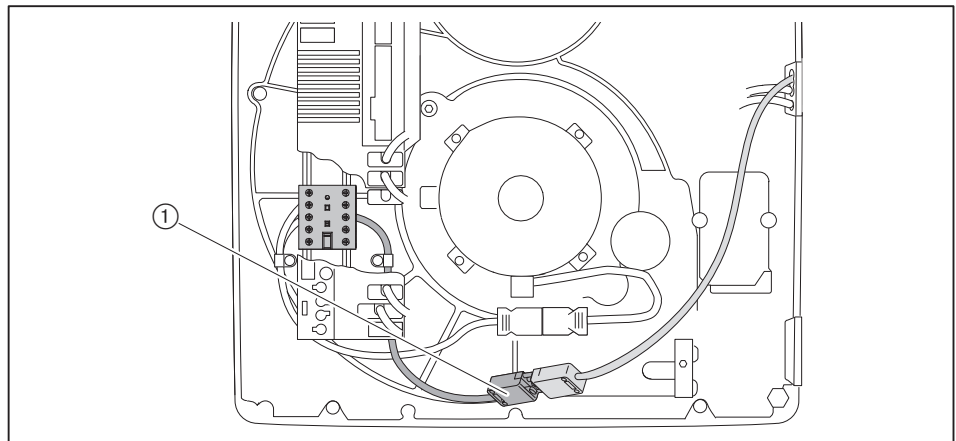
The electrical connection must be made according to the wiring diagram enclosed with each burner. Electrical installation must only be carried out by qualified and trained personnel.

Connecting the W-FM combustion manager

- ▶ Use the cable entry points provided on the burner.
- ▶ Wiring must be performed according to the wiring diagram, specific for the job.

Separate power supply line for the burner motor

- ▶ Plug the power supply line for the burner motor to connection plug ① of the motor starter.

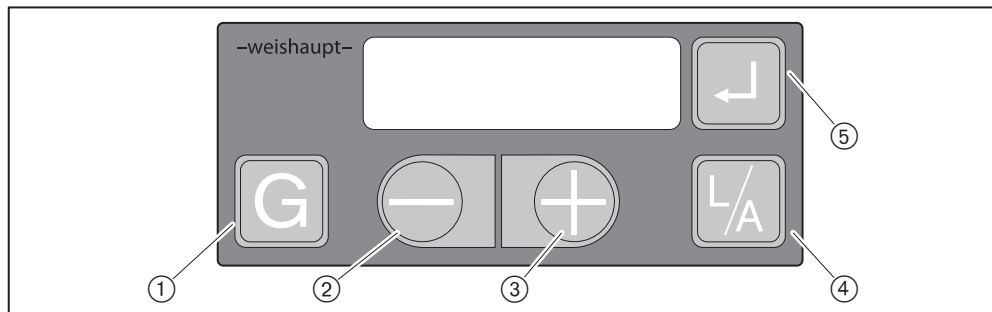


Pre-fusing of the separate power supply line for the motor:

- 10 A, slow blow.

5 Operation

5.1 Operating interface



No.	Key	Function
①	[G] Gas key	Select gas butterfly valve stepping motor
②	[-] Minus key	Decrease value
③	[+] Plus key	Increase value
④	[L/A] Air key	Select air damper stepping motor
⑤	[Enter] Enter key	Reset burner; call up information - press approx. 0.5 sec = Info level - press approx. 2 sec = Service level
③ and ⑤	[+] and [Enter]	Press approx. 2 sec: Parameter level (only with display $\overline{FF}$)



Various actions are only triggered when the key is released, for example changing the display and reset.

5 Operation

Operating level

The current stepping motor position and/or blower speed can be displayed in the operating level (*iB*).

Displaying the gas butterfly valve setting:

- ▶ Press [G] key.

Displaying the air damper setting:

- ▶ Press [L/A] key.

OFF function

- ▶ Press [Enter], [L/A] and [G] keys simultaneously.
 - ✓ Immediate lockout with error *iBh*.

Operating status

The operating status of the combustion manager can also be displayed, which helps in troubleshooting the burner's fault.

- ▶ Press and hold [-] and [+] simultaneously for approx. 3 sec.
 - ✓ The combustion manager changes to operating display. The display shows the current operating status with a number.

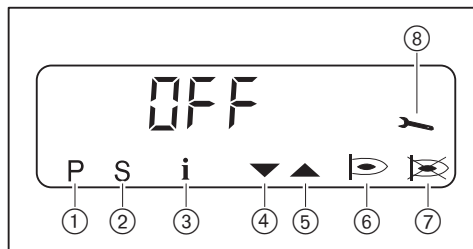
Back to standard display:

- ▶ Press and hold [-] and [+] simultaneously for approx. 3 sec.

5 Operation

5.2 Display

The display shows the current operating statuses and operating data.



- ① Programming level activated
- ② Start phase activated
- ③ Info level activated
- ④ Stepping motor runs to CLOSED position
- ⑤ Stepping motor runs to OPEN position
- ⑥ Burner in operation
- ⑦ Lockout
- ⑧ Service level activated

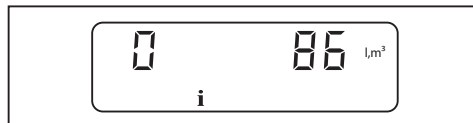
OFF	Stand-by, no call for heat.
OFF 5	Stand-by, X3:7 circuit open (Plug No. 7 removed)
OFFUPr	Unprogrammed condition or programming not completed.
OFF E	Shutdown via Fieldbus.
OFF6d	Insufficient gas pressure
F 1	Under-voltage or internal device error, see error memory (display flashes).
F 9	Connection to the Fieldbus is faulty (display flashes).

5 Operation

5.2.1 Info mode

Burner status and information can be retrieved in the Info mode.

- ▶ Press [Enter] for approx. 0.5 sec.
- ✓ The Info level is activated.
- ▶ Press [Enter] to reach the next information.



No.	Information
0	Total gas consumption in m ³ (via X3:8) Reset value: ▶ Press [L/A] and [+] simultaneously for approx. 2 sec.
1	Hours run
2	- no function -
3	Burner starts
4	Device item number
5	Index of device item number
6	Device number
7	Production date (DDMMYY)
8	Fieldbus address
9	Valve proving setting
11	Current blower speed (only with VSD) Display of standardized speed: ▶ Press [L/A].
12	Current gas consumption (0.1 m ³ /h)
13	Analogue module EM3/3 - or - Fieldbus module EM3/2 available 0 = no 1 = yes

After information 13 or a waiting time of approx. 20 sec, the combustion manager changes back to the Operating mode.

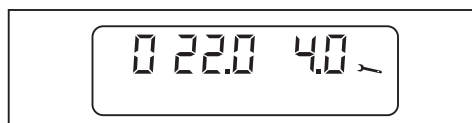
5 Operation

5.2.2 Service mode

The Service mode gives information about:

- Stepping motor position of the individual operating points;
- The most recent fault;
- Flame signal during burner operation.

- ▶ Press [Enter] for approx. 2 sec.
- ✓ The Service mode is activated.
- ▶ Press [Enter] to reach the next information.



No.	Information
0	Stepping motor position in operating point P 0
1	Stepping motor position in operating point P 1
2	Stepping motor position in operating point P 2
3	Stepping motor position in operating point P 3
4	Stepping motor position in operating point P 4
5	Stepping motor position in operating point P 5
6	Stepping motor position in operating point P 6
7	Stepping motor position in operating point P 7
8	Stepping motor position in operating point P 8
9	Stepping motor position in operating point P 9
10 ... 18	Most recent fault ... ninth last occurred fault Display additional information: 1. Detailed error codes / operating status: ▶ Press [+]. 2. Detailed error codes ▶ Press [-] and [+] simultaneously. Repetition counter: ▶ Press [G].
19	Flame signal Flame quality Range: 00 ... 58 < 50 = poor quality ... 58 = high quality Recommended value: > 50

5 Operation

5.2.3 Parameter mode

The Parameter mode can only be called up in Stand-by (0FF) mode.

- Press [+] and [Enter] simultaneously for approx. 2 sec.
- ✓ The Parameter mode is activated.



- Press [+].
- Press [Enter] to reach the next parameter.
- ✓ Only then the value will be stored.

P. No.	Parameters	Range of values	Factory setting
1	Fieldbus address	0 ... 254 / 0FF Switch over to 0FF and to address: ► Press shortly [-] and [+] simultaneously.	0FF
2	Actuator position in Stand-by	00° ... 900° Adjust air damper setting: ► Press [L/A] and [+] or [-]. Adjust gas butterfly valve setting: ► Press [G] and [+] or [-].	00°
4	Post-purge time	0 ... 4095 sec	2
5	Fault memory	0 = Fault memory is empty 1 = Fault memory contains data Delete fault memory: ► Press [L/A] and [+] simultaneously for approx. 2 sec.	-
6	Factor for gas consumption Impulse rate for meter per m ³	1 ... 65535 200 impulses = 1 m ³ ► Adjust factor depending on the gas meter impulse rate.	200
8	Low gas pressure switch/ valve proving gas press. sw. (X3:12)	0 = disabled 1 = Proof-of-closure (valve 1) 2 = without low gas pressure switch 3 = with low gas pressure switch	3
9	Air pressure switch (X3:11) (display only, no adjustment)	0 = disabled 1 = enabled	1
10	Operating mode output (X3:1)	0 = disabled 1 = with pilot valve not interrupted 2 = with pilot valve interrupted 3 = Standard (external LPG valve)	3
11	Flame sensor	0 = ionization electrode / flame sensor FLW 1 = switch input (X3:14) 2 = flame sensor QRB	0
12	Display mode	00 = Parameter E0 ... E3 activated in setting mode 0FF = Parameter E0 ... E3 not activated in setting mode	0FF
13	Restart attempts following flame failure	0 ... 1	0

After parameter 13 or a waiting time of approx. 20 sec, the combustion manager changes back to the operating level.

5 Operation

5.2.4 Access mode

In the Access mode, the configuration can be adapted relative to the burner type or version.

In the Parameter mode, the display mode must be configured to $\overline{N}$, in order to enable access to parameters $\overline{E} \overline{0}$. $\overline{E} \overline{3}$.

- ▶ Press [G] and [L/A] simultaneously.
- ✓ The Access level is activated.



- ▶ Press [+].
- ✓ Parameter $\overline{E} \overline{0}$ is displayed
- ▶ Press [Enter] to reach the next information.

Parameters	Information	Range of values
$\overline{E} \overline{0}$	Burner type	$\overline{0}$ = single fuel burner $\overline{1}$ = dual fuel burner
$\overline{E} \overline{1}$	Operating mode (display only, no adjustment possible)	$\overline{0}$ = intermittent operation $\overline{1}$ = continuous operation
$\overline{E} \overline{2}$	Flame sensor type	$\overline{0}$ = ionization electrode / flame sensor FLW $\overline{1}$ = switch input (X3:14) $\overline{2}$ = flame sensor QRB
$\overline{E} \overline{3}$	Blower configuration	$\overline{0}$ = off $\overline{1}$ = blower control $\overline{2}$ = blower control with blower monitoring $\overline{3}$ = not used (VSD) $\overline{4}$ = blower ctrl. acc. to specified modulating degree $\overline{5}$ = DAU control $\overline{6}$... $\overline{2} \overline{5} \overline{5}$ = off

5 Operation

5.3 Linearization

During commissioning, it is possible to carry out the linearization of the operating points in gas operation.

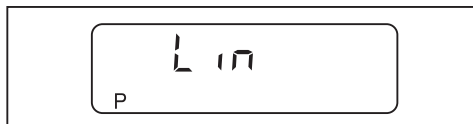
During linearization, a straight line is generated from the operating point displayed, to P_9 . The values on the straight line are adopted as the new operating points.

Initiate a calculation after P_9

► Press [Enter].

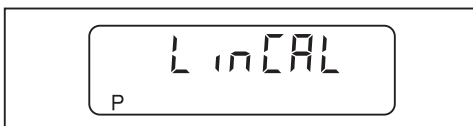
✓ The combustion manager changes to linearization mode.

The linearization mode can be interrupted by pressing the [-] key.

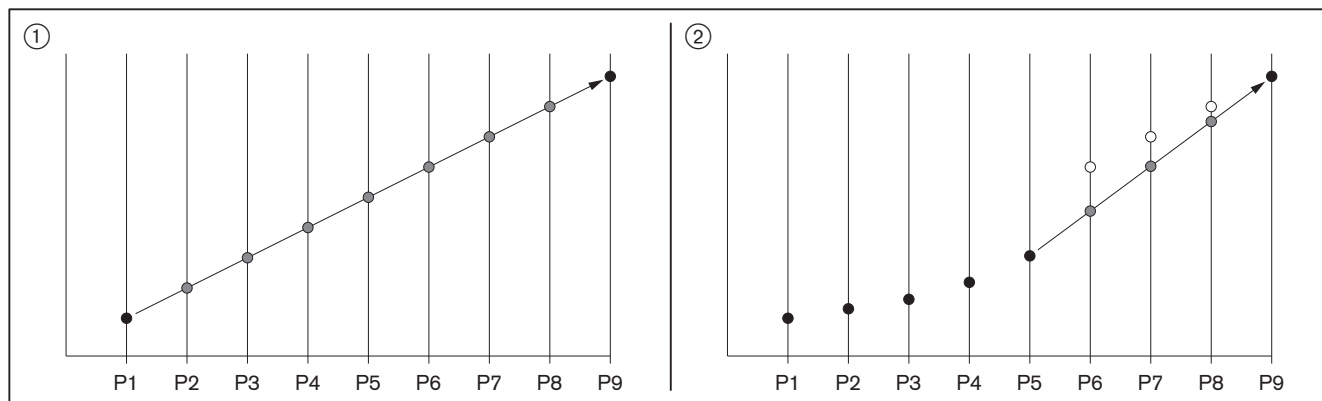


► Confirm with [+] key.

✓ Linearization is initiated.



Example:



① Calculation from P_1 to P_9

② Calculation from P_5 to P_9

6 Commissioning and startup

6.1 Conditions

Commissioning and startup must only be carried out by trained and qualified personnel.

► Prior to commissioning, all installation works must be completed and checked. The burner must be installed on the heat exchanger and ready to function with all control and safety devices connected. Check the following:

- Burner is installed, gap between flame tube and heat exchanger's refractory must be filled with flexible insulation material (refer to Chapter 4.3)
- Fuel supply is ready and complete.
- Electrical connection and control lines are ready and complete.

Depending on the site requirements, further checks may be necessary. Pay attention to the instructions for individual components / items of equipment.



CAUTION

Safety notes on initial commissioning

The initial commissioning must only be carried out by the supplier, manufacturer or their appointed agent. At this time, all the control and safety equipment must be checked to ensure correct operation and, if it can be adjusted, it should be checked that it has been set correctly.

Furthermore the correct fusing of the circuits and the measures for contact protection of electrical equipment and of all wiring must be checked.

Checklist prior to initial commissioning

- | | |
|---|--|
| <ul style="list-style-type: none"> ☐ Heat exchanger must have been correctly installed ☐ Operation procedures of the heat exchanger must be strictly followed ☐ The entire installation must be wired correctly ☐ Heat exchanger and heating system must be adequately filled with heating medium ☐ Flue gas passages must be freed from any obstacle ☐ Any flue gas damper must be opened ☐ Supply of fresh air must be guaranteed ☐ Appropriate points for flue gas measurement must be available ☐ Water level control and interlocks must be correctly set ☐ Temperature controller, pressure regulator and safety limits must be ready for operation | <ul style="list-style-type: none"> ☐ Heat demand must be readily available ☐ Fuel distributing lines must be vented off (free of air or any other inert gas) ☐ Leak test for gas train must have been performed and documented ☐ Ensure correct nozzles have been selected and are installed correctly (refer to nozzle selection table) ☐ Burner must be installed correctly ☐ Gas supply pressure must be according to specification |
|---|--|

Hints: Further installation related tests might be required. Hereby pay attention to the operating instructions of each component

6 Commissioning and startup

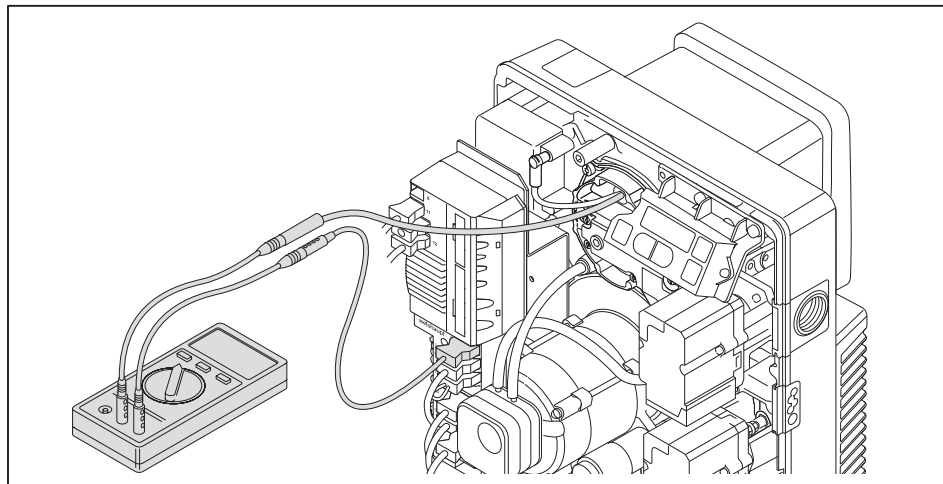
6.1.1 Connecting measuring devices

Measuring device for the ionization current

- Remove ionization cable from the plug coupling.
- Connect the current measuring device in series.

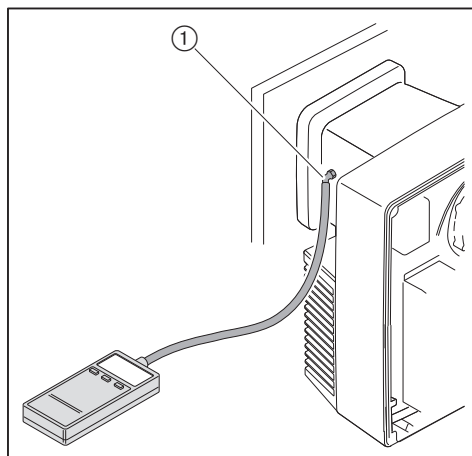
Ionization current

Extraneous light detection from:	1 μA
Minimum ionization current:	5 μA
Recommended ionization current:	9 ... 15 μA



Measuring device for the mixing pressure

- Open pressure test point for mixing pressure ① and connect the pressure measuring device.



6 Commissioning and startup

6.1.2 Air pressure switch presetting

The air pressure switch presetting is only valid during commissioning. After completing the commissioning, the air pressure switch must be set correctly.

Air pressure switch pre-setting prior to commissioning:

- approx. 1.4" w.c.

6.1.3 Gas pressure regulator presetting



Add the combustion chamber pressure in "w.c. to the setting pressure into the gas butterfly valve.

► Determine the setting pressure from the table below.

The values in the table are calculated under ideal conditions.

	Natural gas Calorific value = 1,000 BTU/cu-ft	Propane Calorific value = 2,500 BTU/cu-ft
Burner firing rate in MBTU/h (kW)	Nat. gas manifold pressure in "w.c. (mbar)	Propane manifold pressure in "w.c. (mbar)
273 (80)	3.3 (8.5)	3.6 (9.3)
307 (90)	3.3 (8.5)	3.6 (9.3)
341 (100)	3.3 (8.5)	3.6 (9.3)
375 (110)	3.3 (8.5)	3.6 (9.3)
410 (120)	3.3 (8.5)	3.6 (9.3)
444 (130)	3.5 (8.9)	3.8 (9.6)
478 (140)	3.6 (9.3)	3.9 (9.9)
512 (150)	3.8 (9.6)	4.0 (10.2)
546 (160)	3.9 (9.8)	4.1 (10.4)
580 (170)	4.0 (10.1)	4.2 (10.7)
614 (180)	4.1 (10.3)	4.3 (11.0)
648 (190)	4.2 (10.6)	4.7 (11.9)
682 (200)	4.3 (10.9)	5.0 (12.8)

The table values are guidelines for basic settings. Variations may occur during commissioning, depending on local conditions.

6 Commissioning and startup

6.1.4 Setting values

Set the mixing head relative to the required burner capacity. For this, the diffuser setting and the air damper setting should be matched.

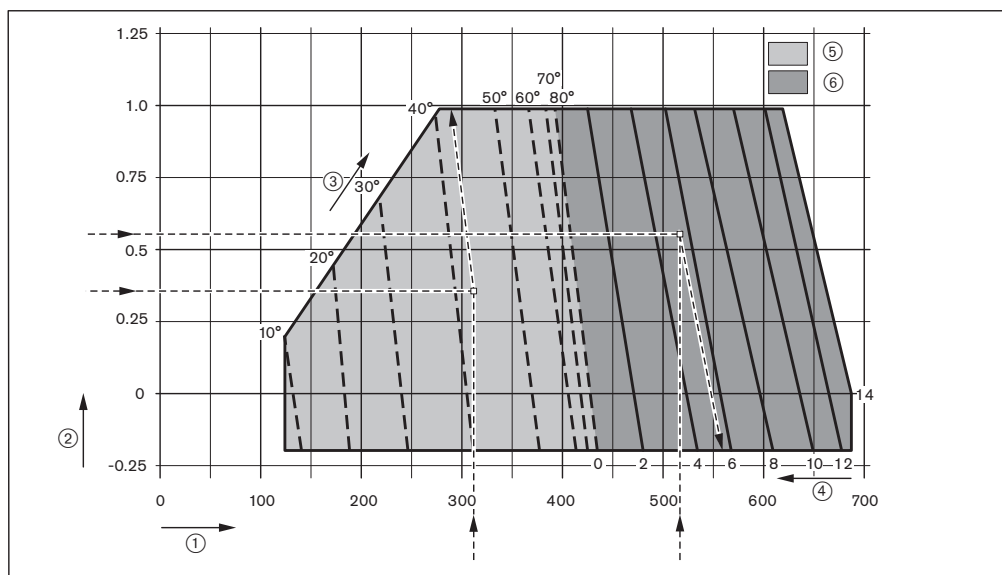
Determine the diffuser and the air damper settings



Do not operate the burner outside its capacity graph.

► Determine the required diffuser setting (dimension X) and air damper setting from the diagram below.

	Example 1	Example 2
Required burner capacity	307 MBTU/h	512 MBTU/h
Combustion chamber pressure	0.31" w.c.	0.51" w.c.
Diffuser setting (dimension X)	0" (0 mm)	1/4" (5.5 mm)
Air damper setting	43°	> 80°

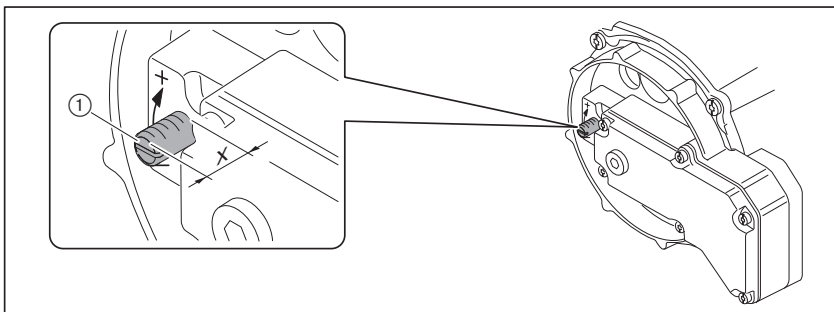


- ① Burner firing rate [MBTU/h]
- ② Combustion chamber pressure ["w.c.]
- ③ Air damper setting
- ④ Diffuser setting [mm] - dimension X
- ⑤ Air damper setting range with diffuser closed (X = 0 mm)
- ⑥ Setting range dimension X with air damper setting > 80°

Setting the diffuser

With dimension X = 0 mm, the indicating bolt is flush with the cover of the nozzle assembly.

► Turn screw ① until dimension X matches the determined value.



6 Commissioning and startup

6.2 Burner setting



Risk of electric shock

Touching the ignition device can lead to electric shock.

► Do not touch the ignition device during the ignition process!

► Check the flame signal during commissioning (see Ch. 6.1.1)

1. Presetting the combustion manager

► Unplug the bridging plug No. 7 on the combustion manager.

► Turn on the power supply.

✓ The combustion manager drives to Stand-by.



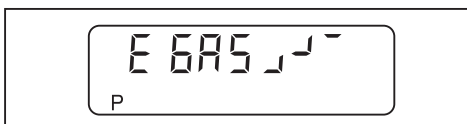
► Press [G] and [L/A] keys simultaneously.

✓ The combustion manager changes to access level.



► Press [+] key.

✓ The combustion manager changes into the setting level for step points.



► Press [+] key.

✓ The factory setting operating point P_{G} is displayed.



► Press and hold [L/A] key and set the determined air damper setting using the [-] or [+] keys.

► Press and hold [G] key and set the gas butterfly valve to the same value using the [-] or [+] keys.

► Press [+] key.

✓ The factory setting operating point P_{I} is displayed.



► Press [+] key to confirm the factory setting.

✓ The factory setting operating point P_{I} (ignition position) is displayed.



6 Commissioning and startup

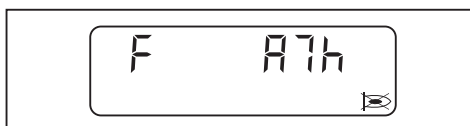
6.2. Burner setting (cont.)

- ▶ Press [+] key to confirm the factory setting.
- ✓ The combustion manager is preset.



2. Checking the sequence of operation

- ▶ Open the gas isolating valve, reset the low gas pressure switch if necessary.
- ✓ The pressure in the gas train increases.
- ▶ Close the gas isolating valve.
- ▶ Plug in the bridging plug No. 7 on the combustion manager.
- ✓ Burner starts.
- ✓ Valve proving is executed (if required and enabled).
- ▶ Check the sequence of operation:
 - Valves open;
 - Gas pressure switch trips;
 - Burner start is interrupted;
 - Burner doesn't detect a flame and goes to lockout.



- ▶ Reset the burner using the [Enter] key.
- ▶ Reset the low gas pressure switch, if necessary.
- ✓ The combustion manager drives to stand-by.



6 Commissioning and startup

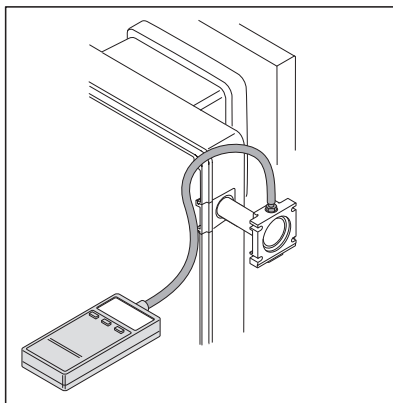
3. Presetting the gas setting pressure



If a controlled shutdown or lockout occurs during setting:

- ▶ Briefly press [G] and [L/A] keys simultaneously.
- ▶ Press [+] key.
- ✓ The combustion manager changes to setting level.

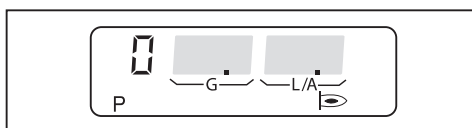
- ▶ Open the test point for the setting pressure and connect the pressure measuring device.



- ▶ Open the gas isolating valve.
- ▶ Briefly press [-] and [+] keys simultaneously.
- ✓ The display shows **E ACCESS**.



- ▶ Press [+] key.
- ✓ The burner starts according to the sequence of operation and stops at the operating point **P** (ignition position).

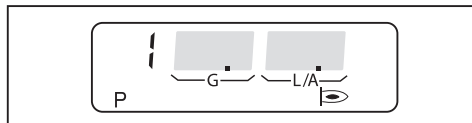


- ▶ Preset the determined setting pressure at the gas pressure regulator.
- ▶ Check the CO content in the flue gas and, if necessary, adjust combustion values via the gas butterfly setting [G].

6 Commissioning and startup

4. Driving to high fire

- ▶ Press [+] key.
- ✓ The burner drives to the operating point P_1 .



- ▶ Check the CO content in the flue gas and, if necessary, adjust combustion values via the gas butterfly setting [G].
- ▶ Press [+] key.
- ✓ The next operating point is initiated.
- ▶ Repeat the steps at each operating point until P_9 has been reached.



5. Adjusting the high fire

The ratings data given by the appliance's manufacturer and the capacity graph must be observed while adjusting the burner.

- ▶ Clock the gas meter for the required gas flow.
- ▶ Optimize the setting pressure and/or the gas butterfly valve setting [G] until the required gas flow has been reached.
- ▶ Check the combustion values.
- ▶ Determine the combustion limit and set the excess air via the air damper setting [L/A].
- ▶ Determine once more the gas throughput and adjust if necessary.
- ▶ Re-set the excess air.

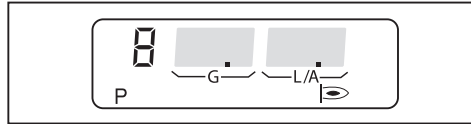


The gas setting pressure must not be altered once this step has been completed!

6 Commissioning and startup

6. Adjusting the operating point $\bar{P}_i$

- ▶ Press [-] key.
- ✓ $\bar{P}_i$ is saved.
- ✓ The burner drives to the operating point $\bar{P}_i$.



- ▶ Check the CO content in the flue gas and, if necessary, adjust combustion values via the gas butterfly setting [G].
- ▶ Press [-] key.
- ✓ The next operating point is initiated.
- ▶ Repeat the steps at each operating point until $\bar{P}_i$ has been reached.

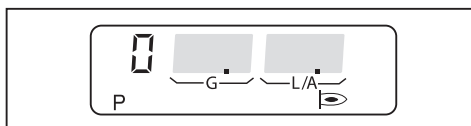


Operating point $\bar{P}_i$ must lie within the capacity graph.

- ▶ Determine the gas throughput and, if necessary, adjust via gas butterfly valve setting [G].
- ▶ Check the combustion values.
- ▶ Determine the combustion limit and set the excess air at approx. 20 ... 25% via the air damper setting [L/A].

7. Adjusting the ignition position $\bar{P}_i$

- ▶ Press [-] key.
- ✓ The burner drives to the operating point $\bar{P}_i$ (ignition position).

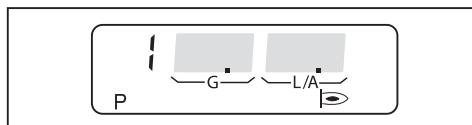


- ▶ Check the combustion values at operating point $\bar{P}_i$ (ignition position).
- ▶ Set the O₂ content at 4 ... 5% above the gas butterfly setting [G].
- ▶ Check the mixing pressure.
- ✓ The mixing pressure at ignition position must be between 0.2...0.8" wc (0.5...2 mbar).
- ▶ If necessary, adjust mixing pressure via the air damper setting [L/A].

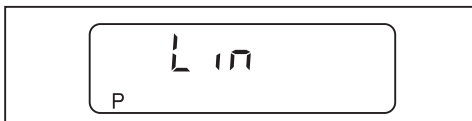
6 Commissioning and startup

8. Performing the linearization process

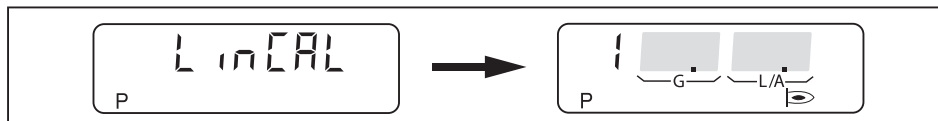
- ▶ Press [+] key.
- ✓ The burner drives to the operating point P_1 .



- ▶ Press [Enter] key.
- ✓ The combustion manager switches to linearization mode.



- ▶ Confirm with [+] key.
- ✓ The linearization is initiated.
- ✓ The display then shows operating point P_1 .
- ✓ The calculation from P_1 to P_9 has completed.

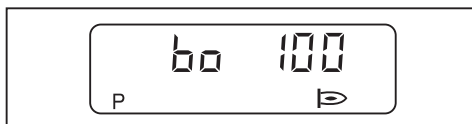


9. Optimizing the operating points

- ▶ Check the combustion values.
- ▶ Press and hold [G] and optimize the combustion values via the gas butterfly valve setting using [-] or [+] keys.
- ▶ Press [+] key.
- ✓ The next operating point is selected.
- ▶ Repeat the steps for the operating points P_2 to P_9 .



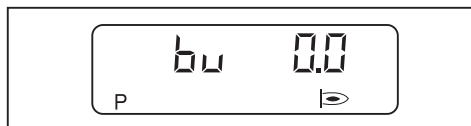
- ▶ Press [G] and [L/A] simultaneously.
- ✓ The upper operating limit (b 100) is displayed.



6 Commissioning and startup

10. Adjusting low fire

- ▶ Press [G] and [L/A] keys simultaneously.
- ✓ The burner drives to low fire.
- ✓ The lower operating limit (b_u) is displayed.



- ▶ Set the low fire while observing:
 - the data supplied by the appliance's manufacturer - e.g. min. firing rate, min. stack temperature;
 - the burner's capacity graph.
- ▶ Determine the gas throughput and adjust, if necessary, the low fire (b_u) using [+] key.
- ▶ Press [G] and [L/A] simultaneously.
- ✓ The combustion manager changes to Operating mode ($P_{PROCESS}$).
- ✓ The programming of the combustion manager is completed.



11. Checking the start behaviour

- ▶ Switch off and restart the burner.
- ▶ Check the start behaviour and, if necessary, correct the operating point P_{PI} (ignition position).

If the ignition firing rate has been altered:

- ▶ Re-check the start behavior.

6 Commissioning and startup

6.3 Setting the air pressure switch

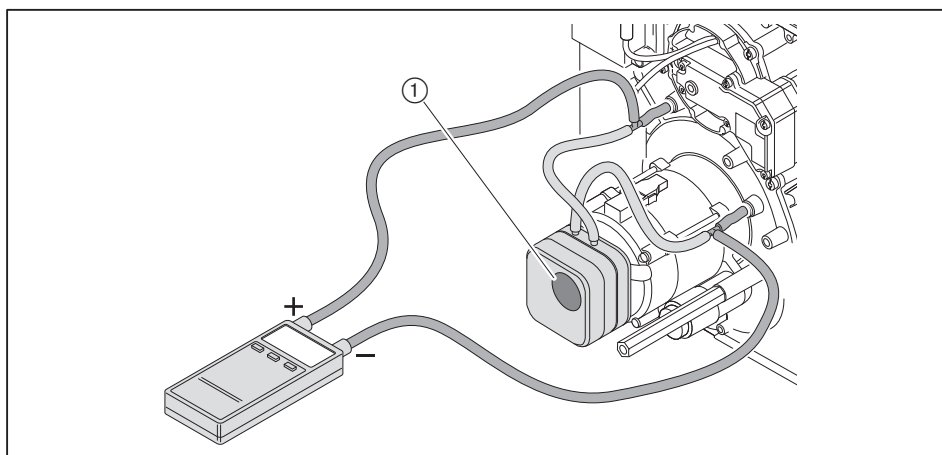
Switching point must be checked and, if necessary, adjusted during commissioning.

- ▶ Connect the pressure gauge for differential pressure measurement.
- ▶ Start the burner.
- ▶ Check differential pressure over the whole operating range and determine the lowest differential pressure.
- ▶ Drive the burner to the point with the lowest differential pressure and turn the setting disk on air pressure switch slowly to the right until the burner shuts down.
- ▶ Set the air pressure switch at 80% of the verified value at the setting cam ①.

Example

Lowest differential pressure	1.7" w.c.
Switching point air pressure switch (80%)	$1.7" \text{ w.c.} \times 0.8 = 1.4" \text{ w.c.}$

Site specific conditions (such as: flue gas system, heat exchanger, boiler room, etc) might affect the air pressure switch and, therefore, it might require a different value than the above recommended setting.



6.4 Concluding works

- ▶ Check the functions of all safety devices (Gas pressure switches, Thermostat, Pressure sensor, etc.).
- ▶ Close / remove gas pressure gauges and close all measuring ports.
- ▶ Record burner settings and combustion test results.
- ▶ Inform the owner on how to operate the system.
- ▶ Keep a copy of this manual on site for the plant operator.

6 Commissioning and startup

6.5 Combustion analysis

For safe and economic operation of the plant, flue gas measurements are essential when commissioning.

The maximum CO₂ content for various gases can be obtained from the gas suppliers.

Example:

With 15% excess air ($\lambda = 1.15$) and 12% CO₂ max. a test value of

$$\text{CO}_2 = \frac{12}{1.15} = 10.4 \% \text{ should be reached.}$$

The CO content must not be more than 0.005 % Vol. (50 ppm).

Flue gas temperature for high fire is the result of burner setting at nominal firing rate.

Flue gas temperature for low fire is the result of control range adjustment.

The instructions of the manufacturer are to be followed strictly. On hot water boiler installations, low fire is normally set to 50 ... 65% of the high fire rating (some of the data may be on the boiler rating plate).

On air heater installations, the low fire is normally even higher. Again, the instructions of the manufacturer should be closely followed.

The flue gas installation should also be set out to protect against damage through condensation (excluding acid-proof chimneys).

6 Commissioning and startup

6.6 Calculating the gas throughput

To provide the correct thermal input to the appliance, the required gas throughput must be determined beforehand.

Conversion from standard to operating conditions

The calorific value (H) of combustible gases is generally given in relation to the standard barometric conditions.

$$\begin{aligned} Q_N &= \text{Boiler rating [BTU/h]} & P_{\text{BARO}} &= \text{Barometric pressure [\" w.c.]} \\ \eta &= \text{Efficiency [\%]} & P_G &= \text{Gas pressure at meter [\" w.c.]} \\ H &= \text{Calorific value [BTU/cu-ft]} & t_G &= \text{Gas temperature [° C]} \\ f &= \text{Conversion factor} & t_F &= \text{Gas temperature [°F]} \end{aligned}$$

Burner's high fire has to be adjusted according to the capacity of the appliance. Therefore, the gas throughput must be verified and set accordingly.

Normal volume V_N :

$$V_N = \frac{Q_N}{\eta \times H}$$

Actual volume V_B : **Gas temperature in Celsius**

$$V_B = \frac{V_N}{f} \quad t_G = (t_F - 32) \times 0.5556$$

Conversion factor f:

$$f = \frac{P_{\text{BARO}} + P_G}{399} \times \frac{273}{273 + t_G}$$

Mean annual barometric pressure

Average geodetic altitude (ft)	From	1	160	330	490	660	820	985	1150	1315	1480	1640	1800	1970	2130	2300	
of installation area	To	0	160	330	490	660	820	985	1150	1315	1480	1640	1800	1970	2130	2300	2460
Mean annual barometric pressure	" w.c.	400	399	396	394	392	389	387	385	382	380	377	375	373	371	368	366
	mbar	1016	1013	1007	1001	995	989	983	977	971	965	959	953	947	942	936	930

Example

Altitude above sea level	= 656 ft
Barometric pressure P_{BARO} as per table	= 392\" w.c. (995 mbar)
Gas pressure P_G at meter	= 5 PSI (135\" w.c.)
Total pressure P_T ($P_{\text{BARO}} + P_G$)	= 527\" w.c. (1339 mbar)
Gas temperature t_G	= 68°F (20°C)
Conversion factor (f)	= 1.23
Boiler rating Q_N	= 1,000,000 BTU/h
Efficiency η (assumed)	= 82 %
Calorific value H	= 1,000 BTU/cu-ft.

6 Commissioning and startup

6.7 Subsequent optimization of the operating points

For safe and economic operation of the plant, the combustion values can subsequently be corrected.

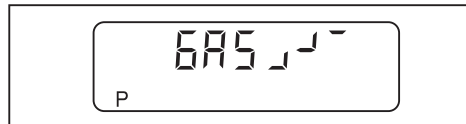
- ▶ Unplug the bridging plug No. 7 from the combustion manager.
- ✓ The combustion manager drives to stand-by.



- ▶ Briefly press [-] and [+] keys simultaneously.
- ✓ The combustion manager changes to access level.



- ▶ Press [+].
- ✓ The combustion manager changes to setting level.



- ▶ Plug the bridging plug No. 7 on the combustion manager.
- ✓ The burner starts and stops in operating point P_{ign} (ignition position).
- ▶ Move through the other operating points using the [+] and [-] keys and optimize, if necessary.

Exit setting level

- ▶ Press [G] and [L/A] simultaneously.
- ✓ The upper operating limit (b_{u}) is displayed.
- ▶ Press [G] and [L/A] simultaneously.
- ✓ The lower operating limit is displayed (b_{u}).
- ▶ Press [G] and [L/A] simultaneously.
- ✓ The combustion manager changes to operating level.

7 Shutdown

7. Shutdown

For breaks in operation:

- ▶ Switch off the power supply to the burner.
- ▶ Close the gas shut off devices.

8 Maintenance and service

8.1 Notes on maintenance and service



Risk of explosion due to leaking gas

When dismantling and assembling components which are used in the gas line, ensure that they are correctly cross bonded, aligned, clean and in good condition, and that the fixing screws are correctly tightened.



Risk of electric shock

- ▶ Prior to service or maintenance, switch off the main and the safety switches.
- ▶ Failure to comply could cause death or serious injury by electric shock.



Risk of burn

- ▶ Some burner parts (e.g. flame tube, burner flange, etc.) become hot during operation and should be allowed to cool down before performing any service work.



We recommend a minimum of once per year maintenance and inspection of all combustion equipment. It saves fuel and ensures constantly good combustion results. Excellent combustion quality is a pre-requisite for environment friendly operation.

Annual maintenance and inspection program should include inspection of electrodes, flame sensors, flame signal strength readings, inspection and testing of all safeties, including air pressure switch, flange switch, gas pressure switches, flame sensor, interlocks, motor overloads, etc. Also, the burner should be inspected for any mechanical damage.



The following components must not be repaired and must be replaced upon failure:

- Stepping motors
- Flame sensor
- Combustion manager
- Pressure regulator
- Gas valves
- Gas pressure switches
- Air pressure switch

Prior to maintenance or service

- ▶ Inform the owner.
- ▶ Switch off the main switch and the safety switch.
- ▶ Close the gas shut off devices.
- ▶ Remove the cover.
- ▶ Unplug the appliance control connector plug X6 from the combustion manager.

Following maintenance or service

- ▶ Check the tightness of the gas train's components.
- ▶ Check the correct function of:
 - ignition,
 - flame monitoring,
 - gas carrying components (gas connection pressure and setting pressure),
 - air and gas pressure switches,
 - safety interlock circuit.
- ▶ Check the combustion values; re-adjust if necessary.
- ▶ Enter the combustion values and settings in the maintenance/service record.
- ▶ Re-install the cover.

8 Maintenance and service

8.2 Service plan

Components	Criteria / design lifespan ⁽¹⁾	Maintenance or service procedure
Blower wheel	Soiling Damage	Clean Replace
Air duct	Soiling	Clean
Air damper	Soiling	Clean
Air pressure switch	Switch point 250,000 burner starts or 10 years ⁽²⁾	Check Replace
Ignition cable	Damage	Replace
Ignition electrode	Soiling Damage / wear	Clean Replace
Combustion manager	250,000 burner starts or 10 years ⁽²⁾	Replacement recommended
Ionization cable	Damage	Replace
Ionization electrode	Soiling Damage / wear	Clean Replace Recommendation: at least every 2 years
Flame tube / diffuser	Soiling Damage	Clean Replace
Gas valves	Fault identified 100,000 burner starts or 10 years ⁽²⁾	Replace Replace
Gas pressure regulator	Setting pressure Function / soundness 15 years	Check Replace Replace
Gas pressure switch	Switch point 50,000 burner starts or 10 years ⁽²⁾	Check Replace

⁽¹⁾ The specified design lifespan applies for typical use in heating, hot water and steam systems, as well for thermal process systems.

⁽²⁾ If a criteria is met, perform the maintenance or service procedure.

8 Maintenance and service

8.3 Removing and re-installing the mixing head

Observe the notes on maintenance and servicing (see Ch. 8.1).



Risk of explosion due to leaking gas

Gas leakage could occur if the gasket ③ is seated incorrectly.

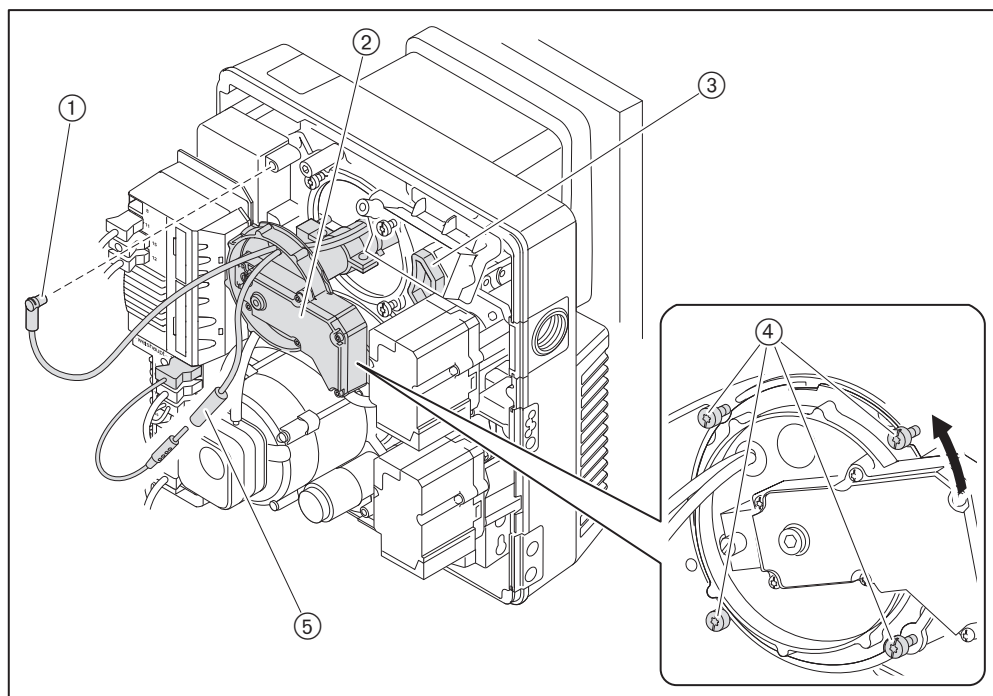
- ▶ Following work at the mixing head, ensure that the gasket is clean and seated correctly. Replace if damaged.
- ▶ Check for leaks.

Removing

- ▶ Unplug ionization cable ⑤.
- ▶ Unplug ignition cable ①.
- ▶ Loosen screws ④.
- ▶ Turn the mixing head ② to the left up to the recess and remove.

Re-installing

- ▶ Re-install the mixing head in reverse order, ensuring the correct alignment and cleanliness of the gasket ③.



8 Maintenance and service

8.4 Setting the mixing head

Observe the notes on maintenance and servicing (see Ch. 8.1).

The distance S1 between the diffuser and the flame tube's front edge cannot be measured with the burner mounted. This is only possible with the mixing head removed, with the help of the dimension Lx.



Dimension Lx changes according to the combustion head extension used.

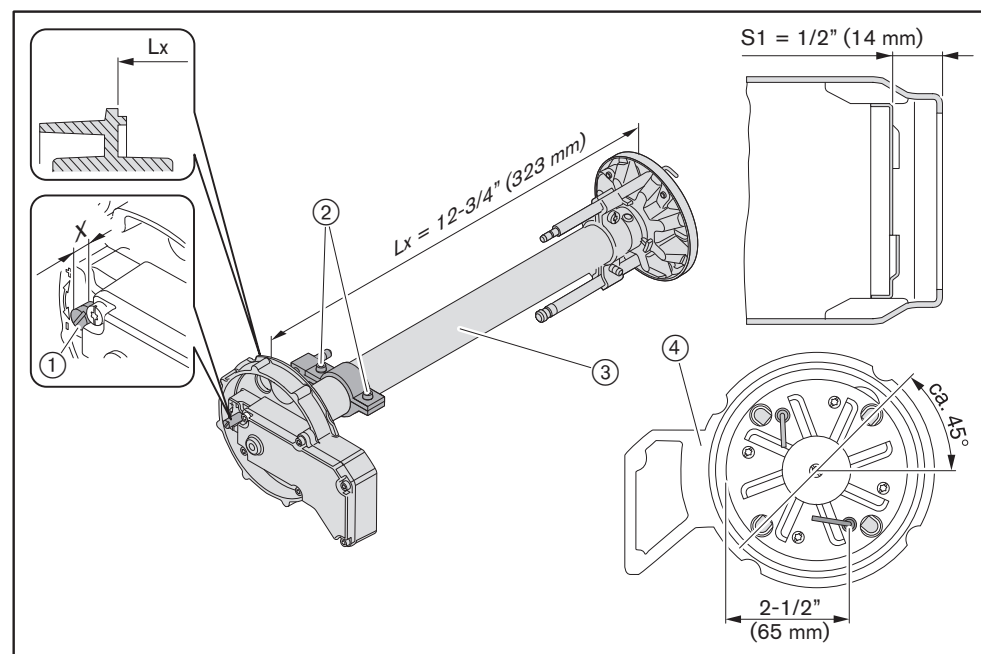
- Remove the mixing head (see Ch. 8.3).
- Turn the setting screw ① until the indicating bolt ⑤ is flush with the nozzle assembly cover (dimension X = 0 mm).
- Check dimension Lx.

If the measured value deviates from dimension Lx:

- Loosen screws ②.
- Adjust flame tube ③ until dimension Lx has been reached.
- Re-tighten screws ②.

If the screws ② have been loosened:

- Check the position of the electrodes and gas orifices ④.

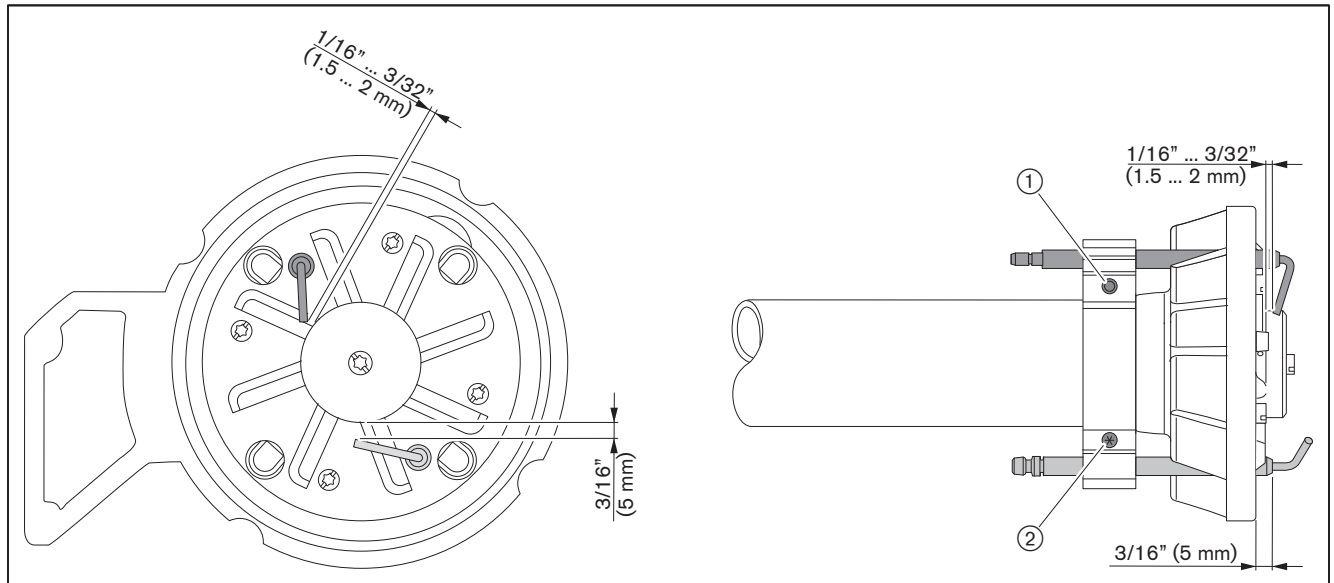


8 Maintenance and service

8.5 Setting the ionization and the ignition electrodes

Observe the notes on maintenance and servicing (see Ch. 8.1).

- ▶ Remove the mixing head (see Ch. 8.3).
- ▶ Loosen screw ①.
- ▶ Set the ignition electrode and re-tighten screw ①.
- ▶ Loosen screw ②.
- ▶ Set the ionization electrode and re-tighten screw ②.



8 Maintenance and service

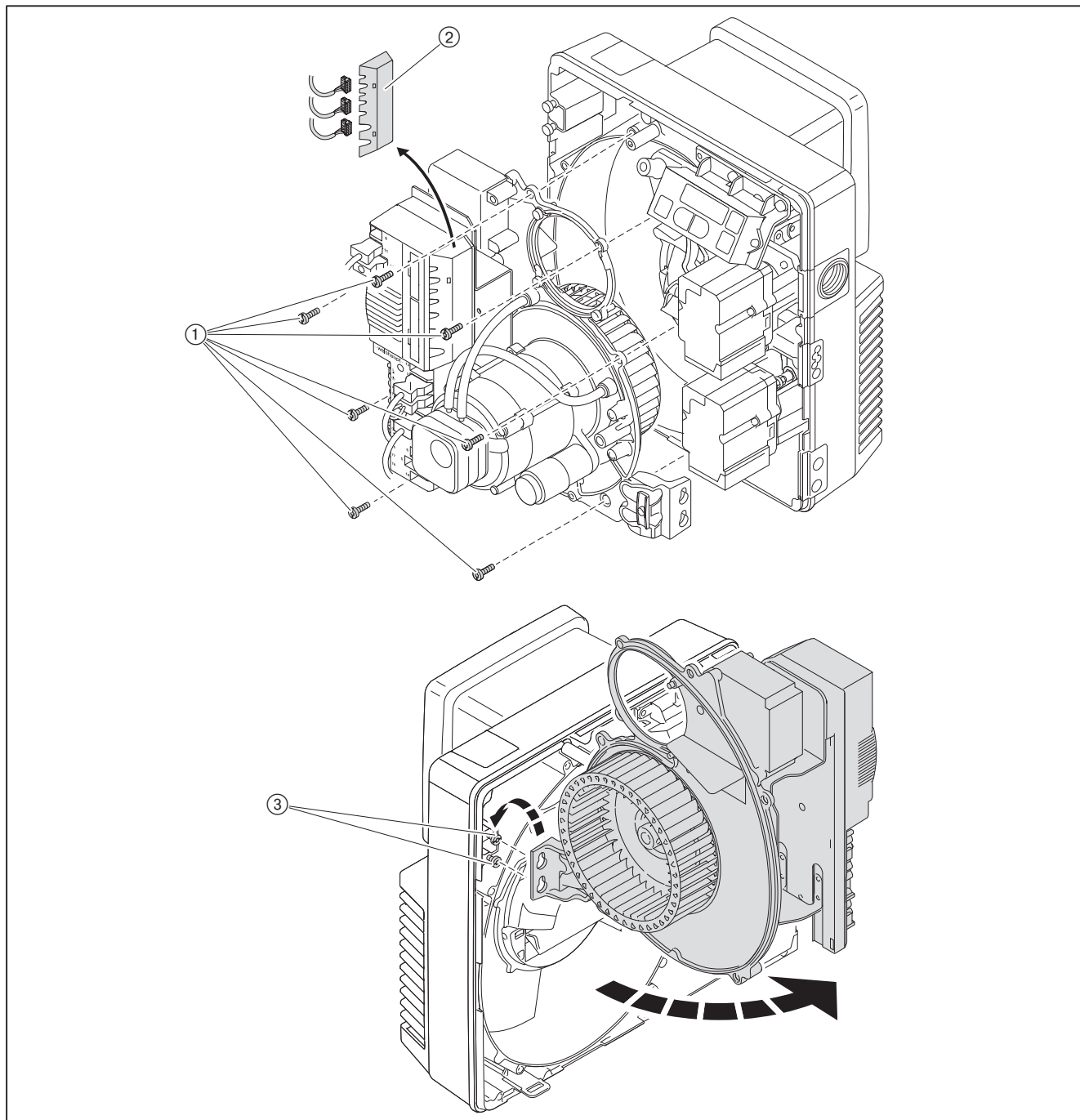
8.6 Service position

Observe the notes on maintenance and servicing (see Ch. 8.1).



The burner mounted rotated by 180° cannot be placed into service position.

- Remove the mixing head (see Ch. 8.3).
- Remove the cover ② and remove the plugs.
- Hold the housing cover and remove the screws ①.
- Place the housing cover onto the hanging bolts ③.



8 Maintenance and service

8.7 Removing and re-installing the blower wheel

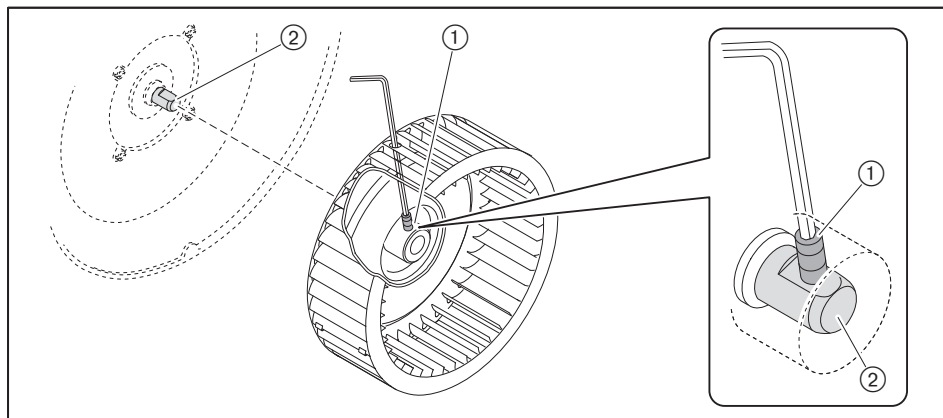
Observe the notes on maintenance and servicing (see Ch. 8.1).

Removing

- ▶ Place the housing cover into service position (see Ch. 8.6).
- ▶ Remove the set screw ① and remove the blower wheel.

Re-installing

- ▶ Re-install the blower wheel in reverse order and
 - ensure correct alignment on the motor shaft ②.
 - screw in a new set screw.
 - turn the blower wheel to ensure it moves freely.

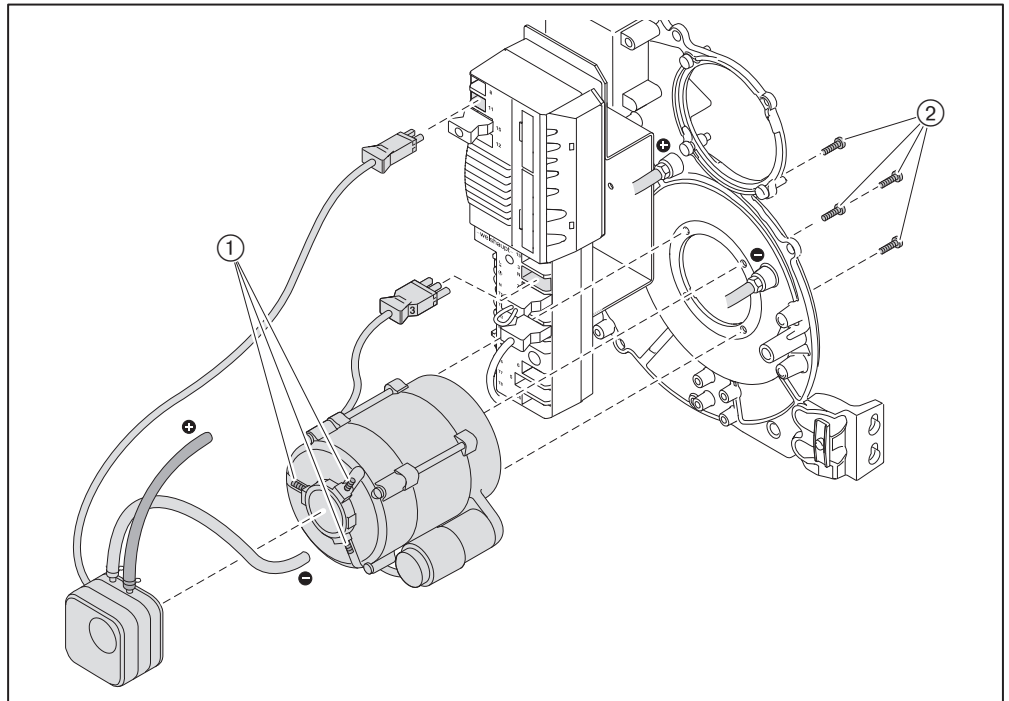


8 Maintenance and service

8.8 Removing the burner motor

Observe the notes on maintenance and servicing (see Ch. 8.1).

- ▶ Remove the blower wheel (see Ch. 8.7).
- ▶ Unplug the plugs number 3 and 11.
- ▶ Disconnect the + and - hoses.
- ▶ Remove screws 1 and the air pressure switch.
- ▶ Hold the motor and remove the screws ②.
- ▶ Remove the motor.



8 Maintenance and service

8.9 Removing and re-installing the air damper stepping motor

Observe the notes on maintenance and servicing (see Ch. 8.1).

Removing

- ▶ Remove the stepping motor plug ④ from the combustion manager.
- ▶ Remove the screws ③.
- ▶ Remove the stepping motor and the shaft ②.

Re-installing

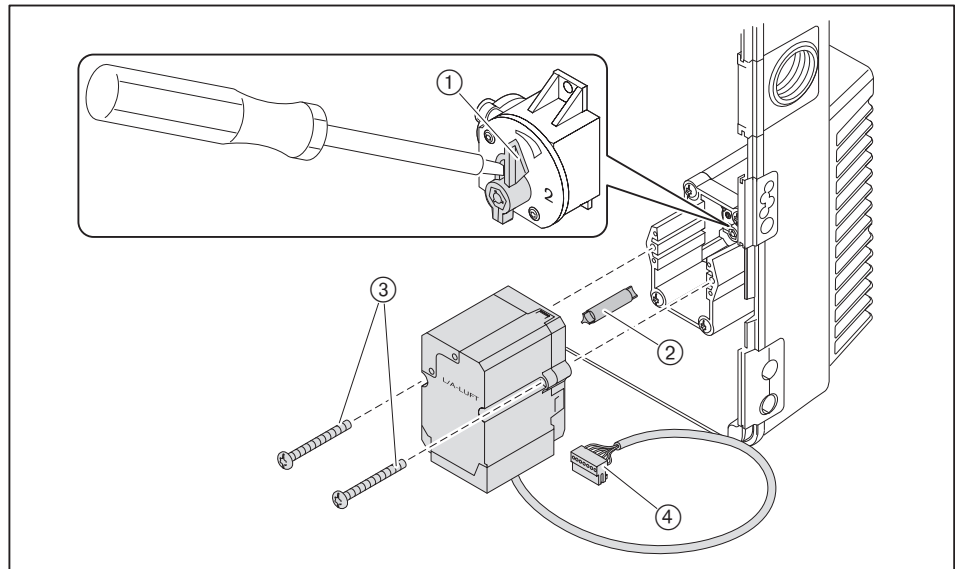


Damage to the stepping motor caused by turning the shaft

The stepping motor could be damaged.

- ▶ Do not turn the shaft manually or with tools.

- ▶ Plug in the stepping motor plug ④ at the combustion manager.
- ▶ Unplug the bridging plug No. 7 from the combustion manager.
- ▶ Switch on the power supply.
- ✓ The combustion manager checks the stepping motor and drives it to the reference point.
- ▶ Disconnect the power supply.
- ▶ Install shaft ② to the stepping motor.
- ▶ Set the indicator ① on angle drive to 0 (air damper CLOSED) and hold.
- ▶ Install the shaft with stepping motor to the angle drive.
- ▶ Install the screws ③ to the stepping motor.
- ▶ Plug in the bridging plug No. 7 in the combustion manager.



8 Maintenance and service

8.10 Removing and re-installing the angle drive

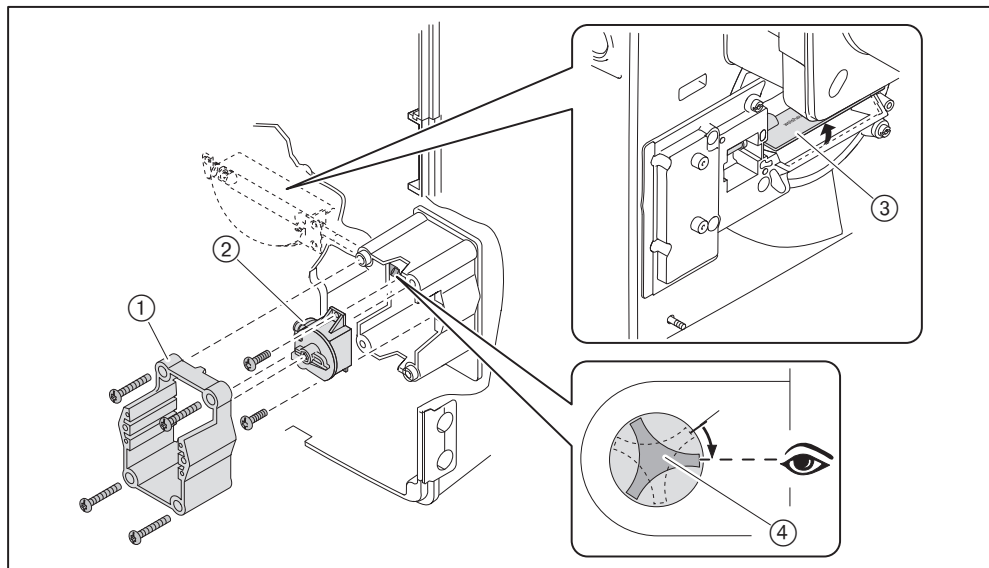
Observe the notes on maintenance and servicing (see Ch. 8.1).

Removing

- Remove the air damper stepping motor (see Ch. 8.9).
- Remove the frame ①.
- Remove the angle drive ②.

Re-installing

- Remove the intake housing.
- Open the air damper ③ until the position ④ has been reached and hold tight.
- Install and secure the angle drive.
- Install the intake housing.
- Install the frame ①.



8 Maintenance and service

8.11 Removing and re-installing the gas butterfly valve stepping motor

Observe the notes on maintenance and servicing (see Ch. 8.1).

Removing

- ▶ Remove the stepping motor plug ① from the combustion manager.
- ▶ Remove the screws ②.
- ▶ Remove the stepping motor.

Re-installing



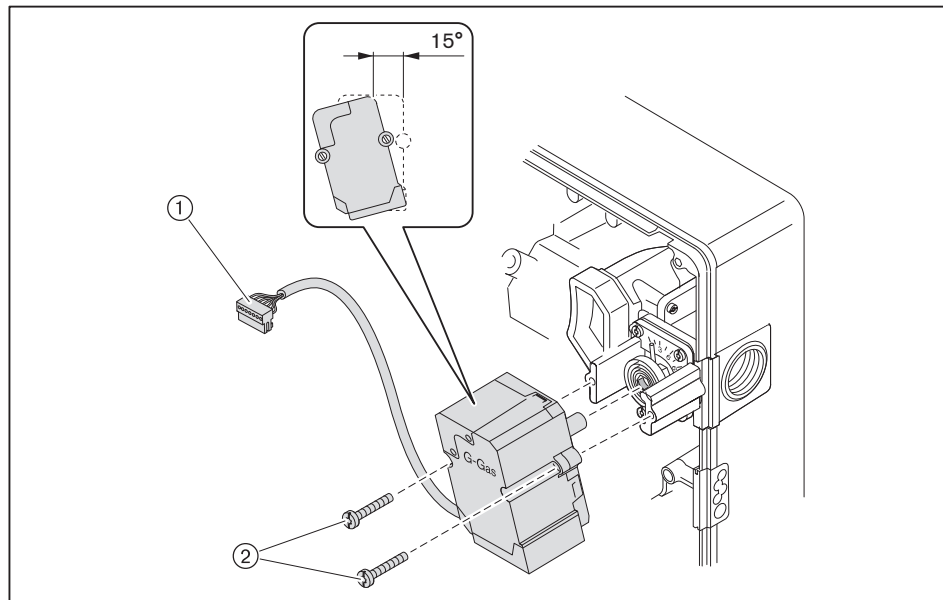
CAUTION

Damage to the stepping motor caused by turning the shaft

The stepping motor could be damaged.

- ▶ Do not turn the shaft manually or with tools.

- ▶ Plug in the stepping motor plug ① at the combustion manager.
- ▶ Unplug the bridging plug No. 7 from the combustion manager.
- ▶ Switch on the power supply.
- ✓ The combustion manager checks the stepping motor and drives it to the reference point.
- ▶ Disconnect the power supply.
- ▶ Install the stepping motor rotated by approx. 15°.
- ▶ Install the screws ② to the stepping motor.
- ▶ Plug in the bridging plug No. 7 in the combustion manager.



8 Maintenance and service

8.12 Removing and re-installing the gas butterfly valve

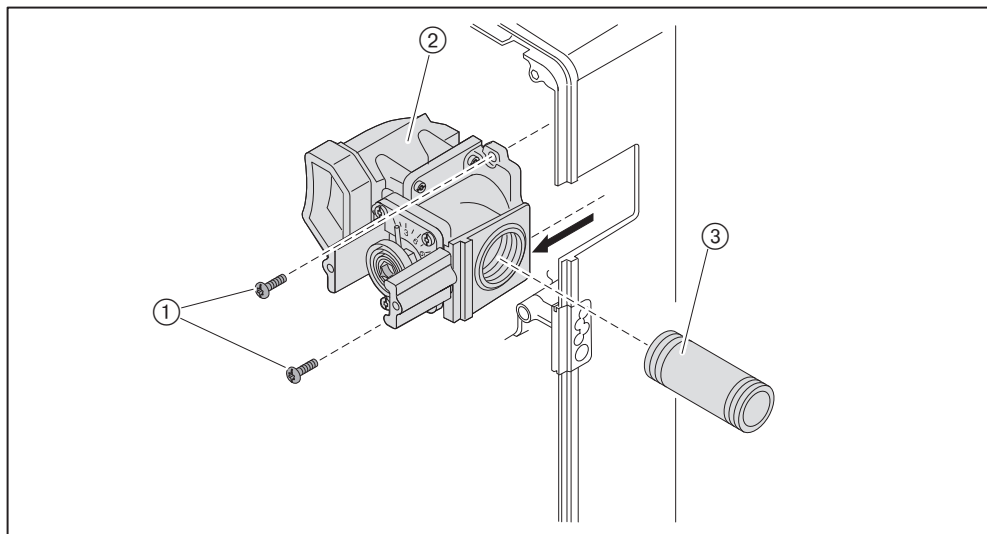
Observe the notes on maintenance and servicing (see Ch. 8.1).

Removing

- ▶ Unscrew the double nipple R1"-1"NPT ③ from the gas butterfly valve.
- ▶ Remove the mixing head (see Ch. 8.4).
- ▶ Remove the screws ① and remove the gas butterfly valve ②.

Re-installing

- ▶ Re-install the gas butterfly valve ② in reverse order, screw the double nipple ③ and perform a gas train soundness test.



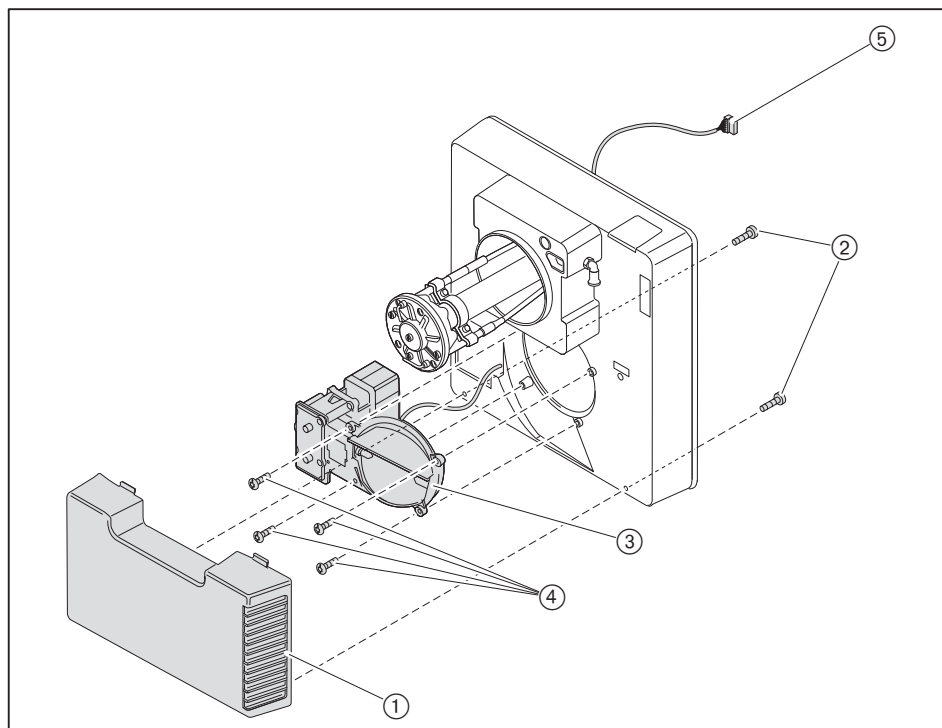
8 Maintenance and service

8.13 Removing and re-installing the air regulator

Observe the notes on maintenance and servicing (see Ch. 8.1).

Removing

- Remove the burner from the appliance.
- Remove the stepping motor plug ⑤.
- Remove the screws ②.
- Remove the intake housing ①.
- Remove the screws ④.
- Remove the air regulator ③.



Re-installing

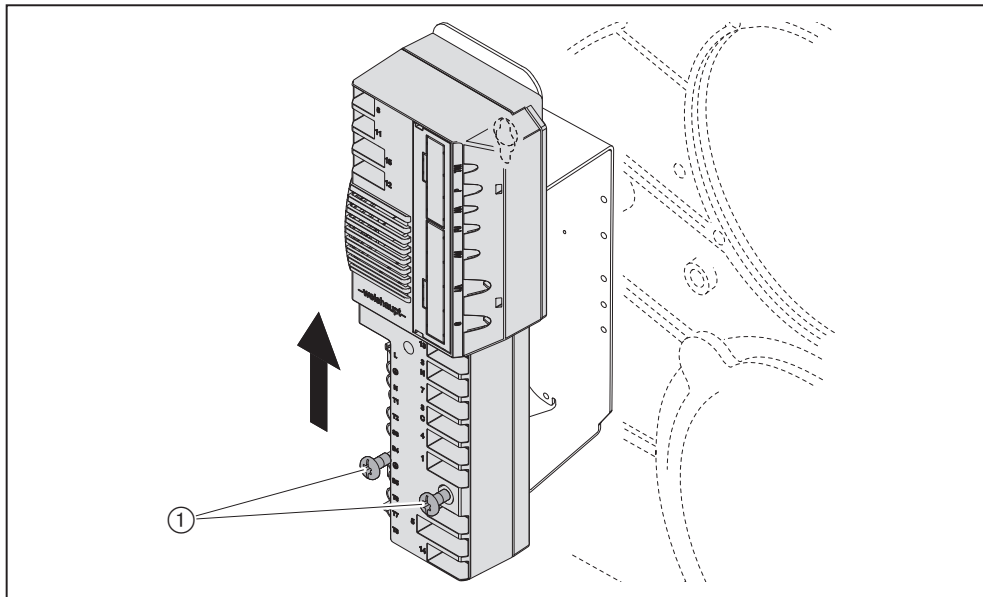
- Re-install the air regulator in reverse order.

8 Maintenance and service

8.14 Replacing the combustion manager

Observe the notes on maintenance and servicing (see Ch. 8.1).

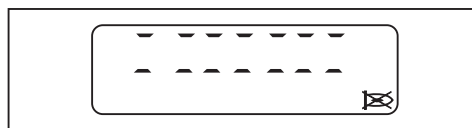
- Unplug all the plugs.
- Loosen screws ①.
- Push and slide up the combustion manager, out from the mounting bracket.



- Install the new combustion manager in reverse order.
- Re-connect all the plugs to the combustion manager.

Presetting the combustion manager

- Unplug the bridging plug No. 7 from the combustion manager.
- Switch on the power supply.
- ✓ The unprogrammed condition of the combustion manager is indicated by a flashing display.
- ✓ The burner goes to lockout.



- Press [Enter].
- ✓ Burner has been reset.
- ✓ The combustion manager goes to stand-by.

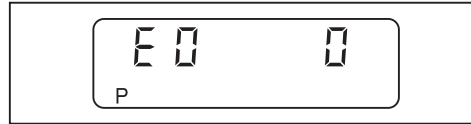


- Press [G] and [L/A] simultaneously.
- ✓ The combustion manager goes to access level.

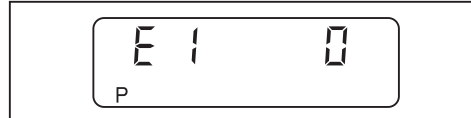


8 Maintenance and service

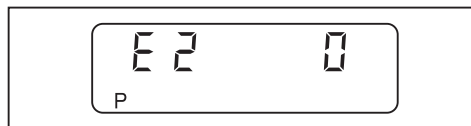
- ▶ Press [+].
- ✓ The setting level (parameter $E0$) is displayed.



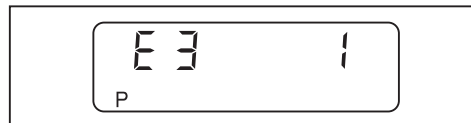
- ▶ Select value 1 (single fuel burner), if necessary, adjust using [Enter] and [-] keys.
- ▶ Press [+].
- ✓ $E1$ is displayed.



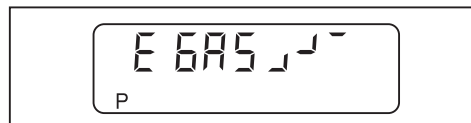
- The value of the $E1$ cannot be altered.
- 0 = intermittent operation (Standard).
 - 1 = continuous operation.
- ▶ Press [+].
 - ✓ $E2$ is displayed.



- ▶ Select value 3 (ionization electrode), if necessary, adjust using [Enter] and [-] keys.
- ▶ Press [+].
- ✓ $E3$ is displayed.



- ▶ If required, set the value 1 (blower control) using [Enter] and [+] keys.
- ▶ Press [+].
- ✓ The combustion manager changes into the setting level for the step points.



- ▶ Determine the operating points from the commissioning record.
- ▶ Set the burner using these operating points and adjust.

Deactivate the E-Parameters

Following commissioning, set the parameter E to $0FF$.

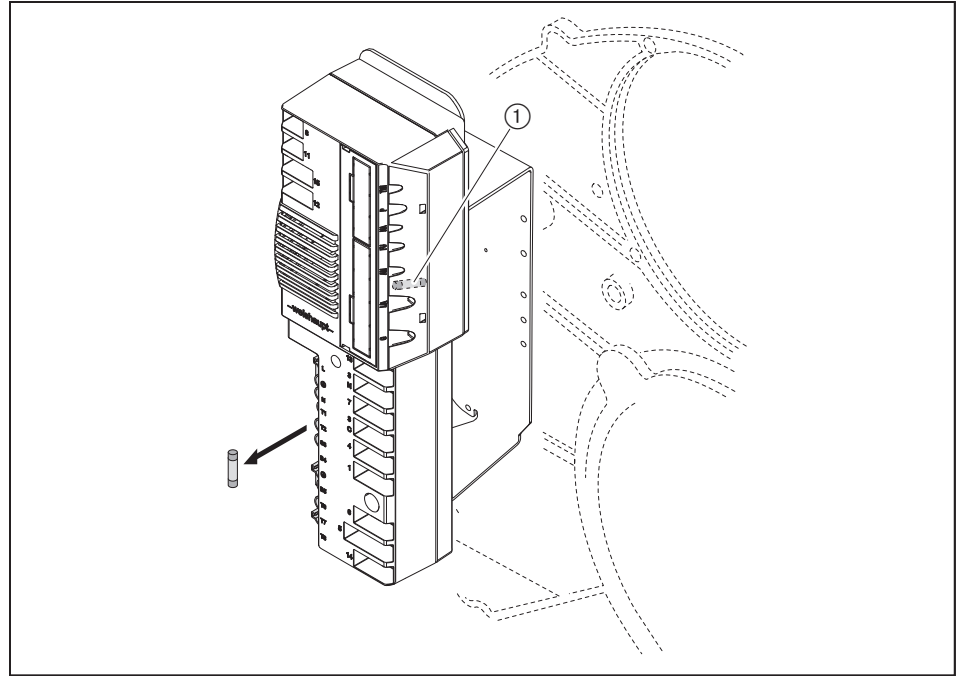
- ▶ Press [Enter] and [+] keys simultaneously for approx. 2 seconds.
- ✓ The parameter level is activated.
- ▶ Press [+].
- ▶ Press [Enter] key until parameter E is displayed.
- ▶ Set parameter E to $0FF$.
- ✓ E-Parameters are not shown in the setting level.
- ▶ Press [Enter] key twice.
- ✓ The combustion manager returns to the operating level.

8 Maintenance and service

8.15 Replacing the combustion manager's fuse

Observe the notes on maintenance and servicing (see Ch. 8.1).

- Unplug the connection plug X6 from the combustion manager.
- Replace the blown fuse with the replacement fuse ① (6.3 AT).



- Reconnect the plug X6.

9 Faults rectification

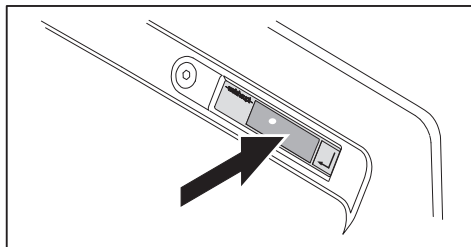
9 Faults rectification

9.1 Procedures during fault condition

The combustion manager recognizes the irregularities of the burner and displays them on the operating interface's display.

The following conditions can occur:

- Display off (see Ch. 9.1.1).
- Display showing $\square F F$ (see Ch. 9.1.2).
- Display flashes (see Ch. 9.1.3).



9.1.1 Display off

The following faults may be corrected by the operator:

Fault	Cause	Rectification
Burner not operating	External fuse has tripped/burnt ⁽¹⁾ .	► Check/replace the fuse.
	Main switch is set to Off.	► Turn the main switch to On.
	The temperature limiter or pressure limiter on the appliance has tripped.	► Reset the temperature or pressure limiter on the appliance.
	The Low Water safety interlock on the boiler has tripped.	► Top up the water in the boiler. ► Reset the Low Water safety interlock on the boiler.

⁽¹⁾ Notify Weishaupt Customer Service or your Weishaupt representative if this problem occurs repeatedly.

9.1.2 Display showing $\square F F$



The following faults may be corrected by the operator:

Fault	Cause	Rectification
Burner not operating	The temperature controller or pressure controller on the appliance has been set incorrectly.	► Adjust the temperature or pressure controller on the appliance.
	Boiler or heating circuit control is not functioning or has been set incorrectly.	► Check the function and the setting of the boiler or heating circuit control.

9 Faults rectification

9.1.3 Display flashes

A burner fault has occurred. The burner is in lockout. The error code is displayed flashing.



- ▶ Read the error code, e.g. *A7h*.
- ▶ Rectify the cause of the fault (see Ch. 9.2).

Resetting



Damage could result from incorrect servicing

The burner could be damaged.

- ▶ Do not reset more than 2 lockouts successively.
- ▶ Faults must be rectified only by qualified personnel.

- ▶ Press [Enter].
- ✓ Burner has been reset.

Fault memory

The last 9 faults are saved in the fault memory.

9 Faults rectification

9.1.4 Detailed fault codes

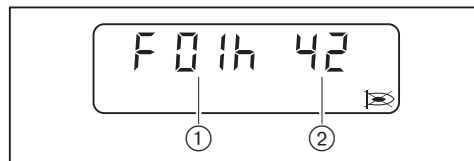
Additional information, which breaks down the error in more detail, can be displayed by pressing a button.

The first detailed fault code and the second detailed fault code are relevant only for the following faults:

- 18h,
- 41h,
- 65h.

First detailed fault code / operating status

► Press [+] key.



① First detailed fault code

② Operating status

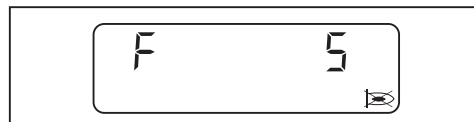
Second detailed fault code

► Press [-] and [+] keys simultaneously.



Repetition counter

► Press [G] key.



9 Faults rectification

9.2 Fault codes, causes and rectification

The following faults must be rectified only by qualified personnel:

Fault codes	Cause	Rectification
01h ... 02h 05h ... 06h 0dh ... 10h 13h ... 15h 17h 19h ... 1Ch 1Eh 43h 45h 50h 56h A0h ACh b0h ... b2h b9h	Internal unit fault	▶ Switch off the power supply temporarily. ▶ Reset the burner. If the fault re-occurs, replace the combustion manager (see Ch 8.12).
03h	Ambient temperature too high	▶ Switch off the power supply temporarily. ▶ Check the ambient temperature. ▶ Reset the burner. If the fault re-occurs, replace the combustion manager (see Ch 8.12).
	Over-voltage	▶ Switch off the power supply temporarily. ▶ Check the power supply's voltage. ▶ Reset the burner. If the fault re-occurs, replace the combustion manager (see Ch 8.12).
04h	More than 5 resets in the last 15 minutes	▶ Wait 3 minutes. ▶ Rectify the fault cause.
0Ch	Burner configuration is incorrect	▶ Check the burner configuration. ▶ Check the values in parameter level. ▶ Check parameters E0 ... E3.
11h	Low voltage	▶ Check the power supply's voltage.
12h	Power supply temporarily interrupted	▶ Check the power supply's voltage and status.
16h	Communication with TWI interface (VisionBox) is incorrect	▶ Plug in and unplug the participants on the TWI Bus only when de-energized. ▶ Reduce the number of participants on the TWI Bus. ▶ Reduce the bus cable length.

9 Faults rectification

The following faults must be rectified only by qualified personnel:

Fault codes	Cause	Rectification
18h	Switch off via PC software	-
	Second detailed fault code: A1h Invalid Fieldbus address	► Check Fieldbus address.
	Second detailed fault code: A5h Configuration at output B4 incorrect	► Check configuration at output B4.
	Second detailed fault code: A6h No keystrokes where made for 30 min. in the setting mode	-
	Second detailed fault code: A7h Off function was activated	-
	Second detailed fault code: A8h No calibration values stored in EEPROM	-
	Second detailed fault code: A9h No bus connection	► Check the bus connection.
	Second detailed fault code: B1h ... 13h Internal unit fault	► Switch off the power supply temporarily. ► Reset the burner. If the fault re-occurs, replace the combustion manager (see Ch 8.12).
	Second detailed fault code: E1h ... E7h Calibration values in EEPROM incorrect	-
	Second detailed fault code: EEh Communication to W-FM 25 failed	-
	Second detailed fault code: EFh Extension module to W-FM 25 incompatible	► Check the version.
1d1h	EMC interference	► Improve the EMC measures.

9 Faults rectification

The following faults must be rectified only by qualified personnel:

Fault codes	Cause	Rectification
44h	Operating points were changed without approval	► Re-adjust the burner.
	Parameter 53 set incorrectly	► Check parameter 53 (access level).
	Parameter 45 was changed and speed was not re-standardized	► Re-adjust the burner.
45h	Rotational direction of the burner motor incorrect	► Check rotation direction of the burner motor.
47h	Type of air stepping motor invalid	► Check parameter 34.
	Type of gas stepping motor invalid	► Check parameter 35.
48h	Plugs of stepping motors for gas and air mixed-up	► Change-over the plugs.
	Tolerance fault stepping motor	► Check freedom of movement of air damper and/or angle drive and gas butterfly valve. ► Replace the stepping motor.
49h	Stepping motor does not drive correctly to the reference point.	► Check freedom of movement of air damper and/or angle drive and gas butterfly valve. ► Replace the stepping motor.
53h	Insufficient gas, low gas pressure switch / valve proving gas pressure switch	► Check the gas connection pressure. ► Set correctly the gas pressure switch. ► Check the gas pressure switch.

9 Faults rectification

The following faults must be rectified only by qualified personnel:

Fault codes	Cause	Rectification
E5h	First detailed fault code: E0h Tolerance fault air stepping motor, gas stepping motor or VSD	► Check freedom of movement of air damper and/or angle drive and gas butterfly valve. ► Replace the stepping motor. ► Check the VSD or blower, replace if necessary.
	First detailed fault code: E1h Tolerance fault air or gas stepping motor	► Check freedom of movement of air damper and/or angle drive and gas butterfly valve. ► Replace the stepping motor.
	First detailed fault code: E2h Tolerance fault gas stepping motor or VSD	► Check freedom of movement of gas butterfly valve ► Replace the stepping motor. ► Check the VSD or blower, replace if necessary.
	First detailed fault code: E3h Tolerance fault gas stepping motor	► Check freedom of movement of gas butterfly valve ► Replace the stepping motor.
	First detailed fault code: E4h Tolerance fault air stepping motor or VSD	► Check freedom of movement of air damper and/or angle drive and gas butterfly valve. ► Replace the stepping motor. ► Check the VSD or blower, replace if necessary.
	First detailed fault code: E5h Tolerance fault air stepping motor	► Check freedom of movement of air damper and/or angle drive and gas butterfly valve. ► Replace the stepping motor.
	First detailed fault code: E7h Time run out during speed standardization Time in setting mode run out Plugs or stepping motors for gas and air mixed up	► Press [+] key within 20 sec. during speed std. ► Press key within 30 min. in setting mode. ► Change-over the plugs or stepping motors.
A2h	Safety circuit is open	► Check safety circuit.
A4h	Reverse voltage valve 1	► Check the wiring to the double gas valves.
A5h	Reverse voltage valve 2	► Check the wiring to the double gas valves.
A6h	Flame simulation/extraneous light	► Find and eliminate extraneous light source. ► Check ionization electrode.
A7h	No flame signal after safety time	► Set the ignition electrode. ► Check the ignition unit, replace if necessary ► Check the ionization electrode and cable, replace if necessary. ► Check the gas valves actuators (solenoids or motors), replace if necessary. ► Check the mixing pressure, reduce if necessary. ► Check the burner settings. ► Replace the combustion manager (see Ch 8.12).

9 Faults rectification

The following faults must be rectified only by qualified personnel:

Fault codes	Cause	Rectification
<i>ABh</i>	Flame failure during operation	► Check burner setting. ► Check the ionization electrode, replace if necessary.
<i>AGh</i>	Flame failure during stabilization time	► See <i>ATh</i>.
<i>AAh</i>	Switch contact of the air pressure switch not in stand-by	► Check the air pressure influences. ► Check the air pressure switch setting. ► Check the air pressure switch and cable, replace if needed. ► Replace the combustion manager (see Ch. 8.12).
<i>Abh</i>	Air pressure switch doesn't react	► Check the air pressure switch setting. ► Check the air pressure switch's hoses. ► Check the air pressure switch and cable, replace if needed. ► Check the burner motor and cable, replace if needed.
<i>Adh</i>	Insufficient gas at the low gas pressure switch	► Check the gas connection pressure. ► Check the gas pressure switch, press the reset button, if needed. ► Set the gas pressure switch.
<i>AEnh</i>	Valve 1 leaking during valve proving	► Check the soundness of the gas train. ► Check the setting and function of the gas pressure switch. ► Replace the valve. ► Check parameter <i>E 0</i>.
<i>AFh</i>	Valve 2 leaking during valve proving	► Check the soundness of the gas train. ► Check the setting and function of the gas pressure switch. ► Replace the valve.
<i>bBh</i>	Fault POC contact	► Check the POC contact ► Check the gas valves.
<i>bAh</i>	Flame simulation - or - extraneous light at start-up	► Find and eliminate the extraneous light source. ► Check the ionization electrode.
<i>bbh</i>	Burner shutdown via X3:7	-
<i>EAh</i>	Valve proving faulty	► Check the low gas pressure switch/valve proving gas pressure switch. ► Check the gas valves.
<i>Ebh</i>	LDW 2 doesn't switch	► Check the air pressure switch setting. ► Check the air pressure switch's hoses. ► Check the air pressure switch and cable, replace if needed.
<i>EEh</i>	Plug No. 15 is disconnected -or - High gas pressure switch doesn't react	► Plug in the plug. ► Check the gas connection pressure. ► Set the high gas pressure switch. ► Check the high gas pressure switch, replace or press the reset button, if necessary.
<i>EFh</i>	No start release (X3:14)	► Check start release.
<i>d 1h</i>	Connection to stepping motor faulty	► Check the connection.
<i>d2h</i>	More than 5 resets in the past 15 min. by remote reset (X3:14)	► Rectify the cause of fault. ► Reset the burner by the operating interface.
<i>d4h</i>	External voltage at op. signal X7:B5	► Find and eliminate the external voltage source.
	Internal unit fault	► Switch off temporarily the power supply. ► Reset the burner, replace the combustion manager if fault re-occurs.

9 Faults rectification

9.3 Operating problems

The following faults must be rectified only by qualified personnel:

Observation	Cause	Rectification
Poor start behaviour of the burner	Mixing pressure too high	► Decrease mixing pressure at ignition position.
	Ignition electrodes set incorrectly	► Set the ignition electrodes.
	Mixing head set incorrectly	► Set the mixing head.
Flame pulsating or burner booming	Mixing head set incorrectly	► Set the mixing head.
	Incorrect combustion air quantity	► Adjust the burner.]
Stability problems	Mixing pressure too high	► Decrease mixing pressure at ignition position.
No display at the operating interface	Plug connection to the operating panel incorrect	► Plug the connector correctly
	Operating interface defective	► Replace the operating interface.

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Print No. 83055116, January 2016

Product		Description	Performance
	W-Burners	The compact series, proven millions of times over: Economical, reliable, fully automatic. Gas, oil and dual fuel burners for domestic and commercial applications.	Up to 1,950 MBH
	Monarch and industrial burners	The legendary industrial burner: Tried and tested, long lived, clear construction. Gas, oil and dual fuel burners for heating plants or process applications.	Up to 37,000 MBH
	multiflam® burners	Innovative Weishaupt technology for large burners: Minimal emission values thank to special burner head. Oil, gas and dual fuel burners with patented fuel distribution system.	Up to 41,000 MBH
	WK industrial burners	Modular powerhouses: Adaptable, robust, powerful. Oil, gas and dual fuel burners for industrial plant.	Up to 100,000 MBH
	Control technology / Building Management System (BMS)	From control panels to complete building management systems – at Weishaupt you can find the entire spectrum of modern control technology. Future oriented, economical and flexible.	
	Service	Customer service completes the Weishaupt range. We're there when you need us. Everywhere.	