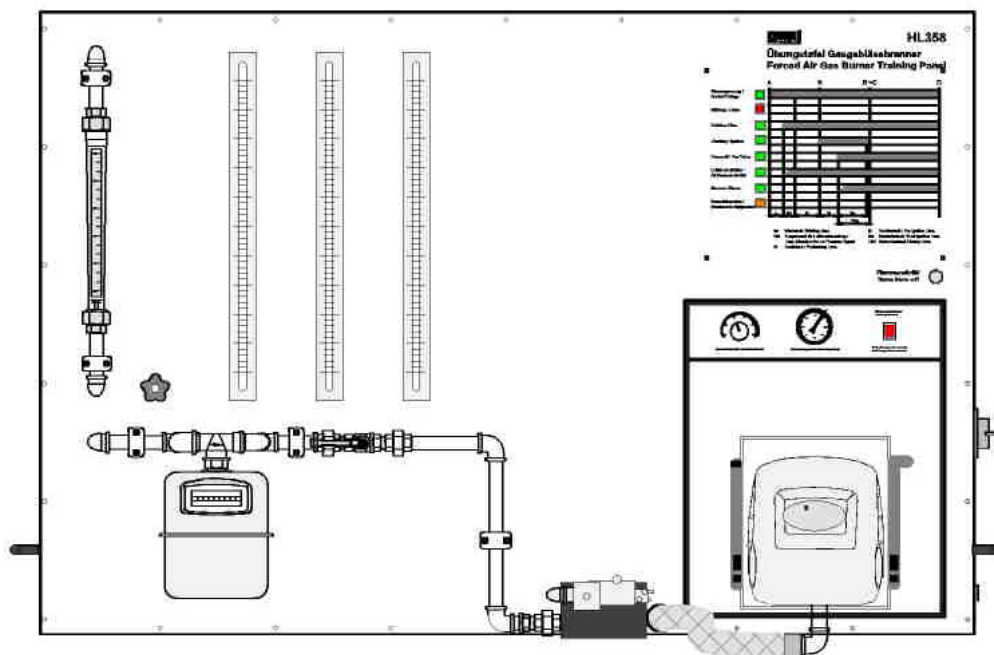


# **Instruction Manual**

HL 358      Forced Air Gas Burner  
Training Panel



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# Instruction Manual

**Please read and follow the safety regulations before the first installation!**

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## 1 Introduction

It takes practice to safely handle gas heating systems and adjust them correctly in accordance with heating requirements. Under normal circumstances, it is extremely difficult to conduct adjustment exercises on heating systems.

Moreover, the hazards arising from improper use of fuel gases almost entirely preclude free experimentation and simulation of disturbances.

The **HL 358 forced air gas burner training panel** contains all the components of a gas bench - including a forced-air burner - needed to gain familiarity with the components of such a system. The training panel can be fitted to the HL 100 Universal Stand.

Systemic safety problems are avoided by using air instead of fuel gas as the operating resource.

Burner program execution can be monitored easily on a large display.

This training panel offers the following possibilities:

- Study of components
- Display of essential operating pressures
- Display of burner control processes
- Practical adjustment of rated load via fuel gas throughput
- Safe handling in the classroom through a use of air instead of fuel gas

An essential exercise in addition to component study is adjustment of the rated load, which can be carried out here in a very transparent and practical manner. The rated load is checked by measuring pressures and throughputs.

Students perform all the required settings following a specification of basic parameters such as heat requirement, gas type, calorific value etc.

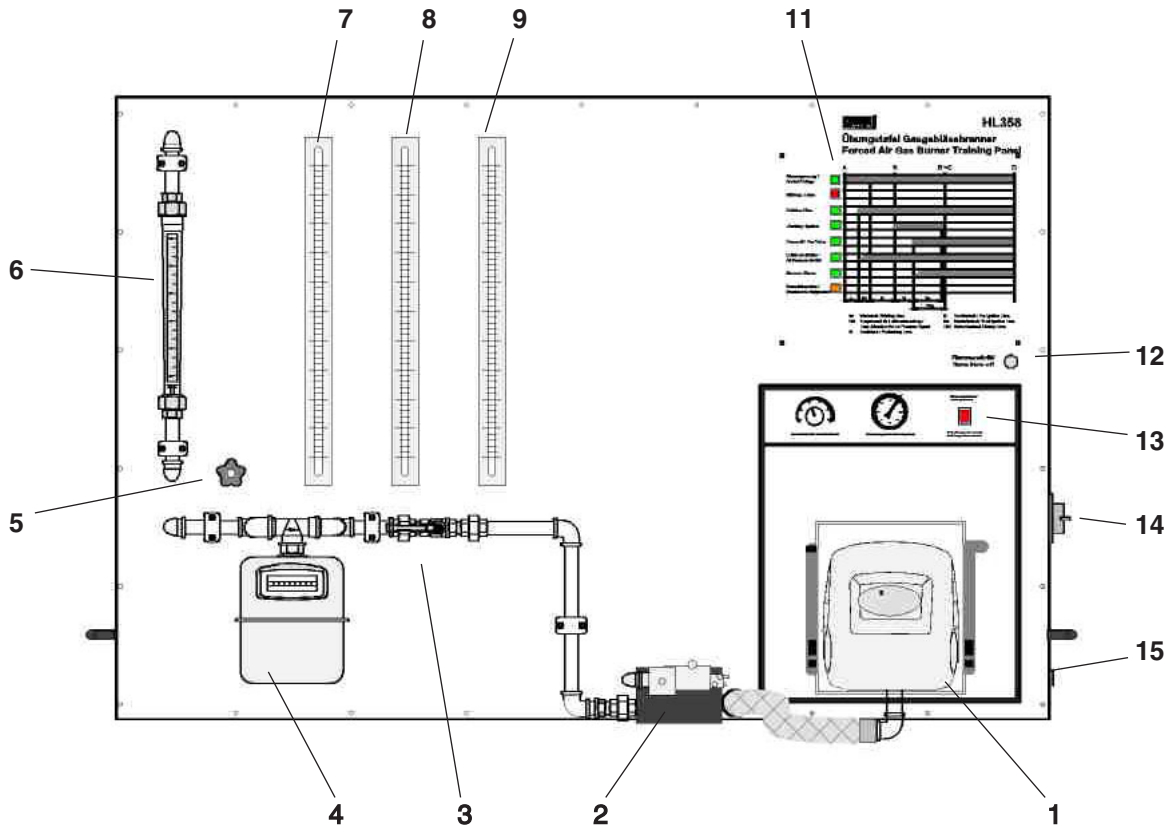
A CD-ROM with EXCEL- data file "CALCULATOR HL358" is included in the HL 358's scope of delivery. This program has been programmed at the factory to ascertain the operating volume  $V_B$  in accordance with the above-mentioned formulas.

The teacher can simulate malfunctions to be identified by the students.

**HL 358** *FORCED AIR GAS BURNER TRAINING PANEL*

**2** Device description

**2.1** Device layout



- |   |   |
|---|---|
| 1 Burner  | 11 Burner control process display with signal lamps |
| 2 Compact gas valve                                       | 12 "Flame blow-off" warning lamp                    |
| 3 Stopcock  | 13 Heating switch                                   |
| 4 Gas meter   | 14 Main switch                                      |
| 5 Manual valve for gas flow                               | 15 Power connection                                 |
| 6 Gas flow meter  |   |
| 7 Manometer for gas network connection pressure           |   |
| 8 Manometer for burner gas flow pressure                  |   |
| 9 Manometer for gas pressure in front of the baffle plate |   |

Fig. 2.1 General view of the HL 358

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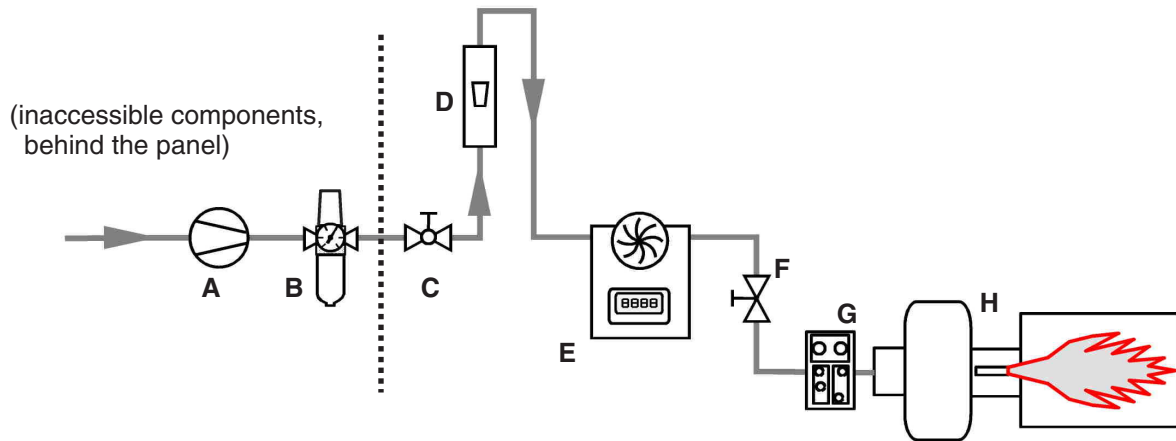
**HL 358****FORCED AIR GAS BURNER TRAINING PANEL****2.2 Function**

Fig. 2.2 HL 358 function diagram

A	Compressor	E	Gas meter
B	Pressure-reducing valve	F	Stopcock
C	Gas flow actuation valve	G	Compact gas valve
D	Gas flow meter	H	Burner

The **HL 358** training panel is a complete gas test bench containing all the relevant components. To enhance safety and facilitate handling, ordinary air is used as the working gas.

A compressor (**A**) provides the required compressed air. A pressure-reducing valve (**B**) regulates the air's system inlet pressure to **40mbar**. The compressor and pressure-reducing valve are concealed behind the training panel.

An actuation valve (**C**) is used to activate the gas flow. This also permits simulations of disturbances (e.g. gas shortages). A flow meter (**D**) is used to precisely determine the gas flow rate. A gas meter

(E) also measures the gas throughput. A stopcock (F) is used to adjust or entirely shut off the gas flow. This component also allows a simulation of disturbances (e.g. spontaneous disruption of the gas supply through full closure of the stopcock).

The compact gas valve (G) is used to dose and supply the gas to the burner. This valve is controlled electronically by a fixed program. Forming part of the burner, the control unit is normally located inaccessibly inside the burner housing. To improve visualization and facilitate readings of pressure values, the compact gas valve on the **HL 358** is installed on the outside of the housing, separately from the burner. The last element in this gas sequence is the burner (H).



### 2.3 Start-up

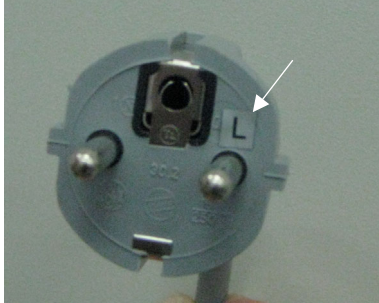


Fig. 2.3 Power plug with marker for phase (L)

- Connect the device via its terminal (15) with the power grid.

#### Notice

Do not confuse phase and ground wire. Check that the ground wire is properly connected. Phase has been marked on the power plug (refer to Fig. 2.3). In case of confusing phase and ground wire the interference cutoff end "TSA", actuated by burners furnace automatic, ensues.

- Turn on the device's main switch (14). The compressor is then activated to supply the required compressed air.

The **HL 358** training panel is now ready for operation.

**HL 358** **FORCED AIR GAS BURNER TRAINING PANEL**

**2.4 Operation**

- Turn on the heating switch (13) to start the burner program. The program sequence can be monitored by means of the signal lamps on the panel.

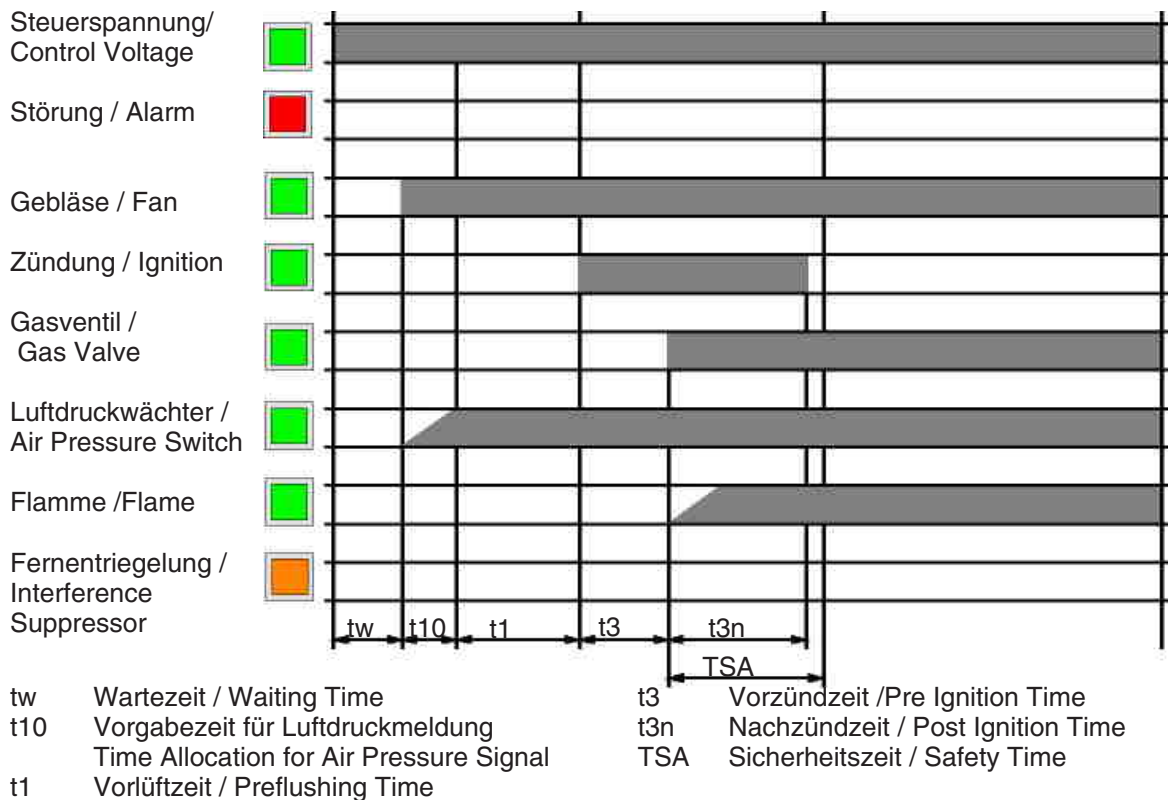


Fig. 2.4 Burner control process display



Fig. 2.5 Fault clearance button at burners housing

On the occurrence of a disturbance, the program is repeated approx. three times automatically before an alarm message occurs (red pilot lamp lights up).

The fault clearance button on top of burners housing to be pressed to restart the program sequence after the disturbance has been cleared (orange pilot lamp lights up).

Possible disturbances include:

- Gas shortage arising from excessively low supply or pressure.

Possible causes of this include:

- Clogged burner nozzles, tubes or hoses
- Excessively low gas pressure in the supply network

Disturbance simulation:

- Close the gas supply with the manual valve (22) until the automatic shutoff mechanism is triggered.
- Close the gas supply with the stopcock (3) until the automatic shutoff mechanism is triggered.

## 2.5 Determining the required gas flow

### 2.5.1 Calculation formulas

By determining and adjusting the required gas throughput (operating volume  $V_B$ ), the burner's output needs to be adapted to the boiler to be heated.

First of all, the rated volume  $V_N$  is determined:

$$V_N = \frac{Q_N}{\eta \cdot H_U}$$

This value needs to be corrected in accordance with the gas pressure / temperature and ambient pressure.

The correction factor  $f$  is determined as follows:

$$f = \frac{(p_{Baro} + p_G)}{1013 \cdot \frac{273}{(273 + T_G)}}$$

This is used to ascertain the required operating volume  $V_B$ :

$$V_B = \frac{V_N}{f}$$

$V_B$	:	Operating volume
$V_N$	:	Rated volume
$Q_N$	:	Boiler's rated output
$\eta$	:	Boiler's efficiency
$H_U$	:	Lower calorific value of the fuel
$p_{Baro}$	:	Current ambient air pressure
$p_G$	:	Gas pressure at the meter
$T_G$	:	Gas temperature at the meter

### **2.5.2 EXCEL- data file to ascertain the operating volume**

A CD-ROM with EXCEL- data file "CALCULATOR HL358" is included in the HL 358's scope of delivery. This program has been programmed at the factory to ascertain the operating volume  $V_B$  in accordance with the above-mentioned formulas.

The program then requests the necessary values in succession.

Each value needs to be entered numerically (compare Fig. 2.6).

**HL 358 Forced Air Gas Burner Training Panel**

Calculating the required gas throughput (operating volume  $V_B$ ):

$$V_B = \frac{Q \cdot p_{Baro} \cdot 273^\circ C}{(p_{Baro} + p_G) \cdot n \cdot H \cdot (273^\circ C + T)}$$

Insert measured values in green fields:

Boiler Rating Q [kW]		kW
Boiler Efficiency n [0 to 1]		
Gas Caloric Value H [kWh/m <sup>3</sup> ]		kWh/m <sup>3</sup>
Gas Temperature T [°C]		°C
Pressure Baro [mbar]		mbar
Pressure Gas [mbar]		mbar

**Operating Volume  $V_B$**  #DIV/0! **m<sup>3</sup>/h**

Insert value of pressure baro + pressure gas and calculated operating volume:

$p_{Baro} + p_{Gas}$ [mbar]	Operating Volume $V_B$

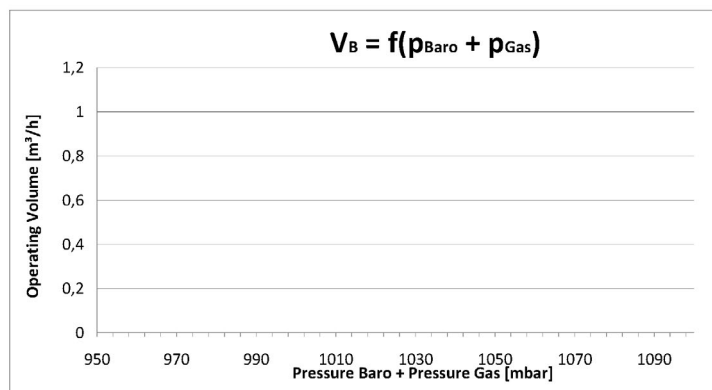


Fig. 2.6 View HL 358 EXCEL-File

### 3 Safety

#### Health hazards



- **DANGER OF ELECTRIC SHOCK Caution: High voltage** Before opening the training panel, turn off the main switch and disconnect the device from the power grid. Work on the electrical system must only be performed by qualified personnel. Protect the electrical system against moisture and spray.



- **DANGER OF EXPLOSION** Never operate the device with flammable gases.

## 4 Appendix

### 4.1 Technical data

L x W x H : 1800 x 550 x 1100 mm  
Weight: Approx. 110 kg  
Power supply: 230V, ~ 50Hz  
Refer to the type plate for alternative options

Gas burner power category: 13 ... 28 kW

Membrane pump:

$Q_{\max}$  5500 litres/h  
at 70 mbar

Gas flow pressure: 0 ... 40 mbar

Nominal gas pressure for burner:  
Approx. 4 mbar

Air flow meter: 400 ... 5200 litres/h

Tube manometer: 0 ... 50 mbar

### 4.2 Scope of delivery

- 1 Training panel, complete
- 1 CD
- 1 Operating manual