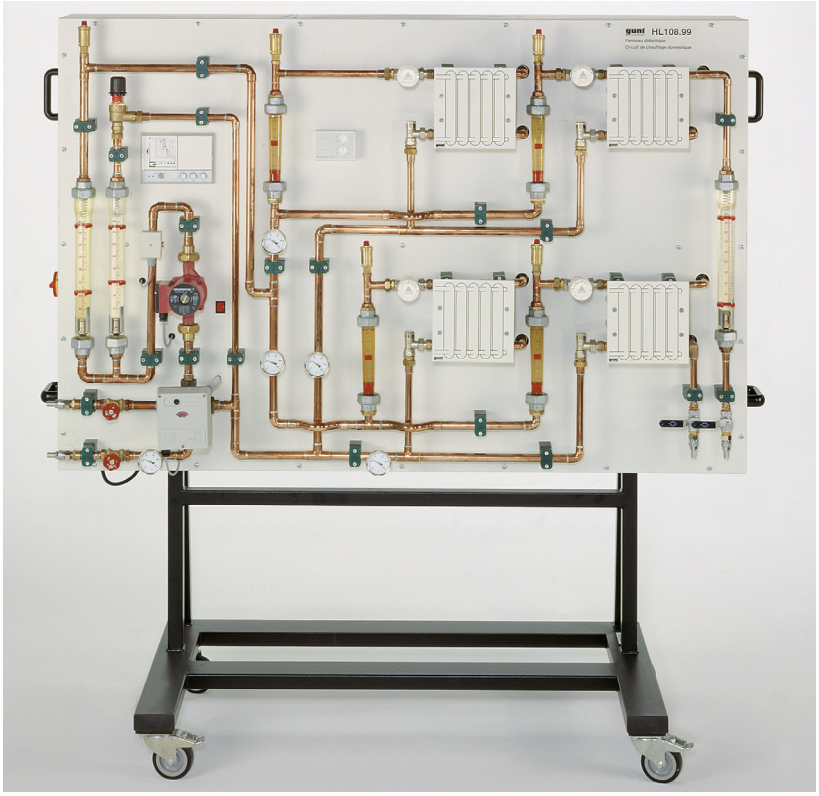
Instruction Manual

HL 108 Domestic Heating Circuit
Training Panel



Instruction Manual

This manual must be kept by the unit.

Before operating the unit:
- Read this manual.
- All participants must be instructed on handling of the unit and, where appropriate, on the necessary safety precautions.

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1 Introduction

In heating engineering today a wide range of plants and systems are built. All have one thing in common: they must control temperatures. This is performed predominantly by changing the heating water forward flow temperature. This temperature can be changed most easily using a control loop in conjunction with a mixer valve as the actuator.

During this process the load on the boiler is maintained constant and thus saves energy.

The **Domestic Heating Circuit Training Panel HL 108** demonstrates the hydraulic conditions in a heating circuit with a four-way valve.

By connecting the training panel to a boiler a complete heating circuit can be set up.

Connection to a boiler is performed using hoses and quick-action couplings.

The training panel contains both the thermostatic valves and lockshields fitted to radiators and all components that belong to a heating control system.

The heating water is pumped around the circuit by a circulating pump.

2 Safety

2.1 Intended Use

The unit is to be used only for teaching purposes.

2.2 Structure of the Safety Instructions

The signal words DANGER, WARNING or CAUTION indicate the probability and potential severity of injury.

An additional symbol indicates the nature of the hazard or a required action.

Signal word	Explanation
⚠ **DANGER**	Indicates a situation which, if not avoided, **will** result in **death or serious injury**.
⚠ **WARNING**	Indicates a situation which, if not avoided, **may** result in **death or serious injury**.
⚠ **CAUTION**	Indicates a situation which, if not avoided, may result in **minor or moderately serious injury**.
NOTICE	Indicates a situation which may result in **damage to equipment**, or provides instructions on **operation of the equipment**.

Symbol	Explanation
	Electrical voltage
	Hot surfaces
	Notice

2.3 Safety Instructions

⚠ WARNING

Exposed electrical connections at open components.

Risk of electric shock.

- Disconnect from the mains supply before opening.
- Work should only be performed by qualified electricians.
- Protect the components against moisture.

⚠ DANGER

Pumpe and components become hot during operation.

Risk of burns.

- Leave the unit cool down before touching.

⚠ DANGER

Hot water.

Risk of scalding.

- Leave the pump cool down before bleeding.

NOTICE

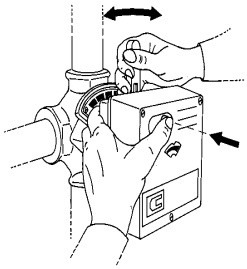
Dry running can damage the pump.

- Never operate the pump without water.

NOTICE

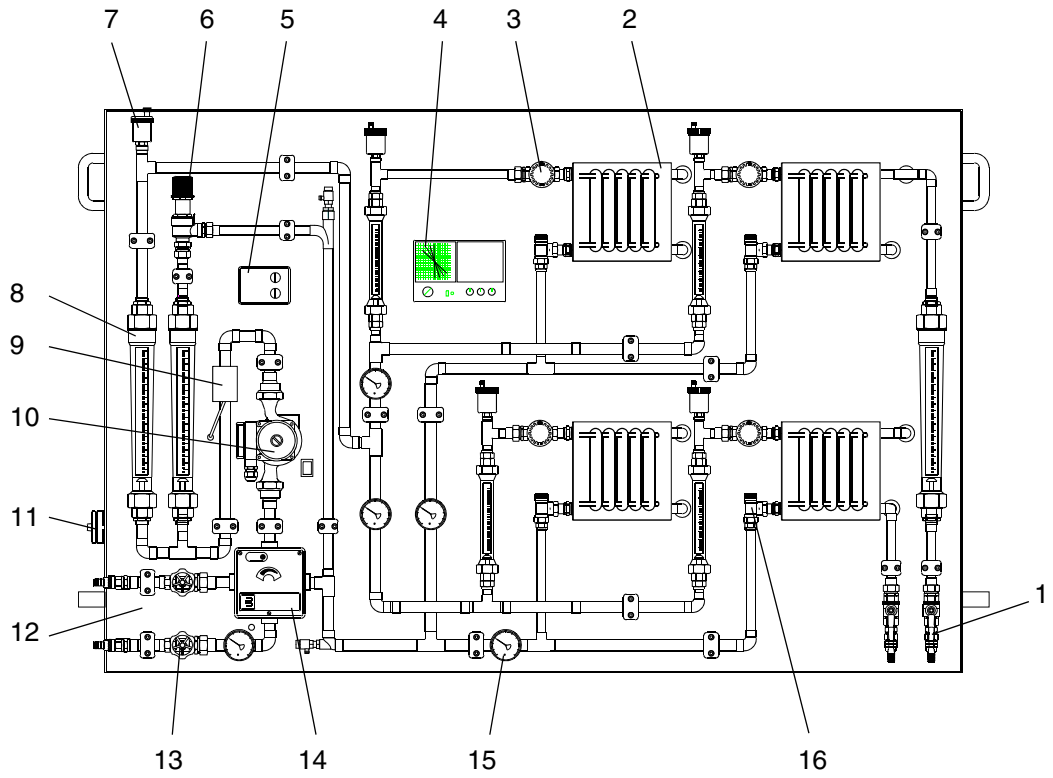
Risk of damage of the locking mechanism.

- Always press the button for manually adjusting the mixer valve.



3 Unit Description

3.1 Unit Layout



1	Ball valve	9	Forward flow temperature
2	Plate heat exchanger (not visible)	10	Circulating pump
3	Thermostatic valve	11	Master switch
4	Heating controller	12	Training panel
5	Room temperature sensor	13	Gate valve
6	Differential pressure overflow valve	14	Four-way valve with actuator motor
7	Quick bleeder	15	Bimetallic thermometer
8	Flowmeter	16	Lockshield

Fig. 3.1 Layout HL 108

3.2 Components of the Unit

3.2.1 Thermostatic Valve

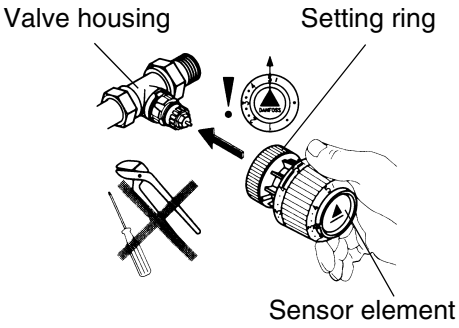


Fig. 3.2 Fitting sensor element

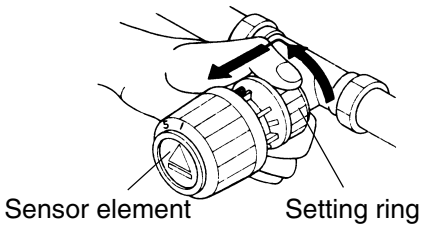


Fig. 3.3 Dismantling and tensioning the fastener

The thermostatic valve is divided into the valve housing and the sensor element.

- Fitting sensor element
  The sensor element is fitted to the valve housing with the marking pointing upward. It is fitted without tools. As it is pressed on, the locking ring snaps closed and the sensor element is fastened in place.
- **Dismantling and tensioning the fastener**
  To dismantle the locking ring is turned counterclockwise and the sensor element removed. During this process the snap-action device is tensioned.

3.2.2 Lockshield

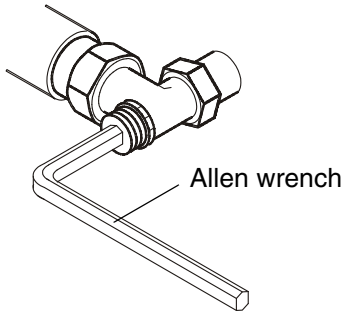


Fig. 3.4 Adjustment of water amount

The lockshield can be pre-set.

Adjustment is performed using a 6mm allen wrench. There is a protective cap over the socket head screw.

In the first step the fitting is closed completely. The adjustment of the required amount of water or the resistance is performed by means of the stepless opening of the fitting.

3.2.3 Four-Way Valve

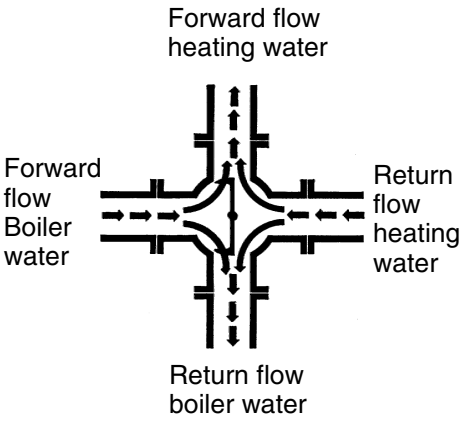


Fig. 3.5 Four-way valve

The four-way valve meets two requirements:

It regulates the required heating forward flow temperature and protects the boiler from low temperature corrosion. It addresses the first task by mixing hot boiler forward flow water with the cooler heating return flow water.

At the same time the valve should feed to the boiler return flow sufficient hot forward flow water so that temperature does not drop below the critical return flow temperature (boiler-dependent 50 °C...75 °C).

Four-way valves raise the boiler return flow temperature and prevent incorrect circulation to the radiators via the boiler return flow.

If the four-way valve is to be adjusted by hand, it only necessary to press the knob on the actuator motor. The valve position is then to be set using the hand lever.

3.2.4 Differential Pressure Overflow Valve

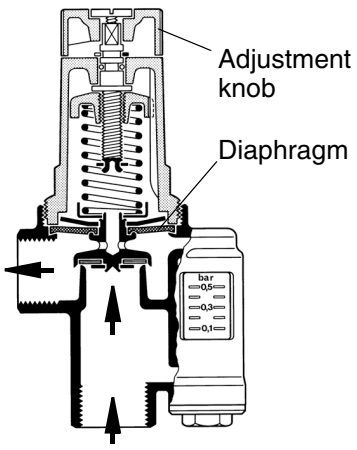


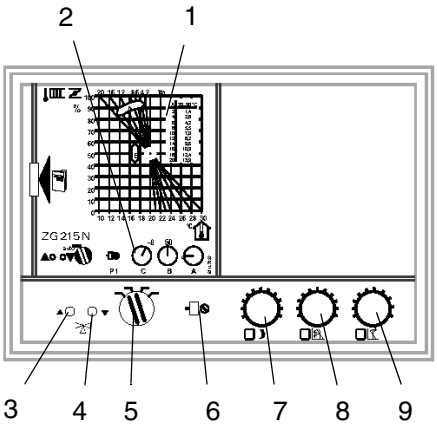
Fig. 3.6 Differential pressure overflow valve

The differential pressure overflow valve has the task of opening at a certain pre-set pressure.

If all thermostatic valves in the heating system are closed, the pressure in the pipe increases. To compensate for this pressure, a bypass with a differential pressure overflow valve is installed between the heating forward flow and heating return flow. This also prevents flow noise in the thermostatic valves on the radiators.

A safety valve has the disadvantage that the pressure escapes to atmosphere, and thus water and heat are lost.

3.2.5 Heating Controller



1 Heating curve diagram
2 Basic settings
3 „Hotter“ LED
4 „Colder“ LED
5 Operating mode selector
6 Sensitivity
7 Reduced mode
8 Operating point setting
9 Proportional range

Fig. 3.7 Heating controller

The heating controller ensures that the required room temperature is maintained. This is performed in conjunction with the following individual items of equipment:

The room sensor, comprising sensor and selector, provides two variables to the controller:

1. The actual room temperature measured by the sensor and
2. The temperature set on the selector knob

These values are compared in the controller, which decides of whether more or less heat is to be supplied to the room

The forward flow sensor controls the heating forward flow temperature. If the forward flow temperature varies from the required value, then the controller signals the actuator motor that adjusts the valve accordingly until the correct supply of heat to the radiators is provided.

This situation is achieved by the valve by means of the stepless change of the mixing ratio between hot boiler water and cold water flowing back from the heating system.

Refer to the manufacturer’s instruction manual for information on the operation of the controller.

Example: Setting the room temperature

On setting knob P2 of the Room Temperature Sensor (5) the setting of the room temperature can be fine tuned. The setting without the remote control is always 20°C. With the installed remote control another stet value may be tuned.

The scale on the selector is divided from -7...+7 and corresponds more or less to the variation in degrees.

+: Increasing the room temperature

-: Lowering the room temperature

The values of the selector knob **P2** and of the setting knob „B“ on the control unit are added to the controllers basic setting of 20°C.

Examples:

Selector knob P2	-1	0	+1	+2
Room temperature in °C	19	20	21	22

Tab. 3.1

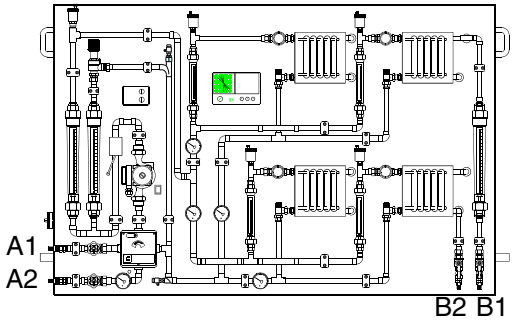
If no temperature selector is available, the desired room temperature can be set only on the setting knob „B“ of the Heating Controller (4).

NOTICE

The gate valve (13) is allways one rotation open.

3.3 Commissioning

3.3.1 Bleeding of the System



A1	Boiler water forward flow
A2	Boiler water return flow
B1	Cold water forward flow
B2	Cold water return flow

Fig. 3.8 Connections

The connections A1 (forward flow) and A2 (return flow) are connected to the boiler water circuit on a suitable boiler.

The system is filled via the filler connection on the boiler, on which there must also be an expansion vessel.

- Place four-way valve in the middle position, fully open gate valves A1,A2 and all thermostatic valves,
- Close shut-off valve in the return flow on the boiler side, undo connection A2, fit connection A2 to a drain or place a bucket underneath
- Open filler cock on boiler side
- The system must be flushed until the air is expelled out of the system via A2 and, after briefly closing and opening the gate valves, no more air bubbles rise up through the variable area flowmeter
- Close gate valve A2
- Continue to fill until the required system pressure (manometer on boiler side) has built up
- Close filler cock on boiler side
- Reconnect A2 to boiler water return flow
- Open gate valve A2.

3.3.2 Bleeding of Pump

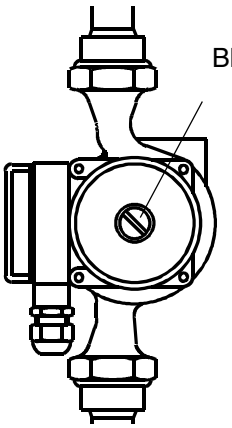


Fig. 3.9 Bleeding of pump

- Switch on pump
- Undo bleed screw on the pump until water without air escapes
- Close bleed screw.

3.3.3 Connecting Cold Water Supply

Connect cold water supply to B1. Connect B2 to a drain. The volumetric flow rate can be adjusted using the ball valve.

4 Principles

The basic principles set out in the following make no claim to completeness. For further theoretical explanations, refer to the specialist literature.

In pipe systems pressure loss, flow rate and flow speed are directly related. The individual fittings in the pipe system generate individual resistances that produce a total resistance. This total resistance of the pipe system has the same magnitude as the pump pressure in pumped heating systems. Pipe system characteristic curve and pump characteristic curve meet at the operating point that is always on the pump characteristic curve. The hot water flows from the higher pressure to the lower pressure.

On the installation of control valves, e.g., thermostatic valves in a flow circuit, the valve must have a certain portion of the total pressure drop in the circuit so that it is effective and has good control behaviour. This is termed **valve authority**.

As the amount of heat required at the individual radiators changes (position of the thermostat on the valve), the state and conditions in the overall system also change. Thermostatic valves may fully open, e.g., on the entry of cold air through open windows. The flow rate then increases. During this process, the radiators close to the boiler may draw extremely large amounts of water while heating up again. The radiators at the end of the system are then not supplied with hot water to suit the amount of heat required. For this reason the maximum amount of hot water to the individual radiators must be limited corresponding to the calculated amount of heat required. This is termed **hydraulic compensation**.

The amount of heat required in a building due to the exchange of heat between room and surroundings is the amount of heat to be provided by the boiler that is necessary to maintain the room temperature constant at a required temperature with the lowest possible losses. Here there exist fixed relationships between the outdoor temperature, the room temperature, and the heating forward flow temperature. A constant room temperature is always assigned to a specific forward flow temperature. To keep the room temperatures constant with fluctuating heat requirement, the amount of heat supplied to the radiators must be changed. This change to the amount of heat required is made either by changing the circulation volume at constant circulation temperature, or by changing the circulation temperature at constant circulation volume.

In general the circulation temperature / forward flow temperature is varied. The forward flow temperature is maintained by means of a control system. The actuator in such a control system is a mixer valve or mixer gate.

5 Technical Data

Dimensions

Width	1850	mm
Depth	400	mm
Height	1150	mm
Weight	approx. 140	kg

Connections

Power supply	230V, 50	Hz
Nominal consumption (rating)	0,1	W
Alternatives optional, see type plate		
Water supply	1,5	bar
2 x Cold water connection	DN 15	
2 x Boiler water connection	DN 15	

Circulating pump:

Rating	60	W
Capacity, maximum	60	ltr/min
Delivery height, maximum	4	m

Flow meter

Measuring ranges		
4 x Measuring range	0...400	ltr/h
1 x Measuring range	0...1000	ltr/h
2 x Measuring range	150...1600	ltr/h
Connection	1	”

Bimetal indicator thermometer

Diameter	NG 63	
Measuring range	0...100	°C

Heat exchanger

Number of plates	8	
Rating	3	kW
Connection	3/4	”

Four-way valve with actuator motor

Connection	DN 20
Control three point	

Heating controller with feedback of the forward temperature

Inputs 2 x temperature sensors

Output three point