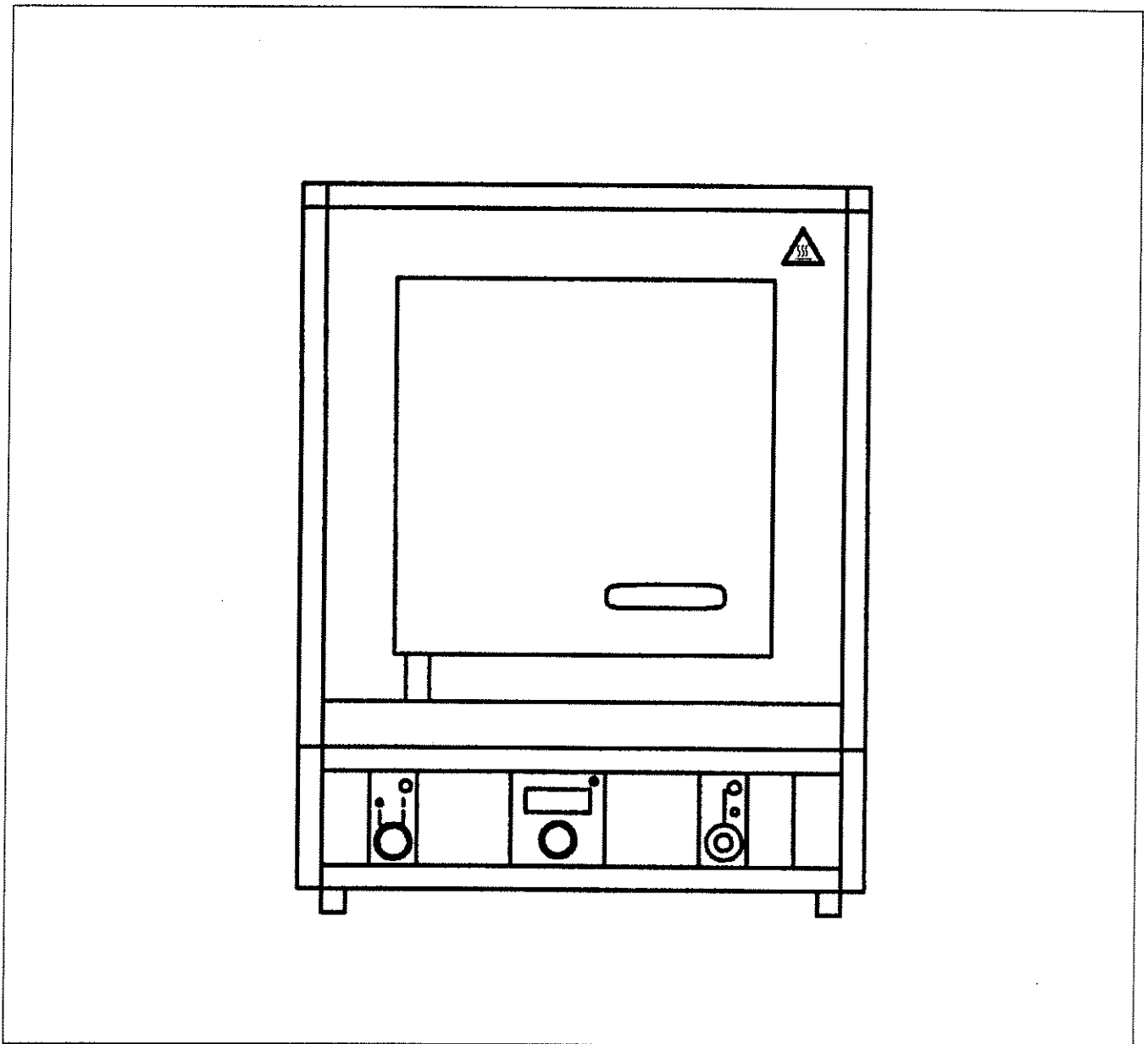


Laboratory Muffle Furnace

M 110



Below is a list of the international Thermo marketing organizations.

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To ensure the safety of personnel, the environment and samples, it is of paramount importance that the operator use these furnaces correctly.

To avoid errors and causing damage, especially personal injuries, be sure to read this manual before using the equipment and to follow all instructions.

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1. GENERAL SAFETY INSTRUCTIONS

EXPLANATION OF ICONS

Icons	Explanation
	This icon marks chapters and sections of the instruction manual dealing with safety topics.
	Caution hot surface! Danger of injury !
	Marks information on most effective use of the unit.
	Unit OFF Unit ON
 	Over-temperature protection, upper limit cut-out Deactivation of over-temperature protection
 on off	Exhaust fan Exhaust fan on Exhaust fan off

1. GENERAL SAFETY INSTRUCTIONS

GENERAL INFORMATION

The unit meets the following safety standards : EN 61010-1:2001
 EN 61010-2-010:2003
 EN 61326:1997

When requesting information or ordering replacement parts, please include the data on the nameplate of your unit.

OPERATING INSTRUCTION

The operator (company) is expected to provide anyone who works on or with the equipment with written instructions for the tasks to be performed based on this instruction manual. These instructions should be easy to understand and in the language of the persons operating the equipment.

▪ LOG BOOK

We suggest that you keep a log book to document information on tests, calibrations and work done on or with the unit, such as maintenance and alterations (see APPENDIX for suggestions).

SAFETY INSTRUCTIONS

To ensure the safety of personnel, the environment and samples, it is of paramount importance that the **operator** uses these laboratory furnaces correctly.

To avoid errors and causing damage, especially personal injuries, be sure to read this manual carefully before using the unit and to follow all instructions.

When installing and operating the unit, be sure to **comply additionally with all applicable laws, regulations and guidelines of your country.**

The **operator** (company) is expected **to provide** anyone who works on or with the equipment with **written instructions** for the tasks to be performed **based on this instruction manual**. These instructions should be easy to understand and in the language of the persons operating the equipment.

1. GENERATION SAFETY INSTRUCTIONS



SAFETY INSTRUCTIONS

The **unit is not to be used** to heat foods.

The **unit is not to be used** for drying or heat treatment of substances which release into the atmosphere gases or vapours that are flammable or dangerously explosive when mixed with air. This furnace is equally unsuitable for the heat treatment of combustible dusts and fibrous materials.



Metal surfaces around the mouth of the furnace become hot at high operating temperatures. There is a **DANGER OF INJURY**. Avoid contact with these furnaces.

Special measures must be taken and strictly observed during **external temperature measurement** to ensure protection of personnel from electric shocks.

The **door-operated safety switch is to be tested** at regular intervals, at the very least once per year, to ensure that it is technically in perfect working order.

To safeguard temperature protection functions, perform a functional **test of the over-temperature protection system** at appropriate intervals (at least every 3 months). Its electrical functions should be tested additionally, at least once each year.

Exhaust gases resulting from heat treatments are to be **safely conducted out of the room**. Be sure to observe the environmental protection measures and regulations applicable in your country.

Test the mains supply cable and connecting plug for possible defects before using the unit. The unit is not to be connected to the mains circuit if defects are detected.

The voltage specified on the nameplate of the unit must match the voltage delivered by the mains power supply.

Work on electrical components installed in the unit may only be carried out by Thermo service personnel. The unit is to be disconnected from the mains power supply during servicing.

Use **only authorized replacement parts**. The use of any other parts can present unforeseeable risks and is not approved under any circumstances..

To ensure the proper functioning and safety of the unit, all necessary tests, maintenance and repair work should be carried out by Thermo service personnel or someone authorized by our company.

Thermo Electron LED GmbH cannot be made liable for any damage caused by the unit if repair work, which is not carried out by Thermo service centres, leads to faulty operation of the unit, or if parts other than authorized **REPLACEMENT PARTS AND ACCESSORIES** are used.

Export versions of the unit, without over-temperature protection systems, may only be operated under constant observation.

2. AREAS OF APPLICATION

The muffle/chamber furnace is designed for thermal technology applications in the laboratory.

- Volume of furnace 9 l
- Heat treatment of samples and objects from 300°C to 1100°C
- Loads of up to 5 kg

The unit is generally designed for installation and operation in the following areas:

- Laboratories, such as those found in manufacturing trades and industry, schools, universities, hospitals and biology.

It is used for:

- aging, analysis, tempering, decomposing, baking, annealing, hardening, soldering, oxidizing, reducing, incineration and preheating.

The over-temperature protection "upper limit cut-out" which can be supplied with the unit enables operation without constant supervision.

The unit is designed for continuous operation.

To avoid samples being unevenly exposed to heat, care must be taken to maintain a distance from the inner surfaces of the furnace work chamber.

Provisions should always be made to provide operators with protective clothing, such as working gloves and protective goggles, due to the often high temperatures existing in the working environment.



Do not use the unit:

- to heat up foods.
 - for drying or heat treatment of substances which release into the atmosphere gases or vapours that are flammable or dangerously explosive when mixed with air. This furnace is equally unsuitable for the heat treatment of combustible dusts and fibrous materials.
-
-

3. DESCRIPTION OF UNIT

The basic design of the unit comprises casing, work chamber, tilting door and switching and controlling components.

The furnace chamber is heated from two sides. The Cr Fe Al heating coils are inserted in replaceable grooved stones and covered with silicon carbide.

Fibre materials provide the unit with thermal insulation. These materials have good heat containment properties and temperature/time parameters.



The metal surfaces around the mouth of the furnace can become extremely hot during operation at high temperatures. Care must be taken against the danger of injury. To warn against touching them, these surfaces have been marked with the symbol shown here.

The furnace chamber is closed by a swivel door.

The door is opened and closed by a lever on the right side of the unit. The hot interior side of the door swings to the left when the door is opened.



The hot interior swivels away from the operator. In the area of intense heat in the interior, do not place any easily flammable materials. Do not put your hands in this area - RISK OF SEVERE BURNS !

There is an aperture (5 mm dia.) in the middle of the swivel door which serves as an access for encased thermocouples providing external measurement of temperatures inside the furnace chamber.



Special measures must be taken and strictly observed to ensure protection of persons against electric shock when using external temperature measurement devices. Failure to observe these measures is EXTREMELY HAZARDOUS and presents a DANGER of DAMAGE TO ALL CONNECTED SYSTEMS - please refer to instructions in the appropriate section of this manual.

The controls for built-in electrical components are integrated in the control panel of the switching and control unit.

The unit is designed as a plug-in unit and is supplied with a fixed mains connection. A PE conductor (protection class I) provides protection against electric shock.

The laboratory furnace is equipped with radio interference suppression.

Temperature control is provided by an electronic temperature controller featuring a sensor defect indicator. The interior temperature is measured by an NiCr-Ni thermocouple. A power semiconductor in the temperature controller regulates the power supplied for heating.

3. DESCRIPTION OF UNIT



SAFETY FEATURES

The unit is designed to provide the following safety features:

- Protection of the operator from injury (burns) and dangerous currents
- Protection against the risk of fire in the work area
- Thermal protection of the load during normal operation and in case of breakdown

■ DOOR-OPERATED SAFETY SWITCH

At operating temperatures above 700°C, the conductivity of the ceramic insulation inside the work chamber is likely to increase. To safeguard against electric shock, the unit is equipped with a reliability-tested positive-open safety switch.

When the tilting door is opened, all poles of the heating current are disengaged and galvanically isolated from the mains power supply circuit.



The door-operated safety switch must be tested at regular intervals, at the very least once per year, to ensure that it is in technically perfect working order.

■ OVERTEMPERATURE PROTECTION FEATURE

The unit is supplied with an electronic upper limit cut-out (TWB) with sensor defect recognition. It is electrically and functionally independent of the temperature control system.

When functioning properly, the TWB shuts down the unit across all poles of the current to the heating elements when temperatures rise above the preset temperature limit, thereby activating the red "malfunction" indicator. The unit is reset manually (control panel key) once the unit has cooled. A tool, such as a coin or screwdriver, is used to adjust the preset temperature value.



To safeguard temperature protection functions, test the over-temperature protection system periodically to ensure that it is functioning properly (at least every 3 months). Its electrical parts should be tested additionally at least once a year.

Please refer to the section "Control panel / Over-temperature protection" for detailed information including how to functionally test and adjust the TWB.

3. DESCRIPTION OF UNIT



SAFETY FEATURES

- SAFETY EXTRA-LOW VOLTAGE

The measurement and control circuits of the control and monitoring system, which have the galvanic contact to the furnace chamber, are isolated from the mains power supply (SELV). This ensures protection against electric shock when the furnace door is open and the controller remains switched on.

It is thus not necessary to switch off the control devices.

- UNITS WITHOUT OVER-TEMPERATURE PROTECTION

Export versions of the unit can also be supplied without over-temperature protection.



Units without over-temperature protection are only to be used when their operation is constantly monitored.

3. DESCRIPTION OF UNIT


OPTIONAL FITTINGS

- Thermicon® P TEMPERATURE CONTROLLER
(see section CONTROL PANEL for description)

On customer request, the unit can be supplied with a programmable temperature controller.

- EXHAUST FAN
(see section CONTROL PANEL and the chapter SETUP AND INSTALLATION for detailed description)

The unit can be equipped with an exhaust fan to expel exhaust gases generated by heat treatment.

 **Exhaust gases resulting from heat treatment must be safely conducted out of the room. Be sure to observe the environmental protection measures and regulations applicable in your country.**

ACCESSORIES ¹⁾

Accessories available for the muffle/chamber furnace:

- FURNACE TRAY

Heat resistant steel (material no.: 1.4841); used as a tray or as a shelf for samples loaded into the chamber.

- EXHAUST FLUE

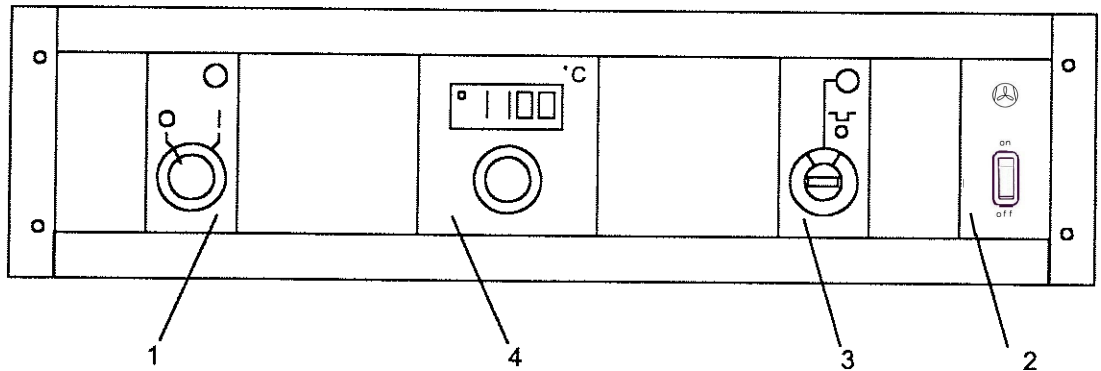
To conduct exhaust gases generated during heat treatment into laboratory or building extraction systems. Refer to the chapter SETUP AND INSTALLATION for further instructions on installation.

¹⁾ For details on ordering see chapter AUTHORIZED REPLACEMENT PARTS AND ACCESSORIES

3. DESCRIPTION OF UNIT

CONTROL PANEL

The items specified refer to the descriptions below.
Fig. 1/3: CONTROL PANEL



- 1 Mains switch
- 2 Exhaust fan switch
- 3 Over-temperature protection
- 4 Temperature controller

■ 1 MAINS SWITCH

- For turning the unit on or off
- A green signal light indicates that the unit is ready for operation.

■ 2 EXHAUST FAN SWITCH (Option)

An on/off switch for the exhaust fan is incorporated in the control panel.
Recommended mode: exhaust fan is on


3. DESCRIPTION OF UNIT

CONTROL PANEL

■ 3: OVER-TEMPERATURE PROTECTION

Over-temperature protection is provided by the electronic upper limit cut-out (TWB).

The "malfunction" display light is illuminated when the TWB is activated. Use a **tool**, such as a coin or screwdriver, **to adjust the value of the TWB**.

The unit is **reset manually after it has cooled down** ( key).

Adjustment of the TWB to the upper temperature limit desired:

-To use the **upper limit cut-out as unit protection** (protecting the unit and the working environment), adjust the TWB to the highest possible temperature setting.

-To use the TWB to protect samples (protecting the unit, environment and the samples), set it **to approx. 50 °C the setting of the temperature controller**.



The upper limit cut-out should periodically be tested to ensure that it is functioning properly (refer also to the section SAFETY FEATURES).



Functional test

Precondition: The temperature set on the temperature controller has been reached and remains constant

Now set the TWB to approx. 50°C below the temperature displayed on the temperature controller. The TWB should be activated (the red "malfunction" display is illuminated).

The TWB functions properly.

Now set the TWB to the temperature limit for the type of protection required.

If "malfunction" is indicated during operation:

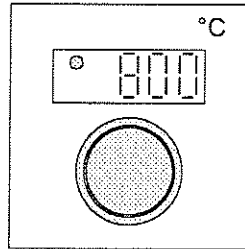
Check the settings of the TWB and the temperature controller. Make any necessary adjustments. If the malfunction persists, contact our service department.






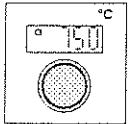
3. DESCRIPTION OF UNIT

CONTROL PANEL

- **4: Digicon® TEMPERATURE CONTROLLER**

Temperature can be displayed and adjusted in increments of 10°K.



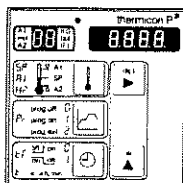
Command	Dial/Remarks	Display/Remarks/Condition
Turn on unit		 Furnace temperature is displayed
Select preset temperature	Press and hold down dial	 Display changes from actual to nominal temperature
	Hold down dial and turn in clockwise direction = raise preset value	 Nominal value rises
	Hold down dial and turn in counterclockwise direction = lower preset value	 Nominal value decreases
Reset unit to NEW nominal value	Release dial	 Furnace temperature is displayed
Pulse signal on "HEATING" indicator: nominal temperature of furnace chamber held constant by controller		

3. DESCRIPTION OF UNIT

CONTROL PANEL

4: Thermicon® P TEMPERATURE CONTROLLER

The controller can be used as a temperature regulator or as a temperature/program regulator.



To use as a temperature controller without programming functions:

Command	Entry / Key(s)/Remarks	Display / Remarks / Condition
Turn unit on	All display elements illuminated for approx. 20 sec. - controller self-text - then display of furnace temperature.	
Display preset temperature	Press (nominal value displayed for approx. 15 sec. after release of key)	 Display nominal value
Select preset temperature	Hold down	 → → → →
	& Select position and change value	
Reset to NEW preset temperature	Release	 Display temporarily dimmed, value being stored, after approx. 15 sec. display of stored value followed by display of temperature in furnace chamber.
Pulse signal on "HEATING" indicator: nominal temperature of furnace chamber held constant by controller		

When using the temperature controller without programming functions, enter "Pr = 0" to switch off operation.

3. DESCRIPTION OF UNIT

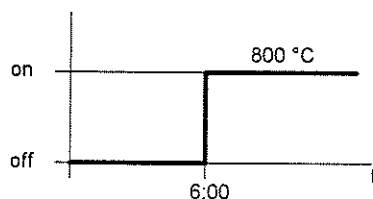
- To use as temperature controller with timer functions

The timer function can be operated in two modes:

tf 0: The timer switches the heating on when the preset time is reached.

tf 1: The timer switches the heating off when the preset time is reached.

Example 1: The timer is to switch the unit on after 6 hours and heat the chamber to 800 °C.

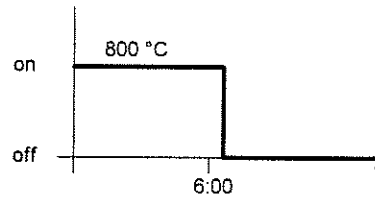


Command	Entry / Key(s) / Remarks	Display /Remarks / Condition
Turn unit on	All display elements illuminated for approx. 20 sec. - controller self-test - then display of furnace temperature.	
Select preset temperature	Refer to use as temperature controller <u>without</u> programming function	
Select operating mode of timer	& Press (select tf 0)	 Flashes ▲
Switch to time setting function	Release	
Enter time (max. period is 99 hours and 59 minutes 99.59))	Hold down	
	Press	 ▲ Flashes
	/ Select position and change value (select 06.00)	 →→→→
	Release	 After approx. 15 sec. "tf 0" and the furnace temperature is displayed.
Unit must remain turned on	Heating will be turned on after the set time period has elapsed.	

3. DESCRIPTION OF UNIT

- To use as temperature controller with timer functions

Example 2: The timer is to switch the unit off after 6 hours (selected operating temperature is 800 °C).



Command	Entry / Key(s) / Remarks	Display / Remarks / Condition
Turn unit on	All display elements illuminated for approx. 20 sec. - controller self-test - then display of furnace temperature	
Select preset temperature	Refer to use as temperature controller <u>without</u> programming function	
Select operating mode of timer	& Press (select tf 1)	 Flashes
Switch to time setting function	Release	
Enter time (max. period is 99 hours and 59 minutes (99.59))	Hold down	
	Press	 ▲ Flashes
	/ Select position and change value (select 06.00)	 →→→→
	Release	 After approx. 15 sec. "tf 1" and the furnace temperature is displayed.
	Heating will be turned on after the set time period has elapsed.	



If no timer function is required, select "tf 0" and enter the time "00.00".

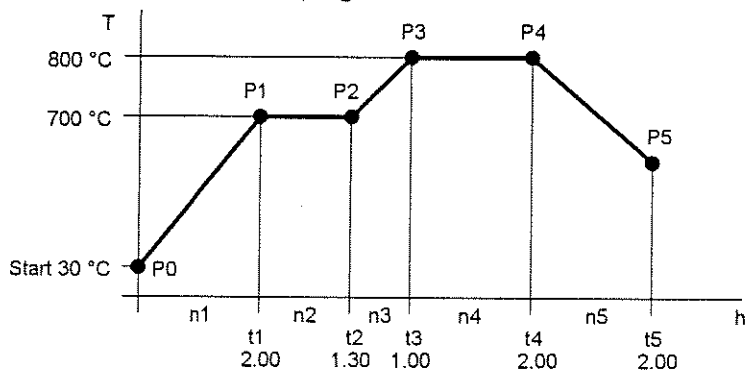
3. DESCRIPTION OF UNIT

- To use as temperature controller with programming functions




















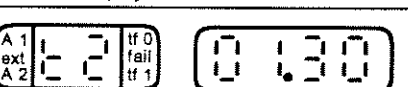




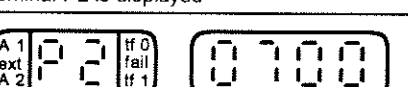





The controller can execute time/temperature programs of up to 9 programming steps followed by a command to return to start position.

n1 ... n9: Program steps
 r: Return command (see example)
 P0 ... P9: Preset nominal temperature
 t1 ... t9: Preset times for each program step

Example 3: Temperature / time program



Command	Entry / Key(s) / Remarks	Display / Remarks / Conditions
Turn unit on	All display elements illuminated for approx. 20 sec. - controller self-test - then display of furnace temperature	
Select programming operation	Hold down	
Select program function	Press (select prog. on I)	
Select number of programming steps	Release quickly and hold down again	
	Press (n = 5)	
Select type of return command	Release quickly and hold down again	
	(r = 0: no return to beginning of program r = I: return, repeat program from beginning)	

Command	Entry / Key(s) / Remarks	Display / Remarks / Condition
Define starting point	 Release quickly and hold down again	 Nominal P0 value is displayed
Enter P0 = 30 °C	 /  Select position and change value	 →→→→
Enter time period for program step (n1)	 Release quickly and hold down again	 Time t1 is displayed
Enter t1 = 2.00 h	 /  Select position and change value	 →→→→
Enter preset temperature (n1)	 Release quickly and hold down again	 Nominal value P1 is displayed
Enter P1 = 700 °C	 /  Select position and change value	 →→→→
Time period for program step (n2)	 Release quickly and hold down again	 Time t2 is displayed
Enter t2 = 1.30 h	 /  Select position and change value	 →→→→
Enter preset temperature (n2)	 Release quickly and hold down again	 Nominal P2 is displayed
Enter P2 = 700 °C	 /  Select position and change value	 →→→→
Repeat the same procedure for program steps n3 and n5		
End entry of further program steps	 Release and wait for tP on display	
Run programmed sequence	 &  Press - The controller executes the program	 The program step and current value are displayed

3. DESCRIPTION OF UNIT

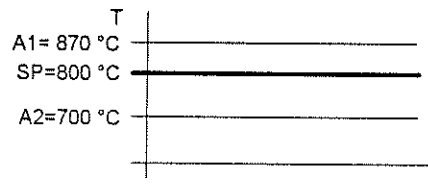
- General information on **Thermicon® P**

You can call up additional information in the different operating modes.

Example 4: Temperature display values can be assigned to monitor any instance of temperatures falling below or rising above the nominal set. These display values, **A1** and **A2**, can be called up at any time during operation on the temperature controller.







Display **A1**: The temperature of the furnace chamber has risen above the value set for A1.

Display **A2**: The temperature of the furnace chamber has fallen below the value set for A2.






Command	Entry / Key(s) / Remarks	Display / Remarks / Condition
Display nominal temperature	Press (nominal value shown for approx. 15 seconds)	0800
Display A1 temperature for A1	Press twice and then hold down	0930
Select temperature for A1	/ Select position and change value After release, A1 value displayed for approx. 15 sec., followed by furnace chamber temperature	0870 →→→→
Display A2 temperature value	Press three times and hold down	0610
Select temperature for A2	/ Select position and change value After release, A2 value displayed for approx. 15 sec., followed by furnace chamber temperature	0700 →→→→
Example: furnace temperature exceeds value for A1		880
Example: furnace temperature below value for A2		690
Display timer function	Press (status displayed for approx. 15 seconds after key is released) tf 0 : Timer turns heating on tf 1 : Timer turns heating off	0

3. DESCRIPTION OF UNIT

Command	Entry / Key(s) / Remarks	Display / Remarks / Condition
Display program (Pr = 2 external programmer not available for this unit)	 Press (status shown for approx. 15. sec. after key is released) Pr = 0 Programmer off Pr = 1 Programmer on	
Exit program / cancel program	 Hold down	
	 Select Pr = 0	


■ Error messages

Display / Condition	Remarks	Remedy
	Power failure during timer operation, timer function halted, controller operation off - display shows furnace temperature	Reset timer
	Incorrect entry or controller defective, controller operation is off	Turn unit off and on, reprogram controller, if fault persists, contact Service
	Temperature sensor problem or defective controller, controller off	Contact Service



Program is retained in memory during power failures. The program must be restarted once power to the unit is restored.

4. SETUP AND INSTALLATION

 Follow instructions contained in this instruction manual carefully when setting up, installing and operating the unit. Be sure to comply with all applicable regulations in your country.

TRANSPORT

Handle with care, avoid vibrating or other possible causes of damage to the unit. Do not grip the door handle or the door itself to lift the unit.
See TECHNICAL SPECIFICATIONS for details on weight and dimensions.

UNPACKING THE UNIT

Unpack the unit. Remove transport safety fixtures from the chamber and clean all surfaces of any grit or other contaminants.

SETUP

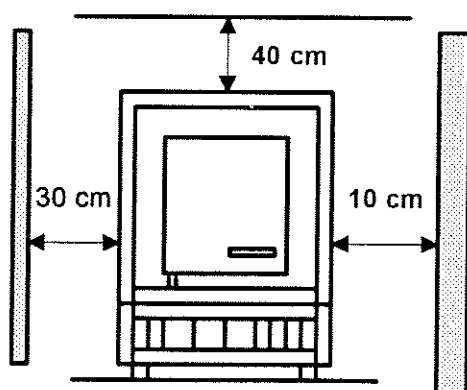
The laboratory furnace is to be placed in a stable and perfectly upright position on a firm fireproof surface, such as a laboratory table or support frame.

It is not possible to stack the furnaces.

Room temperature can be up to 40°C.

Do not cover or obstruct the ventilation or exhaust vents of the unit.

DISTANCE TO OTHER SURFACES AND OBJECTS:



Min. rear spacing to wall 10 cm

To avoid the risk of fire, attach thermal insulation to exhaust gas duct **above** the unit to protect neighbouring surfaces and equipment.

4. SETUP AND INSTALLATION



MAINS CONNECTION

The unit is powered via a permanent flexible mains power cable and mounted plug (grounded). Test the mains supply cable and connecting plug for possible faults before using the unit. Do not connect the unit to the mains circuit if faults are detected.

The device must be set up in a position where the plug of the connecting cable is accessible at any time.

The voltage specified on the nameplate of the unit must match the voltage delivered by the mains power supply.

Only plug the furnace to a properly installed outlet equipped with a PE conductor (Protection Class 1). The mains power circuit should additionally provide protection against electric shocks caused by leakage current.

See TECHNICAL SPECIFICATIONS for **rated power consumption**.

Mains circuit protection required: T 16 A fuse or B 16 circuit break-switch.

Use rubber-sheathed flexible cable of at least 1.5 mm diameter (H 07 RN-F) for any required power extensions to the connecting plug outlet of the unit.

NOISE INSULATION

The and exhaust air fan (option) may cause noise levels to rise above normal levels in unfavourable installation conditions. In such cases, additional measures may have to be undertaken to improve sound insulation in the room.

See TECHNICAL SPECIFICATIONS for **noise levels**.

ROOM VENTILATION

Proper ventilation must be installed wherever the unit is set up for operation. Do not operate the unit in non-ventilated enclosed spaces. Special ventilation measures, such as ventilation of designated work areas, are required when several units are set up in the same room.

4. SETUP AND INSTALLATION

CONNECTION TO EXTRACTION SYSTEMS

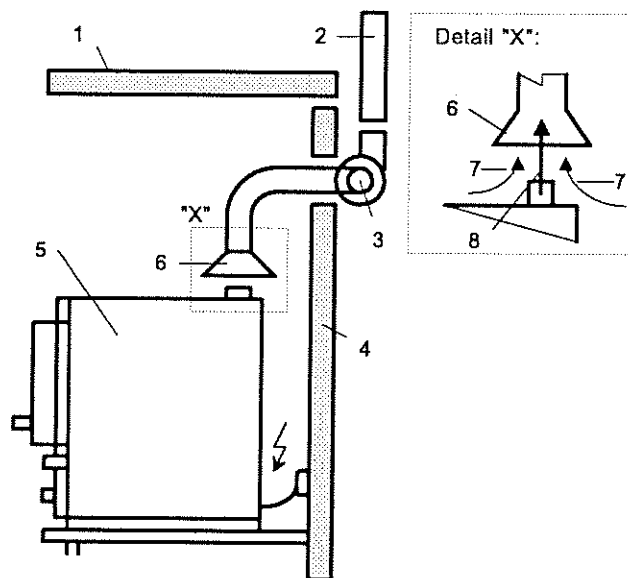
⚠ Be sure to observe environmental protection regulations applicable in your country for dealing with exhaust gases resulting from heat treatment.

This may, for example, involve measures for treating such gases with heat or catalysts.

See TECHNICAL SPECIFICATIONS for volumes and temperature of exhaust gases.

Install a cut-off valve in the port for customer-supplied extraction systems. All exhaust flues must be made of fireproof materials (recommended materials: 1.4301 or 1.4571). Openings are required to remove condensation and deposits from the exhaust flues. The flues must be provided with thermally insulation (recommendation: half-round insulating sleeves made of laminated mineral fibre).

Fig 2/4: Example of installation of a unit equipped with exhaust flue and exhaust fan



- 1 Building ceiling/roof
- 2 Exhaust gas duct
- 3 Exhaust gas fan (customer supply)
- 4 Building wall
- 5 Furnace
- 6 Cut-off valve
- 7 Air flow from installation room
- 8 Exhaust gas flow of laboratory furnace

4. SETUP AND INSTALLATION

CONNECTING TO EXTRACTION SYSTEMS

Information on dimensions of installation example:

- Air flow volume above the cut-off valve (position 3) approx. 5 times the air flow volume of the unit
- Inside diameter of exhaust gas headers: 100 mm

Technical measures should be implemented to monitor the flow of air and exhaust gases and to prevent operation of the furnace when the extraction system serving the room is defective or switched off (interlock).

EXTERNAL MEASUREMENT OF FURNACE TEMPERATURE

There is an aperture (5 mm dia.) in the middle of the swivel door.

This serves as an access for shielded thermocouples providing external measurement of temperatures inside the furnace chamber.



To avoid damage to temperature measurement devices, only connect them to power circuits that are entirely independent of the mains power supply.



To ensure protection against electric shock, only shielded thermocouples which are properly connected to the PE conductor are to be placed through this aperture. Due care must be taken that the thermocouple does not come into contact with the walls of the furnace.



An additional leakage current flows over the thermocouple shield. It is added to the leakage current of the unit. Under unfavourable conditions, the sum of all leakage currents can activate the leakage current protection switch.

Recommendation: Connect the furnace to a separate leakage current protection switch (rated at ≤ 30 mA).

5. OPERATION

STARTUP OF OPERATION

After setting up and installing the unit, proceed as follows to start the unit:

Command	Control / Remarks	Display / Remarks / Condition
Turn on unit	Mains switch = " I "	see Section 3
Select nominal temperature	Adjust temperature controller	
	Digicon	see Section 3
	Thermicon® P	see Section 3
Adjust over-temperature protection to upper limit required	Adjust TWB (position 3)	see Section 3
Turn on exhaust fan (variant)	Select function mode and time on the timer	see Section 3
Load samples, wait until furnace chamber temperature is reached if necessary	Refer to chapter OPERATION	see Section 3

5. OPERATION

OPERATING GUIDELINES

Wear personal safety clothing required to protect hands, face and body; remove jewellery.

Heat is conducted to samples in the furnace chamber by radiation.

To avoid overheating the samples of heat conductors, **distribute samples evenly** throughout the furnace chamber and **do not place them too close to the heating**.

Take care not to damage the heating elements in the furnace chamber when loading the samples.

Soiled surfaces on the inside of the furnace chamber are often the cause of premature damage to insulation and heating. Avoid any direct contact of aggressive chemicals with the ceramic and fibre material surfaces.

The durable life of the heating coils is highly dependent on the temperature load.

Limit operation of the furnace at its highest temperatures only as long as required to complete the task.

The unit's life can also be adversely affected by continually heating and cooling the furnace over a large temperature range. If used often, it is best to run the unit in continuous operation at medium temperatures.

Do not cover the ventilation and extraction vents on the outside of the unit; do not place any objects on them. Be sure to keep these vents clean.

The over-temperature protection should also be tested by authorized personnel while the unit is in operation.

SHUTDOWN

- Remove samples loaded into the furnace chamber.
- Wait for furnace and room temperatures to cool down.
- Turn off unit; if it is not used for a longer period, disconnect from mains and pull out plug.
- Clean out furnace chamber.

6. MAINTENANCE



To ensure the proper functioning and safety of the unit, all necessary tests, and maintenance and repair work should be carried out by Thermo services personnel or someone authorized by our company.

Thermo Electron LED GmbH **cannot be made liable** for any possible damage caused by the unit if repair work which is not carried out by Thermo service centres leads to faulty operation of the unit, or if parts other than authorized replacement parts and accessories are used.

We recommend that you conclude a service contract with our company. Please contact us for an offer.

MAINTENANCE/CLEANING

The unit requires very little maintenance. The bearings of the swivel door can be lubricated with graphite oil.

Clean the outer surfaces and control elements with mild detergent and a soft cloth.

Clean away any spillage or residue from the furnace chamber.

The exhaust ducts should be part of cleaning procedures if the unit is connected to extraction systems serving the room where the unit is installed.

TESTING

To ensure that the unit remains in proper working condition, it should be tested at least once a year for the following:

- Mechanical functions
 - Function according to technical specifications
 - Electric circuits
 - Safety equipment installed in the unit
-

SERVICING

- Replacement of electrical parts
-



Work on electrical components installed in the unit may only be carried out by Thermo service personnel. Disconnect the unit from the mains power supply during servicing. Use only authorized replacement parts.

6. MAINTENANCE

SERVICING

- Authorized replacement parts and accessories



**The safe and reliable operation of the unit can only be ensured if replacement parts authorized by the manufacturer are used.
The use of any other parts can present unforeseen risks and is not approved under any circumstances.**

Replacement / Accessory	Order No.
Instruction manual	50 111 946
Circuit diagram	50 008 214
Tray	50 006 408
Exhaust duct	50 006 394
Exhaust fan (replacement part)	50 006 439
Exhaust fan (retrofit kit)	50 024 794
Base plate	50 005 547

7. SPECIFICATIONS

MECHANICAL		M 110	Unit
Dimensions (W x H x D)	Housing: Work chamber (DIN 17 052): Base plate:	576 x 752 x 720 200 x 150 x 300 200 x 10 x 320	mm mm mm
Min. distance of the furnace to neighbouring surfaces:	left: right: top: at rear (with spacer):	300 100 400 25	mm mm mm mm
Volumes	Work chamber:	9	l
Weight	Unit: Maximum load:	about 80 7	kg kg
THERMAL:			
Operating temperatures:		300 to 1100	°C
Temperature deviation temporal (DIN 12 880 Section 2)	with exhaust flue: with exhaust fan:	1 / 1 1	K K
Spatial, without flue/with flue/ with fan	at 500°C: at 700°C: at 1100°C:	$\pm 18 / \pm 24 / -$ $\pm 13 / \pm 20 / -$ $\pm 7 / \pm 9 / \pm 90$	K K K
Heat rise time (without load) with/without flue	up to 500°C: up to 700°C: up to 1100°C:	about 40 / 45 about 60 / 65 about 125 / 130	min min min
with exhaust fan	up to 1100°C:	about 180	min
Cool down time (to 100°C, without load)	from 500°C: from 700°C: from 1100°C:	about 13 about 16 about 18	h h h
with and without flue	from 500°C: from 700°C: from 1100°C:	6 7 8,5	h h h
with exhaust fan			
Heat radiation to surrounding areas	at 500°C: at 700°C: at 1100°C:	0.4 0.65 1.4	kW kW kW

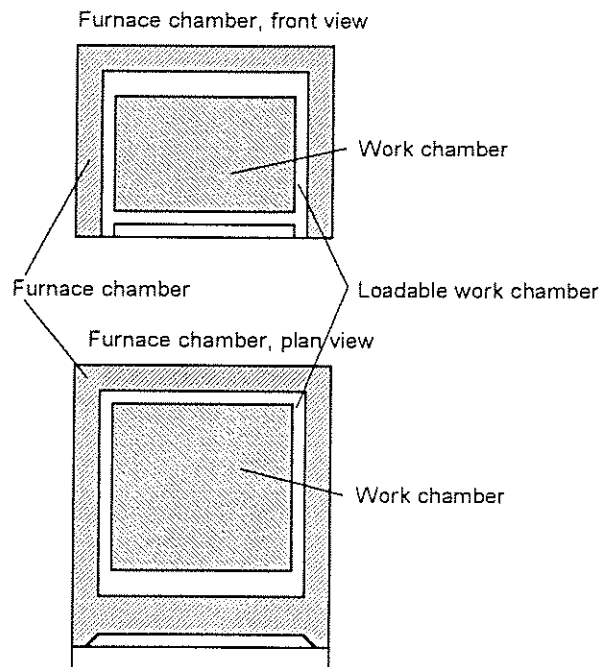
7. TECHNICAL SPECIFICATIONS

VENTILATION / EXHAUST GASES		M 110	Unit
Air replacement in furnace chamber without / with flue	at 1100°C:	about 13	h ⁻¹
	with exhaust fan at 1100°C:	about 192	h ⁻¹
Exhaust gas flow (without load) without / with flue	at 1100°C:	117	l / h
		50	m ³ / h
Diameter of flue port / exhaust fan:		30 / 60	mm
Exhaust gas temperature at port (at max. operating temp.) without / with flue: with exhaust fan:		270 (330 ¹⁾) 150 (200 ¹⁾)	°C °C
¹⁾ the higher value applies momentarily on closing the door			
NOISE			
Noise level (DIN 45 635):		< 58	dB (A)
ELECTRICAL:			
Rated voltage (± 10 %):		1 / PE AC, 230	V
Rated frequency:		50 / 60	Hz
Nominal power consumption:		3	kW
Current load:		13	A
Protection class:		I	
Protection type:		IP 20	
Circuit protection: (Electrotechnical regulations and power station-specific technical requirements must be observed when connecting to mains power supply circuits)		T 16 A fuse or B 16, circuit breaker, connection to leakage current protection switch ≤ 30 mA) recommended	

7. TECHNICAL SPECIFICATIONS

MATERIALS USED	
PART:	M 110
Housing	Zinc-plated sheet steel, painted RAL 9002
Furnace chamber	Silicon carbide panels, aluminium silicate fibre ¹⁾ fireclay brick (chamotte)
Door insulation	Aluminium silicate fibre ¹⁾
Mouth of furnace	Fireclay brick (chamotte)
Thermal insulation of furnace chamber	Aluminium silicate fibre ¹⁾
Base plate	Fireclay brick (chamotte)
Tray	Heat-resistant steel, material no 1.4841
Heater coils	Cr Fe Al
Control panel	Mixture of ABS and PC
Electrical components	Components coated with various plastics, partially mounted with epoxy resins on circuit boards strength- ened with glass fibre.
¹⁾ Fibre materials used for insulation are classified as hazardous to health in certain countries. No serious risks to the working environment arises from normal operation. Improper handling during repairs or dismantling the unit can lead to significant levels of contamination.	

Volume diagram:



APPENDIX
