OPERATING INSTRUCTIONS

A U S T R O M A T
D 4

Version 3

0   INTRODUCTION

Dear Customer,

Congratulations on your new AUSTROMAT D4 ceramic furnace. DEKEMA's many years of experience in the field of dental furnace construction have gone into this equipment ensuring a very high level of quality, and exceptional performance and reliability. In order to take full advantage of the possibilities your ceramic furnace offers to obtain superior results, we would like to ask you to spend a little time studying these instructions. The technical specifications and a description of the furnace can be found in Sections 2 and 3. In order to ensure reliable, long-lasting operation of the ceramic furnace, please observe the safety measures indicated in Sections 4 and 5 and the suggestions regarding service and maintenance of the furnace in Section 6. The AUSTROMAT D4 is a menu-operated furnace whose functions are controlled via keyboard input and screen readouts. The control menus are described in Section 7 from the initial steps to the device's setup settings. Practical examples help clarify the explanations. Section 8 covers making records and the link to the computer. Section 9, Practical Tips, is to assist you in troubleshooting. References in the text refer to this section. Finally, the index enables you to quickly find specific functions or commands.

Please note the following warning symbols:

This symbol warns of hazardous electrical voltage where there is a danger to life and limb. Note these instructions on the device, and be especially careful.

This symbol indicates a burning hazard from hot surfaces. Note these instructions on the device, and be especially careful.

This symbol indicates a personal hazard to life and limb. Take note of this warning in the operating instructions, and take extra precautions.

1   COMPONENTS

- AUSTROMAT D4 ceramic furnace with power cable
- Software module
- Vacuum pump (diaphragm pump) with electrical power supply cable and vacuum line (silicone tube)
- Firing table and press table (only D4*press*)
- Furnace tweezers
- Operating instructions
- Packaging material
- Calibration set for calibrating the temperature

Ensure that all components have been supplied, and that the equipment has not suffered any visible damage in transport. If this is not the case, please immediately contact your service partner. Please store the packaging (two cardboard boxes and foam for protecting against jolts during transportation) in case you need to ship the equipment at a later date.

2 TECNICAL SPECIFICATIONS

2.1 CERAMIC FURNACE UNIT

Supply voltage	depending on the type (rating plate on the rear): ~ 230 V 220…240 VAC / 50 – 60 Hz ~ 115 V 110…120 VAC / 50 – 60 Hz ~ 100 V 95…105 VAC / 50 – 60 Hz
Power consumption	maximum 1450 W with pump
Fuses	according to type ~ 230 V 2 x 6,3 A T 250 V ~ 115 V 2 x 16 A T 500 V ~ 100 V 2 x 16 A T 500 V
Battery	Lithium-cell 3,6 V / 2000 mAh
Vacuum pump connection socket	according to type
Interfaces	serial (with the PC) or printer Soft or memory module (same construction)
Max. firing temperature	1,200°C
Max. rate of temperature rise	160°C/min from 20°C to 500°C 120°C/min from 500°C to 1000°C 60°C/min from 1,000°C to 1,200°C
Dimensions	35 x 63 x 28 cm (W x H x D, D4) 35 x 74 x 28 cm (W x H x D, D4*press*)
Weight	18.0 kg (D4) 18.5 kg (D4*press)*

2.2 VACUUM PUMP UNIT

Pump type	Service-free diaphragm pump
Supply voltage	depending on the type (pump rating plate on the rear): ~ 230 V 220…240 VAC / 50 – 60 Hz ~ 115 V 110…120 VAC / 50 – 60 Hz ~ 100 V 95…105 VAC / 50 – 60 Hz
Ultimate pressure	< 30 hPa
Weight	6 kg

⚠ **DEKEMA assumes no liability for damage arising from the use of a different vacuum pump than the one supplied.**

3 DESCRIPTION OF THE EQUIPMENT

3.1 FRONT

Fig. 1 and 2 are schematic illustrations of the front and rear of the AUSTROMAT D4.

Figure 1
Front view AUSTROMAT D4
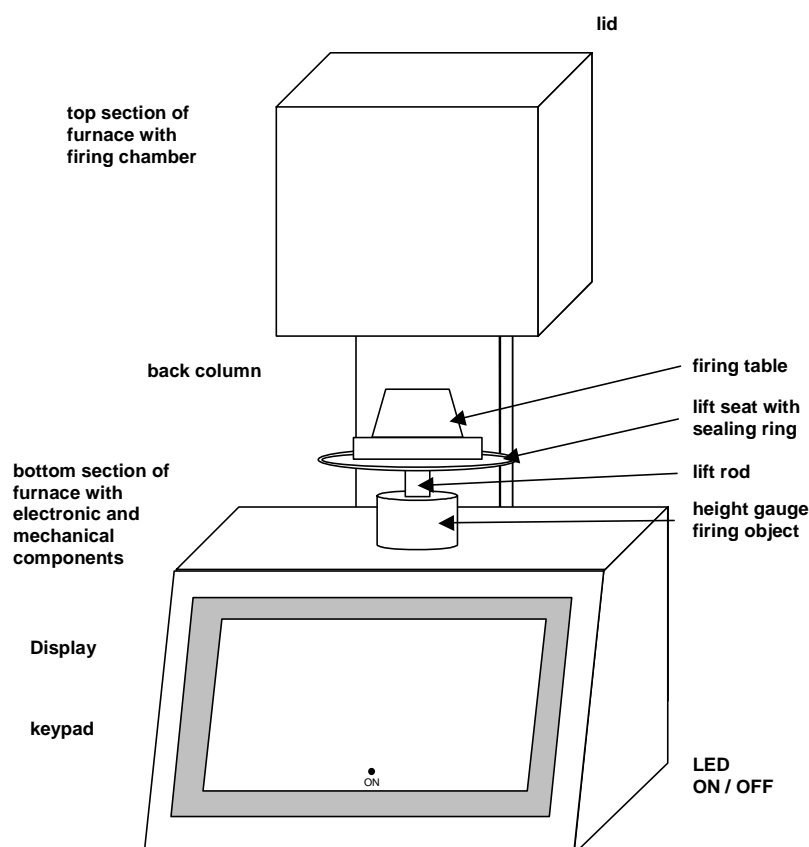
The top of the furnace contains the firing chamber. The bottom section of the furnace contains the electronic and mechanical furnace components used to move the lift system comprising the lift rod, lift seat with sealing ring (yellow O-ring), and the firing table on which the objects to be fired are placed. On the cover plate, there is a cylindrical height gauge that corresponds with the free height of the firing chamber.

On the front of the bottom part of the furnace, you will find the following controls: screen, function keys (softkeys), alphanumeric keypad, control keys, and an LED to display when the device is ready to be used.

3.2 BACK

Figure 2
Back of the AUSTROMAT D4

top section of
furnace with
firing chamber

back column

bottom section of furnace
with electronic and
mechanical components

cover plate

production
number

ON / OFF
switch

battery
compartment

fuse

software /
memory module

mains cable

serial interfaces

connection vacuum pump   vacuum tube
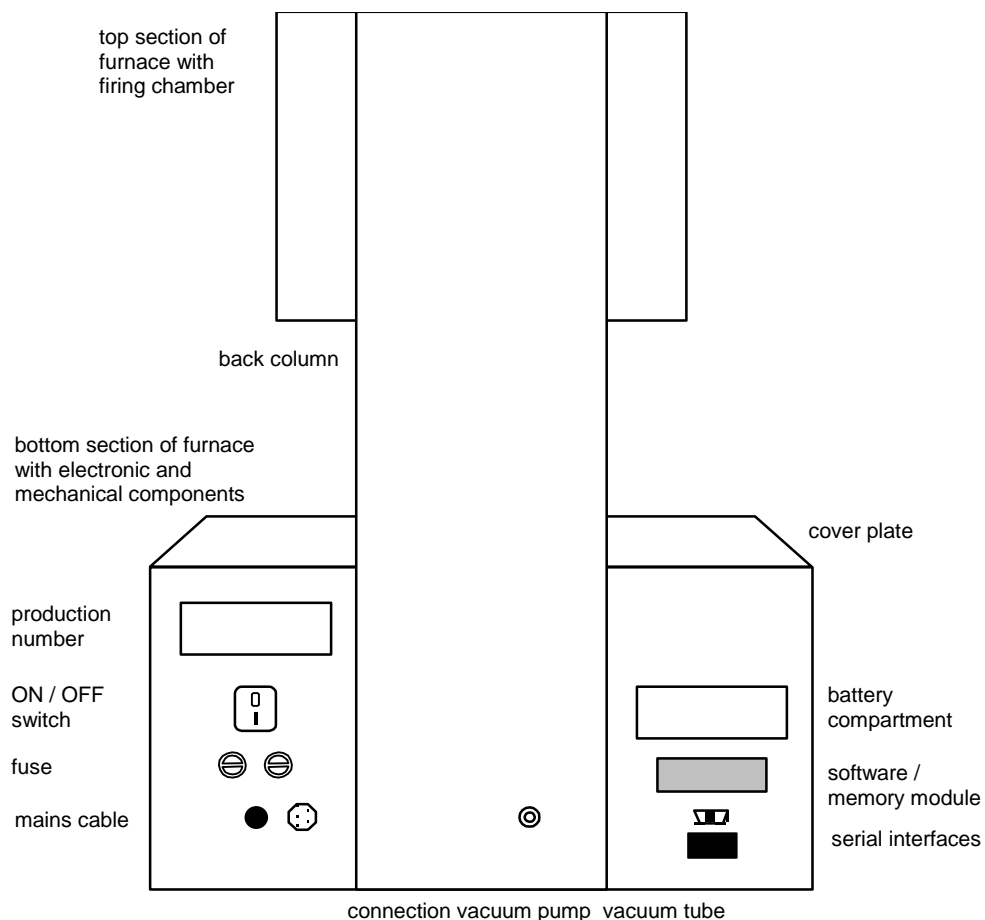
On the back of the bottom section of the furnace you will find the main ON/OFF switch, the battery compartment, a label with the production number, the fuses, and the fixed power cable.

The following connections exist: one plug connection with two clips to hold the soft or memory module, a serial interface for a PC connection (top socket connector) the socket connector for the vacuum pump power cable, and a connection for the vacuum line.

4 SAFETY MEASURES

4.1 NOTES REGARDING SAFETY

- **Never operate the furnace without the firing table!**

- **Always use the firing table or press table that is required for proper use**

- Familiarize yourself with the safety steps and operating instructions to prevent damage to humans and/or materials.

- The AUSTROMAT D4 was designed for firing dental ceramic objects. We assume no liability or guarantee when the device is improperly used handled or not used according to instructions.

- In particular, materials may not be heated that may trigger explosions, implosions and hazardous or flammable gases.

- The equipment may only be operated with the indicated supply voltage (the rating plate is on the back). Please use only suitable power sockets with ground contacts, and never use adapter plugs.

- The power socket should be close to the device and easily accessible. In an emergency, unplug the power plug and turn off the furnace (the main switch is on the back, see p. 6, Figure 2).

- When you mount the object to be fired and firing tray, make sure that nothing extends over the edge of the firing table. The object to be fired and the heat insulation material may otherwise be damaged when you close the furnace.
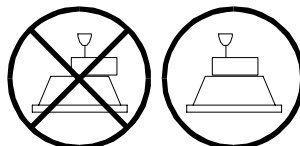
- Only use fuses with the indicated lag and nominal current (see p. 4 Tecnical Specifications).

- Acute danger of burning (only the D4*press*): If the lift is moved down after running a press program, visually check if the press muffle is on the firing table. Move the lift down to a safe lift posiiton (see the setup menu: "Safe lift position", section 7.6.1). If the press muffle is not lying on the firing table, close the lift and let the press muffle cool some more.

- Do not use your hands or any objects for grasping things in the firing chamber. This can cause injury from burns or electrical shock.

- Never directly contact hot parts of the furnace. Do not grasp the lift seat, firing table or object to be fired with your bare hands. Never put your hand into the hot firing chamber.

- Protect yourself from electric shock. Do not simultaneously touch any hazardous active parts such as an optional core-guided heating element and parts connected to the protective conductor. Protect yourself, for example by using insulated tools and/or clothing.

- Before the top and bottom are opened, the furnace must be disconnected from the power source (turn off the furnace and pull the plug). The main switch is on the back (see p. 6, Figure 2.)

- If a lightening stroke hazard exists, separate the furnace from the power source (turn it off and pull the plug).

- If the furnace cannot be operated safely, pull the power plug, and make sure that the furnace cannot be unintentionally switched on, especially when the following error message appears: **TEMPERATURE LIMIT EXCEEDED. SWITCH FURNACE OFF IMMEDIATELY!**

- If the ground conductor is interrupted either inside or outside the device, or the ground conductor is released, the furnace is hazardous to operate. The connection may never be intentionally severed.

- Further reasons for assuming that the equipment cannot be used safely: Visible damage to the housing or power cable, malfunctioning, frequent need to exchange fuses, long storage in a bad environment (moisture). Please also follow the setup instructions in Section 4.2.

- Note that the furnace requires several hours to cool after it is turned off.

- Do not run the connection lines past hot locations of the furnace, and especially avoid direct contact.

4.2 SETUP

- Set up the furnace in a suitable place on a dry, flat, solid surface.

- Make sure that flammable materials or objects that can be damaged by heat are sufficiently distance from the furnace.

- Never place such materials or objects on the pot cover and the cover plate.

- The vents in the top section must not be obstructed in order to ensure circulation of cooling air.

- The vacuum pump should be set up in dust-free, well-ventilated area. Please also note that the length of the vacuum hose is approx. 1.5 m from the pump to the furnace. Never block the vents of the pump. Do not store easily combustible or flammable materials close to the pump.

4.3 OPERATION

- Never operate the ceramic furnace without supervision.

- When positioning the firing object and firing tray, ensure that no parts jut out over the edge of the firing table. There is a danger of damaging the firing object and thermal insulation material when closing the furnace.
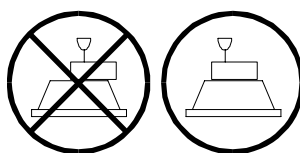
- Never directly contact hot parts of the furnace. Do not grasp the lift seat, firing table or firing object with your bare hands. Never put your hand into the hot firing chamber.

- Protect yourself from electric shock. Do not simultaneously touch any hazardous active parts such as an optional core-guided heating element and parts connected to the protective conductor. Protect yourself, for example by using insulated tools and/or clothing.

- Note that the furnace automatically heats up approximately 30 seconds after it is turned on, even when the firing chamber is open.

- After a program memory is selected or the program is aborted, the standby temperature of the selected or aborted program is automatically set in the firing chamber after approximately 20 seconds. This can be the preheating temperature or the firing chamber temperature required for drying.

- Do not use your hands or any objects to grasp things in the firing chamber. This can cause injury from burns or electrical shock.

- The firing chamber has a clear height of 36 mm. The fired objects (including the firing tray) may not exceed this height since the temperature sensor could otherwise be damaged. On the cover plate, there is a cylindrical height gauge that corresponds with the free height of the firing chamber.

Figure 3
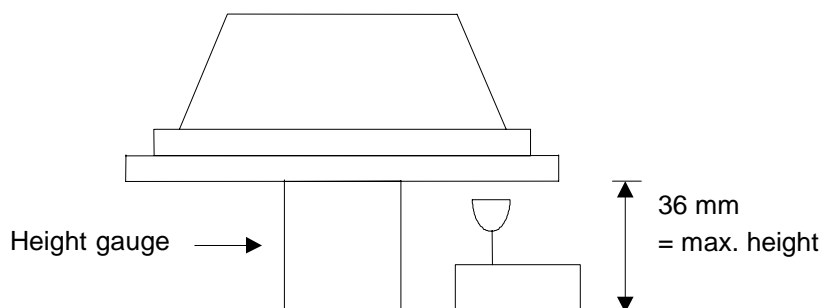
Height gauge

36 mm
= max. height

- In the Press mode of the D4*press*, conventional cylindrical press muffles with a press plunger can be used whose maximum height is 70 mm without the press plunger, and 90 mm with the press plunger, and whose diameter is not greater than 60 mm without the press plunger.

- While the firing program is running, the lift automatically moves up and down. Make sure that no objects are in the way that could hinder the lift movement. Also do not attempt to manually stop or accelerate the lift.

- The furnace should not be operated for some time after sudden change of ambient temperature as otherwise condensation may occur in the electronic components, thus causing damage.

- **Never operate the furnace without the firing table!**

If technical servicing or repairs are necessary, they should only be performed by authorized professionals.

After repair work, the furnace must undergo a safety check:

Federal Republic of Germany   VDE 0701

International   according to the respective national guidelines

5 STARTUP

5.1 SETUP

First, please ensure that the package contains all parts indicated in the list of components (Section 1) and keep the packaging material for any later transport. Read the operating instructions before turning on the device. In particular, familiarize yourself with the furnace description in Section 3, and read the safety instructions in Section 4. Before starting the furnace, remove the software module on the back by slightly pressing together the clips on the narrow side and pulling of the module. Store it in a safe location (see Section 7.6 and Figure 22).

Step 1   Remove the software module on the back, and store it in a safe place (see section 7.6 and Figure 22).

Step 2   Plug in the power cable into a power socket with a ground contact. The ON/OFF switch is on the back of the furnace.

Step 3   Make sure that the pump connected loads (rating plate) correspond to the furnace voltage supply values.

Step 4   Connect the vacuum pump: Plug in the vacuum pump power cable into the associated connection socket of the AUSTROMAT D4 making sure that the guide groove is aligned. Screw tight the cable in the socket since a bad electrical contact can damage the furnace.

Step 5   Connect the pump vacuum line (silicon tube) to the vacuum connector on the back of the furnace.

TIP A

Step 6   Turn on the furnace. The furnace performs an internal software and hardware check and the lift moves down automatically. If necessary, remove any ceramic dust from the lift seat and the sealing ring. Brush the dust into a receptacle. Do not blow away the dust, and do not inhale it.

Step 7   After it is turned on, the furnace waits approximately 30 seconds and automatically heats up to the starting temperature of the preheating program or the program that has been set.

5.2 INSTALLATION ASSISTANT

The installation assistant is optionally activated at the plant before delivery. It is only for special countries and customers. The installation assistant asks you to set up the firing table and connect the pump. After pressing the NEXT key, an installation routine runs. The firing chamber is dried, and the furnace is checked. The installation routine takes approximately 45 minutes, and can be terminated at any time with the CANCEL key. The installation assistant is started each time the furnace is turned on until the entire installation routine has run once.

6 MAINTENANCE AND SERVICE

6.1 MAINTENANCE

- Clean the housing, control panel and control elements with a soft cloth moistened with a mild cleanser. Do not use scouring agents, scouring pads or solvents such as alcohol, gasoline or acetone.

⚠

- Never contact the screen surface with sharp, rough or pointed objects such as tweezers or ballpoint pens. These objects can scratch the screen surface.

- Always keep the sealing ring of the lift seat free of dust to ensure a reliable vacuum. Use a brush with a receptacle (for ceramic dust), or a moist cloth.

- Every now and then, clean the lift rod with a dry cloth. Never oil or grease.

6.2 TEMPERATURE CALIBRATION

TIP F

A number of factors influence the temperature of the firing object. These can include: The color and shape of the firing tray, or the number and type of firing objects. Other major influences can be age-related effects such as heating element wear and changes to the thermoelectric properties of the temperature sensor. To compensate for these factors and ensure normal firing results, we recommend that you calibrate the furnace when the firing results change, or at least once a year. Calibration is carried out by means of the calibration factor (CCF). Observe the following instructions:

- For new furnaces, we recommend that you calibrate the temperature for the first time after approximately six months.

- An internal monitoring program notifies you when you should calibrate the furnace temperature.

TIP C

- Make sure that the heating element and thermocouple are not damaged.

- Only use the DEKEMA calibration set that is for the specific furnace. This consists of a curved silver wire and a white ceramic firing tray.

- For calibration, always use the firing table and not the press table (only applies to the D4*press*)

- Make sure that the temperatures of all the firing programs are adjusted when the CCF value changes. The firing temperatures of individual programs may have to be corrected.

Calibrating the temperature with the calibration set:

⚠

The furnace must be thoroughly preheated before calibrating. The thermocouple must be preconditioned. A cleaning firing must therefore precede temperature calibration. Start the "Cleaning firing" program by selecting "Cleaning firing" in the *Setup* menu, and press Program Start (Section 7.6.2).
Shove the curved silver wire from the calibration set (as shown in Fig. 4) in the middle of the firing tray, then place it on the firing table.

Figure 4
Evaluating the silver wire

silver wire   Silver specimen   silver specimen is stuck in the   position of the specimen on the halved
                                              DUCERA -Tray   DUCERA -Tray, seen from above

effective temperature too low   effective temperature o. k.   effective temperature slightly too high   effective temperature too high
raise CCF -value (c. 5 points)   lower CCF -value (c. 3 points)   lower CCF -value (c. 5 points)
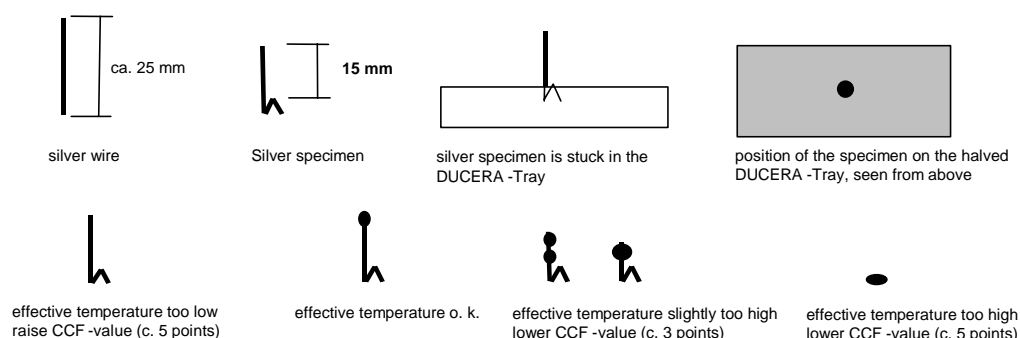
Start the Temperature calibration program by selecting "Temperature calibration" in the *Setup* menu, and press Program Start (Section 7.6.2).

Fig. 4 illustrates how to evaluate the silver wire test specimen. Approach the correct setting of the CCF in small steps of approximately two to three points (such as 1,004 auf 1,006). By increasing the CCF, you increase the firing temperature. By reducing the CCF, you lower the firing temperature.
Observe the following procedure to change the CCF: Select "Temperature calibration" in the *Setup* menu, and enter a new calibration factor (Section 7.6.2).
Minor corrections can be made instinctively. If there are very large or sudden deviations from the original CCF, check for technical faults.

6.3 CHECK-PROGRAM

The **AUSTROMAT D4** has an internal program that checks the function of the major components (check program). Regularly using this non-editable program makes it easier for you and the responsible service personnel to identify aged components (such as heating element wear) and troubleshoot malfunctions (such as vacuum leakage). After approximately 2000 firings, the device displays a recommendation on the screen to start the self check program (duration: approx. 45 min). In the *Setup* menu, select the "Check program" function, and start the program.

⚠️

Start the check program only after running several firing programs, or after a cleaning firing so that the oven is warmed up.

The results of the self-check are saved in a diagnosis file. In certain cases, the **AUSTROMAT D4** automatically notifies you upon starting a firing program if diagnostic data indicate that a firing program will not run properly. This is the case for example when the heating element is too old, and you want to reach a firing temperature quickly.

Overview of error messages after the check program:

Error message	Solution
1. "NO ERRORS FOUND"	No errors were found.
2. "VACUUM PUMP DEFECTIVE"	Contact your service partner (see p. 15).
3. "VACUUM SYSTEM LEAKY"	Clean the lift seat and sealing ring while observing safety instructions. Then rerun the check program.
4. "SOLENOID VALVE LEAKY"	Contact your service partner (see p. 15)
5. "CHANGE HEATING ELEMENT"	Contact your service partner (see p. 15)

The error message "CHANGE HEATING ELEMENT" can also arise when the heating element is technically functional. However, the check program requires a nominal power supply to operate. When the effective power supply is below the nominal value, the error diagnosis of the heating element can be incorrect. This problem generally only occurs in Asian countries. Consult your local power company.

6.4 CHANGING THE BATTERY

The firing programs and the software of the **AUSTROMAT D4** are saved in electronic memory modules that require an uninterrupted power supply to maintain their memory function. When the furnace is turned off, this in ensured by a battery (lithium cell 3.6 V / 2000 mAh, non-chargeable) that lasts approximately three years. After a maximum of three years, the battery should be replaced for the memory modules to work properly and to avoid loss of your firing programs. When turned on, the furnace indicates the battery charge (Figure 7): 100% means the battery is new, and approximately 10% means that the battery is an average of 2½ years old. Note that this value is reached much earlier when the furnace is always turned off. At a charge of 10%, the screen automatically displays a message that they battery must be changed. Observe the following procedure:

- Order a new battery module (original replacement part, order No. LNE18082)

- Turn the furnace on, and leave it on while the battery is being changed.

- Open the battery compartment on the back of the furnace (two Phillips head screws; see Figure 2).

- Carefully pull off the battery compartment cover with the battery and twisted cable up to the cable plug. Unplug the cable.

- Insert the new unit comprising the battery compartment cover, battery and plug (lithium cell / 3.6 V / 2000 mAh). The plug is protected against polarity reversal.

- Screw closed the battery compartment cover.

- Instruct the software that a new battery has been installed by selecting "Change battery" in the *Setup* menu, and confirming that the battery has been changed (Section 7.6.2).

⚠ Do not inform the software that the battery has been changed no new battery was installed. Otherwise this can lead to lose the saved firing programs and software.

Do not throw away used batteries, but dispose of them as prescribed by law.

6.5 REPLACING THE HEATING ELEMENT

Over time, the heating element wears out from use. This can have a negative influence on your firing results. For this reason, change the heating element at the proper time. If the self-check program is run regularly (Section 7.6.2) a recommendation will be displayed when the heating element wear has exceeded the permissible limit. Follow the accompanying installation and safety instructions in Section 4 to install the replacement heating element.

⚠ Only authorized personnel may perform technical work. (see p. 15)

6.6 SERVICE AND TRANSPORT

We recommend regular maintenance of the equipment by your service partner. This will ensure superior firing results.
If you need to replace wearing parts or want to update the set programs, please consult the responsible service partner. If more extensive repairs to the furnace or pump are required, please also contact your service partner. Please direct any questions for the manufacturer to the following address:

DEKEMA Dental-Keramiköfen GmbH
Industriestraße 22
D-83395 Freilassing
Phone   +49-(0) 86 54 / 46 39-0
Fax   +49-(0) 86 54 / 6 61 95
E-mail   info@dekema.com
Homepage   http://www.dekema.com

When transporting the furnace and/or the pump, please use the original cardboard box and packaging.
Please proceed as follows when packing the equipment,:

- Note that the device needs several hours to cool down (see p. 8).

- Close the firing chamber.

- Turn off the device and pull the pump plug.

- Only use the original box and the supplied packaging material.

6.7 REPLACEMENT PARTS

Only use original DEKEMA parts for servicing and maintaining the oven. Contact your service partner, or contact DEKEMA directly.

7 USER INTERFACE

This and the following chapters inform you how to use the **AUSTROMAT D4**. The menu control system is designed to display warnings or messages on the screen when you do something wrong or make incorrect entries. If you have experience with graphic user interfaces (such as Windows™ on a PC), you can skip the section entitled FIRST STEPS

7.1 FIRST STEPS

The basic operating mode of the menu control system is shown in Fig.5. This diagram will help familiarize you with the operation of the device.

Figure 5
Operating diagram
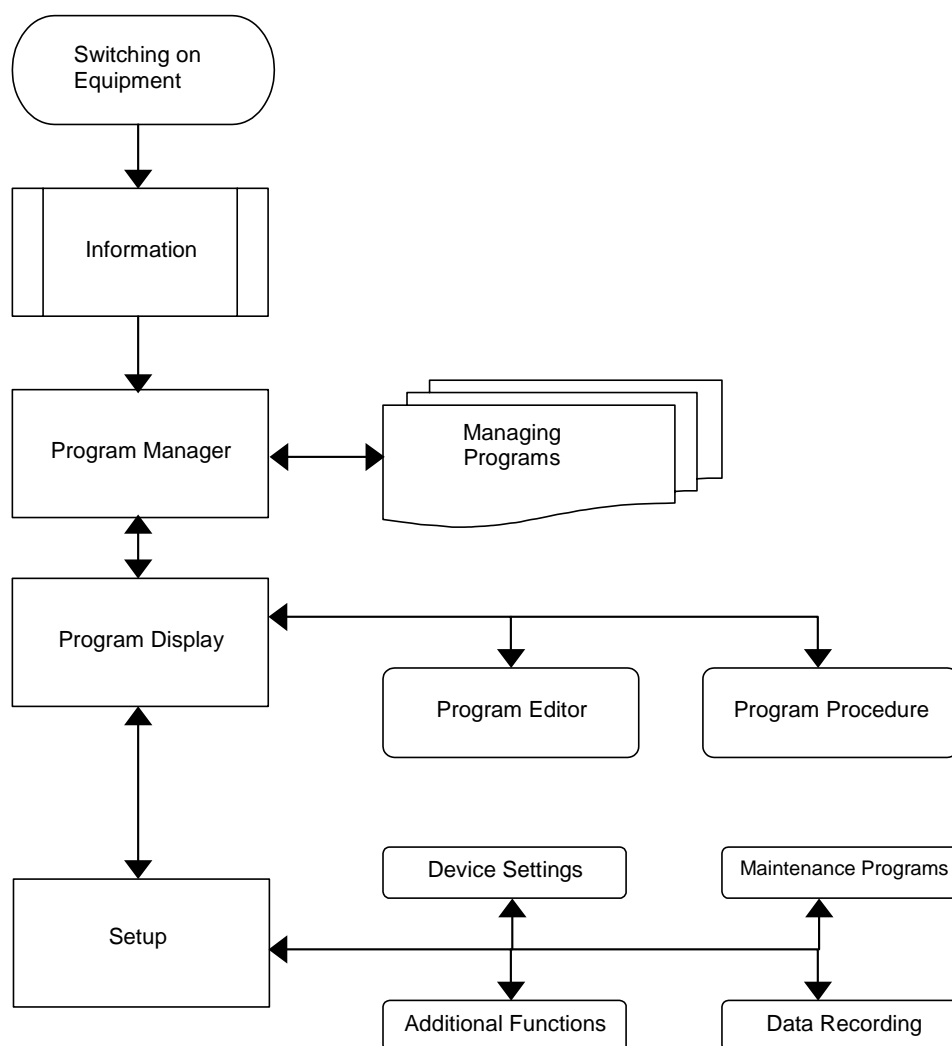
After the oven is turned on, you are initially shown information on the device software and device settings.

Then you automatically go to Program Manager menu. Here you can select firing programs and administer the memories (i.e., delete or copy firing programs).

he most important menu for the user, the Program Display, is accessed from the Program Manager. This shows you the firing progress of the individual programs, and

you can change or create new firing programs with the Program Editor. Firing programs are started in the Program Display menu.

From the Program display, you can go to the Program Manager menu (select a different firing program), or to the Setup menu. In this menu, you select settings (such as screen contrast), start service programs (such as temperature calibration, check program), set options for data recording and transfer (such as record printout), and it also contains a several additional functions (such as general code, data and time).

The arrows in the diagram in Fig. 5 indicate how to get from one menu item to another.

7.1.1   CONTROLS

The **AUSTROMAT D4** is menu controlled, i.e., a selection of commands and program items are suggested on the screen. The selection is made by entries using six function keys below the screen. In addition, there are ten alphanumeric keys (0 to 9, letters and special characters) and six control keys in the front panel to the right of the screen. In these operating instructions, Function keys are framed, "**control keys**" are in bold and in quotes and *menu items* are in italics.

Figure 6
AUSTROMAT D4 operating elements
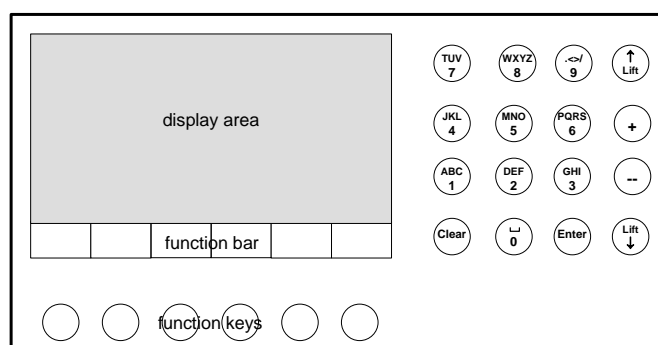
The screen display is divided into two areas (see Fig. 6); the actual display area, and the bar with the functions of the function keys on the bottom of the screen (function bar). Select or confirm the menu items offered in the display field by pressing the associated function key.

The alphanumeric keys (to the right of the screen) are for entering the names of firing programs and for manually entering numeric values (program number, firing temperature, etc.). Control keys are also are also located next to the alphanumeric keys: "**Lift ↑**" "**Lift ↓**" to move the lift up and down, "**+**" "**--**" to browse forward and backward in the program memory, and "**CLEAR**" and "**ENTER**" to confirm and delete entries made in the Program Editor.

After switching on the furnace, an internal hardware check is performed and the software is loaded. This process takes three or four seconds. Next, the lift automatically moves down. At the same time, the screen display changes, and displays information about the software version, time, date, furnace ID and battery status in the display area (Fig. 7).

Figure 7

```
┌─────────────────────────────────────────────────┐
│               AUSTROMAT D4                       │
│                                                  │
│   Software      AUSTROMAT D4 V 1.20              │
│   Time          08:15:24                         │
│   Date          16.07.99                         │
│   Furnace ID    00                               │
│   Battery       99.5 %                           │
│                                                  │
│                                                  │
│         OBSERVE OPERATING INSTRUCTIONS           │
├────────┬─────────┬─────────┬──────────┬────────┬─┤
│        │ Contrast│ Contrast│ Contrast │ Setup  │ │
│   OK   │   --    │    +    │ Standard │        │ │
└────────┴─────────┴─────────┴──────────┴────────┴─┘
```

◯ ◯ ◯ ◯ ◯ ◯

The screen menu options are displayed in the function bar. The user has the following options (keys from left to right):

| OK | Opens the *Program Manager* menu (Section 7.2) |

| Contrast -- | Reduces screen contrast |

| Contrast + | Increases screen contrast |

| Contrast Standard | Default screen contrast |

| Setup | Opens the *Setup* menu (Section 7.6) |

The right function key is not used in this display (empty field in the function bar)

If you do not press a function key, after approx. 10 seconds the *Program Manager* menu is displayed on the screen (Fig. 8)

Figure 8

```
┌─────────────────────────────────────────────────┐
│   PROGRAM MANAGER                                │
│ 001  PREHEATING PROGRAM                          │
│ 002  . . . . . . . . . . . . . . . . . . . . .   │
│ 003  . . . . . . . . . . . . . . . . . . . . .   │
│ 004  . . . . . . . . . . . . . . . . . . . . .   │
│ 005  . . . . . . . . . . . . . . . . . . . . .   │
│ 006  . . . . . . . . . . . . . . . . . . . . .   │
│ 007  . . . . . . . . . . . . . . . . . . . . .   │
│ 008  . . . . . . . . . . . . . . . . . . . . .   │
│ 009  . . . . . . . . . . . . . . . . . . . . .   │
│ .                                                │
│ 1 0                                              │
├──────┬──────┬──────┬───────┬────────┬───────────┤
│ O.K. │  ↓   │  ↑   │ Copy  │ Delete │  Cancel   │
└──────┴──────┴──────┴───────┴────────┴───────────┘
```

◯ ◯ ◯ ◯ ◯ ◯

The AUSTROMAT D4 has 200 memories for firing programs. 100 of these (program number 001 - 100) can be reserved for set programs, or can be freely assigned (depending on the version). The other 100 (program number 101 - 200) are available for individual firing programs. In order to distinguish between the programs, the program number and name and program entries are displayed in different font colors on screen when the set programs are preset.
The program with number 001 (PREHEATING PROGRAM) has a light background and is the default selection suggested immediately after switching the furnace on.

The structure and processing of set and individual programs are described in the next two sections. The difference between set programs and individual programs is that the basic firing procedure is specified for set programs, and only certain firing parameters can be edited. It is therefore also not possible to store another program in an empty program memory reserved for a set program This is only possible by updating the set programs via the software module (Section 7.6.3). Individual programs on the other hand can be defined according to your wishes and requirements. An input mask is provided for the individual firing parameters to facilitate this task.

7.1.2   SET PROGRAMS (OPTIONAL)

The AUSTROMAT D4 *is delivered without set programs. Your service partner can program preset programs.* Select a set program. You can do this in three ways:

(1)   Use the alphanumeric keypad to enter e.g. the sequence "1 1" (you can also press the sequence "0 1 1"). The program 011 appears on a light background.

(2)   Press $\boxed{\uparrow}$ or $\boxed{\downarrow}$ until program 011 appears on a light background. Hold down $\boxed{\uparrow}$ or $\boxed{\downarrow}$ to scroll up or down through the programs quickly.

(3)   Instead of using function keys, you can also press the control keys "**+**" and "**--**".

To confirm your selection, press either $\boxed{\text{O.K.}}$ or the control key **"ENTER"**. A new menu appears on the screen (the *Program Display*) that shows you the entries of the selected set program, and the selection options in the function bar (Fig. 9).

Figure 9

Tc 550°C		# 123456789	⏲ 00:12:22
011	Wash firing		
Drying			4:00
Closing			2:00
Preheating	550°C		-:--
Temperature 1	980°C	80°C/min	1:00
Temperature 2	---°C	---°C/min	--:--
Temperature 3	---°C	---°C/min	--:--
VAC (off/level/hold)	980°C	100 %	--:--

Program Start	Program Edit	Program Manager	Diagram	Setup	

The following are displayed in the top line (from left): the temperature Tc of the firing chamber, an empty field (for vacuum display during program processing), the 9-digit firing number (#123456789) and the expected duration of the firing program in hours:minutes:seconds (⏲ 00:12:22). In day-to-day use, the Tc display will initially flash. This means that the furnace is cooling down and automatically setting the temperature for the beginning of the next firing.
The second line contains the program number (011) and the name of the firing program (wash firing).
The following lines display the individual steps of the firing program with the respective values. Drying is performed with a holding time of 4:00, closing lasts 2:00, preheating at 550°C without indication of time (i.e. only a temperature of 550°C is set without a holding time). The firing temperature 1 of 980°C is heated up at a rate of 80°C/min starting from the preheating temperature, and is held for 1:00. With that, the firing program is finished as the firing temperatures 2 and 3 are not required in this firing program (no entries). If necessary, temperature 2 would be activated from temperature 1, firing temperature 3 would be activated from temperature 2.

Specifically, the vacuum entry line has the following functions: After preheating, before the temperature rises temperature 1 begins, a maximum vacuum is generated (VAC level 100 %). When a temperature of 980°C has been reached, the furnace is immediately vented (VAC off: 980°C), as no holding time has been entered for vacuum (VAC hold: empty entry).

The following functions can be selected from the *Program Display* menu:

| Program Start | Starts a firing program. |

| Program Edit | Opens the *Program Editor* (Section 7.5). |

| Program Manager | Opens the *Program Manager* (Section 7.2). |

| Diagram | Displays a diagram of the time-line of the firing program. |

| Setup | Opens the *Setup* menu (Section 7.6). |

The following display (Fig. 10) is shown for the Diagram

Figure 10
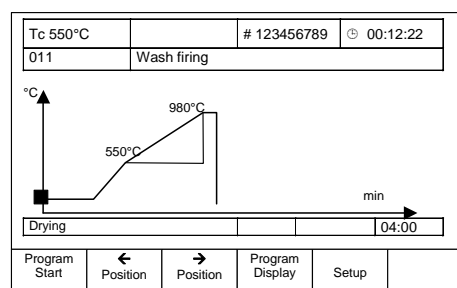
The firing time is indicated on the horizontal axis (min) and the firing temperature is indicated on the vertical axis (°C).
The time-line of the firing program is displayed by the temperature curve, and the vacuum curve indicated in a different color. The current program step is indicated by a square marker. The values of the current program step are displayed in the line below the diagram (e.g. Drying, 04:00 min holding time).
With ← and → you can move the marker along the program time-line and browse through the individual steps. Use Program Display to return to text display mode. In this way you can switch between text and graphic display. You can start the firing program by pressing Program Start both in text mode and graphic mode.
If the firing chamber is closed when the firing program begins, the lift automatically moves down to the lowest position. Only then does the actual program commence. In text display mode, the current program step being processed is displayed by a flashing input field. At the same time, the time display provides information about the expected remaining duration of the program. The current program step is indicated in the diagram by the position of a vertical bar that moves to the right as the program progresses, and in the information line below the diagram.
If you wish to abort the program prematurely, press Program Cancel . You will be asked whether you really want to abort the program (yes or no). This safety query is displayed on the screen for approx. 10 s. If you do not press a function key within this time, the furnace automatically returns to processing the program. However, the program is not interrupted during this time, but continues to run. It is possible to

abort a running program being both in text and graphic mode. Please note that in this case the program does not count as a firing, i.e. the firing number is not incremented.

Additionally in text mode, you can also use ⌷Program Edit⌷ to modify firing programs. This menu is explained in Section 7.5.

7.1.3   INDIVIDUAL FIRING PROGRAMS

The layout of the screen display for a firing program is exactly the same for individual programs as it is for set programs (Section 7.1.2). This section explains how to create an individual program. As an example, we will create firing program 011 as an individual program below.

Exit the *Program Display* menu by pressing ⌷Program Manager⌷. This will take you to the *Program Manager* level. Now select a program memory reserved for individual programs. For example, key in "2 0 0" on the alphanumeric keypad. The empty program memory 200 is displayed on a light background on the screen. Press ⌷O.K.⌷ (or **"ENTER"**) to confirm your selection, and the following display appears (Fig. 11).

Figure 11
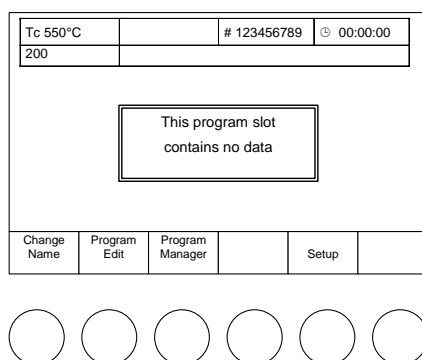
The entry for the name of the firing program is empty, as is the program progress display. Instead, the message "This program memory contains no data" is displayed. This is why the function bar does not contain the functions "Program Start" and "Diagram" (compare with the program display of 011).

Now press ⌷Change name⌷ if you only want to enter a group name without creating a related program. The window for entering a name appears on the screen. Enter for example the name "NEW_PROCEDURE_2005" ("_" stands for a space) on the alphanumeric keypad. The alphanumeric keys have four to five characters in the name entry mode (and only in this mode). The first character is the left one in the smaller font on the key (such as "W"), and the last one is the number on the key (such as "8"). To select the first character, press the key once, for the second character "X", press it twice rapidly, and for the fifth character, press it five times in rapid sequence. Each time after you press a key, wait a bit for the entry to be automatically confirmed, and the flashing cursor will move one position to the right. To delete a character , move the cursor with ⌷←⌷ or ⌷→⌷ until the character starts to flash, and press the control key **"CLEAR"**. To insert a character, move the cursor to the desired location, and press the key corresponding to the desired character. To write over a character, you first need to delete it, and then you can insert the desired new character. After entering the program name, you then confirm it with the **"OK"** key.

Press ⌷Program Edit⌷ if you want to create a program. The following prompt appears on screen: "How do you want to create your program? Standard or professional programming?" (see Section 7.5). Select "Standard" by pressing ⌷←⌷ or ⌷→⌷ and confirm with ⌷O.K.⌷. You are now in the input mode of the *Program Display* (*Program Editor*), and you will see the menu of Fig. 12 on the screen.

Figure 12

Tc 350°C			# 123456789	⊕ 00:00:00
200				
Drying				-:--
Closing				-:--
Preheating	----°C			-:--
Firing Temperature	----°C	---°C/min		--:--
Cooling				-:--
Relief				-:--
VAC (level)		--- %		

Save	← Position	→ Position		Program Start	Cancel

○ ○ ○ ○ ○ ○

In the second line from the top, there is a colored bar instead of the program name. The first character flashes (cursor), prompting you to enter the name of the program. Now enter e.g. the name "WASH_FIRING_TEST" ("_" stands for space) via the alphanumeric keypad (see above). After entering the program name, you then confirm it with the **"ENTER"** key.

The cursor jumps to the next entry field, the holding time for drying. Enter either the number "4" or press one of the control keys **"+"** or **"--"** until the number 4 appears (i.e. scroll up and down through the possible entries). Confirm the entry by pressing **"ENTER"**.

The cursor automatically jumps to the next entry field, the closing time. Enter 2 min closing time, then 550 preheating temperature, no holding time for preheating (just press **"ENTER"**; an empty entry is interpreted as 0 or "do not perform"), then 980 firing temperature, 80 temperature rise rate, 1 min firing temperature holding time, no holding time for cooling and relaxation, and 100% VAC level.

If you confirm an incorrect entry by pressing "**ENTER**", you can correct the entry by moving the cursor to the position by pressing ← or → and entering the correct value. Please note that an input value is only accepted by confirming with **"ENTER"**.

If an input is outside the permissible range, an error message will be displayed on the screen indicating the permissible range (Fig. 13).

Figure 13

Tc 550°C			# 123456789	⊕ 00:12:22
011	Wash firing			
Drying				4:00
Closing				2:00
Preheating	ERROR!			-:--
Firing Temperature	RANGE: [100 – 1200°C]			1:00
Cooling	old value: 980°C			--:--
Relief				--:--
VAC (level)	980°C	100 %		--:--

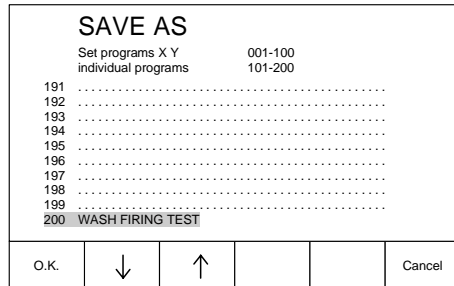| O.K					

○ ○ ○ ○ ○ ○

For example, if you enter and confirm a firing temperature of 1,300°C, the appropriate message is displayed on the screen. Press O.K. to return to program display entry mode.

After you finish entering the program, the program must be saved . This is done by pressing Save .

This will take you to the *SAVE AS* menu (Fig.14).

Figure 14

Only a complete firing program can be saved (program name + program procedure). The program number under which the program will be stored is displayed on a light background. If you wish to select a different memory, you can enter the number directly via the alphanumeric keypad or with the aid of the control keys **"+"** and **"--"** or use ↑ or ↓ to browse through the memory slots. Press O.K. to store the program and access the *Program Display* automatically.

In order to reverse this example, please proceed as follows. In the *Program Display* menu, press Program Manager , then select program number 200 (light background) and press Delete . Answer the security query concerning the deletion by pressing yes . You are now back in the *Program Manager* menu.

7.2 PROGRAM MANAGER

The *Program Manager* is used to select a firing program and to manage the individual memories (copying, deleting firing programs). Altogether, the AUSTROMAT D4 offers 200 memory slots (program numbers) for firing programs. Memories 001 – 100 are reserved for set programs (Section 7.1.2) (depending on software version), and memories 101 – 200 are reserved for individual programs (Section 7.1.3). In the set programs, the firing procedure is pre-defined, and only certain parameters may be modified. Specifically, you may not delete nor overwrite a set program. It is only possible to change the allocation of these memory slots by updating the set programs with a software module. Individual programs, on the other hand, can be freely managed in the reserved memory area.

In the *Program Manager* (Fig. 15), you can select from the following functions (function bar):

Abbildung 15
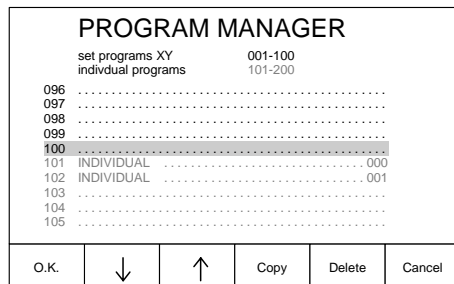
<table>
<tr><td>↓ ↑</td><td>Select firing program: The selected firing program appears on a light background (program 100 in Fig. 15). You may also select a program by entering the program number via the alphanumeric keypad or via the control keys "**+**" and "**-**".</td></tr>
<tr><td>Note:</td><td>The program names, numbers and entries of set and individual programs differ in color. An allocated program number (firing program with entries) must have a name. Empty memories only contain a dotted line.</td></tr>
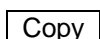<tr><td>O.K.</td><td>Confirm selection, or with control key **„ENTER"**. This will take you to the porgram Display menu.</td></tr>
<tr><td>Note:</td><td>Only one program may be selected at a time.</td></tr>
<tr><td>Copy</td><td>Copy firing program; procedure: Select the program to be copied (source); Copy ;
Select the program number to copy program to (target); Insert (execute the copy command).</td></tr>
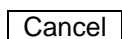<tr><td>Note:</td><td>For copying, the source may be a set program or an individual program. The target, on the other hand, must be a program number from the individual range.
If the target is already occupied, you will be asked whether you want to overwrite the target.
A program cannot be copied onto itself.
An empty program cannot be copied.
Two programs may not have the same name. During copying, the source and target are thus automatically numbered (Fig. 16, programs 101, 102).</td></tr>
<tr><td>Delete</td><td>Delete firing program; procedure: Select the program to be deleted; Delete ; Answer the prompt (yes or no).</td></tr>
<tr><td>Note:</td><td>An empty program cannot be deleted</td></tr>
<tr><td>Cancel</td><td>End the Program Manager and return to previous menu.</td></tr>
</table>

TIP E

⚠ Please note the restricted options of the Program Manager when the general code is activated (see Section 7.6.4).

7.3 PROGRAM DISPLAY

If a program number is selected, the *Program Display* menu with the firing parameters is displayed (Fig. 16[*]). The display is divided into three sections: The information bar, the entry boxes and the function bar.

Figure 16

Tc 550°C			# 123456789	☺ 00:12:22	
011	Wash firing				
Drying				4:00	
Closing				2:00	
Preheating	550°C			-:--	
Temperature 1	980°C	80°C/min		1:00	
Temperature 2	---°C	---°C/min		--:--	
Temperature 3	---°C	---°C/min		--:--	
VAC (off/level/hold)	980°C	100 %		--:--	

Program Start	Program Edit	Program Manager	Diagram	Setup	Protocol Print	*)

The information bar contains two lines. The first line displays the chamber temperature Tc, the vacuum in the firing chamber (empty: atmospheric pressure), the firing number and the probable duration of the program. As long as the temperature is too high for the program to start, the temperature display will flash. The second line contains the program number and the program name.

The entry boxes contain the respective program steps with the firing parameters. The first column contains the program steps in the order of execution, the second column indicates the temperature at which the step is executed. The third column indicates the heating rate at which the temperature in column 2 is activated. The respective holding times are entered in the fourth column.

An exception is the vacuum program step (VAC). In this case, the second column contains the temperature at which the furnace is vented after expiration of the holding time (VAC off), and the third column indicates the level of the vacuum in percent (VAC level). The furnace is evacuated after expiration of the Preheating program step. Please note that the vacuum holding time is included in the holding time e.g. for temperature 1.

An empty entry box in column 2,3,4 means that the respective value is automatically specified by the program step or is not required.
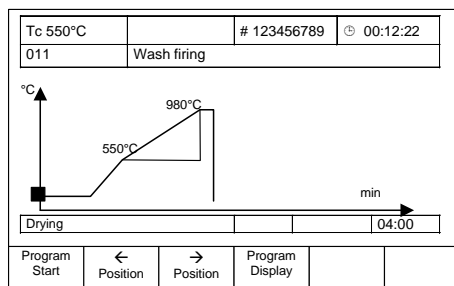
The function bar displays the menu options (empty field: no function). The following options are available:

Program Start	Starts the program: Opens the *Program Procedure* menu.

Program Edit	Edits the program: Opens the *Program Editor* menu.

Program Manager	Opens the *Program Manager* menu.

Diagram	Diagram of the program.

Setup	Opens the *Setup* menu*.*

When | Diagram | is activated, the program procedure is displayed in diagram form instead of the entry boxes (Fig. 17). The position of a program step is displayed by a cursor (solid square); the program step and the related firing parameters are displayed in the line below.

Figure 17

The function bar provides the following options:

| Program Start | Starts the program. opens the *Program Procedure*.

| ← | | → | Browse through program procedure.

| Program Display | Displays program entries.

| Setup | Opens the *Setup* menu.

If an empty memory was selected when selecting the program number, the message "This memory contains no data" is displayed instead of the entry boxes (see Figure 11). Fig. 11). You now have the following options (function bar):

| Program Edit | Create a new program. Opens the *Program Editor* menu*.*

| ProgramManager | Opens the *Program Manager* menu.

| Setup | Opens the *Setup* menu.

7.4 PROGRAM PROCEDURE

A firing program is started from the *Program Display* by pressing | Program Start |. This can also be done from the graphic display of the program procedure. The program steps are processed according to the set sequence of the entry mask (Standard or Professional, or press, (only the D4*press*) cf. Section 7.5). An exception is the Vacuum program step. After closing, the furnace is evacuated to [VAC level] or [Press level] for the D4*press.* At the temperature [VAC off] the furnace is vented after expiration of the holding time [VAC hold], or after [Press time] for the D4*press.* A program procedure as in Fig. 18 executes the following firing process:

Figure 18

| firing chamber temperature | vacuum level | firing number | remianing firing duraction |

Tc 460°C		# 123456789	⏱ 00:12:22
011	Wash firing		
Drying			4:00
Closing			2:00
Preheating	550°C		-:--
Temperature 1	980°C	80°C/min	1:00
Temperature 2	---°C	---°C/min	--:--
Temperature 3	---°C	---°C/min	--:--
VAC (off/level/hold)	980°C	100 %	--:--

| | Program Edit | | Diagram | | Program Cancel |

0. Program start (firing chamber open, i.e. the lift moves down if necessary)
1. 4:00 min drying
2. Closing 2:00 min (lift moves up);;
3. Set preheating temperature (no holding time);
4. Evacuate to 100 %;
5. Set temperature 1 with a rate of 80°C/min (550°C to 980°C);
6. Vent;
7. 1:00 min firing (temperature 1 holding time);
8. End of program: the lift moves down, and the firing number is automatically incremented by one.

The firing number indicates how many firings have been performed in the furnace. Note that only a fully completed firing procedure counts.
Specifically, the program steps execute the following functions:

Drying: The firing object is dried for the specified holding time. The firing chamber remains open.

Closing: The firing chamber is completely closed in the specified time, and the firing object is heated to preheating temperature.

Preheating: The firing object is subjected to the preheating temperature in the closed firing chamber for the specified holding time.

Temperature 1:   The closed firing chamber is heated up to temperature 1 from preheating temperature at the specified heat-up rate 1. When temperature 1 is reached, the firing object is subjected to temperature 1 for the specified holding time.

Temperature 2/3: Starting from temperature 1/2, temperature 2/3 is activated at the specified heat-up rate 2/3 and held for holding time 2/3. The firing chamber may be open (e.g. cooling, relaxation).

VAC: After preheating, the firing chamber is evacuated to vacuum level [VAC level]. The vacuum is held until temperature [VAC off] is reached and then held for time [VAC hold].

Observe the following features In the program procedure

- The firing program is processed after the correct temperature has been reached for starting the selected program. Otherwise the Tc display flashes, and a message is displayed indicating that the furnace is too hot or the furnace is still heating (message "Furnace not ready yet"). You can now quickly cool the furnace with the vacuum pump. The following options are available:

  1. ⎢ VAC ⎥ "fast cooling": The furnace cools to the starting temperature. The firing program must be manually started after cooling. You can stop fast cooling at any time by pressing ⎢Cancel ⎥.

  2. ⎢ Start ⎥ „"Fast start": The lift remains open. The drying time passes without consideration of the drying time. The lift closes after the drying time is over, or as soon as the preheating temperature is reached.

- In the DRYING program step without the fast start, the lift is automatically moved to the right position. This position depends greatly on the temperature of the firing chamber. Thus, the lift may move up and down several times in small steps during the DRYING program step.

- The program step currently being processed will flash.

- The firing chamber is evacuated after preheating. The furnace is vented when the temperature [VAC off] is reached for the first time.

- A vacuum holding time [VAC hold] can only be entered if the temperature [VAC off] coincides with the temperatures 1,2,3 and if a holding time has also been entered at this temperature. The vacuum holding time does not count as an additional holding time.

- Temperature 2/3 is set at the respective heat-up rate starting from temperature 1/2.

- In the STANDARD entry mask, temperature 1 is called FIRING TEMPERATURE. Temperature 2 is predefined and called COOLING. The cooling temperature is approx. 90 % of the firing temperature. 3 is also pre-defined (RELAXATION) and is 65 % of firing temperature. The Cooling and Relaxation steps are only processed if a holding time has been specified.

The function bar offers the following options:

⎢ Diagram ⎥   During the program procedure it is possible to switch between the entry mask and the graphic display. The current program step is indicated in the diagram by the position of a vertical bar that moves to the right as the program progresses, and in the information line below the diagram. With the aid of ⎢ Display program ⎥ you will return to the entry mask, and by pressing ⎢ Program Cancel ⎥ you will prematurely terminate the program.

⎢ Program Cancel ⎥   Premature termination of a program in progress. In this case, the firing number is not incremented. You will access the entry mask of the *Program Display* menu (also from Diagram mode).

⎢ Program Edit ⎥   A program in progress can be edited (Section 7.5).

| Sleep ON/OFF | (De)activation of long-term readiness. This function must be selected in Setup (see Section 7.6.1). In this context, DEKEMA notes that the ceramic furnace may only be operated under supervision. |

- Long term readiness can be switched on by pressing the Sleep ON - key with the green background.
- Long term readiness can be switched of by pressing the Sleep OFF - key with the red background.
- If the Sleep OFF – OFF key with the red background appears in the display, the furnace enters "Sleep mode" after the program is over. This ensures that the furnace will not automatically heat up to the start temperature over night or after a power failure.
- Sleep mode procedure: After the program ends (lift moves up), an acoustic signal sounds. "Long-term readiness active" is displayed, and the CANCEL key remains available. The heating is turned off. The furnace cools to the firing chamber temperature of 100°C and then closes. The firing chamber continues to cool while it is closed. The screen saver is activated after a set period (standard 30 min.).
- Furnace restart (press any key): The lift moves to L0 (bottom position). The furnace automatically heats to the start temperature. The following text appears: "Long-term readiness aborted. Removed the fired object. The firing chamber is set to the start temperature." The text must be confirmed with the OK key. The furnace returns
  - o   back to the last program by default, or,
  - o   back to the start window after a power failure or rebooting.

7.5 PROGRAM EDITOR

TIP F
see p. 43

The *Program Editor* is used to create new firing programs or to edit existing programs. Furthermore, it is possible to edit a firing program in progress. The *Program Editor* menu is activated from the *Program Display* menu by selecting Program Edit . The options differ slightly depending on whether a set program, an individual program or a program in progress is edited. In order to facilitate programming, an entry mask is always displayed with the basic program procedure.

The following aspects must be observed when editing a firing program:

- The editable values differ in color from other entries.
- The value currently being edited flashes.
- The permissible values for every entry can be incremented and decremented by pressing **"+"** and **"-"**.
- An entered value must be confirmed by pressing **"ENTER"**. Otherwise, the entry or changed value has no effect.
- If you attempt to confirm an illegal value, an error message is displayed indicating the permissible range. Press O.K. to return to *Program editor*. The original value is retained..
- A value is deleted by pressing **"CLEAR"**.".
- An empty entry is interpreted as 0 and vice-versa.
- In order to save a program <u>at least</u> the following entries must have been entered: program name, preheating temperature, temperature 1 or firing temperature, temperature 1 rise..
- A program name may be up to 37 characters long.

Use of the alphanumeric keypad is described in Section 7.1 beschrieben.

⚠️ Please note the restricted options of the Program Manager when the general code is activated (see Section 7.6.4).

7.5.1   INDIVIDUAL PROGRAMS – STANDARD

When creating an individual program, you can choose between the STANDARD and PROFESSIONAL entry masks. STANDARD mode allows faster and easier programming. Table 1 lists the permissible values for the individual program steps in STANDARD mode.

Table 1: Permissible range of values of program steps in Standard mode.

Program Step	Temperature	Temperature rise °C/min	Holding period min
Drying			0:00 – 9:59
Closing			0:00 – 9:59
Preheating	100 – 700		0:00 – 9:59
Firing temperature	100 – 1200	2 – 99, MAX [1]	0:00 – 99:59
Cooling	[2]	[4]	0.00 – 9:59
Relaxing	[3]	[4]	0:00 – 9:59
Vacuum	[5]	level in % [6]	0:00 – 99:59

1)   maximum rise for input 0°C/min (see technical specifications)
2)   cooling temperature predefined as 90 % of firing temperature
3)   relaxation temperature predefined as 65 % of firing temperature
4)   cooling / relaxation temperature is activated as quickly as possible (opening of firing chamber)
5)   venting (vacuum off) when firing temperature is reached
6)   0 % = pump off; 100 % = continuous pump operation

The permissible values for VAC level are divided in steps of ten from 0 % to 100%.

The function bar in the *Program Editor* (Fig. 19) provides the following options.

Figure 19

Tc 550°C			# 123456789	⏱ 00:12:22
102				
Drying			-:--	
Closing			-:--	
Preheating	----°C		-:--	
Firing temperature	----°C	---°C/min	--:--	
Cooling			-:--	
Relief			-:--	
VAC (level)		--- %		

Save	← Position	→ Position		Program Start	Cancel

Save   The program is saved after editing has been completed. The *Save as* menu is displayed. Select the number under which the program is to be saved (↓   ↑ , **"+" "-"**, input via alphanumeric keypad). Press O.K. to save the program and access the *Program Display*; press Cancel to abort saving and return to the *Program Editor*. If the selected program number is already allocated, a prompt is displayed asking

whether you wish to overwrite the old program with the new data. Press ⌑yes⌑ to overwrite and return to *Program Display*; press ⌑no⌑ to cancel overwriting and return to *Save as*.

⌑Position ← →⌑   Selects the value to be edited.

⌑Program Start⌑   Starts the entered provisional program from the Program Editor. A prompt is displayed. Press ⌑Cancel⌑ to return directly to the *Program Editor*. Press ⌑O.K.⌑ to run the program. You will have the options of the respective *Program Procedure* (Section 7.4). After the program has finished, you will return to the *Program Editor* and you can save or continue to edit the program.

⌑Cancel⌑   Cancels the *Program Editor* and returns to the previous menu.

7.5.2   INDIVIDUAL PROGRAMS – PROFESSIONAL

The editing restrictions in STANDARD mode can be avoided by selecting PROFESSIONAL mode. Table 3 lists the permissible values for the individual program steps. The options offered by the function bar are the same as in STANDARD mode.

Table 2: Permissible range of values of program steps in Professional mode.

Program Step	Temperature °C	Temperature rise °C/min	Holding period min. sec
Dry			0:00 – 9:59
Close			0:00 – 9:59
Preheat	100 – 700		0:00 – 9:59
Temperature 1 [1]	100 – 1200	2 – 99, MAX [4]	0:00 – 99:59
Temperature 2 [2]	100 – 1200	2 – 99, MAX [4]	0:00 – 99:59
Temperature 3 [3]	100 – 1200	2 – 99, MAX [4]	0:00 – 99:59
Vacuum	T_{max} [5]	level in % [6]	0:00 – 99:59

1)   Temperature 1 = Firing temperature in Standard entry mask
2)   Temperature 2 = Cooling temperature in Standard entry mask
3)   Temperature 3 = Relaxation in Standard entry mask
4)   maximum rise at 0°C/min (see technical specifications p. 2)
5)   T1 = Temperature 1; T_{max} = max. value of T1, T2, T3
6)   0 % = pump off; 100 % = continuous pump operation

7.5.3   INDIVIDUAL PROGRAMS – PRESS PROGRAMS (ONLY D4*press*)

In addition to entering a processing firing programs, you can also select press programs in the D4*press*. The options that are offered under this function are in the following table.

Table 3: Permissible range of values of program steps in Press mode.

Program step	Temperature °C	Temperature rise °C/min	Holding period min:sec
Start temperature	100 – 900		
End temperature	100 – 1200	2 – 99, MAX [1]	0:00 – 99:59
Pressing time			0:00 – 99:59
Press level		1 – 5 [2]	

1)   maximum rise at 0°C/min (see technical specifications, p. 4)
2)   Press levels 1 – 5 corresponding to 60 - 100 vacuum

In the Press mode of the D4*press*, conventional cylindrical press muffles with a press plunger can be used whose maximum height is 70 mm without the press plunger and 90 mm with the press plunger, and whose diame7ter is not greater than 60 mm without the press plunger.

7.5.4   SET PROGRAMS

In the set programs, the firing procedure is pre-defined, and only certain parameters may be modified. These are indicated in a different color than the other entries in the *Program Editor*. The entry mask and program editing options are the same as for individual programs in Professional mode (see Section 7.5.1). In addition, you have the possibility to restore the original firing parameters after they have been changed by pressing │ Original values │. An exception is program 001 PREHEATING PROGRAM which can not be edited or modified.

7.5.5   EDITING WHILE THE PROGRAM IS RUNNING

After selecting │ Program Start │, you can edit the firing parameters in *Program Procedure* by pressing   │ Program Edit │ (Fig 20).

Figure 2

Tc 550°C			# 123456789	⏲ 00:12:22
011	Wash firing			
Drying				4:00
Closing				2:00
Preheating	550°C			-:--
Temperature 1	980°C	80°C/min		1:00
Temperature 2	---°C	---°C/min		--:--
Temperature 3	---°C	---°C/min		--:--
VAC (off/level/hold)	980°C	100 %		--:--

O.K.	← Position	→ Position			

0

Press   │ Cancel │ to return from the displayed prompt to the *Program Procedure*, press │O.K. │ to open the *Program Editor*. If you do not press a key in this menu within 20 seconds, you will automatically return to *Program Procedure*..
The editing options are the same as the options in Sections 7.5.2 and 7.5.3. However, only the values of unprocessed program steps may be edited. Only between these steps and values can the position be changed with   │ ← │ and │ → │. **"ENTER"** confirms an individual value and stores it in the program procedure; press │ O.K. │ to close the changes and return to the *Program Procedure*. After the program has finished, the furnace is in the *Program Editor* and the provisional program can be further edited (Section 7.5.1 to 7.5.3).

7.6 THE SETUP MENU

The *Setup* menu is used to edit less frequently required furnace settings, to launch maintenance programs, to record and transfer data,   and also offers several additional functions. The *Setup* menu is activated from the *Program Display* or directly after switching on the furnace. The following functions are available:

Function	Section
Set display contrast	7.6.1
Print record	7.6.3

Save data to computer	7.6.3
ID	7.6.4
Print all programs	7.6.4
Cleaning firing	7.6.2
Temperature calibration	7.6.2
Check program	7.6.2
Diagnosis data	7.6.2
Leak test	7.6.2
General code	7.6.4
Set acoustic signal	7.6.1
Language	7.6.1
Data transfer with memory module	7.6.3
Update set programs	7.6.3
°C / °F switchover	7.6.1
Screen saver	7.6.4
Set date and time	7.6.1
Changing battery	7.6.2
Service functions	7.6.4
Long-term readiness	7.6.2
Drying temperature	7.6.2
Safe lift position	7.6.1

In the Setup menu, the function bar provides the following options:

| O.K. | Open the menu item on light background (highlighted). |

| ↓ | ↑ | Select a menu item. The selected function is displayed on a light background. |

| Cancel | Exit the *Setup* menu and return to the previous menu (e.g. *Program Display*). |

> Please note the restricted options of the Setup menu when the general code is activated (Section 7.6.4)

7.6.1   FURNACE SETTINGS

Set display contrast
A contrast test picture is displayed on the screen. The function bar offers the following options:

| O.K. | Confirms screen contrast setting and returns to the *Setup* menu. |

| Contrast - | Reduce contrast one step. |

| Contrast + | Increase contrast one step. |

| Contrast Standard | Set contrast to default value. |

Set acoustic signal
There are 5 acoustic signals to choose from, consisting of individual tones whose duration can be varied from 0 and 9 or 1 to 9. The active signal is displayed on a

colored background and is emitted after a firing program is completed. The function keys are assigned as follows:

| O.K. | Save the selected active signal and return to *Setup*. |

| ↓ | ↑ | Select a signal. |

| Test | Listen to the active signal as a test. |

| Cancel | Quit the acoustic signal setting function and return to *Setup.* Any changes are discarded. |

Change the duration and number of tones of the active signal as follows:
- **"ENTER"**
- Enter number for duration of a tone (1 = short, 9 = long)
- **"ENTER"**
- Enter number for number of tones (0 to 9).
- **"ENTER"**

After the final "ENTER" you will return to the *Acoustic Signal* menu.

Set date and time
The time and date are displayed on the screen. Press ← → to switch between time and date. The active function is displayed on a colored background. Enter the correct time and the correct date via the alphanumeric keypad. Press **"ENTER"** to confirm your entry and proceed to the other function. The **"CLEAR"** key resets date and time to their default setting, i.e. 00:00:00 and Th. 01.01.70. Press O.K. to accept the changes and return to Setup. Press Cancel to return to Setup without saving changes.

Language
Select the desired language setting from German / English / French / Italian / Spanish by pressing ↓ ↑ . The active language setting is displayed on a light background. Press O.K. to accept the changes and return to Setup. Press Cancel to return to Setup without saving changes.

C / °F switchover
Select the desired temperature display °C / °F. The active temperature setting is displayed on a light background. Press O.K. to accept the changes and return to Setup. Press Cancel to return to Setup without saving changes.
The conversion formulas are as follows: °C = 5/9 (°F-32); °F = 9/5 °C + 32.

Safe lift position after the end of the program (only for the D4*press*)
Activate this menu item to move the lift into a safe posiiton after pressing. This provides additional safety should the press muffle tip over. This does not affect moving to the bottom lift postion after the end of a firing program.

7.6.2   MAINTENANCE PROGRAMS

Cleaning firing (see also Section 6.2)
Use the cleaning firing to clean the firing chamber and condition the thermocouple. Start the cleaning firing by pressing Program Start . It automatically runs for approximately 19 min. During the program, a message flashes on the screen that shows the remaining time of the cleaning program. You can stop the program with Cancel . If you respond to the following prompt by pressing no , you continue with the program. If you press yes , the program aborts, and you return to the *Cleaning*

firing menu. Change the cleaning temperature (range of 700 ^{0}C to 1200 ^{0}C) by entering the new value and pressing ⌐Program Start¬. Return to *Setup* by pressing ⌐Cancel.¬

Temperature calibration (see also Section 6.2)
For temperature calibration please use only the DEKEMA calibration set, and preheat the furnace. Start the calibration program by pressing ⌐Program Start¬. It automatically runs for approximately 8 min. During the program, a message flashes on the screen that shows the remaining time of the calibration program. You can stop the program with ⌐Cancel¬. If you respond to the following prompt by pressing ⌐no¬, you continue with the program. If you press ⌐yes¬, the program aborts, and you return to the *Temperature calibration* menu. The calibration factor (range of 0.970 to 1.050) is changed by entering the new value via the alphanumeric keypad, or by pressing the control keys **"+"** and **"-"** (incremental/decremental change). Press ⌐O.K.¬ to accept the new value and return to Setup. Press ⌐Cancel¬ to return to Setup without saving changes.

Check program
The check program is used to monitor proper technical functioning of the furnace and lasts about 45 minutes (see p. 2). It is recommended that you perform the check program on a regular basis. The **AUSTROMAT D4** automatically reminds the user to perform the check after around 2000 firings. The check program can be prematurely cancelled while it is running by pressing ⌐Stop¬ and then confirming a prompt. However, please note, that no check (diagnosis) is performed in this case. The results of the check program are saved in a diagnosis file. If necessary, the furnace indicates any malfunctions and displays a warning if it is likely that a firing process will not be correctly completed. Performing the check program regularly also makes it easier to identify a worn heating element and to diagnose any faults in the vacuum system.
The structure and interpretation of the diagnosis data are important for the service personnel (see the "Diagnosis data" menu item). The data have little significance for the user. They are therefore not detailed here.

Battery change (see also Section 6.4)
The software must be informed of a battery change in order to record the decreasing battery charge from ageing. The purpose of this is to protect the stored firing programs from loss when the furnace is switched off. Confirm a battery change by pressing ⌐Battery change¬ and then answer the prompt by pressing ⌐yes¬. Return to *Setup* by pressing ⌐Cancel¬.

> Do not inform the software that the battery has been changed no new battery was installed. Otherwise this can lead to loss of the saved firing programs.

Diagnosis data
The values and interpretation of the diagnosis data are important for the service personnel. For remote diagnosis (e.g. by phone, see p. 15) it is possible to display the diagnosis file on screen, or to print it by pressing ⌐Print diagnosis¬ on a record printer. The data have little significance for the user. They are therefore not detailed here.

Leak test
This test checks all the components of the vacuum system and the firing chamber for a sufficient seal and provides an error analysis. Run this program occasionally to prevent improper firing. It is recommendable to clean the seals and lift seat according to Section 4 before starting the leak test.

Long-term readiness (see also Section 7.4)

To activate the long-term readiness function, "Long-term readiness" has to be checked in *Setup.* While the program is running, the button $\boxed{\text{Sleep ON}}$ or $\boxed{\text{Sleep OFF}}$ appears.
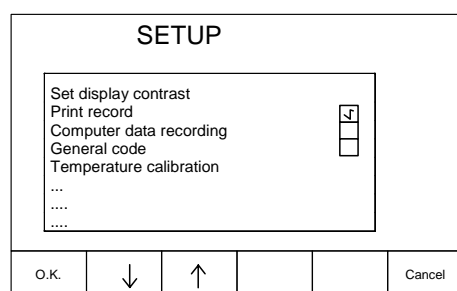
Drying temperature
This menu is for globally adjusting the approximate drying temperature near the firing object. The same holds true for all firing programs. Change the drying temperature if your firing tests indicate that the temperature setting seems too low or too high. Changing the drying temperature (range of 80 ^{0}C to 200 ^{0}C, default setting: 160 ^{0}C) by entering the new value on the numeric keypad, and confirm it by pressing $\boxed{\text{OK}}$. Return to *Setup* by pressing $\boxed{\text{Cancel}}$.

7.6.3   DATA RECORDING AND TRANSFER

Print record
Note that a suitable record printer must be connected for printouts (see Section 8). Activate the printing of a record of the firing by pressing $\boxed{\text{O.K.}}$. After each complete firing, a firing protocol is printed <u>automatically</u>. A check appears in the check box to indicate this (Fig. 21).

Figure 21

```
┌─────────────────────────────────────────────┐
│                                             │
│            SETUP                            │
│                                             │
│   ┌────────────────────────────┬──┐         │
│   │ Set display contrast       │  │         │
│   │ Print record               │ √│         │
│   │ Computer data recording    │  │         │
│   │ General code               │  │         │
│   │ Temperature calibration    │  │         │
│   │ ...                        │  │         │
│   │ .....                      │  │         │
│   │ .....                      │  │         │
│   └────────────────────────────┴──┘         │
│                                             │
├──────┬──────┬──────┬──────┬──────┬──────────┤
│ O.K. │  ↓   │  ↑   │      │      │  Cancel  │
└──────┴──────┴──────┴──────┴──────┴──────────┘

   ○     ○      ○      ○      ○       ○
```

Press $\boxed{\text{O.K.}}$ again to deactivate the print record option (the check disappears). In any case, after a firing run you can manually print a firing record (see . Figure 16).

Save data to computer
Data recording is not active.

**Data transfer with memory module**
This menu item allows the user to save the firing programs with an optionally available memory module (not included with the original delivery). Connect the memory module to the socket at the back side of the furnace. Choose to either save firing programs from the **AUSTROMAT D4** to the memory module, or transfer programs from module to the ceramic furnace by pressing $\boxed{\leftarrow}$ or $\boxed{\rightarrow}$. The data will be transferred with $\boxed{\text{O.K.}}$, or press $\boxed{\text{Cancel}}$ to automatically return to *Setup*.
Please note that all firing programs will be transferred to the target, and its prior memory will be deleted (program numbers 1 to 200). After a data transfer, the identical firing programs are both on the memory module and the **AUSTROMAT D4**.

TIP G
see p. 43

Figure 22

connection socket at back side of the furnace

memory module with two clamps
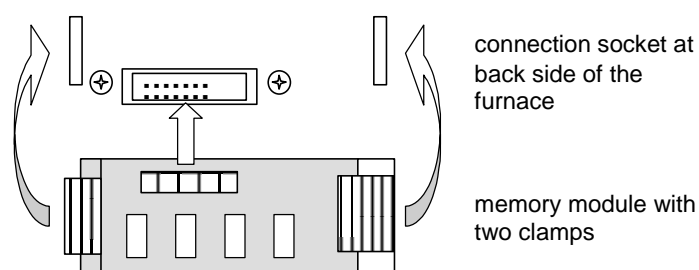
Please refer to Fig. 22 to connect a memory module to the rear of the housing. Disconnect a memory module by softly pressing the two clamps at the narrow sides of the module. Then pull it off from the plug-in connection.

Update set programs (optional)
This menu item allows you to update set programs (program memories 1 to 100). It is the only way to change the memory assignment in program memories 1 to 100. Insert the new software module in the provided socket at the back side of the furnace (see Fig Figure 21). Press ⌐O.K.⌐ to run the update and then go to *Setup,* or press ⌐Cancel⌐ to automatically return to *Setup*.
Note, that all old set programs of the **AUSTROMAT D4** will be erased. They are overwritten with the set programs of the software module. Therefore, please save your old firing programs by writing them down, or by printing out all firing programs. Firing programs 101 to 200 are not affected when this menu item is used.
A software module (same design as the memory module) is included in the delivery that contains the set programs and software of the **AUSTROMAT D4** as backups. Before starting the furnace, remove this module and place it in a safe location.

7.6.4   ADDITIONAL FUNCTIONS

Oven ID
To prevent confusing furnaces from each other (for example when printing records), an individual ID can be entered for each furnace . Assign the ID using the alphanumeric keypad, or pressing "**+**" and "**-**". Press ⌐O.K.⌐ to accept the ID and return to Setup. Press ⌐Cancel⌐ to return to Setup without saving changes.

Print all programs
This setup item allows the user to print out all firing programs stored in the furnace on a suitable printer (see Section 8). Make sure that there is sufficient paper in the printer for a complete printout. Run this program from time to time to have a paper record of your data.

General code
The general code enables you to protect the furnace and firing programs from change. Before activating the general code, please observe the operating restrictions described below.
Select the menu item General code from the *Setup* menu by pressing ⌐O.K.⌐. Enter a four-digit number, and confirm by pressing "**ENTER**". In order to avoid accidental entry, this number must be entered identically a second time and confirmed with "**ENTER**". After entering the general code, you can choose what program range you wish to protect from change (default: all programs from 1 to 200). If, for example, you wish to protect the range of individual programs, the correct entry is from 101 to 200 (confirm each entry with "**ENTER**"). If, for example, you wish to protect program 150 only, enter 150 to 150. The entry can be cancelled at any time by pressing ⌐Cancel⌐ (return to *Setup* without activating the general code). Activate the general code with

O.K.   and return to Setup. A check appears in the check box to indicate that the code has been activated.

⚠️ Activating the general code has various effects on furnace operation. In particular, note the following items:

- Please record the code number since it cannot be later determined.

- Programs protected by the general code are marked with a lock displayed next to the program number.

- Programs protected by the general code cannot be edited or modified (*Program Editor* cannot be invoked for these programs)..

- Programs protected by the general code cannot be deleted (*Program Manager*).

- Program numbers protected by the general code are not available as targets for copying (*Program Manager*)..

- When the general code is activated, only the following functions are available in *Setup*:

   Set display contrast
   General code
   Check program
   Diagnostic data
   Leak test
   Print all programs

- In particular, it is not possible to calibrate the temperature.

If you wish to perform a function that cannot be performed while the general code is activated, you must first deactivate the code. In order to deactivate the general code, select this menu item in *Setup,* and enter the (correct) code (confirm with **"ENTER"**).

Screen saver
The screen saver makes the screen go dark after the furnace has not been used for a while, and thereby protects the display (less power consumption and longer screen life). Press any button to for the original display to appear. Press ↓ and ↑ to switch between activating and deactivating the screen saver. The current setting has a bright background. The wait period for the screen to go dark if no button is pressed can be set after pressing **"ENTER"**. Enter the different wait period (range of 1 – 99 min.) on the alphanumeric keypad or press **"+"** or **"-"** , and then press **"ENTER"**. Press   O.K.   to accept the wait period and return to Setup. Press   Cancel   to return to Setup without saving changes.

Service functions
Service functions are password-protected and are only available to authorized service personnel.

8 PRINTING RECORDS AND CONNECTING TO A PC

8.1 PRINTING RECORDS

As a standard feature, the AUSTROMAT D4 allows you to document a completed firing program for quality assurance. In addition, we offer you the option of manually retrieving records through our PC software, DREAM® (see Section 8.2).

The internally unchangeable record monitors and documents the progress of the set program, especially the target and actual values of the programmed parameters for the vacuum and heating, as well as established fluctuations in temperature during the holding periods (only when the firing chamber is closed).

Printer requirements:

- Modern printer with a serial RS232 interface (9600, 8, N, 1)
  (any printing method: needle, thermal, ink, laser, etc.)

- Minimum input memory (input buffer) 1 Kbyte

- Minimum line length: 50 characters

To connect the printer to the furnace, you need a well-screened (serial) printer cable with a socket connector to connect to the furnace. The data is printed out in standard printing characters (ASCII).

Connection:

- Turn off the furnace (ON/OFF switch is on the rear), see p. 6.

- Make sure that the printer is turned off.

- Connect the furnace and printer with the interface cable

- Turn on both devices.

There are two options for printing the records:

1. Manual printout
   After the program is finished, press the function key ⎡ Print record ⎤ (see Figure 16). The record is then printed out on the printer.

2. Automatic printout
   In this case, a record is printed out automatically each time a program is completely finished. Activate the menu item Print record in *Setup* (see 7.6.3).

In any case, you can manually print out a record after a firing is completely finished. You can obtain as many additional copies of the printout as you want by pressing the function key ⎡ Print record.⎤

The following record diagnoses are possible in deviation from the following example of a record:

1. Firing processed correctly
2. Temperature could not be reached
3. Vacuum could not be attained
4. Excessive temperature fluctuations

When messages 2 and 3 occur, start the check program and take appropriate actions.

Record printout example:

Date	Fr. 07.16.99		
Firing number	#000000007		
Laboratory information			
Name:			
Job number:			
Job type:			
Furnace data			
Oven ID	00		
Software version	AUSTROMAT D4 V. 01.20		
Last check program	14.07.99		
Temperature calibration	1.010		
Firing program			
Program number	102		
Program name			
DENTIN 1			
Program procedure:			
Dry			3:00
Close			3:00
Preheat	550		2:00
Firing temperature	920	55	1:00
Cool			-:--
Relax			-:--
VAC (level)		100	
Starting the program	16:24:56		
Air pressure	961		
Total firing time	00:17:10		
Firing processed correctly			

8.2 PC CONNECTION (DREAM®)

DREAM® (**D**EKEMA **Re**mote **A**ccess **M**anagement) is software for the external programming, archiving and quality management of your AUSTROMAT® D4. DREAM® supports you in the following tasks:

- Administering and archiving firing programs.

- Interactive creation and editing of firing programs.

- Transfer of firing programs.

- Reading out and archiving QM reports

- Converting firing programs.

In addition, DREAM® allows you to directly access our comprehensive firing program database on the Internet.

DREAM® can be downloaded free of charge from the download area of our internet site www.dekema.com.

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9   PRACTICAL TIPS

A)   General operation of the furnace

After switching on the furnace, the lift moves down and performs automatic lift calibration. The brief buzzing noise is due to technical reasons and is completely normal. Please note that the furnace does not react to any key presses during this calibration time.

The furnace heats up automatically to the temperature required to start the next firing program (i.e. PREHEATING PROGRAM after switching on). In general, it occurs when the firing chamber is open.

When the ceramic furnace heats up from a cold state, you will initially hear a rustling noise of the heating element. This noise is due to technical reasons and is completely normal.

Close the firing chamber in the event of prolonged breaks between firings. This will save energy and avoid unnecessary wear on the heating element. This also prevents unnecessary warming of the lid. The AUSTROMAT D4 displays the message "Saving energy" on the screen.

Close the firing chamber before switching off the furnace to avoid unnecessary condensation in the ceramic furnace.

B)   Heating element

The heating element is a wear-sensitive part whose service life depends on how much it is used. Running the check program regularly makes it easier to identify the correct time to replace a heating element. Another way of identifying heating element wear is visual inspection. Look into the open firing chamber from below while the furnace is switched off and cold. The heating coil must be evenly inserted in the glass tube and evenly distributed on the support tube at the core-guided heating element. If the heating coil is deformed or if the glass is broken, the heating element should be replaced.

C)   Thermoelement – temperature calibration

Visually inspect the thermoelement regularly - particularly before temperature calibration - while the furnace is cold and switched off and the firing chamber is open. A mirror held at an angle under the firing chamber can be very helpful. The thermoelement is attached to the middle of the ceiling of the firing chamber and juts out at a 90° angle into the firing chamber. Ensure that it is not bent since this influences temperature measurement and hence the firing results.

D)   Fast cooling

During fast cooling the vacuum pump draws outside air through the open firing chamber. In this way, the temperature sensor is in a cool air current that simulates that the chamber temperature is too low. When the pump is shut off, this cooling flow stops, and the temperature starts to rise. In order to eliminate this deceptive effect, the pump is operated at intervals. Please wait until the initial temperature is actually achieved and fast cooling is automatically finished.

If you activate fast cooling with the pump, you should not place the firing object on the firing table until cooling is completed, as otherwise the temperature may be too high for drying.

E)   Programming and program procedure

Another program can be retrieved directly from the Program Display by pressing **"+"** or **"-"** (browse program numbers), or by entering on the alphanumeric keypad. It is not necessary to launch the Program Manager.

If a program is aborted while under vacuum, the furnace is vented. After venting and an additional waiting time of approx. 10 s the lift moves down.

The firing table is still very hot immediately after firing. The temperature near the firing object may thus be too high for drying. Wait a few minutes until the firing table has cooled down before placing the new firing object on the firing table for drying.

Do not worry if the furnace sets a stand-by temperature in the firing chamber that is lower than the preheating temperature. If a drying time has been programmed, the furnace automatically sets a temperature in the firing chamber that is necessary for the drying.

In program steps COOLING and RELAXATION (standard mode, corresponding to temperature 2/3 in professional mode), the respective temperatures are activated as quickly as possible. The firing chamber is opened in order to move the firing goods out of the hot chamber. As the firing chamber now cools down, the fired materials are subjected to less radiated heat than corresponds to the cooling temperature. To offset this effect, the lift moves up slightly closer to the hot chamber. When the firing chamber has reached cooling temperature, the lift should be completely at the top, and the firing chamber should be closed again. This ensures that the fired materials are always approximately subjected to cooling temperature during the cooling time.

F)   Firing programs

Every type of firing tray has an effect on the temperature of the firing object due to its color and composition. Using a standardized firing tray can thus ensure constant firing results.

Care in creating firing programs and editing firing parameters has a significant effect on the quality of firing results. The recommended firing parameters are thus to be seen only as guidelines. Perform test firings to identify your individual firing parameters based upon these guidelines.

G)   Data security

The furnace includes a software module containing the set programs of the firing programs when the AUSTROMAT D4 is delivered. For reasons of data security, we recommend removing the software module from the furnace and storing it in a safe place. Also, back up your firing programs regularly on an optionally available memory module or on a PC using DREAM® . You should at least note down your firing program parameters on paper or print it out.

10 INDEX

Italicized page numbers refer to the chapter "First Steps", bold type page numbers refer to the Section "Practical Tips".