

SPECTRUM 20

Porcelain Furnace User Manual

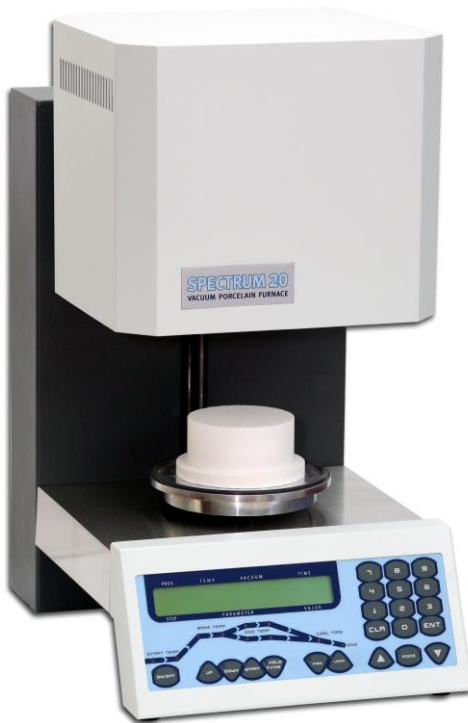


Table of Contents

Introduction	2
Specifications	3
1. General	4
2. Controls	4
2.1 Front panel	5
2.2 Rear panel	5
2.3 Right side	5
3. Display	5
4. Push buttons	6
5. Baking monitoring graph.....	6
6. Baking parameters	7
7. Audio feedback	7
Operation manual	8
8. Stand-by mode	8
9. Program mode	8
10. Work plate movement.....	9
11. Parameter mode	9
12. Setup mode	10
13. Baking cycle	11
14. Postfiring	12
15. Pump ventilation	12
16. Program Hold	12
17. Built-in lamp	13
18. Automatic night program	13
19. Fan chamber ventilation	13
20. Temperature Calibration	13

INTRODUCTION

Vacuum porcelain furnace **SPECTRUM 20** that you have purchased is the modern advanced vacuum porcelain furnace. This state of the art furnace makes possible to achieve the best results with any kind of porcelain materials and ensures unmatched flexibility of baking process. Microcomputer based electronics and other achievements of latest furnace technology have led to a versatile, reliable, high performance and affordable design.

Some of the impressive features of the furnace are listed below:

- ★ 100°C (570°F) to 1200°C (2200°F) temperature range
- ★ 200 fully adjustable baking programs
- ★ Change parameters during baking cycle
- ★ 2 idle programs (Day and Night)
- ★ Automatic Night program
- ★ Calibration and purge programs
- ★ 2-stage baking (first baking stage at BAKING. TEMP., additional baking stage at FINAL TEMP.)
- ★ 2-stage cooling (slow cooling inside the muffle + fast cooling during work plate descend)
- ★ Postfiring programs
- ★ 13 programmable firing parameters
- ★ Permanent monitoring of current baking stage
- ★ Manual overrun function for immediate start of baking program
- ★ Back lighted LCD display
- ★ Built-in lamp for working area illumination
- ★ Power failure and power line disturbance protection
- ★ Vacuum level control
- ★ Built-in self test capability (muffle, thermocouple, vacuum system, memory etc.)
- ★ Easy and clear operation
- ★ Power failure and power line disturbance protection
- ★ 24 months warranty on parts and workmanship including muffle

SPECIFICATIONS

Number of baking programs	- 200
Number of idle programs	- 2
Overall dimensions:	- W 273mm x D 375mm x H 510mm
Net weight	- 16 Kg
Electrical	- 230V 50/60Hz – 2000W

DESCRIPTION OF THE FURNACE

1. GENERAL.

- 1.1 The furnace consists of the main module and the muffle module.
- 1.2 The main module contains computerized control module, front panel and mechanical assembly with work plate.
- 1.3 The muffle module contains vacuum chamber, muffle, fan and built-in lamp for working area illumination.

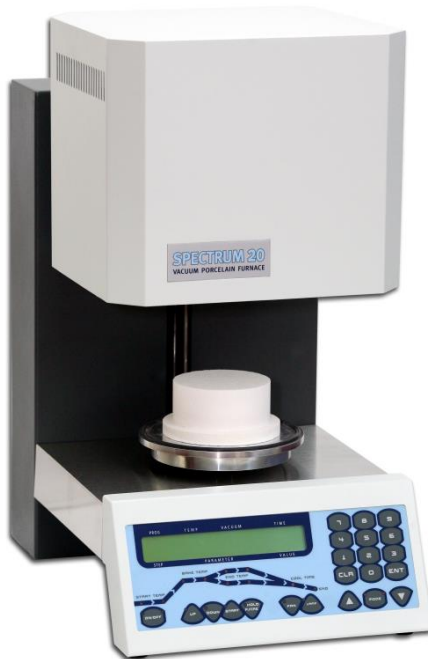


Fig. 1 SPECTRUM 20

2. CONTROLS.

The furnace controls are placed on the front panel and on the rear panel.

2.1 Front panel:

2.1.1 Display

2.1.2 Push buttons

2.1.3 Baking monitoring graph

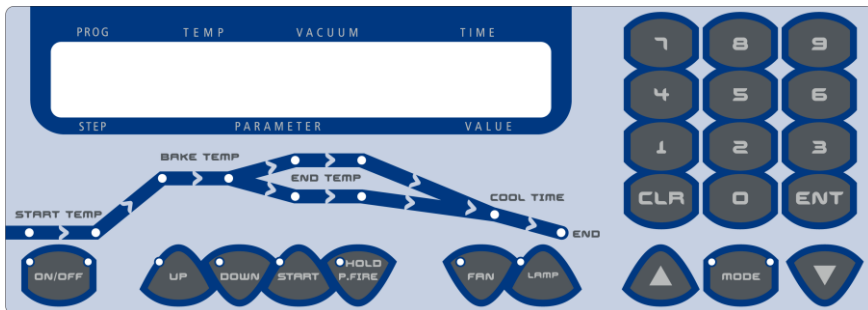


Fig. 2 Front panel

2.2 Rear panel:

2.2.1 Power switch

2.2.2 Pump fuse

2.2.3 Muffle fuse

2.2.4 Power cord receptacle

2.2.5 Pump cord receptacle

2.2.6 Axle for manual movement of Work table

2.3 Right side:

2.3.1 Calibration plate receptacle.

3. DISPLAY.

3.1 The display contains 20-digit alpha-numeric field with large back lighted characters.

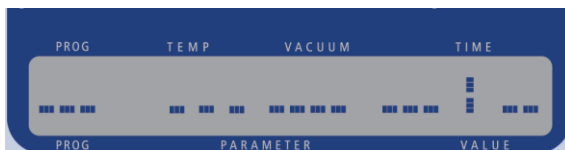


Fig. 2 Display

4. PUSH - BUTTONS.

Three groups of push-buttons are placed on the front panel:

4.1 Data buttons: digits 0 to 9, "ENT" , "CLR".

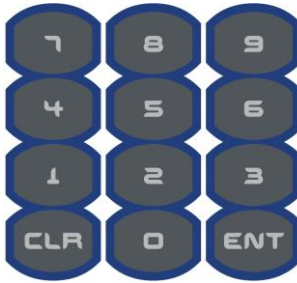


Fig. 3 Data buttons

4.2 Function buttons: **MODE** and "Forward" and "Back" arrows.



Fig. 4 Function buttons

4.3 Control buttons: **ON/OFF**, **UP**, **DOWN**, **START**, **HOLD/POSTFIRE**, **FAN** and **LAMP**.



Fig. 5 Control buttons

5. BAKING MONITORING GRAPH.

5.1 Contains 11LEDs for monitoring of the baking cycle.

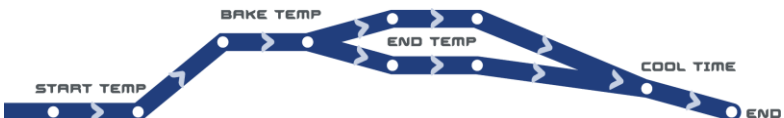


Fig. 6 Monitoring graph

6. BAKING PARAMETERS.

Step	Parameter	Display
s01	Start temperature	- START TEMP
s02	Work table rise time	- DRY TIME
s03	Preheat time inside the muffle at START temp	- PREH TIME
s04	Heating rate	- TEMP RISE
s05	Vacuum on temperature	- VAC ON
s06	Vacuum level	- VAC LEVEL
s07	Vacuum release temperature	- VAC OFF
s08	Hold time with vacuum	- VAC HOLD
s09	Baking temperature	- BAKE TEMP
s10	Hold time at Baking temperature	- BAKE HOLD
s11	Final temperature	- END TEMP
s12	Hold time at END temperature	- END HOLD
s13	Work table exit time	- COOL TIME

7. AUDIO FEEDBACK.

- 7.1 Audio feedback is provided for user comfortability. Single tone means acceptance of pressed button, double tone - rejection.
- 7.2 Bell warning provided in following cases:
 - 7.2.1 End of baking cycle.
 - 7.2.2 User memory fault.
 - 7.2.3 Muffle fault.
 - 7.2.4 Thermocouple fault.
 - 7.2.5 Calibration error.
 - 7.2.6 Vacuum system fault.
 - 7.2.7 Position error.

OPERATION MANUAL

To start operation of the furnace turn the **POWER SWITCH** on rear panel. After 5sec. SELF TEST the device is in **STAND-BY** mode.

8. STAND-BY MODE.

- 8.1 **STAND-BY** mode is provided for long period waiting. In this mode the muffle is turned off and the work plate stays in its previous position. The right led on the **ON/OFF** button is turned on.

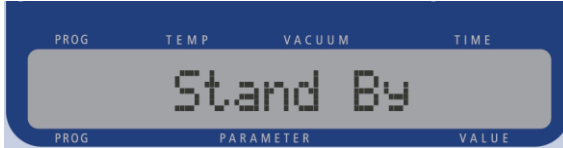



Fig. 7 Stand By mode

NOTE: It is recommended to keep the vacuum chamber closed to prevent muffle moisturizing.

- 8.2 Press the **ON/OFF** button for **PROGRAM** mode selection. The right led will turn off and the **left** led will turn **ON**.

9. PROGRAM MODE.

- 9.1 The **PROGRAM** mode is provided for baking program selection.
- 9.2 Select program number from **0** to **200** or use the arrows  to select program number, then press the **ENT** button to confirm.

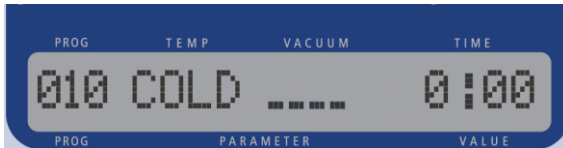


Fig. 8 Program display

NOTE: Programs **0** and **1** are factory set service programs, programs **2** to **200** are free user programs.

- 9.3 To correct selected program number, if desired, press the **CLR** button and return to the previous instruction.
- 9.4 The muffle temperature is displayed during **PROGRAM** mode. When the muffle is cold (less than 100°C), **(COLD)** message is displayed.
- 9.5 The muffle temperature is kept at the initial level for selected program (**START TEMP** or **STAND-BY** temperature).

10. WORK PLATE MOVEMENT.

Use the UP or DOWN buttons  to move the work plate to desired position. Pressing UP or DOWN during movement stops the work plate.


11. PARAMETER MODE.

11.1 **PARAMETER** mode provided for parameter verification and setting.

11.2 Press shortly the **MODE** button for **PARAMETER** mode selection the left led on the **MODE** button will turn on.



Fig. 9 Parameter display

Use arrows  to select required PARAMETER.

11.3 Set new parameter value, if desired (for programs 2 to 200 only), and press the **ENT** button to confirm.

11.4 To correct selected parameter value, if desired, press the **CLR** button and return to the previous instruction.

11.5 Parameter limits table:

s01 START TEMP	-	From 100°C to 1200°C
s02 DRY TIME	-	From 1 Sec to 600 Min
s03 PREHEAT TIME	-	From 1 Sec to 600 Min
s04 TEMP RISE	-	10°C/Min to 180°C/Min
s05 VAC. ON	-	From 100°C to 1200°C
s06 VAC. LEVEL	-	From 100 to 760 mm Hg
s07 VAC. OFF	-	From 100°C to 1200°C
s08 VAC. HOLD	-	From 1 Sec to 600 Min
s09 BAKE TEMP	-	From 100°C to 1200°C
s10 BAKE HOLD	-	From 1 Sec to 600 Min
s11 END TEMP	-	From 100°C to 1200°C
s12 END HOLD	-	From 1 Sec to 600 Min
s13 COOL TIME	-	From 1 Sec to 600 Min

11.6 Press the **MODE** button to return to the **PROGRAM** mode.

11.7 Press the **ON/OFF** button to get to the **STAND-BY** mode.





11.8 Use power switch to turn off the furnace.

12. SETUP MODE

- 12.1 **SETUP** mode enables to define options such as: temperature and vacuum measuring units, interface language, acoustic signal, temperature correction, vacuum pump ventilation etc.,
- 12.2 To enter **SETUP** mode, press and hold the **MODE** button for about 2sec., both LEDs on the **MODE** button will turn on.



Fig. 10 SETUP display

- 12.3 Use arrows   to select function to setup and press the **ENT** button, the value will start to blink.
- 12.4 Use the Data buttons to set new unit/value and press the **ENT** button to confirm.
- 12.5 To correct selected parameter value press the **CLR** button and return to the previous instruction.
- 12.6 Functions in setup mode:
- TEMP UNIT** - select the measuring unit ($^{\circ}\text{C}$ / $^{\circ}\text{F}$)
 - VAC UNIT** - select the measuring unit (mm Hg / " Hg / bar)
 - POST FIRE** - enter a value between 0°C - 30°C
 - PUMP VENT** - select On/Off
 - SOUND** - select sound ON / OFF
 - LANGUAGE** - select between ENGLISH, RUSSIAN, GERMAN
 - TEMP CORR** - Use UP/DOWN arrows   to select "+" or "-" and enter temperature correction value between -30°C to $+30^{\circ}\text{C}$
- 12.7 Press the **MODE** button to return to **PROGRAM** mode:

13. BAKING CYCLE.

- 13.1 Select a desired program and press the **START** button, led on start button turns on.

Baking cycle will not start if parameter correlation error exists, blinking error value of problematic parameters will be displayed on the screen. Correct the error and press **START** button again.

- 13.2 To start baking cycle the work plate should be in **DOWN** position. If the work place wasn't in this position, the work plate moves to **DOWN** position, and baking cycle begins.
- 13.3 Baking cycle starts automatically when muffle temperature is equal to the **START TEMP** for selected program.

The progress of the baking cycle is displayed on led temperature graph.

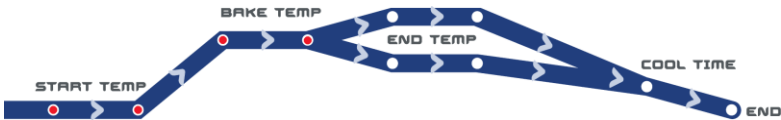


Fig. 11 Progress of the baking cycle

- 13.4 You may start baking cycle immediately independently of current muffle temperature by pressing **START** button and holding it pressed for about 1 second.
- 13.5 Use **MODE** button to check parameter values during baking cycle.
- 13.6 Back running counter is provided for baking cycle.
- 13.7 Press **DOWN** button to interrupt baking cycle if desired. In this case vacuum is released from the chamber, the work plate goes down and the furnace stays in the **PROGRAM** mode.

14. POSTFIRING.

Postfiring means additional baking without need to wait for furnace cooling. This option is especially important for **GLAZE** programs if baking temperature of regular program was not high enough (see POST FIRE setup in SETUP MODE).

Postfiring is performed with accordance to following parameters:

- Heating rate - **TEMP RISE**
- Baking temperature - **BAKE TEMP + P.F. STEP**
- Hold time - **BAKE HOLD**

- Final temperature** - **END TEMP + P.F. STEP**
 (for two-stage baking, if **END TEMP > BAKE TEMP**)
- **END TEMP**
 (for two-stage cooling, if **END TEMP < BAKE TEMP**)
- Final hold time** - **END HOLD**
- Work plate exit time** - **COOL TIME**

When **POST FIRE** button is pressed, the work table goes up immediately without reference to present temperature, and the baking cycle is performed from current temperature.

Every additional push on **POST FIRE** button will cause postfiring cycle.

Baking temperature of every consequent postfiring will be higher then the previous one by P.F. STEP. When START button is pressed or new program number is selected, the postfiring counter is cleared and the maximum temperature of following postfiring will be equal to BAKE TEMP + P.S. STEP as in the first postfiring cycle.

Postfiring can be used only when backing cycle is over and the work plate is down.

15. PUMP VENTILATION

Chamber ventilation by vacuum pump is implemented to enable faster muffle cooling between successive baking cycles. If the temperature inside the muffle exceeds starting temperature of the selected program, the pump is turned on automatically when working plate descends to the **DOWN** position and ventilates the chamber. When the temperature drops to the **START TEMP** or **STAND-BY TEMP** value, the pump turns off automatically. Chamber ventilation may be stopped manually by pressing any buttons.

16. HOLD

This function is used to change the parameters during baking cycle.

- 16.1 Press the HOLD button
- 16.2 Press MODE and select the desired parameter
- 16.3 Change the value of the selected parameter
- 16.4 press the ENT button
- 16.5 press the HOLD button to resume the baking cycle

17. BUILT-IN ILLUMINATING LAMP.

SPECTRUM 20 is equipped by built-in illuminating lamp that.

You may turn the lamp manually ON and OFF by pressing **LAMP** button. After 40 sec. delay the lamp turns off automatically.

18. AUTOMATIC NIGHT PROGRAM.

Automatic night program enables to save operator's time in the end of work day. If the **ON/OFF** button is pressed when baking cycle is running, the **OFF** led is turned on in addition to the **ON** led. The furnace will finish the baking cycle as usual and after that will switch itself to the **NIGHT** program (**No. 0**). When temperature inside the muffle will reach 100°C, the work table will go up and the muffle will stay at this temperature. It is possible to cancel automatic night program by pressing **DOWN** button.


19. FAN CHAMBER VENTILATION

Fan Chamber ventilation is implemented in the SPECTRUM 20 furnace to reduce the temperature of the body of the furnace. Press the **FAN** button to activate or deactivate the fan.

20. CALIBRATION.

Automatic calibration program is provided to correct temperature measurement that may change during extended use of the furnace.

The sequence of operations during calibration procedure is as follows:

- 20.1 Connect the pins on calibration plate using pure silver wire.
- 20.2 Turn the furnace OFF, remove ceramic table, put calibration set on the work plate and center it.
- 20.3 Insert calibration plug into receptacle on the right side of the furnace.
- 20.4 Turn the furnace on.
- 20.5 Move work plate down, press and hold the MODE button for about 2 sec.
- 20.6 Use UP/DOWN arrows  to select CLB TEMPERATURE
- 20.7 press START button
- 20.8 When muffle temperature reaches the melting point of silver (**960°C/1760°F**), temperature measurement of the furnace is adjusted to this temperature. The value of correction (positive or negative) appears on data display.

BAKING PROGRAMS

SERVICE PROGRAMS				
Program number		0	1	
Program name	Day	Night	Purge	
1. START TEMP	(°C)	300	100	700
2. DRY TIME	(Min)	--	--	--
3. PREHEAT TIME	(°C/Min)	--	--	--
4. TEMP RISE	(Min)	--	--	90
5. VAC. ON	(°C)	--	--	700
6. VAC. LEVEL	(mm. Hg)	--	--	700
7. VAC. OFF	(°C)	--	--	1040
8. VAC. HOLD	(Min)	--	--	5
9. BAKE TEMP	(°C)	--	--	1040
10. BAKE HOLD	(Min)	--	--	5
11. END TEMP	(°C)	--	--	--
12. END HOLD	(Min)	--	--	--
13. COOL TIME	(Min)	--	--	--

USER PROGRAMS					
Program number					
Program name					
1. START TEMP	(°C)				
2. DRY TIME	(Min)				
3. PREHEAT TIME	(°C/Min)				
4. TEMP RISE	(Min)				
5. VAC. ON	(°C)				
6. VAC. LEVEL	(mm. Hg)				
7. VAC. OFF	(°C)				
8. VAC. HOLD	(Min)				
9. BAKE TEMP	(°C)				
10. BAKE HOLD	(Min)				
11. END TEMP	(°C)				
12. END HOLD	(Min)				
13. COOL TIME	(Min)				

USER PROGRAMS					
Program number					
Program name					
1. START TEMP	(°C)				
2. DRY TIME	(Min)				
3. PREHEAT TIME	(°C/Min)				
4. TEMP RISE	(Min)				
5. VAC. ON	(°C)				
6. VAC. LEVEL	(mm. Hg)				
7. VAC. OFF	(°C)				
8. VAC. HOLD	(Min)				
9. BAKE TEMP	(°C)				
10. BAKE HOLD	(Min)				
11. END TEMP	(°C)				
12. END HOLD	(Min)				
13. COOL TIME	(Min)				

USER PROGRAMS					
Program number					
Program name					
1. START TEMP	(°C)				
2. DRY TIME	(Min)				
3. PREHEAT TIME	(°C/Min)				
4. TEMP RISE	(Min)				
5. VAC. ON	(°C)				
6. VAC. LEVEL	(mm. Hg)				
7. VAC. OFF	(°C)				
8. VAC. HOLD	(Min)				
9. BAKE TEMP	(°C)				
10. BAKE HOLD	(Min)				
11. END TEMP	(°C)				
12. END HOLD	(Min)				
13. COOL TIME	(Min)				

USER PROGRAMS					
Program number					
Program name					
1. START TEMP	(°C)				
2. DRY TIME	(Min)				
3. PREHEAT TIME	(°C/Min)				
4. TEMP RISE	(Min)				
5. VAC. ON	(°C)				
6. VAC. LEVEL	(mm. Hg)				
7. VAC. OFF	(°C)				
8. VAC. HOLD	(Min)				
9. BAKE TEMP	(°C)				
10. BAKE HOLD	(Min)				
11. END TEMP	(°C)				
12. END HOLD	(Min)				
13. COOL TIME	(Min)				

USER PROGRAMS					
Program number					
Program name					
1. START TEMP	(°C)				
2. DRY TIME	(Min)				
3. PREHEAT TIME	(°C/Min)				
4. TEMP RISE	(Min)				
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7. VAC. OFF	(°C)				
8. VAC. HOLD	(Min)				
9. BAKE TEMP	(°C)				
10. BAKE HOLD	(Min)				
11. END TEMP	(°C)				
12. END HOLD	(Min)				
13. COOL TIME	(Min)				

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