Electrically Heated Furnace

BSM-FC30

User Manual

V2.1

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Chengdu Besmile Medical Technology Co., Ltd

www.bsmdental.com

Content

Chapter 1. Introduction

Thank you for choosing BSM-FC30 Electrically Heated Furnace (Hereafter referred as “BSM-FC30”) from Chengdu Besmile Medical Technology Co., Ltd. (Hereafter referred as “BSM”).

BSM-FC30 is specially designed for sintering zirconia materials. It adopts unique high purity aluminium oxide fiberboard as the refractory materials for its sintering chamber, which has outstanding heat preservation performance and guarantees perfect sintering effect of zirconia restorations. Equipped with advanced PID intelligent temperature control technology, BSM-FC30 achieves high temperature control accuracy and ensures reliable sintering results. Besides, BSM-FC30 features easy operation with the large-size high-resolution color LCD touch screen display. It also has a simple and good-looking overall appearance with ergonomic design, which meets the modern aesthetic perception and experience of users.

BSM-FC30 has been deigned according to the latest industry standards and manufactured with advanced modern machinery manufacturing and processing technology with great workmanship and quality. However, inappropriate use may damage the equipment and be harmful to the personnel.

To prevent personal injury or material damage, please observe all the relevant safety instructions and read this instruction manual carefully.

Chapter 2. Safety Information

2.1 Electrical safety

BSM-FC30 adopts AC 220V/50HZ power supply， the maximum current is 32A. Before switching on the furnace, make sure the voltage indicated on the rating plate complies with your local power supply.

It is suggested to use voltage transformer and voltage stabilizer for different voltage versions.

Different versions of power plugs are prepared for different region. Plug into the socket for use as shown in Fig. 1 for reference.

Figure 1. Power plug

For proper use, please ensure the power cable is securely connected to the circuit breaker's power socket and bolts are tightly fastened. Loose or improper connections can cause overheating and potential hazards due to high contact resistance.

2.2 Operation safety

The refractory materials and the heating elements of the furnace are fragile. Please avoid violent collision after installation and move carefully to ensure that the components of the furnace are not damaged.

The BSM-FC30 is exclusively designed for sintering zirconia restorations ONLY. Do NOT use it for sintering any flammable, explosive, or toxic objects.
The sintering heating rate must comply with the product specifications detailed in Table 1.

Model	Rated power (KW)	Temperature (°C)	Max. heating rate (°C/min)	Max. operating temperature (°C)
BSM-FC30	3	Room temperature ~1550	50	1600

Table 1. Heating rate table

During the sintering process, the temperature of the furnace surface will reach up to about 60 ℃ and the temperature on the top of the furnace may reach over 80 ℃, posing a burn hazard, please avoid any direct skin contact.

Please do not place any inflammable or explosive objects on the top of the furnace to avoid safety risks.

2.3 Safety signs

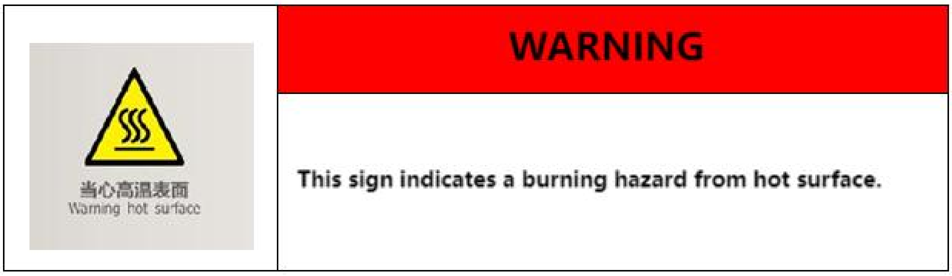


Figure 2. Safety sign

This sign can be found on the device.
Meaning: This sign indicates a burning hazard from hot surface. Please avoid skin contact to the furnace surface during the sintering process.

Chapter 3. Product Description

3.1 Product introduction

BSM-FC30 offers two types of sintering:

Fast sintering. It can provide fast sintering for the restorations (within 3-unit full contour bridge) with BSM Aconia.

Standard sintering. It can also provide standard sintering for long bridges.

BSM-FC30 adopts 4 silicon carbide heating elements located all around the sintering chamber for sintering, which implements homogeneous temperature distribution and guarantees excellent sintering performance.

3.2 Appearance and dimension

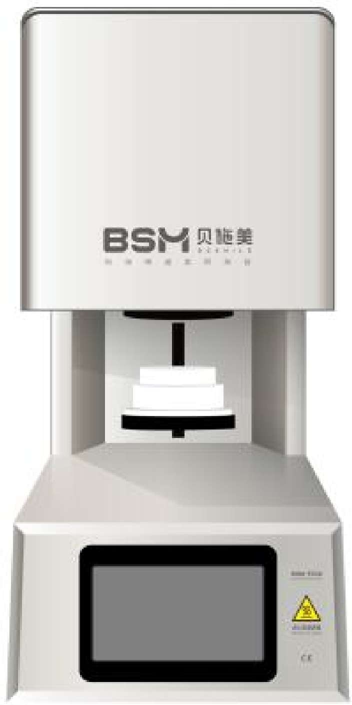


Figure 3. Product appearance

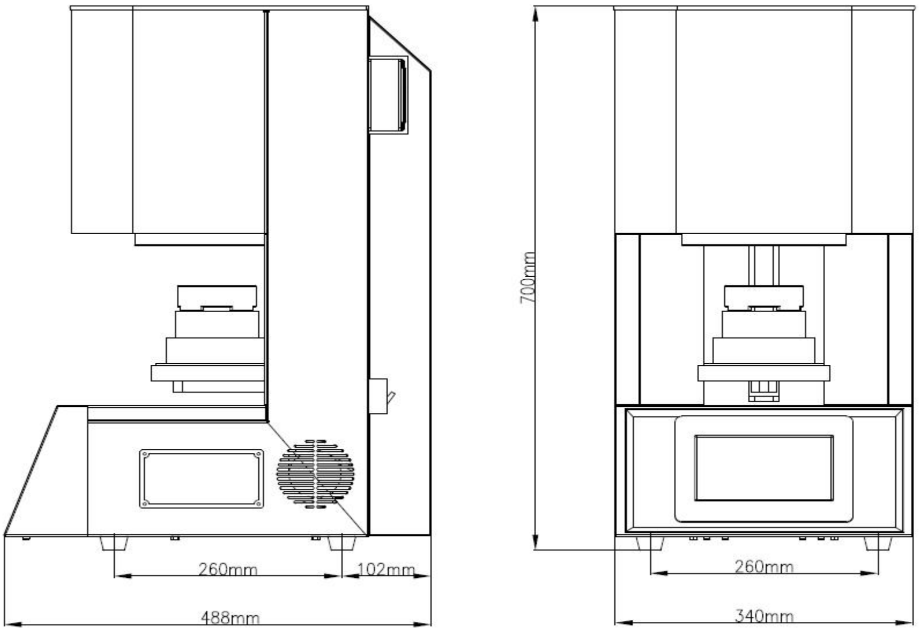


Figure 4. Product dimensions

Please choose a suitable space for installation according to the product dimension, which will be detailed in Section 4.2.

3.3 Main components

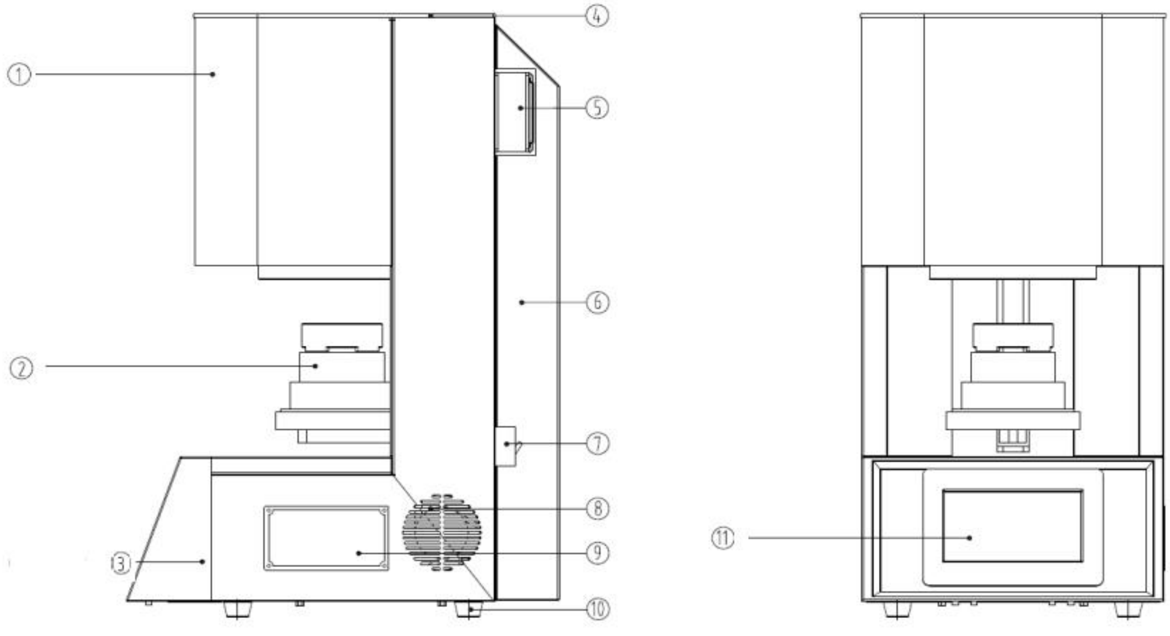


Figure 5. Main components

As shown in Fig.5, the following is the detailed description of each part/component of the equipment:

①Sintering chamber: composed of high-purity silicon carbide heating elements and unique high-purity thermal insulation refractory materials, which can guarantee the sintering outcomes of zirconia restorations;
②Sintering table: carrying the sintering tray with restorations;
③Electric control system: composed of controller, regulator, transformer, relay, etc., controlling the normal operation of BSM-FC30.
④Top cover: protecting heating elements and operators;
⑤Fan: cooling the furnace surface;
⑥Rear cover: protecting the circuit behind the furnace，there are motor and wires for controlling the lift inside;
⑦Power switch ON/OFF: controlling the power on and off;
⑧Fan: cooling the control circuit;
⑨Nameplate: indicating the parameter and serial number of the furnace;
⑩Base: supporting the furnace;
⑪Touch screen: accurately control the heating process in accordance with the sintering program.

3.4 Technical parameters

Application scope	Zirconia ONLY
Dimension (W.D.H)	340*490*700mm
Weight	55Kg
Chamber size	Φ90*50mm
Numbers of tray	1
Diameter of tray	74mm
Heating element type	High purity silicon carbide
Number of heating elements	4
Power supply	220V/50HZ
Maximum tolerable temperature	1600℃
Working temperature	≤1550℃
Control method	7” color touch screen
Rated power	3KW
Sensor type	High precision type-B thermocouple
Heating rate	≤50℃/min
Max. customized programs	100
Max. sintering restorations	25 single crowns
Fastest sintering time	3H (cooling time including)
Heating type	Fast& Standard

Table 2. Technical parameters

3.5 Data Interface

The BSM-FC30 features a USB interface for system upgrades and updates. The USB port is located behind the display screen. Please contact the manufacturer if necessary.

3.6 Nameplate

If the device goes wrong, please send the picture of nameplate with clear problem description to BSM authorized dealer or BSM.

Fig. 6 Nameplate

Chapter 4. Transportation and Installation

4.1 Transportation

- If you transport the device unsafely, it may slip and cause injuries.
- Always transport the device in an upright position, and the arrow on the transport position sticker is pointing upward.
- Transport and position the device with as many people as required for the weight of the machine.

4.2 Installation condition

Please select a proper installation platform that meets the product's dimension and weight, and follow these important safety points:

- Put the device on the indoor platform, dry, ventilated, and no dusty, the ambient temperature should be between -10 ℃ and 75 ℃ ,and relative humidity not exceeding 85%.
- Position the device not less than 20cm from surrounding walls and objects.
- DO NOT place flammable or explosive materials around the device.
- Ensure surrounding equipment is heat-resistant. This device generates a certain level of heat during use, which remains within safe limits. However, be aware that if nearby equipment is placed too closely for a long period of time, there's a risk of discoloration due to heat radiation.

4.3 Installation

1) Please place the packing box vertically upwards according to the indication signs. Check the package and if any damage occurs, please take photos or videos and contact BSM immediately. If no damage occurs, unpack the box.

2) Check the appearance of device for damage, deformation, etc. after unpacking. If any damage occurs, please take photos or videos and contact BSM immediately.

3) After unpacking， please check whether the components and parts are complete according to the accessories list (Refer to attachment).

4) Open the top cover, take out the protective foam, then inspect the heating element for any damage that may have occurred during transportation, check the silicon carbide heating elements to make sure they are firmly connected. If all parts are intact, reattach the top cover and securely tighten it with screws.

Figure 7. Protection foam

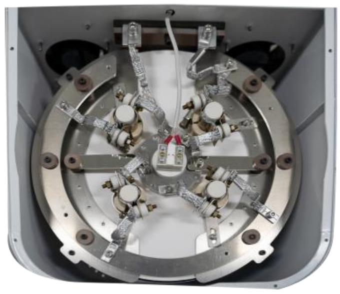


Figure 8. Top view

5) Follow the instructions in Figure 1. Section 2.1.3 to correctly install the power cord for the equipment. Please make that the power supply matches the specifications indicated on the cord. Incorrect voltage (the standard in this context is 220V/50HZ) may cause damage to the control system. It is recommended to use voltage stabilizer.

6) Power on the device, click 'BSM' logo page anywhere once to enter main screen page， then click the 'Down' button to lower the sintering table, and remove protective material inside the sintering chamber. Refer to Section 5.2 for detailed information.

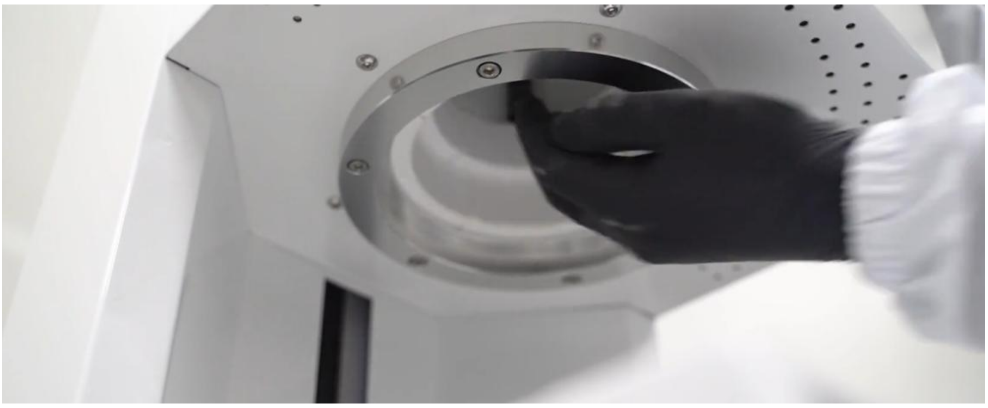


Figure 9. Sintering chamber

7) Put the sintering table on the metal platform. Pour the sintering beads into the sintering tray（2-3 layers of sintering beads is enough）.

4.4 Calibration

4.4.1 PTCR ring

The property and shade of zirconia restoration will be greatly influenced by the sintering temperature. Before shipment, each BSM-FC30 device underwent rigorous temperature calibration to ensure optimal performance. In order to have a better use experience, it's suggested to test one single crown and a PTCR ring first after installation.

For calibration, you need the PTCR ring (In accessory box), a vernier caliper (a measuring device as shown in figure 10.) and a conversion table (In the accessory box).

4.4.2 Calibration as follows:

1) Put one PTCR ring and some waste of zirconia (especially white or light shade disc) into the sintering tray, then put the tray on the sintering table.

2) Click 'Select program', choose 'BSM-S' and click 'Apply', then click 'Main screen'.

3) Click 'Up' to lift the sintering table up.

4) Click 'Start' to start sintering. The standard sintering will take about 10 hours.

5) After sintering, check the shade accuracy with the shade guide and translucency of the zirconia waste, if they are good, no need to do adjustment. If not, we need to do some adjustment.

6) Place the PTCR ring on an even surface and measure the exact diameter using the vernier caliper. Make sure that the ring is flush with the two arms of the vernier caliper.

Figure 10. PTCR ring and vernier caliper

7) Find the measured diameter in the conversion table and read off the corresponding temperature correction value. If the result is different with the

temperature in the program, you can change the sintering temperature in the sintering program. (For example, if the result is only 1500℃， you can increase the top temperature in program from 1520 to 1540, refer to section 5.4) Or you can contact with BSM or BSM authorized dealer.

8) **The PTCR ring is for reference, the most important thing is to make adjustment according to the sintering result.**

9) After adjustment, sinter some zirconia waste and one PTCR ring again and repeat the above steps.

Chapter 5. Operating Instructions

5.1 Daily operation for users

1) Power on the furnace
2) Load the sintering trays with restorations
3) Choose and apply the program you need
4) Click “**Start**” to start sintering
5) After sintering, take out the tray from sintering table.

5.1.1 Power on/off the furnace

Please refer to Figure 5. Section 3.3 to find the power switch. The device is in shutdown state when the power switch is off. The device is in boot state when the power switch is on.

Figure 11. Power switch

When it shows the ‘BSM’ logo page, single click the screen to enter the main screen

Figure 12. Startup page

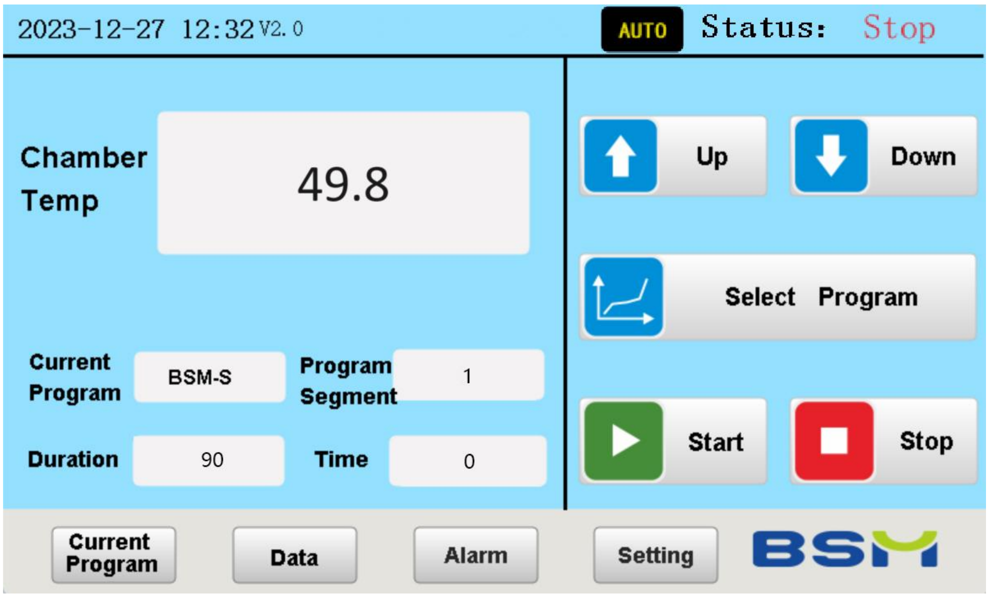


Figure 13. Main screen

5.1.2 Load the sintering trays with restorations

- Click “**down**” to lower the sintering table

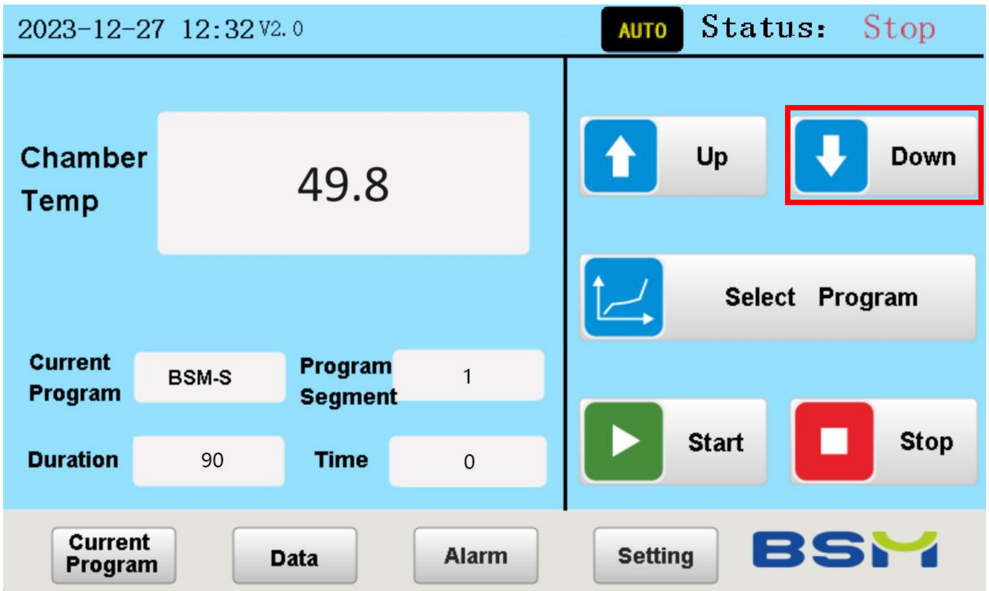


Figure 14. Click “Down”

- Put the restorations into the sintering tray, make sure that all the restorations have no contact with each other.
- Put the tray at the center of the sintering table.

Attention: The available space for the sintering chamber is **95*55mm**, accommodating with 1 tray which dimension is **90×40mm**. Sintering trays **should NOT exceed this height (50mm)** to avoid contact with the thermocouple, as this could impair temperature measurement accuracy.

Sintering trays should be loaded as shown in Figure 15.

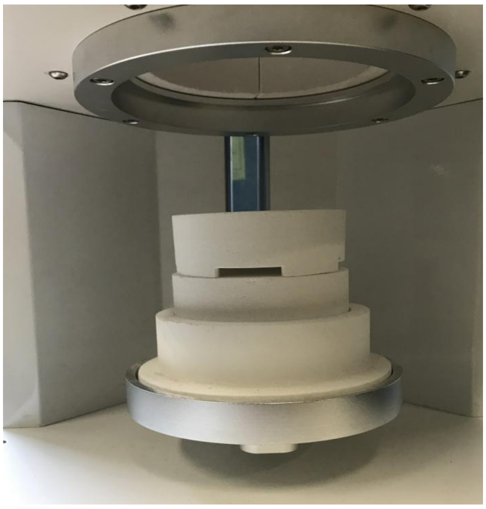


Figure 15. Load the sintering tray

- Click “**Up**” to lift up the platform

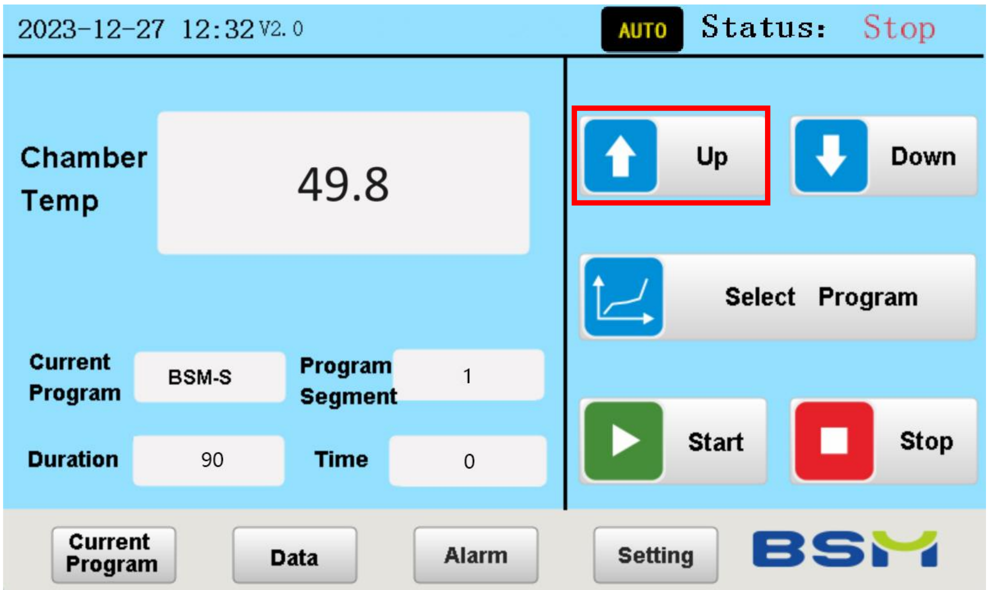


Figure 16. Click “Up”

5.1.3 Choose and apply the program you need

- Click “**Select Program**” to the program list page

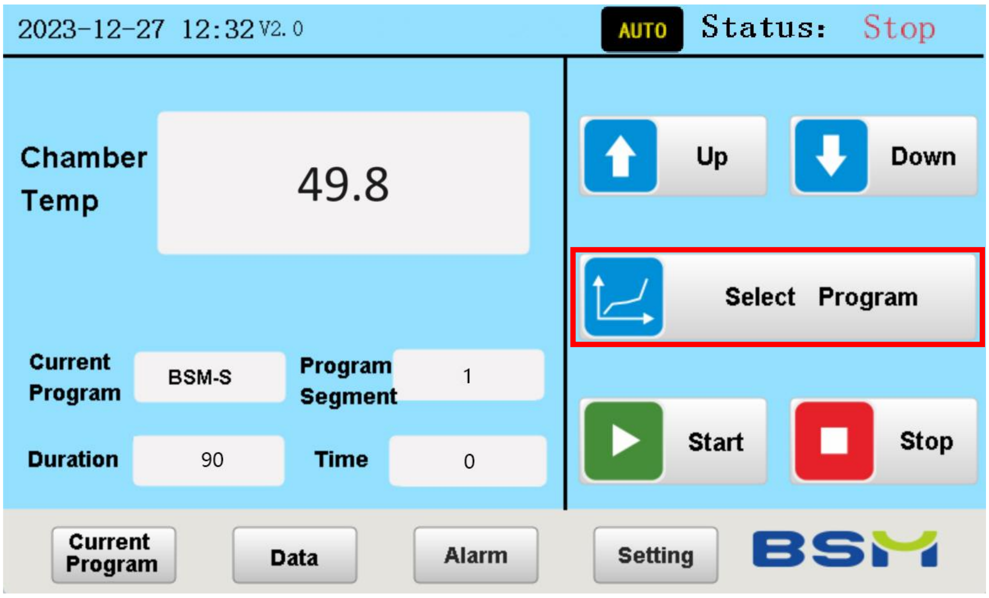


Figure 17. Select Program

Figure 18. Sintering program list

5.1.3.1 For Aconia Zirconia blanks, you can choose the preset sintering program directly. For example, if you want to use the fast sintering program for BSM Aconia, please click "BSM-F" to the program edit page

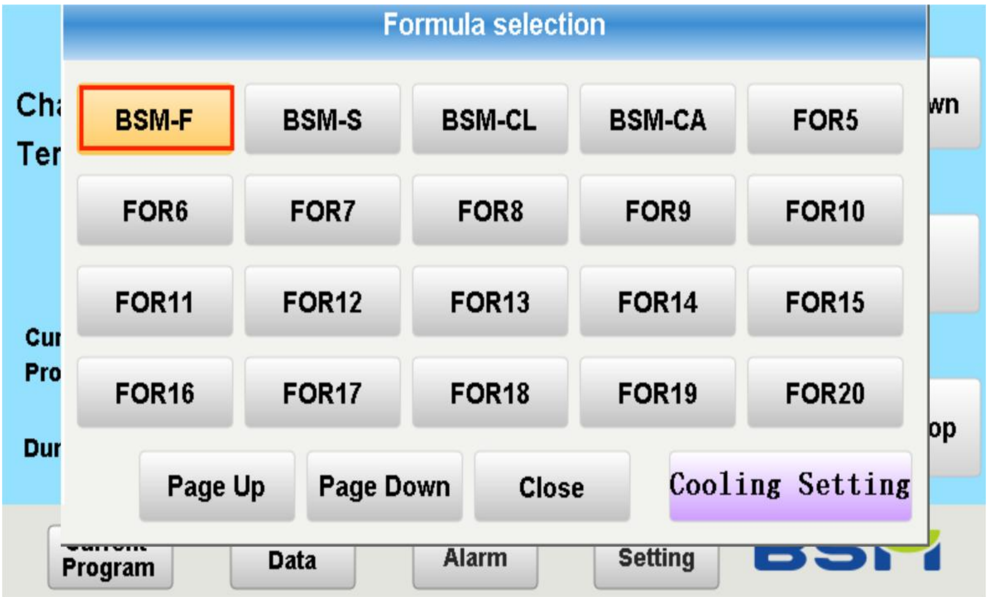


Figure 19. Sintering program list

Then click “**Apply**”

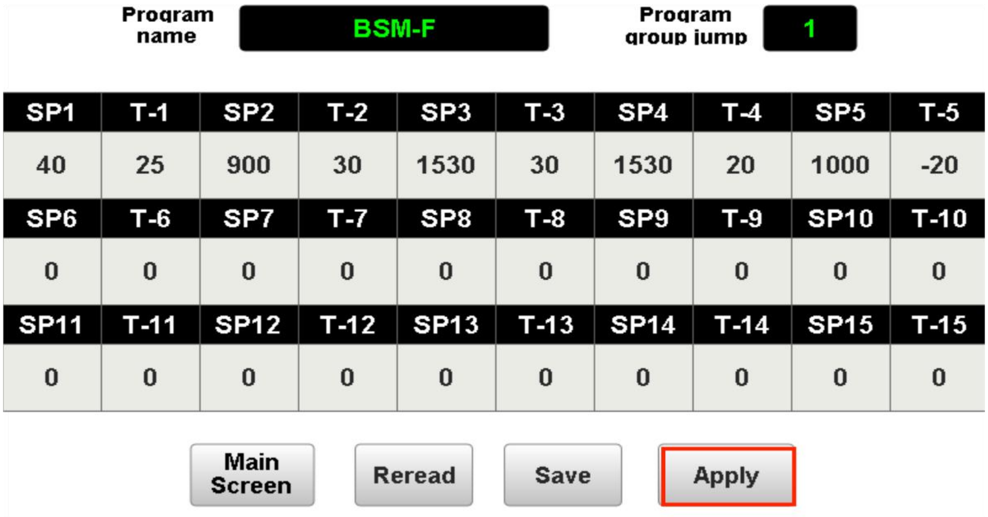


Figure 20. Click “Apply”

When it shows “Saved successfully”, click “**Confirm**” then click “**Main screen**”

Figure 21. Click “Confirm”

Figure 22. Click “Main screen”

5.1.3.2 For other Zirconia brands, please edit the sintering program as Section 5.4.

5.1.4 Start/Stop sintering

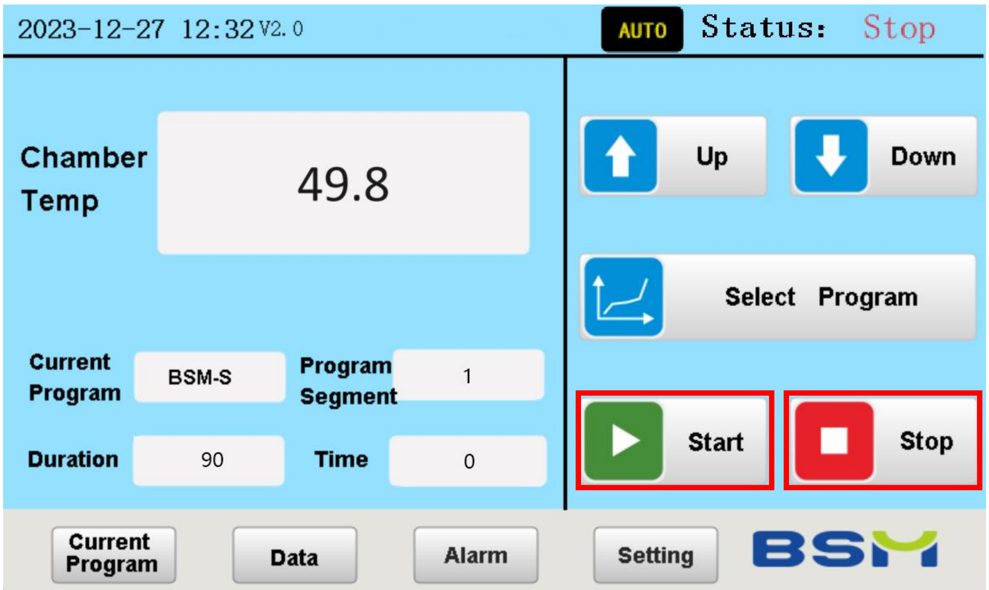


Figure 23. Start/Stop button

5.1.5 After sintering, take out the tray from sintering table. It is suggested to do it when the temperature is close to room temperature.

5.2 Operation page introduction

BSM-FC30 is equipped with a touch screen for daily operation.

➢ **Click anywhere on the ‘Startup page’ as shown in Figure 24 to enter the main screen.**

Figure 24. Startup page

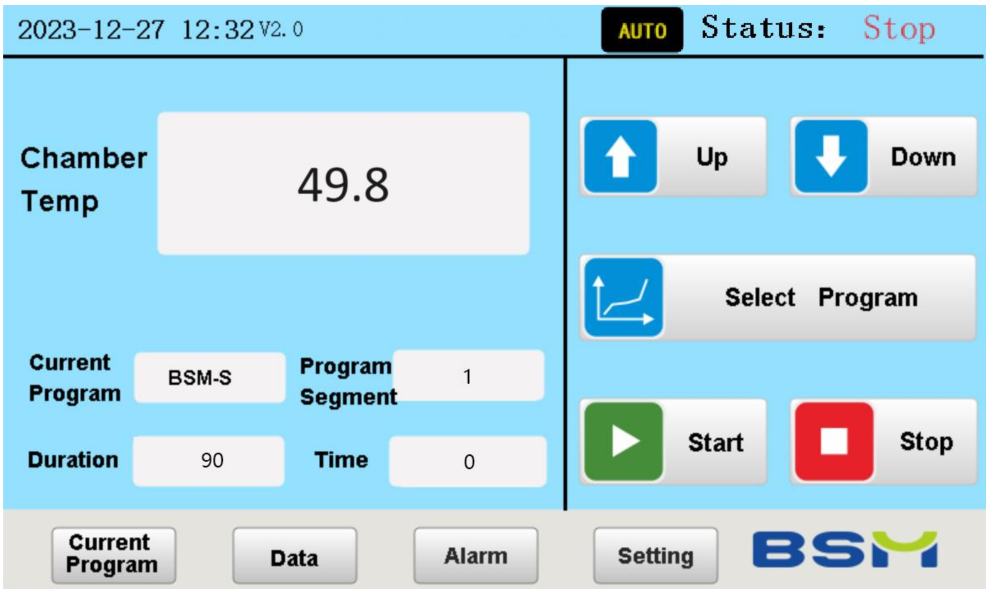
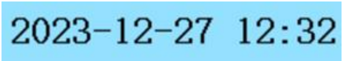
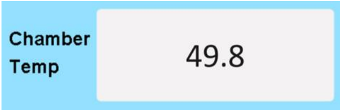


Figure 25. Main screen

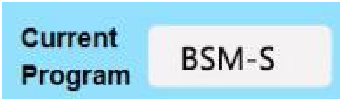


It shows the current date and time

It shows the working status of the device (Start/Stop)

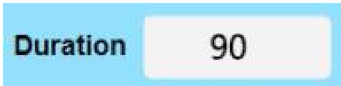


It shows the chamber temperature during sintering. (When the device is standby, this number is not the real temperature of sintering chamber.)



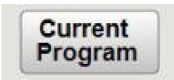
The name of program which has been loaded for sintering

The working segment of sintering program



The total time for each segment

The time that has been run for each segment



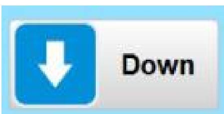
To shows the sintering program by line chart.

To show the sintering program by data sheet

It shows the alarm or error message

The system settings interface contains critical parameters that should NOT be edited, incorrect editing of certain parameters may lead to temperature control issues or even damage to the device. Therefore, some parameters are write-protected, and changing these parameters requires an authorized password. Please contact BSM authorized dealers or BSM for assistance.

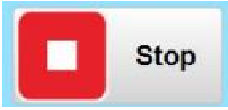
To lift up the sintering table



To lower the sintering table

To select sintering program or create new sintering program

To start the sintering process



To stop the sintering process

- **Click** 

to show the sintering program by line chart

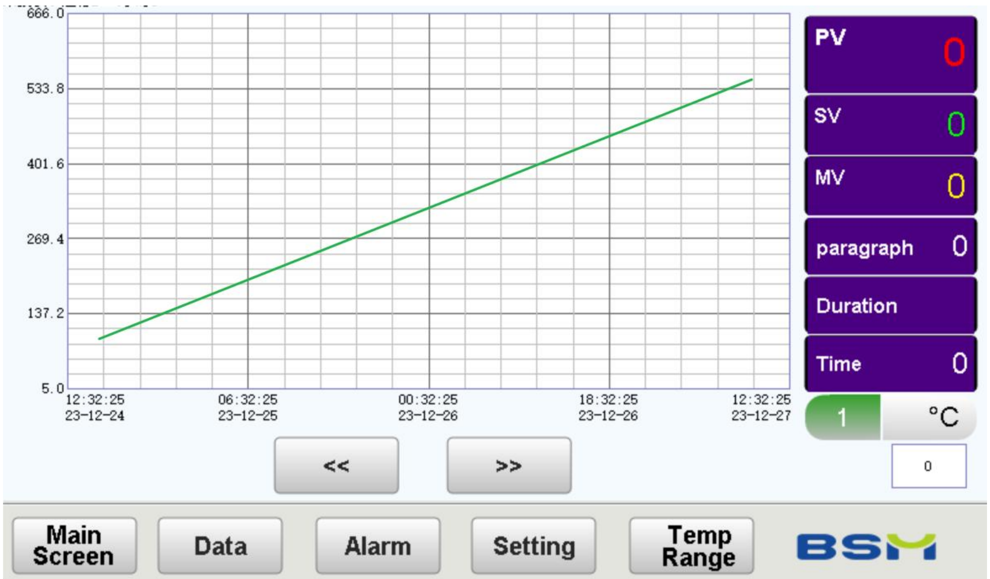
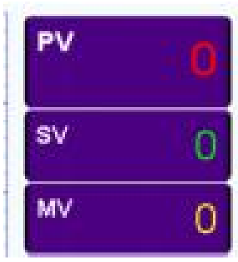


Figure 26. Current program

Go back to main screen

To set the temperature and time range for line chart

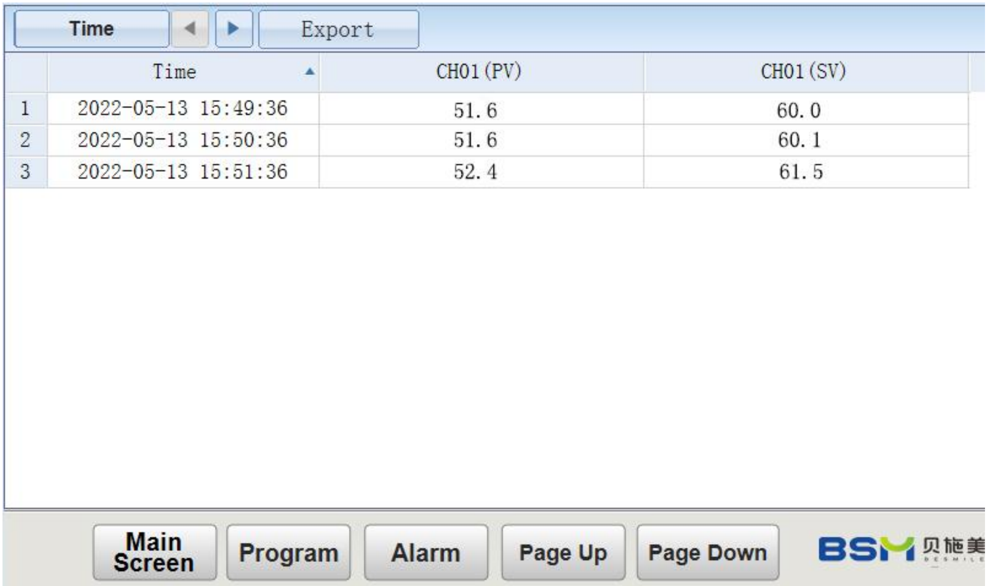


PV: Process value, it's the temperature in the sintering chamber during sintering. (When the device is standby, this number is not the real temperature of sintering chamber.)

SV: Set point value, it's the desired value for the PV.

MV: Manipulation variable, it’s the heating output of this device.
For example, if PV is 50℃ and SV is 80℃, the controller will react to adjust its output（MV） to increase the temperature.

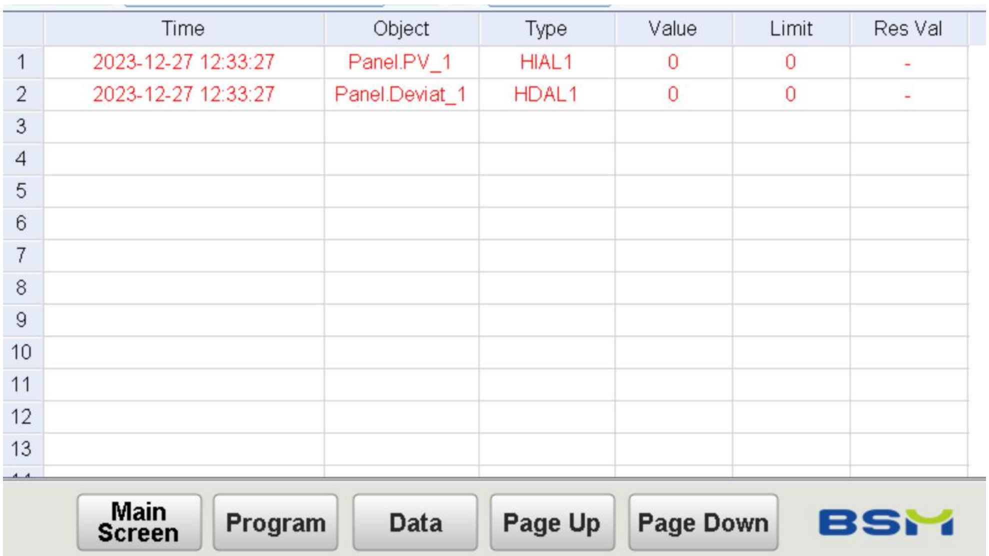
➢**Click**  **to show the sintering program by data sheet**



	Time	CH01(PV)	CH01(SV)
1	2022-05-13 15:49:36	51.6	60.0
2	2022-05-13 15:50:36	51.6	60.1
3	2022-05-13 15:51:36	52.4	61.5

Figure 27. Data

➢ **Click**  **to show alarm or error message**



	Time	Object	Type	Value	Limit	Res Val
1	2023-12-27 12:33:27	Panel.PV_1	HIAL1	0	0	-
2	2023-12-27 12:33:27	Panel.Deviat_1	HDAL1	0	0	-
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						

Figure 28. Alarm

5.3 Sintering programs

5.3.1 BSM-FC30 Sintering programs introduction

After the device is turned on, click 

to enter sintering program list.

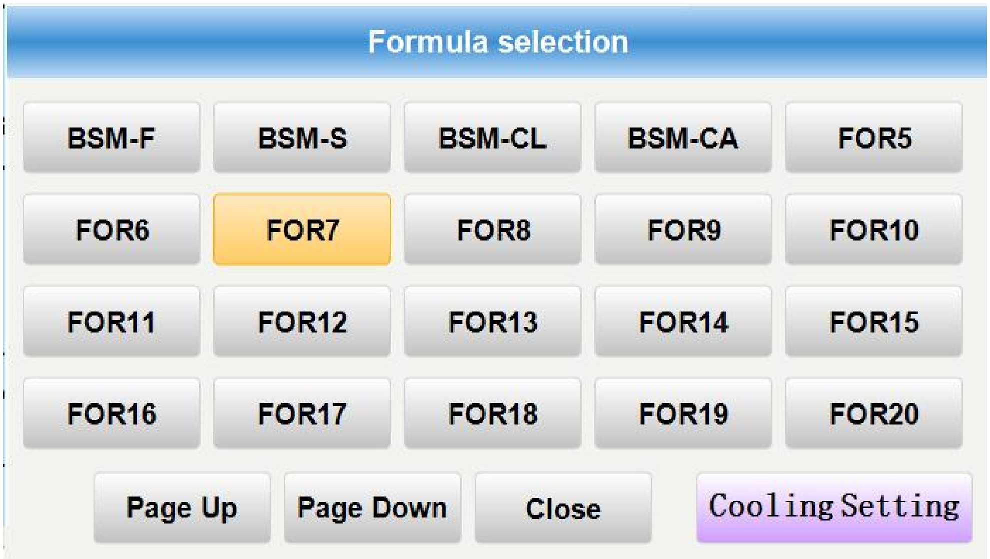


Figure 29. Sintering program list

BSM-FC30 fast sintering program, NO editing needed for most BSM Aconia (For TT white, the top temperature needs to be changed to 1480℃.) It's only for single crowns and 3 units bridges.

BSM-FC30 standard sintering program, NO editing needed for most BSM Aconia(For TT white, it needs to change the top temperature to 1480℃.)

BSM-FC30 cleaning program, used to clean the sintering chamber

BSM-FC30 calibration program, used to calibrate the sintering temperature. Please use it under the guideline of BSM or BSM authorized dealer.

Free programs for users to edit based on specific material needs

5.3.2 BSM-FC30 Fast sintering program

Figure 30. BSM fast sintering program

Temperature/°C	Time/min	Temperature/°C	Time/min	Temperature/°C	Time/min	Temperature/°C	Time/min	Temperature/°C	Time/min
40	25	900	30	1530	30	1530	20	1000	-20

Table 3. BSM fast sintering program

Click 

to load the program, click 

, then click 

to start sintering.

5.3.3 BSM-FC30 Standard sintering program

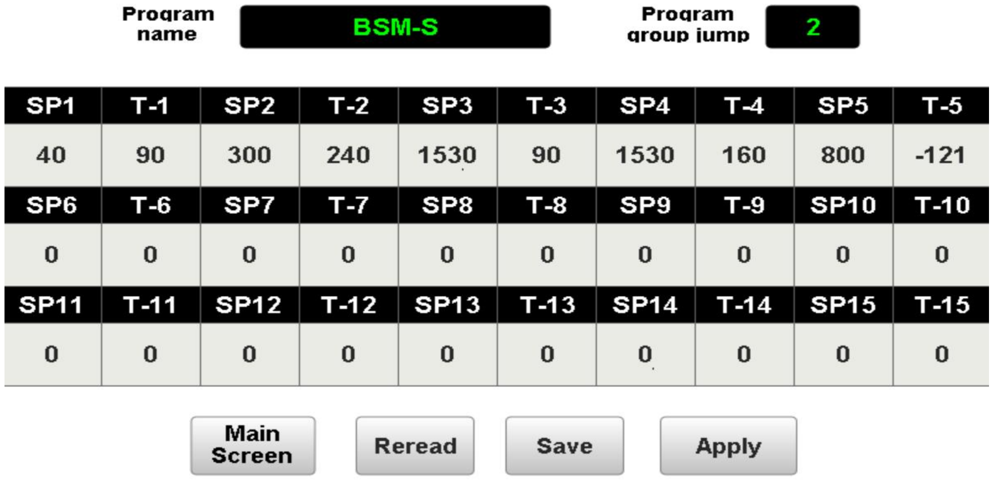


Figure 31. BSM standard sintering program

Temperature/℃	Time/min	Temperature/℃	Time/min	Temperature/℃	Time/min	Temperature/℃	Time/min	Temperature/℃	Time/min
40	90	300	240	1520	90	1520	160	800	-121

Table 4. BSM standard sintering program

Click Apply to load the program, click Main Screen, then click Start to start sintering.

5.3.4 BSM-FC30 Cleaning program

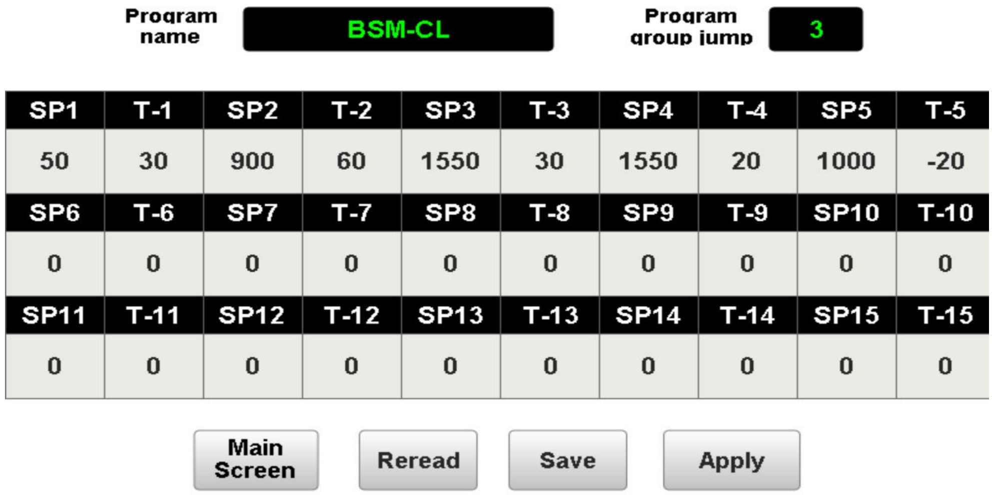


Figure 32. BSM cleaning program

Click Apply to load the program, click Main Screen, then click Start to start sintering.

5.3.5 BSM-FC30 Calibration program

Figure 33. BSM calibration program

Please use it under the guideline of BSM or BSM authorized dealer.

5.4 Customized program

For other Zirconia brands, you need to edit the sintering program as the manufacturers' requirement.

➢ Click "**Select Program**" to the program list page.

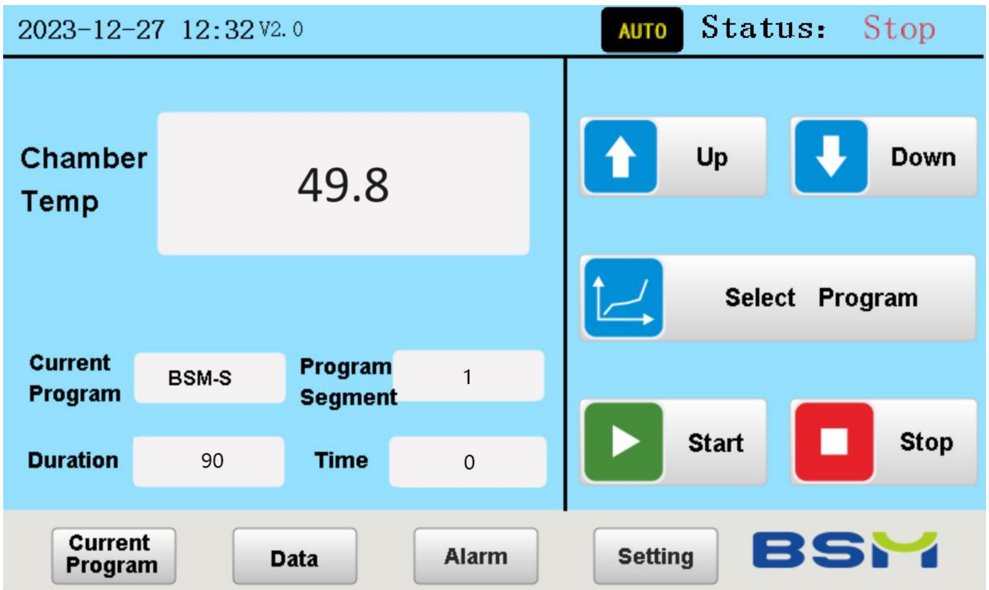


Figure 34. Select Program

➢ Select any one from FOR5 to FOR20.

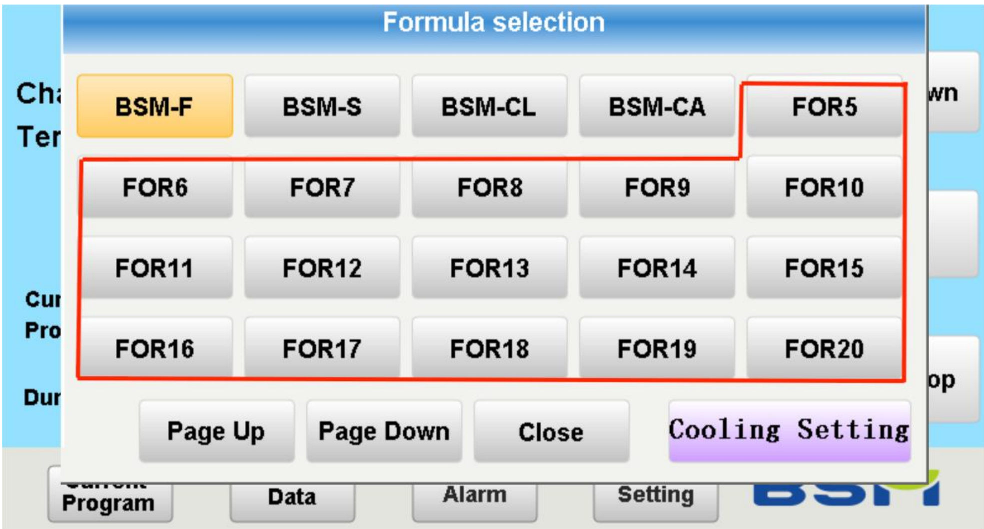


Figure 35. Program list

For example, when selecting FOR6 and entering the program setting interface, you can set a new program named 'TEST' and set temperature and time.

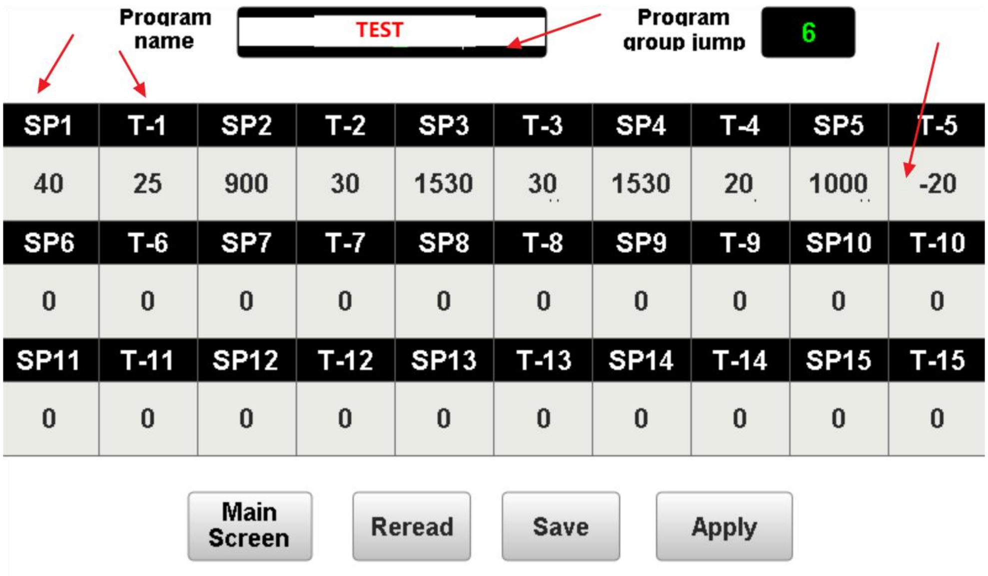


Figure 36. Program setting page

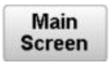
In this context, "SP" represents each temperature stage, and "T" indicates the time required to change the temperature to the next stage. For example, in the above picture, SP1 is 40, T1 is 25, SP2 is 900, it means the furnace will take about 25min to increase the temperature from 40℃ to 900℃.

After input all the temperature and time, we must input an end code for each program. It could be '-20' or '-121'.

The "-20" signifies the end of the sintering program, and the device will enter the next stage to lower the sintering table automatically which will make the cooling faster. The "-121" signifies the end of the sintering program, and the sintering table will stay in the sintering chamber and cooling.

After editing, click 

to save the parameters, then click 

to load the program for next sintering, then click 

to go back to main screen page

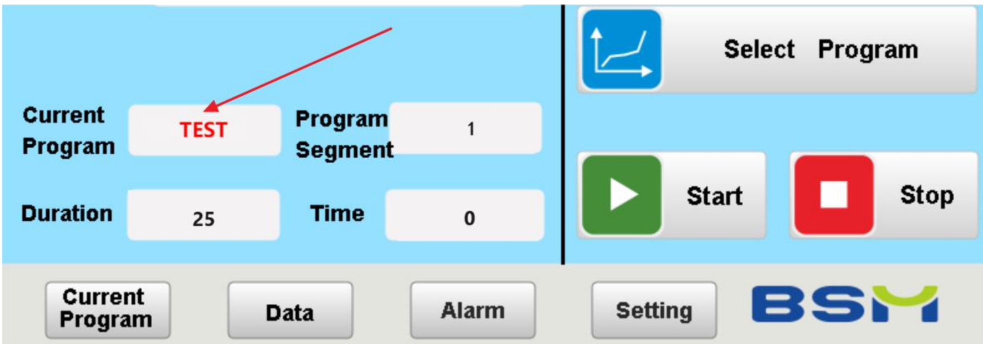


Figure 37. Main screen

5.5 Automatic two-stage cooling procedure

Fast sintering mode is equipped with automatic two-stage cooling procedure. When temperature drops to 795 ℃ , the sintering table will drop 7-8cm automatically, speeding up cooling via air circulation; When temperature drops to 500 ℃ , the sintering table will drop completely.

If any question, please contact BSM or BSM authorized dealer.

5.6 Operation cautions

- Silicon carbide rods are ceramic products. Handle and install them with care to avoid damage from impact or dropping. In case of breakage, avoid direct hand contact with broken surfaces to prevent injury from sharp edges. It is recommended to wear gloves when handling broken shards.

- Do not touch or cover silicon carbide rods with any object when they are electrified. The rods become extremely hot during operation, posing risks of electric shock and burns.

- Do not open the furnace during high-temperature sintering, as it is not only dangerous but can also cause the protective layer on the rods to crack and contaminate the furnace, potentially leading to damage.

- Before first use or if the furnace has not been used for two weeks, conduct a sintering without any case to remove humidity and impurities. Do not exceed the rated temperature to avoid damaging the heating elements and furnace lining.

- Do not pour any liquids or molten metals directly into the furnace; keep the furnace chamber clean.

- Given the fragility of silicon carbide rods at room temperature, once the heating elements are installed, avoid disassembling or moving the furnace.

- Regularly check the electrical connections in the temperature control system, especially the connections at the heating elements, to ensure they are secure.

- If temperature deviations persist around 200℃ to 300℃, and if the temperature differs from the set value or fluctuates significantly, please contact the manufacturer for calibration.

Chapter 6. Maintenance

6.1 Cleaning of the sintering chamber

To ensure the purity of sintering result, it’s suggested to clean the chamber every month to prevent contamination of restorations (If you sinter many restorations with coloring liquid every day, please clean the furnace every 2 weeks). And if you observe surface contamination of the product, or the furnace hasn’t been running for 2 weeks, the furnace should be cleaned immediately.

The suggested cleaning method is as following:

- Load the sintering tray with waste scraps of zirconia white disc.
- Sinter with the built-in 'BSM-CL' cleaning program.
- After sintering, check if the waste has any pigmentation.
- Repeat this cleaning process until the waste shows normal shade and transparency

In the daily sintering, you can also put some waste scraps together with the restorations to absorb the pollution.

6.2 Sintering beads

Replace sintering beads when they are obviously polluted (Deep yellowish shade).

6.3 Temperature calibration

A number of factors influence the temperature of the sintering object. The major influences can be age-related effects such as heating element wear and changes to the thermoelectric properties of the thermocouple. To compensate for these factors and ensure normal sintering results, we recommend that you calibrate the furnace when the sintering results change, or at least every 3 months. Please refer to Section 4.4 for detailed calibration methods.

6.4 Heating elements maintenance

The silicon carbide heating elements are connected by aluminum sheets, and may loosen over extended use. Users are advised to perform regular inspection every 3 months. If necessary, please tighten them using a screwdriver for optimal performance and safety.

Chapter 7. Trouble-shooting

7.1 Heating element broken

If the heating element is broken, for consistent performance, it is recommended to replace all the 4 rods in the same batch at the same time, as mixing old and new rods with different resistances can lead to uneven loads and premature wear. If older rods are still functional, keep them in the same batch. Ensure uniform current in each rod for consistent sintering performance.

Step 1: Prepare the silicon carbide heating elements (the aluminum connecting sheets have been fixed on the silicon carbide heating elements)

Fig. 38 New SiC Rod

Step 2: Take off the packaging

Fig. 39 Unpack

Step 3: Please install the silicon carbide heating elements with the aluminum connection sheets into the corresponding holes in the furnace chamber for the heating elements, and connect them with others in parallel (as same as the old one).

Specific methods: one end of the aluminum connecting sheet is connected to the inner ring board of the sintering furnace as shown in Figure 40, and the other is connected to the outer ring board of the sintering furnace as shown in Figure 41.

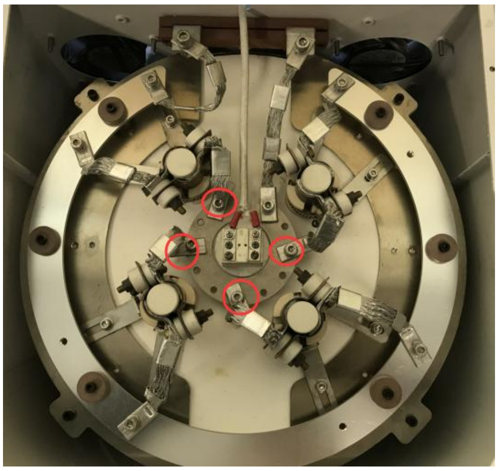


Figure 40

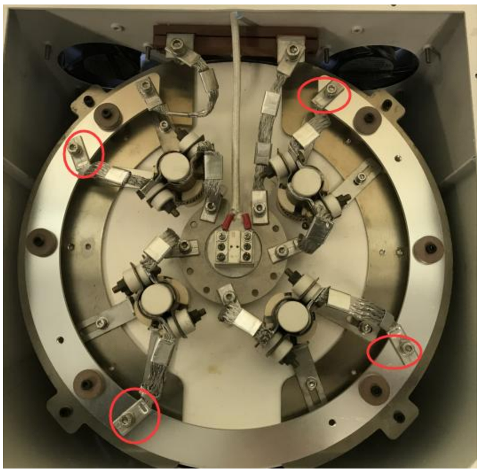


Figure 41

Step 4: Tidy up the aluminum strips by folding any excess and wrapping them with an aluminum sheet. Check each strip to ensure there is no contact with other metal pieces that might cause a short circuit. Then, complete the replacement.

7.2 Sintering result problem

If the shade is lighter or darker for all the restorations, it indicates the temperature calibration is needed, please refer to chapter 4.4 for detailed information.

7.3 Other problems

If you meet any other problems, please take some pictures or videos, and also a picture of the nameplate, contact BSM authorized dealer or BSM, we will help you as soon as possible.

Chapter 8. Warranty and liability

Within 12 months from the date of delivery, if the equipment unable to work due to product quality problems, the company shall provide users with the free services (except artificial damage).

Vulnerable accessories: heating element, sintering table, crucible, zirconium beads are not covered by the warranty.

After the warranty expires, we will continue to provide the paid lifetime maintenance according to user’s requirements.

Chapter 9. Contact Information

9.1 Company information

Thank you for choosing Besmile Zirconia Sintering Furnace for your laboratory needs. For any questions or additional support, please contact us and we will look forward to assisting you.

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9.2 Technical support

If you have any question or meet any problem about our products,please kindly contact with our technical support.

WhatsApp

Wechat

Email:

service@cdbesmile.com