# GSL SERIES
# HIGH-TEMPERATURE TUBE FURNACE
# Operational Manual

**Henan Synthe Corporation**

**No.12 Shangwu Waihuan Road,Zhengzhou City,China**

**Tel : +86 371 6939 2107**

**Fax: +86 371 6394 4282**

**Web: www.syn-thermal.com**

# 1. Introduction

1400 series high temperature tube furnace uses SiC rod and high quality resistance wires as heating element. Max. temperature inside furnace can be reached at 1400 °C under vacuum or flowing gas.The furnace temperature profile can be set up by 51 segments and run automatically by the 708P type advanced temperature controller. It is excellent for material research, ceramic research labs to develop various new materials.

## 2. Technical Specifications

| Name | Unit | Parameter |
|---|---|---|
| Working Power | KW | 3 |
| Voltage | V | AC 220V single phase    60 Hz |
| Max. Temperature | ℃ | 1400℃ |
| Continuous working temperature | ℃ | 1300℃ |
| Suggested heating rate | ℃/min | ≤ 10 |
| Temperature accuracy controlled | ℃ | ± 1 |
| Heating element | | SiC heater |
| Connection of heating element | | Series connection |
| Thermal Couples Heat capacity inside chamber | KWH | K type |
| Dimension of tube | | 50mm (Dia) x 500 mm length |

## 3．Tube Furnace Structure
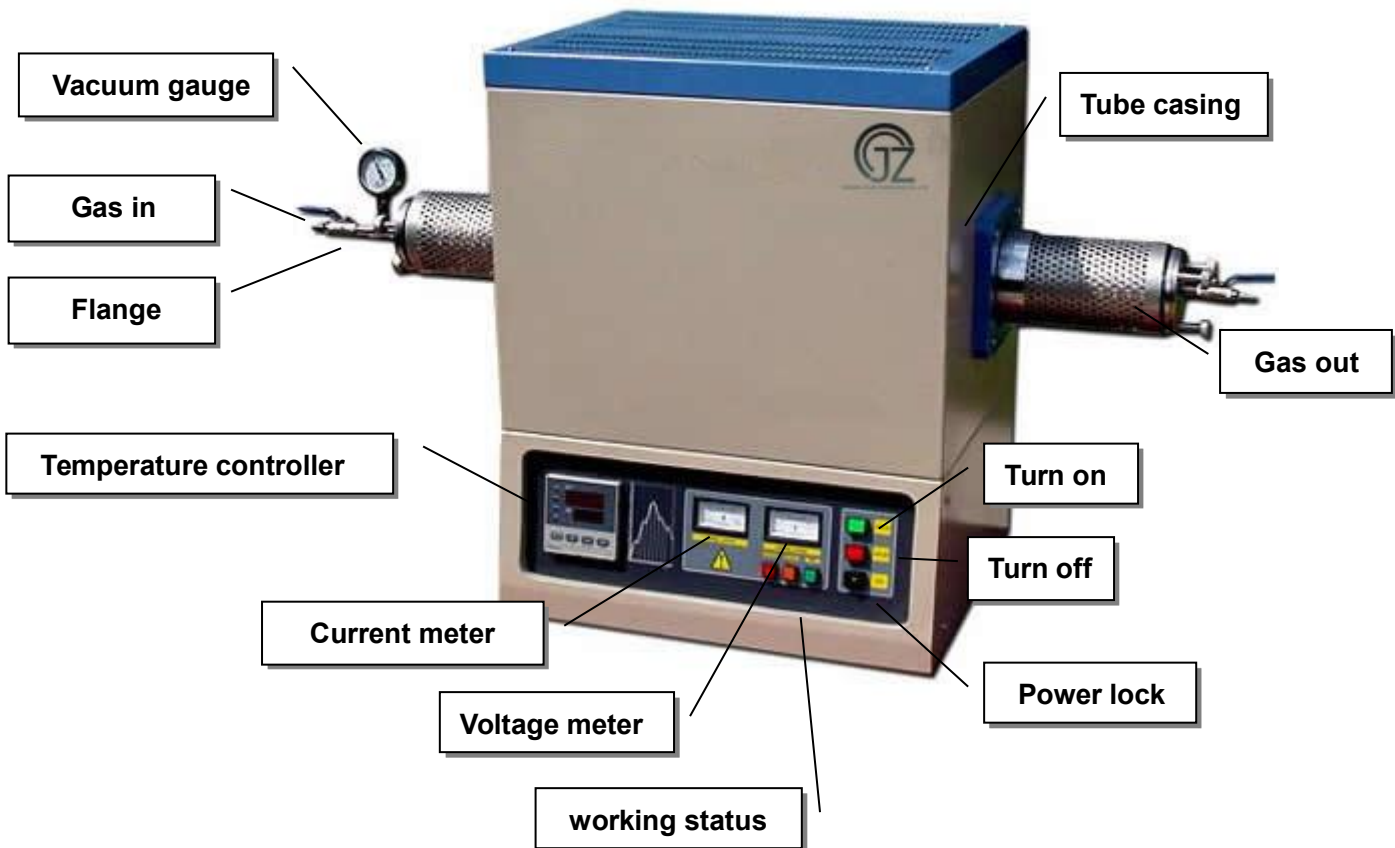
## 4. Installation Procedures

Please follow the instructions as the below for furnace installation

(1) Open shipping package to check if all components are in good condition. If find any damage caused by shipping, please report it to **Henan Synthe Corporation.** immediately by email at marco.mu@synthe-corp.com

(2) The furnace must be placed in flat surface to avoid vibration, where must keep from flammable and explosible materials.

(3) Installation of Tube And Tube Blocks:
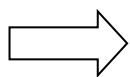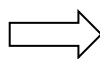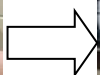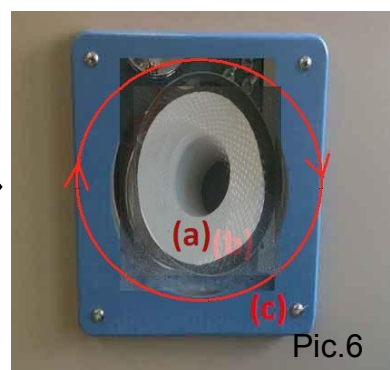


Pic.1　　　　Pic.2　　　　Pic.3



Pic.4　　　　Pic.5　　　　Pic.6

(Pic.1) Alumina Mesh (b)

(Pic.2) Furnace (c)

(Pic.3) Rotate the alumina mesh( b) into furnace, referring to the thread on the alumina mesh( b).

(Pic.4) Please carefully insert ceramic/quartz tube into furnace, and keep tube straight to avoid breaking heating elements which have been installed into the furnace.

Please keep equal length of tube in the two ends of furnace. The tube shall be able to be rotated by hand after insert. Otherwise, tube may crack during heating.   (as Pic.4)

(Pic.5) Put refractory tube block into tube to avoid hot radiation. ( as Pic.5)

(Pic.6) Put the tube casing( a) on the tube. The tube casing( a) is used to protect tube outside the furnace, it can help to support the weight of the tube outside the furnace. And if the length of tube casing( a) is longer than need, it can be carved according to the length of the alumina mesh( b).

(4) Installation Of Flange:

(Pic.7)　　　　　　　(Pic.8)　　　　　　　(Pic.9)　　　　　　　(Pic.10)

(Pic.14)　　　　　　　(Pic.13)　　　　　　　(Pic.12)　　　　　　　(Pic.11)

(Pic.7). Put the inner flange onto tube. Tube should be exceed the alumina mesh.
(Pic.8). Put the silicon O-ring "1" on tube.
(Pic.9). Put the compression ring on.
(Pic.10). Put the silicon O-ring "2" on tube.
(Pic.11). Put on the outer flange.
(Pic.12). Put 3 pieces of inner hexagon screw on.
(Pic.13). Tightening the 3 inner hexagon screws by turn to ensure the flange adjustable.
(Pic.14). The other side is the same.

(5) Please make sure that power source in your lab is enough to meet this power requirement. (Please see details on Page18~ 19). Please make sure ground wire must connector to ground pole at the power, never lead high voltage, in order to protect the meter and control circuit. Please turn off the power while not use.

(6) Please insert thermal couple tube into furnace from backside of furnace, and tighten screw to fix thermal couple's position.
   Connect thermal couple wires to controller. Please make sure that positive and negative polarities are connected correctly (red to positive; green to negative). Otherwise, controller cannot

work. (Pic.11)



(Pic.11)

（7）Connect to vacuum pump, to inspect airproof.

## 5. Instructions for Quick Start:

*Procedure for running furnace*

Plug in power (Green Power indicator is on, cooling fan run)



Turn Power switch lock on, (Yudian 708P controller is on)



Let 708P control display is at "starting state ", e.g. PV panel shows temperature value, and SV displays "stop". If controller is no at the state, touch key ▲, 708P controller shall be back to "starting state "

Input temperature program. (Please be advised that heating rate shall not be too fast in low temperature stage to avoid damage furnace )
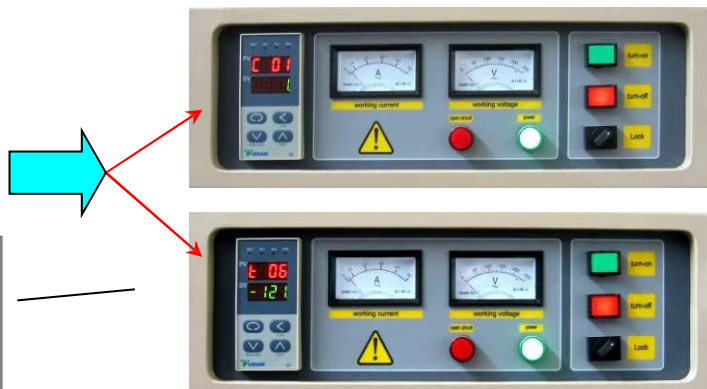


Must input the end of operation curve, the last word should be TXX. -121

Push green "Turn On "power switch button.



Push Key ▼ on the controller and hold for 2 seconds, PV panel shows "Run", now furnace is running automatically



*Procedure for shut down furnace*

Push key ▲ to make sure the controller is at "stop "state.
Touch Red "Turn-Off" button shut down furnace power
Turn lock to close position to cut off power to control panel
If possible, close power switch from cable.
End

## 6．Instruction of the 708 Intelligent Temperature Controller

（1）Main Features：

• The 708 temperature controller uses advanced AI intelligent adjustment method, no over shooting, and has auto tune function.
• Both of Input and output employ digital calibration system and insure accurate and stable measurement.
• Measuring accuracy:     0.2% in full scale.
• Alarm function:         Up limit and input open circuit.
• 30 segments programmable.   Auto and manual operation can be switched without disturbing.
• Power off protection.    In the case power off or other disturbing, input data can be saved via smart EPROM IC to ensure continuously running once power resume
• Universal switching power:   85V -264V AC, 50 – 60 Hz
• Power consumption:      ≤ 5W



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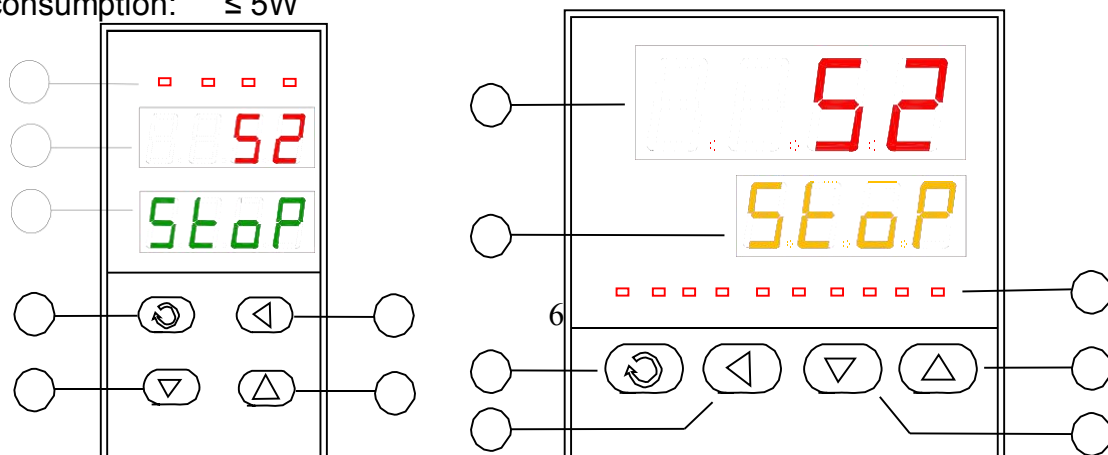
（2）Temperature Controller Connections：
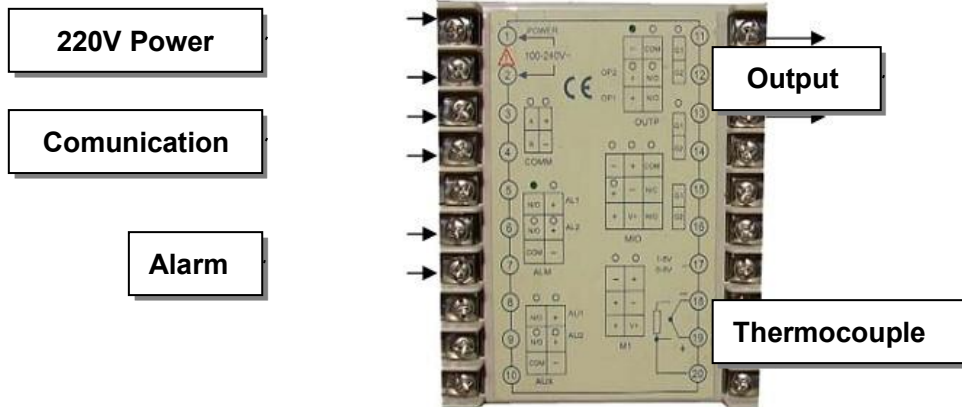There are 20 connectors in the backside of temperature controller.　The connection is shown as
Fig 1:：



**220V Power**

**Comunication**

**Alarm**

**Output**

**Thermocouple**

**Fig. 1**

（3）Indication of Front Panel of Temperature Controller：

**PV** ---Current Temperature from thermal couples

**SV** ----Control Temperature value

Key for changing display and setting parameters in various

Key for reducing value, also for program running or pause

Indicating lights

Key for shift setting. Also enter program setting
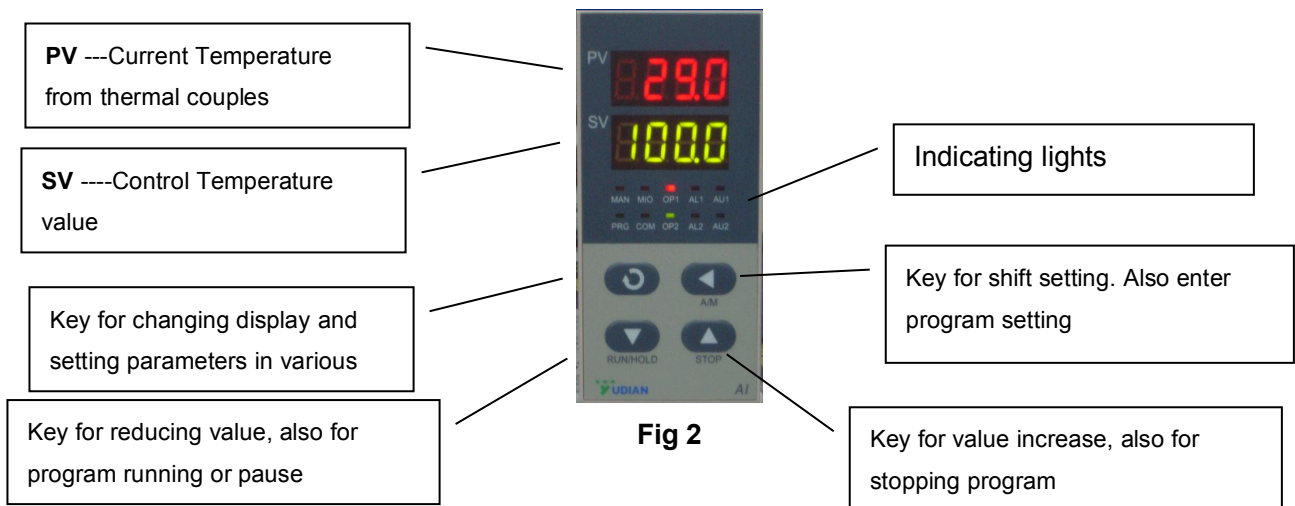
Key for value increase, also for stopping program



**Fig 2**

10 LED indicating lights, light "MAN" on means hand-control, off means auto-control；PRG means
meters in the running state; M2，OP1，OP2，AL1，AL2，AU1，AU2 and so on mean output/input
actions of corresponding module；Light "COM" means connecting with upper machine.

## 7．Setting Procedure of 708 Temperature Controller

Before running the furnace, you must plug in 220-240V AC power.
Install thermal couples at the back of the furnace and make sure connection correctly (blue wire
connecting with negative; brown wire connecting with positive, Fig.3)
Then turn lock in clockwise rotation to get temperature controller power on (Fig.4)
After setting program in temperatuer controller, push "power on" button to make cooling fan
running (Fig. 4)

**Figure 3**



**Figure 4**

## *(1) Starting State of Display of Controller Panel*

When turning power on, controller display shows the model No (708) of controller, software version first. A few seconds later, controller will display temperature condition. PV shows real temperature, and SV shows setting temperature. If "SV" flashing and shows "Stop", it means that control program is at stop state; If "SV" shows "Hold", means that program is at the pause stage.



| **Fig. 5** | **Fig.6** | **Fig.7** | **Fig. 8** |

## *(2) Switching Function of Display*

Under starting state of temperature display as Fig. 5, e.g. the panel can be switched to program setting function and parameter setting function by touching key: [icon] Touch key [icon] and hold for one second, PV will show "Step" and SV show Step # (Usually show 1) as Fig. 6 Press key [icon] once again, PV will show the setting time in the step, and SV shows the time that has run in this step. Press key [icon] and hold for two seconds under "starting state", Display will show parameter setting function as Fig 8, (PV shows M5, and SCV shows 289.7)

Please don't change any parameter unless you understand what parameter is.

The all parameter has been preset according to our experience. Next chapter will explain how to change "Parameters "

**Please be advised that**

*If no any key touch action on the panel, display will return to*
*"Starting State "automatically. And all revised data will be saved.*

## *(3)Setting Temperature Control Program*

In order to set temperature control program, you must switch display panel from "starting state "to Fig. 7 state. (Please follow procedure from Fig. 4 to Fig 7)

Then touch Key [icon] and hold for one second, the temperature program setting stage. On the display, PV shows first segment for temperature SV shows temperature value

Then touch Key[icon], program enters holding time



Panel enters (as Fig. 9) Initial

(as Fig. 10)

8

PV show the segment number for time

SV shows time setting ( Munites ) in this segment.   **Fig. 9**     **Fig. 10**

By touch key ▲ or ▼, you can increase or decrease the value to be set.

Yudian 708 controller allows you to set one temperature profile up to 30 segments

By touch key ◄ and uses key ▲ and ▼ you can get in next segment for temperature or time setting.

During program setting, by touching ◄ and holding for two seconds, you can return to previous setting and make revising.

By touching key ◄ first, then press key ↺, you can exit program setting mode. If no key operation for 30 seconds, display exits program setting mode and returns to "starting state".

### *(4) Example for Setting Temperature Control Program with 6-segment Profile*

For a complicated temperature control profile, we strongly suggest you to make drawing as Fig.11 then make form as table 1 to list all data in every segemnt.

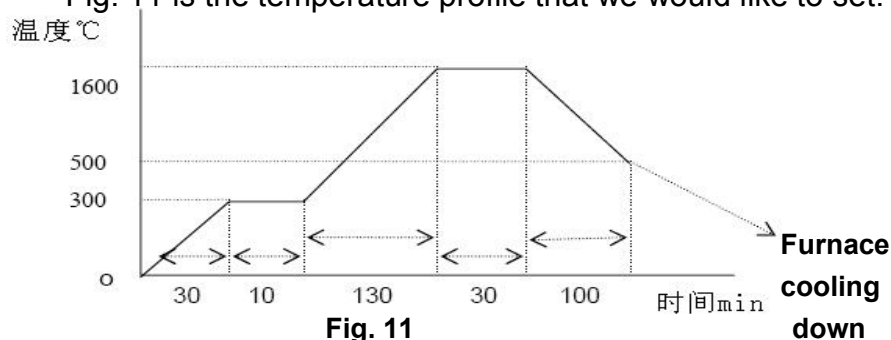Fig. 11 is the temperature profile that we would like to set.



**Fig. 11**

**According to this profile, you shall list all segments in the following Table**

| Segment # | Symbol in Panel | Data to be In-put | Meaning in the program |
|---|---|---|---|
| 1 | **C 01** | **0** (℃) | Initial Temperature |
| 2 | **t 01** | **30** (min.) | Ramping time from 0 – 300℃ Average Heating rate is 10℃ /min |
| 3 | **C 02** | **300** (℃) | Target temperature value to first heating stage ( 300℃ ) |
| 4 | **t 02** | **10** (min.) | Soaring time at 300℃ stage |
| 5 | **C 03** | **300** (℃) | Temperature value at the heating flat |
| 6 | **t 03** | **130** (min.) | Second Heating time from 300 -1600℃ Average heating rate is 10℃ /min |
| 7 | **C 04** | **1500** (℃) | Target temperature value to peak heating stage ( 1500℃ ) |
| 8 | **t 04** | **30** (min.) | Soaring time at 1500℃ stage |
| 9 | **C 05** | **1500** (℃) | Temperature value at peak heating flat |
| 10 | **t 05** | **100** (min.) | Cooling time to 500℃ |

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| | | | Cooling rate is 11℃ /min |
|---|---|---|---|
| 11 | **C 06** | **500** (℃) | Target temperature to be cooled ( 500℃) |
| 12 | **t 06** | **-121** | Program end, Out-put power off. Furnace cooling down naturally (t 06 = -120 is an order to stop running. |

Using 4 keys of ⟲, ▲ , ▼ , ◀ enter data listed the above table into controller separately , then , you finish one temperature control program finish Please be noted that " t xx " is time value for XX segment. It can be set from 1- 9999 munites. However, if "t xx "is set as the following values, it can be as a special order. These orders only can be used in complicated multi temperature profile program.

If **t xx = o:** Controller will be paused at xx segment (Hold)

If **txx = - (1-150)** Negative value is a control order, which let program stop running, or jump to other segment.

If **txx = - (Ax30+B)** , here B values is 1- 30. Which indicates program will jump to the segment at B value

When **A=0**, only execute segment jump function.

When **A=1**, program will cut off power delay

When **A=4, B=1**, Program will execute "stop "order

## *(5) Run Temperature Control Program with Furnace*

When temperature program set up ready, touch key ▼ and hold for two seconds, then display SV will show letter "run", furnace will run automatically segment by segment according to program step by step.

Under furnace running state, "Out "indicator's brightness will change based on power out value.

If you want the furnace to stop running temporarily, please push key ▼ and hold for two seconds, then display SV will show letter " Hold", the furnace enters "pause state ". In the "pause state", controller will keep furnace temperate at the value when "pause" order was given, but time running is stop.

Under the " Pause " state, push key ▼ for two seconds, SV display will shows " run". And furnace will start running again from the point where is paused.

If you want to stop running furnace, whatever under " pause" or " running " state, you can push key ▲ and hold for two seconds, then, SV display shows " stop" , furnace totally stop running and controller will be in "starting sate". If you want to run again, the program will start at the beginning step. If furnace temperature still is higher than " C 02", program will not run until temperature going down to " C 02". In order to run faster, you can choose program run from "step 2", or "step 3".

## *(6) Function Parameters Set Up and Revise*

The following fuction parameters are preset in the temperature controller. They are very important for controlling furnace temperature stably and accurately. Unless you have enough experience, please don't change the preset parameters in the controller. In order to change the function parameters, follow procedure as below:

Press key 🔄and hold for two seconds under "starting state", display will enter parameter setting function

Touch key ◀and hold for one second again, PV display will shows symbol: "M5 "(Fig.12), "P" (Fig. 13), "t" (Fig. 14), "CtrL" (Fig 15) and "LOC" (Fig.16) respectively.

Using ▲ and ▼ key to change the value under different parameter setting.

Hold key ◀ for two seconds, setting will go back to previous parameter.

Press Key◀, then push🔄, Display will exist "parameter setting".



| Fig.12 | Fig.13 | Fig.14 | Fig.15 | Fig.16 |

**таble 2** lists the parameters and their meanings:

| Parameter in Display Panel | Range to set | Parameter 's fuction | Preset value in the controller |
|---|---|---|---|
| **M5** Maintenance parameter | 0 -9999 | Adjus temperature difference between set value and real value. the larger M5 value, the longer adjust time, and M5 smaller time is shorter | **389.7** ( adjust between 200 –500 ) |
| **P** Speed parameter | 1-9999 | Adjustment rate in controller. P value increases adjustment faster; decrease, adjustment slower | **8** ( select betweem 3-10 ) |
| **T** Delay time parameter | 0 - 2000 | Control temperature over shooting. **t** value smaller, temperature overshoot smaller, otherwise overshoot larger. | **4** ( 3-10) |
| **CtrL** Control type | 1, 2, 3, 4, | 1= Auto tune from front panel 2= Auto tune first, then go to 3 or 4 automatically 3= built-in Auto tune, can not be changed from front panel 4= more accurate auto tune | 1 |
| **LOC** Parameter lock | 0 - 9999 | Preset in controller. Please never change | 0 |

Again, only in the case that you find temperature controll is not stable during running, the parameters above may be considered to be adjusted.

Before adjust the parameters, you shall use *"Auto-Tune"* function to achieve the best setting result. The procedure is as the following:

let furnace stay in a temperature that is the most important for you.

Set Loc value to 2

let display return to "starting state "

Hold key ◀ for two seconds, then front panel of controller will flash with letter " AT", which means controller is in " Auto-Tune" state.

After "Auto-Tune", AT letter will disappear and controller will select all M5, P and t value automatically.

You may repeatly set "Auto-tune "2-3 times to achieve the best result.

After Auto-tune please set Ctrl to 3.

If temperature is still not stable after Auto-tune; you may adjust M5, P, and t value manually. In the special case, furnace can not be run properly due to voltage varies in different area; you may need to adjust some parameters as the Table 3.

Again, the parameters have been preset according to our experience. Please don't adjust the following parameters unless you are very familiar with the function of parameters

**Table 3.**

| Parameter symbol in PV panel | Value preset in SV Panel | Function | Note |
|---|---|---|---|
| **HIAI** | 1650 | Max. Temp limit | |
| **Local** | 200 | Initial Temp limit | Limit output current beflow 200 oC |
| **dHAL** | 999.9 | Alarm in positive tolerance | |
| **dLAC** | 999.9 | Alarm in negative tolerance | |
| **dF** | 0.3 | Adjsutment difference | dF smaller, auto tune has higher accuracy |
| **CtrL** | 3 | Control type | |
| **M5** | 389. 7 | Maintenance parameter | |
| **P** | 8 | Speed parameter | |
| **t** | 4 | Delay time parameter | |
| **CTI** | 1 | Output period | Reflect controller's adjstment speed |
| **Sn** | 6 | Thermal couples type | B type T.C |
| **DIp** | 0 | Position of decimal | |
| **DIL** | 0 | Display valve in Min. | |

| DIH | 1600 | Display value in Max. | |
|---|---|---|---|
| Sc | 0 | Main input shift and adjustment | Tolerance between input and sensor |
| OP1 | 4 | Output type | Select 1 is output from 0 – 10 mA. Please make sure if this value is compatible with controller |
| OPL | 30 | Output limit below 200 oC | This value will determine Max. output current when below 200 oC. Please select 16 first. If the output current is too low, please increase the value up to 80. The most suitable value that the current -meter shows is 120 – 140 A in initial heating stage |
| OPH | 80 | Output Up limit | Limit Max. output power. Max value is 130. Please set the value as low as possible to avoid damaging heating element |
| ALP | 5503 | Alarm function | |
| CF | 18 | System fuction selection | |
| Addr | 1 | Communication address | |
| bAud | 9600 | Communication frequency | |
| dL | 1 | Inputdigital filter | dL value larger, measured temperature more stable, but reaction time is slow |
| run | 28 | Running condition | |
| Loc | 0 | Parameter revising grade | Value "0" will lock the data that has been entered. The value " 808" will open lock to allow you to revise all parameters |
| EP1 | M5 | | |
| EP2 | P | | |

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| EP3 | t | | |
|-----|-----|-----|-----|
| EP4 | OPL | | |
| EP5 | OPt | After adjusting, set to NoneE | |
| EP6 | | After adjusting, set to NoneE | |
| EP7 | NoneE | | |
| EP8 | NoneE | | |

In order to adjust the parameters above, you need to do as the following:

From function parameter state of " Loc" as shown in Fig. 16, change "Loc" value from " 0" to "808" as shown in Fig. 17



    **Fig.17**     **Fig.18**     **Fig.19**     **Fig.20**     **Fig.21**     **Fig.22**

Then, you can revise the parameters from "HI AL" ( Fig 18) ---- "Sn "(Fig 19) ------ " oPL "( Fig20) --" oPH" ( Fig. 21) by The Key 🔄 , 🔼 , 🔽 step by step. After changing the parameter and make sure all parameters are correct, you need to change "LOC" to '0' as shown in Fig. 22.to lock all data entered without change.

## 8. Maintenance and Cautions

a) When power on, if you can not hear a sound from cooling fan, please don't continue to operate. You must shut down power to check or replace the cooling fan.

b) During furnace running, please don't touch furnace to avoid any high temperature burn.

c) Before operating the furnace please must place the alumina insulation block (see Fig. 24a and 24b) behind the front door of the furnace for good insulation performance.

d) Please don't open the front door of the furnace above 300℃ to prevent insulation inside furnace from cracking.

e) If the furnace is used at first time or not use for long time, please preheat the furnace at 300℃ for at least 2 hours to remove moisture inside to avoid chamber cracking.

f) MoSi2 heating element is only suitable for using in air or inert gas envoriments. Other active gas, such as H2, Cl2 and SO2, will damage heating element.

g) Please don't use the furnace at 400 – 700℃ temperature range for long time because MoSi2 heating element will be easy to be oxidized in the temperature range.

h) MoSi2 heating element is very brittle. Please pay a great attention during moving and handling. Also, please avoid rapid heating and cooling to avoid the heating element broken. Max. 10℃/min heating or cooling rate is suggested.

i) Please check heating element for every three months to see if they are in good connecting condition. If connection gets loose, please open case and tighten them properly.

j) Please always keep inside clean before operation to avoid contamination to your sample.

k) Furnace must be used under following condition:

Temperature: -10 – 75℃; Elevate: < 1000 M, Humunity < 85%; Environment: no vibration and conductible dust, explosive, flammable and corrosive gases

*How to replace Heating element*

1) Take of 4 screws on top of furnace, and then open the cover, as Fig 25

2) Take off the screw of clip for heating element, as Fig 26

3) Take off aluminum plates between connections of heating element, as Fig. 27



**Fig. 25**          **Fig. 26**          **Fig. 27**

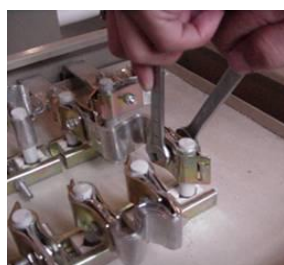4) Take off the screws of metal clip for fixing ceramic block, as Fig 28

5) Take off the ceramic black between rods of U type heating element, as Fig 29

6) Take off the U type heating element which needs to be replaced, as Fig. 30

7) Replace a new heating element. Please put ceramic block together with the heating element, and make sure the ceramic block shall fit position as before, as Fig 31.

| Fig. 28 | Fig. 29 | Fig. 30 | Fig. 30 |

8) When tighten the screw of metal clip for heating element, please make sure the bottom of U heating element does not touch the bottom of furnace chamber. Usually the bottom of U element shall rise 5 mm high from the bottom of furnace chamber

9) Then, follow the procedure 4, 3, 2, 1 to tighten screw and finish the exchange of heating element

10) **Cautions**

o Please handle the heating element very carefully. Keep it from any impact.

o When tighten aluminum connecting plates between rod of heating element, please don't over tighten to avoid breaking of the heating element. However, can not be tighten too loose, it will cause higher contact resistibility and temperature rising on the top of furnace.

o If you find temperature is too high on the top of furnace during heating, please shut down power, re-open the top cover of furnace, tighten further of the screw between heating element rod and aluminum plate

o For further question, please email to marco.mu@synthe-corp.com, jozofurnace@vip.163.com

Any defective part caused by manufacturer please feel free to contact us. We will replace detective part and instruct you how to change the part by yourselves during warranty period. However, **Henan Synthe Corporation** is not responsible for any damage or consequence damage cuased by misuse. After warranty, **Henan Synthe Corporation** will continue to provide technical support and spare parts at a reasonable cost. *(The alumina tube is excluded from the warranty because it is a dissipative material).*

**9. Trouble shooting for typical Problems**

| Problems | Reason | Solution |
|---|---|---|
| Open Power Lock, no power indication | Fuse (4A) in control panel is broken | Check control panel, and replace fuse |
| Green Power indictor is off, but Red open circuit indicator is On | Fuse ( 50A) in main power circuit is broken | Open the cover of front panel and replace the fuse |
| No current shows in meter , but has Max. Voltage | Heating element broken | Find broken heating rod, and replace it |
| Controller display panel SV shows" OraL" | Thermal Couples broken | Replace Thermal couples ( B type ) |
| Controller display panel SV shows" HI AL" | Furnace temperature > 1700 oC, Protection from Alarm | Cool furnace down, and find reason why temperature is so high ( program setting may be wrong) |
| Power and heating element are OK, but | Controller or related circuit may be damaged | Heck controller. If not, please inform |

| | | |
|---|---|---|
| furnace can't be controlled by program. | | manufacturer to check what the |
| Program running, but furnace can not be heated, or real temperature is far behind the setting value | oPL or oPH value is too low due to local voltage lower or frenquency different | Incraese "oPL" and "oPH" value till current meter shows " 120 A – 140 A", and program runs smoothly |
| During heating below 300 oC, the temperature value ( PV) is not stable, and doesn't match with setting program (SV) | It is normal because the furnace comes with a high temperature thermocouple, which is not sensitive at temperature below 300 oC | Don't worry. Let the furnace heat to 300 oC, then thermocouple will function stably with program. If the PV value at 300 oC is still less than that of SV, you may need to increase OPL value a little. |

## How to Use and Maintain Alumina Tube in High temperature Tube furnace

Alumina tube is very brittle and easy to damage.   We don't provide any warranty for alumina tube in high temperature tube furnace. You must handle alumina tube very carefully to keep longer service life.   Please take following suggestion on how to use alumina tube.

1. Please heat and cool tube furnace slowly.   5 $^{o}$C/ min is Max rate. Slower is better. From room temperature to 300 $^{o}$C, heating rate 2 $^{o}$C/min. Please never take furnace cooling without control from high temperature, which will cause alumina tube cracking immediately.

2. Please always keep inside tube clean.   Never leave some chemical inside tube to avoid the chemical react with Al2O3 tube which will cause tube cracking.   Pleae use a proper crucible contain your sample

3. When you push sample or crucible into a hot tube    ( 200 $^{o}$C ) , must move it from edge to center very slowly.   Never push a sample into alumina tube when its temperature is > 200 $^{o}$C.

4. Please always remember to put foam refractory block in two end of tube to avoid hot radiation damage O-ring on flange.   The ceramic blocks shall locate at edge of furnace case as drawing below

**Put sample into a crucible, never put sample into tube inside directly**
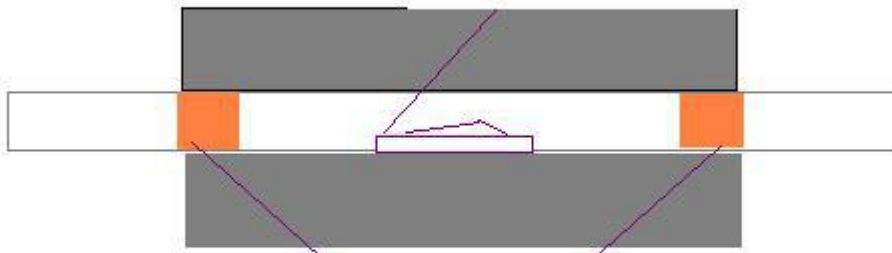


**Position of Foam ceramic blocks**

# PACKING LIST

| No. | DESCRIPTION | UNIT | PCS | REMARK |
|---|---|---|---|---|
| 1 | High Temperature Vacuume Tube Furnace | pc | 1 | |
| 2 | Additional Heating Elements | pc | 2 | avoid the damage during delivery |
| 3 | Thermal couple | pc | 1 | |
| 4 | Vacuum Flange | set | 1 | |
| 5 | Alumina Ceramic tube | pc | 2 | |
| 6 | Furnace hook | pc | 1 | |
| 7 | Tube Blocks | pc | 4 | |
| 8 | Seal Rings | pc | 5 | 4 pcs has been builted in flanges |
| 9 | Tube Casing | pc | 2 | |
| 10 | Alumina Mesh Outside Tube Casing | pc | 2 | |
| 11 | Glue 704 | pc | 1 | |

**Thank you for purchasing SYNTHE furnace. To avoid any misuse and damage, please read the operation instruction carefully before operation**