PA-1700TX
High Temperature Muffle Furnace

PAWA DENTAL

Contents

Instructions and Operation Manual for PA-1700TX High Temperature Muffle Furnace

Thank you for purchasing MTI PA-1700 High Temperature Muffle Furnace. To avoid any misuse and damage, please read the operation instruction carefully before operation
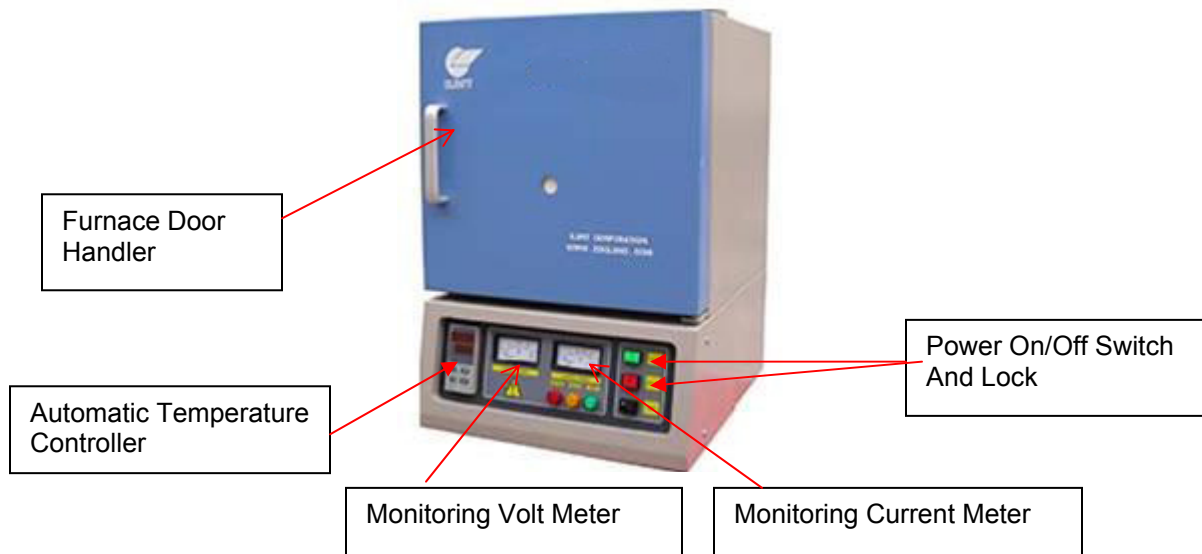
1. Introduction

PA-1700TX high temperature muffle furnace uses $MoSi_2$ rod as heating element. Max. Temperature inside furnace can be reached at 1700 ^oC. The furnace temperature profile can be set up by 51 segments and run automatically by the 708P type temperature controller. It is excellent for material research, ceramic research labs.

2. Technical Specifications

Item	Unit	Parameter
Max.Power	KW	1
Voltage	V	AC 220 single phase 50/60 Hz
Max. Temperature	^oC	1700
Continuous working temperature	^oC	1600
Suggested heating rate	^oC/min	$\leqslant$ 10
Temperature accuracy controlled	^oC	$\pm$ 1 ^oC
Heating element		$MoSi_2$
Connection of heating element		Series connection
Thermal Couple		B type Pt-Rh to Pt-Rh
Heat capacity inside chamber	KWH	$\leqslant$ 80
Dimension of inside chamber	mm	100L x 100W x 110 H
Dimension of outside	mm	330 L x 320W x 480 H
Net Weight	Kg	38

3. Furnace Structure

Furnace Door Handler

Automatic Temperature Controller

Monitoring Volt Meter

Monitoring Current Meter

Power On/Off Switch And Lock

PA-1700TX high temperature furnace uses high quality fiber Alimina as refractory material, and selects $MoSi_2$ as heating element. Temperature control panel comes with power lock, power and circuit open indicator, as well as output voltage and current meter. It is evry easy to operate and observe furnace working condition.

4. Instruction of the 708 Intelegent Temperature Controller.

(1) Main Feature:
- The 708P 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.
- 51 segments programmable.
- 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

(2) Temperature Controller Connections:

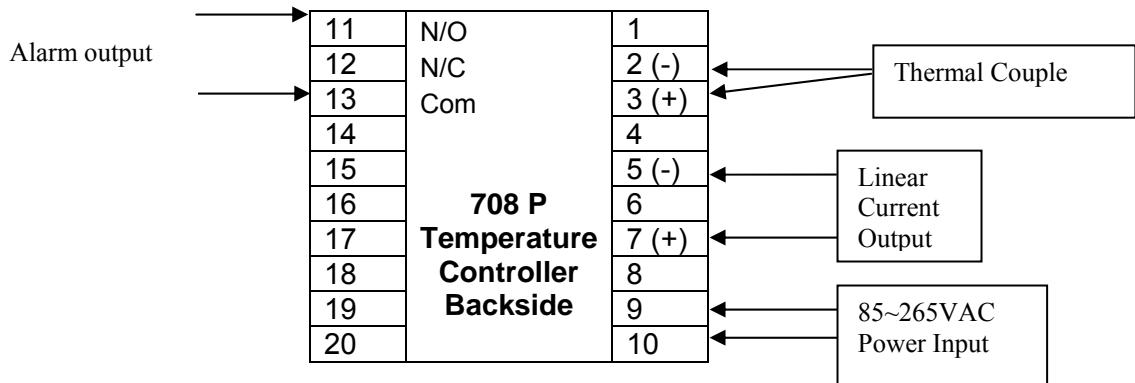There are 20 connectors in backside temperature controller. The connection is as Fig 1:

11	N/O	1	
12	N/C	2 (-)	
13	Com	3 (+)	
14		4	
15		5 (-)	
16	**708 P**	6	
17	**Temperature**	7 (+)	
18	**Controller**	8	
19	**Backside**	9	
20		10	

Alarm output

Thermal Couple

Linear Current Output

85~265VAC Power Input

Fig. 1

 (3) Indication of Front Panel of Temperature Controller

On Front Panel of Yudian 708P temperature controller, there are several signs and icons such as OUT, AL1, AL2, AUX, PV, SV, ⟲, ⟨, ∨, and ∧, which indicate the meaning as the Figure 2

Out ---Indicates the state of controlled running

Aux ---   Given instruction from outside

AL1 --- Indicates Alarm 1 working

SV ----Control Temperature value setting in program

AL2 -- Indicates Alarm 2 working

key for shift setting. Also enter program setting

PV ---Current Temperature from thermocouple

 Key for value increase, also for stop program

Key for changing disply and setting parameters in various fuctions

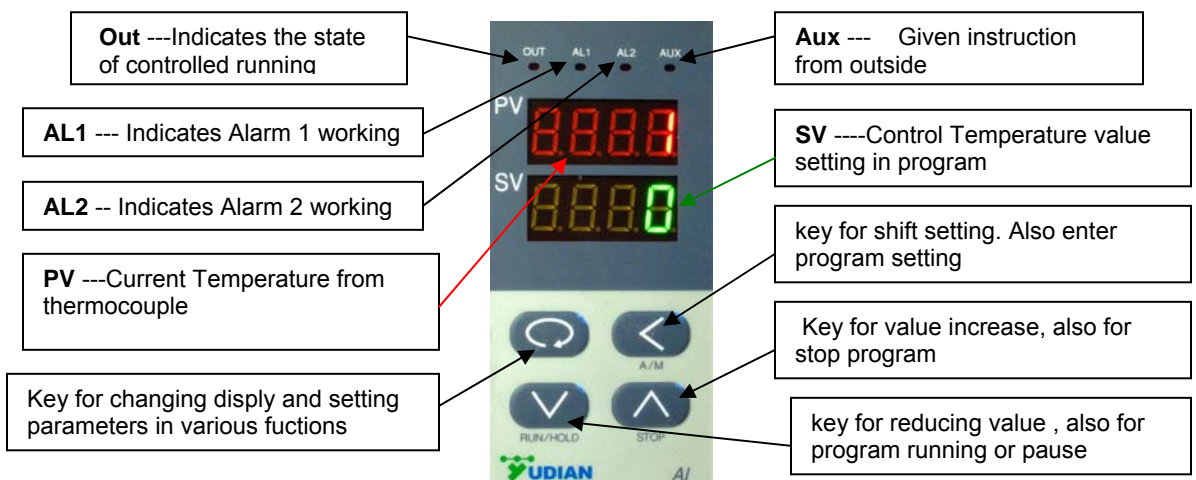key for reducing value , also for program running or pause

Fig.2

5. Setting Procedure of 708P Temperature Controller

Before running the furnace, you must plug in 220-240V AC power.

Install thermal couples on the back of the furnace and make sure connection correctly (blue wire connecting with negative; brown wire connecting with positive, Fig.3)

Figure 3

(1) Starting State of Display of Controller Panel

When turn power on, controller display show the model No (708P) of controller, software version first, Several 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. 4

(2) Switching Function of Display

Under starting state of temperature display as Fig. 4, e.g.   the panel can be switched to program setting function and parameter setting function by touch key:

Touch ⟳ key for one second,
PV will show " Step" and
SV show Step # (Usually show 1) as Fig. 5

Touch ⟳ key for once again, PV will show the setting time in the step, and SV shows the time that has run in this step.

Fig.5

Fig.6

Touch ⟳ key for two second under "starting state",
Display will enter parameter setting function as Fig 7,
(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.

Fig.7

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(3) Setting Temperature Control Program

In order to set temperature control program, you must switch display panel from "starting state "to Fig. 5 state.

Then touch Key [<] for one second,
the Panel enter temperature program setting stage.
On the display, (as Fig. 8)
PV shows first segment for temperature
SV shows Initial temperature value

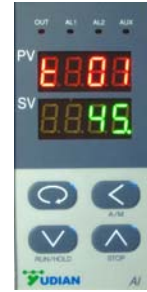Then touch Key [<], program enters holding time
(as Fig. 9)

 PV show the segment number for time

 SV shows time setting (Munites) in this segement

Fig. 8   **Fig. 9**

By touch key [∧] , and [∨] , you can increase or decrease the value to be set.
Yudian 708 controller allows you to set one temperature profile up to 51 segements
By touch key [<] and uses key [∧] [∨] you can get in next segement for temperature or time setting.
During program setting, by touching [<] for two seconds, you can return to previous set to make revise.
By touching [<] key first, then touch [○] key, you can exist program setting.
 If no key operation for 30 seconds, display exists program setting and return to "starting state".

(4) Example for Setting Temperature Control Program with 6-segement Profile

For a complicated temperature control profile, we strongly suggest you to make drawing as Fig. 10, then make form as table 1 to list all data in every segemnt.
Fig. 10 is the temperature profile that we would like to set.

Fig. 10

According this profile, you shall list all segments in the following table: **Table 1**

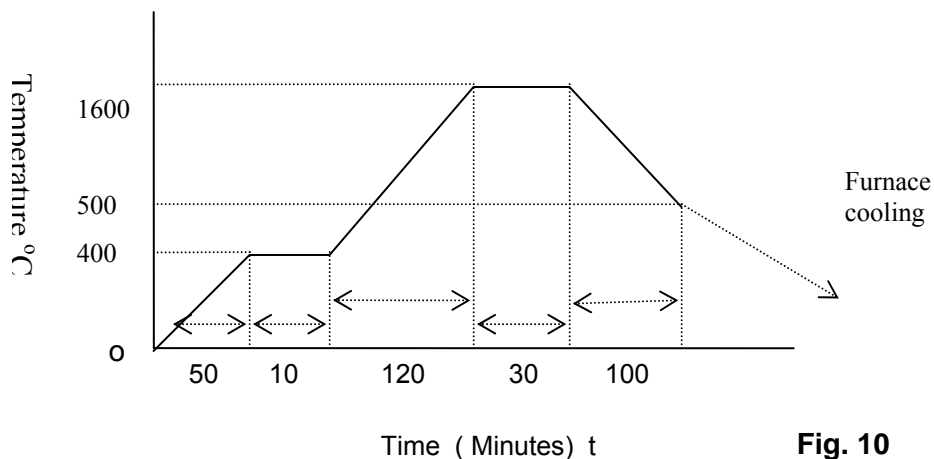| Segment #	Symbol in Panel	Data to be In-put	Meaning in the program
1	**C 01**	**0**	Initial Temperature
2	**t 01**	**50**	Ramping time from 0 – 400 ^{o}C Average Heating rate is 8 ^{o}C /min
3	**C 02**	**400**	Target temperature value to first heating stage (400 ^{o}C)
4	**t 02**	**10**	Soaring time at 400 ^{o}C stage
5	**C 03**	**400**	Temperature value at the heating flat
6	**t 03**	**120**	Second Heating time from 400 -1600 ^{o}C Average heating rate is 10 ^{o}C /min
7	**C 04**	**1600**	Target temperature value to peak heating stage (1600 ^{o}C)
8	**t 04**	**30**	Soaring time at 1600 ^{o}C stage
9	**C 05**	**1600**	Temperature value at peak heating flat
10	**t 05**	**100**	Cooling time to 500 ^{o}C Cooling rate is 1110 ^{o}C /min
11	**C 06**	**500**	Target temperature to be cooled (500 ^{o}C)
12	**t 06**	**-121**	Program end, Out-put power off. Furnace cooling naturedly. (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 valuve , it can be as a special order. These order only can be used in
complicated multi temperture profile program.

If **t xx = o** :   Controller will be paused at xx segent (Hold) . Next program only can
                    be run by a manual order (touch A/M key)
If **txx = -(1-150)**   Negative valuve is a control order, which let program stop running, or jump to
                    other segment.

If **txx = -(Ax30+B)** , here B valuve is 1- 30. which indicates prgram will jump to the segement at B value
                When **A=0**, only execute segment jump fuction.
                When **A=1**, program will cut off power relay
                When **A=4, B=1**, Program will excetue " stop " order

(5) Run Temperature Control Program with Furnace

    When temperature pragram set up ready, touch key ∨ for two seconds, then display SV
will show letter "run" , furnace will run automatically segement by segement 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 ∨ 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 ∧ 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

furnace coolling 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:
  ➢   Touch ⟳ key for two second under "starting state", display will enter parameter setting function
  ➢   Touch ⟨ key for one second again, PV display will shows symbol: " M5 " (Fig. 11) , " P" (fig. 12), "t" (fig. 13),   "CtrL" (fig 14) and " LOC" (fig.15) separately.
  ➢   Using ⋁ and ⋀ key to change the value under diferent parameter setting.
  ➢   Push ⟨ key for two seconds, seting will go back to previous parameter.
  ➢   Puch Key ⟨, then push ⟳, Display will exist "parameter setting".
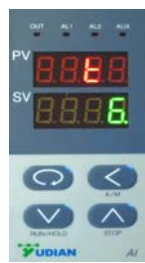
| **Fig.11** | **Fig.12** | **Fig.13** | **Fig.14** | **Fig.15** |

Table 2 lists the parameters and their meanings:

Parameter in Display Panel	Range to set	Parameter 's fuction	Preset value in the controller
M5 Mataince parameter	0 -9999	Adjus temperature difference between set value and real value. M5 value is larger, adjust time is longer,, and M5 smaller time is shorter	(adjust between 200 – 500)
P Speed parameter	1-9999	Adjustment rate in controller. P value increases adjustment faster, decrease, adjustment slower	(choose betweem 3- 10)
T Delay time parameter	0 - 2000	Control temperature over shooting. **t** value smaller, temperature overshoot smaller, otherwise overshoot larger.	(3-10)
CtrL Control type	1, 2, 3, 4,	1= Auto tune from front panel 2= Auto tune first, then go to 3 or 3 3= built in Auto tune, can not be changed from front panel 4= more accurate auto tune	**3**
LOC Parameter lock	0 - 9999	Preset in controller. Please never chang	**808**

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

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

> Let furnace stay in a temperature that it is most important for you.
> Set Loc value to 2
> Let display return to "starting state "
> Push ◁ key for two seconds, then front panel of controller will flash with letter " AT", wich means controller enter " Auto-Tune" state.
> After Auto-Tune", AT letter will disappear. Controller has choose all M5, P and t value automatically.
> You may repeat " Auto-tune " 2-3 times to achieve best result.
> After Auto-tune, please set Ctrl to 3.
> If temperature is still not stable after Auto-tune, then you may adjust M5, P, and t value manually.

In the spcial case, furnace can not run properly due to voltage varies in different area, you may need to adjust some parameters as the Table 3.
Agaian, The parameters have beem preset according to our experience. Please don't adjust the following parameter unless you are very fimilar with the function of parameter

Table 3.

Parameter symbol in PV panel	Value preset in SV Panel	Function	Note
HIAI	1700	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		Mataince parameter	
P		Speed parameter	
t		Delay time parameter	
Ctr	1	Output period	Reflect controler's adjstment speed
Sn	6	Thermo cpuple type	B type T.C
Dlp	0	Position of decimal	
DIL	0	Display valve in Min.	
DIH	1800	Display value in Max.	
Sc	0.0	Main input shift and adjustment	Tolerance between input and sensor
OP1	1	Output type	Chhose 1 is output from 0 – 10 mA. Please make sure this value is compatible with controller
OPL		Output limit below 200 oC	This value will decide Max. output current when below 200 oC. Please choose 16 first. If found output current is too low, please increase the value up to 80. The most suitable value is the current meter show 120 – 140 A in initial heating stage
OPH	100	Output Up limit	Limit Max. output power. Max value is 130. Please the value as low as possible to avoid heating element is damaged
ALP	10	Alarm function	
CF	16	System fuction selection	82 means limit output current in two stages
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	27	Running condition	
Loc	0	Parameter revising grade	Value 'O" woll lock will data that has been enter. " 808" will open lock to allow you to revise all parameters
EP1	M5		
EP2	P		
EP3	t		
EP4	CtrL		
EP5	OPL	After adjusting, set to NoneE	
EP6	NOneE	After adjusting, set to NoneE	
EP7	NoneE		
EP8	NoneE		

In order to adjust the above parameters, you need do as the follows:
From function parameter state of " Loc" as Fig. 15, change "LoC" value from " 0" to "808" as Fig. 16

Fig .16   **Fig .17**   **Fig .18**   **Fig .19**

Fig. 20   **Fig. 21**

Then, you can revise the parameters from "HIAL" (Fig 17) ----   "Sn " ------ " oPL " --" oPH" (fig. 20) by The Key ⟳ , ∧ , ∨ seperately.   After change the parameter , and make sure all parameters are correct, then you need change " LOC" to '0" as Fig. 21. to lock all data without change.

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6. Installation Procedures

Please follow the instructions as the below for furnace installtion
- ➢ Open shipping package to check if all compoments are good condition. If find any damage cuased by shipping, please report it to our Corporation immediately by email.

- ➢ The furmace must be placed in flat surface to avoid vibration, where must keep from flamable and explosible materials.
- ➢ The furnace uses AC 220V / 4KW power. Please make sure that power source in your lab is enough to meet this power requirement.

- ➢ Ground wire (double color --- green/white) shall be connected to ground well. Shut down power if you don't use furnace to avoid any damage by accident
- ➢ Please insert thermal couple tube (ceramic tube)in to furnace from backside of furnace, then tighten screw to fix thermal couple's position
- ➢ Connect thermal couple wires to controller. Please make sure that positive and negative polarties are connected correctly (brown to positive; blue to negative. otherwise, controller can not work. Fig. 22).

Wire to T.C
Please make sure
"+" and "-" before
connecting thermal
couples

Cable to AC
220V power
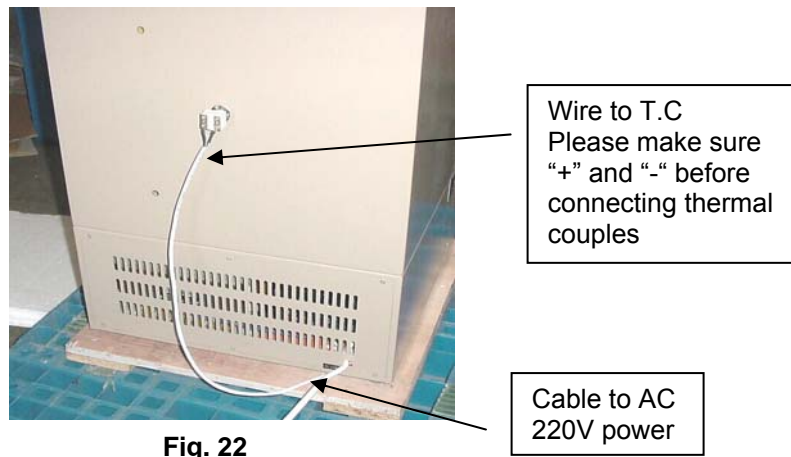
Fig. 22

7. 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 displat is at " starting state ", e.g PV panel shows temperature value , and SV dispalys " 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)
- ➢ Push green " Turn On " power swtich 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

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 outside body to avoid any high temperature burn.
c) $MoSi_2$ heating element is only suitable for using in air or inert gas envoriments. Other active gas, such as H_2, Cl_2 and SO_2 will damage heating element.
d) Please don't use the furnace at $400 - 700\ ^oC$ temperature range for long time because $MoSi_2$ heating element will be easy to be oxidized in the temperature range.
e) $MoSi_2$ heating element is very brittle. Please pay a geat attention during moving and handing. Also, please avoid rapid heating and cooling to avoid the heating element broken. Max. $10\ ^oC$/min heating or cooling rate is suggested.
f) Please check heating element for every three months to see if they are in good connecting condition. If connection get loose, please open case and tighten them properly.
g) Please always keep inside chamber clean before running furnace to avoid contamination to your sample.
h) Furnace must be used under following condition:
Inside room at temperature between $-10 - 75\ ^oC$
Elevate < 1000 M, Humunity < 85%
In the envoriment without vibration and conductible dust, explosive, flamable and corrosive gases
i) MTI Corporation provides one year limited warranty from date that we shipped goods. If you find any defective cuased by product's quality please feel free to contact us for replacement during warranty period. However, MTI Corp is not responsible for any damage or consequence damage cuased by misuse.
After warranty, MTI will continue to provide technical support and spare parts at a reasonable cost.

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 furnace front panel and replace the fuse
No current in meter , but has Max. Voltage	Heating element broken	Find broken heating rod, and replace it

Controller panel SV show " OraL"	Thermal Couples broken	Replace Thermal couples (B type)
Controller panel SV show " HiaL"	Furnace temperature > 1700 ^{o}C, 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 furnace can't be controlled by program.	Controller or related circuit may damaged	Please inform manufacturer to check what is real problem
Program running, but furnace can not be heated, or real temperature is far behind the setting value	oPL or oPH values are too low due to local voltage lower or frenquency different	Incraese "oPL" and " "oPH" value, until current meter show " 120A – 140 A", and program running smoothly

10. Attention

When the equipment is used for the first time, observe the ammeter please after it is set automatic operation. If the heated-current is too small, please turn the values of OPL on the parameter chart high properly until the heated-current is less than or equal to 140A!

symbol	name	type
	KSL—1700	
MTC	SCR	MTC110A/1600V
FU1	FUSE	RT14-20/4A
FU2	FUSE	RT36-00/32A
KA	AC Contactor	CJX1-32-22
JHBC1	Trigger	208V/60Hz
708P	Temperature control	AI-708PEXL1
FAN	Cooling fan	1202S-220V
LOCK	Knob switch	LAS1-AJ-11X/2
SB	Push button	LAS1-AJ-11/220V
J	Relay	IEC255-5A/220V
RC	RC absorb circuit	0.33uf+20Ω/2W
VR	Varistor	
V	Volt meter	250v
A	Amp meter	200/5A
B	Thermocouple	
RL	Heating element	
R	Resistance	500Ω/0.25W
XD	Signal lamp	LAS1-AY-D/220V
TB	Transformer	
CT	Current transformer	200A/5A

Title: KSL-1700X / AC220V / MTI Corporation
Size: B
Number
Revision
Date: 21-Apr-2008
Sheet of
Drawn By:

Working current — Brown（red） + S RL Blue（Green） −
CT 17 A 18
智能仪表
13 14 16 15
1 11+ / 2 12 / 3 13+ / 4 14 / 5 15 / 6 16 / 7 17 / 8 18− / 9 19+ / 10 20
00 03 06 05

Green ⊗ 20
Red ⊗ 19 KA2 KA3
ON/OFF Show

KA 00
Working voltage — TB
Open circuit / Read ⊗ FU2 — V 11
0-10mA R 0-5v

JHB—C1
00 03 13 14 +5
1 2 3 -4 +5 6
7 8 9 10 11 G1 12 G2

MTC 12 09 VR RC MTC 08
KA 08 07

AC208V~220V
green N 00
L 01 Red
PE Double color
FU1 02
FAN1 ℃ FAN2 温控开关
Green LD ⊗
LOCK 03
SB1 03 TURN-OFF 04
SB2 TURN-ON 05
KA1

Packing List

NO.	NAME	UNIT	AMOUNT	INDEX
1	PA-1700TX high temperature furnace	Stand	1	
2	MoSi2 heating elements	Root	2	Largess
3	Double plantinum-rhodio thermocouple	Pair	1	
4	Al_2O_3 cushion block	Block	1	
5	Al_2O_3 sprue	Block	1	
6	High temperature glove	Pair	1	Largess
7	Instruction	Copy	1	
8	Packing list	Copy	1	
9	Certificate of qualification	Copy	1	
10	Crucible pliers	Pair	1	Largess

Eligible certificate

Spec and model: PA-1700TX

Serial number:

Date:

The product has been identified eligible, and is authorized to be sailed.

Quality inspection department: