

Hot-Runner Temperature Controller with METICOM TM20 module

User Guide



WARRANTY

We warrant that this product will be free from defects in materials and workmanship for a period of two (2) years from the date of shipment. If any such product proves defective during this warranty period, we, at our option, either will repair the defective product without charge for parts and labor or will provide a replacement in exchange for the defective product.

This warranty shall not apply to any defect, failure or damage caused by improper use or improper or inadequate maintenance and care. We shall not be obligated to furnish service under this warranty; a) to repair damage resulting from attempts by personnel other than our representatives to repair or service the product; b) to repair damage resulting from improper use or connection to incompatible equipment; or c) to service a product that has been modified or integrated with other products when the effect of such modification or integration increases the time or difficulty of servicing the product.

This warranty excludes replacement of fuses, triac, calibration, contact points and damage to the module from the use of improper styles of fuses. The maximum allowable fuse rating is 15 amps. Lower ratings may be used for improved protection.

SAFETY

Our products have been designed to be safe and simple to operate. As with any electronic equipment, you must observe standard safety procedures to protect both yourself and the equipment.

Cautions:

- Service and installation of this equipment should only be performed by qualified service personnel familiar with high voltage electrical circuits.
- All international and local electrical codes must be followed when connecting this equipment.
- Only persons with knowledge of the system's operation and capabilities should operate the system.
- Read all of these instructions before connecting power and turning on the system.
- Unless specifically explained in this manual or directed by us, do not attempt to repair the system yourself. Doing so could result in damage to the system, or serious personal injury.

To Prevent Injuries:

- Do not apply voltage to a terminal that exceeds the range specified for that terminal.
- Do not operate this product with covers or panels removed. All unused slots of a main frame must be covered with the appropriately sized blank panels.
- Do not operate this product when wet.
- Do not operate this product in an explosive atmosphere.

To Prevent Product Damage:

- Do not operate this product from a power source that applies more than the voltages specified.
- Do not connect thermocouples to any live areas of the heaters. Lock out and tag the controller and mold and make sure there is electrical insulation between the thermocouple and any live areas.
- After turning on the system, you should make sure that fans are running.
- Never allow the fan outlets on the unit become blocked, this is where the system's cooling airflow exits. If this area of the mainframe becomes cluttered and insufficient airflow or the system maybe damaged.

◆ MAINFRAME

1. GENERAL DESCRIPTION

- This controller is designed as a closed-loop power distribution and temperature controlling system. It provides the user with premier temperature control capabilities.
- This unit has one or more heavy duty connectors (rated 10A or 16A) on back, used to connect with the mold by mold-power & thermocouple cables.
- This unit has one or more built-in cooling fans, one or two circuit breakers and power input cable. Neon indicators illuminate after power on.



Heavy Duty Connector



Power Input Cable

2. UNPACKING & INSPECTION

- 1) After unpacking, inspect your mainframe and check for any damage that may have occurred during shipment.
- 2) Check the circuit breaker and neon phase voltage indicators for damage.
- 3) Check for proper operation of circuit breaker by flipping breaker on and off with no voltage applied.
- 4) Check power output connector and thermocouple input connector for any physical damage.
- 5) Check AC input power configuration. The power input diagram is located on the back panel of the mainframe. This diagram indicates the input voltage configuration that was prewired at the factory. Make sure it matches what you ordered.

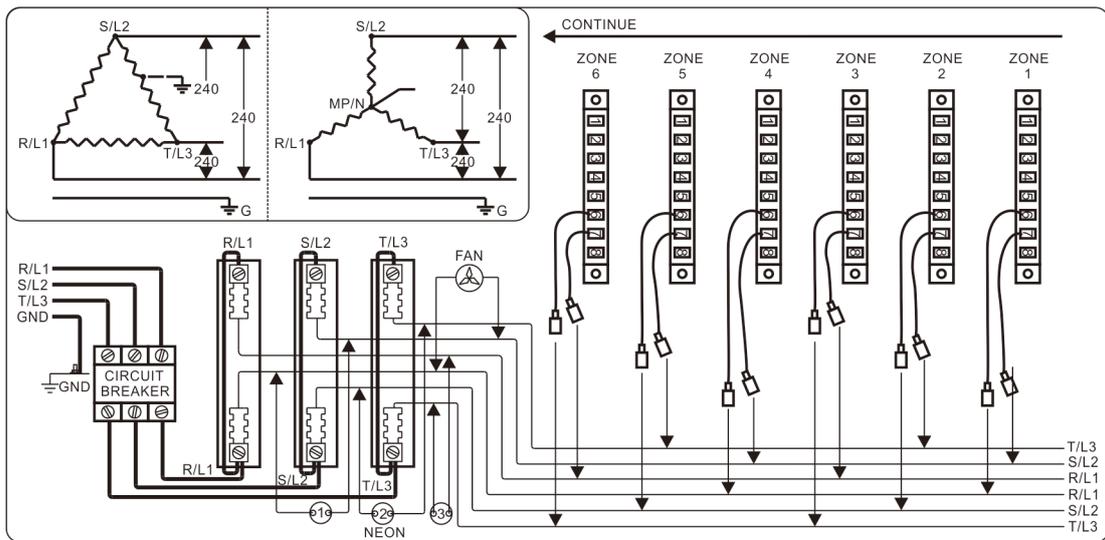
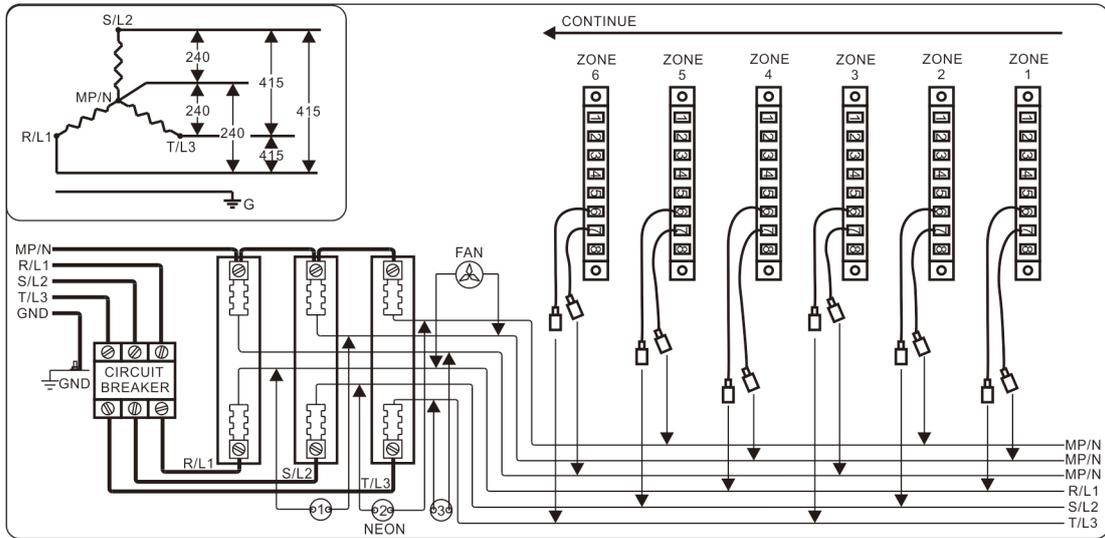
3. INSTALLATION

- 1) You are installing a piece of electronic equipment which is delicate and should not be subjected to any physical or environmental abuse. Select a cool, dry, well ventilated, environmentally clean location, away from heat, moisture and liquid carrying lines, i.e.: water cooling hoses, hydraulic hoses, etc.
- 2) Unless customized, all controllers will be configured for a power supply with single-phase 3-wire 208~240Vac for 1~2 zones controller, and either 3-phase 5-wire 380~415Vac or 3-phase 4-wire 200-240Vac for 3~48 zones controller.
Please follow the power supply configuration on the back panel.
If the configuration of power supply needs to be re-wired, please follow the back panel wiring diagram in this manual.
- 3) Route AC input cable to a branch circuit (service) disconnect switch and attach leads to fused side of switch. Be sure ground lead is attached to a good earth ground.
- 4) Connect power & thermocouple cables to mainframe and mold.

WARNING: Before applying power, make sure all international and local electrical codes have been followed and all safety precautions are taken.

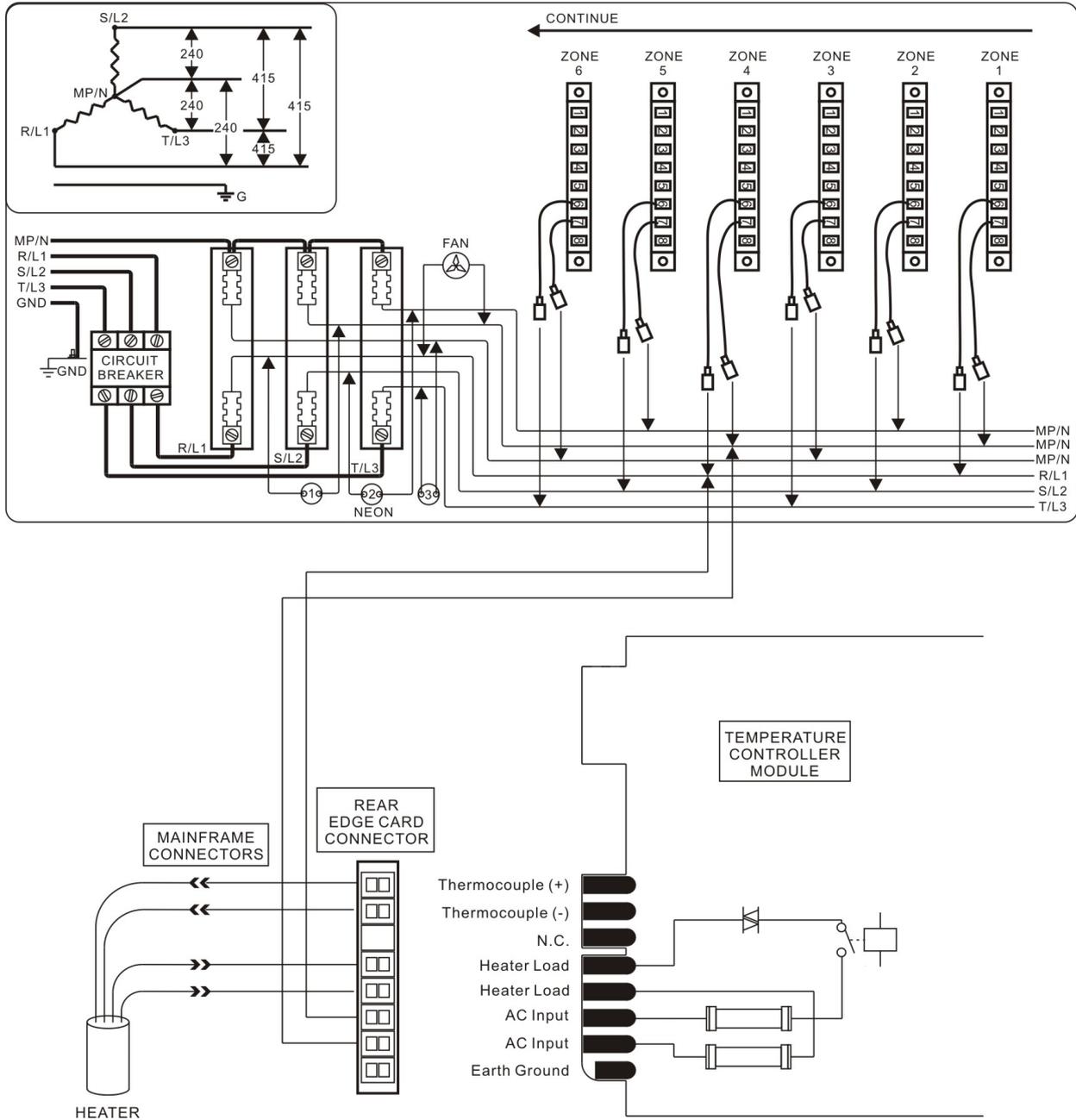
IMPORTANT: For mold wiring and heater connection information, refer to mold connector wiring diagram.

4. BACK PANEL WIRING



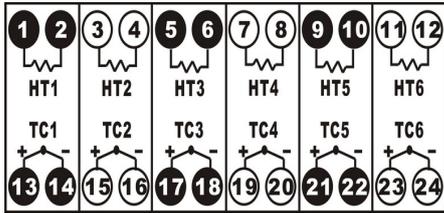
5. TYPICAL SYSTEM

WIRING DIAGRAM

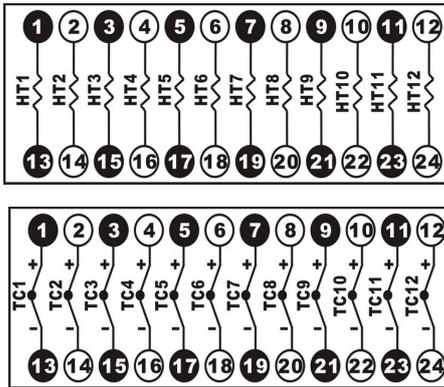


6. Default CONNECTOR WIRING (can be customized)

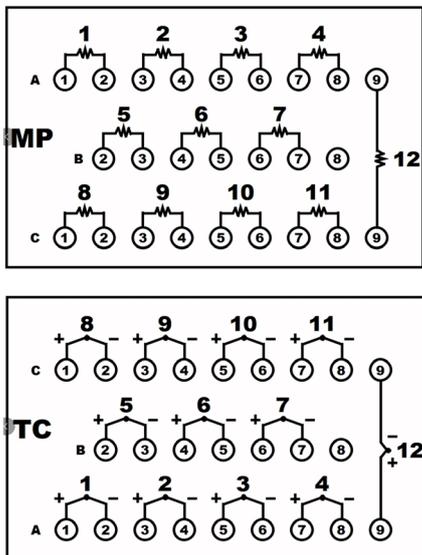
- ✓ Combination Power & Thermocouple Connector (16 or 24 Pin)



- ✓ Separate Power & Thermocouple Connector (16 or 24 Pin)



- ✓ Separate Power & Thermocouple Connector (25 Pin)



◆ TM20 Temperature Control Module

CAUTIONS

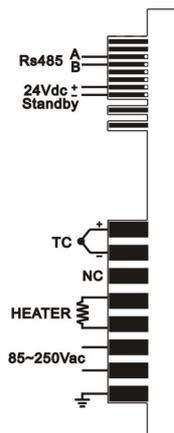
- Please read the instructions carefully before any operation.
- If there are any signs indicating that the temperature control module has been damaged during transportation, please do not power on it.
- Before the temperature control module is powered on, please
 - 1) Confirm if the power supply of the mainframe meets the requirements;
 - 2) Confirm that the mold-power & thermocouple cables are connected reliably and the wiring style on controller mainframe is the same as on the mold.
 - 3) Ensure that the fan of mainframe is in working condition.
- The temperature control module is set to be automatic closed-loop control mode before shipping.
- The temperature control module will show the code of the expected thermocouple type, please check it and adjust the related setting according to this manual if it does not match the system.
- If the temperature control module alarms during working, please check the alarm code and analyze the cause.
- Before you pull out or insert the temperature control module, please turn off the module's power and the circuit breaker on the mainframe.

Module Operation

1. Specifications

- ◆ Power requirements: AC85~250V, 50/60Hz
- ◆ Sensor type: J or K thermocouple
- ◆ Setting range: 0°C~450°C (32°F~842°F)
- ◆ Measurement accuracy: ±0.25%F.S.
- ◆ Cold-junction compensation accuracy: ±1°C
- ◆ Control mode: Auto PID or Manual
- ◆ Control accuracy: ±0.25%F.S.
- ◆ Control output device: Triac
- ◆ Load capability: 15A, 50W~1650W(110V), 100W~3600W(240V)
- ◆ Operating temperature: 0°C~55°C(32°F~131°F)
- ◆ Operating humidity: 10~80%, non-condensing
- ◆ Storage temperature: -20°C~70°C (-4°F~158°F)

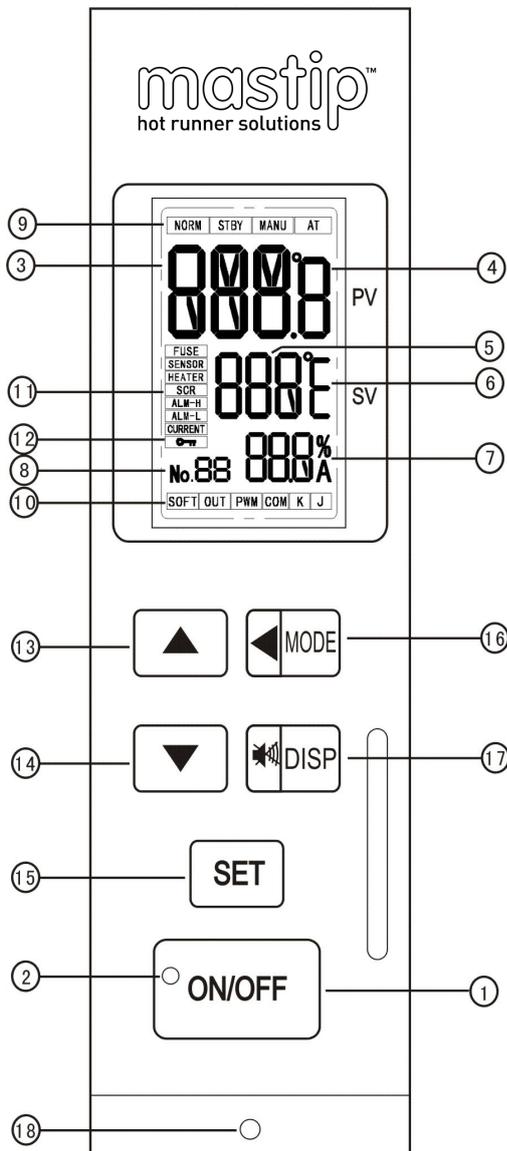
2. Wiring



3. Features

- ◆ Display unit: LCD
- ◆ Sensor type J/K
- ◆ Remote standby control is optional
- ◆ Over-voltage protection
- ◆ Reverse of sensor and heater protection
- ◆ Short load protection
- ◆ Fuse blowout alarm
- ◆ Triac breakdown alarm
- ◆ Overload alarm
- ◆ Thermocouple open alarm
- ◆ Thermocouple reverse alarm
- ◆ Temperature high alarm
- ◆ Temperature low alarm
- ◆ Heater fault alarm
- ◆ Heating invalid alarm
- ◆ High alarm of ambient temperature
- ◆ High limit of load current
- ◆ High limit of output percentage

4. Faceplate



- ① **ON/OFF key:** Turn on or turn off the module.
*Auto-ON can be selected by parameter "on-".
- ② **Power indicator:**
 - a) Flashing when module is powered up but in off state.
 - b) Light up when module is turned on.
- ③ **Display unit of present value:**
 - a) Normal mode: Present temperature value.
 - b) Parameter mode: Parameter name.
- ④ **Temperature unit or decimal digit of present value:**
 - a) Temperature unit (°C/°F) when resolution is 1(°C/°F).
 - b) Decimal digit when resolution is 0.1(°C/°F).
* Selected by parameter "Poi".
- ⑤ **Display unit of setting value:**
 - a) Normal mode: Setting temperature value (Auto control).
Setting power output percent (Manual control)
 - b) Parameter mode: Parameter value.
- ⑥ **Temperature unit: °C/°F.**
* Selected by parameter "C-F".
- ⑦ **Display unit of load current (Amps) or power output (%) .**
* Selected by DISP key.
- ⑧ **Display unit of zone number / communication ID**
* Set by parameter "Adr".
- ⑨ **Display area of control mode:**
 - **NORM:** Auto PID mode; Flash in Boost period.
 - **STBY:** Standby mode, the target is 70% of setting value.
 - **MANU:** Manual mode, SV shows the setting power output %.
 - **AT:** PID auto tune, flashing before confirmed by SET.
- ⑩ **Display area of working status:**
 - **SOFT:** Soft start.
* Selected by parameter "Sot".
 - **OUT:** Output state when output control type is zero-switching.
 - **PWM:** Output control type is phase control.
* zero-switching or phase control is selected by parameter "t".
 - **COM:** Working status: blink-normal, on/off-fault
 - **K / J:** Sensor type.
* K or J is selected by parameter "Sn", or press DISP key >9s.

- (11) **Display area of alarms:**
 - **FUSE:** Fuse blown out.
 - **SENSOR:** Sensor error.
 - **HEATER:** Heater fault.
 - **SCR:** Triac breakdown.
 - **ALM-H:** High deviation alarm.
 - **ALM-L:** Low deviation alarm..
 - **CURRENT:** Over load.
- (12) **Parameters' Lock:** Parameters cannot be changed.
* Selected by parameter "LCK".
- (13) **↑key:** Used to increase setting number.
- (14) **↓key:** Used to decrease setting number.
- (15) **SET key:** Used for parameter Calling up/Registration.

- (16) ←/MODE key:
- Parameter mode: Used for select adjustable digit.
 - Normal mode: Press it >1s to switch control mode :
Normal (Auto) \ Standby \ Manual \ AT (Auto Tune).
**** New control mode will be active after 5s.**
**** When shift to AT mode, press SET key in 3sec. to start auto-tuning, or the controller auto-back to normal mode.**
 - Soft start process: Press it to terminate soft start (when boS=1).
 - BOOST function can be activated by pressing it after soft start process (when boS=1).
- (17) DISP key:
- Press it to switch load current / power output % display.
 - Press it to silence buzzer until new alarm happen.
 - Press it >9s to change sensor type.
- (18) Mounting hole .

5. Operating modes

■ Normal mode:

After power on self-test, controller starts to work in normal mode.

PV displays present temperature value, and SV displays setting temperature value (Auto control) or power output percent (Manual control).

Note: Auto/Manual control mode, and the output percent of Manual control when power on, see parameter "nSL".

In this mode, you can

- Change setting temperature value (Auto control) or setting power output percent (Manual control): Press **Λ**、**V**、**<** to modify the setting, and the modified value will become effective after 3sec., or press **SET** to make it effective at once.
- Change setting temperature value (Auto control): Press **SET** to enter the setting temperature value adjustable state (flashing), then press **Λ**、**V**、**<** to change it and press **SET** to save it.
- Enter the parameter mode: Press **SET** >1sec.
- Switch control mode (Auto-Standby-Manual-AT): Press **MODE** >1sec.
**** When shift to AT mode, press SET key in 3sec. to start auto-tuning, or the controller auto-back to normal mode.**
- Switch load current (Amps) or power output (%) display: Press **DISP** >1sec.
- End soft start process: Press **MODE** (when boS=1).
- Activate BOOST function: Press **MODE** (when boS=1, and soft start process end).
- Change sensor type: Press **DISP**>9sec.

■ Parameter mode:

By pressing **SET** >1sec. in normal mode, the controller enters the parameter mode.

It displays parameter name and its value. In this mode, you can

- Change the parameter value: Press **Λ**、**V**、**<** to modify the value, and press **SET** to save it, then the next parameter and its value are displayed.
 - Look over the parameters: Press **SET** to shift the parameters.
 - Exit the parameter mode with saving: Press **SET** >1sec.
- If there's any operation in 60sec., the controller will exit the parameter mode without saving automatically.

■ Alarm mode:

The controller displays the corresponding faulty code.

6. Control modes (selected by MODE key)

■ Normal (Auto PID) mode:

This type of control is a "closed-loop" system and requires a thermocouple feedback signal.

The controller's PV displays present temperature value, and SV displays setting temperature value (power output % and load current can be selected by DISP key).

The controller uses a PID algorithm to determine the required output power to hold the present temperature value equal

to setting temperature value.

■ Standby mode:

This type of control operates similar to auto mode. It is a "closed-loop" system and requires a thermocouple feedback signal.

The controller's PV displays present temperature value, and SV displays standby temperature value (70% of setting temperature value; power output % and load current can be selected by DISP key).

The controller uses a PID algorithm to determine the required output power to hold the present temperature value equal to standby temperature value.

Standby mode can be activated or stopped by an external signal (when **Std**'s number in the hundreds place ≠0).

■ Manual mode:

This type of control is an "open-loop" system and requires no thermocouple feedback signal.

It can be used when thermocouple is failed or without thermocouple in system.

The controller's PV displays present temperature value, and SV displays power output percent (load current can be selected).

Note: The output percent initial value, see parameter "A-n" and "nSL".

The controller regulates output power according to the setting. The setting can be adjusted by pressing **Λ**、**V**.

■ AT (PID Auto Tune) function:

This function is for getting the optimal PID value for a system.

It is a "closed-loop" system and requires a thermocouple feedback signal.

Generally, AT function only needs to be executed when PID factory setting cannot meet the system requirements.

After finished auto tuning, the optimal PID value is saved, and the controller returns to normal (auto PID) mode.

When $SuP \leq 900$, the controller executes auto-tune function by making 80% of setting value as target.

When $SuP > 900$, the controller executes auto-tune function by making setting value as target.

7. Soft start (dehumidify) function

To avoid humidity making the heater burn out prematurely, the soft start function heats the system slowly to remove excess moisture from the heater.

During soft start, the output power step's up slowly from 0% to the setting (Manual control) or will make the temperature rise to 100°C (212°F) slowly and hold it (Auto control).

When soft start time is over, the controller will return to auto or manual control mode according to the setting.

Soft start condition:

- The soft start function is on (parameter $Sot=1\sim10$).
- The process temperature is less than 100°C (212°F).

Terminate soft start process:

The soft start process can be terminated by pressing **MODE** key (when $boS=1$).

8. PID self-adjusting function (when $SuP=453$ or 845)

The controller will start to learn the system after power up (the process temperature should be less than 90% of set point).

Once the controller finishes "learning" the system, it returns to a standard PID control with the heat PID values automatically set.

9. Boost (speed up heating) function (when $boS=1$)

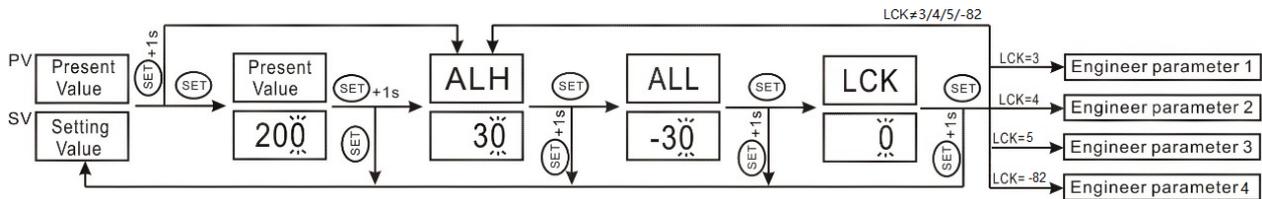
In normal (auto PID) control mode (soft start process is over or terminated), press **MODE** key to activate the boost function.

For the next 15 seconds (or until you press the **MODE** key again, whichever is sooner), 20% is added to the controller output (100% output or parameter Pub limited maximum).

Normal indicator flashes.

10. Parameters

10-1. General parameters



1) **Setting Value:** full scale.

Notes: It can be set by pressing Δ , ∇ , $<$ directly and the modified value will become effective after 5sec., or press **SET** to make it effective at once.

2) **ALH:** high deviation alarm value.

When present value $>$ SV+ALH, the buzzer is beeping, and the output is shut off (when Adr<100).

No alarm when power on or after modifying the setting until new alarm happens.

3) **ALL:** low deviation alarm value.

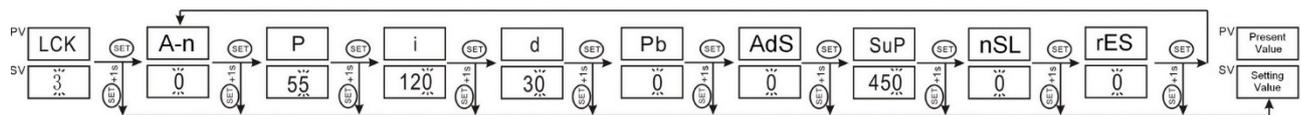
When present value $<$ SV+ALL, the buzzer is beeping.

No alarm when power on or after modifying the setting until new alarm happens.

4) **LCK:** parameter setting lock.

0: Off; 1: On, all parameters cannot be changed; 11: On, all parameters cannot be changed except setting value.

10-2. Engineer parameters 1



1) **A-n:** initial power output percent for manual control, 0~100%, used with parameter nSL.

Note: When A-n is effective, its value is auto-refreshed by latest manual output percent.

2) **P:** control proportional band, 1~999.

3) **i:** integral time, 0~999s.

4) **d:** differential time, 0~999s.

5) **Pb:** PV bias, -120~120. Sensor correction is made by adding Pb to measured value (PV).

6) **AdS:** ambient temperature (internal mainframe) high alarm value, temperature unit is same as parameter C-F setting. When Ads=0, this function is off.

7) **SuP:** SV setting upper limit / AT target setting (see AT function) / PID self-adjusting (see Section 7), full scale.

SuP $<$ 900, the controller executes auto-tune function by making 80% of setting value as target.

SuP $>$ 900, the controller executes auto-tune function by making setting value as target.

SuP = 453 or SuP = 845, PID self-adjusting function is on.

8) **nSL:** Manual/Auto control mode.

0: Auto mode when power on; initial power output is same as auto mode when shift to manual mode.

1: Auto mode when power on; initial power output is same as parameter A-n when shift to manual mode.

2: Manual mode when power on; initial power output is 0%.

3: Manual mode when power on; initial power output is same as parameter A-n.

4: If auto mode when power off, same as nSL=1 when power on;

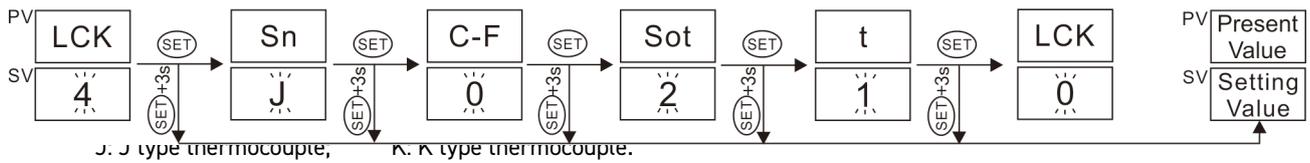
If manual mode when power off, same as nSL=3 when power on.

9) **rES:** initialize controller.

0: Off.

1: All parameters are reset to factory setting after power-on.

10-3. Engineer parameters 2



J: J type thermocouple, K: K type thermocouple.

2) C-F: temperature unit.

0: °C; 1: °F.

3) Sot: soft start (heater dehumidify) function.

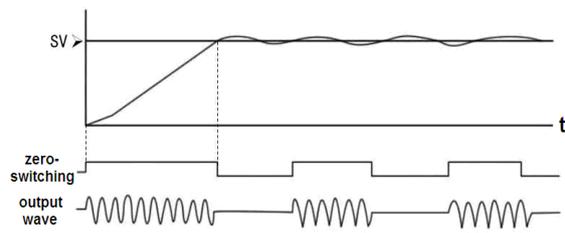
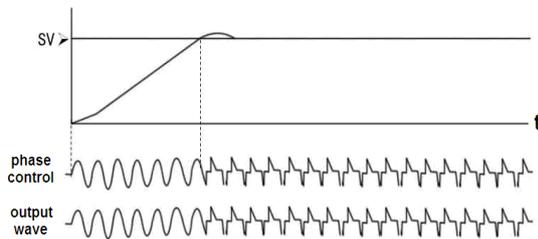
0: Off; 1~10: On, soft start time= Sot×80s

Notes: The rest of soft start time reduced to one-third if the process temperature reached 100°C(212°F).

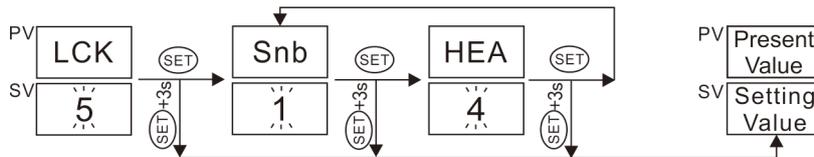
4) t: output control type.

0: phase control output;

1~10: zero-switching control output, proportional cycle = t×1s



10-4. Engineer parameters 3



1) Snb: diagnostic function for misconnection of heater and thermocouple.

0: Off.

1: Checking the heater after power on, if the controller judge it as thermocouple, alarm and cut off output to protect it.

Notes: It may cause a false alarm if the heater power is large. When identified as false alarm, please set Snb=0.

2: Reserved

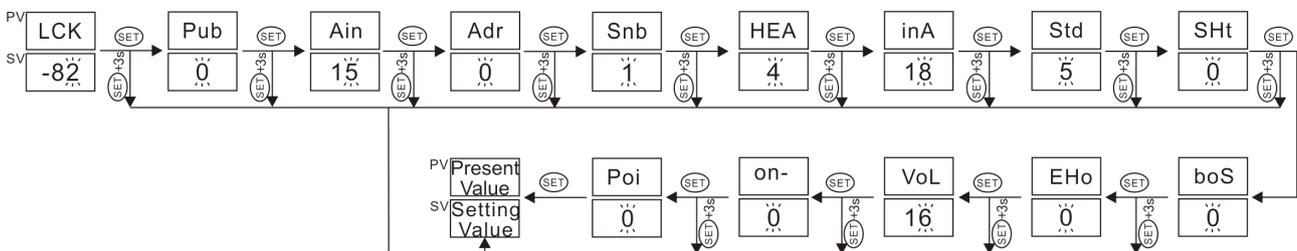
2) HEA: diagnostic function for heater (It is used as HEA=1 in manual mode, no matter the setting is).

0: Off.

1~10: Checking the load current when output is HEA×10%, if the controller judge the heater fault, it will alarm.

Recommended setting is HEA=3~5.

10-5. Engineer parameters 4



1) Pub: high limit of output percent, 0~99%.

0: Off.

2) Ain: rated load current, 1~40A, can be set according to the heater's real power and used to diagnose the heater; when the load current is higher than Ain, the controller will alarm and the current display will flash.

3) Adr: communication ID and zone number displayed / output setting when high deviation alarm (ALM-H).

0~99: ID / Zone number displayed as 0~99; and in case ALM-H active, output relay will not be active (cut off output).

100~199: ID / Zone number displayed as 0~99; and in case ALM-H active, output relay will be active (not cut off output).

4) **Snb**: See 9-4

5) **HEA**: See 9-4

6) **inA**: high limit of load current, 1~40A, can be set according to the heater's real power.

When the load current is higher than inA, the controller will limit it by decrease the power output.

7) **Std**: **delay time to auto-start standby mode** (Std's number in the hundreds place; unit: 10 mins);

When external input (injection) signal ends, the timer starts to count down. If the signal does not start again until the timer counts to 0, the controller will auto-start standby mode until the operator end it by pressing MODE key.

0: Off.

filtering value (Std's number in the tens place & ones place);

Used to reduce the influence of interference.

Notes: The larger the value is, the slower the controller responded. When it is too large, the controller may be out of control.

8) **SHT**: diagnostic sensitivity for load shorted, 0~100. The greater the value is, the lower the sensitivity.

Recommended setting is SHT=0.

9) **boS**: soft-start process termination & Boost function.

0: Disable; 1: Enable.

10) **EHo**: diagnostic function for heat invalid.

0: Off;

1~999: When output percent is 100%, if the temperature does not rise in EHo seconds, the controller will judge heating invalid, show alarm code "HER" and adjust output percent to 0%.

11) **VoL**: over-voltage alarm setting, 6~30.

When the power supply voltage is over about $(VoL \times 4.5 + 210)$ V, the controller will alarm and cut off output..

Recommended setting is VoL=16 (over-voltage is about 270Vac).

12) **on-**: status after power-on

0: Off, press ON/OFF key to turn on.

1: Same as the status before power off.

2: Off, press ON/OFF key to turn on; controller auto-changes to manual mode when thermocouple is wrong.

3: Same as the status before power off; controller auto-changes to manual mode when thermocouple is wrong.

Note: The manual output percent initial value is 0 (when nSL=0) or equal to parameter "A-n" (when nSL=1).

13) **Poi**: present temperature display resolution.

0: 1°C/°F 1: 0.1°C/°F

11. Default of parameters

Parameter	Default	Parameter	Default	Parameter	Default	Parameter	Default
SV	200	Pb	0	t	1	SHT	0
ALH	30	AdS	0	Pub	0	boS	0
ALL	-30	SuP	450	Ain	15	EHo	0
LCK	0	nSL	0	Adr	1	VoL	16
A-n	0	RES	0	Snb	1	on-	0
P	29	Sn	J	HEA	4	Poi	0
i	160	C-F	0	inA	18		
d	20	Sot	2	Std	5		

12. Alarm messages

Alarm Code	PV	SV	Current Value	Related Paramete	Cut off output	Troubles	Solution
FUSE	Temperature	Setting	Normal	-----	Yes	Fuse Blowout	Check the load and replace the fuse.
SENSOR	Temperature	Setting	Normal	Snb	Yes	Misconnection of thermocouple & heater.	Check the wiring. Set Snb=0 if the connection is right.
	ErH	Setting	Normal	-----	Yes	Thermocouple open	Check the sensor, or switch to manual control mode.
	ErL	Setting	Normal	-----	Yes	Thermocouple inverse	
HEATER	Temperature	Setting	Normal	HEA	No	Heater fault	Check the heater.
SCR	Temperature	Setting	Normal	-----	Yes	Triac error	Replace the triac.
ALM-H	Temperature	Setting	Normal	ALH	Yes	High deviation alarm	Check the controller & the sensor.
ALM-L	Temperature	Setting	Normal	ALL	No	Low deviation alarm	Check the system thermal insulation, or switch to manual control mode.
CURRENT	Temperature	Setting	flash	Ain	No	Over load	Check the load.
	Temperature	SHt		SHt	Yes	Short load	Check the load.
-----	Temperature	Hot	Normal	AdS	No	Ambient temp. is too high	Check the fans of mainframe.
-----	Temperature	HHH	Normal	VoL	Yes	Over voltage	Check the power supply.
-----	Temperature	HER	Normal	EHo	Yes	Thermocouple is out of its position	Check the thermocouple.