

STM-D

Oil Heater

Date: Jun. 2024

Version: Ver.1



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1. General Description



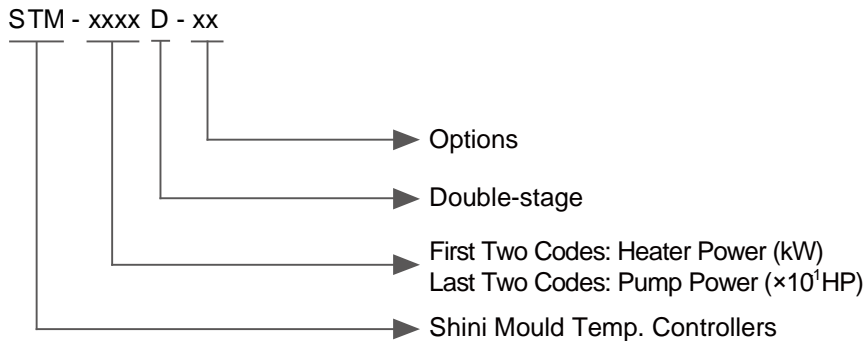
Read this manual carefully before operation to prevent damage of the machine or personal injuries.

The STM-D series oil heaters are used to heat up the mould and maintain this temperature, although they can be used in other similar applications. High temperature oil from the mould is sent to the moulds after pressurized by the pump and heated up by the pipe heater through indirect cooling of the cooler, so as to heat up and maintain constant temperature. It adopts new temperature controller that can ensure stable temperature control.



Picture 1-1: Oil Heater STM-D

1.1 Coding Principle



1.2 Feature

- I Adopt SSR solid-state relay with heating output, the max. heating temperature can reach 200°C , with the precision of $\pm 0.5^{\circ}\text{C}$.
- I Adopt a vertical structure with a small footprint.
- I The controller adopts 4.3" touch panel with dual-stage independent displayer for easy operation;
- I Adopt high-efficient high temp. pump, which can meet the demands of temperature control for precise moulds and mould loop with minor diameter to achieve precise temperature control and high efficient heat exchange.
- I In-build multiple safety plus warning devices, such as reverse phase, pump overload, overheat, and high and low-pressure protection.
- I Stainless steel pipe heater.
- I RS485 communication interface achieves centralized monitoring with the host.
- I With reverse oil return function, and oil tank overflow port.

1.3 Options

- I Water flow regulator, Teflon pipe and heat-transfer oil .
- I Display mould return oil and mould temperature.

All service work should be carried out by a person with technical training or corresponding professional experience. The manual contains instructions for both handling and servicing. Chapter 6, which contains service instructions intended for service engineers. Other chapters contain instructions for the daily operator.

Any modifications of the machine must be approved by SHINI in order to avoid personal injury and damage to machine. We shall not be liable for any damage caused by unauthorized change of the machine.

Our company provides excellent after-sales service. Should you have any problem during using the machine, please contact the company or the local vendor.

Shini Hotline Service:

Headquarter and Taipei factory:

Tel: + 886 (0)2 2680 9119

Shini Plastics Technologies (Dongguan), Inc.:

Tel: +86 (0)769 8331 3588

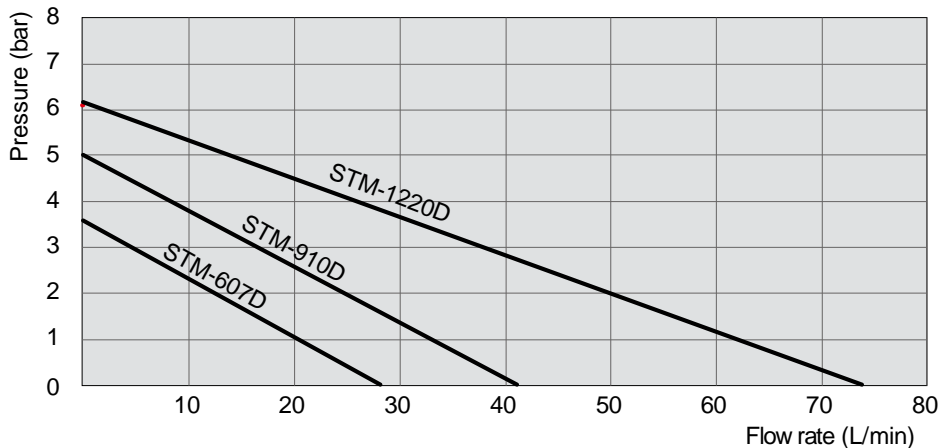
Shini Plastics Technologies (Pinghu), Inc.:

Tel: +86 (0)573 8522 5288

Shinden Precision Machinery (Chongqing), Inc.:

+86 (0)23 6431 0898

1.4 Pump Performance



Picture 1-2: Pump Performance

1.5 Reference Formula of Mould Controllers Model Selection

Heater Power (kW) = mould weight (kg) × mould specific heat (kcal/kg°C) × temperature difference between mould and environment (°C) × safety coefficient / heating duration / 860

Note: safety coefficient can select a value from 1.3 to 1.5.

Flow Rate (L/min) = heater power (kw) × 860 / [heating medium specific (kcal/kg°C) × heating medium density (kg/L) × in/outlet temperature difference (°C) × time (60)]

Note: Water specific heat = 1kcal/kg°C

Heating medium oil specific heat = 0.49kcal/kg°C

Water density = 1kg/L

Heating medium oil density = 0.842kg/L

1.6 Safety Regulations

Strictly abide by the following safety regulations to prevent damage of the machine or personal injuries.

1.6.1 Safety Signs and Labels



Danger!

The unit is designed to endure high temp, and high pressure. For safe operation, do not remove the covers or switches.



Attention!

The unit should be operated by qualified personnel only.

During operation, avoid wearing gloves or clothes that may cause danger.

Turn off main switch when power supply is off.

Stop the unit when there may be power supply problems caused by static electricity.

Put on safety gloves and shoes during installation or relocation.

Components from our company can only be used for replacement.



Warning!

Do not touch the switch with wet object or hands.

Do not use the machine before fully aware of its performance.

Be careful not to touch or hit the switch or sensor.

Please keep enough operation space, and keep away obstacles.

To avoid producing statics, clean the floor from oil or water to keep a dry environment.

Protect the machine against severe vibration or collision.

Do not remove safety signs or make it dirty.

Drunken, medicine-taking, or men without proper judgement should not operate the machine.



Warning!

High temperature, take care of hands! This label is attached on the surface of heating parts.

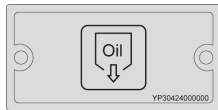
1.6.2 Signs and Labels

Maintenance Schedule		
Item	CT	
Check whether the pipeline joints are under looseness.	Weekly	
Clean the Y-type filter.	Weekly	
Clean the solenoid valve.	Monthly	
Check the sensitivity of EGO.	Weekly	
Check the level switch.	Three months	
Check the contactor.	Three months	
Clean the process heater/cooler.	Three months	
Check the indicator and buzzer.	Six months	
Control board	Every 3 year exchange	
No fuse breaker.	Every 3 year exchange	
Thermal oils	≤ 120 °C	Renew annually
	120 °C~160 °C	Renew every six months
	> 160 °C	Renew every three months

Note: Please refer to the Manual for detailed operations.

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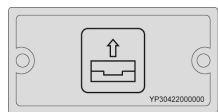
Please according to schedule to make regular maintenance.



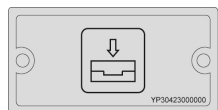
Oil outlet valve: oil discharge outlet for renewing oil.



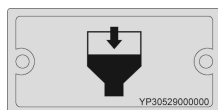
High liquid level: the highest oil level to which machine can reach under room temperature.



From mould: connector for circulating water/oil coming from mould.



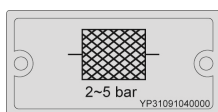
To mold: connector for circulating water/ oil to go to mould.



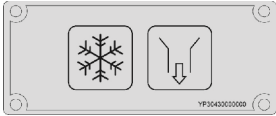
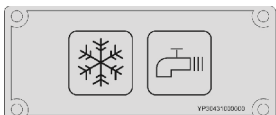
Oil inlet: oil filler for machine.



Overflow



1. To maintain temperature consistency, cooling water pressure must be higher than 2 bar at all time, but should never exceed 5 bar in any case.
2. Clean Y-shape Cooling Water Strainer periodically to ensure perfect cooling capacity.

	<p>Water outlet: drainage outlet.</p>
	<p>Water inlet: inlet for cooling water.</p>

1.6.3 Operation Regulations

- 1) Before operation, make sure that cooling water is clean soft water without pollutants.
 - ※ Low quality water brings limescales, which may cause problems.
- 2) If problems of drainage or bad temperature control are noted, please clean solenoid valve and cooling water inlet and outlet.
- 3) Do not move the unit when it is in operation.
- 4) When in need of repairing, wait until oil temperature falls below 30°C.
- 5) Motor overload may be caused by phase shortage, pipe obstruction, broken bearing, etc. Motor overload relay will trip off to stop the machine when this happens. Fixing the problems, press RESET on overload relay to clear the alarm.
- 6) Before turn off the pump, wait until oil temperature falls blow 50°C. Or the life of the unit would be affected.

1.7 Exemption Clause

The following statements clarify the responsibilities and regulations born by any buyer or user who purchases products and accessories from Shini (including employees and agents).

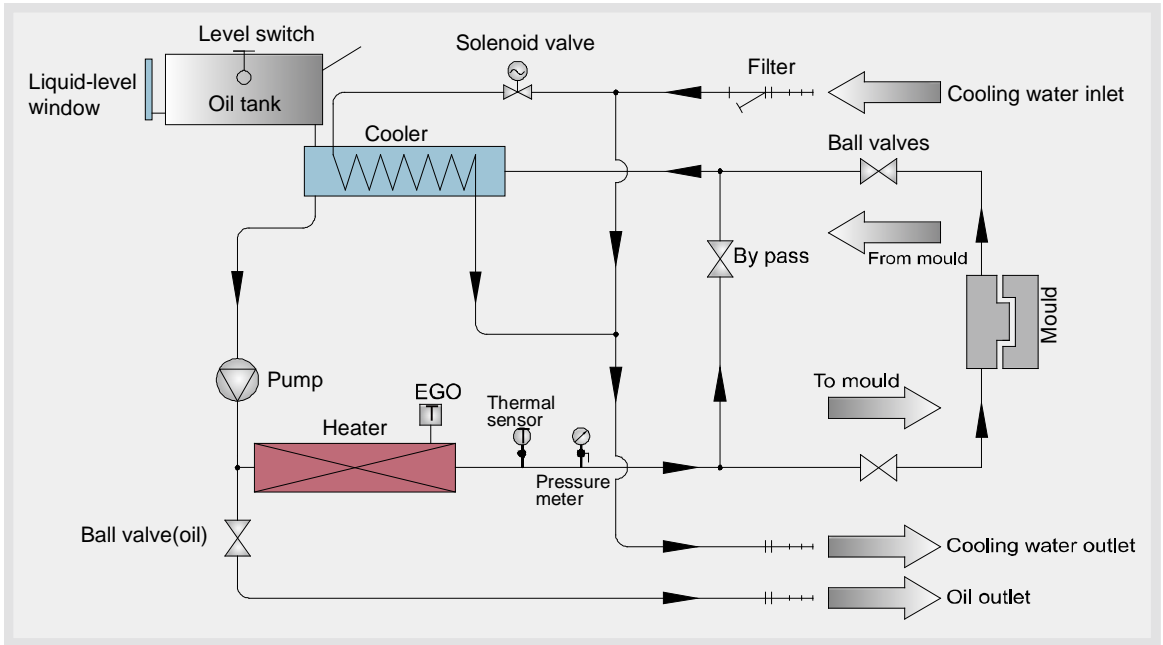
Shini is exempted from liability for any costs, fees, claims and losses caused by reasons below:

- 1) Any careless or man-made installations, operation and maintenances upon machines without referring to the Manual prior to machine using.
- 2) Any incidents beyond human reasonable controls, which include man-made vicious or deliberate damages or abnormal power, and machine faults caused by irresistible natural disasters including fire, flood, storm and earthquake.

- 3) Any operational actions that are not authorized by Shini upon machine, including adding or replacing accessories, dismantling, delivering or repairing.
- 4) Employing consumables or oil media that are not appointed by Shini.

2. Structure Characteristics and Working Principle

2.1 Working Principle



Picture 2-1: Working Principle

The high temperature oil returns to the heater through the pipeline, and then goes into the mould and continues the circle. In the process, if the oil temperature is too high, system will activate the solenoid valve to let cooling water cool down high temperature oil indirectly until the temperature is down to the system requirement, thus achieving the constant temperature control. If the temperature keeps increasing and reaches to the set point of EGO, the system will sound alarm and stop operation. The system will give low level signal and sound the alarm if the oil level falls down below the set point.

3. Installation and Debugging

3.1 Installation Space

During installation of the machine, keep at least 500mm installation space around the machine as shown by the picture. Do not install the machine in a position crowded with other objects. This would cause inconvenience to operation, maintenance and repair.

Do not sit on the machine.

Keep away flammable and explosive goods.



Picture 3-1: Installation Space

3.2 Mould and Water Coupling

- 1) Heating tank and return oil inlet and outlet dimension

STM-607D/910D: 3/4" PT female thread

STM-1220D: 1" PT female thread

- 2) Cooling water connection

Connect the cooling water inlet to clean water, connect the system water inlet to the clean water, connect the cooling water outlet to the drain, and turn on the water source. The cooling water flow shall not be less than 10L / min.

Refer to **Water Quality for Industrial Boilers** GB1576-2001



Picture 3-2: Mould and Water Coupling 2

Table 3-1: Cooling Water Inlet and Outlet Spe.

Model	Cooling Water Inlet	Cooling Water Outlet	Connector Type
STM-607D/910D	Φ13mm(ext. dia.)	Φ13mm(ext. dia.)	Pagoda type
STM-1220D	Φ16mm(ext. dia.)	Φ13mm(ext. dia.)	Pagoda type

Notice:

The cooling water inlet and outlet are shown in the figure, and don't connect them reversely! When the working temp. is above 100 °C, the cooling water must be connected with high temp. resistant pipes.

3.3 Power Connection

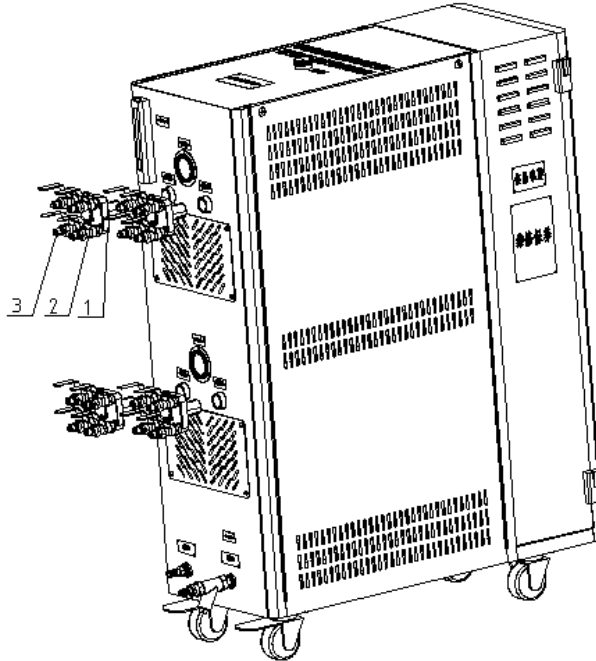
Make good electrical grounding of the oil heater to ensure the safe operation of the equipment.

- 1) Make sure the voltage and frequency of the power source comply with those indicated on the manufacturer nameplate that attached to the machine.
- 2) Power cable and earth connection should conform to your local regulations.
- 3) Use independent electrical wires and power switch. Diameter of electrical wire should not be less than those used in the control box.
- 4) The power cable connection terminals should be tightened securely.
- 5) The machine requires 3-phase 4-wire power source, connect the power lead (L1, L2, L3) to the live wires, and the earth (PE) to the ground.
- 6) Power supply requirements:
 Main power voltage: +/- 5%
 Main power frequency: +/- 2%

7) Please refer to electrical drawing of each model to get the detailed power supply specifications

3.4 Options Installation

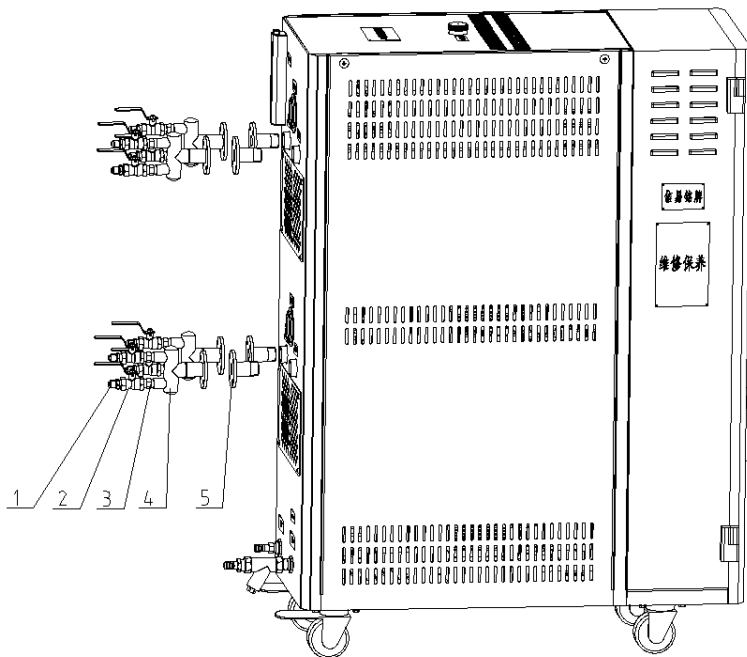
3.4.1 Installation Steps for Options Water Manifold (Dewaxing)



- 1) Install copper joint to the level valve.
- 2) Install level valve with copper joint to the dewaxing water manifold.
- 3) Install water manifold to the machine.
- 4) Install Teflon to copper joint.

Note: For the operating temperature not higher than 200°C, Teflon with temperature resistance 200°C is usable; for the operating temperature from 200 to 300°C, must use Teflon with temperature resistance 300°C.

3.4.2 Installation Steps for Options Water Manifold (Welding)



- 1) Install copper joint to the level valve.
- 2) Install level valve with copper joint to the welding water manifold.
- 3) Install water manifold to the machine.
- 4) Connect water manifold with manifold joint via screws.
- 5) Install Teflon to copper joint.

Note: For the operating temperature not higher than 200°C, Teflon with temperature resistance 200°C is usable; for the operating temperature from 200 to 300°C, must use Teflon with temperature resistance 300°C.

4. Operation Guide

4.1 Control Panel

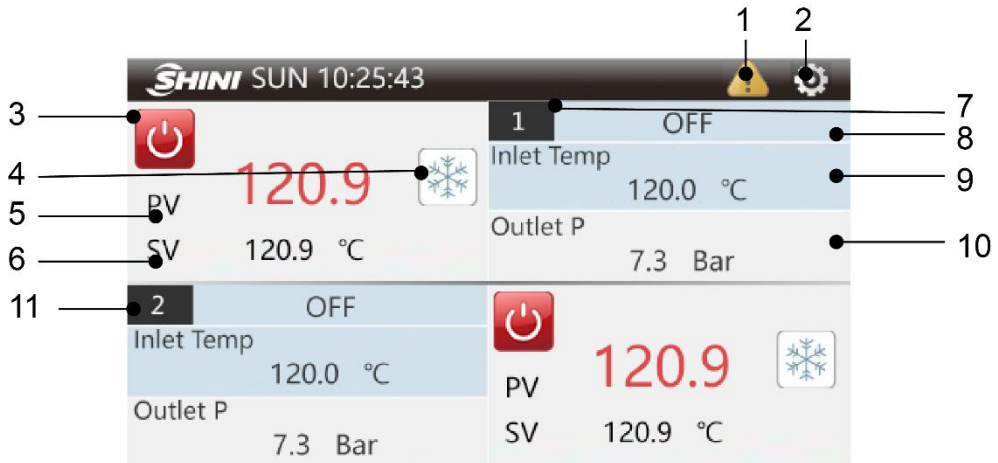
After the system is powered on, the panel displays the startup screen, as below:



Picture 4-1: Startup Screen

4.2 Main Screen

4.2.1 Standby Screen



Picture 4-2: Standby Screen(1)



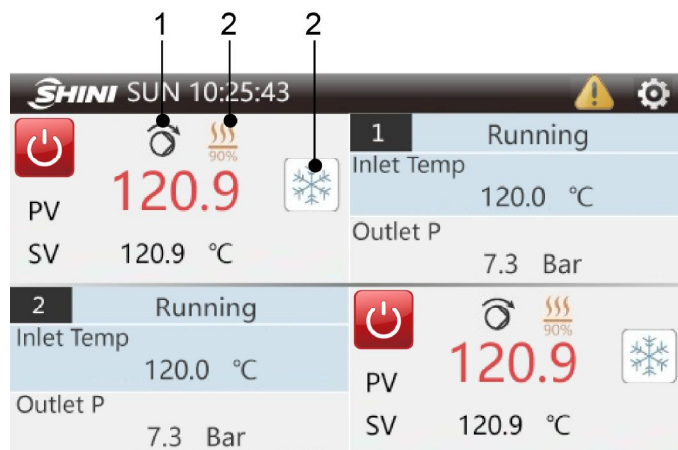
Picture 4-3: Standby Screen(2)

Table 4-1: Standby Screen Icon & Press Key Description

No.	Icon	Name	Function Type	Description
1		Fault inquiry	press key	<ol style="list-style-type: none"> When the system failure occurs, it will flash on the main interface. Click to enter and query current fault information; When there's no fault in the system, press to enter the "Historical Faults" query.
2		Setting	press key	Enter the user setting screen
3		Switch	press key	standby status, running status
4		Forced cooling	button	Press to activate the forced cooling function Press to close the forced cooling function
5	PV	Actual temp. value	display only	Used to display the actual value of the controlled temp.
6	SV	Set temp. value	press key	Click this button to set the heating temp..
7	1	Machine No.1	display only	It displays machine No.1.

8		Standby	display only	Display machine running status.
9		Return medium temp.	display only	Display the medium temp. returned from the mould, which is optional function. When this function is not optional, it displays gray.
10		Outlet medium pressure	display only	Display the medium real-time pressure, and the machine can exhaust the air and release the pressure based on actual pressure.
11		Machine No.2	display only	It displays machine No.2.I
12		Mold Temp	Only display	Display the mould real-time temperature, and it's an optional function. When not selecting this function, it will display grey.
13		Out Flux	Only display	Display the medium real-time flow, and it's an optional function. When not selecting this function, it will display grey.
14		Upper Page	Press button	Click on Return to the standby main screen 1


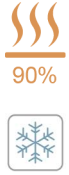


4.2.2 Operation Screen



SHINI THU 12:00:00  					
1		Running			
In Temp	120.0	°C	Outlet P	12.0	bar
Mold Temp	120.0	°C	Out Flux	30.0	L/min
2		Running			
In Temp	120.0	°C	Outlet P	12.0	bar
Mold Temp	120.0	°C	Out Flux	30.0	L/min

Picture 4-4: Operation Screen

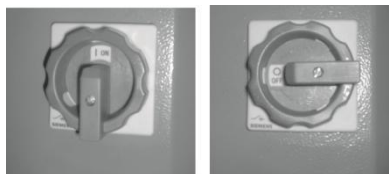
Table 4-2: Operation Screen Icon & Press Key Description

No.	Icon	Name	Description
1		Pump rotating /reverse rotating	This icon indicates the unit starts pump rotating/reverse rotating.
2		Heating/cooling	  This icon indicates the unit starts the temp. heating control. The bottom is heating percentage.

4.3 Startup and Shutdown

4.3.1 Start-up Steps

- 1) Connect the pipeline from the water heater’s water outlet and inlet to the mould pipeline properly (Please refer to Chapter 3 for details).
- 2) Connect the cooling water inlet/refilling port (Please refer to Chapter 3 for details).
- 3) Open the globe ball valve of all connected pipelines.
- 4) Turn “ON” the main power switch



ON

OFF

Picture 4-5: Main power switch



Picture 4-6: Running Screen

- Click the value corresponding to the SV to set the required temp. The upper limit temp. is the max. value can be set by the system (The values of various models are as follows)

Table 4-3: Upper Limit Temp. and Maximum Temp. of Each Model

Model	Upper Limit Temp.	Lower Limit Temp.
STM/STM-D	200°C	Default value: 0°C
STM-HT	300°C	
STM-W/STM-WF/STM-WE/STM-W-D	120°C	
STM-PW	180°C	
STM-W/O	Water 90°C , Oil 160°C	

Note: It requires external cooling water to cool the unit, and the cooling temperature will be greater than the cooling water temperature.

Temp. Unit ——°C/°F (Celsius / Fahrenheit)

Decimal point—— min. temp. unit: 1°C/°F or 0.1°C/°F, default: 1

- Set the temp., and then click <ON/OFF key>. After the auto water refilling time T1, the pump will run time T2 automatically to eliminate the air inside the system, and the pipe heater will start after the refilling time T2.
Water refilling time T2: water refilling interval; After the pump is started, the water refilling valve is still open, and the heater will start to work after the time is over.

Table 4-4: Water Refilling Time of Each Water Heater Model

Model	STM-607W/W-D/PW /PW-D/HPW/WF STM-910W/W-D//WF	STM-1220W/W-D/PW/WF/ STM-2440W/STM-2430WF	STM-3650W /STM-3650WF /STM-4875WF	STM/STM-D STM-HT
t1	60S	120S	180S	1S
t2	10S	15S	20S	0S

4.3.2 Shutdown

- 1) In the standby screen, press the < Forced Cooling > button to turn off the heating output, and the cooling is 100% on.
- 2) When the temp. drops below 50 °C, press the < Forced Cooling > button to turn off the forced cooling, and then press the < Switch > key to stop the operation.
- 3) Turn the main power switch to the OFF position.



Attention!

When the main power switch is at ON position, be careful of the electric shock danger!



Attention!

The pump running direction must be correct!

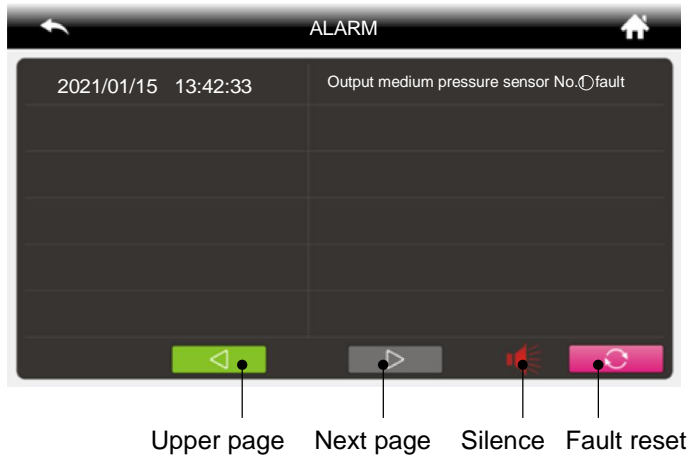


Attention!

In order to reduce the machine damage and prolong the service life, please start and shut down according to the correct steps.





4.4 Current Fault Inquiry

When the unit fails, in the “Operation” screen, the < Fault Inquiry > button will flicker. At this time, click the < Fault Inquiry > button to silence and enter following screen:



Picture 4-7: Current Fault Inquiry Screen

Table 4-5: Current Fault Inquiry Screen Icon Key Description

Press Key	Key Name	Description
	Fault reset	After trouble-shooting, press this key to reset the fault.
	Silence	Eliminate the system alarm sound
	Page up	Turn the page to query the fault information, gray key can't be pressed, and green key can be pressed.
	Page down	Turn the page to query the fault information, gray key can't be pressed, and green key can be pressed.

When there is no fault currently, click the < Fault Inquiry > button in the "Operation" screen to enter the history fault inquiry.



Picture 4-8: History Fault Inquiry Screen

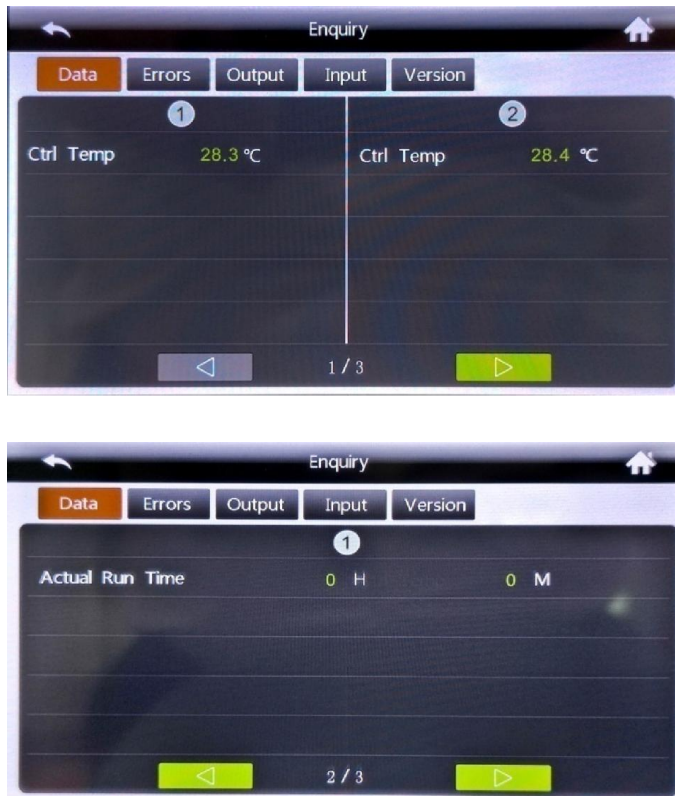
4.5 Inquiry Screen

In the "Operation" screen, click the < Setting > button to enter the "User Setting" screen, and click the < Inquiry > button to enter the inquiry screen.



Picture 4-9: User Setting Screen

4.5.1 Data Inquiry



Picture 4-10: Data Inquiry Screen

It starts to count the unit running time after the assembly is finished, so the new machine will need some time for running.

Check the current temperature or pressure of all probes in the system, and the system running time.

4.5.2 History Fault Inquiry





Picture 4-11: History Fault Inquiry Screen

4.5.3 Output Inquiry

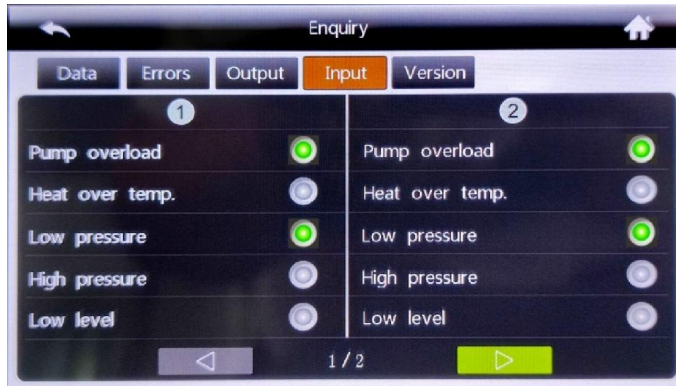


Picture 4-12: Output Inquiry Screen


When the indicator  is gray, it means that the corresponding relay has no output.


When the indicator  is green, it means that the corresponding relay is outputting.

4.5.4 Input Inquiry

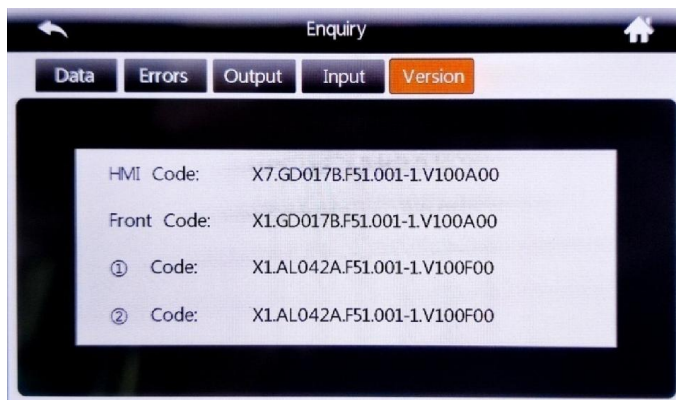


Picture 4-13: Input Inquiry Screen

When the indicator  is gray, it means that the corresponding switching value input is invalid

When the indicator  is green, it means that the corresponding switching value input is valid.

4.5.5 Controller Version Inquiry



Picture 4-14: Version Inquiry Screen

Take actual display as standard.

4.6 Password Management

4.6.1 Login

Two groups of user names and passwords, as shown in the Table below:

Table 4-6: User and Password Function

User Name	Password (can be modified)	Function
User	none	Enter 【User Setting】 screen
Project	3588	Enter 【Project Setting】 【User Setting】 screen
Manufacturer	6361	Enter the 【Manufacturer Set】 interface

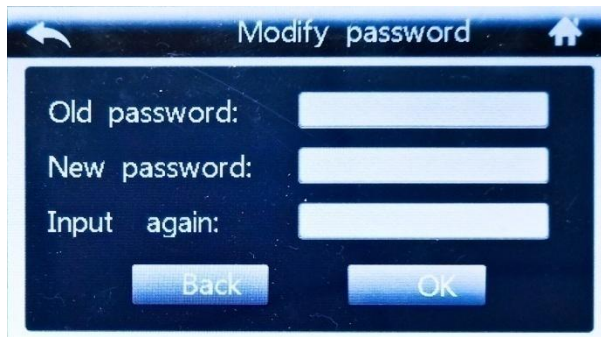
4.6.2 Password Modification

In the "User Setting" screen, click < System Setting >, and then click < Modify User Password >, it can modify the user password;

In the "Project" screen, click < Password Mgmt. >, and then click < Modify Project Password >, it can modify the project's password;

The modifying steps of the two groups of passwords are the same. Take "User" password modification as an example, as follows:

Enter "User Setting" screen, click <System Setting>, and then click < Modify User Password > to enter the screen below:



Picture 4-15: Modifying User Password Screen

- 1) Enter the old password.
If the password is wrong, the password input box displays "Password Error". Press the input box to clear and re-enter the old password.
- 2) Input the new password;
- 3) Input the new password again;
- 4) Confirm

If the passwords of twice inputs are different, it will pop up the prompt box of "different passwords", it indicates the password

modification is not success. If the modified password is successful, it will pop up the prompt box of "Password Modified Successfully! Please be noted to save the new password! "

4.7 Setting Screen



Picture 4-16: User Setting Screen

4.7.1 User Parameter Setting

Click the < User Parameter > button in the "Setting Screen" to enter the setting.



Picture 4-17: User Parameter Setting Screen

Table 4-7: User Parameter Description

Parameters	Initial Value	Setting Range	Unit	Remarks
Locking temp.	disable	disable ~ enable		When selecting the "Enable", it is not allowed to set temp. on the main interface.
Setting temp.	80.0	0-200.0	°C	

Start/stop Mode	local	local ~ local + remote ~ remote		Local: Unit startup and shutdown can only be controlled locally. Local + Remote: unit startup and shutdown can both be controlled locally and remotely. Remote: Unit startup and shutdown can only be controlled remotely.
Auto Tuning	disable	disable ~ enable		
Temp. Unit	°C	°C/°F		Temp. display unit.
Decimal Point	0.1	1/0.1		Main interface has min. temp. unit

4.7.2 Action Setting

Click the < Action Setting > button in the "Setting Screen" to enter this screen.



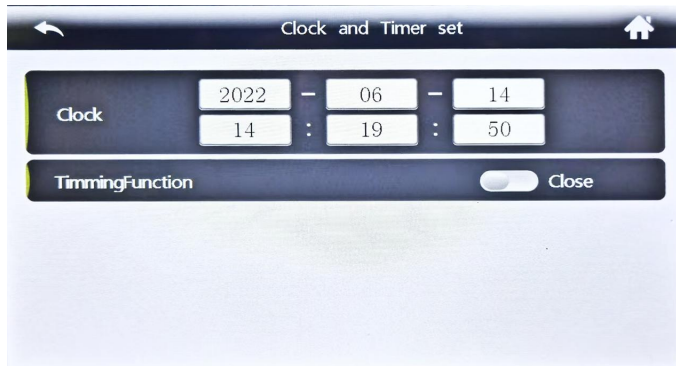
Picture 4-18: Action Setting Screen

Reverse emptying: After machine shutdown, start the pump reverse running and the emptying valve. It can start and stop manually, or run the [reversal time] and stop automatically. The default time is 60s and the start temp. is 60 °C (140 °F).

Note: If the reverse emptying function is activated during machine operation, it will stop first, and then execute the reverse emptying action.

4.7.3 Timer Setting

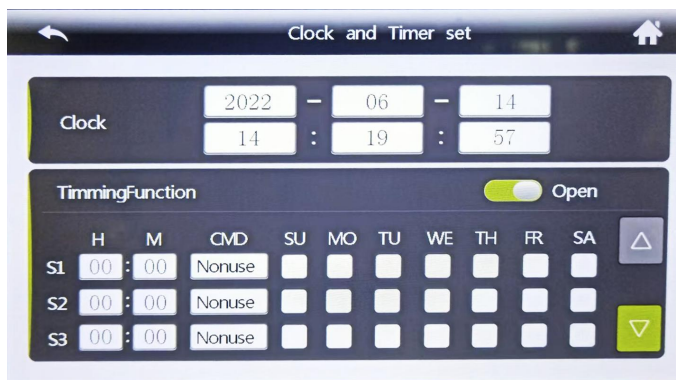
Click the < Timer Setting > button in the "Setting Screen" to enter this screen



Picture 4-19: Timer Setting Screen

Set the system time in the “clock” area.

After the timer main switch is turned on, it can set the timing on/off process, as shown in picture below:



Picture 4-20: Timing On/Off Setting

Timer main switch: It is used to select the timing on/off function. After it is turned on, the user can check the main screen. There are six groups of time can be set in all, and the time of each group can be selected by the switch: unuse, timing on or timing off.

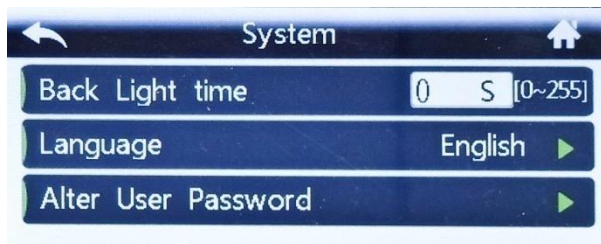
If the "timer main switch" is turned "ON", press the < Clock > button on the main screen to check the timing and modify the screen.



Picture 4-21: Timer Inquiry and Modification Screen

4.7.4 System Setting

In the "User Setting" screen, click the < System Setting > button to enter the picture below:



Picture 4-22: System Setting Screen

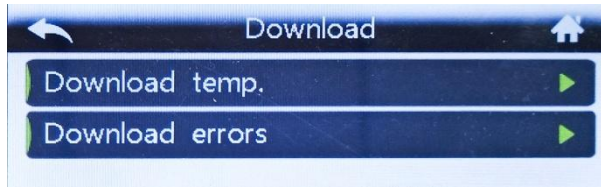
Table 4-8: System Setting Table

Set the backlight time	Setting range is 0 ~ 255 secs.
Language	Chinese or English
The default user password	3588

4.7.5 Data Download

When downloading data, please use the U disk format: FAT32, and the recommended U disk capacity is 16g or below.

In the user setting screen, click the < Data Download > button to enter the following screen:



Picture 4-23: Data Download Screen

1) Temp. Data Download



Picture 4-24: Temp. Data Download Screen

Local data backup: copy the temp. data on the display board to the U disk (the data of display board can be saved for up to 48 hrs.). Copy the temperature data stored on the display board to the USB flash disk. Insert the U disk, wait until the "U disk" displays "connected" status, and then follow the prompts. Other operations are prohibited during the download process.

Real-time data recording: After inserting the U disk and starting the real-time data recording function, the temp. data will be updated in real time and stored in the U disk automatically, and the recording will be interrupted after unplugging the U disk. Operations on other screens are available during recording.

 **Attention!**

After data export, a folder/SF51XXX will be created in the U disk root directory, and the data will be saved in Excel.

Important: Other operations are prohibited during downloading.

2) Alarm Record Download

The same as "Temp. Data Download" method.



Picture 4-25: Alarm Record Download Screen

4.7.6 Project Setting

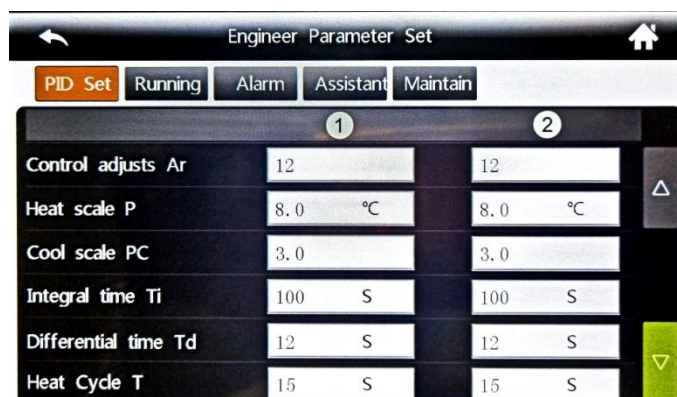
In the "User Settings" screen, click the < Advanced Setting > button and enter the password to enter the "Project" screen.



Picture 4-26: Project Screen

1. Project Parameter Setting

Set project parameters, and the specification of each parameter refers to "Project Parameter Table".



Picture 4-27: Project Parameter Setting Screen

Table 4-9: Project Parameter Description

Parameter Name		Initial Value	Setting Range	Unit	Remarks
PID	Control response adjustment Ar	15.0	1~30		Adjust PID control response
	Heating proportional band P	8.0	0.1~200.0℃	℃	
		46.4	32.2~392.0		
	Cooling proportional band PC	3.0	0.1~20.0		The times of heating proportional band
	Integral time Ti	100.0	1~3600	secs.	
	Differential time Td	12.0	0~3600	secs.	
	Heating cycle T	20.0	1~300	secs.	Outputting cycle of the pipe heater
	Cooling cycle TC	20.0	1~300	secs.	Outputting cycle of the cooling valve
	overlap zone db	0.0	-30.0~30.0	℃	For high temp. water heater, it usually sets the db to a positive number (e.g.: 0.5℃)
PID		0.0	-54.0~54.1	℉	
Running	Startup water refilling time	1~0	0~600	secs.	Water heater: forced water refilling time after startup;
	water refilling delay time	0	0~600	secs.	Water heater: After the water is refilled, delay the time and stop;
	shutdown temp.	35.0	0~60.0	℃	Forced cooling shutdown temp.: stop the machine when it cools down to this temp. Note: If pressing the off button, it can directly shut down without cooling.
		95.0	32.0~140.0	℉	
	Emptying time	60 secs.	0~600 secs.	secs.	Reverse emptying: After machine shutdown, start the pump reverse running and the emptying valve. It can start and stop manually, or run the [reversal time] and stop automatically. Note: Reverse emptying can only be started when the machine is
	Emptying temp.	60.0	0~120.0	℃	
140.0		32.0~248.0	℉		

					shut down and the PV temp. is less than the [Emptying Temp.]. High temp. water heater: without pump reverse running.
	Auxiliary heating output temp. difference	5.0	0-60.0	°C	<p>1. 【Auxiliary heating output temp. difference】 =0: Only use the main heating output.</p> <p>2. 【Auxiliary heating output temp. difference】! =0:</p> <p>1) When the control temp. is less than (set temp.- 【Auxiliary heating output temp. difference】) temp. difference, start the heating and auxiliary heating output simultaneously to make the temperature climb rapidly in a short time.</p> <p>2) Control temp. is greater than or equal to the (set temp. - 【Auxiliary heating output temp. difference】) temp. difference, stop the auxiliary heating.</p>
		9.0	0-108.0	°F	
Running	Cooling valve 2 startup temp. difference	5.0	0-60.0	°C	Flow water heater:
		9.0	0-108.0	°F	At the normal cooling or forced cooling stage: When the PV-SV is greater than the [cooling valve 2 startup temp. difference], open the cooling valve 2 to cool down. Otherwise, don't open it.
	Risen temp. value	5.0	0-60.0	°C	High-temp. water heater:
		9.0	0-108.0	°F	When the parameter – risen temp. value is set to 5 °C , and the exhaust solenoid valve's opening time is set to 0.5 sec. After the water is refilled, when the temp. rises by every 5 °C , it needs to open the solenoid valve for 0.5 secs. till the temp. stabilizes at the set value.
Exhaust valve opening time	0.5	0.0-99.0	secs.	High-temp. water heater: When the parameter – risen temp.	

					value is set to 5 °C , and the exhaust solenoid valve's opening time is set to 0.5 sec. After the water is refilled, when the temp. rises by every 5 °C , it needs to open the solenoid valve for 0.5 secs. till the temp. stabilizes at the set value.
	Plunger pump start temp.	100.0	0.0-180.0	°C	High temp. water heater: Use plunger pump to refill the water and start temp. Only when it reaches this temp. can the plunger pump be used.
		212.0	32.0-356.0	°F	
	Plunger pump start time	10.0	0-180	secs.	High temp. water heater: the plunger pump needs to be started at intervals
	Plunger pump stop time	10.0	0-180	secs.	
	Probe type	K type	K-type thermocouple /PT100	/	/
	The number of probes	control circuit	Control loop ~ control+ return medium ~control +mould ~control +return medium +mould	/	/
Running	The cycle of temp. rise and pressure release	0	0-250	secs.	
	The cycle of heat-preservation and pressure release	0	0-100	Min.aa a	
Fault	3-phase power detection	Use	disable / use		Whether it uses the on-board 3-phase power detection;
	Return medium deviation alarm	0.0	0-50.0	°C	(1) Return medium temp. – medium output temp. > 【return medium temp. deviation】 , delay
0.0		0-90.0	°F		

					<p>【temp. deviation alarm delay】secs., it alarms “Large return medium temp. difference”, make auto reset. 0: disable</p> <p>(2) After modifying [SV] or forced cooling, this fault will not be solved in previous temp. rises / drops.</p>
	Different mould temp. alarm	0.0	0-50.0	°C	<p>(1) Return medium temp. – medium output temp. > 【return medium temp. deviation】 , delay 【temp. deviation alarm delay】 secs., it alarms “Large return medium temp. difference”, make auto reset. 0: disable</p> <p>(2) After modifying [SV] or forced cooling, this fault will not be solved in previous temp. rises / drops.</p>
		0.0	0-90.0	°F	
	Different temp. alarm delay	5	0-360	secs.	Temp. difference alarm delay time
	Low temp. deviation alarm	0.0	0-50.0	°C	<p>【SV】 – PV > 【Low temp. deviation alarm】 delay two secs., it alarms low temp., 【SV】 – PV < 【low temp. deviation alarm】 , it will reset the fault automatically.</p> <p>When【Low temp. deviation alarm】=0, this function is disabled.</p>
		0.0	0-90.0	°F	
	High temp. deviation alarm	0.0	0-50.0	°C	
Fault	High temp. deviation alarm	0.0	0-90.0	°F	<p>PV – 【SV】>【High temp. deviation alarm】 delay two secs., it alarms high temp., , PV – 【SV】 < 【High temp. deviation alarm】 , it will reset the fault automatically.</p> <p>When 【 High temp. deviation alarm】=0, this function is disabled.</p>
	Low flow alarm	0.0	0-100	L/min	<p>Use flow sensor, the medium flow is lower than the [Low flow alarm], it delays two secs., and alarms “Low flow”;</p> <p>0: disable</p>
	High pressure	0.0	0-50	bar	Use pressure sensor, the medium pressure is high than the [High

	alarm				pressure alarm], it delays two secs., and alarms "High pressure"; 0: disable
	Heater alarm	0.0	0~999	Min.	1. If the machine fails to reach the set temp. of - 5 °C within the [heater alarm] time, it will give the "heater alarm", and continue to control the temp. Manual reset. 2. Set to 0, disable the limit detection.
	Overheat tripping temp. difference	15.0	0~100	°C	PV - 【SV】> 【overheat trip output temp. difference】 , open the circuit breaker, the EGO will alarm;
		19.0	0-180	°F	
	Interference alarm	0.0	0~200	°C/ sec.	1. Monitor temp. variation trend 2. The temp. rises or drops exceeds the 【Interference alarm temp.】 per second, it will give "Interference Alarm", and reset the fault automatically. 3. Set to 0: disable.
		0.0	0-360.0	°F/ sec.	
	Water refilling alarm time	90	0-300	sec.	Only the high temp. water condition: 1. During the heating process, if the high liquid level signal has invalid timing, and water refilling exceeds the 【water refilling alarm time】 , it gives "low liquid level" alarm, and shuts down.
	High pressure alarm time	5	0-99	sec.	High temp. water machine: When the high-pressure switch receives the high-pressure signal, the emptying valve will open according to the set opening time. If it continues the [high-pressure alarm time] and is still in the high-pressure state, the system will give high temp. alarm.
Assist	Control temp. compensation	0.0	-30.0~30.0	°C	Compensate the measurement error of the medium output temp.

	Return medium temp. compensation	0.0	-30.0~30.0	°C	Compensate the measurement error of the return medium temp.
	Return medium temp. compensation	0.0	-30.0~30.0	°C	Compensate the measurement error of the return medium temp.
	Analog quantity AI1 compensation	0.0	-10.0~10.0	bar	Compensate the pressure measurement error
Assist	Analog quantity AI2 compensation	0.0	-30.0~30.0	L/min	Compensation flow measurement error.
	Comm. address	01	0-32		Communication basic info. setting
	Baud rate	19200.0	4800, 9600, 19200		
	Check bit	No parity	No parity, even parity check, odd parity		
	Stop bit	1bit	1 bit, 2 stop bits		
Comm. wiring method	9-pin male connector		For wiring definition, please refer to the circuit diagram.		
Maintenance	Unit maintenance time	0.0	0-3000	hr.	When the set accumulative running time is greater than [unit maintenance time], it alarms" Unit Maintenance Fault";
	Unit maintenance time	0.0	0-3000	hr.	When the set accumulative running time is greater than [unit maintenance time], it alarms" Unit Maintenance Fault";
	Accumulative total running time (hr.)	0.0	0-3000	hr.	
	Accumulative total running time (min.)	0.0	0-59	Min.	

4.8 Controller Exception List

No.	Fault Name	Detection Logic	Reset Mode	Remark
0	Pump overload	1. Power-on detection 2. Pump overload input point is valid, and the alarm delays 2 secs. Stop and release.	Manual reset	
1	EGO overheat	1. Power-on detection 2. Alarm action: EGO input point alarms delay 2 secs. effectively, and it opens the circuit breaker output point	Manual reset	
2	Low pressure	1. After system powered on, it starts to detect the inlet water pressure. 2. Low pressure input point is valid, and the alarm delays 2 secs.	Manual reset	
3	High pressure	1. Switching detection: Non high temp. water machine: 1) Power-on detection 2) High pressure input point is effective, and the alarm delays two secs. and shuts down. High temp. water machine: When the high-pressure switch receives the high-pressure signal, the emptying valve will open according to the set opening time. If it continues the [high-pressure alarm time] and is still in the high-pressure state, the system will give high temp. alarm. 2. Pressure sensor detection It uses the pressure sensor during the operation stage. If the medium pressure is higher than the [high pressure alarm], it delays two secs. and gives "too high pressure". When [high pressure alarm] is set to 0, disable this function.	Manual reset	

4	Low liquid level	<p>Oil machine:</p> <ol style="list-style-type: none"> 1. Power-on detection 2. Detection method: When it detects there's no signal input of the low liquid level, the alarm delays for two secs. <p>High temp. water machine:</p> <ol style="list-style-type: none"> 1. Detect after the start-up 【water refilling time】, if there's no high liquid level signal input, it alarms for the "low liquid level" and shuts down. 2. During the heating process, if the high liquid level signal has invalid timing, and water refilling exceeds the 【water refilling alarm time】, it gives "low liquid level" alarm, and shuts down. 	Manual reset	
5	3-phase power phase reverse / phase loss	<ol style="list-style-type: none"> 1. When alarm occurs, the machine stops running. After troubleshooting, reset manually. 2. When powered on, it starts detection, the phase reverse alarm delays 1.2 secs., and the phase shortage alarm delays 3 secs. If it needs to disable the on-board phase sequence detection, please set the project parameter [3-phase power detection] to "disabled". 	Manual reset	
6	Abnormal control probe	<ol style="list-style-type: none"> 1. Power-on detection. When it alarms, the machine stops running. 	Manual reset	
7	Abnormal return medium probe	<ol style="list-style-type: none"> 1. Power-on detection. When it alarms, the machine stops running. 	Manual reset	
8	Abnormal mould probe	<ol style="list-style-type: none"> 1. Power-on detection. When it alarms, the machine stops running. 	Manual reset	
9	Pressure sensor fault	<ol style="list-style-type: none"> 1. Check whether the sensor input signal is normal. When it alarms, the machine runs continuously. 2. AI 1 input is defined as "disabled", disable the fault. 	Manual reset	

10	Flow sensor fault	<p>1. Check whether the sensor input signal is normal. When it alarms, the machine runs continuously.</p> <p>2. AI2 input is defined as "disabled", disable the fault.</p>	Manual reset	
11	Large temp. difference of return medium	<p>1. When it alarms, the machine runs normally. After troubleshooting, reset manually.</p> <p>2. Detecting during unit's operation:</p> <p>(1) Control temp. – return medium temp. > 【Return medium temp. deviation】 , it delays 【Temp. difference alarm delay】 secs., and it alarms large return medium temp. difference. When the 【Output and return medium temp. difference】 = 0, disable this function.</p> <p>(2) It processes only the temp. exceeds the set value and after a temp. variation cycle. After modifying the [SV], it doesn't process this fault.</p>	Auto reset	
12	Interference Alarm	<p>1. When it alarms, the machine runs normally. After the fault is dismissed, it will reset automatically.</p> <p>2. In the temp. control stage, the temp. drops or rises beyond the [Interference alarm] temp. within 1s.</p> <p>When the 【Interference alarm】 = 0, disable this fault.</p>	Auto reset	
16	Heater alarm	<p>1. When it alarms, the machine runs normally.</p> <p>2. In the temp. control stage, when the control temp. can't reach the set temp. of - 5 °C within the 【Heater alarm】 time, it alarms. When it reaches the set temp., it will dismiss the alarm automatically.</p> <p>When the 【Heater alarm】 = 0, disable this fault.</p>	Auto reset	

13	Too high temp.	<p>1. When it alarms, the machine runs normally.</p> <p>2. $PV - \text{【SV】} > \text{【High temp. deviation alarm】}$, it delays 2 secs., and gives high temp. alarm. $PV - \text{【SV】} < \text{【High temp. deviation alarm】}$, it resets the fault automatically.</p> <p>When the 【High temp. deviation alarm】 = 0, disable this function.</p> <p>Note: In order to prevent false alarm after modifying the set temp., the fault can only be solved after the PV temp. reaches the set temp. once.</p>	Auto reset	
14	Too low temp.	<p>1. When it alarms, the machine runs normally.</p> <p>2. $\text{【SV】} - PV > \text{【Low temp. deviation alarm】}$, it delays 2 secs., and gives low temp. alarm.</p> <p>$\text{【SV】} - PV > \text{【Low temp. deviation alarm】}$, it resets the fault automatically.</p> <p>When the 【Low temp. deviation alarm】 = 0, disable this function.</p> <p>Note: In order to prevent false alarm after modifying the set temp., the fault can only be solved after the PV temp. reaches the set temp. once.</p>	Auto reset	
15	Rear plate data error	Parameter data verification error. Please contact the manufacturer in case of this fault,	Manual reset	
16	Unit needs maintenance	Power on detection: Once this fault occurs, the unit can't start. Enter the project parameter to set the [Unit maintenance time] to 0, and eliminate this fault.	Manual reset	

17	Overheat alarm	<p>1. When it alarms, the machine runs automatically, and the circuit breaker opens.</p> <p>2. $PV - \text{【SV】} > \text{【Overheat release output temp.】}$, the circuit breaker opens, and it gives overheat alarm.</p> <p>When the $\text{【Overheat release output temp.】} = 0$, disable this function.</p> <p>Note: In order to prevent false alarm after modifying the set temp., the fault can only be solved after the PV temp. reaches the set temp. once.</p>	Manual reset	
18	Too large mould temp. difference	<p>1. When it alarms, the machine runs normally. After troubleshooting, reset manually.</p> <p>2. Detecting during unit's operation:</p> <p>(1) $\text{Control temp.} - \text{mould temp.} > \text{【Mould temp. deviation】}$, it delays $\text{【Temp. difference alarm delay】}$ secs., and it alarms large return medium temp. difference. When the $\text{【Mould temp. deviation】} = 0$, disable this function.</p> <p>(2) It processes only the temp. exceeds the set value and after a temp. variation cycle. After modifying the [SV], it doesn't process this fault.</p>	Auto reset	
19	Too low flow	<p>1. Machine shutdown when it alarms. After the flow becomes normal, reset manually.</p> <p>2. Use flow sensor. When it running, the medium flow is lower than the 【Low flow alarm】, it delays 2 secs. and alarms "low flow".</p> <p>When the $\text{【Low flow alarm】} = 0$, disable this fault.</p>	Manual reset	

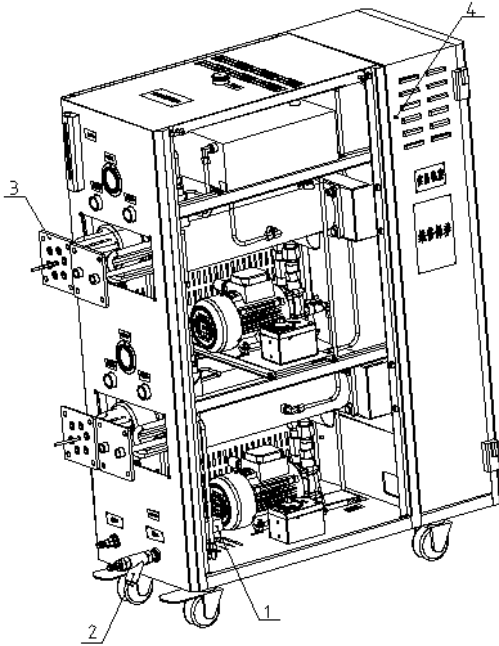
20	3-phase power phase reverse / phase loss	<p>1. When alarm occurs, the machine stops running. After troubleshooting, reset manually.</p> <p>2. When powered on, it starts detection, the phase reverse alarm delays 1.2m secs., and the phase shortage alarm delays 3 secs. If it needs to disable the on-board phase sequence detection, please set the project parameter [3-phase power detection] to "disabled".</p>	Manual reset	
21	Overtime when communicating with the rear plate	The comm. wire between the display panel and the control board breaks	Auto reset	

5. Trouble-shooting

Failures	Possible reasons	Solutions
LCD displays nothing after switch on power and press ON/OFF key.	<p>No power supply.</p> <p>Main power switch broken.</p> <p>Power circuit broken.</p> <p>Control circuit breaker tripped.</p> <p>Control transformer broken.</p>	<p>Connect through power supply.</p> <p>Replace main switch.</p> <p>Check electrical wires.</p> <p>Fix the fuse.</p> <p>Replace the transformer.</p>
Phase alarm.	<p>Power supply low voltage.</p> <p>Phase shortage.</p> <p>Phase reversal.</p> <p>PCB problems.</p>	<p>Check power supply.</p> <p>Check power supply.</p> <p>Exchange two of the wires of power supply.</p> <p>Replace the PCB.</p>
Pump overload.	<p>Abnormal fluctuations of power supply.</p> <p>Pump blocked.</p> <p>Pump motor problems.</p> <p>Overload relay (F1) setting value error.</p>	<p>Check power supply.</p> <p>Check the pump.</p> <p>Check pump motor.</p> <p>Set the setting current of overload relay (F1) to equal to 1.1 times of motor rated current.</p> <p>After inspection, it cools down the pump to normal temp. and then start the reset overload alarm:</p> <p>Wait for one minute, then press the blue button to reset the relay.</p>
EGO overheat.	<p>EGO temperature setting mistakes.</p> <p>EGO poor temperature detecting.</p> <p>Heater solid-state relay problem.</p>	<p>Correctly set EGO temperature. (EGO temperature setting value= temperature setting value+10°C)</p> <p>Replace EGO.</p> <p>Replace the solid-state relay.</p>
Low liquid level.	Oil shortage.0	Fill high temp. oil.
Low pressure.	<p>Low pressure of external water supply.</p> <p>Poor pressure switch.</p>	<p>Increase external water supply pressure.</p> <p>Replace the pressure switch.</p>

High pressure	The mould circular water ball valve doesn't open or pipe blocked. Poor pressure switch.	Check the ball valve and pipe. Replace the pressure switch.
Temp. window displays "----"	Abnormal sensor.	Check and repair sensor.
Once running, pump output indicator lightens but pump cannot start. After a while pump still fails to run.	PCB output relay problems. Electrical circuit problems.	Check or replace the PCB. Check electrical circuit.
Differences between setting temp. and actual temp. is too big.	Too short time after machine startup. Temperature parameter setting error. Cooling water valve problems.	Wait for a while. Check temperature parameters. Please refer to the standard manual of setting parameters. Replace solenoid valve.
Temperature can't rise up.	Heater solid-state relay problems. Heater problems. Thermocouple problems. PCB output point problems.	Replace the solid-state relay. Replace pipe heater. Replace thermocouple. Check and repair PCB.
Circuit breaker tripping off at turning on main switch.	Short circuit of main circuit. Transformer short circuit or connected with earth wire. Problems of circuit breaker.	Check electrical wire. Replace circuit breaker.
Circuit breaker tripping off at turning on pump switch.	Pump motor coil short circuit. Problems of circuit breaker.	Check pump motor. Replace circuit breaker.
Circuit breaker tripping off after short heater output.	Heater tube short circuit or shell contact. Problems of circuit breaker.	Replace heater tube. Replace circuit breaker.

6. Maintenance and Repair



1. Clean solenoid valve.
Period: Trimonthly.
2. Clean Y-type filter.
Period: monthly.
3. Clean the pipe heater, cooling pipe.
Period: Every three months.
4. Check the contactor.
Period: Every three months.

Pay attention to the following rules during maintenance:

- 1) Need at least two persons present when checking the machine. Let the machine cool down, turn off power supply, drain out the oil and water. Make sure enough place before checking and maintenance.
- 2) The machine works in high temperature. Stop the machine, wait it to cool down. Put on protective gloves before servicing or maintenance.
- 3) In order to prolong the life of the machine and to prevent accidents, check the machine regularly.
- 4) During operation, the oil is heated up to a high temperature, wait it to fall below 50°C to perform repairing or maintenance.

(Please note that it is dangerous to check or tear down the machine during operation.)

6.1 Open the Covers

- 1) Remove the screws on the side plate, and lift the plate to open (Refer to the pictures below).



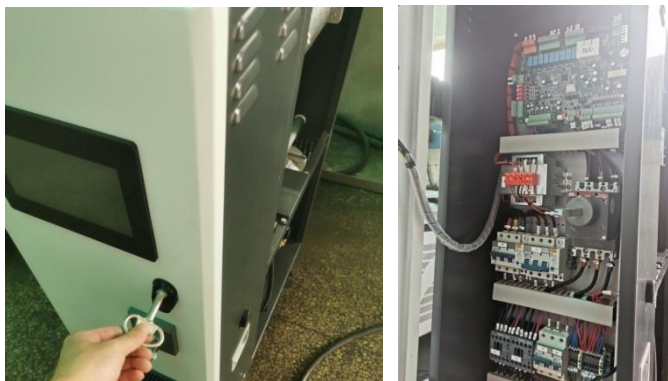
Picture 6-1: Open the Covers 1

- 2) Remove the four screws on the cover plate, lift the cover plate to open (Refer to the pictures below).



Picture 6-2: Open the Covers 2

- 3) Open the cover of the control box (Open the door lock on the door plank with the key to open).



Picture 6-3: Open the Covers 3

6.2 Y Type Strainer

- 5) Clean soft water should be used as cooling water. Y type strainer is used in the strainer to stop impurities and pollutants entering into water pipe.
- 6) Impurities or pollutants may cause errors and bad temperature control. Clean Y type strainer periodically.
- 7) Cleaning steps: turn off power and cooling water supply. Open the cover of Y type strainer to clean the strainer (as below picture).



Picture 6-4: Y Type Strainer

6.3 Solenoid Valve

Replace solenoid valve:

- 1) Open machine top cover (refer to 6.1)
- 2) Take down right side cover (refer to 6.1)
- 3) Unfix the solenoid valve for replacement.
- 4) Install the covers in a reverse order.



Solenoid valve

Picture 6-5: Solenoid Valve

6.4 Pipe Heater

- 1) Open the heating cover (Remove the screws on the cover plate, as shown in picture below).



Picture 6-6: Pipe Heater 1

- 2) Remove the pipe heater cover (Unlock the screw, loosen the wire fixture, and remove the cover).



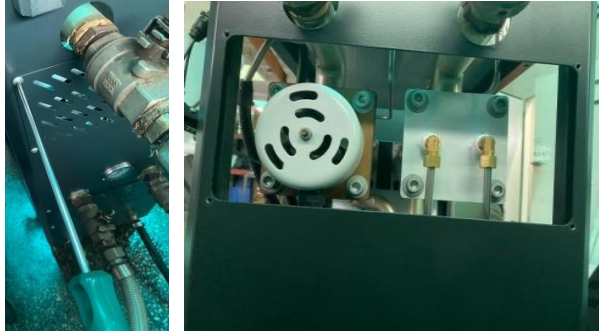
Picture 6-7: Pipe Heater 2

- 3) After cleaning the pipe heater, install the pipe heater to the machine according to above opposite orders.

6.5 Cooling Pipes

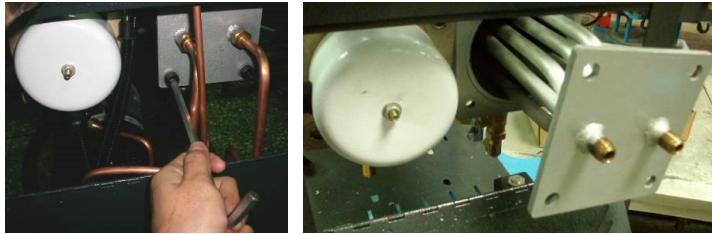
After long use of the machine, as it is heated by high temperature, the heat transfer oil would carbonize and accumulate on machine pipeline. Too much of carbonization would lower the cooling efficiency of the cooling pipe. So it is needed to clean the carbon deposited on the cooling pipe. The cleaning steps are as below:

- 1) Open the heater cover (Remove the screws on the plate, as shown in the picture below).



Picture 6-1: Cooling Pipes 1

- 2) Remove the cooling pipe (Unlock the screws, and remove the cooling pipe, as shown in the picture).



Picture 6-2: Cooling Pipes 2

- 3) Use the thinner or cloth dipped with thinner to clean the cooling pipe. After the cleaning, put the cooling pipe in the cool place for thinner total volatilization.
- 4) Install the cooling pipe to the machine according to above opposite orders.

6.6 Maintenance Schedule

6.6.1 About the Machine

Model _____ SN _____ Manufacture date _____

Voltage _____ Φ _____ V Frequency _____ Hz Power _____ kW

6.6.2 Installation & Inspection

- Check the installation space is enough as required.
- Check the pipes are correctly connected.

Electrical installation

- Voltage: _____ V _____ Hz
- Fuse melting current: 1 Phase _____ A 3 Phase _____ A
- Check phase sequence of power supply.

6.6.3 Daily Checking

- Check machine startup function.
- Check all the electrical wires.

6.6.4 Weekly Checking

- Check loose electrical connections.
- Check and clean Y type filter ¹.
- Check solenoid valve.
- Check motor overload and phase reversal alarm function.
- Check whether pipeline joints are under looseness.
- Check the sensitivity of EGO.

6.6.5 Trimonthly Checking

- Check level switch.
- Check the contactor ².
- Replace the hot kerosene with a using temperature above 160 degree ³.

6.6.6 Half-yearly Checking

- Check damaged pipes.
- Clean process heater/cooler.
- Check indicator and buzzer.
- Replace the hot kerosene with a using temperature above 120~160 degree ⁴.

6.6.7 Yearly Checking

- Replace the hot kerosene with a using temperature above 120 degree ⁵.

6.6.8 3 year Checking

- PC board renewal.
- No fuse breaker renewal.

Note: 1. Y-type filter has the function of filling water cooling protection effect, be sure the waterway are clear to avoid cooling failure.

2. Manufacturer laboratory data for AC contactor is two million times in life. we suggest service life for one million four hundred thousand times, if work eight hours per day, recommended replacing frequency is 1.5 years, if work day and night, replacement is suggested to be done every six months.
3. Hot kerosene coke will influence the detection accuracy of internal temperature probe and the efficiency of heat elements, three months replacing frequency is suggested.
4. Hot kerosene coke will influence the detection accuracy of internal temperature probe and the efficiency of heat elements, six months replacing frequency is suggested.
5. Hot kerosene coke will influence the detection accuracy of internal temperature probe and the efficiency of heat elements, suggested replacing frequency is one year.

Appendix 1

STM Comm. Variable Table (1)

STM Comm. Variables					Comm. Protocol: MODBUS-RTU
D-Map (40000 +i)	English	Chinese	Range	Description	Type
1	CONTROL PV.	Control temp.	-50 ~ 500	※ 1 (Different displays depending on whether the temp. unit ° C has a decimal point.)	read only
2	RET PV	Return water temp.	-50 ~ 500		read only
3	ENT PV	Output water temp.	-50 ~ 500		read only
4	SV	Control target value	-50 ~ 500		read only
5	RTC YEAR	Current year	0 ~ 99	2000(0), 2001(1), ..., 2099(99)	read only
6	RTC MONTH	Current month	1 ~ 12		read only
7	RTC DATE	Current date	1 ~ 31		read only
8	RTC DAY	Current week	0 ~ 6	Sun.(0), Mon. (1), Tues.(2), ..., Sat.(6)	read only
9	RTC HOUR	Current hour	0 ~ 23		read only
10	RTC MINUTE	Current minute	0 ~ 59		read only
11	RTC SECOND	Current secs.	0 ~ 59		read only
12	CONTROL STATUS	Control status	0 ~ 3	Fault(0), stop control(1), In controlling(2), Auto-tuning(3)	read only
13	MMI STATUS	Running status	0 ~ 255	※ 2 (Operate it with bit address)(as shown in Appendix 3)	read only
14	DO STATUS	Contact output status	0 ~ 255	※ 2 (Operate it with bit address)(as shown in Appendix 3)	read only

15	DI STATUS	Contact input status	0 ~ 255	※ 2 (Operate it with bit address)(as shown in Appendix 3)	read only
16	ALARM STATUS	Alarm status	0 ~ 255	※ 2 (Operate it with bit address)(as shown in Appendix 3)	read only
17	CONTROL PV ERROR	Control temp. input alarm	0 ~ 255	※ 2 (Operate it with bit address)(as shown in Appendix 3)	read only
18	RET PV ERROR	Return water temp. input alarm	0 ~ 255	※ 2 (Operate it with bit address)(as shown in Appendix 3)	read only
19	ENT PV ERROR	Water outlet temp. input alarm	0 ~ 255	※ 2 (Operate it with bit address)(as shown in Appendix 3)	read only
20	REMOTE ERROR	Remote control input alarm	0 ~ 255	※ 2 (Operate it with bit address)(as shown in Appendix 3)	read only
21	KEY STATUS	KEY key status	0 ~ 255	※ 2 (Operate it with bit address)(as shown in Appendix 3)	read only
22	LED STATUS	LED indicator status	0 ~ 255	※ 2 (Operate it with bit address)(as shown in Appendix 3)	read only
30		Switching value status	-	※3 As shown in Appendix 4	read only
31		Relay status	-	※3 As shown in Appendix 4	read only
32		Fault info. 1	-	※3 As shown in Appendix 4	read only
33		Fault info. 2	-	※3 As shown in Appendix 4	read only
100	HOUT	Heating end output	0 ~ 100%		read only
101	COUT	Cooling end output	0 ~ 100%		read only

102		Backlight time	0 ~ 255	0 ~255	read /write
104	RUN/RESET KEY	RUN/RESET KEY	0, 1	1 = Key (button) operation. After this operation, it will be automatically reset to 0.	write only
105	AUTO-TUNING KEY	AUTO-TUNING KEY	0, 1		write only
106	AUTO-START KEY	AUTO-START KEY	0, 1		write only
107	SUCTION KEY	SUCTION KEY	0, 1		write only
108	COOLING KEY	COOLING KEY	0, 1		write only
109	BUZZER OFF KEY	BUZZER OFF KEY	0, 1		write only
110	SUCTION OFF KEY	SUCTION OFF KEY	0, 1		write only
111	F KEY	F KEY	0, 1		write only
112		Reset	1		write only
120		Flow value		Unit: 0.1L/min	read only
125		Pressure value		Unit:0.1bar	read only
150		Emptying temp.	0-120.0℃	When the PV temp. is less than [Emptying temp.], the reverse emptying can be started.	read /write
151		Emptying time	60 secs.	0-600 secs.	read /write

Appendix 2: STM Comm. Variable Table (2)

D-Map (40000+i)	English	Chinese	Range	Description	Type
200	SV	Control target value (℃)	-50 ~ 500℃	※1 (Different displays depending on whether the temp. unit °C has a decimal point.)	read /write
201	PB	Heating control belt	0 ~ 550℃	※1 (Different displays depending on whether the temp. unit °C has a decimal point.)	read /write
202	TI	Integral time	1 ~ 3600s		read /write
203	TD	Differential time	1 ~ 3600s		read /write

204	PBC	Cooling control zone	0 ~ 550℃	※1 (Different displays depending on whether the temp. unit °C has a decimal point.)	read /write
205	CT	Heating control cycle	1 ~ 100s		read /write
206	CTC	Cooling control cycle	1 ~ 100s		read /write
300	PHASE ALARM	Phase detection	0, 1	Unuse (0), use(1)	read /write
301	DEV1 ALARM	Output water temp. deviation	0 ~ 550℃	※1 (Different displays depending on whether the temp. unit °C has a decimal point.)	read /write
302	DEV2 ALARM	Return water temp. deviation	0 ~ 550℃		read /write
303	TURB ALARM	Interference alarm	0 ~ 550℃		read /write
304	HEATER ALARM	Heater alarm	0 ~ 3600s		read /write
401	SUB HEATING	Auxiliary output	0 ~ 550℃	※1 (Different displays depending on whether the temp. unit °C has a decimal point.)	read /write
402	COOLING TEMP	Cooling temp.	-50 ~ 500℃		read /write
500	H.LIMIT TEMP	Upper limit temp.	-50 ~ 500℃	※1 (Different displays depending on whether the temp. unit °C has a decimal point.)	read /write
501	L.LIMIT TEMP	Lower limit temp.	-50 ~ 500℃		read /write
502	TEMP UNIT	Temp. unit	0, 1	℃(0), °F(1)	read /write
503	TEMP DEGREE	Decimal point	0, 1	0.1(0), 1(1)	read /write
504	CTL TEMP BIAS	Control temp. correction	-550 ~ 550℃	※1 (Different displays depending on whether the	read /write

				temp. unit ° C has a decimal point.)	
505	RET TEMP BIAS	Return water temp. correction	-550 ~ 550°C		read /write
506	ENT TEMP BIAS	Output water temp. correction	-550 ~ 550°C		read /write
600	NOW YEAR	Year setting	0 ~ 99	2000(0), 2001(1), ..., 2099(99)	read /write
601	NOW MONTH	Month setting	1 ~ 12		read /write
602	NOW DATE	Date setting	1 ~ 31		read /write
603	NOW DAY	Week setting	0 ~ 6	Sun.(0), Mon. (1), Tues.(2), ..., Sat.(6)	read /write
604	NOW HOUR	Hour setting	0 ~ 23		read /write
605	NOW MINUTE	Minute setting	0 ~ 59		read /write
606	SCHEDULE DAY	Week reserve setting	0 ~ 127	Sun.(0), Mon. (1), Tues.(2), ..., Sat.(6)	read /write
607	AUTO-START HOUR	Reserve auto start hr. setting	0 ~ 24	Unuse (00:00)	read /write
608	AUTO-START MINUTE	Reserve auto start min. setting	0 ~ 59		read /write
609	AUTO-END HOUR	Reserve auto shutdown hr. setting	0 ~ 24	Unuse (00:00)	read /write
610	AUTO-END MINUTE	Reserve auto shutdown min. setting	0 ~ 59		read /write
611	AS SETTING TIME	Check time setting	0 ~ 9999	Unuse (00:00)	read /write
612	RUNNING TIME	Device using time	0 ~ 9999		read only
D-Map (40000+i)	English	Chinese	range	Description	Type
700	LANGUAGE	Language setting	0, 1	Chinese(0), English(1)	read /write

702	PASSWORD	Password setting	0 ~ 9999		read /write
703	RET/ENT DISP	Return water output temp.	0, 1	Unuse (0), use(1)	read /write
704	W-FILL TM T1	Water refilling time T1	0 ~ 600s		read /write
705	W-FILL TM T2	Water refilling time T2	0 ~ 60s		read /write
706	RET/ENT DISP	Return loop display settings	0, 1, 2, 3	Display control loop, control+ return medium, control + mould, control+ return medium + mould	read /write

Appendix 3: Bit Address Variable (1)

D-Map (40000 +i.j)	Name	Bit							
		0	1	2	3	4	5	6	7
13	MMI STATUS	Control	Cooling	Auto-tuning	Suction	Reserve	Buzzer Off	-	Input power
14	DO STATUS	Pump forward action	Pump forward action	Water refilling	Suction	Alarm	Breaker	Air	-
15	DI STATUS	Pump overload	EGO	Low pressure	High pressure	Low liquid Level	High liquid Level	-	start control
16	ALARM STATUS	Phase alarm	Temp. alarm	Deviation alarm	Interference alarm	Heating alarm	-	-	-
17	CONTR OL PV ERROR	-	-Over	+Over	Sensor Open	AD Error	-	-	-
18	RET PV ERROR	-	-Over	+Over	Sensor Open	AD Error	-	-	-

19	ENT PV ERROR	-	-Over	+Over	Sensor Open	AD Error	-	-	-
20	REMOTE ERROR	-	-Over	+Over	Input Open	AD Error	-	-	-
21	KEY STATUS	RUN	AUTO-T UNING	AUTO-S TART	SUCTION OFF	COOLIN G	SUCTIO N	BUZZ ER OFF	power

D-Map (40000 +i.j)	Name	Bit							
		0	1	2	3	4	5	6	7
		8	9	10	11	12	13	14	15
22	LED STATUS(KEY LED)	RUN	AUTO-T UNING	SUCTIO N	COOLING	BUZZER OFF	AUTO-S TART	SUCTI ON OFF	F
	LED STATUS	Power	Heater output	Auxiliary heating output	Cooling output	Pump forward action	Pump reverse action	Water refilling	Alarm