Bunsen Air Controller

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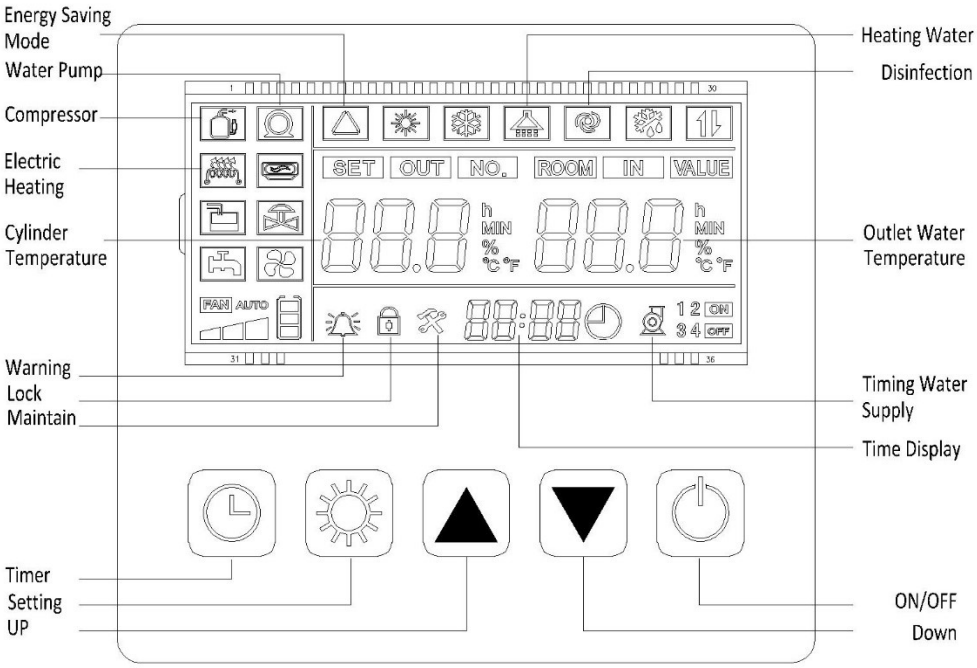
Introduction

The Bunsen Air is designed to provide Automatic constant hot water heating preset to 55℃. If the cylinder temperature drops by 5℃ the Bunsen Air will switch on and run until the target temperature of 55℃ is reached, then it will return to Stand-By.

Advanced Settings - The Bunsen Air has 2 Run Time settings so you can program 2 periods when the unit does or does not run during the 24HR day.
The Bunsen Air has 3 Energy Saving periods where you can choose 3 target temperature zones over the 24 HR day. These can be used with or without the Run Time settings.

If an Immersion Heater is wired into the unit, then it will be automatically called on to work with the Bunsen Air unit to achieve the Disinfection target temperature once a week. The immersion unit is also called upon along with the Bunsen Air for either Single Boost or for if the Daily Boost is set-up.
The immersion called on as a heating back-up should anything affect the functionality of the Bunsen Air unit.

Bunsen Air Controller Keys



Bunsen Air Controller

Mode display

Heating mode when device starts up  .

Lock and Unlock the control panel

When the device is locked – see lock icon on the screen diagram, press and hold  button for 3 seconds， the control is unlocked after a ‘beep’ sound and the icon disappears.

- ✓ The control will be automatically locked if there is no command for 60 seconds；

Controller buttons

ALWAYS UNLOCK THE SCREEN FIRST (see above)

On/Off Switch

 Power switch – This is NOT to switch electrical power off to the Bunsen Air unit. It is to stop the unit running and return it to standby mode.

Press the  button, Compressor and the immersion will turn off after 5 seconds, the water pump would be 30 seconds later. The unit then returns to standby mode.

- ✓ When screen is unlocked, press and hold for 1 second to switch ON/OFF；
- ✓ Otherwise, press this button to return to the main interface；
- ✓ When screen is locked, press and hold for 5 seconds to unlock the screen；

Functions

 Functions

- ✓ Firstly unlock the screen

- ✓ Then SINGLE Press  to move to the listings.

Scroll up and down to view or alter data  Up &  Down: (A0-A9, E1-E6 which is shown the Unit Status Table)

Timer

 Timer

- ✓ This is used both to set the clock time and also to set up to 2 ON/OFF Run Times.
- ✓ See Real Time Clock Setting to set the time
- ✓ See Time 1 and 2 Run-Time settings

Using the Control Panel

Lock and unlock

- ✓ When the device is locked, press and hold  button for 3 seconds，the control is unlocked after a 'beep' sound and the lock symbol disappears from the display；
- ✓ The control will be automatically locked if there is no command for 60 seconds；

Setting the Time

- ✓ In main interface, press  button for 10 seconds to enter real-time clock setting interface；
- ✓ In real-time clock setting interface, press  button，the hour digit blinks. Press  or  to alter the hour digit；
- ✓ After setting the hour digit, press  again and repeat the same steps to alter minute digits;
- ✓ After setting the minute digits, press  to confirm the real-time clock settings and return to main interface；
- ✓ In real-time clock setting interface, if there is no command input for 30 seconds, the device will confirm the current settings and return to the main interface;

- ✓ In real-time clock setting interface, press ⏻ button to confirm the current real-time clock setting and return to the main interface;

Setting Run-Time settings

You can either leave the Bunsen Air unit to automatically switch on and raise the cylinder temperature back to the target temperature (default 55℃) or you can use this function to select 2 time periods when the unit works.

- ✓ In main interface, press 🕒 and '1 **ON**' and the time will all flash.
- ✓ Press 🕒 to select the hours (hours will flash) and use the ▲ and ▼ to select the correct hour for start '1'.
- ✓ Press 🕒 to move to the minutes and again use arrows to change the value.
- ✓ Press 🕒 to move to '2 ON' to set the start time for the second Time setting.
- ✓ Press 🕒 to select the hours (hours will flash) and use the ▲ and ▼ to select the correct hour for start '2'.
- ✓ Press 🕒 to move to the minutes and again use arrows to change the value.
- ✓ Press 🕒 and '**1 2** and **ON/OFF'** will show on the display to show that Time settings 1 and 2 are active.

Checking Run-Time settings and Turning ON or OFF

- ✓ Press 🕒 once and then ☼ to show each Time setting on and off
- ✓ If **1 2** and **ON/OFF** does not show bottom left you have turned them all off
- ✓ Repeat this sequence to turn back on the Time Settings

Boost Function

Boost Function (temp set by L3)

A quick requirement to Boost the temperature quickly back to target temperature.

- ✓ The Boost time is preset Default 55℃ L3 and can be adjusted (see User Parameter checking and setting) below.
- ✓ To start (or stop once started) the Boost Function hold both ⏻ and 🕒 buttons for 3 seconds; once

activated both the Bunsen Air and the immersion will be called on until the target temperature is met. Then the unit will return to stand-by.

Daily Boost Function

Daily Boost Function - (temp set by L5)

The DAILY BOOST period which will run every day to Boost the temperature quickly back to target temperature ONLY if that temperature is not already achieved. Both the Bunsen and Immersion will run during this period.

- ✓ The Daily Boost Function is preset (Default Time: 18:00~23:00, parameter: L9, L10)
- ✓ This run period will then be in place each day.
- ✓ To amend these times (see User Parameter checking and setting) below.
- ✓ The unit will run until the water temperature reaches the **Default of 45℃ (adjustable, parameter L5),**
- ✓ Within the set time period (L9~L10), the Daily Boost will not activate if the water temperature is already reached - water tank temperature ≥ L5 (46)℃,
- ✓ To **DE-ACTIVATE** this function reset L9~L10 from the default setting of 18:00~24:00; to 00:00~00:00. The function will not activate.

User Parameter checking and setting

This allows you to check all the user parameters and make changes if required. See the Chart of L2-L17 shown below.

- ✓ Press and hold ☼ for 3 seconds to enter user parameter checking interface, then press UP and DOWN to scroll to other parameters:
- ✓ In user parameter checking interface, press ☼ to enter current user parameter setting interface. (When you press ☼ 1 time, this will allow you to change the data which will be flashing.)
- ✓ Press ▲ or ▼ to alter current user parameter values, and press ☼ again to return to user parameter checking interface；
- ✓ When in user parameter checking interface or setting interface, if there is no commands input for 30 seconds,

the display screen will automatically exit the interface and return to the main interface；Pressing power switch button  can also reset the display screen to main interface.

Energy Saving – Time Period setting

This advanced feature allows you to divide into 3 sections the 24hr clock from 00 00 to 24 00 hrs. When Energy saving is activated, these will be the Bunsen Target temperatures during these time periods. When activated these will be the target temperatures in both Automatic or if you use the Run Time settings.

This is a 24 hour set up so that each value for L11, 12 and 13 is both a start and finish time.

- Time on L11-L12, (the target water temperature is L14 default 55℃)
- Time on L12-L13, (the target water temperature is L15 default 50℃)
- Time on L13-L11, (the target water temperature is L16 default 45℃)

✓ Press **and hold** for 3-5 seconds  until the screen shows the L2 value

✓ Press  until you reach L11 (Zone 1 start/finish time)

✓ Press  to move to the Hour value and use  or  to select the hour

✓ Press  to enter this new time

✓ Press  to move to L12 and repeat the setting process

✓ Repeat to change L13 to a new value and press  to enter these settings and exit.

Energy Saving - Temperature Settings

The setting of L14, L15 and L16 provides the start and finish times for 3 time zones over the 24 Hr clock.

- Time on L11-L12, (the target water temperature is L14 default 55℃)
- Time on L12-L13, (the target water temperature is L15 default 50℃)
- Time on L13-L11, (the target water temperature is L16 default 45℃)

- ✓ Press ⏻ + ▼ key TOGETHER for at least 3 seconds until the symbol △ is shown on the display.
- ✓ Press and hold the ☼ until it shows L2
- ✓ Use the ▲ to scroll up to L14.
- ✓ Press the ☼ to move to the temperature of L14 and use the ▲ and ▼ to change the value
- ✓ Press the ☼ enter the new value for L14, then the ▲ to move to L15.
- ✓ Follow the same procedure to change the L15 and L16 values.
- ✓ Amend all the temperatures you wish then press ⏻ to save.

Energy Saving – Switching ON/OFF

When turned on (as below) these will be your target temperatures in your time zones in both automatic or Run Time settings.

- ✓ Press ⏻ + ▼ key TOGETHER for at least 3 seconds until the symbol △ is shown on the display.
- ✓ If the △ is shown then the Energy saving is activated.
- ✓ Press ⏻ + ▼ key TOGETHER for at least 3 seconds until the symbol △ is no longer on the display.
- ✓ When the △ is not showing then the Energy saving is NOT activated and the unit is in automatic mode.

Clearing error history:

There are up to 6 records kept on the controller of Error Events. Follow these instructions to clear them if you need to.

- ✓ Scroll down to the error section (E1..E6)
- ✓ While on an Error page (E1…E6), hold ⏻ and ☼ for 5 seconds to clear the error history.

Restoring default parameter settings

It is possible to quickly restore all default settings of both User parameters and Factory parameters. Any parameters that have been changed can be simply returned to default:

- ✓ Hold UP and DOWN button to restore default parameter settings;

Operation modes

Heating mode

i. Normal heating

The Bunsen Air will switch on when it detects a drop in the cylinder temperature. This is determined by the Target Temperature (L3 or default 55℃ less the differential number (default 5℃ - L2).

Cylinder temperature ≤ water tank preset temperature L3 – preset differential of L2, the device turns ON. Heating stops when the Water tank temperature≥water tank preset temperature L3.

Water disinfection mode (Legionella prevention)

Automatic disinfection

This function activates automatically every week (switching on according to preset time (L7). The day of the week is according to when the unit is powered on – that becomes the designated day. So if you wish to change this to a Friday, completely power off the unit on a Friday and then re-power the unit.

Please Note that the cut-off for changing the DAY setting is 14:00 Hrs, so any time after this will set to the following day. Once the water temperature has reached preset value (60℃) and stays at this temperature for a combined 60 mins (in case the water temp is dropped during this period) the system will return to stand-by mode.

After switching the unit on, the disinfection begins at 14:00 (default setting, the starting time in the day can be changed manually as parameter L7 and L8, and disinfects every 7days).

1) When the disinfection mode is activated, the heating mode symbol  displays.

2) When parameter L6=0, this mode is nullified.

3) Water temperature ≤ Parameter L17 - 2℃, the electrical heating and the compressor is ON; Water temperature ≥ Parameter L17, the electrical heating and the compressor is OFF.

Exiting water disinfection mode:

1) When the water temperature has achieved Parameter L17-2℃ to the time value of parameter L6, the device exits disinfection mode and resets the timer.

   NOTE: The time will be paused if the temperature drops below target during this period, and then restart when temperature is returned.

2) If the immersion is called on for more than 3 hours it will be switched off to protect it.

3) Please set the disinfection function for a time period of minimal hot water usage.

4) Duration of High temperature disinfection(L6) is accumulated the total time on 60℃, and keep it achieve 1 hour

5) If running the energy saving mode, the target set temperature ≥ parameter L17 means (60 OR 61℃) the disinfection is done, so we do not need starting the disinfection.

6) If the system is running at the time when the disinfection is due to start, the target temperature will simply be increased to 60 ° C and the disinfection mode will override to complete the process, leaving the cylinder fully heated.

7) If the compressor detects a fault and stops operating, the electric heating (Immersion) still needs to perform the disinfection command (when the fault is the water temperature sensor fault will not allowed to open the electric heating (Immersion).

8) The water pump is always running during the disinfection operation.

Control of loads

1. Table of control loads

√：ON；×：OFF；○：TO BE DETERMINED BY PRECONDITIONS；

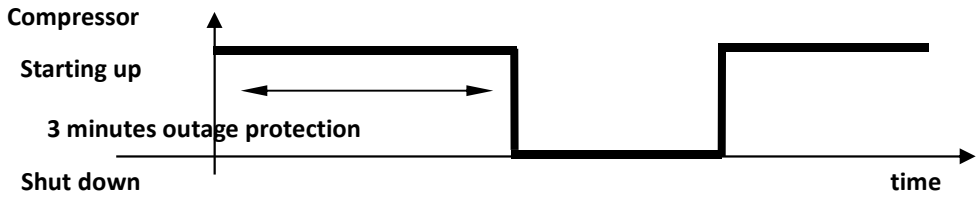
Load / Mode	Compressor	Circulating Water Pump		Water Tank Electrical Heating	
		1	0	1	0
Heating	√	√	×	○	×

Compressor

Compressor ON→ Device ON safe (protection) time

To restart the compressor, there is a 3 minute protection delay after the compressor is powered off.

1) There is no 3-minute protection time when the unit is on for the very first time.
2) The water pump has to operate for 90 seconds, then check the water tank temperature to determine whether the compressor needs to be switched on.

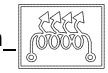


Water pump

1) When the system switches on, the water pump switches on immediately.
2) If you wish to stop the heating process, the water pump switches off 30 seconds after the compressor stops operating.

Immersion heating or switching off.

When the dip switch 2 = ON, the immersion heater becomes functional. 

When the Immersion is ON the Electric Heating Icon is shown_ 

Immersion Switch On

Immersion Switch On Periods:

- Single Boost Function

  The Single Boost Function uses BOTH the Bunsen Air and the immersion heater to achieve the preset target temperature
- Daily Boost Function

The Daily Boost function uses BOTH the Bunsen Air and the immersion heater to achieve the preset target temperature

- Weekly Disinfection Cycle

  The Weekly Disinfection Cycle uses BOTH the Bunsen Air and the immersion heater to achieve the preset target temperature for a combined time of 60 minutes (incase the cylinder temperature is reduced during this time zone).

- Antifreeze Protection

  When the ambient air temperature is detected at ≤ 2°C, then the pump will run with the immersion heater to clear any freezing before the Bunsen Air switches on fully.

- System Faults

  If the system has an error which causes the compressor to stop (ex: low temperature protection, etc.) then the electrical heating will be called on as back up to maintain hot water supply.

  Note: the controller will automatically not allow activate electrical heating during the water probe and water tank fault.

Electronic expansion valve (EV)

Operating Mode

Initial opening degrees: 350P

Operating opening range (Parameter P5) – 500P

When the unit is switched on, the expansion valve first restores to initial status, the opening degree raises to 500P (maximum) and then adjusted to initial opening degrees 350P.

System Protection Information – See Error Code Table

Error Code 05

System High Pressure Protection - **Error Code 05**

1) The system detects the high pressure switch when the device is in stand-by mode, if the switch is disconnected, the device will enter high pressure protection, and the system will not switch on.
2) In normal heat pump heating mode, after the compressor has activated for 20 seconds, if it is detected that the high pressure switch P1 has been disconnected for 10 seconds, the device will activate high pressure

protection mode and close down for protection and maintenance;

3) If the error occurs for 3 times within 30 minutes, electrical heating activates. Unless the power is off, it could not be recovered (The first 2 times could be automatically recovered);
4) When the unit malfunctions, the wired control alarms for Error Code 05

Error Code 09

Communication error - **Error Code 09**

1. Within 20 seconds since the device is switched on, the mainboard fails to receive communication signals from the remote control, it is determined as disconnection of the remote control, and the wired control is unable to exit full visual display. The system runs only according to 'the last set of status data transported from the display screen'.
2. During the start-up process, the remote control does not receive status signal from the mainboard for more than 10 seconds, it is determined as communication error and displays error code. The device operates to reach the preset temperature. The error is cleared as the communication recovers.
3. When the unit malfunctions, the wired control alarms for Error Code 09

Error Code 12

Exhaust Gas Superheat Protection - **Error Code 12**

1) Detection begins 1 minute after the compressor is switched on. If the exhaust gas temperature ≥ 125℃ and lasts longer than 1 minute, the device closes down for protection;
2) When exhaust gas temperature ≤ 85℃, the device exits protection mode;
3) If this error is detected 3 times within 30 minutes, the device activates electrical heating and it is not recoverable unless the power is switched off (The first 2 times could be automatically recovered);
4) When the unit malfunctions, the wired control alarms for Error Code 12

NOTE: High Pressure Protection, Low Pressure Protection and Exhaust Gas Superheat Protection, any one of these protection modes is unrecoverable if the device detects error for 3 times within 30 minutes;

Error Code 15

Water tank temperature probe error - **Error Code 15**

1) Detection begins after the power is on;
2) If the water tank temperature probe is ever detected to be short-circuited or disconnected, it will be determined as water tank temperature probe error. The system automatically shut down for protection;
3) This error can be self-fixed.
4) When the unit malfunctions, the wired control alarms for Error Code 15

Error Code 16

Coil Temperature Probe Error- **Error Code 16**

1) Detection begins after the power is on;
2) If the coil temperature probe is ever detected to be short-circuited or disconnected, it will be determined as coil temperature probe error. The system does not shut down for protection;
3) When the unit malfunctions caused by this error, the expansion valve is controlled manually;
4) This error can be self-fixed;
5) When the unit malfunctions, the wired control alarms for Error Code 16

Error Code 18

Exhaust gas temperature probe error (After the unit is powered on and if it is detected the temperature is above 108°C for 10 minutes continuously, it will be determined as an error) - **Error Code 18**

1) After the unit is switched on, if the exhaust gas temperature probe is ever detected to be short-circuited or disconnected after the compressor has been switched on and operated for 1 minute, it will be determined as exhaust gas temperature probe error. Water tank electrical heating activates and the system shut down for protection;
2) This error can be self-fixed;
3) When the unit malfunctions, the wired control alarms for Error Code 18

Error Code 21

Ambient temperature probe error - **Error Code 21**

1) Detection begins after the power is on;
2) If the ambient temperature probe is ever detected to be short-circuited or disconnected, it will be determined as ambient temperature probe error. The system does not shut down for protection;
3) This error can be self-fixed;
4) When the unit malfunctions, the wired control alarms for Error Code 21

Error Code 27

Water outlet temperature probe error - **Error Code 27**

1) Detection begins after the power is on;
2) If the water outlet temperature probe is ever detected to be short-circuited or disconnected, it will be determined as water outlet temperature probe error. The system does not shut down for protection;
3) When the unit malfunctions caused by this error, corresponding defrost conditions are canceled;
4) This error can be self-fixed.
5) When the unit malfunctions, the wired control alarms for Error Code 27

Error Code 29

Return gas temperature probe error - **Error Code 29**

1) Detection begins after the power is on;
2) If the return gas temperature probe is ever detected to be short-circuited or disconnected, it will be determined as return gas temperature probe error. The system does not shut down for protection;
3) When the unit malfunctions caused by this error, the expansion valve is controlled manually;
4) This error can be self-fixed;
5) When the unit malfunctions, the wired control alarms for Error Code 29

Other functions

Blackout memory

1) Automatically memorize operation mode and all parameters in the setting;
2) The working status and parameter settings before black out could be recovered after the unit is powered up again.

Correction of water tank temperature display (according to parameter F6)

1) When parameter F3 is set as 0, this function is nullified;
2) If required an alteration value may be added.
3) Otherwise, water tank temperature display value=Water tank temperature + parameter F3;

Run Zone settings

1) Sets the Bunsen to run by defined Run Zone settings.
2) See details Run Zone Time Settings
3) See details Run Zone Temperature Settings

Troubleshooting using the Memory

1) The system can memorize the last 6 errors that have occurred and display them on the screen, even if the system blacks out;

   Checking mode: In checking mode, press ▲ or ▼ to find E1~E6. The listings of E1~E6 are the Error code histories.
2) Deleting malfunction histories: In checking mode, press and hold  and  for 5 seconds to delete histories.

1. When electrical heating is operating, the circulating pump can be activated compulsively

   F2 is set as 1, when supportive electrical heating is switched on, circulating pump is on 3 seconds ahead; supportive electrical heating is switched off, circulating pump is on 3 seconds later.

Tables of parameter, status and troubleshooting code

Unit parameter table

(press “Mode” 5 seconds into setting) - User Parameters

Parameter	Definition	Setting range	Default	Comments
L2	Compressor activating return temperature difference	2℃~18℃	5℃	
L3	Water tank temperature	35℃~ 60℃	55℃	Maximum temperature is limited by 60℃
L5	Run Zone Target temperature (Ambient)	30℃~60℃	45℃	
L6	Duration of High temperature disinfection	0 Min -180 Min	60 Min	
L7	Starting time of disinfection	0-23H	14H	
L8	Minute timer of disinfection	0-59 Min	0	
L9	Daily Boost start time	0~23H	18H	
L10	Daily Boost end time	0~23H	23H	
L11	Starting 1st Energy Saving period	0~23H	8H	
L12	Starting 2nd Energy Saving period	0~23H	18H	
L13	Starting 3rd Energy Saving period	0~23H	23H	
L14	Target temperature of 1st Energy Saving period	0 ~ 60℃	55℃	
L15	Target temperature of 2nd Energy Saving period	0 ~ 60℃	50℃	
L16	Target temperature of 3rd Energy Saving period	0 ~ 60℃	45℃	
L17	Target temperature of compressor and electrical heater (Immersion) during disinfection	59-63℃	60℃	

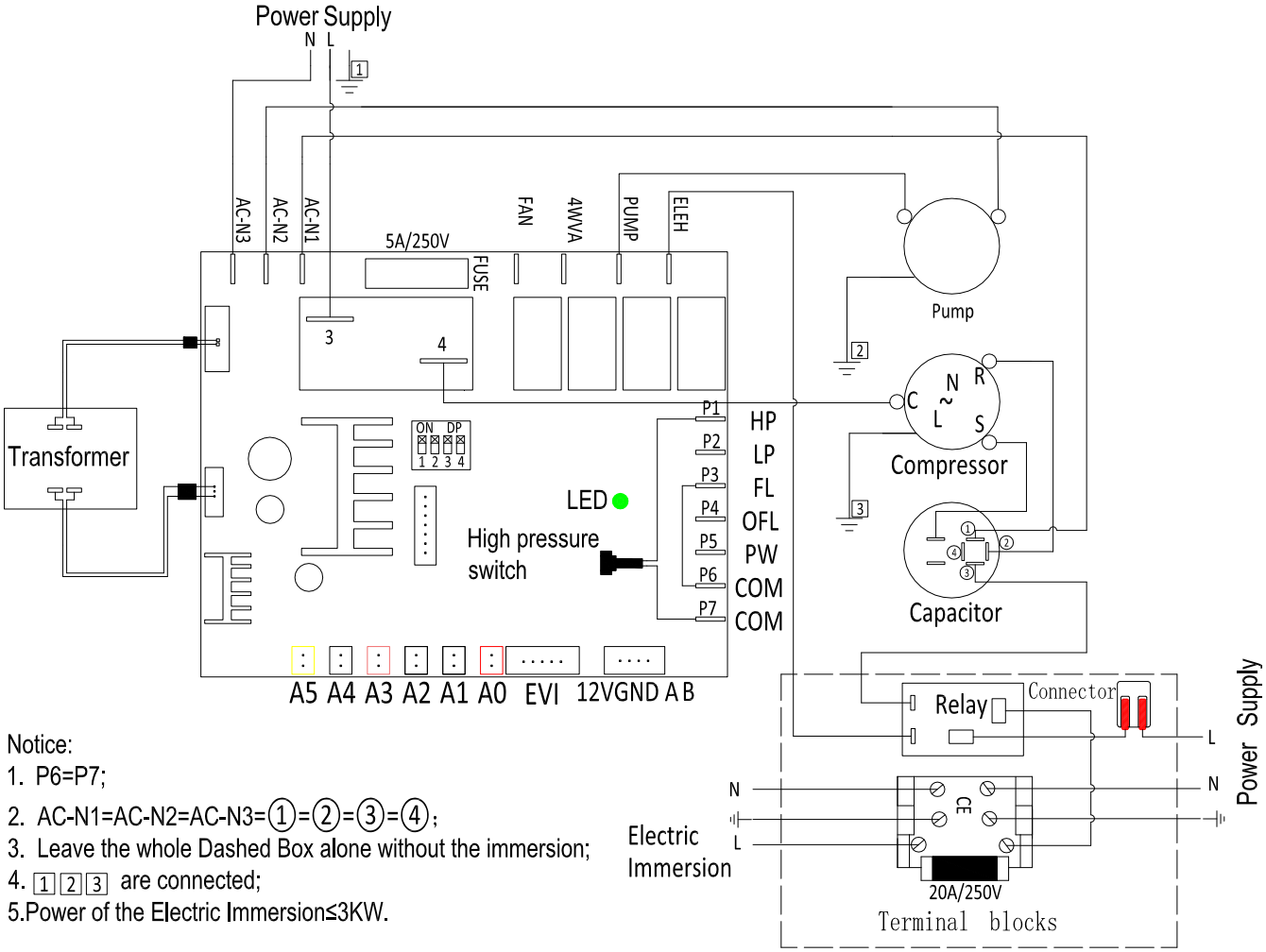
Unit status table

Unit Status Code	Definition	Display Range	Display Value	Comments
A0	Water tank temperature	-31℃~99℃(Parameter F3=0）		
A1	Coil Temperature	-31℃~99℃	Measured Value	
A2	Return Gas Temperature	-31℃~99℃	Measured Value	
A3	Exhaust Gas Temperature	0℃~125℃	Measured Value	
A4	Ambient Temperature	-31℃~99℃	Measured Value	
A5	Water Outlet Temperature	-31℃~99℃（Parameter F3=0）	Measured Value	Only when water pump is connected
A9	Expansion Valve Steps	10~50	Measured Value	Step=display value*10
E1	Error Code			
E2	Error Code			
E3	Error Code			
E4	Error Code			
E5	Error Code			
E6	Error Code			

Error code table

Error Code	Definition	Comments
02	Low ambient temperature protection	
03	Water flow error	Water circulating pump connected
04	Winter freeze-proofing protection	
05	High pressure protection	
09	Communication error	
12	Exhaust gas superheat	
15	Water tank temperature probe error	
16	Coil temperature probe error	
18	Exhaust gas temperature probe error	
21	Ambient temperature probe error	
27	Water outlet temperature probe error	
29	Return gas temperature probe error	

Electronic control board diagram

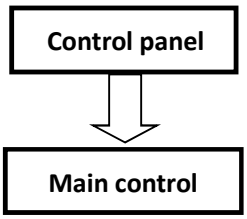


Notice:

1. P6=P7;
2. AC-N1=AC-N2=AC-N3=①=②=③=④;
3. Leave the whole Dashed Box alone without the immersion;
4. 1 2 3 are connected;
5. Power of the Electric Immersion≤3KW.

Overview

1. Control system diagram



2. Model selection switch

Dial switch1	Dial switch2	Dial switch3	Dial switch4
Water pump	Electrical heating	Electronic expansion valve	Reserved
0=OFF 1=ON			