

Precision Lead Free Reflow Oven

Operation & Maintenance Manual ®

SMTmax
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Overview

SMTmax AE tabletop reflow oven is designed mainly for SMT product production and repairing. The reflow oven is equipped with high efficient far-infrared heating elements and thermal coupler sensors. The reflow oven is controlled by a core microprocessor that can be used to accurately adjust its heating curve and heating distribution. A closed-loop control provides higher accuracy in the reflow settings and more uniform temperature distribution on the reflow panel. Its structure of the circuit adopts high efficiency, convenient and integrated design. The oven uses aluminum silicate high temperature environmental protection heat preservation cotton that has good heat preservation functionality, by which the operation performance has been dramatically improved.

SMTmax AE tabletop reflow Oven is able to adapt to a variety of alloys, lead-free solder Paste, and other reflow requirements. Its temperature curve can be precisely adjusted; in addition, the reflow oven has been built with a number of other advanced features such as automatic fault detection alarm.

This product has been used in many applications such as reflow soldering, repair, drying and so on. It's suitable for small quantities of SMT products production, research labs, electronic product development, school training and others.

I. Technical Parameters

Model	AE-5010	AE-5080	AE-6070
Max power	1600w	2400w	3600w
Heating Method	Infrared Radiation Heating & Hot Air Circulation		
Working Area	250mm*200mm	350mm*300mm	500mm*400mm
Actually Area	425*400*314mm	523*500*314mm	675*600*314mm

III. Exploded View

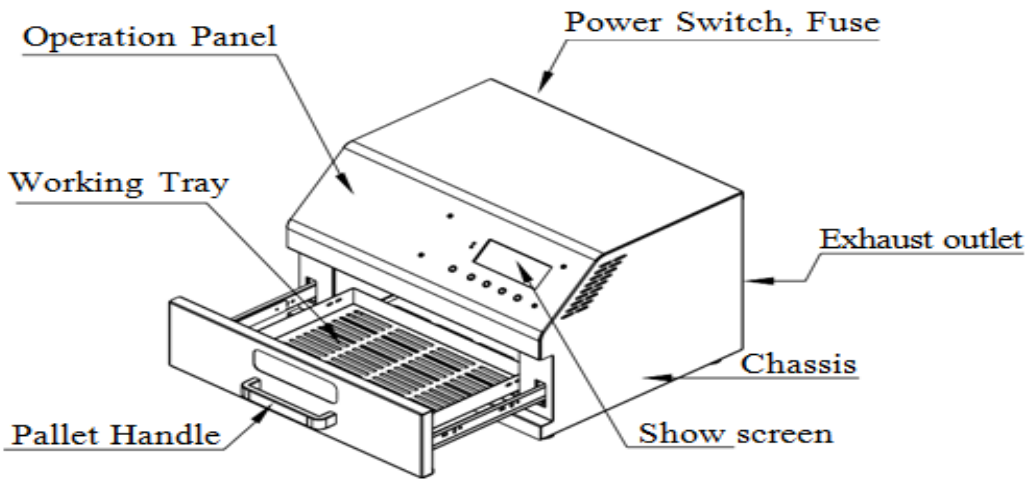


Fig. 1

IV. Function Button Descriptions

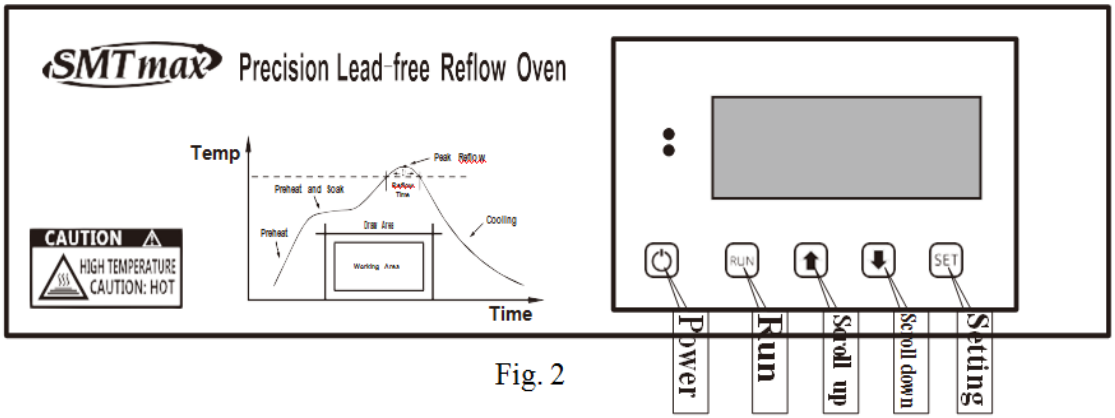


Fig. 2

There are 5 buttons on the operation panel of the device: “Power button”, “Run button” ,“Up button”, “Down button”, and “Set button” in which the keys “RUN” and “SET” are multi-function keys, different "SETTING" operation interface, the bottom of the screen will have the corresponding keyboard function display.

V. Role and Function of Temperature Curve

In the SMT production process, the temperature curve can be adjusted according to different alloy formulations of solder or tin paste, which is one of major parameters to ensure the product quality. Typical reflow typically has five temperature zones, and five temperature zones are typically set in the box reflow oven to simulate the five temperature zones of the tunnel reflow oven. Each temperature section of the temperature point and the corresponding time is designed to ensure SMT PCB board different requirements. In order to better explain the requirements and functions of each temperature section, the temperature difference is now described separately.

1. The purpose and function of the preheating section

The purpose is to heat the PCB board to 120-150 ℃ at room temperature, which can fully volatilize the PCB board moisture, eliminate the PCB board internal stress and some residual gas, and is a gentle transition to the next temperature section. Time is generally controlled in 1-5 minutes. The specific situation depends on the size of the board and the number of components.

2. The Purpose and Role of Heating Section

The PCB board, which is processed by the preheating section, activates the scaling powder in the tin paste when it is in the process of heating, and eliminates the oxide in the tin paste and the surface of the component by the action of the scaling powder to make it ready for welding process. At this stage, the temperature of lead alloy solder and precious metal alloy solder is usually set between 150-180 degrees, such as Sn42%-Bi58% Sn Bi alloy low temperature lead-free solder, Sn43%-Pb43%-Bi14% lead solder and so on. Medium temperature lead alloy solder is generally set at 180-220 degrees centigrade. High temperature lead free alloy solder is generally set at 220-250 degrees centigrade. If you have some solder and tin paste on hand, the temperature of the heating section can be set at about 10 degrees lower than the melting point of the tin paste.

3. The Purpose and Role of the soldering Section

The soldering section is to complete the soldering the components on PCB and uses the highest temperature of the whole process. It is easy to damage components that can't meet the temperature requirements. The physical and chemical changes of solder are the largest and molten solder is easy to oxidize in high temperature air. This stage is generally based on the tin paste data, the melting temperature of about 30-50 ℃higher. No matter lead or lead free solder, we usually divide it into low temperature solder (150-180 DEG), medium temperature solder (190-220 DEG C) and high temperature solder (230-260 DEG C). High temperature solder is now widely used in the use of lead-

free solder, low temperature solder is usually lead-free solder of precious metals and low temperature lead solder which has special requirements, however, it's relatively rare in general electronic products, mostly it's used in electronic equipment with special requirements. Lead temperature solder has excellent electrical, physical and mechanical properties, thermal shock resistance and oxidation resistance. These properties cannot be replaced by all kinds of lead-free solder at present, so they are widely used in general electronic products.

The time of this phase is usually set according to the following requirements. Soldering Tin displays in liquid in high temperature melting, all the SMT elements will be floating on the liquid soldering tin surface, under the action of scaling powder and liquid surface tension, the floating components move to the center of the pad and are automatically aligned effect. In addition, under the wetting of the flux, the solder will form an alloy layer with the surface metal of the prefabricated parts and penetrate into the structural structure of the element to form the ideal brazing structure. The time is generally about 10-30 s, large area and a PCB board components with large shade should be set to cover larger nightside long time; PCB in less parts small area generally set for a shorter time. In order to ensure the quality of reflow, it is necessary to shorten the time of this stage as much as possible so as to protect the components.

4. The Purpose and Role of the Insulation Section

The role of the insulation section is to make high-temperature liquid solder solidified into solid welding point, the quality of solidification directly affect the crystal structure and mechanical properties of solder, too fast solidification time will make the formation of crystalline solder rough, and physical performance decreased. In the high temperature and mechanical impact, welding points can easily crack and lose mechanical connection and electrical connection function, the durability of the product is reduced. What we use is to stop heating and keep it warm for some time so that the solder can solidificate and crystalize better,

the temperature is generally set 10-20 ℃ lower than the solder melting point, by setting natural cooling time, the solder will enter into cooling section when temperature drop to that point.

5. The Purpose and Function of Cooling Section

The function of cooling section is relatively simple, usually cooling to the temperature that is not hot. But in order to speed up the operation process, you can also end the process when it drops below 150 ℃. However, when taking out PCB board, use a tool or hand belt or even temperature gloves to prevent burns.

6. *Notes*

Temperature curve is generally raised from low temperature, and reduce the reflow temperature as much as possible after meeting the requirement of reflow furnace operation. The temperature can also be reduced by appropriately prolonging the reflow time. This is beneficial to protect the low

temperature resistant components, and connectors. Some components cannot meet the temperature requirements; this problem can be solved by back welding.

VI. Operating Parameter Setting

Generally speaking, you need to set the operating parameter at the time of using the machine or when the tin liquid formula is changed. Moreover, you may set up the language of the machine according to your preference. There are two operating modes, i.e. “REFLOW SOLDERING” and “CONSTANT TEMPERATURE”. “REFLOW SOLDERING” Mode is
designed for soldering SMT circuit board components and has five temperature setting modes in the entire process, i.e. Preheat, Heating, Soldering, Heat Preservation and Cooling. “CONSTANT TEMPERATURE” mode is designed for dismantling circuit board components or drying goods and only has one temperature setting mode. Before heating, please confirm whether set temperature value and set time value are reasonable.

1、Starting Up

Turn on the main power switch at the back of the machine, and the red indicator light on the upper left of the screen will be on. Press “POWER SUPPLY” on the panel and then “PRESET”, “PRODUCTION” and “CONSTANT TEMPERATURE” will be displayed on the LCD screen as shown in Fig. 3

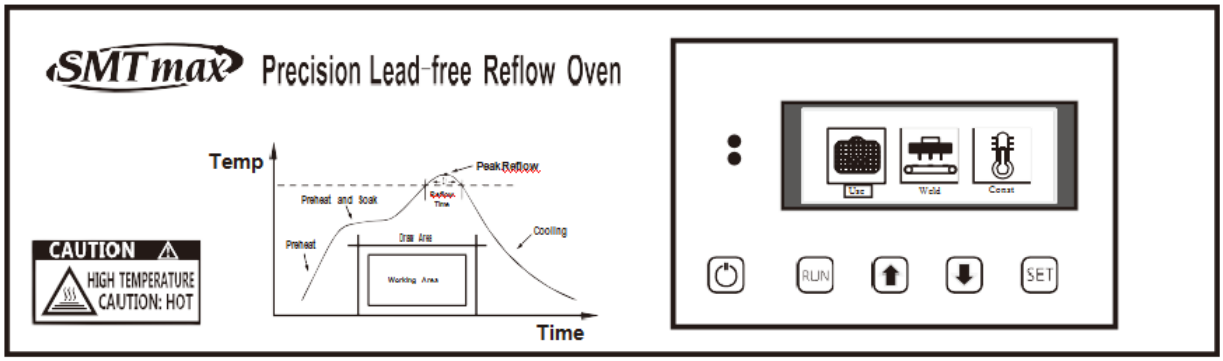


Fig. 3

2、Language Setting

Before pressing “POWER SUPPLY”, long press “SET” button as shown in Fig. 4. Press

“PAGE DOWN” button and select language setting to conduct Chinese-English switch

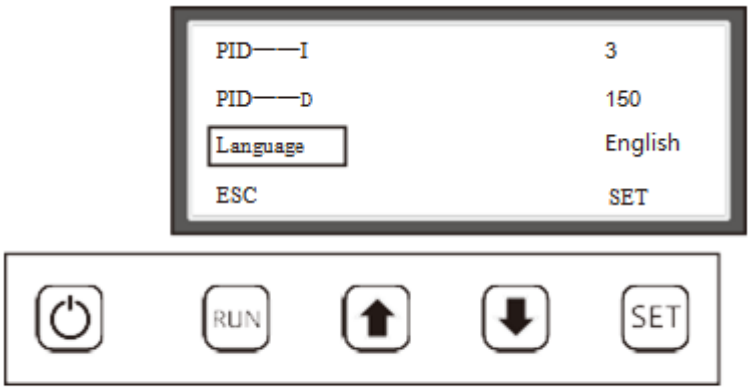


Fig. 4

3、Production Mode Setting (Temperature and Time Settings Are Only for Reference)

①.After pressing “POWER SUPPLY”, “PRODUCTION” is in highlighted state, which means being selected. Press “RUN” as shown in Fig. 5 and press “SET” button to select “PREHEAT”, “TEMPERATURE” and “TIME” modes. When the heating mode is “PREHEAT”, press “SET” button to switch “TEMPERATURE” column to the highlighted state, as shown in Fig. 6. Press “PAGE UP” button and “PAGE DOWN” button to conduct preheating temperature preheating setting. The minimum preheating temperature shall be set as 70℃. Press “SET” button to switch “TIME” to the highlighted state and conduct time setting.

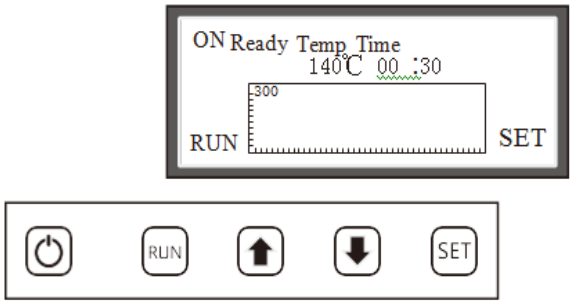


Fig. 5

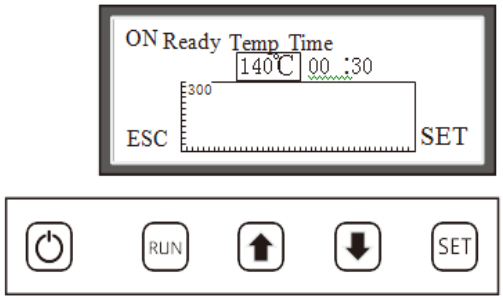


Fig. 6

②.Press “SET” button to switch “PREHEAT” to the highlighted state, press “PAGE DOWN” button to switch to “Heating” as shown in Fig. 7. Press “SET” button again to switch “TEMPERATURE” to the highlighted state and conduct temperature setting by pressing“PAGE UP” button and “PAGE DOWN” button. The temperature setting range shall be higher than the set preheating temperature. Press “SET” button to switch “TIME” to the highlighted state as shown in Fig. 8 and then conduct time setting.

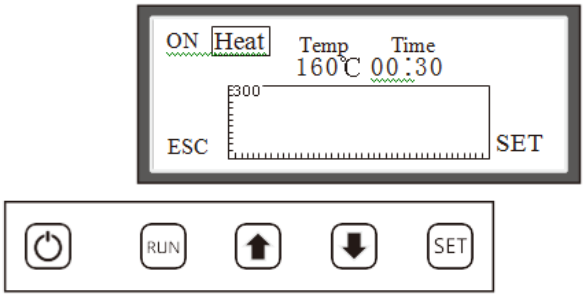


Fig. 7

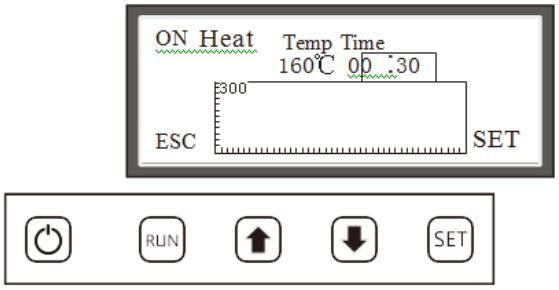


Fig. 8

③.Press “SET” button to switch “Heating” to highlighted state, and press “PAGE DOWN” button to switch to “SOLDERING”. Press “SET” Button again to switch “TEMPERATURE” to highlighted state. Press “PAGE UP” button and “PAGE DOWN” button to conduct the setting of “TEMPERATURE” as shown in Fig.9. Press “SET” Button again to switch to “TIME” setting to highlighted state as shown in Fig.10, and then conduct time setting.

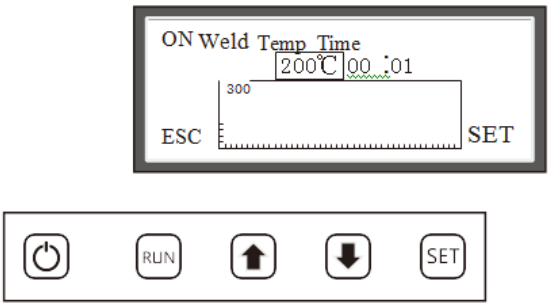


Fig. 9

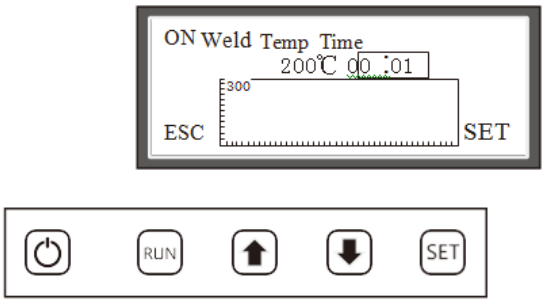


Fig. 10

④.Press “SET” button to switch “SOLDERING” to highlighted state, and press “PAGE DOWN” button to switch to “HEAT PRESERVATION”. Press “SET” Button again to switch “TEMPERATURE” to highlighted state. Press “PAGE UP” button and “PAGE DOWN” button to conduct the setting of “TEMPERATURE” as shown in Fig.11. The heat preservation setting range shall be lower than the soldering temperature. Press “SET” Button again to switch to “TIME” setting to highlighted state as shown in Fig.12, and then conduct time setting.

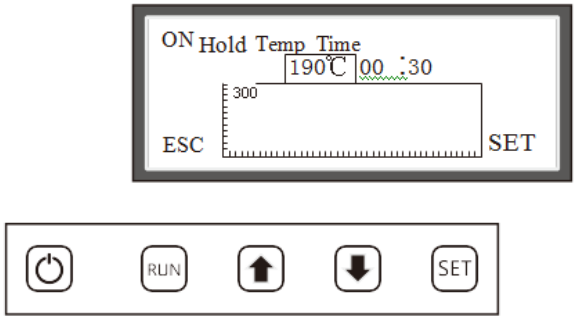


Fig. 11

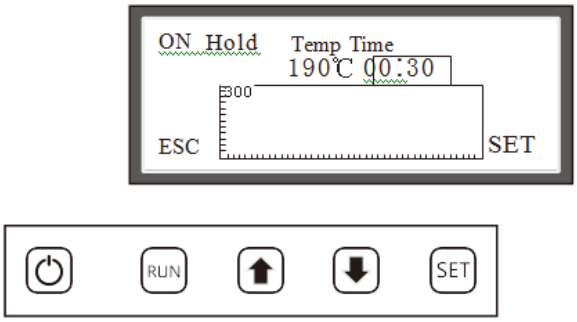


Fig. 12

⑤.Press “SET” Button to switch “Heat Preservation” to highlighted state, and press “PAGE DOWN” button to switch to “cooling”. Press “SET” Button again to switch“TEMPERATURE” to highlighted state. Press “PAGE UP” button and “PAGE DOWN” button to conduct the setting of “TEMPERATURE” as shown in Fig. 13. The heat preservation setting range shall be lower than the soldering temperature. “TIME” setting is not available under cooling mode and its default value is 00:00.

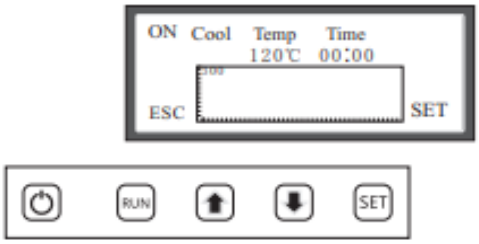


Fig. 13

4、Constant Temperature Mode Setting (Temperature and Time Settings Are Only for Reference)
After pressing “POWER SUPPLY”, “PRODUCTION” is highlighted. Press “PAGE DOWN” button button to switch “CONSTANT TEMPERATURE” to highlighted state, which means being selected as shown in Fig. 14. Press “RUN” button to confirm entry as shown in Fig. 15. Press “PAGE UP”button and “PAGE DOWN” button to conduct temperature setting. Press “RUN” button to run and Press “SET” Button to exit.

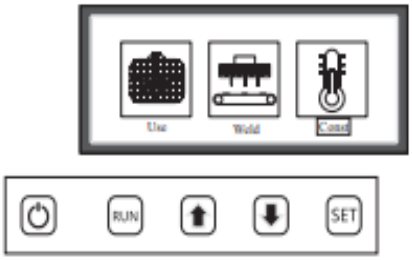


Fig. 14

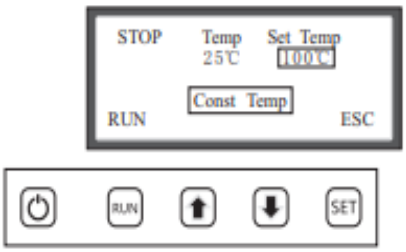


Fig. 15

5、Preset Mode Setting (Temperature and Time Settings Are Only for Reference)

①.After pressing “POWER SUPPLY”, “PRODUCTION” turns into highlighted state.
Press “PAGE UP” button to turn “PRESET” into highlighted state, which means being selected as shown in Fig. 14. Press “RUN” button to confirm entry as shown in Fig. 15. Press “PAGE UP” button and “PAGE DOWN” button to conduct the setting of “Lead Soldering 1” and “Lead-Free Soldering”.

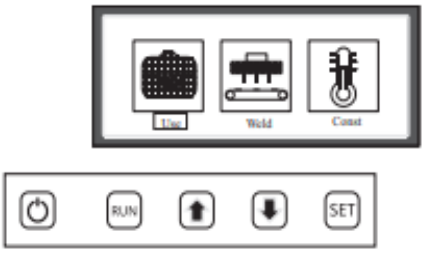


Fig. 16

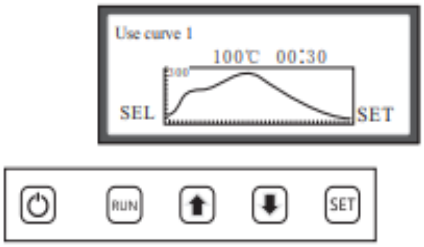


Fig. 17

②.After selecting “Lead Soldering 1”, press “SET” button to conduct setting as shown in Fig. 18. Press “SET” button to switch “Heating Zone”, “TEMPERATURE” and “TIME”. Press “PAGE UP” button and “PAGE DOWN” button to conduct the setting of “TEMPERATURE” and “TIME”. Press “RUN” button to exit as shown in Fig. 15. Press “RUN” button again to select as shown in Fig. 19. After saving the preset is successful, it will automatically switch to main interface of “PRESET”, “PRODUCTION” and “CONSTANT TEMPERATURE”, as shown in Fig. 14. After entering “PRODUCTION” interface, the time and temperature values are preset values.

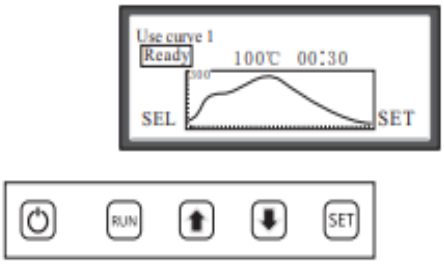


Fig. 18

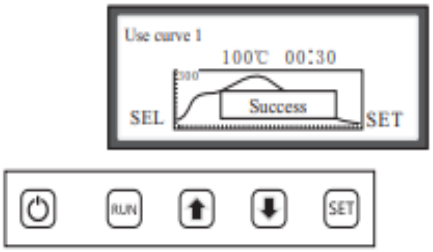


Fig. 19

VII. Reflow Soldering Operation

When the setting is completed and the machine meets safety operating conditions, put the circuit board placed with the components into the middle of the tray and then feed into the case. Press “RUN” button to enter working state after entering production state, as shown in Fig. 20. Highlighted state in the upper left is shown in the display screen; the temperature display is current case temperature, and the time display is the set time value. After the temperature reaches the set value, the time starts counting down. After counting down, it will enter the next temperature zone. When each temperature zone reaches the constant temperature zone, the lower operating panel indicator light will flicker. When the actual temperature are about 5℃ more than the set temperature, the fan will be opened to cool the temperature and the power indicator light on the upper operating panel will flicker at this time. If you want to exit during the operation, you can press “SET” button to exit. When the machine reaches the cooling zone during operation, the fan will make all-out efforts to exhaust air. At this time, the power indicate light will be off, the buzzer alarm will be alerted when the temperature is dropped to the set temperature. The displayer screen will show “COMPLETE”, as shown in Fig. 21. For the sake of safety, the cooling fan will continue working until the temperature is decreased to 80 and the fan will stop exhausting air.

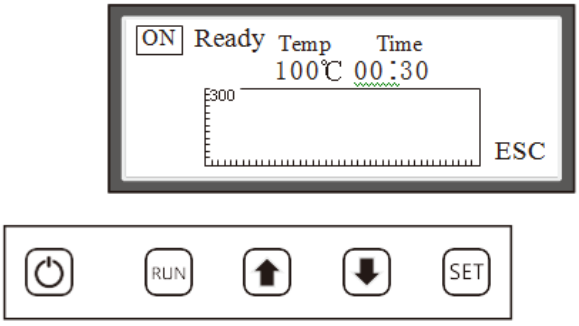


Fig. 20

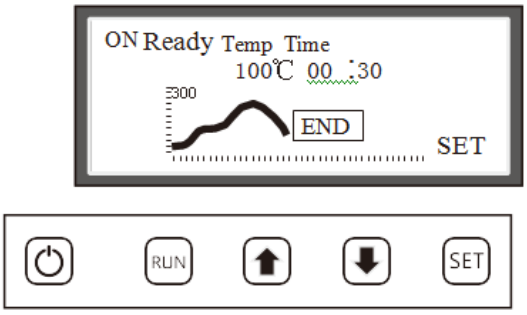


Fig. 21

VIII. Connect the computer for operating

AE drawer type reflow oven equipped with DB9 port to connect the customer's computer, which is convenient for the customers to operate the reflow oven with computer and test the temperature curve in time.。

1、Equipment connection

Connect the right and back of the reflow oven with one side then connect the computer with DB9 with the other side through equipped series report extension cord. Secondly, press power supply then the button screen light after getting through the power supply. Check the port part and record the communication port name by double-clicking to open the reflow oven monitoring software. "Port" choosing record communication port name and clicking to open then click again to connect, then the reflow oven screen will show: upper computer communicating... the software info part will show: has connected this equipment. The window display will show as Fig. 22.

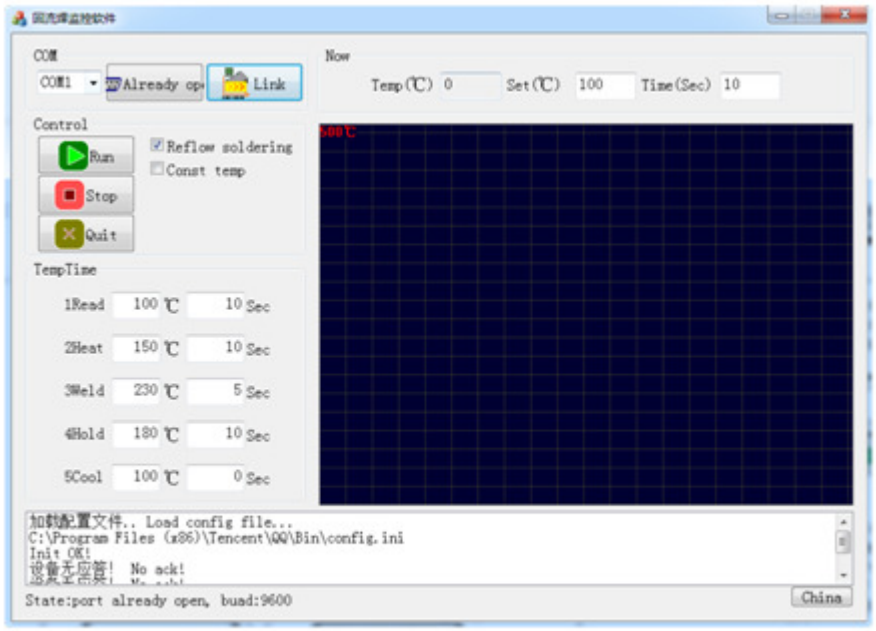


Fig. 22

2、Specifications setting

Check and choose reflow oven mode "temperature and time" column to set each section temperature and time of the reflow oven, click Run after complete setting then can show the real time temperature on the "front" column, show temperature curve at the lower down corner. Check and choose constant temperature mode and set the constant temperature need to import on the "front"column. The

window display show as Fig. 23

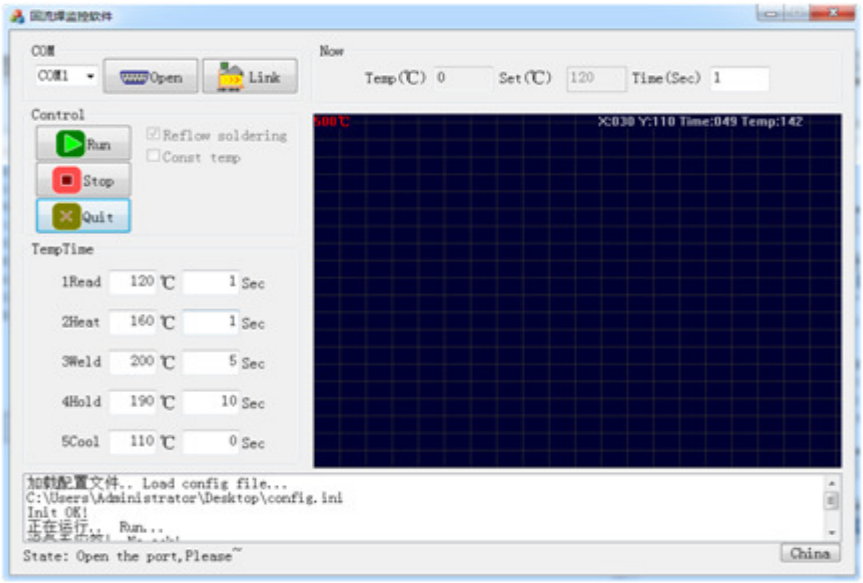


Fig. 23

IX. Physical Constants and Characteristics of Common Alloy Solder

Filler metal									Melting point	Mechanical properties			Conductivity
Tin	Lead	Silver	Antimony	Bismuth	Indium	Gold	Copper	Zinc	Liquid line	Tensile strength	Elongation	Hardness	
Sn	Pb	Ag	Sb	Bi	In	Au	Cu	Zn	(℃)	(MPa)	(%)	(HB)	
63	37								183	61	45	16.6	11
60	40								183	60	43	16.4	11
10	90								299	41	45	12.7	8.2
5	95								312	30	46	12	7.8
62	36	2							179	64	39	16.5	11.3
1	97.5	2.5							309	31	50	9.5	7.2
96.5		3.5							221	45	55	13	13.4
	97.5	2.5							304	30	52	9	8.8
95			5						245	40	38	13.3	11.9
43	43			14					163	55	57	14	8
42				80					138	77	20-30	19.3	5
48					52				117	11	83	5	11.7
	15	5			80				157	17	58	5	13
20						80			280	28	-	118	75
	96.5					3.5			21	20	73	40	14
87		3		7	7		3		21	45	60	14	9
91								9	199				
95.74		3.1					1.5		217				
99.3							0.7		227				
95			5						240				

X. Adjusting Parameters of Temperature Curve of Common Alloy Solder

The type of filler	Formula proportion	Preheating temperature zone ℃	Heating temperature zone ℃	Welding temperature zone ℃	Heat preservation temperature zone ℃	Cooling temperature zone ℃
Lead cpyogenic material	Sn43-Pb43-Bi14	100-120	130--150	200-210	170	150
Lead-free low cpyogenic material	Sn42-Bi58	100-120	120-130	180-200	150	150
Lead-free low cpyogenic material	Sn48-In52	100-120	120-130	180-200	150	150
Lead cpyogenic material	Sn63-Pb37	130--150	170-180	230-240	180	150
Lead cpyogenic material	Sn60-Pb40	130--150	170-180	230-240	180	150
Lead cpyogenic material	Sn62-Pb46-Ag2	130--150	170-180	230-240	180	150
Lead-free low cpyogenic material	Sn96.5-Ag3.5	130--150	180-190	240-250	240	150
Lead-free low cpyogenic material	Sn87-Ag3-Cu3-In7	130--150	180-190	240-250	240	150
Lead-free low cpyogenic material	Sn91-Zn9	130--150	180-190	240-250	230	150
Lead-free low cpyogenic material	Sn95.4-Ag3.1-Cn1.5	130--150	180-190	250-260	240	150
Lead-free low cpyogenic material	Sn99.3-Cu0.7	130--150	180-190	270-280	260	150
Lead-free low cpyogenic material	Sn94-Ag3-Cu3	130--150	190-220	240-250	240	150
Lead-free low cpyogenic material	Sn97-Cu3	130--150	190-220	270-280	250	150
Lead-free low cpyogenic material	Sn95-Sd5	130--150	190-220	270-280	250	150

XI. Equipment Installation/ Debugging and Installation Environment

- Equipment should be installed in a place convenient for short distance exhaust. The power supply should be equipped with a 15A high current tripod socket, and the ground terminal must be grounded reliably.
- The exhaust pipe should use ϕ100mm aluminum exhaust pipe, the outlet height of exhaust pipe should be higher than the machine installation height of 1000mm or more. This is conducive to the use of hot air chimney exhaust effect.
- Machine of short-term use is not required to install the exhaust pipe. But the distance from wall to the back of the machine should be increased at least 200mm.

- Do not place other objects on the top of the machine, especially flammable liquids, such as "washing board water, sky water, alcohol, methanol, gasoline" and so on.
- The machine can be cleaned in the state of cooling off. Wipe the inside of the machine with a wiping cloth to wash plate water or anhydrous alcohol, the outside of the machine can be scrubbed with water detergent. The machine can only be switched on until it is completely dry.
- At the beginning of use the machine may discharge some miscellaneous gas, this is a normal phenomenon, after a period of time this kind of smell will disappear.
- When the machine is not used, you should switch off the power switch behind the machine. In the state of the software shutdown, the main control board of the machine is still at work. When not in use for a long time, you should remove the machine, pack it and put it back to the original container to avoid moisture and prevent insects, mice or other things alike to climb inside to damage the machine.
- When reflow oven is in the reflow of small pieces of PCB board or FPC board, you should use the high temperature mica plate, and four sides leave at least 30mm gap to ensure uniformity of temperature. A good reflow process should be retained and used after the machine has been tested accurately. The machine's built-in temperature curve is used only as a reference. Try to be able to use low temperature long time reflow temperature curve to reflow temperature sensitive precision devices, such as "LED, laser head, micro connector, soft package, IC, camera" and so on. In the case of components can resist high temperature, you can appropriately increase the "welding section" temperature to reduce reflow soldering time.

XII NOTES

- Please use a separate 15A or more dedicated power outlet, do not share the same electrical outlet with other electrical appliances, and the power outlet must be reliable grounding.
- Reflow oven should be placed horizontally; the surrounding wall should be more than 20cm gap.
- Do not use reflow oven in humid or high temperature environments.
- Please don't wash the machine directly with water to avoid destroying the insulation performance of the machine.
- Do not insert wire or other foreign objects into the air inlet and outlet to avoid burns or affect the ventilation and heat.
- Do not put flammable, explosive dangerous goods near the reflow oven; items with flammable and explosive gas can’t be dried to avoid danger.
- Please avoid collision with the machine to avoid damage to the heating pipe, if found the heating pipe rupture, should turn off the power supply and sent to repair.
- If the machine is working or has not cooled to a safe temperature, do not put your hand into the chassis to avoid burn.
- If the infrared heat pipe damages, it must be equipped with the original dedicated infrared heating tube.

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XIII. Fault Alarm

- Sensor Failure

In the operation of the equipment, if the temperature measurement element is damaged, it will automatically alarm and the display will show "sensor fault", as shown in Fig. 24.

- Heating Failure

In the operation of the equipment, if the temperature of the oven cannot be detected, the device will report heating failure alarm, and the display will show "heating fault", as shown in Fig. 25.

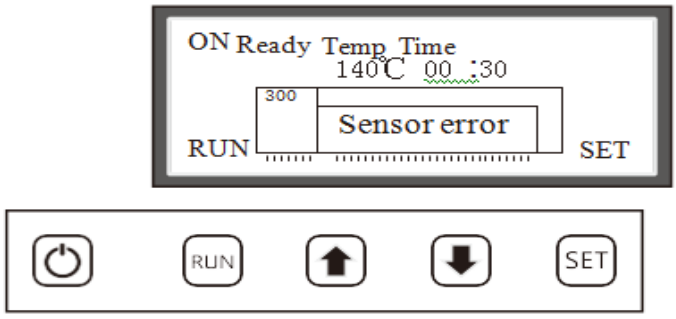


Fig. 24

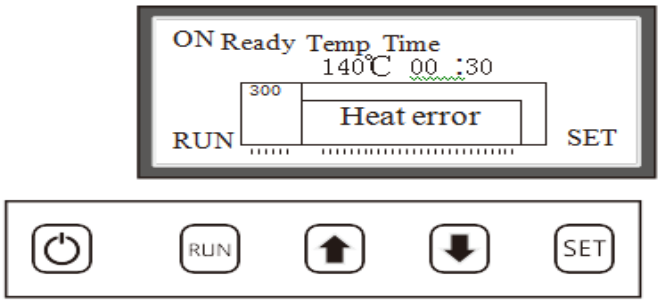


Fig. 25