Madell MD-RF330, MD-RF430, MD-F630 Reflow Oven
User's Manual

Madell Technology
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Specifications

MD-RF330:

Heating channel width: 300mm
Heating channel length: 750mm
Entry clearance: 25mm
Conveyor speed: 200-800mm/minute
Regular reflow time: 5-8 minutes
Max power: 6 Kw
Normal working power: 1.8Kw
Power supply: single phase 220V AC, 30A
Weight: 125Kg

MD-RF430:

Heating channel width: 300mm
Heating channel length: 1000mm
Entry clearance: 25mm
Conveyor speed: 200-800mm/minute
Regular reflow time: 3-5 minutes
Max power: 8 Kw
Normal working power: 2.2Kw
Power supply: single phase 220V AC, 40A
Weight: 150Kg

MD-F630 (panel controlled version):

Heating channel width: 300mm
Heating channel length: 1000mm
Entry clearance: 25mm
Conveyor speed: 200-800mm/minute
Regular reflow time: 3-8 minutes
Max power: 12 Kw
Normal working power: 6Kw
Power supply: single phase 220V AC, 60A
Weight: 250Kg

Installation

Installation Site:

- Select a clean site
- The site should not be high temperature and humidity
- Avoid electronic magnetic interference
- Do not let the reflow oven input and output openings face a fan or open windows

Warning:

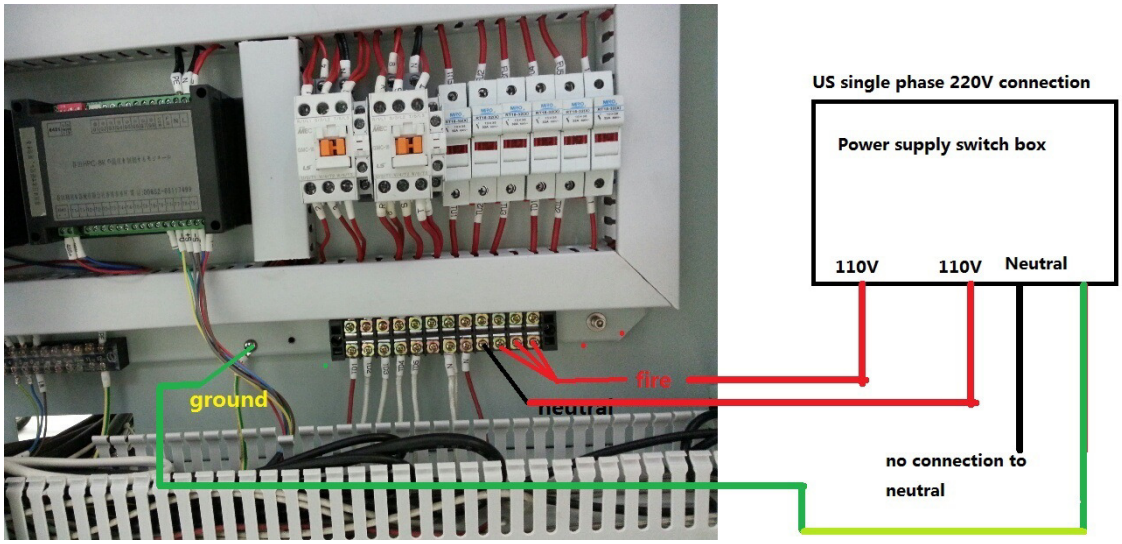
- Do not place items except PCB into the oven
- Pay attention to high temperature when the oven is in operation
- Do not maintain the oven when the temperature is still high

Operation Temperature:

- Temperature: 5-40ºC
- Humidity: 20-95%
- Transportation temperature: -22-55ºC. Avoid extreme humidity, shake, vibration and pressing on it

Electricity:

- 3 phase 380V AC, or single phase 220V AC
- Normally, the Red wire from the oven is connected to power supply fire, Black wire connected to neutral, Yellow/Green wire connected to ground
- Make sure Ground is securely connected
- **No matter 3 phase/380V or single phase/220V is used, there should be 220V voltage between fire and neutral (between red and black wires from the oven)**
  If single phase 220V is used, all red wires should be connected together to fire.
  If three phase 380V is used, red wires can be distributed to different phases.
- Installation must be performed by certified electricians and technicians



Height Adjustment:

Use the four adjustable legs under the oven to adjust the height of the oven

Operation notifications:

- The oven should be used in a clean environment
- Do not use the oven outdoors
- Power should be turned off anytime the oven is maintained
- The mesh conveyor should be clean of strange items
- Keep the oven leveled and stabilized
- Keep hands and other body parts off the oven to avoid burning injury

Reflow Oven Heating

Convection heating:

Air is heated and blow to the PCB's.

Advantages of convection heating:

- Better to part not directly exposed
- Heat is directly transferred to pads and solder paste
- Parts not easily get overheat
- Temperature is spreads evenly on different parts
- Better heat distribution
- Can be used for different working pieces, like flexible PCB's

Infrared Heating:

Heat is radiated from heating elements. The IR waveform is 4.5μm.

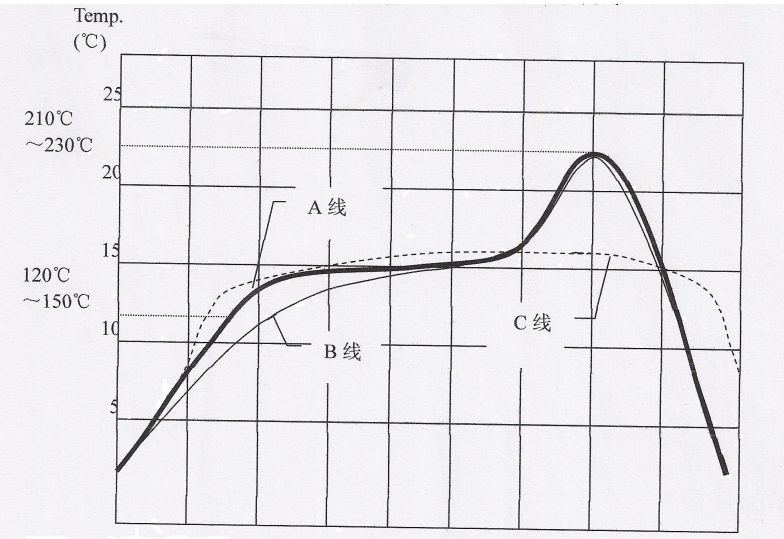
Advantages of IR heating:

- Less solder oxidization
- Lower power consumption
- Faster heating up
- Room to working temperature: about 30 minutes
- Temperature change: about 10 minutes
- Cleaner for flux

Each heating zone has a temperature sensor. The sensor is calibrated and should not be altered.

Each zone has a PID temperature controller.

Temperature Profile



Suggested temperature profiles

Curve A: for regular solder paste

- The PCB pads temperature reaches to 120-150ºC within 60 seconds. Temperature rising rate is below 3ºC/second.
- The temperature stays at from 150ºC up to 183ºC from 80 to 180 seconds. This will make sure the paste temperature is evenly raised to below the melting point.
- Keep the temperature at 183ºC up to 210ºC-220ºC for 30 seconds at the reflow temperature

Curve B: for PCB with fine pitch components and small parts (1005)

Slow down the temperature rising rate to avoid the formation of solder balls.

Curve C: for glue

Keep the temperature at 150ºC for 3-5 minutes.

Designing a Temperature Profile

Many factors affect the heating process of a PCB: PCB thickness, PCB material, SMT parts, density of parts on the PCB, pad sizes, solder paste, etc. A proper temperature/timing curve should be obtained for successfully PCB reflowing.

Four stages:

- Fast heating up: main purpose is to heat up the PCB board
- Preheat: solder paste heating up
- Reflow: solder paste meting
- Cool down

Top Heating:

- Temperature should be set relatively higher and time shorter if pads or solder paste is exposed directly to IR radiation
- Temperature should be set lower and time longer if pads are not exposed directly to IR radiation

Conveyor speed

Conveyor speed directly affects the timing of the reflow process. It should be set slower for thick PCB's and faster for thinner PCB's.

Bottom Heating

Bottom heating is slower and gentler. Bottom heating should be selected if the part can be damaged by the faster top heating.

The MD-R330 and MD-R430 ovens are not manufactured with bottom heating zones.

Temperature Setting

1. The oven comes with pre-set temperatures and conveyor speed.
2. Oven should be warmed up for 20-30 minutes before it can used to process PCB's.
3. If the solder paste does not melt:
4. Reduce conveyor speed 5-10%.
5. Increase temperature. Increase 5ºC every time.
6. Fine adjust the conveyor speed after the above adjustment to reduce excessive heating.
7. Note: The PCB and parts normally can go through 2 times of reflow process.

Turn On the Oven

1. Turn on supply power switch.
2. Turn on oven power switch.
3. Press the green button on the oven
4. Turn on the conveyor switch (turn from "Stop" to "RUN"). Make sure that the speed setting is at the desired number.
5. Turn on the heating zones.
6. Temperature can be changed by pressing the "Set" key till the LED flashes. Use the up and down arrow keys to change the temperatures. Press the "Set" key again to enter the new temperature.
7. The oven temperatures should be stable at the desired temperature after about 20-30 minutes.

It may be necessary if temperature still changes up and down more than 10ºC after warm up. Press the "Set" key for more than 10 seconds till the menu LED display flashes. Press "Set" key again at this time to bring up the ATU list. Change its number from 0000 to 0001. Press the "Set" key till the LED stops flashing. Wait for 5 minutes for the new setting to reflect on the oven temperatures.

Turn Off the Oven

In normal operation:

1. Check if all PCB's are out.
2. Turn off all temperature switches.
3. Let the conveyor move for 10-15 minutes.

4. Turn off the conveyor.
5. Press the red button and turn off the main power supply.
6. Turn off the power supply.

Emergency button is pressed
First press the red power button to cut off the power supply to the oven, and then turn off the main power supply.

Double Side PCB

Both of the convection and IR (or mixed) can be used for double side PCB's.

- Turn on oven.
- Adjust conveyor speed to 1.8-2.2M (it takes about 5 minutes for the PCB to go through the oven).
- Finish one side of the PCB first.
- Turn over the PCB and place on the oven to process the other side. Melting point of the solder is changed from 183ºC (leaded paste) to 260ºC so that it will not be melt again.

Trouble Shooting

For a new reflow oven, the most happened problems are:

- Oven timer is loose. It looks like a small watch and is located at back of the oven. Unplug it and plug back securely
- Emergency button is pressed down
- Power between fire and neutral is not 220B

Machine does not turn on:

- Check power supply
- Check fuses at back of the oven

Temperature does not go up

- Check if solid state relays are plugged in securely

- Check if IR heating elements are broken or bad connection

Convey does not move:

- Check if motor is turning
- Check if mesh belt is stopped by something

Fan is not on:

Check if the connection wires are loose or broken

Maintenance:

Make sure power cable is unplugged from the power supply before doing any maintenance work.

Change conveyor belt:

Find the connect section on the belt. Pull it out and take off the belt from the oven. Reverse this procedure to install a new belt. The belt tension can be adjusted by the adjustment screws located at both ends of the oven. Do not make the belt too tight.

PCB Reflow Problems

Problems	Possible causes	What to do
Solder paste not melt	• Temperature too low • Show to prevent IR • Ground layer	• Reduce conveyor speed • Increase temperature • Do both
PCB deshape	Temperature too high	• Reduce temperature • Increase conveyor speed
PCB brown or black	Temperature too high	Increase conveyor speed Reduce preheat temperature
	Temperature rises too fast	Reduce conveyor speed
Small paste residues	• Temperature too high • Solder paste too thin • Stencil too thick	• Reduce temperature • Replace solder paste • Replace stencil
Solder balls	• Preheat temperature too high • Bad stencil printing • Bad paste • Paste has water • Too much paste	• Reduce conveyor speed • Reduce temperature • Replace paste • Reduce room humidity • Improve stencil printing
Flux burnt	Temperature too high	• Increase conveyor speed • Reduce preheat temperature
Fine pitch part moved	• Not placed correctly • Bad stencil printing • Preheat temperature too high	• Check pick and place • Check stencil printing • Reduce conveyor and preheat
Short bridge	• Bad stencil printing • Stencil has paste at back • Solder paste too thin • Preheat too fast	• Check stencil printing • Clean stencil • Adjust printing pressure • Replace solder paste • Adjust conveyor and temperature
Solder shift	• Solder paste over time • Solder paste too thin • Room temperature too high	• Adjust conveyor speed • Adjust oven temperature • Control room temperature • Select proper paste
Part stand up	• Preheat temperature too fast • Temperature not even • Part is dirty • Bad solder paste	• Adjust temperature and speed • Check the part • Replace solder paste
Fault soldering	• Paste printed too thin	• Check stencil printing

	• Not even printing • Pad not even or dirty	• Check PCB flatness • Check part legs

Regular Maintenance

- Check if power supply is stable and is within working range
- Check if conveyor speed and temperature setting have changed
- Do not turn off the conveyor when the temperature is still high
- Clean the outside and inside of the oven regularly as necessary
- Lubricate the conveyor belt once in two months
- Conveyor motor should be lubricated twice a week with high temperature lubrication oil, like auto oil
- Clean the cooling fan regularly
- Make sure that the power supply ground wire is connected to the oven body securely