

# HotAir06

HOT AIR / QUARTZ REFLOW OVEN

## User manual

Version 3.00



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## IMPORTANT SAFETY RULES FORCED AIR CONVECTION OVEN



### ***Risk of fire and burning:***

***When the oven is in production mode it is dangerous to leave the oven unattended. High temperature! The oven is a heating device and therefore there is always the risk of fire. When you place in - or take out – a PCB when oven is at working temperature use protective gloves or a heat resistant tool. We recommend the use of our PCB carrier to handle the placement and removal of the PCB.***

***When the oven is on fire, pull out the plug and close the door because then the flames will be extinguished.***

***Put no flammable materials near or on the reflow oven. While operating don't touch the cover of the oven, it can be very hot. You risk a serious burning of the skin.***



### ***Machine location:***

***Use this oven not outdoors! The oven is developed to install it on a flat, dry surface. This surface or table must be capable to carry a weight of at least 30 Kg. The oven should be used with normal room temperatures from 18 to 25 degrees.***

***It is not allowed and even dangerous to build it in a cupboard or box. Install this oven not near a heating element or stove, also not in a wet environment.***



### ***Power supply:***

***Put the main plug in the wall socket near by the oven, this is important! Because in case of an emergency the operator can pull out the plug.***

***The power supply is 230V 50 Hz AC normal power outlet. It must be secured with a 16 A fuse. This oven must have a dedicated power outlet which can only be used by this oven.***



### ***Normal use:***

***The oven is developed only for soldering of PCB's, don't use the oven for food, animals or heating of other materials. You will lose warranty if you don't commit to those rules.***

***Don't use the oven when it's damaged or not working properly.***

***Check the properly working of the oven by following the checklist below:***

- 1.** Check the door. The door must not be bent or damaged. After firing-up on the oven check the closing mechanism by opening and closing door. The oven must respond to it. If not: **DON'T USE THE OVEN** but contact your dealer. Don't use the oven when there is a piece of material between the door latch and ceiling's. When the door or ceilings are damaged it's dangerous to use the oven
- 2.** Check the hinge and safety door handles. Don't use the oven if they are broken or loose.
- 3.** Check the door sealing. Are they not damaged?

4. Check if there are no dents in the oven space
5. Check the line cord, plug and outlet. Be sure they are not damaged. *Clean the oven frequently by removing old parts drops from the PCB. Keep the glass clear so you can observe what is going on inside the oven.*



**High voltage - ONLY QUALIFIED PERSONS MAY OPEN THE CASING:**

**The casing may never be opened or removed when it is plugged into an active wall outlet!** *Inside the machine there are high voltages which can be lead to dead or serious injuries. Don't put the plug and the line cord into any kind of liquid. Avoid situations that liquids or other materials entering the oven through door latching or ventilation grate.*

In the case this is happening:

**Pull the power plug out of the wall outlet.**

Ask your supplier what to do.

Be sure the line cord is not making a sharp hook or is hanging on sharp things.

Avoid line cord to be in contact with warm or hot surfaces.

In case of damage only qualified persons may replace the line cord.



**Operating the oven:**

***It's not allowed to operate this oven under the age of 18 years. It's also not allowed that the oven is operated persons with disabilities which will make it impossible to use the machine in a safe and responsible way.***

***It's strongly recommended that the operator has enough knowledge if working with soldering machines and the use of the right paste for soldering.***

***Use the oven only in well ventilated rooms. Follow the safety rules of your paste supplier. During the soldering process gas and heat will be produced. The gasses can be affect your health in a negative way.***

***It is recommended to buy our extraction hood and fume extractor options!***



**Responsibility at improperly use:**

***Nor the supplier or manufacturer is responsible for damage at the oven or personal injury when safety rules and correct installation are not committed. Also, warranty will be immediately omitted.***

## Introduction.

The HA06 is a solder oven for SMD component with the use of lead free paste. The oven is working with full convection forced air during the preheat stage. When the reflow stage is entered the heating will partly be done by hot air and quartz lamps. The lamps are needed to get a short ramp speed. Once the reflow set point is reached the lamp power will be reduced to a minimum. At this point 85% of the heating is caused by forced hot air. This unique feature makes the oven suitable for solder big SMD components and/or components with pads under their casing while using lead free paste. With good maintenance and proper use the oven will serve your solder needs for a long time with high quality solder results.

*Some of the features include:*

- *Outstanding reflow soldering quality for SMD and hybrid*
- *Cures SMD adhesive*
- *Two microprocessor-controlled heat zones*
- *Optional the oven can be controlled with a PC using a USB port. With the PC the oven can be used as a multi zone oven.*

## Inside the box

When you've opened the box you will find:

- One spare quartz lamp
- One external sensor
- One tube lubricant
- This manual
- The oven

Carefully take out the oven.

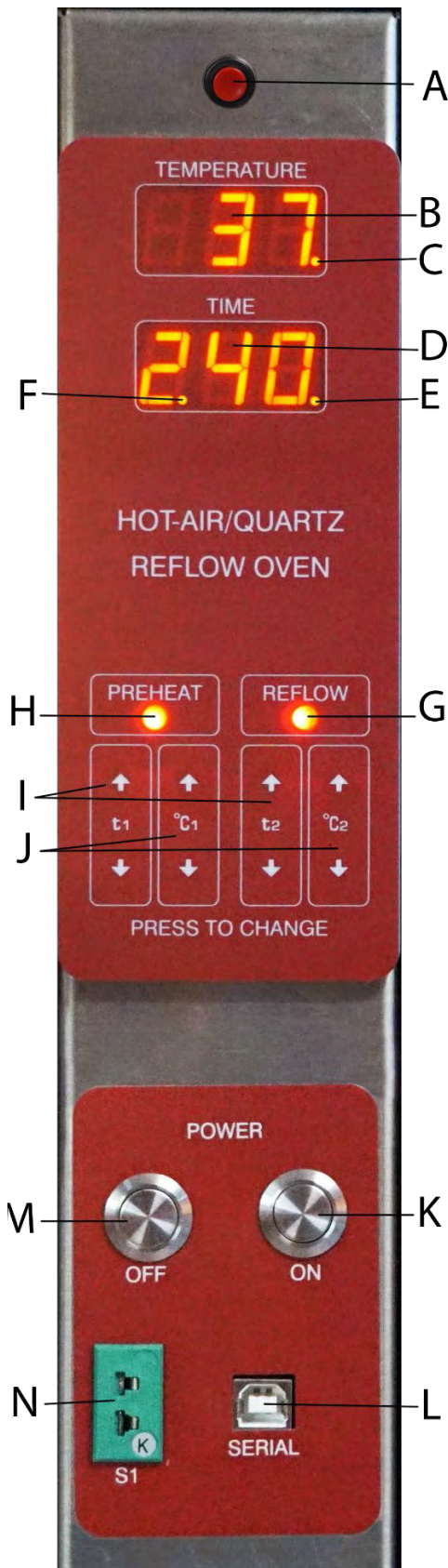


***Watch the weight: 23Kg!***

## Installation.

The oven is to be installed on a heat resistant surface capable of carry a load of at least 30 Kg. Put the main supply plug into the wall outlet. This wall outlet/power line must be dedicated to the oven and no other equipment shall use the same power line. The power line must be secured with a 16 amp fuse.

Control panel layout.



## Controls explained.

### A. **Reset button**

When the reset button is pressed all processes are stopped immediately and the oven will restart.

### B. **Temperature display**

Depending of the cycle you will see the pre-heat or reflow temperature in degree Celsius

### C. **Decimal point.**

The decimal point shows the status preheating element. If the point lights on, heater is powered, and the temperature rises. The decimal point one digit to the left has the same function for the quartz heaters.

### D. **Time display / sensor temperature**

Depending of the cycle you will see the actual preheat or reflow time left. When the oven is in standby position you will see the set preheat time.

This display has a double function depending on when a sensor is plugged in or not.

#### a. **No sensor is being used**

Now only the time will be displayed. Depending on the which stage of the solder process is active it will show the preheat or reflow time.

#### b. **Sensor is used**

The display alternately shows the sensor temperature or the process timer. When point F is on you'll see the sensor temperature. When point E is on you'll see the process timer.

### E. **+ F. Point**

E is be used for time and F is used for sensor value

### G. **+ H. Reflow and Preheat LED**

a. When the oven is in idle state both LED's will have the GREEN colour

b. When the oven is going to the idle state while the preheat setpoint is not met both LED's will alternating between RED and GREEN

c. If the oven is running a process cycle the active process LED is alternating between RED and GREEN. If the preheat cycle is running this LED will be alternating while the reflow LED stays GREEN. Once a process cycle I ready the corresponding LED will stay RED.

### I. **Set time switches**

With those switches you set the process time for both, preheat and reflow from 1 to 999 seconds. After time is changed, the new values will be saved.

### J. **Set setpoint switches**

With those switches you set the preheat and reflow set point temperature.

The preheat setpoint can be set between 60 and 240 °C.

The reflow set point temperature between 100 and 290 °C.

Because of physical limits the minimum gap between preheat en reflow setpoint has a minimum value of 40 °C.

### K. **+M Press buttons**

With ON you turn on the oven. With off you'll turn it OFF

### L. **USB B input**

Used to connect the oven with a PC to control the oven or upload a firmware update.

### N. **Thermocouple sensor input**

The external sensor type K is plugged in here. The sensor can be mounted onto your PCB so you can see the temperature on this location.

## Soldering parameters.

If you are an experience operator you know that soldering is more than just heating your product until the paste is melting. You know what to do. For those who hasn't that experience we recommend reading about soldering as much as you can.

Ask your paste supplier for advice because the paste demands the solder heating curve and timing together with the SMD components.

To create a good solder curve you must set the temperatures and times from both the preheating and the reflow. This can be done with the push buttons I and J. The labels above the switches shows to which the switches are used for.

Editing the value during a soldering cycle isn't possible. You can interrupt the soldering process by opening the drawer or pushing the reset button. ***This will terminate the solder process!***

It is not possible to set preheat and reflow temperature in a way that the gap between them is less than 40 °C.

The preheat set point values are between 60 °C and 240 °C. The time values from 1 to 999 seconds.

The reflow set point values are between 100 °C and 290 °C. The time values from 1 to 999 seconds.

Although those settings are available it isn't recommended to use such extreme parameters. Your board will be either too cold or burned out when using the extremes. A standard receipt cannot be given because it depends on both solder paste and components. As mentioned before: let your paste supplier inform you about best practice.

## Prepare oven for soldering

Be sure the drawer is closed. If closed press switch K on the front. The oven will now start heating up to the preheat set point. To speed up this heating both heaters, hot air and quartz lamps are used. Both LED's (H-G) are blinking in this stage, alternating between RED and GREEN. In the time panel you will see the current preheat time. If a sensor is plugged in it will be alternating between sensor and time.

In the temperature panel you can see how the temperature is rising to the preheat set point. During the heat-up time you can edit the temperatures and timing of both zones. In that case the heating-up process is stopped and will be continued after editing is finished.

If the set point temperature is reached the quartz will be turned off. This causing the temperature to drop. When it drops below a certain point (it depends on the height of the set point) the quartz will be activated again. This cycle is repeated for several times and is a normal behaviour.

When the preheat temperature is reached and established the LED's (H-G) are stop blinking, and stay steady at the colour GREEN, accompanied by an acoustic signal. The oven is now ready for soldering PCB boards with SMD components.

**REMARK.** When the oven is ready for use and is not used for a period of 30 minutes it will shut down automatically. This will also happen if the drawer is opened for starting a solder cycle and not closed with 5 minutes. When this happens push at the "Reset" button A to restart the oven. The same cycle now is started as if you pushed on switch K.

## Soldering your first PCB



**Paste and PCB has materials which are release gasses and smoke when heated. Those gasses, especially the gasses and smoke from the paste, are very bad for your health! Therefore, arrange enough room ventilation to extinct the gasses and smoke and thereby conserve your health.**



*We recommend the use of an “Extraction hood” combined with a fume extractor which is capable to suck off the gasses and smoke fast enough.*

*When soldering this PCB model for the first time you better use the “**Learning mode**” described in the next chapter. If you are unexperienced and you will solder a PCB with lead free paste use this setting to start from.*

*Use paste with a melt point of 217 °C.*

*Preheat temperature of 180-190 °C*

*Reflow temperature of 230-240 °C.*

***Remember! Those settings do not guarantee good results but a guideline to start with!***

Once you have set all the parameters correctly, and the oven is ready to solder, you can start soldering.



***WARNING! Use protective gloves or a heat resistant tool to place the PCB in position.***

1. Open the drawer and carefully place your PCB onto drawer frame. This should preferable be done within five minutes. If the drawer is not closed within five minutes, the oven will switch off automatically!  
Close the drawer. As you can see the temperature has dropped a few degrees, that’s normal.
2. The preheater cycle is started after closing the drawer. On the time display you will see the time decreasing. The time display is decreasing in seconds and, if SENSOR is used, between TIME and SENSOR temperature.  
De temperature display is showing the actual temperature. When the timer is reaching zero the reflow stage is automatically started.
3. If the reflow cycle starts, the quartz lamps are turn on for 100% and the temperature display shows a rapidly increasing temperature. The time display is decreasing in seconds and, if SENSOR is used, between TIME and SENSOR temperature.  
When temperature is reaching the reflow set point you’ll see the strength of the quartz heaters are decreasing. This means that the main part of soldering is caused by forced hot air and not radiation. Which make the machine unique in its class.
4. When the cycle is ended the oven starts making noise and on the display the message: “**oPn dOr**”. To avoid the burning out of your PCB it recommended to do this right away! Opening the drawer to maximum giving the PCB and oven the opportunity to cool down.



***WARNING. The air coming out of the oven is VERY HOT. You can easily burn your skin in a seriously way! KEEP DISTANCE!***

***When all solder joints are solid remove your PCB a lay it down on a heat resistant surface.***

***Use protective gloves or a heat resistant tool to remove the PCB from the drawer!***

5. The oven will cool down to a much lower temperature as the preheat set point, that's normal. How much depends of the preheater- and reflow set points. At a certain point the oven demands that you close the drawer. After you've done this you will see that the temperature is rising to its preheater set point. When established at set point the oven will beep and the status LED's will burn steady.

Congratulations! You just finished soldering you first PCB! You now can restart the cycle from step 1.

## Learning mode

Every PCB has its own problems with soldering. When you must solder new type of PCB there is always the risk you make a wrong choice with the settings. The most problematic setting are time. How long will it take until the PCB has its target preheat temperature? You must make a best guess and chose a time!

How much time will it take to reach the melting point? This you can see while looking to the glass window. If the temperature is reached you'll see the past melting. So, to be sure there is enough time to reflow all points you take a long time for the reflow.

When you see all solder points are melted, notice the time used and open the drawer to break the process. Now you can use the found time to edit the reflow time.

In other words: it's a lucky shot when you solder a PCB for the first time and it was successfully.

To overcome this we build in a "learning mode". For this you'll use the external sensor and the best is to use the optional PCB carrier (See Appendix).



*Put the sensor at a place were you expect the soldering will be the most difficult. For this it is the best to put the sensor tip into a small hole like a via. Now you'll measure the PCB temperature and not the air temperature!*



***WARNING. The air coming out of the oven is VERY HOT. You can easily burn your skin in a seriously way! KEEP DISTANCE!***

***When all solder joints are solid remove your PCB a lay it down on a heat resistant surface. Use protective gloves or a heat resistant tool to remove the PCB from the drawer!***

When the oven is ready for soldering (both LED's are GREEN) open the drawer put in the PCB on the drawer frame. Fix the sensor onto the frame so its not moving while closing the drawer. Before you close the drawer press on the [Time UP] below the "Preheat" label and close the drawer. You'll see the timer is set to zero and start counting up.

The time display is now alternating between time and external sensor temperature.

- a. When time is active point E will be ON.
- b. When sensor temperature is active point F will be ON.

Observe the sensor temperature and once it reaches the temperature you like to have press on the [Time UP] below the Reflow label. The time display start at zero and is counting up. Again, observe the sensor temperature to see if the melting point is reached. Once at the melting point observe the PCB to see if all soldering points are melted. Keep the PCB about 10-15 seconds in reflow after everything is melted.

Now, open the drawer. All settings found are saved into memory for later use. Wait with removing the PCB until all solder points are solidified. Remove the PCB from the frame and put it on a heat resistant surface to prevent the risk of fire.

## Inert gas extension (Optional).



***WARNING! Arrange enough ventilation and/or use a safety mask. Be sure that the gas you're using is a non-toxic, non-explosive and non-flammable gas when heated! Its recommended to use N2. Do not use more gas than necessary for the process. Be sure that there is suffices room ventilation to preserve your health!***

Inert gas is being used when you will prevent oxidation of the solder during soldering. With this extension it is possible to use an inert gas like N<sub>2</sub>. The use of an "Extraction hood" is strongly recommended so the minimum of gas is flow into the room.

***Be sure that there is suffices room ventilation to preserve your health!***

The optional flowmeter on the solder oven has a scale for air/nitrogen. Working with other gasses will only indicate a flow and inaccurate.

It isn't possible to work in a complete inert process chamber since there always will leak some air in to this process chamber. This is inherent onto the machine construction. Its recommended to use a gas flow to approximately 100-400 L/hour with a pressure between 2 and 4 bar. The flowmeter is limited to 500 L/hour.

The inert gas is little bit heated before entering the process chamber to get minimal disruption to the process temperature.

## Maintenance

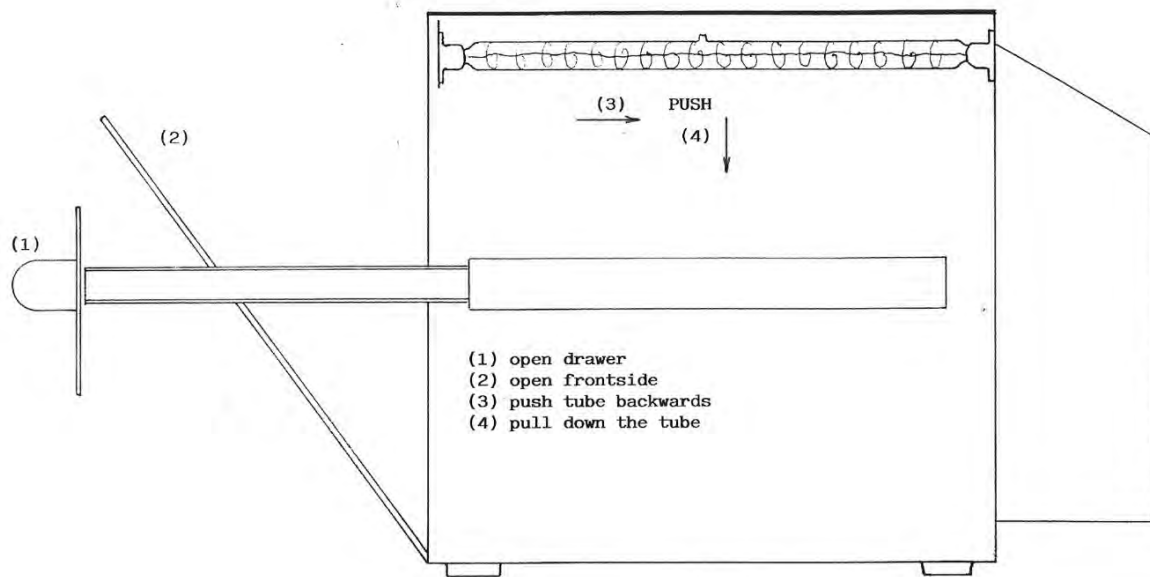
In general, there is no need to maintenance the oven. After a while the glass can become trouble by residues on it, caused by the flux. You use any cleaner as long it doesn't scratch.

### Replacing quartz lamp.

The lifetime of quartz lamps is limited. After +/- 1000 hours lamps need to be replaced. Ask your dealer for new lamps. Generally replacing the lamps is not problematic. Remove the two outer screws at the top of the door. Now open the door and replace the lamps. (See the sketch below.)



It can be helpfully when you remove the drawer front. If you do this you also have the possibility to clean the inside of the oven.



### Lubricating drawer slides



***Lubricants emit a lot of smoke and harmful gases when heated.***

***Ensure a good room ventilation to remove gasses and smoke to conserve your health.***

Enclosed in the package there is a small tube lubricant. This is a special heat resistant lubricant. Apply it on the bars with a narrow tassel. Open and close the drawer a few times. Now you need to "burn in" this lubricant. It will give a lot of smoke. Therefore you need to do this procedure in a well-ventilated area. Apply a normal solder cycle times without a PCB.

### Cleaning the glass window

After a while the smoke coming out of the paste will settle on the inside glass. The best practice is to remove it regularly. Your supplier of the past can advice you about which cleaner will have the best results. Dirty glass will make it difficult to see what is happening during the melting process.

## Technical specifications

Power requirements	: 200 – 230 VAC. / 50-60Hz
Max. power consumption	: 3680W
• Pre-heat zone	: 2180W
• Reflow zone	: 1500W
Max. PCB substrate surface	: 300 x 370mm
Max. pre-heat time	: 1 – 999 sec.
Max. pre-heat temperature	: 60 -240 °C
Max. reflow time	: 1 – 999 sec.
Max. reflow temperature	: 100 – 290 °C
Heat up time	: approx. 8 minutes
Net weight	: +/- 23Kg
Options (not standard)	: N2 inert gas connection with flowmeter
	: Solder rack

## Appendix

### Error codes

The text "Err" appears on the temperature display.

The following code appears on the time display:

1. E2Prom write error (memory chip)
2. N.U.
3. N.U.
4. Some error with the thermocouple
5. Thermocouple connected to VCC
6. Thermocouple connected to GND
7. Thermocouple not connected or error in the circuits

### Alternate switch functions

When the oven is started it shows the current software revision. During this period the switches has different functions.

Pressing the combination below during this period to get:

LED test:	Reflow UP switches
Burn in mode	Reflow DOWN switches ( can also be used to burn in the lubricant)
Fabric defaults	Preheat UP switches
Invert LED colours	Preheat DOWN switches
Goto bootloader	Preheat TIME UP + DOWN (used in combination with PC and USB port)

### Serial mode

Instruction how to use are coming with the PC communication software.

### Solder rack (Optional)

When using the optional solder rack it becomes easy to mount the external sensor onto the PCB and fix it to prevent movements of the sensor.

