RF100 CONVECTION REFLOW OVEN

OPERATING INSTRUCTIONS

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Introduction

The RF100 is a stylish, practical reflow oven for manufacturing and reworking of SMT products. The oven has a large display. The intuitive menu navigation is controlled by a membrane keyboard. The product uses highly efficient infrared heating elements and has several thermocouple temperature gauges. Due to this and the precise evaluation in the microprocessor, the temperature curve of the reflow process is highly accurate and the temperature in the respective reflow sections very uniform.

With the RF100 all common alloys can be processed. The oven has an automatic error detection with alarm.

This product has a variety of applications such as reflow soldering, repairing, drying and so on. It is suitable for SMT small series, for research and development of electronic products, school, education and study. The operating system software is in English.

The stove is well insulated by a special Aluminium silicate cotton, which reduces energy consumption, protects the circuit and allows optimal operation and keeps the temperature in the furnace constant.

Technical Data

Power connection	200 – 230 VAC. / 50-60Hz
Max. Power Consumption	2400 W
Max. PCB-Board Size	350 x 300 mm x 85mm High
Time Settings	00:00 – 99:59 sec.
Temperature	60 -300 °C
Setting Options	5 Phases adjustable in time and temperature: Preheat Heat Soldering Holding Cool down
Working Mode	Automatic Reflow-Soldering Permanent Heating or Drying function Option to store 4 different Reflow profiles
Interface	Graphic display with Keyboard automatic Alarm function Display of Process progress
Heat up Time	ca. 8 min
Extraction	Sheet metal outer diameter 101,5 mm inner 99,5 mm, internal ventilator with 84 cfm
Dimensions (LxWxH) (mm)	504 x 500 x 314 mm
Weight	+/- 28 kg

Technical Changes reserved

Intended Use of Machine

The RF100 is a soldering furnace for SMD components and also designed for lead-free soldering processes.

All other applications require our written consent or at the user's own risk.

Safety Regulations

IMPORTANT SAFETY INSTRUCTIONS FOR THE FORCED CONVECTION OVEN

Generally

Please read the following text carefully and pay particular attention to the instructions on safety at work and on commissioning.

Please keep this manual at a safe place. It contains instructions that are also important for later maintenance or cleaning work.

The machines are not intended for integration or interconnection with other machines or equipment. They may only be operated in rooms equipped for this purpose and operated only by qualified specialist personnel (soldering skills). Children and pets are to be kept away!

Do not use the oven if it is damaged or does not work properly.

Avoid strong shocks and collisions. This could damage the glass heating rods. If the glass heating elements are damaged, switch off the machine immediately and replace with original glass heating rods.

Do not run the oven unattended !

Site

The oven must be level and dry and there must be enough space around the oven for service and maintenance (about 1m on all sides). Do not use this device outdoors! The table must be able to carry a weight of at least 30 kg. The oven should be used at normal room temperatures of 15 to 25 degrees.

It is not allowed and even dangerous to install the oven in a cabinet or box. Do not install this unit near a heating element or stove, even in a damp environment.

Electricity

The machine is manufactured using tested parts according to the usual electrical safety regulations. However, this does not relieve the user of his duty of care when handling electrically operated devices.

The main switch disconnects the machine from the power supply. The protection of the circuit and the fault circuit must be carried out by the customer (13A).

After completion of work, the main switch should always be switched off.

Before carrying out any work on the machine (cleaning, etc.), switch off the machine and pull out the mains plug. The power outlet should be near the machine and accessible so that the plug can be pulled quickly in an emergency. This stove must have its own socket, which may only be used by this stove.

High voltage - the housing may only be opened by qualified persons. High voltages can cause death or serious injury.

Keep the plug and power cord away from liquid. Avoid liquids entering through the door or through the ventilation grilles.

Should this nevertheless happen once:

Immediately switch off the oven and unplug the appliance from the socket.

In case of damage, the power cord may only be replaced by qualified persons.

Danger of fire and burns

During operation, the stove becomes hot and it must therefore only be operated under supervision. Long heating times and high heating temperatures can lead to overheating of the stove, which in turn may cause fire.

When placing PCBs into the oven or removing them, wear suitable gloves or use fireproof equipment.

If the stove generates too much smoke, pull the plug and close the door. That stifles the flames.

Do not place flammable materials in the vicinity or on the reflow oven.

Do not block the ventilation grilles.

Do not touch the cover of the stove, it can be very hot and you risk severe skin burns.

Do not place flammable, explosive or other hazardous substances near the reflow oven. Do not dry objects that emit flammable and explosive gases!

Never set a temperature higher than 300 ° C! The stove is not designed for that and could be damaged. We exclude a guarantee for this!

Exhaust

Use the oven only in well-ventilated areas. Follow the safety rules of the solder paste and adhesive suppliers. During the soldering process gases can arise. These gases may endanger your health. We recommend the use of a hood or an alternative extractor option!

1. Check the proper function of the stove using the following checklist:
2. Check the drawer. The drawer must not be kinked or damaged. Do not use the oven if something is stuck between the lock and the ceiling. If the drawer is damaged, do not use the oven
3. Check the seal for damage
4. Check if the oven room is free of dents.
5. Check the power cord, plug and socket for damage.

Maintenance

Clean the oven regularly. A dirty stove can lead to dangerous situations.

Do not insert wire or other foreign objects into the air inlet and outlet to avoid burns or damage to ventilation and heat.

Do not wash the machine directly with water in order not to affect the insulation performance of the machine.

Note: The oven temperature is measured from the air in the upper area of the heating compartment. The temperature on the workpiece can vary due to radiation, conduction and reflection. For sensitive materials, we recommend test runs to determine the optimal process parameters. Different measuring devices may be recommended.

Scope of delivery

- Reflow-Oven RF100
- Foil tube D100 x 1.5 x 2 m for Exhaust
- Hose clamp
- This manual

Installation

Takeover from transport companies

After receiving and unpacking the machine, check for possible transport damage. In case of transport damage, please inform your insurance company, the carrier and the manufacturer / supplier.

Site

The oven must be level and around the machine there must be sufficient space for operation and maintenance (about 1 m on all sides). When setting up the machine, observe all safety prevention regulations and other local regulations.

The oven should be set up on a well accessible table. The surface must be level and heat resistant and be able to carry at least a load of 30 kg.

Install the device near exhaust vent. For the connection between the stove and the vent, use the supplied Aluminium foil pipe D100.

Make sure the power supply is correctly protected (13A) and residual current protection.
The outlet height of the exhaust air should be about 1m above the machine to use the chimney effect.
Do not place any other objects on the device, especially no flammable liquids, such as: As water, hot water, alcohol, methanol, gasoline.
The machine can be cleaned in the cooled state. Wipe the inside of the machine with a dishcloth. You can use some rinse water or anhydrous alcohol. Do not switch on the machine until it is completely dry.
At the beginning of operation, odours may occur during operation. This is a normal phenomenon. After a while, this kind of smell disappears.

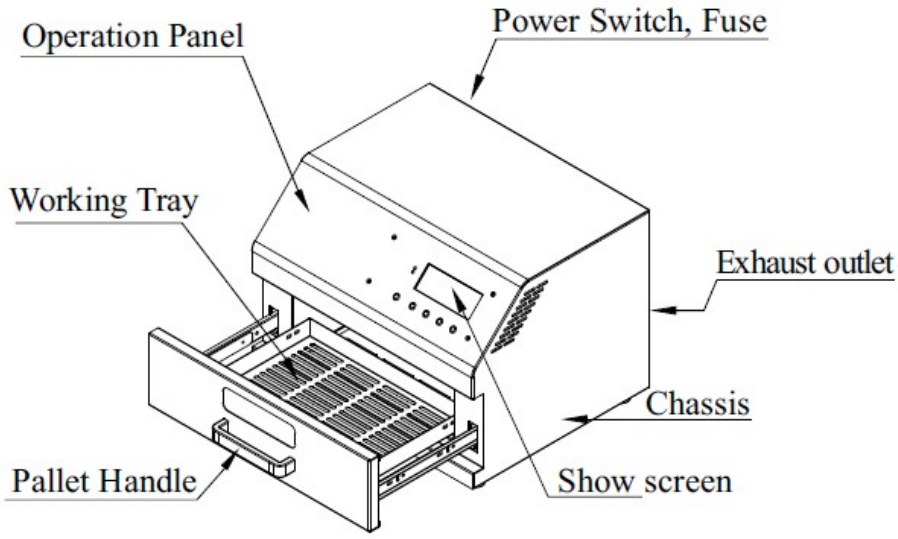
When not in use, turn off the main switch and unplug the power cord
If you are not going to use the device for a long time, you should take it out, pack it and put it back in the original container in order to avoid moisture damage.

If you want to solder small PCB or FPC board pieces, use a high temperature mica board. Leave at least 30 mm space between the boards on four sides to ensure uniform heating.

The manufacturer's specifications in the menu are only clues. Use tests to determine the optimal parameters for your application. Temperature-sensitive precision devices such as LED, s laser head, micro connectors, soft packages, ICs or similar. Can be soldered by gently lowering the temperature while lengthening the times.

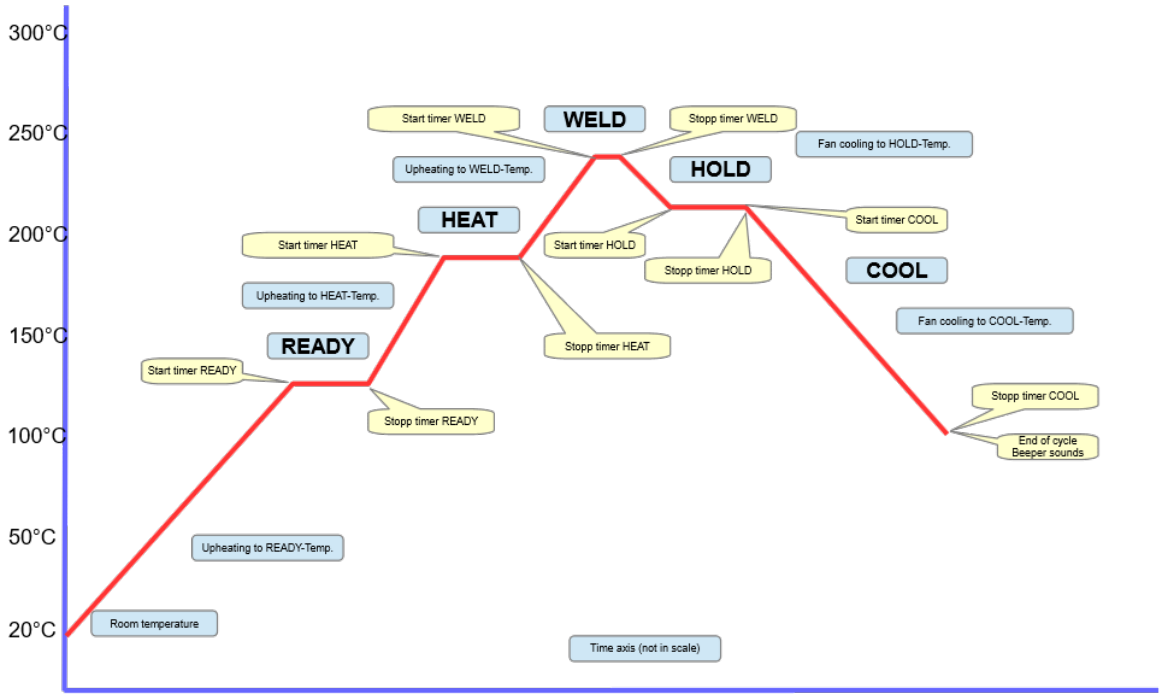
For components that can withstand high temperatures, you can increase the soldering temperature accordingly to shorten the reflow soldering time.

Overview



Description of the function keys

There are 5 buttons on the front panel of the unit: **POWER**, **UP**, **DOWN**, **SET,** and **RUN**, with the RUN and SET buttons being multifunction buttons. Depending on the dialog, there are various commands above the keys that are activated by pressing the keys.



The temperature curve

In the SMT production process, the temperature curve must be adapted to different alloy compositions of solder paste. This temperature curve is one of the most important parameters to ensure product quality. A standard reflow process typically has five temperature zones. For this reason, you can define 5 temperature zones in the RF100 software to map the standard reflow process.

Each temperature plane with the appropriate temperature and time performs another function during the soldering process. The requirement and function of each temperature section are explained below.

Preheating (READY)

Here, the circuit board is heated from room temperature to 120-150°C to remove residual moisture or residual gas and possibly reduce internal stress in the circuit board. It also achieves a smooth transition to the next section. The duration is usually 1 - 5 minutes. The specific time and temperature depends on the size of the board and the number of components.

Heating up (HEAT)

Here, the preheated circuit board is further heated until the flux contained in the solder paste becomes liquid. The flux removes oxides of tin paste and component. Usually the following temperatures are set in this section:

Lead alloy solder and precious metal alloy solder (Sn 42% -Bi58% lead-free or Sn43% -Pb43% -Bi14% lead containing low-temperature solder)	150 – 180°C
Lead-containing medium temperature solder	180 – 220°C
Lead-free high-temperature solder	220 – 250°C

Soldering (WELD)

Here the reflow process is basically completed. Since the highest temperature is used here, temperature-sensitive components can easily be damaged. The physical and chemical changes within the solder paste are the biggest here and the molten solder can easily oxidise by air in combination with high temperature. The settings of this stage are based primarily on the data of tin pastes.

Solder pastes are usually classified into low temperature solder pastes (150-180°C), medium temperature solder pastes (190-220°C) and high temperature solder pastes (230-260°C).

The lead-free solder used today is a high-temperature solder.

Lead-free low-temperature solder paste usually contains precious metals. Leaded low temperature solder paste is rarely used and then for special applications. Lead solder has excellent electrical, physical and mechanical properties, e.g. Temperature change and oxidation resistance.

In this phase, the solder should be liquid so that the components will float and automatically center and align with the surface tension of the liquid solder. In addition, 2 intermetallic phases are formed between the circuit board and component, in which the tin mixes with the copper of the circuit board and the metal of the component and forms the ideal brazing structure.

The soldering time is usually about 10-30 s. Larger boards and circuit boards with components that form large soldering shadows require a longer soldering time.

Generally, the soldering time should be kept as long as necessary and as short as possible so as not to expose the components to unnecessary thermal stress, which can lead to component malfunction.

Hold time (HOLD)

The holding time plays a role especially for high temperature solders. When high temperature solder paste rapidly cools, the tin forms very coarse crystals with undesirable mechanical and physical properties.

At high temperatures and mechanical effects, the welding spots may easily tear off and lose the mechanical and electrical connection function, thereby reducing the durability of the product.

By the holding time, the solidification occurs slowly and it form fine crystals.

The temperature is generally set 10-20 ° C lower than the solder melting point.

Cooling time (COOL)

Here the oven is no longer heated and the natural cooling accelerated by a fan. In principle, you can remove the printed circuit boards when the temperature has fallen below 150 ° C. Please use tools and personal protective equipment to avoid burns.

Annotation

In general, the soldering temperatures are set as low as possible, so that the components as well as the printed circuit board are not damaged by thermal stress.

The temperature can also be lowered by extending the reflow time accordingly. This is advantageous for protecting heat sensitive components, connectors and connectors.

Setting of Parameters

In general, the parameters are set during commissioning and each time the requirements change due to other materials, components or solder pastes.

Start

Turn on the main power switch on the back of the unit and the indicator light in the upper left of the screen lights up in green. If you press the red **ON-OFF** button, the display on the picture below will show **USE**, **WELD** and **CONST**.

Soldering Mode (WELD)

Preliminary note: the temperature and time settings in the delivery condition of the stove are only indicative. The parameters suitable for your application must be determined by test soldering. Please also refer to the information provided by the solder paste manufacturer.

After pressing **ON-OFF**, **WELD** is highlighted. Press **RUN** to display the dialogue as shown in the picture on the left.

RUN starts the cycle, the indicator light in the upper left corner of the display turns red and the oven starts to heat up. The soldering cycle will be explained later. Here we first explain the setting options.

If you press **SET** instead of **RUN**, then **READY** (pre-heat-phase) will be highlighted. Use the arrow keys to change the text to **HEAT**, **WELD**, **HOLD** or **COOL**. Stay on **READY** and press **SET**. The marking jumps to **TEMP** (temperature) and you can adjust the temperature between **70** and **130°C** with the arrow keys. Another press on **SET** and you can change the time between **00:00** and **99:99** (minutes: seconds).

Button **SET** takes you back to **READY** and here you can use the arrow keys to go e.g. to **HEAT** to set the parameters for the heating phase. Press **SET** to go to the temperature settings and use the arrow keys to set values between **120** and **300°C**. Another **SET** takes you to the time setting for the heating phase.

Back to **HEAT**, press arrow down to get to the actual soldering phase. **WELD** is marked and with **SET** you can change the temperature again between **120** and 3**00 ° C** and set the time with another **SET**.

For **HOLD**, the holding time, the same applies, but the temperatures can only be adjusted between **70** and **230 ° C** here.

When you have finally arrived at **COOL**, the cooling phase, you can only set the temperature between **70** and **200 ° C** here. A time is not set in section **COOL**, but a signal terminates the entire soldering cycle when the set temperature is reached.

To exit the **WELD** dialogue, press **ON-OFF**.

Permanent heating mode

In the main menu, you can use the arrow keys to switch between **USE**, **WELD** and **CONST**. Highlight **CONST** and press **RUN**. The dialogue on the left side appears.

With **RUN** you switch on the heating, the control light turns red and the oven heats up to the set temperature (= **SET TEMP**). The current temperature is displayed to the left. At the same time the display changes RUN upwards and **STOP** downwards, so that you can end the heating process at any time by pressing the green **RUN** button. In this case, **RUN** returns to the bottom of the display and **STOP** to the top and you can restart heating by pressing the **RUN** key.

When the set temperature is reached, the indicator changes to green and the oven keeps the temperature.

Saving custom temperature profiles

The RF100 oven allows you to store and recall 4 different temperature curves.

Select **USE** in the main dialogue and press **RUN**. On the now appearing dialogue, you can see Use curve 1 with the currently set temperature curve.

RUN selects this temperature curve and using the arrow keys you can toggle between the 4 possible curves.

With **SET**, the word **READY** appears below the selected curve and the word **ESC** above the **RUN** key. Here you can change the temperature curve 1 now.

With **RUN** you leave the setting mode and with the arrow keys you switch back and forth between **READY**, **HEAT**, **WELD**, **HOLD** and **COOL** in the mode Soldering (**WELD**).

Pressing **SET** jumps to the temperature first and, if you press again, to the time. All settings can now be made as explained in the chapter Soldering Mode (**WELD**).

Pressing **RUN** quits the insert mode and the settings are saved.

Above the **RUN** key, the word **SEL** appears for Select. If you now press **RUN**, then user curve 1 will be selected. Attention! If you have previously made settings in the **WELD** dialogue, they will now be overwritten

Reflow-Process

When the adjustment is complete and all safety precautions have been taken, place the board with the components in the middle of the drawer and slide the drawer closed.

Highlight **WELD** in the main menu and press the "**RUN**" key to enter the soldering menu.

If you press **RUN** again, the cycle starts. **ON** is marked and the current oven temperature is displayed. The indicator will turn red to indicate a heating process. In this case the heating process for the preheat phase (**READY**). The temperature rises in the display.

When the temperature reaches the set value, the indicator turns green and starts counting down the preset time. The indicator light may also flicker in the transitional phase. If the temperature is set above **5°C**, the fan will switch on to lower the temperature. Temperature and the power indicator on the top panel will flash at this time.

At the end of the countdown, the **HEAT** phase begins. Control light switches back to red, the heating starts, temperature rises. When the temperature is reached, the indicator goes green and the next countdown starts.

If you want to stop the soldering process, you can do this at any time by pressing **SET**.

After **HEAT**, the soldering phase **WELD** starts, then the holding time **HOLD** and then automatically follows the cooling phase **COOL**. The fan turns on and a timer shows the elapsed cooling time.

When the set cooling temperature is reached, the warning light goes out and a buzzer sounds.

The message **END** appears on the display. For safety reasons, the fan will continue to operate until the temperature has dropped to 80 ° C.

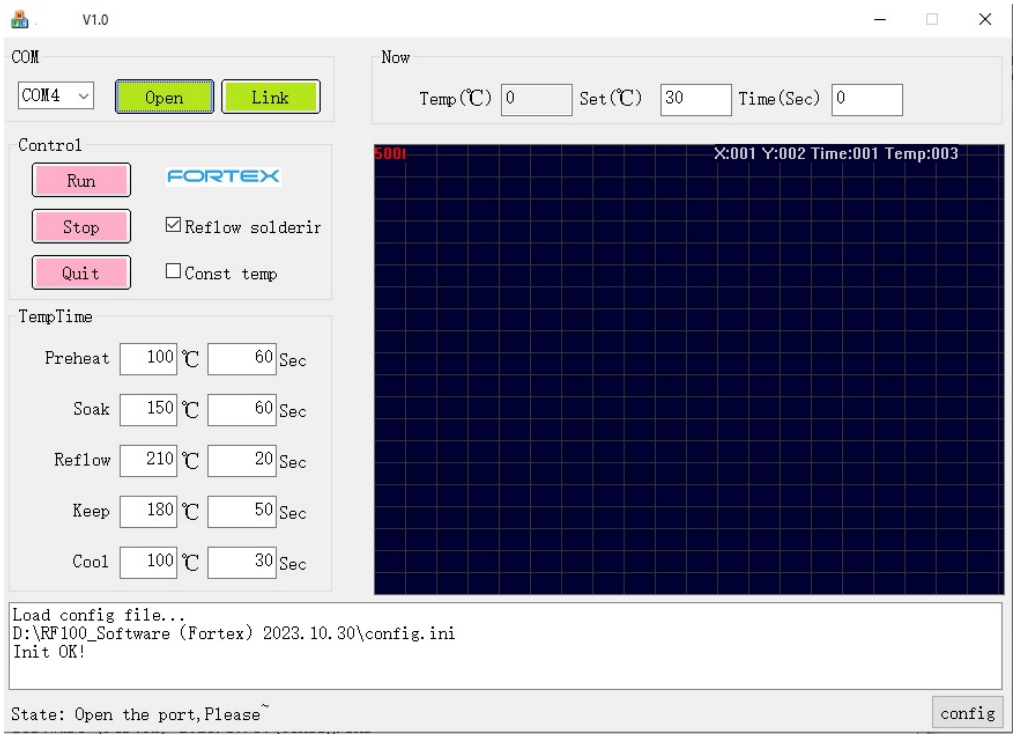
RF100 PC Operating Software

Convenient Operation and monitoring of the oven is possible using a PC connected to the oven with a USB-Serial lead. The oven is equipped with a DB9 serial port to connect your computer to via a UBD to Serial connector lead. This allows operation of the oven with a computer to test temperature curves with the function of time.

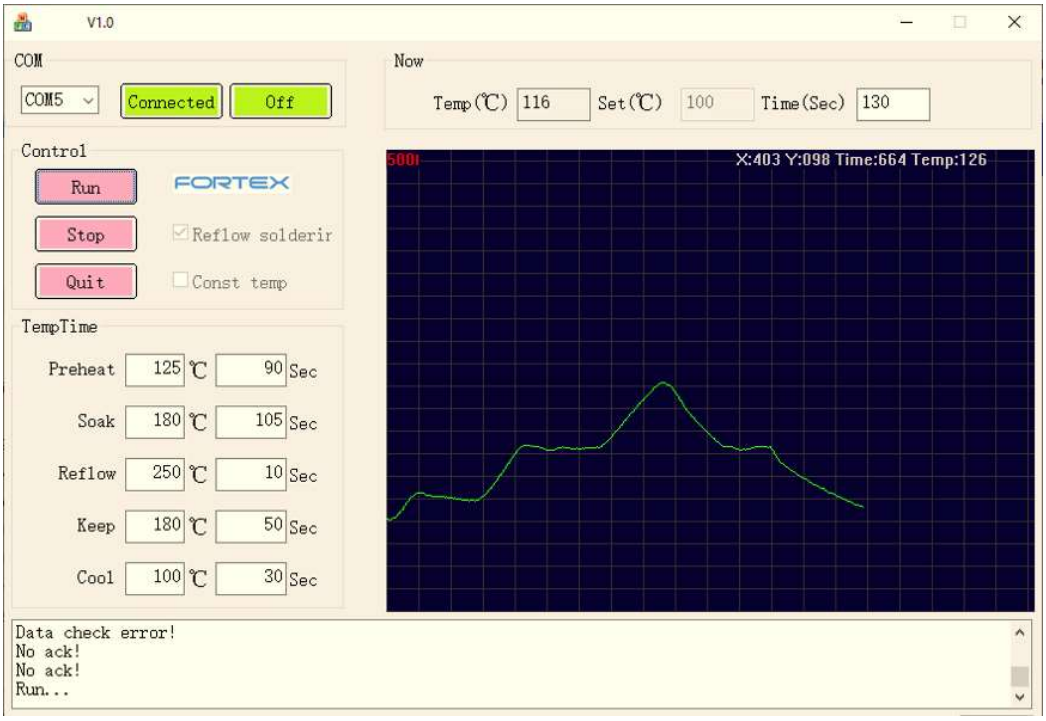
One end of the supplied USB serial link lead is connected to the rear DB9 serial port of the oven and the other end of the lead to the USB serial port of your PC.

Relevant software may need to be installed on your PC for the USB/Serial link lead. Make a note of the “COM PORT” number been used for the USB to serial link by looking in “Device manager” on your PC. Ensure the USB to Serial lead is connected to the correct corresponding USB serial port number on your PC.

Download and install the RF100 Oven control software onto your PC and you should see a screen similar to the below once the software in installed and opened:-



Press the green buttons on the software “Open port” and then “Link” on the software. Your PC should now be connected to the oven and LCD display on the oven should display “PC Link . . .”.



Next in the software tick the box next to “Reflow Soldering”. Temperature and Time values can now be entered to set each section for the desired reflow parameters.

Click “RUN” after completing the settings and a real time graph will be plotted of temperature and time on the Graphical display of the PC software as the Reflow oven runs through the Reflow Process.

Check and choose “Constant Temperature” for fixed constant temperature operation of the oven.

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Characteristics of soldering alloys

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	(°C)	(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
63	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				
95.7		3.1					1.5		217				
99.3							0.7		227				
95			5						240				

Temperature curve parameters

Type of filler	Formula proportion	Pre-Heat Temperature range (°C)	Heat Temperature range (°C)	Solder Temperature range (°C)	Hold Temperature range(°C)	Cool Temperature range (°C)
Lead cypogenic material	Sn43-Pb43-Bi14	100-120	130-150	200-210	170	150
Lead-free low cypogenic material	SN42-Bi58	100-120	120-130	180-200	150	150
Lead-free low cypogenic material	Sn48-In52	100-120	120-130	180-200	150	150
Lead cypogenic material	Sn63-Pb37	130-150	170-180	230-240	180	150
Lead cypogenic material	Sn60-Pb40	130-150	170-180	230-240	180	150
Lead cypogenic material	Sn62-Pb46-Ag2	130-150	170-180	230-240	180	150
Lead-free low cypogenic material	Sn96.5-Ag3.5	130-150	180-190	240-250	240	150
Lead-free low cypogenic material	Sn87-Ag3-Cu3-In7	130-150	180-190	240-250	240	150
Lead-free low cypogenic material	Sn91-Zn9	130-150	180-190	240-250	230	150
Lead-free low cypogenic material	Sn95.4-Ag3.1-Cn1.5	130-150	180-190	250-260	240	150
Lead-free low cypogenic material	Sn99.3-Cu0.7	130-150	180-190	270-280	260	150
Lead-free low cypogenic material	Sn94-Ag3-Cu3	130-150	190-220	240-250	240	150
Lead-free low cypogenic material	Sn97-Cu3	130-150	190-220	270-280	250	150
Lead-free low cypogenic material	Sn95-Sd5	130-150	190-220	270-280	250	150

Cleaning and Maintenance

The machine can be cleaned in the cooled state. Wipe the inside of the machine with a dishcloth. You can use rinse water or anhydrous alcohol. Do not switch on the machine until it is completely dry.

Error message

Sensor error

If the temperature measuring element is damaged during operation of the device, an alarm is automatically triggered and the display shows "Sensor error".

Heating errors

If the oven temperature cannot be detected during the reflow process, the unit will report a heater failure alarm and the display will show "Heating Failure".

Spare Parts and Options

Spare Heater Part Order Code **RF100-HEATER**

Guarantee

All machines are submitted before distribution to examination on tightness, function and continuous operation firmness. On the machine we grant a work warranty of 12 months to our customers starting from purchase date on accuracy in material and processing. We warrant at our choice by exchange of incorrect parts or by repair of the machine in our house. Old parts change into our possession.

Disclaimer of Warranty

Fortex Engineering Ltd reserves the right to change or enhance its machines or machine specifications according to its judgement, if necessary. Fortex cannot be held responsible to implement aforesaid changes into machines sold already.

Fortex products and services are liable to the current prices and conditions, which are subject to change.

The instructions and definitions in this document are also subject to change and mark no assurance on the part of Fortex.

Please regard the “Sales terms and delivery conditions”. These are available after fulfilment of the contract. We don't furnish a guarantee or warranty in cause of damages at material or hurts of people because of

Incorrect use of the machine

Wrong setup, installing and operating of the machine or incapable service

Use of the machine with defective safety equipment

Non-observance of the service manual in regard to transport, stocking, setup, installation and service of the machine

Unlicensed modifications at the machine

Incorrect or incomplete repairs

Destructive force effect at the machine in cause of foreign objects or external use of force

Use of non-original spare parts

normal wear parts.

We cannot accept subsequent claims from damage or destruction of work pieces worked on in the machine, because we have no knowledge or control over the operating conditions at your site. This is valid in a general manner also for requirements from damage to articles, buildings and persons as well as the environment.

We do not warrant that the function of the machine will meet the customer's requirements or that the operation of the machine will to this regard be error free.

In no event will we be liable to the customer for any incidental, consequential, or indirect damages of any kind, including loss of profit and prosecution for environmental pollution, even if we could have been aware of the possibility of such damages.

All information was arranged with great care. We reserve ourselves however mistake and technical changes without previous announcement.

Running the machine in corroding, humid, dusty, extremely hot or explosive atmosphere happens at the operator's own risk and responsibility.

We explicitly exclude any warranty for damages resulting from running the machine in in corroding, humid, dusty, extremely hot or explosive atmosphere.

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