



X-Reflow306 LF-AC Manual



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I. INTRODUCTION



Congratulations on your purchase of an X-Reflow306 LF-AC Oven. This oven was designed to achieve the highest degree of process control possible for demanding applications that require uniform temperature distribution, temperature stability, and accelerated cooling.

Unique Features to utilize

- **PC Interface**
This allows for viewing temperatures, documenting them, creating/modifying programs, and even directly controlling the oven from a PC. Please see the Oven Commander section under accessories (page 20) for more information. That same PC interface can be used to download upgrades to the oven firmware. The upgrades are made following feedback and special request from our worldwide users, so please feel free to send any feedback or requests to bokar@bokar.com. The new firmware is available free of charge and can be installed on the oven via the X-KAR X485-USB Converter.
- **Two External “K” Thermocouple Inputs**
They can be used to monitor temperature points of particular concern. They are found on the back panel of the oven.
- **Fume Extraction Port**
Batch ovens are often placed in relatively small rooms with limited ventilation. However, each reflow or curing process releases fumes which can be harmful to the operators and have an unpleasant smell. The X-Reflow306 provides a solution. It allows for fumes to be removed at the end of the soldering/heating cycle and before the lid is opened. To accomplish this, a high vacuum fume extractor is needed. Almost any commercially available high vacuum fume extractor will work. Our oven features a built-in heat exchanger which lowers the temperature of the fumes to a level safe for most commercial filters. The oven

also features an additional socket on the back panel to supply power to the fume extractor and turn it on/off as needed.

- **Accelerated Cooling System**

Cooling rate is vital to optimize the reliability of soldering connections. A slower cooling rate results in larger crystals formed in the solidified solder. This is not ideal as a smaller crystal structure is stronger and more reliable. Most batch ovens are limited to cooling fans which take at least 15 minutes to cool the board. The X-Reflow306 has an array of tubes placed in the top cover which injects pressurized shop air or ideally nitrogen into the heating chamber. Air expansion expends heat; utilizing this results in much more efficient cooling than traditional fan setups. The accelerated cooling system will bring the temperature of the soldered PCB to below 100 degrees in a few minutes. Exact cooling rate depends on the cooling media. Rates of 1-4 degrees a second can be achieved.

- **Programming Options**

The oven features several programming options to give the user exact control over the heating process.

- **Programmable purging time**
 - This allows the operator to purge the heating chamber of oxygen after the oven is reloaded.
- **Sequencer Mode**
 - This allows for the running of up to eight programs one after another without opening or restarting the oven. This can be used to test behavior of boards or other heated objects when heated and cooled in rapid succession.
- **Targeted Cooling**
 - This cools the heated object to a pre-defined temperature.



II. Safety

The purpose of this section is to inform the user of precautions to observe when operating or servicing this product. It also explains the heading guidelines used to indicate special notes, cautions, warnings, or danger. Please note that this list of precautions is not exhaustive.

a. Precautions

1. Please read the operation manual prior to use.
2. Utilize all standard electrical safety precautions when using this or any other electrical equipment.
3. Always use this system in a well-ventilated area. The fumes emitted during soldering are irritants and should be removed. A pumped vent is located at the rear of the unit and should be ducted accordingly. A fume extraction system is highly recommended to protect personnel from solder flux fumes. Please see page 22 for information about the X-306A Fume Cleaning System.
4. Exercise proper precautions when using chemicals such as solder paste. Refer to the Material Safety Data Sheet supplied with each chemical and adhere to all safety precautions recommended by the manufacturer.
5. The oven must be properly grounded.
6. The area around the viewing window becomes hot. Care should be taken when working in the vicinity.
7. After ending the cooling cycle, the inside of the oven may still be hot. Care should be taken when removing and mounting the PCB. Heat-resistant gloves are recommended.

b. Heading Guidelines

1. **Note**
 - Used to indicate company recommendation or policy
2. **Caution**
 - Used to indicate a hazardous situation which may result in minor to moderate injury, as well as potential damage to product or equipment
3. **Warning**
 - Used to indicate a hazardous situation which may result in serious injury to personnel or serious damage to equipment

III. Unpacking

Prior to use of the system, check if the system is complete. Should you notice any missing items, please notify us. Include model number, voltage, date of purchase, place of purchase, and what is missing. Missing items must be reported within 7 days from the date of purchase.

WARNING
When unpacking, please be careful and read the manual prior to turning the system on. Please check that the voltage of the system corresponds with the voltage of your supply. Connection to an incorrect voltage supply may cause damage to the system!

The packaging of the oven has been carefully designed to ensure maximum protection during shipping. However, no packaging can guarantee 100% protection so damage may occur during shipping. Please ensure that any claims for shipping damage are reported promptly to the carrier and to the distributor from whom the product was purchased.

IV. Contents of the box

- a. 1x X-Reflow306 LF-AC Batch Oven
- b. 2x “K” thermocouples
- c. 1x X485-USB Converter
- d. 1x Exhaust connecting elbow
- e. 1x User Manual
- f. 1x Warranty Card

V. General Information



Fig.1. X-Reflow306 Front Panel

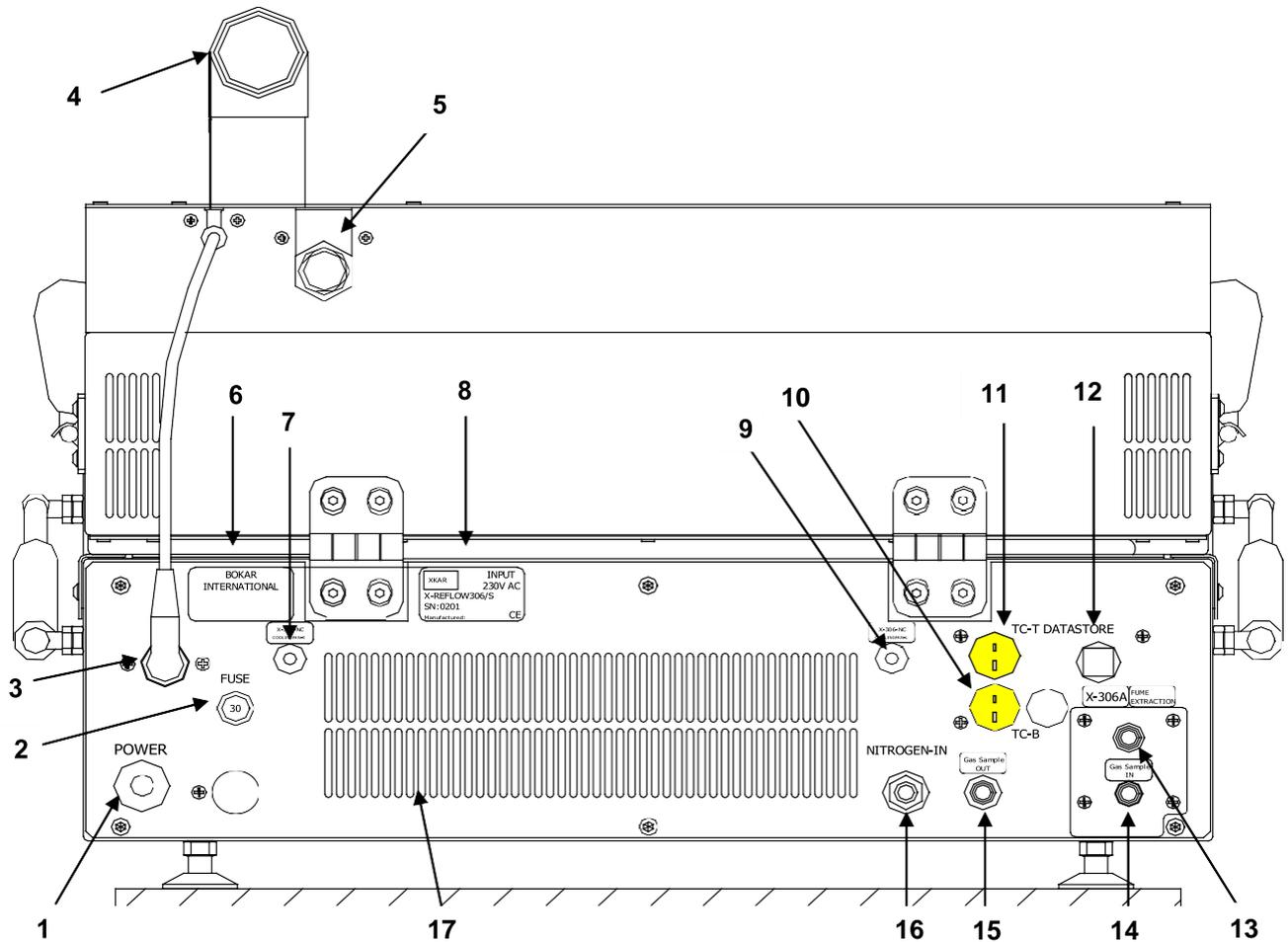


Fig.2. X-Reflow306 Back Panel

1. Power Cord
2. 30A Circuit Breaker
3. Socket and connector to open exhaust pipe
4. Exhaust pipe for X306A Fume Cleaning System
5. .5" pneumatic male nipple to connect cooling media
6. Bokar International company label
7. X-306-NC Cooling Fan-R connector (only models with the suffix NC)
8. Label with serial number, model information, and working voltage
9. X-306-NC Cooling Fan-L connector (only models with the suffix NC)
10. External "K" thermocouple input TC-B (Bottom TC)
11. External "K" thermocouple input TC-T (Top TC)
12. Datastore socket to connect to a PC
13. Socket to connect X-306A Fume Cleaning System
14. Gas sample IN
15. Gas sample OUT
16. N₂ inlet port
17. Louvers to provide ambient air for cooling oven subsystems

VI. Setup and Installation

a. Electrical Requirements

The X-Reflow306 LF-AC require 5 Kilowatts of power. A separate, dedicated AC supply line circuit may be required to adequately power the system. If your power outlet cannot provide suitable power, arrange for a qualified, licensed electrician to install one for you.

b. Setup

1. Remove the X-Reflow306 LF-AC from its shipping box. Store the shipping box in a convenient location as reuse of the box will help prevent damage when shipping or storing the system.
2. The system should be located on a rigid and stable work surface. We recommend using the ATR-1/360 ESD-safe cart. Please see page 21 for more information.
3. Confirm that the power switch on the front panel is in the OFF position.
4. Open the top clamshell and check if there are accessories or documentation inside the heating chamber.
5. If you plan to use nitrogen, attach the nitrogen source (.5 - 1 kg/cm²) to the nitrogen input port on the rear panel of the oven. Up to 6 bar of pressure for nitrogen can be used if required.

c. Powering Up and Logging In

1. Install a proper AC plug at the end of the power cord. The color coding of the wires is as follows:
 - Brown = Hot wire
 - Blue = Neutral wire
 - Green/Yellow = Grounding wire
2. Insert the plug into an appropriate AC supply receptacle. Make sure that the voltage matches the oven. The 208V model needs 208V and the 230V model needs 220-230V. The nominal voltage can be found on a label on the back panel. See page 7 for the exact location of the label.

CAUTION

For operator safety, the AC supply receptacle must be checked for grounding before initial system operation.

3. Turn the power switch to the ON position.
4. A short sound will be heard. The display will show a welcome screen with the oven name, serial number, and the revision number of the oven's firmware.

- After a few seconds, the display will show the login screen in Fig.3. Detailed information on privileges and accounts can be found on page 15. Use the up and down arrows on the keypad to highlight the desired login. Press “Enter” to confirm the login. If any selection other than Guest is made, the next screen will ask for a password. If you are the admin for the oven and are turning the oven on for the first time, enter the default Admin password, “1234,” and press “Enter.”



Fig.3.Login Screen

- After successfully logging in, the Process Window will be shown. This is the main window of the oven. Press the “ESC”button on the keypad to return to this screen. It has all the information about the settings and temperatures in the oven. It also has the readings from the two external thermocouples connected to the TC-T and TC-B sockets on the back panel.

VII. Operation



Fig.4. Oven Front Panel

The soldering process or program cycle starts from the Process Window. Press the “Start/Stop” button to begin the program cycle. A red LED will illuminate in the corner of the key as shown in Fig.4. The LEDs to the left of the keypad indicate the current zone. Press the “Start/Stop” button again at any point during the program cycle to stop it. Pressing the “Cool” key opens the cooling air valve and starts the cooling cycle. The fan inside the oven circulates the air. If shop air is connected to the cooling input on the back panel, cold air jets will cool the object in the oven. Additionally, the top clamshell can be opened to speed up cooling.

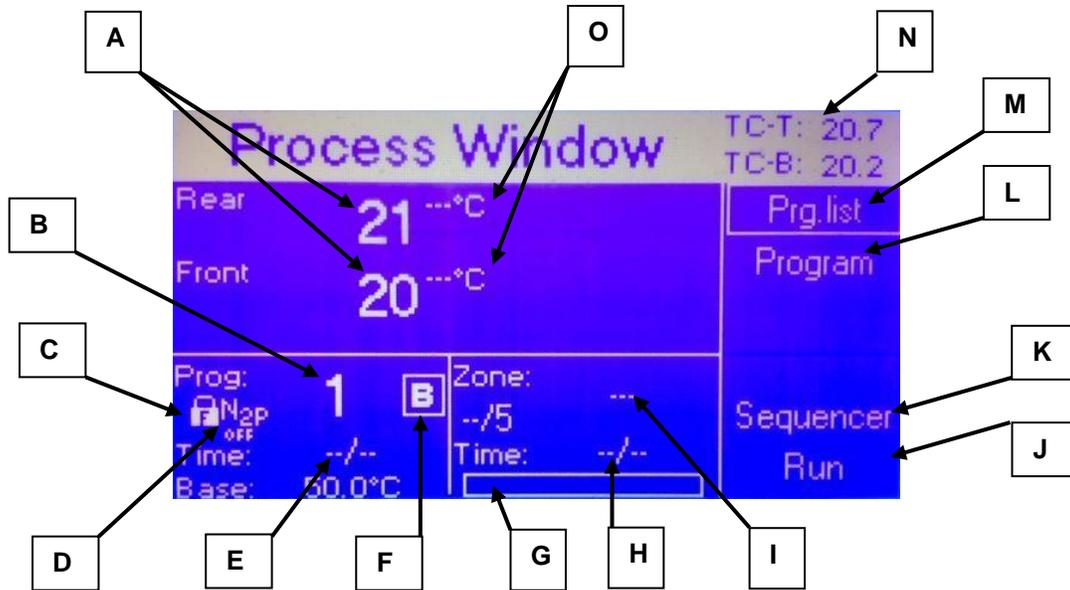


Fig.5. Process Window Before Program Start

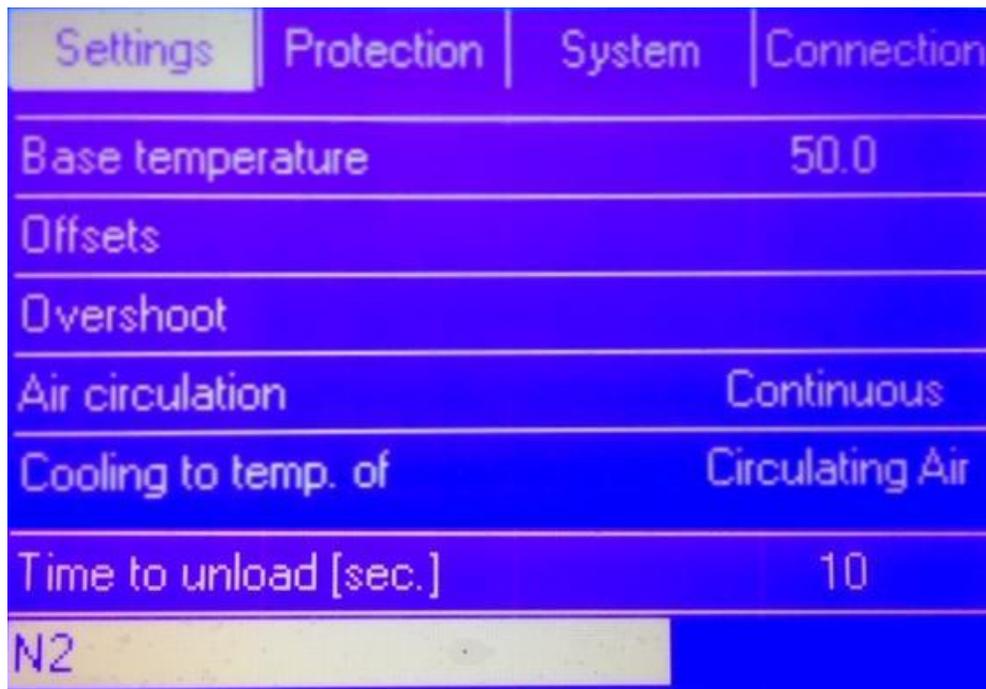
- A. **Actual Temperature** of the air from the rear and front heaters
- B. **Program Number.** An asterisk next to the number means that the program was modified
- C. **Lock Status.** Shows if the program is locked and who locked it
- D. **Nitrogen Status.** Indicates the type of nitrogen injection
 - a. **P** = Proportional injection
 - b. **T** = Timed injection
 - c. **OFF** = Nitrogen valve closed
- E. **Process Time / Elapsed Time.** Sum of all pre-programmed zones on the left of "/" and elapsed time from the start of the process on the right
- F. **Process Status.**
 - a. **Square** = Process is stopped
 - b. **Triangle** = Process is running
 - c. **B (Inside Shape)** = Base Mode is on (appears if N₂ mode is selected)
 - d. **P (Inside Shape)** = Purging in Progress (appears if N₂ mode is selected)
- G. **Elapsed Time in Current Zone.** The current zone progress as a bar
- H. **Elapsed Time in Current Zone.** The current zone progress as a fraction
- I. **Name of Current Zone.**
- J. **Run Process.** Move the cursor over this and press "Enter" to start process
- K. **Sequencer Mode.** Select this to set up Sequencer mode
- L. **Program Details.** Details of current program
- M. **Program List.** List of programs
- N. **External Thermocouple Temperatures.** Readings from TC-T and TC-B
- O. **Set Temperature for Rear and Front Heaters.** Appears when program is run

VIII. Accessing the Settings Menu

These parameters allow the user to adjust how the oven functions such as how it heats and cools or how it displays parameters. These settings can only be adjusted by an Administrator. The operator must be logged in at either the Admin or Factory level.

a. How to Access the Settings Menu

1. Log in at the Admin or Factory level.
2. Press the “Menu” button on the keypad.
3. Using the up and down arrow keys, select “Settings” and press “Enter”.
4. This opens the window shown in Fig.6.
5. To navigate this menu, use the arrow keys and “Enter”.
6. The left side shows the parameter being edited and the right side shows the value.



Settings	Protection	System	Connection
Base temperature			50.0
Offsets			
Overshoot			
Air circulation			Continuous
Cooling to temp. of			Circulating Air
Time to unload [sec.]			10
N2			

Fig.6. Settings Screen

IX. Description of General Settings

Use the up and down arrow keys to navigate between the following options.

a. Base Temperature

When in this mode, the oven always maintains this as a minimum temperature after the “Start/Stop” key is pressed. When a heating profile is started in the cold oven, it takes at least a minute to heat the mass of the oven body which slows down the heating of the object in the oven. Additionally, starting from a known temperature gives better repeatability. Base mode is also useful when using the oven as a one zone device for pre-heating or curing purposes as it offers a very quick setup for constant temperature heating.

Settings	Protection	System	Connection
Base temperature			Off
Offsets			
Overshoot			
Air circulation		Continuous	
Cooling to temp. of			TC-T

Settings	Protection	System	Connection
Base temperature			50 (Blinking)
Offsets			
Overshoot			
Air circulation		Continuous	
Cooling to temp. of			TC-T

Fig.7. Base Temperature Settings

To enable this option, press the right arrow key while “Base Temperature” is highlighted. Then use the numerical keypad to input the desired temperature. Press “Enter” to save the setting. The possible range is 50°C to 300°C.

b. Offsets

1. Using the up and down arrow keys, scroll to “Offsets.” Press “Enter.”

Offsets	Overshoot	Pwr at Max.
Front heater offset		0.0
Rear heater offset		0.0
Override factory offset		Yes

Fig.8. Offsets Menu

2. Setting the Front Heater Offset

Use the right arrow key to highlight the value. Once the value is highlighted and blinking, use the numerical keypad to set the desired value. Press “Enter” to confirm the setting. The possible range ranges from -20°C to +90 °C. The default setting is 0 °C.

3. Setting the Rear Heater Offset

Use the down arrow key to move to the rear offset and repeat the process outlined above to set the rear offset.

4. Override Factory Offset

Select “Yes” if you want to override the default factory offset of 0°C.

c. Overshoot

Because of differences in the temperatures of the heaters and the heated object, the oven has an overshoot feature to better reflect the temperature of the object. This means that the heaters will be on until the temperature is higher than the set temperature by the preset value. This will be maintained for a preset time. Factory overshoot is set to 10°C for 10 seconds.

d. Air Circulation

This has two modes

- **Continuous Mode**
The blower circulating air is always on during oven operation.
- **Pulsed Mode**
The blower pulses during oven operation.

e. Cooling to Temp. of

This has two options:

- **Cooling to Temperature of Circulating Air**
This mode directs the oven to cool until the pre-programmed time elapses and/or the pre-programmed temperature is achieved for the thermocouples measuring the temperature of the air entering the heating chamber.
- **Cooling to Temperature of TC-T**
This mode directs the oven to cool until the pre-programmed time elapses and/or the pre-programmed temperature is achieved for the thermocouple connected to the TC-T port. This mode allows the heated object to be cooled to exactly the desired temperature.

f. Time to Unload

This option sets the time given to unload the oven before it starts to heat again in Base Mode.

g. N₂

1. Selecting this option will open the window shown in Fig.9.

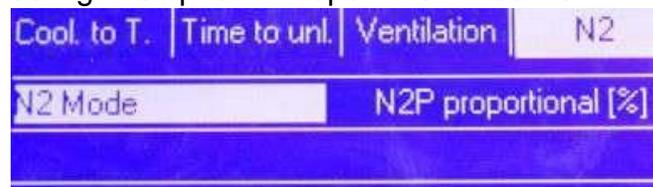


Fig.9. N₂ Options

2. From this window, the N₂ mode of operation can be set from the following options:
 - **N2C** = Continuous fill
 - **N2T** = Periodic fill (seconds)
 - **N2P** = Proportional (%)
3. Press “ESC” to return to the settings menu.

X. Description of Protection Settings

Passwords can be assigned from this menu. The different user accounts are as follows:

a. Admin

This is the highest level of authority. The default password is “1234”. There is an emergency password that can be used if the Admin password is lost. Please call the distributor or factory for this password. The Admin can do the following:

- Assign passwords for the User accounts
- Set the privilege level for each User account
- Access and change all oven settings
- Run all programs
- Create new programs and modify existing ones
- Lock and unlock all programs except for the factory one
- Delete programs
- See Program settings
- See the Graphic Display

b. Guest

This is the lowest level of authority. The Guest can only run preset oven programs but does not require a password. This level of access can be disabled. The Guest can do the following:

- Run existing programs
- See Program settings
- See the Graphic Display

c. User Accounts

This account can be set to Privileged or Limited. The default password is “1111” for User1, “2222” for User2, “3333” for User3, “4444” for User4, “5555” for User5, and “6666” for User6. A Limited User can do the following:

- Run existing programs
- See Program settings
- See the Graphic Display

A Privileged User can do the following:

- Run existing programs
- Create new programs
- Delete programs created by themselves
- Edit programs created by themselves
- Lock and unlock programs created by themselves
- See Program settings
- See the Graphic Display

XI. Description of System Settings

a. Language

Press the “Enter” key and then use the up and down arrows to select the desired language. Currently, English and German are the available options.

b. Temp. Scale

The temperature scale can be set to either Fahrenheit or Celsius. The factory default is Celsius.

c. Time and Date

This is not set at the factory. The user must set the initial time. The oven has a built-in clock which is maintained by an internal battery. Its main function is to remember the time and date when programs are created. The correct time and date settings will allow for accurate tracking of the order in which programs are created.

Setting the Time and Date

1. Selecting “Date / time” will open the window shown in Fig.10.
2. Use the numeric keypad to set the correct values and use the “Enter” key to confirm.

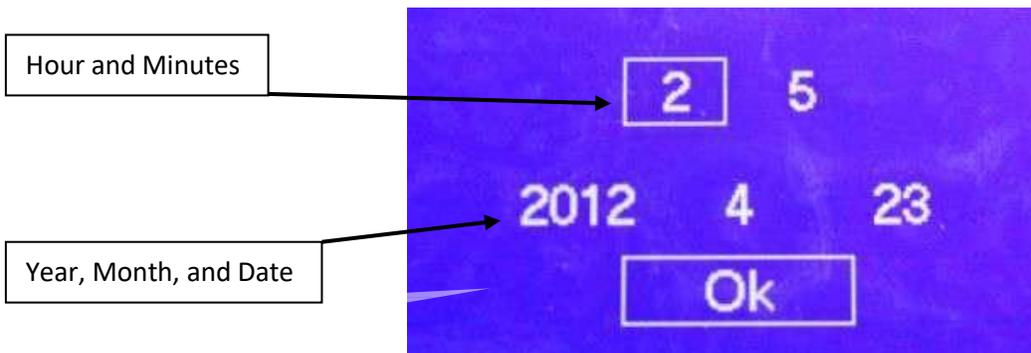


Fig.10. Time and Date Window

d. Sound

Sound can be toggled on or off. The factory default is on.

e. Contrast

This adjusts the display contrast. The possible range is from 32 to 255.

XII. Description of Connection Settings

The address the oven uses when it is connected to a computer can be set here. The available range is from 1 to 247. The factory default is 247.

XIII. Description of Restore Settings

All settings in the oven can be reset to factory defaults from this menu.

XIV. Programs

Each program can have 3 to 5 time/temperature zones to fulfill all the requirements for proper soldering of SMT parts to PCBs. The programs should have at least four zones.

a. Preheat Zone

A minimum of one Preheat zone is recommended to properly activate the flux in the solder paste and to gradually heat the cold board to mitigate stress on the board and the vias.

b. Soak Zone

This zone equalizes heat across the board.

c. Reflow Zone

This zone brings the temperature high enough above the solder's melting point to melt it and holds the temperature for the required time.

d. Cooling Zone

This zone cools the board and solder.

The names of the zones can be customized by the user. Every program also records the date of creation and what user created it. It also shows if the program is locked and who locked it. Please note that saved programs can only be locked/unlocked by the creator or the Admin. For example, a program locked by User1 cannot be erased, unlocked, or modified by User2. However, the Admin can perform all those actions. The icons indicating locked status are as follows:



= Unlocked



= Locked by User1



= Locked by User2



= Locked by Admin



= Locked by Factory

The oven has one example program from the factory that cannot be changed. Operators can enter and save up to 249 programs; however, only the Admin and privileged users can create and save programs.

a. Creating a Program

1. Turn on the oven.
2. Log into the oven.
3. Make sure "Prg.list" is highlighted in the right menu. Press the "Enter" key to enter the Program List.

4. Highlight an empty slot and press the right arrow key to navigate to the right menu.
5. Make sure “New” is selected and press the “Enter” key.
6. A program with default values will load. Make sure the “Edit” option is highlighted and then press the “Enter” key to change the values.
7. Set the desired values for the front and rear heaters in each zone using the numerical keypad and the “Enter” key to confirm each entry.
8. Once all values are entered, press the “Esc” key to return to the right menu.
9. Select the desired save option and press the “Enter” key to save the program.

b. Starting a Program

1. Turn on the oven.
2. Log into the oven.
3. If the correct program is already selected, press the “Start/Stop” key to start it.
4. If the correct program is not selected, make sure “Prg.list” is highlighted in the right menu. Press “Enter” to enter the Program List window.
5. Use the up and down arrow keys to highlight the correct program. Press the “Enter” key to select it. The program details will be shown.
6. Use the down arrow key to select “Run” and press the “Enter” key.
7. The program will start.

c. Stopping a Program

1. Press the “Start/Stop” key to end the program

CAUTION
The inside of the oven can be very hot. Start the cooling cycle before opening the oven and/or moving the PCB. Make sure to wear proper protective equipment.

d. Editing a Program

1. From the Process Window screen, use the down arrow key to select “Program” and press the “Enter” key.
2. Make sure the “Edit” option is highlighted in the right menu and press the “Enter” key.
3. The program edit screen will appear. Enter the desired temperatures for the front and rear heaters in each zone.
4. Press the “Esc” key to go to the right menu.
5. Use the down arrow key to select “Save” and press the “Enter” key.

XV. Sequencer

The sequencer allows the user to run up to eight selected programs one after another. When the temperature reaches the user's preset value during the cooling zone of the current program, the current program ends and the next program in the sequencer is started. The oven uses the temperature measured by the external thermocouple connected to the TC-T port on the back of the oven to gauge when to move onto the next program. If there is no thermocouple connected to the TC-T port, the internal thermocouple measuring the front heater temperature is used. Please note that this overrides the settings of each program's cool zones. Regardless of the program's setting, the zone will end when the temperature reaches the specified value.

a. Overview of the Sequencer Window

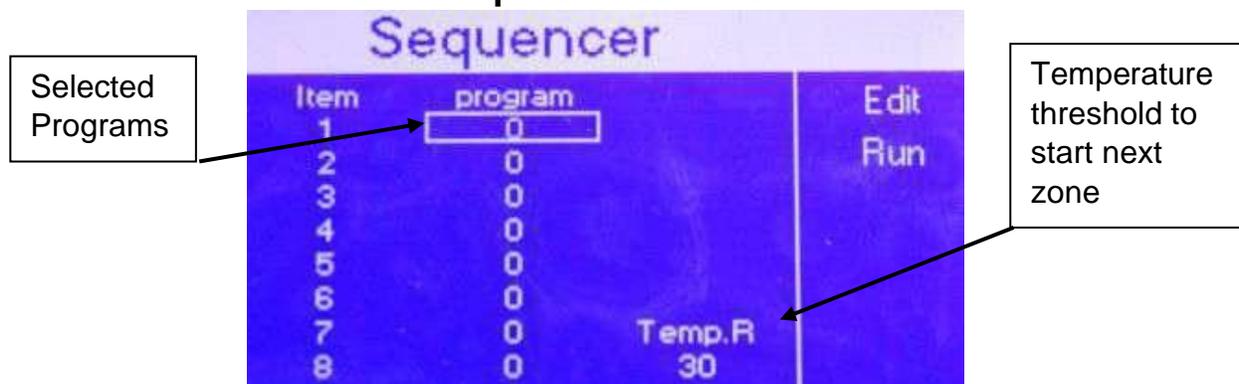


Fig.11. Sequencer Window

b. How to Run the Sequencer

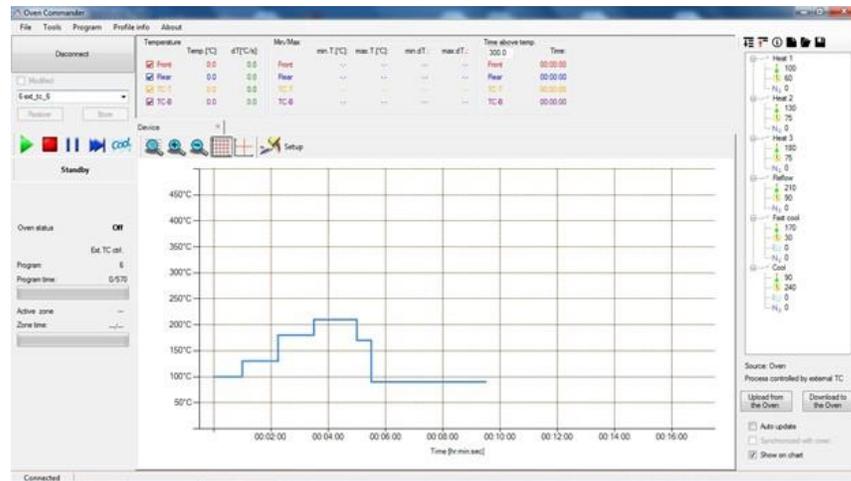
1. Use the right arrow key to navigate to the right menu from the Process Window screen. Then use the down arrow key to highlight "Sequencer". Press the "Enter" key to open the Sequencer Window shown in Fig.11.
2. Enter the desired program number using the numerical keypad when the correct slot is highlighted to set the program. Note that "0" means no program will be run.
3. Once the desired programs are entered, use the down arrow key to highlight the "Temp. R" field. Press the "Enter" key to use the numerical keypad to enter the desired temperature threshold for advancing the sequencer.
4. Press the right arrow key to navigate to the right menu. Use the down arrow key to highlight "Run". Press the "Enter" key to start the sequencer. This will return to the Process Window screen and the first program will start. The title of the screen changes to "Process Window S" instead of "Process Window" to provide confirmation that the sequencer is running.

XVI. Technical Specifications

Temperature Range	50°C to 350 °C
Number of Zones	Three to five zones + Purging zone
Heaters	2 Heaters (Front and Rear) both at 3.45kW (230V) or 3.45kW (208V)
Max PCB Size	12" x 12" (306mm x 306 mm)
Advanced Cooling Module (AC models only)	Cooling media: Either Nitrogen or Shop Air Cooling media enters through an array of tubes located over the heated object. Opening and closure of the exhaust port is programmable. Removable for maintenance or if extra chamber height is needed.
Monitoring Window Size	7.8" x 7.8" (200mm x 200 mm)
Nitrogen Connection	Nitrogen Pressure: .5 to 1 bar Standard Connector.
Size	Length: 28" (711mm) Width: 21" (530mm) Height: 15.4" (390mm)
Weight(Unpacked)	125lbs (~57 kg)
Communication Ports	RS485 Port (X485-USB converter is included with the oven to allow for PC connection)
Advanced Features	<ul style="list-style-type: none"> • Process Window that displays actual temperature/time numerically or as a graph and provides indicators for what functions are set and process parameters • Independent offsets for the heaters (useful for processing unevenly loaded boards) • Nitrogen ready with an optional Residual O₂ Monitor • Oven Commander Software (See page 20 for details)

XVII. Optional Accessories and Equipment

a. Oven Commander

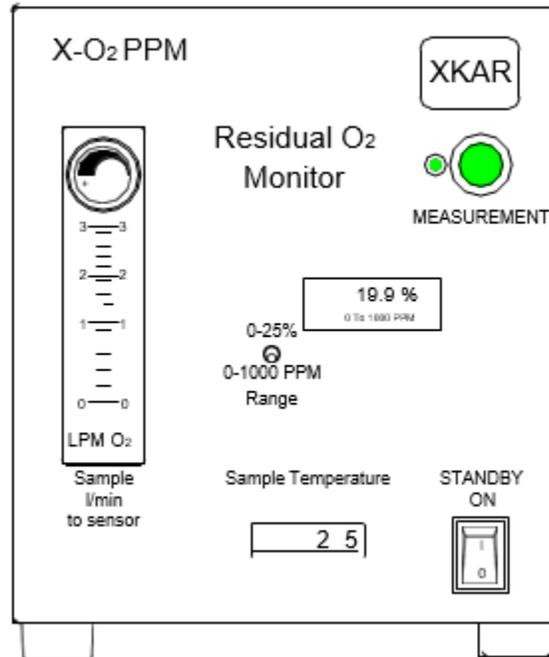


This software allows the operator to monitor and control the oven from a PC. Programs can be created on the PC and then downloaded to the oven. Once downloaded, they can be run from the PC and will display a time/temperature graph to allow the operator to monitor the program and, if needed, make changes directly from the PC as the program is running. These graphs can be tagged with additional information and then exported to Excel for documentation.

Key Features:

- Create custom programs on a PC
- Directly control the oven (including on the fly modifications while a program is running)
- Store temperature/time profiles
- Print time/temperature graphs and programs or export them to Excel
- Export time/temperature graphs
- Document additional information (PCB number, PCB description, etc.)

b. Residual O₂ Monitor



The X-O₂PPM monitor allows the oven operators to see actual purity of the N₂ environment during the heating cycle

c. ATR-1 Utility Cart



The ATR-1 is an ESD-safe cart for X-Reflow306 Ovens on four ESD wheels (2 with brakes). It has a middle shelf to store accessories needed when using the oven (e.g. Heat resistant gloves, spare thermocouples, notepads, pens/pencils, products processed in the oven, etc.) The cart allows access to the oven from all sides.

d. X-306A Fume Cleaning System



The X-306A Fume Cleaning System is a cost-effective unit capable of filtering the fumes emitted from the oven. The cooling media pushes the fumes through this system which cools the fumes and filters them.

e. XTC Profiler



The XTC Profiler is an 8 Channel Data Logger with eight 39" long "K" type, 36- gauge thermocouples that can withstand temperatures up to 482 deg C. It is very helpful when determining temperature uniformity of the heated object.

f. Side Cooling Fans



Fan modules that can be mounted on the side of the oven are available. When the cooling cycle starts, the fans will start and cool the heated object once the top clamshell is opened.

XVIII. How to Upgrade the Firmware

1. Unpack the file titled "X-Reflow306_firmware.zip" into one folder. Make sure that all files are in the same folder.
2. Connect the X-Reflow306 oven to a PC using the X485-USB Converter. Note that a driver is required for proper operation. The driver should be installed automatically when the converter is first connected to the PC. If needed, it can be downloaded from <http://www.bokar.us/downloads/drv.zip>.
3. Power on the oven while holding down the "Enter" key.
4. Release the "Enter" key once the oven displays "Bootloader mode".
5. Run the program "Flasher.exe" on the PC.
6. The flasher should automatically detect the oven and ask, "Do you want to start to update device?".
7. Select "Yes" to confirm.
8. Do not disconnect the oven while the flasher is working.
9. After the upgrade is finished, you should see the message "Write successful. Would you like to run application?". Press "Enter".
10. The oven should power on as normal, indicating that the upgrade was successful.