OPERATING MANUAL

X-Reflow306/S

Superior, Full Convection Bench Top Batch Oven offering Fast Cooling with N2 or shop air (or both), using programmable 2 zones Cooling media Flow rate Controller XMF-306KL.

The oven can be programmed and controlled from the optional PC application X-306/S Oven Commander

The oven is nitrogen ready, equipped with PC connection capabilities**,** and is supplied with an **XMF-306KL Cooling System Controller.** It also has two connectors for external "K" thermocouples (whose readings are shown on the oven display and stored/displayed online on a PC using the optional programs **X-306/S Oven Commander or X-306 Oven Monitor**). The "K" Thermocouple plugged into a TCT-connector and connected to the heated object allows for direct control of heat delivered to the object. This batch oven has a sealed heating chamber which permits heating in N2 environment up to 2000ppm or better.

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I.   INTRODUCTION

<p style="text-align:center">The Superior Convection Batch Oven</p>

Congratulations on the purchase of a Superior Convection Batch Oven **X-Reflow306/S.**
You now own a uniquely designed full convection Batch Oven for use in precisely controlled production, heat resistance testing of components and in laboratory experiments for any purposes where precise and accurate heating and precisely controlled cooling media flow rate is required.

The unit offers several unique features, not found in any other ovens on the market today:
- <u>An operating mode in which the control of the heating/cooling process is implemented by reading the real temperature of the heated/cooled object via a thermocouple attached to it and the TC-T input and then controlling heat to reach pre-programmed temperatures.</u>
- Advanced two zone, two media (N2, shop air, or both) programmable flow rate cooling system which enables cooling of heated objects (e.g. PCB's after reflow at the rates of 2 to 3 deg. C per second, giving greater reliability of soldered connections and safer handling of the heated objects.
- An <u>XMF-306KL</u> <u>Programmable cooling Module</u> controls the amount of cooling media (Air or N2) to provide the exact volume of L/min or SCFM's needed for cooling a particular load with required cooling rate.
- True convection heating with independent control of front and rear heaters, which enables higher accuracy of hot air temperature distribution to unevenly populated boards or irregular objects.
- Time settings in 9 time/temperature zones plus a time setting for purging the oven with nitrogen (N2) and a time setting for unloading the heated object if the oven works in Base or Sequencer mode.
- Presetting of profiles for different heated objects with memory space for 255 profiles. The profiles may be preset to control heaters using the air temperature in the chamber (the method all other ovens use) or using the thermocouple attached to the heating object.
- A large 7 7/8" x 7 7/8" inspection window allows the user to monitor the heating process during operation (inspection can be done using a microscope or camera system if needed).
- Microprocessor-based control uses closed-loop monitoring to ensure absolute repeatability of the temperature profiles and has enough memory to store 255 profiles.
- The large backlight display shows <u>all process parameters</u> and the specific temperatures and times, or a real time graph of temperature versus time

The Nitrogen inlet is standard, and the oven can be used for heating or soldering in Nitrogen environment without requiring any additional hardware.

Each oven has a built-in proprietary heat exchanger on the heating media sampling port to protect the Residual O2 Monitor (Optional) which usually has sensors requiring operating temperatures 70 deg. C or lower. On the back panel there is another connector to return the media sample to the unit.

SAFETY

The purpose of this "SAFETY" section is to inform the users of the heading guidelines used in this manual to indicate special Notes, Cautions, Warnings or Dangers. Also included are precautions, which must be observed when operating or servicing this product.

These "NOTES", "CAUTIONS", "WARNINGS" and "DANGERS" are inserted in this manual whenever deemed necessary. They appear in blocked off form with an outline and a shaded background to highlight the information as shown below.

NOTE
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

NOTE
- Used to indicate a statement of company recommendation or policy. The message may relate directly or indirectly to the safety of personnel or protection of property. NOTE is not associated directly with a hazard or hazardous situation and is not used in place of "CAUTION", "WARNING" or "DANGER".

CAUTION

- Used to indicate a hazardous situation, which may result in minor or moderate injury. May also be used to alert personnel to conditions, procedures and practices which, if not observed, could result in damage to or destruction of the product or other equipment.

WARNING
- Used to define additional information, that if not closely followed may result in serious damage to equipment and represent a potential for serious personnel injury.

DANGER
- Defines additional information, that if not closely followed may result in severe personnel injury or death. Danger is not used for property damage unless personal injury risk is present.

PRECAUTIONS

The following are general safety precautions, which personnel must understand and follow when using or servicing this product. These precautions may or may not be included elsewhere in this manual.

1. Utilize all standard electrical safety precautions when using this or any other electrical equipment.
2. Always use this system in a well-ventilated area. A fume extraction system (such as those offered by the XTRACTOR Brand) is highly recommended to protect personnel from solder flux fumes.
3. Exercise proper precautions when using chemicals (e.g., solder paste). Refer to the Material Safety Data Sheet (MSDS) supplied with each chemical and adhere to all safety precautions recommended by the manufacturer.
4. The fumes emitted during soldering are irritants and therefore should be removed. A pumped vent is located at the rear of the unit and should be ducted accordingly.
5. The area close to the hood becomes hot. Care should be taken when working around this area.
6. This oven must be properly grounded.
7. Please read this operation manual carefully prior to use.
8. The area around the viewing window becomes hot; therefore, care should be taken when working around this area.
9. After ending the cooling cycle, the inside of the oven is still hot; therefore, care should be taken when removing and mounting the PCB.
10. Be sure to wear appropriate gloves to prevent burns when taking the PCBs out of the oven and placing new ones. The PCB is still hot. The temperature inside the oven may be as high as 350 deg. Celsius. Use ESD safe heat-resistant gloves like Bokar P/N AHRG-26 or AHRG-39

To ensure continued peak performance through the years, use genuine X-KAR replacement parts.

II.   PACKAGING

The packaging of the X-Reflow306/S oven has been carefully designed to ensure maximum protection during shipping. However, no packaging can guarantee 100% protection, and damage may occur through rough handing by the carrier. Please ensure that any claims for shipping damage are reported promptly to the carrier and to the Distributor from whom the product was purchased.

The Oven is packaged in 2 boxes:
The content of box 1 is as follows:
1. X-Reflow306/S Full Convection Superior Batch Oven
2. Two "K" thermocouples
3. X485-USB Converter
4. User Manual
5. Warranty Card

The content of box 2: XMF-306KL Cooling Media Controller.
We recommend ordering the **X-306/S Oven Commander or X-306 Oven Monitor** to see the temperatures of the air and the object in the oven in real time on your laptop. For more monitoring points, choose the **XTC-Profiler**, an eight channel "K" TC data logger. (see both products on www.bokar.com).
Note: Because there are no unified standards for plugs and sockets used for high current 230V power lines, the unit comes without the AC plug. The oven recipient has to install the three-prong plug matching the 230 or 208V supply sockets existing in their location.

III. **UNPACKING**

Prior to use of the system, please check if the system is complete. Should you notice that any items are missing, please notify us, giving the details of model number, voltage, date of purchase, place of purchase and what is missing. Missing items must be reported within 7 days of the date of purchase.
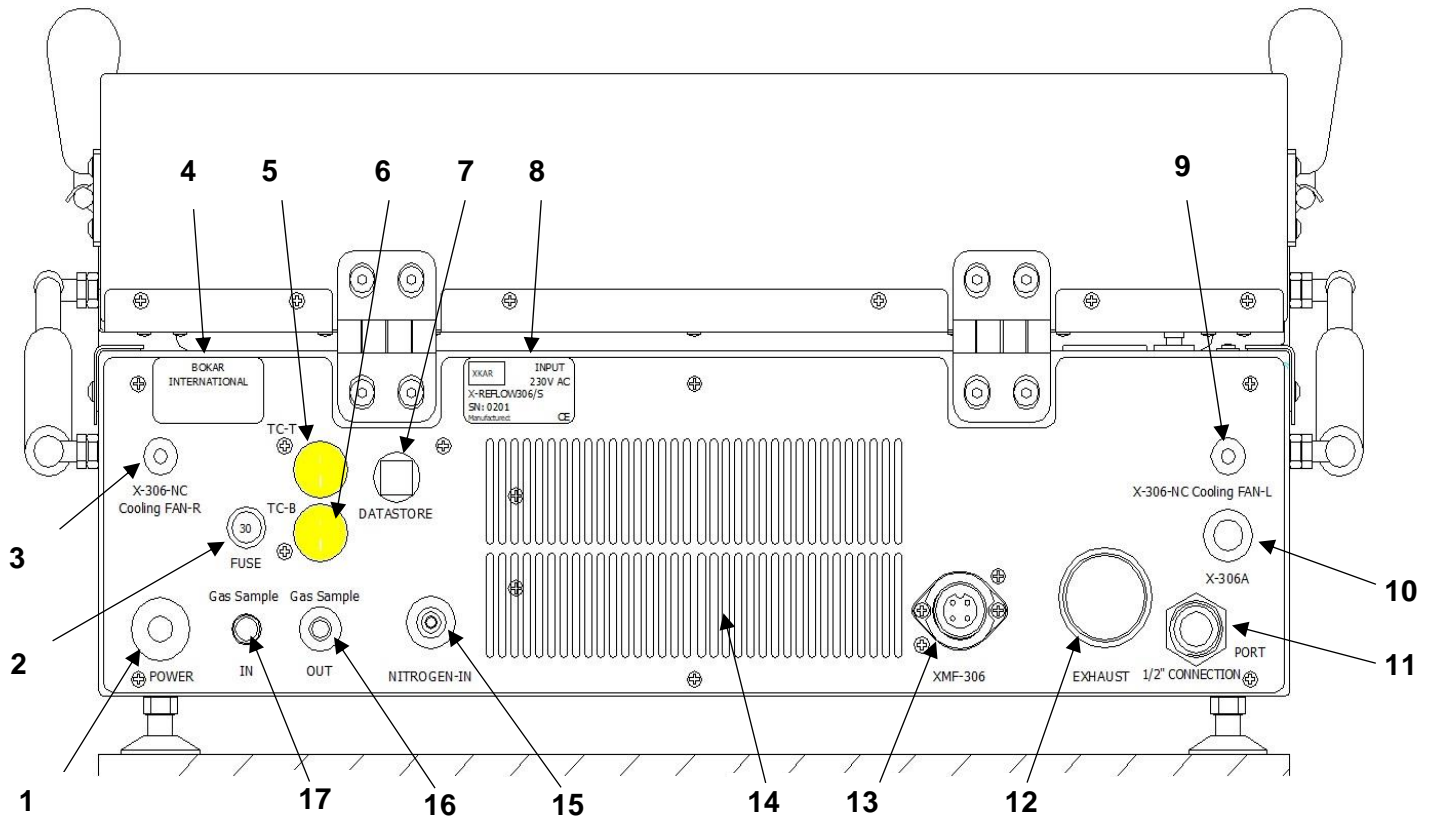
WARNING
When unpacking, please be careful and read the manual prior to turning the System "ON". Please check that the voltage of the System corresponds with the voltage of your available supply. Connection to incorrect voltage supply may cause damage to the System!

IV. **GENERAL INFORMATION**

X-REFLOW306/S front panel view

1. Display
2. Current zone indicators
3. Numerical keypad
4. Cool Key
5. Start/Stop Key
6. Power switch
7. Mode indicators (Base, N2 and Purging Modes)
8. TC-T and TCB status indicators

Rear Panel View

Bokar International 650 Scranton Pocono Hwy., Covington Twp., 18444 Pennsylvania USA
www.bokar.com e-mail: bokar@bokar.com Tel: 1-570-842-2812 www.BestBatchOven.com

What is on the back of the oven:

1. Power Cord
2. 30A Circuit Breaker
3. X-306-NC COOLING FAN-R Connector to supply cooling air (Models with the prefix NC only)
4. Bokar International Company Label
5. External 'K" Thermocouple Input TC-T (Top TC)
6. External "K" Thermocouple Input TC-B (Bottom TC)
7. DATASTORE Socket to connect to a PC for firmware upgrades and/or use of X-306S Oven Commander (or X306 Oven Monitor)
8. Unit Label (Model, Serial # and working Voltage)
9. X-306-NC COOLING FAN-L Connector to supply cooling air (Models with the prefix NC only)
10. Socket to connect X-306A Fume Cleaning System
11. ½" airline pneumatic male nipple to connect cooling media line
12. Exhaust pipe (Models with the prefix AC only) or connect pipe from X-306A Fume Cleaning System
13. Electrical connector to connect XMF-306KL Controller
14. Louvers to provide ambient air for cooling the oven subsystems
15. N2 Inlet Port
16. Gas sample OUT
17. Gas sample IN

V.   SET-UP AND INSTALLATION

ELECTRICAL REQUIREMENTS
The X-Reflow306/S unit requires 5 kW 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.

SETUP
1. Remove the X-Reflow306/S from its shipping box. Store the shipping box in a convenient location. Reusing this box will prevent damage if you ship or store the unit.
2. The system should be located on a rigid and stable work surface.
   The ATR-1/306 ESD cart which was designed to provide the space for accessories like the XMF-306KL Mass Flow Controller makes the oven mobile and independent. (to see the cart details please go to www.ESDcarts.net)
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 oven.
5. If you wish to use nitrogen for heating in a N2 environment, attach the nitrogen source (0.5~1 kg/cm^2) to the nitrogen input port on the rear panel of the oven.
   Note: Higher N2 pressure can be used (up to 6 bars) if your process requires.
   If you plan to use N2 for cooling, please secure a high-volume source. A volume of 40 to 60 SCFM is recommended for fast cooling.
6. Unpack the XMF-306KL Mass Flow Controller and place it next to the unit (or under the unit if you have an ATR-1/306 cart.
7. Connect the electrical cable attached to the XMF-306KL ending with a right-angle connector to the mating connector on the back panel of the oven. Use the ½" ID flex line supplied with the unit to connect the XMF-306KL cooling media output to the ½" cooling media input located on the back part of the oven's top clamshell.
8. The XMF-306KL controller allows using N2 for fast cooling to solidify the molten solder and shop air for cooling further to desired temperature. It has 2 cooling media inputs. Connect N2 to the fast cooling (Cool1) input and shop air to the cooling (Cool2) input.

   The oven is now ready for use.

POWERING UP and LOGGING IN

1. For first-time installation: Install the 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. Plug the power cord plug into the appropriate AC supply receptacle (208V for the oven model ending with 208V, and 220-230V for the oven model ending with 230V. (One can find the oven nominal voltage on the label on the oven's back panel.)

CAUTION
To ensure operator safety, the AC supply receptacle must be checked for proper grounding before initial system operation.

3. Turn the power switch to the "ON" position.
4. A short sound will be heard, and the display will show a welcome screen with the manufacturer's logo, the oven name, a serial number and the oven firmware revision number (below-left).


Please check if the red LED marked "POWER" illuminates on the panel of the XMF-306KL Flow Controller. If yes, this will confirm that the electrical cable from the XMF-306KL was properly connected to the Oven.

5. After few seconds the display will show a "Login" screen where different level users are listed (above – right). Depending on your privileges (Administrator, User, Guest or Factory Authorized Representative), choose an appropriate login. Detailed information about privileges and accounts is presented in another chapter of this Manual.
6. If the operator is not the one of the authorized users, he/she can login as a GUEST.
Pressing "up" or "down" arrows on the numerical keypad moves the cursor to the desired

user selection. When the appropriate position is selected press `ENTER`
7. If any selection other than GUEST is selected, the screen will ask for a Password (below-left).
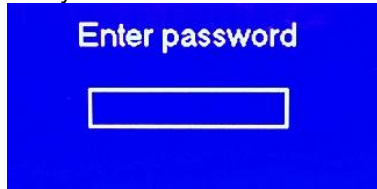
Enter Your four digit Password and press `ENTER`. If you are going to be the administrator of the oven and are turning on the oven for the first time, please enter the preset at the factory code "1234" selected for

the administrator and press `ENTER`. The Admin code can be changed later to any four digit combination. If you change it, please write it down and keep it in a safe place.
8. When the password is entered, the Process Window of the last used profile will appear on the display (above–right). The Programming and Heating Process starts from this window.   The

Process Window is the main window of the Oven Program. Pressing `P W` when viewing any other window will always return the operator to the "Process Window" screen. This window has all the information about the settings of times and temperatures in the oven in different zones as well as the temperatures read by the external thermocouples connected to TC-T and TC-B sockets on the back panel and temperatures of the thermocouples placed in the front and back of the heating chamber which read temperatures of the air circulating in the chamber.
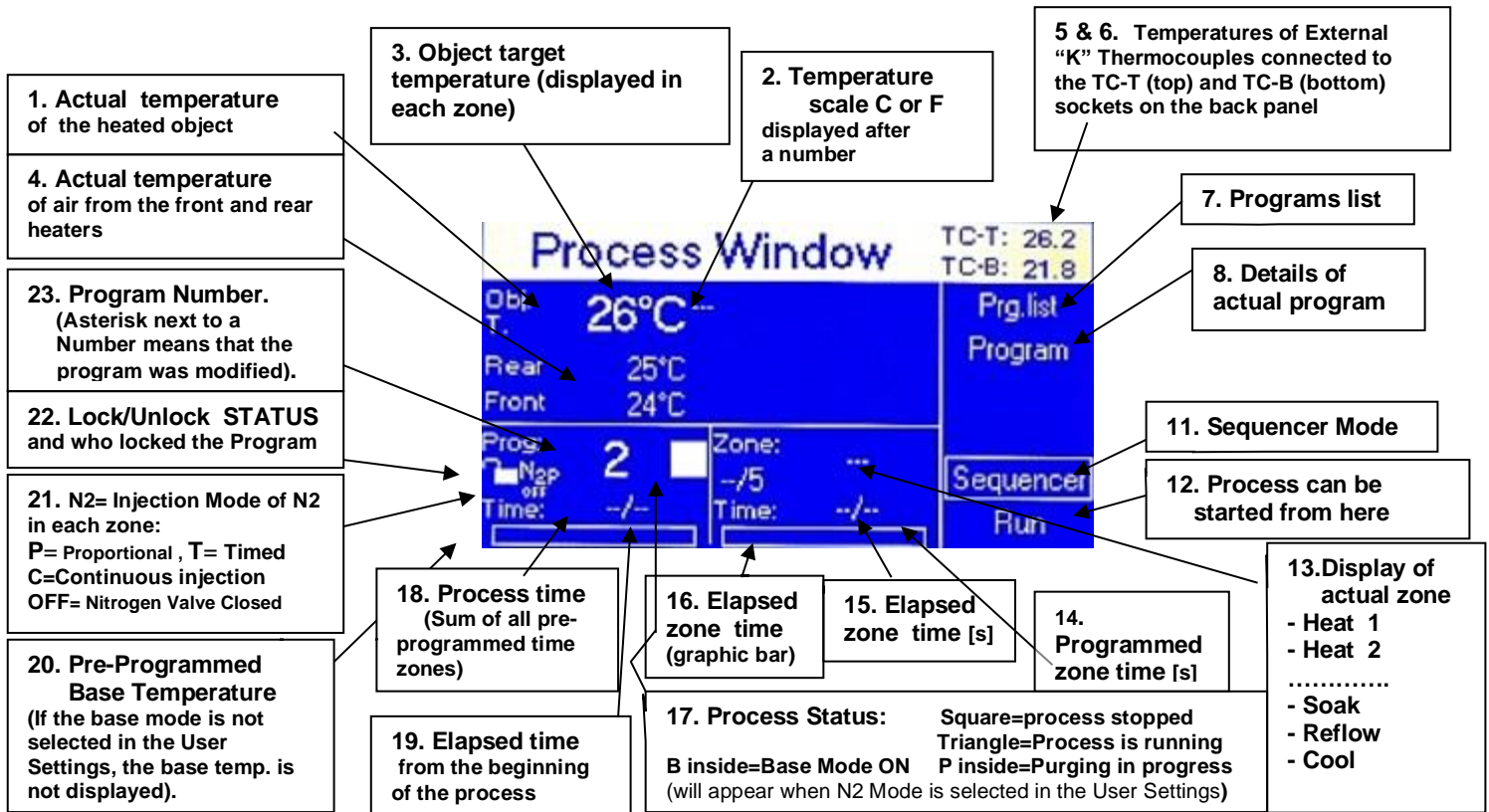

VI.   OPERATION

Human Interface with the Oven is done by pressing the ON/OFF power switch, the keys on the oven keypad and observing the oven display and LED indicators.

The heating process (or Program Cycle) can be started from the "Process Window" and "Program window"

Pressing the `START STOP` key begins the Program Cycle. When the process has started, a Red LED illuminates in the corner of the Start/Stop key. The display shows the "Process Window" screen (Fig.4 below), and color LED's on the graph located next to the display indicate the phase of the cycle and in which zone the program executes the cycle.
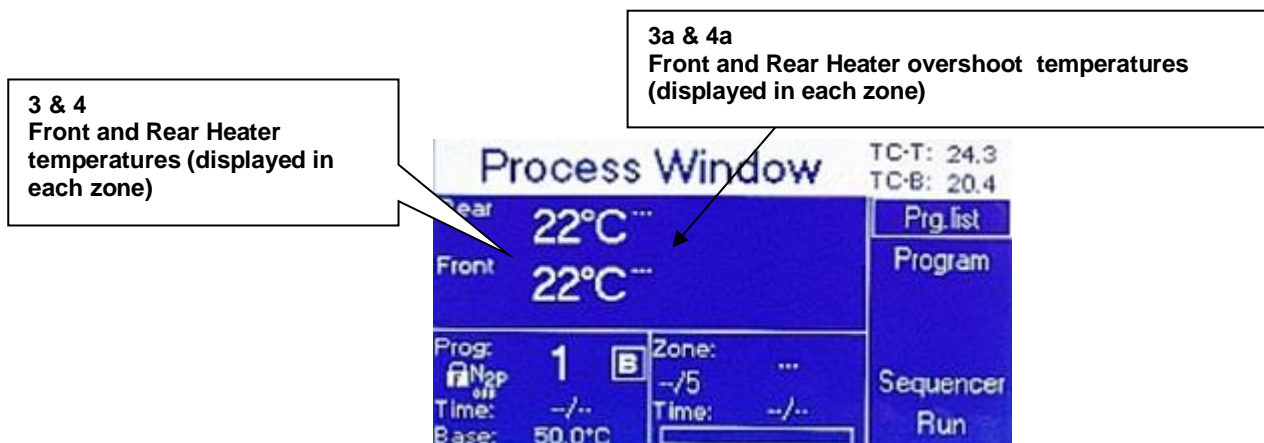
Pressing the `START STOP` key at any time during the process advances the oven to the next task (not to the next

zone) and eventually stops the cycle. Pressing the `COOL` key opens the cooling air valve and starts the cooling immediately via the media connected to Cool2 input of the XMF-306KL. During the cooling cycle, the fan inside the oven circulates the air. The cold air jets will cool the object in the oven.

1. Actual temperature of the heated object

4. Actual temperature of air from the front and rear heaters

23. Program Number. (Asterisk next to a Number means that the program was modified).

22. Lock/Unlock STATUS and who locked the Program

21. N2= Injection Mode of N2 in each zone:
P= Proportional , **T**= Timed
C=Continuous injection
OFF= Nitrogen Valve Closed

20. Pre-Programmed Base Temperature (If the base mode is not selected in the User Settings, the base temp. is not displayed).

3. Object target temperature (displayed in each zone)

2. Temperature scale C or F displayed after a number

5 & 6. Temperatures of External "K" Thermocouples connected to the TC-T (top) and TC-B (bottom) sockets on the back panel

7. Programs list

8. Details of actual program

11. Sequencer Mode

12. Process can be started from here

13.Display of actual zone
- Heat 1
- Heat 2
....
- Soak
- Reflow
- Cool

18. Process time (Sum of all pre-programmed time zones)

16. Elapsed zone time (graphic bar)

15. Elapsed zone time [s]

14. Programmed zone time [s]

19. Elapsed time from the beginning of the process

17. Process Status: Square=process stopped
Triangle=Process is running
B inside=Base Mode ON   **P inside**=Purging in progress
(will appear when N2 Mode is selected in the User Settings)

Process Window display:
TC-T: 26.2
TC-B: 21.8
Obj. T. 26°C
Rear 25°C
Front 24°C
Prg.list
Program
Prog. N2P off   2   □   Zone: --/5   ···
Time: --/--   Time: --/--
Sequencer   Run

Above: The Process Window before the program starts is <u>shown for the oven set to execute the program where the oven temperature is controlled by the thermocouple TC-T</u> connected to the heated object and plugged into to the TC-T input on the rear panel of the oven.

Below: The Process Window before the program starts is shown for an oven set to execute the program when the oven temperature is control, by maintaining preset temperature of the air or N2 in the oven.

3 & 4
Front and Rear Heater temperatures (displayed in each zone)

3a & 4a
Front and Rear Heater overshoot temperatures (displayed in each zone)

Process Window display:
TC-T: 24.3
TC-B: 20.4
Rear 22°C ···
Front 22°C ···
Prg.list
Program
Prog. N2P off   1   B   Zone: --/5   ···
Time: --/--   Time: --/--
Base: 50.0°C
Sequencer   Run

On the right side of the Process Window there is a keypad. To set the required oven parameters press [MENU].
The screen will change to the one shown below left.

Settings

Log Off

Exit

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

Press [ENTER]. The display will show general oven settings in the first top row.
Also, in the vertical column below the word "Settings", the display will show a list of the first five oven parameters which can preset.

Use [◄][►] to move from the left side to the right side of the screen. Pressing the [▲][▼] arrows, allows an operator to scroll up and down the screen to choose the required item.

1. **Settings: From this window you can set the way you want the oven to function. You can set the units in which your oven shall display the parameters and how it should execute heating and cooling.**

Proceed from the Settings screen (when the word Settings is highlighted).

Press: [▼] to move to the first parameter, the Base Temperature.
The display will look like the image below-left.

1.1. Base Temperature.

This is the temperature which the oven will maintain inside the heating chamber at all times after this option

is selected and [START STOP] start key is pressed. This option is unique and not found on other ovens. It is very useful because when the heating profile is started with a cold start it takes a minute or longer to heat the mass of the oven body which slows down the heating of the object in the oven. A warm start from a known starting temperature gives better repeatability of the same programs run at any time on the same day or a different day in the future. The Base mode is also very useful when using the oven as one zone device for pre-heating or curing purposes. It offers 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

To turn this option ON press [►] and then [▲]. The right part of the line will highlight and the number in the highlighted area will blink showing the previously set Base Temperature. You can use the numerical

keypad to set your desired base temperature value. Press [ENTER] to save your setting. The possible range when setting the Base Temperature is: +50ºC to +300ºC.

From the display as shown on the left above scroll down by pressing [▼] to set the next 2 parameters, which are heater offsets. The display will look like the image below on the left side.

Offsets

This feature is also unique. Theoretically the hot air mixes in the heating chamber and reaches an average value. Both heaters are set up in the factory to deliver the same temperature of the air stream at the front and at the rear of the heating chamber. But if the heated object mass is not evenly distributed (e.g. the board is heavily populated by large components on the back and lightly populated at the front), the oven heating gas will need to have higher temperature of air at the back to evenly heat the mass imbalanced object. This is because the mass of the hot air injected to the heating chamber from both the front and the back is the same.

In case of unevenly distributed mass to be heated, the operator should measure the difference in the temperature rise and set the heater offset accordingly. Example: If the back heater should give air hotter by 20ºC, the operator should set the rear heater temperature offset to + 20.

Note: one may also enter negative offset values.

From the display as shown on the above left, scroll down by pressing ▼ to highlight "Offsets". Then press **ENTER** or ➤ to set one or both heaters offsets. The display will show the screen below-center.

Base temp.	Offsets	Overshoot	Air circ.
Front heater offset			0.0
Rear heater offset			0.0
Override factory offset			Yes

1.1.1.Front heater offset – Press ➤. The right part of the line will highlight, and the 0.0 value will blink.

Using the numerical keypad set your desired value. Press **ENTER** to confirm your setting. Possible settings for the offset for front heater are -20ºC to +90ºC. The factory setting is 0ºC.

1.1.2.Rear heater offset – Press ▼ to scroll to Rear heater offset line. Press ➤.
The right part of the line will highlight, and the 0.0 value will blink. Using numerical keypad set your desired value. Press **ENTER** to confirm your setting. Possible settings for the offset for rear heater are -20ºC to +90ºC. The factory setting is 0 ºC.

1.1.3.Override Factory Offset – Factory offset is set to 0 ºC. For some customers (on demand) it is set to a different value. You should choose to override the Factory Offset.

1.2. Overshoot

To speed up the object temperature rise and start the PID control of the air temperature in the heating chamber as close as possible to the moment when the heated object reaches the desired temperature, we give the operator a possibility to set target air temperature a bit higher than desired by a programmed number of ºC and for a programmed amount of time.

Press ▼ to go the "Overshoot". Then press **ENTER**. The right part of the line will highlight and "off" will blink. Pressing ▲ ▼ arrows turns the overshoot ON or OFF (picture below-left).

Base temp.	Offsets	Overshoot	Air circ.
Overshoot			Off

Base temp.	Offsets	Overshoot	Air circ.
Overshoot			
Overshoot time			30
Overshoot temp.			30.0

After selecting "ON", press [ENTER]. The display will show the settings of Overshoot: (picture above-right).

Press [▼] to go to "Overshoot time". Press [▶] to go to overshoot time setting section.

Set the desired time and press [ENTER]. Repeat the action to set the "Overshoot temperature".
Recommended Overshoot is 10 to 30ºC in 10 to 30 seconds.

1.4 Air Circulation

Press [▼] to go to "Air Circulation" (screen below-left). Press [▶]. The right part of the line will highlight and a previously set mode of air circulation will blink.

Settings	Protection	System	Connection
Base temperature			100.0
Offsets			
Overshoot			
Air circulation			Continuous
Cooling to temp. of			TC-T

Settings	Protection	System	Connection
Base temperature			100.0
Offsets			
Overshoot			
Air circulation			Pulsed
Cooling to temp. of			TC-B

By pressing [▲][▼] you can set the air circulation mode to Continuous or Pulsed. Continuous means that the blower circulating the air in the heating chamber works all the time and Pulsed that the blower works on and off. Press [ENTER] to confirm your setting.

1.5 Cooling to temperature of
The operator can set how long the cooling shall operate. It can be set to track temperature of the circulating air and stop the cooling action when the circulating air drops to the pre-programed value. Working simultaneously there is a setting for the maximum cooling time. The cooling action will stop when either a pre-set time elapses or
the temperature of the air in the oven drops below the pre-set value.

Press [▼] to go to "Cooling to temp. of". Press [▶]. The right part of the line will highlight and the previously set mode of Cooling to temperature of will blink.

By pressing [▲][▼] you can select to cool to the temperature of the circulating air or to the temperature measured by the TC-B or TC-T (thermocouple connected to the heated object and to the input on the back panel of the oven). The TC-B or TC-T Mode will make the oven cooling work until the temperature measured by the selected thermocouple reaches the pre-programmed value.

Press [ENTER] to confirm your setting.
Note: Cooling to the temperature of the circulating air (as in all other batch ovens) does not give any guarantee that, when the air is cold, the load is cold as well.

1.6 Time to unload

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

Press ▼ to go to "Time to unload". Press [ENTER] or ➤. The right part of the line will highlight and the previously set value will blink. Using the numerical keypad, set your desired value and press [ENTER] to confirm your setting.

Possible settings for Time to unload range from 3 to 300 sec. The factory setting is 15 sec.

1.7 N2 – Nitrogen Environment settings.

Press ▼ to go to N2. To turn this option ON press ➤ or [ENTER]. The window below left will open.

Cool. to T.	Time to unl.	Ventilation	N2
N2 Addition Mode			N2C cont.
Purging time			120
Purging flow			650

Cool. to T.	Time to unl.	Ventilation	N2
N2 Addition Mode			N2T periodic fill
N2T fill time [s]			10
N2T Repetition rate[s]			60
Purging time			120
Purging flow			650

Press ➤. The right part of the line will highlight and the highlighted area will blink showing the previously set N2 Mode. By pressing ▲ ▼ you can set the N2 mode of operation to OFF, N2C=Continuous fill, N2T=Periodic fill [sec] or N2P=Proportional [%].

Press [ENTER] to confirm your choice. N2 Mode will be highlighted.

N2 Modes mean: Mode **"N2C=Cont."** – during the program, nitrogen is added continuously.

Mode "N2T**"Periodic fill"** [sec]: N2T fill time [s] - how long nitrogen will be added in each zone. Possible settings are 5 to 120 sec. The factory setting is 10sec. Mode **"N2P=Proportional"** [%] – N2 will be injected to the heating chamber for a set % of the zone time duration. Possible settings are 0 to 100%.

Purging time – how long to purge the oven before starting the heating cycle. Possible settings are 0 to 1200 sec.
Purging flow – Flow rate for purging in l/min (or scfm). Possible settings are 0 to 1500 l/min.

Press [ESC] to return to the Settings menu.

1.8 Cooling Media Flow Control (or Cooling Air Flow Control).

These settings define how the XMF-306KL Mass Media Flow Controller attached to the oven will function. The XMF-306KL has two inputs (one for fast cooling with N2 and the second for shop air). Each Fast Cooling (Cool1) and Cooling (Cool2) can be programmed independently when creating the program.

In the settings, the Operator can choose cooling flow units (l/min or SCFM's).

Note: Fast cooling is to solidify the solder which is best done with N2. The flow should be chosen depending on the mass and size of soldered components to avoid blowing them out of place. After solder solidifies, the air flow in Cool2 can be higher.

When in the Settings – N2 screen, press ▼ to go to the Cooling Air (or N2) flow Control.

The window shown below/left will open. Press ➤ or [ENTER] to go to the right side. Turn the control ON using ▲ ▼ up/down arrows.

1.9 Cooling Air (or N2) flow Units

Press ▼ to go to "Cooling Air Flow Scale". Press ► or ENTER to go to the right side. The right part of the line will highlight and the previously set units will blink. Using ▲▼ (up/down arrows), set your desired units (L/min or SCFM).

1.10 Max.Temp.diff. heater to object

When controlling the heating rate in the oven via the thermocouple attached to the heated object you want as high gas temperature as possible to quickly transfer heat to the object. But the user may have temperature sensitive devices and may want to have control over how much differential to set between the heating air and the heated object. This setting allows for specifying this max. temperature difference.

Press ▼ to go to "Max.Temp.diff. heater to object". Press ► or ENTER to go to the right side. The right part of the line will highlight and the previously set value will blink. Using ▲▼ (up/down arrows) adjust this value with the increment of 0.1 ºC. You can also use the numerical keypad to set your desired value without going through .1deg. increments. Press ENTER to confirm your setting.

Press ENTER to confirm your setting. Top Heater temp. will be highlighted.

Press ESC to return to the Settings menu.

2 System

System parameters which shall be set for all oven users.

2.1 Language (At this time we have a choice of English and German)
2.2 Temp. Scale – Choice of Temperature Scale: The factory setting is ºC
  ºC – Degree Celsius   ºF – Degree Fahrenheit
2.3 Time and Date – Please set. No Factory Settings.

The X-Reflow306/S has built-in real time clock which is maintained by an internal battery.
It is mainly used to remember the time and date when the programs were created. The correct time and date settings will provide accurate tracking of the order in which the programs were created.

Setting time:
Hour and minutes

Setting of the date (year, month and day)

Settings confirmation button
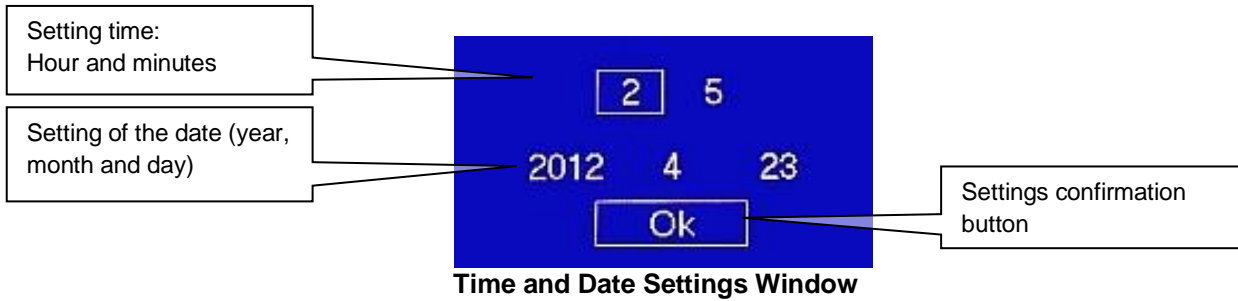
Time and Date Settings Window

a) Access the time and date settings window (In settings menu)
b) The active frame shows the parameters which can be set. The first one is "hour".
c) Set the hour using the numeric keypad.
d) Confirm by pressing **ENTER**.
e) Set the minutes and confirm by pressing **ENTER**.
f) Set the year and confirm by pressing **ENTER**.
g) Set the month and confirm by pressing **ENTER**.
h) Set the day of the month and confirm by pressing **ENTER**.
i) Active frame moves to "OK." If satisfied with the settings, confirm pressing by **ENTER**.

2.4 Sound - Available settings:
ON – sound is on
OFF – sound is off
2.5 Contrast – Display contrast setting.
Available values: 32 to 255
2.6 Calibration (An option for the administrator to perform periodic calibration of temperature sensors)

3 Connection

3.1 Address – Oven address used when it is connected to a computer.
Available numbers 1 to 247. The factory setting is 247.

4 Restore

4.1 Restore Settings –This option allows an administrator to restore all settings to the

factory-set values. When the **Restore Settings** is highlighted - press **ENTER**.
4.2 Restore Analog Settings This option allows an administrator to restore analog settings to the factory-set values.

When the **Restore Analog Settings** is highlighted - press **ENTER**.

VII.   CREATION OF PROGRAMS

Each program has a set of time/temperature zones to fulfill all the requirements of a temperature PROFILE which is necessary for proper soldering of the SMT parts to the PCB's or any other heat treatment process.
The PROGRAM should have:
a) A minimum of one PREHEAT Zone as recommended by solder paste manufacturers for the purpose of proper activation of the flux contained in the solder paste and to gradually change the temperature of the cold board to avoid stress across the entire board and especially on the vias (connections between the pcb layers).

b) SOAK or Heat Equalization Zone to evenly spread the heat across the board,

c) REFLOW Zone to bring the temperature high enough above the melting point of the solder to melt and hold it in a liquid state for a sufficient time.

d) COOLING Zone to cool the board and solder, preferably at the rate of one degree per second or better.

X-Reflow306/S has one program example entered at the factory which cannot be changed. The user can enter and save 250 Programs.

Only the Administrator and Privileged Users can create and save the Programs.

X-Reflow306/S PROGRAM Characteristics:

This SuperOven X-Reflow306/S can work in a conventional mode (same as other ovens work). This is the mode when the profile is created to control the heating gas temperature in each zone guessing the difference between the real temperature on the board and the gas temperature. This method was used for years. An experienced oven operator could run the pilot test and use the results to estimate how much higher to set the temperature of the Air or N2 in each zone to bring the board to a desired temperature in a given time.

X-Reflow306/S has a second mode (which can be selected when creating the program) which eliminates the guessing of the temperature differential. The thermocouple is attached to the board (or other heated object) and measures real board temperature. The oven will heat the air in such a manner so that the temperature set for the board in each zone is reached and maintained. The operator needs to set the max time duration of each zone.

Each PROGRAM created and saved in X-Reflow306/S Memory gives the following choices:

- Number of zones (choice of 3 to 9 Temperature/Time Zones + purging zone)
- Choice of temperature control in the oven (Either by external TC connected to the heated object or by the thermocouples measuring the temperature of the air in the oven)
- A record of the date on which it was created
- The identity of the creator of the PROGRAM
- Whether it is Locked or Unlocked and who locked it.
  Note: The saved Program can be locked/unlocked only by the creator or the Administrator.

Example:
A program locked by User1 cannot be erased, unlocked or modified by User2 or User3 but can be modified and/or locked/unlocked by the Administrator or Factory Serviceman.

 - program unlocked

 - program locked by User1

 - program locked by User2

 - program locked by User3

 - program locked by the Administrator

 - program locked by the Manufacturer

To create a new program, go to the process window (below left).

Using and/or arrows go to the Prg. List. Press ENTER. A program list window similar to the one shown above right will open. Scroll using the and/or arrows to the first empty space for the program. The space will be shown in a white line outline. Then press ▶ and the section New will be outlined in the right part of the Program List window. Press ENTER. The window shown below left will appear.

Using the keypad enter the desired number of zones which your profile requires. The max is 9 zones. (The purging with N2 is an additional 10th zone). Press ENTER. The window shown above right will appear.

Select "No" if you want to enter the conventional program when the temperature of the air in oven is controlled,

or "Yes" if you want the oven to heat your object to desired and pre-programmed temperature in each zone as measured by the external thermocouple attached to the heated object. Press ENTER.

If you have chosen to control the air temperature in the oven the display will be as shown below left. If you have chosen to control the object temperature in each zone as measured by attached to it thermocouple TC, the display will be as shown below- right.

Press ENTER to edit the sample program to set your required values.

Depending on your choice of number of zones and the type of the temperature control one of the two windows shown below will appear.

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Program edit (left table)

Zone:	Front°C	Rear	Time[s]
Heat 1	100	100	90
Heat 2	130	130	75
Heat 3	130	130	75
Heat 4	130	130	75
Heat 5	130	130	75
Reflow	240	240	90
Cool	90	90	240

Edit / Save / Save&lock / Save As... / Run

Program edit (right table)

Zone:	Temp	Time[s]	N2 [%]
Heat 3	150	75	30
Heat 4	180	75	30
Heat 5	200	75	20
Heat 6	220	75	20
Reflow	240	90	30
FastCool	170	30	80
Cool	90	240	0

Edit / Save / Save&lock / Save As... / Run

Using ◄ ► and/or ▲ ▼ arrows or the keypad set the required values for your program.

When finished, press ESC. The screen will outline Edit on top of the right column. Press ▼. The rectangular outline will move over "Save". Press ENTER and then P.W. to go to the Process Window screen.

Now you can run your newly created program.

Information about the program:

3. Number of zones

1. Program Number

4. Program number

5. Program just created.

2. Program Short Description

6. Menu accessible from this window

3. Program Status (Locked, unlocked and if locked, who locked it.

6. White background shows the chosen selection

Program List window

Moving around the Menu:

Use ◄ ► to move from the left side to the right side of the screen. Pressing the ▲ ▼ arrows allows an operator to scroll up and down the screen to choose the required item.

The selected item is framed by a rectangle. While in the MENU, pressing ENTER selects the highlighted action (view of the Program List, Current Program Settings, the Sequencer Mode or the RUN position from which he/she can start the process by pressing either ENTER or the START STOP key.)

Note: To return to Process Window from any place just press P.W..

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To change the program to a different one:

Go back to the Program List. Select desired program and press **ENTER** .

To edit the Current Program or create a new one:

Select "Edit" on the Menu and press **ENTER**. If you are authorized to do so, you will be able to edit this program's parameters.

A. Starting Program Cycle

- Power up the oven
- Select the program

- Press the **START/STOP** key to start the oven.

B. Stopping Program Cycle

- Press the **START/STOP** key to stop the oven.

CAUTION
The inside of the oven can be very hot. Start the cooling cycle before opening the oven and/or placing or removing the PCB.

C. Cooling Cycle

- When the reflow process is completed at the end of the REFLOW zone, the cooling cycle starts.

    OR   one can press **COOL** to start the cooling cycle at any time during program cycle.

NOTE
During the cooling cycle a fan inside the oven circulates the air. (Unless it is programmed to stop after a pre-defined number of seconds). To speed up the cooling, open the lid of the oven.

D. Selecting the program

To select a program to run:

a)   Use the **▲ ▼** keys to select the desired program.

b)   Press **ENTER** to access this program.

    When in the Process Window, press **START/STOP** to run the program.

E. Program Edit

a)   When in the window "Program" select Edit on the MENU and press **ENTER** If you are authorized, you will be able to edit the program. If not, ask the oven Administrator for help.

VIII. The Sequencer

The Sequencer can be used by the following types of users:

        PRIVILEGED USER
        ADMIN
        FACTORY

        The Sequencer is an additional tool which allows up to eight selected programs to run one after another. The parameter which ends one set program and starts the next selected program is the temperature measured by the external thermocouple connected to the "K" TC 1 connector located on the back panel of the oven. During the cooling cycle (zone) of the running program, when the temperature reaches the value pre-set by the user, the current program ends, and the oven automatically starts the next program chosen in the sequencer. If the external thermocouple "K" TC1 is not connected, the temperature which ends one program and starts the next one is determined by the internal thermocouple measuring front heater temperature.

Note:

        During the Sequencer cycle the settings in the cool zones of the selected programs do not have any meaning. They are over-written by the reading of the "K" TC1 temperature. The program will end when the TC-1 temperature reaches the pre-set in the Sequencer temperature "R". After the oven is cooled to this temperature, the running program stops and the next program selected in the sequencer starts running.

Selected programs to run in the order pre-programmed in this window
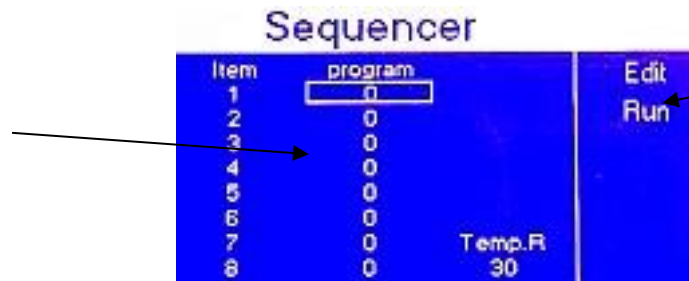
Menu

Sequencer window

Temperature which defines the end of one program (after cooled PCB reaches this temperature), and the start of the consecutive program on the sequencer list.

A. How to run the SEQUENCER

1. Access "Process Window".
2. From the menu on the right-hand side, select "Sequencer". The sequencer window will be displayed.
3. Select the first desired program to run using the numerical keypad and press [ENTER]
4. Select the consecutive programs to be run.
    (If you want to run only four out of the possible eight programs in the sequence, select 0 for items 5 to 8 on the program list (zero means that there is no program to run).
5. Pressing [▲] [▼] or [ENTER] to select "Temp. R" field.
6. Set the cooling temperature which you want to reach in each cooling zone of each program run in the Sequencer.
7. Press [►] to get to the menu on the right-hand side.
8. Press [▼] to select "Run"
9. Press [ENTER] to start the first program to be run in the Sequencer Mode.

Note:

To differentiate the view of the "Process Window" in the "Sequencer" mode from the view when a single program is run, in the "Process Window" the letter S is displayed after the word "window".
 "Process Window **S**" is displayed instead of "Process Window"

VIII. LEVELS OF AUTHORITIES for OVEN OPERATORS

The X-REFLOW306 LF oven, to protect stored profiles and oven settings, is programmed to give a selected choice of authorities to different users. In other words, the Operator can have either full access to oven settings (Administrator), limited access (USER), or no access (GUEST). The Administrator has the highest level of authority. He/She manages the use of the Oven. This Security System protects against unauthorized or accidental changes in oven settings and/or loss of stored profiles. To use the oven, the Operator must select the Level of Authority assigned to him/her and login by entering the PASSWORD assigned to him/her. Only GUEST does not require a PASSWORD (but GUEST can only RUN existing programs and cannot change any settings or delete anything).

WHO CAN OPERATE THE SUPEROVEN:

- Guest   (No limits on the number of Guests)
- User   (There are three accounts available for authorized users)
- Admin   (There is one Administrator account)
- Factory (There is one account for Factory Personnel for Maintenance and Service purposes)

A. Level of Authorities for each Group of possible OPERATORS:

Admin – The Highest Level of Authority. The account for the Oven Administrator.

The Administrator can:
- Assign passwords for the USERS
- Set the privileges for each USER
- Access and change all Oven settings
- Create New Programs and modify the Existing ones
- Lock and unlock all programs (except for the factory pre-programmed examples)
- Delete programs
- Run all programs
- Edit programs "on the go" in real time
- See the Program settings
- See the graphic display

User – Standard and Extended Set of Privileges for Oven Operator
(Requires Password to Login and operate the Oven)
- ➢ **Limited User** (with Limited Privileges) can:
  - Run existing programs
  - See the Program settings
  - See the graphic display
- ➢ **Privileged User** can:
  - Run existing programs
  - See the Program settings
  - See the graphic display
  - Create New Programs
  - Delete Programs
  - Edit the Programs "on the go" in real time
  - Lock and unlock the programs

Guest – This type of Operator does not need a PASSWORD to operate the oven

The GUEST can:
- Run existing programs
- See the Program settings
- See the graphic display

Factory – Account for Factory Personnel for Maintenance and Service purposes. It requires special factory password known only to the Factory Authorized Personnel.

B. List of Factory set PASSWORDS when the unit is shipped out to the Customer.

(The Administrator can change these PASSWORDS at any time)

- Admin : 1234 User1 : 1111 User2 : 2222

- User3 : 3333 User4 : 4444 User5 : 5555

- User6 : 6666 Guest : Does not require a password

- XXXXX Emergency Password for the Administrator

NOTE: *The emergency PASSWORD should be used only when the regular PASSWORD is lost (or forgotten). This PASSWORD is for one use only and cannot be changed. Please call the Distributor or Factory to get this PASSWORD if you need it.*
All other PASSWORDS can be set and/or changed in Oven Settings menu accessible only by the Oven Administrator.
He/She has to remember not to assign the same passwords for different Users.

IX.   X-Reflow306/S TECHNICAL SPECIFICATIONS

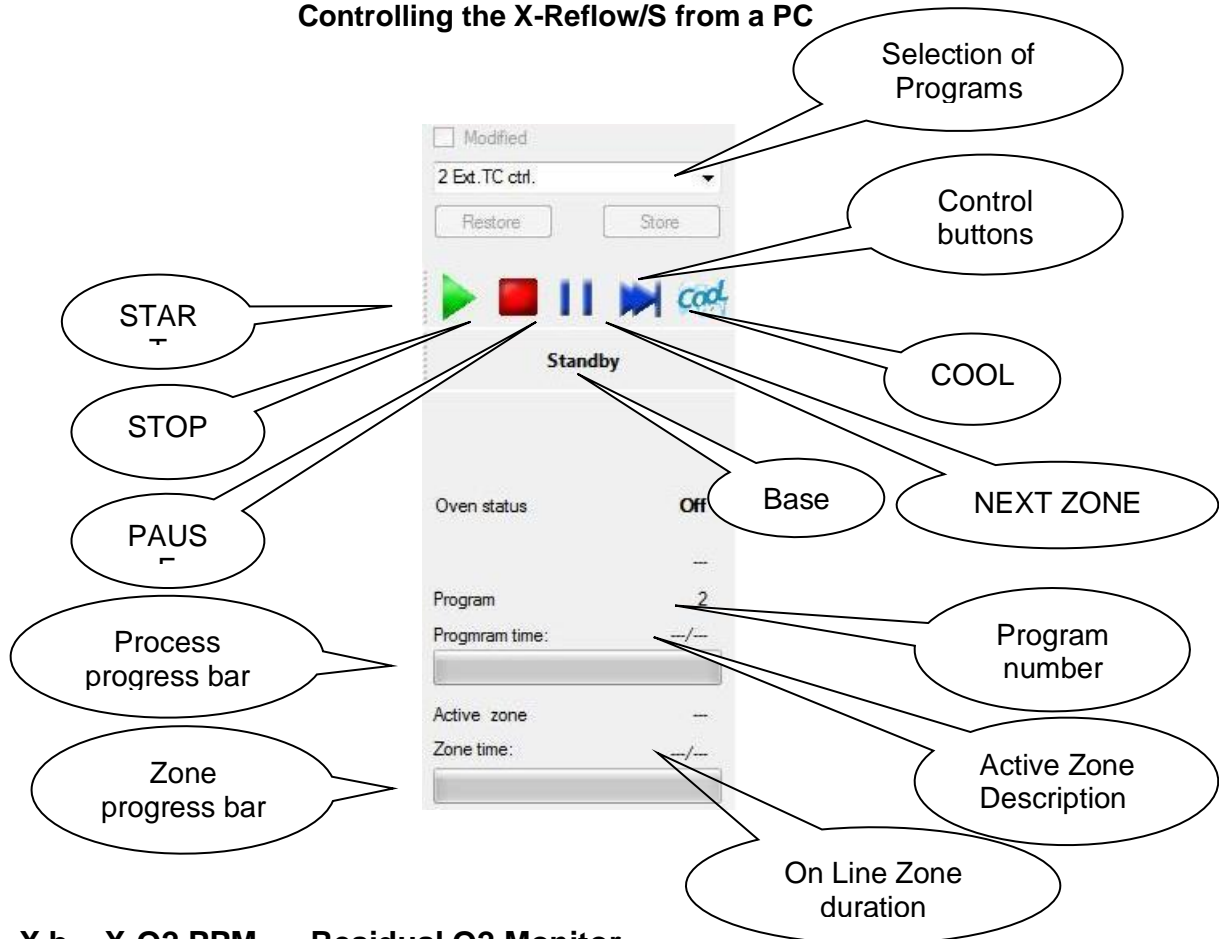|	
Reflow area	12"x12"x1.75" (305x305x45 mm)
Temperature range	30°C to 350°C
Temperature Zones	Purging, to push oxygen out + variable, three to nine zones, set by the operator for each program. Last zone is a cooling zone. Max: up to 10 (ten) zones.
Heaters	2 Heaters (Front and Rear) 3.1kW (230V) and 3.1kW (208V)
Max. PCB size	12"x12" (305x305 mm)
Supply Requirements	30 amps, 230V 50/60 Hz (Max power draw: 7 kW for 6 sec and 4-5 KW after that time
Advanced Cooling Module	Cooling media: Nitrogen or Shop Air. Timing and object temperature to cool to, is defined by the operator in the program ("K" TC must be attached to the heating object and plugged into the TC-B connector at the back of the unit. Cooling media is delivered to the oven from XMF-306KL Cooling controller and enters the heating chamber through four ½" tubes in the corners of the Top Clam Shell. Advanced cooling produces more reliable soldering connections and helps to handle heated objects after heating cycle. Opening and closure of the exhaust port is controlled by the programming.
Monitoring Window Size	7.8"x7.8" (200×200 mm)
Nitrogen Connection	1/2 "connector on XMF-306KL for Purging and Cooling (3-6 bar) and standard I/M 1/4" pneumatic male plug connector for adding N2 during heating cycle (pressure:1-2bar (14.5 - 29 psi)

Size	L=31,5"xW=21"xH=10,6"-11,4" {L=800mm x W=530mm x H=270-290mm (adjustable)}
Weight	Unpacked: 89 lb. (~40 kg) Packaged for shipping: 132 Ib. (60kg)
Computer controlled	Optional X-306/S Oven Commander PC application allows for pre-programming and storage of up to 254 programs and controlling the Oven in real time from a PC.
Communication with PC	RS485 port (XKAR X485-USB converter required to connect to a PC USB port)
Advanced Features **Advanced Features (continuation)**	- Display of the actual temperature/time numerically or as a graph and full indication of set functions and process parameters along with their values in the Process Window. - Choice to control the temperature in the oven getting feedback from the measurement of the air temperature (conventional way) or to control the air temperature to heat the object to a preset temperature by measuring this object real temperature using the thermocouple attached to this object and connected to TC-T connector (located on the back of the oven) . - Advanced, two stage cooling system allowing use of N2 and/or the air to cool the heated object at extra ordinary rate of few degrees per second. - Independent off-set for the 2 heaters, (useful when processing unevenly loaded boards). - RS-485 port for downloading firmware upgrades from a PC and monitoring air and two additional "K" Thermocouples temperatures during reflow process. (X-KAR R485-USB Converter is needed for connection to a PC. Ready to solder in Nitrogen environment. - Means to monitor the process in progress using X-306 Oven Commander program which completely controls the Oven or X306 Oven Monitor program which monitors in real time hot gas entering the oven from both heaters and the temperatures of two other "K" thermocouples which can read heated object temperature and the temperature of the air in the oven. - Built-in heat exchanger for extraction of hot N2 from the oven to measure residual O2 with the Residual O2 Monitor which requires samples of the gas from the Oven. . - Multi-point, user adjustable hot air diverters to optimize heat distribution for different size and different mass heated objects.

X. OPTIONAL ACCESSORIES and EQUIPMENT

X a. X-306 Oven Commander (Highly Recommended)

http://www.bokar.com/documents/Manuals/X-306-S%20OvenCommander%20Manual-R-CzR1.pdf

Controlling the X-Reflow/S from a PC

Selection of Programs

Control buttons

STAR T

COOL

STOP

PAUS E

Base

NEXT ZONE

Process progress bar

Program number

Zone progress bar

Active Zone Description

On Line Zone duration

Modified
2 Ext.TC ctrl.
Restore   Store

Standby

Oven status   Off

Program   2
Progmram time: ---/---

Active zone   ---
Zone time: ---/---

X b. X-O2 PPM   Residual O2 Monitor

http://www.bokar.com/x-o2-ppm-residual-o2-monitor.html

X-O$_2$ PPM

XKAR

Residual O$_2$ Monitor

MEASUREMENT

3 — 3
2 — 2
1 — 1
—
0 — 0
LPM O$_2$

19.9 %
RANGE LOCKED
0   To 1000 PPM

0-25%
0-1000 PPM
Range

Sample l/min to sensor

Sample Temperature
2 5

STANDBY ON

This monitor was developed for X-KAR Reflow Ovens to give X-KAR ovens users the comfort of seeing the actual purity of N2 during the heating cycle when working in N2 envitonment.

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X c. ATR-1R Utility cart to use as a mobile oven stand

http://esdcarts.net/

The ATR-1R was designed especially to facilitate mobility of a batch oven. It is fully antistatic to add security and comfort. The oven fits on top of the cart and can be moved around the workplace. The cart has a brake on one of the front wheels to secure it in place.
There is enough space on the side of the oven to place an additional TC meter, tools, hot gloves or a notepad.
The bottom shelve is reserved for various accessories one may need when using the oven [polyamide (Kapton™) tape, knife or scissors, test boards etc. The cart makes it easy to store the oven out of your way when not in use.
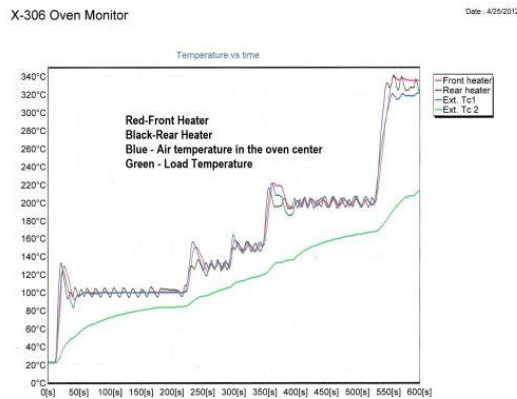
X d.   X-306A Fumes Cleaning System with HEPA Filtration

http://www.bokar.com/x-306a-fumeextract-for-x-reflow306lf-ac-and-x-reflow306/s.html

A cost-effective unit capable of filtering fumes from the X-Reflow306 Batch Oven. Shop air or N2 used for cooling pushes the fumes through the X-306A Fumes Purification System which cools the hot fumes and filters them so that they can be released as clean air into the atmosphere

X e.   X306 Oven Monitor (Not needed if a more capable X-306/S Oven Commander was ordered)

Process Monitoring Software that displays the graphs of temperature versus time on a PC.

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It reads the front and rear thermocouples of the oven and two additional thermocouples connected by the oven operator. One can see, record, save and print the profile of the soldered PCB. One or two external "K" thermocouples can be connected to the board, or one to the board and another placed inside the oven above the board to see the actual board and air temperatures during the program cycle.

X f. XTC Profiler

http://www.bokar.com/inspection-and-measuring-systems.html

An eight channel K-TC data logger which connects to a PC and allows to monitor 8 "K" thermocouples. This unit is very useful to determine heating object temperature uniformity in real time when running heating/cooling process.

X g. Side Cooling Fan Modules Set

http://www.bokar.com/x-reflow306/nc.html

Two Fan Modules are available to be mounted on each side of the oven. When cooling cycle starts, the fans blow room air into the oven rapidly cooling the object inside the oven after the top clam shell is opened. This option was developed for the users who do not have sufficient shop air supply for cooling purposes. The option also is very helpful for users who are using shop air, providing additional cooling to drop the heated object temperature faster after the oven is opened.

XI. How to upgrade the firmware in X-Reflow306/S in the future:

Receive the latest firmware version from Bokar International by e-mail.

1. Copy file firmware XXX.zip and unpack this to one folder (All files must be in the same folder)
2. Connect X-Reflow 306 (Data Store Connector) with PC (USB) via an X485-USB converter.
   NOTE: The X485-USB Converter needs an installed driver for proper operation.
   When the converter is first connected to the PC, you should install the X485-USB driver.
3. Press and hold the enter button on the Oven

4. Turn the Power switch to ON position.
5. Release the "Enter" button. The oven display should show "Bootloader mode"
6. Run the program Flasher.exe on the PC (double click on the flasher icon)
7. The Flasher should find the serial port where the oven is connected.
8. The Flasher will ask "Do you want to start up update device?",
9. Select "Yes" to confirm and press "enter".
10. After the upgrade is finished, you should get the message "Write successful. Would you like to run application?"
11. Press "ENTER"
12. The application will start. The display in the oven should show X-KAR logo, name, serial number and firmware version number.
13. Flasher window will automatically close.

XII. Product Related Bokar Web Pages

www.ESDcarts.net   www.ESDchair.com   www.ESDbrushes.com
www.ESDapparel.com   www.ESDmeters.com   www.ZeroCharge.net
www.No-Stat.com   www.ESDchair.com   www.ESDlabcoats.com

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www.ESDcarts.net www.ESDchair.com www.ESDbrushes.com
www.ESDapparel.com   www.ESDmeters.com
www.ZeroCharge.net   www.No-Stat.com   www.ESDchair.com www.ESDlabcoats.com

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