SIKAMA INTERNATIONAL, INC.

FALCON 5/C
Conduction/Convection Multi-Purpose System
EQUIPMENT MANUAL.

(P/N: 1259 REV NC)
(EFFECTIVE SERIAL NUMBER: **079 AND BELOW**)

SIKAMA INTERNATIONAL, INC.
118 E. GUTIERREZ STREET
SANTA BARBARA, CA, 93101-2314
PHONE: (805) 962-1000 FAX: (805) 962-6100
http://www.sikama.com

FALCON 5/C

TABLE OF CONTENTS

SECTION I

GENERAL INFORMATION

1-1 DESCRIPTION

The **FALCON 5/C Conduction/Convection Multi Purpose System** is designed to reflow solder on a variety of circuits and packages where a temperature profile in a controlled atmosphere is important. The **FALCON 5/C Conduction/Convection Multi Purpose System** is unique in its features. This is due to the fact that the reflow process is actually governed by the temperatures of the **conduction (bottom) stages** and **convection (top) stages**. The parts are moved in a linear fashion between the conduction and convection zone, which are located in an **inert hood** having an inert atmosphere. The temperature of the conduction and the convection stages can be individually monitored to a very exact temperature profile for the reflow process. The FALCON 5/C system utilizes seven conduction (bottom) stages. Its has a **pusher bar transport mechanism** (parts consisting of "sweeper bars" attached to double link chains) to move products in a linear motion over these stages. The first stage is a loading platform, which is a cool stage (water-cooled) and is outside the inert hood. The next four stages are heat stages, the temperatures on which can be individually controlled **(a tolerance of ±2° C).** The last two stages are cool stages, which are water-cooled. Similar to the first stage the last one is also outside the inert hood.

The FALCON 5/C being unique has the addition of four gas heated convection (top) stages directly above the four conduction (bottom) heat stages. These heat stages disburse heated air, nitrogen or forming gas directly down onto the conduction stage below. The temperature of these stage are individually controlled **(a tolerance of ±2° C.)**. This gives the reflow system a great flexibility in setting up; stage also disburses gas, which is not heated. The combination of the five internal stages (conduction and convection) inside the inert hood provide excellent atmosphere conditions for reflow soldering with paste or preforms. The gas flow settings of the heat and cooling convection stages are all individually controlled.

The **FALCON 5/C Conduction/Convection Multi Purpose System** can be operated as a stand-alone tabletop system or through a computer and software provided by SIKAMA INTERNATIONAL, INC.

The combination of conductive heat transfer, convective heat transfer, atmosphere control and water cooling make the **FALCON 5/C Conduction/Convection Multi Purpose System** a powerful and effective reflow soldering system for its size and cost.

1-2. WARRANTY

This system is supplied under a one-year warranty for all parts under normal operating conditions. Should minor in-house adjustments and repair not solve a particular problem, call directly to SIKAMA INTERNATIONAL, INC. for customer assistance. (805) 962-1000 or email at bga@sikama.com

1-3. SCOPE OF MANUAL

This manual provides operating and maintenance instructions for the **FALCON 5/C Conduction/Convection Multi Purpose System**. Refer to Table of Contents for particular information desired. Should specific information be required and it is not listed, contact the Factory directly.

Please have your Serial Number available.

Placard having information on Serial # and Machine model located on the bottom right hand side of the machine, facing the rear of the machine.

SECTION II

INSTALLATION

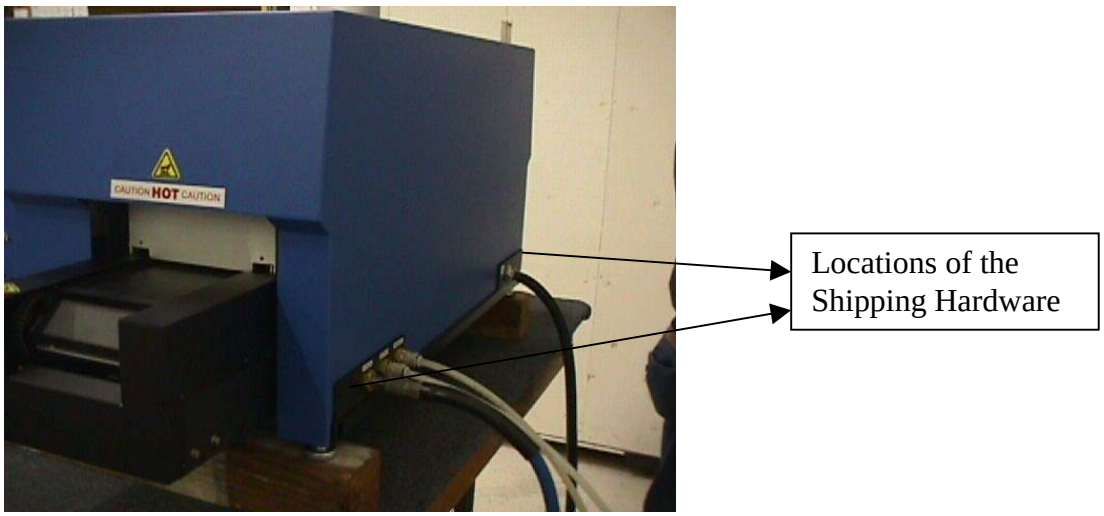
2-1. INITIAL INSPECTION

MECHANICAL CHECK:

If external damage to the shipping carton is evident, ask the carrier's agent to be present when the instrument is unpacked. Check the instrument for external damage such as broken controls or connectors and dents or scratches on the chassis surfaces. If damage is evident, see Section 2-7 for recommended claims procedure. If the shipping carton is not damaged, check the cushioning material and note any signs of severe stress as an indication of rough handling in transit. If the instrument appears undamaged, perform the electrical check as outlined in the next paragraph. Retain the packaging material for possible future use.

! Note: Before doing the electrical checks it is important that the shipping hardware is removed, (two, 10-32 x 3/8" socket head cap screws) as this may cause damage to the machine when powered up.

(Locations of the shipping hardware is as shown in the picture.)



Rear view of the FALCON 5C

ELECTRICAL CHECK:

The following steps should be followed to perform a pre-operation electrical check:

1. Remove the shipping hardware so that the blue hood on the machine can be lifted and removed giving access to the terminal blocks to which the electrical cord can be attached
2. An electrical line cord should be attached to the terminal block on the left rear of the machine. (Viewing from front).
3. Attach a water supply line and a gas supply line to the appropriate connections provided at the right rear of the machine.
4. The machine is powered up using the Power switch provided on the front of the machine. At this time all the displays should be observed for having some kind of reading on it.
5. Turn on the gas and water valves located on the front side of the machine. It should be noted that the gas flow through the machine should be set to have atleast a minimum flow of 20 SCFH.
6. The START/RESET button is now pressed and the machine should cycle (that is the push bar transport mechanism should start to operate)

   Note: If for any reason the gas and water is not turned on and the START/RESET button is pressed for the machine to cycle an alarm will sound. Pressing the START/RESET button the second time silences this alarm temporarily. This alarm will continue sound until the gas and water valves are turned on, on the machine.

Check the electrical performance of the FALCON 5/C as soon as possible after receipt. If the instrument does not operate as specified, refer to Section 2-7 for recommended claim procedure.

2-2. POWER REQUIREMENTS

The FALCON 5/C can be configured for the following power requirements:

1. A voltage of 200 volts to 240 volts for 50/60 Hz. The wiring on the system can be configured to be a single phase or three phases. Depending on the phase the line cord can have three conductors (single phase) or 4 conductors (three phase). **The green lead on the power cord is always the ground.**
   For the single phase wiring systems the power consumption is **960 Watts for each stage** (there are four heat stages in the conduction and convection parts of the machine.)
2. A voltage of 380 volts. The wiring on a system of this type is only configured for three phases. For this particular phase configuration the line cord will be of the five-conductor type. **The green lead on the power cord is always the ground.**

! NOTE: For the protection of operating personnel as per the National Electrical Manufacturer's Association (NEMA), the front instrument panel and the inert hood are electrically grounded to the chassis. It is important that the chassis be grounded using the electrical cord. The green conductor lead on the power cord is always used to ground the machine.

! NOTE: Earth Fault /Residual Current Protection is NOT included in the reflow system and should be installed at the customer's installation site.

2-3. COOLANT REQUIREMENTS

The **FALCON 5/C Conduction/Convection Multi Purpose System** consists of the following cool stages:

- There are three bottom cool stages. (Conduction stages).
  On the bottom stages, the first/loading stage (which is outside the inert hood) is a cool stage. The purpose of this is to have consistent temperatures and product profiles. Two of the cooling stages transfer heat from the product leaving the reflow stage.
- There is one top cool stage. (Convection Stage).

A greater proportion of the heat exchange occurs between the part and the cooling platen (conduction stage) and a smaller percentage of the heat transfer occurs in between the cooled gasses of the convection cool stage.
The cooling stages (conduction) lose the heat from the parts by transferring it to the water/liquid flowing through the stages. The liquid is transferred through flexible lines routed to the back of the reflow system.
There are two flex lines, one for water in and one for water out. They are 1/4" NPT connections. The water flow rate is adjusted using a flow gauge mounted on the front panel.

! NOTE: **It is essential to operate the reflow system with liquid flow. System pressure should not exceed 50 PSI.**

2-4. AIR/GAS REQUIREMENTS

The FALCON 5/C uses a gas supply of air, nitrogen or forming gas (Nitrogen / Hydrogen) to achieve the convection capability. This convection feature is unique in that it forces the gas through a manifold, which evenly disburses the gas evenly over the five conduction stages. The first four convection stages are heat stages having heated gas manifolds. The convection cooling stage has cooled gas manifolds. This convection capability of the FALCON 5/C displaces oxygen and provides a good inert atmosphere. The inert atmosphere causes the reflow process to be of a better quality due to the lack of oxygen.

Each of the five manifolds (convection stages) have a flow gauge. The five flow meters are located in the front of the machine. The flow gauges have black adjustment knobs, which once adjusted, should need little additional adjustment. The flow gauges are calibrated in surface cubic feet per hour (SCFH) There is a 1/4 NPT connection on the back of the machine for attaching the air/gas supply.

! NOTE: The working pressure should be between 50 psi. MIN. and 70 psi MAX.

Flow rates will vary depending on the desired effect. A shut-off valve is located on the front panel next to the water flow meter to stop flow to the flow gauges and the convection stage manifolds. The use of this valve allows the operator to start air/gas flow to the convection modules without having to reset the flow gauges at each start up.

2-5. SYSTEM INSTALLATION

- Remove the two socket head screws (10-32 x 3/8") on back of machine to release hood. These are only for transportation purposes. The FALCON 5/C may now put in a work area, normally a worktable in the assembly area.
- The pre-operation electrical check out procedure (section 2-1) may be performed if not already performed.
- **After the checkout it is important to make sure the ON/OFF switch is in the OFF position before proceeding to the following step.** Since all sweeper bars, hoods, etc., have been installed in place at the factory, it is important to make sure that these are in proper places and secure. Next, tilt the exit end of machine up, so you can see under the machine and make sure all sweeper bars are still attached to the drive chain. If not, tighten the screws (section 6-4: Adjustments, Sweeper bars).

2-6. SYSTEM VENTILATION

The FALCON 5/C comes standard with an exhaust hood, which covers the inert atmosphere hood. This hood has a four-inch (diameter) exhaust tube six inches long. This four-inch exhaust tube also has a flue type baffle so exhaust flow rates can be adjusted to not overpower the inert chamber inside. The hood is easily removable for access to the internal hood. A four-inch flex tube is best for connection to the exhaust system. A flow rate not to exceed 200 cubic feet/minute (38.19 ft/min) is recommended.

2-7. CLAIMS

The warranty statement applicable to SIKAMA INTERNATIONAL, INC. instruments are provided in Section 1-2 of this manual. If physical damage is found or if operation is not as specified when the instrument is first received, notify the carrier and SIKAMA INTERNATIONAL, INC. Sales/Service Department immediately. The Sales/Service Office will arrange for repair or replacement of the instrument without waiting for settlement of a claim with the carrier. For questions regarding initial inspection warranty claims, contact the Sales/Service Office directly at the telephone number (805) 962-1000 or email at bga@sikama.com

Please have your Serial Number available.

Placard having information on Serial # and Machine model located on the bottom right hand side of the machine, facing the rear of the machine.

2-8. REPACKING FOR SHIPMENT

If a FALCON 5/C has to be re-shipped to another facility or returned to the Factory, special care should be taken in packing the system for transportation. The packing system in which you received your FALCON 5/C was specially designed for this instrument. If you plan to trans-ship the instrument in the near future, save the packing system. The original shipping cartons and all packing material were designed to be re-used if need be. The Sales/Service Office will provide information and recommendations on materials to be used if the original packaging materials are not available. Materials used for shipping an instrument of this size and weight should include plywood and cushioning material so that the instrument can withstand moderate to rough handling. Also, plan to use at least five inches of tightly packed, industry approved, shock absorbing material such as extra firm polyurethane foam.

SECTION III
MANUAL OPERATION

3-1. INTRODUCTION

The **FALCON 5/C Conduction/Convection Multi Purpose System** may be controlled either manually or using a computer. This chapter describes each set of procedures necessary to operate the system manually.
The following topics are covered in this section:

- Operating considerations:
- Front Panel Components:
- FALCON 5/C Start up procedures:
- Controller Board Configurations: Under which is covered the descriptions of settings for each of the boards on the FALCON 5/C.
- Error conditions:
- Shut down procedures:

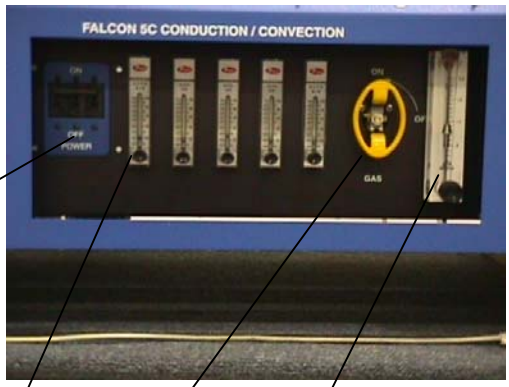
3-2 OPERATIONAL CONSIDERATIONS

The **FALCON 5/C Conduction/Convection Multi Purpose System** is designed for reflow soldering of various types of products utilizing solder paste or preforms. These processes may require fixtures to increase throughput. The conduction heat transfer process makes fixture heating very efficient. Circuit boards, ceramic substrates and BGA's are all processes suited to the conductive/convection system. Close attention should be paid to manufacturers' specifications for both components and solder paste as to storage preheat and reflow temperatures. These items will make the difference for a reliable solder connection and a superior product. Solder paste may either be dispensed or silk-screened on the circuit board. After this, components are mounted. Then the board, with components mounted, should be processed on the FALCON 5/C as soon as possible after assembly.

The optimum utilization of the **FALCON 5/C Conduction/Convection Multi Purpose System** involves a careful look at all procedures leading up to the actual bulk melting and cooling process. Careful preplanning of actual work flow patterns, parts loading techniques and quality control procedures can have a marked effect on maximizing the capability of the system and produce yields of 100% perfect circuit assemblies.

3-3 FRONT PANEL COMPONENTS

The controls are located on the front face of the instrument. This feature is largely for safety reasons. It eliminates the hazard of personnel reaching across the heating stages. The following components/controls are located on the face of the front panel.



THE POWER SWITCH.

COOLANT
FLOW GAUGE.

GAS MANIFOLD ON/OFF VALVE

GAS FLOW GAUGES

- The **Power switch** is located on the left, center section on the front panel of the machine
- The **Gas manifold ON/OFF** valve is located in the right, center section on the front panel of the machine.
- The **Gas flow gauges** and the corresponding adjusting knobs is located in the center section of the front panel.
- The **Coolant flow gauge** and the corresponding adjusting knob is located on the right, center section of the front panel.
- The **Speed control display** and the related switches is located on the offload side of the machine. Full speed is approximately 60 inches per minute. This display is fairly linear. The speed control is also capable of operating in a dwell mode operation. This allows a dwell at each stage from 1 second to 99 minutes 59 seconds.
- The **Temperature displays** for the conduction and convection stages are located in line with the stages along the upper edge of the front panel. The upper and lower displays are for the convection and conduction stages respectively. But in setting up the temperature profile, this number should be used for an indication only. **The control circuit maintains the stage within ± 2°C.**

3-4 START UP PROCEDURE

The following start up procedure should be undertaken only for a properly adjusted and configured system. In some cases the system will need to be fine-tuned during a test operation period.

! IMPORTANT NOTES:

- **UNDER NO CIRCUMSTANCES SHOULD THE FALCON 5/C CONDUCTION/CONVECTION MULTI PURPOSE SYSTEM BE OPERATED WITHOUT WATER FLOWING THROUGH THE SYSTEM.**
- **BEFORE POWERING UP THE FALCON 5/C IT IS IMPORTANT THAT THE SHIPPING HARDWARE BE REMOVED, (TWO, 10-32 X 3/8" SOCKET HEAD CAP SCREWS) AS THIS MAY CAUSE DAMAGE TO THE MACHINE WHEN POWERED UP.**

(Refer to section 2-1)

1. **COOLANT**- Turn on the coolant at the Coolant Flow Gauge on the front panel. Set the flow 0.5 GPM. Some applications may require a lower flow rate.

   Although the furnace cooling system can withstand a maximum pressure of 50-psi and a maximum flow rate of 2.0 GPM; these values are very much **"process" dependent**. Having an optimum cooling pressure (of approximately 20 to 25-psi) will allow a higher degree of coolant flow control. It will also prevent any plumbing from failing due to excessive force being experienced by the fixtures when the control valve is opened with the system at a very high pressure.

   ! NOTE: The following precautions should be observed regarding the coolant flows and pressures:

   - The coolant should not exceed a flow rate of 2.0 G.P.M.
   - The coolant "system" pressure should not exceed 50-psi.

2. **INERT GAS**- Turn on the inert gas or forming gas at the valve on the front panel. Set the flow rate at each stage to15-20 SCFH using the flow gages. Some applications may require a higher flow rate. Adjusting the internal pressure valve will simultaneously change the pressure at all gages. After setting the flow rates the system should purged for 10 -15 minutes.

3. **VENTILATION**- Ensure that the machine is properly ventilated. An airflow rate of 200 CFM is adequate to clear the fumes. An airflow rate should be adequate enough to clear any fumes generate by the process. An airflow rate that will provide adequate ventilation is very much dictated by the process being run by the machine. An optimum amount of airflow should be provided so as to have adequate ventilation and at the

same time not to cause any disturbance to the inert atmosphere under the furnace hood. The airflow rate may be regulated at the ventilating duct located on the ventilation hood.

4. **POWER**- Turn on the power at the main circuit breaker located on the front panel. The POWER ON

toggle switch located on the front panel is moved to the UP position.

! NOTE: For the protection of operating personnel as per the National Electrical Manufacturer's Association (NEMA), the front instrument panel and the inert hood are electrically grounded to the chassis. It is important that the chassis be grounded using the electrical cord. The green conductor lead on the power cord is always used to ground the machine.

! NOTE: The FALCON 5/C should be cycled through by pressing the START RESET button before actually setting a temperature profile on the machine.

! NOTE: Earth Fault /Residual Current Protection is NOT included in the reflow system and should be installed at the customer's installation site.

5. **HOOD ADJUSTMENTS**: Use the hood control (preferably from computer) to adjust clearance between upper and lower stages. Hood adjustment is provided to customize the furnace tunnel to individual process height. Doing so will greatly improve efficiency in both gas consumption and power requirements as the hood clearance is decreased. Additionally, larger openings will require higher gas flow rates to maintain PPM levels.

6. **TEMPERATURE PROFILE**- If a new temperature profile needs to be created do so now.

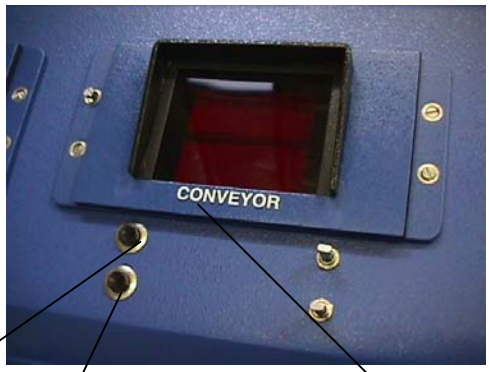
7. **START**- Press the START RESET button located on the front panel.

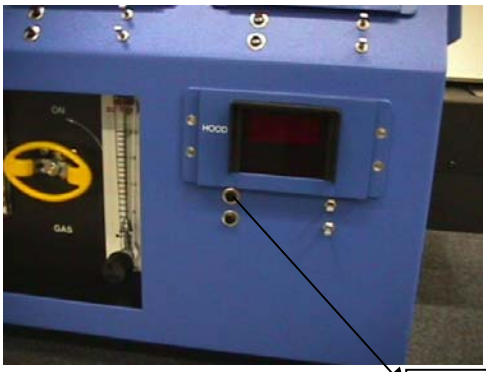
3-5 ELECTRONIC / CONTROL BOARD CONFIGURATION:

11 individual controller boards control the FALCON 5/C.The following is an inventory of the controller boards:

- There are 8 temperature controller boards located in line with the stages of the machine.
- There is one CONTROLLER. (Master I/O board).
- There is one Conveyor board. (Motor board)
- There is one Hood controller board. (Motor board)

CONTROL LOCATIONS FOR PARTICULAR BOARDS





MASTER I/O

CONVEYOR

The "factory" access button located behind this bezel.

HOOD

All controller boards have a menu of items that should be set according to the application.

MENU button

Two-way (Toggle) switch

Pic : 3-5

A **MENU button** and a **2-way (Toggle) switch** control each board. The button is called the MENU button. The switch on the right can be raised to increase (+) a particular value or lowered (-) to reduce a particular value for a MENU item.

To change a particular setting the steps below are followed:

1. **PRESS** the MENU button on the left and use the 2-way switch on the right of the display (UP and DOWN control) to scroll through the MENU settings.
2. To adjust a particular setting for a MENU item, get to the particular MENU item using the applicable buttons. When the MENU item to be changed is reached, **keeping the MENU button held down** and using the UP and DOWN buttons adjust the settings for that particular MENU item. After which the MENU button is released.
3. When you have the MENU setting you want, release the MENU button. The display will show the setting for the particular MENU item about ten seconds after which the display reverts back to showing the original MENU, at this time the UP and DOWN buttons are disabled.
4. If another MENU item setting is to be changed use the UP and DOWN buttons to move to another MENU and follow step 2 and 3.
5. After adjustments are complete the MENU button is released to for the display to revert back to the reading of the default MENU.

3-5.1 TEMPERATURE BOARDS

The temperature boards have a menu with three items. Each item can be set according to application as outlined in subsection 3.5

TEMP Sets the target temperature for the heater stage.

LO-A Sets the low alarm margin (relative to the TEMP setting)

HI-A Sets the high alarm margin (relative to the TEMP setting)

3-5.2 MOTOR BOARDS

All systems have two motor boards. One that controls the conveyor motor, which in turn drives the sweeper bars and one that controls the hood raising and lowering mechanism. There will be individual motor boards for each motor assembly on the machine. The motor boards have a menu with seven items. The motor boards are universal and consequently some items are not applicable to certain motors. In addition the meaning of the item may change from motor to motor. Each of the four motor boards is described separately.

Conveyor Motor Board

The conveyor motor board controls the movement and position of the conveyor motor, which in turn drives the sweeper bars.

Three of the seven menu items are not applicable for the conveyor motor board.

RATE Sets the running speed of the sweeper bars in inches per minute. The maximum setting is 60 inches/minute.

MODE Sets the operating mode for the conveyor as **FWRD** (forward), **REVR** (reverse), or **POS1** (position). The Falcon 5/C requires the **POS1** setting to function and automatically sets this item when the machine is powered up.

TLIM Torque limit. Higher numbers here tell the controller to allow for heavier loads on the motor before shutting off power to the motor. The range of this control is 0 to 40. Setting the torque limit too low will cause a **STOP** error when the machine tries to run the sweeper bars.

This value of TLIM is determined by the values, which are stored in the LOSP and HISP locations in the factory settings for motor boards (section 7.3). If for any reason these values needed to be altered or re-calibrated please contact the factory.

STRT N/A.

END1 End-1 tells the sweeper bar where to stop. Setting this number higher will cause the sweeper bar to stop at a location farther along its direction of travel. Due to the high gear ratio in the main table motor **(218.4:1)**, the bar position can be set very precisely.

END2 N/A.

DUMP N/A.

Hood Lift Motor Board

The FALCON 5/C has a motor dedicated to raising and lowering the hood. The hood is most conveniently operated from the computer. However if needed be to operated manually, the following steps should be followed: (The controls are similar to **Pic: 3-5**)

- Push and release the **MENU** button located next to the HOOD display.
- Use the UP and DOWN buttons to find the menu item '**MODE**'.
- Hold down the **MENU** button and use **UP** and **DOWN** buttons to select either **FWRD** for raising or **RVRS** for lowering the hood. Release the MENU button.
- Use the **UP** and **DOWN** buttons to select the menu item '**RATE**'.
- Hold down the **MENU** button and use the **UP** and **DOWN** buttons to set the speed to 40 to run the hood motor or to 0 to stop.

Note : The Hood will continuously move up or down till reaches it travel limit at which an alarm will sound. Raising or lowering the toggle switch can silence this alarm.

3-5.3 CONTROLLER (MASTER I/O BOARD).

Each Falcon 5/C contains one master board. This board is responsible for executing the sequence of operations in the machine. It does this by reading various sensors and issuing commands to the motor and temperature boards. Since it runs the sequencing, it also does the timing and has the following menu items:

SECS Number of seconds to wait between movements of the sweeper bars. Time starts counting from the time both arms reach their home positions. Maximum setting - 59 seconds.

MINS Number of minutes between sweeper bar movements. Maximum setting - 99 minutes.

MODE Sets the operational mode to either SPED (speed) or TIME. In the speed mode the sweeper bar runs continuously. The FALCON 5/C is used in the TIME mode in which there is a **DWELL** time, which is set for the period the conveyor motor if off. In the TIME mode dwell time can be set in seconds and minutes

HEAT Sets the temperature boards to either ON or OFF. If this control is set to OFF, the temperature boards will not be turned on and the machine will cycle parts. This may be a convenient setting for 'practice' runs during set up adjustments.

3-6 ERROR CONDITIONS

Error conditions cause an audible alarm along with other actions. **The audile alarm on individual controller boards may be cleared by moving the toggle switch to the up position ("+") momentarily or pressing the START/RESET button.**

Here is a list of the error conditions.

STOP **Error shows only on motor boards.** Indicates that the particular motor has exceeded its torque limit setting (see TLIM under motor boards). This error is triggered by too much power being sent to a motor than would be expected under normal conditions. It will also be triggered if the motor fails for any other reason including problems with the encoder pulses coming back from the motor.

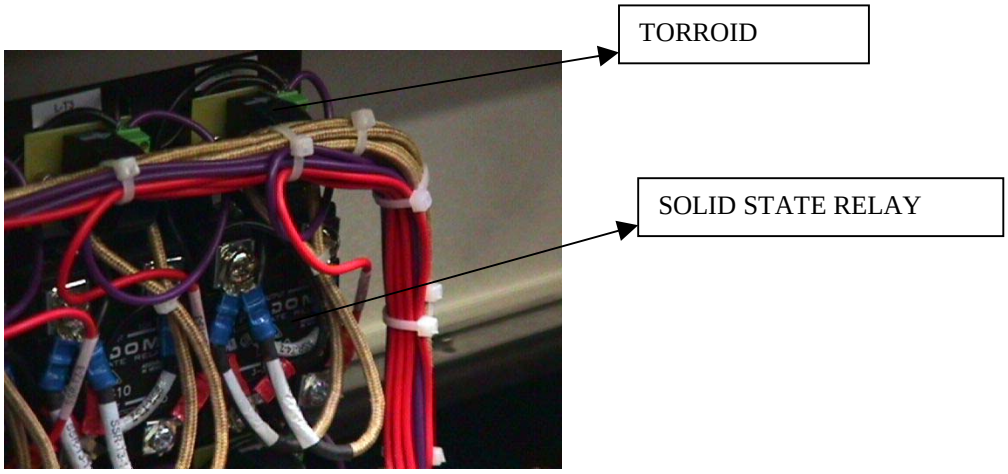
TEMP **Error shows on the Master I/O boards.** When one or more of the temperature stages is out of tolerance (as set by the HI-A and LO-A values on each board), the Master controller shows TEMP. All temperature boards that are out of tolerance will flash their temperature readings.

COM **Error shows on the Master I/O boards.** Communications error means that the Master controller was unable to communicate with one of the other boards. Since this machine runs on a network of controller cards, this error means the machine cannot run.

MOTR **Error shows on the Master I/O boards.** Shows on Controller board when one of the motor controllers has an error condition.

HBAD **Error shows on the Temperature boards**. Caused due to a heating element failing on a particular heating stage.

! <u>IMPORTANT NOTE:</u> This warning is designed to be noted and then disarmed temporarily so that production can continue running until a convenient time for maintenance can be scheduled. The quantity and watt density of the heat module cartridge heaters are designed so that process change due to a failed cartridge heater is negligible or non-existent.



To disarm alarm, locate torroid and solid state relay for the temperature controller indicating the 'HBAD' error. The torroids and the solid state relays (SSR) are located inside the machine and can be accessed by opening the front panel. The labels on these components specify the kind of component followed by the particular stage it is connected to. For example a solid state relay controlling the first convection (top) stage is labeled as SSR-T1. Locate the stage for which the alarm needs to be disconnected. Disconnect the violet wire to the torroid board 2-pin connector for the stage in question. This bypasses the alarm to allow normal use of the machine. Schedule a convenient time for service and be sure to connect the torroid board after heater cartridge is replaced.

H2O: Error shows on the Master I/O boards. A lack of water flow was detected. Check water flow gage.

GAS: Error shows on the Master I/O boards. A lack of gas flow was detected. Check for gas flow.

! IMPORTANT NOTE: Under no circumstances should the FALCON 5/C Conduction/Convection Multi Purpose System be operated without water flowing through the system.

3-7 SHUTDOWN PROCEDURE

Under normal conditions the shutdown procedure should be as follows:

1. Visually check to see that all parts have cycled through the machine.

2. Toggle the breaker in front of the machine to the OFF position.

3. Turn off the ventilation.

4. Turn off the inert gas.

5. **The coolant on the Falcon 5/ C should be left running till the temperature has dropped approximately below 100 °C**

SECTION IV
PC SOFTWARE CONTROL

NOTE: Disregard this chapter for manual controlled operation.

4-1 INTRODUCTION

The FALCON 5/C CONDUCTION/CONVECTION MULTI PURPOSE SYSTEM can be controlled either manually or using a computer.

Note: To use the software that in works in conjunction with the SIKAMA FALCON 5/C the computer must have access to a DOS operating system. This chapter describes each set of procedures necessary for computer controlled operation.

The software accessory allows for control of most all functions of the furnace as well as providing several additional features. Most importantly it allows for viewing and modification of temperature profiles, and when optimized for your process, these profiles can be named and stored for recall at a later time. Any stored profile is only a couple of keyboard strokes away for review or loading to the furnace for quick production changeover and profile consistency.

The software comes to you with a couple of simple profiles for you to experiment with - usually a calibration temperature profile and a cool down or room temperature profile. These are chosen in the select screen - F2. Once selected with the cursor and loaded (type L and press enter), they can be viewed or edited in the edit screen - F3. It is from this screen that the profile is sent to the furnace by placing the cursor on “send profile” and pressing enter. There are details on this further on in this section.

4-1.1 PC SOFTWARE CONTROL - QUICK START STEPS

The software that works in conjunction with the Sikama Falcon 5C reflow machine consists of three files:

SIKAMA.EXE	the PC/dos executable program
SIKAMA.PFR	a data file of reflow profile recipes
SIKAMA.PWF	the password file

Copy all three of the files from the floppy disk provided onto your hard drive. The following DOS command will load all the three SIKAMA software files on to your computer “C” drive.

Copy A:/SIKAMA.* C:/SIKAMA.*

! NOTE: **Save the original disk in a safe place; you will need it should you forget the supervisor password. It is for this reason that during computer controlled operation the FALCON 5/C is operated with the software loaded on to the hard drive. Its is recommended that the FALCON 5/C be computer controlled with the software loaded on to the hard drive.**

Connect the com-1 port of the PC to the db-9 connector on the side of the Falcon 5C using a 9-pin male/female serial cable. Turn on the Falcon 5C with its main power switch/circuit breaker and wait a few seconds for start up.
Run the program by typing **Sikama** from the DOS prompt. The program automatically gathers information from the furnace and updates the display every few seconds. If the unit is connected properly, the current temperature displays should be visible on the operator screen.

Remember!

- Select " run machine " and enter or press start/reset button on machine when furnace is first turned on.

- Avoid sending a blank profile (edit screen-F3, immediately after start up)

The program is logically organized into 5 screens.

- **OPERATOR** screen: – selected using the function key F1.
- **SELECT** screen:- selected using the function key F2.
- **EDIT** screen:- selected using the function key F3
- **DEBUG** screen :- selected using the function key F4
- **SUPERVISOR** screen:- selected using the function key F5
- To exit the program press the function key F10

4-2 OPERATOR SCREEN <F1>

This is the screen used to monitor the machine while operating. It contains a few controls for use in normal operation. A short description of each item on the screen is provided as follows:
Note: Each time the FALCON 5/C is powered up, the computer should be rebooted for the SIKAMA software to go through the process of communicating with the machine and recognizing the pertinent details about the machine.

Screen Text

Profile Shows the currently selected profile (blank when the program is first run).

Status Shows condition of communication with FALCON 5/C

Time Shows countdown timer in minutes and seconds.

Zone Shows heat zone readings in degrees Celsius.

Location Shows which physical zones (sweeper bar positions) have parts loaded on them.

The remainder of the screen contains the operator commands. Use the arrow keys to move the cursor (small triangle) to the command you wish to execute and hit the ENTER key.

Operation

Run Machine Starts the FALCON 5/C operation cycle. Also used to restart machine after a motor jam condition.

Temps On Manually turns on temperature controllers regardless of whether machine is cycling parts.

Temps Off Manually turns off temperature controllers regardless of whether machine is cycling parts.

Clear Temps Turns off audible alarm on temperature controllers that have been out of spec. Works only after the temperature is back within operational limits.

Clear Motors Clears any audible alarms caused by jammed motors.

Hood Movement

Raise Slow Raise Fast	Runs the hood motor to raise the hood.
Lower Slow Lower Fast	Runs the hood motor to lower the hood.
Stop	Stops the hood motor.

NOTE: When the hood reaches either end of travel, it automatically activates a safety limit switch. These switches act independently of the hood motor controller. This results in a motor alarm condition (audible alarm) but does not affect the rest of the machine operating. The alarm condition may be cleared by using the 'Clear Motors' command on the operator screen.

4.3 SELECT SCREEN <F2>

The select screen is used to load profiles from a disk, save profiles to a disk, delete profiles, or send profiles to the system. As with the other screens, use the arrow keys to move the cursor (small triangle) up and down the list. Once the cursor is in position press the key corresponding to the desire command. To send a profile, position the cursor in front of the profile to be sent and press ENTER. The descriptions of the stored profiles are shown. The operations on this screen are all single letter commands as follows:

L Load profile (at cursor) from disk. After loading the profile name is displayed at the top of the screen.

S Store profile (named at top of screen) into the location of the cursor. The profiles after this location are all pushed down one.

R Replace the profile at the cursor location. The replaced profile is deleted and overwritten with the new profile

D Delete the profile at the cursor. Any profiles that follow are moved up one.

*Up to fifty (50) profiles may be stored.

4.4 EDIT SCREEN <F3>

The edit screen is used to modify the current temperature profile and change the motor settings. It is also used to transfer profiles to and from the system. The following describes the functions of each item on this page.

SCREEN TEXT

PROFILE Shows the name of the current profile. This is the only screen that allows access to this item. Other screens only display the name. Move the cursor to this location and hit ENTER to edit the name (full cursor, insert, and delete are provided). When done, hit ENTER again to exit the edit field.

STATUS Shows condition of communications when transferring profiles to or from the system.

ZONE Shows the name of temperature zones as displayed on the operator screen. In FALCON 5/C there are ten heat zones.

DEG C The temperature set point of each heater is listed in degrees Celsius.

+ALARM Sets the hi. Temperature alarm (in degrees Celsius). This is the number of degrees above the set point that is required to activate a temperature alarm.

-ALARM Sets the low temperature alarm. This is the number of degrees below the set point that will trigger an alarm.

OPERATION

SEND PROFILE Transfers the profile as shown on the edit screen to the FALCON 5/C. As each block of data is sent, a beep is sounded. When the profile has been entirely transferred, the Status at the top of the screen shows ‘complete’.

READ PROFILE Transfers the profile from the FALCON 5/C to the PC. Since the name of the profile is never sent to the FALCON 5/C, doing a read operation clears the profile name field at the top of the screen.

DWELL TIME

Minutes Sets minutes of time between sweeper bar movements. This item has a range of 0 to 99 minutes.
Seconds Sets seconds of dwell time. The range is 0 to 59 seconds.

SWEEPER BAR

Speed Sets speed of sweeper bars in inches per minute. The usable range on this control is from 5 to 60 inches per minute.

Location Sets location at which sweeper bars stops. Increasing this number moves the bar to a more advanced location. Each unit represents approximately 1/1000 th of an inch.

Torque Limit Sets amount of force needed to stop the sweeper bar motor. Useful settings are between 10 and 40 units.

4.5 DEBUG SCREEN <F4>

The debug screen is used for creating profiles in a computer not connected to the FALCON 5/C. Since no information is coming in, to set the number of temperature and physical zones, these numbers can be entered here so that the Edit screen will be usable to create profiles from scratch.

The controls are available as follows:

Physical Zones This is the total number of stages (heat and cool) under the hood. This is used only on the operator screen to show locations of parts moving their way through the machine.

Temp. Controllers Total number of heater units in the machine

Heater Config. Use pageup and pagedown keys to set this to either Bottom or Top & Bottom. This information is used in formatting the operator and edit screen information.

Machine Type The FALCON 5/C furnace can have only one configurations:
Manual operation (MAN),

COM Port Select the particular COM Port used to communicate with the FALCON 5/C

Temp Boards Specify the number of Temp. Boards on the FALCON 5/C.

Motor Boards Specify the number of Motor Boards on the FALCON 5/C.

4.6 SUPERVISOR SCREEN <F5>

This screen provides access to the passwords for each of the screens except the operator screen. A blank in the password makes the corresponding screen always accessible. This screen itself has a password.

! NOTE: Save the original disk in a safe place; you will need it should you forget the supervisor password. It is for this reason that during computer controlled operations the FALCON 5/C be operated with the software loaded on to the hard drive. Its is recommended that the FALCON 5/C be computer controlled with the software loaded on to the hard drive.

It is at the customer's discretion to use this feature as needed. Should the password for the supervisor screen itself be lost or forgotten, the file SIKAMA.PWF *from the original floppy disk provided* should be copied over the current SIKAMA.PWF file in the PC. This will create a blank password for all of the screens.

The password protection for the software is organized so that each 'screen' of software can be password protected separately - with the exception of the operator screen (F1).

Select the supervisor screen (F5) and type in a password for the screen you desire to be protected. If a password is in use for that screen, then every time there is a request to access that screen a password request appears in the lower left corner of the display. The supervisor screen displays the individual passwords (in the event that you want screen access limited to different people).

!NOTE: **Should the 'supervisor' forget the password, the SIKAMA.pwf file must be deleted and the empty file from the SIKAMA software disk copied in.**

If the time comes to change the passwords, this can be done with the help of the supervisor by accessing the screen and using the cursor and delete or backspace keys to change the desired password.

4-7 START UP PROCEDURE

The following start up procedure should be undertaken only for a properly adjusted and configured system. In some cases the system will need to be fine-tuned during a test operation period.

! IMPORTANT NOTES:

- **Under no circumstances should the FALCON 5/C Conduction/Convection Multi Purpose System be operated without water flowing through the system.**
- **Before powering up the FALCON 5/C it is important that the shipping hardware be removed, (two, 10-32 x 3/8" socket head cap screws) as this may cause damage to the machine when powered up.**

(refer to section 2-1)

1. **COOLANT-** Turn on the coolant at the Coolant Flow Gauge on the front panel. Set the flow 0.5 GPM. Some applications may require a lower flow rate.

   Although the furnace cooling system can withstand a maximum pressure of 50-psi and a maximum flow rate of 2.0 GPM; these values are very much **"process" dependent**. Having an optimum cooling pressure (of approximately 20 to 25-psi) will allow a higher degree of coolant flow control. It will also prevent from any plumbing from failing due to excessive force being experienced by the fixtures when the control valve is opened with the system at a very high pressure.

   ! NOTE: The following precautions should be observed regarding the coolant flows and pressures:

   - The coolant should not exceed a flow rate of 2.0 G.P.M.
   - The coolant "system" pressure should not exceed 50-psi.

2. **INERT GAS**- Turn on the inert gas or forming gas at the valve on the front panel. Set the flow rate at each stage to15-20 SCFH using the flow gages. Some applications may require a higher flow rate. Adjusting the internal pressure valve will simultaneously change the pressure at all gages. After setting the flow rates the system should purge for 10 -15 minutes.

3. **VENTILATION**- Ensure that the machine is properly ventilated. An airflow rate of 200 CFM is adequate to clear the fumes. The airflow rate may be regulated at the ventilating duct located on the ventilation hood.

4. **POWER**- Turn on the power at the main circuit breaker located on the front panel. The POWER ON toggle switch located on the front panel is moved to the UP position.

! NOTE: For the protection of operating personnel as per the National Electrical Manufacturer's Association (NEMA), the front instrument panel and the inert hood are electrically grounded to the chassis. It is important that the chassis be grounded

using the electrical cord. The green conductor lead on the power cord is always used to ground the machine.

! NOTE: The FALCON 5/C should be cycled through by pressing the START RESET button before actually setting a temperature profile on the machine.

! NOTE: Earth Fault /Residual Current Protection is NOT included in the reflow system and should be installed at the customer's installation site.

5. **HOOD ADJUSTMENTS**: Use the hood control (preferably from computer) to adjust clearance between upper and lower stages. Hood adjustment is provided to customize the furnace tunnel to individual process height. Doing so will greatly improve efficiency in both gas consumption and power requirements as the hood clearance is decreased. Additionally, larger openings will require higher gas flow rates to maintain PPM levels.

6. **TEMPERATURE PROFILE**- if a new temperature profile needs to be created do so now.

7. **START**- Press the START / RESET button located on the front panel.

4-8 LOADING EXISTING PROFILES

The following procedure loads an existing temperature profile into the FALCON 5/C.
Steps 1-4 may be skipped if the machine is currently running.

1. Turn on the machine at the breaker and. Do Not press the START/RESET button.

2. Turn on the computer and run the Sikama software, by typing SIKAMA at the C:\ prompt.

3. Press <F1> to go to the Operator Screen.

4. Run the machine by positioning cursor in front of the Run Machine and pressing return. This will cause the last profile to be run.

5. Press <F2> to go to the Select Screen.

6. Load the profile by positioning the cursor in front of the desired profile and pressing L.

7. Press <F3> to go to the Edit Screen.

8. Check to see that all settings are correct.

9. Send the profile by positioning the cursor in front of the Send Profile command and pressing enter.

4-9 EDITING OR CREATING A NEW PROFILE

The following procedure describes the necessary steps to edit or create a new profile. Communication with system is not required to create a new profile but it is useful to read the current settings from the system.

1. Turn on the machine at the breaker and the Power On switch. Do Not press the START/RESET button.

2. Turn on the computer and run the Sikama software, by typing SIKAMA at the C:\ prompt.

3. Press <F3> to go to the Edit Screen.

4. If an adjustment is to be made, for example changing the temperature values only, then position the cursor in front of the Read Profile command and press return. Then adjust the values by placing the cursor in front of the setting, typing the new value, and pressing enter.

5. If a completely new profile is being created type in the setting values by placing the cursor in front of the setting, typing the new value, and pressing enter.

6. Name the new profile by positioning the cursor at the profile label, typing in the new name, and pressing return.

7. Press <F2> to go to the Select Screen.

8. Store the profile by moving the cursor to the desired number and pressing S. Other profiles will be moved down if they are in the desired location.

9. Press <F1> to go to the Operator Screen

10. Run the machine by positioning cursor in front of the Run Machine and pressing return. This will cause the last profile to be run.

11. Press <F2> to go to the Select Screen

12. Load the profile by positioning the cursor in front of the desired profile and pressing L.

13. Press <F3> to go to the Edit Screen

14. Send the profile by positioning the cursor in front of the Send Profile command and pressing enter.

4-10 ERROR CONDITIONS

Error conditions cause an audible alarm along with other actions. **The audile alarm on individual controller boards may be cleared by moving the toggle switch to the up position ("+") momentarily or pressing the START/RESET button.**

(PLEASE REFER TO SECTION: 3-6 FOR A LIST OF ERROR CONDITIONS)

- The operator screen (F1) can be used to clear temperature alarms and motor alarms.
- **For gas and water alarms are actually turned off using the START/REST button. It is important that the gas and water supplies are checked before continuing with machine operation.**

4-11 SHUTDOWN PROCEDURE

Under normal conditions the shutdown procedure should be as follow

1. Visually check to see that all parts have cycled through the machine.
2. Press the F10 button on the computer to exit the program
3. Toggle the power switch to the OFF position.
4. Turn off the ventilation. Turn off the inert gas.
5. **The coolant on the Falcon 5/ C should be left running till the temperature has dropped approximately below 100 °C**

SECTION V

SERIAL ACCESS TO SIKAMA FALCON 5C *

5-1. EXTERNAL CONTROL

The Falcon 5C provides for external control of the machine via a standard DB-9 RS-232 port on the rear of the machine. It uses the same cable commonly available for connecting external modems to a PC serial (COM) port. The data format is:

8 data bits (high bit is always cleared)
1 stop bit
no parity bits
2400 Baud

All communication with the machine is in ASCII. All letters must be in upper case. The machine responds in ASCII with either a decimal number followed by a carriage return (ASCII 13) or with the carriage return alone.

Because of the internal design of the machine, up to 1 second may pass before the machine acknowledges a command. External software must therefor provide a one-second 'time-out' before reporting a communications error with the machine.

The exception to the above are **global** commands (commands that go to several controllers in the machine at the same time). Because multiple controllers are accessed with one command, no response of any kind is generated to prevent data collisions.

Here are the commands and responses for each of the types of controllers in the machine. **All commands must end with a <cr> (ASCII 13).** All letters must be in upper case and no spaces are allowed.

* This section is being provide by SIKAMA INTERNATIONAL as a tool for customizing the accompanying software used to interface the furnace and the computer. SIKAMA INTERNATIONAL will provide complete technical support on the operation of the SIKAMA software but can give only limited technical support on this section.

5-2. MASTER CONTROLLER

These commands are for the master controller. No unit number is specified because there is always only one master controller in a machine. All commands that do not return a decimal value will still return a single carriage return (ASCII 13).

CR — Start machine running. (used when machine has been powered on)

CLSnn — Load Seconds for cycle timing to value nn (0-59).

CLMnn — Load Minutes for cycle timing to value nn (0-99).

CLTnn — Load Seconds Down Counter. Unlike the load seconds command above, this sets the actual counter while it is counting.

CLQnn — Like the above command, loads the Minutes Down Counter.

CQS — Reads back the cycle timer Seconds value.

CQM — Reads back the cycle timer Minutes value.

CQB — Reads back a number representing where boards have been loaded in the machine. When a board is loaded, the low order bit is set. At each cycle of the machine, the bits are shifted up one position. This produces a binary representation of which stages in the machine have a part on them. The binary number is converted to ASCII decimal before being returned. (if boards are only on stages 1, 3, and 5; the decimal value 21 is returned).

CQT — Returns current Seconds value of Down Counter (as shown on Master Controller display).

CQQ — Returns current Minutes value of Down Counter.

CQ — Return Error bits as follows:

bit-0	Communications error with Motor or Temperature controller.
bit-1	Motor Controller Error
bit-2	Temperature Controller error.
bit-3	Handshake signal error (i.e. not ready)

CQZ — Returns physical stage count of machine.

CQH — Returns number of temperature controllers.

CQL — Returns type of machine as follows:

0	Manual operation
1	Automatic loader and unloader
3	Buffer table loader

CQK — Returns 0 for bottom only and 1 for top and bottom heater machines.

CW — Writes data previously sent to EEPROM on specified controller. If this command is not sent, none of the new data will be maintained when the machine is powered off.

5-3. MOTOR CONTROLLER

In each of the following commands, 'x' stands for the unit number of the controller in question. A unit number of zero (0) is a global command for all motor controllers. Global commands do not respond at all.

MxR	Run motor
MxS	Stop motor.
MxLLnnnn	Load location with value nnnn. This stuffs the value into the motor controllers position counter.
MxLSnnnn	Load START location with value nnnn.
MxLEnnnn	Load END1 location with value nnnn.
MxLFnnnn	Load END2 location with value nnnn.
MxLDnnnn	Load DUMP location with value nnnn.
MxLVnnn	Load RATE with value nnn.
MxLTnn	Load Torque Limit with value nn.
MxLXtttt	Load text characters 'tttt' onto front display. (Great for trade shows!)
MxLCnnnn	Load calibration location with value nnnn. This is the location value, which is jammed into the location counter each time the optical sensor on the arm is detected. It keeps the arm calibrated without having to do a physical 'home' operation.
MxLMn	Loads operating mode as follows:

0	run motor forward (at current velocity)
1	run motor backward.
2	run motor to specified position (see G commands below).

MxQL	Reads back current location value (0 - 65535).
MxQS	Reads back START location.
MxQE	Reads back END1 location.
MxQF	Reads back END2 location.
MxQD	Reads back DUMP location.
MxQV	Reads back current RATE (whether or not stopped).
MxQT	Reads back Torque limit (TLIM) value.
MxQB	Reads back button data as follows:

bit-0	MENU button
bit-1	FACTORY button
bit-2	UP (+) button
bit-3	DOWN (-) button
bit-4	OPTO-0 input state
bit-5	OPTO-1 input state

bit-6 OPTO-3 input state

MxQC Reads back Calibration value.

MxQM Reads back mode (see MxLM for details).

MxQA Returns software version.

Mx? Returns controller status as follows:

bit-0 busy (not yet at target location)
bit-1 jammed (motor stopped by obstruction)
bit-2 motor in position mode
bit-3 motor currently running in reverse

MxGLnnnn Go to location nnnn. Controller must be in Position mode.

MxGS

MxGE

MxGF

MxGD Go to location as specified by START, END1, END2, or DUMP values previously stored. Controller must be in Position mode.

MxXAn Turn Auxiliary output A to off (0) or on (1).

MxXBn Same for Auxiliary output B.

MxXCn Same for Auxiliary output C.

MxZC Set up to capture Calibration value. The next time the calibration sensor is detected, the current location counter value is loaded into the calibration counter.

MxZZ Clears alarm and motor jam conditions.

MxW Writes data previously sent to EEPROM on specified controller. If this command is not sent, none of the new data will be maintained when the machine is powered off.

5-4. TEMPERATURE CONTROLLER

TxR Turns on heater. Heater will not go on until the current temperature reading is below the set point.

TxS Turns off heater regardless of set point.

TxTnnn Loads Set Point with value nnn.

TxLnn Loads low temperature margin with nn.

TxHnn Loads high temperature margin with nn.

TxQT Reads temperature Set Point.

TxQR Reads temperature reading.

TxQL Reads low temperature margin.

TxQH Reads high temperature margin.

TxQA Reads software version.

TxXBn Sets auxiliary output B to off (0) or on (1).

TxXCn Sets auxiliary output C to off (0) or on (1).

TxZZ Clears temperature alarms and sets controller to Not At Temperature.

Tx? Reads error flag as follows:

bit-0	Not At Temperature (has not reached set point)
bit-1	Undertemp Error
bit-2	Overtemp Error
bit-3	Heating Element Bad (HBAD error)

TxW Writes data previously sent to EEPROM on specified controller. If this command is not sent, none of the new data will be maintained when the machine is powered off.

5-5. EXAMPLES:

The following examples may be helpful in demonstrating communication with the Falcon 5C controllers. Command strings may be combined as long as not more than one numeric response is requested in a single command. Command strings may be up to thirty (30) characters plus the carriage return.

Send: M1ZZLM2LL0GL500<cr>

Returns: <cr>

Clear motor #1 of any alarms, set the mode to Position, load the location counter with zero, and move to location 500.

Send: M1?<cr>

Returns: 0<cr> (arrived)
1<cr> (busy)
2<cr> (jammed)

Interrogate status of motor #1. Get status of previous operation. Bit-0 (busy) indicates not yet at target location.

Send: M2ZCLL0GL600<cr>

Returns: <cr>

After having previously homed the motor, this command sets up for calibration capture (ZC); clears the location counter (LL0) and sends the motor to location 600 (GL600).

Send: T1LT210LL15LH7<cr>

Returns: <cr>

Sets temperature controller #1 to 210 degrees target temperature (set point) with a lower limit of 195 degrees and an upper limit of 217 degrees.

Send: T0S<cr>

Returns: (nothing)

Turns off all temperature controllers.

Send: M0ZZ<cr>

Returns: (nothing)

Turns off all motor controller alarms.

SECTION VI

MAINTENANCE

6-1 INTRODUCTION

A person familiar with the maintenance practices should perform servicing of either mechanical or electronic parts for a FALCON 5/C or, while the system is under warranty, a person designated by SIKAMA INTERNATIONAL. While no mechanical adjustment should be necessary, certain electronic adjustments may be required for calibration purposes.

6-2 PERFORMANCE CHECK

While connected to the proper power source, the following should be observed: when unit is cold after over night cooling off, the temperature controllers should read approximately 20°C. The heat stages are capable of sustaining 420°C, although a reading of 500°C is attainable. Sweeper bar speed should range from 0 to 60 per minute. Warm-up time is approximately 15 minutes to 250°C, slightly longer to 420°C.

6-3 SYSTEM CLEANING

Depending upon process requirements and throughput, flux buildup will occur on the platens, hood, and load mechanism. This could require cleaning on a daily basis, but at least every week the system should be inspected and cleaned.
It is best to clean the system when it is cold. Raise the hood up all the way (approximately 10”).
Using IPA or Flux remover and a single edge razor blade, carefully scrape and wipe away flux buildup on the platens and hood. The finish surfaces of the reflow stages are type III hard coat anodize and are very tough so scraping and abrasions are no problem. Use IPA and a wipe to clean the load and unload mechanisms and slide bars. Depending on rates and use, the roller bearing and the drive belt may require light oil.

6-4 ADJUSTMENTS, MECHANICAL

The mechanical adjustments have been set at the factory and no further adjustment should be necessary for operation of the equipment. Should repairs or adjustments be needed, simple tools are all that is required to accomplish most tasks. The system was designed in modules so controls and platens are installed the same way for each stage on the machine.

BOTTOM STAGE ADJUSTMENTS: All of the stages or stages on the reflow system are mounted the same way using a three-point suspension to adjust height and level within the sweeper bar slider rails. Each leg has an "adjusting nut foot" and a lock nut to raise and lower its corner of the platen. A 1/4" and 9/16" wrench are needed to loosen, adjust and tighten each leg. This operation is done in conjunction with a feeler gauge and the sweeper bars above each platen. Each platen is adjusted to the following clearances: (in between the sweeper bars and the platens)

Cooling stages (at room temperature)	**. 007-. 010"**
Heat stages (at room temperature)	**. 015-. 017”**

This operation should be performed while the system is at room temperature.

6-5 ADJUSTMENTS, SWEEPERBARS

Sweeper Bars are bolted every 6.5" on chain (16 total). The sprockets are spaced 7.3" center to center. As each sweeper bar is installed, **it should be connected on the chain roller; on the inboard chain rollers** using a 4-40 x 1/2 screw and a 4-40 nut. After the sweeper bar has been attached, they should be moved over the sprockets to be snugged. **The tightness on the Sweeper Bar 4-40 nuts is critical, as they should not be over tightened.** Once the bars are snug, a small amount of endplay should be evident. This allows the bar to move freely over the sprockets and not bind up as they approach and leave the sprockets. This also eliminates the possibility of bending the sweeper bars, as they do become soft with temperature exposure.

After the sweeper bars are checked for end play over the sprockets a drop of a hi-temp. Chemical thread locking compound should be used (preferably LOCTITE ® 242) on the sweeper bar 4-40 nuts.

The sweeper bars slide on two rails on each side of the system. These rails have a graphite coating to provide smooth operation. Cleaning and re-application of graphite may be required. Use graphite spray and a "Q-tip" to re-apply to the rail if necessary. This should be inspected and maintained at least every six months. The slide rails do have a cover to isolate the chain and rail from the hood environment and this should be removed for inspection and maintenance.

6-6 ADJUSTMENTS, ELECTRICAL

The drive motor "encoder feedback system" working in conjunction with the micro switch (located at the back of the machine on the offload end) controls the sweeper bar movements. This system does not require any calibration. If the system is used in "dwell mode"* the microprocessor needs to sense when the sweeper bars have reached the next stage. This is accomplished by a combination of signals coming from the drive motor encoder system and a calibrating signal supplied by the micro switch. The micro switch supplies a "calibrating signal" (a motor count; value stored in the CAL value of the board) when depressed by the sweeper bars to the microprocessor. The microprocessor will use this calibrating signal to restart its count and position sweeper bars.

* The DWELL time can be defined as the "total" time a part remains on a particular stage. For example if the total time required for a sweeper bar to travel across a stage is 15 sec and the DWELL time was set for 25 seconds, the sweeper bar would wait at the beginning of the stage for 10 seconds and then start moving across the stage. Therefore when the sweeper bar reaches the end of the stage it would have completed a total of 25 seconds.

This switch is adjusted to be depressed with the mounting hardware of each sweeper bar. Should it need replacement the micro switch will need to be readjusted so to be activated (switch contacts made or broken) when the sweeper bar mounting hardware passes over the micro switch.

The hood has top and bottom limit switches mounted on brackets that signals the inert hood end of travel positions. The switches are adjusted at the factory and should not require adjustment. The adjustments of these switches should not be tampered with. Should they require replacement note there physical location on the mounting brackets and duplicate it with the new switch. The hood bottom switch positioning is most critical as that should be adjusted so as to signal the position of the hood approx. 1/32" prior to physically hitting the bottom brackets.

6-7 PERIODIC MAINTENANCE

Oil the two main drive shafts and the drive chain between motor and drive shaft every six months. Light grade motor oil such as SAE 10 is recommended. (Put two or three drops on each of the four-loctite bushings.) If unit is operated more than eight hours per day and/or high temperature is experienced, oil every other month. Periodic coating of the slide rails with graphite may be necessary depending upon the reflow speed, volume and temperature. This can be simply applied with a Q-tip and McKay 405 graphite spray. Depending on use occasional cleaning of the hood and platens may be requires. Heat platen surfaces must be clean to conduct heat as efficiently as possible. "Scotch Brite: abrasive pads with a little solvent should be adequate in most cases. A single edge razor blade can be used much the same way one would clean glass. The hard-anodized finish will resist any scratching from these methods.

SECTION VII

FACTORY SETTINGS

7-1 INTRODUCTION

11 individual controller cards control the FALCON 5/C. These controller cards are accessible from the front of the machine after removing the four screws holding the bezel in place in front of the card. (see picture 3-5). You can configure the controller cards using the 3 buttons near the front of each board and the four-character display on each card.

There are three types of cards (motor, temperature, and master) in the machine. In order to access the initialization and calibration parameters, you must press the factory access button in the machine located on the MASTER I/O card. This card is located behind the bezel with CONVEYOR silk screened on the bottom and CONTROLLER silk-screened on top.

NOTE: Under normal operating conditions any need to access these factory settings should not arise. But under certain circumstances, which may include troubleshooting, if these factory settings were to be accessed, extreme caution is to be exercised. Under certain conditions, accessing these settings might put the entire machine in an inoperative condition.

This section includes documentation of the 'factory' items in the controller board menus***. When accessing the factory settings the person responsible should be thoroughly familiar with the operation, calibrating procedures of the FALCON 5/C. There are also the operator and factory-setting modes in the MENU/FACTORY SETTING CHECKLIST provided at the end of this manual which the person should be familiar with.***

FACTORY ACCESS BUTTON

Master I/O

7.2 TEMPERATURE BOARDS

These items can only be accessed with the machine in factory access mode.

UNIT Each temperature board has a specific unit number assigned to it. The number assigned to it will depend on the direction the parts flow in the machine and if it's a conduction or convection stage. This is how the master controller identifies each board.

INIT **WARNING: This operation UNCALIBRATES/INITIALIZES the board. The LTMP and HTMP controls must be used to recalibrate the board**.

Puts factory defaults into other settings. When a new board is manufactured, or if the EEPROM is ever replaced, this is the first operation to be performed on the board. When this item is accessed and the MENU button is held down, **"→"** appears on the display. Hitting the '+' button once while the MENU button is held down displays 'SET!' and the operation is complete.

LTMP With the machine at room temperature, accessing this item in the same way as 'INIT' above causes the boards to self calibrate for room temperature.

HTMP **WARNING: Changing this value without the associated heating stage at a known temperature above 100 degrees Celsius will totally recalibrate the controller.**

After the machine has heated up and stabilized at some target temperature (we use 200 degrees) as shown on the display, this control is used to set the high temperature calibration.

Using an independent temperature-measuring device, determine the actual temperature of the heater stage surface. Hold down the MENU button and use the '+' and '-' buttons to enter that temperature into the machine. Release the buttons and calibration is complete.

RTMP Utility function to show approximate room temperature at the board. This is the value used in the calculation of actual heater temperature.

HCAL This shows the high temperature calibration constant currently in use by the controller. It is produced automatically by use of HTMP above.

LCAL This shows the room temperature calibration constant currently in use by the controller. It is produced automatically by the use of LTMP above.

HEAT **Set to OFF for FALCON 5/C machines**. All temperature boards power up in the off mode.

VERS Shows the software version in the micro controller chip on the board.

7.3 MOTOR BOARDS

The factory menus for the Motor Boards are described here, as with the other boards, the factory access button pressed in order for the menu to access the following items.

UNIT Each motor board has a specific unit number that is used to identify it. The FALCON 5/C is configured as follows:

#1	Conveyor (sweeper bar) motor controller
#2	Load Arm motor controller **(not applicable to the FALCON 5/C)**
#3	Unload Arm motor controller **(not applicable to the FALCON 5/C)**
#4	Hood motor controller.
#5	Buffer motor controller. **(not applicable to the FALCON 5/C)**

INIT **WARNING:** Enter the "INIT" Menu Option if specifically instructed to do so by a factory representative. Instead "scroll" past the "INIT" menu display with the +/- buttons to other desired menu options. **Pressing the MENU button while in the "INIT" menu option by will actually re-initialize all the settings.**

LOSP Low speed calibration value for motor torque limit sensing. Raising this number affects the lower speed setting torque limit calculations.

HISP Hi speed calibration value for motor torque limit sensing. Higher numbers cause higher speed torque limit calculations to allow more power to the motor.

MXSP Sets maximum RATE value allowed on the user menu. This number varies depending on the use of the associated motor.

PLIM This is the calculated maximum power setting for the current speed and torque limit. If the actual power setting exceeds this value, all power to the motor is removed and a 'STOP' error condition is displayed.

PVAL This is the actual power level going to the motor (0 to 255).

CAL Is not applicable in the case of a FALCON 5/C. This value is set during calibration**.**

VERS Version number of software in the micro controller chip on the board.

7.4 MASTER I/O BOARD

INIT **WARNING: Puts factory default settings in place. This control renders the machine inoperable until the other controls are given their proper settings.**

PROG **Selects the following value for a FALCON 5/C:**
Manual operation (MAN),

The following values are not applicable in the case of the FALCON 5/C
AUTO
BUFF
BFLD
BFNS
BFND

HAND Not applicable in the case of a FALCON 5/C.

ZONE Sets the number of physical positions in the machine including both heating and cooling stages. Used by PC software to show which physical zones have a part present as they proceed through the machine. Each sweeper bar defines one physical zone.

TMPS Number of temperature controller cards present in the machine. Each heating plate (top or bottom) has its own controller. The master controller board needs to know this number. This information is also passed to the PC program if for automatic formatting of the display.

HEAT The choices here are bottom only (BOT) or top and bottom (T&B). The only place this information is used is by the PC software for purposes of formatting the display of temperatures.

VERS Reads out the current software version in the micro controller on the board.

SECTION VIII

REPLACEMENT PARTS

8-1. INTRODUCTION

All components in the FALCON 5/C are commercially available; however, refer to Factory for replacement of parts whenever necessary. Parts which may need replacement due to continued use may be ordered from either the Mechanical or Electrical Parts Lists and their corresponding numbers as follows.

8-2. ORDERING INFORMATION

PART NO.	DESCRIPTION
5699	Heating Element, 240 Watt-240 Volt.
5745	Gas-Flow Gauge 10-100
5747	H20 Flow Gauge
5821	Sweeper bars, Set of 16
4603	Motor Controller Assembly
4607	Temperature Control Assembly- GEN3
8624	Circuit Breaker, 30 Amp, 3 Pole
8697	Circuit Breaker, 40 Amp, 2 Pole
4859	Power Supply
8745	10amp Solid State Relay
4601	Motor Encoder Assembly – Conveyor / Hood.
9607	TC Assembly
1251	Complete Conduction Heat Assembly- Bottom.
1252	Complete Convection Heat Assembly- Top.
1253	Complete Conduction Cool Assembly- Bottom.
1254	Complete Convection Cool Assembly- Top.
4608	Controller Assembly
9819	Contactor-Main power, 50 Amp.
1259	Equipment Manual.

SIKAMA INTERNATIONAL, INC.
118 E. Gutierrez Street
Santa Barbara, CA 93101-2314
(805) 962-1000
FAX (805) 962-6100
email: bga@sikama.com

SECTION IX
FALCON 5/C CHECK-OUT LIST

Machine Serial Number: _____-_____-_____ Date:_____
Equipment Manual P/N: 1249 Revision Number: REV A

Temp Stages Calibrated @	_____	Hood Clearance (if applicable)	_____
Room Temp Set (20°--all same)	_____	Led Digits	_____
Bearings Oiled	_____	"Caution Hot" Label	_____
Chains Checked at Temp.	_____	Safety and Serial Decals	_____
Sweeper Bars Checked	_____	Water Cool Pres. Test Time/Pres.	_____
Switches	_____	Power Requirements	_____
Fans	_____	Platen Heat Cartridge Wattage	_____
Connections	_____	Wiring Schematic Revision	_____
"TUV" certificate in the manual	_____	**"CE" sticker installation**	_____

Card Cage	Board	P/N	Rev	Prom
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				

Platen	Clearance	Conduction. Current	Convection. Current
Stage 1Cool _____	_____		
Stage 2Heat _____	_____	_____amp	_____amp
Stage 3Heat _____	_____	_____amp	_____amp
Stage 4Heat _____	_____	_____amp	_____amp
Stage 5Heat _____	_____	_____amp	_____amp
Stage 6Cool _____	_____		
Stage 7Cool _____	_____		

RS232 Port (Check Program) _____
On-Loader Connections/Clearances _____
Off-Loader Connections/Clearances _____

Testing Completed By: _____ **Unit O.K. to Ship** _____

MENU/FACTORY SETTINGS CHECKLIST

MASTER I/O:

OPERATOR MODE
SECS____ MINS____ MODE____ HEAT____

FACTORY
INIT____ PROG____ HAND____ ZONE____ TMPS____ CFG____ VERS____

MOTOR BOARDS:

CONVEYOR (operator mode)
RATE___ MODE___ TLIM___ STRT___ END1___ END2___ DUMP___

CONVEYOR (factory mode)
UNIT___ INIT___ LOSP___ HISP___ MXSP___ PLIM___ PVAL___ CAL___
VERS___

HOOD (operator mode)
RATE___ MODE___ TLIM___ STRT___ END1___ END2___ DUMP___

HOOD (factory mode)
UNIT___ INIT___ LOSP___ HISP___ MXSP___ PLIM___ PVAL___ CAL___ VERS___

BUFFER (operator mode)
RATE___ MODE___ TLIM___ STRT___ END1___ END2___ DUMP___

BUFFER (factory mode)
UNIT___ INIT___ LOSP___ HISP___ MXSP___ PLIM___ PVAL___ CAL___
VERS___

TEMPERATURE BOARDS:

#1 (operator mode) **TEMP___ LOA___ HIA___**

(factory mode) **UNIT___ INIT___ LTMP___ HTMP___ RTMP___**
HCAL___ LCAL___ HEAT___ VERS___

#2 (operator mode) **TEMP___ LOA___ HIA___**

(factory mode) **UNIT___ INIT___ LTMP___ HTMP___ RTMP___**
HCAL___ LCAL___ HEAT___ VERS___

#3 (operator mode) **TEMP___ LOA___ HIA___**

(factory mode) **UNIT___ INIT___ LTMP___ HTMP___ RTMP___**
HCAL___ LCAL___ HEAT___ VERS___

#4 (operator mode) **TEMP___ LOA___ HIA___**

(factory mode) **UNIT___ INIT___ LTMP___ HTMP___ RTMP___**
HCAL___ LCAL___ HEAT___ VERS___

#5 (operator mode) **TEMP___ LOA___ HIA___**

(factory mode) **UNIT___ INIT___ LTMP___ HTMP___ RTMP___**
HCAL___ LCAL___ HEAT___ VERS___

#6 (operator mode) **TEMP___ LOA___ HIA___**

(factory mode) **UNIT___ INIT___ LTMP___ HTMP___ RTMP___**
HCAL___ LCAL___ HEAT___ VERS___

#7 (operator mode) **TEMP___ LOA___ HIA___**

(factory mode) **UNIT___ INIT___ LTMP___ HTMP___ RTMP___**
HCAL___ LCAL___ HEAT___ VERS___

#8 (operator mode) **TEMP___ LOA___ HIA___**

(factory mode) **UNIT___ INIT___ LTMP___ HTMP___ RTMP___**
HCAL___ LCAL___ HEAT___ VERS___

SECTION X
WIRE LIST

SECTION XI
SCHEMATICS