SERVICE & TROUBLESHOOTING

3.1 Routine Maintenance

3.1.1 General

Generally external cleaning is all that is required. The chambers are not to be touched or removed. If chamber cleaning is required, contact FurnacePros.

> WARNING. DO NOT ATTEMPT TO OPEN OR MANUALLY CLEAN THE CHAMBERS OR THE FURNACE MAY BE INOPERABLE DUE TO DAMAGE TO THE INSULATION. Contact the manufacturer if cleaning is required.

3.2 Service and Maintenance Access

> Observe extreme caution when the furnace power is engaged while the access panels are removed. Dangerous levels of AC and DC voltages will be present.

LOWER DOOR PANELS. Gain access to the lower sections of the furnace by turning the quick release screws and opening the hinged doors. Make sure the EPO switches on lower panels are pulled out if the furnace is to be energized while these lower panels are open.

UPPER PANELS. The upper panels can be lifted and removed to access the chamber level of the furnace. When replacing the upper panels carefully lower the top of the panel into the slot provided and insert the bottom of the panel so it is resting on the stainless steel shoulder screws.

COMPUTER ENCLOSURE PANELS. These panels are located on either side of the furnace near the entrance and are not interlocked. These panels can be removed to gain access to the computer enclosure. Remove lower pedestal panel to service an owner-installed UPS (if so equipped).

DRIVE ENLOSURE. Remove Panels at entrance and exit of the furnace to adjust the belt tracking.

HEATING ELEMENTS. Remove upper side panels to access sealed plenum covers. Remove plenum covers to access lamp elements.

3.3   Daily Maintenance

Daily maintenance consists of a simple series of functional checks that will alert maintenance personnel to any signs of developing problems. The importance of regularly checking the machine cannot be over stressed to prevent not only damage to the machine, but also loss of productive time and product. Whenever the furnace is started up the failure alarms should be checked for signs of trouble. An intermittent exhaust failure indicates that something is wrong and that the alarm mechanism, system exhaust fan, and possibly exhaust ductwork must be checked and corrected as necessary. Other alarm functions should be monitored, such as the lamp failure indicator, to see if corrective action is required. As the machine is being started up, each control and switch should be briefly checked to ensure that all functions are working properly. Any controls that do not respond as expected, or alarms that do not clear should be checked out and corrected before putting the machine into operation.

3.4   Monthly Maintenance

Monthly maintenance, in general, means four weeks of operation for one eight-hour shift per day. This period of operation is not an absolute number, and it is possible that some of the tasks are needed more often. Experience with the machine and process being performed should dictate the need.

> **Run a temperature profile, no less often than monthly, on machines that are used for sensitive processes.**

On machines that are used for a variety of products, it is advisable to set up a profiling schedule so that each process can be checked periodically. The most sensitive profiles should be checked at least monthly, while less sensitive profiles could be checked every 2-6 months.

3.5   Other Scheduled Maintenance

3.5.1   Preventive Maintenance Screen

The Preventive Maintenance Screen is used to list maintenance and their preferred frequency of occurrence. Consult the Reference Manual, Chapter 7 for a description of the use of this screen.

The Remaining Time Status Bar on the Maintenance Screen will provide a graphical representation of the time remaining before maintenance is required. When any Maintenance Item has timed out/reached the maintenance required date, the MAINT status box on the Process Screen will Flash.

As Maintenance Items are completed, click on the appropriate "Completed" pushbutton the Maintenance Screen in order to set a new maintenance required date that is based upon the #days field.

3.5.2   Recommended Maintenance and Frequency

Equipment	Recommended Maintenance	Recommended Interval
Air Filters, Door	Remove the foam sponge air filters from the lower electrical compartment (base doors); clean or replace them. These filters can be washed out with a mild detergent and water, but must be completely dry before being replaced.	Annually, or as required.

Equipment	Recommended Maintenance	Recommended Interval
Air Filters, compressed air	Remove the door panel below the flowmeters and replace filter set in the compressed air line to assure furnace receives clean dry air. 	6 months or as required.
Compressed Air Tank (optional)	With air pressure still on the furnace system, remove the door panel below and to the left of the flowmeters. Open the small valve for the air compressor reservoir drain. Purge the tank until the condensate has been removed. 	Monthly or as required.
Belt Shaft Bearings- perm	To gain access to the belt shaft bearings remove the end covers from both ends of the machine. Located at both ends of each belt shaft are permanently-lubricated bearings. These bearings should not be lubricated.	None
Belt Shaft Bearings with grease fittings	Bearings with grease fittings should be lubricated with a general multipurpose bearing grease. Apply enough grease to the bearing block so that excess grease can be visually seen squirting out along the shaft of the device. Wipe off all excess grease that has squirted out to avoid dirt accumulation.	6 months
Belt Shaft Rollers	The belt shaft rollers should be inspected periodically to make sure that they are centered on their respective shafts. Remove the end covers to gain full access to the belt shaft rollers. If a roller is misaligned, loosen the setscrews that hold the roller onto the shaft and use a rubber mallet to move the roller on its shaft. Use a scale to make sure the rollers are centered to within 0.125 inches on the belt shaft. 	After first 30 days, annually thereafter

Equipment	Recommended Maintenance	Recommended Interval
Belt Tracking Adjustment	The belt should be checked periodically to make sure that it is tracking through the center of the oven. Belt tracking can be checked visually at the entrance and exit ends of the oven. The belt should be centered between the belt guides at the entrance and exit ends of the oven. If the belt tracks off-center this problem can be rectified by realigning the belt shafts. First, set the belt speed to zero and remove the end covers at the entrance and exit end of the machine to expose the frame ends and the belt shaft bearing mounts at the end of the belt shafts. The following procedure can be used to correct tracking problems at either end of the furnace. Loosen the belt shaft bearing mount bolts at one end of the furnace (entrance or exit). While facing the end (entrance or exit) of the furnace, use the following procedure. If the belt is tracking to your left, pull the left side of the belt shaft forward and/or move the right side of the belt shaft rearward. If the belt is tracking to your right, pull the right side of the belt shaft forward and/or move the left side of the belt shaft rearward. Repeat this procedure at the other end of the furnace. It is best to make these adjustments in small increments. Adjustments that are too large will cause a belt tracking problem in the other direction. At the exit end of the furnace, the transport motion sensor will also have to be loosened and moved with the belt shaft to maintain engagement with the gear on the belt shaft. Now run the belt at its highest speed and observe how the belt is tracking. Repeat the adjustment procedure until the belt tracking is centered.	Weekly
Chamber	The chamber normally does not require maintenance. If a problem with the chamber is suspected, the manufacturer should be consulted. Because the process gas is inserted through the insulation, the gas flow away from the insulation prevents contamination from building up on the chamber walls. To help reduce flux residue buildup in the chamber, the zones can be set at 400°C and the furnace can be put into a self-cleaning cycle for about an hour to burn out these organic residues.	Process dependent
Cooling Fans	Inspect all system cooling fans and flow switches, for freedom of movement and proper operation.	6 months
Drip Trays	Remove and clean the drip trays, located under the process exhaust stacks. Access to the trays is through the top removable section of the furnace chamber, located above the trays, or at the furnace entrance, behind the cosmetic entrance molding. For procedure on removal and cleaning of the trays, consult the furnace Reference Manual, Section 7.5.1. Depending on the process, if very little buildup is found, cleaning may not be necessary more than once a year.	After the first 6 months of operation,
Drive Chain	The chain drive system is contained in the motor enclosure at the exit end of the oven. Lubricate the drive chain with FurnacePros #100523 chain lube or a commercial quality non-dripping chain lube.	Every 6 months of operation

Equipment	Recommended Maintenance	Recommended Interval
Drive Chain Tensioner	The chain tensioner is equipped with a grease fitting for lubrication. The chain tensioner should be lubricated every 6 months with a general multipurpose bearing grease. Apply enough grease to the tensioner so that excess grease can be visually seen squirting out along the shaft of the device. Wipe off all excess grease that has squirted out to avoid dirt accumulation.	6 months
Drive Motor Mounts	The drive motor is contained in the enclosure at the exit end of the oven. The motor mount bolts must be checked periodically and tightened if necessary.	Annually, or as required.
Exhaust Stacks	Check the exhaust stacks, after 6 months of operation, for possible buildup of materials generated from firing processes. The stacks should be cleaned, as necessary, with a brush and solvent to remove the buildup. A periodic inspection of the stacks is essential to establish a sensible maintenance cycle, since some processes will require frequent cleaning, and others require none at all.	After the first 6 months, and thereafter as required.
Lamp Heating Elements	No maintenance is required for the heating elements other than replacement when one burns out. Note that with low temperature operations, the lifetime of the heating element is in excess of 100,000 hours. It is only at temperatures in the 900°C to 1000°C range that the expected lifetime begins to shorten. Also, the heating elements do not degrade over time. Should failure occur, it will be sudden and catastrophic. Use ohmmeter for best results visual inspection is unreliable. Refer to the Reference Manual for changing heating elements.	Inspect regularly, replace lamps as required.
Lamp Seals	Inspect the lamp seals for loose, cracked or missing packing material. Once the side covers are removed, the lamp seals can be visually inspected.	6 months
Sprocket Alignment	The sprockets are contained in the motor enclosure at the exit end of the oven. Visually verify that the sprockets are aligned. Adjust according to the furnace Reference Manual, Chapter 7.	After first 30 days and annually thereafter.
Sprocket Shaft Bearing Block	The sprockets are contained in the motor enclosure at the exit end of the oven. The sprocket shaft bearing block is equipped with a grease fitting for lubrication. The bearing block should be lubricated with a general multipurpose bearing grease. Apply enough grease to the bearing block so that excess grease can be visually seen squirting out along the shaft of the device. Wipe off all excess grease that has squirted out to avoid dirt accumulation.	6 months
Transport Belt Length	Check the length of the transport belt and shorten it if the gravity loop comes within 6 inches of the floor. A properly shortened belt should hang between 2 and 3 inches below the main frame.	Annually, or as required.
Transport Clutch	The clutch should be inspected periodically to insure proper tension on the belt. To adjust, a large hex nut at the chain sprocket end of the drive drum must be tightened until the drum turns. If the drum cannot be stopped by firm pressure with your hands, the clutch is too tight. Do not over tighten the clutch, as it is there for safety reasons.	Annually, or as required

3.6 Troubleshooting

To troubleshoot, follow all suggestions sequentially to determine cause of problem.

3.6.1 Unable to log on:

The PLC control system does not have any power

A) Check fuse "FB" in safety enclosure box. (Ref: Power Control Schematic in Section 6)

B) Check the Ethernet cable between the PC and the OPTO22 controller at the back of the PC and at the controller. (Ref: Frame Wiring Schematic in Documentation Section)

C) Check the setup of the installed Ethernet card. (Ref: Section 3)

3.6.2 Temperature

1) The furnace has been in "WARM UP" mode for more than 15 minutes.

On the Process screen, the zone temperature does not change. Perform the following procedures sequentially to determine cause.

A) Check K1 main contactor (located in safety enclosure) to be sure it is operational. If not, check fuse "FD". (Ref: Power Control Schematic in Section 6)

B) Check K3 and K6 relays (located in safety enclosure) to be sure they are operational. If not, check interlock switches (located on frame) to be sure they are engaged. (Ref: Power Control Schematic in Section 6.)

C) Check K4 relay (located on OPTO22 PLC panel. (Ref: Channel Assignment Sheet in Sections 5 and 6) Check for illuminated LED, indicating an active output.

NOTE: K4 has diagnostic circuitry by allowing the user to manually control the status of the output

Set @ 3: Automatic (Factory set)
Set @ 2: Off (Bypass)
Set @ 1: Manual On/Off

2) The heat is in a runaway condition and cannot be shut off by changing the setpoint to a lower value.

A) The SCR needs calibration. See Maintenance ("Maint") screen for details. (Ref: Reference Manual)

B) The SCR has failed and shorted. Replace SCR.

NOTE: The following are factory typical settings:
Gain: 9
Integral: 45
Derivative: 0

3.6.3 Zone temperature fluctuates.

1) The SCR needs calibration

2) Improper flowmeter setting(s)

3) Adjacent zone temperature differentials are too large

4) Improper PID setting(s)

3.6.4 Conveyor System

1) A Transport Speed Error occurred.

A) Check fuse "FB" (located in safety enclosure box). (Ref: Power Control Schematic in Section 6)

B) Check fuses "F1" and "F2" on Motor Speed Control PCB (located in the motor box). (Ref: Frame Wiring Schematic in Section 6)

C) Inspect clutch for slippage.

D) Visually inspect for belt jam or snag.

E) Check the input signal on Motor Speed Control PCB (located in motor box);S1 is common, S2 is speed control. (Ref: Frame Wiring Schematic in Section 6)

At maximum speed the voltage is approximately 10 VDC.

2) Transport Motion Fault has occurred.

In addition to Section 0.0.0, the following items should be checked:

A) Check for wear and tear on the small gear present on the transport motion sensor, and the gear located on the drive shaft at the exit end of the furnace.

B) The optical coupler mounted on the sensor must be kept clean and positioned properly. The timing wheel must be adjusted so the edge of the wheel and the face of the wheel have the same spacing, with respect to the optical coupler.

3.6.5 Jerking or vibrating of transport system

See Recommended Maintenance and Frequency table 3.5.2 for transport system alignment and maintenance.

3.7 Hardware Communication and Software Troubleshooting

3.7.1 Controller Communication

The most often seen problem is no communication between the computer and the controller and is characterized by pound signs "######" on the screen where you should have temperature or the date or any type of data.

Check the following things in this order:

<u>Log Event Viewer</u>: Any event happening between the computer and the controller is logged on this screen. You can access it by "ALT-TAB". The following are messages that are displayed:

- the normal message is "Attaching to Scanner"

- then a file download, such as the default recipe file.

- a message relating to the Ethernet card, make sure the coaxial cable is plugged in, and the controller IP address is correct.

- out of memory, switching to low scan mode; there is insufficient memory to run the software. Contact FurnacePros for additional memory.

- Incompatible gml file date/time; the source code has been changed, contact FurnacePros.

<u>PLC</u>: If you have communication, but it looks like some data is frozen, it may be a loss of communication between the PLC controller and the PLC modules. Check the PLC LCM4 controller module to be sure the LED's BATT, LINE AND STAT are green.

- Line "green" indicates 5VDC power status is good.

- BATT "green" indicates CMOS battery status is good.

- STAT "green" indicates the firmware is good.

- The LED's "TX" and "RX" indicate data is communicating between the controller and the modules.

Otherwise use the following table to troubleshoot communication problems:

INDICATION	EXPLANATION	REMEDY
LINE LED is off	No Power.	Check wiring.
LIINE LED is red or Controller resets.	Power may be out of specification	Check the power supply for 5V DC power.
STAT LED is off	Controller is faulty	Call FurnacePros Technical Support.
STAT LED blinks red	Firmware problem	Call FurnacePros Technical Support
BATT LED is red	Backup battery is low	Replace backup battery.
RX LED is stuck on	Wiring polarity problem	Call FurnacePros Technical Support.
Controller cannot transmit to PC	Configuration jumpers were changed without cycling power.	Cycle power off/on and retry transmission.
No communication to host PC.	Communication Problems	Check serial port. Check PC IP address (10.192.105.100)
No communication to host PC. RX LED is on, but TX LED is off	Communication Problems	Check controller address (10.192.105.102), baud rate, and ASCII/binary settings.
No communication to host PC. RX and TX LEDs are on	Communication Problems	Try a slower baud rate.
No communication to I/O modules. TX LED is off while trying to communicate.	Communication Problems	Check that I/O port software is configured for correct port. If RX LEDs on I/O modules are off while trying to communicate, check for loose connections, shorts or breakage. IF RX LEDs on I/O are on, check I/O address, baud rate, and protocol setting in software.

If you have communication, but some variables appear as "###", this means the controller does not know what this particular variable is. Check the Event Log viewer for more details.

3.8   Remote Diagnostics

To setup the remote control on the furnace for troubleshooting by FurnacePros from the factory, start PcAnywhere, click on "Be a Host" and "Wait for Call". The computer should be connected to an ANALOG phone line. See section 2.9 for Remote Access options.

3.9   Process Problems

3.9.1 Belt speed

Measure the belt speed with a stopwatch. If it differs from the value on the process screen by more than 5% (1 IPM off for each 20 IPM of belt speed), re-calibrate the belt speed. Follow the Belt Speed Calibration procedure in the furnace Reference Manual, Chapter 7.

3.9.2 Temperature or large power fluctuation

If the temperature fluctuates by more than 5 degrees in less than 20 seconds after you reached ready state, it might be a problem with the PID. Go to the PID tuning screen for that particular zone.

If the SCR is out of calibration, most likely it will not be noticeable in the medium range of the temperature. Only at low temperature (<100°C) or near the maximum temperature, will there be deviation from the setpoint. See the SCR Calibration procedure in the Documentation Section.

3.10 Abnormal sensor behavior

There are numerous sensors (standard and optional) on the furnace, from thermocouple to a board counter, gas analyzer, and so on. If one particular sensor seems to behave erratically, you will need to look into the value reported by the control subsystem.

The errors could be

• a temperature with a negative value,

• a gas analyzer readout that never changes value,

• a board counter that doesn't count.

For the digital sensors, first locate the relay module connected to that sensor on the OPTO panel, using the Channel Assignment configuration sheet. The red LED should toggle every time the sensor changes state. If it doesn't, the problem is with the sensor or the wiring. Most unlikely the relay module itself.

If the relay does toggle, make sure the module is talking to the controller; the TX LED should be flashing.

The analog inputs cannot be checked visually.

3.11 Transport Belt Replacement

When replacing the transport belt, it will be helpful to have an assistant for the task.

1) Place the rolled up belt at the entrance end of the furnace and orient, as shown in the figure below.
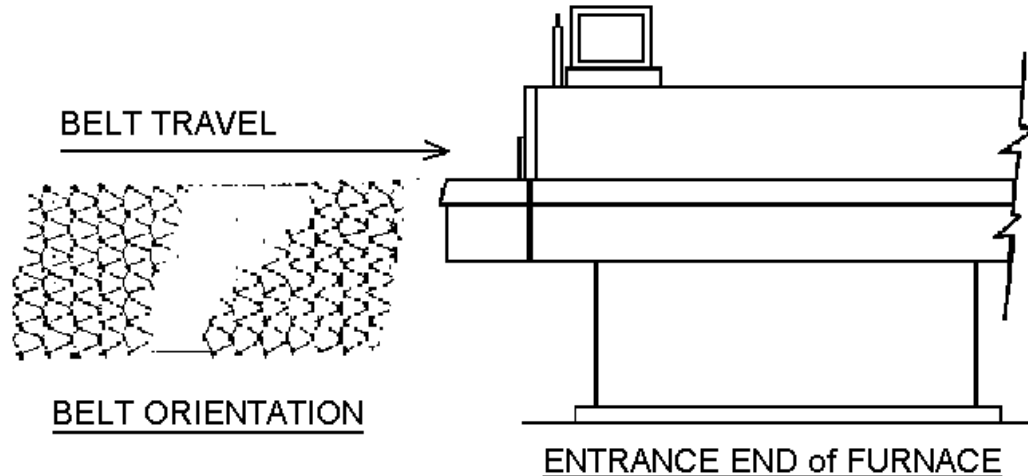
2) Extend a long rod or stick through the furnace chamber, being careful not to damage the lamps or insulation. If possible, use the old belt to draw a pull wire through the chamber during its removal. Securely attach the leading edge of the belt to the rod. Carefully pull the belt through the furnace from the exit end, while an assistant unrolls and guides the belt into the furnace.

3) When the belt has been pulled through the furnace chamber, remove the rod and thread a pull wire through the rollers and drive drum, as shown below. Attach the wire to the leading edge of the belt and pull the belt through.

Figure 3.11.1 Belt Installation
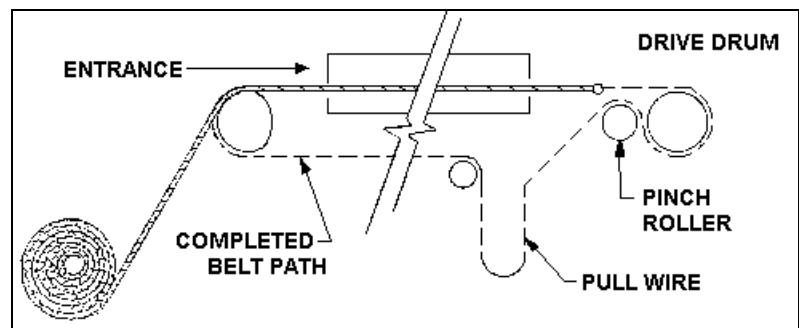
4) Continue pulling the belt through the drive system using the wire, and then by hand, until the belt path is complete.

5) Splice the belt, as shown below.

Figure 3.11.2 Inserting the Belt Splice
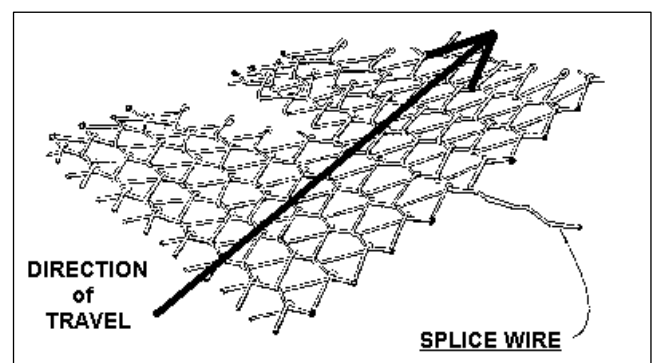
3.12 Heating Element Test Procedure

This procedure is to be used to test for open heating or failed lamp heating elements.

3.12.1 Required Equipment

1. Continuity Tester (Ohmmeter preferred)

2. 3/8" Box or Open End Wrench

3. Control & Element Wiring Schematic

3.12.2 Test Procedure

Remove all power from the furnace, and if a UPS or EPS is installed, locate and shut off the unit. Remove all side covers, completely exposing all lamp terminations.

Using the schematic as a reference, locate the bus bars linking the elements in each zone. The bus bars are made from aluminum, and are connected to the lamp terminal screws.

Starting at the front of the furnace, remove the bus bars for only zone 1 (top & bottom), taking note of which terminals the bus bars were connected to. Using the multimeter on ohms scale, and a technician on either side of the furnace, check each lamp by measuring the resistance across the terminations of the lamp. If the resistance is less than 10 ohms, the element is good. If resistance is greater, replace the element following the procedure in Section **Error! Reference source not found.** of the manual. Next, check the bottom half of the zone in the same manner. After verifying the top and bottom lamps, replace the bus bars on the proper terminals, and securely tighten all hardware.

Following the same procedure, check the other zones, one at a time, throughout the furnace.

Once the elements have been completely tested, replace the covers on the furnace. Turn on the EPS/UPS (if so equipped) and power to the furnace. Bring the furnace up to temperature, and, next, run a profile verifying that no leaks occurred around the lamps that were replaced.

The procedure is now complete.

3.13 Lamp Replacement

See furnace Reference Manual, Section 7.5.3 Heat Lamp Replacement.

3.14 Controller Installation

Connect the various cables between the modules, the controller and the computer.

INITIALIZE: Turn the computer on. When the WIN XP logo comes up, hold down the shift key to prevent the MMI from starting, since the controller is not ready yet. If it started, exit using ALT +F4.

The first time the controller is turned on, its memory is empty, and the software has to be downloaded. Double click on the download icon in the furnace group in Windows or the furnace icon on the desktop.

FURNACE SOFTWARE. The furnace icon or menu item will download the kernel (the Operation System for the controller) and the furnace ProControl2007™ software, and start running it.

You can now start the MMI software by double clicking on the Furnace icon. From now on, startup will be automatic.

You should see the correct date and day in the bottom left corner. If not, go to the Ethernet Installation and troubleshooting section.

LOG-IN. Check the log-in dialog box for one of the 3 proposed users: operator, tech and Factory (FPD). Enter appropriate password for the level selected.

3.15 Ethernet Installation and Troubleshooting

3.15.1 Setup of Windows© PC Ethernet Interface

  a.   Open Windows Control Panel<start\settings\control panel

  b.   Double click on the "Network Connections" icon.

  c.   Choose "Local Area Connection", right click, "Properties".

  d.   Highlight "Internet Protocol (TCP/IP)", make sure the box is checked.

  e.   "Client for Microsoft Networks', and "File and Printer Sharing for Microsoft Networks" should be checked.

  f.   Click the pushbutton labeled "Properties".
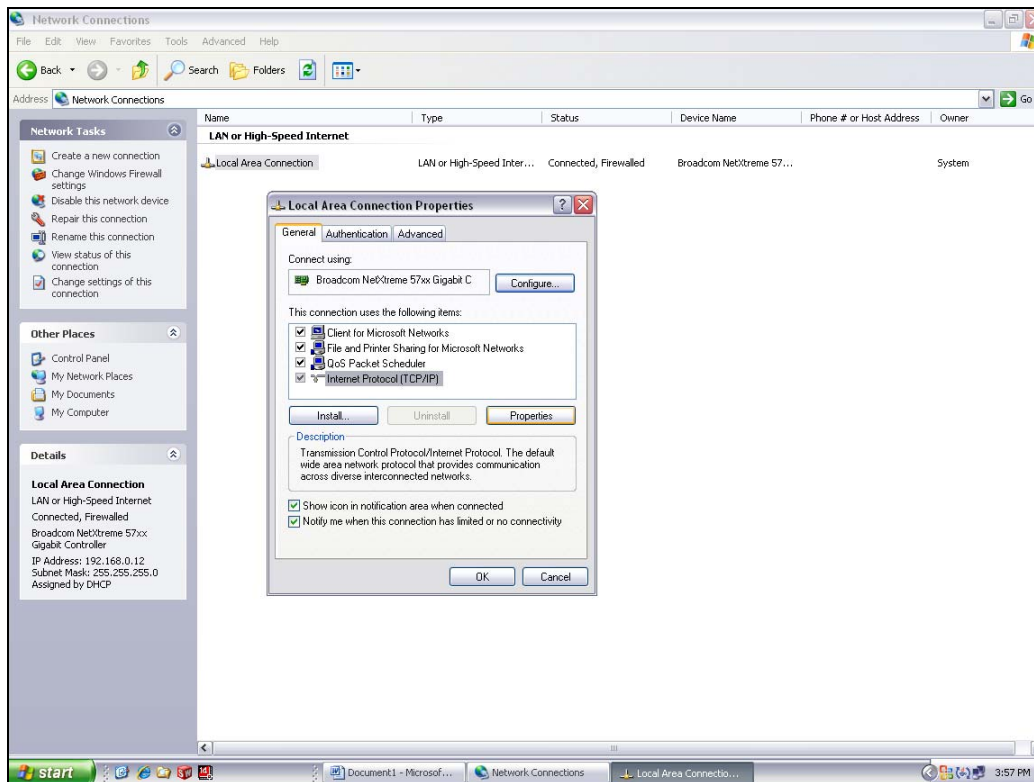
  g.   A dialog box called "Internet Protocol (TCP/IP) Properties" will appear.

  h.   On the "General" tab look for the following available two choices:

"Obtain an IP address automatically"

"Use the following IP address:"
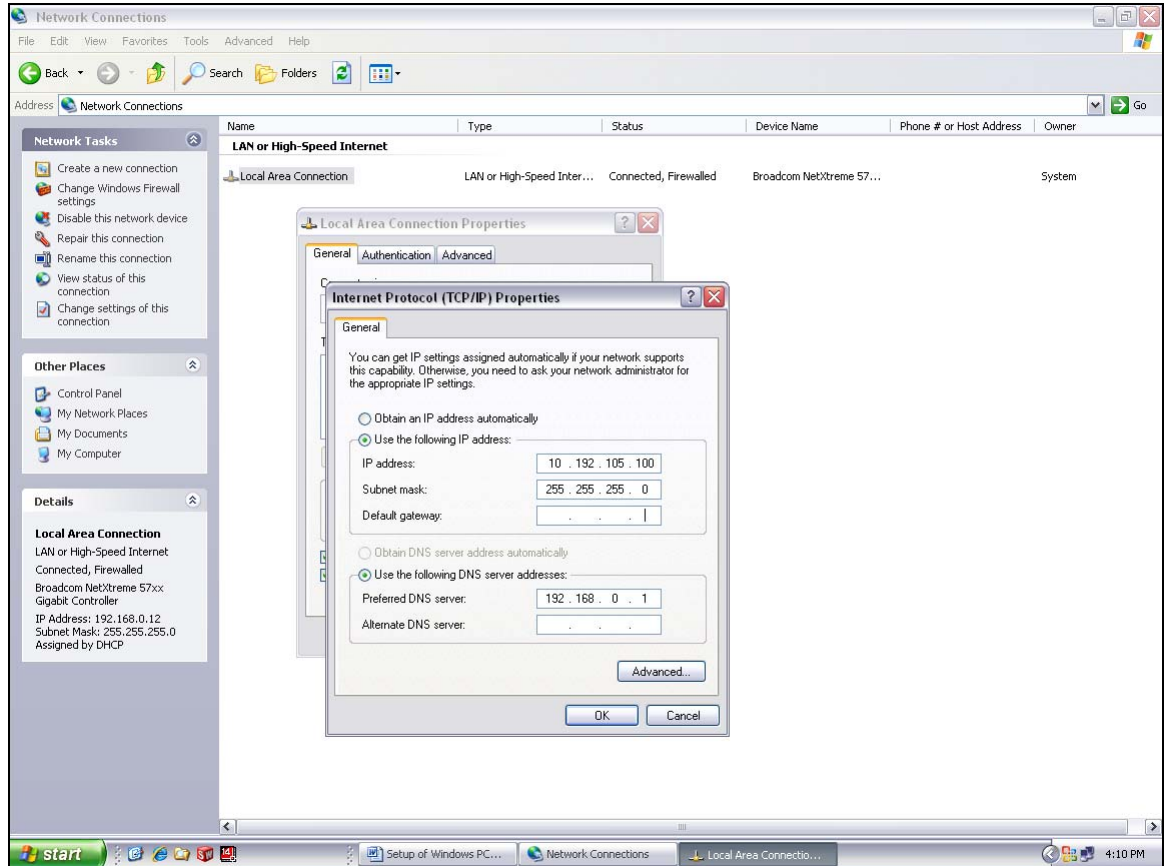
IP Addresses

i. For the case of setting up the communication link between the PC and the Opto22 Controller use the following information. (Setup of the communication link using the second Ethernet card on the PC will be shown afterward.)

j. Select "Use the following IP address:"

Enter the following in the fields:

> IP address: 10.192.105.100

> Subnet mask: 255.255.255.0

Clear the Default gateway: fields, and the DNS server addresses fields.

k. When the furnace PC computer contains two Ethernet cards, configure the "Local Area Connection2" communication link for the second Ethernet card as done above, however, with the following modification shown below:

l. Select "Obtain an IP address automatically"; Click "OK", "OK".

m. Close "Network Connections".

3.15.2 Reset and Assign an IP Address to the Controller's Ethernet Adapter Card.

a.   Remove power from the controller chassis box.

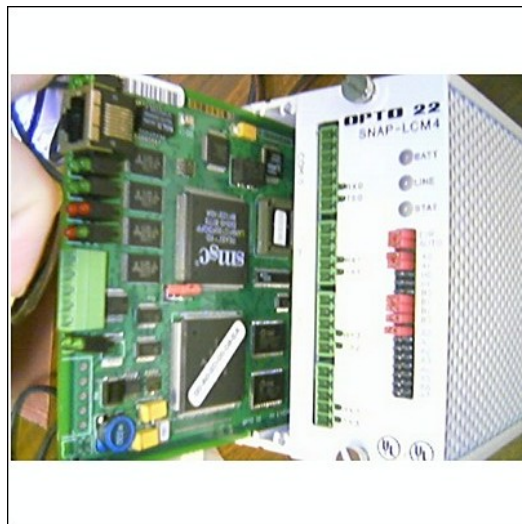b.   Remove the controller's Ethernet adapter card from the controller chassis.

Note: Follow standard anti-static dissipative procedures when removing and handling the card.

c.   Remove Ethernet and RS-232 connectors

d.   Release (4) front panel set screws and (2) covers
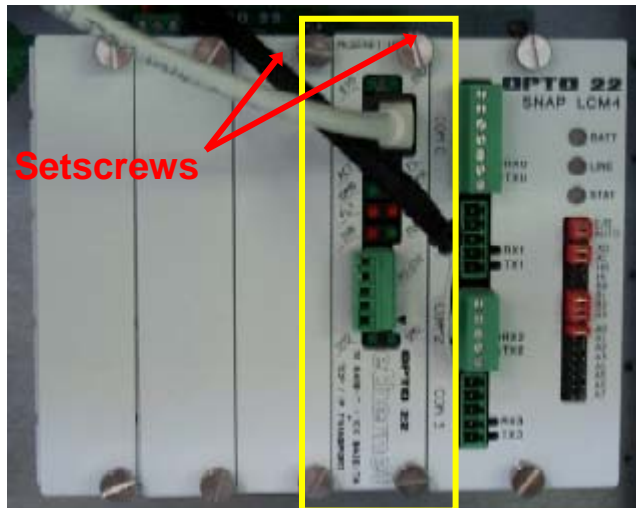
Remove Card from chassis. (See figure below)
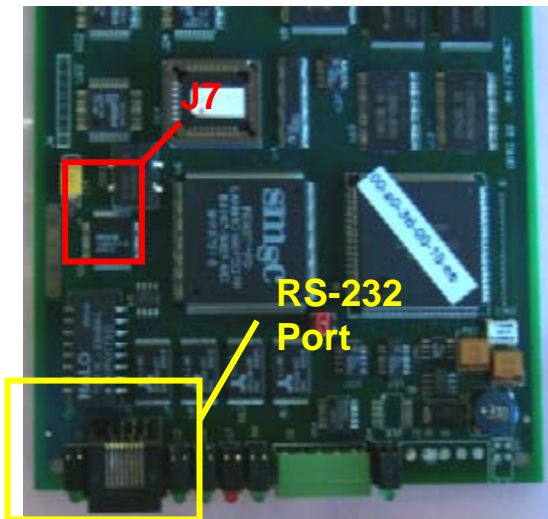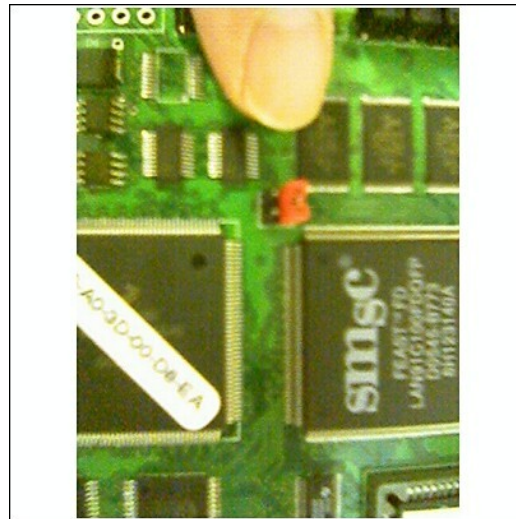
e.   Release (4) front panel set screws and (2) covers

Removal of Ethernet Card

f.   Move the J7 Jumper to the Module Reset Position as shown in the following pictures.

Location of Port and J7 Jumper
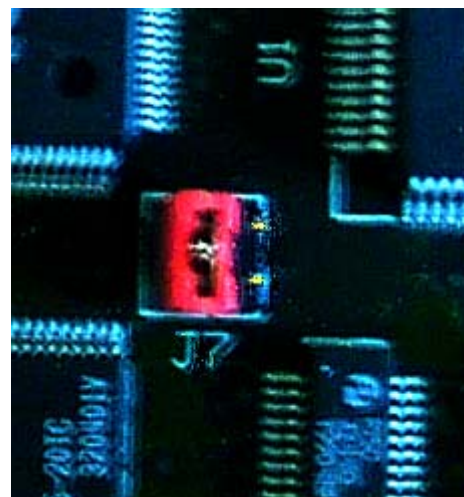

Move J7 Jumper to Module Reset

    g.   Reinstall the Ethernet adapter card into the Opto22 controller chassis box.

    h.   Wait for the STD LED on the Ethernet adapter card to stop blinking, and then turn off, or remove power from the system.

> **Note: The power switch on the PC may need to be initialized.**

    i.   Apply power to the controller system.

> **Note: This procedure resets the Ethernet Adapter Card to its factory default settings.**

j. After removing power from the controller system, again remove the Ethernet Adapter card and restore the J7 Jumper to its original position as shown at right

Original J7 Position

k. Reinstall the Ethernet Adapter card into the Opto22 controller chassis box making sure the covers and set screws are in place.
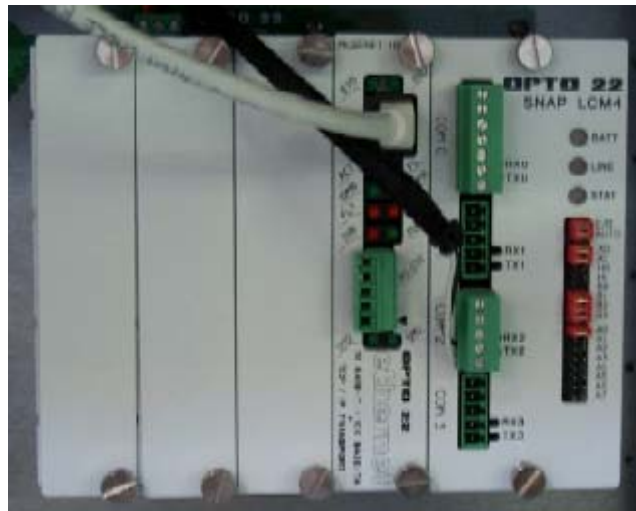
Ethernet Adapter

l. From the Windows© Toolbar, Select <Start/Programs\Opto22\OptoUtil\OptoBootP Utility>

m. On the "OptoBoot Tool" dialog box, click the "Listen" pushbutton located at the upper right.

n. After a few seconds, in the dialog box's data window, a Mac address will be listed followed by 0.0.0.0 IP Address and a ?.?.?.?. Subnet Mask.
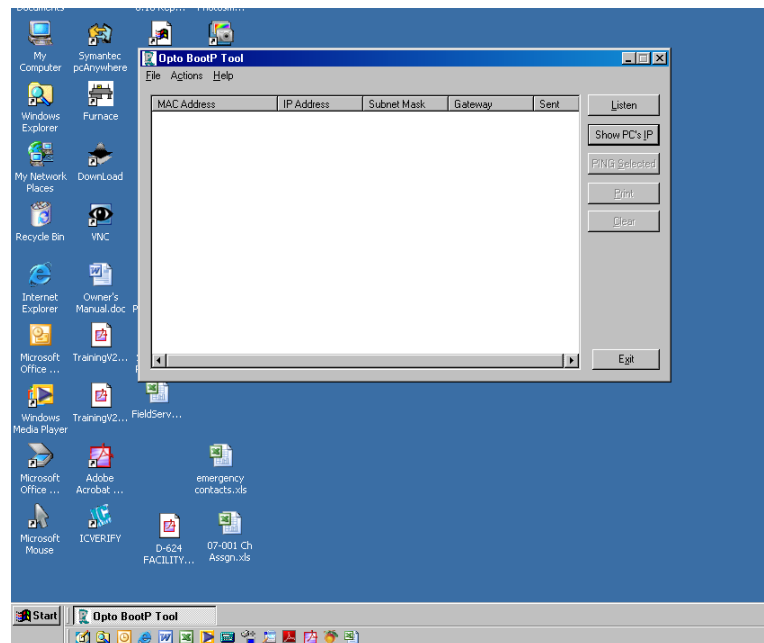
Double Click on the 0.0.0.0 field to assign an IP Address

Enter "10.192.105.102" for the IP Address and "255.255.255.0" for the Subnet Mask. Leave the Gateway field 0.0.0.0.

Click the "Send" pushbutton to assign the entered address.

OptoBoot Screen

The data window should now be updated to display a "Yes" under the "Sent" Column.

o. Click on "Exit" to leave the OptoBoot tool application.

3.15.3 Troubleshooting Windows© Setup of Ethernet Connection

a. Open Windows Control Panel<start\settings\control panel>

b. Double click on the "System" icon.

c. A dialog box called "System Properties" will appear.

d. On the "Hardware" tab look for the pushbutton called "Device Manager".

e. Click on "Device Manager". A listing will appear showing the hardware devices installed on the computer. Verify the Ethernet card(s) are shown in this list.

f. Exit "Device Manager", "OK", close Control Panel.
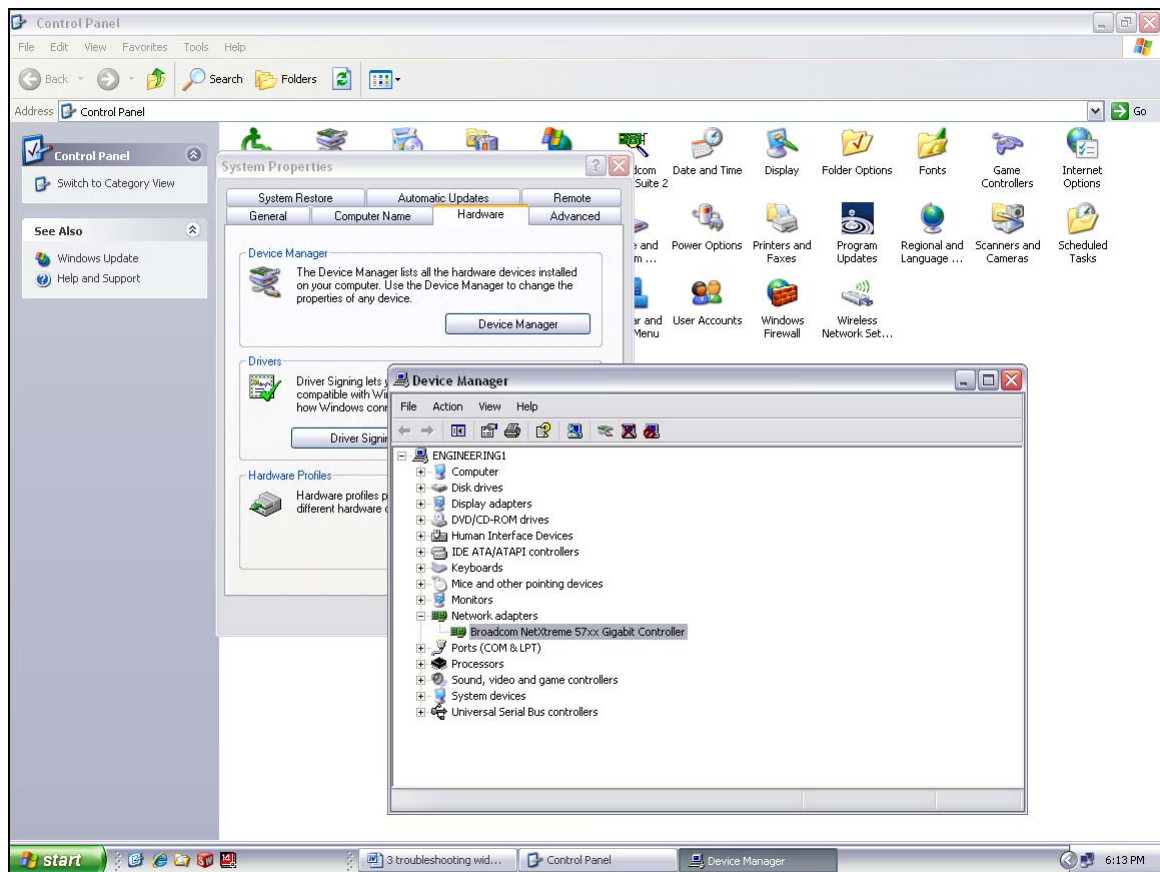
g. Open Windows Control Panel<start\settings\control panel>

h. Double click on the "Network Connections" icon.

i. Check to see that the network connection for the communication link between the PC and the Opto22 Controller (Local Area Connection) appears under the listing Name "LAN or High-Speed Internet".

j. Choose "Local Area Connection", right click, "Properties".

k. Highlight "Internet Protocol (TCP/IP)", make sure the box is checked.

l. Click the pushbutton labeled "Properties".

m. Within the dialog box, "Internet Protocol (TCP/IP) Properties", in the "General" tab, verify that "Use the following IP address:" is selected and the following address information is entered:

> IP address: 10.192.105.100
> Subnet mask: 255.255.255.0

n. Click "OK", "OK".

o. Close "Network Connections"

3.15.4 Verify configuration of the external jumpers of Opto22 Controller

See Section 7, PLC I/O CONFIGURATION drawing for jumper settings.

3.16 Calibration

Consult the Reference Manual for most calibration procedures.

3.16.1 SCR

Follow the calibration procedure described in the Reference Manual.

3.16.2 Belt speed

Go to the calibration screen. Check the box 50% output. Using a stopwatch, time the belt speed over a known distance, and calculate the actual belt speed. Enter the number in the Actual speed field. Un-check the 50% output box. See Reference Manual Chapter 7 for more detail.

3.16.3 Thermocouples

The thermocouples are pre-calibrated. They do not require any additional calibration.

3.16.4 PID tuning

If you notice unstable behavior in a certain zone, use the following procedure to retune the PID:

> NOTE: This procedure should only be attempted by qualified personnel. Unreasonable PID parameters can stress the components of the system and cause premature failure of some electrical systems.

Go to the recipe screen and select the PID tuning for the zone you're interested in. Write down the values of Gain and Integral before you start changing them! If all else fails, you can return to the factory default.

Set the integral to the maximum possible value and the Gain to 1. Wait until the temperature stabilizes. Increase the Gain by 10%. Repeat until the temperature starts oscillating. Always wait for at least 5 oscillations before changing any parameters again. The temperature will be oscillating at a value BELOW the setpoint. This is normal. The temperature will be anywhere between 5° and 50°C below the setpoint.

Now set the Integral to the period of previous oscillations (usually between 5 and 15 seconds). Round up to the nearest integer. The temperature will slowly drift to a new value. Reduce the Integral term for faster convergence.

At that point, the system may start oscillating again. Decrease the Gain by an additional 10% until stable.

The heating process inside the chamber is a first order process with very little lag time. This means that the PID does not need a Derivative value to operate.

Oscillations are caused by gain too high, integral too short, or rate too long. Never set rate to more than one-fourth of integral time. Sluggish response is caused by gain too low, integral too long, or rate too short.

The PID values will work over a rather wide range of temperature. However, on a High Temperature furnace, the PID might require tuning for the low range of temperature, around 200°C, and different set of parameters above 500°C. The machines are set up for one set of PID parameters at the factory. For furnace fine tuning, it is the responsibility of owner's process engineer to determine the final settings.

3.17 Over Temperature Alarm Setpoints (installed equipment may vary)

The Over Temperature Alarm system watchdog system fully independent of the furnace temperature software. The Over Temperature Alarm system is typically factory set to 200°C for each zone. The system consists of a microprocessor-based eight channel analog input scanner/multiplexer and annunciator that provides automatic switching for multi-point display and alarm of the furnace zone temperatures. Signals received from redundant type K thermocouples in each zone of the furnace are scanned and alternately displayed on the digital temperature panel meter mounted below the Main Control Console of the furnace. See drawing 802-101915-03 Over Temperature Monitor wiring schematic.

DIGITAL PANEL METER SCALE (F or C). F or C can be switched to indicate Fahrenheit or Celcius.

1.   Press ENTER, when F or C appears press ENTER again.

2.   The meter will display F or C alternatively. Press ENTER when desired character is flashing. Meter will then return to indication mode and display the temperature in either Fahrenheit or Celcius.

DIGITAL PANEL METER ALARM SET AND RESET PROGRAMMING. The panel meter alarm set and reset point is performed in the ALAr5 routine.

1. To enter the ALAr5 routine, press ENTER and when ALAr5 appears, press ENTER again. This starts a scan of the system set and reset points. The scan sequence begins with a flashing display of alarm #1 set point. The "1" LED and "S" LED are illuminated to indicate the meter is flashing alarm #1 set point value.

2. All digits flash for 3 seconds. If this is the desired display for this alarm point, press ENTER. Pressing ENTER completes this alarm point programming. Proceed to step 8 for next alarm point programming.

If this is not the desired display, wait for the first digit to flash. It will flash for 3 seconds before it starts to scroll.

3. If the first flashing digit is OK, press ENTER before it starts to scroll to accept it, the next digit flashes – go to step 6. If not OK, wait for first digit to scroll.

4. When the first digit is OK, press ENTER and the next digit flashes for 3 seconds before it starts to scroll.

5. If the flashing digit is OK, press ENTER before it scrolls. If not OK, wait for digit to scroll

6. When digit is OK, press ENTER. Program remaining digits in same fashion.

7. When the last digit is OK, press ENTER. The entire display flashes for 3 seconds. Press ENTER if OK to complete alarm point programming and proceed to step 8. If not OK, wait, first digit flashes. Repeat steps 3-7.

8. When an alarm set or reset point has been programmed the scan moves to the next alarm set or reset point. To program the remaining alarm set and reset points, repeat steps 2-8.

SCANNER/ANNUNCIATOR. The scanner/annunciator is programmed for scanning and alarm functions using the CTRL button and a four-position DIP switch (S1). The CTRL button is used to set the dwell time for each channel (if using internal scanning) and DIP switch S1 is used to program the following:

S1 Switch	Function
S1-1	Sequence A or F2A alarm operation (if needed)
S1-2	Stopping-on-alarm or continuous scan-on-alarm (if needed)
S1-3	Internal or external scanning
S1-4	RUN or SETUP mode

The scanner/annunciator's front cover is held in place by 6 latches that snap into notches on the cover. To remove the cover grasp it firmly on its top and bottom edges and pull it forward. The latch plate remains around the case. DIP switch S1 is located below the right bank of LEDs.

PRPGRAMING DWELL TIME (INTERNAL SCAN ONLY). The default dwell time is four seconds per channel. It can be adjusted for any time between 0.6 and 30 seconds per channel. A channel can be disabled from the scan sequence by programming that channel's dwell time for less than 0.5 seconds during setup.

To program a dwell time for other than the four second default or to disable a channel:

1. Set the switch S1-4 to the SETUP (off/up) position.

2. Unit will beep and channel 1 will illuminate, indicating it is ready to be programmed.

3. Dwell times are programmed with the CTRL button, either
   a) Press and release CTRL button within 0.5 seconds to disable a selected channel,
   b) Press and release CTRL button after the 0.5 second beep to program channel for minimum dwell time, or
   c) Press and hold CTRL button for desired length of dwell time up to 30 seconds maximum.

4. After the CTRL button is released the unit will beep and go to the next channel.

5. Program the remaining channels in a similar fashion.

6. When the dwell times for all eight channels have been programmed, a red LED will light up next to channels that have been disabled (default: channels 4-8 are disabled).

7. To make sure the dwell times have been programmed as desired, set switch S1-4 back to the RUN (on/down) position and scanner will begin scanning.

8. To make any corrections to the dwell times, set switch S1-4 back to the SETUP (off/up) position and press the ACK button to advance to the desired channel.

9. When the dwell times have been programmed as desired set switch S1-4 to the RUN (on/down) position.