Vitronics Soltec

XPM3m

Reflow Soldering Systems

Version XPM3m.2.0.000

Original Instructions

Technical Reference Manual

ITW ELECTRONICS (SUZHOU) Co. Ltd.

Visit address Workshop II, 858 Zhujiang Road, Suzhou New District, China 215129

Telephone: +86-512-6841-3378

Fax: +86-512-6841-1711

TABLE OF CONTENTS

PURPOSE OF THIS MANUAL & WHO SHOULD USE IT

This manual is intended to meet the needs of service personnel responsible for the regular service of Vitronics Soltec Reflow Ovens. Vitronics Soltec does not consider this manual a specification for Vitronics Soltec products or any components contained in those products and reserves the right to change information contained in this manual without notification.
This manual is intended to be a reference. Some of the topics explain manufacturing and assembly methods and practices; however, many topics deal with specific service information and methods. Hopefully, insight will be provided about the various sub-systems of the electrical control system to allow quick identification of problems and possible solutions.

IMPROPER SAFETY PRECAUTIONS OR UNSAFE WORK METHODS MAY RESULT IN <u>SERIOUS INJURY!</u>

ATTENTION

This Manual is <u>NOT INTENDED</u> as a substitute for proper technical training or educational background in the various technologies used in reflow ovens.
This manual is for service of Vitronics Soltec ovens by **<u>Trained Qualified Personnel.</u> An appropriate understanding and use of safety procedures when working on and around the oven is NECESSARY.**

<u>Caution</u>

The following conditions may be encountered when working on any reflow oven:

- ⇒ **High Temperature areas (up to 350^{o} C)**
- ⇒ **High Voltage areas (up to 480 VAC)**
- ⇒ **High Current areas (up to 200 Amps)**
- ⇒ **Moving Mechanical Parts and Systems**
- ⇒ **Heavy Components**
- ⇒ **Sensitive Electronic Components**

Some people who might use this manual are:

Vitronics Soltec service technicians
Customer service technicians
Customer facilities maintenance personnel
Technical operators

CONTROL PANEL SYMBOLS

Use Caution

NOTICE

WHEN CONTROL POWER IS INTERUPTED, PARTS OF THE OVEN ARE ELECTRICALLY POWERED AND DANGEREROUS TO PERSONNEL!

SELECTOR SWITCH ADJUSTS RAIL IN or OUT

KEY SWITCH RAISES AND LOWERS THE OVEN HOOD

OPERATOR CONTROL STATION

GLOSSARY OF TERMS GLOSSARY OF TERMS & MEASUREMENT CONVERSIONS

999 º C	Indicates an open thermocouple or thermocouple connection.
Actuator	Used to raise and lower the top section of the oven.
AI	Analog Input board. One of the boards in the Oven internal control unit.
Antistatic	Device to inhibit the generation and instantaneous dissipation of static electricity.
Control Ladder	Oven electrical schematic which show the relationship of all electrical circuits the oven controller and to each other.
DC Drive	An electronic power amplifier used to control the speed of DC motors.
E-stop	Emergency stop.
EPO	Emergency Power Off
Encoder	The electronic mechanism that supplies feedback information to the oven controller on how fast the conveyor system is moving.
ESD	Electro Static Discharge.
FNPT	Female National Pipe Thread.
GPM	Gallons Per Minute.
Heat slinger	A set of fan blades mounted on the shaft of every cell motor. The function of a heat slinger is to push heated air away from the motor windings and thus prevent premature motor failure.
Heater panel	A large aluminum “sandwich” panel on the face of each heater cell in the oven.
Heat sink	A piece of metal generally used to dissipate heat from some device.
ICB	Inter Cell Baffle. These are pieces of metal used to help increase zone definition within the Oven process tunnel.
Interlocks	Optional Switches used to ensure that the access panels are closed on the Oven.
Inverter	Variable Frequency Drive used to control the speed of the convection fan motors in the Oven.
IR	Infrared, refers to a component of the heat which is generated in an oven.
LED	Light Emitting Diode.
DI	Digital Input Board. One of the boards in the Oven internal control unit.
MNPT	Male National Pipe Thread.
Offload	The end of the oven where product exits the tunnel.
Ohmmeter	A precision instrument used to check and display the value of electrical resistances in Ohms.
Onload	The end of the oven onto which product is placed.
Phase	One leg of three-phase power.
Plenum	A large (or elongated) cavity or chamber, usually in ductwork.
Preheat t	A thermal area inside a Vitronics Soltec Reflow oven.
Recipe	A part of the Vitronics Soltec software in which heater temperatures and conveyor speed are set.
Reflow	A thermal area inside a Vitronics Soltec Reflow oven.
ROSCO	Redundant Over-temperature Sensing and Control Option.
RTV	Brand name for a silicone sealing agent used in the Reflow oven.
Set point	A number used to define a particular parameter in the oven. For example, the temperatures that are defined in a recipe are referred to as the heater set points for each heater.
Slot settings	Air passages (slots) on both sides of the heater panel that can be adjusted from fully open to fully closed. Slot settings refers to the actual opening size of these air passages.
SSR	Solid State Relay
T/C	ThermoCouple
OCP	Oven Control Program. The software which controls the operation of the Vitronics Soltec Reflow oven.
VCS	Vitronics Soltec Control System – Oven controller consisting of the card cage / backplate, a DI board, and one or more A.I boards
Zone	An area of a Vitronics Soltec Reflow oven that is comprised of an upper and a lower cell within the process tunnel. Usually referred to as a “heat zone” or “cooling zone”.

MEASUREMENT CONVERSIONS

Temperature	Length
Degrees Celsius (°C) = 5 / 9 x (°F - 32) Degrees Fahrenheit (°F) = (9 / 5 x °C) + 32	Centimeters (cm) = 2.54 x inches Feet (') = 3.281 x meters Inches (") = 0.03937 x millimeters Inches (") = 0.3937 x centimeters Meters (m) = 0.3048 x feet Millimeters (mm) = 25.4 x inches

Area	Volume
Centimeters^2 = 6.452 x inches^2 Inches^2 = 0.155 x centimeters^2 Feet^2 = 10.76 x meters^2 Meters^2 = 0.0929 x feet^2	Centimeters^3 = 1000000 x meters^3 Centimeters^3 = 16.387 x inches^3 feet^3 = 0.161 x Imperial gallons feet^3 = 35.31 x meters^3 feet^3 = 0.134 x US gallons inches^3 = 0.061 x centimeters^3 inches^3 = 0.061 x milliliters (ml) inches^3 = 1728 x feet^3 Imperial gallons = 0.833 x US gallons Imperial gallons (gal) = 0.22 x liters (l) Liters (l) = 1000 x meters^3 Liters (l) = 3.7854 x US gallons (gal) Liters (l) = 4.55 x Imperial gallons (gal) Liters (l) = 0.001 x milliliters (ml) meters^3 = 0.00455 x Imperial gallons meters^3 = 0.02832 x feet^3 meters^3 = 0.00379 x US gallons US gallons (gal) = 0.264 x liters (l) US gallons = 1.2012 x Imperial gallons

Pressure	Volumetric flow rates
Bar = 1.01325 x atmosphere (ATM)	Imperial gallons / minute = 0.1035 x feet^3 / hour
Kilograms / meter^2 (kg/m^2) = 10332.3 x atmosphere (ATM)	Imperial gallons / minute = 220.06 x meters^3 / Min
Kilograms / centimeter^2 = 0.0703 x pounds / inch^2 (psi)	liters^3 / second = 0.06308 x US gallons / minute
KiloPascals (KPa) = 101325 x atmosphere (ATM)	meters^3 / minute = 0.00006 x centimeters^3 / second
Kilograms / meter^2 (kg/m^2) = 703.07 x pounds / inch^2 (psi)	meters^3 / hour = 0.02832 x feet^3 / hour
millimeters mercury (mm Hg) = 1 x Torr = 760 x atmosphere (ATM)	meters^3 / hour = 0.22713 x US gallons / minute
Pounds / inch^2 (psi) = 14.696 x atmosphere (ATM)	US gallons / minute = 264.18 x meters^3 / minute
Pounds per square inch (psi) = 14.504 x Bar	US gallons / minute = 0.12468 x feet^3 / hour

CONTROL SYSTEM OPERATION

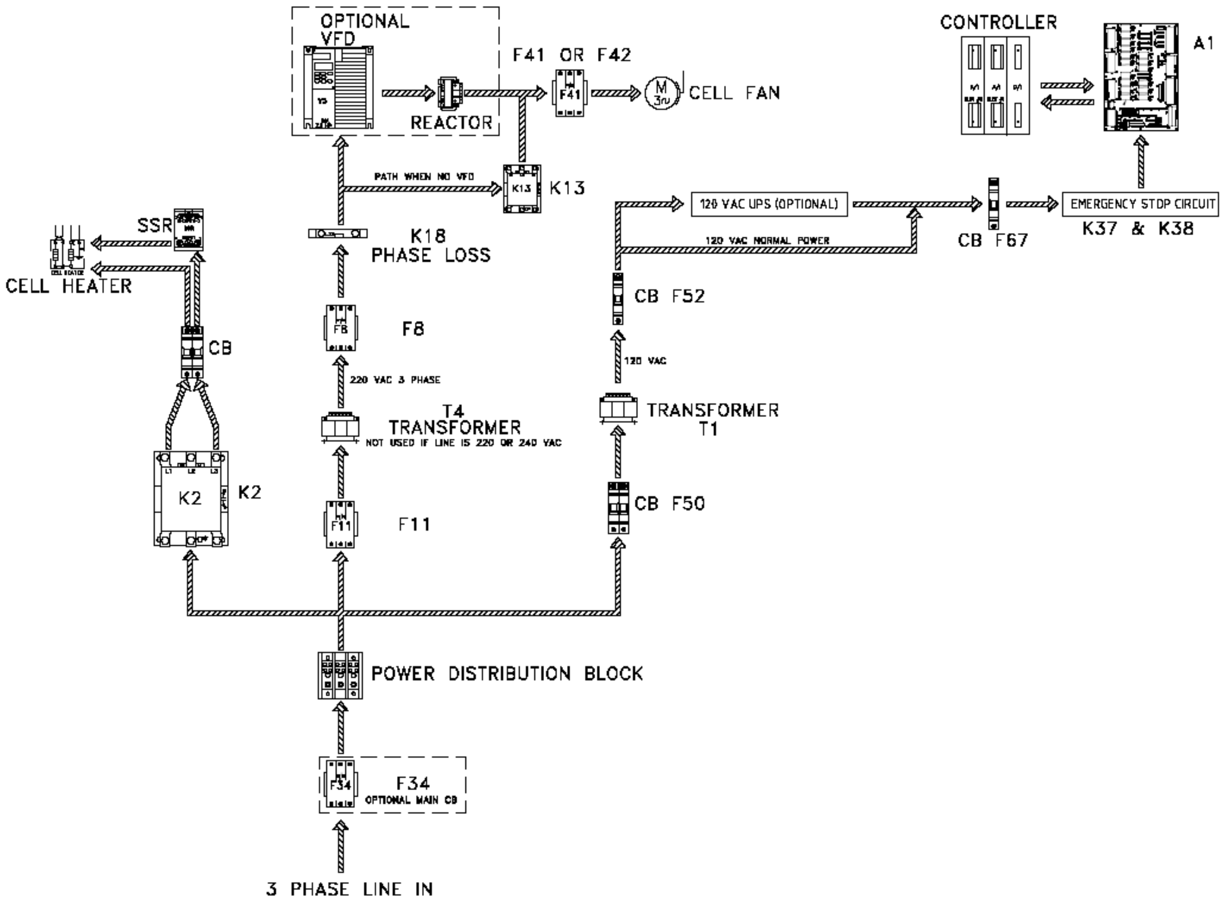
OVEN CONTROL SYSTEM OVERVIEW

The Oven Control System will be divided into five parts:

- Power Distribution Overview
- Computer and Controller Overview
- Conveyor Control Overview
- Fan Control Overview
- Heat Control Overview.

The following pages contain subsystem diagrams relating to those described above. When working on any part of the oven, electrical safety measures must be observed. Adherence to local safety policies as well as lockout-tagout ,is required. Use of the oven electrical schematics to assist in troubleshooting is recommended. Prior to working on any of the oven subsystems please read the descriptions, review the diagrams, and become familiar with the oven electrical schematics.

POWER DISTRIBUTION OVERVIEW



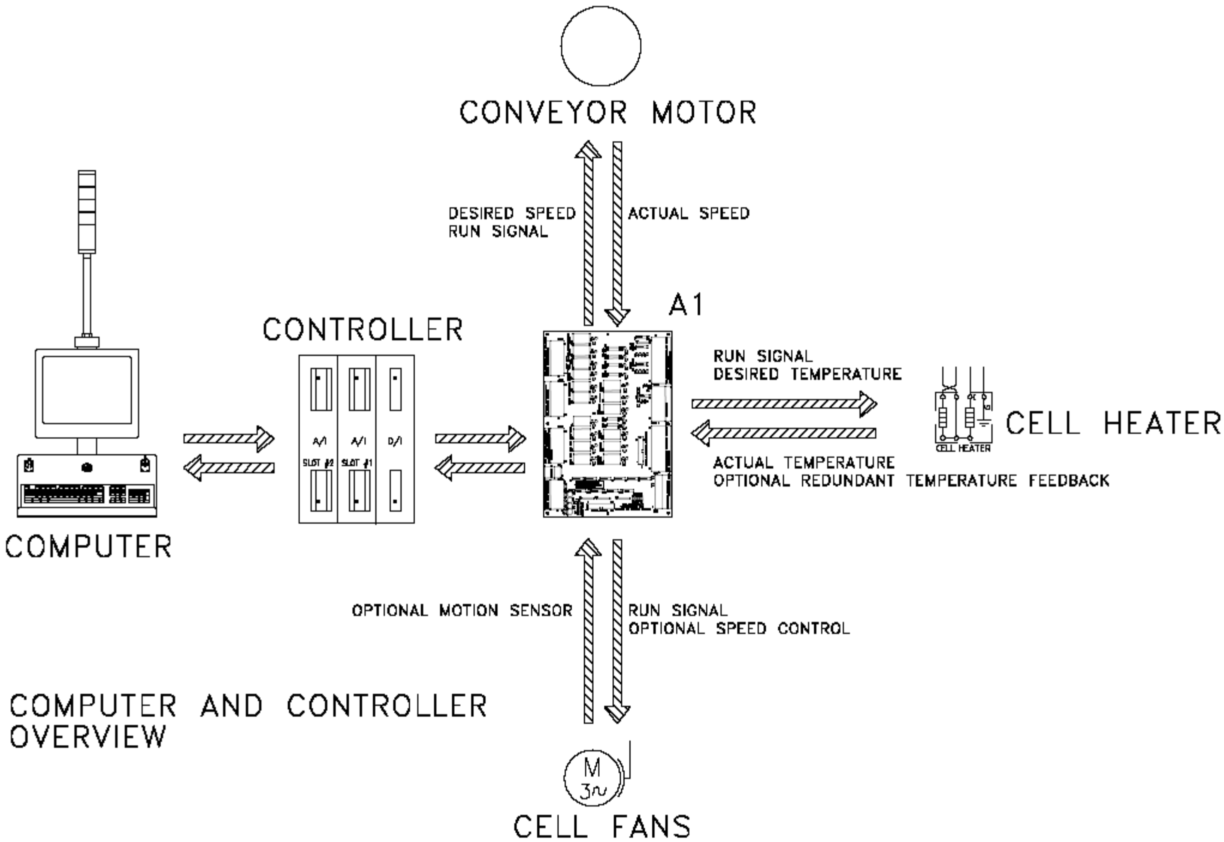
3-phase power supplied to the High Voltage terminals on the electrical panel is distributed to:

1) The primary terminals on the Control Transformer (T1), the secondary side of T1 is connected to the line side of the E-stop relay (K37). T1 provides 120VAC for ALL control functions throughout the oven.
2) The line terminals of the Heater Contactor (K2),
3) To either the line terminals of the Fan Contactor (K13), the primary side of the INVERTER (if the oven has the Fan Speed Control Option), or the three phase Fan transformer (if the three phase supply voltage is higher than 240 volts).

CAUTION

REMEMBER, WHEN THE OVEN IS "OFF", MANY PARTS OF THE OVEN MAY BE ELECTRICALLY POWERED AND DANGEROUS

COMPUTER AND CONTROLLER OVERVIEW

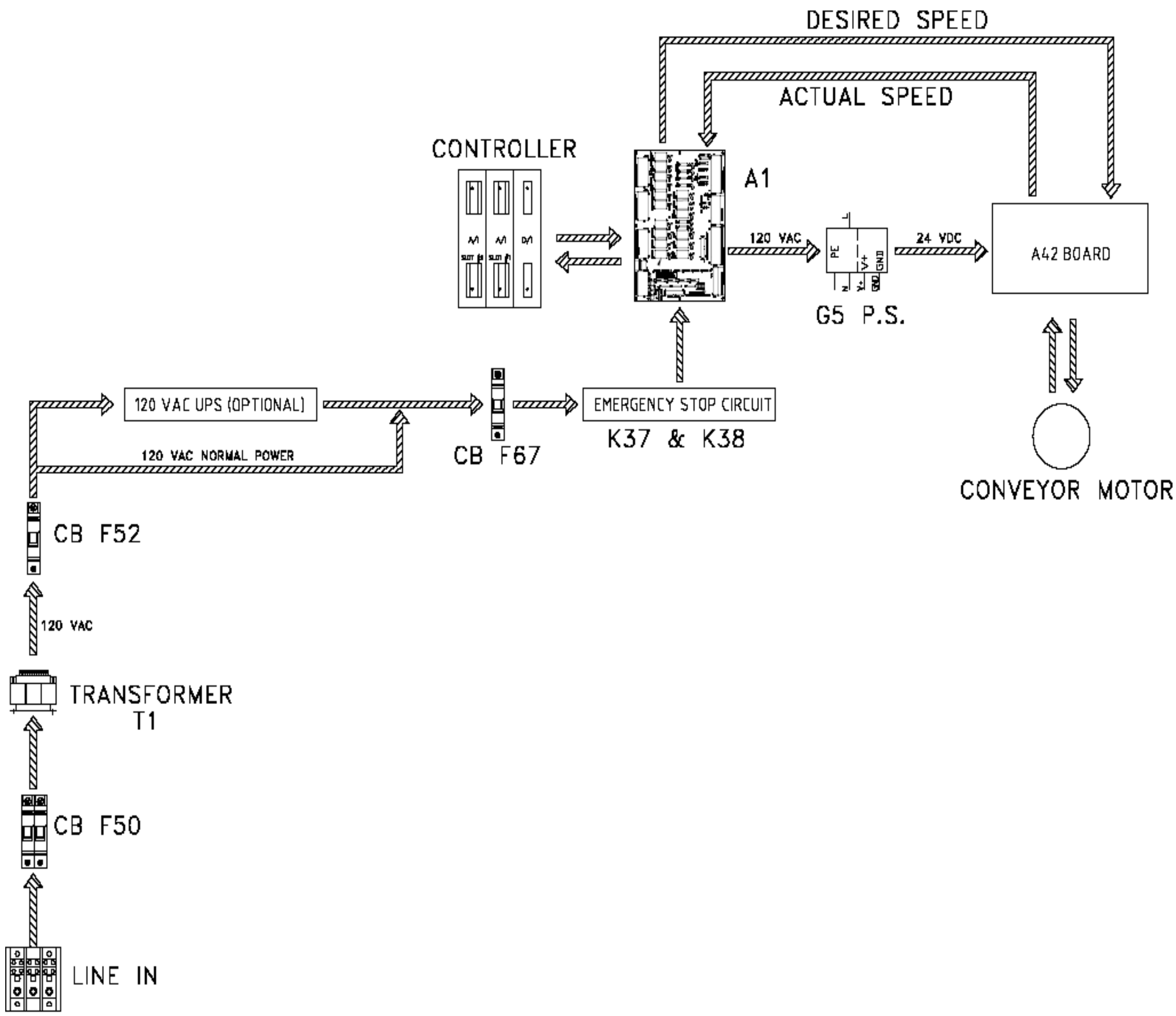


Control of the oven is accomplished by:

1. A DELL compatible COMPUTER runs the Oven Control Program. The computer has a serial communication link with the CONTROLLER on the electrical panel.

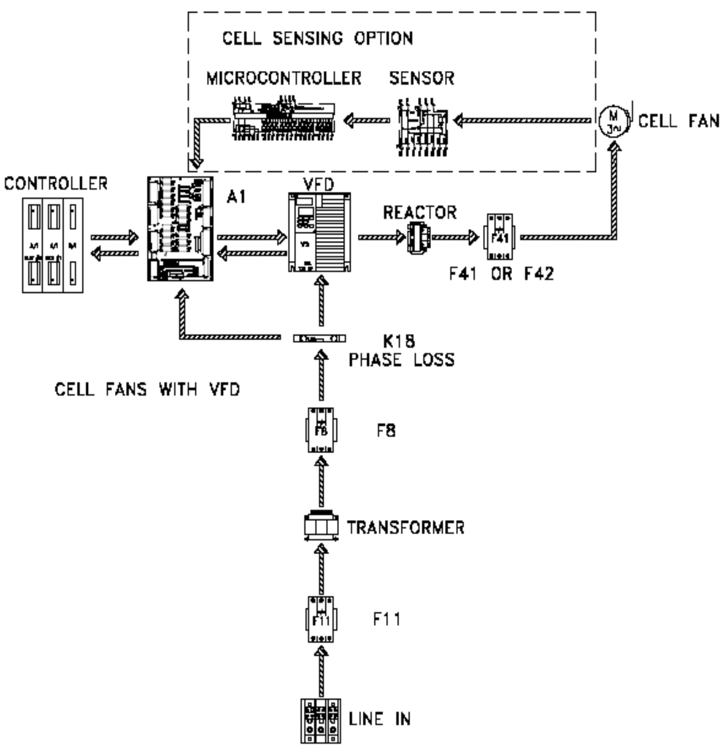
2. The CONTROLLER interprets the Computer’s requests to *energize*, *de-energize*, or *modulate* devices or sub-systems within the oven, then receives or sends the necessary signals. If the required signal (in or out) is 5VDC or less, it is handled directly by the CONTROLLER. If a 120VAC output signal is needed, the CONTROLLER communicates with the INPUT / OUTPUT BOARD. The I/O board relays will switch the necessary power for operation.

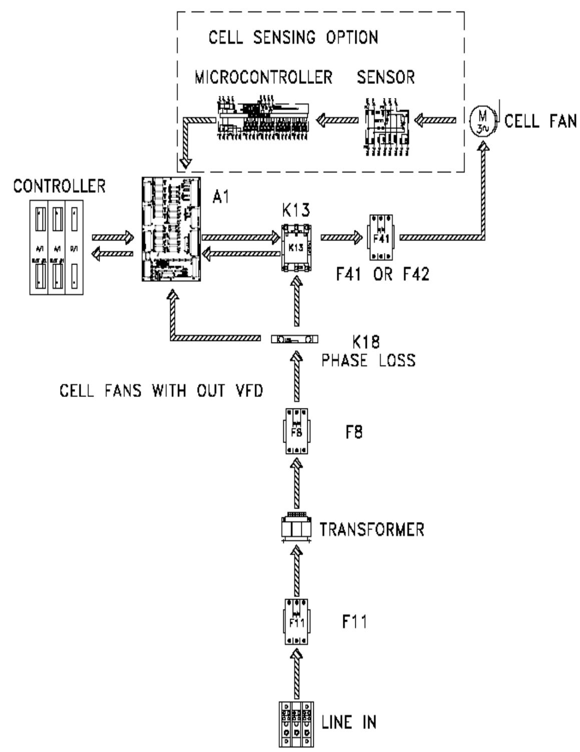
CONVEYOR OVERVIEW



The oven controller supplies an analog voltage reference signal between 0 and 10 volts to the conveyor motor electronics to set the desired conveyor speed. The A42 board divides it in half and passes it through an Opamp to avoid loading and signal loss issues from the resistor voltage divider before it sends it to pin 9 on the Integramotor. The internal Integramotor electronics require a regulated power supply between 20 and 28 volts DC to operate, otherwise the electronics indicate a fault condition and the motor will not operate. This voltage is supplied by the G5 power supply of the circuit. The internal Integramotor electronics control the motor speed based on a 0- 5VDC reference signal that is supplied by dividing the 0-10VDC analog output voltage in half.

FAN CONTROL OVERVIEW





1) POWER SOURCE: 3 Phase power is provided to either the line terminals of the Fan Contactor (K13), the primary side of the INVERTER**,** the 3 phase Fan transformer, or the 3-phase line filter depending on the Oven options and Operating Voltage.

2) CONTROL ELEMENTS:

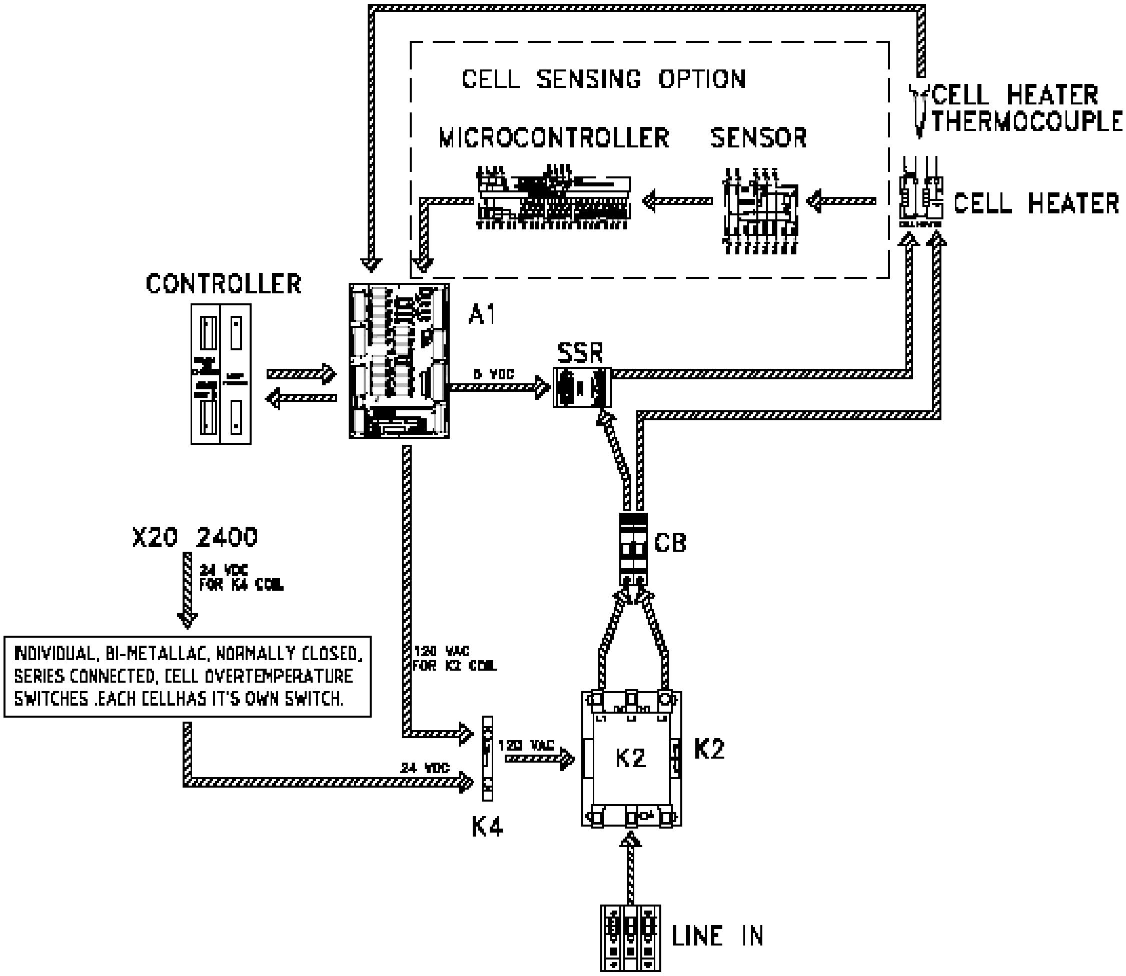
a) **Fixed Fan Speed Ovens:**
FAN CONTACTOR (K13) coil is energized by I/0 Board Output Relay A1-K5, K13's contacts close, 3 phase power is permitted to flow to/through the Fan CIRCUIT BREAKER(s). (F41 for all upper Fans & F42 for all lower Fans) to the Fans for Full-Speed On/Off Control.

b) **Ovens with Blower Speed Control:** FAN CONTACTOR (K13**)** does not exist. I/0 Board Output Relay A1-K18, in this case, serves as the Enable input to the INVERTER. An analog (modulated) Low Voltage D.C. output from the CONTROLLER signals the INVERTER to vary it's output frequency to the Fans, resulting in variable-speed Control of the Fans.

3) FANS:

The FAN MOTORS are Open Frame, 3 Phase, 50/60 Hz, 1/6 Hp, 2800-3400 RPM @ rated frequency, continuous duty.

HEAT CONTROL OVERVIEW



The electrical portion of the Heat Control System consists of three major parts:

1) POWER SOURCE:

Three Phase power is provided to the line terminals of the Heater Contactor (K2).

2) CONTROL ELEMENTS:

A) POWER DEVICES:

HEATER CONTACTOR (K2) coil is energized by I/0 Board Output Relay A1-K4, (see Interlocks, below) it's contacts close, three phase power is permitted to flow to the Heater CIRCUIT BREAKER(s). (Each Heater has it's own Circuit Breaker) and to the SSRs (one Solid State Relay for each Heater) which is the final Heater power control element.

2- B) INTERLOCKS:

1) Over Temp Switch (es):
BI-metallic snap switch (es) mounted on each Cell Assembly, open when the temperature exceeds normal operating temperature of the Cell. They are all wired in series and power the coil of K3. (K3 is not shown on this Overview) The coil of K2 is wired through the contacts of K3. When an over temperature switch opens, voltage to the coil of K3 is lost. This will cause K2 to de-energize, and ALL power will be removed from ALL heaters. K4 is the Heater Power Enable Relay, and the voltage for K2 runs through K4, then K3, to K2. (K3 also signals the Controller to shut the Oven down)

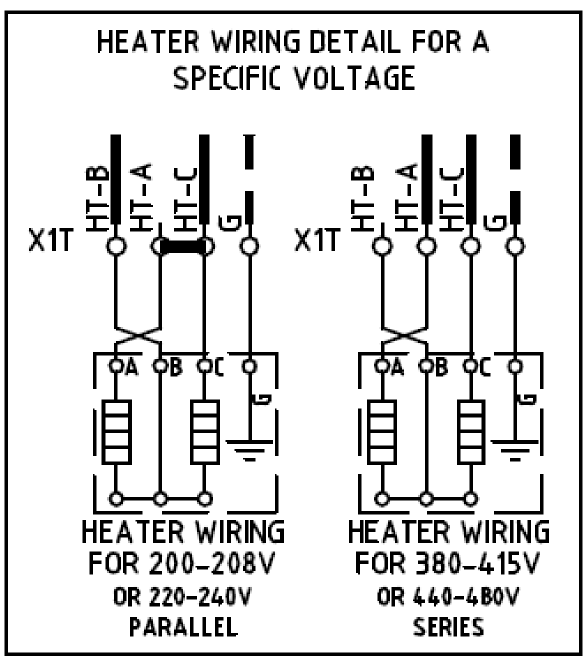
2) Heater Thermocouple (IAS Option)
A Heater mounted thermocouple connected to the **In**dependent **A**larm **S**canner option. The I.A.S. output contacts are wired in series prior to the cell over temperature switches and power to the coil of K3. (K3 is not shown on this Overview) The coil of K2 is wired through the contacts of K3. When an over temperature condition is sensed, the I.A.S board contacts open and voltage to the coil of K3 is lost. This will cause K2 to de-energize, and ALL power will be removed from ALL heaters. (K4 also signals the Controller to shut the Oven down)

3) Heater Thermocouple (Standard)
A Heater mounted thermocouple(s) to sense the temperature of the Heat Cell and connected to the Controller for heater control.

3) HEATERS:

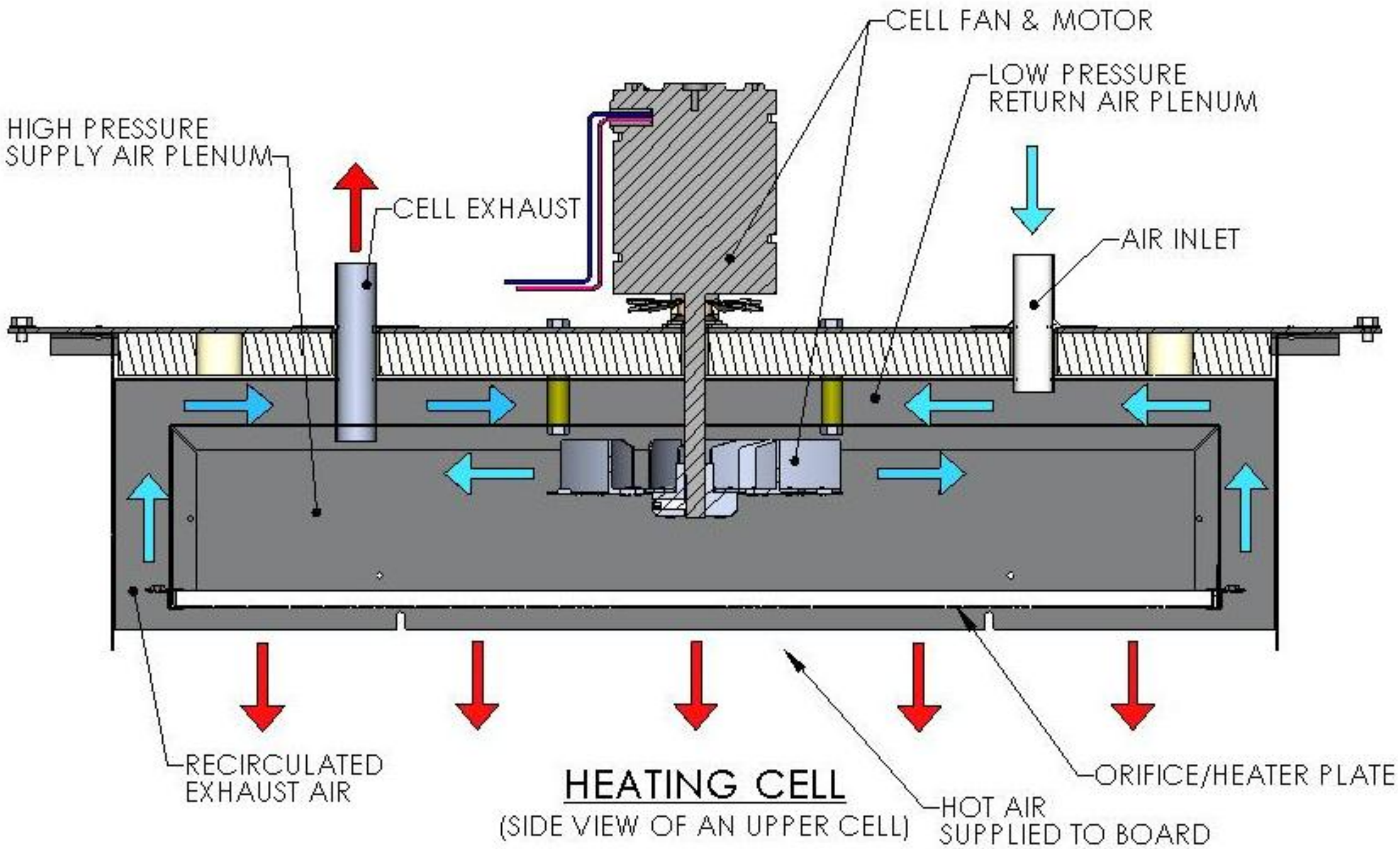
Each Heater Assembly has one large flat Inconel element (resistor) mounted between two aluminum plates. Each element may be wired in series or parallel, depending on the operating voltage of the oven.

Heater Schematic
See: "Heater Element Resistance Reference Chart" under Heater Testing Procedure in this manual for resistance values.



HEATING CELL DESCRIPTION

XPM3m HEATING CELL CROSS-SECTION

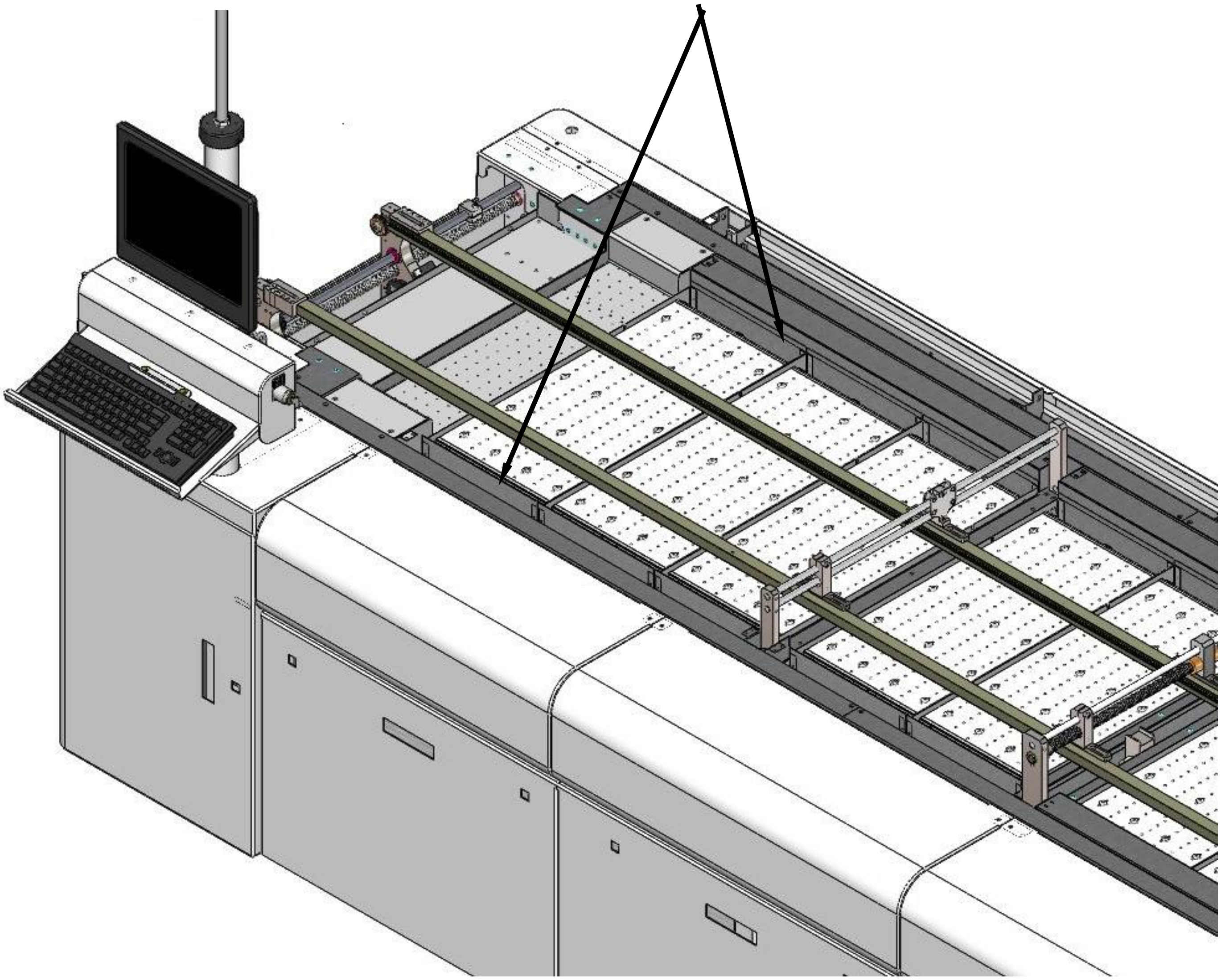


CONSTRUCTION: The heat Cells are assembled and sealed as self-contained units with the Fan Motor, and Over Temperature Switch mounted and wired to terminals, and the Thermocouples (1 or 2) mounted and wired to connectors.

OPERATION: The relatively thick heater assembly has a series of holes allowing heat transfer to the oven gases passing from the Cell Cavity to the process tunnel.
Recirculation occurs through the low-pressure intakes at the sides of the Cell. These gasses are drawn into the cell cavity, where they are passed through the heater and back into the process tunnel.
Fan Speed controls the velocity of the heated atmosphere, which influences the heat transfer to the PCB.

XPM3m OVEN CELL ARRANGEMENT

Front – to – Back Recirculation slots on XPM3m



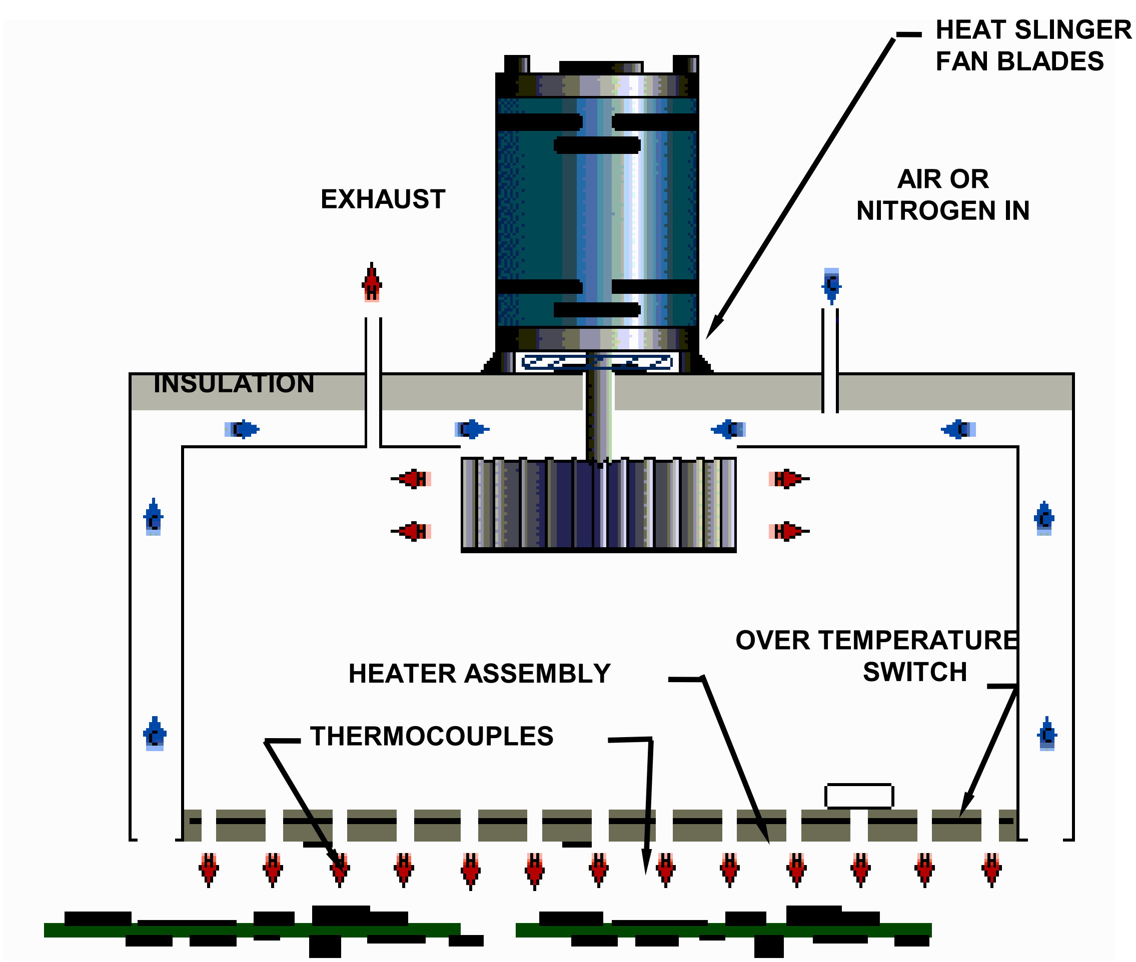
The cells are mounted both above and below the conveyor, as shown, forming a series of “Heat Zones”.

Each Heat Zone circulates heat primarily within itself, thereby maximizing the thermal isolation between zones.

An oven contains several heating zones (5,7,8,10, or 12) and 2, 3, or 4 cooling zones. Cooling zones are similar to heating zones except they have no heating elements and no exhausts (only gas intakes).

A properly operating oven is an inter-dependent system. When a heater or fan malfunctions, the balance and performance of the oven as a system may be affected. Usually, an irregularity in operation could be the result of any one (or more) malfunctions.

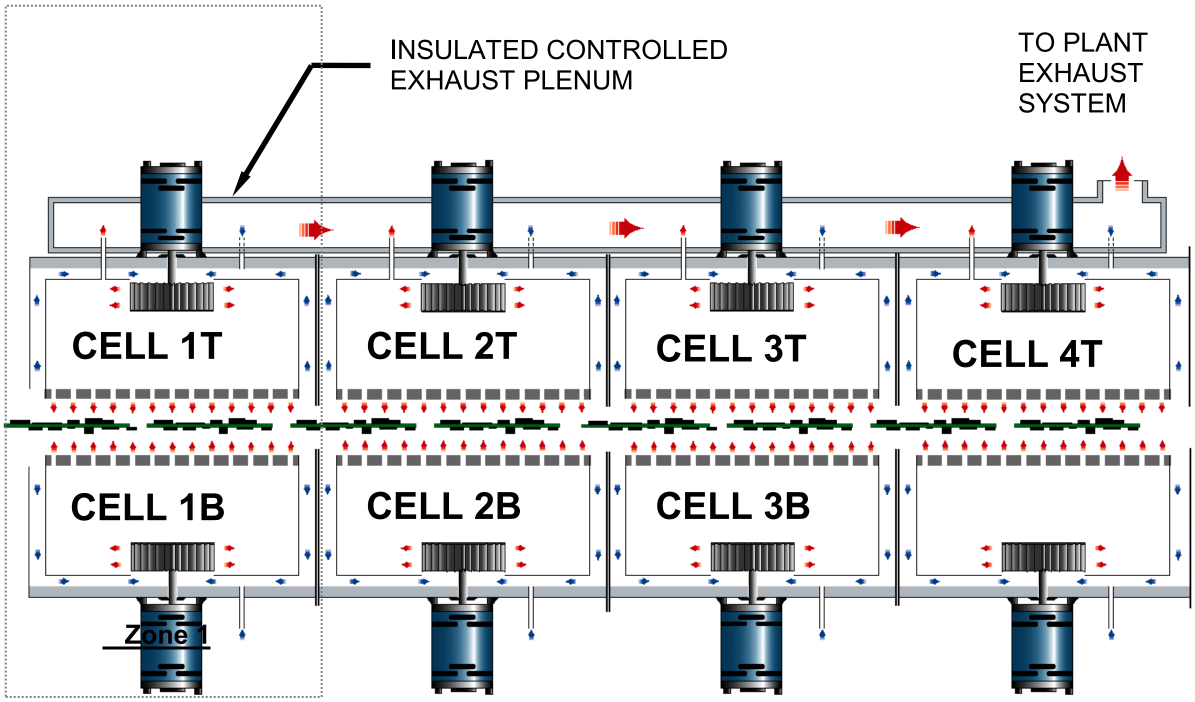
XPM3m HEATING CELL DESCRIPTION



HEATING CELL CROSS-SECTION

CONSTRUCTION: The heat Cells are assembled and sealed as self-contained units with the Fan Motor, and Over Temperature Switch mounted and wired to terminals, and the Thermocouples (1 or 2) mounted and wired to connectors.

OPERATION: The relatively thick heater assembly has a series of holes allowing heat transfer to the oven gases passing from the Cell Cavity to the process tunnel.
Recirculation occurs through the low-pressure intakes at the sides of the Cell. These gasses are drawn into the cell cavity, where they are passed through the heater and back into the process tunnel.
Fan Speed controls the velocity of the heated atmosphere, which influences the heat transfer to the PCB.



XPM3m OVEN CELL ARRANGEMENT – SIDE-TO-SIDE RECIRCULATION

The cells are mounted both above and below the conveyor, as shown, forming a series of "Heat Zones".

Each Heat Zone circulates heat primarily within itself, thereby maximizing the thermal isolation between zones.

An insulated exhaust plenum mounted under the Bonnet collects gases from the individual upper heat cell exhausts and conveys the combined flow to the Plant Exhaust System.

An oven contains several heating zones (5,7,8,10, or 12) and 2, 3, or 4 cooling zones. Cooling zones are identical to heating zones except they have no heating elements and no exhausts (only gas intakes).

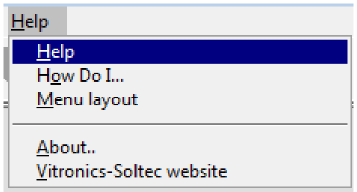
A properly operating oven is an inter-dependent system. When a heater or fan malfunctions, the balance and performance of the oven as a system may be affected. Usually, an irregularity in operation could be the result of any one (or more) malfunctions.

TROUBLESHOOTING

GENERAL TROUBLESHOOTING

For general troubleshooting of the oven systems, first to go the Help menu in the oven software. Click on the link for Help (under Help), Then click on the link for Alarm Help. This will bring up the online troubleshooting document that is present in the oven software.

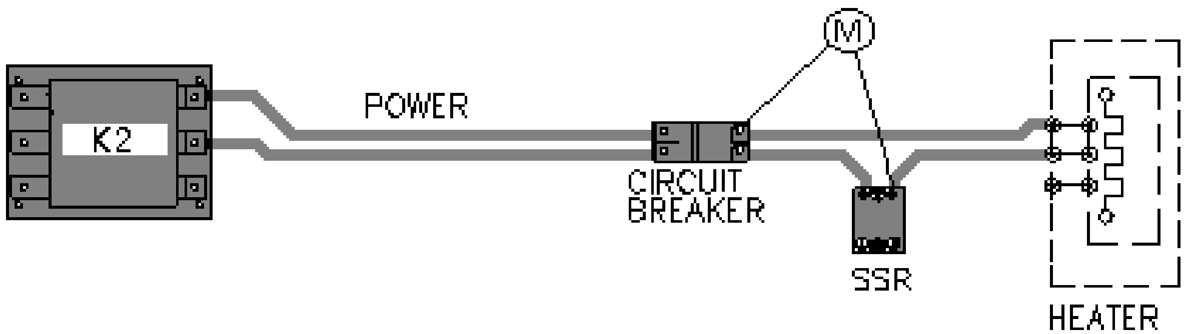
Internet Explorer may try to block the active content in this document. It will be necessary to allow the blocked content in order to view the complete contents of this document.



HEATER TESTING PROCEDURE

When a heating problem is suspected, applying this procedure should reduce the time required to eliminate a number of items that may **NOT** be responsible for the problem. This will leave a much smaller number of possibilities for consideration.

To be effective and efficient, the trouble-shooting process does not jump directly to the “answer”, but rather, eliminates all of the possibilities one-at-time with a systematic approach, until only the “answer” remains.



SIMPLIFIED HEATER CONTROL CIRCUIT

EXPLANATION:

Each heater has a Circuit Breaker and SSR. K2 supplies two hot, high voltage conductors to the Line Side of the Heater Circuit Breaker(s). Both of the current paths are interrupted by the Circuit Breaker when it is open or tripped.

A) On the Load Side of the Circuit Breaker, one of the conductors goes directly to the heater terminals (HT-A, HT-B, HT-C) on the outside of the Heater Cell.
B) The other conductor is interrupted by the SSR. When the SSR operates, it conducts power from the Circuit Breaker to the heater terminals (1, 1A, and 2) on top of the Heater Cell.

O.K. TEST: Check the heater(s) for agreement with the “HEATER ELEMENT RESISTANCE REFERENCE CHART” after disconnecting the supply conductors at the heater terminals (HT-A, HT-B, HT-C) on top of the Heater Cell. (This does work, however, it is time consuming, and does not check the conductors between the Circuit Breaker / SSR and the Heater Cell.)
BEST TEST: The heater(s) and conductors can be checked at the Circuit Breakers/SSRs. Reference the “ HEATER RESISTANCE CHECK LOCATIONS” diagram.

PROCEDURE:

1) <u>Disconnect ALL POWER to the Oven</u>.

2) Check for Tripped Heater Circuit Breakers, (F8 & F11 are not heater circuit breakers) If a circuit breaker is tripped (open), (See **10**, and **17** in the Heating System Diagnostic tree)

3) Open ALL Heater Circuit Breakers: F1-B to F12-B and F1-T to F12-T (Depending on Oven size, the highest CB No. may not be 12 as shown in the illustration on the next page)

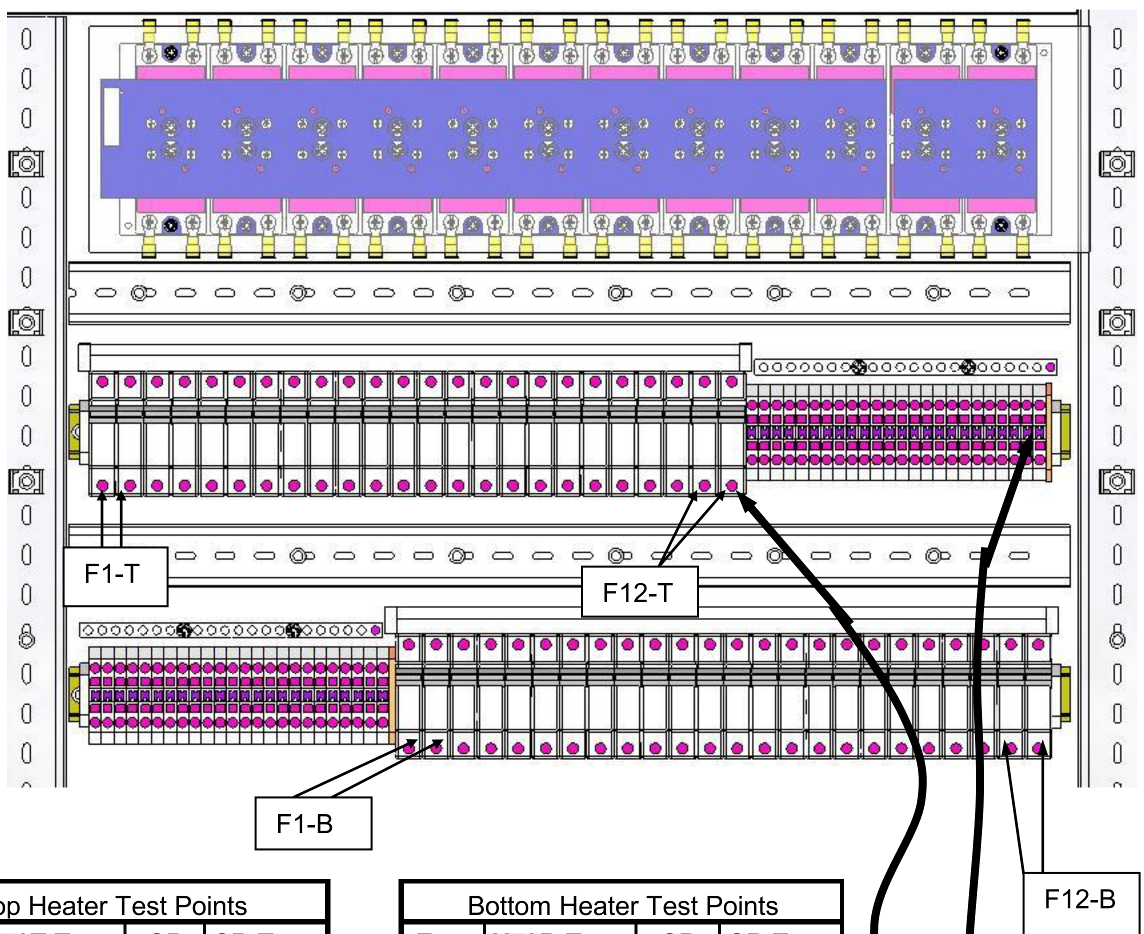
4) Perform Resistance Checks. See "HEATER ELEMENT RESISTANCE REFERENCE CHART" (Oven Type & Voltage must be known) See " HEATER RESISTANCE CHECK LOCATIONS" and connect Meter (**M**) on CBs and SSRs as shown.
    - A) If the resistance is "infinite" (open), the Heater may have a broken/disconnected wire or the heater element may have an "open" in it.
    - B) If the resistance on Parallel wired Heaters - (see "CHART", Fig A)- is twice what it should be:
        1. One Heater element may be "open"
        2. One conductor from the Heater may be disconnected.
        3. The jumper from term (1) to term (1A) may be missing or loose.
    - C) If the resistance is in agreement with the "HEATER RESISTANCE REFERENCE CHART", then it is reasonable to expect that the Heater and its conductors are in proper operating condition.

5) Close ALL Heater Circuit Breakers.

6) Refer to "<u>HEATING - Problems *and Possible Solutions*</u>" for other possibilities.

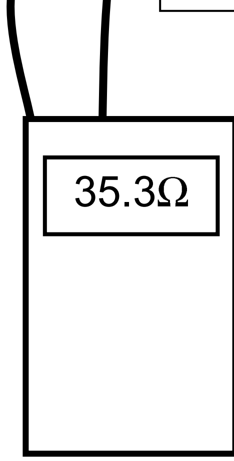
<u>DISCONNECT ALL POWER BEFORE TESTING!</u>

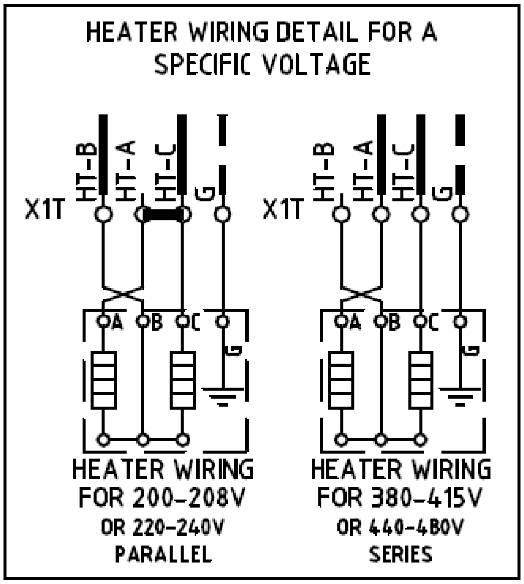
Heater Resistance Check Locations



Top Heater Test Points			
Zone	**X70T Term**	**CB**	**CB Term**
1	4L3	F1-T	T2 3L1
2	4L2	F2-T	T2 5L3
3	5L1	F3-T	T2 5L2
4	7L3	F4-T	T2 6L1
5	7L2	F5-T	T2 8L3
6	8L1	F6-T	T2 8L2
7	10L3	F7-T	T2 9L1
8	10L2	F8-T	T2 11L3
9	1L1	F9-T	T2 11L2
10	13L3	F10-T	T2 12L1
11	13L2	F11-T	T2 14L3
12	14L1	F12-T	T2 14L2

Bottom Heater Test Points			
Zone	**X70B Term**	**CB**	**CB Term**
1	24L3	F1-B	T2 23L1
2	24L2	F2-B	T2 25L3
3	25L1	F3-B	T2 25L2
4	27L3	F4-B	T2 26L1
5	27L2	F5-B	T2 28L3
6	28L1	F6-B	T2 28L2
7	30L3	F7-B	T2 29L1
8	30L2	F8-B	T2 31L3
9	31L1	F9-B	T2 31L2
10	33L3	F10-B	T2 32L1
11	33L2	F11-B	T2 34L3
12	34L1	F12-B	T2 34L2





XPM3m		Release date: July 1, 2013		
Heater Element Resistance Reference Chart				
VOLTAGE	**RESISTANCE**	**HOLE SIZE**	**HEATER ASSY #** (*stamped on face plate*)	**ELEMENT #** (*2 ELEMENTS PER HEATER*)
200 - 208 Volts (LOW RANGE) -PARALLEL WIRING-	***Test: 8.2 Ω - 9.1 Ω*** ***8.65 Ω nominal*** ***18.0 Ω = 1 open element***	.156"	**D3200402**	D6126202
380 - 415 Volts (LOW RANGE) -SERIES WIRING-	***Test: 33.0 Ω - 36.5 Ω*** ***34.75 Ω nominal***	.156"	**D3200402**	D6126202
220 - 240 Volts (HIGH RANGE) -PARALLEL WIRING-	***Test: 11.0 Ω - 12.1 Ω*** ***11.55 Ω nominal*** ***24.0 Ω = 1 open element***	.156"	**D3200401**	D6126201
440 – 480 Volts (HIGH RANGE) -SERIES WRING-	***Test: 43.9 Ω - 48.5 Ω*** ***46.2 Ω nominal***	.156"	**D3200401**	D6126201

TEST PROCEDURE FOR HEATER GROUND CONTINUITY

1) Disconnect the main power connection to the oven and disable all heater circuit breakers.
2) Check each line to the respective heater element for a short to ground using an Ohmmeter.
3) The heater element conductors should be completely isolated from ground (i.e. open circuit with reference to ground).

MAXIMUM HEATERS ON

The Oven Control Program limits the maximum number of heaters to be energized at the same time to seven for most customers. Some customers have special requirements that require more than seven heaters to be energized at one time. This special requirement increases the machine current draw, and this current rating is noted on the machine identification tag.

MAXIMUM PHASE IMBALANCE

The difference between the maximum loaded phase and the minimum loaded phase is limited to two heaters by the Oven Control Program.
The Oven Control Program limits the number of heaters “ON” at the same time for each phase.

THERMOCOUPLES

All thermocouples in the oven are type 'K', and identified by a red (-) and a yellow (+) wire. Connectors, wires and terminals must be designated for use with type “K” thermocouples.

Test procedure

1) Remove the thermocouple connection block from the front of the AI board in the Anafaze controller.
2) Measure the resistance of each thermocouple using an Ohmmeter. *(All T/Cs have one side connected to ground.For best results, isolate the T/C being tested).*
3) The resistance of a thermocouple wire should be approximately 5 ohms.
4) Test for shorts between the thermocouple wires by disconnecting the thermocouple cable from the plug on the outside of the cell.
5) Measure the resistance between the two thermocouple wires; it should be open circuit with the connector removed from the front of the controller.
6) Check for short circuit to ground on both thermocouple wires.
7) Wiring connections must be tight. Verify that all negative thermocouple connections are grounded, along with all unused thermocouple ports on the front of the controller.
8) Check to determine that one side of the TC probe is NOT common to ground.

HEATER REMOVE AND REPLACE PROCEDURES

TOP HEATER REMOVAL

1. Remove power from the oven.

2. Loosen the screw holding the thermocouple clamp(s) in place on the cell face. Using a permanent black marker, circle the thermocouple on the heater face. (This will help relocate the thermocouple when reassembling the cell). If the oven has the Redundant Over Temperature Option (ROSCO) there will be two thermocouple probes. Be sure to identify each thermocouple probe and the corresponding mounting hole.

3. Carefully straighten the thermocouple wire and cover it with a piece of 1.7mm vinyl tubing

4. Remove the support angle brackets on the left and right side of the heater panel.
5. Remove the Philips head screw holding the front panel support bracket. Remove the bracket.

6. Lower the heater panel enough to gain access to the heater wires on the inside of the cell. Block the panel up with a 10"(or 254mm) 4x4 block of wood to relieve the strain on the wires.

7. Document the wire placement on the connections on the heater panel. They will need to be replaced later in the same positions.

   IF THE HEATER FOIL TEARS, IT CANNOT BE REPAIRED AND THE HEATER PANEL ASSEMBLY MUST BE REPLACED.

8. Remove the four wires by using a 2.5mm hex key and a 7mm open wrenche.

9. Disconnect the two wires on the thermal switch.

10. Remove the heater panel and set it aside.

TOP HEATER REPLACEMENT

1 Retrieve the heater panel for this cell and set the rear of the heater panel into place in the cell between the bracket and the cell. Be careful not to bend the thermocouple wire. Prop the heater panel up from the front so the heater wires can be reconnected.

2 Reconnect the wires to the panel referring to the SKETCH made when the panel and wires were removed *Do not forget to connect the thermal switch wires*.

3 Carefully place the thermocouple probe in its protective 1.7mm vinyl tubing through the correct hole in the panel. If you did NOT circle the thermocouple(s) before removing the panel use another heater panel as a reference for the thermocouple position. The ROSCO and the control thermocouple probes CAN NOT be mixed up and installed in the incorrect position.

4 Once the thermocouple is located in its proper hole, raise the heater panel into place.

5 Replace the front panel bracket and fasten it with the Philips head screw. Remove the vinyl tubing protecting the thermocouple.

6 Replace the left and right support angle brackets and fasten them in place with cap head screws each.

7. Carefully bend the thermocouples into the correct places and replace the clamps and screws. Tighten the screws

BOTTOM HEATER REMOVAL

1 If the Oven is belt-only, disconnect the belt at the master link and unthread the belt from the tunnel. See the procedure for disconnecting the conveyor belt.

2 If the Oven is rail-only, disconnect the conveyor chains at the master links and unthread them from the tunnel. See the procedure for disconnecting rails and chains.

3 If the Oven has a combination rail/belt conveyor, disconnect and unthread the chains first and then the belt from the tunnel. See the procedures for disconnecting rails and chains and disconnecting the conveyor belt.

4 Remove the screw(s) holding the thermocouple(s) in place on the cell face. Using a permanent black marker, circle the hole that the thermocouple(s) pass through on the heater face. If the oven has the Redundant Over Temperature Option (ROSCO) there will be two thermocouple probes. Be sure to identify each thermocouple probe and the corresponding mounting hole. Carefully straighten the thermocouple wire and cover it with a piece of 1.7mm vinyl tubing. This will aid in relocating the thermocouple when reassembling the cell later.

5 Remove the support angle brackets on the left and right side of the heater panel.

6 Remove the Philips head screw holding the rear heater panel bracket. Remove the Philips head screw holding the front heater panel bracket. Remove the brackets.

7 Using a hex head wrench, carefully insert the short end into a hole in the heater panel and gently pull up on the heater panel. Use the 3" putty knife to push the insulation guard clear of the heater panel.

8 Tip the heater panel on its side far enough to expose the heater wires on the inside of the cell. Block the panel in place to remove the heater wires.

9 SKETCH the wire placement on the connections on the inside of the heater panel. They will be replaced in the same order.

10 Remove the four wires by using a 2.5 hex key and a 7mm open wrenche.

IF THE HEATER FOIL TEARS, IT CANNOT BE REPAIRED AND THE HEATER PANEL ASSEMBLY MUST BE REPLACED.

BOTTOM HEATER REPLACEMENT

1 Retrieve the heater panel for this cell and lay it into place in the cell. Be careful not to bend the thermocouple wire. Prop the heater panel up from the front to reconnect the heater wires.

2 Reconnect the wires to the panel referring to the SKETCH made when the panel and wires were removed.

3 Carefully place the thermocouple wire in its protective 1.7mm vinyl tubing through the correct hole in the panel. If you did NOT circle the thermocouple(s) before removing the panel use another heater panel as a reference for the thermocouple position. If you did NOT circle the thermocouple(s) before removing the panel use another heater panel as a reference for the thermocouple position. The ROSCO and the control thermocouple probes CAN NOT be mixed up and installed in the incorrect position.

4 Once the thermocouples are located in their proper holes, lower the heater panel in place. Remove the vinyl tubing from the thermocouple(s).

5 Install the support angle brackets on the left and right side of the heater panel

6 Replace the front panel bracket and fasten it down with the Philips head screw. Replace the rear heater panel bracket and fasten it down with the Philips head screw.

7 Carefully bend the thermocouples into the correct places and replace the clamps and screws. Tighten the screws.

8 Reconnect the conveyor system. See the procedures for reconnecting rails and chains and reconnecting the belt.

CELL FAN MOTORS

Each cell is fitted with a convection motor and fan assembly. The motor is a three-phase, 1/6-hp unit. The motor and fan assemblies are dynamically balanced to reduce vibration. On some ovens, an inverter is used to control the operating speed of the motors.

The convection cell motors have a thermal cutout switch installed internally. If the motor exceeds its maximum operating temperature (155° C), the cutout switch will “open” and the motor will not run. If the cutout is “open”, it will be necessary to let the motor cool down before attempting to restart it. During normal operations, the motor should not reach temperatures that cause the cutout to “open”. The upper and lower banks of cell fans are protected by circuit breakers.

The motor supply voltage may be derived from a three Phase step-down transformer. The inputs and outputs of this transformer are protected by circuit breakers.

TEST PROCEDURE FOR MOTOR RESISTANCE

⇒ With power off to the oven, disable the circuit breakers to the motors (top and bottom).

⇒ Using an Ohmmeter on its lowest scale, measure the resistance between each phase leg of the motor loads.

⇒ Using an Ohm meter check for short to ground (between each phase leg and the motor housing)

The resistance measured between each pair of phase legs should be approximately the same. If the resistance of one phase leg is significantly different from the other two, either there is a defective motor (short in the windings) or one of the motors is incorrectly connected.

CELL FAN MOTOR ROTATION CHECK

Create a recipe to activate the cell fans only. Start the recipe and observe the rotation of each motor. During normal operation, the heat slinger fan turns counter clockwise as viewed from the outside of the cell. If a group of motors (top or bottom) is not turning in the correct direction, de-activate the cell fan motors via the computer (stop recipe). Shut off motor circuit breaker (F8) and swap two phase leads at **one** of the following locations:

- The Load side of K13. (to change rotation of ALL fans), **or** the load side of F41, F42, F43, F44. (to change rotation of all Upper or Lower fans), **or** for an individual Fan Motor rotating backwards, swap any 2 power leads to the Fan Motor at the Cell terminal Block. *(Do NOT move the Green Wire)*

VERIFYING CELL FAN SPEED

The system will run the fans at full speed (approx. 3500 RPM). The Output from the controller to the Inverter is +10 VDC. The cell fans will slowly accelerate to full speed.
After the cell fans reach full speed, the true speed of the fans can be measured with a stroboscope. If one or more fans are NOT between 3400-3600 RPM, then it is likely that either a fan motor or the fan motor wiring is faulty.

CELL FAN ASSEMBLY REMOVE AND REPLACE PROCEDURES

<u>CAUTION: BEFORE STARTING ANY MAINTENANCE, DISCONNECT THE OVEN FROM ALL POWER SOURCES</u>.

TOOLS AND MATERIALS REQUIRED:

- RTV SS986 silicone sealer.
- Cleaning solvent or Isopropyl alcohol.
- Clean rags.
- Putty knifes 3" wide & 1" wide.
- Razor scrapers.
- 1/8" tip, 4" long, flat bladed screwdriver. (Or 3mm tip, 100mm long)
- #2 cross head, 8-10" long, screwdriver. (Or equivalent)
- 2.5mm hex key T-handle or 2.5mm hex key bit for impact wrench.
- 3mm hex key T-handle or 3mm hex key bit for impact wrench.
- 4mm hex key T-handle or 4mm hex key bit for impact wrench.
- Impact wrench.
- Torque wrench calibrated in inch pounds with a range exceeding 50 inch pounds (5.65 N.m) (click type).
- 7mm open end wrenches 1/8" (3mm)or less in thickness.
- 0.106" (2.7mm) Fan mounting gauge.
- A 10" 4x4 block of wood
- 2mm tubing
- Paper and pencil.

1 Remove the oven sheet metal skin(s) to gain access to the cell fans.

2 At the front of the Oven open the Hood with the hood up switch. Make sure that the 'hood' is in the fully open position. NOTE: watch the overhead clearance and exhaust duct movement while raising the Hood.

Motors and Fans MUST NOT be separated or mixed up. The motor/ fan units are dynamically balanced and MUST remain together.

BOTTOM CELL MOTOR REMOVAL

1 If the Oven is belt-only, disconnect the belt at the master link and unthread the belt from the tunnel. See the procedure for disconnecting the conveyor belt.
2 If the Oven is rail-only, disconnect the conveyor chains at the master links and unthread them from the tunnel. See the procedure for disconnecting rails and chains.
3 If the Oven has a combination rail/belt conveyor, disconnect and unthread the chains first and then the belt from the tunnel. See the procedures for disconnecting rails and chains and disconnecting the conveyor belt.
4 Remove all outer panels to allow access to the underside of the Oven. Remove power from the Oven.
5 Remove the screw(s) holding the thermocouple(s) in place on the cell face. Using a permanent black marker, circle the hole the thermocouple(s) pass through on the heater face. Carefully straighten the thermocouple wire and cover it with a piece of 1.7mm vinyl tubing. This is to aid relocating the thermocouple when reassembling the cell.
6 Remove the support angle brackets on the left and right side of the heater panel.
7 Remove the Philips screw holding the front heater panel bracket. Remove the bracket.
8 Remove the Philips screw holding the rear heater panel bracket. Remove the bracket.
9 Using a hex head wrench, carefully insert the short end into a hole in the heater panel and gently pull up on the heater panel.
10 Tip the heater panel on its side to gain access to the heater wires on the inside of the cell. Block the panel in place to remove the heater wires.
11 SKETCH the wire placement on the connections on the heater panel. They will have to be replaced in the same order.
12 Remove the four wires by using a 2.5mm hex key and a 7mm open end wrenche. Uses one to hold the bottom nut (closest to the panel) steady, while the other unscrews the top nut to free the wire.

IF THE HEATER FOIL TEARS, IT CANNOT BE REPAIRED, AND THE HEATER PANEL ASSEMBLY MUST BE REPLACED.

13 Disconnect the thermal switch, then remove the heater panel and set it aside.
14 Remove the blower from the motor shaft. Using a 3mm hex head wrench, loosen the two setscrews on the blower enough to remove the blower from the motor shaft. Save the blower to return with the motor.
15 Go to the rear of the oven and go in under the cell that has the motor to be removed. Document the locations of the wires in the terminal block. Using a 3mm hex head wrench or T-handle, carefully remove the three screws holding the motor in place on the cell.
16 **CAUTION: Hold the motor with one hand while you remove the last screw as the weight of the motor may cause it to fall on top of you.**
17 Remove the Cell Fan motor. You may have to tap on the motor to break it loose from its mount on the cell.
18 Scrape all RTV off the cell in the motor area. Clean all grease, dirt and RTV from the shaft hole area and the motor support areas.

BOTTOM CELL MOTOR REPLACEMENT

1 Under the rear of the oven, locate the cell where the motor is to be installed.

2 Assemble three screw assemblies. A screw assembly consists of one 3mm hex head screw, one flat washer, and one rubber washer in that order. The rubber washers are to aid in vibration isolation.

3 Using RTV, put a very small dab on each support leg of the motor. Place one rubber washer (not the rubber washer from the screw assembly in Item 2 above) on the bottom of each motor leg and position them so they are centered on the screw holes.

4 Put a small amount of RTV into each of the fan mounting holes on the cell plate.

5 Insert one screw assembly into a hole on the motor base and place the motor up against the cell face. **CAUTION: Orient the motor so the wires will reach the terminal block.** Center the holes and hand-start the screw. Tighten it until it is snug.

6 Insert the second screw into a hole on the motor base and hand start it. Tighten it until it is snug.

7 Finally, insert the last motor mounting screw into the last hole and hand start it. Tighten it until it is snug.

8 Using the 3mm T-handle, tighten all three screws until they are tight and the motor is securely fastened onto the cell plate.

9 Properly connect the motor wires to the connector block. (Red=L2, Yellow=L3, Blue=L1)

10 Place the fan mounting gauge on the cell on the cell face with the opening of the V facing the rear of the oven and surrounding the motor shaft. Make sure that the sides of the gauge are between the screws in the cell plate. See drawing of the fan gauge.

11 Place the matching fan blade onto the motor shaft of the motor just installed. Note that the fan has two setscrews and the motor shaft has two flats on it.

12 With the fan blade resting on the gauge, tighten the setscrews with a 3mm hex head bit on a torque wrench set to 50 inch pounds(5.65 N.m). Remove the gauge by sliding it forward and lifting it out of the cell.

13 Retrieve the heater panel for this cell and lay it into place in the cell. Be careful not to bend the thermocouple wire. Prop the heater panel up from the front so the heater wires can be reconnected.

14 Reconnect the wires to the panel referring to the SKETCH made when the panel and wires were removed. Use a 2.5 hex head key and a 7mm open end wrenche to prevent tearind the foil connected to the lower (closest to the panel) nut on the stud. Reconnect the thermal switch.

15 Carefully place the thermocouple wire in its protective 1.7mm vinyl tubing through the correct hole in the panel. If the thermocouple(s) was NOT marked (circled) before removing the panel, then count three rows from the right and seven holes from the front to locate the correct hole. If the Oven has the Independent Alarm Scanner (IAS) over-temperature sensing option, refer to the SKETCH to locate the second thermocouple.

16 After the thermocouples are located in their proper holes, lower the heater panel in place. Remove the vinyl tubing from the thermocouple(s).

17 Replace the front panel bracket and fasten it down with the Philips screw. Replace the rear heater panel bracket and fasten it down with the Philips screw.

18 Install the support angle brackets on the left and right side of the heater panel.

19 Carefully bend the thermocouple probes into the proper position under the hold down clamps, and tighten the clamps screws.(Do NOT use longer screws, they will damage the heater panel)

20 Reconnect the conveyor system. See the procedures for reconnecting rails and chains and reconnecting the belt.

TOP CELL MOTOR REMOVAL

1 Remove power from the oven.
2 Remove the screw holding the thermocouple in place on the cell face. Using a permanent black marker, circle the thermocouple on the heater face. Carefully straighten the thermocouple wire and cover it with a piece of 1.7mm vinyl tubing. This will aid in relocating the thermocouple when reassembling the cell later.
3 Remove the support angle brackets on the left and right side of the heater panel.
4 Remove the Philips style screws holding the front heater panel bracket. Remove the bracket.
5 If the heater panel does not fall down by itself, using a hex key wrench, carefully insert the short end into a hole in the heater panel and gently tug down on the heater panel. You may need to use the 3" putty knife to push the insulation guard clear of the heater panel.
6 Lower the heater panel far enough to gain access to the heater wires on the inside of the cell. Block the panel up with a 10" (or 254mm) 4x4 block of wood to relieve the strain on the wires.
7 Document the wire placement on the connections on top of the heater panel as you will have to replace them later in the exact same order.
8 Remove the four wires by using a 2.5mm hex head key and a 7mm open end wrenche hold the bottom nut (closest to the panel) steady while the other unscrews the top nut to free the wire.
9 **IF THE HEATER FOIL TEARS, YOU WILL HAVE TO REPLACE THE ENTIRE HEATER PANEL.**
10 Disconnect the two wires on the thermal switch.
11 Remove the heater panel and set it aside.
12 Remove the fan assembly from the motor shaft. Using a 3mm hex head wrench, loosen the two setscrews on the fan blade enough to remove the fan blade from the motor shaft. Save the fan blade to return to Vitronics Soltec with the motor.
13 At the rear of the oven, SKETCH the locations of the wires in the terminal block and then remove the wires. Using a 3mm hex head wrench or T-handle, remove the three screws holding the motor in place on top of the cell.
14 Remove the fan motor. Tap on the motor to break it loose from the cell.
15 Scrape all RTV off the cell in the motor area. Clean all grease, dirt and RTV from the shaft hole area and the motor support areas.

TOP CELL MOTOR REPLACEMENT

1. Mark the fans and motors so they will not be mixed up.

2 At the rear of the oven, assemble three screw assemblies. A screw assembly consists of one 3mm hex head screw, one flat washer, and one rubber washer in that order. The rubber washers are to aid in vibration isolation.

3 Using RTV, put a very small dab of RTV on each support leg of the motor. Place rubber washer (not the rubber washer from the screw assembly in Item 2 above) on each leg and position them so that they are centered on the screw holes.

4 Put a small amount of RTV into each of the fan mounting holes on the cell plate.

5 Insert one screw assembly into a hole on the motor base and place the motor up against the cell face. Center the holes and hand-tighten the screw.

CAUTION: Orient the motor so that the wires will reach the terminal block.

6 Insert the second screw into a hole on the motor base and hand-tighten it.

7 Finally, insert the last motor mounting screw into the last hole and hand-tighten it.

8 Using the 3mm T-handle, tighten all three screws until they are tight and the motor is securely fastened onto the cell plate.

9 Properly connect the motor wires to the connector block. (Red=L2, Yellow=L3, Blue=L1).

10 At the oven, place the fan mounting gauge in the cell up against the cell face with the opening of the V facing the rear of the oven and surrounding the motor shaft. Make sure that the sides of the gauge are between the screws in the cell plate. Hold the gauge in place. See drawing for the fan gauge.

11 Place the matching fan blade onto the motor shaft of the motor that you just installed. Note that the fan has two setscrews and the motor shaft has two flats on it.

12 With the fan blade resting against the gauge, tighten the setscrews with a 3mm hex key bit on a torque wrench set to 50 inch pounds(5.65 N.m). Remove the gauge by sliding it forward and down out of the cell.

13 Retrieve the heater panel for this cell and set the rear of it into place in the cell between the bracket and the cell. Be careful not to bend the thermocouple wire. Prop the heater panel up from the front so that you can reconnect the heater wires.

14 Reconnect the wires to the panel referring to the SKETCH made when the panel and wires were removed. Use a 2.5mm hex head key and a 7mm open end wrenche. Be careful not to tear the foil.

15 Reconnect the wires to the over-temperature switch.

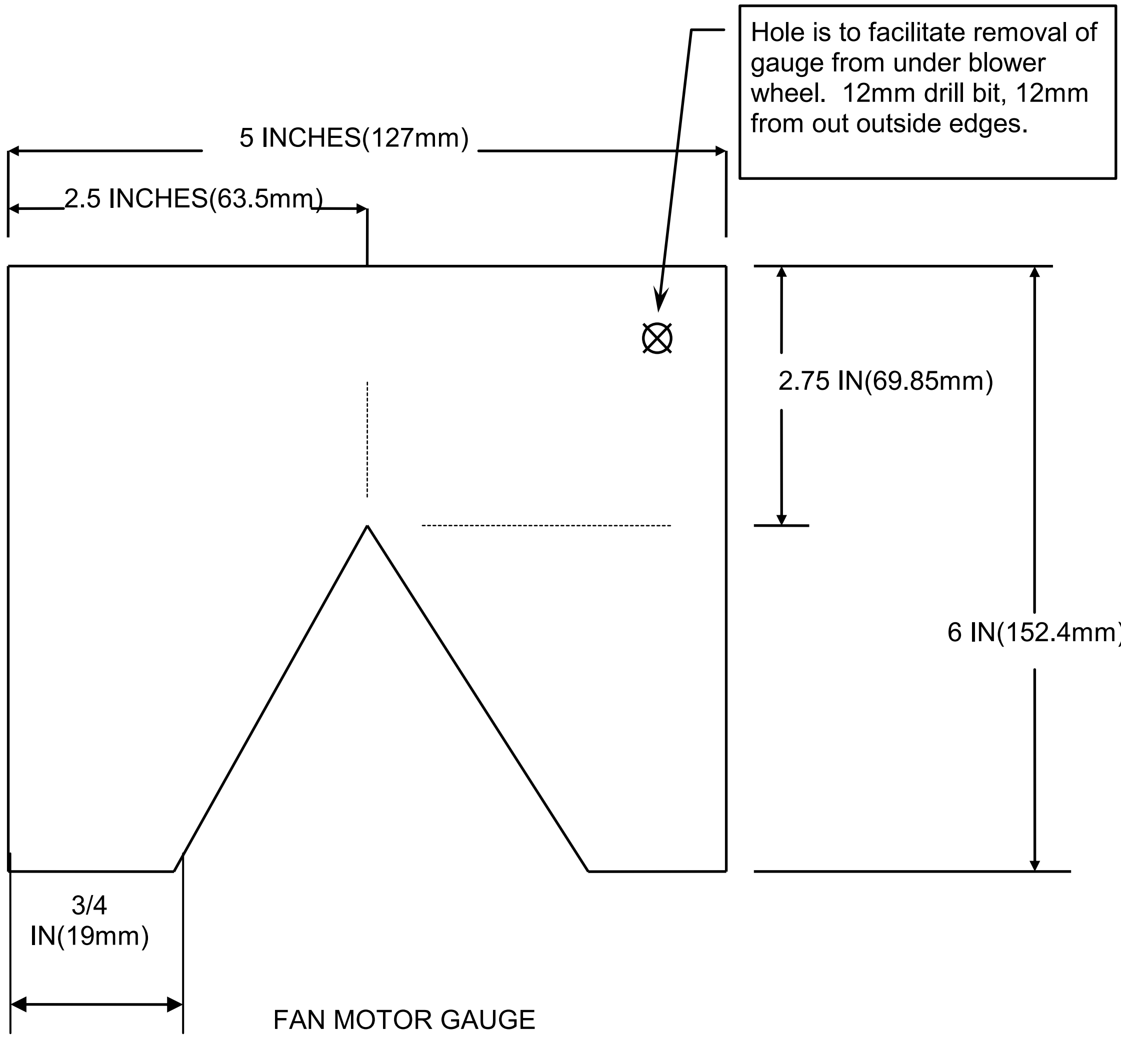
15 Carefully place the thermocouple wire in its protective 1.7mm vinyl tubing through the correct hole in the panel. *If the thermocouple(s) location was NOT marked (circle) prior to removing the panel, then count four rows from the left and seven holes (6 visible) from the front to locate the correct hole.*

16 Once the thermocouple is located in its proper hole, raise the heater panel in place.

17 Replace the front panel bracket and fasten it with the Philips style screw. Remove the vinyl tubing protecting the thermocouple(s).

18 Install the support angle brackets on the left and right side of the heater panel.

19 Carefully bend the thermocouple into its correct place and replace the clamp and screw. Tighten the screw.



FAN MOTOR GAUGE
-2.7mm Stainless steel sheet

CONVEYOR

CONVEYOR TYPES

This Section describes the three types of conveyor transport systems available on the Vitronics Soltec Reflow Ovens. They are:

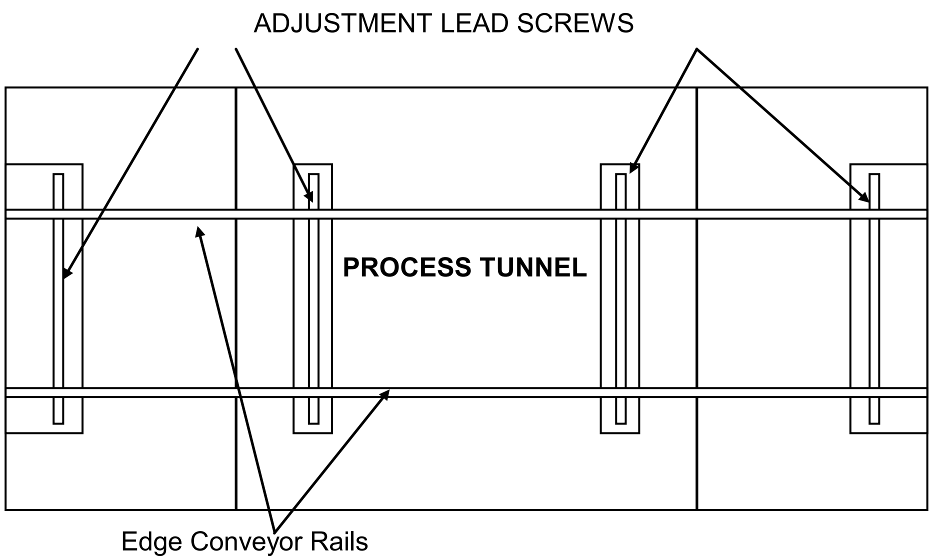
1) Edge Rail Conveyor System,
2) Mesh Belt Conveyor System,
3) Combination Conveyor System.
4) Edge Rail with XCS Board Support System

The Mesh Belt conveyor system is standard on most Vitronics Soltec Reflow Ovens. By special order, Ovens may have only the Edge/Rail or Combination Edge Rail / Belt Conveyor System'

The description of all three follow:

EDGE / RAIL CONVEYOR SYSTEM

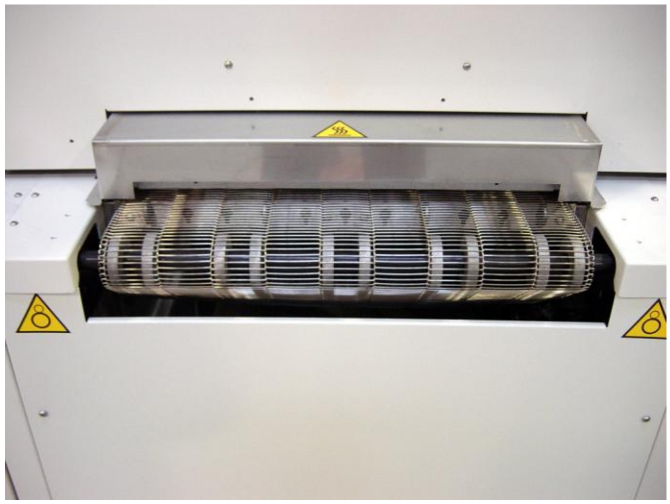
The edge / rail conveyor system (shown below) permits single or double sided surface mount printed circuit boards to be processed through the oven. The standard chain conveyor carries circuit boards on 0.185 inch (4.75mm) long pins extending from the chains. This conveyor system provides a convenient interface to other equipment in the production line. Some Ovens have two sets of rails and chains (Dual Rail) for the processing of two PCBs at the same time.



Edge / rail conveyor system.

MESH BELT CONVEYOR SYSTEM

The mesh belt conveyor system is used to process single sided surface mount printed circuit boards.

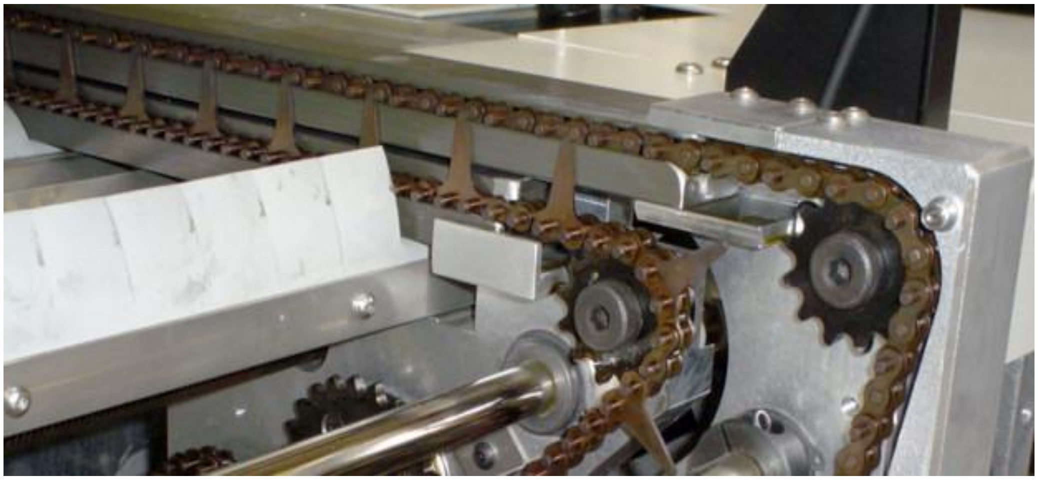


COMBINATION CONVEYOR SYSTEM

The combination belt/rail conveyor has both the edge rail and the mesh belt. The mesh belt is below the edge rail conveyors, and both conveyors are driven together. The belt conveyor is shorter than the outside edge of the machine with the sheet metal covers on, and shorter than the end of the rails with chain guards installed.

Approximately 3 inches (76.2mm) between end of belt and end of rail conveyor (both ends).

EDGE RAIL WITH EXTRUDED CENTER SUPPORT SYSTEM (XCS)



The Extruded Center Support system consists of an additional rail extrusion and a special chain with upright supports that prevent warping of the PCB. The upright support is 1.1mm (0.043 inch) thick. The XCS chain pins extend to the same height as the top conveyor chain pins where the PCB sits. The XCS chain can be parked between the conveyor pins on the fixed rail chain, enabling the user to move the system out of the process lane when not required. After a period of time both the conveyor chains and the XCS chain will stretch, and it will no longer be possible to park the XCS between the fixed rail pins. When this happens, the conveyor chains and the XCS chain must be replaced as a matched set.

The Extruded Center Support system is available on Rail Only conveyors. This option is available with both manual and automatic positioning.

CONVEYOR BELT, CHAIN & RAIL SERVICE

REMOVE AND REPLACE CONVEYOR BELT

DISCONNECTING THE CONVEYOR BELT

1. Locate the master link in the belt. The master link can be identified by the double size 'holes' in the belt. There will be two double size holes located at the fourth link in from each end. There are five master links in the belt. The single lane master link is the center link on the belt. The conveyor will have a belt with five single master links. (instead of two triples and one single master link).

2. At the right side of the belt, locate the master link. Using screwdriver or chain nose pliers, unhook the left hook of this master link from the belt. Then, using the same tool, unhook the right hook of the master link from the belt.

3. Using a screwdriver, lift the left side of the master link out of its position in the fourth link from the end on the oven side of the belt. Using a screwdriver, unhook the right side of the master link from the belt.

4. Locate the triple master link on the left side of the belt. Using screwdriver or chain nose pliers, unhook the right hook of this master link from the belt. Now using the same tool, unhook the left hook of the master link from belt.

5. Using a screwdriver, lift the right side of the master link out. Using a screwdriver, unhook the left side of the master link from belt.

6. Squeeze the ends of the triple master link together and slide the master link ends out of the oven side of the second link in from the end.

7. At the right side of the belt, squeeze the ends of the triple master link together and slide the master link ends out of the oven side of the second link in from the end.

8. The triple master links will stay in this position to reassemble the conveyor belt. Carefully lower the bottom end of the conveyor belt taking care not to let it get caught anywhere

9. At the center of the belt, using a screwdriver, unhook the right side of the single link. Lift the unhooked side up and remove the single master link from the belt. The belt will now separate. Unhook the bottom edge of the belt from the driven shaft and lay it on the floor under the oven.

NOTE: Use only single links for replacement.

RECONNECTING THE CONVEYOR BELT

1. Retrieve the single master link previously removed. Hold the master link so that the opening faces you and the curve in the link matches the curve in the belt. Insert the link into the belt so the hooks go into the two links surrounding the center link.
2. Hook the right hook into the center link of the bottom belt edge. Push the link back into place and using a screwdriver, connect the left hook to the center link of the bottom belt edge.
3. Grasp a triple link and squeeze it into a U shape. While holding this shape, slide the ends of the triple master link into the belt. Release the ends of the master link.
4. Grasp the other triple master link and squeeze it into a U shape. While holding the U shape, slide the ends of the master link into the belt. The master links should now be connecting the two belt ends.
5. At the right side of the belt, using a screwdriver, hook the master link right hook into the last hook of the belt (insert the master link hook from the top). Then using a screwdriver connect the master link right hook into the first link on the bottom edge of the belt.
6. Using a screwdriver slide the left side of the same master link into the belt. Then, using the screwdriver, connect the left master link hook to the belt, inserting the hook from the underside of the belt.
7. At the left side of the belt, using a screwdriver, hook the master link left hook into the last hook on the belt (insert the master link hook from the top). Then using a screwdriver connect the master link left hook to the belt.
8. Using a screwdriver, slide the right side of the same master link into the belt. Then, using the screwdriver, connect the right master link hook to the belt, inserting the hook from the underside of the belt.

End of procedure.

CONVEYOR DRIVE SYSTEM

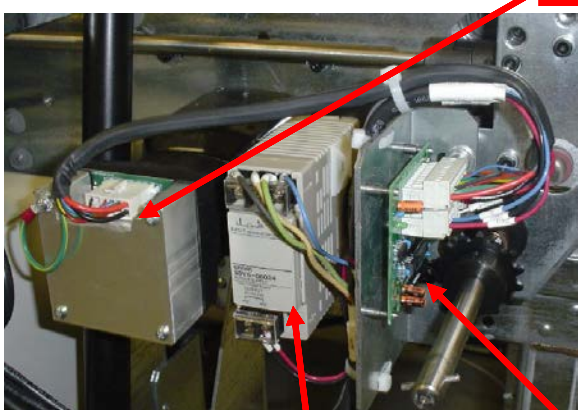
The oven controller supplies an analog voltage reference signal between 0 and 10 volts to the conveyor motor electronics to set the desired conveyor speed. The A42 board divides it in half and passes it through an Opamp to avoid loading and signal loss issues from the resistor voltage divider before it sends it to pin 9 on the Integramotor.
The internal Integramotor electronics require a regulated power supply between 20 and 28 volts to operate, otherwise the electronics indicate a fault condition and the motor will not operate. The internal Integramotor electronics control the motor speed based on a 0- 5VDC reference signal that is supplied by dividing the 0-10VDC analog output voltage in half.

The speed of a brushless motor is not controlled by varying the voltage to the windings of the motor like a brush type or a universal motor is controlled. The speed and rotation direction of a brushless motor is controlled in a similar method to that of a stepper motor. Through switching the motor windings on and off in a specific sequence for a specific direction. The faster the windings are switched on and off using the specified sequence the faster the motor rotates.

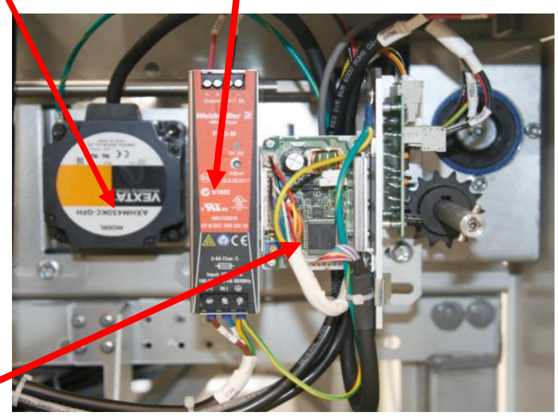
One major difference with a brushless motor versus a stepper motor is that a brushless motor has built in hall-effect sensors that are used by the drive electronics to sense and to regulate how fast the motor is rotating. A stepper motor has no internal feedback and no speed regulation.

The internal Integramotor electronics switch the windings of the motor faster as the 0-5VDC reference signal is increased while regulating the speed of the motor through the feedback from the built in hall-effect sensors.

A hall-effect sensor built into the conveyor motor supplies pulses to the oven controller, which is used by the controller for feedback to close loop the conveyor speed to the setpoint by varying the analog voltage signal to the conveyor motor electronics.



Integra Motor assembly



Oriental Motor Assembly

Set up the Conveyor Drive within the Oven Operation Program.
***NOTE: This operation may require a password*.**

If the conveyor motor does not rotate, check the following:

- Verify that the conveyor is switched on in the PC oven software.
- Verify that K37 is energized and that A1-K8 is also energized.
- Verify that 120 VAC is present at the G5 power supply or verify that the green LED on the front of the power supply is on.
- If 120VAC is not present then make sure that A1-K8 is energized on the A1 board, that F68 is not tripped and that the inrush current limiter on pins 1 and 2 of connector P52 on the A1 board are intact.
- Verify the analog voltage reference signal to the A42 board.
- The signal should be +10 VDC between pins 1(+) and 2 (-) on connector P2 of A42 when the analog output is at full scale.
- If there is no signal present, make sure that the controller rack has +15 VDC at pin 4 of connector P26 of the A1 board. (-15 is not present or required on the new controller)
- If +15 VDC is present , but the drive is not receiving +10 VDC, there is either a wiring error or the DI board is faulty, or a poor wire connection.

If motor turns, but no speed is reported, check the following:

- Verify that the hex drive shaft is rotating.
- Verify that the sprocket installed on the hex drive shaft is also rotating.
- Verify that LED2 on A42 is flashing as each sprocket tooth from the sprocket on the hex drive shaft passes by the fork shaped sensor on A42.
- If LED2 is not flashing on A42 and the hex shaft and sprocket are rotating then perform the following:
- Verify the alignment of the sprocket with the fork shaped sensor on A42. The sensing area on the fork shaped sensor is on the top most edge of the sensor and only the tips of the sprocket teeth should be extending into the opening on the sensor. If the sprocket teeth extend too far the sensor won't detect the gaps between each sprocket tooth and will sense the hub around the sprocket teeth instead.
- If LED2 on A42 does not light or never changes state then test the following.
- Verify that 5VDC is present between pins 1(+) and 3(-) of connector P3 on A42. The 5VDC is required to operate the logic components on A42.
- If the polarity is reversed or if connector P1 and P3 are reversed on A42 then A42 will have to be replaced after the wiring has been corrected. Because reverse polarity and or 24VDC will permanently damage all of the logic components on A42.
- If 5VDC is present and LED2 on A42 still doesn't change state then perform the following:
- Shut off the conveyor motor.
- Unplug connector P4 from A42.
- Loosen and remove the (2) 1/4-20 bolts that secure the bracket that A42 is mounted on to the front of the rail width gearbox.
- With the A42 assembly separated from the sprocket on the hex drive shaft pass a small object back and forth between the top most tip of the fork sensor while observing LED42 on A42.
- A pen or the tip of your finger can be used.
- If LED2 still does not change state and 5VDC is present between pins 1(+) and 3(-) of connector P3 on A42 then A42 is defective and needs to be replaced.

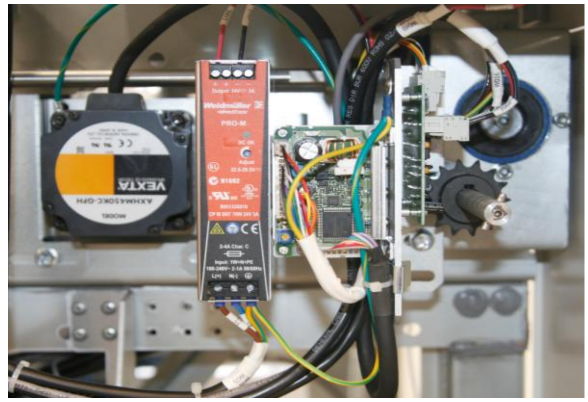
After the conveyor system has been repaired, run the conveyor calibration routine in the Oven Control Program.

DRIVE MOTOR SERVICE & REPLACEMENT

Conveyor Drive Motor Replacement - MOTOR LOCATION

There are only two locations for the conveyor motor on all Vitronics Soltec Reflow Ovens. On an oven with a left To right conveyor, the motor assembly is in the front right corner of the oven. On an oven with a right to left conveyor system, the motor assembly is on the front left corner of the oven.

Integra Motor



Oriental Motor

Left To Right Conveyor

<u>CONVEYOR MOTOR REPLACEMENT</u>

To remove/replace the Conveyor Drive Motor:

1. Open the Hood

2. Turn off the U.P.S. and disconnect all power from the oven.

3. Remove the sheet metal at the exit end of the end the oven to gain clear access to the motor and components.
4. Remove the G5 power supply
5. Unplug the cable from the motor.
6. The Motor is attached to a mounting plate with four bolts. That plat is mounted with four bolts on the Oven Frame “C” Channel. Loosen the four bolts and slide the plate to the exit end of the oven. This will allow the Chain to be removed from the Drive Sprocket without removing the Master Link from the Chain.
7. While supporting the Motor, remove the four bolts. Remove the motor, mounting plate and sprockets from the Oven.

8. Rotate the Motor to permit access to the setscrews that secure the drive sprocket to the Motor Drive Shaft. Loosen the setscrews and remove the sprocket, then remove the Motor from the mounting plate.

9. Install the new motor and drive sprocket on the mounting plate.

Reverse steps 7 through 1 to replace the Conveyor Drive Motor

REMOVE AND REPLACE CONVEYOR RAILS AND CHAINS

DISCONNECTING RAILS AND CHAINS

1. At the off-load end of the oven, remove the chain guard from each chain by removing the 3mm hex key head screws.

2. Run the conveyor until the master link for one or both chains comes up just under the rail. Remove the master link(s) from the chain(s). Unthread the chain from all of the pulleys that it wraps around on its way under the oven. Make sure that the chain is off the drive sprocket and tie wrap it to the idler shaft just below the end of the oven. Be sure to note the position of the chain around all pulleys. Go to the on-load end of the oven and remove the chain guards. Pull the chains out of the rails in the direction of the on-load end of the oven. Let the chains drop down and tie wrap them to the idler shaft below the end of the oven.

3. If only one master link came into position, run the conveyor until the second chain master link shows up. When it does, remove it as you did on the other chain.

4. Remove the 3mm hex head screws holding each rail onto the conveyor assemblies.

5. Remove the rails. <u>DO NOT to let them bend or they may be permanently deformed</u>.

RECONNECTING RAILS AND CHAINS

1. Reconnect each rail to its end assembly using the 3mm hex head screw.

3. Install the chains in the rails making sure the long pins face in toward the center of the oven. Be careful not to twist the chains.

4. Slide the chains through the rails until they reach the off-load end of the oven.

5. Rethread the chains on the sprockets and idler pulleys at the on-load end of the oven. Reinstall the chain guards with the 4mm hex key head screws.

6. At the off-load end of the Oven, rethread the chains through the sprockets and idler pulleys. Reconnect the master links in both chains. *Make sure the closed end of the keeper clip is facing the direction of conveyor travel (off-load end).* Reinstall the chain guards on the rails with the 4mm hex key head screws.

7. Make sure the chains are not hung up or twisted anywhere on top or underneath the Oven.

ELECTRICAL POWER & COMPUTER

CAUTION:

WHEN THE OVEN IS “OFF”, MANY PARTS OF THE OVEN MAY BE ELECTRICALLY POWERED AND DANGEROUS

ELECTRO - STATIC DISCHARGE PROCEDURES (ESD)

When any electronic PC board or any semiconductor device is to be handled, an antistatic wrist strap and an antistatic work surface or mat must be used to reduce the possibility of causing damage to electronic components on the PC board.

Semiconductor devices are sensitive to static electricity which can reach potentials of 20,000 volts or more. Static electricity may reach 3000 volts before it can be felt ! If the discharge (spark) is visible, it is probably in excess of 5000 volts!

The current in static electricity is low. The component is usually weakened by the static damage, but does not fail immediately. This causes intermittent problems, which can be very difficult to isolate. Static electricity can also cause immediate failures on boards and components. Static failures from improper handling and packing can mask the original problem from a repair person so that when you receive a board back from a repair facility, you end up with the same problem you had before the repair.

Any clothing made with synthetic fibers is capable of generating static electricity. Any clothing can insulate a wrist strap from your skin. The purpose of the strap is to discharge static electricity that has been built up on your body in a controlled manner to prevent personal injury and damage to the equipment involved.

As long as you are properly connected to the oven ground by the antistatic wrist strap, you will be at the same potential, as the oven and the risk of damaging the components with static electricity will be reduced.

When a board with electronic components on it is removed, it is important to remain connected to the oven. When the board has been completely removed from the oven, it may be placed on top of the antistatic mat (connected to the oven).

The board should be put into an antistatic bag while you are still connected to the oven. The bag should be 'sealed' before disconnecting yourself from the oven ground.

Some antistatic bags are made of plastic that is coated on the inside with a thin conducting metallic film. This film turns the bag into a “Protective Shield” surrounding its contents with a path for electricity to follow, thus preventing damage to the contents when it is completely closed. (Torn bags should be discarded.).

The bags can hold a static charge on their outside surfaces. Always properly ground yourself and have a properly connected antistatic work surface to rest the bag and contents on before opening an antistatic bag.

When replacing a PC board or electronic component, always be properly grounded until finished with the repair or replacement procedure. Always be properly grounded to the oven that is being worked on. *Not all ovens are at the same ground potentials.*

All electronic boards and components must always be properly protected from static electricity and properly stored.

Every Field Service Technician should be issued an antistatic kit consisting of a static dissipative portable work surface and a combined wrist strap and grounding strap to connect to the work surface. The proper way to use the kit follows.

NOTE: Vitronics Soltec strongly recommends the use of a similar antistatic kit for all customers who do any self-maintenance on an Oven involving PC assemblies or semiconductor components.

1 Unfold the antistatic work surface and place it near the section of the oven where work will take place. Set it down with the pocket side up. In addition, the surface under the mat must be clean and dry.
2 Remove the wrist strap and grounding cord from one of the pockets in the mat. Snap the round black connector in the middle of the cord to the snap connector that is at one corner of the mat. You might want to rotate the mat at this time so that the cord connector is closest to the oven where it will be grounded.
3 Slide the alligator clip onto the banana jack which is on one end of the cord. Use the alligator clip to connect the cord to an appropriate ground on the oven. Usually a piece of frame that is not painted works well.
4 Connect the wrist strap to the snap connector on the other end of the cord. The strap should 'snap' onto the connector for a positive connection.
5 Put the wrist strap onto your wrist, making sure that the strap is in contact with your skin all the way around your wrist. Make sure that the strap is facing in the correct direction. The 'inside' of the strap will have metallic strands woven into the material on the inside. You may not be able to see the strands but you will see the wrong color of these strands, typically off-white or gray.
6 Make sure that the wrist strap is tight on your wrist. If it needs to be adjusted, then 'pop' open the small plastic clip and pull the strap until it is tight around your wrist. When it is tight, hold the strap and close the clip so that it 'snaps' in place. This clip can be re-opened and the strap resized at anytime.

You are now ready to work on the static sensitive portions of the oven**.**

Remember, always put the wrist strap on before working on PC boards or semiconductors and leave it on until finished with the task. Always remain connected until all PC assemblies are re-installed on the oven or protected by antistatic bags.

When working on any electronic component, ALWAYS observe proper ESD handling procedures.

TAKE THE WRIST STRAP OFF before working on AC power!

A.C. & D.C. POWER SUPPLIES

CONTROL CIRCUIT TRANSFORMER

The control circuit transformer is a multi-tapped transformer. Determine that the primary conductors to this transformer are connected in agreement with the supply voltage at the Oven Installation site.

Refer to the table below for transformer tap settings.

SPLIT PRIMARY T1 CONNECTIONS			
INPUT VAC	**CONNECT F50 TO 1L1**	**1L2**	**INSTALL JUMPER**
190V	H1A & H1B	H2A & H2B	
200V	H1A & H1B	H3A & H3B	
208V	H1A & H1B	H4A & H4B	
220V	H1A & H1B	H5A & H5B	
240V	H1A & H1B	H6A & H6B	
380V	H1A	H2B	H2A & H1B
400V	H1A	H3B	H3A & H1B
415V	H1A	H4B	H4A & H1B
440V	H1A	H5B	H5A & H1B
480V	H1A	H6B	H6A & H1B

Test procedure for control transformer voltage

⇒ With main power to the oven off, close the circuit breaker on the primary (line) side of the transformer. Open the circuit breaker on the secondary (load) side of the transformer. Verify that the secondary side of the transformer's neutral leg is grounded.

⇒ Re-apply oven power. Using a Voltmeter set the proper range, measure the output voltage of the single phase control transformer.(X1 – X4). The output voltage of the transformer should be within +/-10% of the nominal transformer voltage (i.e. 108 VAC to 132 VAC). If the output voltage of the transformer is outside these values, the primary taps of the transformer should be adjusted accordingly. When done, close the circuit breaker on the secondary (load) side of the control transformer.

120 VAC PERIPHERAL SUPPLY (Option)

Two double way AC convenience outlets are located on the oven.
The 120 volt convenience outlets have their hot terminals connected to wire #5, neutral to wire #2, ground to any ground terminal on the main electrical back panel. These outlets are protected by circuit breaker F54, located on the main electrical back panel.

Test procedure for AC Convenience Outlets

⇒ Disconnect power to the system. Using an Ohmmeter on its lowest scale, measure the resistance between the ground terminal on the socket and the ground block on the main electrical back panel. This value should typically be less than 1 ohm.

⇒ With power applied to the system, use a Voltmeter set on the proper scale, measure the voltage between the live and neutral terminals on the socket, this value should be nominally 120 VAC.

D.C. POWER SUPPLY

The DC power regulation is internal to the A1 Board. 120 VAC is converted to 24 VDC. Step-down switching regulators change the 24 VDC to separate 15 VDC and 5 VDC supplies. These DC voltages are self regulated and have no adjustment.

Voltage Checks

When troubleshooting an electrical or electronic problem, always verify the basic AC and DC voltages supplied for operation.

OVEN CONTROLLER

The Oven Control System is comprised of one DI (Digital Input /Output) board, a back-plane board, and one or more AI (Analog Input) boards. One AI board controls up to 32 process loops. Each additional AI board increases the number of control loops by 32. The Oven Control System controls the temperature of the cells, drives the conveyor and rail drive motors, and drives various logic signals through the I/O board.
The Oven Control System receives all of its instructions from the computer by a serial interface.

NOTE: DI OR AI BOARDS SHOULD NEVER BE INSERTED OR REMOVED WITH POWER APPLIED TO THE VITRONICS SOLTEC CONTROL SYSTEM!

Test procedure for D.C. input voltage:

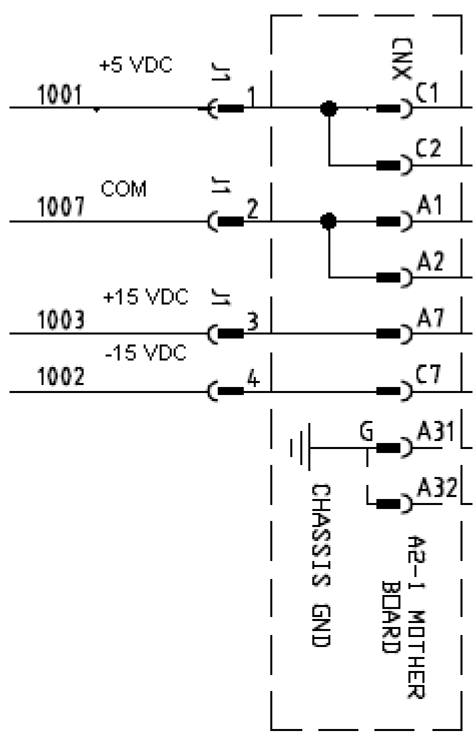
The power requirements for the Vitronics Soltec Control System, with one AI board, is:

+5.0 VDC @ 2 Amps max (+5.0 to +5.10 VDC)
+15 VDC @ 0.1 Amps max (+12 to +15 VDC)
-15 VDC @ 0.1 Amps max (+15 to -15 VDC)

⇨ Shut off circuit breaker F55 supplying 120 VAC power to A1 board.

⇨ Remove DI and AI boards from Vitronics Soltec Control System.

⇒ Reactivate 120 VAC power to DC power supply. Using a DC Voltmeter, measure the DC voltages at the backplane connector:



ADDRESSING DIP SWITCHES ON DI BOARD

Currently, only dip switch #4 is utilized for 50 or 60 Hz operation. All others are reserved for future use on the XPM3m. For 60 Hz, dip switch #4 is in the **Off** position, and for 50 Hz operation, dip switch #4 is in the **On** position.

ADDRESSING LINKS ON AI BOARD

The AI board contains two series of jumpers, combinations of which dictate the address of the AI board. The following table identifies the required jumper settings for the first two AI boards in a system:

Board number	Channels	Jumpers set
1	1 to 32	JU1 and JU11
2	33 to 64	JU2 and JU10

CONTROLLER STATUS

Upon power up the AI board's status lights should be in the following states:

⇒ Green light: On, steady.
⇒ Orange light: On, flashing at approximately once per second.
⇒ If the status lights are not in the above states check the +5 VDC at the terminal block mounted on the motherboard.

RS-232 Serial Communication check

Make sure that the RS-232 cable connections from the PC to the controller are correct.

The communication baud rate on the PC oven software is set to 38,400 baud and should never be changed without consulting the factory.

Verify that the 9 pin d-sub connector is firmly connected on the back of the PC.

Verify that the RS-232 cable to the controller is connected firmly into connector P2 on the front the oven controller (DI board) and not plugged into connector P1 on the front of the oven controller (DI board).

RS-232 Serial Communication check - continued

Connector P1 on the oven controller (top most connector) is an RS-232 programming port used for updating the program application stored in the flash memory of the oven controller.
Connector P2 on the oven controller (second connector from the top) is used for RS-232 communications with the PC.

Check that the run toggle switch on the front of the oven controller (DI board) is in the up position and that the top green run LED is on. Refer to sheet 46 on schematic 4254600 for wire connections and an LED layout of the oven controller (DI board).

The COM2 RXD and COM2 TXD LEDs on the front of the oven controller indicate RS-232 communication activity between the PC and the oven controller.
COM2 RXD is a green LED and flashes as the PC sends data to the oven controller.
COM2 TXD is a red LED and flashes as the oven controller sends response data to the PC.

Verify that the COM2 RXD green LED is flashing to indicate that the PC is sending commands to the oven controller. If the LED is not flashing then verify that the PC oven software is running and sending data by observing the modem icon on the screen.

Using an Ohm meter check the continuity of the communications cable. The pin assignments are as follows:

- DB-9 Pin #2 (RX of PC) to DI Board P2-1 (TX of VCS)
- DB-9 Pin #3 (TX of PC) to DI Board P2-2 (RX of VCS)
- DB-9 Pin #5 (SG of PC) to DI Board P2-5 (SG)

  DB-9 Pin #4 (DTR of PC) to DI Board P2-3 (used for programming mode only on P1)
  DB-9 Pin #6 (DSR of PC) to DI Board P2-4 (used for programming mode only on P1)

If the COM2 RXD green LED is flashing to indicate that the PC is sending commands and the COM2 TXD red LED is not flashing then the oven controller is not responding to the commands sent by the PC.

Important Note: If the run toggle switch on the oven controller is set in the down position the oven controller will **not** automatically run the application stored in its flash memory on power up and will not respond to any commands sent by the PC.
Momentarily press the small red reset button on the front of the oven controller with the run toggle switch on the front of the oven controller (DI board) set in the up position. This restarts the oven controller application, assuming that there is a valid application loaded in the oven controller. When the oven controller starts running an application all of the green LEDs on the front are on initially and all of the red LEDs are off until there is communication activity on the oven controller communication ports.

In the rare case that the 3 green and 3 red communication status LEDs on the front of the oven controller flash on and off approximately every 2 seconds in sync then the oven controller may be experiencing a run time error or other unforeseen error from invalid or possibly corrupt data. To clear this type of error perform the following:

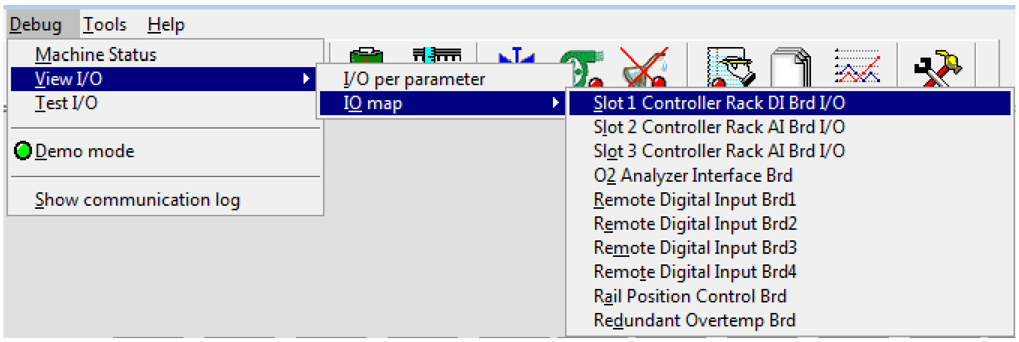
- Shut off power to the oven controller by switching off F55.
- Remove the DI board from the rack.
- Remove the battery from the DI board for a few seconds to clear all of the RAM on the board.
- Re-install the battery.
- Re-install the DI board in the rack.
- Switch F55 back on.

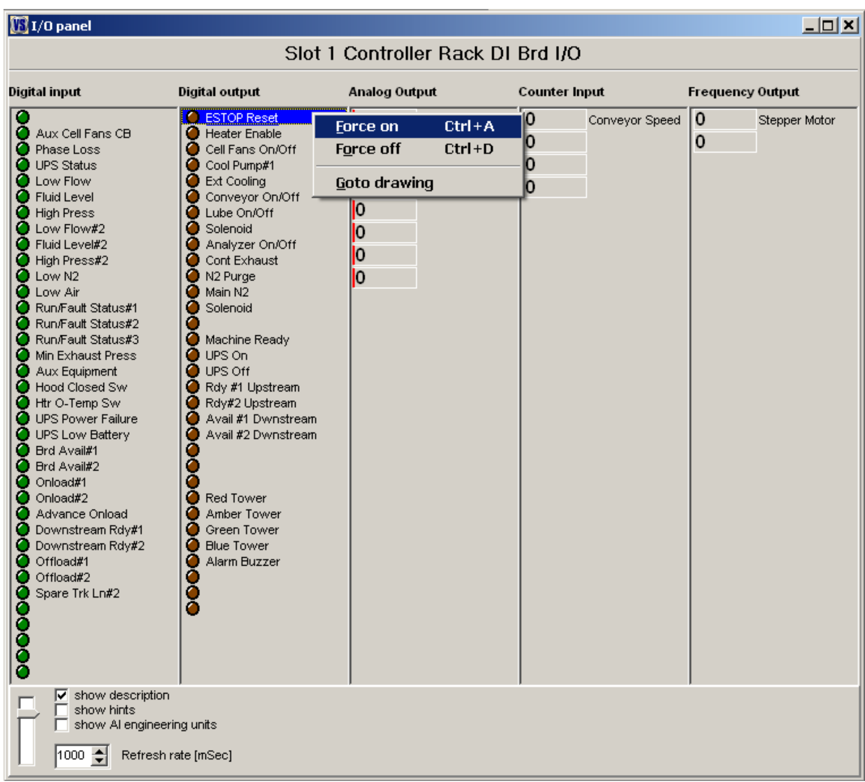
The communication status LEDs should not be flashing at this point other then the COM2 RXD green LED if the PC oven software is running and attempting to communicate with the oven controller.
Through the PC oven software download the oven configuration to the oven controller since the configuration was lost when the battery was disconnected. The PC oven software normally displays a pop up dialog when it detects that the oven controller is not configured.

A further test is to use an oscilloscope or volt meter to look at the voltages at P2-1 (TX) and P2-2 (RX). The signal should switch between a positive value (+5 VDC to +10 VDC) and a negative value (-5 VDC to -10 VDC). The signal should be free from noise greater than +/- 0.2 VDC.
Noisy communication lines can be corrected by grounding the shield of the communication line, as well as moving the communication link away from any high voltage sources (especially running parallel to the communications lines).

CONTROLLER OUTPUTS (INPUT/OUTPUT BOARD)

The Input/Output board provides the ability to switch 120 VAC power through interposing relays. The oven controller controls the output status of the Input/Output board As a diagnostic tool, the Input/Output board outputs may be manually activated one at a time.





COMPUTER SYSTEM

The computer system must be set up and connected to the Vitronics Soltec Oven. The monitor and keyboard are placed on the swing arm / light tower. The keyboard, monitor, and computer connect together. The connections on the back of the computer are color coded, and they are different sizes/shapes to help connect them properly. (If the keyboard/mouse does not function, swap the two connectors on the back of the Computer.)
One data cable must be connected from the computer to the oven.
Two 120VAC power cables (they are identical) are factory-wired for the Computer and Monitor. Plug the power cables into the receptacles on the rear of the Computer and Monitor.

CONTROL CIRCUIT

Test procedure for safety interlock circuit

⇒ Activate all circuit breakers.
⇒ Ensure all E-stop switches are pulled out.
⇒ Log into the Oven control Program and reset the E-Stop Alarm
⇒ The E-stop relay K37 should be energized. If not, check the output of the control transformer using a Voltmeter at wires #3 and #2. If voltage is present, but K37 is not energized, there is a break in the series connection of safety interlocks.
⇒ Check that each E-stop and safety interlock switch de-energizes K37

Note: The enclosure safety interlock switches mentioned above are optional and do not exist on all ovens.

ELECTRICAL GROUNDING OF OVEN

GENERAL:

1) All ground wires have green or green/yellow insulation. Ground wires without green or green/yellow insulation are identified using green or green/yellow tape.
2) The main electrical panel has a single ground terminal. All grounds must be connected to the ground terminal.
3) Bare copper grounding wire inserted into an aluminum grounding block should be coated with an oxidation inhibitor. Copper to aluminum has a natural galvanic reaction, which will degrade the electrical connection in a short time. Inhibitor is not required when ferrules are used.
4) Use long nose pliers when inserting a ground wire into a double layered ground block. Insert the wire completely into the block for a proper ground bond.
5) Ground blocks should be mounted on a clean and paint free surface. Use a star washer under the mounting screws.

Test procedure for system ground continuity

1) Check continuity between the main ground terminal of the oven and the ground terminal on the mains connecting plug or distribution board using an Ohmmeter.
2) Check continuity from the mains ground terminal of the oven to each individual component using an Ohmmeter.
3) The resistance values should not exceed one Ohm.

Test procedure for insulation leakage (MEGGER [or Resistance] TEST)

1) Disconnect the system from the mains supply
2) Connect the three phases together at the mains supply connection point on the oven.
3) Disconnect the Circuit Breakers supplying the control circuit transformer and the circuit breaker supplying the inverter.
4) Disconnect the computer and all peripheral equipment from the oven.
5) Connect an insulation test meter between one of the three phases and the ground connection point.
6) Turn on the Main Disconnect and test the system insulation for leakage at twice the single-phase voltage. For example, for 240 VAC phase to neutral, check insulation at 500 Volts.
7) The resistance should be at least 1 MegOhm.

ASSOCIATED SUBSYSTEMS

TRUE N2 / AIR SWITCHING

TRUE N2 / AIR Switching is:

☐ Standard on all ***NITROGEN*** ovens ☑ An option (NOT installed on all ovens)

On Nitrogen (*N2*) Reflow Ovens, the *N2 / Air Automatic Switching Option* permits switching from a Nitrogen to an Ambient Air (room air, not compressed air) atmosphere.

DESCRIPTION

This configuration is for customers who want a nitrogen oven, but intend to run both air and nitrogen atmospheres. The machine is set up to optimize nitrogen performance, minimize 02 levels, minimize N2 consumption, and minimize tunnel maintenance.

APPLICATION

The True N2 / Air switching provides automated switching from the N2 Mode to Air Mode with all of the benefits of a true air machine. Any application considering air operation to any extent should incorporate this option.

BENEFITS

In addition to the benefits of Nitrogen, this option offers the ability to run a true air process, with the benefits long associated with air machines (economical gas flow, and continuously flushing cleanliness). Both modes are controlled automatically by the selection in the recipe file.

FUNCTION

A series of valves are added to the individual cell intakes, the Controlled Exhaust, and the FFC manifold to allow automatic control of gas flows in the machine.

> N2 MODE-
> Nitrogen flow to the machine automatically closes individual cell intake valves, closes the Air Controlled Exhaust valve, and opens the Flux Flow Control manifold valve. In this configuration the machine functions as the standard N2 FFC machine.
>
> AIR MODE-
> Upon closing the N2 solenoid, individual cell intake valves automatically open, the Controlled Exhaust valve opens, and the FFC manifold valve closes (stopping gas recirculation). A valve on the far end of the FFC manifold opens to allow air intake into the manifold. In this configuration the machine functions as an Air machine

MAINTENANCE**:**

The True N2 / Air switching system requires minimal maintenance if operating properly, using recommended flows settings, and periodic checks, as outlined in the operator manual. Periodic (every six months) inspection of the valve cylinders and valve seats is recommended to insure proper operation. Nitrogen lines to the valves should be checked for leaks.

BATTERY BACK-UP FOR PC, CONTROLLER, CONVEYOR, AND HOOD LIFTS

The UPS Battery Back-up is:

☐ Standard, (installed on all ovens)   ☑ An option, (NOT installed on all ovens)

DESCRIPTION:

In case of a power failure, the UPS, (uninterruptable power supply) battery provides power to the PC, oven controller, conveyor, and hood lift system. This provides a sufficient amount of time to completely empty out the Reflow Oven of any product that may have been in process when the power failure occurred. The oven controller will provide an audible alarm, and the PC will provide a message indicating the operation of the UPS system. The Battery Back-up Option will also allow the Reflow Oven operator to open the Hoodlift should there be a need to remove product from the oven due to the power failure.

NOTE: The length of time the UPS will operate is dependent on oven size, not time. The UPS will operate for a period of time equal to the amount of time it will take a PCB to travel the full length of the oven at the speed contained in the running recipe at the time of the power failure. After this period, the UPS will turn off, shutting down the PC, oven controller, conveyor, and hoodlift system.

(If the operator wishes to prevent the conveyor from running, the UPS backup battery should be disabled through the Oven Control Program before a power failure.)

“POWER ON” DEFAULT FOR THE UPS BACKUP BATTERY:

Each time the oven’s PC is turned on or resets the UPS backup battery unit is reset to the previous status (on or off). The oven software remembers the last configuration, even after being ‘reset'.

PLEASE READ THE UPS MANUFACTURERS MANUAL DELIVERED WITH THE OVEN

PRODUCT TRACKING AND ALARM

Product Tracking and Alarm is:

☐ Standard, (installed on all ovens)   ☑ An option, (NOT installed on all ovens)

The product tracking option has two photo-sensors. One mounted at the Onload end and one at the Offload end of the oven. Boards loading onto the conveyor are detected by the sensor and counted. The program calculates board travel through the oven, and each board is expected to pass under the Offload sensor within a time period based on the conveyor speed (as measured in PPI) and the oven length.

If a board does not pass under the Offload sensor within the calculated time, the "Board Dropped Alarm" is activated. The product length specified in the Product Definition determines the board length displayed on the screen.

COMPUTER CONTROLLED EDGE-RAIL LUBRICATION

Computer Controlled Edge-Rail Lubrication is:

☐ Standard, (installed on all ovens) ☑ An option, (NOT installed on all ovens)

DESCRIPTION:

The edge-rail lubrication system is designed to improve the lifetime of the rail chain conveyor by periodically applying lubrication to the chain during oven operation.

Two modes of lubrication are available, automatic and manual. Systems with automatic chain lubrication are also capable of performing manual chain lubrication, initiated by the operator, through the Oven Operation Program.

OPERATION:

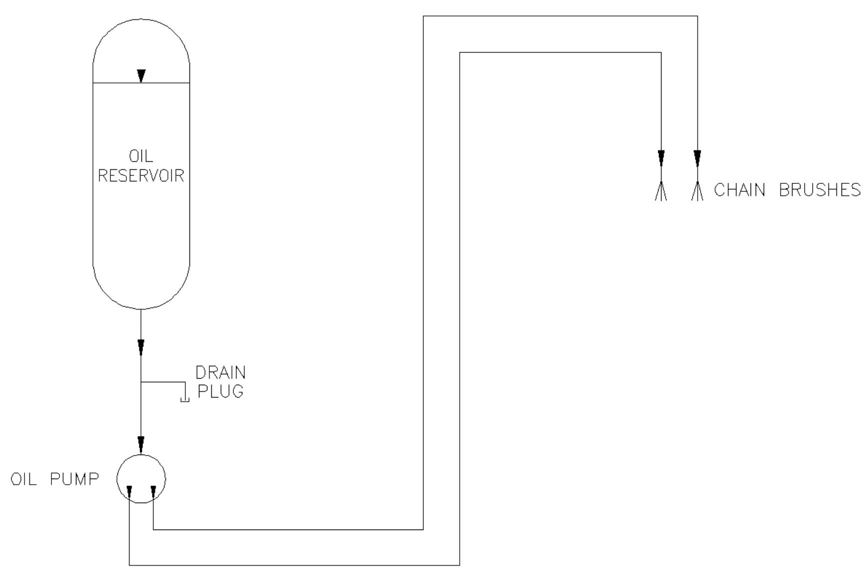
⇒ Following the enabling of an output from the controller, the system pumps oil from the reservoir, through tubing, to stainless steel brush/wheels which are touching the chain and the oil is applied to the chain.

⇒ It is the user's responsibility to ensure that this reservoir is always filled with the required lubricant. The system generates a warning message when it calculates that the oil in the reservoir is getting low.

⇒ The lubricant type is Anderol Chian Oil XL220

During the lubrication process, the oil is applied for two complete cycles of the chain. The user may determine the number of chain cycles between automatic lubrications. 67 is the default number.

The number of complete lubrications held within one reservoir is set to the factory default of 300. The system will display a warning whenever it calculates that the reservoir level is getting low when the number of lubrication cycles that have occurred reaches the tank count number in the lubrication setup screen. Since the amount of oil dispensed in one application is system dependent, the number of complete lubrications is best found by trial and error.



Auto Chain Lube System Schematic

Construction:

The Auto Chain Lube System consists of a 1 quart polypropylene oil reservoir, drain plug, electrically powered pump, tubing for oil distribution, and two stainless steel brushes for the application of lubricating oil directly to both oven conveyor chains.

AUTO CHAIN LUBE TANK/PUMP ASSY

Operation:

The pump will output 3 drops of oil for every 90 seconds of conveyor chain travel. The oil is sent through the oil distribution hoses up to the stainless steel brushes.

Priming:

Priming the system through the software can be very time consuming because of the low displacement of the pump...

Priming should only be necessary after:

1. Servicing the auto lube system
2. The reservoir has been allowed to run dry and air has been pumped into the lube lines

Location:

The Lubrication Tank-Pump Assembly is mounted to the frame at the front of the oven, inside the utility cabinet, at the exit end of the oven.

INITIAL SETUP

The following process is done at the time the oven is built. It should be required <u>only</u> after repair or service of the Autolube System.

1) Locate the lubrication reservoir. (see illustration above)
2) Fill the reservoir with the lubricant, Anderol Chain Oil (Vitronics Soltec P/N C00152 (for 1 liter)). (Remove the cap and pour the lubrication into the top of the reservoir.
3) Start the oven converyor before you prime the lube system.
4) In the Oven Control Software click on the Oil Can Icon. This will bring up the Chain Lubrication utility dialog box. Click on the box for *Lube for Prime Period*.
5) Priming the autolube system can take as much 6 hours depending on the size of the oven. The priming operation will not shut-off automatically, therefore it MUST be monitored to prevent excess oil from dripping on the floor. (During normal “Manual” & “Auto” Lube operations, the system does stop automatically)

NORMAL OPERATION

First, refer to Rail Chain Lubri*cation* in the How Do I section under the Help menu in the oven software..

<u>To perform a single manual lubrication of the conveyor chain</u>:

Select manual lubrication in the Oven Control Software by clicking on the Oil Can Icon. This will bring up the Chain Lubrication utility dialog box. Click on the box for *Lube for Chain Distance*. The conveyor chain will run, and lube oil will be applied for two complete cycles of the chain(s).

F<u>or automatic lubrication of the conveyor chain on a regular basis:</u>

Select automatic lubrication in the Oven Control Software by clicking on the Oil Can icon. This will bring up the Chain Lubrication utility dialog box. Put a check mark in the box for *Use Automatic Lubrication*.

In automatic mode, the lubrication process does not interrupt oven processing. **<u>The chain will be lubed while there is product in the oven</u>**.

ALARMS:

When the alarm count for lubrications has been reached a “*Low Oil Message*” will be displayed at the bottom of the Operating Screen. Automatic or manual lubrication will not be permitted until the reservoir has been filled, and the alarm reset. Reset the lubrication counter in the Oven Control Software by clicking on the Oil Can icon. This will bring up the Chain Lubrication utility dialog box. Click on the box for Reset Lubrication Counter After Filling Tank.

- This is the best time to adjust the cycles between lubes and/or the number of lubes before “Low Oil Message alarm.

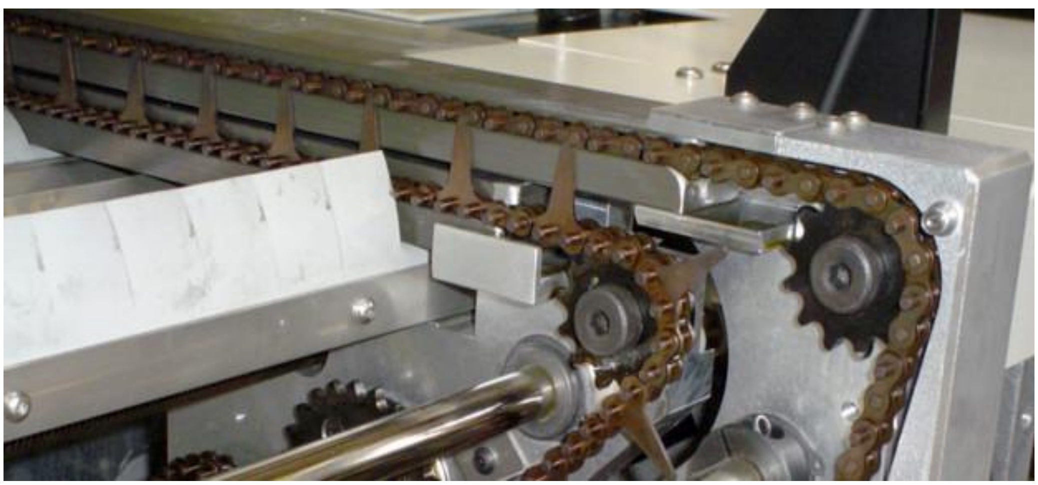
BOARD SUPPORT

Board Support is**:**

☐ Standard, (installed on all ovens) ☑ An option, (NOT installed on all ovens)

The Board Support system on the XPM3m ovens is the Extruded Center Support system. The system includes a single rail extrusion and a special chain with upright supports that prevent warping of the PCB. The upright support is 0.05 inches thick (1.27mm). This option is available with both manual and automatic positioning. This system is available on Rail Only conveyors. The XCS system can be parked against the fixed rail when not in use.

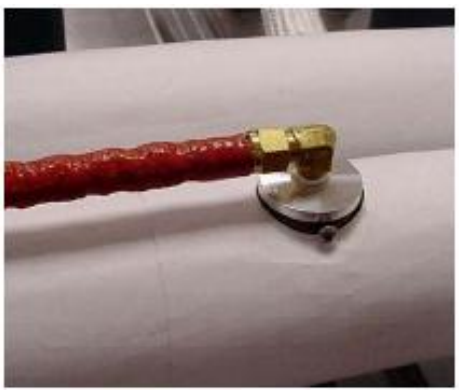
<u>There must be a clear space of 1.27mm (0.05 inch) on the bottom side of the PCB for the pins of the XCS</u>.



CONTROLLED EXHAUST SYSTEM (AIR ONLY OR OVENS EQUIPPED WITH AIR SWITCHING)

CONTROLLED EXHAUST SYSTEM (CES) (Air Mode)

This exhaust subsystem extracts heated gas directly from the oven chamber between the last heating zone and the first cooling zone, minimizing the amount of heat and flux entering the cooling section of the oven. The result is product cooling improvement and maintenance reduction in the Air Mode. It generates a controllable, positive exhaust flow and does not depend on the facility exhaust for its operation.
A small amount of compressed air flows through a Venturi (mounted inside the *Controlled Exhaust Tube*) and creates a negative pressure at the CES slot in the oven chamber. This draws gas out of the Oven Chamber. The oven chamber exhaust flow rate is controlled by the amount of air supplied to the oven.
The cooling effect of the incoming compressed air causes an accumulation of flux condensate in the exhaust nozzle.
***The nozzle requires periodic cleaning*.**



INDIVIDUAL CELL INLETS

The “makeup” gas to replace the exhaust flow is supplied by the gas intakes of the individual Zones (cells).
Additional “makeup” enters the oven chambers at the “onload” and “offload” openings.
The CES system is not used with N2 to minimize nitrogen consumption.

INTEGRATED exhaust STACK FILTER

The Integrated Exhaust Stack Filter is:

☐ Standard, (installed on all ovens) ☑ An option, (NOT installed on all ovens)

PURPOSE:

To capture and dispose of the byproducts of SMT reflow by condensing and filtering the oven exhaust.

APPLICATION

The Integrated Exhaust Stack Filter option is a simple filtering method for capturing and disposing of many of the by-products of the Surface Mount Reflow Process. The Integrated Exhaust Stack filter consists of two filters in metal enclosure. The enclosure has an inlet and a connection point for a factory exhaust duct. There is an access door for changing the disposable filters.

The introduction ambient room air powered by the facility exhaust accomplishes condensation. The hot gas exhaust stream from the FFC system is routed to the intake tube of the filter enclosure where it is mixed with several streams of ambient air. The cooling effect of the room air streams causes flux and other outgassed contaminants to condense in the exhaust stream as it enters the box, but prior to passing through the filter. Contaminants are trapped in the filter, and the cleaned gas continues out the exhaust duct.

BENEFITS

- Flux and other out-gassed contaminants are captured in an easily changed, disposable filter.
- Provides increased protection of the facility exhaust system from contaminants.
- Totally within the overall footprint of the Reflow Oven.
- Inexpensive locally available filter

MAINTENANCE:

Filter change interval is approximately every 2 weeks, but is throughput and paste dependent.
Filter change requires 1 minute or less
Filter Enclosure cleaning interval is approximately every two months, but is throughput and paste dependent.

Note: The contaminants caught by the filters are hazardous waste. Proper disposal techniques should be followed. The filter contaminants are paste and product dependent. Refer to the paste specification for more information.

<u>Wear latex gloves, eye protection and breathing protection when changing filter.</u>

<u>Filters:</u>

Part # D1481601 Filter 500x250x24 Polyester
Part # D1481701 Filter 500x250x24 Sep Pleated
Part # D3176201-A, Contains 12 of each filter

FLUX EVACUATION SYSTEM   (FLUX FLOW CONTROL™)

The Flux Evacuation System is:

☐ Standard, (installed on all ovens)   ☑ An option, (NOT installed on all ovens)

NOTE: The Flux Evacuation System is STANDARD on all N_2 Ovens

PURPOSE

The Vitronics Soltec Flux Evacuation System is designed to reduce the flow of flux fumes into the cool zones of the tunnel, resulting in longer maintenance intervals.

APPLICATION

The Flux Evacuation System is the standard gas management system on Vitronics Soltec ovens equipped with the Nitrogen option.   This configuration is best suited for applications running nearly exclusively nitrogen recipes. The oven is setup to minimize tunnel maintenance, optimize nitrogen performance, minimize O2 levels, and minimize N2 consumption.

BENEFITS

The XPM3m series Flux Evacuation System is designed to inhibit the flow of hot flux fumes into the cool zones of the tunnel (where they can cause maintenance problems), while still optimizing nitrogen performance. This control of gas flow insures a cleaner cooling zone with maintenance intervals significantly increased. Although widely varying process parameters will cause individual maintenance intervals to differ, an average expectation should be up to 8 times less frequent.

The Flux Evacuation System has secondary benefits. In all applications, there should be a noticeable reduction in cooling zone temperatures. Actual reductions will, of course, be dependent on individual process parameters. The Flux Evacuation System will not adversely effect nitrogen consumption or 02-PPM levels, as specified by Vitronics Soltec for XPM3m series ovens.

It is important to be aware that fan speed settings lower than 2500 RPM will disable the Flux Evacuation System and will increase flux contamination in the oven

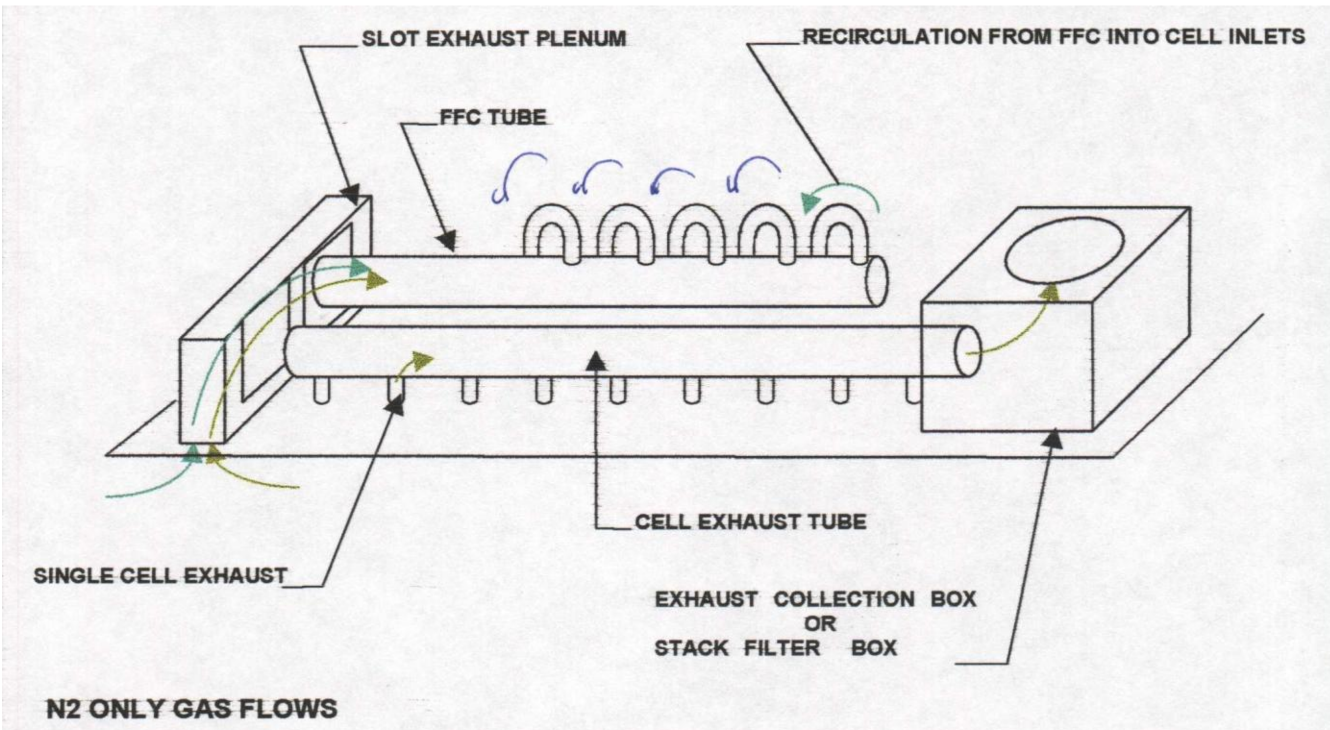
MAINTENANCE

The Flux Evacuation System is virtually maintenance free if operating properly. To ensure this, it is recommended that the inlet tube from the Flux Flow Control manifold into zone 2 be checked periodically (every three months) for flux residue. If a flux accumulation is noticed, the flux evacuation manifold may need to be cleaned.

FUNCTION OF THE FLUX EVACUATION SYSTEM (FLUX FLOW CONTROL™)

N2 Mode -

The Flux Flow Control Manifold creates a recirculation loop by drawing gas from the tunnel into the controlled exhaust plenum between the last heat and first cool zones, and returning it to the preheat and soak zones through several of the patented individual cell inlets. The force powering this recirculation loop is low pressure at the cell inlet, created by the cell fan. There are no moving parts to this system.

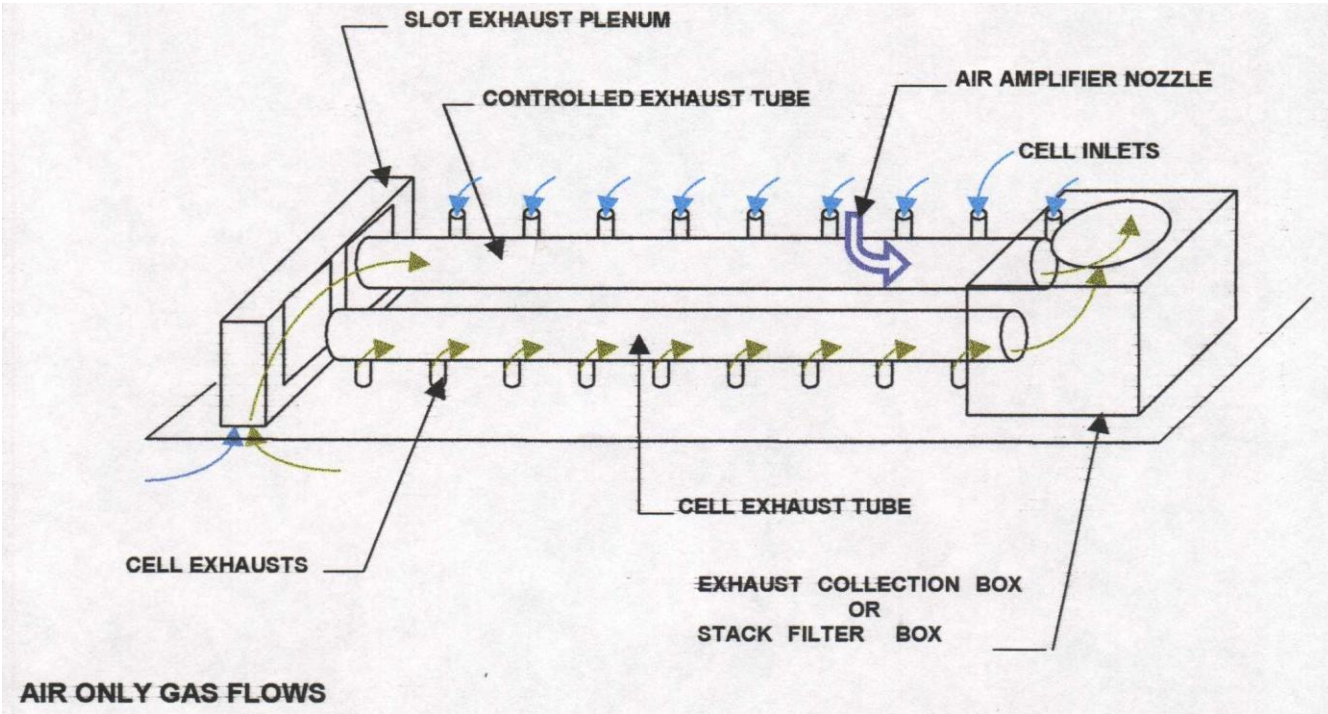


Flow into the controlled exhaust plenum is biased in favor of drawing from the cool zone side. This is accomplished by raising the pressure in the cool zone (by inputting a high percentage of the total oven nitrogen consumption into that area), and by reducing the pressure in the last heated zone (by fully opening the individual cell outlet.) The total oven exhaust is taken from this one port.

The recirculation loop carries low O2 PPM gas from the first cool zone, into the preheat and soak sections of the heated zone, maintaining low O2 PPMs throughout the tunnel. The recirculation loop carries out flux contaminants trying to enter the cooling zones. The higher pressure in the cooling zones inhibits the migration of flux contaminants from the heated zones. The amount of flow into the controlled exhaust from the last heated zone is at a rate that will maintain the total recirculation loop gas temperature above 120°C, which prevents condensation.

Exhaust flow out of the oven is maximized in volume, and also positioned in the tunnel at the point of highest flux concentration (the last heated zone), to maximize the amount of flux contaminant per cubic foot of exhaust.

AIR MODE-

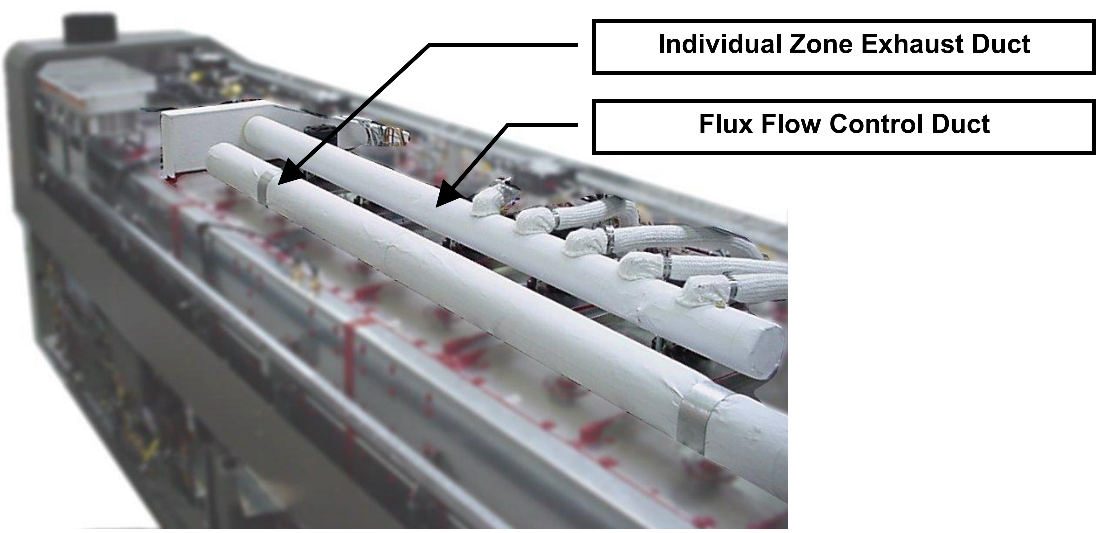


The N2 solenoid and the Compressed Air Solenoid will toggle, following the selection of an Air profile by the operator. <u>All gas flows in the oven remain identical to the N2 Mode, except that Nitrogen is replaced with compressed Air</u>. Flow ratios and all other process parameters remain identical.

MAINTENANCE

The Flux Flow Control system is virtually maintenance free if operating properly. To ensure this, it is recommended that the inlet tube from the Flux Flow Control manifold into zone 1 be checked periodically (every six months) for flux residue.

The Flux-Flow Control System is located under the sheet metal skins at the top of the Oven:

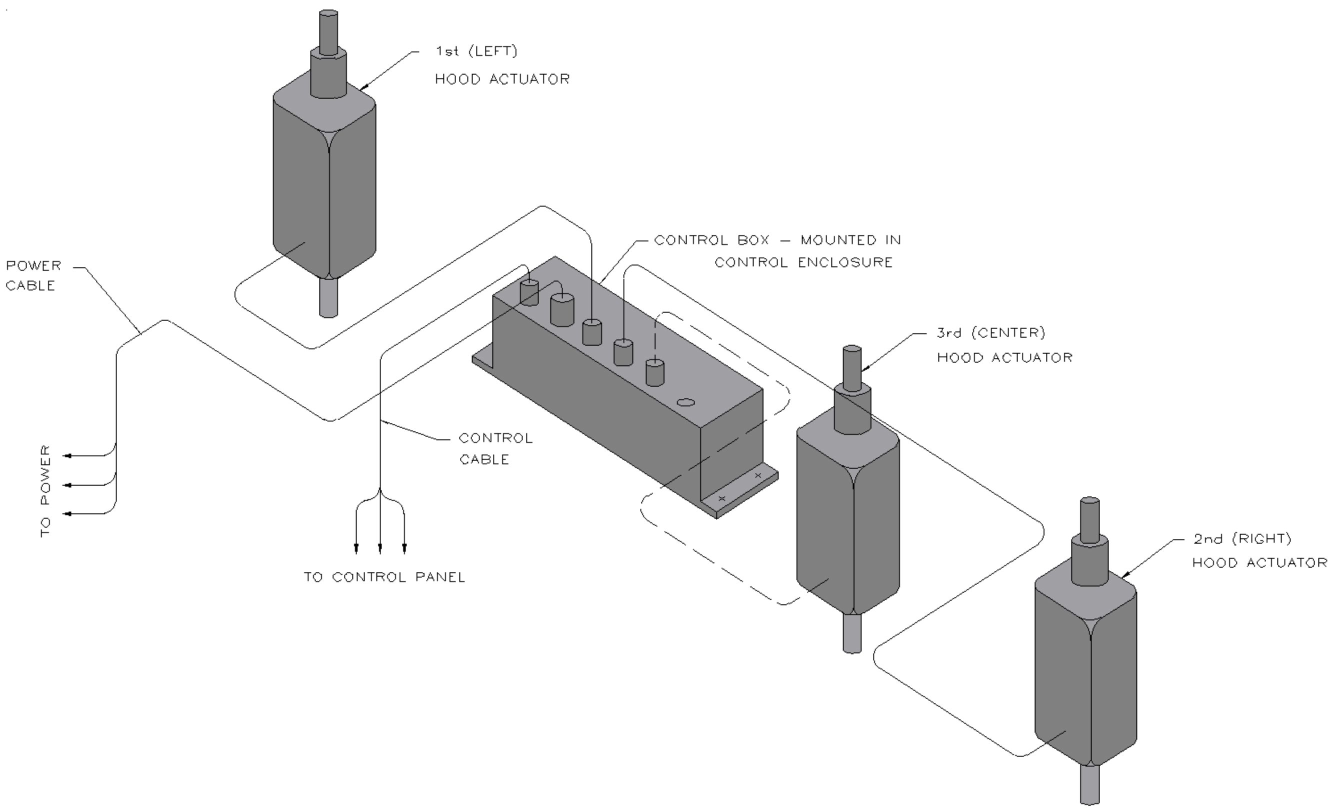


HOODLIFTS

☑ Standard, (installed on all ovens) ☐ An option, (NOT installed on all ovens)

Operation;

The electromechanical actuators raise and lower the Hood (including the upper heat zones of the oven). All models of Vitronics Soltec Reflow Ovens have 2 or 3 (depending on oven size) LINAK hoodlift Actuators with a LINAK control box directly wired to the HOOD UP and HOOD DOWN selector switch on the oven operator control panel. The general arrangement of the LINAK Actuators is shown here. A UPS option is available to permit opening the Oven Hood in the event of a power failure.

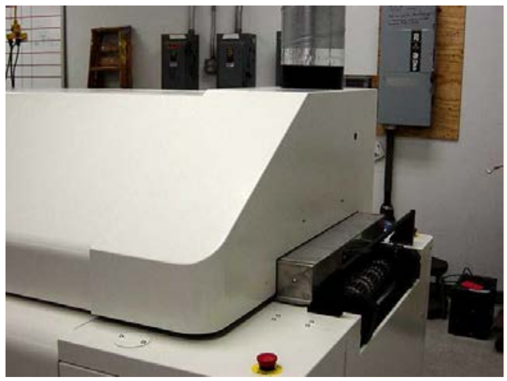


ACTUATOR REMOVE AND REPLACE PROCEDURES

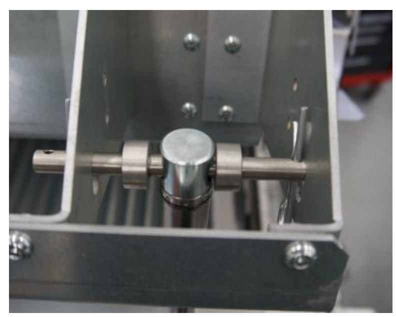
Removing the actuator assembly when the actuator has failed in the open position:

Stack wooden blocks/boards under the hood (where the actuator is connected to the hood), to keep the hood open when the actuator is removed. Be careful to make the stack of wood stable.

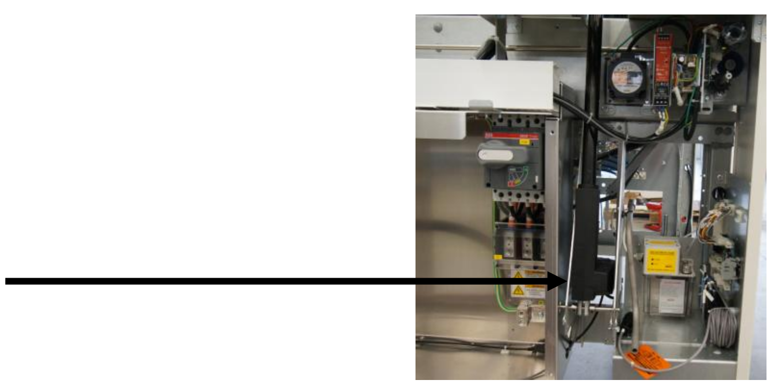
Remove the bonnet bridge sheet metal piece on the end of the oven where the actuator will be changed.



Remove the two safety clips from the pin holding the actuator piston to the bracket. Remove the piston pin holding the actuator piston to the bracket. You may need to exert some pressure on the inner hood assembly to remove the pin.



The body of the actuator is accessed through the equipment cabinets on each end of the oven.



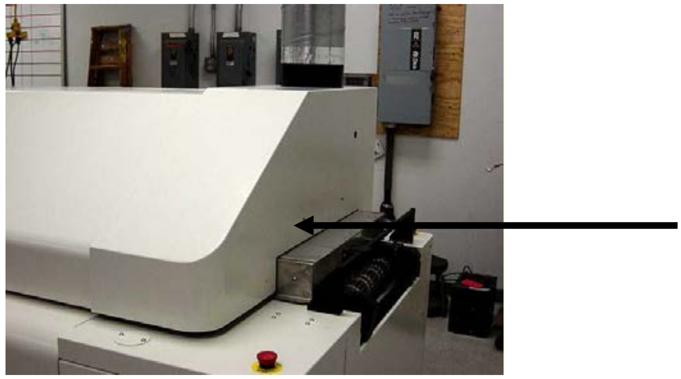
Unplug the actuator from the control box and remove the actuator cable with the actuator.

Remove the two safety clips from the pin holding the actuator piston to the bracket. Remove the piston pin holding the actuator piston to the bracket.

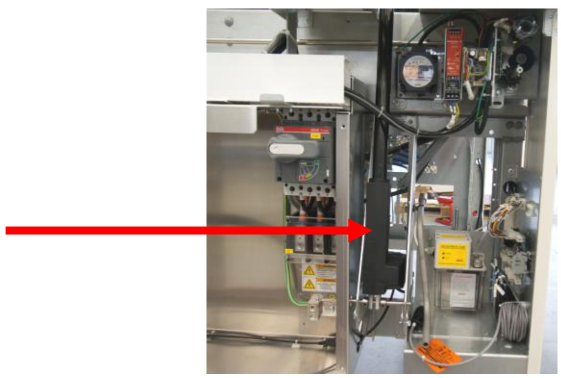
The installation procedure is the reverse if the removal procedure.

REPLACING THE ACTUATOR ASSEMBLY WITH THE BONNET IN THE CLOSED POSITION:

Remove the bonnet bridge sheet metal piece on the end of the oven where the actuator will be changed.



The body of the actuator is accessed through the equipment cabinets on each end of the oven.



Carefully raise the actuator and position it in its frame location. Use the mounting pin to lock the piston in place in the bracket. As you are pushing the mounting pin into place, install the locking shaft collars on each side of the piston. Replace the two safety clips on the mounting pin. Let the actuator hang from the mounting pin.

Carefully position the actuator so that the holes for the actuator pivot pin are aligned with the holes in the side of the actuator sheet metal. Insert the actuator pivot pin. As you are pushing the mounting pin into place, install the locking shaft collars on each side of the piston. Replace the two safety clips on the mounting pin. Let the actuator hang from the mounting pin.

Plug the control cable of the new actuator to the control box. Turn power on to the oven so the actuator can be operated. Perform the actuator set-up and synchronization at this time.

The installation procedure is the reverse of the removal procedure.

SET-UP AND SYNCHRONIZATION OF THE LINAK ACTUATORS:

The actuators are installed and synchronized on the oven when it is built.

Caution Notes:
The following process is used for two or three actuators on the same oven, and is required only after replacement of an actuator or control box, or if an actuator is out of adjustment.

1. ***Do not turn the spindle while the actuator is plugged into the actuator control box*****.** This will send erroneous pulses to the control box causing misalignment and possible damage to the system. For initial factory set-up or field replacement, the spindle may be turned no more than three revolutions to align the clevis pin hole to the bracket. This must only be done when the actuator is unplugged from the control box.

2. Do not unplug the actuator from the control box during operation or in an attempt to adjust or synchronize the actuators. This will cause misalignment resulting in possible damage to the system.

3. Raising or lowering one side of the heat zone more than the prescribed distance may cause structural damage to the system.

TWO ACTUATOR SYSTEM

The following initialization procedure applies to a two actuator system and requires two people to complete it:

1. With the bonnet in the down position and the actuators properly connected mechanically and electrically, raise the heat zone no more than 1" (25mm).

2. Disconnect the power to the control box by shutting off the circuit breaker (F52) for at least 5 seconds.

3. On the operator control panel, turn the Hood selector switch to the DOWN position and hold while reconnecting the main power to the actuator control box. Listen for a buzzing sound coming from the control box. At this point the hood selector switch will activate the LEFT actuator and lower the heat zone on that side.

4. Keep the hood selector switch engaged making sure the left actuator pulls the main heat zone down tightly against the lower channel, then release the hood selector switch.

5. Disconnect the power to the control box again by shutting off circuit breaker (F52) for at least 5 seconds

6. On the operator control panel, and turn the hood selector switch to the UP position and hold while reconnecting the main power to the actuator control box. Listen for a buzzing sound coming from the control box. At this point, the hood selector switch has been used to activate the RIGHT actuator causing it to raise the heat zone on that side. Once you notice the right side rising slightly, immediately turn the selector switch to the DOWN position and lower the heat zone completely. **Caution:** Moving the heat zone any more than the prescribed distance may cause structural damage to the system.

7. Keep the hood selector switch engaged making sure the right actuator pulls the main heat zone down tight against the lower channel, and then release the hood selector switch.

8. Disconnect the power to the actuator control box again by shutting off circuit breaker (F52) for at least 5 seconds. The initialization process is now complete.

THREE ACTUATOR SYSTEM

The following initialization procedure applies to a three actuator system and requires two people to complete it:

1. With the bonnet in the down position and the actuators properly connected mechanically and electrically, raise the heat zone no more than 1” (25mm).

2. Disconnect the power to the control box by shutting off the F52 circuit breaker for at least 5 seconds

3. On the operator control panel, turn the hood selector switch to the UP position while reconnecting the main power to the actuator control box. Listen for the buzzing sound coming from the control box. At this point turn the hood selector switch to the DOWN position; this will activate all three actuators to the DOWN position.

4. Keep the hood selector switch engaged making sure that each actuator pulls the main heat zone down tightly against the lower channel, then release the hood selector switch.

5. Disconnect the power to the control box again by shutting off the F52 circuit breaker for at least 5 seconds. The initialization process is now complete.

Periodic Inspection and Maintenance:

Clean the piston rod in the fully extended position and inspect for mechanical wear or damage. Inspect the attachment points, wiring, plugs, and control box. The LINAK actuator is an enclosed unit and does not require any internal maintenance or lubrication.

Troubleshooting:

Symptom: No motor sound or movement of piston rod.

Possible Cause:

1. The actuator is not plugged securely into the control box.
2. Blown fuse in the control box.
3. Cable damage.

Symptom: Movement of actuators not synchronized.

Possible Cause: Control box out of initialization.

INDEPENDENT ALARM SCANNER OVER-TEMP & ALARM/SHUTDOWN

The Independent Alarm Scanner is:

☐ Standard, (installed on all ovens) ☑ An option, (NOT installed on all ovens)

DESCRIPTION:

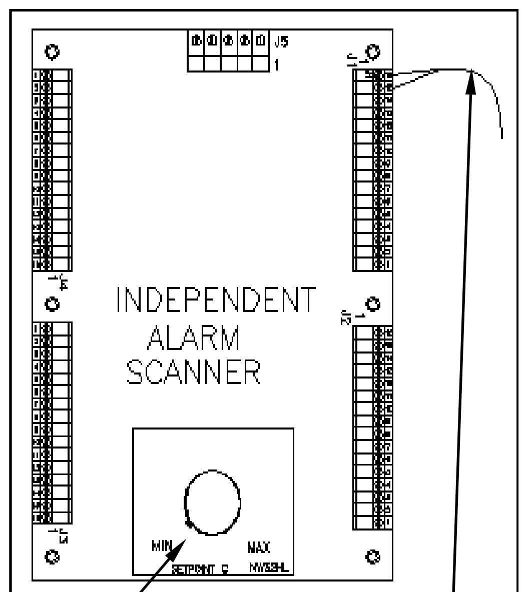
The Independent Alarm Scanner & Alarm/Shutdown (IAS) system provides a redundant temperature backup system in the event that a heating cell exceeds the critical temperature safety limit. The hardware consists of one (1) additional thermocouple per heat cell, and the Independent Alarm Scanner (IAS) instrument, which can monitor as many as 32 thermocouples.
A second type K thermocouple is clamped on the face of every addition to the standard *T/C*
The **I**ndependent **A**larm **S**canner (**IAS**) receives each of these thermocouple signals as separate inputs and scans them for an over-temperature indication.

<u>The control circuit inter-action is:</u>

In the event that an alarm condition (generated from the Redundant T/Cs) occurs, the IAS' alarm contact interrupts the 24 VAC to relay K4. This in interrupts the 120 VAC to the coil of heater contactor K2, and supplies an alarm signal to the controller. The IAS unit scans all redundant thermocouples wired to it for an "Over-temperature" condition.

<u>Notes:</u>

⇒ All unused T/C terminals MUST be jumpered.
⇒ In case of a nuisance trip, the defective T/C can be found by placing a jumper on the T/Cs one-at-a-time until the "alarm" is eliminated.
⇒ The setpoint should be set slightly higher than the temperature expected during "normal oven operation".
⇒ The IAS will go into an alarm state in case of an IAS failure or loss of power. A jumper on the output contacts will allow the oven to be operated without the IAS until a replacement can be installed.



INDIVIDUAL CELL SENSING

Individual Cell Sensing and Alarm is**:**

☐ Standard, (installed on all ovens) ☑ An option, (NOT installed on all ovens)

DESCRIPTION:

The Individual Cell Sensing Option monitors for a cell fan motor failure or a heating cell over-temperature switch failure.

Each Cell Fan Motor has a speed sensor mounted on the end of the motor shaft. When a motor slows to less than 500 RPM, the sensor sends a signal to produce the Fan Low Alarm. . When a low fan speed warning exists, an alarm message indicating the specific failed fan motor is displayed in the oven software. (Check the heat slinger on the suspect motor to determine actual fan operation.)

Each heating cell is equipped with a bimetallic over-temperature switch mounted on the backside of the heater panel. When the cell temperature exceeds the switch temperature, the internal contacts open. This will interrupt the 3- phase power to the heaters, and a signal is sent to the Oven Controller to indicate an "over-temperature" condition. This will generate an IAS alert alarm message along with an alarm message that corresponds to the cell location that generated the alarm.

General

Cell sensor monitoring only takes place when the cell fans are running to avoid nuisance alarms due to the limitations of the existing controller. The IAS alarm level setting must be set for an alarm level other then critical in order to sense and report individual temperature switch alarms. This is because a critical alarm level setting will cause the cell fans to shut off immediately when an alarm occurs with a critical alarm level setting.

INDIVIDUAL CELL SENSING - CELL MOTOR SENSORS

Disconnect the following cell motor sensors one at time by unplugging connector P2 (E1479503 3 position connector) on the corresponding E3152701 cell interface board with the cell fans running above 100 rpm.
Install a 3-pin connector (E1479503) with a jumper installed between pin 2 and pin 3 of the connector in place of the cell motor sensor to force a cell fan alarm.
Verify that each alarm message is displayed on the PC and that the alarm message text corresponds to the cell location with the alarm. It takes up to 68 seconds for an alarm condition to be detected and reported on the PC.

Inversely, removing the wire from P2-2 will remove a sensor failure indication.

This test verifies that each E3152202 board is configured correctly and is communicating correctly with the DI board.

E3152202 Board#	Model 520	Model 730/820	Model 940/1030	Model 1240
Master	Zone 1 Top	Zone 1 Top	Zone 1 Top	Zone 1 Top
Board 2	Zone 1 Bottom	Zone 1 Bottom	Zone 1 Bottom	Zone 1 Bottom
Board 3		Zone 10 Top	Zone 13 Top	Zone 16 Top
Board 4		Zone 10 Bottom	Zone 13 Bottom	Zone 16 Bottom

INDIVIDUAL CELL SENSING -CELL OVER TEMPERATURE SWITCHES

Preliminary Testing

Verify continuity of the heater over temperature switch circuit from wire number 2400 on zone 1 top to the coil of K4 on the back panel.
Verify that the harness wiring is correct on connector P3 (E1479508 8 position connector) of each E3152701 cell interface board by unplugging the heater over temperature switch connector P1 (E1479502 2 position connector) on each cell interface board.
The red led on each cell interface board will light when the heater over temperature switch connector is unplugged to the board. If the red led fails to light and continuity is OK in the heater over temperature switch circuit then the wires are reversed in position 1 and 2 of connector P3.

Alarm Testing

Disconnect the following heater over temperature switches one at time by unplugging connector P1 (E1479502 2 position connector) on the corresponding E3152701 cell interface board.
Verify that each alarm message is displayed on the PC and that the alarm message text corresponds to the cell location that has the alarm. It takes up to 68 seconds for an alarm condition to be detected and reported on the PC.
Verify that an IAS alert alarm message is present, which indicates that K4 on the back panel is shutting off when a heater over temperature switch is opened.

This test verifies that each E3152202 board is configured correctly and is also communicating correctly with the DI board and that relay K4 on the back panel shuts off when a heater over temperature switch is opened.

E3152202 Board#	Model 520	Model 730/820	Model 940/1030	Model 1240
Master	Zone 1 Top	Zone 1 Top	Zone 1 Top	Zone 1 Top
Board 2	Zone 1 Bottom	Zone 1 Bottom	Zone 1 Bottom	Zone 1 Bottom
Board 3		Zone 7 Top	Zone 9 Top	Zone 12 Top
Board 4		Zone 7 Bottom	Zone 9 Bottom	Zone 12 Bottom

E3152202 Assembly 16 Channel Input Board Theory of Operation

The Atmel Atmega8 micro-controller is the main component on the board. The Atmega8 has one built in UART. The UART is used to communicate to an RS485 connection on a multi-drop network through MODBUS protocol.

The RS485 port is not used directly with the existing controller since the existing controller does not have additional serial ports available. Instead a frequency generator output from the micro-controller is used on the controller that is set as the Master through switch 4 of dip switch S1 to communicate digital input status data to the existing controller through using a counter input on the existing controller. The frequency generator output is derived by using the timer/counter compare output of timer 1 of the Atmega8 micro-controller.

The master controller initiates MODBUS commands to up to three other E3152202 boards connected on a RS485 network to gather digital input status information from each board. The master controller transfers digital input status information for itself and for up to three other E3152202 boards using a digital input handshake with the existing controller. The frequency generator output transfers digital input status data as one nibble at a time (4 bits) to a counter input on the existing controller. There is a special frequency output setting that serves as an identity stamp to mark the very first nibble of the possible 16 nibbles that are sent. The existing controller momentarily sets a digital output that is connected to a digital input on the E3152202 board serving as a Master. This is to signal that a frequency has been read correctly and to prompt the Master to send the data for the next nibble or the identity stamp depending on where the Master controller is in the send sequence. The existing controller checks the counter input once a second and signals the Master to send data for the next nibble when the past and current counter values are equal, which is typically 4 seconds. It takes 68 seconds to transfer all of the digital input status information for four E3152202 boards.

Table 1.0

Board	S1 Dip Switch Settings				Description
	Switch 1	Switch 2	Switch 3	Switch 4	
Master	OFF	OFF	OFF	ON	Board address offset 0, board functions as a master on a MODBUS network and initiates MODBUS commands to other boards on the network
Board 2	ON	OFF	OFF	OFF	Board address offset 1, board functions as a slave on a MODBUS network
Board 3	OFF	ON	OFF	OFF	Board address offset 2, board functions as a slave on a MODBUS network
Board 4	ON	ON	OFF	OFF	Board address offset 3, board functions as a slave on a MODBUS network

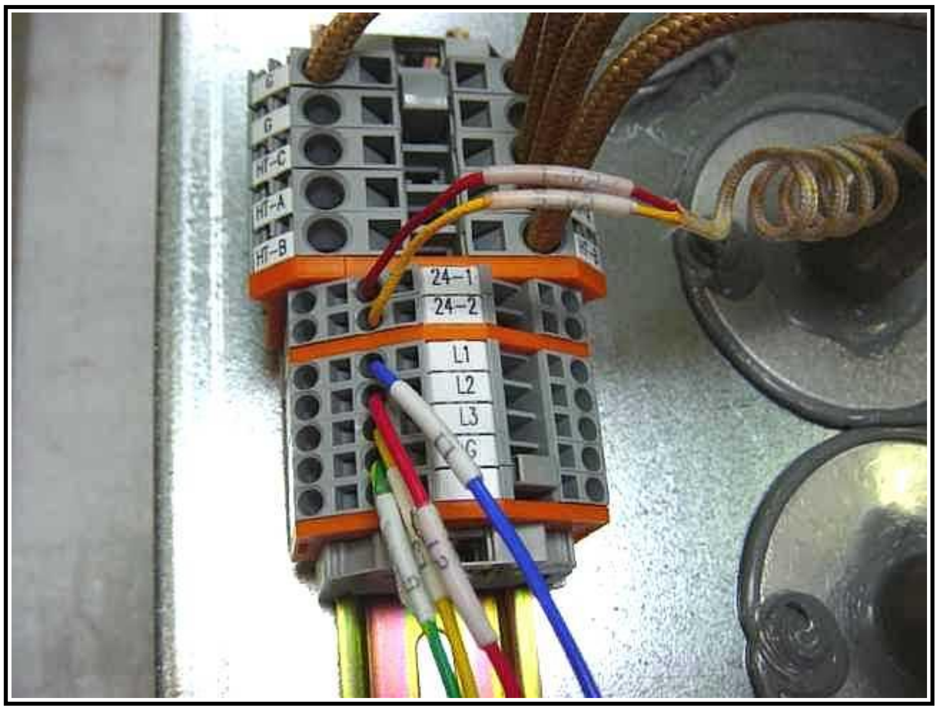
HEATER CELL OVER-TEMPERATURE SWITCHES

Heater cell over-temperature switches are:

☑ Standard, (installed on all ovens) ☐ An option, (NOT installed on all ovens)

DESECRIPTION:

Each heating cell is equipped with a bimetallic over-temperature switch mounted on the backside of the heater panel. When the cell temperature exceeds the switch temperature, the internal contacts open. This will interrupt the 3- phase power to the heaters, and a signal is sent to the Oven Controller indicating an "over-temperature" condition. This will generate an IAS alert alarm message.
<u>This system generates only an IAS alert alarm message and will not indicate the cell location that generated the alarm.</u> The faulty cell must be found by diagnostically testing the functions of the cell over-temperature switches, looking for either continuity (machine power removed) or voltage loss across the switch.



On the back (top / bottom side) of each heater cell is a terminal block assembly.
Check for either continuity or +24 VDC between terminals 24-1 and 24-2. To read continuity machine power must be completely disconnected.
To read voltage place the positive lead in terminal 24-1 and the negative lead in ground to verify input voltage to the switch. If input voltage is present, then move the positive lead to terminal 24-2. If there is no voltage present, the switch is open. If the switch continuity or voltage checks are good, then move on to the next switch. Is it easiest to start at the last heat zone on the top and then divide the machine in half for each subsequent check. If the last top heat zone switch checks good, move directly to the bottom heat cells.

LIGHT TOWER ☐ Standard, (installed on all ovens) ☑ **An option, (NOT installed on all ovens)**

State	Description
Off	A Light remains constantly off
On	A Light remains constantly on
Flash	A Light cycles on and off proportionally once per second
Blink	A Light cycles on and off proportionally twice per second
Alt Flash	A Light cycles on and off once a second inverse to Flash, i.e. the opposite state of flash to allow 2 or more lights to alternately cycle back and forth instead of being activate at the same time
Alt Blink	A Light turns on and off twice per second inverse to Blink, i.e. the opposite state of blink to allow 2 or more lights to alternately cycle back and forth instead of being active at the same time

Light Tower Operation in each Oven State

Oven State	State Description	Red Light	Amber Light	Green Light
Standby	The oven is powered, but not running and is below 100C.	Off	Alt Flash	Alt Flash
Shutdown	The oven is above 100C and is in the process of cooling down.	Off	Flash	Off
Cool Down	An operator is in the process of cooling down the oven below 40C instead of 100C.	Off	Flash	Off
Quick Cool	An operator is in the process of cooling down the oven below 40C instead of 100C with the hood open.	Off	Flash	Off
Critical Alarm	An emergency stop related alarm has occurred, all motion is stopped immediately.	Blink	Off	Off
Alarm	An alarm has occurred the heaters are switched off. One of the controlled parameters experienced a deviation beyond its corresponding alarm setting in the active recipe after the oven has reached process ready.	Flash	Off	Off
Warning	One of the controlled parameters experienced a deviation beyond its corresponding warning setting in the active recipe after the oven has reached process ready.	Off	On	Off
Warmup	The oven is in the process of heating up after starting a new recipe or after restarting an existing recipe.	Off	Flash	Off
Countdown	The oven is waiting for an additional time-out after all of the controlled parameters are within limits while heating up. This is to improve stability.	Off	Flash	Off
Ready	The oven is operating normally with all of the controlled parameters within the warning and alarm deviation settings in the current recipe.	Off	Off	On

LIGHT TOWER - Continued

Oven State	State Description	Red Light	Amber Light	Green Light
Setup	The operator is performing a width adjustment or other calibration.	Off	Flash	Off
Burnin	The oven is in an automated test mode and is not available to run product.	Off	Flash	Off
Block & Empty	An alarm with a block and empty action level has occurred after the oven has reached process ready. The oven continues to run for a set time-out while setting the upstream SMEMA to block. After the time-out the oven is switched into the shutdown state.	Alt Flash	Alt Flash	Off
KIC Inhibit Ready (option)	The oven is ready to process product, but the optional KIC system is inhibiting the ready state through software.	Off	Off	Flash

Notes:

An optional blue light follows the state of the nitrogen supply solenoids to indicate when nitrogen is in use.
An optional white light is hard wired and not controlled to indicate control power on.

.

ON-BOARD OXYGEN (O2) ANALYZER

THE ON-BOARD OXYGEN ANALYZER IS:

☐ Standard, (installed on all ovens ☑ An option, (NOT installed on all ovens)

O_2 Analyzer Zr-Ox MKII

DESCRIPTION:

The On-Board O2 Analyzer is a self-contained unit consisting of an oxygen sensor, pump, and power supply, completely integrated with the Reflow Oven. The Analyzer is mounted at the rear of the oven behind the lower skins and near the N2 flow meters.
The oxygen sensor consists of a solid state ion conductor of stabilized zirconiumoxide, which is heated to a constant temperature of 1000 K (727°C). The measured oxygen content is displayed on the face of the Analyzer and on the computer monitor through the Oven Control Program.

PURPOSE:

XPM3m Nitrogen ovens are equipped with a single sampling port located in the peak zone (standard) or a 4 port system (optional) with the ability to sample from the Preheat, Soak, and Reflow zones and Source Gas).
The 4-port option has either a rotary 5-way valve located next to the Analyzer, or a series of solenoid valves that are actived through the oven software to select the location from which the Analyzer sample is taken. These sampling ports are used to determine the oxygen content inside the oven.

APPLICATION:

The Analyzer has controls on its front panel for the operation of the unit. The Analyzer settings should **not** be changed during normal oven operation while using nitrogen as an atmosphere. The Analyzer will continuously sample to provide a real-time measurement of the tunnel atmosphere.

ANALYZER OPERATION

E3152502 ASSEMBLY O2 ANALYZER INTERFACE BOARD THEORY OF OPERATION

The Atmel Atmega161 micro-controller is the main component on the board. The Atmega161 has two built in UARTS. The first UART is used to communicate to an RS485 connection on a multi-drop network through MODBUS protocol. The second UART is used to communicate directly to an O2 analyzer through an RS232 connection.

The RS485 port is not used with the existing controller since the existing controller does not have additional serial ports available. Instead, two frequency generator outputs from the micro-controller are used to communicate O2 analyzer data to the existing controller by using two counter inputs on the existing controller. Using the timer/counter compare outputs of timer 1 and timer 2 of the Atmega161 micro-controller derives the two frequency generator outputs. Timer 1 has 16-bit resolution and is used to send measured value information, while timer 2 has 8-bit resolution and is used to send range and alarm information. The Neutronics model 3100 analyzer has six ranges and automatically changes ranges to measure from 0ppm to 100% concentration.
Dipswitch 4 on S1 is used to enable the use of the two frequency generator outputs through software when the switch is set to the ON position.
Oxygen analyzer related parameters in the recipe editor are not displayed when the atmosphere setting is for air on a switching atmosphere oven or on an air only oven. A graphic LED indicator is displayed in the oxygen analyzer field to indicate that the “ready to measure signal” is present from the oxygen analyzer. The oxygen analyzer reading is included in trending and data logging.

COOLING SYSTEMS

XPM3m Cooling Configurations

	Atmosphere		Heat Exchanger		Coolant Supply Type			Coolant Temperature Control
Cooling Option	Air	N2	Tube HX	*Fin HX	Customer Supplied Coolant & Control	Onboard Recirculating System	VS Supplied Chiller	Closed-Loop
AC1	S	-	-	-	-	-	-	-
EC1	-	S	S	O	X	-	-	-
EC2	O	O	O	O	-	X	-	X
EC3	O	O	-	X	-	-	X	X

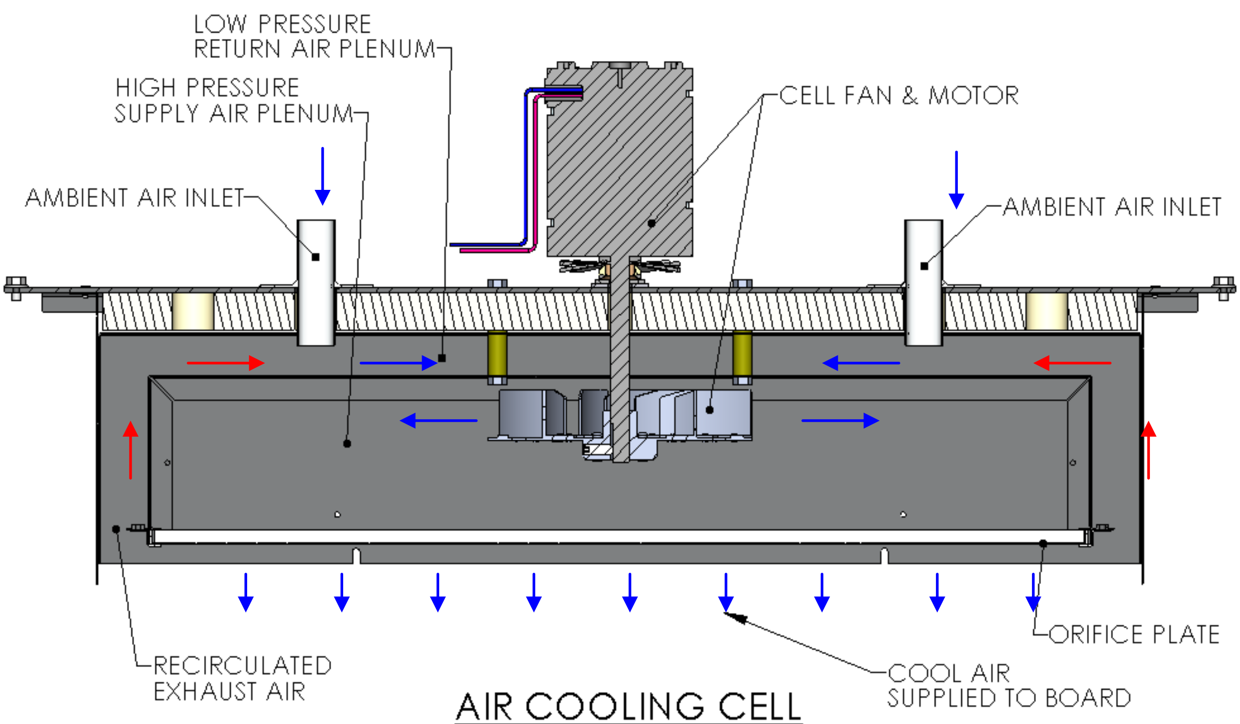
S = Standard feature
O = Optional
- = Not available
x = Provided with feature or option selected
* Fin Type HX provides maximum efficiency

XPM3m AMBIENT AIR COOLING – AC1 OPTION

Description:	Standard on air-only machines
Performance Level:	Entry level
Cooling Medium:	Ambient air
Warnings/Alarms:	None
Controls:	None
Facilities Impact:	None

The cells in the cooling section of the machine allow ambient air to enter via inlets mounted on both top and bottom cells. Air enters the inlets and mixes with the recirculated exhaust air, which in turn lowers the overall cell temperature. The cooler recirculated air is then used to cool boards being processed.

Cooling performance is dependent on ambient air temperatures. It is an uncontrolled system with only a thermocouple mounted in the top cells for temperature monitoring. The amount of cooling is limited and therefore not recommended for customers who have specific cooling requirements.



AIR COOLING CELL
(UPPER COOL CELL SHOWN)

XPM3m HEAT EXCHANGER ASSEMBLIES

The five active XPM3m cooling systems all use air-to-liquid heat exchangers mounted in the upper cool cells. These heat exchangers are used to transfer heat from the tunnel atmosphere into a liquid that can be transported out of the cell and exhausted. The method of transportation and exhaust will depend on the cooling package selected.

TUBE TYPE HEAT EXCHANGER

- Used for basic level cooling systems
- Removable for ease of maintenance
- Valved quick-disconnect fittings to prevent fluid loss
- Interchangeable with fin & tube type heat exchanger

FIN & TUBE TYPE HEAT EXCHANGER

- Used for enhanced level cooling systems
- High efficiency for improved cooling
- Removable for ease of maintenance
- Valved quick-disconnect fittings to prevent fluid loss
- Interchangeable with tube type heat exchanger

The cooling fluid is ***Vitronics Soltec Antifreeze cooling fluid, Part No. C00234 (4 liters)***. During normal operation, the cooling fluid will be warmer than the “dew point temperature” of the room and not warmer than the frame of the oven.

DO NOT SUBSTITUTE ANY OTHER FLUID AS COOLANT IN THIS SYSTEM!

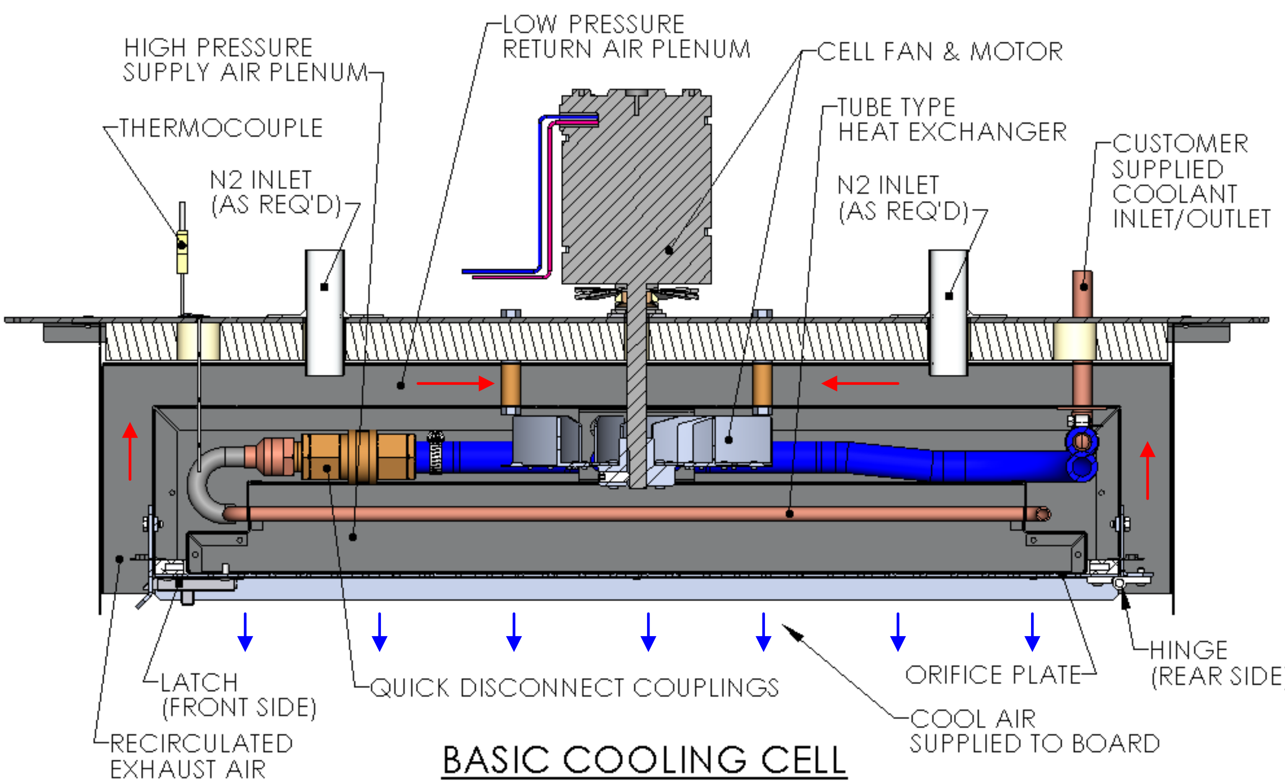
XPM3m BASIC COOLING PACKAGE – EC1 OPTION

Description:	Standard on all machines
Performance Level:	Entry level
Cooling Medium:	Liquid
Warnings/Alarms:	Coolant Low Flow, Coolant High Pressure
Controls:	None
Facilities Impact:	Requires customer-supplied coolant (see Site Prep Manual for specification)

The upper cells in the cooling section are fitted with an internal tube type heat exchanger. Heat is transferred from the recirculated gas to the coolant as the gas flows around the heat exchanger tubes. The heat is then carried out of the tunnel via the customer-supplied coolant.

All upper cool cells are supplied with a hinged faceplate that is opened from the inside of the tunnel for ease of maintenance. The tube type heat exchangers have valved quick disconnect couplings to prevent fluid loss during removal for maintenance.

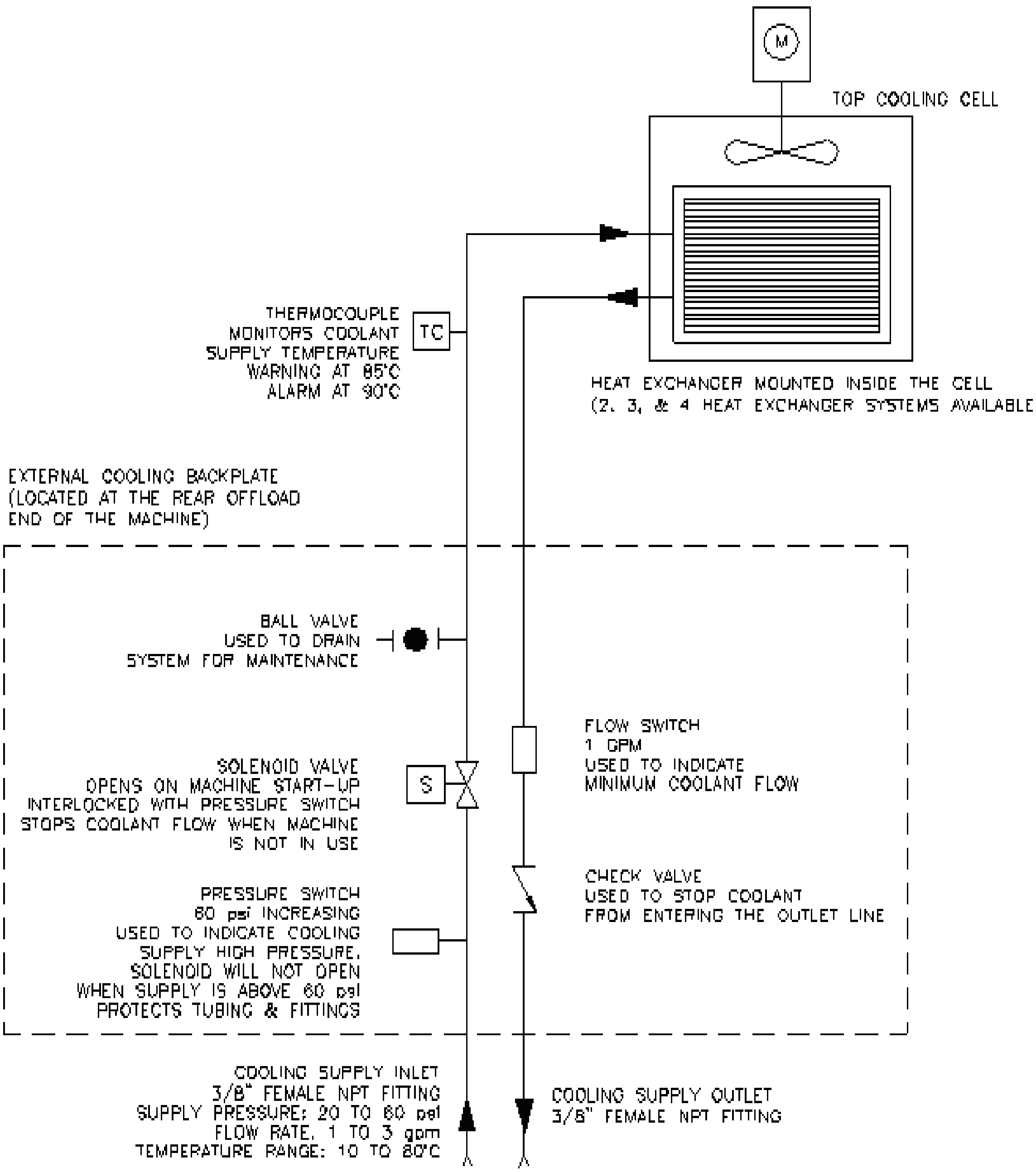
Cooling performance is dependent on the temperature of the customer-supplied coolant. It is an uncontrolled system with only a thermocouple mounted in the top cells for temperature monitoring.



BASIC COOLING CELL

(UPPER COOL CELL SHOWN)

BASIC COOLING PACKAGE COOLANT FLOW DIAGRAM – **EC1 OPTION**



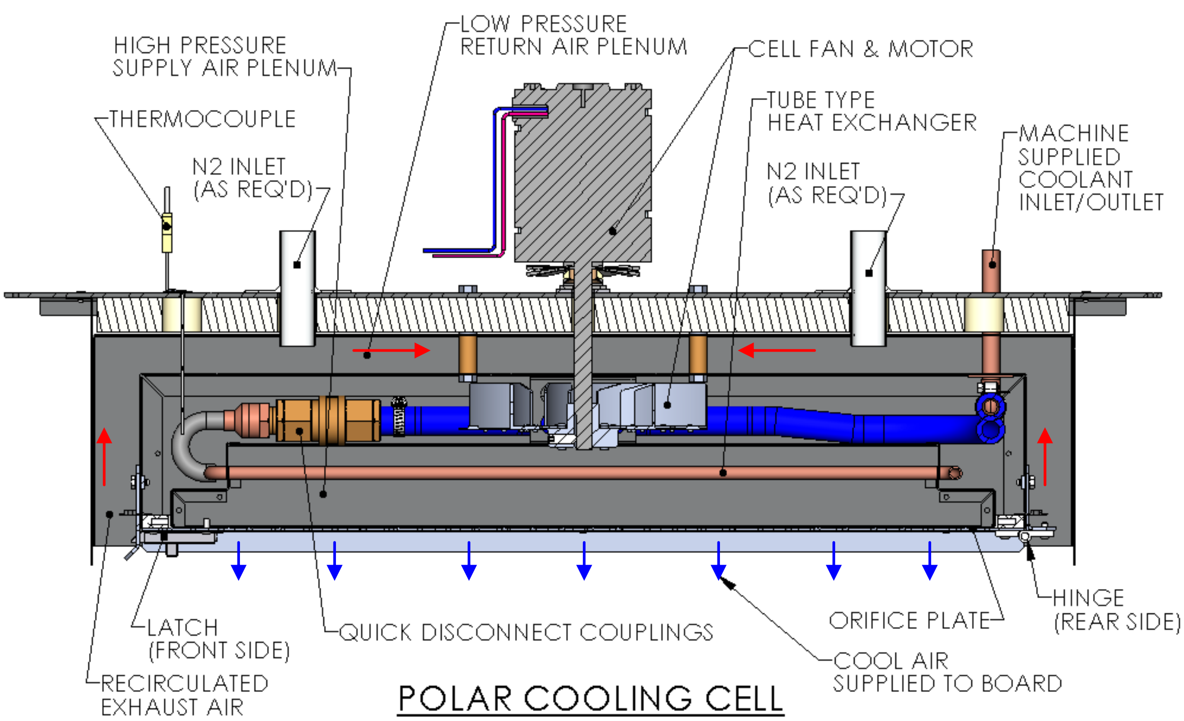
XPM3m EC2 COOLING PACKAGE

Description:	Optional on all machines
Performance Level:	Entry level
Cooling Medium:	Liquid
Warnings/Alarms:	Coolant Low Flow, Coolant High Pressure
Controls:	None
Facilities Impact:	Uses on-board pump & reservoir system, waste heat exhausted through top of bonnet

The Polar Cooling package is optional on N2 systems and is meant to be used for entry level cooling performance. It is similar to the option offered on XPM2 in that it uses an on-board recirculating pump and reservoir to supply coolant to the internal heat exchangers. The heat collected by the internal heat exchangers is exhausted through the top of the bonnet via an externally mounted heat exchanger.

All upper cool cells with heat exchangers are supplied with hinged and latched faceplates that can be opened from the inside of the tunnel. This provides access to remove, clean and maintain the heat exchangers with a minimum of effort.

Cooling performance is dependent on the temperature of the machine-supplied coolant. There is no control over the temperature of the coolant or the cooling cells only a monitoring thermocouple. The heat load of the oven will determine the actual coolant temperature. The more cooling cells there are the higher the coolant temperature will be.



POLAR COOLING CELL
(UPPER COOL CELL SHOWN)

EC2 Cooling Option Reservoir-Pump assembly is mounted on the frame at the rear of the oven.

The reservoir is a 1.6 Gallon(6 Liters) stainless steel tank. The level switch in the reservoir monitors coolant level and the flow switch checks return flow. The high-pressure switch trips at 60 PSI. A periodic check of the coolant level in the reservoir is necessary.

The coolant return line is submerged near the bottom of the reservoir to reduce aeration of the coolant and to help assure condensation of any returning vapor. The supply line to the coolant pump is in the bottom of the reservoir with a valve for draining the system. The check valve in the supply line prevents coolant flow back to the reservoir. It also permits cleaning the in-line strainer without draining the heat exchangers.

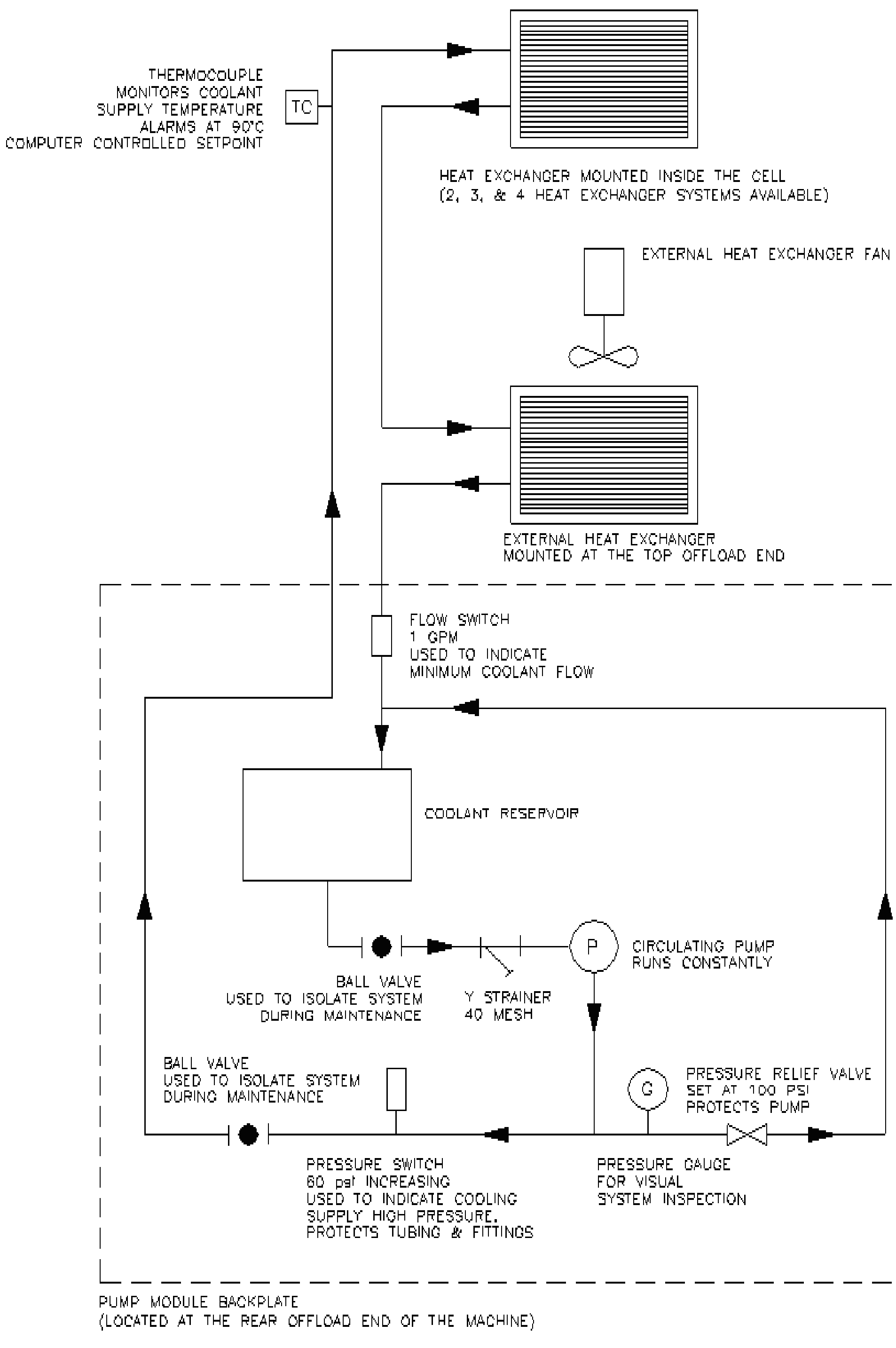
The flow switch and level switch are inputs for the Oven Control Program display of the LOW FLOW - LOW COOLANT alarm.

TESTING:
The motor and supply circuit should be tested. If the Voltage is NOT within the 100 to 120V range recommended, the transformer connections should be changed according to the changeover chart.

1) Allow the motor to reach a stable temperature with the oven hot.
2) The case temperature of the motor should not exceed 80°C. A normal Pump Motor Case temperature is about 70 - 80°C at 115V.
3) The internal temperature cut off switch is set for 150° C. (case temperature about 100° C.)
4) If the motor is over temperature, operating at 100 to 116 VAC, it should be replaced.

FLOW DIAGRAM – EC2 OPTION

The following diagram shows the Polar Cooling™ option configured for an oven with two cooling zones. (Three or four cooling zones would be similar)



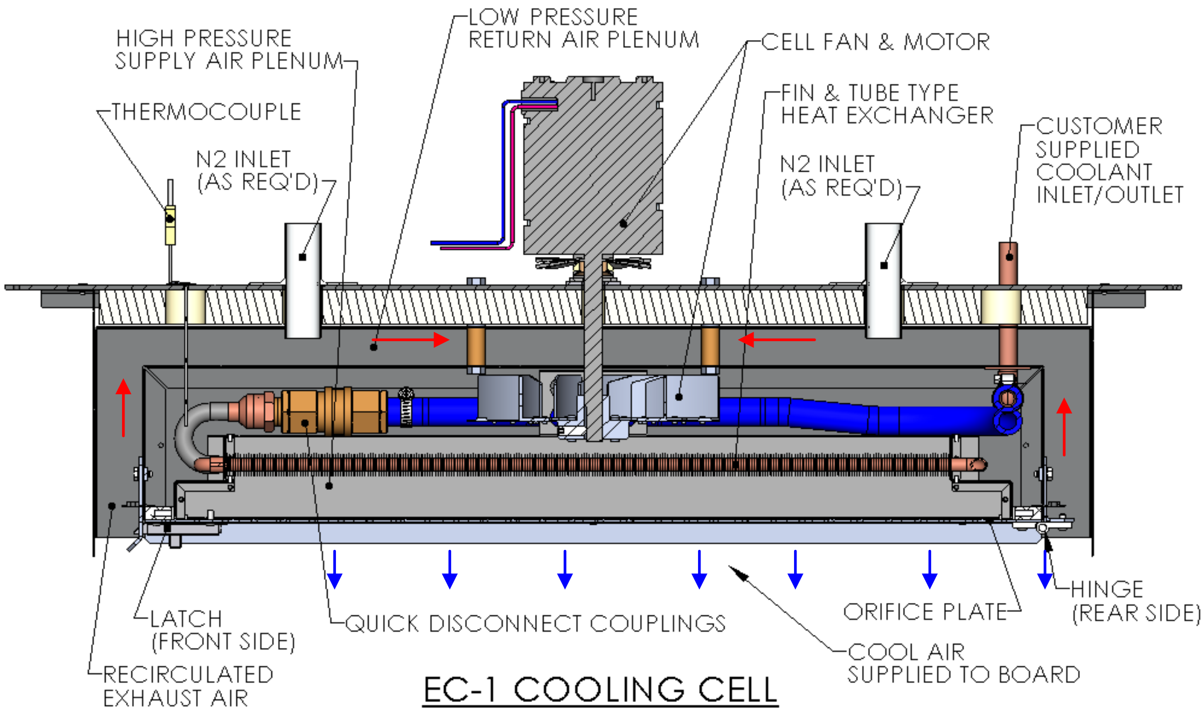
XPM3m ENHANCED COOLING PACKAGE EC-1

Description:	Optional on all machines
Performance Level:	High Efficiency
Cooling Medium:	Liquid
Warnings/Alarms:	Coolant Low Flow, Coolant High Pressure
Controls:	None
Facilities Impact:	Requires customer-supplied coolant (see Site Prep Manual for specification)

The EC-1 Cooling package is optional on N2 machines and is meant to be used for the high end cooling applications. It makes use of an internally mounted high efficiency heat exchanger to remove heat from the tunnel. The upper cells in the cooling section are fitted with an internal fin & tube type heat exchanger. As recirculated gas flows over the fin and tubes a transfer of heat from the air stream to the liquid stream is made. The heat is then carried out of the tunnel via the customer-supplied coolant.

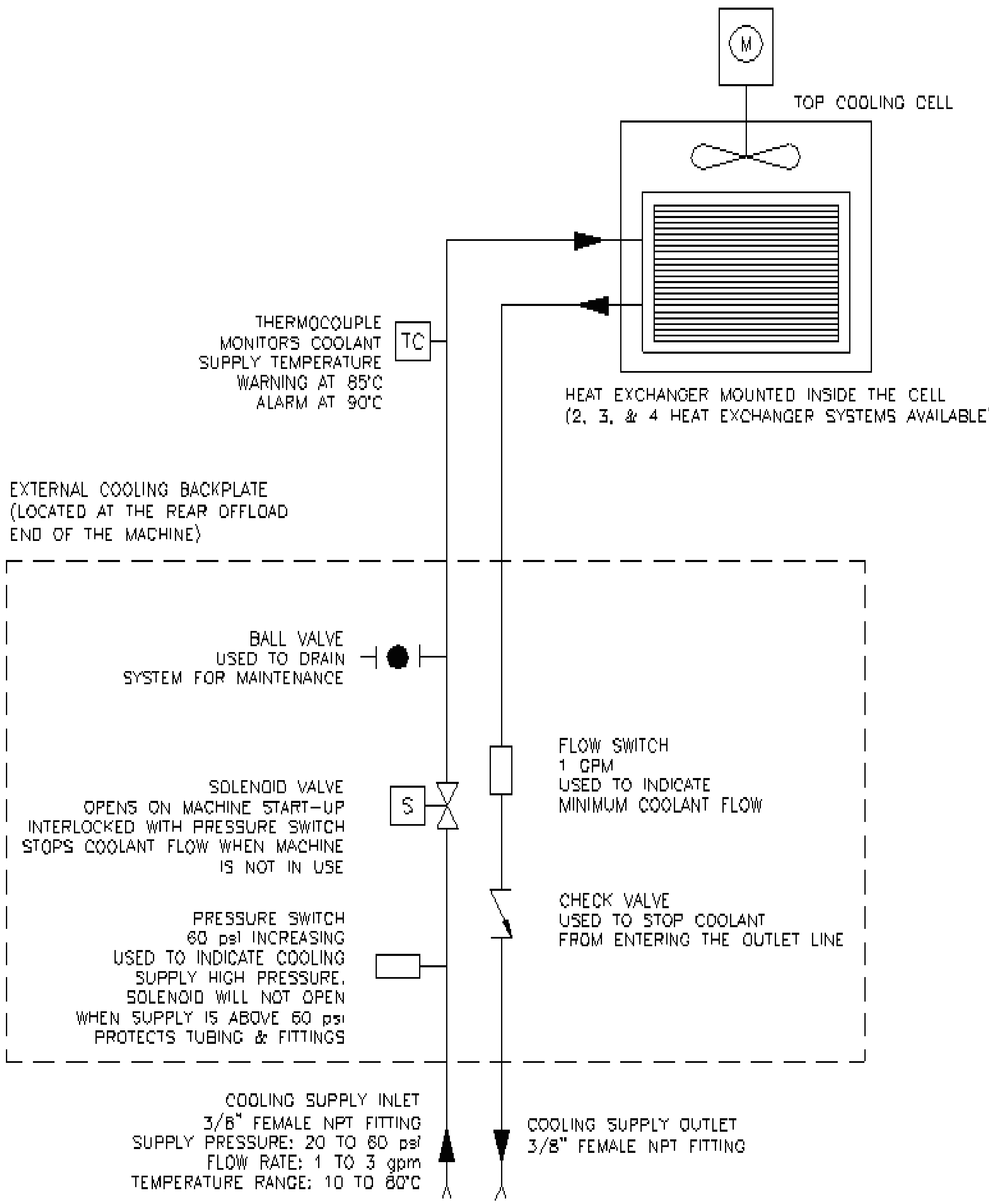
All upper cool cells with heat exchangers are supplied with hinged and latched faceplates that can be opened from the inside of the tunnel. This provides access to remove, clean and maintain the heat exchangers with a minimum of effort.

Cooling performance is dependent on the temperature of the customer-supplied coolant. It is an uncontrolled system with only a thermocouple mounted in the top cells for temperature monitoring



EC-1 COOLING CELL
(UPPER COOL CELL SHOWN)

ENHANCED COOLING PACKAGE EC-1 FLOW DIAGRAM



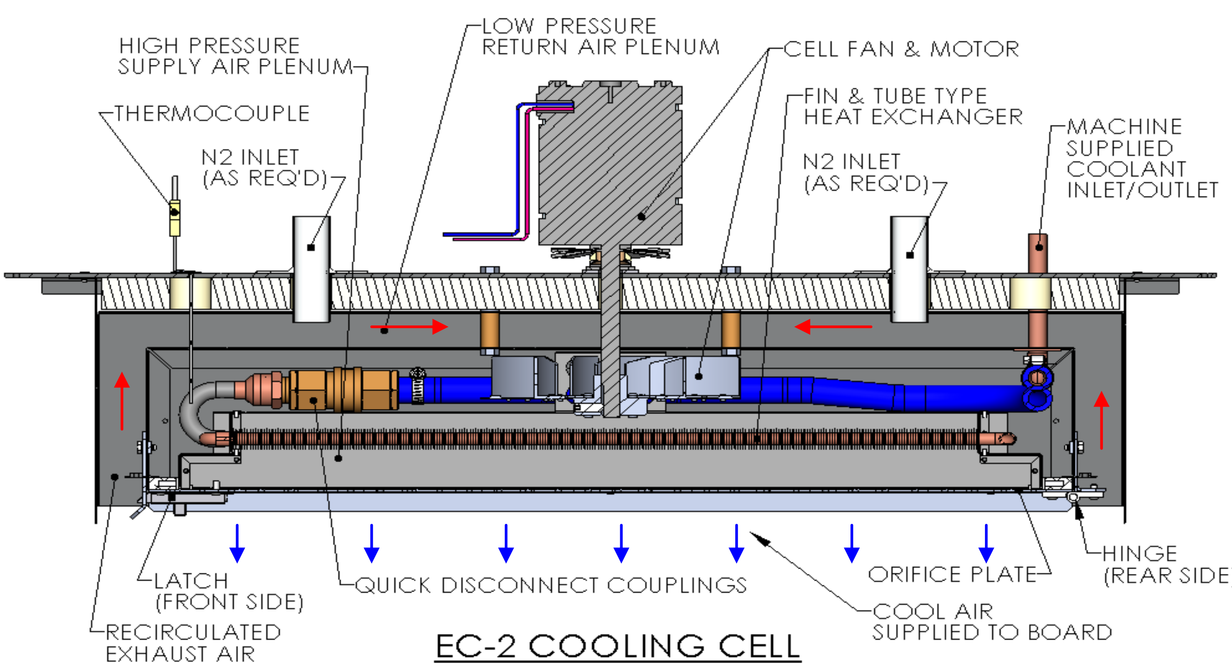
XPM3m ENHANCED COOLING PACKAGE EC-2

Description:	Optional on all machines
Performance Level:	High Efficiency
Cooling Medium:	Liquid
Warnings/Alarms:	Coolant Low Flow, Coolant High Pressure
Controls:	Adjustable coolant temperature
Facilities Impact:	Uses on-board pump & reservoir system, waste heat exhausted through top of bonnet

The EC-2 Cooling package is optional on N2 machines and is meant to be used for the high end cooling applications. It makes use of an internally mounted high efficiency heat exchanger to remove heat from the tunnel. The upper cells in the cooling section are fitted with an internal fin & tube type heat exchanger. As recirculated gas flows over the fin and tubes a transfer of heat from the air stream to the liquid stream is made. The heat is then carried out of the tunnel via an on-board pump and reservoir system and exhausted through the top of the bonnet via an externally mounted heat exchanger.

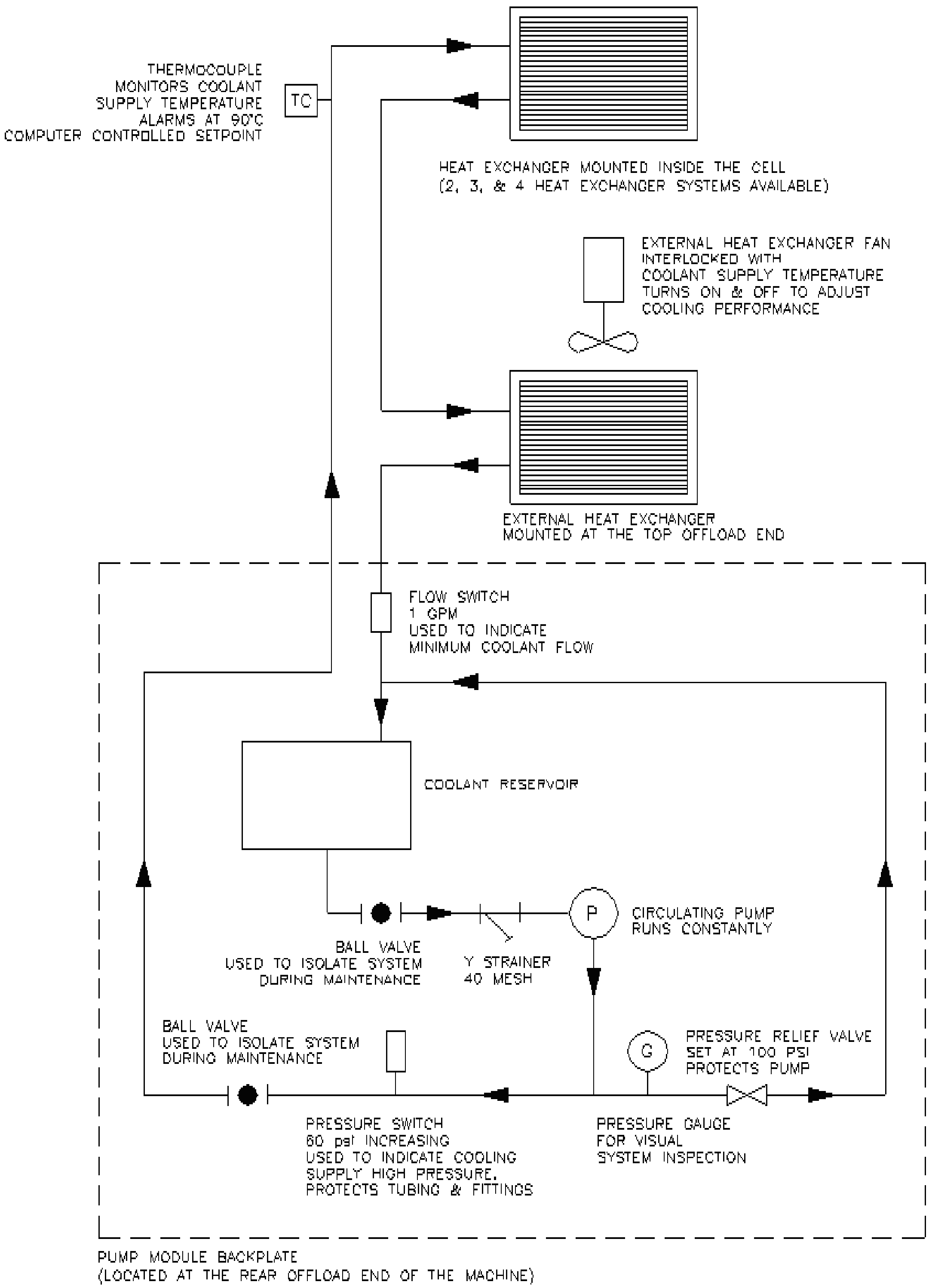
All upper cool cells with heat exchangers are supplied with hinged and latched faceplates that can be opened from the inside of the tunnel. This provides access to remove, clean and maintain the heat exchangers with a minimum of effort.

Cooling performance is dependent on the temperature of the machine-supplied coolant that has a control range of 55 to 80°C. The external heat exchanger fans turn on and off to hold the coolant at ±2 °C from set point. The coolant temperature adjustment provides an indirect control over the temperature of the cooling cells.



EC-2 COOLING CELL
(UPPER COOL CELL SHOWN)

ENHANCED COOLING PACKAGE EC-2 FLOW DIAGRAM



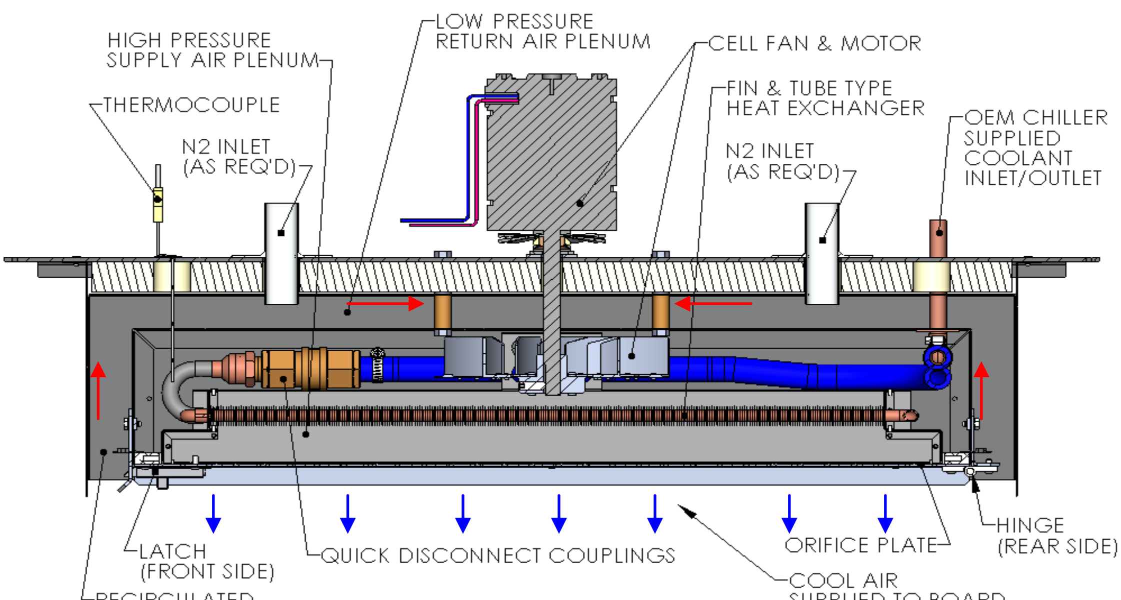
XPM3m ENHANCED COOLING PACKAGE EC-3

Description:	Optional on all machines
Performance Level:	High Efficiency
Cooling Medium:	Liquid
Warnings/Alarms:	Coolant Low Flow, Coolant High Pressure, Coolant Low Pressure, Pump Overload, Low Tank Level, Over Temperature, Under Temperature
Controls:	Adjustable coolant temperature
Facilities Impact:	OEM chiller requires floor space, waste heat exhausted from chiller

The EC-3 Cooling package is optional on N2 machines and is meant to be used for the high end cooling applications. It makes use of an internally mounted high efficiency heat exchanger to remove heat from the tunnel. The upper cells in the cooling section are fitted with an internal fin & tube type heat exchanger. As recirculated gas flows over the fin and tubes a transfer of heat from the air stream to the liquid stream is made. The heat is then carried out of the tunnel via an external OEM chiller. This option provides an all-inclusive approach to get the maximum cooling performance from XPM3m.

All upper cool cells with heat exchangers are supplied with hinged and latched faceplates that can be opened from the inside of the tunnel. This provides access to remove, clean and maintain the heat exchangers with a minimum of effort.

Cooling performance is dependent on the temperature of the machine-supplied coolant that has a control range of 10 to 80°C. The chiller controls to ±2 °C from set point. The coolant temperature adjustment provides an indirect control over the temperature of the cooling cells. This option provides the maximum cooling capabilities for the XPM3m.

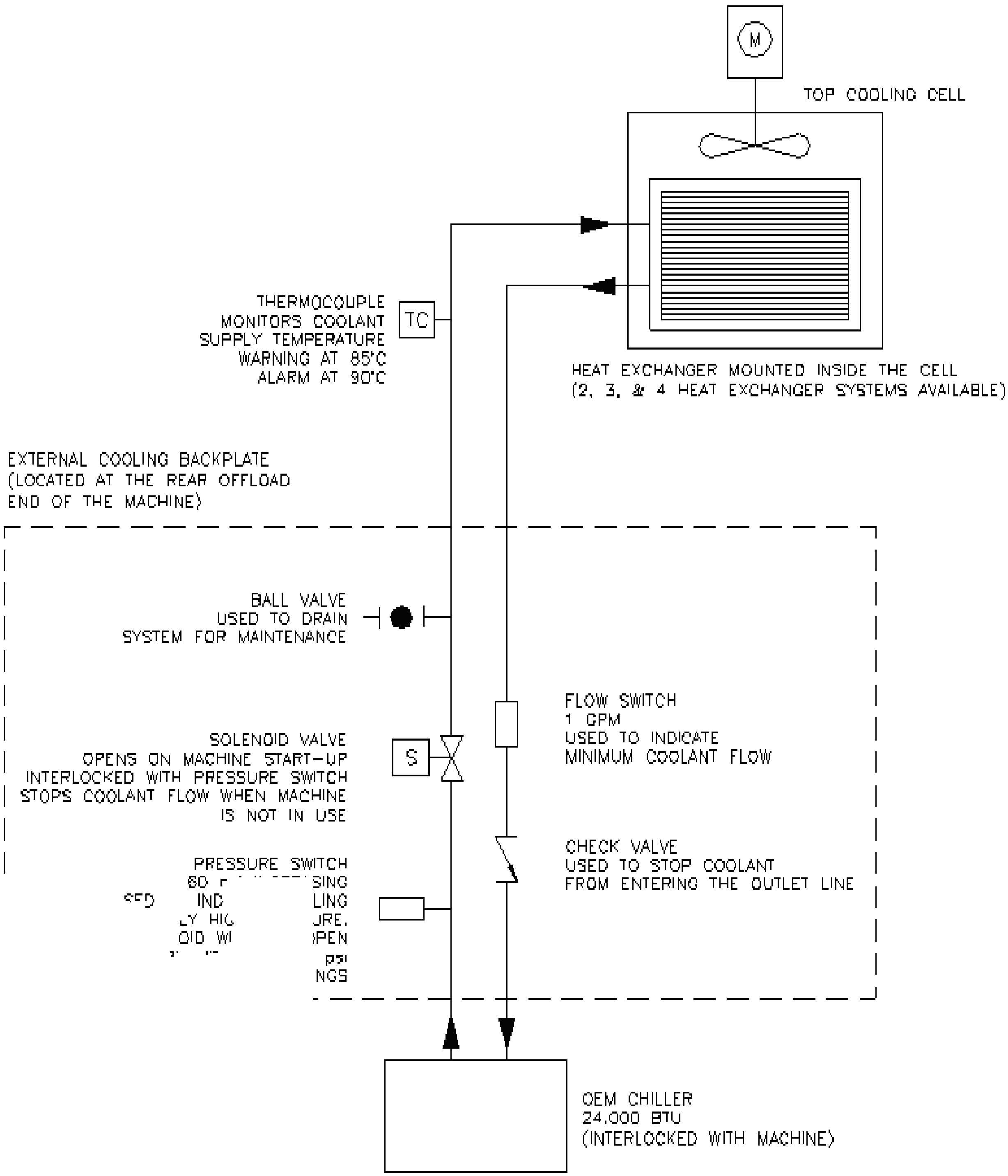


EC-3 COOLING CELL

(UPPER COOL CELL SHOWN)

.

ENHANCED COOLING PACKAGE EC-3 FLOW DIAGRAM



XPM3m EXTERNAL COOLANT SUPPLY OPERATION:

The External Cooling Liquid Supply Option is designed to be activated and operated with the reflow system at all times. It requires a temperature-controlled flow of clean coolant at a constant pressure and flow to the heat exchanger(s). The coolant temperature should remain above the local dew point when operating to avoid condensation inside the cooling cells. The system can be drained by using the ball valve attached to the inlet plumbing leg.

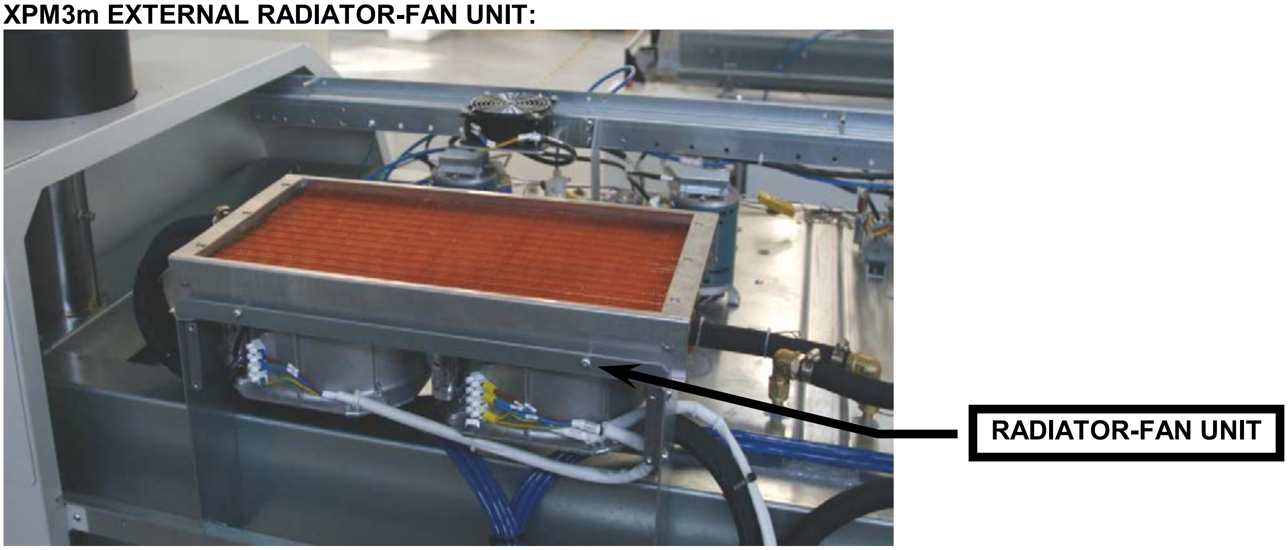
SAFETY AND CONTROLS:

Inlet High Pressure Switch:	Set to 50 psi, alarms when supply pressure is greater than 50 psi.
Inlet Shut Off Valve:	Solenoid valve used to stop flow when machine is inactive
Inlet Thermocouple (T/C 1):	Monitors inlet cooling liquid temperature
Flow Switch:	Set to 1gpm, alarms when flow falls below set point
Check Valve:	Prevents outlet from back filling system

COOLANT SPECIFICATION:
<u>Recommended:</u>
Vitronics Soltec Super Cool Part No. C00234 (4 liters)
Distilled Water (recommend use of an additive to prevent algae growth)
Lab grade Propylene Glycol mixed with Distilled Water (20%-80% mixture)

NOTE: De-ionized water or other coolants that will react negatively with the materials used in the system <u>must not</u> to be used. This will void the machine warranty.

XPM3m EXTERNAL RADIATOR-FAN UNIT:



The radiator-fan units are at the rear of the Oven, mounted to the top frame under the sheet metal panels near the Off-load (Exit) end of the Oven. Air is forced through the radiator by an axial fan.

<u>Proper operation and cooling cannot take place without adequate airflow through the radiator-fan unit(s). Pay extra attention to the underside of the radiator, as this is the area where the dirt and dust will build up.</u>

RAIL ADJUST:

MANUAL RAIL ADJUST

Manual Rail Adjust is:

☑ Standard, (installed on all ovens with an edge rail conveyor) ☐An option, (NOT installed on all ovens)

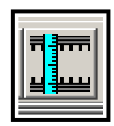
DESCRIPTION

A PTC (**P**ositive **T**emperature **C**oefficient **T**hermister) limits inrush current and a diode bridge rectifies the 120 VAC control power for the Rail Adjust Drive Motor. The selector switch mounted on the operator control station enables this DC voltage to be applied to the Rail Adjust Drive Motor (providing that the controller has enabled the manual rail adjust function). Depending upon the polarity of the signal applied to the motor, the motor operates in one direction or the other moving the rails closer together or further apart. Two limit switches at one end of the oven open the circuit and stop the motor at the end of travel in or out.

OPERATION

Run the "Manual rail adjust" within the Oven Control Program. NOTE: This operation may require a password.

Manual rail adjust can be activated by clicking on the rail width adjust icon,



Test Procedure

1. Enable the manual rail adjust.
2. Select the rail to move if the oven has more then one rail adjust axis installed. The manual in/out rail switch is a momentary 3 position rotary switch with a spring return to the center position and the center position is the off position. None of the rails will move until the manual in/out switch is rotated and held in one direction.
   The rail controller (A42) is a stand-alone controller that executes commands sent by the DI board through RS485 communication. The rail controller (A42) only activates one of the rail direction relays (A1-K23 through A1-K26) if the corresponding limit switch input is on or present. The rail controller (A42) activates the enable output relay A1-K22 one second after one of the rail direction relays (A1-K23 through A1-K26) has been set.

3. Turn the rail in/out button in one direction. If the rail motor does not turn, turn the button in the other direction. If the motor still does not turn, refer to the Oven Schematics and perform the following test procedure:
   - Disable the manual rail adjust.
   - Verify that the run status led on the rail controller (A42) is flashing. If the led is not flashing then there is a problem with the rail controller board (A42).
   - Verify that the rail controller (A42) is firmly seated into the A1 board. If the run status led is not flashing then the rail controller (A42) needs to be replaced.
   - If the run status led is flashing then verify that the cable from connector P3 on the front of the DI board to connector P48 on the A1 board is installed correctly and that there are no loose wires on either connector.
   - Verify that the COM3 RXD and COM3 TXD leds on the front of the DI board flash periodically to indicate that there is RS485 communication activity from the DI board to the rail controller (A42) and other boards connected to the RS485 network.
   - The rail controller (A42) will not activate any of the rail output relays without RS485 communications being initiated from the DI board.
   - Verify that the rail limit switch input status indicators are on on the rail controller (A42).

- Verify that each of the 2 manual rail in/out switch status indicator leds changes state on the rail controller (A42) when the manual rail in/out switch is actuated in each direction. Each manual switch led status indicator lights when the manual rail in/out switch is held on one direction.
- If the rail in/out selections do not cause the corresponding status indicators to change on the rail controller board to change, there MAY be a wiring error with the rail selector switch.
- Verify that the jumpers are installed correctly on connector P62 on the A1 board. Also verify that there is ~130 VDC at connector P62 on the A1 board between pins 1 and 4.
- Enable the manual rail switch.
- Select “Rail IN”: A1-K24 or A1-K26 should energize depending on which rail is selected for movement. A1-K22 should energize after a delay.
- Select “Rail OUT”:A1-K23 or A1-K25 should energize depending on which rail is selected for movement. A1-K22 should energize after a delay.
- After the rail selection logic has been corrected, check to see that the wiring to the motor is correct.
- Disable the manual rail adjust.
- Enable the manual rail adjust.
- Check the operation of both the “in” and the “out” adjust switch positions.
- Disable the manual rail adjust.

AUTO RAIL ADJUST

Auto Rail Adjust is:

☐ Standard, (installed on all ovens) ☑ An option, (NOT installed on all ovens)

DESCRIPTION

The Oven Control Program automatically adjusts the rail in/out to meet the board size entered in the PRODUCT file in the Oven Control Program.

OPERATION
Run the Automatic rail adjust within the Oven Operation Program. NOTE: This operation may require a password. (The direction of travel of the rail and the speed of the width adjust may be selected by choices in the Oven Operation Program.)

While conducting the following tests ensure that each rail moves to its minimum or maximum value and stop. The rail adjust system is designed to stop at these positions.

1. Verify that the DC drive card is receiving 120 VAC power between terminals L1 and L2. If not, verify that K37 is energized.
2. Check that the I/O board relay A1-K22 is energized.
3. Measure and verify that the voltage at wire number V2+ at P45 pin 1 on the I/O board is +10 VDC.
4. If voltage is present, check the wiring at the signal input of the DC Drive.
5. If the preceding steps check out, measure the DC voltage output of the DC drive circuit board between terminals A1 and A2. Voltage present should be 90-130 VDC. If there is no voltage present, the drive circuit board is likely to be defective. Otherwise, adjust the SIGNAL ADJUST potentiometer on the DC drive board to produce the 90-130 VDC.

If steps 1-5 have been performed and the rail motor still does not operate, refer to the Oven Schematics and proceed with the following:

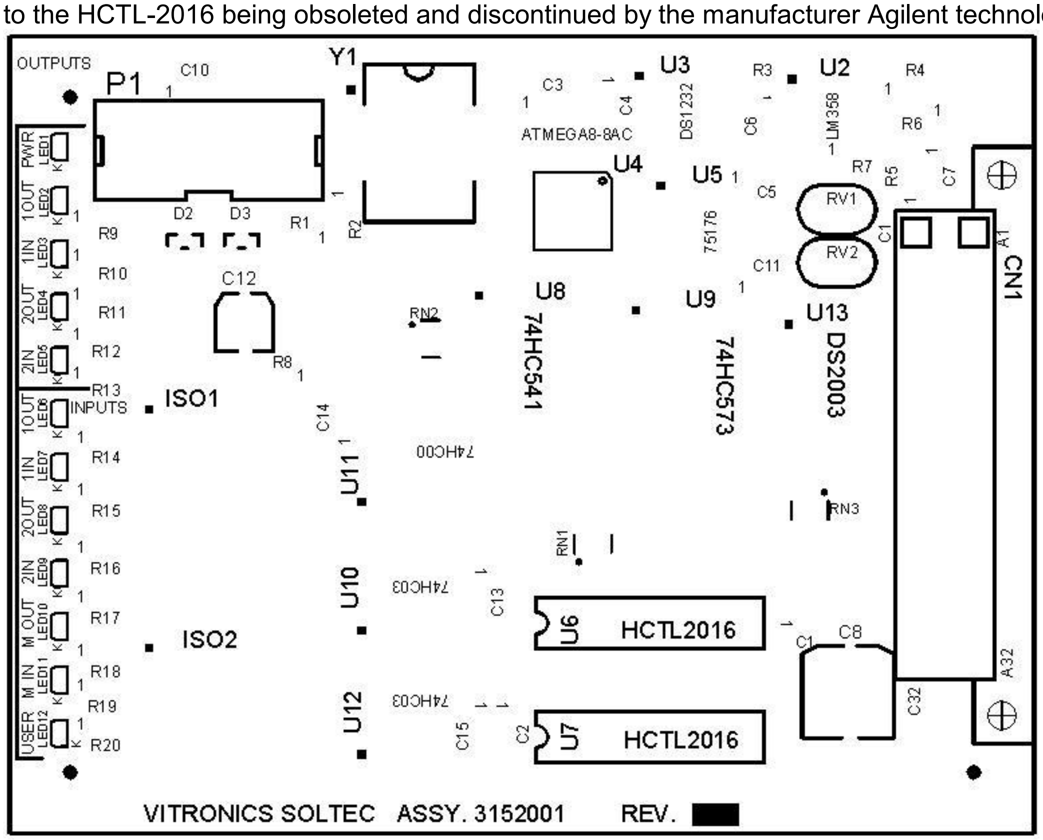
1. Verify the status of the rail limit switches by observing the status leds on the A40 board. These right angle leds on the outer edge of the A40 board. A rail is not allowed to move if the corresponding limit switch led on the A40 board is off in the desired direction to move. The A40 board will not energize relay A1-K22 if a rail is not allowed to move due to a limit switch input not being present. This also applies for all of the direction control relays A1-K23 through A1-K26.
2. Verify that the rail enable relay A1-K22 is energized.
3. Verify that the “rail out” relay A1-K23 or A1-K25 for the corresponding rail axis to move is energized.
4. If the correct relays are energized, check the associated wiring.
5. If the rail motor still does not turn, press an e-stop switch to disable 120 VAC control power.
6. Using an Ohm meter, verify that there is continuity through each rail limit switch.
   (If either the switch is wired incorrectly <u>or the rail is pressed up against the limit switch,</u> there should be no continuity through the switch.)
7. Pull out the E-stop recently pressed and reset the E-Stop in the Oven Control Program.

After the ‘rail out’ function has been tested, the ‘rail in’ function check out should be greatly reduced. Activate the ‘rail in’ function in the Oven Operation Program (this is assuming you have already logged into the software as previously described). The part of the auto rail circuit which can be a problem is the ‘rail in’ limit switch. The test procedure for these components would be the same as described for the ‘rail out’ circuit.

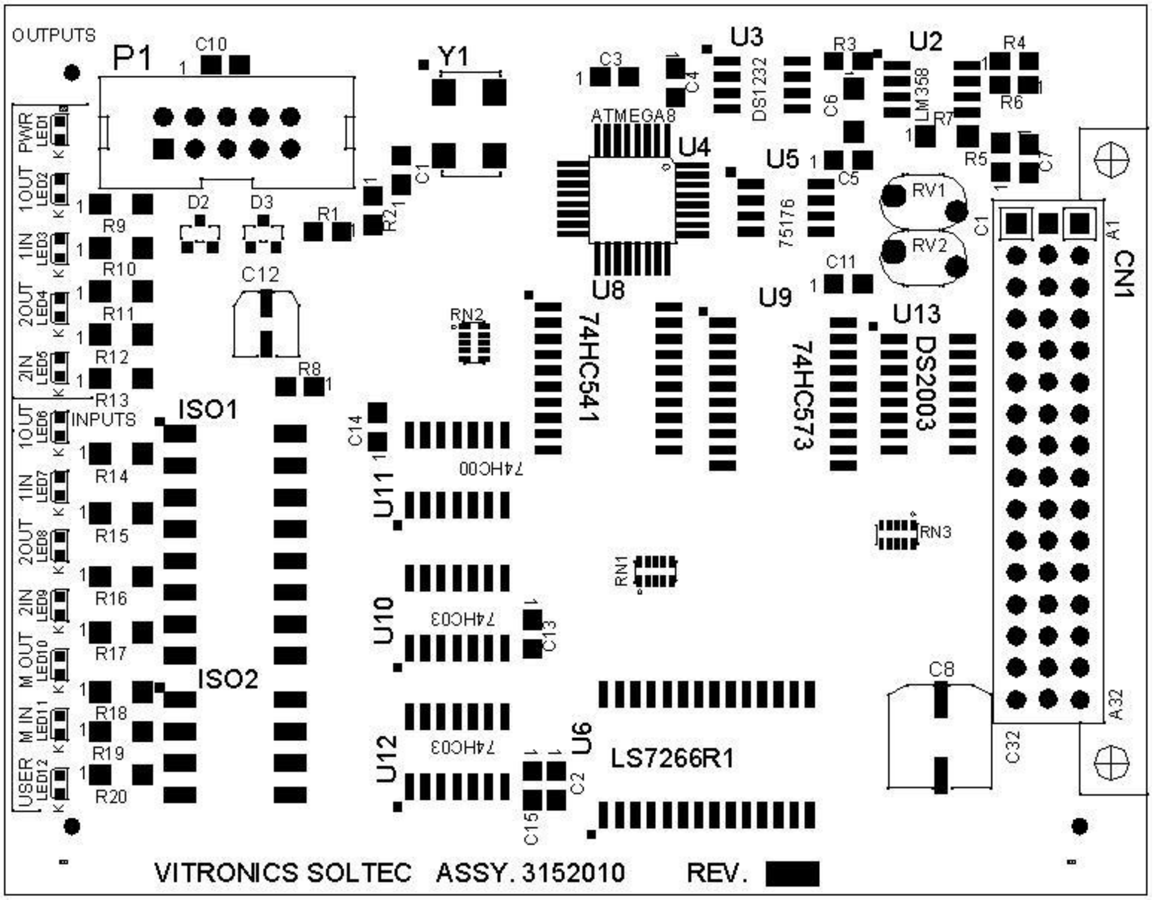
<u>Rail Position Encoder</u>

The final check out procedure is to verify that the rail position encoder feedback signal is being received and processed by the computer.
A rotary quadrature encoder has a minimum of 2 sets of lines on a circular shaped disk instead of only one set on a single ended encoder. One set of lines is 90 degrees out of phase with the other to allow the rotation direction of a shaft to be determined. There is an optical decoder and output signal for each set of lines designated as output channel A and output channel B. The rotation direction of a quadrature encoder is determined by monitoring which output channel signal is ahead of or leading the other.
The rail width adjust on the XPM3m uses a 250 pulse per revolution quadrature encoder mounted on the end of a lead screw. The lead screw is a ¾-10 acme screw, which translates to 10 turns to move a rail one-inch or 2.54 cm of travel.

The two axis rail controller board E3152001 utilizes a quadrature counter for the auto rail option. On the E3152001 two axis controller a quadrature counter IC must be installed by inserting a HCTL-2016 device into a separate 16 pin DIP socket for each of the 2 possible auto rail axes to be controlled. U6 is the quadrature counter location for the first axis and U7 is the quadrature counter location for the second axis. On the next generation E3152010 two axis controller two quadrature counters are part of the base board through a single surface mount device. This was due to the HCTL-2016 being obsoleted and discontinued by the manufacturer Agilent technologies.



E3152001A Existing two axis rail control board.
U6 and U7 are only installed for auto rail options.



E3152010A future two axis controller board.

Each quadrature counter has a digital input filter that is synchronized with the 8 megahertz microcontroller clock on the two axis rail controller board to filter out noise on the channel A and channel B inputs for each quadrature encoder.

Each quadrature counter is set up to count on every state transition (count up and count down) from a quadrature encoder. This is called 4X mode and results in the 250 pulse per revolution encoder used on the rail width adjust producing an equivalent of 1000 counts per revolution instead of 250.

The quadrature counter used on the two axis rail controller is a 16 bit counter on the E3152001 board and a 24 bit counter on the E3152010 board. Each quadrature counter counts independently of the microcontroller and does not lose counts as long as power is not shut off to the oven.

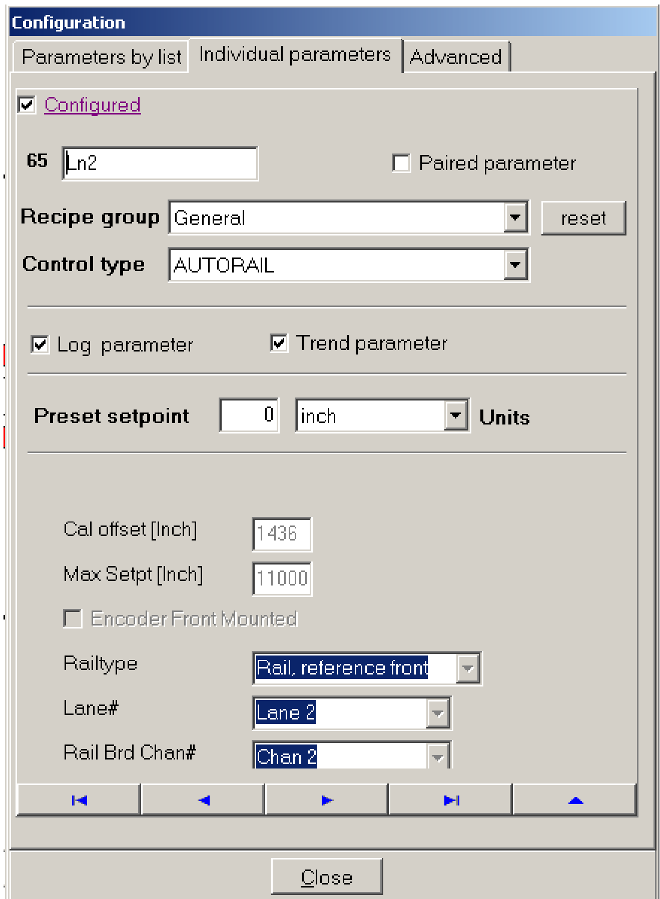
Channel A leading channel B results in counting up. Channel B leading channel A results in counting down.

TROUBLESHOOTING:

The quadrature encoder used on the rail width adjust is not subjected to much mechanical stress because of the slow rotating speed of the rail adjust lead screw and also due to the intermittent operation of the rail width adjust hardware. A properly aligned quadrature encoder shouldn't wear out or need to be replaced.

<u>If an auto rail position fails to count or update verify the following:</u>

1. The PC oven software is configured correctly. The correct lane number, and axis type is specified for an axis. The valid choices for lane number are 1 or 2. The axis type determines how and what direction the oven controller moves and axis. The valid selection choices for axis type are moveable rail reference front, moveable rail reference rear, board support 1 or board support 2. To view this configuration will require the highest level of password. The configuration can be viewed under the Vitronics Soltec menu. Go to Configuration, Parameters, Individual Parameters. Click on the button with the blue arrow pointing to the right until you come to the parameter you wish to view.



An axis will always reference at its fixed rail location by moving towards the fixed rail until the in limit switch input is encountered and then moving away from the fixed rail in the opposite direction until the in limit switch input is present again. Each quadrature counter is cleared or reset to zero when a rail axis is set to its in limit switch and then moved away from the in limit switch until the in limit switch signal is present again. This is considered the true reference position for an axis. Because the make contact distance for a limit switch can vary due to the large amount of over travel built into the switch mechanism, but the break contact distance is relatively constant and therefore more accurate to use as a reference.

2. The cable assembly (E3156025) to the rotary encode is securely connected. Each rotary encoder has a finger release on the connector to disconnect the 5pin cable assembly from the encoder.
3. Verify the continuity of the encoder cable assembly E3156025.

Wire Color	A1-P46 or A1-P47 Pin #	5 Pin Connector on Encoder Pin #	Description
Red	1	4	5 VDC
Green	2	3	A channel output signal
White	3	5	B channel output signal
Black	4	1	0V dc common
Shield	5	No connection	Shield
-	-	2	Index output signal (not used)

4. Monitor the output signals on the 5pin connector on the A1 board for each encoder in question.
5. The channel A and channel B outputs should transition from 0v to 5v while a lead screw is rotating and 5v power should be present between pin 1(-) and pin 4(+) on the 5 pin connector on each encoder.
6. Verify that the plastic encoder disk is secured firmly on the lead screw by the set screw in the mounting collar.
7. Refer to the attached encoder manufactures instructions to verify the alignment of the encoder using the alignment tool supplied by the manufacturer to properly align the plastic optical disk with the sensor assembly.
8. Replace the encoder assembly (E1480801) if the output signals do not transition correctly or if the plastic optical disk appears to be damaged.

DC DRIVE CALIBRATION **(RAIL WIDTH ONLY)**

1. Definitions-

A DC drive is actually a DC voltage amplifier. A small signal is sent to the drive and a large voltage is sent to the motor. The typical DC drive uses an AC power source of 120 or 240 volts.

The set of controls found on a DC drive is:

A. Minimum speed adjust
B. Maximum speed adjust
C. IR comp
D. Torque
E. Signal

2. What do the controls do?

A. Minimum speed adjust -- adjusts the minimum voltage output of the DC drive at the minimum-input value. This value is typically 0 - 10% of the maximum input voltage.

B. Maximum speed adjust – not used.

C. IR comp -- this adjusts the feedback circuit from the output of the DC drive. If the output voltage drops, the IR comp circuit senses the drop, and more power is fed to the motor. This function is preset to a value that covers 90% of all applications.

D. Torque -- this limits output current, and should only be adjusted by experienced people.

G. Signal -- signal adjust is found on DC drives which provide an option of being controlled by a computer. If the DC drive is adjusted by a speed control potentiometer, signal or signal adjust has no function.

Note: A DC drive with computer control will have a signal/manual selector switch or jumper. If the input does not match the input selected, the DC drive will <u>not</u> operate correctly.
If a computer controls the DC drive, the maximum adjustment potentiometer will have no function.

3. Additional useful information

A. Always recalibrate when any component of a control system is changed.

B. Conveyor speed can be calibrated to specific requirements. This takes practice, but can yield greater speed accuracy.

C. The conveyor speed should be measured with a stopwatch every sixty days.

D. Motor brushes wear out.

E. Calibration values may change with the age of the system.

F. Always record the adjusting potentiometer settings <u>before</u> replacing or calibrating a DC drive.

G. When replacing a DC drive, record the potentiometer settings; draw a sketch of the wire hookups; make sure all wires have labels.

CALIBRATION PROCEDURE FOR DC DRIVE BOARD (**<u>rail width only)</u>**

Tools required:

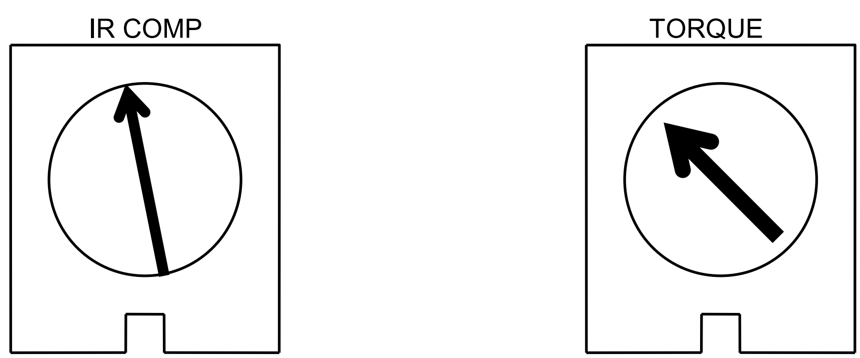
- Multimeter (auto-ranging)
- Small non-metallic screwdriver
- Stop watch or other device to time conveyor movement

Before connecting the power supply*:*

1. Set the ‘Jumper’ to ‘signal’.
2. Set the MAX SPEED pot to full counter-clockwise.
3. Set the MIN SPEED pot to the 10 o’clock position.
4. Set the IR COMP pot to the 12 o’clock position.
5. Set the TORQUE pot to the 10 o’clock position.
6. Set the signal Pot to the 12 o’clock position.

With the power supply connected:

1. Set the multimeter to VOLTS AC and measure the input voltage to the control. If the voltage is less than 108V or greater than 132V disconnect the power supply and correct the supply voltage problem.
2. Disconnect the multimeter and set to measure VOLTS DC. Attach leads to the motor side of the control.
3. Log in to the oven software with the master password. Under Vitronics Soltec, Advanced, Service Mode Testing, go to the Conveyor tab. Type in a percentage number (0-100) in the box for Conveyor%, then select either Move in min speed or Move out min speed. Adjust the MIN speed pot so the conveyor is just barely moving. When done select Stop Rail.
4. Select either Move in Max speed or Move out Max Speed. Adjust the Signal Adjust pot until the conveyor movement speed is equal to 5 inches per minute. When done select Stop Rail and exit this function.
5. Verify that the width adjust hits setpoint. If not, the minimum speed may be set too low or too high.



MINARIK DRIVE POTENTIOMETER SETTINGS

SMEMA INTERFACE

The SMEMA Interface is:

☐ Standard, (installed on all ovens)   ☑ An option, (NOT installed on all ovens)

(SMEMA is the acronym for Surface Mount Equipment Manufacturer's Association)

DESCRIPTION

On the XPM3m, all SMEMA functionality is built into the oven controller and an external PLC is not used.
The XPM3m utilizes a board tracking/SMEMA interface circuit board E3151801 located on the on-load and off-load ends of the oven, and photo-sensors are mounted on brackets above each end of the oven. A 14 pin round AMP connector is attached to cables on each end of the Reflow Oven.
Each E3151801 board supports the following:

1. Connections for 3 board tracking sensors per on-load and or off-load.
2. Connections for 2 lanes of SMEMA control. A relay must be installed onto a socket on each E3151801 board for each SMEMA lane (one on the on-load, one on the off-load).
3. LED status indicators for board tracking sensors and SMEMA output relays.

NOTE:
Ovens with a Dual Rail conveyor (with two sets of rails and chains) have two separate sets of SMEMA Interface sensors. Each conveyor must be ready to receive product before it independently sends a "Ready" signal to its respective "upline" equipment. EITHER conveyor can send a "Product at Offload" signal to the "downline" equipment.

OPERATION

Action by the Reflow Oven operator is not necessary for the SMEMA interface to function. As long as the upline / downline connections are made and a component failure has not occurred, operation will be automatic when the Reflow Oven is powered up.
The SMEMA interface accepts a 'Board Available' signal from the upline (onload side) of the Reflow Oven on pins 3&4 of the onload connector. It replies with a 'Busy' signal on pins 1&2 of the onload connector to the machine upline. On the downline (offload) side, a 'Board Available' signal is sent on pins 3&4 and looks for a 'Busy' signal to come back on pins 1&2 of the offload connector.
Because the Reflow Oven should not be stopped with product in the heat zone, the busy signal coming from the downline end is used to generate the busy signal for the upline equipment without stopping the Reflow Oven. When all of the conditions are 'False', the Reflow Oven is "not busy" and will accept more product from the upline equipment. If any of the conditions are 'True', the Reflow Oven will transmit a "busy" signal to the upline equipment. This should stop the upline equipment from sending product to the Reflow Oven, thus preventing a product buildup.
The upline "busy" signal can be a result of one (or more) of the following:

1. Board at 'on-load'
2. Board Jam at off-load
3. Downline machine is not ready
4. Oven is not 'Process Ready'

SMEMA - continued

Software operation.

The XPM3m has 2 user settings for the SMEMA option, Infeed delay and Outfeed alarm delay.
The infeed delay setting provides a delay in board travel inches between each circuit board introduced into the oven by delaying when the oven ready to upstream signal is switched back on after a board is introduced into the oven.

The outfeed alarm delay setting is to provide a delay for a transfer conveyor or board stacker on the off-load of the oven to provide a down stream ready signal to the oven. This setting is to allow more boards to be introduced into the oven while ignoring the downstream ready signal for a set delay. If a downstream ready signal remains absent beyond this delay setting then the oven clears the ready signal to an upstream conveyor to indicate that no more boards can be accepted until the downstream conveyor is ready.

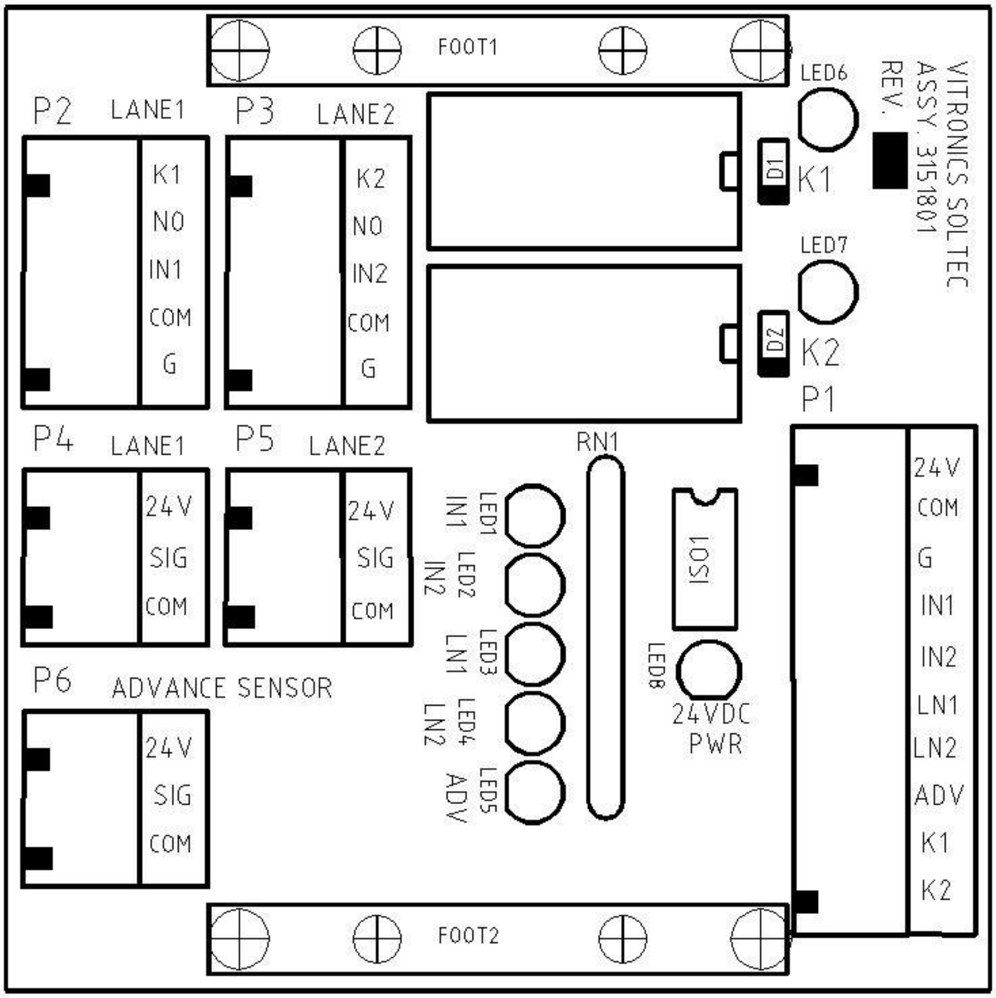
On older ovens with a PLC this delay was fixed at 30 seconds.

Note: Setting zero for the outfeed alarm delay disables monitoring for the downstream ready signal and is equivalent to installing a jumper wire on the SMEMA off-load connector to indicate that the downstream is always ready.

The XPM3m has SMEMA settings for each lane for up to 2 lanes of SMEMA control and the SMEMA control for each lane operates independently as it did with ovens with a PLC.

The XPM3m provides optional alarm messages to indicate that the downstream ready signal is absent beyond the outfeed alarm delay setting when a board is exiting the oven. Also that the oven is not ready when a board is arriving into the oven.

By installing a connector on the off-load to indicate that the downstream equipment is ready and by installing a flashlight or light assembly on the on-load to indicate when the oven is ready to accept boards. The ready to accept boards indicator should light when the oven is ready and when the downstream equipment is ready signal is also present. The ready to accept boards indicator switches off as a board is detected by a corresponding on-load board sensor and switches back on after the corresponding on-load board sensor is clear for the onfeed delay distance set in the software.



E3151801A ASSY SMEMA/BOARD TRACKING INTERFACE PCB

K1 is installed for a single or dual lane SMEMA configuration by plugging in a SPST relay (E1480201).
K2 is installed for a dual lane SMEMA configuration by plugging in a SPST relay (E1480201).

P1 WA100 interface cable to oven for on-load connections or WA101 interface cable to oven for off-load connections.
P2 lane 1 SMEMA cable assembly E3153401 on-load or E3153402 off-load.
P3 lane 2 SMEMA cable assembly E3153401 on-load or E3153402 off-load.
P4 lane 1 on-load or off-load board sensor.
P5 lane 2 on-load or off-load board sensor.
P6 lane 3 on-load or off-load board sensor.
LED1 lane 1 board available at on-load from SMEMA interface.
LED2 lane 2 board available at on-load from SMEMA interface.
LED3 lane 1 on-load or off-load board sensor signal.
LED4 lane 2 on-load or off-load board sensor signal.
LED5 lane 3 on-load or off-load board sensor signal.
LED6 lane 1 oven is ready to accept boards to upstream or lane 1 board is available to downstream.
LED8 lane 1 oven is ready to accept boards to upstream or lane 1 board is available to downstream.
LED9 24vdc power is present to the E3151801 board.

TEMPERATURE PROFILE PLOTTING (PRECISION PROFILING)

☑ Standard, (installed on all ovens) ☐ An option, (NOT installed on all ovens)

Plotting a temperature profile provides a graphic display of temperature relative to time and distance at one or more points on a test PCB going through the oven. It also determines values of Peak Temperature, Liquidous Time and Heat/Cool slope. This helps fine tune the system for optimization of individual profile parameters on the PCB.