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Dimension® 1200es/1200 3D Printer

Service Manual

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Notice

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About This Guide

This service guide is designed to help you easily find the information you need to successfully service Dimension BST and SST systems. This guide is arranged in chapters with tabs for easy reference.

When viewing the electronic PDF version, you can easily hyperlink to specific headings or chapters using the following methods:

- Use the Bookmarks window in the PDF application as hyperlinks.
- Click on the headings and page numbers in the Table of Contents to go to a specific page or chapter.
- Click on italicized text, which are cross-references to figures, headings, and chapters.

The following conventions are used in this guide:

- When you see text in blue, it indicates that the text is a linked reference to a specific figure, heading, or page number.
- When you see text in **Bold**, it indicates important information that needs to be emphasized.
- Text representing **Interface Messages** that appear on the display panel are presented in a bold font.

Table of Contents

Safety

1

Dimension 1200es/1200 are designed to be safe and reliable rapid prototyping systems. However, as an installer and service engineer for this equipment, it will be required that you access areas of the printer that are potentially dangerous. This chapter includes the hazard classifications that are listed throughout this guide. Specific safety warnings will appear in the service guide, when a potential danger exists.

Hazard Classifications

Please be aware of the following hazard classifications that are used throughout this guide.

Caution: Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

Warning: Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

Product Safety Symbols

Gloves: The gloves symbol indicates the presence of devices with high temperatures. Always use extra care, and wear safety gloves, when working around heated components.

ESD Sensitive!

ESD: Use standard electrostatic discharge (ESD) precautions when working on or near electrical circuits.

Product Information Symbol

Note: Always read and adhere to safety statements, and be aware of the safety symbol when you see it in the printer.

Safety Devices

The following safety devices are incorporated into the system:

- Chamber T/C alarm – activated for a bad or missing thermocouple
- Liquefier T/C alarm – activated for a bad or missing thermocouple
- Power shut down signal from the PDB – activated if any thermal limit switches trip
- Thermal snap switch located on the Head Board.
- Main thermal fuse

System Overview

2

In this chapter you will learn about the main components of the system. The contents and page numbers of this chapter are as follows:

Dimension 1200/1200es Specifications

Build Size	Parts can be built up to 254 x 254 x 305 mm (10 x 10 x 12 in.)
Material	1200 ABS- White, Black, Steel Grey, Red, Blue, Green, Yellow. 1200es ABS+ - Ivory, White, Black, Dark Grey, Red, Blue, Olive Green, Nectarine, Fluorescent Yellow.
Material Supply	Two autoload cartridges with 0.95 kg (2.1 lbs) material per printer (1 model and 1 support). Each cartridge has enough material to build continuously for three days without reloading.
Layer Resolution	User may select 0.010 in (0.245 mm) or 0.013 in (0.33 mm) layer resolution.
Positional Accuracy (X,Y)	0.025 mm (0.001 in.)
Z Repeatability	0.0127 mm (0.0005 in.)
Automatic Operation	CatalystEX software automatically imports and slices .stl files, allows you to orient parts for optimal builds, generates support structures, if necessary, and creates the deposition path to build parts.
Support Structures	Any necessary support structures are automatically created within CatalystEX software. Break-away Support System (BASS^{TM}) allows for easy support removal. Dimension SST uses Soluble Support Technology (SST), which allows supports to be washed away with a water-based solution.
Functionality	Multiple parts may be packed within the build envelope to maximize build efficiency. CatalystEX software provides queue management capabilities, build and material status, runtimes, and printer status information. The display panel located on the front of the printer guides you through startup, material reload steps, and provides status information on the printer including material remaining in the cartridges.
Regulatory Compliance	CE
Operator Attendance	Not required

Physical specifications

Height	1143 mm (45 in)
Width	737 mm (29 in)
Depth	838 mm (33 in)
Weight	148 kg (326 lbs)

Facility specifications

Installation location	Stable flat surface capable of holding 159 kg (350 lbs).
Power Requirements	110–120VAC ~ 15A Max to 220-240VAC ~ 7A max 50/60Hz 1200W dedicated circuit within 2 m (80 in.) The printer will auto-detect the input voltage. Do not use an extension cord or a power strip, using these can possibly cause intermittent power issues.)
Air Circulation	115 mm (4.5 in) minimum space behind printer for air circulation. 153 mm (6 in) minimum space around printer for air circulation.
Network Connection	Ethernet 10/100 Base T within 4m (14 ft).

Workstation specifications

Operating System	Microsoft Windows XP, Microsoft Windows Vista or Microsoft Windows 7
Processor	Minimum: 2.4 GHz Faster processors will shorten job processing times
RAM	Minimum: 1GB (2GB for Windows Vista or Windows 7) Recommended: 2GB (3GB for Windows Vista or Windows 7)
Hard Disk	Installation: 90MB
Monitor graphics resolution	Minimum: 1024x768 Recommended: 1280x1024 (wide screen acceptable)
Video Card	Required: OpenGL compliant accelerated graphics card Recommended: Hardware support for OpenGL Recommended 128MB graphics card memory

Environmental specifications

Temperature range	15°C to 30°C (59°F to 86°F)
Relative humidity range	30 to 70 percent, non condensing
Heat emission	1080 Watts = 3686 BTU/hr typical 1380 Watts = 4710 BTU/hr max

What Happens When...

Powering Up

When power is supplied to the system, the fans run continuously until power is shut off. Like any PC compatible computer, the SBC executes a built-in test and then goes out the HDD and loads the Linux Operating System. The OS and controller software are loaded and the Linux drivers are initialized. The system manager sends the starting up message to the display and establishes communication with the Controller Board. The system manager then asks the Controller Board to “find home”.

While the OS is loading, the Controller Board initializes all the secondary processors, tests dual port memory integrity, and begins heating the liquefier and chamber. When a “find home” command is received from the SBC, the Controller board moves the x and y axis to their limits of travel, checks the end of travel switches and home sensors, and saves the locations for reference during modeling. This defines the location of home and the dimensions of X and Y axis.

As the unit is warming up, the display shows the current head and chamber temperatures being read by the Controller. Once modeling temperature is reached (BST: 300° C, SST: 300° C Model, 300° C support), the SBC will ask the Controller to check for cartridges and the amount of material in each. The material remaining will be displayed. “0 %” can either mean that there is an empty cartridge installed or no cartridge installed.

Once the unit is ready to build, the display will read “IDLE” (no part in the queue) or “READY TO BUILD” followed by the part name.

Powering Off

When the PDS (Power Down Switch) is turned off, the unit begins a controlled shut down. The active software processes are suspended, eliminating any disk I/O. The power to the liquefier and chamber is turned off. The Controller board monitors the temperature of the liquefier and chamber. The display will say “SHUTTING DOWN”. Once the liquefier temperature drops below 102° C, the SBC changes the display to “SHUT DOWN” and turns off all power to the unit.

Loading Material

When the load material button is pressed with cartridges installed in the unit, the SBC will ask the Controller Board to unload the cartridge requested by the operator. The most recent value for material remaining is written to the cartridge EPROM. The appropriate filament motor(s) is run in reverse to unload the liquefier. When filament is clear of the drive wheels, the Controller Board tells the SBC that the command is complete. The SBC sends “REMOVE CARTRIDGE” to the display, the cartridges are unlatched, and the unit waits for you to respond.

If there are no cartridges in the system when the material button is pushed, or if an unload has just been completed, the SBC will ask the operator to INSERT CARTRIDGE. The unit will look for a valid cartridge EPROM. If there is no change to cartridge EPROM status in 30 seconds, you are asked if you want to RETRY. Once valid cartridges are read, the unit engages the cartridge loading motors. These motors drive filament out of the cartridge and up to the liquefier. It should be noted that the head will be in the front right corner when loading is occurring.

Once the filament is detected in the head, the loading motors stop, and the head moves to the right rear location over the purge bucket. At this time, the filament motors are driven forward, loading the liquefier, causing it to purge. You will be asked to verify that the purge has occurred.

Making a Part

Once the printer is in **READY TO BUILD**, the **Start Model** button will begin to flash. Once you press the **START MODEL** button, the printer will start to make a part. The first thing that happens is that the printer lowers the substrate sensor and moves around the XY envelope and measures the height of the substrate. At the same time that the printer is finding the Z zero position, the SBC is converting the model file into the motion commands that the Controller board will execute to build the model. Once the substrate has been measured in four locations it moves the Z stage down to check the Z end-of-travel. Once this operation is complete, the head will move over the purge bucket and prepare both tips for use.

Once the start of model purge is complete, the printer will start to build the model. During model construction, the printer will display the percentage of material remaining on each spool, and buttons that allow you to pause the printer, or turn on the chamber lights. The printer will stay in the Building State until the model is finished or the printer pauses. If the printer pauses, it will enter a Pending Pause state until the current road is finished. Once that road is complete, the head will move over the purge bucket, and the Z stage will descend to the bottom of the envelope. In the Pause State the printer can be resumed, material can be loaded and unloaded, the build can be canceled, and printer maintenance may be performed.

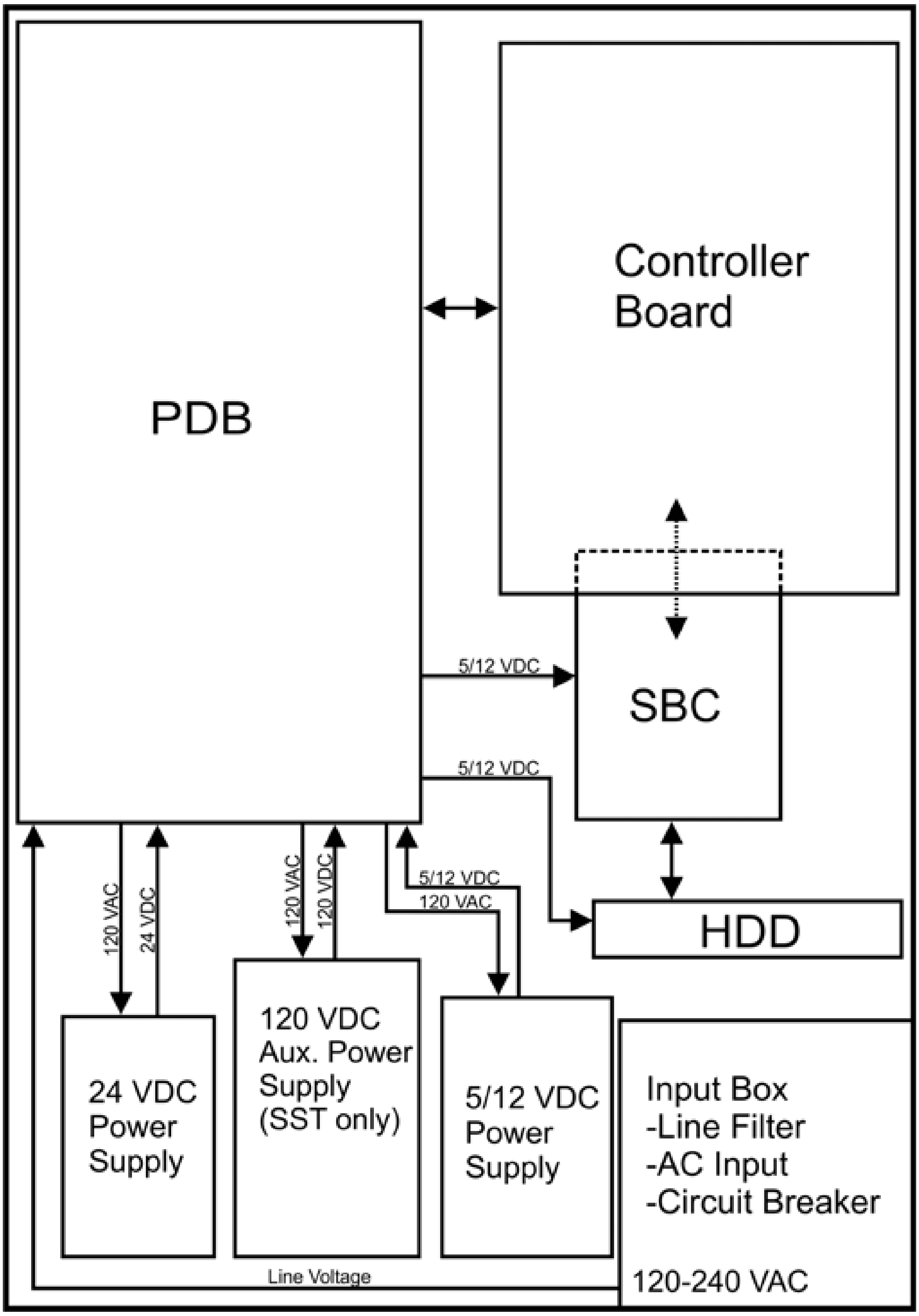
A System Error Occurs

Should an error occur during normal operation, the SBC will display SYSTEM ERROR followed by an error code such as code 14, 4. A code 14 is an error reported by the Controller board and the 4 indicates a bad or missing modeling base (foam or substrate). For a complete list of error codes, see Troubleshooting on page 6-1.

Gen 2 Electronics

Electronics Overview

Figure 2-1: Gen 2 electronics block diagram



Single Board Computer

The single board computer (SBC) is the main processor in the system. It is a complete “PC compatible computer” on a single board. See Figure 2-2.

The TCP/IP network interface connects directly to the RJ-45 connector on the SBC. The network interface supports both 10baseT and 100baseT operation. The hardware differentiates automatically. There are three LEDs to the right of the RJ-45 connector. These show the status of the network connection as follows:

- Green LED: Indicated a valid Ethernet connection has been established.
- Yellow LED: Indicated valid data is being sent and received (e.g. traffic).
- Red LED: Indicates bad packet data is being received. This is most likely a bad network connection. This LED should rarely be on for normal operation.

The Hard Disk Drive connects to a standard wide IDE interface located on the left side of the board. The HDD contains the Linux operating system and all the control software needed to run the system (except the Controller firmware). This is also where all the downloaded models are stored (the Queue).

The Control Panel Display (CPD) connects to the SBC on J13 of the Ampro board and CN7 on the Nova board. See Figure 2-4. All user commands from the buttons come in here and all the display text is output from here. For the Gen 2 Electronics, the CPD connects to the PDB and passes through the SBC.

The P104 connector on the top edge of the board is a bus level interface to the Controller board. This allows the SBC to read and write to the dual port ram on the Controller board, which forms the communication channel between the two boards.

Figure 2-2: New Ampro SBC detail

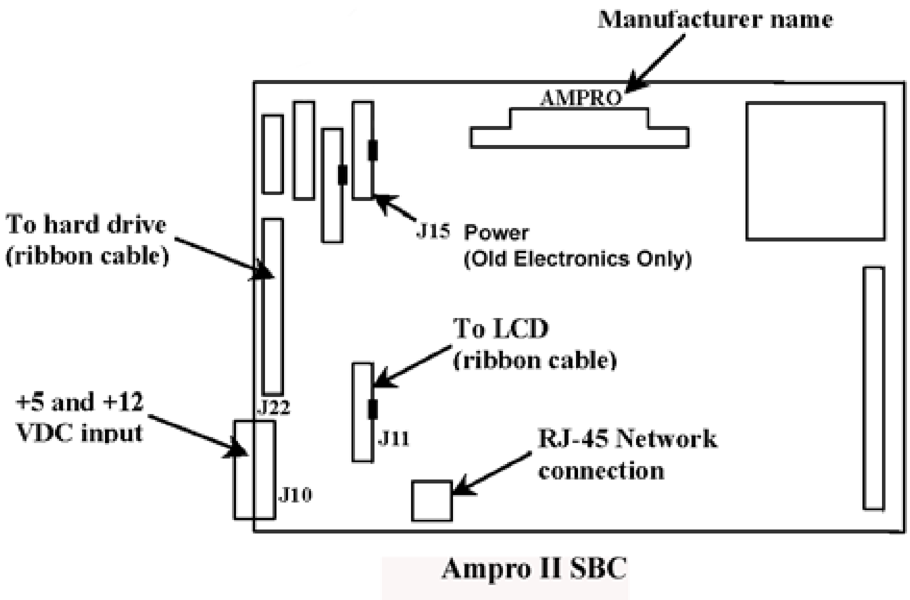


Figure 2-3: Old Ampro SBC detail

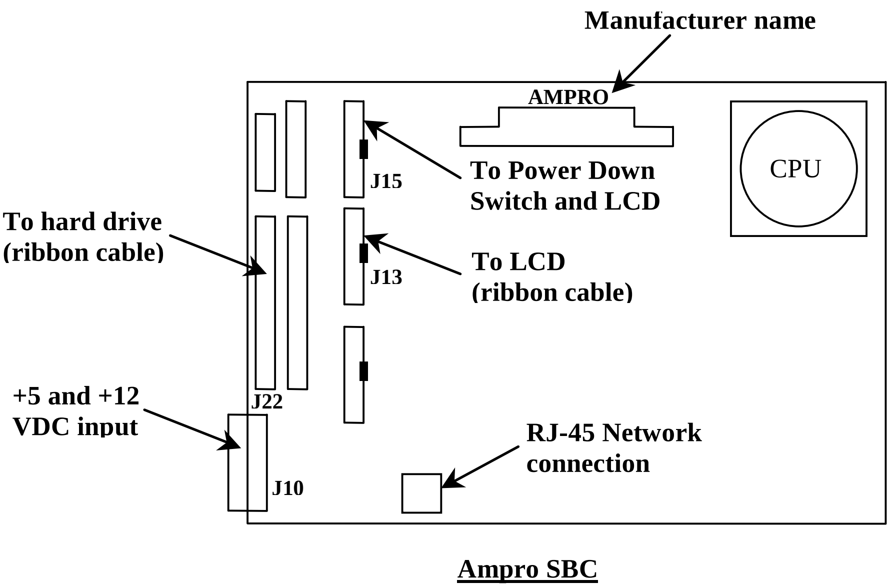
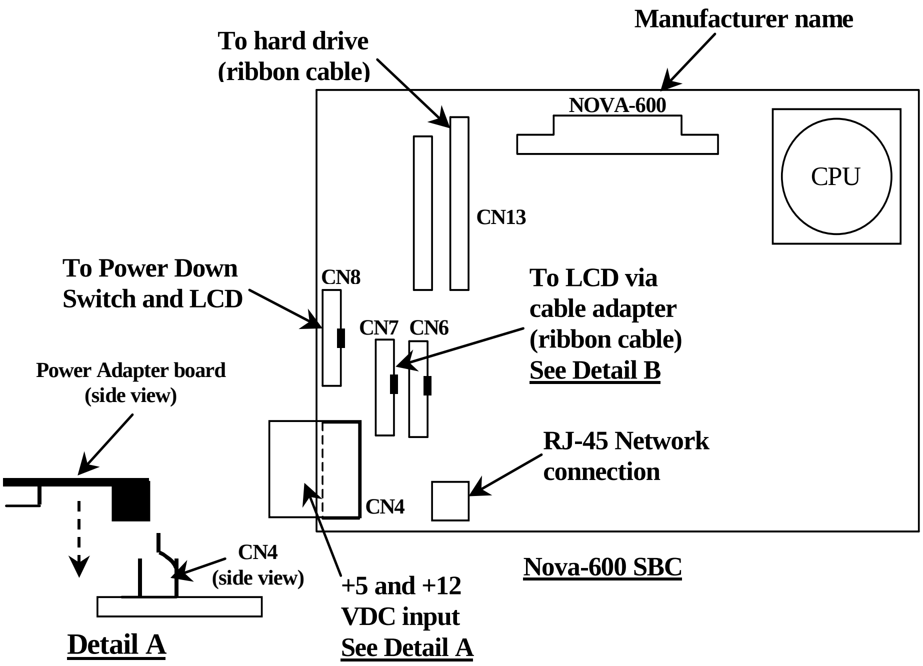


Figure 2-4: Nova 600 SBC detail



Controller Board

Overview

The controller board in BST/SST provides all of the low level hardware control and sensing for the system. The software runs on the controller cpu and is flash resident (rather than on the HDD as with the SBC).

Voltage Generation

- +/-15 VDC is used for PMD DACs
- 10 VDC is used for DAC reference
- 3.3 VDC is used for controller board logic

Dual Port Memory Interface

The dual port memory located on the controller board provides the communication channel with the single board computer (SBC) through the P104 connector. This connector has long gold pins coming out of the back of the board and care must be exercised when handling the controller board to avoid damage. The SBC provides the coordinates, velocities, and flow rate commands for modeling to the controller. The controller board provides the status/error information about the hardware back to the SBC.

X, Y, Z Axis Control

The controller takes the flow rate information from the SBC and sends it to the PMD processor. The PMD 2840 processor services the X and Y stepper motors and the model and support head servo motors. The 3410 processor services the Z axis stepper motor. There is no feedback from the stepper motors to the system (they are open-loop controlled).

Filament Motor Control

The controller takes the flow rate information from the SBC and sends it to the PMD 2840 processor. The PMD uses this information along with the encoder signals from the filament motors to generate an output signal to drive the servo motors in the head assembly. Since the encoders provide feedback ,the filament motors have a closed-loop control. Their position and rotation are precisely known at all times.

Temperature Control

The controller board reads the three thermocouple (T/C) inputs/signals (2 for the head, 1 for the chamber).

Liquefier Temperature Control

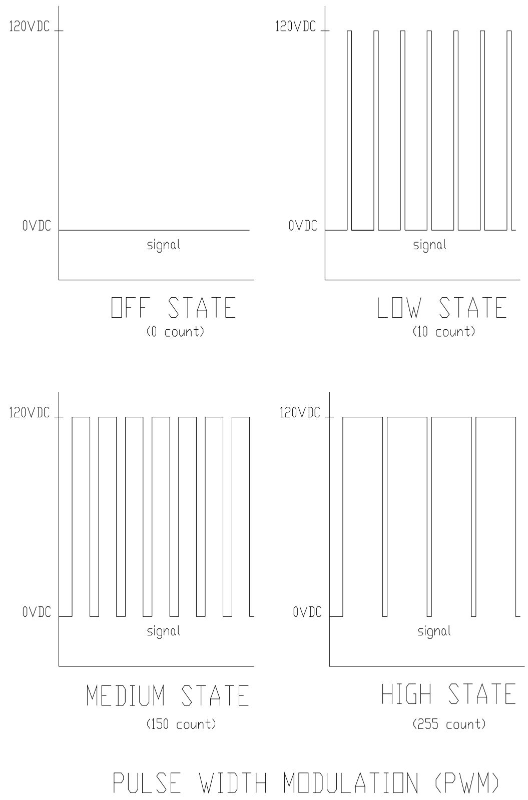
The liquefier T/C connects to the controller board through the power distribution board. The T/C generates a variable low level current that depends on the temperature of the T/C. This analog signal from the T/C is amplified by the head board. It is then sent down the umbilical cable to the PDB, and then to the controller board. An A to D converter in the ColdFire chip converts the analog signal to digital. In order to improve temperature resolution, this signal is biased. The lowest reading possible is 89.5° C. The highest reading is 330° C.

The liquefier temperature is maintained at:

	BST Single Heater	SST Dual Heater
Model	300° C	300° C
Support	NA	300° C

Temperature control is accomplished using pulse width modulation. See Figure 2-5.

Figure 2-5: Pulse Width Modulation (PWM)



Actual power to the liquefier heater is supplied by the PDB, which is controlled by the controller board. The head heaters are turned off and on 1000 times a second (pulses). The duration of the 120 VDC pulse determines the average power being supplied to keep the liquefier at temperature. Temperatures can be read using a volt meter at test points TP5 for model, and TP4 support on the PDB (10 mV per degree C).

Actuators, Switches & Optical Sensors

The input and output signals are passed through the PDB and then processed by the controller board. The non-motor actuators on a BST/SST system are 24 volt solenoids. The 24 volt power is supplied by the PDB which in turn is controlled by the controller board. The following is a list of actuators:

- Door solenoid – locks the door to the modeling chamber.
- Cartridge latches (2) – holds cartridges in the receiver unit.
- Receiver solenoids – engage the motor that feeds filament from cartridges to liquefier during auto load.

The controller board reads and updates the remaining material information on the smart cartridge (e-prom). This is accomplished through a serial interface to the receiver encryption board. The receiver encryption board in turn connects to the e-prom on the cartridge via two pogo pins.

The controller board monitors the following optical sensors:

- Z limit switches – upper and lower
- X end of travel switch
- Y end of travel switch
- X home sensor
- Y home sensor
- Top of foam sensor

Safety Devices

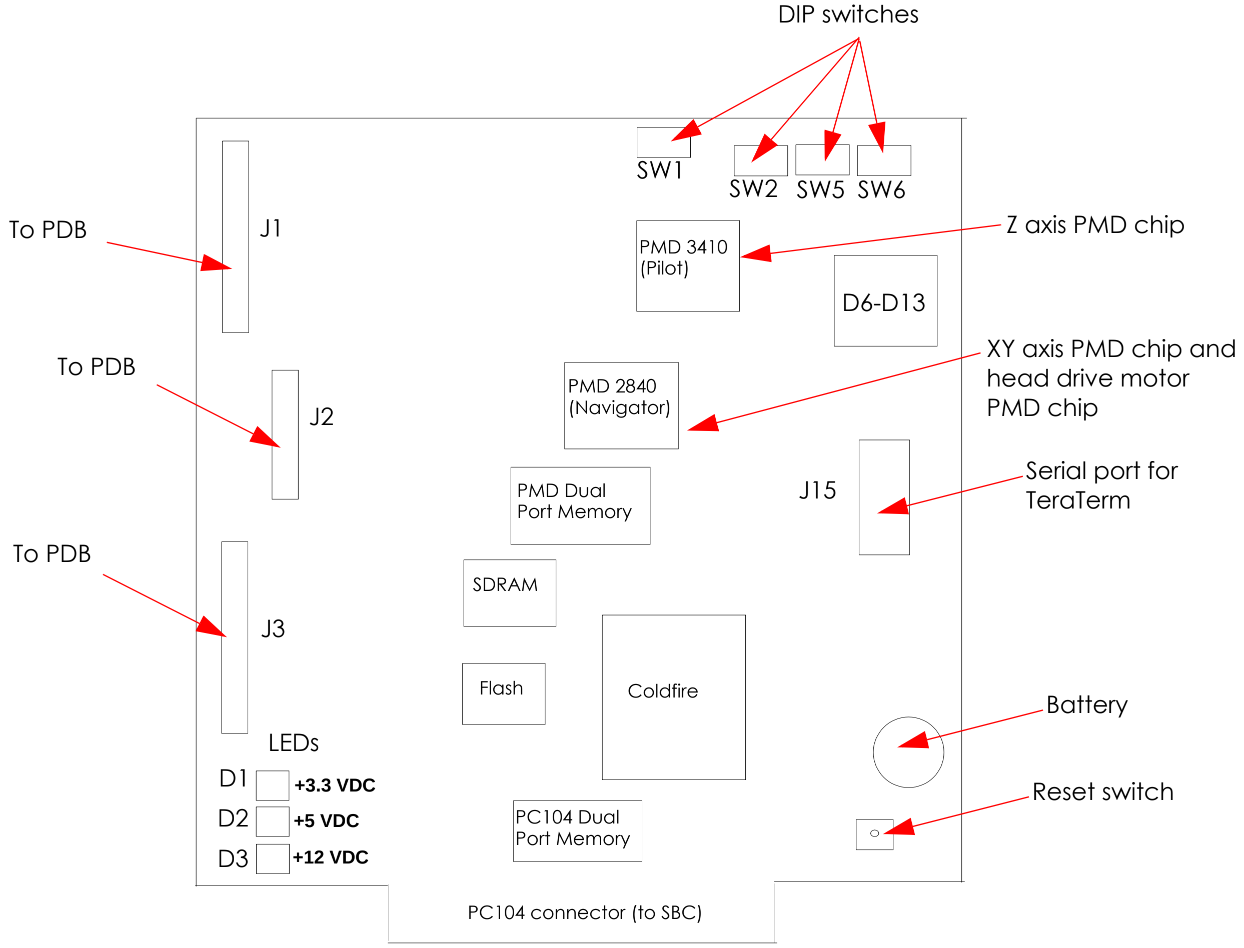
The controller board monitors the following safety devices:

- Chamber T/C alarm – activated for a bad or missing T/C
- Liquefier T/C alarm – activated for a bad or missing T/C
- Head and chamber snap switches
- Main thermostat
- Door open switch
- Door latch solenoid

Controller Board Layout

Figure 2-6 below shows the layout of the controller board connectors with labels indicating where each of the functions described previously are connected. In addition to those functions, the figure shows a reset button, a set of dip switches, and the LEDs (D1-D3 and D6-D13).

Figure 2-6: Controller board detail



Reset Button

Located on the lower right side of the board, the reset button will do a hard reset of the controller board. Before continuing with normal operation after resetting the board, system power must be cycled.

Dip Switches

There are four dip switch banks (SW1, SW2, SW5, SW6) located on the top right side of the board.

> **Note:** Read the black numbers on the switch bank for SW1 and read the white numbers on the board for SW2, SW5, and SW6.

SW1

Number (in black)	Description	Setting	Default
1-3	PMD pilot baud rate	57600	1-2 off, 3 on
4-5	Pilot parity bits	None	Off
6	Pilot stop bits	2	Off
7	Pilot protocol	Point to point	On
8	Unused	Unused	Off

SW2

Number (in white)	Description	Default
16-24	Unused	Off

SW5

Number (in white)	Description	Default
8-15	Unused	Off

SW6

Number (in white)	Description	Default
0	Run built-in self test (BIST)	Off
1	Load Firmware (turn on when using SNDBIN.EXE)	Off
2	Disable door latching	Off
3	Unused	Off
4	Don't reset controller when in command is issued	Off
5	Disable WatchDog timer	Off
6	Enable use of dc commands	Off
7	Unused	Off

Memory

There are three types of memory contained on the controller board.

- Dual Port RAM: The communication buffer between the controller board and the single board computer. Events (from the controller), commands (from the SBC), and motion control vertices (from the SBC) are passed through the P104 connector joining the two boards.
- Flash Memory: Where the executable code resides.
- Battery backup RAM: Where the controller board stores system parameters.

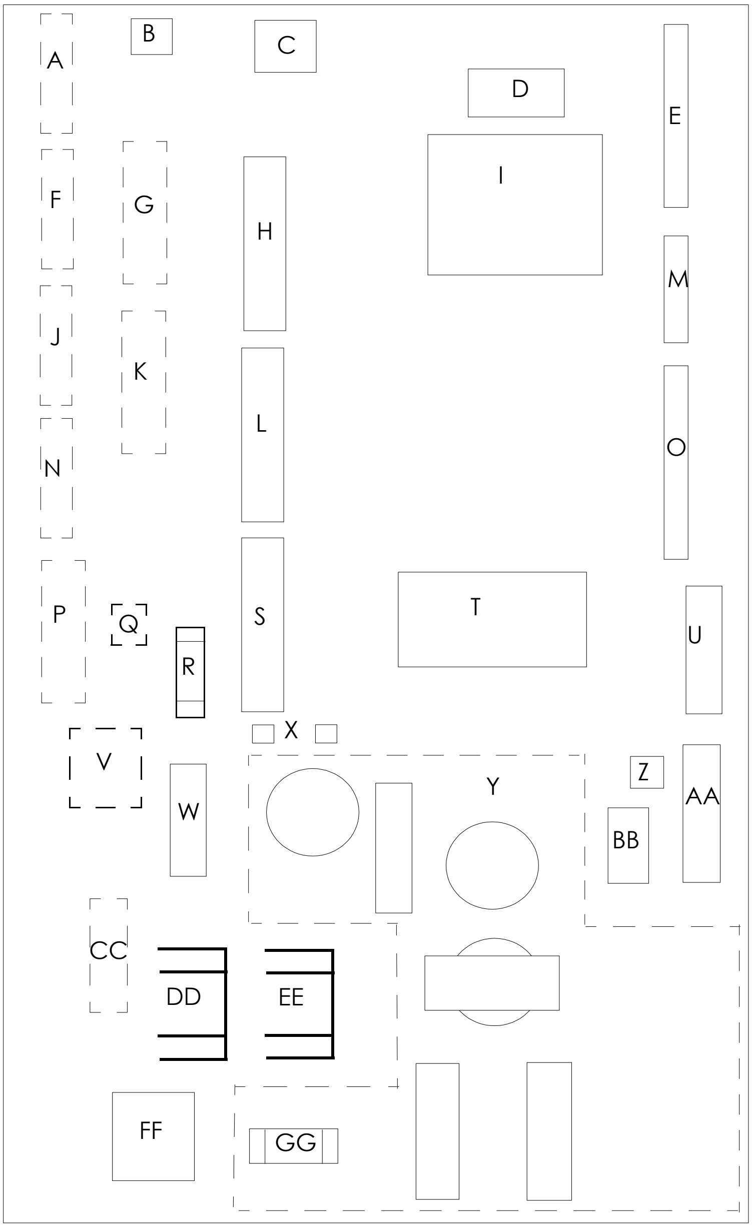
LEDs

There are 11 LEDs located on the controller board. A grouping of three (D1-D3) are located on the lower left side. The other group of eight (D6-D13) are located on the upper right side. D1-D3 are lit when their associated voltage, as shown in table below, is present. The 3.3 VDC supply is generated on the controller board, +5 and +12 VDC come from the PDB. One function of the D6-D12 LEDs is that they turn on sequentially to show software download progress. During normal operation, D13 will blink approximately once every two seconds to indicate that the watchdog is being serviced.

LED Label	Description
D1	+3.3 VDC Supply
D2	+5 VDC Supply
D3	+12 VDC Supply
D6-D12	Debug LEDs (software use only)
D13	Coldfire processor heartbeat

Power Distribution Board (PDB)

Figure 2-7: Power distribution board detail



A	J16 - To LCD display (ribbon)
B	J21 - Not used
C	J13 - Chamber thermocouple connector
D	J24 - To external UPS dry contact (768 Only)
E	J14 - To controller (ribbon cable)
F	J7 - To receiver
G	J9 - Head umbilical II (X motor, filament motors, head snap switch)
H	X motor driver
I	Test points (main)
J	J10 - Head umbilical I (Head T/C signal, X home, X EOT, Z Substrate Detect)
K	J5 - Mid unit (door latch, lights, chamber fans, head blower fan)
L	Z motor driver
M	J19 - To controller (ribbon cable)
N	J12 - Mid unit (Y home, Y EOT, Z home, Z EOT, on/off switch)
O	J17 - To controller (ribbon cable)
P	J8 - Y and Z motor
Q	J11 - Head heaters
R	F2 - 120 VDC to head fuse
S	Y motor driver
T	Voltage indicator LEDs
U	LCD DATA FROM SBC
V	J3 - Chamber Heaters
W	J22 - Support heater 120 VDC in (SST only)
X	Liquefier heater drive indicator LEDs (model left, support right)
Y	Model heater 120 VDC circuit
Z	J23 - PDB cooling fan
AA	J6 - +5/+12 VDC input
BB	J4 - 24 VDC in
CC	J2 - Power down switch AC & chamber main thermostat
DD	Power down (AC on/off) solid state relay
EE	Chamber heater relay solid state relay
FF	AC in & AC out to +5/12/24 VDC power supplies
GG	F1 - 120VAC fuse to 120VDC supply

This board provides the power required to run the system. AC line voltage, +5 VDC, +12 VDC, and +24 VDC feed into the PDB. For SST and Prodigy Plus only, an additional +120 VDC input feeds into the PDB.

AC line voltage comes into the PDB (Figure 2-7.) The voltage is routed through the solid state relay to an auto switching circuit. The circuit is used to supply the chamber heater voltage: 240 VAC in series, or 120 VAC in parallel. The solid state relay is controlled by the controller board, and turns the heater on/off to regulate the chamber temperature. A second solid state relay provides AC line voltage to the system. It is controlled by the controller board and safely shuts down the system when the power down switch is turned off.

- The 5 VDC and 12 VDC are used by the controller board, single board computer, and hard drive. The 12 VDC also powers the filament motors.
- The 24 VDC powers the stepper motors, solenoids, fans, and chamber lights.
- The 120 VDC circuit powers the model heater. For SST only, a separate 120 VDC supply powers the support heater.

There are two fuses on the power distribution board. See Figure 2-7.

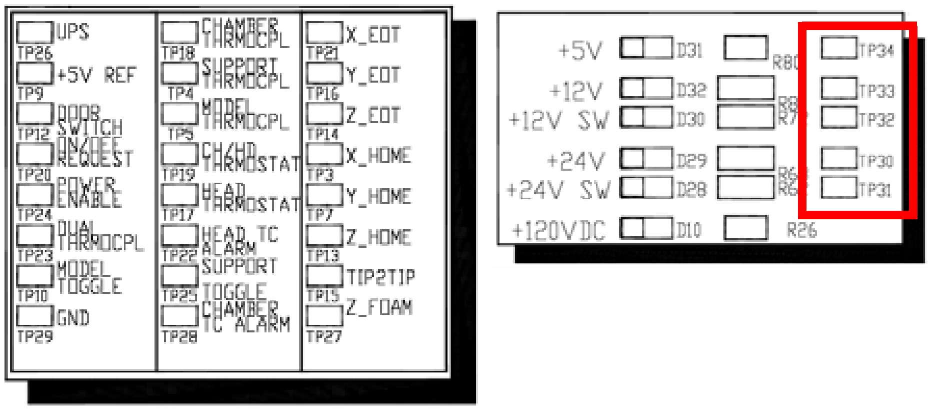
- Fuse F1 fuses the AC input to the +120 VDC supply.
- Fuse F2 fuses the +120 VDC output.

Chamber Temperature Control

The chamber thermocouple (T/C) connects directly to the PDB and the signal is sent to the controller board. The T/C generates a variable low level voltage that depends on the temperature of the chamber. This analog signal from the thermocouple is amplified on the PDB. From the amplifier, the signal goes to an A to D converter in the ColdFire chip on the Controller board. The controller reads the chamber temperature and turns the heaters on and off to maintain 75° C. The chamber fans run continuously when the printer is on. Temperatures can be read on the PDB using a volt meter at test points TP5 for model, TP4 support, and TP18 for the chamber (10 mV per degree C).

Test Points

Test points, located on the PDB board, are very useful for troubleshooting the system. The test points are listed below with a brief description.



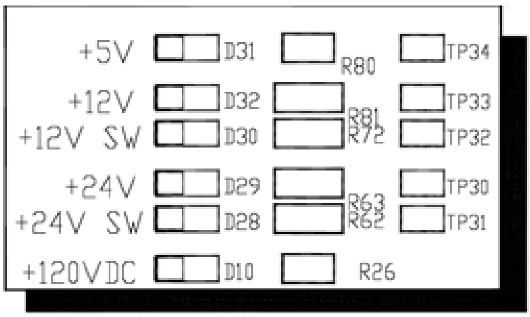
System Component	Test Point	Description
UPS	TP26	Power fail signal from external UPS
+5V REF	TP9	Head T/C service reference
Door Switch	TP12	State of the door (open or closed)
On/Off Request	TP20	State of power down switch
Power Enable	TP24	Enables power to circuitry (normally high)
Dual Thermocouple	TP23	
Model Toggle	TP10	Not used
GND	TP29	Ground
Chamber Thermocouple	TP18	Voltage corresponds to chamber temperature (10 mV=° C)
Support Thermocouple	TP4	Voltage corresponds to support temperature (10 mV=° C)
Model Thermocouple	TP5	Voltage corresponds to model temperature (10 mV=° C)
CH/HD Thermostat	TP19	Chamber and head thermostat (snap switches) (+5 VDC if both switches closed) Normal = tp17 lo, tp19 hi ch thermostat fault=tp17 lo, tp19 lo.
Head Thermostat	TP17	Goes high if head thermostat trips Normal=tp17 lo, tp19 hi hd thermostat fault=tp17 hi, tp19 lo
Head TC Alarm	TP22	High if head T/C not plugged in or open
Support Toggle	TP25	Toggle travel complete
Chamber TC Alarm	TP28	High if chamber T/C not plugged in or open
X EOT	TP21	X end of travel sensor (5 VDC), switches are wired normally closed (NC)
Y EOT	TP16	Y end of travel sensor (5 VDC), switches are wired normally closed (NC)
Z EOT	TP14	Z end of travel sensor (5 VDC), switches are wired normally closed (NC)
X Home	TP3	X home sensor (5 VDC), switches are wired normally closed (NC)
Y Home	TP7	Y home sensor (5 VDC), switches are wired normally closed (NC)
Z Home	TP13	Z home sensor (5 VDC), switches are wired normally closed (NC)
Tip-to-Tip	TP15	Not used

System Component	Test Point	Description
Z Foam	TP27	Z substrate sensor (5 VDC)
+5 VDC	TP34	+5 VDC
+12 VDC	TP33	+12 VDC
+12 VDC SW	TP32	+12 VDC switched (off when power enable is off, when powering up, and during download)
+24 VDC	TP31	+24 VDC
+24 VDC SW	TP30	+24 VDC switched (off when power enable is off, when powering up, and during download)
AC On/Off	TP1	Drive signal to power down relay
Chamber Heater	TP2	Chamber heater on or off

LEDs

LED voltage is present when LED is lit. The LEDs are listed below with a brief description.

Note: Lit LEDs do not imply accurate voltage. Verify voltage levels using a meter.

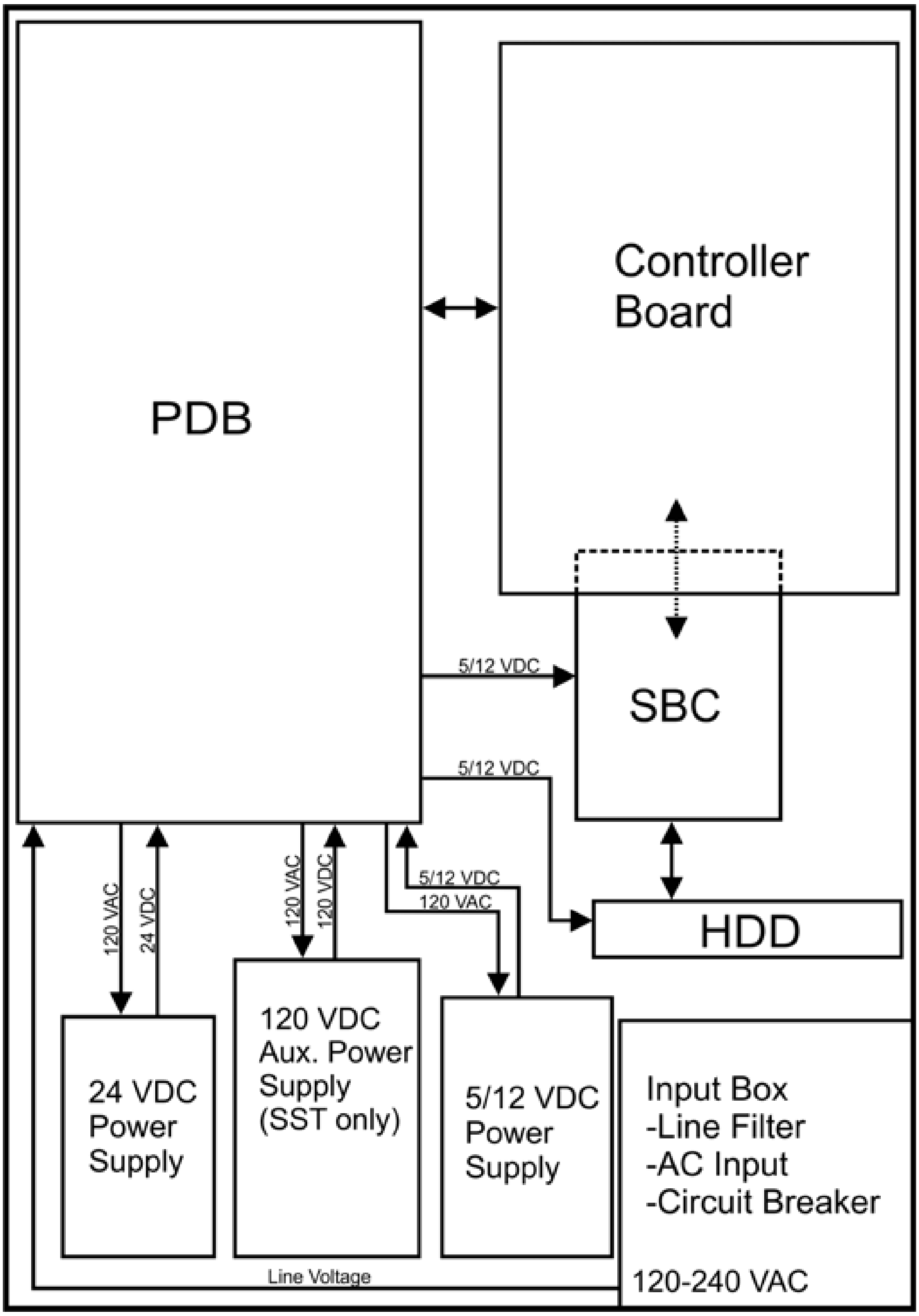


System Component	LED	Description
+5 V	D31	+5 VDC present
+12 V	D32	+12 VDC present
+12 V SW	D30	+12 VDC switched (power enabled)
+24 V	D29	+24 VDC present
+24 V SW	D28	+24 VDC switched (power enabled)
+120 VDC	D10	+120 VDC will blink if voltage is above +50 VDC
AC On/Off	D16	Drive signal to the power down relay
Chamber Heater	D15	On or off
+120 VDC	D7	Model +120 VDC on
Model Heater PWM	D39	Indicates duty cycle of model PWM
Support Heater PWM	D40	Indicates duty cycle of support PWM

Gen 3 Electronics

Electronics Overview

Figure 2-8: Gen 3 electronics block diagram



Controller Board

Overview

The controller board in BST/SST provides all of the low level hardware control and sensing for the system. The software runs on the controller cpu and is flash resident (rather than on the HDD as with the SBC).

Voltage Generation

- +/-15 VDC is used for PMD DACs
- 10 VDC is used for DAC reference
- 3.3 VDC is used for controller board logic

Dual Port Memory Interface

The dual port memory located on the controller board provides the communication channel with the single board computer (SBC) through the P104 connector. This connector has long gold pins coming out of the back of the board and care must be exercised when handling the controller board to avoid damage. The SBC provides the coordinates, velocities, and flow rate commands for modeling to the controller. The controller board provides the status/error information about the hardware back to the SBC.

X, Y, Z Axis Control

The controller takes the flow rate information from the SBC and sends it to the PMD processor. The PMD 2840 processor services the X and Y stepper motors and the model and support head servo motors. The 3410 processor services the Z axis stepper motor. There is no feedback from the stepper motors to the system (they are open-loop controlled).

Filament Motor Control

The controller takes the flow rate information from the SBC and sends it to the PMD 2840 processor. The PMD uses this information along with the encoder signals from the filament motors to generate an output signal to drive the servo motors in the head assembly. Since the encoders provide feedback, the filament motors have a closed-loop control. Their position and rotation are precisely known at all times.

Temperature Control

The controller board reads the three thermocouple (T/C) inputs/signals (2 for the head, 1 for the chamber).

Liquefier Temperature Control

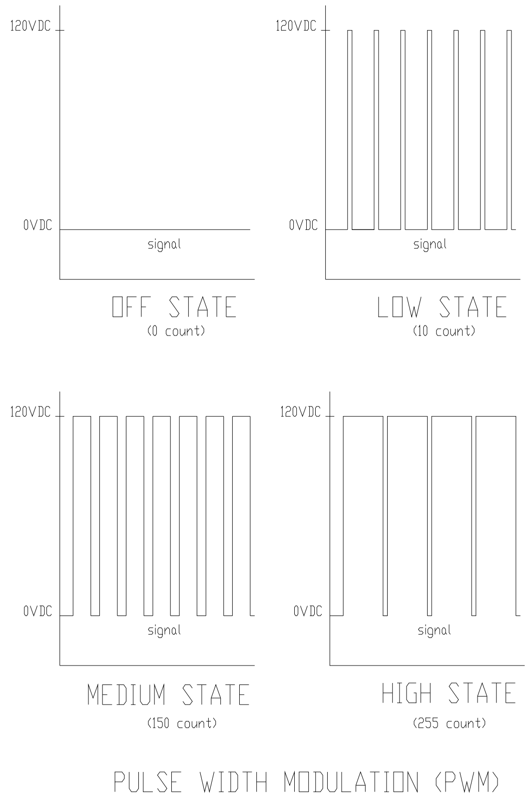
The liquefier T/C connects to the controller board through the power distribution board. The T/C generates a variable low level current that depends on the temperature of the T/C. This analog signal from the T/C is amplified by the head board (1200) or TC Amp Board (1200es). It is then sent down the umbilical cable to the PDB, and then to the controller board. An A to D converter in the ColdFire chip converts the analog signal to digital. In order to improve temperature resolution, this signal is biased. The lowest reading possible is 89.5° C. The highest reading is 330° C.

The liquefier temperature is maintained at:

	BST Single Heater	SST Dual Heater
Model	300° C	300° C
Support	NA	300° C

Temperature control is accomplished using pulse width modulation. See Figure 2-9.

Figure 2-9: Pulse Width Modulation (PWM)



Actual power to the liquefier heater is supplied by the PDB, which is controlled by the controller board. The head heaters are turned off and on 1000 times a second (pulses). The duration of the 120 VDC pulse determines the average power being supplied to keep the liquefier at temperature. Temperatures can be read using a volt meter at test points TP22 for model, and TP20 support on the PDB (10 mV per degree C).

Actuators, Switches & Optical Sensors

The input and output signals are passed through the PDB and then processed by the controller board. The non-motor actuators on a BST/SST system are 24 volt solenoids. The 24 volt power is supplied by the PDB which in turn is controlled by the controller board. The following is a list of actuators:

- Door solenoid – locks the door to the modeling chamber.
- Cartridge latches (2) – holds cartridges in the receiver unit.
- Receiver solenoids – engage the motor that feeds filament from cartridges to liquefier during auto load.

The controller board reads and updates the remaining material information on the smart cartridge (e-prom). This is accomplished through a serial interface to the receiver encryption board. The receiver encryption board in turn connects to the e-prom on the cartridge via two pogo pins.

The controller board monitors the following optical sensors:

- Z limit switches – upper and lower
- X end of travel switch
- Y end of travel switch
- X home sensor
- Y home sensor
- Top of foam sensor

Safety Devices

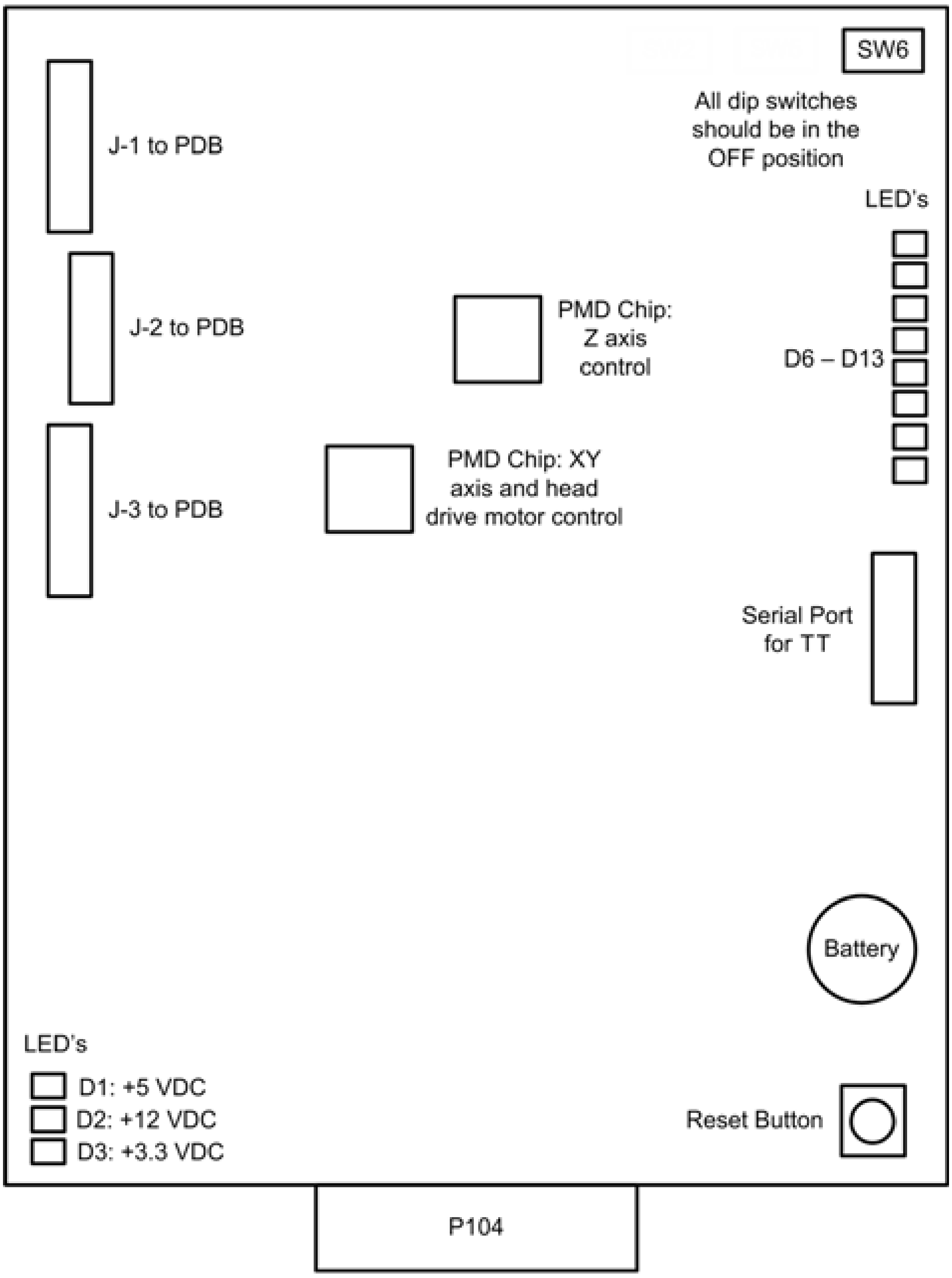
The controller board monitors the following safety devices:

- Chamber T/C alarm – activated for a bad or missing T/C
- Liquefier T/C alarm – activated for a bad or missing T/C
- Head and chamber snap switches
- Main thermostat
- Door open switch
- Door latch solenoid

Controller Board Layout

Figure 2-10 below shows the layout of the controller board connectors with labels indicating where each of the functions described previously are connected. In addition to those functions, the figure shows a reset button, a set of dip switches, and the LEDs (D1-D3 and D6-D13).

Figure 2-10: Controller board connection detail



Reset Button

Located on the lower right side of the board, the reset button will do a hard reset of the controller board. Before continuing with normal operation after resetting the board, system power must be cycled.

Dip Switches

There is one dip switch bank **(SW6)** located on the top right side of the board. All dip switches should be in the OFF position.

SW6

Number (in white)	Description	Default
0	Run built-in self test (BIST)	Off
1	Load Firmware (turn on when using SNDBIN.EXE)	Off
2	Disable door latching	Off
3	Unused	Off
4	Don't reset controller when in command is issued	Off
5	Disable WatchDog timer	Off
6	Enable use of dc commands	Off
7	Unused	Off

Memory

There are three types of memory contained on the controller board.

- Dual Port RAM: The communication buffer between the controller board and the single board computer. Events (from the controller), commands (from the SBC), and motion control vertices (from the SBC) are passed through the P104 connector joining the two boards.
- Flash Memory: Where the executable code resides.
- Battery backup RAM: Where the controller board stores system parameters.

LEDs

There are 11 LEDs located on the controller board. A grouping of three (D1-D3) are located on the lower left side. The other group of eight (D6-D13) are located on the upper right side. D1-D3 are lit when their associated voltage, as shown in table below, is present. The 3.3 VDC supply is generated on the controller board, +5 and +12 VDC come from the PDB. One function of the D6-D12 LEDs is that they turn on sequentially to show software download progress. During normal operation, D13 will blink approximately once every two seconds to indicate that the watchdog is being serviced.

LED Label	Description
D1	+3.3 VDC Supply
D2	+5 VDC Supply
D3	+12 VDC Supply
D6-D12	Debug LEDs (software use only)
D13	Coldfire processor heartbeat

Single Board Computer

The single board computer (SBC) is the main processor in the system. It is a complete "PC compatible computer" on a single board. See Figure 2-11.

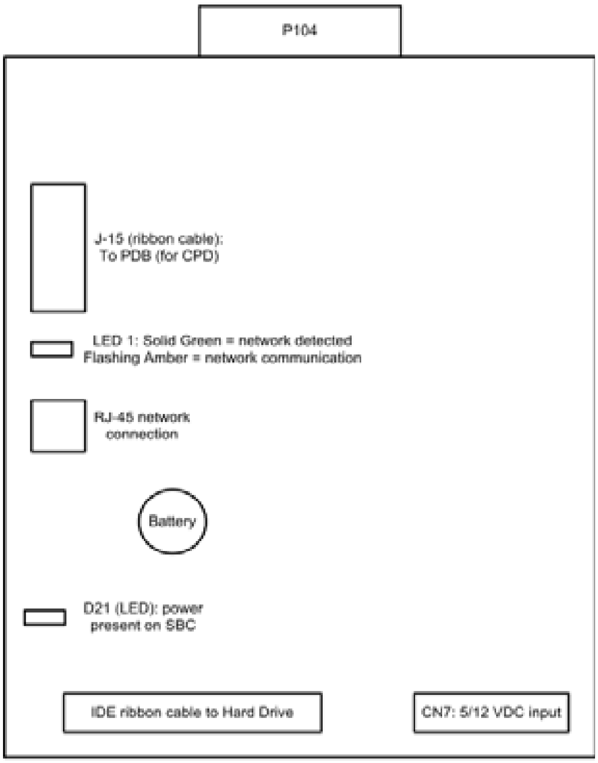
The TCP/IP network interface connects directly to the RJ-45 connector on the SBC. The network interface supports both 10baseT and 100baseT operation. The hardware differentiates automatically. There is a green LED next to the RJ-45 connector. The LED shows the status of the network connection as follows:

- Green LED: Indicates there is a network connection present.
- Yellow LED: Indicates there is network communication present.

The HDD contains the Linux operating system and all the control software needed to run the system (except the controller firmware). This is also where all the downloaded models are stored (the queue).

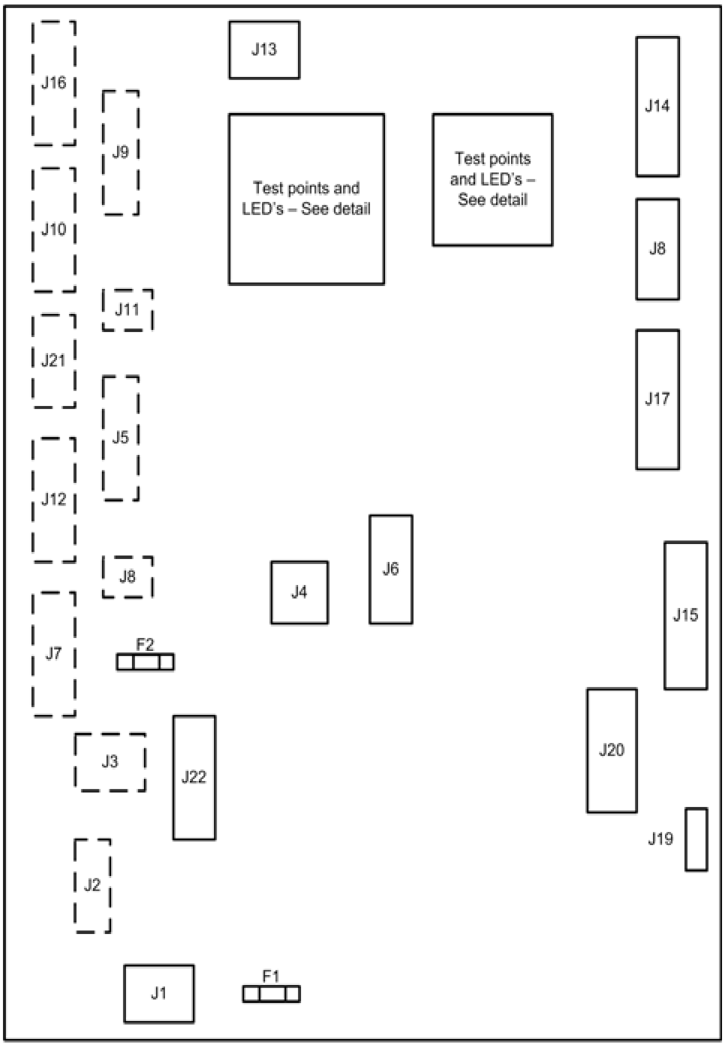
The Control Panel Display (CPD) connects to the SBC at J15 connector. The ribbon cable will connect to the Power Distribution Board (PDB). All user entered commands from the CPD buttons are routed through the PDB and then to the SBC.

Figure 2-11: Single Board Computer detail



Power Distribution Board (PDB)

Figure 2-12: Power Distribution Board detail



J1	AC power in
J2	To power switch and main thermal cutoff fuse
J3	To chamber heaters (AC)
J4	24VDC in
J5	Mid unit harness 2
J6	5/12 VDC in
J7	Receiver cable
J8	To controller - ribbon cable
J9	Head umbilical 2
J10	Head umbilical I
J11	Head heater
J12	Mid unit harness 1
J14	To controller - ribbon cable
J15	To SBC
J16	To LCD display
J17	To controller - ribbon cable
J21	Head umbilical 3
J22	120VDC aux (SST only)
F1	120VAC fuse to 120VDC supply
F2	120VDC

This board provides the power required to run the system. AC line voltage, +5 VDC, +12 VDC, and +24 VDC feed into the PDB. For SST and Prodigy Plus only, an additional +120 VDC input feeds into the PDB.

AC line voltage comes into the PDB (Figure 2-12.) The voltage is routed through the solid state relay to an auto switching circuit. The circuit is used to supply the chamber heater voltage: 240 VAC in series, or 120 VAC in parallel. The solid state relay is controlled by the controller board, and turns the heater on/off to regulate the chamber temperature. A second solid state relay provides AC line voltage to the system. It is controlled by the controller board and safely shuts down the system when the power down switch is turned off.

- The 5 VDC and 12 VDC are used by the controller board, single board computer, and hard drive. The 12 VDC also powers the filament motors.
- The 24 VDC powers the stepper motors, solenoids, fans, and chamber lights.
- The 120 VDC circuit powers the model heater. For SST only, a separate 120 VDC supply powers the support heater.

There are two fuses on the power distribution board. See Figure 2-12.

- Fuse F1 fuses the AC input to the +120 VDC supply.
- Fuse F2 fuses the +120 VDC output.

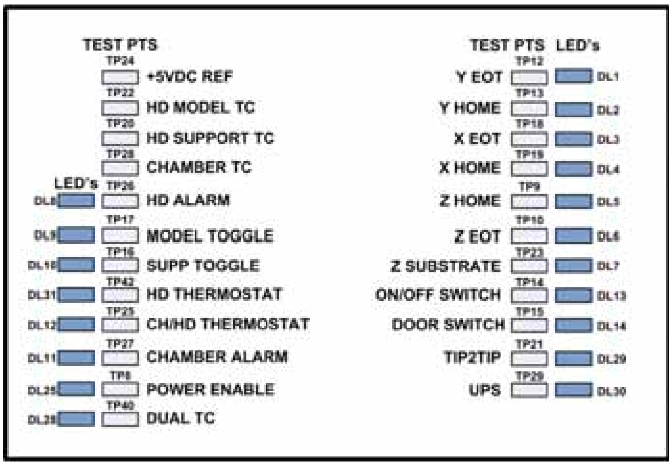
Chamber Temperature Control

The chamber thermocouple (T/C) connects directly to the PDB and the signal is sent to the controller board. The T/C generates a variable low level voltage that depends on the temperature of the chamber. This analog signal from the thermocouple is amplified on the PDB. From the amplifier, the signal goes to an A to D converter in the ColdFire chip on the Controller board. The controller reads the chamber temperature and turns the heaters on and off to maintain 75° C. The chamber fans run continuously when the printer is on. Temperatures can be read on the PDB using a volt meter at test points TP22 for model, TP20 for support, and TP28 for the chamber (10 mV per degree C).

Test Points and LED's

Test points (located on the PDB board) and LED's are very useful for troubleshooting the system. The test points and LED's are listed below with a brief description.

Figure 2-13: Test Points

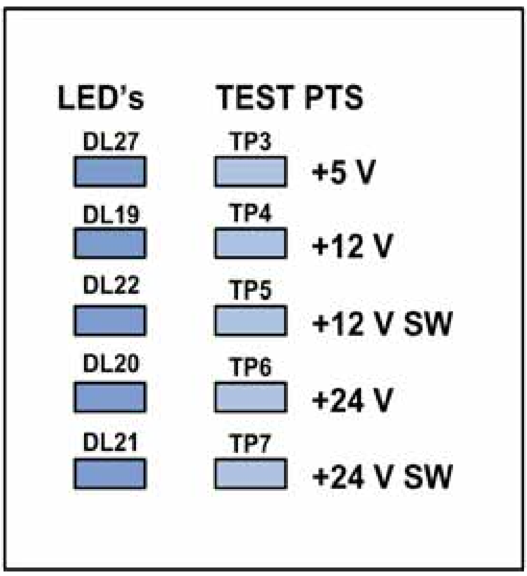


System Component	LED	Test Point	Description
UPS	DL30	TP29	Power fail signal from external UPS
+5V REF	N/A	TP24	Head T/C service reference
Door Switch	DL14	TP15	State of the door (open or closed)
On/Off Request	DL13	TP14	State of power down switch
Power Enable	DL25	TP8	Enables power to circuitry (normally high)
Dual Thermocouple	DL28	TP40	
Model Toggle	DL9	TP17	Not used
GND	N/A	Ground Points	Ground
Chamber Thermocouple	N/A	TP28	Voltage corresponds to chamber temperature (10 mV=° C)
Support Thermocouple	N/A	TP20	Voltage corresponds to support temperature (10 mV=° C)

System Component	LED	Test Point	Description
Model Thermocouple	N/A	TP22	Voltage corresponds to model temperature (10 mV=° C)
CH/HD Thermostat	DL31	TP25	Chamber and head thermostat (snap switches) (+5 VDC if both switches closed) Normal = tp25 lo, tp42 hi ch thermostat fault=tp25 lo, tp42 lo.
Head Thermostat	DL31	TP42	Goes high if head thermostat trips Normal=tp25 lo, tp42 hi hd thermostat fault=tp25 hi, tp42 lo
Head TC Alarm	DL8	TP26	High if head T/C not plugged in or open
Support Toggle	DL10	TP16	Toggle travel complete
Chamber TC Alarm	DL11	TP27	High if chamber T/C not plugged in or open
X EOT	DL3	TP18	X end of travel sensor (5 VDC), switches are wired normally closed (NC)
Y EOT	DL1	TP12	Y end of travel sensor (5 VDC), switches are wired normally closed (NC)
Z EOT	DL6	TP10	Z end of travel sensor (5 VDC), switches are wired normally closed (NC)
X Home	DL4	TP19	X home sensor (5 VDC), switches are wired normally closed (NC)
Y Home	DL2	TP13	Y home sensor (5 VDC), switches are wired normally closed (NC)
Z Home	DL5	TP9	Z home sensor (5 VDC), switches are wired normally closed (NC)
Tip-to-Tip	DL29	TP21	Not used
Z Foam	DL7	TP23	Z substrate sensor (5 VDC)
AC On/Off	DL15	TP1	Drive signal to power down relay
Chamber Heater	DL16	N/A	Chamber heater on or off

Note: Lit LEDs do not imply accurate voltage. Verify voltage levels using a meter.

Figure 2-14: LED and test point detail



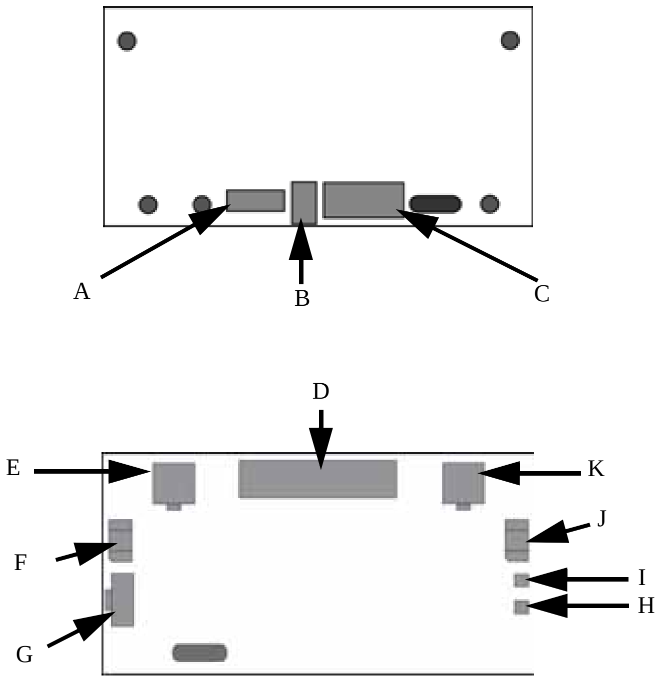
System Component	LED	Description
+5 V	DL27	+5 VDC present

System Component	LED	Description
+12 V	DL19	+12 VDC present
+12 V SW	DL22	+12 VDC switched (power enabled)
+24 V	DL20	+24 VDC present
+24 V SW	DL21	+24 VDC switched (power enabled)
+120 VDC	DL18	+120 VDC will blink if voltage is above +50 VDC
AC On/Off	DL15	Drive signal to the power down relay
Chamber Heater	DL16	On or off
+120 VDC	DL17	Model +120 VDC on
Model Heater PWM	DL23	Indicates duty cycle of model PWM
Support Heater PWM	DL24	Indicates duty cycle of support PWM

Head Board

Figure 2-15: Head board layout

Rear view



Front view

A	J304	Z Sensor
B	J302	Head Motor Power
C	J303	Head Motor Ribbon Cable
D	J301	Umbilical Cable
E	J102	Support Heater
F	U303	X Home Sensor
G	J305	Toggle Sensor
H	D1	Support 120VDC LED (120 VDC present if on)
I	D2	Model 120VDC LED (120 VDC present if on)
J	U304	X EOT Sensor
K	J202	Model Heater

Software

3

In this chapter you will learn about the software that is used in the system. The contents and page numbers of this chapter are as follows:

System Software Download Procedure

Required Tools

- "Dimension" system software and CatalystEX CD
- Crossover cable or network connection
- Notebook computer or workstation with Windows 2000, XP Pro, Vista or Windows 7.

Caution: Do not open the printer door or interrupt power to the printer during the upgrade. Controller damage can result if interruption occurs.

Procedure

1. Make sure that CatalystEX has been installed on the PC and that the PC can communicate with the printer.
2. Turn on the printer.
3. When the printer enters Idle status, press the Maintenance button
4. From the System Maintenance Menu, press the Load Upgrade button
5. Place the controller software CD in the CD drive of the PC running CatalystEX.
6. From the Printer Services tab of CatalystEX, select the printer to be upgraded, then click the 'Update Software' button.
7. From the pop-up, navigate to the location of the controller software upgrade file (.upg file) on the CD. Select the file specific to the printer type and Open the file.

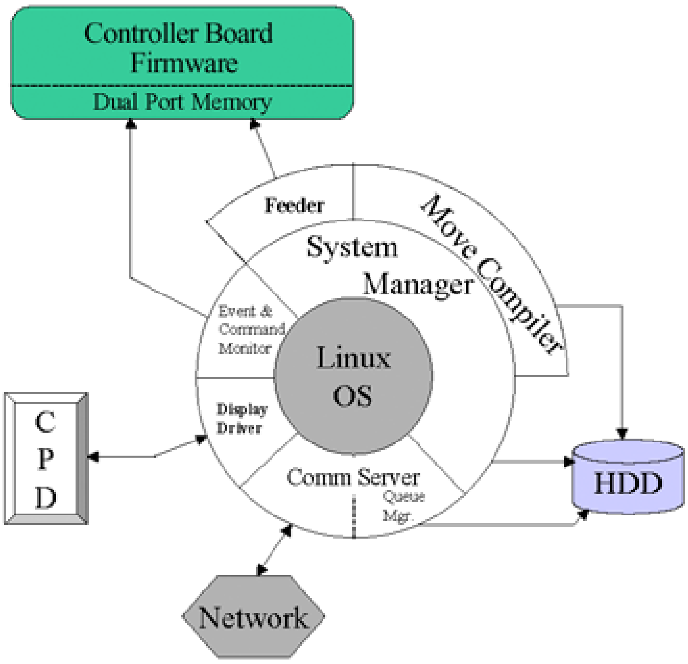
Caution: Do not open the printer door or interrupt power to the printer during the upgrade. Controller damage can result if interruption occurs.

8. The update will be automatically loaded to the printer.
9. After load, the printer will display Verifying update.
10. At completion of verification process, the printer will display, Reboot to Complete. Select Yes.
11. The printer will automatically reboot and return to Idle.
12. From Idle press the Maintenance button to enter System Maintenance
13. From the System Maintenance menu verify that the printer software version now matches the controller software CD version.

Software Architecture

Figure 3-16. shows the major software components that control the system. The software that runs on the Controller Board is EPROM based. The software that runs on the single board computer is stored on the HDD and loaded during power up. Like all PC compatible computers, the SBC runs a brief self-test on power up and then loads the operating system followed by the system's application components.

Figure 3-16: Software Architecture Diagram



Operating System

The system's software currently runs on RedHat Linux. The OS is multi tasking allowing the software components to run fairly independently. The OS also provides support for the TCP/IP network interface and the HDD.

Display Driver

This software interacts with the operator display panel on the front of the system. This software processes all button pushes. The driver also formats the information going to the four line display and the context sensitive button labels.

Comm Server

The comm server software on the system is the other half of the download software that is part of the CatalystEX workstation software. Parts to be built (.cmb files) are received by the comm server and saved on the data partition of the HDD. Queue management of the parts to be built is also part of the comm server. Lastly the comm server provides CatalystEX the system status information that is displayed on workstation.

System Manager

The system manager software provides the overall control and decision making functions that are used by the system during all operations. User requests are received from the Display Driver (in response to button pushes). The requests are processed and commands sent to the Controller Board to activate the appropriate hardware.

Move Compiler

When “start part” is requested the system manager activates the move compiler. The move compiler retrieves the cmb file from the top of the queue. The cmb defines the tool path for the part on a layer by layer basis. The move compiler calculates the proper extrusion rate for the road thus combining tool path and extrusion. The resulting motion control is saved in a PCB file.

Feeder

This driver takes the output of the move compiler and feeds the motion control information to the Controller Board on demand. The feeder will typically start before the move compiler has finished the calculations for the part. This eliminates waiting for all calculation to be complete. As the Controller Board executes the motion control commands they are removed from dual port memory. The feeder adds new commands as space becomes available.

Event/Command Monitor

This software handles all non-motion control interactions between the SBC and the Controller Board. Events are printer status information being sent to the SBC. Commands come from the SBC telling the Controller Board to do something such as find home.

DataStatEX

Overview

To inform resellers, distributors and customer support of DataStatEX's release and its uses. DataStatEX is a "condensed" version of MaracaEX. It was developed to:

- Aid in troubleshooting system problems by allowing the customer to view and report specific system information.
- Allow the customer to adjust Z offset (tip depth).

Using DataStatEX allows you to:

- Select a modeler.
- Add or delete a modeler.
- View a detailed system status window. The window includes important output "state" information. This information will aid in troubleshooting system problems without being on-site.
- View detailed material information.
- Adjust Z offset (tip depth).
- Reset the administrator password to null.

DataStatEX is located as a separate program on all controller CD's. DataStatEX will NOT install on the workstation when performing a system software download. DataStatEX is used primarily for diagnosing system problems. Generally the customer does not need to access DataStatEX. For this reason, the customer should only use DataStatEX when requested by a trained service representative.

It is very important that you assist the customer when adjusting the Z offset. Failure to do so could cause damage to the system. Reference Appendix E of the Service Guide for the Z offset adjustment procedure.

Parts and Tools Required

- Controller CD
- Workstation

Procedure

1. Insert the controller CD into workstation.
2. Select the CD drive and open the *DataStatEX* folder.
3. Select *setup.exe*.
4. Follow the install steps displayed to load the program on the workstation.
5. Open DataStatEX from Start – Programs pull down.
6. Select the "+" button and enter the system name, type and IP address. Do not enter leading 0's in the IP address.
7. Select the green arrow to close the window.

8. Select the “connect to modeler” (two blue arrows) button to establish communications to the system.
9. Information is now shown in the State, Internal State, and Home State windows of DataStatEX.
10. From this point the customer can open any of the button options.

CatalystEX Help

CatalystEX Overview

CatalystEX is an intuitive, user-friendly application designed to interface with Dimension 3D printers. It allows you to quickly and easily open a 3D drawing of a part, prepare the drawing for print, and send the print command to create the part.

CatalystEX provides 'Help' information in two ways - through a Conventional Help file and through a Dynamic Help system.

Conventional Help File

The entire Help file is accessible through the Menu Bar (Help>Contents). This will open CatalystEX Help in a separate window containing standard Help tools - TOC, Search, Index, and personally selected Favorites.

Dynamic Help

Dynamic Help is available from within the CatalystEX application window. The right side of the application window is dedicated to Dynamic Help.

MaracaEX Help

Overview

MaracaEX is a program used for machine configuration and troubleshooting. It is intended for use by trained service personnel only.

Caution: It is possible, using this program, to damage the controller software and make the machine non-functional.

Using MaracaEX you can select a modeler to work with, modify machine-specific configuration parameters, download new calibration file data, download new test parts, and test the machine's operation.

- Select a Modeler
- Modeler States
- Modeler Setup
- MaracaEX Configuration
- Show Machine Status
- Materials
- Tip Offset and Liquefier Calibration
- Gantry
- Temperatures
- Outputs
- Table Calibration
- Get Calibration
- Send Calibration
- Get Configuration
- Test Parts
- Reset Password
- Connect

Select a Modeler

From the Current Modeler drop down list select a modeler to connect to with MaracaEX. To add modelers to the list, use the plus button at the bottom of the window.

Modeler States

These three fields provide the current information for the state of the machine:

State	The current machine state as reported to CatalystEX status.
Internal State	The current internal software state (e.g. stIdle)
Home State	The previous internal state in any state that cares about that state.

Modeler Setup

In order to use MaracaEX on a network modeler, you must first create a modeler definition. You can create modeler definitions by clicking the + button in the main window.

A modeler definition is made complete by specifying the following:

- Modeler name (You can use any descriptive name for the modeler.)
- Modeler type
- Modeler IP address

You can delete a modeler definition by selecting the - button in the main window and then choosing the modeler to delete from the current list of modelers.

Configuration

Clicking the properties icon, "Set up the display parameters", in the main window will bring up a dialog to select Metric or English units of measure. Click the green arrow to close the window after making your selection. MaracaEX will now display numerical values in the units you chose.

Status

MaracaEX machine status provides the ability to set the machines serial number and detailed information about the current mechanical state of the machine.

- Position and Temperatures
- Versions
- Travel Limits
- Filament
- Door
- Setting the Serial Number

Printer Status

Current Position	The current X, Y and Z position in inches.
XYZ Scale/Inch	Scale factors in microsteps per inch.
Current / Total Layers	The current build layer and the total number of layers in the model.
Current Curve	The current curve number of the model.
Head Temp	The model liquefier temperature and its set point in C.
Head PWM	Not used.
Support Temp	The support liquefier temperature and its set point in C (SST only).
Support PWM	Not used.
Chamber Temp	The actual chamber temperature and its set point in C.

Versions

Product Version	The current version number for the complete software release.
Build Version	The build number for current SBC software.
Firmware Version	The current version for the 186/Controller software.
PLD Version	The current version of the programmable logic devices on the 186 or Controller boards.
Product serial number	The serial number of the complete system.

Travel Limits

If the box is checked the switch is tripped.

Note: Only updates when system is looking for the input. Manually blocking the sensor will not update this field.

X home	The X axis home limit switch state.
X Limit	The X axis end of travel limit switch state.
Y Home	The Y axis home limit switch state.
Y Limit	The Y axis end of travel limit switch state.
Z Home	The Z axis home limit switch state.
Z Limit	The Z axis end of travel limit switch state.
Z Jam	The Z jam encoder switch state.
Z Foam	The Z top of foam switch state.

Filament

Model Latched	The model material cartridge latch state.
Model in Head	The state of the modeling material in the machine. True = material moved out of cartridge. False = material not moved out of cartridge.
Support Latched	The support material cartridge latch state.
Support in Head	The state of the support material in the machine. True = material moved out of the cartridge. False = material not moved out of the cartridge

Door

Door Latched	The state of the door latch solenoid.
Door Open	The state of the door switch.

Miscellaneous

Lights On	State of the chamber light.
Chamber Heater	State of the chamber heater.

Setting the Serial Number

To set the system serial number enter the serial number in the "Product Serial Number" field and click on the green check mark. The serial number displayed in this field is the current serial number of the product.

Materials

Every cartridge has a SmartSpool EEPROM attached that tracks information about the filament remaining on the cartridge, and shelf life information. The following information is provided for each cartridge. The top cartridge is the Model material cartridge, and the bottom cartridge is the Support material cartridge.

Cartridge Information

Serial Number	This is a unique number assigned to each cartridge.
Material Type	This is the type of material on the cartridge. For example: P400 - is a standard modeling material P400R - is a standard release material. P400SR - is a standard soluble release material.
Manufacturing Lot	This is a lot code used by Stratasys to control the manufacturing process.
Manufacturing Date	This is the date that the cartridge was manufactured.
Use Date	This is the date that the cartridge was first inserted in a machine.
Initial Quantity	This is the amount of material that was on the cartridge initially.
Current Quantity	This is the amount of material currently on the cartridge.

Tip Offset

The tip offset control dialog allows you to adjust the tip offset values.

Tip Offset X,Y	XY distance from model tip to support tip.
Z Tip to Base	Depth of tip into modeling base.
Z Tip to Tip	Z distance from model tip to support tip with desired offset.

Gantry

The gantry controls the adjustment for the XY gantry. These values are set in the factory and do not need to be adjusted unless the XY gantry is adjusted or replaced.

Gantry Hysteresis

Y Lash	Mechanical lash is the tendency of the gantry to remain stationary after a change in direction until the mechanical slop in the system is taken up by the move.
X Adjust	X Axis adjustment provides a method of removing additional linear part error that is present in the XY Gantry after assembly.

Part Calibration

Left	Measured on left side of modeling base, front to back.
Right	Measured on right side of modeling base, front to back.
Front	Measured on front side of modeling base, left to right.
Back	Measured on back side of modeling base, left to right.
Left Front	Measured from front left corner to rear right corner.
Left Rear	Measured from front right corner to rear left corner.

Temperatures

The temperature control dialog allows you to adjust the set points for the head and chamber temperatures, for both modeling and at standby.

Temperature Setpoints

Item	Build Setpoint	Standby Setpoint
Model	300	102.5
Support	300	102.5
Chamber	75	75

Outputs

The outputs dialog contains toggle buttons to control solenoids and motors that can not be directly controlled on the Control Panel Display.

Model Latch	The check box shows the state of the model (top) cartridge latch, and the toggle button changes that state.
Motor Enabled	The check button shows the state of the model (top) feed motor solenoid, and the toggle button changes that state.
Motor Running	The check box shows the state of the model (top) filament feed motor, and the toggle button changes that state.
Support Latched	The check box shows the state of the support (bottom) cartridge latch, and the toggle button changes that state.
Motor Enabled	The check box shows the state of the support (bottom) feed motor solenoid, and the toggle button changes that state.
Motor Running	The check box shows that state of the support (bottom) filament feed motor, and the toggle button changes that state.
Door Latch	This check box shows the state of the door latch solenoid, and the toggle button changes that state.
Lights On	This check box shows the state of the chamber lights, and the toggle button changes that state.

Table

Table calibration consists of downloading the correct XY table calibration file to the machine to properly adjust for table-to-table tolerance issues. The Table dialog allows you to browse for and select the calibration file for the currently installed XY table and to download it to the machine.

Get Calibration

The Get Calibration button allows a single calibration file to be retrieved from any machine with a build number greater than or equal to 1132. This calibration file will also be on the system calibration floppy disk/CD that ships in the electronics pan for systems with a build number greater than or equal to 1132. This file contains all the factory calibration information, including, but not limited to: Tip Offset, Tip Depth, Y Lash, X Correction, and the table calibration DAT file.

When the button is pressed, a file selection dialog is presented allowing the assignment of a file name and the selection of a storage location. This file should be updated any time maintenance is performed that affects the factory calibration.

Send Calibration

The Send Calibration button allows you to send the complete set of factory calibrations to the machine as a single file. This includes but is not limited to: Tip Offset, Tip Depth, YLash, X Correction, and the gantry DAT file. This file is stored on the system calibration floppy disk/CD if the system shipped with Controller software build 1132 or higher installed. A calibration file can be retrieved from the modeler using Get Calibration from any system with a build number of 1132 or higher.

When this button is pressed a dialog box appears that allows you to browse for and select the calibration file to send to the machine.

Get Config

When the Get Config button is pressed a file selection dialog is presented allowing the assignment of a file name and the selection of a storage location.

Test Parts

Test Parts consists of downloading sample and test part files to the machine. These file must be in the .cmb.gz format produced by CatalystEX.

The Test Part dialog allows you to browse for and select the sample or test file and to download it to the machine. The Test Parts are not preserved during a software upgrade. To remove unwanted test parts, upgrade the software to the current level and only the factory test parts will remain on the system.

Reset Password

This button resets the administrator password to null. This turns off password control of the queue. This is used for clearing a forgotten password.

Connect

If the system is not available over the network, when MaracaEX first loads, MaracaEX will only try to connect one time. This allows you to interact with MaracaEX when it is not connected to a machine. The Connect button allows you to request additional connection attempts.

Help

Click the question mark to display the Help files.

Service Procedures

4

This chapter describes removal and replacement procedures for Dimension 1200 and 1200es printers.

Maintenance Preparation

Should you have any questions about Dimension 1200 /1200es replacement procedures, contact Stratasys Customer Support at 1-800-801-6491 for further information or assistance.

Read these warnings before performing any service on this system!

Warning: Make sure the power is disconnected when performing any of the disassembly or assembly instructions in this chapter. Failure to do so can cause severe personal injury or damage to the electronics.

Warning: Servicing instructions outlined in this chapter are intended for use by qualified personnel only. Failure to follow these guidelines can cause severe injury.

Warning: The Power Switch does NOT remove power from the printer. The Breaker Switch located on the rear of the printer MUST be off before service is performed on the printer. It is recommended that the AC power cord be disconnected before performing maintenance outlined in this chapter.

Warning: Use extreme caution when the door solenoid is disabled. Axes may move unexpectedly, which may cause serious injury. Always remember to enable the door solenoid once service is completed.

Caution: It is recommended that the Network Cable and the UPS cable (if used) be disconnected prior to performing maintenance outlined in this chapter.

Caution: A grounding strap must be worn anytime electronic components are to be touched during maintenance.

Note: All references within this procedure to 'Left' or 'Right' are made assuming that the printer is being viewed from the 'Front' (the door and user interface panel side).

Pre-Maintenance Procedures

1. Unload support and/or model material as required for the specific maintenance procedure.
2. Power down the system using the power switch.
3. After the system has powered down, turn the circuit breaker off.
4. Unplug the AC power cord, RJ-45 network cables, and the UPS cable (if used) from the rear of the printer.
5. Remove the Rear Panel. See Rear Panel on page 4-5.
6. Remove the Side Panels. See Side Panels on page 4-6.

Required Tools list

Distributor/Reseller supplied Tools

1. Standard screwdriver set
2. Phillips screwdriver set
3. Allen wrench set
4. Pliers
5. Channel locks
6. Small wire cutters
7. Needle nose pliers
8. Assorted wire ties
9. Box wrenches
10. Flashlight
11. Grounding strap
12. Voltmeter
13. Network crossover cable (for communication testing)
14. Laptop computer
15. Nut driver set
16. Dial indicator
17. Serial data cable (for issuing Tera Term commands).
18. Serial to USB adapter, recommended IOGEAR GUC232A (for issuing Tera Term commands).

Supplied by Stratasys

1. Belt tension gauge (for adjusting XY table drive belts)
2. Y-Motor belt tensioning tool (for adjusting belt Y table motor belt)
3. Head dial indicator bracket (for XY table and Z stage leveling)
4. Spring Removal Tool
5. Drive Wheel Alignment Rod
6. Set of Shims (Feeler Gauges)
7. Liquefier Alignment Rod
8. Filament Guide Alignment Rod (For SST Only)
9. Service Guide (CD and Hardcopy)
10. MaracaEX CD
11. CatalystEX CD
12. Controller software CD

Exterior Components

Rear Panel

Required Tools

- $^{5}/_{16}$″ nut driver or standard screwdriver

Removing the Rear Panel

1. Using a $^{5}/_{16}$″ nut driver or standard screwdriver, loosen but do not remove the 5 mounting screws (the screws are 'captured' on the inside of the Side Panels). See Figure 4-17.

Figure 4-17: Rear and panel mounting screw locations

2. Remove the panel - lift up and pull it away from the printer.

Installing the Rear Panel

1. With the Fan Filter and Rear Panel flange on the outside of the printer, position the panel with the large portion of the mounting slots placed over the mounting screws.
2. Lower the panel into position. Make sure all 5 mounting screws are properly positioned in the narrow portion of their mounting slots.
3. Using a $^{5}/_{16}$″ nut driver or standard screwdriver, tighten the 5 mounting screws.

Side Panels

Required Tools

- $^{5}/_{16}$″ nut driver or standard screwdriver

Removing the Side Panels

1. Remove the Rear Panel (See "Removing the Rear Panel" on page 4-5.)
2. Using a $^{5}/_{16}$″ nut driver or standard screwdriver, remove the 6 mounting screws. See Figure 4-18.

Figure 4-18: Side panel mounting screw locations

3. Remove the Right Side Panel - pull up and toward rear of printer.
4. Remove the Left Side Panel - pull up and toward rear of printer.

Installing the Side Panels

1. Align the left side panel.
2. Align the right side panel.
3. Using a $^{5}/_{16}$″ nut driver or standard screwdriver, tighten the 6 mounting screws.

User Interface Panel

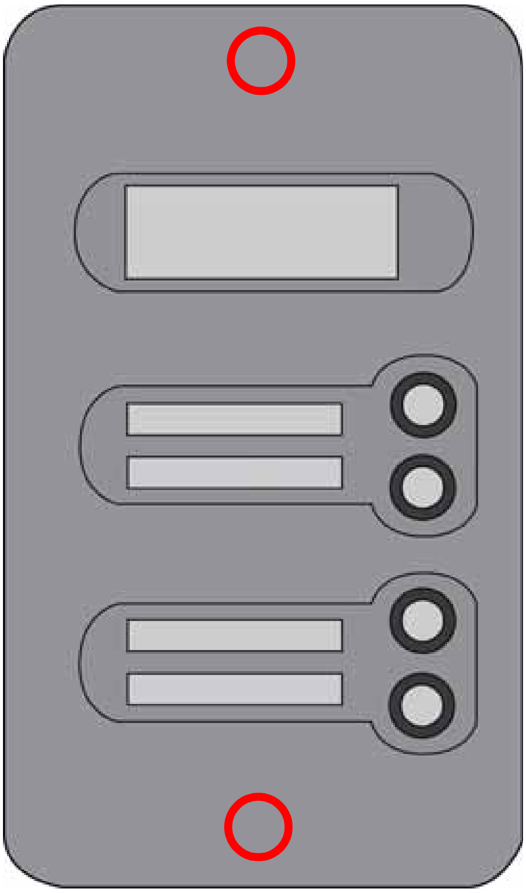
Required Tools

- 1/8" allen wrench

Removing the User Interface Panel

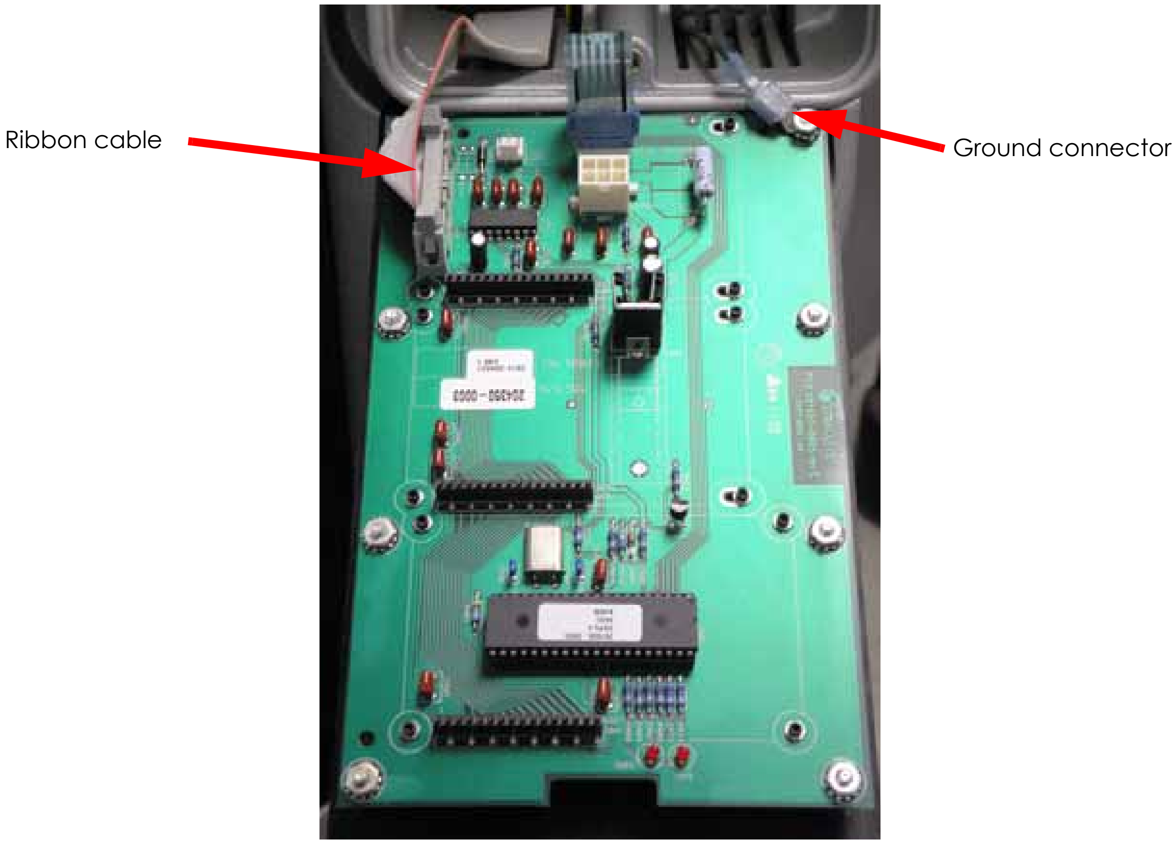
1. Using a 1/8" allen wrench, remove the 2 screws holding the user interface panel to the front bezel. See Figure 4-19.

Figure 4-19: User interface panel screw locations



2. Carefully pull the user interface panel out.
3. Disconnect the ribbon connector by pressing the tabs away from the connector and pulling the cable outward. See Figure 4-20.
4. Disconnect the ground wire by pulling the connector away from the spade. See Figure 4-20.

Figure 4-20: User interface panel connections



5. Remove the user interface panel and discard.

Installing the User Interface Panel

1. Reinstall the ground wire by pushing the connector on to the spade.
2. Reconnect the ribbon cable to the rear of the panel.
3. Align the user interface panel and use a $^1/_8$″ allen wrench to reinstall the 2 mounting screws.

Door Solenoid

Required Tools

- $^{5}/_{16}$″ nut driver or standard screwdriver
- $^{7}/_{8}$″ box wrench (or adjustable wrench)
- Cutters

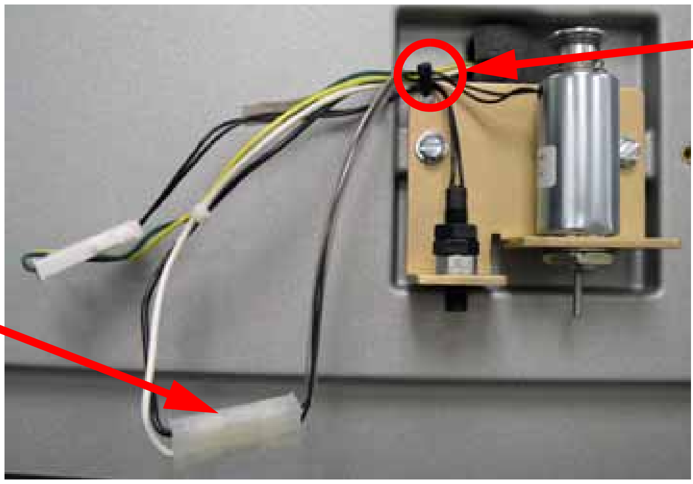
Removing the Door Solenoid

1. Open the chamber door and locate the door solenoid/sensor cover. See Figure 4-21.
2. Using a $^{5}/_{16}$″ nut driver or standard screwdriver, remove the 2 mounting screws. See Figure 4-21.

Figure 4-21: Door solenoid/sensor cover location

3. Using a cutters, remove the wire tie and discard. See Figure 4-22.
4. Disconnect the solenoid by pressing the tab in and pulling connectors apart. See Figure 4-22.

Figure 4-22: Solenoid connector location



5. Using a $^{7}/_{8}$″ box wrench, remove the door solenoid mounting nut and lock washer. See Figure 4-23.

Figure 4-23: Solenoid mounting nut location

6. Remove the door solenoid by lifting upward and discard.

Installing the Door Solenoid

1. Align the door solenoid and use a $^{7}/_{8}$″ box wrench to reinstall the lock washer and mounting nut.
2. Reconnect the Door Solenoid by pushing the 2 connectors together.
3. Reinstall the wire tie.
4. Align the Door Solenoid/Sensor cover so the slots are facing down and use a $^{5}/_{16}$″ nut driver to reinstall the 2 mounting screws.

Door Sensor

Required Tools

- $^{5}/_{16}$" nut driver or standard screwdriver
- $^{1}/_{2}$" box wrench (or adjustable wrench)
- Cutters

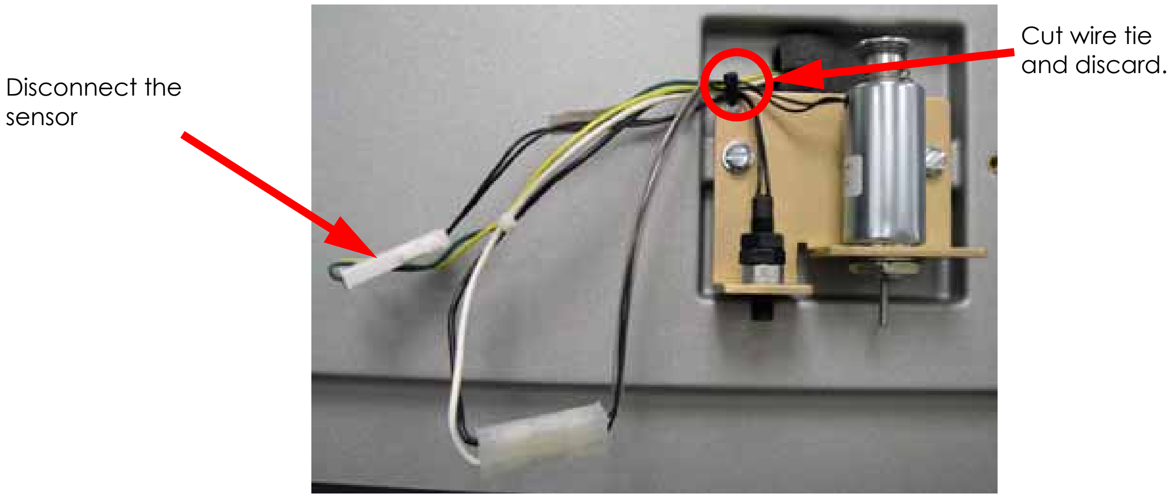
Removing the Door Sensor

1. Open the chamber door and locate the door solenoid/sensor cover.
2. Using a $^{5}/_{16}$" nut driver or standard screwdriver, remove the 2 mounting screws. See Figure 4-24.

Figure 4-24: Door solenoid/sensor cover location

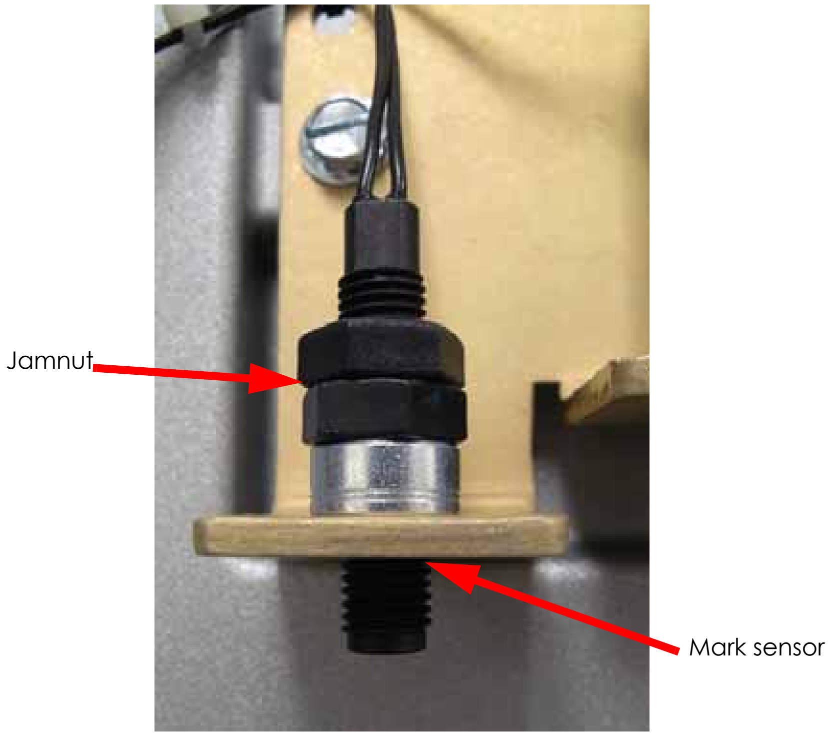
3. Using a cutters, remove the wire tie and discard. See Figure 4-25.
4. Disconnect the solenoid. See Figure 4-25.

Figure 4-25: Sensor connector location



5. Using a white marker, mark the door sensor for easy re-installation. See Figure 4-26.
6. Using a ½" box wrench, loosen the door sensor jamnut and set aside. See Figure 4-26.
7. Unthread the door sensor from mounting bracket and set aside.

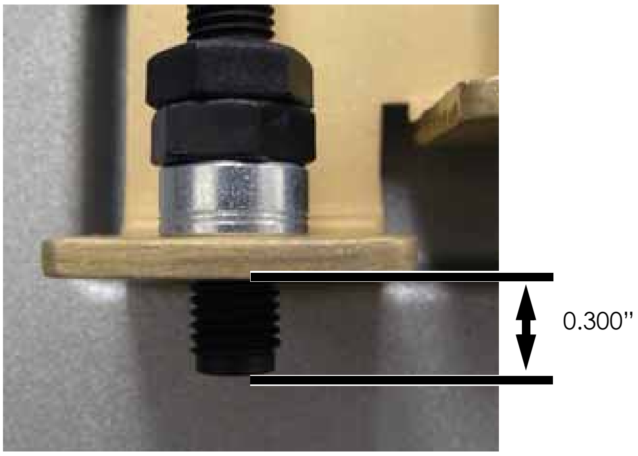
Figure 4-26: Door sensor jamnut location



Installing the Door Sensor

1. Mark the new sensor in the same place as the old sensor, or measure 0.300” inch from the bottom of the sensor and place a mark. See Figure 4-27.

Figure 4-27: Sensor length



2. Thread the jamnut onto the sensor.
3. Thread the sensor into the mounting bracket until the mark is even with the bottom of the mounting bracket.
4. Tighten the jamnut until it is snug - hold the door sensor so it does not rotate while tightening the jamnut. Do not over tighten the jamnut as it may break the sensor.
5. Recheck the door sensor extension below the mounting bracket.
6. Reconnect the door sensor.
7. Reinstall the door solenoid/sensor cover.

Front Door Glass Panel

Required Tools

- Scraper

Removing the Front Door Glass Panel

1. Separate the panel from the door frame by inserting a scraper near each velcro strip and work the glass panel free of the door frame. See Figure 4-28.

Note: Each side of the panel has 2 velcro attach points. Keep a firm grasp on the panel with one hand at all times.

Figure 4-28: Velcro strip locations

Installing the Front Door Glass Panel

1. Align the panel to door frame and press in on panel at each velcro strip to lock in place.

Front Bezel

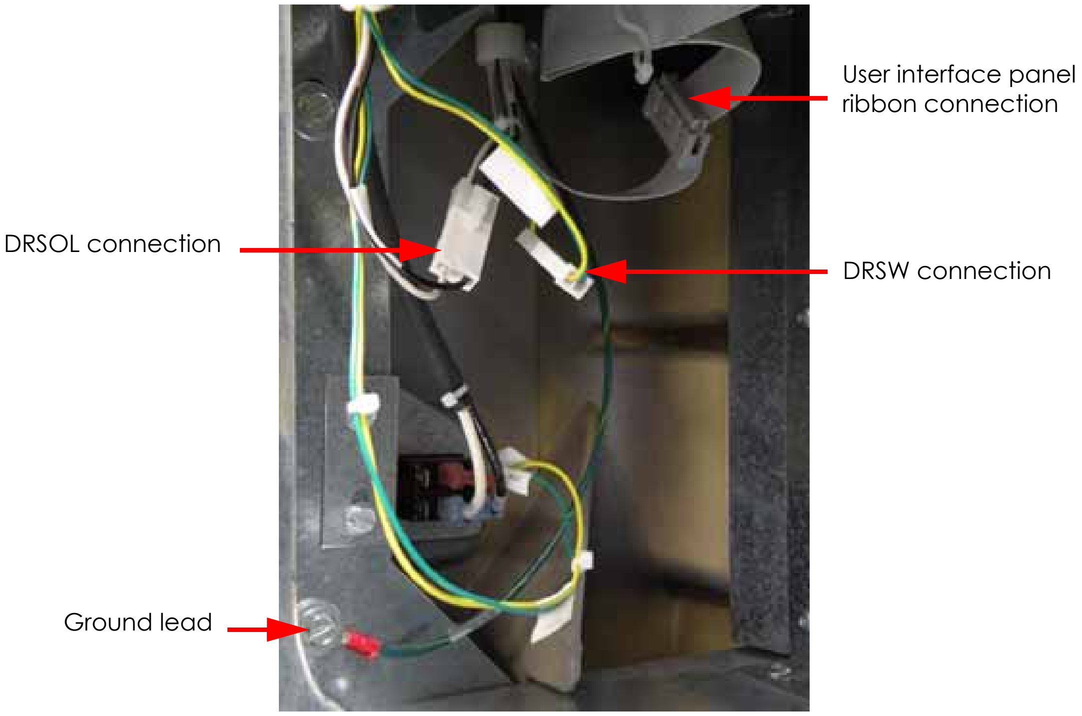
Required Tools

- $^{5}/_{16}$″ nut driver or standard screwdriver
- $^{3}/_{8}$″ nut driver or box wrench

Removing the Front Bezel (Panel)

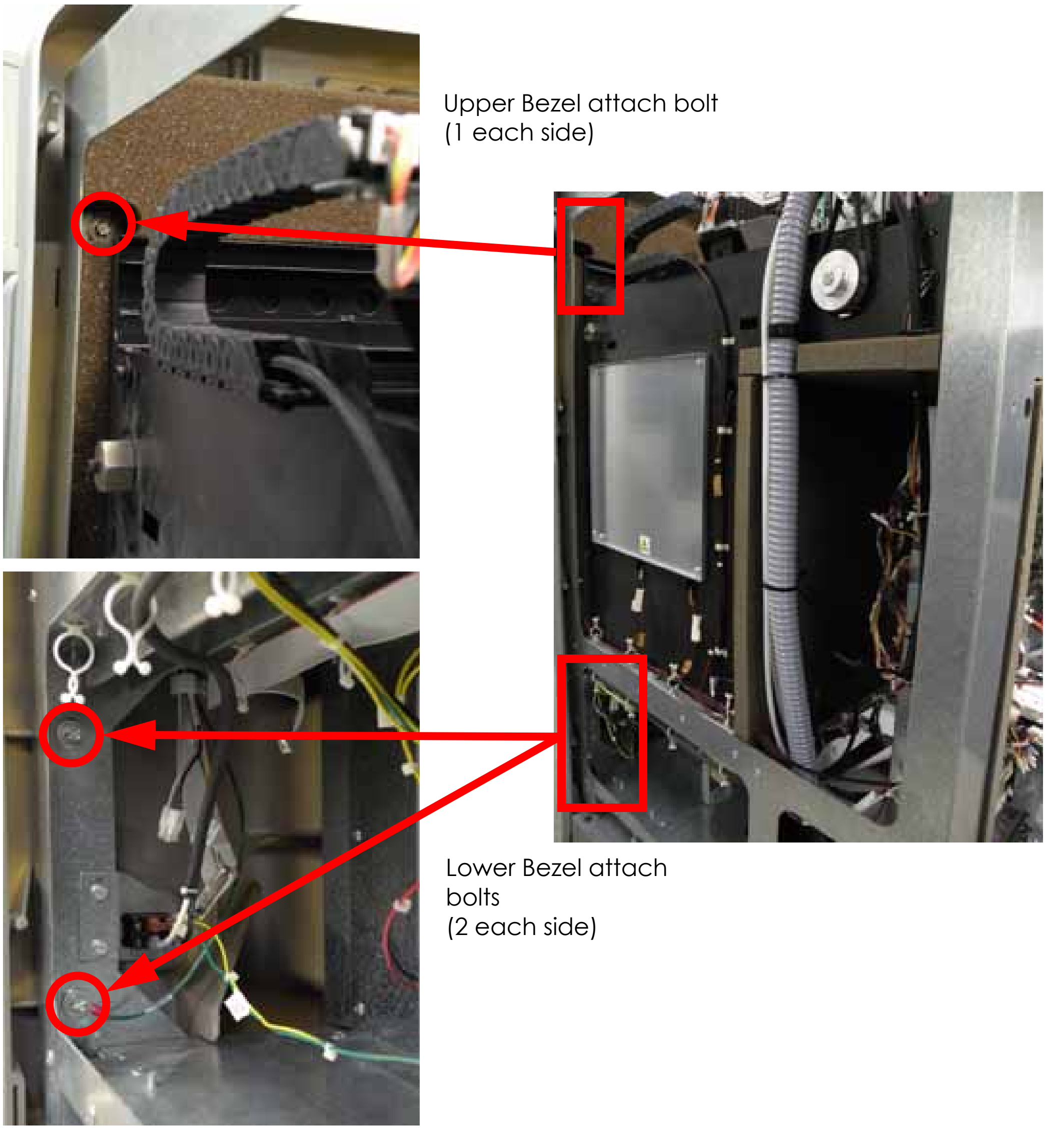
1. Remove the user interface panel. See Removing the User Interface Panel on page 4-7.
2. Remove the door solenoid/sensor cover. See Removing the Door Solenoid on page 4-9.
3. Disconnect the door solenoid electrical lead. See Removing the Door Solenoid on page 4-9.
4. Disconnect the door sensor electrical lead. See Removing the Door Sensor on page 4-11.
5. Disconnect the Bezel wire leads where they connect on the lower right side of the printer, see Figure 4-29.

Figure 4-29: Bezel electrical leads



6. Using a $^{3}/_{8}$″ nut driver or box wrench remove the 6 Bezel retaining bolts and washers (3 on each side - 1 on the lower right is the ground wire connection) see Figure 4-30.

Figure 4-30: Front bezel mounting screw locations



7. Carefully slide the Bezel forward - do not put strain on wires running to printer - and set it aside.

Installing the Front Bezel

1. Install the Front Bezel - retain with washers and bolts. see Figure 4-30. Make sure that ground lead is installed on lower right side mount bolt, see Figure 4-29.
2. Connect Bezel electrical leads on lower right side, see Figure 4-29.
3. Connect the User Interface Panel, see Installing the User Interface Panel on page 4-8.
4. Connect the Door Sensor lead, see Installing the Door Sensor on page 4-13.
5. Connect the Door Solenoid lead and install the cover, see Installing the Door Solenoid on page 4-10.

Gen 2 Electrical Components

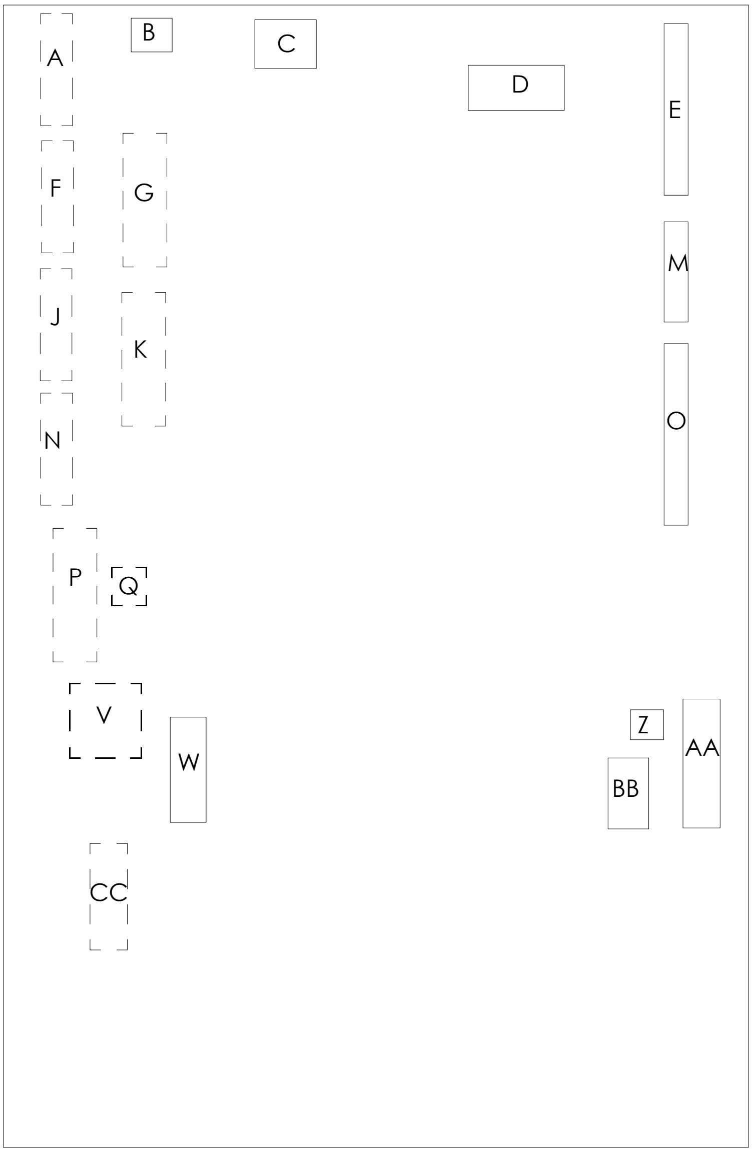
Gen 2 electronics will be installed on printers with serial numbers between P4000 and P08999

Power Distribution Board (PDB)

Required Tools

- Phillips screwdriver
- Small standard screwdriver
- Grounding wrist strap

Figure 4-31: Gen 2 power distribution board detail

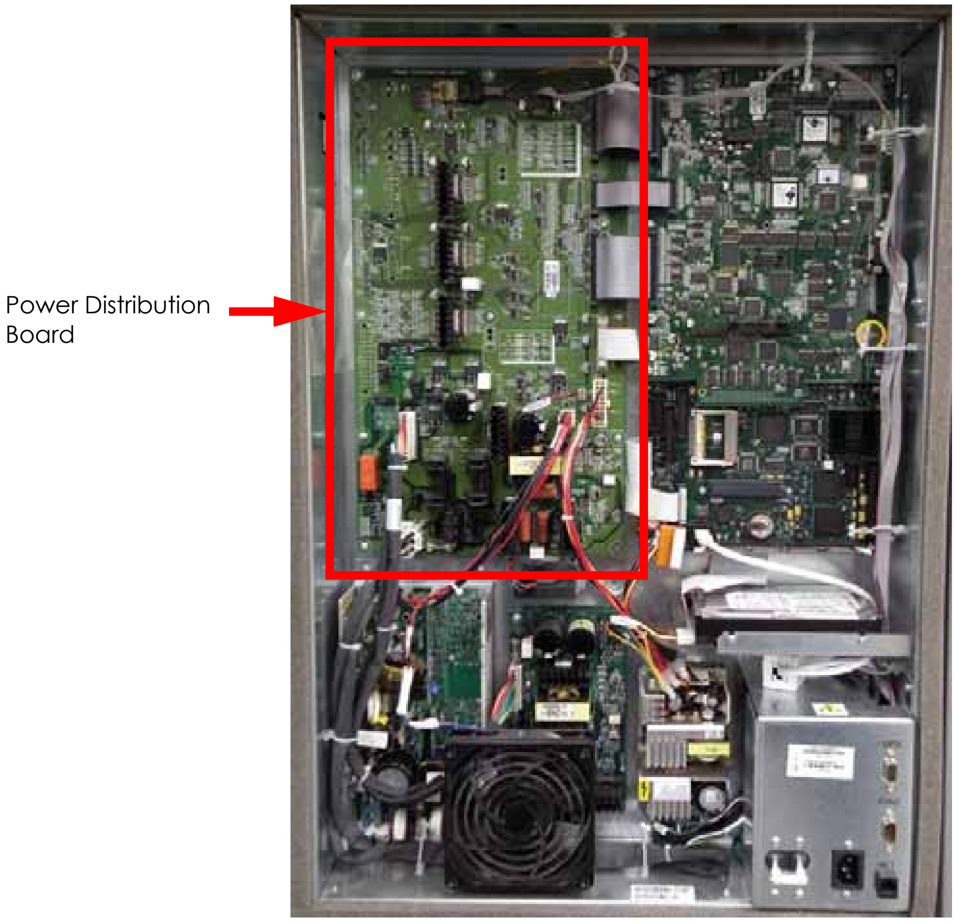


A	J16 - To LCD display (ribbon)
B	J21 - Not used
C	J13 - Chamber thermocouple connector
D	J24 - To external UPS dry contact (768 Only)
E	J14 - To controller (ribbon cable)
F	J7 - To receiver
G	J9 - Head umbilical II (X motor, filament motors, head snap switch)
J	J10 - Head umbilical I (Head T/C signal, X home, X EOT, Z Substrate Detect)
K	J5 - Mid unit (door latch, lights, chamber fans, head blower fan)
M	J16 - To controller (ribbon cable)
N	J12 - Mid unit (Y home, Y EOT, Z home, Z EOT, on/off switch)
O	J17 - To controller (ribbon cable)
P	J8 - Y and Z motor
Q	J11 - Head heaters
R	F2 - 120 VDC to head fuse
V	J3 - Chamber Heaters
W	J22 - Support heater 120 VDC in (SST only)
Z	J23 - PDB cooling fan
AA	J6 - +5/+12 VDC input
BB	J4 - 24 VDC in

Removing the Power Distribution Board

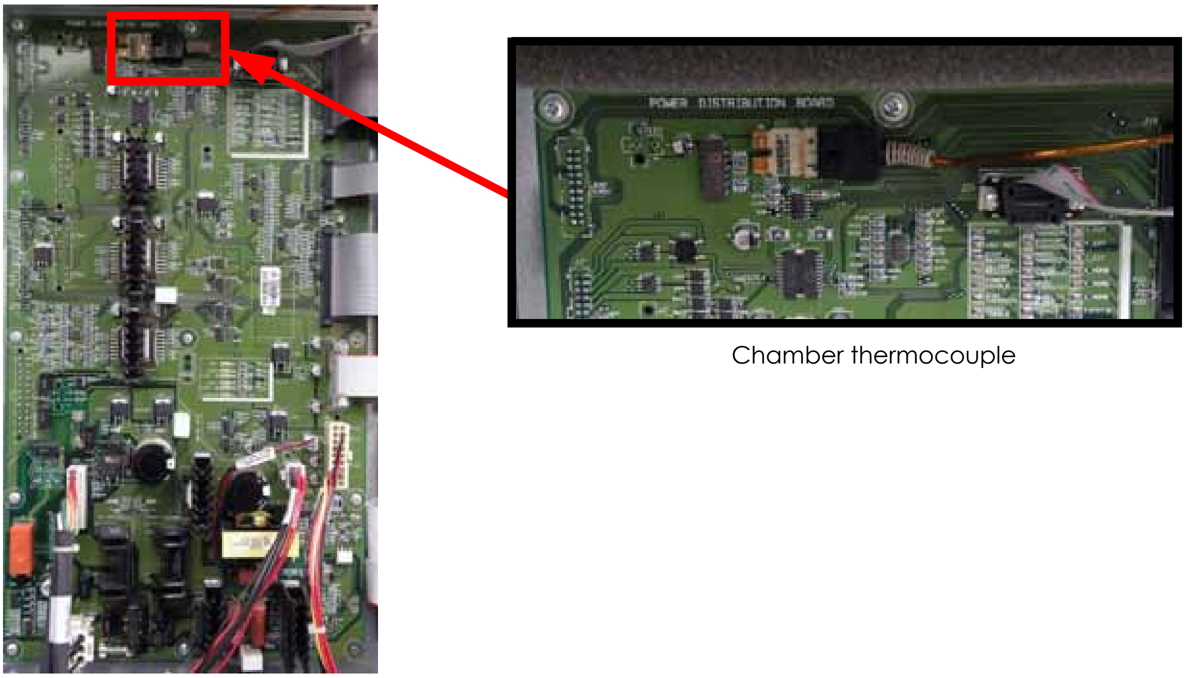
1. Power down the system using the power-down switch. Once the system is powered down, switch the circuit breaker to the **off** position.
2. Unplug the AC power cord, RJ-45 network cable and UPS cable (if used) from the rear of the printer.
3. Remove the rear panel. See Removing the Rear Panel on page 4-5.
4. Remove the side panels. See Removing the Side Panels on page 4-6.
5. Wear a grounding wrist strap and connect the end to the electronics bay pan.
6. Locate the power distribution board. See Figure 4-32.

Figure 4-32: Power distribution board location



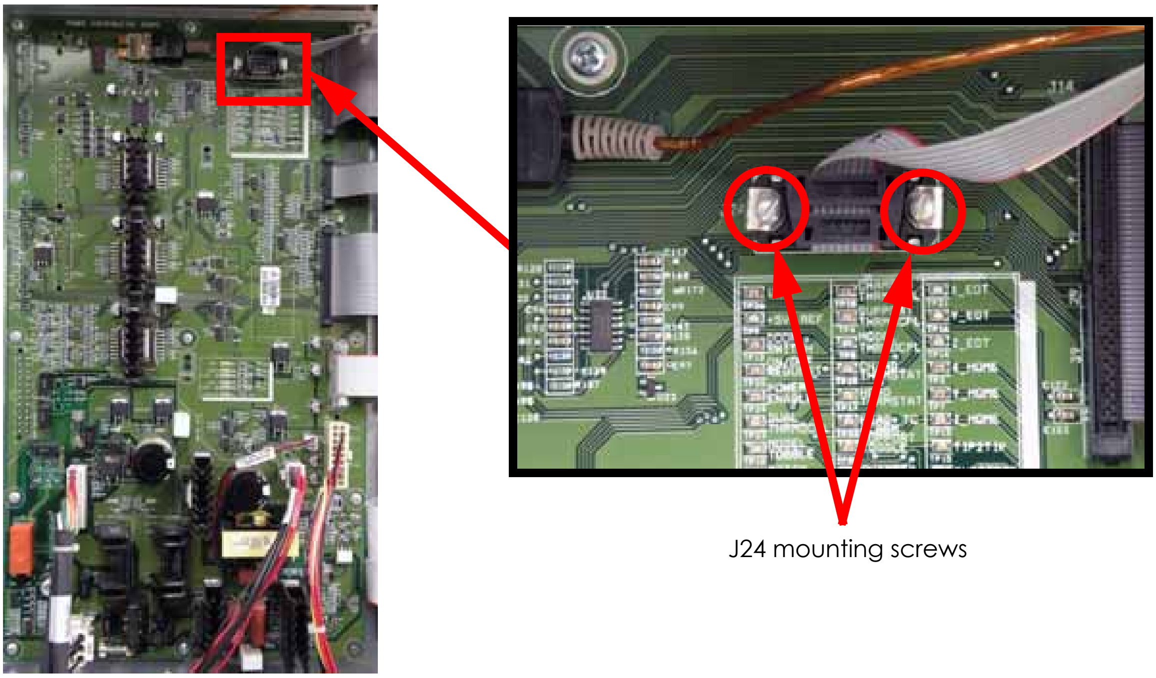
7. Disconnect the chamber thermocouple from the power distribution board by pulling outward. See Figure 4-33.

Figure 4-33: Chamber thermocouple location



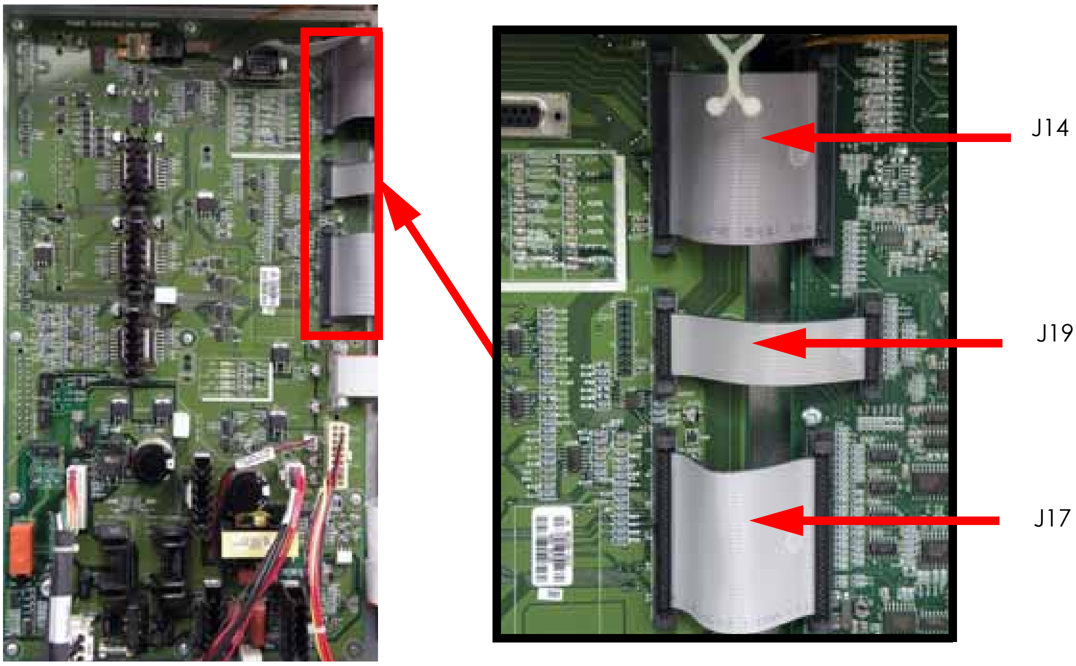
8. Using a standard screwdriver, loosen the J24 DB-9 connector on the power distribution board and pull outward to disconnect. See Figure 4-34.

Figure 4-34: J24 location



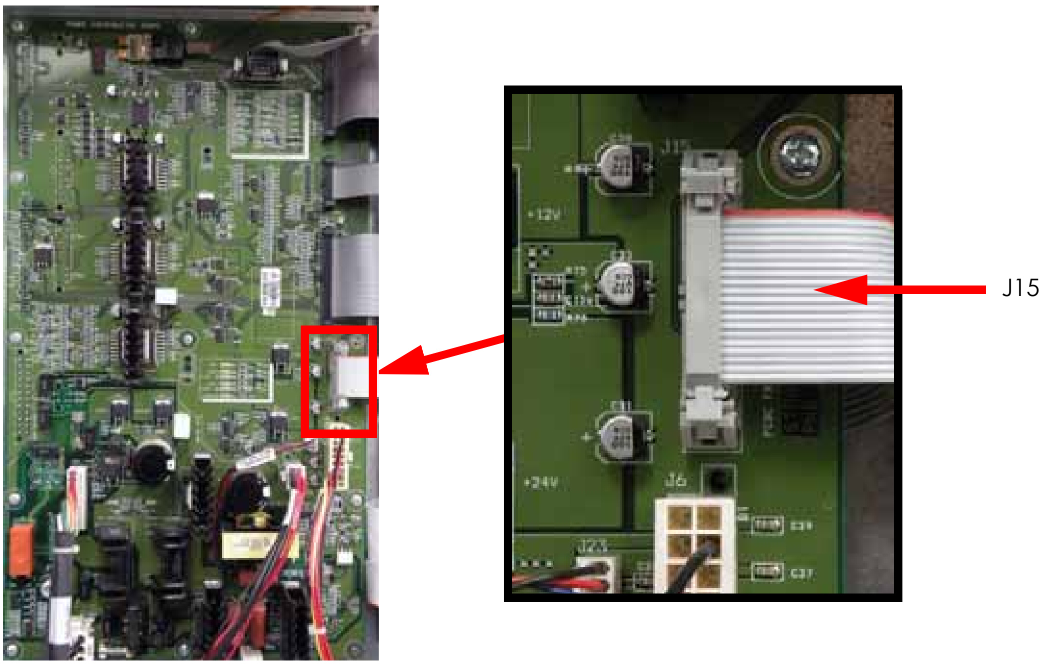
9. Disconnect the J14, J17 and J19 ribbon cables from the power distribution board by pressing the tabs in and pulling outwards. See Figure 4-35.

Figure 4-35: Power distribution board ribbon cable locations



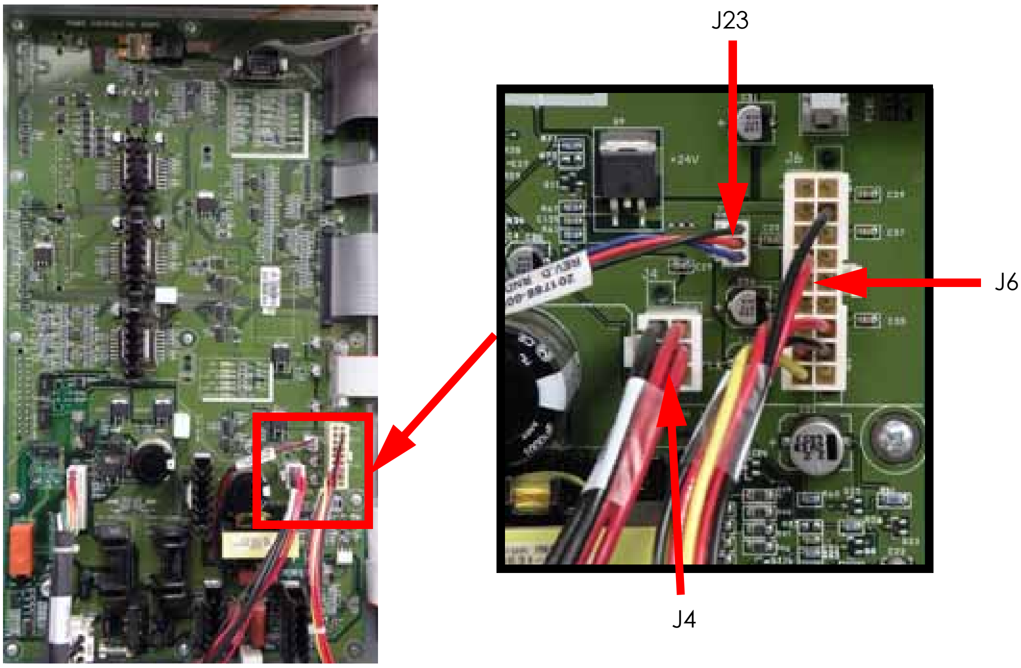
10. Disconnect the J15 ribbon cable by pressing the tabs in and pulling outward. See Figure 4-36.

Figure 4-36: J15 ribbon cable location



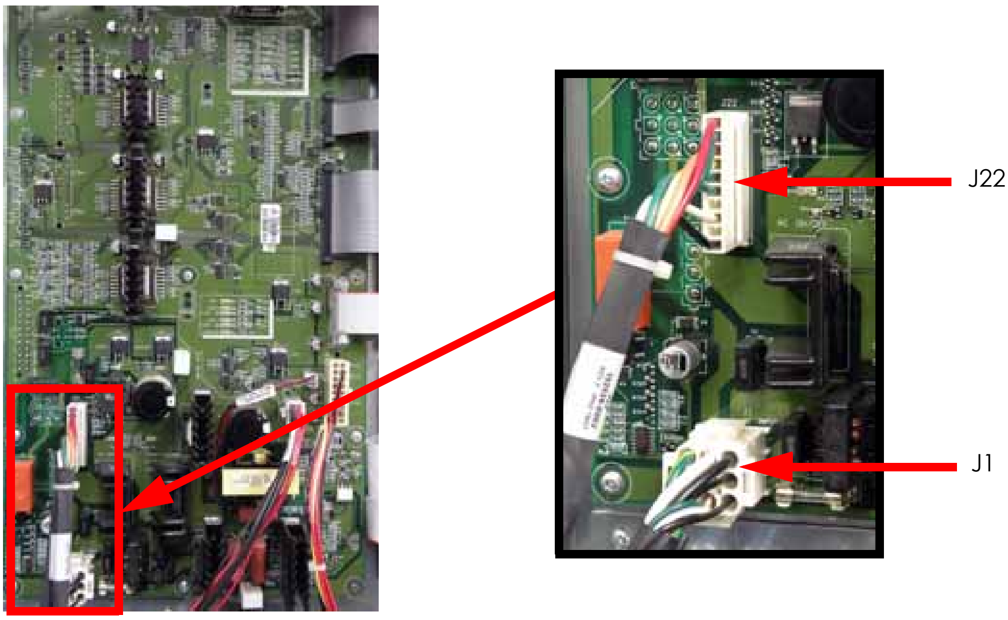
11. Disconnect the J4, J6 and J23 cables by pressing the tabs in and pulling outwards. See Figure 4-37.

Figure 4-37: Power distribution board cable locations



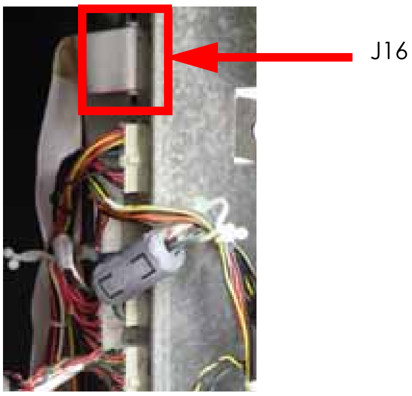
12. Disconnect the J1 and J22 cables by pressing the tabs in and pulling outwards. See Figure 4-38.

Figure 4-38: Power distribution board cable locations



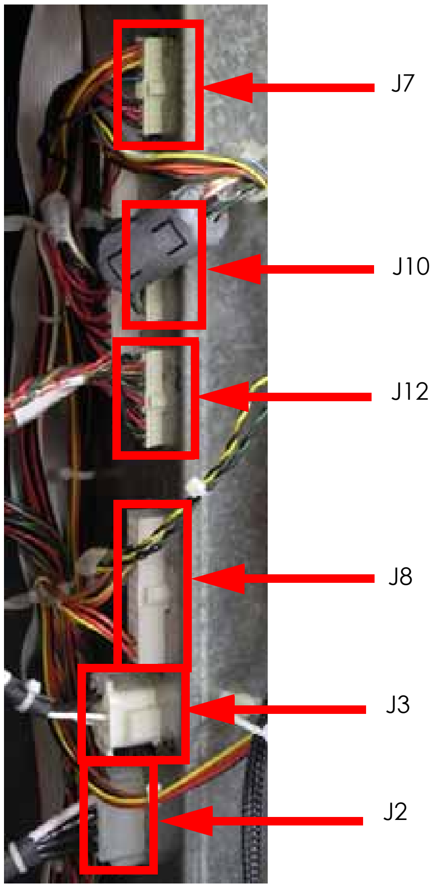
13. At the back side of the power distribution board, disconnect the J16 ribbon cable by pulling outwards. See Figure 4-39.

Figure 4-39: J16 cable location



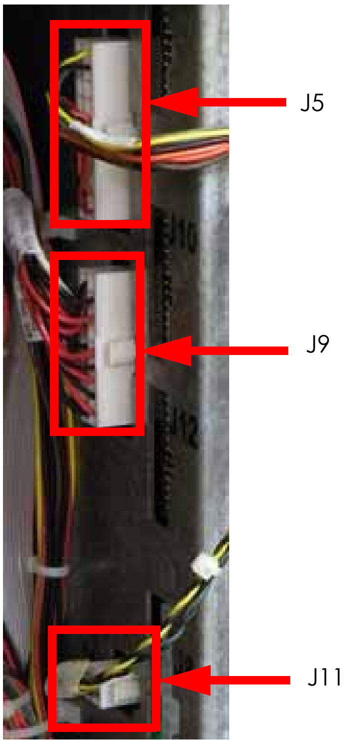
14. At the back side of the power distribution board, disconnect the J7, J10, J12, J8, J3 and J2 cables by pressing the tabs in and pulling outwards. See Figure 4-40.

Figure 4-40: Power distribution board rear cable locations



15. At the back side of the power distribution board, disconnect the J5, J9 and J11 cables by pressing the tabs in and pulling outwards. See Figure 4-41.

Figure 4-41: Power distribution board rear cable locations



16. Using a phillips screwdriver, remove the 11 power distribution board mounting screws. See Figure 4-42.

Figure 4-42: Power distribution board mounting screw locations

17. Gently pull the power distribution board away from the mounting posts.

Installing the Power Distribution Board

1. Wear a grounding wrist strap and connect the end to the electronics bay pan.
2. Align the power distribution board with the mounting holes and press into place.
3. Use a phillips screwdriver to reinstall the 11 mounting screws.
4. Reconnect J5, J9 and J11 at the rear of the power distribution board by pushing into place.
5. Reconnect J7, J10, J12, J8, J3 and J2 at the rear of the power distribution board by pushing into place.
6. Reconnect the J16 ribbon cable at the rear of the power distribution board by pushing into place.
7. Reconnect the J1 and J22 cables by pushing into place.
8. Reconnect the J4, J6 and J23 cables by pushing into place.
9. Reconnect the J15 ribbon cable by pushing into place.
10. Reconnect the J14, J17 and J19 ribbon cables by pushing into place.
11. Reconnect the J24 DB-9 connector by pushing into place. Use a standard screwdriver to tighten the 2 mounting screws.
12. Reconnect the chamber thermocouple by pushing into place.

Note: Be sure the + terminal of the chamber thermocouple is at the top when reconnecting.

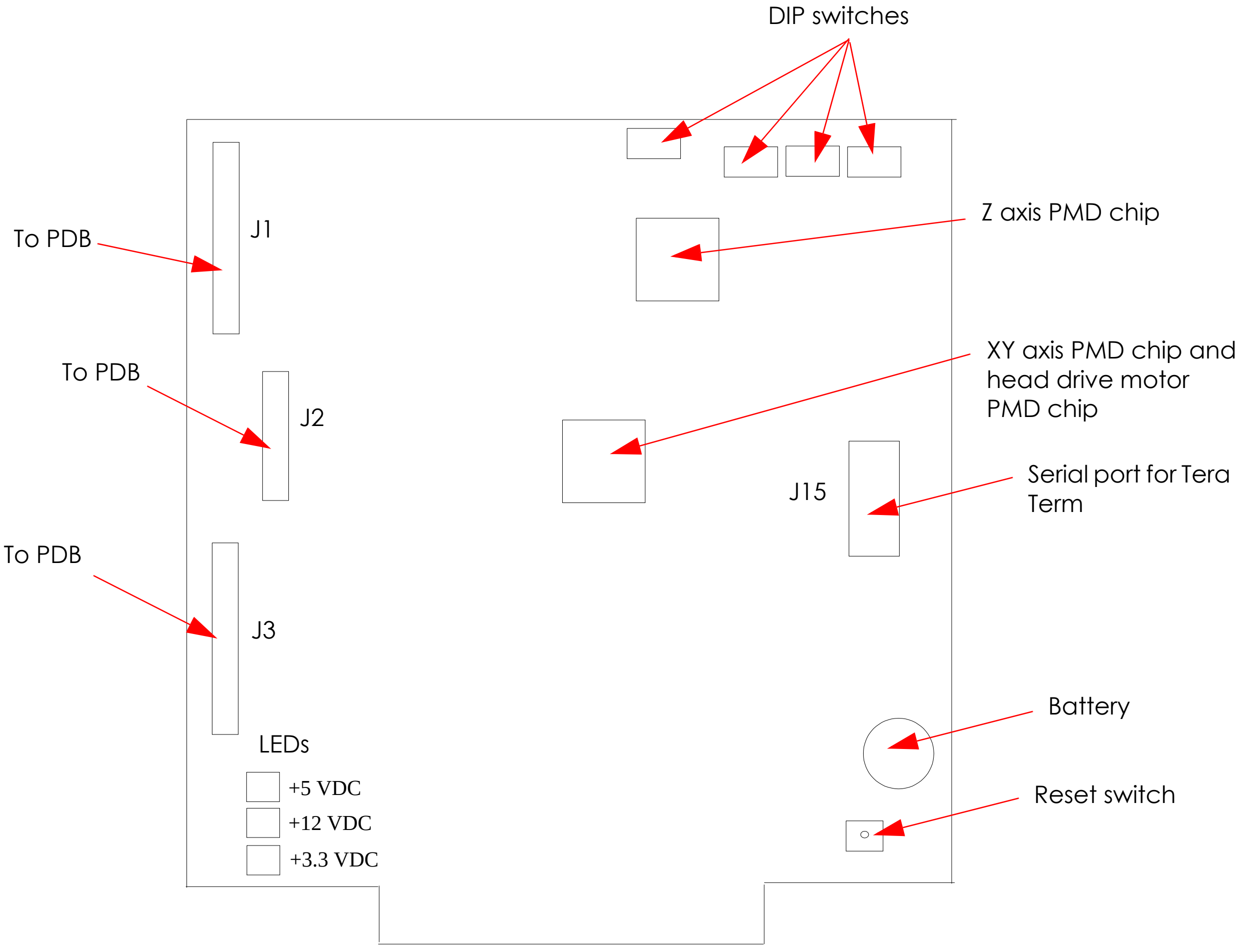
13. Reinstall the side panels. See Installing the Side Panels on page 4-6.
14. Reinstall the rear panel. See Installing the Rear Panel on page 4-5.
15. Reconnect the AC power cord, RJ-45 network cable and UPS cable (if used).
16. Power on the system. The system should reach **Idle** with no displayed errors.
17. Run a small test part and monitor system operation during build.
18. Send the bad power distribution board back to Stratasys, Inc.

Controller Board

Required Tools

- Phillips screwdriver
- Small standard screwdriver
- Grounding wrist strap

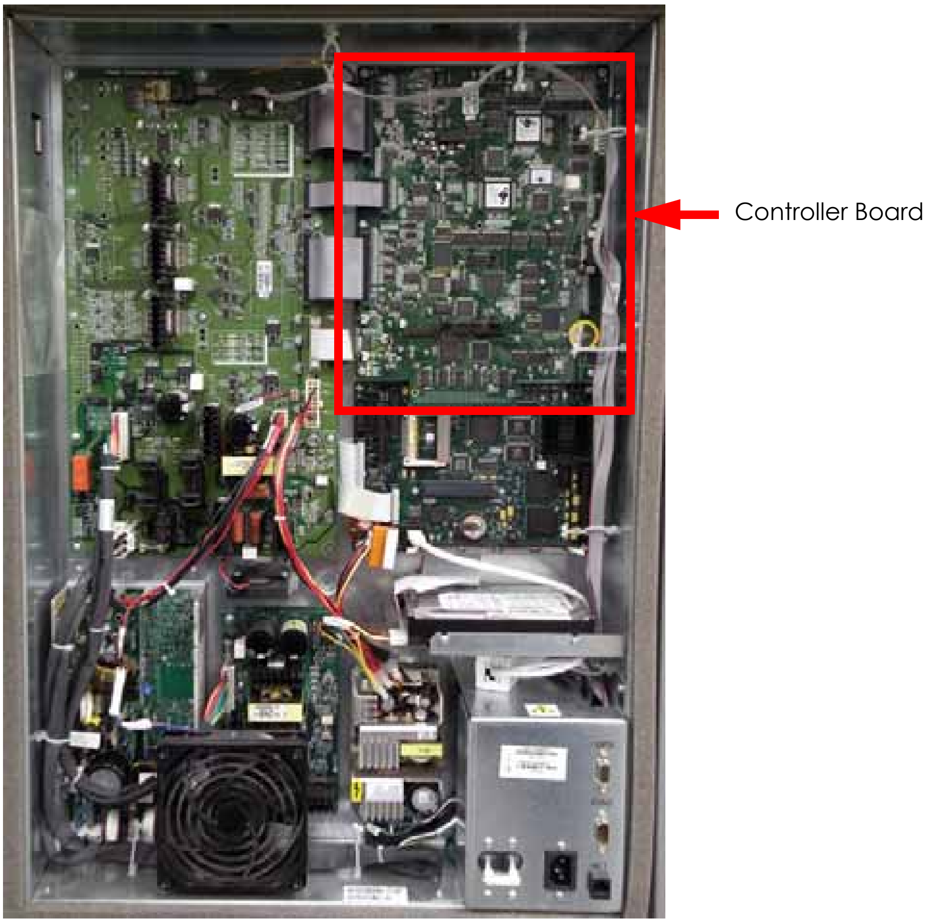
Figure 4-43: Controller board detail



Removing the Controller Board

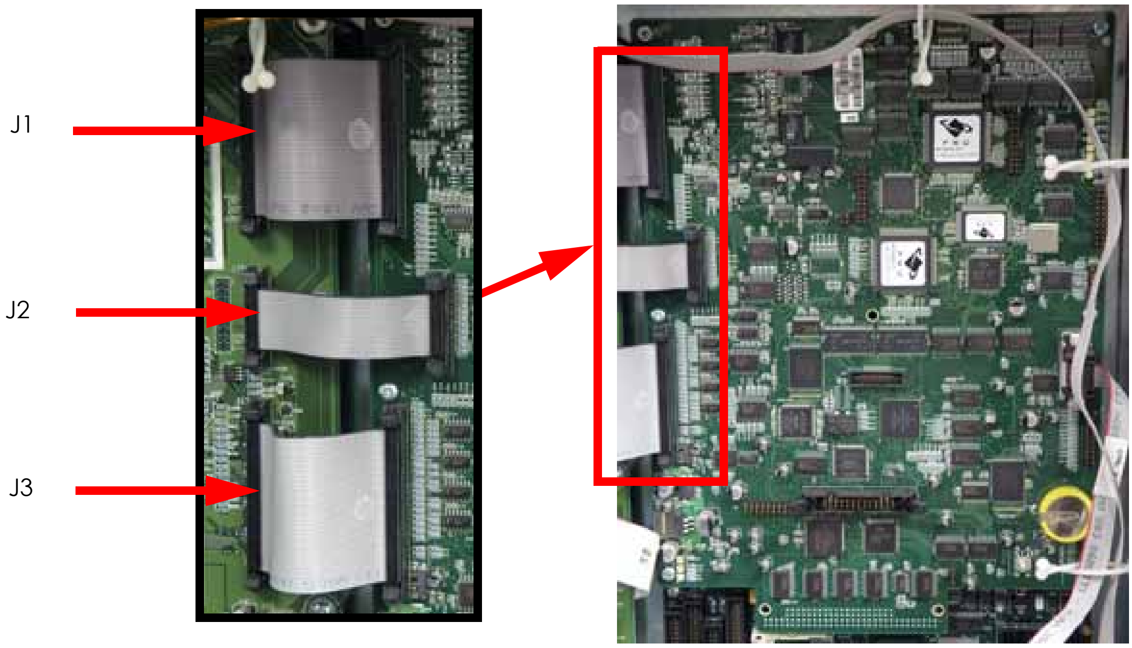
1. Power down the system using the power-down switch. Once the system is powered down, switch the circuit breaker to the **off** position.
2. Unplug the AC power cord, RJ-45 network cable and UPS cable (if used) from the rear of the printer.
3. Remove the rear panel. See Removing the Rear Panel on page 4-5.
4. Wear a grounding wrist strap and connect the end to the electronics bay pan.
5. Locate the controller board. See Figure 4-44.

Figure 4-44: Controller board location



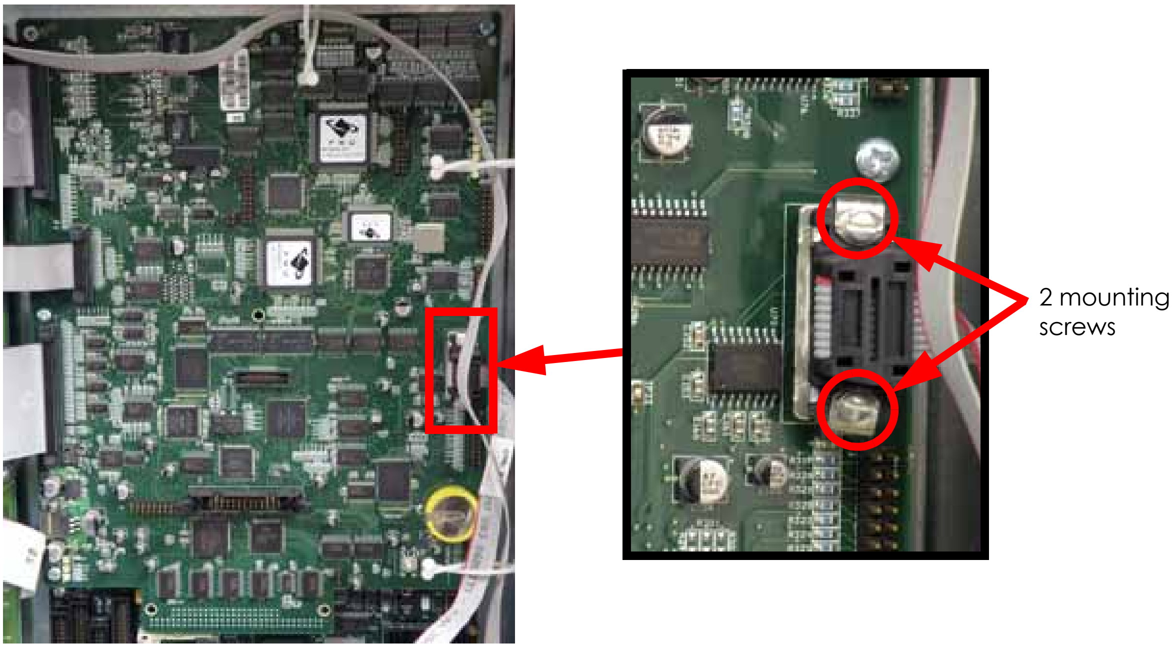
6. Disconnect the J1, J2 and J3 ribbon cables by pressing the tabs in and pulling outwards. See Figure 4-45.

Figure 4-45: Controller board ribbon cable locations



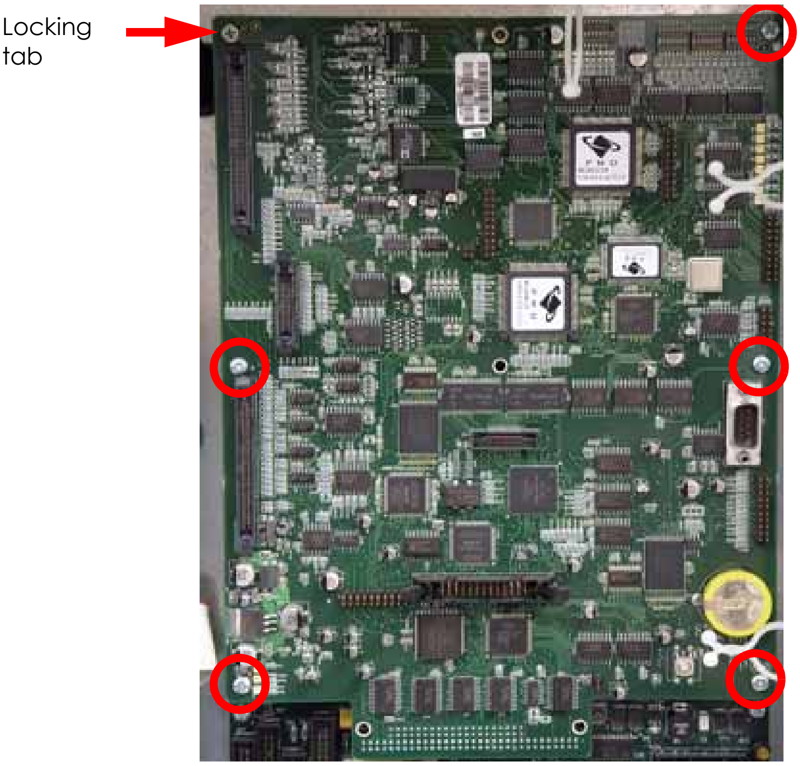
7. Using a small standard screwdriver, loosen the 2 J15 DB-9 ribbon cable mounting screws and disconnect by pulling outwards. See Figure 4-46.

Figure 4-46: J15 DB-9 cable location



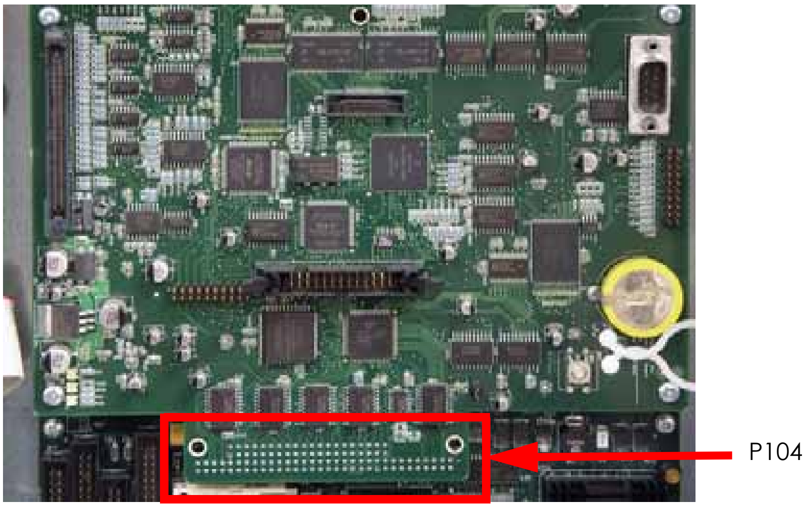
8. Using a phillips screwdriver, remove the 5 controller board mounting screws. See Figure 4-47.

Figure 4-47: Controller board mounting screw locations



9. Gently pull the controller board at the P104 connector on the single board computer to remove. See Figure 4-48.

Figure 4-48: P104 location



Installing the Controller Board

1. Wear a grounding wrist strap and connect the end to the electronics bay pan.
2. Gently align the controller board P104 with the single board computer socket and press into place.

> **Note:** Be careful not to bend any pins on the P104 connector.

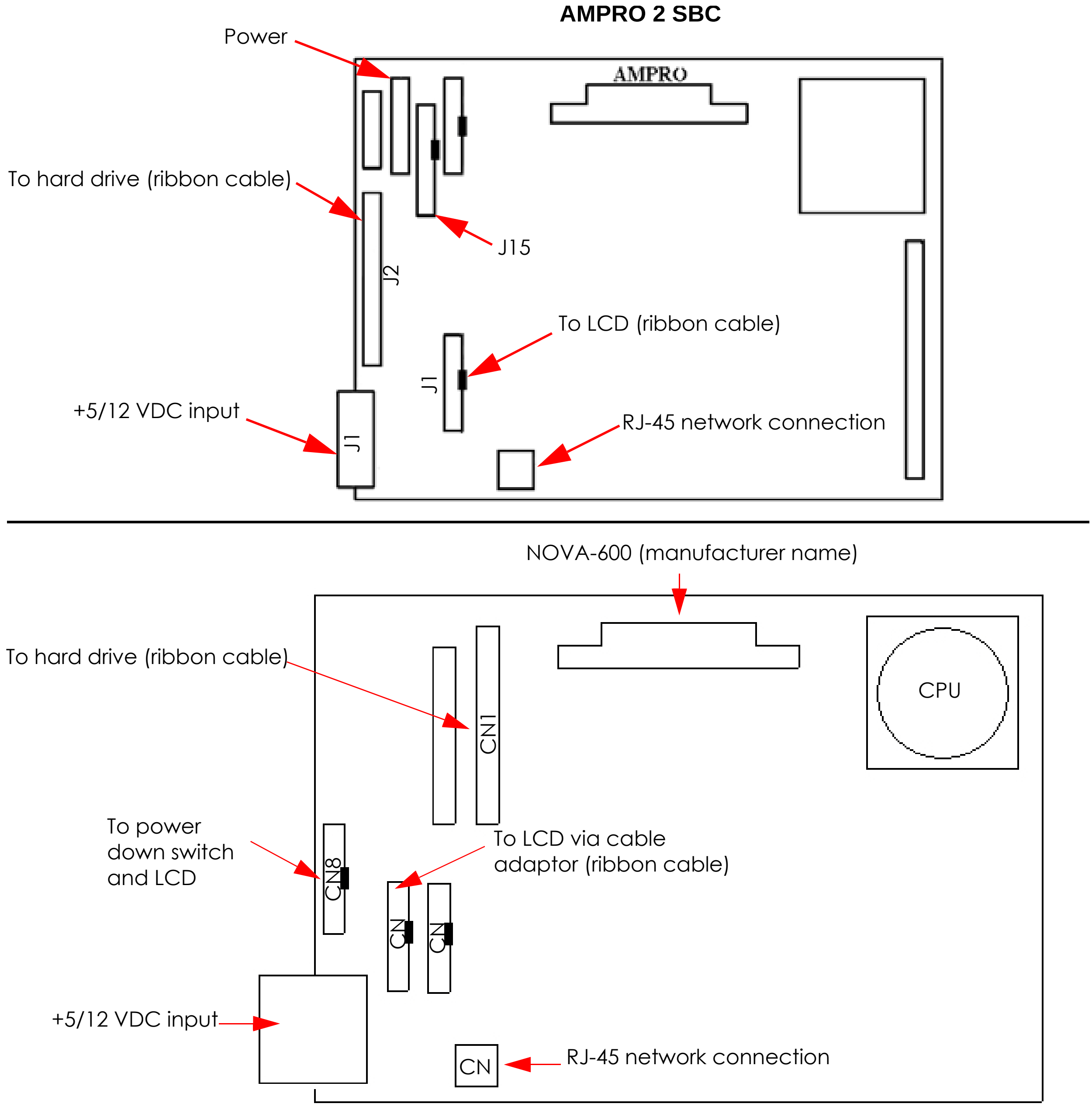
3. Using a phillips screwdriver, reinstall the 5 mounting screws.
4. Reconnect the J15 DB-9 connector by pushing into place. Use a small standard screwdriver to tighten the mounting screws.
5. Reconnect the J1, J2 and J3 ribbon cables by pressing into place.
6. Reinstall the rear panel. See Installing the Rear Panel on page 4-5.
7. Reconnect the AC power cord, RJ-45 network cable and UPS cable (if used).
8. Power up the printer. You will be prompted to load the controller software.
9. Assign the printer static IP or dynamic IP networking depending on your network. If you assign it static IP you will need to enter the static IP address. When finished press **Done**.
10. Insert the system software CD into the notebook computer or workstation CD drive.
11. Open CatalystEX from the notebook computer or workstation.
12. Click on the **Printer Services** tab.
13. Click on the **Update Software** button.
14. Navigate CatalystEX to the CD drive and select the proper .UPG file for the printer.
15. When finished downloading, verifying and installing, reboot the printer.
16. Run a small test part and monitor system operation during build.
17. Send the bad controller board back to Stratasys, Inc.

Single Board Computer (SBC)

Required Tools

- Phillips screwdriver
- Small standard screwdriver
- Grounding wrist strap

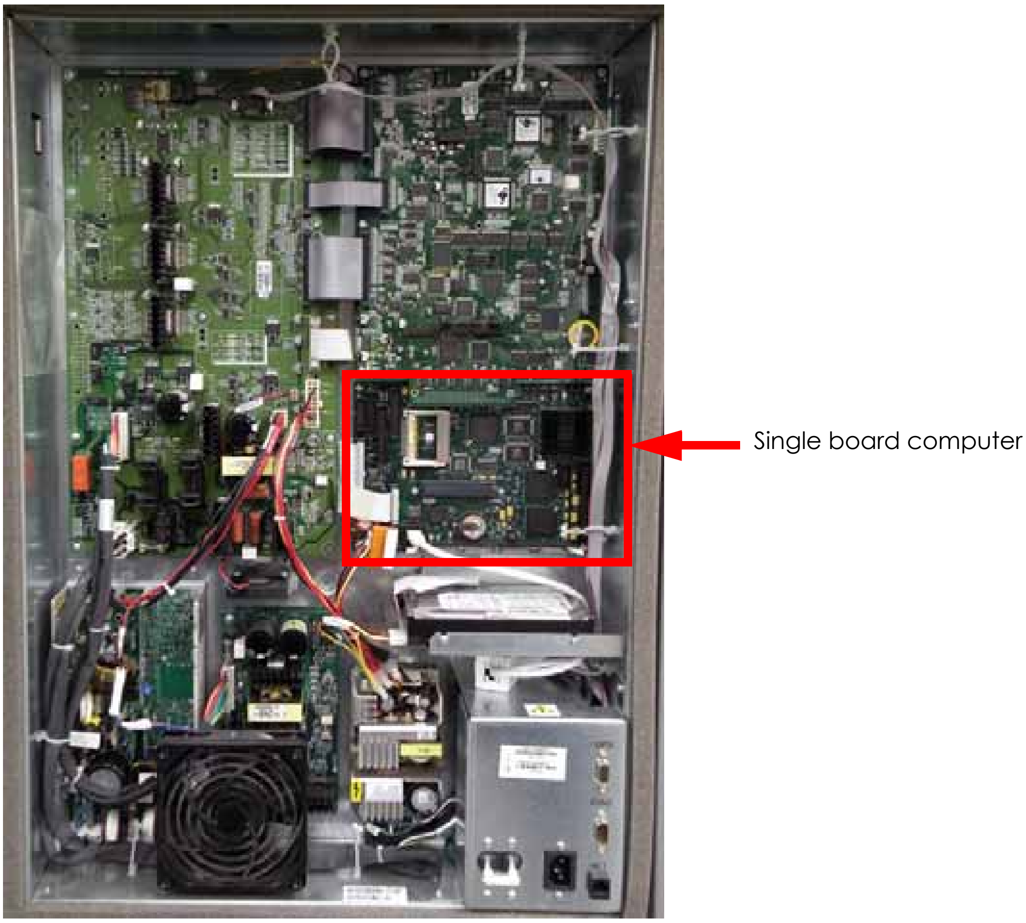
Figure 4-49: Single board computer details



Removing the Single Board Computer

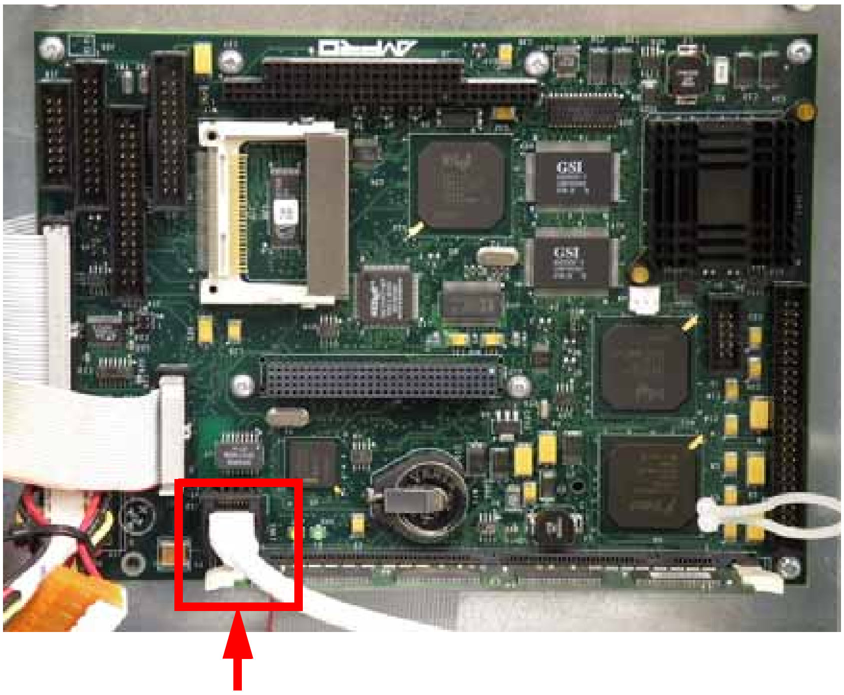
1. Power down the system using the power-down switch. Once the system is powered down, switch the circuit breaker to the **off** position.
2. Unplug the AC power cord, RJ-45 network cable and UPS cable (if used) from the rear of the printer.
3. Remove the rear panel. See Removing the Rear Panel on page 4-5.
4. Wear a grounding wrist strap and connect the end to the electronics bay pan.
5. Locate the single board computer. See Figure 4-50.

Figure 4-50: Single board computer location



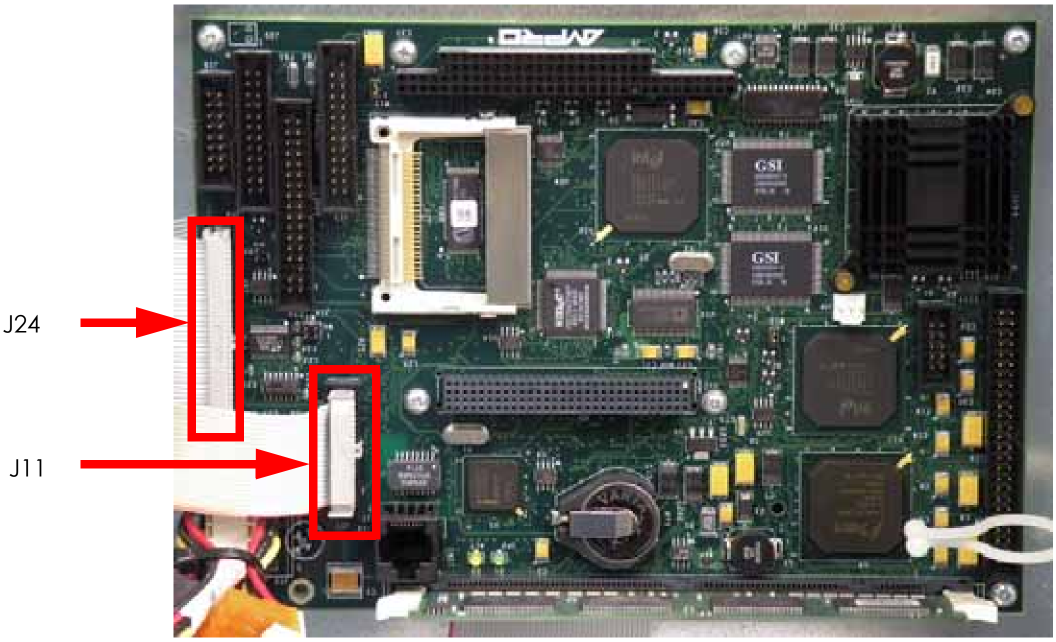
6. Remove the controller board. See Removing the Controller Board on page 4-26.
7. Disconnect the RJ-45 network cable from the single board computer by pressing the tab in and pulling outward. See Figure 4-51.

Figure 4-51: RJ-45 network cable location



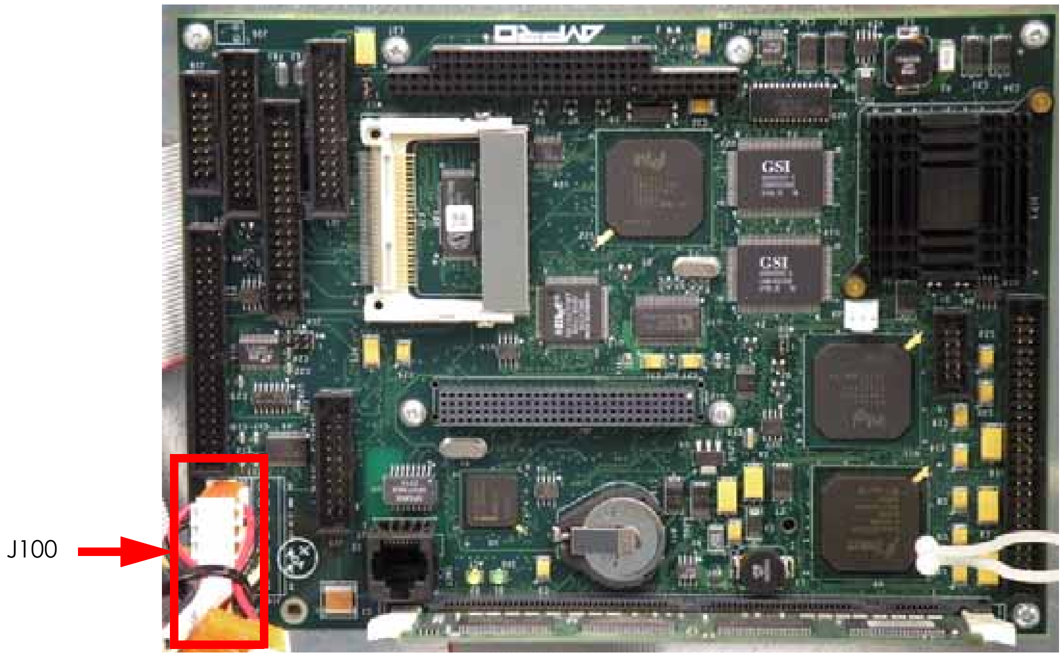
8. Disconnect the J11 ribbon cable (for Ampro SBC, CN7 for Nova SBC) by pulling outward. See Figure 4-52.
9. Disconnect the J24 ribbon cable by pulling outward. See Figure 4-52.

Figure 4-52: J11 and J24 ribbon cable locations



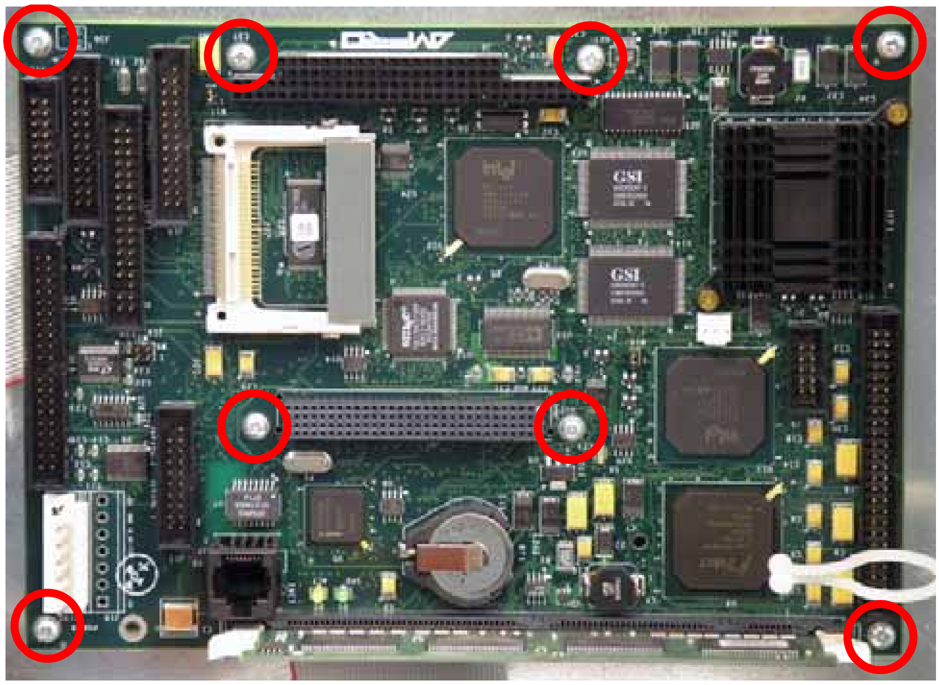
10. Disconnect the power J100 cable by pulling outward. See Figure 4-53.

Figure 4-53: J100 cable location



11. Using a phillips screwdriver, remove the 8 single board computer mounting screws and remove the single board computer. See Figure 4-54.

Figure 4-54: Single board computer mounting screw locations



Installing the Single Board Computer

1. Wear a grounding wrist strap and connect the end to the electronics bay pan.
2. Align the single board computer with the mounting holes and use a phillips screwdriver to reinstall the 8 mounting screws.
3. Reconnect J100 by pushing into place.
4. Reconnect the J24 ribbon cable by pushing into place.
5. Reconnect the J11 ribbon cable (for Ampro SBC's, CN7 for Nova SBC's) by pushing into place.
6. Reconnect the RJ-45 network cable by pushing into place.
7. Reinstall the controller board. See Installing the Controller Board on page 4-29.
8. Reinstall the rear panel. See Installing the Rear Panel on page 4-5.
9. Reconnect the AC power cord, RJ-45 network cable and UPS cable (if used).
10. Power up the printer.
11. Run a small test part and monitor system operation during build.
12. Send the bad single board computer back to Stratasys, Inc.

Hard Drive

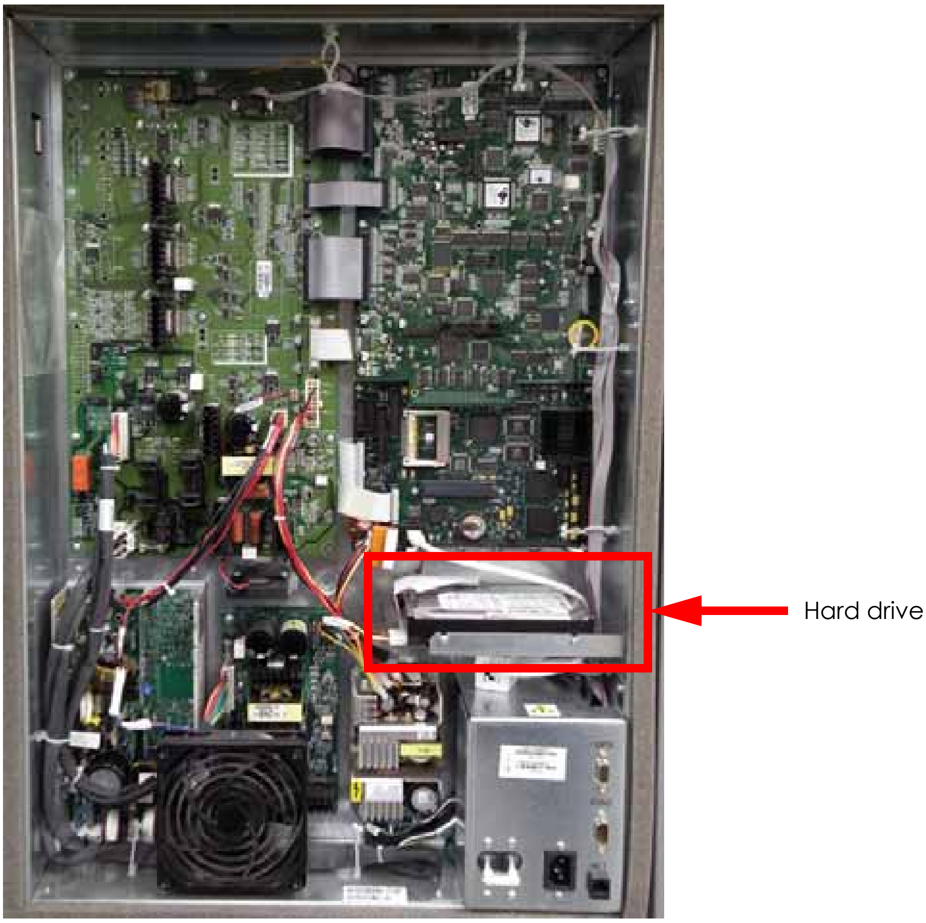
Required Tools

- Phillips screwdriver
- Grounding wrist strap

Removing the Hard Drive

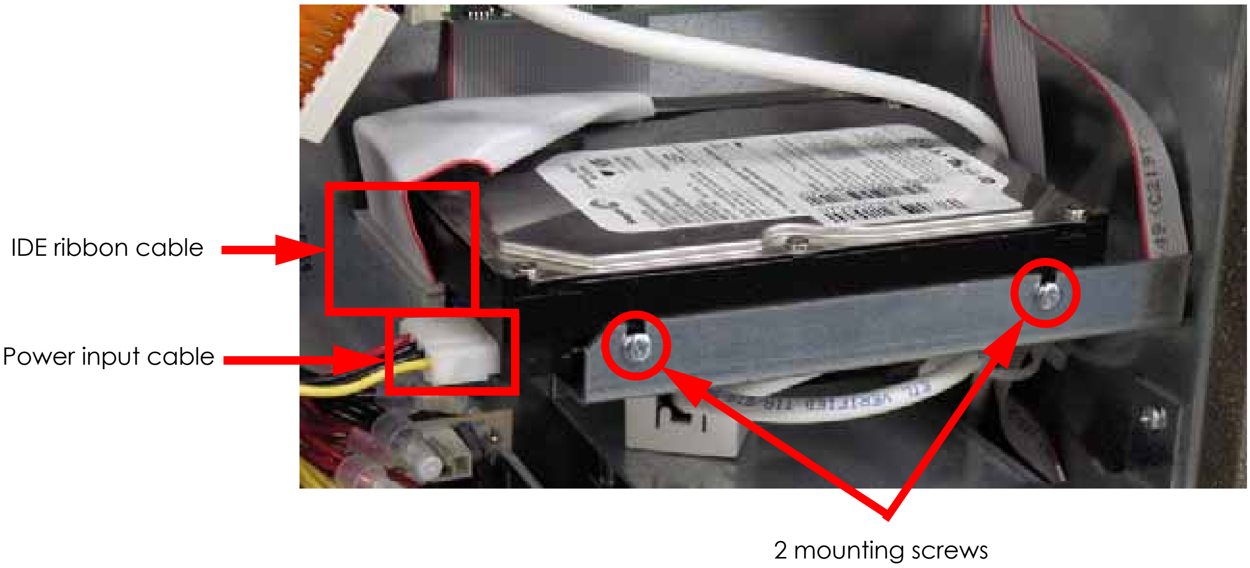
1. Power down the system using the power-down switch. Once the system is powered down, switch the circuit breaker to the **off** position.
2. Unplug the AC power cord, RJ-45 network cable and UPS cable (if used) from the rear of the printer.
3. Remove the rear panel. See Removing the Rear Panel on page 4-5.
4. Wear a grounding wrist strap and connect the end to the electronics bay pan.
5. Locate the hard drive. See Figure 4-55.

Figure 4-55: Hard drive location



6. Disconnect the power input cable by pulling outwards. See Figure 4-56.
7. Disconnect the IDE ribbon cable by pulling outwards. See Figure 4-56.
8. Using a phillips screwdriver, remove the 2 hard drive mounting screws. See Figure 4-56.

Figure 4-56: Hard drive cable and mounting screw locations



9. Remove the hard drive.

Installing the Hard Drive

1. Wear a grounding wrist strap and connect the end to the electronics bay pan.
2. Align the back side of the hard drive with the mounting posts in the electronics bay. See Figure 4-57.

Figure 4-57: Hard drive mounting post locations

3. Using a phillips screwdriver, reinstall the 2 mounting screws.
4. Reconnect the IDE ribbon cable by pressing into place.
5. Reconnect the power input cable by pressing into place.
6. Reinstall the rear panel. See Installing the Rear Panel on page 4-5.
7. Reconnect the AC power cord, RJ-45 network cable and UPS cable (if used).

8. Power up the printer. You will be prompted to load the controller software.
9. Assign the printer static IP or dynamic IP networking depending on your network. If you assign it static IP you will need to enter the static IP address. When finished press **Done**.
10. Insert the system software CD into the notebook computer or workstation CD drive.
11. Open CatalystEX from the notebook computer or workstation.
12. Click on the **Printer Services** tab.
13. Click on the **Update Software** button.
14. Navigate CatalystEX to the CD drive and select the proper .UPG file for the printer.
15. When finished downloading, verifying and installing, reboot the printer.
16. Remove the calibration floppy disk/CD from the electronics bay and send the .cal file to the printer with MaracaEX, see "Send" .cal file – from calibration Floppy Disk/CD to the printer: on page 5-38. If the last update of the calibration CD is unknown, perform the following calibrations:
    A. Perform Z calibration, see Z Calibration on page 5-2.
    B. Perform XY calibration, see XY Calibration on page 5-2.
    C. Perform part based calibrations, see Part Based Calibration on page 5-3.
    D. Get the .cal file from the printer and copy to a new floppy disk/CD. See "Get" .cal file – from hard drive to the calibration Floppy Disk/CD: on page 5-38.
17. Replace the calibration floppy disk/CD in the electronics bay.
18. Run a small test part and monitor system operation during build.
19. Send the bad hard drive back to Stratasys, Inc.

Electronics Bay Cooling Fan

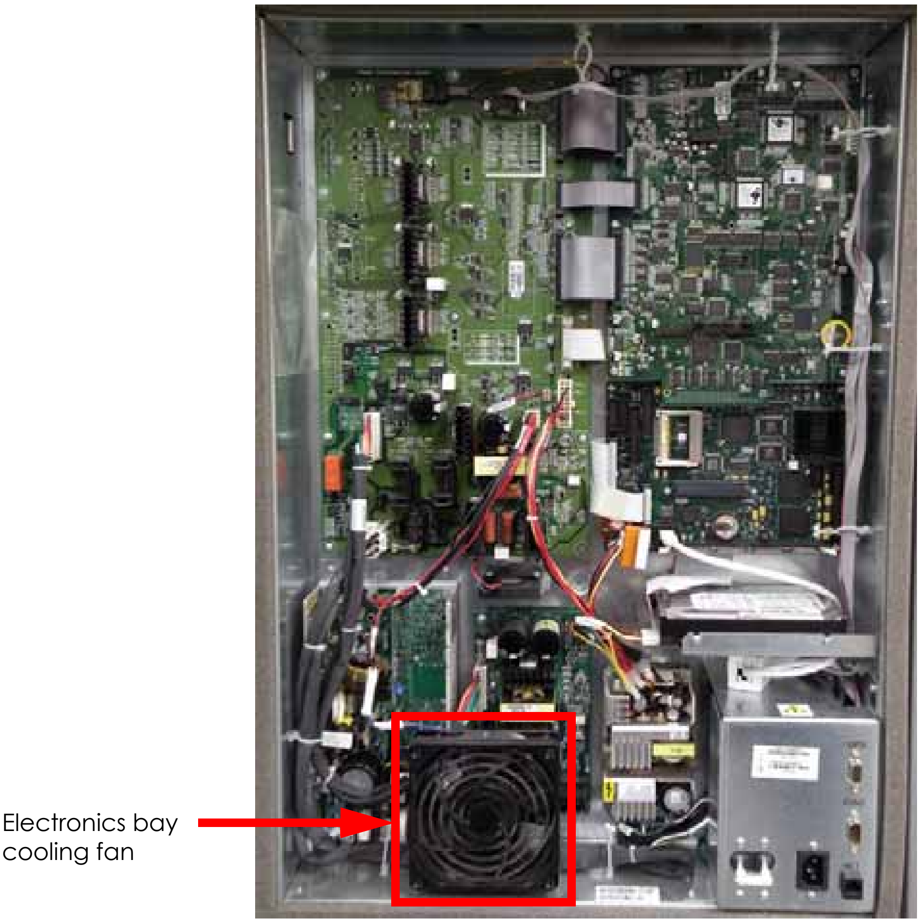
Required Tools

- $^{5}/_{64}$″ allen wrench
- Grounding wrist strap

Removing the Electronics Bay Cooling Fan

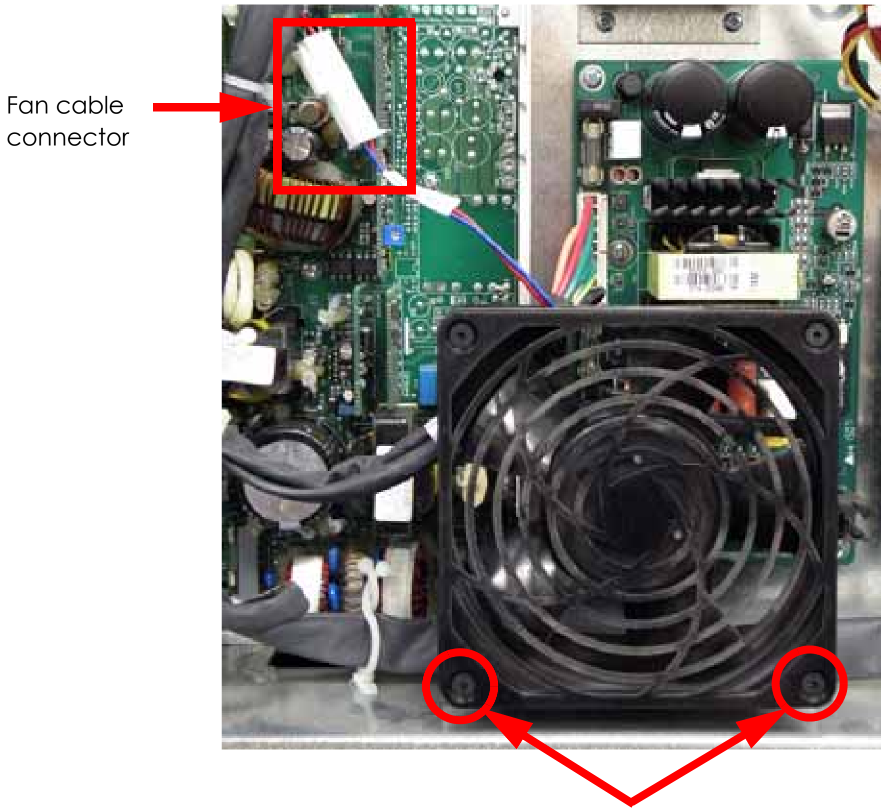
1. Power down the system using the power-down switch. Once the system is powered down, switch the circuit breaker to the **off** position.
2. Unplug the AC power cord, RJ-45 network cable and UPS cable (if used) from the rear of the printer.
3. Remove the rear panel. See Removing the Rear Panel on page 4-5.
4. Wear a grounding wrist strap and connect the end to the electronics bay pan.
5. Locate the electronics bay cooling fan. See Figure 4-58.

Figure 4-58: Electronics bay cooling fan location



6. Disconnect the electronics bay cooling fan cable by pressing the tab in and pulling outwards. See Figure 4-59.
7. Using a $^{5}/_{64}$″ allen wrench, remove the lower 2 electronics bay cooling fan mounting screws. See Figure 4-59.

Figure 4-59: Electronics bay cooling fan connector location



1. Remove the electronics bay cooling fan.

Installing the Electronics Bay Cooling Fan

1. Align the electronics bay cooling fan with the mounting holes.
2. Using a $^{5}/_{64}$" allen wrench, reinstall the 2 lower mounting screws.
3. Reconnect the fan cable by pushing the connectors together.
4. Reinstall the rear panel. See Installing the Rear Panel on page 4-5.
5. Reconnect the AC power cord, RJ-45 network cable and UPS cable (if used).
6. Power up the printer.
7. Run a small test part and monitor system operation during build.

24 VDC Power Supply

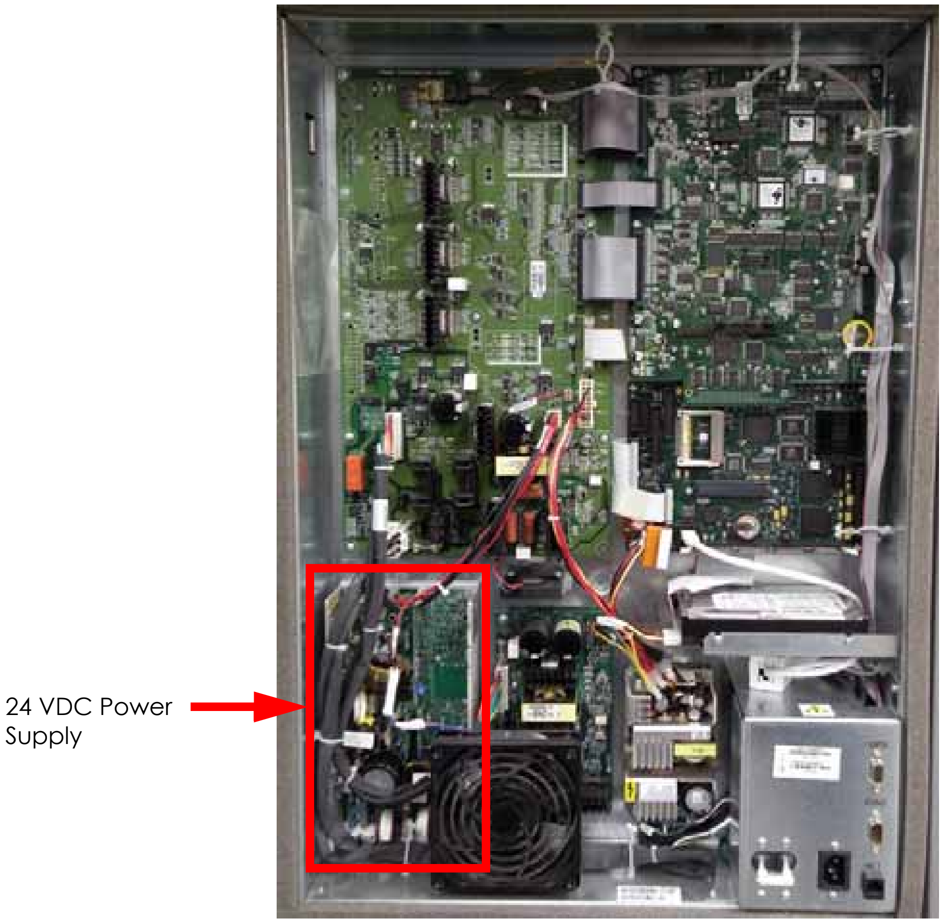
Required Tools

- Phillips screwdriver
- Grounding wrist strap

Removing the 24 VDC Power Supply

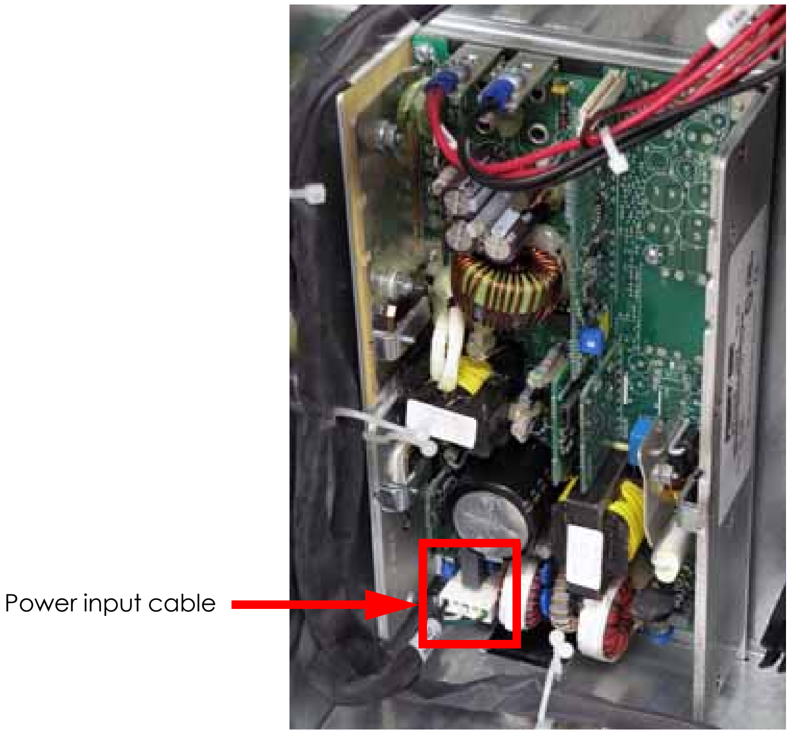
1. Power down the system using the power-down switch. Once the system is powered down, switch the circuit breaker to the **off** position.
2. Unplug the AC power cord, RJ-45 network cable and UPS cable (if used) from the rear of the printer.
3. Remove the rear panel. See Removing the Rear Panel on page 4-5.
4. Wear a grounding wrist strap and connect the end to the electronics bay pan.
5. Locate the 24 VDC power supply. See Figure 4-60.

Figure 4-60: 24 VDC power supply location



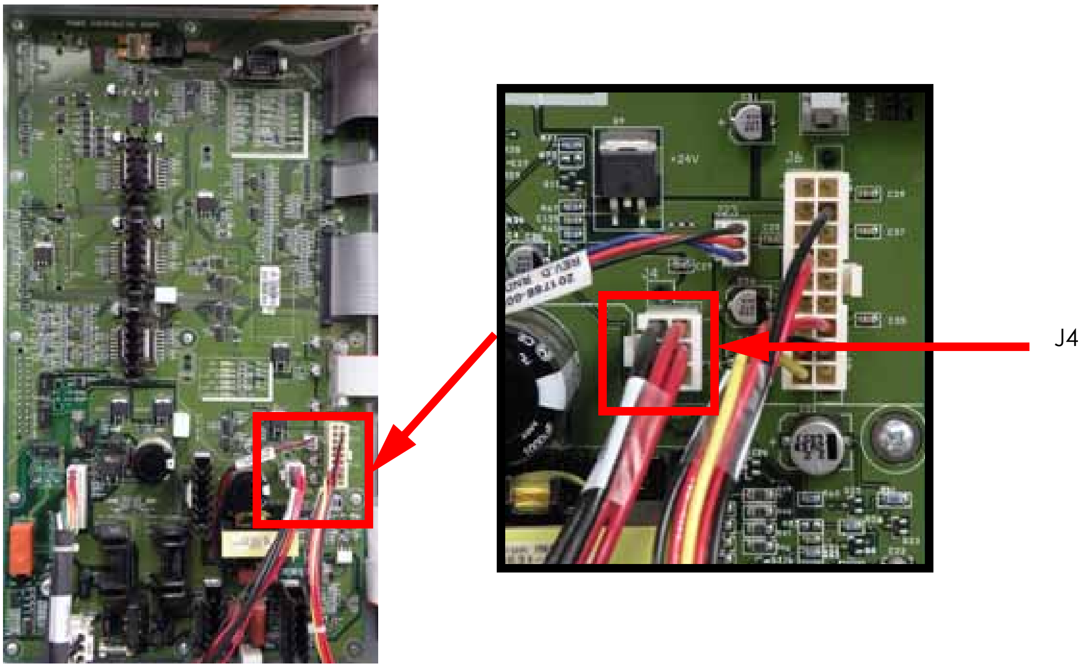
6. Remove the electronics bay cooling fan. See Removing the Electronics Bay Cooling Fan on page 4-38.
7. Disconnect the 24 VDC power input cable by pulling outward. See Figure 4-61.

Figure 4-61: 24 VDC power input cable location



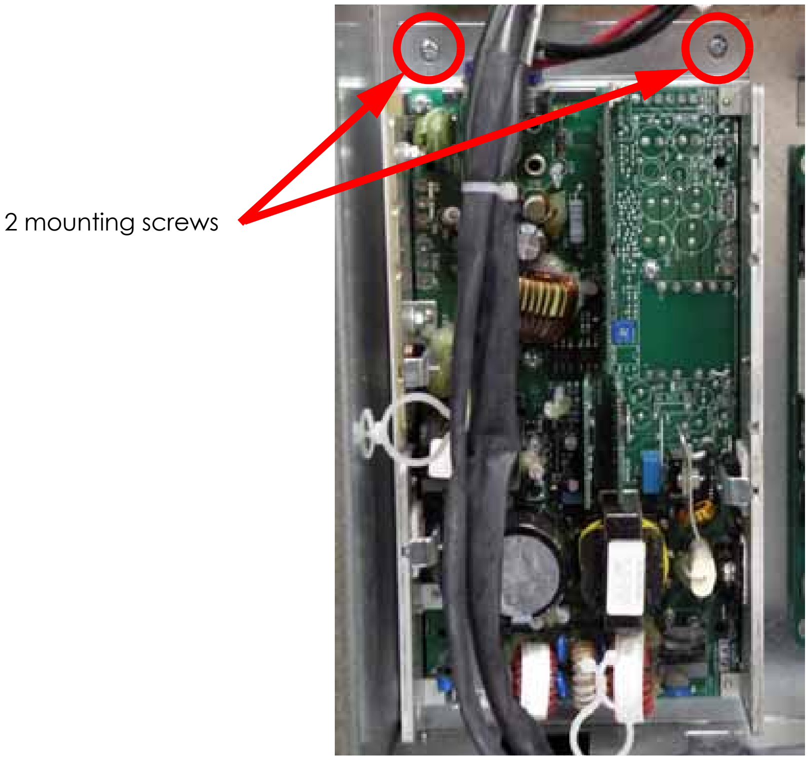
8. Disconnect J4 from the power distribution board by pressing the tab in and pulling outward. See Figure 4-62.

Figure 4-62: J4 location



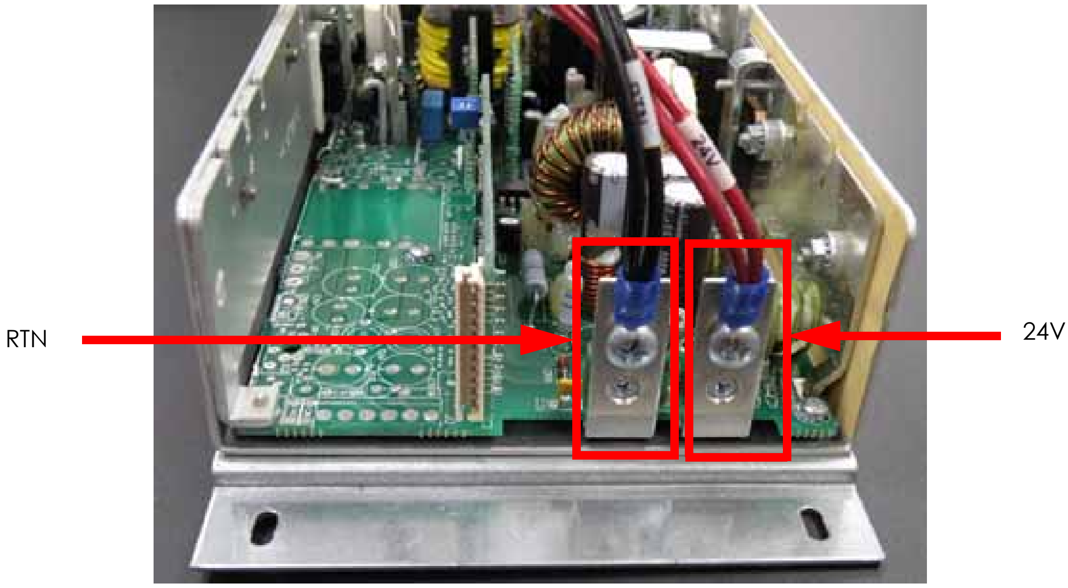
9. Using a phillips screwdriver, remove the 2 mounting screws. See Figure 4-63.

Figure 4-63: 24 VDC mounting screw locations



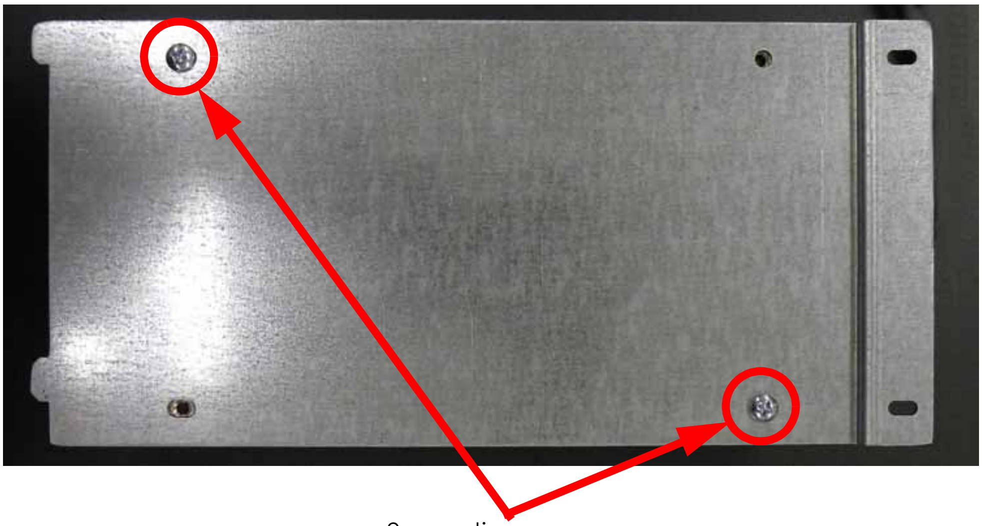
10. Lift the power supply up and angle outwards to remove from the electronics bay.
11. Using a phillips screwdriver, remove the 24V (red) cable and RTN (black) cable from the 24 VDC power supply. See Figure 4-64.

Figure 4-64: 24 VDC output cable locations



12. Turn the 24 VDC power supply over and use a phillips screwdriver to remove the 2 mounting bracket mounting screws. See Figure 4-65.

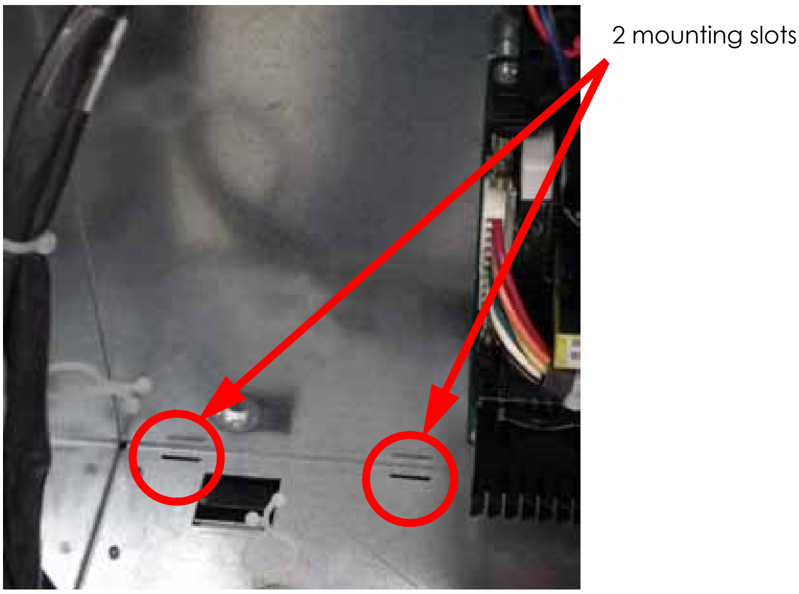
Figure 4-65: 24 VDC power supply mounting bracket mounting screw locations



Installing the 24 VDC Power Supply

1. Wear a grounding wrist strap and connect the end to the electronics bay pan.
2. Align the 24 VDC power supply with the mounting bracket and use a phillips screwdriver to reinstall the 2 mounting screws.
3. Using a phillips screwdriver, reinstall the 24V (red) cable to the right post and the RTN (black) cable to the left post.
4. Align the 24 VDC power supply mounting bracket tabs with the slots in the electronics bay and slide into place. See Figure 4-66.

Figure 4-66: 24 VDC power supply mounting slot locations



5. Using a phillips screwdriver, reinstall the 2 mounting screws.
6. Reconnect J4 to the power distribution board.
7. Reconnect the power input cable to the 24 VDC power supply.

8. Reinstall the electronics bay cooling fan. See Installing the Electronics Bay Cooling Fan on page 4-39.
9. Reinstall the rear panel. See Installing the Rear Panel on page 4-5.
10. Reconnect the AC power cord, RJ-45 network cable and UPS cable (if used).
11. Power up the printer.
12. Run a small test part and monitor system operation during build.

120 VDC Power Supply (SST only)

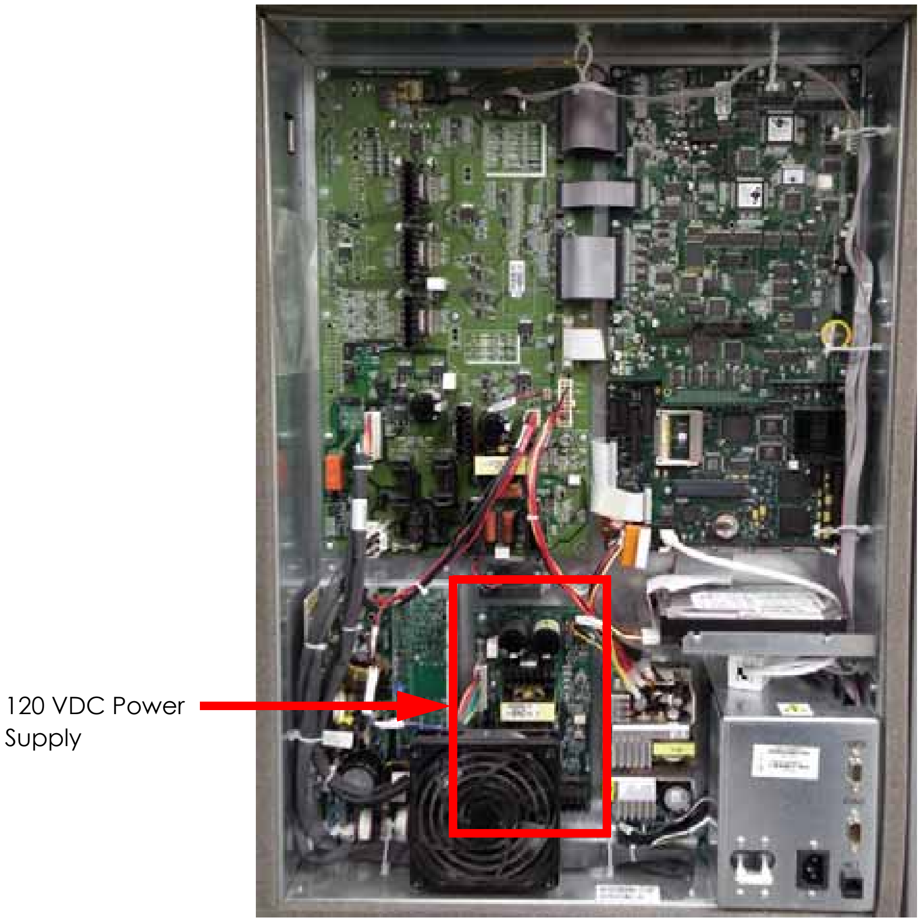
Required Tools

- Phillips screwdriver
- Grounding wrist strap

Removing the 120 VDC Power Supply

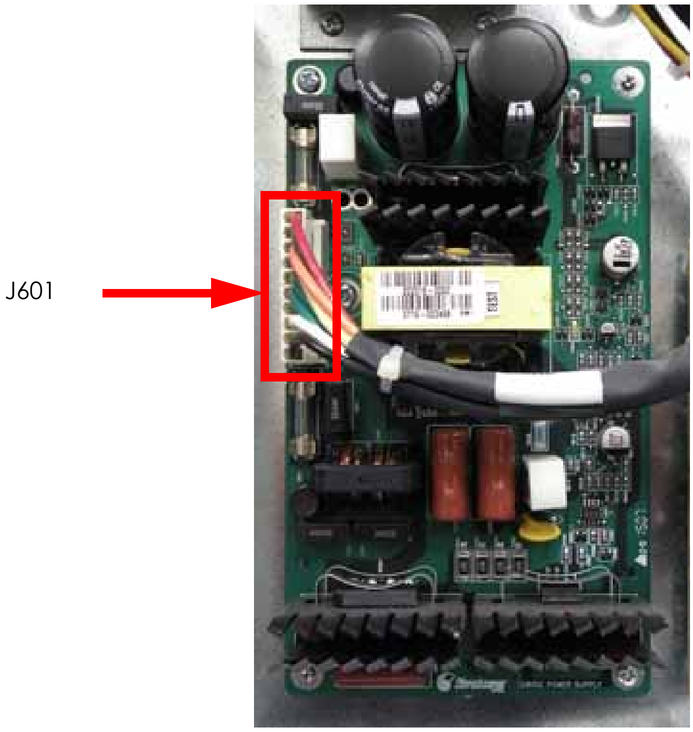
1. Power down the system using the power-down switch. Once the system is powered down, switch the circuit breaker to the **off** position.
2. Unplug the AC power cord, RJ-45 network cable and UPS cable (if used) from the rear of the printer.
3. Remove the rear panel. See Removing the Rear Panel on page 4-5.
4. Wear a grounding wrist strap and connect the end to the electronics bay pan.
5. Locate the 120 VDC power supply. See Figure 4-67.

Figure 4-67: 120 VDC power supply location



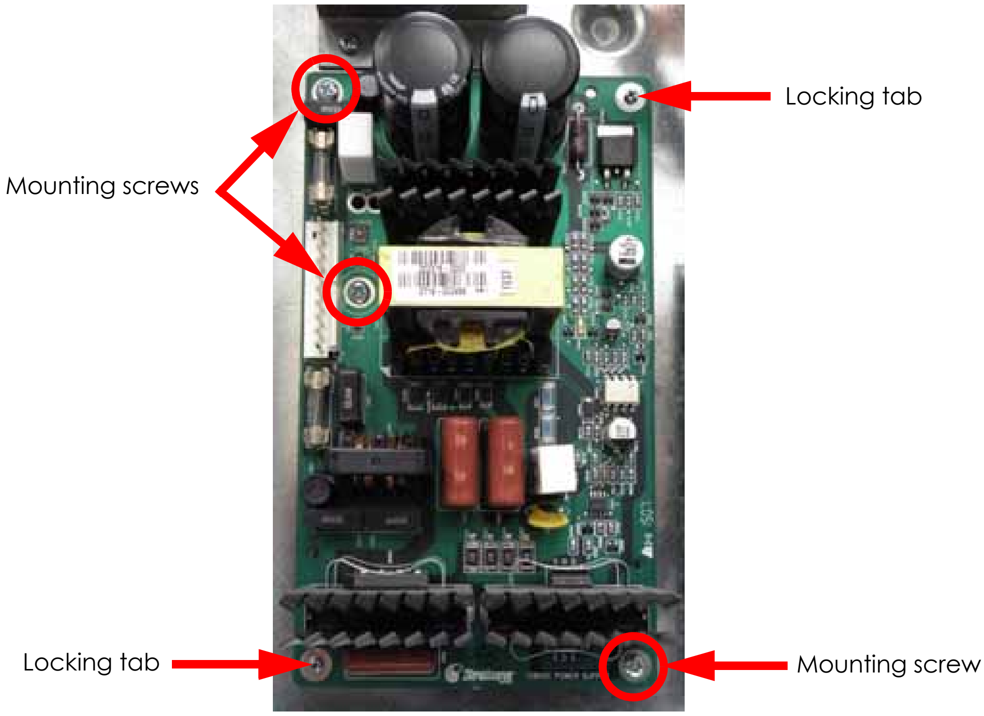
1. Remove the electronics bay cooling fan. See Removing the Electronics Bay Cooling Fan on page 4-38.
2. Disconnect the J601 cable by pulling outward. See Figure 4-68.

Figure 4-68: J601 cable location



3. Using a phillips screwdriver, remove the 3 mounting screws. See Figure 4-69.

Figure 4-69: 120 VDC power supply mounting screw locations



Installing the 120 VDC Power Supply

1. Wear a grounding wrist strap and connect the end to the electronics bay pan.
2. Align the 120 VDC power supply with the mounting holes and use a phillips screwdriver to reinstall the 3 mounting screws.
3. Reconnect J601.
4. Reinstall the electronics bay cooling fan. See Installing the Electronics Bay Cooling Fan on page 4-39.
5. Reinstall the rear panel. See Installing the Rear Panel on page 4-5.
6. Reconnect the AC power cord, RJ-45 network cable and UPS cable (if used).
7. Power up the printer.
8. Run a small test part and monitor system operation during build.

5/12 VDC Power Supply

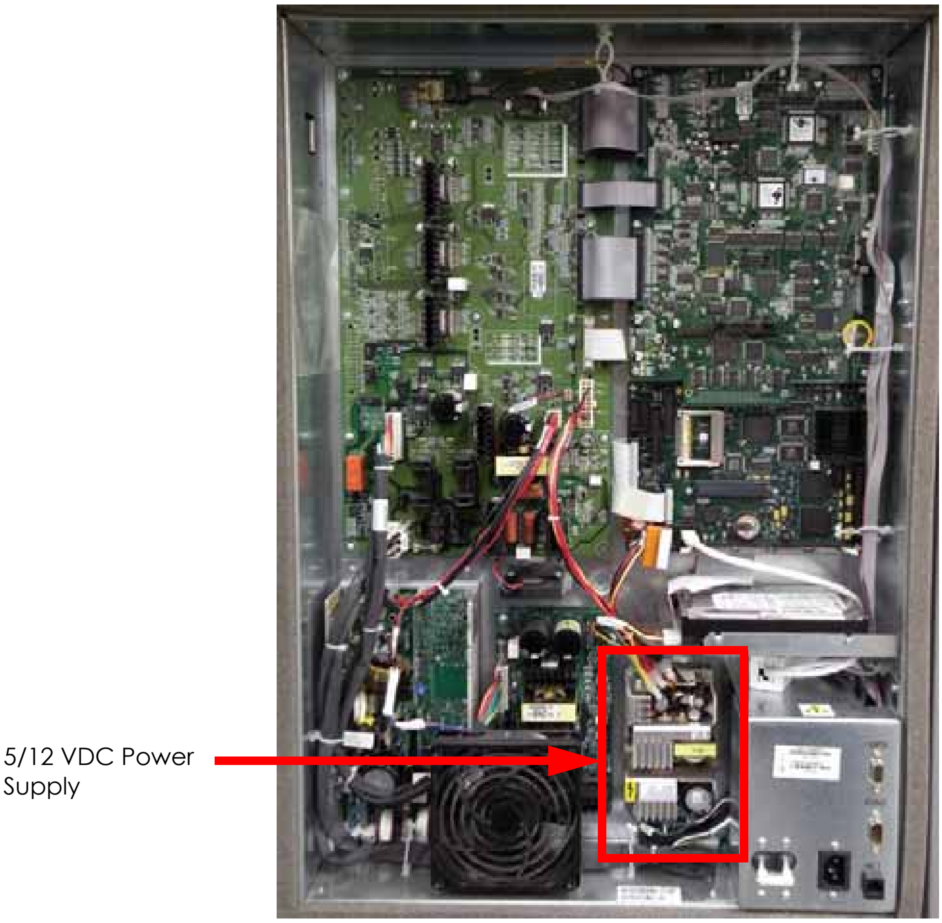
Required Tools

- Phillips screwdriver
- Grounding wrist strap

Removing the 5/12 VDC Power Supply

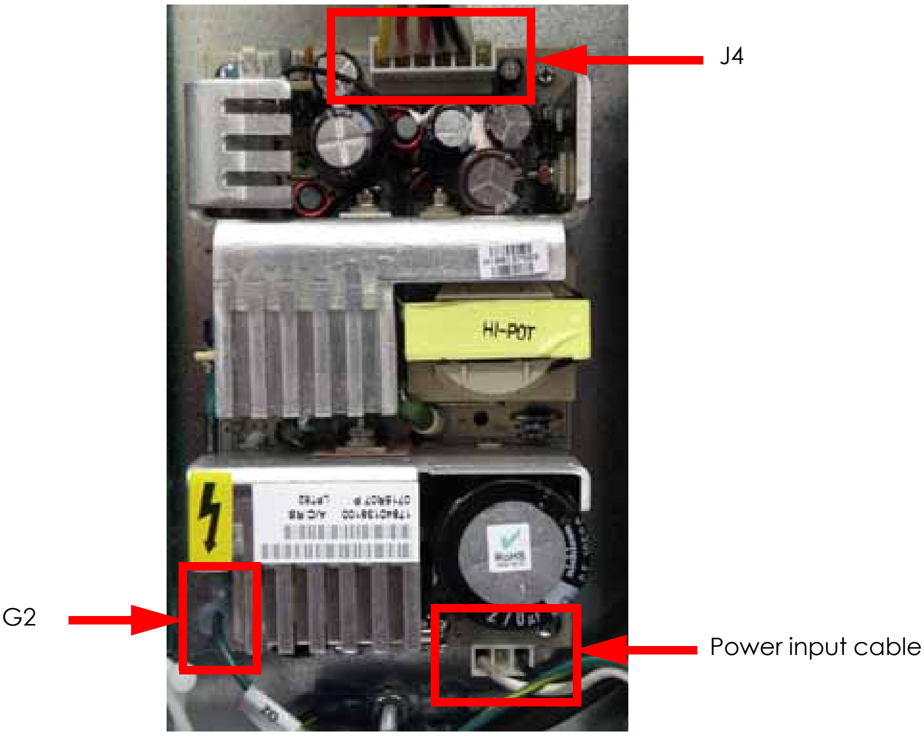
1. Power down the system using the power-down switch. Once the system is powered down, switch the circuit breaker to the **off** position.
2. Unplug the AC power cord, RJ-45 network cable and UPS cable (if used) from the rear of the printer.
3. Remove the rear panel. See Removing the Rear Panel on page 4-5.
4. Wear a grounding wrist strap and connect the end to the electronics bay pan.
5. Locate the 120 VDC power supply. See Figure 4-70.

Figure 4-70: 5/12 VDC power supply location



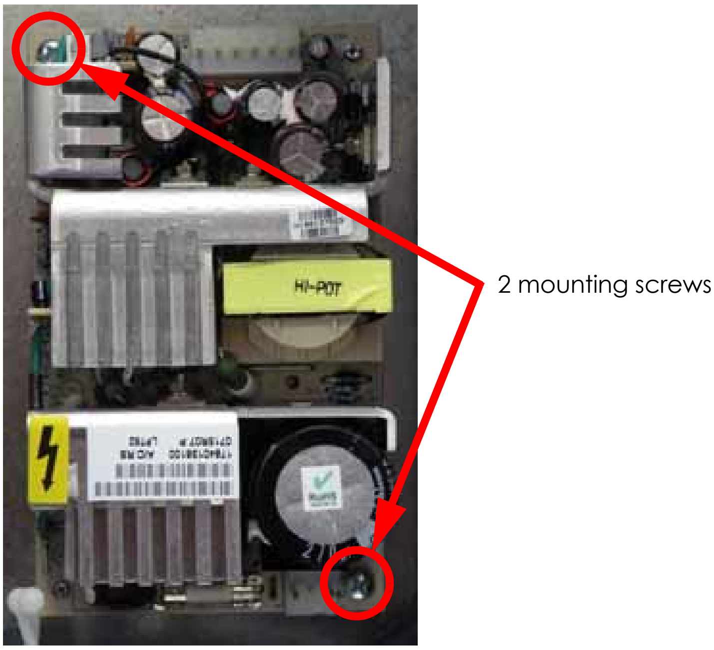
6. Disconnect the J4 cable by pulling outwards. See Figure 4-71.
7. Disconnect the power input cable by pulling outwards. See Figure 4-71.
8. Disconnect the G2 ground wire by pulling outwards. See Figure 4-71.

Figure 4-71: J4 cable location



9. Using a phillips screwdriver, remove the 2 mounting screws. See Figure 4-72.

Figure 4-72: 5/12 VDC power supply mounting screw locations



Installing the 5/12 VDC Power Supply

1. Wear a grounding wrist strap and connect the end to the electronics bay pan.
2. Align the 5/12 VDC power supply with the mounting holes and use a phillips screwdriver to reinstall the 2 mounting screws.
3. Reconnect the G2 ground wire.
4. Reconnect the power input cable.
5. Reconnect the J4 cable.
6. Reinstall the rear panel. See Installing the Rear Panel on page 4-5.
7. Reconnect the AC power cord, RJ-45 network cable and UPS cable (if used).
8. Power up the printer.
9. Run a small test part and monitor system operation during build.

Line Filter Board

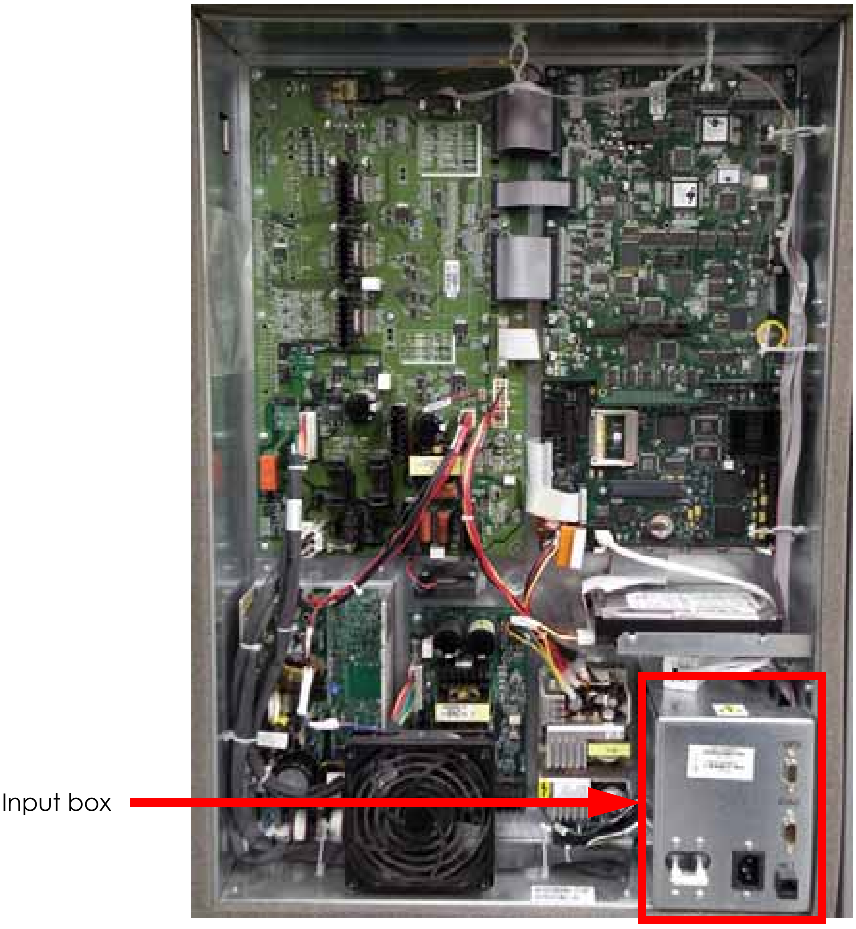
Required Tools

- Phillips screwdriver
- Grounding wrist strap

Removing the Line Filter Board

1. Power down the system using the power-down switch. Once the system is powered down, switch the circuit breaker to the **off** position.
2. Unplug the AC power cord, RJ-45 network cable and UPS cable (if used) from the rear of the printer.
3. Remove the rear panel. See Removing the Rear Panel on page 4-5.
4. Wear a grounding wrist strap and connect the end to the electronics bay pan.
5. Locate the input box. See Figure 4-73.

Figure 4-73: Input box location

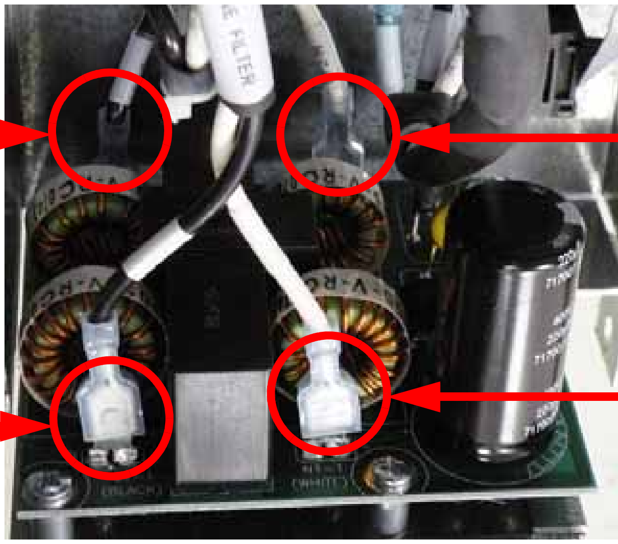


6. Using a phillips screwdriver, remove the 3 input box mounting screws. See Figure 4-74.

Figure 4-74: Input box mounting screw locations

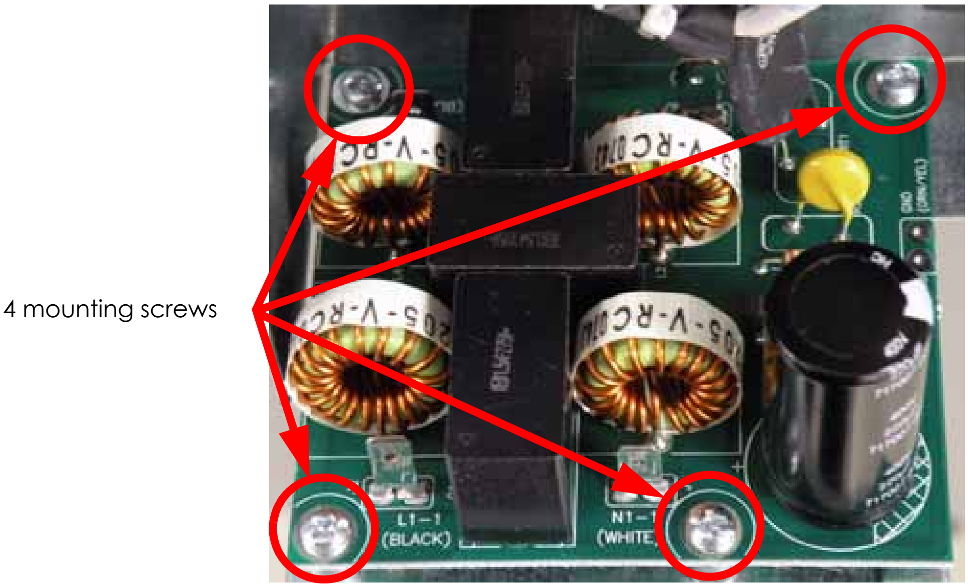
7. Disconnect L2-1 (black) and N2-1 (white) from the front of the line filter board. See Figure 4-75.
8. Disconnect LF2-P (black) and LF2-N (white) from the rear of the line filter board. See Figure 4-75.

Figure 4-75: Line filter connector locations



9. Using a phillips screwdriver, remove the 4 mounting screws. See Figure 4-76.

Figure 4-76: Line filter mounting screw locations



Installing the Line Filter Board

1. Wear a grounding wrist strap and connect the end to the electronics bay pan.
2. Align the line filter with the mounting standoffs and use a phillips screwdriver to reinstall the 4 mounting screws.
3. Reconnect LF2-P (black) to the left rear of the line filter board.
4. Reconnect LF2-N (white) to the right rear of the line filter board.
5. Reconnect L2-1 (black) to the left front of the line filter board.
6. Reconnect N2-1 (white) to the right front of the line filter board.
7. Align the input box cover with the mounting holes and use a phillips screwdriver to reinstall the 3 mounting screws.
8. Reinstall the rear panel. See Installing the Rear Panel on page 4-5.
9. Reconnect the AC power cord, RJ-45 network cable and UPS cable (if used).
10. Power up the printer.
11. Run a small test part and monitor system operation during build.

AC Input

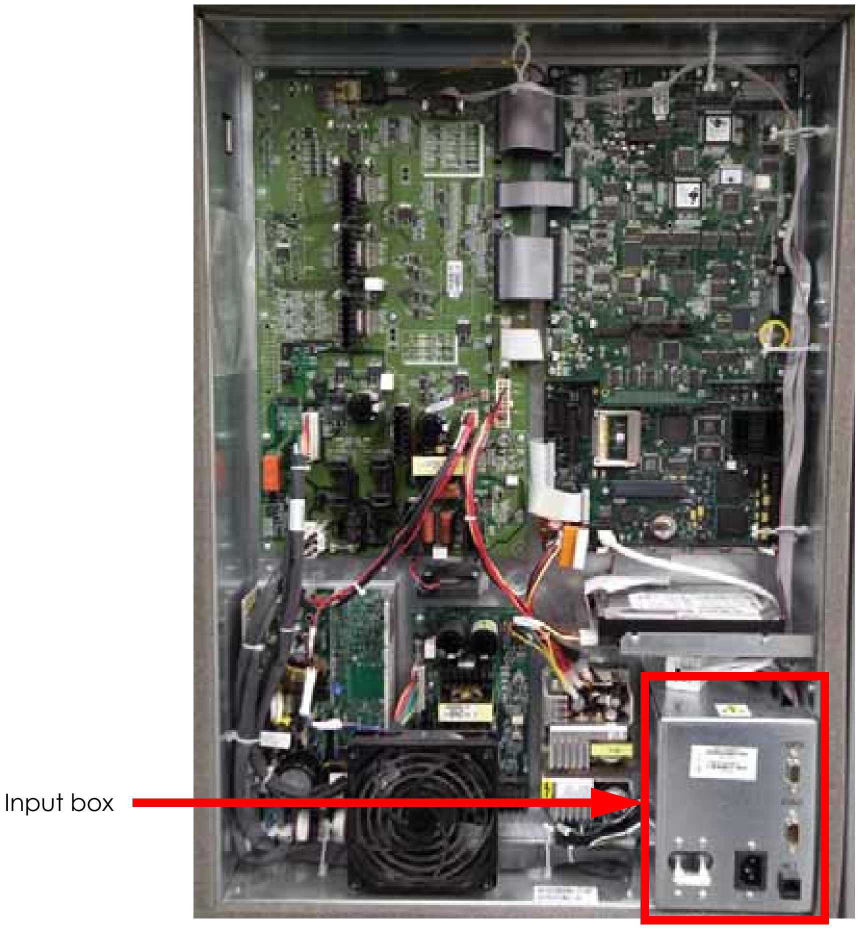
Required Tools

- Phillips screwdriver
- Grounding wrist strap

Removing the AC Input

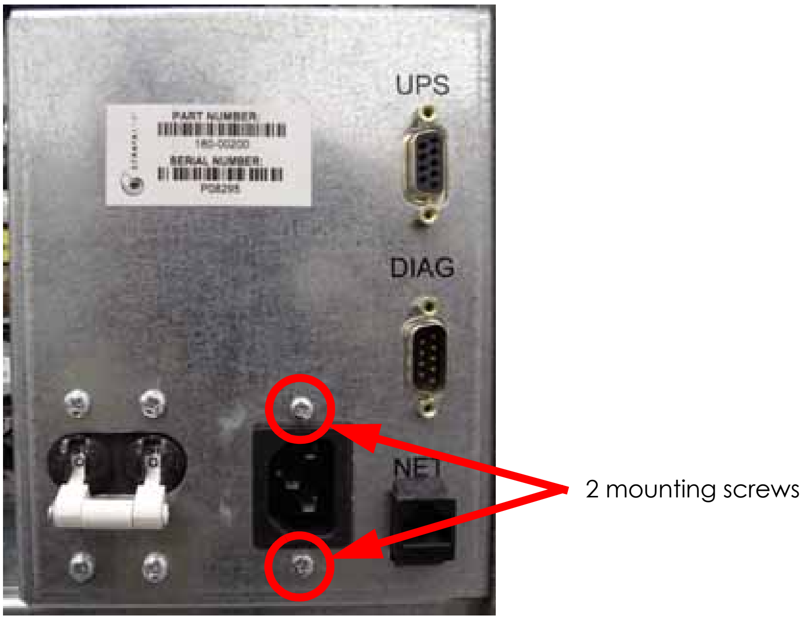
1. Power down the system using the power-down switch. Once the system is powered down, switch the circuit breaker to the **off** position.
2. Unplug the AC power cord, RJ-45 network cable and UPS cable (if used) from the rear of the printer.
3. Remove the rear panel. See Removing the Rear Panel on page 4-5.
4. Wear a grounding wrist strap and connect the end to the electronics bay pan.
5. Locate the input box. See Figure 4-77.

Figure 4-77: Input box location



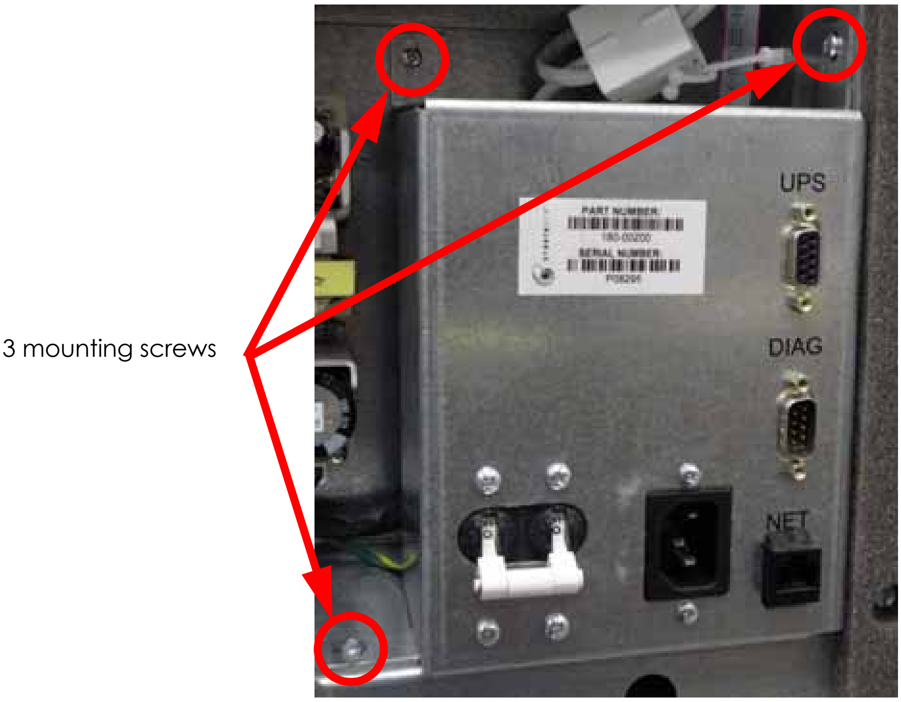
6. Using a phillips screwdriver, remove the 2 AC input mounting screws. See Figure 4-78.

Figure 4-78: AC input mounting screw locations



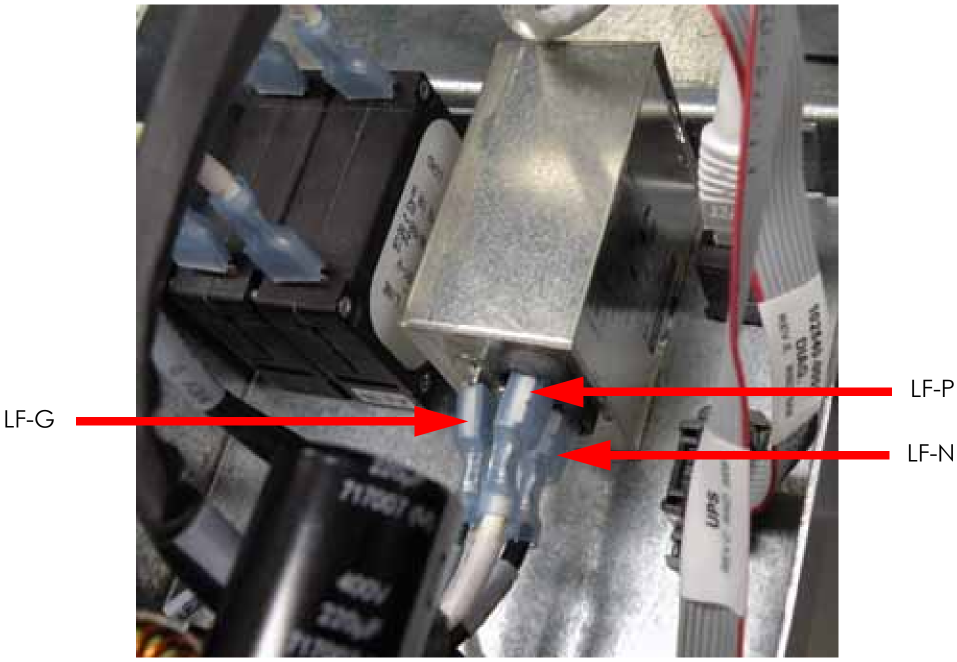
7. Using a phillips screwdriver, remove the 3 input box mounting screws. See Figure 4-79.

Figure 4-79: Input box mounting screw locations



8. Disconnect LF-P (black) from the bottom right side of the AC input by pulling outwards. See Figure 4-80.
9. Disconnect LF-N (white) from the upper right side of the AC input by pulling outwards. See Figure 4-80.
10. Disconnect LF-G (green) from the left side of the AC input by pulling outwards. See Figure 4-80.

Figure 4-80: AC input connection locations



Installing the AC Input

1. Wear a grounding wrist strap and connect the end to the electronics bay pan.
2. Reconnect LF-P (black) to the lower right side of the AC input.
3. Reconnect LF-N (white) to the upper right side of the AC input.
4. Reconnect LF-G (green) to the left side of the AC input.
5. Align the AC input with the mounting holes and use a phillips screwdriver to reinstall the 2 mounting screws.
6. Align the input box with the mounting holes and use a phillips screwdriver to reinstall the 3 mounting screws.
7. Reinstall the rear panel. See Installing the Rear Panel on page 4-5.
8. Reconnect the AC power cord, RJ-45 network cable and UPS cable (if used).
9. Power up the printer.
10. Run a small test part and monitor system operation during build.

Circuit Breaker

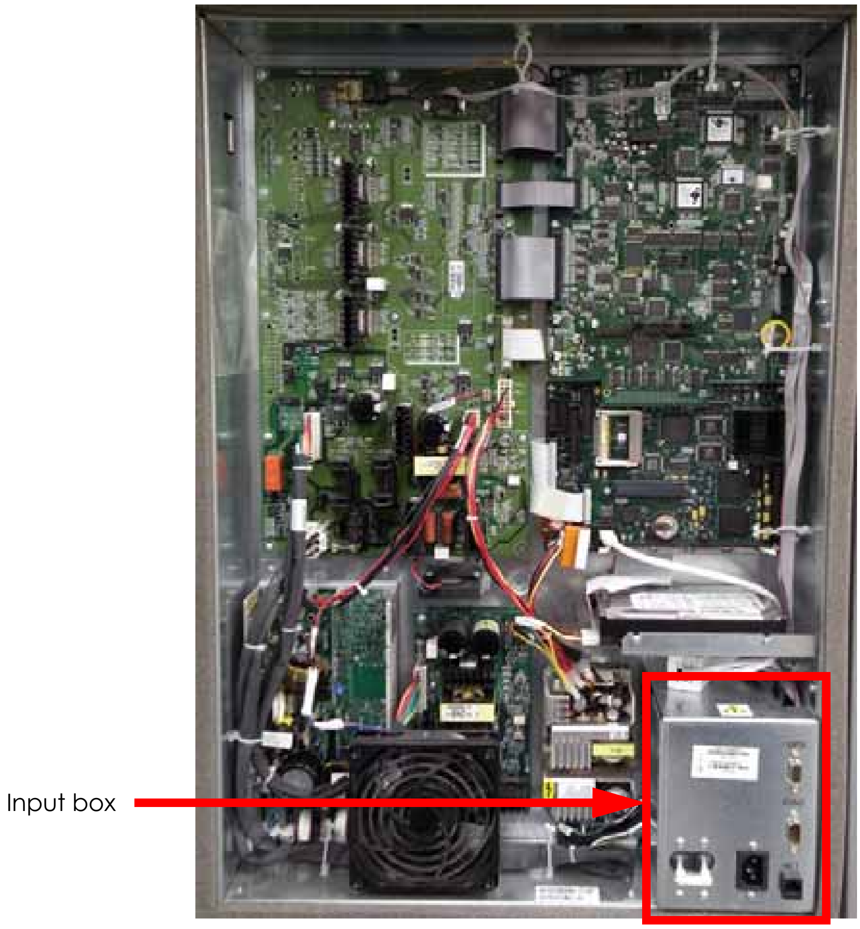
Required Tools

- Phillips screwdriver
- Grounding wrist strap

Removing the Circuit Breaker

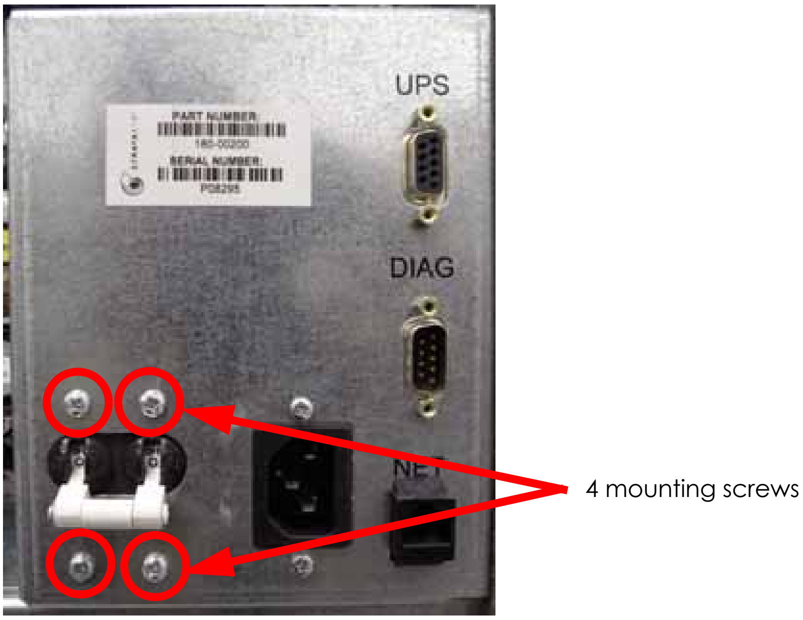
1. Power down the system using the power-down switch. Once the system is powered down, switch the circuit breaker to the **off** position.
2. Unplug the AC power cord, RJ-45 network cable and UPS cable (if used) from the rear of the printer.
3. Remove the rear panel. See Removing the Rear Panel on page 4-5.
4. Wear a grounding wrist strap and connect the end to the electronics bay pan.
5. Locate the input box. See Figure 4-81.

Figure 4-81: Input box location



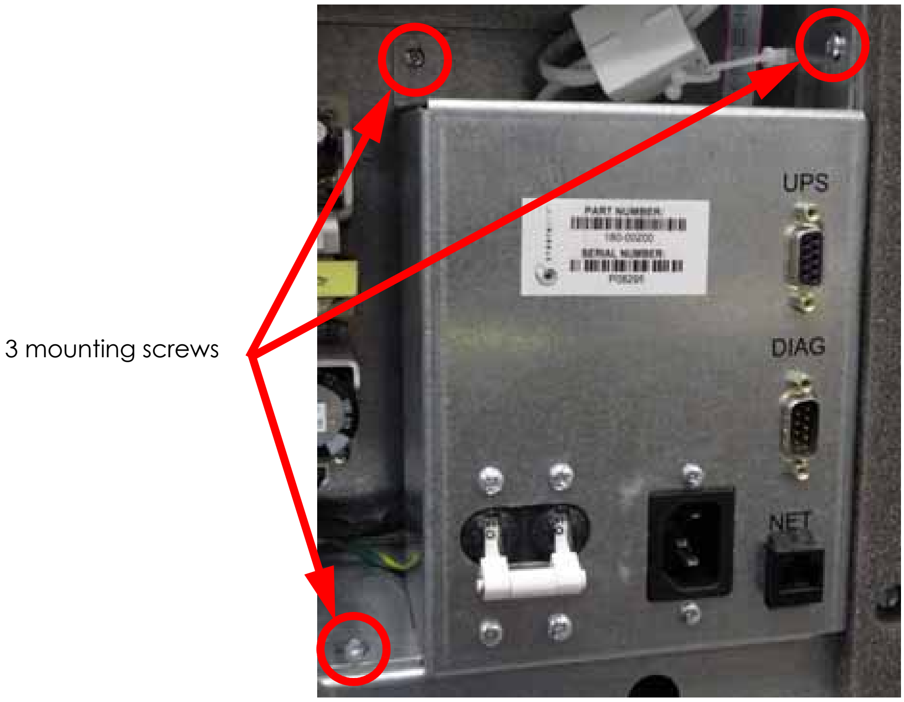
6. Using a phillips screwdriver, remove the 4 circuit breaker mounting screws. See Figure 4-82.

Figure 4-82: AC input mounting screw locations



7. Using a phillips screwdriver, remove the 3 input box mounting screws. See Figure 4-83.

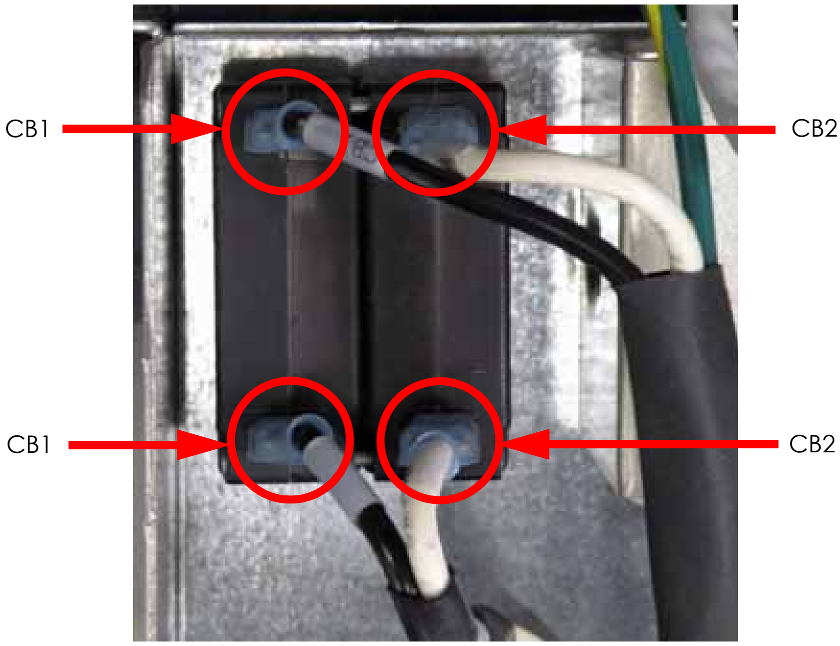
Figure 4-83: Input box mounting screw locations



8. Disconnect CB1 (black) from the upper left side of the circuit breaker by pulling outward. See Figure 4-84.
9. Disconnect CB2 (white) from the upper right side of the circuit breaker by pulling outward. See Figure 4-84.
10. Disconnect CB1 (black) from the lower left side of the circuit breaker by pulling outward. See Figure 4-84.

11. Disconnect CB2 (white) from the lower right side of the circuit breaker by pulling outward. See Figure 4-84.

Figure 4-84: Circuit breaker connection locations



Installing the Circuit Breaker

1. Wear a grounding wrist strap and connect the end to the electronics bay pan.
2. Reconnect CB1 (black) to the upper left side of the circuit breaker.
3. Reconnect CB2 (white) to the upper right side of the circuit breaker.
4. Reconnect CB1 (black) to the lower left side of the circuit breaker.
5. Reconnect CB2 (white) to the upper right side of the circuit breaker.
6. Align the circuit breaker with the mounting holes and use a phillips screwdriver to reinstall the 4 mounting screws.
7. Align the input box with the mounting holes and use a phillips screwdriver to reinstall the 3 mounting screws.
8. Reinstall the rear panel. See Installing the Rear Panel on page 4-5.
9. Reconnect the AC power cord, RJ-45 network cable and UPS cable (if used).
10. Power up the printer.
11. Run a small test part and monitor system operation during build.

Gen 3 Electrical Components

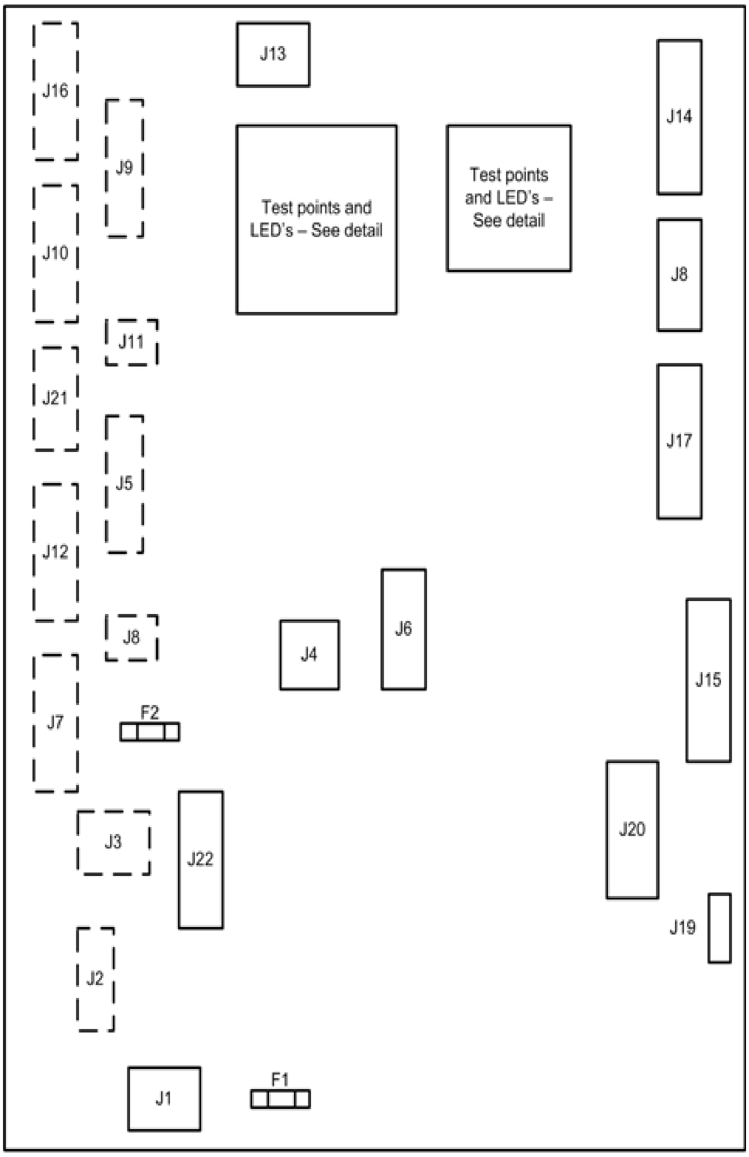
Gen 3 electronics will be installed on printers with serial numbers greater than P09000.

Power Distribution Board (PDB)

Required Tools

- Standard screwdriver
- Phillips screwdriver
- Grounding wrist strap

Figure 4-85: Power distribution board details

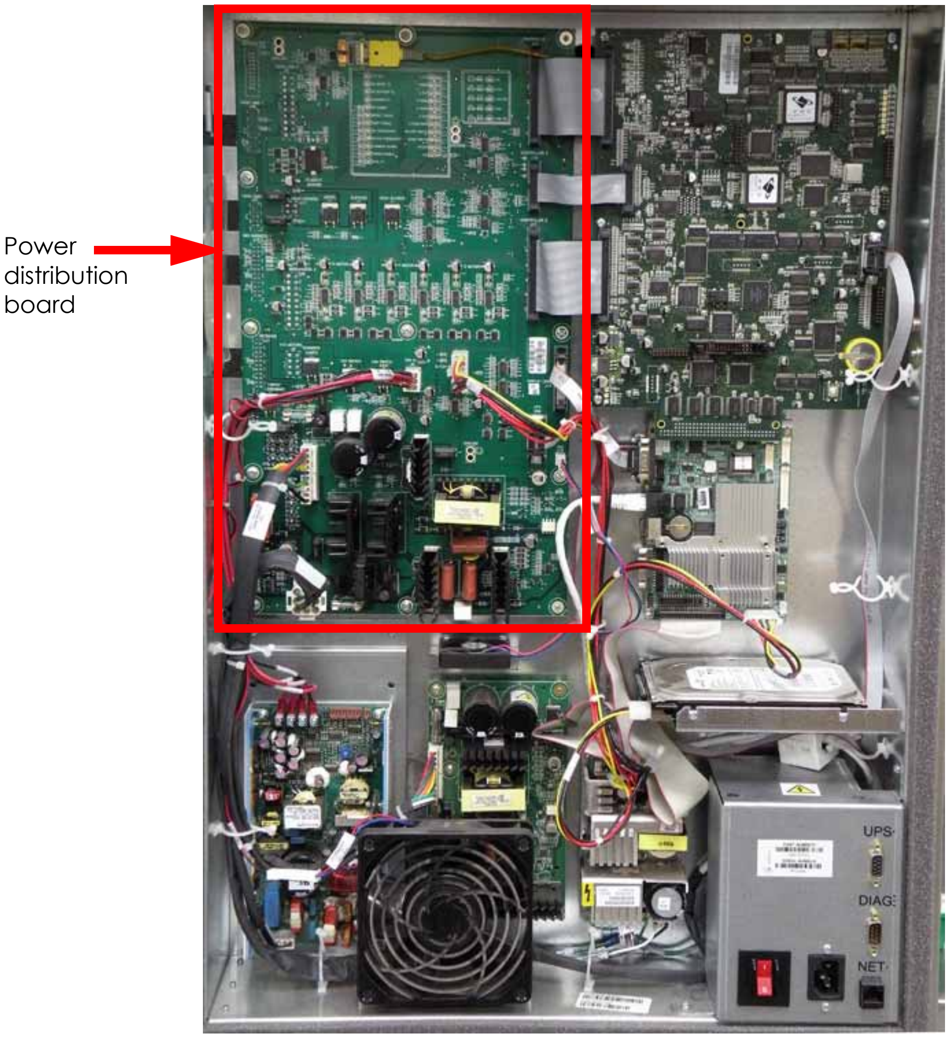


J1	AC power in
J2	To power switch and main thermal cutoff fuse
J3	To chamber heaters (AC)
J4	24VDC in
J5	Mid unit harness2
J6	5/12 VDC in
J7	Receiver cable
J8	To controller - ribbon cable
J9	Head umbilical 2
J10	Head umbilical I
J11	Head heater
J12	Mid unit harness1
J14	To controller - ribbon cable
J15	To SBC
J16	To LCD display
J17	To controller - ribbon cable
J21	Head umbilical 3
J22	120VDC aux (SST only)
F1	120VDC input fuse
F2	120VDC

Removing the Power Distribution Board

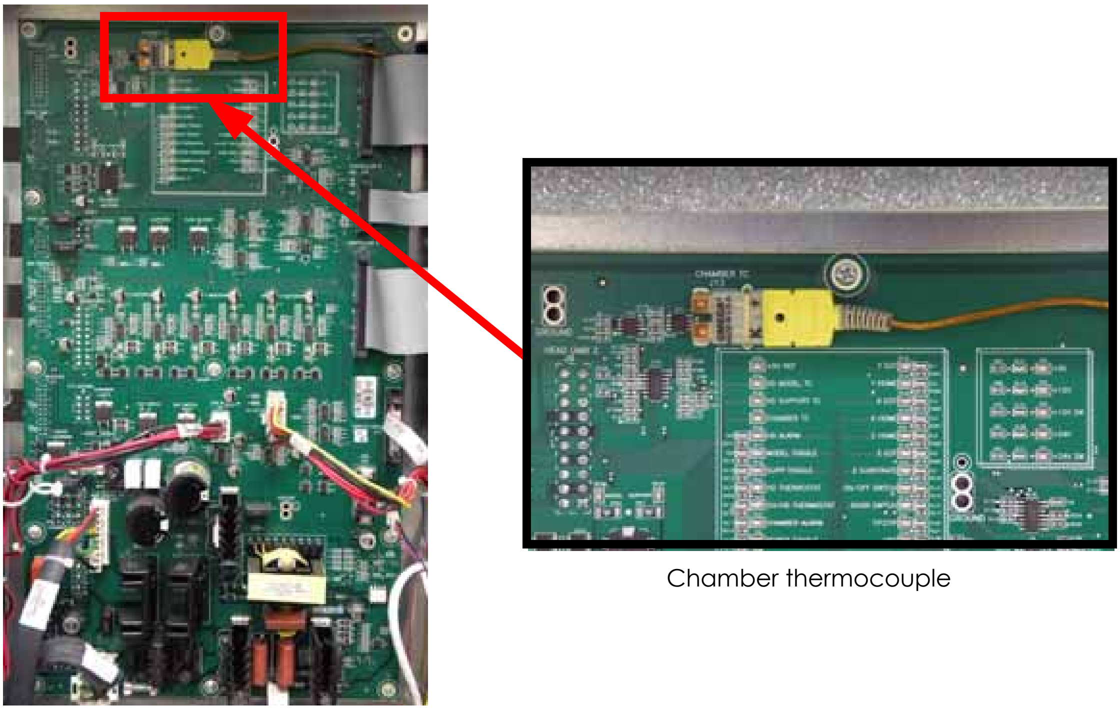
1. Power down the system using the power-down switch. Once the system is powered down, switch the circuit breaker to the **off** position.
2. Unplug the AC power cord, RJ-45 network cable and UPS cable (if used) from the rear of the printer.
3. Remove the rear panel. See Removing the Rear Panel on page 4-5.
4. Remove the side panels. See Removing the Side Panels on page 4-6.
5. Wear a grounding wrist strap and connect the end to the electronics bay pan.
6. Locate the power distribution board. See Figure 4-86.

Figure 4-86: Power distribution board location



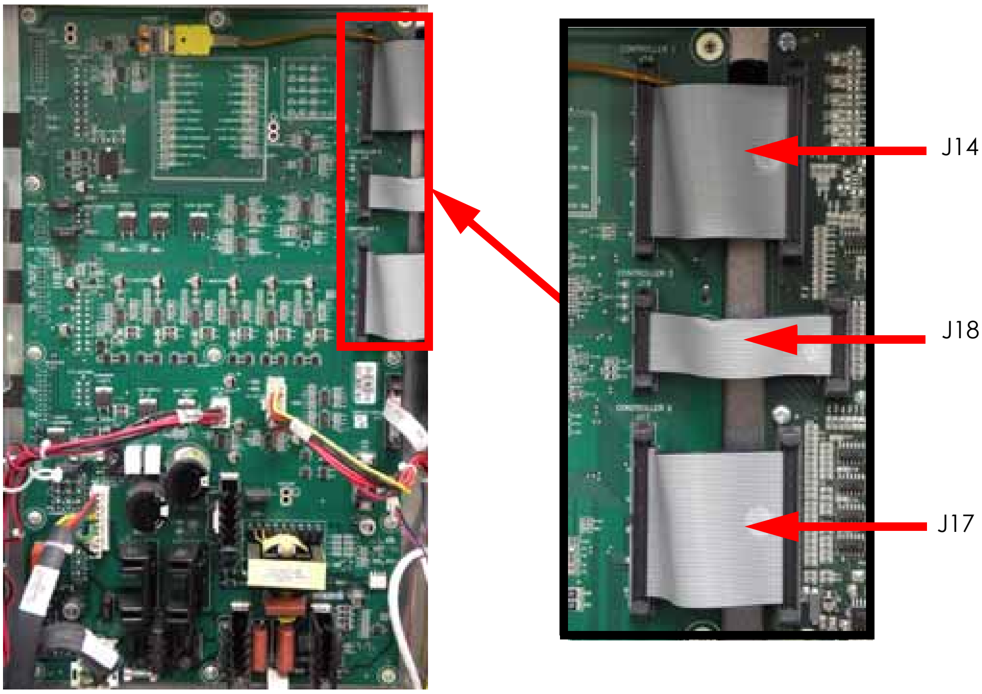
7. Disconnect the chamber thermocouple by pulling outward. See Figure 4-87.

Figure 4-87: Chamber thermocouple location



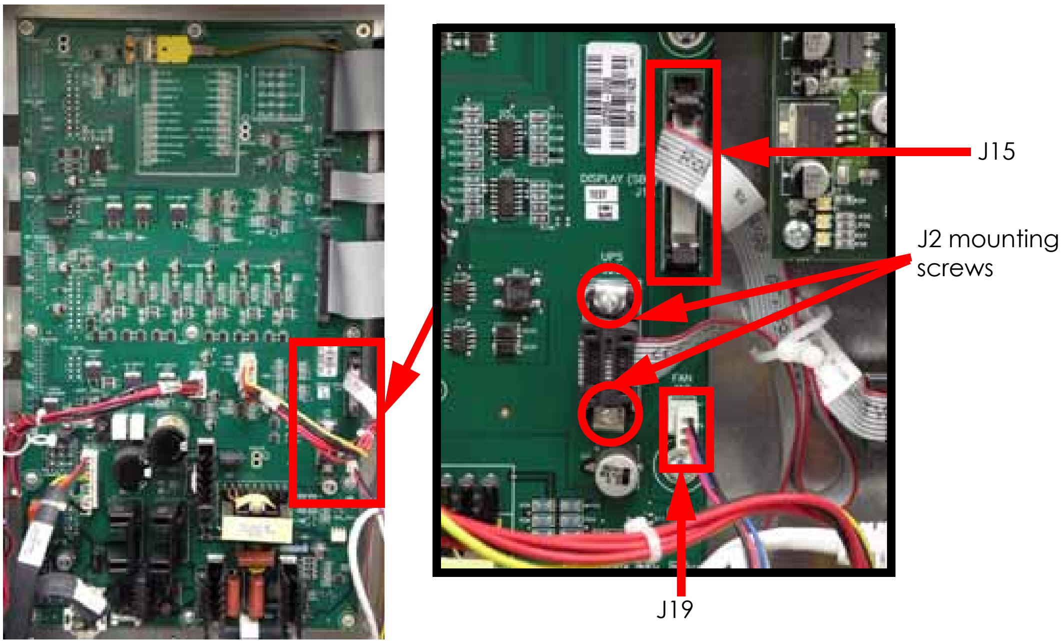
8. Disconnect the J14, J17 and J18 ribbon cables from the power distribution board by pressing the tabs and pulling outwards. See Figure 4-88.

Figure 4-88: Power distribution board ribbon cable locations



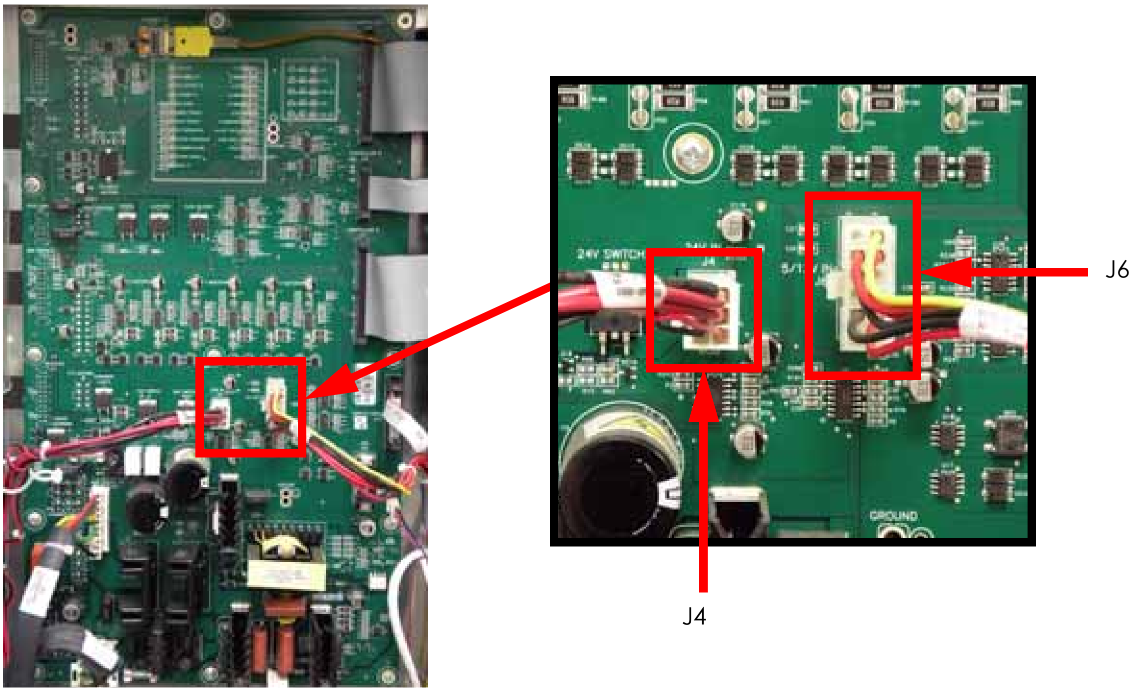
9. Disconnect the J19 fan cable by pulling outwards. See Figure 4-89.
10. Disconnect the J15 ribbon cable by pressing the tabs and pulling outwards. See Figure 4-89.
11. Using a standard screwdriver, loosen the J2 DB-9 cable mounting screws and pull outwards to remove. See Figure 4-89.

Figure 4-89: Power distribution board cable locations



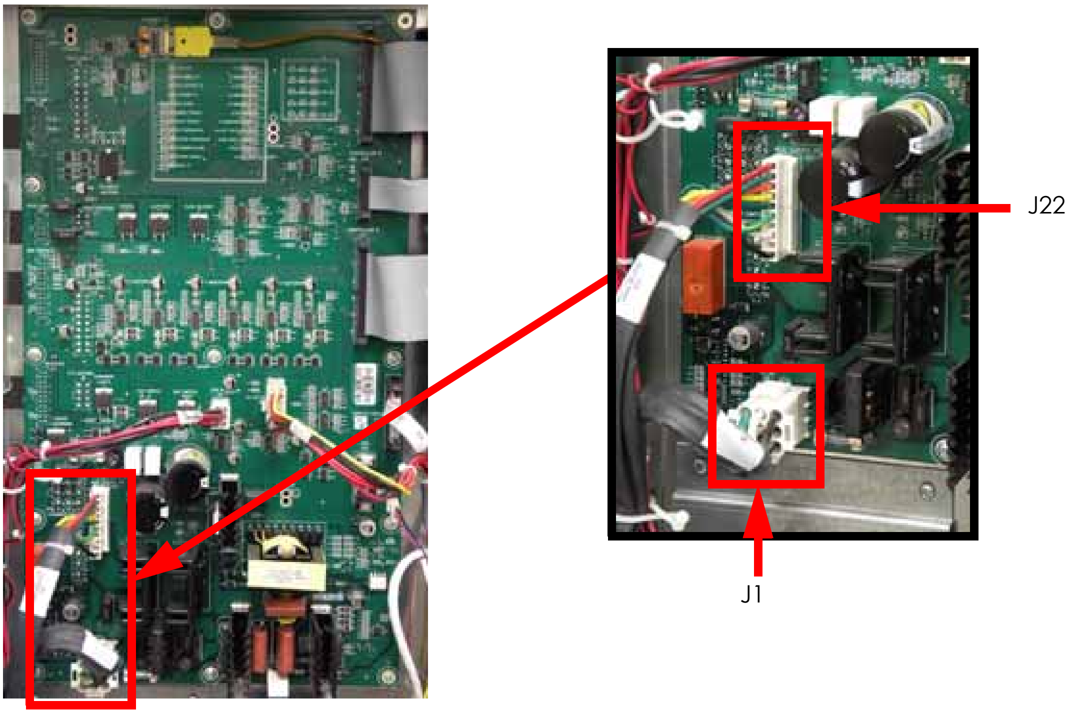
12. Disconnect J6 from the power distribution board by pressing the tab in and pulling outwards. See Figure 4-90.
13. Disconnect J4 from the power distribution board by pressing the tab in and pulling outwards. See Figure 4-90.

Figure 4-90: Power distribution board cable locations



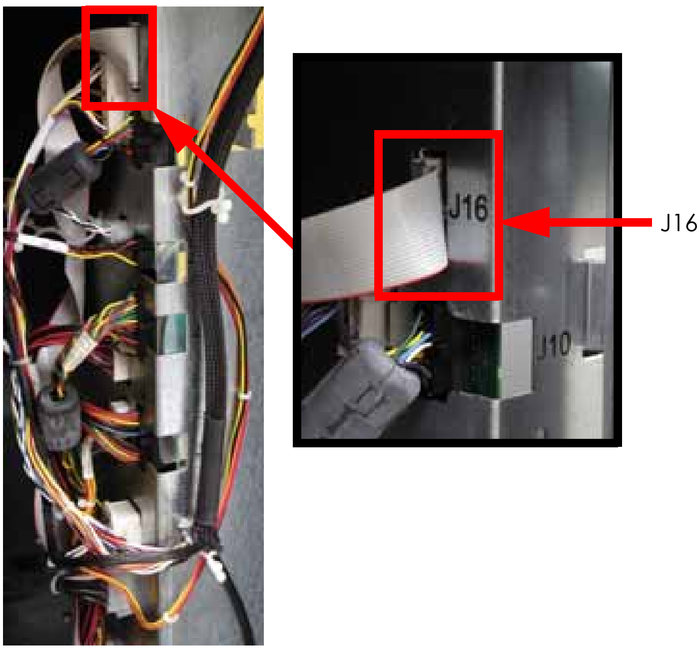
14. Disconnect J22 from the power distribution board by pressing the tab in and pulling outwards. See Figure 4-91.
15. Disconnect J1 from the power distribution board by pressing the tab in and pulling outwards. See Figure 4-91.

Figure 4-91: Power distribution board cable locations



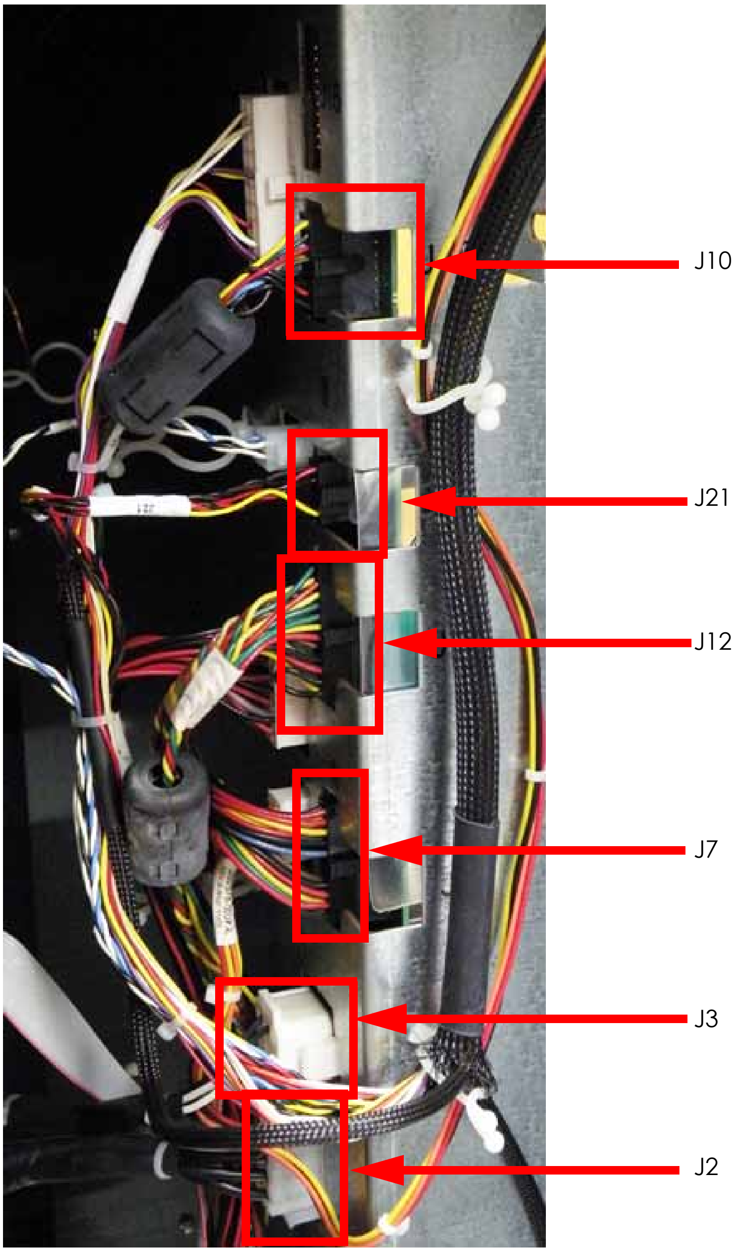
16. At the back side of the power distribution board, disconnect the J16 ribbon cable by pulling outwards. See Figure 4-92.

Figure 4-92: J16 ribbon cable location



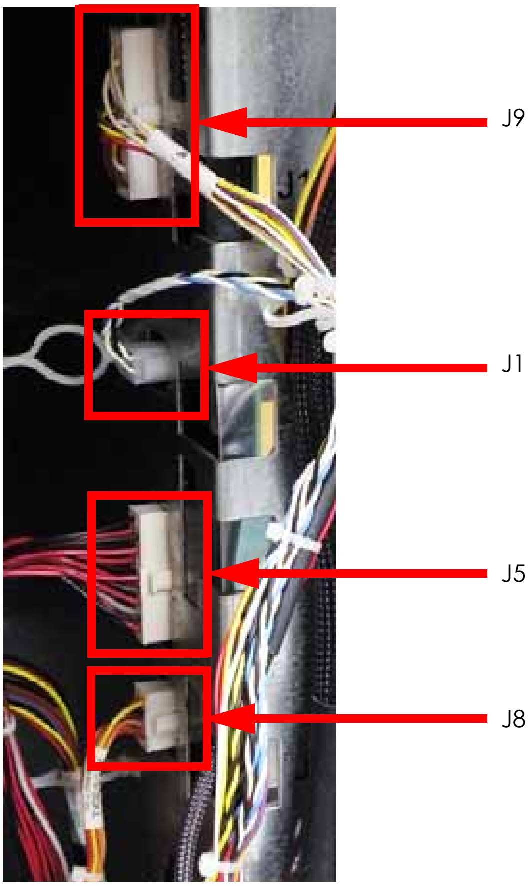
17. Disconnect the J10, J21, J12, J7, J3 and J2 cables from the back side of the power distribution board by pressing the tabs in and pulling outwards. See Figure 4-93.

Figure 4-93: Rear power distribution board cables



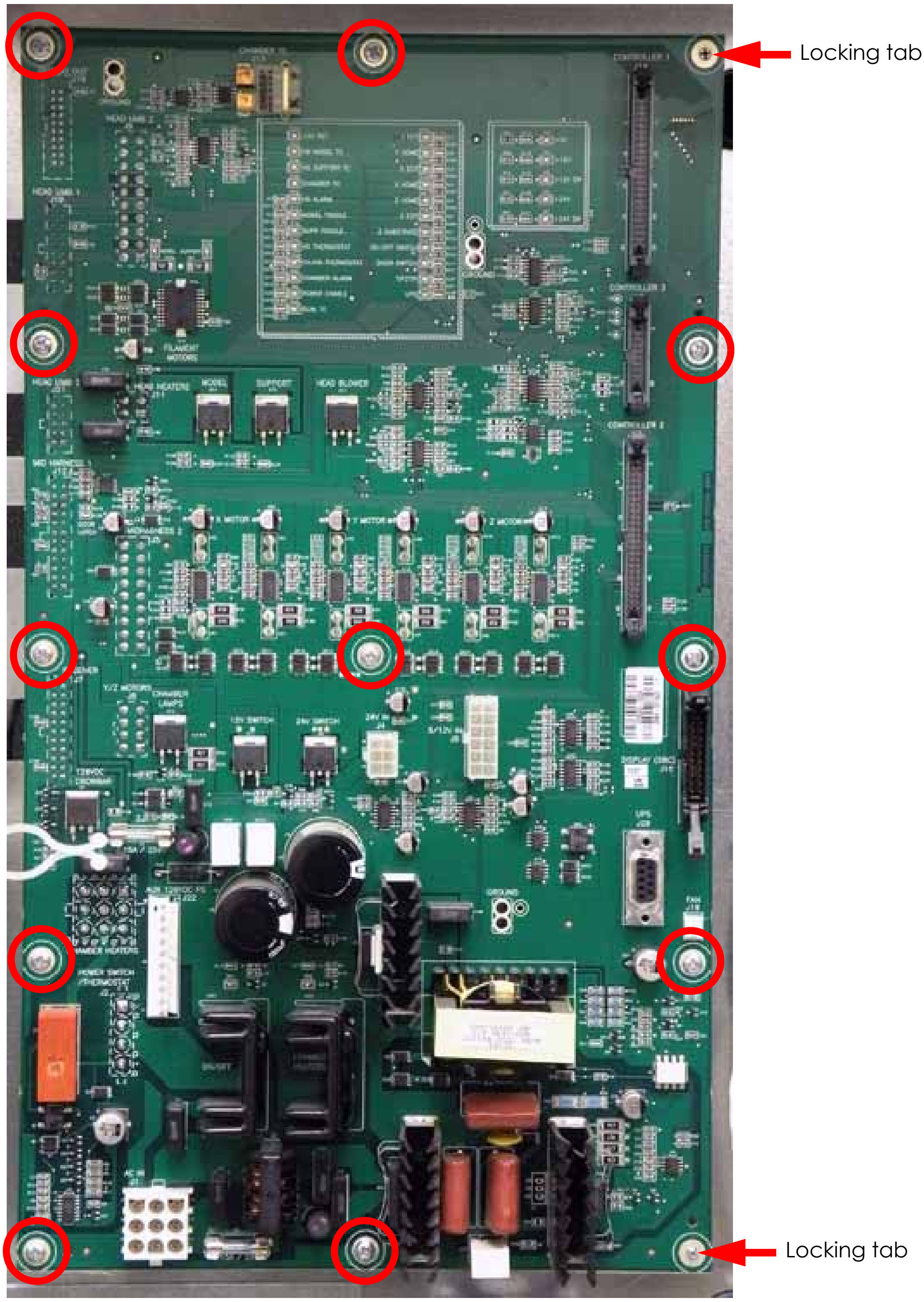
18. Disconnect the J9, J11, J5 and J8 cables from the back side of the power distribution board by pressing the tabs in and pulling outwards. See Figure 4-94.

Figure 4-94: Rear power distribution board cables



19. Using a phillips screwdriver, remove the 11 power distribution board mounting screws. See Figure 4-95.

Figure 4-95: Power distribution board mounting screw locations



20. Gently pull the power distribution board away from the mounting posts.

Installing the Power Distribution Board

1. Wear a grounding wrist strap and connect the end to the electronics bay pan.
2. Align the power distribution board with the mounting posts and use a phillips screwdriver to reinstall the 11 mounting screws.
3. Reconnect the J9, J11, J5 and J8 cables to the back side of the power distribution board by pushing into place.
4. Reconnect the J10, J21, J12, J7, J3 and J2 cables to the back side of the power distribution board by pushing into place.
5. Reconnect the J16 ribbon cable to the back side of the power distribution board by pushing into place.
6. Reconnect the J1 and J22 cables to the power distribution board by pushing into place.
7. Reconnect J4 and J6 cables to the power distribution board by pushing into place.
8. Reconnect the J15 ribbon cable and the J19 cable to the power distribution board by pushing into place.
9. Reconnect the J15 DB-9 cable to the power distribution board by pushing into place and use a standard screwdriver to tighten the mounting screws.
10. Reconnect the J14, J17 and J18 ribbon cables to the power distribution board by pushing into place.
11. Reconnect the chamber thermocouple by pushing into place.

> Be sure the + terminal of the chamber thermocouple is at the top when reconnecting.

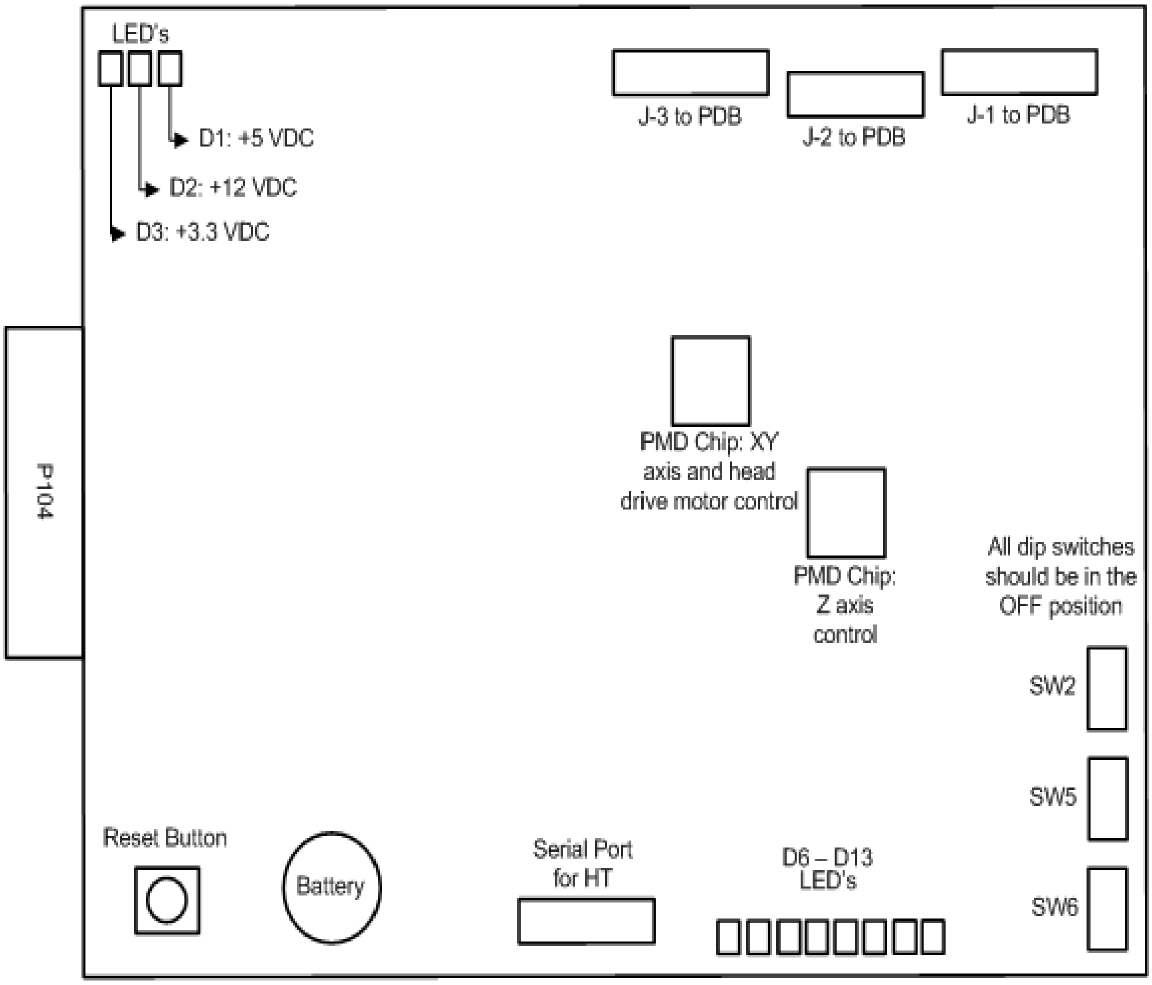
12. Reinstall the side panels. See Installing the Side Panels on page 4-6.
13. Reinstall the rear panel. See Installing the Rear Panel on page 4-5.
14. Reconnect the AC power cord, RJ-45 network cable and UPS cable (if used).
15. Power on the system. The system should reach **Idle** with no displayed errors.
16. Run a small test part and monitor system operation during build.
17. Send the bad power distribution board back to Stratasys, Inc.

Controller Board

Required Tools

- Standard screwdriver
- Phillips screwdriver
- Grounding wrist strap

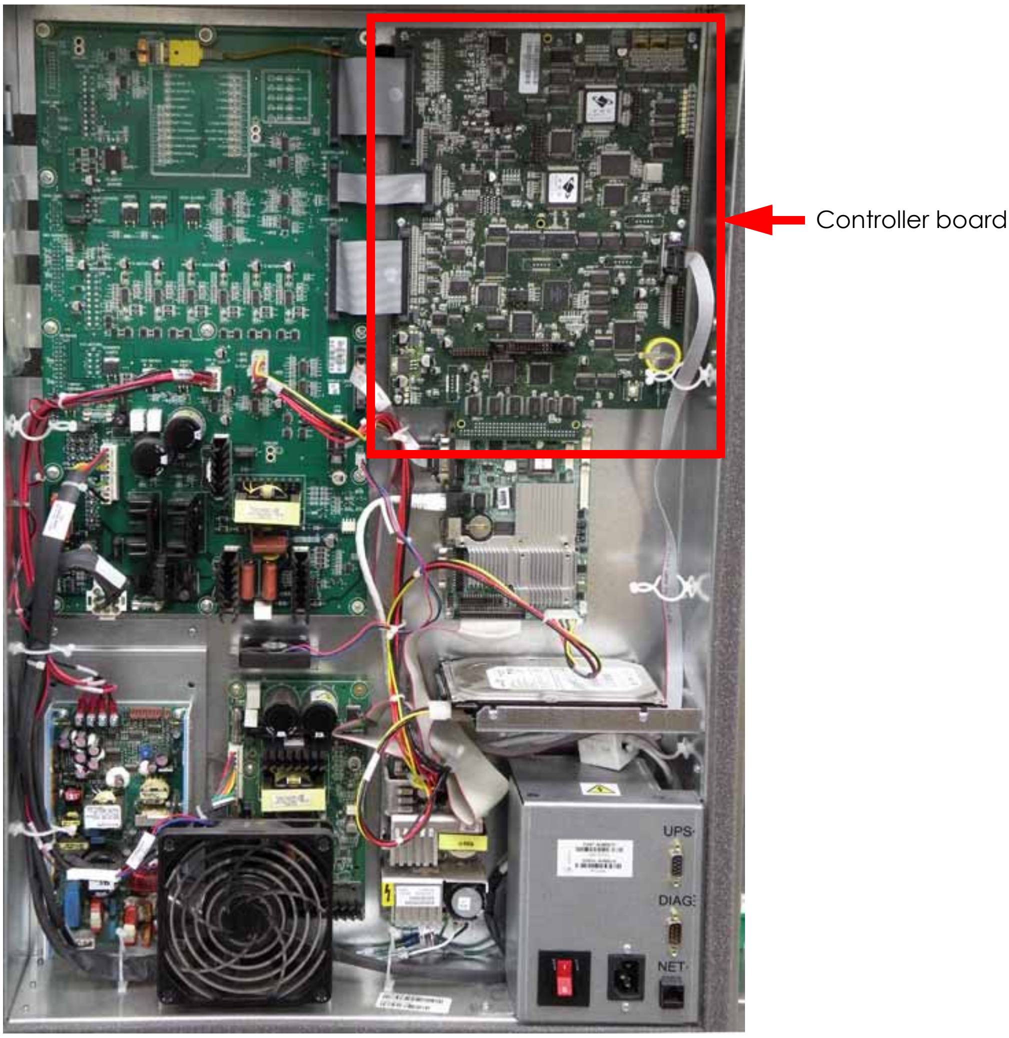
Figure 4-96: Controller board detail



Removing the Controller Board

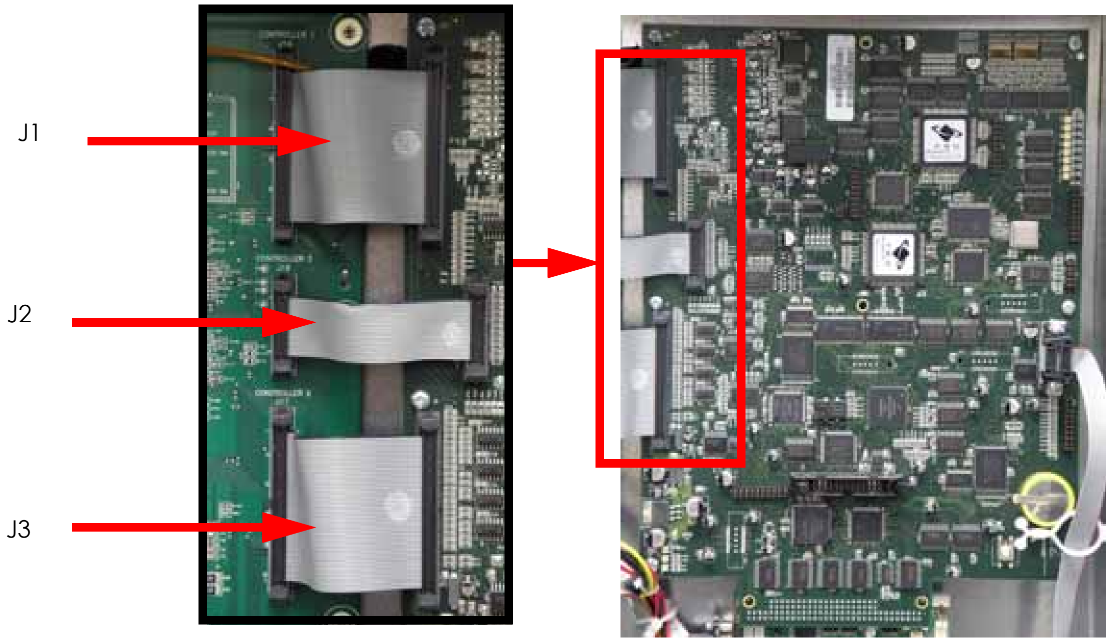
1. Power down the system using the power-down switch. Once the system is powered down, switch the circuit breaker to the **off** position.
2. Unplug the AC power cord, RJ-45 network cable and UPS cable (if used) from the rear of the printer.
3. Remove the rear panel. See Removing the Rear Panel on page 4-5.
4. Wear a grounding wrist strap and connect the end to the electronics bay pan.
5. Locate the controller board. See Figure 4-97.

Figure 4-97: Controller board location



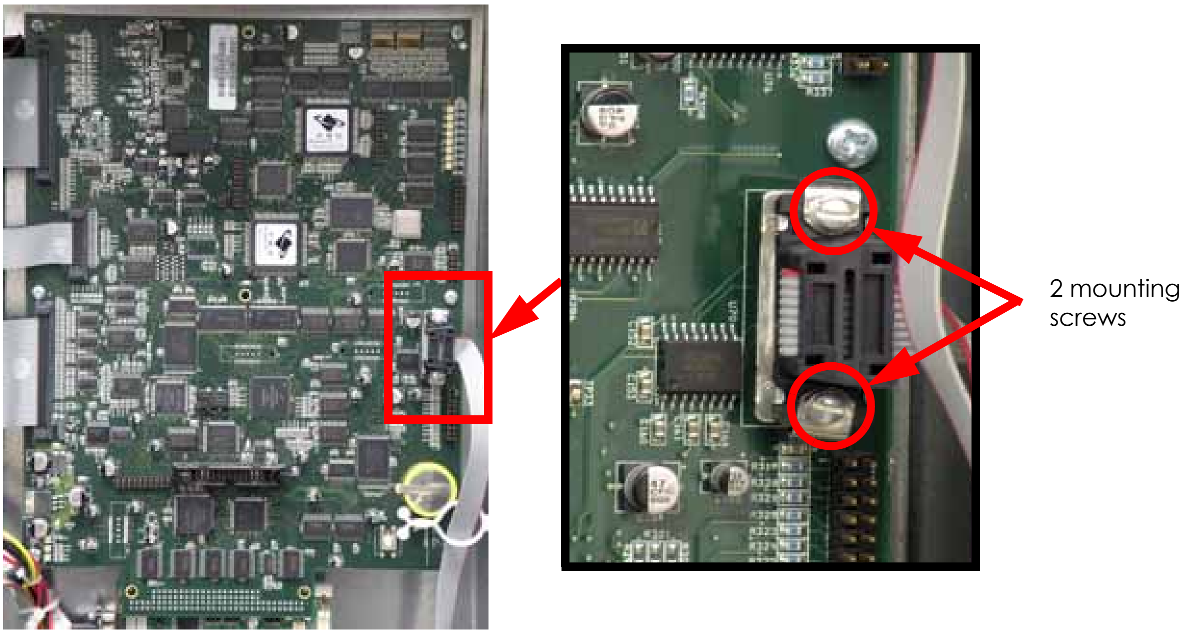
6. Disconnect the J1, J2 and J3 ribbon cables from the controller board by pressing the tabs and pulling outwards. See Figure 4-98.

Figure 4-98: Ribbon cable locations



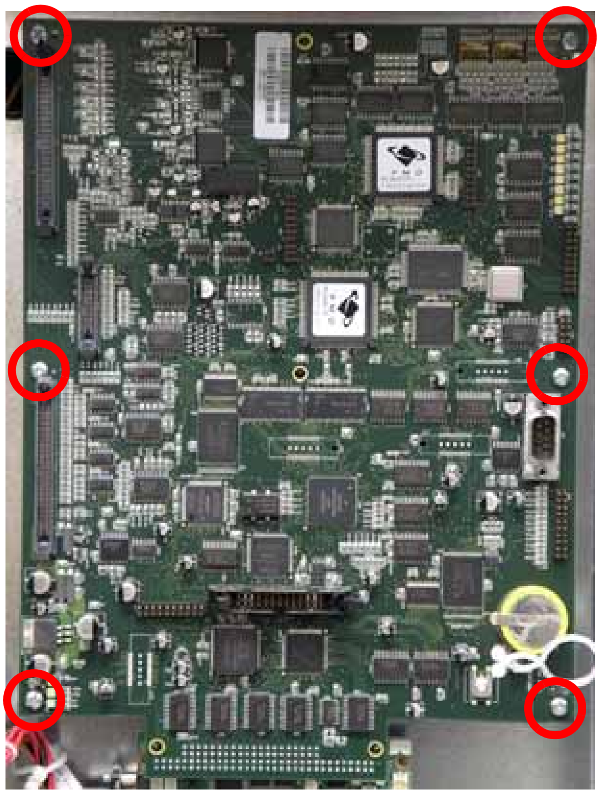
7. Using a standard screwdriver, loosen the J15 DB-9 connector and pull outwards to disconnect. See Figure 4-99.

Figure 4-99: J15 location



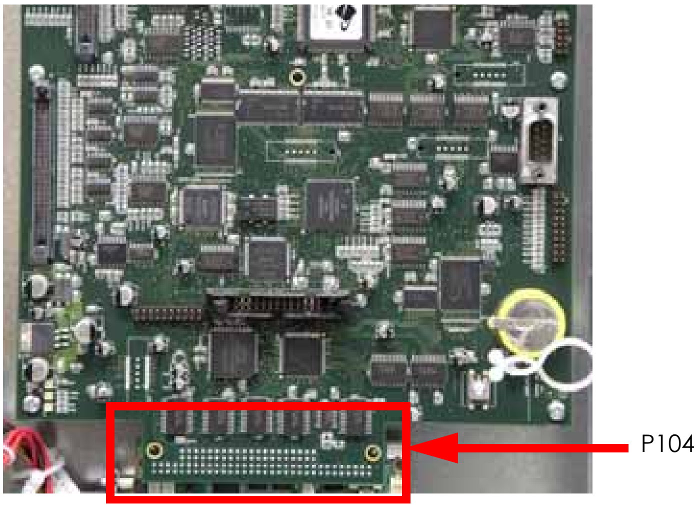
8. Using a Phillips screwdriver, remove the 6 controller board mounting screws. See Figure 4-100.

Figure 4-100: Controller board mounting screw locations



9. Gently pull the controller board at the P104 connector on the single board computer to remove. See Figure 4-101.

Figure 4-101: P104 location



Installing the Controller Board

1. Wear a grounding wrist strap and connect the end to the electronics bay pan.
2. Gently align the controller board P104 with the single board computer socket and press into place.

> Be careful not to bend any pins on the P104 connector.

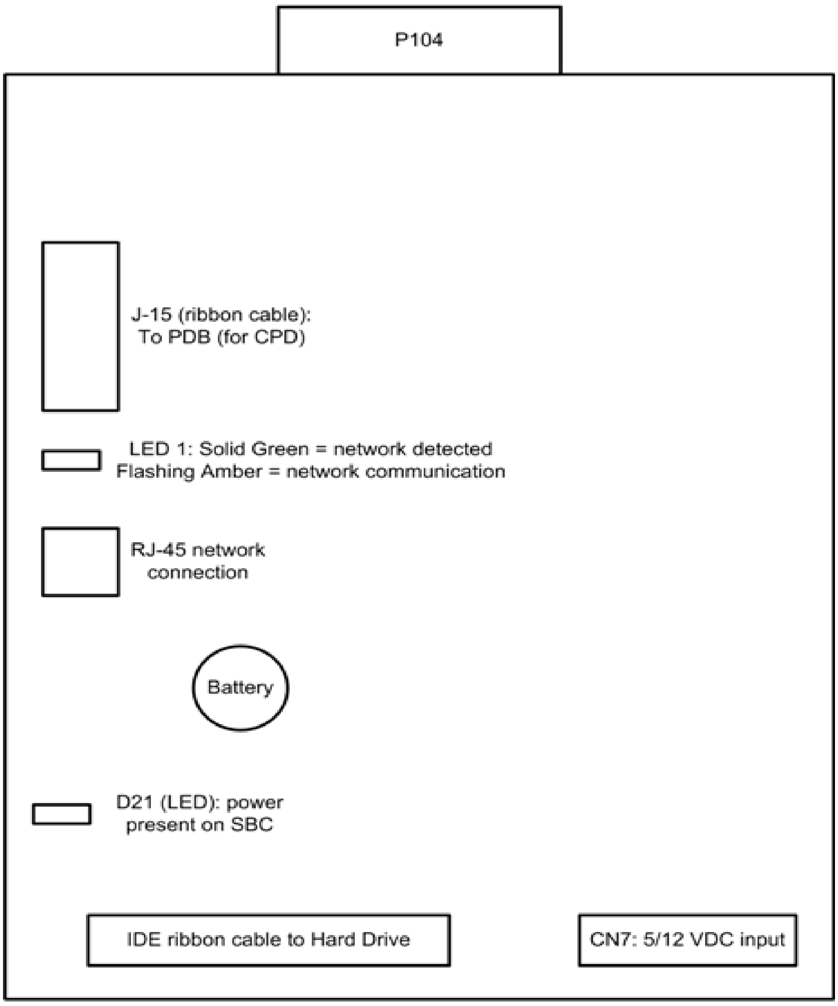
3. Using a phillips screwdriver, reinstall the 6 mounting screws.
4. Reconnect the J15 DB-9 connector by pushing into place and use a standard screwdriver to tighten the 2 mounting screws.
5. Reconnect the J1, J2 and J3 ribbon cables by pushing into place.
6. Reinstall the rear panel. See Installing the Rear Panel on page 4-5.
7. Reconnect the AC power cord, RJ-45 network cable and UPS cable (if used).
8. Power up the printer. You will be prompted to load the controller software.
9. Assign the printer static IP or dynamic IP networking depending on your network. If you assign it static IP you will need to enter the static IP address. When finished press **Done**.
10. Insert the system software CD into the notebook computer or workstation CD drive.
11. Open CatalystEX from the notebook computer or workstation.
12. Click on the **Printer Services** tab.
13. Click on the **Update Software** button.
14. Navigate CatalystEX to the CD drive and select the proper .UPG file for the printer.
15. When finished downloading, verifying and installing, reboot the printer.
16. Run a small test part and monitor system operation during build.
17. Send the bad controller board back to Stratasys, Inc.

Single Board Computer (SBC)

Required Tools

- Standard screwdriver
- Phillips screwdriver
- Grounding wrist strap

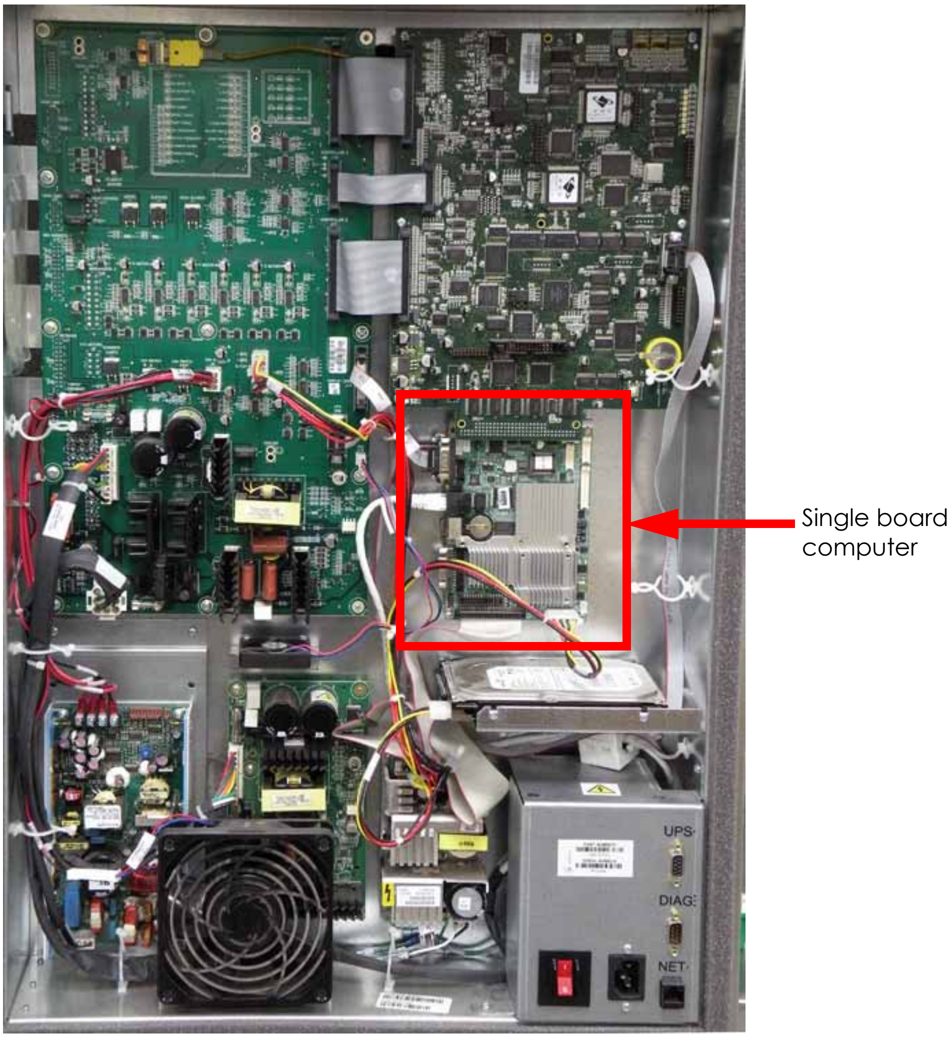
Figure 4-102: Single board computer detail



Removing the IDE Single Board Computer

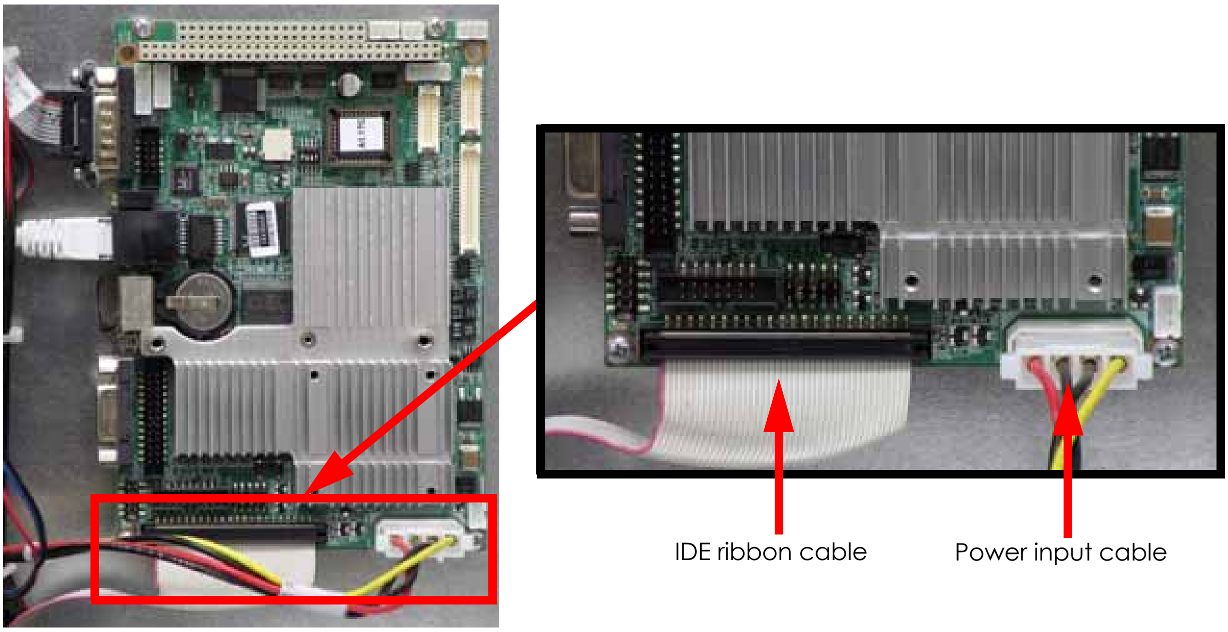
1. Power down the system using the power-down switch. Once the system is powered down, switch the circuit breaker to the **off** position.
2. Unplug the AC power cord, RJ-45 network cable and UPS cable (if used) from the rear of the printer.
3. Remove the rear panel. See Removing the Rear Panel on page 4-5.
4. Wear a grounding wrist strap and connect the end to the electronics bay pan.
5. Locate the Single board computer. See Figure 4-103.

Figure 4-103: Single board computer location



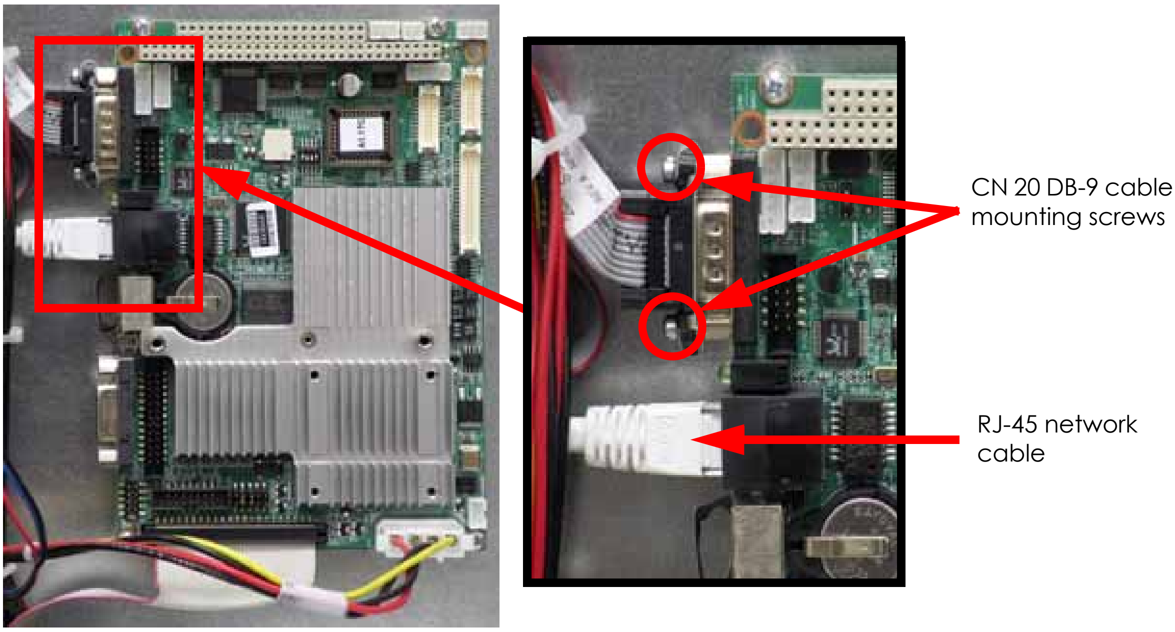
6. Remove the controller board. See Removing the Controller Board on page 4-69.
7. Disconnect the IDE ribbon cable by pulling downwards. See Figure 4-104.
8. Disconnect the power input cable by pulling outwards. See Figure 4-104.

Figure 4-104: IDE ribbon cable and power input cable locations



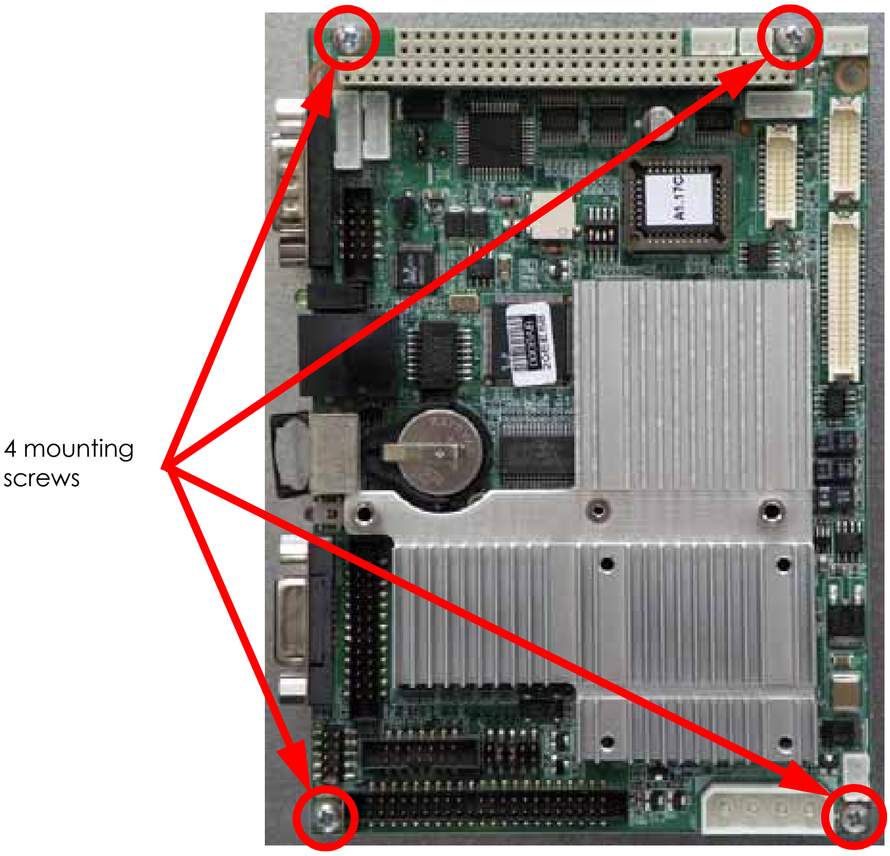
9. Disconnect the RJ-45 network cable by pressing the tab in and pulling outwards. See Figure 4-105.
10. Using a standard screwdriver, loosen the 2 CN 20 DB-9 connector mounting screws and then pull outwards to remove. See Figure 4-105.

Figure 4-105: Single board computer connector locations



11. Using a Phillips screwdriver, remove the 4 single board computer mounting screws. See Figure 4-106.

Figure 4-106: Single board computer mounting screw locations



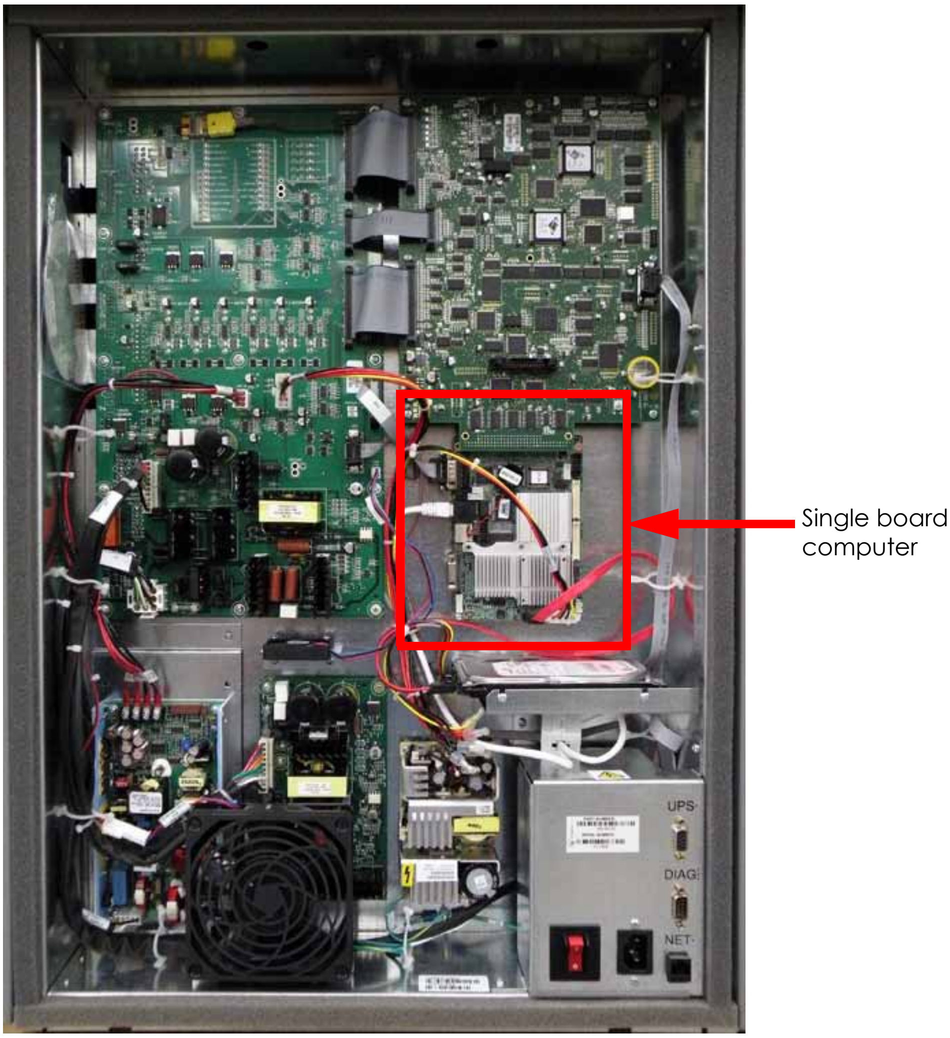
Installing the IDE Single Board Computer

1. Wear a grounding wrist strap and connect the end to the electronics bay pan.
2. Align the single board computer with the mounts and use a phillips screwdriver to reinstall the 4 mounting screws.
3. Reconnect the CN 20 DB-9 connector by pushing into place and use a standard screwdriver to tighten the 2 mounting screws.
4. Reconnect the RJ-45 network cable by pushing into place.
5. Reconnect the IDE ribbon cable by pushing into place.
6. Reconnect the power input cable by pushing into place.
7. Reinstall the controller board. See Installing the Controller Board on page 4-73.
8. Reinstall the rear panel. See Installing the Rear Panel on page 4-5.
9. Reconnect the AC power cord, RJ-45 network cable and UPS cable (if used).
10. Power up the printer.
11. Run a small test part and monitor system operation during build.
12. Send the bad single board computer back to Stratasys, Inc.

Removing the SATA Single Board Computer

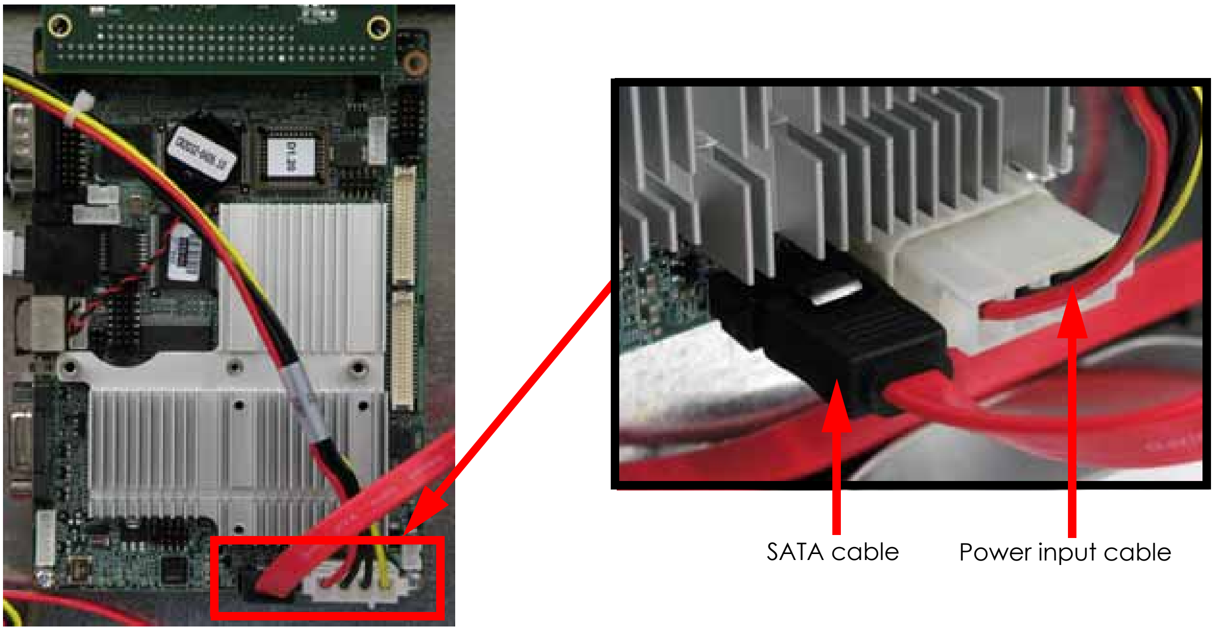
1. Power down the system using the power-down switch. Once the system is powered down, switch the circuit breaker to the **off** position.
2. Unplug the AC power cord, RJ-45 network cable and UPS cable (if used) from the rear of the printer.
3. Remove the rear door. See Removing the Rear Panel on page 4-5.
4. Wear a grounding wrist strap and connect the end to the electronics bay pan.
5. Locate the Single board computer. See Figure 4-107.

Figure 4-107: Single board computer location



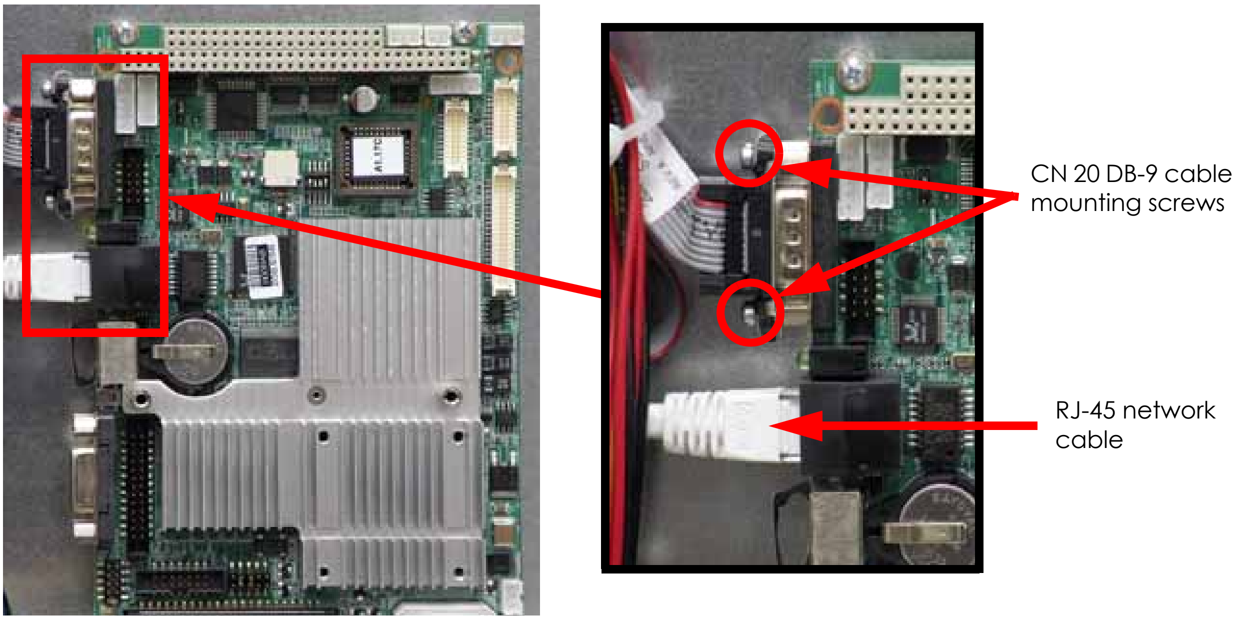
6. Remove the controller board. See Removing the Controller Board on page 4-69.
7. Disconnect the SATA cable by pressing the metal tab in and pulling outwards. See Figure 4-108.
8. Disconnect the power input cable by pulling outwards. See Figure 4-108.

Figure 4-108: SATA cable and power input cable locations



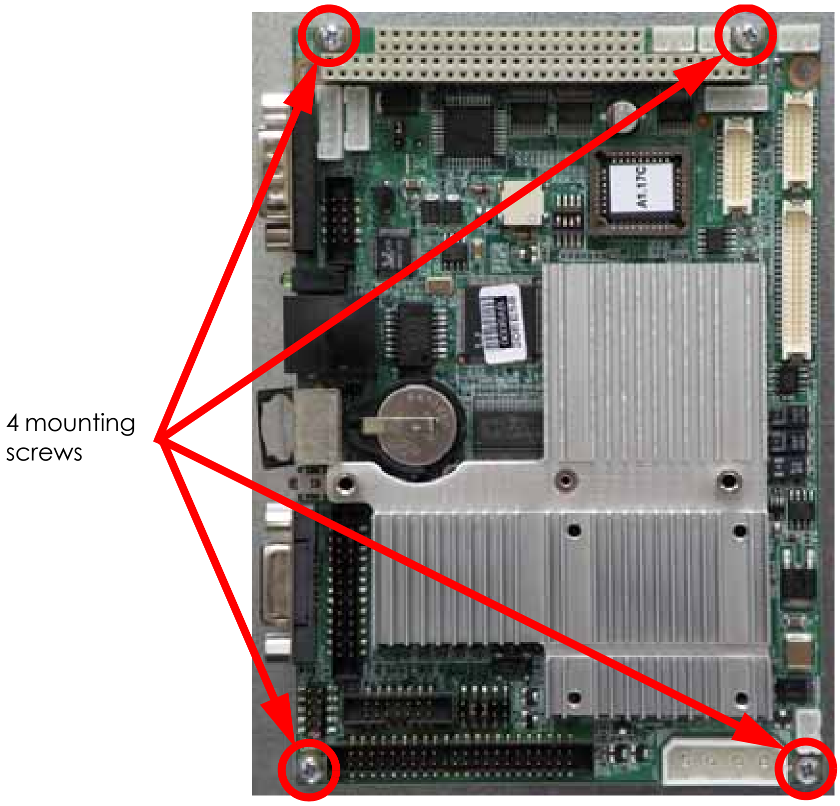
9. Disconnect the RJ-45 network cable by pressing the tab in and pulling outwards. See Figure 4-109.
10. Using a standard screwdriver, loosen the 2 CN 20 DB-9 connector mounting screws and then pull outwards to remove. See Figure 4-109.

Figure 4-109: Single board computer connector locations



11. Using a Phillips screwdriver, remove the 4 single board computer mounting screws. See Figure 4-110.

Figure 4-110: Single board computer mounting screw locations



Installing the SATA Single Board Computer

1. Wear a grounding wrist strap and connect the end to the electronics bay pan.
2. Align the single board computer with the mounts and use a phillips screwdriver to reinstall the 4 mounting screws.
3. Reconnect the CN 20 DB-9 connector by pushing into place and use a standard screwdriver to tighten the 2 mounting screws.
4. Reconnect the RJ-45 network cable by pushing into place.
5. Reconnect the SATA cable by pushing into place.
6. Reconnect the power input cable by pushing into place.
7. Reinstall the controller board. See Installing the Controller Board on page 4-73.
8. Reinstall the rear panel. See Installing the Rear Panel on page 4-5.
9. Reconnect the AC power cord, RJ-45 network cable and UPS cable (if used).
10. Power up the printer.
11. Run a small test part and monitor system operation during build.
12. Send the bad single board computer back to Stratasys, Inc.

Hard Drive

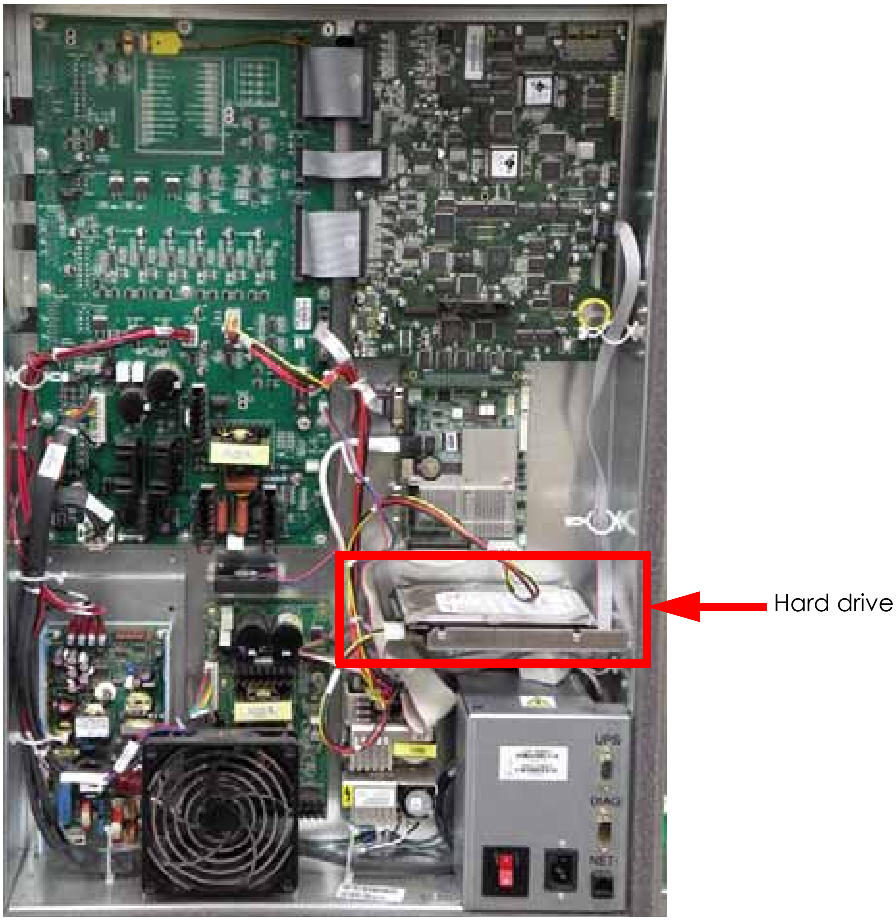
Required Tools

- Phillips screwdriver
- Grounding wrist strap

Removing the IDE Hard Drive

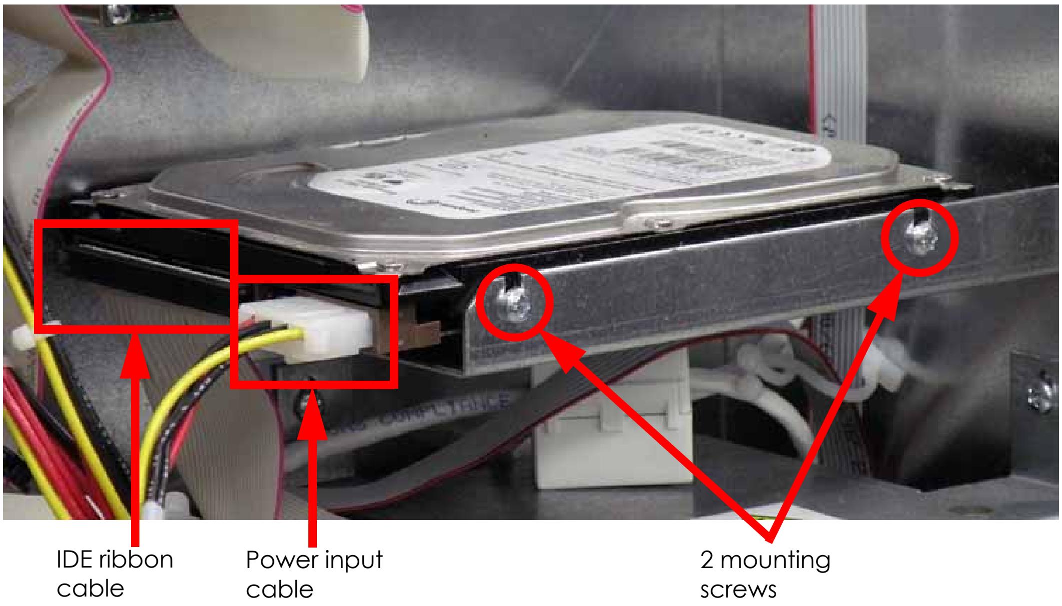
1. Power down the system using the power-down switch. Once the system is powered down, switch the circuit breaker to the **off** position.
2. Unplug the AC power cord, RJ-45 network cable and UPS cable (if used) from the rear of the printer.
3. Remove the rear panel. See Removing the Rear Panel on page 4-5.
4. Wear a grounding wrist strap and connect the end to the electronics bay pan.
5. Locate the controller board. See Figure 4-111.

Figure 4-111: Hard drive location



6. Disconnect the power input cable by pulling outwards. See Figure 4-112.
7. Disconnect the IDE ribbon cable by pulling outwards. See Figure 4-112.
8. Using a phillips screwdriver, remove the 2 hard drive mounting screws. See Figure 4-112.

Figure 4-112: Hard drive connector locations

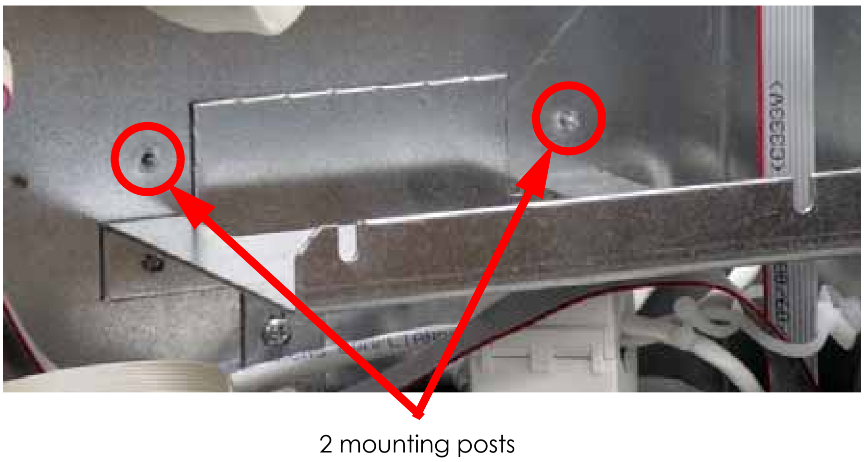


9. Remove the hard drive from the electronics bay.

Installing the IDE Hard Drive

1. Wear a grounding wrist strap and connect the end to the electronics bay pan.
2. Align the hard drive with the mounting posts. See Figure 4-113.

Figure 4-113: Hard drive mounting post locations



3. Using a phillips screwdriver, reinstall the 2 mounting screws.
4. Reconnect the IDE ribbon cable by pushing into place.

> The IDE ribbon cable should be installed with the red line to the right

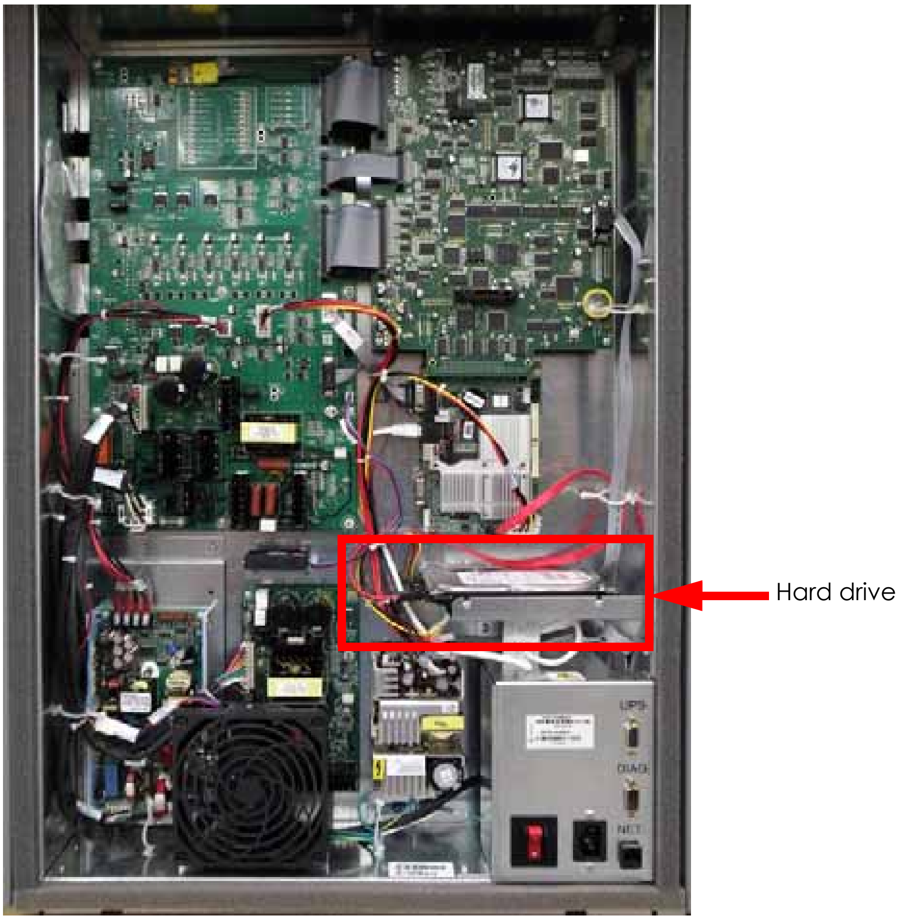
5. Reconnect the power input cable by pushing into place.
6. Reinstall the rear panel. See Installing the Rear Panel on page 4-5.
7. Reconnect the AC power cord, RJ-45 network cable and UPS cable (if used).
8. Power up the printer. You will be prompted to load the controller software.

9. Assign the printer static IP or dynamic IP networking depending on your network. If you assign it static IP you will need to enter the static IP address. When finished press **Done**.
10. Insert the system software CD into the notebook computer or workstation CD drive.
11. Open CatalystEX from the notebook computer or workstation.
12. Click on the **Printer Services** tab.
13. Click on the **Update Software** button.
14. Navigate CatalystEX to the CD drive and select the proper .UPG file for the printer.
15. When finished downloading, verifying and installing, reboot the printer.
16. Remove the calibration floppy disk/CD from the electronics bay and send the .cal file to the printer with MaracaEX, see "Send" .cal file – from calibration Floppy Disk/CD to the printer: on page 5-38. If the last update of the calibration CD is unknown, perform the following calibrations:
    A. Perform Z calibration, see Z Calibration on page 5-2.
    B. Perform XY calibration, see XY Calibration on page 5-2.
    C. Perform part based calibrations, see Part Based Calibration on page 5-3.
    D. Get the .cal file from the printer and copy to a new floppy disk/CD. See "Get" .cal file – from hard drive to the calibration Floppy Disk/CD: on page 5-38.
17. Replace the calibration floppy disk/CD in the electronics bay.
18. Run a small test part and monitor system operation during build.
19. Send the bad hard drive back to Stratasys, Inc.

Removing the SATA Hard Drive

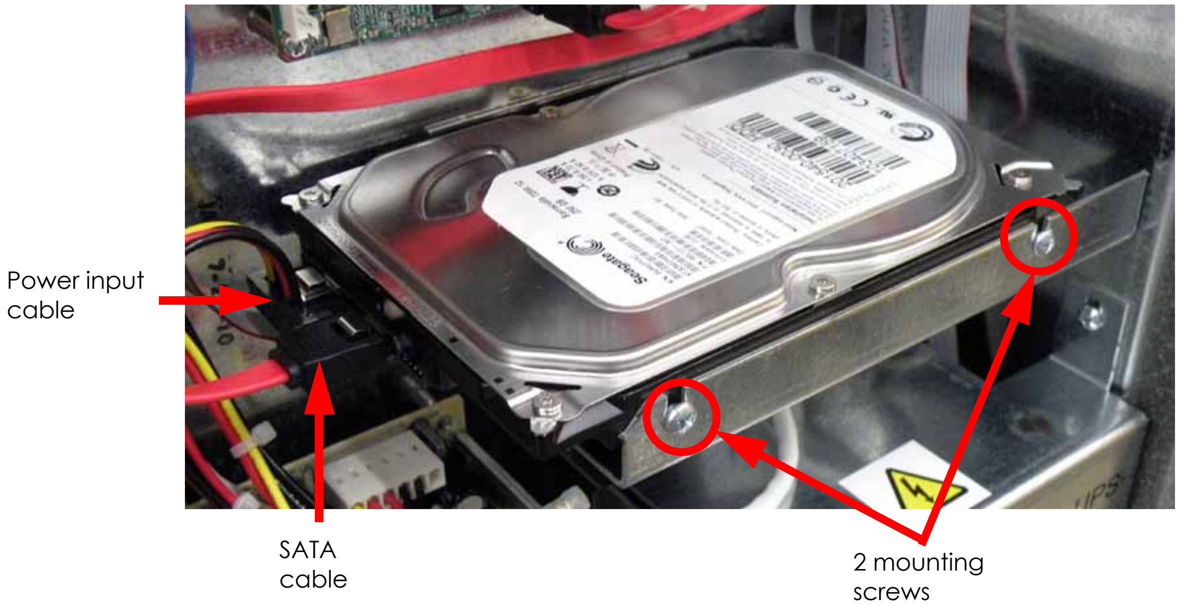
1. Power down the system using the power-down switch. Once the system is powered down, switch the circuit breaker to the **off** position.
2. Unplug the AC power cord, RJ-45 network cable and UPS cable (if used) from the rear of the printer.
3. Remove the rear panel. See Removing the Rear Panel on page 4-5.
4. Wear a grounding wrist strap and connect the end to the electronics bay pan.
5. Locate the hard drive. See Figure 4-114.

Figure 4-114: Hard drive location



6. Disconnect the power input cable by pressing the metal tab in and pulling outwards. See Figure 4-115.
7. Disconnect the SATA cable by pressing the metal tab in pulling outwards. See Figure 4-115.
8. Using a phillips screwdriver, remove the 2 hard drive mounting screws. See Figure 4-115.

Figure 4-115: Hard drive connector locations

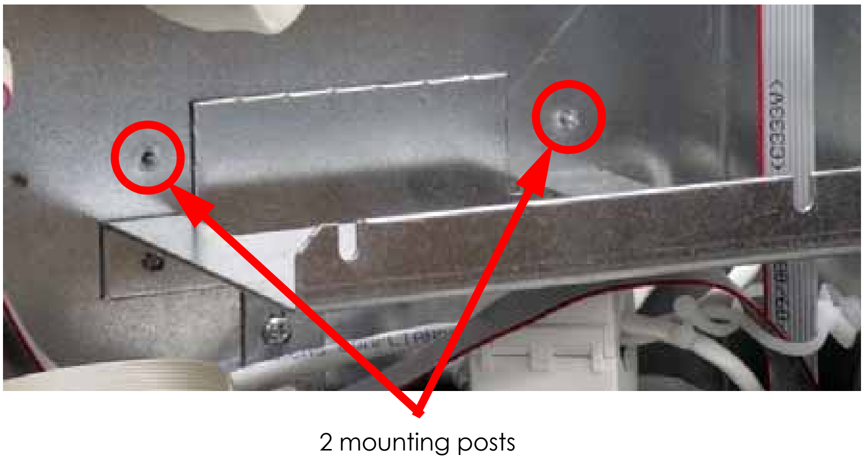


9. Remove the hard drive from the electronics bay.

Installing the SATA Hard Drive

1. Wear a grounding wrist strap and connect the end to the electronics bay pan.
2. Align the hard drive with the mounting posts. See Figure 4-116.

Figure 4-116: Hard drive mounting post locations



3. Using a phillips screwdriver, reinstall the 2 mounting screws.
4. Reconnect the SATA cable by pushing into place.
5. Reconnect the power input cable by pushing into place.
6. Reinstall the rear panel. See Installing the Rear Panel on page 4-5.
7. Reconnect the AC power cord, RJ-45 network cable and UPS cable (if used).
8. Power up the printer. You will be prompted to load the controller software.
9. Assign the printer static IP or dynamic IP networking depending on your network. If you assign it static IP you will need to enter the static IP address. When finished press **Done**.

10. Insert the system software CD into the notebook computer or workstation CD drive.
11. Open CatalystEX from the notebook computer or workstation.
12. Click on the **Printer Services** tab.
13. Click on the **Update Software** button.
14. Navigate CatalystEX to the CD drive and select the proper .UPG file for the printer.
15. When finished downloading, verifying and installing, reboot the printer.
16. Remove the calibration floppy disk/CD from the electronics bay and send the .cal file to the printer with MaracaEX, see "Send" .cal file – from calibration Floppy Disk/CD to the printer: on page 5-38. If the last update of the calibration CD is unknown, perform the following calibrations:
    A. Perform Z calibration, see Z Calibration on page 5-2.
    B. Perform XY calibration, see XY Calibration on page 5-2.
    C. Perform part based calibrations, see Part Based Calibration on page 5-3.
    D. Get the .cal file from the printer and copy to a new floppy disk/CD. See "Get" .cal file – from hard drive to the calibration Floppy Disk/CD: on page 5-38.
17. Replace the calibration floppy disk/CD in the electronics bay.
18. Run a small test part and monitor system operation during build.
19. Send the bad hard drive back to Stratasys, Inc.

Electronics Bay Cooling Fan

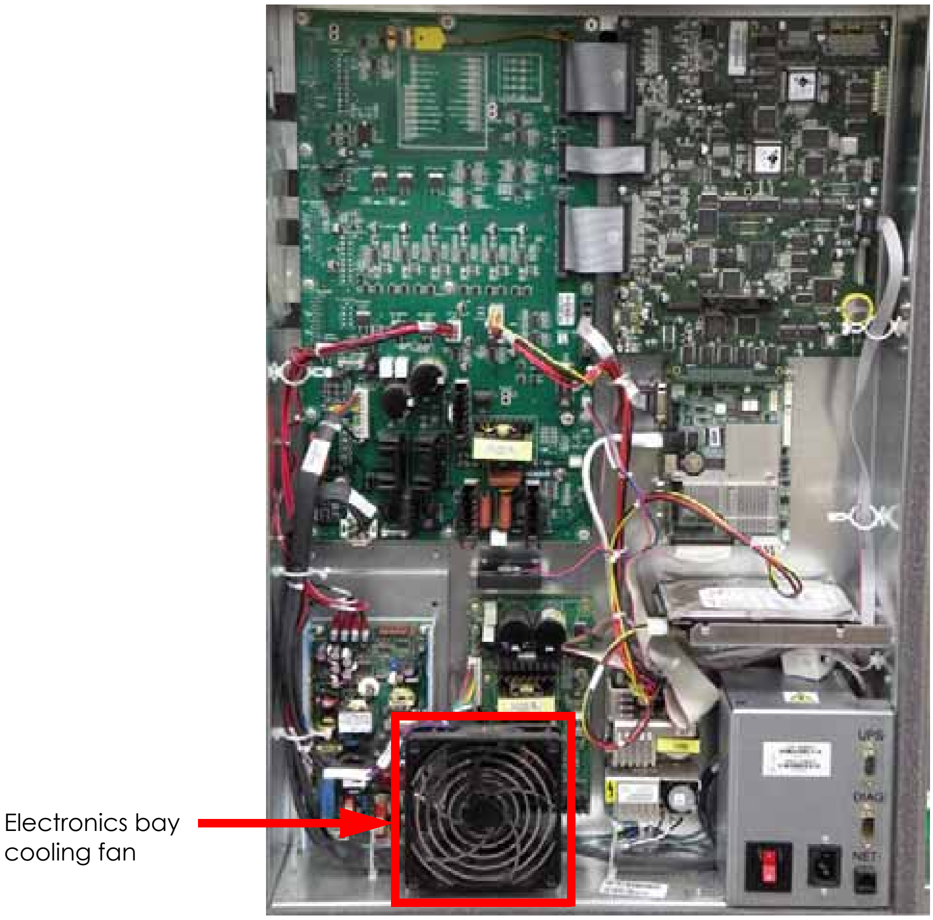
Required Tools

- $^{5}/_{64}$” allen wrench
- Grounding wrist strap

Removing the Electronics Bay Cooling Fan

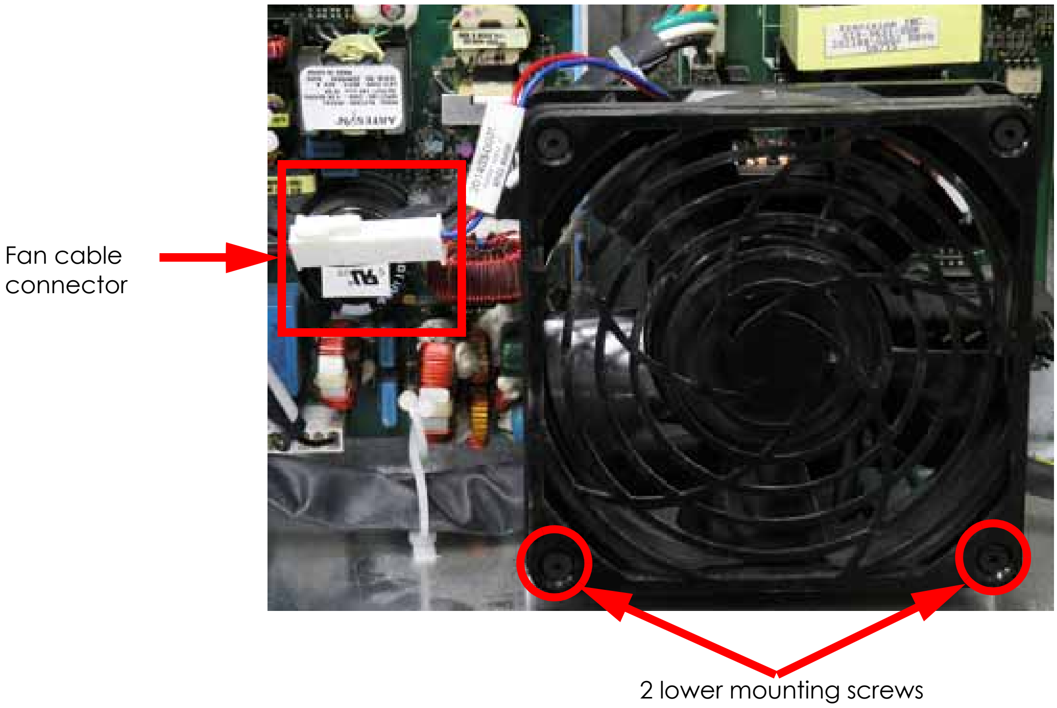
1. Power down the system using the power-down switch. Once the system is powered down, switch the circuit breaker to the **off** position.
2. Unplug the AC power cord, RJ-45 network cable and UPS cable (if used) from the rear of the printer.
3. Remove the rear panel. See Removing the Rear Panel on page 4-5.
4. Wear a grounding wrist strap and connect the end to the electronics bay pan.
5. Locate the electronics bay cooling fan. See Figure 4-117.

Figure 4-117: Electronics bay cooling fan location



6. Disconnect the electronics bay cooling fan cable by pressing the tab in and pulling outwards. See Figure 4-118.
7. Using a $^{5}/_{64}$” allen wrench, remove the lower 2 electronics bay cooling fan mounting screws. See Figure 4-118.

Figure 4-118: Electronics bay cooling fan connector location



8. Remove the electronics bay cooling fan.

Installing the Electronics Bay Cooling Fan

1. Align the electronics bay cooling fan with the mounting holes.
2. Using a $^5/_{64}$″ allen wrench, reinstall the 2 lower mounting screws.
3. Reconnect the fan cable by pushing the connectors together.
4. Reinstall the rear panel. See Installing the Rear Panel on page 4-5.
5. Reconnect the AC power cord, RJ-45 network cable and UPS cable (if used).
6. Power up the printer.
7. Run a small test part and monitor system operation during build.

24 VDC Power Supply

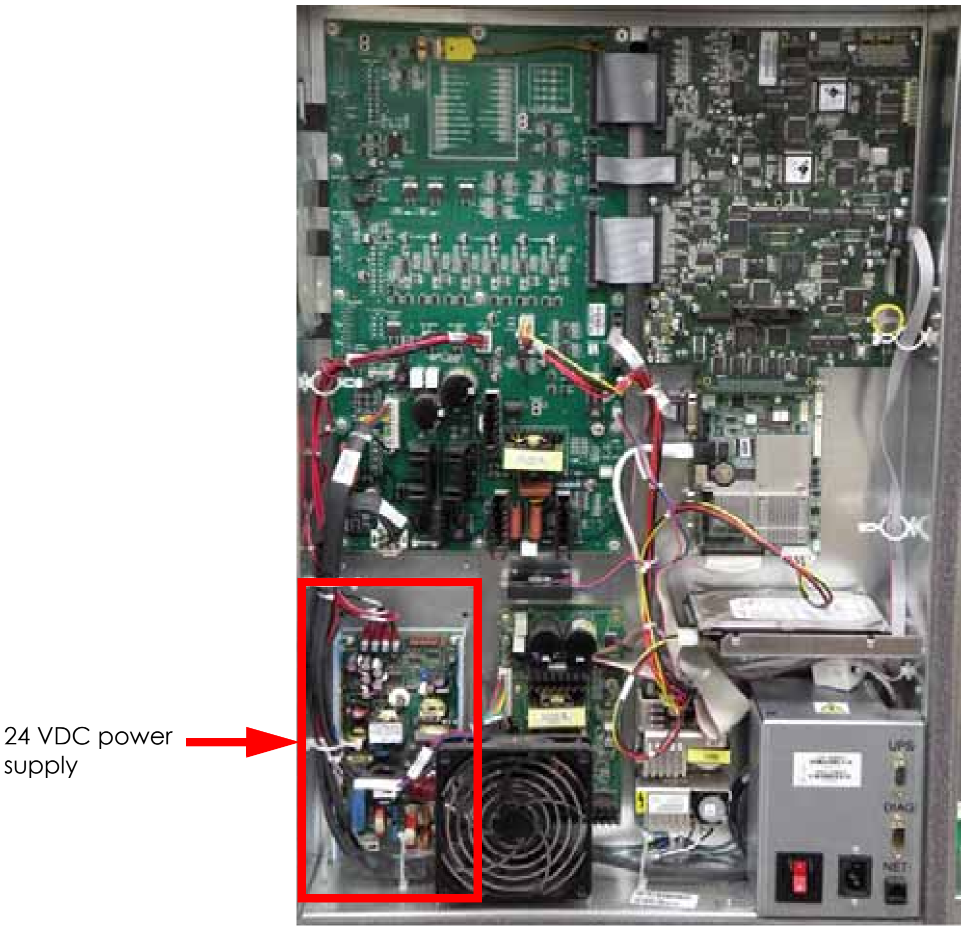
Required Tools

- Phillips screwdriver
- Grounding wrist strap

Removing the 24 VDC Power Supply

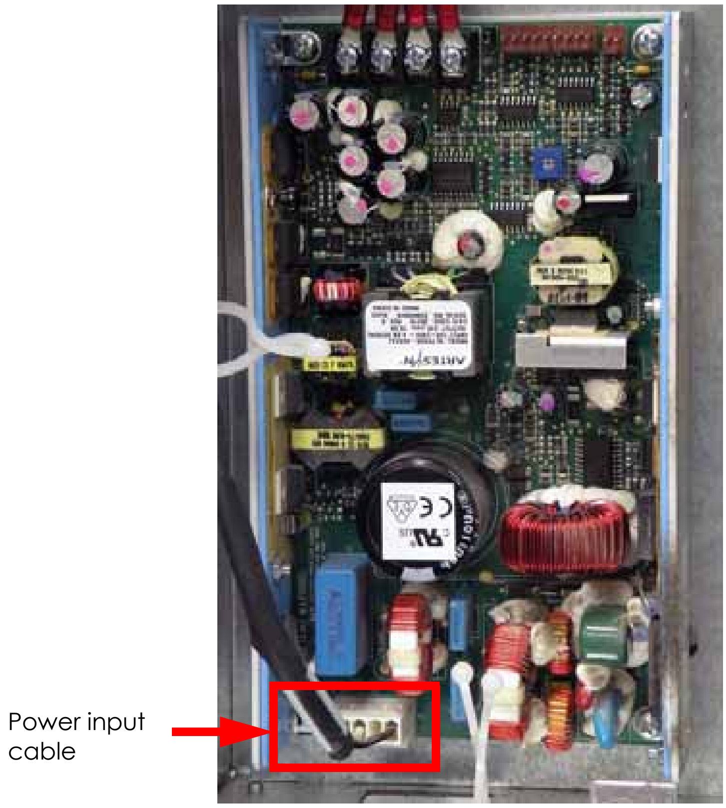
1. Power down the system using the power-down switch. Once the system is powered down, switch the circuit breaker to the **off** position.
2. Unplug the AC power cord, RJ-45 network cable and UPS cable (if used) from the rear of the printer.
3. Remove the rear panel. See Removing the Rear Panel on page 4-5.
4. Wear a grounding wrist strap and connect the end to the electronics bay pan.
5. Locate the 24 VDC power supply. See Figure 4-119.

Figure 4-119: 24 VDC power supply location



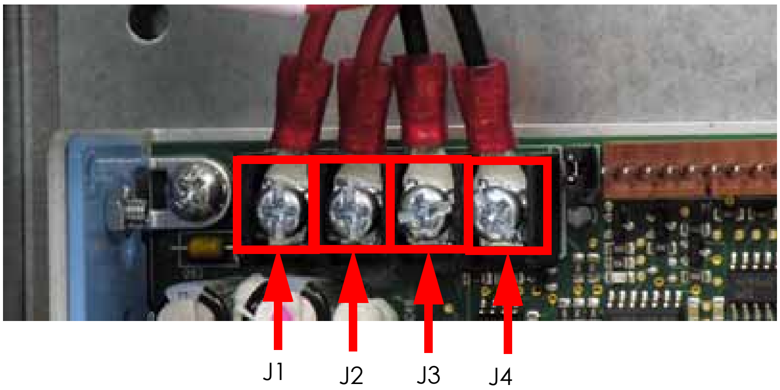
6. Remove the electronics bay cooling fan. See Removing the Electronics Bay Cooling Fan on page 4-87.
7. Disconnect the power input cable by pulling outwards. See Figure 4-120.

Figure 4-120: Power input cable location



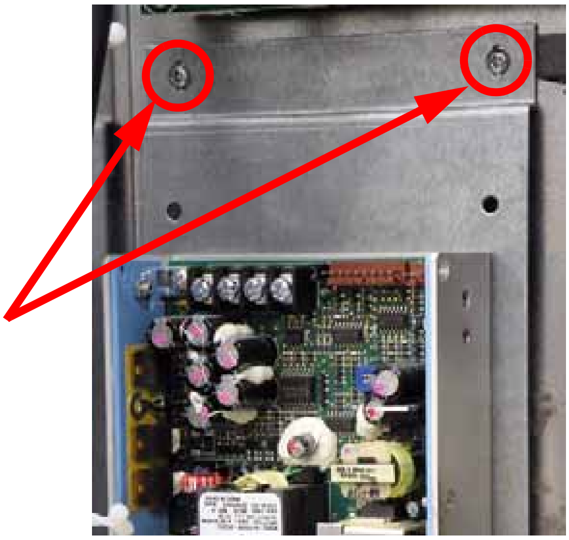
8. Using a phillips screwdriver, loosen but do not remove the J1, J2, J3 and J4 output wire terminals and remove the wires from the terminal. See Figure 4-121.

Figure 4-121: 24 VDC output wire locations



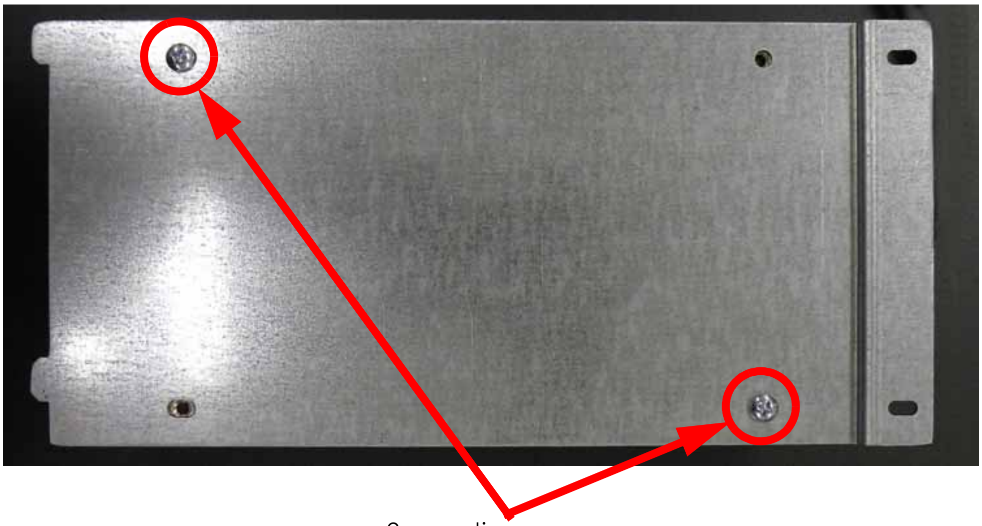
9. Using a phillips screwdriver, remove the 24 VDC power supply mounting screws. See Figure 4-122.

Figure 4-122: 24 VDC power supply mounting screw locations



10. Lift the 24 VDC power supply upwards and angle out of the electronics bay.
11. Turn the 24 VDC power supply over and use a phillips screwdriver to remove the 2 mounting bracket mounting screws. See Figure 4-123.

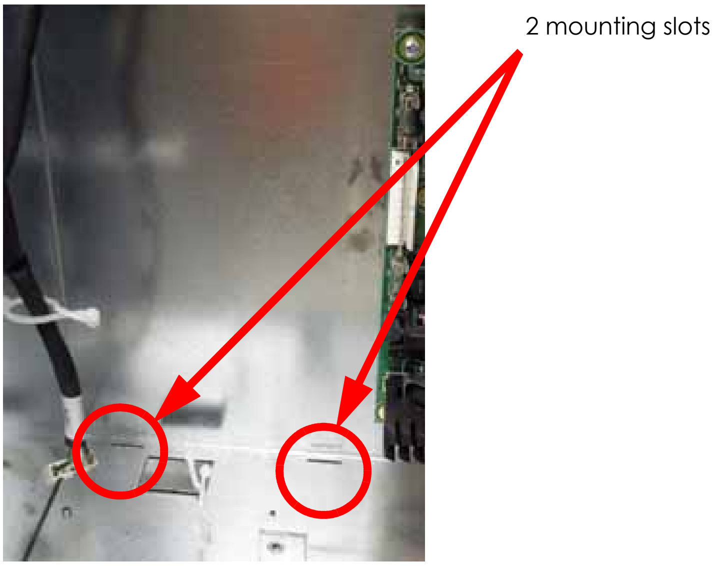
Figure 4-123: 24 VDC power supply mounting bracket mounting screw locations



Installing the 24 VDC Power Supply

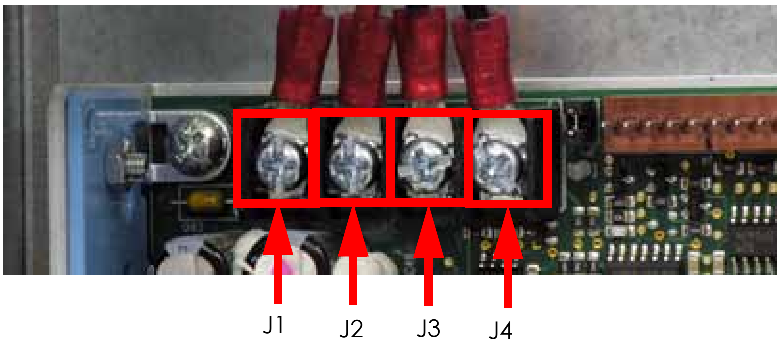
1. Wear a grounding wrist strap and connect the end to the electronics bay pan.
2. Align the 24 VDC power supply with the mounting bracket and use a phillips screwdriver to reinstall the 2 mounting screws.
3. Align the 24 VDC power supply mounting bracket tabs with the slots in the electronics bay and slide into place. See Figure 4-124.

Figure 4-124: 24 VDC power supply mounting slot locations



4. Using a phillips screwdriver, reinstall the 2 mounting screws.
5. Reconnect J1, J2, J3 and J4 output wires and use a phillips screwdriver to tighten the terminal screws. See Figure 4-125.

Figure 4-125: 24 VDC output wire locations



6. Reconnect the power input cable to the 24 VDC power supply.
7. Reinstall the electronics bay cooling fan. See Installing the Electronics Bay Cooling Fan on page 4-39.
8. Reinstall the rear panel. See Installing the Rear Panel on page 4-5.
9. Reconnect the AC power cord, RJ-45 network cable and UPS cable (if used).
10. Power up the printer.
11. Run a small test part and monitor system operation during build.

120 VDC Power Supply (SST only)

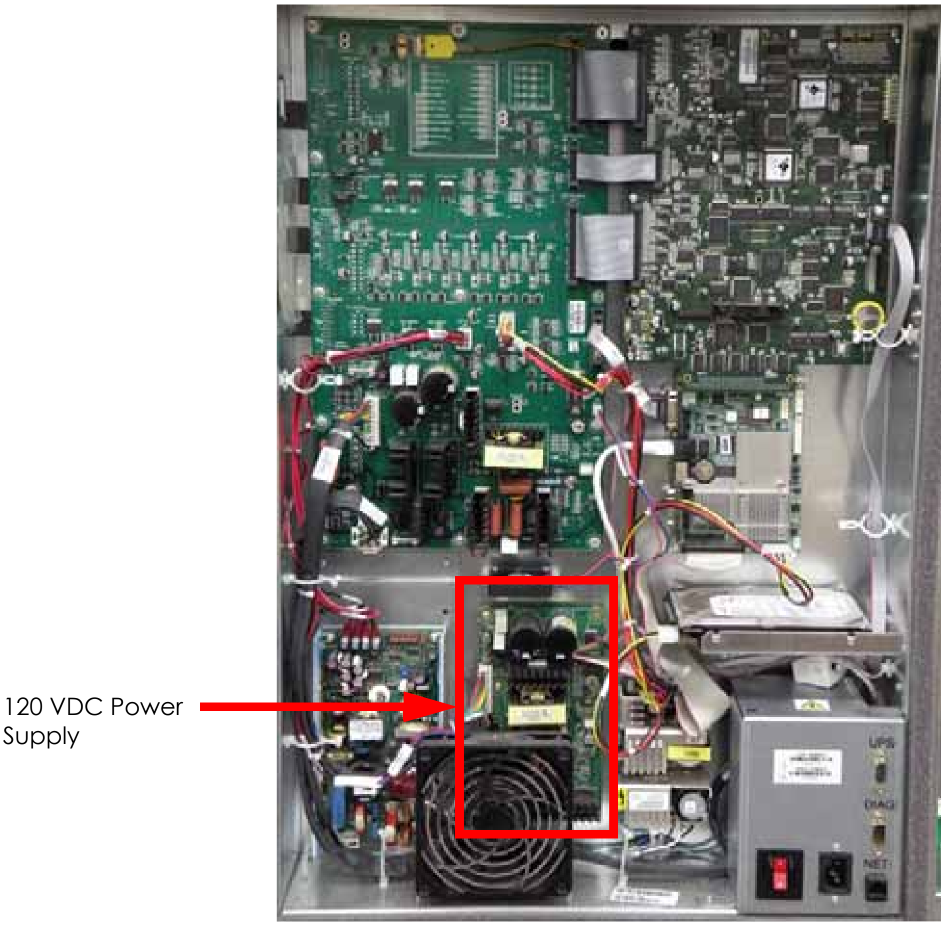
Required Tools

- Phillips screwdriver
- Grounding wrist strap

Removing the 120 VDC Power Supply

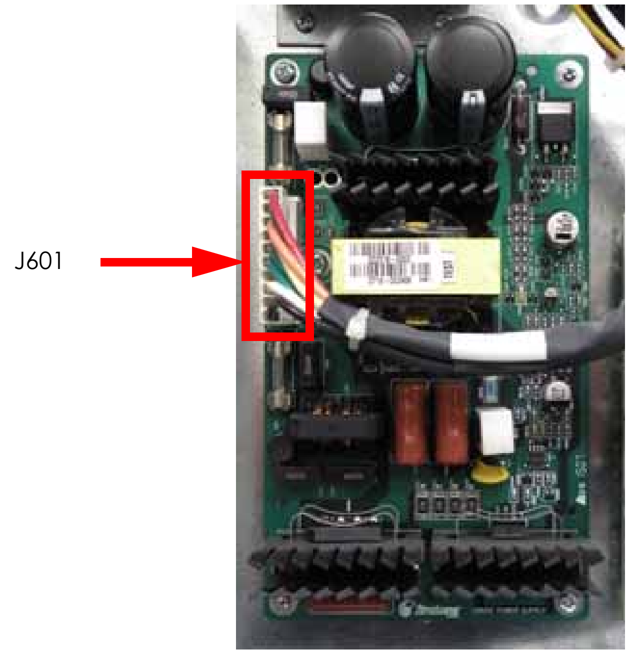
1. Power down the system using the power-down switch. Once the system is powered down, switch the circuit breaker to the **off** position.
2. Unplug the AC power cord, RJ-45 network cable and UPS cable (if used) from the rear of the printer.
3. Remove the rear panel. See Removing the Rear Panel on page 4-5.
4. Wear a grounding wrist strap and connect the end to the electronics bay pan.
5. Locate the 120 VDC power supply. See Figure 4-126.

Figure 4-126: 120 VDC power supply location



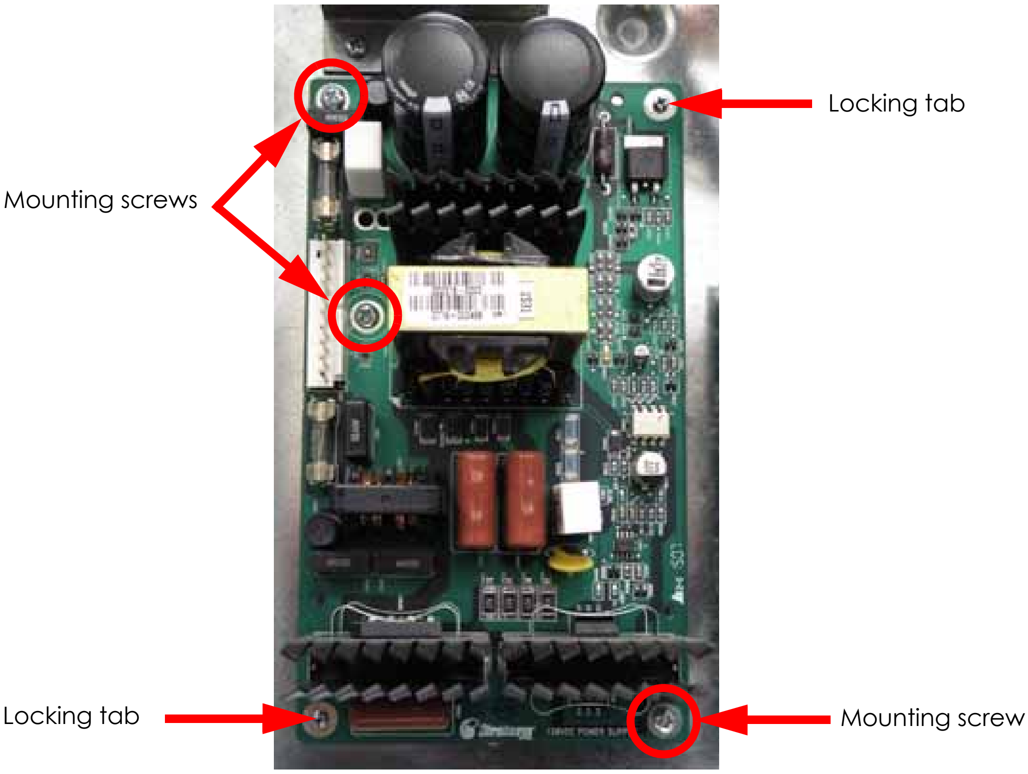
6. Remove the electronics bay cooling fan. See Removing the Electronics Bay Cooling Fan on page 4-38.
7. Disconnect the J601 cable by pulling outward. See Figure 4-127.

Figure 4-127: J601 cable location



8. Using a phillips screwdriver, remove the 3 mounting screws. See Figure 4-128.

Figure 4-128: 120 VDC power supply mounting screw locations



Installing the 120 VDC Power Supply

1. Wear a grounding wrist strap and connect the end to the electronics bay pan.
2. Align the 120 VDC power supply with the mounting holes and use a phillips screwdriver to reinstall the 3 mounting screws.
3. Reconnect J601.
4. Reinstall the electronics bay cooling fan. See Installing the Electronics Bay Cooling Fan on page 4-39.
5. Reinstall the rear panel. See Installing the Rear Panel on page 4-5.
6. Reconnect the AC power cord, RJ-45 network cable and UPS cable (if used).
7. Power up the printer.
8. Run a small test part and monitor system operation during build.

5/12 VDC Power Supply

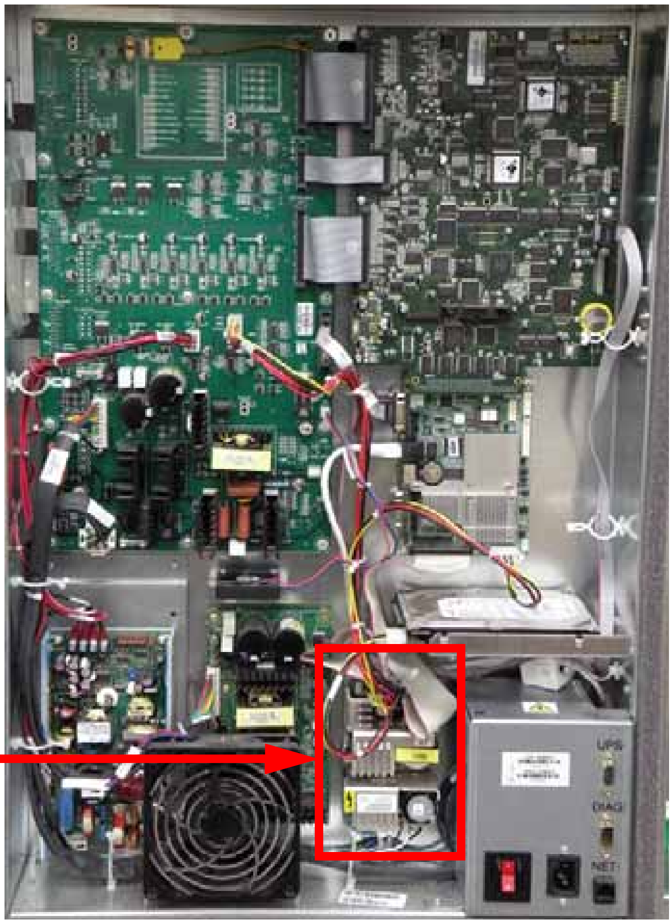
Required Tools

- Phillips screwdriver
- Grounding wrist strap

Removing the 5/12 VDC Power Supply

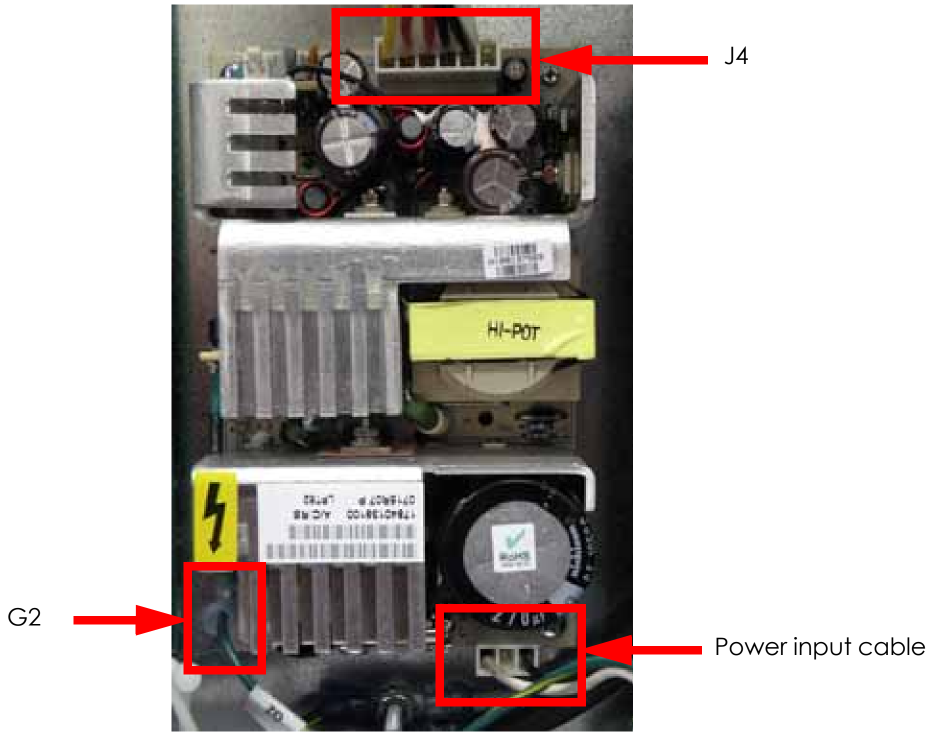
1. Power down the system using the power-down switch. Once the system is powered down, switch the circuit breaker to the **off** position.
2. Unplug the AC power cord, RJ-45 network cable and UPS cable (if used) from the rear of the printer.
3. Remove the rear panel. See Removing the Rear Panel on page 4-5.
4. Wear a grounding wrist strap and connect the end to the electronics bay pan.
5. Locate the 120 VDC power supply. See Figure 4-129.

Figure 4-129: 5/12 VDC power supply location



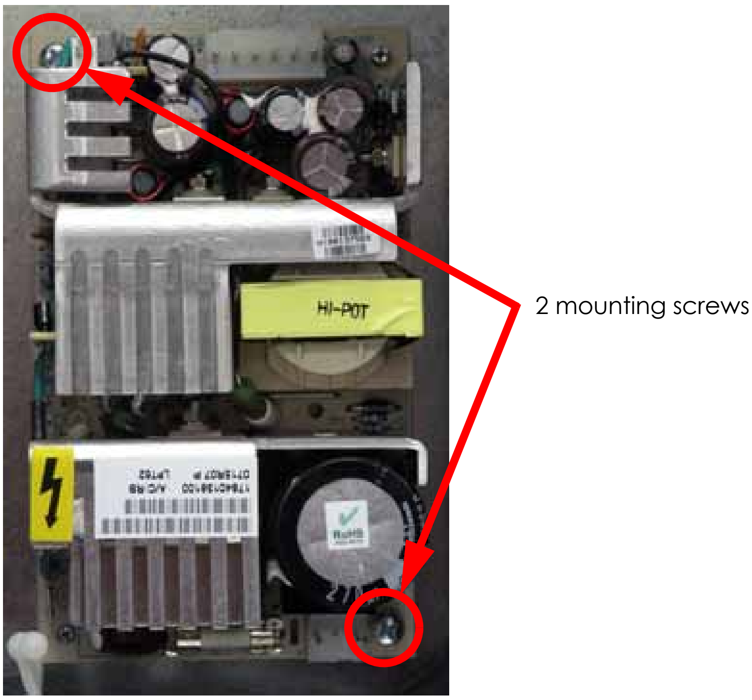
6. Disconnect the J4 cable by pulling outwards. See Figure 4-130.
7. Disconnect the power input cable by pulling outwards. See Figure 4-130.
8. Disconnect the G2 ground wire by pulling outwards. See Figure 4-130.

Figure 4-130: J4 cable location



9. Using a phillips screwdriver, remove the 2 mounting screws. See Figure 4-131.

Figure 4-131: 5/12 VDC power supply mounting screw locations



Installing the 5/12 VDC Power Supply

1. Wear a grounding wrist strap and connect the end to the electronics bay pan.
2. Align the 5/12 VDC power supply with the mounting holes and use a phillips screwdriver to reinstall the 2 mounting screws.
3. Reconnect the G2 ground wire.
4. Reconnect the power input cable.
5. Reconnect the J4 cable.
6. Reinstall the rear panel. See Installing the Rear Panel on page 4-5.
7. Reconnect the AC power cord, RJ-45 network cable and UPS cable (if used).
8. Power up the printer.
9. Run a small test part and monitor system operation during build.

Line Filter Board

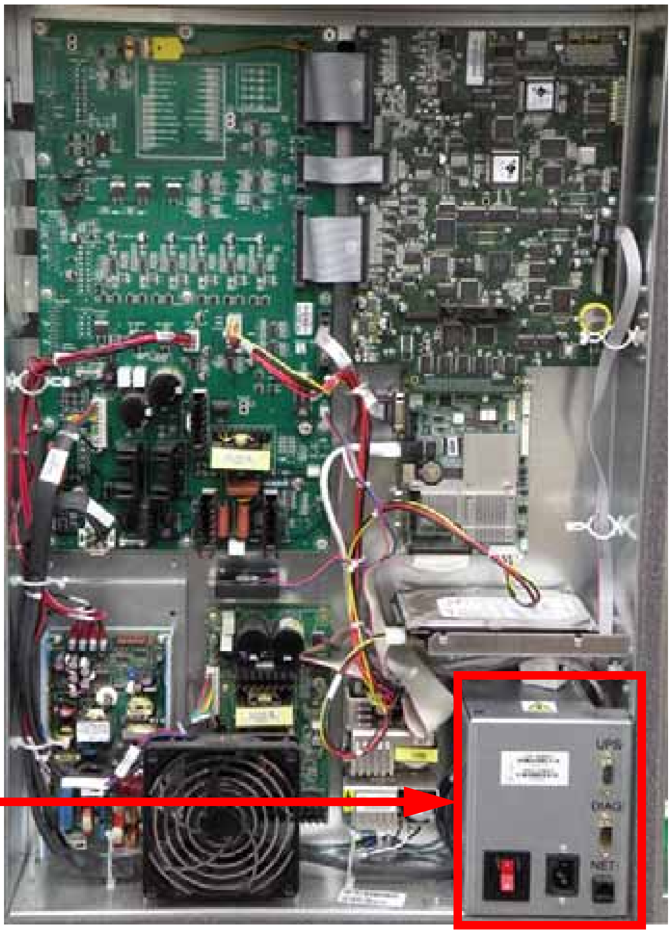
Required Tools

- Phillips screwdriver
- Grounding wrist strap

Removing the Line Filter Board:

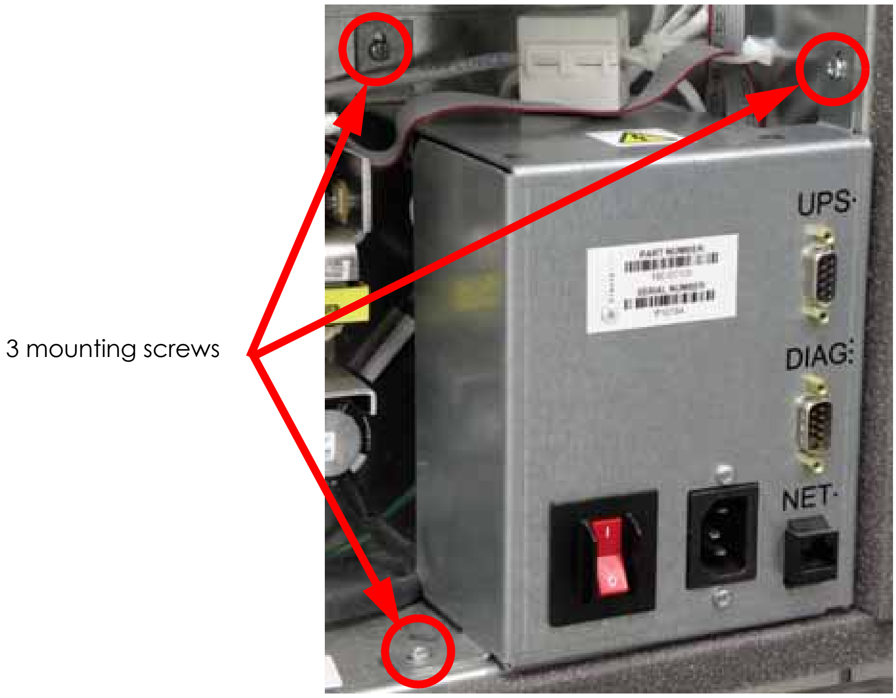
1. Power down the system using the power-down switch. Once the system is powered down, switch the circuit breaker to the **off** position.
2. Unplug the AC power cord, RJ-45 network cable and UPS cable (if used) from the rear of the printer.
3. Remove the rear panel. See Removing the Rear Panel on page 4-5.
4. Wear a grounding wrist strap and connect the end to the electronics bay pan.
5. Locate the input box. See Figure 4-132.

Figure 4-132: Input box location



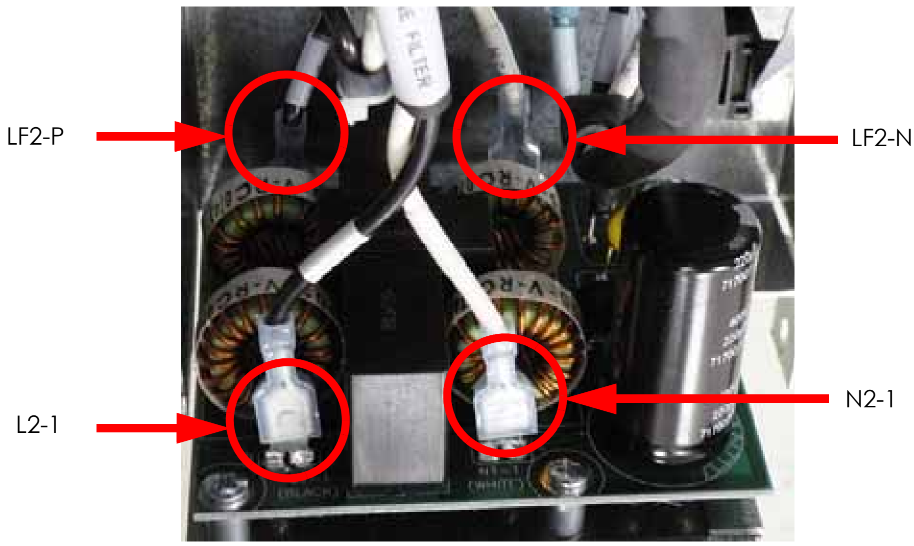
6. Using a phillips screwdriver, remove the 3 input box mounting screws. See Figure 4-133.

Figure 4-133: Input box mounting screw locations



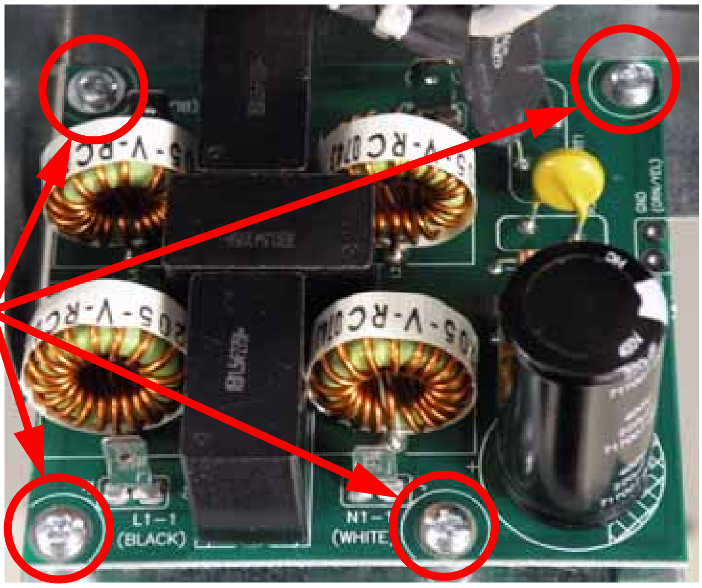
7. Disconnect L2-1 (black) and N2-1 (white) from the front of the line filter board. See Figure 4-134.
8. Disconnect LF2-P (black) and LF2-N (white) from the rear of the line filter board. See Figure 4-134.

Figure 4-134: Line filter connector locations



9. Using a phillips screwdriver, remove the 4 mounting screws. See Figure 4-135.

Figure 4-135: Line filter mounting screw locations



Installing the Line Filter Board

1. Wear a grounding wrist strap and connect the end to the electronics bay pan.
2. Align the line filter with the mounting standoffs and use a phillips screwdriver to reinstall the 4 mounting screws.
3. Reconnect LF2-P (black) to the left rear of the line filter board.
4. Reconnect LF2-N (white) to the right rear of the line filter board.
5. Reconnect L2-1 (black) to the left front of the line filter board.
6. Reconnect N2-1 (white) to the right front of the line filter board.
7. Align the input box cover with the mounting holes and use a phillips screwdriver to reinstall the 3 mounting screws.
8. Reinstall the rear panel. See Installing the Rear Panel on page 4-5.
9. Reconnect the AC power cord, RJ-45 network cable and UPS cable (if used).
10. Power up the printer.
11. Run a small test part and monitor system operation during build.

AC Input

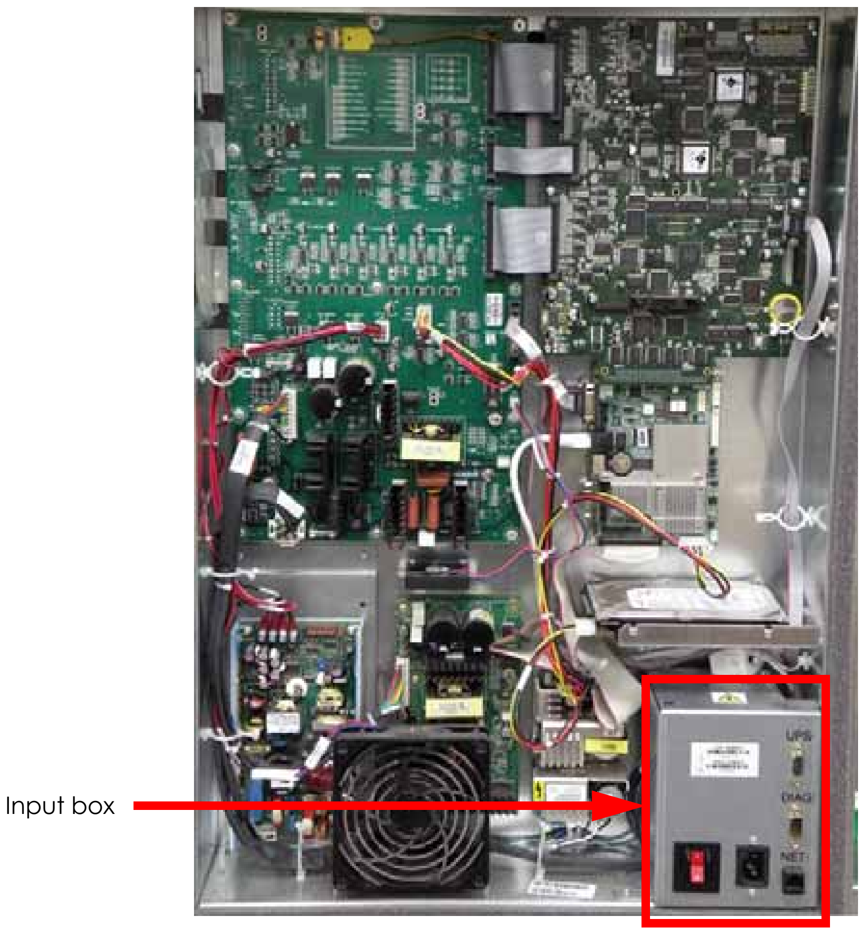
Required Tools

- Phillips screwdriver
- Grounding wrist strap

Removing the AC Input

1. Power down the system using the power-down switch. Once the system is powered down, switch the circuit breaker to the **off** position.
2. Unplug the AC power cord, RJ-45 network cable and UPS cable (if used) from the rear of the printer.
3. Remove the rear panel. See Removing the Rear Panel on page 4-5.
4. Wear a grounding wrist strap and connect the end to the electronics bay pan.
5. Locate the input box. See Figure 4-136.

Figure 4-136: Input box location

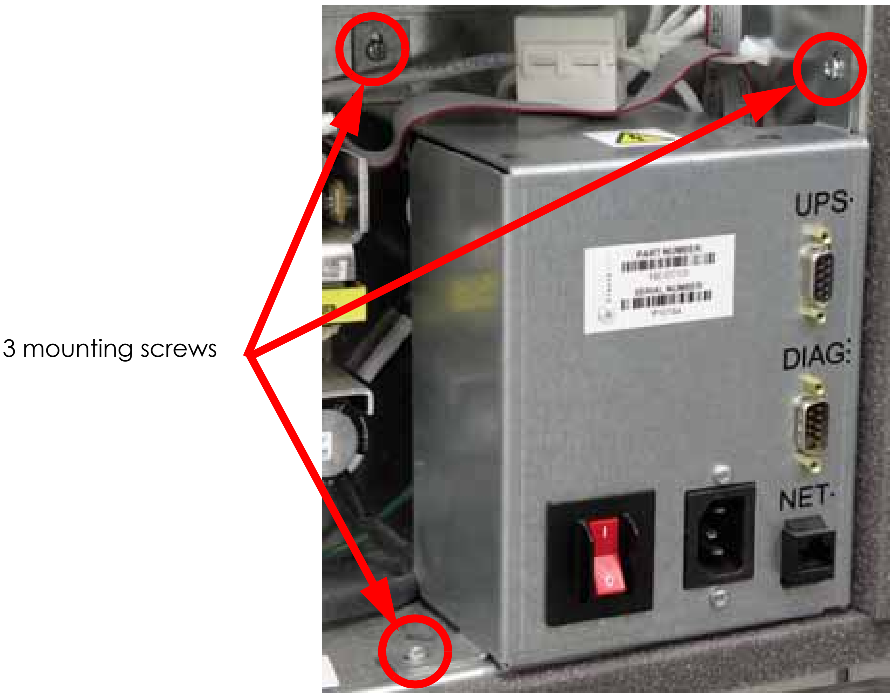


6. Using a phillips screwdriver, remove the 2 AC input mounting screws. See Figure 4-137.

Figure 4-137: AC input mounting screw locations

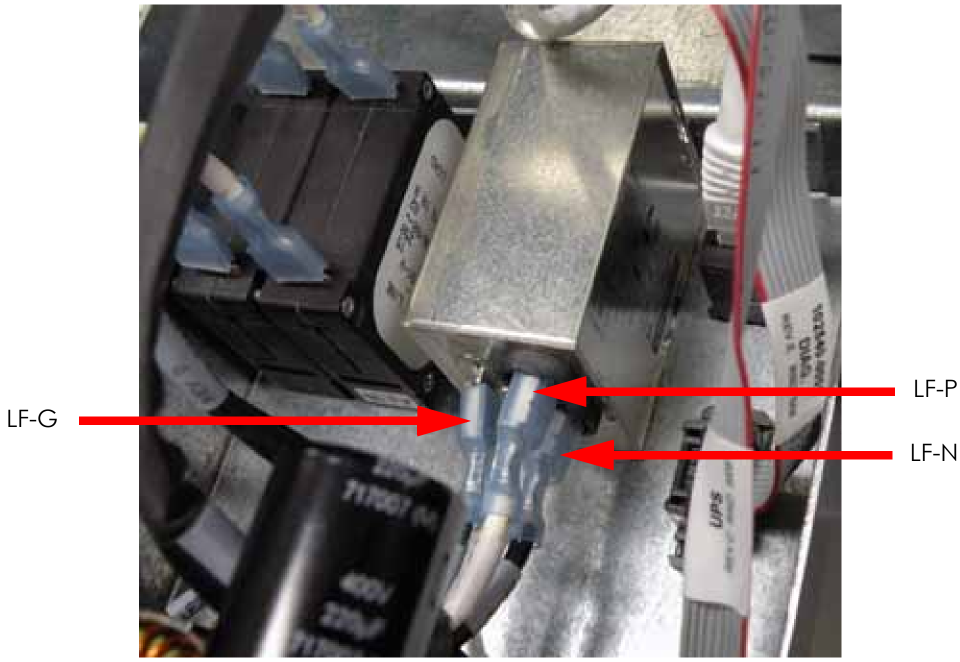
7. Using a phillips screwdriver, remove the 3 input box mounting screws. See Figure 4-138.

Figure 4-138: Input box mounting screw locations



8. Disconnect LF-P (black) from the bottom right side of the AC input by pulling outwards. See Figure 4-139.
9. Disconnect LF-N (white) from the upper right side of the AC input by pulling outwards. See Figure 4-139.
10. Disconnect LF-G (green) from the left side of the AC input by pulling outwards. See Figure 4-139.

Figure 4-139: AC input connection locations



Installing the AC Input

1. Wear a grounding wrist strap and connect the end to the electronics bay pan.
2. Reconnect LF-P (black) to the lower right side of the AC input.
3. Reconnect LF-N (white) to the upper right side of the AC input.
4. Reconnect LF-G (green) to the left side of the AC input.
5. Align the AC input with the mounting holes and use a phillips screwdriver to reinstall the 2 mounting screws.
6. Align the input box with the mounting holes and use a phillips screwdriver to reinstall the 3 mounting screws.
7. Reinstall the rear panel. See Installing the Rear Panel on page 4-5.
8. Reconnect the AC power cord, RJ-45 network cable and UPS cable (if used).
9. Power up the printer.
10. Run a small test part and monitor system operation during build.

Circuit Breaker

Required Tools

- Phillips screwdriver
- Grounding wrist strap

Removing the Circuit Breaker

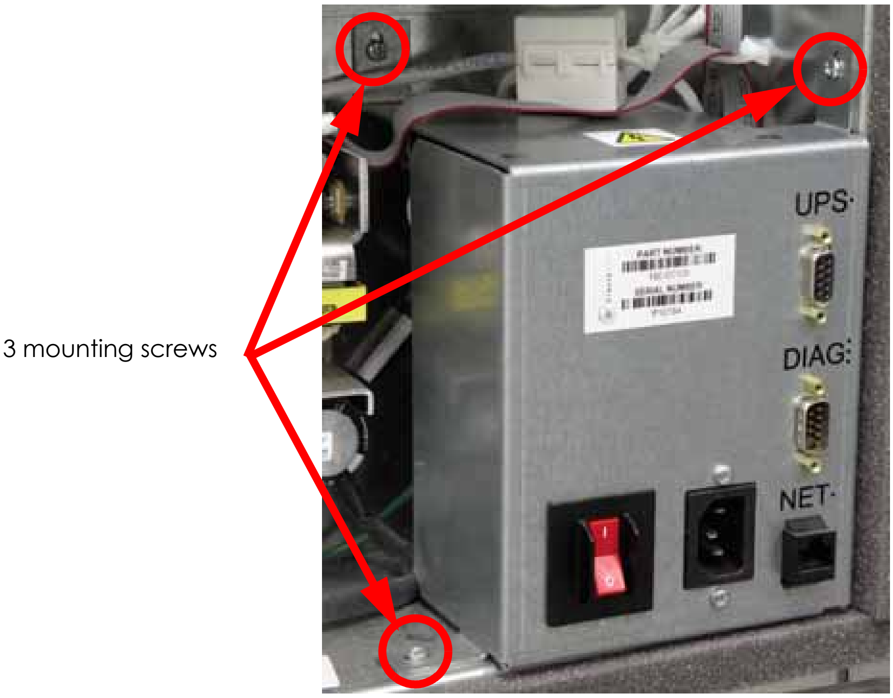
1. Power down the system using the power-down switch. Once the system is powered down, switch the circuit breaker to the **off** position.
2. Unplug the AC power cord, RJ-45 network cable and UPS cable (if used) from the rear of the printer.
3. Remove the rear panel. See Removing the Rear Panel on page 4-5.
4. Wear a grounding wrist strap and connect the end to the electronics bay pan.
5. Locate the input box. See Figure 4-140.

Figure 4-140: Input box location

Input box

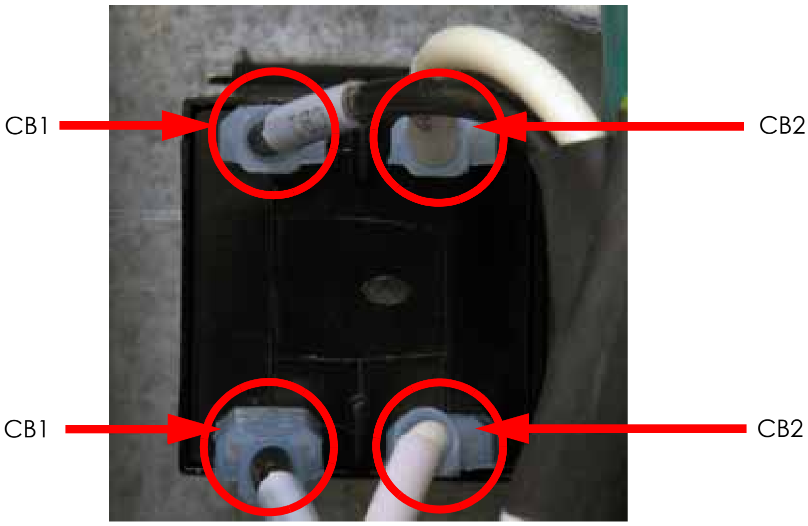
6. Using a phillips screwdriver, remove the 3 input box mounting screws. See Figure 4-141.

Figure 4-141: Input box mounting screw locations



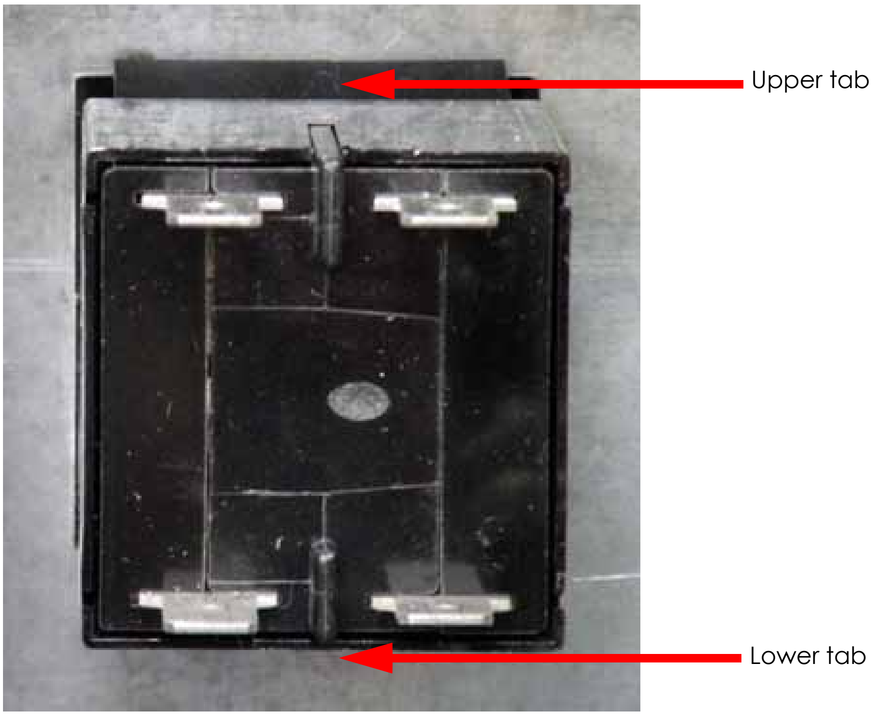
7. Disconnect CB1 (black) from the upper left side of the circuit breaker by pulling outward. See Figure 4-142.
8. Disconnect CB2 (white) from the upper right side of the circuit breaker by pulling outward. See Figure 4-142.
9. Disconnect CB1 (black) from the lower left side of the circuit breaker by pulling outward. See Figure 4-142.
10. Disconnect CB2 (white) from the lower right side of the circuit breaker by pulling outward. See Figure 4-142.

Figure 4-142: Circuit breaker connection locations



11. Press the 2 tabs in and push the circuit breaker outwards to remove. See Figure 4-143.

Figure 4-143: Circuit breaker tab locations



Installing the Circuit Breaker

1. Wear a grounding wrist strap and connect the end to the electronics bay pan.
2. Push the circuit breaker into the input box until it locks in place.
3. Reconnect CB1 (black) to the upper left side of the circuit breaker.
4. Reconnect CB2 (white) to the upper right side of the circuit breaker.
5. Reconnect CB1 (black) to the lower left side of the circuit breaker.
6. Reconnect CB2 (white) to the upper right side of the circuit breaker.
7. Align the input box with the mounting holes and use a phillips screwdriver to reinstall the 3 mounting screws.
8. Reinstall the rear panel. See Installing the Rear Panel on page 4-5.
9. Reconnect the AC power cord, RJ-45 network cable and UPS cable (if used).
10. Power up the printer.
11. Run a small test part and monitor system operation during build.

Head Components

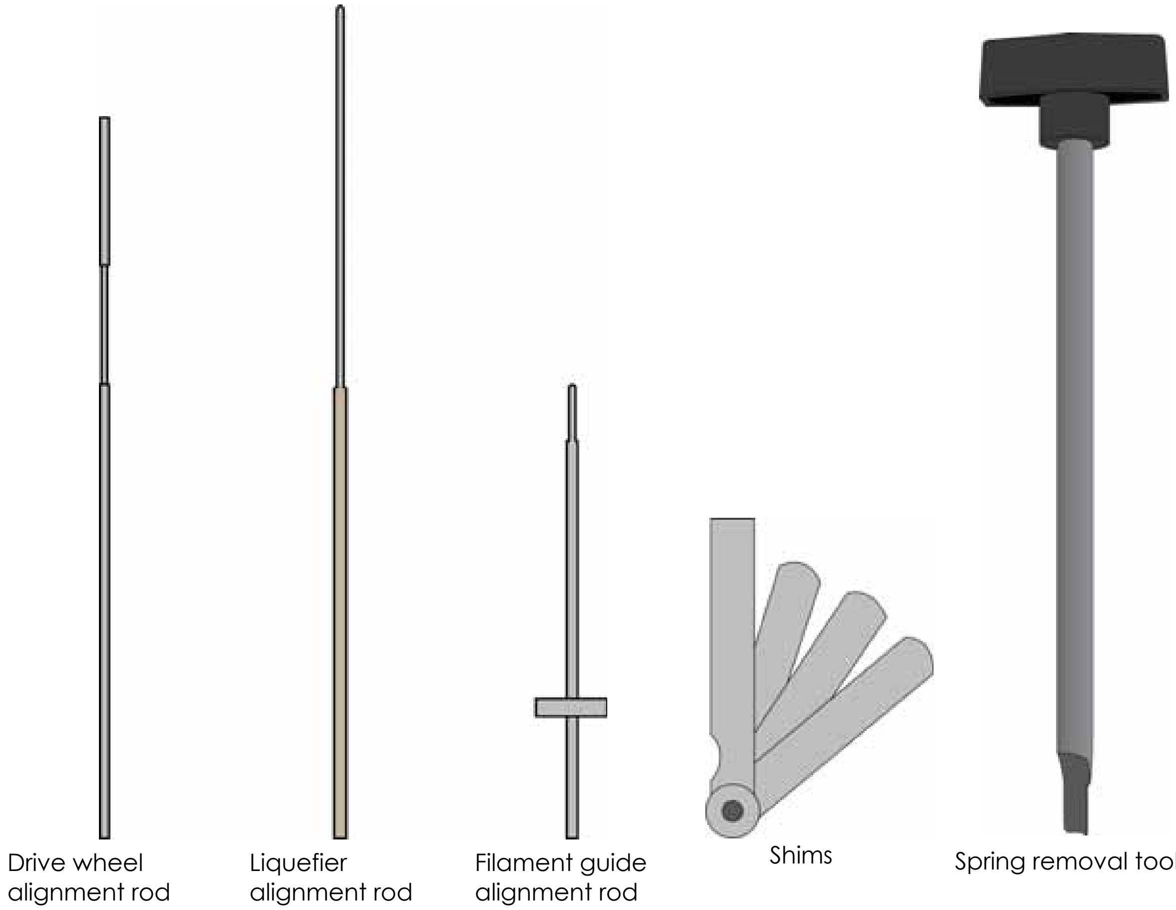
1200 Toggle Plate Assembly

Caution: Wear a grounding wrist strap when performing this procedure.

Required Tools

- $^5/_{16}$″ nut driver or standard screwdriver
- $^7/_{64}$″ allen wrench
- Phillips screwdriver
- Needle nose pliers
- Wire ties
- Alignment rods
- Shims
- Spring removal tool

Figure 4-144: Alignment rods and shims



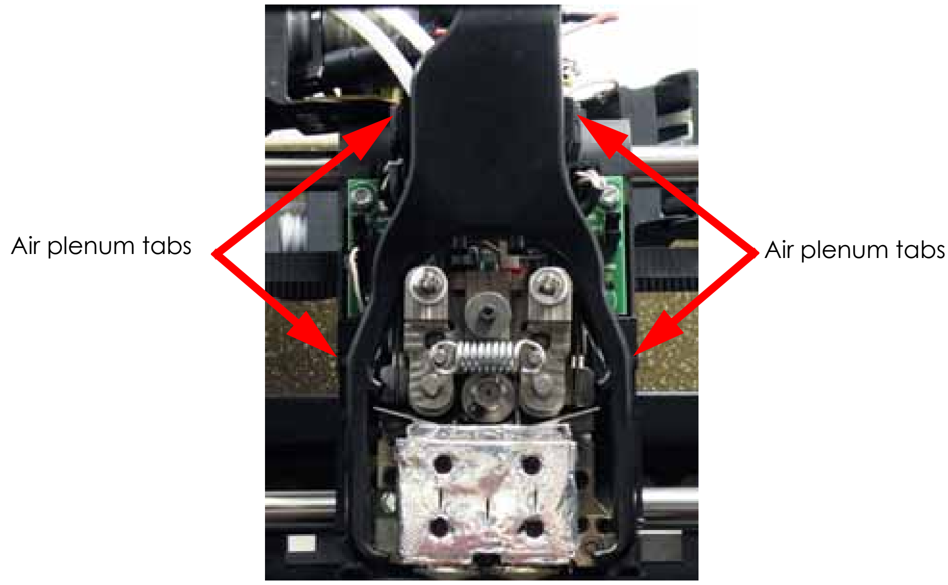
Removing the 1200 Toggle Plate Assembly

1. Unload model and support material.
2. Power down the printer.
3. Remove the rear panel, see Removing the Rear Panel on page 4-5.
4. Remove the right side panel, see Removing the Side Panels on page 4-6.
5. Position the head in the center of the build envelope.
6. Remove plastic head cover by squeezing raised pads on sides of cover, see Figure 4-145.

Figure 4-145: Removing the head cover

7. Remove the 01 by pressing in on tabs to release from translator. Work the air plenum free of umbilical hose at top, see Figure 4-146.

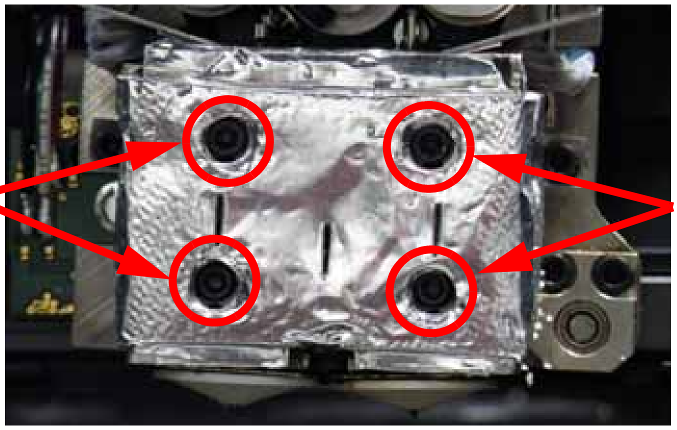
Figure 4-146: Removing the air plenum



8. Remove liquefier tips:

   A. Use a $^{7}/_{64}$" allen wrench to loosen the tip (heater block clamp) screws three to four full turns counterclockwise - or until the top of the screws are flush with the metal cover, see Figure 4-147.

Figure 4-147: Liquefier tip mounting screw locations



B. Use a needle nose pliers to grasp the stainless steel shield of the tip.

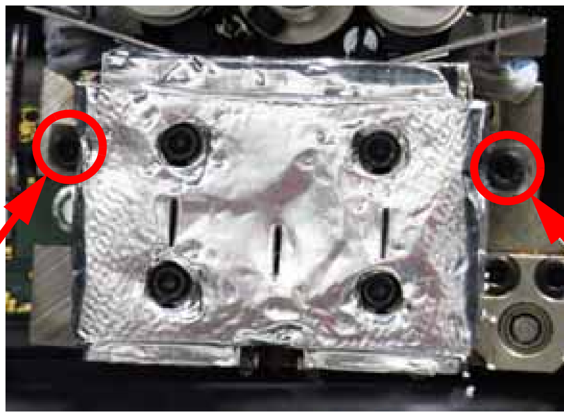
C. Pull the tip shield toward you, then pull down to remove the tip. Discard the used tip.

D. Repeat for second tip.

9. Using a $^7/_{64}$" allen wrench, loosen but do not remove the 2 heat shield mounting screws. See Figure 4-148.

Note: There is a teflon washer on each screw - between the back of the heat shield tabs and the translator, see #20 in Figure 4-151. If the screw is not completely removed from the heat shield and the washer is not damaged, the washer will act as a retainer, holding the screw to the heat shield.

Figure 4-148: Heat shield mounting screw locations



10. Inspect the Teflon Shield for:
    - Damage - replace if the area around a cover hole is not intact or if the shield is torn.
    - Material trapped between shield and cover - replace the shield if there is evidence of trapped material.
    - Security of attachment to metal cover - replace the shield if it does not appear to be attached firmly to the cover. The shield is held in place by an adhesive strip.

11. Replace the teflon shield if necessary:

A. Remove the old teflon shield from the heat shield - remove excess adhesive and support/modeling material.

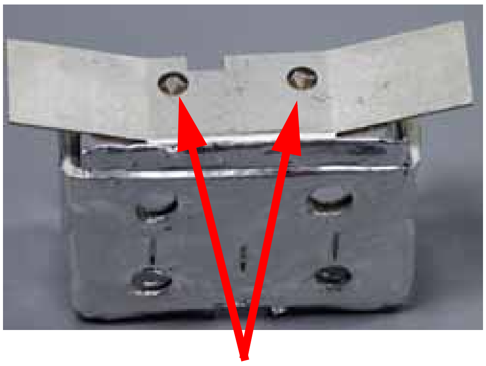
B. Remove any excess support/model material around the heater assemblies and toggle plate assembly.

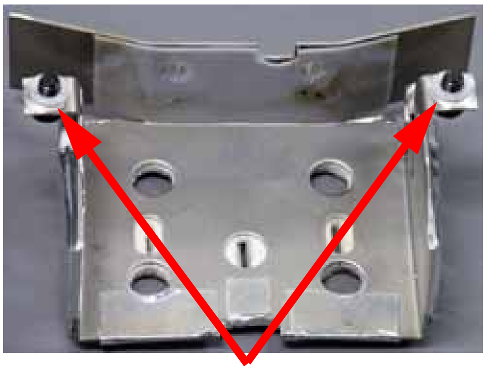
C. Remove the protective strip from the adhesive band on the new teflon shield.

D. Position the new teflon shield on the inside of the cover. Center the intersecting cut lines of the teflon shield in the center of the heat shield holes, see Figure 4-149.

E. Press the new shield in place. Check for good adhesion of teflon shield to heat shield, see Figure 4-149.

Figure 4-149: Teflon shield





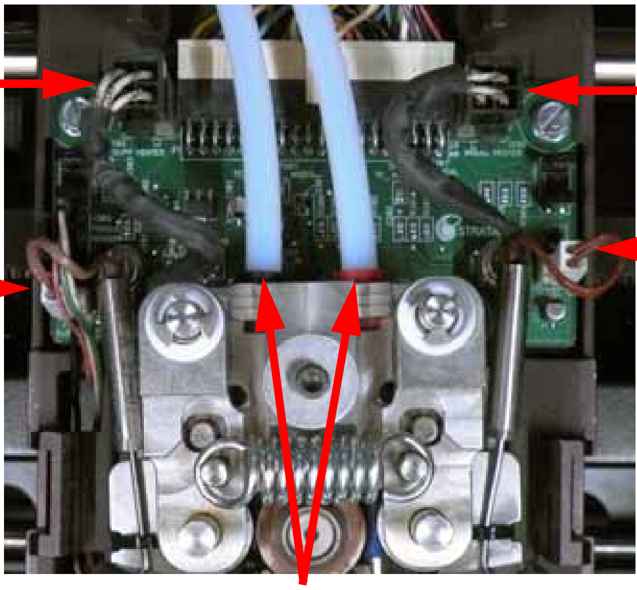
12. Disconnect the model and support heater cables from the head board, see Figure 4-150.

13. Disconnect the model and support thermocouples from the head board, see Figure 4-150.

14. Disconnect the filament tubes from the top of the toggle plate assembly by pressing down on the tube retaining rings and lifting the tubes upward, see Figure 4-150.

Note: Use a piece of tape to identify the filament tubes (as model or support) before removing them.

Figure 4-150: Head Heater and Thermocouple Connections



15. Using a $^{7}/_{64}$" allen wrench, loosen and remove the lower toggle pin screw, see #14 in Figure 4-151.
16. Remove the lower toggle shaft spring, see #13 in Figure 4-151.
17. Remove the lower toggle shaft thrust washers, see #12 in Figure 4-151.

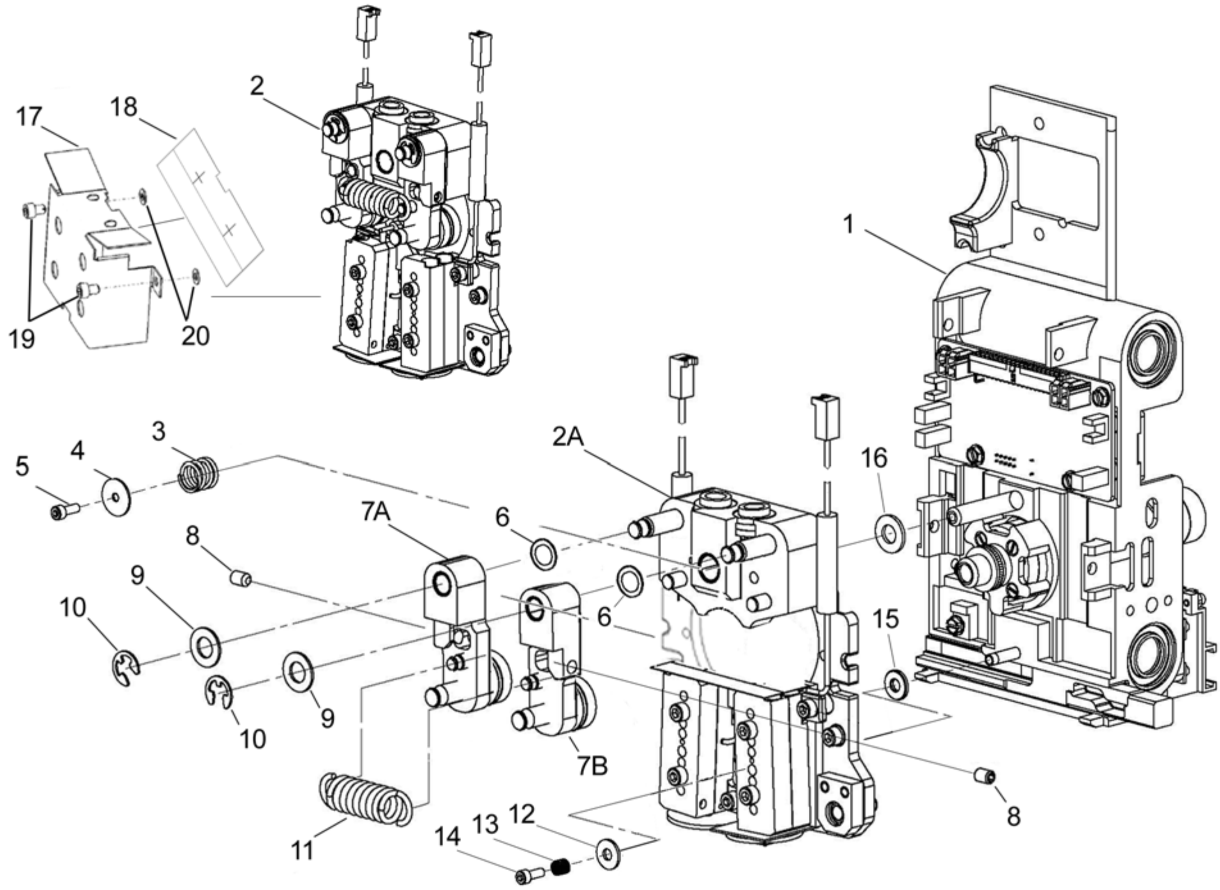
Note: If the lower toggle thrust washer has a copper side, there will be a specific orientation for assembly. The copper side is oriented AWAY from the toggle plate assembly when installed. If the washer is made of teflon and not copper, there are no orientation considerations when reinstalling.

18. Using a $^{7}/_{64}$" allen wrench, loosen and remove the upper toggle pin screw, see #5 in Figure 4-151. Remove the washer; see #4 in Figure 4-151. Remove the spring, see #3 in Figure 4-151.
19. Pull the toggle plate assembly forward to slide it off of the translator, see #2 in Figure 4-151. On SST systems, due to the presence of the support filament guide, slightly rotating the toggle plate assembly clockwise while sliding it forward will facilitate removal.

Note: There are two washers behind the toggle plate assembly - between the assembly and the translator. One is on the upper toggle pin and the other is on the lower toggle pin, see #15 and #16 in Figure 4-151. If the washer on the lower toggle pin has a copper side, there is a specific orientation for assembly. The copper side is toward the translator - away from the toggle plate assembly when installed.

The washer on the upper toggle pin does NOT have a specific orientation for assembly.

Figure 4-151: Toggle Plate Assembly



Item	Nomenclature	Item	Nomenclature
1	Translator	10	Clip
2	Toggle Plate Assembly	11	Toggle Spring
2A	Plate, Toggle Assembly	12	Washer, Thrust, Lower Toggle Shaft
3	Spring, Upper Toggle Shaft	13	Spring, Lower Toggle Shaft
4	Washer, Front, Upper Toggle Shaft	14	Screw, Lower Toggle Shaft
5	Screw, Upper Toggle Shaft	15	Washer, Thrust, Lower Toggle Shaft
6	Shim	16	Washer, Rear, Upper Toggle Shaft
7A	Pivot Block Assy (Left)	17	Heat Shield Assembly
7B	Pivot Block Assy (Right)	18	Teflon Shield
8	Idler Wheel Tension Screw	19	SHC 6-32 X 3/16 A Screw
9	Teflon Washer	20	Teflon Washer

Installing the 1200 Toggle Plate Assembly

Caution: Before installing the toggle plate, make sure that the mounting screws for the head motor are tight.

Caution: When installing the toggle plate assembly, follow the Toggle Plate Assembly Installation Checklist on page 9-4.

1. If it was removed, install the rear washer on the upper toggle shaft, see #16 in Figure 4-151.
2. If it was removed, install the rear thrust washer on the lower toggle shaft, see #15 in Figure 4-151.

Note: If the lower toggle thrust washer has a copper side, there will be a specific orientation for assembly. The copper side is oriented AWAY from the toggle plate assembly when installed. If the washer is made of teflon and not copper, there are no orientation considerations when reinstalling.

3. Slide the toggle plate assembly onto the upper and lower toggle pins of the translator. On SST systems, due to the presence of the support filament guide, slightly rotating the toggle plate assembly clockwise while sliding it onto the pins will facilitate installation.
   A. Prior to assembly make sure the pin on the back of the toggle plate assembly rotates freely.
   B. Make sure the pin on the back engages the slot in the toggle bar.
   C. When installing the toggle plate assembly, if the head motor drive wheel is loose, it may interfere with the installation if it is allowed to be pushed too far back.
4. Reinstall the lower toggle shaft thrust washer, see #12 in Figure 4-151.

Note: If the lower toggle thrust washer has a copper side, there will be a specific orientation for assembly. The copper side is oriented AWAY from the toggle plate assembly when installed. If the washer is made of teflon and not copper, there are no orientation considerations when reinstalling.

5. Reinstall the lower toggle shaft spring, see #13 in Figure 4-151.
6. Reinstall the lower toggle pin retaining screw, see #14 in Figure 4-151.
7. Reinstall the upper toggle pin spring, see # 3 in Figure 4-151.
8. Reinstall the upper toggle pin washer, see # 4 in Figure 4-151.
9. Reinstall and tighten the upper toggle pin retaining screw.
10. Reconnect the model and support heater connectors.
11. Reconnect the model and support thermocouple connectors.
12. Connect the model and support filament tubes to the top of the toggle plate assembly by pushing down into the lock rings.
13. Perform the head alignment procedure, see Head Alignment Procedure on page 4-123.
14. Remove the calibration floppy disk/CD from the electronics bay and send the .cal file to the printer with MaracaEX, see “Send” .cal file – from calibration Floppy Disk/CD to the printer: on page 5-38. If the last update of the calibration CD is unknown, perform the following calibrations:
    A. Perform Z calibration, see Z Calibration on page 5-2.
    B. Perform XY calibration, see XY Calibration on page 5-2.

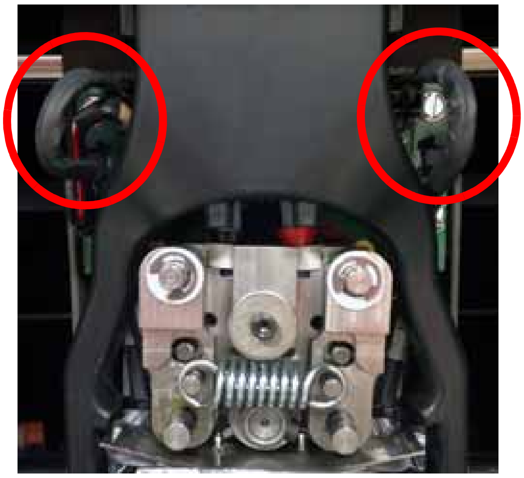
C. Perform part based calibrations, see Part Based Calibration on page 5-3.

D. Get the .cal file from the printer and copy to a new floppy disk/CD. See "Get" .cal file – from hard drive to the calibration Floppy Disk/CD: on page 5-38.

15. Replace the calibration floppy disk/CD in the electronics bay.
16. Reinstall the heat shield.
17. Install the model and support tips.
18. Check and adjust the brush/flicker height, see Adjusting Brush/Flicker Height (1200) on page 5-50.
19. Reconnect the filament tubes to the top of the toggle plate assembly - make sure the model tube is on the right; the support tube on the left.
20. Reinstall the air plenum.

Caution: Ensure the head heater wires are not pinched behind the air plenum when reinstalling air plenum. If wires are not properly routed, they can be cut by the sensor flags causing the head to short.

Figure 4-152: Heater wire placement



21. Reinstall the head cover.
22. Reinstall the right side panel, see Installing the Side Panels on page 4-6.
23. Reinstall the rear panel, see Installing the Rear Panel on page 4-5.
24. Perform the Z Calibration and XY Tip Offset procedure, see Adjusting Z Calibration and XY Tip Offset on page 5-2.

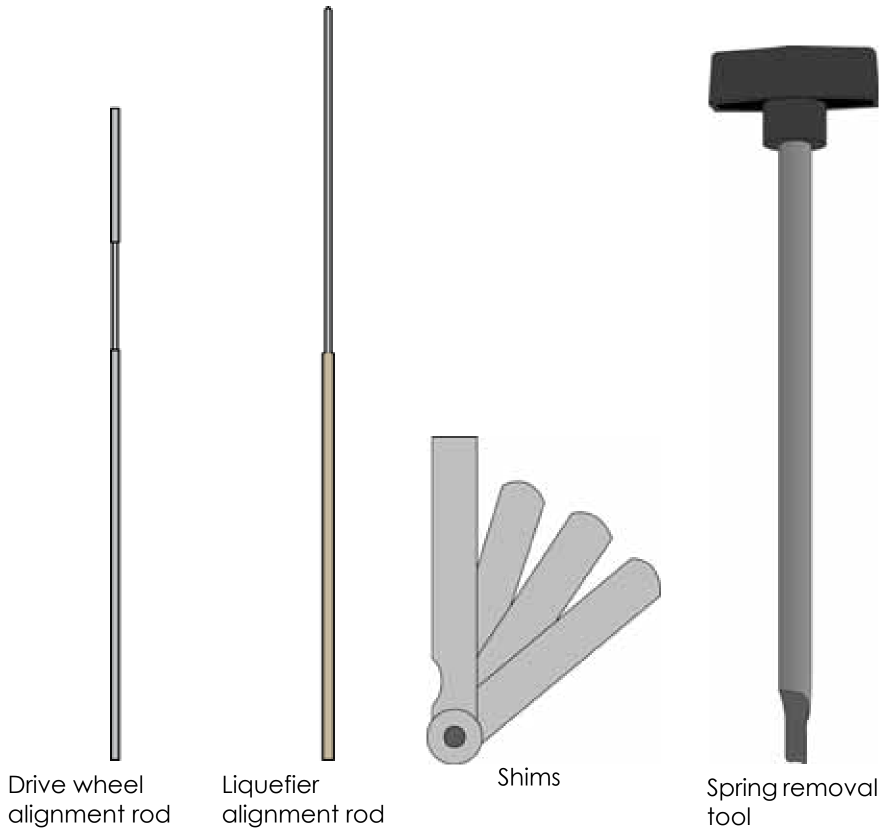
Note: Follow the head installation checklist after completing toggle plate assembly replacement, see Toggle Plate Assembly Installation Checklist on page 9-4.

1200es Toggle Plate Assembly

Required Tools

- $^5/_{16}$″ nut driver or standard screwdriver
- $^7/_{64}$″ allen wrench
- Phillips screwdriver
- Needle nose pliers
- Wire ties
- Alignment rod set
- Shims
- Spring removal tool

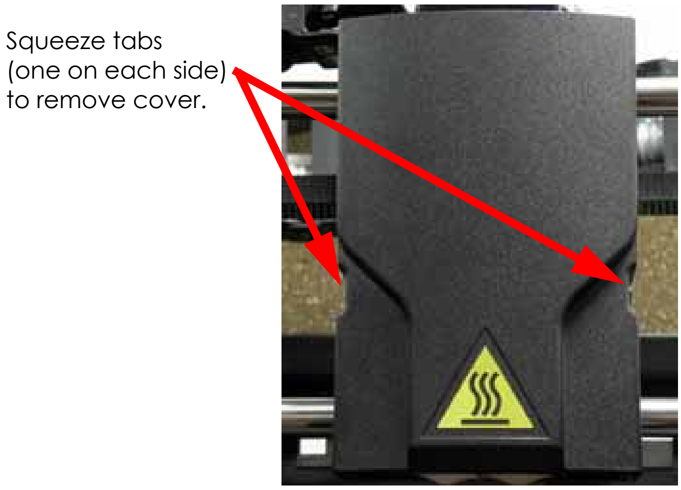
Figure 4-153: Alignment rods and shims



Removing the 1200es Toggle Plate Assembly

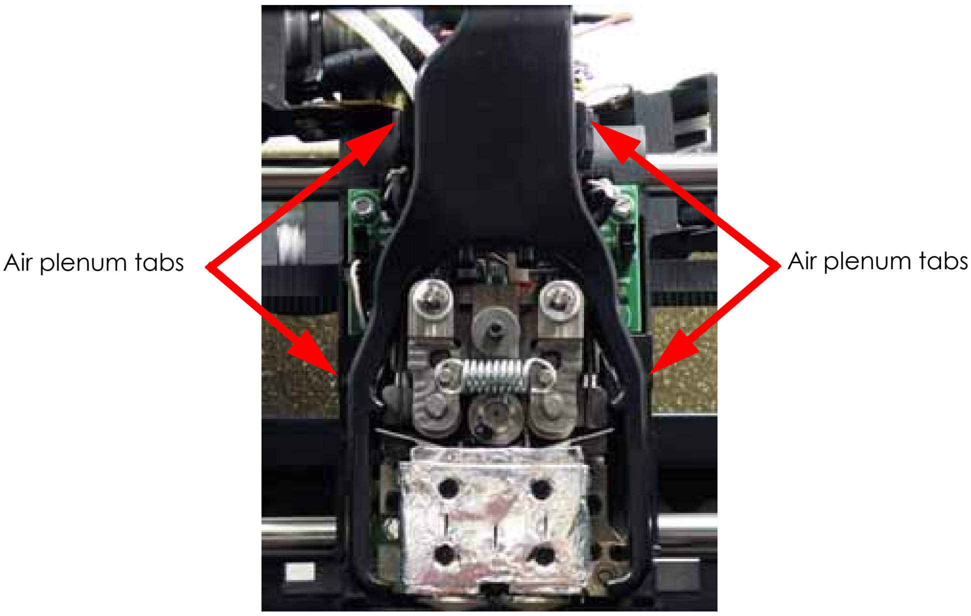
1. Unload model and support material.
2. Power down the printer.
3. Remove the rear panel, see Removing the Rear Panel on page 4-5.
4. Remove the right side panel, see Removing the Side Panels on page 4-6.
5. Position the head in the center of the build envelope.
6. Remove plastic head cover by squeezing raised pads on sides of cover, see Figure 4-154.

Figure 4-154: Removing the head cover



7. Remove the air plenum by pressing in on tabs to release from translator. Work the air plenum free of air duct at top (not shown), see Figure 4-155.

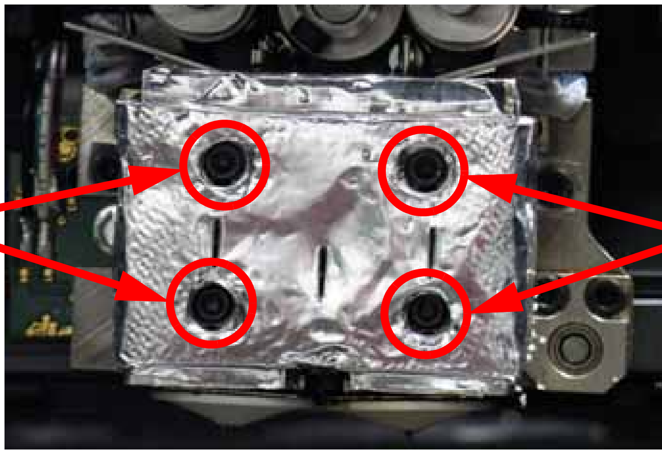
Figure 4-155: Removing the Air Plenum



8. Remove liquefier tips:

A. Use a $^{7}/_{64}$" allen wrench to loosen the tip (heater block clamp) screws three to four full turns counterclockwise - or until the top of the screws are flush with the metal cover. See Figure 4-156.

Figure 4-156: Liquefier tip mounting screw locations



B. Use needle nose pliers to grasp the stainless steel shield of the tip.

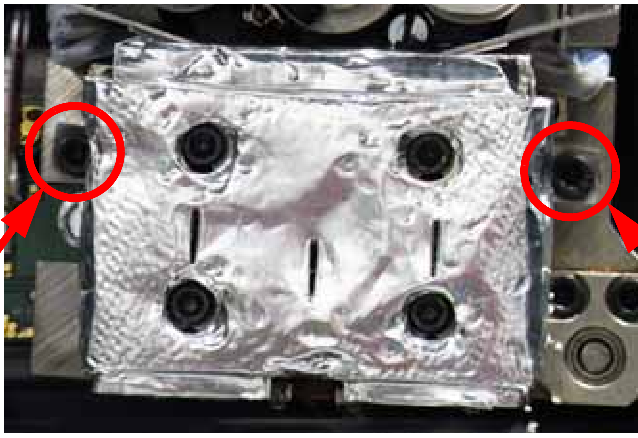
C. Pull the tip shield toward you, then pull down to remove the tip. Discard the used tip.

D. Repeat for second tip.

9. Using a $^{7}/_{64}$" allen wrench, loosen but do not remove the 2 heat shield mounting screws. See Figure 4-157.

Note: There is a teflon washer on each screw - between the back of the heat shield tabs and the translator, see #20 in Figure 4-151. If the screw is not completely removed from the heat shield and the washer is not damaged, the washer will act as a retainer, holding the screw to the heat shield.

Figure 4-157: Heat shield mounting screw locations

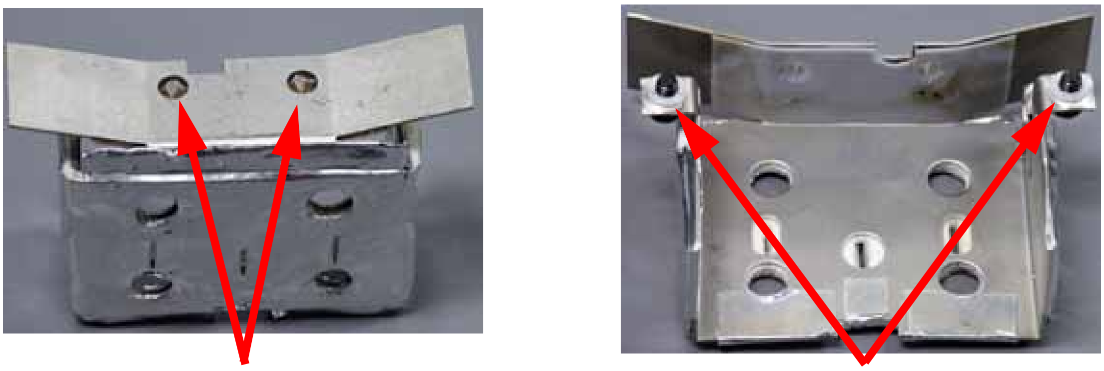


10. Inspect the teflon shield (Figure 4-158.) for:

- Damage - Replace if the area around a cover hole is not intact or if the shield is torn.
- Material trapped between shield and cover - Replace the shield if there is evidence of trapped material.
- Security of shield to metal cover - Replace the shield if it does not appear to be attached firmly to the cover. The shield is held in place by an adhesive strip.

11. Replace the teflon shield if necessary, see Figure 4-158.
   A. Remove the old teflon shield from the heat shield - remove excess adhesive and support/modeling material.
   B. Remove any excess support/model material around the heater assemblies and toggle plate assembly.
   C. Remove the protective strip from the adhesive band on the new teflon shield.
   D. Position the new teflon shield on the inside of the cover. Center the intersecting cut lines of the teflon shield in the center of the heat shield holes.
   E. Press the new shield in place. Check for good adhesion of teflon shield to heat shield.

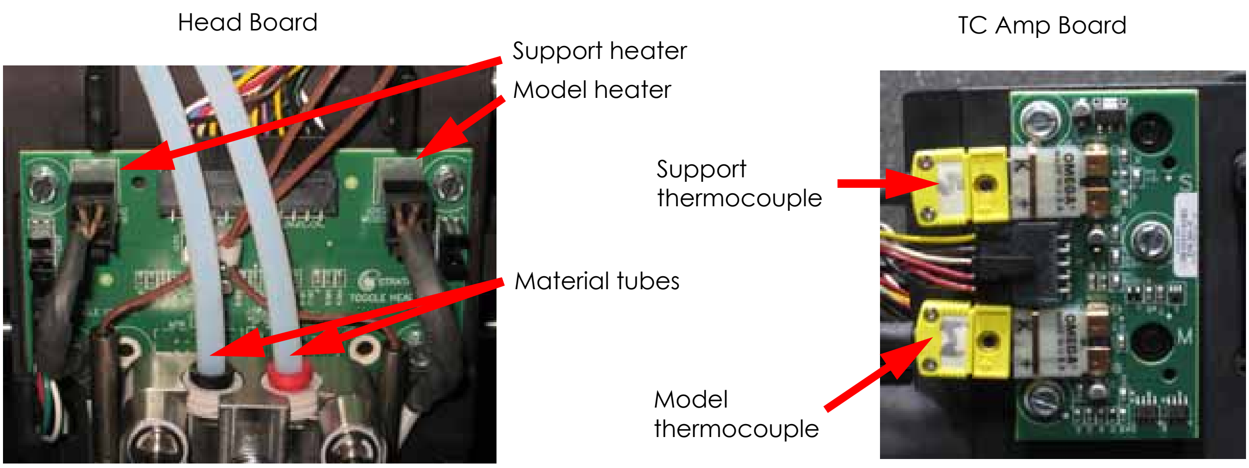
Figure 4-158: Teflon shield



12. Disconnect the model and support heater cables from the head board, see Figure 4-159.
13. Disconnect the model and support thermocouples from the TC amp board, see Figure 4-159.
14. Disconnect the filament tubes from the top of the toggle plate assembly by pressing down on the tube retaining rings and lifting the tubes upward, see Figure 4-159.

Note: Use a piece of tape to identify the filament tubes (as model or support) before removing them.

Figure 4-159: Head Heater and Thermocouple Connections



15. Using a $^{7}/_{64}$" allen wrench, loosen and remove the lower toggle pin screw, see #14 in Figure 4-160.
16. Remove the lower toggle shaft spring, see #13 in Figure 4-160.
17. Remove the lower toggle shaft thrust washers, see #12 in Figure 4-160.

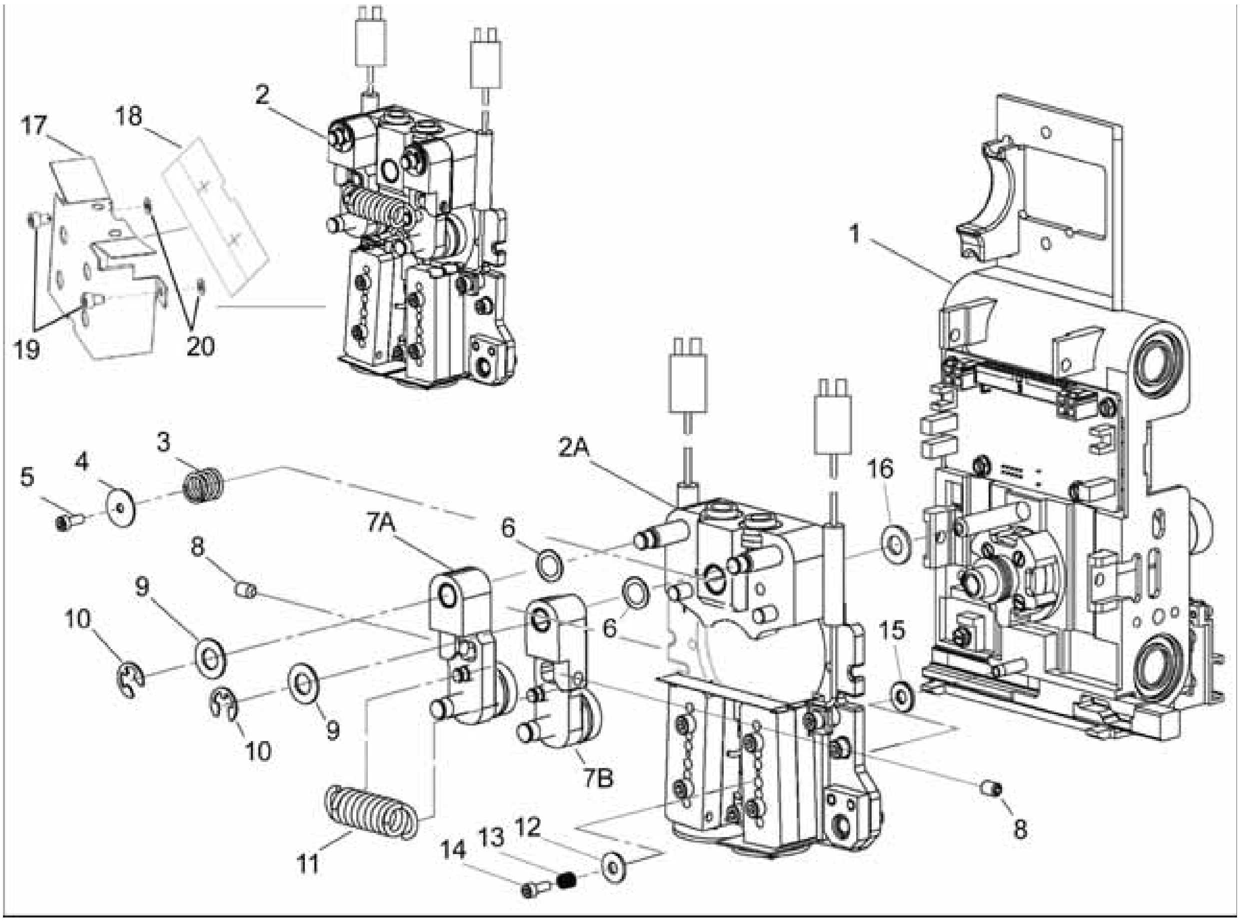
Note: If the lower toggle thrust washer has a copper side, there will be a specific orientation for assembly. The copper side is oriented AWAY from the toggle plate assembly when installed. If the washer is made of teflon and not copper, there are no orientation considerations when reinstalling.

18. Using a $^{7}/_{64}$" allen wrench, loosen and remove the upper toggle pin screw, see #5 in Figure 4-160. Remove the washer; see #4 in Figure 4-160. Remove the spring, see #3 in Figure 4-160.
19. Pull the toggle plate assembly forward to slide it off of the translator, see #2 in Figure 4-160. On SST systems, due to the presence of the support filament guide, slightly rotating the toggle plate assembly clockwise while sliding it forward will facilitate removal.

Note: There are two washers behind the toggle plate assembly - between the assembly and the translator. One is on the upper toggle pin and the other is on the lower toggle pin, see #15 and #16 in Figure 4-160. If the washer on the lower toggle pin has a copper side, there is a specific orientation for assembly. The copper side is toward the translator - away from the toggle plate assembly when installed.

The washer on the upper toggle pin does NOT have a specific orientation for assembly.

Figure 4-160: Toggle Plate Assembly



Item	Nomenclature	Item	Nomenclature
1	Translator	10	Clip
2	Toggle Plate Assembly	11	Toggle Spring
2A	Plate, Toggle Assembly	12	Washer, Thrust, Lower Toggle Shaft
3	Spring, Upper Toggle Shaft	13	Spring, Lower Toggle Shaft
4	Washer, Front, Upper Toggle Shaft	14	Screw, Lower Toggle Shaft
5	Screw, Upper Toggle Shaft	15	Washer, Thrust, Lower Toggle Shaft
6	Shim	16	Washer, Rear, Upper Toggle Shaft
7A	Pivot Block Assy (Left)	17	Heat Shield Assembly
7B	Pivot Block Assy (Right)	18	Teflon Shield
8	Idler Wheel Tension Screw	19	SHC 6-32 X 3/16 A Screw
9	Teflon Washer	20	Teflon Washer

Installing the 1200es Toggle Plate Assembly

Caution: Before installing the toggle plate, make sure that the mounting screws for the head motor are tight.

Caution: When installing the toggle plate assembly, follow the Toggle Plate Assembly Installation Checklist on page 9-4.

1. If it was removed, install the rear washer on the upper toggle shaft, see #16 in Figure 4-160.
2. If it was removed, install the rear thrust washer on the lower toggle shaft, see #15 in Figure 4-160.

Note: If the lower toggle thrust washer has a copper side, there will be a specific orientation for assembly. The copper side is oriented AWAY from the toggle plate assembly when installed. If the washer is made of teflon and not copper, there are no orientation considerations when reinstalling.

3. Slide the toggle plate assembly onto the upper and lower toggle pins of the translator. On SST systems, due to the presence of the support filament guide, slightly rotating the toggle plate assembly clockwise while sliding it onto the pins will facilitate installation.
   A. Prior to assembly make sure the pin on the back of the toggle plate assembly rotates freely.
   B. Make sure the pin on the back engages the slot in the toggle bar.
   C. When installing the toggle plate assembly, if the head motor drive wheel is loose, it may interfere with the installation if it is allowed to be pushed too far back.
4. Reinstall the lower toggle shaft thrust washer, see #12 in Figure 4-160.

Note: If the lower toggle thrust washer has a copper side, there will be a specific orientation for assembly. The copper side is oriented AWAY from the toggle plate assembly when installed. If the washer is made of teflon and not copper, there are no orientation considerations when reinstalling.

5. Reinstall the lower toggle shaft spring, see #13 in Figure 4-160.
6. Reinstall the lower toggle pin retaining screw, see #14 in Figure 4-160.
7. Reinstall the upper toggle pin spring, see # 3 in Figure 4-160.
8. Reinstall the upper toggle pin washer, see # 4 in Figure 4-160.
9. Install and tighten the upper toggle pin retaining screw.
10. Reconnect the model and support heater connectors.
11. Reconnect the model and support thermocouple connectors.
12. Connect the model and support filament tubes to the top of the toggle plate assembly by pushing down into the lock rings.
13. Perform the head alignment procedure, see Head Alignment Procedure on page 4-123.

Head Alignment Procedure

Note: This procedure must be accomplished in its entirety and in the order presented. The procedure consists of 3 sub-procedures:

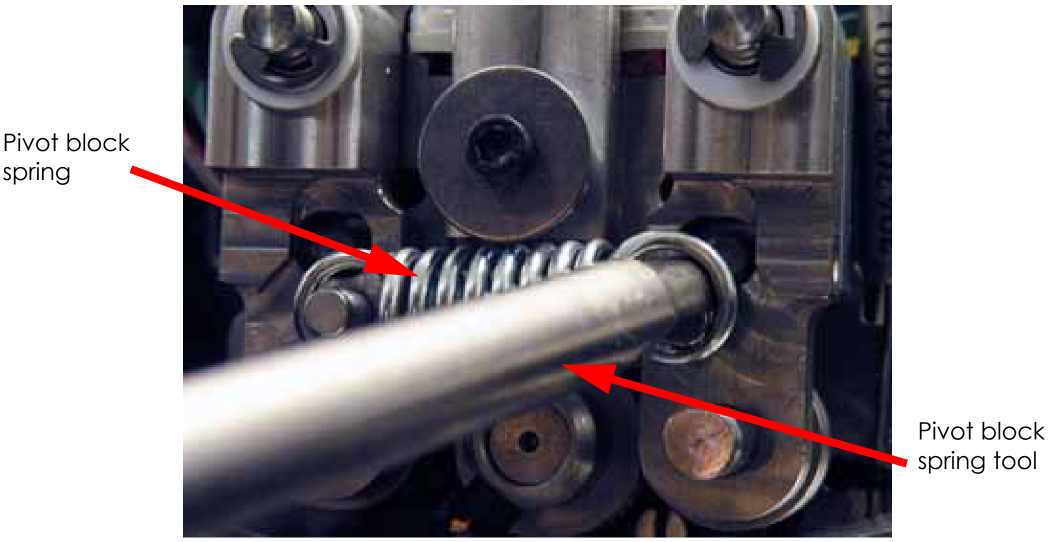
- Liquefier, drive wheel, and filament guide alignment.
- Idler Wheel Check/Adjustment
- Liquefier Alignment Check

Liquefier, Drive Wheel and Filament Guide Alignment

Warning: Use eye protection when removing or installing the pivot block spring.

1. Using the pivot block spring removal tool (PN 204242-0001), remove the pivot block spring (see #11 in Figure 4-160.) by inserting the spring removal tool and prying the spring away from the pivot block, see Figure 4-161.

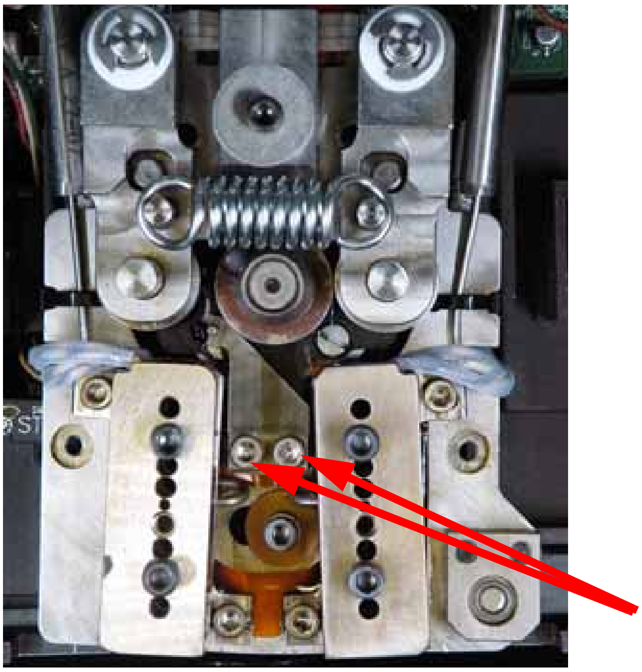
Figure 4-161: Removing the pivot block spring



2. Using a needle nose pliers, remove the retaining clip and teflon washer from the left side pivot block pin, see # 9 and # 10 in Figure 4-160.
3. Remove the left side pivot block by pulling away from the toggle plate, see # 7A in Figure 4-160.
4. Move the toggle bar to the left.
5. Using a $^{7}/_{64}$" allen wrench, slightly loosen the 2 support filament guide mounting screws. See Figure 4-162.

Note: Step 5 applies only to SST 1200 printers. BST 1200, BST 1200es and SST 1200es printers do not require this step. For BST 1200, BST 1200es and SST 1200es continue to step 6.

Figure 4-162: SST 1200 Support filament guide mounting screw locations

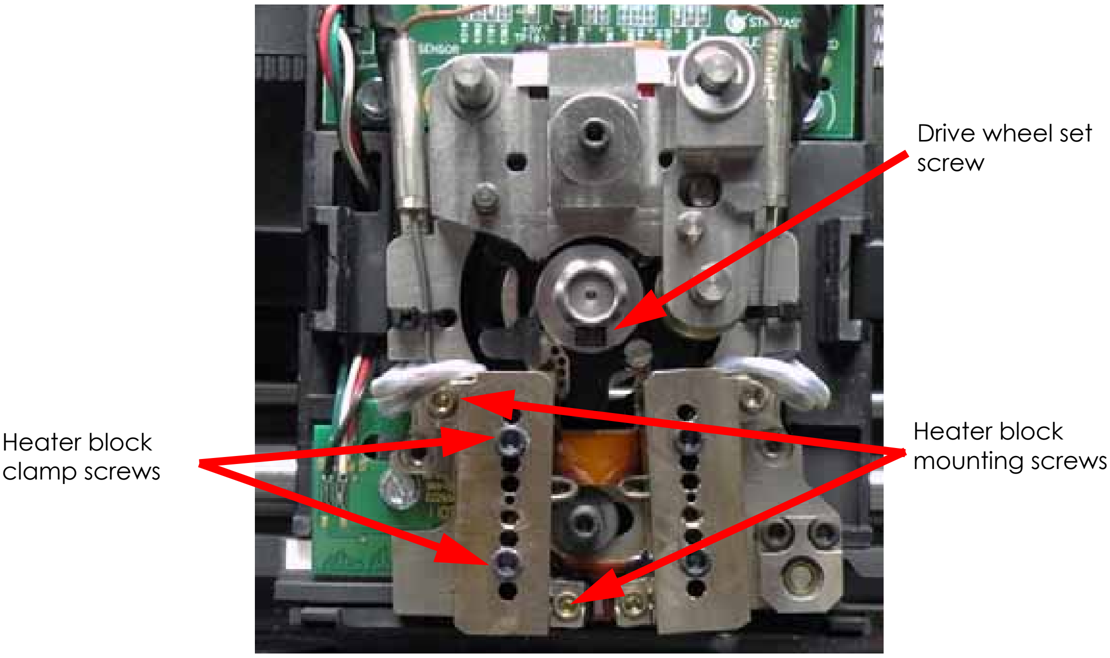


6. Using a $^7/_{64}$" allen wrench, remove the drive wheel set screw, see Figure 4-163.
7. Remove the drive wheel pulling it off of the drive shaft.
8. Use the end of the spring removal tool to clean out the old LocTite from the inside diameter of the drive wheel.
9. Using a wire brush, clean the drive wheel gear teeth.
10. Place the drive wheel back on the drive shaft. Apply LocTite 222 to the screw threads, and loosely reinstall the screw.

Note: Make sure that the drive wheel is free to slide axially on the motor shaft.

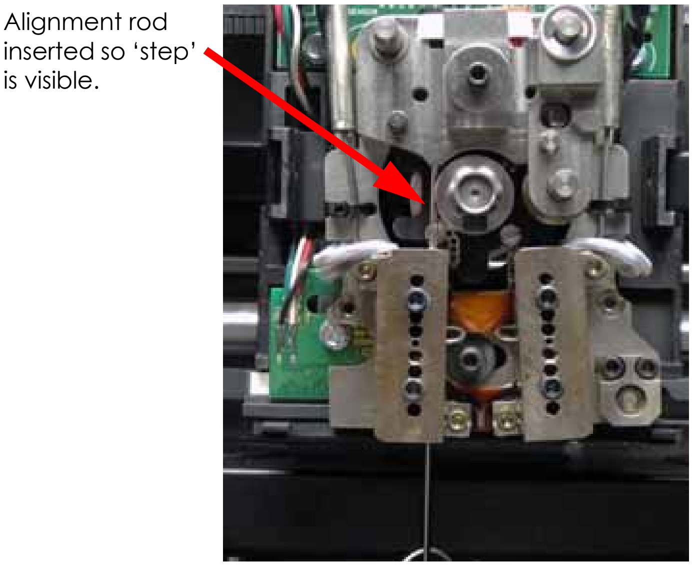
11. Position the drive wheel so the set screw is facing downward, see Figure 4-163.
12. Using a $^7/_{64}$" allen wrench; loosen, but do not remove the support side heater block mount screws and the support side heater block clamp screws, see Figure 4-163.

Figure 4-163: Heater block screw locations



13. Make sure that the drive wheel alignment rod is straight. Roll the rod along a flat surface to check for bends. Straighten as necessary.
14. Insert the drive wheel alignment rod from the bottom of the support (left side) heater block, see Figure 4-164.
15. Push the alignment rod up into the main pivot block, see Figure 4-164.
16. Position the alignment rod so that the recessed portion is centered between the heater block and the pivot block, see Figure 4-164.

Figure 4-164: Alignment rod placement



17. Tighten the heater block clamp screws.
18. Tighten the lower heater block mount screw until it is snug.
19. Tighten the upper heater block mount screw until it is snug.
20. Completely tighten the heater block mounting screws.

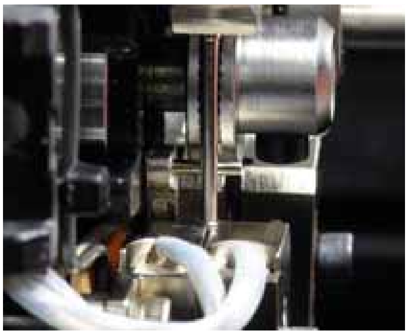
Note: Make sure that the heater block does not move while tightening the mount screws by holding it in place firmly with your thumb.

21. With the drive wheel set screw loose, gently move the toggle bar to the right until the alignment rod rests in the groove of the drive wheel. See Figure 4-165.

Note: Do not force the toggle bar to the full right position. Forcing the toggle bar to the full right position may cause the alignment rod to bend.

22. Adjust the drive wheel until the alignment rod is centered in the groove of the drive wheel, see Figure 4-165.

Figure 4-165: Drive wheel alignment



Drive wheel is positioned so that alignment rod is centered in wheel track.

23. Tighten the drive wheel set screw.
24. Verify proper drive wheel alignment:
    A. Gently move the toggle bar to the right, then back to the left while observing the drive wheel and alignment rod.

Note: View the alignment of the drive wheel and alignment rod from the left side of the system.

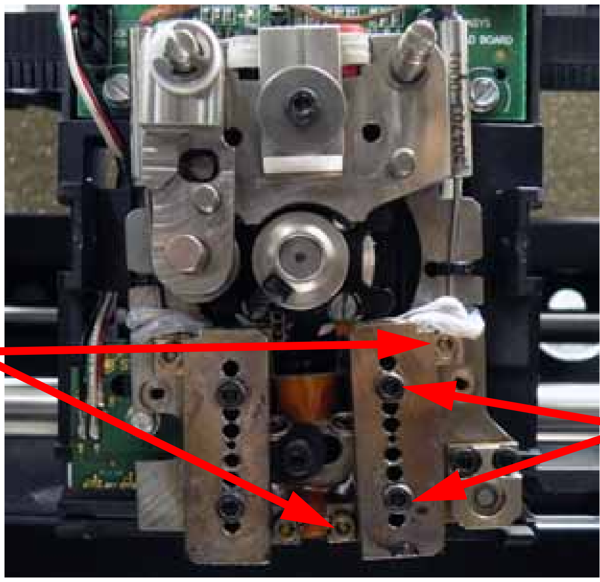
    B. The alignment rod should not deflect forward or backward as the drive wheel is brought into contact with the rod.
    C. The alignment rod should be centered within the groove of the drive wheel.
    D. If the alignment rod is misaligned, loosen the drive wheel set screw and repeat steps 21 through 24.
25. Move the toggle bar to the left.
26. Push the filament guide against the alignment rod and hold firmly in place and use a $^{7}/_{64}$″ allen wrench to tighten the filament guide screws (left screw first).

Note: Apply pressure down and to the left against the filament guide to ensure that it remains in contact with the alignment rod while tightening the screws.

Note: Step 26 applies only to SST 1200 printers. BST 1200, BST 1200es and SST 1200es printers do not require this step. For BST 1200, BST 1200es and SST 1200es continue to step 28.

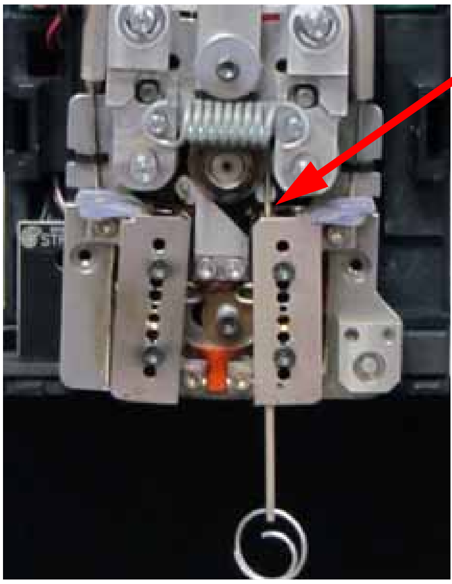
27. Loosen the heater block clamp screws and remove the alignment rod.
28. Move toggle bar to the right.
29. Using a $^{7}/_{64}$″ allen wrench; loosen, but do not remove the model side heater block mount screws and the model side heater block clamp screws, see Figure 4-166.

Figure 4-166: Heater block screw locations



30. Make sure that the Drive Wheel alignment rod is straight. Roll the rod along a flat surface to check for bends. Straighten as necessary.
31. Insert the drive wheel alignment rod from the bottom of the model (right side) heater block, see Figure 4-167.
32. Push the alignment rod up into the main pivot block, see Figure 4-167.
33. Position the alignment rod so that the recessed portion is centered between the heater block and the pivot block, see Figure 4-167.

Figure 4-167: Alignment rod placement



34. Tighten the heater block clamp screws.
35. Tighten the lower heater block mount screw until it is snug.
36. Tighten the upper heater block mount screw until it is snug.
37. Completely tighten the lower and upper heater block mount screws.

Note: Make sure that the heater block does not move while tightening the mount screws by holding it in place firmly with your thumb.

38. Loosen the heater block clamp screws and remove the alignment rod.
39. Reinstall the left side pivot block:
    A. Make sure the shim washer is installed, see #6 in Figure 4-160.

Note: The shim normally remains on the pin when the pivot block is removed.

    B. Reinstall the teflon washer and retaining clip.

Idler Wheel Check/Adjustment

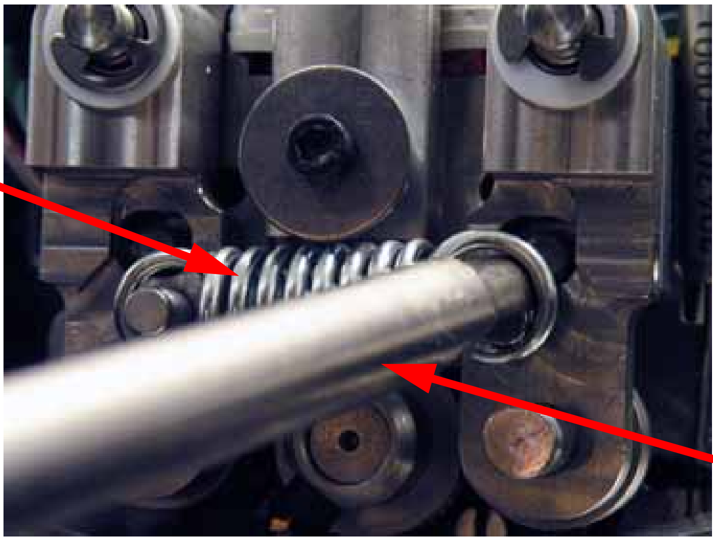
This procedure sets the idler wheel stopping point. Drive wheel alignment must be performed before this procedure.

Warning: Use eye protection when removing or installing the pivot block spring.

Caution: Use care when installing the pivot block spring so as to prevent spring distortion. A distorted or stretched spring can cause system operation errors. Orienting the spring on the toggle plate per Figure 4-168 will reduce the risk of distortion during installation.

1. Using the spring removal tool, reinstall the pivot block spring**, see** Figure 4-168.

Figure 4-168: Removing the pivot block spring



2. Rotate the drive wheel so that the set screw is on the bottom of the wheel, see Figure 4-169.
3. Check and adjust (if necessary) the right (Model) side idler wheel clearance:
   A. Place the toggle bar in the neutral position (half way between full left and full right).
   B. Insert a 0.003 inch feeler gauge between the drive wheel and the idler wheel. See Figure 4-169.
   C. Place the toggle bar in the full left position. The 0.003 inch feeler gauge should have light drag when pulling away from the drive wheel and idler wheel.
   D. Place the toggle bar in the neutral position.
   E. Insert a 0.005 inch feeler gauge between the drive wheel and the idler wheel. See Figure 4-169.
   F. Place the toggle bar to the full left position. The 0.005 inch feeler gauge should be firmly held between the drive wheel and the idler wheel when pulling away from the drive wheel and idler wheel.
   G. If the clearance is not correct, use a $^{5}/_{64}$″ allen wrench to remove the idler wheel tension adjustment screw, apply LocTite 222 to the screw threads, and reinstall the screw. See Figure 4-169.

H. Insert a 0.003 inch feeler gauge between the drive wheel and the idler wheel. See Figure 4-169.

I. Place the toggle bar in the full left position.

J. Adjust the screw to obtain a light drag on .003 inch feeler gauge.

K. Insert a 0.005 inch feeler gauge between the drive wheel and the idler wheel. See Figure 4-169.

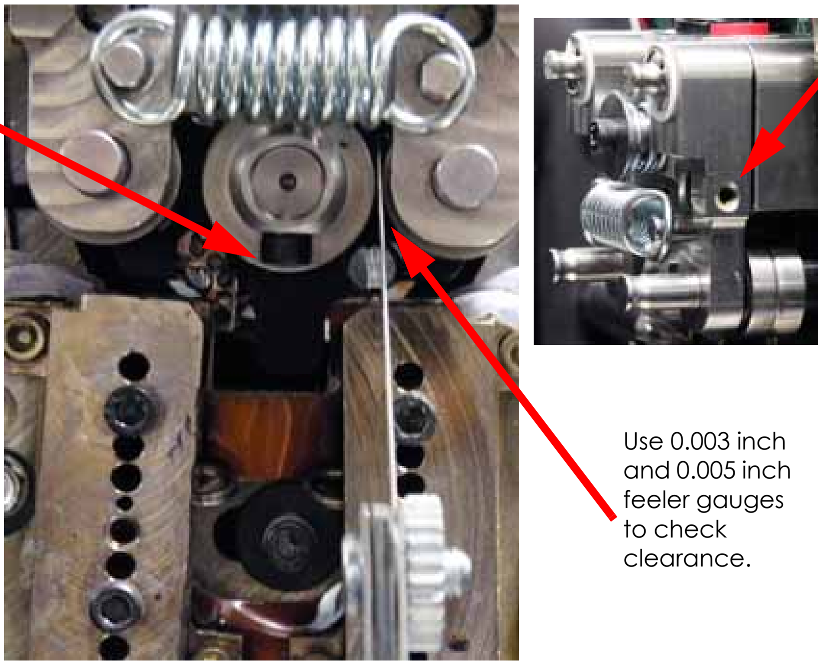
L. Place the toggle bar to the full left position.

M. Continue to adjust the screw until the prescribed clearance is obtained.

N. When adjustment is complete, place the toggle bar in the neutral position, and remove the feeler gauge.

O. Place the toggle bar in the full left position and spin the idler wheel by hand. The idler wheel should spin freely without drag. If drag is present, re-check adjustments.

Figure 4-169: Idler Wheel Adjustment - Right Side



4. Check and adjust (if necessary) the left (Support) side idler wheel clearance:

A. For BST:

a. Repeat step 3 above, except the toggle bar should be placed in the full right position instead of the full left position.

B. For SST:

a. Place the toggle bar in the neutral position.

b. Insert a 0.012 inch feeler gauge between the drive wheel and the idler wheel. See Figure 4-170.

c. Place the toggle bar in the full right position. The 0.012 inch feeler gauge should have light drag when pulling away from the drive wheel and idler wheel.

d. Place the toggle bar in the neutral position.

e. Insert a 0.015 inch feeler gauge between the drive wheel and the idler wheel.

f. Return the toggle bar to the full right position - the 0.015 inch feeler gauge should be firmly held between the drive wheel and the idler wheel.

g. Place the toggle bar in the neutral position.

h. Insert a 0.010 inch feeler gauge between the drive wheel and the idler wheel.

i. Return the toggle bar to the full right position - the 0.010 inch feeler gauge should not be held between the drive wheel and the idler wheel - there should be no drag felt on the feeler gauge.

j. If the clearance is not correct, use a $^5/_{64}$" allen wrench to remove the idler wheel tension adjustment screw, apply LocTite 222 to the screw threads, and reinstall the screw. See Figure 4-170.

k. Place the toggle bar in the neutral position.

l. Insert a 0.012 inch feeler gauge between the drive wheel and the idler wheel.

m. Place the toggle bar in the full right position.

n. Adjust the screw to obtain a light drag on 0.012 inch feeler gauge.

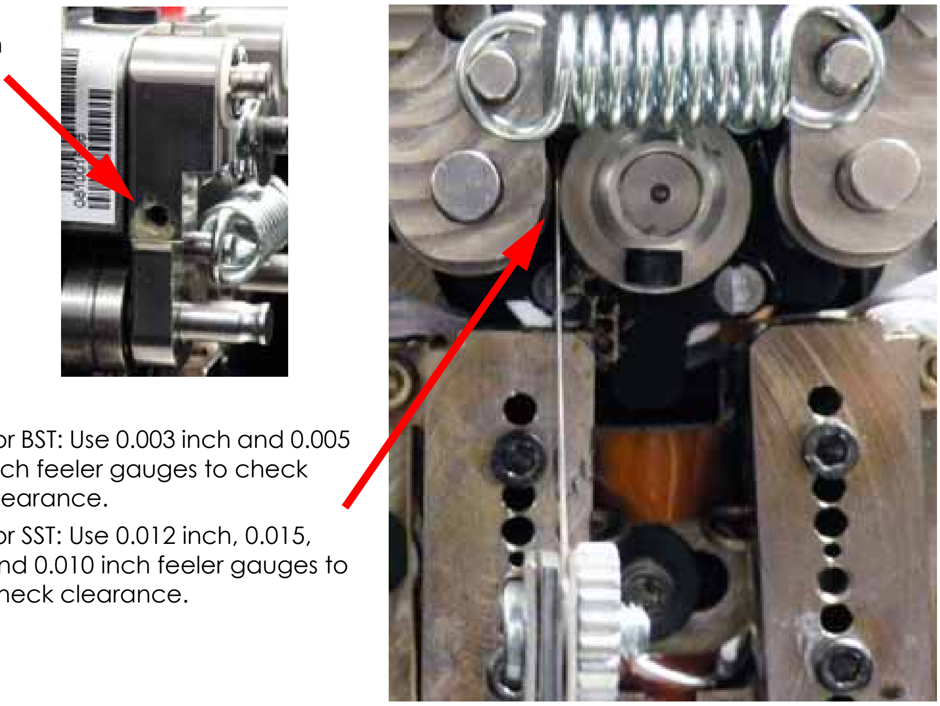
o. Check the clearance with the 0.015 inch and 0.010 feeler gauges as above.

p. Continue to adjust the screw until the prescribed clearance is obtained.

q. When adjustment is complete, place the toggle bar in the neutral position, and remove the feeler gauge.

r. Place the toggle bar in the full right position and spin the idler wheel by hand. The idler wheel should spin freely without drag. If drag is present, re-check adjustments.

Figure 4-170: Idler Wheel Adjustment - Left Side

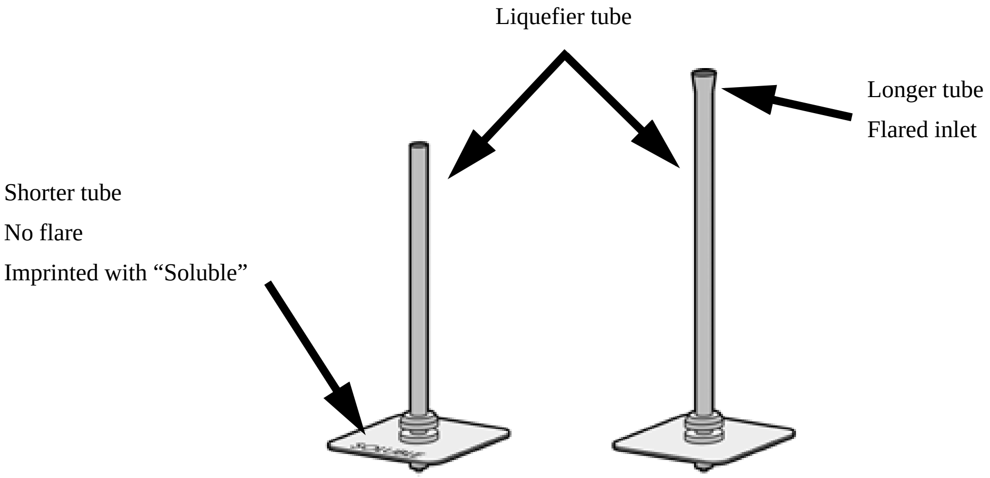


Liquefier Alignment Check

This aligns the liquefier tubes with the filament path.

1. Install the new liquefier tips:
   A. For BST 1200 and BST 1200es, the SUPPORT tip and MODEL tip are interchangeable. Both sides use the MODEL tip. (The tips come in a red capped container). See Figure 4-171.
   B. For SST 1200 and SST 1200es, you must identify the correct replacement tip. The SST uses two tip types. You must make sure a SUPPORT tip is used on the LEFT side of the head assembly. A MODEL tip must be used on the RIGHT side of the head assembly. The Model tip comes in a red capped container. The Support tip comes in a black capped container and is labeled “Soluble”, see Figure 4-171.

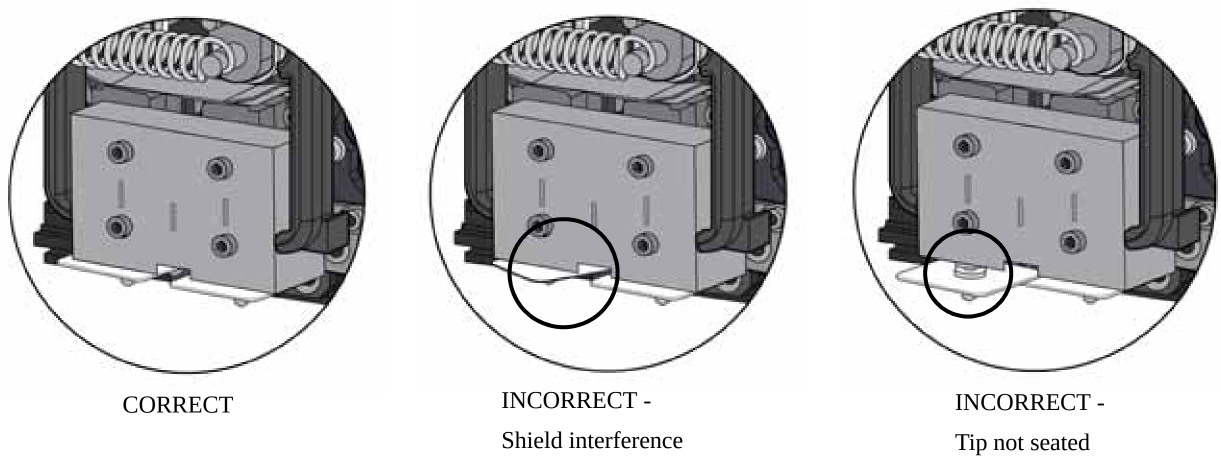
Figure 4-171: Identifying Tips



   C. Insert the new tip into the heater block.
   D. Pull the tip shield toward you, then lift up to install the tip.
   E. Push the tip toward the back of the printer once it is all the way up against the heater block.
   F. Verify the tip is fully inserted into the heater block and that the stainless steel shield is aligned, see Figure 4-172.

Note: Make sure tip remains all the way up against the heater block as you tighten the screws.

Figure 4-172: Tip Stainless Steel Shield Alignment



G. Using a $^{7}/_{64}$" allen wrench, firmly tighten the heater block clamp screws.

H. Repeat steps C through G for second tip.

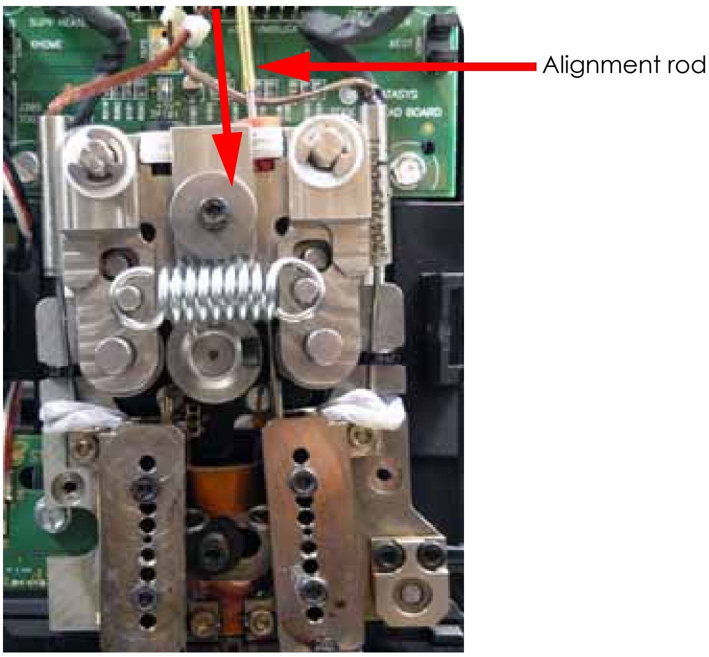
2. Verify right (Model) side alignment:

   A. Move the toggle bar to the full right position.

   B. Make sure that the liquefier alignment rod is straight. Roll the rod along a flat surface to check for bends. Straighten as necessary.

   C. Insert the liquefier alignment rod - small end first - from the TOP of the right side toggle block, past the drive wheel, to just above the liquefier inlet. See Figure 4-173.

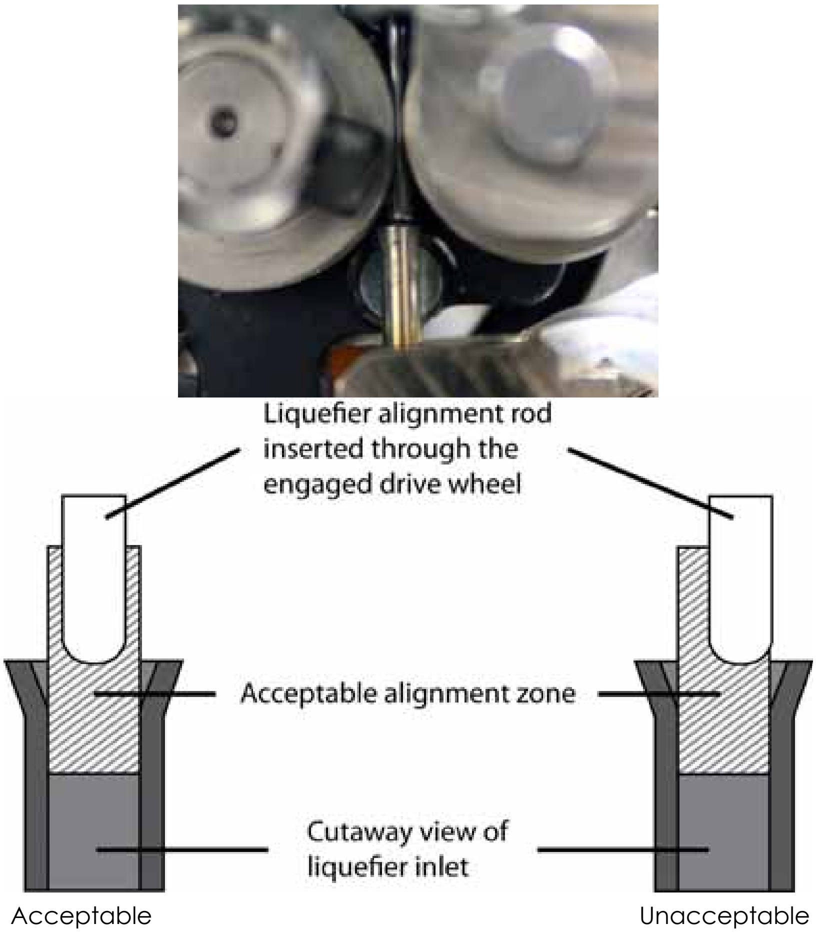
Figure 4-173: Alignment rod placement



   D. Move the toggle bar to the full left position.

   E. Visually check the alignment of the alignment rod with the liquefier inlet tube. The liquefier inlet must be aligned with the centerline of the alignment rod. See Figure 4-174.

Figure 4-174: Model liquefier alignment check



F. Perform a physical check of the alignment by pushing down on the top of the alignment rod so that it enters the inlet of the liquefier. Alignment is not correct if additional pressure is required on the rod as it enters the inlet - the pressure required to move the rod should be consistent throughout its travel.

G. If the alignment rod is not centered with the tip inlet, loosen the upper heater block mounting screw ONLY.

H. Pivot the heater block until the alignment rod is centered with the tip inlet.

I. Firmly hold the heater block in position with your thumb and tighten the heater block mounting screw.

J. Toggle to the right and remove the alignment rod.

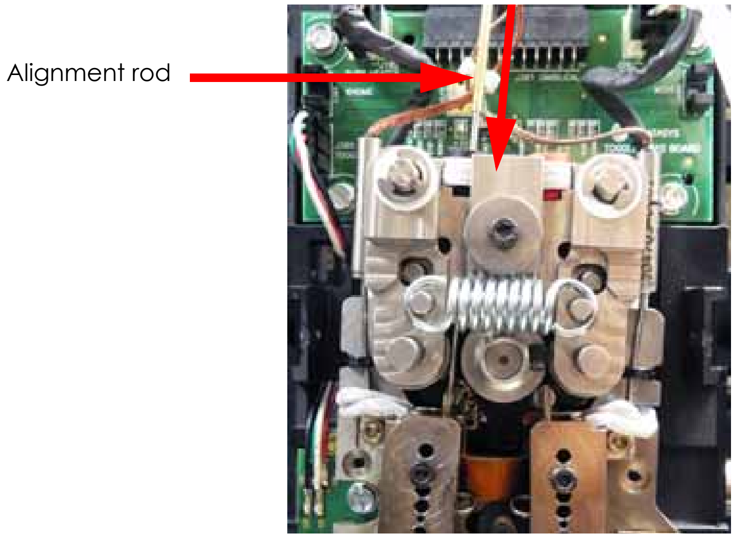
3. Verify Left (Support) side alignment:

   A. Move the toggle bar to the full left position.

   B. Make sure that the liquefier alignment rod is straight. Roll the rod along a flat surface to check for bends. Straighten as necessary.

   C. Insert the liquefier alignment rod - small end first - from the TOP of the left side toggle block, past the drive wheel, to just above the liquefier inlet. See Figure 4-175.

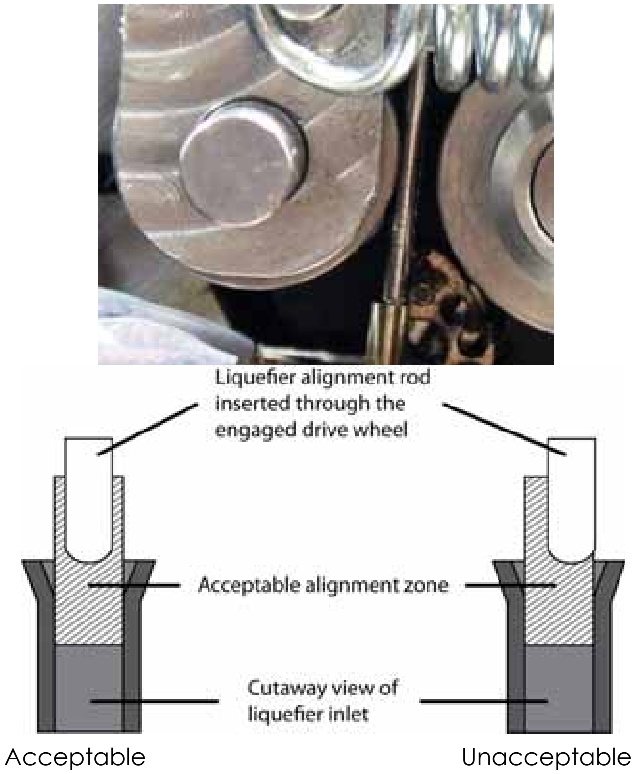
Figure 4-175: Alignment rod placement



D. Move the toggle bar to the full right position.

E. Visually check the alignment of the alignment rod with the liquefier inlet tube. The liquefier inlet must be aligned with the centerline of the alignment rod. See Figure 4-176.

Figure 4-176: Model liquefier alignment check



F. Perform a physical check of the alignment by pushing down on the top of the alignment rod so that it enters the inlet of the liquefier. Alignment is not correct if additional pressure is required on the rod as it enters the inlet - the pressure required to move the rod should be consistent throughout its travel.

G. If the alignment rod is not centered with the tip inlet, loosen the upper heater block mounting screw ONLY.

H. Pivot the heater block until the alignment rod is centered with the tip inlet.

I. Firmly hold the heater block in position and tighten the heater block mounting screw.
J. Move the toggle bar to the full left position and remove the alignment rod.
K. Using a $^7/_{64}$″ allen wrench, loosen the model and support heater block clamp screws.
L. Remove the model and support tips.

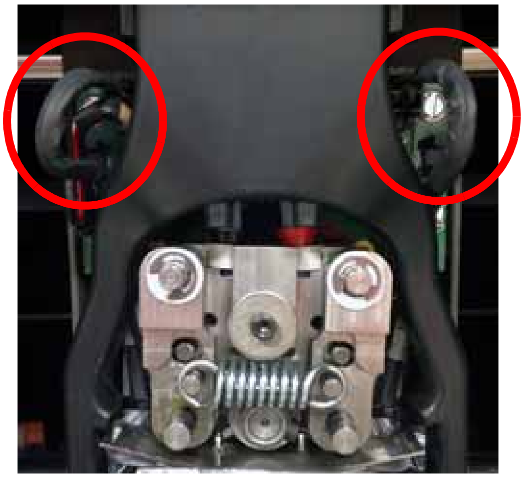
4. Reassemble the toggle head, see Reassemble the Toggle Plate Assembly on page 4-138.

Reassemble the Toggle Plate Assembly

1. Reinstall the heat shield.
2. Install the model and support tips.
3. Check and adjust the brush/flicker height, see Adjusting Brush/Flicker Height (1200) on page 5-50.
4. Reconnect the filament tubes to the top of the toggle plate assembly - make sure the model tube is on the right; the support tube on the left.
5. Reinstall the air plenum.

Caution: Ensure the head heater wires are not pinched behind the air plenum when reinstalling air plenum. If wires are not properly routed, they can be cut by the sensor flags causing the head to short.

Figure 4-177: Heater wire placement



6. Reinstall the head cover.
7. Reinstall the right side panel, see Installing the Side Panels on page 4-6.
8. Reinstall the rear panel, see Installing the Rear Panel on page 4-5.
9. Perform the Z Calibration and XY Tip Offset procedure, see Adjusting Z Calibration and XY Tip Offset on page 5-2.

Note: Follow the head installation checklist after completing toggle plate assembly replacement, see Toggle Plate Assembly Installation Checklist on page 9-4.

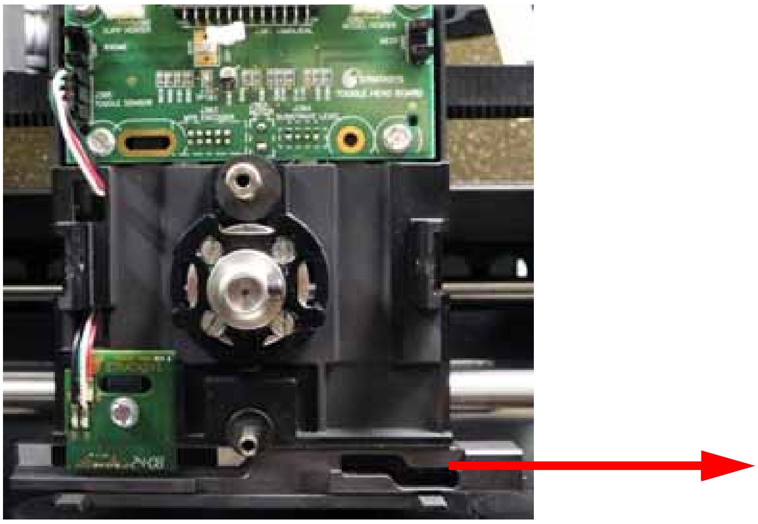
Head Toggle Bar

Removing the Toggle Bar

Caution: Do not lubricate the toggle bar. Clean only with a dry cloth. Be careful not to damage the reflective tape.

1. Remove the toggle plate assembly, see "Removing the 1200 Toggle Plate Assembly" on page 4-109 or "Removing the 1200es Toggle Plate Assembly" on page 4-117.
2. Remove the toggle bar by sliding it to the right, see Figure 4-178.

Figure 4-178: Location of Components Behind Toggle Plate Assembly



Slide toggle bar out to the right

Installing the Toggle Bar

Caution: Do not lubricate the toggle bar. Clean only with a dry cloth. Be careful not to damage the reflective tape.

1. Slide the toggle bar behind the toggle bar sensor from the right side.
2. Reinstall the toggle plate assembly, see "Installing the 1200 Toggle Plate Assembly" on page 4-114 or Installing the 1200es Toggle Plate Assembly on page 4-122.

Note: It is not necessary to perform the drive wheel alignment or the idler wheel adjustment procedures when only the toggle bar has been replaced. However, the Liquefier Alignment and (for SST) the Support Filament Guide Alignment must be performed.

3. Reinstall the right side panel, see Installing the Side Panels on page 4-6.
4. Reinstall the rear panel, see Installing the Rear Panel on page 4-5.
5. Perform the Z Calibration and XY Tip Offset procedure, see Offset Calibrations on page 5-2.

Head Toggle Sensor

Required Tools

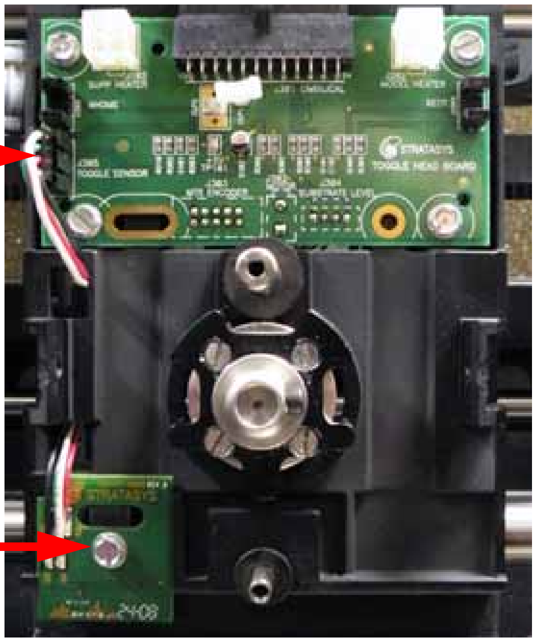
- $^1/_4$" nut driver or standard screwdriver

Removing the Toggle Sensor

1. Remove the toggle plate assembly, see "Removing the 1200 Toggle Plate Assembly" on page 4-109 or "Removing the 1200es Toggle Plate Assembly" on page 4-117.
2. Remove the toggle bar, see Removing the Toggle Bar on page 4-139.
3. Disconnect the toggle sensor electrical connector from the head board, see Figure 4-179.
4. Using a $^1/_4$" nut driver or standard screwdriver, remove the toggle sensor retaining screw and toggle sensor. See Figure 4-179.

Figure 4-179: Toggle sensor location

Toggle sensor connector



Toggle sensor mounting screw

Installing the Toggle Sensor

1. Route the wires of the toggle bar sensor in the translator housing and position the toggle sensor.
2. Install and tighten the toggle sensor retaining screw.
3. Reconnect the toggle sensor electrical lead to the head board.
4. Reinstall the toggle bar, see Installing the Toggle Bar on page 4-139.
5. Reinstall the toggle plate assembly, see "Installing the 1200 Toggle Plate Assembly" on page 4-114 or Installing the 1200es Toggle Plate Assembly on page 4-122.
6. Reinstall the right side panel, see Installing the Side Panels on page 4-6.
7. Reinstall the rear panel, see Installing the Rear Panel on page 4-5.

1200 Head Board

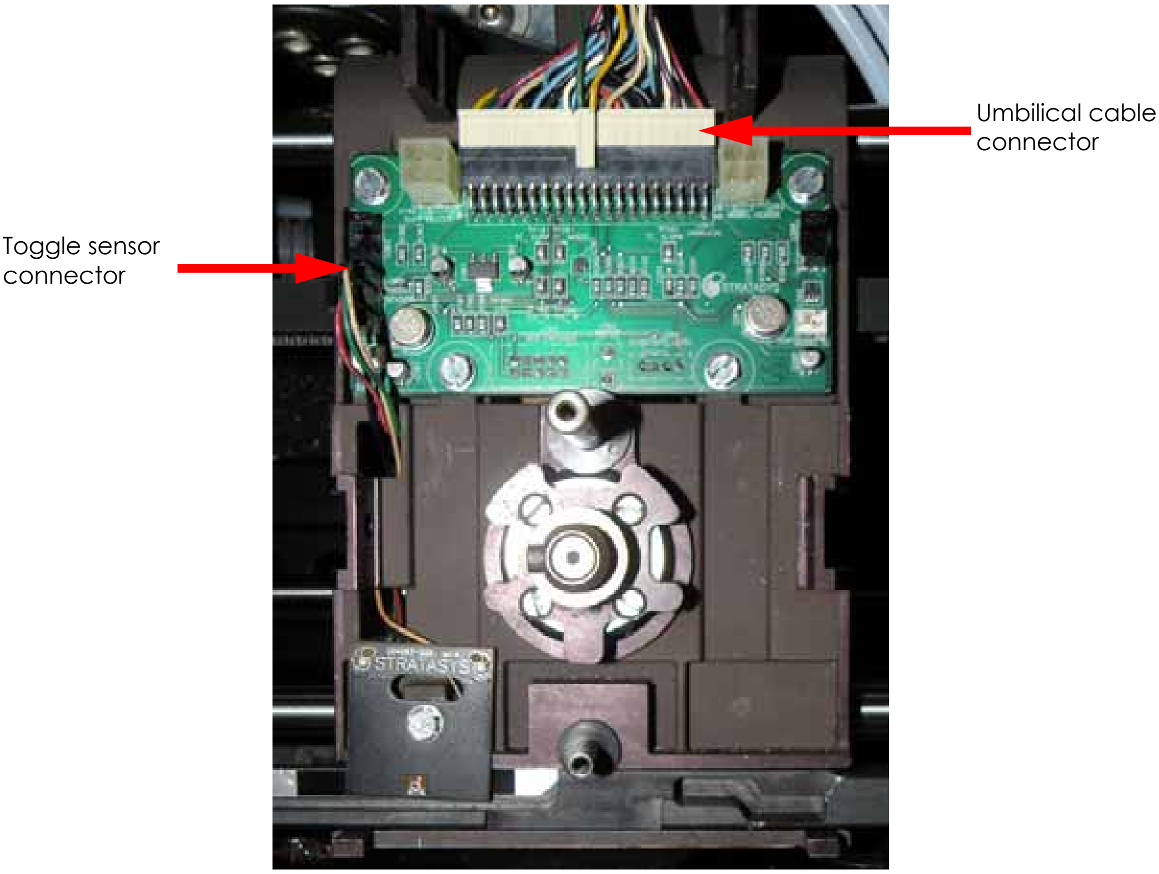
Required Tools

- ¼″ nut driver or standard screwdriver

Removing the Head Board

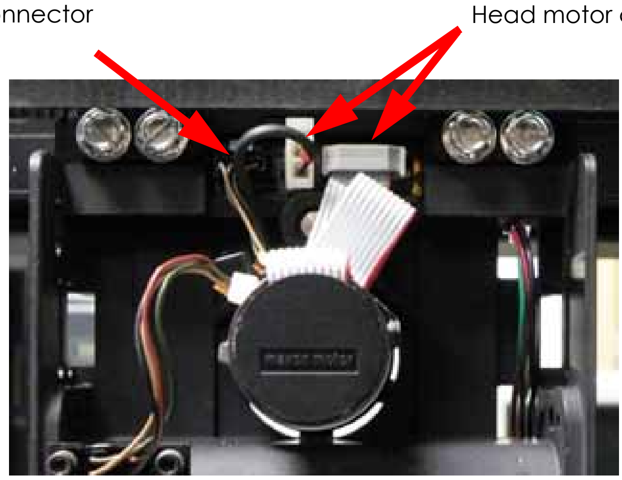
1. Remove the toggle plate assembly, see Removing the 1200 Toggle Plate Assembly on page 4-109.
2. Disconnect the toggle sensor electrical lead from the head board by pressing the tab in and pulling upward, see Figure 4-180.
3. Disconnect the umbilical cable lead from the head board by pressing the tab in and pulling outward, see Figure 4-180.

Figure 4-180: Head board detail



4. Disconnect the three electrical connectors (2 from motor, one from Z level assembly) on rear of the head board, see Figure 4-181.

Figure 4-181: Head board rear connections



5. Using a $\frac{1}{4}$″ nut driver or standard screwdriver, remove the 4 head board mounting screws and remove the head board, see Figure 4-182.

Figure 4-182: Head board mounting screw locations

Installing the Head Board

1. Position the head board on the front side of the translator.
2. Using a $\frac{1}{4}$″ nut driver or standard screwdriver, reinstall the 4 head board mounting screws.
3. Reconnect the three electrical connectors to the rear of the head board.
4. Reconnect the umbilical cable lead to the head board.
5. Reconnect the toggle sensor electrical lead to the head board.
6. Reinstall the toggle plate assembly, see Installing the 1200 Toggle Plate Assembly on page 4-114.
7. Reinstall the right side panel, see Installing the Side Panels on page 4-6.
8. Reinstall the rear panel, see Installing the Rear Panel on page 4-5.

1200es Head Board

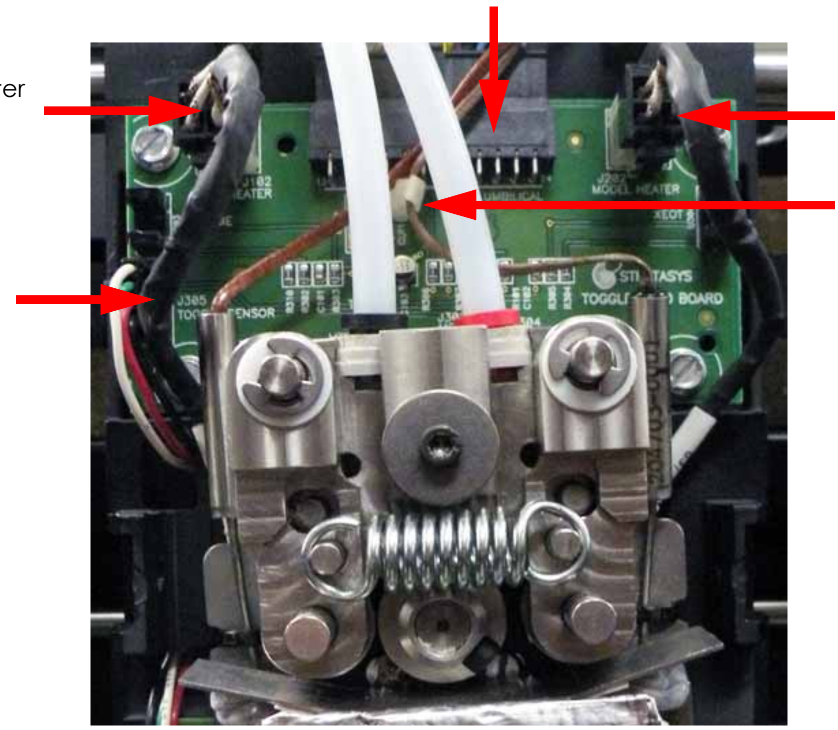
Required Tools

- $^{1}/_{4}$" nut driver or standard screwdriver

Removing the Head Board

1. Power down the printer.
2. Disconnect the toggle sensor electrical lead from the head board by pressing the tab in and pulling outward, see Figure 4-183.
3. Disconnect the model and support heater cables from the head board by pressing the tabs in and pulling outward, see Figure 4-183.
4. Disconnect the umbilical cable lead from the head board by pressing the tab in and pulling upward, see Figure 4-183.
5. Remove the model and support thermocouple wires from the retaining clip in the center of the head board, see Figure 4-183.

Figure 4-183: Head board connections



6. Disconnect the three electrical connectors (2 from motor, one from Z level assembly) on rear of the head board, see Figure 4-184.

Figure 4-184: Head board rear connections

7. Using a $\frac{1}{4}$″ nut driver or standard screwdriver, remove the 4 head board mounting screws and remove the head board, see Figure 4-185.

Figure 4-185: Head board mounting screw locations

Installing the Head Board

1. Position the head board on the front side of the translator.
2. Using a $\frac{1}{4}$″ nut driver or standard screwdriver, reinstall the 4 head board mounting screws.
3. Reconnect the three electrical connectors to the rear of the head board.
4. Reconnect the umbilical cable lead to the head board.
5. Reconnect the toggle sensor electrical lead to the head board.
6. Reconnect the model and support heater cables to the head board.
7. Place the model and support thermocouple wires into the thermocouple wire retaining clip.

1200es TC Amp Board

Required Tools

- $^1/_4$" nut driver or standard screwdriver

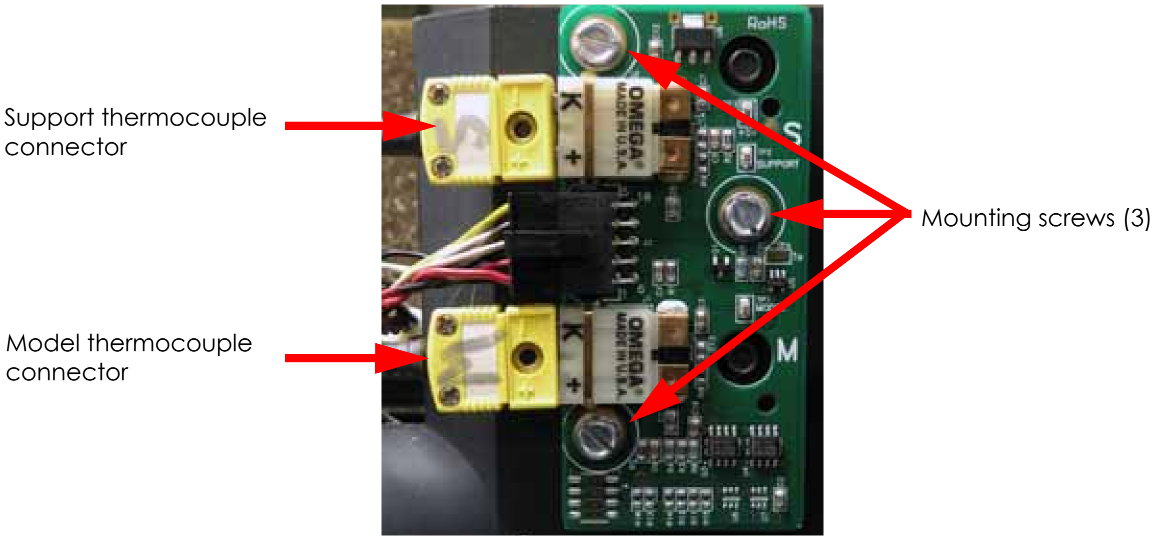
Removing the TC Amp Board

1. Power down the printer.
2. Remove the rear panel, see Removing the Rear Panel on page 4-5.
3. Remove the side panels, see Removing the Side Panels on page 4-6.
4. Disconnect the model and support thermocouple wires from the TC Amp board by pulling outwards, see Figure 4-186.

Note: The model and support thermocouple connectors are labeled. Model is labeled with an M and support is labeled with an S.

5. Disconnect the umbilical cable lead from the TC Amp board, see Figure 4-186.
6. Using a $^1/_4$" nut driver or standard screwdriver, remove the 3 TC Amp board mounting screws, see Figure 4-186.
7. Remove the TC Amp board.

Figure 4-186: 1200es TC Amp board detail



Installing the TC Amp Board

1. Position the TC Amp board on the back side of the translator.
2. Using a $^1/_4$" nut driver or standard screwdriver, reinstall the 3 TC Amp Board mounting screws.
3. Reconnect the umbilical cable connector to the TC Amp board.
4. Reconnect the model and support thermocouple connectors to the TC Amp board, see Figure 4-186.

Head Motor

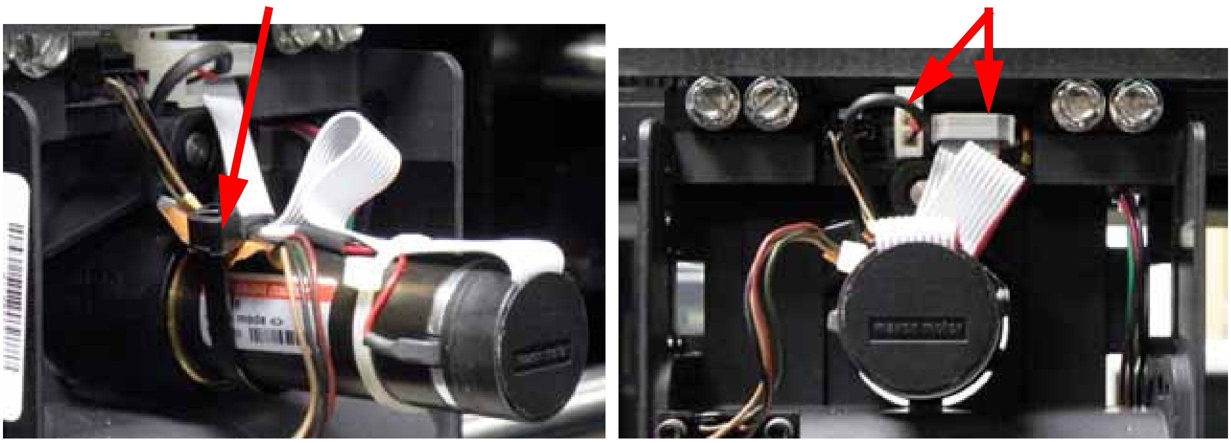
Required Tools

- $\frac{7}{64}$" Allen wrench
- Standard screwdriver
- Cutters
- Wire tie
- LocTite 222

Removing the Head Motor

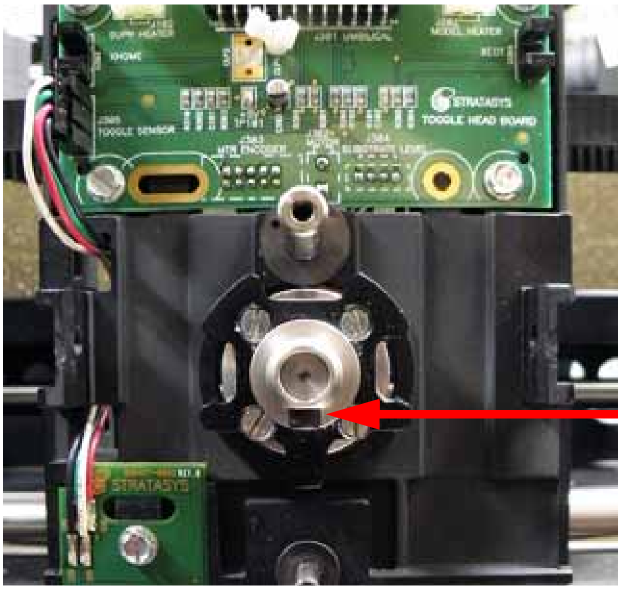
1. Remove the toggle plate assembly, see "Removing the 1200 Toggle Plate Assembly" on page 4-109 or Removing the 1200es Toggle Plate Assembly on page 4-117.
2. Cut and remove the forward wire tie that secures the motor harness to the motor housing, see Figure 4-187.
3. Disconnect the 2 motor electrical connections from rear of head board, see Figure 4-187.

Figure 4-187: Head board rear connections



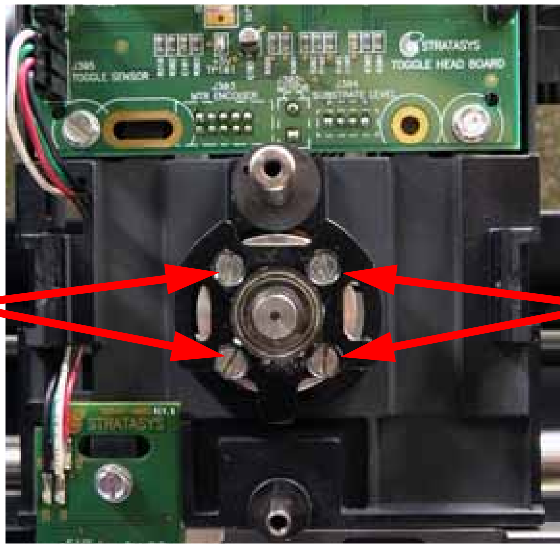
4. Using a $\frac{1}{4}$" allen wrench, remove the filament drive wheel set screw and the filament drive wheel, see Figure 4-188.

Figure 4-188: Drive wheel set screw location



5. Using a standard screwdriver, remove the 4 motor mounting screws while carefully removing the motor from the translator, see Figure 4-189.

Figure 4-189: Head motor mounting screw locations



Installing the Head Motor

1. Position the head motor onto the rear of the translator. Orient the head motor so the electrical leads are on the top side.
2. Apply LocTite 222 to the 4 head motor mounting screws. Install and tighten the screws.

Caution: Be careful when applying LocTite. Do not get LocTite on other components.

3. Install the filament drive wheel and filament drive wheel set screw - do not tighten the set screw at this time.
4. Connect the head motor electrical leads to the back of the head board.
5. Install and tighten the head motor wire tie- cut off the excess.
6. Install the toggle plate assembly, see "Installing the 1200 Toggle Plate Assembly" on page 4-114 or Installing the 1200es Toggle Plate Assembly on page 4-122.

Note: The toggle plate assembly installation procedure requires the accomplishment of a head alignment. The filament drive wheel is aligned as a part of this procedure. See Liquefier, Drive Wheel and Filament Guide Alignment on page 4-123.

Z Level Assembly (Z Foam Sensor)

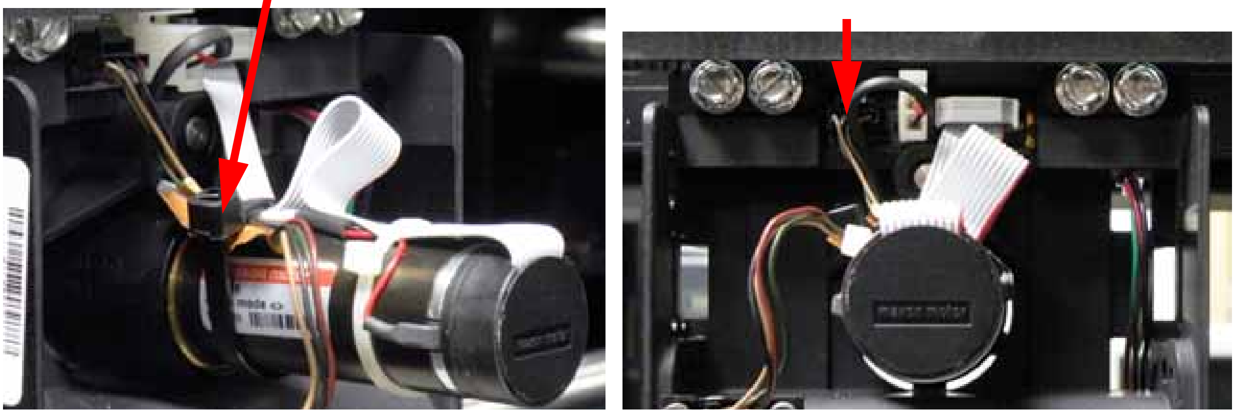
Required Tools

- $^{3}/_{32}$″ allen wrench
- Wire ties
- Soft rag
- Small brush

Removing the Z Foam Sensor

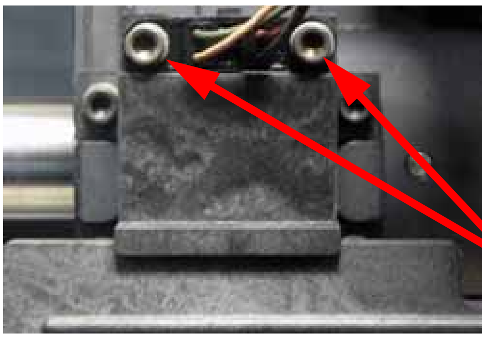
1. Power down the printer.
2. Remove the rear panel, see Removing the Rear Panel on page 4-5.
3. Remove the right side panel, see Removing the Side Panels on page 4-6.
4. Cut and remove the wire tie that holds the Z foam sensor lead to head motor, see Figure 4-190.
5. Disconnect the Z foam sensor from the head board, see Figure 4-190.

Figure 4-190: Wire tie location



6. Using a $^{3}/_{32}$″ allen wrench, remove the 2 Z foam sensor mounting screws and lock washers, see Figure 4-191.

Figure 4-191: Z foam sensor mounting screw locations



7. Remove the Z foam sensor and discard.

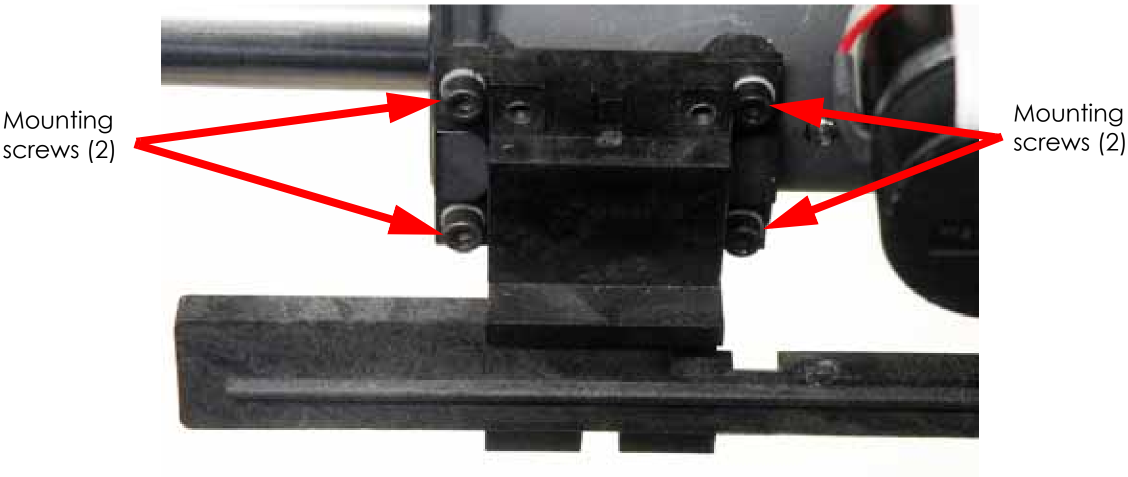
Installing the Z Foam Sensor

1. Align the sensor with the mounting holes and use a $^{3}/_{32}$″ allen wrench to reinstall the 2 mounting screws.
2. Reconnect the Z foam sensor to the back side of the head board.
3. Reinstall a wire tie around the Z foam sensor wire and the head motor.

Removing the Z Level Assembly

1. Remove the Z foam sensor, see Removing the Z Foam Sensor on page 4-149.
2. Using a $^{3}/_{32}$″ allen wrench, remove the 4 Z level assembly mounting screws, see Figure 4-192.

Figure 4-192: Z level assembly mounting screw locations

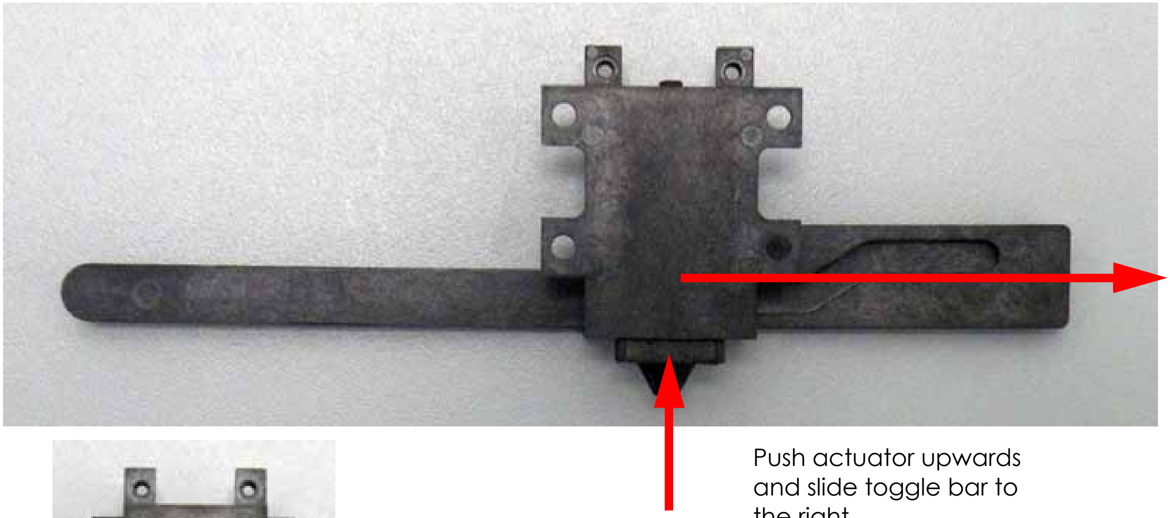


3. Carefully remove the Z level assembly - the Z foam sensor toggle bar will remain attached to the assembly.

Disassembling the Z Level Assembly

1. Position the Z Level Assembly toggle bar so that the sensor pin groove opening is aligned with the sensor pin, see Figure 4-193.
2. Press up on the actuator to make the pin clear the toggle bar slot, see Figure 4-193.
3. Remove the toggle bar.
4. Remove the actuator and spring.

Figure 4-193: Z Level Assembly Disassembly



Push actuator upwards and slide toggle bar to the right

Housing disassembled

Cleaning the Z Level Assembly

This procedure should be performed as part of routine maintenance and before doing any additional troubleshooting, if you encounter:

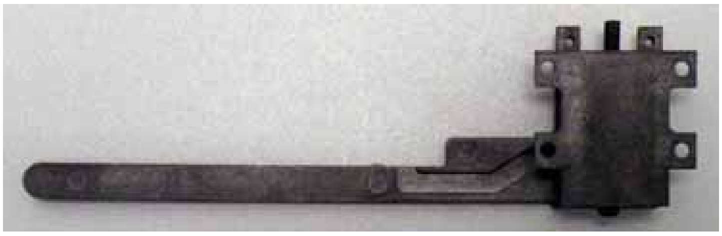
- Parts built too far above or deep into the foam or substrate.
- Z level sensor does not change states (this will cause a failure during the “finding foam or substrate” sequence).

1. With the actuator, spring and arm removed, use a soft rag and small brush to clean the actuator and arm. Ensure to thoroughly clean the recessed track (groove) in the arm.
2. Using a soft rag and brush, clean the Z level assembly.

Assembling the Z Level Assembly

1. Place spring back in position onto the actuator.
2. Slide the actuator assembly up into the housing.
3. Push actuator upward until bottom (point) of actuator is flush with the bottom of the housing.
4. Position the toggle bar with the track (groove) facing towards the front of the printer (thin part of arm to the left).
5. While still holding the actuator up, slide the arm sideways into the right side of the housing about 2 inches (5 cm).
6. Slowly release (lower) the actuator. The actuator will NOT distend fully.
7. Continue sliding the arm to the left until the actuator "snaps" into place.
8. To check for proper operation, continue to push the toggle bar to the left until the actuator retracts into housing. Push toggle bar back and forth several times to ensure proper operation. (Actuator should move up and down freely).
9. Push arm to the left until end of travel is reached.

Figure 4-194: Z level assembly retracted



Installing the Z Level Assembly

1. Align the Z level assembly with the mounting holes on the translator.
2. Using a $^3/_{32}$" allen wrench, reinstall the 4 Z level assembly mounting screws.
3. Reinstall the Z foam sensor, see Installing the Z Foam Sensor on page 4-150.
4. Reinstall the right side panel, see Installing the Side Panels on page 4-6.
5. Reinstall the rear panel, see Installing the Rear Panel on page 4-5.
6. Perform Z calibration, see Z Calibration on page 5-2.

1200 Umbilical Cable

Required Tools

- $^{3}/_{32}$″ Allen wrench
- $^{5}/_{32}$″ Allen wrench
- $^{5}/_{16}$″ Nut driver or standard screwdriver
- Wire ties
- Grounding wrist strap

ESD: Wear a grounding wrist strap when performing this procedure.

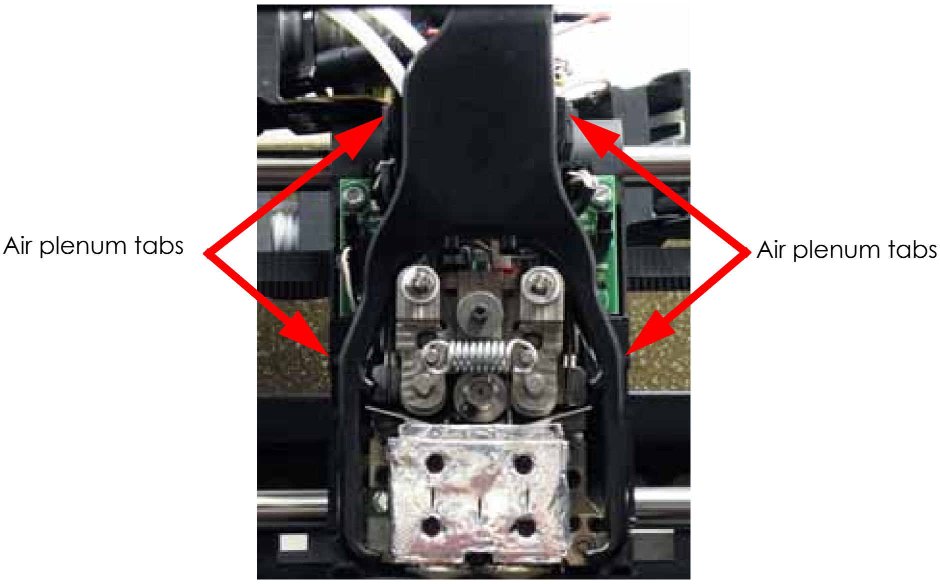
Removing the Umbilical Cable

1. Unload model and support material.
2. Power down the printer.
3. Remove the rear panel, see Removing the Rear Panel on page 4-5.
4. Remove the right side panel, see Removing the Side Panels on page 4-6.
5. Remove the head cover by squeezing the raised pads on sides of cover, see Figure 4-195.

Figure 4-195: Removing the head cover

6. Remove the air plenum by pressing in on clips to release from translator. Work the air plenum free of umbilical hose at top, see Figure 4-196.

Figure 4-196: Removing the air plenum

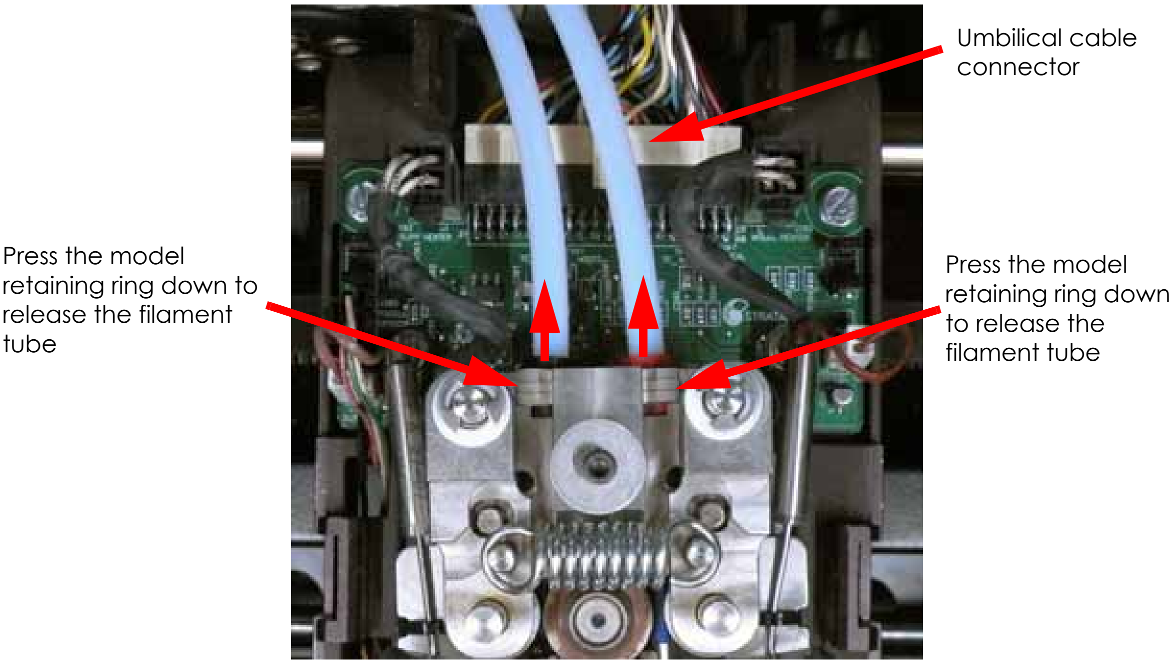


7. Disconnect the filament tubes from the top of the toggle plate assembly, by pressing down on the tube retaining clips to free the tubes, see Figure 4-197.

Note: Mark the tubes for material type to facilitate assembly.

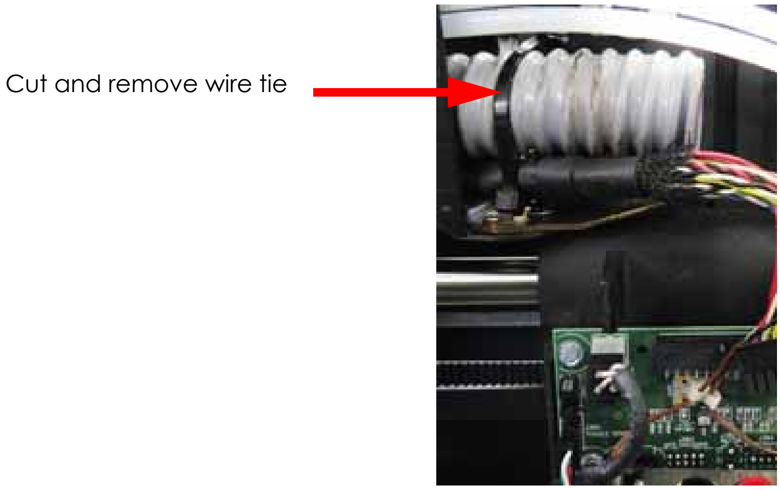
8. Disconnect the umbilical cable from the head board by pressing the tab in and pulling upward, see Figure 4-197.

Figure 4-197: Head detail



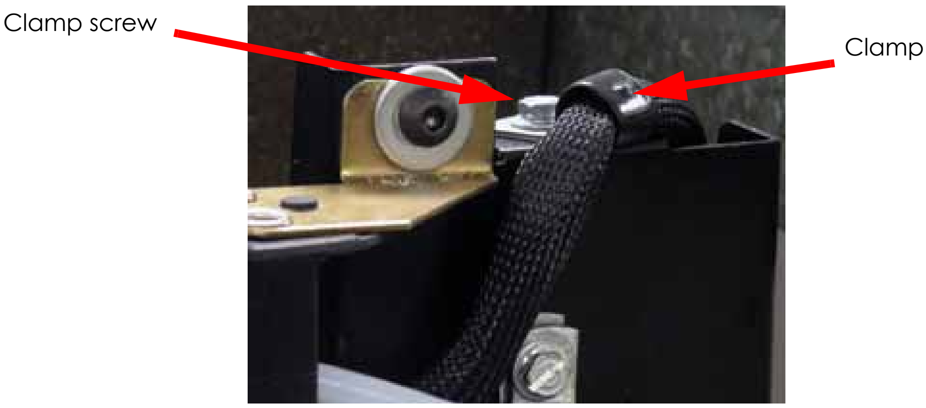
9. Using a cutters, cut and remove the wire tie from around the umbilical cable and umbilical hose at the translator, see Figure 4-198.

Figure 4-198: Wire tie location



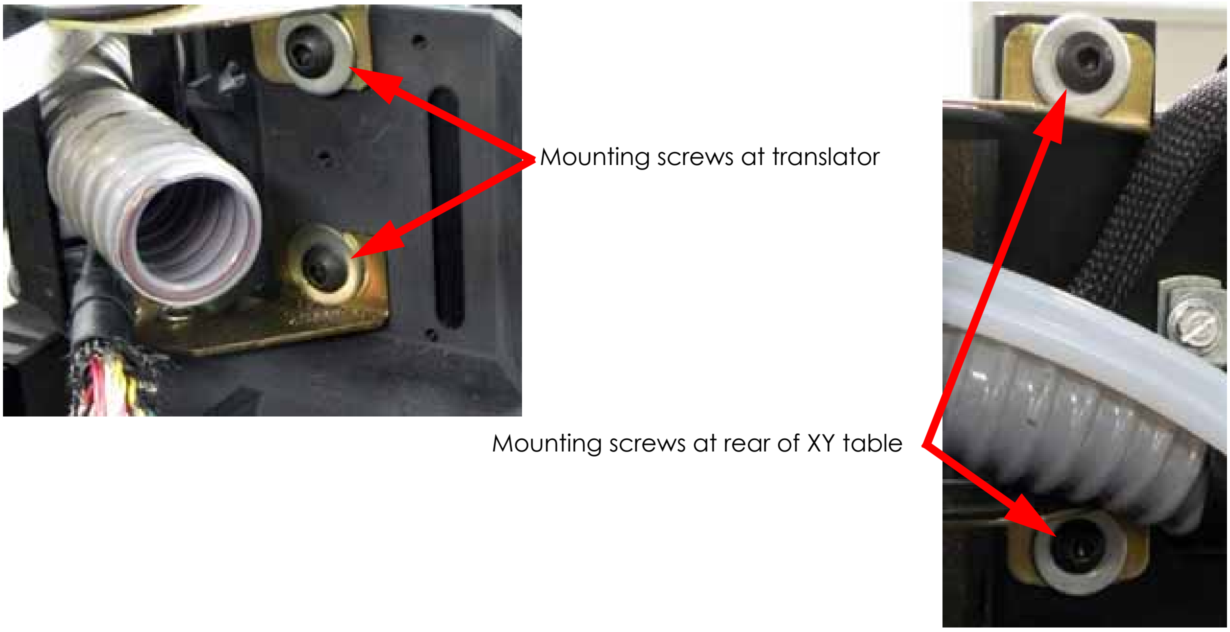
10. Using a $^5/_{16}$" nut driver or standard screwdriver, remove the clamp that is holding the umbilical cable at the right rear corner. Remove the umbilical cable from the clamp and set the clamp aside, see Figure 4-199.

Figure 4-199: Umbilical cable clamp location



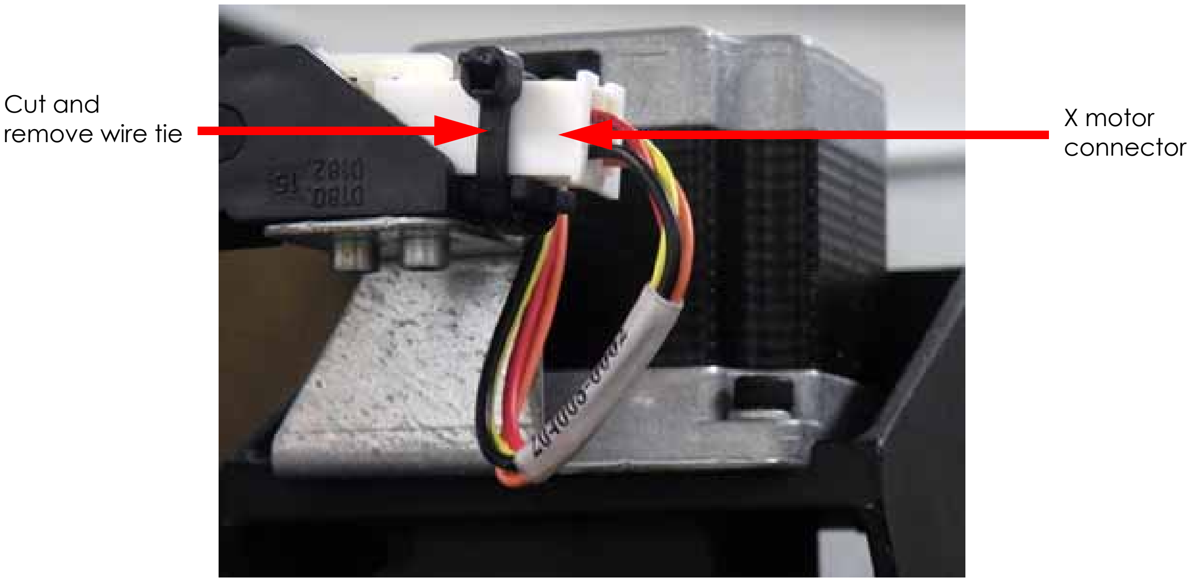
11. Using a $^5/_{32}$" allen wrench, remove the 2 energy chain mounting screws from the translator, see Figure 4-200.
12. Using a $^5/_{32}$" allen wrench, remove the 2 energy chain mounting screws from the XY table, see Figure 4-200.

Figure 4-200: Energy chain mounting screw locations



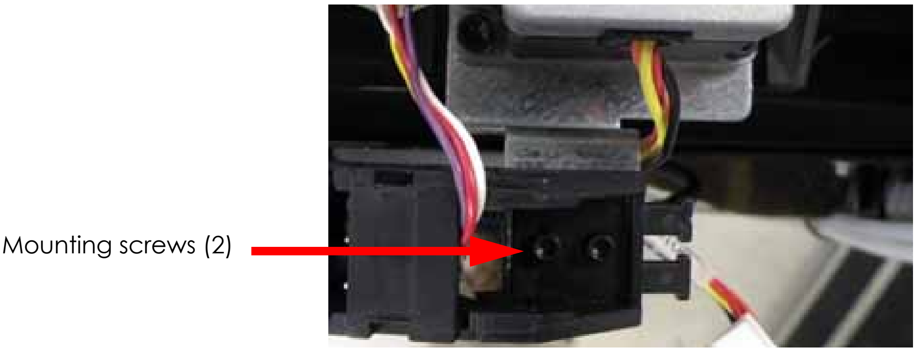
13. Straighten the energy chain and pull the umbilical cable out to remove.
14. Using a cutters, cut the wire tie holding the X motor electrical connector and disconnect the X motor, see Figure 4-201.
15. Disconnect the X motor by pressing the tab in and pulling the connector apart, see Figure 4-201.

Figure 4-201: X motor wire tie location



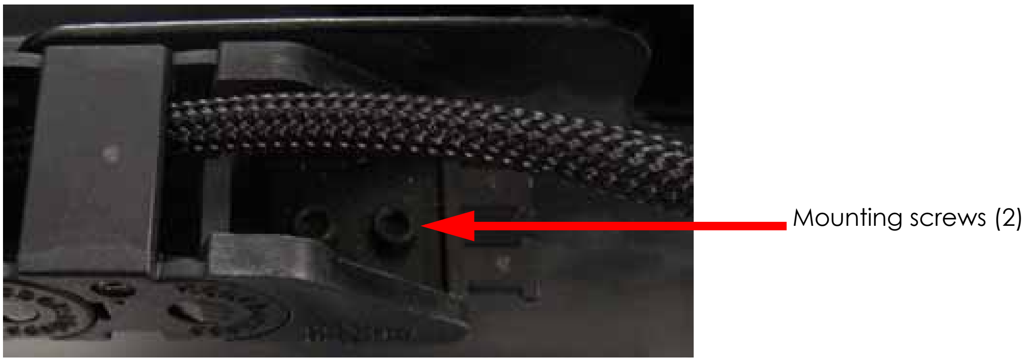
16. Using a $^{3}/_{32}$" allen wrench, remove the upper 2 X motor energy chain mounting screws, see Figure 4-202.

Figure 4-202: X motor energy chain upper mounting screw locations



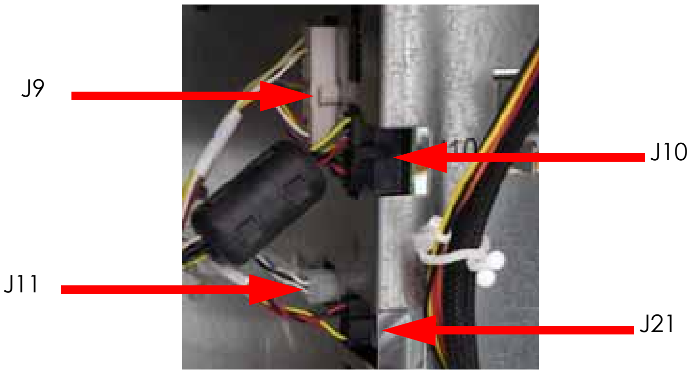
17. Using a $^{3}/_{32}$" allen wrench, remove the lower 2 X motor energy chain mounting screws, see Figure 4-203.

Figure 4-203: X motor energy chain lower mounting screw locations



18. Straighten the X motor energy chain and pull the X motor cable out to remove.
19. Unclip the wire clips on the side of the printer and remove the X motor cable and umbilical cable from the clips.
20. Disconnect the umbilical cable and X motor cable from J9, J10, J11 and J21 at the back of the power distribution board, see Figure 4-204.

Figure 4-204: Cable connector locations

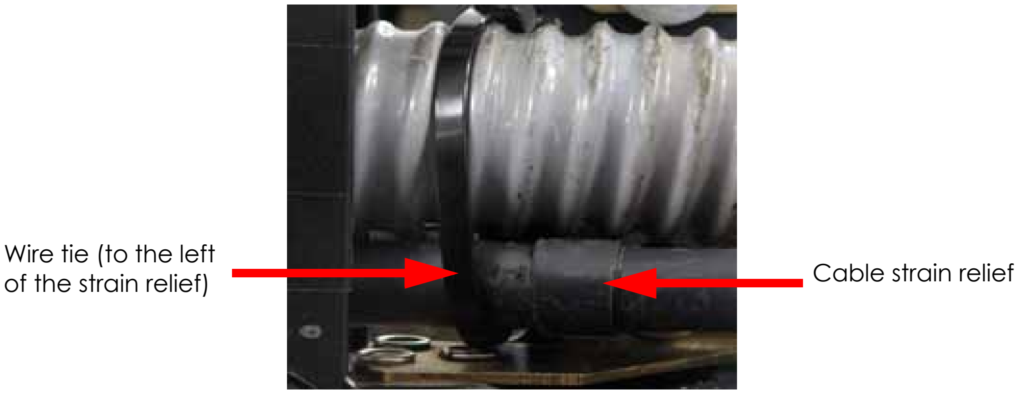


21. Note the routing of the umbilical cable and X motor lead and remove them from the printer.

Installing the Umbilical Cable

1. Connect the umbilical cable and X motor cable to the PDB connectors - J9, J10, J11 and J21.
2. Route the umbilical cable and X motor cable as noted during removal and through their respective energy chains.
3. Align the X motor energy chain with the mounting holes and use a $^{3}/_{32}$" allen wrench to re-install the mounting screws.
4. Reconnect the X motor cable and install a wire tie around the connector.
5. Align the umbilical cable energy chain with the rear mounting holes and use a $^{5}/_{32}$" allen wrench to reinstall the 2 mounting screws.
6. Place the wire clamp around the umbilical cable and use a $^{5}/_{16}$" nut driver or standard screwdriver to reinstall the mounting screw.
7. Align the umbilical cable energy chain with the translator mounting holes and use a $^{5}/_{32}$" allen wrench to reinstall the 2 mounting screws.
8. Reconnect the umbilical cable to the head board.
9. Reinstall a wire tie around the umbilical cable and umbilical hose. Be sure to place the wire tie to the left of the umbilical cable strain relief, this is very important to keep the umbilical cable from becoming disconnected, see Figure 4-205.

Figure 4-205: Umbilical cable wire tie location

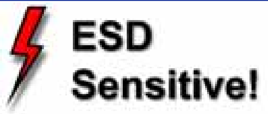


10. Attach the 2 filament tubes to the top of the toggle plate assembly.
11. Reinstall the air plenum.
12. Reinstall the head cover.
13. Reinstall the right side panel, see Installing the Side Panels on page 4-6.
14. Reinstall the rear panel, see Installing the Rear Panel on page 4-5.
15. Power up the printer.
16. Load model and support material.
17. Test system for proper operation.

1200es Umbilical Cable

Required Tools

- $^{3}/_{32}$″ Allen wrench
- $^{5}/_{32}$″ Allen wrench
- $^{5}/_{16}$″ Nut driver or standard screwdriver
- Wire ties
- Grounding wrist strap



ESD: Wear a grounding wrist strap when performing this procedure.

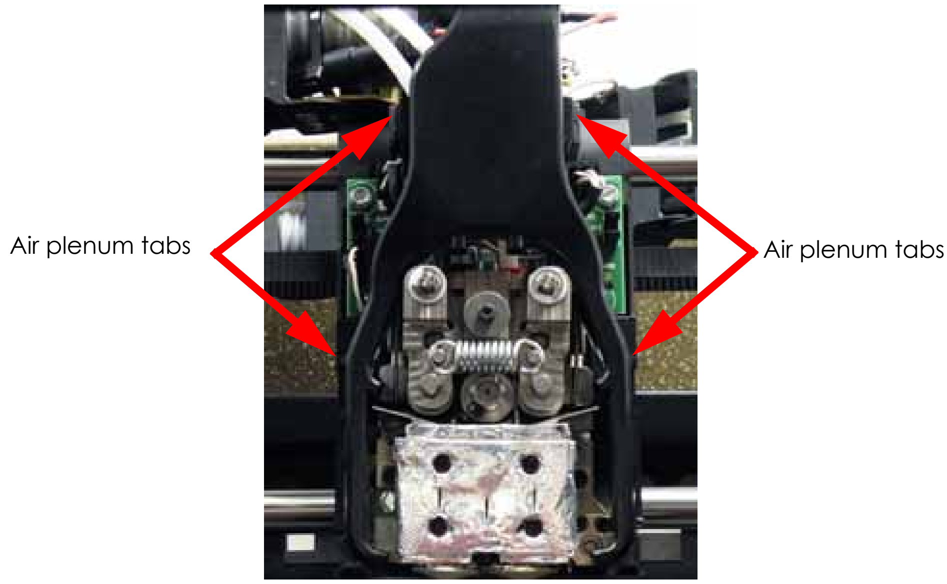
Removing the Umbilical Cable

1. Unload model and support material.
2. Power down the printer.
3. Remove the rear panel, see Removing the Rear Panel on page 4-5.
4. Remove the right side panel, see Removing the Side Panels on page 4-6.
5. Remove the head cover by squeezing the raised pads on sides of cover, see Figure 4-206.

Figure 4-206: Removing the head cover

6. Remove the air plenum by pressing in on clips to release from translator. Work the air plenum free of umbilical hose at top, see Figure 4-207.

Figure 4-207: Removing the air plenum

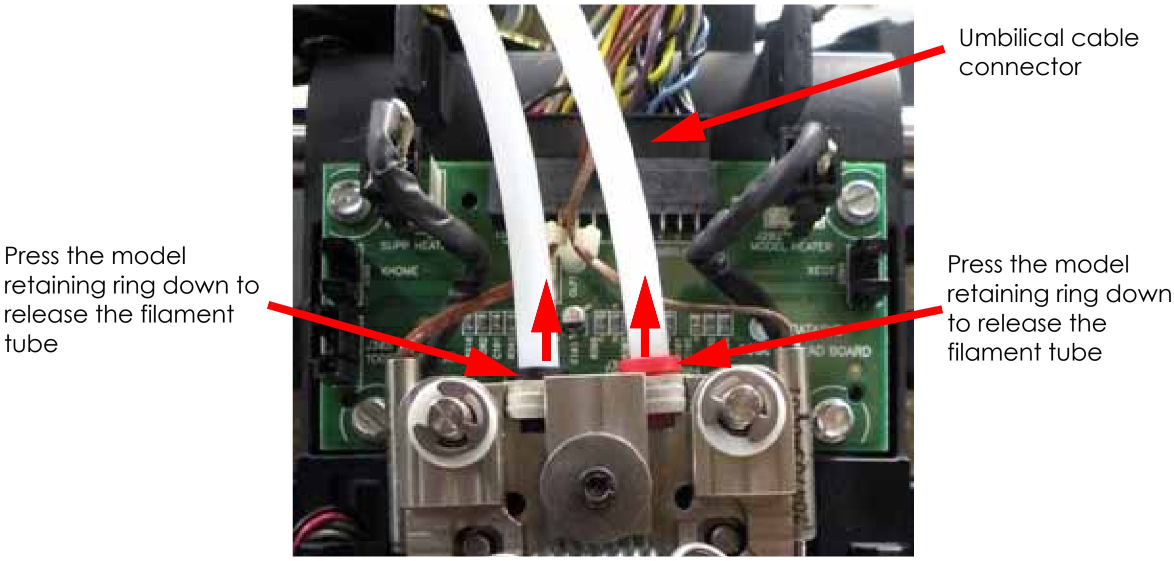


7. Disconnect the filament tubes from the top of the toggle plate assembly, by pressing down on the tube retaining clips to free the tubes, see Figure 4-197.

Note: Mark the tubes for material type to facilitate assembly.

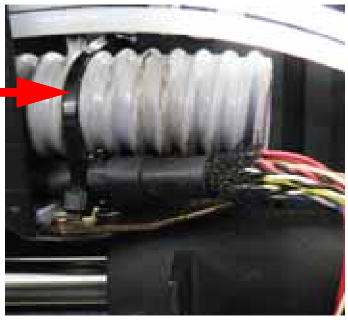
8. Disconnect the umbilical cable from the head board by pressing the tab in and pulling upward, see Figure 4-197.

Figure 4-208: Head detail



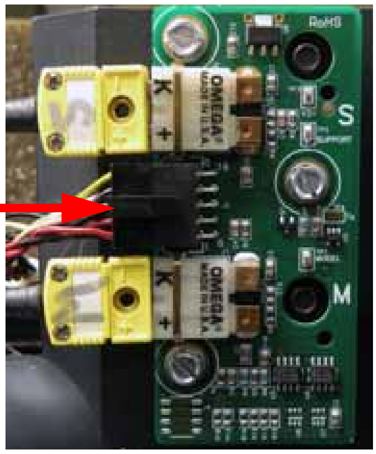
9. Using a cutters, cut and remove the wire tie from around the umbilical cable and umbilical hose at the translator, see Figure 4-198.

Figure 4-209: Wire tie location



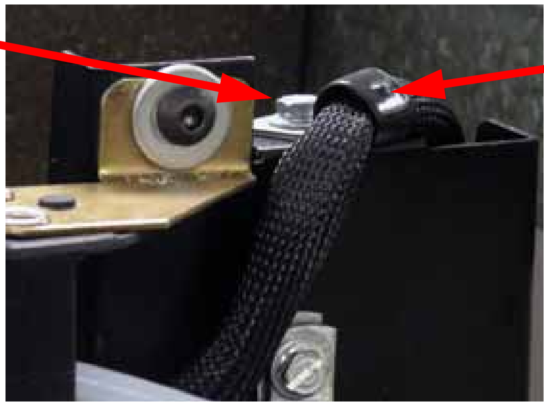
10. Disconnect the umbilical cable from the TC amp board by pressing the tab in and pulling outwards, see Figure 4-210.

Figure 4-210: TC amp board detail



11. Using a $^{5}/_{16}$″ nut driver or standard screwdriver, remove the clamp that is holding the umbilical cable at the right rear corner. Remove the umbilical cable from the clamp and set the clamp aside, see Figure 4-211.

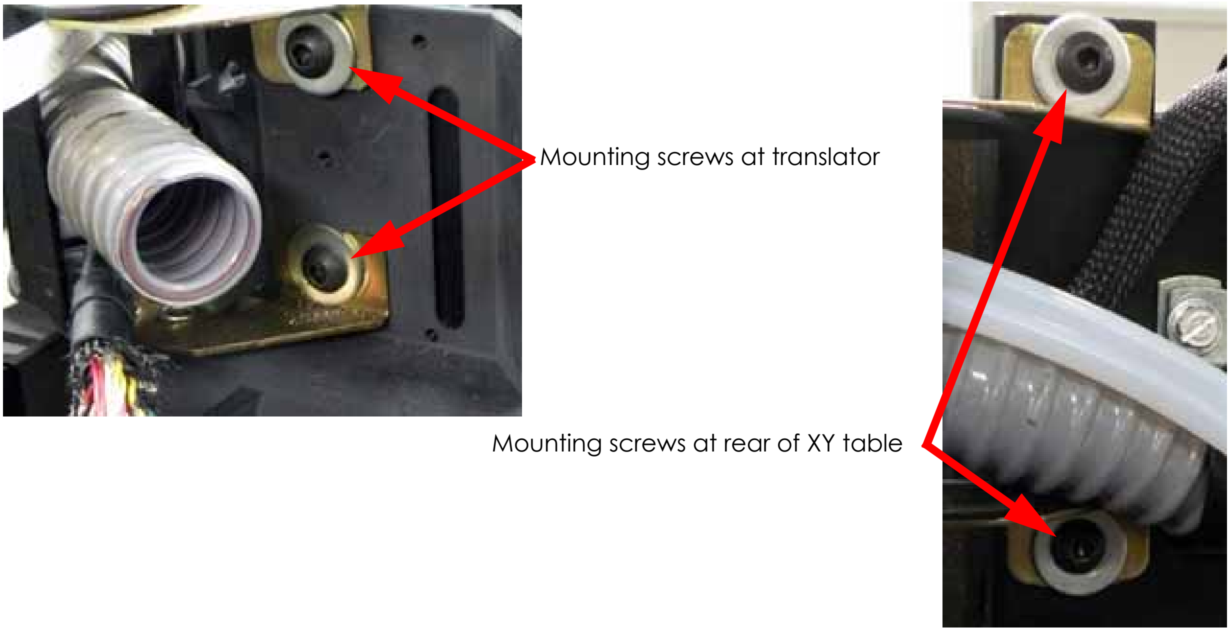
Figure 4-211: Umbilical cable clamp location



12. Using a $^{5}/_{32}$″ allen wrench, remove the 2 energy chain mounting screws from the translator, see Figure 4-200.

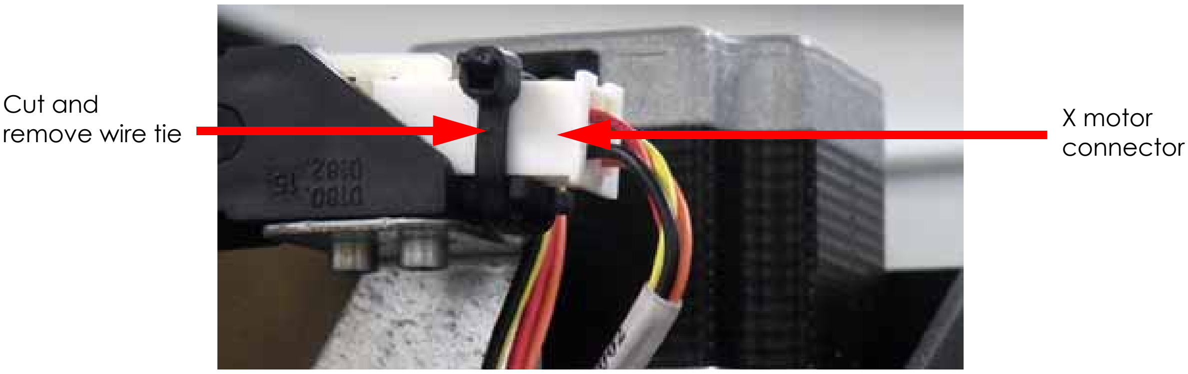
13. Using a $^{5}/_{32}$″ allen wrench, remove the 2 energy chain mounting screws from the XY table, see Figure 4-200.

Figure 4-212: Energy chain mounting screw locations



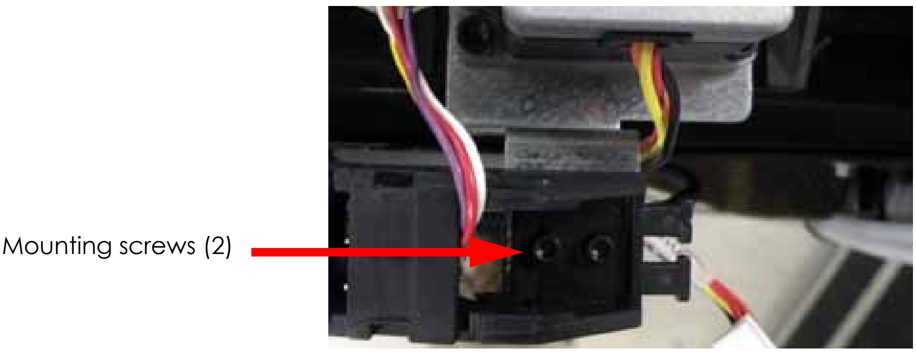
14. Straighten the energy chain and pull the umbilical cable out to remove.
15. Using a cutters, cut the wire tie holding the X motor electrical connector and disconnect the X motor, see Figure 4-201.
16. Disconnect the X motor by pressing the tab in and pulling the connector apart, see Figure 4-201.

Figure 4-213: X motor wire tie location



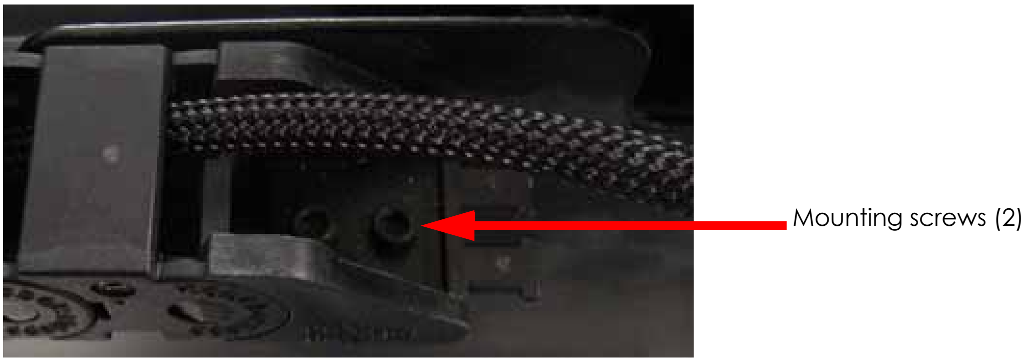
17. Using a $^{3}/_{32}$″ allen wrench, remove the upper 2 X motor energy chain mounting screws, see Figure 4-202.

Figure 4-214: X motor energy chain upper mounting screw locations



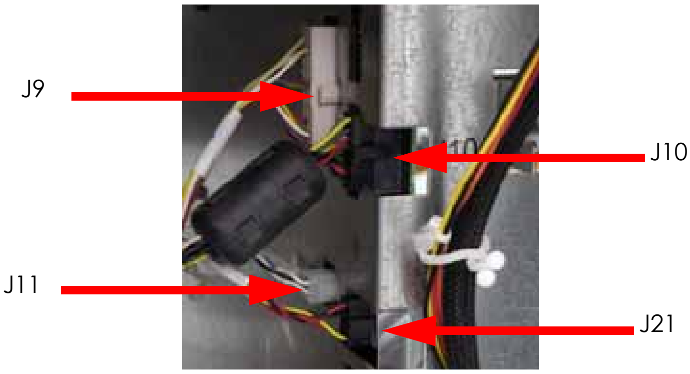
18. Using a $^3/_{32}$" allen wrench, remove the lower 2 X motor energy chain mounting screws, see Figure 4-203.

Figure 4-215: X motor energy chain lower mounting screw locations



19. Straighten the X motor energy chain and pull the X motor cable out to remove.
20. Unclip the wire clips on the side of the printer and remove the X motor cable and umbilical cable from the clips.
21. Disconnect the umbilical cable and X motor cable from J9, J10, J11 and J21 at the back of the power distribution board, see Figure 4-204.

Figure 4-216: Cable connector locations

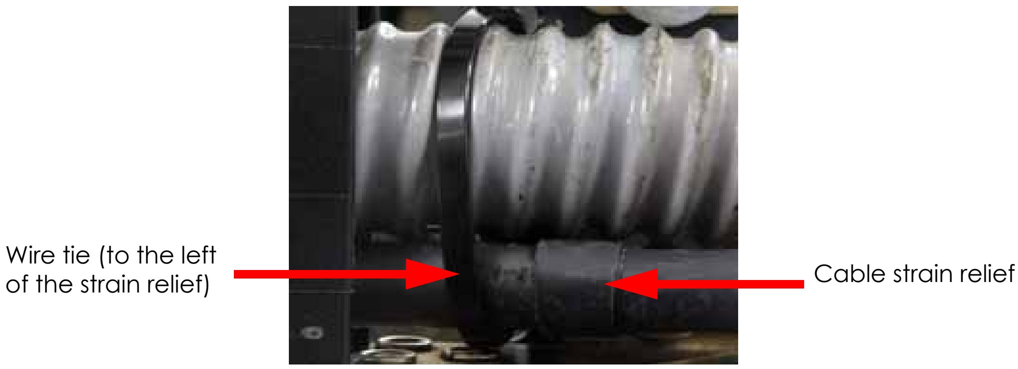


22. Note the routing of the umbilical cable and X motor lead and remove them from the printer.

Installing the Umbilical Cable

1. Connect the umbilical cable and X motor cable to the PDB connectors - J9, J10, J11 and J21.
2. Route the umbilical cable and X motor cable as noted during removal and through their respective energy chains.
3. Align the X motor energy chain with the mounting holes and use a $\frac{3}{32}$″ allen wrench to re-install the mounting screws.
4. Reconnect the X motor cable and install a wire tie around the connector.
5. Align the umbilical cable energy chain with the rear mounting holes and use a $\frac{5}{32}$″ allen wrench to reinstall the 2 mounting screws.
6. Place the wire clamp around the umbilical cable and use a $\frac{5}{16}$″ nut driver or standard screwdriver to reinstall the mounting screw.
7. Align the umbilical cable energy chain with the translator mounting holes and use a $\frac{5}{32}$″ allen wrench to reinstall the 2 mounting screws.
8. Reconnect the umbilical cable to the head board.
9. Reconnect the umbilical cable to the TC amp board.
10. Reinstall a wire tie around the umbilical cable and umbilical hose. Be sure to place the wire tie to the left of the umbilical cable strain relief, this is very important to keep the umbilical cable from becoming disconnected, see Figure 4-205.

Figure 4-217: Umbilical cable wire tie location



11. Attach the 2 filament tubes to the top of the toggle plate assembly.
12. Reinstall the air plenum.
13. Reinstall the head cover.
14. Reinstall the right side panel, see Installing the Side Panels on page 4-6.
15. Reinstall the rear panel, see Installing the Rear Panel on page 4-5.
16. Power up the printer.
17. Load model and support material.
18. Test system for proper operation.

Head Cooling Fan

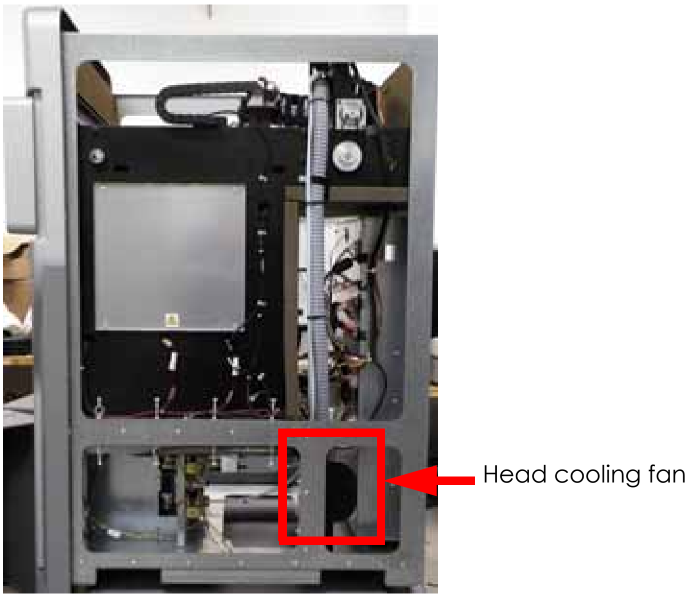
Required Tools

- $^{7}/_{64}$″ Allen wrench

Removing the Head Cooling Fan

1. Power down the printer.
2. Remove the rear panel, see Removing the Rear Panel on page 4-5.
3. Remove the right side panel, see Removing the Side Panels on page 4-6.
4. Locate the head cooling fan, see Figure 4-218.

Figure 4-218: Head cooling fan location

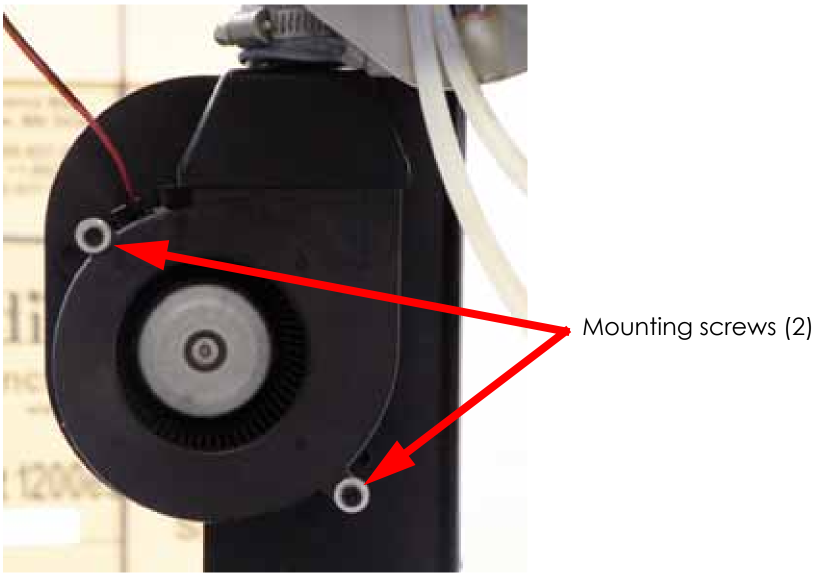


5. Disconnect the head cooling fan by pressing the tab in and pulling the connector apart, see Figure 4-219.

Figure 4-219: Head cooling fan connector location

6. Using a $^{7}/_{64}$″ allen wrench, remove the 2 head cooling fan mounting screws, see Figure 4-220.

Figure 4-220: Head cooling fan mounting screw locations



7. Remove the screws and washers while carefully removing the motor.

Installing the Head Cooling Fan

1. Position the head cooling fan with the inlet facing away from the mounting bracket, see Figure 4-220.
2. Using a $^{7}/_{64}$" allen wrench, reinstall the flat washers and retaining screws.
3. Reconnect the head cooling fan connector.
4. Reinstall the right side panel, see Installing the Side Panels on page 4-6.
5. Reinstall the rear panel, see Installing the Rear Panel on page 4-5.

XY Table Components

X Home Sensor and X EOT Sensor

The X home sensor and X EOT sensor are built into the head board. Replacement of a sensor can only be accomplished by replacing the head board, see "1200 Head Board" on page 4-141 or 1200es Head Board on page 4-143.

X Motor

Required Tools

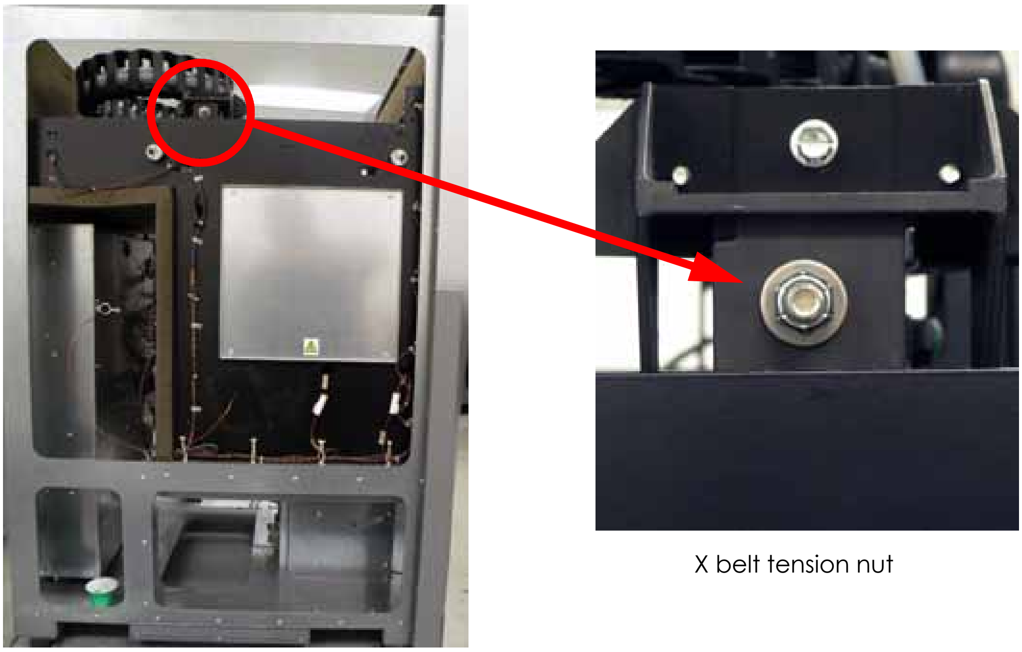
- $^{9}/_{64}$" Allen wrench
- $^{1}/_{2}$" Nut driver or box wrench
- Cutters

Removing the X Motor

1. Power down the printer.
2. Remove the rear panel, see Removing the Rear Panel on page 4-5.
3. Remove the side panels, see Removing the Side Panels on page 4-6.
4. Using a $^{1}/_{2}$" nut driver or box wrench, loosen the X drive belt tension, see Figure 4-221.

> **Note:** The X drive belt does not have to be removed, but reducing the belt tension will facilitate removal and installation.

Figure 4-221: X drive belt tension nut location

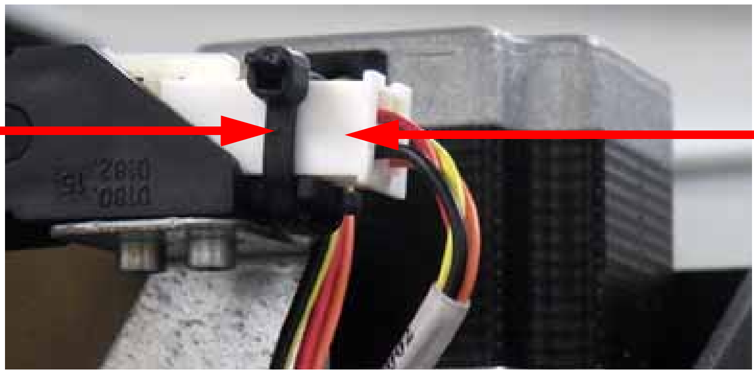


X belt tension nut

5. Using a cutters, cut and remove the wire tie from around the X motor connector, see Figure 4-222.

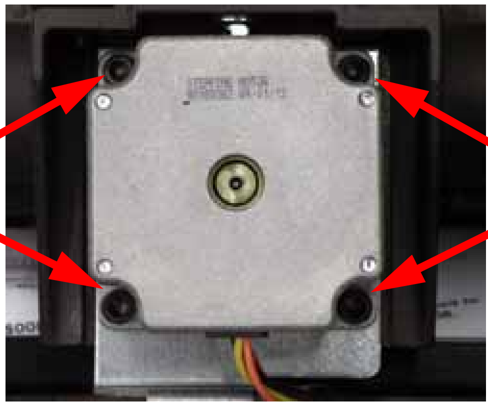
6. Disconnect the X motor cable by pressing the tab in and pulling outward, see Figure 4-222.

Figure 4-222: X motor wire tie location



7. Using a $^{9}/_{64}$" allen wrench, remove the 4 X motor mounting screws, see Figure 4-223.

Figure 4-223: X motor mounting screw locations



8. Remove the X motor and discard.

Installing the X Motor

1. Align the X motor with the mounting holes so that the wires are facing the outer side of the printer and the motor gear shaft bearing is seated properly in place.
2. Place the X drive belt around the X motor drive gear.
3. Using a $^{9}/_{64}$" allen wrench, reinstall the 4 X motor mounting screws and washers.
4. Reconnect the X motor cable.
5. Install a wire tie around the X motor connector.
6. Check and adjust the X drive belt tension, see Tension X Drive Belt on page 5-26.
7. Reinstall the side panels, see Installing the Side Panels on page 4-6.
8. Reinstall the rear panel, see Installing the Rear Panel on page 4-5.

X Drive Belt

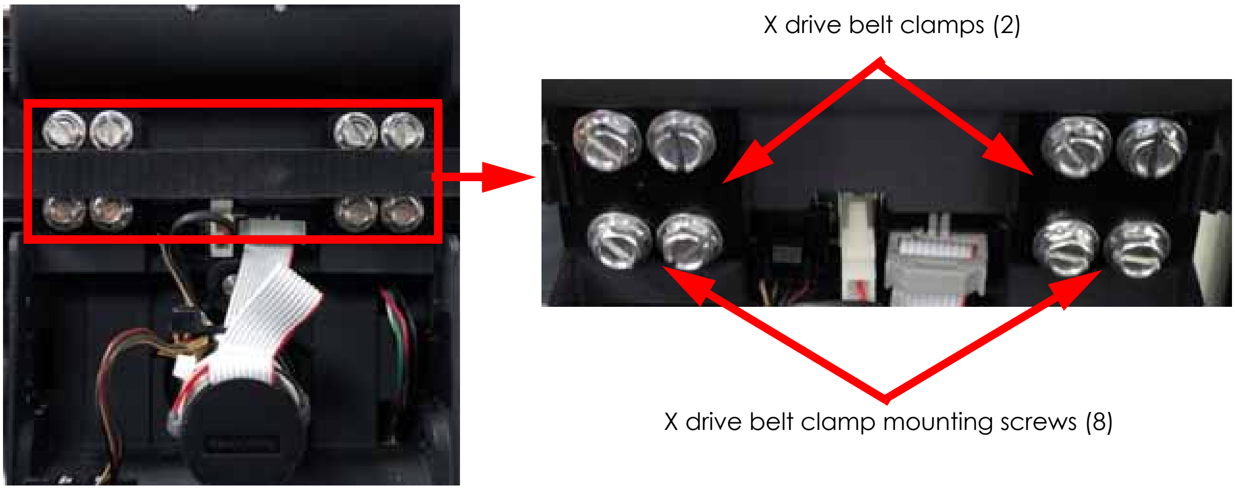
Required Tools

- $^{5}/_{16}$″ Nut driver or standard screwdriver

Removing the X Drive Belt

1. Power down the printer.
2. Remove the rear panel, see Removing the Rear Panel on page 4-5.
3. Remove the side panels, see Removing the Side Panels on page 4-6.
4. Using a $^{5}/_{16}$″ nut driver or standard screwdriver, remove the 2 X drive belt clamp mounting screws. There are 4 mounting screws on each clamp, see Figure 4-224.

Figure 4-224: X drive belt clamp mounting screw locations



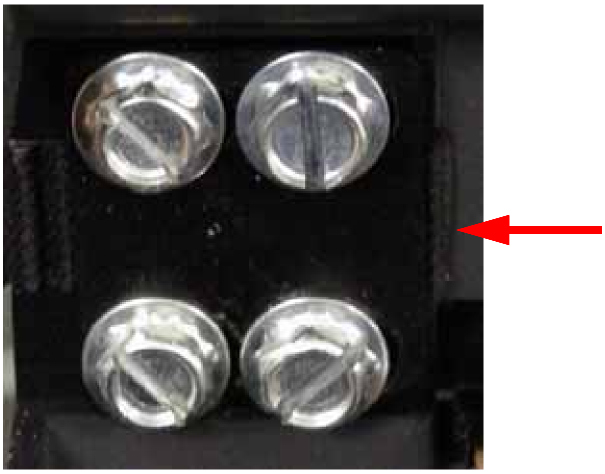
5. Remove the X drive belt by feeding it past the X motor gear and idler/tension gear.

Installing the X Drive Belt

1. Feed the X drive belt around the X motor gear and around the idler/tension gear.
2. Attach one end of belt with clamp - install belt so that one tooth can be seen beyond end of clamp, see Figure 4-225.
3. Using a $^{5}/_{16}$″ nut driver or standard screwdriver, reinstall the 4 mounting screws. See Figure 4-225.

Note: Make sure belt is installed so that teeth on belt will engage with drive/idler gears.

Figure 4-225: X drive belt installation



4. Attach the other end of the X drive belt with remaining clamp - install belt so that at least one tooth can be seen beyond end of clamp.

Note: Make sure belt is engaged on the X drive motor gear and the idler/tension gear before tightening clamp.

5. Using a $^5/_{16}$" nut driver or standard screwdriver, reinstall the 4 mounting screws.
6. Manually move the head back and forth across the envelope 2 times to make sure the belt is seated in the gear teeth and the belt tension is evenly distributed.
7. Adjust the belt tension, see Tension X Drive Belt on page 5-26.
8. Reinstall the side panels, see Installing the Side Panels on page 4-6.
9. Reinstall the rear panel, see Installing the Rear Panel on page 4-5.

Y Motor

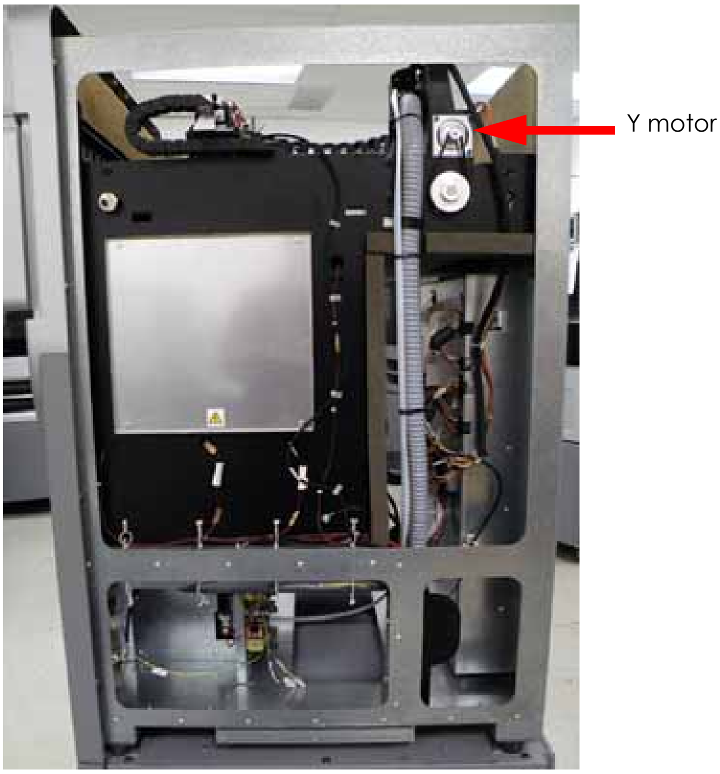
Required Tools

- $^{9}/_{64}$" Allen wrench
- Cutters
- Belt tension tool (PN 304151-0001)

Removing Y Motor and Motor Belt

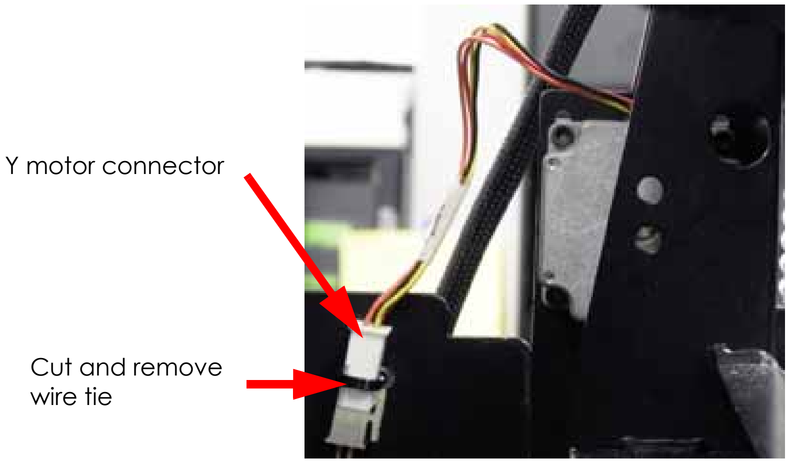
1. Power down the printer.
2. Remove the rear panel, see Removing the Rear Panel on page 4-5.
3. Remove the side panels, see Removing the Side Panels on page 4-6.
4. Locate the Y motor, see Figure 4-226.

Figure 4-226: Y motor location



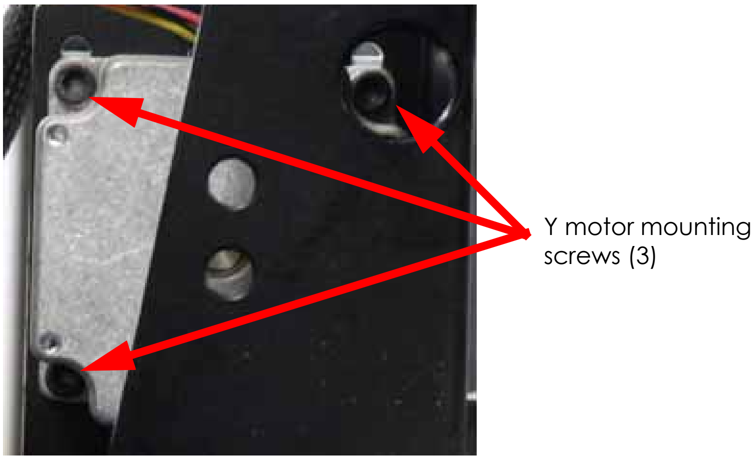
5. Cut and remove the wire tie from around the Y motor connector, see Figure 4-227.
6. Disconnect the Y motor connector by pressing the tab in and pulling apart, see Figure 4-227.

Figure 4-227: Y motor connector location



7. Using a $^9/_{64}$″allen wrench, remove the 3 Y motor mounting screws. See Figure 4-228.

Figure 4-228: Y motor mounting screw locations

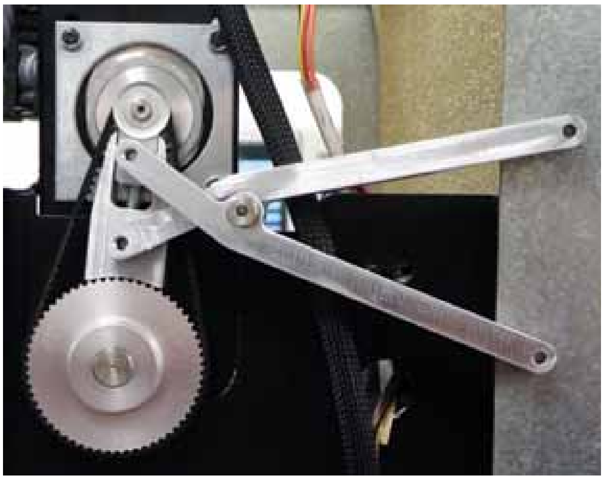


8. Remove the Y motor and Y motor belt.

Installing the Y Motor and Motor Belt

1. Align the Y motor with the mounting holes, position the motor so that the electrical leads face the rear of the printer.
2. Using a $^{9}/_{64}$"allen wrench; reinstall, but do not tighten, the 3 Y motor mounting screws.
3. Reinstall theY motor belt around the Y motor drive gear and Y drive gear.
4. Position the belt tension tool (PN 304151-0001) between the Y motor drive gear and Y drive gear as shown in Figure 4-229.

Figure 4-229: Tensioning the Y motor belt



5. Completely tighten the Y motor mounting screws.
6. Reconnect the Y motor and reinstall a wire tie around the connector.
7. Reinstall the side panels, see Installing the Side Panels on page 4-6.
8. Reinstall the rear panel, see Installing the Rear Panel on page 4-5.

Y Drive Belt

The Y drive belts are continuous belts. Unlike the X drive belt, the Y drive belts are one piece. If a Y drive belt must be replaced, replace the XY Table Assembly. See “1200 XY Table Assembly” on page 4-180 or 1200es XY Table Assembly on page 4-200.

Y Drive Assembly

The Y drive assembly is not a field replaceable item. If a new Y drive assembly is required, replace the XY table. See “1200 XY Table Assembly” on page 4-180 or 1200es XY Table Assembly on page 4-200.

Y Pulley

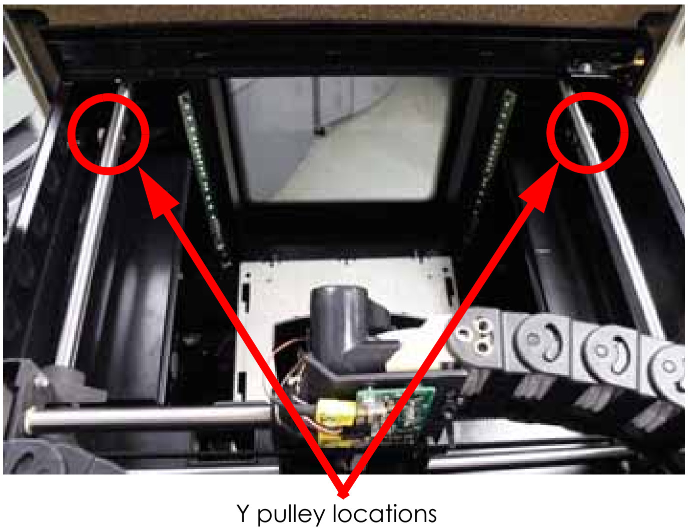
Required Tools

- $\frac{1}{2}$″ nut driver or box wrench
- $\frac{5}{16}$″ nut driver or standard screwdriver
- Needle nose piers

Removing the Y Pulley

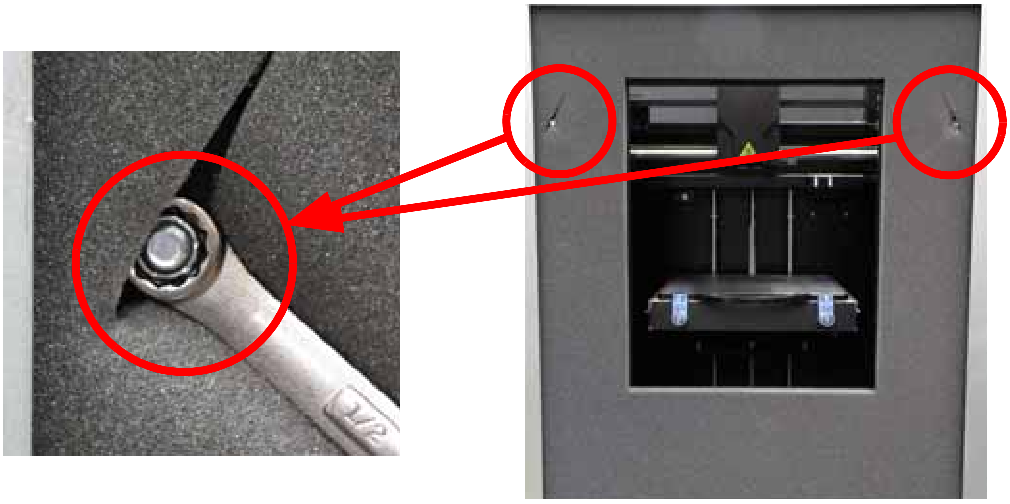
1. Power down the printer.
2. Remove the rear panel, see Removing the Rear Panel on page 4-5.
3. Remove the side panels, see Side Panels on page 4-6.
4. Remove the front bezel, see Removing the Front Bezel (Panel) on page 4-15.
5. Locate the Y pulley(s). There are two Y pulleys - replacing either one requires the same procedure, see Figure 4-230.

Figure 4-230: Y pulley locations



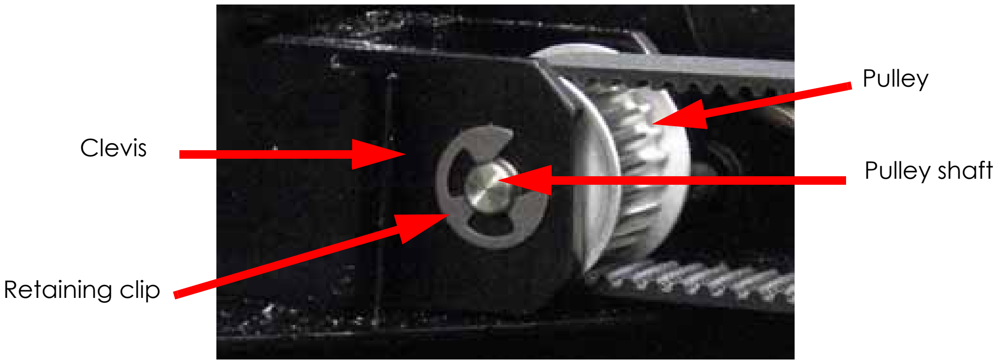
6. Using a $\frac{1}{2}$″ nut driver or box wrench, loosen the Y belt by turning the Y belt tensioning nut counter clockwise, see Figure 4-231.

Figure 4-231: Y Drive belt tension nut locations



7. Using a standard screwdriver or a needle nose pliers, remove the retaining clip from the Y axis pulley shaft. See Figure 4-232.
8. Slide the Y axis pulley shaft out from the Y pulley, see Figure 4-232.
9. Remove the Y pulley from the clevis, see Figure 4-232.

Figure 4-232: Y pulley detail



10. Remove the pulley from the Y drive belt.

Installing the Y Pulley

1. Loop the Y drive belt over the replacement pulley.
2. Position the pulley so that the pulley shaft can slide through the clevis and pulley.
3. Slide the pulley shaft through the clevis and pulley.
4. Reinstall the retaining clip. If needed, turn the Y belt tensioning screw counter clockwise to ease shaft insertion.
5. Adjust the Y drive belt tension, see Y Drive Belt on page 5-29.
6. Reinstall the front bezel, see Installing the Front Bezel on page 4-16.
7. Reinstall the side panels, see Installing the Side Panels on page 4-6.
8. Reinstall the rear panel, see Installing the Rear Panel on page 4-5.

Y Home Sensor

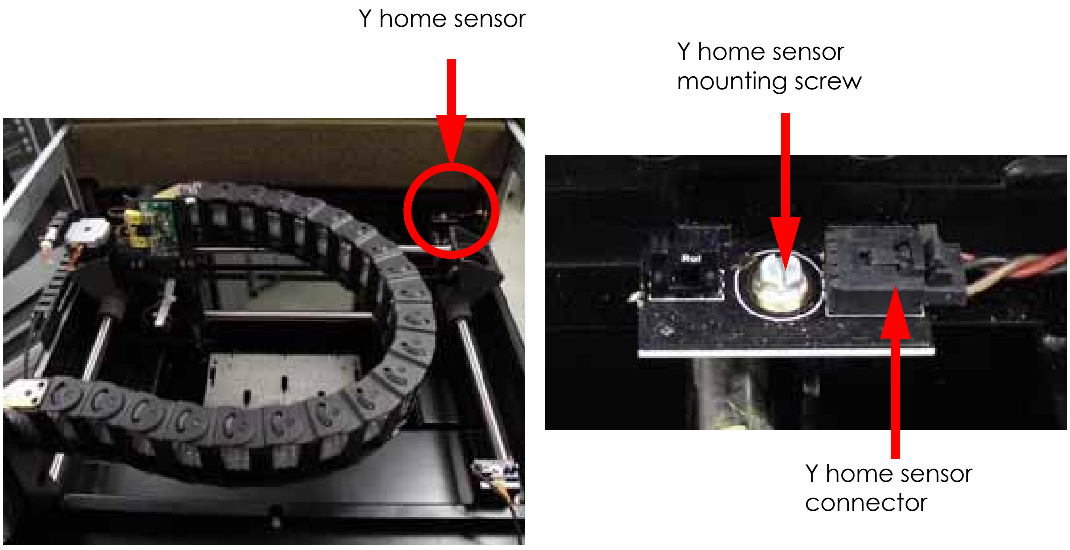
Required Tools

- $\frac{1}{4}$″ nut driver or standard screwdriver

Removing the Y Home Sensor

1. Power down the printer.
2. Remove the rear panel, see Removing the Rear Panel on page 4-5.
3. Remove the side panels, see Removing the Side Panels on page 4-6.
4. Locate the Y home sensor, see Figure 4-233.
5. Disconnect the Y home sensor by pressing the tab in and pulling apart, see Figure 4-233.
6. Using a $\frac{1}{4}$″ nut driver or standard screwdriver, remove the Y home sensor mounting screw, see Figure 4-233.

Figure 4-233: Y home sensor detail



7. Remove the sensor and discard.

Installing the Y Home Sensor

Caution: For Gen 2 Electronics, be sure to use the Y home sensor with the green circuit board and resistor. For Gen 3 Electronics, be sure to use the Y home sensor with the black circuit board, see Figure 4-234.

Figure 4-234: Y Sensor Detail

Gen 2 Y sensor

Gen 3 Y sensor

1. Align the Y home sensor with the mounting hole and use a $\frac{1}{4}$″ nut driver or standard screwdriver to reinstall the mounting screw.

Note: Be sure the sensor is facing into the center of the printer. See Figure 4-233.

2. Reconnect the Y home sensor.
3. Reinstall the side panels, see Installing the Side Panels on page 4-6.
4. Reinstall the rear panel, see Installing the Rear Panel on page 4-5.

Y EOT (End of Travel) Sensor

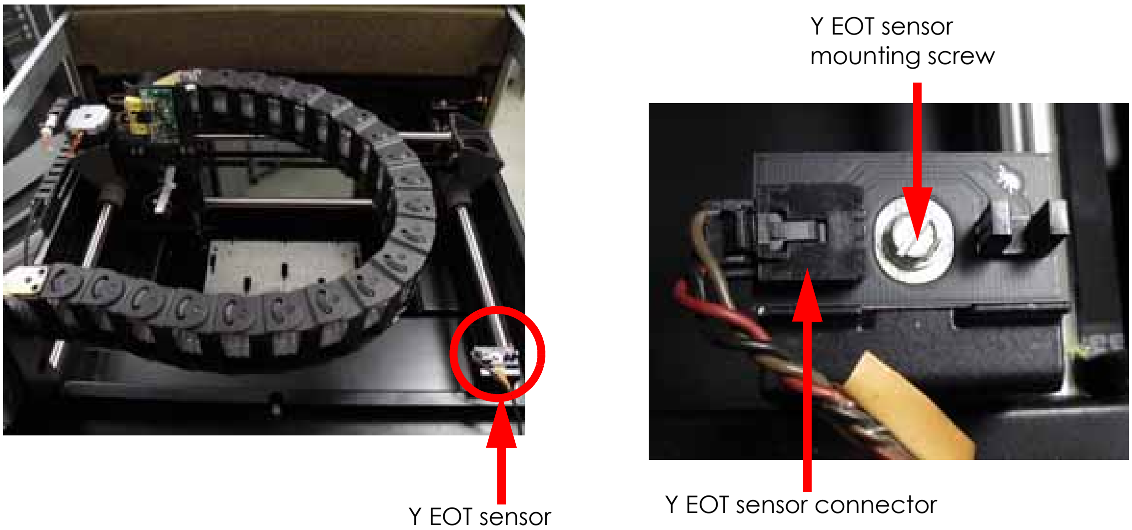
Required Tools

- $^1/_4$″ nut driver or standard screwdriver

Removing the Y EOT Sensor

1. Power down the printer.
2. Remove the rear panel, see Removing the Rear Panel on page 4-5.
3. Remove the side panels, see Removing the Side Panels on page 4-6.
4. Locate the Y EOT sensor, see Figure 4-235.
5. Disconnect the Y EOT sensor by pressing the tab in and pulling apart, see Figure 4-235.
6. Using a $^1/_4$″ nut driver or standard screwdriver, remove the Y EOT sensor mounting screw, see Figure 4-235.

Figure 4-235: Y EOT sensor detail



7. Remove the sensor and discard.

Installing the Y EOT Sensor

Caution: For Gen 2 Electronics, be sure to use the Y EOT sensor with the green circuit board and resistor. For Gen 3 Electronics, be sure to use the Y EOT sensor with the black circuit board, see Figure 4-236.

Figure 4-236: Y Sensor Detail

Gen 2 Y sensor

Gen 3 Y sensor

1. Align the Y EOT sensor with the mounting hole and use a $^1/_4$" nut driver or standard screwdriver to reinstall the mounting screw.

Note: Be sure the sensor is facing into the center of the printer. See Figure 4-235.

2. Reconnect the Y EOT sensor.
3. Reinstall the side panels, see Installing the Side Panels on page 4-6.
4. Reinstall the rear panel, see Installing the Rear Panel on page 4-5.

1200 XY Table Assembly

Parts and Tools Required

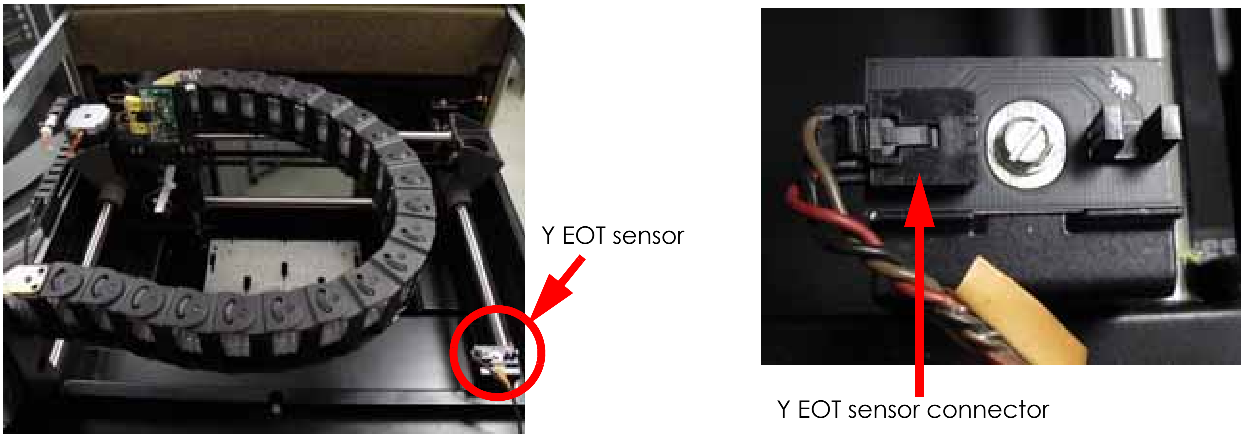
- $\frac{5}{16}$" Nut driver or standard screwdriver
- $\frac{3}{8}$" nut driver or box wrench
- $\frac{1}{2}$" nut driver or box wrench
- $\frac{3}{8}$" Allen wrench
- $\frac{7}{64}$" Allen wrench
- $\frac{5}{32}$" Allen wrench
- $\frac{3}{32}$" Allen wrench
- Cutters
- XY motor belt tension tool
- Belt tension gauge
- Head bracket
- Dial indicator
- Cam wrench or large crescent wrench

Note: After installing the XY table, follow the XY table checklist. See XY Table Installation Checklist on page 9-5.

Removing the 1200 XY Table

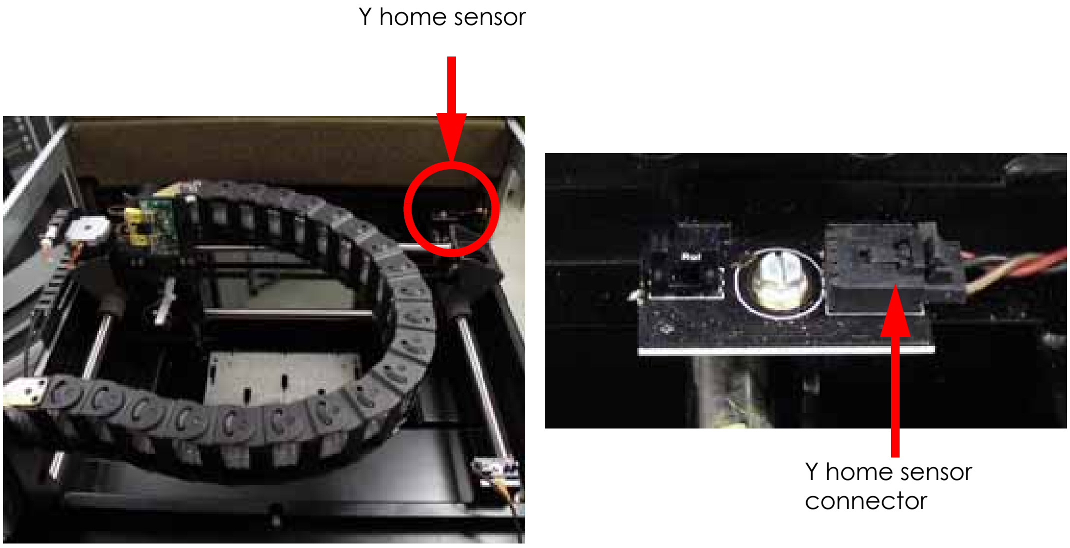
1. Power down the printer.
2. Remove the rear panel, see Removing the Rear Panel on page 4-5.
3. Remove the side panels, see Removing the Side Panels on page 4-6.
4. Remove the toggle plate assembly, see "Removing the 1200 Toggle Plate Assembly" on page 4-109.
5. Remove the toggle bar, see Removing the Toggle Bar on page 4-139.
6. Remove the toggle sensor, see Removing the Toggle Sensor on page 4-140.
7. Remove the head board, see Removing the Head Board on page 4-141.
8. Remove the Z foam sensor, see Removing the Z Foam Sensor on page 4-149.
9. Remove the Z level assembly, see Removing the Z Level Assembly on page 4-150.
10. Disconnect the Y EOT sensor by pressing the tab in and pulling apart, see Figure 4-237.

Figure 4-237: Y EOT sensor detail



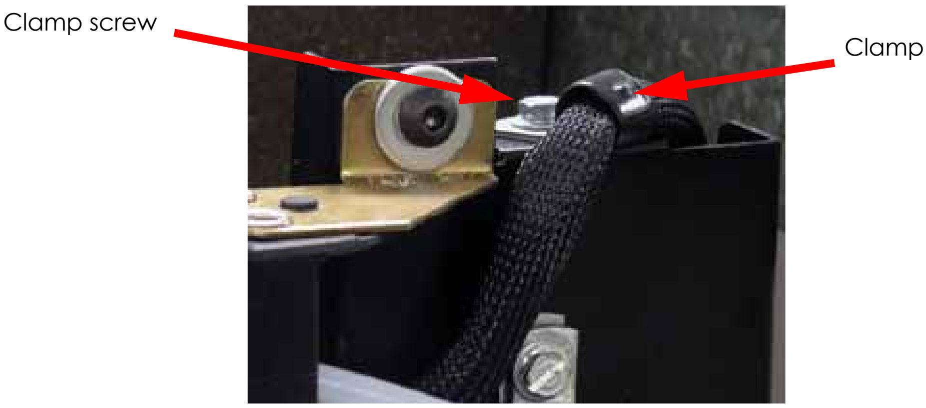
11. Disconnect the Y home sensor by pressing the tab in and pulling apart, see Figure 4-238.

Figure 4-238: Y home sensor detail



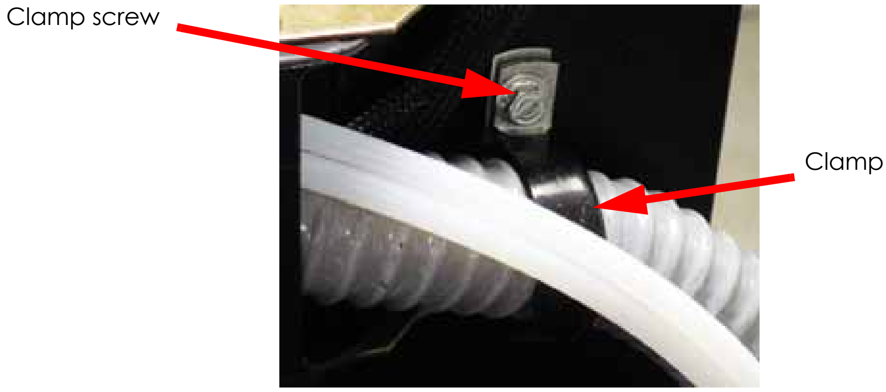
12. Using a $^{5}/_{16}$″ nut driver or standard screwdriver, remove the clamp mounting screw that is holding the umbilical cable at the right rear corner, see Figure 4-239.

Figure 4-239: Umbilical cable clamp location



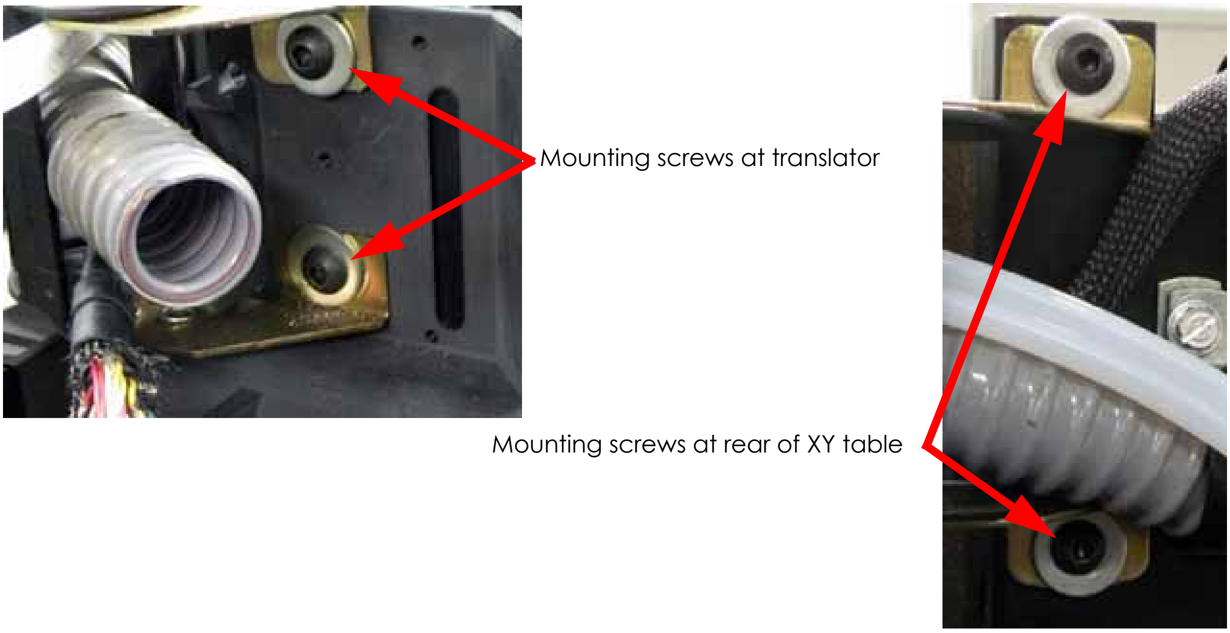
13. Using a $\frac{5}{16}$" nut driver or standard screwdriver, remove clamp that is holding the umbilical hose at the right rear corner, see Figure 4-240.

Figure 4-240: Umbilical cable clamp location



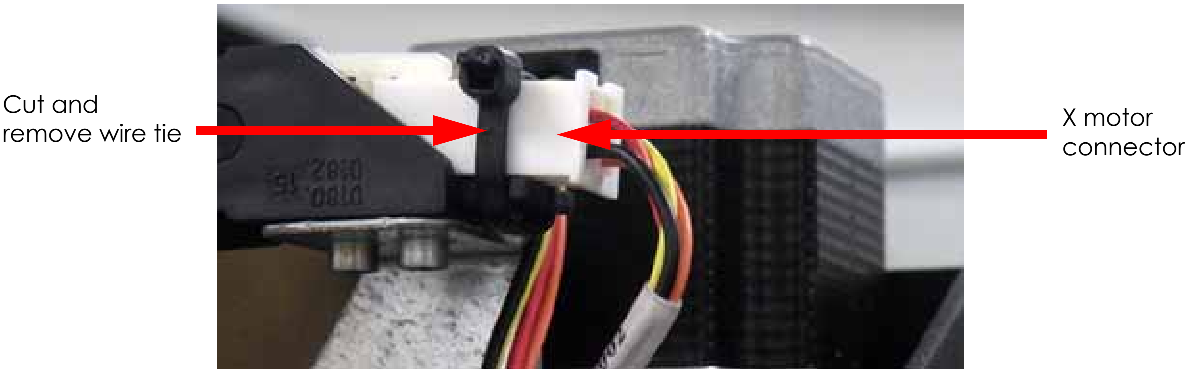
14. Using a $\frac{5}{32}$" allen wrench, remove the 2 energy chain mounting screws from the translator, see Figure 4-241.
15. Using a $\frac{5}{32}$" allen wrench, remove the 2 energy chain mounting screws from the XY table, see Figure 4-241.

Figure 4-241: Energy chain mounting screw locations



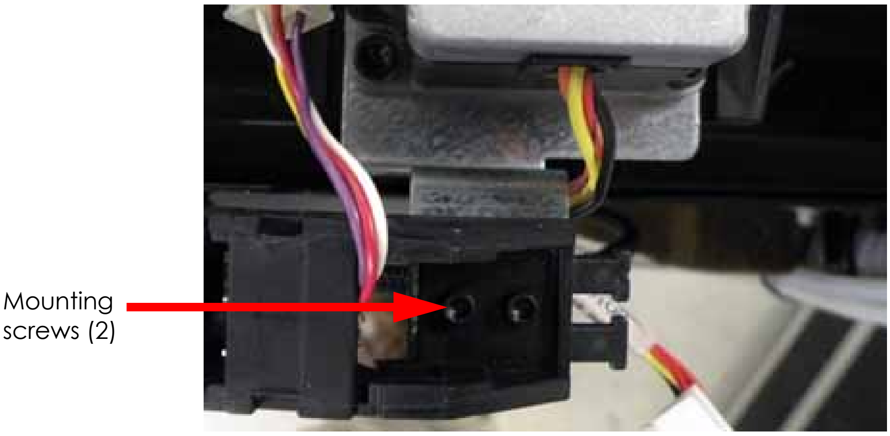
16. Slide the energy chain out through the right side of the XY table and let hang.
17. Using a cutters, cut and remove the wire tie from around the X motor connector, see Figure 4-242.
18. Disconnect the X motor cable by pressing the tab in and pulling outward, see Figure 4-242.

Figure 4-242: X motor wire tie location



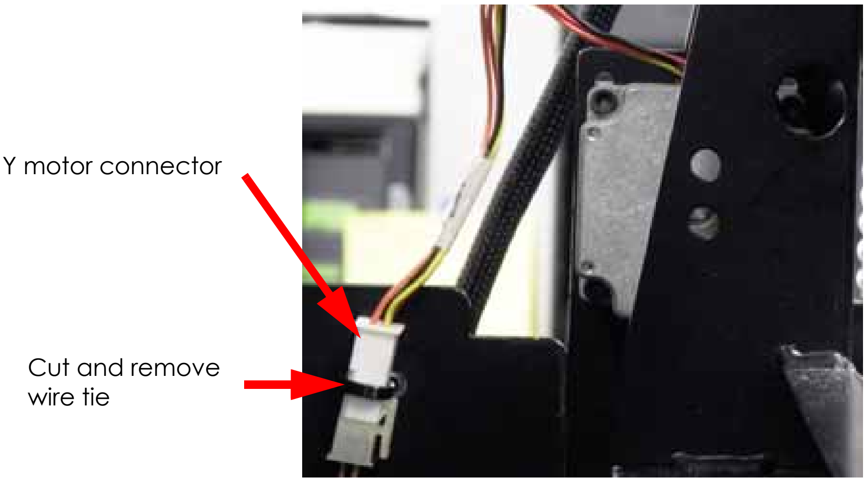
19. Using a $^3/_{32}$" allen wrench, remove the 2 X motor energy chain mounting screws, see Figure 4-243.

Figure 4-243: X motor energy chain mounting screw locations



20. Cut and remove the wire tie from around the Y motor connector, see Figure 4-244.
21. Disconnect the Y motor connector by pressing the tab in and pulling apart, see Figure 4-244.

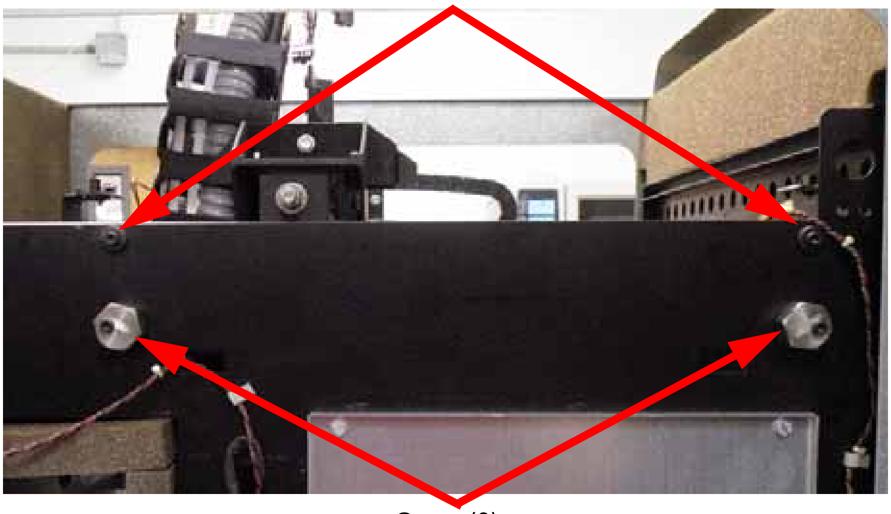
Figure 4-244: Y motor connector location



22. Using a $^5/_{32}$" allen wrench, remove the left side cams and mounting screws, see Figure 4-245.

Figure 4-245: Left side cam and mounting screw locations

Mounting screws (2)

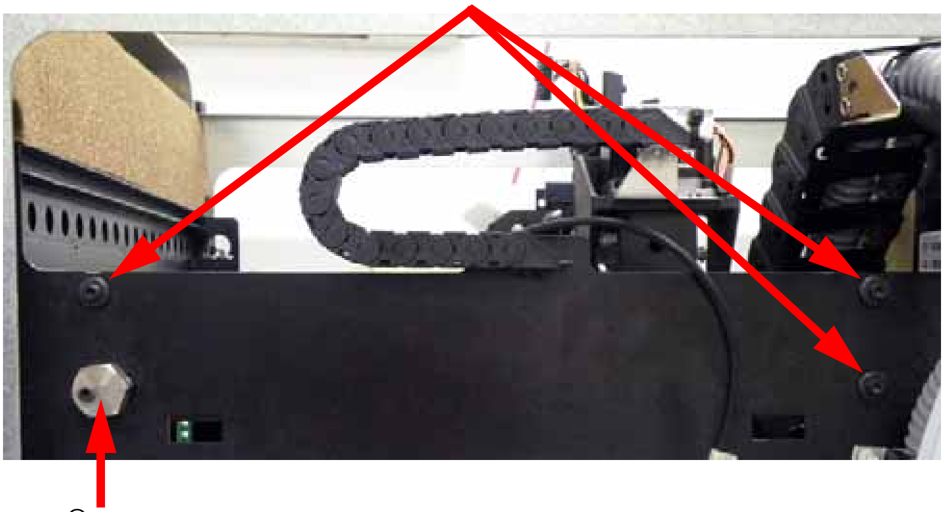


Cams (2)

23. Using a $^5/_{32}$" allen wrench, remove the right side cam and mounting screws, see Figure 4-246.

Figure 4-246: Right side cam and mounting screw locations

Mounting screws (3)



Cam

24. Lift the XY table out of the top of the printer.

Warning: The XY table is heavy. Removal is a two person operation.

Caution: When removing the XY table, be careful not to damage the chamber (LED) lights.

Note: Tilting the XY table so that the left side is elevated will facilitate removal.

Warning: The XY Table is heavy. Installation is a two person operation.

Caution: When installing the XY Table, be careful not to damage the Chamber (LED) Lights.

Note: When installing the XY Table, follow the XY Table Installation Checklist on page 9-5.

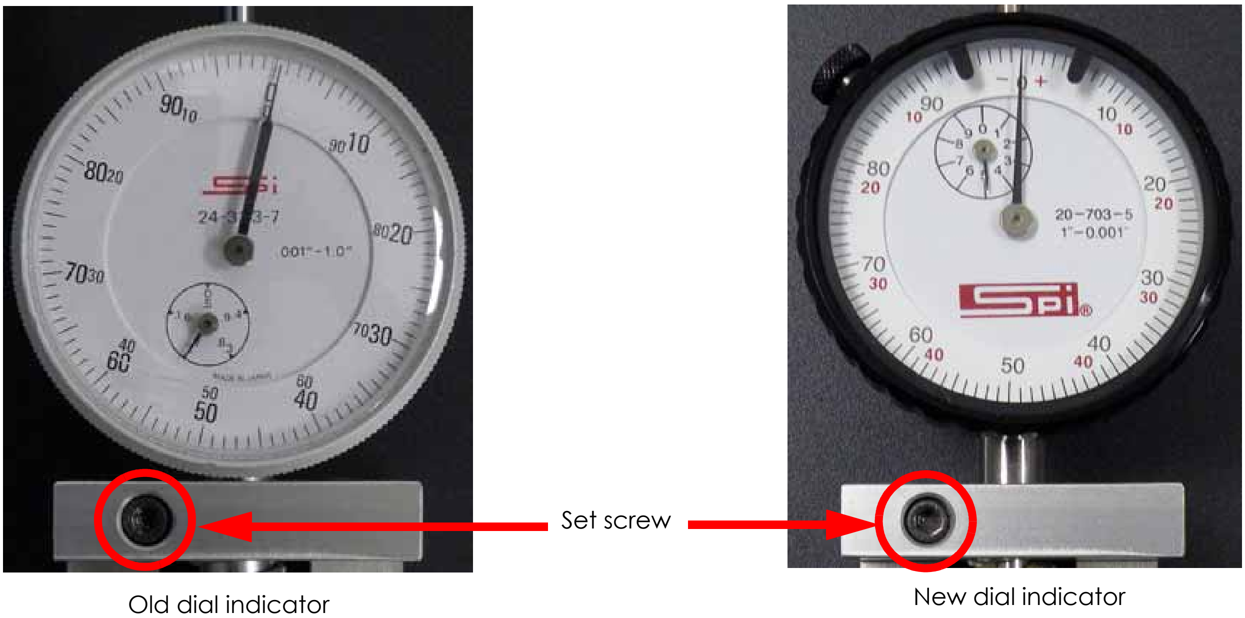
1. Place the XY table on a flat stable surface.
2. Move the toggle head assembly to the full left travel limit (as viewed from the front of the printer).
3. Insert the belt tension gauge zero block into the belt tension gauge. See Figure 4-247.

Figure 4-247: Belt tension gauge zero block

Old dial indicator   New dial indicator

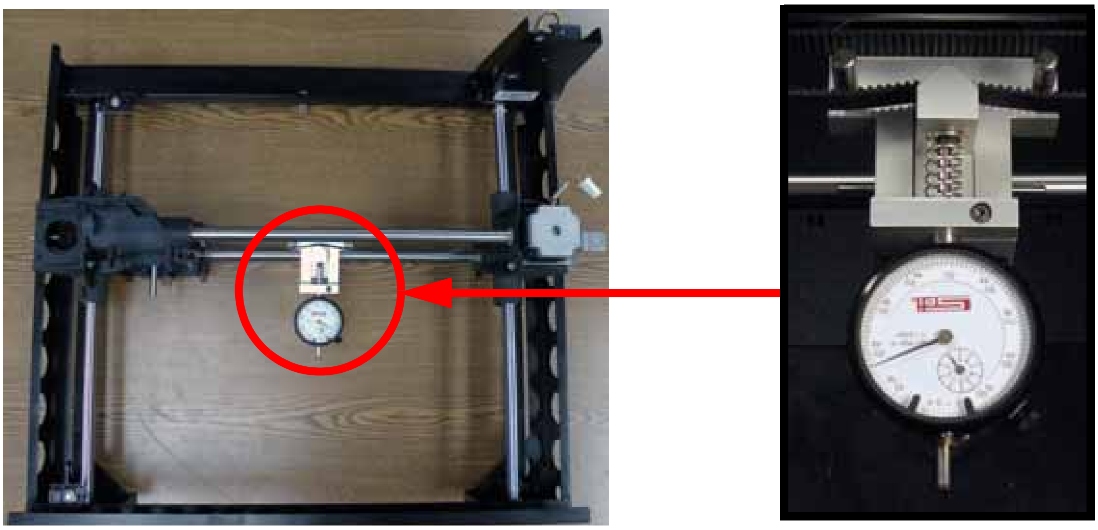
4. Zero the dial indicators by adjusting the dial indicator up or down until the gauge reads:
   A. The old dial indicator will be at zero when the large hand is on 0 and the small hand is on 2.7, when at zero use a $^{7}/_{64}$″ allen wrench to tighten the set screw. See Figure 4-248.
   B. The new dial indicator will be at zero when the large hand is on 0 and the small hand is on 5, when at zero use a $^{7}/_{64}$″ allen wrench to tighten the set screw. See Figure 4-248.

Figure 4-248: Setting the dial indicator



5. Remove the zero block from the belt tension gauge.
6. Move the head to the far right side of the printer.
7. Place the belt tension gauge on the center of the X drive belt. See Figure 4-249.

Figure 4-249: Belt tension gauge location



8. Locate the X drive belt tensioning nut, see Figure 4-250.

Figure 4-250: X drive belt tension nut location

9. Using a 3⁄8″ nut driver or box wrench, tighten the X drive belt by turning the X drive belt tensioning nut clockwise until:
   A. The old dial indicators large hand is between 20 and 25 mils and the small hand is nearly on 1.6. See Figure 4-251.
   B. The new dial indicators large hand is between 30 and 40 mils and the small hand is between 4 and 5. See Figure 4-251.

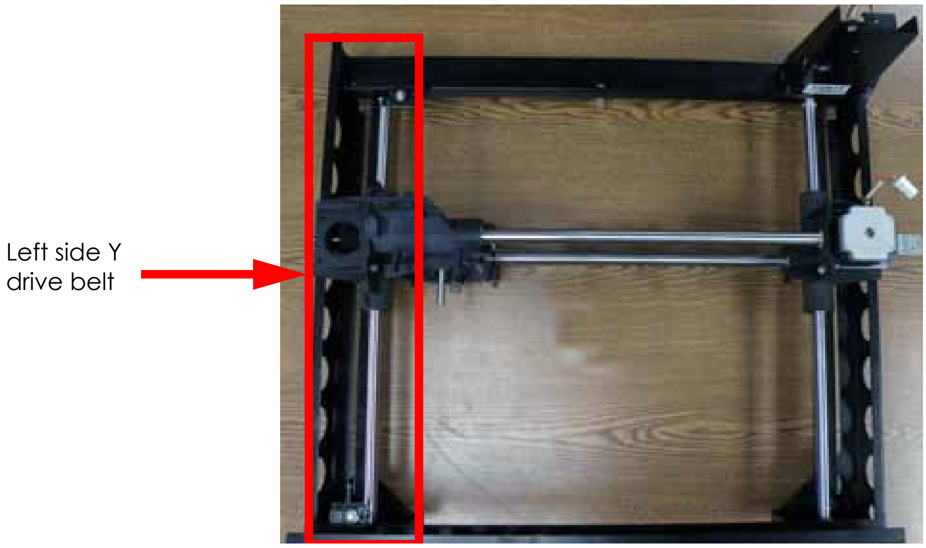
Figure 4-251: Dial indicator readings

Old dial indicator

New dial indicator

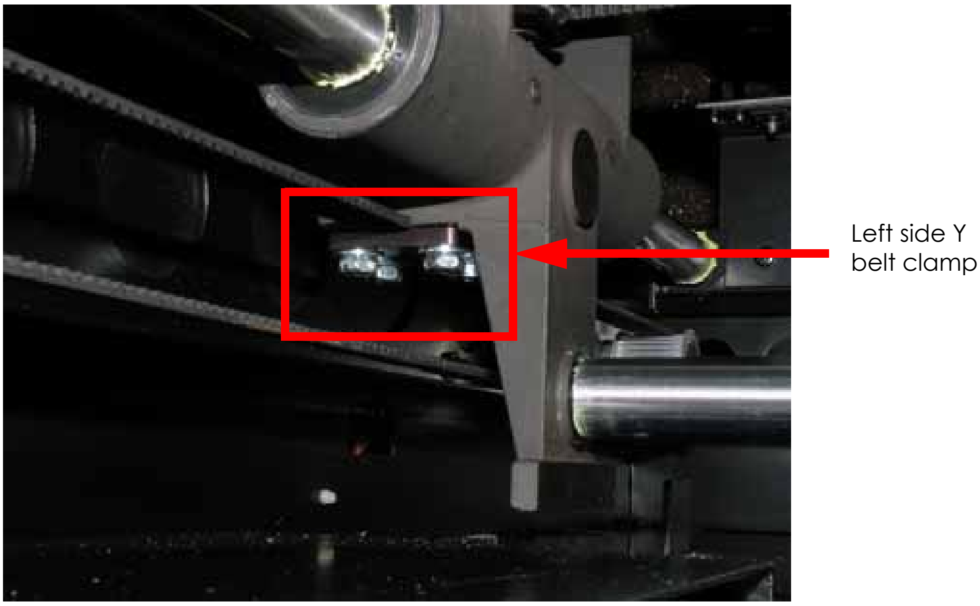
10. Remove the tension gauge and move the head from left to right several times.
11. Reattach the tension gauge to the X drive belt and measure belt tension. If tension is out of specification, repeat steps 7 - 10 until the belt tension is within specification.
12. Locate the left side Y drive belt. See Figure 4-252.

Figure 4-252: Left side Y drive belt location



13. Using a $^{5}/_{16}$″ nut driver or standard screwdriver, remove the 4 left side Y belt clamp mounting screws and remove the belt clamp. See Figure 4-253.

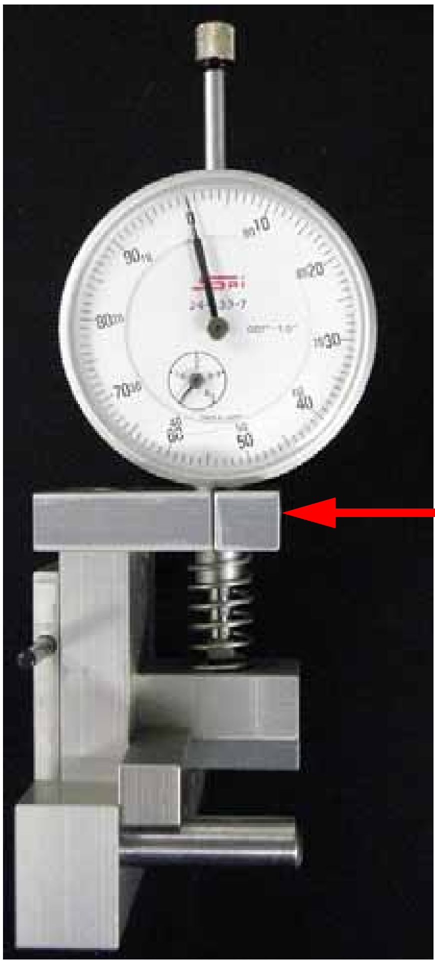
Figure 4-253: Left side Y belt clamp mounting screw locations



14. Insert the belt tension gauge zero block into the belt tension gauge. See Figure 4-254.
15. Zero the dial indicators by adjusting the dial indicator up or down until the gauge reads:
    A. The old dial indicator will be at zero when the large hand is on 0 and the small hand is on 2.7, when at zero use a $^{7}/_{64}$″ allen wrench to tighten the set screw. See Figure 4-254.
    B. The new dial indicator will be at zero when the large hand is on 0 and the small hand is on 5, when at zero use a $^{7}/_{64}$″ allen wrench to tighten the set screw. See Figure 4-254.

Note: Turn the dial indicator to the left so the face is visible while tensioning the right side Y drive belt.

Figure 4-254: Belt tension gauge zero block



Set screw

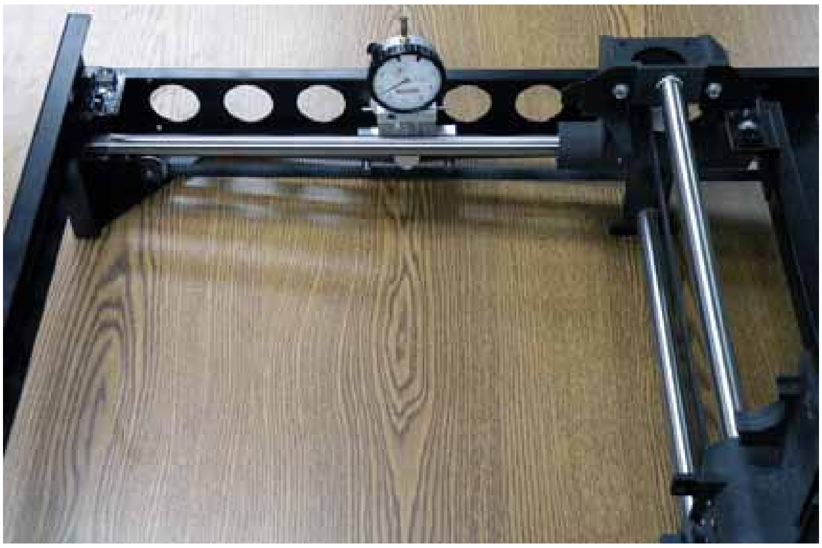
Old dial indicator

Set screw

New dial indicator

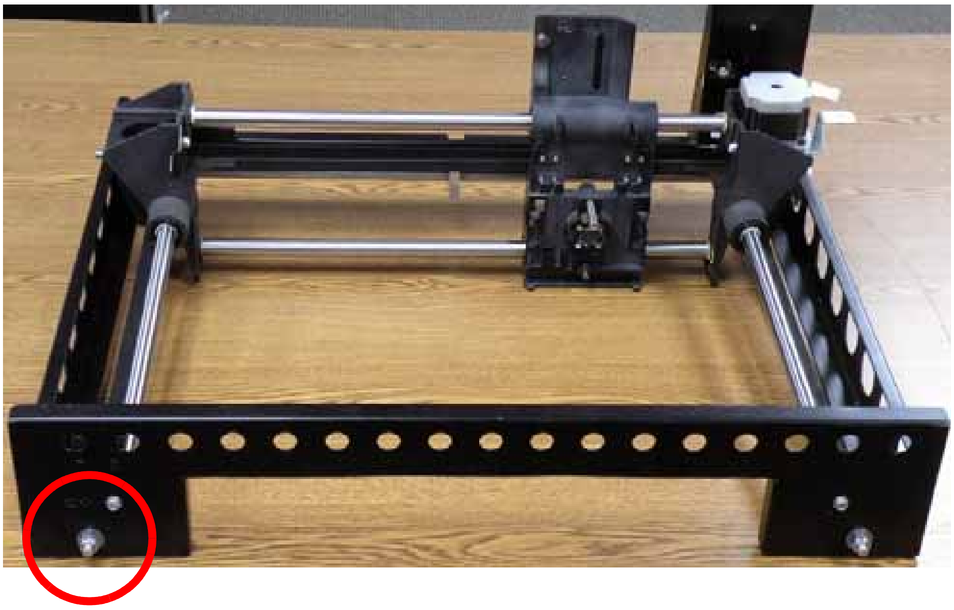
16. Remove the zero block from the belt tension gauge.
17. Move the head to the rear of the printer.
18. Place the belt tension gauge on the center of the left side Y drive belt. See Figure 4-255.

Figure 4-255: Belt tension gauge location



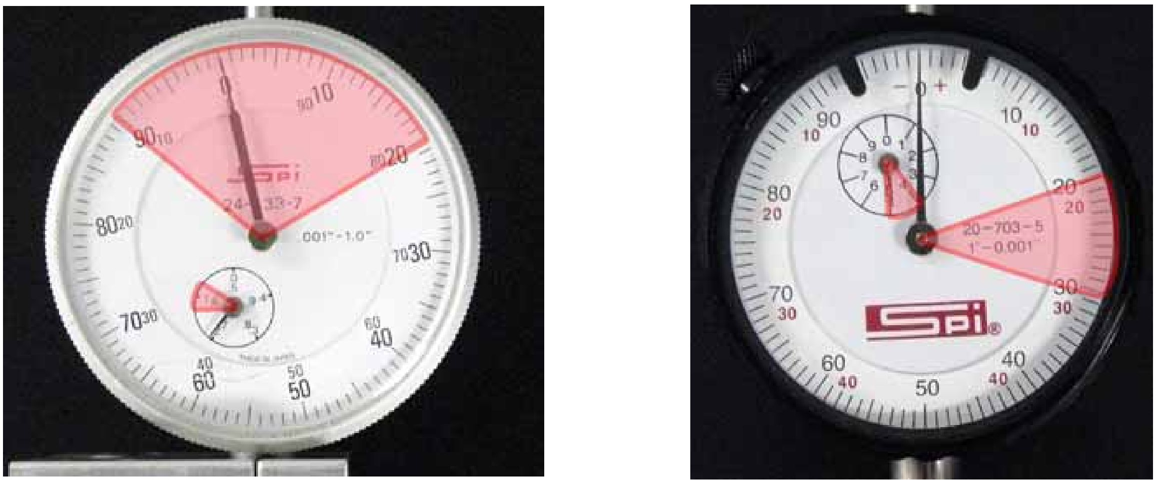
19. Locate the left side Y drive belt tension nut, see Figure 4-256.

Figure 4-256: Left side Y drive belt tension nut location



20. Using a ½″ nut driver or box wrench, tighten the left side Y drive belt by turning the drive belt tensioning nut clockwise until:
    A. The old dial indicators large hand is between 90 and 20 mils and the small hand is nearly on 1.6. See Figure 4-257.
    B. The new dial indicators large hand is between 20 and 30 mils and the small hand is between 4 and 5. See Figure 4-257.

Figure 4-257: Dial indicator readings

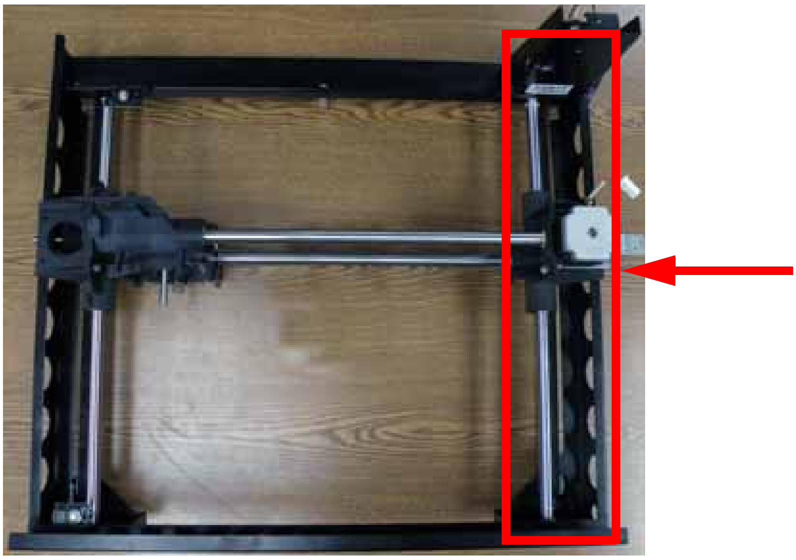


Old dial indicator

New dial indicator

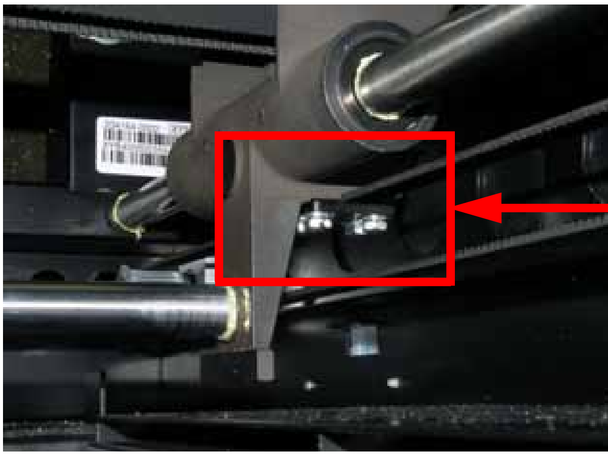
21. Remove the tension gauge and move the head from front to back several times.
22. Reattach the tension gauge to the left side Y drive belt and measure belt tension. If tension is out of specification, repeat steps 17 - 21 until the belt tension is within specification.
23. Align the left side Y drive belt clamp with the mounting holes and use a $\frac{5}{16}$″ nut driver to reinstall the 4 mounting screws.
24. Locate the right side Y drive belt. See Figure 4-258.

Figure 4-258: Right side Y drive belt location



25. Using a $\frac{5}{16}$″ nut driver or standard screwdriver, remove the 4 right side Y belt clamp mounting screws and remove the belt clamp. See Figure 4-259.

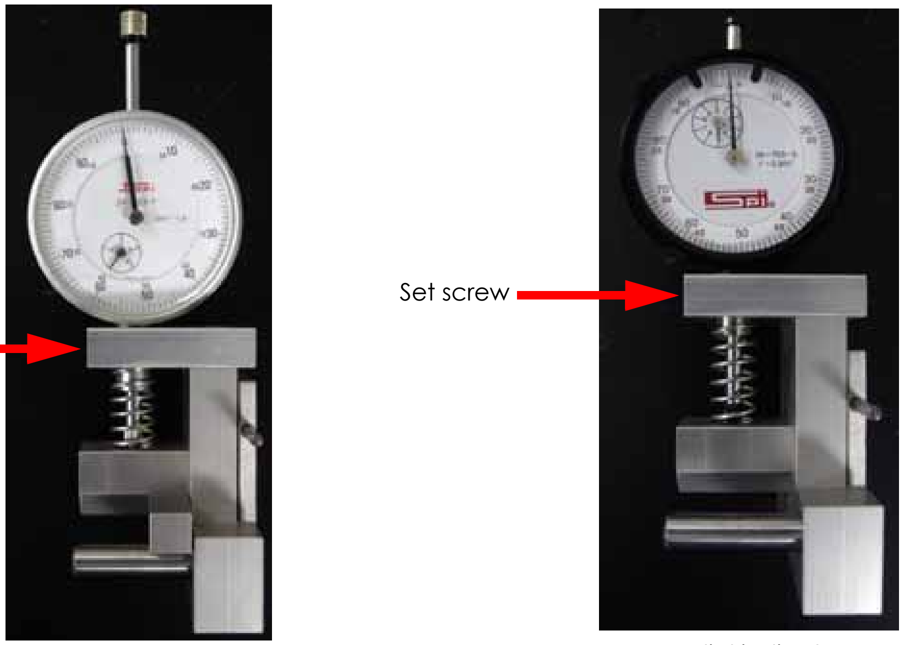
Figure 4-259: Right side Y belt clamp mounting screw locations



26. Insert the belt tension gauge zero block into the belt tension gauge. See Figure 4-260.
27. Zero the dial indicators by adjusting the dial indicator up or down until the gauge reads:
    A. The old dial indicator will be at zero when the large hand is on 0 and the small hand is on 2.7, when at zero use a $^{7}/_{64}$″ allen wrench to tighten the set screw. See Figure 4-260.
    B. The new dial indicator will be at zero when the large hand is on 0 and the small hand is on 5, when at zero use a $^{7}/_{64}$″ allen wrench to tighten the set screw. See Figure 4-260.

Note: Turn the dial indicator to the right so the face is visible while tensioning the left side Y drive belt.

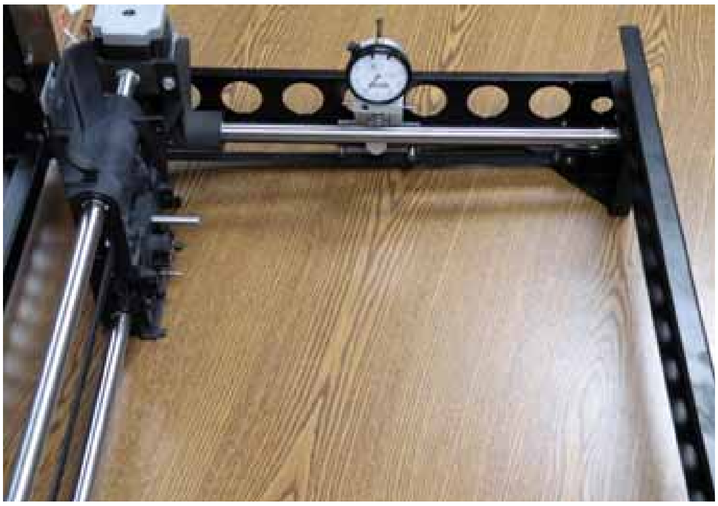
Figure 4-260: Belt tension gauge zero block



28. Remove the zero block from the belt tension gauge.
29. Move the head to the rear of the printer.

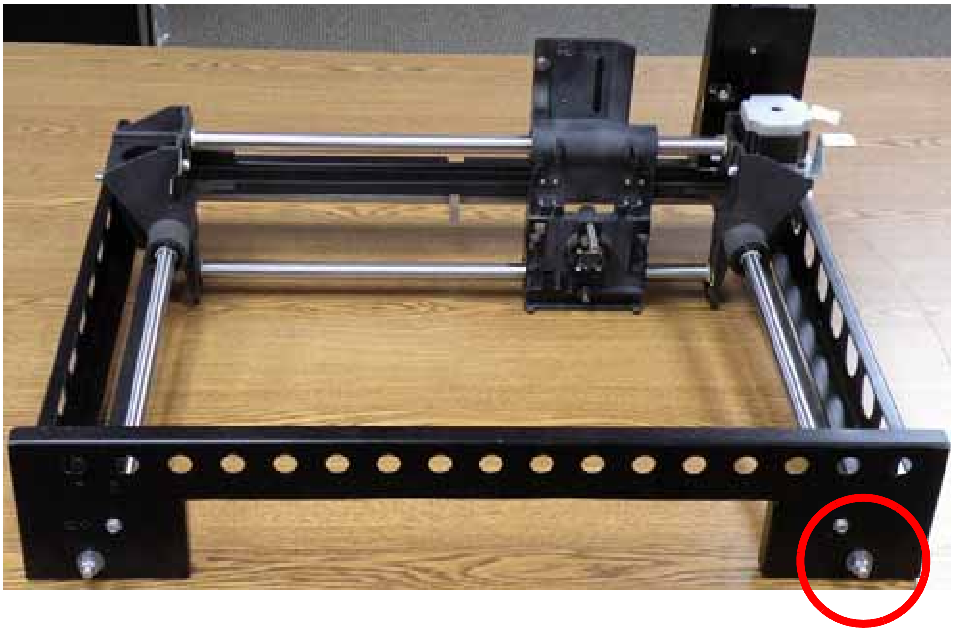
30. Place the belt tension gauge on the center of the right side Y drive belt. See Figure 4-261.

Figure 4-261: Belt tension gauge location



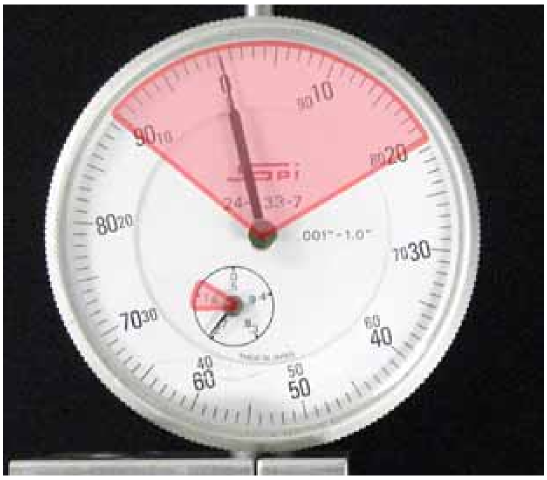
31. Locate the right side Y drive belt tension nut, see Figure 4-262.

Figure 4-262: Right side Y drive belt tension nut location



32. Using a $\frac{1}{2}$" nut driver or box wrench, tighten the right side Y drive belt by turning the drive belt tensioning nut clockwise until:
    A. The old dial indicators large hand is between 90 and 20 mils and the small hand is nearly on 1.6. See Figure 4-263.
    B. The new dial indicators large hand is between 20 and 30 mils and the small hand is between 4 and 5. See Figure 4-263.

Figure 4-263: Dial indicator readings



Old dial indicator

New dial indicator

33. Remove the tension gauge and move the head from front to back several times.
34. Reattach the tension gauge to the right side Y drive belt and measure belt tension. If tension is out of specification, repeat steps 29 - 33 until the belt tension is within specification.
35. Align the right side Y drive belt clamp with the mounting holes and use a $^5/_{16}$” nut driver to reinstall the 4 mounting screws.
36. Place the XY table into position through the top of the printer.

Note: Tilting the XY table so that the left side is elevated will facilitate installation.

37. Loosely reinstall the 5 XY table mounting screws.
38. Align the top of the XY table with top of the system frame and completely tighten the 5 mounting screws, see Figure 4-264.

Figure 4-264: Aligning the XY table with the system frame

Align top edge of XY table with top edge of frame

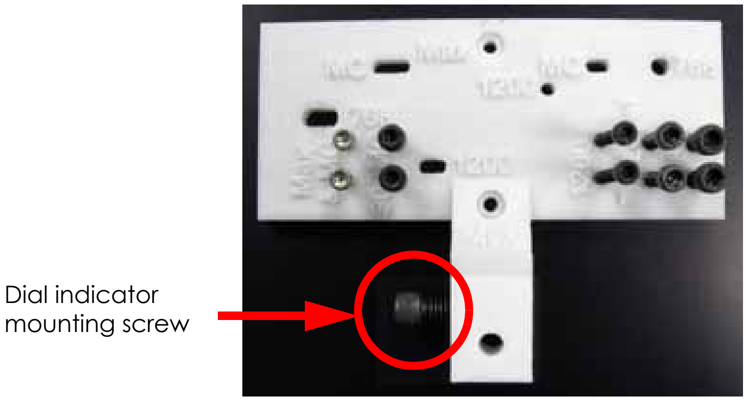
39. Reinstall the 3 XY table cams, and tighten at this time.

40. Connect the Y motor and install a wire tie around the connector.
41. Align the X motor energy chain with the mounting holes and use a $^5/_{32}$" allen wrench to reinstall the 2 mounting screws.
42. Feed the energy chain back in through the XY table and align it with the mounting holes.

Caution: Be careful not to twist the electrical leads or the filament tubes when installing the energy chain.

43. Using a $^5/_{32}$" allen wrench, reinstall the 2 energy chain mounting screws at the right rear of the XY table.
44. Using a $^5/_{32}$" allen wrench, reinstall the 2 energy chain mounting screws at the translator.
45. Align the umbilical hose clamp with the mounting hole and use a $^5/_{16}$" nut driver or standard screwdriver to reinstall the mounting screw.
46. Align the umbilical cable clamp with the mounting hole and use a $^5/_{16}$" nut driver or standard screwdriver to reinstall the mounting screw.
47. Reconnect the Y home sensor by pushing the lead into the connector.
48. Reconnect the Y EOT sensor by pushing the lead into the connector.
49. Reinstall the Z level assembly, see Installing the Z Level Assembly on page 4-152.
50. Reinstall the Z foam sensor, see Installing the Z Foam Sensor on page 4-150.
51. Reinstall the head board, see Installing the Head Board on page 4-142.
52. Reinstall the toggle sensor, see Installing the Toggle Sensor on page 4-140.
53. Reinstall the toggle bar, see Installing the Toggle Bar on page 4-139.
54. Reinstall the toggle plate assembly, see "Installing the 1200 Toggle Plate Assembly" on page 4-114. Do not reinstall the head cover at this time.
55. Using a $^3/_8$" allen wrench, remove the dial indicator mounting screw from the head bracket. See Figure 4-265.

Figure 4-265: Head bracket mounting screws

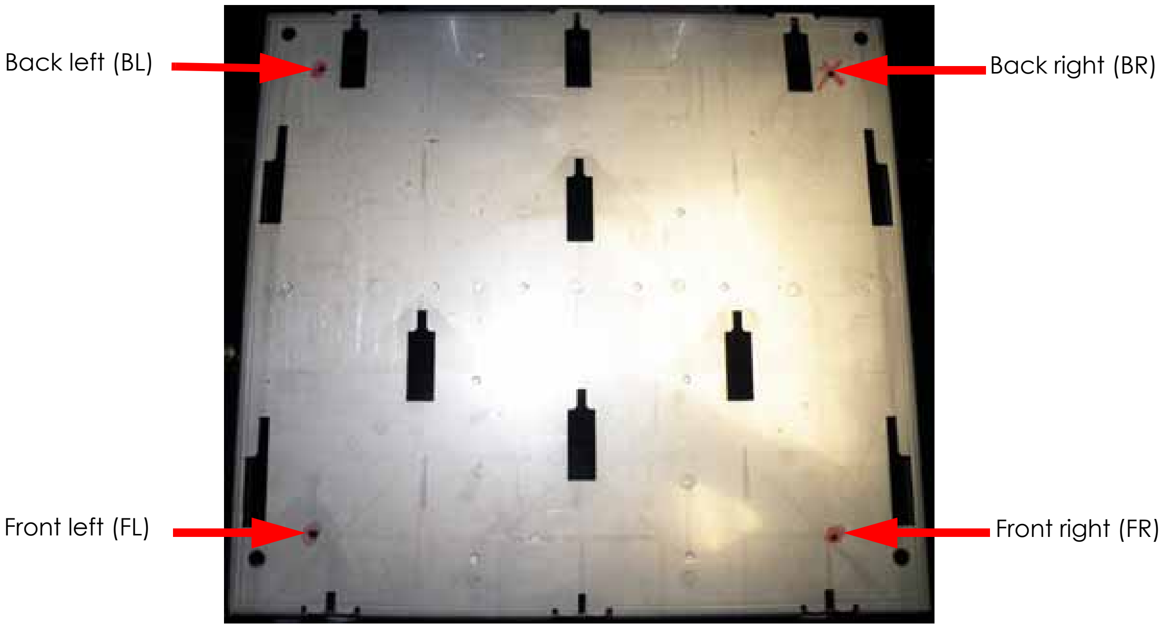


56. Align the dial indicator with the head bracket and use a $^3/_8$" allen wrench to install the mounting screw. See Figure 4-266.

Figure 4-266: Dial indicator installation

57. Using a marker, mark the Z platen in the rear left corner, rear right corner, front left corner and front right corner. See Figure 4-267.

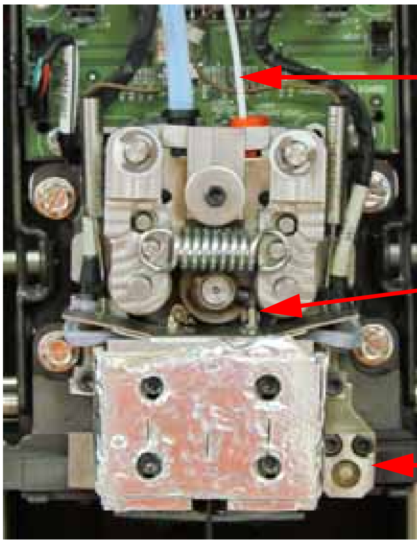
Figure 4-267: Z platen marking locations



58. Manually raise the Z stage, by turning the lead screw with a gloved hand, until it is about 2 inches from the upper limit.
59. Disconnect model side material tube by pressing the retaining ring down and pulling the tube out.
60. Insert a 6 inch piece of model material through model side until it reaches the tip then toggle to the left to engage the model side. See Figure 4-268.

Note: Material is inserted to stabilize the head during the leveling process.

Figure 4-268: Inserting model material



61. Move the dial indicator to the mark on the right rear corner and zero the dial indicator by loosening the set screw and turning the ring until the dial is on the 0. See Figure 4-269.

Figure 4-269: Zero the dial indicator

62. Move the dial indicator to the mark on the front right corner of the Z platen and record the value.
63. Move the dial indicator to the mark on the front left corner of the Z platen and record the value.
64. Move the dial indicator to the mark on the back left corner of the Z platen and record the value.
65. Insert the MaracaEX CD in a workstation and open the *XY Level Calc.xls* file.
66. Enter the recorded values from each corner into the indicator reading boxes of the XY table level calculator. See Figure 4-270.
67. Input the FR, FL and BL values you measured in the Indicator Reading boxes of the spreadsheet.

Note: Make sure to use the correct XLS file. There is a separate file for Dimension 1200 models.

Figure 4-270: Sample XY Level Calculator

Location	Indicator Reading	Knob Adjust
BR	0.000	-
FR	-0.004	0.014
FL	0.010	-0.013
BL	0.008	-0.001

68. The spreadsheet will calculate the required adjustment for each corner, and display them in the Knob Adjust column.
69. Move the dial indicator to the BR position and verify it is zero.

Note: This corner does not have an adjustment cam and will not require adjustment.

70. Move the dial indicator to the FR position.
71. Zero the dial indicator.
72. Using a $^5/_{16}$″ allen wrench, loosen the XY frame screw and the cam adjuster lock screw on the FR corner.
73. Turn the adjuster cam until the dial indicator reading matches the calculated value from the spreadsheet.

Note: Turning the can clockwise will lower the XY table and cause the dial indicator needle to move positive. Turning the can counter-clockwise will raise the XY table and cause the dial indicator needle to move negative.

74. Tighten the cam lock screw and the frame screw on the FR corner.
75. Move the dial indicator to the FL corner.
76. Zero the dial indicator.
77. Using a $^5/_{16}$″ allen wrench, loosen the XY frame screw and the cam adjuster lock screw on the FL corner.
78. Turn the adjuster cam until the dial indicator reading matches the calculated value from the spreadsheet (e.g. -0.013).
79. Tighten the cam lock screw and the frame screw on the FL corner.
80. Move the dial indicator to the BL corner.
81. Zero the Dial indicator.
82. Using a $^5/_{16}$″ allen wrench, loosen the XY frame screw and the cam adjuster lock screw on the BL corner.
83. Turn the adjuster cam until the dial indicator reading matches the calculated value from the spreadsheet (e.g. -0.001).
84. Tighten the cam lock screw and the frame screw on the FL corner.
85. Recheck the four corners again. The maximum difference allowed between the highest and lowest readings is .003 in.
86. Repeat steps 61 through 85 until the measurements are within specification.
87. Perform head alignment, see Head Alignment Procedure on page 5-7.
88. Reinstall the head cover.

89. Set height of tip wipe assembly, see Tip Wipe Assembly (Brush/Flicker) on page 4-252.
90. Reinstall the side panels, see Installing the Side Panels on page 4-6.
91. Reinstall the rear panel, see Installing the Rear Panel on page 4-5.
92. Perform Z calibration, see Z Calibration on page 5-2.
93. Perform XY calibration, see XY Calibration on page 5-2.
94. Perform part based calibrations, see Part Based Calibration on page 5-3.
95. Remove the calibration floppy disk/CD from the electronics bay and get the .cal file from the printer with MaracaEX, see "Get" .cal file – from hard drive to the calibration Floppy Disk/CD: on page 5-38.
96. Copy the .cal file to a new floppy disk/CD and replace the calibration floppy disk/CD in the electronics bay.
97. Build a sample part to verify proper operation of the printer.
98. Box up the defective XY table and send back to Stratasys.

1200es XY Table Assembly

Parts and Tools Required

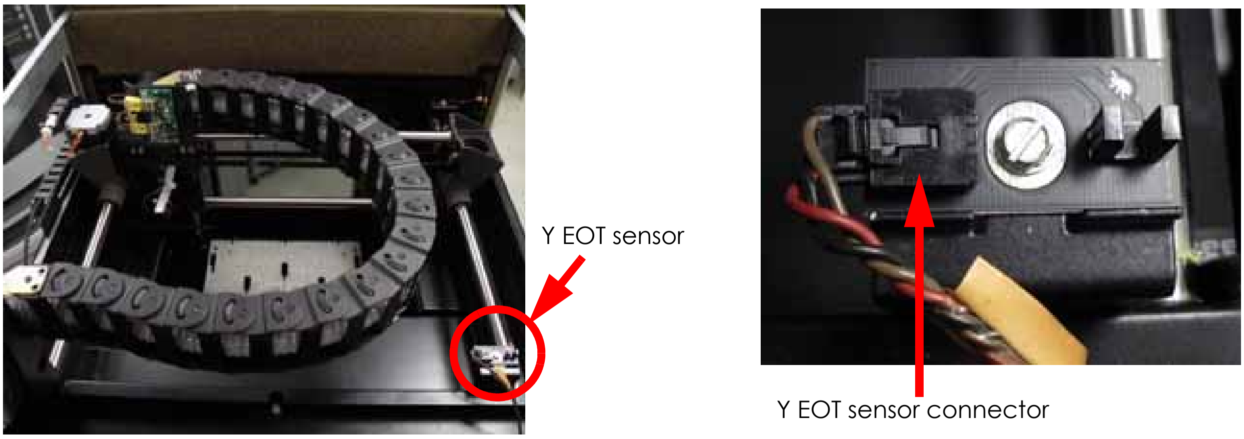
- $^{5}/_{16}$" Nut driver or standard screwdriver
- $^{3}/_{8}$" nut driver or box wrench
- $^{1}/_{2}$" nut driver or box wrench
- $^{3}/_{8}$" Allen wrench
- $^{7}/_{64}$" Allen wrench
- $^{5}/_{32}$" Allen wrench
- $^{3}/_{32}$" Allen wrench
- Cutters
- XY motor belt tension tool
- Belt tension gauge
- Head bracket
- Dial indicator
- Cam wrench or large crescent wrench

Note: After installing the XY table, follow the XY table checklist. See XY Table Installation Checklist on page 9-5.

Removing the 1200es XY Table

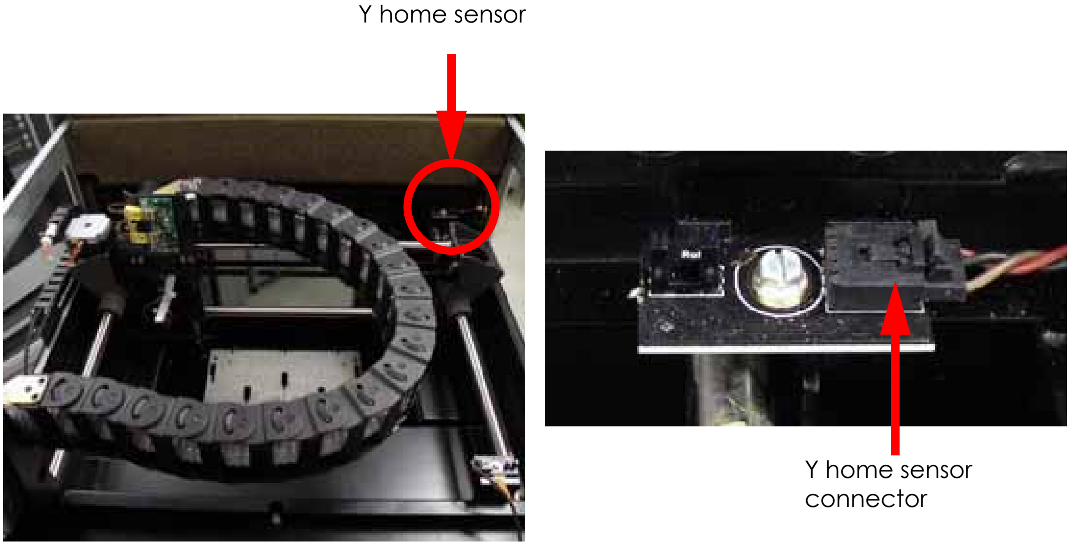
1. Power down the printer.
2. Remove the rear panel, see Removing the Rear Panel on page 4-5.
3. Remove the side panels, see Removing the Side Panels on page 4-6.
4. Remove the toggle plate assembly, see "Removing the 1200 Toggle Plate Assembly" on page 4-109.
5. Remove the toggle bar, see Removing the Toggle Bar on page 4-139.
6. Remove the toggle sensor, see Removing the Toggle Sensor on page 4-140.
7. Remove the head board, see Removing the Head Board on page 4-141.
8. Remove the TC Amp board, see Removing the TC Amp Board on page 4-145.
9. Remove the Z level assembly, see Removing the Z Level Assembly on page 4-150.
10. Disconnect the Y EOT sensor by pressing the tab in and pulling apart, see Figure 4-271.

Figure 4-271: Y EOT sensor detail



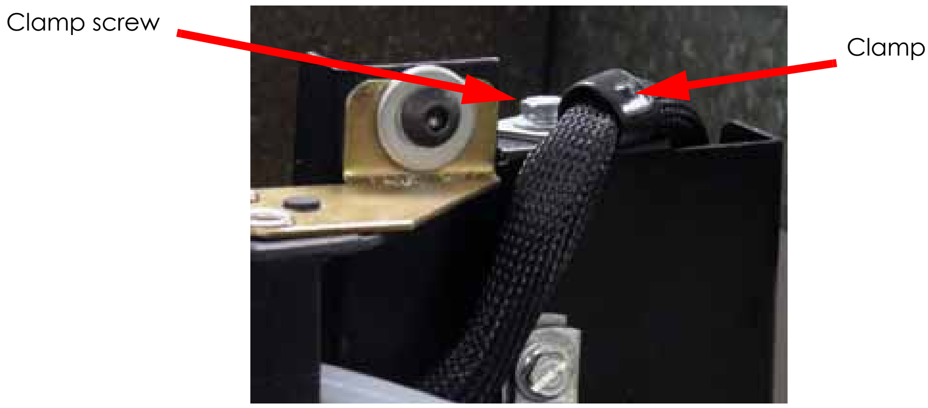
11. Disconnect the Y home sensor by pressing the tab in and pulling apart, see Figure 4-272.

Figure 4-272: Y home sensor detail



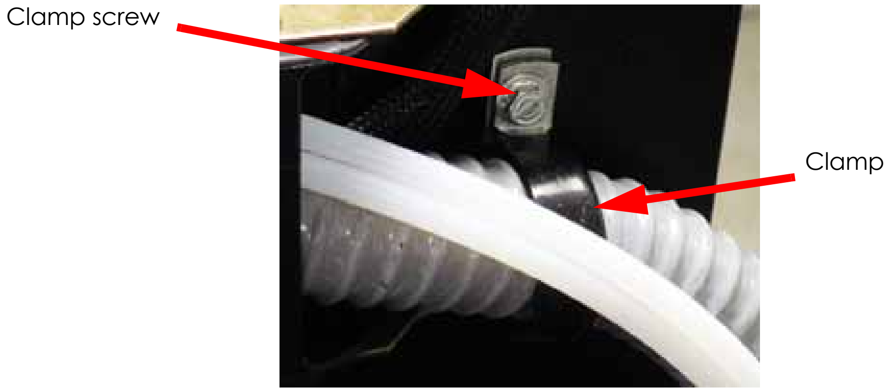
12. Using a $^{5}/_{16}$″ nut driver or standard screwdriver, remove the clamp mounting screw that is holding the umbilical cable at the right rear corner, see Figure 4-273.

Figure 4-273: Umbilical cable clamp location



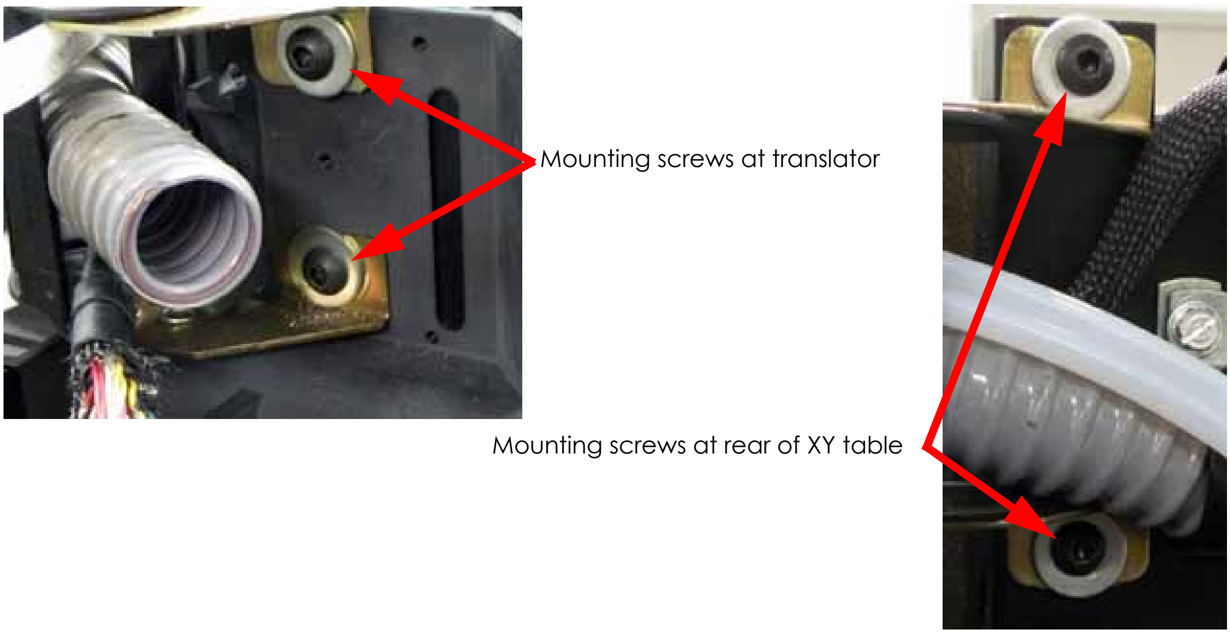
13. Using a $^{5}/_{16}$" nut driver or standard screwdriver, remove clamp that is holding the umbilical hose at the right rear corner, see Figure 4-274.

Figure 4-274: Umbilical cable clamp location



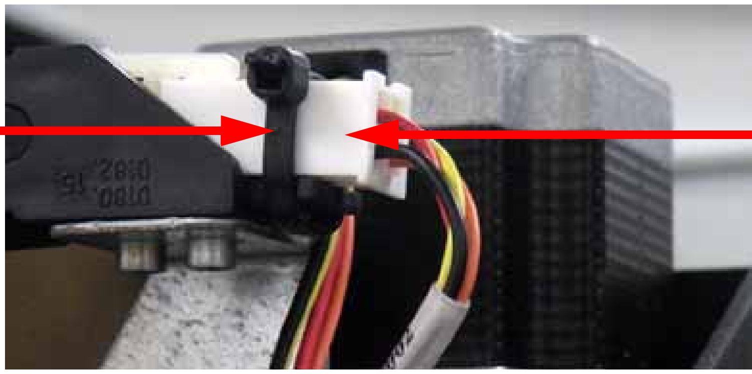
14. Using a $^{5}/_{32}$" allen wrench, remove the 2 energy chain mounting screws from the translator, see Figure 4-275.
15. Using a $^{5}/_{32}$" allen wrench, remove the 2 energy chain mounting screws from the XY table, see Figure 4-275.

Figure 4-275: Energy chain mounting screw locations



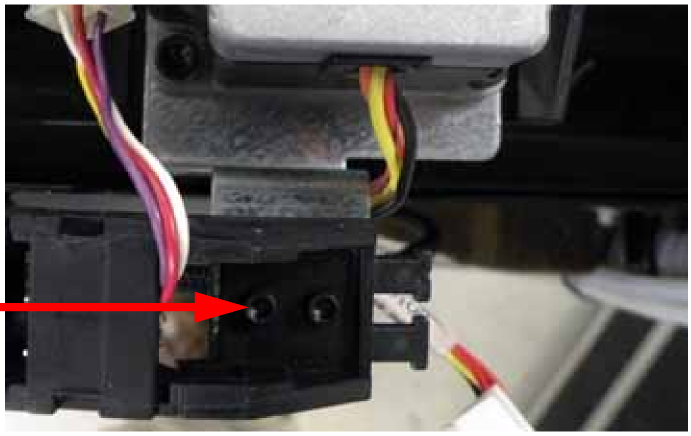
16. Slide the energy chain out through the right side of the XY table and let hang.
17. Using a cutters, cut and remove the wire tie from around the X motor connector, see Figure 4-276.
18. Disconnect the X motor cable by pressing the tab in and pulling outward, see Figure 4-276.

Figure 4-276: X motor wire tie location



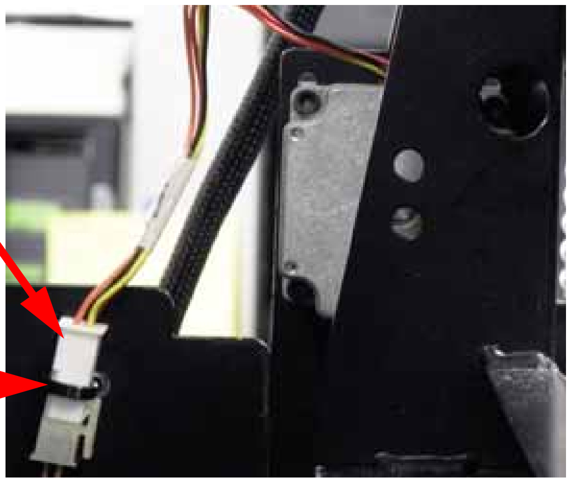
19. Using a $^{3}/_{32}$" allen wrench, remove the 2 X motor energy chain mounting screws, see Figure 4-277.

Figure 4-277: X motor energy chain mounting screw locations



20. Cut and remove the wire tie from around the Y motor connector, see Figure 4-278.
21. Disconnect the Y motor connector by pressing the tab in and pulling apart, see Figure 4-278.

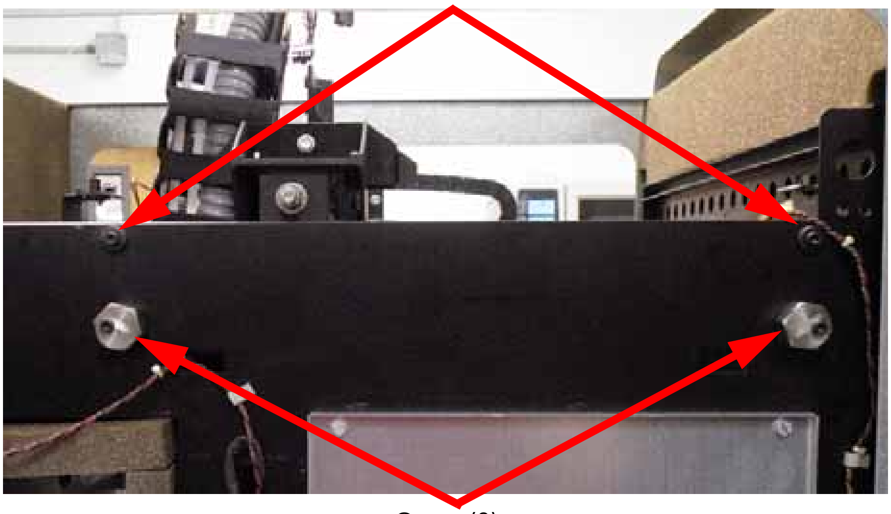
Figure 4-278: Y motor connector location



22. Using a $^{5}/_{32}$" allen wrench, remove the left side cams and mounting screws, see Figure 4-279.

Figure 4-279: Left side cam and mounting screw locations

Mounting screws (2)

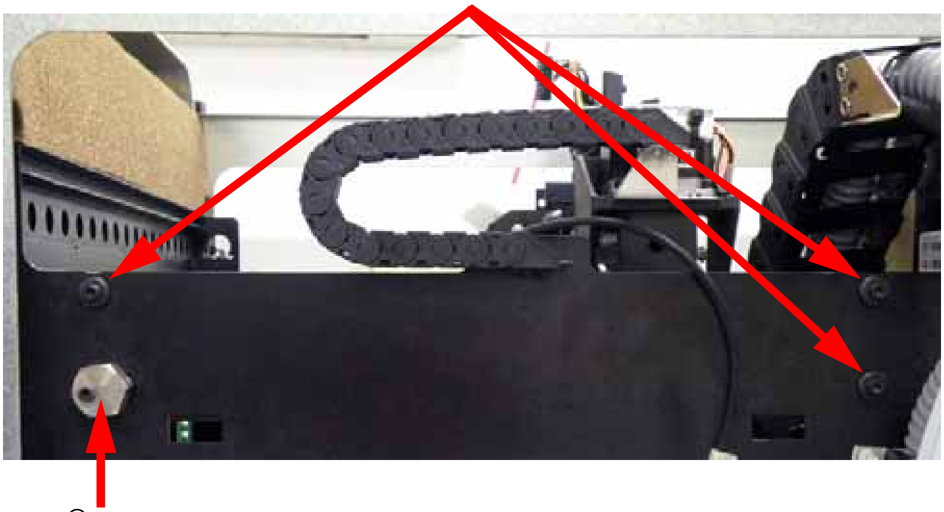


Cams (2)

23. Using a 5/32" allen wrench, remove the right side cam and mounting screws, see Figure 4-280.

Figure 4-280: Right side cam and mounting screw locations

Mounting screws (3)



Cam

24. Lift the XY table out of the top of the printer.

Warning: The XY table is heavy. Removal is a two person operation.

Caution: When removing the XY table, be careful not to damage the chamber (LED) lights.

Note: Tilting the XY table so that the left side is elevated will facilitate removal.

Installing the 1200es XY Table

Warning: The XY Table is heavy. Installation is a two person operation.

Caution: When installing the XY Table, be careful not to damage the Chamber (LED) Lights.

Note: When installing the XY Table, follow the XY Table Installation Checklist on page 9-5.

1. Place the XY table on a flat stable surface.
2. Move the toggle head assembly to the full left travel limit (as viewed from the front of the printer).
3. Insert the belt tension gauge zero block into the belt tension gauge. See Figure 4-281.

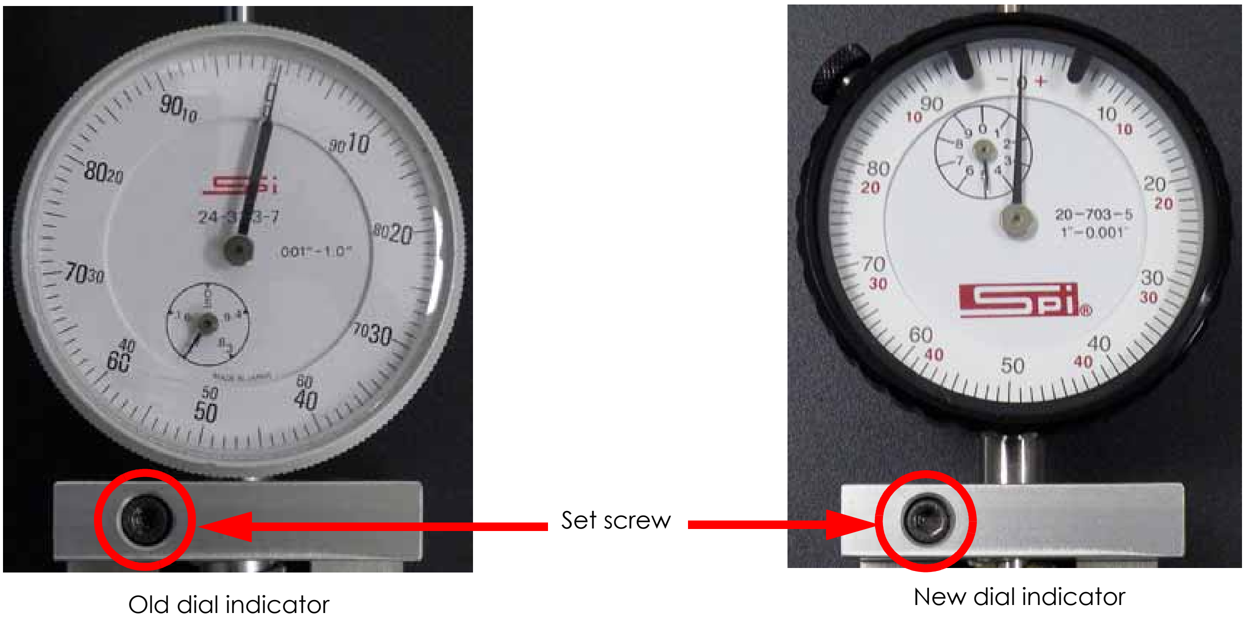
Figure 4-281: Belt tension gauge zero block

Old dial indicator

New dial indicator

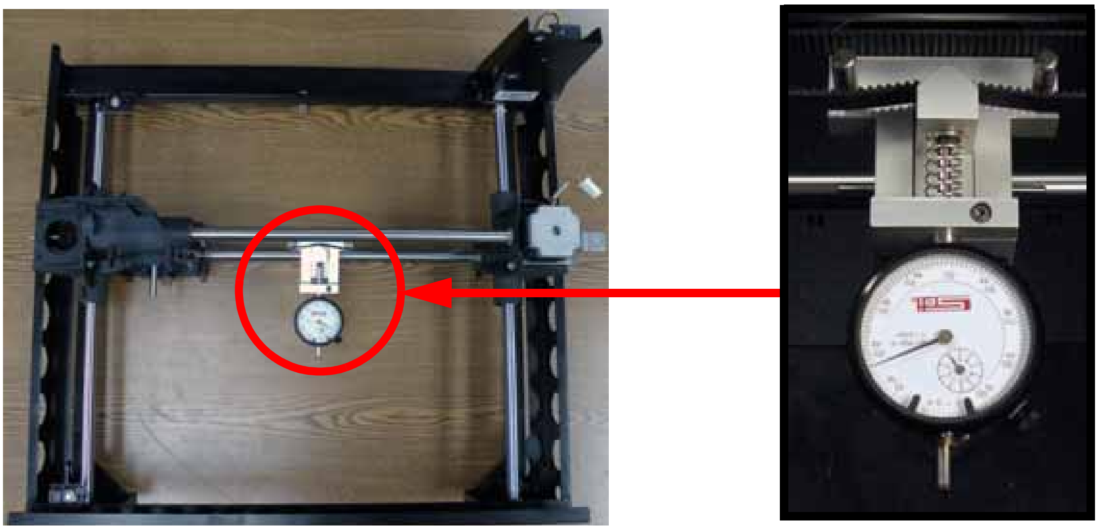
4. Zero the dial indicators by adjusting the dial indicator up or down until the gauge reads:
   A. The old dial indicator will be at zero when the large hand is on 0 and the small hand is on 2.7, when at zero use a $^{7}/_{64}$" allen wrench to tighten the set screw. See Figure 4-282.
   B. The new dial indicator will be at zero when the large hand is on 0 and the small hand is on 5, when at zero use a $^{7}/_{64}$" allen wrench to tighten the set screw. See Figure 4-282.

Figure 4-282: Setting the dial indicator



5. Remove the zero block from the belt tension gauge.
6. Move the head to the far right side of the printer.
7. Place the belt tension gauge on the center of the X drive belt. See Figure 4-283.

Figure 4-283: Belt tension gauge location



8. Locate the X Drive Belt tensioning nut, see Figure 4-284.

Figure 4-284: X drive belt tension nut location

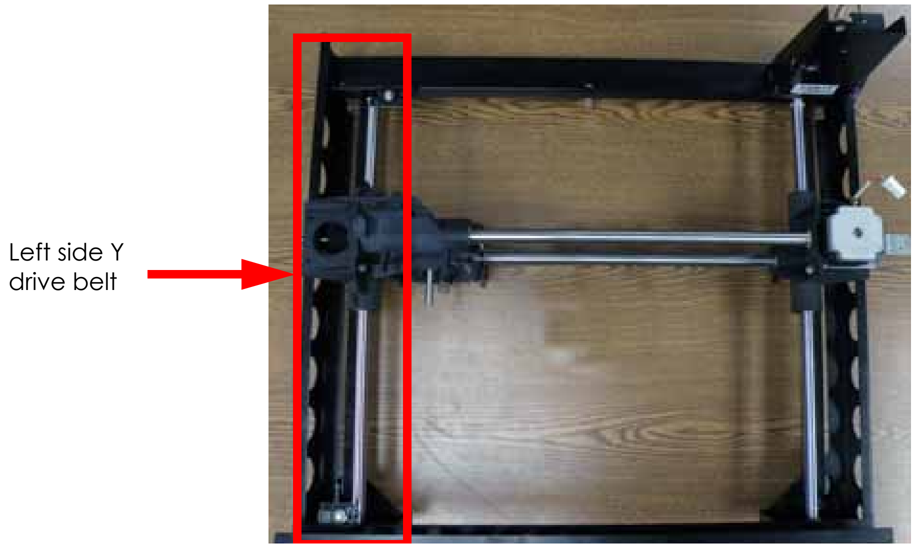
9. Using a $^{3}/_{8}$″ nut driver or box wrench, tighten the X drive belt by turning the X drive belt tensioning nut clockwise until:
   A. The old dial indicators large hand is between 20 and 25 mils and the small hand is nearly on 1.6. See Figure 4-285.
   B. The new dial indicators large hand is between 30 and 40 mils and the small hand is between 4 and 5. See Figure 4-285.

Figure 4-285: Dial indicator readings

Old dial indicator New dial indicator

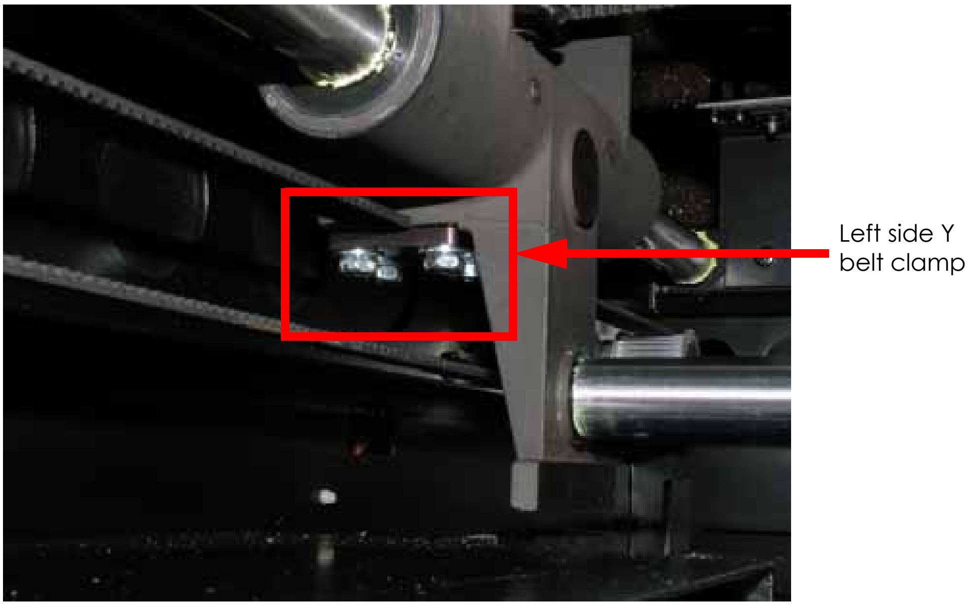
10. Remove the tension gauge and move the head from left to right several times.
11. Reattach the tension gauge to the X drive belt and measure belt tension. If tension is out of specification, repeat steps 7 - 10 until the belt tension is within specification.
12. Locate the left side Y drive belt. See Figure 4-286.

Figure 4-286: Left side Y drive belt location



13. Using a 5⁄16″ nut driver or standard screwdriver, remove the 4 left side Y belt clamp mounting screws and remove the belt clamp. See Figure 4-287.

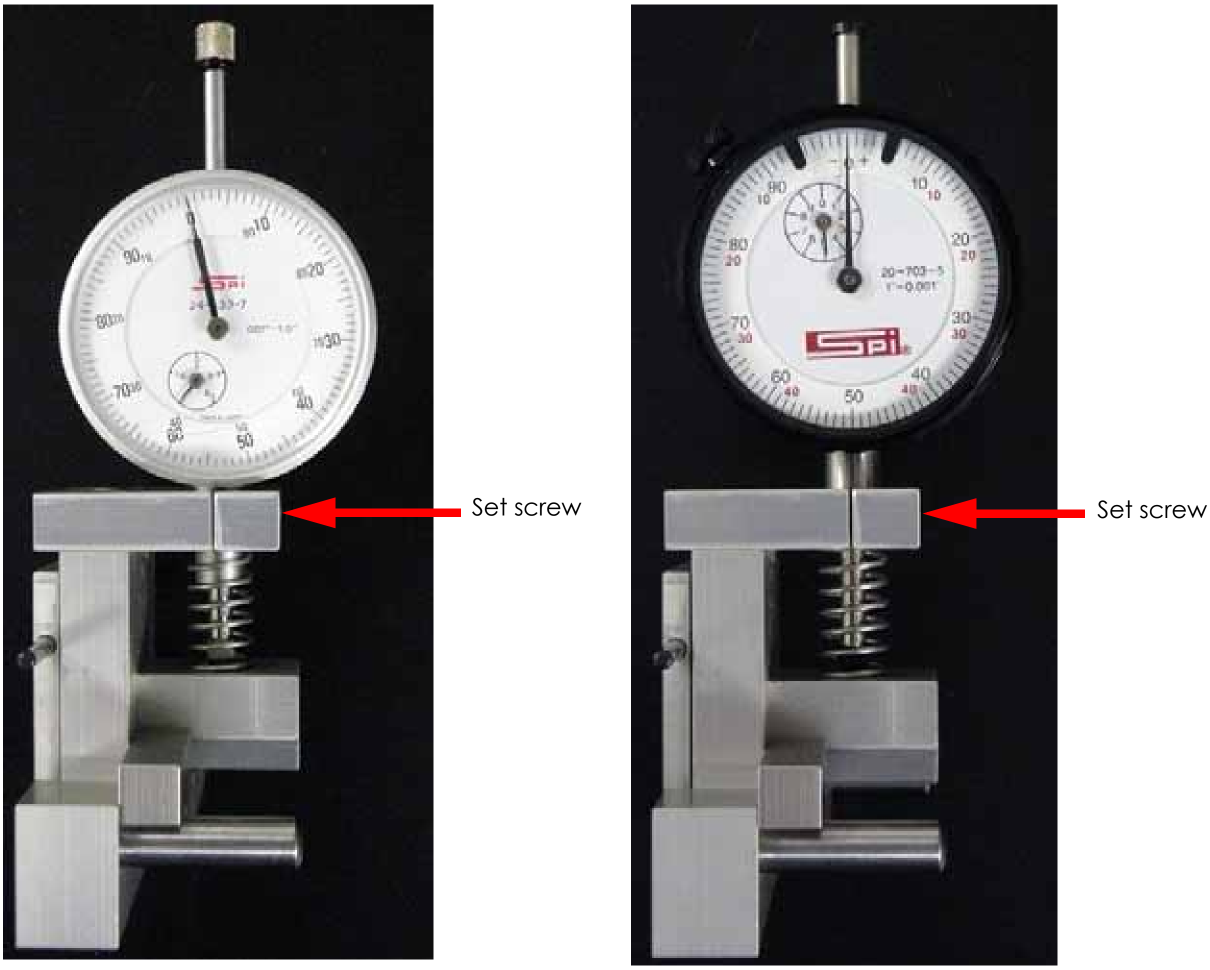
Figure 4-287: Left side Y belt clamp mounting screw locations



14. Insert the belt tension gauge zero block into the belt tension gauge. See Figure 4-288.
15. Zero the dial indicators by adjusting the dial indicator up or down until the gauge reads:
    A. The old dial indicator will be at zero when the large hand is on 0 and the small hand is on 2.7, when at zero use a 7⁄64″ allen wrench to tighten the set screw. See Figure 4-288.
    B. The new dial indicator will be at zero when the large hand is on 0 and the small hand is on 5, when at zero use a 7⁄64″ allen wrench to tighten the set screw. See Figure 4-288.

Note: Turn the dial indicator to the left so the face is visible while tensioning the right side Y drive belt.

Figure 4-288: Belt tension gauge zero block

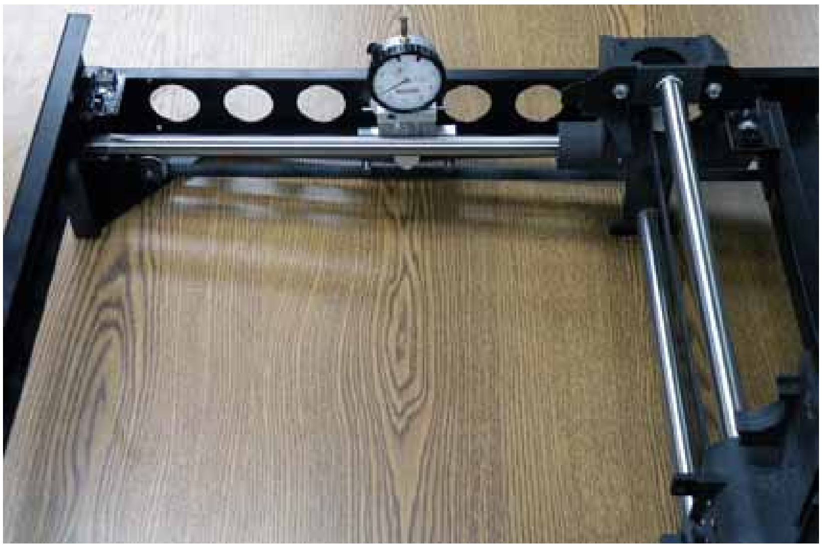


Old dial indicator

New dial indicator

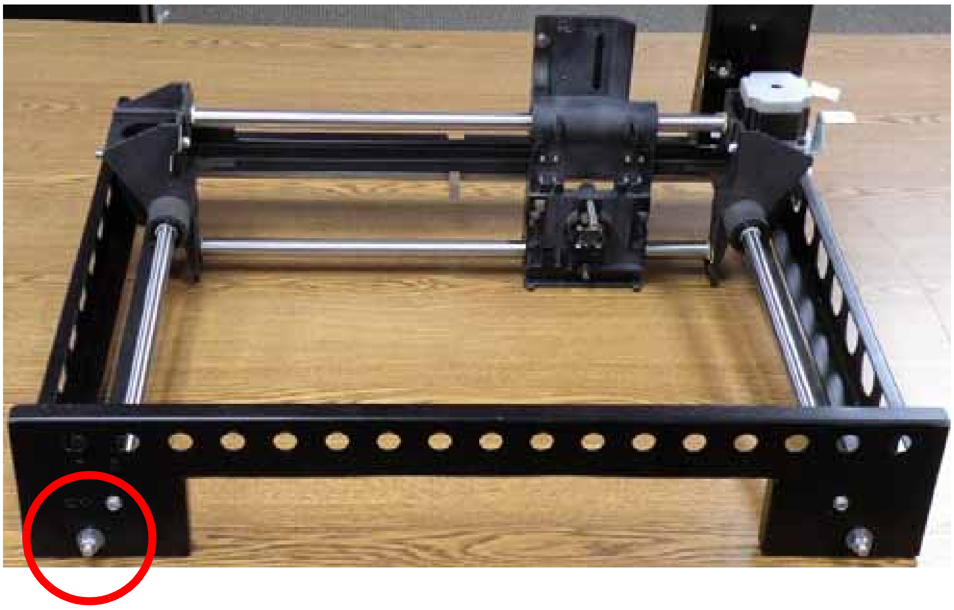
16. Remove the zero block from the belt tension gauge.
17. Move the head to the rear of the printer.
18. Place the belt tension gauge on the center of the left side Y drive belt. See Figure 4-289.

Figure 4-289: Belt tension gauge location



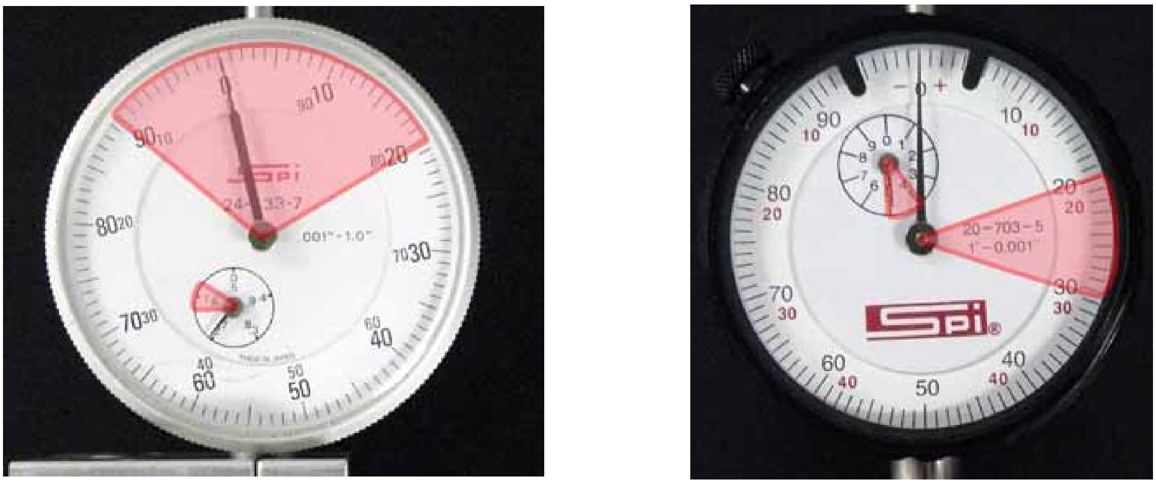
19. Locate the left side Y drive belt tension nut, see Figure 4-290.

Figure 4-290: Left side Y Drive belt tension nut location



20. Using a ½" nut driver or box wrench, tighten the left side Y drive belt by turning the drive belt tensioning nut clockwise until:
    A. The old dial indicators large hand is between 90 and 20 mils and the small hand is nearly on 1.6. See Figure 4-291.
    B. The new dial indicators large hand is between 20 and 30 mils and the small hand is between 4 and 5. See Figure 4-291.

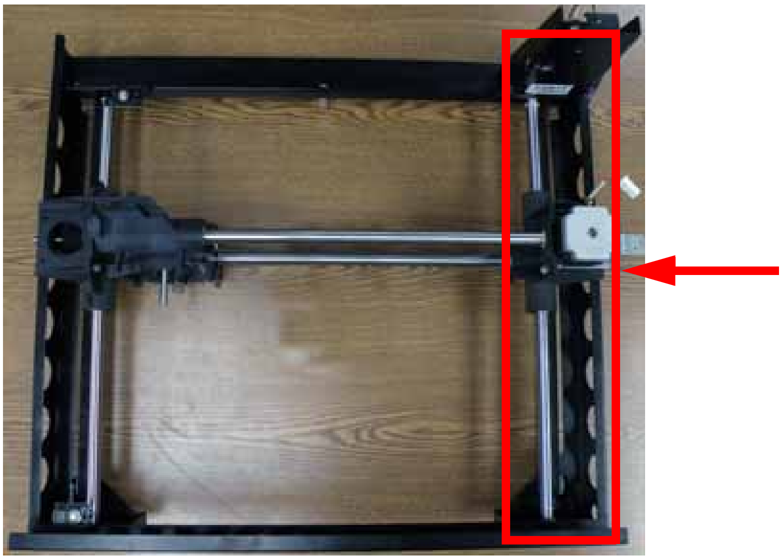
Figure 4-291: Dial indicator readings



Old dial indicator   New dial indicator

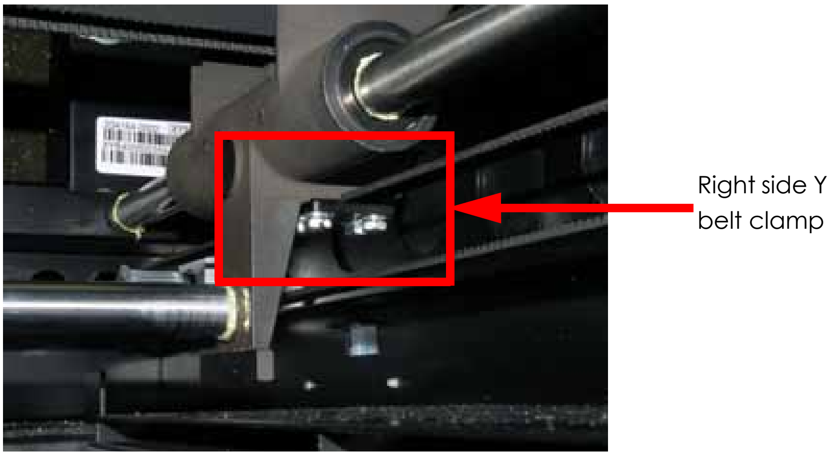
21. Remove the tension gauge and move the head from front to back several times.
22. Reattach the tension gauge to the left side Y drive belt and measure belt tension. If tension is out of specification, repeat steps 17 - 21 until the belt tension is within specification.
23. Align the left side Y drive belt clamp with the mounting holes and use a $^{5}/_{16}$″ nut driver to reinstall the 4 mounting screws.
24. Locate the right side Y drive belt. See Figure 4-292.

Figure 4-292: Right side Y drive belt location



25. Using a $^{5}/_{16}$″ nut driver or standard screwdriver, remove the 4 right side Y belt clamp mounting screws and remove the belt clamp. See Figure 4-293.

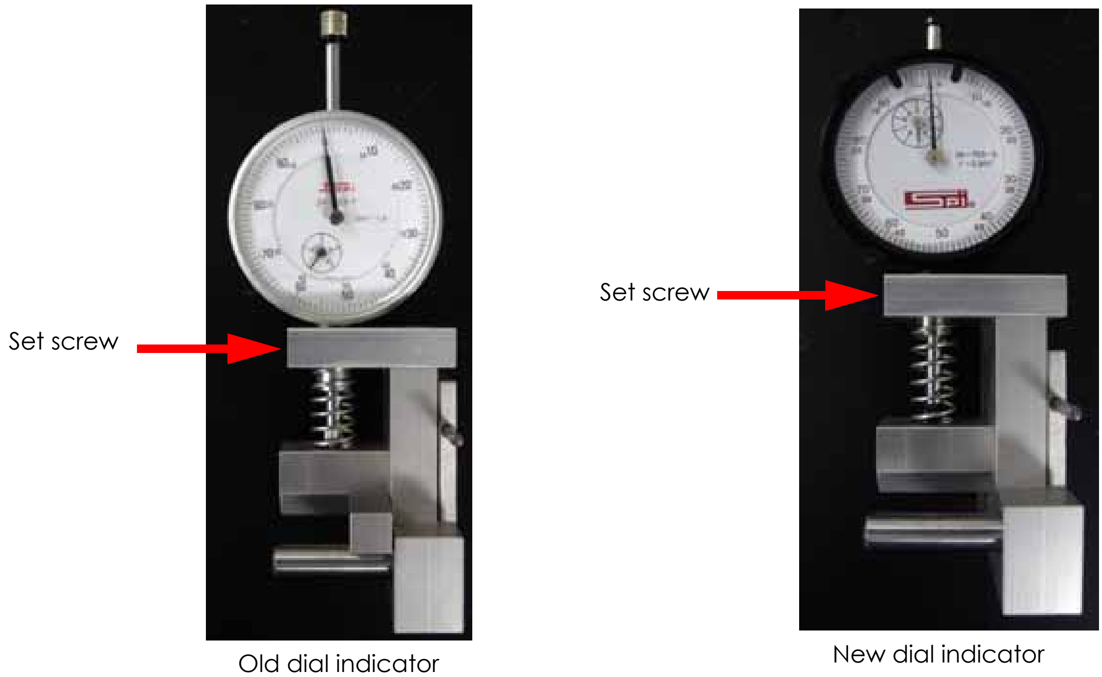
Figure 4-293: Right side Y belt clamp mounting screw locations



1. Insert the belt tension gauge zero block into the belt tension gauge. See Figure 4-294.
2. Zero the dial indicators by adjusting the dial indicator up or down until the gauge reads:
   A. The old dial indicator will be at zero when the large hand is on 0 and the small hand is on 2.7, when at zero use a $^7/_{64}$″ allen wrench to tighten the set screw. See Figure 4-294.
   B. The new dial indicator will be at zero when the large hand is on 0 and the small hand is on 5, when at zero use a $^7/_{64}$″ allen wrench to tighten the set screw. See Figure 4-294.

Note: Turn the dial indicator to the right so the face is visible while tensioning the left side Y drive belt.

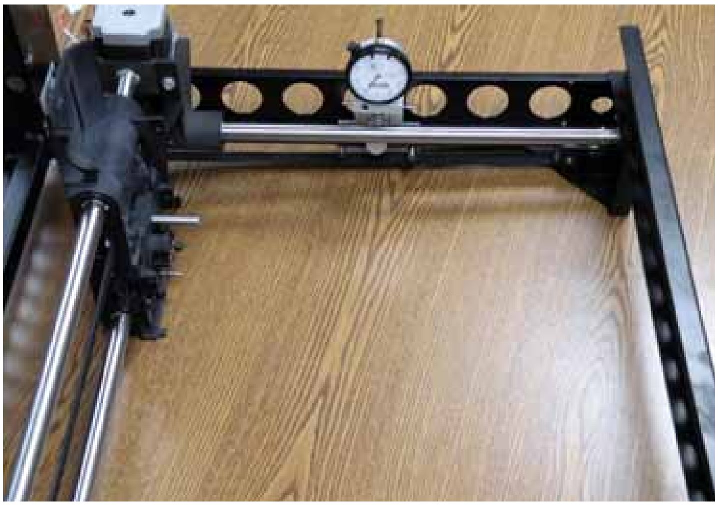
Figure 4-294: Belt tension gauge zero block



3. Remove the zero block from the belt tension gauge.
4. Move the head to the rear of the printer.

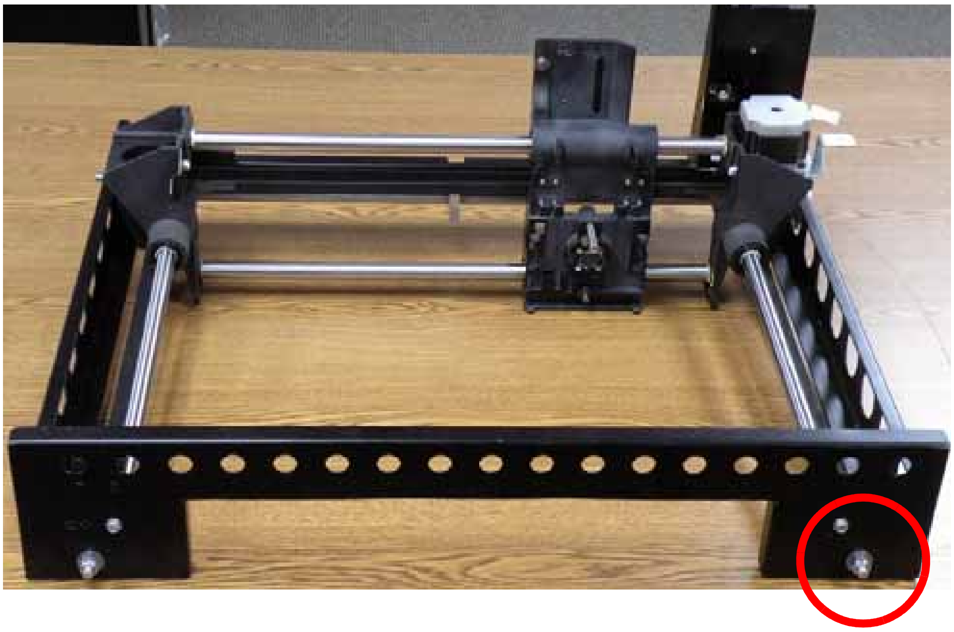
5. Place the belt tension gauge on the center of the right side Y drive belt. See Figure 4-295.

Figure 4-295: Belt tension gauge location



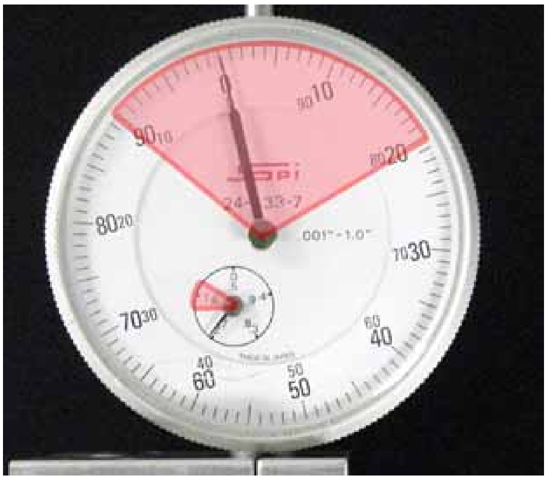
6. Locate the right side Y drive belt tension nut, see Figure 4-296.

Figure 4-296: Right side Y drive belt tension nut location



7. Using a ½" nut driver or box wrench, tighten the right side Y drive belt by turning the drive belt tensioning nut clockwise until:
   A. The old dial indicators large hand is between 90 and 20 mils and the small hand is nearly on 1.6. See Figure 4-297.
   B. The new dial indicators large hand is between 20 and 30 mils and the small hand is between 4 and 5. See Figure 4-297.

Figure 4-297: Dial indicator readings



Old dial indicator

New dial indicator

8. Remove the tension gauge and move the head from front to back several times.
9. Reattach the tension gauge to the right side Y drive belt and measure belt tension. If tension is out of specification, repeat steps 4 - 8 until the belt tension is within specification.
10. Align the right side Y drive belt clamp with the mounting holes and use a $^{5}/_{16}$″ nut driver to reinstall the 4 mounting screws.
11. Place the XY table into position through the top of the printer.

Note: Tilting the XY table so that the left side is elevated will facilitate installation.

12. Loosely reinstall the 5 XY table mounting screws.
13. Align the top of the XY table with top of the system frame and completely tighten the 5 mounting screws, see Figure 4-298.

Figure 4-298: Aligning the XY table with the system frame

Align top edge of XY table with top edge of frame

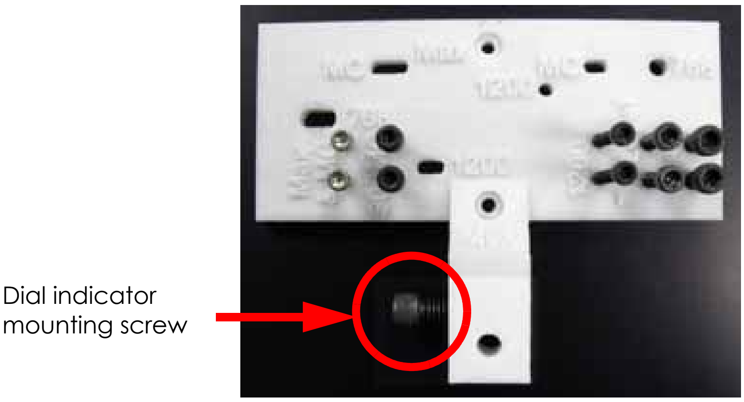
14. Reinstall the 3 XY table cams, do not tighten at this time.

15. Connect the Y motor and install a wire tie around the connector.
16. Align the X motor energy chain with the mounting holes and use a $^5/_{32}$" allen wrench to reinstall the 2 mounting screws.
17. Feed the energy chain back in through the XY table and align it with the mounting holes.

Caution: Be careful not to twist the electrical leads or the filament tubes when installing the energy chain.

18. Using a $^5/_{32}$" allen wrench, reinstall the 2 energy chain mounting screws at the right rear of the XY table.
19. Using a $^5/_{32}$" allen wrench, reinstall the 2 energy chain mounting screws at the translator.
20. Align the umbilical hose clamp with the mounting hole and use a $^5/_{16}$" nut driver or standard screwdriver to reinstall the mounting screw.
21. Align the umbilical cable clamp with the mounting hole and use a $^5/_{16}$" nut driver or standard screwdriver to reinstall the mounting screw.
22. Reconnect the Y home sensor by pushing the lead into the connector.
23. Reconnect the Y EOT sensor by pushing the lead into the connector.
24. Reinstall the Z level assembly, see Installing the Z Level Assembly on page 4-152.
25. Reinstall the Z foam sensor, see Installing the Z Foam Sensor on page 4-150.
26. Reinstall the TC Amp board, see Installing the TC Amp Board on page 4-145.
27. Reinstall the head board, see Installing the Head Board on page 4-142.
28. Reinstall the toggle sensor, see Installing the Toggle Sensor on page 4-140.
29. Reinstall the toggle bar, see Installing the Toggle Bar on page 4-139.
30. Reinstall the toggle plate assembly, see "Installing the 1200 Toggle Plate Assembly" on page 4-114. Do not reinstall the head cover at this time.
31. Using a $^3/_8$" allen wrench, remove the dial indicator mounting screw from the head bracket. See Figure 4-299.

Figure 4-299: Head bracket mounting screws

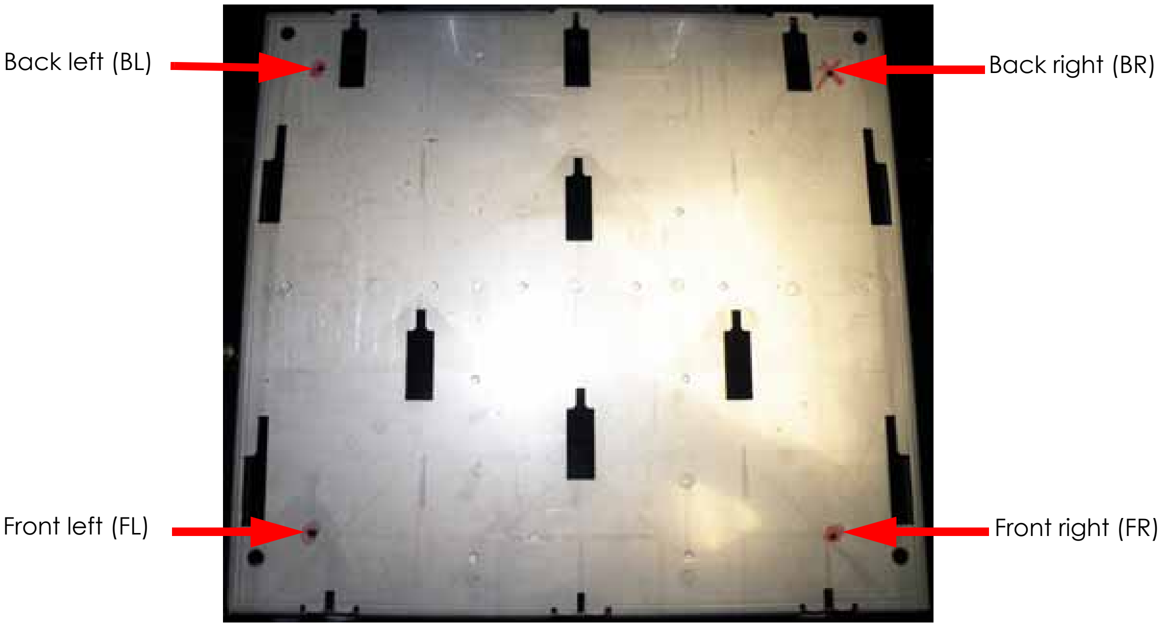


32. Align the dial indicator with the head bracket and use a $^3/_8$" allen wrench to install the mounting screw. See Figure 4-300.

Figure 4-300: Dial indicator installation

33. Using a marker, mark the Z platen in the rear left corner, rear right corner, front left corner and front right corner. See Figure 4-301.

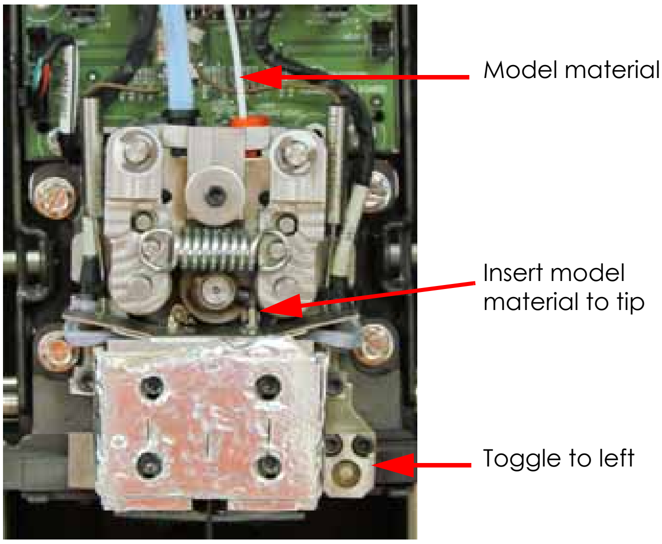
Figure 4-301: Z platen marking locations



34. Manually raise the Z stage, by turning the lead screw with a gloved hand, until it is about 2 inches from the upper limit.
35. Disconnect model side material tube by pressing the retaining ring down and pulling the tube out.
36. Insert a 6 inch piece of model material through model side until it reaches the tip then toggle to the left to engage the model side. See Figure 4-302.

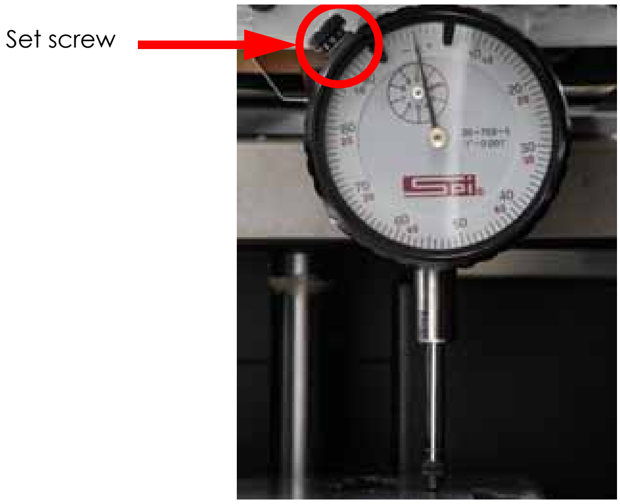
Note: Material is inserted to stabilize the head during the leveling process.

Figure 4-302: Inserting model material



37. Attach dial indicator to head.
38. Move the dial indicator to the mark on the right rear corner and zero the dial indicator by loosening the set screw and turning the ring until the dial is on the 0. See Figure 4-303.

Figure 4-303: Zero the dial indicator



39. Move the dial indicator to the mark on the front right corner of the Z platen and record the value.
40. Move the dial indicator to the mark on the front left corner of the Z platen and record the value.
41. Move the dial indicator to the mark on the back left corner of the Z platen and record the value.
42. Insert the MaracaEX CD in a workstation and open the *XY Level Calc.xls* file.
43. Enter the recorded values from each corner into the indicator reading boxes of the XY table level calculator. See Figure 4-304.

44. Input the FR, FL and BL values you measured in the Indicator Reading boxes of the spreadsheet.

Note: Make sure to use the correct XLS file. There is a separate file for Dimension 1200 models.

Figure 4-304: Sample XY Level Calculator

Location	Indicator Reading	Knob Adjust
BR	0.000	-
FR	-0.004	0.014
FL	0.010	-0.013
BL	0.008	-0.001

45. The spreadsheet will calculate the required adjustment for each corner, and display them in the Knob Adjust column.
46. Move the dial indicator to the BR position and verify it is zero.

Note: This corner does not have an adjustment cam and will not require adjustment.

47. Move the dial indicator to the FR position.
48. Zero the dial indicator.
49. Using a $5/16$" allen wrench, loosen the XY frame screw and the cam adjuster lock screw on the FR corner.
50. Turn the adjuster cam until the dial indicator reading matches the calculated value from the spreadsheet.

Note: Turning the can clockwise will lower the XY table and cause the dial indicator needle to move positive. Turning the can counter-clockwise will raise the XY table and cause the dial indicator needle to move negative.

51. Tighten the cam lock screw and the frame screw on the FR corner.
52. Move the dial indicator to the FL corner.
53. Zero the dial indicator.
54. Using a $5/16$" allen wrench, loosen the XY frame screw and the cam adjuster lock screw on the FL corner.
55. Turn the adjuster cam until the dial indicator reading matches the calculated value from the spreadsheet (e.g. -0.013).
56. Tighten the cam lock screw and the frame screw on the FL corner.
57. Move the dial indicator to the BL corner.
58. Zero the Dial indicator.
59. Using a $5/16$" allen wrench, loosen the XY frame screw and the cam adjuster lock screw on the BL corner.
60. Turn the adjuster cam until the dial indicator reading matches the calculated value from the spreadsheet (e.g. -0.001).
61. Tighten the cam lock screw and the frame screw on the FL corner.
62. Recheck the four corners again. The tolerance from the fixed corner is +/- .0015.
63. Repeat steps 38 through 61 until the measurements are within specification.
64. Perform head alignment, see Head Alignment Procedure on page 5-7.

65. Reinstall the head cover.
66. Reinstall the side panels, see Installing the Side Panels on page 4-6.
67. Reinstall the rear panel, see Installing the Rear Panel on page 4-5.
68. Perform Z calibration, see Z Calibration on page 5-2.
69. Perform XY calibration, see XY Calibration on page 5-2.
70. Perform part based calibrations, see Part Based Calibration on page 5-3.
71. Remove the calibration floppy disk/CD from the electronics bay and get the .cal file from the printer with MaracaEX, see “Get” .cal file – from hard drive to the calibration Floppy Disk/CD: on page 5-38.
72. Copy the .cal file to a new floppy disk/CD and replace the calibration floppy disk/CD in the electronics bay.
73. Build a sample part to verify proper operation of the printer.
74. Box up the defective XY table and send back to Stratasys.
75. Build a sample part to verify proper operation of the printer.
76. Box up the bad XY table and send back to Stratasys.

Z Stage Components

Thermal Snap Switch

Note: The thermal snap switch can be reset by pressing the button.

Required Tools

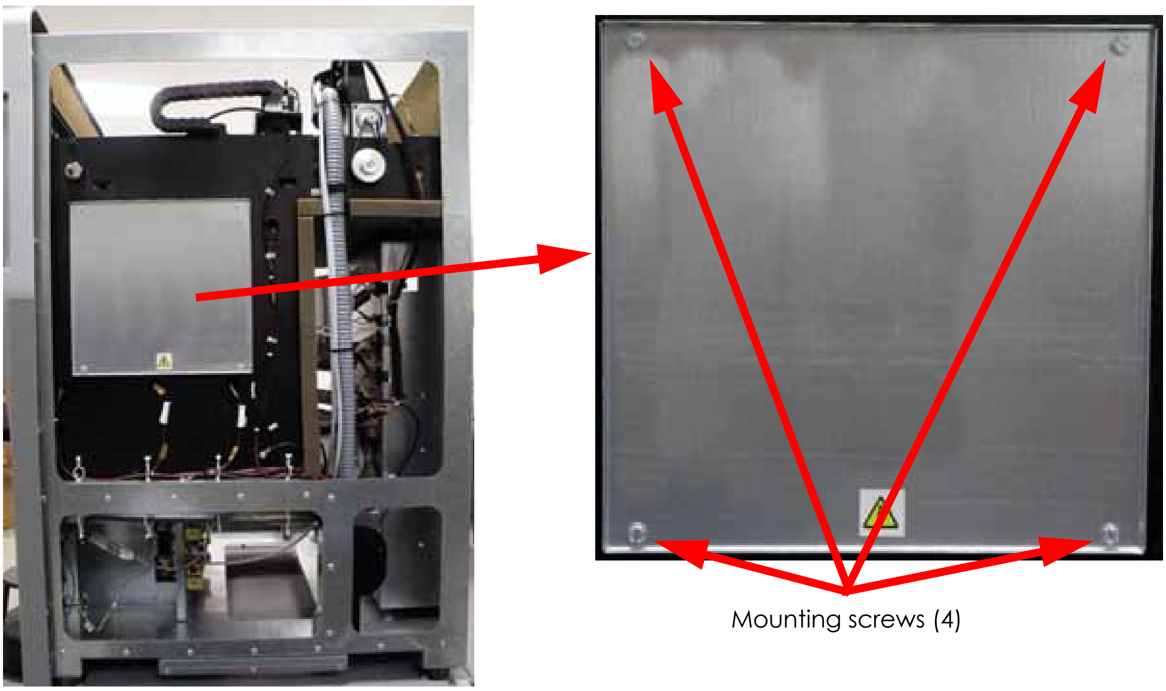
- $^5/_{16}$″ Nut driver or standard screwdriver
- $^3/_{32}$″ Allen wrench

Removing the Thermostat Fuse

Caution: Heater cover and heaters are hot! Allow area to cool before removing cover.

1. Power down the printer.
2. Remove the rear panel, see Removing the Rear Panel on page 4-5.
3. Remove the side panels, see Removing the Side Panels on page 4-6.
4. Using a $^5/_{16}$″ nut driver or standard screwdriver, remove the 4 right side heater cover- mounting screws. See Figure 4-305.

Figure 4-305: Right side heater cover mounting screw locations

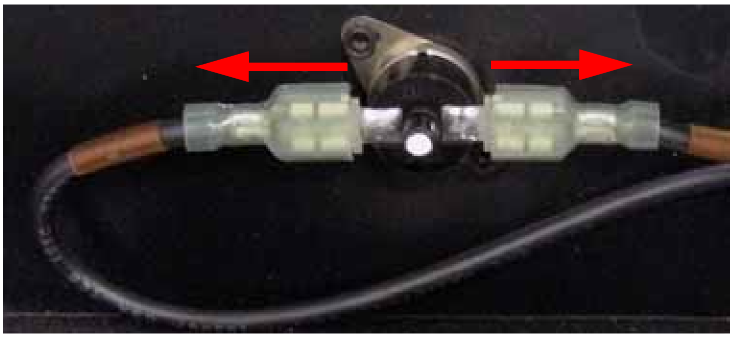


5. Using a $^5/_{16}$″ nut driver or standard screwdriver, remove the cable clamp from the thermal snap switch leads. See Figure 4-306.

Figure 4-306: Cable clamp mounting screw location

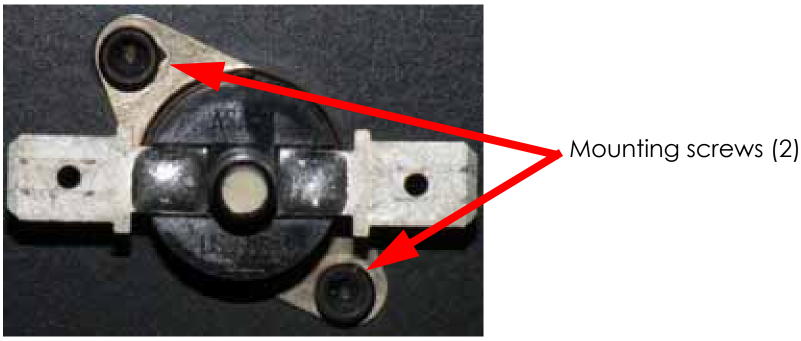
6. Disconnect the thermal snap switch leads by pulling away from the spade connector, see Figure 4-307.

Figure 4-307: Thermal snap switch detail



7. Using a $^{3}/_{32}$″ allen wrench, remove the 2 thermal snap switch mounting screws. See Figure 4-308.

Figure 4-308: Thermal snap switch mounting screw locations



8. Remove the thermal snap switch and discard.

Installing the Thermal Snap Switch

1. Align the thermal snap switch with the mounting holes and use a $^{3}/_{32}$″ allen wrench to reinstall the 2 mounting screws.
2. Reconnect the thermal snap switch leads by pushing the connectors on to the spades.
3. Using a $^{5}/_{16}$″ nut driver or standard screwdriver, reinstall the cable clamp.
4. Using a $^{5}/_{16}$″ nut driver or standard screwdriver, reinstall the right side heater cover.
5. Reinstall the side panels, see Installing the Side Panels on page 4-6.
6. Reinstall the rear panel, see Installing the Rear Panel on page 4-5.

Chamber Thermocouple

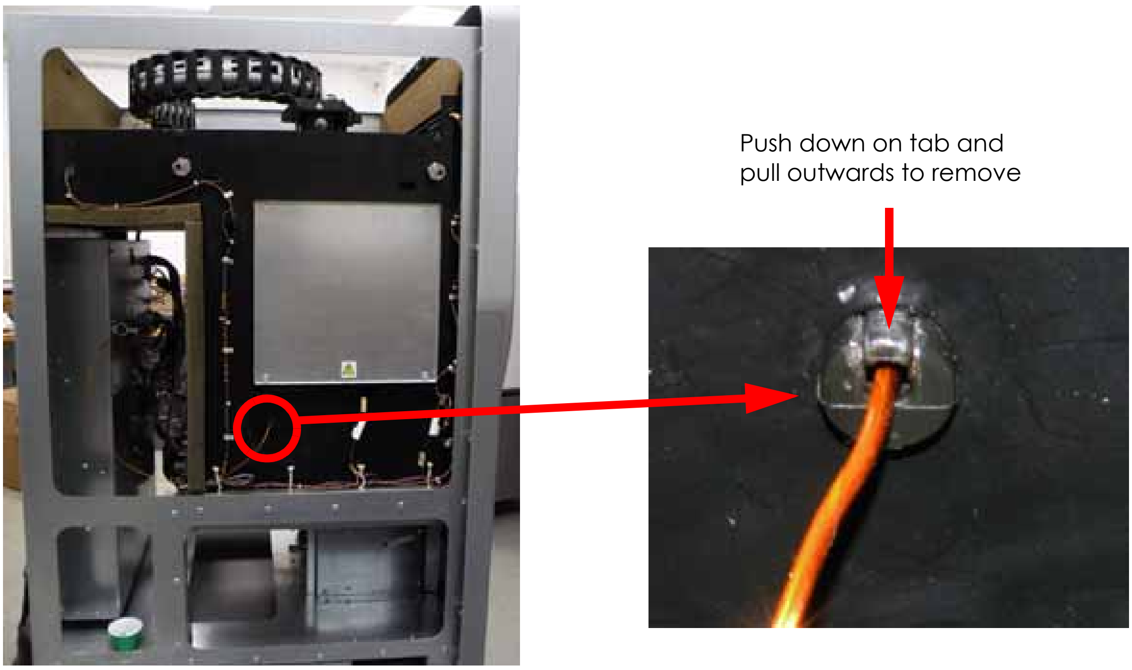
Required Tools

- Small standard screwdriver or needle nose pliers

Remove the Chamber Thermocouple

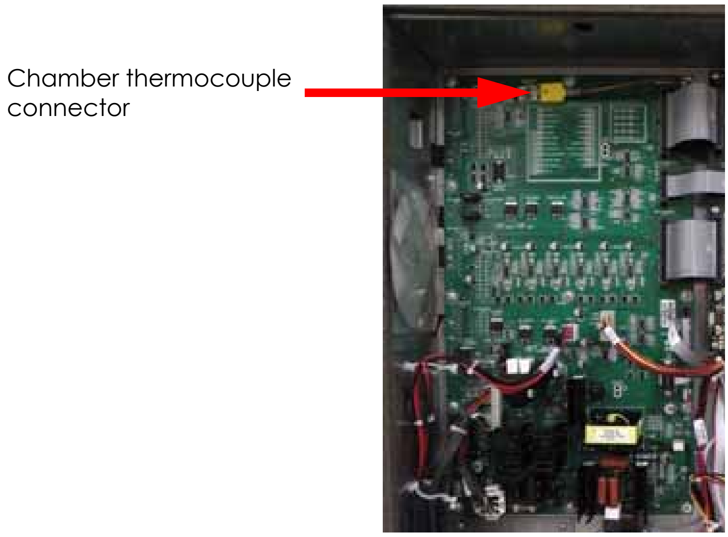
1. Power down the printer.
2. Remove the rear panel, see Removing the Rear Panel on page 4-5.
3. Remove the side panels, see Removing the Side Panels on page 4-6.
4. Locate the chamber thermocouple, see Figure 4-309.
5. Using a needle nose pliers or small standard screwdriver, remove the thermocouple by pushing down on the strain relief tab and carefully pulling back. See Figure 4-309.

Figure 4-309: Chamber thermocouple location



6. Slide the strain relief off of the thermocouple and set aside for reinstallation.
7. Disconnect the chamber thermocouple from the power distribution board by pulling out from the connector, see Figure 4-310.

Figure 4-310: Chamber thermocouple connector location



8. Remove the thermocouple and wire from the system while taking note of the wire routing.

Installing the Chamber Thermocouple

1. Route thermocouple lead between thermocouple mounting hole and the power distribution board.
2. Connect the thermocouple lead to the power distribution board.
3. Slide the strain relief onto the thermocouple so there is $^3\!/_8$″ protruding from the end of the strain relief.
4. Insert the strain relief into the mounting hole.
5. Verify from the inside chamber that $^3\!/_8$″ is still protruding from the end of the strain relief.

Chamber Heater

Required Tools

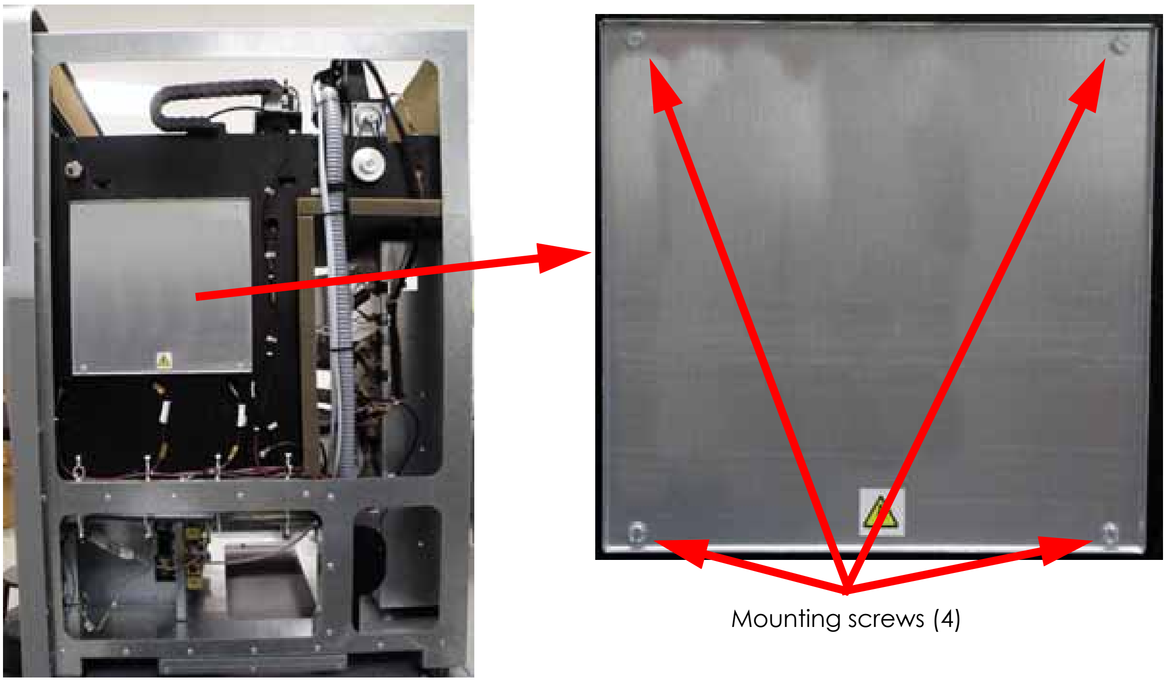
- $^5/_{16}$″ Nut driver or standard screwdriver
- $^3/_8$″ Nut driver or box wrench

Warning: Envelope heater area is very hot. Wear gloves when working in or around heater area or allow envelope to cool.

Removing the Right Side Chamber Heater

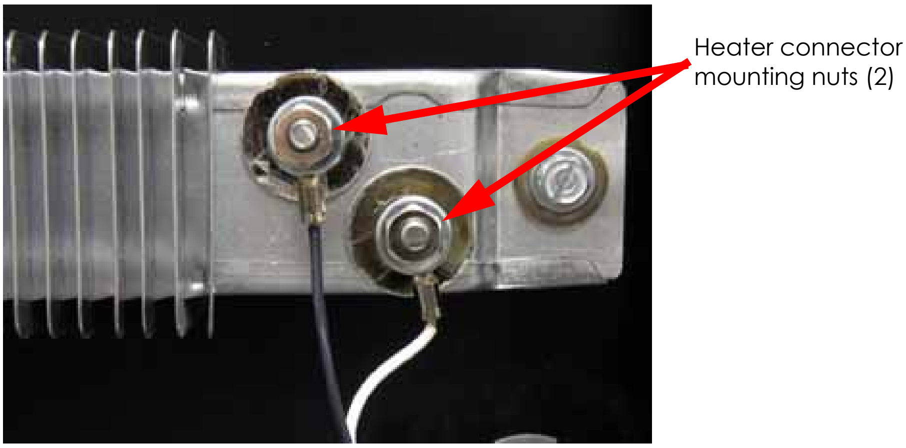
1. Power down the printer.
2. Remove the rear panel, see Removing the Rear Panel on page 4-5.
3. Remove the side panels, see Removing the Side Panels on page 4-6.
4. Locate the right side heater cover and use a $^5/_{16}$″ nut driver or standard screwdriver to remove the 4 mounting screws. See Figure 4-311.

Figure 4-311: Right side heater cover detail



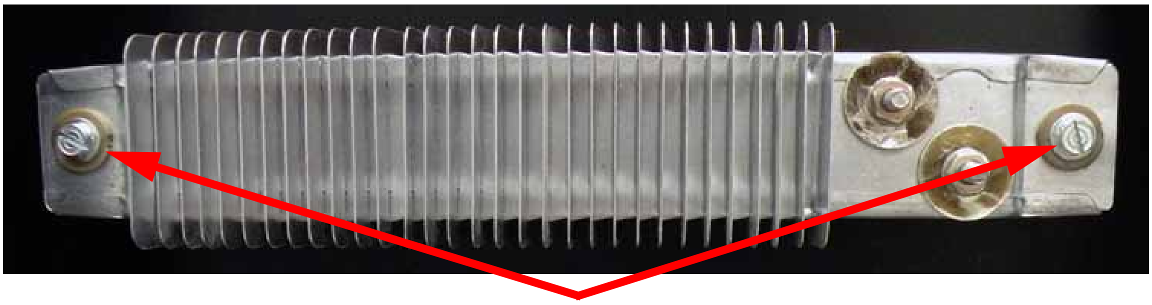
5. Using a $^3/_8$″ nut driver or box wrench, remove the heater connector mounting nuts (2) and washers (4). See Figure 4-312.

Figure 4-312: Right side heater connections



6. Remove the 2 wires from the posts.
7. Using a 5⁄16″ nut driver or standard screwdriver, remove the 2 right side heater mounting screws. See Figure 4-313.

Figure 4-313: Right side heater mounting screw locations



8. Remove the heater and discard.

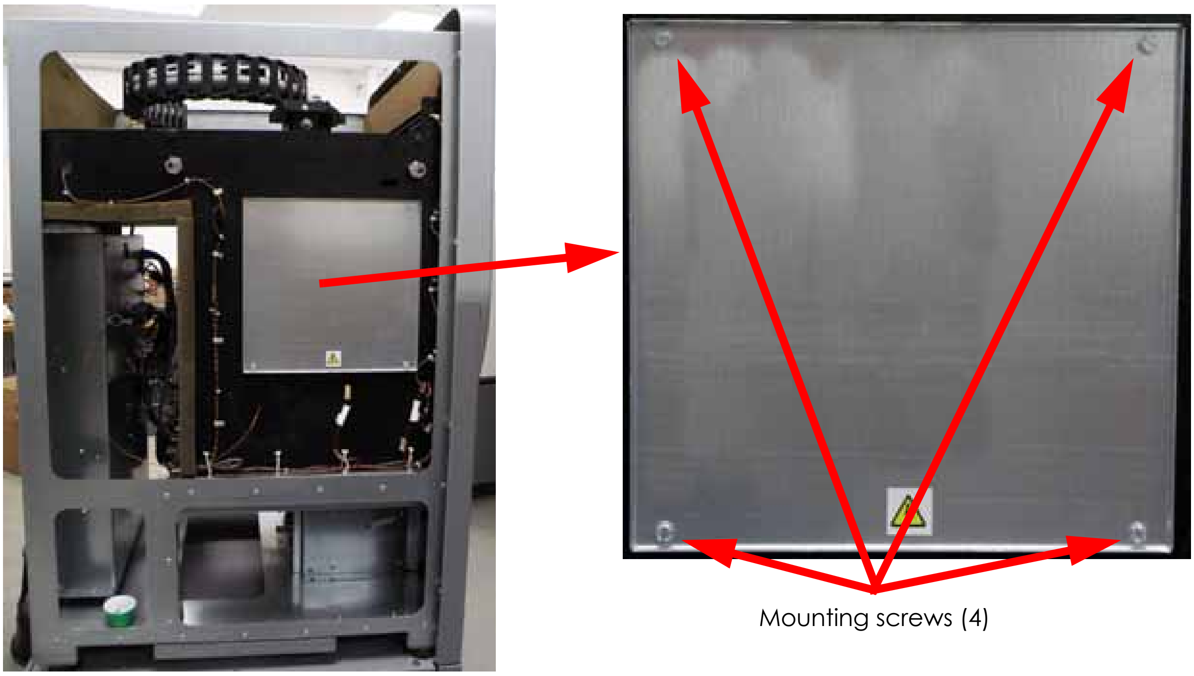
Installing the Right Side Chamber Heater

1. Align the heater with the mounting posts and use a 5⁄16″ nut driver or standard screwdriver to install the mounting screws (2) and washers (4).
2. Reconnect the black power lead to the left post and use a 3⁄8″ nut driver or box wrench to reinstall the mounting nut (1) and washers (2).
3. Reconnect the white power lead to the right post and use a 3⁄8″ nut driver or box wrench to reinstall the mounting nut (1) and washers (2).
4. Align the right side heater cover with the mounting holes and use a 5⁄16″ nut driver or standard screwdriver to reinstall the 4 mounting screws.
5. Reinstall the side panels, see Installing the Side Panels on page 4-6.
6. Reinstall the rear panel, see Installing the Rear Panel on page 4-5.

Removing the Left Side Chamber Heater

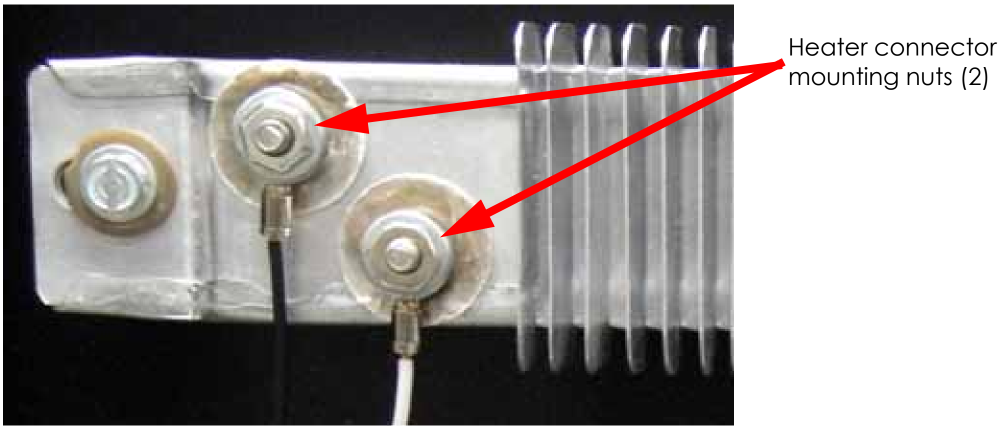
1. Power down the printer.
2. Remove the rear panel, see Removing the Rear Panel on page 4-5.
3. Remove the side panels, see Removing the Side Panels on page 4-6.
4. Locate the left side heater cover and use a $^{5}/_{16}$" nut driver or standard screwdriver to remove the 4 mounting screws. See Figure 4-311.

Figure 4-314: Left side heater cover detail



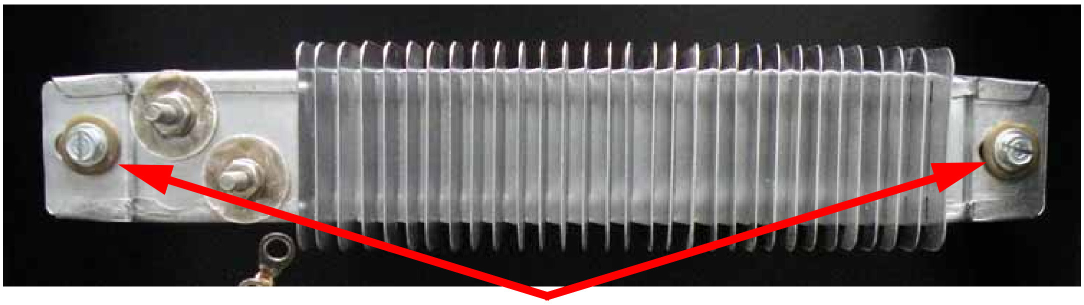
5. Using a $^{3}/_{8}$" nut driver or box wrench, remove the heater connector mounting nuts (2) and washers (4). See Figure 4-312.

Figure 4-315: Left side heater connections



6. Remove the 2 wires from the posts.
7. Using a $^{5}/_{16}$" nut driver or standard screwdriver, remove the 2 left side heater mounting screws. See Figure 4-313.

Figure 4-316: Left side heater mounting screw locations



Mounting screws (2)

8. Remove the heater and discard.

Installing the Left Side Chamber Heater

1. Align the heater with the mounting posts and use a $^{5}/_{16}$″ nut driver or standard screwdriver to install the mounting screws (2) and washers (4).
2. Reconnect the black power lead to the left post and use a $^{3}/_{8}$″ nut driver or box wrench to reinstall the mounting nut (1) and washers (2).
3. Reconnect the white power lead to the right post and use a $^{3}/_{8}$″ nut driver or box wrench to reinstall the mounting nut (1) and washers (2).
4. Place the wires into the wire clamp and use a $^{5}/_{16}$″ nut driver or standard screwdriver to reinstall the mounting screw.
5. Align the right side heater cover with the mounting holes and use a $^{5}/_{16}$″ nut driver or standard screwdriver to reinstall the 4 mounting screws.
6. Reinstall the side panels, see Installing the Side Panels on page 4-6.
7. Reinstall the rear panel, see Installing the Rear Panel on page 4-5.

Chamber Fans

Required Tools

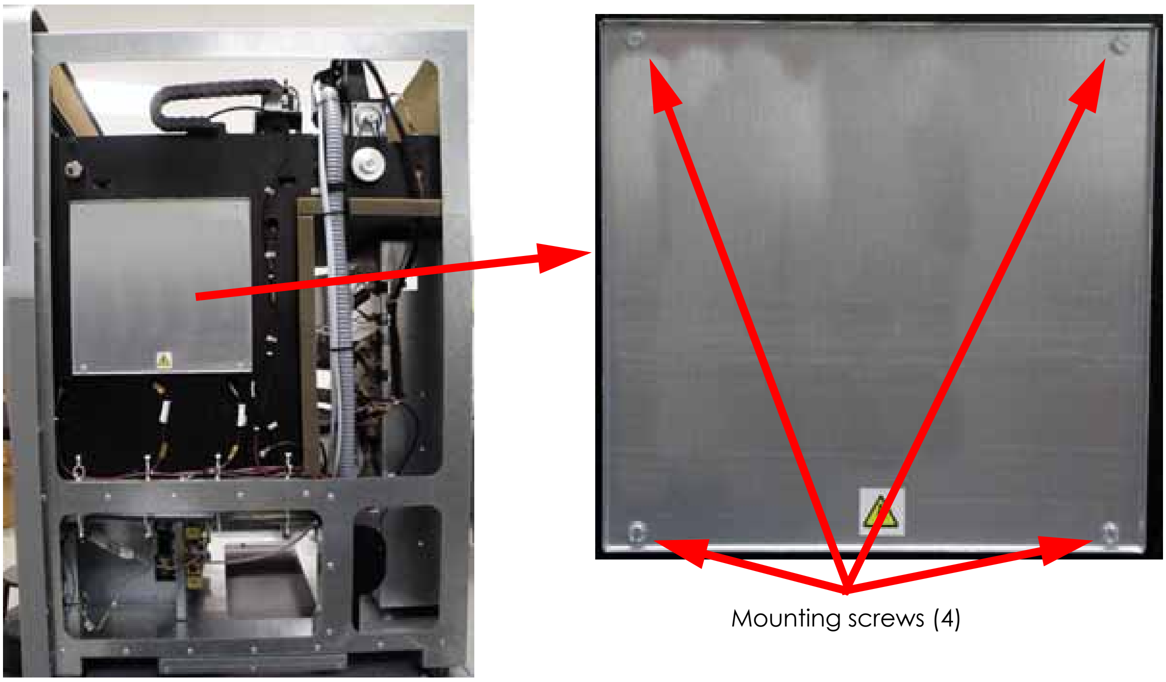
- $^{5}/_{16}$" Nut driver or standard screwdriver

Caution: The heater fan area is hot!

Removing the Right Side Chamber Fans

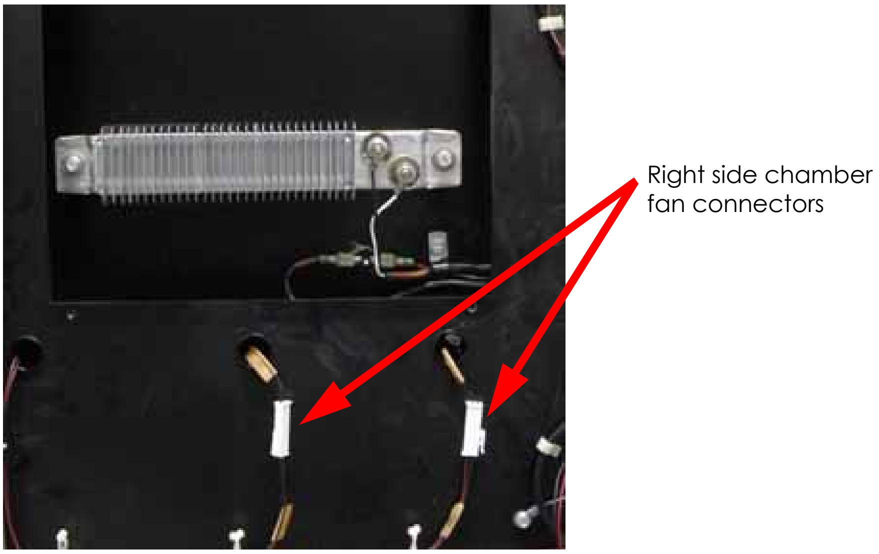
1. Power down the printer.
2. Remove the rear panel, see Removing the Rear Panel on page 4-5.
3. Remove the side panels, see Removing the Side Panels on page 4-6.
4. Locate the right side heater cover and use a $^{5}/_{16}$" nut driver or standard screwdriver to remove the 4 mounting screws. See Figure 4-311.

Figure 4-317: Right side heater cover detail



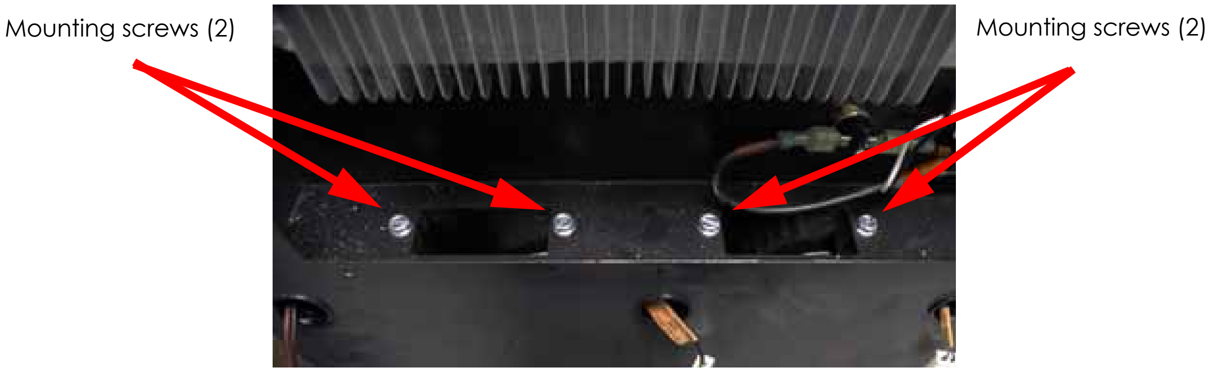
5. Disconnect the 2 right side fan cables by pressing the tab in and pulling apart at the connector, see Figure 4-318.

Figure 4-318: Right side heater connector locations



6. Using a $^{5}/_{16}$″ nut driver or standard screwdriver, remove the chamber fan mounting screws. There are 2 mounting screws per chamber fan. See Figure 4-319.

Figure 4-319: Right side chamber fan mounting screw locations



7. Remove the chamber fans and discard.

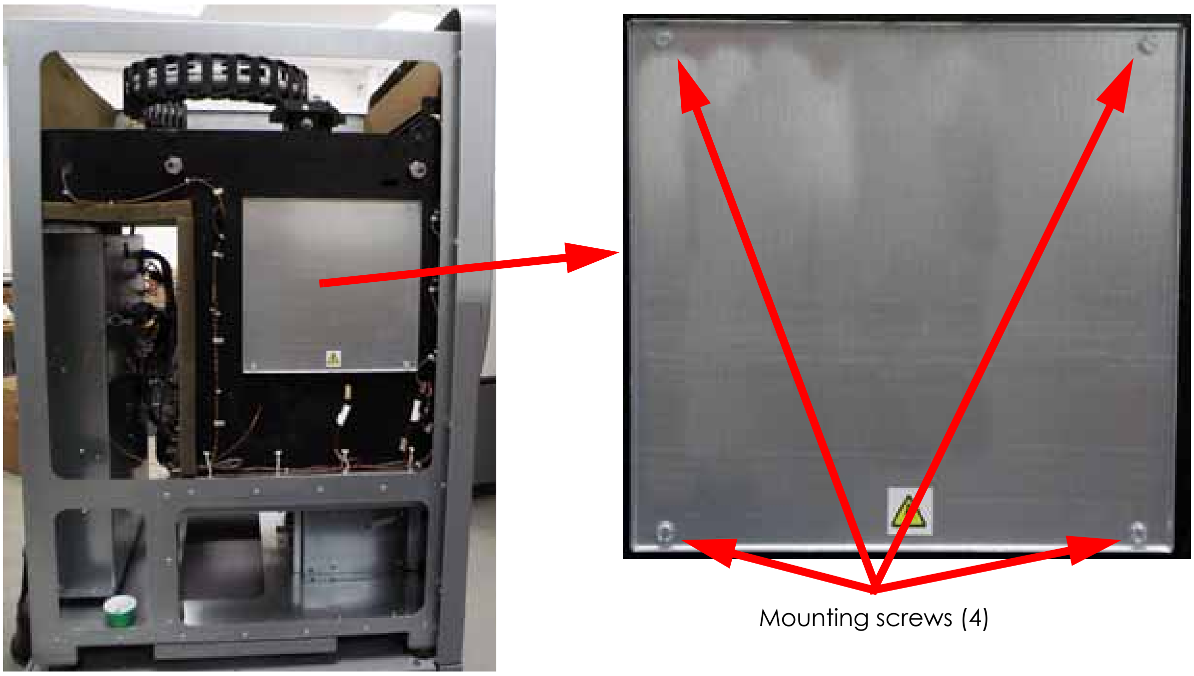
Installing the Right Side Chamber Fans

1. Align the chamber fans with the mounting holes and use a $^{5}/_{16}$″ nut driver or standard screwdriver to reinstall the mounting screws.
2. Route the chamber fan connectors through the chamber and reconnect by pushing the connectors together.
3. Align the right side heater cover with the mounting holes and use a $^{5}/_{16}$″ nut driver or standard screwdriver to reinstall the 4 mounting screws.
4. Reinstall the side panels, see Installing the Side Panels on page 4-6.
5. Reinstall the rear panel, see Installing the Rear Panel on page 4-5.

Removing the Left Side Chamber Fans

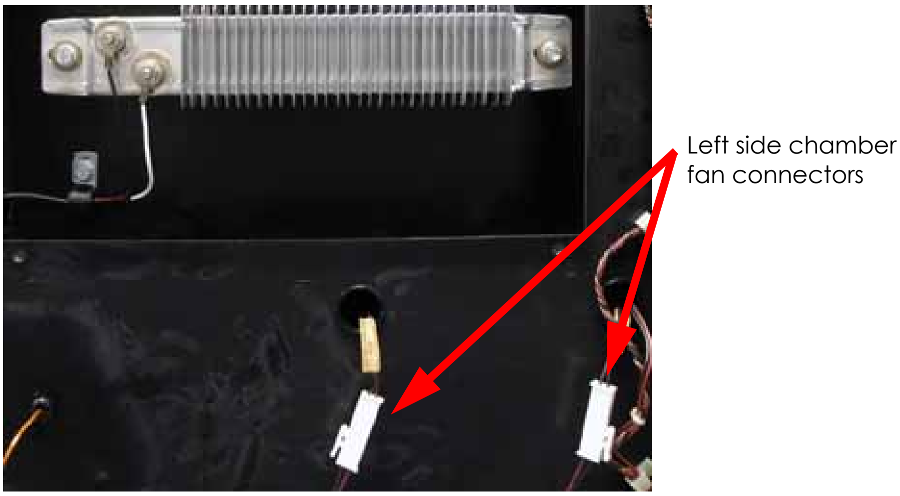
1. Power down the printer.
2. Remove the rear panel, see Removing the Rear Panel on page 4-5.
3. Remove the side panels, see Removing the Side Panels on page 4-6.
4. Locate the left side heater cover and use a $^{5}/_{16}$" nut driver or standard screwdriver to remove the 4 mounting screws. See Figure 4-320.

Figure 4-320: Left side heater cover detail



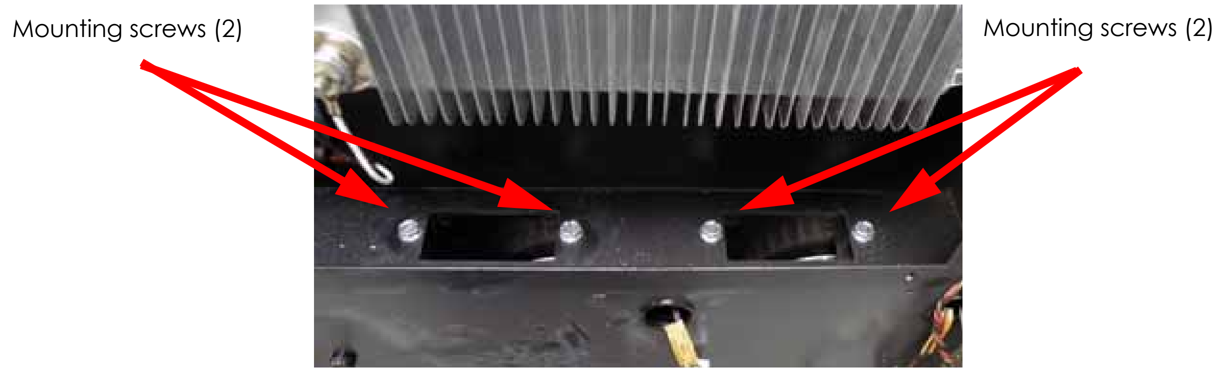
5. Disconnect the 2 left side fan cables by pressing the tab in and pulling apart at the connector, see Figure 4-321.

Figure 4-321: Left side heater connector locations



6. Using a $^{5}/_{16}$" nut driver or standard screwdriver, remove the chamber fan mounting screws. There are 2 mounting screws per chamber fan. See Figure 4-322.

Figure 4-322: Left side chamber fan mounting screw locations



7. Remove the chamber fans and discard.

Installing the Left Side Chamber Fans

1. Align the chamber fans with the mounting holes and use a $^5/_{16}$″ nut driver or standard screwdriver to reinstall the mounting screws.
2. Route the chamber fan wires through the chamber and reconnect by pushing the connectors together.
3. Align the left side heater cover with the mounting holes and use a $^5/_{16}$″ nut driver or standard screwdriver to reinstall the 4 mounting screws.
4. Reinstall the side panels, see Installing the Side Panels on page 4-6.
5. Reinstall the rear panel, see Installing the Rear Panel on page 4-5.

Z Sensors

Required Tools

- ¼″ Nut driver or standard screwdriver

Removing Z BOT (Beginning of Travel) Sensor

1. Power down the printer.
2. Locate the Z BOT sensor, see Figure 4-323.

Figure 4-323: Z BOT sensor location

3. Disconnect the Z BOT sensor by pressing the tab in and pulling outward, see Figure 4-324.
4. Using a ¼″ nut driver or standard screwdriver, remove the Z BOT sensor mounting screw. See Figure 4-324.

Figure 4-324: Z BOT sensor detail

5. Remove the sensor and discard.

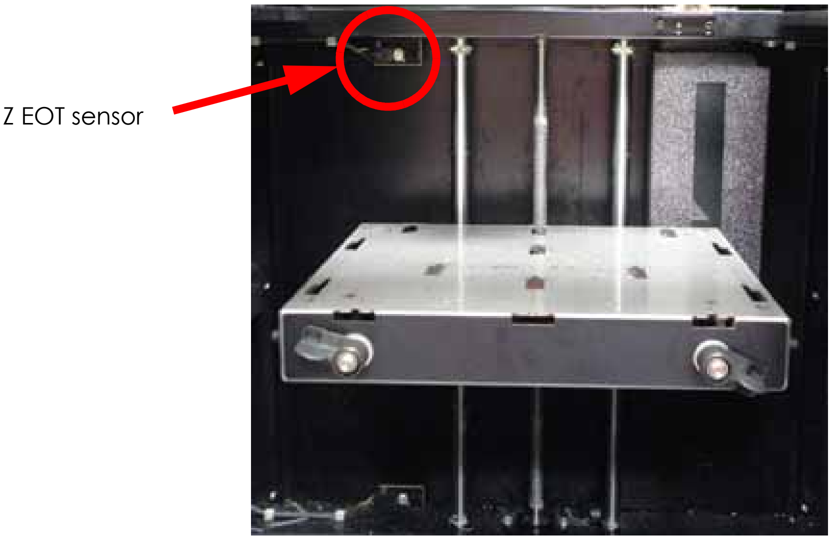
Installing the Z BOT Sensor

1. Align the sensor with the mounting hole and use a ¼″ nut driver or standard screwdriver to reinstall the mounting screw.
2. Reconnect the sensor by pushing into the connector.

Removing Z EOT (End of Travel) Sensor

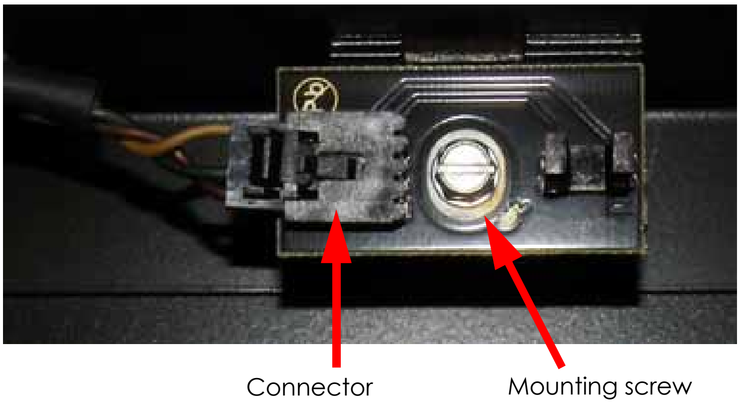
1. Power down the printer.
2. Locate the Z EOT sensor, see Figure 4-323.

Figure 4-325: Z BOT sensor location



3. Disconnect the Z EOT sensor by pressing the tab in and pulling outward, see Figure 4-324.
4. Using a ¼" nut driver or standard screwdriver, remove the Z EOT sensor mounting screw. See Figure 4-324.

Figure 4-326: Z EOT sensor detail



5. Remove the sensor and discard.

Installing the Z EOT Sensor

1. Align the sensor with the mounting hole and use a ¼" nut driver or standard screwdriver to reinstall the mounting screw.
2. Reconnect the sensor by pushing into the connector.

Purge Bucket Light

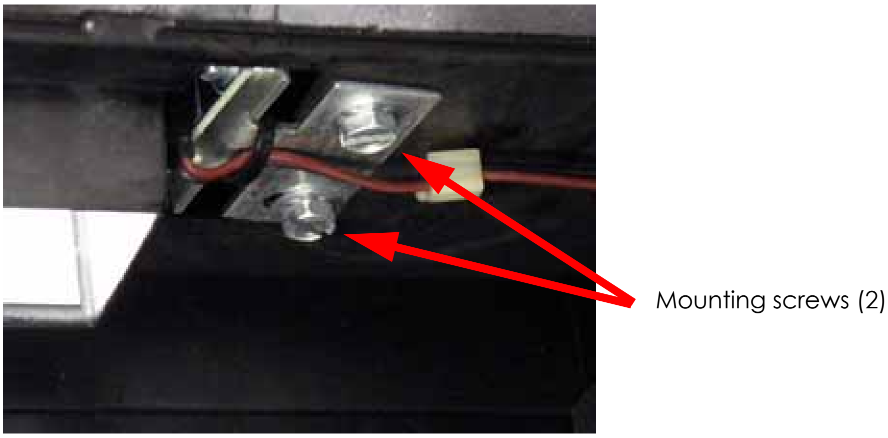
Required Tools

- $^5/_{16}$″ Nut driver or standard screwdriver
- $^1/_4$″ Nut driver
- Cutters
- Wire ties

Removing Purge Bucket Light

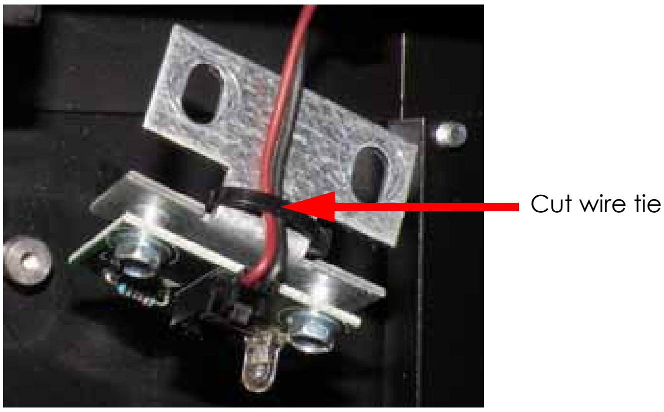
1. Power down the printer.
2. Remove the purge bucket.
3. Using a $^5/_{16}$″ nut driver or standard screwdriver, remove the 2 purge bucket light mounting bracket mounting screws. See Figure 4-327.

Figure 4-327: Purge bucket light mounting bracket mounting screw locations



4. Using a cutters, cut the wire tie holding the electrical lead to the bracket and discard. See Figure 4-328.

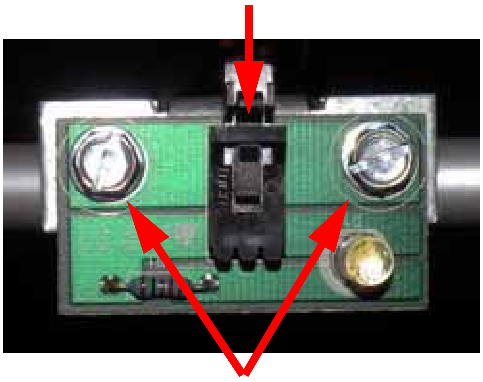
Figure 4-328: Wire tie location



5. Disconnect the electrical lead by pressing the tab in and pulling outwards, see Figure 4-329.

6. Using a ¼″ nut driver or standard screwdriver, remove the 2 purge bucket light mounting screws. See Figure 4-329.

Figure 4-329: Purge bucket light detail



7. Remove the purge bucket light and discard.

Installing Purge Bucket Light

1. Align the purge bucket light with the mounting bracket and use a ¼″ nut driver or standard screwdriver to reinstall the 2 mounting screws.
2. Reconnect the purge bucket light by pushing the lead into the connector.
3. Install a wire tie around the electrical lead and the mounting bracket.
4. Align the purge bucket light mounting bracket with the mounting holes and use a 5⁄16″ nut driver or standard screwdriver to reinstall the 2 mounting screws.
5. Install the purge bucket.

Z Motor & Belt

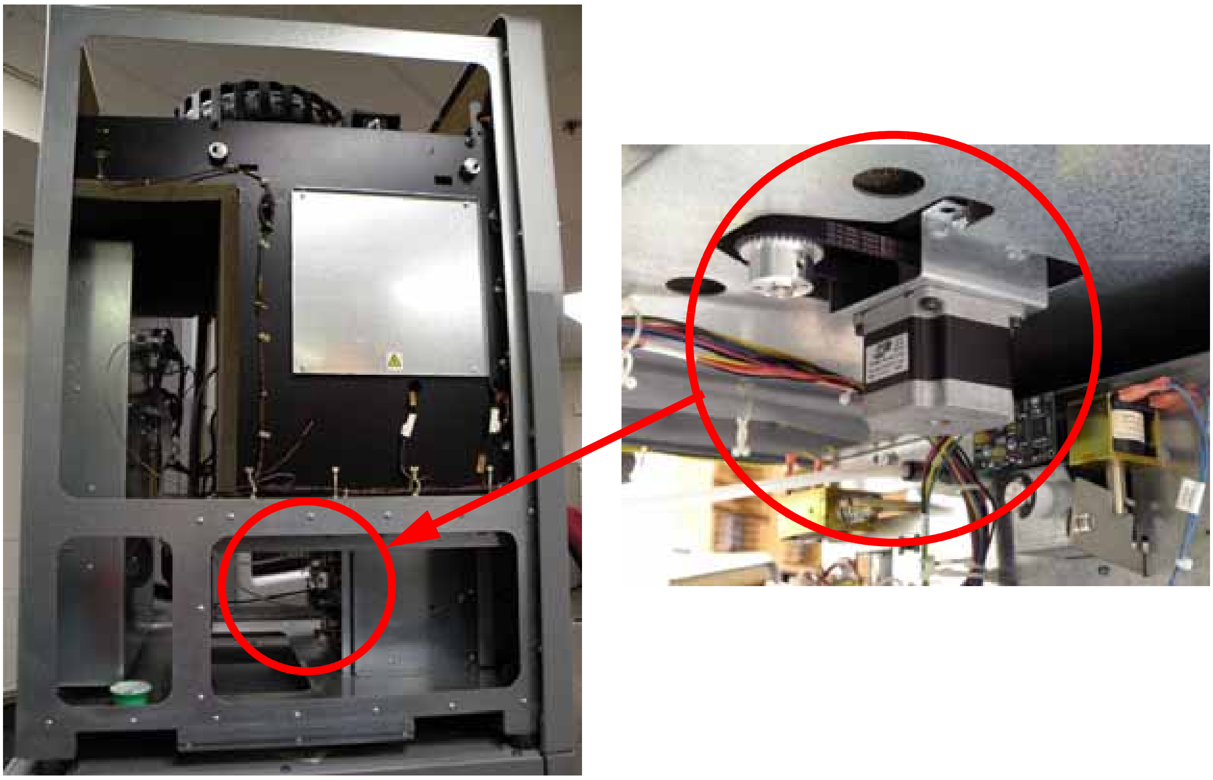
Required Tools

- $^{5}/_{16}$" Nut driver or standard screwdriver
- $^{9}/_{64}$" Allen wrench

Removing Z Motor & Belt

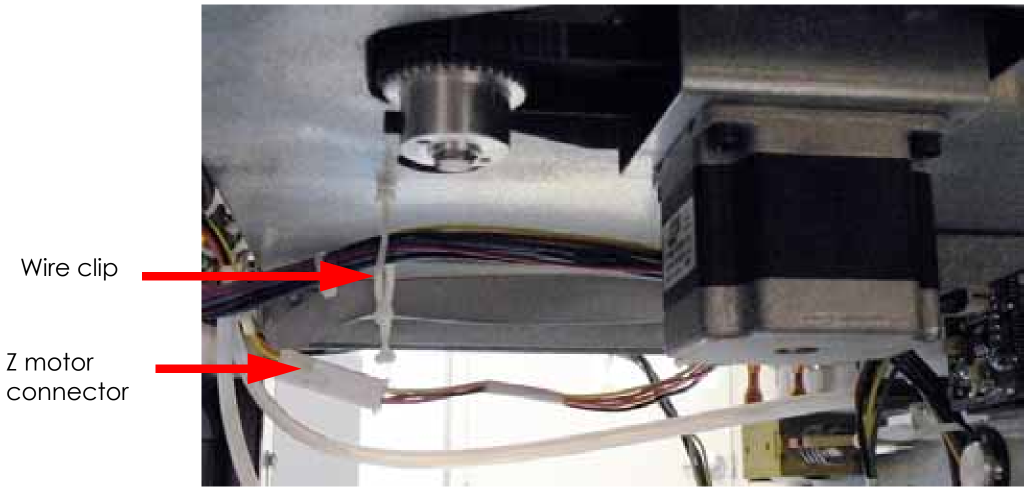
1. Power down the printer.
2. Remove the rear panel, see Removing the Rear Panel on page 4-5.
3. Remove the side panels, see Removing the Side Panels on page 4-6.
4. Locate the Z motor and belt, see Figure 4-330.

Figure 4-330: Z motor location



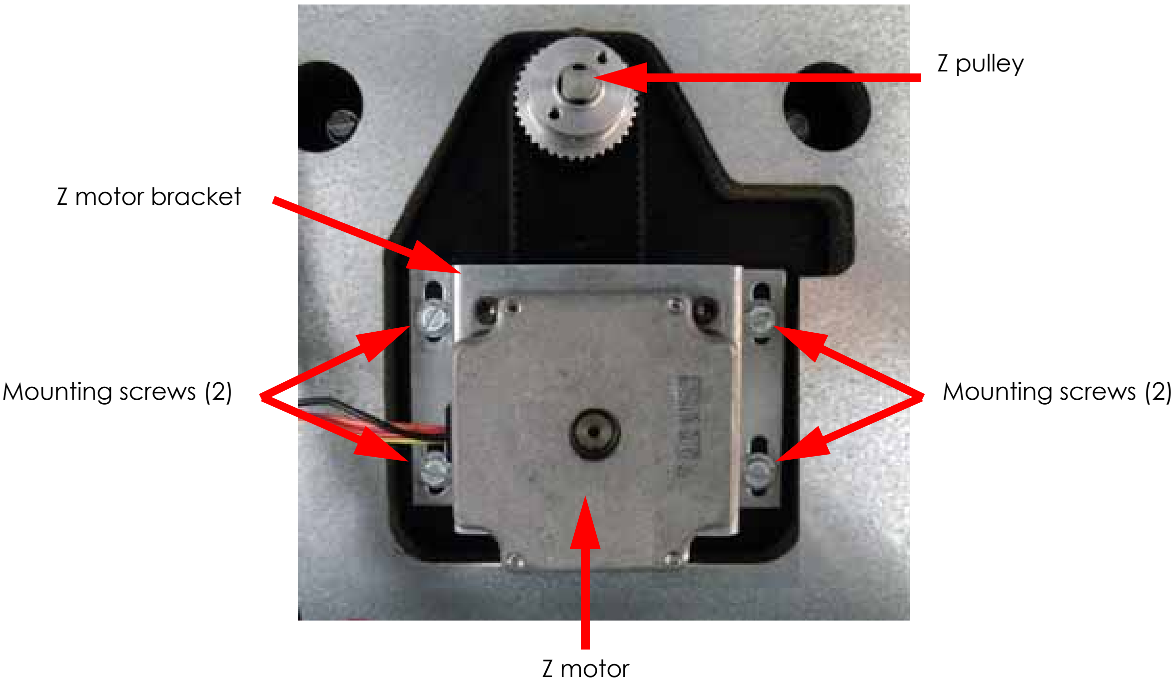
5. Remove the Z motor wire from the wire clip and disconnect the Z motor by pressing the tab in and pulling the connector apart. See Figure 4-331.

Figure 4-331: Z motor connector location



6. Using a $^{5}/_{16}$″ nut driver or standard screwdriver, remove the 4 Z motor bracket mounting screws. See Figure 4-332.

Figure 4-332: Z motor mounting bracket mounting screw locations



7. Remove the Z motor bracket and Z motor belt from the pulley.
8. Using a $^{9}/_{64}$″ allen wrench, remove the 4 Z motor mounting screws, see Figure 4-333.

Figure 4-333: Z motor mounting screw locations

9. Remove the Z motor from the mounting bracket and discard.

Installing Z Motor & Belt

1. Position the motor in the mounting bracket and use a $^9/_{64}$″ allen wrench to reinstall the 4 mounting screws.
2. Align the Z motor bracket with the mounting holes and loop the Z belt over the Z motor pulley and the Z pulley. Position the electrical leads so they point to the right side of the printer.
3. Using a $^5/_{16}$″ nut driver or standard screwdriver, loosely reinstall the 4 Z motor mounting bracket mounting screws.
4. Pull the Z motor away from the drive pulley to tension the belt and completely tighten the mounting screws.
5. Reconnect the Z motor by pushing the connectors together.
6. Place Z motor electrical leads into the wire tie and clip together.

Z Stage Assembly

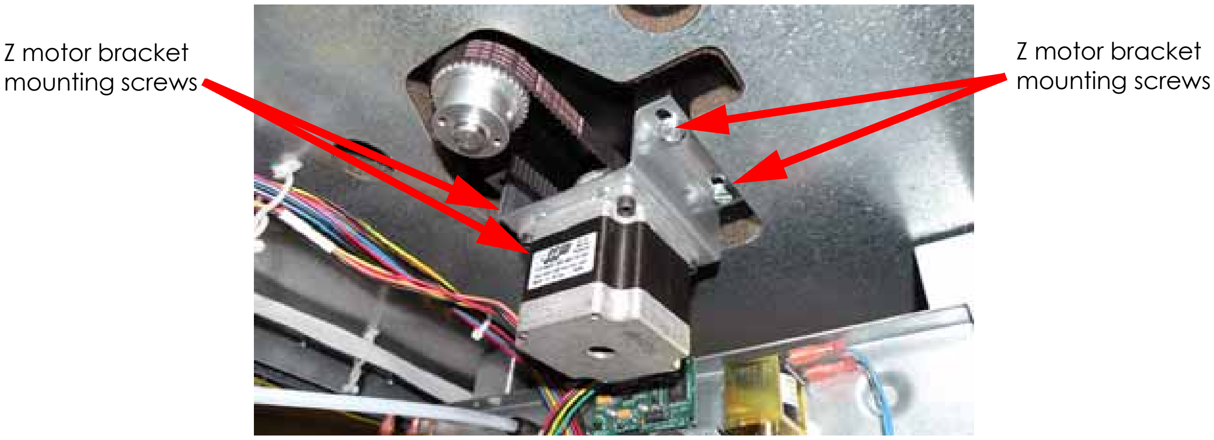
Required Tools

- $^5/_{32}$″ allen wrench
- $^5/_{64}$″ allen wrench
- $^5/_{16}$″ nut driver or standard screwdriver
- $^7/_{64}$″ allen wrench
- $^3/_8$″ nut driver
- Leveling spacer - the 1200/1200es side of the Spacer is 0.441″ thick.

Removing the Z Stage Assembly

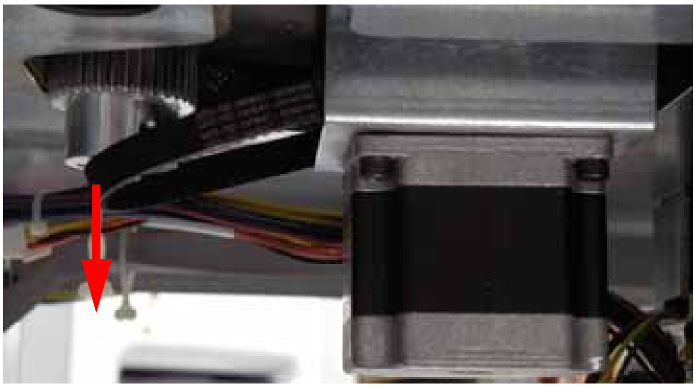
1. Power down the printer.
2. Remove the rear panel, see Removing the Rear Panel on page 4-5.
3. Remove the side panels, see Removing the Side Panels on page 4-6.
4. Move the Z stage to the middle of its travel.
5. Using a $^5/_{16}$″ nut driver or standard screwdriver, loosen the 4 Z motor bracket mounting screws. See Figure 4-334.

Figure 4-334: Z motor bracket and belt location



6. Remove the Z drive belt from the pulley. See Figure 4-335.

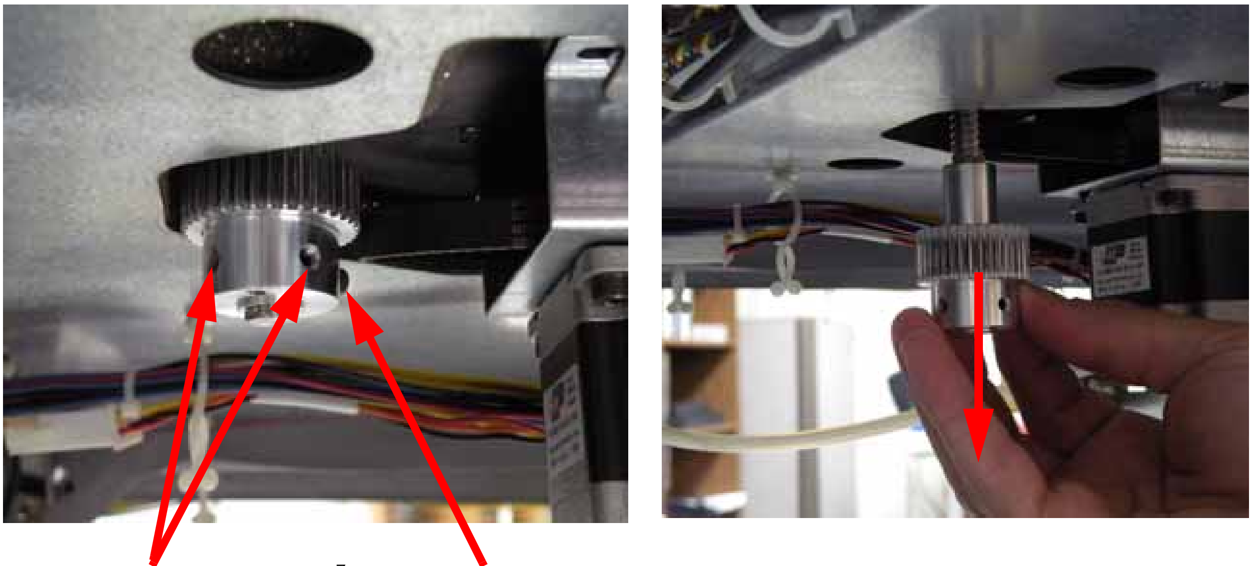
Figure 4-335: Z drive belt removal



7. If so equipped, use a $^{5}/_{32}$″ allen wrench to remove the screw (and its washer) from the bottom of the lead screw shaft.
8. Using a $^{5}/_{64}$″ allen wrench, loosen the 2 smaller set screws on the lead screw pulley. If necessary loosen the larger set screw using a $^{7}/_{64}$″ allen wrench. Slide the pulley off the lead screw shaft. See Figure 4-336.

Note: The larger screw ($^{7}/_{64}$″) is used as a guide pin during installation of the screw pulley. It fits into the slot on the lead screw shaft.

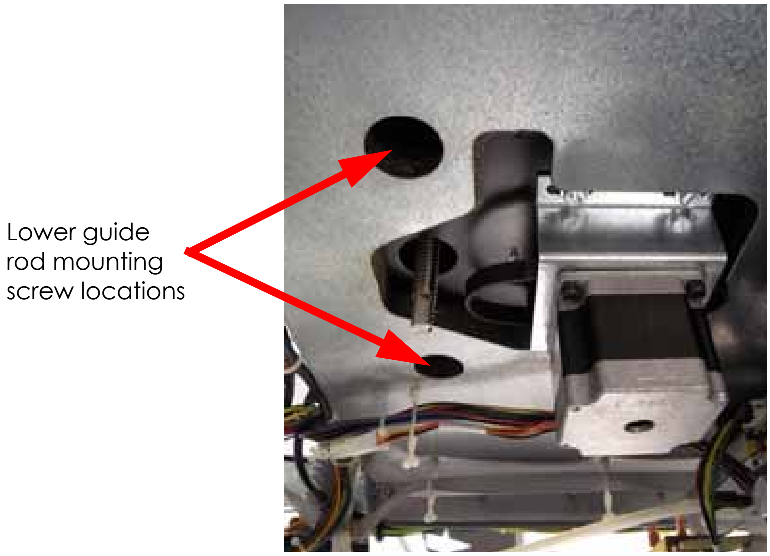
Figure 4-336: Lead screw pulley set screw locations



$^{5}/_{64}$" Z pulley set screws $^{7}/_{64}$" Z pulley set screw

9. Using a $^{5}/_{16}$″ nut driver or standard screwdriver, remove the two 2 lower guide rod mounting screws. See Figure 4-337.

Figure 4-337: Lower guide rod mounting screw location

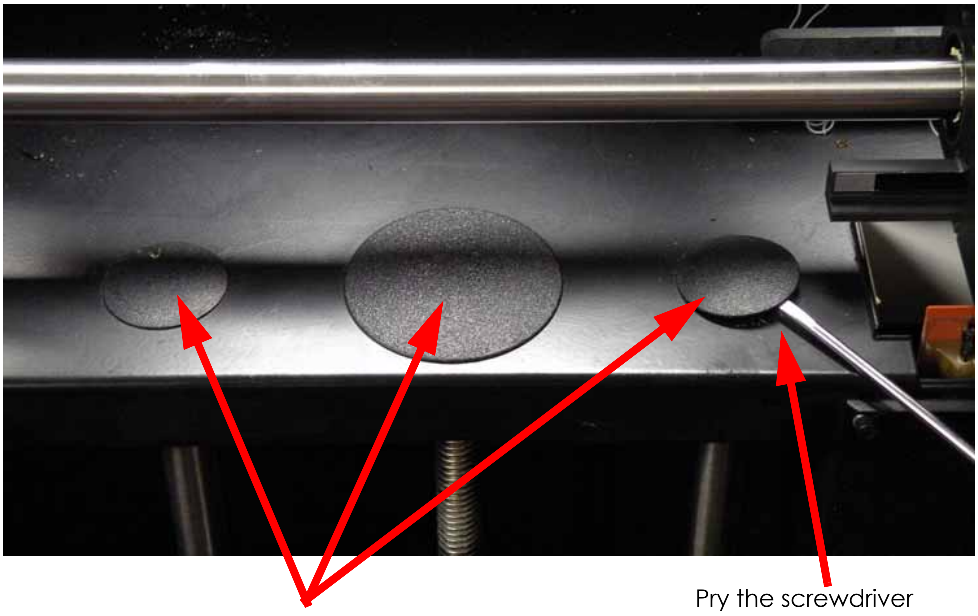


10. Using a $^5/_{16}$" nut driver or standard screwdriver, remove the 2 lower lead screw bearing and retainer plate mounting screws. See Figure 4-338.

Figure 4-338: Lower lead screw bearing and retainer plate location

11. Using a small standard screwdriver, remove the upper guide rod and lead screw covers by prying the screwdriver under the cover and lifting upwards. See Figure 4-339.

Figure 4-339: Guide rod and lead screw cover locations



12. Using a $^5\!/_{16}$″ nut driver or standard screwdriver, remove the upper guide rod screws. See Figure 4-340.

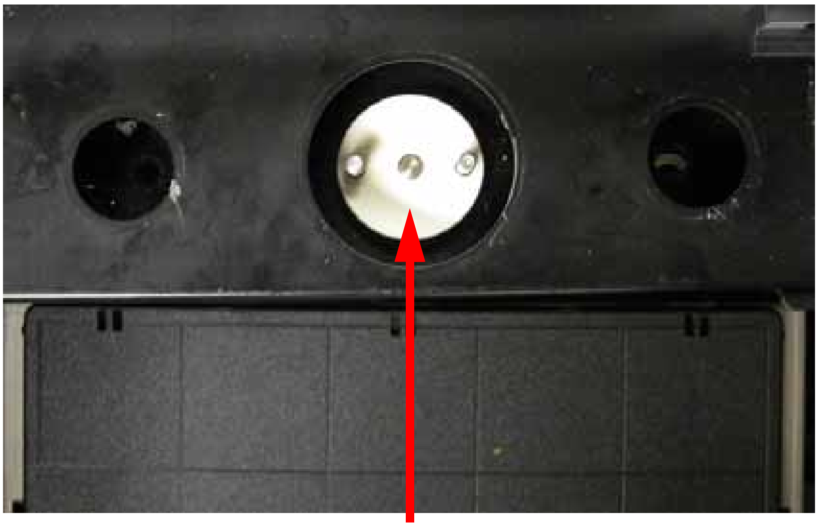
Figure 4-340: Upper guide rod screw locations

13. Using a $^3\!/_8$″ nut driver, remove the lead screw retainer nuts. See Figure 4-341.

Figure 4-341: Upper lead screw retainer nut locations

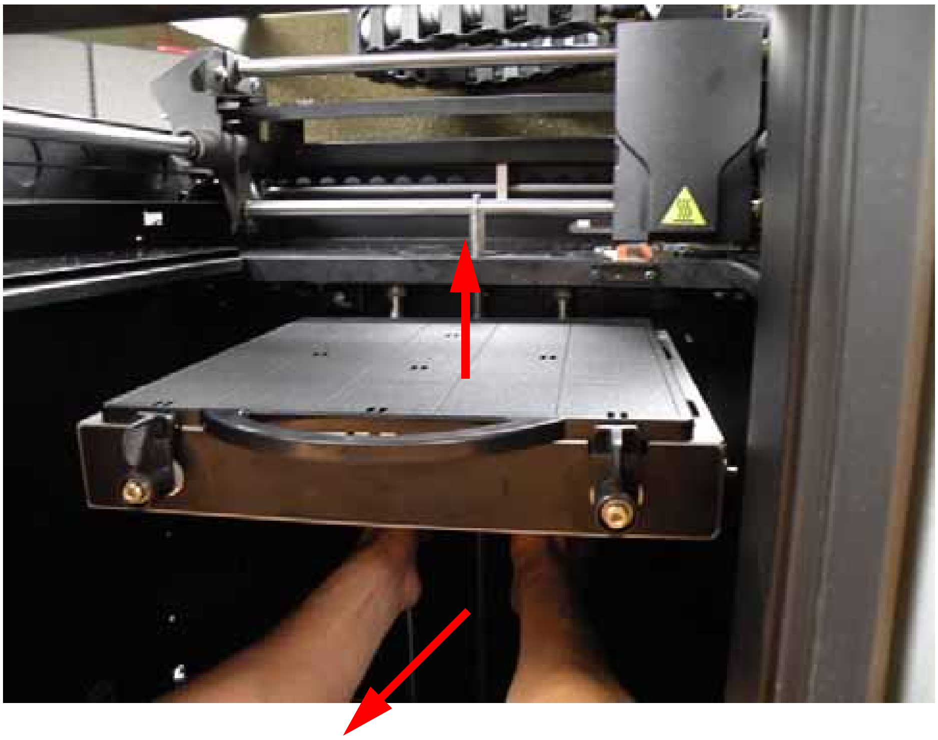
14. Remove the upper lead screw retainer. See Figure 4-342.

Figure 4-342: Upper lead screw retainer location



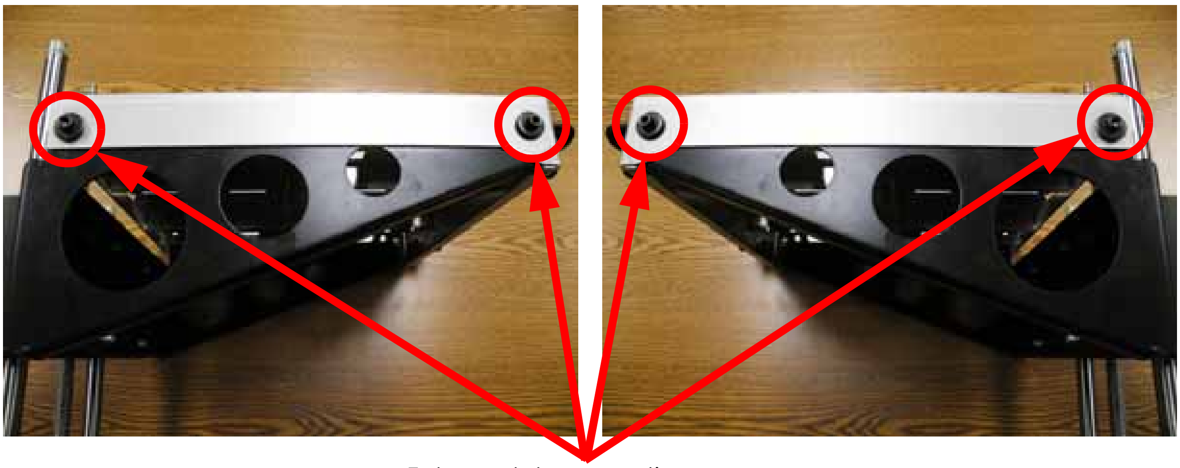
15. Lift the Z stage assembly until the lead screw clears the bottom of the envelope. Grasp the guide rods and carefully remove the assembly from the printer. See Figure 4-343.

Figure 4-343: Removing the Z stage



16. Using a $^{5}/_{32}$″ allen wrench, remove the 4 Z stage platen mounting screws. Set the platen aside. See Figure 4-344.

Figure 4-344: Z stage platen mounting screw locations



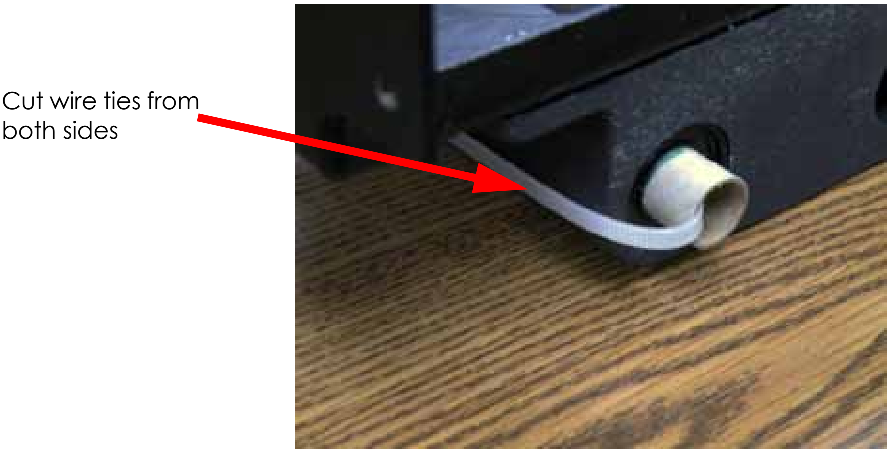
Installing the Z Stage Assembly

1. Carefully remove the new Z Stage assembly from the shipping package.

> **Caution:** Do not remove cardboard inserts from housing until guide rods are inserted.

2. Set the assembly on a flat surface.
3. Using a cutters, cut the 2 wire ties from the cardboard inserts. See Figure 4-345.

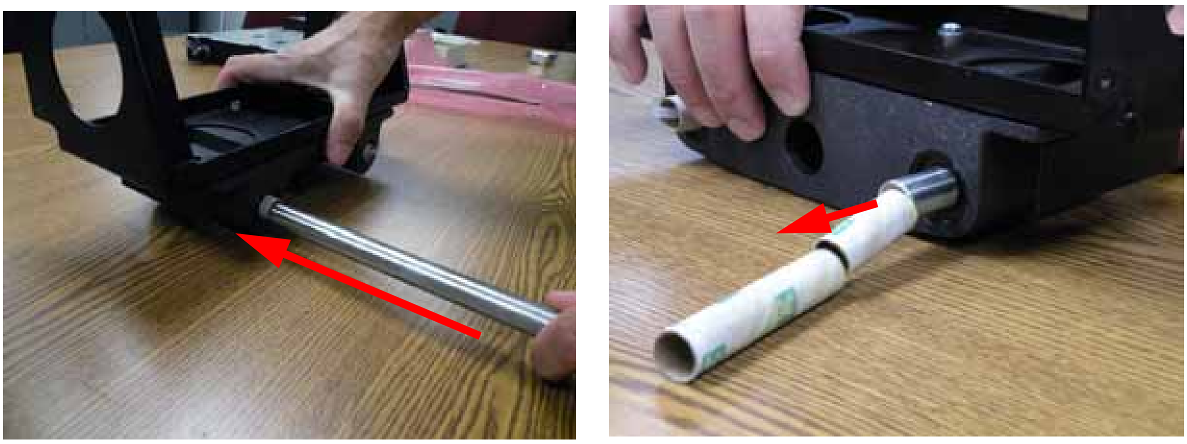
Figure 4-345: Wire tie location



4. Carefully slide the guide rods through the translator, pushing the cardboard inserts out. See Figure 4-346.

> **Note:** This will keep the bearings from falling out of the translator.

Figure 4-346: Removing the cardboard inserts



5. With the pin facing the top of the Z stage, install the lead screw into the translator until it is centered.
6. Align the Z stage platen with the translator and reinstall the 4 mounting screws with a $\frac{5}{32}$″ allen wrench. See Figure 4-344.
7. Insert the level spacer between the translator and the platen at the left rear corner.
8. Slide the corner of the tray up or down until the underside of the tray is snug to the top lip of the spacer lip.

9. Using a $^5/_{32}$" allen wrench secure the left rear mounting screw.
10. Repeat steps 7 - 9 for the remaining 3 corners.
11. Align the lower bearing retainer plate with mounting holes, cup side up.
12. Using a $^5/_{16}$" nut driver or standard screwdriver, loosely reinstall the 2 lower bearing retainer plate mounting screws. Do not tighten completely.
13. Carefully angle the Z stage assembly upwards into its position within the build envelope.

Note: Hold the guide rods while supporting the Z stage.

14. Lower the lead screw into its bearing.
15. Align the upper lead screw retainer with its mounting holes.
16. Using a $^3/_8$" nut driver, loosely reinstall the upper lead screw retainer nuts. DO NOT tighten at this time.
17. Using a $^5/_{16}$" nut driver or standard screwdriver, loosely reinstall the upper and lower guide rod retainer screws. Do not tighten at this time.
18. Tighten only the left upper and left lower guide screws.

Note: The right guide rod mounting holes are slotted to allow the guide rod to self-align.

19. Move the Z stage down to mid travel and tighten the lower right guide rod screw.
20. With the Z stage at mid travel, tighten the 2 lower bearing plate screws.
21. Move the Z stage to the top end of travel and tighten the upper right guide rod screw.
22. With the Z stage at the top of travel, tighten the 2 upper lead screw nuts.
23. Reinstall the 3 guide rod and lead screw covers by pushing into place.
24. Fully tighten the large set screw on the lead screw pulley with a $^7/_{64}$" allen wrench. This needs to be done to assure the lead screw pulley is installed correctly.

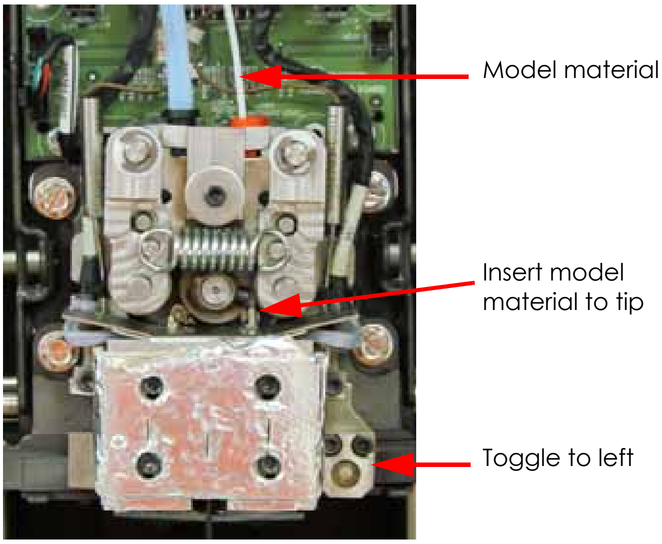
Caution: Make sure Z stage is at top end of travel before tightening lead screw pulley set screws.

25. Reinstall the Z lead screw pulley. Align the large set screw with groove in bottom of lead screw. Push the pulley upwards to its end of travel.
26. If so equipped, reinstall the screw and washer in the bottom of the lead screw shaft and tighten using a $^5/_{32}$" allen wrench.
27. Tighten the 2 small set screws with a $^5/_{64}$" allen wrench.
28. Lift the Z stage up to verify the lead screw does not move. If the lead screw moves, repeat steps 24 through 27.
29. Install the Z drive belt over the Z lead screw pulley.
30. Pull back on the Z motor bracket to tension the Z belt.
31. Tighten the Z motor bracket screws.
32. Remove the substrate if installed.
33. Raise the Z stage towards the top of travel.
34. Remove the head cover by pressing the tabs in and pulling outward.

35. Remove the air plenum by pressing in on tabs to release from translator. Work the air plenum free of air duct at top.
36. Disconnect model side material tube by pressing the retaining ring down and pulling the tube out.
37. Insert a 6 inch piece of model material through model side until it reaches the tip then toggle to the left to engage the model side. See Figure 4-347.

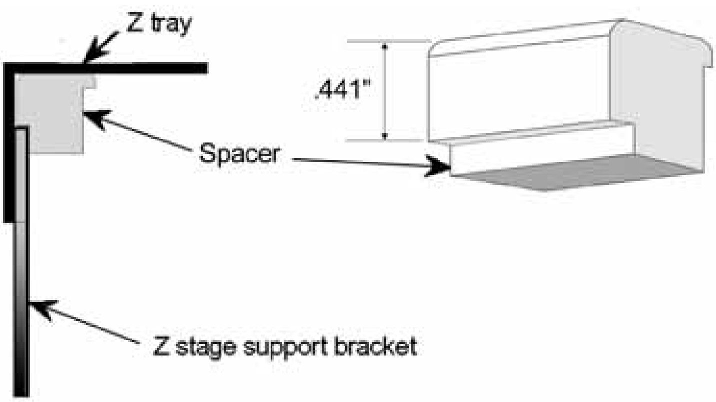
Note: Material is inserted to stabilize the head during the leveling process.

Figure 4-347: Inserting model material



38. Attach the head fixture bracket (with dial indicator) to the front of the head.
39. Move the head (w/indicator) toward the center of the tray.
40. Loosen the four tray mounting screws located on either side of the Z brackets.
41. Place the Leveling Spacer (0.441″ side) in the left rear corner of the Z stage between the support and the tray, see Figure 4-348.

Figure 4-348: Checking Space Using Spacer Part



42. Slide the corner of the tray up or down until the underside of the tray is snug to the top lip of the spacer lip.
43. Snug, but do not tighten, the left, rear mounting screw. You will need some “play” in the tray to complete the leveling adjustment.
44. Move the indicator to the left rear corner of the tray.

45. Zero the indicator by adjusting the Z height up or down, or by rotating the dial.
46. Move the indicator to the right rear corner of the tray.
47. Slide the right corner of the tray up or down until the indicator reads zero. Snug, but do not tighten, the mounting screw.
48. Repeat steps 46 though 47 for the front two corners of the tray.
49. Move the head to the back left rear corner of the Z tray.
50. Zero the indicator by adjusting the Z height up or down, or by rotating the dial.
51. Move the indicator (head) to the other three corners.
52. Verify that the indicator readings in all three locations are within a total tolerance band of 0.003" (+/- 0.0015). If the tray is still out of level, you must readjust the tray. Repeat steps 44 though 51 until the tray is within specification.
53. Once the tray is level, tighten all four tray mounting screws.
54. Verify that the indicator readings in all three locations are within a total tolerance band of 0.003" (+/- 0.0015). If the tray is still out of level, you must readjust the tray. Repeat steps 44 though 53 until the tray is within specification.
55. Remove the spacer and the head fixture bracket.
56. Reinstall the side panels, see Installing the Side Panels on page 4-6.
57. Reinstall the rear panel, see Installing the Rear Panel on page 4-5.
58. Power on the system.
59. Perform Z calibration, see Z Calibration on page 5-2.
60. Remove the calibration floppy disk/CD from the electronics bay and get the .cal file from the printer with MaracaEX, see “Get” .cal file – from hard drive to the calibration Floppy Disk/CD: on page 5-38.
61. Copy the .cal file to a new floppy disk/CD and replace the calibration floppy disk/CD in the electronics bay.
62. Build a sample part to verify proper operation of the printer.
63. Box up the defective XY table and send back to Stratasys.
64. Run a test part to ensure that find Z is working correctly.

Receiver Components

Receiver Back Panel Assembly

Required Tools

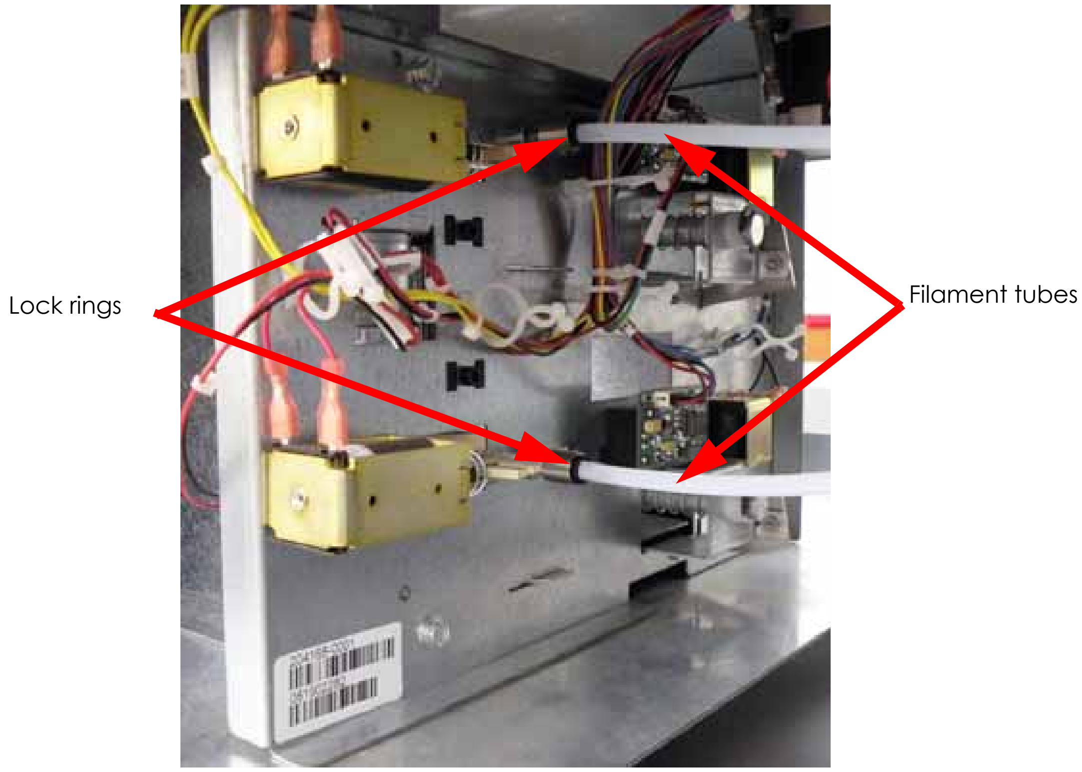
- $^{5}/_{16}$" Nut driver or standard screwdriver

Removing Receiver Back Panel

1. Unload material.
2. Power down the printer.
3. Remove the rear panel, see Removing the Rear Panel on page 4-5.
4. Remove the side panels, see Removing the Side Panels on page 4-6.
5. Disconnect the receiver electrical cable J7 from the power distribution board. Feed through the rear of the electronics bay - note routing for re-installation.
6. Disconnect both filament tubes from the receiver by pushing in on the black lock rings and pulling the tube outwards, see Figure 4-349.

Note: Mark one of the filament tubes for correct placement during reinstallation.

Figure 4-349: Filament tube locations



7. Using a $^{5}/_{16}$" nut driver or standard screwdriver, remove the 3 receiver assembly mounting screws. See Figure 4-350.

Figure 4-350: Receiver Mounting Screws

Mounting screws (3)

8. Slide the receiver assembly out through the side of the printer.

Installing Receiver Back Panel

1. Slide the assembly into place through the side of the system.
2. Align the back receiver back panel with the mounting holes and use a $^5/_{16}$" nut driver or standard screwdriver to reinstall the 3 mounting screws.
3. Reconnect the 2 filament tubes by pushing into the black lock rings.

Note: The model filament tube connects to the upper lock ring and the support filament tube connects to the lower lock ring.

4. Feed the end of the receiver electrical cable through the rear of the electronics bay and connect the cable to J7 of the power distribution board. Route the cable through the cable clips and close the cable clips.
5. Reinstall the side panels, see Installing the Side Panels on page 4-6.
6. Reinstall the rear panel, see Installing the Rear Panel on page 4-5.
7. Power on the system and load material.

Misc. Field Replaceable Units

Tip Wipe Assembly (Brush/Flicker)

Note: The flicker should be replaced after 500 hours. It is only necessary to replace the brush after 2000 hours.

Required Tools

- $^{7}/_{64}$" Allen wrench

Replacing the 1200 Tip Wipe Assembly (Brush/Flicker)

1. Remove the purge container.
2. Remove plastic head cover by squeezing raised pads on sides of cover and pulling outward.
3. Using a $^{7}/_{64}$" allen wrench, loosen, but do not remove, the flicker attachment screws. See Figure 4-351.
4. Remove the old flicker by lifting upwards and discard.
5. Insert the new flicker and tighten the rear screws while gently pushing down on the flicker. See Figure 4-351.

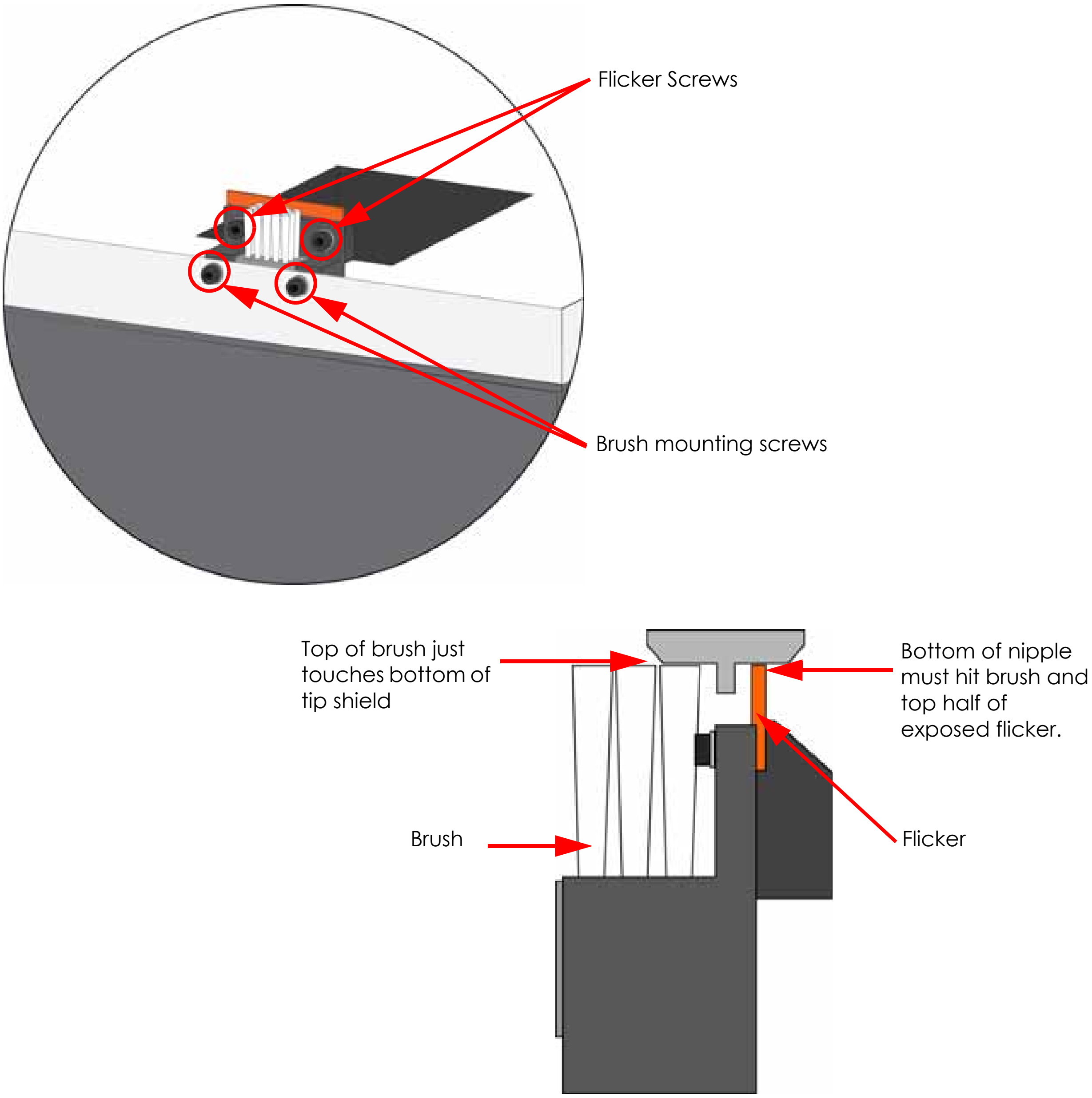
Note: The bottom of the material tip must hit in the top 75% of the flicker.

6. Using a $^{7}/_{64}$" allen wrench, loosen, but do not remove, the brush attachment screws. See Figure 4-351.
7. Remove the old brush by lifting upwards and discard.
8. Install the new tip cleaning brush, but do not tighten the mounting screws.
9. With a glove on your hand, move the head so that the tips are above the tip cleaning brush.
10. Adjust the tip cleaning assembly until the brush lightly touches the bottom of the Model Tip Shield.

Note: Ideally, the top of the brush and the top of the flicker should be the same height. Brush height, however is more important to tip maintenance than the flicker height.

11. Tighten the brush mounting screws.

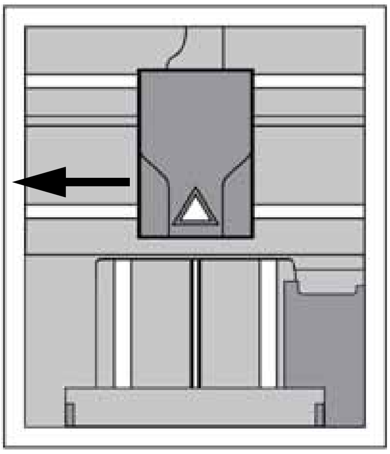
Figure 4-351: Replacing the tip cleaning brush



Replacing the 1200es Tip Wipe Assembly (Brush/Flicker)

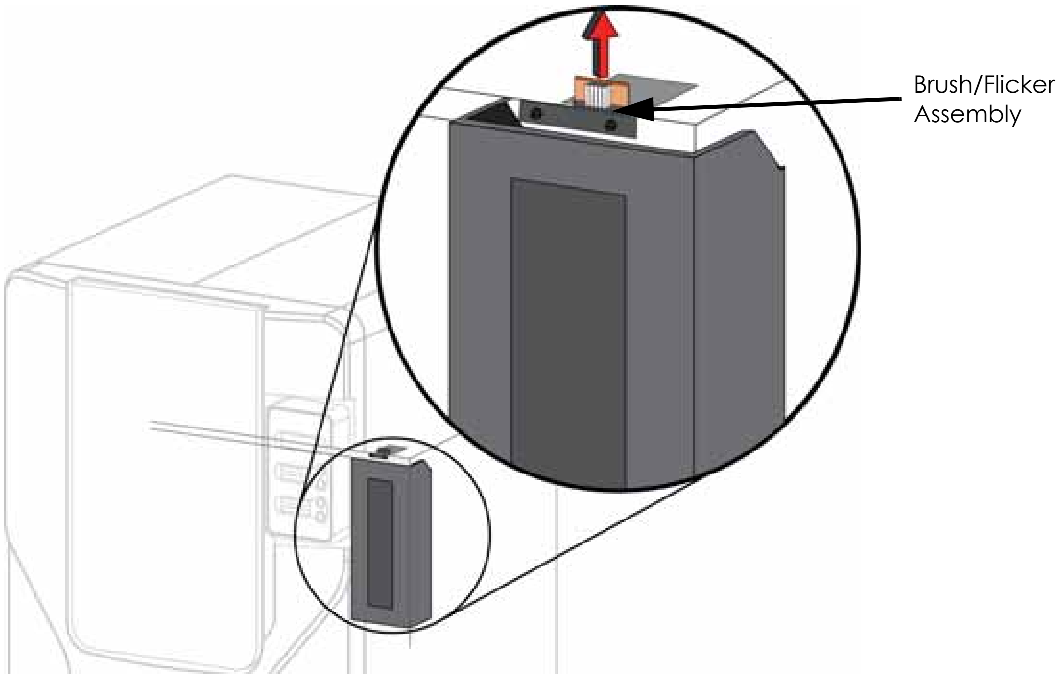
1. Completely power down the printer.
2. Move the toggle head to the left of the machine in order to gain access to the brush/flicker assembly, see Figure 4-352.

Figure 4-352: Move the Toggle Head to the left



3. Remove the brush/flicker assembly by lifting the assembly up and out of the machine. Discard the old brush/flicker assembly, see Figure 4-353.

Figure 4-353: Replacing the Brush/Flicker Assembly



4. Place the new Brush/Flicker Assembly over the two mounting posts making sure the assembly is fully seated.

Maintenance Wrap-Up

Post-Maintenance Procedures

1. Complete applicable check lists, see Checklists on page 9-1.
2. Reinstall the side panels, see Installing the Side Panels on page 4-6.
3. Reinstall the rear panel, see Installing the Rear Panel on page 4-5.
4. Plug in the AC power cord, RJ-45 network cables, and the UPS cable (if used) at the rear of the printer.
5. Turn the circuit breaker on
6. Power up the printer using the power switch.
    - The replacement of the controller board or the hard disk drive will require a download of the latest back end software.
    - Make sure the envelope temperature reaches operating temperature in the appropriate time.
    - The system should reach **Idle** with no displayed errors.
7. If the Z motor was replaced, use the user interface panel to enter **Table Maintenance.** Move the Z stage up and down several inches to confirm proper operation.
8. If a receiver back panel was replaced, install a **new** material cartridge to verify proper operation of the card.
9. Load material.
10. Run a small test part and monitor system operation during build.

Calibrations & Adjustments

5

This chapter guides you through various calibration and adjustment procedures. For MaracaEX instructions, see MaracaEX Help on page 3-8. The contents and page numbers of this chapter are as follows:

Note: Always follow calibration and adjustment procedures in order.

Offset Calibrations

Adjusting Z Calibration and XY Tip Offset

Z Calibration and Tip Offset calibration is required if the tips are replaced. If Tip Replacement is chosen from the Interface Panel, you will be prompted to perform the calibrations as a part of the replacement procedure.

Z Calibration and Tip Offset calibration can also be run without performing a Tip Replacement. From **Idle**, choose **Maintenance**, **Machine then Tip.** After warm-up, choose **Calibrate Z** or **Calibrate XY.**

Z Calibration

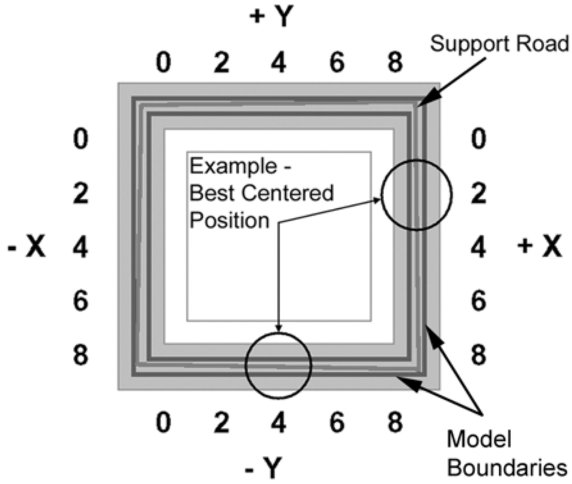
Select **Start Part** - the printer will automatically build a Z Calibration part, measure the part and calibrate the Z Axis for tip depth and tip level (approximately 5 minutes).

XY Calibration

Select **Start Part** - the printer will then automatically build an XY Calibration part (approximately 10 minutes). You must inspect the XY Calibration part and calibrate the X and Y axes for tip offset:

1. When the XY Calibration part is complete the printer will display **Remove Part and Select XY Adjustment - X:0, Y:0**
2. Remove the XY tip calibration part from the Dimension printer.
3. Inspect the part and calibrate the X and Y axes, see Figure 5-354.
   A. Use the magnifier from the Startup Kit to view the support road.
   B. Identify the location on the +X **or** –X side of the part where the support road is best centered within the model boundaries.
   C. Read the number closest to this location. This is the required X Tip Offset adjustment, in mils. If the number is on the -X side, a negative offset is required.
   D. Select **Increment** or **Decrement** to input the X offset adjustment - the value will change in the upper display window (by default, the printer will be ready to accept the X value).
   E. When you are satisfied with your X offset value, **Select Y** and repeat the procedure to identify and input the required Y Tip Offset adjustment.
4. Select **Done** after you have input the X and Y offsets. The printer will return to **Maintenance**.

Figure 5-354: Example XY Tip Offset Part.
This example requires an adjustment of X = + 2 mils, Y = - 4 mils



Part Based Calibration

Required Tools

- Set of basic service tools
- 6” digital calipers
- MaracaEX CD

Part based calibration consists of building a part and then taking six measurements - front, right, left, rear, left rear and left front. Figure 5. These measurements are then entered using MaracaEX.

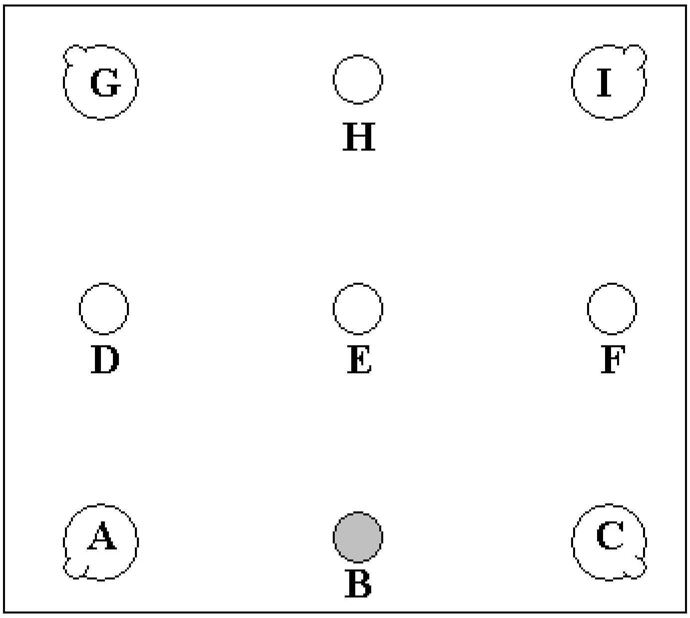
When to perform part based calibration

Part Based Calibration needs to be performed ONLY after replacing the table assembly, Y drive belt, Y drive assembly or the Y pulley.

Performing part based calibration

1. Start MaracaEX and select the Current Modeler from the pull down menu.
2. Open the Gantry Calibration Dialog box in MaracaEX.
3. Set the X adjust value to 0.
4. In the Part Calibration section, there are six boxes: LEFT, RIGHT, FRONT, REAR, LEFT FRONT and LEFT REAR. Set these values to 0.
5. Click on the green check mark and toggle the power down switch.
6. From the modeler test parts menu run the “test_XY_cal” part.
7. When part is completed, remove from printer and let cool for ten minutes. Keep the part on the foam or substrate.
8. Locate the filled circle, this indicates the front of foam or substrate Figure 5-355.

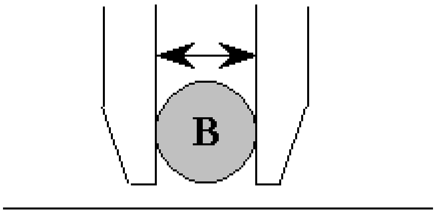
Figure 5-355: Locating the Filled Circle (B)



9. Using a digital caliper, measure and record the diameter of circle B along the center line between A and C, see Figure 5-356.

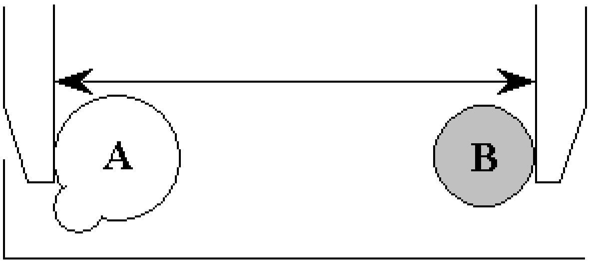
Note: Reference letters are not actually "printed" on the part.

Figure 5-356: Measuring Diameter of B



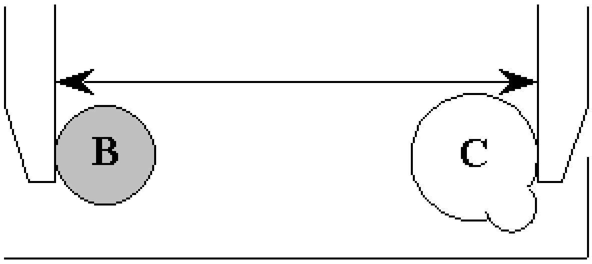
10. Next measure and record the distance from the outside edges of circle A and B, see Figure 5-357. Ensure that the caliper is *not* seated on the small bump of circle A.

Figure 5-357: Measuring Distance from Outside Edges of B & A



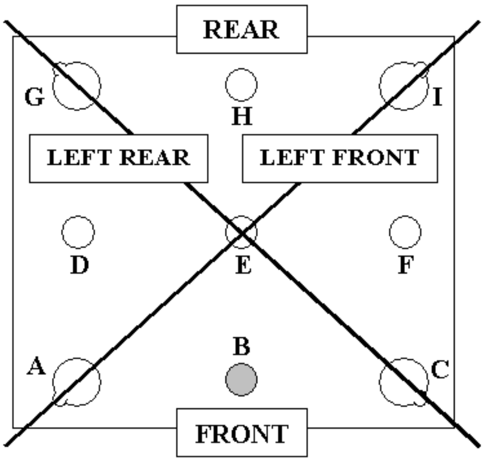
11. Next measure and record the distance from the outside edges of circle B and C, see Figure 5-358. Ensure that the caliper is not seated on the small bump of circle C.

Figure 5-358: Measuring Distance from Outside Edges of B & C



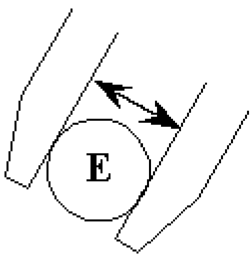
12. Add the lengths derived from steps 10 and 11 (A-B and B-C) and then subtract the width of circle B (from step 9). Record this total as “Front”
13. Repeat steps 9 through 12 for the three remaining sides (Rear, Right and Left) Figure 5-359. Record these values.

Figure 5-359: Repeat Steps 9-12 for All Circles



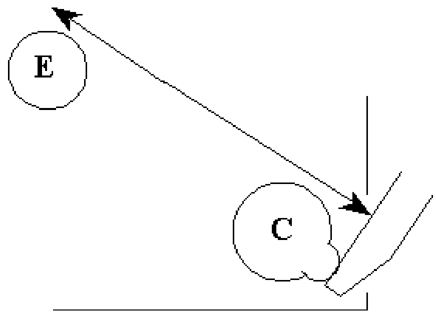
14. Next measure the width of the center circle (E), see Figure 1. Take the measurement at the same diagonal as the centerline measurement to be taken (e.g. left rear).

Figure 1: Measuring Width of Center Circle (E)



15. Next measure and record the distance from the outside edges of circle E and C as shown. Ensure that the caliper *is* seated on the small bump of circle C, see Figure 5-360.

Figure 5-360: Measuring Distance Between Outside Edges of E & C



16. Next measure and record the distance from the outside edges of circle E and G. Ensure that the caliper *is* seated on the small bump of circle G, see Figure 5-359.
17. Add the lengths derived from steps 15 and 16 (C-E and E-G) and then subtract the width of circle E (from step 14). Record this total as "Left Rear".
18. Repeat steps 14 through 17 for "Left Front" (E, A-E, E-I), see Figure 5-359. Record this value.
19. Start MaracaEX and select the Current Modeler from the pull down menu.
20. Open the Gantry Calibration Dialog box in MaracaEX.
21. In the Part Calibration section, there are six boxes: LEFT, RIGHT, FRONT, REAR, LEFT FRONT and LEFT REAR. Enter the measurements in the appropriate box.
22. Once the values have been entered, click on the green check mark.
23. Toggle the red power down switch to accept the new values.
24. Run the hysteresis test and change value if necessary.
25. Run a test part to verify system is operating correctly.

Part Measurement Equations

Use the equations below to record part measurements. Refer to these equations when entering values in MaracaEX.

Front: _______ + ______ - ____ = ________
(A + B) + (B + C) - B

Right: _______ + ______ - ____ = ________
(C + F) + (F + I) - F

Left: _______ + ______ - ____ = ________
(A + D) + (D + G) - D

Rear: _______ + ______ - ____ = ________
(G + H) + (H + I) - H

Left Rear: _______ + ______ - ____ = ________
(C + E) + (E + G) - E

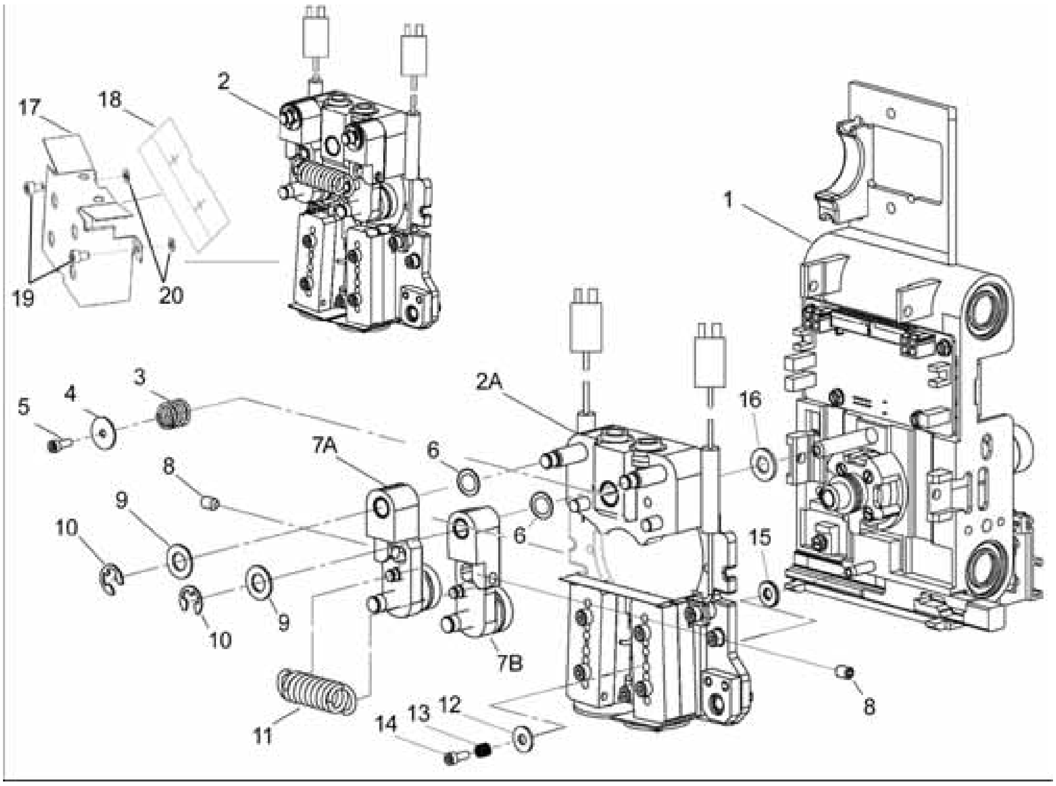
Left Front: _______ + ______ - ____ = _______
(A + E) + (E + I) - E

Head Alignment Procedure

Note: This procedure must be accomplished in its entirety and in the order presented. The procedure consists of 3 sub-procedures:

- Liquefier, drive wheel, and filament guide alignment.
- Idler Wheel Check/Adjustment
- Liquefier Alignment Check

Figure 5-361: Toggle Plate Assembly

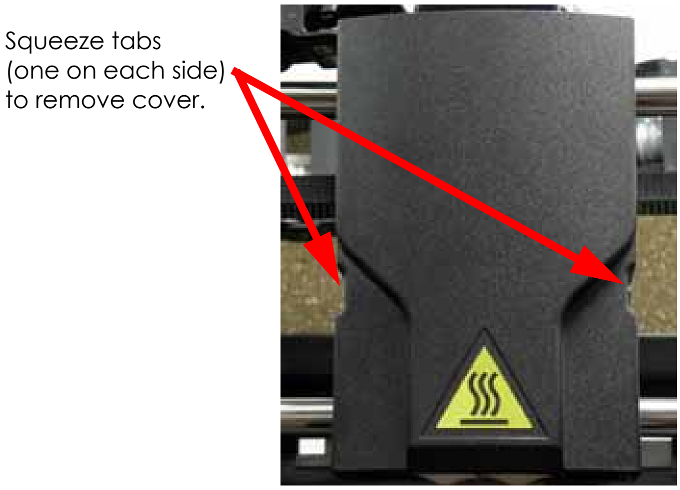


Item	Nomenclature	Item	Nomenclature
1	Translator	10	Clip
2	Toggle Plate Assembly	11	Toggle Spring
2A	Plate, Toggle Assembly	12	Washer, Thrust, Lower Toggle Shaft
3	Spring, Upper Toggle Shaft	13	Spring, Lower Toggle Shaft
4	Washer, Front, Upper Toggle Shaft	14	Screw, Lower Toggle Shaft
5	Screw, Upper Toggle Shaft	15	Washer, Thrust, Lower Toggle Shaft
6	Shim	16	Washer, Rear, Upper Toggle Shaft
7A	Pivot Block Assy (Left)	17	Heat Shield Assembly
7B	Pivot Block Assy (Right)	18	Teflon Shield
8	Idler Wheel Tension Screw	19	SHC 6-32 X 3/16 A Screw
9	Teflon Washer	20	Teflon Washer

Liquefier, Drive Wheel and Filament Guide Alignment

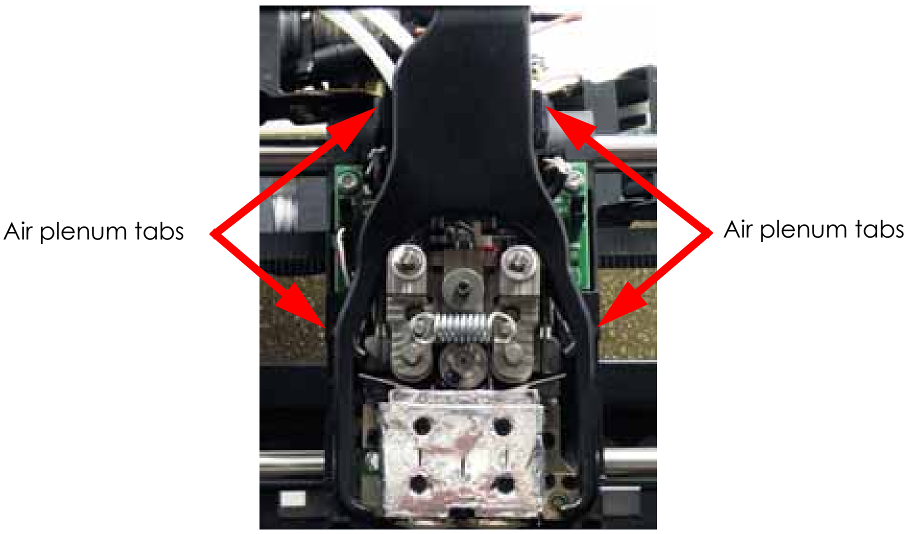
1. Unload model and support material.
2. Power down the printer.
3. Remove the rear panel, see Removing the Rear Panel on page 4-5.
4. Remove the right side panel, see Removing the Side Panels on page 4-6.
5. Position the head in the center of the build envelope.
6. Remove plastic head cover by squeezing raised pads on sides of cover, see Figure 5-362.

Figure 5-362: Removing the head cover



7. Remove the air plenum by pressing in on tabs to release from translator. Work the air plenum free of air duct at top (not shown), see Figure 5-363.

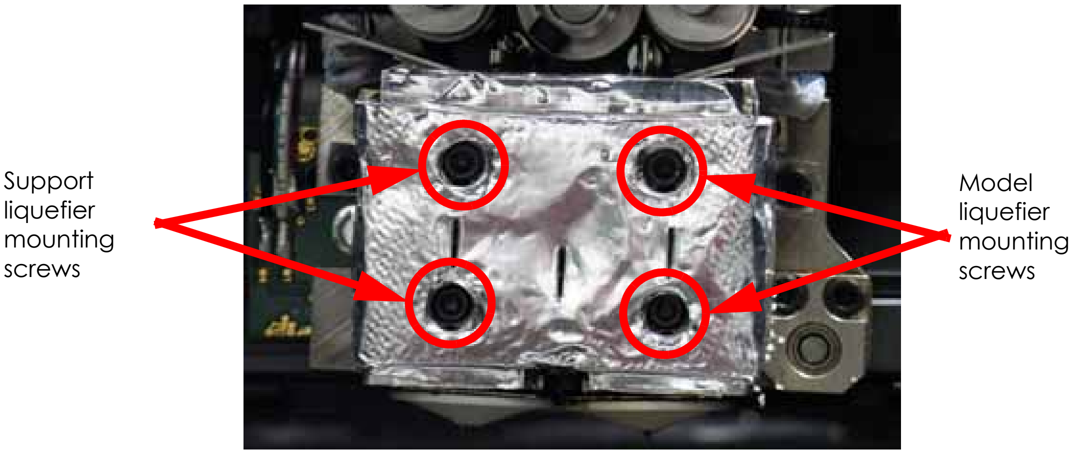
Figure 5-363: Removing the Air Plenum



8. Remove liquefier tips:

   A. Use a $^7/_{64}$″ allen wrench to loosen the tip (heater block clamp) screws three to four full turns counterclockwise - or until the top of the screws are flush with the metal cover. See Figure 5-364.

Figure 5-364: Liquefier tip mounting screw locations



B. Use needle nose pliers to grasp the stainless steel shield of the tip.

C. Pull the tip shield toward you, then pull down to remove the tip. Discard the used tip.

D. Repeat for second tip.

9. Using a $^{7}/_{64}$" allen wrench, loosen but do not remove the 2 heat shield mounting screws. See Figure 5-365.

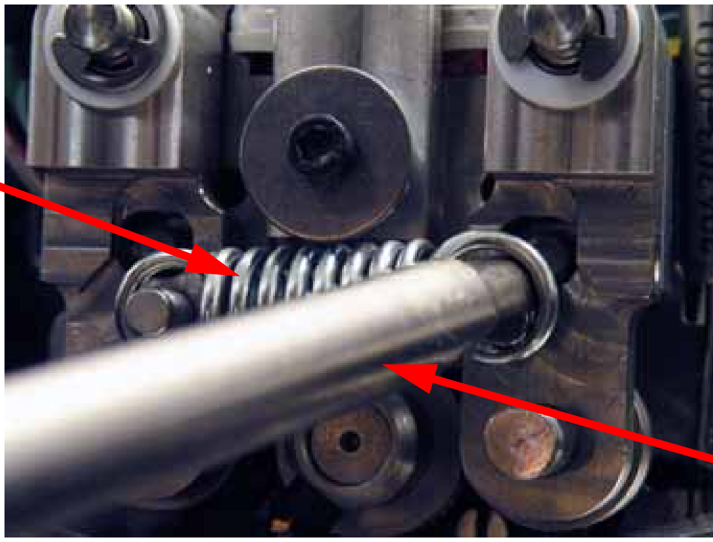
Note: There is a teflon washer on each screw - between the back of the heat shield tabs and the translator, see #20 in Figure 5-361. If the screw is not completely removed from the heat shield and the washer is not damaged, the washer will act as a retainer, holding the screw to the heat shield.

Figure 5-365: Heat shield mounting screw locations

10. Using the pivot block spring removal tool (PN 204242-0001), remove the pivot block spring (see #11 in Figure 5-361.) by inserting the spring removal tool and prying the spring away from the pivot block, see Figure 5-366.

Warning: Use eye protection when removing or installing the pivot block spring.

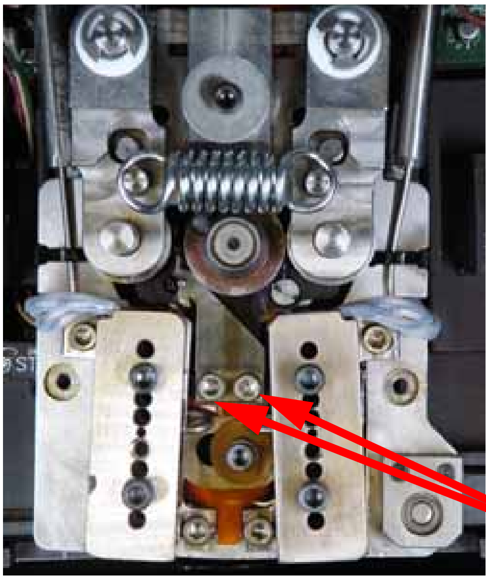
Figure 5-366: Removing the pivot block spring



11. Using a needle nose pliers, remove the retaining clip and teflon washer from the left side pivot block pin, see # 9 and # 10 in Figure 5-361.
12. Remove the left side pivot block by pulling away from the toggle plate, see # 7A in Figure 5-361.
13. Move the toggle bar to the left.
14. Using a $^{7}/_{64}$" allen wrench, slightly loosen the 2 support filament guide mounting screws. See Figure 5-367.

Note: Step 14 applies only to SST 1200 printers. BST 1200, BST 1200es and SST 1200es printers do not require this step. For BST 1200, BST 1200es and SST 1200es continue to step 15.

Figure 5-367: SST 1200 Support filament guide mounting screw locations



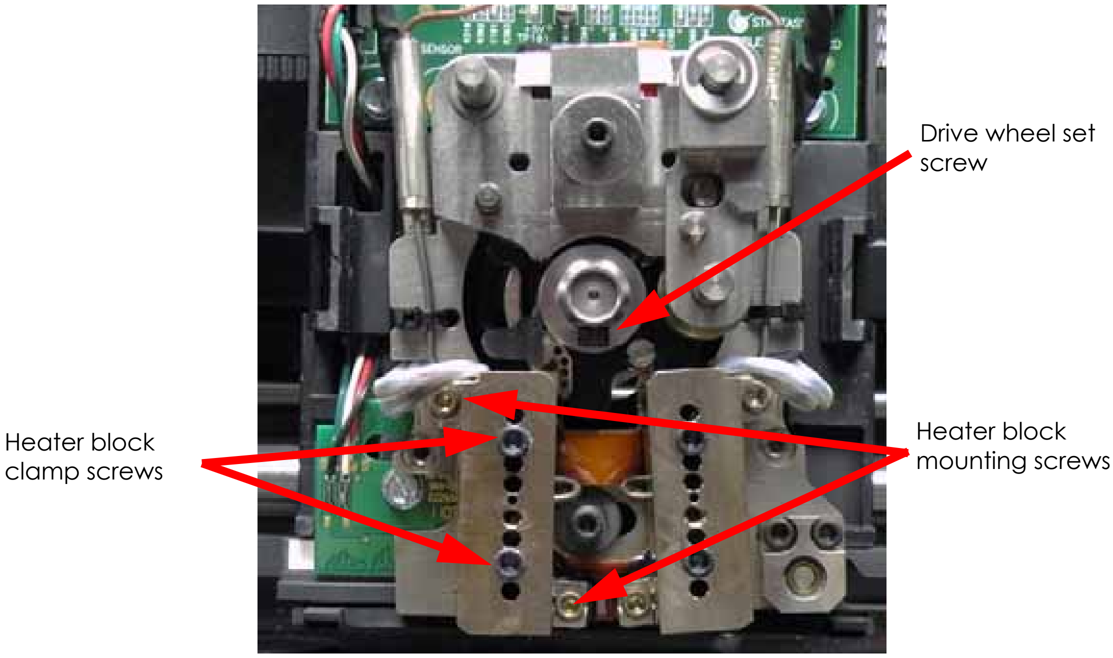
15. Using a $^{7}/_{64}$" allen wrench, remove the drive wheel set screw, see Figure 5-368.
16. Remove the drive wheel pulling it off of the drive shaft.

17. Use the end of the spring removal tool to clean out the old LocTite from the inside diameter of the drive wheel.
18. Using a wire brush, clean the drive wheel gear teeth.
19. Place the drive wheel back on the drive shaft. Apply LocTite 222 to the screw threads, and loosely reinstall the screw.

Note: Make sure that the drive wheel is free to slide axially on the motor shaft.

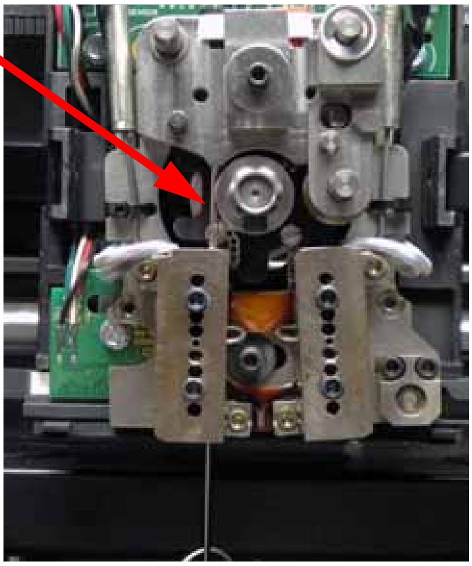
20. Position the drive wheel so the set screw is facing downward, see Figure 5-368.
21. Using a $^7/_{64}$" allen wrench; loosen, but do not remove the support side heater block mount screws and the support side heater block clamp screws, see Figure 5-368.

Figure 5-368: Heater block screw locations



22. Make sure that the drive wheel alignment rod is straight. Roll the rod along a flat surface to check for bends. Straighten as necessary.
23. Insert the drive wheel alignment rod from the bottom of the support (left side) heater block, see Figure 5-369.
24. Push the alignment rod up into the main pivot block, see Figure 5-369.
25. Position the alignment rod so that the recessed portion is centered between the heater block and the pivot block, see Figure 5-369.

Figure 5-369: Alignment rod placement



26. Tighten the heater block clamp screws.
27. Tighten the lower heater block mount screw until it is snug.
28. Tighten the upper heater block mount screw until it is snug.
29. Completely tighten the heater block mounting screws.

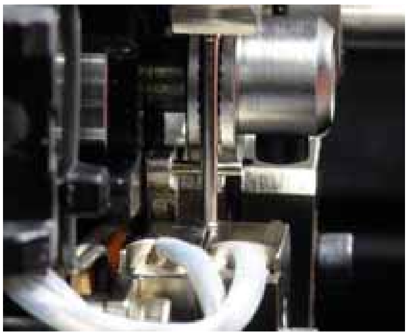
> **Note:** Make sure that the heater block does not move while tightening the mount screws by holding it in place firmly with your thumb.

30. With the drive wheel set screw loose, gently move the toggle bar to the right until the alignment rod rests in the groove of the drive wheel. See Figure 5-370.

> **Note:** Do not force the toggle bar to the full right position. Forcing the toggle bar to the full right position may cause the alignment rod to bend.

31. Adjust the drive wheel until the alignment rod is centered in the groove of the drive wheel, see Figure 5-370.

Figure 5-370: Drive wheel alignment



Drive wheel is positioned so that alignment rod is centered in wheel track.

32. Tighten the drive wheel set screw.
33. Verify proper drive wheel alignment:
    A. Gently move the toggle bar to the right, then back to the left while observing the drive wheel and alignment rod.

Note: View the alignment of the drive wheel and alignment rod from the left side of the system.

B. The alignment rod should not deflect forward or backward as the drive wheel is brought into contact with the rod.

C. The alignment rod should be centered within the groove of the drive wheel.

D. If the alignment rod is misaligned, loosen the drive wheel set screw and repeat steps 30 through 33.

34. Move the toggle bar to the left.

35. Push the filament guide against the alignment rod and hold firmly in place and use a $^{7}/_{64}$″ allen wrench to tighten the filament guide screws (left screw first).

Note: Apply pressure down and to the left against the filament guide to ensure that it remains in contact with the alignment rod while tightening the screws.

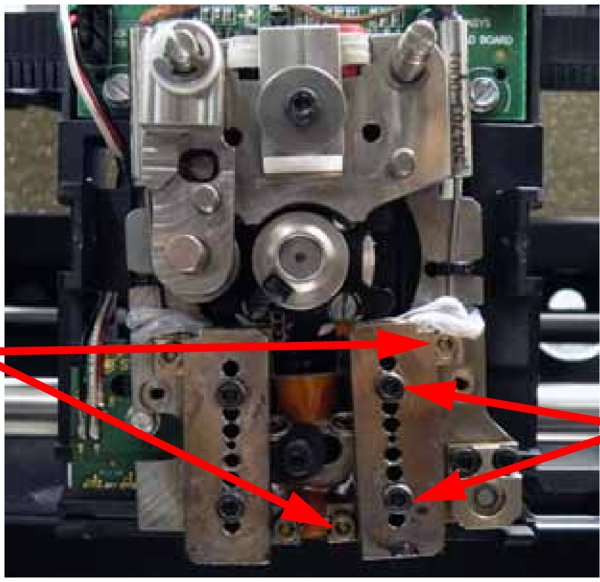
Note: Step 35 applies only to SST 1200 printers. BST 1200, BST 1200es and SST 1200es printers do not require this step. For BST 1200, BST 1200es and SST 1200es continue to step 37.

36. Loosen the heater block clamp screws and remove the alignment rod.

37. Move toggle bar to the right.

38. Using a $^{7}/_{64}$″ allen wrench; loosen, but do not remove the model side heater block mount screws and the model side heater block clamp screws, see Figure 5-371.

Figure 5-371: Heater block screw locations



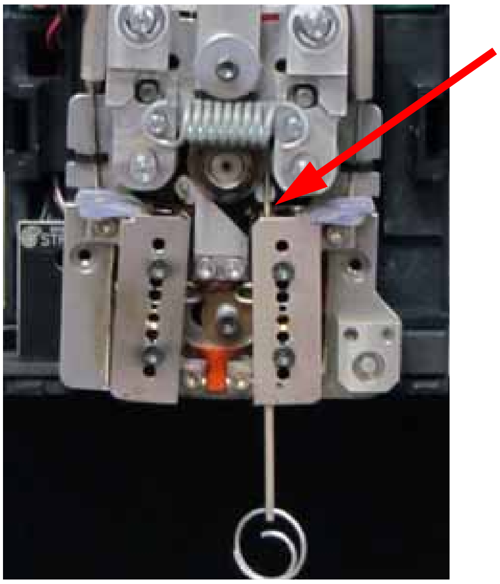
39. Make sure that the Drive Wheel alignment rod is straight. Roll the rod along a flat surface to check for bends. Straighten as necessary.

40. Insert the drive wheel alignment rod from the bottom of the model (right side) heater block, see Figure 5-372.

41. Push the alignment rod up into the main pivot block, see Figure 5-372.

42. Position the alignment rod so that the recessed portion is centered between the heater block and the pivot block, see Figure 5-372.

Figure 5-372: Alignment rod placement



43. Tighten the heater block clamp screws.
44. Tighten the lower heater block mount screw until it is snug.
45. Tighten the upper heater block mount screw until it is snug.
46. Completely tighten the lower and upper heater block mount screws.

Note: Make sure that the heater block does not move while tightening the mount screws by holding it in place firmly with your thumb.

47. Loosen the heater block clamp screws and remove the alignment rod.
48. Reinstall the left side pivot block:
    A. Make sure the shim washer is installed, see #6 in Figure 5-361.

Note: The shim normally remains on the pin when the pivot block is removed.

    B. Reinstall the teflon washer and retaining clip.

Idler Wheel Check/Adjustment

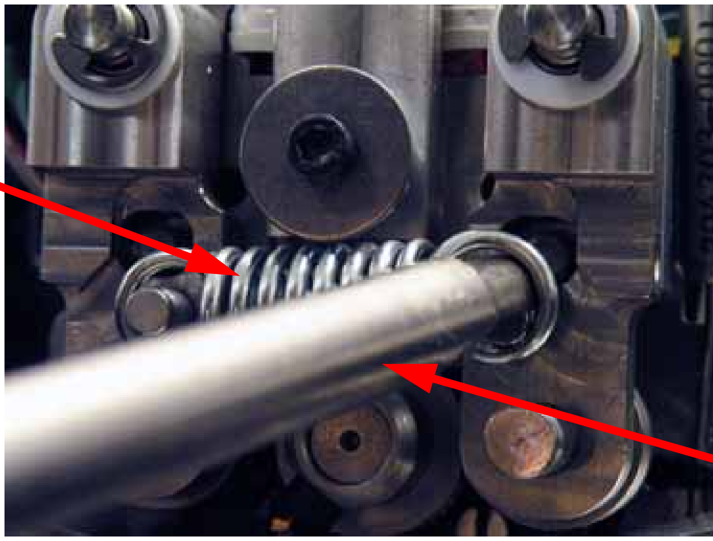
This procedure sets the idler wheel stopping point. Drive wheel alignment must be performed before this procedure.

Warning: Use eye protection when removing or installing the pivot block spring.

Caution: Use care when installing the pivot block spring so as to prevent spring distortion. A distorted or stretched spring can cause system operation errors. Orienting the spring on the toggle plate per Figure 5-373 will reduce the risk of distortion during installation.

1. Using the spring removal tool, reinstall the pivot block spring**, see** Figure 5-373.

Figure 5-373: Removing the pivot block spring



2. Rotate the drive wheel so that the set screw is on the bottom of the wheel, see Figure 5-374.
3. Check and adjust (if necessary) the right (Model) side idler wheel clearance:
   A. Place the toggle bar in the neutral position (half way between full left and full right).
   B. Insert a 0.003 inch feeler gauge between the drive wheel and the idler wheel. See Figure 5-374.
   C. Place the toggle bar in the full left position. The 0.003 inch feeler gauge should have light drag when pulling away from the drive wheel and idler wheel.
   D. Place the toggle bar in the neutral position.
   E. Insert a 0.005 inch feeler gauge between the drive wheel and the idler wheel. See Figure 5-374.
   F. Place the toggle bar to the full left position. The 0.005 inch feeler gauge should be firmly held between the drive wheel and the idler wheel when pulling away from the drive wheel and idler wheel.
   G. If the clearance is not correct, use a $^{5}/_{64}$″ allen wrench to remove the idler wheel tension adjustment screw, apply LocTite 222 to the screw threads, and reinstall the screw. See Figure 5-374.

H. Insert a 0.003 inch feeler gauge between the drive wheel and the idler wheel. See Figure 5-374.

I. Place the toggle bar in the full left position.

J. Adjust the screw to obtain a light drag on .003 inch feeler gauge.

K. Insert a 0.005 inch feeler gauge between the drive wheel and the idler wheel. See Figure 5-374.

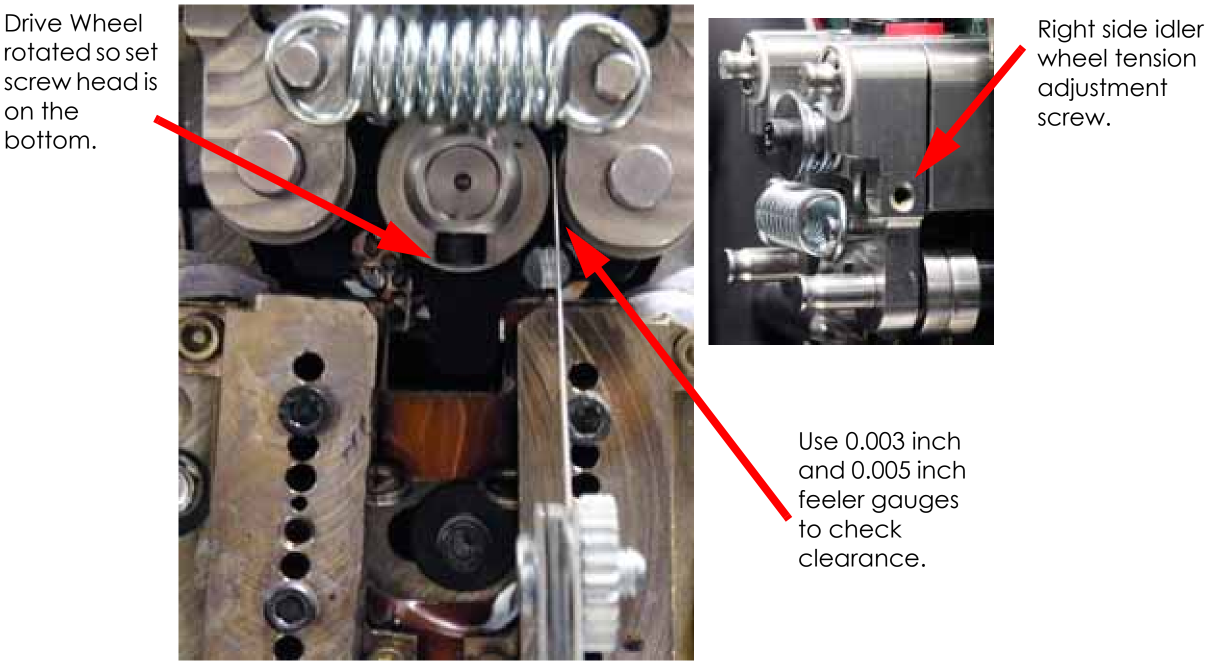
L. Place the toggle bar to the full left position.

M. Continue to adjust the screw until the prescribed clearance is obtained.

N. When adjustment is complete, place the toggle bar in the neutral position, and remove the feeler gauge.

O. Place the toggle bar in the full left position and spin the idler wheel by hand. The idler wheel should spin freely without drag. If drag is present, re-check adjustments.

Figure 5-374: Idler Wheel Adjustment - Right Side



4. Check and adjust (if necessary) the left (Support) side idler wheel clearance:

   A. For BST:

      a. Repeat step 3 above, except the toggle bar should be placed in the full right position instead of the full left position.

   B. For SST:

      a. Place the toggle bar in the neutral position.

      b. Insert a 0.012 inch feeler gauge between the drive wheel and the idler wheel. See Figure 5-375.

      c. Place the toggle bar in the full right position. The 0.012 inch feeler gauge should have light drag when pulling away from the drive wheel and idler wheel.

      d. Place the toggle bar in the neutral position.

e. Insert a 0.015 inch feeler gauge between the drive wheel and the idler wheel.

f. Return the toggle bar to the full right position - the 0.015 inch feeler gauge should be firmly held between the drive wheel and the idler wheel.

g. Place the toggle bar in the neutral position.

h. Insert a 0.010 inch feeler gauge between the drive wheel and the idler wheel.

i. Return the toggle bar to the full right position - the 0.010 inch feeler gauge should not be held between the drive wheel and the idler wheel - there should be no drag felt on the feeler gauge.

j. If the clearance is not correct, use a $^{5}/_{64}$" allen wrench to remove the idler wheel tension adjustment screw, apply LocTite 222 to the screw threads, and reinstall the screw. See Figure 5-375.

k. Place the toggle bar in the neutral position.

l. Insert a 0.012 inch feeler gauge between the drive wheel and the idler wheel.

m. Place the toggle bar in the full right position.

n. Adjust the screw to obtain a light drag on 0.012 inch feeler gauge.

o. Check the clearance with the 0.015 inch and 0.010 feeler gauges as above.

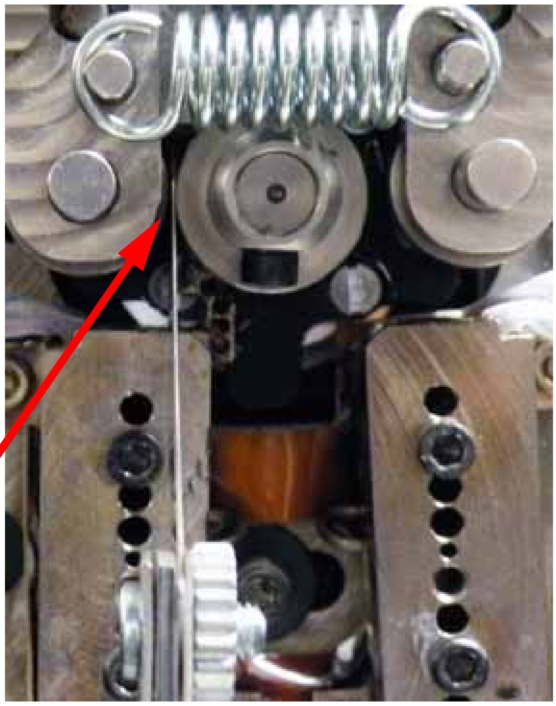
p. Continue to adjust the screw until the prescribed clearance is obtained.

q. When adjustment is complete, place the toggle bar in the neutral position, and remove the feeler gauge.

r. Place the toggle bar in the full right position and spin the idler wheel by hand. The idler wheel should spin freely without drag. If drag is present, re-check adjustments.

Figure 5-375: Idler Wheel Adjustment - Left Side

Left side idler wheel tension adjust screw.



For BST: Use 0.003 inch and 0.005 inch feeler gauges to check clearance.

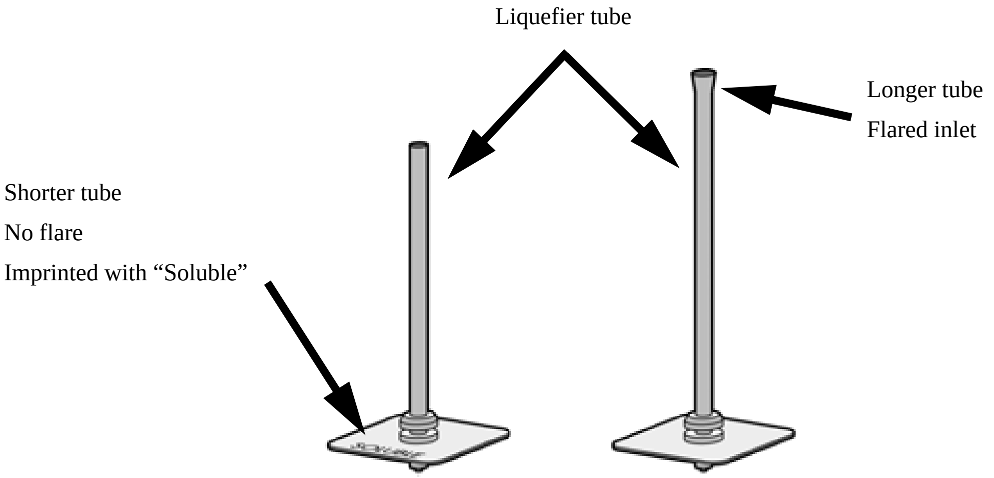
For SST: Use 0.012 inch, 0.015, and 0.010 inch feeler gauges to check clearance.

Liquefier Alignment Check

This aligns the liquefier tubes with the filament path.

1. Install the new liquefier tips:
   A. For BST 1200 and BST 1200es, the SUPPORT tip and MODEL tip are interchangeable. Both sides use the MODEL tip. (The tips come in a red capped container). See Figure 5-376.
   B. For SST 1200 and SST 1200es, you must identify the correct replacement tip. The SST uses two tip types. You must make sure a SUPPORT tip is used on the LEFT side of the head assembly. A MODEL tip must be used on the RIGHT side of the head assembly. The Model tip comes in a red capped container. The Support tip comes in a black capped container and is labeled "Soluble", see Figure 5-376.

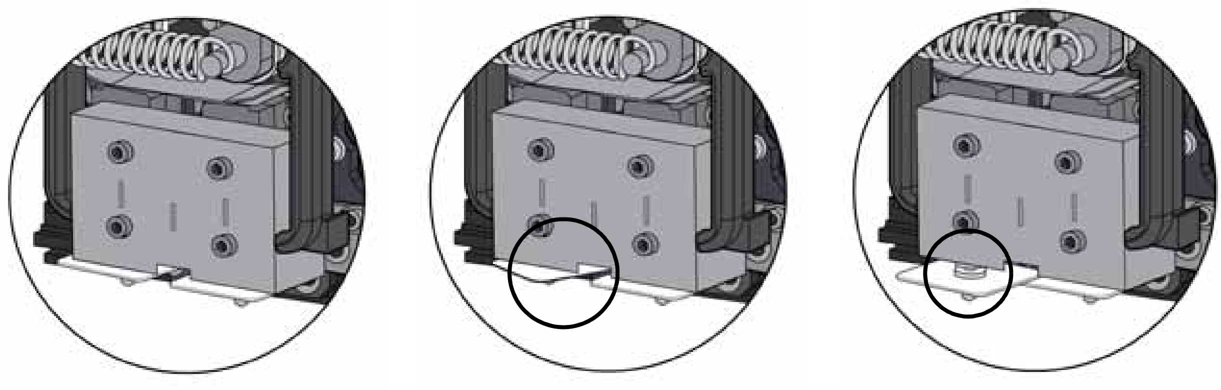
Figure 5-376: Identifying Tips



   C. Insert the new tip into the heater block.
   D. Pull the tip shield toward you, then lift up to install the tip.
   E. Push the tip toward the back of the printer once it is all the way up against the heater block.
   F. Verify the tip is fully inserted into the heater block and that the stainless steel shield is aligned, see Figure 5-377.

Note: Make sure tip remains all the way up against the heater block as you tighten the screws.

Figure 5-377: Tip Stainless Steel Shield Alignment



CORRECT

INCORRECT - Shield interference

INCORRECT - Tip not seated

G. Using a $^{7}/_{64}$″ allen wrench, firmly tighten the heater block clamp screws.

H. Repeat steps C through G for second tip.

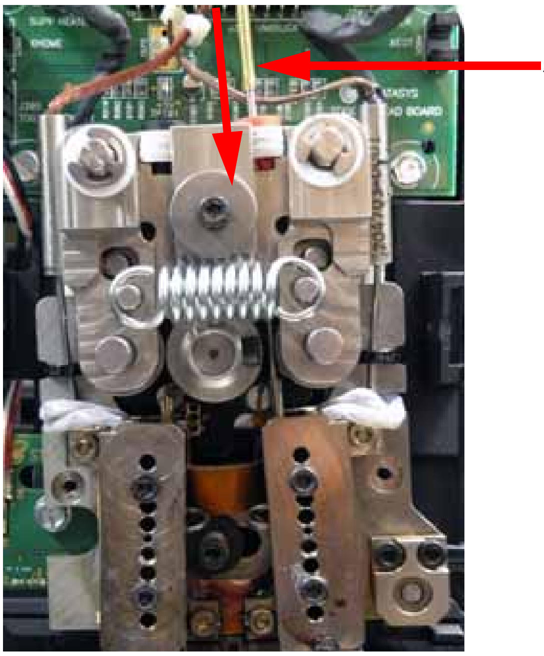
2. Verify right (Model) side alignment:

   A. Move the toggle bar to the full right position.

   B. Make sure that the liquefier alignment rod is straight. Roll the rod along a flat surface to check for bends. Straighten as necessary.

   C. Insert the liquefier alignment rod - small end first - from the TOP of the right side toggle block, past the drive wheel, to just above the liquefier inlet. See Figure 5-378.

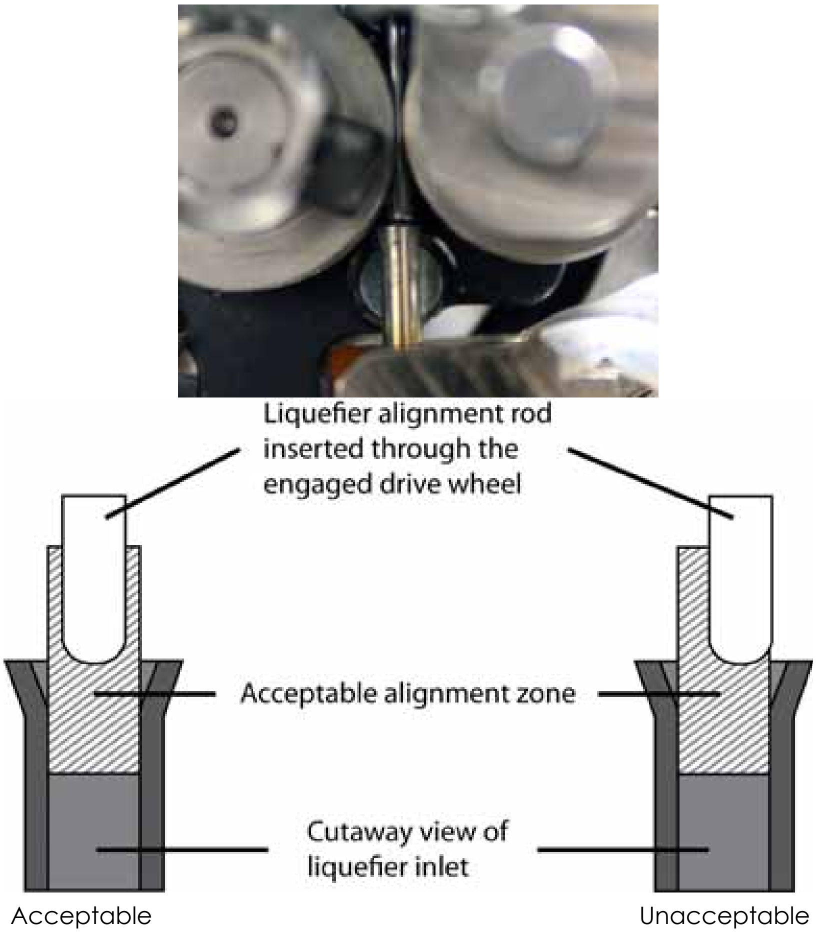
Figure 5-378: Alignment rod placement



   D. Move the toggle bar to the full left position.

   E. Visually check the alignment of the alignment rod with the liquefier inlet tube. The liquefier inlet must be aligned with the centerline of the alignment rod. See Figure 5-379.

Figure 5-379: Model liquefier alignment check



F. Perform a physical check of the alignment by pushing down on the top of the alignment rod so that it enters the inlet of the liquefier. Alignment is not correct if additional pressure is required on the rod as it enters the inlet - the pressure required to move the rod should be consistent throughout its travel.

G. If the alignment rod is not centered with the tip inlet, loosen the upper heater block mounting screw ONLY.

H. Pivot the heater block until the alignment rod is centered with the tip inlet.

I. Firmly hold the heater block in position with your thumb and tighten the heater block mounting screw.

J. Toggle to the right and remove the alignment rod.

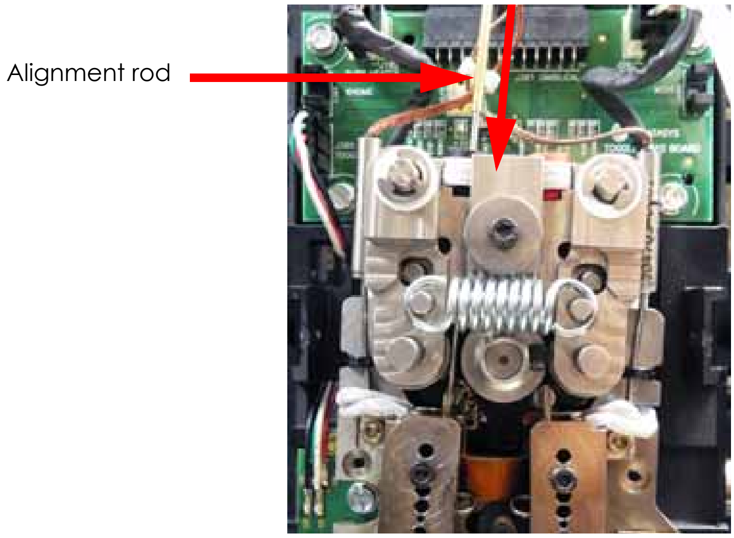
3. Verify Left (Support) side alignment:

   A. Move the toggle bar to the full left position.

   B. Make sure that the liquefier alignment rod is straight. Roll the rod along a flat surface to check for bends. Straighten as necessary.

   C. Insert the liquefier alignment rod - small end first - from the TOP of the left side toggle block, past the drive wheel, to just above the liquefier inlet. See Figure 5-380.

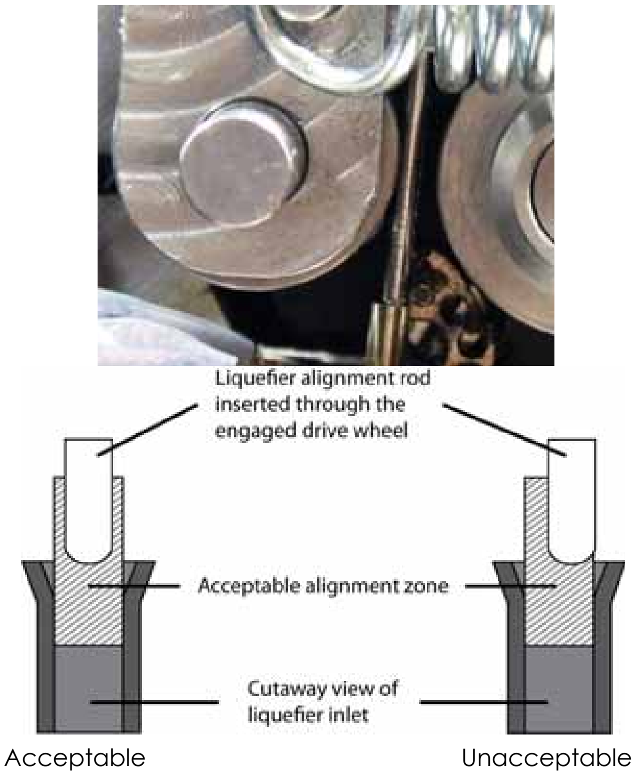
Figure 5-380: Alignment rod placement



D. Move the toggle bar to the full right position.

E. Visually check the alignment of the alignment rod with the liquefier inlet tube. The liquefier inlet must be aligned with the centerline of the alignment rod. See Figure 5-381.

Figure 5-381: Model liquefier alignment check



F. Perform a physical check of the alignment by pushing down on the top of the alignment rod so that it enters the inlet of the liquefier. Alignment is not correct if additional pressure is required on the rod as it enters the inlet - the pressure required to move the rod should be consistent throughout its travel.

G. If the alignment rod is not centered with the tip inlet, loosen the upper heater block mounting screw ONLY.

H. Pivot the heater block until the alignment rod is centered with the tip inlet.

I. Firmly hold the heater block in position and tighten the heater block mounting screw.
J. Move the toggle bar to the full left position and remove the alignment rod.
K. Using a $^7/_{64}$” allen wrench, loosen the model and support heater block clamp screws.
L. Remove the model and support tips.

4. Reassemble the toggle head, see Reassemble the Toggle Plate Assembly on page 5-23.

Reassemble the Toggle Plate Assembly

1. Reinstall the heat shield.
2. Install the model and support tips.
3. Check and adjust the brush/flicker height, see Adjusting Brush/Flicker Height (1200) on page 5-50.
4. Reconnect the filament tubes to the top of the toggle plate assembly - make sure the model tube is on the right; the support tube on the left.
5. Reinstall the air plenum.
6. Reinstall the head cover.
7. Reinstall the right side panel, see Installing the Side Panels on page 4-6.
8. Reinstall the rear panel, see Installing the Rear Panel on page 4-5.
9. Perform the Z Calibration and XY Tip Offset procedure, see Adjusting Z Calibration and XY Tip Offset on page 5-2.

Note: Follow the head installation checklist after completing toggle plate assembly replacement, see Toggle Plate Assembly Installation Checklist on page 9-4.

Tensioning the X & Y Belts

Caution: The X & Y Drive Belt Tension must be checked and adjusted with the system and belts at room temperature.

Y Motor Belt

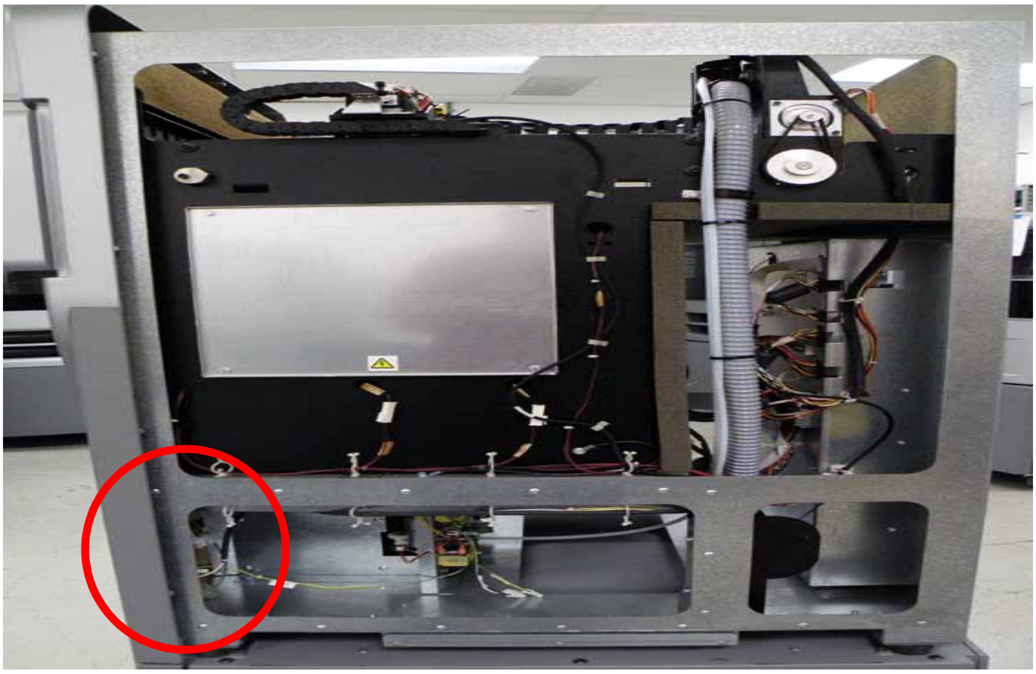
Required Tools

- $^{9}/_{64}$″ allen wrench
- XY motor belt tension tool

Tension Y Motor Belt

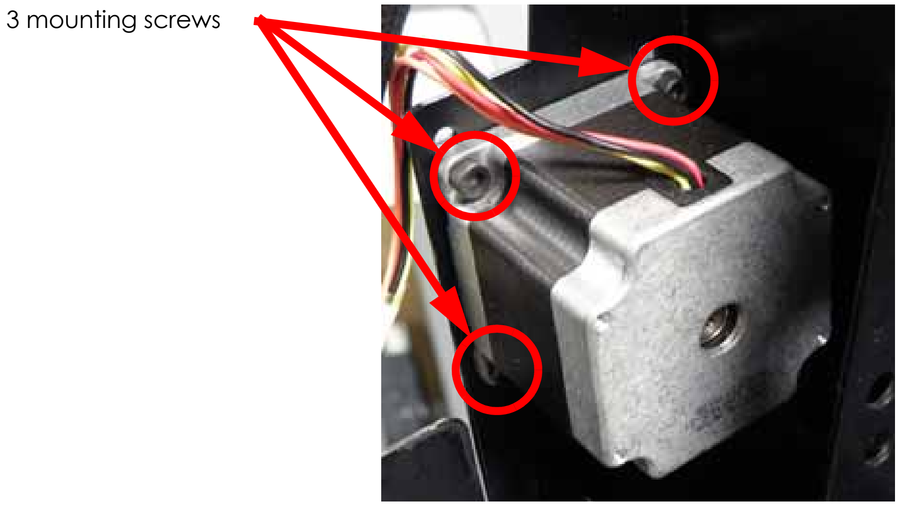
1. Power down the system using the power-down switch. Once the system is powered down, switch the circuit breaker to the **off** position.
2. Unplug the AC power cord, RJ-45 network cable and UPS cable (if used) from the rear of the printer.
3. Remove the rear panel. See Removing the Rear Panel on page 4-5.
4. Remove the side panels. See Side Panels on page 4-6.
5. Locate the Y motor. See Figure 5-382.

Figure 5-382: Y motor location



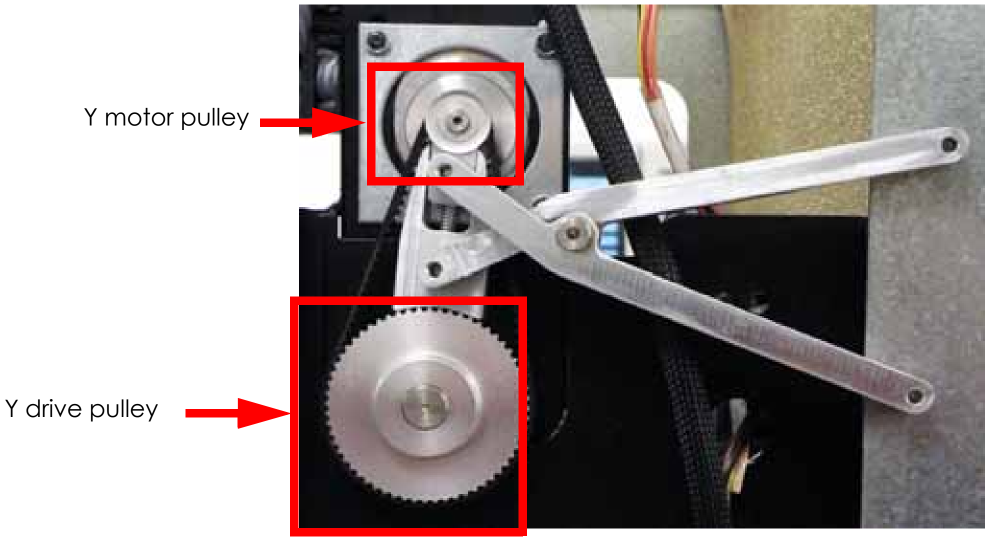
6. Using a $^{9}/_{64}$″ allen wrench, loosen but do not remove the 3 Y motor mounting screws. See Figure 5-383.

Figure 5-383: Y motor mounting screw locations



7. Insert the XY belt tension tool between the Y motor pulley and the Y drive pulley by squeezing the handles together. When in place, release the handles to obtain tension. See Figure 5-384.

Figure 5-384: XY belt tension tool location



8. Using a $^{9}/_{64}$" allen wrench, completely tighten the 3 mounting screws.
9. Remove the XY motor belt tension tool.
10. Reinstall the side panels. See Side Panels on page 4-6.
11. Reinstall the rear panel. See Installing the Rear Panel on page 4-5.
12. Reconnect the AC power cord, RJ-45 network cable and UPS cable (if used).
13. Power on the system. The system should reach **Idle** with no displayed errors.
14. Run a small test part and monitor system operation during build.

X Drive Belt

Required Tools

- $^{9}/_{64}$″ allen wrench
- $^{7}/_{64}$″ allen wrench
- $^{3}/_{8}$″ nut driver or box wrench
- Small standard screwdriver
- XY motor belt tensioning tool
- Belt tension gauge
- Dial Indicator

Tension X Drive Belt

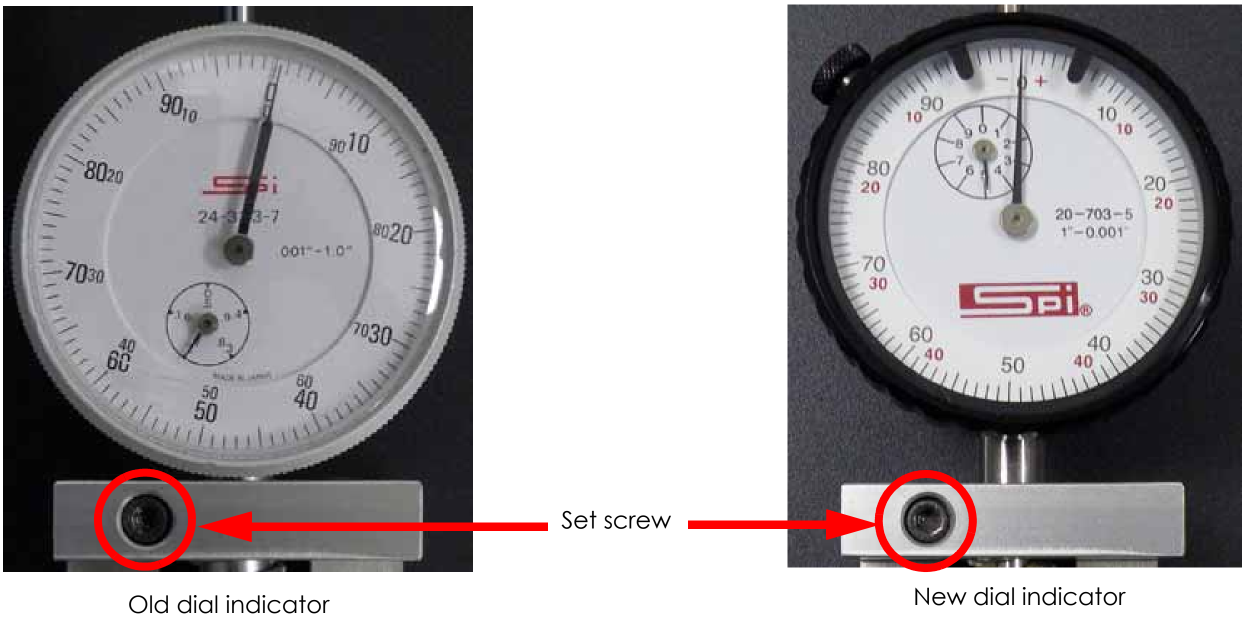
1. Power down the system using the power-down switch. Once the system is powered down, switch the circuit breaker to the **off** position.
2. Unplug the AC power cord, RJ-45 network cable and UPS cable (if used) from the rear of the printer.
3. Remove the rear panel. See Removing the Rear Panel on page 4-5.
4. Remove the side panels. See Side Panels on page 4-6.
5. Let printer cool for 1 hour.
6. Insert the belt tension gauge zero block into the belt tension gauge. See Figure 5-385.

Figure 5-385: Belt tension gauge zero block

Old dial indicator　　New dial indicator

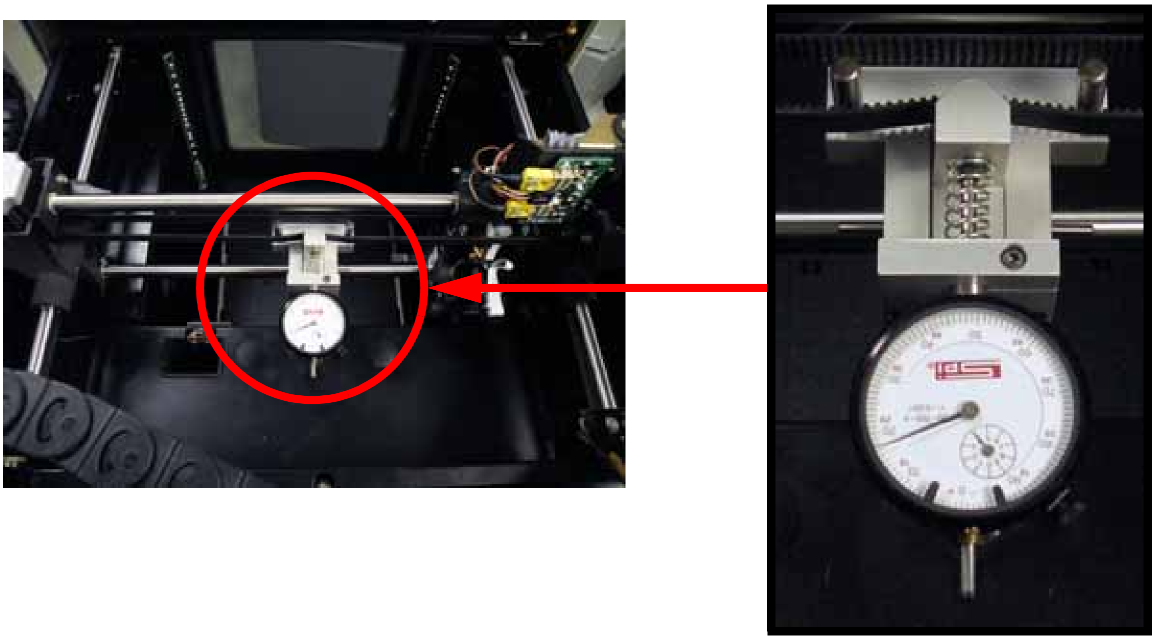
7. Zero the dial indicators by adjusting the dial indicator up or down until the gauge reads:
   A. The old dial indicator will be at zero when the large hand is on 0 and the small hand is on 2.7, when at zero use a $^{7}/_{64}$″ allen wrench to tighten the set screw. See Figure 5-386.
   B. The new dial indicator will be at zero when the large hand is on 0 and the small hand is on 5, when at zero use a $^{7}/_{64}$″ allen wrench to tighten the set screw. See Figure 5-386.

Figure 5-386: Setting the dial indicator



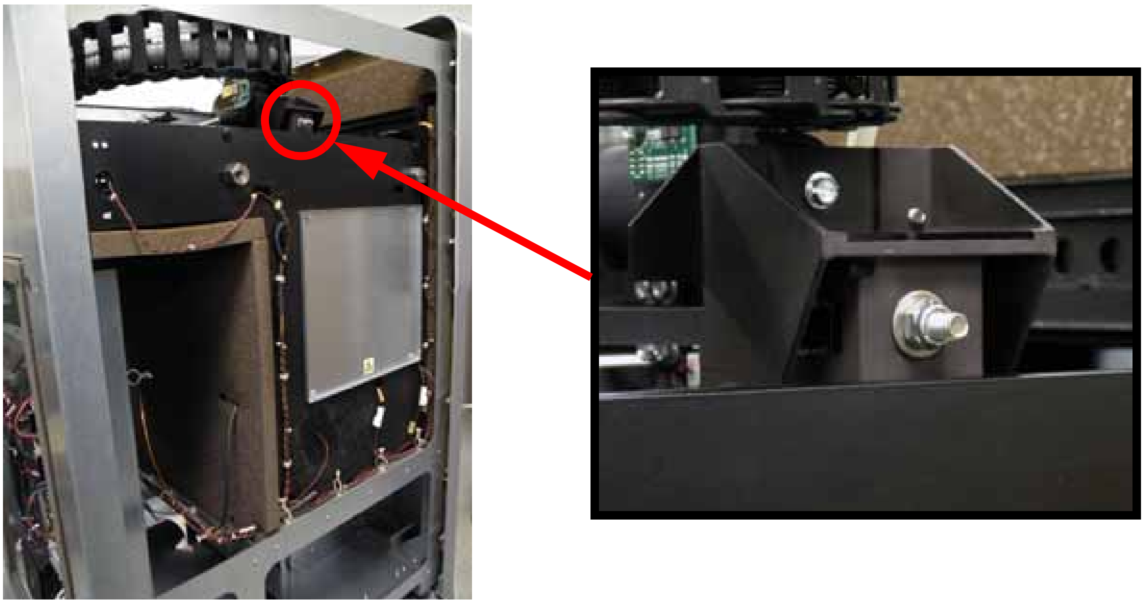
8. Remove the zero block from the belt tension gauge.
9. Move the Head assembly to the full right travel limit (as viewed from the front of the printer).
10. Place the belt tension gauge on the center of the X drive belt. See Figure 5-387.

Figure 5-387: Belt tension gauge location



11. Locate the X Drive Belt tensioning nut, see Figure 5-388.

Figure 5-388: X drive belt tension nut location



12. Using a $\frac{3}{8}$” nut driver or box wrench, tighten the X drive belt by turning the X drive belt tensioning nut clockwise until:
    - A. The old dial indicators large hand is between 20 and 25 mils and the small hand is nearly on 1.6. See Figure 5-389.
    - B. The new dial indicators large hand is between 30 and 40 mils and the small hand is between 4 and 5. See Figure 5-389.

Figure 5-389: Dial indicator readings

Old dial indicator   New dial indicator

13. Remove the tension gauge and move the head from left to right several times.
14. Reattach the tension gauge to the X drive belt and measure belt tension. If tension is out of specification, repeat steps 10 - until the belt tension is within specification.
15. Reinstall the side panels. See Side Panels on page 4-6.
16. Reinstall the rear panel. See Installing the Rear Panel on page 4-5.
17. Reconnect the AC power cord, RJ-45 network cable and UPS cable (if used).
18. Power on the system. The system should reach **Idle** with no displayed errors.
19. Run a small test part and monitor system operation during build.

Y Drive Belt

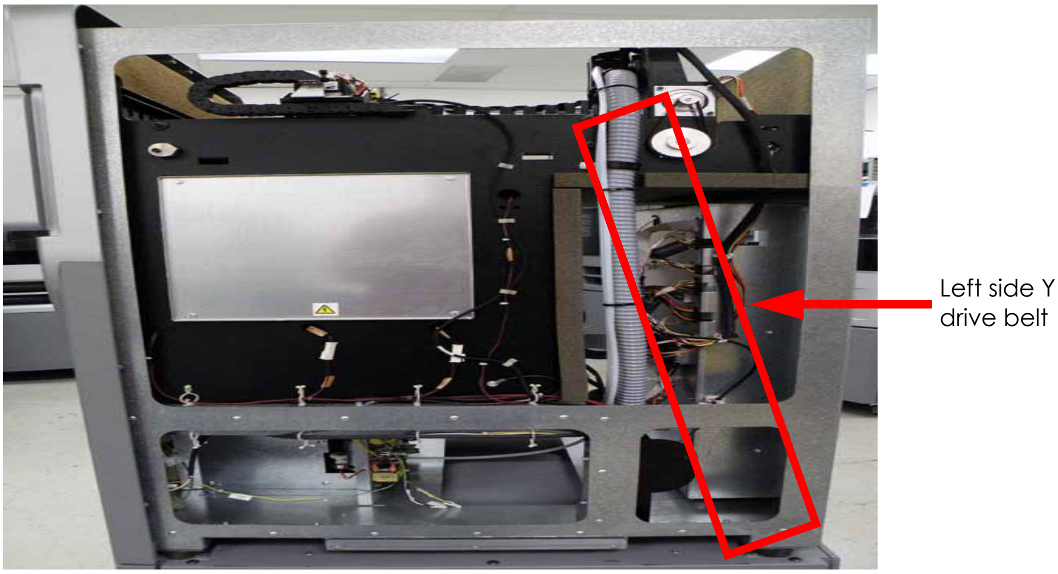
Required Tools

- $\frac{1}{2}$″ nut driver or box wrench
- $\frac{5}{16}$″ nut driver or standard screwdriver
- $\frac{1}{8}$″ allen wrench
- Belt tension gauge
- Dial Indicator

Tension the Left Side Y Drive Belt

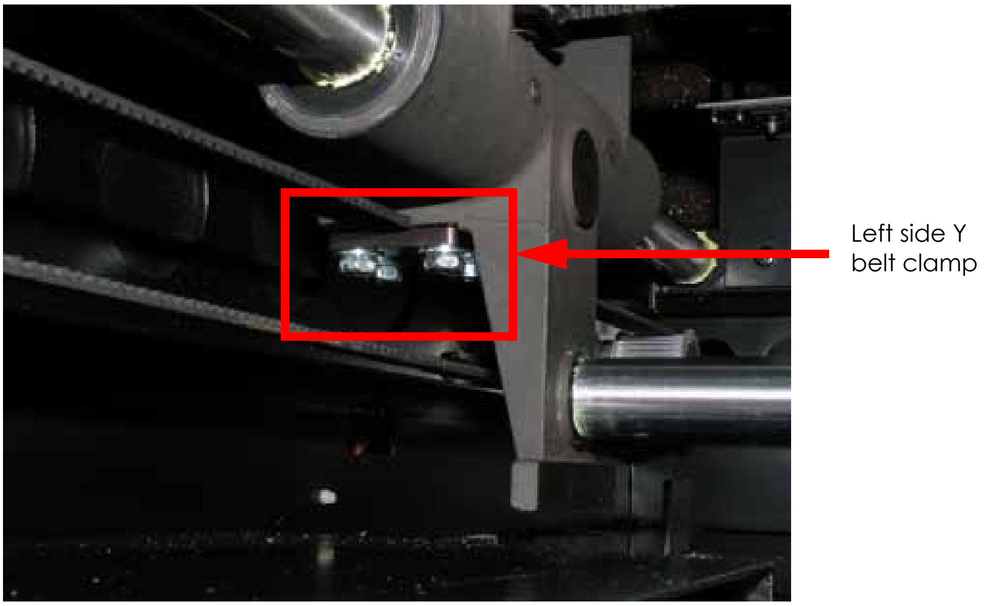
1. Power down the system using the power-down switch. Once the system is powered down, switch the circuit breaker to the **off** position.
2. Unplug the AC power cord, RJ-45 network cable and UPS cable (if used) from the rear of the printer.
3. Remove the rear panel. See Removing the Rear Panel on page 4-5.
4. Remove the side panels. See Side Panels on page 4-6.
5. Remove the front bezel. See Removing the Front Bezel (Panel) on page 4-15.
6. Let printer cool for 1 hour.
7. Locate the left side Y drive belt. See Figure 5-390.

Figure 5-390: Left side Y drive belt location



8. Using a $\frac{15}{16}$″ nut driver or standard screwdriver, remove the 4 left side Y belt clamp mounting screws and remove the belt clamp. See Figure 5-391.

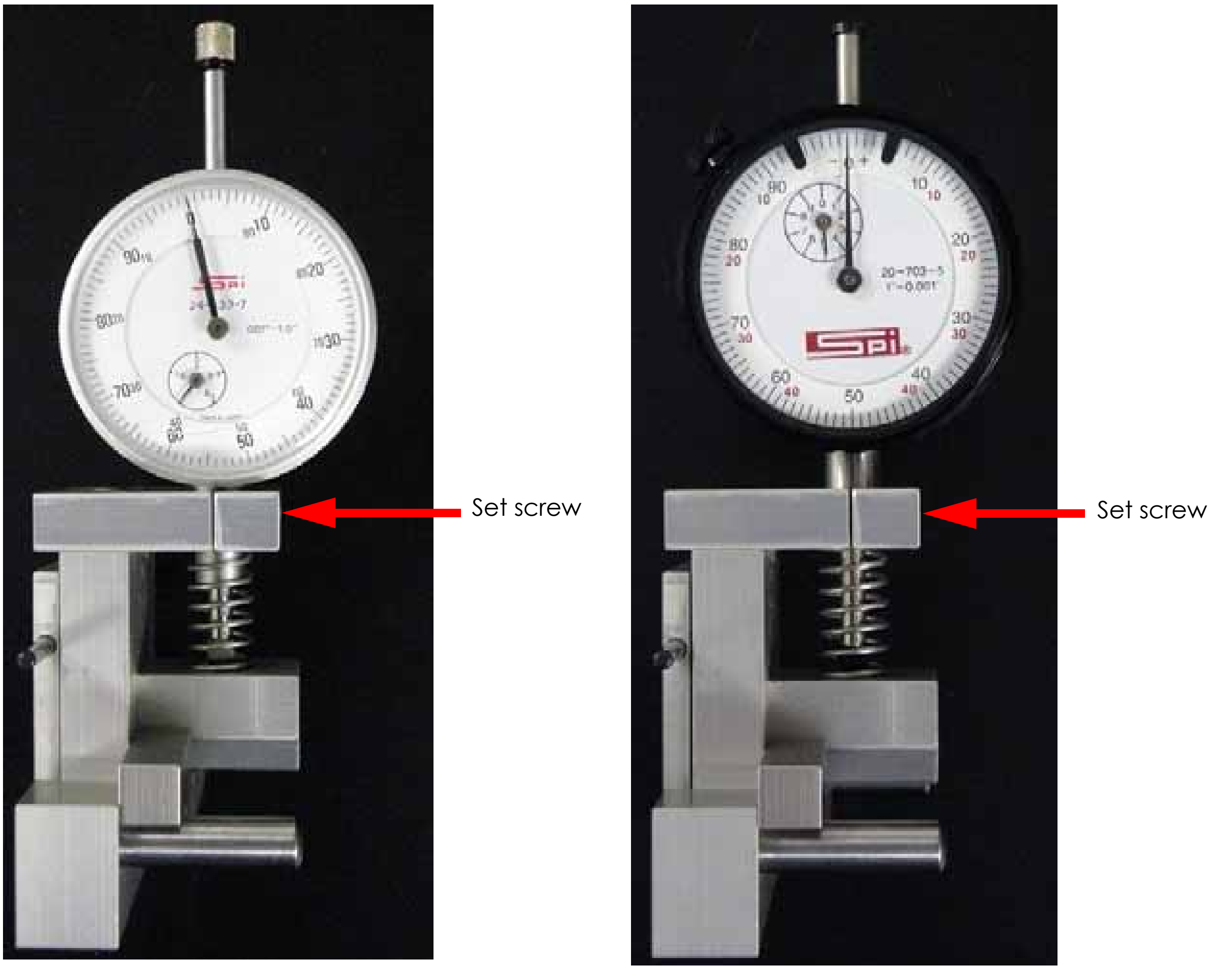
Figure 5-391: Left side Y belt clamp mounting screw locations



9. Insert the belt tension gauge zero block into the belt tension gauge. See Figure 5-392.
10. Zero the dial indicators by adjusting the dial indicator up or down until the gauge reads:
    A. The old dial indicator will be at zero when the large hand is on 0 and the small hand is on 2.7, when at zero use a $^{7}/_{64}$" allen wrench to tighten the set screw. See Figure 5-392.
    B. The new dial indicator will be at zero when the large hand is on 0 and the small hand is on 5, when at zero use a $^{7}/_{64}$" allen wrench to tighten the set screw. See Figure 5-392.

Note: Turn the dial indicator to the left so the face is visible while tensioning the right side Y drive belt.

Figure 5-392: Belt tension gauge zero block

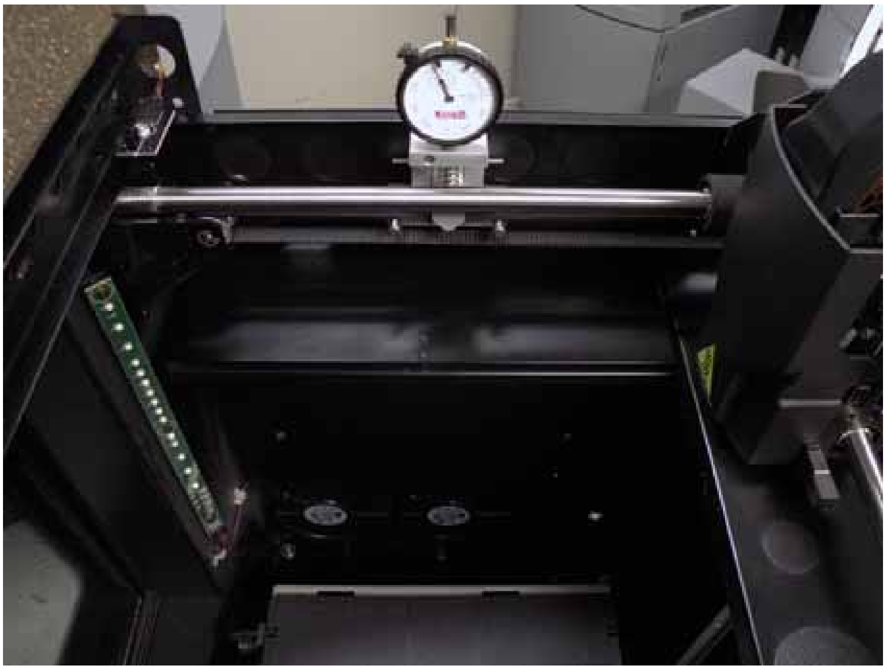


Old dial indicator

New dial indicator

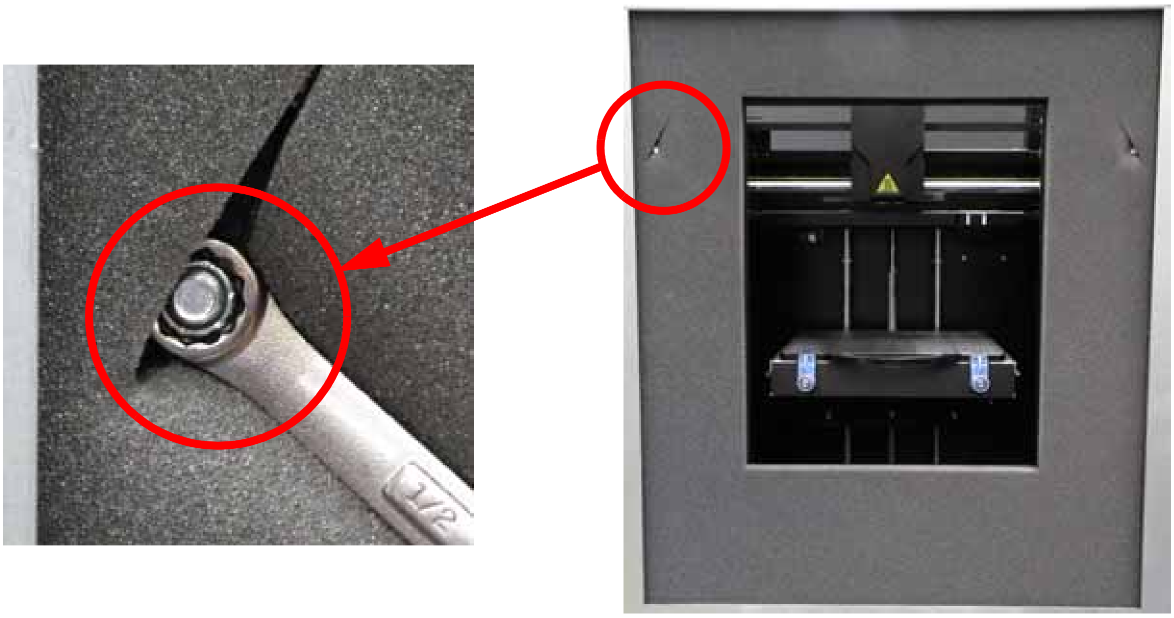
11. Remove the zero block from the belt tension gauge.
12. Move the head to the rear of the printer.
13. Place the belt tension gauge on the center of the left side Y drive belt. See Figure 5-393.

Figure 5-393: Belt tension gauge location



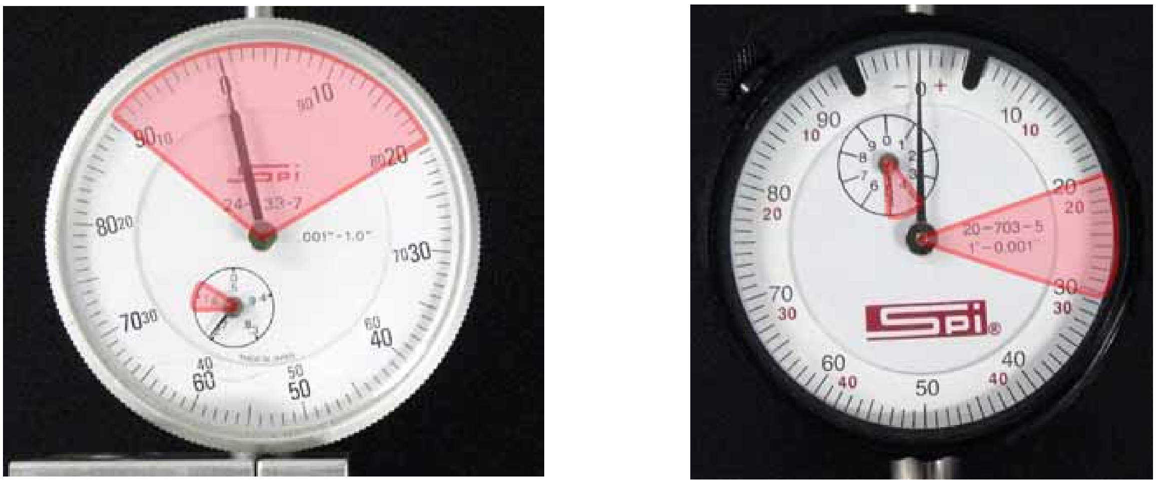
14. Locate the left side Y Drive belt tension nut, see Figure 5-394.

Figure 5-394: Left side Y Drive belt tension nut location



15. Using a ½" nut driver or box wrench, tighten the left side Y drive belt by turning the drive belt tensioning nut clockwise until:
    - A. The old dial indicators large hand is between 90 and 20 mils and the small hand is nearly on 1.6. See Figure 5-395.
    - B. The new dial indicators large hand is between 20 and 30 mils and the small hand is between 4 and 5. See Figure 5-395.

Figure 5-395: Dial indicator readings



Old dial indicator

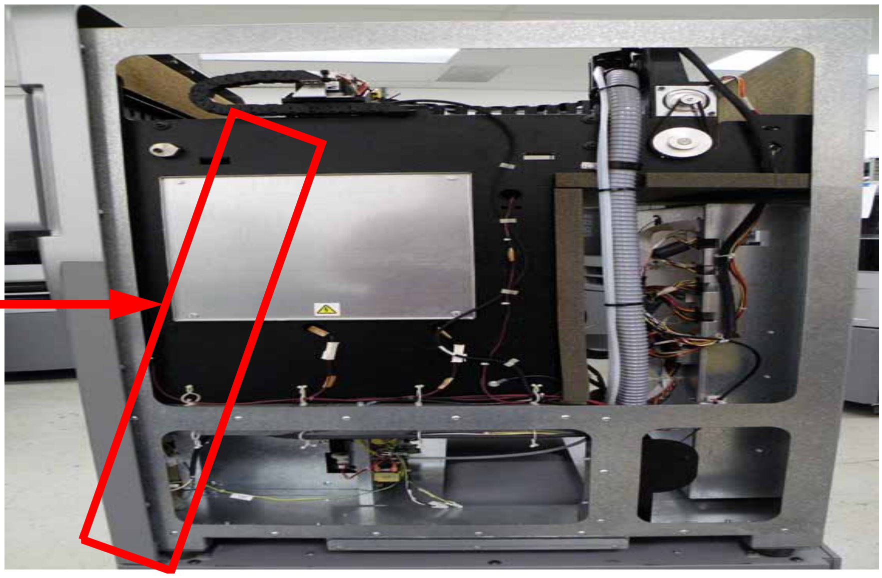
New dial indicator

16. Remove the tension gauge and move the head from front to back several times.
17. Reattach the tension gauge to the left side Y drive belt and measure belt tension. If tension is out of specification, repeat steps 12 - 16 until the belt tension is within specification.
18. Align the left side Y drive belt clamp with the mounting holes and use a $^1/_8$" allen wrench to reinstall the 4 mounting screws.
19. Reinstall the front bezel. See Installing the Front Bezel on page 4-16.
20. Reinstall the side panels. See Side Panels on page 4-6.
21. Reinstall the rear panel. See Installing the Rear Panel on page 4-5.
22. Reconnect the AC power cord, RJ-45 network cable and UPS cable (if used).
23. Power on the system. The system should reach **Idle** with no displayed errors.
24. Run a small test part and monitor system operation during build.

Tension the Right Side Y Drive Belt

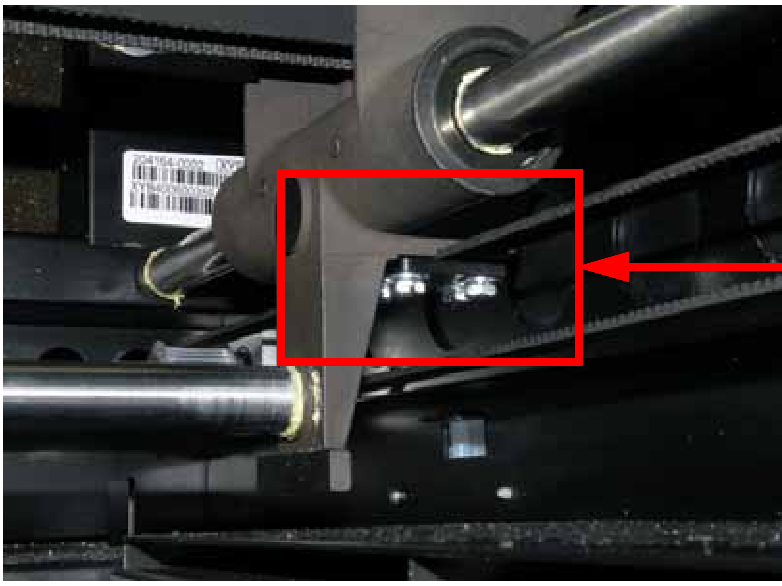
1. Power down the system using the power-down switch. Once the system is powered down, switch the circuit breaker to the **off** position.
2. Unplug the AC power cord, RJ-45 network cable and UPS cable (if used) from the rear of the printer.
3. Remove the rear panel. See Removing the Rear Panel on page 4-5.
4. Remove the side panels. See Side Panels on page 4-6.
5. Remove the front bezel. See Removing the Front Bezel (Panel) on page 4-15.
6. Let printer cool for 1 hour.
7. Locate the right side Y drive belt. See Figure 5-396.

Figure 5-396: Right side Y drive belt location



8. Using a $^{5}/_{16}$″ nut driver or standard screwdriver, remove the 4 right side Y belt clamp mounting screws and remove the belt clamp. See Figure 5-397.

Figure 5-397: Right side Y belt clamp mounting screw locations

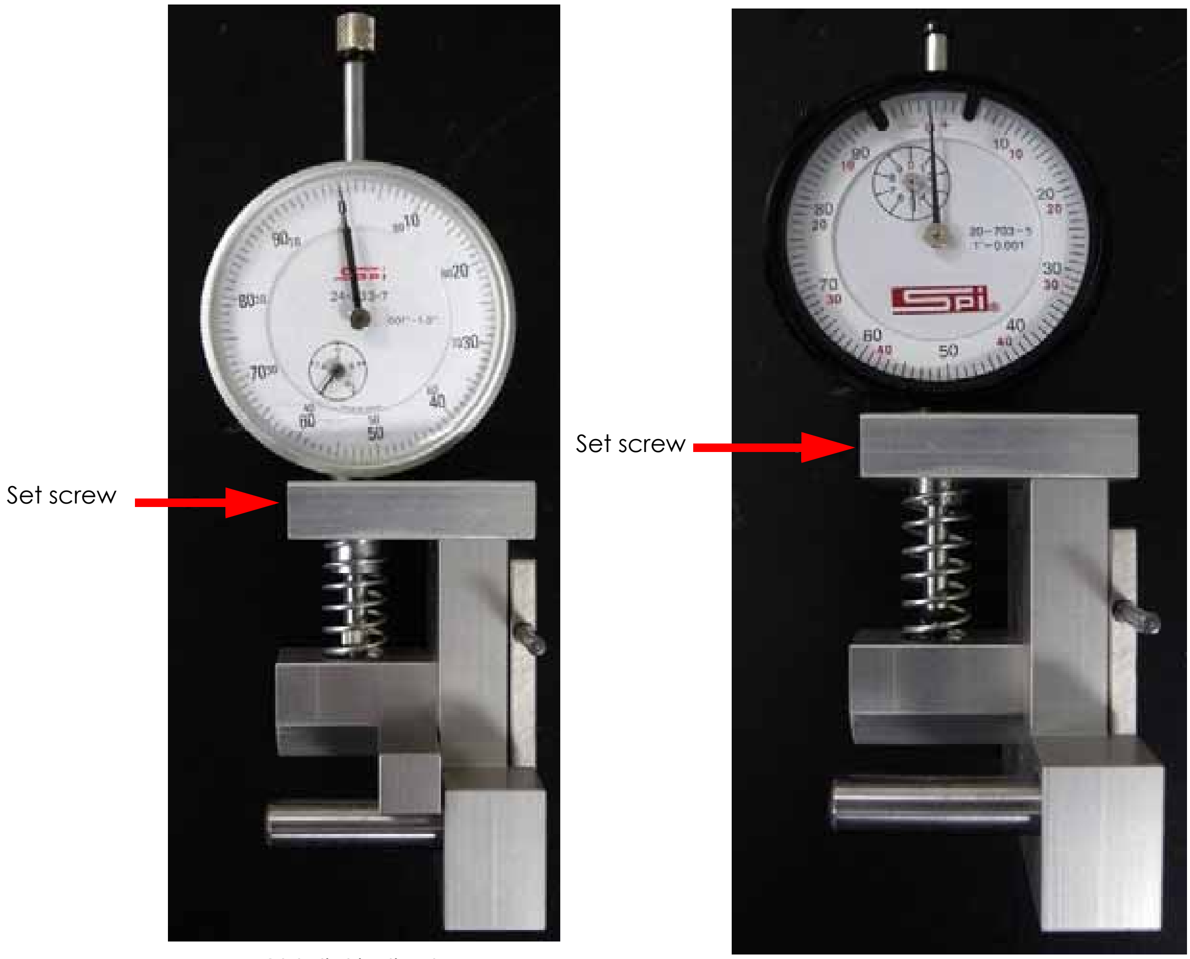


9. Insert the belt tension gauge zero block into the belt tension gauge. See Figure 5-398.
10. Zero the dial indicators by adjusting the dial indicator up or down until the gauge reads:
    A. The old dial indicator will be at zero when the large hand is on 0 and the small hand is on 2.7, when at zero use a $^{7}/_{64}$″ allen wrench to tighten the set screw. See Figure 5-398.

B. The new dial indicator will be at zero when the large hand is on 0 and the small hand is on 5, when at zero use a $^{7}/_{64}$″ allen wrench to tighten the set screw. See Figure 5-398.

Note: Turn the dial indicator to the right so the face is visible while tensioning the left side Y drive belt.

Figure 5-398: Belt tension gauge zero block

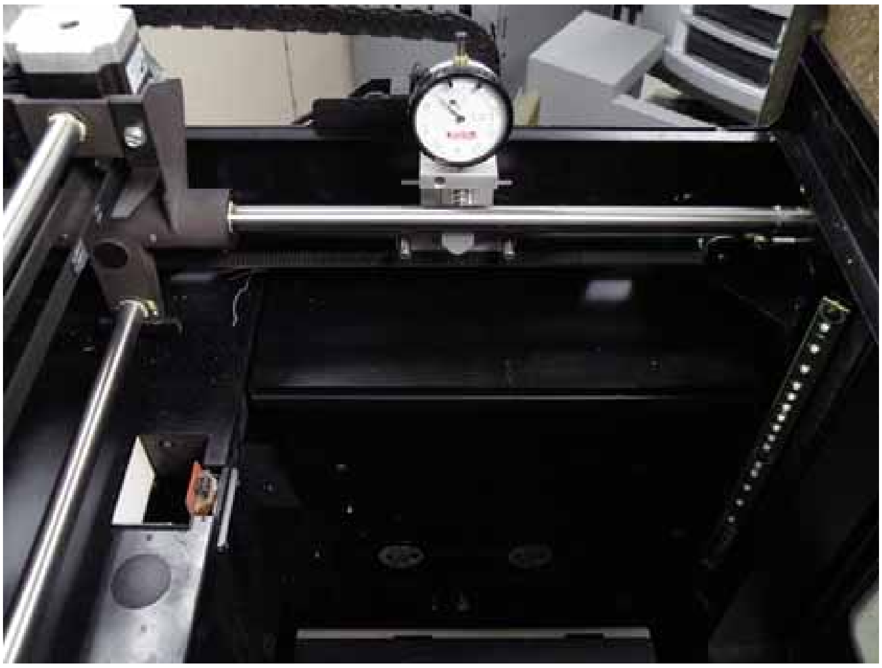


Old dial indicator

New dial indicator

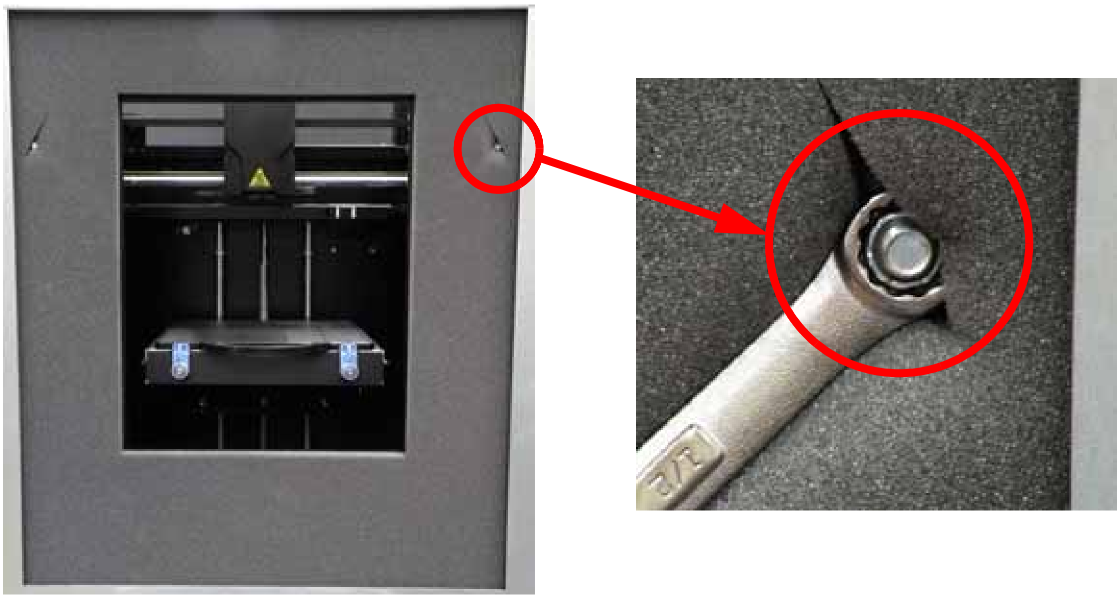
11. Remove the zero block from the belt tension gauge.
12. Move the head to the rear of the printer.
13. Place the belt tension gauge on the center of the right side Y drive belt. See Figure 5-399.

Figure 5-399: Belt tension gauge location



14. Locate the right side Y drive belt tension nut, see Figure 5-400.

Figure 5-400: Right side Y drive belt tension nut location

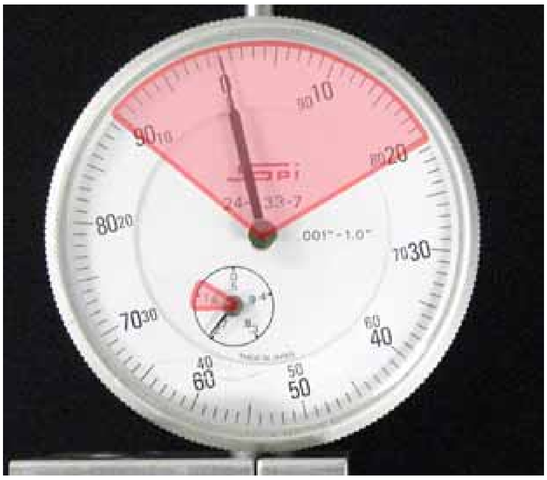


15. Using a ½" nut driver or box wrench, tighten the right side Y drive belt by turning the drive belt tensioning nut clockwise until:

    A. The old dial indicators large hand is between 90 and 20 mils and the small hand is nearly on 1.6. See Figure 5-401.

    B. The new dial indicators large hand is between 20 and 30 mils and the small hand is between 4 and 5. See Figure 5-401.

Figure 5-401: Dial indicator readings



Old dial indicator

New dial indicator

16. Remove the tension gauge and move the head from front to back several times.
17. Reattach the tension gauge to the right side Y drive belt and measure belt tension. If tension is out of specification, repeat steps 12 - 16 until the belt tension is within specification.
18. Align the right side Y drive belt clamp with the mounting holes and use a 1/8″ allen wrench to reinstall the 4 mounting screws.
19. Reinstall the front bezel. See Installing the Front Bezel on page 4-16.
20. Reinstall the side panels. See Side Panels on page 4-6.
21. Reinstall the rear panel. See Installing the Rear Panel on page 4-5.
22. Reconnect the AC power cord, RJ-45 network cable and UPS cable (if used).
23. Power on the system. The system should reach **Idle** with no displayed errors.
24. Run a small test part and monitor system operation during build.

Get/Send Calibration Files

The "Get" button copies the .cal file from the system hard drive to the system calibration floppy disk/CD. The "Send" copies the .cal file from the system calibration floppy disk/CD (located in the electronics bay of the system) to the system hard drive.

Important

- Do not use spaces in the .cal prefix name.
- Once the system is upgraded and anytime calibration changes are made the .cal file should be written ("Get") from the system hard drive to the system floppy disk/CD. The floppy disk/CD should then be returned to the electronics bay.
- The .cal file includes all of the most recent system calibration values.

Parts and Tools Required

- MaracaEX
- Workstation

"Send" .cal file – from calibration Floppy Disk/CD to the printer:

Note: This would typically be used after installation of a new hard drive.

1. Remove the system calibration floppy disk/CD from the electronics bay and insert into the workstation floppy disk/CD drive.
2. Install and open MaracaEX. Ensure that communications has been established with the system.
3. Select "Send" and browse to the floppy disk/CD drive.
4. Select the xxx.cal (where xxx equals printer name) from the floppy disk/CD by double clicking on the file name.
5. To complete sending the file, hit the green check mark. This will write the file to the system hard drive.
6. Cycle power on the printer.
7. Replace the floppy disk/CD back into the electronics bay.

"Get" .cal file – from hard drive to the calibration Floppy Disk/CD:

Note: This would typically be used after changing calibration values or if the .cal file has not been stored on the floppy disk/CD.

1. Remove the system calibration floppy disk/CD disk from the electronics bay or a blank CD and insert it into the workstation floppy disk/CD drive.
2. Install and open MaracaEX. Ensure that communication has been established with the system.
3. Select "Get" and browse to the floppy disk/ CD drive.
4. Select "Save" and the file will be written to the floppy disk/CD.

Note: Spaces are not allowed in the printer name.

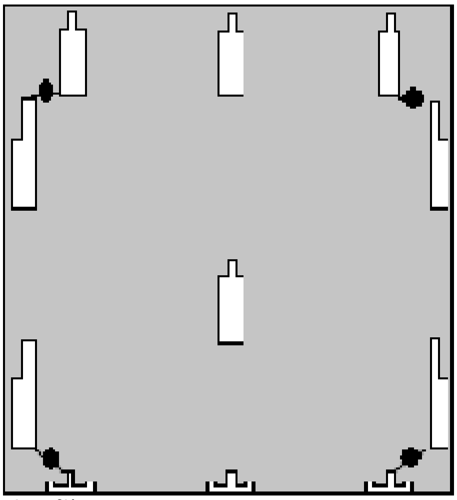
5. Replace the floppy disk/ CD back into the electronics bay.

XY Table Leveling

Checking the XY Table Level

1. Remove the substrate from the Z Stage.
2. Mark a place on each corner of the platen surface with a permanent marker Figure 5-402.

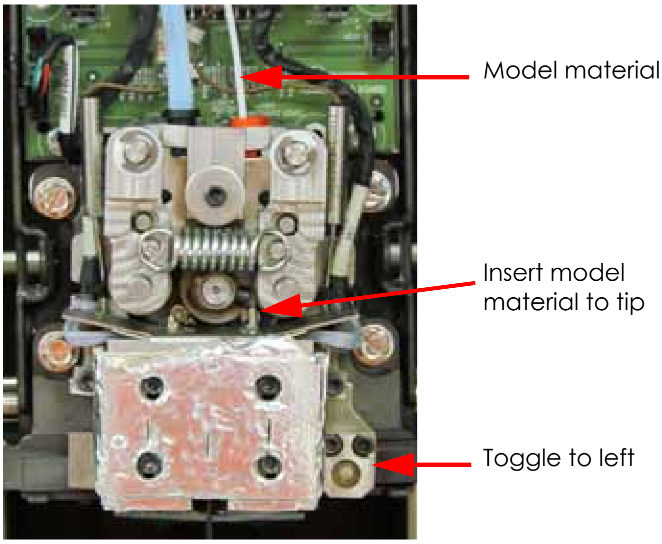
Figure 5-402: Modeling Base Indicator Points



3. Attach a dial indicator and fixture to the head.
4. Move the dial indicator to the back right corner on the marked location.
5. Raise the Z Stage until it contacts the dial indicator. Continue to raise the Z stage an additional two revolutions of the dial indicator.
6. Disconnect model side material tube by pressing the retaining ring down and pulling the tube out.
7. Insert a 6 inch piece of model material through model side until it reaches the tip then toggle to the left to engage the model side. See Figure 5-403.

Note: Material is inserted to stabilize the head during the leveling process.

Figure 5-403: Inserting model material



8. Zero the dial indicator (this is the reference position and will always be zero).
9. Move the XY table to the front right corner Figure 5-402. and measure and record the difference (e.g. the dial indicator reads -0.004 in.)
10. Move the dial indicator to the front left corner Figure 5-402. and measure and record the difference (e.g. the dial indicator reads +0.010).
11. Move to the back left corner Figure 5-402. and measure and record the difference (e.g. the dial indicator reads +0.008 in).
12. Insert the MaracaEX CD in a workstation and open the *XY Level Calc.xls* file.
13. Input the FR, FL and BL values you measured in the Indicator Reading boxes of the spreadsheet.

Note: Make sure to use the correct XLS file. There is a separate file for Dimension 1200 models.

Figure 5-404: Sample XY Level Calulator

Location	Indicator Reading	Knob Adjust
BR	0.000	-
FR	-0.004	0.014
FL	0.010	-0.013
BL	0.008	-0.001

14. The spreadsheet will calculate the required adjustment for each corner, and display them in the Knob Adjust column.

Adjusting the XY Table Level

1. Move the indicator to the BR position and verify it is zero.

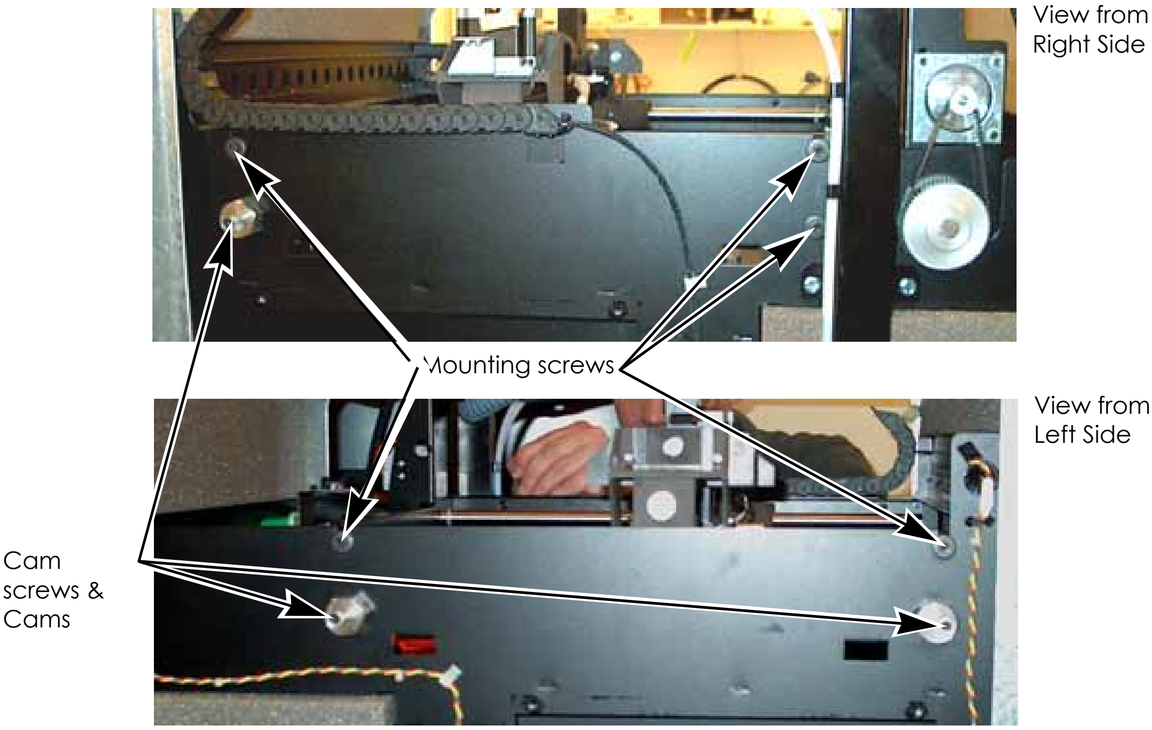
Note: This corner does not have an adjustment cam and will not require adjustment.

2. Move to the FR position.
3. Zero the dial indicator.
4. Loosen the XY frame screw and the cam adjuster lock screw on the FR corner Figure 5-405.
5. Turn the adjuster cam until the dial indicator reading matches the calculated value from the spreadsheet (e.g. 0.014). See Figure 5-404..

Note: Turning the cam clockwise will lower the XY table and cause the dial indicator needle to move positive. Turning the cam counter-clockwise will raise the XY table and cause the dial indicator needle to move negative.

6. Tighten the cam lock screw and the frame screw on the FR corner.
7. Move the dial indicator to the FL corner.
8. Zero the dial indicator.
9. Loosen the frame and cam lock screws on the FL corner.
10. Turn the adjuster cam until the dial indicator reading matches the calculated value from the spreadsheet (e.g. -0.013).
11. Tighten the cam lock screw and the frame screw on the FL corner.
12. Move the dial indicator to the BL corner.
13. Zero the Dial indicator.
14. Loosen the frame and cam lock screws on the BL corner.
15. Turn the adjuster cam until the dial indicator reading matches the calculated value from the spreadsheet (e.g. -0.001).
16. Tighten the cam lock screw and the frame screw on the FL corner.
17. Recheck the four corners again. The maximum difference allowed between the highest and lowest readings is .003 in.
18. Repeat the Measure Level Condition and Adjust XY Table sections until the measurements are within specification.

Figure 5-405: XY Table Cam and Retaining Screws



Z Tray Leveling

Note: This procedure assumes that the XY Table is correctly installed and the Z-stage is out of adjustment. This procedure should not be performed as part of an XY Table replacement.

At the factory, the Z-stage is initially squared using a fixture. The XY Table is then installed and leveled to the Z-stage. Do not attempt to level the Z-Stage if the XY Table level is suspected of being out of adjustment.

Parts and Tools Required

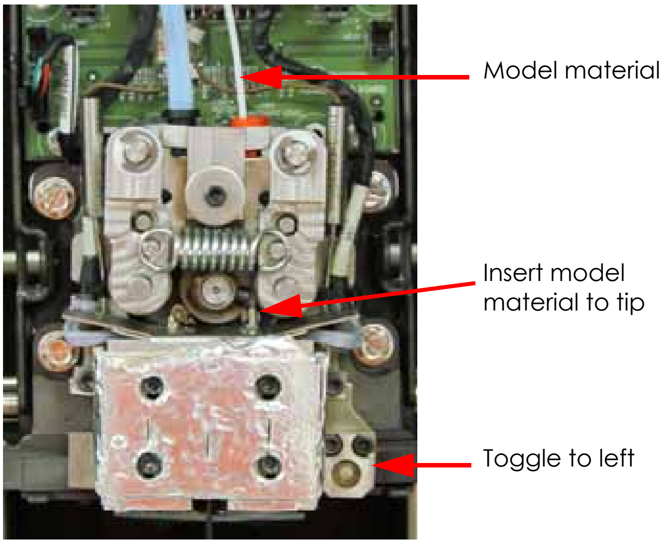
- Spacer gauge
- Head bracket
- Dial indicator
- Allen wrench set

Check Z Stage Level

1. Disconnect model side material tube by pressing the retaining ring down and pulling the tube out.
2. Insert a 6 inch piece of model material through model side until it reaches the tip then toggle to the left to engage the model side. See Figure 5-406.

Note: Material is inserted to stabilize the head during the leveling process.

Figure 5-406: Inserting model material

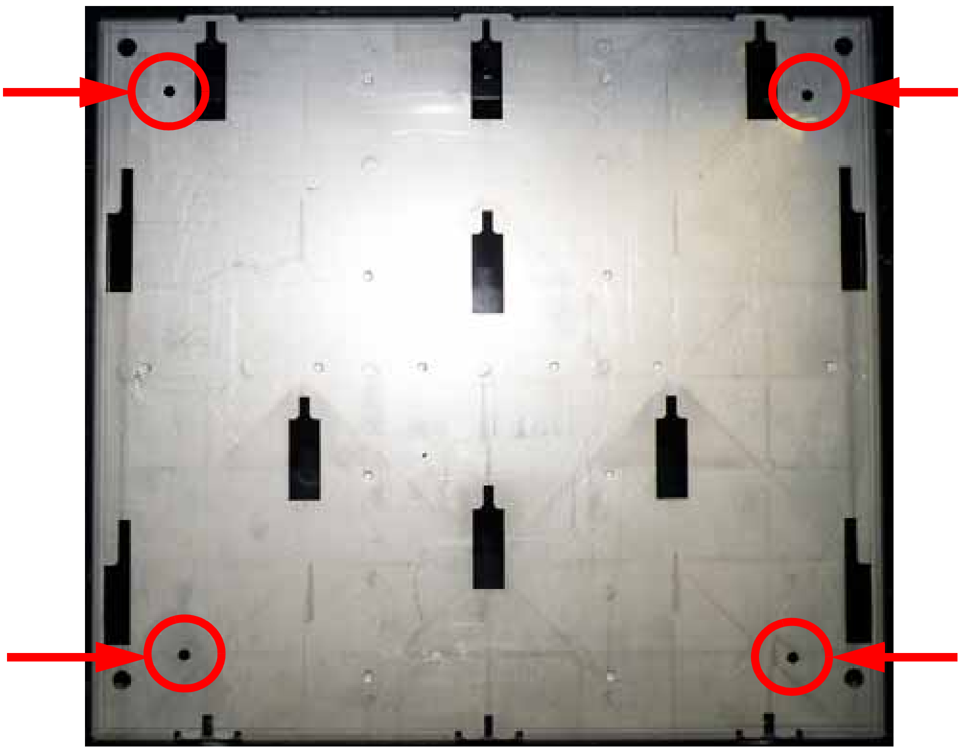


3. Attach the head fixture bracket (with dial indicator attached) to the front of the head, see Figure 5-407.

Figure 5-407: Head bracket placement

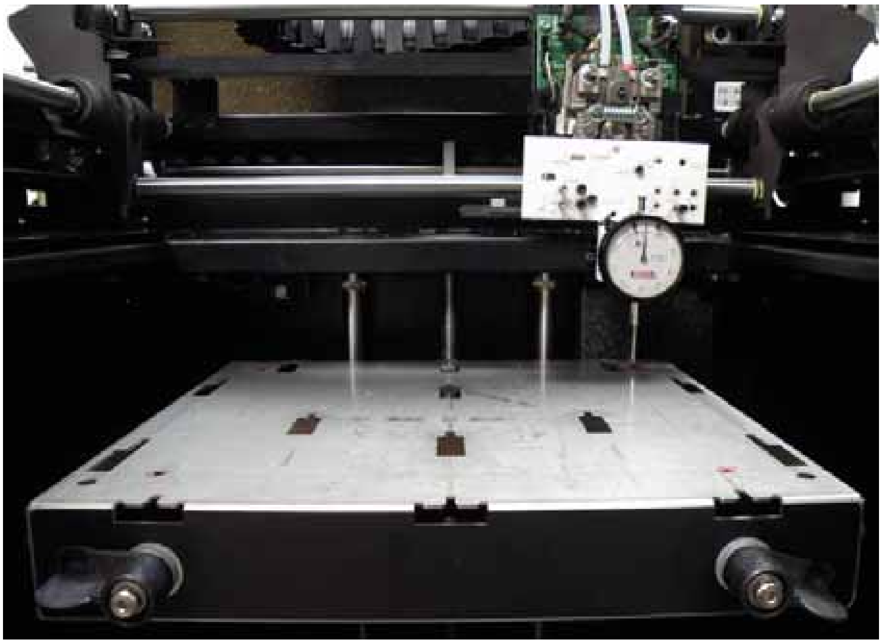
4. Mark the four corners of the platen with a marker, see Figure 5-408.

Figure 5-408: Platen marking locations



5. Move the head to the rear right corner of the platen, see Figure 5-409.

Figure 5-409: Rear right mark location



6. Raise the Z platen up to meet the tip of the dial indicator by manually turning the Z lead screw.
7. Continue moving the Z platen up approximately ½” once the platen contacts the indicator tip. Adjust the head location if necessary.
8. Zero the indicator by adjusting the Z height up or down, or by rotating the dial.
9.
10. Move the indicator (head) to the remaining three corners and record the height at each location.
11. Verify that all indicator readings fall within a total tolerance band of 0.005" between the highest and the lowest readings. If this tolerance is not met, the tray level must be adjusted.

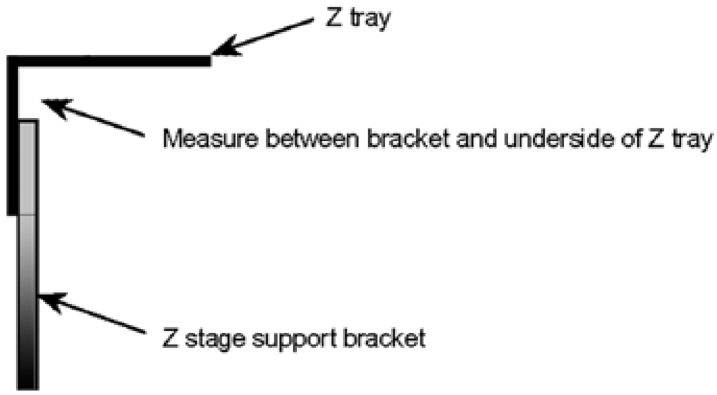
Set Z Stage Spacing

1. Remove the substrate.
2. Raise the Z stage towards the top of travel.
3. Check spacing using a caliper or by using the Spacer Part.

Set Spacing Using a Caliper

1. Using a caliper, measure the distance the between the bracket and the underside of the Z tray Figure 5-410. Adjust the tray to meet the space requirement for all corners.
2. Spacing should be 0.441” ± 0.030”

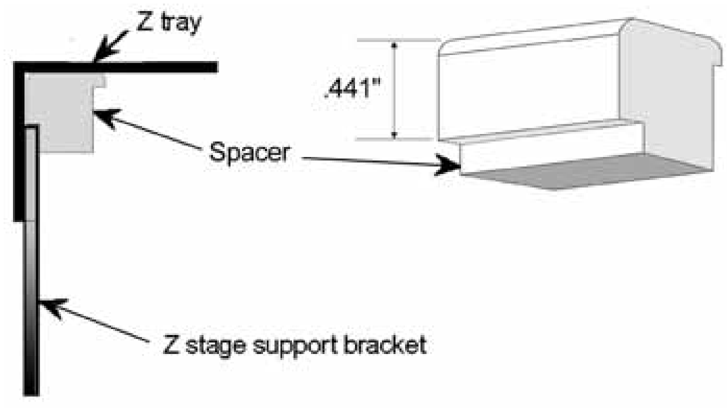
Figure 5-410: Measure the distance between bracket and underside of Z tray



Set Spacing Using the Spacer Part

1. Build the Spacer part - the BST 1200/SST 1200 side of the Spacer is 0.441” thick.
2. Place the Spacer in one of the Z Stage corners - between the support and the tray. Adjust the tray so that it rests on the spacer. Repeat for remaining corners
3. Recheck the spacing at each corner - adjust as necessary.
4. Remove the Spacer and Level the tray.

Figure 5-411: Checking Space Using Spacer Part



Adjusting the Tray Level

1. Move the indicator (head) toward the center of the tray.
2. Loosen the four tray mounting screws located on either side of the Z brackets.
3. Position the spacer “SET” lip at the left rear corner Figure 5-411.
4. Slide the corner of the tray up or down until the underside of the tray is snug to the top lip of the spacer lip.
5. Snug, but do not tighten, the mounting screw. You will need some “play” in the tray to complete the leveling adjustment.
6. Move the indicator to the left rear corner of the tray Figure 5-411.
7. Zero the indicator by adjusting the Z height up or down, or by rotating the dial.
8. Move the indicator to the right rear corner of the tray.

9. Slide the right corner of the tray up or down until the indicator reads zero. Snug, but do not tighten, the mounting screw.
10. Repeat steps 8 and 9 for the front two corners of the tray. See Figure 5-411. for indicator placement locations.
11. Move the head to the back left rear corner of the Z tray.
12. Zero the indicator by adjusting the Z height up or down, or by rotating the dial.
13. Move the indicator (head) to the other three corners. See Figure 5-411. and record the height at each location.
14. Verify that the indicator readings in all three locations are within a total tolerance band of 0.003" (+/- 0.0015). If the tray is still out of level, you must readjust the tray. Repeat steps 18 though 20 until the tray is within specification.
15. Once the tray is level, tighten all four tray mounting screws.
16. Remove the spacer and the head fixture bracket.
17. Power on the system.
18. Run Z Calibration (See "Z Calibration" on page 5-2.).
19. Run a test part to ensure that find Z is working correctly.

Aligning Z Stage Lead Screw

1. Using the keypad, go to Table Maintenance and move the Z stage to the middle.
2. Power off the system and remove the left side panel.
3. Loosen the lower bearing plate screws.

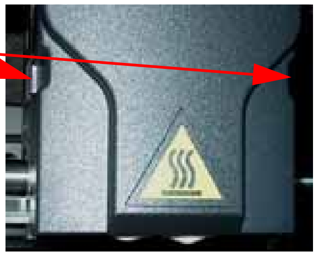
Figure 5-412: Lower bearing and retainer plate

4. Loosen the Z motor screws.
5. Pull back on the Z motor to loosely tension the Z belt. Leave just enough tension belt to engage the Z axis pulley, which allows the Z stage to move up and down. If the belt teeth slip, slightly increase the belt tension. You will re-tension the belt in a later step as over-tensioning at this time will mis-align the lead screw.
6. Tighten the Z motor screws.
7. Replace both side panels, but do not attach the screws.
8. Power up the system until it reaches idle.
9. Using the keypad, go to Table Maintenance and move the Z stage assembly to the top, bottom, and then to the middle.
10. Tighten the two (2) lower bearing plate screws. Ensure you do not move the plate.
11. Remove one side panel and re-tension the motor by loosening the motor mounting screws and pulling away from the lead screw pulley. Tighten the screws.
12. Replace the other side panel and secure both with screws.
13. Ensure that Z stage is running smoothly by moving it up and down several times.

Adjusting Brush/Flicker Height (1200)

1. Completely power down Dimension.
2. Remove the purge container.
3. Remove plastic head cover by squeezing raised pads on sides of cover (Figure 5-413.).

Figure 5-413: Removing the Head Cover



4. Replace the Tip Wipe Assembly:
   A. Remove the old flicker - loosen the flicker attachment (rear) screws and pull up on the flicker.

> **Note:** You may need lower the brush to access the flicker screws. Loosen the brush mounting screws to lower the brush

   B. Insert the new flicker and tighten the rear screws while gently pushing down on the flicker. The flicker should seat firmly in its channel.
   C. Remove the old tip cleaning brush by loosening the two mounting screws. Pull up on the brush to remove it.
   D. Install the new tip cleaning brush, but do not tighten the mounting screws.
5. Adjust the Brush height:
   A. Push the Tip Toggle Bar to the left. This makes the Model (Right Tip) the 'active' tip (Figure 5-414.).

Figure 5-414: Position Tip Toggle Bar for Adjustment of Cleaning Brush

   B. **Method One** for adjusting the Brush Height:
      a. Move the Head by hand so that the Model Tip is directly over the Brush.
      b. With the mounting screws loose, adjust the Brush so that the top of the Brush touches the bottom of the Tip Shield (Figure 5-415).
      c. Tighten the two mounting screws. Make sure that the Brush assembly does not shift while the screws are being tightened. The Brush must be parallel with the Fixture surface.
   C. **Method Two** for adjusting the Brush Height - For more consistent Brush height adjustments, build the `tool_brush_fix` (`Maintenance > Test`

Parts, press **Next** until **tool_brush_fix** is displayed) and perform the following, optional adjustment procedure:

a. With the mounting screws loose, lower the Brush.

b. Snap the Brush Adjustment Fixture onto the Model Tip Shield (orient the cut-out to the rear of the system).

c. Move the Head by hand so that the Model Tip is directly over the Brush.

d. Push the Brush assembly up so that it presses firmly against the Fixture.

e. Tighten the two mounting screws. Make sure that the Brush assembly does not tilt while the screws are being tightened. The Brush must be parallel with the Fixture surface.

f. Remove the fixture.

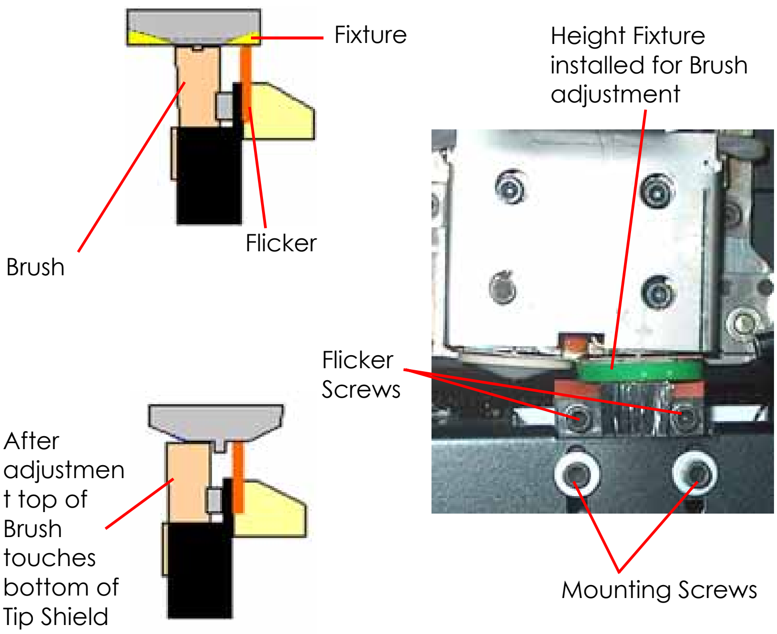
D. Move the Head by hand while observing the Tip-to-Brush relationship across the entire Brush. It should be the same for the entire length of the Brush. Re-adjust if necessary.

E. Push the Tip Toggle Bar to the right - making the Support (Left Tip) the active tip.

F. Verify that the Support Tip Shield touches the brush. If not, raise the brush until it contacts the Support Tip.

G. Tighten the brush mounting screws.

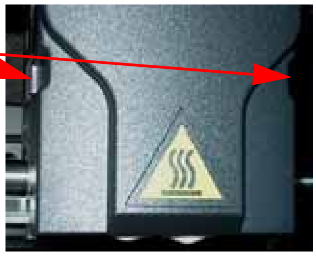
Figure 5-415: Replacing the tip cleaning brush



Adjusting Tip Wipe Assembly Height (1200es)

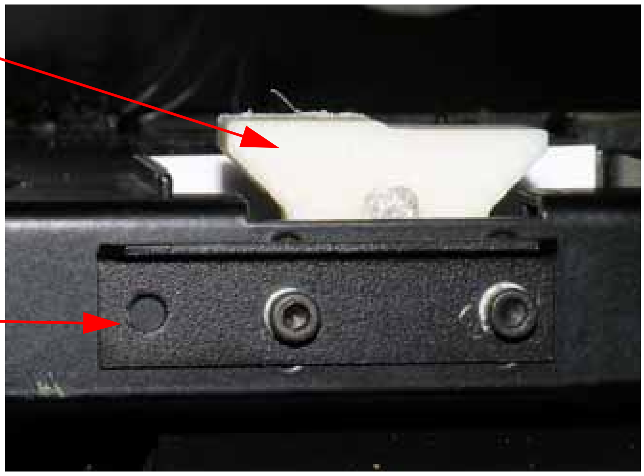
1. Completely power down the printer.
2. Remove the purge container.
3. Remove plastic head cover by squeezing raised pads on sides of cover, see Figure 5-416.

Figure 5-416: Removing the Head Cover



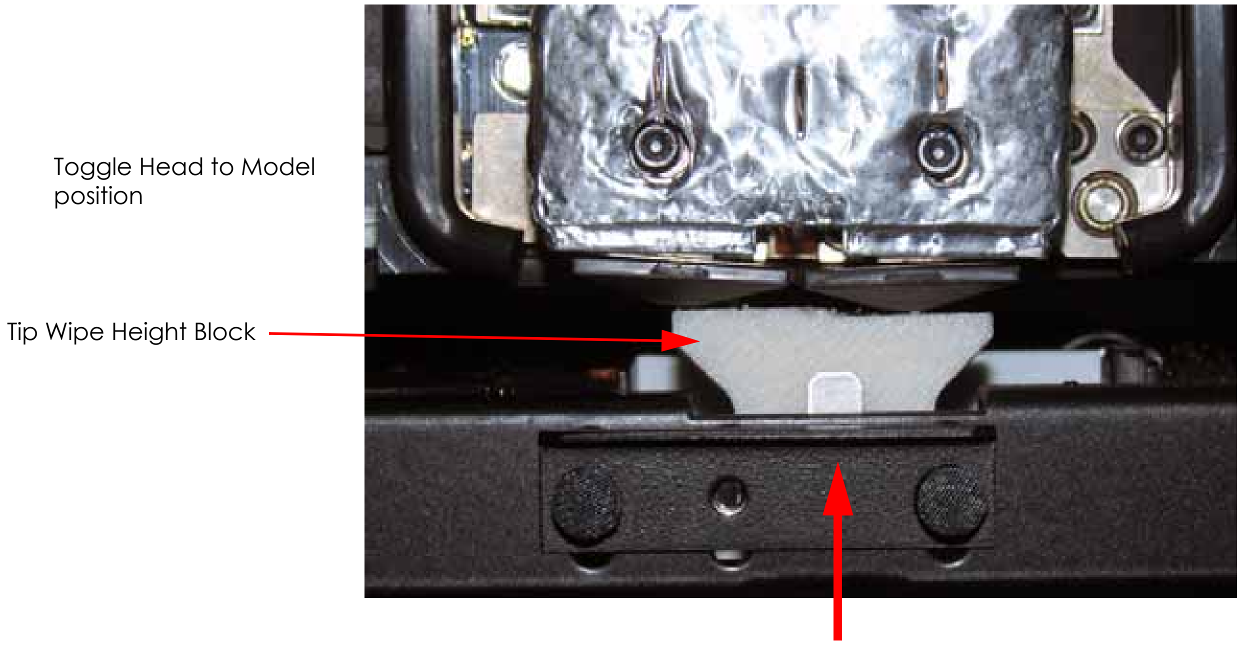
4. Remove the Tip Wipe Assembly.
5. Place the Tip Wipe Height Block into the Tip Wipe Bracket. See Figure 5-417.

Figure 5-417: Tip Wipe Height Block



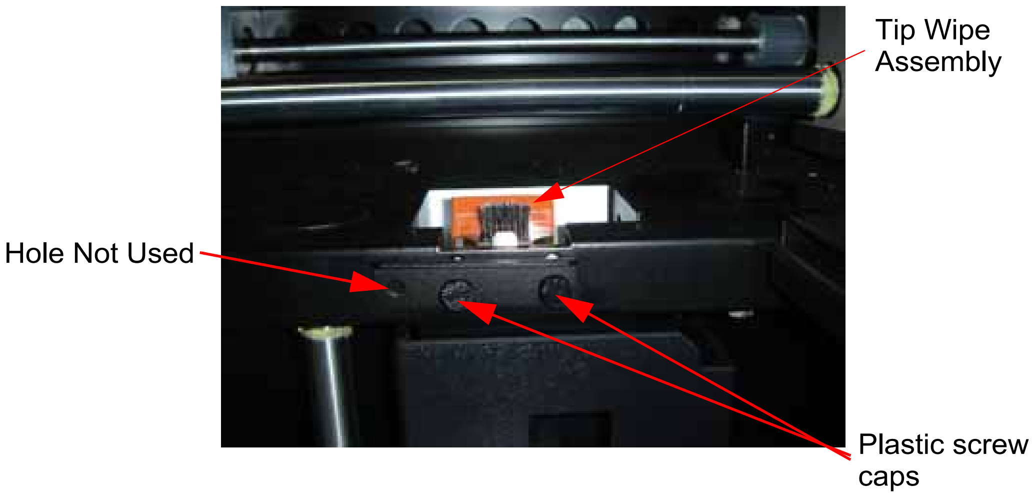
6. Move the tip toggle bar to the "Model" position and then move the Translator over the Tip Wipe Height Block as show in Figure 5-418.
7. Slowly position the Tip Wipe Plate up so the Tip Wipe Height Block touches the Model and Supply tips and then tighten the two mounting screws. (See Figure 5-418.)

Figure 5-418: Tip Wipe Height Block Adjustment



8. Slowly move the toggle Head back and away from the block and remove the Tip Wipe Height block.
9. Press the plastic caps over both mounting screws making sure they are fully seated. See Figure 5-419.
10. Place the Tip Wipe assembly into the Tip Wipe Bracket. See Figure 5-419.

Figure 5-419: Plastic Screw Caps



11. Reinstall Head Cover.
12. Place the purge bucket in position.

Troubleshooting

6

If you have a problem with your 1200/1200es that is not covered in this service guide, please contact Stratasys Customer Support:

- Call (800) 801-6491 (7:00 a.m. to 5:00 p.m. C.T.)

If you have suggestions, additions or changes for this troubleshooting guide, please email us at:

- ProdigyTSGuideTeam@Stratasys.com

How to use this Guide

1. Determine what type of error you are experiencing; either a Code Error or Non-Code Error.
   A. If you experience a Code Error:
      a. Refer to the Code Error Section of the guide. See Code Errors on page 6-16.
      b. Match the code number with the number in the guide.
      c. Follow the corrective actions to fix the error.
      d. Complete and verify each step before proceeding to the next step.
   B. If you experience a Non- Code Error:
      a. Refer to the Non-Code Error Section of the guide. See Non-Code Errors on page 6-31.
      b. Complete and verify each step before proceeding to the next step.

Special notes:

1. Verify that the machine is plugged directly into a wall outlet. Do not use an extension cord or power strip.
2. Verify you are running the current CatalystEX and printer firmware. Upgrade the software if necessary.
3. After **"Power down"** is complete, always shut the breaker off to fully reset the system.
4. When measuring DC voltages and signals using chassis ground is preferred. Do NOT measure AC voltages using chassis ground.
5. Check/re-seat appropriate cables as part of the troubleshooting process.
6. Tera Term move commands are in inches.
7. Check limit switch states using the test points and/or LED's on the power distribution board.
8. Replacement hard drive may take up to 45 minutes to boot. The hard drive is running check disk (chkdsk).
9. Ignore multiple error code listings at end of a CFG file (LE output)
10. Never "hotplug" the material bay cables. Doing so will damage the material bay serial transceiver.
11. Correct seating of the I/O board to the power distribution board is critical. Check for proper alignment through electronics bay viewing window

Device Voltages

Table 1: Device voltages

Cartridge drive motor	12VDC (servo, no encoder)
Cartridge solenoids	24VDC
Chamber heaters	120VAC (parallel) or 240VAC (series)
Chamber heater fans	24VDC
Chamber lights	24VDC
Door solenoid	12VDC
Exhaust fans	24VDC
Head servo drive motor	12VDC
Homing and EOT sensors	5VDC
LCD display (back light)	5VDC
LCD display (text)	12VDC
Liquefier	120VDC (PWM)
X, Y and Z motors	24VDC

Fuse Specifications

Fuses are located on the power distribution board.

Warning: Fuses must be replaced with the same type and rating as listed below.

Head Thermal Cutout Fuse (Snap): Temperature cutout at 150° C (300° F)

Chamber Thermal Cutout Fuse (Snap): Temperature cutout at 83° C (180° F)

Table 2: Fuse F1

Fused Voltage	120VAC
Rating	3.15 Amp 250 Volt
Type	Fast acting
Size	5 x 20 mm
Mfg. P/N	Littelfuse # T3.15AL250V

Table 3: Fuse F2

Fused Voltage	120VDC
Rating	3.15 Amp 250 Volt
Type	Fast acting
Size	5 x 20 mm
Mfg. P/N	Littelfuse # T3.15AL250V

General problems or error messages

Problem or error message	Solution
No power	1. Verify power cord is securely plugged in. 2. Verify that the circuit breaker (at rear of system) and the power switch (on front panel of system) are both in the ON position. 3. Verify AC power is present at wall outlet.
System fails to reach operating temperatures	Verify the system is not connected to an extension cord or power strip.
Material not extruding	Filament may be jammed in extrusion head, see "Recovering from loss of extrusion" on page 6-12.
Purge material accumulating on part.	1. Material may have accumulated behind tips. Clean area around tips. 2. Make sure that the flicker and brush are set to the proper height. 3. Check condition of Flicker and Brush. Replace if worn.
No text displayed on Display Panel	Cycle power (see "Cycling power" on page 6-9).
Cannot communicate with system through network	1. Make sure network cables are connected - at the printer, at the PC, and where cables connect to network boxes. 2. Re-configure settings. 3. If using a Static network address, verify that the IP address entered in CatalystEX has the same value as the address entered for the printer. 4. Your system configuration may have changed. Contact your Network Administrator.
Error Code displayed on Display Panel	Call your local reseller for customer service. For more information, refer to "Troubleshooting a System Malfunction" on page 6-6.
Display Panel displays **Build Error**	Partial or bad part file sent to system. Check STL file validity in CAD software; reprocess STL in CatalystEX and re-download to system.
Display Panel displays **Can't Find Home – Check Modeling Base**	1. Verify a modeling base is inserted. 2. Modeling base may be used or defective – replace.
Display Panel displays **Communication lost at HR:MN UCT**	The system stopped reporting its status at the Universal Coordinated Time (UCT) shown. Wait for the system to complete building the part. The system will automatically restart and display Build Complete. It is then safe to remove the model.
Display Panel displays **Could Not Read Cartridge**	1. Remove cartridge and cycle power, see "Cycling power" on page 6-9; reload cartridge. 2. Try a different cartridge.
Display Panel displays **Load Failed**	1. Retry with same cartridge. 2. Try a different cartridge. 3. Filament may be jammed in extrusion head, see "Diagnosing loss of extrusion" on page 6-10.

Troubleshooting a System Malfunction

Overview

How to troubleshoot system malfunction and narrow down the possible cause of a system malfunction to either the Controller, SBC or hard drive.

Parts and Tools Required

- Null modem cable (Laplink cable)

Note: If your computer does not have a serial port, connect through a quality USB to serial converter. We recommend the IOGEAR GUC232A.

- SBC to monitor cable
- VGA monitor

Note: Always check/re-seat connectors before assuming that the problem is component based.

Testing the Controller board

1. Install the null modem cable to the workstation or laptop.
2. Open TeraTerm as shown in Using TeraTerm on page 6-64.
3. Once communication has been established, enter **IN** (Initialize the Controller) command.
4. Text will then be displayed.
5. If Controller related error codes **only** are displayed, the Controller board is most likely defective. Some examples of Controller related error codes are - "Abort: Hardware turned off power supply" or "Abort: Z-axis not ready".

   Errors other than Controller board related errors need to be interpreted accordingly. As an example if a "Abort : Head thermocouple fault" error is displayed, check the thermocouple and connectors.

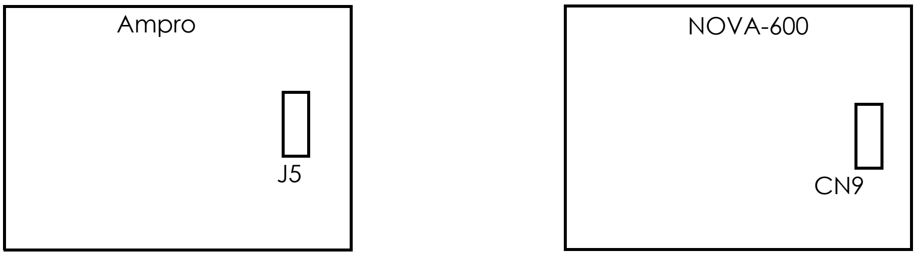
Note: Always download the printer firmware after installation of a Controller board.

6. If only one or two of the **same** error is displayed, the problem is most likely **NOT** the Controller. Continue on to the next section of this bulletin.

Testing the Hard Drive and SBC

1. Power down the system and remove the rear panel.
2. Connect monitor and keyboard to SBC.

Figure 6-420: SBC detail

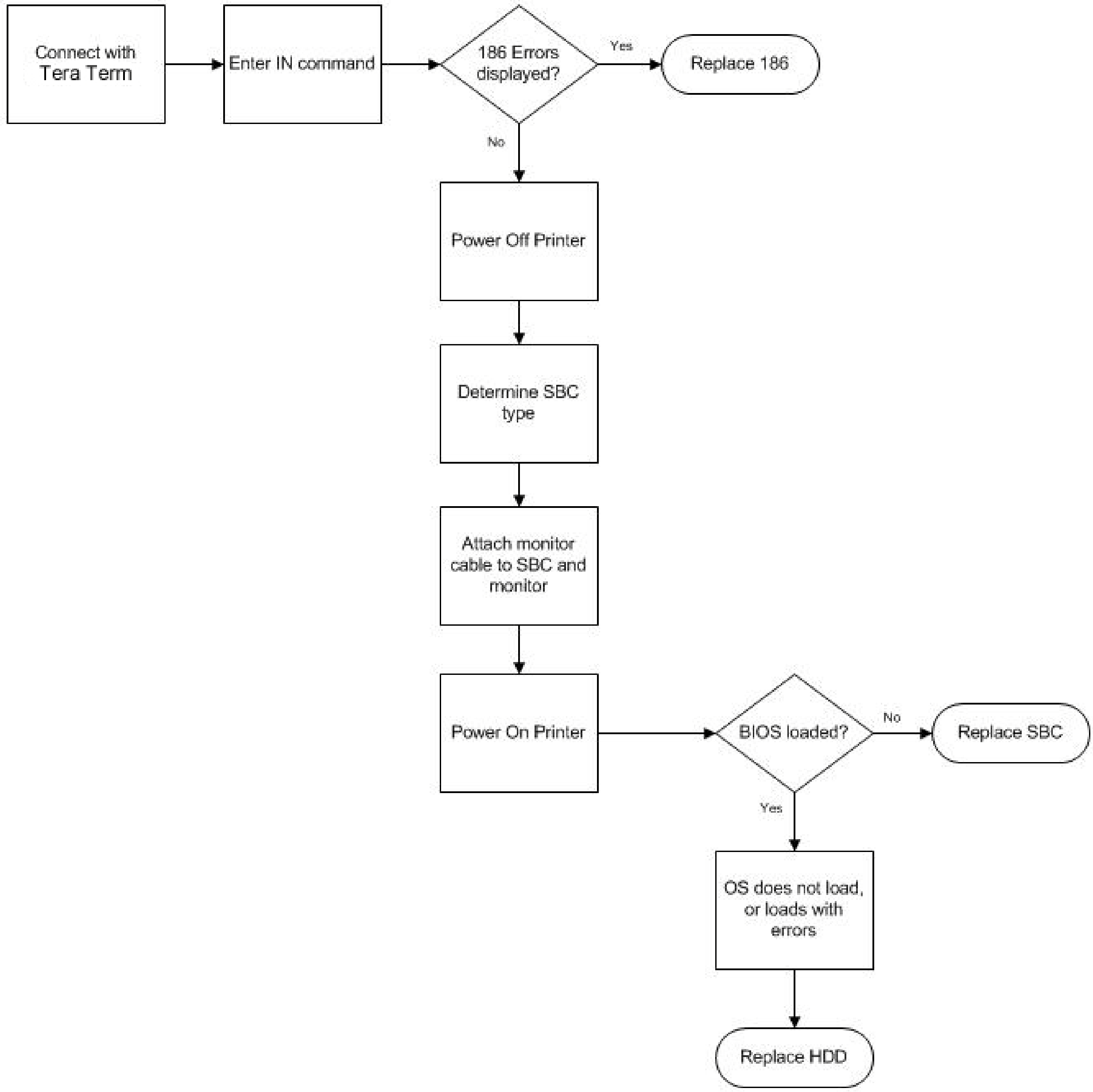


3. Power on the system and observe the text displayed on the monitor.
4. If the hard drive is bad you will not see the normal hard drive booting process. You may see:
   A. The BIOS load but **NOT** the operating system.
   B. The operating system load but with numerous errors.
5. If you **d**o not see the bios load the SBC will need to be replaced.

Final Test

1. If the Controller board was replaced you must download the most current printer firmware.
2. If the hard drive was replaced, update the system software.
3. Run the Hysteresis and tip-offset calibration and adjust settings if appropriate.
4. Run several test parts via the network to ensure proper operation.

Figure 6-421: Troubleshooting sequence



Fault determination codes

If a fault occurs which would prevent the printer from executing an operator request, the printer will begin to shut down and cool. The panel will display an error code. An error-code list (with the filename "error.txt") can be found on the CD-ROM for the printer system software. (Because this list may change with each new software version, be sure to check the error.txt attachment when you install new system software upgrades.)

After the printer has finished cooling, the only option displayed is **Continue**. Press **Continue** and the printer will reboot and try to return to normal operation. If pressing **Continue** does not eliminate the error, power should be cycled (see Cycling power on page 6-9.); wait 60 seconds before switching power on again. In most cases you will be able to continue operation. However, if the printer continues to shut down and display the same error, contact technical support.

Exporting printer configuration (.cfg) file

If your printer is receiving fault determination codes, you may need to export a configuration (.cfg) file from your printer to send to Customer Support.

Exporting configuration file from printer

1. Open CatalystEX from your workstation.
2. Click on the **Printer Services** tab.
3. Click on the **Export Configuration** button.
4. Browse to the directory where you wish to save the configuration file.
5. Click on the **Save** button.
6. Close CatalystEX.

Cycling power

1. Turn the power switch to the OFF position. The display will show **Shutting Down**.
2. After the printer has cooled down enough to shut down, the display will go blank.
3. When the display is blank and the printer has shut down, turn the circuit breaker to the OFF position.
4. Once the circuit breaker has been turned to the OFF position, wait 60 seconds and turn the circuit breaker back to the ON position.
5. Turn the power switch to the ON position. The printer display will show that it is starting up.

Once the display shows **Idle** or **Ready to Print**, you can send a file to the printer to be printed.

Diagnosing loss of extrusion

Occasionally, the printer's head may experience loss of extrusion. This will be evident by observing one of the following:

- The head is moving with no material coming out of either tip.
- The height of the model and support materials are not equal.
- Sagging structures due to lack of support materials.

1. From the display panel press **Cancel** and remove parts from the printer.
2. Insert a new modeling base.
3. From **Idle**, press **Maintenance.**
4. Press **Machine**.
5. Press **Head**. The head will move to the center of the chamber and the Z platform will change position. The display will read: **Model Drive Motor Stopped.**
6. Determine if there is a model material extrusion problem by pressing **Forward** (command will be available after head reaches operating temperature). Watch the model tip (right tip) for any extrusion (material purge).

> **Note:** You may need to wait up to 30 seconds before extrusion will begin as the tip may need to reach operating temperature.

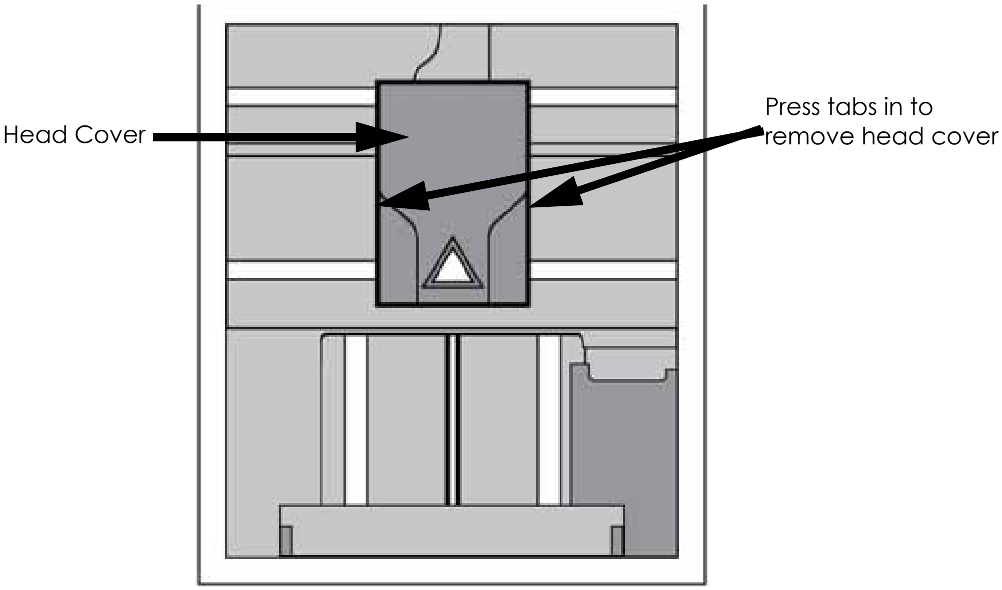
7. Press **Stop** to stop the extrusion.
8. If material did NOT flow from the model tip, see Recovering from loss of extrusion on page 6-12. If material steadily flowed from the model tip, the model tip is functioning properly.
9. Test the support material tip by choosing: **Select Drive**.
10. Determine if there is a support material extrusion problem by pressing **Forward**. Watch the support tip (left tip) for any extrusion (material purge).
11. Press **Stop** to stop the extrusion.
12. If material did NOT flow from the support tip, see Recovering from loss of extrusion on page 6-12. If material steadily flowed from the support tip, the support tip is functioning properly.
13. Return the printer to the Maintenance state - Press **Done,** then press **Yes** when the printer displays **Is Material Loaded?**
14. Press **Done** until back at **Idle**.

Clogged tip

Occasionally, a tip may clog with material. This will often result in a loss of extrusion (LOE). A clogged tip will prohibit material load and part building.

1. Remove the head cover by pressing the tabs in and pulling away from the head. See Figure 6-422.

Figure 6-422: Remove the head cover



2. Inspect top of tips for material build up. If there is excess material build up see Recovering from loss of extrusion on page 6-12.. If there is no excess material build up close the chamber door and continue.
3. From the display panel press **Maintenance**.
4. Press **Machine.** The printer will calibrate which will take approximately 3 minutes.
5. Press **Head.** The head will heat up to operating temperature which will take approximately 3 minutes.
6. Press **Select Drive** and choose the drive that may have the clogged tip.
7. Press **Forward**, the drive wheel will turn the selected drive forward.
8. Press **Blower Off**, this will turn the head cooling fan off for 10 seconds, allowing the tip to heat up beyond operating temperature. If material starts to extrude the tip is no longer clogged. If material does not extrude see Recovering from loss of extrusion on page 6-12.
9. Press **Done**.
10. Replace head cover.

Note: If the head cover is not replaced the printer may not function properly.

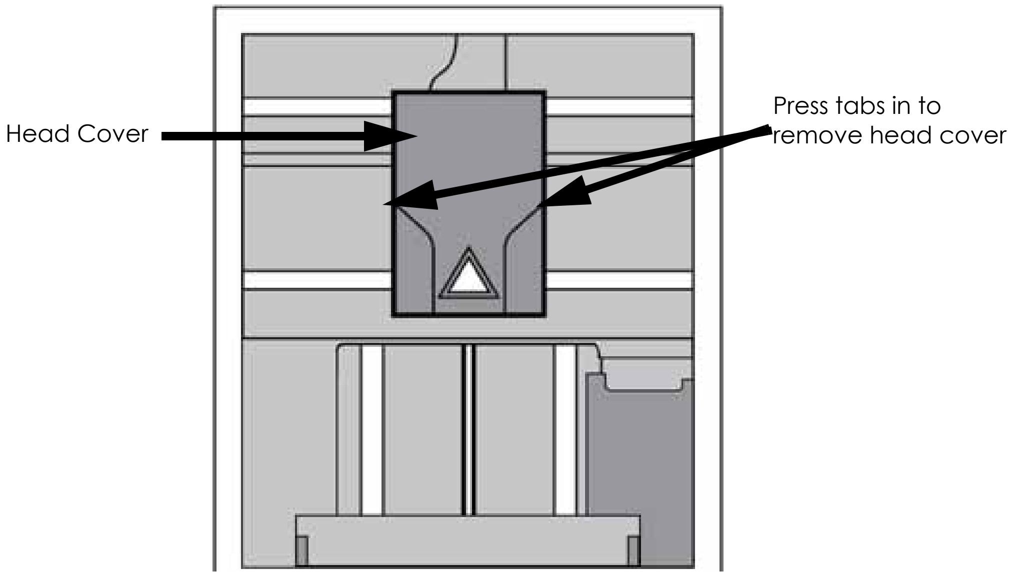
11. Display will ask **Which Materials Loaded?** Press **Both.**
12. Press **Done** until back to **Idle**.

Recovering from loss of extrusion

Note: It is recommended that you read and understand this entire procedure before performing any of the work.

1. Enter **Head Maintenance** mode.
   A. From **Idle**, press **Maintenance**.
   B. Press **Machine**.
   C. Press **Head.** The head will heat up to operating temperature which will take approximately 3 minutes.
2. Remove the head cover by pressing the tabs in and pulling away from the head. See Figure 6-423.

Figure 6-423: Remove the head cover



3. Place the toggle bar in neutral position (bar will extend equally from both sides of head). This can be done manually - push on the extended bar end. See Figure 6-424.

Figure 6-424: Head Components

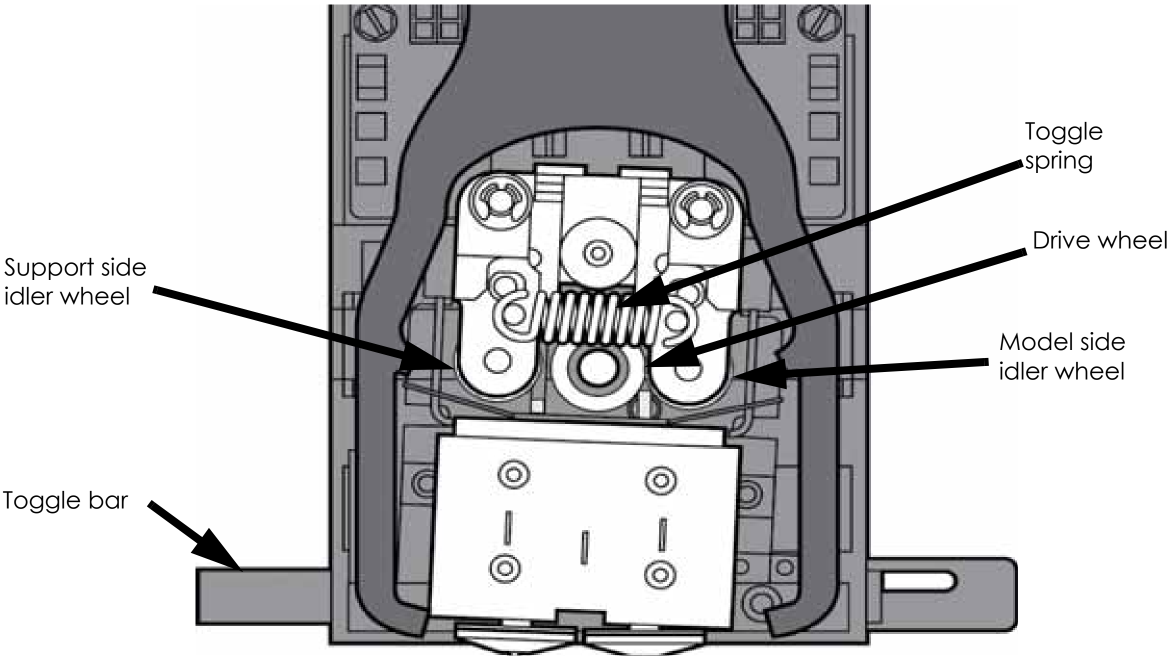
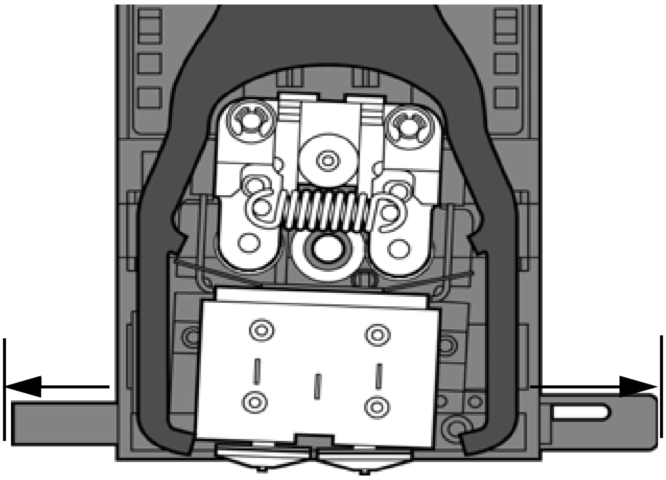


Figure 6-425: Toggle bar in neutral position



4. Remove any excess material found around the head area.

Note: Material fed to the tip can sometimes jam causing a build-up of material under the head cover.

A. Clean out as much of the material as possible using needle nose pliers, a probe, or equivalent tool.

Caution: The end of the tip where the material enters is called the extrusion tube. Extrusion tubes are fragile. Use care when working in this area so as to avoid damage to the tubes.

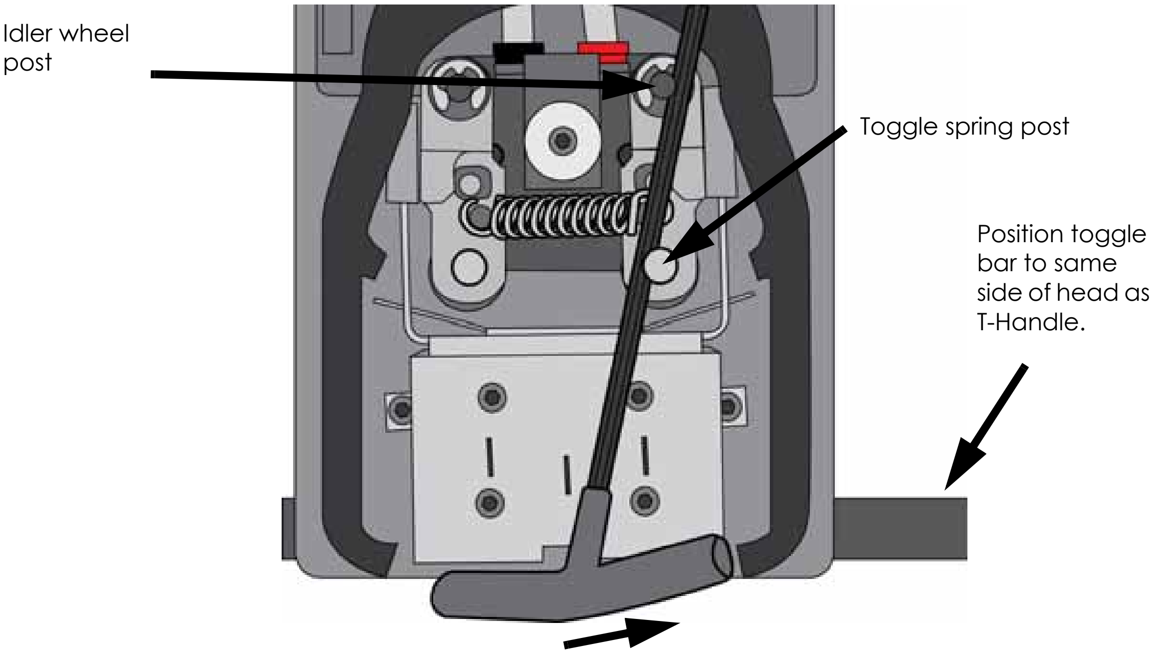
B. For easier access to areas that may need to be cleaned, move the material idler wheels out of the way (there is one idler wheel for support material and one for model material, see Figure 6-424.)

Note: Move only one idler wheel assembly at a time. Finish cleaning around the moved wheel and restore it to its normal position before moving the other idler wheel. Having both wheels out of position simultaneously could stretch the spring.

a. Place a $^7/_{64}$″ T-Handle Allen wrench between the toggle spring post and the idler wheel post as illustrated in Figure 6-426. (model side shown).

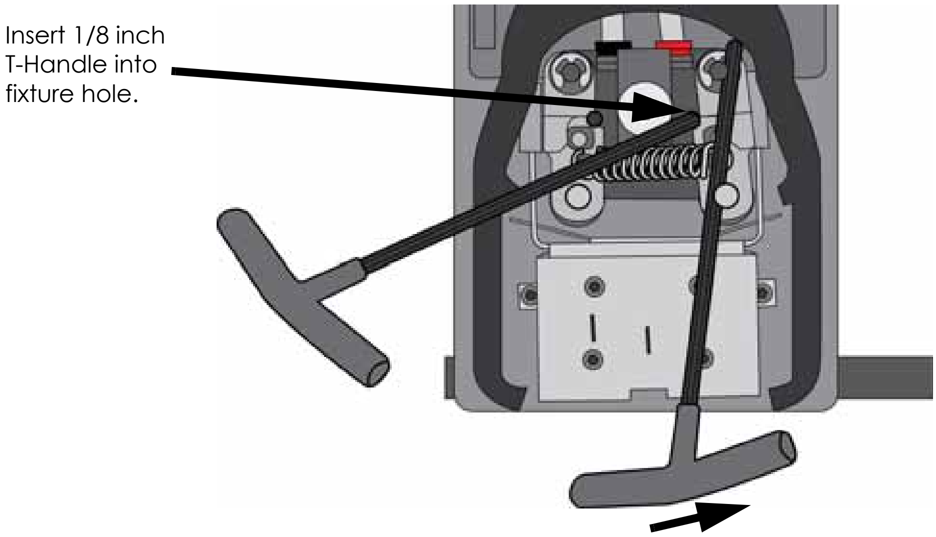
b. Position toggle bar to the same side of the head as the T-Handle allen wrench. See Figure 6-426. (model side shown).

Figure 6-426: Create access space for cleaning - model side shown



c. Move idler wheel assembly by pushing with $^7/_{64}$″ T-Handle Allen wrench against spring tension. Insert a $^1/_8$″ T-handled Allen wrench (from startup kit) into the fixture hole. See Figure 6-427.

Figure 6-427: Holding access space open - model side shown



d. Ease pressure on the 7/64" T-Handle Allen wrench to carefully return the leveraged idler wheel back toward its original position - until the idler assembly is resting against the 1/8" T-Handle Allen wrench.

e. Remove the 7/64" T-Handle Allen wrench.

C. Cut the material above the idler wheel using a cutters.

D. Clean the area that is now accessible using a needle nose pliers, a probe or equivalent tool.

Note: Make sure that all loose material is removed from the affected area.

E. Reposition the 7/64" T-Handle Allen wrench between the toggle spring post and the idler wheel post.

F. Move idler wheel assembly by pushing with 7/64" T-Handle Allen wrench against spring tension and remove the 1/8" T-handled Allen wrench.

G. Remove the 7/64" T-Handle Allen wrench.

5. Repeat for the opposite side as needed.
6. Replace the head cover.

Note: If the head cover is not replaced the printer may not function properly.

7. Press **Done** on the display panel.
8. Display will ask **Which Materials Loaded?** Press **Model** if only model material is loaded, press **Support** if only support material is loaded or press **Both** if both model and support material are still loaded. Press **None** if neither are loaded.
9. Display will ask you to remove the cartridge of the materials that are not loaded. Remove the cartridge and cut the excess material.
10. Press **Done** until back at **Idle**.
11. Reload the material that is not loaded.

Code Errors

Major Codes

Note: These codes are displayed on the system LCD Display.

Code	Error	Definition/Recommendation
01	Unknown Error	No data on what error occurred. Cycle power.
02	PUC Error	Path, utilities and controller development library (Used for software testing). Cycle power.
03	No Display	Process that runs LCD display generated error. Cycle power.
04	Memory Error	Single board computer experienced memory error. Cycle power.
05	LCD Display	Failed to write to LCD display board from SBC (error will be seen in .cfg file). Cycle power. Replace LCD Display
06	LCD Keypad	Failed to read from LCD keypad to SBC (error will be seen in .cfg file). Cycle power. Replace LCD Display
07	Manager Channel	Socket from manager internal manager process was on, SBC (Software error, will not be displayed). Cycle power.
08	Manager Disconnected	Socket from manager internal manager process was off, SBC (Software error, will not be displayed)
09	Manager Send	Failed to send from manager (SBC) (Software error)
10	Command Failed	Sent legal command that was rejected (exp. Move Z command with door open). Cycle power.
11	Queue Communication	Socket from queue process was interrupted (broken) (Software error). Cycle power.
12	Joblog Message Buffer	Failed to write to job log (Software error). Cycle power.
13	Joblog File	Failed to create the job log (Software error). Cycle power.
14	Controller Abort	Controller failure (See sub errors below)
15	Starting Up Failed	Some part of the start up procedure failed. Cycle power.
15.1	Starting Up Failed	Verify controller is correctly gendered (gender is the machine type) from the .CFG file. If not, replace with a neutral gender board and perform firmware upgrade.
16	Find Z Failed	Failed to find Z limit switch. Check for obstructions or Z switch issues.
17	Controller Load Failed	Unable to load global parameters (Temp values, flow control). Cycle power.
18	Temperature Failed to Regulate	Liquefier or chamber failed to reach temperature within 7 min. See 18 error code below.
19	Controller Initialization Failed	Controller failed to reboot or start. See detailed 19 error code section below.

Code	Error	Definition/Recommendation
20	Door Latch Command Failed	See detailed non-error code section of this guide.
21	Ldrool Failed	Cycle power
22	Controller Communications Failed	Not used.
23	Universal Device Name error	Cycle power

Major Codes with Minor Codes

Note: Currently minor codes exist for major codes 14, 15 17-20, 22, & 23 only.

Controller Abort Minor Errors (Code: 14, XX)

Code	Description	Corrective Actions
14,01	Abort: Z Axis jammed	1. Check for objects blocking Z stage. 2. Check for purge material around lead screws. 3. Power cycle machine including rear breaker. 4. Using MaracaEX/LED's/test points: Check Z position. See if both Z home & Z limit boxes are checked. If so, check limit switches and/or mid unit harness. 5. TeraTerm: Check to see if Z stage moves (mz 0.5 or mz -0.5). This will allow you to move the Z stage without tripping the Z jam sensor. + is down, - is up. 6. Replace Z stage motor.
14,02	Report: Attempt to raise modeling base sensor failed	1. Cycle power 2. Replace Substrate. 3. Check for obstructions preventing X or Y movement 4. Check the Z foam sensor bar is not damaged. If so, replace bar. 5. **Gen 2 -** Check connector J10 (pin 19) on the PDB for loose pins. 6. **Gen 3** - Check connector J10 (pin 13) on the PDB for loose pins. 7. Using MaracaEX/LED's/test points: Check to see Z foam box toggles when switch is activated, if not, check Z foam sensor and/or umbilical cable. **Gen 2** - Check signal at TP27. **Gen 3** - check signal at TP23. 8. Using MaracaEX/LED's/test points: Check to see Z home box toggles when switch is activated. If not, check Z home switch and/or Mid-Unit Harness. **Gen 2** - Check signal at TP13. **Gen 3** - Check signal at TP9 9. Check Z home switch position. Adjust if needed.
14,03	Report: modeling base sensor up when it should be down.	1. Cycle power. 2. Check the substrate sensor assembly for free operation. 3. Check to see if the sensor arm is broken. 4. Check connector J10 (pin 19) on the PDB board for loose pins. 5. Using MaracaEX/LED's/test points: Check to see Z foam box toggles when switch is activated. If not, check substrate sensor, sensor assembly and/or umbilical cable. Check signal at TP27.

Code	Description	Corrective Actions
14,04	Report: modeling base sensor down when it should be up.	1. Push the sensor assembly up if it is down. 2. Check to see if the tip-wipe brush is set too high. 3. Run the FZ command using Tera Term -Verify the sensor is being pushed all the way up. 4. Remove, clean and reinstall the substrate sensor assembly. 5. Check spring (replace 5 coils with 7 coils) and verify that the foam sensor arm has a bump added.
14,05 14,06 14,07 14,08	Abort : Unexpected contact with X axis home sensor. Abort : Unexpected contact with X axis EOT sensor. Abort : Unexpected contact with Y axis home sensor. Abort : Unexpected contact with Y axis EOT sensor.	1. Power cycle the machine. 2. Check for an obstruction hitting the model. 3. Check to make sure the homing sensors are clean. 4. Using MaracaEX/LED's/test points: Check if home & limit boxes are checked. If so, check limit switches and/or umbilical cable for X sensors, mid unit harness for Y sensors. 5. Manually move the XY table in X and Y checking for smooth operation. 6. **Belt Drive XY Table** - Check and adjust belt tension. 7. **Cable Drive XY Table** - Check and adjust cable tension. 8. Incorrect length substrate arm installed. Replace substrate arm with the correct length. 9. Replace XY table. Failed bearings in the Y drive shaft possible root cause.
14,09 14,10	Abort : Unexpected contact with Z axis home sensor. Abort : Unexpected contact with Z axis EOT sensor.	1. Check to see if the switch is operating correctly using the LED/test points on the PDB. 2. Check to see if there are any obstructions interfering with Z stage movement. 3. **Gen 2** - Check J12 on the PDB for loose pins. Z Home - pin 3, Z EOT - pin 5. Check signals at TP13 and TP14. 4. **Gen 3** - Check J12 on the PDB for loose pins. Z Home - pin 9, Z EOT - pin 11. Check signals at TP9 and TP10. 5. Check the Z motor. Run the TZ command from Tera Term. 6. Check Z belt condition and adjust tension as needed. 7. If error occurs when running the FZ (find Z) command, replace the Z Foam sensor.
14,11	Abort : Door opened while axis in motion	1. Check to see if door latch is activating using MaracaEX/LED's/test points 2. **Gen 2**- Check signal at TP12 **Gen 3**- Check signal at J5 -pin 1 3. Look at LCD display, should show "Door Open" when machine is idle and door is open. 4. Check J12 pin 1 on the PDB for loose contacts or bent pins. 5. Using MaracaEX/LED's/test points: Check to see "Door Open" box toggles when switch is activated. 6. If not, check door switch and/or Mid-Unit Harness. 7. Wiggle the door, make sure the sensor reads. 8. Verify the door magnet is present. If not, replace door magnet.
14,13 14,14	Abort : Under Run at vertex buffer Abort : Under Run not in tool path	1. Reprocess the part and send again. 2. Reorient the STL and re-send. 3. If the frequency of the error is greater than once every three months, then replace the SBC or Hard Drive.
14,15	Report: Head motor running without XY motion	1. Will not be displayed on LCD display. Will be seen only using TeraTerm.

Code	Description	Corrective Actions
14,16	Abort : Vertex FIFO tail is not on a 4 byte boundary.	1. Communication error between Controller Board and the SBC. Cycle power. 2. Re-seat the Controller Board into SBC. 3. Replace Controller Board and/or SBC.
14,17	Abort : User abort.	1. Build was canceled through the keypad.
14,18	Abort : User panic stop.	1. Will not be displayed on LCD (Opening door during build can cause this error).
14,19	Abort : Idle loop is slow.	1. Cycle power. 2. Escalate the case providing the configuration file.
14,20 14,21	Abort : XY axis not ready. Abort : Z axis not ready.	1. Cycle power. 2. Using the TeraTerm, type SS. "X Axis Ready" should be displayed. If it is not displayed, then type the "FH" & "FZ" commands. Finally type "SS" again. If "X Axis Ready" still is not displayed, then replace the controller Board. 3. Battery could be bad on Controller Board. Open TeraTerm and look for boot error. Replace Controller Board.
14,22	Abort : Head temperature set-point too low.	1. Reinstall system software. 2. Verify the head temperature set point using MaracaEX. • The model must be above 240 degrees. • The support must be above 220 degrees (Prodigy Plus only).
14,23	Report: Begin curve parameters not in sequence.	1. Communication error between Controller Board & SBC - Cycle power 2. Re-seat the Controller Board into SBC. 3. Replace Controller Board and/or SBC.
14,24 14,25 14,26	Abort : X axis command error (PMD error) Abort : Y axis command error (PMD error) Abort : Z axis command error (PMD error)	1. Cycle power. 2. Verify system software at current release. If not, upgrade to current release. 3. If error continues - possible memory problem, replace SBC. 4. If the frequency of the error is greater than once every three months, replace the Controller board.
14,27 14,28 14,29	Abort : X axis motion error (PMD error) Abort : Y axis motion error (PMD error) Abort : Z axis motion error (PMD error)	1. Cycle power. 2. Verify system software at current release. If not, upgrade to current release. 3. If the frequency of the error is greater than once every three months, replace the Controller Board.
14,30	Abort : PMD axis command was not X, Y, or Z.	1. Power cycle machine. 2. Reinstall System Software.
14,31	Abort : Move absolute error.	1. Check and re-seat connectors to the X and Y motors. 2. Check home and EOT switches for correct operation. Replace if defective.
14,32	Abort : PMD checksum error.	1. Cycle power. 2. Verify system software at current release. If not, upgrade to current release. 3. If the frequency of the error is greater than once every three months, replace the Controller Board.

Code	Description	Corrective Actions
14,33	Abort : Invalid being send to PMD chip.	1. Cycle power. 2. Verify system software at current release. If not, upgrade to current release. 3. If the frequency of the error is greater than once every three months, replace the Controller Board.
14,35	Report: Time out while loading cartridge.	1. See Load Failed in the Non-Error Code Section.
14,36 14,37	Report: Modeling material not moving in head. Report: Support material not moving in head.	1. Cycle power. 2. Check/re-seat J9 on PDB. 3. If error continues, replace the Controller Board.
14,38	Abort : Hardware turned off power supply.	1. Jumper WD timeout on PDB to override error. Remove jumper after completing testing! 2. Check head, envelope snap switches, and cables. Head - TP17 normally is high. Envelope - TP19 normally is low. 3. Check/re-seat J9 and J12 connectors on the PDB J9 pin 19 for head snap switch. J12 pin 14 for envelope snap switch. 4. Check and re-seat connectors to Controller Board and PDB. 5. Replace the Controller Board. 6. Replace the PDB. 7. Replace umbilical cable.
14,39	Abort : Head thermocouple fault. **Steps 1-8:** Head Thermocouple is OPEN **Step 9:** Head Thermocouple is CLOSED	1. Check thermocouple wire for damage. 2. Verify ambient temperature is above 18° C (64.4° F). 3. Using a meter, check to see if thermocouple is open at head. 4. Open may be in umbilical head cable. 5. **Gen 2** - Check J10 on the PDB. 6. **Gen 3** - Check J9 on the PDB. 7. Check TC Head Board for correct jumper configuration. (Jumpers are used only on SST or Prodigy Plus) 8. Check the ground wire (connection) at head TC Board. 9. Check the component leads on back of Head TC Board are not shorting to head. 10. Check signal voltage at T/C - if incorrect replace T/C board. a. Single heater board - TPALR and GND should be <3VDC. b. Dual heater board - TP301 and GND should be <3VDC. 11. Check and re-seat J7 and check pins 7 and 10 on the T/C amp board. 12. Replace the swivel head. 13. Check thermal snap switches and wires. Replace as needed.
14,40	Abort : Chamber thermocouple fault.	1. Check to see if chamber thermocouple is plugged in: • connected to PDB. 2. Verify ambient temperature is above 18° C (64.4° F). 3. Using a meter check if thermocouple is open. If so, replace thermocouple. 4. Check chamber thermocouple and wire for damage.

Code	Description	Corrective Actions
14,41 14,42 14,43 14,44 14,47	Abort : Motion command while door open. Abort : Load cartridge while door open. Abort : Modeling command while door open Abort : Select head command while door open. Abort : Tip wipe command while door open.	1. Cycle power. 2. Check to see if door solenoid is operating properly. Toggle solenoid using MaracaEX. 3. Look at LCD display, should read "Door Open" when machine is idle and door is open. 4. Using MaracaEX/LED's/test points: Check to see "Door Open" toggles when switch is activated. If not, check door switch and/or Mid-Unit Harness. 5. Wiggle the door, make sure the sensor reads the magnet with movement to the door. 6. Check that the door magnet is present. If not, install magnet. 7. Verify door is not warped. If warped, replace door.
14,45 14,46	Report: Unable to write to model material guide tube. Report: Unable to write to support material guide tube.	1. Try a different cartridge. Also verify that material is the correct type for printer. 2. Check the LED on card reader board. Should be blinking. If reader board is seeing cartridge, LED blinking speed will double. 3. Re-seat and check pins on J7 on the PDB. 4. Replace cable running from receiver to the controller board. 5. Replace card reader board. 6. Replace the controller board
14,48	Abort : Vertex command error.	1. If this message is displayed on LCD ONLY, possible memory problem, replace SBC. If this message is not displayed on the LCD, (seen in cfg file), RAM is NOT the root cause. 2. If the frequency of the error is greater than once every three months, replace the Controller board.
14,49	Internal : PCode Error, Bad Curve.	This error will not be displayed. Software development use only.
14,50	Internal : PCode Error, DY within curve.	This error will not be displayed. Software development use only.
14,51 14,52 14,53 14,54	Abort : Model material not loaded. Abort : Support material not loaded. Abort : Model head motor not ready. Abort : Support head motor not ready.	1. Reload material. **Note:** **System is not recognizing that material is loaded.**
14,55 14,56	Abort : Find home failed, X home and X eot both on Abort : Find home failed, Y home and Y eot both on	1. Move head away from sensors and cycle power. 2. **Gen2** - Check for loose pins on J10 & J12 on the PDB. Check signals at TP3, 7, 16 & 21. **Note: X home -J10, pin 15, Y home- J12, pin 22, X EOT - J10, pin 24, Y EOT- J12, pin 11.** 3. **Gen 3** - Check for loose pins on J10 & J12 on the PDB. Check signals at TP12, 13, 18 & 19. **Note: X home -J10, pin 2, Y home- J12, pin 22, X EOT - J10, pin 8, Y EOT- J12, pin 11.** 4. Using MaracaEX/LED's/test points: Check to see if switch state toggles. If not, check sensor and/or umbilical cable (for X) / mid-unit harness (for Y). 5. Using MaracaEX/LED's/test points: Check to see if switch state toggles. If not, check switch and/or umbilical cable (for X) / mid-unit harness (for Y).

Code	Description	Corrective Actions
14,57 14,58	Abort : Find home failed, X home timeout Abort : Find home failed, Y home timeout	1. Move the head away from the sensors and cycle power. 2. If chatter in motor, check motor and/or motor cable for Y, umbilical cable for X. 3. Check for obstacles obstructing X or Y movement. 4. Using MaracaEX/LED's/test points: Check to see that the state changes when sensor is activated. If not, check sensor and/or umbilical cable for X and mid unit harness for Y.
14,59 14,60	Abort : Find home failed, X home not tripped Abort : Find home failed, Y home not tripped	1. Move the head away from the sensors and cycle power. 2. **Gen 2** - Check for loose pins on J10 & J12 on the PDB. Check signals at TP3, 7, 16 & 21. **Note: X home -J10, pin 15, Y home- J12, pin 22, X EOT - J10, pin 24, Y EOT- J12, pin 11.** 3. **Gen 3** - Check for loose pins on J10 & J12 on the PDB. Check signals at TP12, 13, 18 & 19. **Note: X home -J10, pin 2, Y home- J12, pin 22, X EOT - J10, pin 8, Y EOT- J12, pin 11.** 4. Using LED's/test points: Check to see home LEDs toggles when sensor is activated. If not, check sensor and/or Umbilical Cable for X and mid unit harness for Y.
14,61 14,62	Abort : Find home failed, X home tripped Abort : Find home failed, Y home tripped	1. Move the head away from the sensors and cycle power. 2. **Gen 2** - Check for loose pins on J10 & J12 on the PDB. Check signals at TP3, 7, 16 & 21. **Note: X home -J10, pin 15, Y home- J12, pin 22, X EOT - J10, pin 24, Y EOT- J12, pin 11.** 3. **Gen 3** - Check for loose pins on J10 & J12 on the PDB. Check signals at TP12, 13, 18 & 19. 4. Using LED's/test points: Check to see home box toggles when sensor is activated. If not, check sensor and/or umbilical cable for X, mid unit harness for Y.
14,63 14,64	Abort : Find home failed, X eot tripped Abort : Find home failed, Y eot tripped	1. Move the head away from the sensors and cycle power. 2. **Gen 2** - Check for loose pins on J10 & J12 on the PDB. Check signals at TP3, 7, 16 & 21. **Note: X home -J10, pin 15, Y home- J12, pin 22, X EOT - J10, pin 24, Y EOT- J12, pin 11.** 3. **Gen 3** - Check for loose pins on J10 & J12 on the PDB. Check signals at TP12, 13, 18 & 19. 4. Using MaracaEX/LED's/test points: Check to see home box toggles when sensor is activated. If not, check sensor and/or umbilical cable for X, mid unit harness for Y.
14,65 14,66	Abort : Find home failed, X eot not tripped Abort : Find home failed, Y eot not tripped	1. Move the head away from the sensors and cycle power. 2. **Gen 2** - Check for loose pins on J10 & J12 on the PDB. Check signals at TP3, 7, 16 & 21. **Note: X home -J10, pin 15, Y home- J12, pin 22, X EOT - J10, pin 24, Y EOT- J12, pin 11.** 3. **Gen 3** - Check for loose pins on J10 & J12 on the PDB. Check signals at TP12, 13, 18 & 19. 4. Using MaracaEX/LED's/test points: Check to see home box toggles when sensor is activated. If not, check sensor and/or umbilical cable for X, mid unit harness for Y.

Code	Description	Corrective Actions
14,67	Abort : Head temperature too high	1. Verify the TC and Liquefier Heaters are plugged in properly. 2. Verify umbilical cable is connected properly. 3. TC Amp board is bad. Replace TC Amp board. 4. Head Board is bad. Replace head board. 5. Replace the umbilical cable.
14,68	Abort: Illegal PMD Command	1. If error occurs more than once a month replace the controller board.
14,69	Abort: XY PMD Read Checksum error	1. If error occurs more than once a month replace the controller board.
14,70	Abort: XY PMD Write Checksum error	1. If error occurs more than once a month replace the controller board.
14,71	Abort: Z PMD Read Checksum error	1. If error occurs more than once a month replace the controller board.
14,72	Abort: Z PMD Write Checksum error	1. If error occurs more than once a month replace the controller board.
14,73	Abort: Head TC Board Configuration error	1. Check jumper configuration on Head TC board. See 14, 39.
14,74	Unexpected contact with unknown limit.	1. Move the head away from the sensors and cycle power. 2. **Gen 2** - Check for loose pins on J10 & J12 on the PDB. Check signals at TP3, 7, 16 & 21 **Note: X home -J10, pin 15, Y home- J12, pin 22, X EOT - J10, pin 24, Y EOT- J12, pin 11.** 3. **Gen 3** - Check for loose pins on J10 & J12 on the PDB. Check signals at TP12, 13, 18 & 19. 4. Using MaracaEX/LED's/test points: Check to see limit box toggles when switch is activated. If not, check switch and/or umbilical cable for X, mid unit harness for Y.
14,75	Unknown	1. No error code associated with an error.
14,76	Software bug	1. Cycle power.
14,77 14,78	Buffer is larger than the data Buffer is smaller than the data	1. Cycle power. 2. Replace single board computer. 3. Replace controller board.
14,79	Run-time error	1. Cycle power. 2. Check configuration file for other errors. 3. Replace single board computer. 4. Replace controller board.
14,80	Index out of bounds	1. Cycle power.
14,81	Invalid argument	1. Cycle power.
14,82	Invalid channel	1. Cycle power.
14,83	Invalid command	1. Cycle power.
14,84	Invalid command opCode	1. Cycle power.
14,85	The operation is not implemented	Software error; will not be displayed.

Code	Description	Corrective Actions
14,86	Timeout	1. Cycle power. 2. If CFG file contains: Time-out due to position • Replace Head Servo Motor. 3. If CFG file contains: Time-out due to temperature • Replace Toggle Plate Assembly. • Replace TC Amp Board. 4. Replace controller board.
14,87	Resource already in use	1. Cycle power.
14,88	The dual-port memory is corrupted	1. Cycle power.
14,89	No valid ISR callback routine set	1. Cycle power.
14,90	An internal queue has overflowed	1. Cycle power.
14,91	Address not properly aligned	1. Cycle power.
14,92	Message too big for queue	1. Cycle power.
14,93	Data unit size violation	1. Cycle power.
14,94	Checksum bad	1. Cycle power. 2. Check 5/12 VDC power (5 and 12VDC LEDs will repeatedly dim). Replace 5/12 VDC power supply. 3. Replace controller board.
14,95	PMD Host IO Error	1. Cycle power. 2. Check 5/12 VDC power (5 and 12VDC LEDs will repeatedly dim). Replace 5/12 VDC power supply. 3. Replace controller board.
14,96	Unidentified interrupt occurred	1. Cycle power.
14,97	Invalid data type	1. Cycle power.
14,98 14,99	Find home failed, X EOT timeout Find home failed, Y EOT timeout	1. Move the head away from the sensors and cycle power. 2. **Gen 2** - Check for loose pins on J10 & J12 on the PDB. Check signals at TP3, 7, 16 & 21. **Note: X home -J10, pin 15, Y home- J12, pin 22, X EOT - J10, pin 24, Y EOT- J12, pin 11.** 3. **Gen 3** - Check for loose pins on J10 & J12 on the PDB. Check signals at TP12, 13, 18 & 19. 4. Using MaracaEX/LED's/test points: Check to see limit box toggles when switch is activated. If not, check switch and/or umbilical cable for X, mid unit harness for Y.

Code	Description	Corrective Actions
14,100 14,101 14,102 14,103	Find home failed, Z HOME (BOT) not tripped Find home failed, Z EOT not tripped Find home failed, Z HOME (BOT) timeout Find home failed, Z EOT timeout	1. Move Z stage away from sensors and cycle power. 2. Check for objects/parts on Z stage and around lead screw. 3. Check for purge material around lead screws. Remove material, clean and lube. 4. Using MaracaEX/LED's/test points: Check Z position. See if Z home & Z limit boxes are checked. If so, check limit switches and/or spread pins. 5. **Gen 2**- Check J12 on the PDB for loose pins. Z home-pin 3, Z EOT-pin 5. Check signals at TP14, TP13. **Gen 3**- Check J12 on the PDB for loose pins. Z home-pin 9, Z EOT-pin 11. Check signals at TP9, TP10. 6. Tera Term: Check to see if Z stage moves (mz 0.5 or mz -0.5). This will allow you to move the Z stage without tripping the Z jam sensor. + is down, - is up. 7. Table is not level. Check and level per the service manual using the head leveling fixture. 8. Z-axis motor has failed (see 14,1) 9. Z-axis belt is loose or worn. Adjust tension or replace belt. 10. Sensor flag has possibly become magnetized - check for magnetism. Replace flag if magnetized. 11. Check pins on Z-axis motor connectors (both ends) to make sure that they are fully seated in connector housing. 12. 14.101 error only - Check 5/12 VDC power (5 and 12VDC LEDs will repeatedly dim) Replace 5/12 VDC power supply
14,104	Surface not found	1. No modeling base. Install modeling base. 2. Modeling base is used/defective, has low spot. Replace Modeling base. 3. Verify substrate sensor is working. If not, replace Substrate Sensor.
14,105	Controller not ready to build a model	1. Cycle power.
14,106	BOT offset is higher than the BOT switch	1. Use MaracaEX to zero the Z offset value. 2. Run tip Z calibration. 3. Check Z home sensor. 4. Check the Z foam level actuator for damage. See "Removing the Z Level Assembly" on page 4-151.
14,107	End model command while not modeling	Software error; will not be displayed.
14,108	Operation was killed	Software error; will not be displayed.
14,109	Out of memory	Software error; will not be displayed.
14,110	Cartridge communication error	1. Replace cartridge. 2. Replace cartridge reader card. 3. Replace receiver cable.
14,111	Invalid frame check sequence	1. Cycle power. 2. If error repeats, replace controller board.
14,112	EEPROM communication error	Software error; will not be displayed.

Code	Description	Corrective Actions
14,113	Door not latched	1. Check .cfg file for error codes 14,113 and 14,114 being posted within 1 second of each other. If present, replace PDB. 2. Inspect solenoid and wiring. 3. Check for 24VDC on the upper harness at the solenoid power connection. 4. Replace solenoid. 5. Replace PDB.
14,114	Thermocouple snap switch tripped	1. Check .cfg file for error codes 14,113 and 14,114 being posted within 1 second of each other. If present, replace PDB. 2. Using a meter, check if head or chamber thermostat are open. If they are open, press the reset button. 3. If thermostat remains open, replace it. 4. Head or chamber thermostat wires are open. 5. Re-seat connectors on PDB. Position the J12 cable in the wire tie so it is not being pulled out of the connector. 6. Replace PDB.
14,115	Z stage planarity beyond tolerance	1. Replace modeling base. 2. Re-level XY table.
14,116	I2C configuration info is corrupt	Software error; will not be displayed.
14,117	A command failed while modeling	1. Download CFG file - check error code details. 2. Gantry/part calibration values have been set to zero - check using MaracaEX. Download CAL files to restore values. 3. Replace PDB (U8 chip failure). 4. Search for “Extrusion head” in .cfg file. If present, replace head servo motor.
14,118	Invalid cyclic redundancy check	Software error; will not be displayed
14,119	Operation already active	Software error; will not be displayed
14,120	Invalid vector detected	1. Reprocess the part and send again. 2. Reorient part and send again. 3. If the frequency of the error is greater than once every three months, then replace the SBC or hard drive.
14,121	Processor Exception	1. Cycle power.
14,122	Processor halted	1. Cycle power.
14,123	Watchdog timeout	1. Cycle power. 2. Check all cable connections including thermocouples. 3. Check 5/12 VDC power (5 and 12VDC LEDs will repeatedly dim). Replace 5/12 VDC power supply 4. Escalate the case providing .cfg file.
14,124	Stack overflow **NOTE:** This error may occur once or twice after installing a new controller board, and should not reoccur.	1. Cycle power. 2. Search CFG for “Controller Log” and verify that last entry is the current date. If not, leave printer on for 24 hours and check again. If date still reads 01/01/70 replace controller board or controller battery. 3. If problem persists, replace controller board.
14,125	Runtime error	1. Cycle power.
14,126	Operation active - try again	1. Cycle power.

Code	Description	Corrective Actions
14,127	Invalid gender	1. Cycle power. 2. If problem persists, replace controller board.
14,128	Invalid platform	1. Cycle power. 2. If problem persists, replace controller board.
14,129	Toggle Head failure	1. Check toggle bar for excessive play. If loose, check security of toggle plate or replace toggle bar. 2. Reflector on toggle bar is missing or damaged, replace toggle bar. 3. Re-seat connectors on head board. 4. **Gen 2** - Check for 5VDC on PDB for toggle signal, TP10-Model, TP25-Support. If no voltage present, see steps 1-3. 5. **Gen 3** - Check LED DL9-Model and DL10-Support for signal. If not lit, see steps 1-3. 6. Check for 5VDC on head board for toggle signal. TP201-Model, TP101-Support. 7. Replace toggle bar and toggle sensor. 8. Replace head board. 9. Using Tera Term run AH to toggle the head. Monitor movement to help determine root cause of issue. 10. Toggle plate is warped, replace toggle plate assembly.
14,130	Temperature setback is active	1. Cycle power.
14,131	Toggle when head motor is running	1. Cycle power. 2. Replace head servo motor.
14,132	UPS low power	1. UPS is shutting down. Check UPS and AC power. 2. Make sure the UPS cable is assembled per print.
14,133	Head liquefier is not heating up	1. Liquefier T/C may be crushed. Test using meter. • If crushed, reading will be 0 Ohms between pin 1 and ground. 2. If head board with LED's is present, check model and support 120VDC LEDs at head board. • If both model (upper) and support (lower) LEDs are illuminated, head heater is bad. Replace head. • If only the model LED (lower) is illuminated, replace the 120VDC power supply • If only the support LED (upper) is illuminated, replace the power distribution board 3. If head board with LED's is not present, use volt meter to check for 120 VDC at head board. • If 120VDC present at both model and support side, heater is bad. Replace head. • If no 120VDC at support side, replace 120VDC power supply. • If no 120VDC at model side, replace power distribution board. 4. The umbilical cable to the heater is broken or has a bad connector. 5. Make sure the machine is plugged directly into a wall outlet. 6. Check the thermocouple connectors, heater connectors. 7. Verify that hard drive has not lost its .CAL values. If values are lost, download .CAL files.
14,134	Invalid packet size	Software use only
14,135	Initialization failure	1. See LE (List Errors) output at end of CFG File.

Code	Description	Corrective Actions
14,136	Invalid state for operation Attempt to program firmware when system is not in upgrade mode.	1. Cycle power. 2. Reinstall upgrade.

Starting Up Failed Minor Errors (15.XX)

Code	Description	Corrective Actions
15,01	Startup state activation failed	Software use only
15,02	Timeout period expired while starting up	1. See CFG file for additional error details. 2. Replacement Controller or Hard Drive is gendered incorrectly. 3. If printer is in Dynamic Mode: a. Issue may be a network timeout due to improper DHCP settings on the network. Verify by looking at CFG, if code reads: MASTER logger: Punching nameserver xxx.xxx.xxx.xxx through the firewall. b. If using System Software version 2230 try workaround. Contact CS for workaround instructions. c. Upgrade System Software to a version newer than 2230. 4. Material Bay Connection timeout. Refer to error code 14,139.

Controller Load Failed Minor Errors (17.XX)

Code	Description	Corrective Actions
17,01	LG_COMMAND Failed on Controller	Software use only.
17,02	LG_COMMAND Timeout	Software use only.

Temperature Failed to Regulate Minor Errors (18.XX)

Code	Description	Corrective Actions
18,01	Temperature not changing fast enough. Chamber is slow to heat up.	1. Status-Details: Check to see if current envelope temperature is above 72C before starting a model. 2. Status--Details: Check to see if envelope temperature set point is 80C. If not, toggle power switch. 3. Check heaters, chamber fans, and heater cables. 4. Check chamber thermocouple - see 14.40. 5. Check AC input. Verify that no extension cords or power strips are attached to the system. 6. Check AC output from PDB to chamber heaters. Check AC cables. Replace PDB.
	Liquefier won't heat up (its cold). Use CatalystEX to check to see if the temp is going over 90C. If temp is above 90C go to next section	7. Liquefier T/C may be crushed. Test using meter. If crushed, reading will be 0 Ohms between pin 1 and ground. 8. If head board with LED's is present, check model and support 120VDC LEDs at head board. • If both model (upper) and support (lower) LEDs are illuminated, head heater is bad. Replace head. • If only the model LED (lower) is illuminated, replace the 120VDC power supply • If only the support LED (upper) is illuminated, replace the power distribution board 9. If head board with LED's is not present, use volt meter to check for 120 VDC at head board. • If 120VDC present at both model and support side, heater is bad. Replace head. • If no 120VDC at support side, replace 120VDC power supply. • If no 120VDC at model side, replace power distribution board. 10. The umbilical cable to the heater is broken or has a bad connector. 11. Check AC input. Verify that no extension cords or power strips are attached to the system. 12. Check that DL18 on the PDB is lit. If not 120VDC circuit maybe bad - replace PDB. 13. Monitor DL23 (M) and DL24 (S). LED's should turn on when head is commanded to heat. If not lit - check 120VDC, if absent replace PDB (model) or 120VDC AUX (support). 14. Check the thermocouple and heater connectors.
	Liquefier is warm but doesn't reach operating temperature.	15. Check AC input. Verify that no extension cords or power strips are attached to the system. 16. Liquefier heater has higher than normal resistance, correct value should be about 98 ohms for BST and 75 ohms for SST. If incorrect replace head. 17. The umbilical cable has an intermittent connection. Replace umbilical cable. 18. Replace the TC Amp board. 19. Check 120VDC, if low, replace PDB (model) or 120VDC AUX (support).
	Chamber temperature too high (over 77 degrees)	20. Chamber T/C has failed. 21. Chamber temperature offset is incorrect. Correctly set at 80 degrees using MaracaEX See "Temperatures" on page 3-12.
18,02	Temperature failed to regulate within 7 degrees.	1. Status--Details: Check to see if head temperature set point is 270C. 2. Check Liquefier Thermocouple wire and/or Heater wires. 3. Check for torn or damaged insulation on the liquefier, especially at the tip. 4. Check head T/C and umbilical cable for a loose connection. Replace umbilical cable.

Code	Description	Corrective Actions
18,03	Incorrect model head temperature.	1. Using MaracaEX, set model temperature to default of 300C. 2. See also 18,01.
18,04	Incorrect support head temperature.	1. Using MaracaEX, set support temperature to default of 300C.
18,05	Incorrect chamber temperature.	1. Using MaracaEX, set chamber temperature to default of 80C.

Controller Initialization Failed Minor Errors (19.XX)

Code	Description	Corrective Actions
19,01	IN_COMMAND Rejected by Controller.	Software use only
19,02	IN_COMMAND Timeout.	1. Cycle power. 2. Replace controller board. 3. Replace Hard Drive.

Door Unlatch Failed (20.XX)

Code	Description	Corrective Actions
20,01 20,02	Unlatch command rejected. Timeout period expired waiting for head to stop.	1. Check door latch solenoid wiring. 2. Check ability of door to latch

Controller Communications Failed Sub Errors (22.XX)

Code	Description	Corrective Actions
22,01 22,02	FC_SERVICE event not received. Insufficient material to complete job.	Install controller software build 1204 or higher.

Unique Device Name Error (23.XX)

Code	Description	Corrective Actions
23,01 23,02	UDN controller command failed. UDN controller command timed out.	1. Check network for connectivity. 2. Cycle power.

Non-Code Errors

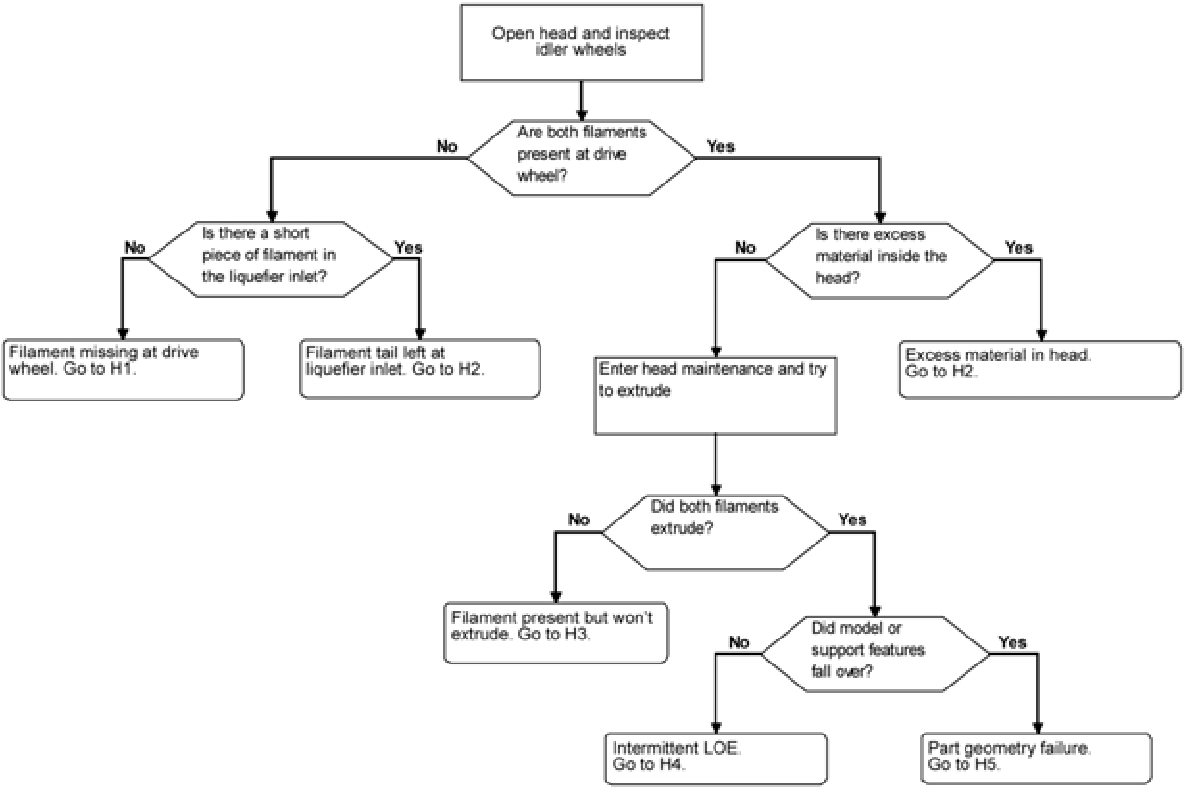
A. "Build Error" displayed on LCD
B. Tip depth is incorrect
C. "Corrupted Upgrade" Displayed on LCD
D. "Cartridge Invalid or Empty" Displayed on LCD
E. Door Latch
F. "Door Open" Displayed on LCD
G. Download
H. Loss of Extrusion (LOE)
I. Lights
J. Material/Unload Error
K. Network Communication
L. Pauses During Build
M. Power UP / Boot
N. "Can't Find Home - Check Modeling Base" displayed on LCD
O. Power Down
P. System VERY slow to reach temperature
Q. Calibration Issues
R. Z Calibration Failure
S. Noise

A. "Build Error" displayed on LCD	
Part stops building before complete.	1. Partial or bad model file sent to unit. - Check and reprocess the STL and re-download
B. Tip depth is incorrect	
Tip Depth is wrong (too deep or above the modeling base)	1. Replace the substrate. 2. Cycle power. 3. Check/Adjust the Z offset calibration using MaracaEX. 4. Check and/or clean the Z foam sensor. 5. Replace the Z foam assembly and sensor
Builds above the foam consistently	1. Verify the Z foam sensor value changes using Tera Term. 2. If no change, possible bad umbilical cable. 3. Check tip depth value in MaracaEX. SHould be less than -0.10 4. Replace the Z foam assembly and sensor 5. Replace controller board.
C. "Corrupted Upgrade" Displayed on LCD	
	1. Verify the CD is the correct gender. (Same as the printer) 2. Cycle power and try download again. If not possible or fails again replace hard drive. 3. Verify the hard drive and the controller board are gendered correctly.
D. "Cartridge Invalid or Empty" Displayed on LCD	
	1. Remove cartridge and cycle power. Reload cartridge. 2. Cartridge e-prom empty or failed. Load a different cartridge. 3. Loose J7 on controller board. Check for spread pins and re-seat connector. 4. Loose connector on card reader. re-seat card connector. 5. Verify card reader board has flashing LEDs.
E. Door Latch	
Door doesn't latch/unlatch.	1. Check for door delamination or warping. If present, replace door. 2. Door solenoid pin is bent, replace door solenoid. 3. Using MaracaEX, toggle door solenoid, if door solenoid will not engage, replace solenoid. 4. Replace solenoid cable. 5. PDB has failed (won't latch only). Replace PDB.
F. "Door Open" Displayed on LCD	
Door doesn't latch/unlatch.	1. The door is open. Close the door. 2. Verify the magnet mounted to door frame is not misaligned or missing. 3. Door switch is bad, replace door switch. 4. Check for door delamination or warping. If present, replace door.
G. Download	

Model sent to system, but did not appear in queue.	1. Verify the IP address on the printer and in CatalystEX match. 2. Send the file again. Check the lower status bar in CatalystEX for error messages. 3. Reprocess and send the file again. 4. Remove special characters from CMB file name. 5. Cycle power on both the system and the work station. 6. Downloading starts but fails during download process. External or internal network cable bad. Try different network cable or replace pigtail (internal) network cable.

H. Loss of Extrusion (LOE)

Use flow chart to determine type of LOE, then follow the steps below to troubleshoot LOE.



1. Material missing at drive wheel - Material pulled back.	1. Drive wheel or mushroom jam. Refer to loss of extrusion section. "Diagnosing loss of extrusion" on page 6-10. 2. Material jammed in cartridge. Replace cartridge. 3. Material motor connector is bad. Test using head maintenance. Also flex wires while extruding to test for loose connection. 4. Liquefier is plugged. Test by manually feeding material into liquefier. 5. Check for pinched wires in the head. 6. Worn drive wheels (intermittent LOE). Replace head. 7. Liquefier heater has higher than normal resistance. Value should be about 98 ohms for BST and about 75 ohms for SST. If value is different, replace head. 8. Umbilical cable is bad. Replace umbilical cable.

H. Loss of Extrusion (LOE) (Continued)	
2. Material frequently breaking.	1. Drive wheel or mushroom jam. Refer to loss of extrusion section. “Diagnosing loss of extrusion” on page 6-10. 2. Material jammed in cartridge. Replace cartridge. 3. Clean drive wheels of excess material. 4. Verify material tubes are not twisted. If twisted, replace material tubes. 5. Replace head.
3. Filament present but won’t extrude.	1. Drive wheel or mushroom jam. Refer to loss of extrusion section. “Diagnosing loss of extrusion” on page 6-10. 2. High pull force or jammed cartridge. Replace cartridge. 3. Material jammed in cartridge. Replace cartridge. 4. Material left loaded to head while powered down for extended period. Moisture in material, replace cartridge. 5. Material motor connector is bad. Test using head maintenance. Also flex wires while extruding to test for loose connection. 6. Liquefier is plugged. See Step 3 on page 6-11. 7. Check for pinched wires in the head. 8. Worn drive wheels (intermittent LOE). Replace head. 9. Worn material tubes. Replace material tubes. 10. Liquefier heater has higher than normal resistance. Value should be about 98 ohms for BST and about 75 ohms for SST. If value is different, replace head. 11. Umbilical cable is bad. Replace umbilical cable.
4. Intermittent LOE.	1. Make sure the head connectors are seated properly. 2. Check for pinched wires in the head. 3. Bad motor. Replace Servo Motor. 4. Broken wire in the umbilical cable. Replace umbilical cable.
5. Part Geometry Failure. • Model or support features fell over.	1. Reorient, reprocess and resubmit the part. 2. Run Z calibration. 3. Replace tip wipe assembly. 4. If part has shifted in X or Y, refer to part quality section, part shift subsection. 5. Replace Z assembly.

I. Lights	
Chamber lights won't come on or are dim. (Unit is otherwise functioning normally)	1. Lights are burned out. Replace bulbs. 2. Check continuity to light with volt meter. If open replace cable. 3. Light socket bad, replace light socket.

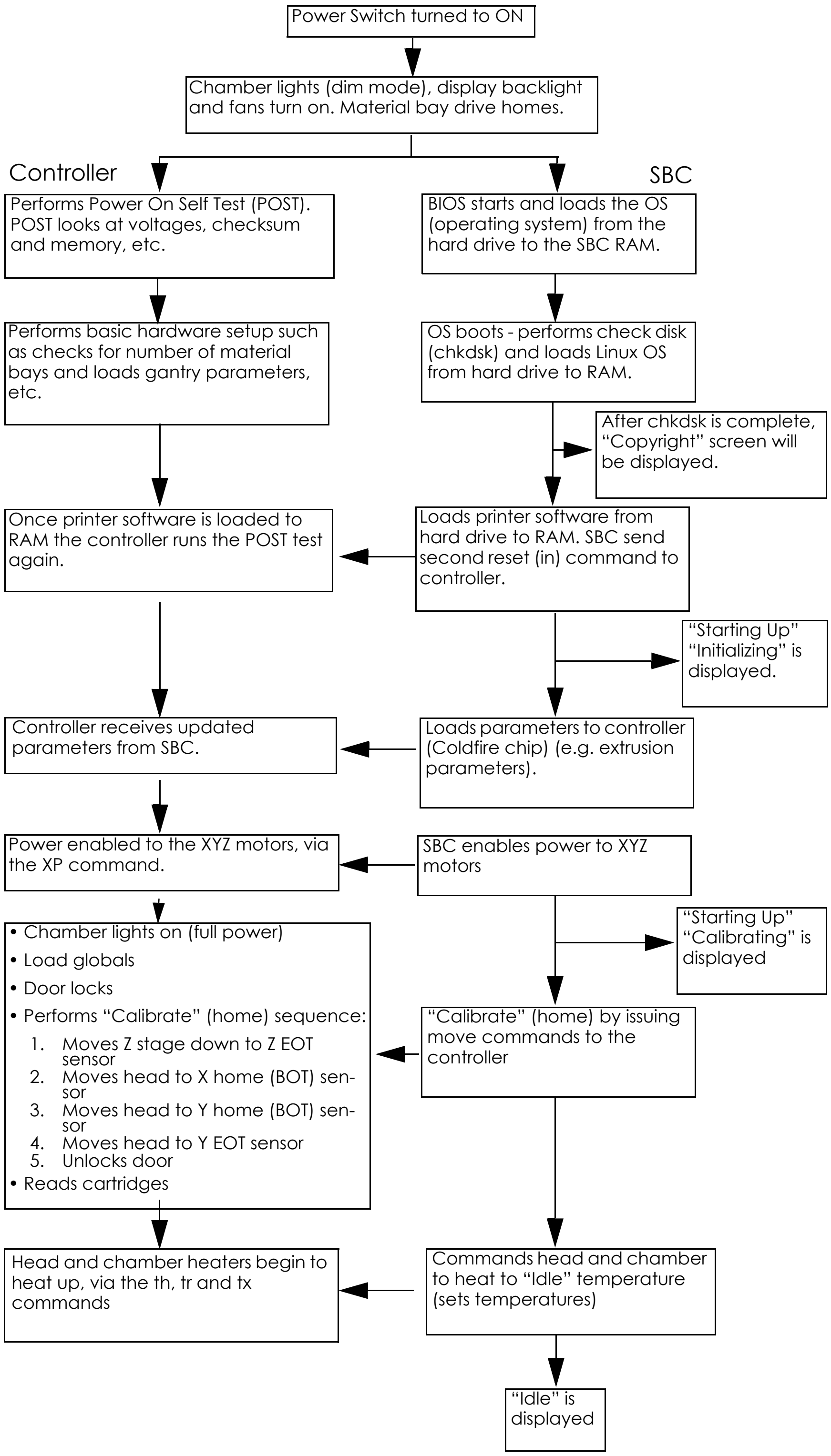
J. Material/Unload Error	
Material Error Filament error	1. Remove the cartridge and verify material is coming out of the material guide. 2. Verify material pulls freely from the cartridge. 3. Verify the material tubes are free of material 4. Receiver encryption board has failed, replace receiver. 5. Reload material.

J. Material/Unload Error (Continued)	
Material Error Filament blocked	1. Remove cartridge and verify material pulls freely from cartridge. 2. Verify the material tubes are free of material. 3. Reload material.
Material Error cartridge invalid	1. Remove cartridge and verify it is not empty. 2. Replace material cartridge.
Cartridge will not load (no movement) after pressing load.	1. Verify cartridge inserted completely and latched. 2. Move Z stage away from sensors and cycle power. 3. E-prom has failed. Replace cartridge. 4. Receiver encryption board has failed, replace cartridge. 5. Pogo pins bent or failed, replace receiver.
Cartridge failed to load after three attempts.	1. Cartridge is defective. Replace cartridge. 2. Cartridge is empty, replace cartridge. 3. Material in head. Clean head. 4. re-seat receiver connections. 5. Worn or bent material tubes. Replace material tubes. 6. Align filament guides at motor blocks. 7. Enter head maintenance and verify motors operate properly.
Galvanized receiver only - Model material loads 2 meters (6 feet) but support material does not move on dual auto load.	1. Material in head. Clean head. 2. Align filament guides at motor blocks. 3. Replace receiver plate.
Galvanized receiver only -Material leaves cartridge but does not reach head.	1. **Model Only** - Adjust the location of the model solenoid. Move solenoid toward the cartridge if motor is bogging down, away from cartridge is wheel is slipping. 2. Straighten the bend in receiver plate. 3. Check for loose receiver drive wheels. Align drive wheels and tighten set screw.

K. Network Communication	
Printer boots but will not communicate over network	1. Wrong IP Address. Verify IP Address on printer is IP Address entered into CatalystEX. 2. Network internal (pigtail) cable bad. Replace cable. 3. Check pin alignment on RJ-45 connection. 4. OS on hard drive may be bad, replace hard drive. 5. Network interface on SBC has failed. Replace SBC.
Unable to communicate using crossover cable (Windows XP)	1. From workstation, open control panel. 2. Open Firewall Client Options. 3. Uncheck the box for Enable Firewall Client. 4. Change the TCP/IP settings in network setup from dynamic to static.
Need to find MAC address	1. Go to setup menu on printer. 2. From DOS command window, type: **arp -a** and press enter.
Loss of Communication displayed and/or part disappears after Start Part is selected.	1. Symbol in filename. Remove symbol and re-send part.

L. Pauses During Build	
Chamber won't heat up to at least - 70 degrees	1. Verify top and side panels and insulation are installed. 2. Verify chamber fans are operating. 3. Re-seat J3 on controller board. 4. Heater bad. Check heater resistance - should be 36 +/- 5 ohms. If out of tolerance, replace heater. 5. Relay failed on PDB, replace PDB.
Head not maintaining temperature.	1. Low AC input power. Make sure system is NOT attached to an ext. cord/power strip 2. One of the four heaters is bad. Check resistance of heaters should read about 92 Ohms 3. Umbilical cable connector loose at head board - check to make sure it is fully seated. 4. T/C board is bad. Replace T/C board 5. Head Board is bad. Replace Head Board 6. If head board with LED's is present, check model and support 120VDC LEDs at head board. • If both model (upper) and support (lower) LEDs are illuminated, head heater is bad. Replace head. • If only the model LED (lower) is illuminated, replace the 120VDC power supply • If only the support LED (upper) is illuminated, replace the power distribution board 7. If head board with LED's is not present, use volt meter to check for 120 VDC at head board. • If 120VDC present at both model and support side, heater is bad. Replace head. • If no 120VDC at support side, replace 120VDC power supply. • If no 120VDC at model side, replace power distribution board. 8. Check ground between Toggle Plate and Head Board. If open, check for missing washers on head. 9. The heater wires in the umbilical cable are broken. Replace cable. 10. Head T/C is crushed. Check by ohming from the T/C connector pin to the head body. Reading should show open. If not, replace toggle head. 11. Replace toggle head
Pausing during build and temperatures are correct. NOTE: Pausing may be caused by multiple cartridge read/write errors, not temperature issues.	1. Check CFG for multiple EEprom write errors. If errors are noted: a. Select Resume. (from display panel) b. Replace card reader. c. Replace receiver plate and receiver cable. d. Replace controller board.
STOPS during build, display still shows building, does not start to build again.	1. Cycle power 2. Reprocess and re-send the part 3. If issue continues replace SBC

What happens during Power Up / Boot



M. Power UP / Boot	
Chamber wont heat up to at least: **BST** - 50 degrees **SST** - 65 degrees	1. Heater bad. Check heater resistance - should be 36 +/- 5 ohms. If out of tolerance, replace heater. 2. Replace PDB.
Chamber won't heat up:	1. Low AC input power. Make sure system is NOT attached to an ext. cord/power strip 2. Fuse on the 120 VDC supply is blown (on PDB). 3. Umbilical cable connector loose at head board - check to make sure it is fully seated. 4. If head board with LED’s is present, check model and support 120VDC LEDs at head board. • If both model (upper) and support (lower) LEDs are illuminated, head heater is bad. Replace head. • If only the model LED (lower) is illuminated, replace the 120VDC power supply • If only the support LED (upper) is illuminated, replace the power distribution board 5. If head board with LED’s is not present, use volt meter to check for 120 VDC at head board. • If 120VDC present at both model and support side, heater is bad. Replace head. • If no 120VDC at support side, replace 120VDC power supply. • If no 120VDC at model side, replace power distribution board. 6. T/C board is bad. Replace T/C board 7. Head Board is bad. Replace Head Board 8. Check ground between Toggle Plate and Head Board. If open, check for missing washers on head. 9. The heater wires in the umbilical cable are broken 10. Replace toggle head
Head won't heat up.	1. Low AC input power. Make sure system is NOT attached to an ext. cord/power strip 2. Fuse on the 120 VDC supply is blown (on PDB). 3. Verify 120 VDC at head heater connectors, if present check resistance of heaters 92 Ohms. If heaters are out of spec, replace head. 4. T/C Amp board is bad. Replace T/C Amp board 5. Check for 120VDC output from the PDB. If voltage is not present or low - replace the PDB. 6. The heater wires in the umbilical cable are broken. Replace umbilical cable.
No fans, lights, text and no LCD back light (no nothing)	1. Verify AC power is present at outlet. 2. Verify circuit breaker is in the ON position 3. Check if the thermal snap switches are open. If snap switches are open, verify chamber fans are operating correctly. Replace chamber fans. 4. 24VDC power supply is bad. Replace 24VDC supply. 5. Check cable from 24VDC supply to PDB. 6. PDB has failed, no 24 volt output. Replace PDB.

M. Power UP / Boot (Continued)	
No fans, lights, text and LCD back light is ON	7. Use Tera Term and/or CFG File to check for additional error codes (root cause). 8. Check 24VDC at power distribution board, if not present replace 24 VDC supply.
System won't boot, no display after 5 minutes. Fans, lights and LCD backlight are operating **NOTE:** Replacement Hard Drive may take up to 45 minutes to boot.	1. If system homes: Check LCD cable, if OK replace LCD 2. If system does NOT home: Power on for at least 10 minutes. If still no text, Cycle power at circuit breaker and wait 10 minutes. If after three power cycles of 10 minutes each and there is still no text replace the hard drive. 3. Measure for 12VDC at the hard drive. If not present check 12VDC power supply, replace cable or supply as needed. 4. Connect a monitor and keyboard to the SBC. a. Does BIOS drive listing show HD as primary, if not re-seat IDE ribbon cable on both ends, Verify red line is to the right. b. Disk Boot Failure shown on monitor, software not seeing the hard drive. re-seat IDE ribbon cable on both ends. Verify red line is to the right. c. Kernel Panic Init Failed shown on monitor. Replace Hard Drive. d. If monitor displays: **/dev/hdaXX: UNEXPECTED INCONSISTENCY;** **RUN fsck MANUALLY** *** An error occurred during the file system check *** Dropping you to a shell; the system will reboot *** when you leave the shell - Replace Hard Drive e. Disk Check Failed (CHKDSK). Replace Hard Drive. 5. Replace SBC.
System powers off after a few seconds.	1. Check for shorts in the AC input. (eg. circuit breaker, line filter board, AC input cabling) 2. Power switch is bad, replace power switch. 3. Verify DC power supply outputs are not shorted to ground.
System reaching temp, does not go to "Idle" screen and head hits into the right side of the machine	1. Substrate sensor broken. System is attempting to retract sensor. Replace the sensor.
System displays "Copyright" screen and does not home within 5 minutes. (Halted on Copyright screen)	1. Cycle Power at the Circuit Breaker. 2. re-seat the IDE cable, Verify red line is to the right. 3. Replace controller board. 4. Replace single board computer. 5. Replace hard drive.
System displays "Initializing" (Halted in Initializing)	1. Cycle Power at the Circuit Breaker. 2. Verify the Substrate Sensor is in the correct position. 3. Re-seat the controller board and SBC.
System displays "Starting Up / Calibrating" (Halted in Starting Up / Calibrating)	1. Cycle Power at the Circuit Breaker. 2. Verify the Substrate Sensor is in the correct position.

N. "Can't Find Home - Check Modeling Base" displayed on LCD

Head stops over Z stage/modeling base	1. No modeling base. Install modeling base. 2. Modeling base is used/defective - Replace. 3. Verify substrate sensor is working properly, verify at LED/test points on PDB. 4. Substrate sensor is loose or defective, tighten or replace. 5. Upper Z limit switch is too low. Adjust as needed.
Head moves to lower modeling base sensor but does NOT move over modeling base	1. Modeling base sensor is NOT turning off before performing touchdown (verify using MaracaEX/LED) 2. Y EOT sensor is not operating correctly. Verify using LED/test points on PDB. 3. Debris on Z Stage casting prevents Z stage from finding home
Head completes finding modeling base routine then displays error message.	1. Modeling base is used/defective - Replace 2. Z offset value is incorrect (out of operating range) Check/ adjust value using MaracaEX or download CAL file from CD to restore factory calibration values. 3. Flatness check may have failed. Use Tera Term to read the touchdown values. Compare these values to the "tolerance" value displayed. If this value is over 1728 replace the modeling base. 4. If failure reoccurs check XY table level using the head bracket and dial indicator. Maximum tolerance is +/- .0015 from the fixed corner. • If values are out of spec: Check for loose tray mounting screws. If so level per procedure. • If screws are tight, level the XY table per procedure. 5. If failure reoccurs the X rear guide rod may be out of alignment. Replace XY table. 6. Upper Z limit switch is too low. Adjust as needed.
Head stops moving while attempting to lower Z detect sensor plunger	1. Using MaracaEX/LED's check to see that all sensors are working correctly. If not check sensor connections/wires or replace sensor 2. Z offset value is incorrect (out of operating range) Check/ adjust value using MaracaEX or download CAL file from CD to restore factory calibration values.

O. Power Down

Fails to shutdown.	1. Toggle the power switch again. Wait 5 minutes 2. Shut system off at the breaker.
Display indicates "Recovery after uncontrolled shutdown"	1. AC power was interrupted. Check customer AC power. 2. Bad power switch cable. 3. UPS malfunctioned, replace UPS.
Display indicates "Recovery after controlled loss of power"	1. AC power was interrupted. Check customer AC power. 2. UPS wiring is incorrect. Check wiring 3. UPS malfunctioned, replace UPS.
Shuts down immediately after the power switch is thrown.	1. Replace the SBC. 2. Replace the PDB. 3. Replace power switch.
Shuts down after part is complete	1. Auto power down was enabled, normal operation.

P. System VERY slow to reach temperature	
Envelope takes unusually long (over 40 minutes) to reach temperature.	1. Verify all covers and panels are properly installed. 2. Envelope heater(s) bad. Check heater resistance - should be about 36 ohms. If not, replace heater(s). 3. Replace PDB

Q. Calibration Issues	
Tip offset cal part - support and model over .25" offset	1. Check that tip offset values are close to default values: **BST** = 0.10, 0.00 **SST** = 0.25, 0.00
Tip offset values change but do not take.	1. Tip offset is changed in MaracaEX and the change is stored correctly in the hard drive (verified by viewing the CFG file). When the tip_offset part is run though, the offset does not change. Replace SBC.

R. Z Calibration Failure	
First layer too deep into modeling base Diagnostic details: Left square (SS) *Upper layers* - Missing *1st layer* - May be visible, but looks choked off. Etches may be visible in modeling base. Right square (model) *Upper layers* - Missing or barely stuck to modeling base. Part layer shifted. *1st layer* - May be visible, but looks choked off. Etches may be visible in modeling base.	1. Add +.010 to Z offset value 2. Check the Z foam level actuator for damage. See "Removing the Z Level Assembly" on page 4-151.
First layer tip too high off modeling base Diagnostic details: Left square (SS) *Upper layers* - Missing or barely stuck to modeling base *1st layer* - Missing or barely stuck to modeling base Right square (model) *Upper layers* - Missing or barely stuck to modeling base *1st layer* - Missing or barely stuck to modeling base	1. Add -.010 to Z offset value 2. Check the Z foam level actuator for damage. See "Removing the Z Level Assembly" on page 4-151.

R. Z Calibration Failure (Continued)	
Support tip much lower than model tip Diagnostic details: Left square (SS) *Upper layers* - Built OK *1st layer* - OK Right square (model) *Upper layers* - Missing or barely stuck to modeling base. *1st layer* - OK	1. Add -.010 to Z offset value 2. Check the Z foam level actuator for damage. See "Removing the Z Level Assembly" on page 4-151.
Support tip much higher than model tip Diagnostic details: Left square (SS) *Upper layers* - Built OK *1st layer* - OK Right square (model) *Upper layers* - Did not build completely. may be some wisps of model material. *1st layer* - May be visible, but roughed up from the support tip	1. Add +.010 to Z offset value 2. Check the Z foam level actuator for damage. See "Removing the Z Level Assembly" on page 4-151.
Possible worn/bad tip shield Diagnostic details: Left square (SS) *Upper layers* - Part built, but surface looks rough or looks OK but cal failed *1st layer* - OK Right square (model) *Upper layers* - Part built, but surface looks rough or looks OK but cal failed *1st layer* - OK	1. Replace tip shield
Model filament not loaded Diagnostic details: Left square (SS) *Upper layers* - Built OK *1st layer* - OK Right square (model) *Upper layers* - Missing or barely stuck to modeling base. *1st layer* - Missing. No evidence of ABS extrusion	1. Load material

R. Z Calibration Failure (Continued)	
Support filament not loaded Diagnostic details: Left square (SS) *Upper layers* - Missing. No evidence of SS extrusion *1st layer* - Missing. No evidence of SS extrusion Right square (model) *Upper layers* - Missing or barely stuck to modeling base. *1st layer* - Missing. No evidence of SS extrusion	1. Load material
Continued difficulty calibrating	1. Replace Z motor 2. Replace XY table. Failed bearings in the Y drive shaft possible root cause. 3. Check the Z foam level actuator for damage. See "Removing the Z Level Assembly" on page 4-151.
S. Noise	
Buzzing noise from XY motors	1. Replace XY motors 2. Replace XY table. Failed bearings in the Y drive shaft possible root cause.

Part Quality Troubleshooting

Embedded support strands in model

Characteristics: Strands of support material embedded in model.

Example of embedded support

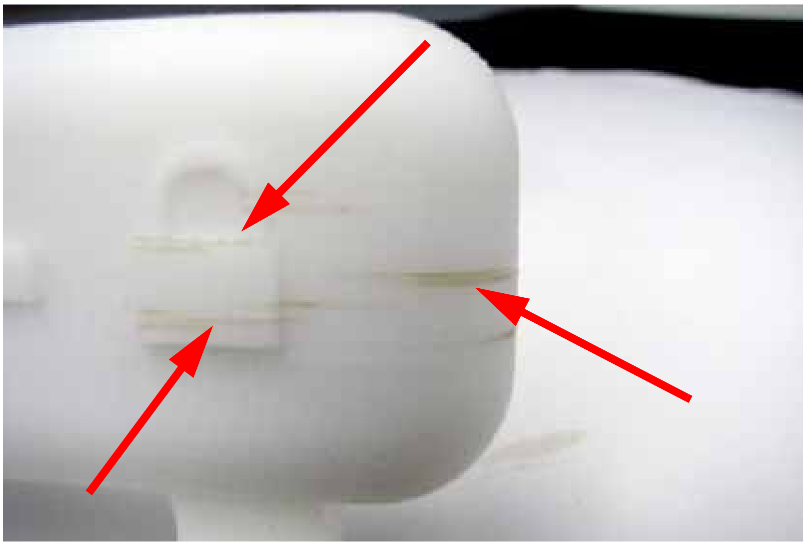
Problem corrected after re-orientation

Corrective actions

1. Change the part orientation. Rotate part 90 degrees - see example above.
2. Build the part using the “Basic” support option.
3. Material is built-up on the shields. Using a brush to remove the excess material.
4. Replace tip shields.
5. Check brush flicker assembly for damage or wear. If worn or damaged, replace brush flicker assembly.
6. Tip(s) are loose, check if tip screws are loose. Tighten tip screws.
7. Replace support material.

Brown streaks (burn marks)

Characteristics: Brown streaks in parts.

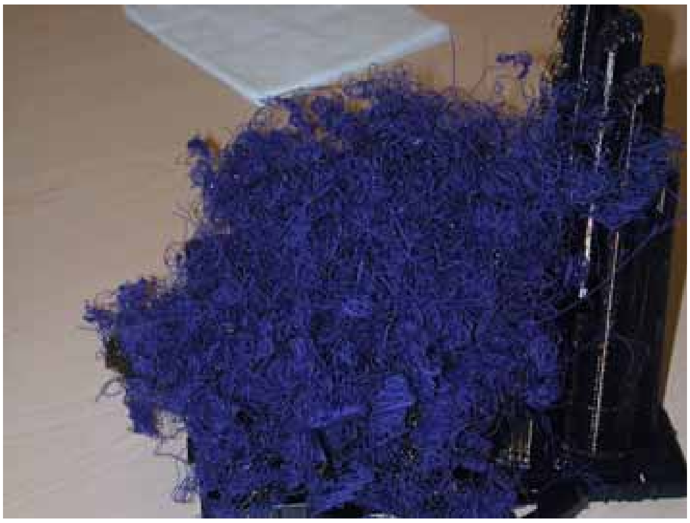


Corrective actions

1. Part geometry's are such that the model tip sits idle for an extended period of time. Change the part orientation.
2. Worn tip shields, replace tip shields.
3. Material build-up behind the tips, remove excess material.
4. Check brush and flicker for damage or wear. Replace brush and flicker if needed
5. Check and adjust the brush and flicker height.
6. Tip(s) are loose, check if tip screws are loose. Tighten tip screws.

Loss of Extrusion (LOE)

Characteristics: Material strands inside build envelope and/or partially built parts. Either the model or support material has failed to extrude from swivel head or toggle plate assembly. Can also be caused by a part falling over or a part shift.



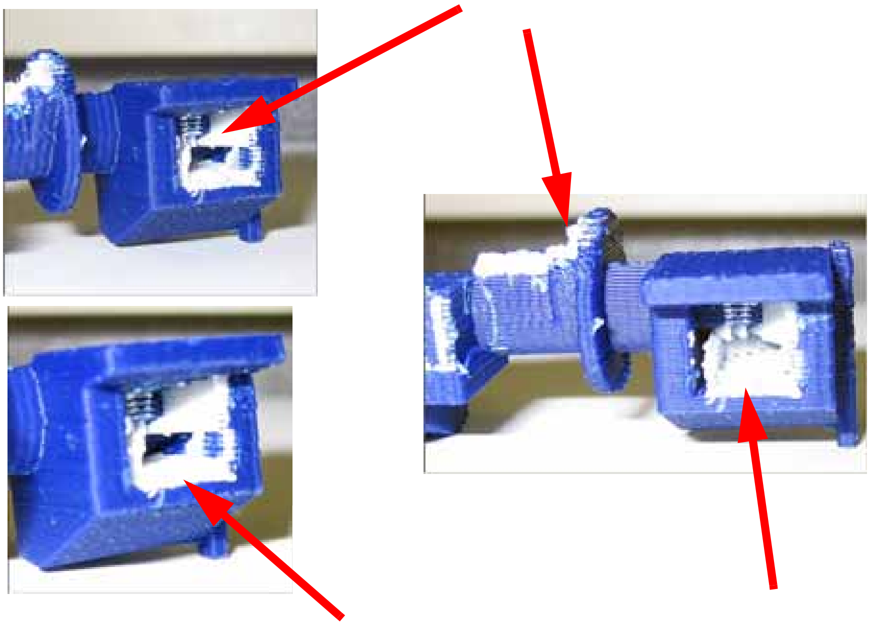
Here the support material has had a loss of extrusion, causing the model material to continue to extrude without support material under it. If the model material has had a loss of extrusion, the scenario would be reversed, the support material would have extruded with no model material under it.

Corrective actions

1. Material cartridge is jammed or empty. Replace cartridge.
2. Tips are plugged. Replace the tips
3. Toggle assembly is jammed. Attempt to clear the jam, replace the toggle head assembly if needed
4. Liquefier heater has higher than normal resistance, value should be between 175 and 216 ohms. If resistance is too high, replace the toggle head assembly.
5. Check for twisted or worn filament guide tubes. If worn replace tubes.
6. Filament motor is malfunctioning or is disconnected. Verify proper operation and connections. Test using head maintenance. Also flex the wires while extruding to test for poor connections.
7. Broken wire in umbilical cable. Replace umbilical cable.
8. Check umbilical hose for proper alignment and connection to the head cooling fan.
9. Head cooling fan has low air flow, replace the head cooling fan.
10. Z table could be jammed. Check for debris build up around lead screw and guide rods. Replace Z stage if needed.
11. Irregular XY table movement, loose guide rods or loose drive belts. Verify the guide rods are securely fastened and the drive belt tensions are correct. Replace XY table if needed.

Model embedded in to support

Characteristics: Difficult to remove the support material.

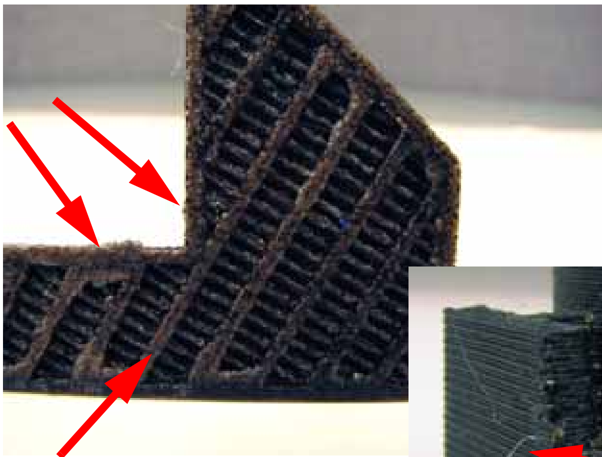


Corrective actions

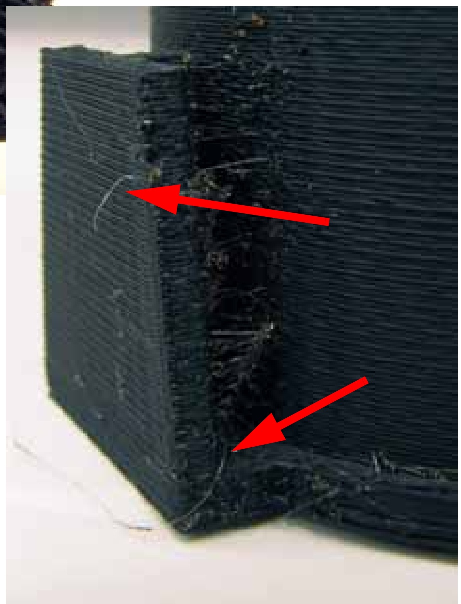
1. Run Z and Offset Calibrations
2. Check for loose tip screws. Tighten screws if required.
3. Check for loose modeling base. Use a new modeling base.

Moisture in material

Characteristics: Material will appear to rough or stringy.



Rough



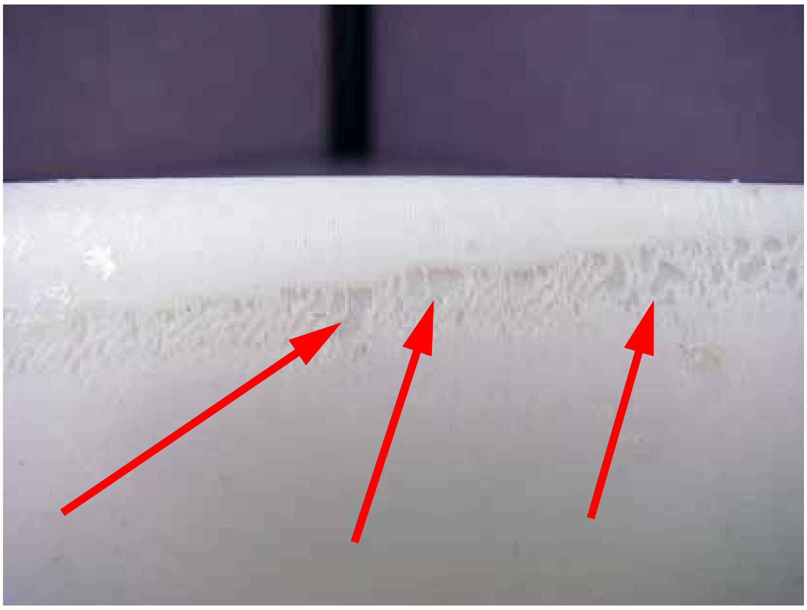
Stringy

Corrective actions

1. Material is older than one year. Replace with newer material.
2. Moisture in material. Replace using new material spool.

Open seams

Characteristics: Visible gap in the model material.

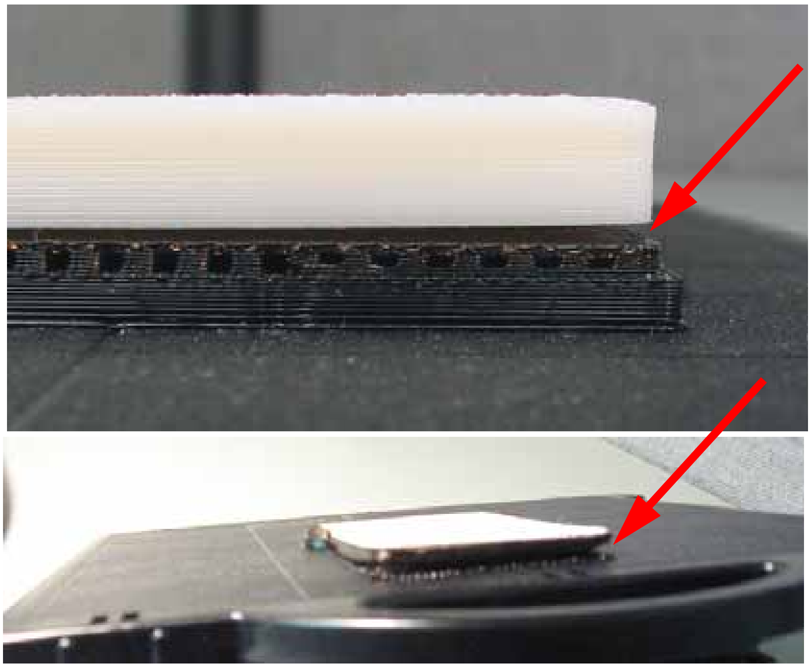


Corrective actions

1. Check the height of the brush and flicker.
2. Verify wall thickness is greater than: 0.040″ for 0.010″ slice.
3. Reprocess the part using the latest version of CatalystEX and check STL report for errors.
4. Repair STL file with original CAD program.
5. Possible bad head motor cable. Replace umbilical cable.
6. Possible bad head motor. Replace toggle head assembly.

Part curling

Characteristics: Top surface appears rough. Model and support will separate or support and substrate will separate.

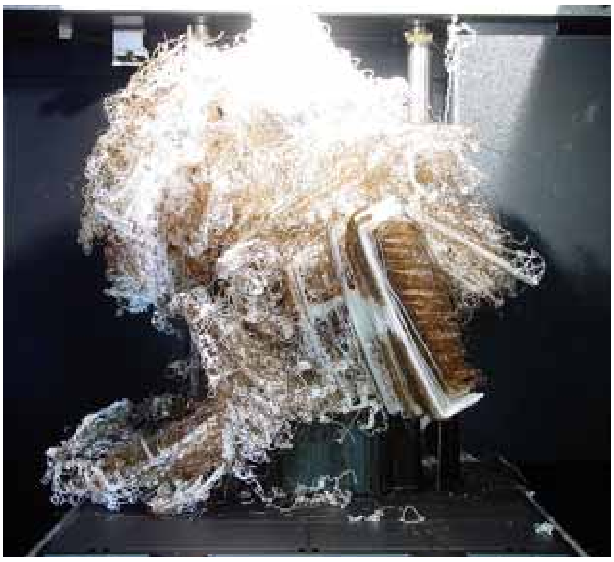


Corrective actions

1. Chamber thermocouple could be protruding too far into the chamber, verify the chamber thermocouple is positioned at the proper length. See Chamber Thermocouple on page 4-224.
2. The part is too dense, try using the “Sparse Fill” option in CatalystEX.
3. Modeling base has been re-used or is defective. Replace with unused modeling base.
4. Run Z Calibrations.
5. Verify proper operation of all chamber fans. Replace fans as needed.
6. Verify chamber heaters are secured and operating properly. Replace heaters as needed.
7. Verify X, Y and Z level is within specification. If not level, re-level and calibrate.

Part fell over

Characteristics: A part falls over and separates at the support base or substrate. Material will continue to extrude causing strands of material to build up in the envelope.



Corrective actions

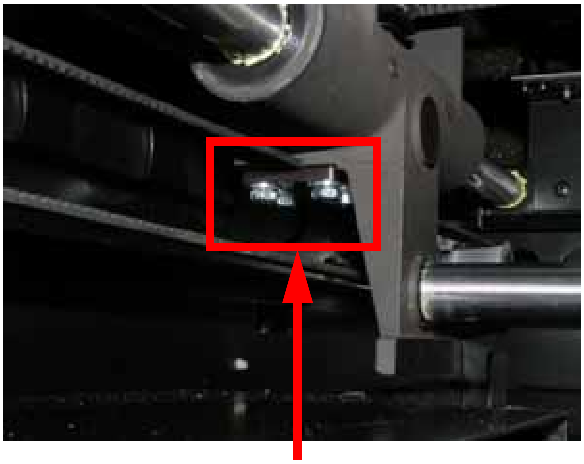
1. Substrate has been re-used or is defective. Replace the substrate.
2. Check for material build up on tips, brush and flicker. Remove excess material.
3. Verify brush/flicker height. Adjust if required.
4. The part does not have sufficient support material. Reprocess the part using basic or surround support in CatalystEX.
5. The base support layer is separating from the substrate. Run Z calibration.
6. Model material is separating from the support base top layer. Run Z calibration.
7. Z stage may not be moving properly. Check for obstructions.

Part shifting

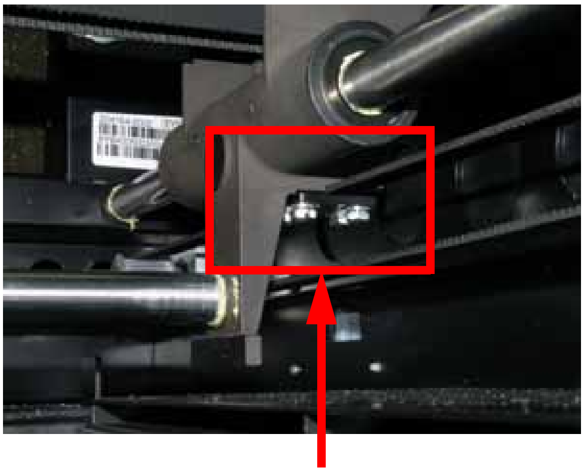
Characteristics: Model shifts in X or Y axis, this may cause unexpected contact errors with X or Y sensors.

Corrective actions

1. The modeling base is defective or is not latched tightly. Replace modeling base and latch properly.
2. Check XY table:
   A. Verify X and Y guide rods are securely fastened.
   B. Verify the toggle head moves freely.
   C. Verify proper belt tensions for X and Y axis. Tension the belts as needed.
   D. With X and Y motors unplugged, make sure the motors will spin freely.
   E. Replace the XY motors or XY table as needed.
3. Check Z stage:
   A. Clean the Z stage lead screw.
   B. Bad Z stage motor and belt. Replace Z motor and belt as needed.
   C. Verify Z stage is level. Re-level as needed.
   D. Verify the Z stage guide rods are not loose. Tighten as needed.
   E. Z stage may have too much play, replace the Z stage as needed.
4. If the part shifts in the Y axis:
   A. Check for part curl.
   B. Replace the J1, J2 and J3 ribbon cables connecting the controller board and the PDB.
   C. Replace the PDB.
   D. Check Y belt clamp for belt slipping.



Left side Y belt clamp

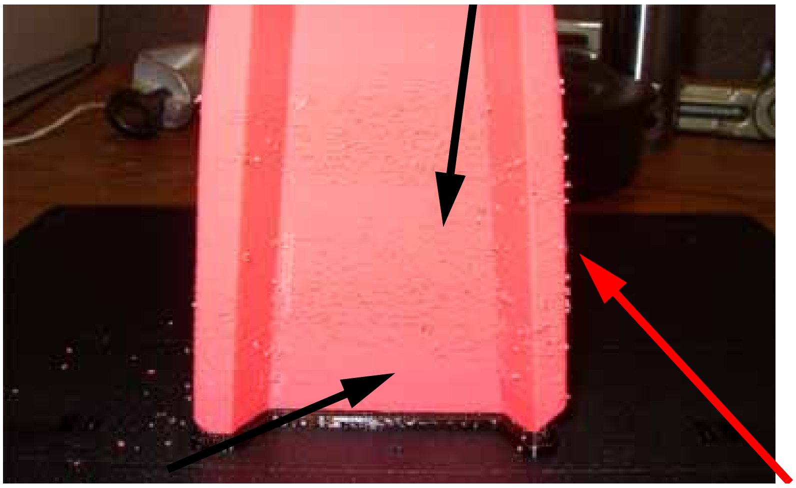


Right side Y belt clamp

E. Verify the substrate latches are latched.

Rough surface quality

Characteristics: Sides of part are rough or over filled, with little or no part shift.



Corrective actions

1. STL wall thickness is too thin. Verify proper wall thickness.
2. Reprocess the part using the latest version of CatalystEX software and check STL report for errors.
3. Check for STL errors in CAD software.
4. Replace the tip shields.
5. Loose tips screws, tighten the screws.
6. Replace the tips.
7. Deformed toggle spring, replace the toggle spring.
8. Check X/Y guide rods for loose hardware. Replace XY table as needed.

Rough quality all over

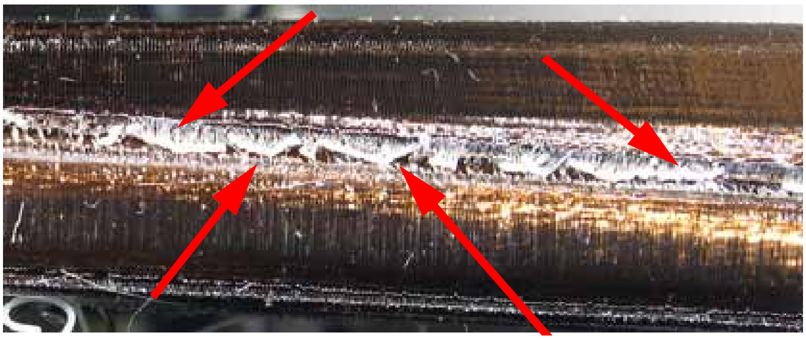
Characteristics: The part sides, top and bottom are very rough.

Corrective actions

1. Moisture in material, replace with new cartridge.
2. Reprocess the part using the latest version of CatalystEX software.
3. Check for STL errors with CAD software.
4. Replace the tip shields.
5. Loose tips screws, tighten the screws.
6. Replace the tips.
7. Deformed toggle spring, replace the toggle spring.

Model strands on parts

Characteristics: Model material strands appear outside the normal model build.

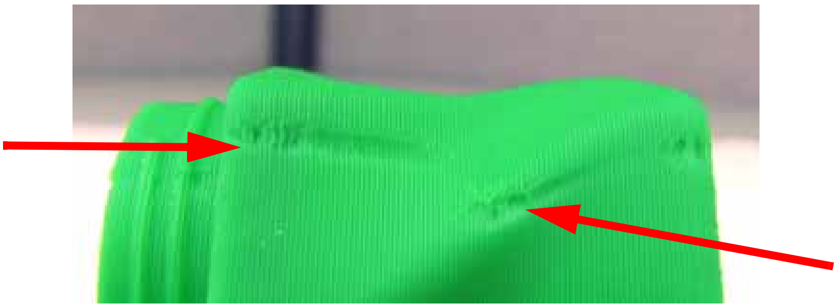


Corrective actions

1. Check for material build up on tips, brush and flicker. Remove excess material.
2. Verify brush/flicker height. Adjust if required.
3. Run Z and Offset Calibrations.
4. Check X and Y drive belt tensions.
5. Umbilical cable may have bad connection or broken wire, replace the umbilical cable.
6. Head motor is not stopping when it is supposed to. Replace the toggle head assembly.
7. Head motor is not stopping when it is supposed to. Replace the controller board.

Witness marks

Characteristics: Small void on one side of the part,

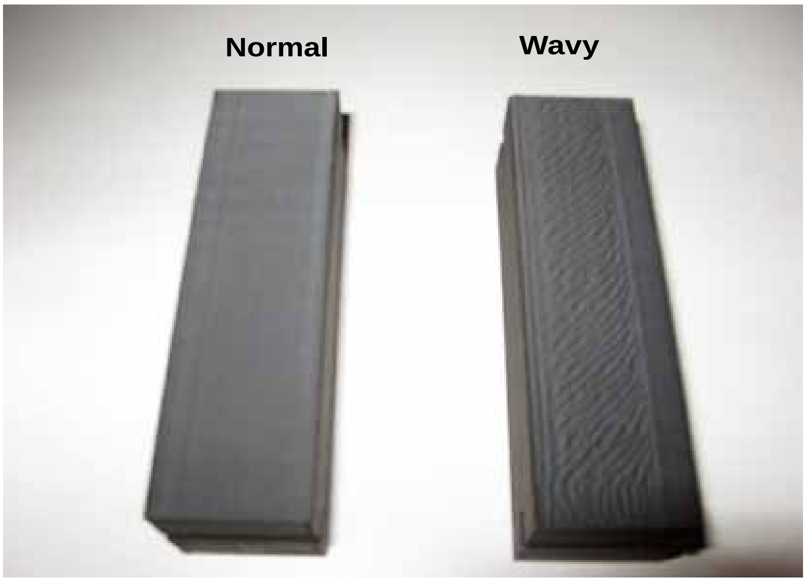


Corrective actions

1. Run Z and Offset calibrations.
2. Replace the tips.
3. Rotate the part 45 degrees in CatalystEX.

Wavy surface

Characteristics: One side of the model will have wavy build.

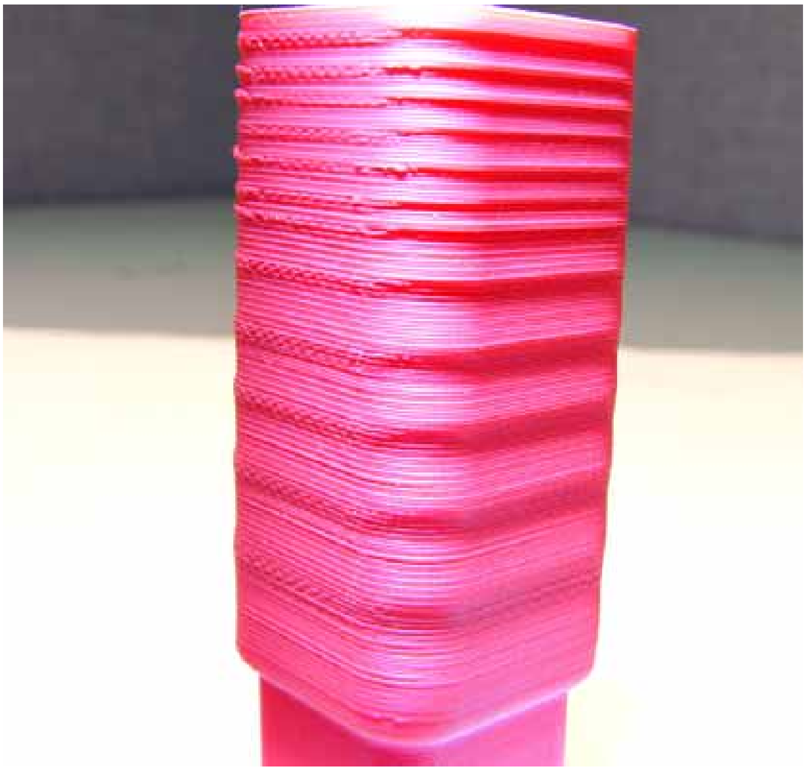


Corrective actions

1. Run Z and Offset calibrations.
2. Reprocess the part using the latest version of CatalystEX and check STL report for errors.
3. Check for STL errors in CAD software.
4. Replace the tip shields.
5. Loose tips screws, tighten the screws.
6. Replace the tips.
7. Deformed toggle spring, replace the toggle spring.
8. Check X/Y guide rods for loose hardware. Replace XY table as needed.

Wavy parts

Characteristics: Parts will shift in X and Y, giving the appearance of waves.

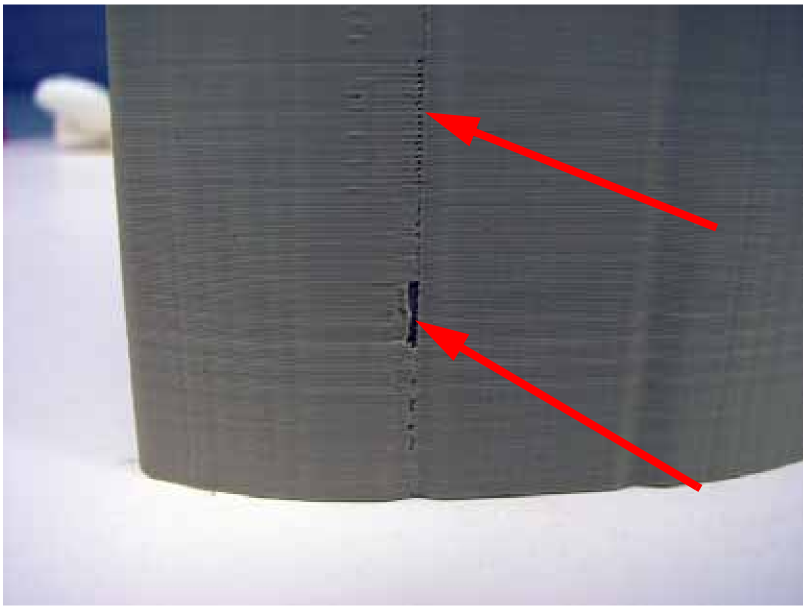


Corrective actions

1. Chamber thermocouple is not protruding far enough into the chamber, verify the chamber thermocouple is positioned at the proper length. See Chamber Thermocouple on page 4-224.
2. Verify X and Y guide rods are securely fastened.
3. Check and adjust X, Y and Z belt tensions.
4. Verify the Z stage is properly leveled.
5. Verify the Z pulley is in the correct position.
6. Replace the Z stage.
7. Replace the XY table.

Under fill

Characteristics: Open seam between start and stop of toolpaths.



Corrective actions

1. Verify wall thickness is greater than: 0.040″ for 0.010″ slice.
2. Reprocess the part using the latest version of CatalystEX software.
3. Check for material build up around head and tips.
4. Replace tips.
5. Replace the head board.

Material sagging on curved parts

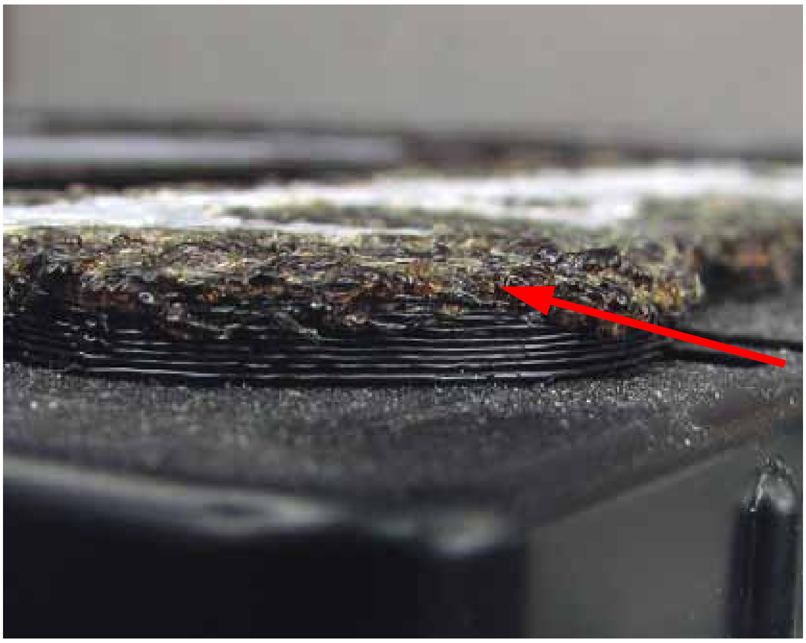
Characteristics: Surface finish not smooth.

Corrective actions

1. Reprocess the part using the latest version of CatalystEX software.
2. Reprocess part with CAD software.
3. Check for bad bearings in X/Y table. Replace XY table if needed.
4. Check Z stage:
    A. Check Z belt tension.
    B. Verify Z stage tray is level.
    C. Verify the Z stage guide rods are not loose. Tighten as needed.
    D. Check for play on Z lead screw, move up and down. Replace Z stage if needed.

Fused layers

Characteristics: Layers appear to be fused together.



Corrective actions

1. Check Z stage:
   A. Check connections to Z motor.
   B. If head is digging in to the part, check Z motor belt tension.
   C. Check to see if Z stage is jamming.
   D. Verify the Z stage is level.
   E. Verify proper operation of the Z jamming flag. May have become magnetized.
   F. If Z stage is running in to the head, verify correct position of the travel sensors.
2. Run Z calibration.

Z layers inconsistent

Characteristics: Z layers not bonding properly.

Corrective actions

1. Check Z stage:
   A. Verify Z motor is tightly secured.
   B. Verify Z stage is level.
   C. Replace the Z motor.
   D. Replace the Z stage if substrate is lower in the back (failed to find home).
2. Replace the tips.

TeraTerm

Using TeraTerm

When using these commands, there is a high risk of damage to the machine because the printer does not recognize the location of any other components in the machine that may be in the way. This means if you use the command to move the Z-Stage, you will have to make sure that the Head is moved out of the way. The same if you want to move the X-Y axis. The Z-Stage has to be moved out of the way. The printer does see the EOT switches and the Home Sensors.

Required Tools

- TeraTerm software installed on workstation or lap top computer.

Note: Version 4.71 is used for these instructions, other version may function differently.

- Null modem cable (“Laplink”) with DB9 style connectors, pins 2 and 3 swapped .

Note: If your computer does not have a serial port, connect through a quality USB to serial converter. We recommend the IOGEAR GUC232A.

- Computer with Windows XP, Windows Vista or Windows 7.

Connecting with TeraTerm

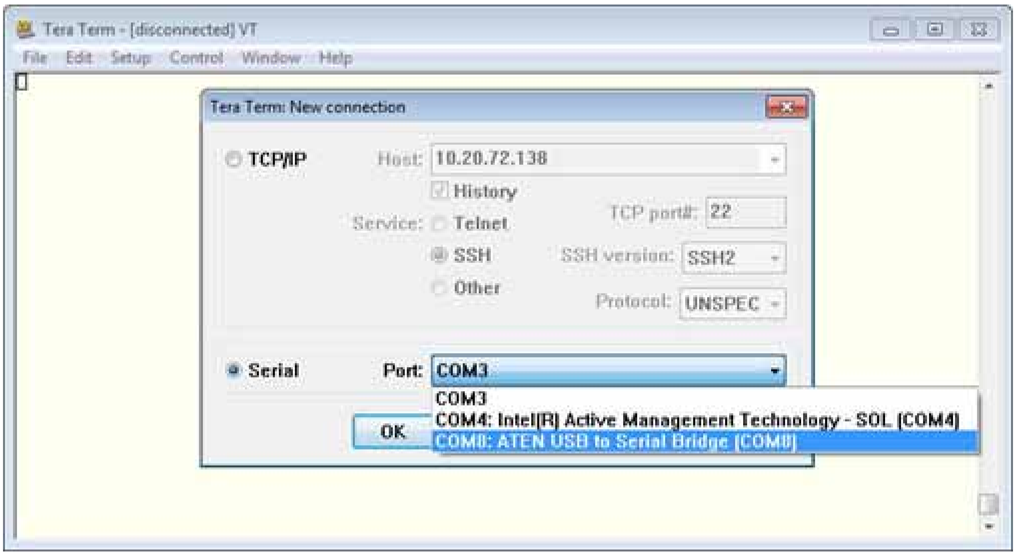
1. Verify printer is powered ON.
2. Connect the Null modem cable or USB to serial converter cable from the computer to the printer serial port connector.
3. Open TeraTerm:

4. Once TeraTerm is started the New Connection Window will come up, see Figure 6-428. If the New Connection window does not open, click **File** > **New Connection.**

Figure 6-428: New Connection Window

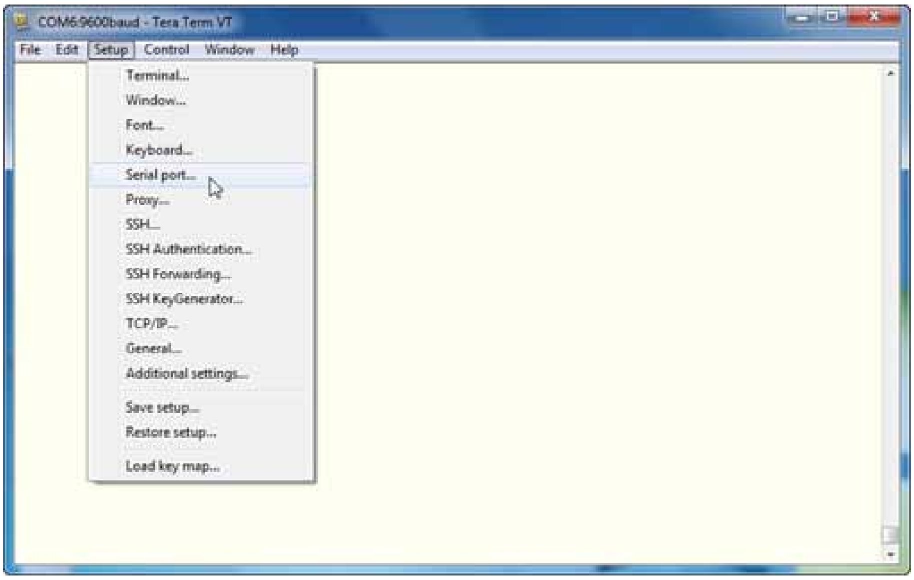
5. Select the **Serial** radio button, see Figure 6-429.
6. From the **Port:** pull-down menu select the COM port that the USB to serial converter is connected to, see Figure 6-429.

Figure 6-429: New Connection Settings



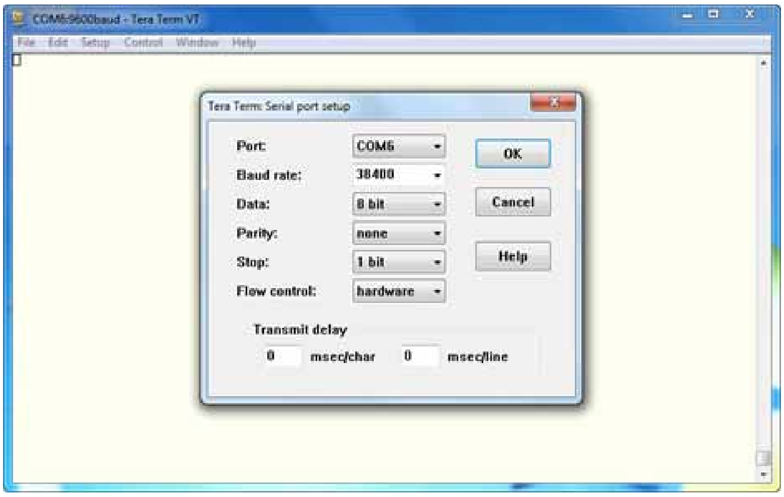
7. Click **OK.**
8. Click on **Setup** > **Serial Port,** see Figure 6-430.

Figure 6-430: Setup Serial Port



9. From the **Baud Rate:** pull-down menu select **38400**, see Figure 6-431.
10. From the **Flow Control:** pull-down menu select **hardware**, see Figure 6-431.
11. The rest of the settings should default to the correct values. Click **OK**, see Figure 6-431.

Figure 6-431: Serial Port Setup



12. The connection should now be established.
    A. To test the connection, type **ss** and press the **Enter** key. "Information should post on the screen if the connection was successful.

Note: "If text does not appear in Tera Term you may have the wrong COM Port selected, there may be an issue with the Null Modem Cable or there may be an issue with the USB to serial converter.

TeraTerm Commands

TeraTerm is an easy way to check and troubleshoot the hardware of a machine. Here are a couple of helpful commands which can be used to operate the machine through TeraTerm. All values, which are displayed in TeraTerm, are in inches. For some commands, the machine must find Home position before you can enter commands.

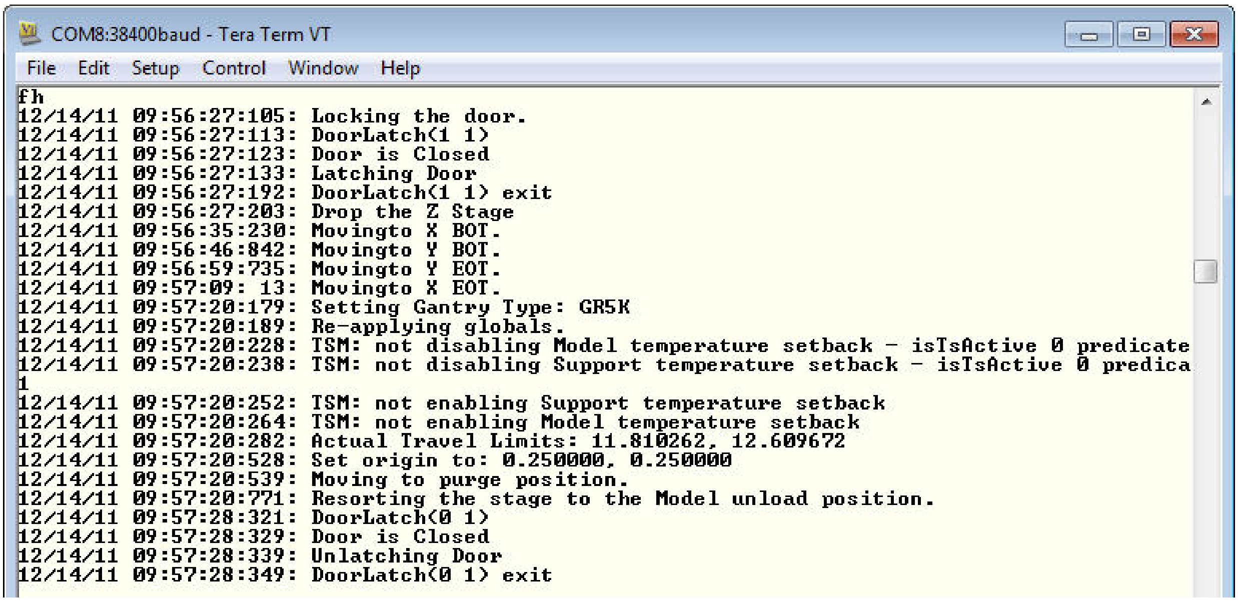
Note: For a list of commands type **help** and press **Enter**.
Type **help** (space) **command** and press **Enter** for command information.
Example = **help fh**

1. **trace c commandDetails on**
   This command enables the printer information to be displayed in the Tera Term window.
2. **fh** = Find Home.
   This command determines the XY axis home position. It locates the X and Y axis limit switches, sets the origin, and places the head over the purge bucket.

   Used for testing X/Y limit sensors. During boot-up process; a bad sensor could leave the machine stuck in initializing, **fh** will help find the right sensor.

   Example= fh The values which are displayed are explained below, see Figure 6-432.

Figure 6-432: Find Home



Setting Gantry Type:	During the home sequence, the machine is also looking at which table is installed in the machine (cable drive or Belt drive). GR5K means, the Gear Ratio is 5000 microsteps/inch.
Actual Travel Limits:	This is the distance between the BOT (Begin Of Travel) and EOT (End Of Travel) Sensors in inches.
Set origin to:	This gives an offset to the BOT sensors so the machine is not moving into the sensors during a build.

3. **fz** = Find Z home

This command determines the Z axis home position. This position is determined by the modeling base that is installed in the system. The find home command must be executed before this command will work.

Used to check for obstructions causing Z sensor errors. Also good for checking the Z foam sensor touch down points (Z stage going bad).

Example: fz The values, which are displayed, are explained below, see Figure 6-433.

Figure 6-433: Find Z Home

```
COM8:38400baud - Tera Term VT
File  Edit  Setup  Control  Window  Help
fz
12/14/11 09:59:45:878: DoorLatch(1 1)
12/14/11 09:59:45:886: Door is Closed
12/14/11 09:59:45:896: Latching Door
12/14/11 09:59:46:955: DoorLatch(1 1) exit
12/14/11 09:59:46:964: DoorLatch(1 1)
12/14/11 09:59:46:974: Door is Closed
12/14/11 09:59:46:984: Door already latched
12/14/11 09:59:46:995: DoorLatch(1 1) exit
12/14/11 09:59:46: 13: Moving Z axis down to clear the modeling plane.
12/14/11 09:59:46:756: Moving head to safe position.
12/14/11 09:59:46:785: Moving to eotClearance below Z BOT.
12/14/11 10:00:04:433: Moving to purge position.
Foundation type: Plastic
12/14/11 10:00:04:925: Ignoring motion limits.
12/14/11 10:00:05: 83: Z stage cleared.
12/14/11 10:00:05: 93: Motion limits restored.
12/14/11 10:00:07:326: Put surface sensor down.
12/14/11 10:00:12:134: Z Moved to BOT.
12/14/11 10:00:12:148: Set Z zero.
12/14/11 10:00:12:753: Z stage cleared.
12/14/11 10:00:12:761: Foundation is Plastic : Wait time is = 60000
12/14/11 10:01:14:732: Surface at touch point 1.400000,5.200000,0.315
12/14/11 10:01:16:465: Surface at touch point 0.000000,0.000000,0.312
12/14/11 10:01:18:655: Surface at touch point 9.000000,0.000000,0.316
12/14/11 10:01:20:376: Surface at touch point 7.100000,5.200000,0.316
12/14/11 10:01:24:399: Put surface sensor up.
12/14/11 10:01:24:409: Average surface 0.314488.
12/14/11 10:01:24:422: Lowest surface 0.312125.
12/14/11 10:01:41:171: Z Moved to EOT.
12/14/11 10:01:41:182: SR64K type Z stage detected..
12/14/11 10:01:41:196: Re-applying globals.
12/14/11 10:01:41:235: TSM: not disabling Model temperature setback - isTsActive 0 predicate
 1
12/14/11 10:01:41:245: TSM: not disabling Support temperature setback - isTsActive 0 predica
te 1
12/14/11 10:01:41:259: TSM: not enabling Support temperature setback
12/14/11 10:01:41:271: TSM: not enabling Model temperature setback
12/14/11 10:01:41:289: Actual Travel Limit: 12.681562
12/14/11 10:01:41:306: Z adjusted for BOT Offset.
12/14/11 10:01:54:135: Move to Z zero.
12/14/11 10:01:54:145: DoorLatch(0 1)
12/14/11 10:01:54:154: Door is Closed
12/14/11 10:01:54:164: Unlatching Door
12/14/11 10:01:54:175: DoorLatch(0 1) exit
```

Surface at touch point:	This is the distance in inches from the surface of the substrate to the Z BOT sensor.
Average surface:	This is the Average distance in inches between the substrate and the Z BOT sensor. The machine is looking for the planarity of the substrate, if the substrate is not flat, then the machine will not home.
Lowest surface:	This is the lowest distance in inches between the substrate and the Z BOT sensor.
	SR64K type Z-Stage detected means, that the Z-Stage has a Gear Ratio of 64000 microsteps per inch. This indicates either a three leadscrew Z-Stage or a single leadscrew Z-Stage.

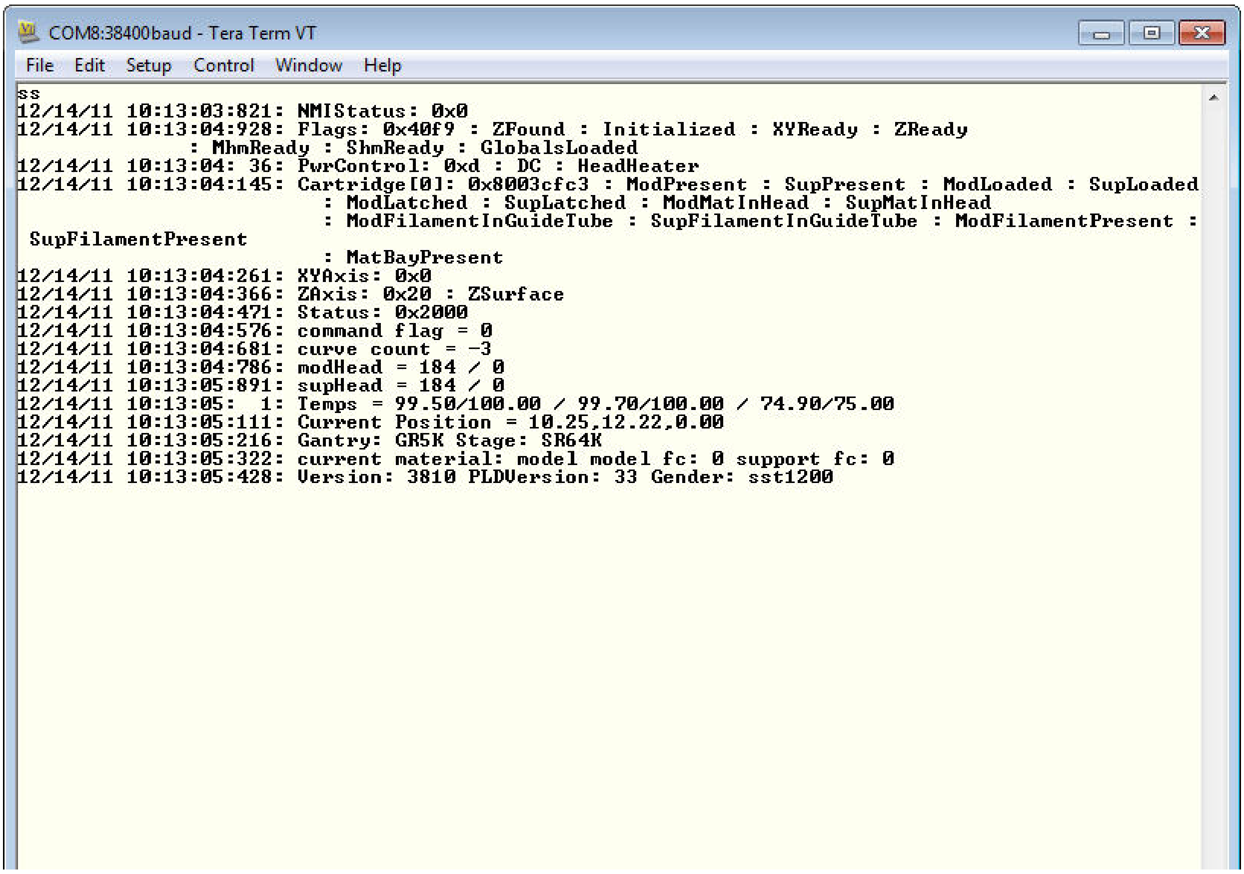
4. **ss** = Switch Status

   The **ss** diagnostic message reports system status. The controller outputs a report on optical and mechanical switches to the terminal window.

   Use this for checking:

- Printer Gender (sent either wrong system software or .CAL file to printer).
- Motor gear ratio (if the system does not home correctly, the gear ratio could be changed from cable table to belt table).
- Head temp set point (with MaracaEX you can change the temp to not match system software specification, causing errors).
- System Software version check.

Figure 6-434: Switch status

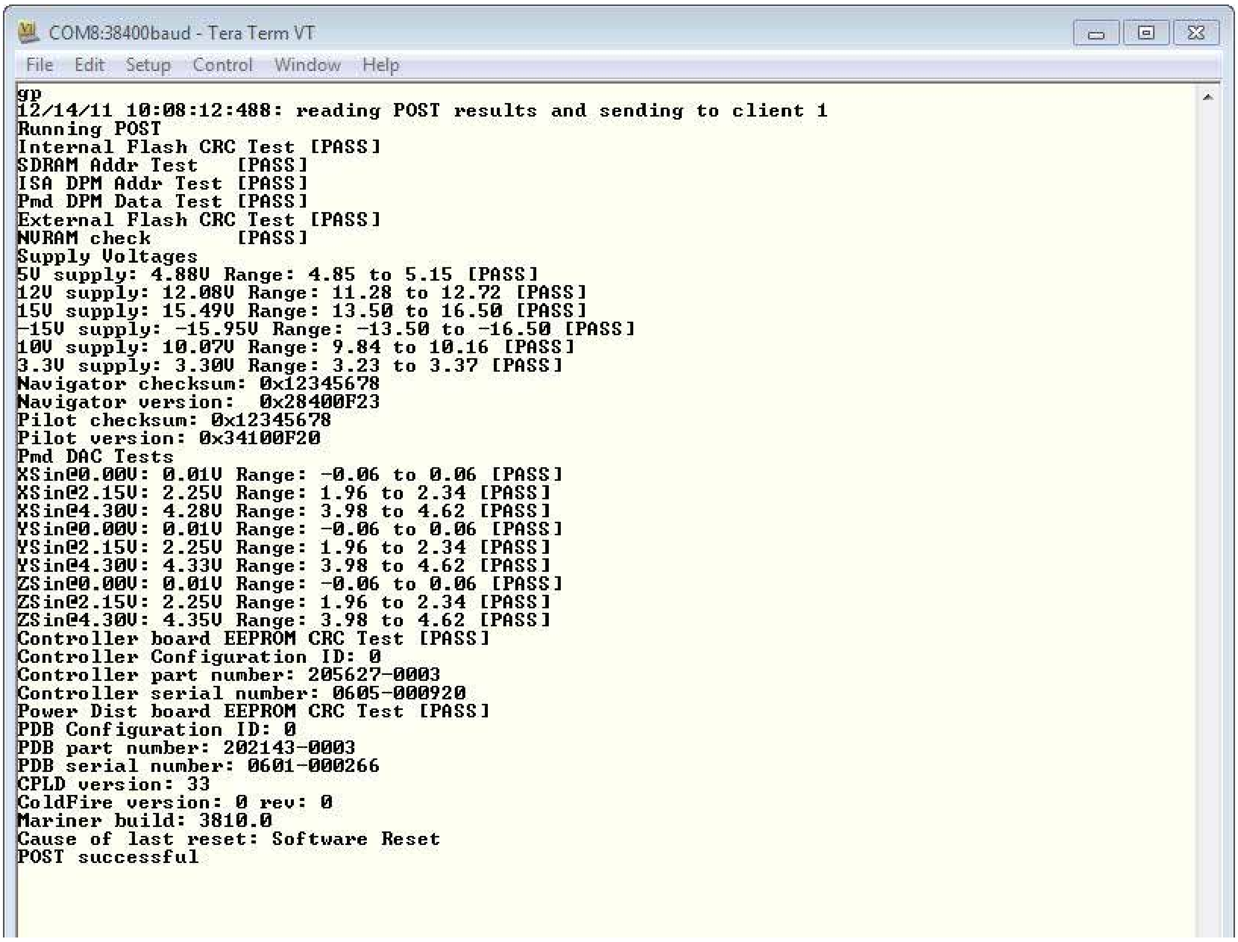


```
COM8:38400baud - Tera Term VT
File  Edit  Setup  Control  Window  Help
ss
12/14/11 10:13:03:821: NMIStatus: 0x0
12/14/11 10:13:04:928: Flags: 0x40f9 : ZFound : Initialized : XYReady : ZReady
              : MhmReady : ShmReady : GlobalsLoaded
12/14/11 10:13:04: 36: PwrControl: 0xd : DC : HeadHeater
12/14/11 10:13:04:145: Cartridge[0]: 0x8003cfc3 : ModPresent : SupPresent : ModLoaded : SupLoaded
                         : ModLatched : SupLatched : ModMatInHead : SupMatInHead
                         : ModFilamentInGuideTube : SupFilamentInGuideTube : ModFilamentPresent :
 SupFilamentPresent
                         : MatBayPresent
12/14/11 10:13:04:261: XYAxis: 0x0
12/14/11 10:13:04:366: ZAxis: 0x20 : ZSurface
12/14/11 10:13:04:471: Status: 0x2000
12/14/11 10:13:04:576: command flag = 0
12/14/11 10:13:04:681: curve count = -3
12/14/11 10:13:04:786: modHead = 184 / 0
12/14/11 10:13:05:891: supHead = 184 / 0
12/14/11 10:13:05:  1: Temps = 99.50/100.00 / 99.70/100.00 / 74.90/75.00
12/14/11 10:13:05:111: Current Position = 10.25,12.22,0.00
12/14/11 10:13:05:216: Gantry: GR5K Stage: SR64K
12/14/11 10:13:05:322: current material: model model fc: 0 support fc: 0
12/14/11 10:13:05:428: Version: 3810 PLDVersion: 33 Gender: sst1200
```

5. **gp =** get POST. Displays power on self test results
   Use this for checking:

- If the controller board passes the power on self test and to see the reason for the last reset.
- For the reason a new hard drive will not boot. The main problem is the voltage checking process will have a voltage fail during POST; this prevents the hard drive from booting.
- Verify all voltages are ok.

Figure 6-435: Get POST



```
COM8:38400baud - Tera Term VT
File  Edit  Setup  Control  Window  Help
gp
12/14/11 10:08:12:488: reading POST results and sending to client 1
Running POST
Internal Flash CRC Test [PASS]
SDRAM Addr Test    [PASS]
ISA DPM Addr Test [PASS]
Pmd DPM Data Test [PASS]
External Flash CRC Test [PASS]
NVRAM check        [PASS]
Supply Voltages
5V supply: 4.88V Range: 4.85 to 5.15 [PASS]
12V supply: 12.08V Range: 11.28 to 12.72 [PASS]
15V supply: 15.49V Range: 13.50 to 16.50 [PASS]
-15V supply: -15.95V Range: -13.50 to -16.50 [PASS]
10V supply: 10.07V Range: 9.84 to 10.16 [PASS]
3.3V supply: 3.30V Range: 3.23 to 3.37 [PASS]
Navigator checksum: 0x12345678
Navigator version:  0x28400F23
Pilot checksum: 0x12345678
Pilot version: 0x34100F20
Pmd DAC Tests
XSin@0.00V: 0.01V Range: -0.06 to 0.06 [PASS]
XSin@2.15V: 2.25V Range: 1.96 to 2.34 [PASS]
XSin@4.30V: 4.28V Range: 3.98 to 4.62 [PASS]
YSin@0.00V: 0.01V Range: -0.06 to 0.06 [PASS]
YSin@2.15V: 2.25V Range: 1.96 to 2.34 [PASS]
YSin@4.30V: 4.33V Range: 3.98 to 4.62 [PASS]
ZSin@0.00V: 0.01V Range: -0.06 to 0.06 [PASS]
ZSin@2.15V: 2.25V Range: 1.96 to 2.34 [PASS]
ZSin@4.30V: 4.35V Range: 3.98 to 4.62 [PASS]
Controller board EEPROM CRC Test [PASS]
Controller Configuration ID: 0
Controller part number: 205627-0003
Controller serial number: 0605-000920
Power Dist board EEPROM CRC Test [PASS]
PDB Configuration ID: 0
PDB part number: 202143-0003
PDB serial number: 0601-000266
CPLD version: 33
ColdFire version: 0 rev: 0
Mariner build: 3810.0
Cause of last reset: Software Reset
POST successful
```

6. **rt =** repeat

   This command will tell the machine to repeat the previous command. The command line takes a repeat count, and flags whether or not to ignore errors. It also flags wether or not to show the command line of the command to be run. The command line consists of one or more commands separated by semicolons. The entire command line must be enclosed within double quotes. Each command within the command line consists of a name and its parameters. The command line is run until the iteration count is reached or an error occurs. For each iteration, each command within the command line is run in the order in which it appears.

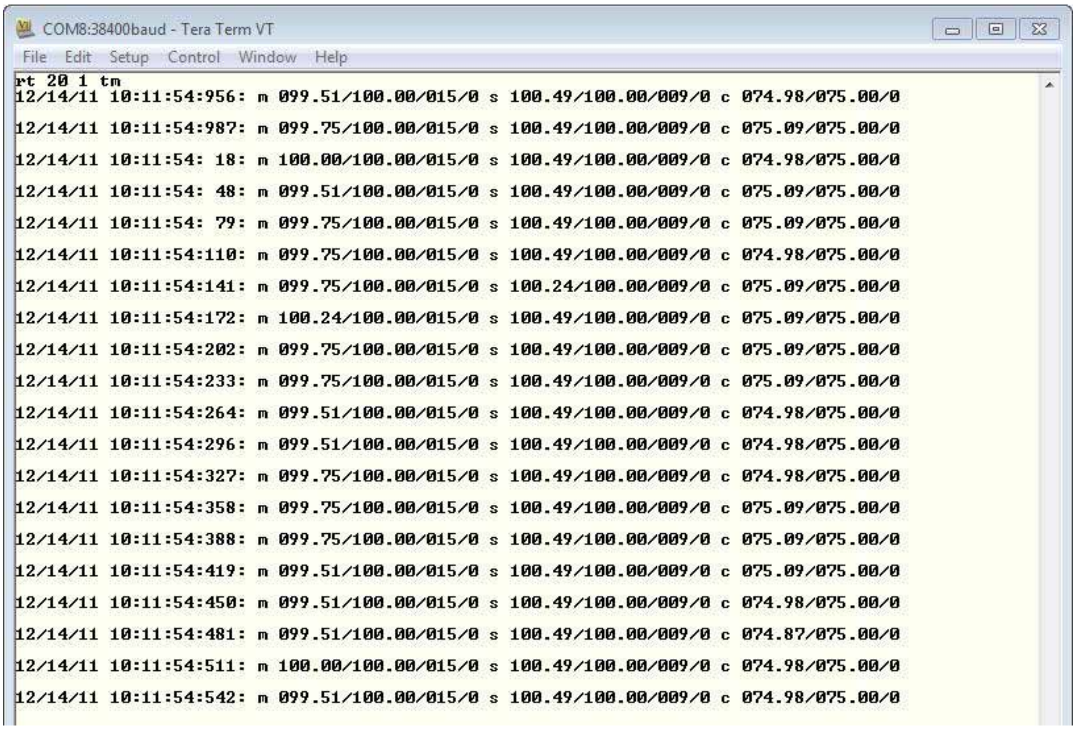
- The command **RT 1000 0 tm** will help troubleshoot temperature issues in maintenance mode only.
- The command **RT 100 0 fh** or **RT 100 0 fz** will help verify any X/Y/Z sensors that had issues before the repair are tested and operational.

  Parameters:

signed integer count	This parameter specifies the number of times the command is to be run.
signed integer ignoreErrors	This parameter specifies whether errors should be ignored. A value of zero causes the test to stop when an is encountered A value of one causes the test to run for the full count even when errors occur.
string commandLine	This parameter contains the command line of the command to be run enclosed within double quotes. A commandline includes the name of the command followed by it's parameters.

Example: **rt 20 1 tm**

Figure 6-436: Repeat



7. **le =** load exception log

This command prints the contents of the exception log located in non-volatile memory. This exception log contains a record of the most recent exceptions that occurred within the controller. The exceptions are printed in chronological order.

Use this command to get the history of system errors printed on the screen. This works best to troubleshoot past error codes and see if they relate to the current issue. Displays in chronological order.

Figure 6-437: Load exception

```
COM8:38400baud - Tera Term VT
File  Edit  Setup  Control  Window  Help
le
   1: 09/23/11 08:51:30:918: LiquefierHeater.cpp:703:INFO:Head liquefier is not heating up:Model
   2: 09/23/11 08:51:30:929: Abort request from CF_PeriodicTimer.cpp line 355: Head liquefier is
not heating up
   3: 09/26/11 05:03:35:321: Head temperature stall condition (Model:89.50/094) - dropping power
   4: 09/26/11 05:03:35:334: LiquefierHeater.cpp:703:INFO:Head liquefier is not heating up:Model
   5: 09/26/11 05:03:35:346: Abort request from CF_PeriodicTimer.cpp line 355: Head liquefier is
not heating up
   6: 09/26/11 06:08:09:320: Head temperature stall condition (Model:89.50/094) - dropping power
   7: 09/26/11 06:08:09:333: LiquefierHeater.cpp:703:INFO:Head liquefier is not heating up:Model
   8: 09/26/11 06:08:09:345: Abort request from CF_PeriodicTimer.cpp line 355: Head liquefier is
not heating up
   9: 11/18/11 10:10:17:388: CommandParser.cpp:470:INFO:Invalid command:
  10: 11/18/11 10:16:37:912: CommandParser.cpp:470:INFO:Invalid command:
  11: 11/18/11 14:01:53:326: Head temperature stall condition (Model:89.50/094) - dropping power
  12: 11/18/11 14:01:53:339: LiquefierHeater.cpp:703:INFO:Head liquefier is not heating up:Model
  13: 11/18/11 14:01:53:351: Abort request from CF_PeriodicTimer.cpp line 355: Head liquefier is
not heating up
  14: 11/18/11 14:09:38:319: Head temperature stall condition (Model:89.50/094) - dropping power
  15: 11/18/11 14:09:38:332: LiquefierHeater.cpp:703:INFO:Head liquefier is not heating up:Model
  16: 11/18/11 14:09:38:344: Abort request from CF_PeriodicTimer.cpp line 355: Head liquefier is
not heating up
  17: 11/18/11 14:18:14:319: Head temperature stall condition (Model:89.50/094) - dropping power
  18: 11/18/11 14:18:14:333: LiquefierHeater.cpp:703:INFO:Head liquefier is not heating up:Model
  19: 11/18/11 14:18:14:344: Abort request from CF_PeriodicTimer.cpp line 355: Head liquefier is
not heating up
  20: 11/18/11 14:33:41:504: Head temperature stall condition (Model:89.50/094) - dropping power
  21: 11/18/11 14:33:41:517: LiquefierHeater.cpp:703:INFO:Head liquefier is not heating up:Model
  22: 11/18/11 14:33:41:528: Abort request from CF_PeriodicTimer.cpp line 355: Head liquefier is
not heating up
  23: 11/28/11 10:44:59:307: FindZHome.cpp:413:INFO:Z stage planarity beyond tolerance:
  24: 11/28/11 10:47:08:285: FindZHome.cpp:413:INFO:Z stage planarity beyond tolerance:
  25: 11/28/11 11:40:04:362: CommandParser.cpp:482:INFO:Invalid command:
  26: 11/28/11 11:49:38:  33: CommandParser.cpp:482:INFO:Invalid command:
  27: 11/28/11 11:50:32:958: ProdigyChamber.cpp:312:INFO:Door safety violation:door is latched, n
ot making toolpath, axes are not in motion
  28: 11/28/11 11:50:32:731: Abort request from CPLD_IoInterface.cpp line 771: Door safety violat
ion
  29: 01/01/70 00:00:52:531: CommandParser.cpp:482:INFO:Invalid command:
  30: 01/01/70 00:02:01:189: CommandParser.cpp:482:INFO:Invalid command:
  31: 11/28/11 13:03:00:582: AtTemperature.cpp:154:INFO:The operation is not implemented:
  32: 11/28/11 13:03:09:357: AtTemperature.cpp:154:INFO:The operation is not implemented:
  33: 11/28/11 13:22:34:765: CommandParser.cpp:482:INFO:Invalid command:
  34: 11/28/11 13:22:47:211: PClassBay.cpp:159:INFO:Invalid argument:bay 1 not present
  35: 11/28/11 13:42:23:   6: CommandParser.cpp:482:INFO:Invalid command:
  36: 11/28/11 13:45:47:312: CommandParser.cpp:482:INFO:Invalid command:
  37: 11/28/11 13:46:32:944: CommandParser.cpp:482:INFO:Invalid command:
  38: 11/28/11 13:46:52:680: CommandParser.cpp:482:INFO:Invalid command:
  39: 11/28/11 13:47:08:531: CommandParser.cpp:482:INFO:Invalid command:
  40: 11/28/11 13:47:16:808: HawaiiLoadCartridge.cpp:206:INFO:Invalid argument:invalid material t
ype 3
  41: 11/28/11 13:49:12:143: CommandParser.cpp:482:INFO:Invalid command:
  42: 11/28/11 13:53:35:665: CommandParser.cpp:482:INFO:Invalid command:
  43: 11/28/11 15:36:37:285: HawaiiActivateHead.cpp:119:INFO:Head temperature set-point too low:
  44: 12/14/11 09:34:27:581: WatchdogMonitor.cpp:104:INFO:Watchdog timeout:Watchdog timeout
SP 0x2000bf9c PC c007154c SR 3700
watchdog supervisor state: 0 0 0
stack:
c0134610 1a51e 18c86 c01f5054 c0014e4a 424ea 42e44 43478 4367c

  45: 12/14/11 09:34:27:581: IntervalTimer.h:350:INFO:Run-time error:IntervalTimer<PmdCommands, i
nt>::isDone(): ipl 7 not less than 6
  46: 12/14/11 09:34:27:581: Abort request from CF_GeneralPurposeTimer.cpp line 1768: Watchdog ti
meout
  47: 01/01/70 00:01:01:358: PClassMotion.cpp:2107:INFO:Find home failed, Z EOT not tripped:
  48: 01/01/70 00:01:02:178: Abort request from Main.cpp line 191: Find home failed, Z EOT not tr
```

8. **tm** = monitors temperatures

This command displays temperature information for the model Liquefier, support liquefier, and chamber heater.

Use this command if you experience temperature problems with the head. Check if the model and support temperature reach the set point and if the temperature is stable once it reaches the set point temperature. Check if the PWM value varies instead of switching on and off. If the PWM switches on and off, then the T/C board might be the root cause. (see also 14:67 error in the Troubleshooting Guide)

Used for troubleshooting TC errors. Enter maintenance mode with the head at full temp and wiggle the umbilical cable to check for wire issue. Also to check if the PWM works to system specifications (you should see a slow change in PWM like 20 to 30 to 40 not 10 to 100).

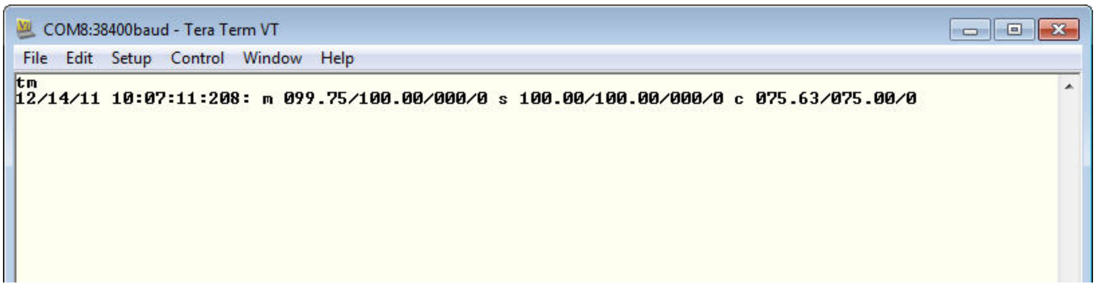
The information is displayed on a single line in the following format:

MM/DD/YY HH:MM:SS:

m <cur>/<set>/<pwm>/<ts> s <cur>/<set>/<pwm>/<ts> c <cur>/<set>/<on/off>

Parameter	Description
<cur>	Current temperature
<set>	Current temperature setpoint
<pwm>	Pulse Width Modulation status
<ts>	Temperature setback (1 = Active, 0 = Inactive)
m	Model
s	Support
c	Chamber

Figure 6-438: Monitor temperatures



Examples:

Command	Description
tm	Single print of the current temperatures
tm 1	One line displaying temperatures updating every second
tm 0	Turns off temperature updating every second
rt XXXX 1 tm	Prints the temperature continually the number of times represented by XXXX

9. **mz** = Move Z

   The MZ command moves the Z-Stage relative to the current position. A positive value moves the Z-Stage down. A negative value moves the Z-Stage up.

   Example: **mz 4.0** This command will move the Z-Stage 4 inch down.

10. **mx** = move x

    This command moves the head in the X axis.

    Parameters:

    Float Position:

    This is the absolute position it moves to, in inches, when the command is sent from the Console and in device units when the command is sent through the DPM.

    Example: **mx 3.0** (moves the X-Axis 3 inches away from the X-Home sensor)

11. **my** = move y

    This command moves the head in the y axis.

    Parameters:

    Float Position:

    This is the absolute position it moves to, in inches, when the command is sent from the Console and in device units when the command is sent through the DPM.

    Example: **my 3.0** (moves the Y-Axis 3 inches away from the Y-Home sensor)

12. **cl** = chamber light

    This command turns the chamber light on and off.

    Example: **cl 1**

    Parameters:

Command	Description
cl 0	Turns the light off
cl 1	Turns the light on

13. **dl** = door latch

    This command controls the door latch solenoid. The door latch can be opened or closed.

    Example: **dl 1**

    Parameters:

Command	Description
dl 0	Opens door latch
dl 1	Closes door latch
dl 2	Places controller in charge of door latch

Preventive Maintenance

7

Follow the simple procedures within this chapter to ensure continued proper operation of the printer.

Startup Kit Tools

The Startup Kit contains replacement parts and a set of tools used to help you maintain the system. The following is a list of the tools contained in the Startup Kit.

- Needle Nose Pliers
- T-Handled Wrench - $^1/_8$"
- T-Handled Wrench - $^7/_{64}$"
- Leather Insulated Gloves (Pair)
- Cutters
- Brush (bronze)
- Magnifier

Preventive Maintenance

Daily

Inspect the tip wipe assembly

After each build you should inspect the tip wipe assembly to make sure there is no material build up or wear. If there is material build up or wear, clean the tip wipe assembly. Material build up on the tip wipe assembly can cause part quality issues. See Replace the Brush/Flicker Assembly on page 7-6.

Inspect the tip shrouds

After each build you should inspect the tip shrouds for damage or material build up. If there is material build up remove it as needed. If the material will not break free or there is damage to the tip shield, replace the tip shield. See Tip Shields on page 7-7.

Remove debris buildup

Remove all material buildup on the Z platform and around the lead screw. Failure to do so could cause the base to not be level or the Z platform to jam at its upper limit.

Vacuum build chamber

Vacuum the build chamber to remove all debris and purged material.

Clean door

The door glass can be cleaned with any commercial glass cleaner.

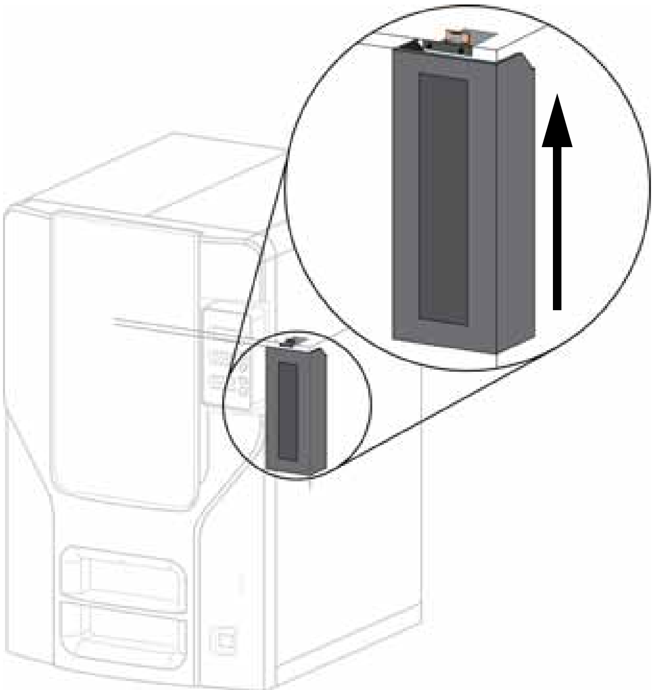
Empty the purge container

The plastic purge container is attached to the right side of the modeling envelope rear wall, see Figure 7-439.

Note: A full purge container may impact part quality.

1. Remove the purge container by grasping it and pushing it upward to release it from its three mounts. See Figure 7-439.

Figure 7-439: Purge container location



2. Pull the container towards you and out of the chamber.

Caution: When reinstalling the container, make sure that it locks on all three mounts and hangs flush with the chamber wall to avoid damage.

3. Empty the container and reinstall on 3 mounts.

Tip Area Clean-up

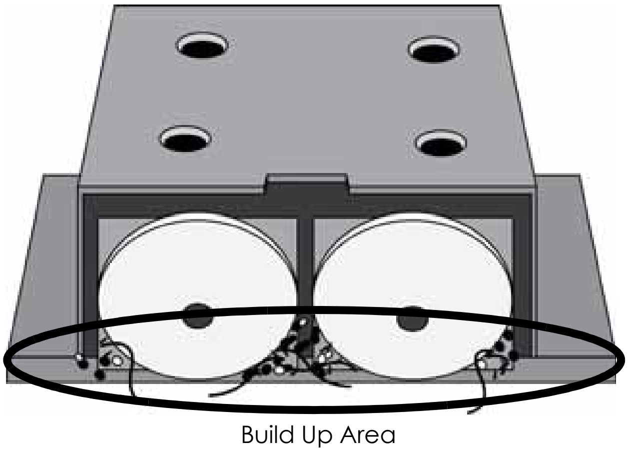
Material can build up on the metal strip behind the extrusion tips (Figure 7-440). Build up can be caused by an overflowing Purge Bucket or an improperly adjusted Tip Cleaning Assembly.

1. From the display panel, press **Maintenance**.
2. Press **Machine**.
3. Press **Head**. The head will come to rest in the center of the chamber and the Z Platform will change position.

Gloves: The head area is very hot! Use leather gloves when working in this area of printer!

4. Clean the area of all material using the needle nose pliers supplied with your Start Up Kit.
5. Press **Done**, until back at **Idle**.

Figure 7-440: Material Buildup Behind Tips



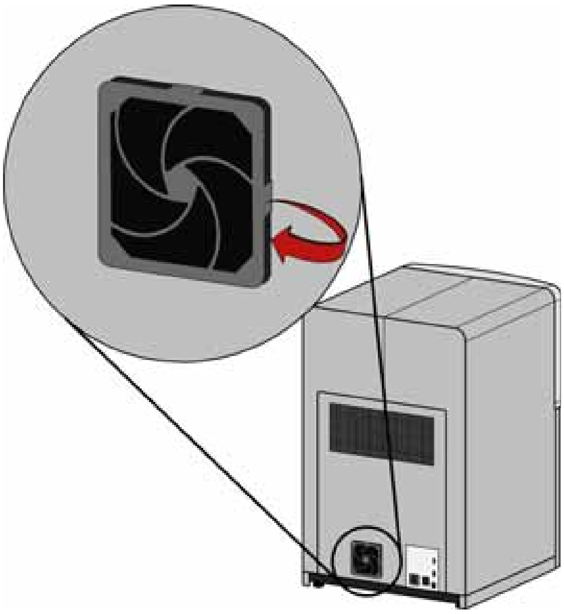
500 Hour Maintenance

Fan Filter

Clean the fan filter

1. Locate the lower fan on the rear panel of the printer and remove the plastic frame (snaps on and off) that secures the fan filter. See Figure 7-441.

Figure 7-441: Lower fan location



2. Clean the filter with soap and water, and blot it dry.
3. Reassemble.

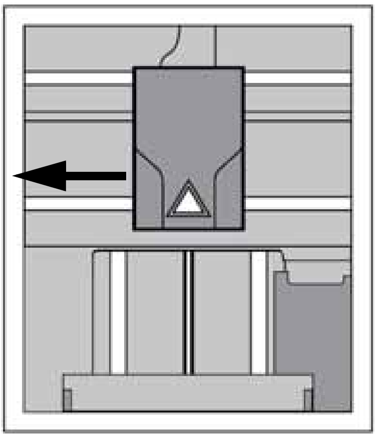
Brush/Flicker Assembly

Note: The brush/flicker should be replaced after 500 hours, prior to performing Tip Cleaning Assembly Maintenance.

Replace the Brush/Flicker Assembly

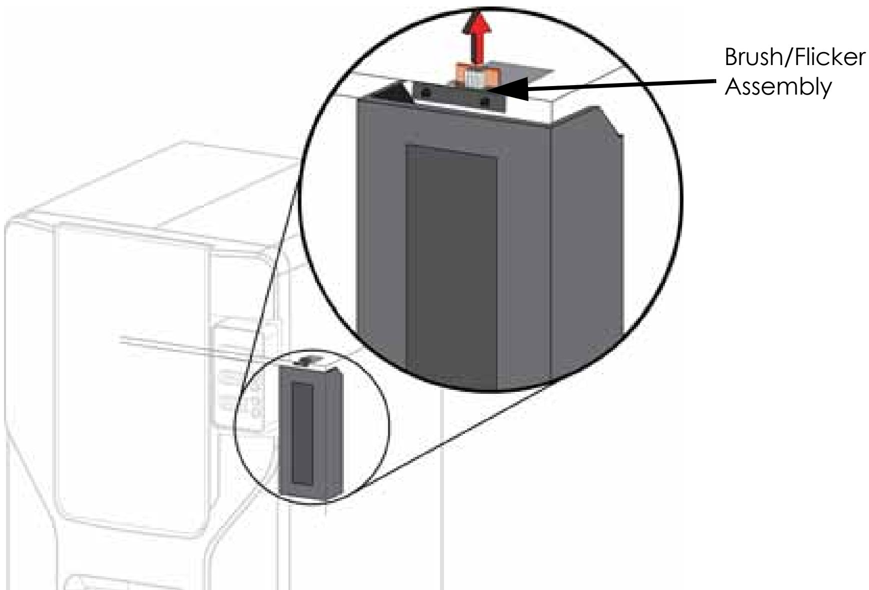
1. Completely power down the printer.
2. Move the Toggle Head to the left of the machine in order to gain access to the Brush/Flicker Assembly, see Figure 7-442.

Figure 7-442: Move the Toggle Head to the left



3. Remove the Brush/Flicker Assembly by lifting the assembly up and out of the machine. Discard the old Brush/Flicker Assembly, see Figure 7-443.

Figure 7-443: Replacing the Brush/Flicker Assembly



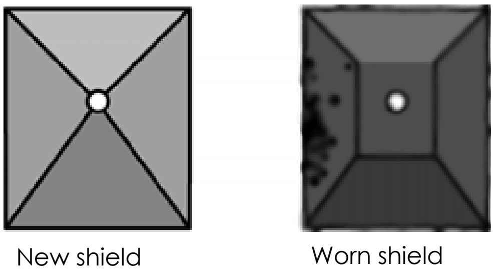
4. Place the new Brush/Flicker Assembly over the two mounting posts making sure the assembly is fully seated.

Tip Shields

Tip shields can become torn or damaged over time. This can have a negative impact on the surface finish and detail of models.

Replacing Tip Shields

Figure 7-444: Tip Shield Damage

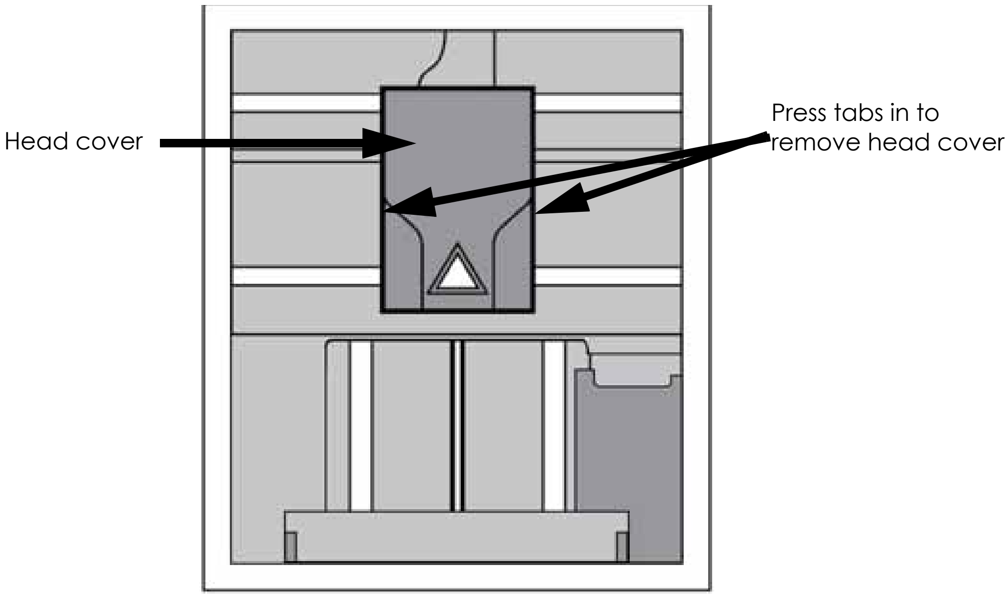


1. Enter **Head Maintenance**.
   A. From the display panel press **Maintenance**.
   B. Press **Machine**.
   C. Press **Head.** The head will come to rest in the center of the chamber and the Z platform will change position.

Gloves: The head area is hot, wear gloves when working in this area of the printer.

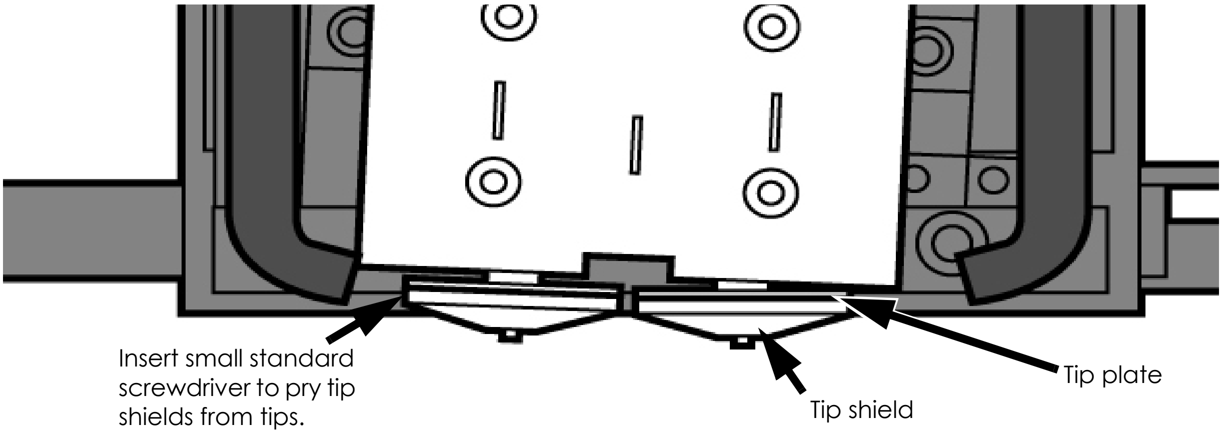
2. Remove the head cover by pressing the tabs in and pulling away from the head. See Figure 7-445.

Figure 7-445: Head cover tab locations



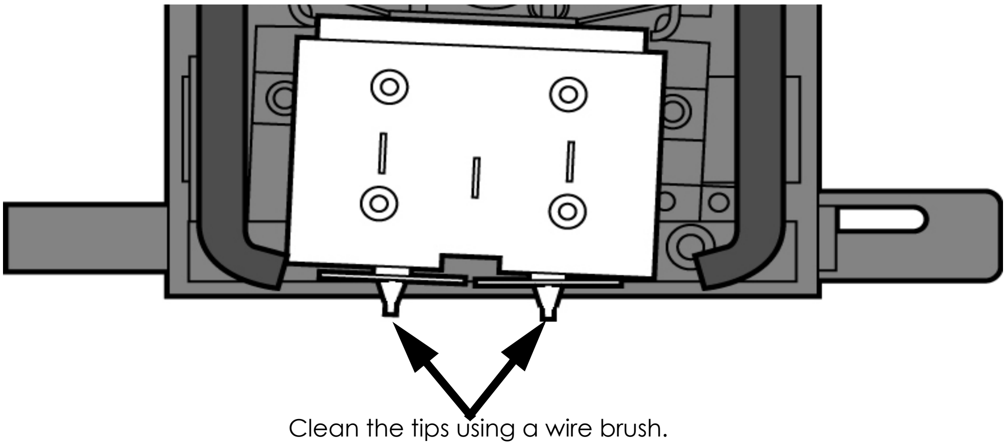
3. Position the blade of a small screwdriver between the tip shield and tip plate. Use the blade of the small screwdriver to separate the tip shield from the tip plate. See Figure 7-446.

Figure 7-446: Tip Shield removal



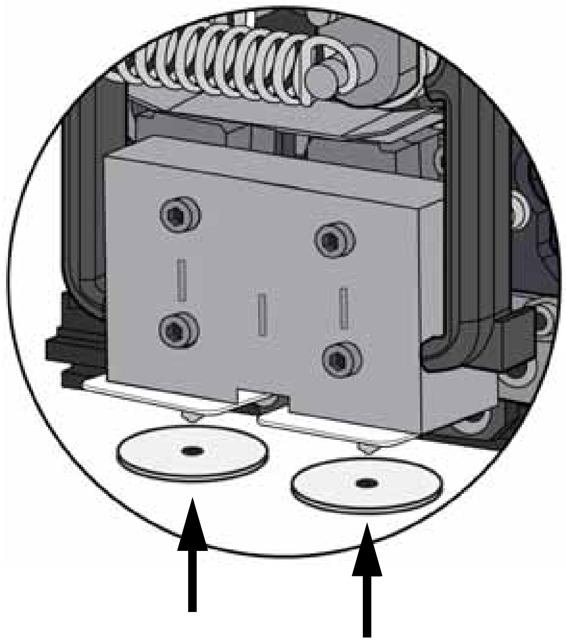
4. Clean the tip using the wire brush supplied with the Startup Kit to remove any debris. See Figure 7-447.

Figure 7-447: Clean tips with wire brush



5. Install a new tip shield by pushing it, by hand, over the exposed tip, keeping the slotted end towards the back of the tip. See Figure 7-448.

Figure 7-448: Tip shield installation



6. Replace head cover.

Note: If the head cover is not replaced the printer may not function properly.

7. Exit **Maintenance**, press **Done** until back at **Idle**.

2000 Hour Maintenance

Liquefier Tip Replacement

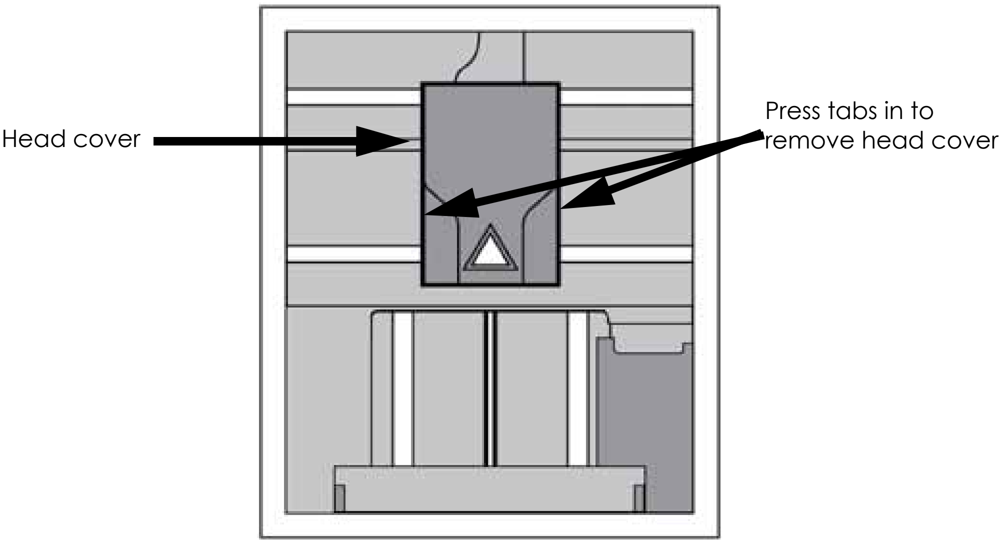
Replace Tips at approximately 2000 hours - depending upon operating conditions. Tips can also be damaged by improper care while performing maintenance in the area around the tips.

Note: CatalystEX displays the tip time (hrs) - from the Printer Services Tab - Printer Info button (Tip time will reset to zero after replacement).

Removing Tips

1. You will need to make sure the printer is powered ON before replacing the extrusion tips.
2. From the display panel press **Maintenance.**
3. Press **Machine.**
4. Press **Tip**.
5. Press **Replace**.
6. The printer will display **Load Model - Unloading.**
7. You can now open the printer door and replace the tips - or you can **Cancel** the tip replacement procedure.
8. Remove plastic head cover by squeezing raised pads on sides of cover. See Figure 7-449.

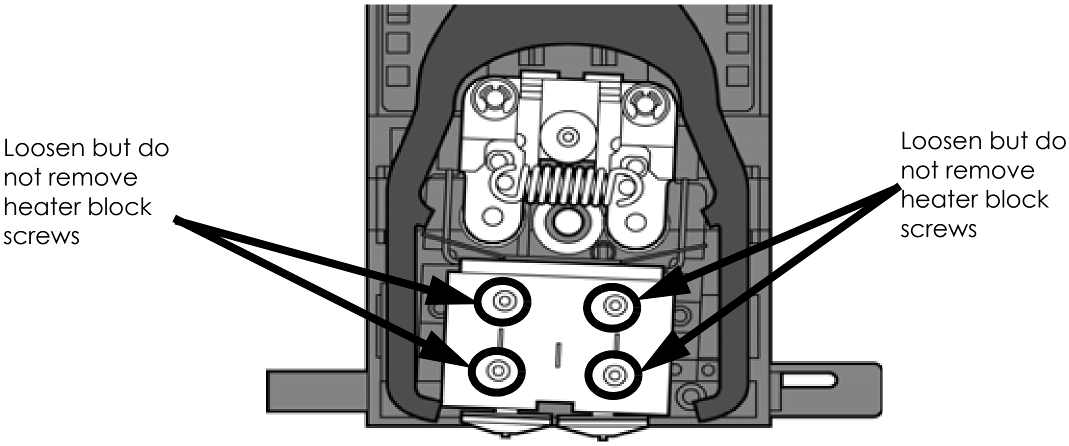
Figure 7-449: Removing the Head Cover



9. Remove Tips:

   A. Use $^{7}/_{64}$″ T-Handle Allen wrench to loosen the heater block screws three to four full turns counterclockwise - or until the top of the screws are flush with the metal cover. DO NOT remove the screws entirely. See Figure 7-450.

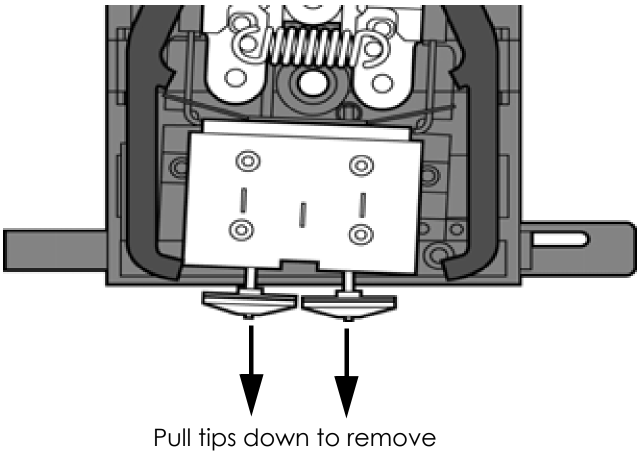
Figure 7-450: Tip removal



B. Use needle nose pliers to grasp the stainless steel shield of the tip.

C. Pull the tip shield toward you, then pull down to remove the tip from the heater block. Discard the used tip. See Figure 7-451.

Figure 7-451: Remove the tips



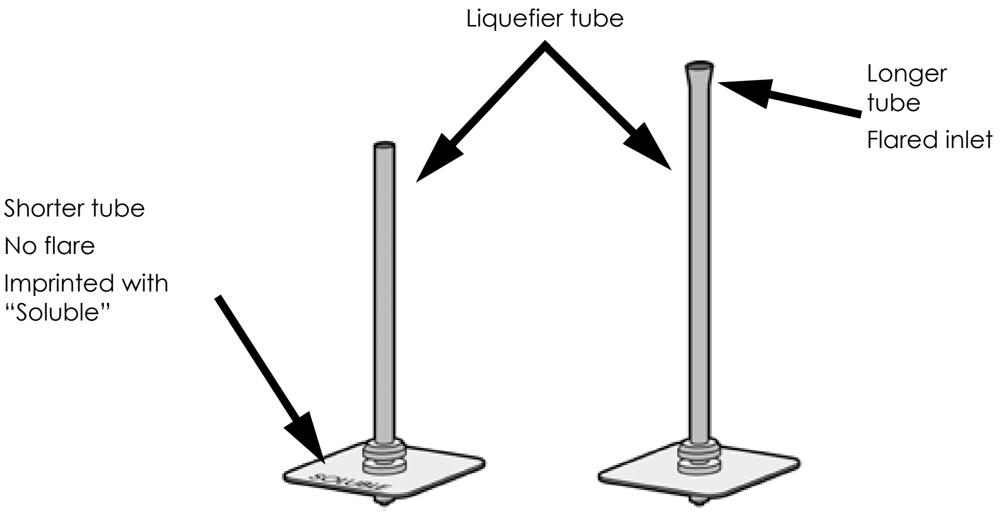
D. Repeat for second tip if necessary.

Installing Tips

1. For a Dimension BST1200es, the SUPPORT tip and MODEL tip are interchangeable. Both tips are the same as the MODEL tip shown in Figure 7-452. (The tips come in a Red capped container).
2. For a Dimension SST 1200es, you must identify the correct replacement tip. The SST 1200es uses two tip types. You must make sure a SUPPORT tip is used on the LEFT side of the head assembly. A MODEL tip must be used on the RIGHT side of the head assembly (See Figure 7-452). The Model tip comes in a red capped container. The Support tip comes in a black capped container.

Caution: For a Dimension SST 1200 or Dimension SST 1200es: Model and SOLUBLE support tips are different. The correct tip must be installed in the correct side.

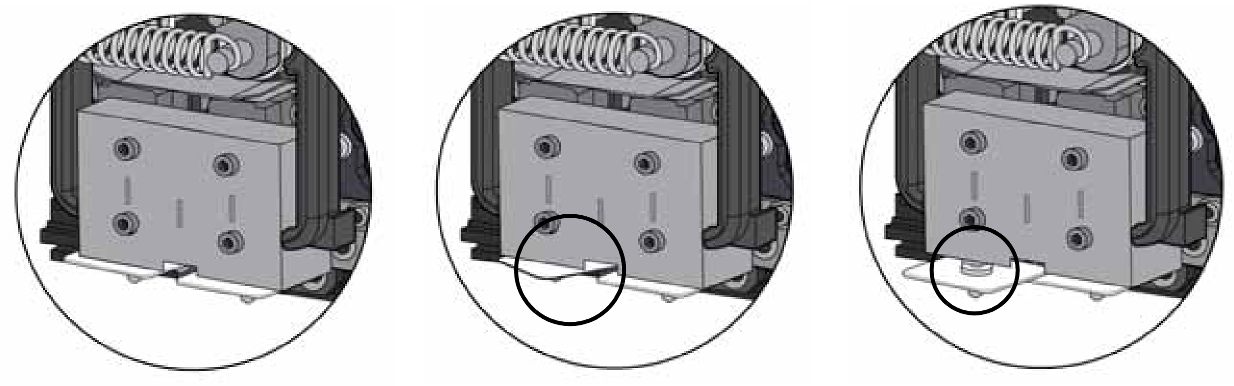
Figure 7-452: Identifying Tips



3. With gloved hand, insert the new tip into the heater block.
4. Use needle nose pliers to grasp the stainless steel shield of the tip.
5. Pull the tip shield toward you, then lift up to install the tip.
6. Push the tip toward the back of the printer once it is all the way up against the heater block.
7. Verify the tip is fully inserted into the heater block and that the stainless steel shield is aligned, see Figure 7-453.
8. Use $^{7}/_{64}$" T-Handle Allen wrench to firmly tighten the heater block clamp screws.

Note: Make sure Tip remains all the way up against the heater block as you tighten the screws.

Figure 7-453: Installation Examples



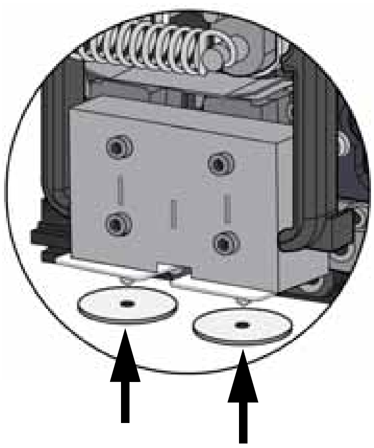
CORRECT

INCORRECT -
Shield interference

INCORRECT -
Tip not seated

9. Repeat steps 3 through 8 for second tip if necessary.
10. Install the tip shields by pushing up onto the tips. See Figure 7-454.

Figure 7-454: Install shields



11. Replace Plastic Head Cover and close the printer door.
12. The printer will display **Tip Maintenance - Tips Replaced?** - select **Yes** to begin material load.
    A. The printer will display **Load Model - Replace Both Cartridges** (flashing).
        - If you want to replace a material cartridge, do so now.
        - If you do NOT want to change a material cartridge, you must unlatch and latch the cartridges to continue (Press the cartridge forward to unlatch, then press it forward again to latch).

> **Note:** Because the material ‘unloaded’ during the tip replacement, the printer is in a material replacement mode. You must unlatch/latch the cartridges to continue.

        - If there is a delay in the unlatch/latch process, the printer will display **Both Cartridges Not Replaced Or Invalid.** Select **Retry**, then unlatch/latch the cartridges.
    B. The printer will now begin to load material.
    C. After Material Loading is complete the printer will display **Tip Calibration - Install Modeling Base And Build Calibration Part.**

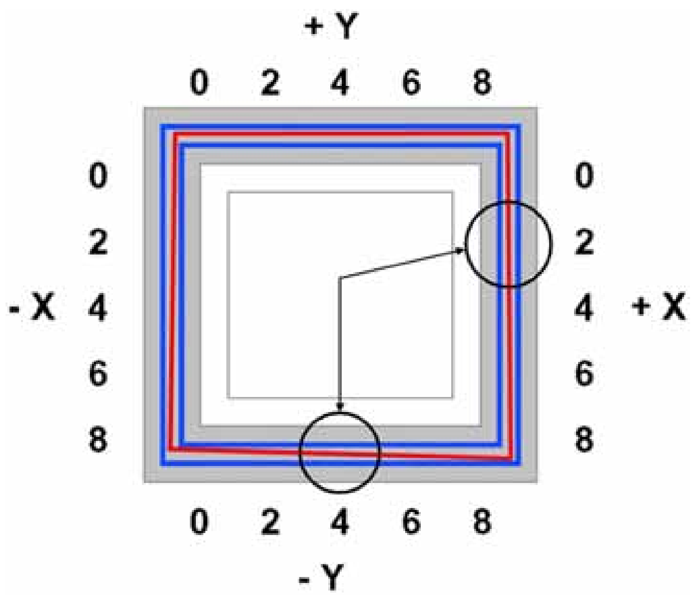
Caution: Make sure a NEW, UNUSED modeling base is installed before starting calibration. Calibration results will be incorrect if a NEW, UNUSED modeling base is not used.

Tip calibration

Tip replacement requires Tip Calibration.

1. Select **Start Part** (flashing) - the printer will run two calibration parts.
   - The printer will automatically build a Z Calibration part, measure the part and calibrate the Z Axis for tip depth and tip level (approximately 5 minutes). The Z calibration is automatic.
   - The printer will then automatically build an XY Calibration part (approximately 10 minutes). You must inspect the XY Calibration part and calibrate the X and Y axis for tip offset:
2. When the XY Calibration part is complete the printer will display **Remove Part and Select XY Adjustment - X:0, Y:0**
3. Remove the XY tip calibration part from the printer.
4. Inspect the part and calibrate the X and Y axis, See Figure 7-455.
   A. Use the magnifier from the Startup kit to view the support road (shown in red).
   B. Identify the location on the +X or –X side of the part where the support road is best centered within the model boundaries (shown in blue).
   C. Read the number closest to this location. This is the required X Tip Offset adjustment. If the number is on the -X side, a negative offset is required.
   D. Select **Increment** or **Decrement** to input the X offset adjustment - the value will change in the upper display window (by default, the printer will be ready to accept the X value).
   E. When you are satisfied with your X offset value, **Select Y** and repeat steps A- D to identify and input the required Y Tip Offset adjustment.

Figure 7-455: Example XY Tip Offset Part.
This example requires an adjustment of X = + 2, Y = - 4



5. Select **Done** after you have input the X and Y offsets. The printer will return to **Maintenance.** Run the XY calibration a second time to be sure the values changed the offset properly.
6. When finished, press **Done** until back at **Idle**.

As Needed Maintenance

The following maintenance items have no routine schedule but should be tended to as needed.

Chamber Light Bar

ESD Sensitive! ESD: Use proper ESD grounding techniques when handling electronic components.

Caution: Use only a factory authorized replacement light bar.

Replace a chamber light bar when it burns out.

Note: There are two light bars in the modeling chamber. They are located on the front wall of the chamber - one to the right, the other to the left of the chamber door.

Replace chamber light bar

1. Power down the printer.
2. Locate the wiring harness leading away from the bottom of the light bar.
3. Disconnect the light bar from the wiring harness by squeezing the wiring harness clip while pulling down.
4. Remove the light bar by removing the 3 attachment screws (top, middle, bottom) - use the $^{7}/_{64}$" T-handle wrench supplied in the Startup Kit.
5. Install a replacement light bar with the 3 attachment screws - do not overtighten the screws.
6. Re-attach the wiring harness lead.

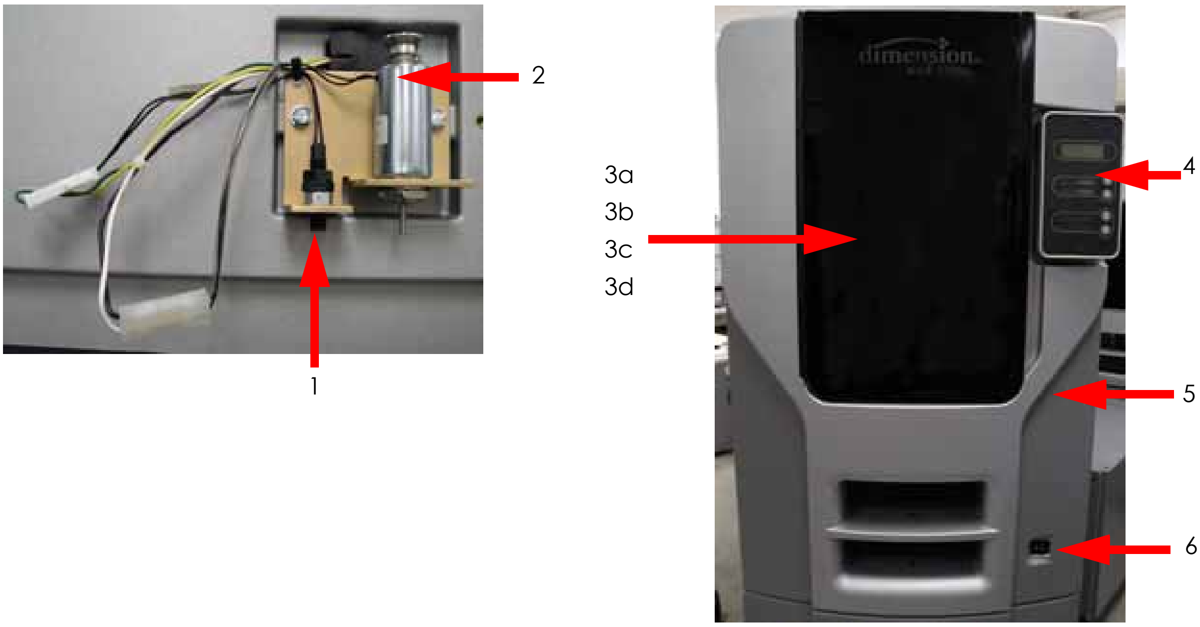
Illustrated Parts Breakdown

8

Printer Front (Misc. Components)

Item	Part Number	Description	Qty
1	204065-00XX	DOOR SWITCH	1
2	204142-00XX	DOOR SOLENOID ASSY	1
3a	209197-00XX	CS, GLASS ASSY, DOOR EXTERIOR BST 1200	1
3b	209199-00XX	CS, GLASS ASSY, DOOR EXTERIOR SST 1200	1
3c	209196-00XX	CS, GLASS ASSY, DOOR EXTERIOR BST 1200es	1
3d	209198-00XX	CS, GLASS ASSY, DOOR EXTERIOR SST 1200es	1
Not Shown	204108-00XX	FRAME, FRONT DOOR	1
4	204429-00XX	CS, LCD ASSEMBLY	1
Not Shown	201750-00XX	FOOT, VIBRATION MOUNT	4
5	204574-00XX	Front panel (Bezel)	1
6	204173-00XX	SWITCH, BLACK, DPDT 10-15A	1

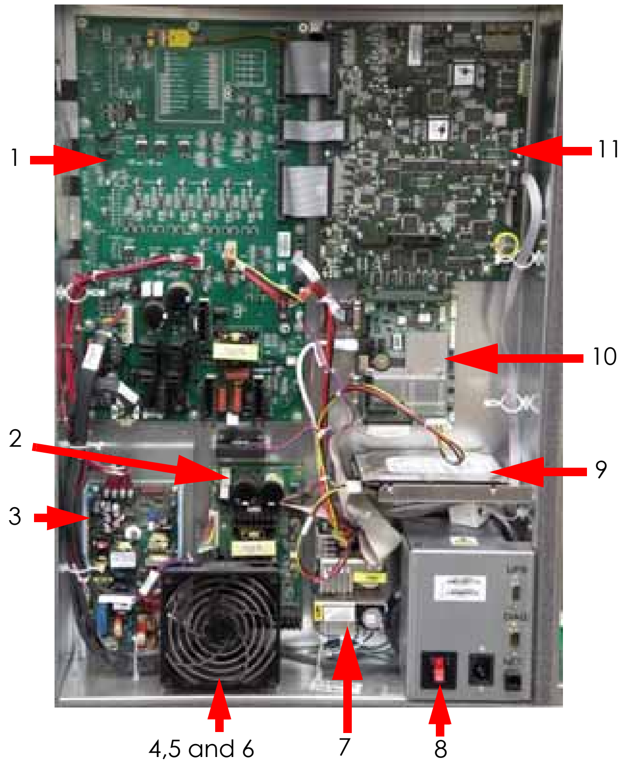
Figure 8-1: Front Panel (Bezel) Assembly



Electronics Bay Area Components

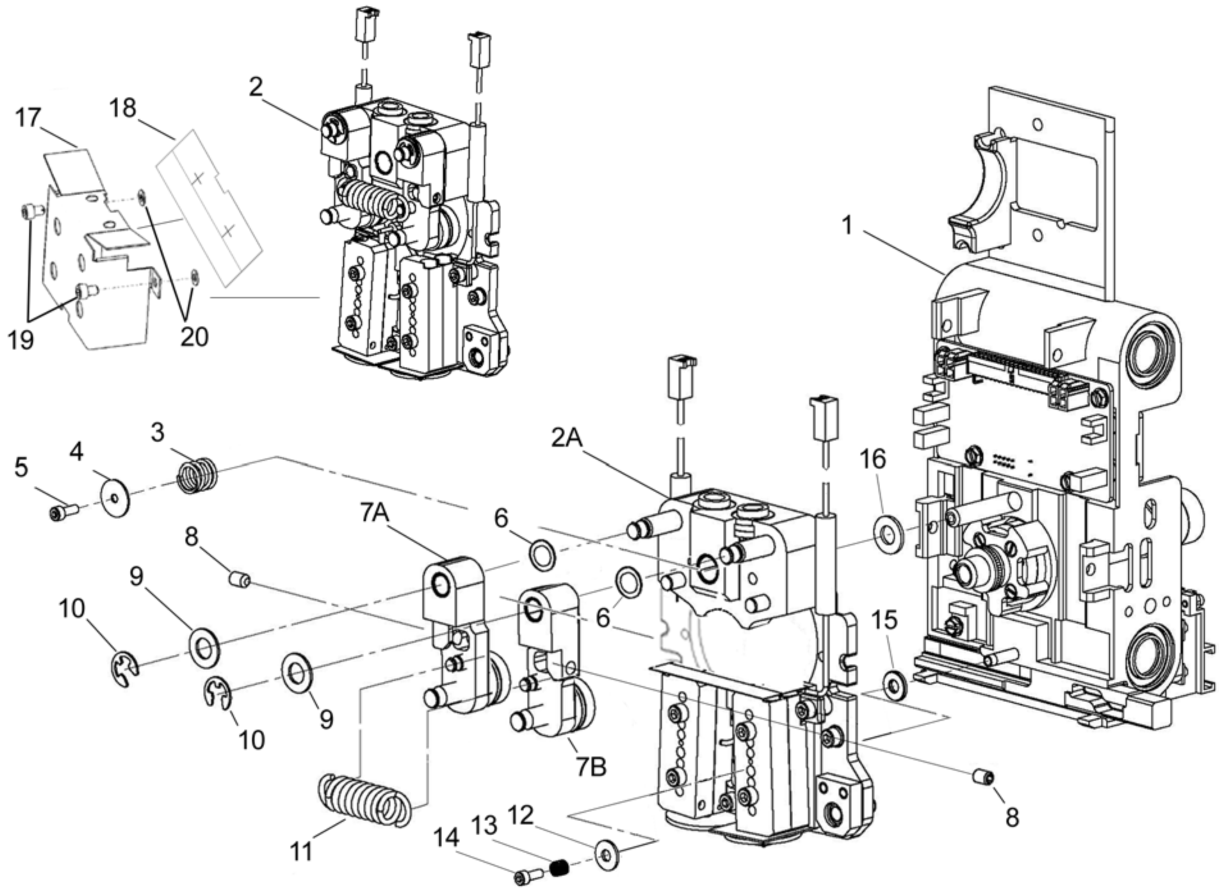
Item	Part Number	Description	Qty
1	202143-CSXX	Gen 2 Electronics POWER DISTRIBUTION BOARD (PDB)	1
-	202569-CSXX	Gen 3 Electronics POWER DISTRIBUTION BOARD (PDB)	1
2	202326-00XX	120VDC AUXILIARY POWER SUPPLY	1
3	202325-00XX	Gen 2 Electronics POWER SUPPLY, +24V, 250W	1
-	205659-00XX	Gen 3 Electronics POWER SUPPLY, +24V, 250W	1
4	201317-00XX	GUARD/FILTER, FAN	1
5	201318-00XX	GUARD, FAN	1
6	201403-00XX	ELECTRONICS BAY COOLING FAN	1
7	205503-00XX	POWER SUPPLY, 5/12V, 65W	1
8	201525-00XX	Gen 2 Electronics CIRCUIT BREAKER	1
-	205510-00XX	Gen 3 Electronics CIRCUIT BREAKER	1
9	202329-CSXX	HARD DRIVE AND SW, 7200 RPM	1
-	206703-CSXX	SATA HARD DRIVE AND SW	1
10	201631-00XX	Gen 2 Electronics SINGLE BOARD COMPUTER (SBC)	1
-	205714-CSXX	Gen 3 Electronics SINGLE BOARD COMPUTER (SBC)	1
-	208005-CSXX	Gen 3 Electronics SINGLE BOARD COMPUTER (SBC) SATA	1
11	202414-CSXX	Gen 2 Electronics CS, CCA, CONTROLLER BOARD	1
-	205627-CSXX	Gen 3 Electronics CS, CCA, CONTROLLER BOARD	1
Not Shown	202182-00XX	FILTER, 15A INLET LINE	1
Not Shown	102538-00XX	CABLE, 120VDC AUX PWR SUPPLY	1

Figure 8-2: Electronics Bay Area Components



Head Area Components

Figure 8-3: Head Area Components



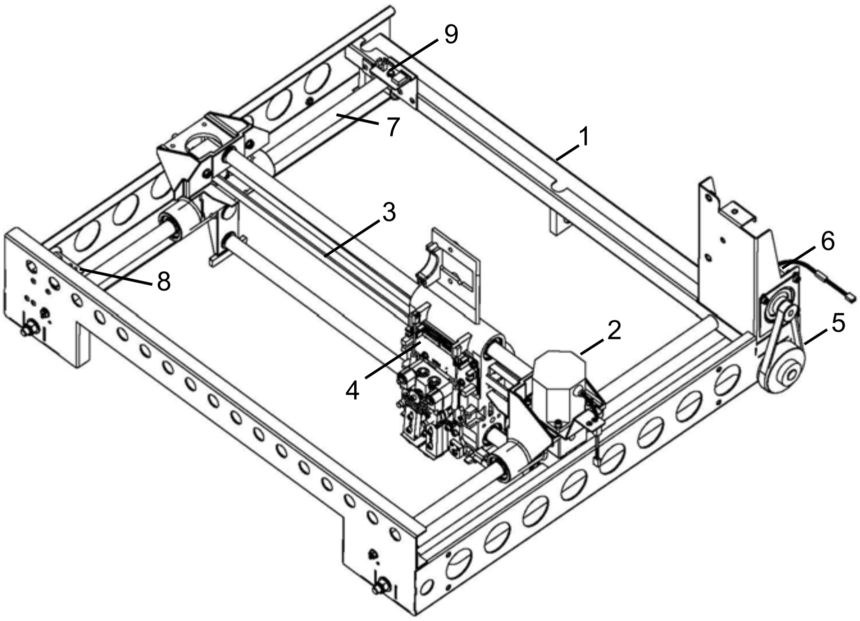
Item	Part Number	Description	Qty
1	Reference	TRANSLATOR	1
Not Shown	204500-CSXX	1200 CS, SST TOGGLE PLATE ASSEMBLY	1
Not Shown	204501-CSXX	1200 CS, BST TOGGLE PLATE ASSEMBLY	1
Not Shown	206377-CSXX	1200es CS, SST TOGGLE PLATE ASSEMBLY	1
Not Shown	206378-CSXX	1200es CS, BST TOGGLE PLATE ASSEMBLY	1
3	204074-00XX	SPRING, COMP TOG PLATE UPPER	1
4	204234-00XX	WASHER, .141ID X .625OD X .031	1
5	201327-30XX	SCREW, SHC 6-32x1/4 A	1
6	30000269	SHIM, .020	2
7A	204087-00XX	BLOCK, PIVOT PIN ASSY LFT SIDE	1
7B	204154-00XX	BLOCK, PIVOT PIN ASSY RGT SIDE	1
8	204230-00XX	SCREW, S-FP 8-32 X .25	2
9	204187-00XX	WASHER, TEFLON .515X.875X.031	2
10	204231-00XX	RETAINER, E-RING .219	2
11	204077-00XX	SPRING, EXTENSION TOGGLE	1
12	204198-00XX	WASHER, THRUST .195ID x .50OD	1

Item	Part Number	Description	Qty
13	204226-00XX	SPRING, COMP TOG PLATE LOWER	1
14	201327-30XX	SCREW, SHC 6-32x1/4 A	1
15	204198-00XX	WASHER, THRUST .195ID x .50OD	1
16	204080-00XX	WASHER, THRUST 8MM ID	1
17	204543-00XX 204544-00XX	COVER ASSEMBLY LIQUIFIER RADIATION SHIELD SST COVER ASSEMBLY LIQUIFIER RADIATION SHIELD BST	1
Not Shown	204055-00XX 204509-00XX	- COVER, LIQUIFIER RADIATION SHIELD SST - COVER, LIQUIFIER RADIATION SHIELD BST	1
Not Shown	204506-00XX	- INSULATION, RADIATION SHIELD	1
Not Shown	204507-00XX	- TAPE, RADIATION SHIELD	1
18	204508-00XX	- FILM, TEFLON BARRIER	1
19	10172901	SCREW, SHC 6-32x3/16 A	2
20	204227-00XX	WASHER, TEFLON	2
Not Shown	204030-00XX	1200 UMBILICAL CABLE, HEAD	1
Not Shown	205681-00XX	Gen 2 Electronics 1200es UMBILICAL CABLE, HEAD	1
Not Shown	202580-00XX	Gen 3 Electronics 1200es UMBILICAL CABLE, HEAD	1
Not Shown	205156-00XX	ASSY, Z FOAM LEVEL SENSOR	1
Not Shown	102531-00XX	SENSOR, OPTICAL Z-FOAM	1
Not Shown	204037-00XX	LIQUIFIER, T16 (BST Model and Support / SST MODEL ONLY)	2/1
Not Shown	204070-00XX	LIQUIFIER WW, T16 (SST SUPPORT ONLY)	1
Not Shown	204224-00XX	BLOCK, FILAMENT GUIDE (SST ONLY)	1
Not Shown	204430-00XX	TUBE,FILAMENT 7.1ft, 1200, SVC	2
Not Shown	206529-00XX	CS, MOTOR, DC SERVO KIT	1

XY Table Area Components

Item	Part Number	Description	Qty
1	204498-CSXX	1200 CS, ASSY, XY TABLE	1
-	206379-CSXX	1200es CS, ASSY, XY TABLE	1
2	204008-00XX	X MOTOR (returned part)	1
3	204013-00XX	X LINEAR (DRIVE) BELT (BELT, 3MM GT .472WW X 356 T)	1
4	204068-00XX	1200 HEAD BOARD (contains X home, X EOT sensor, T/C amp, and thermostat)	1
-	204702-00XX	1200es HEAD BOARD (contains X home, and X EOT sensor)	1
Not Shown	204649-00XX	1200es TC AMP BOARD	1
5	201924-00XX	Y MOTOR BELT	1
6	-	MOTOR, Y ASSY KIT	1
7	204014-00XX	Y LINEAR (DRIVE) BELT (BELT 3MM GT .472W X 350T)	2
8	204073-00XX	CCA, OPTO LIMIT SENSOR	1
9	204380-00XX	Gen 2 Electronics CCA, OPTO LIMIT SENSOR W/RES	1
-	205506-00XX	Gen 3 Electronics CCA, OPTO LIMIT SENSOR W/O RES	1
Not Shown	206529-00XX	CS, MOTOR, DC SERVO KIT	1

Figure 8-4: Belt Drive XY Table Components

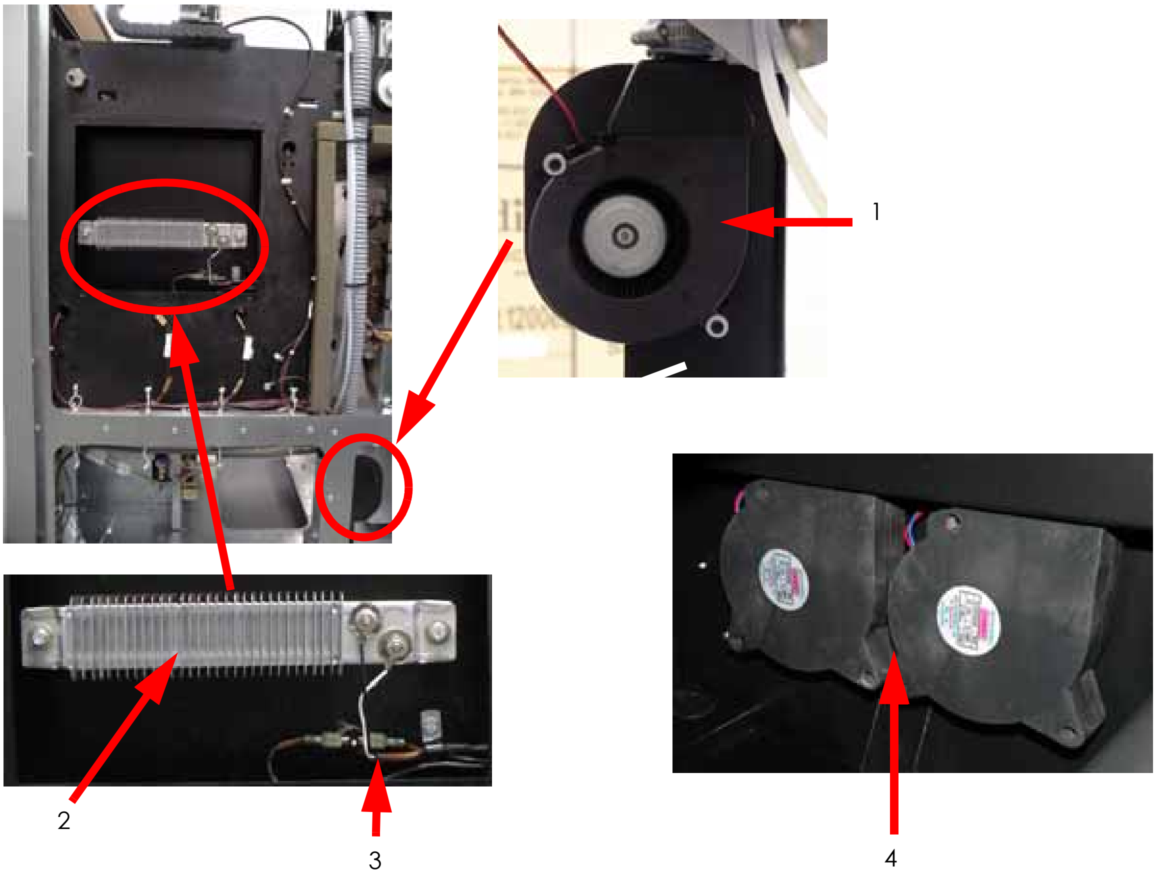


Note: The X home sensor, X EOT sensor, and thermostat are located on the head board.
The Y and Z motors share the same electrical cable.

Chamber Heater Area Components

Item	Part Number	Description	Qty
1	204542-00XX	BLOWER, HEAD COOLING ASSY	1
2	202152-00XX	HEATER, FINNED STRIP 120V 400W (CHAMBER)	2
3	202114-00XX	THERMOSTAT, 121 DEG C DISC	1
4	201402-00XX	ASSY, CHAMBER FAN	4
Not Shown	204026-00XX	CABLE, CHAMBER HEATERS	2
Not Shown	204029-00XX	CABLE, CHAMBER THERMOSTAT (MAIN)	1
Not Shown	204529-00XX	CCA, LED LIGHT BAR	2

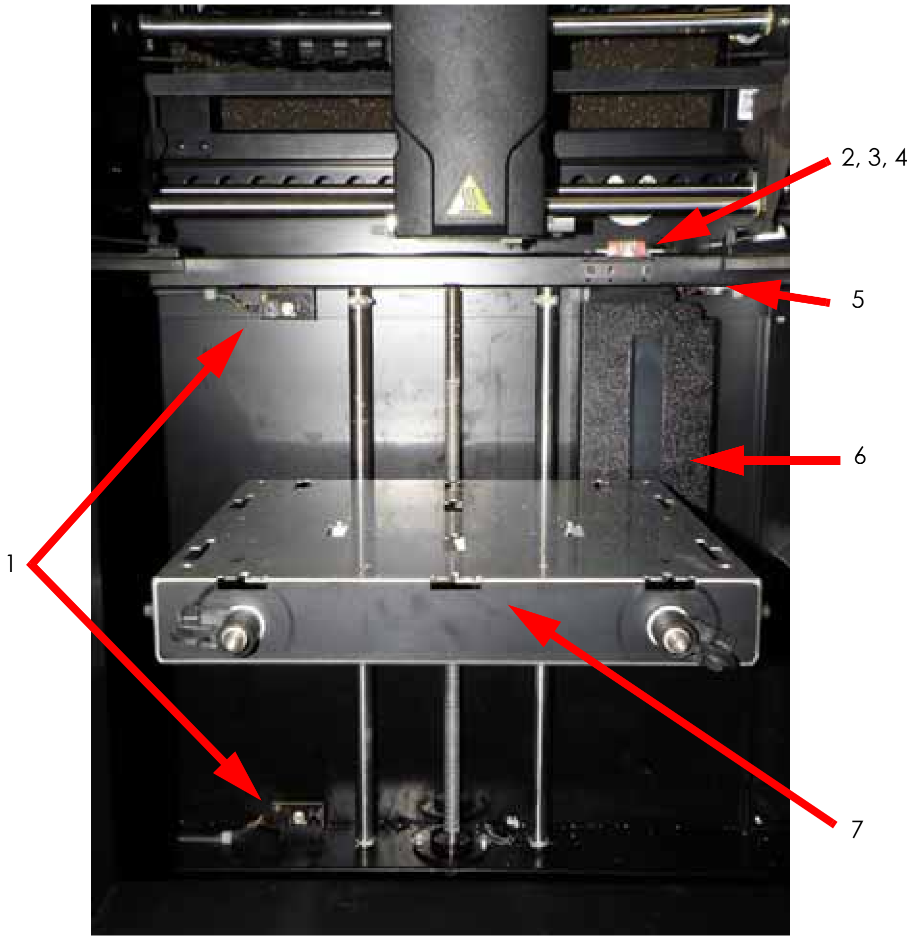
Figure 8-5: Chamber Heater Area Components



Chamber Area Components

Item	Part Number	Description	Qty
1	204073-00XX	Z EOT/HOME OPTO SENSOR	2
2	104223-00XX	1200 BRUSH (tip wipe)	1
3	202080-00XX	1200 FLICKER	1
4	540-00200	1200es Tip Wipe Assembly	1
5	204189-00XX	PURGE BUCKET LIGHT	1
6	204042-00XX	BUCKET, PURGE	1
7	204428-CSXX	Z Stage Assembly	1

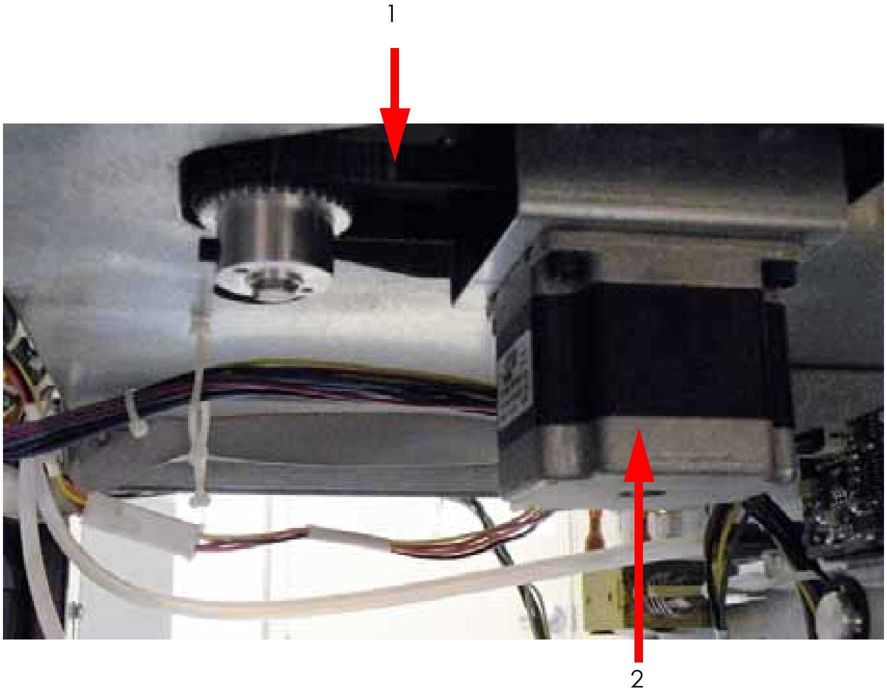
Figure 8-6: Chamber area components



Z Stage Area Components

Item	Part Number	Description	Qty
1	204015-0001	BELT 3mm GT .354W x 89T	1
2	204010-0001	Z MOTOR ASSY	1
Not Shown	202150-0001	Gen 2 Electronics THERMOCOUPLE, J TYPE 36 IN	1
Not Shown	205621-0001	Gen 3 Electronics THERMOCOUPLE, K TYPE 36 IN	1

Figure 8-7: Z Stage Area Components



Receiver Area Components

Item	Part Number	Description	Qty
1	204427-00XX	Gen 2 ASSY, RECEIVER BACKPLATE, SVC	1
-	206401-0001	Gen 3 ASSY, RECEIVER BACKPLATE, SVC	1
Not Shown	204430-00XX	CS, TUBE, FILAMENT, DIM 1200	2

Figure 8-8: Receiver Area Components

1

Additional Cables

Item	Part Number	Description	Qty
-	204030-00XX	1200 Gen 2 Electronics UMBILICAL CABLE, HEAD	1
-	205681-00XX	1200es Gen 2 Electronics UMBILICAL CABLE, HEAD	1
-	202580-00XX	1200es Gen 3 Electronics UMBILICAL CABLE, HEAD	1
-	102570-00XX	Gen 2 Electronics CABLE, UPS TO PDB	1
-	202574-00XX	Gen 3 Electronics CABLE, UPS TO PDB	1
-	204196-00XX	CABLE, DOOR EXTENSION	1
-	204147-00XX	CABLE, DISPLAY EXTENSION	1
-	204027-00XX	Gen 2 Electronics CABLE, ELECTRICAL, Y MOTOR AND Z MOTOR	1
-	202578-00XX	Gen 3 Electronics CABLE, ELECTRICAL, Y MOTOR AND Z MOTOR	1
-	204048-00XX	CABLE, DISPLAY	1
-	204029-00XX	CABLE, CTRLED OFF&THERM SWTCH	1
-	102540-00XX	CABLE, RS232 DIAG	1
-	102541-00XX	Gen 2 Electronics CABLE, RIBBON SBC TO PDB	1
-	205634-00XX	Gen 3 Electronics CABLE, RIBBON SBC TO PDB	1
-	102542-00XX	CABLE, AC TO PDB & PWR SPLYS	1
-	102543-00XX	Gen 2 Electronics CABLE, 24V TO PDB	1
	205660-00XX	Gen 3 Electronics CABLE, 24V TO PDB	1
-	102544-00XX	Gen 2 Electronics CABLE, LOW VOLTAGE	1
-	205635-00XX	Gen 3 Electronics CABLE, LOW VOLTAGE	1
-	102545-00XX	CABLE, LINE FILTER INPUT	1
-	105175-00XX	COUPLER, INLINE RJ45	1
-	105176-00XX	CABLE, COMMUNICATION	1
-	202323-00XX	CABLE, CTRL TO PDB 50POS	1
-	202324-00XX	CABLE, CTRL TO PDB 20POS	1
-	204028-00XX	Gen 2 Electronics CABLE, MID UNIT HARNESS	1
-	202579-00XX	Gen 3 Electronics CABLE, MID UNIT HARNESS	1

- Item Not Shown

Checklists

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Hard Drive Installation Checklist

If you have any questions before or during installation, do not hesitate to call your Customer Support provider.

- ☐ Replace the hard drive.
- ☐ Verify that all cables are connected correctly.
- ☐ Clean the system and lube the Z leadscrew.
- ☐ Power system up.
- ☐ After approximately 10 minutes, the LCD will display **UPGRADE** and **Send Upgrade From Work Station** along with the Static IP Address of the system (the default system setting).

  Note: For convenience, the assigned IP address is visible in the display panel during this process.

  - If the system will be operating in a Dynamic environment, the UPGRADE can be loaded from the PC.
- ☐ Use the Manage 3D Printers button in CatalystEX to connect to the printer -Choose “Add from Network...”
  - If the system will be operating in a Static environment, choose `Set Network...` from the display panel and enter the appropriate network addresses. The customer should provide this information.
- ☐ After all the addresses have been edited, select `Done`.
- ☐ Use the Manage 3D Printers button in CatalystEX to connect to the printer - Choose “Add Manually...”

  Note: The controller software must be downloaded before system operation can continue.
- ☐ Download the controller software using the most current version. Download instructions for performing the download procedure are located on the controller software CD.
- ☐ Once download is complete, system will reach “Idle”.
- ☐ Load material.
- ☐ Remove the system floppy disk/CD from the electronics bay. Using MaracaEX, select “Send Calibration” to send the .cal file from the floppy disk/CD to the system hard drive.
- ☐ Run a small test part to ensure part quality is acceptable and that the system is operating properly.
- ☐ Using MaracaEX, select “Get Calibration” to send the .cal file from the system to the floppy disk/CD. Replace the floppy disk/CD in the electronics bay and secure the rear door.
- ☐ Discuss any of the customer’s questions or issues with them.
- ☐ Pack the defective hard drive into the shipping box along with the RMA documentation and ship back to Stratasys.

Controller Board Checklist

Use this checklist when replacing the Controller Board.

- ☐ Power down the system.
- ☐ Replace the controller board.
- ☐ Power up the system
- ☐ Download the controller software.
- ☐ Toggle power (quick 'OFF' then 'ON' with power switch).
- ☐ Enter Head Maintenance. This will cause the system to run the complete homing process.
- ☐ Exit Head Maintenance.
- ☐ Run a small test part to ensure part quality is acceptable and that the printer is functioning correctly.
- ☐ Discuss any of the customer's questions or issues with them.
- ☐ Pack the defective Controller board into the shipping box along with the RMA documentation and ship back to Stratasys.

Toggle Plate Assembly Installation Checklist

If you have any questions before or during installation, do not hesitate to call your Customer Support provider.

- ☐ Replace the Toggle Plate Assembly.
- ☐ Verify that all electrical leads are connected correctly.
- ☐ Perform Drive Wheel Alignment.
- ☐ Perform Idler Wheel Adjustment.
- ☐ Align Liquefiers.
- ☐ For SST 1200- Align Support Filament Guide.
- ☐ Clean the system and lube the Z leadscrew.
- ☐ Power on system and verify that the head reaches temperature and the system homes correctly.
- ☐ Load material.
- ☐ Perform the Z Calibration and XY Offset Calibration in maintenance mode.
- ☐ Run a small test part to ensure part quality is acceptable and that head is functioning correctly.
- ☐ Remove the system floppy disk/CD from the electronics bay.
- ☐ Using MaracaEX, select “Get Calibration” to send the .cal file from the system to the floppy disk/CD. Replace the floppy disk/CD in the electronics bay and secure the rear door.
- ☐ Discuss with the customer any questions or issues they may have.
- ☐ Pack the defective Toggle Plate Assembly into the shipping box along with the RMA documentation and ship back to Stratasys.

XY Table Installation Checklist

If you have any questions before or during installation, do not hesitate to call your Customer Support provider.

- ☐ Check/Adjust the X-Drive Belt tension
- ☐ Check/Adjust the Y-Drive Belt tension
- ☐ Replace the XY table.
- ☐ Verify that all electrical leads are connected correctly
- ☐ Perform the XY Leveling procedure
- ☐ Manually move the table in both the X and Y direction to ensure it moves smoothly.
- ☐ Clean the system and lube the Z leadscrew.
- ☐ Power on system and verify that system homes correctly.
- ☐ Load material.
- ☐ Perform the Part Based Calibration procedure.
- ☐ Perform the Z Calibration and XY Offset Calibration.
- ☐ Run a small test part to ensure part quality is acceptable and that the XY table is functioning correctly.
- ☐ Remove the system floppy disk/CD from the electronics bay.
- ☐ Using MaracaEX, select "Get Calibration" to send the .cal file from the system to the floppy disk/CD. Replace the floppy disk/CD in the electronics bay and secure the rear door.
- ☐ Discuss with the customer any questions or issues they may have.
- ☐ Pack the defective XY table into the shipping box along with the RMA documentation and ship back to Stratasys.

Pre-Installation Checklist

This checklist is to be used to ensure customer will be prepared for system installation. This list should be used in conjunction with setting up an installation with the customer. This will help the install go as smoothly as possible.

- ☐ Has the system arrived?
- ☐ Does the customer have a loading dock or receiving area to accept the system shipment?
- ☐ Customer has sufficient resources to move the system to its final location?
- ☐ Will the customer have the system unpacked and moved to its final location?
- ☐ System requires that the table (used to support the system) be rated for 400 lbs. (181 kilograms).
- ☐ If possible, confirm that startup kit, **correct** material and wash station (if purchased) is on-site.
- ☐ Remind customer that AC power must be “clean” (does not fluctuate excessively). A dedicated 20 amp circuit is required for 120VAC and 10 amp for 220VAC.
- ☐ Ensure that *no* extension cords or power strips will be connected to the system.
- ☐ Verify minimum workstation requirements.
- ☐ Key contacts should be available for system training during install.

System Information

(For your records only)

Customer name _________________________

Customer contact ________________________

Customer phone _________________________

Customer e-mail _________________________

System type_____________ S/N ____________

BE version _________ FE version ___________

Comments:

System Installation Checklist

If you have any questions before or during installation, do not hesitate to call Customer Support.

- ☐ Shipping crate in good condition, no external signs of damage.
- ☐ Tip Watch and Shock Watch indicators OK. If not, call Stratasys Customer Support.
- ☐ After removing system from the crate, inspect system for scratches or dents.
- ☐ Check that start up kit, substrate, and cartridges are on-site.
- ☐ Check contents of the start up kit. Note any discrepancies on the Install Report Card.
- ☐ Door opens and closes with no binding.
- ☐ Door/glass panels are not scratched or broken.
- ☐ Check that the table (used to support the system) is rated for 400 lbs. (181 kilograms).
- ☐ Verify AC power is “clean” (does not fluctuate excessively). A dedicated 20 amp circuit is required for 120VAC and 10 amp for 220VAC.
- ☐ Ensure that *no* extension cords or power strips are connected to the system.
- ☐ Remove the foam tubes that isolate the extrusion head from the frame.
- ☐ Manually move Z stage down approximately 2” (5 cm), ensuring that the upper limit switch will not be closed upon power up.
- ☐ Manually move the head in both the X and Y direction. Head should move smoothly.
- ☐ Install substrate and power on the system.
- ☐ Check that the lights and fans turn on.
- ☐ Check that system completes XY home and goes to Idle.
- ☐ Plug system into the customer’s network.
- ☐ Install workstation software.
- ☐ Verify workstation is communicating with the system.
- ☐ Install the controller software to the customer workstation.
- ☐ Upgrade controller software if the CD build number is **higher** than build number displayed on system.
- ☐ Build a test part and verify that adhesion to the substrate is good and that supports are easy to remove.
- ☐ Discuss part finishing techniques.
- ☐ Review User Guide with customer.
- ☐ Complete the Pre-Installation Checklist and System Install Report. Email or Fax to Stratasys Inc.

Training Checklist

Workspace REVIEW

- ☐ System weights 326 lbs. (148 Kg)
- ☐ 110-120 VAC or 220-240 VAC dedicated outlet
- ☐ Ethernet 10/100 base T network.
- ☐ Optional UPS for brown out conditions.

Unpacking

- ☐ Remove the foam tubes that isolate the extrusion head from the frame.
- ☐ Table needs to support 400 lbs.
- ☐ Install fork lift covers once systems is placed at intended location.

Power connections

- ☐ No extension cords or power strips.
- ☐ 110-120 VAC or 220-240 VAC dedicated outlet.

Power up/down

- ☐ Demonstrate proper power up and power down procedure.

Front-end Software

- ☐ Demonstrate how to load CatalystEX on the workstation.
- ☐ Cover CatalystEX operation. Focus on part build options – Types of support, fill, etc.
- ☐ Demonstrate how to send a part to the printer and managing the print queue.
- ☐ Demonstrate how to use a pack.
- ☐ Cover details of printing.
- ☐ Discuss the do’s and don’ts of packing parts

Controller Software

- ☐ Demonstrate how to download controller software.
- ☐ Inform customer that they will be expected to download future software releases.

Keypad Operation

- ☐ Step customer through all menu selections.
- ☐ Describe function of each selection.

Material

- ☐ Explain the process of Fused Deposition Modeling.
- ☐ Demonstrate the correct way to load and unload material. Have customer load and unload material.
- ☐ Discuss effect of wet material on part quality.
- ☐ Demonstrate how to install modeling base.
- ☐ Explain the effects of building on "used" modeling base.
- ☐ Instruct customer on how to remove a part.

Maintenance

- ☐ Cover contents of the Start-up Kit and the usage of each tool/spare part.
- ☐ Explain how to remove supports and finishing techniques.
- ☐ Cover system maintenance. Stress the importance of proper maintenance.
- ☐ Cover Tip Replacement procedure.

Troubleshooting

- ☐ Show customer the basic components of the head assembly and their function.
- ☐ Demonstrate how to identify and clear head jams (LOE).
- ☐ Inform customer that they will be expected to clear head jams (LOE).
- ☐ Discuss error codes- what they mean and what to do if one is displayed, e.g. 14,100.
- ☐ Cover the process to report system issues/questions.
- ☐ Discuss how to order material etc.
- ☐ Cover warranty and maintenance.
- ☐ Ensure customer is comfortable with using the system.
- ☐ Ask if customer has any concerns or questions.

Required Tool List

Distributor/Reseller supplied

- ☐ 1. Standard screwdriver set
- ☐ 2. Phillips screwdriver set
- ☐ 3. Allen wrench set
- ☐ 4. Pliers
- ☐ 5. Channel locks
- ☐ 6. Small wire cutters
- ☐ 7. Needle nose pliers
- ☐ 8. Assorted wire ties
- ☐ 9. Box wrenches
- ☐ 10. Flashlight
- ☐ 11. Grounding strap
- ☐ 12. Voltmeter
- ☐ 13. Network crossover cable (for communication testing)
- ☐ 14. Laptop computer
- ☐ 15. Small hand held mirror
- ☐ 16. Nut driver set
- ☐ 17. Dial indicator
- ☐ 18. Serial data cable (for issuing TeraTerm commands).
- ☐ 19. Serial to USB adapter, recommended IOGEAR GUC232A (for issuing TeraTerm commands).

Supplied by Stratasys (From attending training only)

- ☐ 1. Belt tension gauge (for adjusting XY table drive belts)
- ☐ 2. Y-Motor belt tensioning tool (for adjusting belt Y table motor belt)
- ☐ 3. Head dial indicator bracket (for XY table and Z stage leveling)
- ☐ 4. Spring Removal Tool
- ☐ 5. Drive Wheel Alignment Rod
- ☐ 6. Set of Shims (Feeler Gauges)
- ☐ 7. Liquefier Alignment Rod
- ☐ 8. Filament Guide Alignment Rod (For SST Only)
- ☐ 9. Service Guide (CD and Hardcopy)
- ☐ 10. MaracaEX CD
- ☐ 11. CatalystEX CD
- ☐ 12. Controller software CD
- ☐ 13. User guide

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