STRATASYS®

uPrint® and uPrint® Plus
uPrint® SE and uPrint® SE Plus
Service Manual

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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

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

The following symbol is located inside the system to warn you about high temperatures.

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

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

Safety Devices

The following safety devices are incorporated into the system:

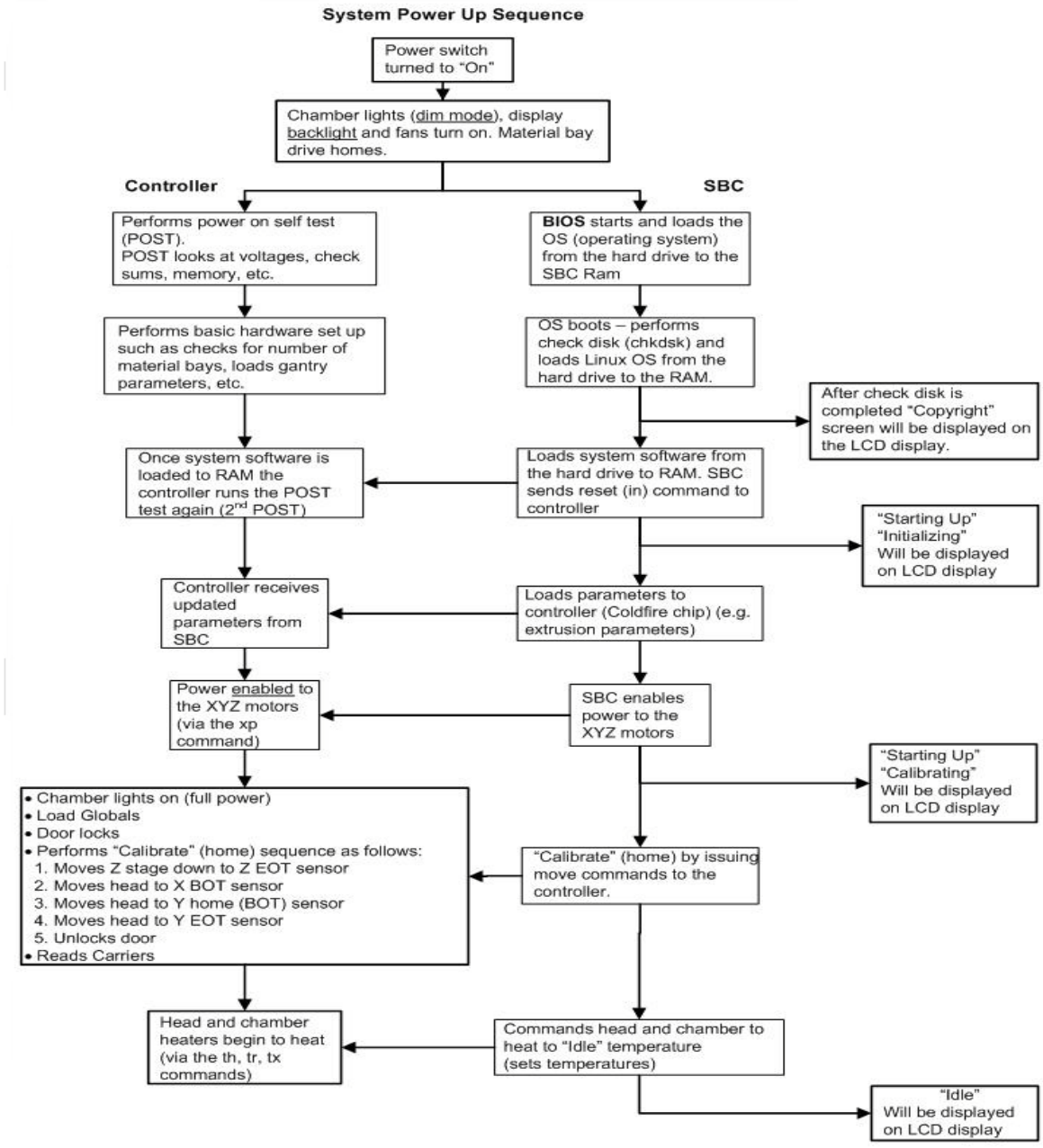
- Chamber T/C alarm – activated for a bad or missing thermocouple
- Liquefier T/C alarm – activated for a bad or missing thermocouple
- Power shut down signal from the PDB – activated if any thermal limit switches trip
- Thermal snap switch located on the Head Board.
- Main thermal fuse

System Overview

2

What happens when...

Powering up



Once the unit is ready to build, the display will show **Idle** (no part in the queue) or **Ready to build** followed by the part name. Once a part is started the appropriate liquefier will begin to heat. Once the liquefier and chamber reach the operating temperature (310C model, 300C support, 77 Chamber) the system will begin to build a part.

Powering Down

When the Power Switch is turned off the unit begins a controlled shut down. The software processes are stopped and the power to the liquefier and chamber heaters are turned off. The Controller Board continues to monitor the temperature of the liquefier and the fans will continue to run. During this time the display will show **"Shutting down"**. The head blower fan continues to run to cool the liquefier down quickly to prevent backflow of material from the liquefier. If the material is not cooled down during power down the system may experience a loss of extrusion due to material build up at the liquefier. Once the liquefier temperature drops below 102° C the SBC changes the display to **"Shut down"** and turns off.

Loading Material

When the load material button is pressed with carriers installed the SBC will ask the Controller Board to unload the carriers requested by the operator. The most recent value for material remaining is written to the cartridge EPROM. The material is run in reverse to unload the liquefier. When filament is clear of the filament sensor the Controller Board tells the SBC that the command is complete. The SBC sends **"REMOVE CARRIER"** to the display, the carriers are unlatched, and the unit waits for you to respond.

If there are no carriers in the printer when the material button is pushed, or if an unload has just been completed, the SBC will ask the operator to **"INSERT CARRIER".** The unit will look for a valid carrier EPROM. If there is no change to the EPROM status in 30 seconds, you are asked if you want to RETRY. Once valid carriers are read, the unit begins the material load sequence.

Building a Part

How to start building a part build is dependent upon whether or not a part is in the printer queue:

1. If a part has not been sent to the printer for building (the build queue is empty):
2. The panel displays **Idle and Queue Empty**.
    A. **Wait for Part** is blinking. Choose whether you want to start the build process from a 'remote' location or from the display panel at the printer.
        a. At Printer **'Start Model'** - You send a part to the printer from your CatalystEX work station. You start the build of the part from the printer.
    B. Do not press the **Wait for Part** button
    C. From your CatalystEX work station, send a part to the printer.
    D. The printer panel displays the name of the first model in the printer queue and **Start Model** is blinking.
    E. From the printer, press the **Start Model** button to begin building the displayed part.
        a. Remote **'Start Model':** - You send a part to the printer from your CatalystEX work station. The part automatically begins to build.

F. From the printer, press the **Wait for Part** button.

Note: Make sure an empty modeling base is installed, then answer **Yes** to the prompt **Is Model Base Installed?**

G. **Wait for Part** is displayed in the upper window. Press **Cancel** `if you wish` to exit the remote start mode.

H. From your CatalystEX work station, send a part to the printer. The printer will automatically start to build the model.

3. If a part has been sent to the printer for build (there is at least one part in the build queue), but is not building:

   A. The panel displays **Ready to Build.**

   B. The name of the first model in the build queue is displayed.

   C. **Start Model** is blinking. Press the **Start Model** button to begin building the displayed part.

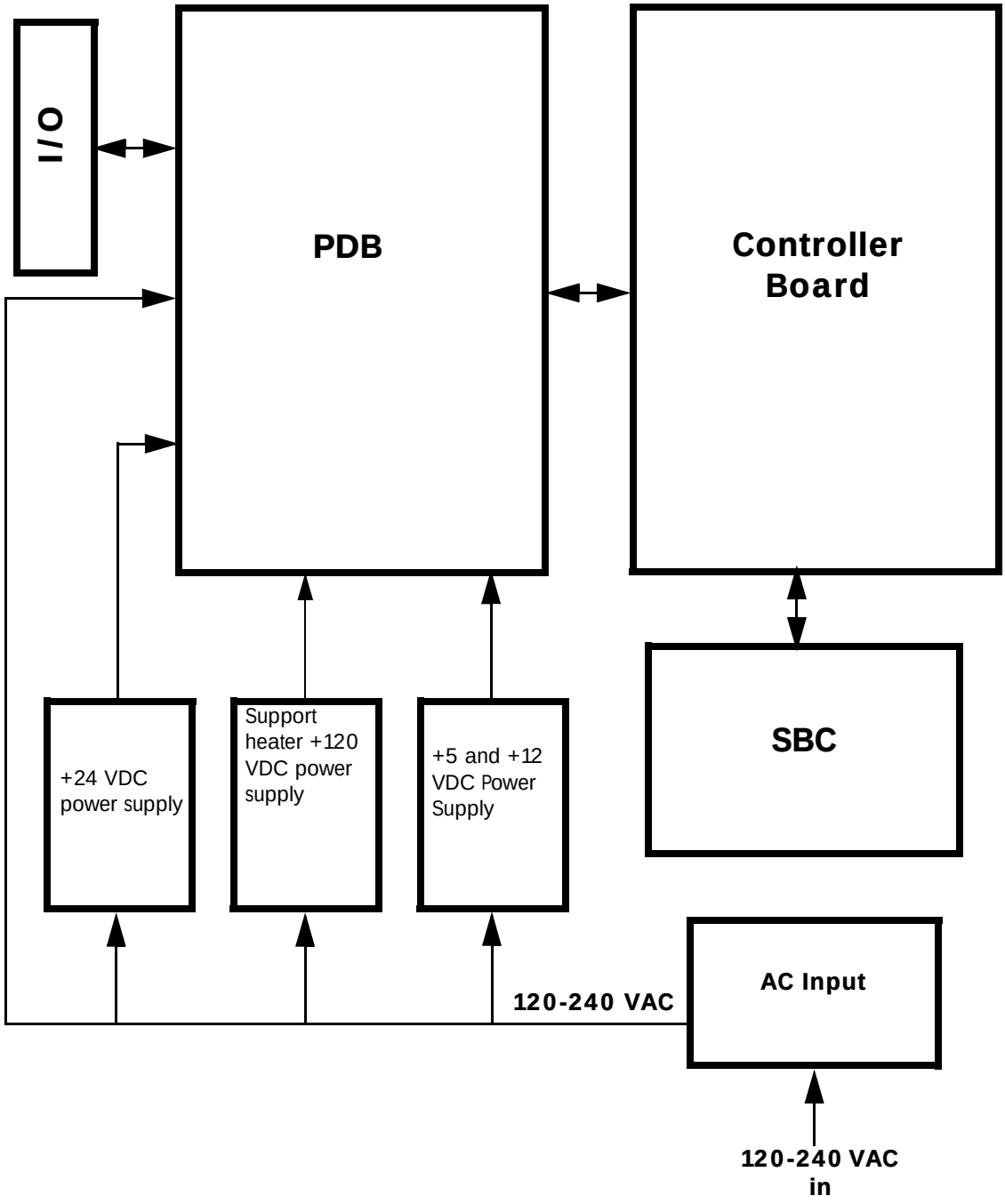
Regardless of the method used to start building a part, the printer will perform the same sequence of steps:

1. The printer drops (lowers) the substrate sensor.
2. System "touches down" six times which measures the height of the substrate.
3. SBC converts the model file (CMB) into the motion commands that the controller will execute to build the model.
4. System completes substrate measurement.
5. Z stage moves to bottom of Z travel.
6. Head moves over the purge bucket and prepares to build purging the appropriate tip.
7. Once 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. During building the keypad will 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.

Electronics Overview

Figure 2-1: Electronics Overview detail



Single Board Computer

The single board computer (SBC) is the main processor in the system. See Figure 2-2. showing the board layout.

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 two LED's at the RJ-45 connector. These show the status of the network connection as follows:

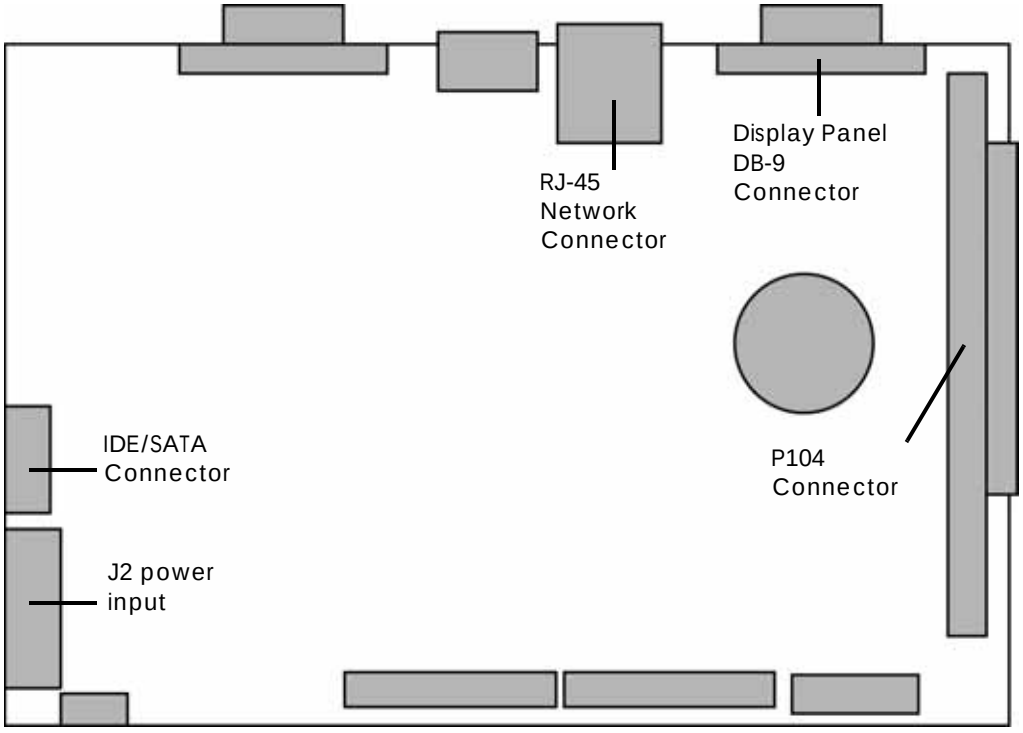
- Green LED: Indicates there is a network connection present.
- Amber LED: Indicates there is a network communication.

The Hard Disk Drive (HDD) connects to the SBC with a standard IDE interface (ribbon cable) or SATA cable. 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 in the queue.

The LCD Control Panel connects to the I/O Card. The signals then travel though the PDB and on to the SBC. All user entered commands from the control panel buttons are routed through the I/O and PDB and then on to 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: Single Board Computer detail



Controller Board

Overview

The controller board provides all of the low level hardware control and sensing for the system. The firmware runs on the controller CPU and is flash resident (rather than on the HDD and 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. 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).

Material Motor Control

The controller takes the flow rate information from the SBC and sends it to the PMD 2840 processors. The PMD uses this information along with the encoder signals from the material motors to generate an output signal to drive the servo motors in the head assembly. Since the encoders provide feedback the material 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.

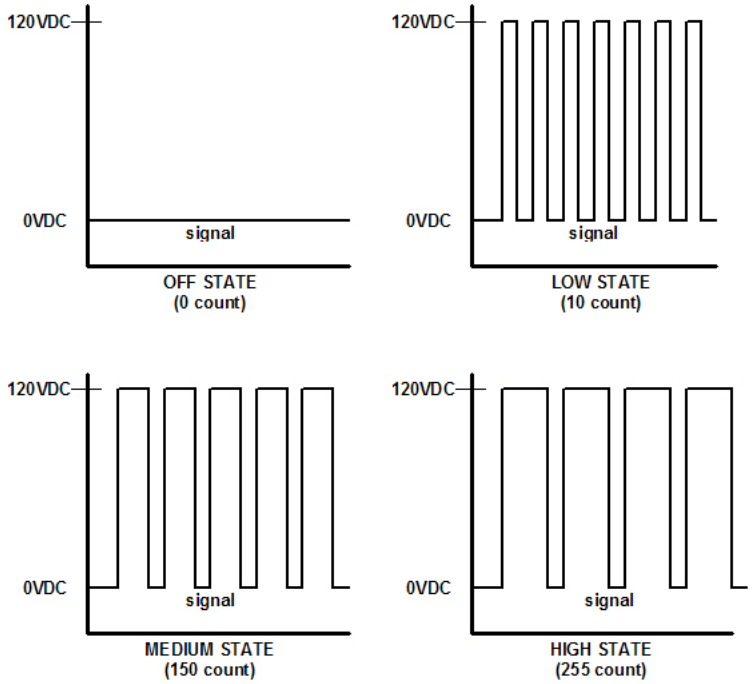
Liquefier Temperature Control

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 distribution. 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 109.5° C. The highest reading is 330° C.

The liquefier temperature is maintained at: Model: 310° C, Support: 300° C

Temperature control is accomplished using "pulse wide modulation" See Figure 2-3.

Figure 2-3: 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 uPrint 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.
- Carrier latches – holds carriers in the material bays.
- Material bay solenoids – engage the motor that feeds filament from carrier to the liquefier during auto load.

The controller board reads and updates the remaining material information on the spool e-prom. This is accomplished through a serial interface to the material bay encryption board. The material encryption board in turn connects to the e-prom on the carrier/spool via two pogo pins.

The controller board monitors these switches:

- Z limit switches – upper and lower
- X end of travel (EOT) switch
- Y end of travel (ETO) switch

The controller board monitors the following optical sensors:

- X home (BOT) sensor
- Y home (BOT) sensor
- Top of modeling base sensor

Safety Devices

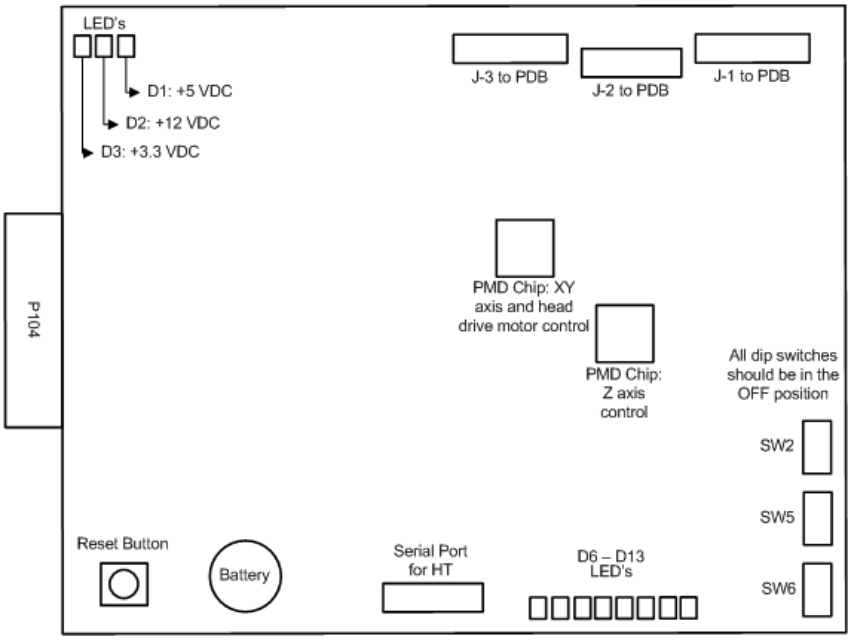
The controller board monitors the following safety devices:

- 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
- Two main thermal fuses
- Door open switch
- Door latch solenoid

Controller Board Layout

Figure 2-4. 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 2-4: 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 before building. The reset button should only be used after using TeraTerm.

Dip Switches

There are three dip switch banks (SW2, SW5, SW6) located on the top right side of the board. Dip switches are factory set and should not be changed unless noted to be in another position.

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 the following system parameters:

1. Results of last power-on self test (POST)
2. Results of certain built-in diagnostic tests, if used
3. Exception trace, which is a list of the most recent exception messages logged on the controller board
4. State information, which stores printer state when it is powered off (includes things like the type of gantry, whether material is loaded, the UDN, etc.).

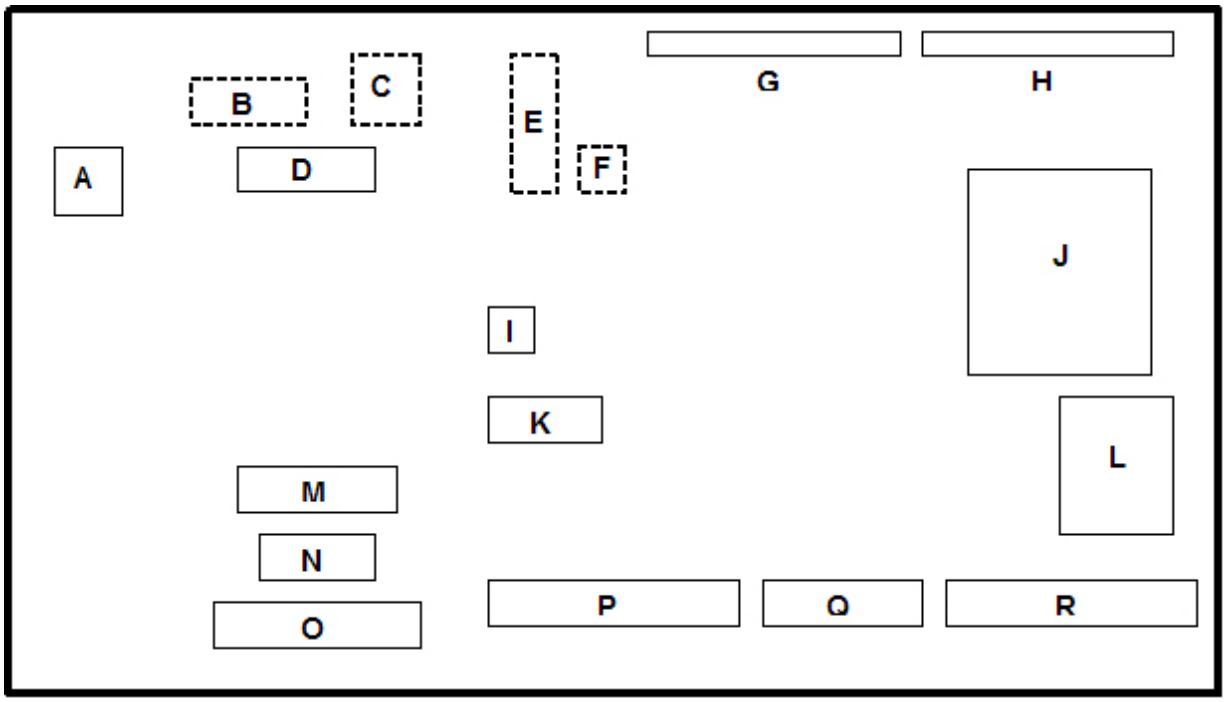
LEDs

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 monitoring the system and everything is operational.

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 2-5: PDB Detail



A	J1	AC Power In
B	J2	Power Switch/Thermostat
C	J3	Chamber Heaters
D	J22	Auxiliary 120VDC power supply
E	J8	Z BOT, Z EOT, Chamber Fans, Frame ID, Filament detect sensor (not used)
F	J9	Z motor
G	J10	I/O board connection
H	J11	I/O board connection
I	J7	24VDC input
J		Test points and LEDs (see detail in this section)
K	J4	5/12VDC input
L		Voltage indicator LEDs (see detail in this section)
M	J12	To material bay
N	J16	To external UPS (optional)
O	J18	LCD display from SBC
P	J15	To controller board (ribbon cable)
Q	J14	To controller board (ribbon cable)
R	J13	To controller board (ribbon cable)

This board provides the power required to run the system. AC line voltage, +5 VDC, +12 VDC, and +24 VDC feed into the PDB. An additional +120 VDC input feeds into the PDB for the support head heater.

AC line voltage comes into the PDB, See Figure 2-5. 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 and a separate 120 VDC supply powers the support heater.

There are two fuses on the power distribution board.

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

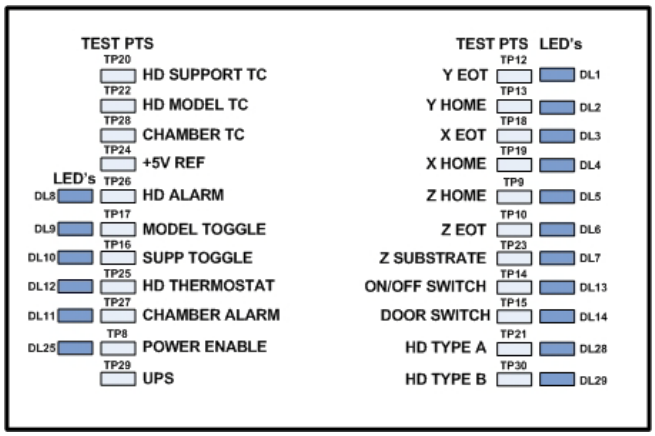
Chamber Temperature Control

The chamber thermocouple (T/C) connects via the I/O board to the PDB and 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 chamber thermocouple is amplified on the I/O board and sent to the PDB. From the amplifier, the signal goes to an A to D converter in the ColdFire. The controller reads the chamber temperature and turns the heaters on and off to maintain 77° C. The chamber fans run continuously when the system 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 NOTE: 10 mV = 1 degree C.

Test Points and LED's

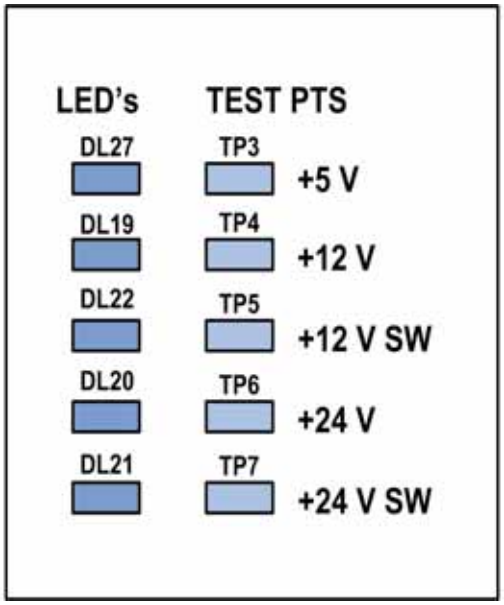
Test points and LED's are very useful for troubleshooting the system. The test points and LED's are listed below with a brief description. See Figure 2-6. and Figure 2-7.

Figure 2-6: Test points and LEDs detail



Component	Test Pt	Description
UPS	TP29	Power fail signal from external UPS
+5V REF	TP24	Head T/C service reference
Door Switch	TP15	State of the door (open or closed)
On/Off Switch	TP14	State of power down switch
Power Enable	TP8	Enables power to circuitry (normally high)
Model Toggle	TP17	Toggle travel complete
Chamber Thermocouple	TP28	Voltage corresponds to chamber temperature (10 mV=° C)
Support Thermocouple	TP20	Voltage corresponds to support temperature (10 mV=° C)
Model Thermocouple	TP22	Voltage corresponds to model temperature (10 mV=° C)
HD Thermostat	TP25	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 TC Alarm	TP26	High if head T/C not plugged in or open
Support Toggle	TP16	Not used
Chamber TC Alarm	TP27	High if chamber T/C not plugged in or open
X EOT	TP18	X end of travel sensor (5 VDC), switches are wired normally closed (NC)
X Home	TP19	X home sensor (5 VDC), switches are wired normally closed (NC)
Y EOT	TP12	Y end of travel sensor (5 VDC), switches are wired normally closed (NC)
Y Home	TP13	Y home sensor (5 VDC), switches are wired normally closed (NC)
Z EOT	TP10	Z end of travel sensor (5 VDC), switches are wired normally closed (NC)
Z Home	TP9	Z home sensor (5 VDC), switches are wired normally closed (NC)
Z Substrate	TP23	Z substrate sensor (5 VDC)
HD Type A	TP21	Not used
HD Type B	TP30	Not used

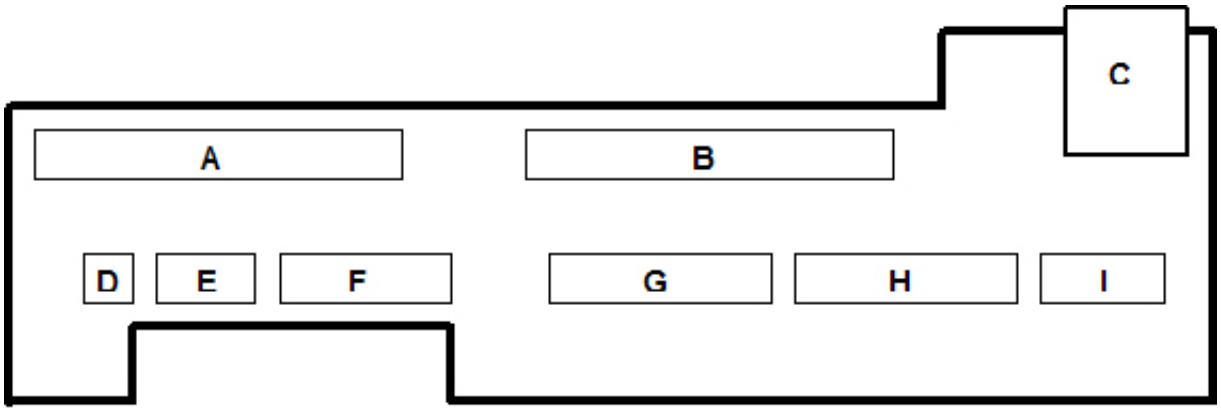
Figure 2-7: Voltage test points and LEDs detail



Component	Test Pt	Description
+ 5 VDC	TP3	+ 5VDC is present
+12 VDC	TP4	+ 12VDC is present
+12 VDC SW	TP5	+ 12VDC Switching is present
+24 VDC	TP6	+ 24VDC is present
+24 VDC SW	TP7	+ 24VDC Switching is present

I/O Card

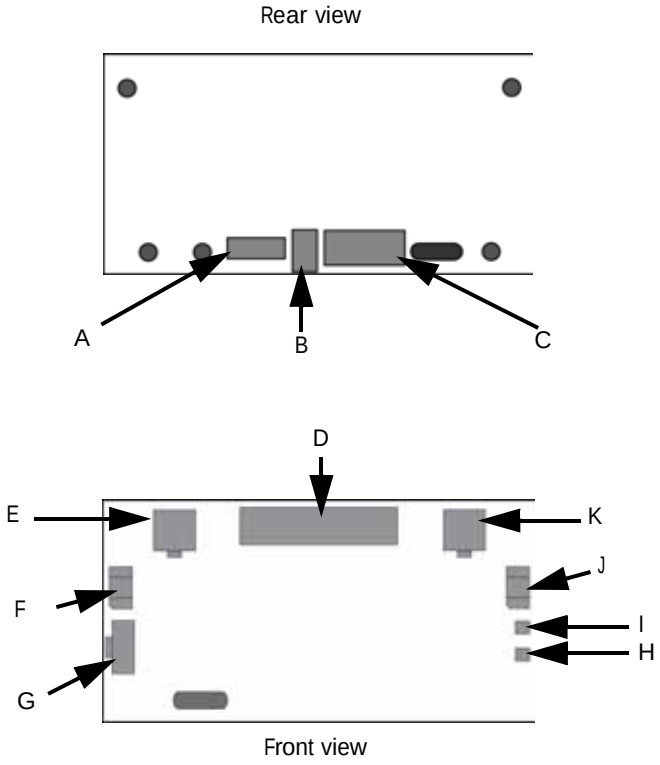
Figure 2-8: I/O card detail



A	J510	PDB Board connection
B	J511	PDB Board connection
C	J507	Chamber thermocouple
D	J501	Y Motor
E	J502	X Motor
F	J503	Y BOT and Y EOT sensors
G	J504	Head blower fan, power on/off switch, left and right chamber lights, LCD display, door solenoid, door switch.
H	J505	Umbilical cable to: Model and support heaters, toggle sensor, X BOT and X EOT sensors
I	J506	Umbilical cable to: Substrate detect sensor, head drive motor, chamber temperature alarm, model thermocouple, support thermocouple, head temperature alarm

Head Board

Figure 2-9: Head board layout



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

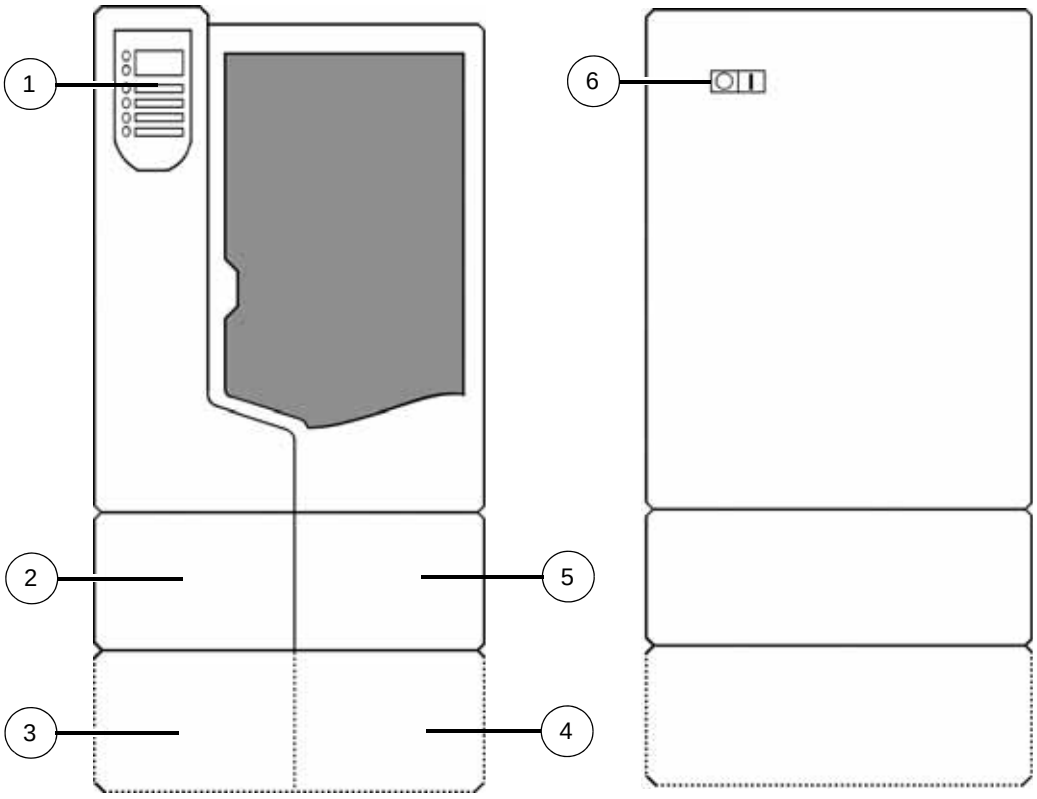
Printer overview

uPrint SE and uPrint SE Plus build models from CAD STL files. The printer builds three-dimensional parts by extruding a bead of ABS material through a computer-controlled extrusion head, producing high quality parts that are ready to use immediately after completion.

uPrint SE and uPrint SE Plus consist of two primary components — the 3D printer and material bay. Catalyst®EX is the preprocessing software that runs on Windows XP Pro, Windows Vista or Windows 7 platforms.

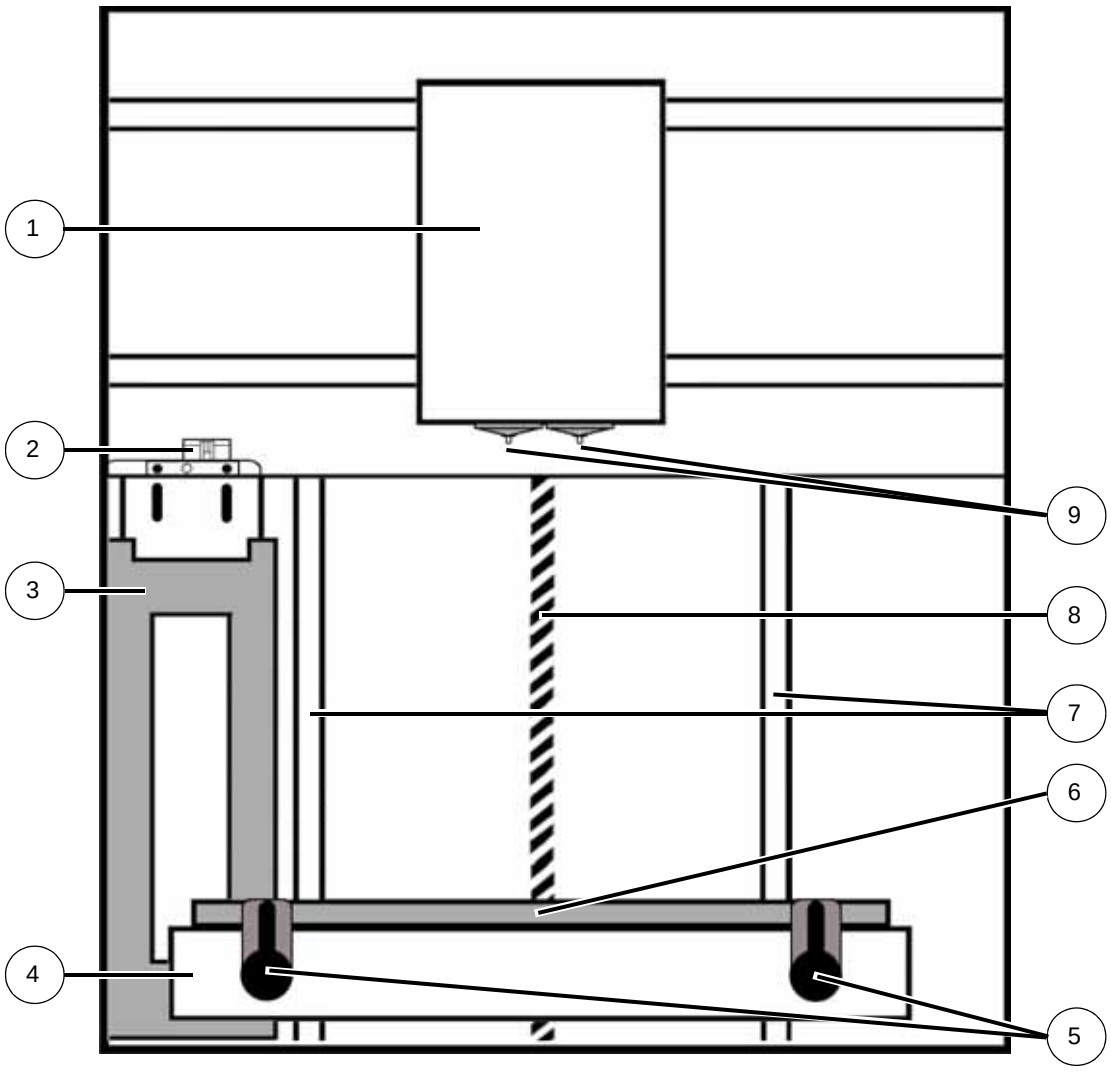
uPrint and uPrint SE build a maximum part size of 203 x 152 x 152 mm (8 x 6 x 6 in). uPrint Plus and uPrint SE Plus build a maximum part size of 203 x 203 x 152 mm (8 x 8 x 6 in). Each uPrint and uPrint Plus material carrier contains 492 cc (30 cu. in.) of usable material — enough to build continuously for about 48 hours without reloading. Each uPrint SE and uPrint SE Plus material carrier contains 688 cc (42 cu. in.) of usable material — enough to build continuously for about 67 hours without reloading. You can add an optional second material bay for extended build times.

Figure 2-10: Front and left side view of printer.



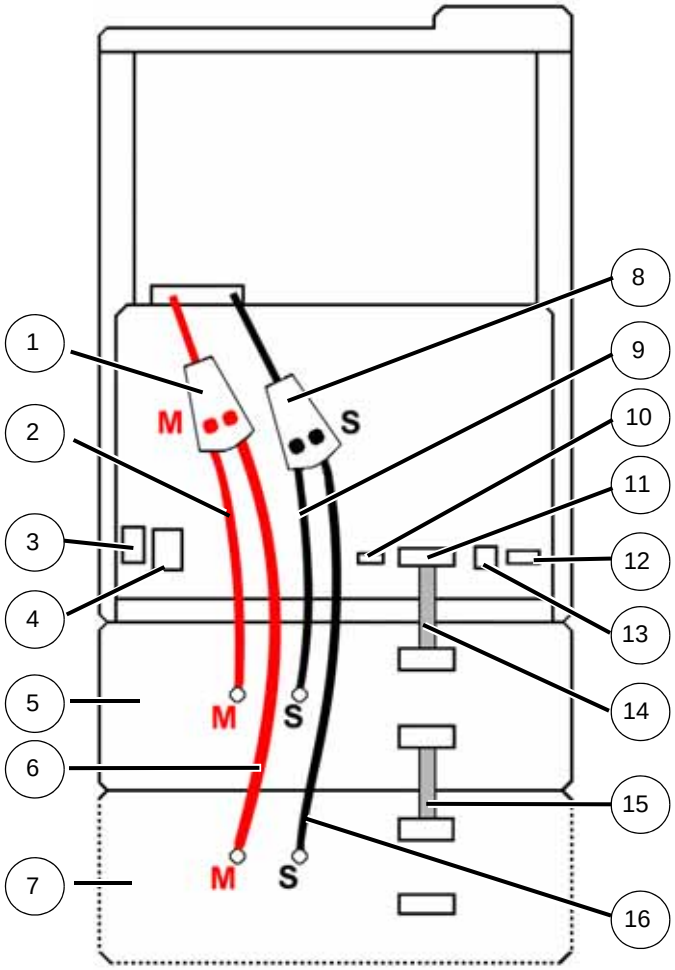
1	Display Panel	4	Optional Material Bay, Model Side
2	Material Bay, Support Side	5	Material Bay, Model Side
3	Optional Material Bay, Support Side	6	Power ON/OFF Switch

Figure 2-11: Interior chamber - front view



1	Extrusion Head
2	Tip wipe assembly
3	Purge bucket
4	Z stage platen
5	Modeling base retainers (x2)
6	Modeling base
7	Z stage guide rods
8	Z stage lead screw
9	Extrusion Tips

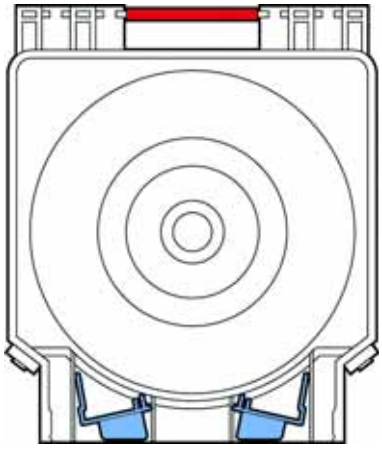
Figure 2-12: Rear view of printer



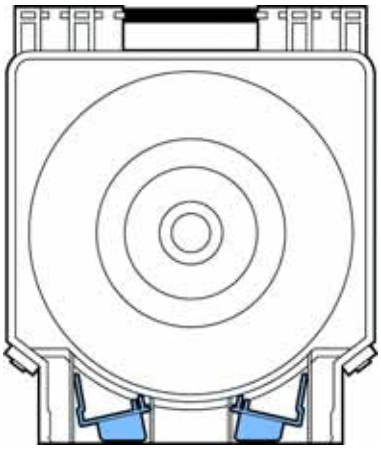
1	Model Material Y Connector	9	Support Material Tube
2	Model Material Tube	10	UPS Connection
3	AC Power Cord Connector	11	Material Bay Cable Connector
4	Circuit Breaker	12	RJ-45 Network Connector
5	Material Bay	13	Diagnostics Cable Connector
6	Optional Model Material Tube	14	Material Bay Communications Cable
7	Optional Material Bay	15	Optional Material Bay Communications Cable
8	Support Material Y Connector	16	Optional Support Material Tube

Note: To avoid damage to the printer from an uncontrolled power loss, installation of a UPS (Uninterruptible Power Supply) is recommended.

Figure 2-13: Material carriers



Model material carrier



Support material carrier

Figure 2-14: Modeling base

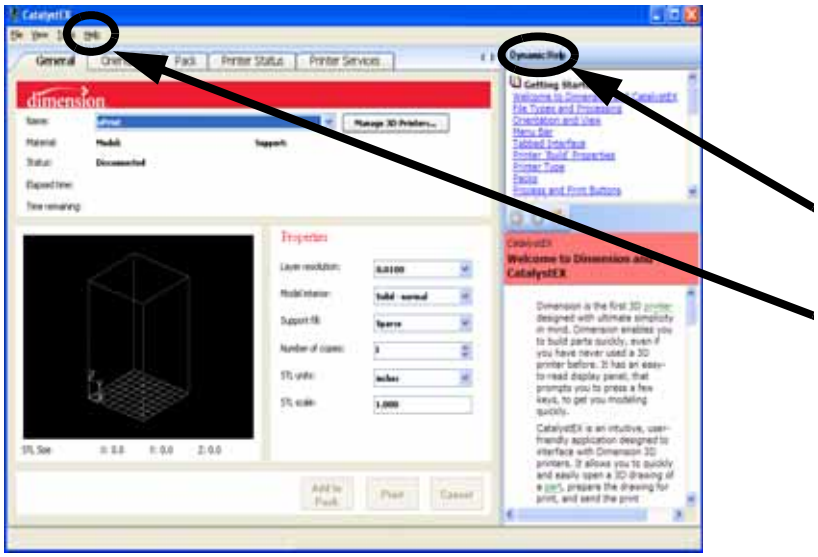
Modeling base

Caution: DO NOT reuse modeling bases. If a modeling base is reused, calibration errors, poor part quality, and loss of extrusion may occur. Additional modeling bases are available from your reseller.

Figure 2-15: Startup Kit contents

1	Gloves
2	Power cord (Euro)
3	Power cord (US)
4	Crossover cable (orange)
5	Network cable (blue)
6	Tip replacement kit (A. Support tip B. Model tip C. 8 Tip shields D. 4 Tip wipe assemblies)
7	10x magnifier loupe
8	Wire brush
9	Cutters
10	1/8 inch T-Handle wrench (red)
11	7/64 inch T-Handle wrench (yellow)
12	Needle nose pliers
13	Model material spool
14	Support material spool
15	CatalystEX CD
16	System Software CD
17	User Guide CD

Finding more information



CatalystEX Online Help

Simple operating instructions for CatalystEX are available in CatalystEX Dynamic Help. You can also see CatalystEX Help from the menu bar - **Help>Contents**

World Wide Web

Additional information is available at:
http://www.uprint3dprinting.com

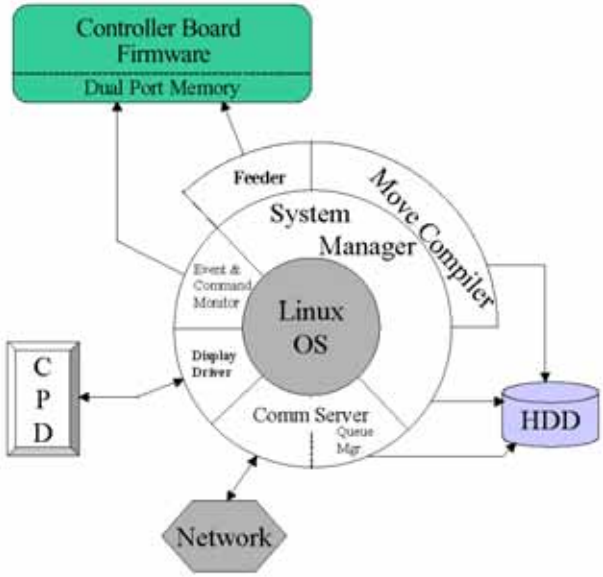
Software

3

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 Catalyst 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 Catalyst 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

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 Tip to Tip (difference in tip heights)
- Replacement toggle heads will be shipped with a factory Z Tip to Tip value. One the head is installed the customer must enter this value using DataStatEX. Service providers may also use MaracaEX to enter this value.

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 Tip to Tip.
- Reset the administrator password to null.

DataStatEX is located as a separate program on all system CD's. DataStatEX will NOT install on the workstation when performing a backend 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.

Parts and Tools Required

- System CD
- Workstation

Procedure

1. Insert the system 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 Current Modeler and State windows of DataStatEX.
10. From this point the customer can open any of the button options.

CatalystEX

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. sttIdle)
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

Maintenance Preparation

Read these warnings before performing service on printer!

	**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.
	**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).

Required Tools list

Distributer/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 TeraTerm 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

Pre-Maintenance Procedures

1. Unload model and support material.
2. Power the printer down using the power switch.
3. After the printer has powered down, turn the main power toggle switch off on the back of the unit.
4. Remove the AC power cord, RJ-45 network cable and UPS cable (if used) from the back of the unit.

Exterior Components

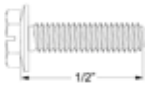
Top Panel

Required Tools

- 5/16" nut driver or standard screwdriver.

Hardware

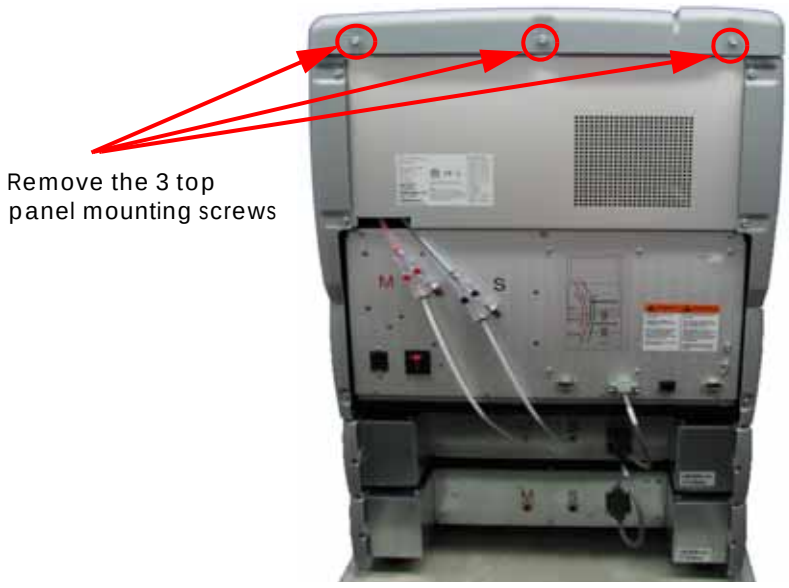
- 10-32 x 1/2" slotted screws (x3)



Removing the top panel

1. Using a 5/16" nut driver or standard screwdriver, remove the 3 mounting screws. See Figure 4-17.

Figure 4-17: Top panel mounting screw location



2. Lift up and slide the top panel towards the back of the printer to remove. See Figure 4-18.

Figure 4-18: Top panel removal

Slide top panel toward the back of the printer and lift up to remove.

Installing the top panel

1. Slide the top panel towards the front and in to place, then push down.
2. Using a $^{5}/_{16}$" nut driver or standard screwdriver, reinstall the 3 mounting screws.

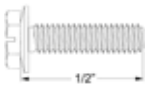
Side Panels

Required Tools

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

Hardware

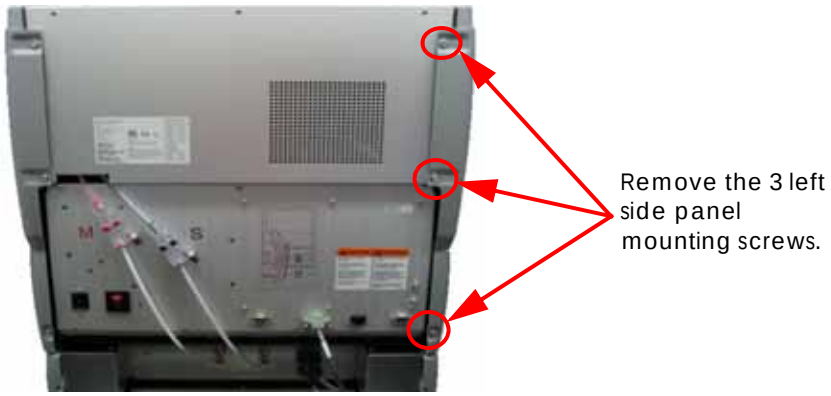
- 10-32 x $^{1}/_{2}$" slotted screws (x6)



Removing the left side panel

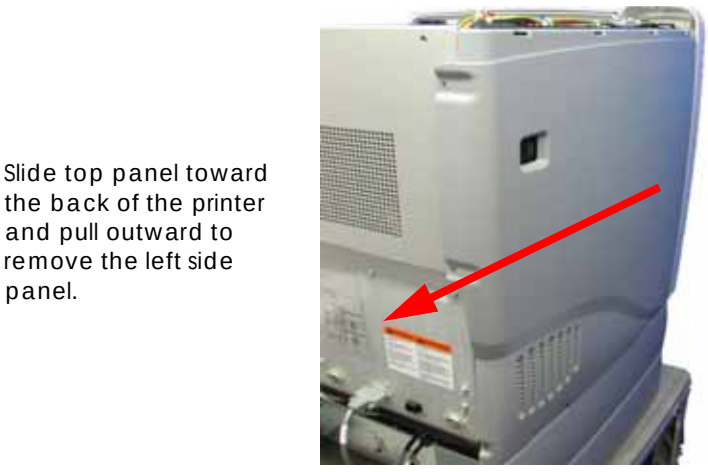
1. Remove the top panel. See Removing the top panel on page 4-5.
2. Using a $^{5}/_{16}$" nut driver or standard screwdriver, remove the 3 mounting screws. See Figure 4-19.

Figure 4-19: Left side panel mounting screw locations



3. Slide panel towards the back of the printer and pull outward to remove. See Figure 4-20.

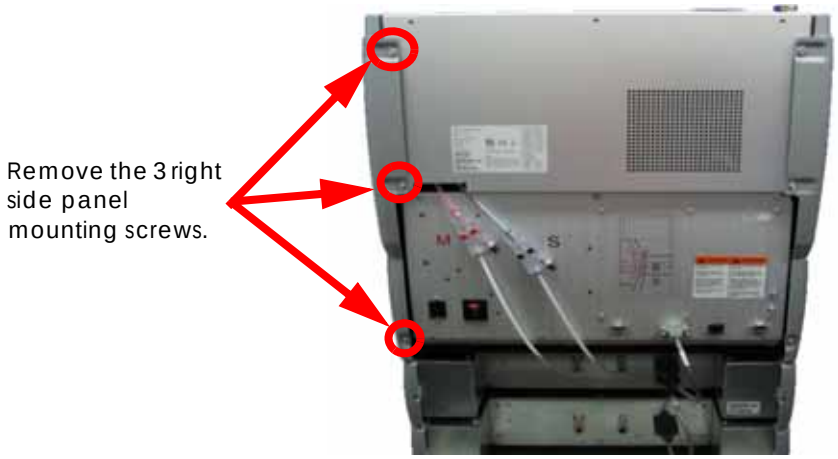
Figure 4-20: Removing the left side panel



Removing the right side panel

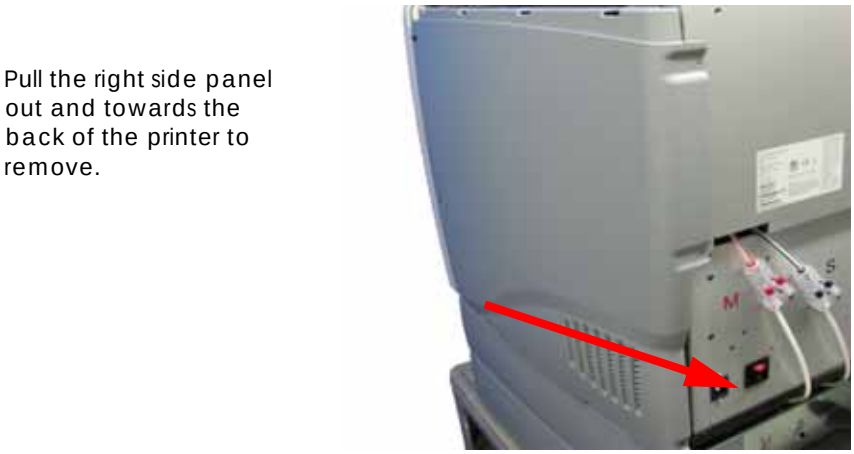
1. Using a $^{5}/_{16}$" nut driver or standard screwdriver, remove the 3 mounting screws. See Figure 4-21.

Figure 4-21: Right side panel mounting screw locations



2. Slide towards the back of the printer and pull outward to remove. See Figure 4-22.

Figure 4-22: Removing the right side panel



Installing the side panels

1. Slide the left side panel towards the front of the printer and push into place.
2. Using a $^{5}/_{16}$" nut driver or standard screwdriver, Reinstall the 3 mounting screws.
3. Slide the right side panel towards the front of the printer and push into place.
4. Using a $^{5}/_{16}$" nut driver or standard screwdriver, Reinstall the 3 mounting screws.
5. Reinstall the top panel. See Installing the top panel on page 4-6.

Display Panel

Required Tools

- Standard screwdriver.

Removing the display panel

1. Open the chamber door.
2. Gently pry open the display panel access hatch with a standard screwdriver. See Figure 4-23.

Figure 4-23: Opening the display panel access hatch

3. Reach behind the display panel and press the tab to release the display panel. See Figure 4-24.

Figure 4-24: Removing the display

4. Disconnect J1 connector. See Figure 4-25.

Figure 4-25: Disconnecting the J1 connector

5. Remove the display panel.

Installing the display panel

1. Connect the J1 Connector.
2. Gently push the display panel into place.
3. Close the display panel access hatch.
4. Close the chamber door.

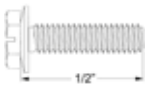
Front Panel

Required Tools

- 5/16″ nut driver or standard screwdriver.

Hardware

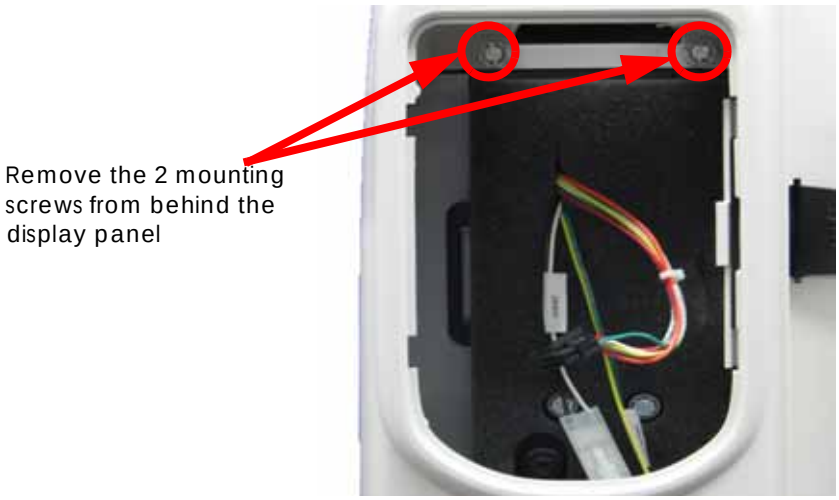
- 10-32 x 1/2″ slotted screws (x8)



Removing the front panel

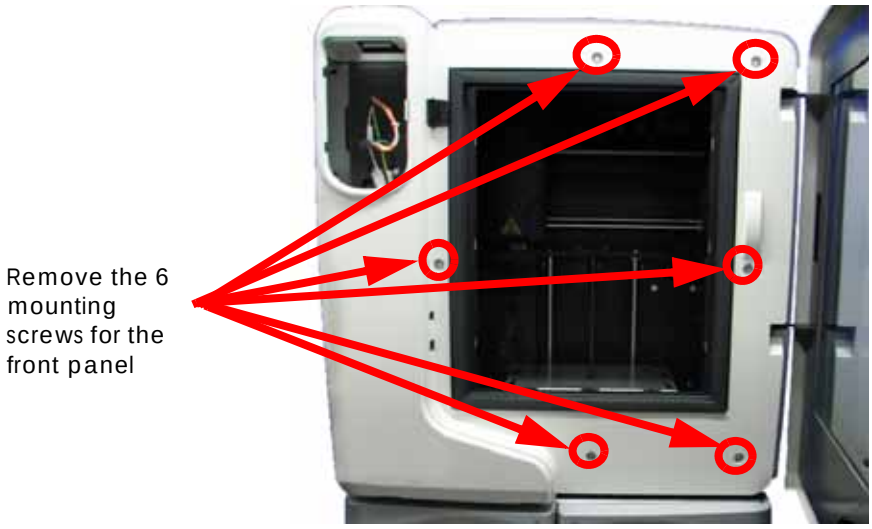
1. Open the chamber door.
2. Remove the display panel. See Removing the display panel on page 4-9.
3. Using a 5/16″ nut driver or standard screwdriver, remove the 2 mounting screws from behind the display panel. See Figure 4-26.

Figure 4-26: Front panel mounting screw locations



4. Using a 5/16″ nut driver or standard screwdriver, remove the 6 mounting screws from the front panel. See Figure 4-27.

Figure 4-27: Front panel mounting screw locations



5. Remove the front panel by pulling outward.

Installing the front panel

1. Align the front panel with the mounting holes.
2. Using a $^{5}/_{16}$" nut driver or standard screwdriver, reinstall the 6 mounting screws.
3. Using a $^{5}/_{16}$" nut driver or standard screwdriver, reinstall the 2 mounting screws behind the display panel.
4. Reinstall the display panel. See Installing the display panel on page 4-10.
5. Close the chamber door.

Door Solenoid

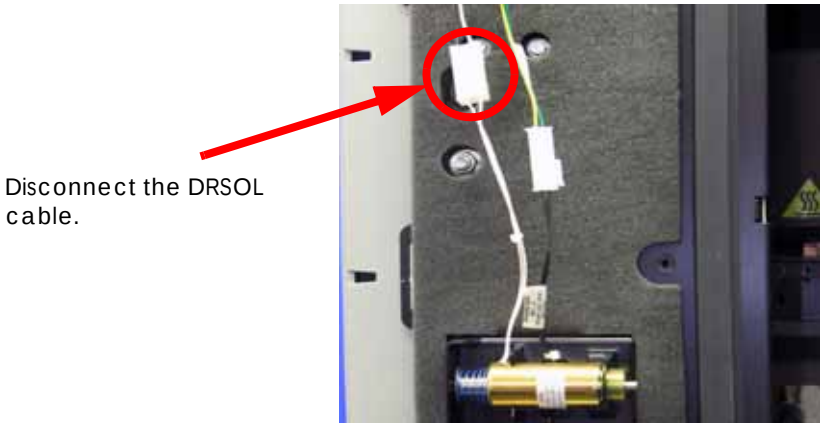
Required Tools

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

Removing the door solenoid

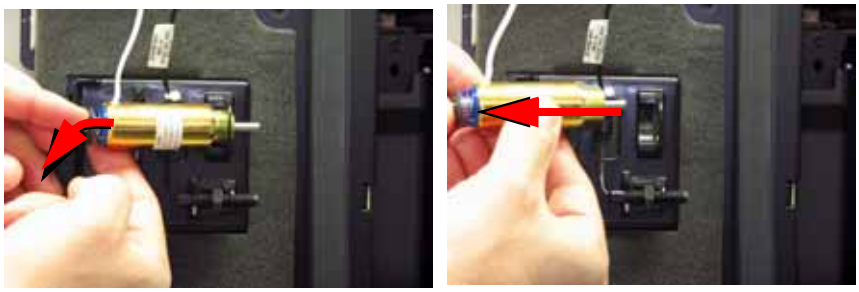
1. Remove the display panel. See Removing the display panel on page 4-9.
2. Remove the front panel. See Removing the front panel on page 4-11.
3. Disconnect the door solenoid (DRSOL) cable by pressing down on the tab. See Figure 4-28.

Figure 4-28: Door solenoid connector location



4. Push the solenoid pin out and down to remove from the mounting bracket. See Figure 4-29.

Figure 4-29: Removing the door solenoid



Installing the door solenoid

1. Push the solenoid pin out and slide door solenoid into place on the mounting plate.
2. Reconnect the DRSOL cable.
3. Reinstall the front panel. See Installing the front panel on page 4-12.
4. Reinstall the display panel. See Installing the display panel on page 4-10.

Door Sensor

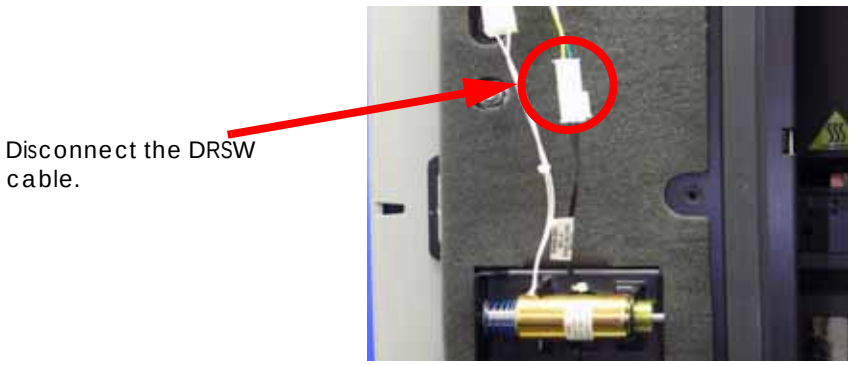
Required Tools

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

Removing the door sensor

1. Remove the display panel. See Removing the display panel on page 4-9.
2. Remove the front panel. See Removing the front panel on page 4-11.
3. Disconnect the DRSW cable. See Figure 4-30.

Figure 4-30: Door sensor cable location



4. Gently pull the door sensor out of the mounting plate. See Figure 4-31.

Figure 4-31: Removing the Door Sensor

Installing the door sensor

1. Gently push the door sensor into place on the mounting plate.
2. Connect the door sensor (DRSW) cable.
3. Install the front panel. See Installing the front panel on page 4-12.
4. Install the display panel. See Installing the display panel on page 4-10.

Electronics Bay Components

The main circuit boards and power supplies for the printer are located in the electronics bay.

Note: When reinstalling components in the Electronics Bay area note that cable J401 is unused. (Not connected)

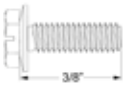
Lower Electronics Bay Cover

Required Tools

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

Hardware

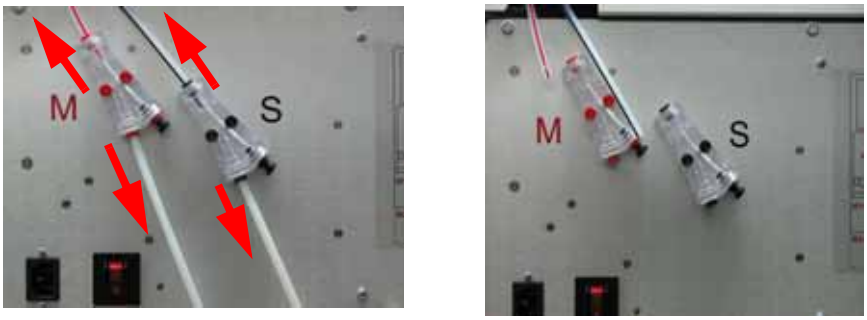
- 10-32 x $^{3}/_{8}$" slotted screws (x3)



Opening the electronics bay

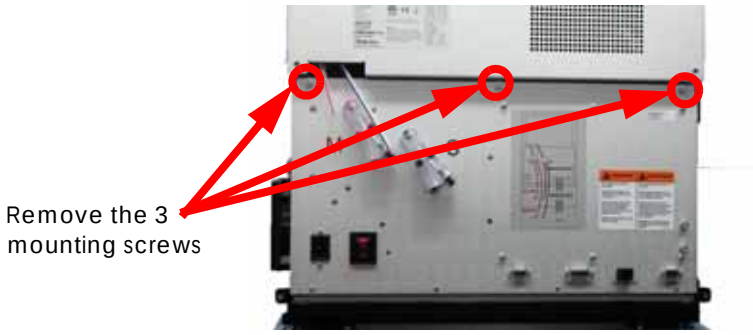
1. Remove the top panel. See Removing the top panel on page 4-5.
2. Remove the side panels. See Side Panels on page 4-7.
3. Remove the filament tubes from the Y connectors by pushing down on the ring and pulling back on the filament tubes. See Figure 4-32.

Figure 4-32: Removing the filament tubes from the Y connectors



4. Using a $^{5}/_{16}$" nut driver or standard screwdriver, remove the 3 mounting screws on the top of the electronics bay cover. See Figure 4-33.

Figure 4-33: Electronics bay cover mounting screw locations



5. Gently pull the electronics bay cover down. See Figure 4-34.

Figure 4-34: Electronics bay with cover lowered

Closing the electronics bay

1. Gently push the electronics bay cover back in to the closed position.
2. Using a $^{5}/_{16}$" nut driver or standard screwdriver, reinstall the 3 mounting screws.
3. Reconnect the filament tubes to the Y connectors.
4. Reinstall the side panels. See Installing the side panels on page 4-8.
5. Reinstall the top panel. See Installing the top panel on page 4-6.

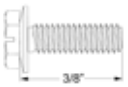
Upper Electronics Bay Cover

Required Tools

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

Hardware

- 10-32x$^{3}/_{8}$" slotted screws (x4)



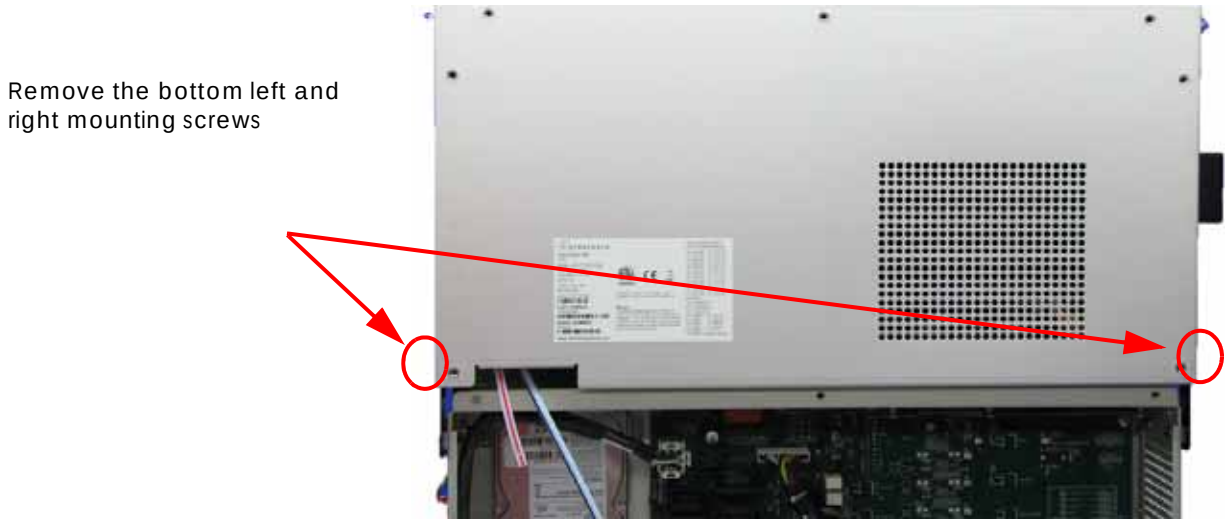
Removing the upper electronics bay cover

1. Remove the top panel. See Removing the top panel on page 4-5.
2. Remove the side panels. See Side Panels on page 4-7.
3. Using a $^{5}/_{16}$" nut driver or standard screwdriver, loosen but do not remove the top left and right mounting screws. See Figure 4-35.

Figure 4-35: Upper electronics bay cover top mounting screw locations

4. Using a $^{5}/_{16}$" nut driver or standard screwdriver, remove the bottom left and right mounting screws. See Figure 4-36.

Figure 4-36: Upper electronics bay cover bottom mounting screw locations



5. Lift the cover up and off of the top mounting screws.

Installing the upper electronics bay cover

1. Slide the cover down on to the top left and right side mounting screws.
2. Using a $^{5}/_{16}$" nut driver or standard screwdriver, reinstall the bottom left and right side mounting screws.
3. Using a $^{5}/_{16}$" nut driver or standard screwdriver, tighten the top left and right side mounting screws.
4. Install the side panels. See Installing the side panels on page 4-8.
5. Install the top panel. See Installing the top panel on page 4-6.

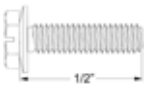
Removing the Electronics Bay

Required Tools

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

Hardware

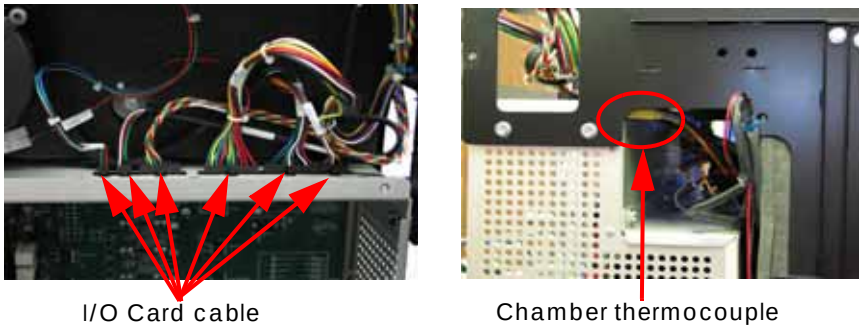
- 10-32 x $^{1}/_{2}$" slotted screws (x8)



Removing the electronics bay

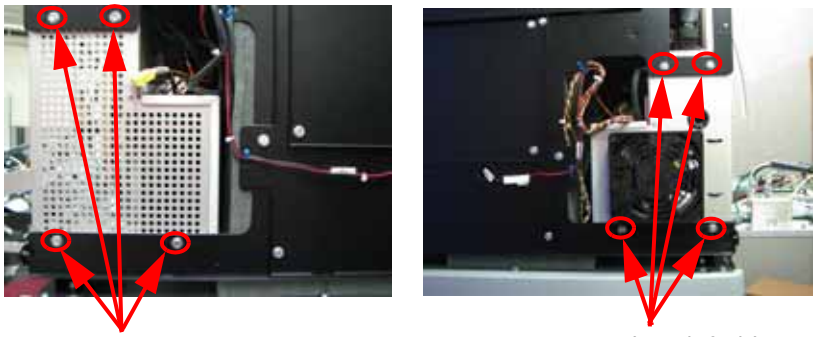
1. Remove the top panel. See Removing the top panel on page 4-5.
2. Remove the side panels. See Side Panels on page 4-7.
3. Remove the upper electronics bay cover. See Removing the upper electronics bay cover on page 4-17.
4. Touch the metal plate of the electronics bay cover to discharge any static electricity.
5. Disconnect the 6 I/O card cables by pressing down on the long tabs and pulling out. See Figure 4-37.
6. Disconnect the chamber thermocouple wire. See Figure 4-37.

Figure 4-37: I/O card cable locations



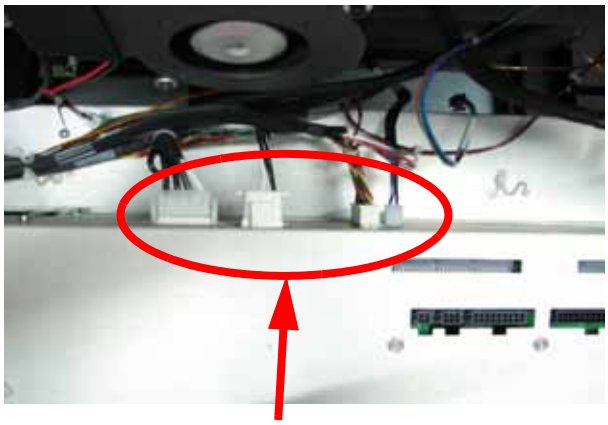
7. Remove the left and right side electronics bay mounting screws with a $^{5}/_{16}$" nut driver or standard screwdriver. See Figure 4-38.

Figure 4-38: Electronics Bay mounting screw locations



8. Slide the electronics bay out 3 inches (76mm) and disconnect the cables from the rear of the power distribution board. See Figure 4-39.

Figure 4-39: Power Distribution Board rear cable locations



9. To remove, slide the entire electronics bay out from the back of the printer.

Installing the electronics bay

1. Slide the electronics bay into position, leaving 3 inches (76mm).
2. Connect the 4 rear power distribution board cables.
3. Slide the electronics bay back into position
4. Using a $^{5}/_{16}$" nut driver or standard screwdriver, reinstall the 4 left and 4 right side mounting screws.
5. Connect the I/O card cables.
6. Reinstall the upper electronics bay cover. See Installing the upper electronics bay cover on page 4-18.
7. Reinstall the side panels. See Installing the side panels on page 4-8.
8. Reinstall the top panel. See Installing the top panel on page 4-6.

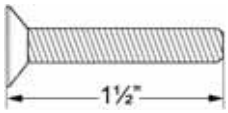
Electronics Bay Cooling Fan

Required Tools

- 5/16" nut driver or standard screwdriver.
- 5/64" allen wrench.

Hardware

- 6-32 x 1½" flat head cap screws (x4)



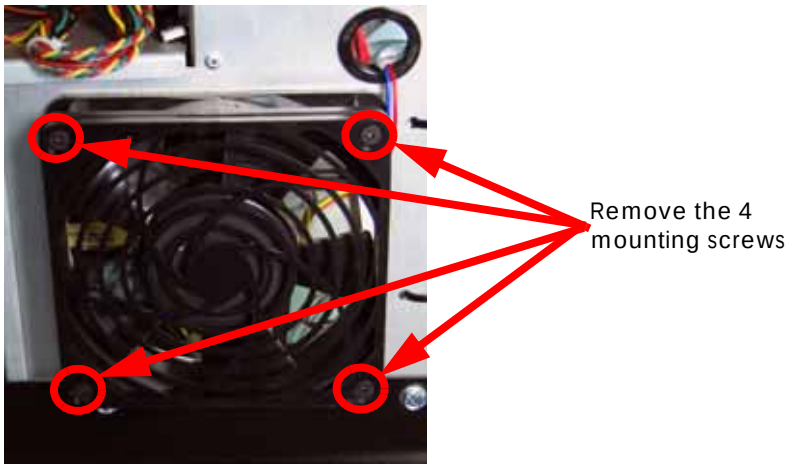
Removing the electronics bay cooling fan

1. Remove the top panel. See Removing the top panel on page 4-5.
2. Remove the side panels. See Side Panels on page 4-7.
3. Open the Electronics Bay. See Opening the electronics bay on page 4-15.
4. Touch the metal plate of the electronics bay cover to discharge any static electricity.
5. Disconnect the P1 cable from the fan. See Figure 4-40.

Figure 4-40: Electronics bay cooling fan connector location

6. Using a 5/64" allen wrench, remove the 4 mounting screws. See Figure 4-41.

Figure 4-41: Electronics bay cooling fan mounting screw locations



7. Remove the cooling fan.

Installing the electronics bay cooling fan

1. Align the cooling fan with the 4 mounting holes.
2. Using a $^{5}/_{64}$" allen wrench, reinstall the 4 mounting screws.
3. Reconnect the P1 cable.
4. Close the electronics bay. See Closing the electronics bay on page 4-16.
5. Install the side panels. See Installing the side panels on page 4-8.
6. Install the top panel. See Installing the top panel on page 4-6.

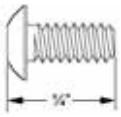
Controller Board

Required Tools

- $^{5}/_{16}$" nut driver or standard screwdriver.
- Phillips screwdriver

Hardware

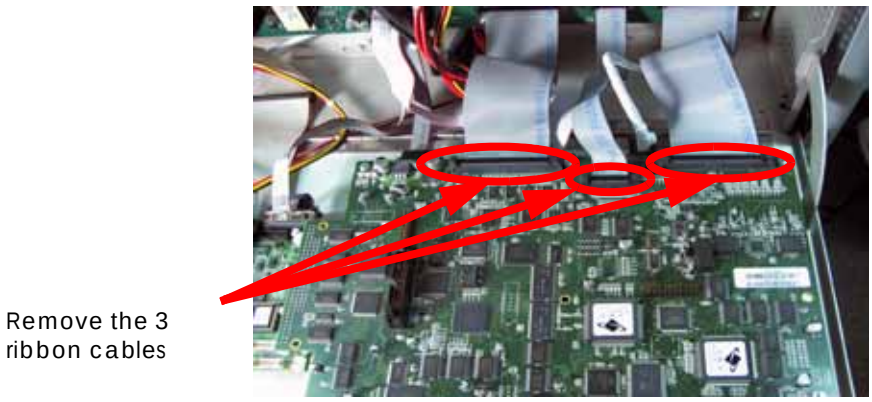
- 6-32 x $^{1}/_{4}$" Phillips pan head screws (x6)



Removing the controller board

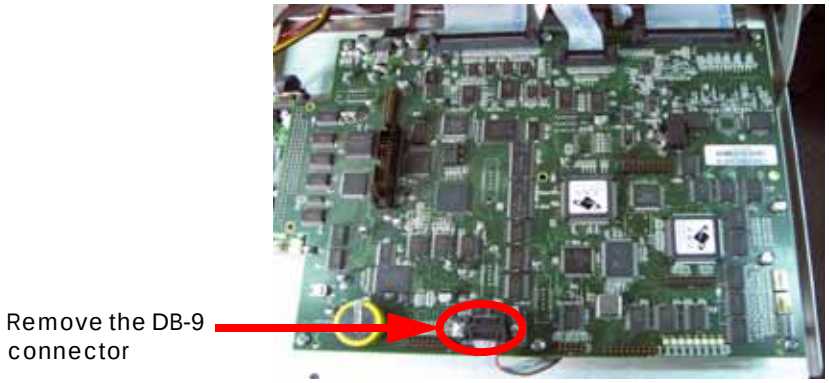
1. Open the electronics bay. See Opening the electronics bay on page 4-15.
2. Touch the metal plate of the electronics bay cover to discharge any static electricity.
3. Remove the 3 ribbon cables by pressing the tabs outward and gently pulling the ribbon cables out of the sockets. See Figure 4-42.

Figure 4-42: Controller board ribbon cable locations



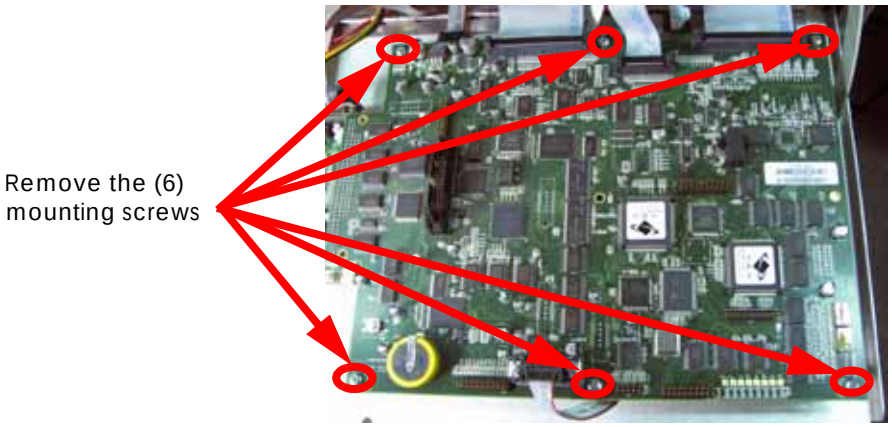
4. Using a standard screwdriver, loosen the 2 screws that hold the diagnostics DB-9 cable in place. Then gently pull the cable out of the connector. See Figure 4-43.

Figure 4-43: Remove the 2 screws that hold the Diagnostics DB-9 cable in place



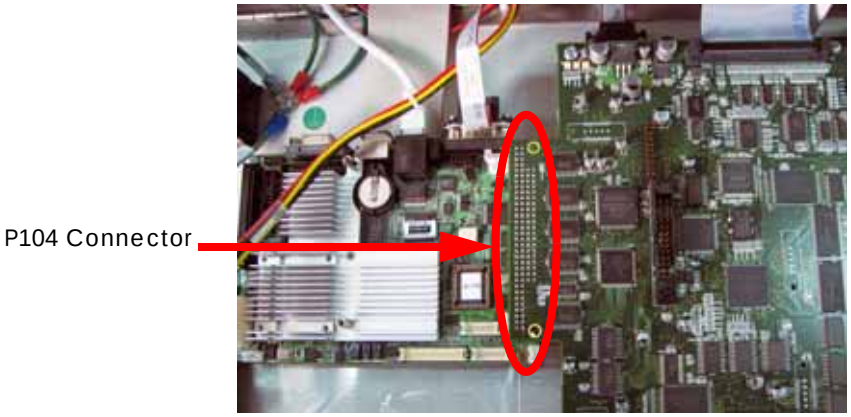
5. Using a Phillips screwdriver, remove the 6 controller board mounting screws. See Figure 4-44.

Figure 4-44: Controller board mounting screw locations



6. Gently lift the controller board up from the single board computer (SBC) at the P104 connector. **DO NOT bend any pins on the board.** See Figure 4-45.

Figure 4-45: P104 connector location



Installing the controller board

1. Align the pins of the Controller board with the P104 connector of the SBC and gently press down in to position.
2. Using a Phillips screwdriver, reinstall the 6 mounting screws.
3. Reconnect the diagnostics DB-9 connector to the controller board.
4. Using a standard screwdriver, tighten the 2 mounting screws.
5. Reconnect the 3 ribbon cables to the PDB.
6. Close the Electronics Bay. See Closing the electronics bay on page 4-16.
7. From the workstation, open CatalystEX.
8. Connect to the printer.
9. Insert the printer firmware CD into the workstation CD drive.
10. From the Printer Services tab, click on the Update Software button.
11. Navigate CatalystEX to the Upgrade (.UPG) file on the printer firmware CD.
12. The printer will load, reboot and verify the upgrade.

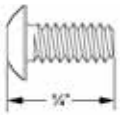
Single Board Computer (SBC)

Required Tools

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

Hardware

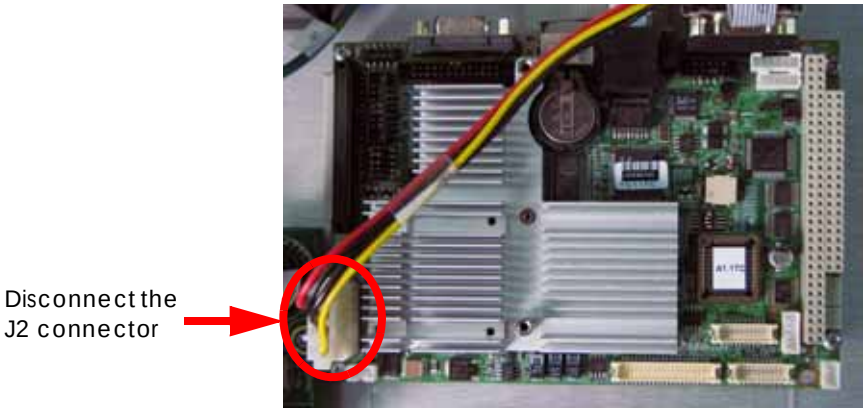
- 6-32 x $^{1}/_{4}$″ Phillips pan head screws (x4)



Removing the single board computer

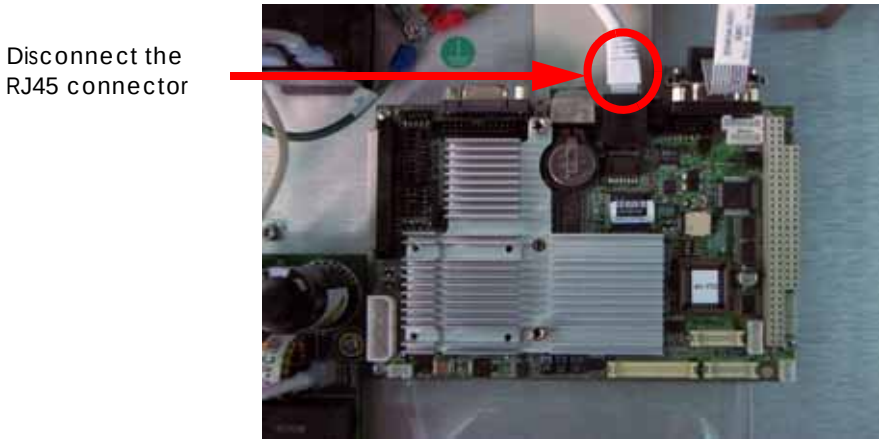
1. Open the electronics bay. See Opening the electronics bay on page 4-15.
2. Touch the metal plate of the electronics bay cover to discharge any static electricity.
3. Remove the controller board. See Removing the controller board on page 4-23.
4. Disconnect the J2 power connector. See Figure 4-46.

Figure 4-46: J2 power connector location



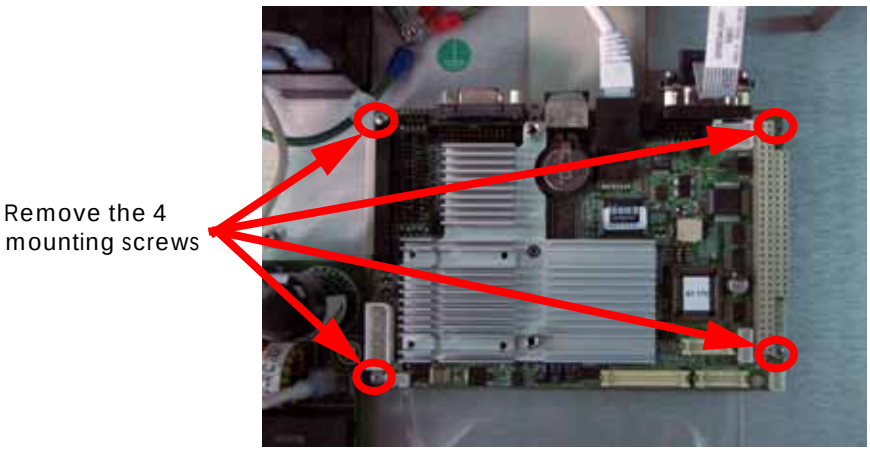
5. Disconnect the RJ-45 network cable. See Figure 4-47.

Figure 4-47: RJ-45 network cable location



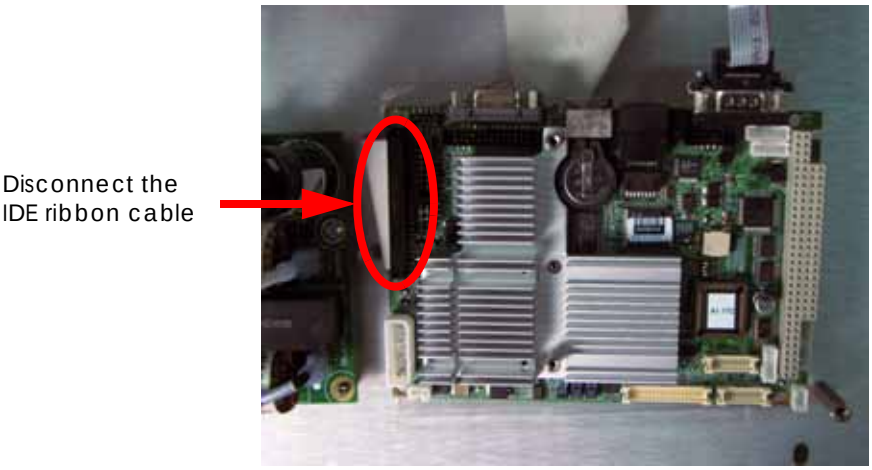
6. Using a Phillips screwdriver, remove the 4 mounting screws. See Figure 4-48.

Figure 4-48: SBC mounting screw locations



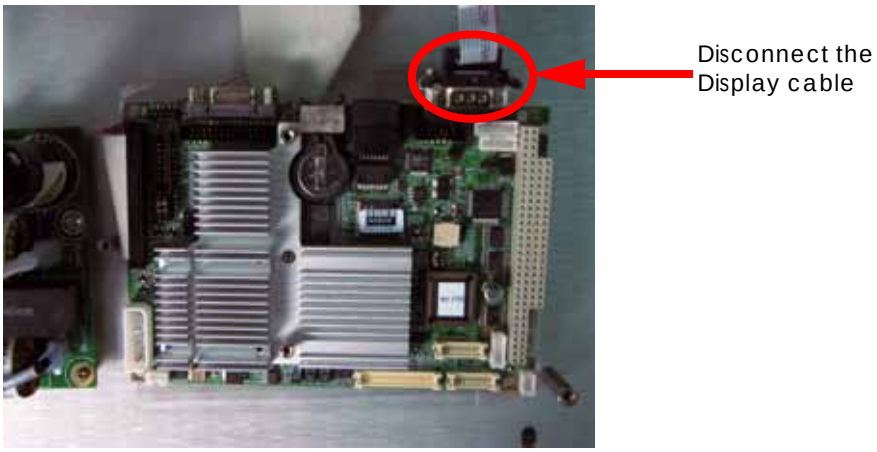
7. Lift the SBC and disconnect the IDE ribbon cable by pulling out of the socket. See Figure 4-49.

Figure 4-49: SBC IDE ribbon cable location



8. Using a standard screwdriver, loosen the display cable mounting screws. See Figure 4-50.
9. Disconnect the display cable from the SBC. See Figure 4-50.

Figure 4-50: SBC display cable location



Installing the single board computer

1. Reconnect the display cable.
2. Using a standard screwdriver, tighten the display cable mounting screws.
3. Reconnect the IDE ribbon cable.
4. Align the SBC with the mounting holes.
5. Using a Phillips screwdriver, reinstall the 4 mounting screws.
6. Reconnect the RJ-45 network cable.
7. Reconnect the J2 power cable.
8. Reinstall the controller board. See Installing the controller board on page 4-25.
9. Close the electronics bay. See Closing the electronics bay on page 4-16.

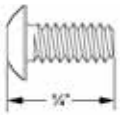
Power Distribution I/O Card

Required Tools

- $^{5}/_{16}$" nut driver or standard screwdriver.
- Phillips screwdriver

Hardware

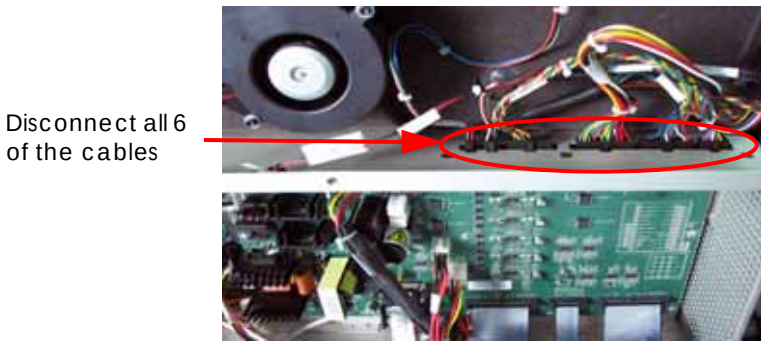
- 6-32 x $^{1}/_{4}$" Phillips pan head screws (x3)



Removing the I/O card

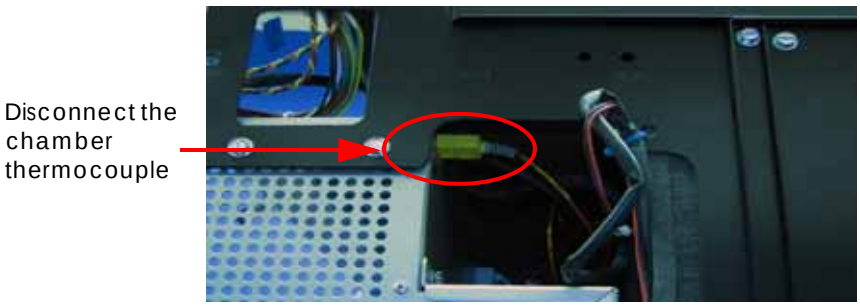
1. Remove the top panel. See Removing the top panel on page 4-5.
2. Remove the side panels. See Side Panels on page 4-7.
3. Open the electronics bay. See Opening the electronics bay on page 4-15.
4. Touch the metal plate of the electronics bay cover to discharge any static electricity.
5. Disconnect the 6 cables from the I/O card by pushing in on the locking tabs and pulling outward. See Figure 4-51.

Figure 4-51: I/O card cable locations



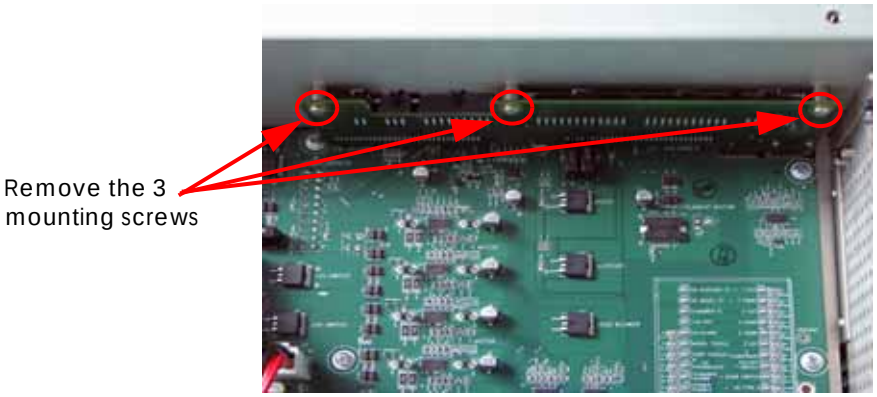
6. Disconnect the thermocouple from the back side of the I/O card by pulling outward. See Figure 4-52.

Figure 4-52: Chamber thermocouple wire location



7. Using a Phillips screwdriver, remove the 3 mounting screws from the I/O card. See Figure 4-53.

Figure 4-53: I/O card mounting screw locations

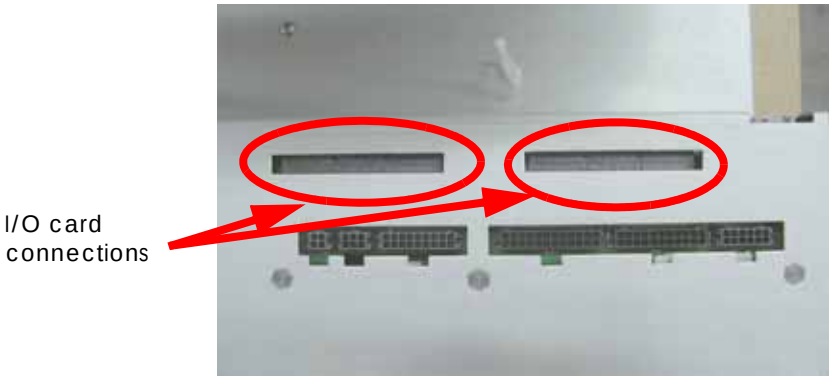


8. Gently pull the I/O card out from the power distribution board sockets.

Installing the I/O card

1. Gently slide the I/O card in to the power distribution board sockets.
2. Verify the I/O card is seated properly by viewing the connection through the viewing slots. See Figure 4-54.

Figure 4-54: I/O card viewing slot location



3. Using a Phillips screwdriver, reinstall the 3 mounting screws.
4. Reconnect the thermocouple to the back side of the I/O card.
5. Reconnect the 6 cables to the I/O card.
6. Close the electronics bay. See Closing the electronics bay on page 4-16.
7. Reinstall the side panels. See Installing the side panels on page 4-8.
8. Reinstall the top panel. See Installing the top panel on page 4-6.

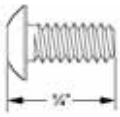
Power Distribution Board (PDB)

Required Tools

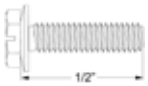
- 5/16" nut driver or standard screwdriver.
- Phillips screwdriver

Hardware

- 6-32 x 1/4" Phillips pan head screws (x12)



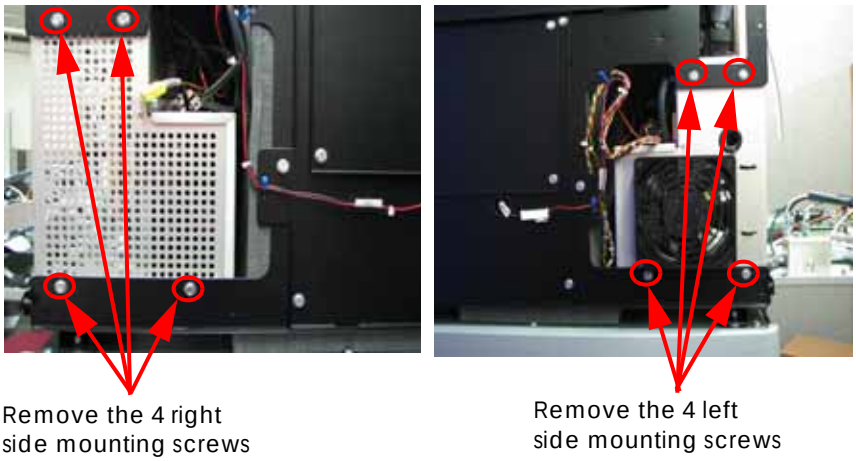
- 10-32 x 1/2" slotted screws (x8)



Removing the power distribution board

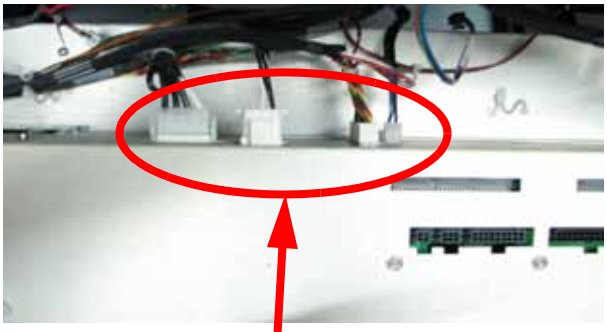
1. Remove the top panel. See Removing the top panel on page 4-5.
2. Remove the side panels. See Side Panels on page 4-7.
3. Open the electronics bay. See Opening the electronics bay on page 4-15.
4. Touch the metal plate of the electronics bay cover to discharge any static electricity.
5. Remove the I/O card. See Removing the I/O card on page 4-29.
6. Using a 5/16" nut driver or standard screwdriver, remove the 4 screws on the left and right side of the electronics bay and carefully slide the electronics bay out of the printer about 3 inches (76mm). See Figure 4-55.

Figure 4-55: Electronics bay mounting screw locations



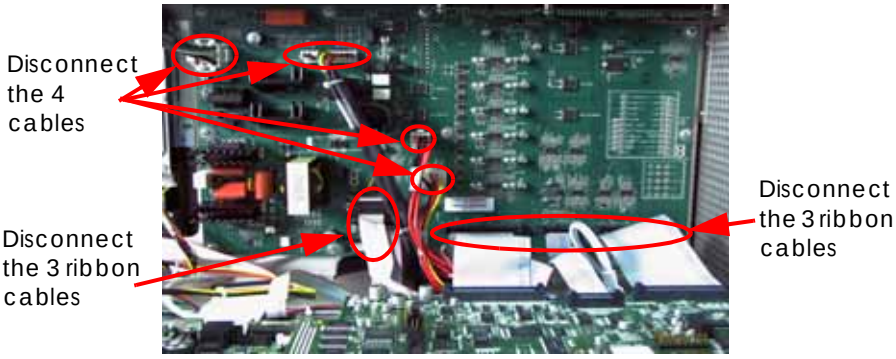
7. Disconnect the 4 cables from the back side of the power distribution board. See Figure 4-56.

Figure 4-56: Power distribution board rear cable locations



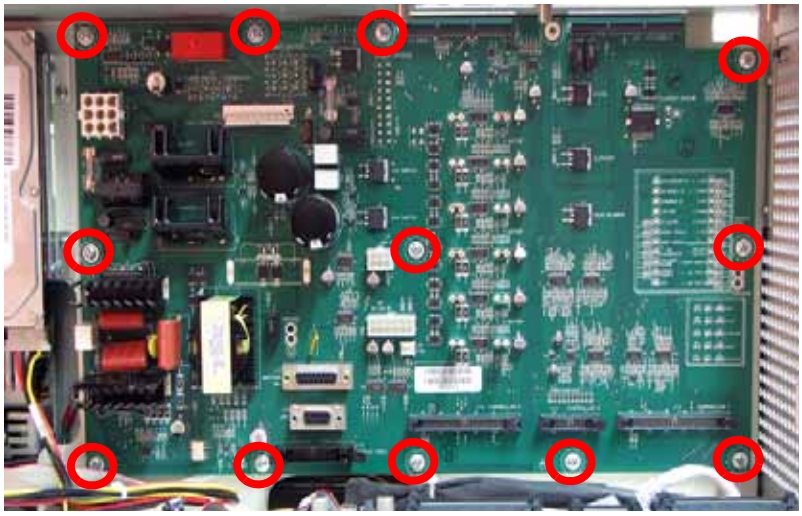
8. Slide the Electronics Bay back into place.
9. Disconnect the 10 cables from the front of the PDB. See Figure 4-57.

Figure 4-57: Power distribution board front cable locations



10. Using a Phillips screwdriver, remove the 12 mounting screws. See Figure 4-58.

Figure 4-58: Power distribution board mounting screw locations



11. To remove, gently pull the power distribution board outward.

Installing the power distribution board

1. Align the power distribution board with the mounting holes.
2. Using a Phillips screwdriver, reinstall the 12 mounting screws.
3. Reconnect the 10 cables to the front of the power distribution board.
4. Carefully slide the electronics bay out 3 inches (76mm) and reconnect the 4 cables to the back of the PDB.
5. Carefully slide the electronics bay back into position.
6. Using a $^{5}/_{16}$" nut driver or standard screwdriver, reinstall the 8 mounting screws on the left and right sides.
7. Reinstall the I/O card. See Installing the I/O card on page 4-30.
8. Close the electronics bay. See Closing the electronics bay on page 4-16.
9. Reinstall the side panels. See Installing the side panels on page 4-8.
10. Reinstall the top panel. See Installing the top panel on page 4-6.

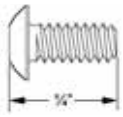
Hard Drive

Required Tools

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

Hardware

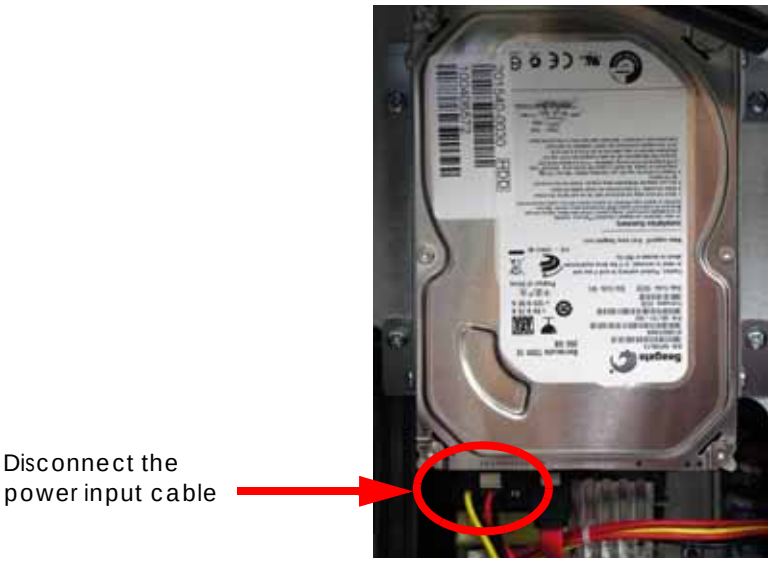
- 6-32 x $^{1}/_{4}$″ Phillips pan head screws (x8)



Removing the SATA Hard Drive

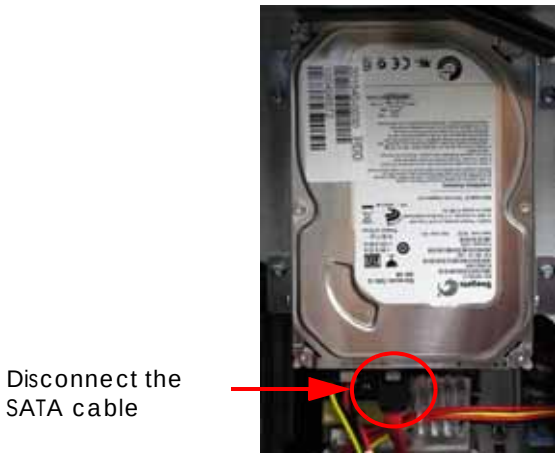
1. Open the electronics bay. See Opening the electronics bay on page 4-15.
2. Touch the metal plate of the electronics bay cover to discharge any static electricity.
3. Disconnect the power input cable by pressing the metal tab in and pulling down. See Figure 4-59.

Figure 4-59: Hard drive power cable location



4. Disconnect the SATA cable by pressing the metal tab in and pulling down. See Figure 4-60.

Figure 4-60: SATA cable location



5. Using a Phillips screwdriver, remove the 4 mounting screws. See Figure 4-61.

Figure 4-61: Hard drive mounting screw locations

6. Slide the hard drive up and out of the electronics bay.
7. Using a Phillips screwdriver, remove the mounting brackets from the hard drive. See Figure 4-62.

Figure 4-62: Hard drive mounting bracket screw locations

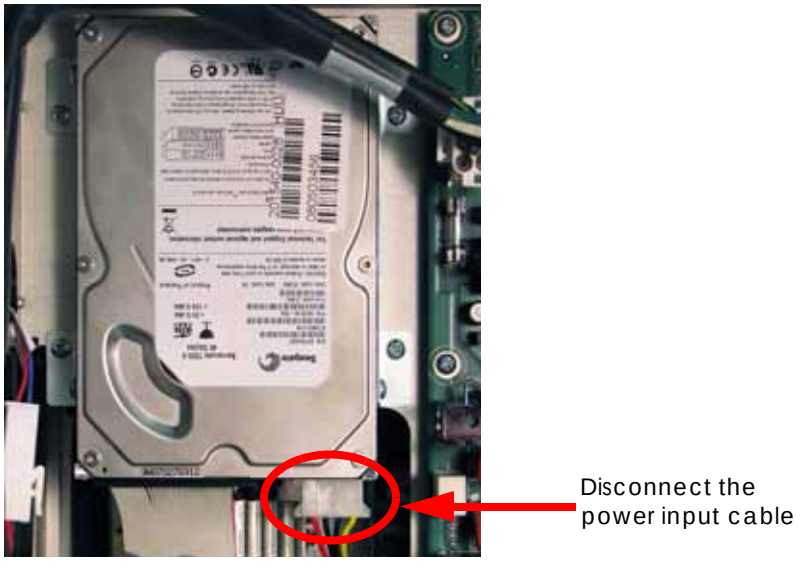
Installing the SATA hard drive

1. Using a Phillips screwdriver, reinstall the 2 mounting brackets.
2. Push the hard drive in the slots and down into position.
3. Using a Phillips screwdriver, reinstall the 4 mounting screws.
4. Reconnect the SATA cable.
5. Reconnect the power input cable.
6. Close the electronics bay. See Closing the electronics bay on page 4-16.
7. Power up the printer. The printer may take up to 45 minutes to run the Check Disc command before any text is displayed on the display panel.
8. After the printer has rebooted and is idle, press **Maintenance > System > Set Network.**
9. Select either Dynamic networking or Static networking.
10. If using Static networking, enter the printers IP Address, Default Gateway and Subnet Mask values.
11. From the PC, open the CatalystEX.
12. Connect to the printer.
13. Insert the printer firmware CD into the workstation CD drive.
14. From the Printer Services tab, click on the Update Software button.
15. Navigate CatalystEX to the Upgrade (.UPG) file on the printer firmware CD.
16. The printer will load, reboot and verify the upgrade.
17. If the printer has System Software version 9.0 build 3230 or newer installation is complete. If the printer System Software is older than version 9.0 build 3230, complete the following steps:
    A. Remove the printer calibration CD from the electronics bay and insert into the workstation CD drive.
    B. Install and open MaracaEX. Ensure that communications has been established with the printer.
    C. Select “Send” and browse to the CD drive.
    D. Select the xxx.cal (where xxx equals printer name) from the CD by double clicking on the file name.
    E. To complete sending the file, click on the green check mark. This will write the file to the printer hard drive.
    F. Cycle power on the printer.
    G. Replace the CD into the electronics bay.
    H. Perform Offset calibrations, see Offset Calibrations on page 5-2.
    I. Perform Part Based calibration, see Part Based Calibration on page 5-7.

Removing the IDE Hard Drive

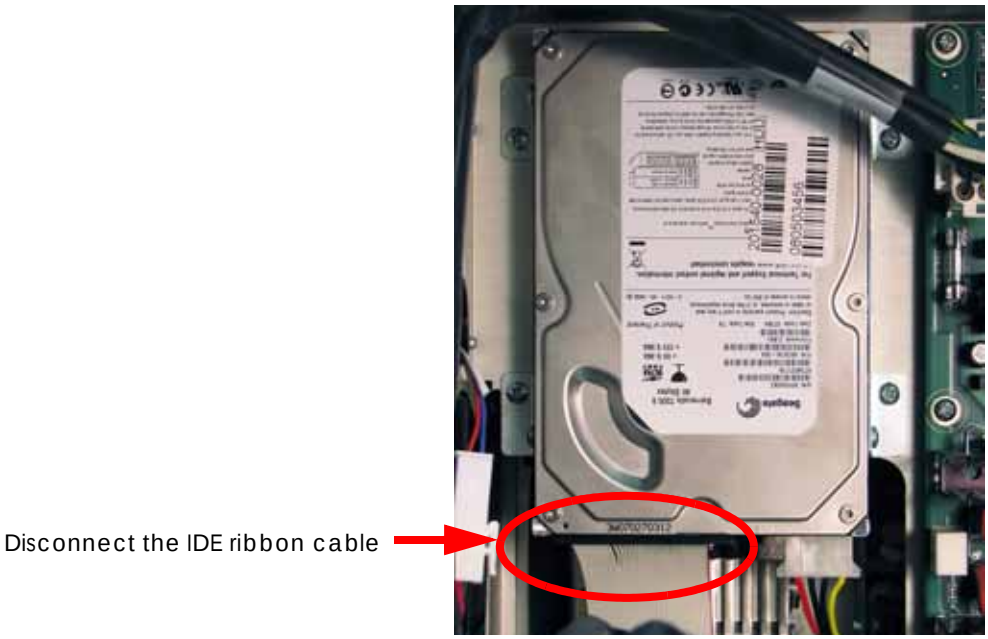
1. Open the electronics bay. See Opening the electronics bay on page 4-15.
2. Touch the metal plate of the electronics bay cover to discharge any static electricity.
3. Disconnect the power input cable by pressing the metal tab in and pulling down. See Figure 4-59.

Figure 4-63: Hard drive power cable location



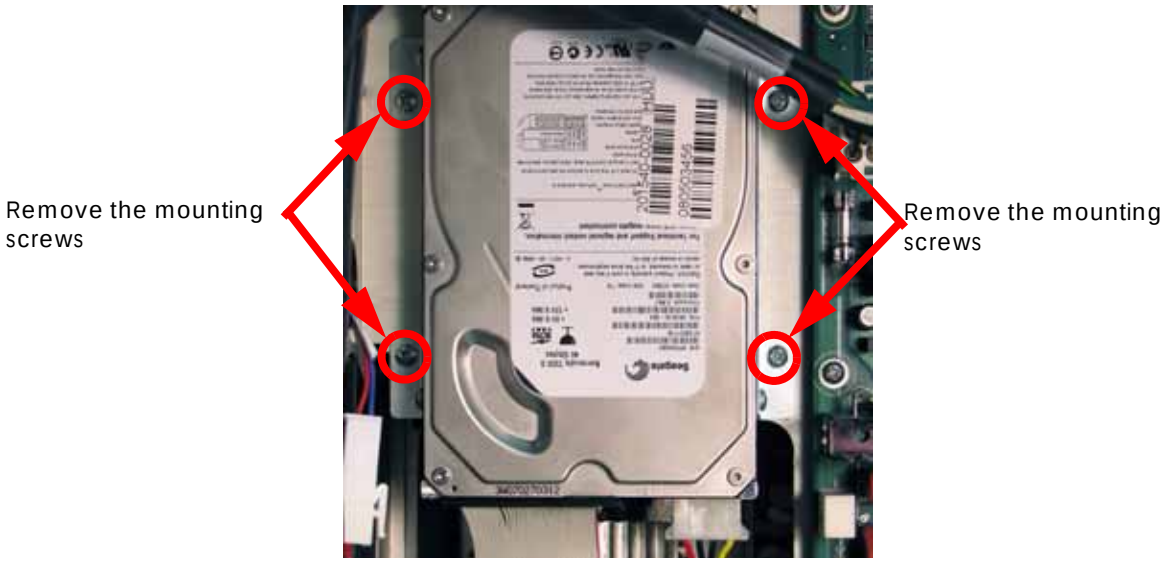
4. Disconnect the SATA cable by pressing the metal tab in and pulling down. See Figure 4-60.

Figure 4-64: IDE cable location



5. Using a Phillips screwdriver, remove the 4 mounting screws. See Figure 4-61.

Figure 4-65: Hard drive mounting screw locations



6. Slide the hard drive up and out of the electronics bay.
7. Using a Phillips screwdriver, remove the mounting brackets from the hard drive. See Figure 4-62.

Figure 4-66: Hard drive mounting bracket screw locations

Installing the IDE hard drive

1. Using a Phillips screwdriver, reinstall the 2 mounting brackets.
2. Push the hard drive in the slots and down into position.
3. Using a Phillips screwdriver, reinstall the 4 mounting screws.
4. Reconnect the SATA cable.
5. Reconnect the power input cable.
6. Close the electronics bay. See Closing the electronics bay on page 4-16.
7. Power up the printer. The printer may take up to 45 minutes to run the Check Disc command before you see anything on the display panel.
8. After the printer has rebooted and is idle, press **Maintenance > System > Set Network.**
9. Select either Dynamic networking or Static networking.
10. If using Static networking, enter the printers IP Address, Default Gateway and Subnet Mask values.
11. From the PC, open the CatalystEX.
12. Connect to the printer.
13. Insert the printer firmware CD into the workstation CD drive.
14. From the Printer Services tab, click on the Update Software button.
15. Navigate CatalystEX to the Upgrade (.UPG) file on the printer firmware CD.
16. The printer will load, reboot and verify the upgrade.
17. If the printer has System Software version 9.0 build 3230 or newer installation is complete. If the printer System Software is older than version 9.0 build 3230, complete the following steps:
    A. Remove the printer calibration CD from the electronics bay and insert into the workstation CD drive.
    B. Install and open MaracaEX. Ensure that communications has been established with the printer.
    C. Select “Send” and browse to the CD drive.
    D. Select the xxx.cal (where xxx equals printer name) from the CD by double clicking on the file name.
    E. To complete sending the file, click on the green check mark. This will write the file to the printer hard drive.
    F. Cycle power on the printer.
    G. Replace the CD into the electronics bay.
    H. Perform Offset calibrations, see Offset Calibrations on page 5-2.
    I. Perform Part Based calibration, see Part Based Calibration on page 5-7.

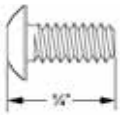
Line Filter

Required Tools

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

Hardware

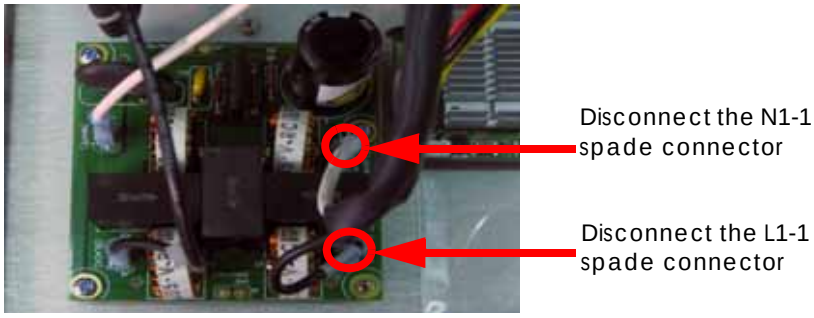
- 6-32 x $^{1}/_{4}$″ Phillips pan head screws (x3)



Removing the line filter

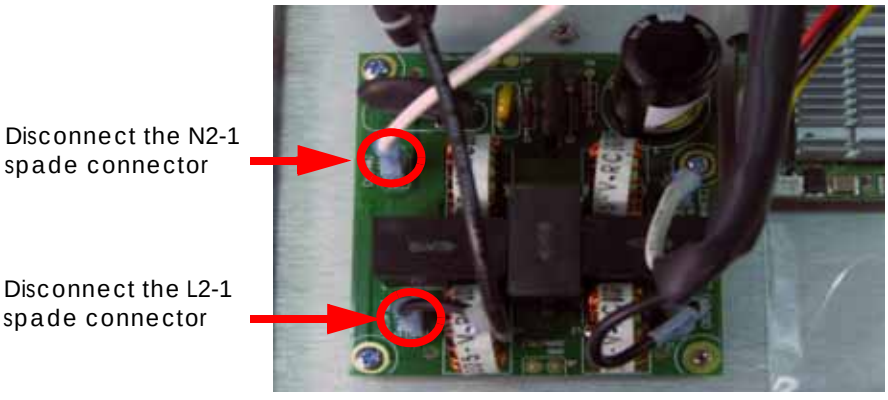
1. Open the electronics bay. See Opening the electronics bay on page 4-15.
2. Touch the metal plate of the electronics bay cover to discharge any static electricity.
3. Remove L1-1 and N1-1 spade connectors from the right side of the board by pulling back on the connector. See Figure 4-67.

Figure 4-67: L1-1 and N1-1 spade connector locations



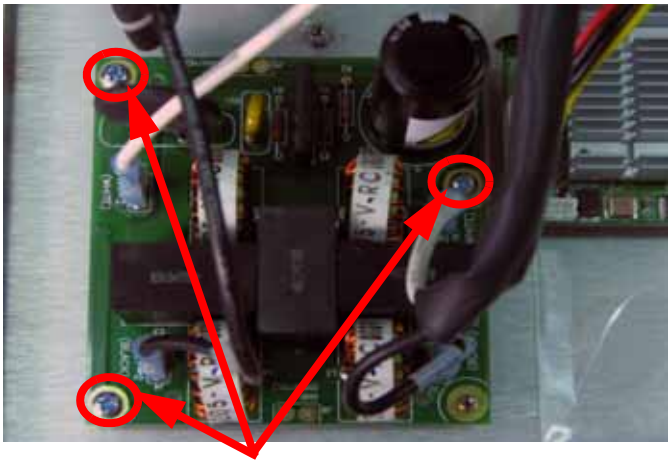
4. Remove L2-1 and N2-1 Spade connectors from the left side of the board by pulling up on the connector. See Figure 4-68.

Figure 4-68: L2-1 and N2-1 Spade connector locations



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

Figure 4-69: Line filter mounting screw locations



Remove the 3 mounting screws

6. Lift board and gently remove the line filter.

Installing the line filter

1. Align the line filter with the mounting holes.
2. Using a Phillips screwdriver, reinstall the 3 mounting screws.
3. Reconnect the L2-1 and N2-1 spade connectors to the left side of the board.
4. Reconnect the LF2-P and LF2-N spade connectors to the right side of the board.
5. Close the electronics bay. See Closing the electronics bay on page 4-16.

Circuit Breaker

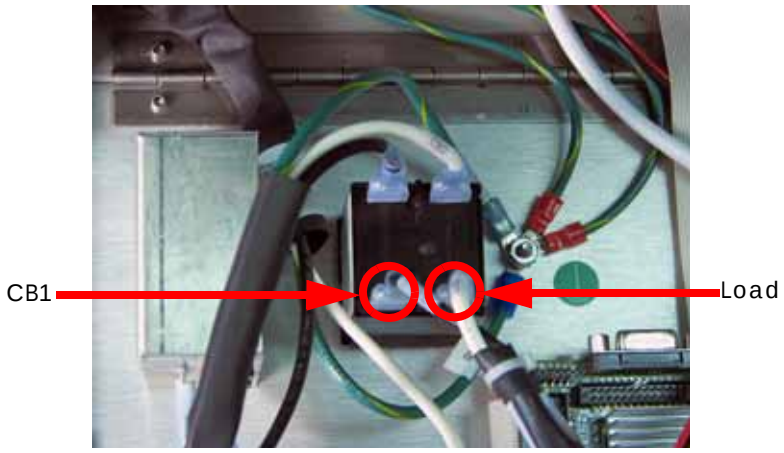
Required Tools

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

Removing the circuit breaker

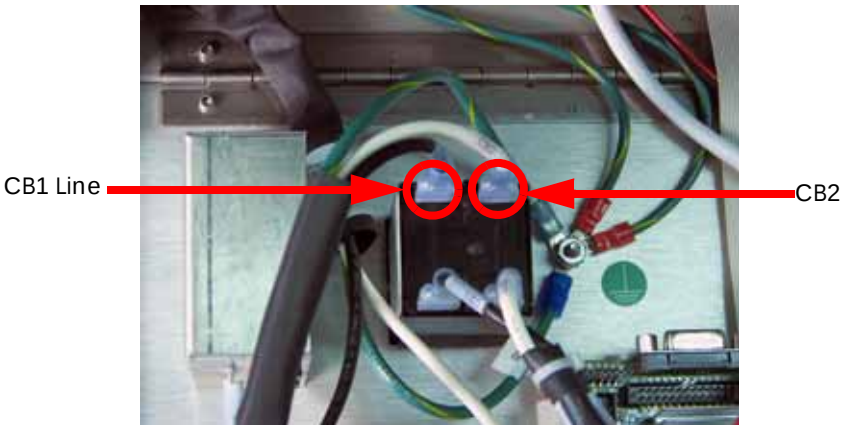
1. Open the electronics bay. See Opening the electronics bay on page 4-15.
2. Touch the metal plate of the electronics bay cover to discharge any static electricity.
3. Remove the Load and CB1 spade connectors from the circuit breaker by pulling up on the connectors. See Figure 4-70.

Figure 4-70: Load and CB1 spade connector locations



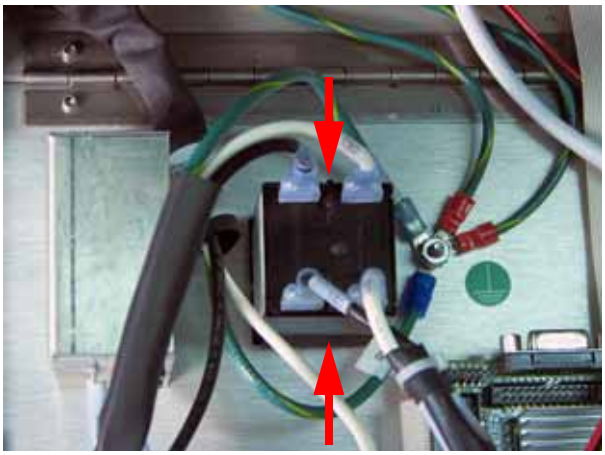
4. Remove the CB1 Line and CB2 spade connectors from the circuit breaker by pulling up on the connectors. See Figure 4-71.

Figure 4-71: CB1 Line and CB2 spade connector locations



5. Squeeze the tabs on the circuit breaker and push through the electronics bay panel. See Figure 4-72.

Figure 4-72: Removing the circuit breaker



Press tabs and push the circuit breaker through the panel

Installing the circuit breaker

1. Push the circuit breaker through the electronics bay panel until it locks in place.
2. Reconnect the CB1 and CB2 spade connectors to the circuit breaker.
3. Reconnect the Load and CB1 spade connectors to the circuit breaker.
4. Close the electronics bay. See Closing the electronics bay on page 4-16.

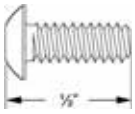
AC Input

Required Tools

- $^{5}/_{16}$" nut driver or standard screwdriver.
- Phillips screwdriver

Hardware

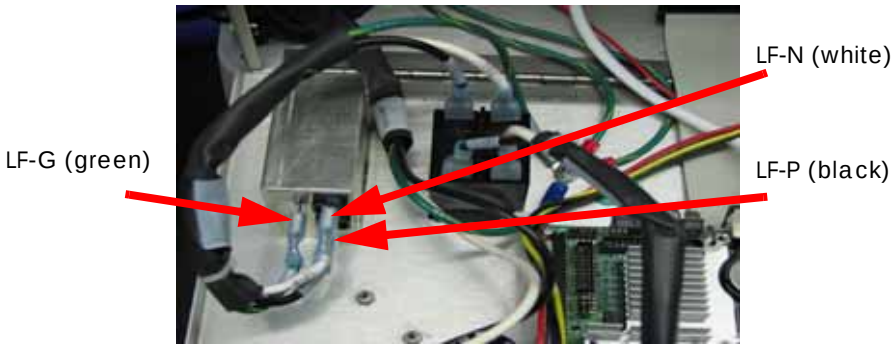
- $^{1}/_{2}$" x 6mm Phillips pan head screws (x2)



Removing the AC Input

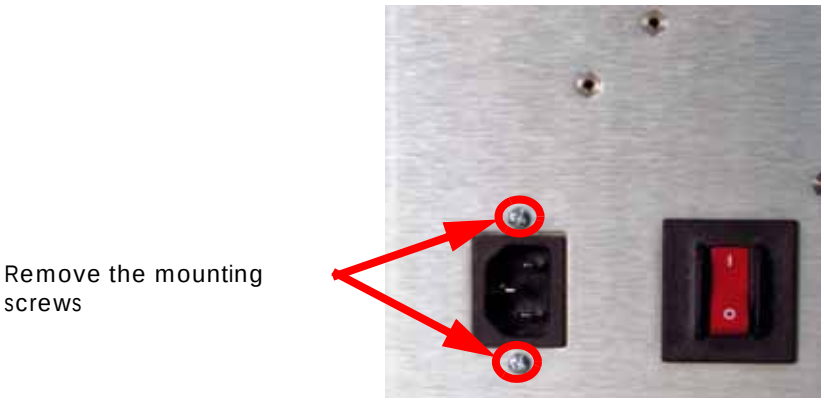
1. Open the electronics bay. See Opening the electronics bay on page 4-15.
2. Touch the metal plate of the electronics bay cover to discharge any static electricity.
3. Remove the LF-G (green) spade connector. See Figure 4-73.
4. Remove the LF-N (white) spade connector. See Figure 4-73.
5. Remove the LF-P (black) spade connector. See Figure 4-73.

Figure 4-73: AC input connection locations



6. Using a Phillips screwdriver, remove the 2 mounting screws and remove the AC Input. See Figure 4-74.

Figure 4-74: AC input mounting screw locations



Installing the AC Input

1. Install the 2 AC Input mounting screws with a Phillips screwdriver.
2. Connect the LF-P (black) spade connector.
3. Connect the LF-N (white) spade connector.
4. Connect the LF-G (green) spade connector.
5. Close the electronics bay. See Closing the electronics bay on page 4-16.

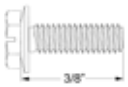
Power Switch

Required Tools

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

Hardware

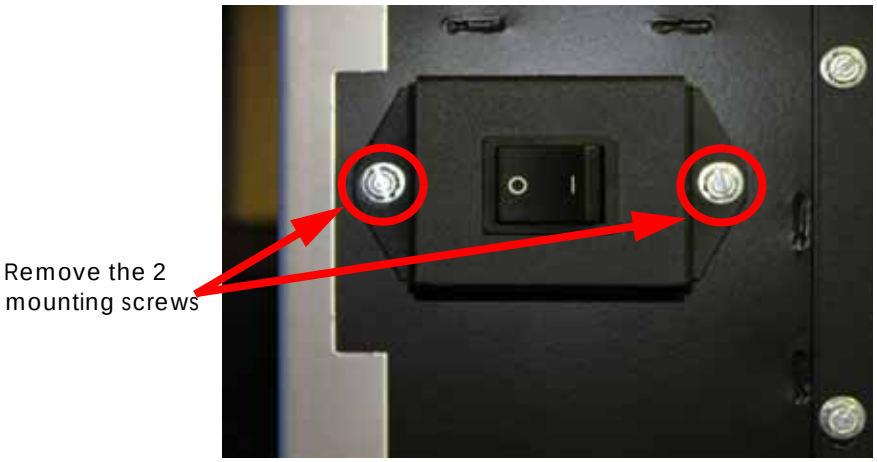
- 10-32 x $^{3}/_{8}$" slotted screws (x2)



Removing the Power Switch

1. Remove the top panel. See Removing the top panel on page 4-5.
2. Remove the left side panel. See Side Panels on page 4-7.
3. Using a $^{5}/_{16}$" nut driver or standard screwdriver, remove the 2 power switch housing mounting screws. See Figure 4-75.

Figure 4-75: Power switch housing mounting screw locations

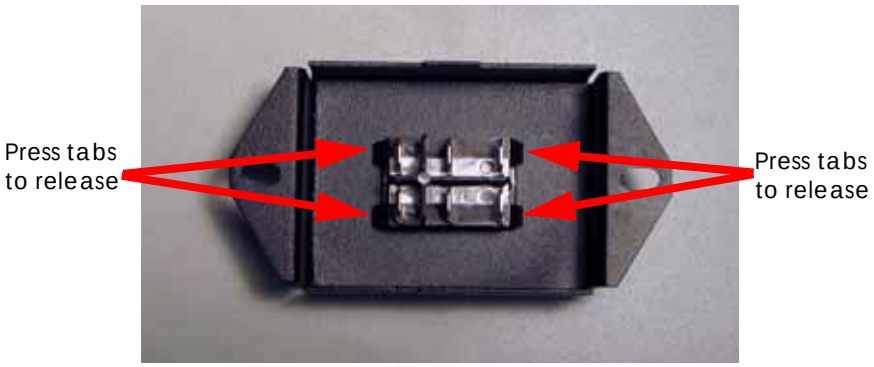


4. Remove the white SW2 wire from the spade connector labeled "3". Remove the black SW3 wire from the spade connector labeled "1a". Remove the yellow NC wire from the spade connector labeled "2a". Remove the green COM wire from the spade connector labeled "2". See Figure 4-76.

Figure 4-76: Power switch connector locations

5. Press the Power Switch tabs in and push it out of the housing. See Figure 4-77.

Figure 4-77: Removing the power switch



Installing the power switch

1. Push the power switch into place on the power switch housing.
2. Connect the yellow NC wire to the spade connector labeled "2a", connect the green COM wire to the spade connector labeled "2", connect the black SW3 wire to the spade connector labeled "1a" and connect the white SW2 wire to the spade connector labeled "3".
3. Align the power switch housing with the mounting holes.
4. Using a $^{5}/_{16}$" nut driver or standard screwdriver, reinstall the 2 mounting screws.
5. Reinstall the left side panel. See Installing the side panels on page 4-8.
6. Install the top panel. See Installing the top panel on page 4-6.

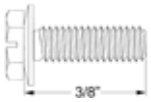
24VDC Power Supply

Required Tools

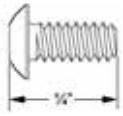
- $^{5}/_{16}$" nut driver or standard screwdriver.
- Phillips screwdriver

Hardware

- 10-32 x $^{3}/_{8}$" slotted screws (x3)



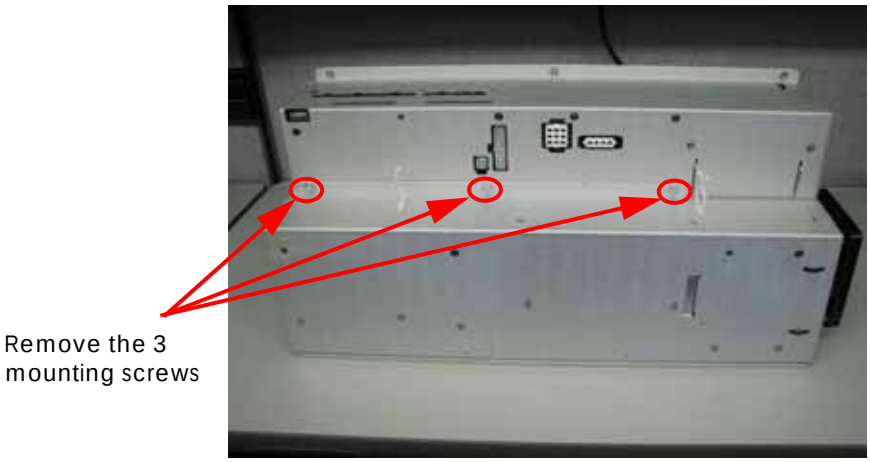
- 6-32 x $^{1}/_{4}$" Phillips pan head screws (x2)



Removing the 24VDC Power Supply

1. Remove the top panel. See Removing the top panel on page 4-5.
2. Remove the side panels. See Side Panels on page 4-7.
3. Remove the electronics bay. See Removing the electronics bay on page 4-19.
4. Using a $^{5}/_{16}$" nut driver or standard screwdriver, remove the 3 rear electronics bay mounting screws. See Figure 4-78.

Figure 4-78: Rear electronics bay mounting screw locations



5. Open the rear panel of the electronics bay.
6. Touch the metal plate of the electronics bay cover to discharge any static electricity.
7. Disconnect the J1 connector on the 24VDC power supply. See Figure 4-79.

Figure 4-79: J1 cable location

8. Disconnect J3 1 through 4 connectors using a Phillips screwdriver. Note the position of the wires for reinstallation. See Figure 4-80.

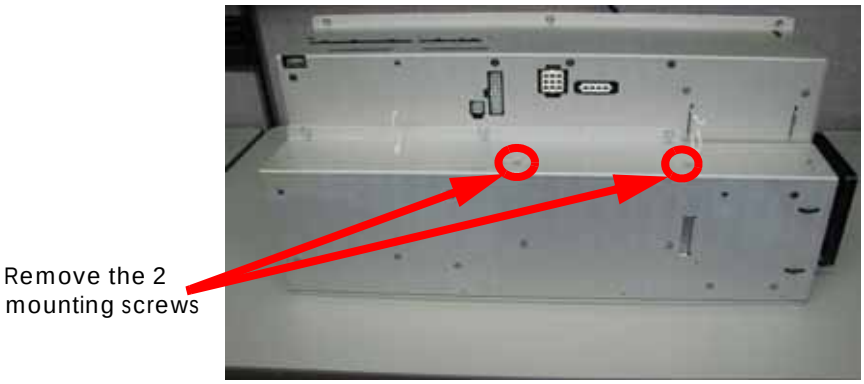
Figure 4-80: J3 1 through 4 connector locations

9. Close the rear panel of the electronics bay and remove the 2 board mounting screws using a Phillips screwdriver. See Figure 4-81.

Figure 4-81: Closing the rear panel of the electronics bay

10. Open the rear panel of the electronics bay and remove the 2 board mounting screws from the top of the panel using a Phillips screwdriver. See Figure 4-82.

Figure 4-82: Removing the 2 mounting screws from the top of the panel

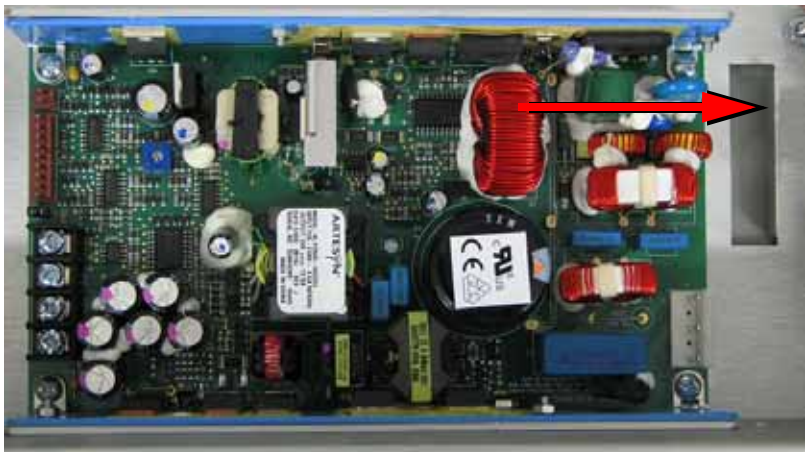


11. Remove the 24VDC power supply.

Installing the 24VDC power supply

1. Align the 24VDC power supply with the top of the rear panel of the electronics bay and the tab to the right of the mounting location. See Figure 4-83.

Figure 4-83: Align the 24VDC power supply



2. Using a Phillips screwdriver, reinstall the 2 mounting screws to the top of the rear panel.
3. Close the rear electronics bay panel.
4. Using a Phillips screwdriver, reinstall the 2 mounting screws.
5. Reconnect J3 1 through 4 connectors using a Phillips screwdriver.
6. Reconnect J1 on the 24VDC power supply.
7. Close the rear panel of the Electronics Bay.
8. Using a $^{5}/_{16}$" nut driver or standard screwdriver, reinstall the 3 mounting screws.
9. Reinstall the electronics bay. See Installing the electronics bay on page 4-20.
10. Reinstall the side panels. See Installing the side panels on page 4-8.
11. Reinstall the top panel. See Installing the top panel on page 4-6.

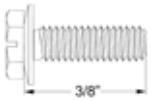
5/12VDC Power Supply

Required Tools

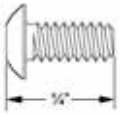
- 5/16″ nut driver or standard screwdriver.
- Phillips screwdriver

Hardware

- 10-32 x 3/8″ slotted screws (x3)



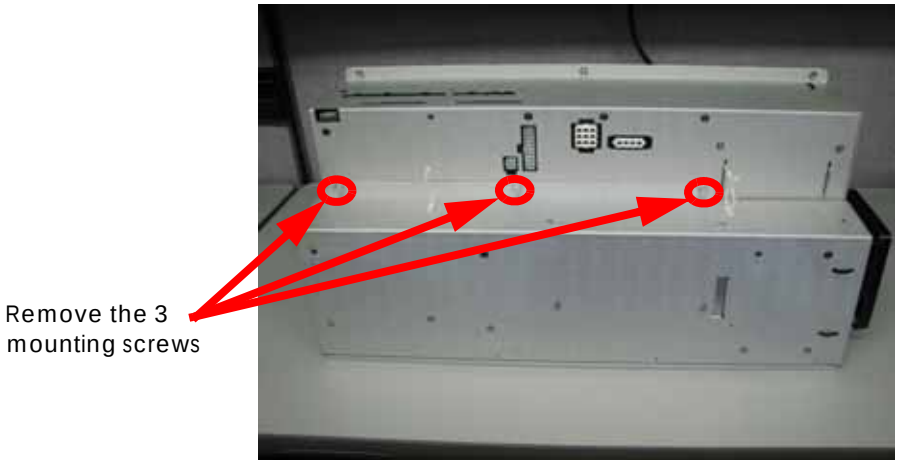
- 6-32 x 1/4″ Phillips pan head screws (x3)



Removing the 5/12VDC power supply

1. Remove the top panel. See Removing the top panel on page 4-5.
2. Remove the side panels. See Side Panels on page 4-7.
3. Remove the electronics bay. See Removing the electronics bay on page 4-19.
4. Using a 5/16″ nut driver or standard screwdriver, remove the 3 rear electronics bay mounting screws. See Figure 4-84.

Figure 4-84: Rear electronics bay mounting screw locations



5. Open the rear panel of the electronics bay.
6. Touch the metal plate of the electronics bay cover to discharge any static electricity.
7. Disconnect the J2 spade connector by lifting up on the connector. See Figure 4-85.

Figure 4-85: J2 spade connector location

8. Disconnect the SK2 connector by pressing the tab and lifting up on the connector. See Figure 4-86.

Figure 4-86: SK2 connector location

9. Disconnect the power input cable by pressing the tab and lifting up on the connector. See Figure 4-87.

Figure 4-87: Power input cable location

10. Using a Phillips screwdriver, remove the 3 mounting screws. See Figure 4-88.

Figure 4-88: 5/12 VDC supply mounting screw locations

11. Remove the 5/12VDC power supply.

Installing the 5/12VDC power supply

1. Align the 5/12VDC power supply and press down into place.
2. Using a Phillips screwdriver, reinstall the 3 mounting screws.
3. Reconnect the SK2 connector.
4. Reconnect the J2 spade connector.
5. Close the rear panel of the electronics bay.
6. Using a $^{5}/_{16}$" nut driver or standard screwdriver, reinstall the 3 rear electronics bay mounting screws.
7. Reinstall the electronics bay. See Installing the electronics bay on page 4-20.
8. Reinstall the side panels. See Installing the side panels on page 4-8.
9. Reinstall the top panel. See Installing the top panel on page 4-6.

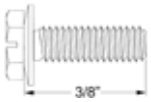
120VDC Power Supply

Required Tools

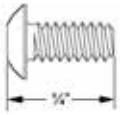
- 5/16″ nut driver or standard screwdriver.
- Phillips screwdriver

Hardware

- 10-32 x 3/8″ slotted screws (x3)



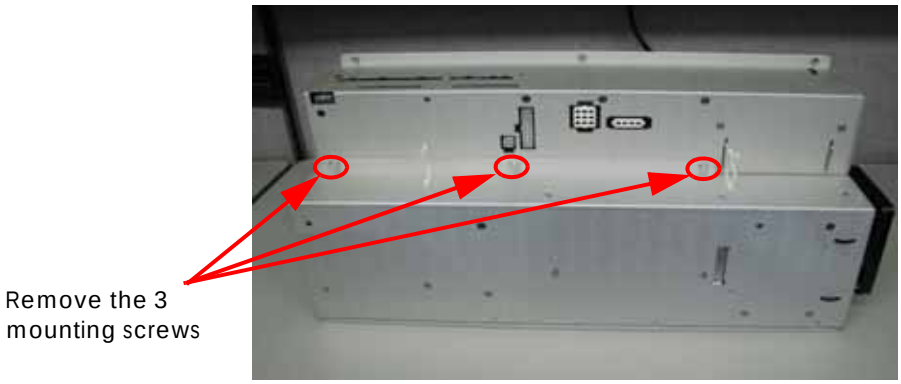
- 6-32 x 1/4″ Phillips pan head screws (x3)



Removing the 120VDC power supply

1. Remove the top panel. See Removing the top panel on page 4-5.
2. Remove the side panels. See Side Panels on page 4-7.
3. Remove the electronics bay. See Removing the electronics bay on page 4-19.
4. Using a 5/16″ nut driver or standard screwdriver, remove the 3 rear electronics bay mounting screws. See Figure 4-89.

Figure 4-89: Rear electronics bay mounting screw locations



5. Open the rear panel of the electronics bay.
6. Touch the metal plate of the electronics bay cover to discharge any static electricity.
7. Disconnect the J601 connector by pressing the tab and pulling the connector up. See Figure 4-90.

Figure 4-90: J601 connector location

8. Using a Phillips screwdriver, remove the 3 mounting screws. See Figure 4-91.

Figure 4-91: 120 VDC mounting screw locations

9. Remove the 120VDC power supply.

Installing the 120 VDC power supply

1. Align the 120VDC power supply with the mounting holes.
2. Using a Phillips screwdriver, reinstall the 3 mounting screws.
3. Reconnect J601.
4. Close the rear panel of the electronics bay.
5. Using a $^{5}/_{16}$" nut driver or standard screwdriver, reinstall the 3 rear electronics bay mounting screws.
6. Reinstall the electronics bay. See Installing the electronics bay on page 4-20.
7. Reinstall the side panels. See Installing the side panels on page 4-8.
8. Reinstall the top panel. See Installing the top panel on page 4-6.

Head Components

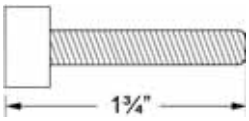
Head Cooling Fan

Required Tools

- $^{5}/_{16}$" nut driver or standard screwdriver.
- $^{7}/_{64}$" allen wrench.

Hardware

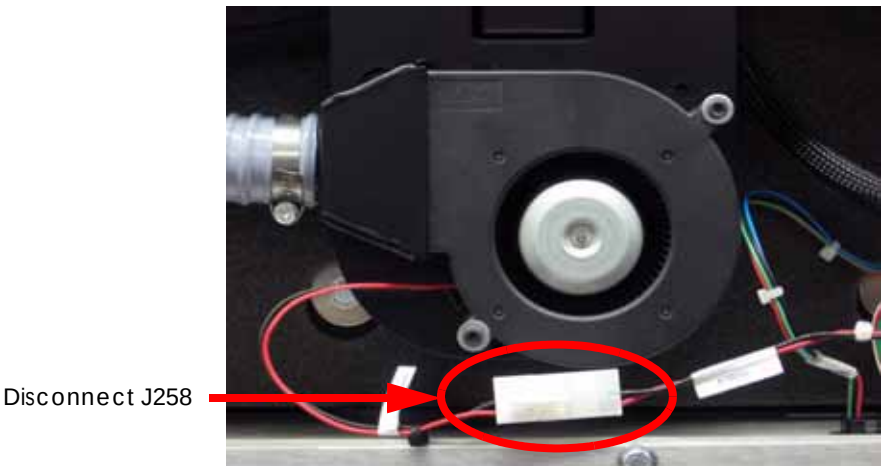
- 6-32 x $1^{3}/_{4}$" flat head cap screws (x2)



Removing the head cooling fan

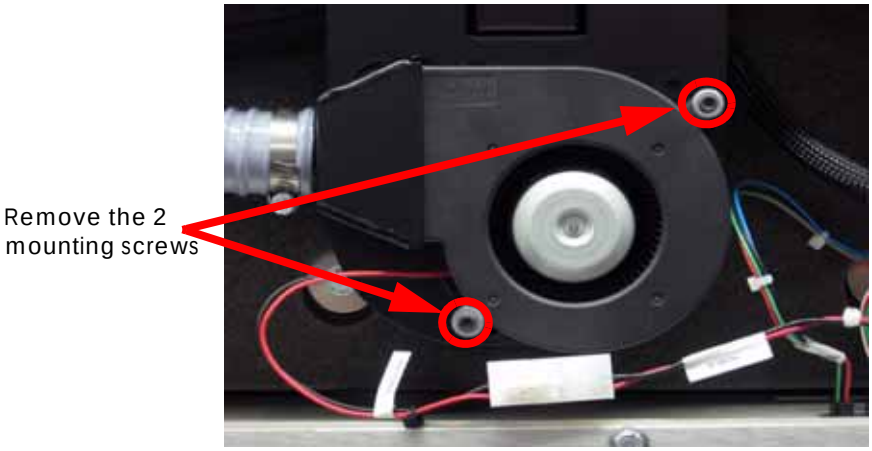
1. Remove the top panel. See Removing the top panel on page 4-5.
2. Remove the side panels. See Side Panels on page 4-7.
3. Remove the upper electronics bay cover. See Removing the upper electronics bay cover on page 4-17.
4. Disconnect the J258 cable by pressing the tab and pulling the connector apart. See Figure 4-92.

Figure 4-92: J258 cable location



5. Using a $^{7}/_{64}$" allen wrench, remove the 2 mounting screws. See Figure 4-93.

Figure 4-93: Head cooling fan mounting screw locations



6. Remove the head cooling fan.

Installing the Head Cooling fan

1. Align the head cooling fan with the 2 mounting holes.
2. Using a $^{7}/_{64}$" allen wrench, reinstall the 2 mounting screws.
3. Reconnect the J258 cable.
4. Install the upper electronics bay cover. See Installing the upper electronics bay cover on page 4-18.
5. Install the side panels. See Installing the side panels on page 4-8.
6. Install the top panel. See Installing the top panel on page 4-6.

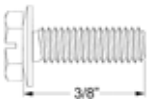
Toggle Head Assembly

Required Tools

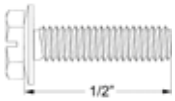
- 5/16" nut driver or standard screwdriver.
- Cutters

Hardware

- Wire tie (x1)
- 10-32 x 3/8" slotted screws (x7)



- 10-32 x 1/2" slotted screws (x4)

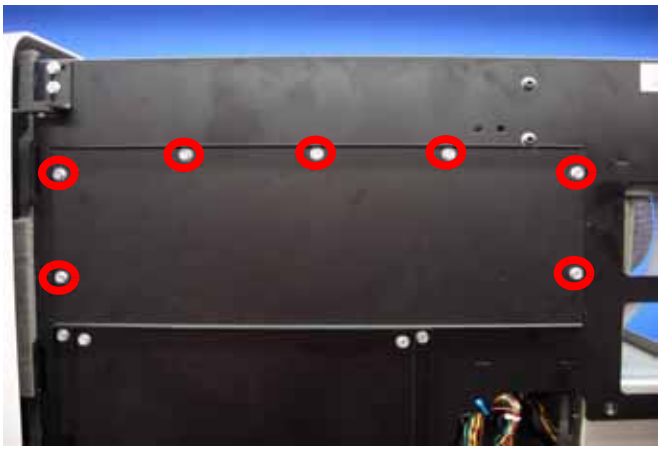


Removing the toggle head assembly

1. Remove the top panel. See Removing the top panel on page 4-5.
2. Remove the side panels. See Side Panels on page 4-7.
3. Using a 5/16" nut driver or standard screwdriver, remove the right side access panel mounting screws and remove the panel. See Figure 4-94.

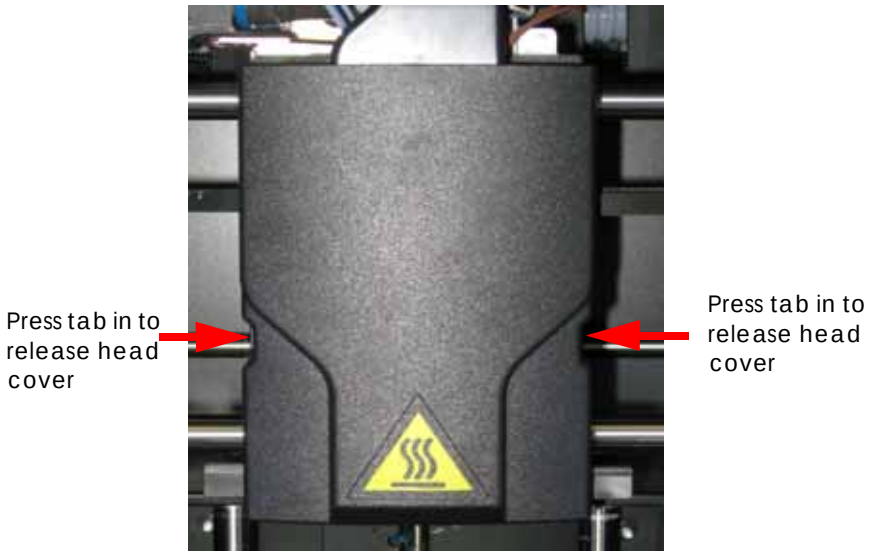
Figure 4-94: Right side access panel mounting screw locations

Remove the 7 mounting screws.



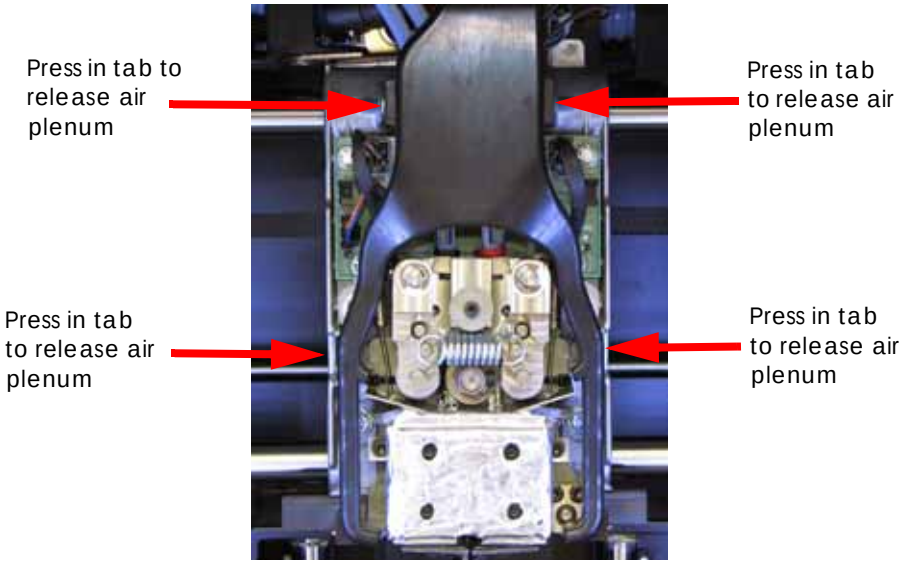
4. Remove the head cover by pressing the tabs in and pulling the cover outward. See Figure 4-95.

Figure 4-95: Head cover tab locations



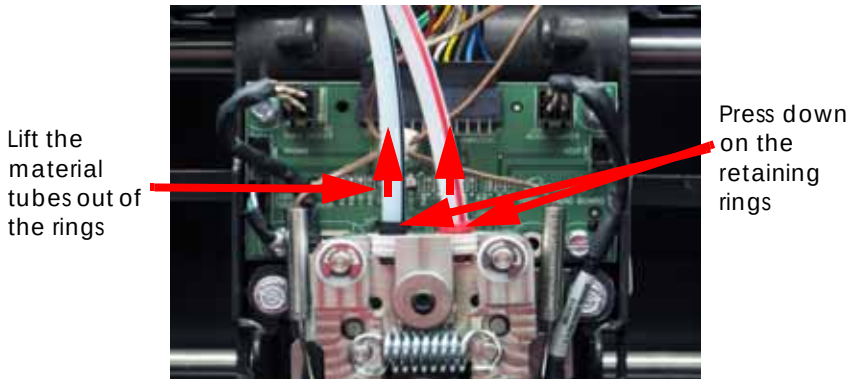
5. Remove the air plenum by pressing in the upper and lower tabs and pulling outward. See Figure 4-96.

Figure 4-96: Air plenum tab locations



6. Disconnect the material tubes by pressing down on the retaining ring and lifting up the material tubes. See Figure 4-97.

Figure 4-97: Material tubes and retaining rings



7. Disconnect the thermocouples from the TC Amp board and remove the wires from the wire retainer. See Figure 4-98 and Figure 4-99.

Figure 4-98: Thermocouple locations

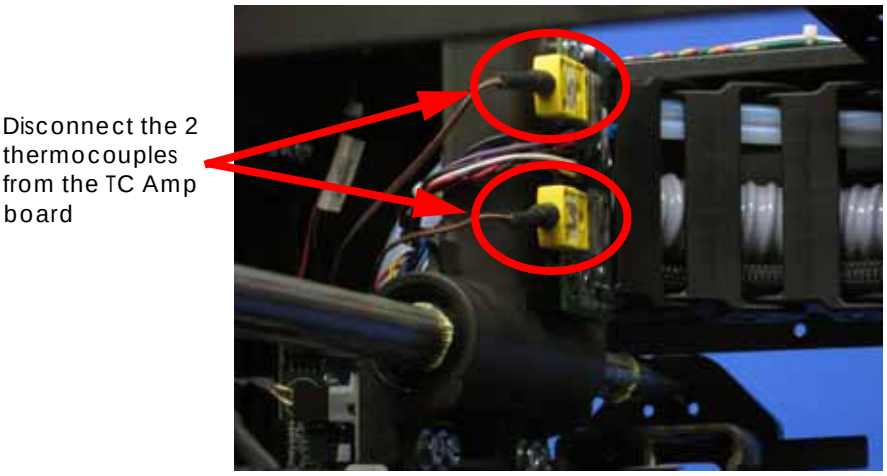
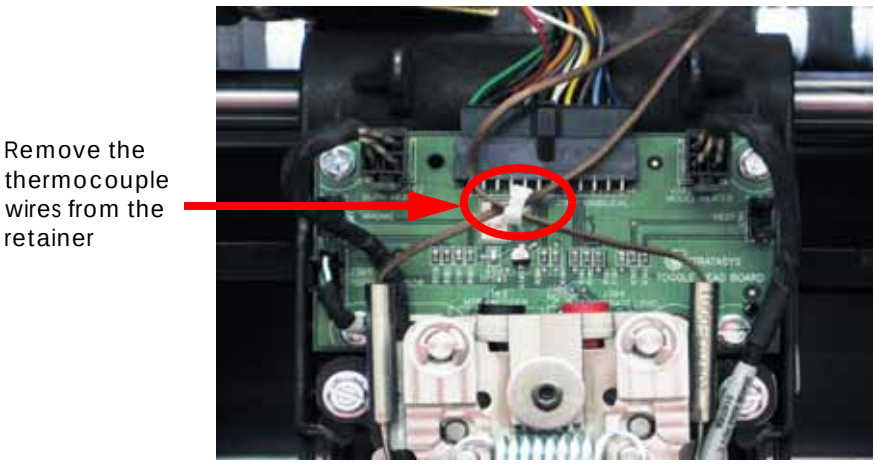
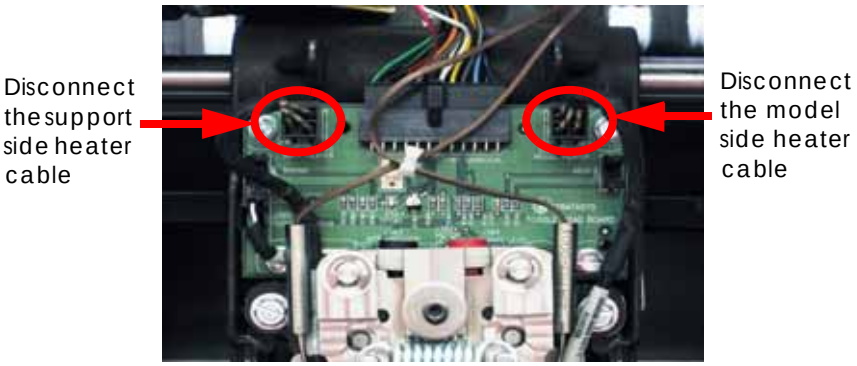


Figure 4-99: Thermocouple wire retainer location



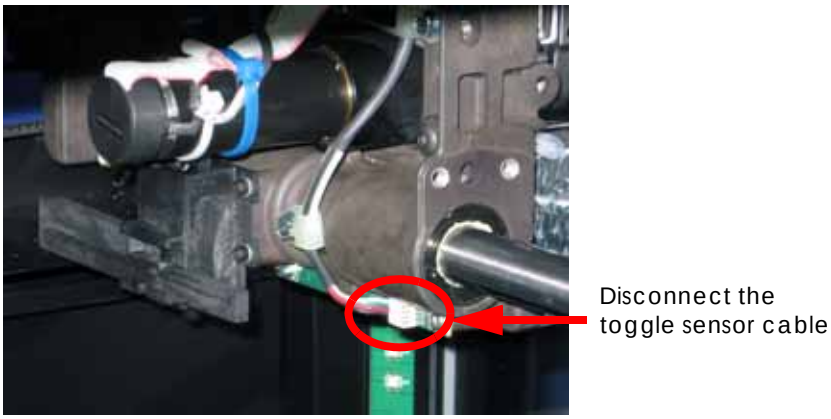
8. Disconnect the model and support heater cables by pressing the tabs in and pulling the cables outward. See Figure 4-100.

Figure 4-100: Heater power cable locations



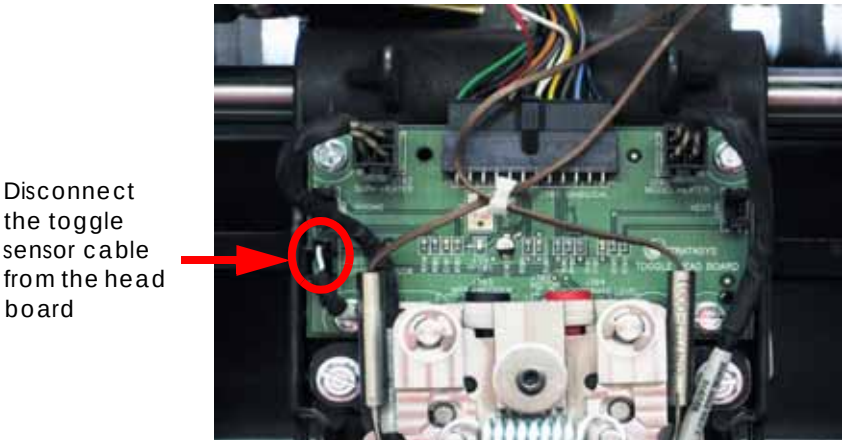
9. Disconnect the toggle sensor cable from the toggle sensor. See Figure 4-101.

Figure 4-101: Toggle sensor location



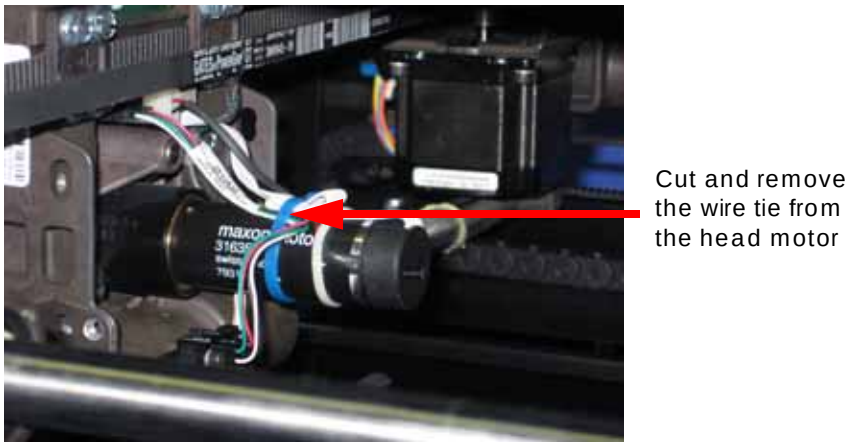
10. Disconnect the toggle sensor cable from the head board. See Figure 4-102.

Figure 4-102: Toggle sensor cable location



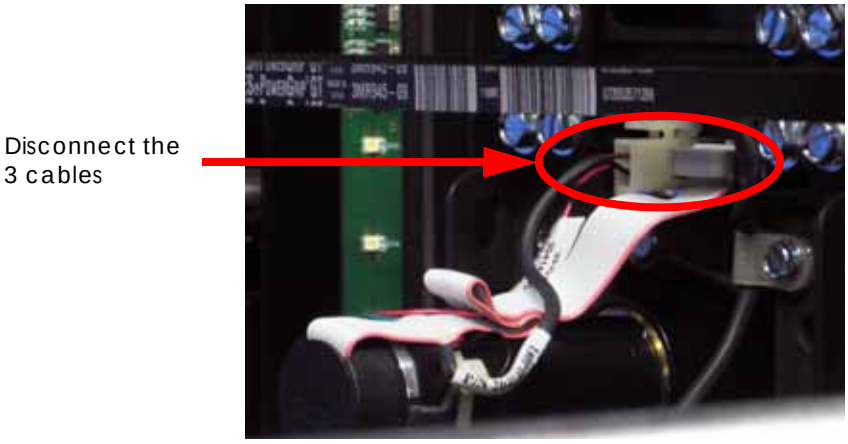
11. Cut the wire tie holding the drive motor cables in place. See Figure 4-103.

Figure 4-103: Wire tie location



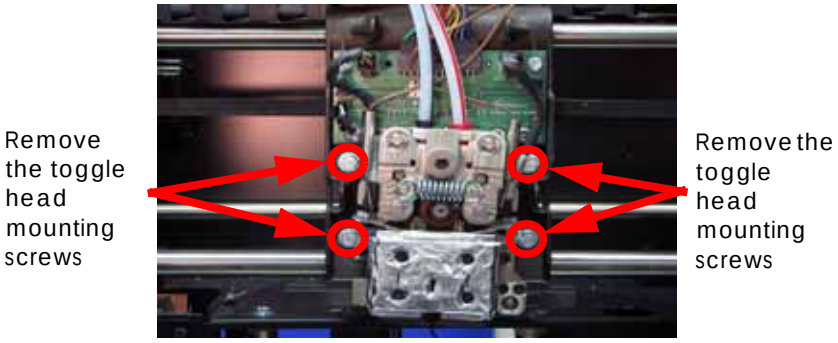
12. Disconnect the 3 cables from the rear of the head board by pressing the tabs in and pulling outward. See Figure 4-104.

Figure 4-104: Rear head board cable locations



13. Using a $^{5}/_{16}$" nut driver or standard screwdriver, remove the 4 toggle head mounting screws. Toggle the head to the left to remove the bottom right screw and toggle the head to the right to remove the bottom left screw. See Figure 4-105.

Figure 4-105: Toggle head mounting screw locations



14. Slide the toggle head assembly out of the translator.

Installing the toggle head assembly

1. Remove the tag from the new toggle head assembly and set aside for later use.
2. Align the 2 mounting posts with the 2 mounting holes and gently push the toggle head into position.
3. Using a $^{5}/_{16}$" nut driver or standard screwdriver, reinstall the 4 mounting screws.
4. Reconnect the 3 head motor cables to the back of the head board.
5. Replace the wire tie holding the head motor cables in place. See Figure 4-106.

Figure 4-106: Wire tie location

6. Reconnect the toggle sensor cable to the head board.
7. Gently reconnect the toggle sensor cable to the toggle sensor.
8. Reconnect the model and support heater cables to the head board.
9. Reconnect the model and support thermocouples to the TC Amp board.
10. Place the model and support thermocouple wires in the wire retaining clip.
11. Connect the model and support material tubes.
12. Install tips into the heater blocks.
13. Install tip shields onto the tips.
14. Reinstall the air plenum
15. Reinstall the head cover
16. Reinstall the right side access cover.
17. Reinstall the side panels. See Installing the side panels on page 4-8.
18. Reinstall the top panel. See Installing the top panel on page 4-6.
19. Power the printer up.
20. Load the MaracaEX.
21. Click on the + button to add the printer.
22. Enter the printer name, printer type, printer location and printer IP address.
23. Click on the green check mark button.
24. Connect to the printer in MaracaEX by selecting it out of the Current Modeler drop down menu.
25. Click on the Tip Offset button.
26. Enter the value from Z Tip to Tip field on the tag that came with the toggle head assembly into the Z Tip to Tip field in the Tip Offset window.
27. Click on the green check mark button.
28. Cycle power to the printer.
29. From the display panel press **Maintenance** > **Machine** > **Tips**
30. Perform Z calibration.
31. Perform XY Offset calibration.

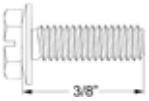
Substrate Sensor

Required Tools

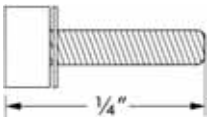
- 5/16" nut driver or standard screwdriver.
- 3/32" allen wrench.

Hardware

- Wire tie (x1)
- 10-32 x 3/8" slotted screws (x7)



- 4-40 x 1/4" slotted screws and # 4 split lock washer (x4)

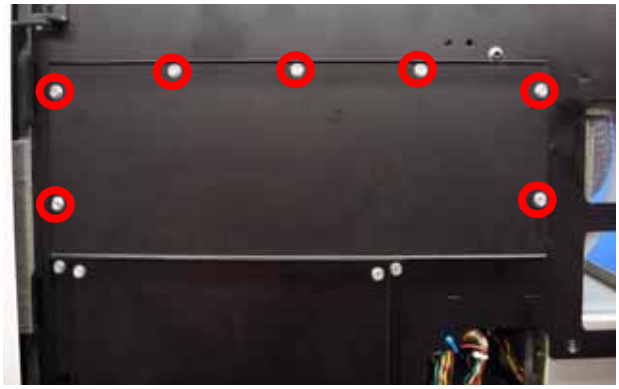


Removing the substrate sensor

1. Remove the top panel. See Removing the top panel on page 4-5.
2. Remove the side panels. See Side Panels on page 4-7.
3. Using a 5/16" nut driver, remove the 7 right side access panel mounting screws. See Figure 4-107.

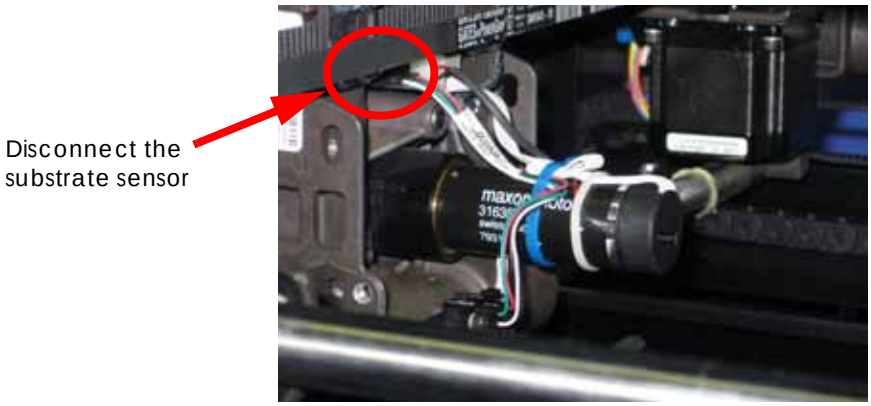
Figure 4-107: Right side access panel mounting screw locations

Remove the 7 mounting screws.



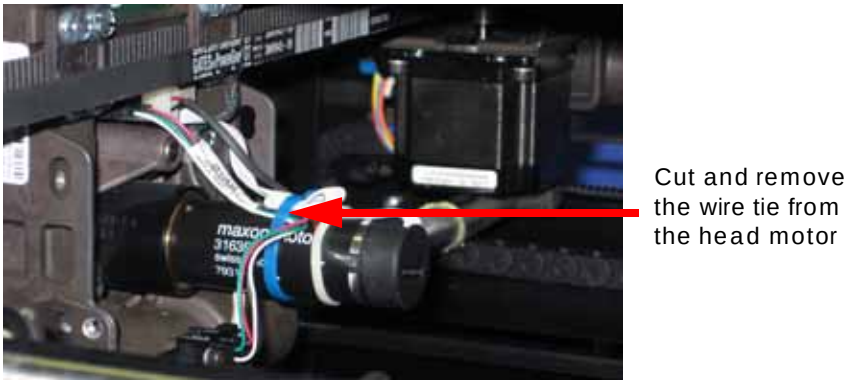
4. Disconnect the substrate sensor wire from the head board by pressing in on the tab and pulling outward. See Figure 4-108.

Figure 4-108: Substrate sensor connector location



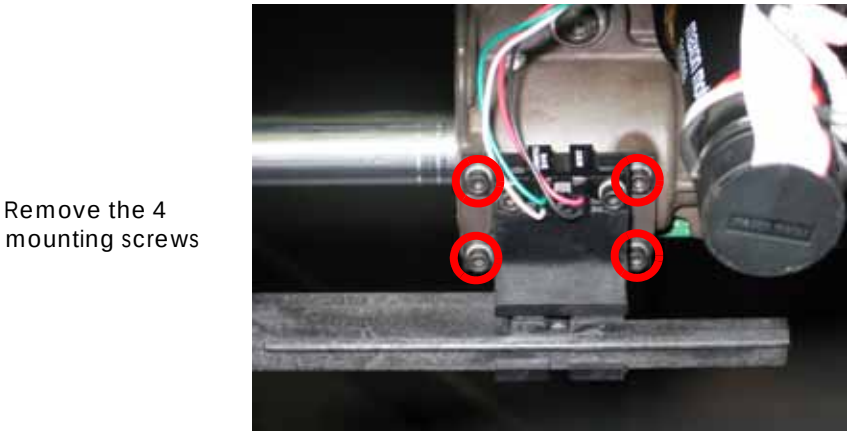
5. Using a cutters, cut and remove the wire tie around the head motor. See Figure 4-109.

Figure 4-109: Wire tie location



6. Using a $^{3}/_{32}$" allen wrench, remove the 4 substrate sensor mounting screws. See Figure 4-110.

Figure 4-110: Substrate sensor mounting screw locations

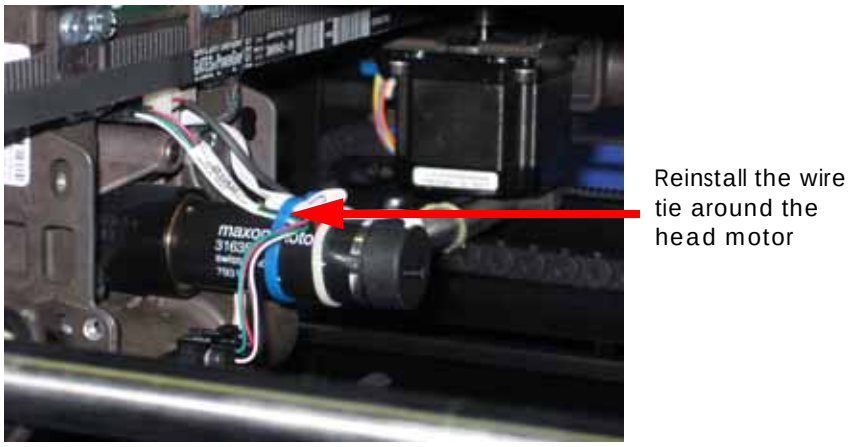


7. Remove the substrate sensor.

Installing the substrate sensor

1. Align the substrate sensor with the mounting holes.
2. Using a $^{3}/_{32}$" allen wrench, reinstall the 4 substrate sensor mounting screws.
3. Reconnect the substrate sensor wire to the head board.
4. Reinstall the wire tie around the head motor and wires. See Figure 4-111.

Figure 4-111: Wire tie location



5. Align the right side access panel with the mounting holes.
6. Using a $^{5}/_{16}$" nut driver, reinstall the right side access panel mounting screws.
7. Reinstall the side panels. See Installing the side panels on page 4-8.
8. Reinstall the top panel. See Installing the top panel on page 4-6.

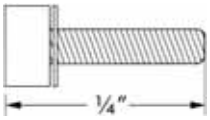
Z Foam Level Assembly

Required Tools

- $^{3}/_{32}$" allen wrench

Hardware

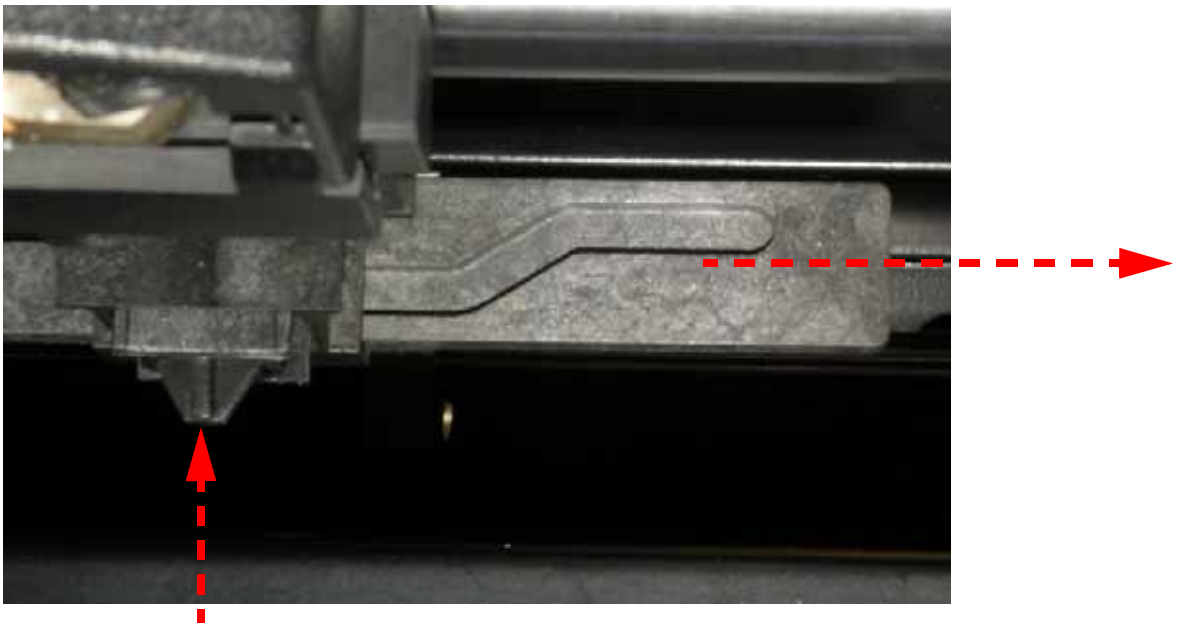
- 4-40 x $^{1}/_{4}$" slotted screws and # 4 split lock washer (x4)



Removing the Z Foam Level Assembly

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 top panel. See Top Panel on page 4-5.
4. Remove the side panels. See Side Panels on page 4-7.
5. Remove the Substrate sensor. See Substrate Sensor on page 4-64.
6. Push the Z foam level assembly actuator up into the assembly and slide the Z foam level bar to the right until it is clear of the assembly. See Figure 4-112.

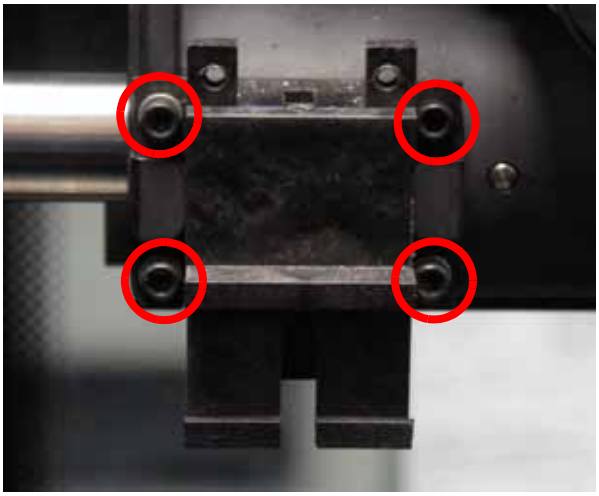
Figure 4-112: Removing the Z foam level bar



7. Using a $^{3}/_{32}$" allen wrench, remove the 4 Z foam level assembly mounting screws and washers. See Figure 4-113.

Note: Be careful not to lose the washers.

Figure 4-113: Z foam level assembly mounting screw locations



4 mounting screws

8. Remove the Z foam level assembly and discard.

Installing the Z Foam Level Assembly

1. Remove the Z foam level bar from the assembly by pushing the actuator into the housing and pulling the bar to the right.
2. Align the housing with the mounting holes and use a $^{3}/_{32}$" allen wrench to reinstall the 4 mounting screws and washers.
3. Insert the actuator and spring into the housing and push all the way up.
4. Slide the bar to the left and into the housing, when installed correctly the actuator will not come out of the housing.
5. Reinstall the Substrate sensor. See Substrate Sensor on page 4-64.
6. Reinstall the side panels. See Side Panels on page 4-7.
7. Reinstall the top panel. See Installing the top panel on page 4-6.
8. Reconnect the AC power cord, RJ-45 network cable and UPS cable (if used).
9. Power on the system. The system should reach **Idle** with no displayed errors.
10. Run a small test part and monitor system operation during build.

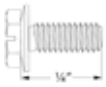
Toggle Sensor

Required Tools

- $^{5}/_{16}$″ nut driver or standard screwdriver.
- $^{3}/_{32}$″ allen wrench.

Hardware

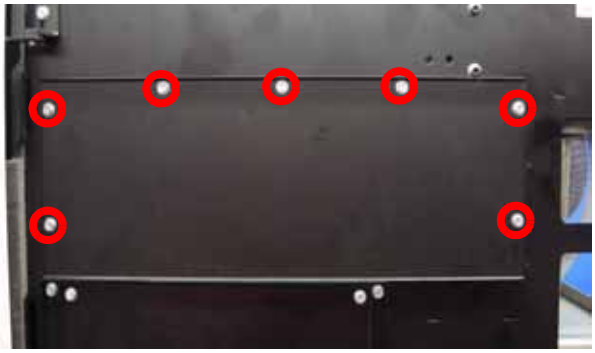
- 4-40 x$^{1}/_{4}$″ slotted screws (x2)



Removing the toggle sensor

1. Remove the top panel. See Removing the top panel on page 4-5.
2. Remove the side panels. See Side Panels on page 4-7.
3. Remove the right side access panel. See Figure 4-114.

Figure 4-114: Right side access panel mounting screw locations

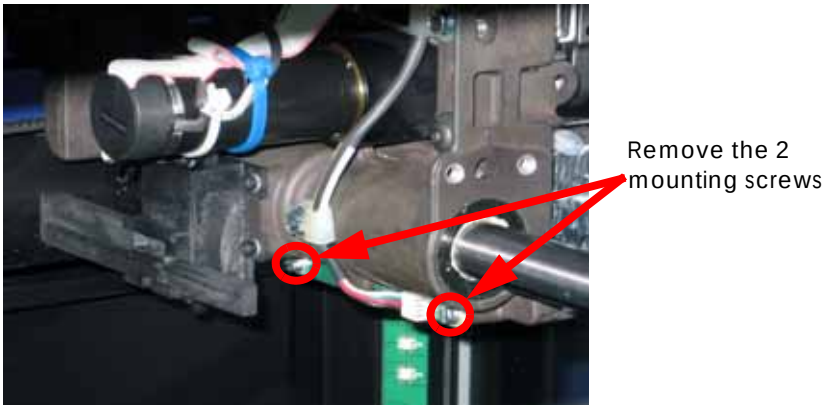


4. Gently disconnect the toggle sensor wire by pulling outwards. See Figure 4-115.

Figure 4-115: Toggle sensor wire connector location

5. Using a standard screwdriver, remove the 2 toggle sensor mounting screws. See Figure 4-116.

Figure 4-116: Toggle sensor mounting screw locations



6. Remove the toggle sensor.

Installing the toggle sensor

1. Align the toggle sensor with the mounting holes.
2. Using a standard screwdriver, reinstall the 2 mounting screws.
3. Reconnect the toggle sensor wire to the toggle sensor.
4. Align the right side access panel with the mounting holes.
5. Using a $^{5}/_{16}$" nut driver or standard screwdriver, reinstall the right side access panel mounting screws.
6. Reinstall the side panels. See Installing the side panels on page 4-8.
7. Reinstall the top panel. See Installing the top panel on page 4-6.

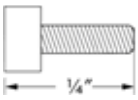
Toggle Bar

Required tools

- 5/16″ nut driver or standard screwdriver
- 7/64″ allen wrench

Hardware

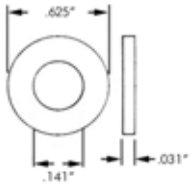
- 6-32 x 1/4″ slotted screws (x2)



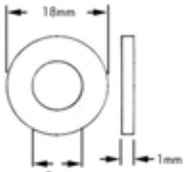
- .380″ ID Closed and grounded spring (x1)

- .194″ ID Closed and grounded spring (x1)

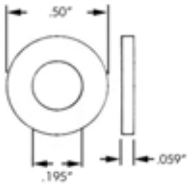
- .141″ ID, .625″ OD x .031″ Washer



- 8mm ID, 18mm OD x 1mm Washer



- .195″ ID, .50″ OD x .059″ PEEK HPV Washer (x2)



Removing the toggle bar

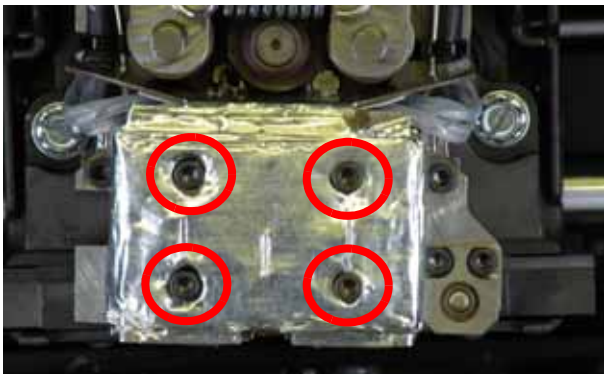
1. Unload model and support material.
2. Power the printer down.

3. Open chamber door and remove the head cover. See Figure 4-117.

Figure 4-117: Head cover tab locations

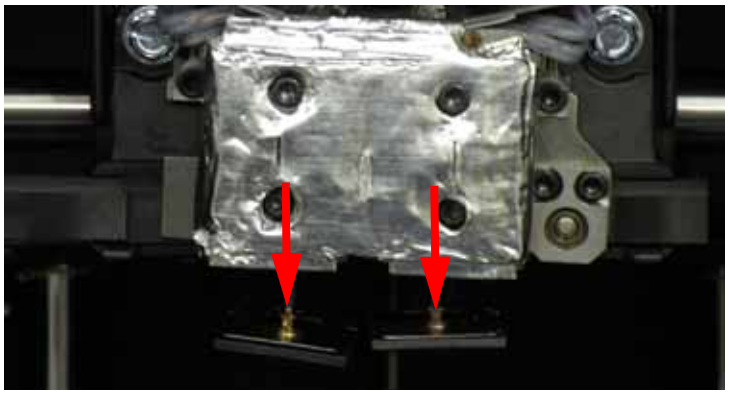
4. Using a $^{7}/_{64}$" allen wrench, loosen but do not remove the 4 tip mounting screws. See Figure 4-118.

Figure 4-118: Tip mounting screw locations



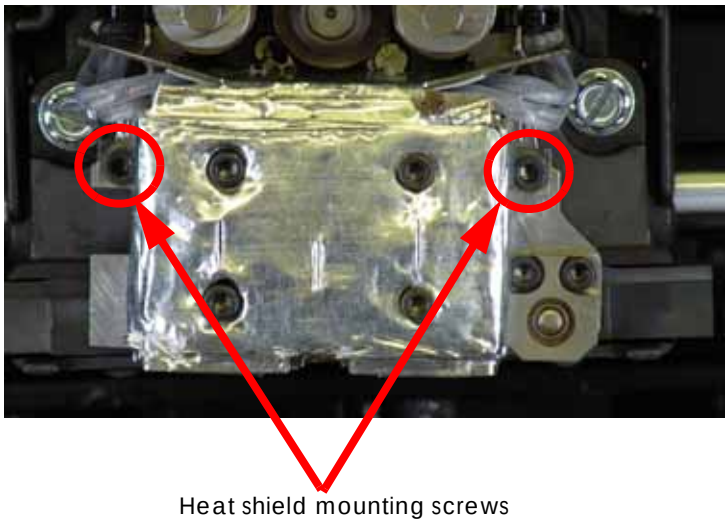
5. Remove the tips by pulling them downwards. See Figure 4-119.

Figure 4-119: Removing the tips



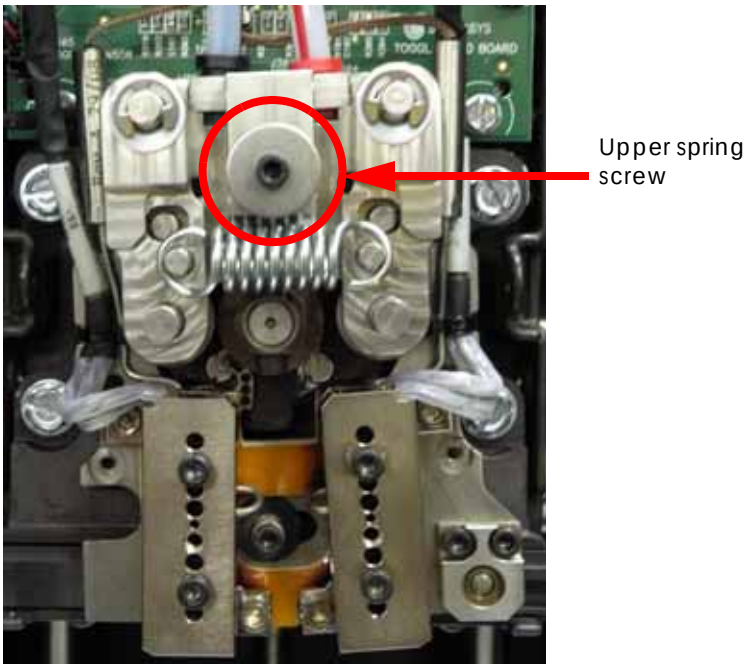
6. Using a $^{7}/_{64}$" allen wrench, loosen the 2 heat shield screws. See Figure 4-120.

Figure 4-120: Heat shield mounting screw locations



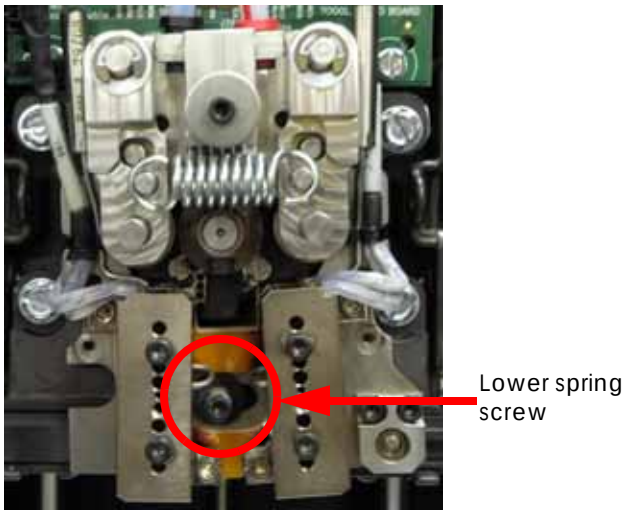
7. Remove the heat shield.
8. Using a $^{7}/_{64}$" allen wrench, remove the upper spring screw. Remove the screw, washer and spring. See Figure 4-121.

Figure 4-121: Upper spring location



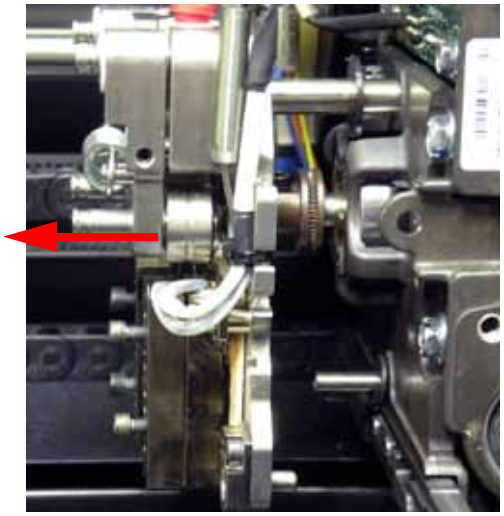
9. Using a $^{7}/_{64}$" allen wrench, remove the lower spring screw. Remove the screw, spring and washer. See Figure 4-122.

Figure 4-122: Lower spring location



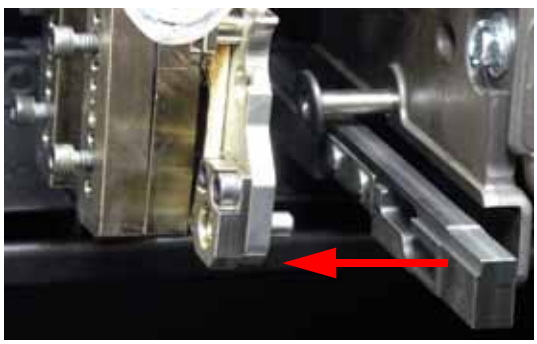
10. Pull the toggle assembly away from the translator until the toggle assembly is at the end of the post. See Figure 4-123.

Figure 4-123: Toggle assembly positioning



11. Remove the washer from the toggle bar.
12. Remove the toggle bar by sliding out. See Figure 4-124.

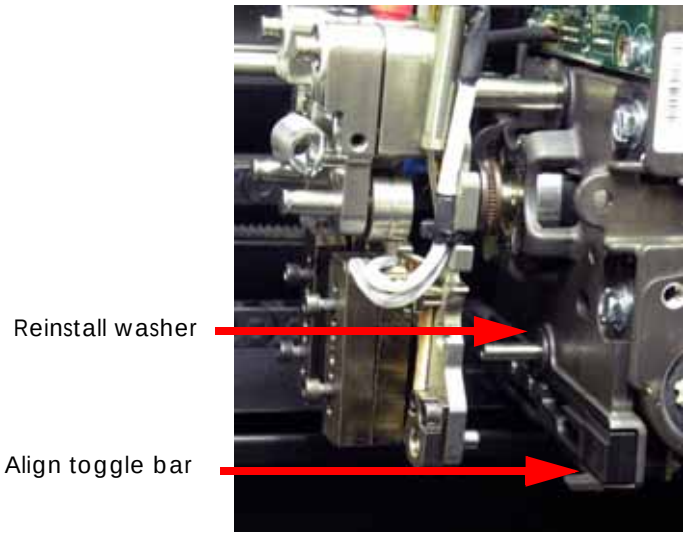
Figure 4-124: Removing toggle bar



Installing the toggle bar

1. Align the toggle bar with the translator and reinstall the washer over the bottom mounting post. See Figure 4-125.

Figure 4-125: Toggle bar alignment



2. Push the toggle assembly back into position.
3. Reinstall the lower washer and spring.
4. Using a $^{7}/_{64}$" allen wrench, reinstall the lower spring screw.
5. Reinstall the upper spring and washer.
6. Using a $^{7}/_{64}$" allen wrench, reinstall the upper spring screw.
7. Using a $^{7}/_{64}$" allen wrench, reinstall the heat shield.
8. Reinstall the model tip (right side) and support tip (left side) by pushing up into place.
9. Using a $^{7}/_{64}$" allen wrench tighten the tip mounting screws.
10. Reinstall the head cover.
11. Power the printer up.
12. Perform calibrations. See Offset Calibrations on page 5-2.

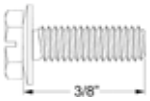
Head Board

Required tools

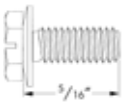
- 5/16" nut driver or standard screwdriver
- 1/4" nut driver

Hardware

- 10-32 x 3/8" slotted screws (x7)



- 6-32 x 1/4" slotted screws (x6)

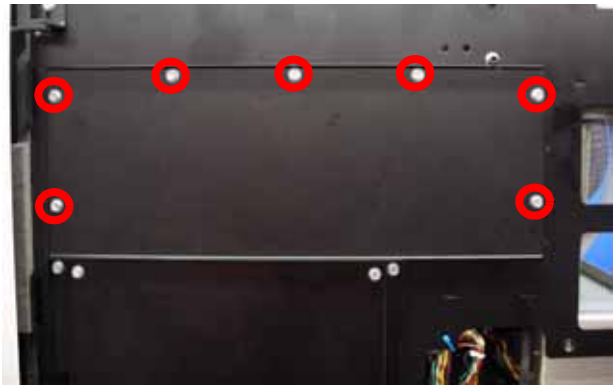


Removing the head board

1. Remove the top panel. See Removing the top panel on page 4-5.
2. Remove the side panels. See Side Panels on page 4-7.
3. Using a 5/16" nut driver or standard screwdriver, remove the right side access panel mounting screws and remove the panel. See Figure 4-126.

Figure 4-126: Right side access panel mounting screw locations

Remove the 7 mounting screws.

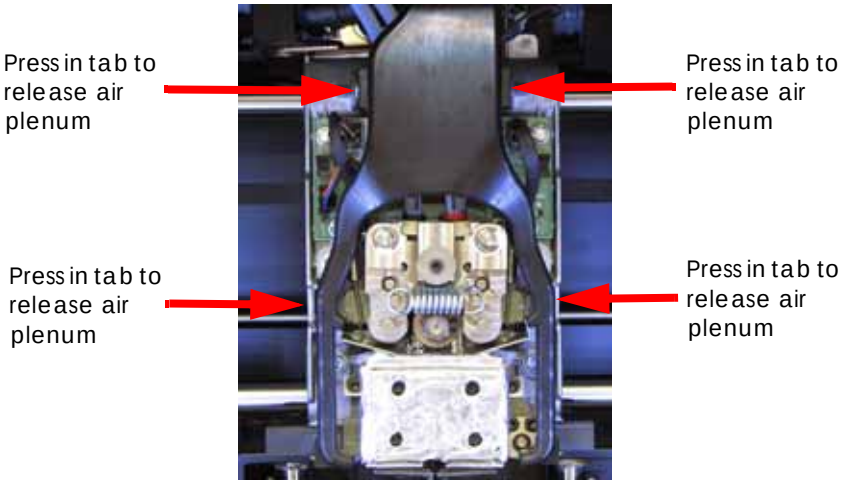


4. Remove the head cover by pressing the tabs and pulling the cover outward. See Figure 4-127.

Figure 4-127: Head cover tab locations

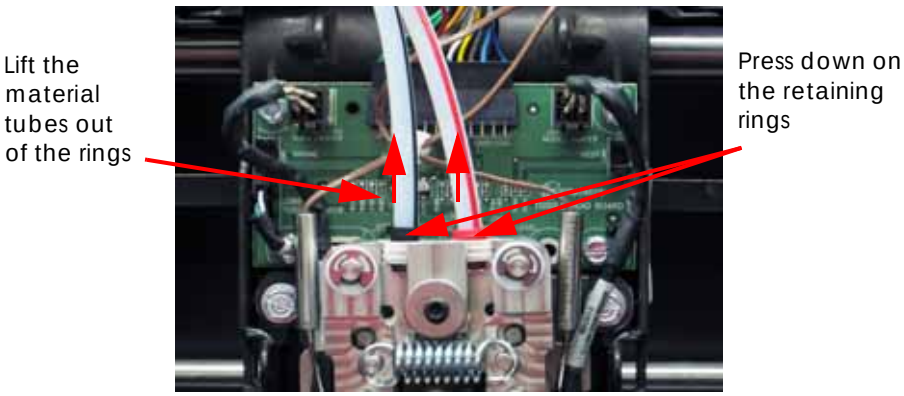
5. Remove the air plenum by pressing in the upper and lower tabs and pulling outward. See Figure 4-128.

Figure 4-128: Air plenum tab locations



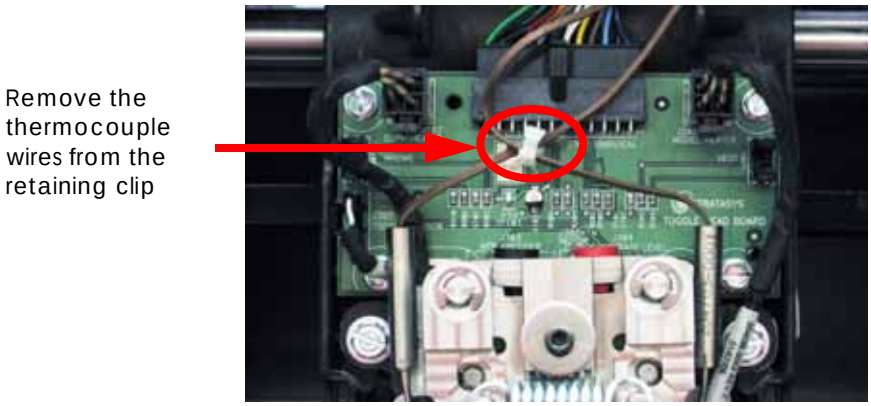
6. Disconnect the model and support material tubes. See Figure 4-129.

Figure 4-129: Material tube and retaining ring locations



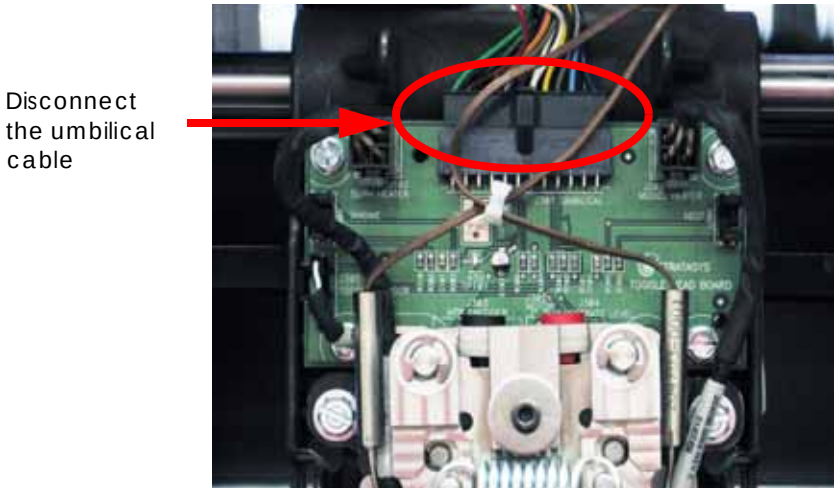
7. Remove the thermocouple wires from the wire retaining clip on the head board. See Figure 4-130.

Figure 4-130: Retaining clip location



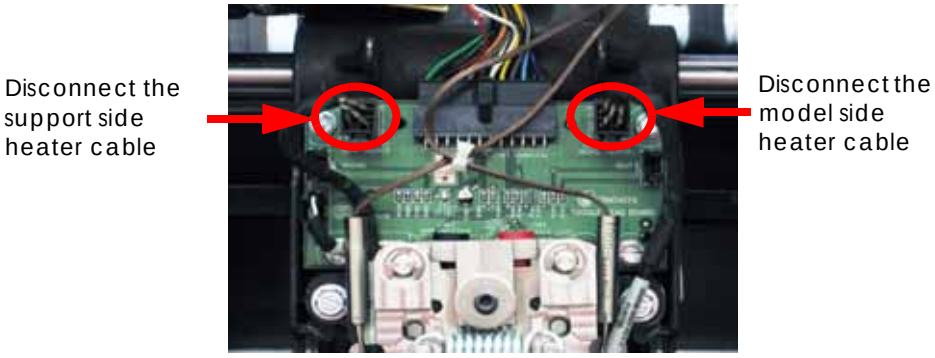
8. Disconnect the umbilical cable by pressing in on the tab and pulling upwards. See Figure 4-131.

Figure 4-131: Umbilical cable location



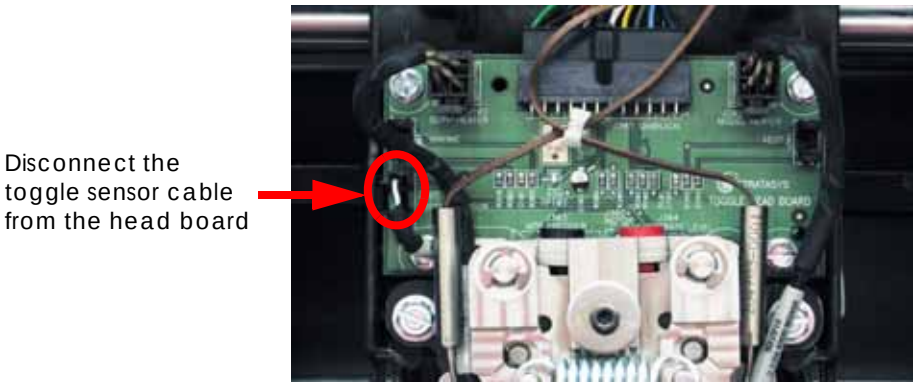
9. Disconnect the model and support heater cables by pressing in on the tabs and pulling outward. See Figure 4-132.

Figure 4-132: Model and support heater cable locations



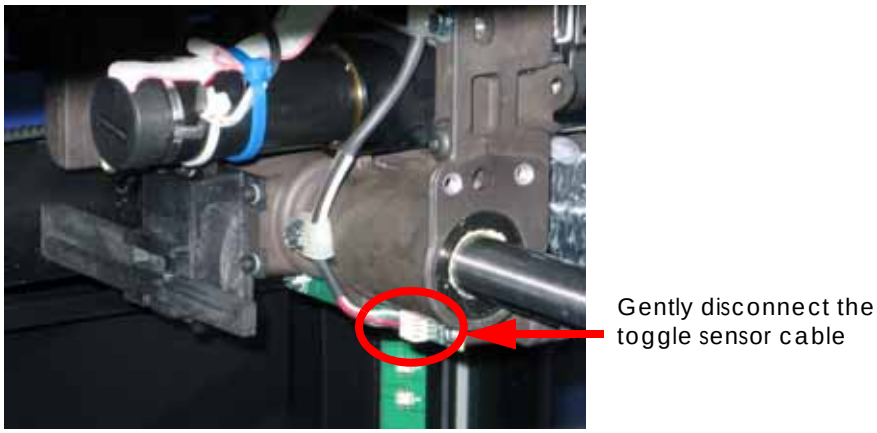
10. Disconnect the toggle sensor cable from the head board by pressing in on the tab and pulling outward. See Figure 4-133.

Figure 4-133: Toggle sensor cable location



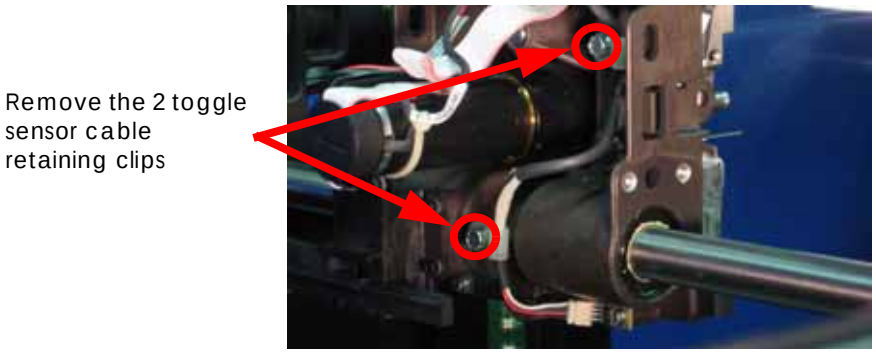
11. Gently disconnect the toggle sensor cable from the toggle sensor by pulling the cable outward. See Figure 4-134.

Figure 4-134: Disconnect the toggle sensor cable from the toggle sensor



12. Using a ¼" nut driver or standard screwdriver, remove the toggle sensor cable retaining clips. See Figure 4-135.

Figure 4-135: Toggle sensor cable retaining clip locations

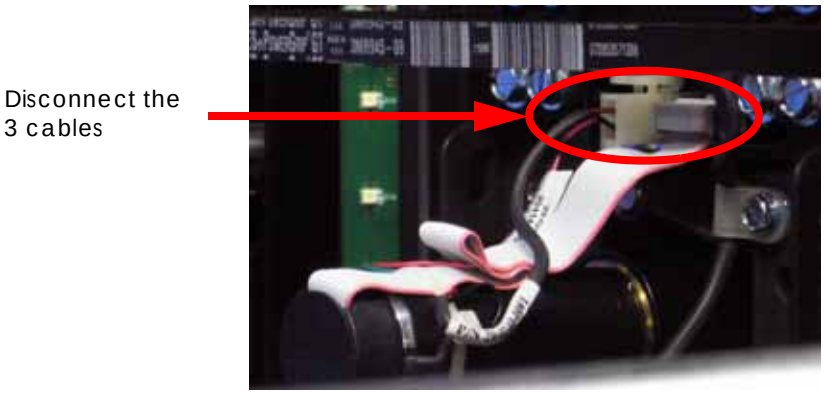


13. Feed the toggle sensor cable out through the head board. See Figure 4-136.

Figure 4-136: Removing the toggle sensor cable from the head board

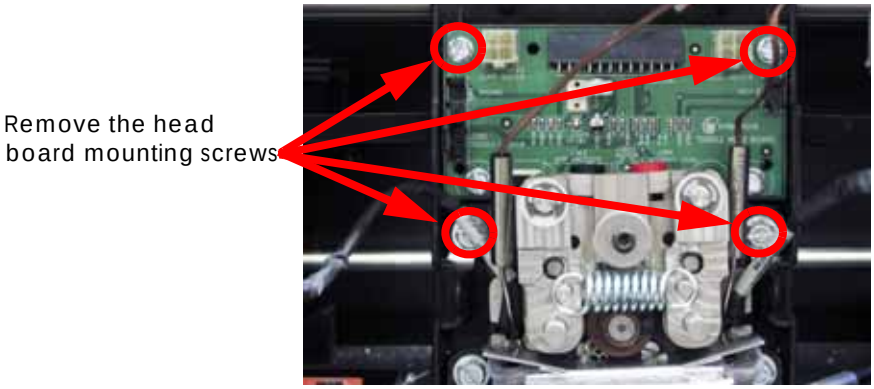
14. Disconnect the substrate sensor cable and filament motor cables from the rear of the head board by pressing the tabs in and pulling outward. See Figure 4-137.

Figure 4-137: Rear head board cable locations



15. Using a ¼" nut driver or standard screwdriver, remove the 4 head board mounting screws. See Figure 4-138.

Figure 4-138: Remove the head board mounting screws



Installing the head board

1. Align the head board with the mounting holes.
2. Using a ¼" nut driver or standard screwdriver, reinstall the 4 mounting screws.
3. Reconnect the substrate sensor cable and the 2 filament motor cables to the rear of the head board.
4. Feed the toggle sensor cable through the head board.
5. Using a ¼" nut driver or standard screwdriver, reinstall the toggle sensor wire clips.
6. Reconnect the toggle sensor cable to the toggle sensor.
7. Reconnect the toggle sensor cable to the head board.
8. Reconnect the model and support heater cables.
9. Reconnect the umbilical cable.
10. Place the thermocouple wires in the wire retaining clip.
11. Reconnect the model and support material tubes.
12. Reinstall the air plenum.
13. Reinstall the head cover.
14. Reinstall the right side access cover.
15. Reinstall the side panels. See Installing the side panels on page 4-8.
16. Reinstall the top panel. See Installing the top panel on page 4-6.

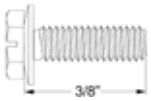
TC Amp board

Required Tools

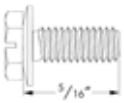
- 5/16″ nut driver or standard screwdriver
- 1/4″ nut driver

Hardware

- 10-32 x 3/8″ slotted screws (x7)



- 6-32 x 1/4″ slotted screws (x3)

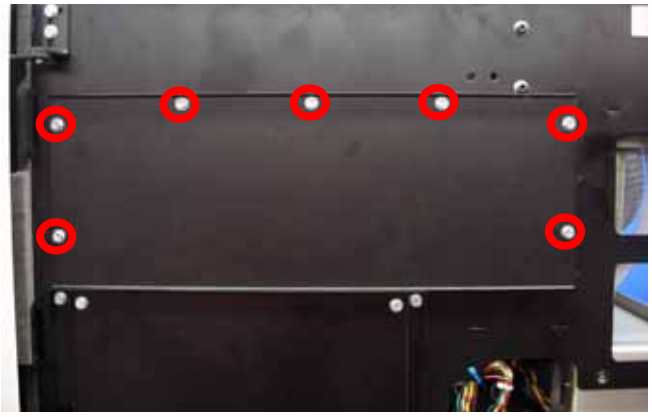


Removing the TC Amp board

1. Remove the top panel. See Removing the top panel on page 4-5.
2. Remove the side panels. See Side Panels on page 4-7.
3. Remove the right side access panel mounting screws with a 5/16″ nut driver or standard screwdriver and remove the panel. See Figure 4-139.

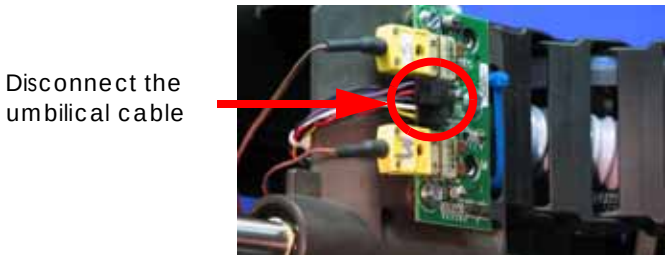
Figure 4-139: Right side access panel mounting screw locations

Remove the 7 mounting screws.



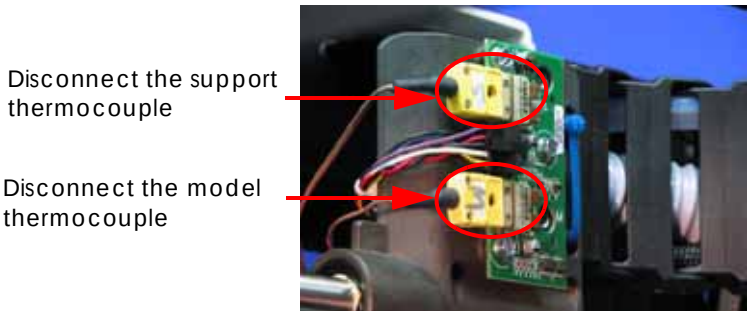
4. Disconnect the umbilical cable by pressing in on the tab and pulling outward. See Figure 4-140.

Figure 4-140: Disconnecting the umbilical cable



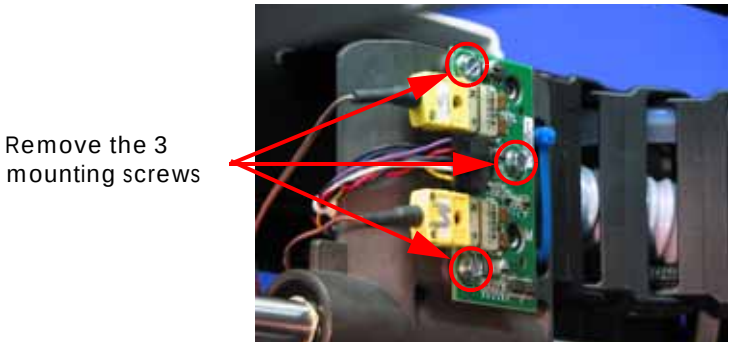
5. Disconnect the model and support thermocouple wires by pulling outward. See Figure 4-141.

Figure 4-141: Thermocouple wire locations



6. Using a ¼" nut driver or standard screwdriver, remove the 3 mounting screws and remove the TC Amp board. See Figure 4-142.

Figure 4-142: TC Amp board mounting screw locations



Installing the TC Amp board

1. Align the TC Amp board with the mounting holes.
2. Using a ¼" nut driver or standard screwdriver, reinstall the 3 mounting screws.
3. Reconnect the model and support thermocouple wires.
4. Reconnect the umbilical cable.
5. Reinstall the right side access panel.
6. Reinstall the side panels. See Installing the side panels on page 4-8.
7. Reinstall the top panel. See Installing the top panel on page 4-6.

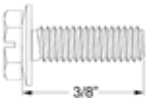
Umbilical Hose

Required Tools

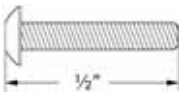
- 5/16" nut driver or standard screwdriver
- 1/4" nut driver
- 5/32" allen wrench
- Cutters

Hardware

- Wire tie
- 10-32 x 3/8" slotted screws (x7)



- 1/4 - 20 x 1/2" button head cap screws (x2)

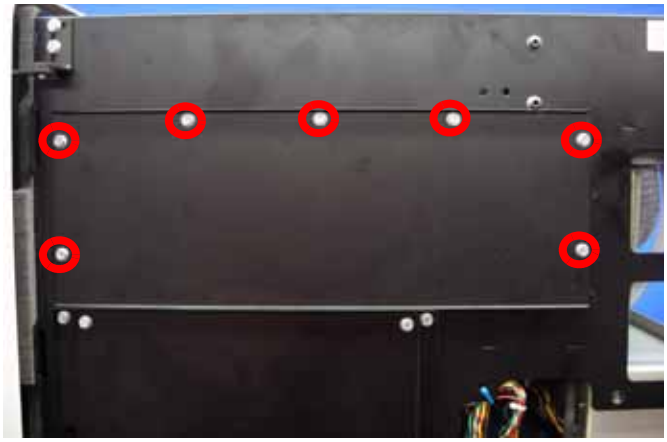


Removing the umbilical hose

1. Remove the top panel. See Removing the top panel on page 4-5.
2. Remove the side panels. See Side Panels on page 4-7.
3. Remove the upper electronics bay cover. See Removing the upper electronics bay cover on page 4-17.
4. Using a 5/16" nut driver or standard screwdriver, remove the right side access panel mounting screws and remove the panel. See Figure 4-143.

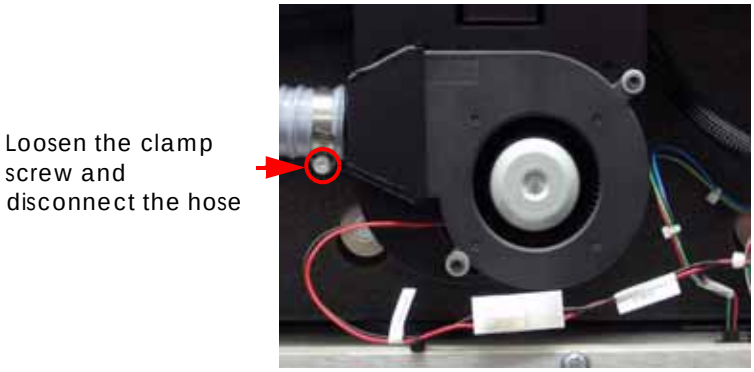
Figure 4-143: Right side access cover mounting screw locations

Remove the 7 mounting screws.



5. Using a ¼" nut driver or standard screwdriver, loosen the umbilical hose clamp. See Figure 4-144.
6. Disconnect the umbilical hose from the head cooling fan and remove the hose clamp. See Figure 4-144.

Figure 4-144: Umbilical hose clamp location

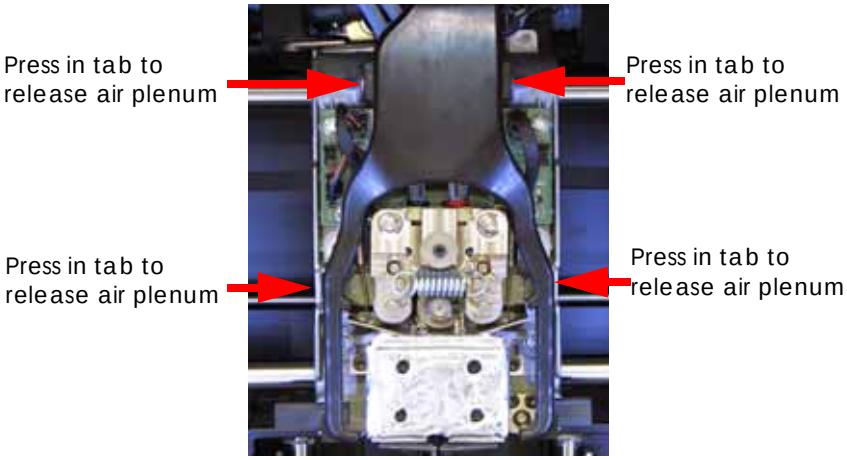


7. Remove the head cover by pressing the tabs in and pulling outward. See Figure 4-145.

Figure 4-145: Head cover tab locations

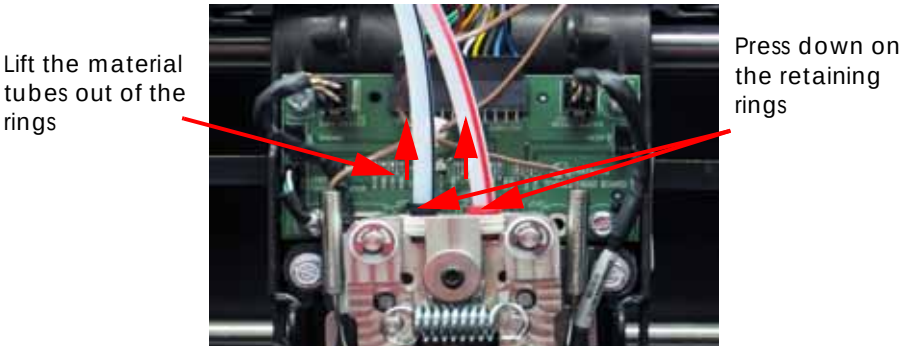
8. Remove the air plenum by pressing in on the tabs and pulling outward. See Figure 4-146.

Figure 4-146: Air plenum tab locations



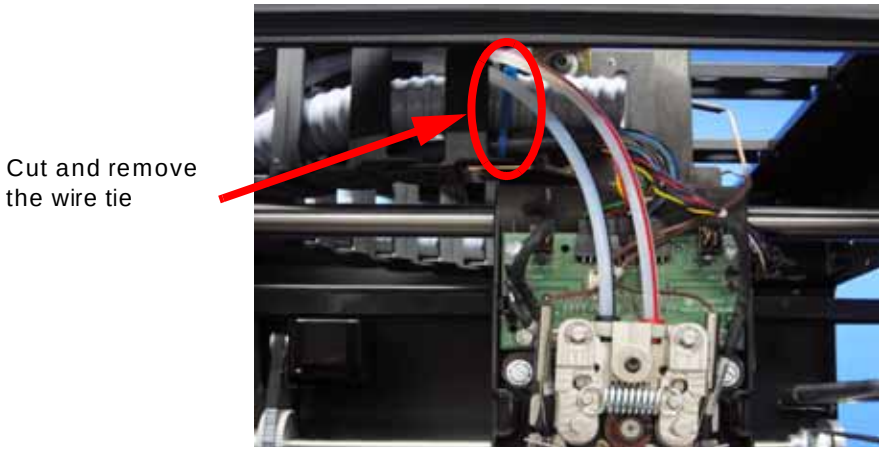
9. Disconnect the model and support material tubes. See Figure 4-147.

Figure 4-147: Material tube and retaining ring locations



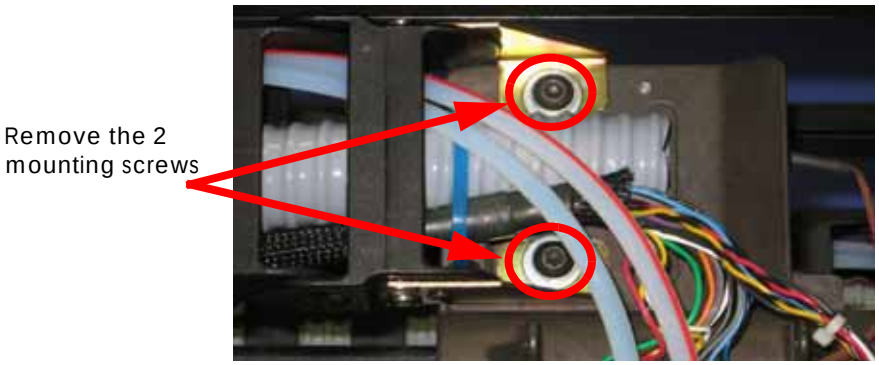
10. Cut the wire tie from around the umbilical hose. See Figure 4-148.

Figure 4-148: Umbilical hose wire tie location



11. Remove the energy chain mounting screws from the translator with a $^{5}/_{32}$″ allen wrench. See Figure 4-149.

Figure 4-149: Remove the energy chain mounting screws

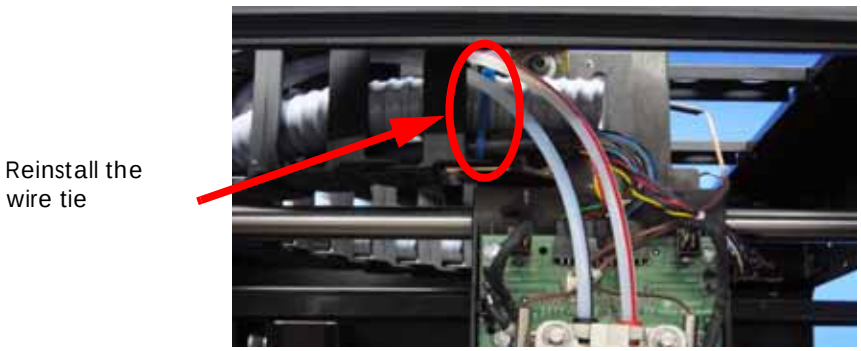


12. Straighten the energy chain and feed the umbilical hose through to remove.

Installing the umbilical hose

1. Feed the umbilical hose through the energy chain.
2. Align the energy chain with the mounting holes.
3. Using a $^{5}/_{32}$" allen wrench, reinstall the energy chain mounting screws.
4. Reinstall a wire tie around the umbilical hose. See Figure 4-150.

Figure 4-150: Umbilical hose wire tie location



5. Reconnect the model and support material tubes.
6. Reinstall the air plenum.
7. Reinstall the head cover.
8. Reconnect the umbilical hose to the head cooling fan.
9. Using a $^{1}/_{4}$" nut driver or standard screwdriver, tighten the umbilical hose clamp.
10. Align the right side access panel with the mounting holes.
11. Using a $^{5}/_{16}$" nut driver or standard screwdriver, reinstall the right side access panel mounting screws.
12. Reinstall the upper electronics bay cover. See Installing the upper electronics bay cover on page 4-18.
13. Reinstall the side panels. See Installing the side panels on page 4-8.
14. Reinstall the top panel. See Installing the top panel on page 4-6.

Material Tubes

Required Tools

- $^{5}/_{16}$″ nut driver or standard screwdriver
- $^{1}/_{4}$″ nut driver
- $^{5}/_{32}$″ allen wrench
- Cutters

Removing the material tubes

1. Remove the top panel. See Removing the top panel on page 4-5.
2. Remove the side panels. See Side Panels on page 4-7.
3. Remove the upper electronics bay cover. See Removing the upper electronics bay cover on page 4-17.
4. Remove the umbilical hose. See Removing the umbilical hose on page 4-84.
5. Feed the material tubes out through the energy chain.

Installing the material tubes

1. Feed the material tubes through the energy chain.
2. Reinstall the umbilical hose. See Installing the umbilical hose on page 4-87.
3. Reinstall the upper electronics bay cover. See Installing the upper electronics bay cover on page 4-18.
4. Reinstall the side panels. See Installing the side panels on page 4-8.
5. Reinstall the top panel. See Installing the top panel on page 4-6.

Umbilical Cable

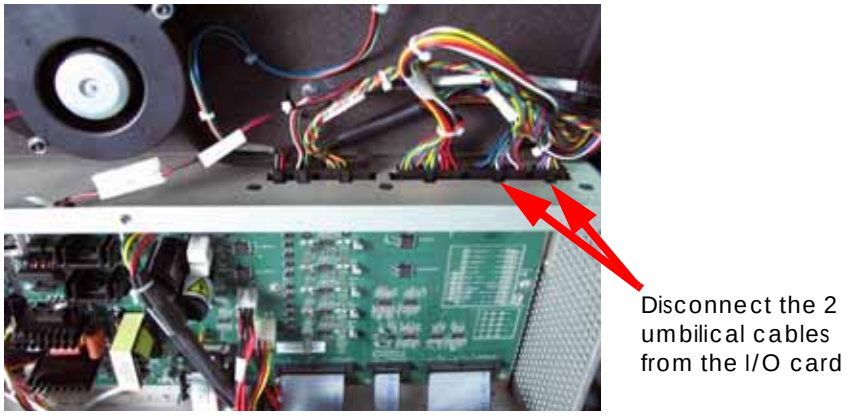
Required Tools

- 5/16″ nut driver or standard screwdriver
- Cutters
- 1/4″ nut driver
- 5/32″ allen wrench

Removing the umbilical cable

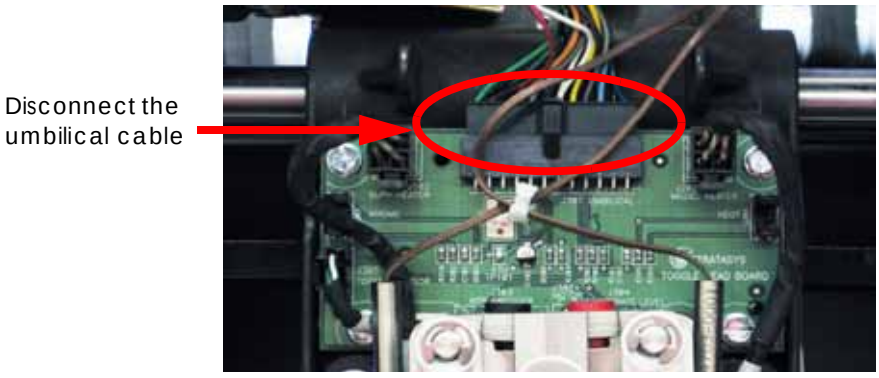
1. Remove the top panel. See Removing the top panel on page 4-5.
2. Remove the side panels. See Side Panels on page 4-7.
3. Remove the upper electronics bay cover. See Removing the upper electronics bay cover on page 4-17.
4. Remove the umbilical hose. See Removing the umbilical hose on page 4-84.
5. Disconnect the umbilical cable from the I/O card. See Figure 4-151.

Figure 4-151: Umbilical cable connector locations



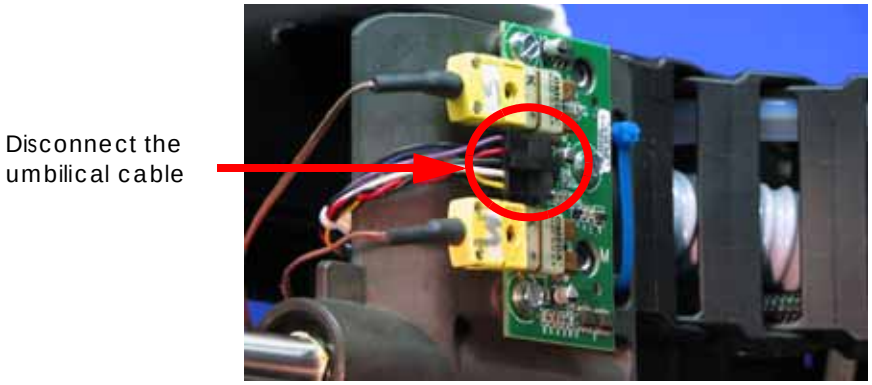
6. Disconnect the umbilical cable from the head board by pressing in on the tab and pulling upward. See Figure 4-152.

Figure 4-152: Head board connector location



7. Disconnect the umbilical cable from the TC Amp board by pressing in on the tab and pulling outward. See Figure 4-153.

Figure 4-153: TC Amp connector location



8. Feed the umbilical cable out through the energy chain.

Installing the umbilical cable

1. Feed the umbilical cable through the energy chain.
2. Reconnect the umbilical cable to the TC Amp board.
3. Reconnect the umbilical cable to the head board.
4. Reconnect the umbilical cable to the I/O card.
5. Reinstall the umbilical hose. See Installing the umbilical hose on page 4-87.
6. Reinstall the upper electronics bay cover. See Installing the upper electronics bay cover on page 4-18.
7. Reinstall the side panels. See Installing the side panels on page 4-8.
8. Reinstall the top panel. See Installing the top panel on page 4-6.

XY Table Components

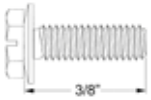
Y Home Sensor

Required Tools

- 1/4" nut driver or standard screwdriver.

Hardware

- 6-32 x 3/8" slotted screw (x1)



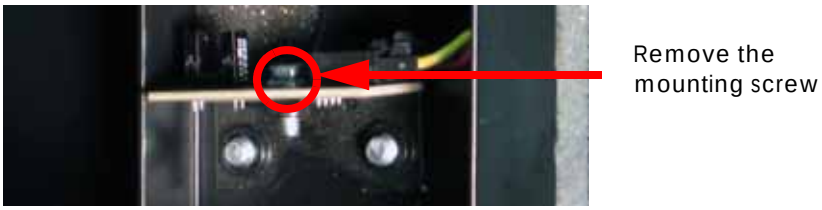
Removing the Y home sensor

1. Remove the top panel. See Removing the top panel on page 4-5.
2. Disconnect the Y home cable by pressing in on the tab and pulling outward. See Figure 4-154.

Figure 4-154: Y Home sensor cable location

3. Using a 1/4" nut driver or standard screwdriver, remove the mounting screw. See Figure 4-155.

Figure 4-155: Y home sensor mounting screw location



4. Remove the Y home sensor.

Installing the Y Home Sensor

1. Align the Y Home Sensor with the mounting hole.
2. Using a 1/4" nut driver or standard screwdriver, reinstall the mounting screw.
3. Reconnect the Y Home cable.
4. Install the top panel. See Installing the top panel on page 4-6.

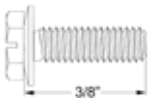
Y EOT (End of Travel) Sensor

Required Tools

- 1/4" nut driver or standard screwdriver.

Hardware

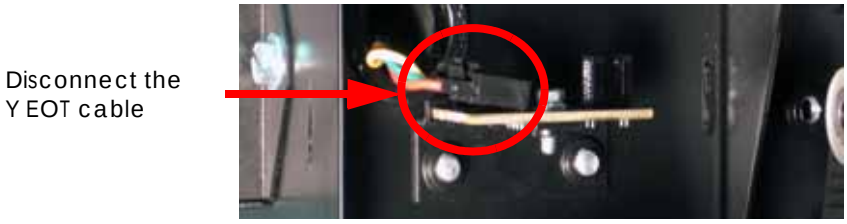
- 6-32 x 3/8" slotted screw (x1)



Removing the Y EOT sensor

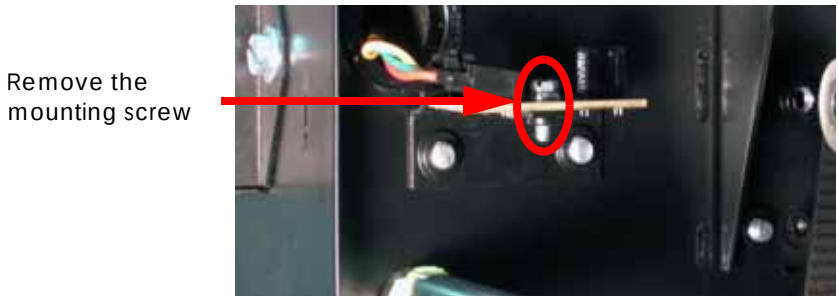
1. Remove the top panel. See Removing the top panel on page 4-5.
2. Disconnect the Y EOT cable by pressing in on the tab and pulling outward. See Figure 4-156.

Figure 4-156: Y EOT sensor cable location



3. Using a 1/4" nut driver or standard screwdriver, remove the mounting screw. See Figure 4-157.

Figure 4-157: Y EOT sensor mounting screw location



4. Remove the Y EOT sensor.

Installing the Y EOT Sensor

1. Align the Y EOT Sensor with the mounting hole.
2. Using a 1/4" nut driver or standard screwdriver, reinstall the mounting screw.
3. Reconnect the Y EOT cable.
4. Install the top panel. See Installing the top panel on page 4-6.

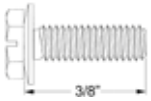
X Motor

Required Tools

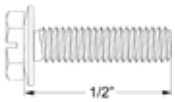
- 5/16″ nut driver or standard screwdriver.
- 1/2″ box wrench.
- 3/32″ allen wrench.
- 1/8″ allen wrench.
- Cutters.

Hardware

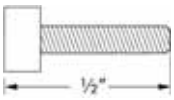
- Wire tie
- 10-32 x 3/8″ slotted screws (x16)



- 10-32 x 1/2″ slotted screws (x4)



- 8-32 x 1/2″ socket head cap screws (x4)

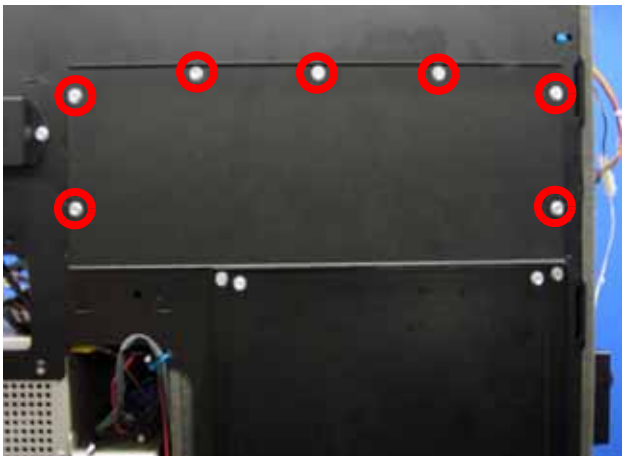


Removing the X motor

1. Remove the top panel. See Removing the top panel on page 4-5.
2. Remove the side panels. See Side Panels on page 4-7.
3. Using a 5/16″ nut driver or standard screwdriver, remove the 7 left side access panel mounting screws and remove the left side access panel. See Figure 4-158.

Figure 4-158: Left side access panel mounting screw locations

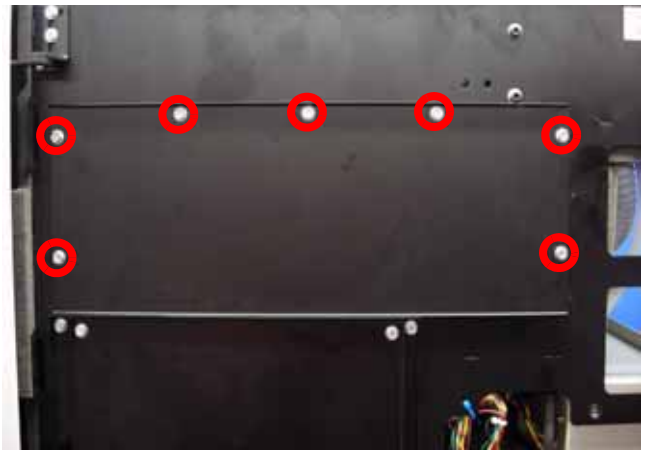
Remove the 7 mounting screws.



4. Using a $^{5}/_{16}$" nut driver or standard screwdriver, remove the 7 right side access panel mounting screws and remove the right side access panel. See Figure 4-159.

Figure 4-159: Right side access panel mounting screw locations

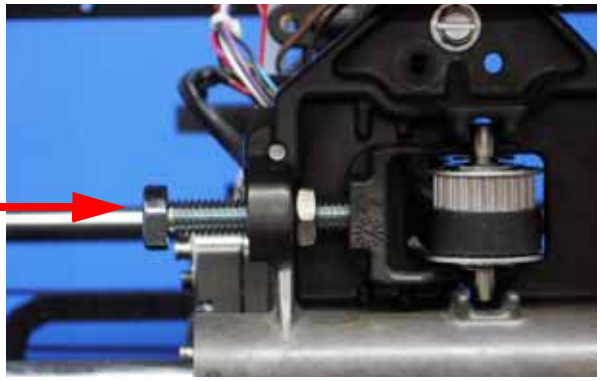
Remove the 7 mounting screws.



5. Using a $^{1}/_{2}$" box wrench, remove the X belt tension adjuster by loosening the inside nut and then backing the bolt out of the mount. See Figure 4-160.
6. Remove the tensioning fork and pulley from the X motor belt.

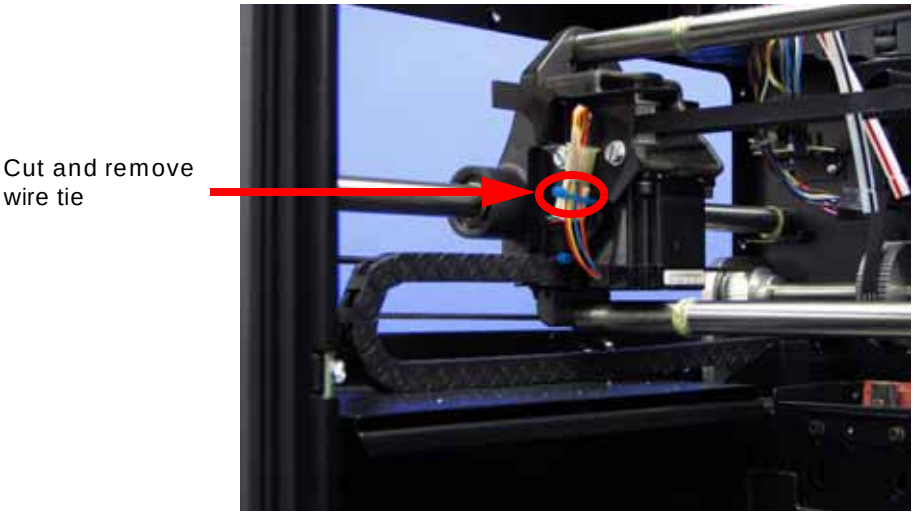
Figure 4-160: X belt tension adjustment bolt location

Loosen X belt adjustment bolt



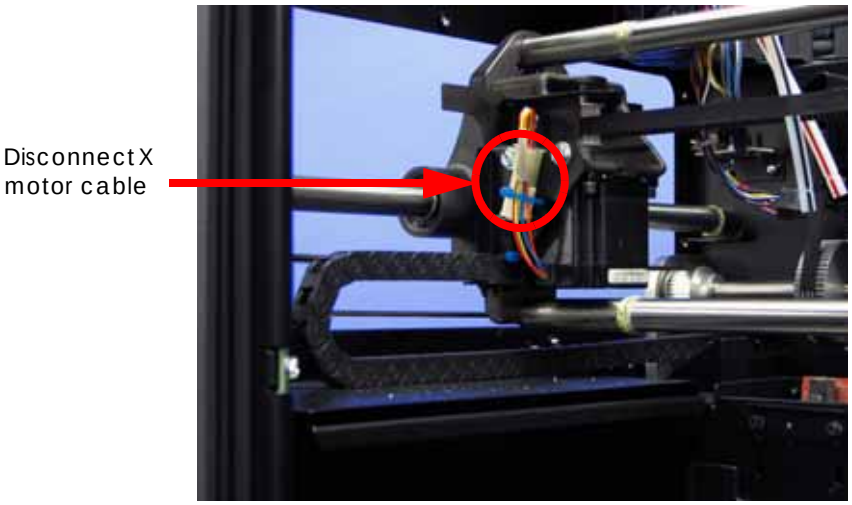
7. Using a cutters, remove the X motor cable connector wire tie. See Figure 4-161.

Figure 4-161: X motor wire tie locations



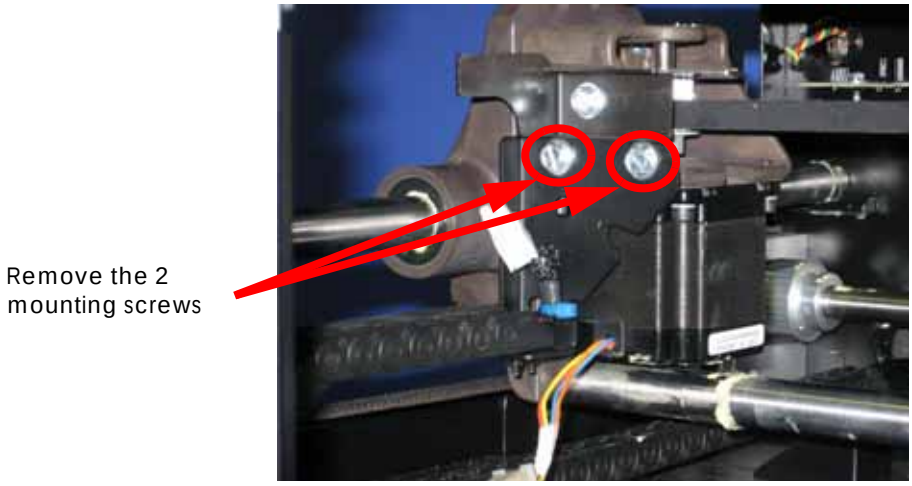
8. Disconnect the X motor cable by pressing in on the tab and pulling outward. See Figure 4-162.

Figure 4-162: X motor cable connector location



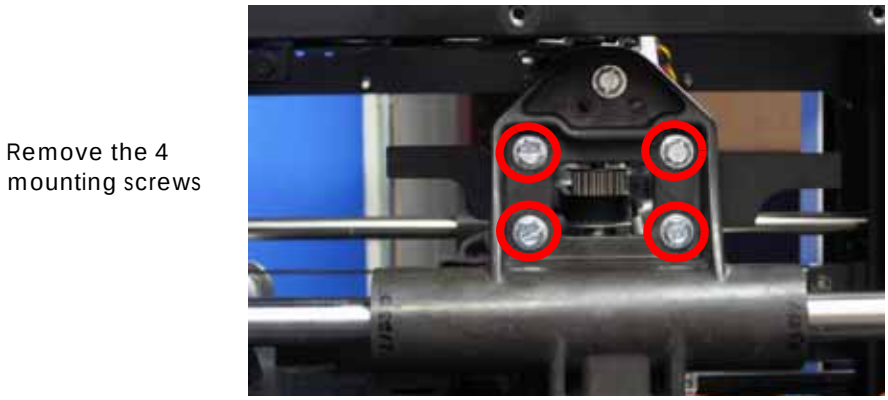
9. Using a $^{5}/_{16}$" nut driver or standard screwdriver, remove the 2 X energy chain mounting bracket mounting screws. See Figure 4-163.

Figure 4-163: X motor energy chain mounting bracket mounting screw locations



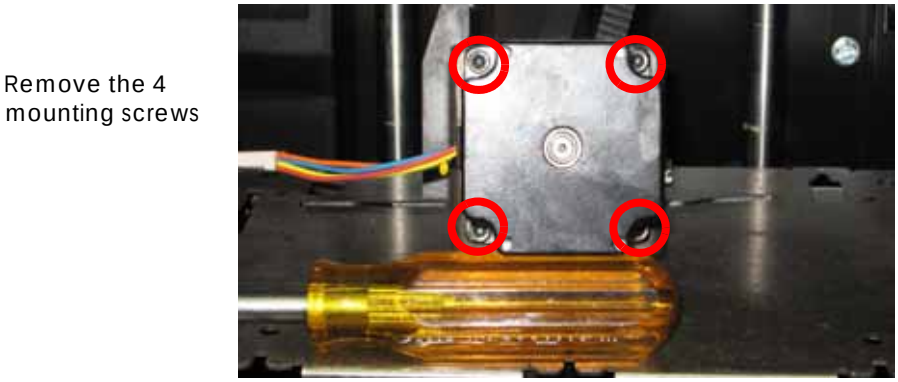
10. Using a $^{5}/_{16}$" nut driver or standard screwdriver, remove the 4 mounting screws from the X motor mounting bracket. See Figure 4-164.

Figure 4-164: X motor mounting bracket mounting screw locations



11. Using a $^{9}/_{64}$" allen wrench, remove the 4 X motor mounting screws from the mounting bracket. See Figure 4-165.

Figure 4-165: X motor mounting screw locations

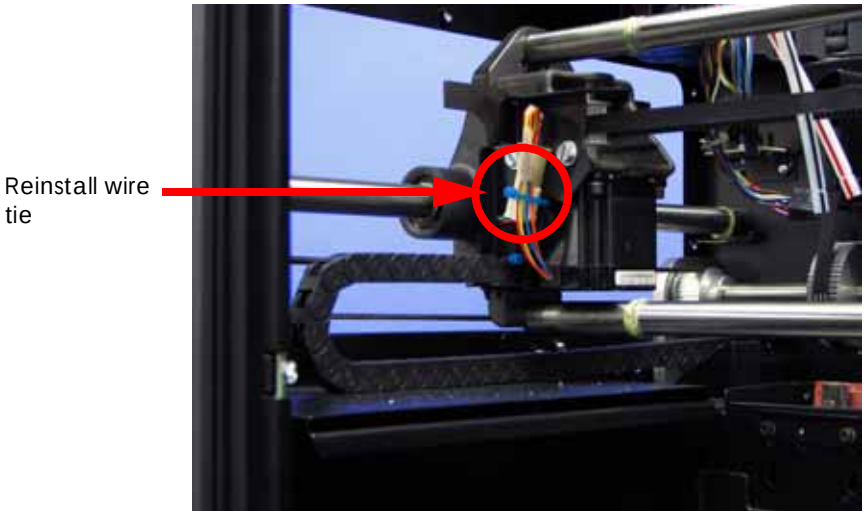


12. Remove the X motor from the X motor mounting bracket.

Installing the X motor

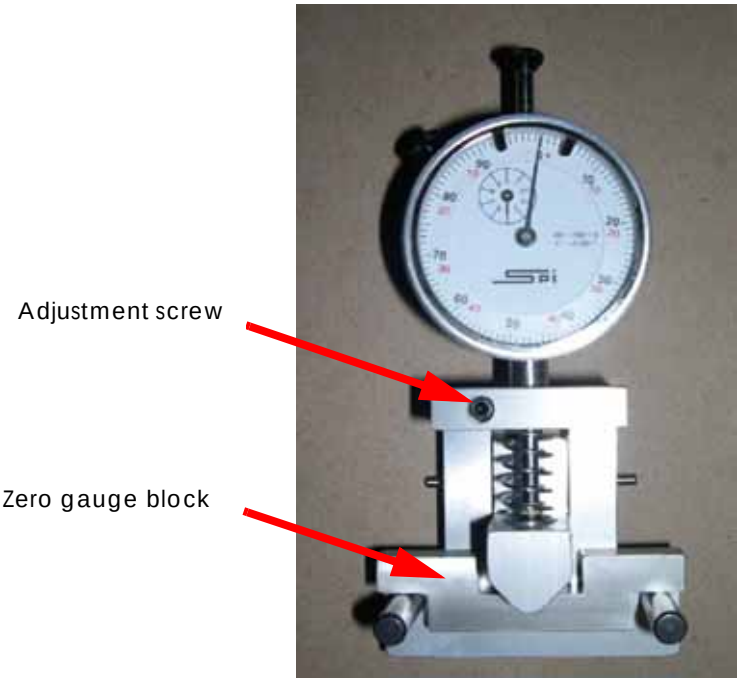
1. Place the X belt around the X motor pulley.
2. Align the X motor into the X motor mounting bracket making sure the X motor cable faces the front of the printer.
3. Using a $^{9}/_{64}$" allen wrench, reinstall the 4 X motor mounting screws.
4. Align the X motor mounting bracket with the mounting holes.
5. Using a $^{5}/_{16}$" nut driver or standard screwdriver, reinstall the 4 X motor mounting bracket mounting screws.
6. Align the X motor energy chain mounting bracket with the mounting holes.
7. Using a $^{5}/_{16}$" nut driver or standard screwdriver, reinstall the 2 X motor energy chain mounting screws.
8. Reconnect the X motor cable.
9. Reinstall a wire tie around the X motor cable connector. See Figure 4-166.

Figure 4-166: X motor wire tie locations



10. Move the Head Assembly to the full right travel position within the build envelope (as viewed from the front of the printer).
11. Insert the zero gauge block into the gauge. See Figure 4-167.
12. Loosen the adjustment screw and slide the dial indicator assembly up or down to set the 'zero' reading: The large hand should be on 0 and the small hand on 5.
13. Tighten the adjustment screw (do not over tighten the screw) and recheck the reading.
14. Remove the zero block gauge block from the fixture.

Figure 4-167: Tension gauge zero setting



15. Position the dial indicator on the rear section of the X-Drive belt - centered between the Head Assembly and the left side of the build envelope. See Figure 4-168.

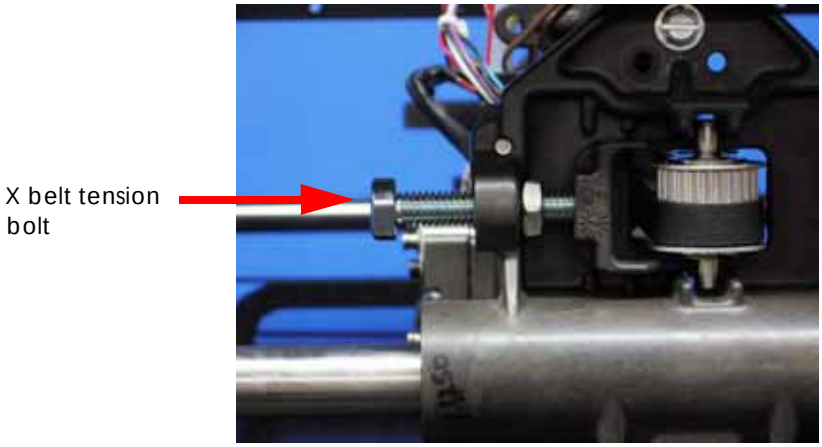
Figure 4-168: X belt tension location

16. Check the tension:
    The large hand on the gauge should read between 25 and 35 mils, and the small hand should read between 4 and 5. See Figure 4-169.

Figure 4-169: Gauge reading at correct X belt tension (Shading indicates acceptable range)

17. If the tension is out of the range specified above, adjust the belt tension by turning the X belt tensioning nut on the X-Drive Idler/Tension Adjust gear. See Figure 4-170.

Figure 4-170: X-Drive Belt Tension Adjustment



18. Remove the belt fixture and run the head back and forth several times.
19. Continue to adjust and check the tension until the tension meets specification.

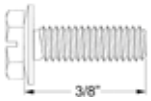
Y Motor

Required Tools

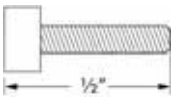
- $^{5}/_{16}$" nut driver or standard screwdriver.
- $^{9}/_{64}$" allen wrench.

Hardware

- 10-32 x $^{3}/_{8}$" slotted screws (x11)



- 8-32 x $^{1}/_{2}$" socket head cap screws (x4)

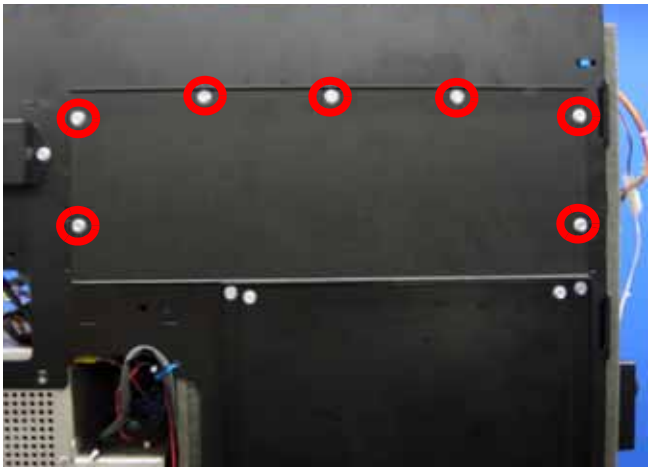


Removing the Y motor

1. Remove the top panel. See Removing the top panel on page 4-5.
2. Remove the side panels. See Side Panels on page 4-7.
3. Remove the upper electronics bay cover. See Removing the upper electronics bay cover on page 4-17.
4. Remove the left side access panel. See Figure 4-171.

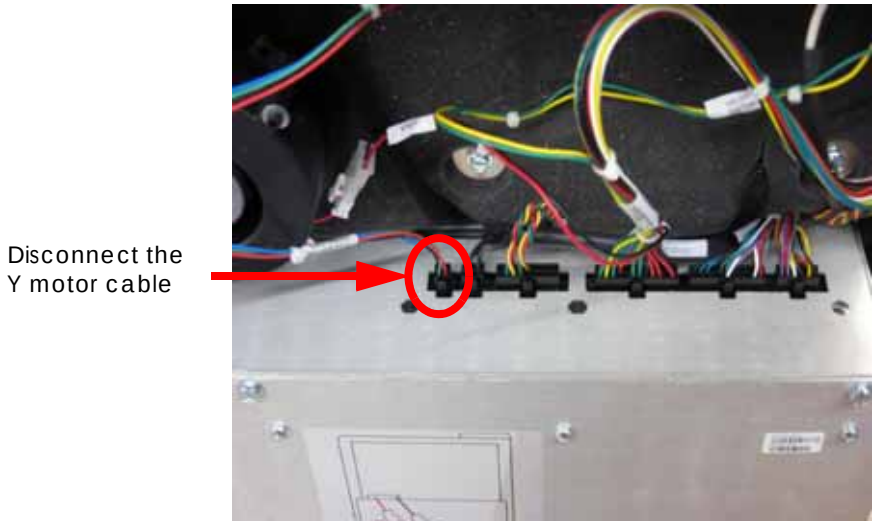
Figure 4-171: Left side access panel mounting screw locations

Remove the 7 mounting screws.



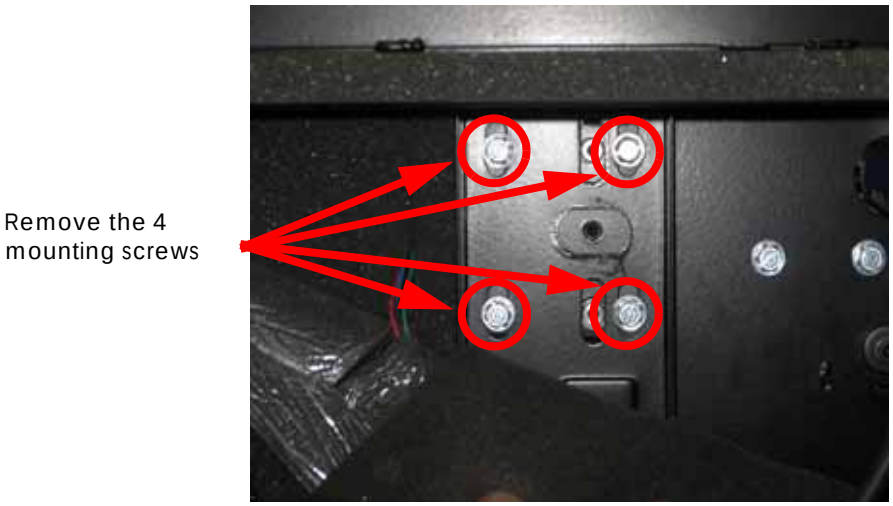
5. Disconnect the Y motor cable by pressing in on the tab and pulling upward. See Figure 4-172.

Figure 4-172: Y motor cable location



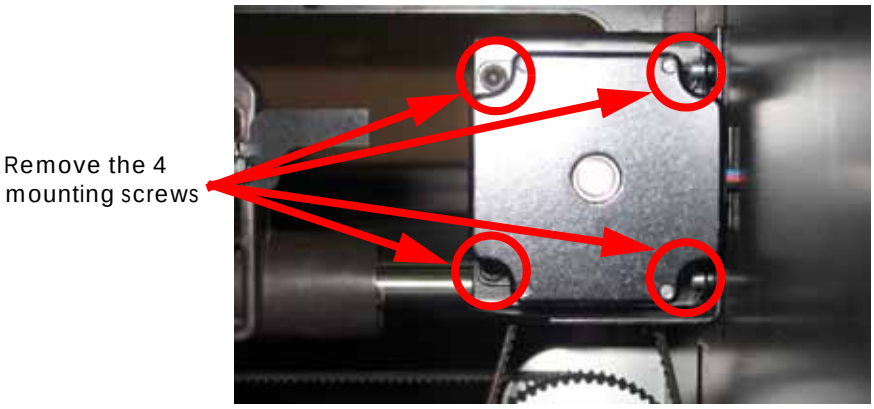
6. Using a $^{5}/_{16}$" nut driver or standard screwdriver, remove the 4 Y motor mounting bracket mounting screws. See Figure 4-173.

Figure 4-173: Y motor mounting bracket mounting screw locations



7. Using a $^{9}/_{64}$" allen wrench, remove the 4 Y motor mounting screws. See Figure 4-174.

Figure 4-174: Y motor mounting screw locations



8. Remove the Y motor.

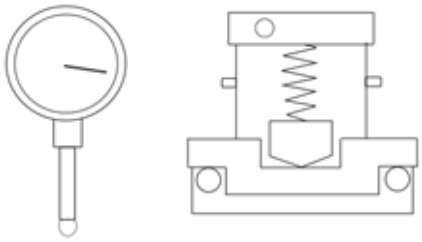
Installing the Y motor

1. Align the Y motor with the Y motor mounting bracket, making sure the Y motor cable faces the back of the printer.
2. Using a $^{9}/_{64}$" allen wrench, reinstall the 4 Y motor mounting screws.
3. Align the Y motor mounting bracket with mounting holes.
4. Using a $^{5}/_{16}$" nut driver or standard screwdriver, loosely reinstall the Y motor mounting bracket mounting screws.
5. Place the Y motor belt around the Y motor pulley.
6. Slide the Y motor mounting bracket up until the Y belt is tight.
7. Using a $^{5}/_{16}$" nut driver or standard screwdriver, securely fasten the Y motor mounting bracket mounting screws.
8. Reconnect the Y motor cable.
9. Align the left side access panel with the mounting holes.
10. Using a $^{5}/_{16}$" nut driver or standard screwdriver, reinstall the left side access panel mounting screws.
11. Reinstall the upper electronics bay cover. See Installing the upper electronics bay cover on page 4-18.
12. Reinstall the side panels. See Installing the side panels on page 4-8.
13. Reinstall the top panel. See Installing the top panel on page 4-6.

Y Motor Belt

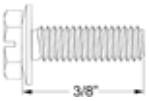
Required Tools

- 5/16″ nut driver or standard screwdriver.
- Dial indicator and belt tension gauge assembly



Hardware

- 10-32 x 3/8″ slotted screws (x30)



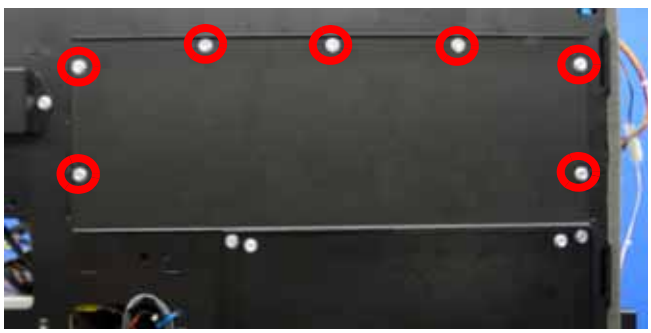
- 3-16 x 1″ fender washer

Removing the Y Motor Belt

1. Remove the top panel. See Removing the top panel on page 4-5.
2. Remove the side panels. See Side Panels on page 4-7.
3. Remove the upper electronics bay cover. See Removing the upper electronics bay cover on page 4-17.
4. Remove the left side access panel. See Figure 4-175.

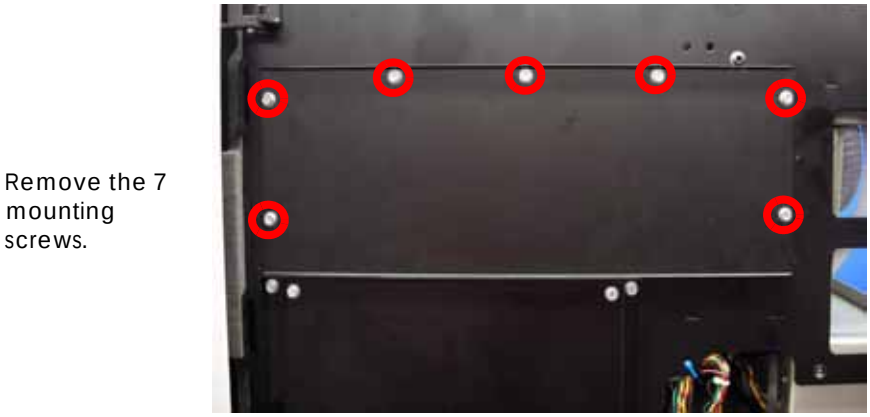
Figure 4-175: Left side access panel mounting screw locations

Remove the 7 mounting screws.



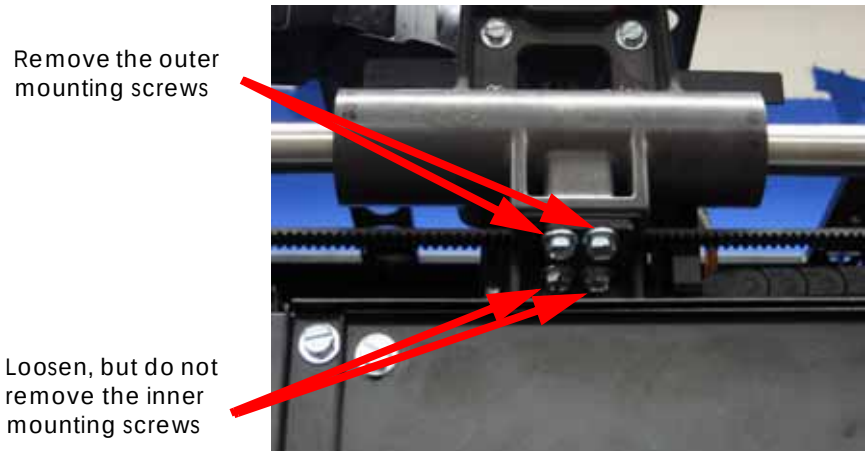
5. Disconnect the material bay cable from the printer.
6. Remove the Front Panel. See Removing the front panel on page 4-11.
7. Remove the Electronics Bay. See Removing the electronics bay on page 4-19.
8. Using a $^{5}/_{16}$" nut driver or standard screwdriver, remove the right side access panel mounting screws and remove the right side access panel. See Figure 4-176.

Figure 4-176: Right side access panel mounting screw locations



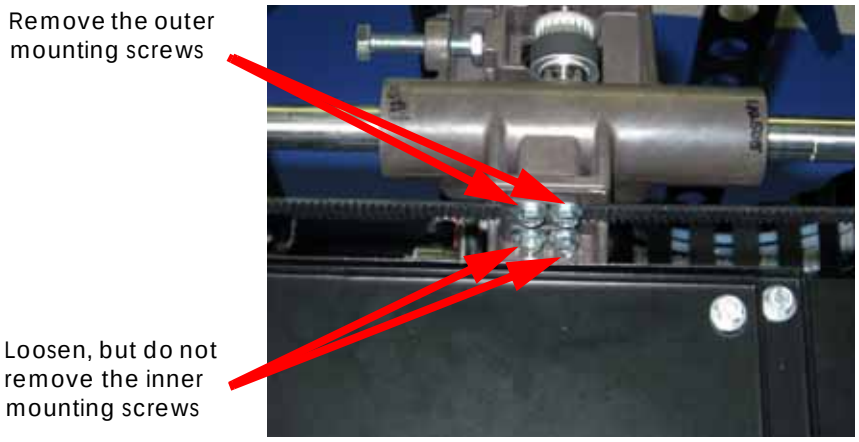
9. Using a $^{5}/_{16}$" box wrench, remove the outer Y belt retaining clip mounting screws from the left side. See Figure 4-177.
10. Using a $^{5}/_{16}$" box wrench, loosen, but do not remove, the inner Y belt retaining clip mounting screws from the left side. See Figure 4-177.
11. Pull the left side Y belt out from the retaining clip.

Figure 4-177: Left side Y belt retaining clip mounting screw locations



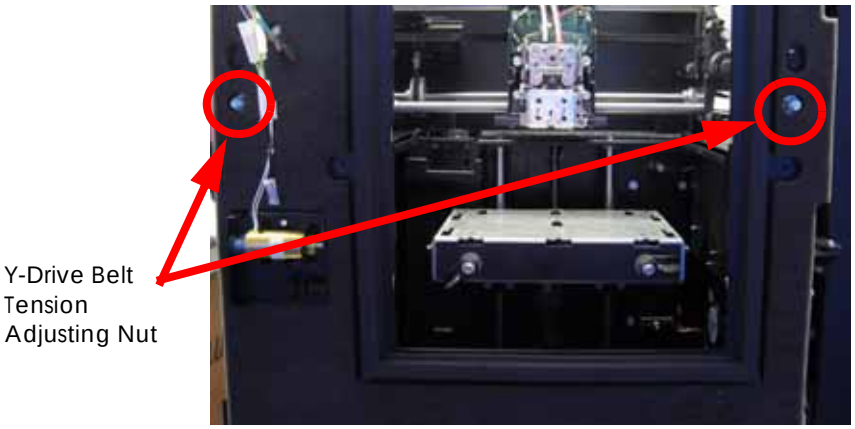
12. Using a $^{5}/_{16}$" box wrench, remove the outer Y belt retaining clip mounting screws from the right side. See Figure 4-178.
13. Using a $^{5}/_{16}$" box wrench, loosen, but do not remove, the inner Y belt retaining clip mounting screws from the right side. See Figure 4-178.
14. Pull the right side Y belt out from the retaining clip.

Figure 4-178: Right side Y belt retaining clip mounting screw locations



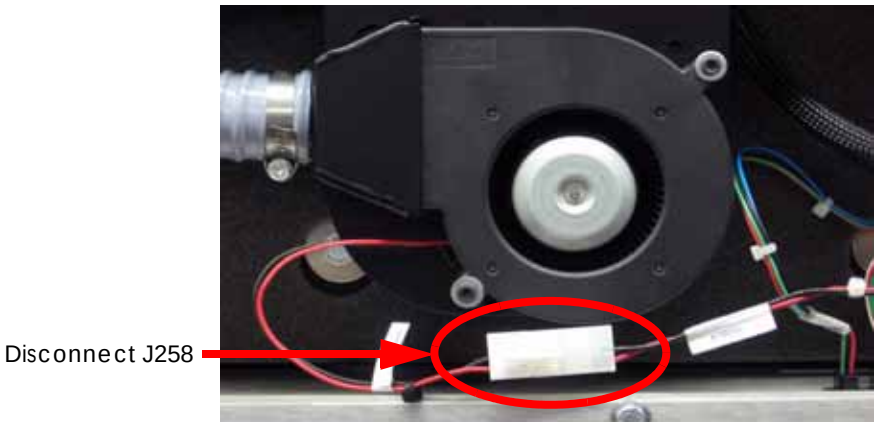
15. Decrease the Y belt tension by turning the tensioning nut. See Figure 4-179.

Figure 4-179: Y drive belt tension adjustment



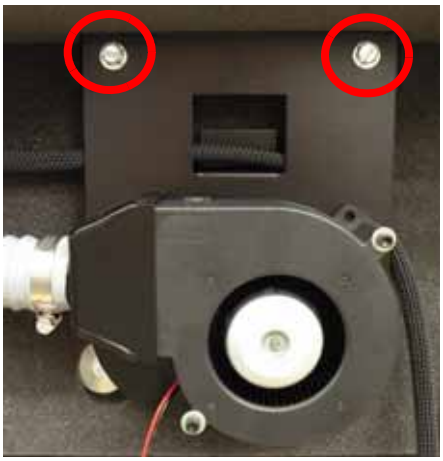
16. Disconnect the head cooling fan. See Figure 4-180.

Figure 4-180: Disconnect head cooling fan J258



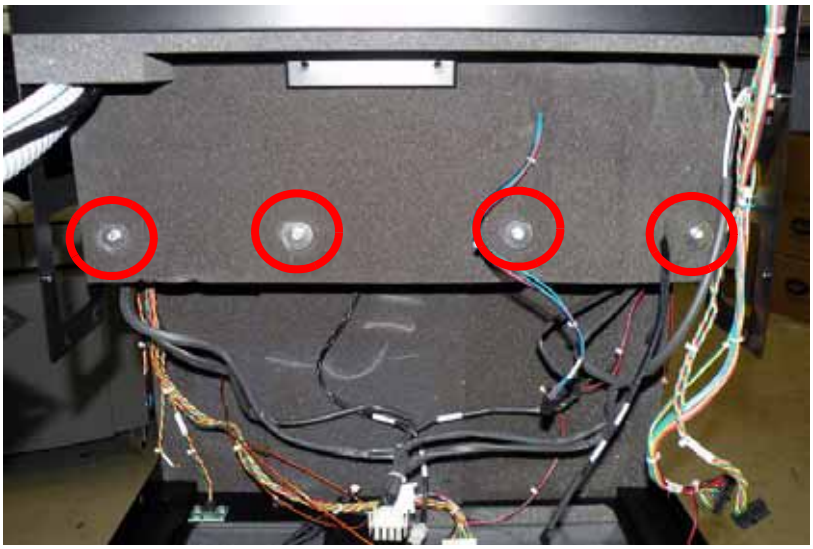
17. Using a $^{5}/_{16}$" nut driver or standard screwdriver, remove the head cooling fan mounting bracket screws. See Figure 4-181.

Figure 4-181: Head cooling fan mounting bracket screw locations



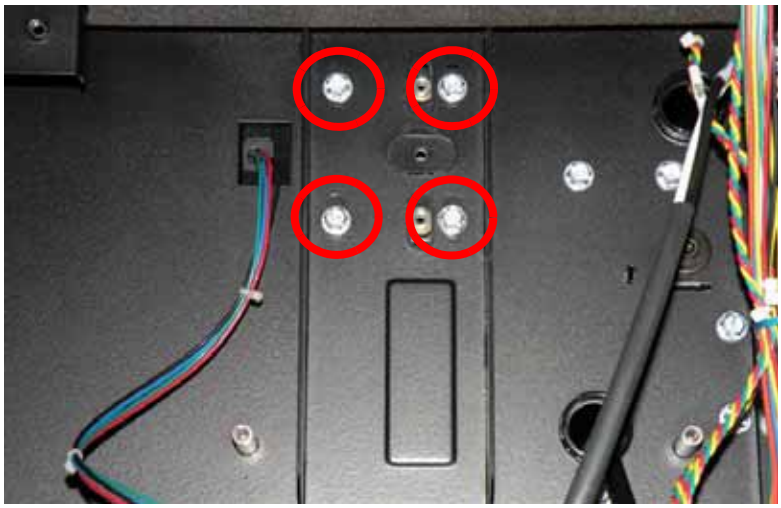
18. Let head cooling fan hang off to side.
19. Using a $^{5}/_{16}$" nut driver or standard screwdriver, remove the 4 foam insert retaining screws and washers. See Figure 4-182.

Figure 4-182: Foam insert retaining screw locations



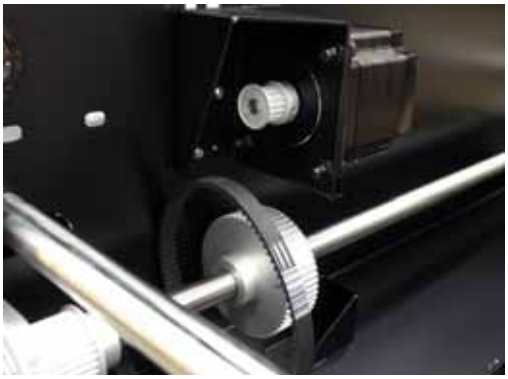
20. Remove the foam insert.
21. Using a $^{5}/_{16}$" nut driver or standard screwdriver, loosen but do not remove the 4 Y motor mounting bracket mounting screws. See Figure 4-183.

Figure 4-183: Y motor mounting bracket screw locations



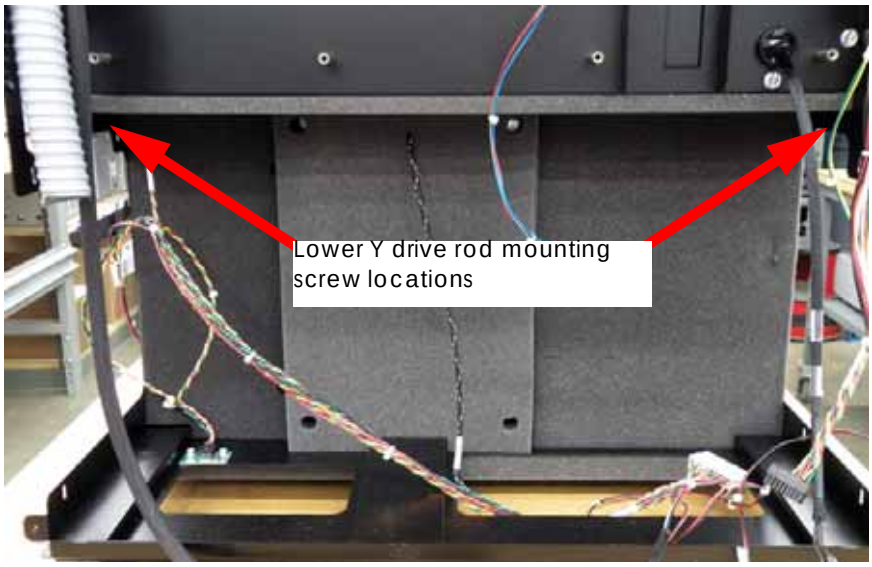
22. Remove the Y motor belt from the Y motor pulley. See Figure 4-184.

Figure 4-184: Y motor belt location



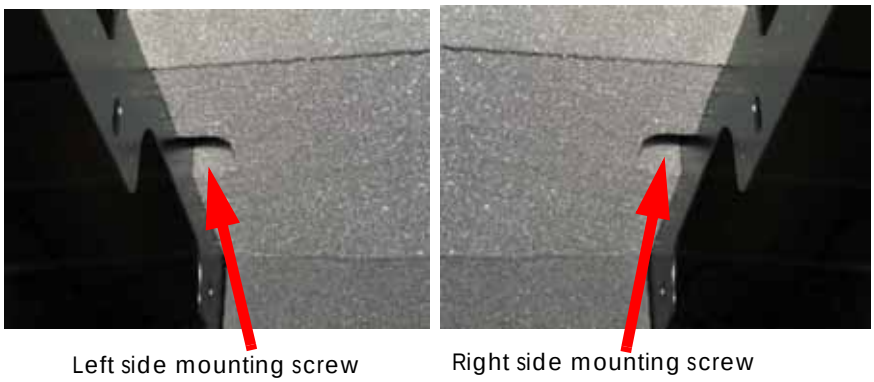
23. Locate the 2 lower Y drive rod mounting screws. See Figure 4-185.

Figure 4-185: Lower Y drive rod mounting screw locations



24. Using a $^{5}/_{16}$" nut driver or standard screwdriver, remove the 2 Y drive rod mounting screws. See Figure 4-186.

Figure 4-186: Y drive rod mounting screws

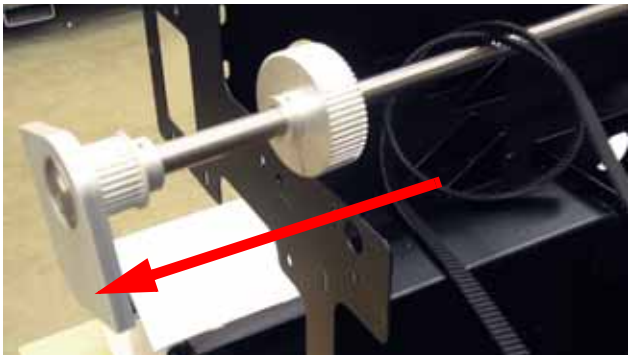


25. Locate and remove the 4 upper Y drive rod mounting screws with a $^{5}/_{16}$" nut driver or standard screwdriver. See Figure 4-187.

Figure 4-187: Upper Y drive rod mounting screw locations

26. Lift the Y drive rod and slide the Y motor belt out of the printer and discard. See Figure 4-188.

Figure 4-188: Remove Y motor belt



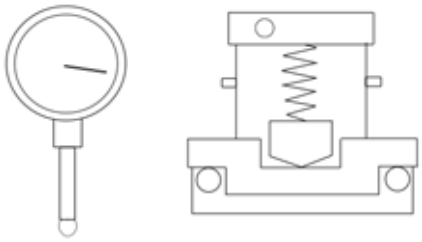
Installing the Y Motor Belt

1. Slide the Y motor belt over the Y drive rod.
2. Align Y drive rod with the 6 mounting holes.
3. Using a $^{5}/_{16}$" nut driver or standard screwdriver, reinstall the 6 Y drive rod mounting screws.
4. Place the Y motor belt around the Y motor pulley.
5. Lift the Y motor until the Y belt is tight and use a $^{5}/_{16}$" nut driver or standard screwdriver to tighten the 4 Y motor mounting bracket mounting screws.
6. Align the foam insert over the mounting brackets.
7. Using a $^{5}/_{16}$" nut driver or standard screwdriver reinstall the 4 foam retaining screws and washers.
8. Align the head cooling fan mounting bracket and Use a $^{5}/_{16}$" nut driver or standard screwdriver to reinstall the 2 mounting bracket screws.
9. Reconnect the head cooling fan.
10. Using a $^{5}/_{16}$" nut driver or standard screwdriver reinstall the left side access panel.
11. Using a $^{5}/_{16}$" nut driver or standard screwdriver reinstall the right side access panel.
12. Reinstall the Electronics Bay. See Installing the electronics bay on page 4-20.
13. Reinstall the upper electronics bay cover. See Installing the upper electronics bay cover on page 4-18.
14. Place the left and right Y belts into the retaining clips. Do not tighten the retaining clips at this time.
15. Tension the Y belts. See Checking/Adjusting the Y-Drive Belt Tension on page 5-39.
16. Reinstall the left and right side access panels.
17. Reinstall the front panel. See Installing the front panel on page 4-12.
18. Reinstall the Side panels. See Installing the side panels on page 4-8.
19. Reinstall the top panel. See Installing the top panel on page 4-6.
20. Reconnect the material bay cable, network cable and power cable.

Y Drive Rod

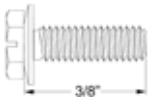
Required Tools

- $^{5}/_{16}$″ nut driver or standard screwdriver.
- Dial indicator and belt tension gauge assembly



Hardware

- 10-32 x $^{3}/_{8}$″ slotted screws (x30)



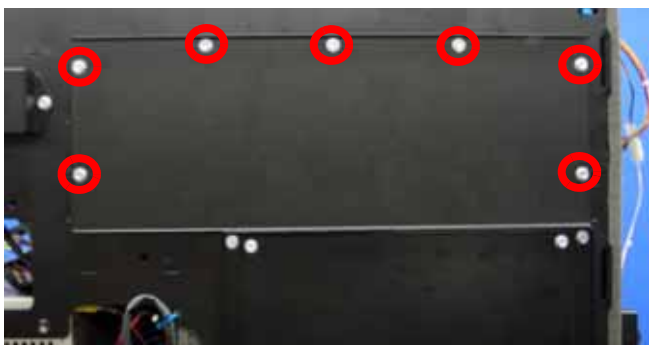
- 3-16 x 1″ fender washer

Removing the Y Drive Rod

1. Remove the top panel. See Removing the top panel on page 4-5.
2. Remove the side panels. See Side Panels on page 4-7.
3. Remove the upper electronics bay cover. See Removing the upper electronics bay cover on page 4-17.
4. Remove the left side access panel. See Figure 4-189.

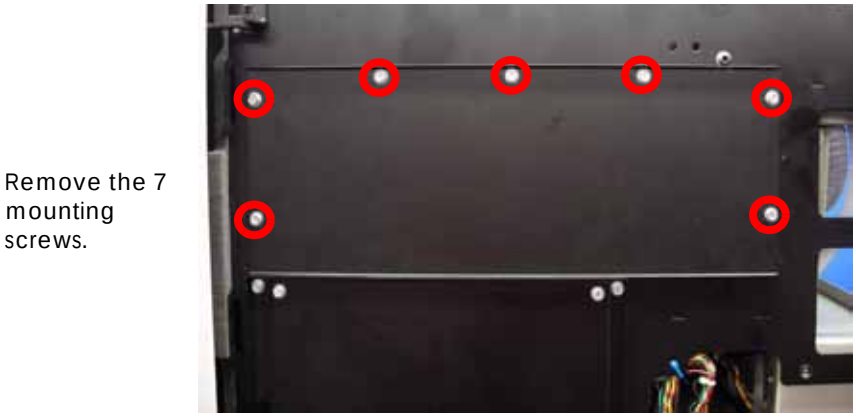
Figure 4-189: Left side access panel mounting screw locations

Remove the 7 mounting screws.



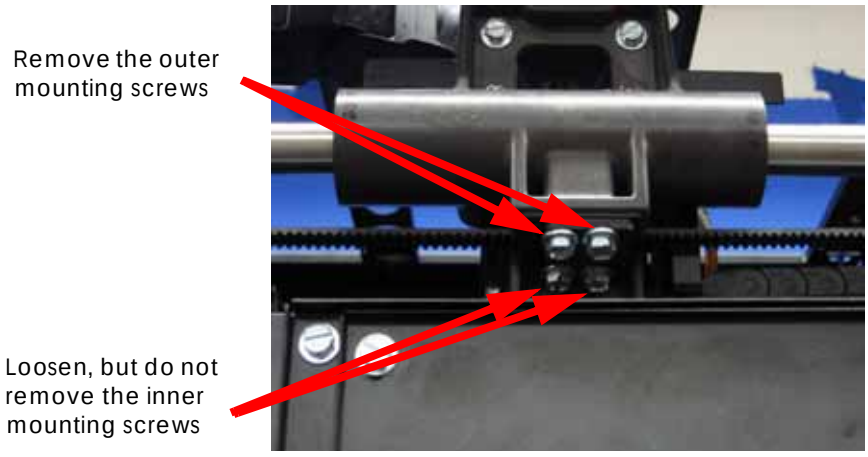
5. Disconnect the material bay cable from the printer.
6. Remove the Front Panel. See Removing the front panel on page 4-11.
7. Remove the Electronics Bay. See Removing the electronics bay on page 4-19.
8. Using a $^{5}/_{16}$" nut driver or standard screwdriver, remove the right side access panel mounting screws and remove the right side access panel. See Figure 4-190.

Figure 4-190: Right side access panel mounting screw locations



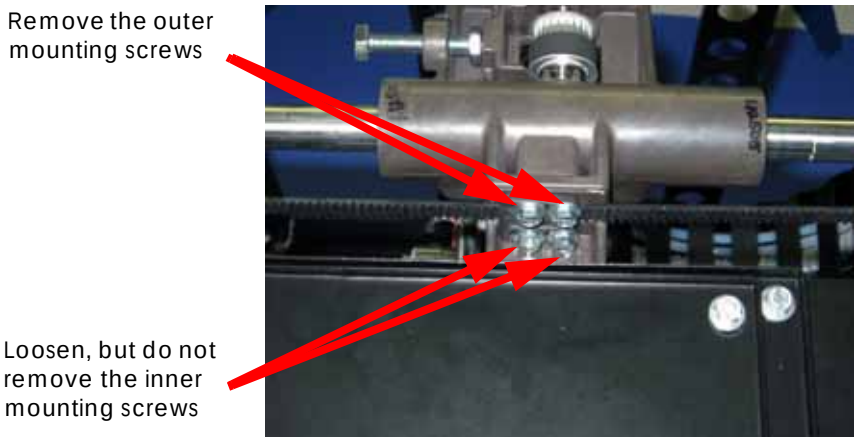
9. Using a $^{5}/_{16}$" box wrench, remove the outer Y belt retaining clip mounting screws from the left side. See Figure 4-191.
10. Using a $^{5}/_{16}$" box wrench, loosen, but do not remove, the inner Y belt retaining clip mounting screws from the left side. See Figure 4-191.
11. Pull the left side Y belt out from the retaining clip.

Figure 4-191: Left side Y belt retaining clip mounting screw locations



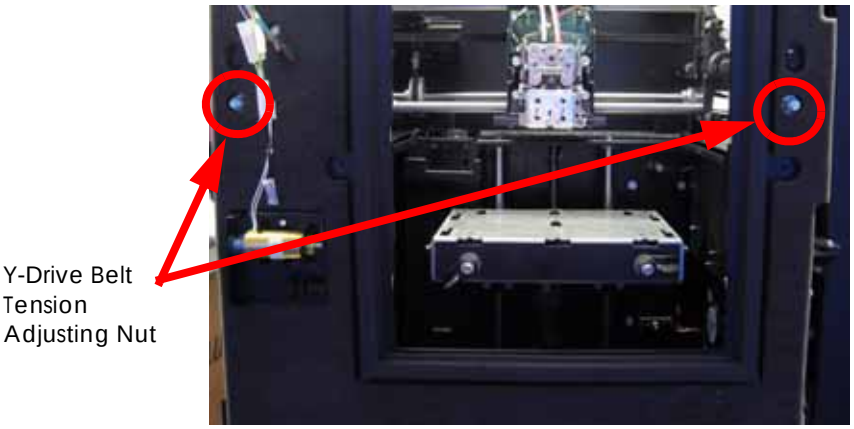
12. Using a $^{5}/_{16}$" box wrench, remove the outer Y belt retaining clip mounting screws from the right side. See Figure 4-192.
13. Using a $^{5}/_{16}$" box wrench, loosen, but do not remove, the inner Y belt retaining clip mounting screws from the right side. See Figure 4-192.
14. Pull the right side Y belt out from the retaining clip.

Figure 4-192: Right side Y belt retaining clip mounting screw locations



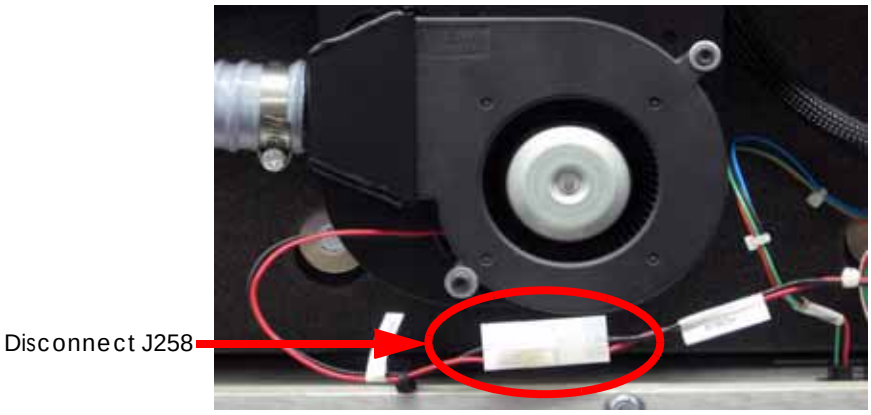
15. Decrease the Y belt tension by turning the tensioning nut. See Figure 4-193.

Figure 4-193: Y drive belt tension adjustment



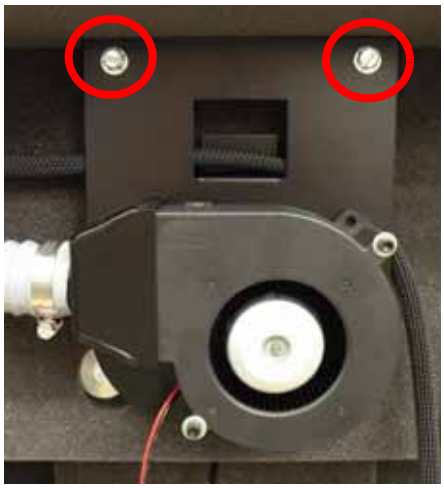
16. Disconnect the head cooling fan. See Figure 4-194.

Figure 4-194: Disconnect head cooling fan J258



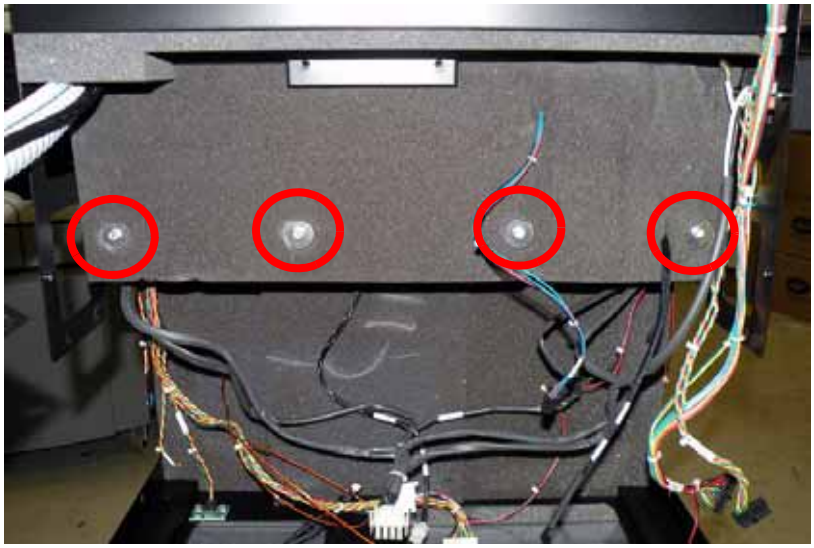
17. Using a $^{5}/_{16}$" nut driver or standard screwdriver, remove the head cooling fan mounting bracket screws. See Figure 4-195.

Figure 4-195: Head cooling fan mounting bracket screw locations



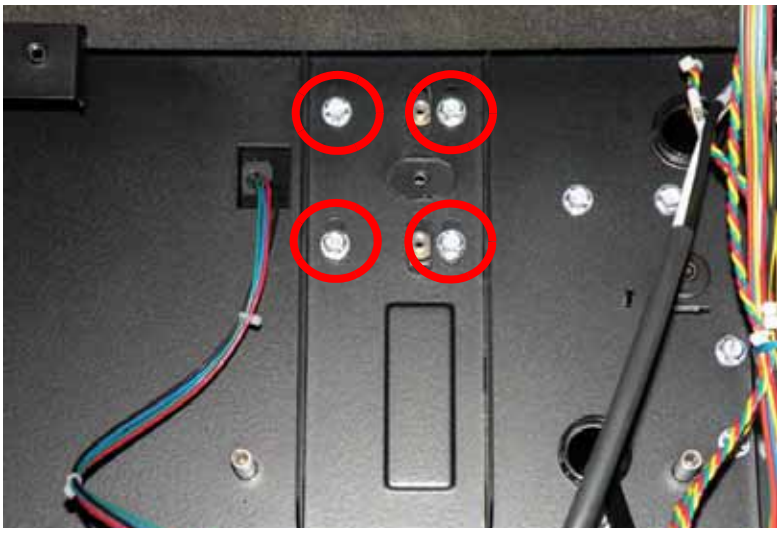
18. Let head cooling fan hang off to side.
19. Using a $^{5}/_{16}$" nut driver or standard screwdriver, remove the 4 foam insert retaining screws and washers. See Figure 4-196.

Figure 4-196: Foam insert retaining screw locations



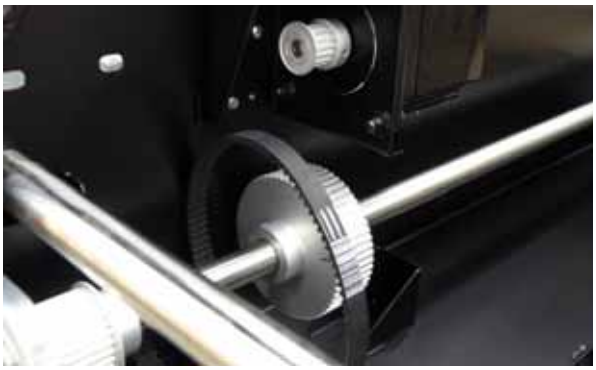
20. Remove the foam insert.
21. Using a $^{5}/_{16}$" nut driver or standard screwdriver, loosen but do not remove the 4 Y motor mounting bracket mounting screws. See Figure 4-197.

Figure 4-197: Y motor mounting bracket screw locations



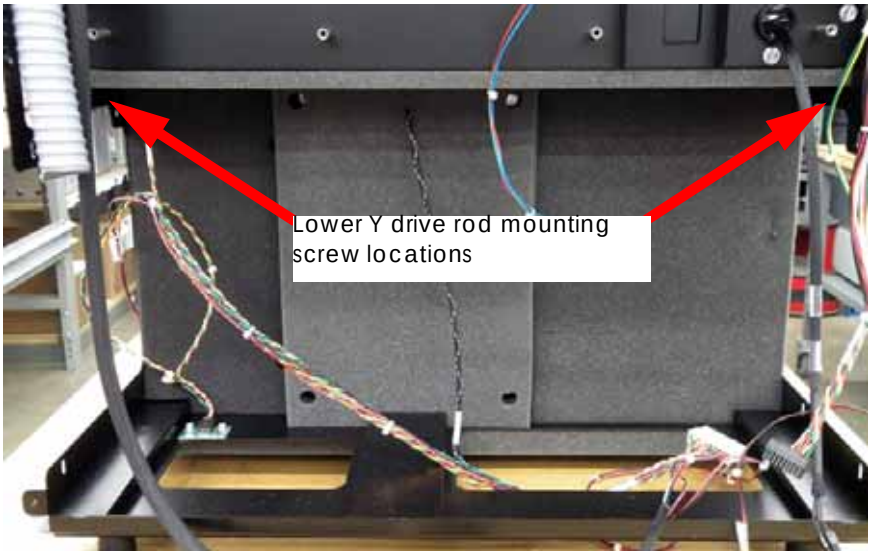
22. Remove the Y motor belt from the Y motor pulley. See Figure 4-198.

Figure 4-198: Y motor belt location



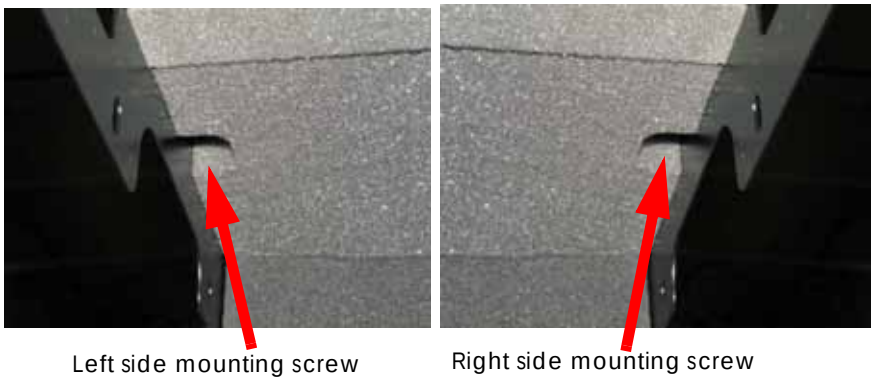
23. Locate the 2 lower Y drive rod mounting screws. See Figure 4-199.

Figure 4-199: Lower Y drive rod mounting screw locations



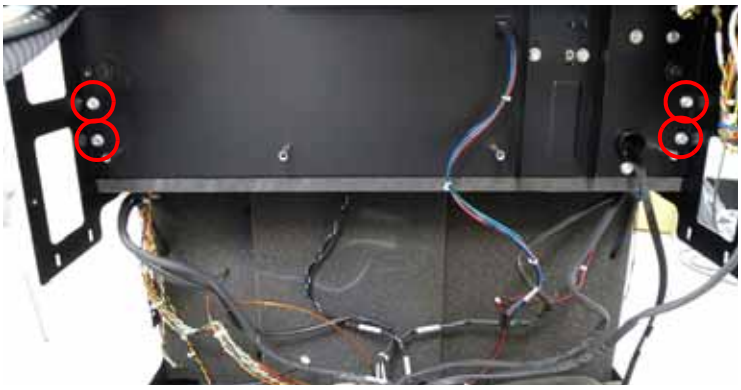
24. Using a $^{5}/_{16}$" nut driver or standard screwdriver, remove the 2 Y drive rod mounting screws. See Figure 4-200.

Figure 4-200: Y drive rod mounting screws



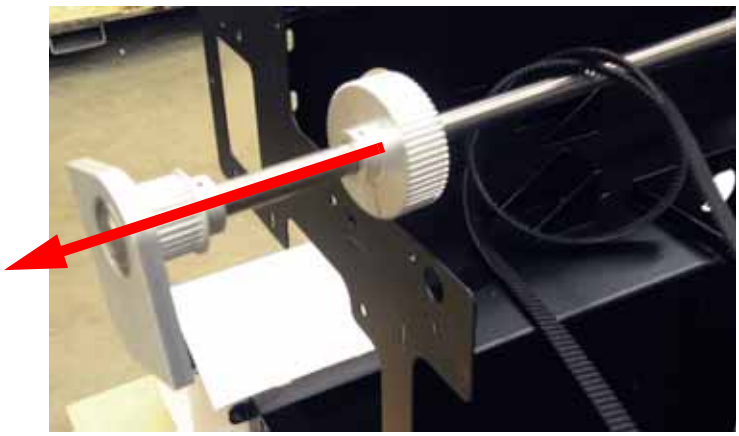
25. Locate and remove the 4 upper Y drive rod mounting screws with a $^{5}/_{16}$" nut driver or standard screwdriver. See Figure 4-201.

Figure 4-201: Upper Y drive rod mounting screw locations



26. Lift the Y drive rod, slide out through the Y belts and discard. See Figure 4-202.

Figure 4-202: Remove Y drive rod



Installing the Y Drive Rod

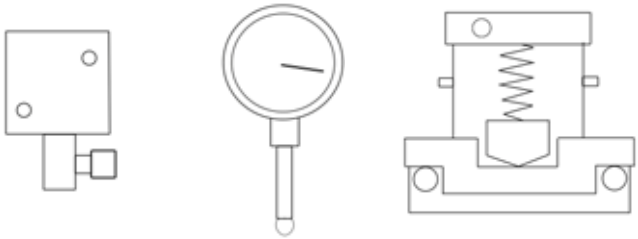
1. Slide the Y drive rod through the Y belts and into position.
2. Align Y drive rod with the 6 mounting holes.
3. Using a $^{5}/_{16}$" nut driver or standard screwdriver, reinstall the 6 Y drive rod mounting screws.
4. Place the Y motor belt around the Y motor pulley.
5. Lift the Y motor until the Y belt is tight and use a $^{5}/_{16}$" nut driver or standard screwdriver to tighten the 4 Y motor mounting bracket mounting screws.
6. Align the foam insert over the mounting brackets.
7. Using a $^{5}/_{16}$" nut driver or standard screwdriver reinstall the 4 foam retaining screws and washers.
8. Align the head cooling fan mounting bracket and Use a $^{5}/_{16}$" nut driver or standard screwdriver to reinstall the 2 mounting bracket screws.
9. Reconnect the head cooling fan.
10. Using a $^{5}/_{16}$" nut driver or standard screwdriver reinstall the left side access panel.
11. Using a $^{5}/_{16}$" nut driver or standard screwdriver reinstall the right side access panel.
12. Reinstall the Electronics Bay. See Installing the electronics bay on page 4-20.
13. Reinstall the upper electronics bay cover. See Installing the upper electronics bay cover on page 4-18.
14. Place the left and right Y belts into the retaining clips. Do not tighten the retaining clips at this time.
15. Tension the Y belts. See Checking/Adjusting the Y-Drive Belt Tension on page 5-39.
16. Reinstall the left and right side access panels.
17. Reinstall the front panel. See Installing the front panel on page 4-12.
18. Reinstall the Side panels. See Installing the side panels on page 4-8.
19. Reinstall the top panel. See Installing the top panel on page 4-6.
20. Reconnect the material bay cable, network cable and power cable.

XY Table

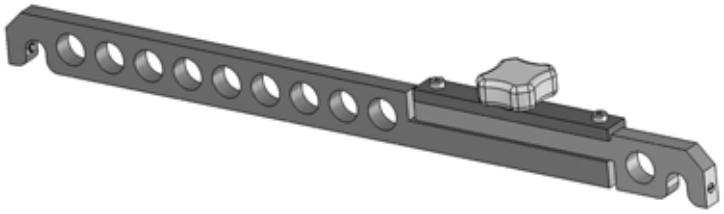
Required Tools

- $^{5}/_{16}$″ nut driver or standard screwdriver.
- $^{5}/_{16}$″ box wrench.
- $^{1}/_{2}$″ box wrench.
- $^{5}/_{32}$″ allen wrench.
- $^{3}/_{32}$″ allen wrench.
- $^{1}/_{8}$″ allen wrench.
- Cutters.
- Z Guide rod stand off (x2)

- Head bracket, dial indicator and belt tension gauge assembly



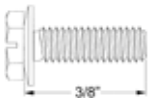
- Y rod spacer (x2)



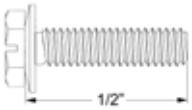
- Leveling wrench

Hardware

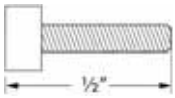
- Wire tie
- 10-32 x $^{3}/_{8}$" slotted screws (x14)



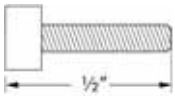
- 10-32 x $^{1}/_{2}$" slotted screws (x4)



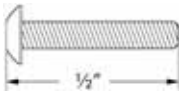
- 10-32 x $^{1}/_{2}$" socket head cap screws (x4)



- 8-32 x $^{1}/_{2}$" socket head cap screws (x4)



- $^{1}/_{4}$ - 20 x $^{1}/_{2}$" button head cap screws (x2)

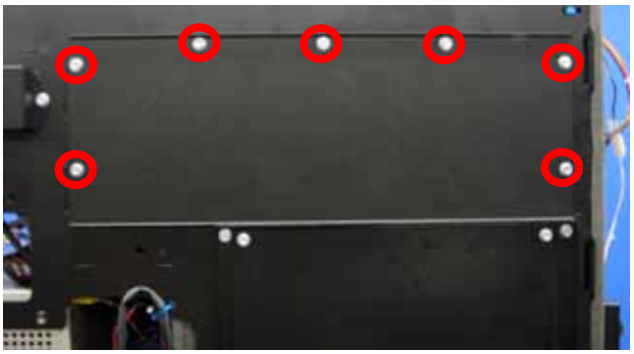


Removing the XY table

1. Remove the top panel. See Removing the top panel on page 4-5.
2. Remove the side panels. See Side Panels on page 4-7.
3. Remove the front panel. See Removing the front panel on page 4-11.
4. Using a $^{5}/_{16}$" nut driver or standard screwdriver, remove the left side access panel mounting screws and remove the left side access panel. See Figure 4-203.

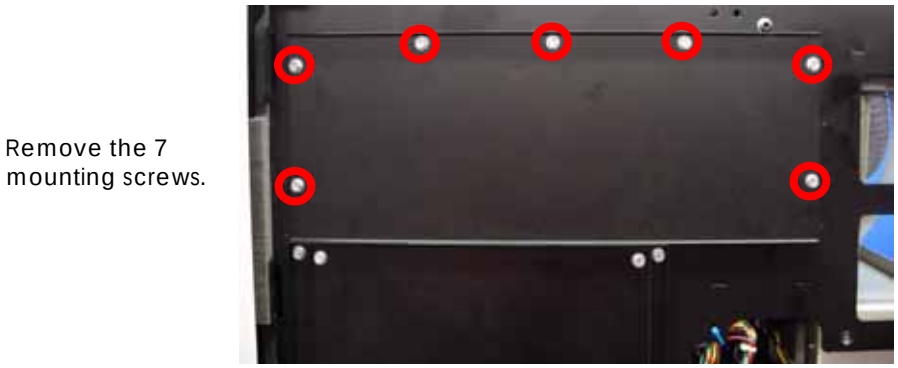
Figure 4-203: Left side access panel mounting screw locations

Remove the 7 mounting screws.



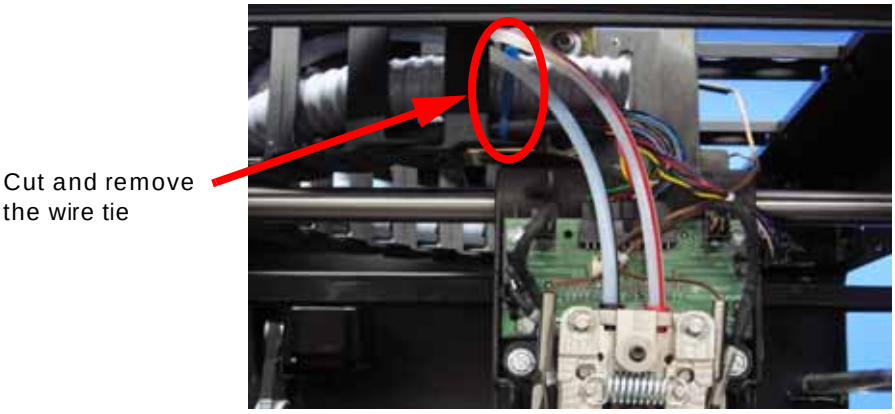
5. Using a $^{5}/_{16}$" nut driver or standard screwdriver, remove the right side access panel mounting screws and remove the right side access panel. See Figure 4-204.

Figure 4-204: Right side access panel mounting screw locations



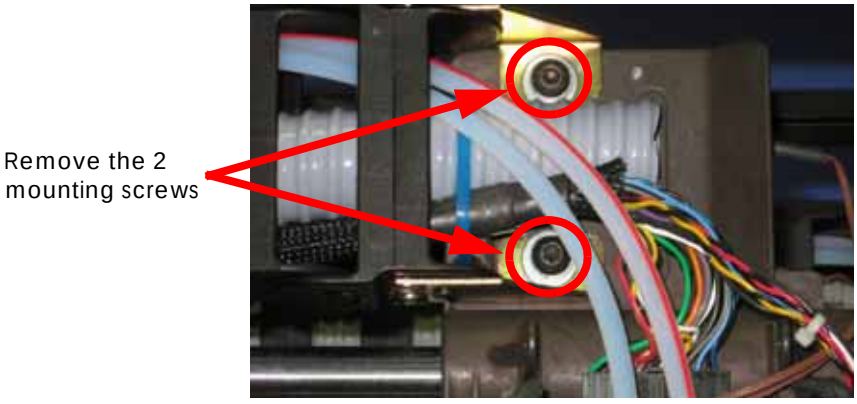
6. Remove the toggle head assembly. See Removing the toggle head assembly on page 4-58.
7. Remove the head board. See Removing the head board on page 4-76.
8. Remove the TC Amp board. See Removing the TC Amp board on page 4-82.
9. Cut the wire tie from the umbilical hose. See Figure 4-205.

Figure 4-205: Umbilical hose wire tie location



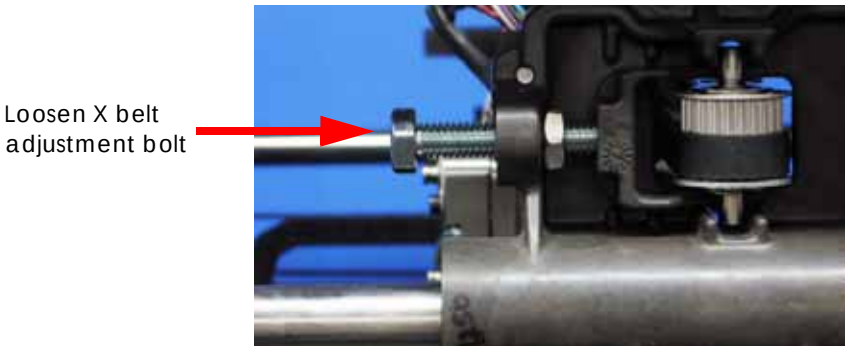
10. Using a $^{5}/_{32}$" allen wrench, remove the 2 energy chain mounting screws. See Figure 4-206.

Figure 4-206: Energy chain mounting screw locations



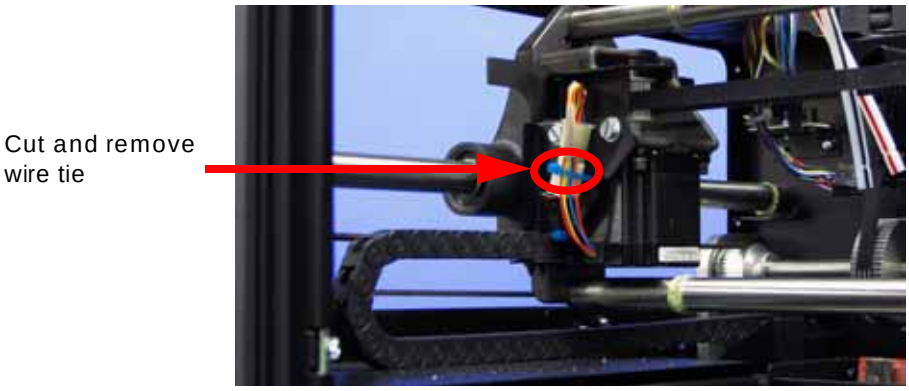
11. Remove the substrate sensor. See Removing the substrate sensor on page 4-64.
12. Using a ½" box wrench, remove the X belt tension adjuster by loosening the inside nut and then backing the bolt out of the mount. See Figure 4-207.
13. Remove the tensioning fork and pulley from the X motor belt.

Figure 4-207: X belt tension adjustment bolt location



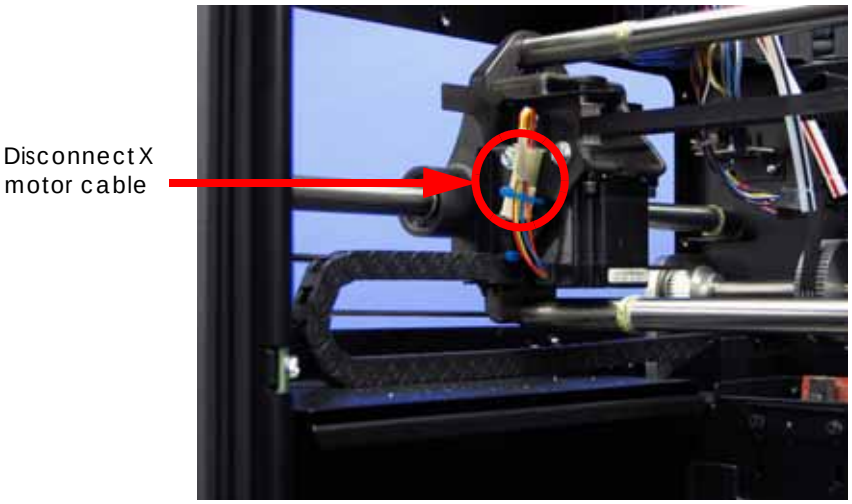
14. Using a cutters, remove the X motor cable connector wire tie. See Figure 4-208.

Figure 4-208: X motor wire tie locations



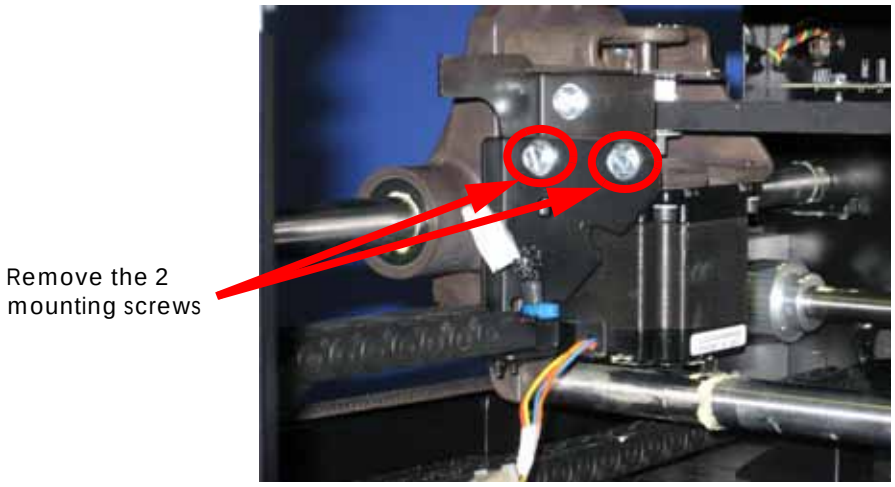
15. Disconnect the X motor cable by pressing in on the tab and pulling outward. See Figure 4-209.

Figure 4-209: X motor cable connector location



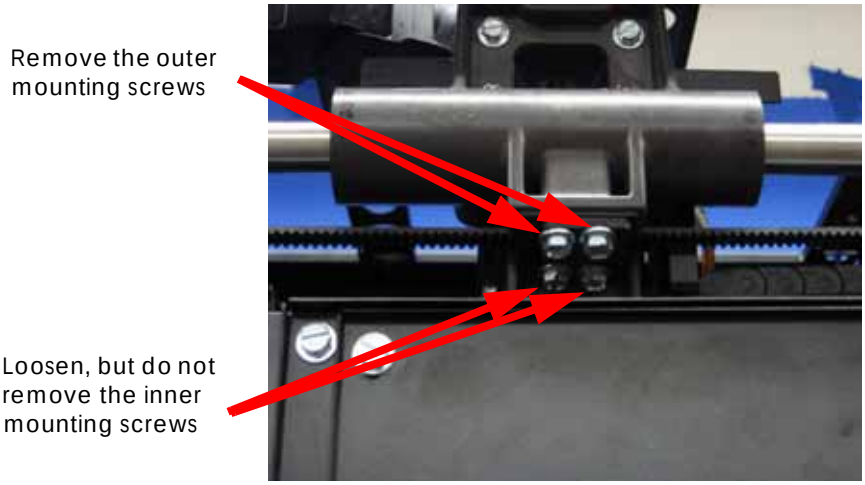
16. Using a $^{5}/_{16}$" nut driver or standard screwdriver, remove the 2 X energy chain mounting bracket mounting screws and set bracket to the side. See Figure 4-210.

Figure 4-210: X motor energy chain mounting bracket mounting screw locations



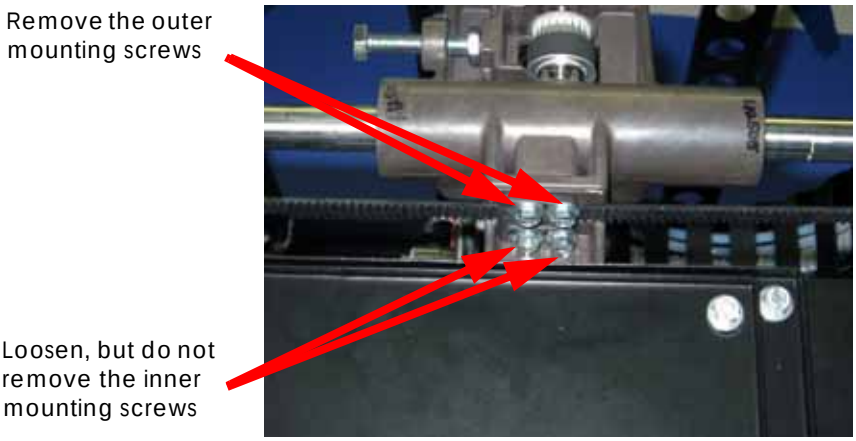
17. Using a $^{5}/_{16}$" box wrench, remove the outer Y belt retaining clip mounting screws from the left side. See Figure 4-211.
18. Using a $^{5}/_{16}$" box wrench, loosen, but do not remove, the inner Y belt retaining clip mounting screws from the left side. See Figure 4-211.
19. Pull the left side Y belt out from the retaining clip.

Figure 4-211: Left side Y belt retaining clip mounting screw locations



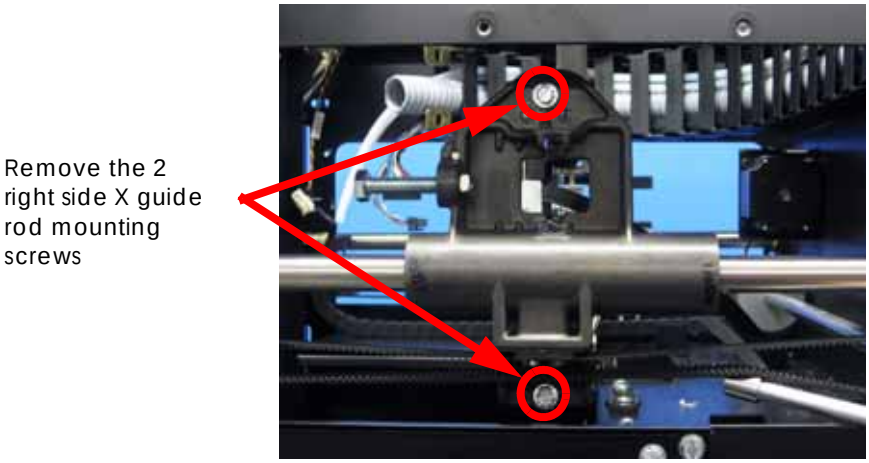
20. Using a $^{5}/_{16}$" box wrench, remove the outer Y belt retaining clip mounting screws from the right side. See Figure 4-212.
21. Using a $^{5}/_{16}$" box wrench, loosen, but do not remove, the inner Y belt retaining clip mounting screws from the right side. See Figure 4-212.
22. Pull the right side Y belt out from the retaining clip.

Figure 4-212: Right side Y belt retaining clip mounting screw locations



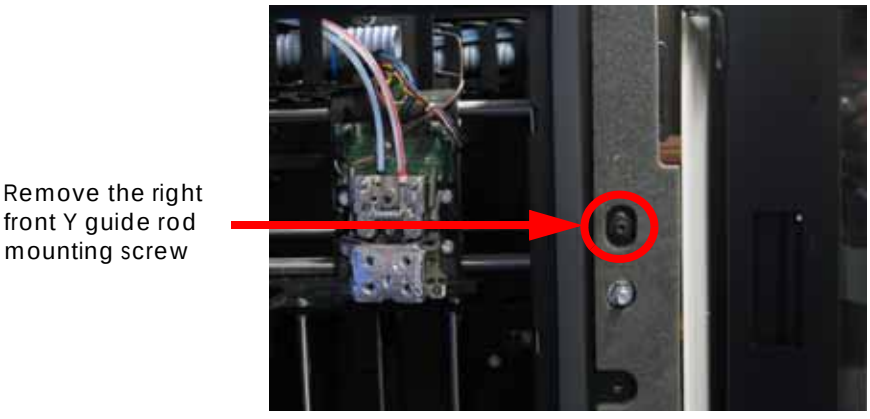
23. Move the translator to the rear of the printer.
24. Using a $^{5}/_{16}$" nut driver, remove the right side X guide rod mounting screws. See Figure 4-213.

Figure 4-213: Right side X guide rod mounting screw locations



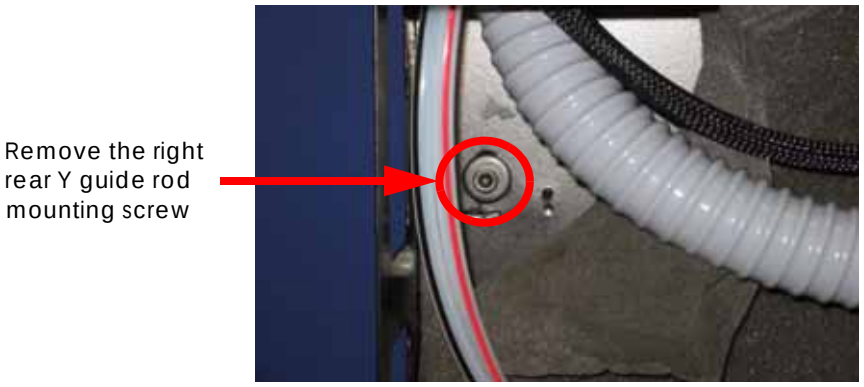
25. Using a $^{5}/_{32}$" allen wrench, remove the right side front Y guide rod mounting screw. See Figure 4-214.

Figure 4-214: Right side front Y guide rod mounting screw location



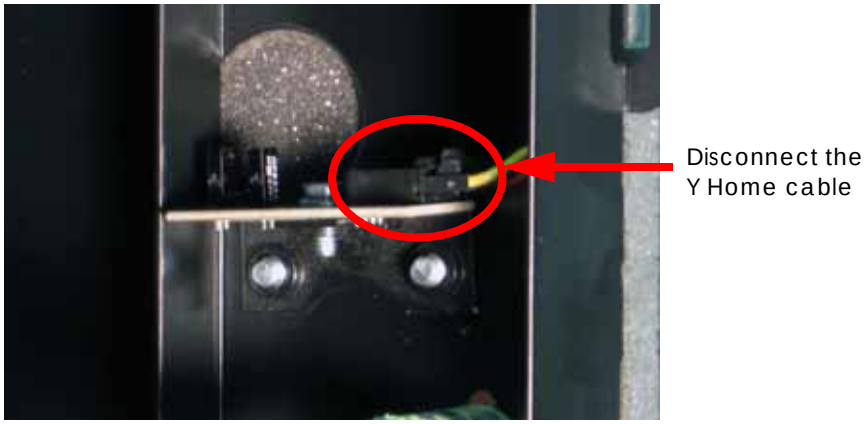
26. Using a $^{5}/_{32}$" allen wrench, remove the right side rear Y guide rod mounting screws and remove the right side Y guide rod. See Figure 4-215.

Figure 4-215: Right side rear Y guide rod mounting screw location



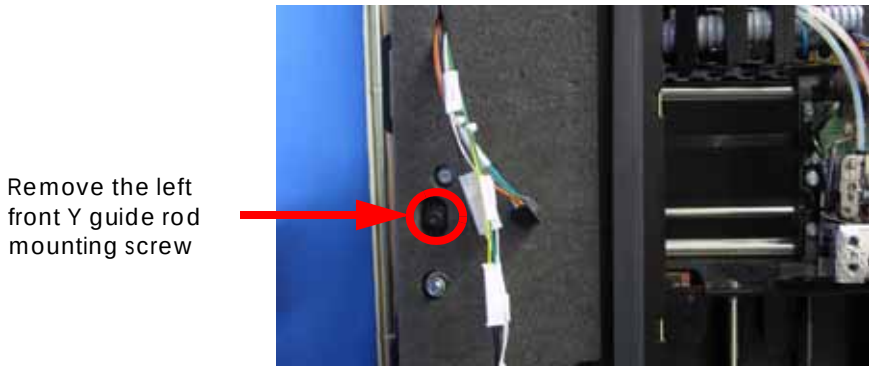
27. Disconnect the Y Home sensor cable by pressing in on the tab and pulling outward. See Figure 4-216.

Figure 4-216: Y EOT sensor wire connector location



28. Using a $^{5}/_{32}$" allen wrench, remove the left side front Y guide rod mounting screw. See Figure 4-217.

Figure 4-217: Left side front Y guide rod mounting screw location



29. Using a $^{5}/_{32}$" allen wrench, remove the left side rear Y guide rod mounting screw. See Figure 4-218.

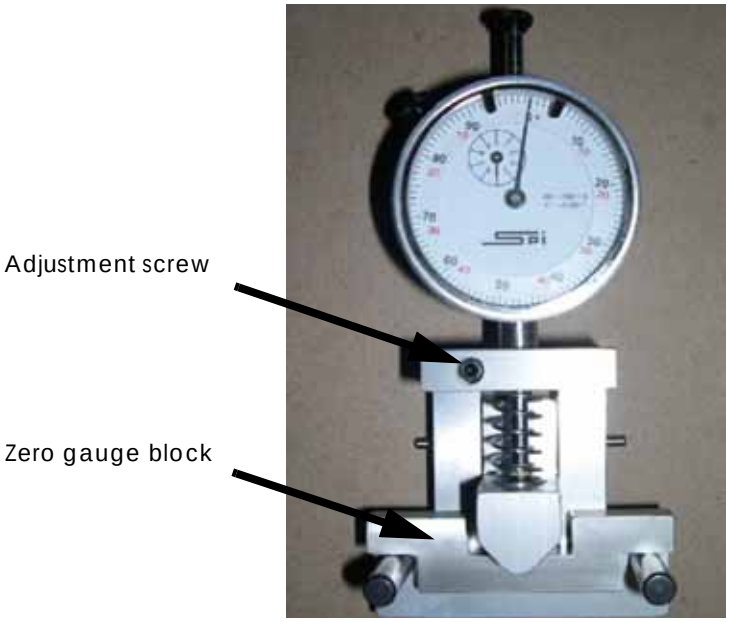
Figure 4-218: Left side rear Y guide rod mounting screw location

30. Lift the front of the left Y guide rod upward until it is near the top of the frame.
31. Rotate the left side Y guide rod towards the center of the printer and lower the guide rod.
32. Pull the left side Y guide rod out towards the door opening.
33. Angle the rest of the XY table out through the chamber door to remove from the printer.

Installing the XY table

1. Insert the zero gauge block into the gauge. See Figure 4-219.
2. Loosen the adjustment screw and slide the dial indicator assembly up or down to set the 'zero' reading: The large hand should be on 0 and the small hand on 5.
3. Tighten the adjustment screw (do not over tighten the screw) and recheck the reading.
4. Remove the zero block gauge block from the fixture.

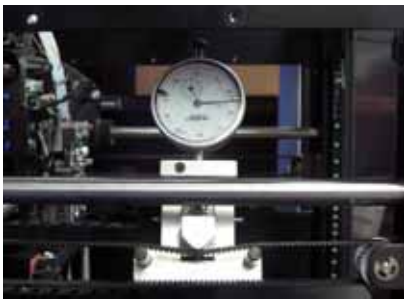
Figure 4-219: Tension gauge zero setting



5. Position the dial indicator on the top section of the Y-Drive belt at the center point of the belt. See Figure 4-220.

Figure 4-220: Y-Drive Belt Tension Check

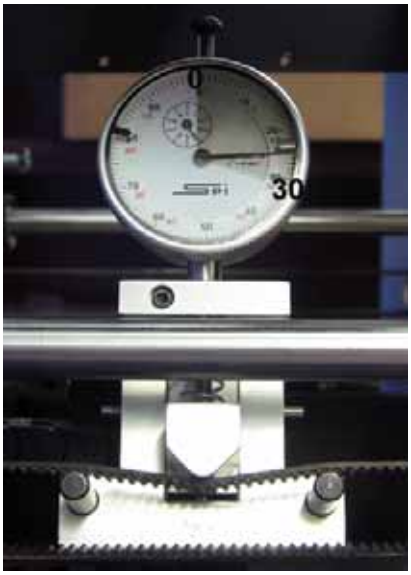
Y-Drive Belt clamp
(one on each side).



Dial Indicator position for
Y-Drive belt tension check.

6. The gauge should read between 0.425 and 0.435 mils. See Figure 4-221.

Figure 4-221: Gauge readings

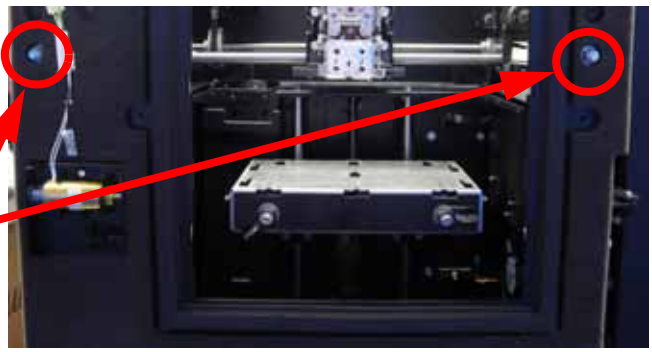


Service Limit

Adjustment Limit

7. If the tension is not within specification, locate the Y belt tension adjustment nut on the front of the system. See Figure 4-220.
8. Adjust (increase/decrease) the tension by turning the tensioning nut (Figure 4-222.) so that the dial indicator reads between 0.425 and 0.435 mils.

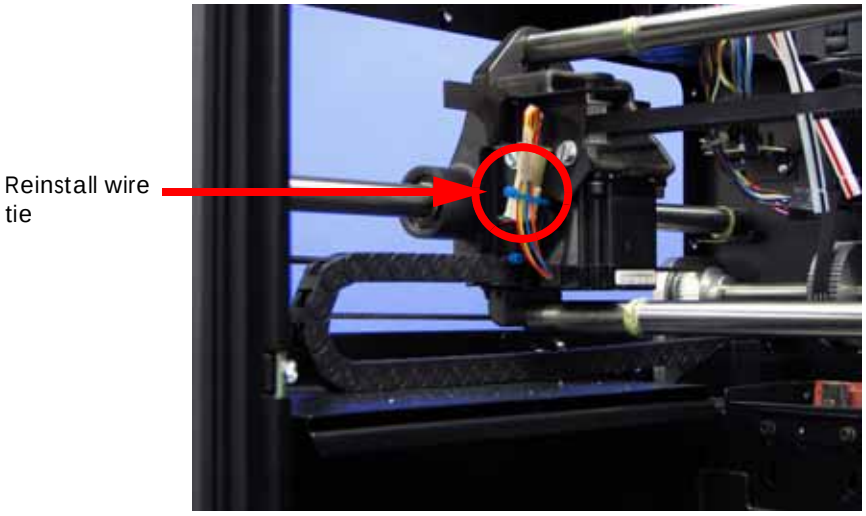
Figure 4-222: Y drive belt tension adjustment



Y-Drive Belt
Tension
Adjusting Nut

9. Remove the belt fixture and move the belt forward and back several times.
10. Reattach the belt tension gauge and recheck the tension.
11. Continue to adjust and check the tension until the tension meets specification.
12. Push the left side Y guide rod in towards the back of the printer.
13. Rotate the left side Y guide rod towards the left side of the printer and raise the guide rod to the top of the frame.
14. Lower the left side Y guide rod into its mounting location.
15. Using a $^{5}/_{32}$" allen wrench, loosely reinstall the left side rear Y guide rod mounting screw.
16. Using a $^{5}/_{32}$" allen wrench, loosely reinstall the left side front Y guide rod mounting screw.
17. Reconnect the Y home sensor cable.
18. Align the right side Y guide rod with the mounting holes.
19. Using a $^{5}/_{32}$" allen wrench, loosely reinstall the right side rear Y guide rod mounting screw.
20. Using a $^{5}/_{32}$" allen wrench, loosely reinstall the right side front Y guide rod mounting screw.
21. Align the X guide rods with the mounting holes.
22. Using a $^{5}/_{16}$" nut driver or standard screwdriver, loosely reinstall the right side X guide rod mounting screws.
23. Align the X motor energy chain mounting bracket with the mounting holes.
24. Using a $^{5}/_{16}$" nut driver or standard screwdriver, reinstall the 2 X motor energy chain mounting screws.
25. Reconnect the X motor cable.
26. Reinstall a wire tie around the X motor cable connector. See Figure 4-223.

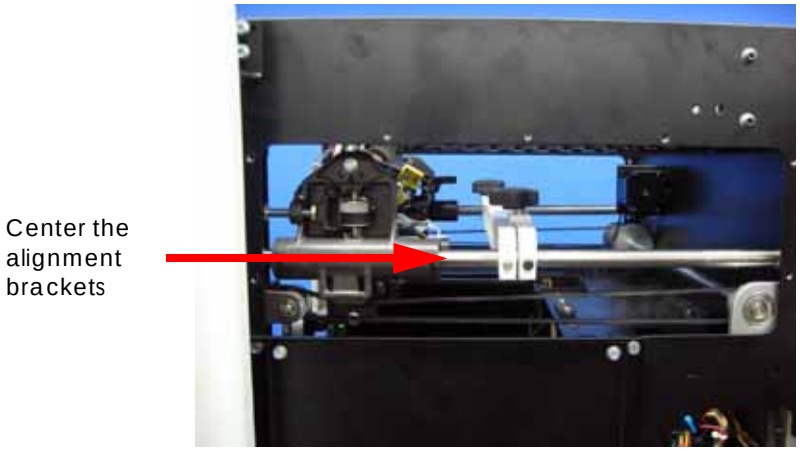
Figure 4-223: X motor wire tie locations



27. Place the right side Y belt into the retaining clip.

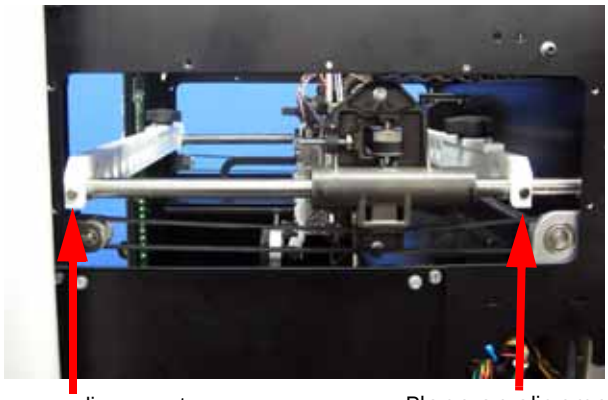
28. Place the left side Y belt into the retaining clip.
29. Slide the translator to the back of the printer.
30. Using a $^{5}/_{16}$" box wrench, tighten the right side Y belt clamp mounting screws.
31. Using a $^{5}/_{16}$" box wrench, tighten the left side Y belt clamp mounting screws.
32. Using a $^{5}/_{32}$" allen wrench, securely fasten the left rear Y guide rod mounting screw.
33. Reinstall the head board. See Installing the head board on page 4-81.
34. Reinstall the TC Amp board. See Installing the TC Amp board on page 4-83.
35. Reinstall the substrate sensor. See Installing the substrate sensor on page 4-66.
36. Reinstall the toggle head assembly. See Installing the toggle head assembly on page 4-63.
37. Reinstall the toggle sensor. See Installing the toggle sensor on page 4-70.
38. Install the 2 XY table alignment brackets to the center of the Y guide rods. See Figure 4-224.
39. Adjust the alignment brackets as needed.
40. Using a $^{1}/_{8}$" allen wrench, tighten the alignment bracket adjustment screws.

Figure 4-224: XY Table alignment bracket center mounting location



41. Move 1 alignment bracket to the front of the printer. See Figure 4-225.
42. Move the translator to the center of the XY table.
43. Move 1 alignment bracket to the rear of the printer. See Figure 4-225.

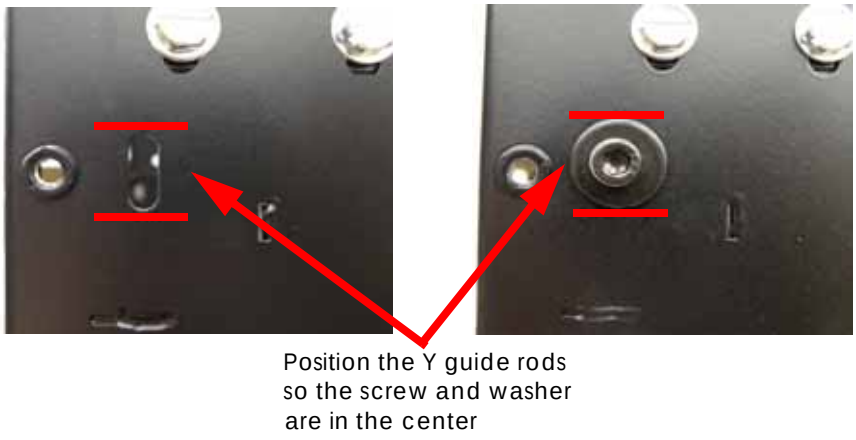
Figure 4-225: XY Table alignment bracket mounting locations



44. Using a $^{5}/_{16}$" nut driver or standard screwdriver, loosen but do not remove the left side X guide rod mounting screws.
45. Center the Y guide rods in the mounting slots and loosely tighten. See Figure 4-226.

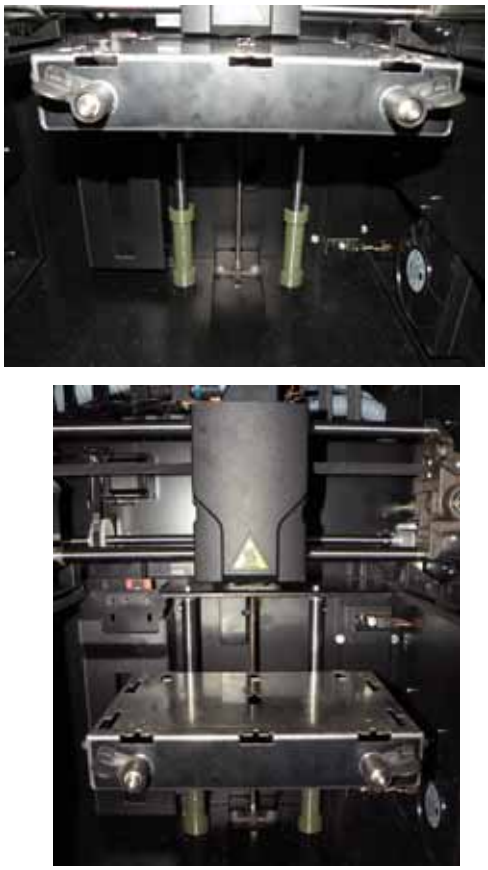
Note: Failure to center the Y guide rods before tightening the X guide rod screws will result in X guide rod misalignment.

Figure 4-226: Center Y guide rods



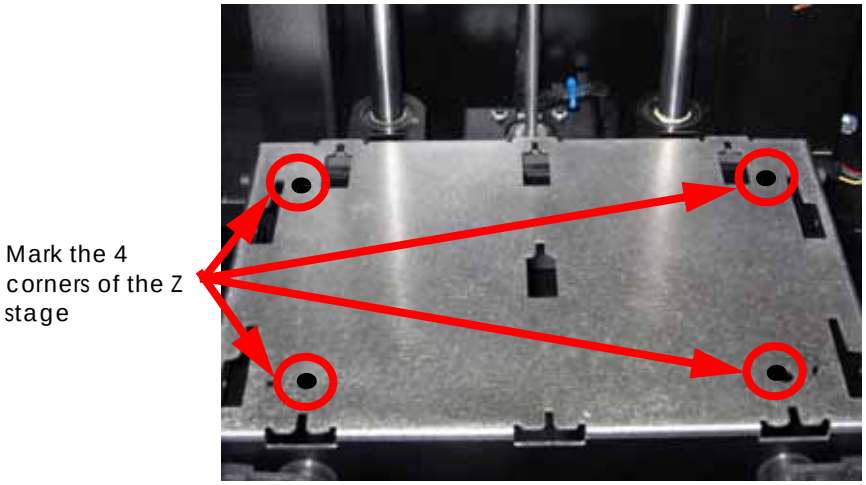
46. Slide the translator to the left side of the printer.
47. Using a $^{5}/_{16}$" nut driver or standard screwdriver, securely fasten the left side X guide rod mounting screws.
48. Slide the translator to the right side of the printer.
49. Using a $^{5}/_{16}$" nut driver or standard screwdriver, securely fasten the right side X guide rod mounting screws.
50. Raise the Z stage up near the XY table and hold in place using 2 Z guide rod stand off's. See Figure 4-227.

Figure 4-227: Z guide rod stand off locations



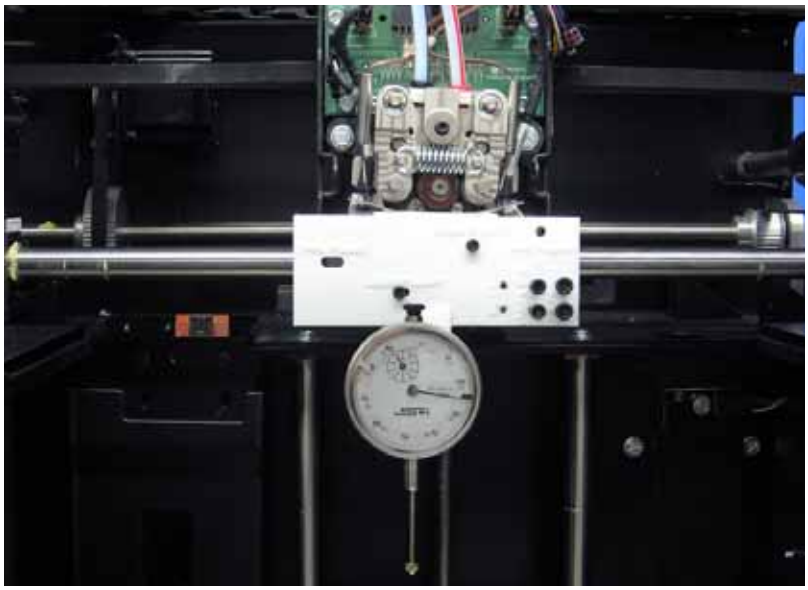
51. Using a black marker or pen, mark the 4 corners of the Z stage. See Figure 4-228.

Figure 4-228: Marking the 4 corners of the Z stage



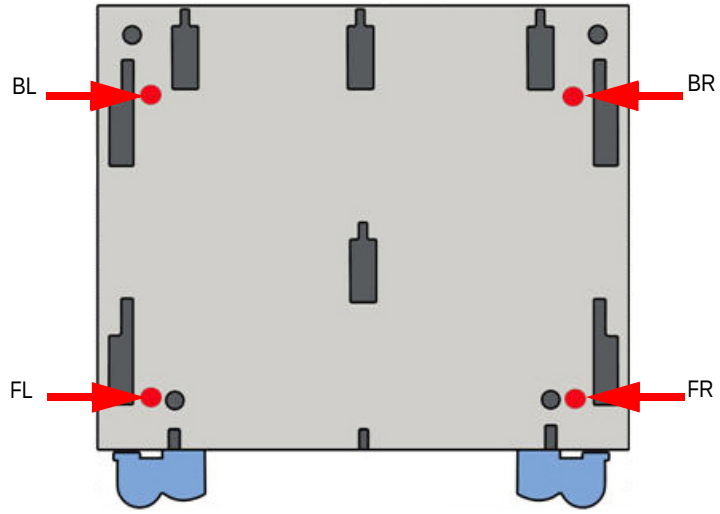
52. Attach the XY leveling bracket and dial indicator to the head. See Figure 4-229.

Figure 4-229: XY Leveling bracket location



53. Move the dial indicator to the back left corner and zero the dial indicator.
54. Move the dial indicator to the front left corner and write down the value.
55. Move the dial indicator to the front right corner and write down the value.
56. Move the dial indicator to the back right corner and write down the value.
57. Enter the values that are written down into the XY level worksheet. Use the 8x6 worksheet for uPrint and uPrint SE, see Figure 4-230. Use the 8x8 worksheet for uPrint Plus and uPrint SE Plus, see Figure 4-231.

Figure 4-230: uPrint and uPrint SE measurement points and worksheet



Indicator Reading Values

FL = ...

FR = _ _ _ _ _

BR = _____

Adjustment Calculation Values

FL Adjust = (-2.6 x .....**) + (0.97 x** _ _ _ _ _**) - (0.88 x** _____**)**

FL Adjust = _____ **+** _____ **-** _____

FL Adjust = _____

FR Adjust = (-1.2 x .....**) - (0.88 x** _ _ _ _ _**) - (0.68 x** _____**)**

FR Adjust = _____ **+** _____ **-** _____

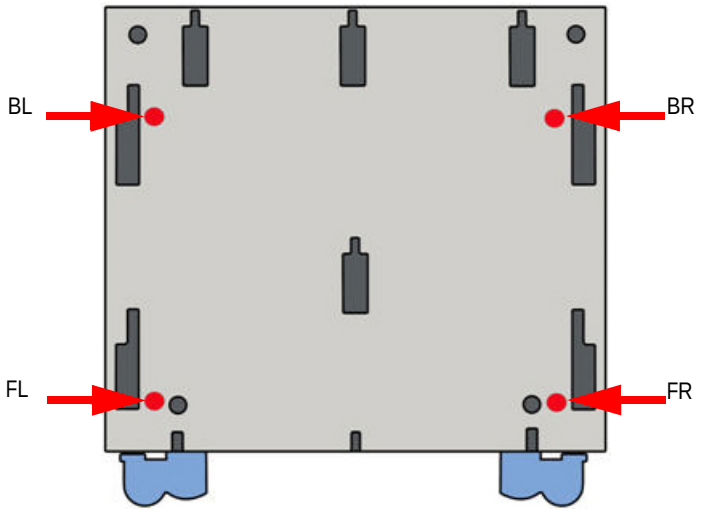
FR Adjust = _____

BR Adjust = (-0.91 x .....**) + (1.02 x** _ _ _ _ _**) - (1.83 x** _____**)**

BR Adjust = _____ **+** _____ **-** _____

BR Adjust = _____

Figure 4-231: uPrint Plus and uPrint SE Plus measurement points and worksheet



Indicator Reading Values

FL = ...

FR = _ _ _ _ _

BR = _____

Adjustment Calculation Values

FL Adjust = (-2.02 x .....**) + (0.74 x** _ _ _ _ _**) - (0.66 x** _____**)**

FL Adjust = _____ **+** _____ **-** _____

FL Adjust = _____

_____

FR Adjust = (-0.41 x .....**) - (1.08 x** _ _ _ _ _**) - (0.38 x** _____**)**

FR Adjust = _____ **+** _____ **-** _____

FR Adjust = _____

_____

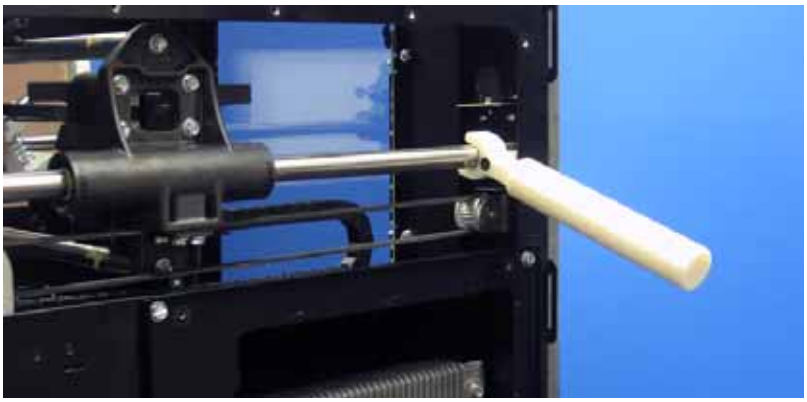
BR Adjust = (-0.6 x .....**) + (0.69 x** _ _ _ _ _**) - (1.7 x** _____**)**

BR Adjust = _____ **+** _____ **-** _____

BR Adjust = _____

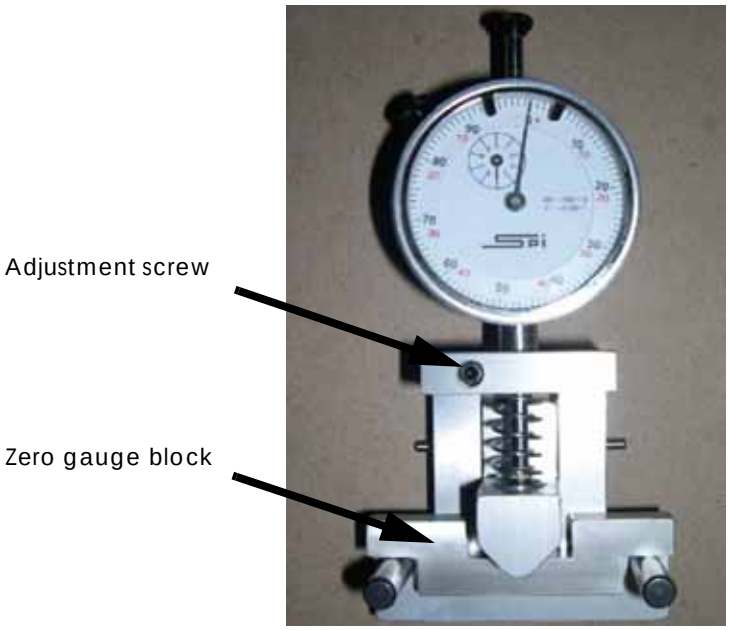
58. Move the dial indicator to the front left of the Z stage and zero the dial indicator.
59. Using the XY guide rod leveling fixture, adjust the rod up or down until the dial indicator reads the value the calculator has given. See Figure 4-232.

Figure 4-232: XY guide rod leveling fixture



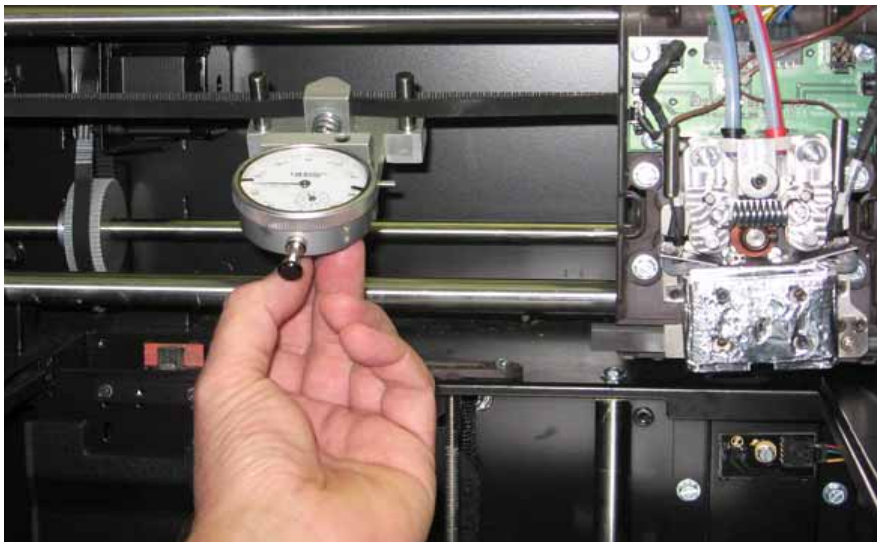
60. Using a $^{5}/_{32}$" allen wrench, securely fasten the front left Y guide rod mounting screw.
61. Move the dial indicator to the front right of the Z stage and zero the dial indicator.
62. Using the XY guide rod leveling fixture, adjust the rod up or down until the dial indicator reads the value the calculator has given.
63. Using a $^{5}/_{32}$" allen wrench, securely fasten the front right Y guide rod mounting screw.
64. Move the dial indicator to the rear right of the Z stage and zero the dial indicator.
65. Using the XY guide rod leveling fixture, adjust the rod up or down until the dial indicator reads the value the calculator has given.
66. Using a $^{5}/_{32}$" allen wrench, securely fasten the rear right Y guide rod mounting screw.
67. Repeat steps 53 - 66 until the XY table is completely level.
68. Remove the XY guide rod alignment brackets.
69. Remove the XY table leveling bracket and dial indicator.
70. Move the Head Assembly to the full right travel position within the build envelope (as viewed from the front of the printer).
71. Insert the zero gauge block into the gauge. See Figure 4-233.
72. Loosen the adjustment screw and insert the dial indicator into the fixture.
73. Adjust the depth of the dial indicator so the gauge reads 0.500 mils and tighten the adjustment screw. Recheck the reading.
74. Remove the zero block gauge block from the fixture.

Figure 4-233: Tension gauge zero setting



75. Position the dial indicator on the rear section of the X-Drive belt - centered between the Head Assembly and the left side of the build envelope. See Figure 4-234.

Figure 4-234: X belt tension location

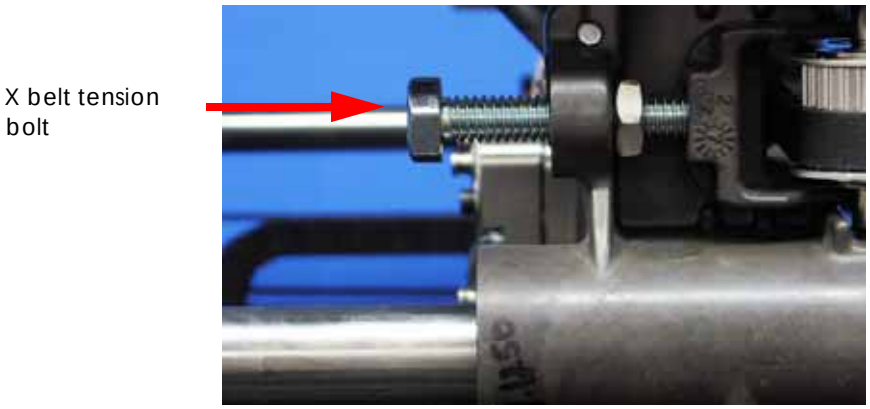


76. Check the tension:
    The gauge should read between 0.425 and 0.435 mils. See Figure 4-234.

Figure 4-235: Gauge reading at correct X belt tension (Shading indicates acceptable range)

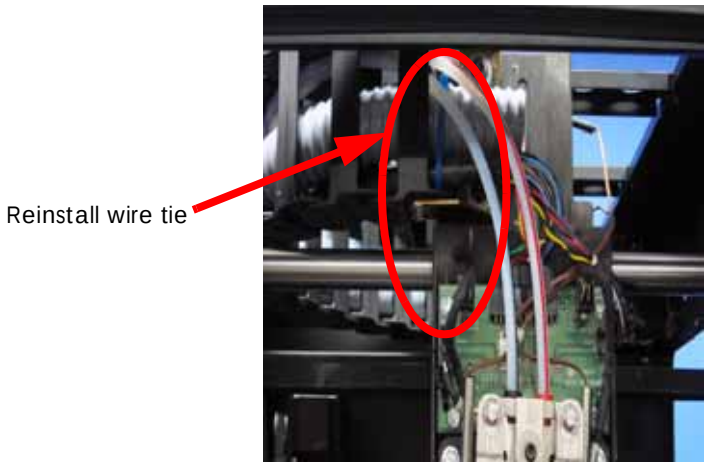
77. If the tension is out of the range specified above, adjust the belt tension by turning the X belt tensioning nut on the X-Drive Idler/Tension Adjust gear. See Figure 4-236.

Figure 4-236: X-Drive Belt Tension Adjustment



78. Remove the belt fixture and run the head back and forth several times.
79. Continue to adjust and check the tension until the tension meets specification.
80. Repeat steps 68 - 71 to zero the dial indicator.
81. Reinstall a wire tie around the umbilical hose. See Figure 4-237.

Figure 4-237: Umbilical hose wire tie location



82. Align the left side access panel with the mounting holes.
83. Using a $^{5}/_{16}$" nut driver, reinstall the 7 left side access panel mounting screws.
84. Align the right side access panel with the mounting holes.
85. Using a $^{5}/_{16}$" nut driver, reinstall the 7 right side access panel mounting screws.
86. Reinstall the front cover. See Installing the front panel on page 4-12.
87. Reinstall the side panels. See Installing the side panels on page 4-8.
88. Reinstall the top panel. See Installing the top panel on page 4-6.
89. Power up the printer.
90. From the display panel press **Maintenance > Machine > Tips.**
91. Perform Z calibration. See Z Calibration on page 5-2.
92. Perform XY Offset calibration. See XY Tip Calibration on page 5-5.
93. Perform Part Based calibration. See Performing part based calibration for uPrint, uPrint SE, uPrint Plus and uPrint SE Plus from the Service Calibration menu (Firmware version 9.1 or newer) on page 5-7.

Z Stage Components

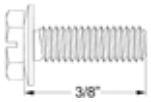
Z Home Sensor

Required Tools

- 1/4" nut driver or standard screwdriver.

Hardware

- 6-32 x 3/8" slotted screw (x1)



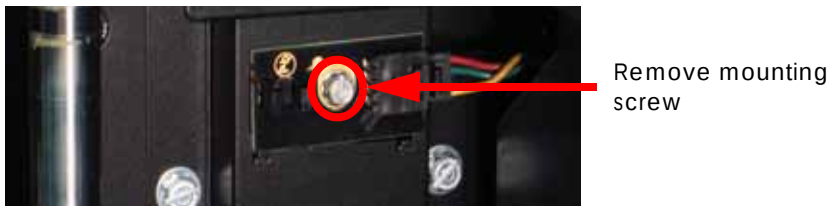
Removing the Z home sensor

1. Open the chamber door.
2. Lower the Z stage all of the way down.
3. Disconnect the Z home sensor cable by pressing in on the tab and pulling outward. See Figure 4-238.

Figure 4-238: Z home sensor cable location

4. Using a 1/4" nut driver or standard screwdriver, remove the mounting screw. See Figure 4-239.

Figure 4-239: Z home sensor mounting screw location



5. Remove the Z home sensor.

Installing the Z home sensor

1. Align the Z home sensor with the mounting hole.
2. Reinstall the mounting screw with a 1/4" nut driver or standard screwdriver.
3. Reconnect the Z home cable.
4. Close the chamber door.

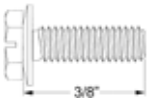
Z EOT (End of Travel) Sensor

Required Tools

- 1/4" nut driver or standard screwdriver.

Hardware

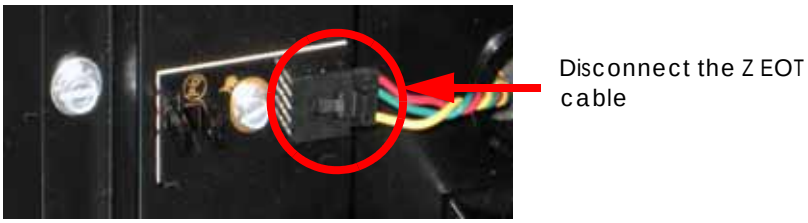
- 6-32 x 3/8" slotted screw (x1)



Removing the Z EOT sensor

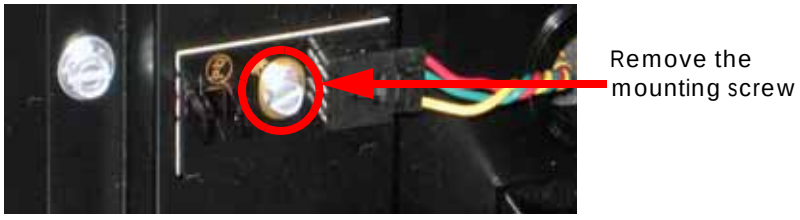
1. Open the chamber door.
2. Raise the Z stage all of the way up.
3. Disconnect the Z EOT sensor cable by pressing in on the tab and pulling outward. See Figure 4-240.

Figure 4-240: Z EOT sensor cable location



4. Using a 1/4" nut driver or standard screwdriver, remove the mounting screw. See Figure 4-241.

Figure 4-241: Remove the mounting screw



5. Remove the Z EOT Sensor.

Installing the Z EOT sensor

1. Align the Z EOT sensor with the mounting hole.
2. Using a 1/4" nut driver or standard screwdriver, reinstall the mounting screw.
3. Reconnect the Z EOT sensor cable.
4. Close the chamber door.

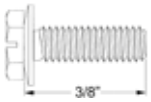
Chamber Fans

Required Tools

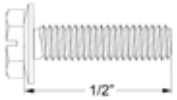
- 5/16" nut driver or standard screwdriver.
- 5/16" box wrench

Hardware

- 10-32 x 3/8" slotted screws (x8)



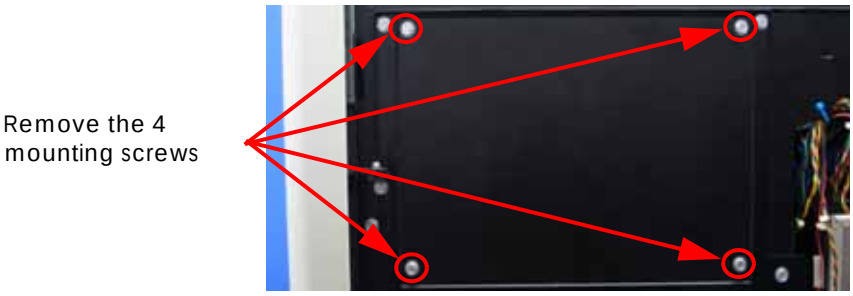
- 8-32 x 1/2" slotted screws (x4)



Removing the right side chamber fan

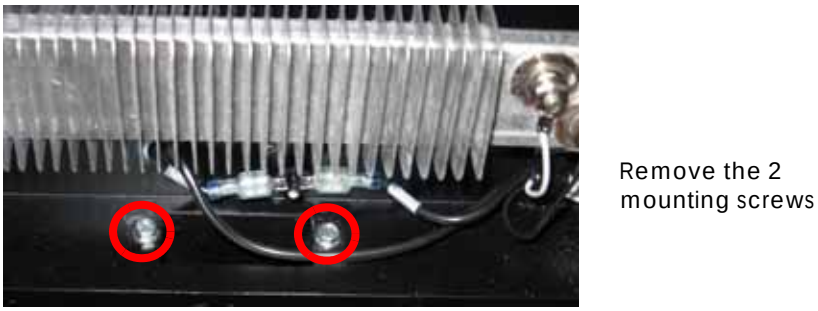
1. Remove the top panel. See Removing the top panel on page 4-5.
2. Remove the side panels. See Side Panels on page 4-7.
3. Using a 5/16" nut driver or standard screwdriver, remove the 4 mounting screws from the right side heater panel. See Figure 4-242.

Figure 4-242: Right side heater panel mounting screw locations



4. Using a 5/16" box wrench, remove the 2 chamber fan mounting screws. See Figure 4-243.

Figure 4-243: Right side chamber fan mounting screw locations



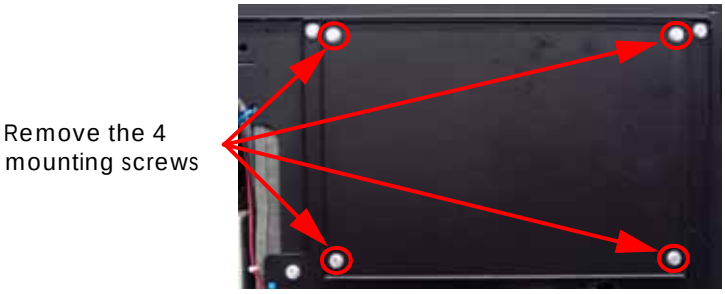
Installing the right side chamber fan

1. Align chamber fan with mounting holes.
2. Using a $^{5}/_{16}$" box wrench, reinstall the 2 chamber fan mounting screws.
3. Align the right side heater panel with the mounting holes.
4. Using a $^{5}/_{16}$" nut driver or standard screwdriver, reinstall the 4 mounting screws for the right side heater panel.
5. Reinstall the side panels. See Installing the side panels on page 4-8.
6. Reinstall the top panel. See Installing the top panel on page 4-6.

Removing the left side chamber fan

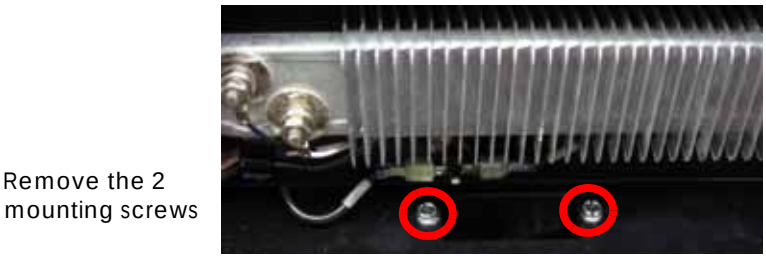
1. Remove the top panel. See Removing the top panel on page 4-5.
2. Remove the side panels. See Side Panels on page 4-7.
3. Using a $^{5}/_{16}$" nut driver or standard screwdriver, remove the 4 mounting screws from the left side heater panel and remove the heater panel. See Figure 4-244.

Figure 4-244: Left side heater panel mounting screw locations



4. Using a $^{5}/_{16}$" box wrench, remove the 2 chamber fan mounting screws. See Figure 4-245.

Figure 4-245: Left side chamber fan mounting screw locations



Installing the left side chamber fan

1. Align chamber fan with mounting holes.
2. Using a $^{5}/_{16}$" box wrench, reinstall the 2 chamber fan mounting screws.
3. Align the left side heater panel with the mounting holes.
4. Using a $^{5}/_{16}$" nut driver or standard screwdriver, reinstall the 4 mounting screws for the left side heater panel.
5. Reinstall the side panels. See Installing the side panels on page 4-8.
6. Reinstall the top panel. See Installing the top panel on page 4-6.

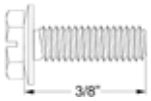
Chamber Heaters

Required Tools

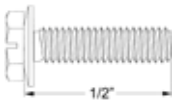
- 5/16″ nut driver or standard screwdriver.
- 3/8″ nut driver.

Hardware

- 10-32 x 3/8″ slotted screws (x8)



- 10-32 x 1/2″ slotted screws (x4)

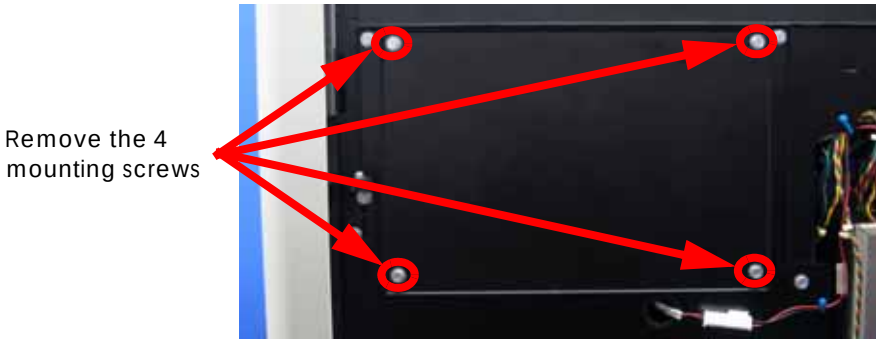


- 10-32 x 1/8″ nut (x4)

Removing the right side heater

1. Remove the top panel. See Removing the top panel on page 4-5.
2. Remove the side panels. See Side Panels on page 4-7.
3. Using a 5/16″ nut driver or standard screwdriver, remove the 4 mounting screws and remove the heater panel. See Figure 4-246.

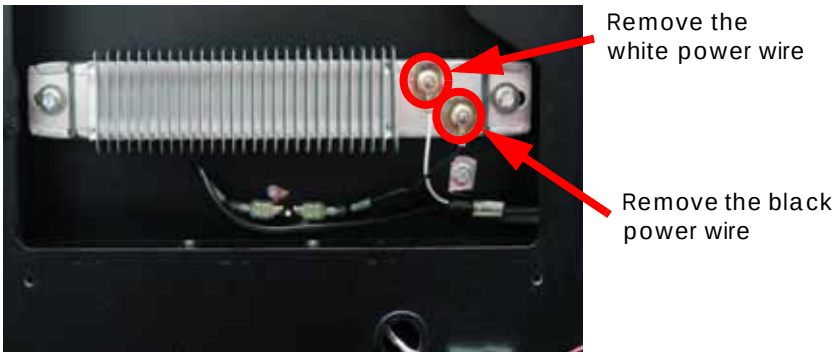
Figure 4-246: Right side heater panel mounting screw locations



4. Remove the black power wire from the right mounting post with a 3/8″ nut driver. See Figure 4-247.

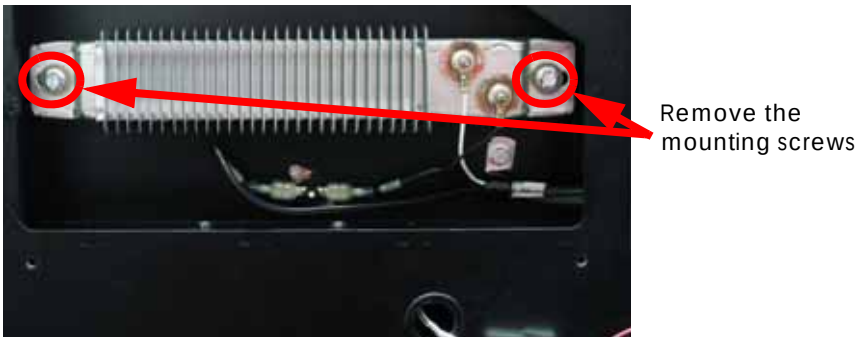
5. Remove the white power wire from the left mounting post with a $^{3}/_{8}$" nut driver. See Figure 4-247.

Figure 4-247: Power wire locations



6. Remove the left and right mounting screws with a $^{5}/_{16}$" nut driver or standard screwdriver. Do not lose the insulating washers as they are need for reinstallation. See Figure 4-248.

Figure 4-248: Right side heater mounting screw locations



7. Remove the heater.

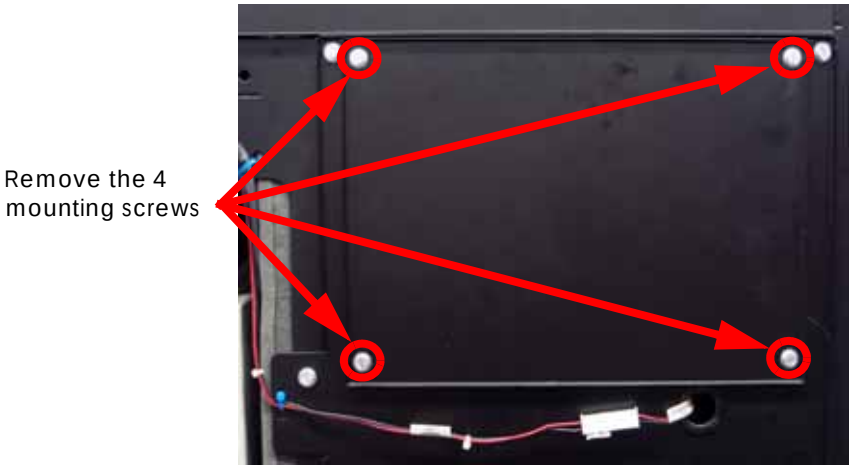
Installing the right side heater

1. Align the heater with the mounting posts.
2. Insert the insulating washers and reinstall the mounting screws using a $^{5}/_{16}$" nut driver or standard screwdriver.
3. Reinstall the white power wire on the left mounting post using a $^{3}/_{8}$" nut driver.
4. Reinstall the black power wire on the right mounting post using a $^{3}/_{8}$" nut driver.
5. Align the heater panel with the mounting holes.
6. Using a $^{5}/_{16}$" nut driver or standard screwdriver, reinstall the 4 heater panel mounting screws.
7. Install the side panels. See Installing the side panels on page 4-8.
8. Install the top panel. See Installing the top panel on page 4-6.

Removing the left side heater

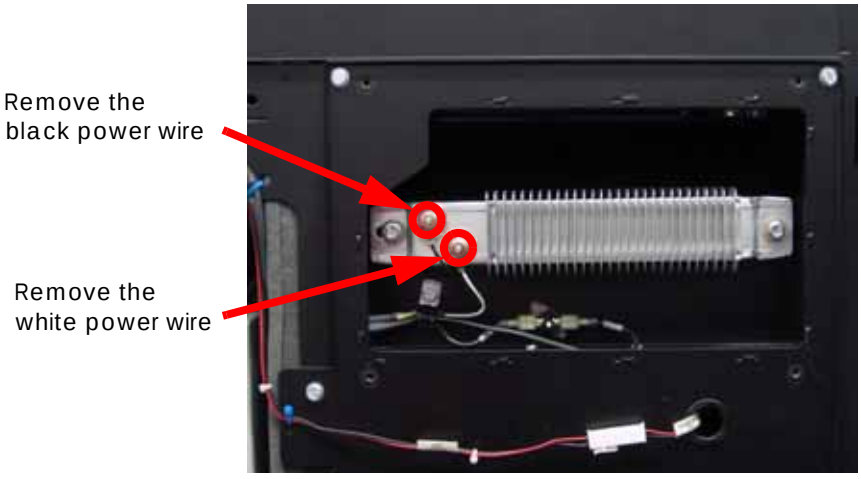
1. Remove the top panel. See Removing the top panel on page 4-5.
2. Remove the side panels. See Side Panels on page 4-7.
3. Using a $^{5}/_{16}$" nut driver or standard screwdriver, remove the 4 mounting screws and remove the heater panel. See Figure 4-249.

Figure 4-249: Left side heater panel mounting screw locations



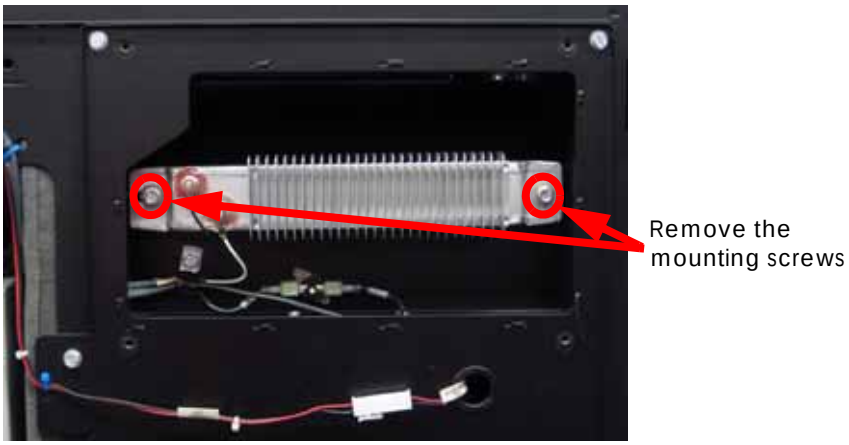
4. Using a $^{3}/_{8}$" nut driver, remove the white power wire from the right mounting post. See Figure 4-250.
5. Using a $^{3}/_{8}$" nut driver, remove the black power wire from the left mounting post. See Figure 4-250.

Figure 4-250: Power wire locations



6. Using a $^{5}/_{16}$" nut driver or standard screwdriver, remove the left and right mounting screws. Do not lose the insulating washers as they are need for reinstallation. See Figure 4-251.

Figure 4-251: Left side heater mounting screw locations



7. Remove the heater.

Installing the left side heater

1. Align the heater with the mounting posts.
2. Insert the insulating washers and reinstall the mounting screws using a $^{5}/_{16}$" nut driver or standard screwdriver.
3. Reinstall the black power wire on the left mounting post using a $^{3}/_{8}$" nut driver.
4. Reinstall the white power wire on the right mounting post using a $^{3}/_{8}$" nut driver.
5. Align the heater panel with the mounting holes.
6. Using a $^{5}/_{16}$" nut driver or standard screwdriver, reinstall the 4 heater panel mounting screws.
7. Install the side panels. See Installing the side panels on page 4-8.
8. Install the top panel. See Installing the top panel on page 4-6.

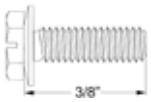
Thermal Fuses

Required Tools

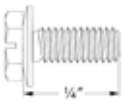
- 5/16" nut driver or standard screwdriver.

Hardware

- 10-32 x 3/8" slotted screws (x8)



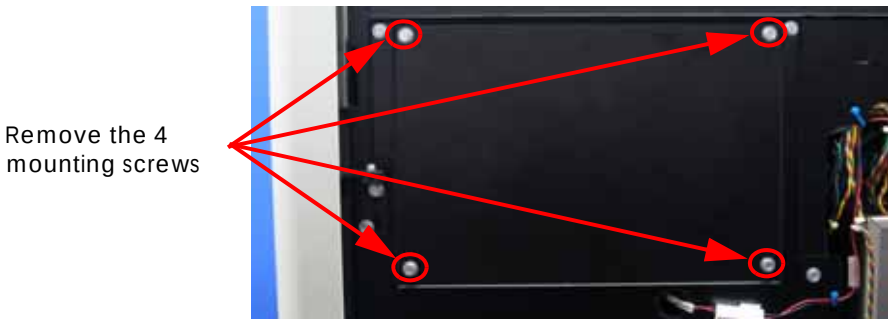
- 4-40 x 1/4" slotted screws (x4)



Removing the right side thermal fuse

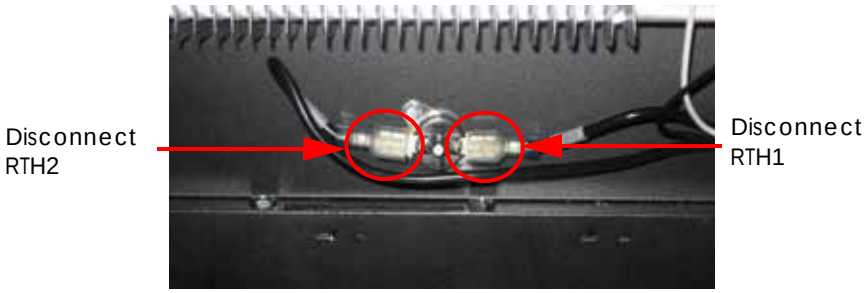
1. Remove the top panel. See Removing the top panel on page 4-5.
2. Remove the side panels. See Side Panels on page 4-7.
3. Using a 5/16" nut driver or standard screwdriver, remove the 4 mounting screws and remove the right side heater panel. See Figure 4-252.

Figure 4-252: Right side heater panel mounting screw locations



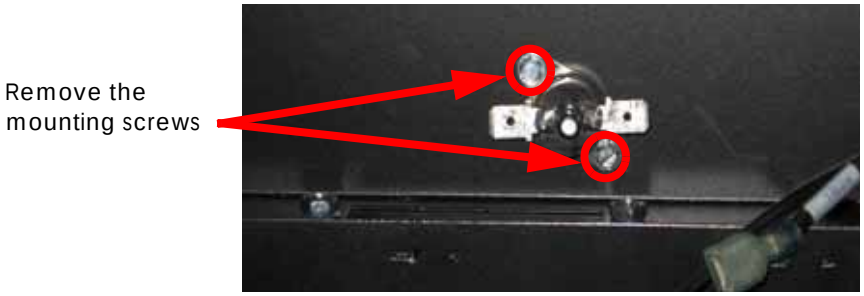
4. Disconnect the RTH1 and RTH2 spade connectors by pulling outward. See Figure 4-253.

Figure 4-253: RTH1 and RTH2 spade connector locations



5. Using a standard screwdriver, remove the 2 mounting screws. See Figure 4-254.

Figure 4-254: Right side thermal fuse mounting screw locations



6. Remove the thermal fuse.

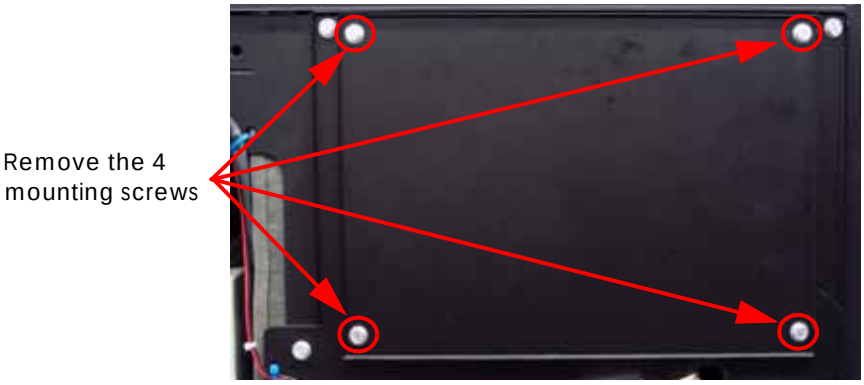
Installing the right side thermal fuse

1. Align the thermal fuse with the mounting holes.
2. Using a standard screwdriver, reinstall the mounting screws.
3. Reconnect RTH1 and RTH2 spade connectors.
4. Align the heater panel with the 4 mounting screws.
5. Using a $^{5}/_{16}$" nut driver or standard screwdriver, reinstall the 4 mounting screws.
6. Reinstall the side panels. See Installing the side panels on page 4-8.
7. Reinstall the top panel. See Installing the top panel on page 4-6.

Removing the left side thermal fuse

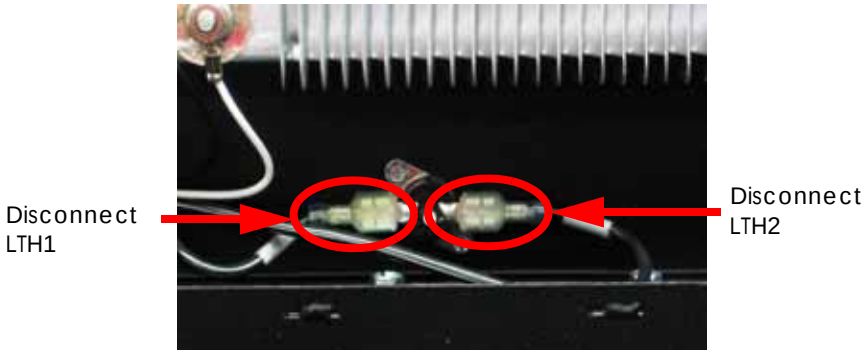
1. Remove the top panel. See Removing the top panel on page 4-5.
2. Remove the side panels. See Side Panels on page 4-7.
3. Using a $^{5}/_{16}$" nut driver or standard screwdriver, remove the 4 mounting screws from the left side heater panel and remove the heater panel. See Figure 4-255.

Figure 4-255: Left side heater panel mounting screw locations



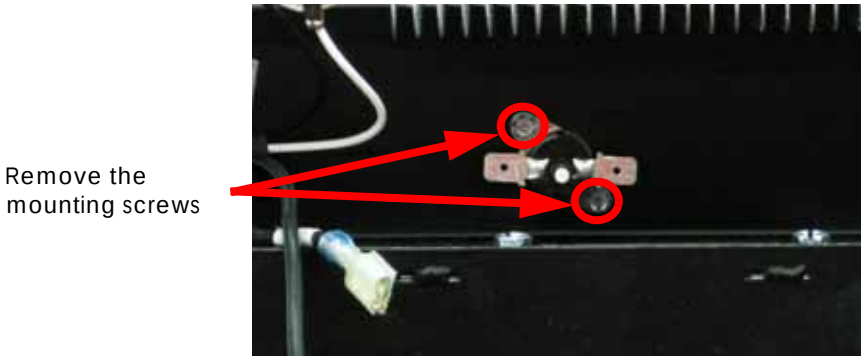
4. Disconnect the LTH1 and LTH2 spade connectors by pulling outward. See Figure 4-256.

Figure 4-256: LTH1 and LTH2 spade connector locations



5. Using a standard screwdriver, remove the 2 mounting screws. See Figure 4-257.

Figure 4-257: Left side thermal fuse mounting screw locations



6. Remove the thermal fuse.

Installing the left side thermal fuse

1. Align the thermal fuse with the mounting holes.
2. Using a standard screwdriver, reinstall the 2 mounting screws.
3. Reconnect LTH1 and LTH2 spade connectors.
4. Align the heater panel with the 4 mounting holes.
5. Using a $^{5}/_{16}$" nut driver or standard screwdriver, reinstall the 4 mounting screws.
6. Reinstall the side panels. See Installing the side panels on page 4-8.
7. Reinstall the top panel. See Installing the top panel on page 4-6.

Chamber Thermocouple

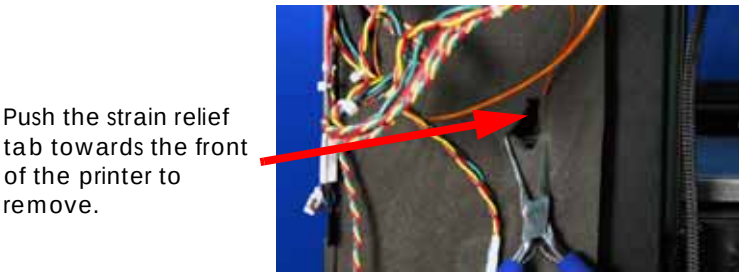
Required Tools

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

Removing the chamber thermocouple

1. Remove the top panel. See Removing the top panel on page 4-5.
2. Remove the side panels. See Side Panels on page 4-7.
3. Remove the upper electronics bay cover. See Removing the upper electronics bay cover on page 4-17.
4. Remove the electronics bay. See Removing the electronics bay on page 4-19.
5. Push the strain relief clip out towards the front of the printer using a small standard screwdriver. See Figure 4-258.

Figure 4-258: Strain relief clip location



6. Bend the tip of the thermocouple straight and slide out through the strain relief clip.
7. Remove the thermocouple.

Installing the chamber thermocouple

1. Push the thermocouple through the mounting hole until it is 3/4″ (19mm) through the other side.
2. Push the strain relief in to lock the thermocouple in place.
3. Bend the thermocouple over to the left. See Figure 4-259.

Figure 4-259: Bending the thermocouple

4. Reinstall the electronics bay. See Installing the electronics bay on page 4-20.
5. Reinstall the upper electronics bay cover. See Installing the upper electronics bay cover on page 4-18.
6. Reinstall the side panels. See Installing the side panels on page 4-8.
7. Reinstall the top panel. See Installing the top panel on page 4-6.

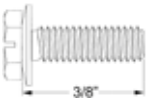
Z Motor

Required Tools

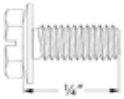
- $^{5}/_{16}$″ nut driver or standard screwdriver.
- $^{3}/_{32}$″ allen wrench.
- $^{9}/_{64}$″ allen wrench.
- Cutters

Hardware

- Wire ties (x2)
- 10-32 x $^{3}/_{8}$″ slotted screws (x4)



- 4-40 x $^{1}/_{4}$″ slotted screws (x8)



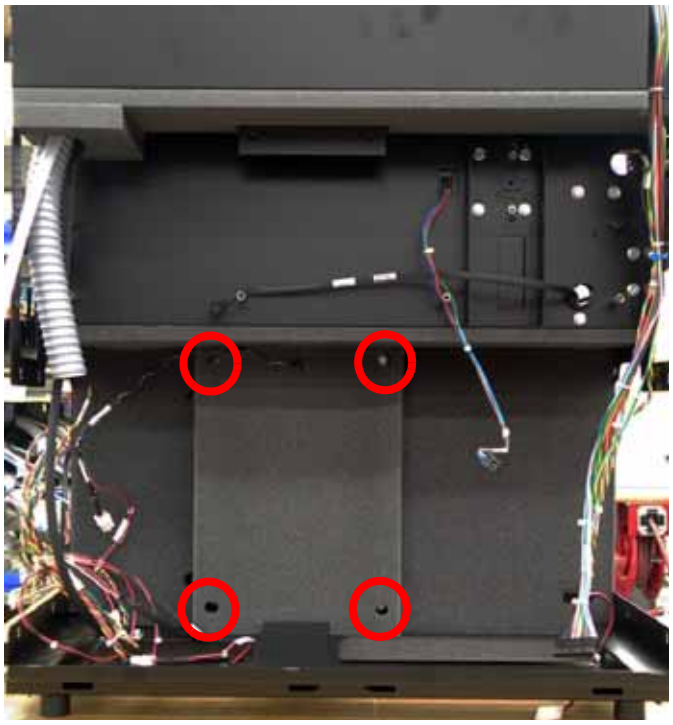
- #4 Split lock washer (x4)

- #4 SAE washer (x4)

Removing the Z motor

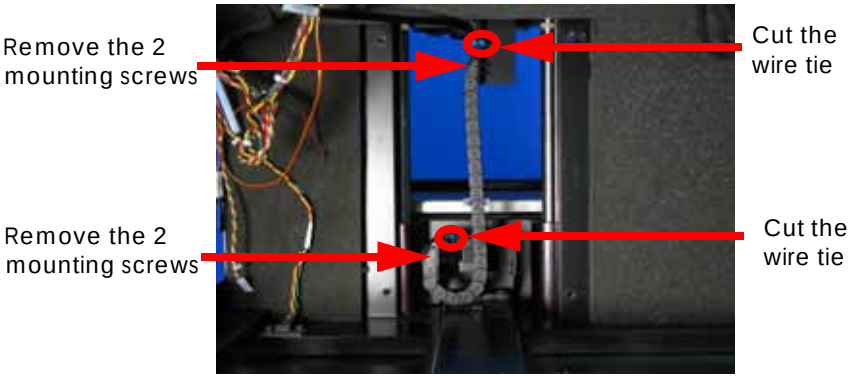
1. Remove the top panel. SeeRemoving the top panel on page 4-5.
2. Remove the side panels. See Side Panels on page 4-7.
3. Remove the upper electronics bay cover. See Removing the upper electronics bay cover on page 4-17.
4. Remove the electronics bay. See Removing the electronics bay on page 4-19.
5. Using a $^{5}/_{16}$″ nut driver or standard screwdriver, remove the 4 Z stage panel mounting screws and remove the Z stage panel. See Figure 4-260.

Figure 4-260: Removing the Z stage panel



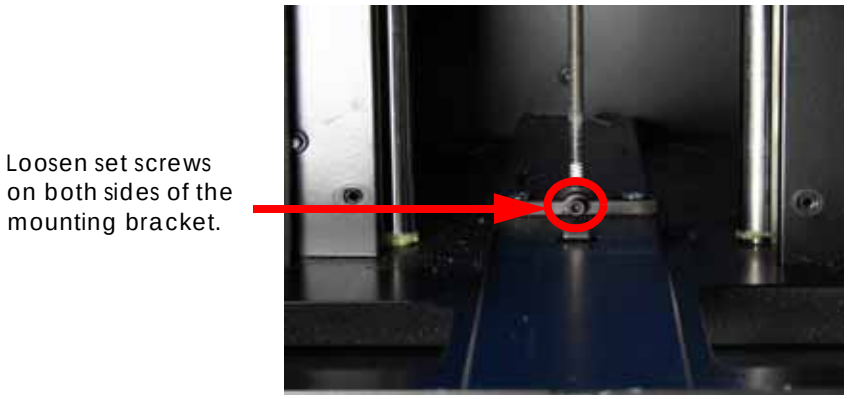
6. Remove the 4 Z motor energy chain mounting screws with a $^{3}/_{32}$" allen wrench. See Figure 4-261.
7. Cut the tie wraps holding from around Z stage energy chain. See Figure 4-261.

Figure 4-261: Remove the Z motor energy chain



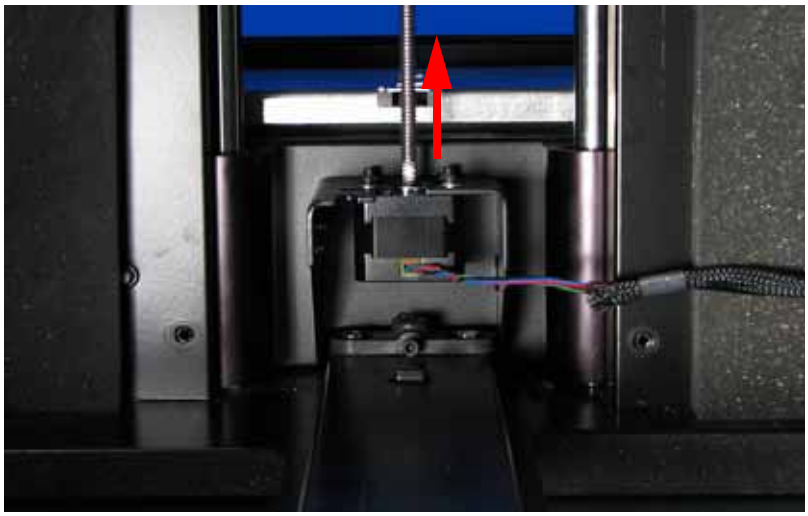
8. Loosen but do not remove the Z stage leadscrew mounting bracket set screws using a $^{9}/_{64}$" allen wrench. See Figure 4-262.

Figure 4-262: Loosen Z stage leadscrew mounting bracket set screws



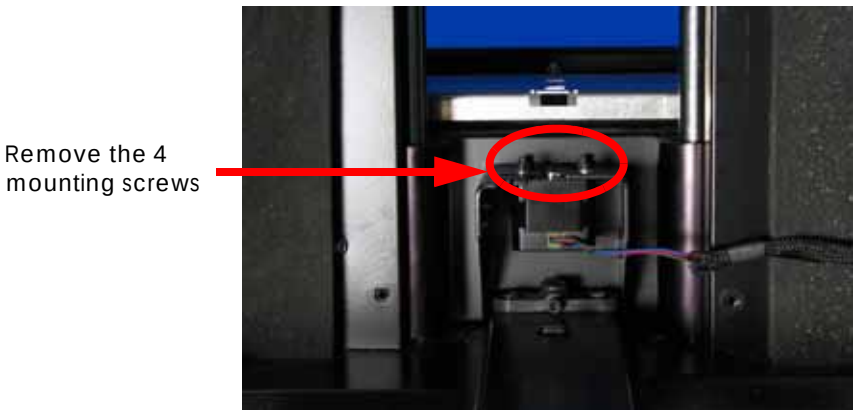
9. Turn the leadscrew counter clockwise until it is free of the motor. See Figure 4-263.

Figure 4-263: Remove the leadscrew



10. Remove the 4 Z stage motor mounting screws with a $^{3}/_{32}$″ allen wrench and remove the motor. See Figure 4-264.

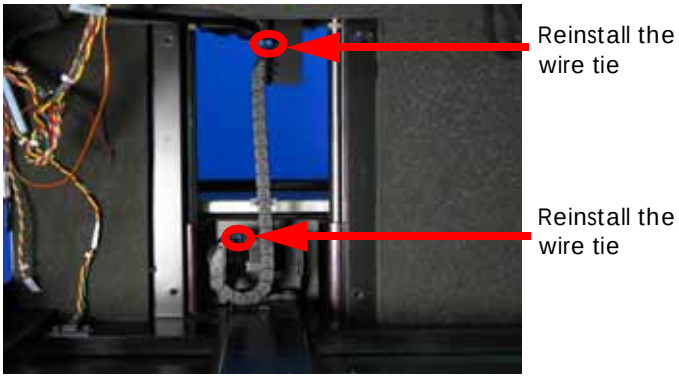
Figure 4-264: Removing the Z stage motor



Installing the Z motor

1. Place the Z motor in its mounting location and loosely fasten the mounting screws with a $^{3}/_{32}$" allen wrench.
2. Insert the leadscrew and turn clockwise until the leadscrew clears the bottom of the motor.
3. Raise the Z stage to the upper limit and tighten the leadscrew mounting bracket set screws.
4. Lower the Z stage down to its lower limit and tighten the Z stage motor mounting screws.
5. Align the Z stage motor energy chain and fasten the mounting screws, be sure not to overtighten and crush the energy chain.
6. Attach and tighten the wire ties on both ends of the Z motor wire.

Figure 4-265: Remove the Z motor energy chain



7. Reinstall the Z stage panel and tighten the 4 mounting screws with a $^{5}/_{16}$" nut driver or standard screwdriver.
8. Reinstall the electronics bay. See Installing the electronics bay on page 4-20.
9. Reinstall the upper electronics bay cover. See Installing the upper electronics bay cover on page 4-18.
10. Reinstall the side panels. See Installing the side panels on page 4-8.
11. Reinstall the top panel. See Installing the top panel on page 4-6.

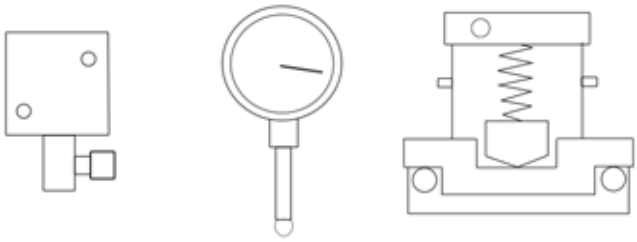
Z Stage

The uPrint and uPrint SE printers have a Z stage pan that is 8 x 6 inches. The uPrint Plus and uPrint SE Plus printers have a Z stage pan that is 8 x 8 inches. The physical replacement is the same for both printers. When its time to calibrate they will have different procedures.

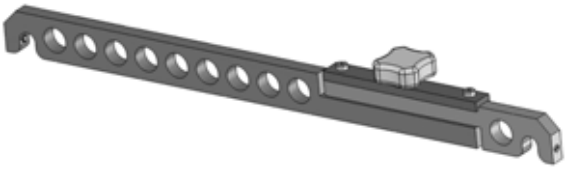
Required Tools

- $^{5}/_{16}$" nut driver or standard screwdriver.
- $^{5}/_{16}$" socket driver or $^{5}/_{16}$" box wrench.
- $^{3}/_{32}$" allen wrench.
- $^{9}/_{64}$" allen wrench.
- Cutters
- Z Guide rod stand off (x2)

- Head bracket, dial indicator and belt tension gauge assembly



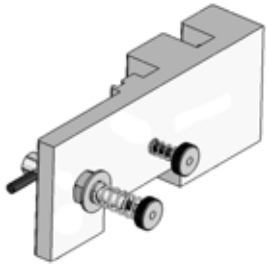
- Y rod spacer (x2)



- Leveling wrench

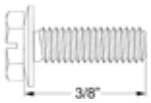
- Z Guide rod spacer (x2)

- Z guide rod alignment fixture



Hardware

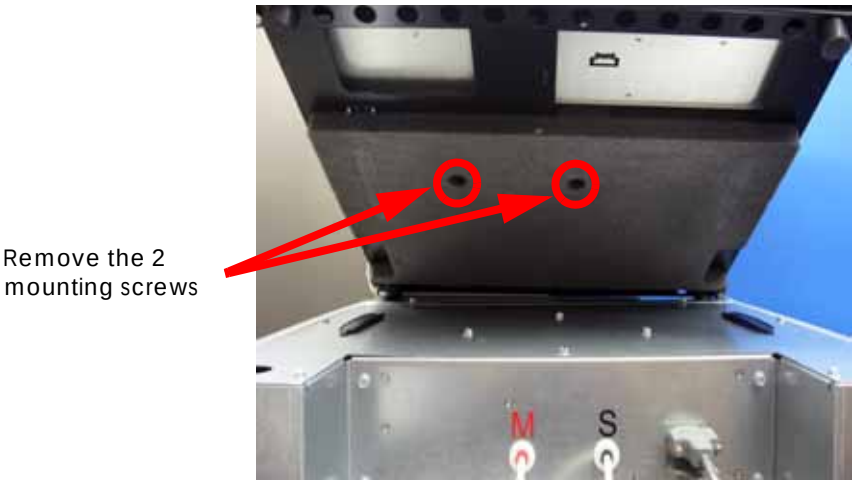
- 10-32 x $\frac{1}{2}$" slotted screws (x4)



Removing the Z stage

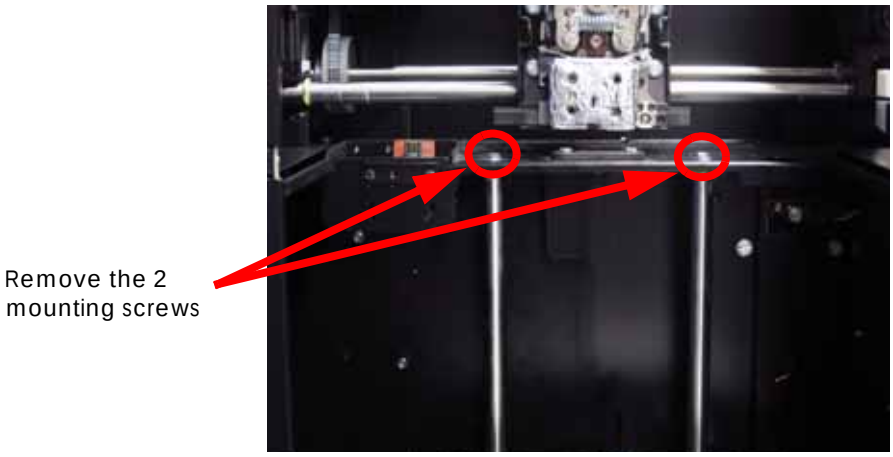
1. Remove the top panel. See Removing the top panel on page 4-5.
2. Remove the side panels. See Side Panels on page 4-7.
3. Remove the electronics bay. See Removing the electronics bay on page 4-19.
4. Remove the Z motor. See Removing the Z motor on page 4-149.
5. Tilt the printer forward 6 inches (152mm) and prop up with a material carrier or something similar.
6. Using a $\frac{5}{16}$" socket driver or $\frac{5}{16}$" box wrench, remove the 2 lower Z stage guide rod mounting screws. See Figure 4-266.

Figure 4-266: Lower Z stage guide rod mounting screw locations



7. Using a $\frac{5}{16}$" nut driver or standard screwdriver, remove the 2 upper Z stage guide rod mounting screws. See Figure 4-267.

Figure 4-267: Upper Z stage guide rod mounting screw locations

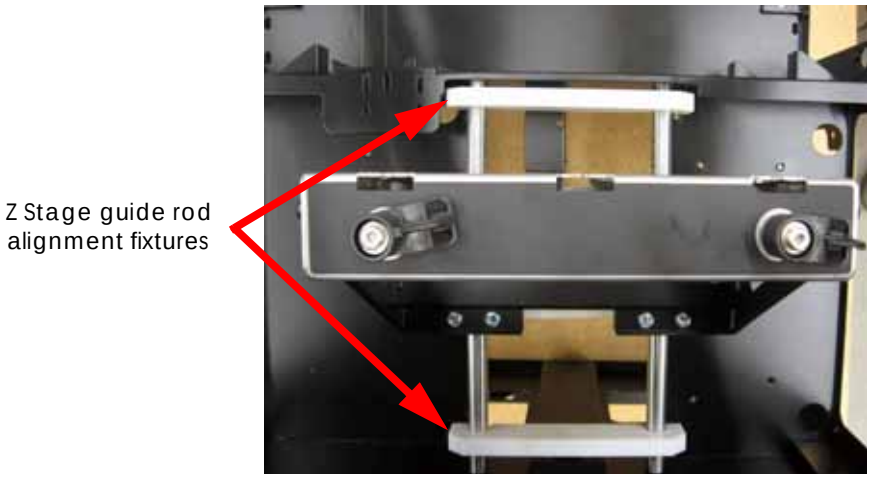


8. Remove the Z stage by pulling out of the printer through the chamber door.

Installing the Z stage

1. Align the Z stage guide rods with the upper and lower mounting holes.
2. Using a $^{5}/_{16}$" socket driver or $^{5}/_{16}$" box wrench, loosely fasten the lower Z stage guide rod mounting screws.
3. Using a 5/6" nut driver or standard screwdriver, loosely fasten the upper Z stage guide rod mounting screws.
4. Using a $^{3}/_{32}$" allen wrench, Reinstall the 4 Z motor energy chain mounting screws.
5. Move Z stage to the middle of travel.
6. Place one Z stage guide rod alignment fixture at the bottom of the Z stage. See Figure 4-268.
7. Place one Z stage guide rod alignment fixture at the top of the Z stage, See Figure 4-268.

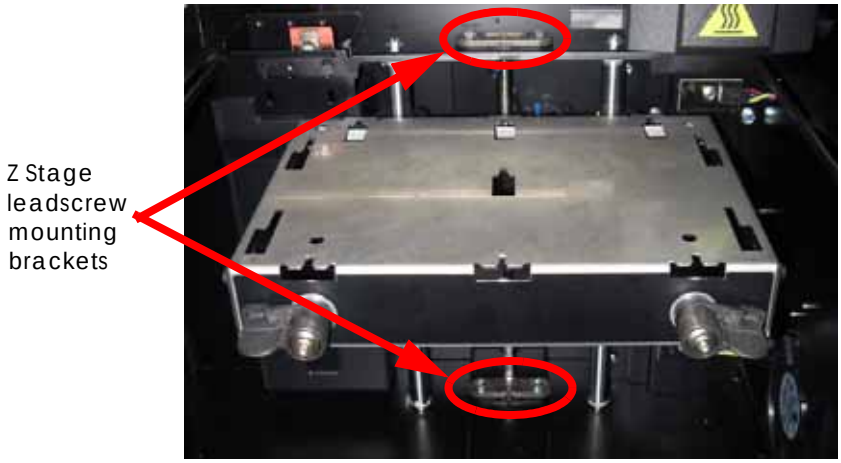
Figure 4-268: Z stage guide rod alignment fixture locations



8. Using a $^{5}/_{16}$" socket driver or $^{5}/_{16}$" box wrench, securely fasten the lower Z stage guide rod mounting screws.

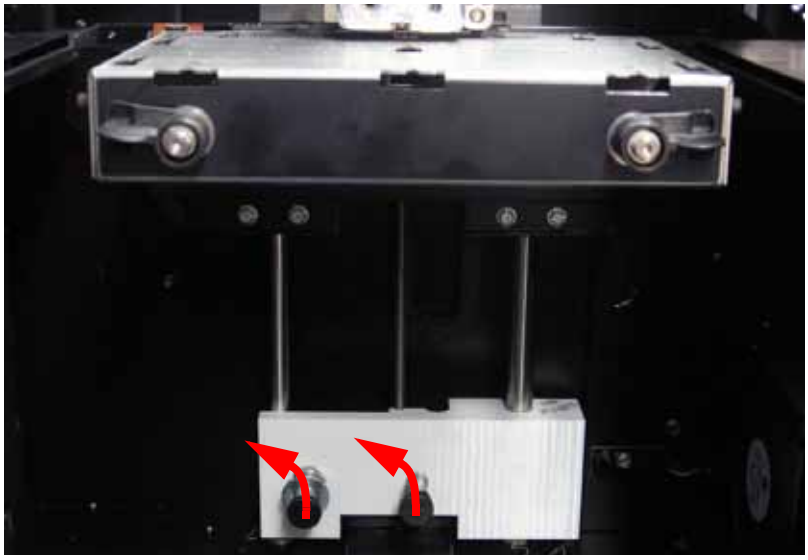
9. Using a $^{5}/_{16}$" nut driver or standard screwdriver, securely fasten the upper Z stage guide rod mounting screws.
10. Remove the upper and lower Z stage guide rod alignment fixtures.
11. Using a 3/32" allen wrench, reinstall the Z motor. Do not tighten the screws completely at this time.
12. Feed the Z stage leadscrew through the mounting brackets and through the Z motor. Align the leadscrew with the set screws.
13. Using a 9/64" allen wrench, tighten the Z stage leadscrew mounting bracket set screws.
14. Using a $^{5}/_{16}$" nut driver or standard screwdriver, loosen but do not remove the upper and lower Z stage leadscrew mounting brackets. See Figure 4-269.

Figure 4-269: Z stage leadscrew mounting bracket locations



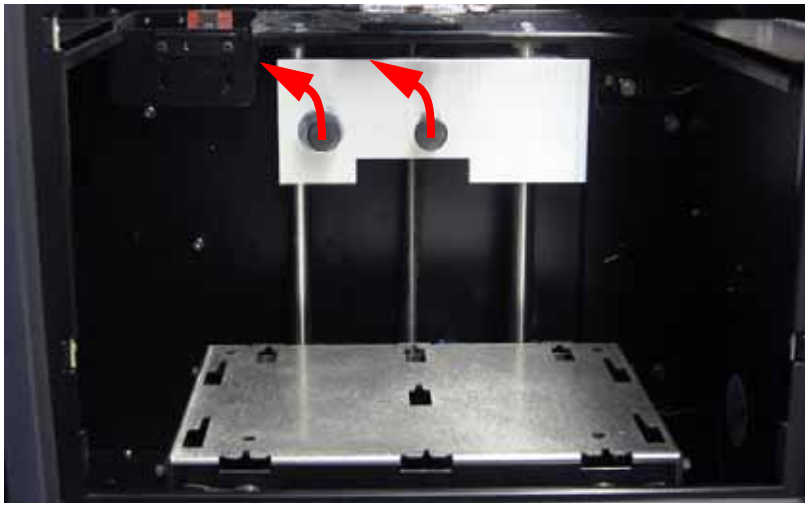
15. Raise the Z stage up all the way and insert the Z stage leadscrew alignment fixture at the bottom of the guide rods. See Figure 4-270.
16. Once the alignment fixture is in properly, turn the locking screws 1/4 turn counter clockwise to lock in place. See Figure 4-270.

Figure 4-270: Inserting the Z stage guide rod alignment fixture



17. Using a $^{5}/_{16}$" socket driver or $^{5}/_{16}$" box wrench, securely fasten the lower Z stage leadscrew mounting bracket screws from the backside of the printer.
18. Remove the Z stage leadscrew alignment fixture by pressing in the screws and turning $^{1}/_{4}$ turn clockwise to unlock.
19. Lower the Z stage to the bottom.
20. Insert the Z stage leadscrew alignment fixture at the top of the guide rods. See Figure 4-271.
21. Once the alignment fixture is in properly, turn the locking screws $^{1}/_{4}$ turn counter clockwise to lock in place. See Figure 4-271.

Figure 4-271: Inserting the Z stage leadscrew alignment fixture

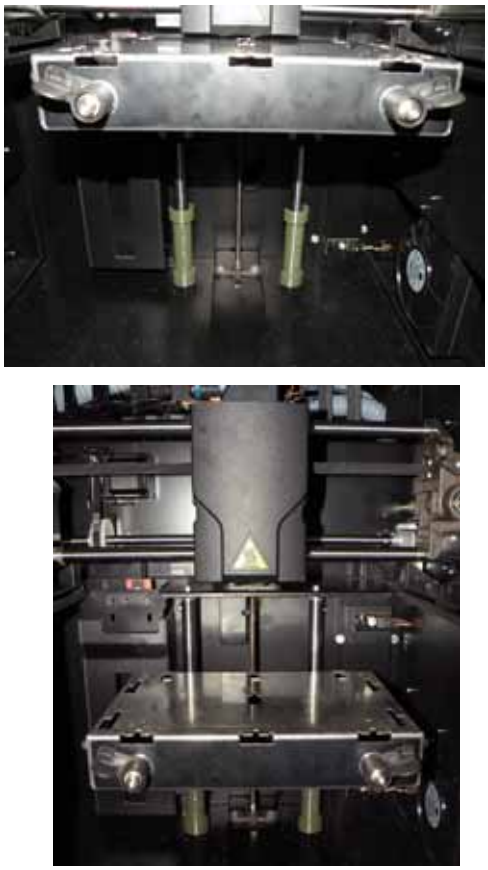


22. Using a $^{5}/_{16}$" nut driver or standard screwdriver, securely fasten the upper Z stage leadscrew mounting bracket screws.
23. Remove the Z stage leadscrew alignment fixture by pressing in the screws and turning 1/4 turn clockwise to unlock.
24. Move the Z stage to its lower limit.
25. Using a $^{3}/_{32}$" allen wrench, securely fasten the Z motor mounting screws.
26. Using a $^{5}/_{16}$" nut driver or standard screwdriver, reinstall the Z stage panel.
27. Slowly lift the Z stage to the top of its travel, making sure it has smooth movement.
28. Let the Z stage travel to the lower limit on its own or with slight downward pressure, making sure it has smooth movement to the end of travel.

Note: If the Z stage is binding, loosen the Z stage motor mounting screws and the Z stage leadscrew mounting bracket screws, then repeat steps 10-24.

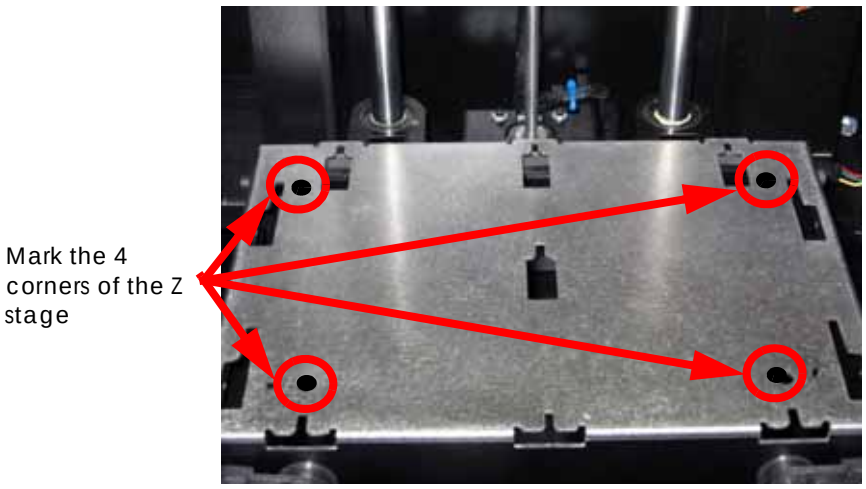
29. Raise the Z stage up near the XY table and hold in place using 2 Z guide rod stand off's. See Figure 4-272.

Figure 4-272: Z guide rod stand off locations



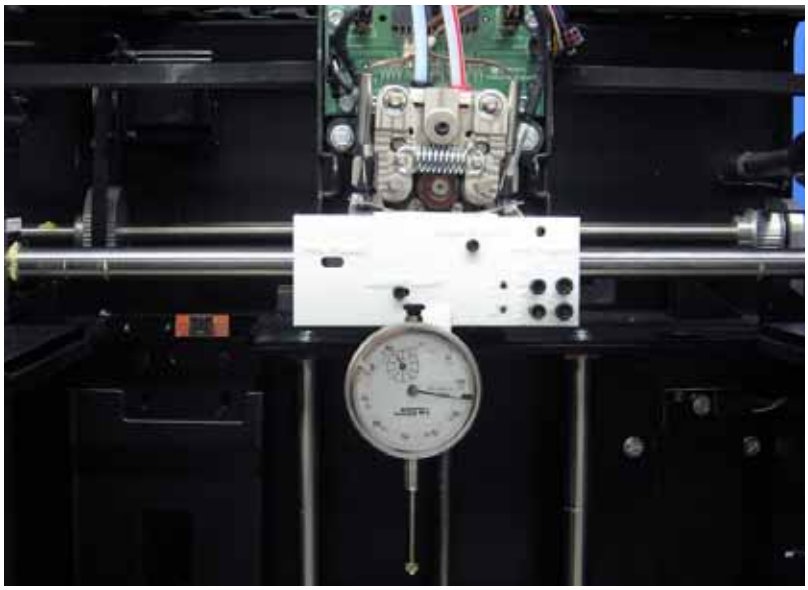
30. Using a black marker or pen, mark the 4 corners of the Z stage. See Figure 4-273.

Figure 4-273: Marking the 4 corners of the Z stage



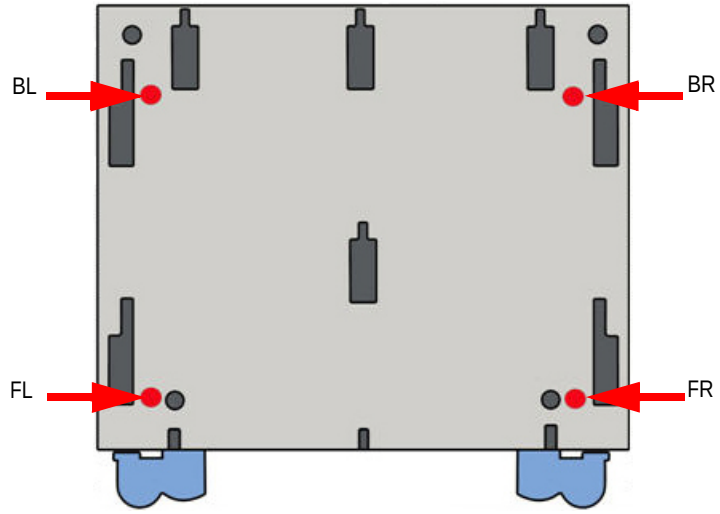
31. Attach the XY leveling bracket and dial indicator to the head. See Figure 4-274.

Figure 4-274: XY Leveling bracket location



32. Move the dial indicator to the back left corner and zero the dial indicator.
33. Move the dial indicator to the front left corner and write down the value.
34. Move the dial indicator to the front right corner and write down the value.
35. Move the dial indicator to the back right corner and write down the value.
36. Enter the values that are written down into the XY level worksheet. Use the 8x6 worksheet for uPrint and uPrint SE, see Figure 4-275. Use the 8x8 worksheet for uPrint Plus and uPrint SE Plus, see Figure 4-276.

Figure 4-275: uPrint and uPrint SE measurement points and worksheet



Indicator Reading Values

FL = ...

FR = - - - - -

BR = _____

Adjustment Calculation Values

FL Adjust = (-2.6 x .....**) + (0.97 x** - - - - -**) - (0.88 x** _____**)**

FL Adjust = _____ **+** _____ **-** _____

FL Adjust = _____

_____

FR Adjust = (-1.2 x .....**) - (0.88 x** - - - - -**) - (0.68 x** _____**)**

FR Adjust = _____ **+** _____ **-** _____

FR Adjust = _____

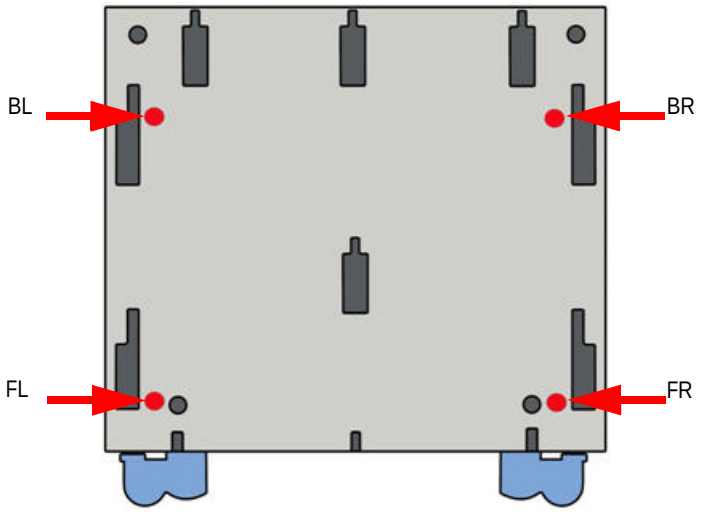
_____

BR Adjust = (-0.91 x .....**) + (1.02 x** - - - - -**) - (1.83 x** _____**)**

BR Adjust = _____ **+** _____ **-** _____

BR Adjust = _____

Figure 4-276: uPrint Plus and uPrint SE Plus measurement points and worksheet



Indicator Reading Values

FL = ...

FR = _ _ _ _ _

BR = _____

Adjustment Calculation Values

FL Adjust = (-2.02 x .....**) + (0.74 x** _ _ _ _ _**) - (0.66 x** _____**)**

FL Adjust = _____ **+** _____ **-** _____

FL Adjust = _____

_____

FR Adjust = (-0.41 x .....**) - (1.08 x** _ _ _ _ _**) - (0.38 x** _____**)**

FR Adjust = _____ **+** _____ **-** _____

FR Adjust = _____

_____

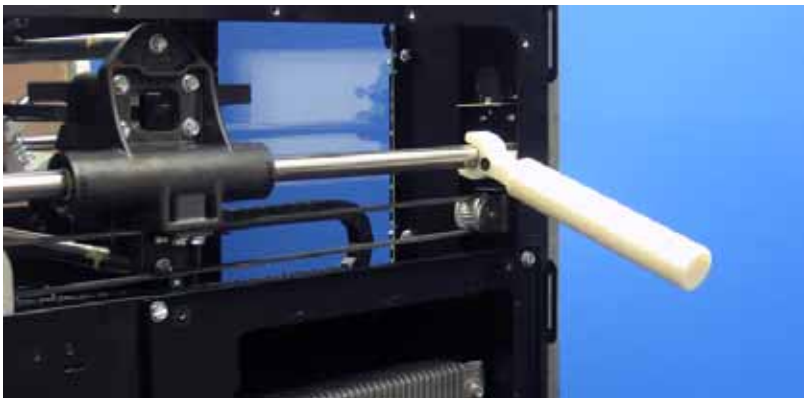
BR Adjust = (-0.6 x .....**) + (0.69 x** _ _ _ _ _**) - (1.7 x** _____**)**

BR Adjust = _____ **+** _____ **-** _____

BR Adjust = _____

37. Move the dial indicator to the front left of the Z stage and zero the dial indicator.
38. Using the XY guide rod leveling fixture, adjust the rod up or down until the dial indicator reads the value the calculator has given. See Figure 4-277.

Figure 4-277: XY guide rod leveling fixture



39. Using a $^{5}/_{32}$" allen wrench, securely fasten the front left Y guide rod mounting screw.
40. Move the dial indicator to the front right of the Z stage and zero the dial indicator.
41. Using the XY guide rod leveling fixture, adjust the rod up or down until the dial indicator reads the value the calculator has given.
42. Using a $^{5}/_{32}$" allen wrench, securely fasten the front right Y guide rod mounting screw.
43. Move the dial indicator to the rear right of the Z stage and zero the dial indicator.
44. Using the XY guide rod leveling fixture, adjust the rod up or down until the dial indicator reads the value the calculator has given.
45. Using a $^{5}/_{32}$" allen wrench, securely fasten the rear right Y guide rod mounting screw.
46. Repeat steps 32 - 45 until the XY table is completely level.
47. Remove the XY guide rod alignment brackets.
48. Remove the XY table leveling bracket and dial indicator.
49. Reinstall the electronics bay. See Installing the electronics bay on page 4-20.
50. Reinstall the side panels. See Installing the side panels on page 4-8.
51. Reinstall the top panel. See Installing the top panel on page 4-6.
52. Power the printer up.
53. From the display panel, press **Maintenance > Machine > Tips.**
54. Press Z Calibration to run the automated Z calibration process.

Calibrations & Adjustments

5

Offset Calibrations

Adjusting Z Calibration and XY Tip Offset

Z calibration is needed to adjust the slight differences in tip heights. XY Tip Offset is required to correct for the slight differences in tip alignment. Failure to perform these calibrations will result in poor part quality and possible LOE's.

Z and Tip Offset calibrations are **mandatory** whenever the tips are replaced. If Tip Replacement is chosen from the Interface Panel **Maintenance>Machine>Tip>Replace**, you will be prompted to perform the calibrations as a part of the replacement procedure.

These calibrations can also be run without performing a Tip Replacement. From **Idle**, choose **Maintenance>Machine>Tip** then **Calibrate Z** or **Calibrate XY.**

Caution: Do not use the Z calibration or XY tip offset from the test parts menu to calibrate the system.

Z Calibration

Typical Z calibration

1. Press **Maintenance.**
2. Press **Machine.**
3. Press **Tip.**
4. Press **Calibrate Z.**
5. Press **Start Part**. The printer will automatically build a Z Calibration part (one square of model and one of support). The system will then measure and calibrate the Z Axis for tip depth and tip level. (Build time is approximately 5 minutes).
6. Repeat steps 1-5 to verify proper calibration.

Note: Unusual circumstances may require that the Z calibration values be entered manually. To change these values, see Entering Z Calibration values manually (Firmware version 9.1 or newer) on page 5-3.

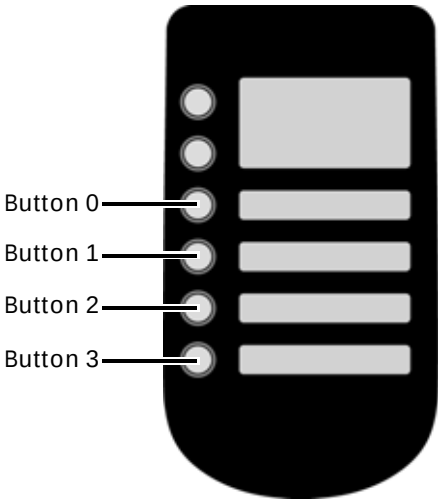
Entering Z Calibration values manually (Firmware version 9.1 or newer)

Z tip to base (ZT2B)

ZT2B is the Z distance from the support tip to the Z substrate sensor activation point. If unable to calibrate automatically, this value may need to be set to default in order to proceed with automatic calibration. The default value is -0.0700".

1. While the printer is at **Idle**, enter standby mode by pressing the **Standby...** button.
2. Enter the Service Calibration menu by pressing the following button sequence on the display panel: **3,2,3,3,1**. See Figure 5-278.

Figure 5-278: Service Calibration button sequence



3. Press the **Edit Configuration** button.
4. Press the **Next...** button.
5. Press the **Next...** button.
6. Press the **ZT2B** (Z tip to base) button.
7. Enter the calibration value by pressing the **Increment**, **Decrement** and **Next Digit** buttons.

Note: The value for ZT2B must be between -0.1500" and 0.0000".

8. When finished, press **Done...**
9. Press the **Next...** button.
10. Press the **Save and reboot** button.
11. The printer will reboot and return to idle.
12. Perform automatic Z calibration. See Z Calibration on page 5-2.

Entering Z Calibration values manually (Firmware version 9.1 or newer)

Z tip to tip (ZT2T)

ZT2T is the Z distance from the model tip to the support tip. A positive ZT2T means the support tip is higher than the model tip. If a support layer on top of model is too thick, add 0.010" to the ZT2T. If a model layer does not stick to supports, subtract 0.010" from the ZT2T. If unable to calibrate automatically, this value may need to be set to default in order to proceed with automatic calibration. The default value is 0.0000".

1. While the printer is at **Idle**, enter standby mode by pressing the **Standby...** button.
2. Enter the Service Calibration menu by pressing the following button sequence on the display panel: **3,2,3,3,1**. See Figure 5-278.
3. Press the **Edit Configuration** button.
4. Press the **Next...** button.
5. Press the **Next...** button.
6. Press the **ZT2T** (Z tip to tip) button.
7. Enter the calibration value by pressing the **Increment**, **Decrement** and **Next Digit** buttons.

Note: The value for ZT2T must be between -0.0500" and 0.0500".

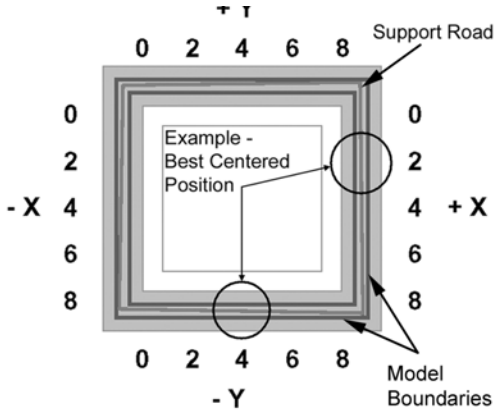
8. When finished, press **Done...**
9. Press the **Next...** button until you reach the last page.
10. Press the **Done...** button.
11. Press the **Save and reboot** button.
12. The printer will reboot and return to idle.
13. Perform automatic Z calibration. See Z Calibration on page 5-2.

XY Tip Calibration

Typical XY calibration

1. Press **Maintenance.**
2. Press **Machine.**
3. Press **Tip.**
4. Press **Calibrate XY.**
5. Press **Start Part.** The printer will automatically build a XY Calibration part. (Build time is approximately 10 minutes).
6. When the XY Calibration part is complete the printer will display **Remove Part and Select XY Adjustment - X:0, Y:0**
7. Remove the XY Tip Calibration part from the printer.
8. Inspect the part and calibrate the X and Y axes as follows. See Figure 5-279.
   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. Once you have entered the X offset value, **Select Y** and repeat the procedure for Y Offset value.
9. Select **Done** after you have input the X and Y tip offsets. The printer will return to **Maintenance**.
10. Repeat steps 1-9 to verify proper calibration.

Figure 5-279: Example XY Tip Offset Part.
This example requires an adjustment of X = + 2 mils, Y = - 4 mils



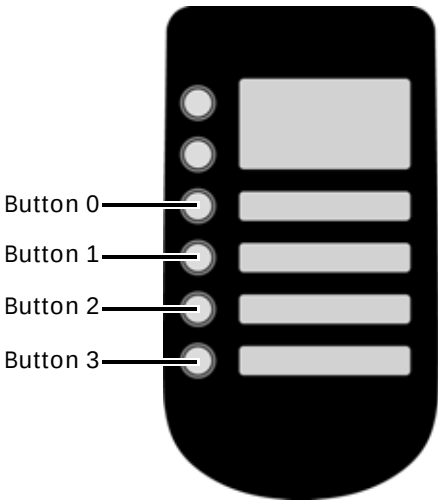
Note: Unusual circumstances may require that the XY tip calibration values be entered manually. To change these values, see Entering XY Tip Calibration values manually (Firmware version 9.1 or newer) on page 5-6.

Entering XY Tip Calibration values manually (Firmware version 9.1 or newer)

XY Tip is the XY distance from model tip to the support tip. To move support roads to the right (+X), apply a positive offset. To move support roads to the back (+Y), apply a positive offset. If the calibration model is too far off to read, these values may be set to default as a starting point for calibration. The default values are X: 0.780" and Y: 0.000".

1. While the printer is at **Idle**, enter standby mode by pressing the **Standby...** button.
2. Enter the Service Calibration menu by pressing the following button sequence on the display panel: **3,2,3,3,1**. See Figure 5-280.

Figure 5-280: Service Calibration button sequence



3. Press the **Edit Configuration** button.
4. Press the **Next...** button.
5. Press the **Next...** button.
6. Press the **XTIP** (X tip offset) button.
7. Enter the calibration value by pressing the **Increment**, **Decrement** and **Next Digit** buttons.

Note: The value for XTIP must be between 0.7300" and 0.8300". For example, the value from Figure 5-279 is + 2, you would increment the current value by +0.002".

8. When finished, press **Done...**
9. Press the **YTIP** (Y tip offset) button.
10. Enter the calibration value by pressing the **Increment**, **Decrement** and **Next Digit** buttons.

Note: The value for YTIP must be between -0.0500" and 0.0500". For example, the value from Figure 5-279 is - 4, you would decrement the current value by -0.004".

11. When finished, press **Done...**
12. Press the **Next...** button until you reach the last page.
13. Press the **Done...** button.
14. Press the **Save and reboot** button.
15. The printer will reboot and return to idle.

16. Perform automatic XY tip calibration, see XY Tip Calibration on page 5-5.

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. These measurements are then entered using MaracaEX.

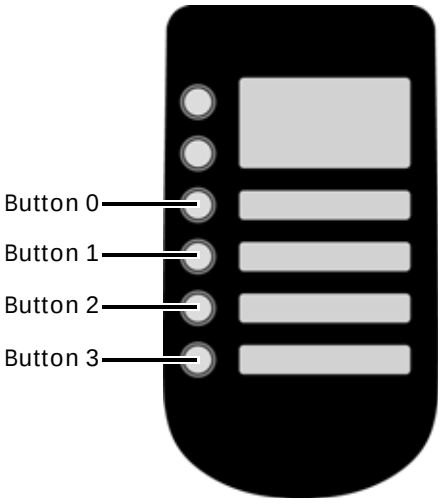
When to Perform Part Based calibration

Part Based calibration needs to be performed after replacing the XY table assembly. Part Based calibration is performed to eliminate any skewing in the X and Y axes.

Performing part based calibration for uPrint, uPrint SE, uPrint Plus and uPrint SE Plus from the Service Calibration menu (Firmware version 9.1 or newer)

1. While the printer is at **Idle**, enter standby mode by pressing the **Standby...** button.
2. Enter the Service Calibration menu by pressing the following button sequence on the display panel: **3,2,3,3,1**. See Figure 5-281.

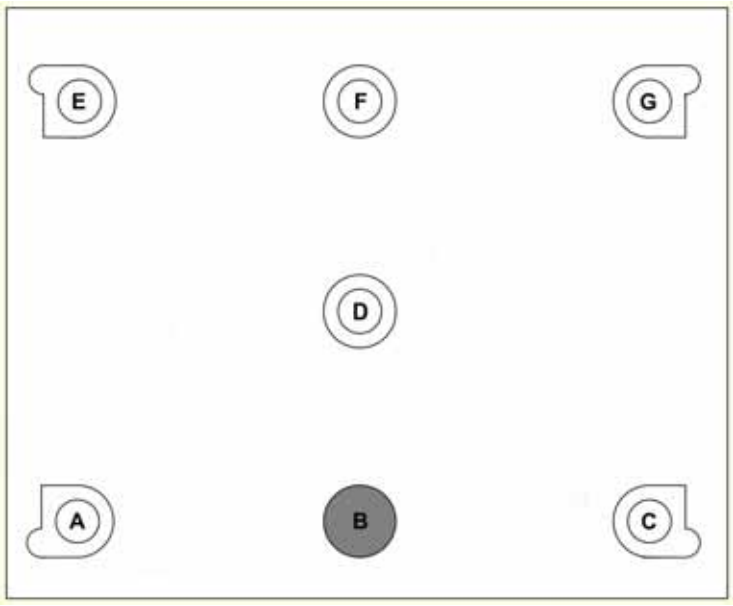
Figure 5-281: Service Calibration button sequence



3. Press the **Reset Part Based Calibration** button.
4. The printer will ask “Do you want to zero settings and reboot?” Press **Yes**.
5. Reboot the printer.
6. Once the system displays Idle, press **Maintenance>System>Test Parts** then **select** the **test_XY_cal** part.
7. When part is completed, remove from printer and let cool for five minutes.

8. Locate the filled circle, this indicates the front of the substrate, see Figure 5-282.

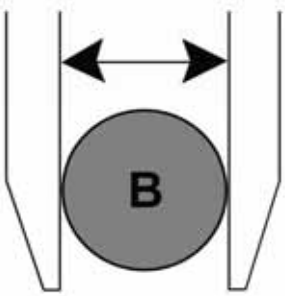
Figure 5-282: Locating the Filled Circle (B)



9. Using a digital caliper, measure and record the diameter of circle B along the center line between A and C, see Figure 5-283.

Note: Reference letters are not actually "printed" on the part. If needed, use the Part Measurement Equations sheet to record the values. See Part Measurement Equations on page 5-21.

Figure 5-283: Measuring diameter of B



10. Next measure and record the distance from the outside edges of circle A and B, see Figure 5-284. Ensure that the caliper is *not* seated on the small bump of circle A.

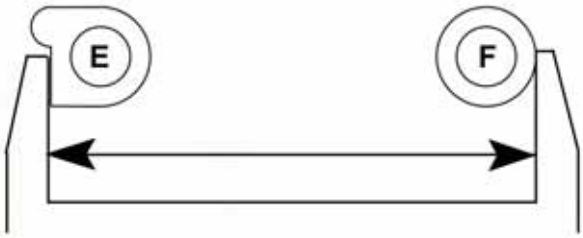
Figure 5-284: Measuring distance from outside edges of A and B

11. Next measure and record the distance from the outside edges of circle B and C, see Figure 5-285. Ensure that the caliper is not seated on the small bump of circle C.

Figure 5-285: Measuring distance from outside edges of B and C

12. Add the lengths derived from steps 10 and 11 (A-B and B-C) and then subtract the width of circle B. Record this total as "GFront"
13. Measure and record the distance from the outside edges of circles E and F. Ensure the caliper is not seated on the small bump of circle E. See Figure 5-286.

Figure 5-286: Measuring distances from outside edges of E and F

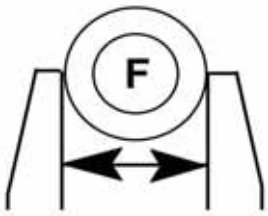


14. Measure and record the distance from the outside edges of circles F and G. Ensure the caliper is not seated on the small bump of circle G. See Figure 5-287.

Figure 5-287: Measuring distances from outside edges of F and G

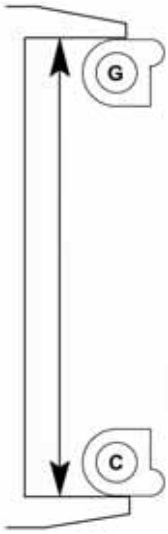
15. Measure and record the diameter of circle F along the center line between E and G. See Figure 5-288.

Figure 5-288: Measuring diameter of circle F



16. Add the lengths derived from steps 14 and 15 (E-F and F-G) and then subtract the width of circle F derived from step 16. Record this total as “GRear”
17. Measure and record the distance from the outside edges of circles C and G. Ensure the caliper is not seated on the small bump of circles C or G. Record this total as “GRight”, see Figure 5-289.

Figure 5-289: Measuring distances from outside edges of C and G

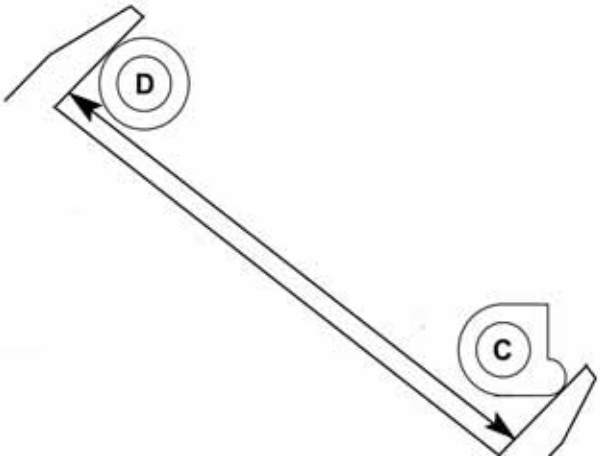


18. Measure and record the distance from the outside edges of circles A and E. Ensure the caliper is not seated on the small bump of circles A or E. Record this total as “GLeft”, see Figure 5-290.

Figure 5-290: Measuring distances from outside edges of A and E

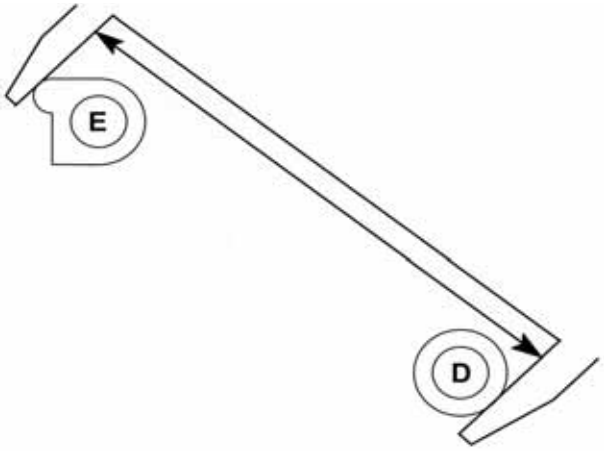
19. Measure and record the distance from the outside edge of the small bump on circle C to the outside edge of circle D. See Figure 5-291.

Figure 5-291: Measuring distances from outside edges of C and D



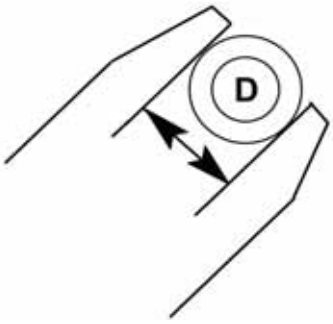
20. Measure and record the distance from the outside edge of the small bump on circle E to the outside edge of circle D. See Figure 5-292.

Figure 5-292: Measuring distances from outside edges of D and E



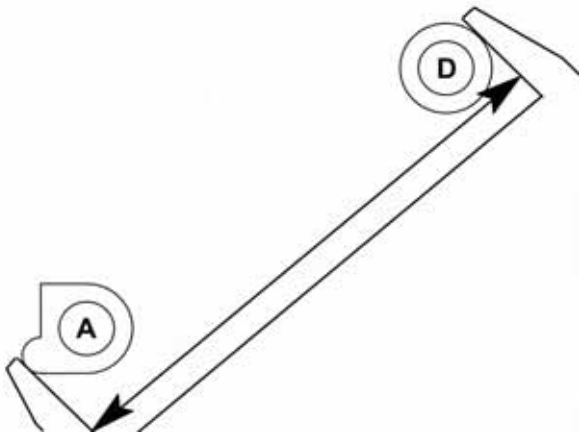
21. Measure and record the diameter of circle D along the center line between C and E. See Figure 5-293.

Figure 5-293: Measuring diameter of circle D



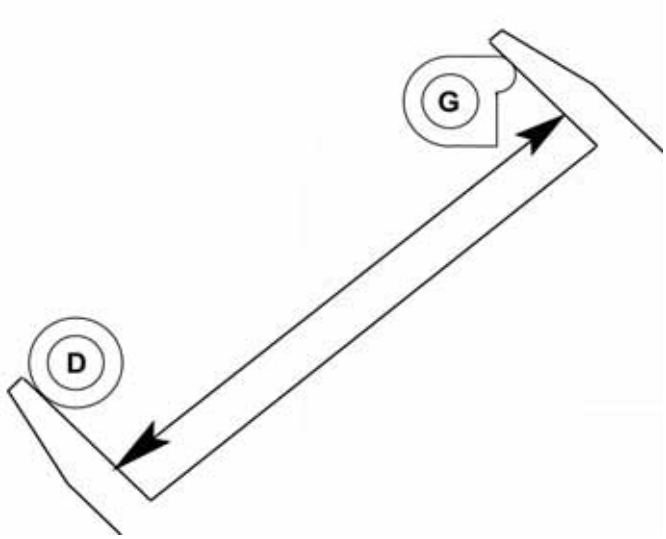
22. Add the lengths derived from steps 19 and 20 (C-D and D-E) and then subtract the width of circle D derived from step 21. Record this total as "GLR"
23. Measure and record the distance from the outside edge of the small bump on circle A to the outside edge of circle D. See Figure 5-294.

Figure 5-294: Measuring distances from outside edges of A and D



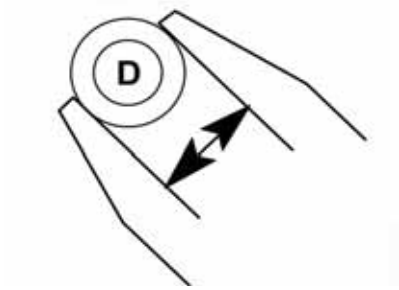
24. Measure and record the distance from the outside edge of the small bump on circle G to the outside edge of circle D. See Figure 5-295.

Figure 5-295: Measuring distances from outside edges of D and G



25. Measure and record the diameter of circle D along the center line between A and G. See Figure 5-296.

Figure 5-296: Measuring diameter of circle D



26. Add the lengths derived from steps 24 and 25 (A-D and D-G) and then subtract the width of circle D derived from step 26. Record this total as "GLF"
27. Enter the Service Calibration menu by pressing the following button sequence on the display panel: **3,2,3,3,1**. See Figure 5-281.
28. Press the **Edit Configuration** button.
29. Press the **GLeft** button. Enter the value recorded from step 18 by pressing the **Increment**, **Decrement** and **Next Digit** buttons.
30. When finished, press **Done...**

Note: The value for GLeft must be between 5.250 and 5.750, the **Done...** button will not appear until the value is within the acceptable range.

31. Press the **GRight** button. Enter the value recorded from step 17 by pressing the **Increment**, **Decrement** and **Next Digit** buttons.
32. When finished, press **Done...**

Note: The value for GRight must be between 5.250 and 5.750, the **Done...** button will not appear until the value is within the acceptable range.

33. Press the **GFront** button. Enter the value recorded from step 12 by pressing the **Increment**, **Decrement** and **Next Digit** buttons.
34. When finished, press **Done...**

Note: The value for GFront must be between 7.250 and 7.750, the **Done...** button will not appear until the value is within the acceptable range.

35. Press the **Next...** button.
36. Press the **GRear** button. Enter the value recorded from step 16 by pressing the **Increment**, **Decrement** and **Next Digit** buttons.
37. When finished, press **Done...**

Note: The value for GRear must be between 7.250 and 7.750, the **Done...** button will not appear until the value is within the acceptable range.

38. Press the **GLF** button. Enter the value recorded from step 26 by pressing the **Increment**, **Decrement** and **Next Digit** buttons.
39. When finished, press **Done...**

Note: The value for GLF must be between 9.051 and 9.551, the **Done...** button will not appear until the value is within the acceptable range.

40. Press the **GLR** button. Enter the value recorded from step 22 by pressing the **Increment**, **Decrement** and **Next Digit** buttons.
41. When finished, press **Done...**

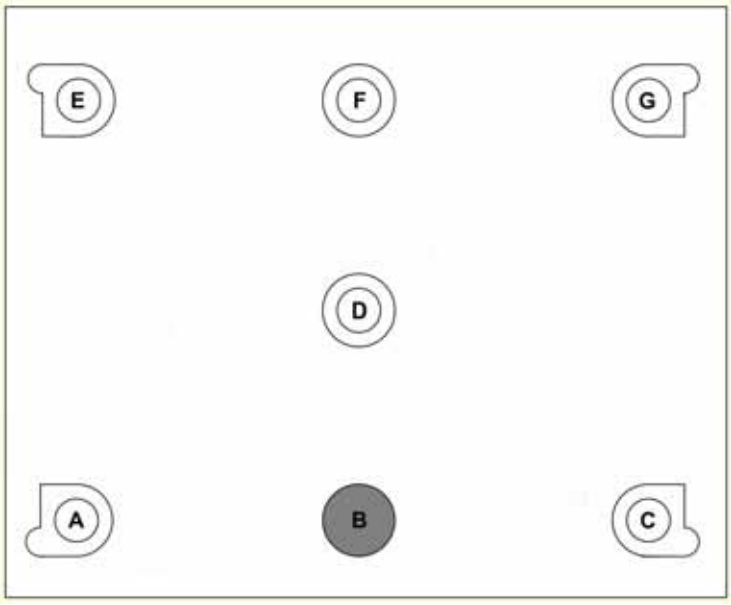
Note: The value for GLR must be between 9.051 and 9.551, the **Done...** button will not appear until the value is within the acceptable range.

42. Press the **Next...** button until you reach the last page.
43. Press the **Done...** button.
44. Press the **Save and reboot** button.
45. The printer will reboot and return to idle.
46. Build a sample part to verify proper operation.

Performing part based calibration for uPrint and uPrint SE with MaracaEX

1. Open MaracaEX and select the current modeler from the pull down menu.
2. Open **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 to save the values.
6. Toggle the system power down switch.
7. Once the system displays Idle, press **Maintenance>System>Test Parts** then **select** the **test_XY_cal** part.
8. When part is completed, remove from printer and let cool for five minutes.
9. Locate the filled circle, this indicates the front of the substrate, see Figure 5-297.

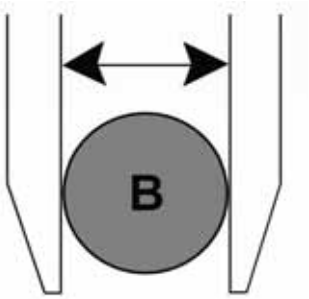
Figure 5-297: Locating the Filled Circle (B)



10. Using a digital caliper, measure and record the diameter of circle B along the center line between A and C, see Figure 5-298.

Note: Reference letters are not actually "printed" on the part. If needed, use the Part Measurement Equations sheet to record the values. See Part Measurement Equations on page 5-21.

Figure 5-298: Measuring diameter of B



11. Next measure and record the distance from the outside edges of circle A and B, see Figure 5-299. Ensure that the caliper is *not* seated on the small bump of circle A.

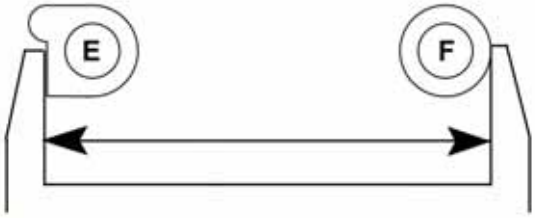
Figure 5-299: Measuring distance from outside edges of A and B

12. Next measure and record the distance from the outside edges of circle B and C, see Figure 5-300. Ensure that the caliper is not seated on the small bump of circle C.

Figure 5-300: Measuring distance from outside edges of B and C

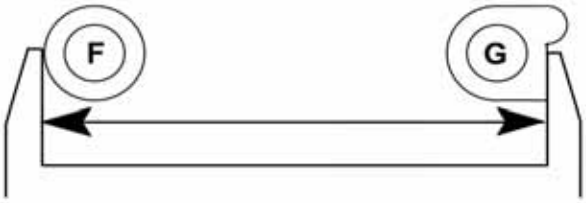
13. Add the lengths derived from steps 11 and 12 (A-B and B-C) and then subtract the width of circle B. Record this total as "Front"
14. Measure and record the distance from the outside edges of circles E and F. Ensure the caliper is not seated on the small bump of circle E. See Figure 5-301.

Figure 5-301: Measuring distances from outside edges of E and F



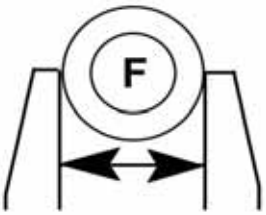
15. Measure and record the distance from the outside edges of circles F and G. Ensure the caliper is not seated on the small bump of circle G. See Figure 5-302.

Figure 5-302: Measuring distances from outside edges of F and G



16. Measure and record the diameter of circle F along the center line between E and G. See Figure 5-303.

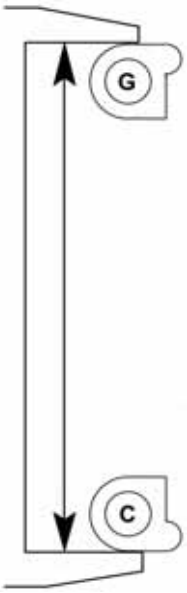
Figure 5-303: Measuring diameter of circle F



17. Add the lengths derived from steps 14 and 15 (E-F and F-G) and then subtract the width of circle F derived from step 16. Record this total as "Rear"
18. Measure and record the distance from the outside edges of circles C and G. Ensure the caliper is not seated on the small bump of circles C or G. Record this total as "Right", see

Figure 5-304.

Figure 5-304: Measuring distances from outside edges of C and G

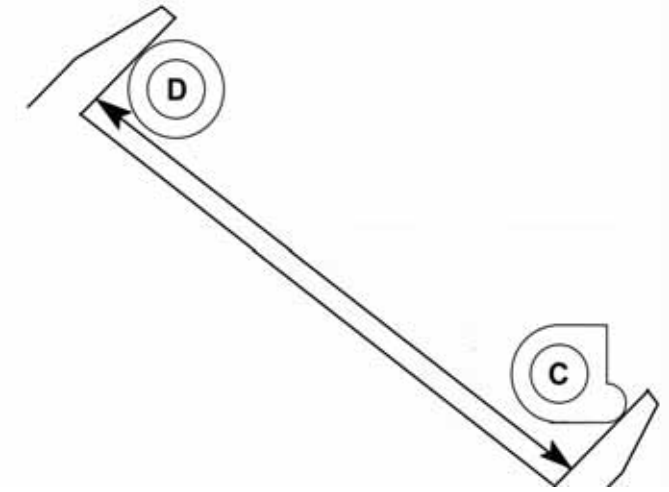


19. Measure and record the distance from the outside edges of circles A and E. Ensure the caliper is not seated on the small bump of circles A or E. Record this total as “Left”, see Figure 5-305.

Figure 5-305: Measuring distances from outside edges of A and E

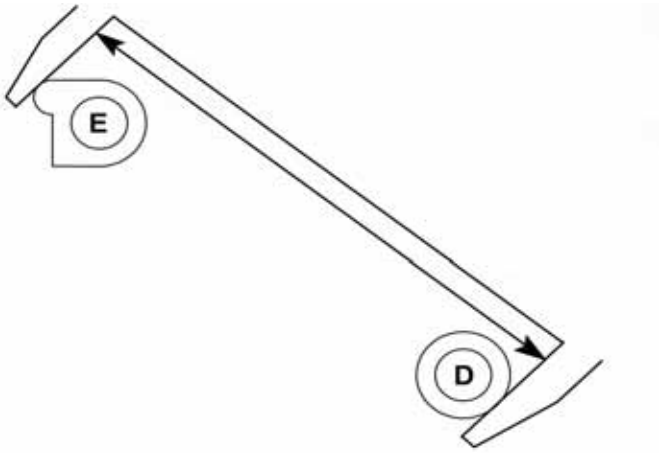
20. Measure and record the distance from the outside edge of the small bump on circle C to the outside edge of circle D. See Figure 5-306.

Figure 5-306: Measuring distances from outside edges of C and D



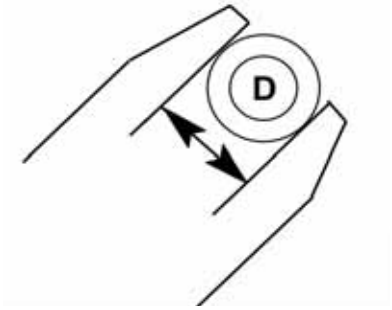
21. Measure and record the distance from the outside edge of the small bump on circle E to the outside edge of circle D. See Figure 5-307.

Figure 5-307: Measuring distances from outside edges of D and E



22. Measure and record the diameter of circle D along the center line between C and E. See Figure 5-308.

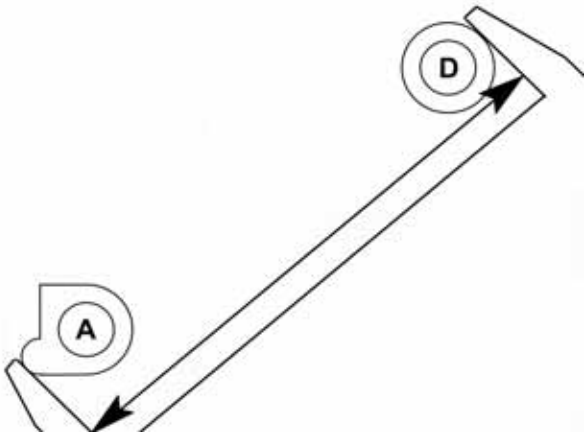
Figure 5-308: Measuring diameter of circle D



23. Add the lengths derived from steps 20 and 21 (C-D and D-E) and then subtract the width of circle D derived from step 22. Record this total as “Left Rear”

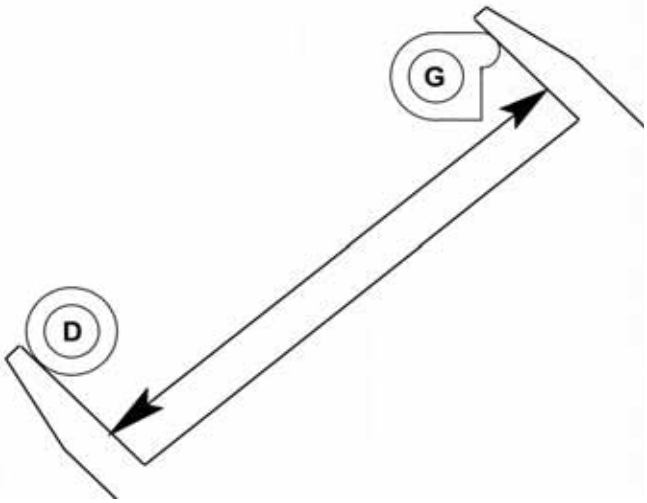
24. Measure and record the distance from the outside edge of the small bump on circle A to the outside edge of circle D. See Figure 5-309.

Figure 5-309: Measuring distances from outside edges of A and D



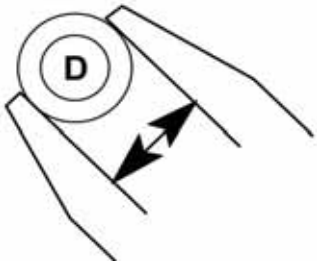
25. Measure and record the distance from the outside edge of the small bump on circle G to the outside edge of circle D. See Figure 5-310.

Figure 5-310: Measuring distances from outside edges of D and G



26. Measure and record the diameter of circle D along the center line between A and G. See Figure 5-311.

Figure 5-311: Measuring diameter of circle D



27. Add the lengths derived from steps 24 and 25 (A-D and D-G) and then subtract the width of circle D derived from step 26. Record this total as “Left Front”
28. Open MaracaEX and select the Current Modeler from the pull down menu.
29. Open the **Open Gantry Calibration** Dialog box in MaracaEX.
30. 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.
31. Once the values have been entered, click on the green check mark.
32. Toggle the system power switch to accept the new values.
33. Run a test part to verify system is operating correctly.

Part Measurement Equations

Use the equation table below to record part measurements. Refer to these equations when entering values in MaracaEX.

Front: _____ + _____ - ____ = _____
(A + B) + (B + C) - B

Right: _____ = _____
(C + G)

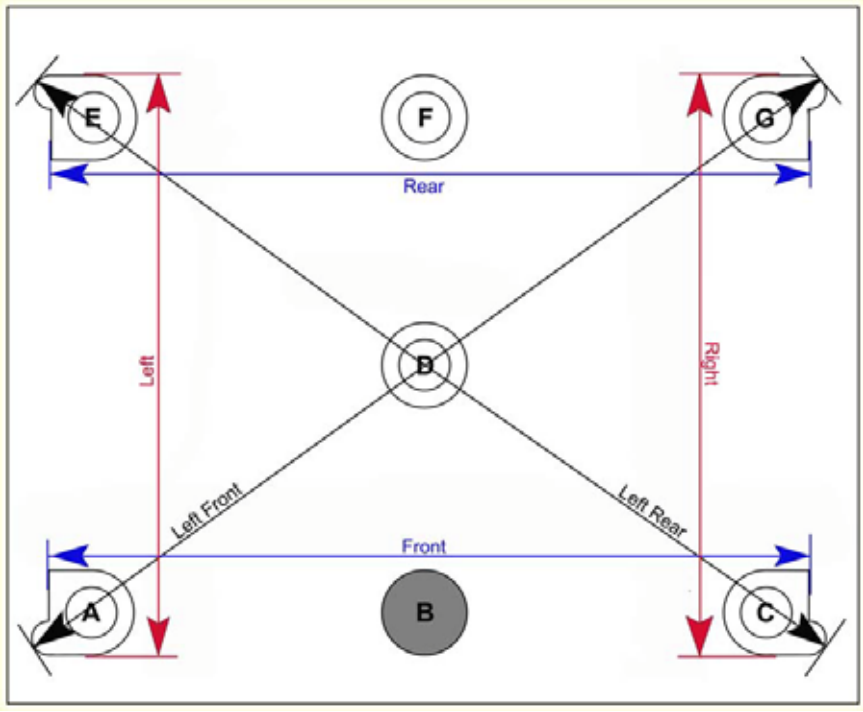
Left: _____ = _____
(A + E)

Rear: _____ + _____ - ____ = _____
(E+ F) + (F + G) - F

Left Rear: _____ + _____ - ____ = _____
(C + D) + (D + E) - D

Left Front: _____ + _____ - ____ = _____
(A + D) + (D + G) - D

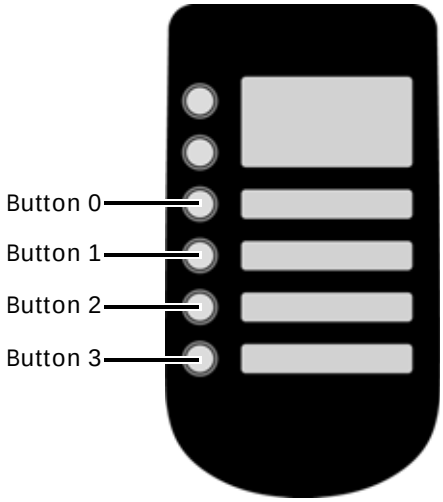
Figure 5-312: Part based calibration measurement locations



Performing part based calibration for uPrint Plus and uPrint SE Plus from the Service Calibration menu

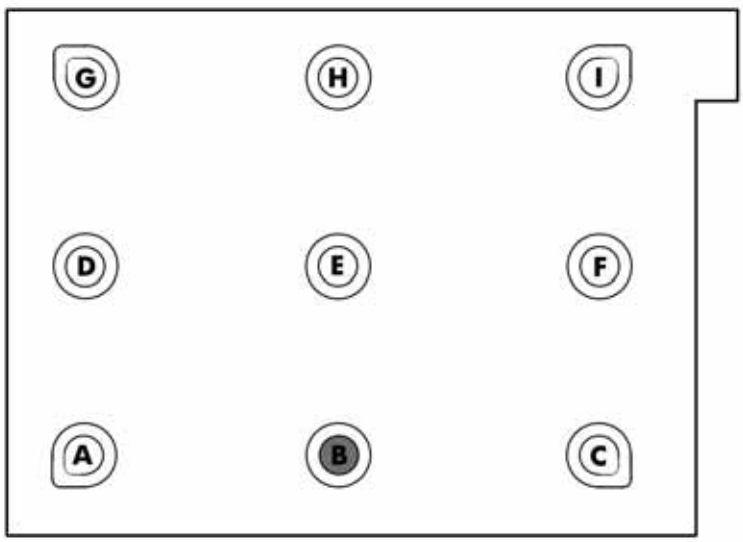
1. While the printer is at **Idle**, enter standby mode by pressing the **Standby...** button.
2. Enter the Service Calibration menu by pressing the following button sequence on the display panel: **3,2,3,3,1**. See Figure 5-313.

Figure 5-313: Service Calibration button sequence



3. Press the **Reset Part Based Calibration** button.
4. The printer will ask "Do you want to zero settings and reboot?" Press **Yes**.
5. Reboot the printer.
6. Once the system displays Idle, press **Maintenance>System>Test Parts** then **select** the **test_XY_cal** part.
7. When part is completed, remove from printer and let cool for five minutes.
8. Locate the filled circle, this indicates the front of the substrate, see Figure 5-314.

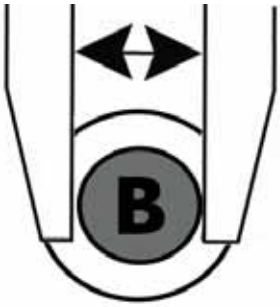
Figure 5-314: Locating the Filled Circle (B)



9. Using a digital caliper, measure and record the diameter of circle B along the center line between A and C. See Figure 5-315.

Note: Reference letters are not actually "printed" on the part. If needed, use the Part Measurement Equations sheet to record the values. See Part Measurement Equations on page 5-36.

Figure 5-315: Measuring diameter of B



10. Next measure and record the distance from the outside edges of circle A and B, see Figure 5-316. Ensure that the caliper is *not* seated on the small bump of circle A.

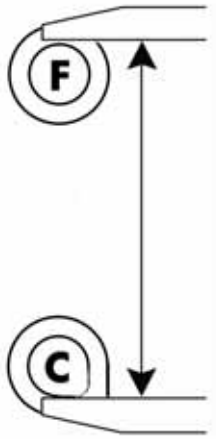
Figure 5-316: Measuring distance from outside edges of A and B

11. Next measure and record the distance from the outside edges of circle B and C, see Figure 5-317. Ensure that the caliper is not seated on the small bump of circle C.

Figure 5-317: Measuring distance from outside edges of B and C

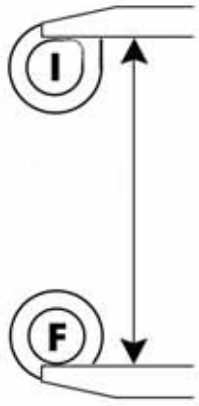
12. Add the lengths derived from steps 9 and 10 (A-B and B-C) and then subtract the width of circle B. Record this total as "GFront"
13. Measure and record the distance from the outside edges of circles E and F. Ensure the caliper is not seated on the small bump of circle E. See Figure 5-318.

Figure 5-318: Measuring distances from outside edges of C and F



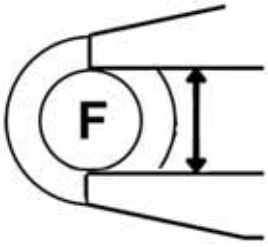
14. Measure and record the distance from the outside edges of circles F and I. See Figure 5-319.

Figure 5-319: Measuring distances from outside edges of F and G



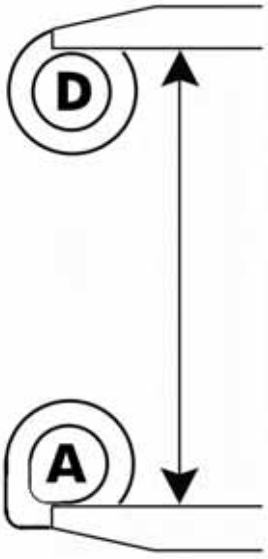
15. Measure and record the diameter of circle F along the center line between C and I. See Figure 5-320.

Figure 5-320: Measuring diameter of circle F



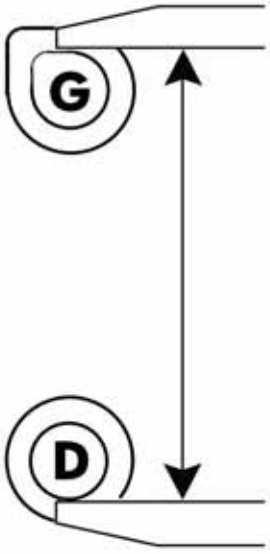
16. Add the lengths derived from steps 13 and 14 (C-F and F-I) and then subtract the width of circle F derived from step 15. Record this total as “GRight”
17. Measure and record the distance from the outside edges of circles A and D. See Figure 5-321.

Figure 5-321: Measuring distances from outside edges of A and D



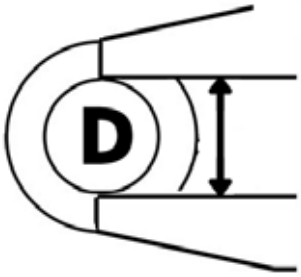
18. Measure and record the distance from the outside edges of circles D and G. See Figure 5-322.

Figure 5-322: Measuring distances from outside edges of D and G



19. Measure and record the diameter of circle D along the center line between A and G. See Figure 5-323.

Figure 5-323: Measuring diameter of circle D



20. Add the lengths derived from steps 17 and 18 (A-D and D-G) and then subtract the width of circle D derived from step 19. Record this total as "GLeft"
21. Measure and record the distance from the outside edge of circle G to the outside edge of circle H. See Figure 5-324.

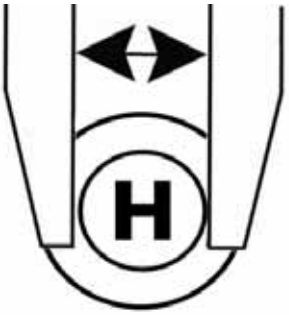
Figure 5-324: Measuring distances from outside edges of G and H

22. Measure and record the distance from the outside edge of circle H to the outside edge of circle I. See Figure 5-325.

Figure 5-325: Measuring distances from outside edges of H and I

23. Measure and record the diameter of circle H along the center line between G and I. See Figure 5-326.

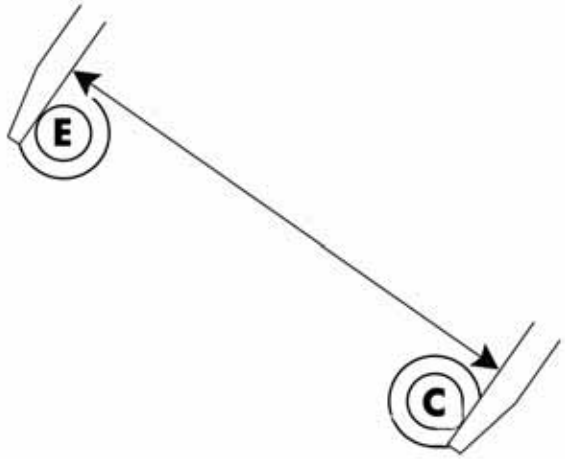
Figure 5-326: Measuring diameter of circle H



24. Add the lengths derived from steps 21 and 22 (G-H and H-I) and then subtract the width of circle H derived from step 23. Record this total as "GRear"

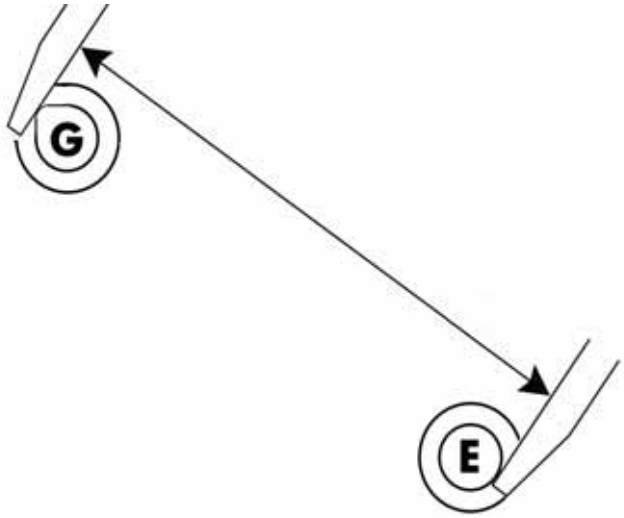
25. Measure and record the distance from the outside edge of circle C to the outside edge of circle E. See Figure 5-327.

Figure 5-327: Measuring distances from outside edges of C and E



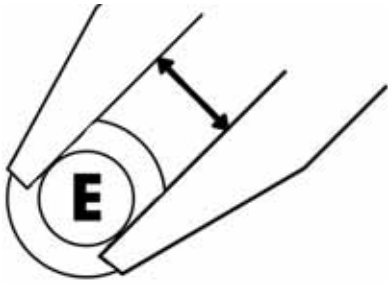
26. Measure and record the distance from the outside edge of circle E to the outside edge of circle G. See Figure 5-328.

Figure 5-328: Measuring distances from outside edges of E and G



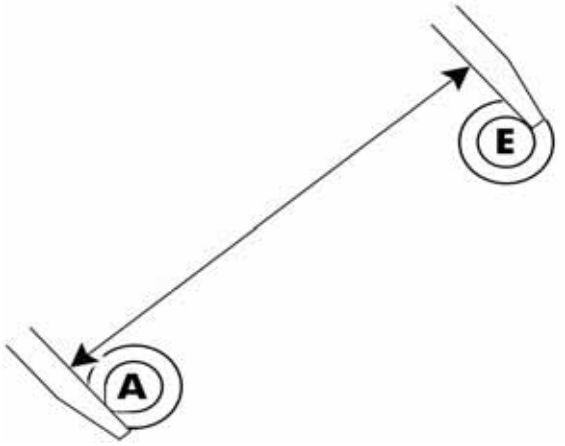
27. Measure and record the diameter of circle E along the center line between C and G. See Figure 5-329.

Figure 5-329: Measuring diameter of circle E



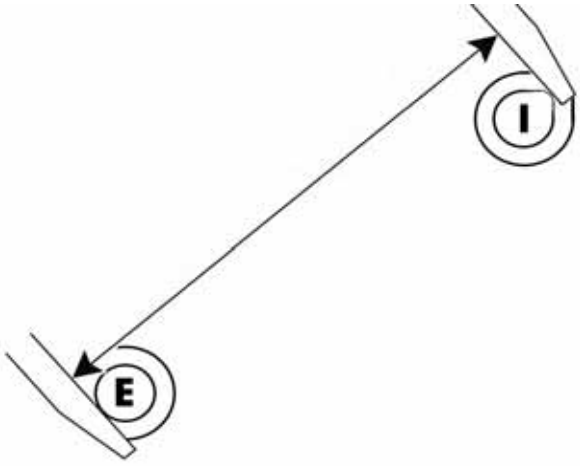
28. Add the lengths derived from steps 25 and 26 (C-E and E-G) and then subtract the width of circle E derived from step 27. Record this total as “GLR”
29. Measure and record the distance from the outside edge of circle A to the outside edge of circle E. See Figure 5-330.

Figure 5-330: Measuring distances from outside edges of A and E



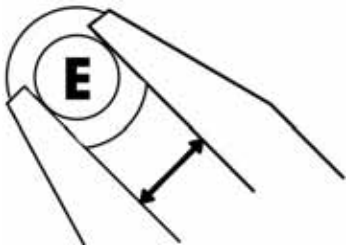
30. Measure and record the distance from the outside edge of circle E to the outside edge of circle I. See Figure 5-331.

Figure 5-331: Measuring distances from outside edges of E and I



31. Measure and record the diameter of circle E along the center line between A and I. See Figure 5-332.

Figure 5-332: Measuring diameter of circle E



32. Add the lengths derived from steps 29 and 30 (A-E and E-I) and then subtract the width of circle E derived from step 31. Record this total as “GLF”
33. Enter the Service Calibration menu by pressing the following button sequence on the display panel: **3,2,3,3,1**. See Figure 5-313.
34. Press the **Edit Configuration** button.
35. Press the **GLeft** button. Enter the value recorded from step 18 by pressing the **Increment**, **Decrement** and **Next Digit** buttons.
36. When finished, press **Done...**

Note: The value for GLeft must be between 5.250 and 5.750, the **Done...** button will not appear until the value is within the acceptable range.

37. Press the **GRight** button. Enter the value recorded from step 17 by pressing the **Increment**, **Decrement** and **Next Digit** buttons.
38. When finished, press **Done...**

Note: The value for GRight must be between 5.250 and 5.750, the **Done...** button will not appear until the value is within the acceptable range.

39. Press the **GFront** button. Enter the value recorded from step 12 by pressing the **Increment**, **Decrement** and **Next Digit** buttons.
40. When finished, press **Done...**

Note: The value for GFront must be between 7.250 and 7.750, the **Done...** button will not appear until the value is within the acceptable range.

41. Press the **Next...** button.
42. Press the **GRear** button. Enter the value recorded from step 16 by pressing the **Increment**, **Decrement** and **Next Digit** buttons.
43. When finished, press **Done...**

Note: The value for GRear must be between 7.250 and 7.750, the **Done...** button will not appear until the value is within the acceptable range.

44. Press the **GLF** button. Enter the value recorded from step 26 by pressing the **Increment**, **Decrement** and **Next Digit** buttons.
45. When finished, press **Done...**

Note: The value for GLF must be between 10.357 and 10.857, the **Done...** button will not appear until the value is within the acceptable range.

46. Press the **GLR** button. Enter the value recorded from step 22 by pressing the **Increment**, **Decrement** and **Next Digit** buttons.
47. When finished, press **Done...**

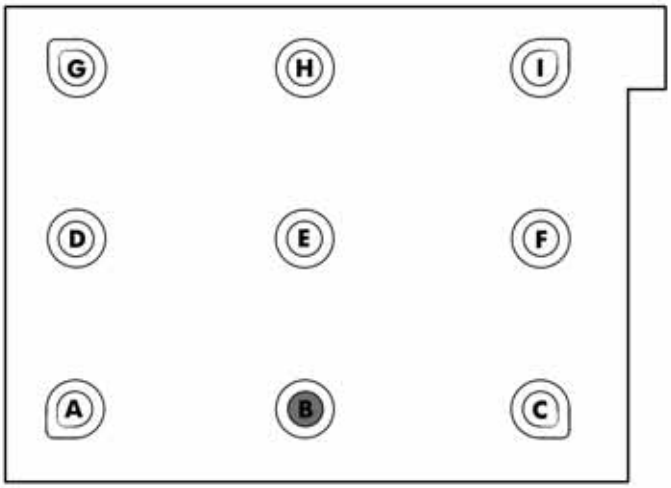
Note: The value for GLR must be between 10.357 and 10.857, the **Done...** button will not appear until the value is within the acceptable range.

48. Press the **Next...** button until you reach the last page.
49. Press the **Done...** button.
50. Press the **Save and reboot** button.
51. The printer will reboot and return to idle.
52. Build a sample part to verify proper operation.

Performing part based calibration for uPrint Plus and uPrint SE Plus with MaracaEX

1. Open MaracaEX and select the current modeler from the pull down menu.
2. Open **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 to save the values.
6. Toggle the system power down switch.
7. Once the system displays Idle, press **Maintenance>System>Test Parts** then **select** the **test_XY_cal** part.
8. When part is completed, remove from printer and let cool for five minutes.
9. Locate the filled circle, this indicates the front of the substrate, see Figure 5-333.

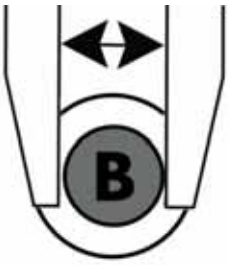
Figure 5-333: Locating the Filled Circle (B)



10. Using a digital caliper, measure and record the diameter of circle B along the center line between A and C, see Figure 5-334.

Note: Reference letters are not actually "printed" on the part. If needed, use the Part Measurement Equations sheet to record the values. See Part Measurement Equations on page 5-36.

Figure 5-334: Measuring diameter of B



11. Next measure and record the distance from the outside edges of circle A and B, see Figure 5-335.

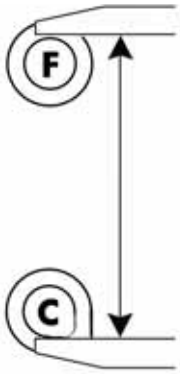
Figure 5-335: Measuring distance from outside edges of A and B

12. Next measure and record the distance from the outside edges of circle B and C, see Figure 5-336.

Figure 5-336: Measuring distance from outside edges of B and C

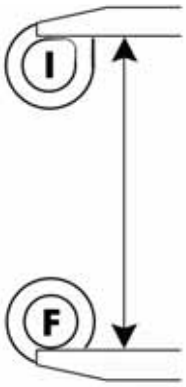
13. Add the lengths derived from steps 11 and 12 (A-B and B-C) and then subtract the width of circle B. Record this total as "Front"
14. Measure and record the distance from the outside edges of circles C and F. Ensure the caliper is not seated on the small bump of circle C. See Figure 5-337.

Figure 5-337: Measuring distances from outside edges of C and F



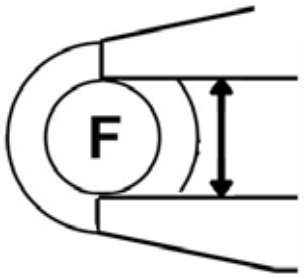
15. Measure and record the distance from the outside edges of circles F and I. See Figure 5-338.

Figure 5-338: Measuring distances from outside edges of F and I



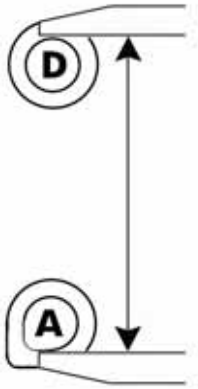
16. Measure and record the diameter of circle F along the center line between C and I. See Figure 5-339.

Figure 5-339: Measuring diameter of circle F



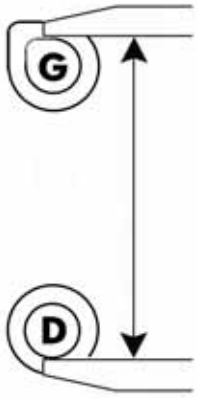
17. Add the lengths derived from steps 14 and 15 (C-F and F-I) and then subtract the width of circle F derived from step 16. Record this total as "Right"
18. Measure and record the distance from the outside edges of circles A and D. See Figure 5-340.

Figure 5-340: Measuring distances from outside edges of A and D



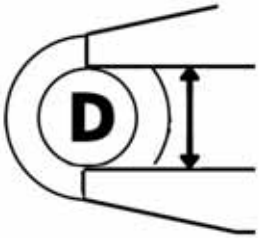
19. Measure and record the distance from the outside edges of circles D and G. See Figure 5-341.

Figure 5-341: Measuring distances from outside edges of D and G



20. Measure and record the diameter of circle D along the center line between A and G. See Figure 5-342.

Figure 5-342: Measuring diameter of circle D



21. Add the lengths derived from steps 18 and 19 (A-D and D-G) and then subtract the width of circle D derived from step 20. Record this total as "Left"
22. Measure and record the distance from the outside edge of circle G to the outside edge of circle H. See Figure 5-343.

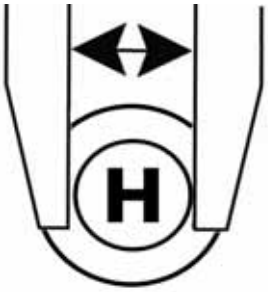
Figure 5-343: Measuring distances from outside edges of G and H

23. Measure and record the distance from the outside edge of circle H to the outside edge of circle I. See Figure 5-344.

Figure 5-344: Measuring distances from outside edges of H and I

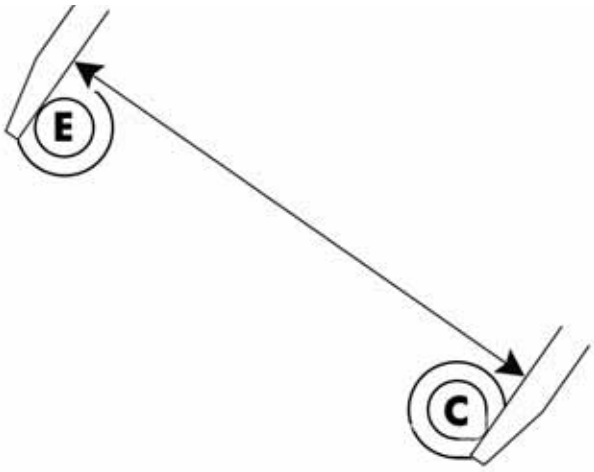
24. Measure and record the diameter of circle H along the center line between G and I. See Figure 5-345.

Figure 5-345: Measuring diameter of circle H



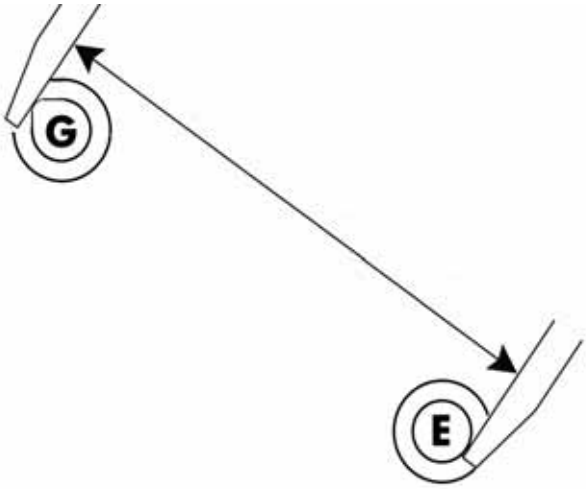
25. Add the lengths derived from steps 22 and 23 (G-H and H-I) and then subtract the width of circle H derived from step 24. Record this total as "Rear"
26. Measure and record the distance from the outside edge of circle C to the outside edge of circle E. See Figure 5-346.

Figure 5-346: Measuring distances from outside edges of C and E



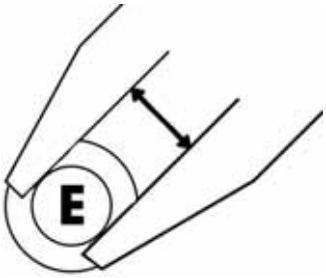
27. Measure and record the distance from the outside edge of circle E to the outside edge of circle G. See Figure 5-347.

Figure 5-347: Measuring distances from outside edges of E and G



28. Measure and record the diameter of circle E along the center line between C and G. See Figure 5-348.

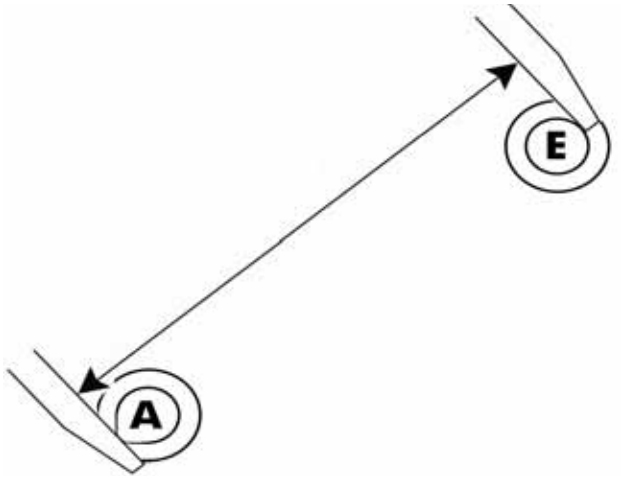
Figure 5-348: Measuring diameter of circle E



29. Add the lengths derived from steps 26 and 27 (C-E and E-G) and then subtract the width of circle E derived from step 28. Record this total as “Left Rear”

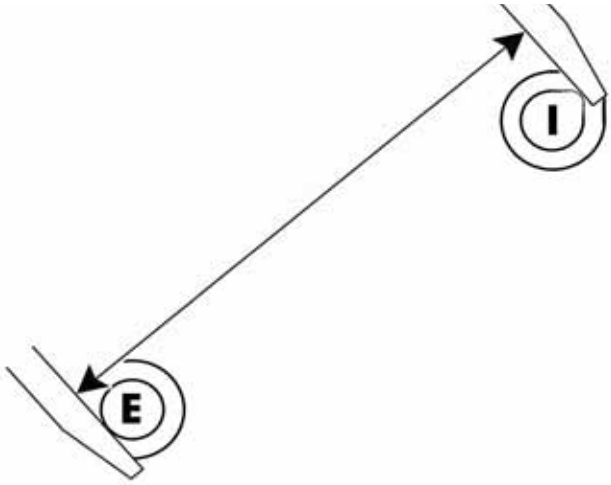
30. Measure and record the distance from the outside edge of circle A to the outside edge of circle E. See Figure 5-349.

Figure 5-349: Measuring distances from outside edges of A and E



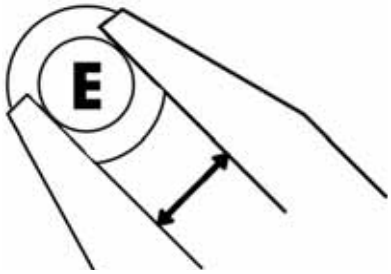
31. Measure and record the distance from the outside edge of circle E to the outside edge of circle I. See Figure 5-350.

Figure 5-350: Measuring distances from outside edges of E and I



32. Measure and record the diameter of circle E along the center line between A and I. See Figure 5-351.

Figure 5-351: Measuring diameter of circle E



33. Add the lengths derived from steps 30 and 31 (A-E and E-I) and then subtract the width of circle E derived from step 32. Record this total as “Left Front”
34. Open MaracaEX and select the Current Modeler from the pull down menu.
35. Open the **Open Gantry Calibration** Dialog box in MaracaEX.
36. 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.
37. Once the values have been entered, click on the green check mark.
38. Toggle the system power switch to accept the new values.
39. Run a test part to verify system is operating correctly.

Part Measurement Equations

Use the equation table 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

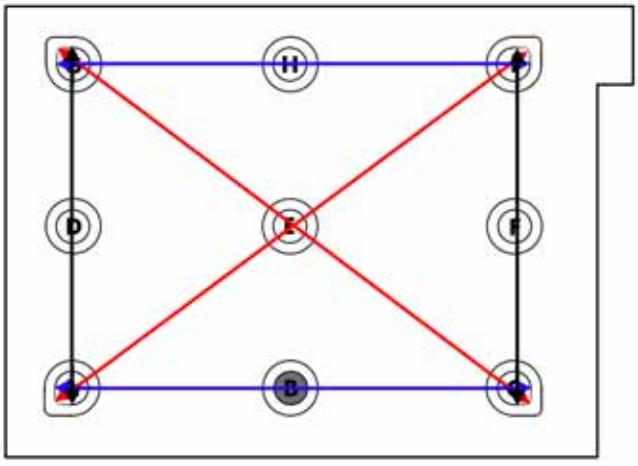
Left: _____ + _____ - ____ = _____
(A + D) + (D + G) - D

Rear: _____ + _____ - ____ = _____
(G + H) + (H + I) - H

Left Rear: _____ + _____ - ____ = _____
(C + E) + (E + G) - E

Left Front: _____ + _____ - ____ = _____
(A + E) + (E + I) - E

Figure 5-352: Part based calibration measurement locations



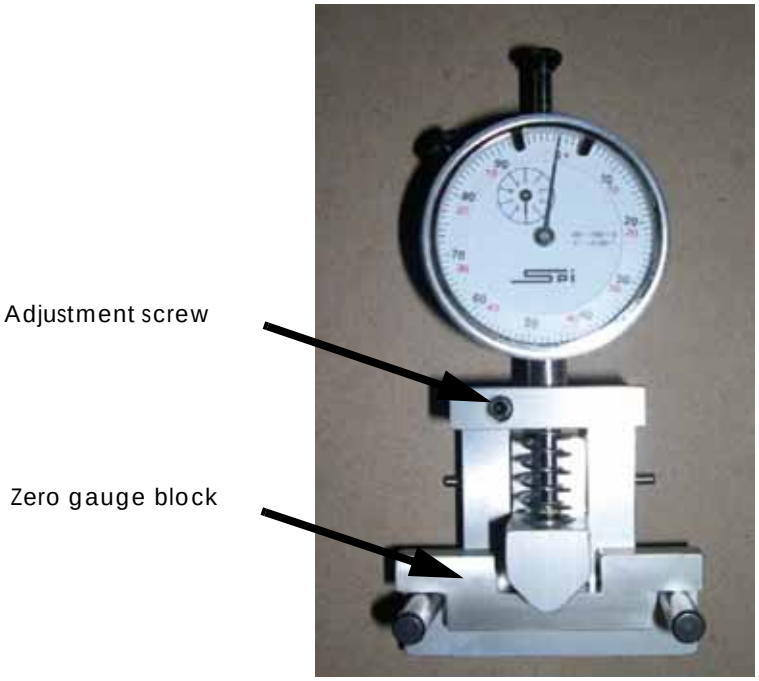
Tensioning the X & Y Drive Belts

Note: The X & Y Drive Belt Tension must be checked and adjusted with the system and belts at room temperature (approximately 20 minutes).

Zero the Dial Indicator

1. Insert the zero gauge block into the gauge. See Figure 5-353.
2. Loosen the adjustment screw and slide the dial indicator assembly up or down to set the 'zero' reading: The large hand should be on 0 and the small hand on 5.
3. Tighten the adjustment screw (do not over tighten the screw) and recheck the reading.
4. Remove the zero block gauge block from the fixture.

Figure 5-353: Tension gauge zero setting



Checking/Adjusting the X-Drive Belt Tension

1. Remove the top and side panels.
2. If required, allow system to cool to room temperature (approximately 20 minutes).
3. Move the Head Assembly to the full right travel position within the build envelope (as viewed from the front of the printer).
4. Position the dial indicator on the **rear** section of the X-Drive belt - centered between the Head Assembly and the left side of the build envelope. See Figure 5-354.

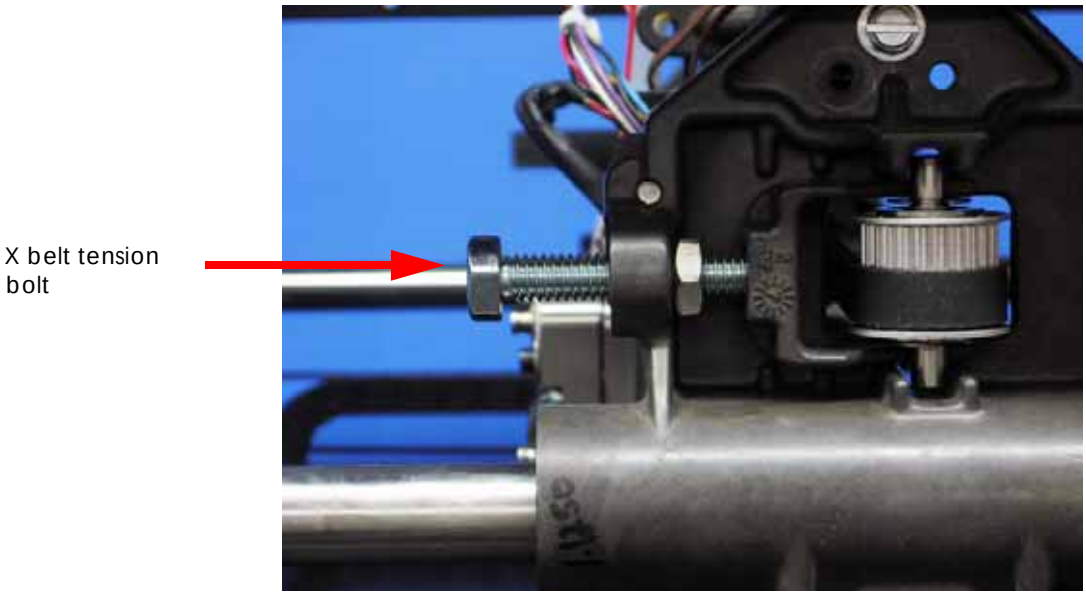
Figure 5-354: X belt tension location

5. Check the tension: See Figure 5-355.
   The large hand on the gauge should read between 25 and 35 mils, and the small hand should read between 4 and 5.

Figure 5-355: Gauge reading at correct X belt tension (Shading indicates acceptable range)

6. If the tension is out of the range specified above, adjust the belt tension by turning the X belt tensioning nut on the X-Drive Idler/Tension Adjust gear. See Figure 5-356.

Figure 5-356: X-Drive Belt Tension Adjustment



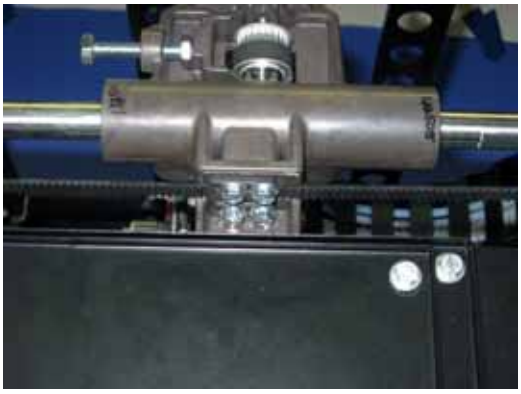
7. Remove the belt fixture and run the head back and forth several times.
8. Continue to adjust and check the tension until the tension meets specification.
9. Reinstall side and top panels.

Checking/Adjusting the Y-Drive Belt Tension

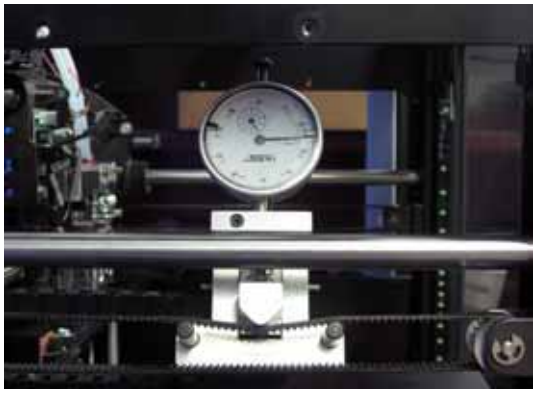
Note: The Y-Drive system consists of two drive belts - one on each side of the build envelope. Each belt must be checked, adjusted and of equal values.

1. Remove the top, side and side access panels.
2. If required, allow system to cool to room temperature (approximately 20 minutes).
3. Move the Head Assembly to full rear travel within the build envelope
4. Position the dial indicator on the top section of the Y-Drive belt at the center point of the belt. See Figure 5-357.

Figure 5-357: Y-Drive Belt Tension Check



Y-Drive Belt clamp (one on each side).

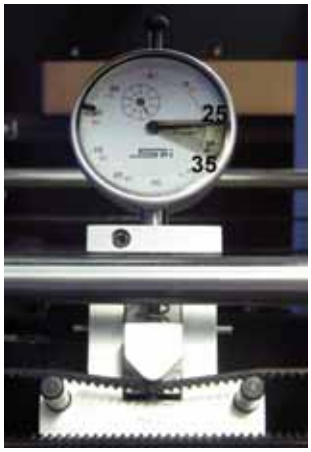


Dial Indicator position for Y-Drive belt tension check.

5. The large hand on the gauge should read between 0 and 30 mils and the small hand should read between 4 and 5. See Figure 5-358.

Figure 5-358: Gauge readings

Service Limit

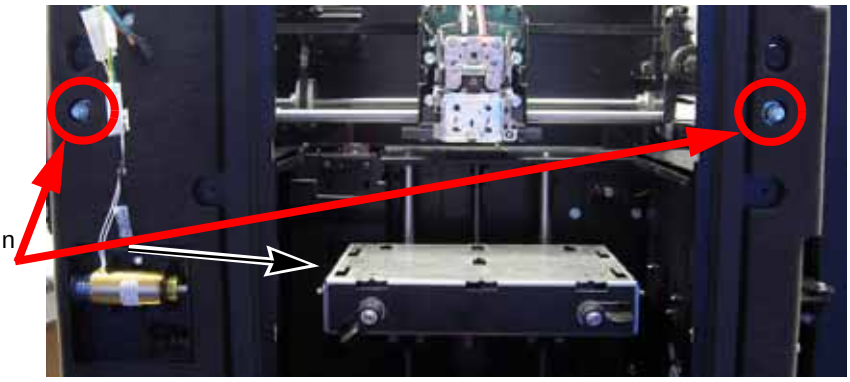


Adjustment Limit

6. If the tension is not within specification, remove the front panel to gain access to the tensioning nuts.
7. Next loosen, but do not remove, the 4 Y-Drive Belt clamp screws. Check that the belt is clear of the clamp before adjusting the tension. Note: There is one clamp per Y belt. See Figure 5-357.
8. Locate the Y belt tension adjustment nut on the front of the system. See Figure 5-359.
9. Adjust (increase/decrease) the tension by turning the tensioning nut so that the dial indicator reads between 25 and 35. See Figure 5-359.

Figure 5-359: Y drive belt tension adjustment

Y-Drive Belt Tension Adjusting Nut



10. Remove the belt fixture and move the head forward and back across the gantry several times.
11. Reattach the belt tension gauge and recheck the tension.
12. Continue to adjust and check the tension until the tension meets specification.
13. Tighten the 4 Y-Drive Belt clamp screws. (One clamp per Y belt).
14. Reinstall the top, front and side panels.

Get/Send Calibration Files

The .cal file contains the calibration values for the system. If the hard drive is replaced the .cal file must be downloaded for the system to function properly.

The "Get" button copies the .cal file from the system hard drive to the system calibration CD.

The "Send" button copies the .cal file from the system calibration CD to the system hard drive. The system CD is located in the electronics bay of the system.

Note: Do not use spaces in the .cal file name.

Note: Once the system is upgraded and anytime calibration changes are made the .cal file should be written ("Get") from the system hard drive to a new system CD. The new CD should then be stored in the electronics bay.

Parts and Tools Required

- MaracaEX
- Workstation
- System calibration CD
- Blank CD (if using the "get" command)

Get/Send calibration files

"Send" .cal file – from the system calibration CD to the printer

Note: This procedure would typically be used after installation of a new hard drive.

1. Remove the system calibration CD from the electronics bay and insert into the workstation CD drive.
2. Install and open MaracaEX. Ensure that communications has been established with the system.
3. Select "Send" and browse to the CD drive.
4. Select the xxx.cal (where xxx equals printer name) from the CD by double clicking on the file name.
5. To complete sending the file, click on the green check mark. This will write the file to the system hard drive.
6. Cycle power on the printer.
7. Replace the CD into the electronics bay.

"Get" .cal file – from the system hard drive to the calibration CD

Note: This would typically be used after changing calibration values or if the .cal file has not been stored on the CD.

1. Obtain a new blank CD for writing the .cal file to.
2. Remove the system calibration CD from the electronics bay and discard.
3. Insert a new blank CD into the workstation CD drive.
4. Install and open MaracaEX. Ensure that communication has been established with the system.
5. Select "Get" and browse to the CD drive.
6. Select "Save" and the file will be written to the CD.

Note: Spaces are not allowed in the printer name.

7. Place the new CD into the CD envelope in the electronics bay.

XY Table Leveling

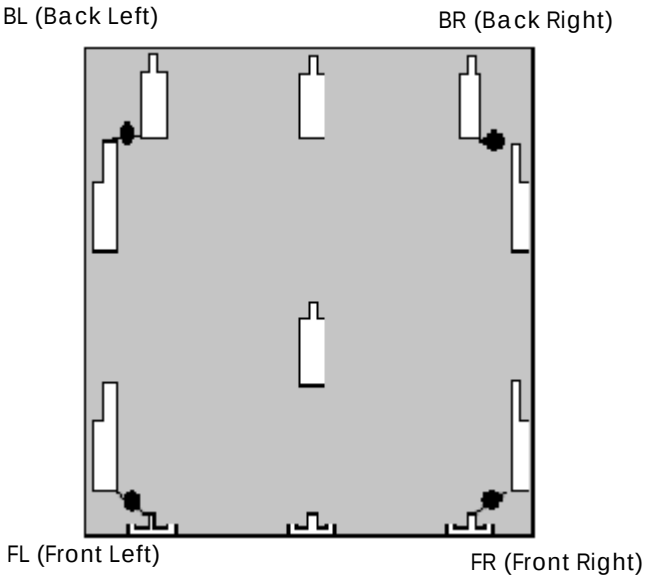
Parts and Tools Required

- MaracaEX CD
- *XY Level Calc.xls* (Excel) file
- Dial indicator
- Head bracket
- Basic tool set
- Table leveling adjustment tool

Checking the XY Table Level

1. Remove the substrate from the Z Stage table.
2. Mark a location on each corner of the platen surface with a marker, see Figure 5-360. These marks will be used to reference the same locations when leveling the table.

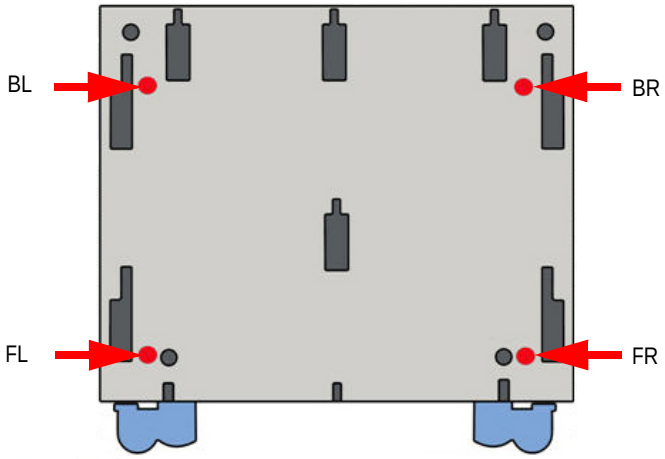
Figure 5-360: Z stage table location points



3. Attach a dial indicator to the head bracket.
4. Attached the head to the toggle head assembly.
5. Move the dial indicator to the back left (BL) corner over the marked location.
6. Raise the Z Stage until it contacts the dial indicator. Continue to raise the Z stage approximately two additional revolutions of the dial indicator. Wedge a screw driver or similar object between the underside of the table and the bottom of the chamber to prevent the Z stage from moving downward.
7. Zero the dial indicator (this is the reference position and will always be zero).
8. Next move the XY table until the dial indicator is over the front left (FL) corner mark Figure 5-360. Measure and record the difference (e.g. the dial indicator reads 0.004 in.)

9. Move the XY table until the dial indicator is over the front right (FR) corner mark Figure 5-360. Measure and record the difference (e.g. the dial indicator reads +0.010 in.).
10. Move XY table until the dial indicator is over the back right (BR) corner mark Figure 5-360. Measure and record the difference (e.g. the dial indicator reads +0.008 in).
11. Enter the values that are written down into the XY level worksheet. Use the 8x6 worksheet for uPrint and uPrint SE, see Figure 5-361. Use the 8x8 worksheet for uPrint Plus and uPrint SE Plus, see Figure 5-362.

Figure 5-361: uPrint and uPrint SE measurement points and worksheet



Indicator Reading Values

FL = ...

FR = _ _ _ _ _

BR = _____

Adjustment Calculation Values

FL Adjust = (-2.6 x .....**) + (0.97 x** _ _ _ _ _**) - (0.88 x** _____**)**

FL Adjust = _____ **+** _____ **-** _____

FL Adjust = _____

_____

FR Adjust = (-1.2 x .....**) - (0.88 x** _ _ _ _ _**) - (0.68 x** _____**)**

FR Adjust = _____ **+** _____ **-** _____

FR Adjust = _____

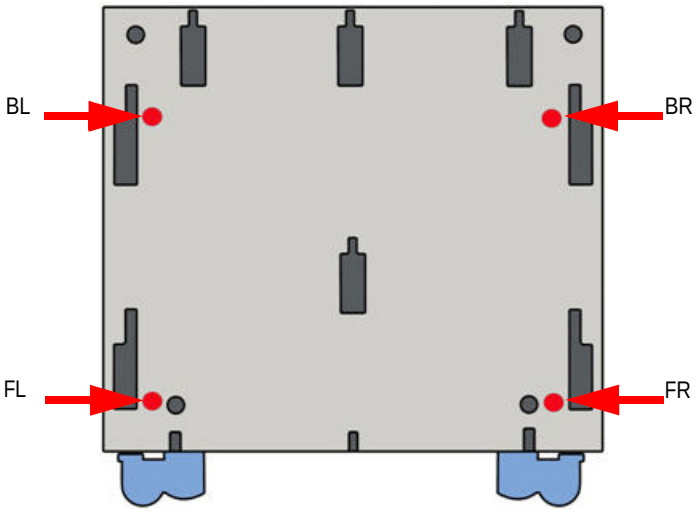
_____

BR Adjust = (-0.91 x .....**) + (1.02 x** _ _ _ _ _**) - (1.83 x** _____**)**

BR Adjust = _____ **+** _____ **-** _____

BR Adjust = _____

Figure 5-362: uPrint Plus and uPrint SE Plus measurement points and worksheet



Indicator Reading Values

FL =

FR =

BR =

Adjustment Calculation Values

FL Adjust = (-2.02 x) + (0.74 x) - (0.66 x)

FL Adjust = _____ + _____ - _____

FL Adjust = _____

_____

FR Adjust = (-0.41 x) - (1.08 x) - (0.38 x)

FR Adjust = _____ + _____ - _____

FR Adjust = _____

_____

BR Adjust = (-0.6 x) + (0.69 x) - (1.7 x)

BR Adjust = _____ + _____ - _____

BR Adjust = _____

Adjusting the XY Table Level

1. Loosen the left front (LF), right front (RF) and back right (BR) guide rod mounting screws.

> **Note:** The back left (BL) corner does not have an adjustment gap and will not require adjustment.

2. Move the indicator to the back left (BL) corner mark and verify gauge reading is still zero
3. Move the indicator over the front left (FL) corner mark.
4. Set the gauge to zero by turing the outer ring of the gauge.
5. Position the table level adjustment tool on front left Y guide rod as shown in Figure 5-363. Note that the adjustment tool prong must rest on the sheet metal shelf. See Figure 5-363.

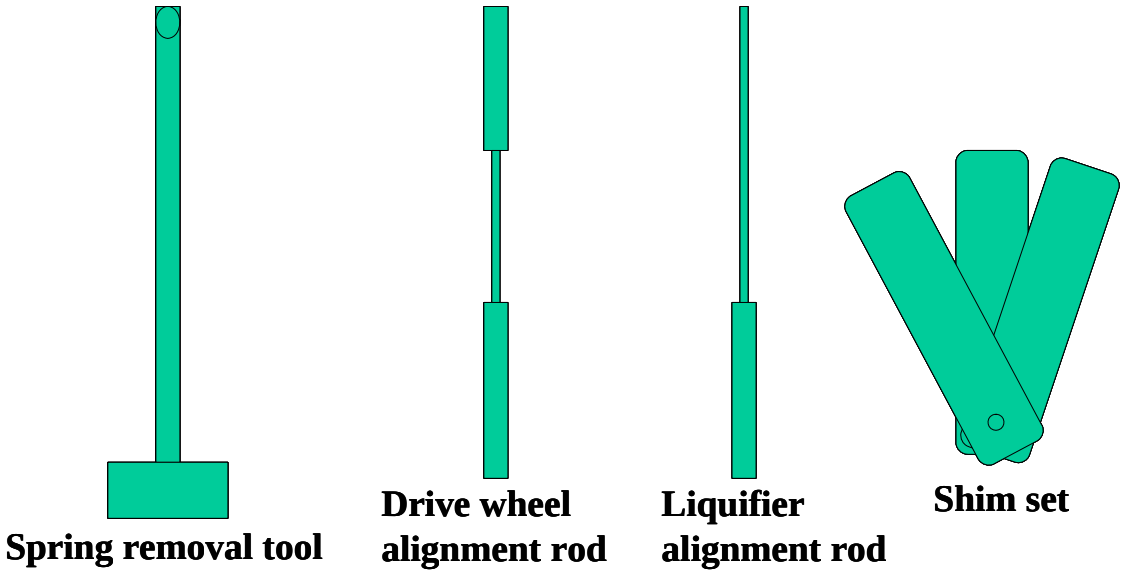
Figure 5-363: Y guide rod adjustment location

6. Using the table leveling adjustment tool, move the rod up until the dial indicator reading matches the value from the calculator (e.g. 0.014).
7. While holding the rod in position, tighten the front left (FL) guide rod screw.
8. Move the dial indicator to the front right (FR) corner mark.
9. Set the gauge to zero by turing the outer ring of the gauge.
10. Position the table level adjustment tool on front right Y guide rod. Note that the adjustment tool prong must rest on the sheet metal shelf.
11. Using the table leveling adjustment tool move the rod up until the dial indicator reading matches the value from the calculator (e.g. -0.013).
12. While holding the rod in position, tighten the front right (FR) guide rod screw.
13. Move the dial indicator to the back right (BR) corner mark.
14. Set the gauge to zero by turing the outer ring of the gauge.
15. Using the table leveling adjustment tool move the rod up until the dial indicator reading matches the value from the calculator (e.g. -0.001).
16. While holding the rod in position, tighten the back right (BR) guide rod screw
17. Recheck the four corners by moving the gauge over the corner marks. The maximum difference allowed between the highest and lowest readings is 0.003 in.
18. Repeat the XY leveling process until the measurements are within specification.

Head Alignment Procedure

Note: This procedure must be accomplished in its entirety and in the order presented. The procedure consists of 2 procedures: Idler Wheel Adjustment and Liquefier Alignment.

Figure 5-364: Special Head Alignment Tools

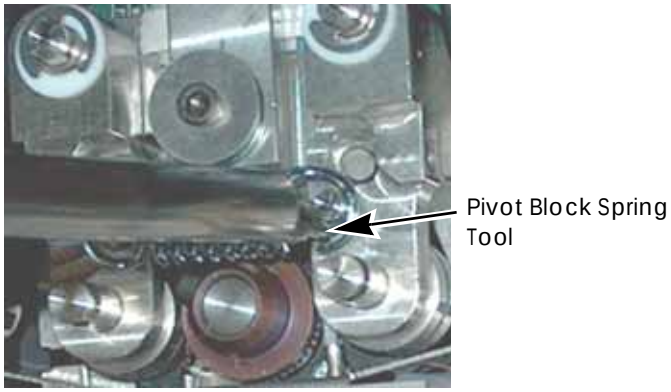


Drive Wheel Alignment

This procedure axially aligns the Head Motor Drive Wheel with the filament path.

1. Remove the Pivot Block Spring using spring removal tool. See Figure 5-365.

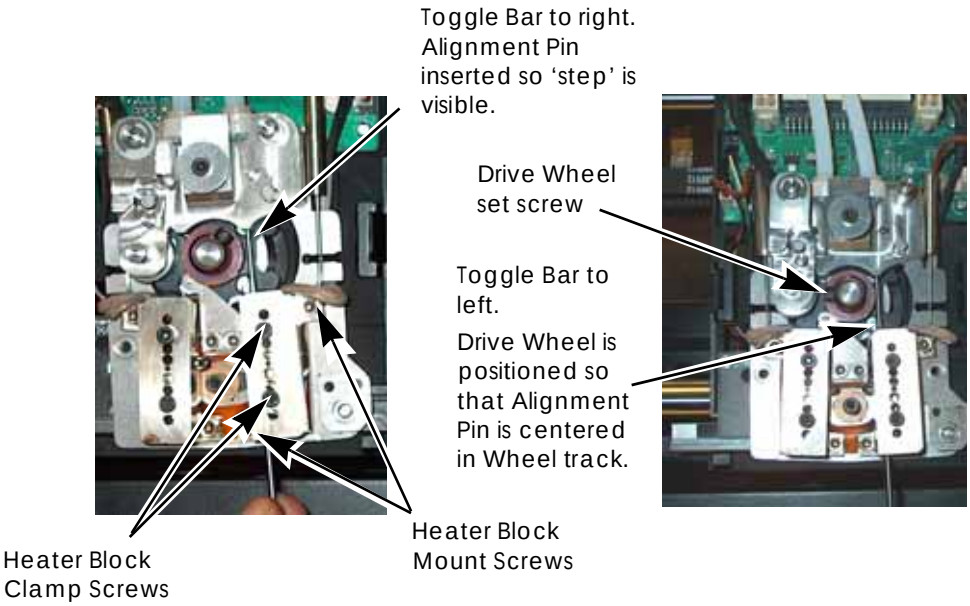
Figure 5-365: Pivot block spring location



2. Remove the right side Pivot Block.
   - Remove the retaining clip and teflon washer from the right side Pivot Block Pin.
3. Move the Toggle Bar to the right.

4. Loosen (don't remove) the model side Heater Block Mount screws and the model side Heater Block Clamp screws
5. Make sure that the Drive Wheel Alignment Rod is straight. Roll the Rod along a flat surface to check for bends. Straighten as necessary.
6. Insert the Drive Wheel Alignment Rod from the bottom of the right side (model) heater block (before using, check the rod to make sure that it is straight).
7. Push the Alignment Rod up into the Main Pivot Block.
8. Position the Alignment Rod so that the stepped portion is centered between the Heater Block and the Pivot Block. See Figure 5-366.
9. Tighten the Heater Block Clamp screws.
10. Tighten the Heater Block Mount screws.

Figure 5-366: Drive wheel alignment



11. With the Drive Wheel set screw loose (make sure that the Drive Wheel is free to slide axially on the Motor shaft), gently move the Toggle Bar to the left until the Alignment Rod rests in the groove of the Drive Wheel.

Note: Do not force the Toggle Bar to the full left position. Forcing the Toggle Bar to the full left position may cause the Alignment Rod to bend.

12. Adjust the Drive Wheel until the Alignment Rod is centered in the groove of the Drive Wheel.
13. Tighten the Drive Wheel set screw.

14. 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 Pin.
    B. The Alignment Pin should not deflect forward or backward as the Drive Wheel is brought into contact with the Pin.
    C. The Alignment Pin should be centered within the groove of the Drive Wheel.
        - Drive wheel must be axially aligned along the centerline between the model liquefier heater blocks and the main toggle block within 0.0025".
    D. If the Alignment Pin is misaligned, repeat steps 11 through 14.

Figure 5-367: Wheel alignment check 1 of 2

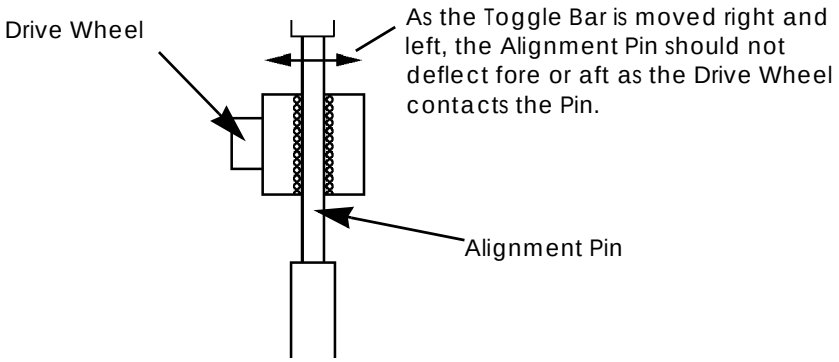
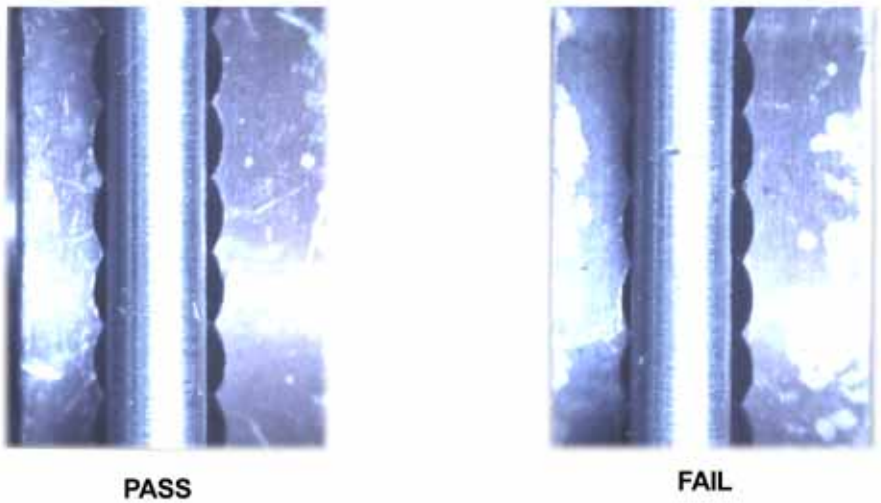


Figure 5-368: Wheel alignment check 2 of 2



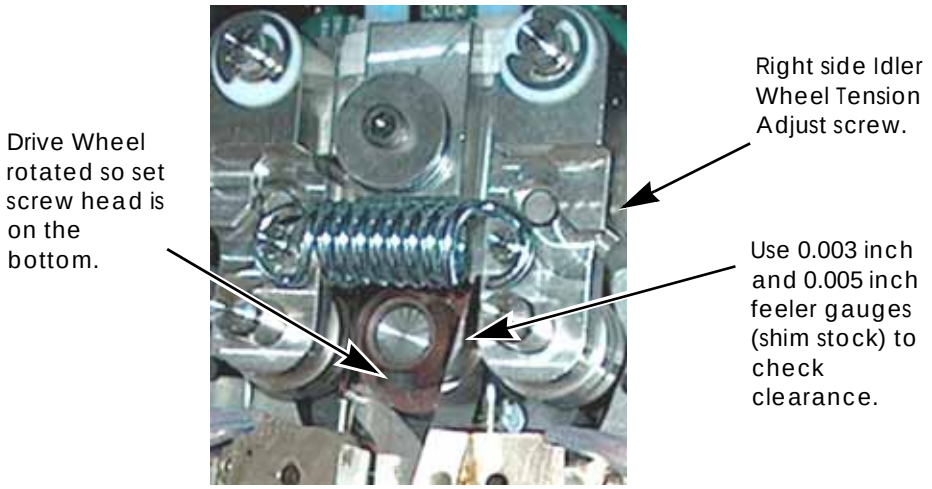
15. Move the Toggle Bar to the right.
16. Loosen the Heater Block Clamp screws and the Heater Block Mount screws.
17. Remove the Alignment Rod.
18. Install the right side Pivot Block.
    A. Make sure the Shim is installed (it normally remains on the pin when the Pivot Block is removed).
    B. Install the teflon washer and retaining clip.

Idler Wheel Check/Adjustment for uPrint

This procedure adjusts the amount of tension that the Idler Wheels apply to the filament.

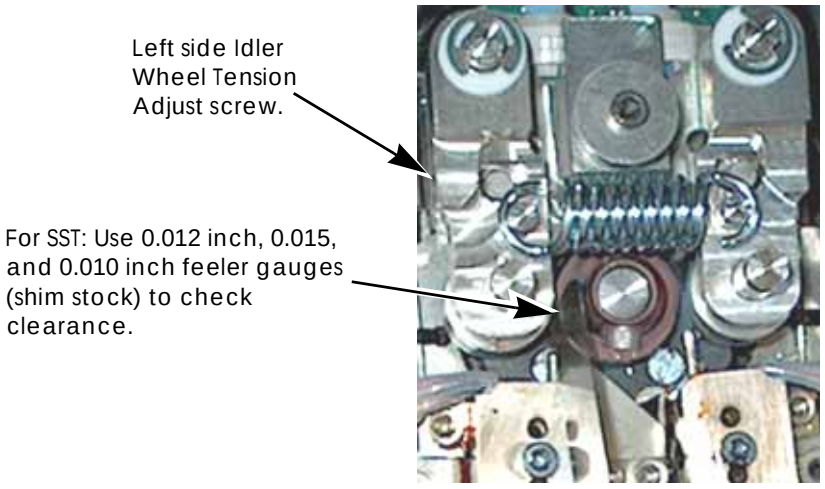
1. Rotate the Drive Wheel so that the set screw head is on the bottom of the Wheel. See Figure 5-369.
2. Check/Adjust the Right (Model) side Idler Wheel clearance: See Figure 5-369.
   A. Place the Toggle Bar in the full Left position.
   B. Check the clearance between the Drive Wheel and the Idler Wheel - a 0.003 inch feeler gauge (shim stock) should have a light drag when placed between the Drive Wheel and the Idler Wheel.
   C. Place the Toggle Bar in the Neutral position (half way between full Left and full Right).
   D. Insert a 0.005 inch feeler gauge between the Drive Wheel and the Idler Wheel.
   E. Return 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.
   F. If the tension is not correct remove the Idler Wheel Tension Adjust screw (5/64" Allen), apply LocTite 222 to the screw threads, and install the screw.
   G. Adjust the screw to obtain a light drag on .003 inch feeler gauge when it is positioned between the Drive Wheel and the Idler Wheel.
   H. Check the tension with the 0.005 inch feeler gauge as above.
   I. Continue to adjust the screw until the prescribed tension is obtained.
   J. When adjustment is complete, place the Toggle Bar in the Neutral position, and remove all feeler gauges.
   K. 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 5-369: Idler Wheel Adjustment - Right Side



3. Check/Adjust the Left (Support) side Idler Wheel clearance: See Figure 5-370.
    A. Move the Toggle Bar to the full Right position.
    B. Check/Adjust the clearance between the Drive Wheel and the Idler Wheel - a 0.012 inch feeler gauge (shim stock) should have a light drag when placed between the Drive Wheel and the Idler Wheel.
    C. Place the Toggle Bar in the Neutral position.
    D. Insert a 0.015 inch feeler gauge between the Drive Wheel and the Idler Wheel.
    E. 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.
    F. Place the Toggle Bar in the Neutral position.
    G. Insert a 0.010 inch feeler gauge between the Drive Wheel and the Idler Wheel.
    H. 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.
    I. If the tension is not correct remove the Idler Wheel Tension Adjust screw (5/64" Allen), apply LocTite 222 to the screw threads, and install the screw.
    J. Adjust the screw to obtain a light drag on 0.012 inch feeler gauge when it is positioned between the Drive Wheel and the Idler Wheel.
    K. Check the tension with the 0.015 inch and 0.010 feeler gauges as above.
    L. Continue to adjust the screw until the prescribed tension is obtained.
    M. When adjustment is complete, place the Toggle Bar in the Neutral position, and remove all feeler gauges.
    N. 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 5-370: Idler Wheel Adjustment - Left Side

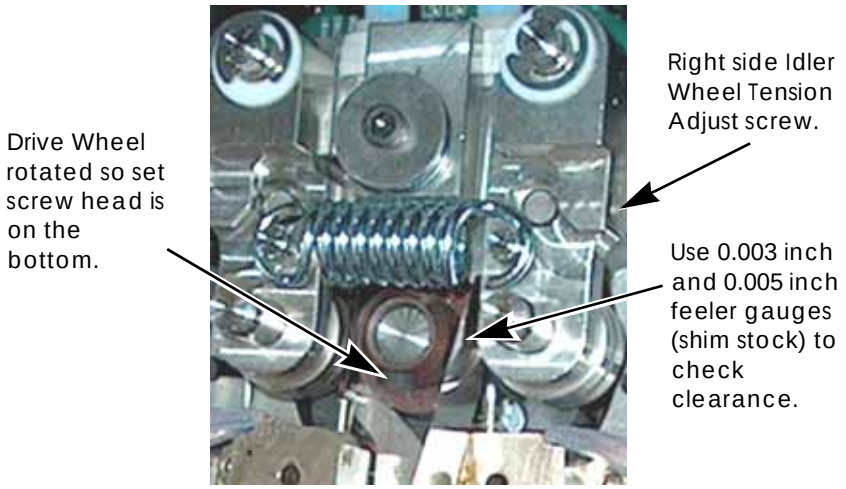


Idler Wheel Check/Adjustment for uPrint SE, uPrint Plus and uPrint SE Plus

This procedure adjusts the amount of tension that the Idler Wheels apply to the filament.

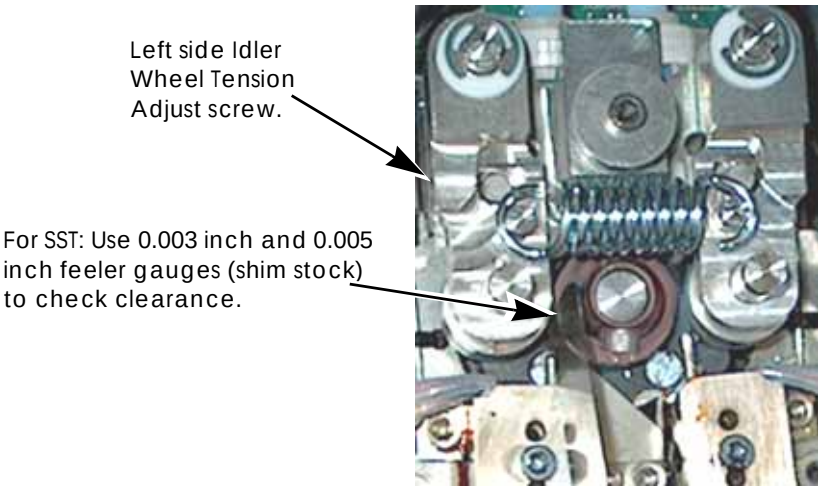
1. Rotate the Drive Wheel so that the set screw head is on the bottom of the Wheel. See Figure 5-369.
2. Check/Adjust the Right (Model) side Idler Wheel clearance: See Figure 5-369.
   A. Place the Toggle Bar in the full Left position.
   B. Check the clearance between the Drive Wheel and the Idler Wheel - a 0.003 inch feeler gauge (shim stock) should have a light drag when placed between the Drive Wheel and the Idler Wheel.
   C. Place the Toggle Bar in the Neutral position (half way between full Left and full Right).
   D. Insert a 0.005 inch feeler gauge between the Drive Wheel and the Idler Wheel.
   E. Return 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.
   F. If the tension is not correct remove the Idler Wheel Tension Adjust screw (5/64" Allen), apply LocTite 222 to the screw threads, and install the screw.
   G. Adjust the screw to obtain a light drag on 0.003 inch feeler gauge when it is positioned between the Drive Wheel and the Idler Wheel.
   H. Check the tension with the 0.005 inch feeler gauge as above.
   I. Continue to adjust the screw until the prescribed tension is obtained.
   J. When adjustment is complete, place the Toggle Bar in the Neutral position, and remove all feeler gauges.
   K. 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 5-371: Idler Wheel Adjustment - Right Side



3. Check/Adjust the Left (Support) side Idler Wheel clearance: See Figure 5-370.
   A. Move the Toggle Bar to the full Right position.
   B. Check/Adjust the clearance between the Drive Wheel and the Idler Wheel - a .003 inch feeler gauge (shim stock) should have a light drag when placed between the Drive Wheel and the Idler Wheel.
   C. Place the Toggle Bar in the Neutral position.
   D. Insert a 0.005 inch feeler gauge between the Drive Wheel and the Idler Wheel.
   E. Return the Toggle Bar to the full Right position - the 0.005 inch feeler gauge should be firmly held between the Drive Wheel and the Idler Wheel.
   F. If the tension is not correct remove the Idler Wheel Tension Adjust screw (5/64" Allen), apply LocTite 222 to the screw threads, and install the screw.
   G. Adjust the screw to obtain a light drag on 0.003 inch feeler gauge when it is positioned between the Drive Wheel and the Idler Wheel.
   H. Check the tension with the 0.005 inch feeler gauge as above.
   I. Continue to adjust the screw until the prescribed tension is obtained.
   J. When adjustment is complete, place the Toggle Bar in the Neutral position, and remove all feeler gauges.
   K. 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 5-372: Idler Wheel Adjustment - Left Side



Liquefier Alignment

This aligns the Liquefier Tubes with the filament path.

1. Right (Model) side:
    A. Move the Toggle Bar to the full Right position.
    B. Make sure the right side Heater Block Mount and Clamp screws are loose.
    C. Make sure that the Liquefier Alignment Rod is straight. Roll the Rod along a flat surface to check for bends. Straighten as necessary.
    D. Insert the Liquefier Alignment Rod from the bottom of the right side heater block - small end first.
    E. Push the Alignment Rod up into the Main Pivot Block.
    F. Position the Liquefier Alignment Rod so that the stepped portion is flush with the top of the Heater Block.
    G. Tighten the Heater Block Clamp screws.

Caution: Use care when moving the Toggle Bar. Forcing the bar, or applying too much pressure, will damage the Liquefier Alignment Rod and cause a misalignment of the Liquefier Tubes with the filament path.

    H. Move the Toggle Bar to the full Left position.
    I. Tighten the lower Heater Block Mount screw until it is snug.
    J. Tighten the upper Heater Block Mount screw until it is snug.
    K. Tighten the lower and upper Heater Block Mount screws to final torque.

Note: Make sure that the Heater Block does not move while tightening the mount screws.

    L. Move the Toggle Bar to the right until the Drive Wheel no longer contacts the Liquefier Alignment Rod.
    M. Loosen the Heater Block Clamp screws and remove the Liquefier Alignment Rod.
2. Left (Support) side:
    A. Repeat step 1 above - except reverse the Toggle Bar positions.

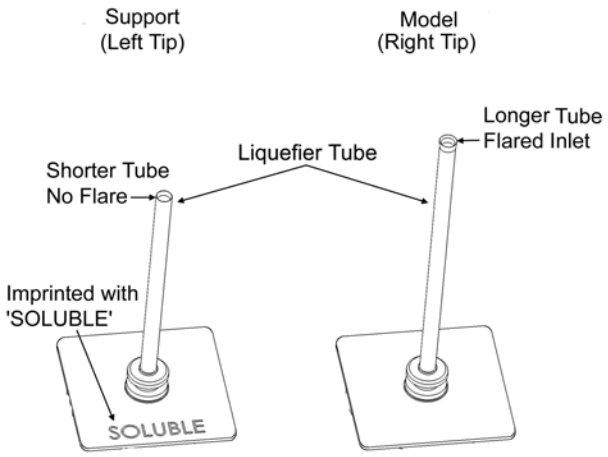
Verify Liquefier Alignment

This procedure makes sure that the Liquefier Tubes are properly aligned with the filament path. This procedure must be performed after Liquefier Alignment on page 5-54. is performed.

1. Install the Heat Shield - install and tighten the 2 retaining screws - make sure the teflon washers are installed between the Heat Shield tabs and the Translator.
2. Install the new Liquefier Tips. See Figure 5-373..
   A. You must identify the correct replacement tip. The printer 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.

Caution: Model and SOLUBLE support tips are different. The correct tip must be installed in the correct side.

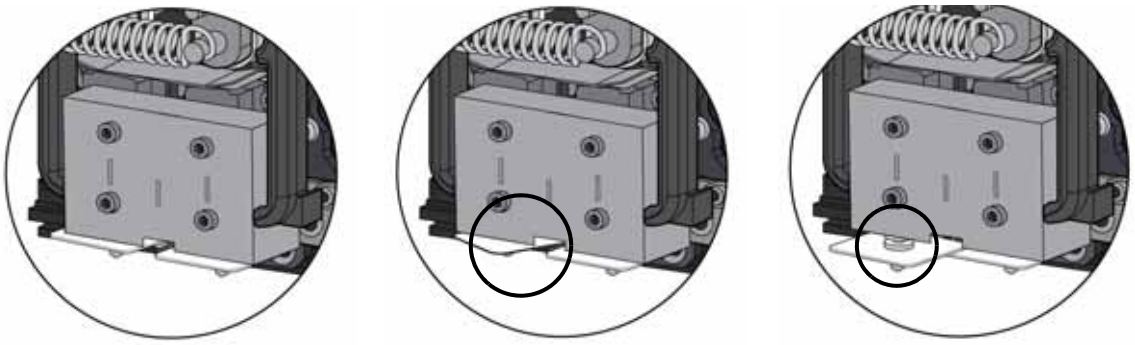
Figure 5-373: Identifying tips



   B. Insert the new tip into the heater block.
   C. Use needle nose pliers to grasp the stainless steel shield of the tip.
   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.

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

Figure 5-374: Tip stainless steel shield alignment



G. Use 7/64 T-Handle Allen wrench to firmly tighten the heater block clamp screws.

H. Repeat step 2 for second tip.

3. 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.

D. Move the Toggle Bar to the full Left position.

E. Visually check (view from the front of the system) the alignment of the Alignment Rod with the Liquefier inlet tube.

- Liquefier inlet must be aligned with the toggle head pinch point +/- 0.0065". (The pinch point is the same as the centerline of the Alignment Rod.)
- If the Support Filament Guide interferes with the Alignment Rod, recheck Liquefier Alignment on page 5-54.

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.

4. Verify Left (Support) side alignment:

A. Repeat steps 1-3 above - except reverse the Toggle Bar positions.

Figure 5-375: Liquefier alignment check (1 of 2)

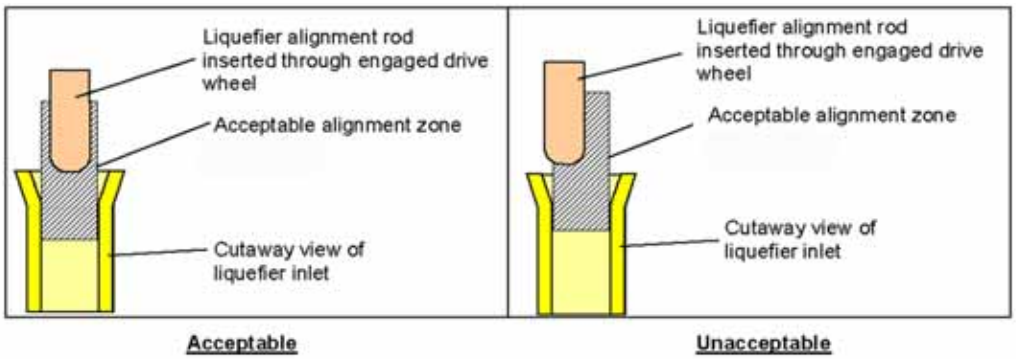
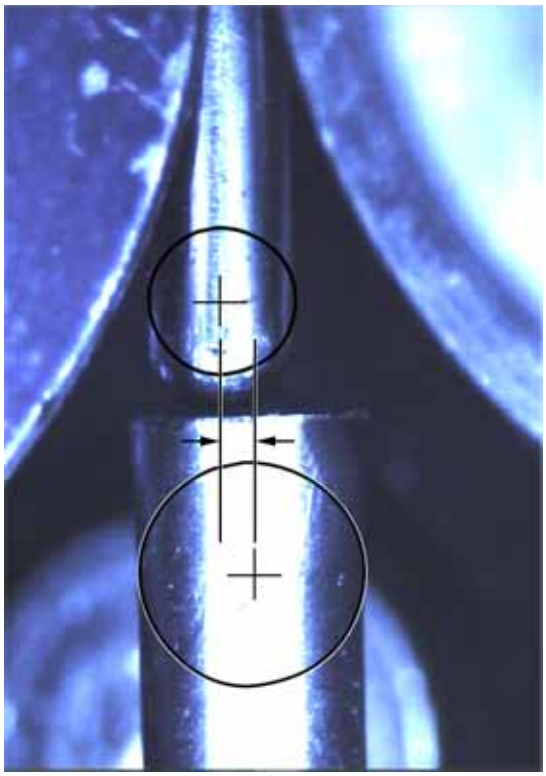


Figure 5-376: Liquefier alignment check (2 of 2)



Complete the Re-Assembly of the Toggle Head Assembly

1. Connect the Filament Tubes to the top of the Toggle Head Assembly - make sure the model tube is on the right; the support tube on the left.
2. Install the Air Plenum - connect the Plenum to the air duct at top - press in on clips to fit the plenum to the Translator.
3. Install the Head Cover - squeeze the side tabs to fit the Translator.
4. Power the printer up.
5. From the display panel, press Maintenance > System > Tips and perform the following calibrations:
   A. Z calibration. See Z Calibration on page 5-2.
   B. XY Tip offset calibration. See XY Tip Calibration on page 5-5.

Note: Follow the Head Installation Checklist after completing Toggle Plate Assembly replacement.

Troubleshooting

6

User Troubleshooting

Problem	Recommendation
No power	1. Verify power cord is securely plugged in. 2. Verify that the circuit breaker (at rear of printer) and the power switch (on left side panel of printer) are both in the ON position. 3. Verify AC power is present at wall outlet.
Material not extruding	Material may be clogged in tip. See "Clogged tip" on page 6-5.
Purge material accumulating on part.	Check condition of tip wipe assembly. Replace if worn.
No text displayed on Display Panel	Cycle power.
Cannot communicate with printer through network or crossover cable	1. Make sure network cables are connected - at the printer, at the PC, or where cables connect to network hubs. 2. Re-configure network settings. 3. If using a static network address, verify that the IP address entered in CatalystEX matches the IP address entered in the printer. 4. Your network configuration may have changed. Contact your Network Administrator.
Error code displayed on display panel	Record error code and reboot printer. If error code repeats, contact Technical Support. For more information, refer to"Fault determination codes" on page 6-3.
Build Error	Partial or bad part file sent to printer. Check STL file in CAD software for errors; reprocess STL in CatalystEX and re-download to printer.

Error message on display panel	Recommendation
Can't Find Home Check Modeling Base	1. Verify a modeling base is inserted. 2. Modeling base may be used or defective – replace.
Material Error Filament error	1. Remove the carrier and verify material is coming out of the material guide. 2. Verify material pulls freely from the carrier. 3. Verify the material tubes are free of material. 4. Reload material.
Material Error Filament blocked	1. Remove carrier and verify material pulls freely from carrier. 2. Verify the material tubes are free of material. 3. If the path is not obstructed, clean debris from Filament Present Switch. See "Remove debris from the Filament Present switch" on page 7-8. 4. Reload material.
Material Error Carrier invalid	1. Remove carrier and verify it is not empty. 2. Replace material spool. 3. Reload material.
Material Error Filament broken	1. Remove the carrier and verify material is coming out of the material guide. 2. Verify material pulls freely from the carrier. 3. Verify the material tubes are free of material. 4. Reload material.
Load Error Filament blocked	1. Remove the carrier and verify material is coming out of the material guide. 2. Verify the material pulls freely from the carrier. 3. Verify the material tubes are free of material. 4. If the path is not obstructed, clean debris from Filament Present Switch. See "Remove debris from the Filament Present switch" on page 7-8. 5. Reload material.

Error message on display panel	Recommendation
Load Error Purge failed	1. Remove the carrier and verify material is coming out of the material guide. 2. Verify the material pulls freely from the carrier. 3. Verify the material tubes are free of material. 4. Check for and clear any excess material build up around the tips.
Unload Error Unload failed	Remove the carrier and verify the material tubes are free of material.
Model/Support Jam in head clear before resuming	"Material Jam" on page 6-6.
Pausing	1. Press **Resume**. 2. Unload the material carriers and reinstall.

Note: Certain Filament related error messages will allow you to enter maintenance mode after a 20 second time out.

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 6-4..); 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

Gloves: The head area is hot. Use gloves when working in this area of printer.

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 6-8.. 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 6-8.. If material steadily flowed from the support tip, the support tip is functioning properly.
13. Return the printer to the Maintenance state - Press **Done.**
14. Display will ask **Which Materials Loaded?** Press **Both.**
15. Press **Done** until back at **Idle**.

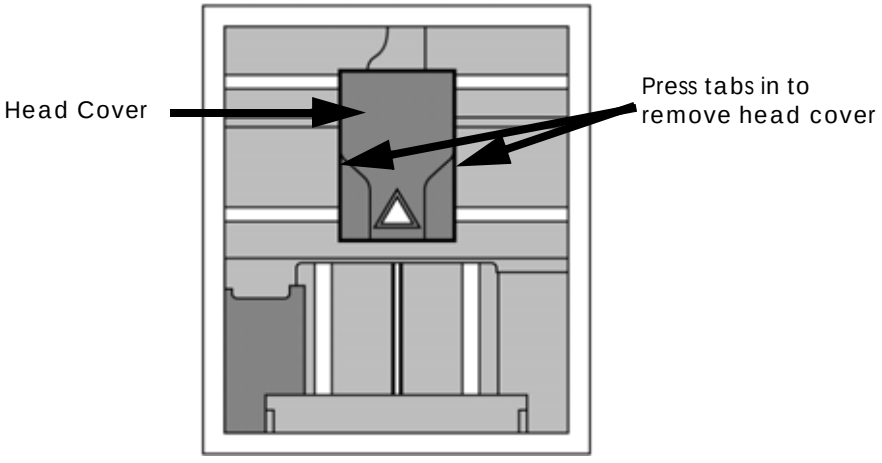
Clogged tip

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 6-377.

Gloves: The head area is hot. Use leather gloves when working in this area of printer.

Figure 6-377: Remove the head cover



2. Inspect to of tips for material build up. If there is excess material build up see Recovering from loss of extrusion on page 6-8.. 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 6-8.
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**.

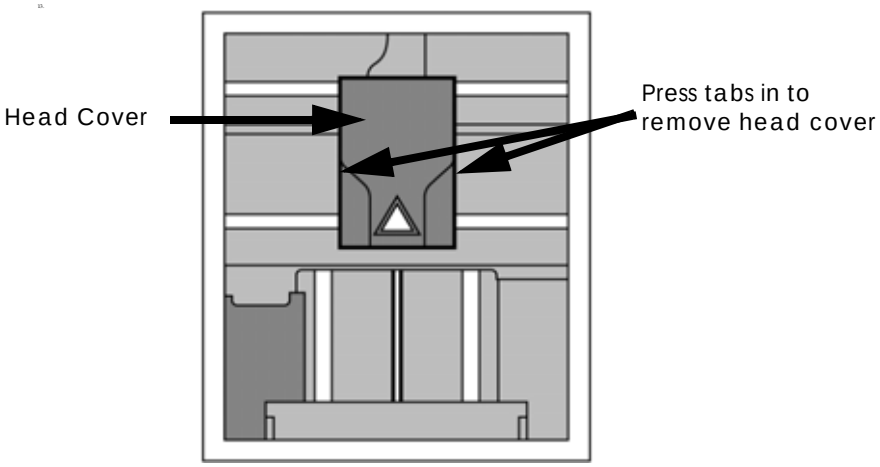
Material Jam

Occasionally, material may become jammed in the head. The printer will notify you of a material jam through a message shown on the display panel. If a material jam is detected, follow these steps to clear the jam.

1. From the display panel, press **Continue**.
2. Press **Maintenance**.
3. Press **Machine**.
4. Press **Head**.
5. Once in head maintenance mode, remove the head cover by pressing the tabs in and pulling away from the head. See Figure 6-378.

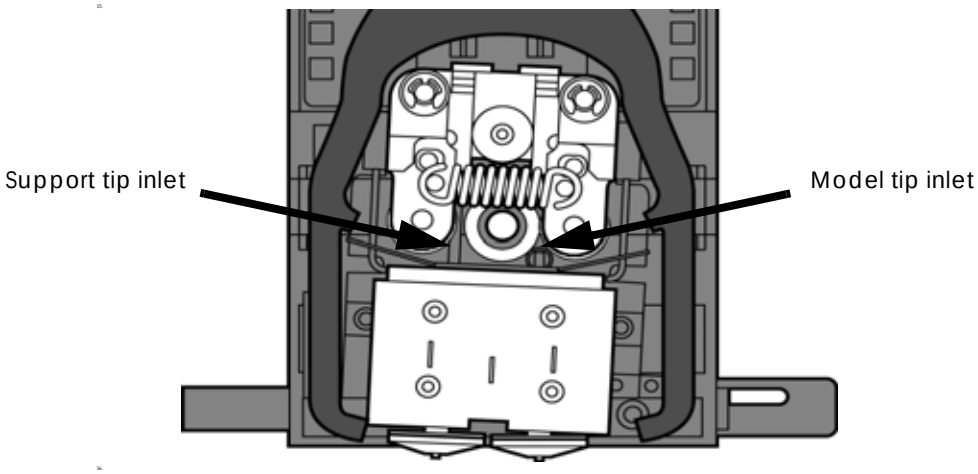
Gloves: The head area is hot. Use leather gloves when working in this area of printer.

Figure 6-378: Remove the head cover



6. Inspect tip inlets for material build up see Figure 6-379. If there is excess material build up see Recovering from loss of extrusion on page 6-8. If there is no excess material build up close the chamber door and continue.

Figure 6-379: Tip inlet locations



7. Press **Select Drive** and choose the drive that may have the clogged tip.
8. Press **Forward**, the drive wheel will turn the selected drive forward.
9. 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 6-8.. If material extrudes, you can continue building your part.
10. Reinstall the head cover.

Note: If the head cover is not replaced the printer may not function properly.

11. Press **Done**.
12. Display will ask **Which Materials Loaded?** Press **Both.**
13. Press **Done** until back to **Pause** screen.
14. Press **Resume** to continue building the part.

Recovering from loss of extrusion

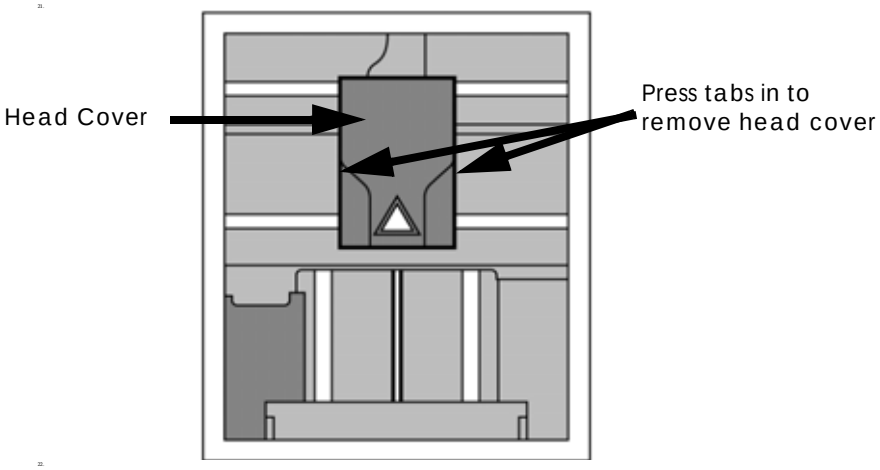
Note: It is recommended that you read and understand this entire procedure before performing any of the work.

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.

Gloves: The head area is hot. Use leather gloves when working in this area of printer.

2. Remove the head cover by pressing the tabs in and pulling away from the head. See Figure 6-380.

Figure 6-380: 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 6-381.

Figure 6-381: Head Components

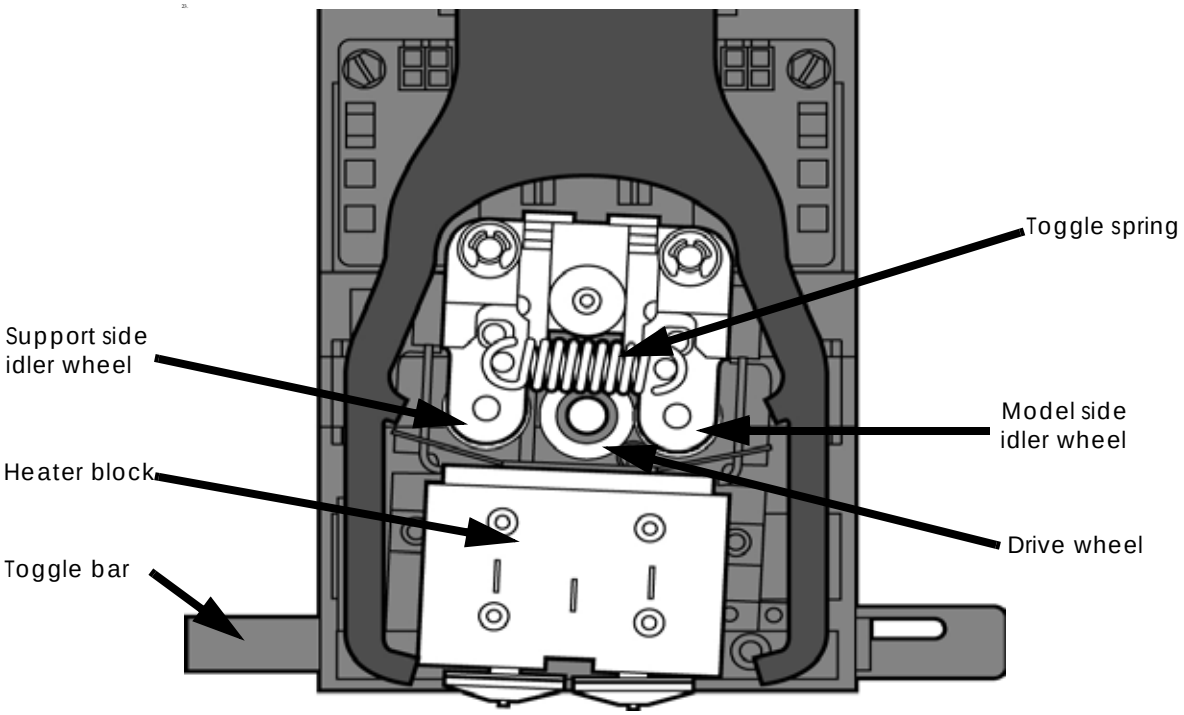
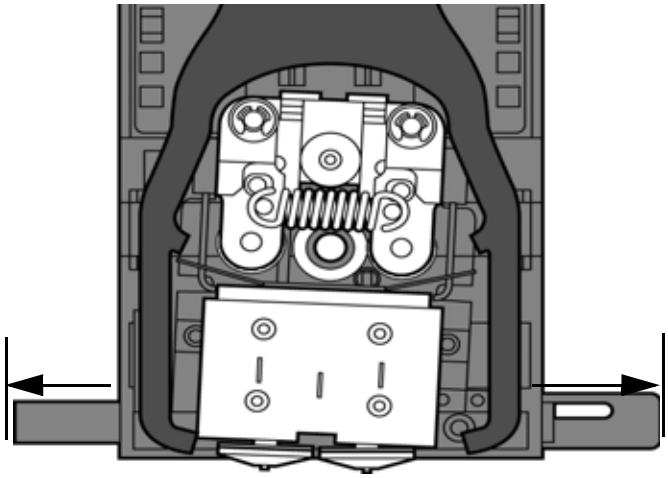


Figure 6-382: Toggle bar in neutral position



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.

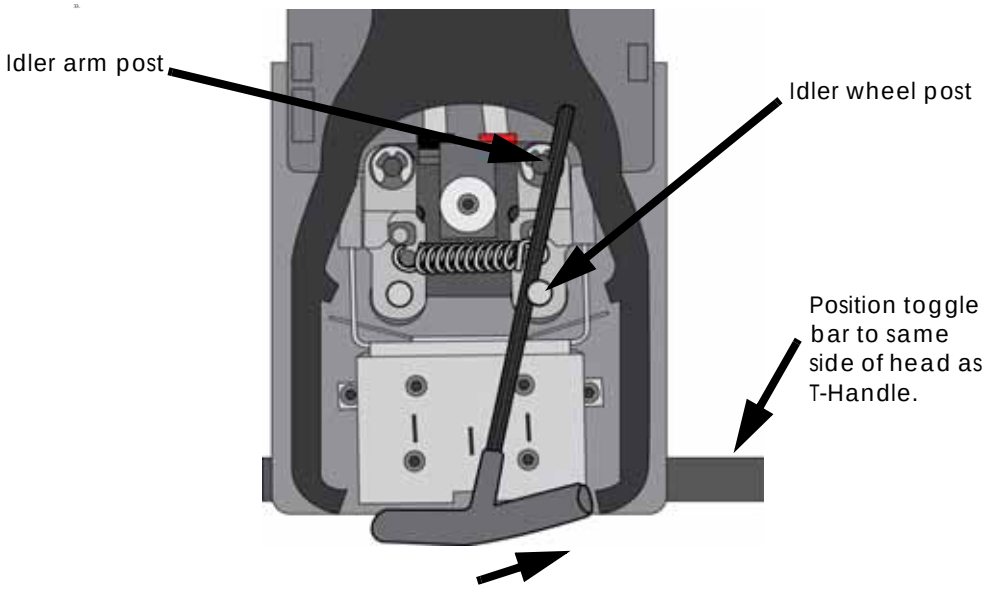
B. For easier access to areas that may need to be cleaned, move the material idler wheels out of the way (there is one idler wheel for support material and one for model material, see Figure 6-381.)

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 6-383. (model side shown).

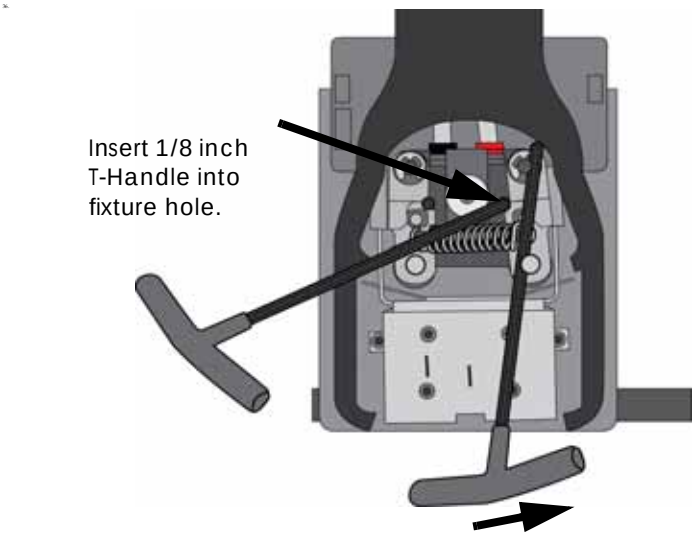
b. Position toggle bar to the same side of the head as the T-Handle allen wrench. See Figure 6-383. (model side shown).

Figure 6-383: Create access space for cleaning - model side shown



c. Move idler wheel assembly by pushing with 7/64 inch T-Handle Allen wrench against spring tension. Insert a 1/8 T-handled Allen wrench (from startup kit) into the fixture hole. See Figure 6-384.

Figure 6-384: 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 inch 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 carrier of the materials that are not loaded. Remove the carrier and cut the excess material.
10. Press **Done** until back at **Idle**.
11. Reload the material that is not loaded.

Service Troubleshooting

1.0 How to use this Guide

1. Determine what type of error you are experiencing; either a Code Error or Non-Code Error.
2. If you experience a Code Error:
    A. Refer to the Code Error Section of the guide (2.0 Code Errors)
    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.
3. If you experience a Non- Code Error:
    A. Refer to the Non-Code Error Section of the guide (3.0 Non-Code Errors)
    B. If the display on the machine displays an error message, match that message to one of the non-error codes in the guide.
    C. If a message does not appear, match the problem to one of the non-error codes in the guide.
    D. Complete and verify each step before proceeding to the next step.
4. If you have any suggestions, additions or changes that need to be made to this guide please e-mail uprinttsguide@stratasys.com.
    A. 2.0 Special Notes
    B. Verify that the machine is plugged directly into a wall outlet. Do not use an extension cord or power strip.
    C. Verify you are running the current CatalystEX and printer firmware. Upgrade the software if necessary.
    D. After **"Power down"** is complete, always shut the breaker off to fully reset the system.
    E. When measuring DC voltages and signals using chassis ground is preferred. Do NOT measure AC voltages using chassis ground.
    F. Check/re-seat appropriate cables as part of the troubleshooting process.
    G. TeraTerm move commands are in inches.
    H. Check limit switch states using the test points and/or LED's on the power distribution board.
    I. Replacement hard drive may take up to 45 minutes to boot. The hard drive is running check disk (chkdsk).
    J. Ignore multiple error code listings at end of a CFG file (LE output)
    K. Never "hot plug" the material bay cables. Doing so will damage the material bay serial transceiver.
    L. Correct seating of the I/O board to the power distribution board is critical. Check for proper alignment through electronics bay viewing window

2.0 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). 1. Cycle power. 2. Replace LCD Display
06	LCD Keypad	Failed to read from LCD keypad to SBC (error will be seen in .cfg file). 1. Cycle power. 2. 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 (ex. 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.
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	Not Used	Not Used
14,02	Report: Attempt to raise modeling base sensor failed	1. Cycle power 2. Check to see if the toggle bar is broken. 3. Check for obstructions preventing X or Y movement 4. Check the substrate sensor bar is not damaged. If so, replace bar. 5. Using LED's/test points: Check to see if Z foam box toggles when switch is activated. If not, check foam sensor and/or Umbilical Cable. 6. Check for loose pins on J506-2, J506- 7, J301-5, and J301-6. See Umbilical cable diagram on page 6-40. 7. Using LED's/test points: Check to see Z home box toggles when switch is activated. If not, check Z home switch and/ lower harness J8 pins 1,11,12. See "Lower harness" on page 6-44.
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 J506, pins 2 and 7 on the I/O card. 5. Using LED's/test points: Check to see Z foam box toggles when switch is activated. If not, check substrate sensor, sensor assembly and/or lower harness.
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 TeraTerm -Verify the sensor is being pushed all the way up. 4. Remove, clean and reinstall the substrate sensor assembly.
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 LED's/test points: Check if home & limit boxes are checked. If so, check limit switches and/or Umbilical Cable for X sensors, Y cable for Y sensors. 5. Manually move the XY table in X and Y checking for smooth operation. 6. Check belt tension. 7. 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.

Code	Description	Corrective Actions
14,11	Abort : Door opened while axis in motion	1. Check to see if door latch is activating using LED's. 2. Check J504 pins 8 and 20 on the I/O card for loose contacts or bent pins. 3. Look at LCD display, should show “Door Open” when machine is idle and door is open. 4. Using 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.
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. Software use only.
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 cancelled 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. Power cycle machine. 2. Escalate the case providing the .cfg file.
14,20 14,21	Abort : XY axis not ready. Abort : Z axis not ready.	1. Power cycle machine. 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.
14,22	Abort : Head temperature set-point too low.	1. Reinstall system software. 2. Verify the head temperature set point using CatalystEX • The model must be above 240 degrees. • The support must be above 240 degrees.
14,23	Report: Begin curve parame-ters 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. Power cycle machine. 2. If error continues - possible memory problem, replace SBC. 3. 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. Power cycle machine. 2. 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.

Code	Description	Corrective Actions
14,32	Abort : PMD checksum error.	1. Power cycle machine. 2. Reinstall System Software. 3. If the frequency of the error is greater than once every three months, replace the Controller Board.
14,33	Abort : Invalid being send to PMD chip.	1. Power cycle machine. 2. Reinstall System Software. 3. If the frequency of the error is greater than once every three months, replace the Controller Board.
14,34	Abort : Z axis table jammed	1. Not used on uPrint, uPrint SE, uPrint Plus and uPrint SE Plus printers.
14,35	Report: Time out while loading carrier.	1. See Load Failed Section (K) 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. Check and re-seat J506 and check pins 2, 3, 7 and 8. 2. If error continues, replace the Controller Board.
14,38	Abort : Hardware turned off power supply.	1. Check and re-seat connectors to Controller Board and PDB. 2. Replace the Controller Board. 3. Replace the PDB. 4. Replace umbilical cable. 5. Jumper the WDT to retrieve CFG to find additional errors.
14,39	Abort : Head thermocouple fault.	1. Verify ambient temperature is above 18° C (64.4° F). 2. Check thermocouple wire for damage. 3. Using a meter, check to see if thermocouple is open at head. 4. Check/re-seat the connectors on the head board. 5. Open may be in umbilical head cable. Check and re-seat J505 and check pins 7 and 17 on the I/O card. 6. Check and re-seat J7 and check pins 7 and 10 on the T/C amp board. 7. Replace the toggle head assembly. 8. Replace the head board.
14,40	Abort : Chamber thermocouple fault.	1. Verify ambient temperature is above 18° C (64.4° F). 2. Check to see if chamber thermocouple is plugged in to the PDB. 3. Using a meter check if thermocouple is open. If so, replace thermocouple. 4. Check chamber thermocouple and wire for damage. 5. Verify chamber fans are on. If not, replace 24VDC power supply. 6. Replace chamber thermocouple. 7. Replace PDB.
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. Check to see if door latch is activating using LED's. 2. Check J504 pins 8 and 20 on the I/O card for loose contacts or bent pins. 3. Look at LCD display, should show “Door Open” when machine is idle and door is open. 4. Using LED's 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.
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 material spool. 2. Clean contacts on carrier and material bay with an eraser. 3. Replace carrier. 4. Replace material bay.

Code	Description	Corrective Actions
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. Power cycle machine - remember to move head away from switches. 2. X errors - Check pins and re-seat connector J505 on the I/O Board. Y errors - Check pins and re-seat connector J503 on the I/O Board. 3. Using LED's check to see if switch state toggles. If not, check sensor and/or umbilical cable for X and Y cable for Y. 4. Replace the head board for X errors and replace the Y sensors for Y.
14,57 14,58	Abort : Find home failed, X home time-out Abort : Find home failed, Y home time-out	1. Power cycle machine - remember to move head away from switches. 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 LED's check to see that the state changes when sensor is activated. If not, check sensor and/or umbilical cable for X and Y cable for Y.
14,59 14,60	Abort : Find home failed, X home not tripped Abort : Find home failed, Y home not tripped	1. Power cycle machine - remember to move head away from switches. 2. Using LED's check to see home LEDs toggles when sensor is activated. If not, check sensor and/or Umbilical Cable for X and Y cable for Y. 3. X errors - Check pins and re-seat connector J505 on the I/O Card. Y errors - Check pins and re-seat connector J503 on the I/O Card.
14,61 14,62	Abort : Find home failed, X home tripped Abort : Find home failed, Y home tripped	1. Power cycle machine - remember to move head away from switches. 2. 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 , Y cable for Y. 3. X errors - Check pins and re-seat connector J505 on the I/O Card. Y errors - Check pins and re-seat connector J503 on the I/O Card.
14,63 14,64	Abort : Find home failed, X eot tripped Abort : Find home failed, Y eot tripped	1. Power cycle machine - remember to move head away from switches. 2. Using LED's check to see home box toggles when sensor is activated. If not, check sensor and/or umbilical cable for X , Y cable for Y. 3. X errors - Check pins and re-seat connector J505 on the I/O Card. Y errors - Check pins and re-seat connector J503 on the I/O Card.
14,65 14,66	Abort : Find home failed, X eot not tripped Abort : Find home failed, Y eot not tripped	1. Power cycle machine - remember to move head away from switches. 2. Using LED's check to see home box toggles when sensor is activated. If not, check sensor and/or umbilical cable for X , Y cable for Y. 3. X errors - Check pins and re-seat connector J505 on the I/O Card. Y errors - Check pins and re-seat connector J503 on the I/O Card.
14,67	Abort : Head temperature too high	1. Verify the TC and Liquefier Heaters are plugged in properly. 2. Check umbilical 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.

Code	Description	Corrective Actions
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	Not used on uPrint, uPrint SE, uPrint Plus and uPrint SE Plus printers.
14,74	Unexpected contact with unknown limit.	1. Power cycle machine - remember to move head away from switches. 2. Using LED's check to see limit box toggles when switch is activated. If not, check switch and/or umbilical cable for X, Y cable for Y. 3. X errors - Check pins and re-seat connector J505 on the I/O Card. Y errors - Check pins and re-seat connector J503 on the I/O Card.
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 .cfg 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.
14,86	Time-out	1. Cycle power. 2. If CFG file contains: Time-out due to position - Replace Toggle Plate Assembly. 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. If error code is displayed again within 3 months, replace Controller Board.
14,95	PMD Host IO Error	1. Cycle power.

Code	Description	Corrective Actions
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 time-out Find home failed, Y EOT time-out	1. Power cycle machine - remember to move head away from switches. 2. Using LED's check to see limit box toggles when switch is activated. If not, check switch and/or umbilical cable for X, Y cable for Y. 3. X errors - Check pins and re-seat connector J505 on the I/O Card. Y errors - Check pins and re-seat connector J503 on the I/O Card.
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) time-out Find home failed, Z EOT time-out	1. Check for objects/parts on Z stage and around lead screw. 2. Cycle power. 3. Check Z Home and Z EOT LED's on PDB to verify state changes correctly. If not, check connector P8 on the PDB and Z switches. Replace cable and/or switches. 4. Replace Z axis motor and lead screw. 5. 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.
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 material spool. 2. Replace material carrier. 3. Replace material bay.
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.
14,113	Door not latched	1. Verify chamber fans are operational. If not, replace 24VDC power supply. 2. Inspect solenoid and wiring. 3. Replace solenoid. 4. Replace PDB.
14,114	Thermocouple snap switch tripped	Not used on uPrint, uPrint SE, uPrint Plus and uPrint SE Plus printers.
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. Toggle failure - reference 14,129. 3. Check and re-seat connectors/pins on J506 on the I/O card and J301 on the head board. 4. Replace Toggle Head assembly. 5. Replace PDB (U8 chip failure).
14,118	Invalid cyclic redundancy check	Software error; will not be displayed

Code	Description	Corrective Actions
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 time-out	1. Cycle power. 2. Check all cable connections including thermocouples. 3. Escalate the case providing .cfg file.
14,124	Stack overflow	1. Cycle power. 2. If problem persists, replace Controller Board.
14,125	Runtime error	1. Cycle power.
14,126	Operation active - try again	1. Cycle power.
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 physical position of head at failure. 2. Ensure toggle bar aligns with toggle stops. 3. Inspect top layer of model for part shift. 4. If any of above indicate a failure, Cycle Power and re-send part. 5. Remove head cover, Verify that you can manually toggle the head. and check liquefier inlets for excessive material build up. Remove if present. 6. Check and re-seat connectors/pins on J506 on the I/O card and J301 on the Head Board. 7. Re-seat toggle connector on the Head Board. 8. Check Model and Support Toggle LED's on PDB. Verify high and low states. • On head board for toggle signal: TP201-Model; TP101-Support 9. Using TeraTerm run AH to toggle the head. Monitor system movement to help determine root cause of issue. 10. Replace Toggle Sensor Board. 11. Replace Head Board. 12. Replace Toggle Head assembly.
14,130	Temperature setback is active	1. Cycle power.
14,131	Toggle when head motor is running	1. Check Model and Support Toggle LED's on PDB. Verify high and low states. • On head board for toggle signal: TP201-Model; TP101-Support 2. Re-seat connectors on the Head Board. 3. Replace Toggle Sensor Board. 4. Replace Head Board. 5. Replace Umbilical Cable.
14,132	UPS low power	1. UPS is shutting down. Check UPS and AC power.

Code	Description	Corrective Actions
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.
14,136	Invalid state for operation Attempt to program firmware when system is not in upgrade mode.	1. Cycle power. 2. Reinstall upgrade.
14,137	MCB Communication error. Failure in command/response protocol with MCB.	1. Power Off. 2. Check/Replace MCB cables (Re-seat while powered down). 3. Power On. 4. Reload material. 5. Replace carrier. 6. Use LE command with TeraTerm. 7. Replace material bay.
14,138	MCB Firmware error: Error upgrading firmware. (possibly mismatched firm-ware/hardware versions)	1. Cycle power. 2. Reinstall upgrade.
14,139	MCB not present : No MCB available on the system. **WARNING:** Always power down system completely before connecting or discon-necting the Material Bay Cables.	1. Power down. 2. Re-seat material bay cables. 3. Replace material bay cables. 4. Replace material bay. 5. Replace PDB or Controller. 6. Replace 24VDC power supply.
14,140	MCB end of filament event. End of filament detected when loading carrier.	1. Cycle power.
14,141	MCB filament loaded event. Attempted to retract filament while it is loaded in the head.	1. Cycle power.
14,142	Auto purge detect failure. Failed to detect any material purge after loading.	Software use only.
14,143	Model filament not present at EOF switch. Currently unused.	Software use only.

Code	Description	Corrective Actions
14,144	Support filament not present at EOF switch. Currently unused.	Software use only.
14,145	Model filament not present at FP switch. Currently unused.	Software use only.
14,146	Support filament not present at FP switch. Currently unused.	Software use only.

Starting Up Failed Minor Errors (15.XX)

Code	Description	Corrective Actions
15,01 15,02	Startup state activation failed Time-out period expired while starting up	Software use only 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 time-out. 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 Time-out	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 77C. 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	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. Check AC input. Verify that no extension cords or power strips are attached to the system. 6. Check that DL18 on the PDB is lit. If not 120VDC circuit maybe bad - replace PDB. 7. 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). 8. Check the thermocouple and heater connectors.
	Liquefier is warm but doesn't reach operating temperature.	1. Check AC input. Verify that no extension cords or power strips are attached to the system. 2. Liquefier heater has higher than normal resistance, correct value should be 175 to 216 ohms. If incorrect replace head. 3. The umbilical cable has an intermittent connection. Replace Umbilical Cable. 4. Replace the Head Board. 5. Check 120VDC, if low, replace PDB (model) or 120VDC AUX (support).
	Chamber temperature too high (over 77 degrees)	1. Chamber T/C has failed. 2. Chamber temperature offset is incorrect. Correctly set at 77 degrees using MaracaEX See "Temperatures" on page 3-10.
18,02	Temperature failed to regulate within 7 degrees.	1. Status--Details: Check to see if head temperature set point is 310C for model and 300C for support. 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.
18,03	Incorrect model head temperature.	1. Using MaracaEX, set model temperature to default of 310C. 2. See also 18,01.

Code	Description	Corrective Actions
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 77C.

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 Time-out.	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. Time-out 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.	Not used on uPrint, uPrint SE, uPrint Plus and uPrint SE Plus printers.

Universal 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.

3.0 Non-Code Errors

A. “Build Error” displayed on LCD
B. Tip Depth Incorrect
C. “Corrupted Upgrade” displayed on LCD
D. “Carrier 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 (failed to load/unload material)
K. Network Communications
L. Pauses during build
M. Power down
N. Power Up/Boot
O. “Can’t Find Home - Check Modeling Base” displayed on LCD
P. System VERY slow to reach temperature
Q. Calibration issues
R. Unexpected behavior
S. Z Calibration failure
T. 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. Run Z tip calibration. 2. Check and/or clean the Z foam sensor. 3. Replace the Z foam assembly and sensor

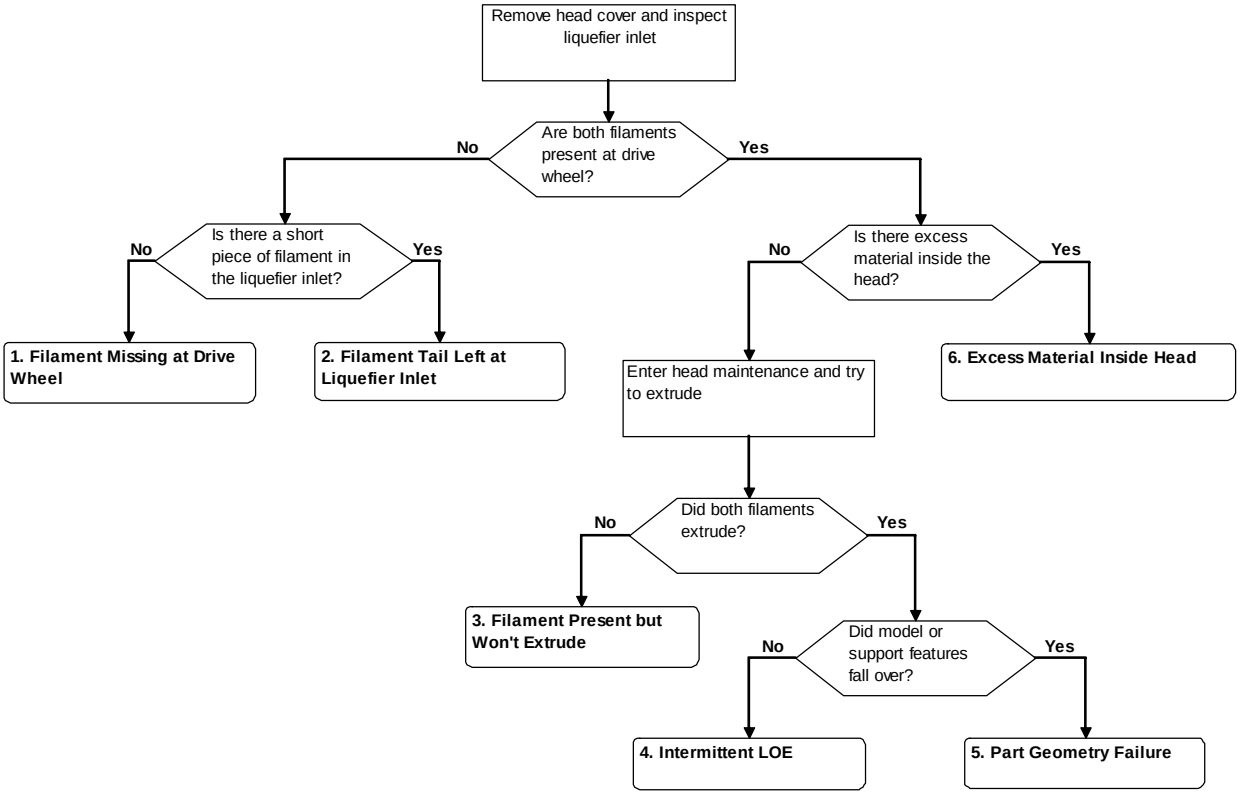
C. “Corrupted Upgrade” Displayed on LCD	
	1. Verify the CD is the correct gender. (Same as the system) 2. Cycle power and try download again. If not possible or fails again replace hard drive. 3. Verify the hard drive and the controller board are gendered correctly.

D. “Carrier Invalid or Empty” Displayed on LCD	
	4. Remove and reinsert the carrier. 5. Spool e-prom empty or failed. Load a different spool. 6. Try a different Carrier 7. Replace material bay

E. Door Latch	
Door doesn’t latch/unlatch.	1. Door is misaligned, adjust door hinge brackets. 2. Upper harness cable to solenoid is unplugged or open. 3. Door solenoid mounting bracket is loose or damaged. Replace mounting bracket. 4. Door solenoid has failed. Check by toggling using MaracaEX. Replace solenoid. 5. PDB has failed (won't latch only).

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 is misaligned, adjust door hinge brackets. 4. Door switch is bad, replace door switch.

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 above to determine type of LOE, then follow the steps below.

1. Filament Missing at Drive Wheel - Filament tube disconnected - Filament pulled back	1. Verify that filament tube is connected at all junctions. 2. High pull force on the material spool. a. Verify spool lid is inserted properly and not rubbing on carrier. b. Remove any debris from bottom of carrier. c. Filament is tangled on spool. Replace spool. 3. High pull force in filament tubes. a. Inspect filament tubes and Y block for debris. Remove debris. b. Inspect for kinked filament tubes. Replace filament tubes. c. Check for twisted feed tubes in energy chain. If twisted, replace filament tubes.
1. Filament Tail Left at Liquefier Inlet - Broken Filament - Undetected EOF	1. Verify that filament tube is connected at all junctions. 2. High pull force on the material spool. a. Verify spool lid is inserted properly and not rubbing on carrier. b. Remove any debris from bottom of carrier. c. Filament is tangled on spool. Replace spool. 3. High pull force in filament tubes. a. Inspect filament tubes and Y block for debris. Remove debris. b. Inspect for kinked filament tubes. Replace filament tubes. c. Check for twisted feed tubes in energy chain. If twisted, replace filament tubes. 4. System did not detect end of filament (EOF). Cycle power. If repeats, verify FP switch functions properly. Replace material bay if defective.

1. Filament Present but Won't Extrude - Spin out - Head Motor Doesn't turn	1. High pull force on the material spool. a. Verify spool lid is inserted properly and not rubbing on carrier. b. Remove any debris from bottom of carrier. c. Filament is tangled on spool. Replace spool. 2. High pull force in filament tubes. a. Inspect filament tubes and Y block for debris. Remove debris. 3. Inspect for kinked filament tubes. Replace filament tubes. 4. Check for twisted feed tubes in energy chain. If twisted, replace filament tubes. 5. Inspect model for excessive overfill. a. Toolpaths should not overlap by more than 50%. If so, reorient and reprocess STL. b. If model curl has caused the part to contact the tip, reprocess part with less dense fill. Re-run tip Z cal if part is separating from supports 6. Check for loose heater block clamp screws. 7. Plugged Liquefier - replace tips. 8. Check idler wheel gap. 9. Check liquefier alignment. 10. Head idler spring is deformed or installed improperly. Replace head idler spring. 11. Possible head temperature issue a. Replace head board and TC Amp board. b. Replace toggle head assembly. 12. Head motor power wires or encoder failure - replace toggle head 13. In case of Z shift: a. Realign Z guide rods. See “Installing the Z stage” on page 4-155. b. Replace Z motor and leadscrew. c. Replace Z assembly.
1. Intermittent LOE - Head Motor - Intermittent tip plug	1. Check for loose heater block clamp screws. 2. Make sure the head connectors are seated properly. 3. Check air plenum for: proper hose connection; properly seating; cracks or damage. 4. Check to make sure head blower fan hose is connected to blower. 5. If extrusion fails on first layer a. If using a used modeling base, retry with a new one b. Rerun Z calibration 6. Plugged Liquefier - replace tips. 7. Inspect model for excessive overfill. a. Toolpaths should not overlap by more than 50%. If so, reorient and reprocess STL. b. If model curl has caused the part to contact the tip, reprocess part with less dense fill. Re-run tip Z cal if part is separating from supports 8. Check idler wheel gap. 9. Check liquefier alignment. 10. Head idler spring is deformed or installed improperly. Replace head idler spring. 11. Possible head temperature issue a. Replace head board and TC Amp board. b. Replace toggle head assembly. 12. Head motor power wires or encoder failure - replace toggle head 13. Blower fan not supplying enough air flow - weak or stalling. Replace fan. 14. Replace umbilical cable 15. Replace controller board 16. In case of Z shift: a. Realign Z guide rods. b. Replace Z motor and leadscrew. c. Replace Z assembly.

1. Part Geometry Failure - Model or support features fell over	1. Reorient, reprocess and resubmit the part 2. Run Z calibration 3. Replace tip shields and tip wipe assembly 4. If part has shifted in X or Y, refer to part quality section, part shift subsection. 5. In case of Z shift: a. Realign Z guide rods. b. Replace Z motor and leadscrew. 6. Replace Z assembly.
1. Excess Material Inside Head - Filament Buckled / Spaghetti Head - Encased Head	1. Check for loose heater block clamp screws. 2. Make sure the head connectors are seated properly. 3. Check air plenum for: proper hose connection; properly seating; cracks or damage. 4. Check to make sure head blower fan hose is connected to blower. 5. If extrusion fails on first layer with a used modeling base, retry with a new one 6. Rerun Z calibration 7. Plugged Liquefier - replace tips. 8. Inspect model for excessive overfill. a. Toolpaths should not overlap by more than 50%. If so, reorient and reprocess STL. b. If model curl has caused the part to contact the tip, reprocess part with less dense fill. Re-run tip Z cal if part is separating from supports c. If part curl continues, see part curl section 9. Check idler wheel gap. 10. Check liquefier alignment. 11. Head idler spring is deformed or installed improperly. Replace head idler spring. 12. Possible head temperature issue a. Replace head board and TC Amp board. b. Replace toggle head assembly. 13. Head motor power wires or encoder failure - replace toggle head 14. Blower fan not supplying enough air flow - weak or stalling. Replace fan. 15. Replace umbilical cable 16. Replace controller board 17. In case of Z shift: a. Realign Z guide rods. b. Replace Z motor and leadscrew. c. Replace Z assembly.
1. Filament motor is running very fast.	1. Make sure the head connectors are seated properly. 2. Bad motor. Replace toggle head assembly. 3. Broken wire in the umbilical cable. Replace umbilical cable.

I. Lights	
Chamber lights won't come on or are dim. (Unit is otherwise functioning normally)	1. Check and re-seat connectors to the light bar. 2. Lights are burnt out - replace light bars. 3. Check for continuity in upper harness cable. If no continuity, replace upper harness.

J. Material/Unload Error	
Material Error Filament error	1. Remove the carrier and verify material is coming out of the material guide. 2. Verify material pulls freely from the carrier. 3. Verify the material tubes are free of material 4. Reload material.
Material Error Filament blocked	1. Remove carrier and verify material pulls freely from carrier. 2. Verify the material tubes are free of material. 3. Reload material.
Material Error Carrier invalid	1. Remove carrier and verify it is not empty. 2. Replace material spool.
Material Error Filament broken	1. Remove the carrier and verify material is coming out of the material guide. 2. Verify material pulls freely from the carrier. 3. Verify the material tubes are free of material.
Load Error Filament blocked	1. Remove the carrier and verify material is coming out of the material guide. 2. Verify material pulls freely from the carrier. 3. Verify the material tubes are free of material.
Load Error Purge failed	1. Remove the carrier and verify material is coming out of the material guide. 2. Verify material pulls freely from the carrier. 3. Verify the material tubes are free of material 4. Check for and clear any excess material build up around the tips. 5. Material may be jammed in head. See “Material Jam” on page 6-6.
Unload Error Unload failed	1. Remove the carrier and verify the material tubes are free of material.
Filament does not reach filament present switch.	1. Filament is being cut off too long at carrier. Less than 1/4” should be exposed 2. Filament slipped into guide tube. Make sure filament extends to the end of the guide tube. 3. High pull force spool, refer to “filament slips at head” under LOE section. 4. Possible bad drive motor, replace material bay.
Carrier failed to load after three tries.	1. Carrier is defective (e.g. material jammed in carrier, worn drive wheel). Replace 2. Carrier is empty. Replace carrier. 3. Filament left in head or needs to be cleaned. 4. Load solenoid or motor not working. Check connections to motor/solenoid. 5. Filament is being cut off too long at carrier. Less than 1/4” should be exposed. 6. Filament guide tubes are kinked or bad. Replace filament tubes. 7. Head filament motor not running. Verify that motor runs though head maintenance. 8. Filament guides are out of alignment with motor blocks. See “Liquefier Alignment” on page 5-54.
“Load Failed” is displayed shortly after hitting “Load”	1. Check that the Z stage is not hitting the lower Z limit switch. Manually raise the Z stage several inches above the lower Z limit switch. 2. Reload material.
Filament makes it to drive wheel pinch point but “Material Error” is displayed.	1. Retry loading material 2. Perform the drive wheel alignment procedure 3. Idler wheel stuck on axle. Realign idler wheel. If wheel remains stuck replace toggle. 4. Check that pivot block spring is mounted on the pivot blocks, not the idler wheel shafts. 5. Check idler wheel stop adjustment. 6. Replace tips.

Filament makes it to drive wheel pinch point but does NOT purge.	1. Retry loading material 2. Perform the drive wheel alignment procedure 3. Idler wheel stuck on axle. Realign idler wheel. If wheel remains stuck replace toggle. 4. Check that pivot block spring is mounted on the pivot blocks, not the idler wheel shafts. 5. Check idler wheel stop adjustment. 6. Replace tips.

K. Network Communication

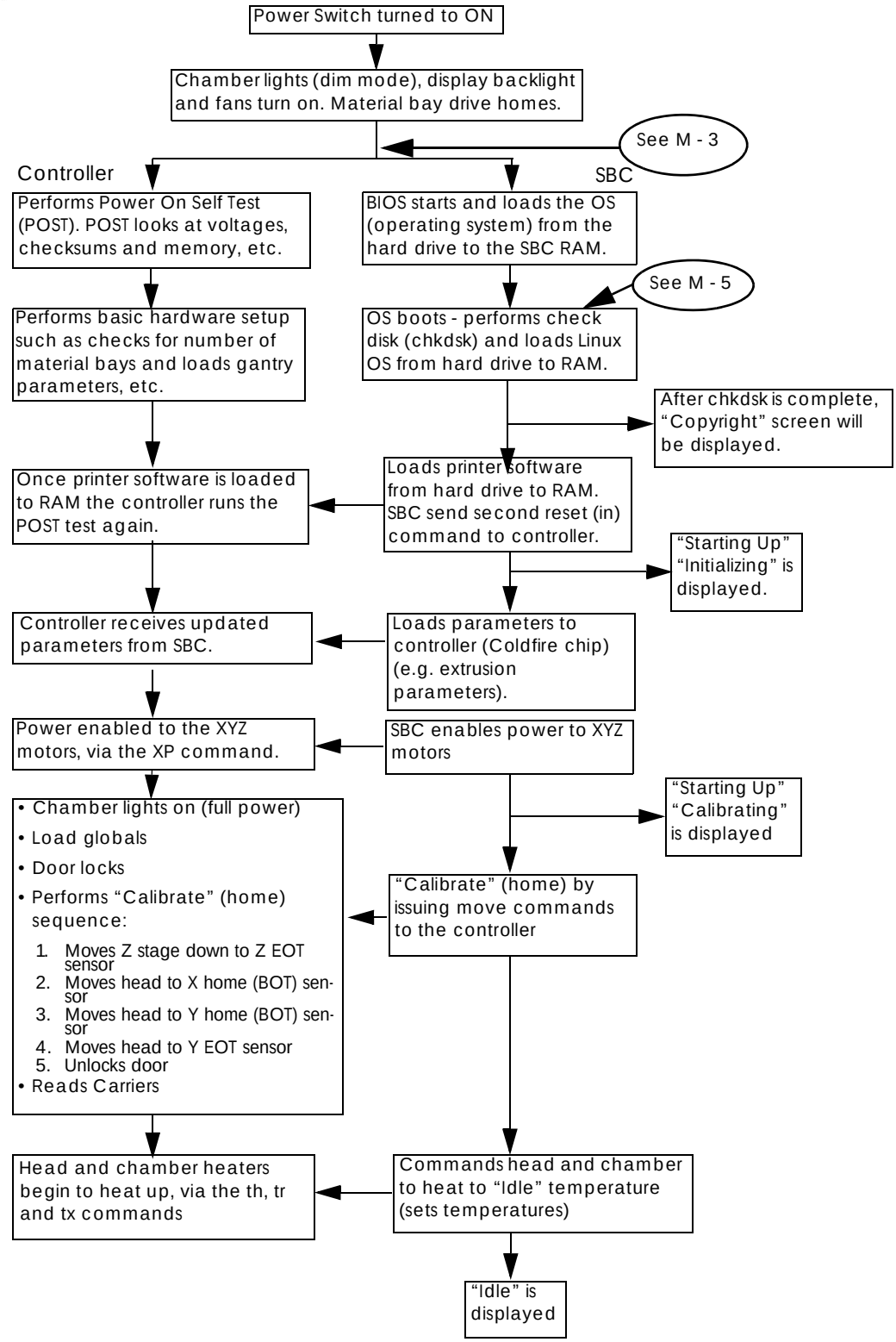
System boots, but won't talk to network.	1. If using static - Wrong IP address, check that IP in machine and CatalystEX are the same. 2. If using static - Make sure the IP address is static on the customer's network. 3. If using static - Verify IP address and netmask are correct with IT administrator. 4. Switch from static network to dynamic network or vice versa. 5. Network Internal (Pigtail) cable bad. Plug network cable directly into SBC to test. 6. Network interface on SBC has failed - green LED on SBC should blink when system is pinged, or green LED stays on when network cable is unplugged. Replace the SBC. 7. OS on Hard Drive maybe corrupt - replace the hard drive.
Cannot communicate using a crossover cable with XP Microsoft Small Business Server adds a piece of software called Firewall Client. This must be turned off.	1. From Control Panel open the Firewall Client Options dialog box, un-check the box that says “Enable Firewall Client”. 2. If using static - verify IP address, Netmask and default gateway are correct on workstation and printer.

L. Pauses During Build

Chamber won't heat up to at least - 77 degrees	1. Verify top and side panels and insulation are installed. 2. Verify chamber fans are operating. 3. Check J3 heater connector/pins on the PDB. 4. Heater bad. Check heater resistance - should be 36 +/- 5 ohms. 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 carrier 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. Unload/Reload carrier c. Replace spool d. Replace carrier e. Replace material bay
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 won't heat up:	1. Verify top and side panels and insulation are installed. 2. Verify chamber fans are operating. 3. Check J3 heater connector/pins on the PDB. 4. Heater bad. Check heater resistance - should be 36 +/- 5 ohms. 5. Relay failed on PDB, replace PDB.
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. 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
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.
No fans, lights, text and LCD back light is ON	1. Use TeraTerm and/or CFG File to check for additional error codes (root cause). 2. 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. Immediately after power-up, the LCD backlight should turn on, then the display pixels should all turn dark briefly before returning to light (blank) again. If this does not happen, then the LCD is bad. If it does happen, then either the LCD, I/O card or PDB could be at fault. 3. Re-seat the I/O card. 4. 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. 5. Measure for 12VDC at the hard drive. If not present check 12VDC power supply, replace cable or supply as needed. 6. Connect a monitor and keyboard to the SBC. a. Does BIOS drive listing show HD as primary, if not reseat 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. Reseat 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. 7. 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. Re-seat the connectors to the I/O Board. 4. Replace Controller Board. 5. Replace Single Board Computer. 6. 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 I/O Board. 4. Re-seat the Controller/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. 3. Re-seat the I/O Board.

N. “Can't Find Home - Check Modeling Base” displayed on LCD	
Head stops over Z stage/ modeling base	1. No 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.
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 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 TeraTerm 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. The tolerance from the fixed corner is +/- 0.0015. - 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.
Head stops moving while attempting to lower Z detect sensor plunger	1. Using PDB 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. Power UP / Boot	
Chamber won't heat up:	1. Verify top and side panels and insulation are installed. 2. Verify chamber fans are operating. 3. Check J3 heater connector/pins on the PDB. 4. Heater bad. Check heater resistance - should be 36 +/- 5 ohms. 5. Relay failed on PDB, replace PDB.
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. Umbilical cable connector loose at head board - check to make sure it is fully seated. 4. Verify 120 VDC at head heater connectors, if present check resistance of heaters 92 Ohms. If heaters are out of spec, replace toggle head. 5. T/C board is bad. Replace T/C board 6. Head Board is bad. Replace Head Board 7. Check for 120VDC output from the PDB. If voltage is not present or low - replace the PDB. 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
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.
No fans, lights, text and LCD back light is ON	1. Check .cfg File for additional error codes (root cause). 2. 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. Re-seat the I/O card. 3. 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. 4. Measure for 12VDC at the hard drive. If not present check 12VDC power supply, replace cable or supply as needed. 5. Replace SBC to hard drive ribbon cable. 6. 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.

Q. 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. 3. Replace PDB

R. Calibration Issues	
Tip offset cal part - support and model over 0.78" offset	1. Check that tip offset values are close to default values. default = 0.78, 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.

S. 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 +0.010 to Z offset value
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 -0.010 to Z offset value
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 -0.010 to Z offset value

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 +0.010 to Z offset value
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
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.

T. Noise	
Buzzing noise from XY motors	1. Replace XY motors 2. Replace XY table. Failed bearings in the Y drive shaft possible root cause.

4.0 Connector Pinouts and Signals

Umbilical cable diagram

Umbilical Cable

I/O Card to Head Board and T/C Amp Board

Cable # 205680-0004

		I/O card P505	**Head board P301**
Pin	Signal		Pin
P505-17	HD_ALARM_IN		P301-14
P505-7	12V		P301-6
			P301-5
P505-4	HD_SUPPORT_HEATER		P301-17
P505-3	120VDC-2		P301-16
P505-1	HD_MODEL_HEATER		P301-19
P505-2	120VDC-1		P301-20
P505-5	GND		
P505-6	GND		P301-2
P505-21	MODEL_TOGGLE_IN		P301-1
P505-10	SUPPORT_TOGGLE_IN		P301-11
P505-11	XEOT_IN		P301-12
P505-22	XHOME_IN		P301-13
			P301-22
			P301-7
			P301-8
		I/O card P506	P301-21
			P301-4
Pin	Signal		
P506-1	GND		
P506-7	SUBSTRATE_DETECT_IN		**T/C board P3**
P506-2	SUBSTRATE_CLK_OUT		
P506-8	HD_MTR_PH0_1		Pin
P506-3	HD_MTR_PH1_1		P3-8
P506-9	HD_MOTOR_OUT_1		P3-1
P506-4	HD_MOTOR_OUT_2		P3-9
			P3-6
P506-10	CHAMBER_TEMP_ALARM		P3-3
P506-5	GND		
P506-6	SUPP_TC		P3-7
P506-11	MODEL_TC		P3-10
P506-12	GND		

Umbilical cable pinouts

Pin	Signal	Signal Information
T/C Open Alarm		
P505-17	HD_ALARM_IN	T/C open alarm (open T/C on either model or support). Normal = 4 V Open = 0 V
P505-7	12V	12VDC
Support Heater		
P505-4	HD_SUPPORT_HEATER	Return from heater
P505-3	120VDC-2	120 VDC out to support heater
Model Heater		
P505-1	HD_MODEL_HEATER	Return from heater
P505-2	120VDC-1	120 VDC out to model heater
P505-5	GND	Signal ground
P505-6	GND	Signal ground
Toggle Sensors		
P505-21	MODEL_TOGGLE_IN	Toggle in model position. In position = 0 V
P505-10	SUPPORT_TOGGLE_IN	Toggle in support position. In position = 0 V
X Axis Sensors		
P505-11	XEOT_IN	X EOT sensor. Sensor is NC = 5VDC. Open = 1.8VDC. See TP18 and DL3 on PDB
P505-22	XHOME_IN	X BOT sensor. Sensor is NC = 5VDC. Open = 1.8VDC. See TP19 and DL4 on PDB
Substrate Detect		
P506-7	SUBSTRATE_DETECT_IN	Up position = 5 V. Signal in normally high (in up position).
P506-2	SUBSTRATE_CLK_OUT	Square wave that drives the opto sensor
Head Motor Encoder		
P506-8	HD_MTR_PH0_1	Encoder signal (phase 1 from head drive motor encoder)
P506-3	HD_MTR_PH1_1	Encoder signal (phase 2 from head drive motor encoder)
Head Motor Power		
P506-9	HD_MOTOR_OUT_1	Power to head drive motor - 12 VDC
P506-4	HD_MOTOR_OUT_2	Power to head drive motor - 12 VDC
Over Temp Alarm		
P506-10	CHAMBER_TEMP_ALARM	Chamber/Head area is over temp (+100C) Chip located on T/C Amp Board Normal = 0 V. Over temp alarm = +4 V
T/C Signals		
P506-6	SUPPORT_TC	Support T/C signal (0.010 = 1 C). Signal amplified on T/C Amp Board
P506-11	MODEL_TC	Model T/C signal (0.010 = 1 C). Signal amplified on T/C Amp Board
P506-12	GND	Signal ground
P506-1	GND	Signal ground
P506-5	GND	Signal ground

Upper harness

Upper Harness

From I/O card to head blower fan, power on/off switch, left and right chamber lights, LCD display, door solenoid and door switch

Cable # 102597-0002

		I/O Card			
Pin	Signal			**Door latch**	Pin
P504-8	+12V-3 DOOR LATCH	**P504**		**P11**	P11-1
P504-20	RTN DOOR LATCH				P11-3
				Chamber light right	
P504-21	24V LAMP #1 RT			**P14**	P14-1
P504-9	RTN LAMP#1 RT				P14-4
				Chamber light left	
P504-22	24V LAMP#2 LF			**P16**	P16-1
P504-10	RTN LAMP#2 LF				P16-4
				Door switch	
P504-7	DRSW			**P10**	P10-1
P504-19	GND				P10-2
				On/Off switch	
P504-6	ON/OFF SW			**SW**	T6-NC
P504-18	ON/OFF GND			**SW**	T5-COM
				Head cooling fan	
P504-24	24V HEAD COOL FAN			**P50**	P50-1
P504-12	SWITCHED RTN HEAD FAN				P50-2
				LCD display	
P504-1	+12V-2				P1-10
P504-13	GND			**P1**	P1-5
P504-2	RXD1				P1-4
P504-14	TXD1				P1-9
P504-3	RTS1				P1-7
P504-4	CTS1				P1-2
P504-15	CHASSIS GND				P1-6

Upper harness pinouts

Pin	Wire Color	Signal	Signal Information
		Door Latch	
P504-8	WHITE	+12V-3 DOOR LATCH	Latched = 8 V (does not receive full 12VDC to reduce heat). Unlatched = 0 V

Pin	Wire Color	Signal	Signal Information
P504-20	BLACK	RTN DOOR LATCH	Latched = >1 V. Unlatched = 0 V
Chamber Light Right			
P504-21	RED	24V LAMP #1 RT	24 VDC to light
P504-9	BLACK	RTN LAMP#1 RT	Light on = 0 V. Light off = 24 V
Chamber Light Left			
P504-22	RED	24V LAMP#2 LF	24 VDC to light
P504-10	BLACK	RTN LAMP#2 LF	Light on = 0 V. Light off = 24 V
Door Switch			
P504-7	YELLOW	DRSW	Door closed = 0 V. Door open = 5 V
P504-19	GREEN	GND	GND
On/Off Switch			
P504-6	YELLOW	ON/OFF SW	Requesting shutdown to controller board. (LED on PDB is on when powering down)
P504-18	GREEN	ON/OFF GND	GND
Head Cooling Fan			
P504-24	RED	24V HEAD COOL FAN	24 VDC
P504-12	BLACK	SWITCHED RTN HEAD FAN	Blower on = 0 V. Blower off = 24 V
LCD Display			
P504-1	W/R	+12V-2	12 VDC
P504-13	GREEN	GND	GND
P504-2	WHITE	RXD1	Receive data
P504-14	YELLOW	TXD1	Transmit data
P504-3	BLUE	RTS1	Request to send
P504-4	ORANGE	CTS1	Clear to send
P504-15	GRN/Y	CHASSIS GND	GND

Lower harness

Lower Harness

From PDB to Z BOT, Z EOT, chamber fans, frame ID

Cable # 102598-0004

Pin	Signal	PBD
P8-11	ZHOME_C	P8
P8-1	ZHOME_E_GND	
P8-12	ZHOME_A	
P8-13	ZEOT_C	
P8-3	ZEOT_E_GND	
P8-14	ZEOT_A	
P8-5	+3.3V	
P8-15	I2C CLOCK	
P8-6	GND	
P8-16	I2C DATA	
P8-18	24V L-R FAN	
P8-8	RTN L-R FAN	
P8-20	24V R-F FAN	
P8-10	RTN R-F FAN	
P8-17	PURGING	
P8-7	GND	
P8-19	DETECTED	
P8-9	+5VDC	

Z home (BOT) sensor

P2	P2-4	ZHOME_C
	P2-2	ZHOME_E_GND
	P2-1	ZHOME_A

Z EOT sensor

P3	P3-4	ZEOT_C
	P3-2	ZEOT_E_GND
	P3-1	ZEOT_A

Frame ID

P1	P1-1	+3.3V
	P1-2	I2C CLOCK
	P1-4	GND
	P1-3	I2C DATA

Left Chamber Fan

P6	P6-1	24V L-R FAN
	P6-2	RTN L-R FAN

Right Chamber Fan

P5	P5-1	24V R-F FAN
	P5-2	RTN R-F FAN

NOTE: Purge detect sensor is not used or intalled

Purge Detect

P401	P401-4	PURGING
	P401-2	GND
	P401-3	DETECTED
	P401-1	+5VDC

Lower harness pinouts

Pin	Wire Color	Signal	Signal Description
Z Home (BOT) Sensor			
P8-11	YELLOW	ZHOME_C	Collector (return) to PDB
P8-1	GREEN	ZHOME_E_GND	GND
P8-12	RED	ZHOME_A	Anode (opto driver)
Z End of Travel (EOT) Sensor			
P8-13	YELLOW	ZEOT_C	Collector (return) to PDB
P8-3	GREEN	ZEOT_E_GND	GND
P8-14	RED	ZEOT_A	Anode (opto driver)
Frame ID			
P8-5	RED	+3.3V	Future enhancement. Frame ID. E-PROM signal (SN, CAL file, etc.)
P8-15	YELLOW	I2C CLOCK	Future enhancement. Frame ID. E-PROM signal (SN, CAL file, etc.)
P8-6	BLACK	GND	Future enhancement. Frame ID. E-PROM signal (SN, CAL file, etc.)
P8-16	GREEN	I2C DATA	Future enhancement. Frame ID. E-PROM signal (SN, CAL file, etc.)
Left Chamber Fan			
P8-18	RED	24V L-R FAN	24VDC
P8-8	BLACK	RTN L-R FAN	GND
Right Chamber Fan			
P8-20	RED	24V R-F FAN	24VDC
P8-10	BLACK	RTN R-F FAN	GND
Purge Detect (not used)			
P8-17	BLACK	PURGING	Not used
P8-7	GREEN	GND	Not used
P8-19	WHITE	DETECTED	Not used
P8-9	RED	+5VDC	Not used

Part Quality Troubleshooting

Embedded support strands in model

Characteristics: Strands of support material embedded in model.

Example of embedded support

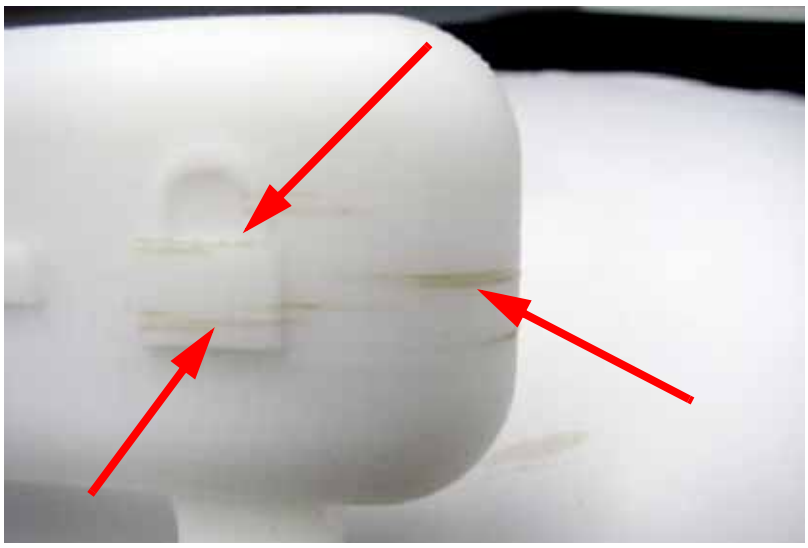
Problem corrected after re-orientation

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.

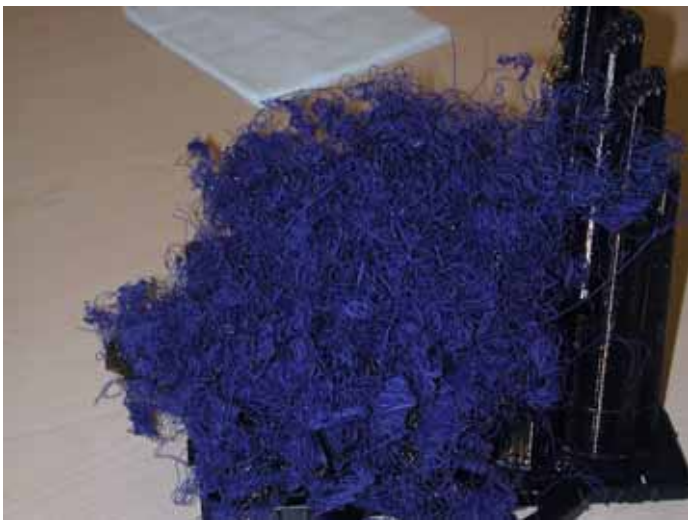


Corrective actions

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 shrouds, replace tip shrouds.
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.



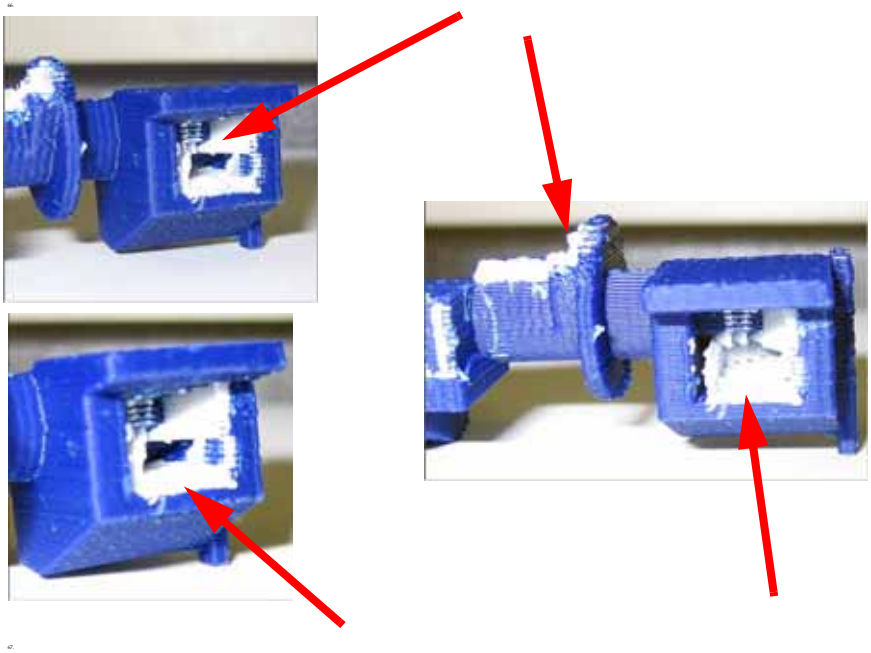
Here the support material has had a loss of extrusion, causing the model material to continue to extrude without support material under it. If the model material has had a loss of extrusion, the scenario would be reversed, the support material would have extruded with no model material under it.

Corrective actions

1. Material cartridge is jammed or empty. Replace cartridge.
2. Tips are plugged. Replace the tips
3. Swivel head is jammed. Attempt to clear the jam, replace the swivel 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 swivel 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.

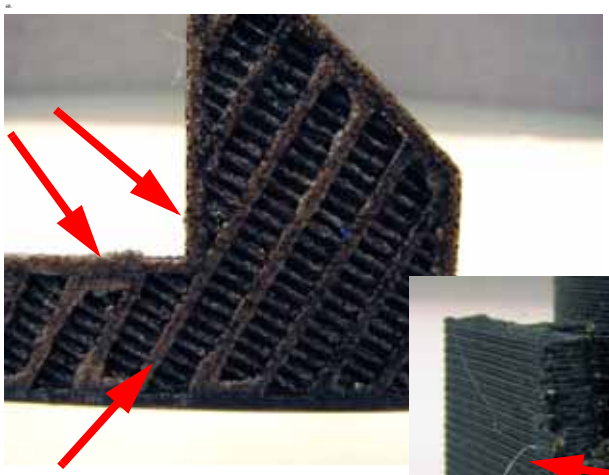


Corrective actions

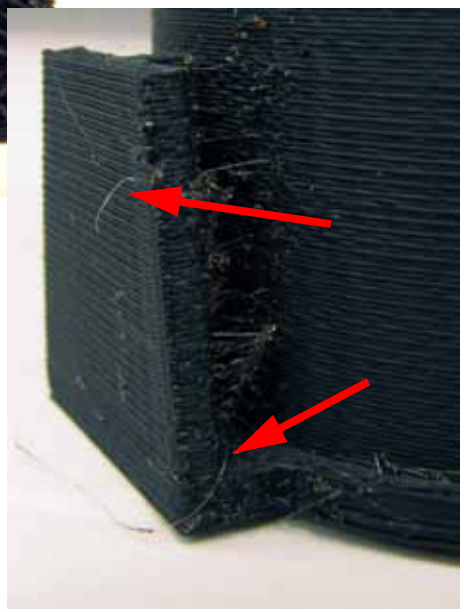
1. Run Z and Offset Calibrations
2. Check for loose tip screws. Tighten screws if required.
3. Check for loose modeling base. Use a new modeling base.

Moisture in material

Characteristics: Material will appear to rough or stringy.



Rough



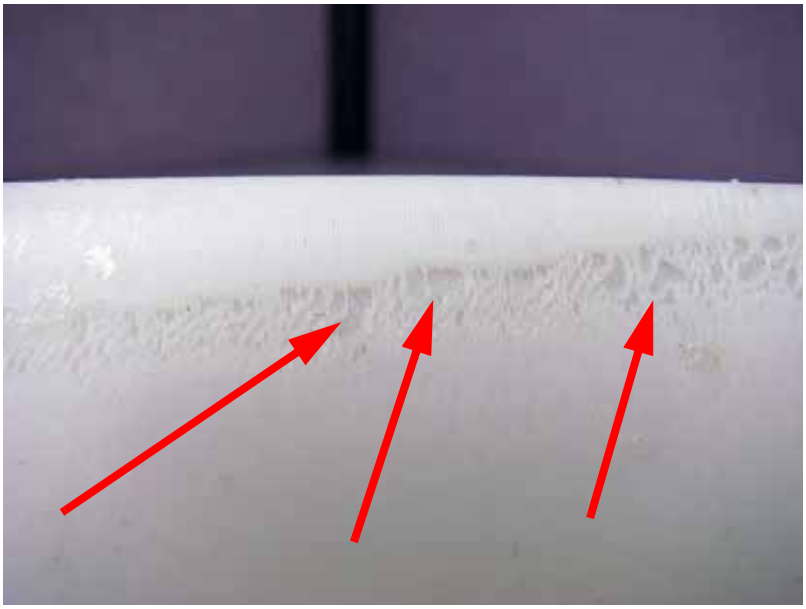
Stringy

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.

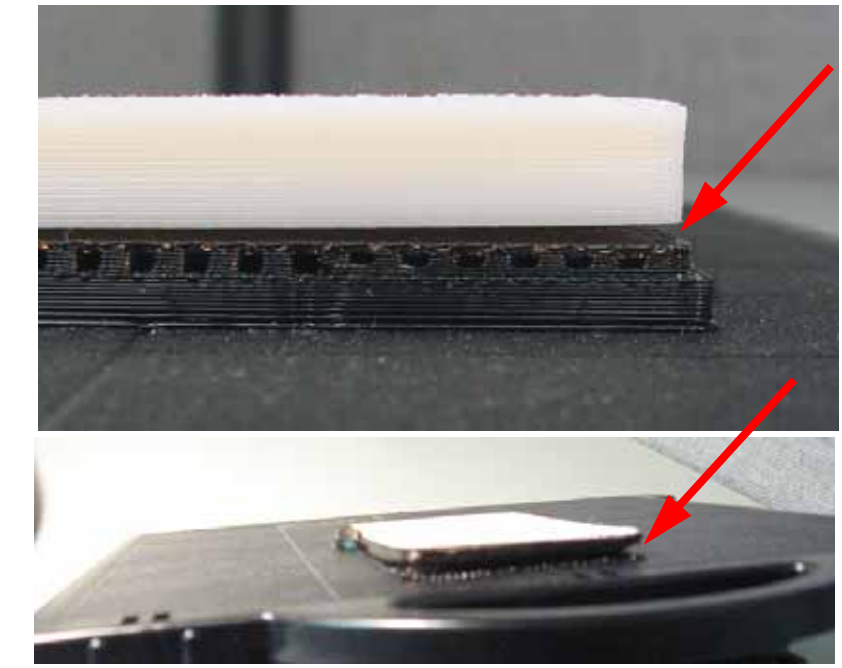


Corrective actions

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 swivel head assembly.

Part curling

Characteristics: Top surface appears rough. Model and support will separate or support and substrate will separate.

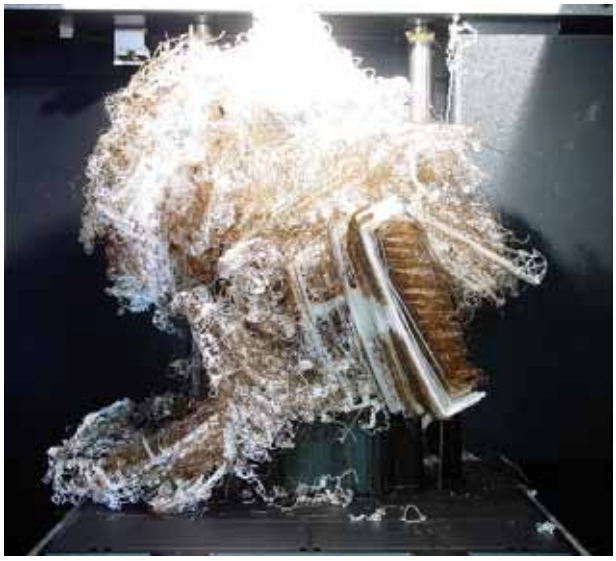


Corrective actions

1. The part is too dense, try using the “Sparse Fill” option in CatalystEX.
2. Modeling base has been re-used or is defective. Replace with unused modeling base.
3. Run Z Calibrations.
4. Verify proper operation of all chamber fans. Replace fans as needed.
5. Verify chamber heaters are secured and operating properly. Replace heaters as needed.
6. 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.

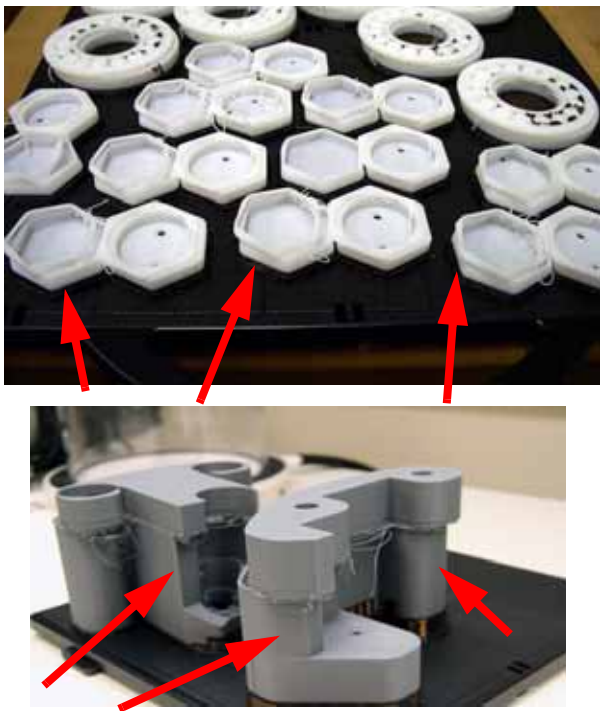


Corrective actions

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.

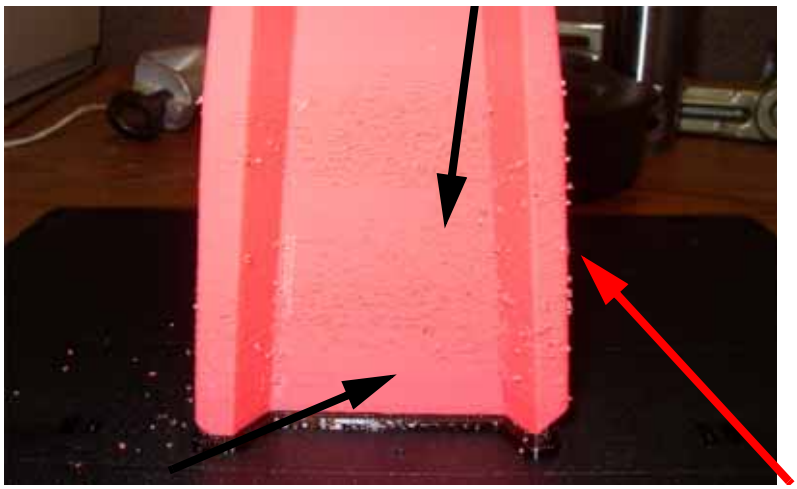


Corrective actions

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 swivel 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.

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 shrouds.
5. Loose tips screws, tighten the screws.
6. Replace the tips.
7. Check X/Y guide rods for loose hardware. Replace XY table as needed.

Rough quality all over

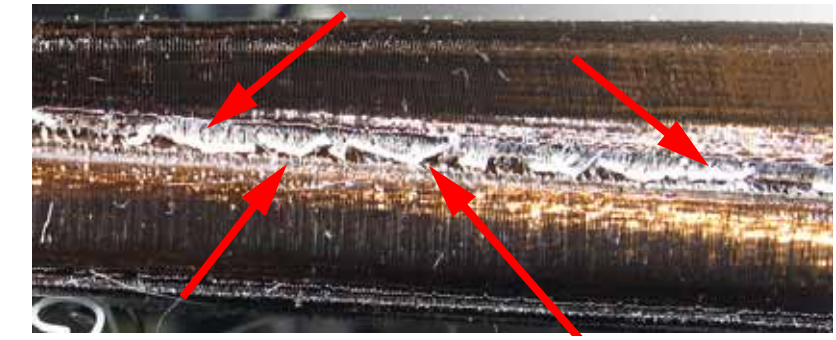
Characteristics: The part sides, top and bottom are very rough.

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 shrouds.
5. Loose tips screws, tighten the screws.
6. Replace the tips.

Model strands on parts

Characteristics: Model material strands appear outside the normal model build.

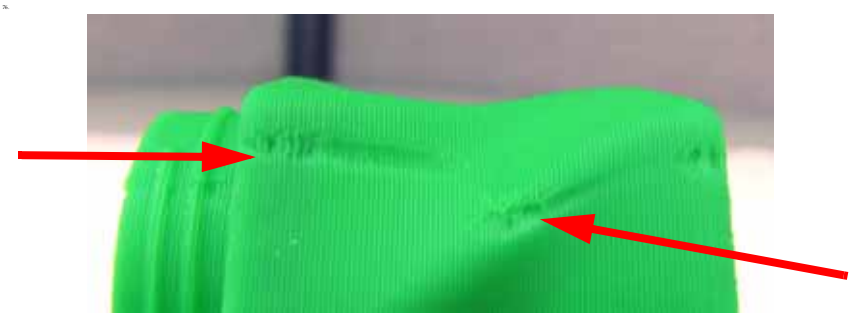


Corrective actions

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 swivel 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,

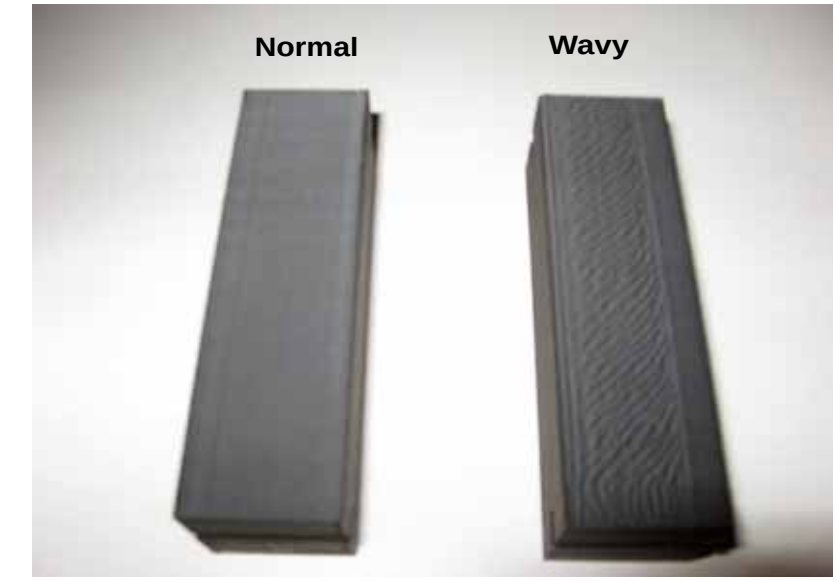


Corrective actions

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 shrouds.
5. Loose tips screws, tighten the screws.
6. Replace the tips.
7. Check X/Y guide rods for loose hardware. Replace XY table as needed.

Wavy parts

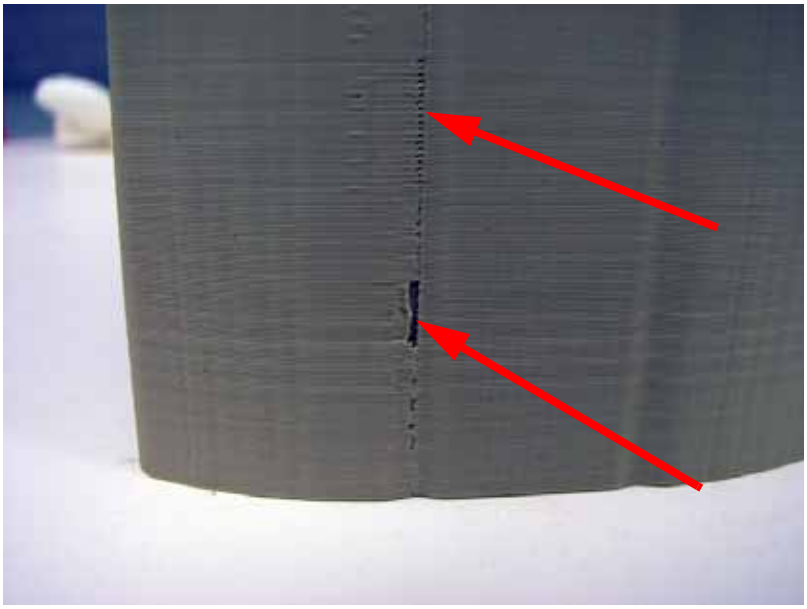
Characteristics: Parts will shift in X and Y, giving the appearance of waves.

Corrective actions

1. Verify X and Y guide rods are securely fastened.
2. Check and adjust X, Y and Z belt tensions.
3. Verify the Z stage is properly leveled.
4. Verify the Z pulley is in the correct position.
5. Replace the Z stage.
6. Replace the XY table.

Under fill

Characteristics: Open seam between start and stop of toolpath.



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

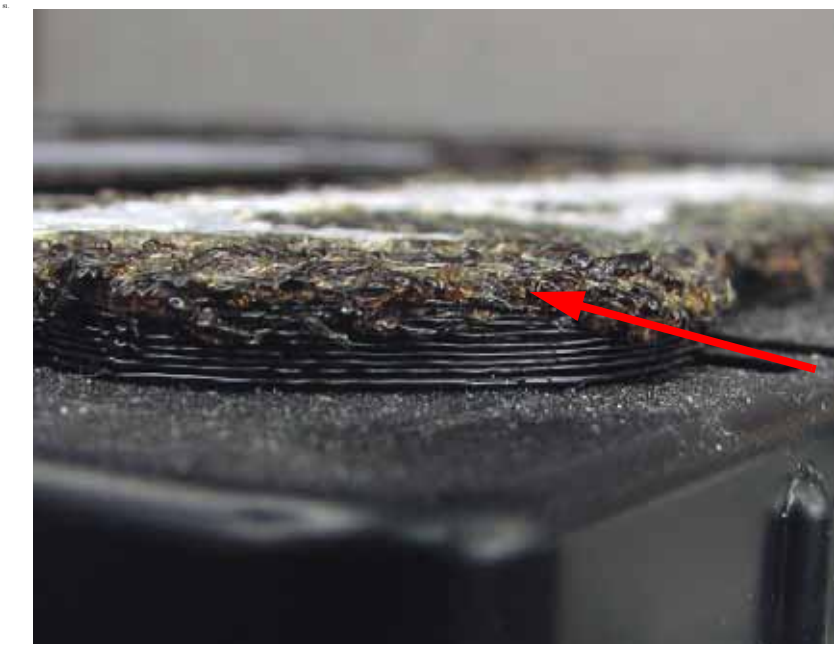
Characteristics: Surface finish not smooth.

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.

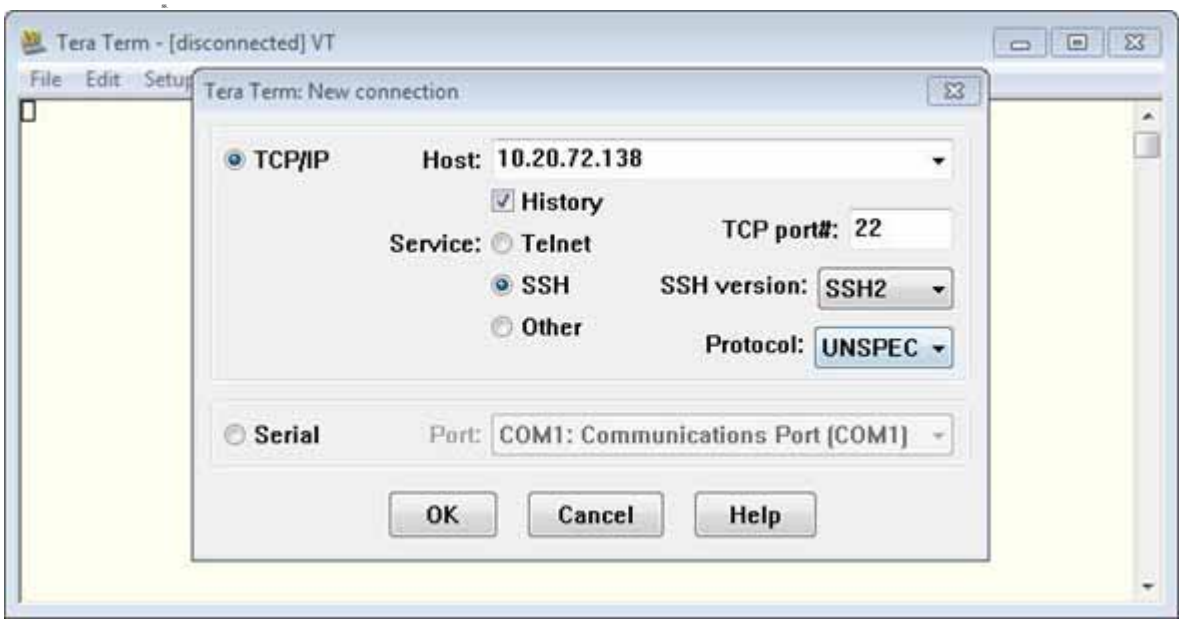
- Computer with Windows XP, Windows Vista or Windows 7.

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:

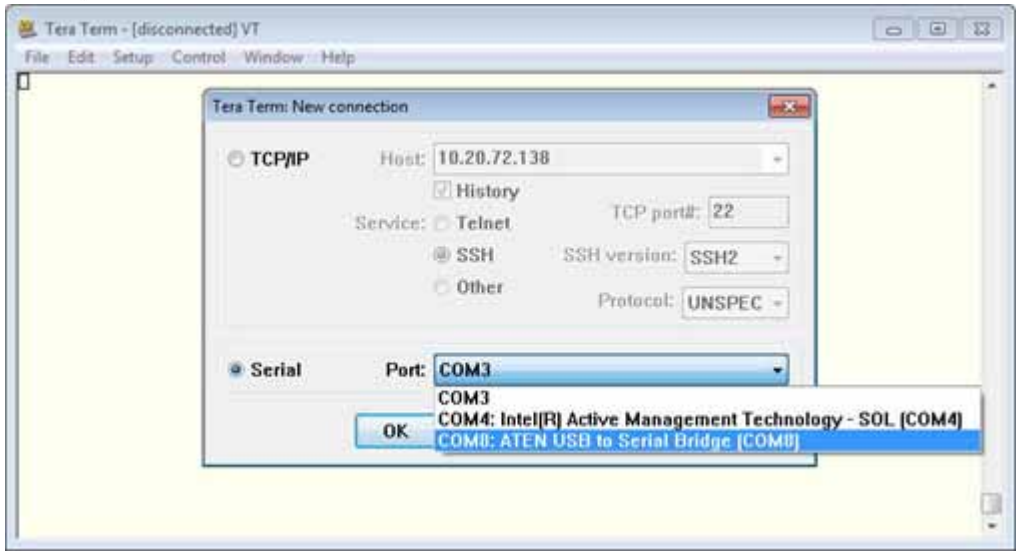
4. Once TeraTerm is started the New Connection Window will come up, see Figure 6-385. If the New Connection window does not open, click **File > New Connection.**

Figure 6-385: New Connection Window



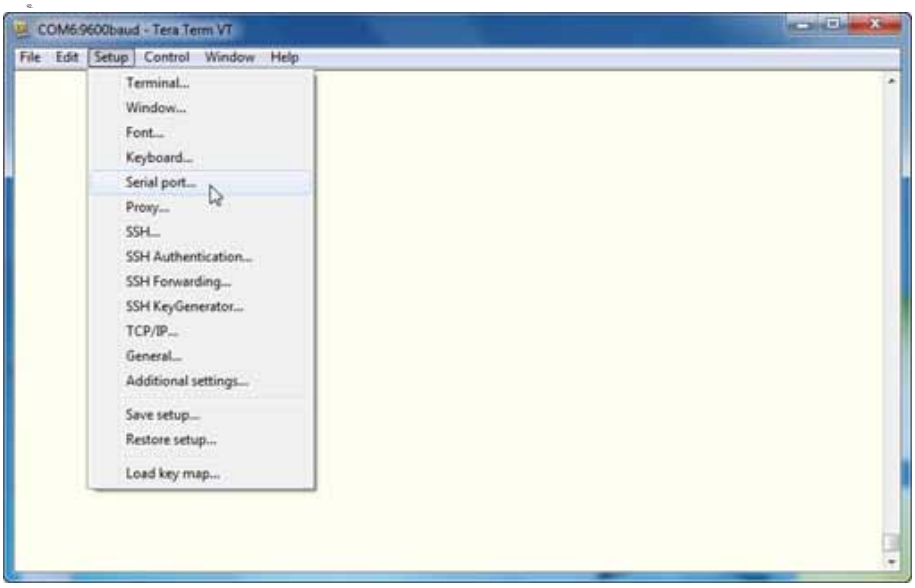
5. Select the **Serial** radio button, see Figure 6-386.
6. From the **Port:** pull-down menu select the COM port that the USB to serial converter is connected to, see Figure 6-386.

Figure 6-386: New Connection Settings



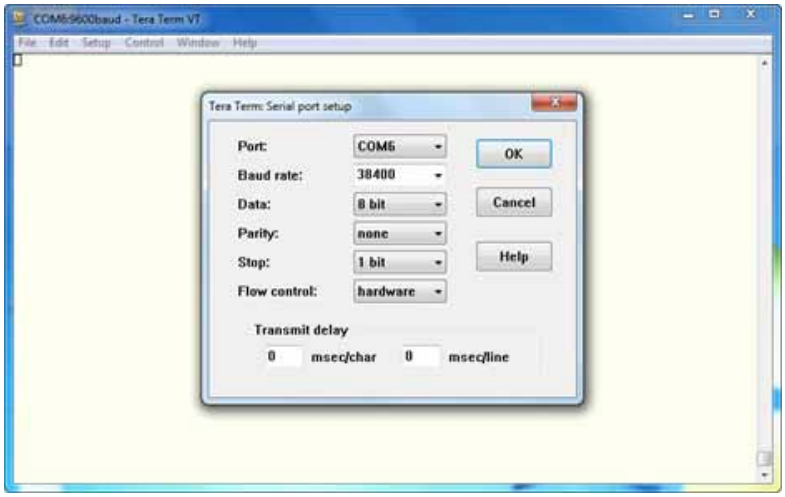
7. Click **OK**.
8. Click on **Setup > Serial Port**, see Figure 6-387.

Figure 6-387: Setup Serial Port



9. From the **Baud Rate:** pull-down menu select **38400**, see Figure 6-388.
10. From the **Flow Control:** pull-down menu select **hardware**, see Figure 6-388.
11. The rest of the settings should default to the correct values. Click **OK**, see Figure 6-388.

Figure 6-388: 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 TeraTerm 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 TeraTerm window.

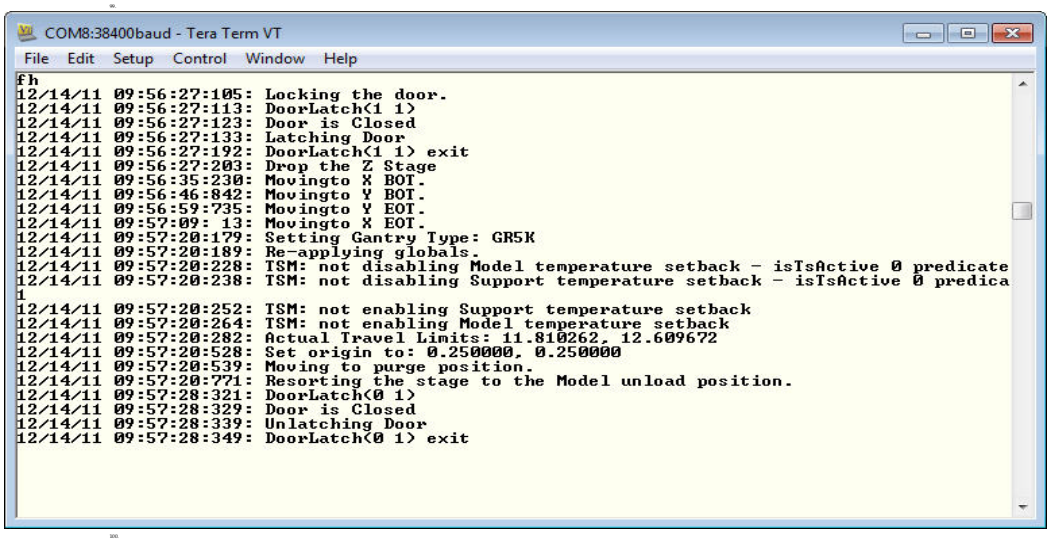
2. **fh =** Find Home.

   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 6-389.

Figure 6-389: 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.

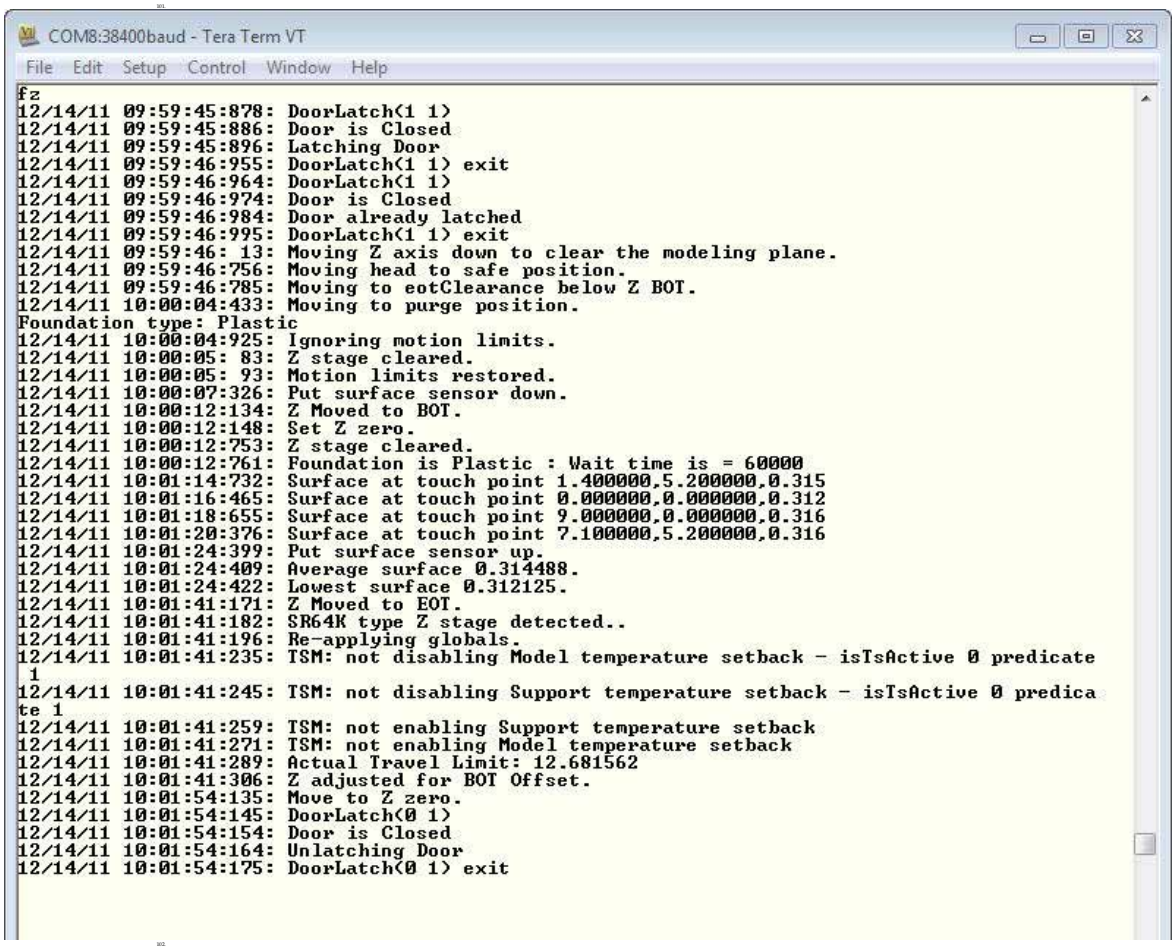
3. **fz =** Find Z home

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 6-390.

Figure 6-390: Find Z Home



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 micro-steps per inch. This indicates either a three leadscrew Z-Stage or a single leadscrew Z-Stage.

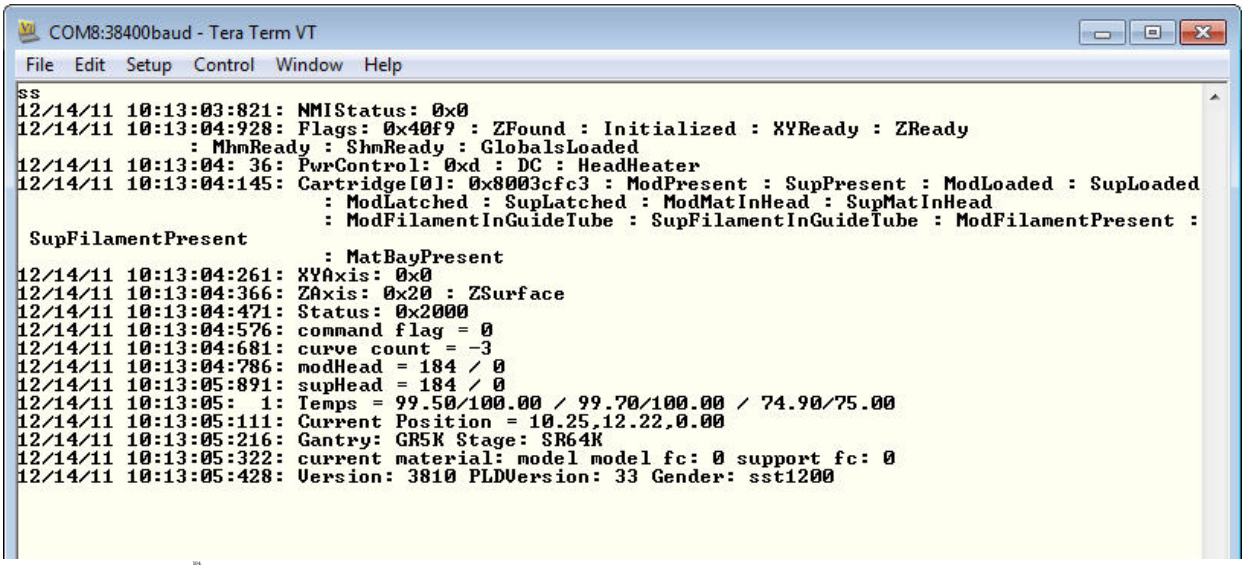
4. **ss** = Switch Status

   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:

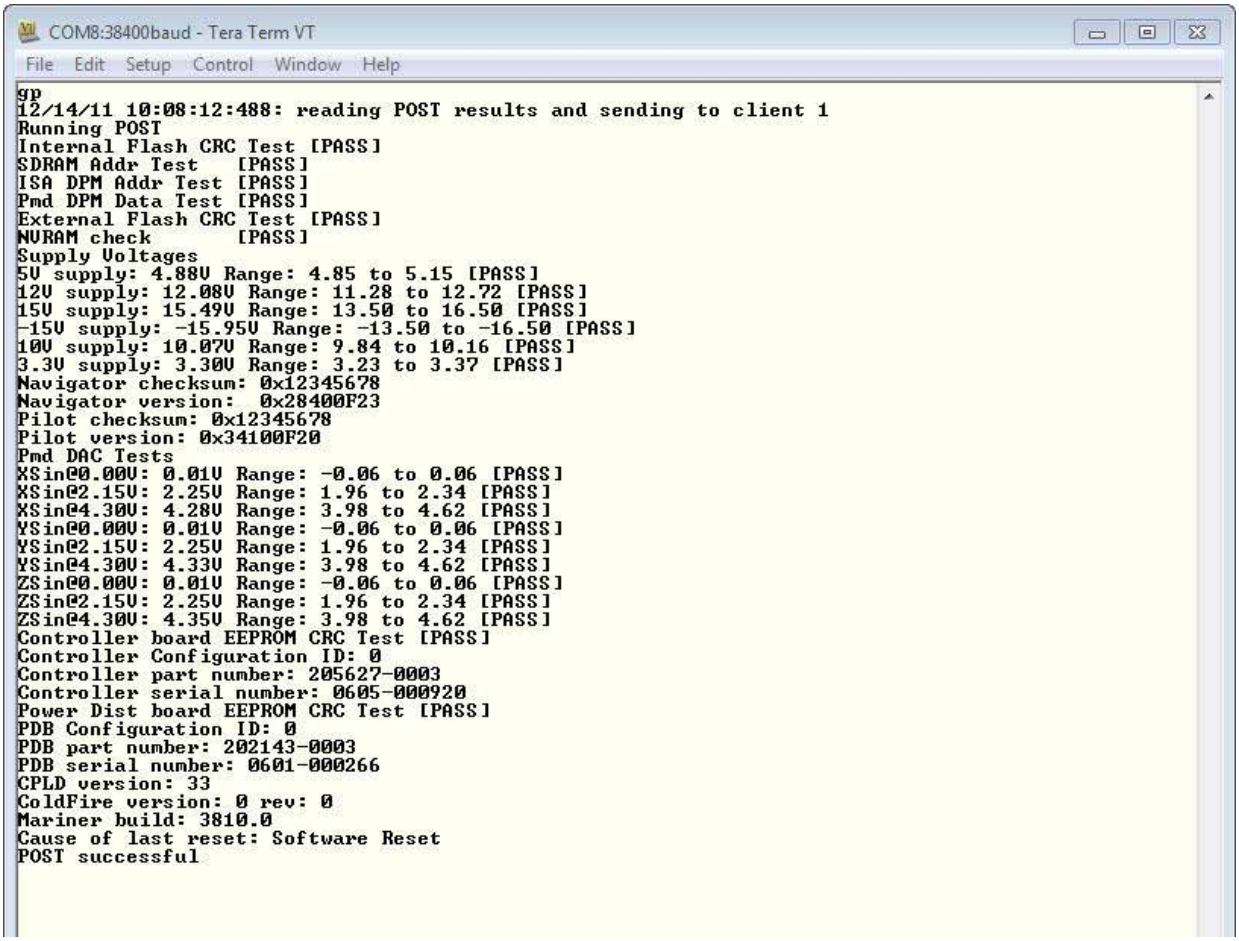
- Printer Gender (sent either wrong system software or .CAL file to printer).
- Motor gear ratio (if the system does not home correctly, the gear ratio could be changed from cable table to belt table).
- Head temp set point (with MaracaEX you can change the temp to not match system software specification, causing errors).
- System Software version check.

Figure 6-391: Switch status



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 6-392: Get POST



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.

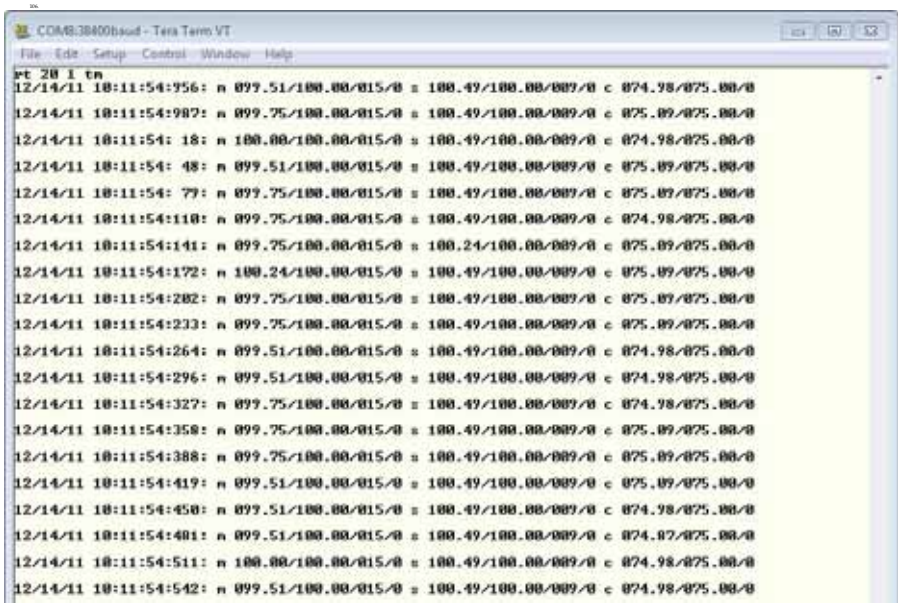
- The command **RT 1000 0 tm** will help troubleshoot temperature issues in maintenance mode only.
- The command **RT 100 0 fh** or **RT 100 0 fz** will help verify any X/Y/Z sensors that had issues before the repair are tested and operational.

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 6-393: 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 6-394: Load exception

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 setpoint and if the temperature is stable once it reaches the setpoint 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).

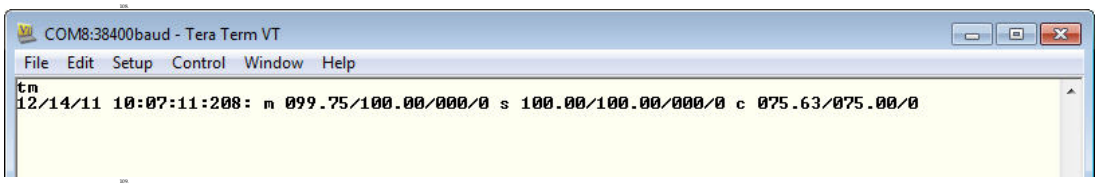
   The information is displayed on a single line in the following format:

   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 6-395: 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

Startup kit tools

The startup kit contains a set of tools used to help you maintain the printer. The following is a list of the tools contained in the startup kit.

- Needle nose pliers
- T-Handled allen wrench - 1/8 inch
- T-Handled allen wrench - 7/64 inch
- Gloves (Leather)
- Cutters
- Brush
- Magnifier

Preventive Maintenance

Daily

Empty the purge bucket

Empty the purge bucket after each build has completed.

Inspect the tip wipe assembly

After each build you should inspect the tip wipe assembly to make sure there is no material build up. If there is material build up, clean the tip wipe assembly. Material build up on the tip wipe assembly can cause part quality issues. See Tip wipe assembly on page 7-3.

Inspect the tip shields

After each build you should inspect the tip shields 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 shield replacement on page 7-5.

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

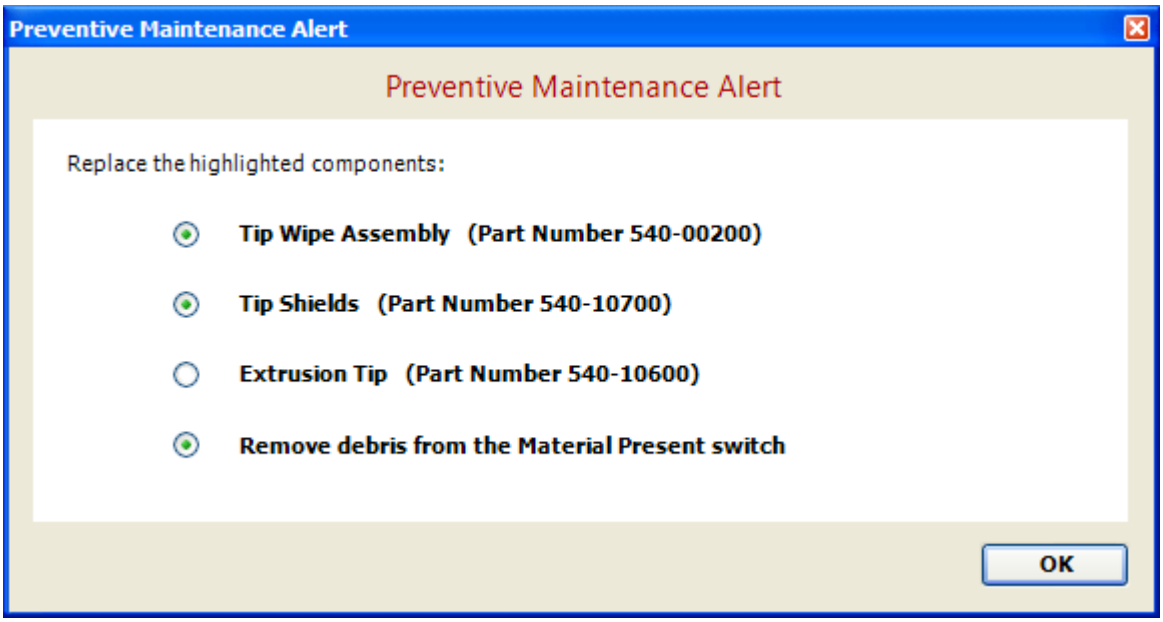
Do not use ammonia based glass cleaner on the door. It will damage the acrylic window.

Caution: ONLY use acrylic cleaner.

500 Hour maintenance

Preventive Maintenance Alerts will be displayed on the workstation at the 500 hour time interval as a reminder to perform preventive maintenance. See Figure 7-396.

Figure 7-396: Preventive Maintenance Alert

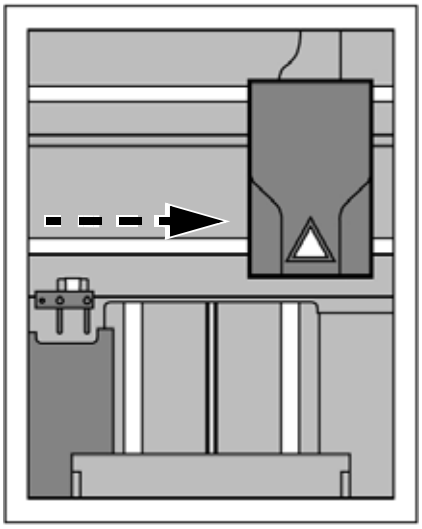


Tip wipe assembly

The tip wipe assembly should be replaced approximately every 500 hours.

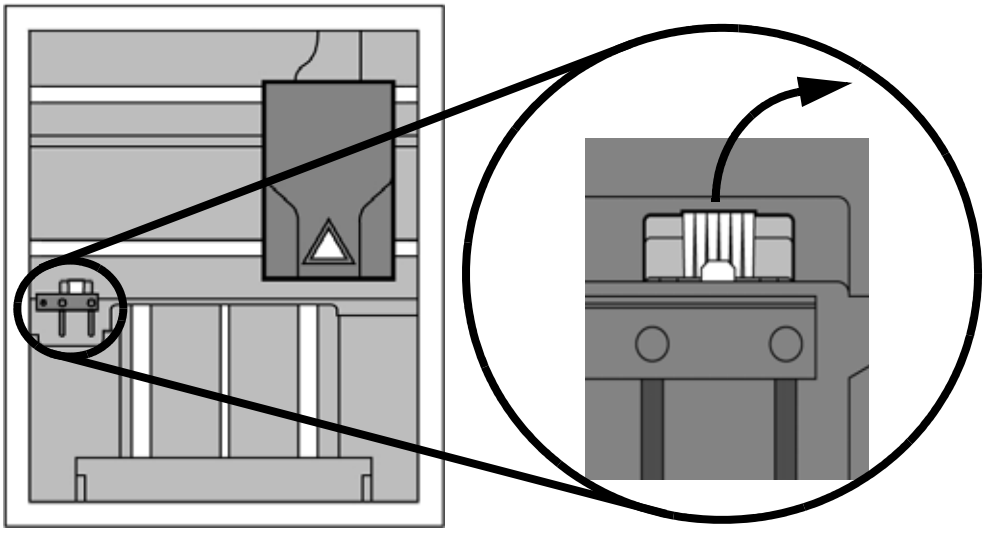
1. Completely power down the printer.
2. Move the head to the right of the printer to gain access to the tip wipe assembly.

Figure 7-397: Move the toggle head to the right



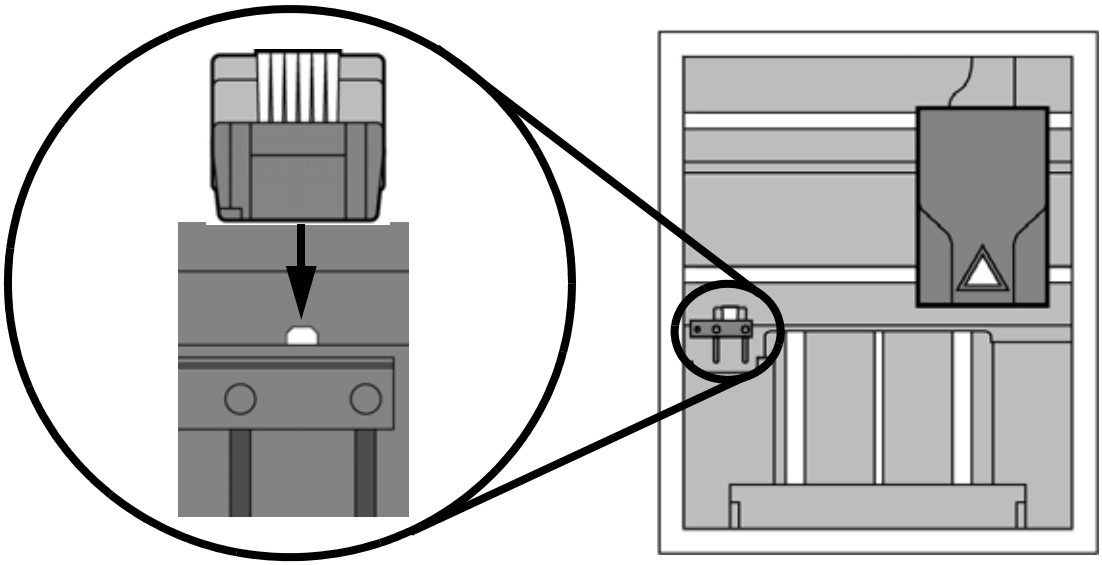
3. Remove the tip wipe assembly by lifting the assembly up and out of the printer. Discard this tip wipe assembly. See Figure 7-398.

Figure 7-398: Replacing the tip wipe assembly



4. Place the new tip wipe assembly over the two mounting posts making sure the assembly is fully installed. See Figure 7-399.

Figure 7-399: Installing tip wipe assembly

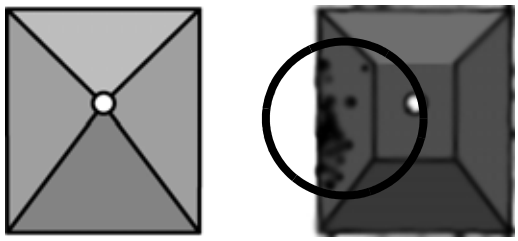


5. Power the printer back up.

Tip shield replacement

Tip shields can become worn or damaged over time. This can have a negative impact on the surface finish and detail of models. Replace the tip shields every 500 hours.

Figure 7-400: Tip Shield damage

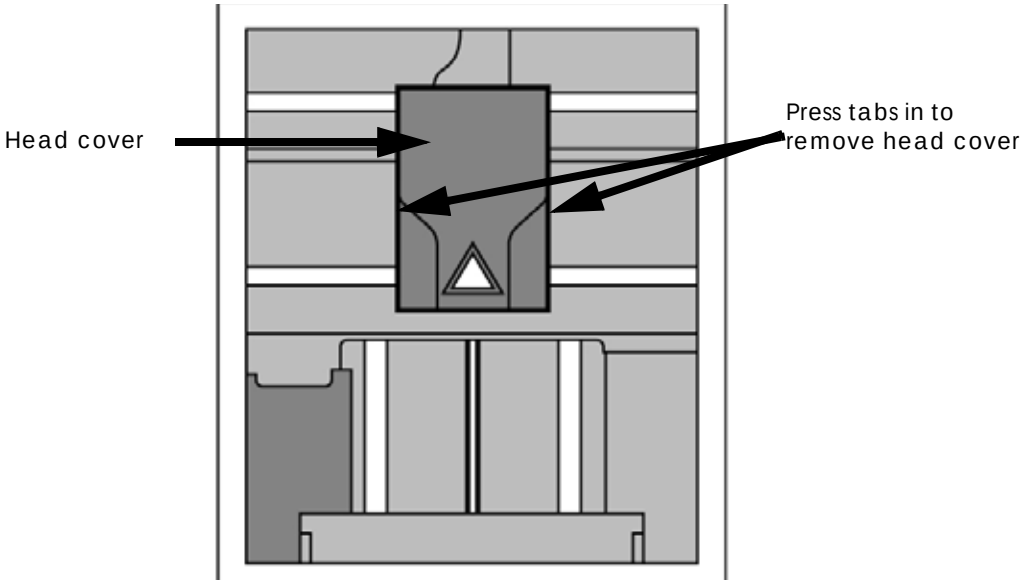


1. Enter **Head Maintenance**.
   A. From the display panel press **Maintenance**.
   B. Press **Machine**.
   C. Press **Head.** The head will come to rest in the center of the chamber and the Z platform will change position.

Gloves: The head area is hot, wear gloves when working in this area of the printer.

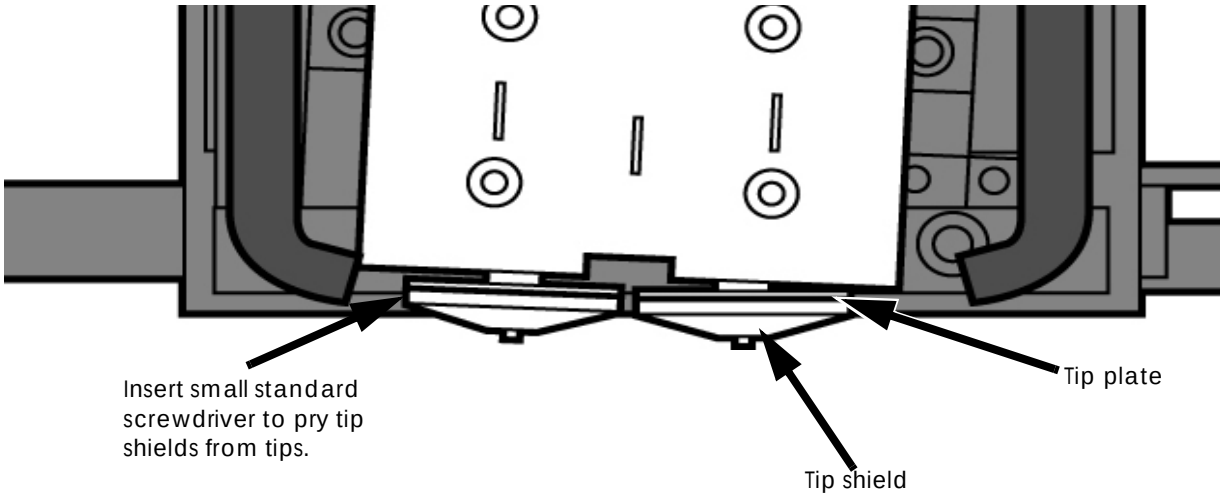
2. Remove the head cover by pressing the tabs in and pulling away from the head. See Figure 7-401.

Figure 7-401: Head cover tab locations



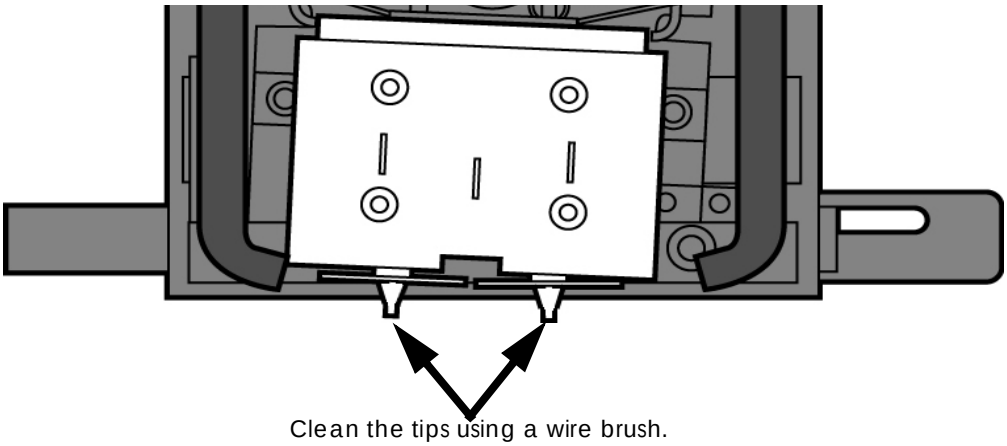
3. Position the blade of a small screwdriver between the tip shield and tip plate. Use the blade of the small screwdriver to separate the tip shield from the tip plate. See Figure 7-402.

Figure 7-402: Tip Shield removal



4. Clean the tip using the wire brush supplied with the Startup Kit to remove any debris. See Figure 7-403.

Figure 7-403: Clean tips with wire brush



5. Install a new tip shield by pushing it over the exposed tip, keeping the slotted end toward the back of the head. See Figure 7-404.

Note: Tip shield should be flush with the tip plate as shown in Figure 7-405.

Figure 7-404: Tip Shield installation

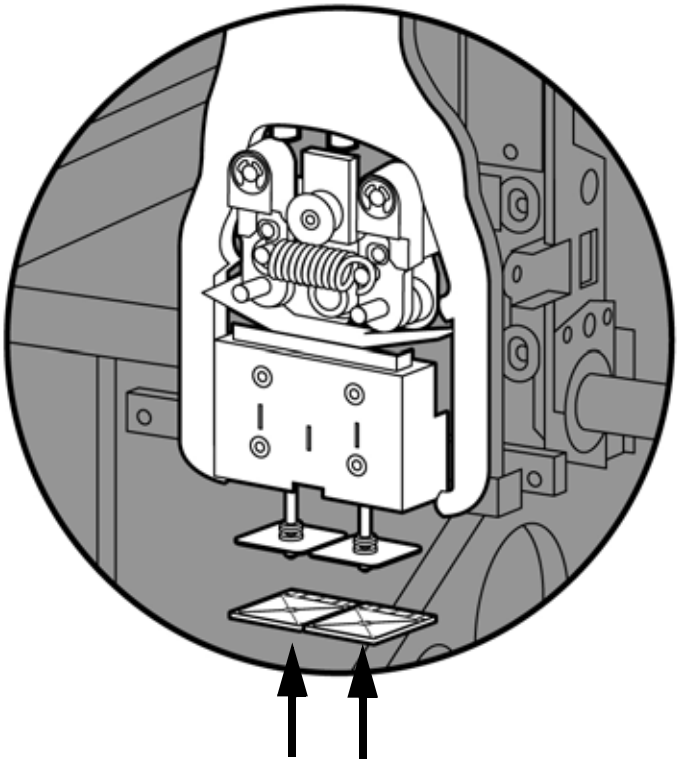
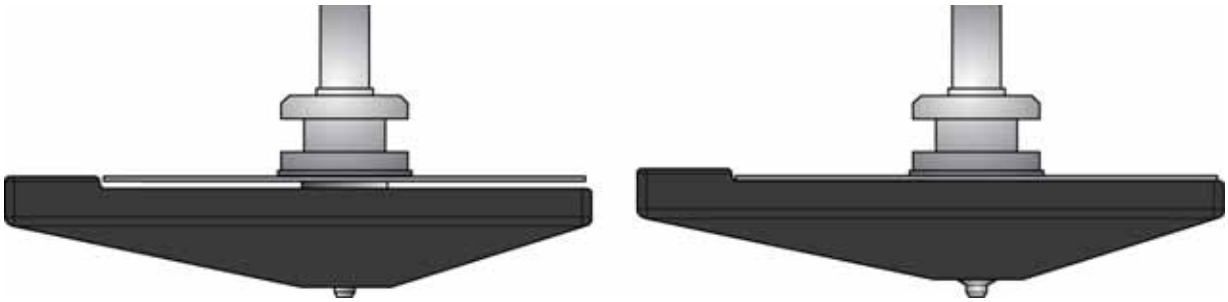


Figure 7-405: Tip shield placement



Tip shield NOT seated correctly

Tip shield seated correctly

6. Replace head cover.

Note: If the head cover is not replaced the printer may not function properly.

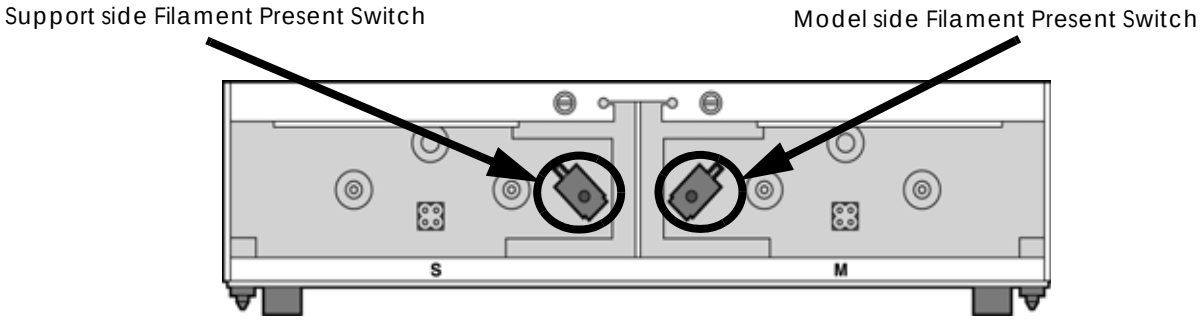
7. Exit **Maintenance**, press **Done** until back at **Idle**.

Remove debris from the Filament Present switch

There may be a time when the Filament Present switch needs to be cleared in addition to the 500 hour maintenance. For example, if a **Material Error-Filament blocked** message appears on the display panel; the recommendation may be to clear debris from the Filament present switch.

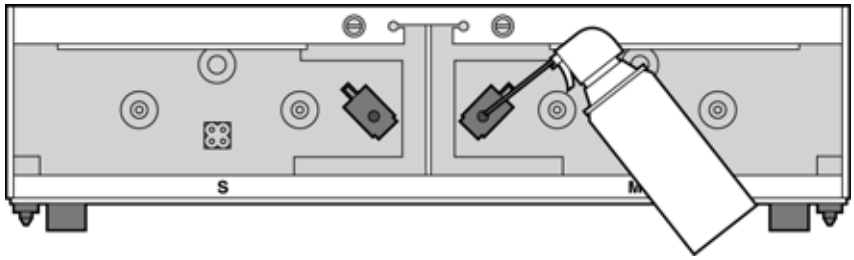
1. Unload material from the printer and remove the material carriers.
2. Open the material bay doors by gently pressing in to release and pulling outwards.
3. Remove the material carriers by first pushing them in to unlatch and then pulling them outwards.
4. Disconnect the material tubes from the rear of the material bay(s). Leave them attached to the Y block.
5. Locate the entrance hole to the Filament Present Switch in the material bay(s). See Figure 7-406.

Figure 7-406: Filament Present Switch location



6. Obtain a can of compressed air.
7. Insert the canned air extension tube to its spray nozzle.
8. Align the canned air extension tube with the entrance hole of the Filament Present Switch. See Figure 7-407.

Figure 7-407: Cleaning the Filament Present Switch



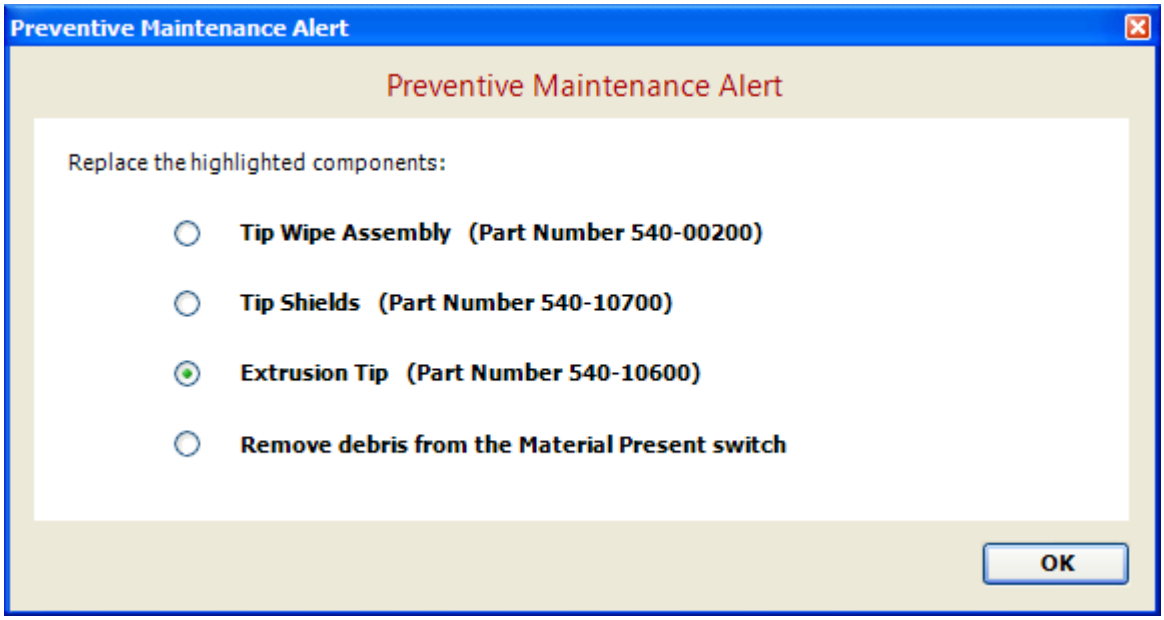
9. Squeeze the spray nozzle for one quick burst (approximately 2 seconds) to clear each Filament Present Switch on the model and support sides of the material bay. If an optional material bay is installed, repeat this procedure for the second bay.
10. Reconnect the material tubes to the rear of the material bay(s).
11. Replace the material carriers and load material.

2000 Hour maintenance

Tip replacement and calibration

A Preventive Maintenance Alert will be displayed after 2000 hours of run time informing you that tips need to be replaced and calibrated. See Figure 7-408.

Figure 7-408: Preventive Maintenance Alert



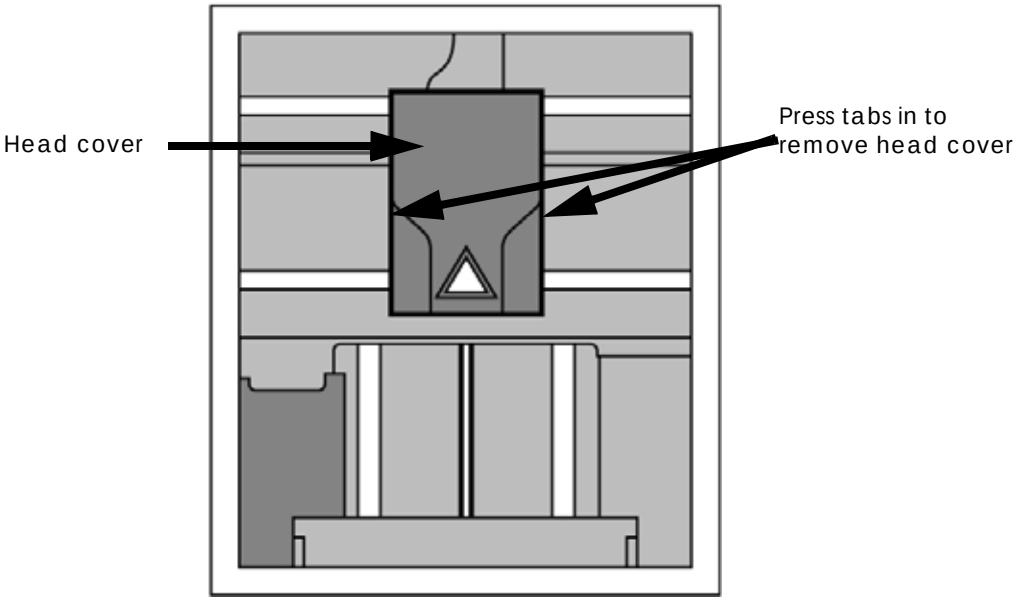
Note: Tips can also be damaged by improper care while performing maintenance in the area around the tips.

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

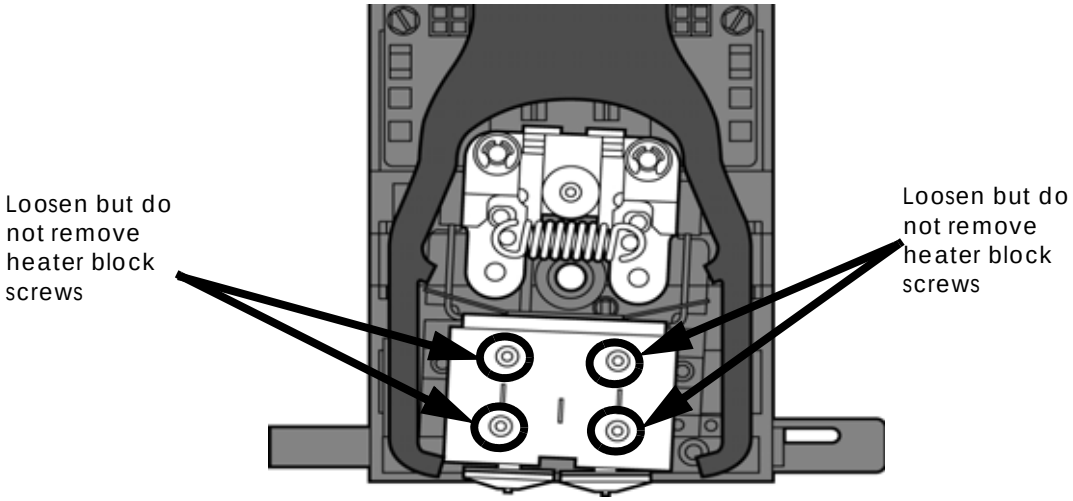
1. You will need to make sure the printer is powered ON before replacing the extrusion tips.
2. From the display panel press **Maintenance.**
3. Press **Machine.**
4. Press **Tip**.
5. Press **Replace**.
6. The printer will display **Material Unload - Unloading Model.**
7. When finished unloading, the display will prompt to remove the material carriers. Push the material carriers in and release to unlatch.
8. You can now open the printer door and replace the tips - or you can **Cancel** the tip replacement procedure.
9. Remove plastic head cover by squeezing raised pads on sides of cover. See Figure 7-409.

Figure 7-409: Head cover tab locations



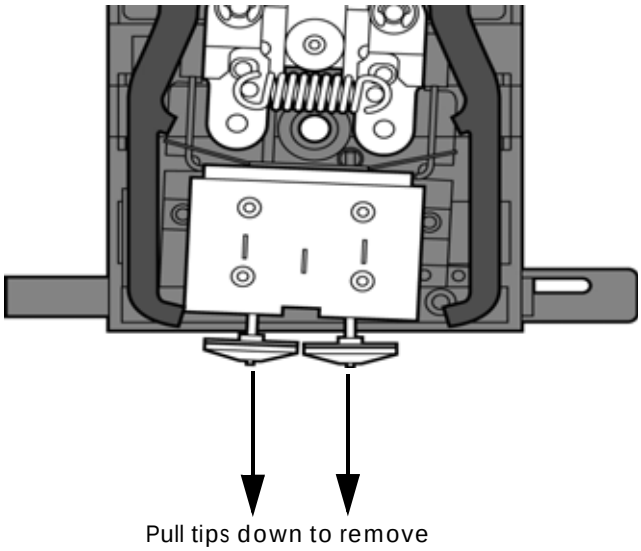
10. Remove tips
    A. Use 7/64 T-Handle Allen wrench to loosen the heater block screws three to four full turns counterclockwise - or until the top of the screws are flush with the metal cover. DO NOT remove the screws entirely. See Figure 7-410.

Figure 7-410: 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 7-411.

Figure 7-411: Remove the tips

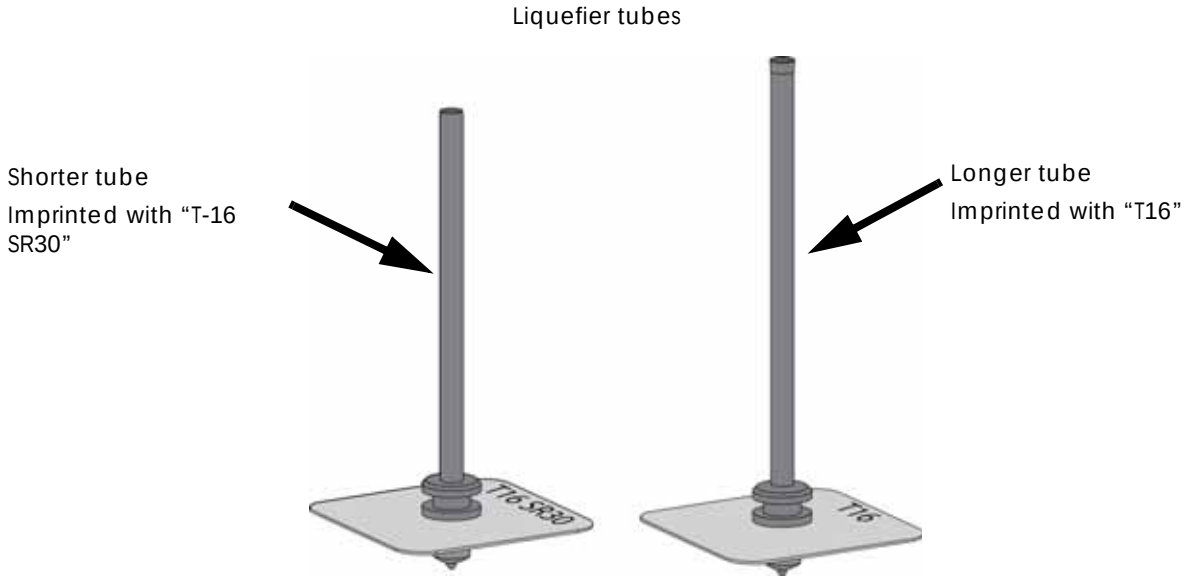


D. Repeat for second tip if necessary.

Installing tips

1. Place the tip shield on the tip. Be sure to install the proper tip. See Figure 7-412.

Figure 7-412: Tip shield alignment

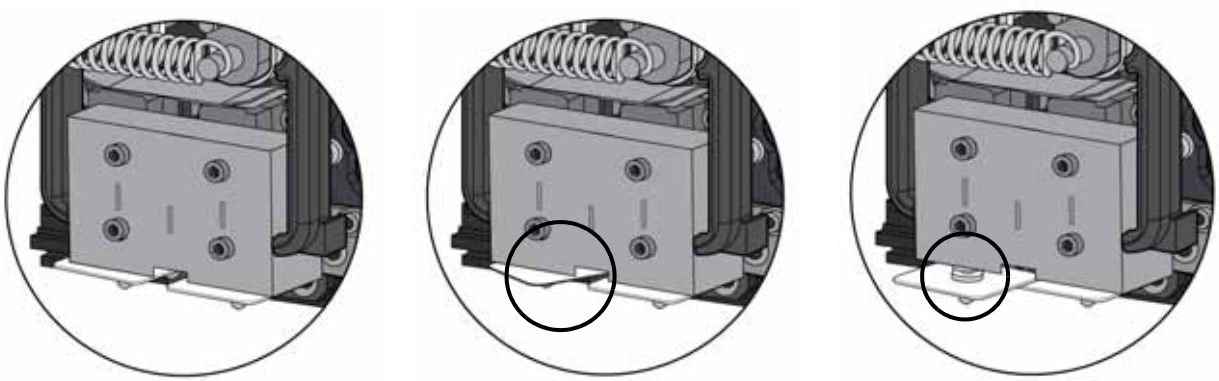


2. With gloved hand, insert the new tip into the heater block.
3. Use needle nose pliers to grasp the stainless steel shield of the tip.
4. Pull the tip shield toward you, then lift up to install the tip.
5. Push the tip toward the back of the printer once it is all the way up against the heater block.

6. Verify the tip is fully inserted into the heater block and that the stainless steel shield is aligned. See Figure 7-413.
7. Use 7/64 T-Handle Allen wrench to firmly tighten the heater block clamp screws. See Figure 7-413.

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

Figure 7-413: Installation Examples



8. Repeat steps 3 through 7 for the other tip if necessary.
9. Install a new tip shield by pushing it over the exposed tip, keeping the slotted end toward the back of the head. See Figure 7-414.

Note: Tip shield should be flush with the tip plate as shown in Figure 7-415.

Figure 7-414: Tip shield installation

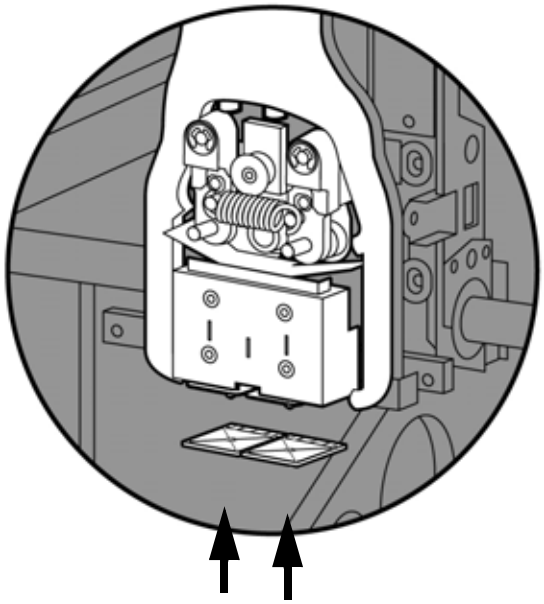
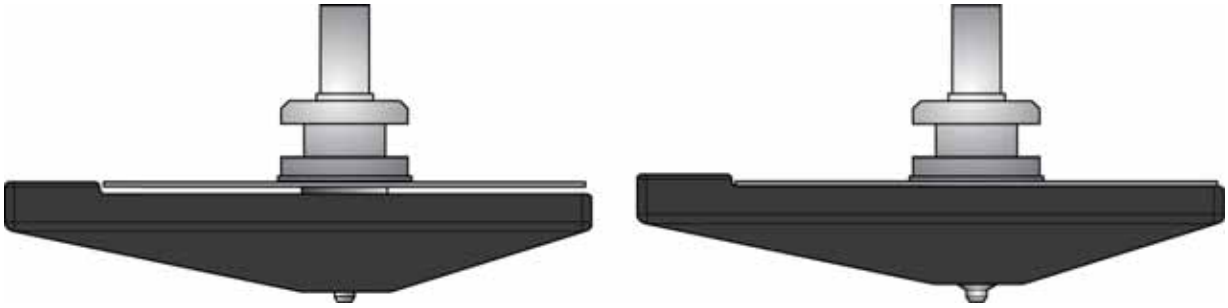


Figure 7-415: Tip shield placement



Tip shield NOT seated correctly

Tip shield seated correctly

10. Replace head cover and close the printer door.

Note: If the head cover is not replaced the printer may not function properly.

11. The printer will display **Tip Maintenance - Tips Replaced?** - press **Yes** to begin material load.
    A. The printer will display **Maintenance - Add/Remove** (flashing).
       - If you want to replace a material carrier, do so now.
    B. Load the model and support material carriers by pushing in until they latch. Press the **Load Selected** button.
12. The printer will now begin to load material.
13. After material loading is complete the printer will display **Tip Calibration - Install Modeling Base And Build Calibration Part.**

Note: Make sure a NEW modeling base is installed before starting calibration. Calibration results will be incorrect if a NEW modeling base is not used.

Tip calibration

Tip replacement requires Tip Calibration.

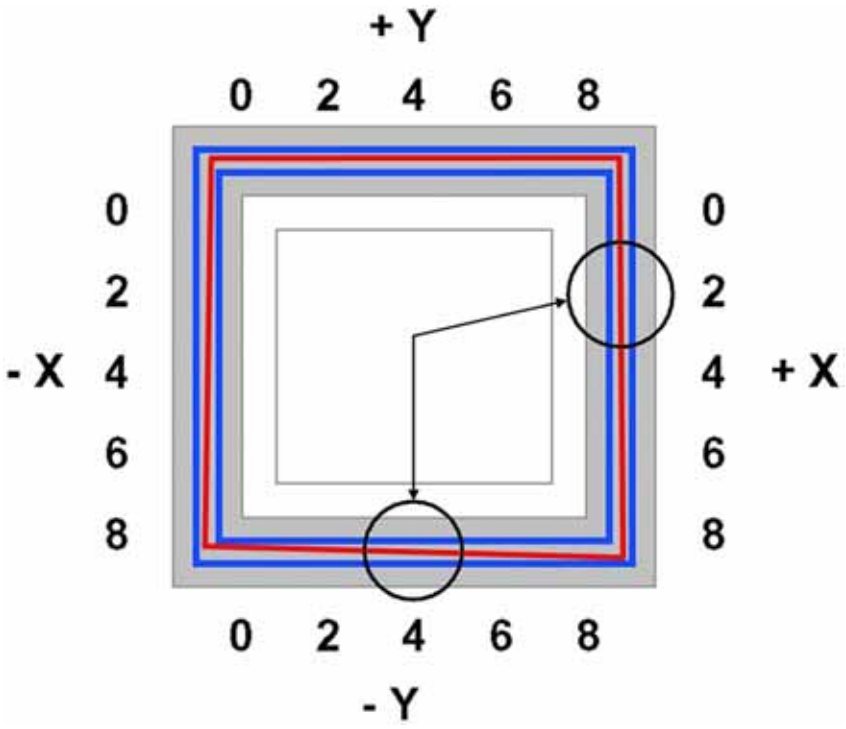
1. Select **Start Part** (flashing) - the printer will run two calibration parts.
   - The printer will automatically build a Z Calibration part, measure the part and calibrate the Z Axis for tip depth and tip level (approximately 5 minutes). The Z calibration is automatic.
   - The printer will then 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 7-416.
   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 7-416: Example XY Tip Offset Part.
This example requires an adjustment of X = + 2, Y = - 4

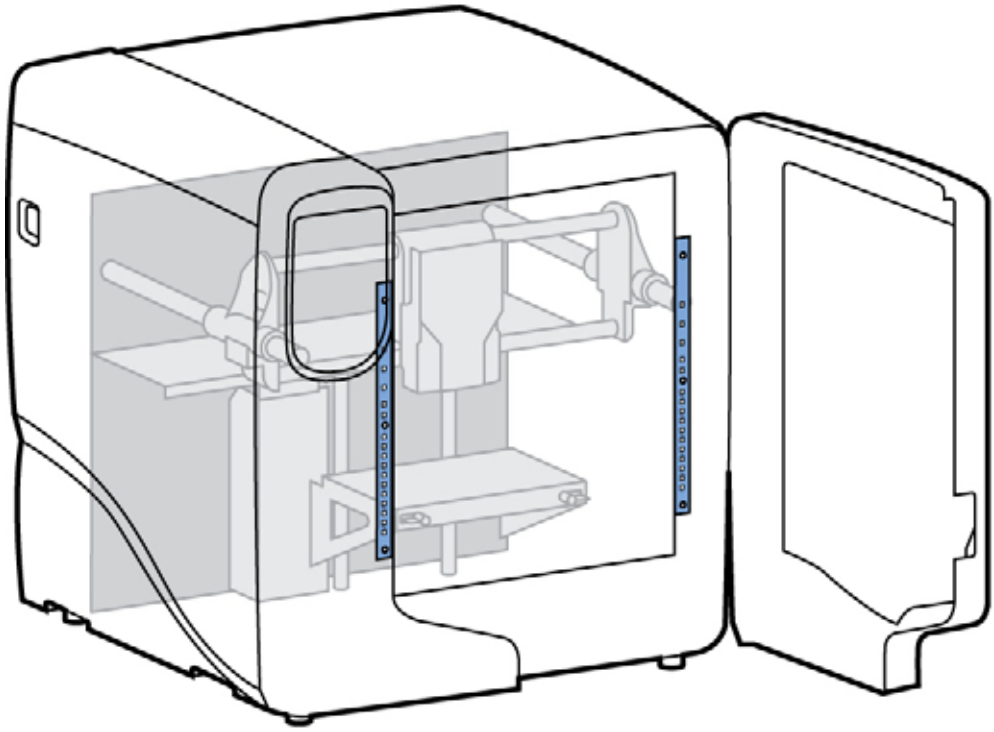


5. Select **Done** after you have input the X and Y offsets. The printer will return to **Maintenance.** Run the XY calibration a second time to be sure the values changed the offset properly.
6. When finished, press **Done** until back at **Idle**.

Chamber light bar replacement

1. Power down the printer.
2. Locate the wiring harness leading away from the top 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 three 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 three attachment screws - do not overtighten the screws.
6. Re-attach the wiring harness lead.

Figure 7-417: Chamber light bar locations

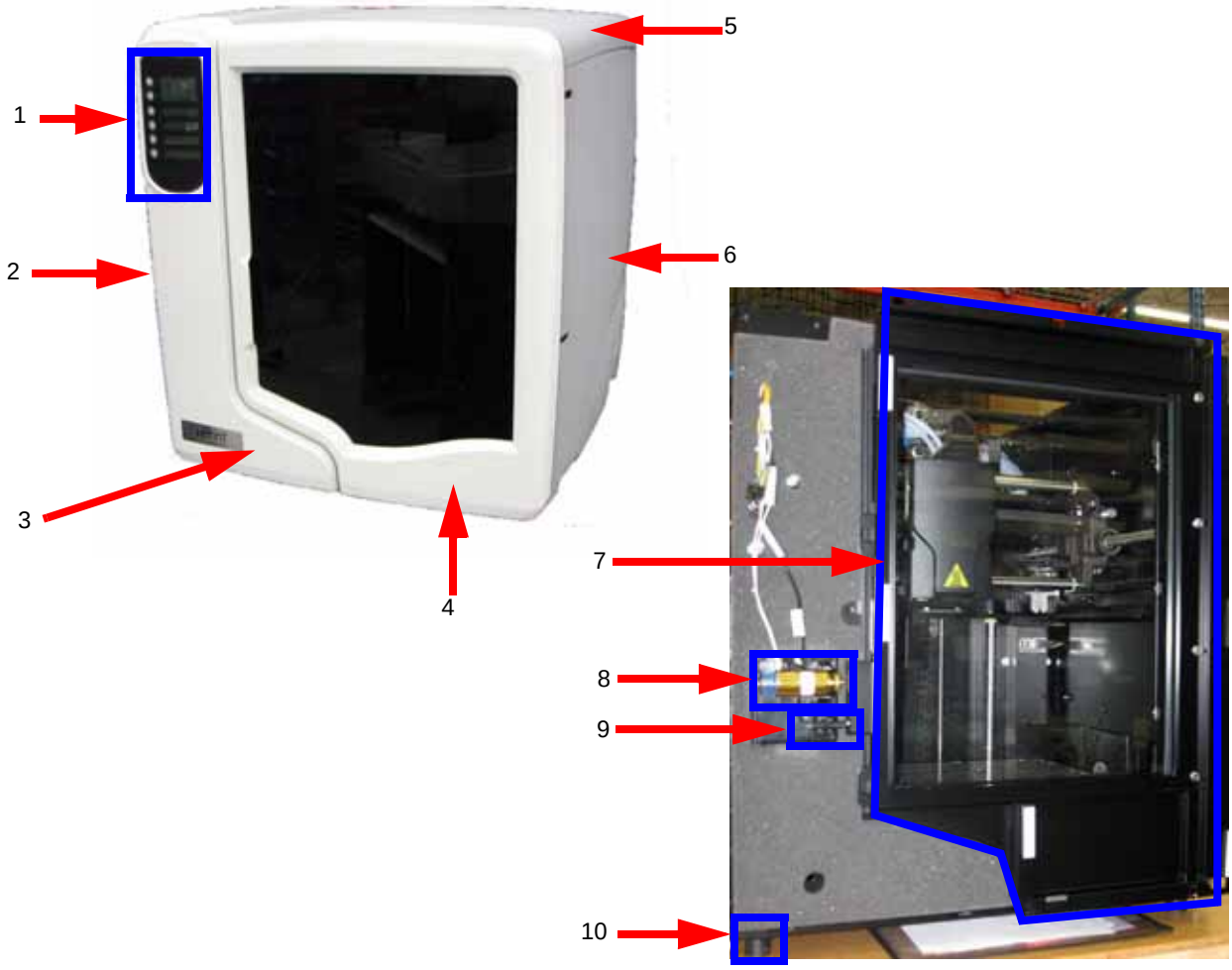


Illustrated Parts List

8

Front Door Area Components

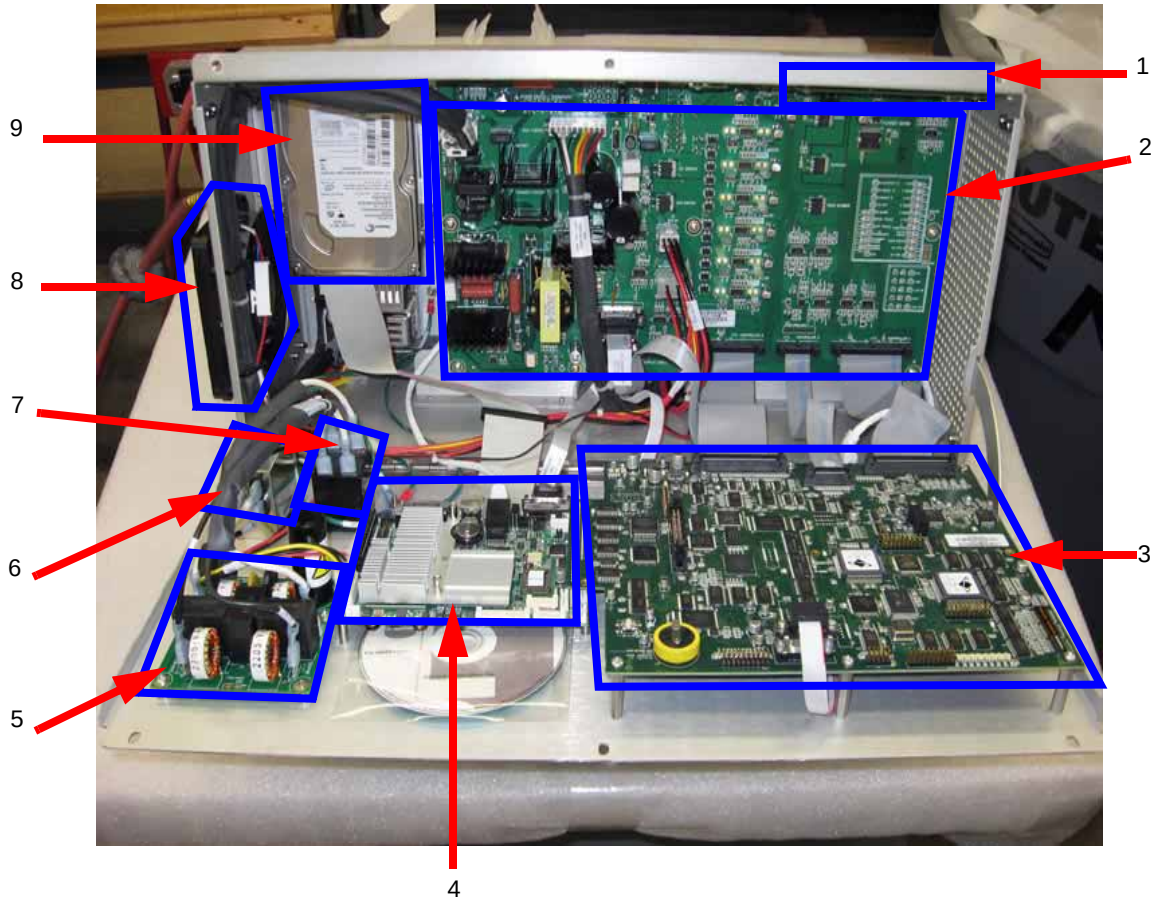
Figure 8-418: Front Door Area Component Locations



Item	Part Number	Description	Qty
1	204754-00XX	LCD Display	1
2	206355-00XX	Panel, Left Side	1
3	209265-00XX	Panel, Front uPrint	1
	209267-00XX	Panel, Front uPrint SE	1
	209266-00XX	Panel, Front uPrint Plus	1
	209268-00XX	Panel, Front uPrint SE Plus	1
4	206357-00XX	Panel, Door	1
5	206354-00XX	Panel, Top	1
6	206356-00XX	Panel, Right Side	1
7	204736-00XX	Glass Door Assembly	1
8	204455-00XX	Door Solenoid	1
9	204065-00XX	Door Sensor	1
10	205398-00XX	Foot, Vibration Mount	4

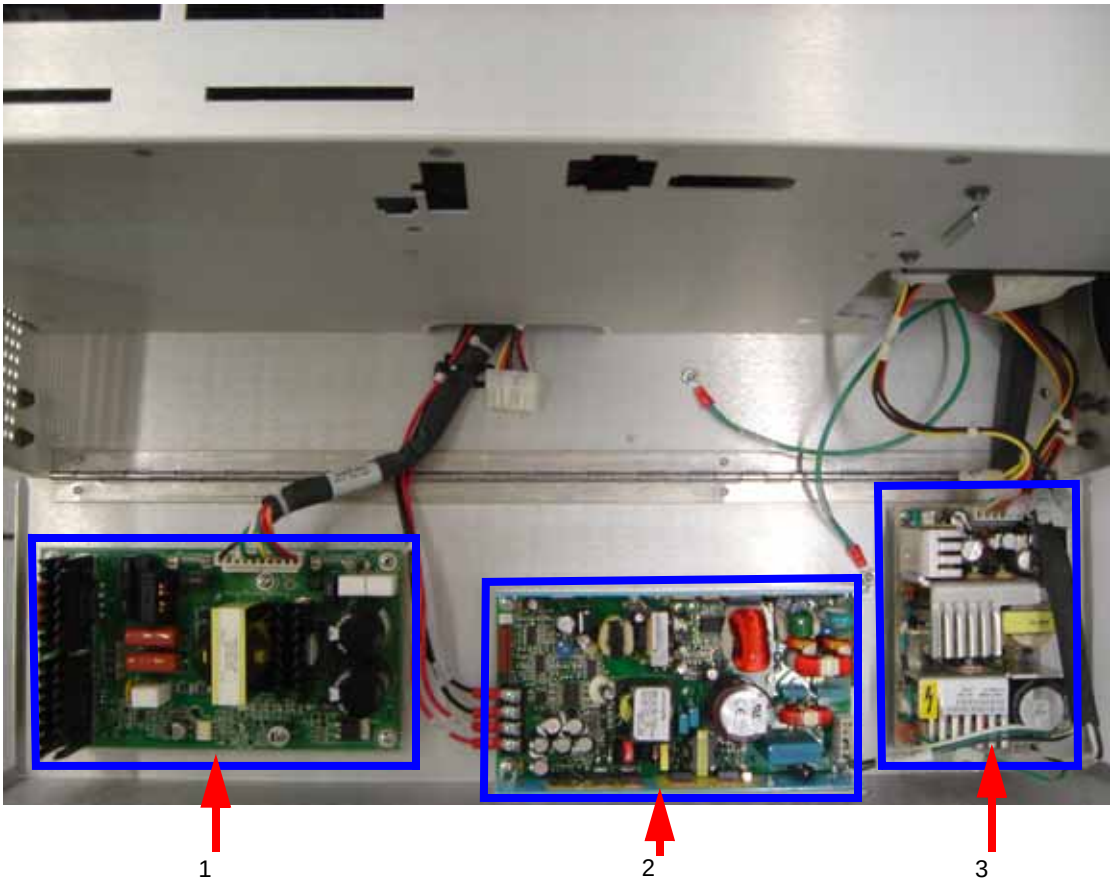
Electronics Bay Components

Figure 8-419: Electronics Bay Component Locations



Item	Part Number	Description	Qty
1	205618-00XX	I/O Card	1
2	205615-CSXX	Power Distribution Board (PDB)	1
3	205627-CSXX	Controller Board	1
4	208005-CSXX	SATA Single Board Computer (SBC)	1
	205668-CSXX	IDE Single Board Computer (SBC)	1
5	205509-00XX	Differential Line Filter	1
6	202182-00XX	AC Input	1
7	205510-00XX	Circuit Breaker	1
8	201403-00XX	Electronics Bay Cooling Fan	1
9	208051-CSXX	SATA Hard Drive with Software	1
	208040-CSXX	IDE Hard Drive with Software	1

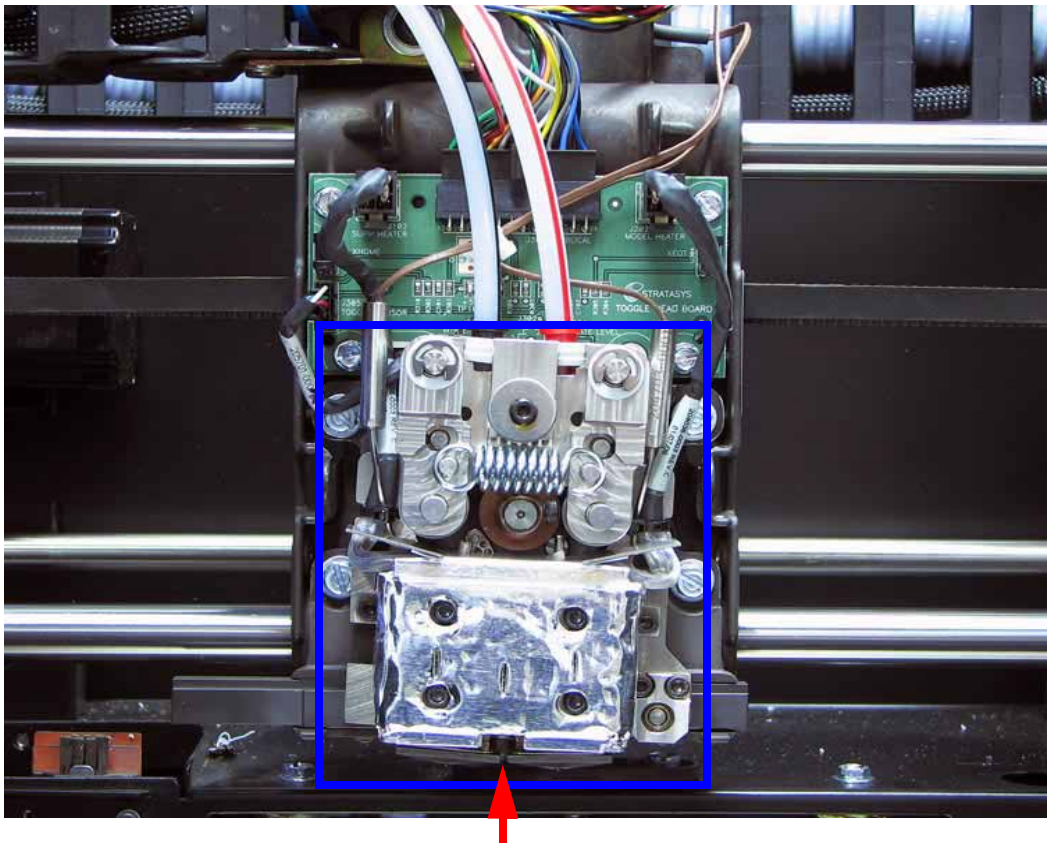
Figure 8-420: Electronics Bay Component Locations



Item	Part Number	Description	Qty
1	205503-00XX	120 VDC Auxiliary Power Supply	1
2	205659-00XX	24 VDC Power Supply	1
3	202326-00XX	5/12 VDC Power Supply	1

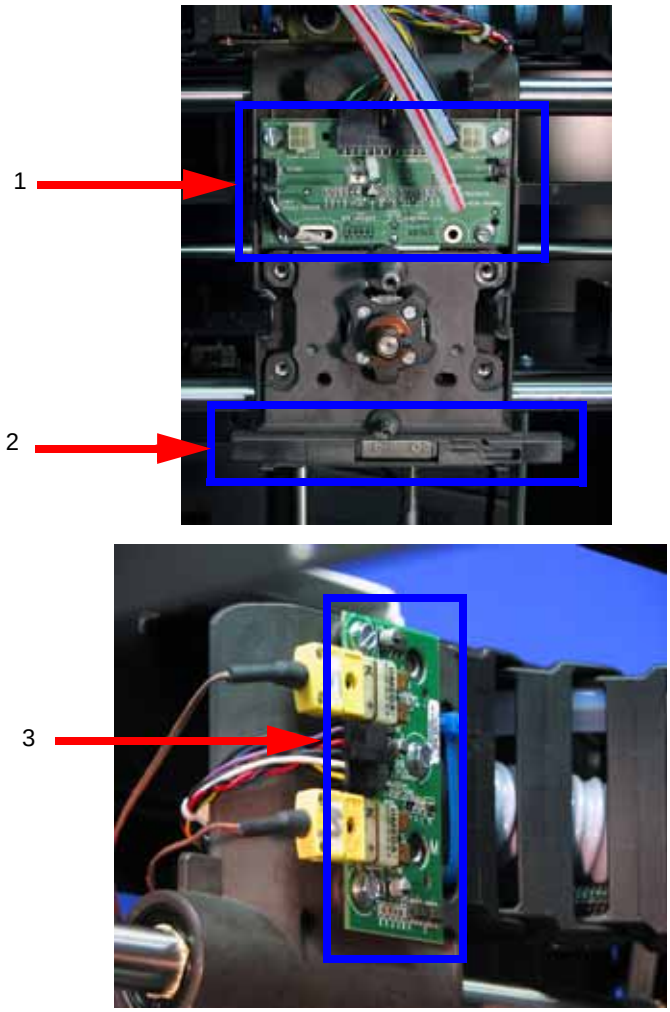
Head Area Components

Figure 8-421: Toggle head assembly location



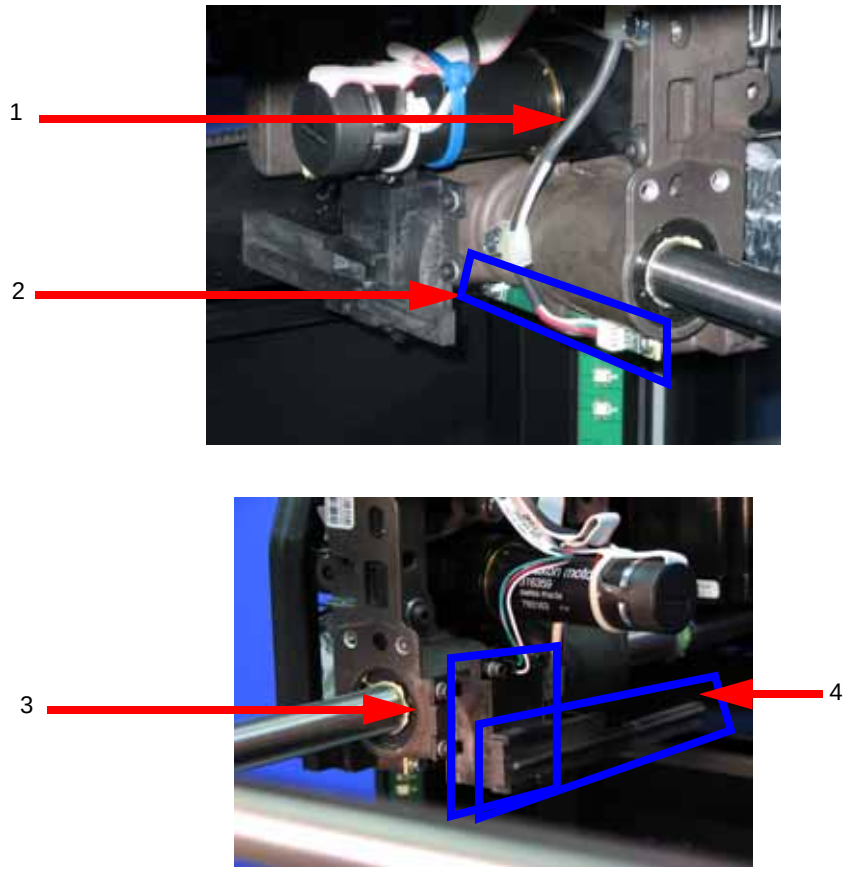
Item	Part Number	Description	Qty
1	204802-CSXX	uPrint Toggle Head Assembly	1
	205982-CSXX	uPrint SE, uPrint Plus and uPrint SE Plus Toggle Head Assembly (SR30)	1

Figure 8-422: Head area component locations



Item	Part Number	Description	Qty
1	204702-00XX	Head Board	1
2	205558-00XX	Toggle Bar	1
3	204649-00XX	TC Amp Board	1

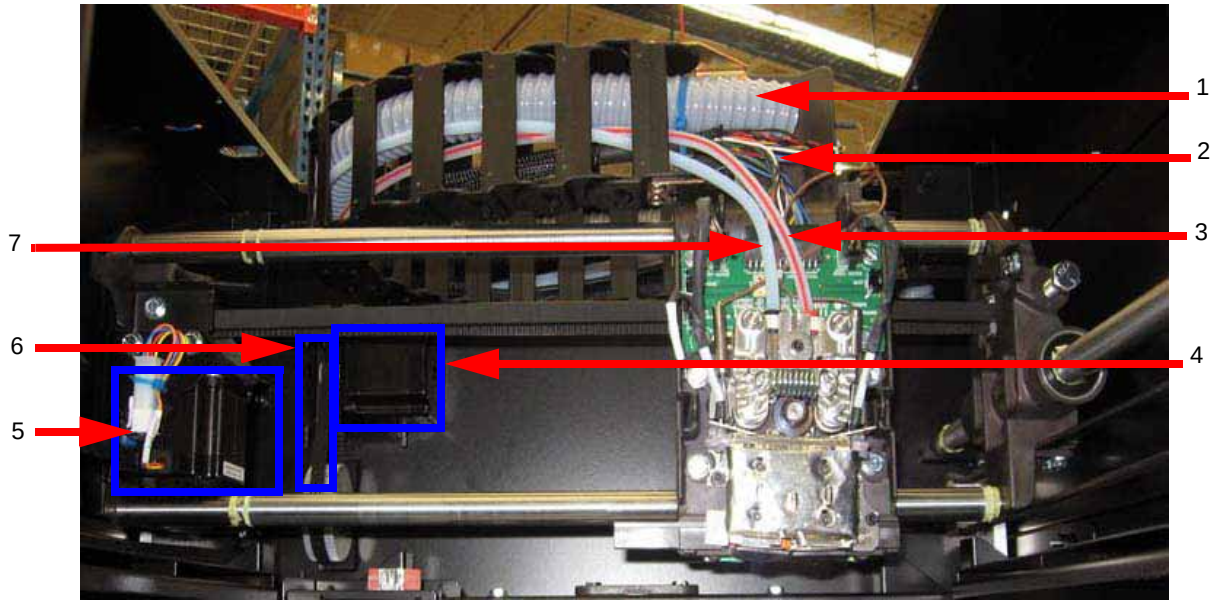
Figure 8-423: Head area component locations



Item	Part Number	Description	Qty
1	205701-00XX	Toggle Sensor Cable	1
2	205498-00XX	Toggle Sensor	1
3	204141-00XX	Substrate Sensor	1
4	201972-00XX	Substrate Sensor Arm	1

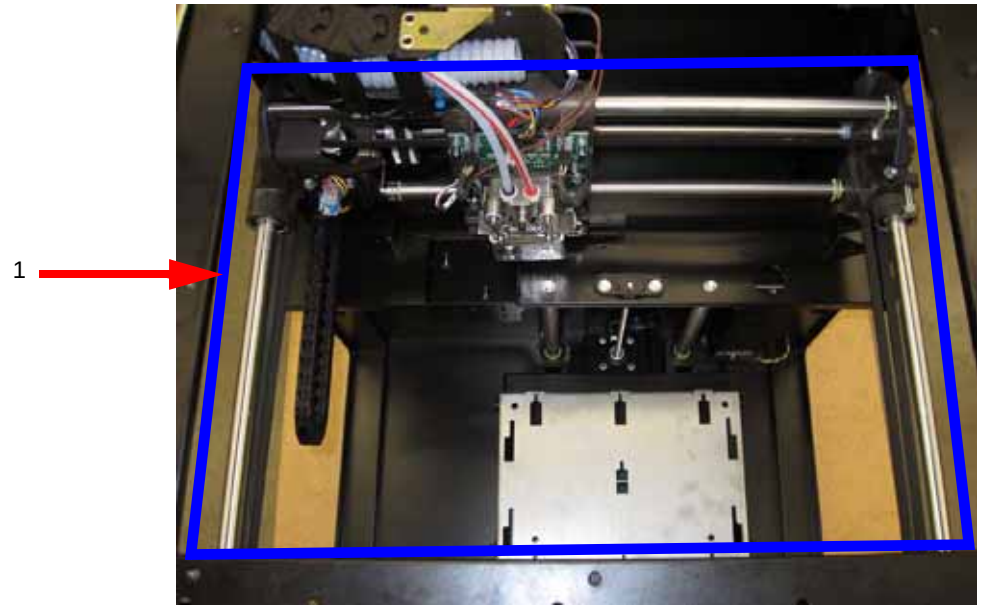
XY Table Area Components

Figure 8-424: XY Table component locations



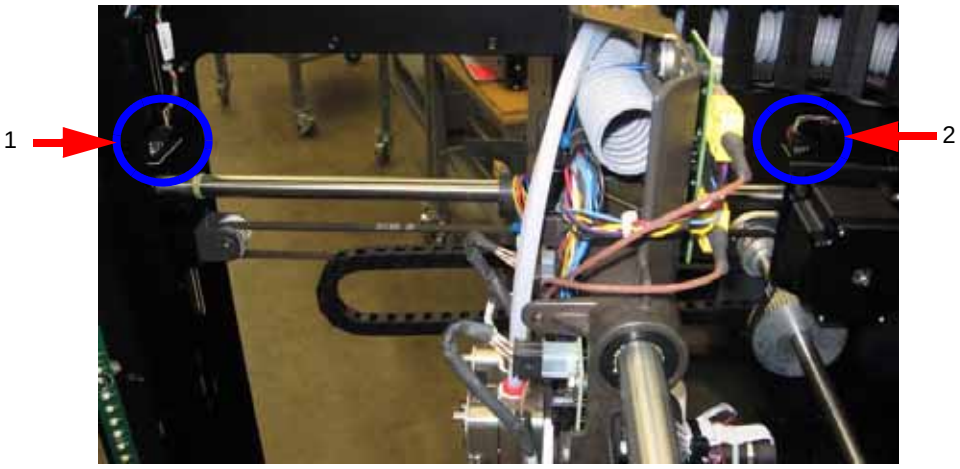
Item	Part Number	Description	Qty
1	204207-00XX	Umbilical Hose	1
2	205680-00XX	Umbilical Cable	1
3	205479-00XX	Model Material Tube	1
4	204685-00XX	Y Motor	1
5	204684-00XX	X Motor	1
6	201924-00XX	Y Motor Belt	1
7	205480-00XX	Support Material Tube	

Figure 8-425: XY Table component locations



Item	Part Number	Description	Qty
1	206468-CSXX	XY Table	1

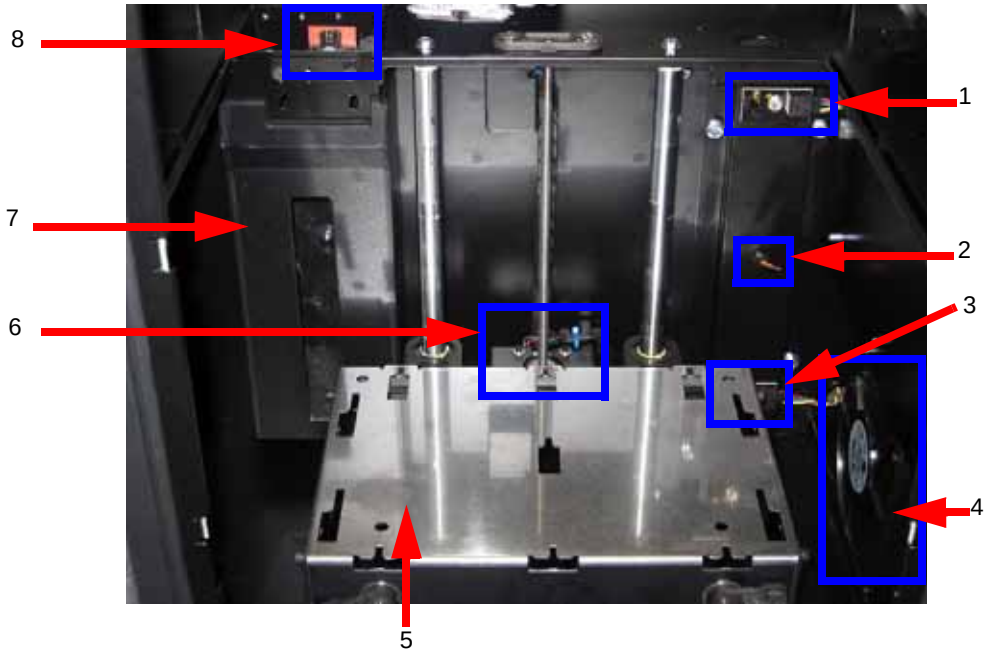
Figure 8-426: XY Table component locations



Item	Part Number	Description	Qty
1	205506-00XX	Y Home sensor	1
2	205506-00XX	Y EOT (End of Travel) Sensor	1

Z Stage Area Components

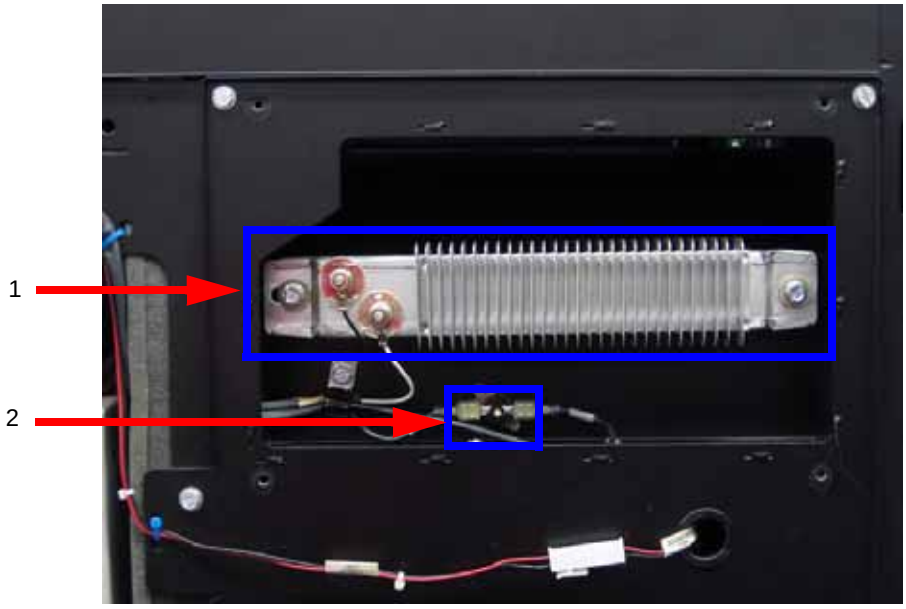
Figure 8-427: Z Stage component locations



Item	Part Number	Description	Qty
1	205506-00XX	Z Home Sensor	1
2	205621-00XX	Chamber Thermocouple, K-type 36 inch	1
3	205506-00XX	Z EOT (End of Travel) Sensor	1
4	201402-00XX	Chamber Fan	2
5	204737-CSXX	uPrint and uPrint SE 8x6 Z Stage	1
	205882-CSXX	uPrint Plus and uPrint SE Plus 8x8 Z Stage	1
6	204367-00XX	Z motor, leadscrew and energy chain	1
7	205707-00XX	Purge Bucket	1
8	205529-00XX	Tip Wipe assembly	1

Chamber Heater Area components

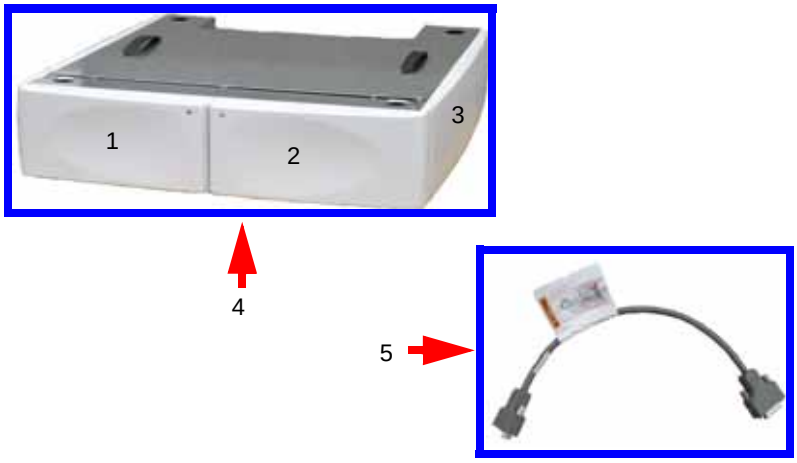
Figure 8-428: Chamber heater area components



Item	Part Number	Description	Qty
1	202152-00XX	Heater, Finned Strip	2
2	202114-00XX	Thermostat, 121 DEG C Disc	2

Material Bay

Figure 8-429: Material Bay components



Item	Part number	Description	Qty.
1	207081-00XX	Door, Support Side	1
2	207080-00XX	Door, Model Side	1
3	205431-00XX	Skins, Left or Right Side	1
4	205335-00XX	Material Bay Assembly	1
5	205447-00XX	Material Bay Cable	1

Cables

Part Number	Description	Qty
102538-00XX	Cable, 120 Volt Auxiliary Power	1
102578-00XX	Cable, UPS to PDB	1
102579-00XX	Cable, RS232 Diagnostic	1
205634-00XX	Cable, Ribbon, SBC to PDB	1
102577-00XX	Cable, AC to PDB and Power Supplies	1
205660-00XX	Cable, +24VDC to PDB and Fan	1
205635-00XX	Cable, +5/12 VDC Power	1
102582-00XX	Cable, Line Filter Input	1
102583-00XX	Cable, Line Filter to Circuit Breaker	1
102584-00XX	Cable, Panel Ground	1
102585-00XX	Cable, Controller to PDB, 50-pos	1
102586-00XX	Cable, Controller to PDB, 20-pos	1
105716-00XX	Cable, Communication, RJ45, 3 ft.	1
105175-00XX	Cable, Inline RJ45	1
205647-00XX	Cable, Material Bay Communication, Power, Internal	1
102587-00XX	Cable, Chamber Heater	1
102594-00XX	Cable, X-axis Stepper (with energy chain)	1
102598-00XX	Cable, Lower Harness	1
102597-00XX	Cable, Upper Harness	1
102596-00XX	Cable, Y Limit Sensors	1
102590-00XX	Cable, Controlled Off, Thermostat	1
205680-00XX	Cable, Umbilical	1
205621-00XX	Cable, Thermocouple, K-Type 36”	1
205447-00XX	Cable, Material Bay to Modeler	1
206528-00XX	Cable, SBC, Advantech (IDE cable to Hard Drive)	1

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.
- ☐ Remove the system CD from the electronics bay.
- ☐ Verify that all cables are connected correctly.
- ☐ Clean and vacuum the system.
- ☐ Power system up.
- ☐ After 10 minutes to 45 minutes, the LCD will display **UPGRADE** and **Send Upgrade From Work Station** along with the Dynamic 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 system software using the most current version. Download instructions for performing the download procedure are located on the system software CD.
- ☐ Once download is complete, system will reach "Idle".
- ☐ Using MaracaEX, "send" the .cal file from the CD to the system hard drive.
- ☐ Replace the system CD to the electronics bay.
- ☐ Load material.
- ☐ Run a small test part to ensure part quality is acceptable and that the system is operating properly.
- ☐ Discuss any of the customer's questions or issues with them.
- ☐ Pack the old hard drive into the shipping box along with the RMA documentation and shipping back to Stratasys.

Toggle Head Assembly Installation Checklist

If you have any questions before or during installation, do not hesitate to call your Customer Support provider.

- ☐ Replace the Toggle Head Assembly.
- ☐ Verify that all electrical leads are connected correctly.
- ☐ Clean and vacuum the system.
- ☐ Power system up and verify that head reaches temperature and the system homes correctly.
- ☐ Using DataStat or MaracaEX enter the Z Tip to Tip value that came with the head and cycle power.
- ☐ Load material.
- ☐ Perform the Z Calibration and XY Offset Calibration.
- ☐ Run a part to ensure part quality is acceptable and that head is functioning correctly.
- ☐ Unload material.
- ☐ Remove the system CD from the electronics bay and discard.
- ☐ Using MaracaEX select "Get" to send the .cal file from the system to a new blank CD. Place the new CD in the electronics bay and secure the rear door.
- ☐ Load material.
- ☐ Discuss with the customer any questions or issues they may have.
- ☐ Pack the old Toggle Head Assembly into the shipping box along with the RMA documentation and ship back to Stratasys.

XY Table Assembly Installation Checklist

If you have any questions before or during installation, do not hesitate to call your Customer Support provider.

- ☐ Replace the XY table Assembly.
- ☐ Verify that all electrical leads are connected correctly
- ☐ Perform the XY Leveling procedure
- ☐ Check/Adjust the X-Drive Belt tension
- ☐ Check/Adjust the Y-Drive Belt tension
- ☐ Manually move the table in both the X and Y direction to ensure it moves smoothly.
- ☐ Clean and vacuum the system.
- ☐ Power system up and verify that system homes correctly.
- ☐ Load material.
- ☐ Perform the Part Based Calibration procedure.
- ☐ Perform the Z Calibration and XY Offset Calibration.
- ☐ Unload material.
- ☐ Remove the system CD from the electronics bay and discard.
- ☐ Using MaracaEX select “Get” to send the .cal file from the system to a new blank CD. Place the new CD in the electronics bay and secure the rear door.
- ☐ Load material.
- ☐ Run a small test part to ensure part quality is acceptable and that the XY table is functioning correctly.
- ☐ Discuss with the customer any questions or issues they may have.
- ☐ Pack the old XY table 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. Due to possible software version conflicts, additional steps must be taken after installing a Controller Board - the complete (X, Y, Z) homing process must be run before building a part. Failure to perform these steps may result in Z build location and/or cartridge read issues. This problem will be corrected in the next board firmware release.

Procedure

- ☐ Unload material.
- ☐ Power down the system.
- ☐ Replace the controller board.
- ☐ Power up the system
- ☐ When prompted, download the system software.
- ☐ Enter Head Maintenance. This will cause the system to run the complete homing process.
- ☐ Exit Head Maintenance
- ☐ Load material.
- ☐ Run a small test part to ensure part quality is acceptable and that the XY table is functioning correctly.
- ☐ Discuss with the customer any questions or issues they may have.
- ☐ Pack the old controller board into the shipping box along with the RMA documentation and ship back to Stratasys.

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)

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
- ☐ 13. User guide

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