dimension

Service Guide
BST 1200/SST 1200

Version 1.2

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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.

Table of Contents

Notice

About This Guide iii

Safety

Hazard Classifications ..... 1 - 1
Product Safety Symbols ..... 1 - 1
Safety Devices ..... 1 - 2

System Overview

Chapter Overview ..... 2 - 1
Dimension BST 1200 /SST 1200 Specifications ..... 2 - 3
What Happens When... ..... 2 - 4
Powering Up ..... 2 - 4
Powering Down ..... 2 - 4
Loading Material ..... 2 - 4
Making a Part ..... 2 - 4
A System Error Occurs ..... 2 - 5
Single Board Computer ..... 2 - 6
Electronics Overview ..... 2 - 8
Controller Board ..... 2 - 9
Overview ..... 2 - 9
Voltage Generation ..... 2 - 9
Dual Port Memory Interface ..... 2 - 9
X, Y, Z Axis Control ..... 2 - 9
Filament Motor Control ..... 2 - 9
Temperature Control ..... 2 - 9
Actuators, Switches & Optical Sensors ..... 2 - 10
Safety Devices ..... 2 - 11
Controller Board Layout ..... 2 - 11
Reset Button ..... 2 - 12
Dip Switches ..... 2 - 12
Memory ..... 2 - 12
LEDs ..... 2 - 13

Power Distribution Board (PDB) ..... 2 - 14
Chamber Temperature Control ..... 2 - 15
Test Points ..... 2 - 15
LEDs ..... 2 - 16

Setup & Installation

Chapter Overview ..... 3 - 1
Workspace ..... 3 - 2
Unpacking ..... 3 - 2
Installing Forklift Access Covers ..... 3 - 3
Power Connections ..... 3 - 4
Powering On Dimension ..... 3 - 4
Insert Modeling Base ..... 3 - 5
Installing Software ..... 3 - 6
Networking the Printer ..... 3 - 6
Connecting Directly to the PC ..... 3 - 8

Service Procedures

Breakdown of Service Procedures ..... 4 - 1

Maintenance Preparation

Pre-Maintenance Procedures ..... 4 - 3

Exterior Components

Rear Panel ..... 4 - 4
Side Panels ..... 4 - 5
User Interface Panel ..... 4 - 5
Door Solenoid and Door Sensor ..... 4 - 6
Front Door Glass Panel ..... 4 - 8
Front Bezel ..... 4 - 9

Electrical Components

Power Distribution Board (PDB) ..... 4 - 11
Controller Board ..... 4 - 14
Single Board Computer (SBC) ..... 4 - 16
Hard Drive ..... 4 - 19
24 VDC Power Supply ..... 4 - 20
120 VDC Power Supply ..... 4 - 21
5/12 VDC Power Supply ..... 4 - 22
Line Filter Board ..... 4 - 23

Head Components

Toggle Plate Assembly ..... 4 - 26
Head Toggle Bar ..... 4 - 42
Head Toggle Sensor ..... 4 - 43
Head Board ..... 4 - 43
Head Motor ..... 4 - 44
Z Level Assembly (Foam Sensor) ..... 4 - 45
Umbilical Cable ..... 4 - 47
Head Cooling Fan ..... 4 - 50
Loss of Extrusion ..... 4 - 50
Clogged Liquefier Tip ..... 4 - 54

XY Table Components

X Home Sensor and X EOT Sensor ..... 4 - 56
X Motor ..... 4 - 56
X Drive Belt ..... 4 - 57
Y Motor ..... 4 - 60
Y Drive Belt ..... 4 - 61
Y Pulley ..... 4 - 61
Y Drive Assembly ..... 4 - 62
Y Home Sensor / Y EOT Sensor ..... 4 - 62
XY Table Assembly ..... 4 - 63

Z Stage Components

Thermostat Fuse ..... 4 - 72
Envelope Thermocouple ..... 4 - 73
Envelope Heater ..... 4 - 74
Heater Fan ..... 4 - 74
Z EOT Sensors ..... 4 - 76
Purge Bucket Light ..... 4 - 76
Z Stage Motor and Motor Belt ..... 4 - 77
Z Stage Assembly ..... 4 - 78
    Required Tools ..... 4 - 78

Receiver Components

Receiver Back Panel Assembly ..... 4 - 84
Receiver Cable ..... 4 - 84
Receiver Motor ..... 4 - 85
Receiver Drive ..... 4 - 86
Receiver Card ..... 4 - 87

Misc. Field Replaceable Units

Tip Wipe Brush/Flicker ..... 4 - 89

Maintenance Wrap-Up

Post-Maintenance Procedures ..... 4 - 91

Calibrations & Adjustments

Chapter Overview ..... 5 - 1
Offset Calibrations ..... 5 - 2
Adjusting Z Calibration and XY Tip Offset ..... 5 - 2
Part Based Calibration ..... 5 - 3
When to Perform Part Based Calibration ..... 5 - 3
Part Measurement Equations ..... 5 - 6
Tensioning the Y Motor Belt ..... 5 - 7
Y Motor Belt ..... 5 - 7
Tensioning the X & Y Drive Belts ..... 5 - 8
Zero the Dial Indicator ..... 5 - 8
Get/Send Calibration Files ..... 5 - 13
XY Table Leveling ..... 5 - 14
Z Tray Leveling ..... 5 - 16
Adjust Z Stage Level ..... 5 - 17
Aligning Z Stage Lead Screw ..... 5 - 20

Software

Chapter Overview ..... 6 - 1
Software Architecture ..... 6 - 2
Operating System ..... 6 - 2
Display Driver ..... 6 - 2
Comm Server ..... 6 - 2
System Manager ..... 6 - 3
Move Compiler ..... 6 - 3
Feeder ..... 6 - 3
Event/Command Monitor ..... 6 - 3
DataStat ..... 6 - 3
Overview ..... 6 - 3
Parts and Tools Required ..... 6 - 4
Procedure ..... 6 - 4
CatalystEX Help ..... 6 - 4
CatalystEX Overview ..... 6 - 4
Maraca Help ..... 6 - 5
Overview ..... 6 - 5
Select a Modeler ..... 6 - 5
Modeler States ..... 6 - 5
Modeler Setup ..... 6 - 5

Configuration ....6 - 6
Printer Status ....6 - 6
Materials ....6 - 8
Tip Offset and Liquefier Calibration (not applicable for 1200)....6 - 8
Adjusting Z Clearance (not applicable for 1200)....6 - 8
Adjusting XY Tip Offset....6 - 8
Adjusting Tip Depth on Plastic Substrate (not applicable for 1200)....6 - 8
Gantry....6 - 8
Temperatures....6 - 8
Outputs ....6 - 9
Table Calibration (not applicable for 1200) ....6 - 9
Get Calibration....6 - 9
Send Calibration ....6 - 10
Get Configuration....6 - 10
Test Parts....6 - 10
Reset Password....6 - 10
Connect ....6 - 10

Preventive Maintenance

Chapter Overview ....7 - 1
Startup Kit Tools ....7 - 2
After Each Build ....7 - 2
500 Hour Maintenance....7 - 3
2000 Hour Maintenance....7 - 5
As Needed Maintenance....7 - 6

Troubleshooting

Troubleshooting a System Malfunction ....
Using HyperTerminal....8 - 29

Index

Appendix

....Appendix - 1
Appendix Overview ....Appendix - 1
Illustrated Parts Breakdown ....Appendix - 2
Backend Download Procedure....Appendix - 13
Procedure ....Appendix - 13
Fuse Specifications ....Appendix - 14
Device Voltages ....Appendix - 15

Hard Drive Installation Checklist .....Appendix - 16
Toggle Plate Assembly Installation Checklist .....Appendix - 17
XY Table Installation Checklist .....Appendix - 18
Pre-Installation Checklist.....Appendix - 19
    Checklist .....Appendix - 19
    System Information.....Appendix - 19
System Installation Checklist.....Appendix - 20
    System Information.....Appendix - 20
Training Checklist.....Appendix - 21
Required Tool List .....Appendix - 23
Controller Board Checklist .....Appendix - 24
    Procedure .....Appendix - 24

Chapter 1
Safety

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

Hazard Classifications

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

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

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

DANGER: Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

Product Safety Symbols

The following symbol is located inside the printer 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 printer.

Hot Surface Sign. The hot surface sign indicates the presence of devices with high temperatures. Always use extra care, and wear safety gloves, when working around heated components.

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

Chapter 2
System Overview

Chapter Overview

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

Dimension BST 1200 /SST 1200 Specifications2

What Happens When..... 3
- Powering Up..... 3
- Powering Down..... 3
- Loading Material..... 3
- Making a Part..... 3
- A System Error Occurs 4

Single Board Computer 5
Electronics Overview..... 7
Controller Board..... 8
- Overview 8
- Voltage Generation 8
- Dual Port Memory Interface 8
- X, Y, Z Axis Control 8
- Filament Motor Control..... 8
- Temperature Control 8
- Actuators, Switches & Optical Sensors..... 9
- Safety Devices 10
- Controller Board Layout 10
- Reset Button 11
- Dip Switches 11
- Memory 11

LEDs 12

Power Distribution Board (PDB) 13

Chamber Temperature Control..... 14

Test Points..... 14

LEDs 15

Dimension BST 1200 /SST 1200 Specifications

Build Size	Parts can be built up to 254 x 254 x 305 mm (10 x 10 x 12 in.)
Material	Parts are built of tough, durable ABS plastic in white (standard), blue, black, red, yellow, gray or green. Custom colors are available.
Material Supply	Two autoload cartridges with 0.95 kg (2.1 lbs) material per printer (1 model and 1 support). Each cartridge has enough material to build continuously for three days without reloading.
Layer Resolution	User may select 0.010 in (0.245 mm) or 0.013 in (0.33 mm) layer resolution.
Positional Accuracy (X,Y)	0.025 mm (0.001 in.)
Z Repeatability	0.0127 mm (0.0005 in.)
Automatic Operation	CatalystEX software automatically imports and slices .stl files, allows you to orient parts for optimal builds, generates support structures, if necessary, and creates the deposition path to build parts.
Network Connectivity	TCP/IP 100/10 baseT
Workstation Compatibility	Windows 2000 or Windows XP Pro
Support Structures	Any necessary support structures are automatically created within CatalystEX software. Break-away Support System (BASS™) allows for easy support removal. Dimension SST uses Soluble Support Technology (SST), which allows supports to be washed away with a water-based solution.
Functionality	Multiple parts may be packed within the build envelope to maximize build efficiency. CatalystEX software provides queue management capabilities, build and material status, runtimes, and printer status information. The display panel located on the front of the printer guides you through startup, material reload steps, and provides status information on the printer including material remaining in the cartridges.
Size and Weight	838 x 737 x 1143 mm (33 x 29 x 45 in.) 195 kg (430 lbs in crate), 148 kg (326 lbs) on table
Power Requirements	110-120 VAC, 60 Hz, 15A max. to 220-240 VAC, 50/60 Hz, 7 A max. The printer will auto-detect the input voltage.
Regulatory Compliance	CE
Special Facility Requirements	None
Operator Attendance	Not required

What Happens When...

Powering Up

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

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

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

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

Powering Down

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

Loading Material

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

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

Making 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 build (the build queue is empty):
   a. The panel displays **`Idle`** and **`Queue Empty`**.
   b. **`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.
      (1) **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.

(a). Do not press the **Wait for Part** button

(b). From your CatalystEX work station, send a part to the printer.

(c). The printer panel displays the name of the first model in the printer queue and **Start Model** is blinking.

(d). From the printer, press the **Start Model** button to begin building the displayed part.

(2) **Remote 'Start Model':** - You send a part to the printer from your CatalystEX work station. The part automatically begins to build.

(a). From the printer, press the **Wait for Part** button

(b). Make sure an empty modeling base is installed, then answer **Yes** to the prompt **Is Model Base Installed?**

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

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

2. 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:

The first thing that happens is that the printer drops the top of substrate sensor and moves around the XY envelope and measures the height of the substrate. At the same time that the printer is finding the Z zero position, the SBC is converting the model file into the motion commands that the controller will execute to build the model. Once the substrate has been measured in four locations it moves the Z stage down to check the Z end-of-travel. Once this operation is complete, the head will move over the purge bucket and prepare to build the model by purging the appropriate tip.

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

A System Error Occurs

Should an error occur during normal operation, the display panel will show SYSTEM ERROR followed by an error code such as code 14, 4. A code 14 is an error reported by the Controller Board and the 4 indicates a bad or missing substrate. See Chapter 8, "Troubleshooting", for a complete list of error codes.

Single Board Computer

The single board computer (SBC) is the main processor in the system. It is a complete “PC compatible computer” on a single board. See Fig. 1 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 three LEDs to the right of the RJ-45 connector. These show the status of the network connection as follows:

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

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

The Control Panel Display (CPD) connects to the SBC on J13 of the Ampro board and CN7 on the Nova board (Fig. 1). All user commands from the buttons come in here and all the display text is output from here. For the new electronics, the CPD connects to the PDB and passes through the SBC.

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

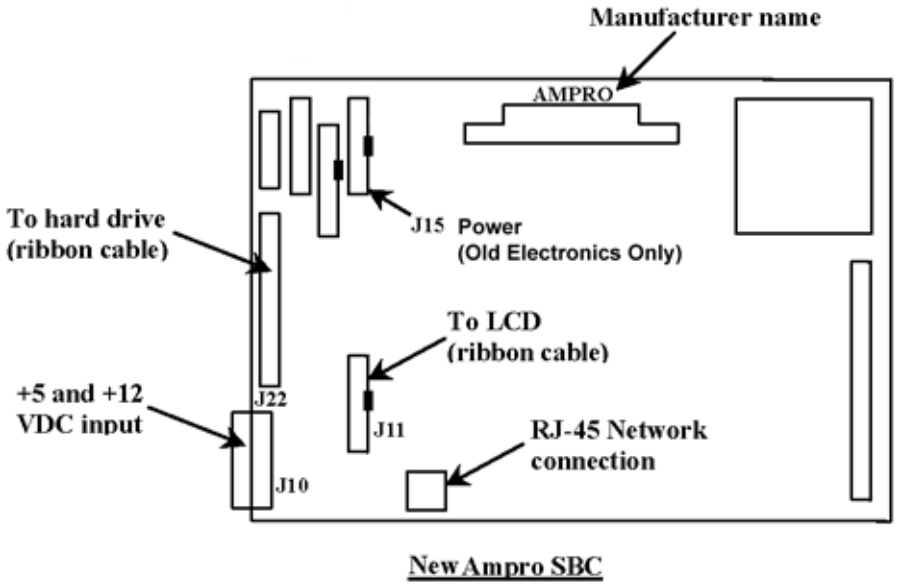
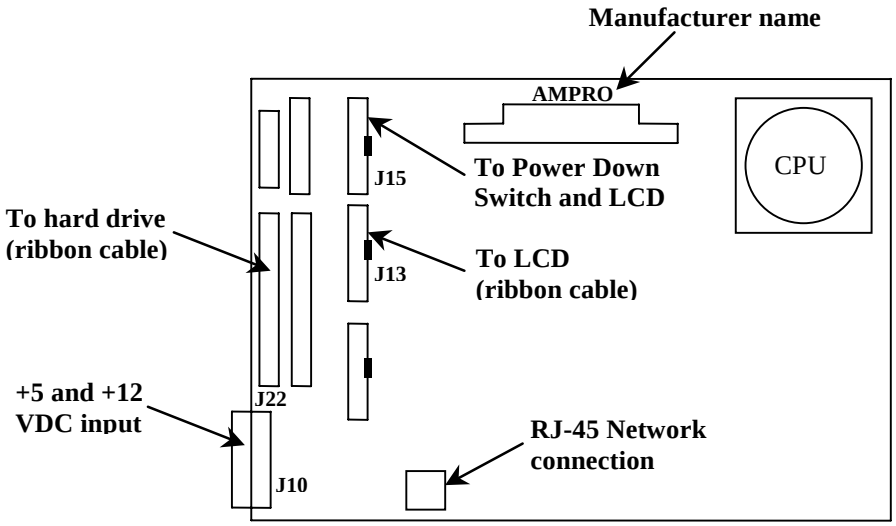


Figure 1: Sheet 1



Ampro SBC

Figure 1: Sheet 2

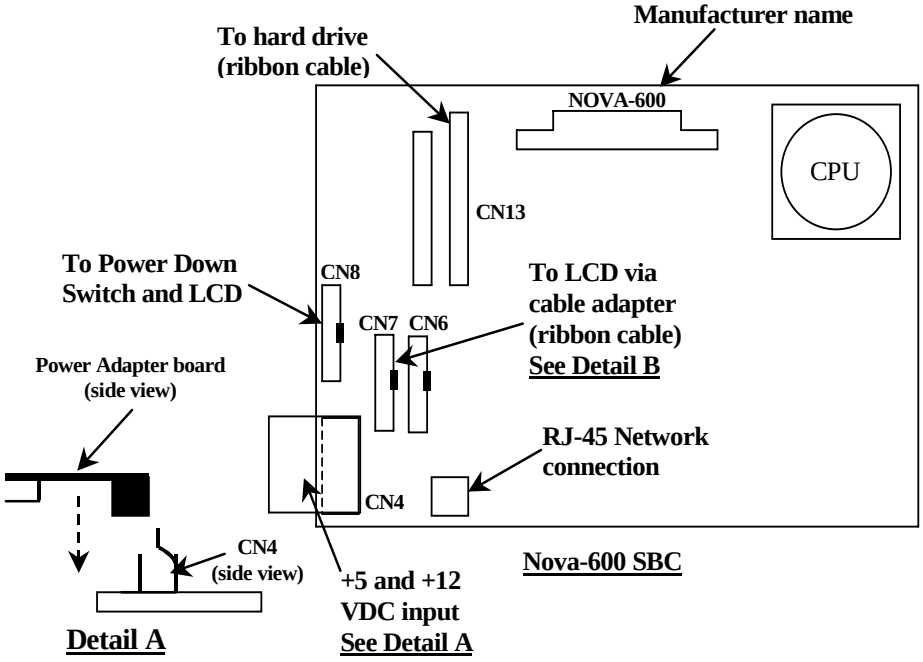


Figure 1: Sheet 3

Electronics Overview

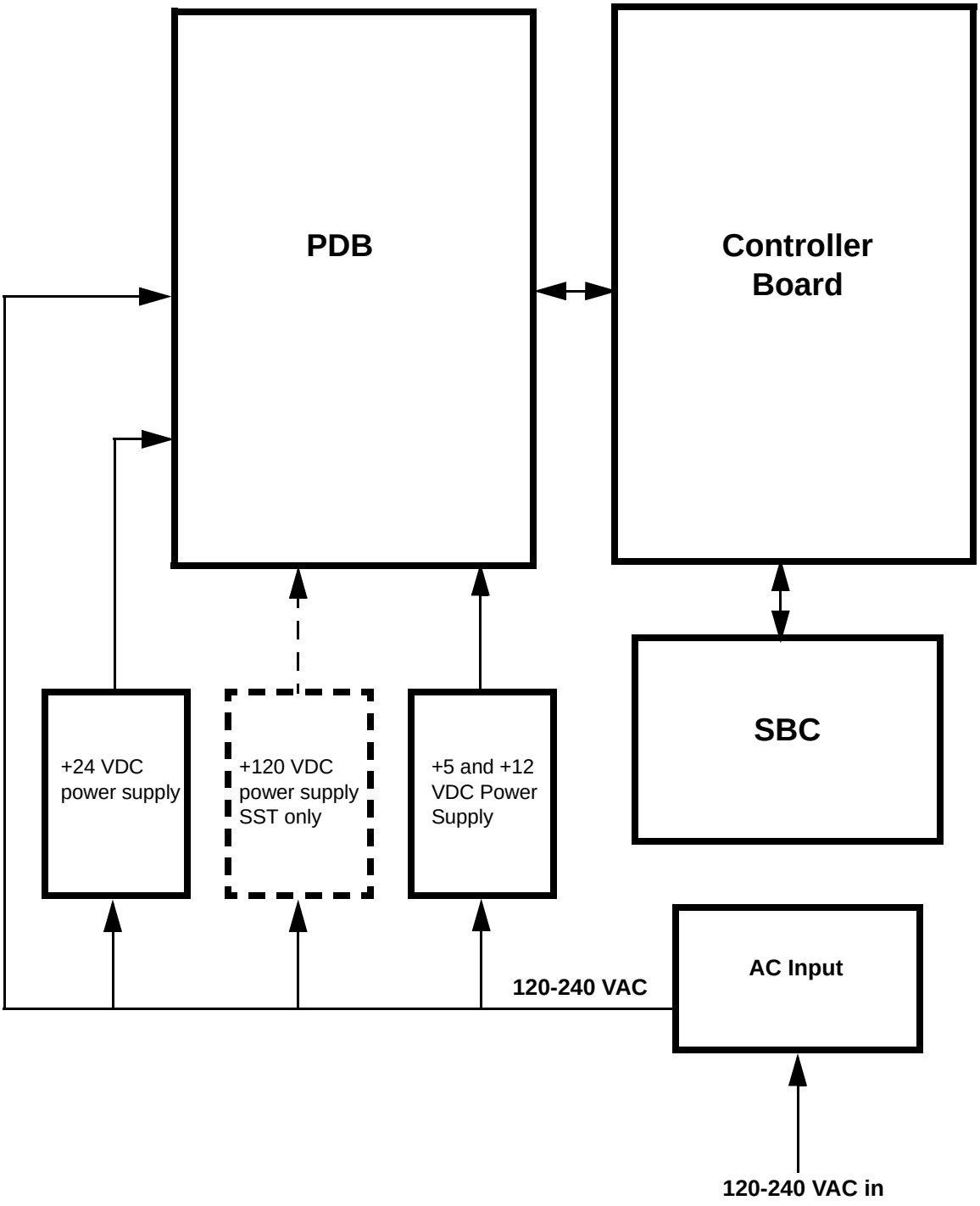


Figure 2: Electronics Overview Detail

Controller Board

Overview

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

Voltage Generation

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

Dual Port Memory Interface

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

X, Y, Z Axis Control

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

Filament Motor Control

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

Temperature Control

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

Liquefier Temperature Control

The liquefier T/C connects to the controller board through the power distribution board. The T/C generates a variable low level current that depends on the temperature of the T/C. This analog signal from the T/C is amplified by the head 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 89.5° C. The highest reading is 330° C.

The liquefier temperature is maintained at:

BST & SST
Model: 300° C
Support: 300° C

Temperature control is accomplished using “pulse wide modulation” (Fig. 3).

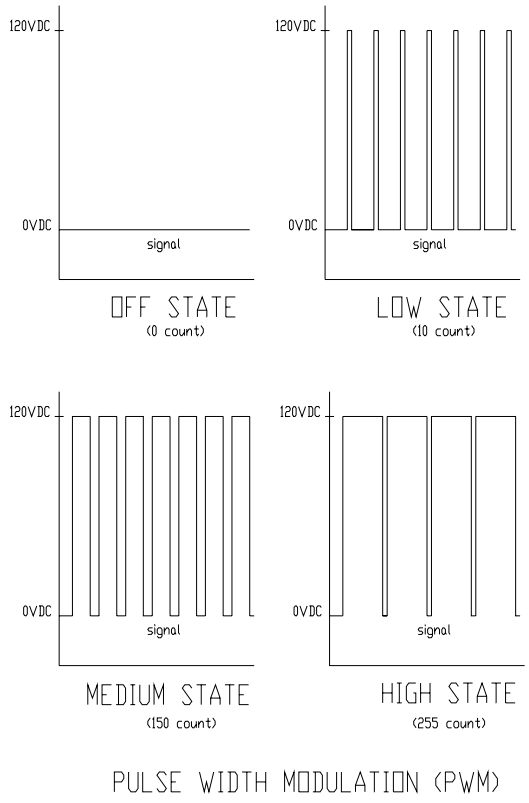


Figure 3: Pulse Width Modulation (PWM)

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 BST/SST system are 24 volt solenoids. The 24 volt power is supplied by the PDB which in turn is controlled by the controller board. The following is a list of actuators:

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

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

The controller board monitors these switches:

- Z limit switches – upper and lower
- X end of travel switch
- Y end of travel switch

The controller board monitors the following optical sensors:

- X home sensor
- Y home sensor
- Top of foam sensor

Safety Devices

The controller board monitors the following safety devices:

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

Controller Board Layout

Fig. 4 below shows the layout of the controller board connectors with labels indicating where each of the functions described previously are connected. In addition to those functions, the figure shows a reset button, a set of dip switches, and the LEDs (D1-D3 and D6-D13).

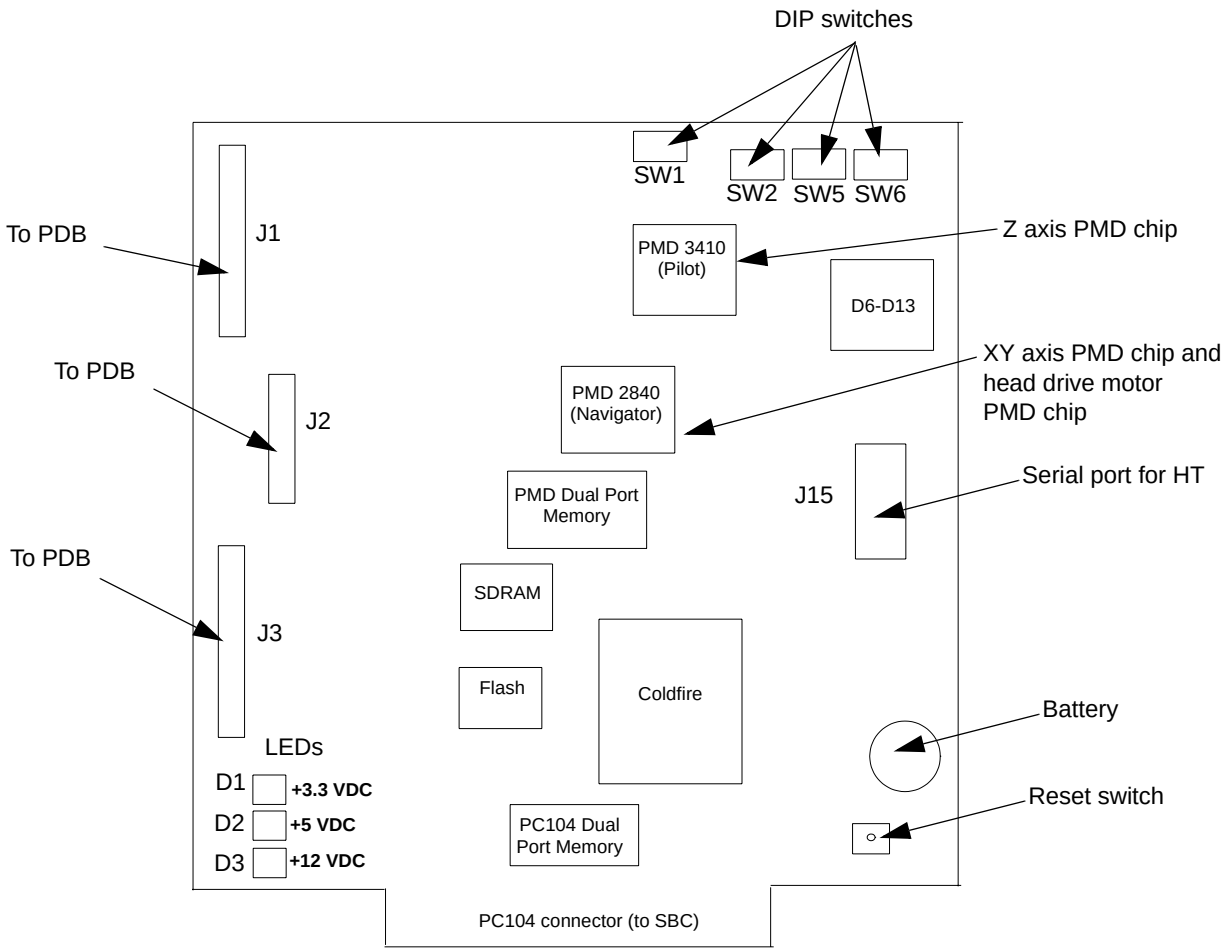


Figure 4: Controller Board Connection Detail

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.

Dip Switches

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

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

SW1

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

SW2

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

SW5

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

SW6

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

Memory

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

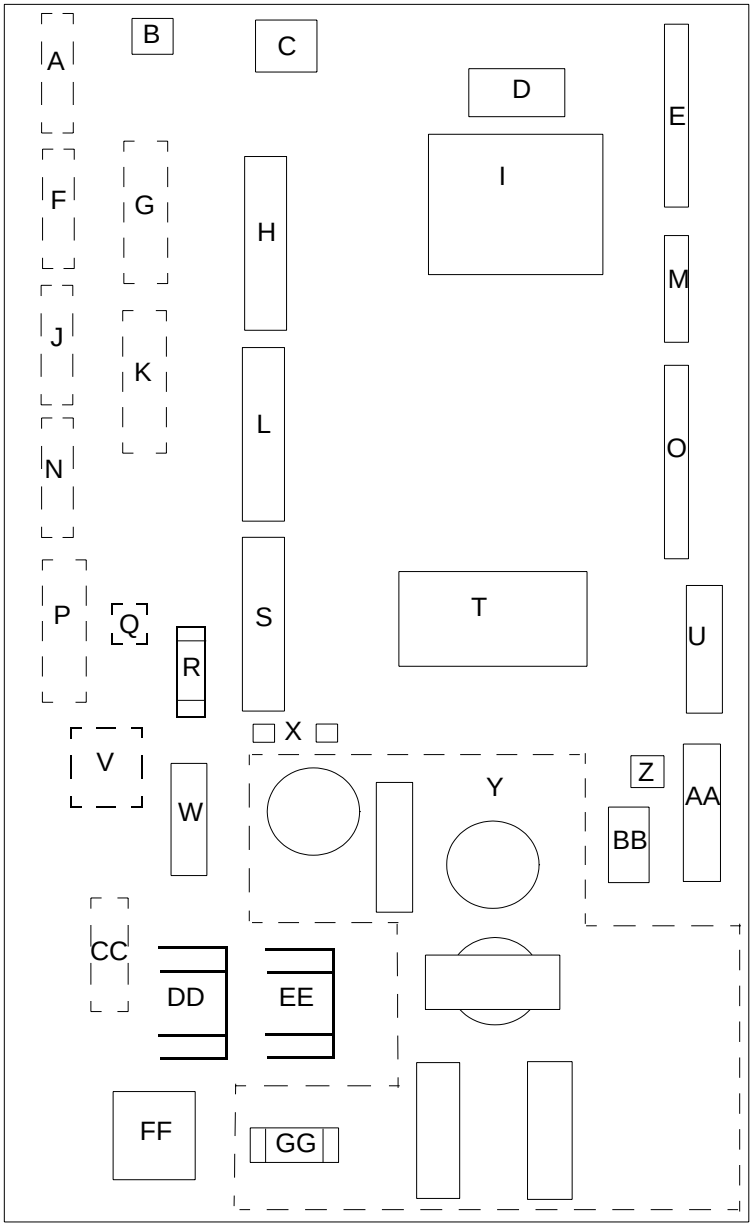
- Dual Port RAM: The communication buffer between the controller board and the single board computer. Events (from the controller), commands (from the SBC), and motion control vertices (from the SBC) are passed through the P104 connector joining the two boards.
- Flash Memory: Where the executable code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

LEDs

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

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

Power Distribution Board (PDB)



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

Figure 5: PDB Detail

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

AC line voltage comes into the PDB (Fig. 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. For SST only, a separate 120 VDC supply powers the support heater.

There are two fuses on the power distribution board (Fig. 5).

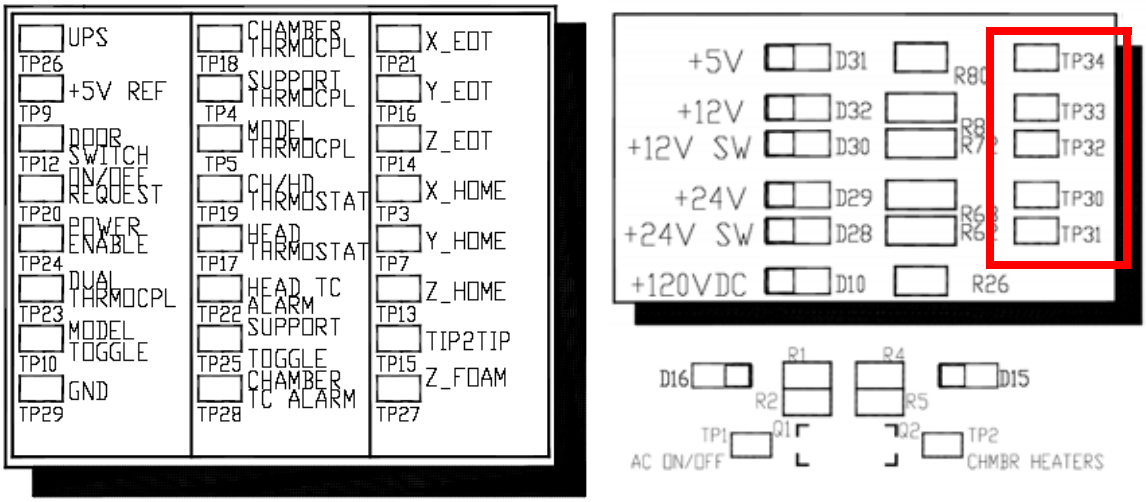
- Fuse F1 fuses the AC input to the +120 VDC supply.
- Fuse F2 fuses the +120 VDC output.

Chamber Temperature Control

The chamber thermocouple (T/C) connects directly to the PDB and the signal is sent to the controller board. The T/C generates a variable low level voltage that depends on the temperature of the chamber. This analog signal from the thermocouple is amplified on the PDB. From the amplifier, the signal goes to an A to D converter in the ColdFire. The controller reads the chamber temperature and turns the heaters on and off to maintain 75° 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 TP5 for model, TP4 support, and TP18 for the chamber (10 mV per degree C).

Test Points

Test points are very useful for troubleshooting the system. The test points are listed below with a brief description.



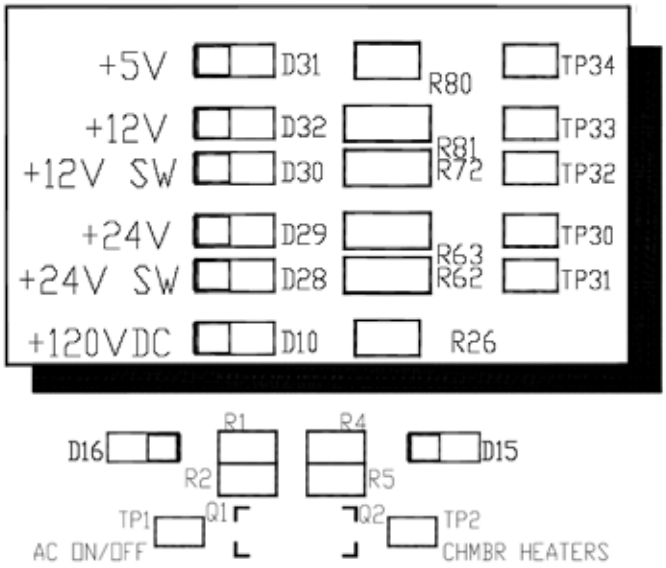
System Component	Test Point	Description
UPS	TP26	Power fail signal from external UPS
+5V REF	TP9	Head T/C service reference
Door Switch	TP12	State of the door (open or closed)
On/Off Request	TP20	State of power down switch
Power Enable	TP24	Enables power to circuitry (normally high)
Dual Thermocouple	TP23	SST: High, T/C board jumper present BST: Low, T/C board jumper removed
Model Toggle	TP10	Toggle travel complete

System Component	Test Point	Description
GND	TP29	Ground
Chamber Thermocouple	TP18	Voltage corresponds to chamber temperature (10 mV=° C)
Support Thermocouple	TP4	Voltage corresponds to support temperature (10 mV=° C)
Model Thermocouple	TP5	Voltage corresponds to model temperature (10 mV=° C)
CH/HD Thermostat	TP19	Chamber and head thermostat (snap switches) (+5 VDC if both switches closed) Normal = tp17 lo, tp19 hi ch thermostat fault=tp17 lo, tp19 lo.
Head Thermostat	TP17	Goes high if head thermostat trips Normal=tp17 lo, tp19 hi hd thermostat fault=tp17 hi, tp19 lo
Head TC Alarm	TP22	High if head T/C not plugged in or open
Support Toggle	TP25	Not used
Chamber TC Alarm	TP28	High if chamber T/C not plugged in or open
X EOT	TP21	X end of travel sensor (5 VDC), switches are wired normally closed (NC)
Y EOT	TP16	Y end of travel sensor (5 VDC), switches are wired normally closed (NC)
Z EOT	TP14	Z end of travel sensor (5 VDC), switches are wired normally closed (NC)
X Home	TP3	X home sensor (5 VDC), switches are wired normally closed (NC)
Y Home	TP7	Y home sensor (5 VDC), switches are wired normally closed (NC)
Z Home	TP13	Z home sensor (5 VDC), switches are wired normally closed (NC)
Tip-to-Tip	TP15	Not used
Z Foam	TP27	Z substrate sensor (5 VDC)
+5 VDC	TP34	+5 VDC
+12 VDC	TP33	+12 VDC
+12 VDC SW	TP32	+12 VDC switched (off when power enable is off, when powering up, and during download)
+24 VDC	TP31	+24 VDC
+24 VDC SW	TP30	+24 VDC switched (off when power enable is off, when powering up, and during download)
AC On/Off	TP1	Drive signal to power down relay
Chamber Heater	TP2	Chamber heater on or off

LEDs

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

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



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

Chapter 3
Setup & Installation

Chapter Overview

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

Workspace **2**
Unpacking **2**
Unpack the printer: 2
Installing Forklift Access Covers **3**
Power Connections **4**
Prepare all power connections: 4
Powering On Dimension **4**
Insert Modeling Base **5**
Installing Software **6**
Install CatalystEX: 6
Verifying controller software version: 6
Networking the Printer **6**
Establishing communication on a Dynamic network: 6
Setting the Static Network addresses: 7
Connecting Directly to the PC **8**

Workspace

Observe the following when placing the system in its operating location:

- Dimension has an approximate weight of 148 kg (326 lbs) and requires a table capable of safely supporting 181 kg (400 lbs).
- System Dimensions:
  838 x 737 x 1143 mm (33 x 29 x 45 in)
  Four-inch minimum space behind unit for air circulation
- Dedicated outlet requirements:
  110-120 VAC, 60 Hz, 15 A min. (20 amp recommended)
  –or–
  220-240 VAC, 50/60 Hz, 7 A min. (10 amp recommended)
- Temperature: 18–30°C (65-86°F)
- Relative Humidity: 30-70%, Non-condensing
- Ethernet 10/100 Base T network
- Optional UPS for power interruptions (brown-out conditions):
  Rated Power – 2200 VA
  Output Power – 1600 watts

Unpacking

This section describes the recommended procedures for unpacking and preparing Dimension for its first use.

Unpack the printer:

WARNING: The Dimension printer weighs approximately 148 kg (326 lbs). Use proper moving and lifting techniques when positioning the unit. For convenience, there are forklift pads built into the bottom of the unit. They are accessible from the side of the unit.

1. Before unpacking the printer, move it near to its operating location.
2. Remove the plastic banding from around the cardboard.
3. Remove the top cover. Set aside the fork access covers (2) and bag of screws (2).
4. Remove screws (4) that attach cardboard to pallet and remove the cardboard side panels.
5. Remove the top foam.
6. Remove outer plastic wrap - use care if using a knife so as to not scratch the printer.
7. Remove the foam door channels (2) and tape.

WARNING: The Lead Screw and Guide Rods are lubricated with a thin coat of Krytox grease. Krytox grease can cause skin irritation. Be careful not to get the grease on hands or clothing.

CAUTION: Remove the foam tubes that isolate the extrusion head from the frame (see Figure 1). The printer will be damaged if powered on with the foam tubes in place.

CAUTION: Be careful not to damage the rod sensors when removing the foam tubes (see Figure 1).

8. Remove the foam tubes that isolate the extrusion head from the frame (see Figure 1).

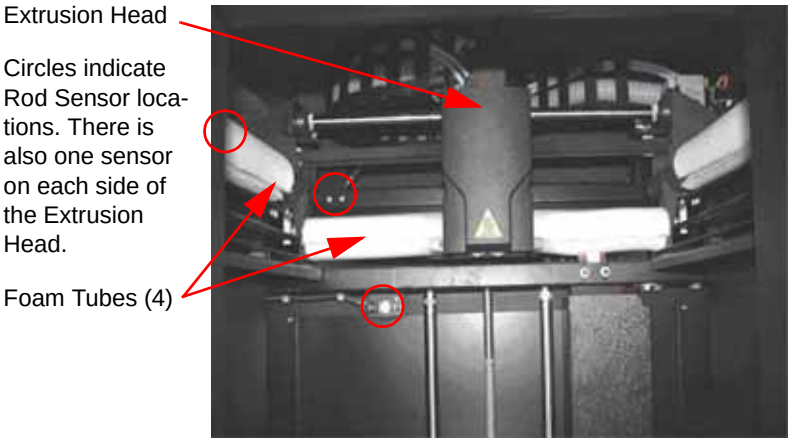


Figure 1: Foam tubes isolating the extrusion head from the Z-axis frame

9. After unpacking, inspect the printer and report any shipping damage to the carrier.

Installing Forklift Access Covers

The forklift access covers can be placed over the forklift channels after the printer is placed in its final location (see Figure 2). The covers are press-fit in the front and held in place with one screw in the rear.

Figure 2: Installing the forklift access covers

Power Connections

This section discusses the procedure for preparing all power connections for the printer.

CAUTION: Before connecting power to the printer, make sure that the Dimension circuit breaker is in the off (down) position. It is located in the rear of the printer next to the power cord attachment point.

Dimension is provided with two power cords: one for 110 V and one for 220 V.

Prepare all power connections:

1. Connect the male end of the supplied power cord directly into a grounded electrical outlet, as shown in Figure 3. (If using a Uninterrupted Power Supply (UPS), connect the cord directly into the UPS).

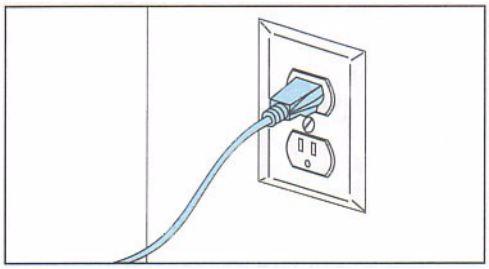


Figure 3: Connecting to a grounded electrical outlet

CAUTION: Do not use an extension cord or power strip with the Dimension system. Connect the cord directly into the receptacle or UPS.

2. Connect the female end of the power cord directly into the rear of the cabinet.
3. Switch the Dimension circuit breaker to the on (up) position.

   The Dimension system is now ready to have power applied.

Powering On Dimension

WARNING: Dimension's build chamber and extrusion-head tip get very hot! The chamber and head tip reach temperatures of approximately 75°C (167°F) and 300°C (572°F) respectively. Personal injury can occur if proper techniques and safety materials are not used. Use the leather safety gloves provided in the Startup Kit when working inside the printer.

CAUTION: Remove the foam tubes that isolate the extrusion head from the frame (see Figure 1). The printer will be damaged if powered on with the foam tubes in place.

Dimension's power switch is located on the front of the cabinet, near the bottom right corner (see Figure 4). After the switch is pushed, Dimension boots up in three to seven minutes.

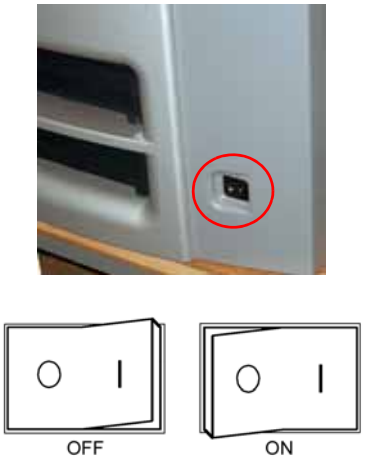


Figure 4: Location of Power Switch (View From Front of Printer)

Note: ***If the printer was off and is at room temperature, it requires approximately 40 minutes to warm up before you can perform any functions. Temperatures are factory-preset and not adjustable. The panel displays the head and envelope temperatures while Dimension is warming up and cooling down.***

Note: **For safety, the head and Z Platform do not move while the chamber door is open. During warm-up and operation the door is locked. The door can be opened only when Dimension is not building a part, getting ready to build a part, or in Pause mode.**

Insert Modeling Base

Make sure retainers are turned 'down' - so as not to interfere with the modeling base installation. Set the modeling base on the Z Platform aligning the tabs on the modeling base with the slots on the metal tray. Slide the modeling base toward the back of the unit until its front edge (with the handle) is flush with the front edge of the tray (see Figure 5). Secure the base with the two retainers by turning them up.

Note: **When inserting and removing the modeling base, use the handle to avoid touching the top surface. Grease and oil that contact the top build surface could cause poor part adhesion. You can clean the build surface with isopropyl alcohol if necessary.**

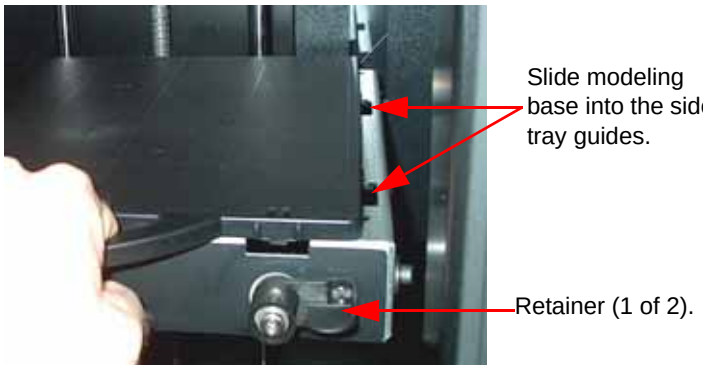


Figure 5: Inserting a modeling base

Installing Software

There are two software programs that work with Dimension.

- CatalystEX is the preprocessing software that controls Dimension. If you have not already done so, you will need to install the CatalystEX software on the PC. You will find the CatalystEX software on the CD-ROM included in the Startup Kit.
- There is also 'controller' software loaded directly onto the Dimension system from the factory. Because we do occasionally make changes to this software, you will need to verify that you have the latest version installed. A controller software CD is included in the Startup Kit.

Install CatalystEX:

1. Insert the CatalystEX installation disc into the CD-ROM drive.
   The installation menu automatically appears.
2. Click the **Install** button.
3. Follow the prompts to finish installing the software.

Note: **CatalystEX's installation setup allows you to change or confirm the target installation directory. To install CatalystEX in a directory other than the default, type the path and directory name in the dialog box when prompted.**

4. If you want to customize the installation, select the **Custom** option. Custom options include the following:
   - CatalystEX Files
   - Training Files

Verifying controller software version:

1. Check the version displayed on the system keypad.
   - From **`Idle`**, press **`Maintenance`**. The version number will be listed in the top display window under **`System Maintenance`**.
2. Compare the version number to the controller software CD provided in the Startup Kit.
3. If the version on the controller software CD is newer than the system version, follow the Controller Software Upgrade Notice instructions provided in the Startup Kit.

Networking the Printer

You will need to establish communication between the PC and printer before you can send files to print. How you establish this communication is dependent upon how the computer network is configured. In many cases, it is a simple matter of letting the CatalystEX software 'find' the printer. In some situations you may need to set the network address for the printer and, possibly, record the IP address in the CatalystEX program.

Establishing communication on a Dynamic network:

If you are on a Dynamic network (or not sure of the network type) follow these steps to allow the CatalystEX software to 'find' the printer and establish communication.

1. Plug in the network patch cable from the network to the rear of Dimension. (A 14 foot network cable (blue) is included with the Start Up Kit.)

2. Make sure the printer is 'on' and determine the Unique Device Name (UDN) for the printer.
   A. From **`Idle`** (or **`Ready to Build)`**, press **`Maintenance`**. The panel displays **`System Maintenance`** and the software version.
   B. Press **`Set Network`**. The top window displays: **`Network Admin - Dynamic IP Address; UDN`**
   C. The UDN for the printer is listed here. This is preset at the factory and cannot be changed.
3. From the PC, start the CatalystEX application.
   A. From the General Tab, click the 'Manage 3D Printers' button.
   B. Click the 'Add from Network...' button in the lower right corner of the pop-up.
   C. A new pop-up, 'Add 3D Printer', should list the printer in the main window (identified by its UDN). Click on the printer in this window and enter a Name and Location (user choice) in the lower portion of the pop-up.
   D. Click 'Add Printer' - and you are ready to go. Close the 3D Printer pop-up.

Note: **If the printer is not displayed in the 'Add 3D Printer' pop-up, you are not using a Dynamic network. You will need to set up a Static Network address.**

Setting the Static Network addresses:

(if necessary)

1. Obtain the network addresses from the Network Administrator.
2. From **`Idle`** (or **`Ready to Build)`**, press **`Maintenance`**. The panel displays **`System Maintenance`** and the software version.
3. Press **`Set Network`**. The top window displays: **`Network Admin - Static IP Address; UDN`**
4. Press **`Static IP`** to display current settings. For example::

   ```
   IP Address: 192.000.000.001
   NM Address: 255.255.000.000
   GW Address: 198.000.000.001
   ```

   These are the factory default addresses; they must be changed for the network.
5. Look for the cursor beneath the first digit of the IP address. The cursor does *not* blink. To update the IP address:

   Press **`Increment`** to increase the value one digit at a time.

   Press **`Next Digit`** to move the cursor one place to the right.

   Press **`Last Digit`** to move the cursor one place to the left.
6. Use the three functions above to set the IP address.
7. After setting the final digit of the IP address, move the cursor one more place to the right. The cursor moves to the NM (or Netmask) address. Follow the same steps for setting the NM and GW addresses.
8. When you have finished setting the addresses, press **`Done`**. The panel displays **`Change IP, Netmask, Gateway`**?

9. Press **Yes**. The panel then displays **Resetting Network** and after a moment returns to **Idle** or starts warming up.
10. If you have not done so already, plug in the network patch cable from the network to the rear of Dimension.
11. From the PC, start the CatalystEX application.

Note: **Detailed instructions for using CatalystEX can be found in the CatalystEX Help file.**

   A. From the General Tab, click the 'Manage 3D Printers' button.
   B. Click the 'Add from Network...' button in the lower right corner of the pop-up.
   C. A new pop-up, 'Add 3D Printer', should list the printer in the main window (identified by its UDN). Click on the printer in this window and enter a Name and Location (user choice) in the lower portion of the pop-up.
   D. Click 'Add Printer' - and you are ready to go. Close the 3D Printer pop-up.

12. If the printer is NOT displayed in the 'Add 3D Printer' pop-up (Step <Reference>11.<Reference>C.), you will need to add the printer IP address manually.
   A. From the General Tab, click the 'Manage 3D Printers' button.
   B. Click the 'Add Manually...' button in the lower right corner of the pop-up.
   C. In the pop-up, 'Add 3D Printer', enter a Name and Location (user choice) for the printer in the appropriate fields.
   D. Enter the IP Address for the printer in the appropriate field. It will be the same address as the one entered in Step <Reference>4.
   E. Select the appropriate printer type from the drop down list.
   F. Click 'Add Printer' and close the 3D Printer pop-up.
13. If you are unable to connect the printer to the PC, contact the Network Administrator.

Connecting Directly to the PC

You can connect the Dimension printer directly to the PC without the use of a network. This is most easily accomplished with the printer in Dynamic network mode (as received from the factory).

1. Connect a crossover cable from the printer directly into a network port on the PC (A 14 foot crossover cable (orange) is included with the Start Up Kit.)
2. Make sure the printer is 'on' and determine the Unique Device Name (UDN) for the printer.
   A. From **Idle** (or **Ready to Build)** , press **Maintenance**. The panel displays **System Maintenance** and the software version.
   B. Press **Set Network**. The top window displays: **Network Admin - Dynamic IP Address; UDN**
   C. The UDN for the printer is listed here. This is preset at the factory preset and cannot be changed.

3. From the PC, start the CatalystEX application.

Note: **Detailed instructions for using CatalystEX can be found in the CatalystEX Help file.**

   A. From the General Tab, click the ‘Manage 3D Printers’ button.

   B. Click the ‘Add from Network...’ button in the lower right corner of the pop-up.

   C. A new pop-up, ‘Add 3D Printer’, should list the printer in the main window (identified by its UDN). Click on the printer in this window and enter a Name and Location (user choice) in the lower portion of the pop-up.

Note: **It may take up to 1 minute for the printer to appear in the pop-up window.**

   D. Click ‘Add Printer’ - and you are ready to go. Close the 3D Printer pop-up.

4. If the printer does not appear in the pop-up window:

   A. Cancel the ‘Add 3D Printer’ pop-up and click the ‘Add Manually’ button on the ‘3D Printers’ pop-up.

   B. In the pop-up, ‘Add 3D Printer’, enter a Name and Location (user choice) for the printer in the appropriate fields.

   C. Enter the Dynamic IP Address for the printer (from Step <Reference>2<Reference>B) in the appropriate field.

   D. Select the appropriate printer type from the drop down list.

   E. Click ‘Add Printer’ and close the 3D Printer pop-up.

   F. If you get an ‘Error: Unable to connect to printer.’ message it may be that the PC is not configured for Dynamic networking. To configure the PC for Dynamic networking:

      i. From the ‘Control Panel’ of the PC, choose ‘Network and Internet Connections’.

      ii. Choose ‘Network Connections’, then double click ‘Local Area Connection’.

      iii. Scroll the ‘Local Area Connection Properties’ window to find the ‘Internet Protocol’ (TCP/IP) selection. Double click or highlight and click the ‘Properties’ button.

      iv. From the ‘General’ Tab of the ‘Internet Protocol TCP/IP’ Properties pop-up click the ‘Obtain an IP address automatically’ radio button.

      v. Click OK, then OK again.

      vi. After allowing the PC a minute or so to adjust to the new setting, the PC should connect to the printer.

      vii. If you are still unable to connect to the printer, recheck the connections and settings. Contact the local reseller for additional customer service.

Chapter 4
Service Procedures

Breakdown of Service Procedures

In this chapter you will learn how to replace field replaceable units (FRUs) in the system. You will also learn various service procedures. The contents and page numbers of this chapter are as follows:

Maintenance Preparation

Pre-Maintenance Procedures 3

Exterior Components

Rear Panel 4
- Removing the Rear Panel 4
- Installing the Rear Panel 4

Side Panels 5
- Removing the Side Panels 5
- Installing the Side Panels 5

User Interface Panel 5
- Removing the User Interface Panel 5
- Installing the User Interface Panel 6

Door Solenoid and Door Sensor 6
- Removing the Door Solenoid 6
- Installing the Door Solenoid 7
- Removing the Door Sensor 7
- Installing the Door Sensor 8

Front Door Glass Panel 8
- Removing the Front Door Glass Panel 8
- Installing the Front Door Glass Panel 8

Front Bezel 9
- Removing the Front Bezel (Panel) 9
- Installing the Front Bezel 10

Electrical Components

Power Distribution Board (PDB) 11
- Removing the PDB 11
- Installing the PDB 13

Controller Board 14
- Removing the Controller Board 14
- Installing the Controller Board 15

Single Board Computer (SBC) 16
- Removing the SBC 16
- Installing the SBC 18

Hard Drive 19
- Removing the Hard Drive 19
- Installing the Hard Drive 20

24 VDC Power Supply 20
- Removing the 24 VDC Power Supply 20
- Installing the Power Supply 21

120 VDC Power Supply 21
- Removing the 120 VDC Power Supply 21
- Installing the 120 VDC Power Supply 22

5/12 VDC Power Supply 22
- Removing the 5/12 VDC Power Supply 23
- Installing the 5/12 VDC Power Supply 23

Line Filter Board 23

Head Components

Toggle Plate Assembly 26
- Removing the Toggle Plate Assembly 26
- Installing the Toggle Plate Assembly 31
- Head Alignment Procedure 32

Head Toggle Bar 42
- Removing the Head Toggle Bar 42
- Installing the Head Toggle Bar 42

Head Toggle Sensor 43
- Removing the Toggle Sensor 43
- Installing the Toggle Sensor 43

Head Board 43
- Removing the Head Board 43
- Installing the Head Board 43

Head Motor 44

Removing the Head Motor 44
Installing the Head Motor 44

Z Level Assembly (Foam Sensor)..... 45
Removing the Z Level Assembly..... 45
Installing the Z Level Assembly..... 47
Test of Z Level Assembly..... 47

Umbilical Cable..... 47
Removing the Umbilical Cable 47
Installing the Umbilical Cable 49

Head Cooling Fan..... 50
Removing the Head Cooling Fan..... 50
Installing the Head Cooling Fan..... 50

Loss of Extrusion..... 50
Diagnosing Loss of Extrusion..... 51
Recovering From Loss of Extrusion..... 51

Clogged Liquefier Tip 54
Clearing A Clogged Liquefier Tip 54

XY Table Components

X Home Sensor and X EOT Sensor 56

X Motor..... 56
Removing the X-Drive Motor..... 56
Installing the X-Drive Motor..... 56

X Drive Belt 57
Removing the X-Drive Belt..... 57
Installing the X-Drive Belt..... 57
Check/Adjust the X-Drive Belt Tension..... 58

Y Motor..... 60
Removing Y-Drive Motor & Motor Belt..... 60
Installing Y-Drive Motor & Motor Belt..... 60

Y Drive Belt 61

Y Pulley 61
Removing the Y Pulley..... 61
Installing the Y Pulley..... 62

Y Drive Assembly..... 62

Y Home Sensor / Y EOT Sensor..... 62
Remove Y Home Sensor & Y EOT Sensor62
Install Y Home Sensor & Y EOT Sensor... 63

XY Table Assembly 63
Removing the XY Table 63
Installing the XY Table 65
Checking the XY Table Level..... 67
Adjusting the XY Table Level..... 68
Check/Adjust Y-Drive Belt Tension..... 68

Z Stage Components

Thermostat Fuse 72
Removing the Thermostat Fuse 72
Installing the Thermostat Fuse 72

Envelope Thermocouple 73
Removing the Envelope Thermocouple 73
Installing the Thermocouple 73

Envelope Heater.....74
Removing the Envelope Heater.....74
Installing the Heater.....74

Heater Fan 74
Removing the Heater Fan 74
Installing the Heater Fan 75

Z EOT Sensors 76
Removing Z EOT Sensors.....76
Installing Z EOT Sensors.....76

Purge Bucket Light.....76
Removing Purge Bucket Light 77
Installing Purge Bucket Light 77

Z Stage Motor and Motor Belt.....77
Removing Z Stage Motor & Motor Belt.....77
Installing Z-Stage Motor & Motor Belt.....78

Z Stage Assembly 78
Adjust Z Stage Level 81
Check Z Stage Level 82

Receiver Components

Receiver Back Panel Assembly.....83
Remove Receiver Back Panel Assembly ..83
Install Receiver Back Panel Assembly 83

Receiver Cable 83
Removing the Receiver Electrical Cable ...84
Installing the Receiver Electrical Cable 84

Receiver Motor.....84
Removing the Receiver Motor 84
Installing the Receiver Motor 85

Receiver Drive.....85
Removing the Receiver Drive.....85
Installing the Receiver Drive.....86

Receiver Card.....86
Removing the Receiver Card 86
Installing the Receiver Card 86

Misc. Field Replaceable Units

Tip Wipe Brush/Flicker.....88
Replacing the Tip Wipe Brush/Flicker 88

Maintenance Wrap-Up

Post-Maintenance Procedures 90

Maintenance Preparation

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

Read these warnings before performing any service on this system!

WARNING: Make sure the printer is not powered on 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 Down Switch (PDS) 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 performing maintenance outlined in this chapter.

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

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

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

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

Pre-Maintenance Procedures

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

Exterior Components

Rear Panel

Required Tools

- 5/16” nut driver (or slotted screwdriver)

Removing the Rear Panel

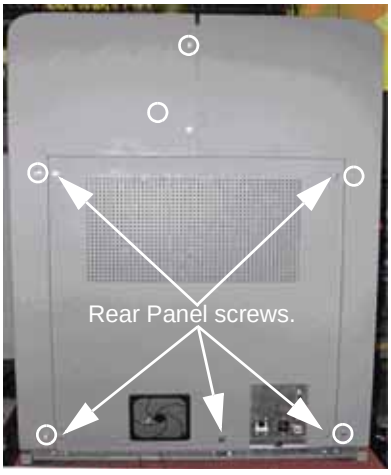
(Figure 1)

1. Loosen, but do not remove, the 5 mounting screws (5/16” nut driver) (the screws are ‘captured’ on the inside of the Side Panels).
2. Remove the panel - lift up and pull it away from the printer.

Installing the Rear Panel

(Figure 1)

1. If removed, install the Side Panels (See “Installing the Side Panels” on page 4 - 5).
2. With the Fan Filter and Rear Panel flange on the outside of the printer, position the panel with the large portion of the mounting slots placed over the mounting screws.
3. Lower the panel into position. Make sure all 5 mounting screws are properly positioned in the narrow portion of their mounting slots.
4. Tighten the 5 mounting screws (5/16” nut driver).



Side Panel screws indicated with circles.

Figure 1: Rear and Side Panel Removal / Installation

Side Panels

Required Tools

- 5/16” nut driver (or slotted screwdriver)

Removing the Side Panels

(Figure 1)

1. Remove the Rear Panel (See “Removing the Rear Panel” on page 4 - 4).
2. Loosen and remove the 6 mounting screws (5/16” nut driver).
3. Remove the Right Side Panel - pull up and toward rear of printer.
4. Remove the Left Side Panel - pull up and toward rear of printer.

Installing the Side Panels

(Figure 1)

1. Install the Left Side Panel.
2. Install the Right Side Panel.
3. Tighten the 6 mounting screws.

User Interface Panel

Required Tools

- 1/8” allen wrench
- 5/16” nut driver

Removing the User Interface Panel

(Figure 2)

1. Loosen and remove the 2 screws (1/8 Allen) holding the User Interface Panel to the Front Bezel.
2. Carefully pull the User Interface Panel out.
3. Disconnect the ribbon connector.
4. Remove the ground spade (5/16 nut driver).
5. Carefully set the User Interface Panel aside.

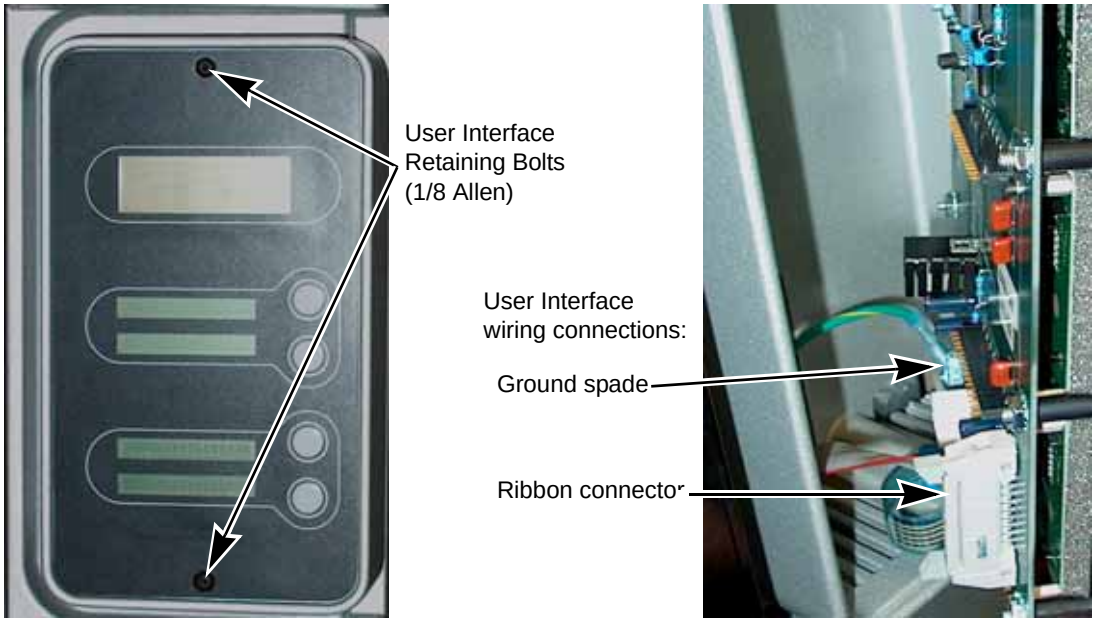


Figure 2: Removing the User Interface Panel

Installing the User Interface Panel

(Figure 2)

1. Connect the ground spade and ribbon connector to the rear of the panel.
2. Position the panel in the front of the Bezel.
3. Install and tighten the 2 retaining screws.

Door Solenoid and Door Sensor

Required Tools

- 5/16” nut driver
- 7/8” wrench (or adjustable wrench)
- 1/2” wrench (or adjustable wrench)

Removing the Door Solenoid

(Figure 3)

1. Open the front door and remove the Door Solenoid/Sensor Cover - loosen and remove the 2 mounting screws (5/16” nut driver)
2. Disconnect the solenoid electrical lead - located in Bezel opening.

Note: Carefully pull the wire lead from the opening. Make sure that there is enough lead wire extending from the opening so that it does not pull back inside the opening when the lead is disconnected.

3. Remove the Door Solenoid - loosen and remove the Door Solenoid mounting nut (7/8”) and lock washer.

Installing the Door Solenoid

(Figure 3)

1. Install the Door Solenoid, lock washer, and mounting nut - tighten the nut.
2. Connect the Door Solenoid electrical lead and carefully feed the lead into the Bezel opening.
3. Install the Door Solenoid/Sensor Cover - orient so slots for Solenoid and Sensor are on the bottom. Install and tighten the 2 cover retaining screws.

Removing the Door Sensor

(Figure 3)

1. Open the front door and remove the Door Solenoid/Sensor Cover - loosen and remove the 2 mounting screws (5/16” nut driver)
2. Disconnect the sensor electrical lead - located in upper Bezel opening.

Note: Carefully pull the wire lead from the opening. Make sure that there is enough lead wire extending from the opening so that it does not pull back inside the opening when the lead is disconnected.

3. Remove the Door Sensor - loosen the Door Sensor jamnut (1/2”) and unthread the Door Sensor from mounting spacer.

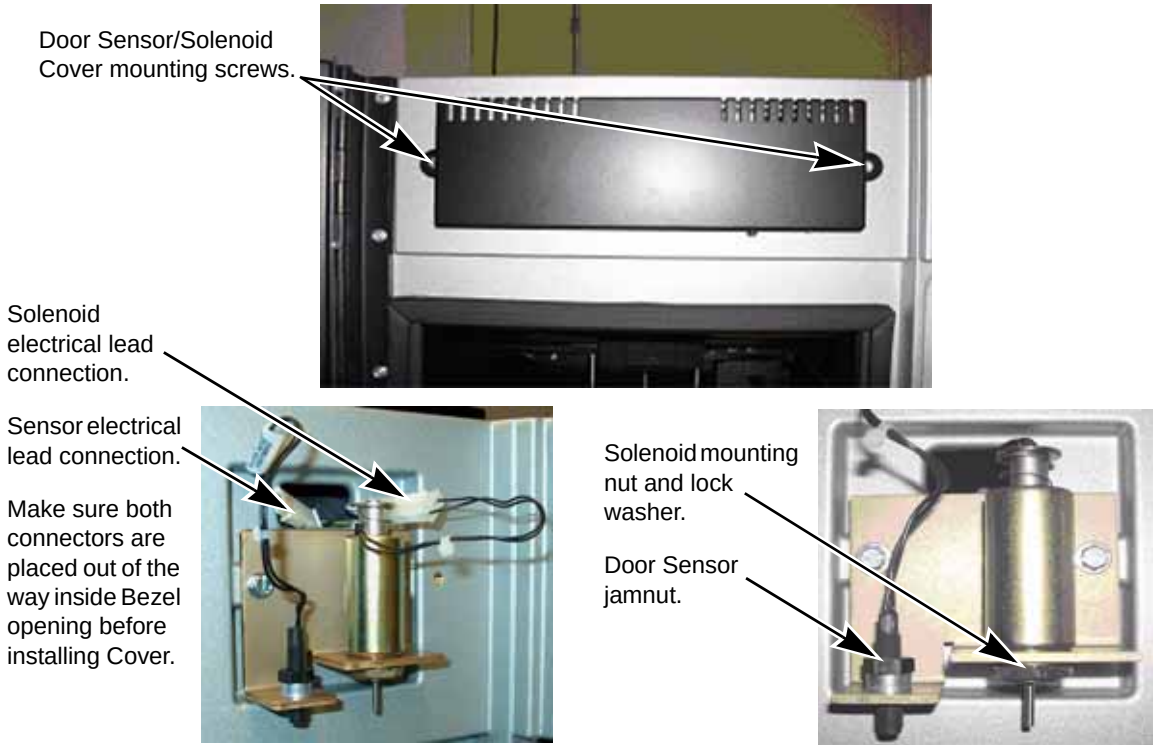


Figure 3: Door Solenoid and Door Sensor Removal / Installation

Installing the Door Sensor

(Figure 3)

1. Thread the Door Sensor jamnut onto the Door Sensor.

CAUTION: Be careful not to twist the sensor electrical leads when installing the sensor. Twisting may cause the wires to break. Connect the leads after adjustment of sensor is complete.

2. Thread the Door Sensor into the mounting spacer.
3. Adjust the Door Sensor so that it extends .300” below the bottom surface of the mounting bracket (Figure 4).

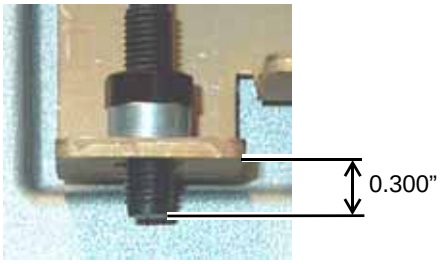


Figure 4: Door Sensor Adjustment

CAUTION: Overtightening the jamnut can lead to internal breakdown of the Door Sensor electrical components - resulting in premature failure.

4. Tighten the jamnut until it is snug - hold the Door Sensor so it does not rotate while tightening the jamnut.
5. Recheck the Door Sensor extension below the mounting bracket.
6. Connect the Door Sensor electrical lead and carefully feed the lead into the Bezel opening.
7. Install the Door Solenoid/Sensor Cover - orient so slots for solenoid and sensor are on the bottom. Install and tighten the 2 cover retaining screws.

Front Door Glass Panel

Required Tools

- Plastic Scraper

Removing the Front Door Glass Panel

(Figure 5)

1. Separate the panel from the door frame - insert a wide plastic scraper near each velcro strip and work the glass panel free of the door frame.
   - Each side of the panel has 4 velcro attach points.
   - Keep a firm grasp on the panel with one hand at all times.

Installing the Front Door Glass Panel

1. Attach panel to door frame - press in on panel at each velcro strip.

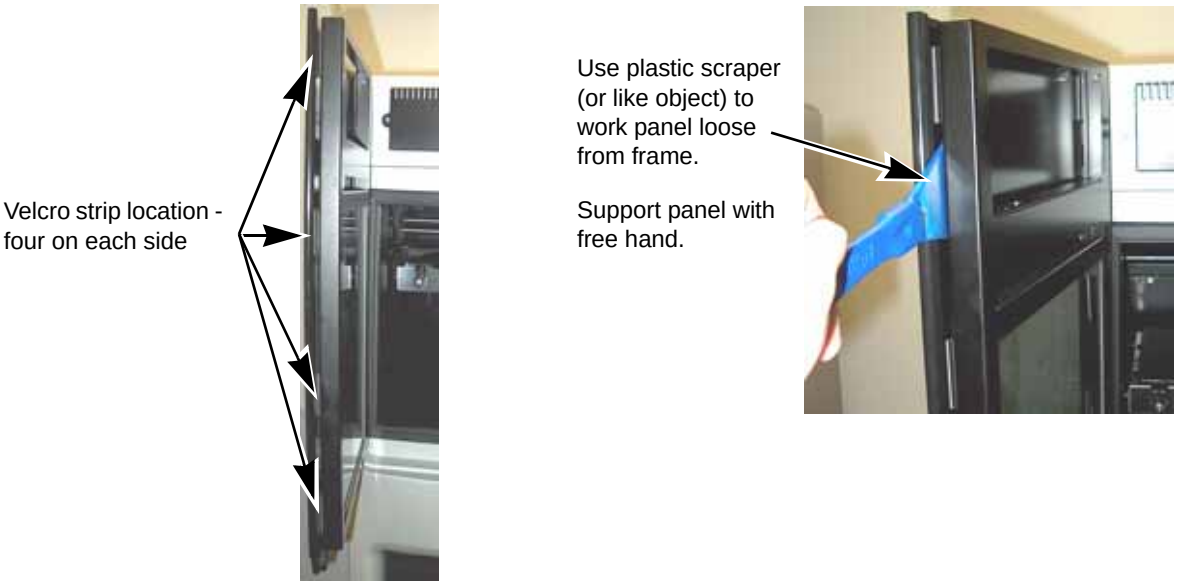


Figure 5: Front Door Glass Panel

Front Bezel

Required Tools

- Slotted screwdriver

Removing the Front Bezel (Panel)

1. Remove the User Interface Panel (See “Removing the User Interface Panel” on page 4 - 5).
2. Remove the Door Solenoid/Sensor Cover (See “Removing the Door Solenoid” on page 4 - 6).
3. Disconnect the Door Solenoid electrical lead.
4. Disconnect the Door Sensor electrical lead (See “Removing the Door Sensor” on page 4 - 7).
5. Disconnect the Bezel wire leads where they connect on the lower right side of the printer (Figure 6).
6. Loosen and remove the 6 Bezel retaining bolts and washers (3 on each side - 1 on the lower right is the ground wire connection) (Figure 7).
7. Carefully slide the Bezel forward - do not put strain on wires running to printer - and set it aside.

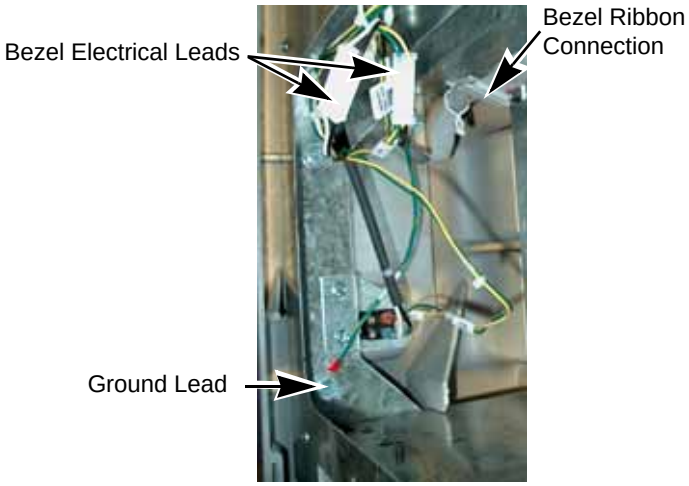


Figure 6: Front Bezel Electrical Leads

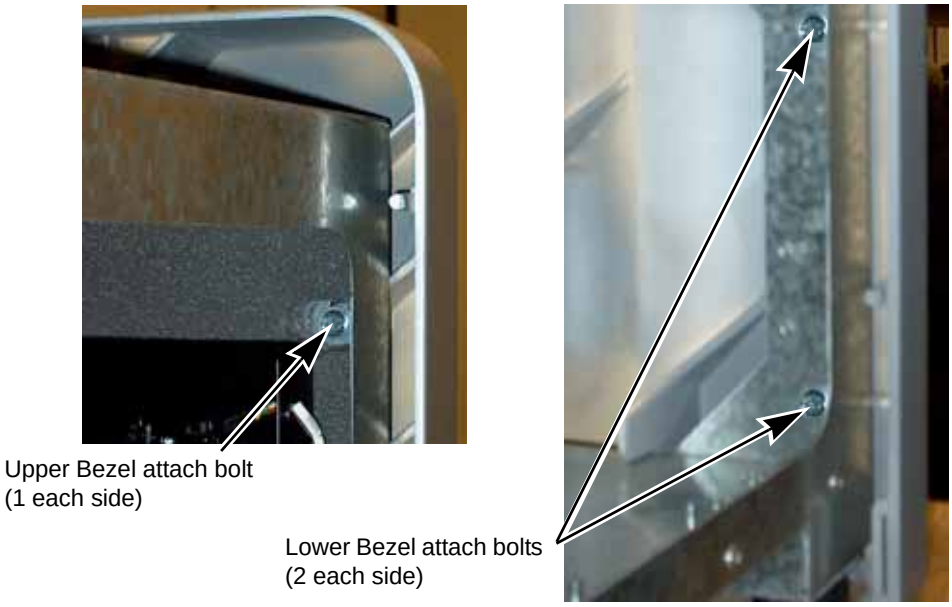


Figure 7: Removing the Front Bezel

Installing the Front Bezel

1. Install the Front Bezel - retain with washers and bolts (Figure 7). Make sure that ground lead is installed on lower right side mount bolt (Figure 6).
2. Connect Bezel electrical leads on lower right side (Figure 6).
3. Connect the User Interface Panel (See “Installing the User Interface Panel” on page 4 - 6).
4. Connect the Door Sensor lead and Door Solenoid lead - tuck leads into opening in Bezel.
5. Install the Door Solenoid/Sensor Cover - install and tighten retaining screws.

Electrical Components

Power Distribution Board (PDB)

Required Tools

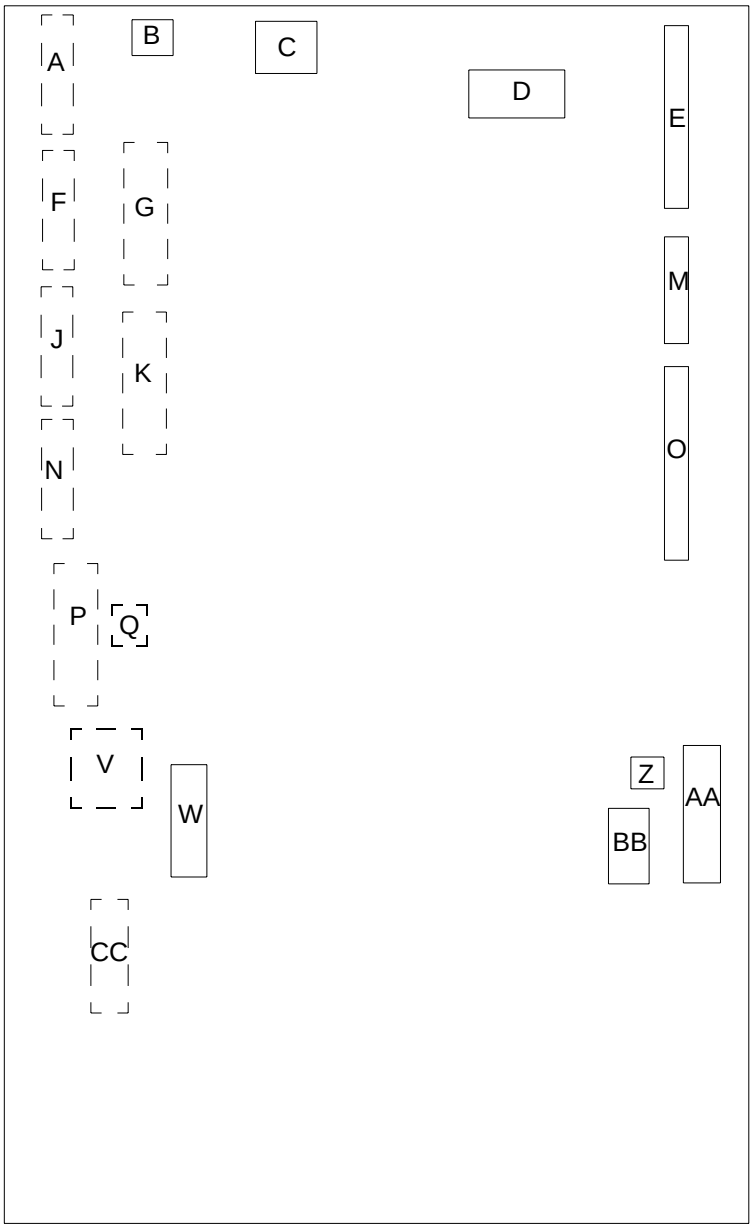
- Allen wrench set
- Phillips screwdriver
- Grounding wrist strap

CAUTION: A grounding strap must be worn to perform this replacement.

Removing the PDB

1. Locate the Power Distribution Board (PDB) (Figure 8).

Figure 8: PDB Location



A	J16 - To LCD display (ribbon)
B	J21 - Not used
C	J13 - Chamber thermocouple connector
D	J24 - To external UPS dry contact
E	J14 - To controller (ribbon cable)
F	J7 - To receiver
G	J9 - Head umbilical II (X motor, filament motors, head snap switch)
J	J10 - Head umbilical I (Head T/C signal, X home, X EOT, Z Substrate Detect)
K	J5 - Mid unit (door latch, lights, chamber fans, head blower fan)
M	J16 - To controller (ribbon cable)
N	J12 - Mid unit (Y home, Y EOT, Z home, Z EOT, on/off switch)
O	J17 - To controller (ribbon cable)
P	J8 - Y and Z motor
Q	J11 - Head heaters
R	F2 - 120 VDC to head fuse
V	J3 - Chamber Heaters
W	J22 - Support heater 120 VDC in (SST only)
Z	J23 - PDB cooling fan
AA	J6 - +5/+12 VDC input
BB	J4 - 24 VDC in
CC	J2 - Power down switch AC & chamber main thermostat

Figure 9: PDB Connector Detail

2. Carefully note the location and orientation of the connectors. If necessary, mark cable orientation and location to guarantee correct re-connection.
3. Disconnect the ten connectors from the rear of the electronics bay (Figure 10). The connector tab must be pushed down to remove the connectors.
4. Disconnect the eleven connectors from the front of the electronics bay (Figure 10). The connector tab must be pushed down to remove the connectors.

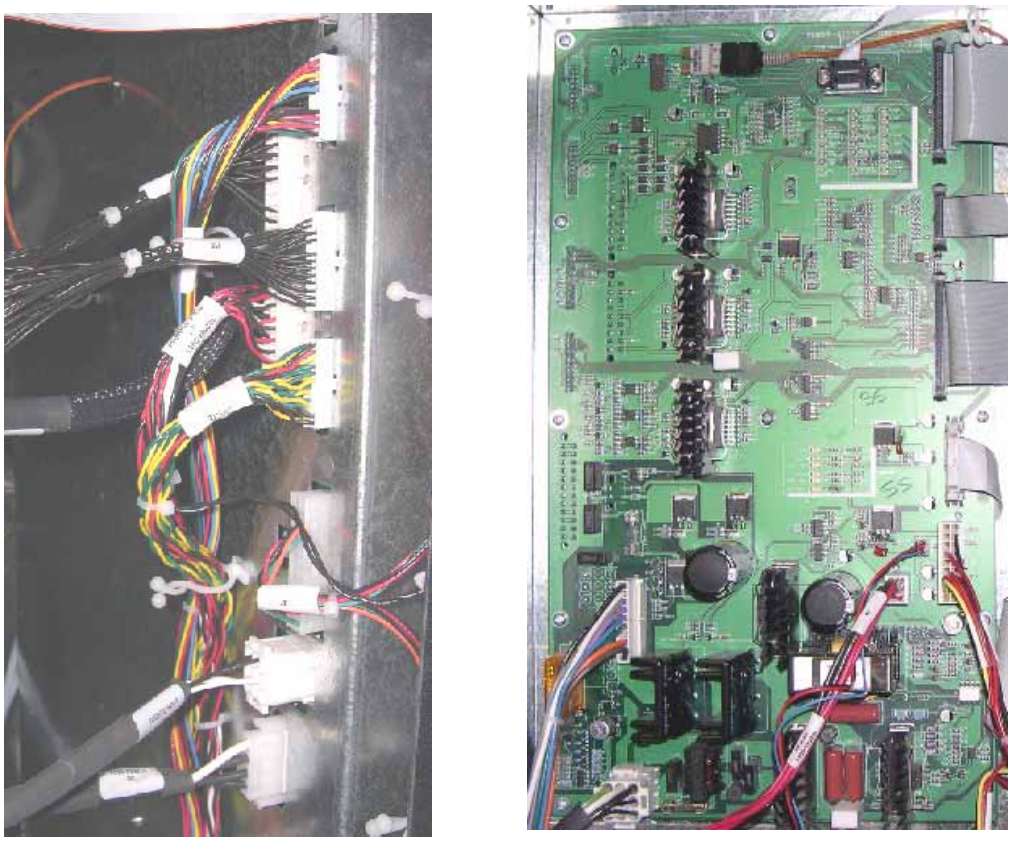


Figure 10: PDB Connector Locations

5. Using a standard screwdriver, remove the UPS connector from the front of the board.
6. Remove the ten remaining connectors from the front of the board.
7. Using a Phillips screwdriver, remove the eleven screws from the front of the board.

Installing the PDB

1. Inspect the replacement board for any signs of damage.
2. Install the replacement board with the eleven screws.
3. Reconnect the ten connectors on the rear of the board, making sure that the location and orientation are correct.
4. Reconnect the eleven connectors on the front of the board, making sure that the location and orientation are correct.
5. Using a standard screwdriver, reconnect the UPS connector to the front of the board.
6. Reconnect the eight connectors to the rear of the board.
7. Double check that all connectors are seated correctly and that orientation is correct.

Controller Board

Required Tools

- Allen wrench set
- Phillips screwdriver
- Grounding wrist strap

CAUTION: A grounding strap must be worn to perform this replacement.

Note: When replacing the Controller Board, follow the "Controller Board Checklist" on page 9 - 24.

Removing the Controller Board

1. Locate the controller board (Figure 11).
2. Carefully note the location and orientation of the four connectors. Mark cables if necessary to guarantee correct re-connection (Figure 12).
3. Disconnect the connectors from the board. Connectors have locking tabs that must be depressed to remove connector.
4. Using a Phillips screwdriver, remove only the lower four screws holding the board to electronics bay.
5. Loosen, do not remove, the upper mounting screw.
6. Carefully "pull" the bottom of the controller board from the Single Board Computer (SBC) by pulling outward until the board is free of the SBC. The lower portion of the board is connected to the top of the SBC via an array of pins. Use caution not to bend the pins or put excessive force on either board.
7. Remove the upper screw and remove the board.

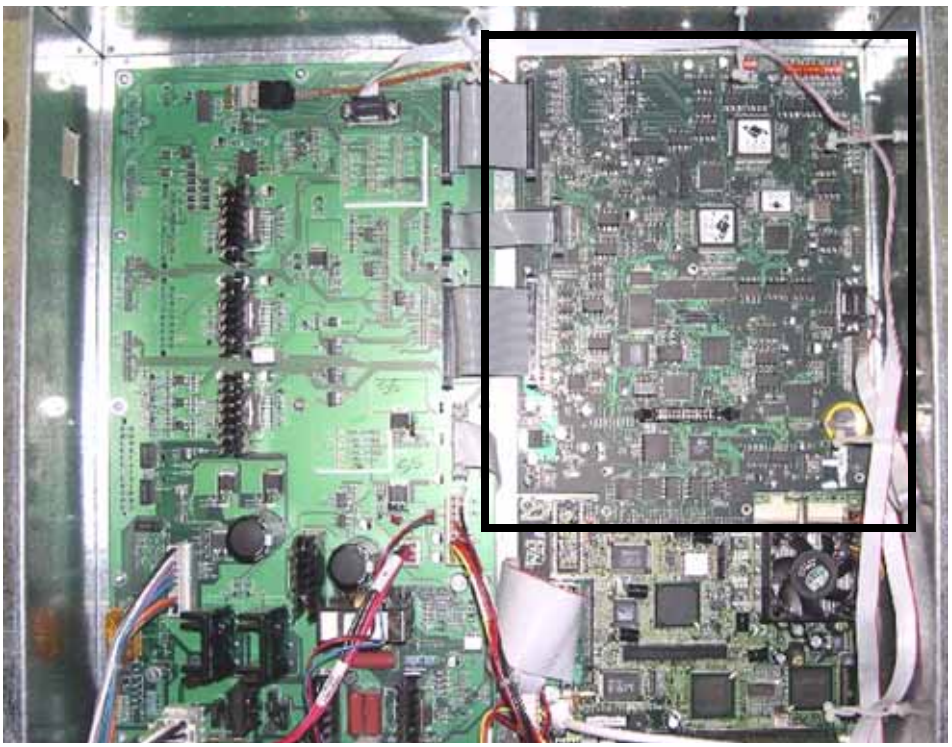


Figure 11: Controller Board Location (Electronics Bay)

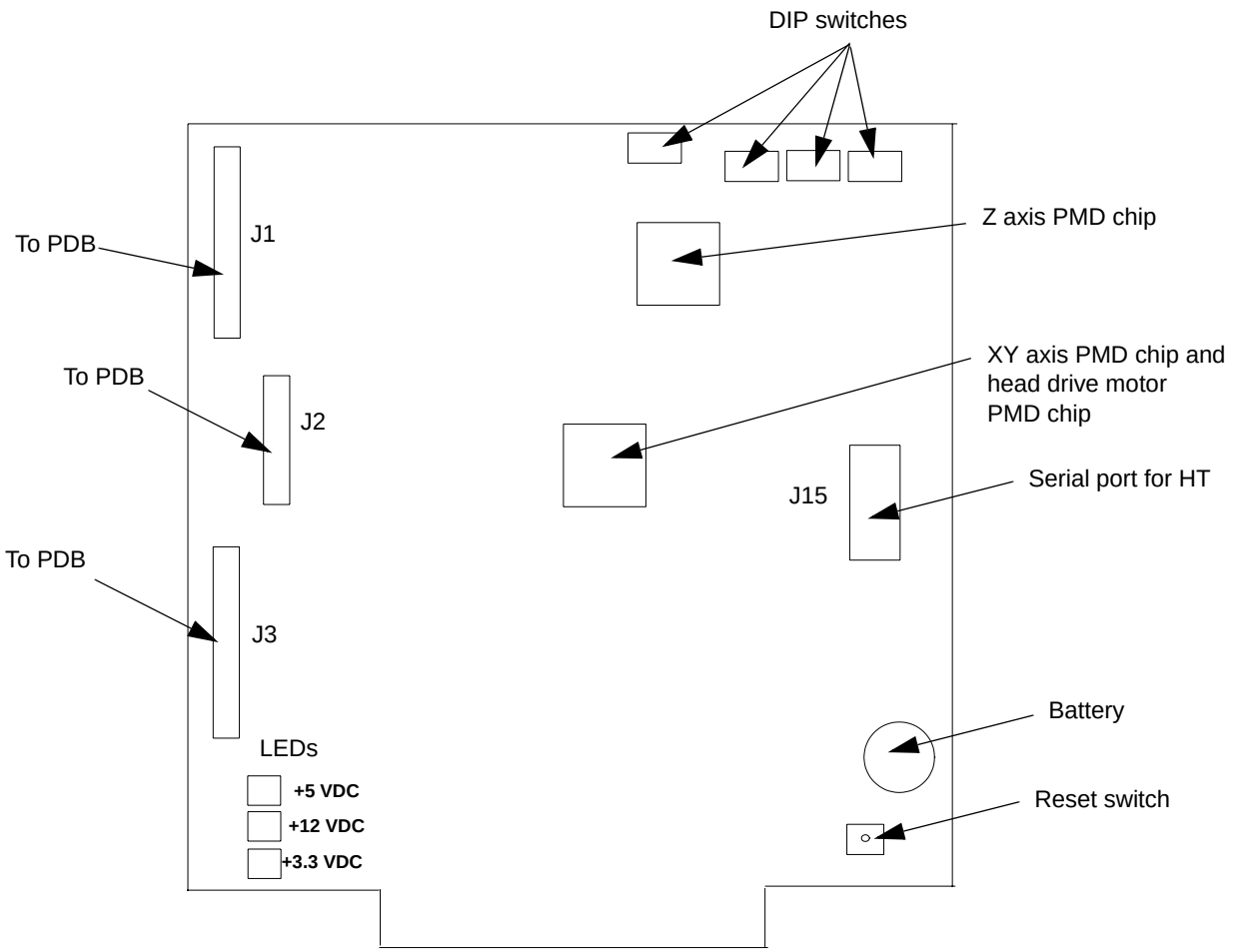


Figure 12: Controller Board Connector Detail

Installing the Controller Board

1. Inspect the replacement board for any signs of damage.

Note: All dip switches should be in the "Off" position.

2. Position the board in place and loosely screw in the top screw.
3. Carefully align the pin array (P104 Bus) with the connector on the SBC. Gently press the pin array into the connector.
4. Replace the remaining four screws and tighten them.
5. Reconnect all connectors making sure that location and orientation are correct (Figure 12).
6. Double check that all connectors are seated correctly and that orientation is correct.

Single Board Computer (SBC)

Required Tools

- Allen wrench set
- Phillips screwdriver
- Grounding wrist strap

Removing the SBC

1. Locate the Single Board Computer (SBC) (Figure 13).

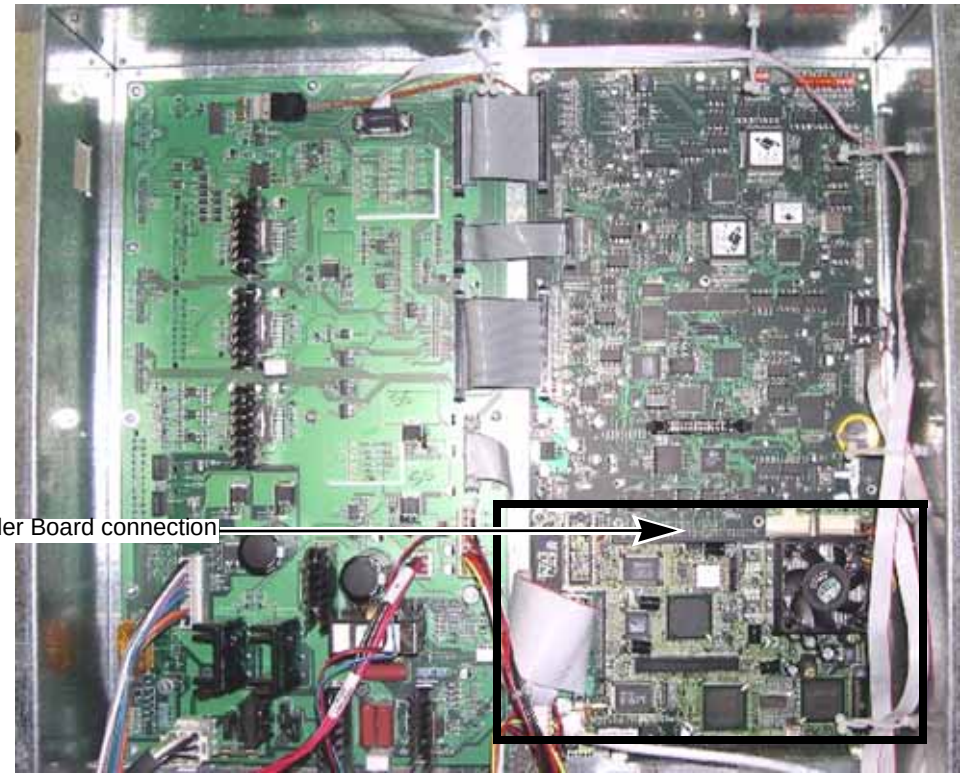


Figure 13: Single Board Computer (Electronics Bay)

2. Remove the Controller Board (See “Removing the Controller Board” on page 4 - 14).
   - The lower portion of the Controller Board is connected to the top of the SBC by an array of pins (Figure 13). After all of the mounting screws are removed from the Controller Board, carefully “disconnect” the bottom of the Controller Board from the SBC. Use caution not to bend the pins or put excessive force on either board.
3. Determine the type of SBC currently installed in the system (Figure 14). Carefully note the location and orientation of the five connectors. Mark cable orientation and location if necessary to ensure correct connection during installation.
4. Using a Phillips screwdriver, remove the four screws holding the board to the electronics bay (Figure 15).

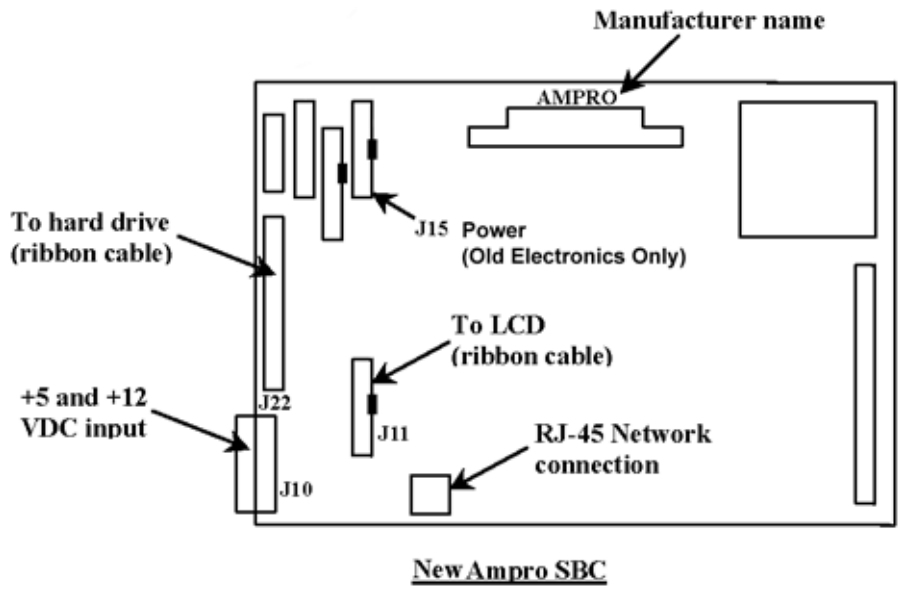


Figure 14: Sheet 1

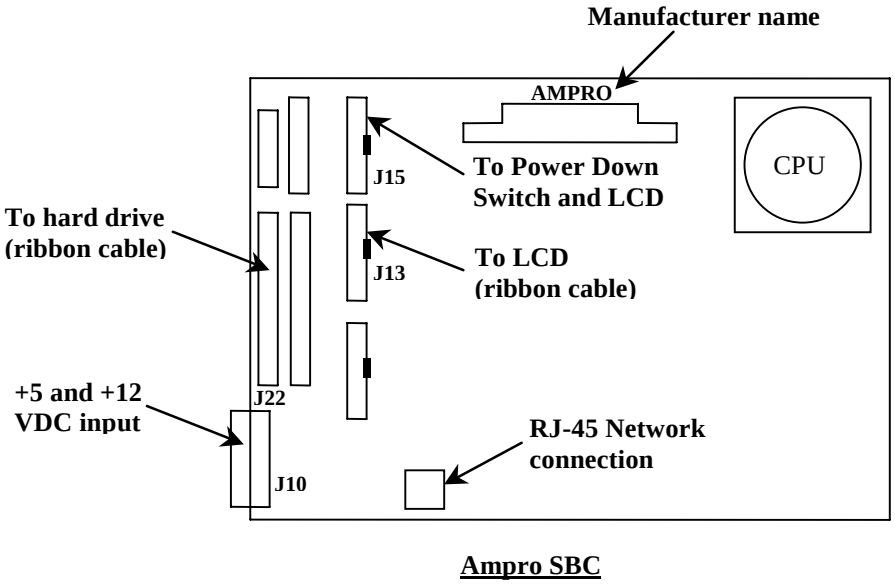


Figure 14: Sheet 2

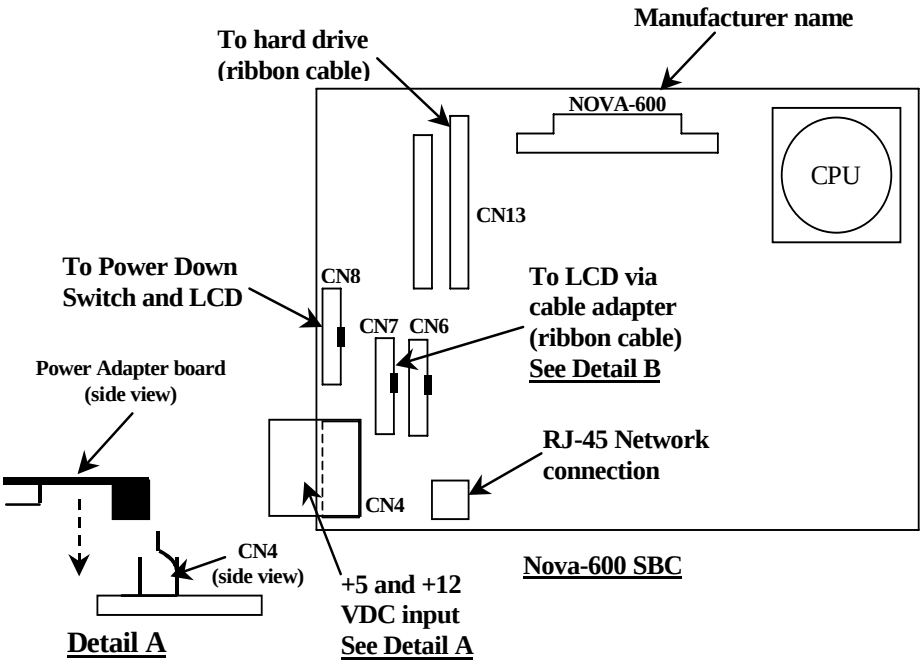


Figure 14: Sheet 3

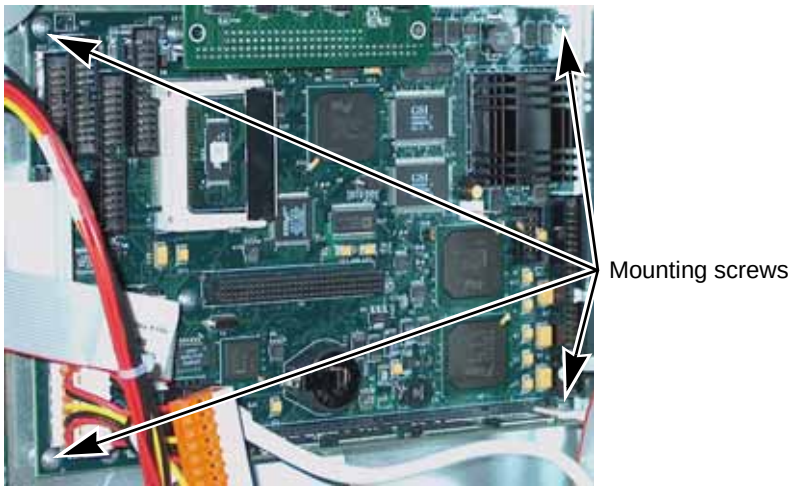


Figure 15: Single Board Computer Detail

Installing the SBC

1. Inspect the replacement board for signs of damage.
2. Install the replacement board by aligning the holes in the board with the mounting holes and securing with the four screws.
3. Install the Controller Board.
   a. Position the Controller Board in place and loosely screw in the top two screws.
   b. Carefully align the pin array (P104 Bus) with the connector on the SBC. Gently press the pin array into the connector.

c. Replace the remaining six screws and tighten all eight screws.

4. Note the type of SBC being used for replacement (Figure 14).
5. Connect the five cables to the SBC (Figure 14).
6. Connect the cables on the Controller Board making sure that location and orientation are correct.
7. Double check that all connectors are seated correctly and that orientation is correct.

Hard Drive

Required Tools

- Allen wrench set
- Phillips screwdriver

Note: When installing the hard drive, follow the "Hard Drive Installation Checklist" on page 9 - 16.

Removing the Hard Drive

1. Locate the hard drive. The drive is located just below the Single Board Computer (Figure 16).
2. Remove the two mounting screws using a Phillips screwdriver and lift the drive out about 6 inches (15.25 cm) (Figure 16).
3. Disconnect the two connectors from the hard drive. Note connector location and orientation (Figure 16).

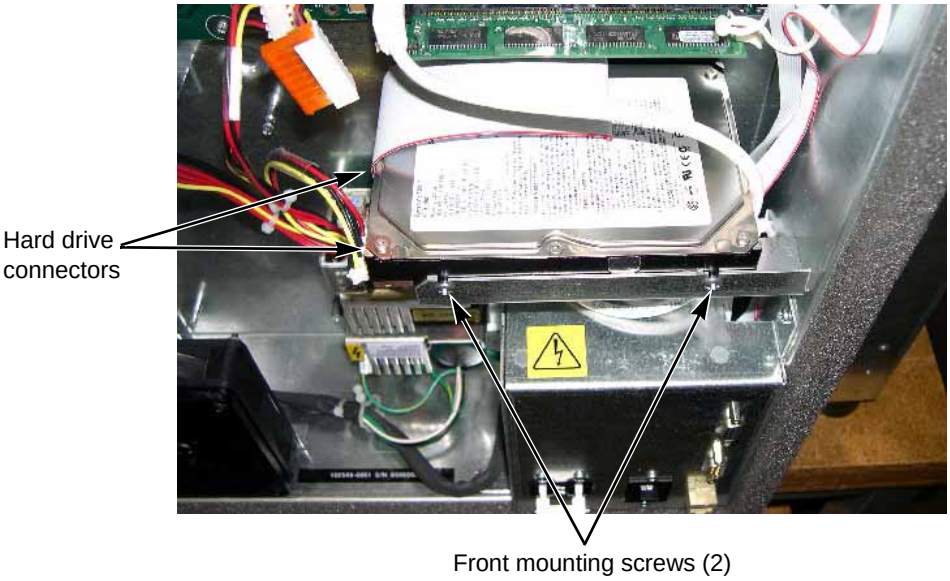


Figure 16: Hard Drive

Installing the Hard Drive

Note: When installing the hard drive, follow the "Hard Drive Installation Checklist" on page 9 - 16.

4. Reattach the connectors to the hard drive.
5. Insert the hard drive into place.
6. Replace the two mounting screws.
7. Power system up. You will be prompted to load the controller (backend) software.
8. Using the keypad, enter the appropriate IP address.
9. Download the controller software.
10. Using Maraca, download the *.cal* file from the system disk.
11. Turn the power-down switch to the OFF position, wait 10 seconds, turn switch to the ON position.

24 VDC Power Supply

Required Tools

- Allen wrench set
- Phillips screwdriver
- Grounding wrist strap

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

Removing the 24 VDC Power Supply

1. Locate the 24 VDC power supply (Figure 17).
2. Remove the fan connector.
3. Using an Allen wrench, remove the screws holding the fan in place. Note the airflow direction by the embossed flow direction arrows on side of fan. Fan must be replaced with the correct direction of airflow.
4. Remove the two power supply bracket mounting screws. Carefully pull the power supply forward about about 6 inches (15.25 cm).
5. Remove the AC connector from the power supply.
6. Using a Phillips screwdriver, remove the DC wires from the terminal posts. Note the location of the wires for reinstallation.
7. Remove the mounting plate by removing the four Phillips screws.

Figure 17: 24 VDC Power Supply Location

Installing the Power Supply

1. Attach the power supply to the mounting plate with the four Phillips screws.
2. Reattach the DC wires to the terminal posts.
3. Reattach the AC connector to the power supply.
4. Replace the two power supply bracket mounting screws.
5. Reattach the fan with airflow in the proper direction.
6. Reconnect fan connector.

120 VDC Power Supply

Required Tools

- Allen wrench set
- Phillips screwdriver
- Grounding wrist strap

CAUTION: A grounding strap must be worn to perform this replacement.

Removing the 120 VDC Power Supply

1. Locate the 120 VDC power supply (Figure 18).
2. Remove the fan connector.

3. Using an Allen wrench, remove the screws holding the fan in place. Note the airflow direction by the embossed flow direction arrows on side of fan. Fan must be replaced with the correct direction of airflow.
4. Remove the connector from the power supply.
5. Using a Phillips screwdriver, remove the three screws from the power supply to remove it.

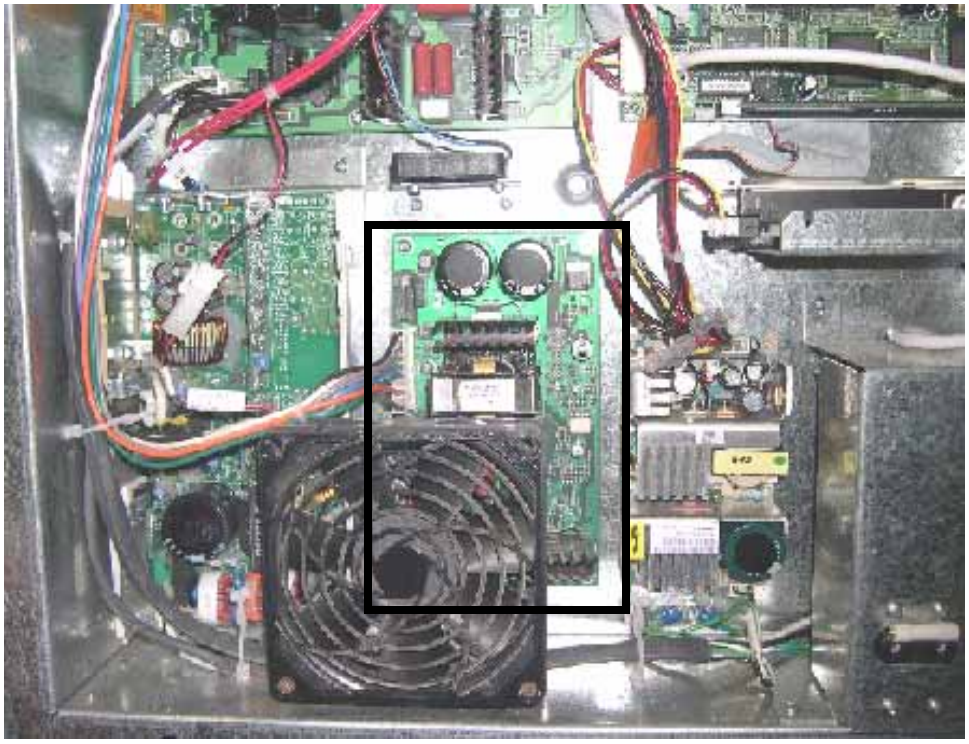


Figure 18: 120 VDC Power Supply Location

Installing the 120 VDC Power Supply

1. Attach the power supply with the three screws.
2. Reattach the connector.
3. Reattach the fan with airflow in the proper direction.
4. Reconnect fan connector.

5/12 VDC Power Supply

Required Tools

- Allen wrench set
- Phillips screwdriver
- Grounding wrist strap

CAUTION: A grounding strap must be worn to perform this replacement.

Removing the 5/12 VDC Power Supply

1. Locate the 5/12 VDC power supply (Figure 19).

Figure 19: 5/12 VDC Power Supply Location

2. Remove the fan connector.
3. Using an Allen wrench, remove the screws holding the fan in place. Note the airflow direction by the embossed flow direction arrows on side of fan. Fan must be replaced with the correct direction of airflow.
4. Remove the three connectors from the power supply.
5. Remove the two screws from the power supply to remove the board.

Installing the 5/12 VDC Power Supply

1. Attach the power supply with the two screws.
2. Reattach the three connectors.
3. Reattach the fan with airflow in the proper direction.
4. Reconnect fan connector.

Line Filter Board

Required Tools

- Allen wrench set
- Phillips screwdriver
- Grounding wrist strap

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

Removing the Line Filter Board

1. Locate the input box (Figure 20).

Figure 20: Input Box location

2. Remove the three input box mounting screws using a Phillips screwdriver.
3. Carefully pull out the input box approximately 8 inches.

Note: Several cables will remain attached to the box.

4. Pull up on the four connectors to disconnect them from the board while noting their location for reconnection (Figure 21).

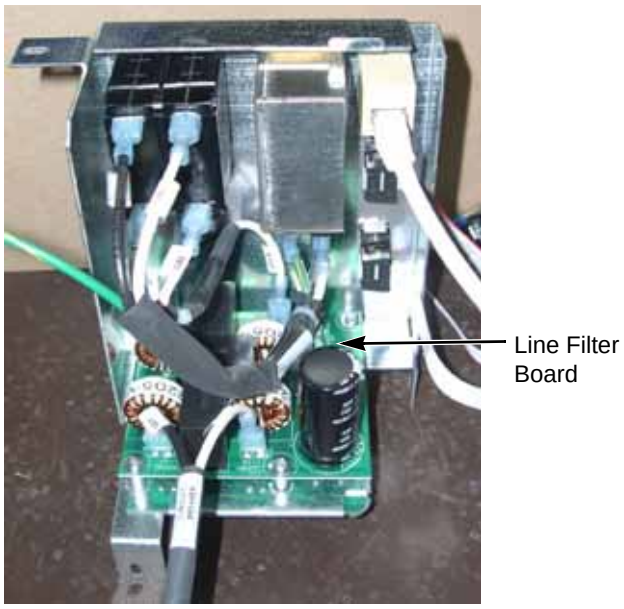


Figure 21: Line filter detail

5. Remove the four line filter board mounting screws using a Phillips screwdriver. You may need to remove the breaker switch and RJ-45 coupler to access the mounting screws.

Installing the Line Filter Board

1. Position the board in place and secure with the four mounting screws.
2. Attach the four connectors to the board.
3. Reinstall the input box with the three mounting screws.

Head Components

Toggle Plate Assembly

Required Tools

- Allen wrench set
- Phillips screwdriver
- Slotted screwdriver
- Wire ties
- Alignment Fixture
- Alignment Rod Set (Figure 22)

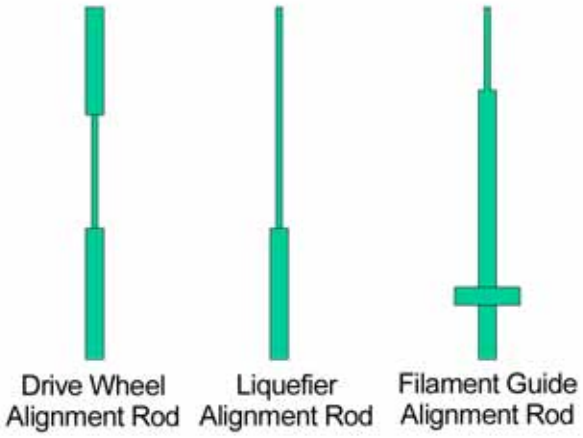


Figure 22: Toggle Alignment Rods

Removing the Toggle Plate Assembly

1. Remove the Right Side Panel (See “Removing the Side Panels” on page 4 - 5)
2. Position the head in the center of the build envelope.
3. Remove plastic Head Cover by squeezing raised pads on sides of cover (Figure 23).

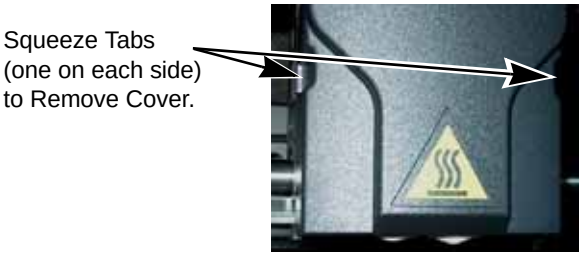


Figure 23: Removing the Head Cover

4. Remove the Air Plenum (Figure 24). Press in on clips to release from Translator. Work Plenum free of air duct at top (not shown).

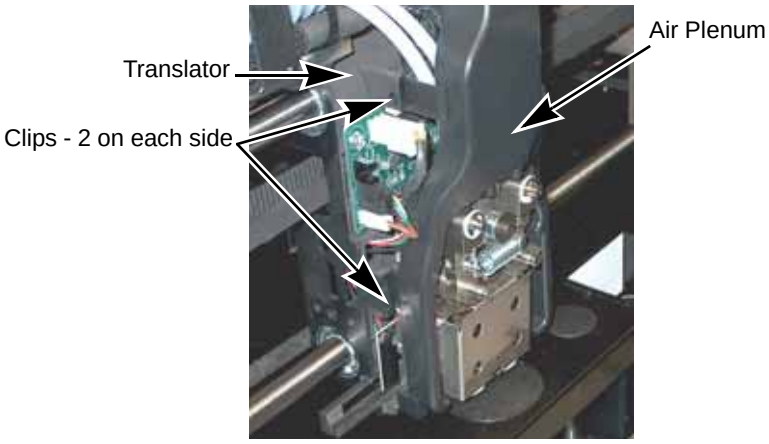


Figure 24: Removing the Air Plenum

5. Remove Liquefier Tips (Refer to Figure 25).
   a. Use 7/64 T-Handle Allen wrench to loosen the tip (heater block clamp) screws three to four full turns counterclockwise - or until the top of the screws are flush with the metal cover.
   b. Use needle nose pliers to grasp the stainless steel shield of the tip.
   c. Pull the tip shield toward you, then pull down to remove the tip. Discard the used tip.
   d. Repeat for second tip.
6. Remove the Heat Shield (17, Figure 28) - loosen and remove the 2 Heat Shield retaining screws (19, Figure 28, 7/64 allen) (also refer to Figure 25.

Note: There is a teflon washer (20, Figure 28) on each screw - between the back of the Heat Shield tabs and the Translator. If the screw is not completely removed from the Heat Shield and the washer is not damaged, the washer will act as a retainer, holding the screw to the Heat Shield.

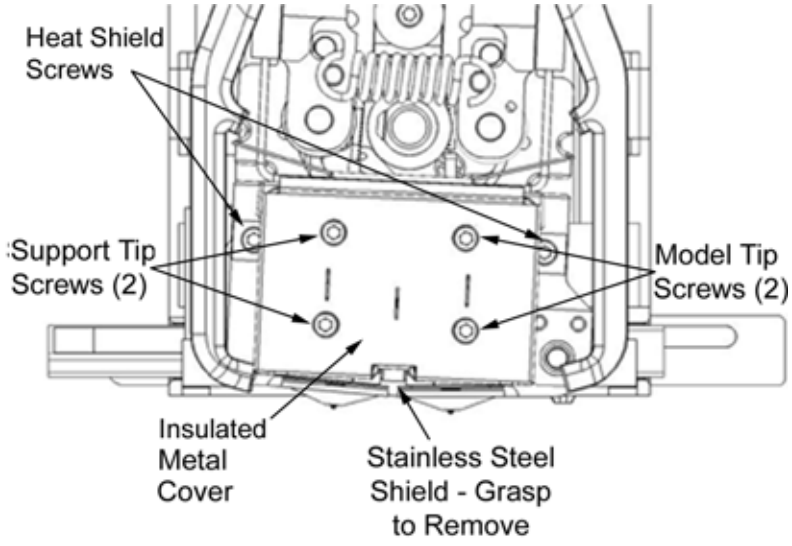


Figure 25: Removing the Liquefier Tips

7. Inspect the Teflon Shield (18, Figure 28) for:
   - Damage - Replace if the area around a cover hole is not intact or if the shield is torn.
   - Material trapped between shield and cover - Replace the shield if there is evidence of trapped material.
   - Security of attachment to metal cover - Replace the shield if it does not appear to be attached firmly to the cover. The shield is held in place by an adhesive strip.
8. Replace the Teflon Shield if necessary (Figure 26).
   a. Remove the old Teflon shield from the heat shield - remove excess adhesive and support/ modeling material.
   b. Remove any excess support/model material around the Heater assemblies and Toggle Plate Assembly.
   c. Remove the protective strip from the adhesive band on the new teflon shield.
   d. Position the new Teflon shield on the inside of the cover. Center the intersecting cut lines of the teflon shield in the center of the heat shield holes.
   e. Press the new shield in place. Check for good adhesion of teflon shield to heat shield

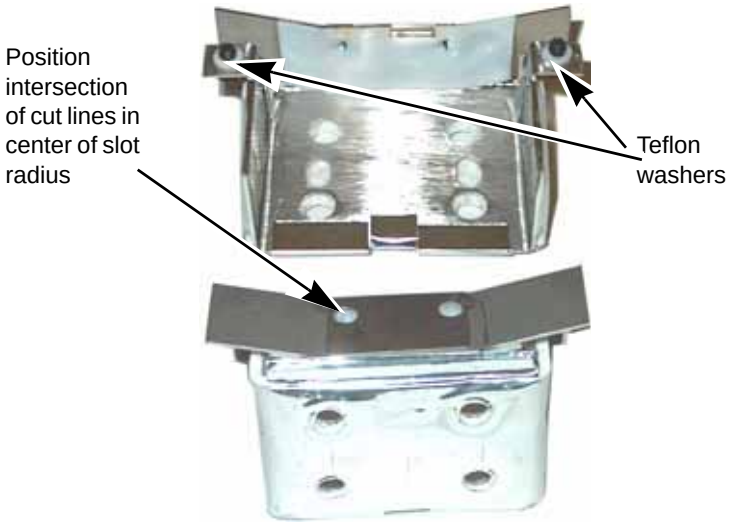


Figure 26: Replacing the Teflon Shield

9. Disconnect the 2 Head Heater electrical leads and the 2 Thermo-Couple electrical leads from the Head Board (Figure 27).

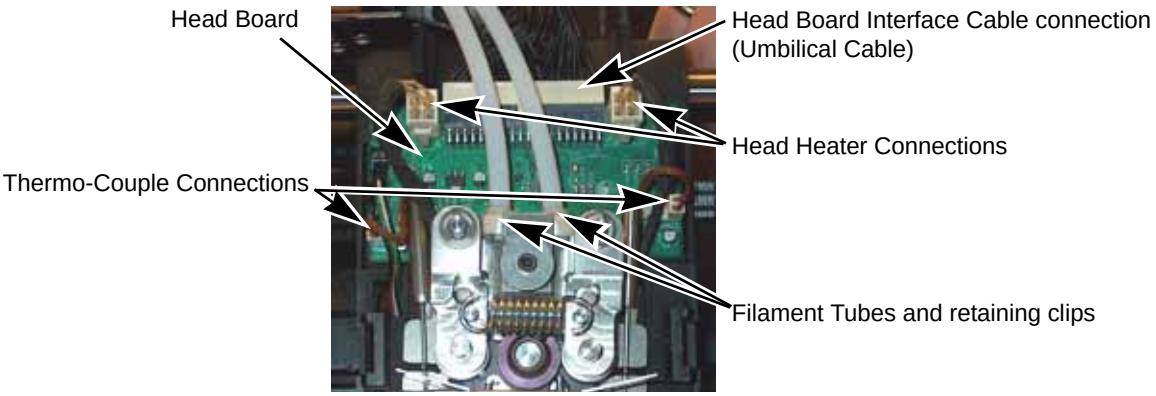


Figure 27: Head Heater and Thermo-Couple Connections

10. Disconnect the Filament Tubes from the top of the Toggle Plate Assembly. Press down on the tube retaining clips to free the tubes (Figure 27).

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

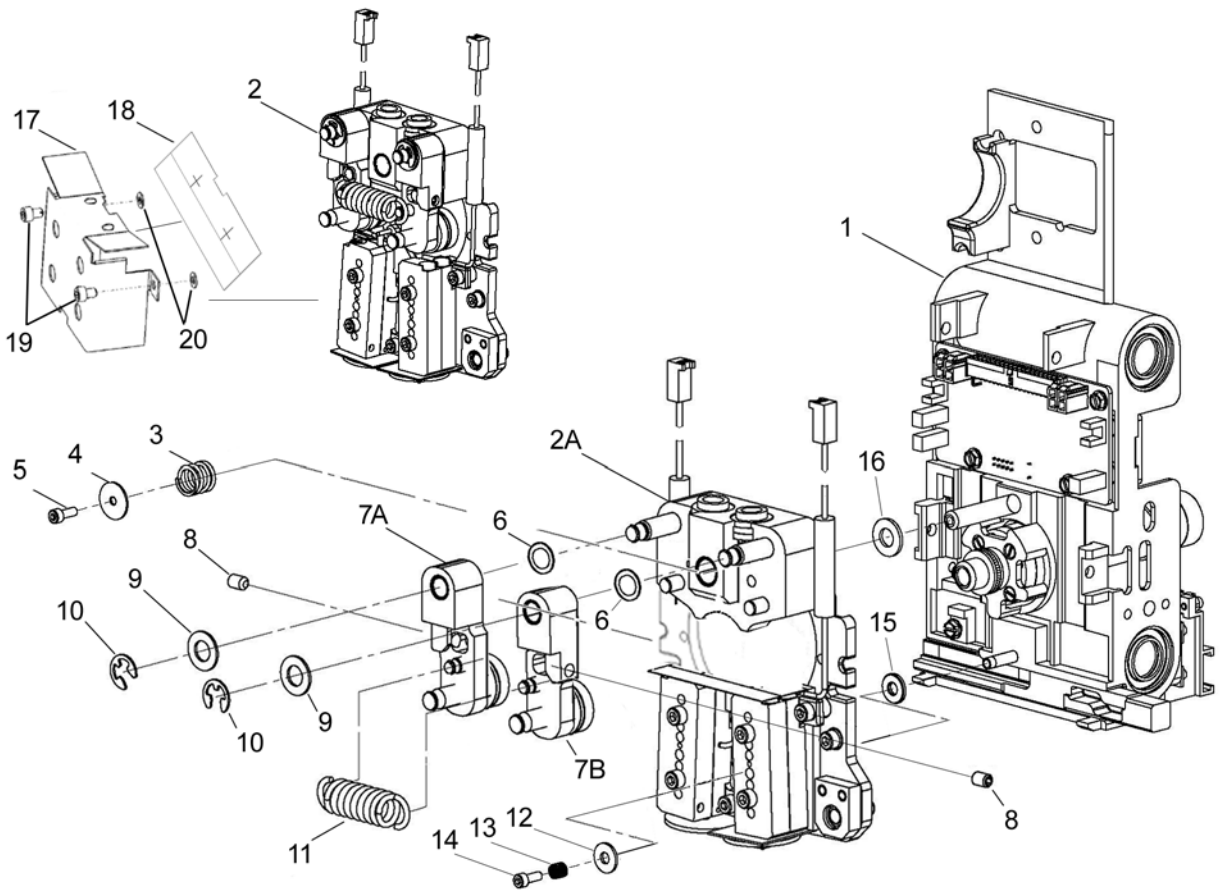
11. Loosen and remove the Lower Toggle Pin screw (14, Figure 28) (7/64 allen), spring (13, Figure 28), and thrust washer (12, Figure 28).

Note: The Lower Toggle Pin thrust washer has a specific orientation for assembly. The copper-colored side is oriented AWAY from the Toggle Plate Assembly when installed.

12. Loosen and remove the Upper Toggle Pin screw (5, Figure 28) (7/64 allen), washer (4, Figure 28), and spring (3, Figure 28).
13. Pull the Toggle Plate Assembly (2, Figure 28) forward to slide it off of the Translator (1, Figure 28). On SST systems, due to the presence of the Support Filament Guide, slightly rotating the Toggle Plate Assembly clockwise while sliding it forward will facilitate removal.

Note: There are two washers behind the Toggle Plate Assembly - between the assembly and the Translator. One (16, Figure 28) is on the Upper Toggle Pin and the other (15, Figure 28) is on the Lower Toggle Pin. The washer on the Lower Toggle PIn is a thrust washer and has a specific orientation for assembly. The copper-colored side is toward the Translator - away from the Toggle Plate Assembly when installed.

The washer on the Upper Toggle Pin does NOT have a specific orientation for assembly.



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

Figure 28: Toggle Plate Assembly

Installing the Toggle Plate Assembly

CAUTION: Before installing the Toggle Plate, make sure that the mounting screws for the Head Motor are tight.

Note: When installing the Toggle Plate Assembly, follow the "Toggle Plate Assembly Installation Checklist" on page 9 - 17.

1. If it was removed, install the rear washer (16, Figure 28) on the Upper Toggle Pin (a specific orientation of this washer is not required - either side can face out).

CAUTION: The Lower Toggle Pin thrust washers (12 & 15, Figure 28) has a specific orientation for assembly. The copper-colored side is oriented AWAY from the Toggle Plate Assembly when installed.

2. If it was removed, install the rear thrust washer (15, Figure 28) on the Lower Toggle Pin - copper side against the translator.
3. Slide the Toggle Plate Assembly (2, Figure 28) onto the Upper and Lower Toggle Pins of the Translator (1, Figure 28). On SST systems, due to the presence of the Support Filament Guide, slightly rotating the Toggle Plate Assembly clockwise while sliding it onto the Pins will facilitate installation.
   a. Prior to assembly make sure the pin on the back of the Toggle Plate Assembly rotates freely.
   b. Make sure the pin on the back engages the slot in the Toggle Bar.
   c. When installing the Toggle Plate Assembly, if the Head Motor Drive Wheel is loose, it may interfere with the installation if it is allowed to be pushed too far back.
4. Install the Upper Toggle Pin spring (3, Figure 28) and washer (4, Figure 28) (a specific orientation of this washer is not required - either side can face out).
5. Apply anti-seize to the Upper Toggle Pin retaining screw (5, Figure 28). Install and tighten the screw.

CAUTION: The Lower Toggle Pin thrust washers (12 & 15, Figure 28) has a specific orientation for assembly. The copper-colored side is oriented away from the Toggle Plate Assembly when installed.

6. Install the front Lower Toggle Pin thrust washer (12, Figure 28) - copper side out, away from the Toggle Plate Assembly.
7. Apply anti-seize to the Lower Toggle Pin retaining screw (14, Figure 28). Install the Toggle Pin spring (13, Figure 28). Install and tighten the screw.
8. Connect the 2 Head Heater electrical leads and the 2 Thermo-Couple electrical leads to the Head Board (Figure 27).
9. Perform the Head Alignment Procedure (See "Head Alignment Procedure" on page 4 - 32).

Head Alignment Procedure

Note: This procedure must be accomplished in its entirety and in the order presented. The procedure consists of 3 sub-procedures (4 for the SST) - Drive Wheel Alignment, Idler Wheel Adjustment, and Liquifier Alignment (plus Support Filament Guide Alignment for the SST).

Drive Wheel Alignment

This procedure axially aligns the Head Motor Drive Wheel with the filament path.

WARNING: Use eye protection when removing or installing the Pivot Block Spring.

1. Remove the Pivot Block Spring (11, Figure 28) - use tool PN 204242-0001 (Figure 29).

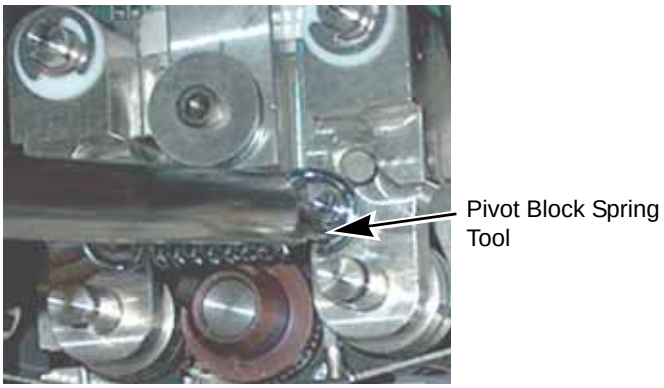


Figure 29: Removing the Pivot Block Spring

2. Remove the right side Pivot Block (7B, Figure 28).
   - Remove the retaining clip (10, Figure 28) and teflon washer (9, Figure 28) 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 (Figure 30).
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 (Figure 30).
9. Tighten the Heater Block Clamp screws.
10. Tighten the Heater Block Mount screws.

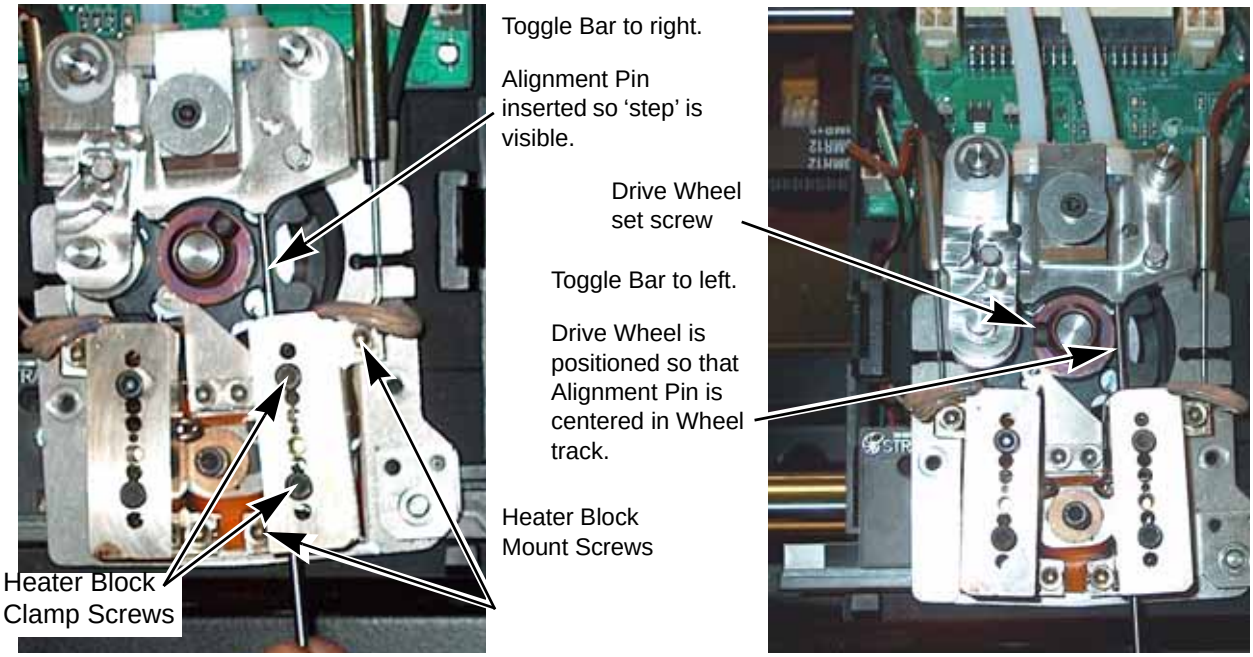


Figure 30: Drive Wheel Alignment

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 (Figure 30).
13. Tighten the Drive Wheel set screw.
14. Verify proper Drive Wheel alignment: (Figure 31, Figure 32 & Figure 33)
    a. Gently move the Toggle Bar to the right, then back to the left while observing the Drive Wheel and Alignment Pin.
       - View the alignment of the Drive Wheel and Alignment Pin from the right side of the system.

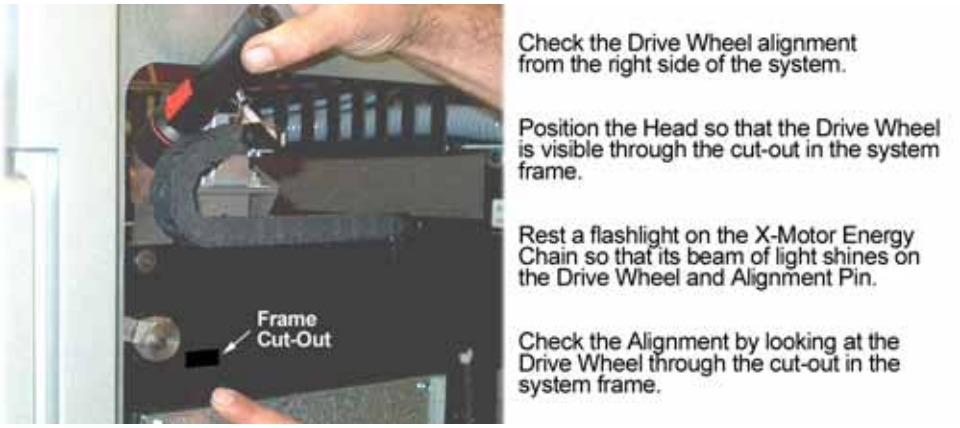


Figure 31: Viewing the Drive Wheel Alignment

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 .0025".
d. If the Alignment Pin is misaligned, repeat steps 11 through 14.

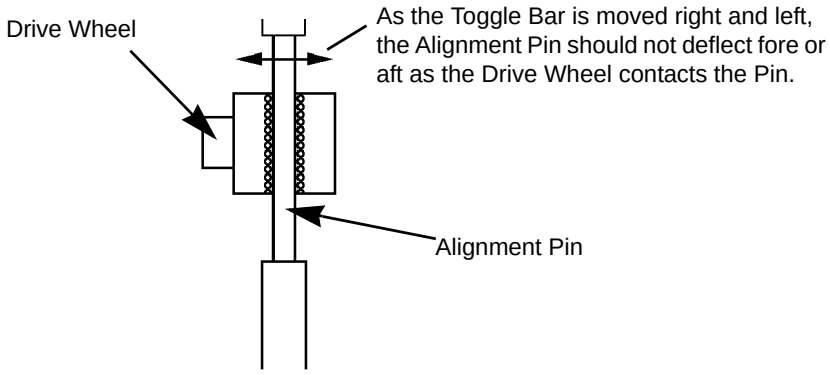


Figure 32: Wheel Alignment Check (1 of 2)

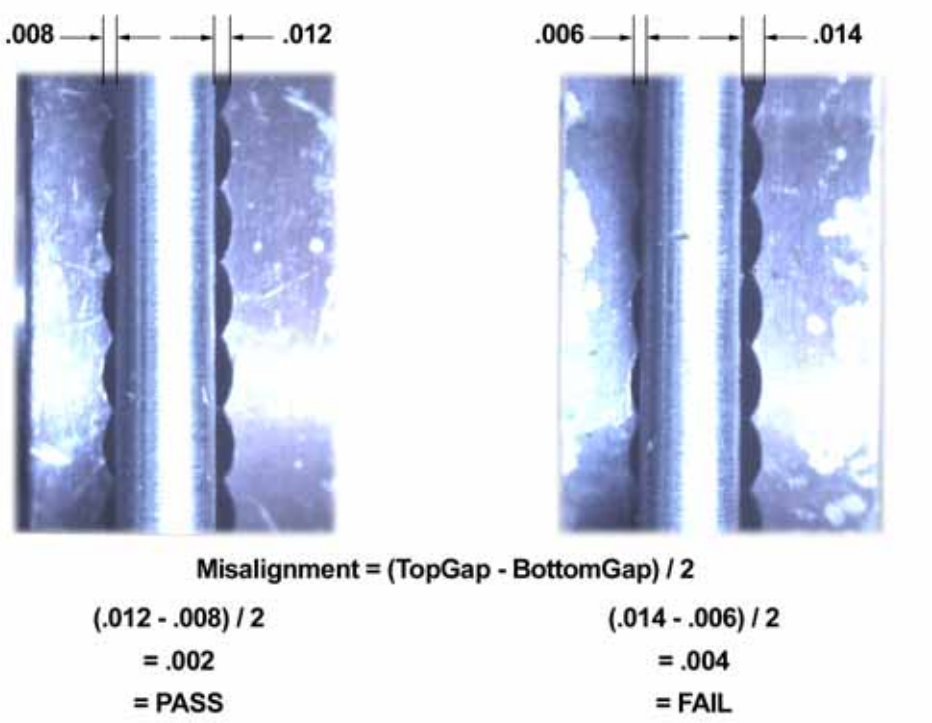


Figure 33: Wheel Alignment Check (2 of 2)

15. Move the Toggle Bar to the right.
16. Loosen the Heater Block Clamp screws and the Heater Block Mount screws (Figure 30).
17. Remove the Alignment Rod.

18. Install the right side Pivot Block (7B, Figure 28).
    a. Make sure the Shim (6, Figure 28) is installed (it normally remains on the pin when the Pivot Block is removed).
    b. Install the teflon washer (9, Figure 28) and retaining clip (10, Figure 28).

Idler Wheel Check/Adjustment

This procedure adjusts the amount of tension that the Idler Wheels apply to the filament. Drive Wheel Alignment must be performed before this procedure.

WARNING: Use eye protection when removing or installing the Pivot Block Spring.

CAUTION: Use care when installing the Pivot Block Spring so as to prevent spring distortion. A distorted or stretched Spring can cause system operation errors. Orienting the Spring on the Toggle Plate per Figure 34 ***will reduce the risk of distortion during installation.***

1. Install the Pivot Block Spring (11, Figure 28) - use tool PN 204242-0001 (Figure 29).
2. Rotate the Drive Wheel so that the set screw head is on the bottom of the Wheel (Figure 34).
3. Check/Adjust the Right (Model) side Idler Wheel clearance: (Figure 34)
    a. Place the Toggle Bar in the full Left position.
    b. Check 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 (half way between full Left and full Right).
    d. Insert a .005 inch feeler gauge between the Drive Wheel and the Idler Wheel.
    e. Return the Toggle Bar to the full Left position - the .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 .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.

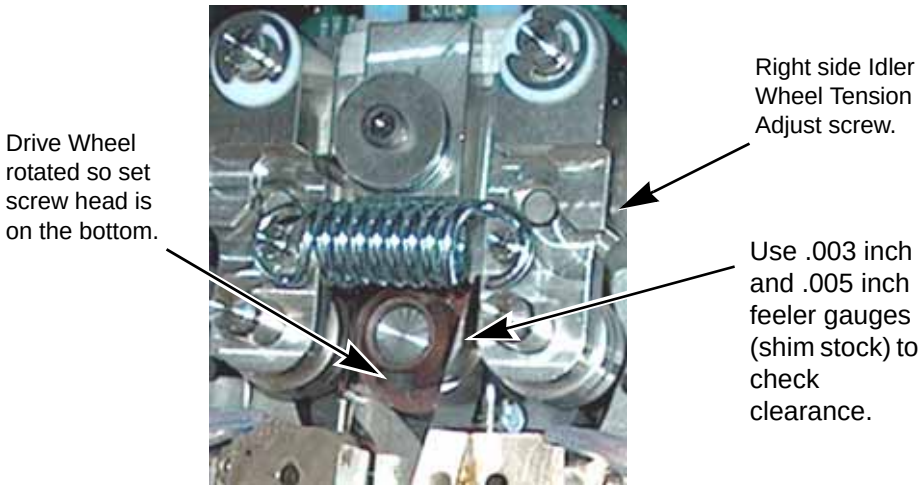


Figure 34: Idler Wheel Adjustment - Right Side

4. Check/Adjust the Left (Support) side Idler Wheel clearance: (Figure 35)
   a. For BST:
      (1) Use the same procedure as for Right (Model) side (Step 3) - except Toggle Bar direction is reversed. Toggle Bar is moved to full Right position to check clearance.
   b. For SST:
      (1) Move the Toggle Bar to the full Right position.
      (2) Check/Adjust the clearance between the Drive Wheel and the Idler Wheel - a .012 inch feeler gauge (shim stock) should have a light drag when placed between the Drive Wheel and the Idler Wheel.
      (3) Place the Toggle Bar in the Neutral position.
      (4) Insert a .015 inch feeler gauge between the Drive Wheel and the Idler Wheel.
      (5) Return the Toggle Bar to the full Right position - the .015 inch feeler gauge should be firmly held between the Drive Wheel and the Idler Wheel.
      (6) Place the Toggle Bar in the Neutral position.
      (7) Insert a .010 inch feeler gauge between the Drive Wheel and the Idler Wheel.
      (8) Return the Toggle Bar to the full Right position - the .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.
      (9) 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.
      (10) Adjust the screw to obtain a light drag on .012 inch feeler gauge when it is positioned between the Drive Wheel and the Idler Wheel.
      (11) Check the tension with the .015 inch and .010 feeler gauges as above.
      (12) Continue to adjust the screw until the prescribed tension is obtained.
      (13) When adjustment is complete, place the Toggle Bar in the Neutral position, and remove all feeler gauges.
      (14) 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.

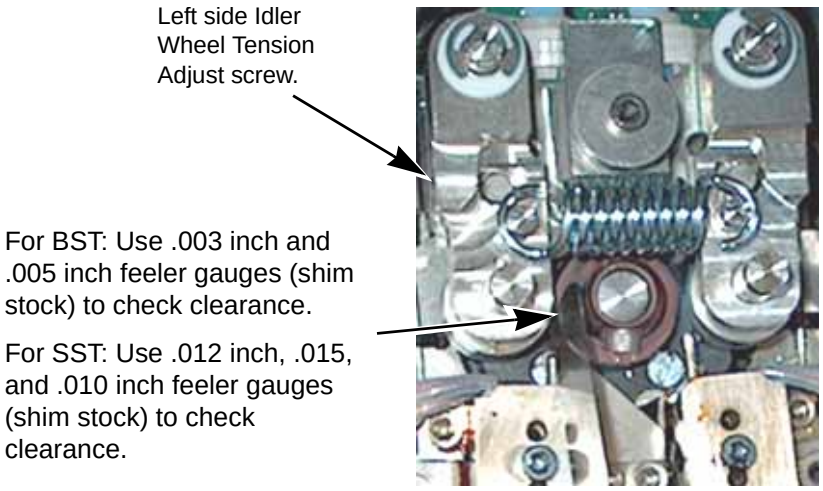


Figure 35: Idler Wheel Adjustment - Left Side

Liquifier 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 (Figure 30).
   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 Liquifier Alignment Rod and cause a misalignment of the Liquifier 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. Following the procedure in steps 1.i, j, & k helps to keep the Block from moving.

   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 Liquifier Alignment Rod.
2. Left (Support) side:
   a. Repeat steps 1.a. through 1.m. above - except reverse the Toggle Bar positions.
3. Perform “Verify Liquefier Alignment” on page 4 - 38.

Support Filament Guide Alignment (SST Only)

This procedure aligns the Support Filament Guide.

1. Move the Toggle Bar to the full Right position.
2. Make sure the Heater Block Clamp screws are loose (Figure 30).
3. Loosen the Filament Guide Block mounting screws and insert the Filament Guide Alignment Rod from the bottom of the Left side heater block - position the rod as indicated in Figure 36.

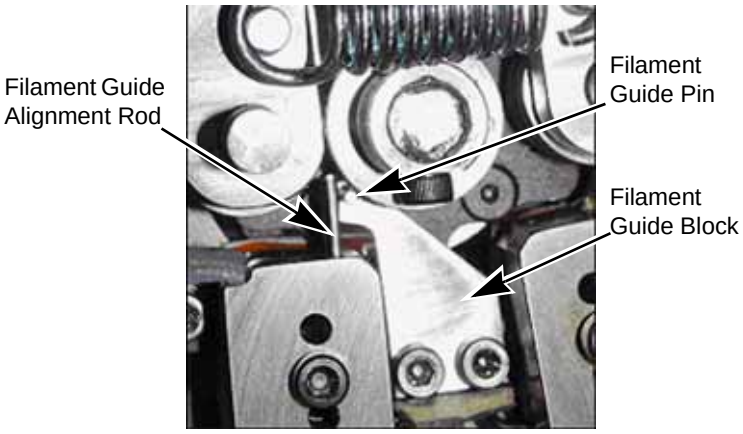


Figure 36: Support Filament Guide Alignment - SST Only

4. Tighten the Heater Block Clamp screws.
5. Position the Filament Guide Pin against the Alignment Rod while applying pressure, in the direction of the Support Heater Block, against the screw end of the Filament Guide Block.
6. Tighten the Filament Guide Block screws (left screw first).

Note: Apply pressure down and to the left against the Filament Guide Block to make sure that it remains in contact with the Alignment Rod while tightening the screws. The Guide Block Pin can be easily damaged (bent) if pressure is applied against it.

7. Verify that the Guide Pin is touching the Alignment Rod and that the Guide Pin is not touching the Drive Wheel.
8. Loosen the Heater Block Clamp screws and remove the Filament Guide Alignment Rod.

Verify Liquefier Alignment

This procedure makes sure that the Liquefier Tubes are properly aligned with the filament path. This procedure must be performed after “Liquifier Alignment” on page 4 - 37 and “Support Filament Guide Alignment (SST Only)” on page 4 - 38 are performed.

1. Install the Heat Shield (Figure 25) - install and tighten the 2 retaining screws (19, Figure 28; 7/64 allen) - make sure the teflon washers (20, Figure 28) are installed between the Heat Shield tabs and the Translator.
2. Install the new Liquefier Tips (Figure 37 & Figure 38)
   a. For a Dimension BST, the SUPPORT tip and MODEL tip are interchangeable. Both sides use the MODEL tip. (The tips come in a Red capped container).
   b. For a Dimension SST, you must identify the correct replacement tip. The SST uses two tip types. You must make sure a SUPPORT tip is used on the LEFT side of the head assembly. A MODEL tip must be used on the RIGHT side of the head assembly. The Model tip comes in a Red capped container. The Support tip comes in a Black capped container.

CAUTION: For a Dimension SST: Model and SOLUBLE support tips are different. The correct tip must be installed in the correct side.

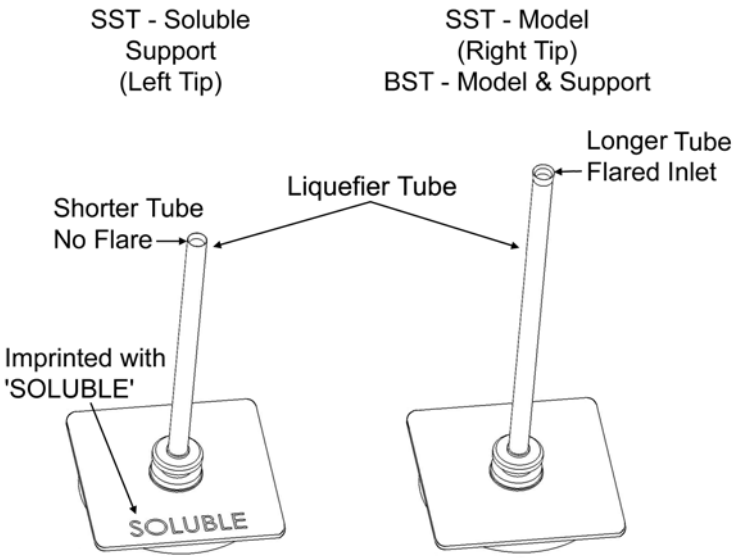


Figure 37: Identifying Tips

c. Insert the new tip into the heater block.
d. Use needle nose pliers to grasp the stainless steel shield of the tip.
e. Pull the tip shield toward you, then lift up to install the tip.
f. Push the tip toward the back of the printer once it is all the way up against the heater block.
g. 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.

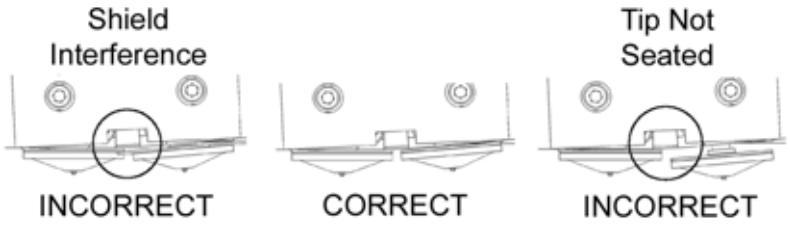


Figure 38: Tip Stainless Steel Shield Alignment

h. Use 7/64 T-Handle Allen wrench to firmly tighten the heater block clamp screws.
i. Repeat steps c. through h. for second tip.

3. Verify Right (Model) side alignment: (Figure 39 & Figure 40)
   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 (SST Only) interferes with the Alignment Rod, recheck “Liquifier Alignment” on page 4 - 37 and “Support Filament Guide Alignment (SST Only)” on page 4 - 38.
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 3.a. through 3.f. above - except reverse the Toggle Bar positions.

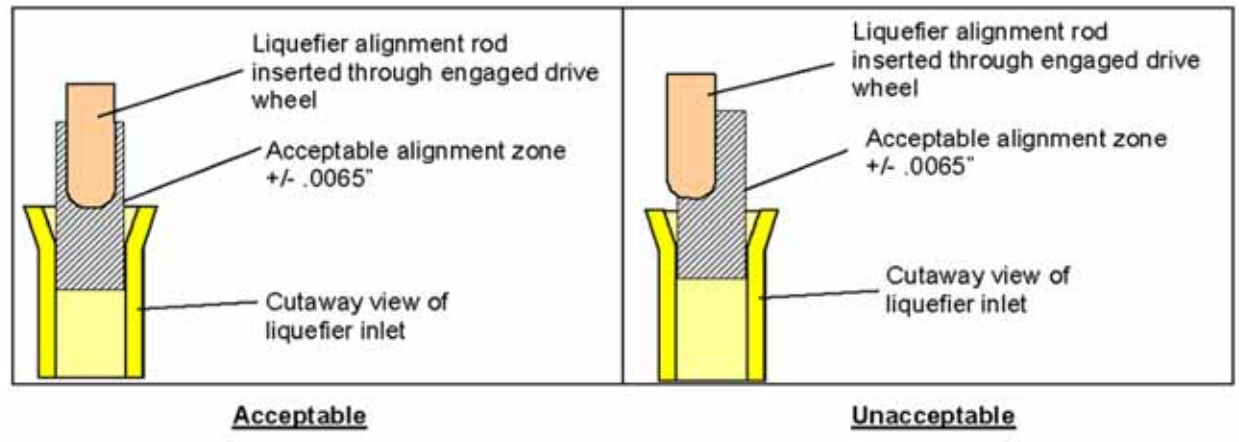


Figure 39: Liquefier Alignment Check (1 of 2)

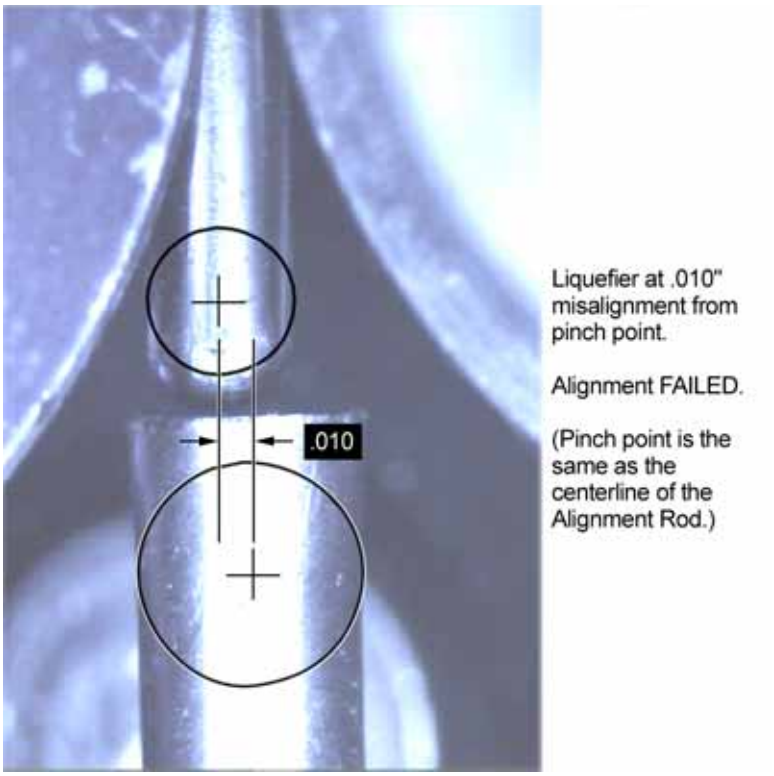


Figure 40: Liquefier Alignment Check (2 of 2)

Complete the Re-Assembly of the Toggle Plate Assembly

1. Adjust the Brush height (Refer to See “Adjust the Brush height.” on page 7 - 3).
2. Connect the Filament Tubes to the top of the Toggle Plate Assembly - make sure the model tube is on the right; the support tube on the left (Figure 27).
3. Install the Air Plenum - connect the Plenum to the air duct at top - press in on clips to fit the plenum to the Translator (Figure 24).
4. Install the Head Cover - squeeze the side tabs to fit the Translator (Figure 23).
5. Perform the Z Calibration and XY Tip Offset procedure (See “Adjusting Z Calibration and XY Tip Offset” on page 5 - 2).

Note: Follow the Head Installation Checklist after completing Toggle Plate Assembly replacement.

Head Toggle Bar

Removing the Head Toggle Bar

(Refer to Figure 41)

CAUTION: Do not lubricate the Head Toggle Bar. Clean only with a dry cloth. Be careful not to damage the reflective tape.

1. Remove the Toggle Plate Assembly (See "Removing the Toggle Plate Assembly" on page 4 - 26).
2. Remove the Head Toggle Bar by sliding it to the right.

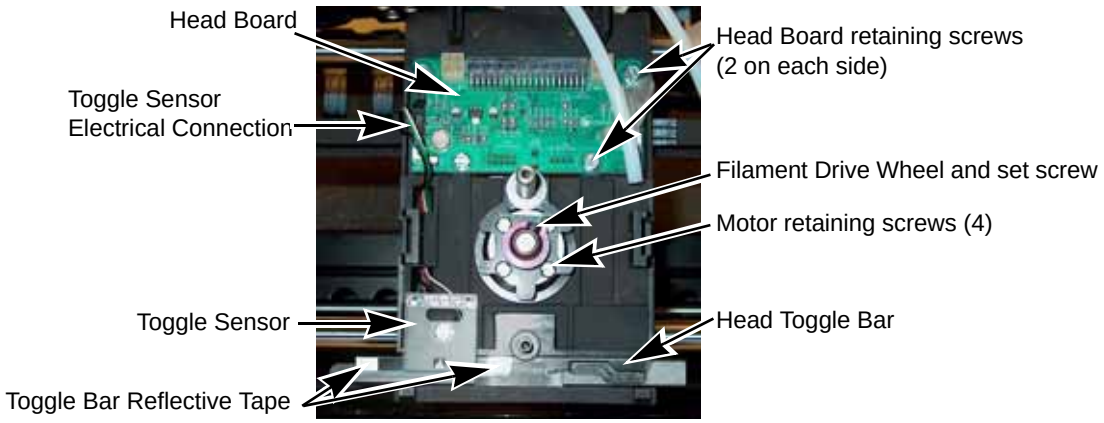


Figure 41: Location of Components Behind Toggle Plate Assembly

Installing the Head Toggle Bar

CAUTION: Do not lubricate the Head Toggle Bar. Clean only with a dry cloth. Be careful not to damage the reflective tape.

1. Slide the Head Toggle Bar behind the Toggle Bar Sensor from the right side.
2. Install the Toggle Plate Assembly (See "Installing the Toggle Plate Assembly" on page 4 - 31).

Note: It is not necessary to perform the Drive Wheel Alignment or the Idler Wheel Adjustment procedures when only the Toggle Bar has been replaced. However, the Liquifier Alignment and (for SST) the Support Filament Guide Alignment must be performed.

Note: If removed, install the Toggle Sensor, Head Board, and Head Motor before installing the Toggle Plate Assembly.

3. Perform the Z Calibration and XY Tip Offset procedure (See "Adjusting Z Calibration and XY Tip Offset" on page 5 - 2)

Head Toggle Sensor

Required Tools

- 1/4” nut driver or slotted screwdriver

Removing the Toggle Sensor

(Refer to Figure 41)

1. Remove the Toggle Plate Assembly (See “Removing the Toggle Plate Assembly” on page 4 - 26).
2. Remove the Head Toggle Bar (See “Removing the Head Toggle Bar” on page 4 - 42).

Note: It is recommended that the Head Toggle Bar be removed before removing the Toggle Sensor. The Sensor board helps hold the Head Toggle Bar in position. Without the board, the bar can easily fall from its position and be damaged.

3. Disconnect the Toggle Bar Sensor electrical connector from the Head Board.
4. Loosen and remove the Toggle Bar Sensor retaining screw (1/4” nut driver) and Toggle Sensor.

Installing the Toggle Sensor

(Refer to Figure 41)

1. Route the wires of the Toggle Bar Sensor in the Translator housing and position the Toggle Sensor.
2. Install and tighten the Toggle Bar Sensor retaining screw.
3. Connect the Toggle Bar Sensor electrical lead to the Head Board.
4. Install the Toggle Bar.
5. Install the Toggle Plate Assembly (See “Installing the Toggle Plate Assembly” on page 4 - 31).

Note: If removed, install the Head Board and Head Motor before installing the Toggle Plate Assembly.

Head Board

Required Tools

- 1/4” nut driver or slotted screwdriver

Removing the Head Board

1. Remove the Toggle Plate Assembly (See “Removing the Toggle Plate Assembly” on page 4 - 26).
2. Disconnect the Toggle Sensor electrical lead from the Head Board (Figure 41).
3. Disconnect the Head Board Interface Cable (Umbilical Cable) lead from the Head Board (Figure 27).
4. Disconnect the three electrical connectors (2 from motor, one from Z Level Assembly) on rear of the Head Board (Figure 42).
5. Loosen and remove the 4 Head Board retaining screws (1/4” nut driver) (Figure 41).
6. Remove the Head Board.

Installing the Head Board

1. Position the Head Board on the front side of the Translator (Figure 41).

2. Install and tighten the 4 Head Board retaining screws (Figure 41).
3. Connect the three electrical connectors to the rear of the Head Board (2 from motor, one from Z Level Assembly) (Figure 42).
4. Install and tighten the 2 Head Motor tie wraps - cut off the excess.
5. Connect the Head Board Interface Cable lead to the Head Board (Figure 27).
6. Connect the Toggle Sensor electrical lead to the Head Board (Figure 41).
7. Install the Toggle Plate Assembly (See “Installing the Toggle Plate Assembly” on page 4 - 31).

Note: If removed, install the Head Toggle Bar, Toggle Sensor, and Head Motor before installing the Toggle Plate Assembly.

Head Motor

Required Tools

- 7/64 allen
- Slotted screwdriver

Removing the Head Motor

1. Remove the Toggle Plate Assembly (See “Removing the Toggle Plate Assembly” on page 4 - 26).
2. Cut and remove the forward tie-wrap that secures the Motor harness to the Motor housing (Figure 42).
3. Disconnect Motor electrical connections from rear of Head Board (Figure 42).
4. Loosen and remove the Filament Drive Wheel set screw (7/64 allen) and the Filament Drive Wheel (Figure 41).
5. Loosen and remove the 4 motor retaining screws while carefully removing the Motor from the Translator. (Figure 41).

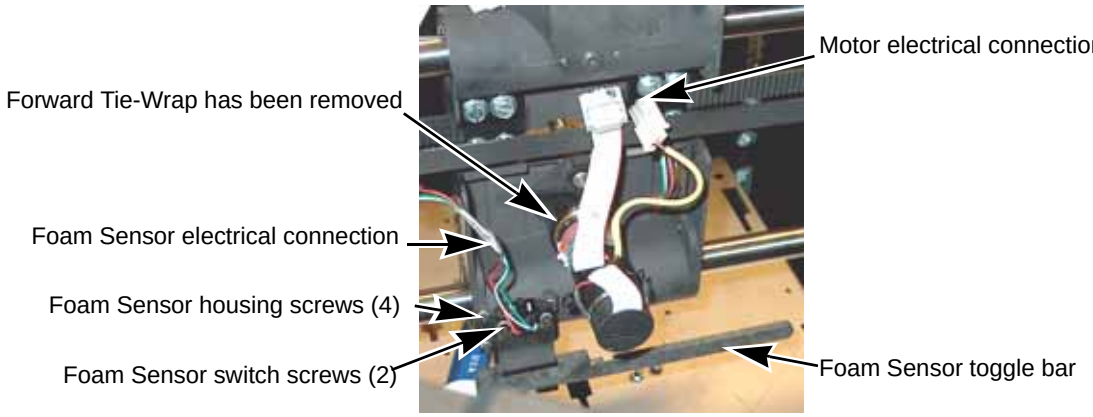


Figure 42: Rear View of Translator (Head Board Removed)

Installing the Head Motor

1. Position the Head Motor onto the rear of the Translator. Orient the Head Motor so the electrical leads are on the top side (Figure 42).

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

2. Apply LocTite 222 to the 4 Head Motor retaining screws. Install and tighten the screws (Figure 41).
3. Install the Filament Drive Wheel and Filament Drive Wheel set screw - do not tighten the set screw at this time.
4. Connect the Head Motor electrical leads to the Head Board (Figure 42).
5. Install and tighten the 2 Head Motor tie wraps - cut off the excess.
6. Install the Toggle Plate Assembly (See “Installing the Toggle Plate Assembly” on page 4 - 31).

Note: The Toggle Plate Assembly installation procedure requires the accomplishment of a Head Alignment. The Filament Drive Wheel is aligned as a part of this procedure.

Note: If removed, install the Head Toggle Bar, Toggle Sensor, and Head Board before installing the Toggle Plate Assembly.

Z Level Assembly (Foam Sensor)

Required Tools

- Allen wrench set
- Wire ties
- Soft rag
- Small brush

Removing the Z Level Assembly

(Refer to Figure 42)

1. Cut tie wrap that holds Foam Sensor lead to Head Motor.
2. Disconnect Foam Sensor from Head Board.
3. Loosen and remove the 4 Foam Sensor housing screws (3/32 Allen) and lock washers while carefully removing the Foam Sensor housing - the Foam Sensor toggle bar will remain attached to the Foam Sensor assembly.

Disassembling the Z Level Assembly

Note: The Z Level toggle bar can be removed without removing or disassembling the Z Level Assembly. Align the toggle bar slot with the sensor pin, press up on the actuator to make pin clear the toggle bar slot, then remove the bar (Figure 43).

1. Loosen and remove the 2 Z Level Assembly switch screws (3/32 Allen) and lock washers while carefully removing the switch (Figure 42).
2. Position the Z Level Assembly toggle bar so that the sensor pin groove opening is aligned with the sensor pin (Figure 43).
3. Press up on the actuator to make the pin clear the toggle bar slot.
4. Remove the toggle bar.
5. Remove the actuator and spring.

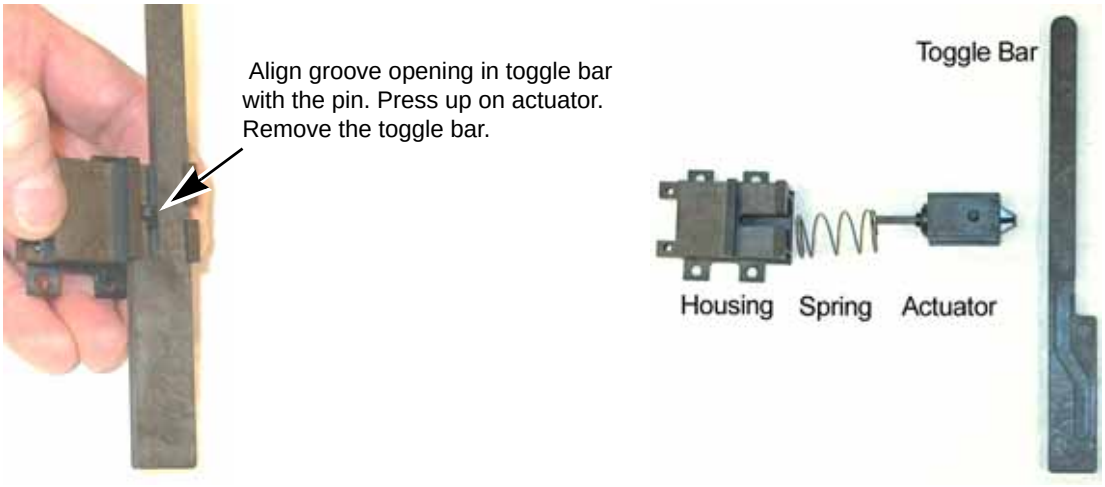


Figure 43: Z Level Assembly Disassembly

Cleaning the Z Level Sensor Assembly

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

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

1. With the plunger, spring and arm removed, use a soft rag and small brush to clean the plunger and arm. Ensure to thoroughly clean the recessed track (groove) in the arm.
2. Using a soft rag and brush, clean the Z Level Assembly and the foam sensor housing.

Note: Be careful not to damage the sensor, connectors or wires during this step.

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

Figure 44: Foam Sensor Assembly - Retracted

Assembling the Z Level Assembly

1. Install the sensor spring and actuator (Figure 43).
2. Install the toggle bar - press up on sensor actuator and align slot opening in actuator with sensor pin - release actuator.
3. Install the Z Level Assembly switch - retain with lock washers and screws (Figure 42).

Installing the Z Level Assembly

(Refer to Figure 42)

1. Install the Z Level Assembly - retain with 4 lock washers and screws (Figure 42).
2. Connect sensor lead to Head Board.
3. Hold sensor lead to Head Motor with tie wrap.

Test of Z Level Assembly

Note: Failure to perform this step will result in homing/foam detection errors.

1. Power up the printer.
2. Start a build and note if the homing and foam sensing operations complete successfully.
3. Run Z Calibration (See “Z Calibration” on page 5 - 2)

Umbilical Cable

Required Tools

- Standard Allen wrench set
- Standard screwdriver
- Wire ties
- Grounding wrist strap

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

Removing the Umbilical Cable

1. Remove plastic Head Cover by squeezing raised pads on sides of cover (Figure 23).

2. Remove the Air Plenum (Figure 24). Press in on clips to release from the Translator. Work Plenum free of air duct at top.
3. Disconnect the Filament Tubes from the top of the Toggle Plate Assembly. Press down on the tube retaining clips to free the tubes (Figure 27). Mark the tubes for material type to facilitate assembly.
4. Disconnect the Umbilical Cable (Head Board Interface Cable) lead from the Head Board (Figure 27).
5. Loosen and remove the 2 screws and clamps holding the umbilical cable at the top, rear, right corner (Figure 45).
6. Detach the Energy Chain from the XY Table (Figure 45).
   a. Loosen and remove the 2 bolts that attach the Energy Chain to the Translator.
   b. Loosen and remove the 2 bolts in the top, rear, right corner (as viewed from the front).

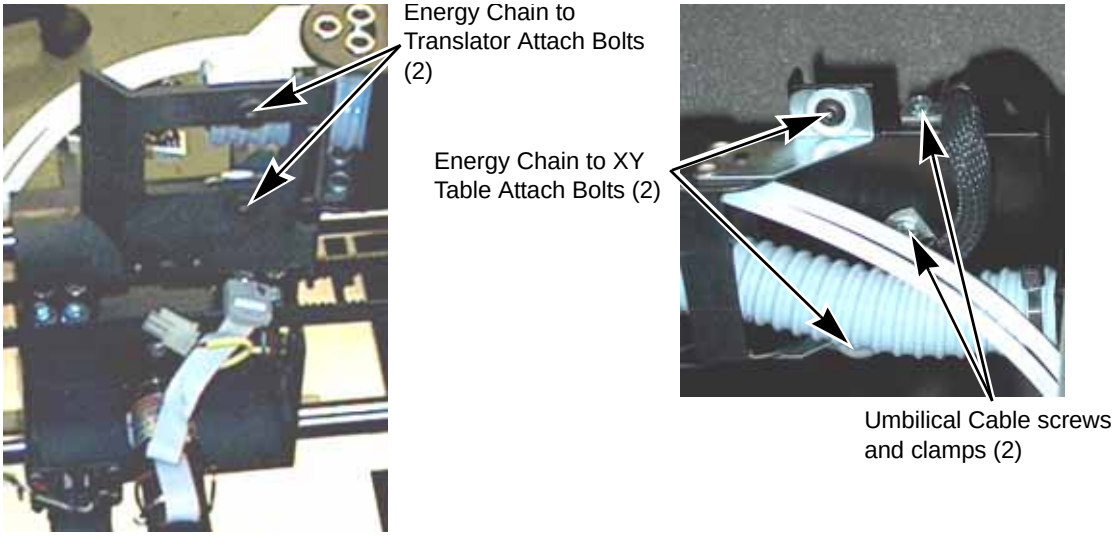


Figure 45: Energy Chain Attach Points

7. Cut the tie-wraps holding the X-Motor electrical connector and disconnect the X-Motor electrical lead (Figure 46).
8. Detach X-Motor energy lead from X-Motor assembly - loosen and remove 2 mounting screws (Figure 46).

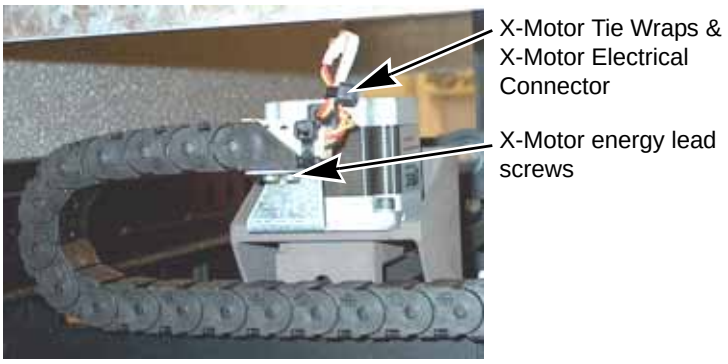


Figure 46: X-Motor Cable Disconnect

9. Cut the tie wraps holding the X-Motor lead (2) and Umbilical Cable (1) to the side of the printer (Figure 47).
10. Disconnect the Umbilical Cable from the J9, J10, and J11 PDB connectors.

11. Carefully work the X-Motor electrical lead out of the X-Motor energy chain.
12. Carefully work the Umbilical Cable out of the Head Energy Chain.
13. Note the routing of the Umbilical Cable and X-Motor lead and remove them from the printer.

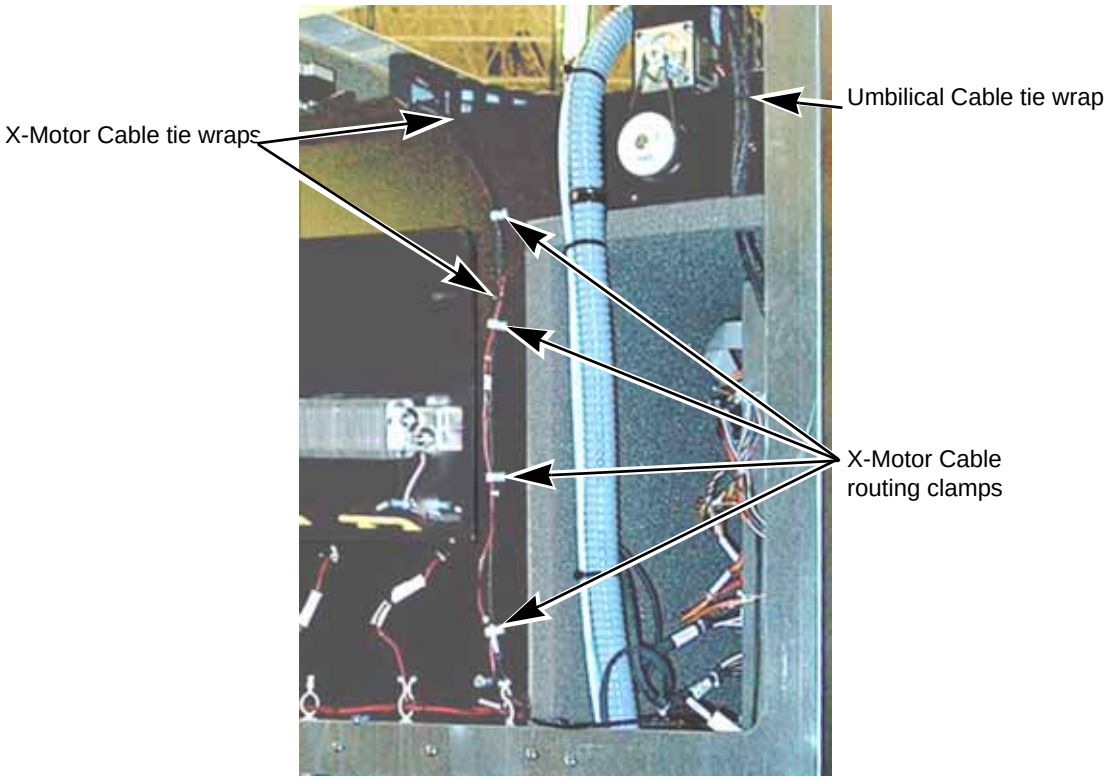


Figure 47: Umbilical and X-Motor Cable Routing

Installing the Umbilical Cable

1. Connect the Umbilical and X-Motor Cables to the PDB connectors - J9, J10, and J11
2. Route the Umbilical and X-Motor Cables as noted during disassembly and through there respective energy chains.
3. Attach the Head Energy Cable.
   a. Install and tighten the 2 bolts in the top, rear, right corner (as viewed from the front).
   b. Install and tighten the 2 bolts that attach the Energy Chain to the Translator.
4. Attach the Umbilical Cable at the top, rear, right corner of the printer - install the clamps and clamp screws.
5. Attach the Umbilical Cable electrical connector to the Head.
6. Attach the X-Motor energy chain at the X-Motor bracket - install and tighten the 2 mounting screws.
7. Attach the X-Motor cable to the X-Motor electrical connection.
8. Replace tie wraps removed during disassembly - 2 holding X-Motor lead to side of printer; 2 holding X-Motor electrical leads and connector at the X-Motor; 1 holding Umbilical Cable to side of printer.
9. Attach the 2 filament tubes to the top of the Toggle Plate Assembly.
10. Install the Air Plenum - connect the Plenum to the air duct at top - press in on clips to fit the plenum to the Translator.
11. Install the Head Cover - squeeze the side tabs to fit the Translator.
12. Test system for proper operation.

Head Cooling Fan

Required Tools

- 7/64” Allen wrench

Removing the Head Cooling Fan

(Refer to Figure 48)

1. Disconnect the Head Cooling Fan wiring harness lead.
2. Loosen the 2 mount screws (7/64 Allen).
3. Remove the screws and washers while carefully removing the motor.

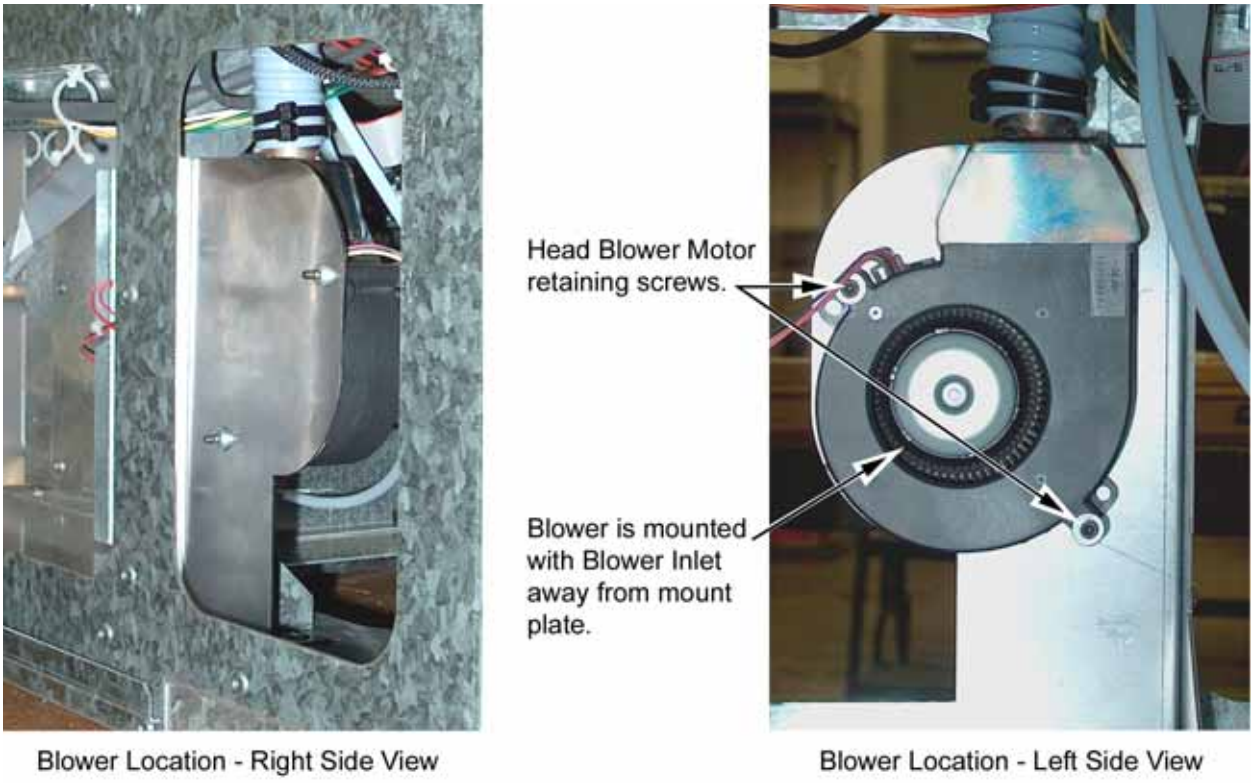


Figure 48: Removing the Head Blower Motor

Installing the Head Cooling Fan

(Refer to Figure 48)

1. Position the Head Cooling Fan with the inlet facing away from the mounting bracket.
2. Install the flat washers and retaining screws.
3. Tighten the retaining screws.

Loss of Extrusion

Required Tools

- Allen wrench set

Diagnosing Loss of Extrusion

Occasionally, the printer's head may experience loss of extrusion. This will be evident by observing one of the following:

- Seeing the head moving with no material coming out of either liquefier tip
- The height of the model and support materials are not equal
- Sagging structures due to lack of support materials

WARNING: The head area is very hot!! Use gloves when working in this area of printer!

Diagnose loss of extrusion:

1. Press **Cancel** and remove any parts from the printer.
2. Insert a new modeling base.
3. From **Idle**, enter **Head Maintenance**
   a. Using the keypad, press **Maintenance**.
   b. Press **Next**. The head will come to rest in the center of the chamber and the Z Platform will change position. Choose **Head Maintenance**.
4. The display will read:
   Model Drive Motor
   Stopped
5. 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 several seconds, looking for extrusion (material purge).

Note: If it was previously at a cool temperature, the tip may not immediately extrude material. After the tip reaches operating temperature you may need to wait up to 30 seconds before extrusion will begin.

6. Press **Stop** to stop the extrusion.
7. If material steadily flowed from the model tip, the model tip is not experiencing loss of extrusion.
8. Test the support material tip by choosing: **Select Drive -** the display will read:

9. Support Drive Motor
Stopped

10. Determine if there is a support material extrusion problem by pressing **Forward**. Watch the support tip (left tip) for several seconds, looking for extrusion (material purge).
11. Press **Stop** to stop the extrusion.
12. If material steadily flowed from the support tip, the support tip is not experiencing loss of extrusion.
13. Return the printer to the Maintenance state - Push **Done,** then answer **Yes** when the printer displays **Is Material Loaded?**
14. If material did not extrude from both tips follow the procedure in the following section, "Recovering From Loss of Extrusion".

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.
   - From **`Idle`**, press **`Maintenance >`** then **`Next`** > then **`Head Maintenance`**.

WARNING: The head area is very hot!! Use leather gloves when working in this area of printer!

2. Remove plastic head cover.
   - Remove plastic head cover by squeezing raised pads on sides of cover. (Figure 15 on page 47)
3. Place the tip toggle bar in neutral position (bar will extend equally from both sides of head - Figure 49). This can be done manually - push on the extended bar end.

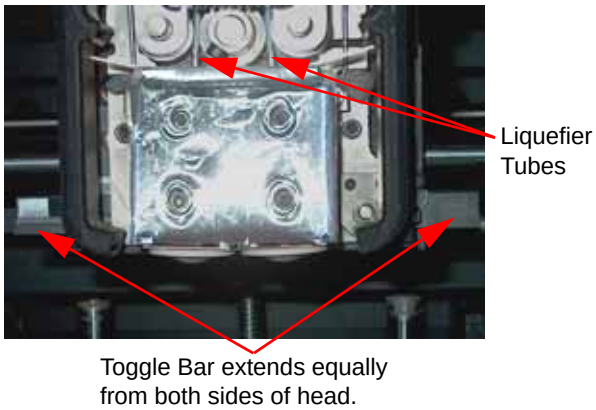


Figure 49: Tip Toggle Bar in Neutral Position

CAUTION: The end of the extrusion tip where the material enters is called the Liquefier Tube. Liquefier Tubes are fragile. Use care when working in this area so as to avoid damage to the tubes.

4. Remove excess material found around the head area.

Note: Filament feed 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.
   b. To facilitate 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 - Figure 50 illustrates the model side):

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.

   (1) Using a 7/64 T-handled hex driver (from Start-Up Kit) to leverage against the lower idler wheel shaft, push the idler assembly away from the filament drive gear by pushing against the spring tension.

Note: ***When moving the idler wheel assembly, you can obtain maximum clearance for cleaning if you also move the Tip Toggle Bar so that it is extended to the same side of the head assembly as the one on which you are working. It is not necessary to keep Toggle Bar in a neutral position.***

(2) Insert 1/8 T-handled hex driver (from Start-Up Kit) into the fixturing hole.

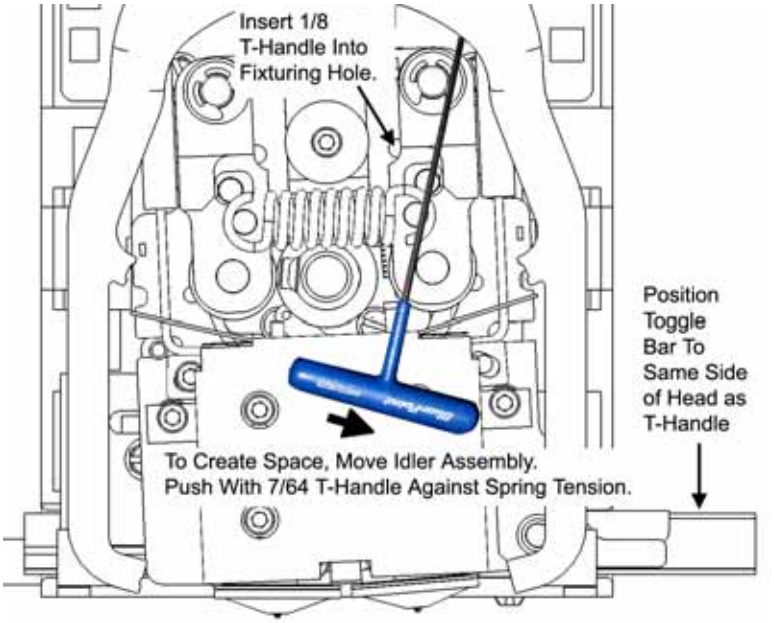


Figure 50: Create Access Space for Cleaning - Model Tip Side
Repeat for Support Tip Side

(3) Ease pressure on the 7/64 T-handle driver to carefully return the leveraged idler wheel back toward its original position - until the idler assembly is resting against the 1/8 T-handled hex driver.

(4) Remove the 7/64 T-handled driver used to leverage the idler assembly.

(5) Clean the area that is now accessible. Remove the 1/8 T-handle hex driver when complete.

CAUTION: **Liquefier Tubes are fragile. When removing excess material from the top of the liquefier be careful not to damage the tube.**

5. Remove excess material from the top of the liquefier.
   - Use needle nose pliers to carefully grip and remove excess material from the top of the liquefier.
6. Snip the filament line from the cartridge close to the drive wheel.
7. Make sure that all loose filament is removed from the affected liquefier inlet area.
8. Check for loose material in the other liquefier inlet area. Clean the area as necessary.
9. Install plastic head cover.
10. Exit **`Maintenance`** - press **`Next`** > then **`Done`**.
11. Unload the material. Make sure that the cartridges are entirely removed so that all of the filament loaded into the printer can be withdrawn.
    - It is recommended that an unload be performed for each material.
12. Load material.

Clogged Liquefier Tip

Occasionally, a Liquefier Tip may clog with material. This is often accompanied by a Loss of Extrusion (LOE). (Refer to “Loss of Extrusion” on page 4 - 50). A clogged Tip will prohibit material load.

Clearing A Clogged Liquefier Tip

Note: ***It is recommended that you read and understand this entire procedure before performing any of the work.***

This procedure assumes that filament is loaded to near the liquefier tip.

1. Enter **`Head Maintenance`** mode.

   From **`Idle`**, press **`Maintenance >`** then **`Next`** > then **`Head Maintenance`**.
2. Move the material idler wheel out of the way on the side that is clogged. Use a 7/64 and 1/8 T-Handle as illustrated in Figure 50 (model side shown).
3. Move the toggle bar so as to ‘deactivate’ the clogged tip.

Note: **Push the toggle bar to the right to deactivate the support side; push the toggle bar to the left to deactivate the model side.**

4. Snip the filament just after the it passes between the filament drive and the idler wheel (‘pinch point’).

Note: **If necessary manually pull more filament forward in order to reach the ‘pinch point’.**

5. Move the toggle bar to activate the clogged side. This will make the drive wheel control options active for the clogged side.

Note: **Push the toggle bar to the left to activate the support side; push the toggle bar to the right to activate the model side.**

6. Press **`Forward`** on the interface panel. The drive wheel will turn, but filament will not feed because the idler wheel is held out of position.
7. Use the 7/64 T-Handle to hold pressure against the toggle spring and keep the idler wheel away from the filament. Remove the 1/8 T-Handle.
8. Press **`Blower Off`** on the interface panel. With the head blower off the temperature the liquefier tube will increase.
9. After approximately 5 seconds, reduce pressure against the toggle spring and allow the idler wheel to contact the filament. Filament should extrude from the clogged tip.

Note: ***The blower will automatically turn on in 10 seconds.***

10. Press **Stop** on the interface panel.
11. Move the toggle bar to activate the drive wheel control options for the non-clogged side.
12. Press **Forward** on the interface panel. Make sure that filament extrudes from the non-clogged liquefier.

Note: **It is necessary to confirm proper operation of the non-clogged side. Temporarily having the blower off can occasionally cause the non-clogged side to clog.**

13. Press **Stop** on the interface panel.
14. Install plastic head cover.
15. Exit **Maintenance** - press **Next** > then **Done**.

XY Table Components

X Home Sensor and X EOT Sensor

The X Home Sensor and X EOT Sensor are built into the Head Board. Replacement of a sensor can only be accomplished by replacing the Head Board (See “Removing the Head Board” on page 4 - 43).

X Motor

Required Tools

- Set of basic service tools

Removing the X-Drive Motor

1. Loosen the X-Drive Motor belt by reducing the belt tension with the adjusting nut. The belt does not have to be removed, but reducing the belt tension will facilitate removal and installation (Figure 54).
2. Cut the tie-wraps holding the X-Motor electrical connector and disconnect the connector (Figure 60).
3. Loosen and remove the 4 mounting screws (9/64 allen) (Figure 60).
4. Lift Motor to remove it. Also remove the X-Motor Bracket (Figure 51).

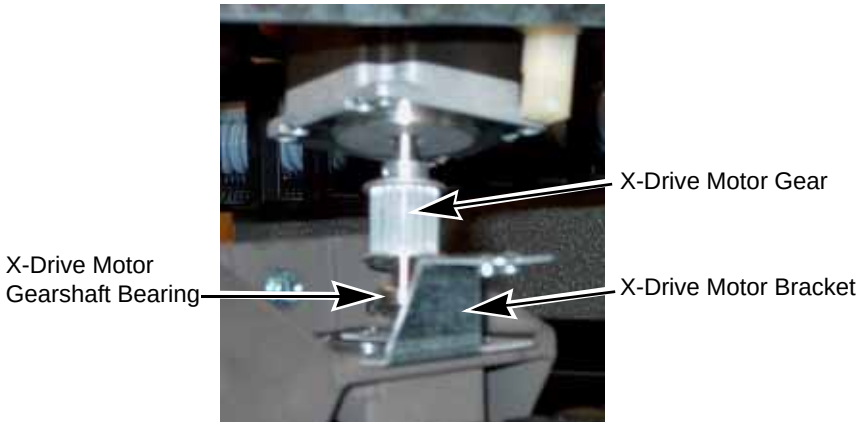


Figure 51: X-Drive Motor External Parts

Installing the X-Drive Motor

1. Install the X-Motor ...
   - Place the bracket under the motor prior to motor installation (Figure 51).
   - Make sure that the Motor Gearshaft Bearing properly seats in its bore (Figure 51).
   - If the belt has not been removed, make sure that the X-Motor drive gear engages the belt teeth.
   - Make sure that the X-Drive Motor is oriented so that the wiring and electrical connector are on the RIght Side of the printer (Figure 60).
2. Tighten the 4 mounting screws (Figure 60).
3. Adjust the belt tension (See “Check/Adjust the X-Drive Belt Tension” on page 4 - 58).

X Drive Belt

Required Tools

- Set of basic service tools
- Belt tension gauge

Removing the X-Drive Belt

(Refer to Figure 52)

1. Remove the 2 X-Drive Belt clamps - loosen and remove the clamp screws (4 on each clamp).
2. Remove the X-Drive Belt by feeding it past the X-Motor gear and Idler/Tension Gear.

Installing the X-Drive Belt

(Refer to Figure 52)

1. Feed the belt around the X-Motor gear and around the Idler/Tension Gear.
2. Attach one end of belt with clamp - install belt so that one tooth can be seen beyond end of clamp.

Note: Make sure belt is installed so that teeth on belt will engage with Drive/Idler Gears.

3. Tighten the 4 clamp screws.
4. Attach remaining end of belt with remaining clamp - install belt so that at least one tooth can be seen beyond end of clamp.

Note: Make sure belt is engaged on the X-Drive Motor gear and the Idler/Tension Gear before tightening clamp.

5. Tighten the 4 clamp screws.

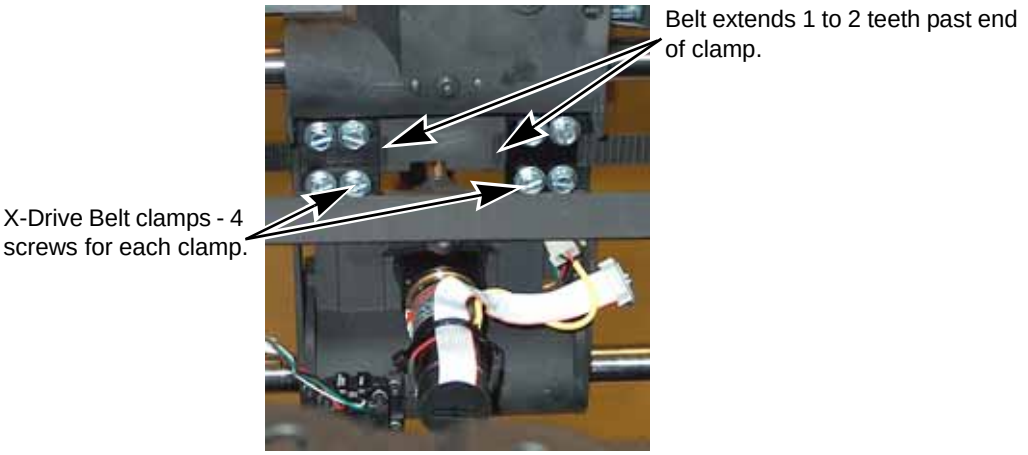


Figure 52: X-Drive Belt Clamps

6. Manually move the head back and forth across the envelope 2 times to make sure the belt is seated in the gear teeth and the belt tension is evenly distributed.
7. Adjust the belt tension (See “Check/Adjust the X-Drive Belt Tension” on page 4 - 58).

Check/Adjust the X-Drive Belt Tension

CAUTION: The X & Y Drive Belt Tension must be checked and adjusted with the system and belts at room temperature.

Zero the Dial Indicator

(Figure 63)

1. Insert the zero gauge block into the gauge.
2. Loosen the adjustment screw and slide the dial indicator assembly up or down to set the 'zero' reading:
   - With old gauge: The big hand should be on 0 and the little hand on .2.7.
   - With new gauge: The big hand should be on 0 and the little hand on 5.
3. Tighten the adjustment screw - recheck the reading.
4. Remove the zero block gauge block from the fixture.

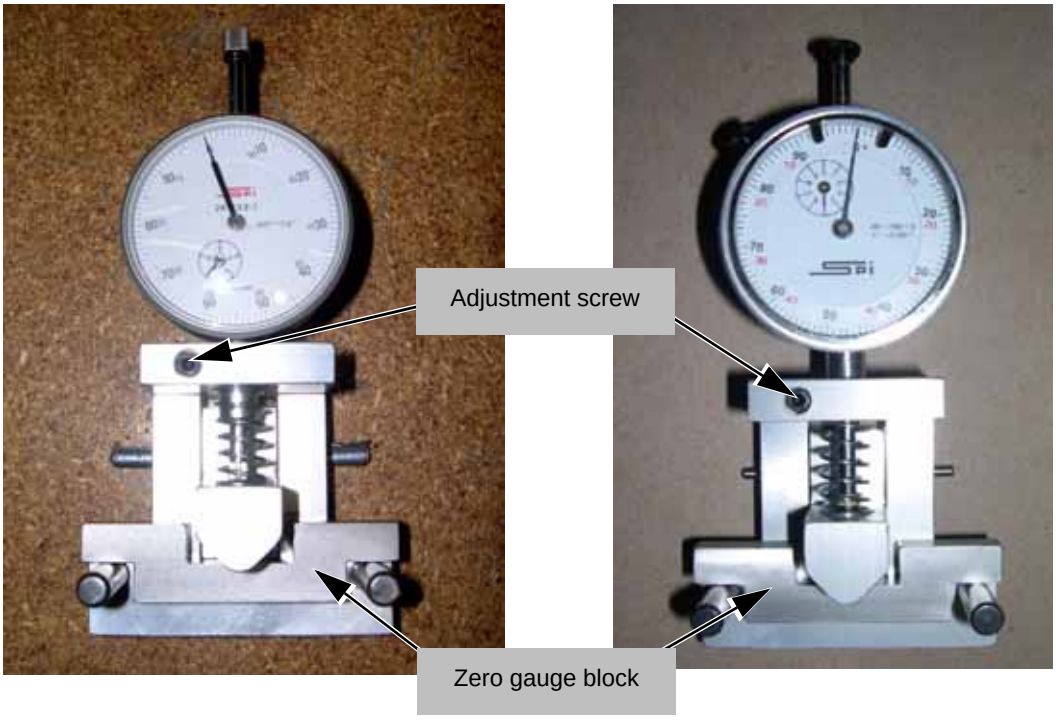
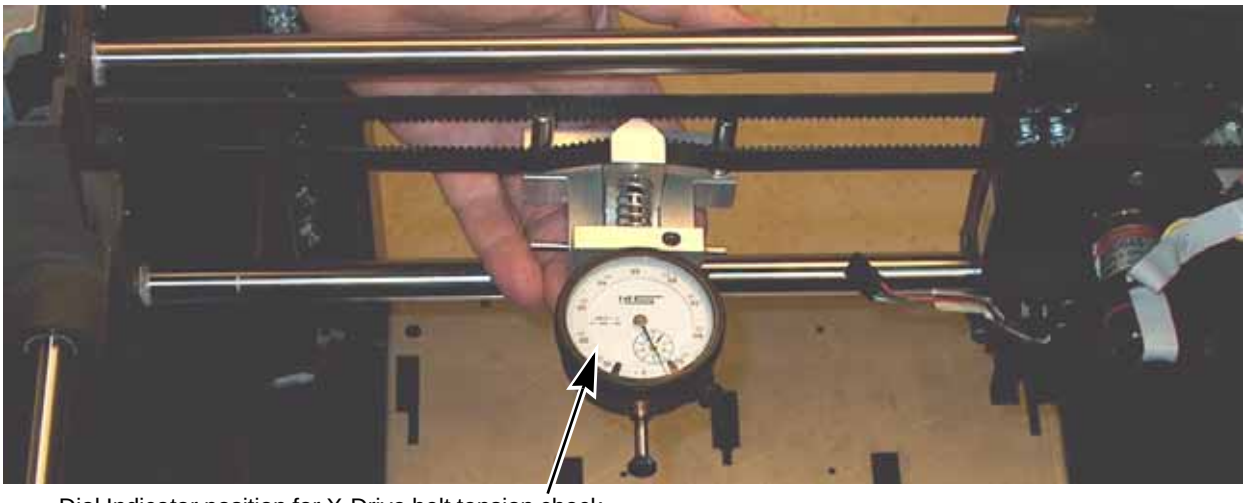


Figure 53: Tension gauge zero setting

Check/Adjust the X-Drive Belt Tension

1. Move the Head Assembly to full left travel within the build envelope (as viewed from the front of the printer).
2. Position the dial indicator on the rear section of the X-Drive belt - centered between the Head Assembly and the right side of the build envelope. (Figure 54)



Dial Indicator position for X-Drive belt tension check. Head assembly to left (if viewed from the front of printer - this picture view is from the rear).

Figure 54: X-Drive Belt Tension Check

3. Check the tension: (Figure 55)

   Old gauge: The big hand on the gauge should read between 20 and 30 mils, and the small hand should be at the .1.6 position.

   New gauge: The big hand on the gauge should read between 30 and 40 mils, and the small hand should read between 4 and 5.

Old dial indicator

New dial indicator

Figure 55: Gauge reading at correct belt tension (Shading indicates acceptable range)

4. If the tension is out of the range specified above, adjust the belt tension with the X belt tensioning nut on the X-Drive Idler/Tension Adjust gear. (Figure 56)

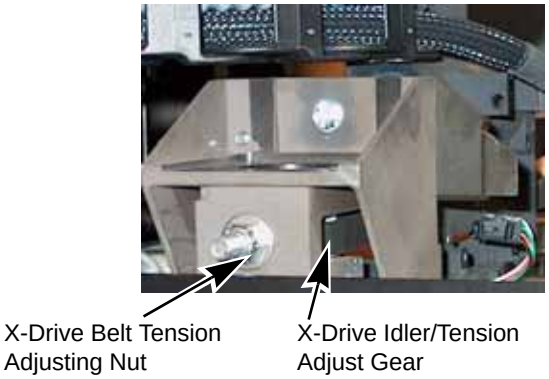


Figure 56: X-Drive Belt Tension Adjustment

5. Remove the belt fixture and run the head back and forth several times.
6. Re-attach the belt tension gauge, re-check the tension and adjust if necessary.

Y Motor

Required Tools

- Set of basic service tools
- Belt tension tool

Removing Y-Drive Motor & Motor Belt

(Refer to Figure 60)

1. Cut the tie-wrap holding the Y-Motor electrical connector and disconnect the Y-Drive Motor electrical connector.
2. Loosen and remove the 3 Y-Drive Motor retaining bolts.
3. Remove the Y-Drive Motor and Motor Belt.

Installing Y-Drive Motor & Motor Belt

(Refer to Figure 60)

1. Install the Y-Drive Motor - position the motor so that the electrical leads face the rear of the printer.
2. Install, but do not tighten, the 3 Y-Drive Motor retaining bolts.
3. Install the Y-Drive Motor belt around the Y-Drive Motor drive gear and Y-Drive gear.
4. Position the Y-Drive Motor belt tension tool (PN 304151-0001) as shown (Figure 57).
5. Tighten the Y-Drive Motor retaining bolts.
6. Connect the Y-Drive Motor electrical lead to the connector and install a tie wrap.

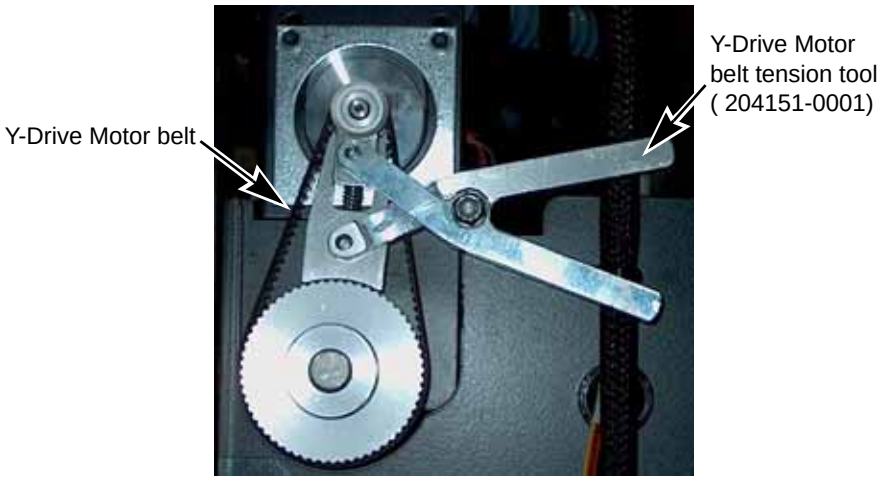


Figure 57: Y-Drive Motor Belt and Tensioning Tool

Y Drive Belt

1. The Y-Drive Belts are ‘continuous’ belts - unlike the X-Drive belt, the Y-Drive Belts are one-piece. If a Y-Drive Belt must be replaced, replace the XY-Table Assembly (See “Removing the XY Table” on page 4 - 63).
2. Adjust the Y-Drive Belt tension after the XY-Table has been reinstalled (See “Check/Adjust Y-Drive Belt Tension” on page 4 - 68).

Y Pulley

Required Tools

- Set of basic service tools
- Belt tension gauge

Removing the Y Pulley

1. Remove the Front Bezel (See “Removing the Front Bezel (Panel)” on page 4 - 9).
2. Locate the Y pulley(s) - there are two Y pulleys - replacing either one requires the same procedure (Figure 58).
3. Loosen the Y belt by turning the Y belt tensioning nut counter clockwise (Figure 67).
4. Remove the Y axis pulley shaft retaining clip.
5. Slide the Y axis pulley shaft out from the Y pulley.
6. Remove the Y pulley from the clevis.
7. Remove the pulley from the Y drive belt.

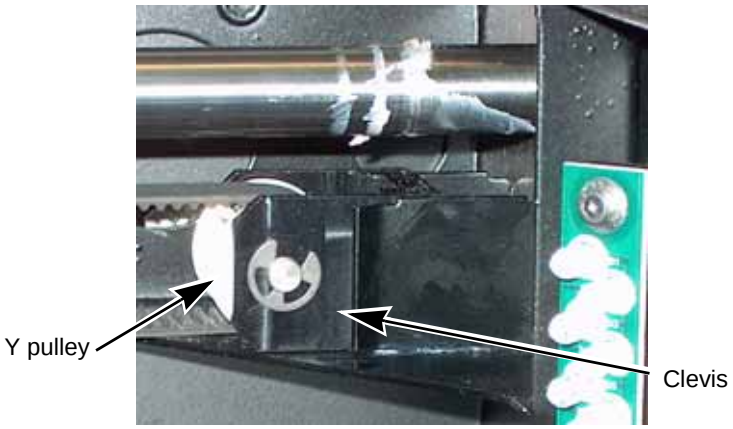


Figure 58: Y Pulley Detail

Installing the Y Pulley

1. Loop the Y drive belt over the replacement pulley.
2. Position the pulley so that the pulley shaft can slide through the clevis and pulley.
3. Slide the pulley shaft through the clevis and pulley and retain shaft using the retaining clip. If needed, turn the Y belt tensioning screw counter clockwise to ease shaft insertion.
4. Adjust the Y-Drive belt tension (See “Check/Adjust Y-Drive Belt Tension” on page 4 - 68).
5. Install the Front Bezel (See “Installing the Front Bezel” on page 4 - 10).

Y Drive Assembly

The Y-Drive Assembly is not a field replaceable item. If a new Y-Drive Assembly is required, replace the XY Table.

Y Home Sensor / Y EOT Sensor

Required Tools

Set of basic service tools

Remove Y Home Sensor & Y EOT Sensor

(Figure 59)

1. Disconnect electrical lead from sensor.
2. Loosen and remove the mounting screw (1/4 inch nut driver or slotted screw driver)
3. Remove the sensor.

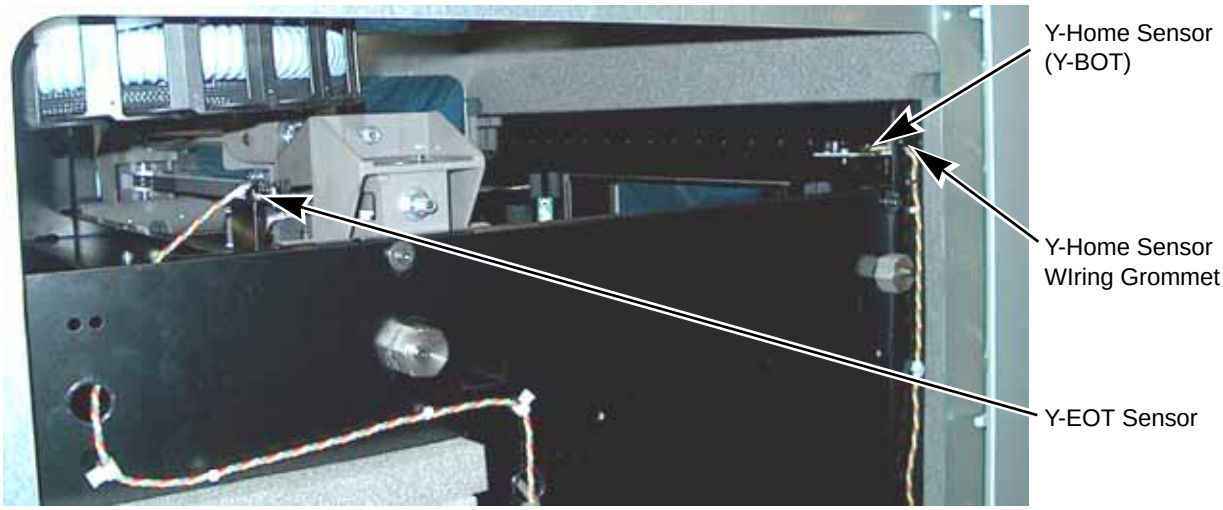


Figure 59: Y Sensors (Left Side View)

Install Y Home Sensor & Y EOT Sensor

(Figure 59)

1. Position the sensor.
2. Install and tighten the mounting screw.
3. Connect electrical lead to sensor.

XY Table Assembly

Parts and Tools Required

- Set of basic service tools
- Dial indicator and zero gauge block
- Allen wrench set
- Large crescent wrench
- Maraca CD

Note: After installing the XY table, follow the XY Table Checklist.

Removing the XY Table

1. Remove the Toggle Plate Assembly (See “Removing the Toggle Plate Assembly” on page 4 - 26).
2. Remove the Toggle Bar (See “Removing the Head Toggle Bar” on page 4 - 42).
3. Remove the Toggle Sensor (See “Removing the Toggle Sensor” on page 4 - 43).
4. Remove the Head Board (See “Head Board” on page 4 - 43).
5. Remove the Head Motor (See “7/64 allen” on page 4 - 44).
6. Remove the Foam Sensor. (See “” on page 4 - 45).
7. Disconnect the electrical connections for the Y-Home (Y-BOT) and Y-EOT Sensors from the XY Table and remove the Y-Home Sensor Wiring Grommet (Figure 59).
8. Detach the Energy Chain from the XY Table (Figure 45).

a. Loosen and remove the 2 bolts that attach the Energy Chain to the Translator.
b. Loosen and remove the 2 bolts in the top, rear, right corner (as viewed from the front).
c. Loosen and remove the 2 screws holding the umbilical clamps (top, rear, right corner).

9. Cut the tie-wraps holding the X-Motor electrical connector and disconnect the X-Motor electrical lead (Figure 60).
10. Detach X-Motor energy lead from X-Motor assembly - loosen and remove 2 mounting screws (Figure 60).
11. Cut the tie-wrap holding the Y-Motor electrical connector and disconnect the Y-Motor electrical lead (Figure 60).
12. Loosen and remove the XY Table Cam screws (3), Cams (3), and retaining screws (5) (Figure 61).

WARNING: The XY Table is heavy. Removal is a two person operation.

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

13. Lift the XY Table out of the top of the printer.

Note: Tilting the XY Table so that the Left Side is elevated will facilitate removal.

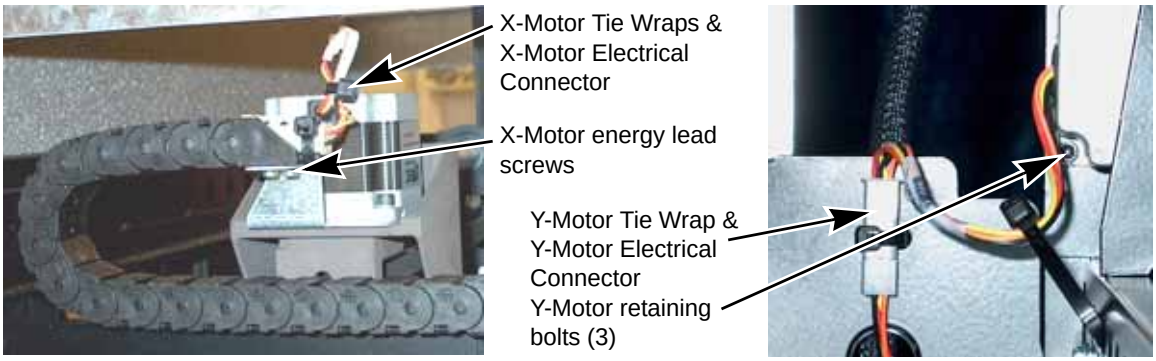


Figure 60: X and Y Motor Electrical Leads

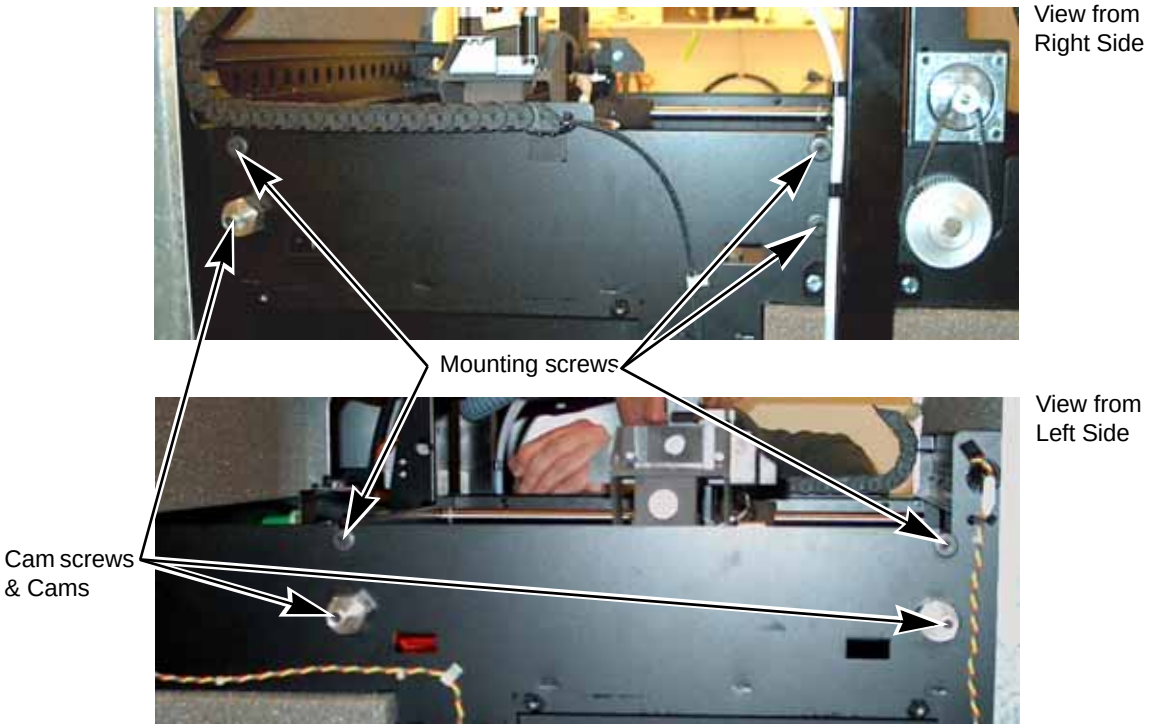


Figure 61: XY Table Cam and Retaining Screws

Installing the XY Table

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

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

Note: When installing the XY Table, follow the "XY Table Installation Checklist" on page 9 - 18.

1. Place the XY Table into position through the top of the printer.

Note: Tilting the XY Table so that the Left Side is elevated will facilitate installation.

2. Install the XY 3 Table Cam screws, 3 Cams, and 5 retaining screws (Figure 61) - do not tighten at this time.
3. Connect the Y-Motor electrical lead and install a tie wrap (Figure 60).
4. Attach X-Motor energy lead at the X-Motor assembly - tighten the 2 mounting screws (Figure 60).
5. Connect the X-Motor electrical lead and install two tie wraps (Figure 60).

CAUTION: Be careful not to twist the electrical leads or the Filament Tubes when installing the Energy Chain.

6. Attach the Energy Chain to the XY Table (Figure 45).
   a. Attach the umbilical bracket (top, rear, right corner) - install and tighten the 2 retaining screws.

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

   b. Attach the Energy Chain at the top, rear, right corner (as viewed from the front) - apply LocTite 222 to the 2 bolts.
   c. Attach the Energy Chain to the Translator - apply LocTite 222 to the 2 bolts - install and tighten the bolts.
7. Install the Y-Home Sensor Wiring Grommet (Figure 59).
8. Connect the electrical connections for the Y-Home (Y-BOT) and Y-EOT Sensors to the XY Table. (Figure 59).
9. Install the Z Level Assembly. (See “Installing the Z Level Assembly” on page 4 - 47).
10. Install the Head Motor (See “Installing the Head Motor” on page 4 - 44).
11. Install the Head Board (See “Installing the Head Board” on page 4 - 43).
12. Install the Toggle Sensor (See “Installing the Toggle Sensor” on page 4 - 43).
13. Install the Toggle Bar (See “Installing the Head Toggle Bar” on page 4 - 42).
14. Install the Toggle Plate Assembly (See “Installing the Toggle Plate Assembly” on page 4 - 31).
15. Level the XY Table (See “Checking the XY Table Level” on page 4 - 67).
16. Check/Adjust the X-Drive Belt tension (See “Check/Adjust the X-Drive Belt Tension” on page 4 - 58).
17. Check/Adjust the Y-Drive Belt tension (See “Check/Adjust Y-Drive Belt Tension” on page 4 - 68).

Checking the XY Table Level

1. Remove the substrate from the Z Stage.
2. Mark a place on each corner of the platen surface with a permanent marker (Figure 62).

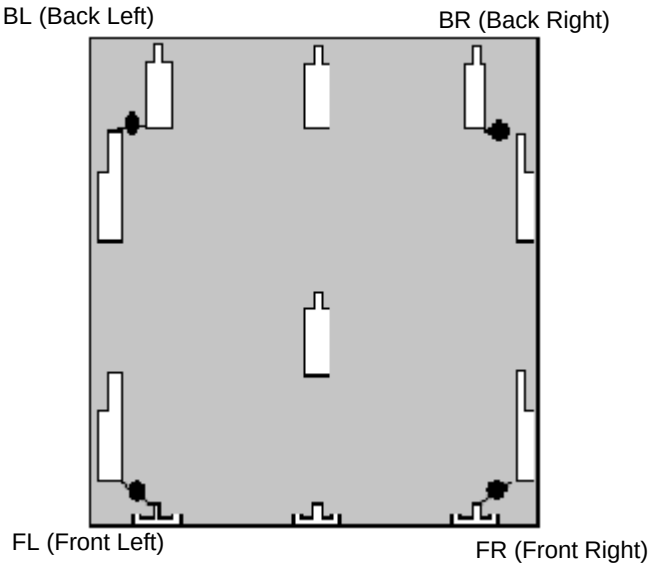


Figure 62: Modeling Base Indicator Points

3. Attach a dial indicator and fixture to the head.
4. Move the dial indicator to the back right corner on the marked location.
5. Raise the Z Stage until it contacts the dial indicator. Continue to raise the Z stage an additional two revolutions of the dial indicator.
6. Zero the dial indicator (this is the reference position and will always be zero).
7. Move the XY table to the front right corner (Figure 62) and measure and record the difference (e.g. the dial indicator reads -0.004 in.)
8. Move the dial indicator to the front left corner (Figure 62) and measure and record the difference (e.g. the dial indicator reads +0.010).
9. Move to the back left corner (Figure 62) and measure and record the difference (e.g. the dial indicator reads +0.008 in).
10. Insert the Maraca CD in a workstation and open the *XY Level Calc.xls* file.
11. Input the FR, FL and BL values you measured in the Indicator Reading boxes of the spreadsheet.

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

Table 1 : Sample XY Level Calc

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

12. The spreadsheet will calculate the required adjustment for each corner, and display them in the Knob Adjust Column.

Adjusting the XY Table Level

1. Move the indicator to the BR position and verify it is zero.

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

2. Move to the FR position.
3. Zero the dial indicator.
4. Loosen the XY frame screw and the cam adjuster lock screw on the FR corner (Figure 61).
5. Turn the adjuster cam until the dial indicator reading matches the calculated value from the spreadsheet (e.g. 0.014) (Table 1).

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

6. Tighten the cam lock screw and the frame screw on the FR corner.
7. Move the dial indicator to the FL corner.
8. Zero the dial indicator.
9. Loosen the frame and cam lock screws on the FL corner.
10. Turn the adjuster cam until the dial indicator reading matches the calculated value from the spreadsheet (e.g. -0.013).
11. Tighten the cam lock screw and the frame screw on the FL corner.
12. Move the dial indicator to the BL corner.
13. Zero the Dial indicator.
14. Loosen the frame and cam lock screws on the BL corner.
15. Turn the adjuster cam until the dial indicator reading matches the calculated value from the spreadsheet (e.g. -0.001).
16. Tighten the cam lock screw and the frame screw on the FL corner.
17. Recheck the four corners again. The maximum difference allowed between the highest and lowest readings is .003 in.
18. Repeat the Measure Level Condition and Adjust XY Table sections until the measurements are within specification.

Check/Adjust Y-Drive Belt Tension

CAUTION: The X & Y Drive Belt Tension must be checked and adjusted with the system and belts at room temperature.

Zero the Dial Indicator

(Figure 63)

1. Insert the zero gauge block into the gauge.
2. Loosen the adjustment screw and slide the dial indicator assembly up or down to set the ‘zero’ reading:
   - With old gauge: The big hand should be on 0 and the little hand on .2.7.
   - With new gauge: The big hand should be on 0 and the little hand on 5.

3. Tighten the adjustment screw - recheck the reading.
4. Remove the zero block gauge block from the fixture.

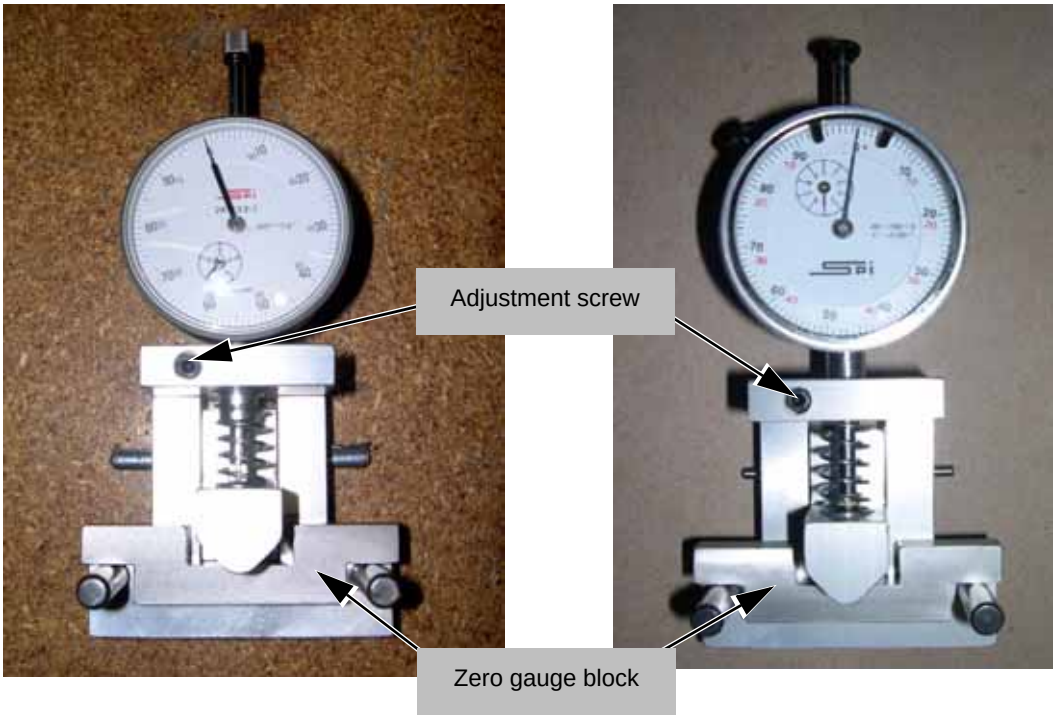
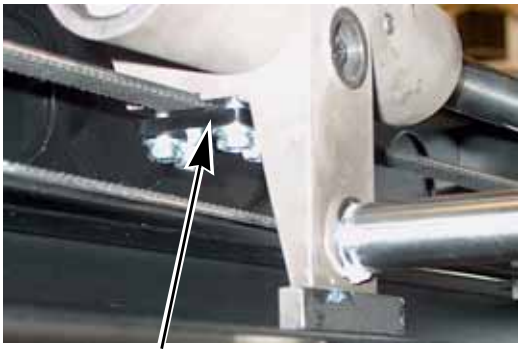


Figure 63: Tension gauge zero setting

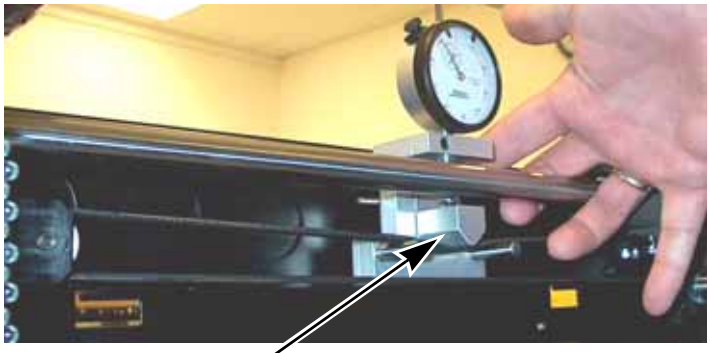
Check/Adjust the Y-Drive Belt Tension

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

1. Move the Head Assembly to full rear travel within the build envelope (as viewed from the front of the printer).
2. Position the dial indicator on the top section of the Y-Drive belt - centered between the Head Assembly and the front side of the build envelope. (Figure 64)



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



Dial Indicator position for Y-Drive belt tension check. Head assembly to rear (if viewed from the front of printer).

Figure 64: Y-Drive Belt Tension Check

3. Check the tension:

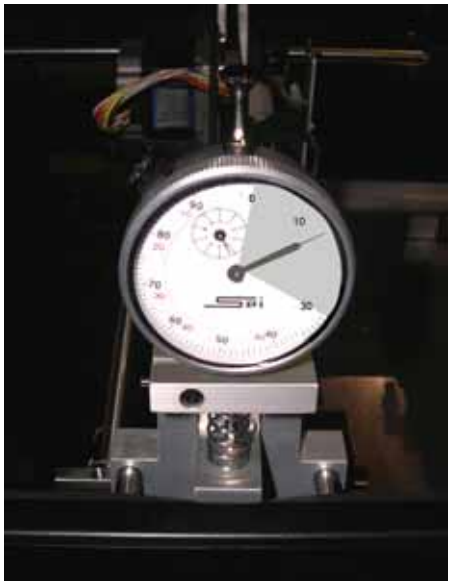
   Old gauge: The big hand on the gauge should read between 90 and 20 mils (inclusive), and the small hand should be at the .1.6 position (Figure 65)

   New gauge: The big hand on the gauge should read between 0 and 30 mils (inclusive), and the small hand should read between 4 and 5 (Figure 66).

Service LImit

Adjustment LImit

Figure 65: Old Gauge Readings



Service LImit

Adjustment LImit

Figure 66: New Gauge Readings

4. If the tension is not within the limit, loosen the 4 Y-Drive Belt clamp screws (Figure 64), and increase the tension so that the dial indicator reads between 0 and 10 (old gauge) or 10 and 20 (new gauge). Adjust the tension with the nut on theY-Drive tension adjustment. The Y-Drive tension adjustment is behind the front bezel. To gain access to the adjustment See “Removing the Front Bezel (Panel)” on page 4 - 9. (Figure 67)

Note: ***It is not necessary to completely remove the Bezel. It only needs to be tilted forward far enough to allow access to the adjustments. However, if working alone, it is recommended that the bezel be removed.***

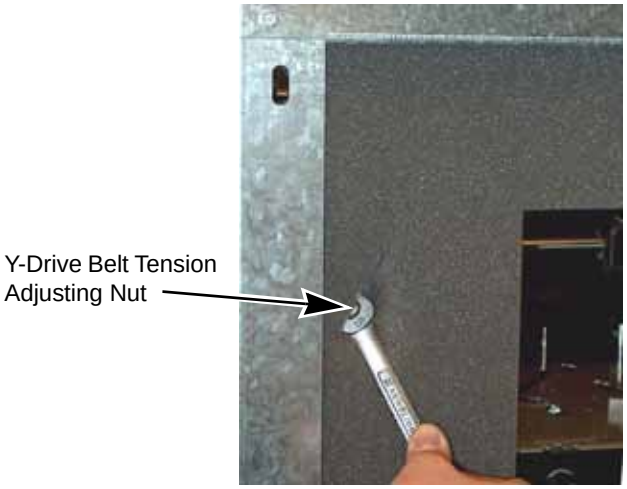


Figure 67: Y-Drive Belt Tension Adjustment

5. Remove the belt fixture, tighten the 4 Y-Drive Belt clamp screws (Figure 64), and move the head forward and back across the gantry several times.
6. Reattach the belt tension gauge and recheck th etension. If the tension is not between 0 and 10 (old gauge) or 10 and 20 (new gauge), loosen the 4 Y-Drive Belt clamp screws and re-adjust tension.
7. Continue to adjust and check the tension until the tension meets the adjustment limits.
   - Always loosen the belt clamp to adjust tension.
   - Recheck tension after tightening the clamp and moving the head forward an back across the gantry several times.

Z Stage Components

Thermostat Fuse

Note: This thermostat is resettable.

Required Tools

- Standard tool kit

Removing the Thermostat Fuse

CAUTION: Heater cover and heaters are hot! Allow area to cool before removing cover.

1. Remove the right side heater cover- loosen and remove the 4 cover screws (5/16 nut driver) (Figure 68).
2. Remove the cable clamp from the heater bay.
3. Disconnect the thermostat leads.
4. Remove the thermocouple - loosen and remove the 2 retaining screws (3/32 allen) (Figure 68).

Heater Cover

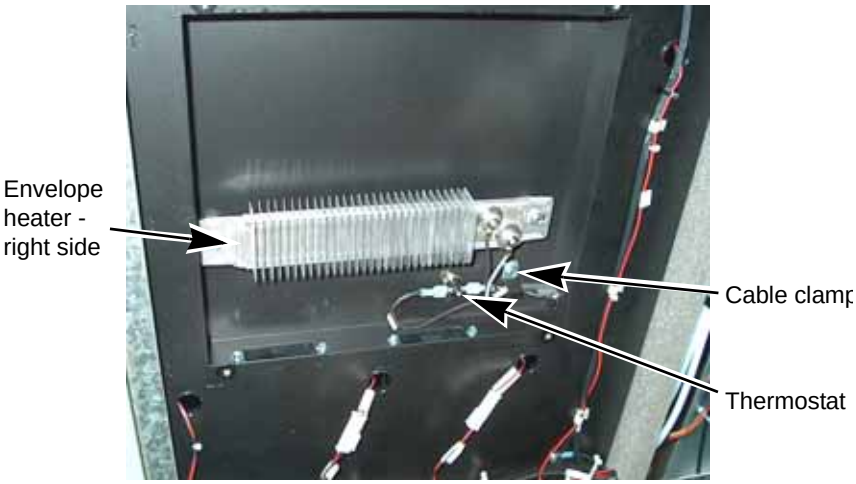


Figure 68: Envelope Heater (Right Side)

Installing the Thermostat Fuse

1. Install thermocouple - install and tighten 2 mounting screws.
2. Attach thermostat leads to thermocouple.
3. Anchor the cable clamp to the side of the heater bay.
4. Install heater cover - install and tighten the 4 mounting screws.

Envelope Thermocouple

Required Tools

Allen wrench set

Removing the Envelope Thermocouple

1. Locate the envelope thermocouple Figure 69.
2. Remove the thermocouple by pushing down on the strain relief tab (Figure 69) and carefully pulling back.
3. Slide the strain relief off of the thermocouple and retain it for reinstallation.
4. Locate the thermocouple connector on the PDB Figure 70.
5. Disconnect the thermocouple connector from the PDB by pulling the connector out.
6. Remove the thermocouple and wire from the system while taking note of the wire routing.

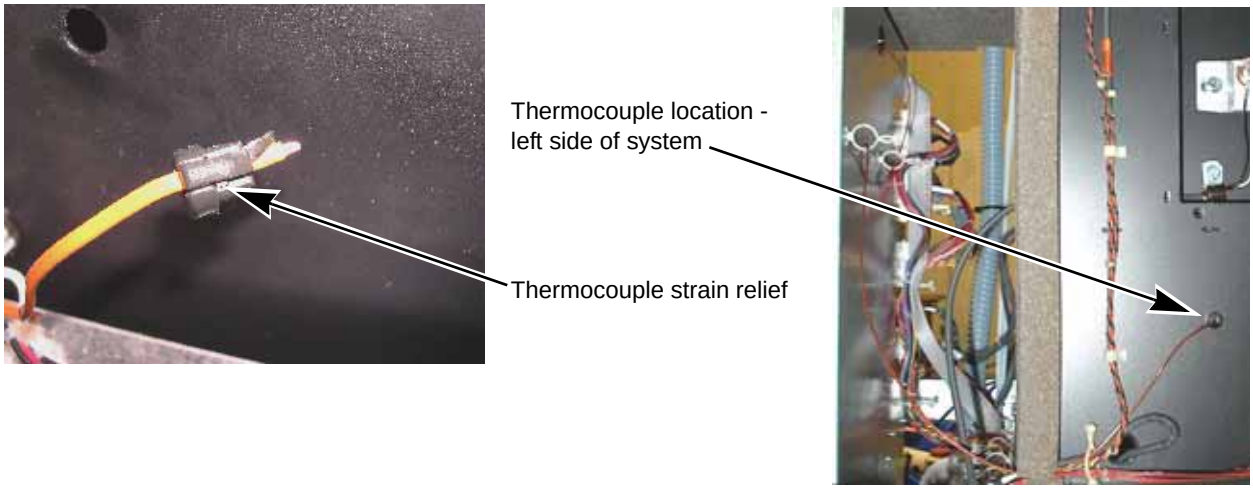


Figure 69: Envelope Thermocouple Location

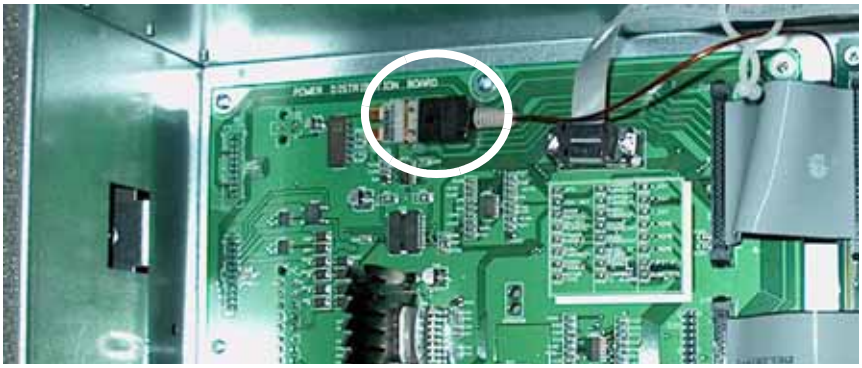


Figure 70: Thermocouple Connection on PDB

Installing the Thermocouple

1. Route thermocouple lead between thermocouple mounting hole and PDB.
2. Connect the thermocouple lead to the PDB.
3. Slide the strain relief onto the thermocouple Figure 69. Insert the strain relief into the mounting hole.

4. Check wiring routing and adjust if necessary.

Envelope Heater

Required Tools

- 5/16” nut driver (or slotted screwdriver)
- 3/8” wrench or nut driver

WARNING: Envelope heater area is very hot. Wear gloves when working in or around heater area or allow envelope to cool.

Removing the Envelope Heater

1. Remove the Envelope Heater Cover - loosen and remove the 4 cover screws (5/16” nut driver) (Figure 68).
2. Locate the envelope heater (Figure 68).
3. Using a 3/8” wrench or nut driver, remove the two nuts and washers that retain the wire lugs taking note of the wire locations.
4. Remove the two lugs from the posts.
5. Using a 1/8” Allen wrench, remove the two heater mounting screws and washers holding the heater to the Z stage panel.
6. Remove the existing heater.

Installing the Heater

1. Install the heater with the two heater mounting screws and washers.
2. Place the lugs back on the threaded posts.
3. Verify that the correct wire is going to the correct post (Figure 68).
4. Replace and tighten the two nuts and washers on the threaded posts.
5. Reinstall the envelope heater cover with the four heater cover screws.

Heater Fan

Required Tools

- Allen wrench set
- Standard screwdriver

CAUTION: The heater fan area is hot!

Removing the Heater Fan

1. Locate the heater fans - there are 4 fans (2 on each side) mounted on the inside, lower portion of the modeling envelope (Figure 71). Access to wire lead connections and mounting screws is from the outside of the modeling envelope - inside the heater bay.

2. Remove the right side heater cover- loosen and remove the 4 cover screws (5/16 nut driver) (Figure 72).
3. Disconnect the fan cables by unplugging at the connector - located in the heater bay (Figure 72).
4. Loosen and remove the mounting screws for the fan - located in the heater bay - 2 per fan (Figure 72).
5. Remove the fan.

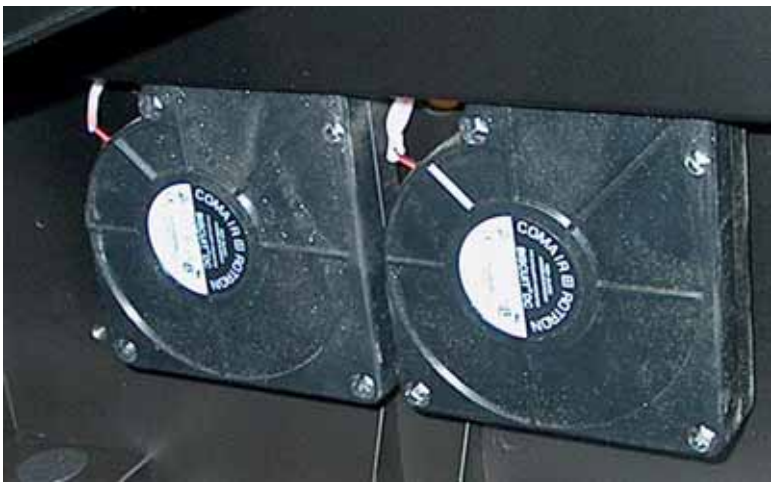
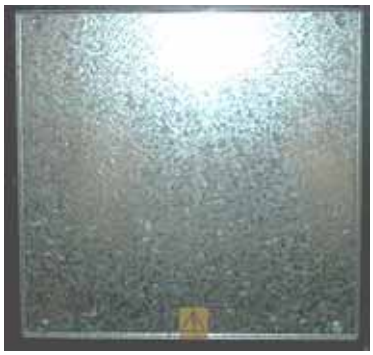


Figure 71: Envelope Heater Fans
(Viewed from Inside of Modeling Envelope)



Heater Cover

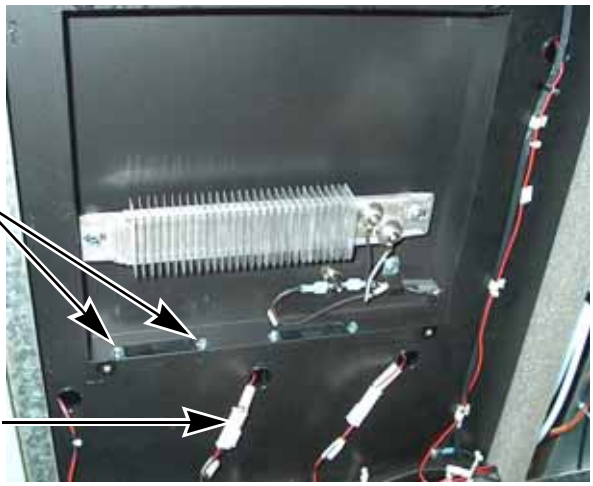


Figure 72: Heater Cover and Bay

Installing the Heater Fan

1. Position the fan - routing the electrical lead into the heater bay.
2. Mount the fan using the two fan mounting screws (Figure 72).
3. Connect the fan electrical lead (Figure 72).
4. Power on system. The system should reach “Idle” with no displayed errors.
5. Verify fan operation - from the heater bay slowly insert a wire tie into the fan area. You should feel a vibration or hear a noise when the wire tie contacts the fan.
6. Remove the wire tie and install the heater cover - install and tighten the 4 mounting screws.

Z EOT Sensors

Required Tools

- 1/4 inch nut driver or Slotted screwdriver

Removing Z EOT Sensors

1. Locate the EOT sensors (Figure 73).
1. Disconnect electrical lead from sensor.
2. Loosen and remove the mounting screw (1/4 inch nut driver or slotted screw driver)
3. Remove the sensor.

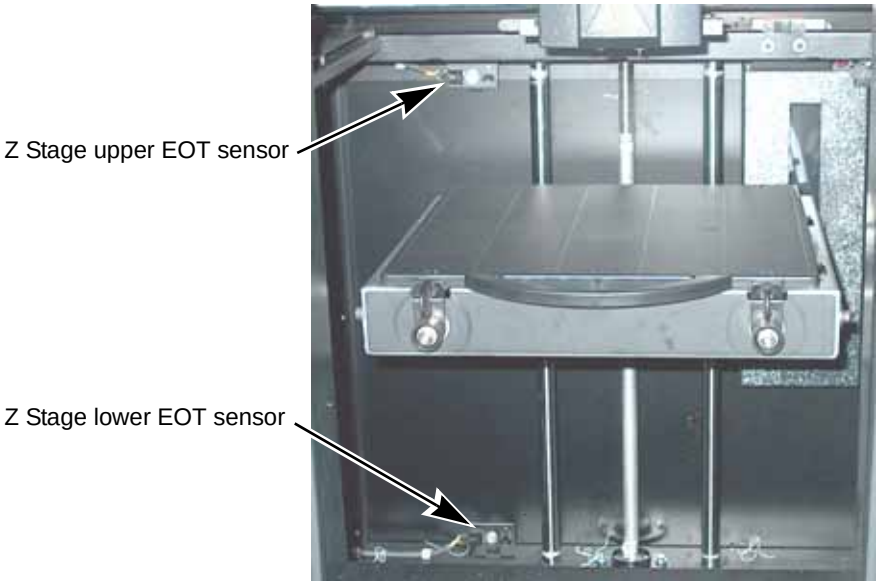


Figure 73: Z Stage EOT Sensors

Installing Z EOT Sensors

(Figure 73)

1. Position the sensor.
2. Install and tighten the mounting screw.
3. Connect electrical lead to sensor.
4. Power on the system.
5. Using Maraca, test that the sensor is operating properly.

Purge Bucket Light

Required Tools

- 5/16 inch nut driver or Slotted screwdriver
- 1/4 inch nut driver or Slotted screwdriver

Removing Purge Bucket Light

Figure 74

1. Remove the Purge Bucket.
2. Remove the Purge Bucket Light bracket - loosen and remove the 2 mounting screws (5/16” nut driver).
3. Cut the tie wrap holding the electrical lead to the bracket.
4. Disconnect the electrical lead from the Purge Bucket Light card.
5. Remove the Purge Bucket Light card from the bracket - loosen and remove the 2 mounting screws (1/4” nut driver).

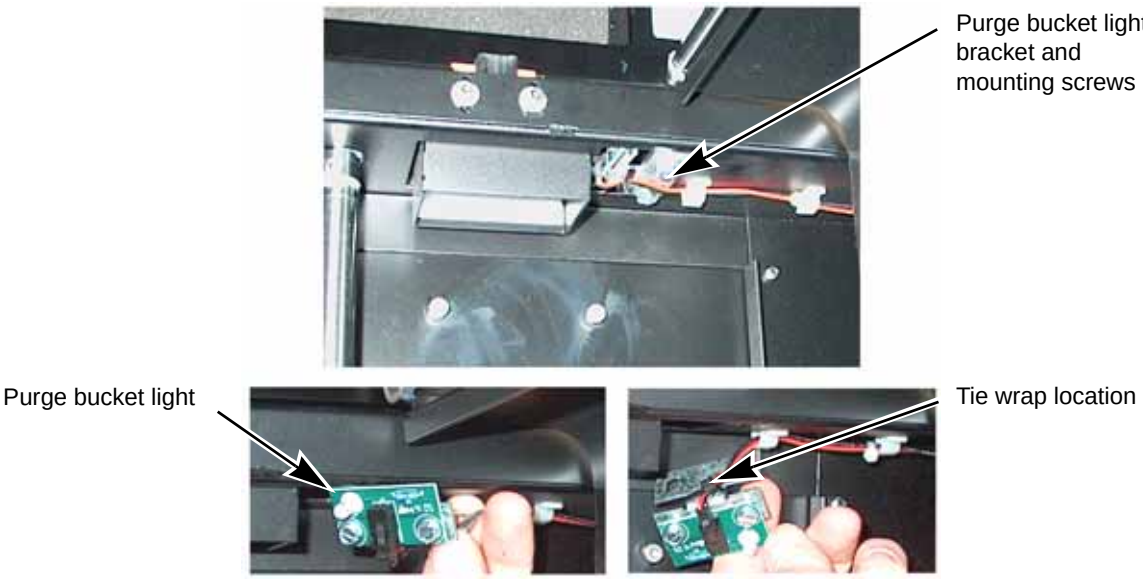


Figure 74: Purge Bucket Light

Installing Purge Bucket Light

Figure 74

1. Mount the Purge Bucket Light card to the bracket - install and tighten the 2 mounting screws.
2. Attach the electrical lead to the Purge Bucket Light card.
3. Tie wrap the electrical lead to the small neck of the bracket.
4. Install the bracket - center the light in the opening - install and tighten the 2 mounting screws.
5. Install the Purge Bucket.

Z Stage Motor and Motor Belt

Required Tools

- Allen wrench set
- 5/16” box wrench

Removing Z Stage Motor & Motor Belt

1. Locate the Z stage motor (Figure 75).
2. Remove the four motor mounting screws using a 9/64” Allen wrench and remove the motor.
3. Remove the motor belt from the pulley.

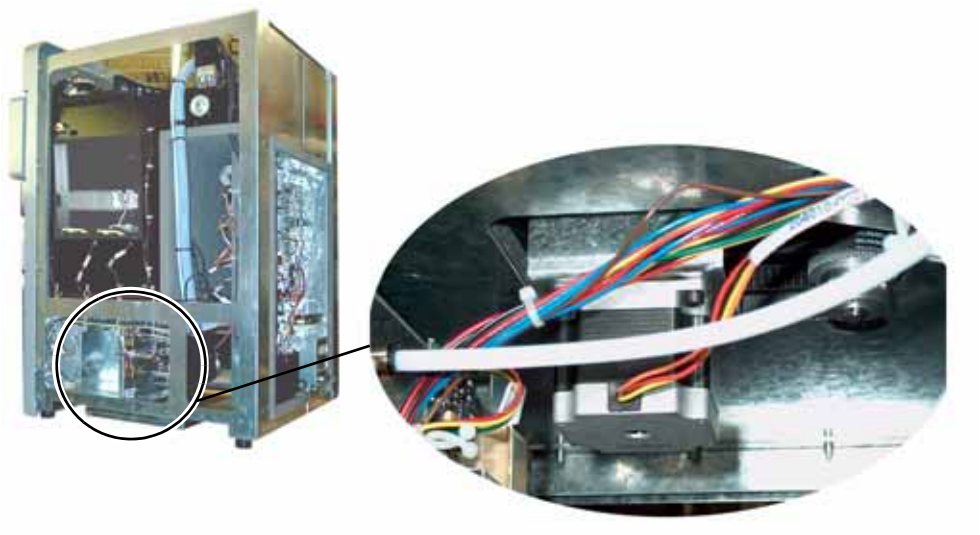


Figure 75: Z Stage Motor Location

Installing Z-Stage Motor & Motor Belt

1. Position the motor in the mounting bracket while looping the belt over the motor pulley - position leads so they point to the right side of the printer.
2. Reattach the motor using the four motor screws. DO NOT tighten the screws at this time.
3. Pull the motor away from the drive pulley to tension the belt.
4. Tighten the four screws and check that the belt is tight.

Z Stage Assembly

Required Tools

- Basic service tools
- Allen wrench Set
- Nut driver set
- Leveling spacer - the BST 1200/SST 1200 side of the Spacer is 0.441” thick.

Removing the Z Stage Assembly

1. Move the Z stage to the middle of its travel.
2. Remove the Z motor and bracket with a 5/16 nut driver (remove as an assembly).
3. Remove the Z drive belt from the pulley.
4. Loosen the 2 smaller setscrews on the lead screw pulley with a 5/64 allen wrench. If necessary loosen the larger setscrew (7/64 allen wrench). Slide the pulley off the lead screw shaft.

Note: The larger screw (7/64 allen) is used as a guide pin during installation of the screw pulley. It fits into the slot on the screw shaft.

5. Remove the two 2 lower guide rod mounting screws with a 5/16 nut driver (Figure 76).

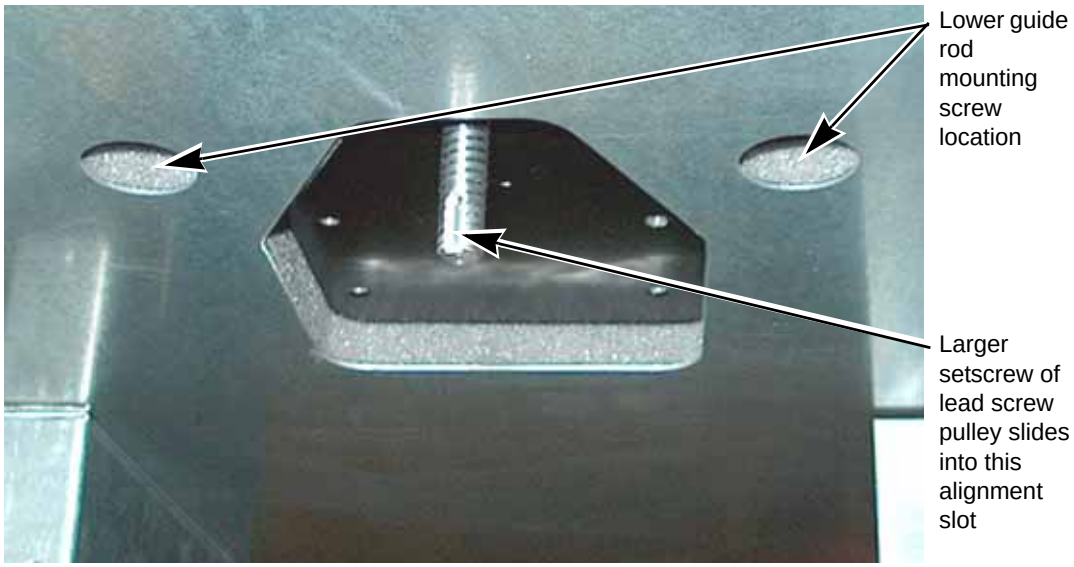


Figure 76: Lower guide rod mounting screw location

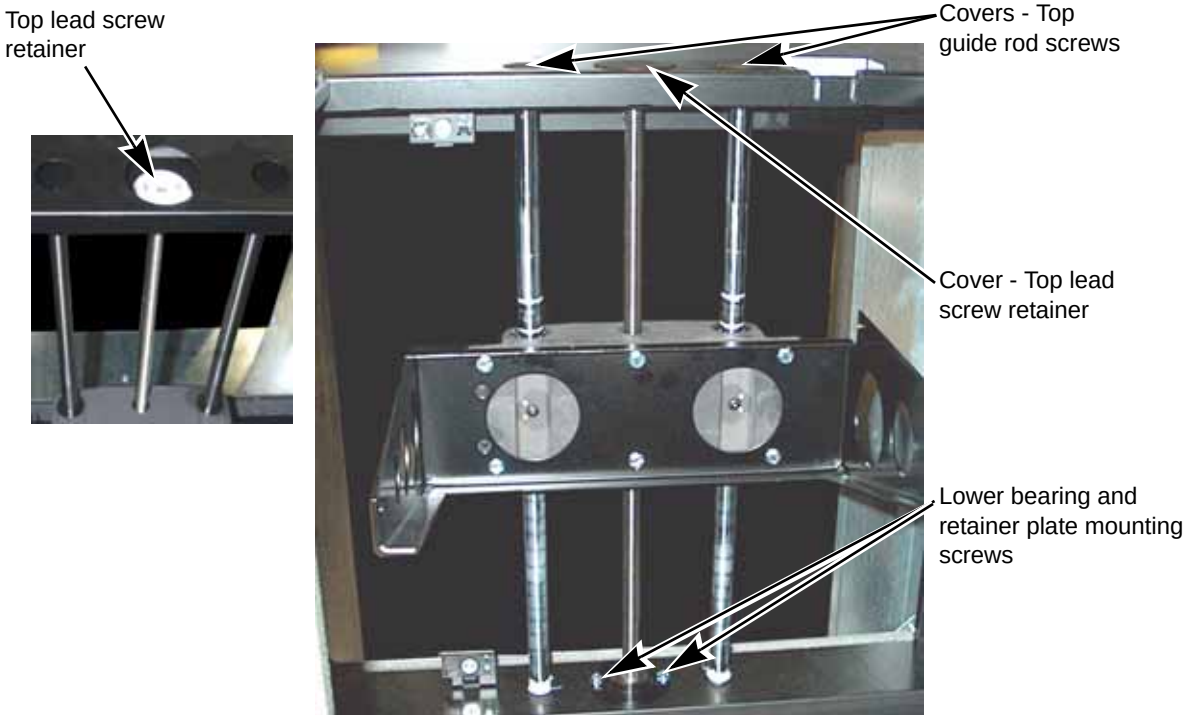


Figure 77: Lower guide rod mounting screw location (Z-Table removed for clarity)

6. Remove the 2 lower lead screw bearing and retainer plate mounting screws with a 5/16 nut driver (Figure 77).
7. Remove the upper guide rod and lead screw covers (Figure 77).
8. Remove the top guide rod screws with a 5/16 nut driver (Figure 77).
9. Remove the lead screw retainer nuts with a 3/8 nut driver (Figure 77).
10. Remove the top lead screw retainer.

11. Lift the z stage assembly until the leadscrew clears the bottom of the envelope. Grasp the guide rods and carefully remove the assembly from the printer.

Installing the Z Stage Assembly

1. Carefully remove the new Z Stage assembly from the shipping package.

CAUTION: Do not remove cardboard inserts from housing until guide rods are inserted.

2. Set the assembly on a flat surface and remove retaining straps - sort the package contents.
3. Place the lower bearing and bearing retainer plate into position at rear of envelope.
4. Tighten the 2 lower bearing plate screws.
5. Install the lead screw by threading it into the leadscrew nut.
6. Continue threading the leadscrew into the nut until the z stage is positioned about midway through its travel.
7. Slide the two guide rods into their housing bearings.

Note: To prevent balls from falling out of bearings, use the guide rods to push out the cardboard inserts as the rods are installed .

8. Carefully slide the z stage assembly into its position within the build envelope.
   - Hold the guide rods while supporting the z stage.
   - Lower the leadscrew into its bearing.
9. Place lead screw retainer on the top of the lead screw.
10. Install the upper lead screw retainer nuts until they come in contact with the lead screw retainer. DO NOT tighten at this time.
11. Install the upper and lower guide rod retainer screws but DO NOT tighten them.
12. Tighten only the left upper and lower guide screws. The right guide rod mounting holes are slotted to allow the guide rod to self-align.
13. Move the Z stage down a few inches from the bottom. Tighten the lower right guide rod screw.
14. Move the Z stage to the top end of travel. Tighten the upper right guide rod screw.
15. Tighten the upper lead screw nuts.

CAUTION: Make sure Z stage is at top end of travel before tightening lead screw pulley set screws.

16. Reinstall the Z lead screw pulley. Align the large set screw with groove in bottom of lead screw (Figure 76). Push the pulley upwards to its end of travel. Tighten all 3 set screws.
17. Install the Z drive belt over the Z lead screw pulley.
18. Install the Z motor and bracket assembly, but DO NOT tighten the bracket screws.
19. Place the Z motor belt around the pulleys.
20. Pull back on the Z motor bracket to tension the Z belt.
21. Tighten the Z motor bracket screws.
22. Adjust the Z Stage Level (See “Adjust Z Stage Level” on page 4 - 81).

Adjust Z Stage Level

1. Remove the substrate if installed.
2. Raise the Z stage towards the top of travel.
3. Attach the head fixture bracket (with dial indicator) to the front of the head.
4. Move the head (w/indicator) toward the center of the tray.
5. Loosen the four tray mounting screws located on either side of the Z brackets.
6. Place the Leveling Spacer (0.441” side) in the left rear corner of the z stage (Figure 78) - between the support and the tray.

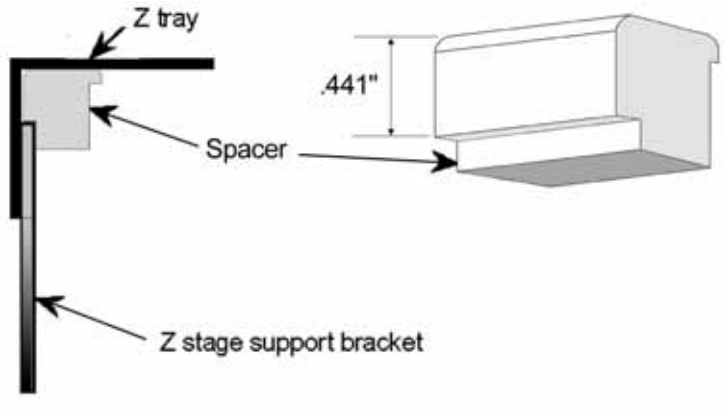


Figure 78: Checking Space Using Spacer Part

7. Slide the corner of the tray up or down until the underside of the tray is snug to the top lip of the spacer lip.
8. Snug, but do not tighten, the left, rear mounting screw. You will need some “play” in the tray to complete the leveling adjustment.
9. Move the indicator to the left rear corner of the tray (Figure 79).
10. Zero the indicator by adjusting the Z height up or down, or by rotating the dial.
11. Move the indicator to the right rear corner of the tray.
12. Slide the right corner of the tray up or down until the indicator reads zero. Snug, but do not tighten, the mounting screw.
13. Repeat steps 11 though 12 for the front two corners of the tray. See Figure 79 for indicator placement locations.
14. Move the head to the back left rear corner of the Z tray.
15. Zero the indicator by adjusting the Z height up or down, or by rotating the dial.
16. Move the indicator (head) to the other three corners. See Figure 79 and record the height at each location.
17. Verify that the indicator readings in all three locations are within a total tolerance band of 0.003" (+/- 0.0015). If the tray is still out of level, you must readjust the tray. Repeat steps 18 though 20 until the tray is within specification.
18. Once the tray is level, tighten all four tray mounting screws.
19. Remove the spacer and the head fixture bracket.
20. Power on the system.
21. Run Z Calibration (See “Z Calibration” on page 5 - 2).
22. Run a test part to ensure that find Z is working correctly.

Check Z Stage Level

Figure 79

1. Attach the head fixture bracket (with dial indicator attached) to the front of the head.
2. Move the head to the rear left corner of the Z tray.
3. Raise the Z platen up to meet the tip of the dial indicator by manually turning the Z lead screw.
4. Continue moving the Z platen up approximately ½" once the platen contacts the indicator tip. Adjust the head location if necessary.
5. Zero the indicator by adjusting the Z height up or down, or by rotating the dial.
6. Move the indicator (head) to the remaining three corners and record the height at each location.
7. Verify that all indicator readings fall within a total tolerance band of 0.003" between the highest and the lowest readings. If this tolerance is not met, the tray level must be adjusted.

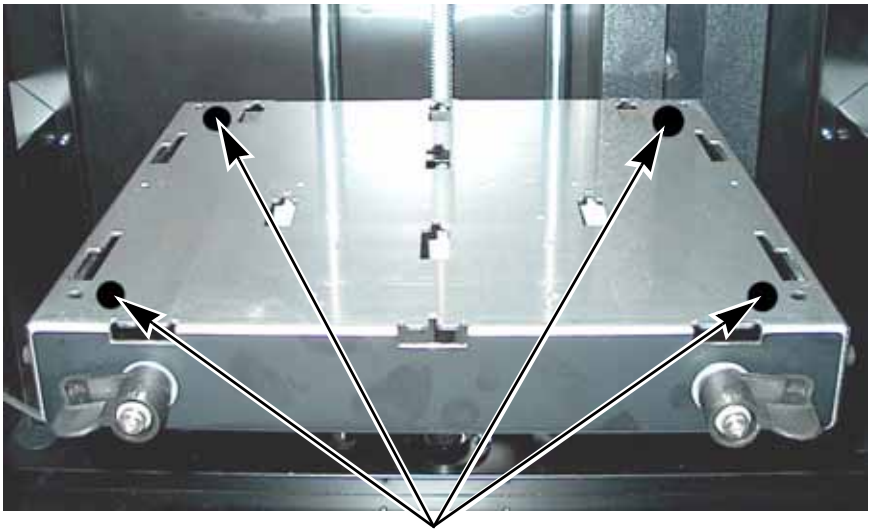


Figure 79: Check Points for Leveling Z tray

Receiver Components

Receiver Back Panel Assembly

Required Tools

Set of basic service tools

Remove Receiver Back Panel Assembly

1. Disconnect the receiver electrical cable J7 from the PDB. Feed through the rear of the electronics bay - note routing for re-installation.
2. Disconnect both filament tubes from the receiver by pushing in on the black ring and pulling back on the tube.
3. Remove the 3 receiver assembly mounting screws using a 5/16” nut driver (Figure 80).
4. Slide the receiver assembly out the side of the printer.

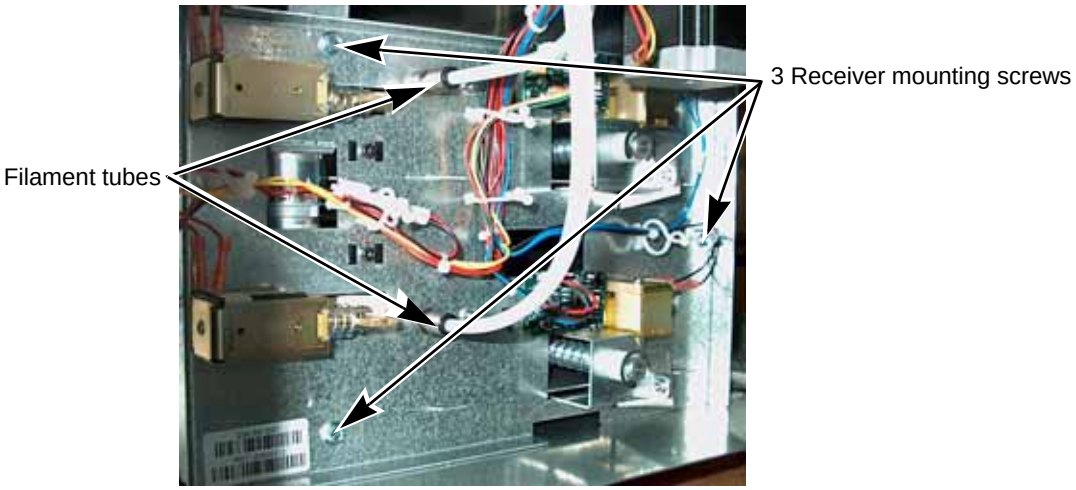


Figure 80: Receiver Mounting Screws

Install Receiver Back Panel Assembly

5. Slide the assembly into place through the side of the system.
6. Install and tighten the 3 mounting screws.
7. Reconnect the 2 filament tubes.
8. Feed the end of the receiver electrical cable through the rear of the electronics bay and connect the cable to J7 of the PDB.
9. Power on the system and test motors and solenoids using Maraca. You can view the motors through the side of the printer.

Receiver Cable

Required Tools

Set of basic service tools

Removing the Receiver Electrical Cable

1. Locate the receiver cable and record all connector locations and wire colors; wires are color coded (Figure 81).
2. Unplug the filament drive motor, model and support solenoids, model and support latch solenoids and the model and support card reader connectors (Figure 81).
3. Unplug connector J7 from the PDB.
4. Feed the cable out through the electronics bay and remove cable.

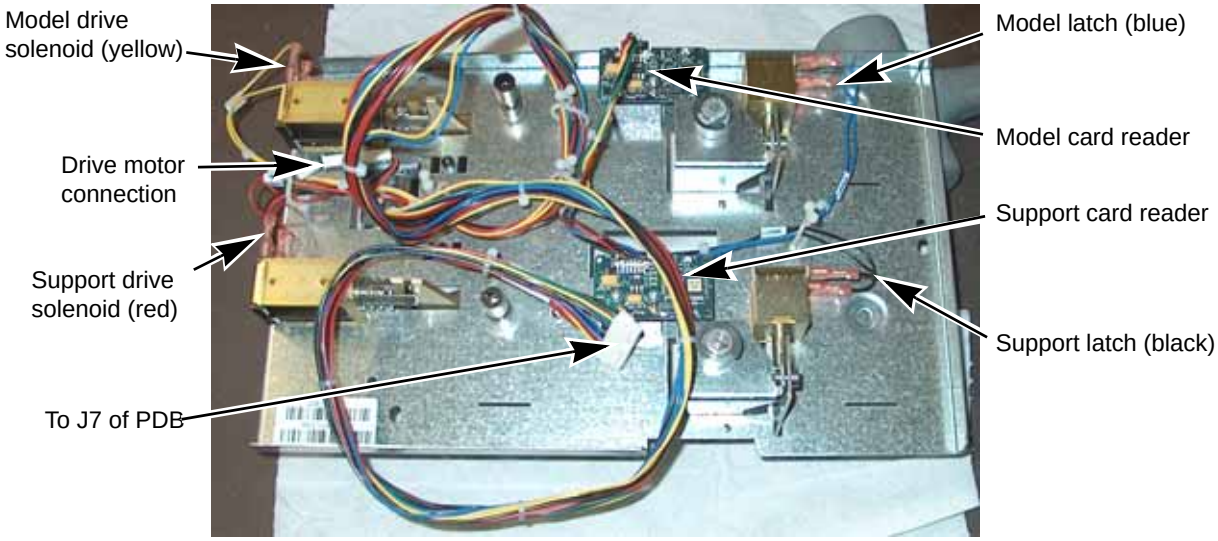


Figure 81: Cable Connection Detail

Installing the Receiver Electrical Cable

5. Attach the cable to the receiver material drive motor, model and support solenoid, model and support latch solenoid and the model and support card reader connectors (Figure 81).
6. Feed the other end of the cable through the rear of the electronics bay.
7. Connect the cable to J7 of the PDB.
8. Power on the system and test motors and solenoids using Maraca. Motor and solenoids can be viewed through the receiver opening.

Receiver Motor

Required Tools

Set of basic service tools

Removing the Receiver Motor

1. Locate the material drive motor (Figure 82).
2. Unplug the motor at the connector (Figure 81).
3. Using a 1/16” Allen wrench loosen the motor gear drive setscrew (Figure 82).
4. Slide the motor gear up and off the motor shaft.
5. Remove the 3 motor mounting screws using a 3/32” Allen wrench (Figure 82).
6. Remove the motor by sliding it sideways from the mounting bracket.

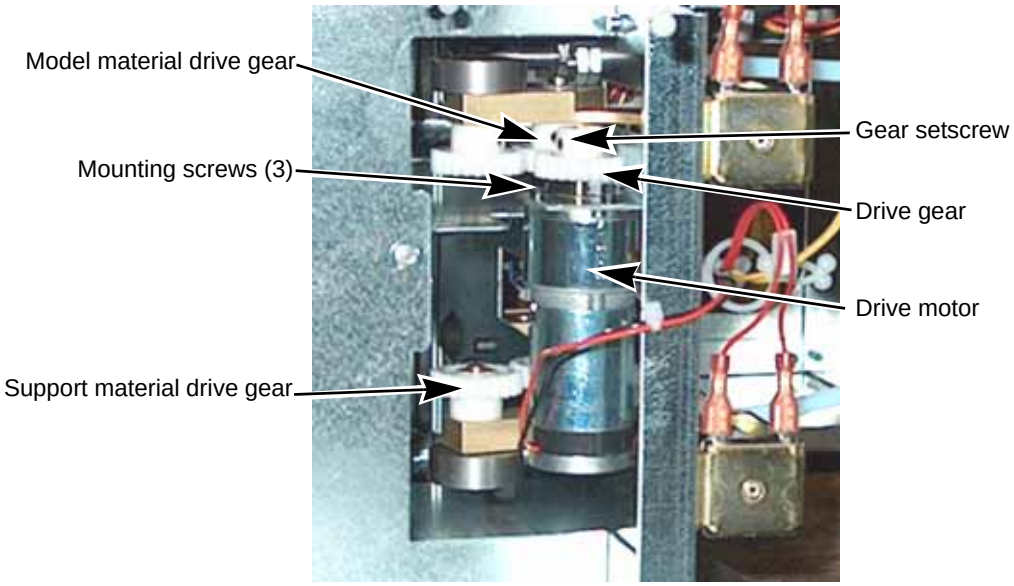


Figure 82: Material Drive Detail

Installing the Receiver Motor

1. Place the motor in position and secure using the three motor mounting screws.
2. Slide the motor gear onto the motor shaft. Make sure that the gear set screw is aligned with the flat spot on the motor shaft when installing.
3. Align the motor drive gear teeth with the model material drive gear teeth and tighten the setscrew.
4. Reconnect the motor connector.
5. Power on the system and test motor using Maraca. Motor operation can be viewed through the receiver opening.

Receiver Drive

Required Tools

Set of basic service tools

Removing the Receiver Drive

1. Unload material.
2. Locate the receiver drive assembly. The drive assembly includes both model and support material drive gears (Figure 82).
3. Using a 1/16” Allen wrench loosen the motor gear drive set screw (Figure 82).
4. Slide the motor gear up and off the motor shaft.
5. Remove the two drive assembly mounting screws (Figure 83).
6. Slide the assembly towards the front of the receiver and remove.

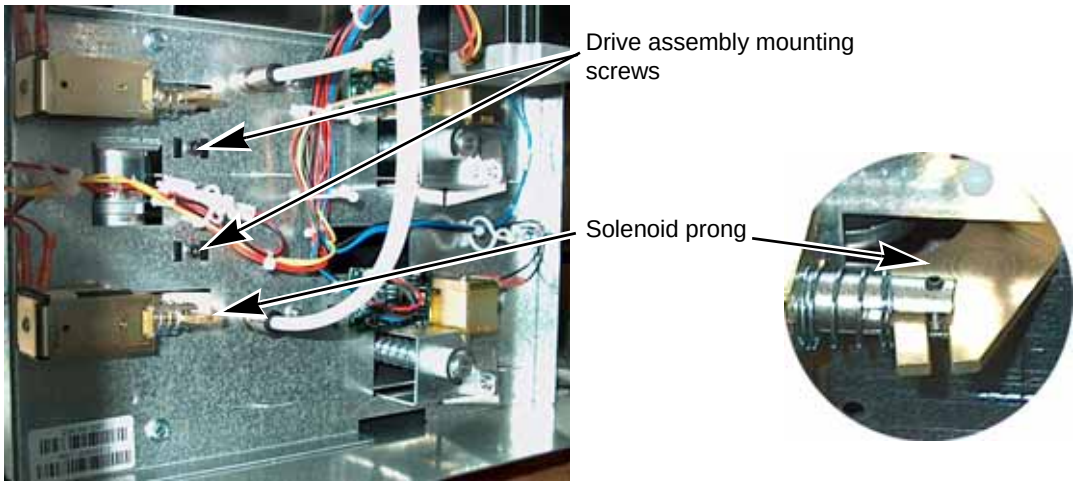


Figure 83: Drive Assembly Mounting Screw Location

Installing the Receiver Drive

1. Slide the assembly into the receiver making sure the two prongs of the assembly are inserted into the solenoid rods. The solenoid springs may need to be pushed towards the solenoid before the prongs can be inserted.
2. Attach the drive assembly using the 2 mounting screws.
3. Slide the motor gear onto the motor shaft. Ensure that the gear set screw is aligned with the flat spot on the motor shaft when installing.
4. Align the motor drive gear teeth with the model material drive gear teeth and tighten the setscrew.
5. Power on the system and test motors and solenoids using Maraca. Motor and solenoids can be viewed through the receiver opening.

Receiver Card

Required Tools

Set of basic service tools

Removing the Receiver Card

1. Locate the cassette card reader (model or support) (Figure 81).
2. Disconnect the reader card lead from the card (Figure 81).
3. Remove reader card from the rear of the receiver assembly - loosen and remove the reader card mounting screw (9/64” Allen wrench) (Figure 84).

Installing the Receiver Card

1. Slide the reader card into position and secure with mounting screw.
2. Connect the reader card electrical lead to the card.

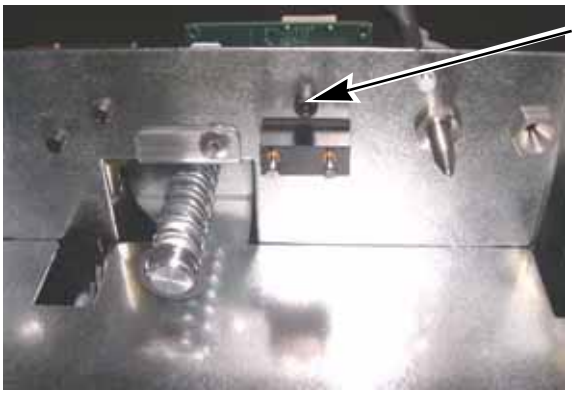


Figure 84: Receiver Card Mount Screw

Misc. Field Replaceable Units

Tip Wipe Brush/Flicker

Required Tools

Allen wrench set

Replacing the Tip Wipe Brush/Flicker

(Refer to Figure 86).

Note: ***The flicker should be replaced after 500 hours. It is only necessary to replace the brush after 2000 hours.***

3. Remove the purge container.
4. Remove plastic head cover by squeezing raised pads on sides of cover (Figure 23).
5. Replace the Tip Cleaning Assembly.
   A. Remove the old flicker. - loosen the flicker attachment (rear) screws and pull up on the flicker.

Note: **You may need lower the brush to access the flicker screws. Loosen the brush mounting screws to lower the brush**

   B. Insert the new flicker and tighten the rear screws while gently pushing down on the flicker.The flicker should seat firmly in its channel.
   C. Remove the old tip cleaning brush by loosening the two mounting screws. Pull up on the brush to remove it.
   D. Install the new tip cleaning brush, but do not tighten the mounting screws.
6. Adjust the Brush height.
   A. Push the Tip Toggle Bar to the left. This makes the Model (Right Tip) the ‘active’ tip (Figure 85).

Figure 85: Position Tip Toggle Bar for Adjustment of Cleaning Brush

   B. **Method One** for adjusting the Brush Height:

   (1). Move the Head by hand so that the Model Tip is directly over the Brush.

(2). With the mounting screws loose, adjust the Brush so that the top of the Brush touches the bottom of the Tip Shroud (Figure 86).

(3). Tighten the two mounting screws. Make sure that the Brush assembly does not shift while the screws are being tightened. The Brush must be parallel with the Fixture surface.

C. **Method Two** for adjusting the Brush Height - For more consistent Brush height adjustments, build the **`tool_brush_fix`** (**`Maintenance > Test Parts`**, press **`Next`** until **`tool_brush_fix`** is displayed) and perform the following, optional adjustment procedure:

(1). With the mounting screws loose, lower the Brush.

(2). Snap the Brush Adjustment Fixture onto the Model Tip Shroud (orient the cut-out to the rear of the system).

(3). Move the Head by hand so that the Model Tip is directly over the Brush.

(4). Push the Brush assembly up so that it presses firmly against the Fixture.

(5). Tighten the two mounting screws. Make sure that the Brush assembly does not tilt while the screws are being tightened. The Brush must be parallel with the Fixture surface.

(6). Remove the fixture.

D. Move the Head by hand while observing the Tip-to-Brush relationship across the entire Brush. It should be the same for the entire length of the Brush. Re-adjust if necessary.

E. Push the Tip Toggle Bar to the right - making the Support (Left Tip) the active tip.

F. Verify that the Support Tip Shroud touches the brush. If not, raise the brush until it contacts the Support Tip.

G. Tighten the brush mounting screws.

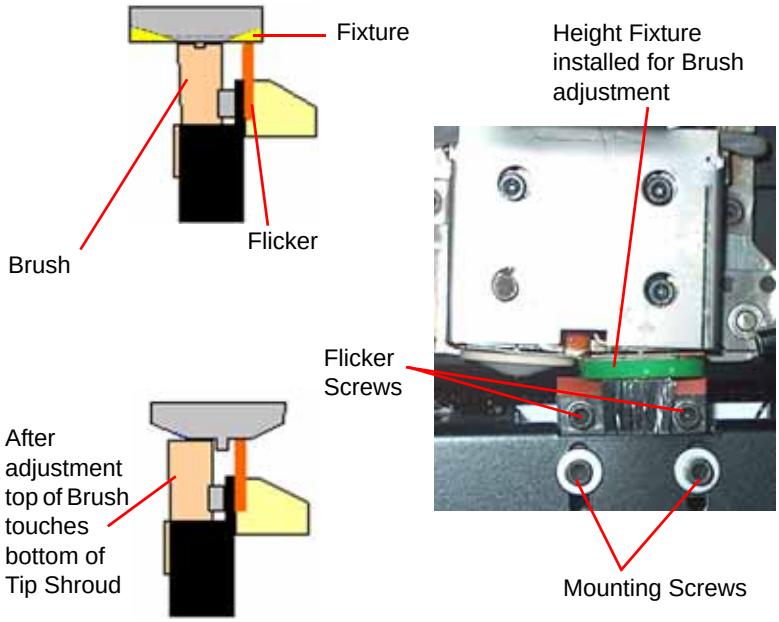


Figure 86: Replacing the tip cleaning brush

Maintenance Wrap-Up

Post-Maintenance Procedures

1. Complete applicable Check Lists (See “Checklists” on page 9 - 1).
2. Plug in the AC power cord, RJ-45 network cables, and the UPS cable (if used) at the rear of the printer.
3. Turn the circuit breaker on
4. Power up the system using the power switch.
   - The replacement of the Controller Board or the Disk Drive will require a download of the latest backend software.
   - Make sure the envelope temperature reaches operating temperature in the appropriate time.
   - The system should reach **`Idle`** with no displayed errors.
5. If the Z-Motor was replaced, use the User Interface Panel to enter **`Table Maintenance`**. Move the Z Stage up and down several inches to confirm proper operation.
6. If a Receiver Card was replaced, install a **new** material cartridge to verify proper operation of the card.
7. Run a small test part and monitor system operation during build.
8. Install the Side Panels (See “Installing the Side Panels” on page 4 - 5).
9. Install the Rear Panel (See “Installing the Rear Panel” on page 4 - 4).

Chapter 5
Calibrations & Adjustments

Chapter Overview

This chapter guides you through various calibration and adjustment procedures. For Maraca instructions, *see* See “Maraca Help” on page 6 - 5. The contents and page numbers of this chapter are as follows:

Offset Calibrations 2
Adjusting Z Calibration and XY Tip Offset 2
Z Calibration 2
XY Calibration 2
Part Based Calibration 3
When to Perform Part Based Calibration 3
Procedure 3
Part Measurement Equations 6
Tensioning the Y Motor Belt 7
Y Motor Belt 7
Tensioning the X & Y Drive Belts 8
Zero the Dial Indicator 8
Checking/Adjusting the X-Drive Belt Tension 8
Checking/Adjusting the Y-Drive Belt Tension 10
Get/Send Calibration Files 13
Procedure 13
“Send” .cal file – from the system calibration floppy to the printer 13
“Get” .cal file – from the system hard drive to the calibration floppy 13
XY Table Leveling 14
Checking the XY Table Level 14
Adjusting the XY Table Level 15
Z Tray Leveling 16
Check Z Stage Level 16
Adjust Z Stage Level 17
Set Z Stage Spacing 17
Adjusting the Tray Level 19
Aligning Z Stage Lead Screw 20

Offset Calibrations

Adjusting Z Calibration and XY Tip Offset

Z Calibration and Tip Offset calibration is required if the tips are replaced. If Tip Replacement is chosen from the Interface Panel (**`Maintenance>Tip Maintenance>Replace`**), you will be prompted to perform the calibrations as a part of the replacement procedure.

Z Calibration and Tip Offset calibration can also be run without performing a Tip Replacement. From **`Idle`**, choose **`Maintenance`**, then **`Next.`** After warm-up, choose **`Tip Maint,`** then **`Calibrate Z`** or **`Calibrate XY.`**

Z Calibration

Select **`Start Part -`** the printer will automatically build a Z Calibration part, measure the part and calibrate the Z Axis for tip depth and tip level (approximately 5 minutes).

XY Calibration

Select **`Start Part -`** the printer will then automatically build an XY Calibration part (approximately 10 minutes). You must inspect the XY Calibration part and calibrate the X and Y axes for tip offset:

1. When the XY Calibration part is complete the printer will display **`Remove Part and Select XY Adjustment - X:0, Y:0`**
2. Remove the XY tip calibration part from the Dimension printer.
3. Inspect the part and calibrate the X and Y axes (See Figure 1).
   A. Use the magnifier from the Startup Kit to view the support road.
   B. Identify the location on the +X **or** –X side of the part where the support road is best centered within the model boundaries.
   C. Read the number closest to this location. This is the required X Tip Offset adjustment, in mils. If the number is on the -X side, a negative offset is required.
   D. Select **`Increment`** or **`Decrement`** to input the X offset adjustment - the value will change in the upper display window (by default, the printer will be ready to accept the X value).
   E. When you are satisfied with your X offset value, **`Select Y`** and repeat the procedure to identify and input the required Y Tip Offset adjustment.
4. Select **`Done`** after you have input the X and Y offsets. The printer will return to **`Maintenance`**.

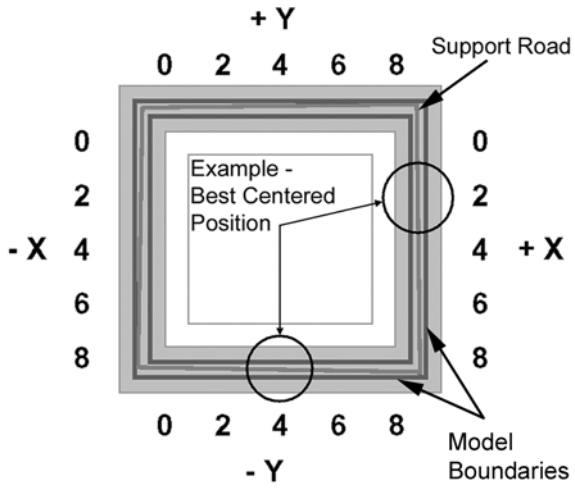


Figure 1: Example XY Tip Offset Part.
This example requires an adjustment of X = + 2 mils, Y = - 4 mils

Part Based Calibration

Required Tools

- Set of basic service tools
- 6” digital calipers
- Maraca CD

Part based calibration consists of building a part and then taking six measurements - front, right, left, rear, left rear and left front. Figure 5. These measurements are then entered using Maraca.

When to Perform Part Based Calibration

Part Based Calibration needs to be performed ONLY after replacing the table assembly, Y drive belt, Y drive assembly or the Y pulley.

Procedure

1. Start Maraca and select the Current Modeler from the pull down menu.
2. Open the Gantry Calibration Dialog box in Maraca
3. Set the X adjust value to 0.
4. In the Part Calibration section, there are six boxes: LEFT, RIGHT, FRONT, REAR, LEFT FRONT and LEFT REAR. Set these values to 0.
5. Click on the green check mark and toggle the power down switch.
6. From the modeler test parts menu run the “test_XY_cal” part.
7. When part is completed, remove from printer and let cool for ten minutes. Keep the part on the foam or substrate.

8. Locate the filled circle, this indicates the front of foam or substrate (Figure 2).

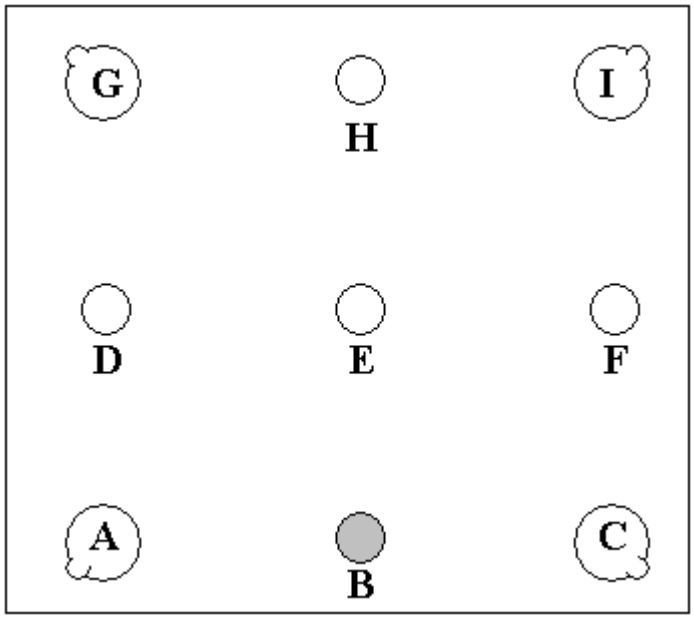


Figure 2: Locating the Filled Circle (B)

9. Using a digital caliper, measure and record the diameter of circle B along the center line between A and C (Figure 2) (Figure 3).

Note: Reference letters are not actually "printed" on the part.

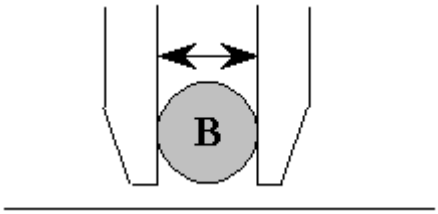


Figure 3: Measuring Diameter of B

10. Next measure and record the distance from the outside edges of circle A and B (Figure 2) (Figure 4). Ensure that the caliper is *not* seated on the small bump of circle A.

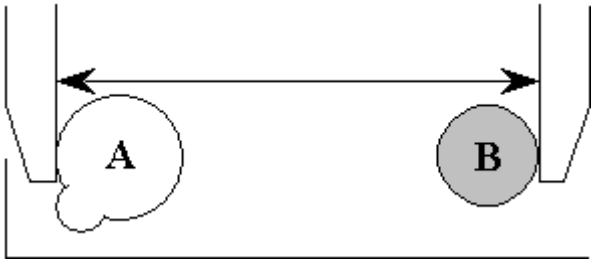


Figure 4: Measuring Distance from Outside Edges of B & A

11. Next measure and record the distance from the outside edges of circle B and C (Figure 2) (Figure 5). Ensure that the caliper is not seated on the small bump of circle C.

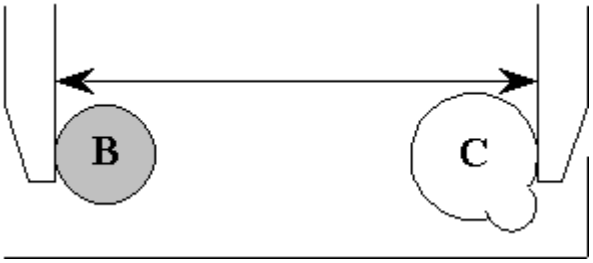


Figure 5: Measuring Distance from Outside Edges of B & C

12. Add the lengths derived from steps 5 and 6 (A-B and B-C) and then subtract the width of circle B (from step 4). Record this total as “Front”
13. Repeat steps 9 through 12 for the three remaining sides (Rear, Right and Left) (Figure 6). Record these values.

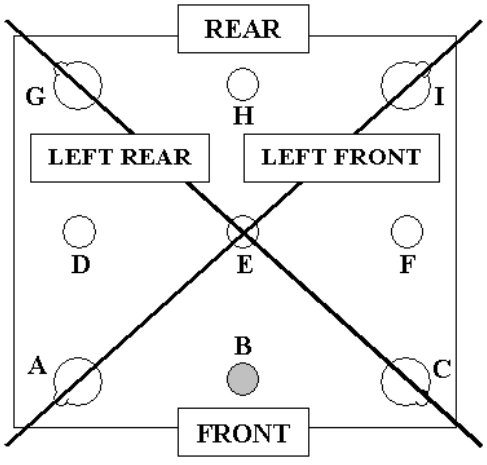


Figure 6: Repeat Steps 9-12 for All Circles

14. Next measure the width of the center circle (Figure 7). Take the measurement at the same diagonal as the centerline measurement to be taken (e.g. left rear).

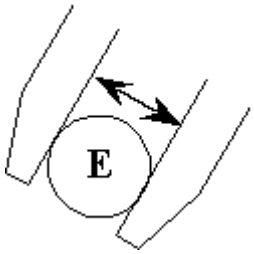


Figure 7: Measuring Width of Center Circle (E)

15. Next measure and record the distance from the outside edges of circle E and C as shown. Ensure that the caliper *is* seated on the small bump of circle C (Figure 2) (Figure 6) (Figure 8).

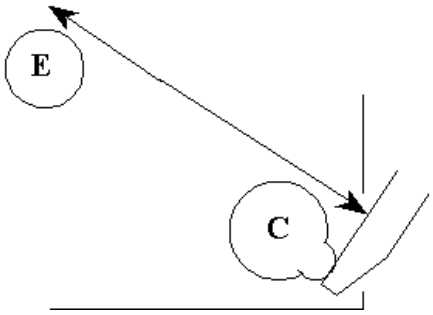


Figure 8: Measuring Distance Between Outside Edges of E & C

16. Next measure and record the distance from the outside edges of circle E and G. Ensure that the caliper *is* seated on the small bump of circle G (Figure 2) (Figure 6).
17. Add the lengths derived from steps 15 and 16 (C-E and E-G) and then subtract the width of circle E (from step 14). Record this total as “Left Rear”.
18. Repeat steps 14 through 17 for “Left Front” (E, A-E, E-I) (Figure 6). Record this value.
19. Start Maraca and select the Current Modeler from the pull down menu.
20. Open the Gantry Calibration Dialog box in Maraca.
21. In the Part Calibration section, there are six boxes: LEFT, RIGHT, FRONT, REAR, LEFT FRONT and LEFT REAR. Enter the measurements in the appropriate box.
22. Once the values have been entered, click on the green check mark.
23. Toggle the red power down switch to accept the new values.
24. Run the hysteresis test and change value if necessary.
25. Run a test part to verify system is operating correctly.

Part Measurement Equations

Use the equations below to record part measurements. Refer to these equations when entering values in Maraca.

Front: $\frac{\_\_\_\_\_}{(A + B)} + \frac{\_\_\_\_\_}{(B + C)} - \frac{\_\_\_\_}{B} = \_\_\_\_\_$

Right: $\frac{\_\_\_\_\_}{(C + F)} + \frac{\_\_\_\_\_}{(F + I)} - \frac{\_\_\_\_}{F} = \_\_\_\_\_$

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

Tensioning the Y Motor Belt

Y Motor Belt

1. Verify that the screws on the motor are loose so the Y motor can slide back and forth.
2. Place the Y motor belt tension fixture in-between the pulleys (Figure 9). Ensure the fixture is not on the flange of the pulleys.
3. Tighten the three Y motor mounting screws.
4. Remove belt tension fixture.

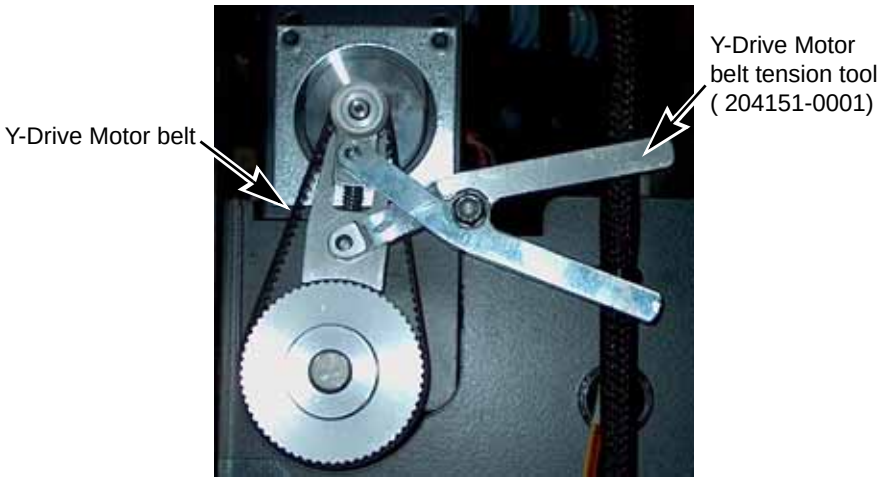


Figure 9: Y-Drive Motor Belt and Tensioning Tool

Tensioning the X & Y Drive Belts

CAUTION: The X & Y Drive Belt Tension must be checked and adjusted with the system and belts at room temperature.

Zero the Dial Indicator

(Figure 10)

1. Insert the zero gauge block into the gauge.
2. Loosen the adjustment screw and slide the dial indicator assembly up or down to set the 'zero' reading:
   - With old gauge: The big hand should be on 0 and the little hand on .2.7.
   - With new gauge: The big hand should be on 0 and the little hand on 5.
3. Tighten the adjustment screw - recheck the reading.
4. Remove the zero block gauge block from the fixture.

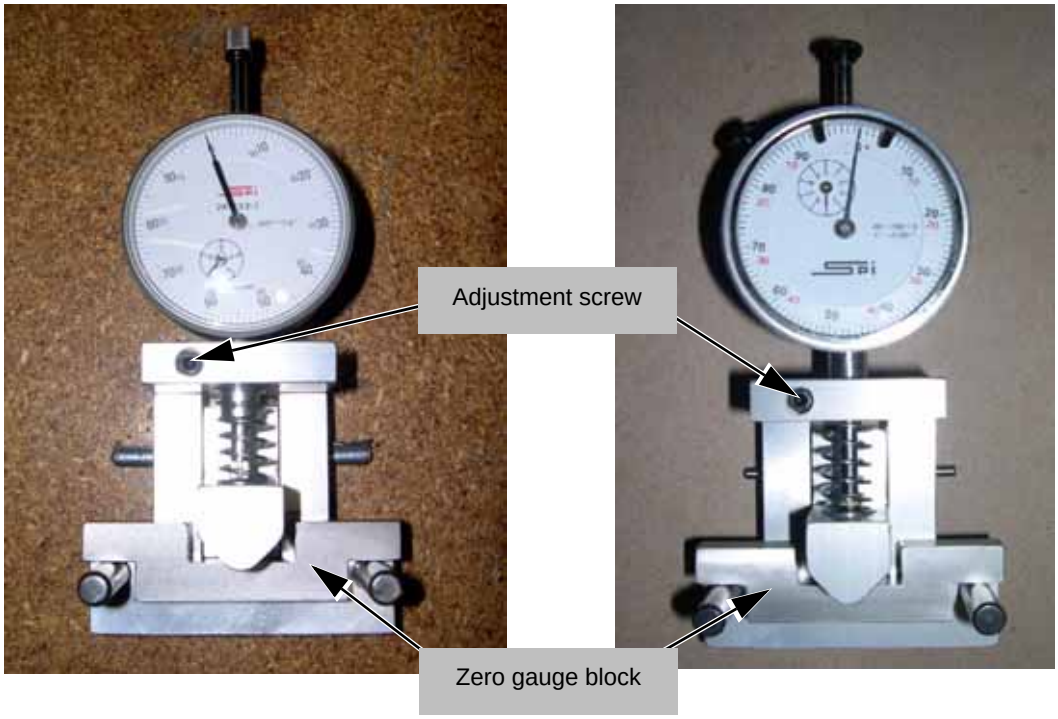
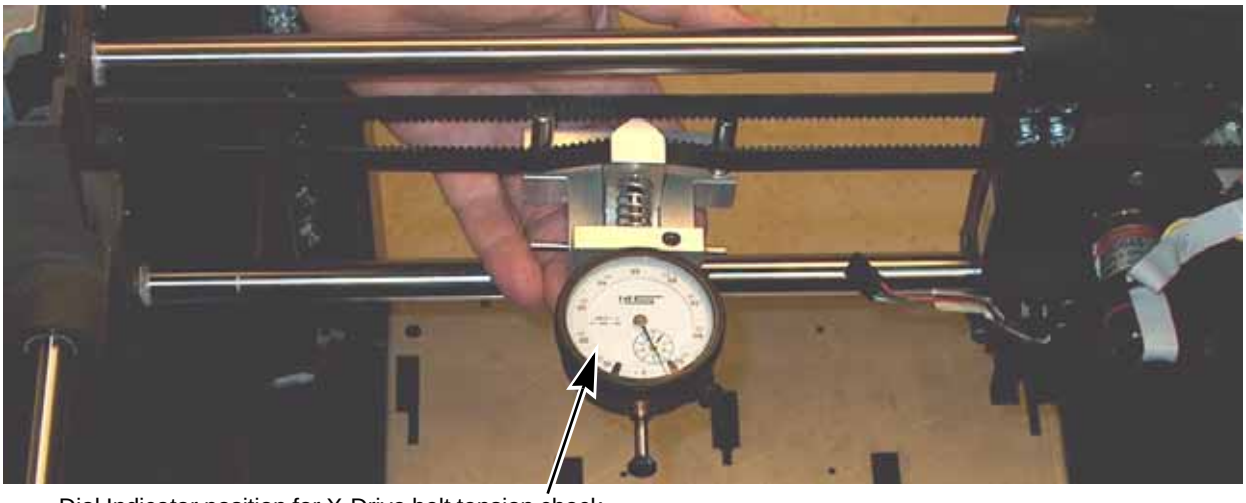


Figure 10: Tension gauge zero setting

Checking/Adjusting the X-Drive Belt Tension

1. Move the Head Assembly to full left travel within the build envelope (as viewed from the front of the printer).
2. Position the dial indicator on the rear section of the X-Drive belt - centered between the Head Assembly and the right side of the build envelope. (Figure 11)



Dial Indicator position for X-Drive belt tension check. Head assembly to left (if viewed from the front of printer - this picture view is from the rear).

Figure 11: X-Drive Belt Tension Check

3. Check the tension: (Figure 12)

   Old gauge: The big hand on the gauge should read between 20 and 30 mils, and the small hand should be at the .1.6 position.

   New gauge: The big hand on the gauge should read between 30 and 40 mils, and the small hand should read between 4 and 5.

Old dial indicator

New dial indicator

Figure 12: Gauge reading at correct belt tension (Shading indicates acceptable range)

4. If the tension is out of the range specified above, adjust the belt tension with the X belt tensioning nut on the X-Drive Idler/Tension Adjust gear. (Figure 13)

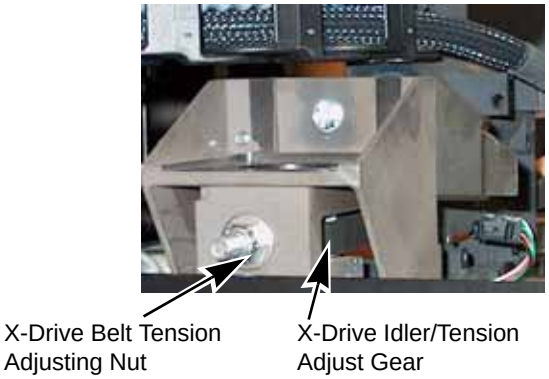


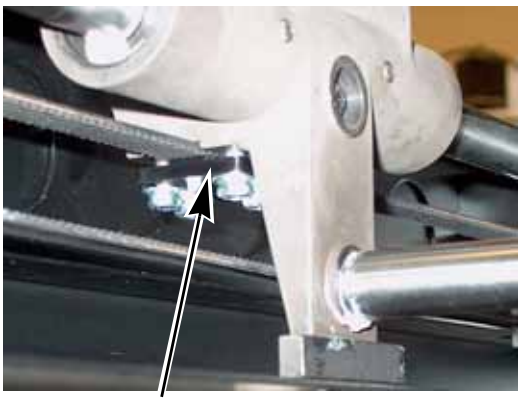
Figure 13: X-Drive Belt Tension Adjustment

5. Remove the belt fixture and run the head back and forth several times.
6. Re-attach the belt tension gauge and adjust tension if necessary.

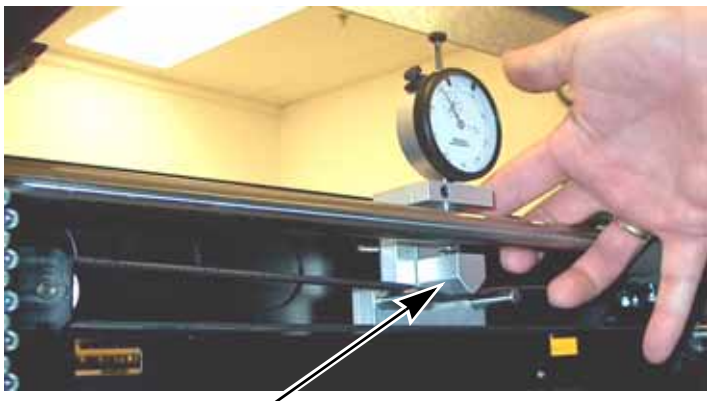
Checking/Adjusting the Y-Drive Belt Tension

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

1. Move the Head Assembly to full rear travel within the build envelope (as viewed from the front of the printer).
2. Position the dial indicator on the top section of the Y-Drive belt - centered between the Head Assembly and the front side of the build envelope. (Figure 14)



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



Dial Indicator position for Y-Drive belt tension check. Head assembly to rear (if viewed from the front of printer).

Figure 14: Y-Drive Belt Tension Check

3. Check the tension:

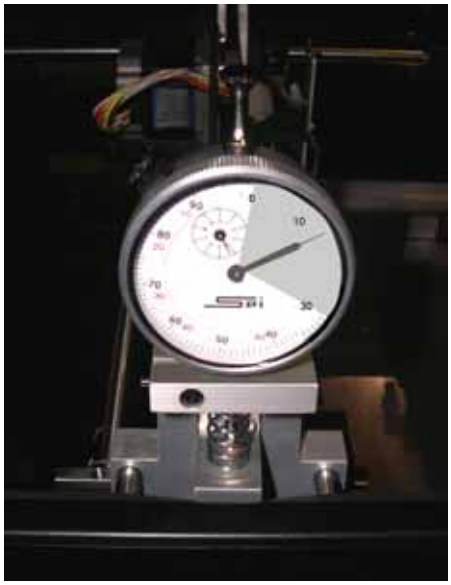
   Old gauge: The big hand on the gauge should read between 90 and 20 mils (inclusive), and the small hand should be at the .1.6 position (Figure 15)

   New gauge: The big hand on the gauge should read between 0 and 30 mils (inclusive), and the small hand should read between 4 and 5 (Figure 16).

Service LImit

Adjustment LImit

Figure 15: Old Gauge Readings



Service LImit

Adjustment LImit

Figure 16: New Gauge Readings

4. If the tension is not within the limit, loosen the 4 Y-Drive Belt clamp screws (Figure 14), and increase the tension so that the dial indicator reads between 0 and 10 (old gauge) or 10 and 20 (new gauge). Adjust the tension with the nut on theY-Drive tension adjustment. The Y-Drive tension adjustment is behind the front bezel. To gain access to the adjustment See “Removing the Front Bezel (Panel)” on page 4 - 9. (Figure 17)

Note: ***It is not necessary to completely remove the Bezel. It only needs to be tilted forward far enough to allow access to the adjustments. However, if working alone, it is recommended that the bezel be removed.***

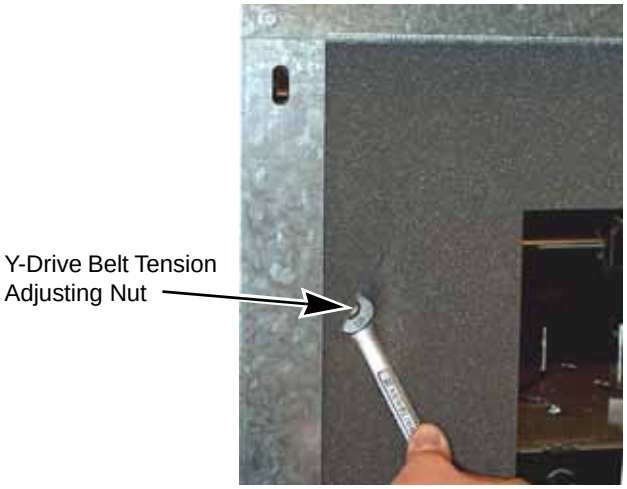


Figure 17: Y-Drive Belt Tension Adjustment

5. Remove the belt fixture, tighten the 4 Y-Drive Belt clamp screws (Figure 14), and move the head forward and back across the gantry several times.
6. Reattach the belt tension gauge and recheck th etension. If the tension is not between 0 and 10 (old gauge) or 10 and 20 (new gauge), loosen the 4 Y-Drive Belt clamp screws and re-adjust tension.
7. Continue to adjust and check the tension until the tension meets the adjustment limits.
   - Always loosen the belt clamp to adjust tension.
   - Recheck tension after tightening the clamp and moving the head forward an back across the gantry several times.

Get/Send Calibration Files

The “Get” button copies the .cal file from the system hard drive to the system calibration floppy. The “Send” copies the .cal file from the system calibration floppy (located in the electronics bay of the system) to the system hard drive.

Important

- Do not use spaces in the .cal prefix name.
- Once the system is upgraded and anytime calibration changes are made the .cal file should be written (“Get”) from the system hard drive to the system floppy. The floppy should then be returned to the electronics bay.
- The .cal file includes all of the most recent system calibration values.

Parts and Tools Required

- Maraca
- Workstation

Procedure

“Send” .cal file – from the system calibration floppy to the printer

Note: This would typically be used after installation of a new hard drive.

1. Remove the system calibration floppy from the electronics bay and insert into the workstation floppy drive.
2. Install and open Maraca. Ensure that communications has been established with the system.
3. Select “Send” and browse to the floppy drive.
4. Select the xxx.cal (where xxx equals printer name) from the floppy by double clicking on the file name.
5. To complete sending the file, hit the green check mark. This will write the file to the system hard drive.
6. Cycle power on the printer.
7. Replace the floppy into the electronics bay.

“Get” .cal file – from the system hard drive to the calibration floppy

Note: This would typically be used after changing calibration values or if the .cal file has not been stored on the floppy.

1. Remove the system calibration floppy from the electronics bay and insert it into the workstation floppy drive.
2. Install and open Maraca. Ensure that communication has been established with the system.
3. Select “Get” and browse to the floppy drive.
4. Select “Save” and the file will be written to the floppy.
   Spaces are not allowed in the printer name.
5. Replace the floppy back into the electronics bay.

XY Table Leveling

Checking the XY Table Level

1. Remove the substrate from the Z Stage.
2. Mark a place on each corner of the platen surface with a permanent marker (Figure 18).

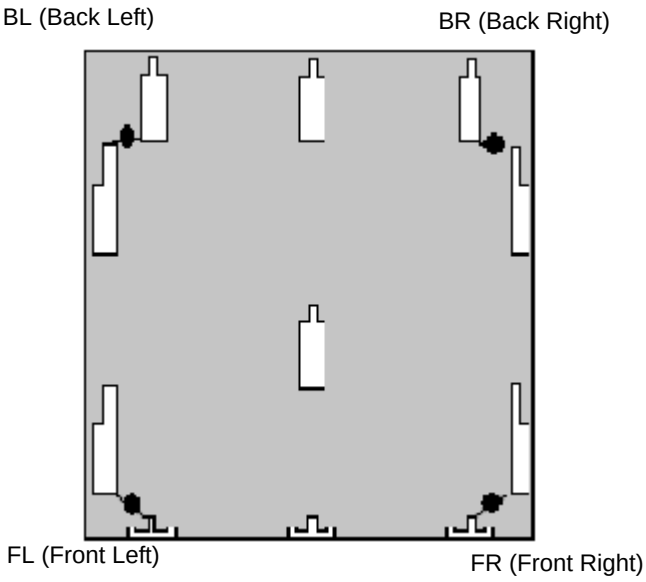


Figure 18: Modeling Base Indicator Points

3. Attach a dial indicator and fixture to the head.
4. Move the dial indicator to the back right corner on the marked location.
5. Raise the Z Stage until it contacts the dial indicator. Continue to raise the Z stage an additional two revolutions of the dial indicator.
6. Zero the dial indicator (this is the reference position and will always be zero).
7. Move the XY table to the front right corner (Figure 18) and measure and record the difference (e.g. the dial indicator reads -0.004 in.)
8. Move the dial indicator to the front left corner (Figure 18) and measure and record the difference (e.g. the dial indicator reads +0.010).
9. Move to the back left corner (Figure 18) and measure and record the difference (e.g. the dial indicator reads +0.008 in).
10. Insert the Maraca CD in a workstation and open the *XY Level Calc.xls* file.
11. Input the FR, FL and BL values you measured in the Indicator Reading boxes of the spreadsheet.

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

Table 1 : Sample XY Level Calc

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

12. The spreadsheet will calculate the required adjustment for each corner, and display them in the Knob Adjust Column.

Adjusting the XY Table Level

1. Move the indicator to the BR position and verify it is zero.

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

2. Move to the FR position.
3. Zero the dial indicator.
4. Loosen the XY frame screw and the cam adjuster lock screw on the FR corner (Figure 19).
5. Turn the adjuster cam until the dial indicator reading matches the calculated value from the spreadsheet (e.g. 0.014) Table 1.

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

6. Tighten the cam lock screw and the frame screw on the FR corner.
7. Move the dial indicator to the FL corner.
8. Zero the dial indicator.
9. Loosen the frame and cam lock screws on the FL corner.
10. Turn the adjuster cam until the dial indicator reading matches the calculated value from the spreadsheet (e.g. -0.013).
11. Tighten the cam lock screw and the frame screw on the FL corner.
12. Move the dial indicator to the BL corner.
13. Zero the Dial indicator.
14. Loosen the frame and cam lock screws on the BL corner.
15. Turn the adjuster cam until the dial indicator reading matches the calculated value from the spreadsheet (e.g. -0.001).
16. Tighten the cam lock screw and the frame screw on the FL corner.
17. Recheck the four corners again. The maximum difference allowed between the highest and lowest readings is .003 in.

18. Repeat the Measure Level Condition and Adjust XY Table sections until the measurements are within specification.

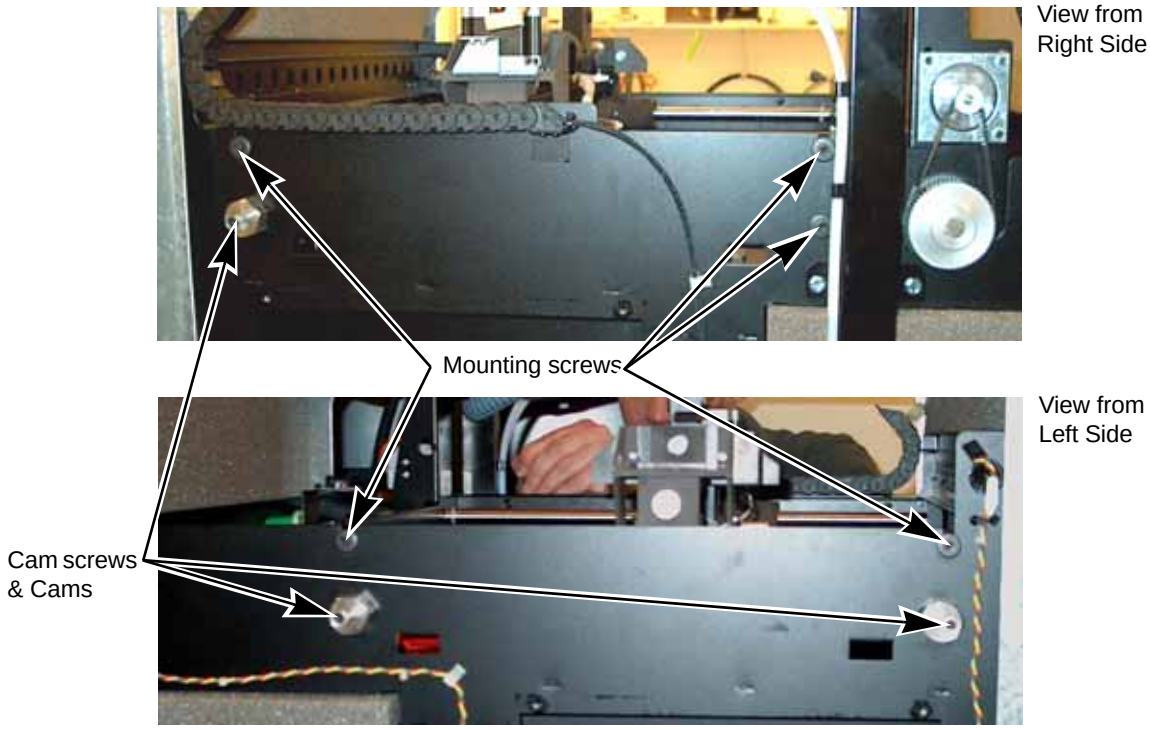


Figure 19: XY Table Cam and Retaining Screws

Z Tray Leveling

Objective

To inform resellers, distributors, and customer service personnel how to level the Z tray.

Note: ***This procedure assumes that the XY Table is correctly installed and the Z-stage is out of adjustment. This procedure should not be performed as part of an XY Table replacement.***

At the factory, the Z-stage is initially squared using a fixture. The XY Table is then installed and leveled to the Z-stage. Do not attempt to level the Z-Stage if the XY Table level is suspected of being out of adjustment.

Parts and Tools Required

- Spacer gauge
- “T” head fixture with dial indicator
- Allen wrench set

Check Z Stage Level

Figure 20

1. Attach the head fixture bracket (with dial indicator attached) to the front of the head.

2. Move the head to the rear left corner of the Z tray.
3. Raise the Z platen up to meet the tip of the dial indicator by manually turning the Z lead screw.
4. Continue moving the Z platen up approximately ½" once the platen contacts the indicator tip. Adjust the head location if necessary.
5. Zero the indicator by adjusting the Z height up or down, or by rotating the dial.

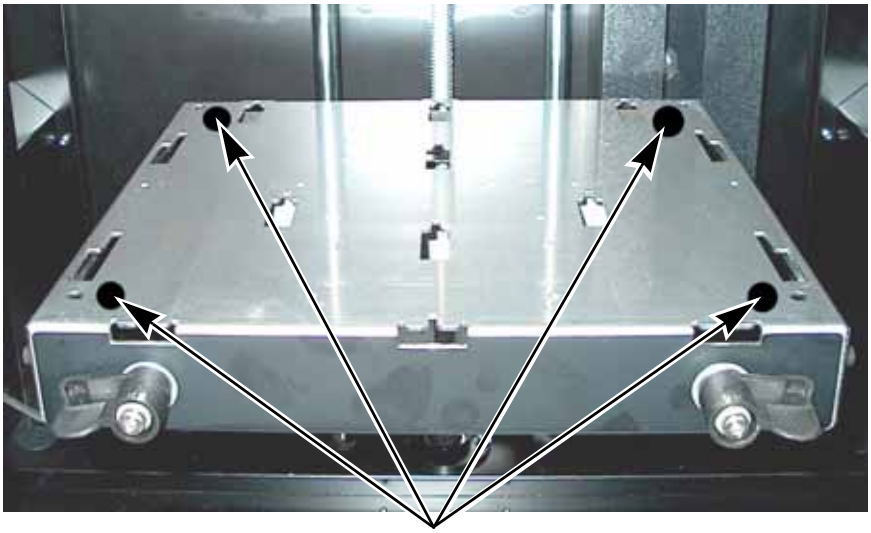


Figure 20: Check Points for Leveling Z tray

6. Move the indicator (head) to the remaining three corners and record the height at each location.
7. Verify that all indicator readings fall within a total tolerance band of 0.005" between the highest and the lowest readings. If this tolerance is not met, the tray level must be adjusted.

Adjust Z Stage Level

Set Z Stage Spacing

1. Remove the substrate.
2. Raise the Z stage towards the top of travel.
3. Check spacing using a caliper or by using the Spacer Part.

Set Spacing Using a Caliper

1. Using a caliper, measure the distance the between the bracket and the underside of the Z tray (Figure 21). Adjust the tray to meet the space requirement for all corners.

2. Spacing should be 0.441” ± 0.030”

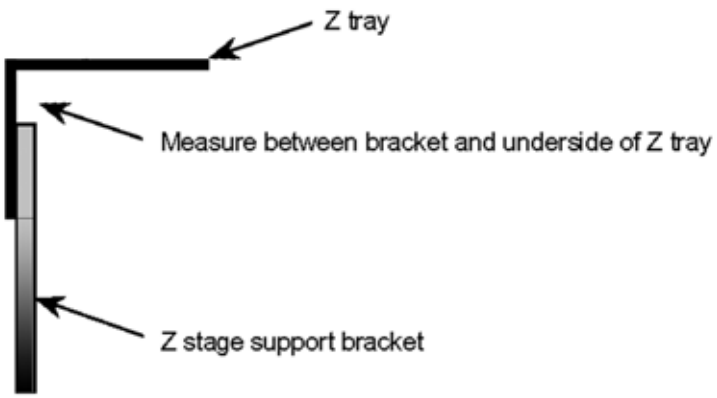


Figure 21: Measure the distance between bracket and underside of Z tray

Set Spacing Using the Spacer Part

1. Build the Spacer part - the BST 1200/SST 1200 side of the Spacer is 0.441” thick.
2. Place the Spacer in one of the Z Stage corners - between the support and the tray. Adjust the tray so that it rests on the spacer. Repeat for remaining corners
3. Recheck the spacing at each corner - adjust as necessary.
4. Remove the Spacer and Level the tray.

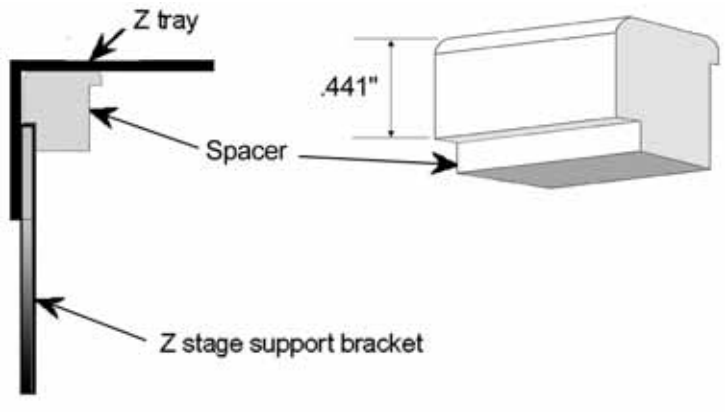


Figure 22: Checking Space Using Spacer Part

Adjusting the Tray Level

1. Move the indicator (head) toward the center of the tray.
2. Loosen the four tray mounting screws located on either side of the Z brackets.
3. Position the spacer “SET” lip at the left rear corner (Figure 22).
4. Slide the corner of the tray up or down until the underside of the tray is snug to the top lip of the spacer lip.
5. Snug, but do not tighten, the mounting screw. You will need some “play” in the tray to complete the leveling adjustment.
6. Move the indicator to the left rear corner of the tray (Figure 20).
7. Zero the indicator by adjusting the Z height up or down, or by rotating the dial.
8. Move the indicator to the right rear corner of the tray.
9. Slide the right corner of the tray up or down until the indicator reads zero. Snug, but do not tighten, the mounting screw.
10. Repeat steps 8 though 9 for the front two corners of the tray. See Figure 20 for indicator placement locations.
11. Move the head to the back left rear corner of the Z tray.
12. Zero the indicator by adjusting the Z height up or down, or by rotating the dial.
13. Move the indicator (head) to the other three corners. See Figure 20 and record the height at each location.
14. Verify that the indicator readings in all three locations are within a total tolerance band of 0.003" (+/- 0.0015). If the tray is still out of level, you must readjust the tray. Repeat steps 18 though 20 until the tray is within specification.
15. Once the tray is level, tighten all four tray mounting screws.
16. Remove the spacer and the head fixture bracket.
17. Power on the system.
18. Run Z Calibration (See “Z Calibration” on page 5 - 2).
19. Run a test part to ensure that find Z is working correctly.

Aligning Z Stage Lead Screw

1. Using the keypad, go to Table Maintenance and move the Z stage to the middle.
2. Power off the system and remove the left side panel.
3. Loosen the lower bearing plate screws.

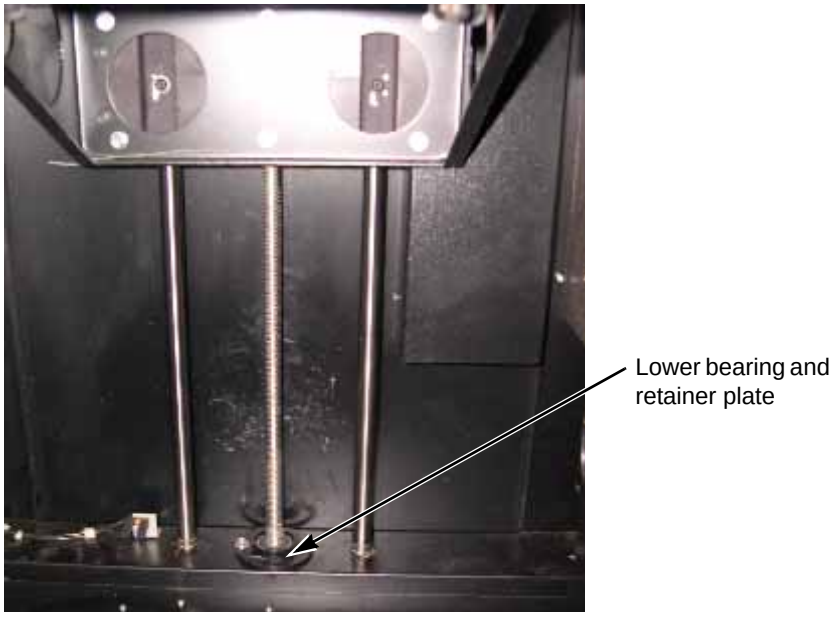


Figure 23: Lower bearing and retainer plate

4. Loosen the Z motor screws.
5. Pull back on the Z motor to loosely tension the Z belt. Leave just enough tension belt to engage the Z axis pulley, which allows the Z stage to move up and down. If the belt teeth slip, slightly increase the belt tension. You will re-tension the belt in a later step as over-tensioning at this time will misalign the lead screw.
6. Tighten the Z motor screws.
7. Replace both side panels, but do not attach the screws.
8. Power up the system until it reaches idle.
9. Using the keypad, go to Table Maintenance and move the Z stage assembly to the top, bottom, and then to the middle.
10. Tighten the two (2) lower bearing plate screws. Ensure you do not move the plate.
11. Remove one side panel and re-tension the motor by loosening the motor mounting screws and pulling away from the lead screw pulley. Tighten the screws.
12. Replace the other side panel and secure both with screws.
13. Ensure that Z stage is running smoothly by moving it up and down several times.

Chapter 6
Software

Chapter Overview

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

Software Architecture 2
- Operating System 2
- Display Driver 2
- Comm Server 2
- System Manager 3
- Move Compiler 3
- Feeder 3
- Event/Command Monitor 3

DataStat 3

CatalystEX Help 4
- CatalystEX Overview 4
  - Conventional Help File 4
  - Dynamic Help 4

Maraca Help 5
- Overview 5
- Select a Modeler 5
- Modeler States 5
- Modeler Setup 5
- Configuration 6
- Printer Status 6
  - Position and Temperatures 6
  - Versions 7
  - Travel Limits 7
  - Filament 7
  - Door 7
  - Setting the Serial Number 7

Materials 8
- Cartridge Information 8

Tip Offset and Liquefier Calibration (not applicable for 1200) 8

Adjusting Z Clearance (not applicable for 1200) 8

Adjusting XY Tip Offset 8

Adjusting Tip Depth on Plastic Substrate (not applicable for 1200) 8

Gantry 8
- Part Based Calibration 8

Temperatures 8
- Temperature Limits 9

Outputs 9

Table Calibration (not applicable for 1200) 9

Get Calibration 9

Send Calibration 10

Get Configuration 10

Test Parts 10

Reset Password 10

Software Architecture

(Fig. 1) 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.

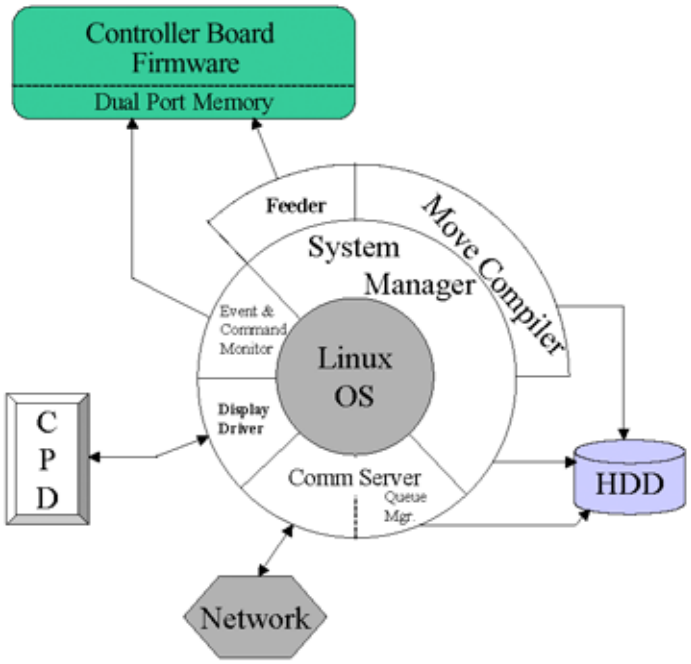


Figure 1: Software Architecture Diagram

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.

DataStat

Overview

To inform resellers, distributors and customer support of DataStat’s release and its uses. DataStat is a “condensed” version of Maraca. 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 tip depth into foam (Z offset).

Using DataStat allows you to:

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

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

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

Parts and Tools Required

- Controller CD
- Workstation

Procedure

1. Insert the controller CD into workstation.
2. Select the CD drive and open the *datastat* folder.
3. Select *setup.exe*.
4. Follow the install steps displayed to load the program on the workstation.
5. Open DataStat from Start – Programs pull down.
6. Select the “+” button and enter the system name, type and IP address. Do not enter leading 0’s in the IP address.
7. Select the green arrow to close the window.
8. Select the “connect to modeler” (two blue arrows) button to establish communications to the system.
9. Information is now shown in the State, Internal State, and Home State windows of DataStat.
10. From this point the customer can open any of the button options.

CatalystEX Help

CatalystEX Overview

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

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

Conventional Help File

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

Dynamic Help

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

Maraca Help

Overview

Maraca is a program used for printer 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 printer non-functional.

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

- Select a Modeler
- Modeler States
- Modeler Setup
- Maraca Configuration
- Show Printer 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 Maraca. 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 printer:

State	The current printer state as reported to Catalyst 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 Maraca 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. Maraca will now display numerical values in the units you chose.

Printer Status

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

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

Position and Temperatures

Current Position	The current X, Y and Z position in micro steps. X and Y = 16000 micro-steps per inch. Z = 128000 micro-steps 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
Current Vertex	The current vertex number of the model.
Head Temp	The actual head temperature and its set point in C.
Head PWM	The pulse width modulation value 0 = off / 255 = 100%
Support Temp	The support liquefier temperature and its set point (SST only)
Support PWM	The pulse width modulation value 0 = off / 255 = 100%
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 Controller Board software
PLD Version	The current version of the programmable logic devices on the Controller Board.
Product serial number	The serial number of the complete system.

Travel Limits

If the box is checked the switch is tripped.

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 printer. 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 printer. 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

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 printer.
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 and Liquefier Calibration (not applicable for 1200)

Adjusting Z Clearance (not applicable for 1200)

Adjusting XY Tip Offset

See “Offset Calibrations” on page 5-2.

Adjusting Tip Depth on Plastic Substrate (not applicable for 1200)

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.

“Y Lash” (not applicable for 1200)

“X Adjust” (not applicable for 1200)

“Part Based Calibration”

Part Based Calibration

See “Part Based Calibration” on page 5-3.

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 Limits

Temperature	Min.	Max
Head	89.5	333
Support	89.5	333
Chamber	40	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 Calibration (not applicable for 1200)

Get Calibration

The Get Calibration button allows a single calibration file to be retrieved from any printer with a build number greater than or equal to 1132. This calibration file will also be on the system calibration floppy 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 printer 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 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 printer.

Get 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. Maraca will now display numerical values in the units you chose.

Test Parts

Test Parts consists of downloading sample and test part files to the printer. The files must be in the .cmb.gz format produced by Catalyst.

The Test Part dialog allows you to browse for and select the sample or test file and to download it to the printer. 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 Maraca first loads, Maraca will only try to connect one time. This allows you to interact with Maraca when it is not connected to a printer. The Connect button allows you to request additional connection attempts.

Chapter 7
Preventive Maintenance

Chapter Overview

In this chapter you will learn preventive maintenance procedures. Follow the simple procedures to ensure continued proper operation of the system. The contents and page numbers of this chapter are as follows:

Startup Kit Tools **2**

After Each Build **2**
Empty Purge Container 2
500 Hour Maintenance **3**
Clean Fan Filter 3
To clean the fan filter: 3
Tip Cleaning Assembly (Brush/Flicker Assembly) 3
2000 Hour Maintenance **5**
Axis Maintenance 5
As Needed Maintenance **6**
Remove Debris Buildup 6
Vacuum Build Chamber 6
Clean Door Glass 6
Chamber Light Bar 6
Replace chamber light bar: 6
Tip Area Clean-up 6
Tip Shroud Replacement 7
Tip Replacement 8
Tip Calibration 12

Startup Kit Tools

The Dimension Startup Kit contains replacement parts and a set of tools used to help you maintain the system. The following is a list of the tools contained in the Startup Kit.

- Needle Nose Pliers
- T-Handled Wrench - 1/8 inch
- T-Handled Wrench - 7/64 inch
- Leather Insulated Gloves (Pair)
- Putty Knife
- Cutters
- Brush (bronze)
- Magnifier

WARNING: Krytox grease can cause skin irritation. Avoid contact with skin and clothing when it is being handled.

- 2 oz. Tube Krytox Grease

After Each Build

Empty Purge Container

The black, plastic purge container is attached to the right side of the modeling envelope rear wall.

Note: A full purge container may impact part quality.

1. Remove the purge container by grasping it and pushing it upward to release it from its three mounts.
2. Pull the container towards you and out of the chamber.

CAUTION: When reinstalling the container, make sure that it locks on all three mounts and hangs flush with the chamber wall to avoid damage.

3. Empty the container and reinstall on 3 mounts.

500 Hour Maintenance

Clean Fan Filter

To clean the fan filter:

1. Locate the lower fan on the rear panel of Dimension and remove the plastic frame (snaps on and off) that secures the fan filter.
2. Clean the filter with soap and water, and blot it dry.
3. Reassemble.

Tip Cleaning Assembly (Brush/Flicker Assembly)

Note: ***The flicker should be replaced after 500 hours. It is only necessary to replace the brush after 2000 hours.***

1. Completely power down Dimension.
2. Remove the purge container.
3. Remove plastic head cover by squeezing raised pads on sides of cover (Figure 1).

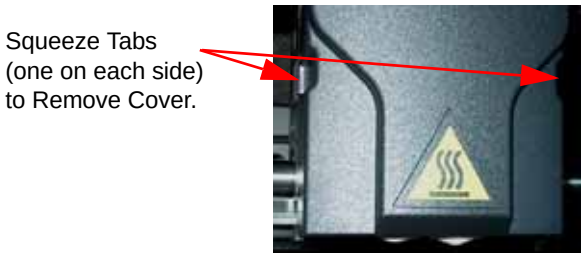


Figure 1: Removing the Head Cover

4. Replace the Tip Cleaning Assembly.
   A. Remove the old flicker. - loosen the flicker attachment (rear) screws and pull up on the flicker.

Note: **You may need lower the brush to access the flicker screws. Loosen the brush mounting screws to lower the brush**

   B. Insert the new flicker and tighten the rear screws while gently pushing down on the flicker.The flicker should seat firmly in its channel.
   C. Remove the old tip cleaning brush by loosening the two mounting screws. Pull up on the brush to remove it.
   D. Install the new tip cleaning brush, but do not tighten the mounting screws.
5. Adjust the Brush height.
   A. Push the Tip Toggle Bar to the left. This makes the Model (Right Tip) the ‘active’ tip (Figure 2).

Figure 2: Position Tip Toggle Bar for Adjustment of Cleaning Brush

B. **Method One** for adjusting the Brush Height:

(1). Move the Head by hand so that the Model Tip is directly over the Brush.

(2). With the mounting screws loose, adjust the Brush so that the top of the Brush touches the bottom of the Tip Shroud (Figure 3).

(3). Tighten the two mounting screws. Make sure that the Brush assembly does not shift while the screws are being tightened. The Brush must be parallel with the Fixture surface.

C. **Method Two** for adjusting the Brush Height - For more consistent Brush height adjustments, build the **`tool_brush_fix`** (**`Maintenance > Test Parts`**, press **`Next`** until **`tool_brush_fix`** is displayed) and perform the following, optional adjustment procedure:

(1). With the mounting screws loose, lower the Brush.

(2). Snap the Brush Adjustment Fixture onto the Model Tip Shroud (orient the cut-out to the rear of the system).

(3). Move the Head by hand so that the Model Tip is directly over the Brush.

(4). Push the Brush assembly up so that it presses firmly against the Fixture.

(5). Tighten the two mounting screws. Make sure that the Brush assembly does not tilt while the screws are being tightened. The Brush must be parallel with the Fixture surface.

(6). Remove the fixture.

D. Move the Head by hand while observing the Tip-to-Brush relationship across the entire Brush. It should be the same for the entire length of the Brush. Re-adjust if necessary.

E. Push the Tip Toggle Bar to the right - making the Support (Left Tip) the active tip.

F. Verify that the Support Tip Shroud touches the brush. If not, raise the brush until it contacts the Support Tip.

G. Tighten the brush mounting screws.

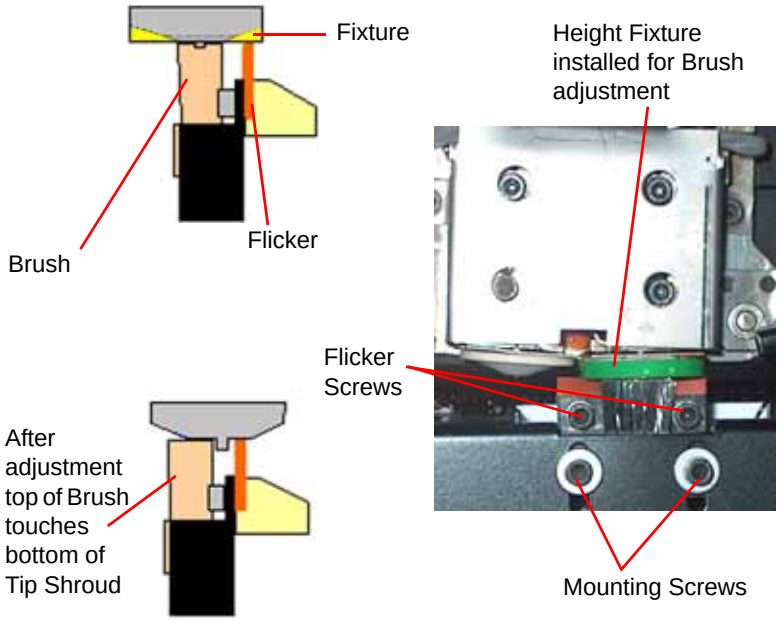


Figure 3: Replacing the tip cleaning brush

2000 Hour Maintenance

Axis Maintenance

1. Clean and lubricate the Z-axis lead screw (*drive* screw), X-axis guide rods (2), Y-axis guide rods (2), and Z-axis guide rods (2). See Figure 4 for locations.
   - Clean with isopropyl alcohol.

WARNING: Krytox grease can cause skin irritation. When it is being handled, use impervious gloves and avoid contact with skin and clothing.

   - Lubricate using the Krytox grease provided in the Startup Kit. Use the grease sparingly.

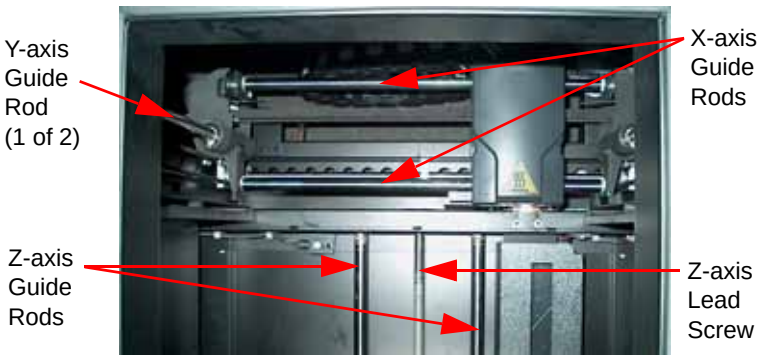


Figure 4: Lead Screw and Guide Rod Identification

As Needed Maintenance

The following maintenance items have no routine schedule but should be tended to as needed.

Remove Debris Buildup

Remove all material buildup on the Z Platform and around the lead screw (Figure 4). Failure to do so could cause the base to become unlevel or the Z Platform to jam at its upper limit.

Vacuum Build Chamber

Vacuum the build chamber to remove all foreign particles and purged material.

Clean Door Glass

The door glass can be cleaned with any commercial glass cleaner.

Chamber Light Bar

CAUTION: Use only a factory authorized replacement light bar.

Replace a chamber light bar when it burns out.

Note: There are two light bars in the modeling chamber. They are located on the front wall of the chamber - one to the right, the other to the left of the chamber door.

Replace chamber light bar:

1. Power down the system.
2. Locate the wiring harness leading away from the bottom of the light bar.
3. Disconnect the light bar from the wiring harness by squeezing the wiring harness clip while pulling down.
4. Remove the light bar by removing the 3 attachment screws (top, middle, bottom) - use the 1/8 T-handle wrench supplied in the Startup Kit.
5. Install a replacement light bar with the 3 attachment screws - do not overtighten the screws.
6. Re-attach the wiring harness lead.

Tip Area Clean-up

Material can build up on the metal strip behind the extrusion tips (Figure 5). Build up can be caused by an overflowing Purge Bucket or an improperly adjusted Tip Cleaning Assembly.

1. Enter **`Head Maintenance`** (tips must be hot to clean area).
   A. From **`Idle,`** press **`Maintenance`**.
   B. Press **`Next`**. The head will come to rest in the center of the chamber and the Z Platform will change position. Choose **`Head Maintenance`**.

WARNING: The head area is very hot!! Use leather gloves when working in this area of printer!

2. Clean the area of all material using the needle nose pliers supplied with your Start Up Kit.
3. Exit **Maintenance**.

Figure 5: Material Buildup Behind Tips

Tip Shroud Replacement

Tip shrouds can become torn or damaged over time. This can have a negative impact on the surface finish and detail of models.

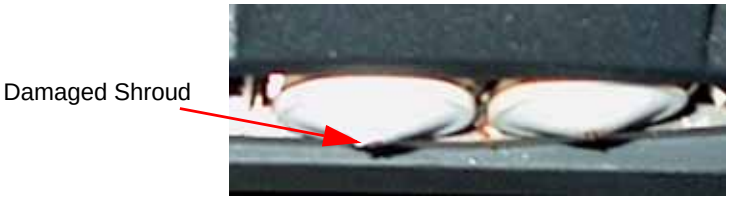


Figure 6: Tip Shroud Damage

1. Enter **Head Maintenance**.
   A. From **Idle,** press **Maintenance**.
   B. Press **Next**. The head will come to rest in the center of the chamber and the Z Platform will change position. Choose **Head Maintenance**.

WARNING: The head area is very hot!! Use leather gloves when working in this area of printer!

2. Position the blade of the putty knife supplied with Start-Up Kit between the Tip Shroud and Tip Shield (Figure 7)
3. Pry off the Tip Shroud.

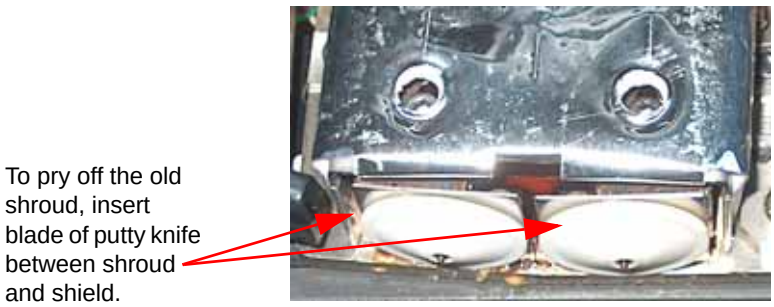


Figure 7: Tip Shroud Removal

4. Clean the tip using the wire brush supplied with the Start Up Kit to remove any debris.
5. Install a new Tip Shroud by pushing it, by hand, over the exposed tip. Make sure it is fully seated against the Tip Shield.
6. Exit **`Maintenance`**.

Tip Replacement

Tips will need to be replaced at approximately 2000 hours - depending upon operating conditions. Tips can also be damaged by improper care while performing maintenance in the area around the tips.

Note: CatalystEX displays the tip time (hrs) - from the Printer Services Tab - Printer Info button (Tip time will reset to zero after replacement).

1. Enter **`Tip Maintenance`** - **`Replace Tips`**.
   - From Idle, Select **`Maintenance`** > then **`Next`** > then **`Tip Maint > then Replace.`**
   - The printer will display **`Load Model - Unloading`**, followed by **`Tip Maintenance - Adjusting Temperature`**.
   - After the temperature has stabilized, the printer will display **`Tip Maintenance - Replace Tips`**. You can now open the printer door and replace the tips - or you can **`Cancel`** the tip replacement procedure.
2. Remove Plastic Head Cover
   - Remove plastic head cover by squeezing raised pads on sides of cover. (Figure 1)
3. Remove Liquefier Tips (Figure 8)
   A. Use 7/64 T-Handle Allen wrench to loosen the tip (heater block clamp) screws three to four full turns counterclockwise - or until the top of the screws are flush with the metal cover.
   B. Use needle nose pliers to grasp the stainless steel shield of the tip.
   C. Pull the tip shield toward you, then pull down to remove the tip. Discard the used tip.
   D. Repeat for second tip.
4. Remove the Heat Shield - loosen and remove the 2 Heat Shield retaining screws (Figure 8).

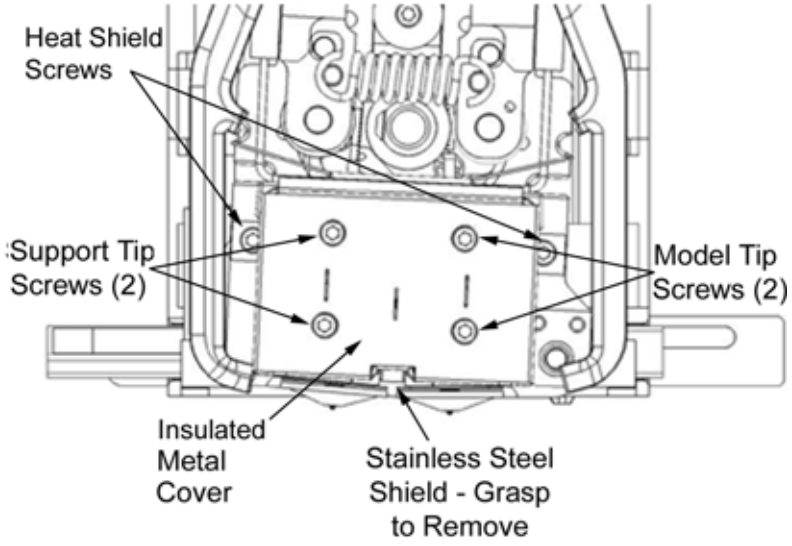


Figure 8: Tip Removal

5. Inspect the Heat Shield Teflon Shield for:
   - Damage - Replace if the area around a cover hole is not intact or if the shield is torn.
   - Material trapped between shield and cover - Replace the shield if there is evidence of trapped material.
   - Security of attachment to metal cover - Replace the shield if it does not appear to be attached firmly to the cover. The shield is held in place by an adhesive strip.
6. Replace the Teflon Shield if necessary.
   A. Remove the old Teflon shield from the heat shield - remove excess adhesive and support/ modeling material.
   B. Remove any excess support/model material around the Heater assemblies and Toggle Plate Assembly.
   C. Remove the protective strip from the adhesive band on the new teflon shield.
   D. Position the new Teflon shield on the inside of the cover. Center the intersecting cut lines of the teflon shield in the center of the heat shield holes.
   E. Press the new shield in place. Check for good adhesion of teflon shield to heat shield.

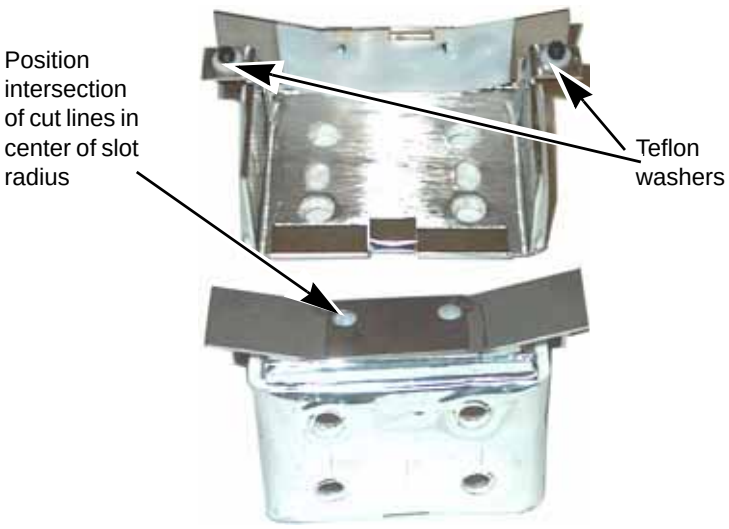


Figure 9: Replacing the Teflon Shield

7. 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 (Figure 8 & Figure 9).
8. Install Liquefier Tips (Figure 10 & Figure 11).
   A. For a Dimension BST, the SUPPORT tip and MODEL tip are interchangeable. Both sides use the MODEL tip. (The tips come in a Red capped container).
   B. For a Dimension SST, you must identify the correct replacement tip. The SST uses two tip types. You must make sure a SUPPORT tip is used on the LEFT side of the head assembly. A MODEL tip must be used on the RIGHT side of the head assembly. The Model tip comes in a Red capped container. The Support tip comes in a Black capped container.

CAUTION: For a Dimension SST: Model and SOLUBLE support tips are different. The correct tip must be installed in the correct side.

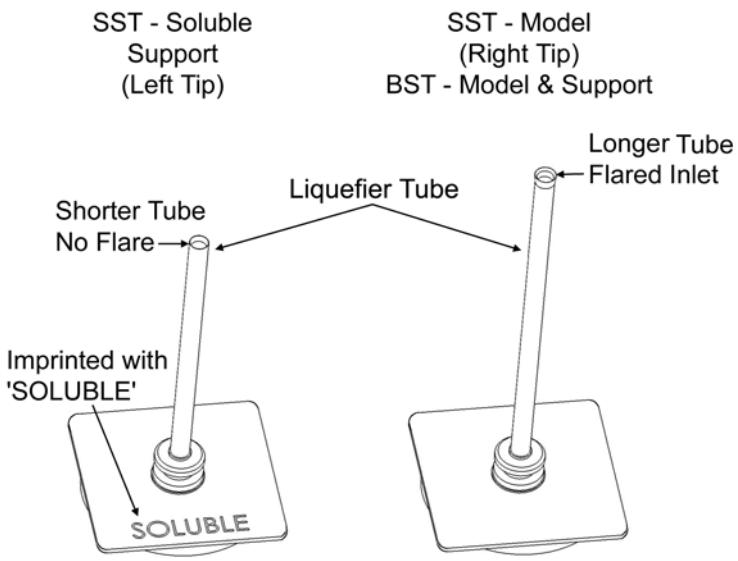


Figure 10: Identifying Tips

C. Insert the new tip into the heater block.

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

E. Pull the tip shield toward you, then lift up to install the tip.

F. Push the tip toward the back of the printer once it is all the way up against the heater block.

G. 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.

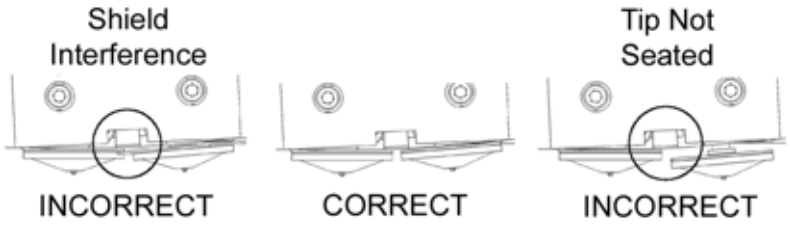


Figure 11: Tip Stainless Steel Shield Alignment

H. Use 7/64 T-Handle Allen wrench to firmly tighten the heater block clamp screws.

I. Repeat steps c. through h. for second tip.

9. Adjust the Brush height (Refer to “Adjust the Brush height.” on page 7 - 3).
   - If necessary, replace the Tip Cleaning Assembly (Refer to “Tip Cleaning Assembly (Brush/Flicker Assembly)” on page 7 - 3).
10. Replace Plastic Head Cover and close the printer door.
11. The printer will display **`Tip Maintenance - Tips Replaced?`** - select **`Yes`** to begin material load.

A. The printer will display **`Load Model - Replace Both Cartridges`** (flashing).

•If you want to replace a material cartridge, do so now.

•If you do NOT want to change a material cartridge, you must unlatch and latch the cartridges to continue (Press the cartridge forward to unlatch, then press it forward again to latch).

Note: ***Because the material 'unloaded' during the tip replacement, the printer is in a material replacement mode. You must unlatch/latch the cartridges to continue.***

If there is a delay in the unlatch/latch process, the printer will display `Both Cartridges Not Replaced Or Invalid`. Select `Retry`, then unlatch/latch the cartridges.

B. The printer will now begin to load material.

C. After Material Loading is complete the printer will display **`Tip Calibration - Install Modeling Base And Build Calibration Part`**.

CAUTION: ***Make sure a NEW, UNUSED modeling base is installed before starting calibration. Calibration results will be incorrect if a NEW, UNUSED modeling base is not used.***

D. Select **`Start Part`** (flashing).

Tip Calibration

Tip Replacement requires that a Tip Calibration must be performed. When you select **`Start Part`** 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 printer will then automatically build an XY Calibration part (approximately 10 minutes). You must inspect the XY Calibration part and calibrate the X and Y axes for tip offset:

1. When the XY Calibration part is complete the printer will display **`Remove Part and Select XY Adjustment - X:0, Y:0`**
2. Remove the XY tip calibration part from the Dimension printer.
3. Inspect the part and calibrate the X and Y axes (See Figure 12).
   A. Use the magnifier from the Startup Kit to view the support road.
   B. Identify the location on the +X **or** –X side of the part where the support road is best centered within the model boundaries.
   C. Read the number closest to this location. This is the required X Tip Offset adjustment, in mils. If the number is on the -X side, a negative offset is required.
   D. Select **`Increment`** or **`Decrement`** to input the X offset adjustment - the value will change in the upper display window (by default, the printer will be ready to accept the X value).
   E. When you are satisfied with your X offset value, **`Select Y`** and repeat the procedure to identify and input the required Y Tip Offset adjustment.
4. Select **`Done`** after you have input the X and Y offsets. The printer will return to **`Maintenance`**.

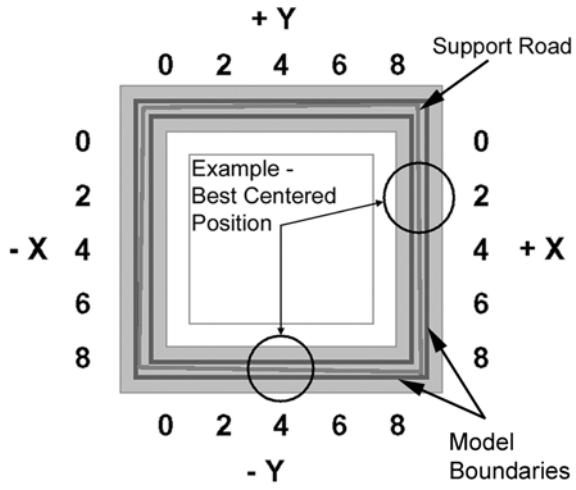


Figure 12: Example XY Tip Offset Part.
This example requires an adjustment of X = + 2 mils, Y = - 4 mils

Chapter 8
Troubleshooting

Troubleshooting a System Malfunction

Dimension 1200 BST/SST

Troubleshooting Guide

Revision Date: 6/18/07

Table of Contents

1.0 How to Use the Guide

2.0 Special Notes

3.0 Code Errors

4.0 Non-Code Errors

5.0 Common Hyperterminal Commands

1.0 How to Use the Guide

1.1 Determine what type of error you are experiencing; either a Code Error or Non-Code Error.

1.2 If you are experiencing a Code Error:

- **A)** Refer to the Code Error Section of the guide (Section 3.0)
- **B)** Match the code number with the number in the guide.
- **C)** Follow the corrective actions to fix the error.

1.3 If you are experiencing a Non- Code Error:

- **A)** Refer to the Non-Code Error Section of the guide (Section 4.0)
- **B)** If the display on the machine displays an error message, match that message to one of the buckets in the guide.
- **C)** If a message does not appear, match the problem to one of the buckets in the guide.

Note: The Non-Code Errors are listed in alphabetical order.

1.4 If you have any suggestions, additions or changes that need to be made to this guide please e-mail **ProdigyTSGuideTeam@Stratasys.com**.
The suggestions and changes will be brought to the troubleshooting meeting, where they will be discussed and approved.

2.0 Special Notes

2.1 Field Special Notes

A. Verify that the machine is plugged directly into a wall outlet. Do not use an extension cord or power strip.

B. Verify you are running the current build software. Upgrade the software if necessary.

C. Power the machine down. Shut the machine off at the breaker.
Move the head & Z-Stage away from the sensors. Power up the machine.

D. Check and reset connectors and pins.
· Give special attention to J7, J10, and J12 connectors. Make sure pins are not protruding from rear of connector housings.
(If pin protrudes, disconnect connector, push pin fully into connector, re-install connector.)

E. When measuring DC voltages and signals chassis ground is preferred.
Do NOT measure AC voltages using chassis ground.

F. Check/reseat the three ribbon cables between the PDB (J14, J17, J19) and the controller board (J1, J2, J3) as part of the troubleshooting process.

G. Hyperterminal move commands are in inches.

H. Limit switch states are NOT displayed in Maraca for 'New' electronics (due to PMD differences).
Use test points on PDB to determine limit switch states.

I. Replacement Hard Drive may take up to 45 minutes to boot. HD is running File System Check.

3.0 Code Errors

3.1 Major Codes

Note: These codes are displayed on the system LCD.

01: Unknown Error - No data on what error occurred
02: PUC Error - Path, utilities and controller development library (Used for software testing)
03: No Display - Process that runs LCD display generated error
04: Memory Error - Single board computer experienced memory error
05: LCD Display - Failed to write to LCD display board from SBC - Replace LCD
06: LCD Keypad - Failed to read from LCD keypad to SBC - Replace LCD
07: Manager Channel - Socket from manager internal manager process was on, SBC (Software error, will not be displayed)
08: Manager Disconnected - Socket from manager internal manager process was off, SBC (Software error, will not be displayed)
09: Manager Send - Failed to send from manager (SBC) (Software error)
10: Command Failed - Sent legal command that was rejected (exp. Move Z command with door open) - Cycle power.
11: Queue Communication - Socket from queue process was interrupted (broken) (Software error)
12: Joblog Message Buffer - Failed to write to job log (Software error)
13: Joblog File -Failed to create the job log (Software error)
14: Controller Abort - Controller failure (See sub errors below)
15: Starting Up Failed - Some part of the start up procedure failed
16: Find Z Failed - Failed to find Z limit switch
17: Controller Load Failed - Unable to load global parameters (exp. Temp values, flow control)
18: Temperature Failed to Regulate - Liquefier or chamber failed to reach temperature within time constraints (No change in 7 min.)
19: Controller Initialization Failed - Controller failed to reboot or start
20: Door Latch Command Failed.
21: Ldrool Failed.
22: Controller Communications Failed - Not used.
23: Universal Device Name error.

3.2 Major Codes with Minor Codes

Note: Currently minor codes exist for major codes 14, 15 17-20, 22, & 23 only.

Errors	Corrective Actions
Controller Abort Minor Errors (Code: 14, XX)	
14, 01: Abort : Z axis is jammed	1. Check for objects blocking Z stage. 2. Check for purge material around lead screws. 3. Power cycle machine including rear breaker. 4. Maraca: Status: Check Z position. See if both Z home & Z limit boxes are checked. If so, check limit switches and/or Mid-Unit Harness. 5. HyperTerminal: Check to see if Z stage moves (mz 0.5 or mz -0.5). This will allow you to move the Z stage without tripping the Z jam sensor. + is down, - is up. 6. Z stage motor maybe bad. Does motor "groan" when attempting to move the Z stage.
14, 02: Report: Attempt to raise foam/substrate sensor failed	1. Replace substrate. 2. Power cycle machine. 3. Check connector J10 (pin 19) on the PDB board for loose pins. 4. Maraca--Status: Check to see Z foam box toggles when switch is activated. If not, check foam sensor and/or Umbilical Cable. Check signal at TP27. 5. Maraca--Status: Check to see Z home box toggles when switch is activated. If not, check Z home switch and/or Mid-Unit Harness. Check signal at TP13 6. Check Z home switch position. Adjust if needed.
14, 03: Report: Substrate sensor up when it should be down.	1. Check the substrate sensor assembly for free operation. 2. Check to see if the sensor arm is broken. 3. Check connector J10 (pin 19) on the PDB board for loose pins 4. Use Maraca--Status: Check to see Z foam box toggles when switch is activated. If not, check substrate sensor, sensor assembly and/or Umbilical Cable. Check signal at TP27.
14, 04: Report: Substrate 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 HyperTerminal -Verify the sensor is being pushed all the way up. 4. Remove, clean and reinstall the substrate sensor assembly
14, 05: Abort : Unexpected contact with X axis home sensor. **14, 06: Abort : Unexpected contact with X axis EOT sensor.** **14, 07: Abort : Unexpected contact with Y axis home sensor.** **14, 08: Abort : Unexpected contact with Y axis EOT sensor.**	1. Use Maraca or DataStat--Status: Check if home & limit boxes are checked. If so check limit switches and/or Umbilical Cable (for X) / Mid-Unit Harness (for Y). 2. Power Cycle the machine 3. Check for loose pins on J10 & J12 on the PDB. Check signals at TP3, 7, 16 & 21. Note: X home -J10, pin 15, Y home- J12, pin 22, X EOT - J10, pin 24, Y EOT- J12, pin 11. 4. Check for an obstruction hitting the model. 5. Manually move the XY table in X and Y checking for smooth operation. 6. Check the XY table cable tension. Adjust if necessary. 7. Incorrect length substrate arm installed. Replace substrate arm with the correct length. 8. Check to make sure the homing sensors are clean.

14, 09: Abort : Unexpected contact with Z axis home sensor. **14, 10: Abort : Unexpected contact with Z axis EOT sensor.**	1. Check the to make sure the switches are adjusted correctlyper the service guide procedure. 2. Check to see if the switch is operating correctly (See if the switch is loose or broken). 6. Check J12 on the PDB for loose pins. Z home-pin 3, Z EOT-pin 5. Check signals at TP14, TP13 3. Check the Z motor - Run the TZ command using HyperTerminal 4. Check the Z belt condition and tension. 5. If error occurs when running the "Find Z" command (FZ), replace the Z Foam Sensor.
14, 11: Abort : Door opened while axis in motion	1. Check to see if door latch is activating using Maraca or DataStat.Check signal at TP12 2. Check J12 on the PDB (pin 1) for loose contacts or bent pins. 3. Look at LCD display, should show "Door Open" when machine is idle and door is open. 4. Maraca/DataStat--Status: Check to see "Door Open" box 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 of the door. Check that magnet is present.
14, 12: Not Applicable for Dimension 1200	
14, 13: Abort : Under Run at vertex buffer (Asked for another vector interrupt, but none was available) **14, 14: Abort : Under Run not in tool path** (Asked for another vector interrupt, when it shouldn't have)	1. Reprocess the part and send again. 2. If the frequency of the error is greater than once every three months, then replace the SBC or Hard Drive.
14, 15: Report: Head motor running without XY motion	1. Will not be displayed on LCD display. Will be seen only using HyperTermina
14, 16: Abort : Vertex FIFO tail is not on a 4 byte boundary. (vector is corrupted)	1. Communication error between controller board and the SBC - Power cycle system
14, 17: Abort : User abort.	1. Build was cancelled through the keypac
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. (Housekeeper needs to be preformed every second but did not)	1. Power cycle machine. 2. If problem still continues send outfile to SSYS CS.
14, 20: Abort : XY axis not ready. (Chip that controls the PMD chip not ready) **14, 21: Abort : Z axis not ready.** (PMD chip not ready)	1. Power cycle machine. 2. Using the HyperTerminal, type SS. "X Axis Ready"<u>should</u> be displayed. If it is <u>not displayed</u>, 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. (Head temperature set to below 220C)	1. Go to Maraca and change temperature 2. Verify the head temperature set point using Maraca. - The model must be <u>above</u> 240 degrees. - The support must be <u>above</u> 240 degrees
14, 23: Report: Begin curve parameters not in sequence.	1. Communication error between controller & SBC - Cycle power 2. If problem still continues send outfile to SSYS CS.

14, 24: Abort : X axis command error (PMD error) **14, 25: Abort : Y axis command error (PMD error)** **14, 26: Abort : Z axis command error (PMD error)**	1. Check to see if machine software is current release. If not, upgrade software to current build. 2. Power cycle machine. 3. If error continues - possible memory problem, replace SBC Ram. 4. If the frequency of the error is greater than once every three months, replace the controller board
14, 27: Abort : X axis motion error (PMD error) **14, 28: Abort : Y axis motion error (PMD error)** **14, 29: Abort : Z axis motion error (PMD error)**	1. Check to see if machine software is current release. 2. Power cycle machine. 3. If the frequency of the error is greater than once every three months, replace the controller board.
14, 30: Abort : PMD axis command was not X, Y, or Z. (Tried to command axis other than X,Y or Z)	1. Check to see if machine software is current release. If not, upgrade to current build.
14, 31: Abort : Move absolute error. (Failed to move when commanded)	1. Check connectors to the X and Y motors. 2. Check home and EOT switches for correct operation. Replace if defective
14, 32: Abort : PMD checksum error. (Corrupted PMD command)	1. Check to see if machine software is current release. If not, upgrade to current build. 2. Power cycle machine. 3. If the frequency of the error is greater than once every three months, replace the controller board. 4. Check the controller version using Maraca.
14, 33: Abort : Invalid being send to PMD chip. (Error in format of data sent to PMD)	1. Check to see if machine software is current release. If not, upgrade to current build. 2. Power cycle machine. 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 **Not applicable with the 1200**	Not used on 1200 systems
14, 35: Report: Time out while loading cartridge. (Waited too long for filament to reach head drive motor)	1. See Load Failed Section (K) in the Non-Error Code Section.
14, 36: Report: Modeling material not moving in head. **14, 37: Report: Support material not moving in head.** PMD chip on the controller board controls movement	1. Check/reseat J9 on the PDB. 2. Cycle power at the breaker. 3. If error continues, then replace the controller board.
14, 38: Abort : Hardware turned off power supply. Note: Symptoms of this error will be that system will power down after a few seconds.	1. Reseat connectors to controller and PDB 2. Replace the controller board 3. Replace the PDB
14, 39: Abort : Head thermocouple fault. **Note:** Head Thermocouple is OPEN	1. Check thermocouple wire for damage. 2. Using a meter, check to see if thermocouple is open at head. 3. Open may be in umbilical head cable. Check J10 on the PDB 4. Check/reseat the connectors on the head board. 5. Check for unseated pins in J10 of the umbilical cable. 6. Check the component leads on back of Head Board are not shorting to the translator 8. Replace the head 9. Replace the head board

14, 40: Abort : Chamber thermocouple fault.	1. Check to see if chamber thermocouple is plugged in to the PDB. 2. Using a meter check if thermocouple is open. If so, replace thermocouple. 3. Check chamber thermocouple and wire for damage.
14, 41: Abort : Motion command while door open. **14, 42: Abort : Load cartridge while door open.** **14, 43: Abort : Modeling command while door open** **14, 44: Abort : Select head command while door open.** **14, 47: Abort : Tip wipe command while door open.**	1. Close door 2. Check to see if door solenoid is operating properly. Toggle solenoid using Maraca. 3. Look at LCD display, should read "Door Open" when machine is idle and door is open. 4. Cycle power. 5. Maraca--Status: Check to see Door open box toggles when switch is activated. If not, check door switch and/or Mid-Unit Harness. 6. Make sure door magnet is present. 7. Check to see if door has warped.
14, 45: Report: Unable to write to modeling material cartridge **14, 46: Report: Unable to write to support material cartridge** NOTE: Will see in log file only	1. Try a different cartridge. Also verify that material is the correct type for system. 2. Check the LED on card reader board. Should be blinking. If reader board is seeing cartridge, LED blinking speed will double. 3. Reseat and check pins on J7 on the PDB 4. Replace cable running from receiver to the PDB board. 5. Replace card reader board. 6. Replace the controller board.
14, 48: Abort : Vertex command error. (Illegal command on vertex channel)	1. If this message is displayed on LCD ONLY, replace SBC Ram. 2. If this message is not displayed on the LCD, (seen in outfile), RAM is NOT the root cause. 3. 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: Abort : Model material not loaded. **14, 52: Abort : Support material not loaded.** **14, 53: Abort : Model head motor not ready.** **14, 54: Abort : Support head motor not ready.**	**Note:** System does not recognize material is loaded 1. Reload material
14, 55: Abort : Find home failed, X home and X eot both on **14, 56: Abort : Find home failed, Y home and Y eot both on**	1. Power cycle machine - remember to move head away from switches. 4. Check for loose pins on J10 & J12 on the PDB. Check signals at TP3, 7, 16 & 21. Note: X home -J10, pin 15, Y home- J12, pin 22, X EOT - J10, pin 24, Y EOT- J12, pin 11. 2. Using Maraca/DataStat - Status or voltmeter: Check to see if switch state toggles. If not, check sensor and/or umbilical cable (for X) / mid-unit harness (for Y). 3. Using Maraca/DataStat - Status or voltmeter: Check to see if switch state toggles. If not, check switch and/or umbilical cable (for X) / mid-unit harness (for Y).

14, 57: Abort : Find home failed, X home timeout **14, 58: Abort : Find home failed, Y home timeout** **Note:** These errors occur most often due to a problem with the motor, not the switch	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 Maraca or Meter--Status: Check to see home box toggles when sensor is activated. If not, check sensor and/or umbilical cable (for X) / mid-unit harness (for Y).
14, 59: Abort : Find home failed, X home not tripped **14, 60: Abort : Find home failed, Y home not tripped** **Note:** These errors occur most often due to a problem with the motor, not the switch	1. Power cycle machine - remember to move head away from switches. 2. Using Maraca Status or voltmeter-: Check to see home box toggles when sensor is activated. If not, check sensor and/or Umbilical Cable (for X) / Mid-Unit Harness (for Y). 3. Check for loose pins on J10 & J12 on the PDB. Check signals at TP3, 7, 16 & 21 Note: X home -J10, pin 15, Y home- J12, pin 22, X EOT - J10, pin 24, Y EOT- J12, pin 11.
14, 61: Abort : Find home failed, X home tripped **14, 62: Abort : Find home failed, Y home tripped**	1. Power cycle machine - remember to move head away from switches. 2. Using Maraca Status or voltmeter-: Check to see home box toggles when sensor is activated. If not, check sensor and/or umbilical cable (for X) / mid-unit harness (for Y). 3. Check for loose pins on J10 & J12 on the PDB. Check signals at TP3, 7, 16 & 21 Note: X home -J10, pin 15, Y home- J12, pin 22, X EOT - J10, pin 24, Y EOT- J12, pin 11.
14, 63: Abort : Find home failed, X eot tripped **14, 64: Abort : Find home failed, Y eot tripped**	1. Power cycle machine - remember to move head away from switches. 2. Using Maraca Status or voltmeter-: Check to see limit box toggles when switch is activated. If not, check switch and/or umbilical cable (for X) / mid-unit harness (for Y). 3. Check for loose pins on J10 & J12 on the PDB. Check signals at TP3, 7, 16 & 21 Note: X home -J10, pin 15, Y home- J12, pin 22, X EOT - J10, pin 24, Y EOT- J12, pin 11..
14, 65: Abort : Find home failed, X eot not tripped **14, 66: Abort : Find home failed, Y eot not tripped** Note: Receive interrupt but switch not tripped.	1. Power cycle machine - remember to move head away from switches. 2. Using Maraca Status or voltmeter-: Check to see limit box toggles when switch is activated. 3. Check for loose pins on J10 & J12 on the PDB. Check signals at TP3, 7, 16 & 21 Note: X home -J10, pin 15, Y home- J12, pin 22, X EOT - J10, pin 24, Y EOT- J12, pin 11..
14, 67: Abort : Head temperature too high **- Liquefier is too hot, smell burning plastic (+300deg)**	1. T/C is bad reporting below set point temperature.. 2. Head Board is bad 3. Head T/C cables are not plugged in.
14, 68: Abort: Illegal PMD Command	1. If error occurs more than once a month replace the controller board
14, 69: Abort: XY PMD Read Checksum error	1. If error occurs more than once a month replace the controller board
14, 70: Abort: XY PMD Write Checksum error	1. If error occurs more than once a month replace the controller board
14, 71: Abort: Z PMD Read Checksum error	1. If error occurs more than once a month replace the controller board
14, 72: Abort: Z PMD Write Checksum error	1. If error occurs more than once a month replace the controller board
14, 73: Abort: Head TC Board Configuration error	Not used on 1200 systems
14, 74: Unexpected contact with unknown limit. This message occurs when we interrupt for contact with a limit switch, but when we read which limit we interrupted for, there are no limit switches set. This is normally associated with an intermittent wire in the harness to one of the limit switches.	1. Power cycle machine - remember to move head away from switches. 2. Using Maraca Status or voltmeter-: Check to see limit box toggles when switch is activated. If not, check switch and/or umbilical cable (for X) / mid-unit harness (for Y). 3. NE - Check for loose pins on J10 & J12 on the PDB. Check signals at TP3, 7, 16 & 21 Note: X home -J10, pin 15, Y home- J12, pin 22, X EOT - J10, pin 24, Y EOT- J12, pin 11.

14, 75: Unknown	No error code associated with an error
14, 76: Software bug (Internal software bug)	Cycle power.
14, 77: Buffer is larger than the data **14, 78: Buffer is smaller than the data** (Command channel formatting issue between controller and SBC)	1. Cycle power. 2. Replace single board computer.
14, 79: Run-time error	Cycle power.
14, 80: Index out of bounds	Cycle power.
14, 81: Invalid argument	Cycle power.
14, 82: Invalid channel	Cycle power.
14, 83: Invalid command	Cycle power.
14, 84: Invalid command opCode (Malformed commands)	Cycle power.
14, 85: The operation is not implemented (Command not applicable for that gender)	Software error; will not be displayed.
14, 86: Timeout (System failed to complete a task)	Cycle power.
14, 87: Resource already in use (System trying to use resource already in use)	Cycle power.
14, 88: The dual-port memory is corrupted (header stamped on dual-port memory (DPM) is corrupt)	Cycle power.
14, 89: No valid ISR callback routine set (Failed to setup interrupt)	Cycle power.
14, 90: An internal queue has overflowed	Cycle power.
14, 91: Address not properly aligned	Cycle power.
14, 92: Message too big for queue	Cycle power.
14, 93: Data unit size violation	Cycle power.
14, 94: checksum bad	Cycle power.
14, 95: PMD Host IO Error	Cycle power.
14, 96: Unidentified interrupt occurred	Cycle power.
14, 97: Invalid data type	Cycle power.
14, 98: Find home failed, X EOT timeout **14, 99: Find home failed, Y EOT timeout** Note: No interrupt detected.	1. Power cycle machine - remember to move head away from switches. 2. Using voltmeter-: Check using PDB test points to see if signal toggles when switch is activated. If not, check switch and/or umbilical cable (for X) / mid-unit harness (for Y). 3. Check for loose pins on J10 & J12 on the PDB. Check signals at TP3, 7, 16 & 21. Note: X home -J10, pin 15, Y home- J12, pin 22, X EOT - J10, pin 24, Y EOT- J12, pin 1

14, 100: Find home failed, Z HOME (BOT) not tripped **14, 101: Find home failed, Z EOT not tripped** **14, 102: Find home failed, Z HOME (BOT) timeout** **14, 103: Find home failed, Z EOT timeout**	1. Check for objects/parts on Z stage. 2. Look for debris on Z-Stage casting - remove debris 3. Check for purge material around lead screws. Remove material, clean and lube. 4. Toggle power switch. 5. Manually move the table away from the upper and lower Z limit switches then cycle power. 6. Check Z position. Check using PDB test points to see if signal toggles. If so, check limit switches and/or loose pins. Z home J12, pin 3. Z EOT J12 pin 5 on the PDB. 7. HyperTerminal: Check to see if Z stage moves (mz 0.5 or mz -0.5). This will allow you to move the Z stage without tripping the Z jam sensor. + is down, - is up. 8. Table is not level. Check and level per the service manual using the head leveling fixture. 9. Z-axis motor has failed (see 14.1) 10. Z-axis belt is loose or worn. Adjust tension or replace belt. 11. Check pins on Z-axis motor connectors (both ends) to make sure that they are fully seated in connector housing.
14, 104: Surface not found (Substrate didn't find switch)	1. No modeling base 2. Modeling base is used/defective, has low spot. 3. Verify substrate sensor is working.
14, 105: Controller not ready to build a model	Cycle power
14, 106: BOT offset is higher than the BOT switch (Find home completed)	1. Calibration error occurred. 2. Forgot a minus sign in the Z offset value. 3. Customer may be shaving the foam and adjusted Z offset accordingly. Use new substrate and run Z calibration. 4. Check/adjust 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 cartridge. 2. Replace cartridge reader card. 3. Replace receiver cable.
14, 111: Invalid frame check sequence	1. Cycle power. 2. If error repeats, replace controller board.
14, 112: EEPROM communication error	Software error; will not be displayed.
14, 113: Door not latched (Solenoid current not detected)	1. Inspect solenoid and wiring.
14, 114: Thermocouple snap switch tripped	1. Reseat connectors to controller and PDB 2. Replace the controller board 3. Replace the PDB
14, 115: Z stage planarity beyond tolerance	1. Substrate may be out of level or damaged, replace substrate. 2. XY table or tray out of level.

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 and 14.130 3. Check for loose pins onf J12. 4. Gantry/part calibration values have been set to zero - check using Maraca. Download CAL files to restore values.
14, 118: Invalid cyclic redundancy check	Cycle power.
14, 119: Operation already active	Software error; will not be displayed.
14, 120: Invalid vector detected	1. Reprocess the part and send again. 2. If the frequency of the error is greater than once every three months, then replace the SBC or hard drive
14, 121: Processor Exception	Cycle power.
14, 122: Processor halted	Cycle power.
14, 123: Watchdog timeout	Cycle power.
14, 124: Stack overflow	1. Cycle power. 2. Replace Controller Board
14, 125: Runtime error	Cycle power.
14, 126: Operation active - try again	Cycle power
14, 127: Invalid gender	Cycle power.
14, 128: Invalid platform	1. Cycle power. 2. Replace Controller Board
14, 129: Toggle head failure Failure to toggle	1. Check toggle bar for excessive play. If loose, check security of toggle plate or replace toggle bar. 2. Reflector on toggle bar missing or damaged - replace toggle bar. 3. Reseat connectors on the head board. 4. Check voltage (5V) on PDB for toggle signal: TP10-Model; TP25-Support 5. Check voltage (5V) on head board for toggle signal: TP201-Model; TP101-Support 6. Replace toggle bar and toggle sensor. 7. Replace head board 8. Using HT run AH to toggle the head. Monitor system movement to help determine root cause of issue. 9. Toggle plate is warped - replace toggle plate assembly
14, 130: Temperature setback is active	Cycle power
14, 131: Toggle when head motor is running System "thinks"' toggle bar moved while building	1. Check toggle bar for excessive play. If loose, check security of toggle plate or replace toggle bar. 2. Reflector on toggle bar missing or damaged - replace toggle bar. 3. Reseat connectors on the head board. 4. Check voltage (5V) on PDB for toggle signal: TP10-Model; TP25-Support 5. Check voltage (5V) on head board for toggle signal: TP201-Model; TP101-Support 6. Replace toggle bar and toggle sensor. 7. Replace head board 8. Using HT run AH to toggle the head. Monitor system movement to help determine root cause of issue. 9. Toggle plate is warped - replace toggle plate assembly 10. Replace Umbilical Cable
14, 132: UPS low power	1. UPS is shutting down. Check UPS and AC power
14, 133: Head liquefier is not heating up Note: 14:133 error differs from code 18 errors in that the 14:133 error signal is sent from the Controller instead of the SBC.	1. Liquefier heater is open (infinite resistance). Liquefier T/C may be crushed. Test using meter If crushed, reading will be 0 Ohms between pin 1 and ground. 2. Check for 120 VDC at head board, if OK heater is bad. Replace head. 3. The umbilical cable to the heater is broken or has a bad connector. 4. Make sure the machine is plugged directly into a wall outlet. 5. Check that D10 on the PDB is lit. If not 120VDC circuit maybe bad - replace PDB. 6. Check the thermocouple connectors, heater connectors.. 8. Check PDB output voltage to model. If OK, check outut voltage to support. If support voltage is low, auxillary 120VDC power supply. 9. 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 Note: Software is not finding a hardware device	1. Use LE command in HyperTerminal (display exception log)

Starting Up Failed Minor Errors (15.XX)

15, 01: Startup state activation failed	Software use only
15, 02: Timeout period expired while starting up	Software use only

Controller Load Failed Minor Errors (17.XX)

17, 01: LG_COMMAND Failed on Controller	Software use only
17, 02: LG_COMMAND Timeout	Software use only

Temperature Failed to Regulate Minor Errors (18.XX)

Note: SW "Code:18" on the display. It does not differentiate between Chamber and Head temperature regulation failures.

18, 01: Temperature not changing fast enough.	1. Status-Details: Check to see if current envelope temperature is above 65 before starting a model. 2. Status--Details: Check to see if envelope temperature set point is 75C. If not, toggle power switch. 3. Check heaters, chamber fans, and heater cables. 4. Check chamber thermocouple - see 14.40. 5. Check if head board grounding wire is connected (not grounded).
- Liquefier won't heat up (its cold). **Note: 89.5 Deg = 0 Deg.**	1. Liquefier heater is open (infinite resistance). 2. Liquifier T/C may be crushed. Test using meter. If crushed, reading will be 0 Ohms between pin 1 and ground. 3. Check for 120 VDC at head board, if OK heater is bad. Replace head. 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 that D10 on the PDB is lit. If not 120VDC circuit maybe bad - replace PDB. 7. Check the thermocouple connectors, heater connectors.. 8. Use Maraca to check to see if the temp is going over 182 Deg.
- Liquefier is warm but doesn't reach operating temperature.	1. Check AC input and 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 4. Replace the head board. 5. Grounding problem at head board.
- Chamber temperature too high (over 75 degrees)	1. Chamber T/C has failed. 2. Chamber temperature offset is incorrect. Correct using Maraca.
18, 01: Temperatures not moving in correct direction	1. Cycle power - If it repeats check head and chamber heaters and thermocouples
18, 02: Temperature failed to regulate within 7 degrees	1. Status--Details: Check to see if head temperature set point is 300 degrees C. 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.
18, 03: Incorrect model head temperature. *ALSO SEE 18.01*	1. Using Maraca, set temperature to default of 300 for 1200 and280 for Prodigy Plus
18, 04: Incorrect support head temperature	1. Using Maraca, set temperature to default of 300 for 1200 and280 for Prodigy Plus
18, 05: Incorrect chamber temperature	1. Incorrect Chamber Temperature. Using Maraca, set temperature to default of 7

Controller Initialization Failed Minor Errors (19.XX)

19, 01: IN_COMMAND Rejected by Controller	Software use only
19, 02: IN_COMMAND Timeout Failed to load globals	1. Cycle power 2. Replace controller board 3. Replace hard drive

Door Unlatch Failed (20.XX)

20, 01: Unlatch command rejected **20, 02: Timeout period expired waiting for head to stop**	1. Check door latch solenoid wiring 2. Check ability of door to latch

Controller Communications Failed Sub Errors (22.XX)

22, 01: FC_SERVICE event not received **22, 02: Insufficient material to complete job**	

Universal Device Name Error (23.XX)

23, 00: UDN controller command failed **23, 01: UDN controller command timed out**	1. Check network for connectivity 2. Cycle power

4.0 Non-Code Errors

A) "Build Error" displayed on LCD
B) Tip Depth Incorrect
C) "Corrupted Upgrade" displayed on LCD
D) "Could Not Read Cartridge" displayed on LCD
E) Door Latch
F) "Door Open" displayed on LCD
G) Download
H) Loss of Extrusion (LOE)
I) Lights
J) Load Failed
K) Network Communications
L) Part Quality
M) Pauses During Build
N) Power Down
O) Power Up / Boot
P) "Can't Find Home - Check Modeling Base" displayed on LCD
Q) System VERY slow to reach temperature
R) Calibration Issues
S) Unexpected behavior
T) Z Calibration Failure

Errors	Corrective Actions

A). "Build Error" displayed on LCD

1. Part stops building before complete.	1. Partial or bad model file sent to unit. - Check and reprocess the STL and redownload the file.

B). Tip depth is incorrect

1. Tip Depth is wrong (too deep or above the substrate)	1. Check the substrate - replace if necessary. 2. Cycle the power at the breaker. 3. Run Z calibration again 4. Check and/or clean the Z foam sensor. - See the Service Data Bulletin 00044 5. Replace the Z foam assembly and sensor.
2. Builds above the foam consistently.	1. Verify Z foam sensor value changes using HT. Possibly intermittent open in umbilical cable 2. Run Z calibration again 3. Replace Z foam sensor and assembly. 4. Replace controller board (noise on signal)

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 not from a different "class" system.

D). "Could Not Read Cartridge" Displayed on LCD

1. Cartridge reads empty (with more than 5 wraps left).	1. Remove the cartridge & cycle the power. Reload the cartridge. 2. Cartridge spool e-prom has failed. Load a different cartridge. 3. Check 'heartbeat' LED on card-reader card. If slower than 1 beat per second, replace card-reader assembly. 4. Loose J7 on the controller board. Check for spread pins and reseat connector. 5. Loose connector on the card reader. Remove and reseat the card reader connector. 6. Check to make sure the cartridge reader board LCD is blinking

E). Door Latch

1. Door doesn't latch/unlatch.	1. Check to see if door has delaminated or is bowed. If so replace door. 2. Door solenoid (rod) has been bent. 3. Door solenoid has failed. Check by toggling using Maraca. 4. Cable (wire) to solenoid is open. 5. PDB has failed (won't latch only).

F). "Door Open" Displayed on LCD

	1. The door is open. 2. The door switch is bad. Check using Maraca/DataStat Status 3. The latch mechanism is not contacting the switch. 4. The door is warped. Replace door. 5. Misaligned or missing magnet.

G). Download

1. Model sent to system, but did not appear in queue.	1. Send the file again. 2. Reprocess and send the file again. 3. Cycle power on both the system and the work station. 4. Check the STL file. 5. 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)

1. Liquefier doesn't extrude material	1. Drive wheel or mushroom jam. Refer to Loss of Extrusion section in the Users Guide 2. Material jammed in cartridge. Replace or repair cartridge. 3. Tip is plugged. 3a. See 'Clearing a Clogged Liquefier Tip', chapter 4 of Service Guide (under LOE section) 3b. Replace tip. 4. Perform the head alignment procedure. 5. Check air plenum for: proper hose connection; properly seating; cracks or damage. 6. Replace toggle plate assembly. 7. Check to make sure head blower fan hose is connected to blower. 8. Blower fan not supplying enough air flow - weak or stalling. Replace fan. 9. Intermittant blower fan operation Pins on fan wire connector are spread. Replace fan. 10. Liquefier heater has higher than normal resistance, value should be about 98 ohms Replace toggle plate if value is incorrect. 11. Replace head board 12. If on first layer and on a used substrate, retry with a new one 13. Replace umbilical cable
2. Filament motor is running very fast.	1. Make sure the head connectors are seated properly. 2. Bad motor. Replace motor. 3. Broken wire in the umbilical cable.
3. <u>Waterworks</u> filament frequently breaking (More than once per 1000 hours)	1. Drive wheel or mushroom jam. Refer to Loss of Extrusion section in the Users Guide 2. Material jammed in cartridge. Replace or repair cartridge. 3. Clean drive wheels of excess material. 4. Check for twisted feed tubes. NOTE: If twisted the support tube must be replaced
4. Filament slips at head	1. High pull force or jammed cartridge - replace cartridge. 2. Plugged Liquefier - replace tip. 3. Worn filament tubes - replace filament tubes.
5. Filament motor moves in reverse when building	1. Reseat connectors. 2. Replace controller and PDB. 3. Replace head motor. 4. Replace umbilical cable.

I). Lights

1. Chamber lights won't come on. (Unit is otherwise functioning normally)	1. Lights are burnt out - replace lights 2. Open wire to light - check for continuity

J). Load Failed

1. Cartridge won't load (no movement) after pressing load.	1. Filament is being cut off too long at cartridge. Less than 1/4" should be exposed 2. Smart spool e-prom has failed. Replace cartridge. 3. Receiver encryption board has failed. Replace cartridge. 4. Pogo pins bent or failed. 5. Cartridge not in all the way and latched. 6. Insure the Z stage is not on the lower or upper limit switches.
2. Cartridge failed to load after three tries.	1. Cartridge is defective (e.g. material jammed in cartridge, worn drive wheel). Replace 2. Cartridge is empty. Replace cartridge. 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 cartridge. 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.
3. "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.
4. Filament makes it to drive wheel pinch point but "Load Failed" 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.
5. 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

1. System boots, but won't talk to network.	1. If using static - Wrong IP address, check that IP in machine and Admin are the same. 2. If using static - Make sure the IP address is static on the customer's network. 3. Network Internal (Pigtail) cable bad. Plug network cable directly into SBC to test. 4. Check pin alignment on rear RJ45 socket. 5. OS on Hard Drive maybe corrupt - replace the hard drive. 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.
2. 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. 2. Uncheck the box that says "Enable Firewall Client".
3. Need to find MAC address (SBC)	1. From a DOS prompt type arp -a and hit return. 2. If system is running controller software build 1204 or higher go to "Setup" menu.
4. When sending a part, an error window displays	1. From a DOS prompt type arp -a and hit return. 2. If system is running controller software build 1204 or higher go to "Setup" menu. 3. "Missing close-brace" in error window - replace both cartridges.

L). Part Quality

1. Part surface is rough. **1.1 Part is overfilled.**	1. STL wall thickness is too thin 2. Check XY table for loose hardware 3. Filament diameter is too large (should be between .068 - .072). - Try another WHITE cartridge. 4. Toggle spring is deformed - replace toggle spring
1.2 Just Plain Rough	1. Replace tip shroud 2. Loose tip. Tighten screws. 3. Loose heater block. Tighten screws. 4. Replace tip. 5. Check XY table for loose hardware 6. If part is curling, rerun Z calibration. 7. Check that Y belt clamp is tight. 8. Deformed toggle spring. Replace spring

1.3 Hysteresis Problem	1. Reprocess part and resend. 2. Loose tip. Tighten screws. 3. Loose heater block. Tighten screws. 4. Lube the XY Guide Rods. 5. Check and adjust belt tension. 6. Build XY test part (part pending).
1.4 Extreme over extrusion.	1. Filament motor runaway. - Check motor connection and connectors on 2. Umbilical cable to the filament motor is bad 3. Reprocess the part and resend
1.5 Witness Mark (a vertical scar/groove on the part) from trailing tip.	Not applicable
1.6 Surface appears very slightly shifted	1. Make sure that XY guide rods are tight. 2. Check Z Stage for loose screws and loose guide rods 3. Make sure Y Belt clamps are tight 4. Replace motors 5. Replace XY table
2. Support is embedded in model.	1. Run Z Calibration and check / adjust XY Tip Offset
3. Model has shifted during build.	1. Power off the machine and manually move the XY. Ensure the movement is smooth and consistent - if not smooth, could have bad bearings, motors or belts. 2. Check for rust on rods - clean small amounts 3. Reprocess part and resend 4. Problem with XY table - Check belts and bearings. Check lubrication. 5. Replace motor 6. Substrate wasn't latched (multiple shifts in y-axis). 7. Loose tip or heater block - Tighten heater block screws and run Z calibration. 7. Bad motor cable (x-axis shift only). 8. Bad Y motor drive belts. 9. Overflowing Purge Bucket 11. Purge Blobs - look for damaged Tip Shroud 12. CFG file can be used to determine if the shift is Toggle induced or an XY caused shift.
4. Part shifted in X only	1. Check Toggle Plate Assembly Force a. Material build-up behind toggle plate or inlet tube - remove material b. Thrust washers on lower toggle shaft are installed backwards or are missing c. Physical interference with the toggle. 2. Bad Toggle Sensor - replace toggle sensor board 3. Bad Head Board - replace head board

4. Burn marks in part	1. Check tip wipe brush and flicker. 2. Replace Tip Shroud 3. Loose tip. 4. Material build-up behind the tip - remove excess material
4. Yellow Streaks in Part	1. Re-Orient part
5. Part Fell Over	1. Run Z-Calibration. 2. Reprocess - Resend part 3. Overfill / part curl / unstable geometry 4. Bad Z motor - test with HyperTerminal and running the TZ command.
6. Wavy Roads	1. Problem with XY table - Check belt tension and bearings. 2. Reprocess STL at a higher resolution
7. Part Curl	1. Part is too dense - try "Sparse" fill 2. Re-run Z Calibration 3. Check that all chamber fans are working 4. Check for loose heater covers 5. Verify the chamber temperature using a thermometer
8. Part shifts in the Z Direction	1. Check that lead screw is clean and well lubricated 2. Binding Z stage nuts -replace nut. 3. Bad Z motor - test with HyperTerminal and running the TZ command. 4. Z drive belt is worn or loose
9. Wavy parts	1. X or Y Motor issue - replace motors 2. Replace Toggle plate Assembly 3. Idler pulley problem - replace XY table 4. Reprocess STL at a higher resolution
10. Underfill	1. Install a new material cartridge. 2. Replace tips 3. Reprocess part using CatalystEX default settings 4. Check to make sure Work Station is running the latest version CatalystEX 5. Inspect for Spaghetti Head 6. Replace head board
11. Model material sagging on curved parts	Change material.

M). Pauses During Build

1. Chamber won't heat up to at least- **75 degrees**	1. Heater element(s) are burnt out. Using a thermometer check if one side is blowing cooler air than the other 2. Check heaters connections. J3 on the controller 3. Heater bad. Check heater resistance - should be about 36 ohms. 4. Check chamber fans.
2. 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. 3. Head board ground wire loose or not attached. Using a meter, ohm to head chassis 4. Check for 120VDC output from the PDB. If voltage is not present or low - replace the PDB. 5. Umbilical cable connector loose at head board - check to make sure it is fully seated. 6. Head Board is bad. Replace Head Board 7. Check ground between Toggle Plate and Head Board. 8. Head T/C wire is shorted to the head chassis. Check or torn or damaged wire insulation. 9. The heater wires in the umbilical cable are broken 10. Head T/C is not fully inserted into heater block. Check that T/C is installed correctly. 11. Head T/C is crushed. Check by ohming from the T/C connector pin to the head body Reading should show open.
3. Pausing during build and temperatures are correct. **NOTE:** Pausing may be caused by multiple read/write errors not temperature issues.	1. Check CFG for valid (over 60) R/W errors. If errors are noted: a. Check card reader LED for heartbeat - if none check connector J18 on the 186. b. Replace card reader c. Replace receiver cable/receiver d. Replace the controller board
4. STOPS during build, display still shows building, does not start to build again.	1. Cycle power 2. Follow TS instructions for Pausing issues (see above) 3. If issue continues (randomly) replace SBC (SBC is unexpectedly rebooting)

N). Power Down

1. Fails to shutdown.	1. Toggle the power down switch again. 2. Shut system off at the breaker.
2. Display indicates "Recovery after uncontrolled shutdown" **Display indicates "Lost Power"** **Display indicates "Recovery after controlled loss of power"**	1. AC power was interrupted. Check customers AC power. 2. Bad control power down switch cable.
3. Shuts down immediately after the control power down switch is thrown.	1. Check to make sure all connectors are seated on the SBC. 2. Replace the PDB. 3. Replace the SBC.

O). Power UP / Boot

1. Chamber won't heat up to at least: **65 degrees**	1. Envelope Heater bad. Check heater resistance -should be about 36 ohms 2. Heater element(s) are burnt out. Using a thermometer check if one side is blowing cooler air than the other 3. Check heaters connections. J3 on the controller 4. Heater bad. Check heater resistance - should be about 36 ohms. 5. Check chamber fans.
2. Head won't heat up.	1. Liquefier heater is bad. Check for 120VDC at head. If OK replace head. 2. Fuse on the 120 VDC supply is blown (on PDB). 3. Check for 120VDC output from the PDB. If voltage is not present or low - replace the PDB. 4. AC input power is inadequate. Check AC input power. 5. Liquefier heater is open (infinite resistance). 6. Low AC input power. Make sure system is NOT attached to an ext. cord/power strip 7. One of the four heaters is bad. 8. Head board ground wire loose or not attached. Using a meter, ohm to head chassis 9. Umbilical cable connector loose at head board - check to make sure it is fully seated. 10. Head Board is bad. Replace Head Board 11. Check ground between Toggle Plate and Head Board. 12. Head T/C wire is shorted to the head chassis. Check or torn or damaged wire insulation. 13. The heater wires in the umbilical cable are broken 14. Head T/C is not fully inserted into heater block. Check that T/C is installed correctly. 15. Head T/C is crushed. Check by ohming from the T/C connector pin to the head body Reading should show open.

3. No fans, lights, text and no LCD back light (no nothing)	1. Check if the main thermostat is open. 2. 24VDC power supply is bad. Replace 24VDC supply. 3. Check cable from 24VDC supply to PDB. 4. PDB has failed, no 24 volt output. Replace PDB. 5. Bad Thermal safety switch - Replace Head Board
4. No fans, lights, text and LCD back light is ON	1. Use HyperTerminal and/or CFG File to check for additional error codes (**root cause**). 2. Thermal safety switch has opened. Reset switch by cycling power 3. Replace head board, chamber heater cable, and/or umbilical cable
5. System won't boot, no display after 5 minutes. Fans and lights are operating **NOTE:** Replacement Hard Drive may take up to 45 minutes to boot.	1. If system homes: Check LCD ribbon cable, if OK replace LCD 2. If system does NOT home: Power on for at least 10 minutes, repeat 2 more times if there is still no text. If after three power cycles of 10 minutes each and there is still no text replace the hard drive. 3. Measure for 12VDC from the PDB (to the hard drive). Replace PDB 4. Replace SBC.
6. System powers off after a few seconds.	1. Check that ALL the dip switches are in the proper position (see Service Guide). 2. Use HyperTerminal and/or CFG File to check for additional error codes (**root cause**). 3. 24VDC power supply may be crow-barring. Measure resistance at the PDB If resistance is within tolerance replace supply, if not there is most likely a short in the system.
7. System reaching temp, does not go to "Idle" screen and head hits into the right side of the machine	1. Modeling base sensor broken. System is attempting to retract sensor. Replace the sensor.

P). "Can't Find Home - Check Modeling Base" displayed on LCD

1. Head stops over Z stage/modeling base	1. No modeling base 2. Modeling base is used/defective - Replace
2. Head moves to lower modeling base sensor but does NOT move over substrate	1. Modeling base sensor is NOT turning off before performing touchdown (verify using Maraca) 2. Y EOT sensor is not operating correctly. Check using Maraca or DataStat 3. Debris on Z Stage casting prevents Z stage from finding home
3. Head completes finding modeling base routine then displays error message.	1. Z offset value is incorrect (out of operating range) Check/adjust value using Maraca or download CAL file from floppy to restore factory calibration values. 2. Flatness check may have failed. Use HT to read the touchdown values. Compare these values to the "tolerance" value displayed. If this value is over 1728 replace the substrate. 3. If failure reoccurs check XY table level using the head bracket and dial indicator. Values should be a band of 0.010 total for the four points (0.003 total) 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. 4. If failure reoccurs the X rear guide rod may be out of alignment. Replace XY table.
4. Head stops moving while attempting to lower Z detect sensor plunger	1. Using Maraca 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 Maraca or download CAL file from floppy to restore factory calibration values.

Q). System VERY slow to reach temperature

1. Envelope takes unusually long (over 40 minutes) to reach temperature.	1. Replace PDB (Loose SS relay) 2. Envelope heater(s) bad. Check heater resistance - should be about 36 ohms.

R) Calibration Issues

1. Tip offset cal part - support and model over .78" offset	1. Check that tip offset values are close to default values. default = 0.78, 0.00
2. Tip offset values change but do not take.	Tip offset is changed in Maraca 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) Unexpected Behavior

1. System continues to display "load upgrade" after performing upgrade (upgrade loop)	1. Try loading upgrade at lease three times. 2. Controller firmware is not upgrading. Verify by reading the CFG file. Upgrade firmware using HT and running sndbin
2. Substrate sensor arm does not fully retract sensor after finding substrate.	1. Substrate sensor is turning on prematurely. 2. Check if sensor assemble is loose.

T) Z Calibration Failure

1. First layer too deep into substrate **Solution: Z offset +.010**	**SST** Left square (SS) *Upper layers* - Missing *1st layer* - May be visible, but looks choked off. Etches may be visible in substrate. Right square (model) *Upper layers* - Missing or barely stuck to substrate. Part layer shifted. *1st layer* - May be visible, but looks choked off. Etches may be visible in substrate.	**BST** Left square (BASS) *Upper layers* - Missing/barely stuck to substrate *1st layer* - May be visible, but looks choked off. Etches may be visible in substrate. Right square (model) *Upper layers* - Did not build completely. May be some wisps of model material. *1st layer* - May be visible, but looks choked off. Etches may be visible in substrate.
2. First layer tip too high off substrate **Solution: Z offset -.010**	**SST** Left square (SS) *Upper layers* - Missing or barely stuck to substrate *1st layer* - Missing or barely stuck to substrate Right square (model) *Upper layers* - Missing or barely stuck to substrate *1st layer* - Missing or barely stuck to substrate	**BST** Left square (BASS) *Upper layers* - Missing or barely stuck to substrate *1st layer* - None Right square (model) *Upper layers* - Missing or barely stuck to substrate *1st layer* - None
3. Support tip much lower than model tip **Solution: Z offset -.010**	**SST** Left square (SS) *Upper layers* - Built OK *1st layer* - OK Right square (model) *Upper layers* - Missing or barely stuck to substrate. *1st layer* - OK	**BST** Left square (BASS) *Upper layers* - Did not build completely. *1st layer* - May be visible, but roughed up form the support tip Right square (model) *Upper layers* - Built OK *1st layer* - OK

4. Support tip much higher than model tip **Solution: Z offset +.010**	**SST** 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	**BST** Left square (BASS) *Upper layers* - Missing/barely stuck to substrate *1st layer* - OK Right square (model) *Upper layers* - Built OK *1st layer* - OK
5. Bad tip shroud **Solution: Replace tip shroud**	**SST** Pad (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	**BST** Pad (BASS) *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
6. Model filament not loaded **Solution: load material**	**SST** Left square (SS) *Upper layers* - Built OK *1st layer* - OK Right square (model) *Upper layers* - Missing. No evidence of ABS extrusion. *1st layer* - OK	**BST** Left square (BASS) *Upper layers* - Missing/barely stuck to substrate *1st layer* - Missing. No evidence of ABS extrusion Right square (model) *Upper layers* - Missing. No evidence of ABS extrusion *1st layer* - OK
7. Support filament not loaded **Solution: load material**	**SST** 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 substrate. *1st layer* - Missing. No evidence of SS extrusion	**BST** Left square (BASS) *Upper layers* - Missing. No evidence of BASS extrusion *1st layer* - OK Right square (model) *Upper layers* - Built OK *1st layer* - OK

5.0 Using HyperTerminal

HyperTerminal (HT) is a useful tool for checking system functions.While the list of possible HT commands is extensive, only the commands that are most appropriate for field service work are listed here.

WARNING: HyperTerminal commands can override system safety systems. Personal injury and system damage is possible if care is not exercised when using HyperTerminal commands.

Starting HyperTerminal

Required Tools

- Null modem cable (“Laplink”) with DB9 style connectors, pins 2 and 3 swapped.
- Computer with Windows NT 4.0, 2000, or XP.

Procedure

1. Connect the serial cable from the computer COM port to the COM port on the back of the Dimension printer.
2. From the computer start HyperTerminal.
   a. Select Start > Programs > Accessories > Communications > HyperTerminal
   b. From “Connection Description” window, select any “icon” and enter an icon “name” - user choice. Click “OK”.
   c. From the “Properties” window: “Connect to” tab, choose a COM port from the “Connect to” window. Click “Configure”.
   d. From the “Ports” tab set:
      - Bits per second - 38,400
      - Data Bits - 8
      - Parity - None
      - Stop Bits - 1
      - Flow Control - Hardware
   e. Click “OK”.
3. With HperTerminal running:
   a. From the HyperTerminal File menu select “Properties”.
   b. Select the “Settings” tab, then click the “ASCII Setup...” button.
   c. From “ASCII Setup” window check “Append line feeds to incoming line ends” and “Wrap lines that exceed terminal width”.
   d. Click “OK”.

Before Using HyperTerminal Commands

Type the following commands to initialize controller and to establish an operator-friendly environment (HT commands are **case-sensitive**. Separate all parameters with a space.):

in <Enter>
trace category commandDetails on <Enter>
trace category commandNames on <Enter>
trace category commandParameters on <Enter>
trace category commandCompletion on <Enter>

Useful HyperTerminal Commands

NOTE: A complete list of HT commands is accessible through HT. Type **help** for a list of all commands or **help command** (where **command** is a specific 2-letter command) for an explanation of a command and its parameters.

HT commands are **case-sensitive**. Separate all parameters with a space.

Command	Definition and Use
cl	Chamber Light: turns chamber light ON or OFF Parameters: 0 (light OFF); 1 (light ON) Example: to turn the light ON, type **cl 1** <Enter>
dl	Door Latch: controls the door latch Parameters: 0 (Unlock); 1 (Lock); 2 (latch controlled by system controller) Example: to unlock the door latch, type **dl 0** <Enter>
fh	Find Home: Determines the XY axis home position. X and Y axis limit switches are located, origin is set, and head is placed over the purge bucket. Example: to find home, type **fh** <Enter>
fz	Find Z Home: Determines the Z axis home position based on the modeling base installed. Example: to find Z home type **fz** <Enter> NOTE: For fz to be accurate fh must be run before running fz. Commands can be combined in HT. Separate the commands with a semi-colon. Example: to find home and then find Z home, type **fh; fz** <Enter>
gp	Get Post: returns power on self-test results. Example: to see power on self-test results, type **gp** <Enter>
le	Load Exception: displays the contents of the exception log in chronological order. The exception log contains a record of the most recent exceptions that occurred within the system controller. Example: to display the exception log, type **le** <Enter>
mz	Move Z: moves the Z-Stage **relative** to a current position (movement will be from the current position of the Z-Stage). ***CAUTION: Use extreme care when using the mz command. Limit switches are disabled during execution of the command. Damage may occur if the Z-Stage is driven into a stop. Know the approximate position of the Z-Stage and the amount and direction of available movement before running the command.*** Parameters: value will be the amount and direction of Z-Stage movement. A negative (-) value moves the Z-Stage up. A positive value moves the Z-Stage down (do not use a plus sign, value is positive unless a negative sign is used). Decimal point number moves the Z-Stage in inches. Non-decimal point number moves the Z-Stage in microsteps. Example: to move the Z-Stage up 2 inches from its current position, type **mz -2.0** to move the Z-Stage down 2 inches from its current position, type **mz 2.0**

Command	Definition and Use
mx	Move X: moves the X-Axis to an **absolute** position (movement will be to a defined position relative to the home position - without regard to the current position of the X-Axis). Parameters: value will be the absolute position to which the X-Axis will be moved relative to home. Because all positions are absolute, a negative (-) value is meaningless and cannot be used. Decimal point number moves the X-Axis to an absolute position in inches. Non-decimal point number moves the X-Axis to an absolute position in microsteps. Example: to move the X-Axis to a position 2 inches from home, type **mx 2.0**
my	Move Y: same definition as mx, except my is for the Y-Axis (See mz).
rt	Repeat: runs command (or series of commands) a user defined number of times. Parameters: First non-decimal number defines the number of times to repeat a command. Second number (0 or 1) is for ignoreErrors. 0 will stop a run if an error is reported; 1 will cause the test to run all cycles, ignoring errors. Third parameter must be in double quotes - and is the command(s) to be repeated. Example: to run a tz command 3 times and ignore errors, type **rt 3 1 "tz 0.4"**
ss	Switch Status: controller outputs a report on optical and mechanical switches Example: to see controller report on switches, type **ss** <Enter>
tz	Test Z: measures the distance from a user-defined offset to the Z limit switches. ***Note: fh and fz must be run before executing tz or xt.*** Parameters: Offset is the starting point for the measurement and is defined by the user. Decimal point number sets offset in inches. Non-decimal point number sets offset in microsteps. Example: to check for position of switches relative to a starting point of 2 inches, type **tz 2.0** <Enter>
xt	Test XY Limits: measures the distance from a user-defined offset to the X and Y limit switches. ***Note: fh and fz must be run before executing tz or xt.*** Parameters: Offset is the starting point for the measurement and is defined by the user. Decimal point number sets offset in inches. Non-decimal point number sets offset in microsteps. Example: to check for position of switches relative to a starting point of 2 inches, type **xt 2.0** <Enter>

Disconnecting HyperTerminal

1. Close the HyperTerminal window.
2. Disconnect the cable from the printer.
3. Cycle the power on the printer.

Index

Symbols/Numerics

120/240 VAC
Jumper Configuration 9-13

A

Adjusting
Upper Z Limit Switch 5-13
Automatic Operation 2-3

B

Bezel 4-9
Build Size 2-3

C

Calibration
Get/Send Files 5-13
Part Based 5-3
Tip Offset 5-2
Y Lash 5-3
Controller Board
Functionality 2-6
Safety Devices 2-11

D

DataStat 6-3
Dip Switches 2-12
Door Solenoid 4-89

E

Electrical Components 4-3
Envelope Heater
1 Lead Screw 4-74
Envelope Thermal Cutout Switch 4-26
Envelope Thermocouple
1 Lead Screw 4-73
Errors
Overview 2-5

F

Foam Retainer 4-72
Front Bezel (Panel) 4-8, 4-9

G

Galvanized Receiver
Assembly 4-84
Get/Send Calibration Files 5-13

H

Hazard Classifications 1-1
Head Amplifier Board 4-42
Head Components 4-26
Head Cooling Fan 4-26
Head Temp Snap Switch 4-26
Heater Fan 4-26
Hot Surface Sign 1-1

L

Layer Resolution 2-3
LED's 2-13
Leveling
    Z Tray 5-16
Leveling the XY Table
    Belt Drive 4-63
Loading Material 2-4

M

Machine
    Size and Weight 2-3
Making a Part 2-4
Material
    Loading 2-4
    Supply 2-3
    Types 2-3
Motor Driver Board 2-6

N

Network Addresses 3-6
Network Connectivity 2-3

O

Operator Attendance 2-3
Optical Sensors 2-10

P

Panels
    Front 4-8
    Side 4-5
Positional Accuracy (X,Y) 2-3
Power Requirements 2-3
Powering Down 2-4
Powering Up 2-4
Product Safety Symbols 1-1

R

Receiver Assembly
    Black 4-84
    Galvanized 4-84
Receiver Components 4-84
Regulatory Compliance 2-3
Reset Button 2-12

S

Safety 1-1
Safety Devices 1-2
Side Panels 4-5
Single Board Computer 2-6
Software Architecture 6-2
Special Facility Requirements 2-3
Specifications 2-3
SST Head 4-42
Startup Kit 7-2
Support Structures 2-3
Switches 2-10
Swivel Head 4-26
System Functionality 2-3

T

Tensioning
    X & Y Drive Belts 5-8
    X & Y Motor Belts 5-7
    XY Cable Table 5-7
Thermostat Fuse & Cable 4-72
Tip Offset Calibrations 5-2
Tip Wipe Brush/Flicker 4-89
Troubleshooting 8-28

U

Umbilical Cable 4-42
Upper Z Limit Switch 5-13

W

Workstation Compatibility 2-3

X

X Home Sensor 4-56
X Motor 4-56
XY Table Belt Components 4-56
XY Table Cable Components 4-56

Y

Y Drive Assembly 4-62
Y Drive Belt 4-61
Y EOT Sensor 4-63
Y Home Sensor 4-60
Y Lash 5-3
Y Motor 4-60
Y Motor Belt 4-61
Y Pulley 4-61

Z

Z Jam Sensor
    1 Lead Screw 4-76
Z Level Assembly 4-45
Z Level Sensor 4-45
Z Repeatability 2-3
Z Stage Components 4-72
    3 Lead Screws 4-73
Z Stage Motor Belt
    1 Lead Screw 4-77
Z Tray Leveling 5-16

Appendix

Appendix Overview

The appendix contains the following types of documents:

- Illustrated parts breakdown
- Reference Diagrams
- Miscellaneous procedures
- Checklists
- FCOs

The contents and page numbers of this appendix are as follows:

.....1

Appendix Overview.....1

Illustrated Parts Breakdown.....2

Front Panel (Bezel) Assembly.....2
Electronics Bay Area Components.....3
Head Area Components.....5
Cable Drive XY Table Components.....7
Chamber Heater Area Components.....8
Envelope Area Components.....9
Z Stage Area Components.....10
Receiver Area Components.....11
Additional Cables.....12

Backend Download Procedure.....13

Fuse Specifications.....14

Device Voltages.....15

Hard Drive Installation Checklist.....16

Toggle Plate Assembly Installation Checklist.....17

XY Table Installation Checklist.....18

Pre-Installation Checklist.....19

System Installation Checklist.....20

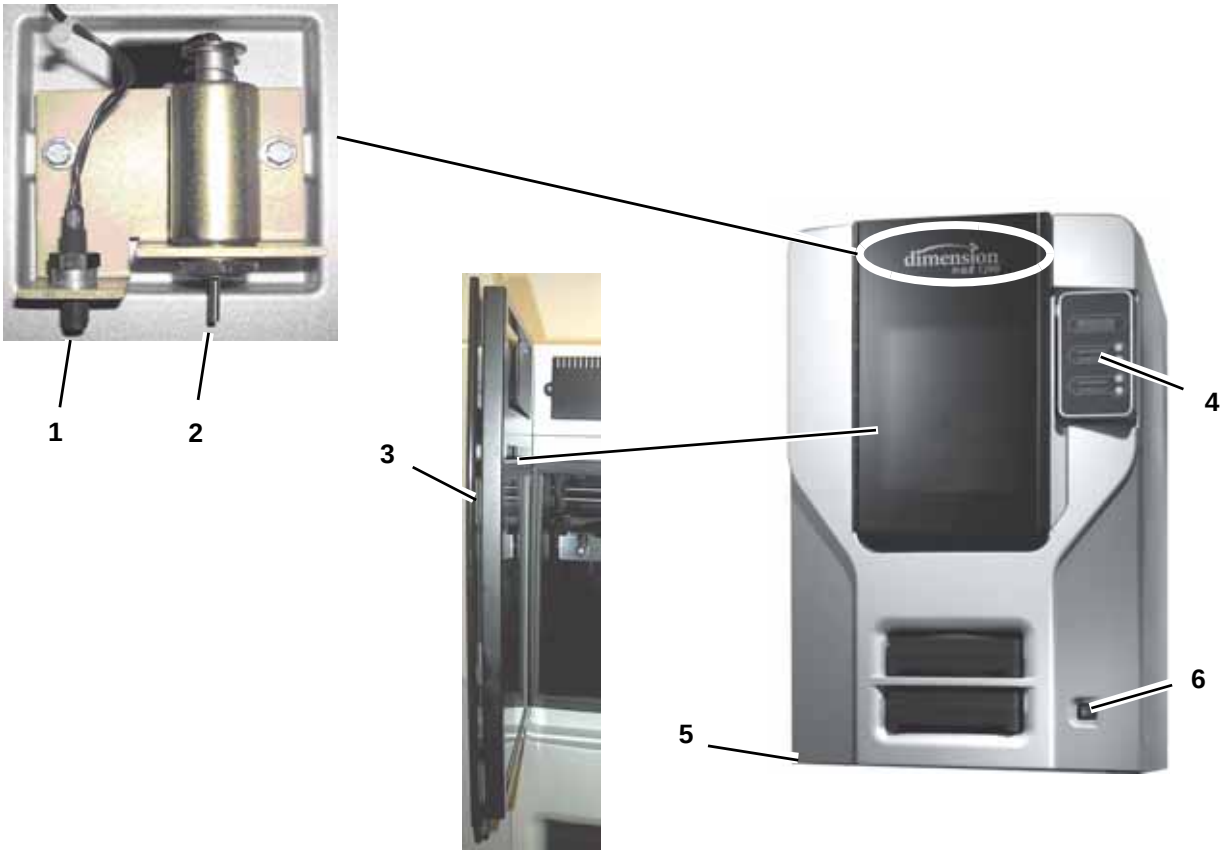
Training Checklist.....21

Required Tool List.....23

Controller Board Checklist.....24

Illustrated Parts Breakdown

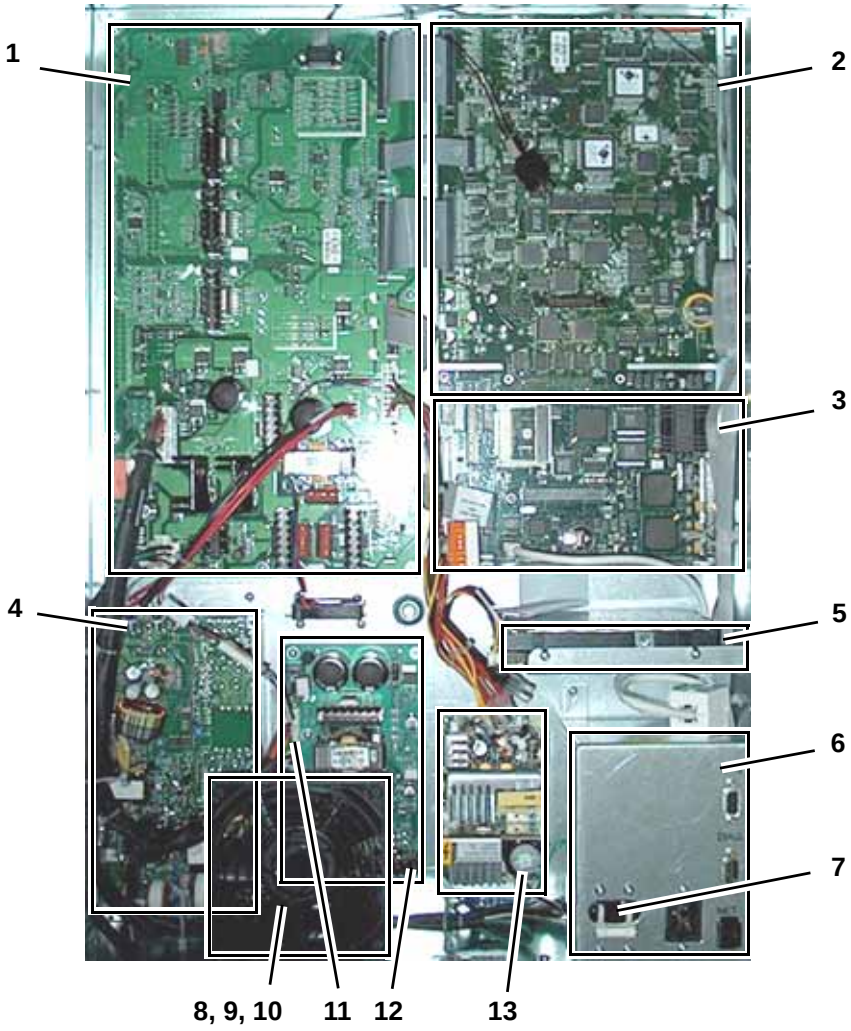
Figure 1: Front Panel (Bezel) Assembly



Key to Figure 1

Item	Part Number	Description	Qty
1	204065-0001	DOOR SWITCH	1
2	204142-0001	DOOR SOLENOID ASSY	1
3	204431-0001	CS, GLASS ASSY, DOOR EXTERIOR BST	1
	OR		
	204432-0001	CS, GLASS ASSY, DOOR EXTERIOR SST	1
4	204429-0001	CS, LCD ASSEMBLY	1
5	201750-0002	FOOT, VIBRATION MOUNT	4
6	204173-0001	SWITCH, BLACK, DPDT 10-15A	1

Figure 2: Electronics Bay Area Components



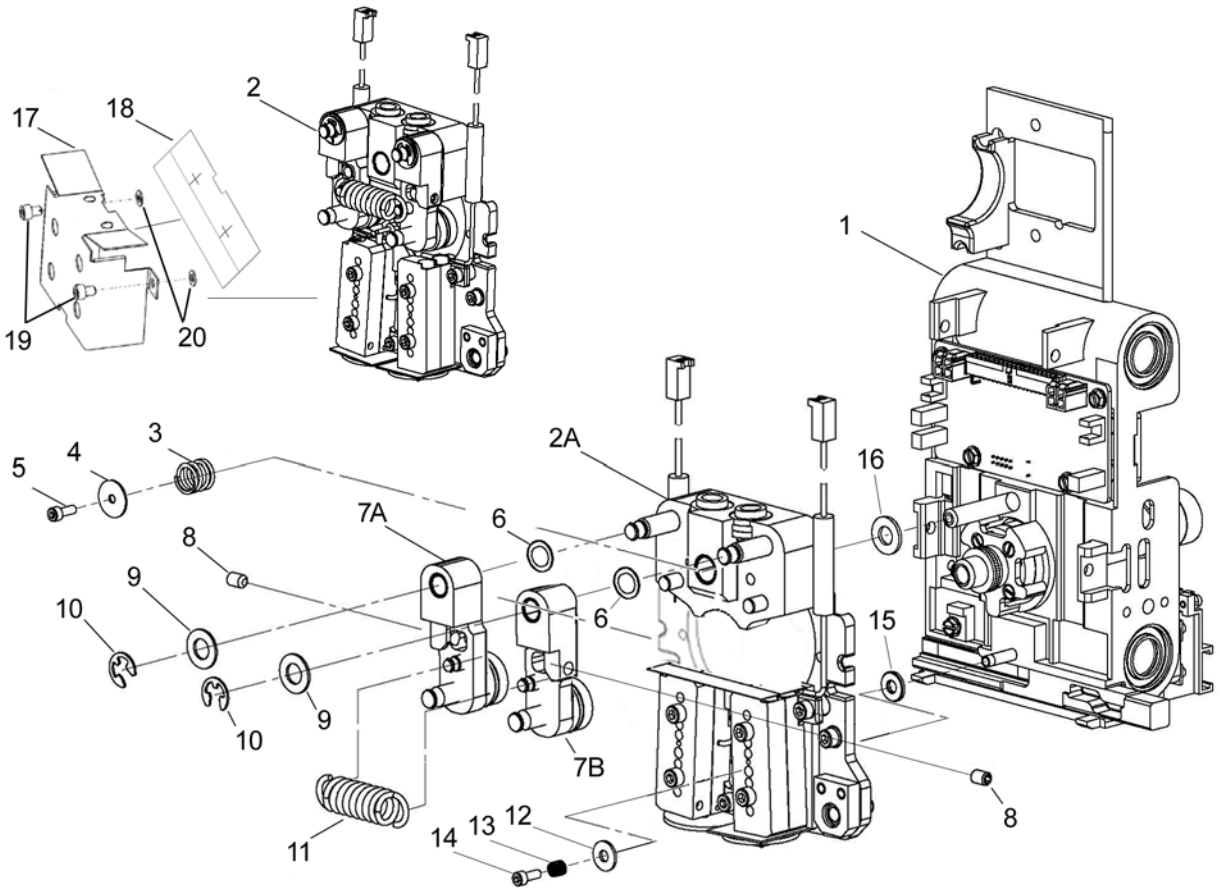
Key to Figure 2

Item	Part Number	Description	Qty
1	202406-CS01	POWER DISTRIBUTION BOARD (PDB)	1
2	202405-CS01	CS, CCA, CONTROLLER BOARD	1
3	201631-0001	SINGLE BOARD COMPUTER (SBC)	1
4	202325-0001	POWER SUPPLY, +24V, 250W	1
5	202329-CS04	HARD DRIVE AND SW, 7200 RPM	1
6	202182-0001	FILTER, 15A INLET LINE	1
7	201525-0002	CIRCUIT BREAKER	1
8	201403-0001	ELECTRONICS BAY COOLING FAN	1
9	201317-0001	GUARD/FILTER, FAN	1

Key to Figure 2 (Continued)

Item	Part Number	Description	Qty
10	201318-0001	GUARD, FAN	1
11	102538-0002	CABLE, 120VDC AUX PWR SUPPLY	1
12	202408-CS01	120VDC AUXILIARY POWER SUPPLY	1
13	202326-0001	POWER SUPPLY, 5/12V, 65W	1

Figure 3: Head Area Components



Key to Figure 3

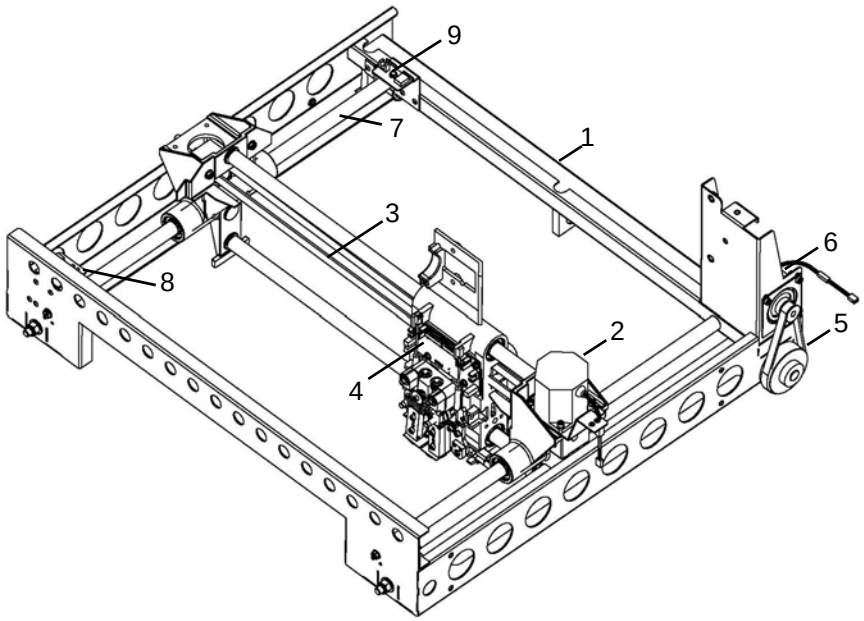
Item	Part Number	Description	Qty
1	Reference	TRANSLATOR	1
2	204162-CS01 204163-CS01	CS, SST TOGGLE PLATE ASSEMBLY CS, BST TOGGLE PLATE ASSEMBLY	1
3	204074-0001	SPRING, COMP TOG PLATE UPPER	1
4	204234-0001	WASHER, .141ID X .625OD X .031	1
5	201327-3004	SCREW, SHC 6-32x1/4 A	1
6	30000269	SHIM, .020	2
7A	204087-0001	BLOCK, PIVOT PIN ASSY LFT SIDE	1
7B	204154-0001	BLOCK, PIVOT PIN ASSY RGT SIDE	1
8	204230-0001	SCREW, S-FP 8-32 X .25	2
9	204187-0001	WASHER, TEFLON .515X.875X.031	2
10	204231-0001	RETAINER, E-RING .219	2

Key to Figure 3 (Continued)

Item	Part Number	Description	Qty
11	204077-0001	SPRING, EXTENSION TOGGLE	1
12	204198-0001	WASHER, THRUST .195ID x .50OD	1
13	204226-0001	SPRING, COMP TOG PLATE LOWER	1
14	201327-3004	SCREW, SHC 6-32x1/4 A	1
15	204198-0001	WASHER, THRUST .195ID x .50OD	1
16	204080-0001	WASHER, THRUST 8MM ID	1
17	204543-0001 204544-0001	COVER ASSEMBLY LIQUIFIER RADIATION SHIELD SST COVER ASSEMBLY LIQUIFIER RADIATION SHIELD BST	1
-	204055-0002 204509-0001	- COVER, LIQUIFIER RADIATION SHIELD SST - COVER, LIQUIFIER RADIATION SHIELD BST	1
-	204506-0001	- INSULATION, RADIATION SHIELD	1
-	204507-0001	- TAPE, RADIATION SHIELD	1
18	204508-0001	- FILM, TEFLON BARRIER	1
19	10172901	SCREW, SHC 6-32x3/16 A	2
20	204227-0001	WASHER, TEFLON	2
-	204068-0003	HEAD BOARD (contains X home, X EOT sensor, T/C amp, and thermostat)	1
-	204030-0003	UMBILICAL CABLE, HEAD	1
-	205156-0001	ASSY, Z FOAM LEVEL SENSOR	1
-	102531-0001	SENSOR, OPTICAL Z-FOAM	1
-	204037-0002	LIQUIFIER, T16 (BST Model and Support / SST MODEL ONLY)	2/1
-	204070-0002	LIQUIFIER WW, T16 (SST SUPPORT ONLY)	1
-	204224-0001	BLOCK, FILAMENT GUIDE (SST ONLY)	1
-	204430-0001	TUBE,FILAMENT 7.1ft, 1200, SVC	2
-	204040-CS01	CS, MOTOR, DC SERVO KIT	1

- Item Not Shown

Figure 4: Cable Drive XY Table Components



Key to Figure 4

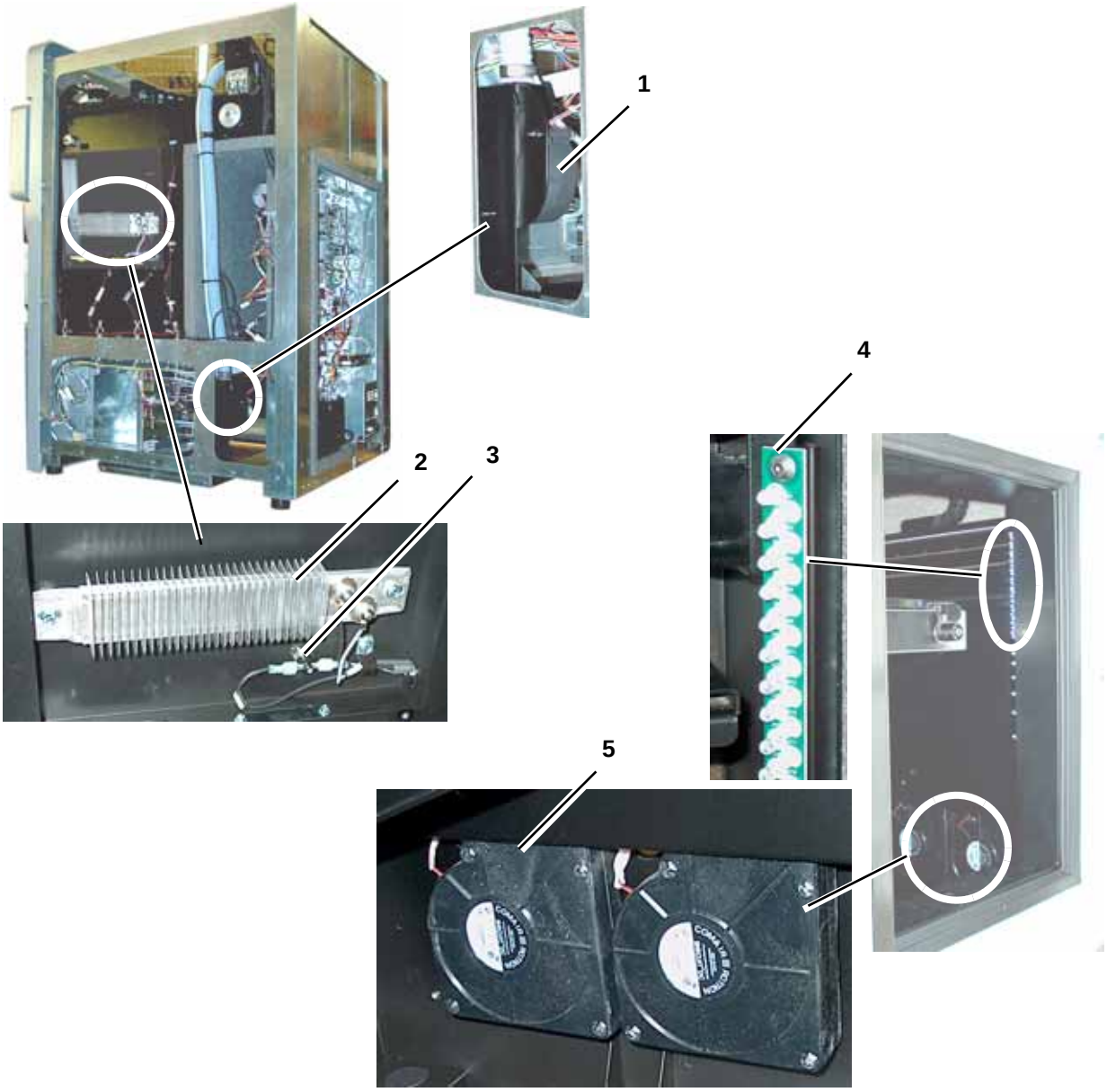
Item	Part Number	Description	Qty
1	204165-CS01 (204165-RT01)	CS, ASSY, XY TABLE 1200	1
2	204008-0001	X MOTOR (returned part)	1
3	204013-0001	X LINEAR (DRIVE) BELT (BELT, 3MM GT .472WW X 356 T)	1
4	204068-0003	HEAD BOARD (contains X home, X EOT sensor, T/C amp, and thermostat)	1
5	204009-CS01	MOTOR, Y ASSY KIT	1
6	201924-0001	Y MOTOR BELT	1
7	204014-0001	Y LINEAR (DRIVE) BELT (BELT 3MM GT .472W X 350T)	2
8	204073-0001	CCA, OPTO LIMIT SENSOR	1
9	204380-0001	CCA, OPTO LIMIT SENSOR W/RES	1
-	204040-CS01	CS, MOTOR, DC SERVO KIT	1

- Item Not Shown

Note: The X home sensor, X EOT sensor, and thermostat are located on the head board

The Y and Z motors share the same electrical cable.

Figure 5: Chamber Heater Area Components



Key to Figure 5

Item	Part Number	Description	Qty
1	204542-0001	BLOWER, HEAD COOLING ASSY	1
2	202152-0001	HEATER, FINNED STRIP 120V 400W (CHAMBER)	2
3	202114-0001	THERMOSTAT, 121 DEG C DISC	1
4	204186-0002	CCA, LED LIGHT BAR	2
5	201402-0001	ASSY, CHAMBER FAN	4

Key to Figure 5 (Continued)

Item	Part Number	Description	Qty
-	204026-0001	CABLE, CHAMBER HEATERS	2
-	102535-0001	CABLE, CHAMBER THERMOSTAT (MAIN)	1

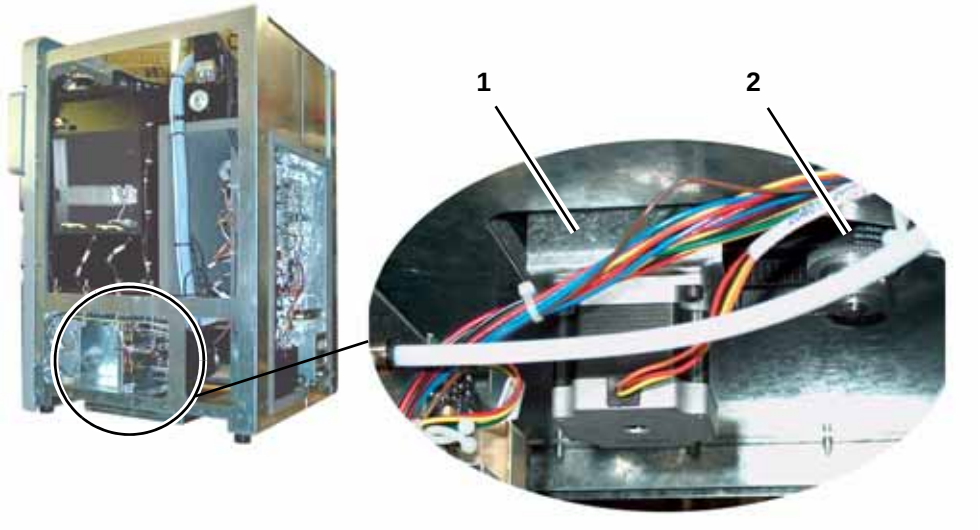
- Item Not Shown

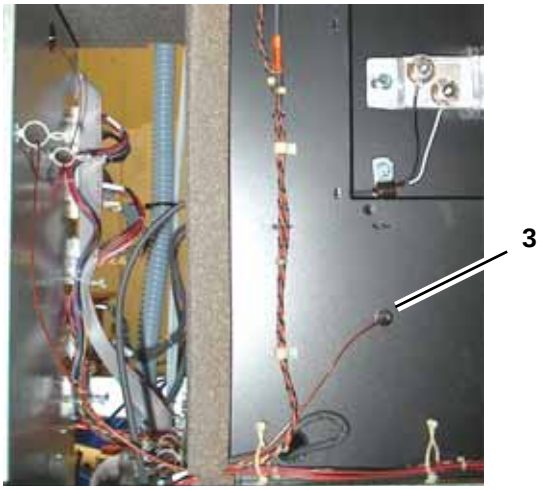
Figure 6: Envelope Area Components

Key to Figure 6

Item	Part Number	Description	Qty
1	204073-0001	Z EOT/HOME OPTO SENSOR	2
2	104223-0001	BRUSH (tip wipe)	1
3	202080-0001	FLICKER	1
4	204189-0001	PURGE BUCKET LIGHT	1
5	204042-0002	BUCKET, PURGE	1

Figure 7: Z Stage Area Components



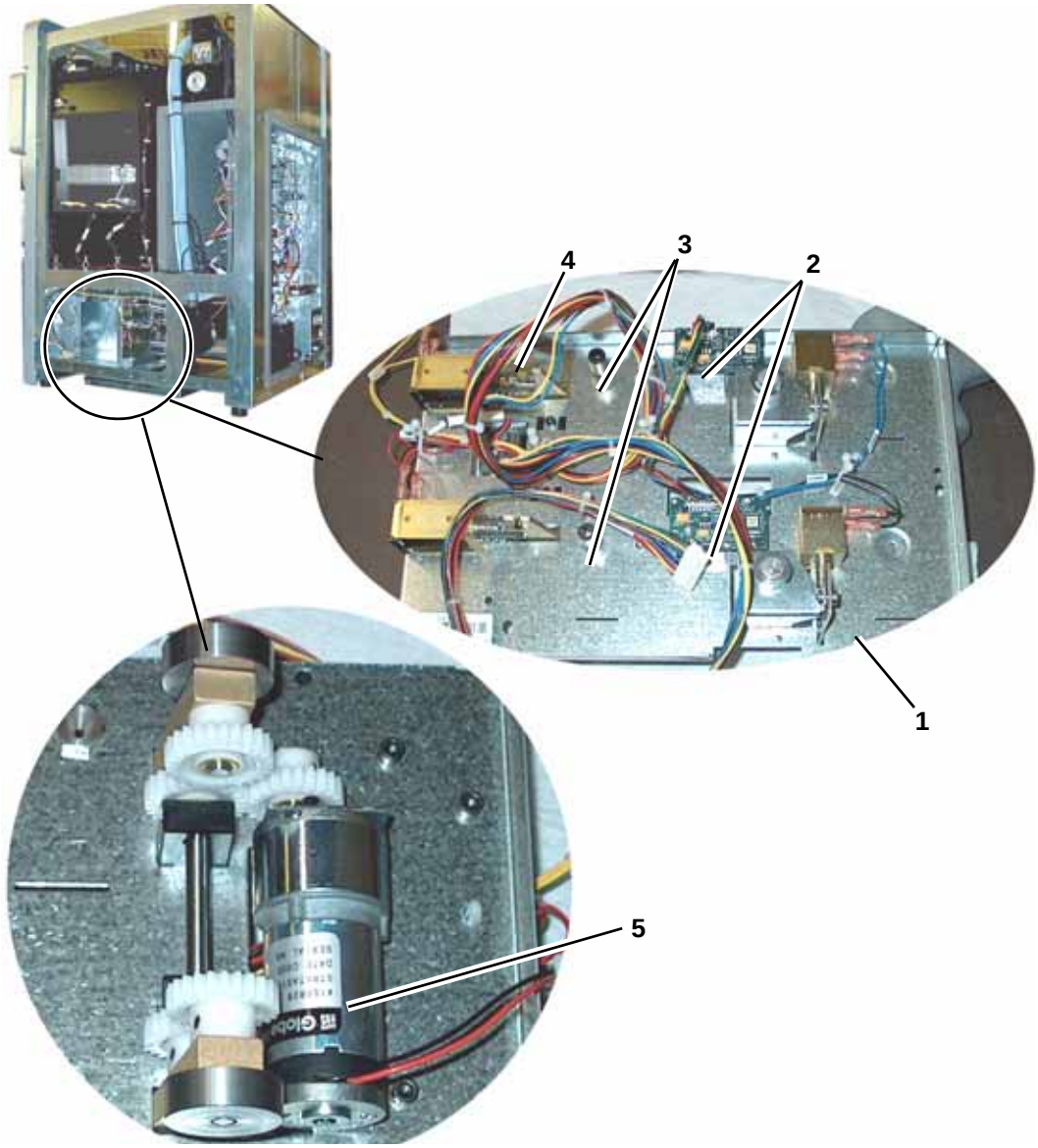


Key to Figure 7

Item	Part Number	Description	Qty
1	204010-0001	Z MOTOR ASSY	1
2	204015-0001	BELT 3mm GT .354W x 89T	1
3	202150-0001	THERMOCOUPLE, J TYPE 36 IN	1
-	204428-CS01	CS, Z-STAGE ASSY, DIM 1200	1

- Item not shown

Figure 8: Receiver Area Components



Key to Figure 8

Item	Part Number	Description	Qty
1	204427-0001	ASSY, RECEIVER BACKPLATE, SVC	1
2	202039-0002	CASSETTE READER CARD	2
3	102814-0003	FITTING, MODIFIED UNIVERSAL (filament tube fitting)	2
4	102539-0002	CABLE, ELECTRICAL, RECEIVER MOTOR	1
5	202009-0002	MOTOR, RECEIVER DRIVE	1
-	204430-0001	CS, TUBE, FILAMENT, DIM 1200	2

- Item not shown

Additional Cables

Item	Part Number	Description	Qty
-	204030-0003	UMBILICAL CABLE, HEAD	1
-	102570-0001	CABLE, UPS TO PDB	1
-	204196-0001	CABLE, DOOR EXTENSION	1
-	204147-0001	CABLE, DISPLAY EXTENSION	1
-	204027-0001	CABLE, ELECTRICAL, Y MOTOR AND Z MOTOR	1
-	204048-0001	CABLE, DISPLAY	1
-	204029-0001	CABLE, CTRLED OFF&THERM SWTCH	1
-	102540-0001	CABLE, RS232 DIAG	1
-	102541-0001	CABLE, RIBBON SBC TO PDB	1
-	102542-0004	CABLE, AC TO PDB & PWR SPLYS	1
-	102543-0001	CABLE, 24V TO PDB	1
-	102544-0002	CABLE, LOW VOLTAGE	1
-	102545-0002	CABLE, LINE FILTER INPUT	1
-	105175-0001	COUPLER, INLINE RJ45	1
-	105176-0001	CABLE, COMMUNICATION	1
-	202323-0001	CABLE, CTRL TO PDB 50POS	1
-	202324-0001	CABLE, CTRL TO PDB 20POS	1
-	204028-0001	CABLE, MID UNIT HARNESS	1

- Item Not Shown

Backend Download Procedure

Required Tools

- “Dimension” backend and CatalystEX CD
- Crossover cable or network connection
- Notebook computer or workstation with Windows 2000 or XP Pro

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

Procedure

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

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

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

Fuse Specifications

Fuses are located on the Power Distribution Board.

WARNING: Fuses must be replaced with the same type and rating as listed below.

Head Thermal Cutout Fuse (Snap): Temperature cutout at 150° C (300° F)

Chamber Thermal Cutout Fuse (Snap): Temperature cutout at 83° C (180° F)

Table 1 : F1

Fused Voltage	24VDC
Rating	6 Amp 250 Volt
Type	Fast acting
Size	5 x 20 mm
Mfg. P/N	• Littelfuse #21706.3 • Bussmann # GDB-6.3 • Wickmann #193-6, 3

Table 2 : F2

Fused Voltage	12VDC
Rating	2 Amp 250 Volt
Type	Fast acting
Size	5 x 20 mm
Mfg. P/N	• Littelfuse #217002 • Bussmann # GDB-6.3 • Wickmann #193-2,0

Table 3 : F3

Fused Voltage	120VDC
Rating	3.15 Amp 250 Volt
Type	Fast acting
Size	5 x 20 mm
Mfg. P/N	Littelfuse # T3.15AL250V

Device Voltages

Cartridge drive motor - 12VDC (servo, no encoder)

Cartridge solenoids – 24VDC

Chamber heaters – 120VAC (parallel) or 240VAC (series)

Chamber heater fans – 24VDC

Chamber lights – 24VDC

Door solenoid – 12VDC

Exhaust fans – 24VDC

Head servo drive motor – 12VDC

Homing and EOT sensors – 5VDC

LCD display (back light) – 5VDC

LCD display (text) – 12VDC

Liquefier – 120VDC (PWM)

X, Y and Z motors – 24VDC

Hard Drive Installation Checklist

If you have any questions before or during installation, do not hesitate to call your Customer Support provider.

- ☐ Replace the hard drive.
- ☐ Verify that all cables are connected correctly.
- ☐ Clean and lube the system. See “Preventive Maintenance” on page 7 - 1 of the service guide.
- ☐ Power system up.
- ☐ After approximately 10 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 controller software using the most current version. Download instructions for performing the download procedure are located on the controller software CD.
- ☐ Once download is complete, system will reach “Idle”.
- ☐ Load material.
- ☐ Remove the system floppy from the electronics bay. Using Maraca, “send” the .cal file from the floppy to the system hard drive.
- ☐ Run a small test part to ensure part quality is acceptable and that the system is operating properly.
- ☐ Using Maraca, select “Get” to send the .cal file from the system to the floppy. Replace the floppy in the electronics bay and secure the rear door.
- ☐ 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 Plate Assembly Installation Checklist

If you have any questions before or during installation, do not hesitate to call your Customer Support provider.

- ☐ Replace the Toggle Plate Assembly. See “Toggle Plate Assembly” on page 4 - 26.
- ☐ Verify that all electrical leads are connected correctly.
- ☐ Perform Drive Wheel Alignment. See “Drive Wheel Alignment” on page 4 - 32
- ☐ Perform Idler Wheel Adjustment. See “Idler Wheel Check/Adjustment” on page 4 - 35
- ☐ Align Liquefiers. See “Liquifier Alignment” on page 4 - 37
- ☐ For SST - Align Support Filament Guide. See “Support Filament Guide Alignment (SST Only)” on page 4 - 38
- ☐ Verify Liquefier Alignment. See “Verify Liquefier Alignment” on page 4 - 38
- ☐ Clean and lube the system. See “Preventive Maintenance” on page 7 - 1.
- ☐ Power system up and verify that head reaches temperature and the system homes correctly.
- ☐ Load material.
- ☐ Perform the Z Calibration and XY Offset Calibration (See “Adjusting Z Calibration and XY Tip Offset” on page 5 - 2).
- ☐ Run a part to ensure part quality is acceptable and that head is functioning correctly.
- ☐ Remove the system floppy from the electronics bay.
- ☐ Using Maraca select “Get” to send the .cal file from the system to the floppy. Replace the floppy in the electronics bay and secure the rear door.
- ☐ Discuss with the customer any questions or issues they may have.
- ☐ Pack the old Toggle Plate Assembly into the shipping box along with the RMA documentation and ship back to Stratasys.

XY Table Installation Checklist

If you have any questions before or during installation, do not hesitate to call your Customer Support provider.

- ☐ Replace the XY table. See “XY Table Assembly” on page 4 - 63.
- ☐ Verify that all electrical leads are connected correctly
- ☐ Perform the XY Leveling procedure (See “Checking the XY Table Level” on page 4 - 67).
- ☐ Check/Adjust the X-Drive Belt tension (See “Check/Adjust the X-Drive Belt Tension” on page 4 - 58).
- ☐ Check/Adjust the Y-Drive Belt tension (See “Check/Adjust Y-Drive Belt Tension” on page 4 - 68)
- ☐ Manually move the table in both the X and Y direction to ensure it moves smoothly.
- ☐ Clean and lube the system according to the instructions under the Preventative Maintenance section of the Users Guide.
- ☐ Power system up and verify that system homes correctly.
- ☐ Perform the Part Based Calibration procedure. (See “Part Based Calibration” on page 5 - 3)
- ☐ Load material.
- ☐ Perform the Z Calibration and XY Offset Calibration (See “Adjusting Z Calibration and XY Tip Offset” on page 5 - 2).
- ☐ Run a small test part to ensure part quality is acceptable and that the XY table is functioning correctly.
- ☐ Remove the system floppy from the electronics bay.
- ☐ Using Maraca select “Get” to send the .cal file from the system to the floppy. Replace the floppy in the electronics bay and secure the rear door.
- ☐ 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.

Pre-Installation Checklist

This checklist is to be used to ensure customer will be prepared for system installation. This list should be used in conjunction with setting up an installation with the customer. This will help the install go as smoothly as possible.

Checklist

- ☐ Has the system arrived?
- ☐ Does the customer have a loading dock or receiving area to accept the system shipment?
- ☐ Customer has sufficient resources to move the system to its final location?
- ☐ Will the customer have the system unpacked and moved to its final location?
- ☐ System requires that the table (used to support the system) be rated for 400 lbs. (181 kilograms).
- ☐ If possible, confirm that startup kit, **correct** material and wash station (if purchased) is on-site.
- ☐ Remind customer that AC power must be “clean” (does not fluctuate excessively). A dedicated 20 amp circuit is recommended.
- ☐ Ensure that *no* extension cords or power strips will be connected to the system.
- ☐ Verify minimum workstation requirements.
- ☐ Key contacts should be available for system training during install.

System Information

(For your records only)

Customer name _____

Customer contact _____

Customer phone _____

Customer e-mail _____

System type_____ S/N _____

BE version _____ FE version _____

Comments:

System Installation Checklist

If you have any questions before or during installation, do not hesitate to call Customer Support.

- ☐ Shipping crate in good condition, no external signs of damage.
- ☐ Tip Watch and Shock Watch indicators OK. If not call Stratasys Customer Support.
- ☐ After removing system from the crate, inspect system for scratches or dents.
- ☐ Check that start up kit, substrate, and cartridges are on-site.
- ☐ Check contents of the start up kit. Note any discrepancies on the Install Report Card.
- ☐ Door opens and closes with no binding.
- ☐ Door/glass panels are not scratched or broken.
- ☐ Check that the table (used to support the system) is rated for 400 lbs. (181 kilograms).
- ☐ Verify AC power is “clean” (does not fluctuate excessively). **A dedicated 20 amp circuit is recommended**.
- ☐ Ensure that *no* extension cords or power strips are connected to the system.
- ☐ Remove the foam tubes that isolate the extrusion head from the frame.
- ☐ Manually move Z stage down approximately 2” (5 cm), ensuring that the upper limit switch will not be closed upon power up.
- ☐ Manually move the head in both the X and Y direction. Head should move smoothly.
- ☐ Install substrate and power on the system.
- ☐ Check that the lights and fans turn on.
- ☐ Check that system completes XY home and goes to Idle.
- ☐ Plug system into the customer’s network.
- ☐ Install workstation software.
- ☐ Verify workstation is communicating with the system.
- ☐ Upgrade controller software if the CD build number is **higher** than build number displayed on system.
- ☐ Instruct customer on proper controller download procedure.
- ☐ Instruct customer on proper loading and unloading of material.
- ☐ Verify material purge.
- ☐ Instruct customer on system keypad operations.
- ☐ Train customer on workstation software operation.
- ☐ Build the gear (from the training folder) and verify that adhesion to the substrate is good and that supports are easy to remove.
- ☐ Discuss part finishing techniques.
- ☐ Demonstrate how to clear a jammed head and explain the causes for a head jam.
- ☐ Instruct customer on routine system maintenance (See User Guide).
- ☐ Review User Guide with customer.
- ☐ Complete the Delivery Form and System Install Report. Fax, e-mail, or mail copies to Stratasys Inc.

System Information

(for your records only)

Company name _____

Customer contact _____

Customer phone _____

Customer e-mail _____

System type_____ S/N _____

Controller version _____ W/S version _____

Comments:

Training Checklist

Workspace REVIEW

- ☐ System weights 326 lbs. (148 Kg)
- ☐ 110-120 VAC or 220-240 VAC dedicated outlet
- ☐ Ethernet 10/100 base T network.
- ☐ Optional UPS for brown out conditions.

Unpacking

- ☐ Remove the foam tubes that isolate the extrusion head from the frame.
- ☐ Table needs to support 400 lbs.
- ☐ Install fork lift covers once systems is placed at intended location.

Power connections

- ☐ No extension cords or power strips.
- ☐ 110-120 VAC or 220-240 VAC dedicated outlet.

Power up/down

- ☐ Demonstrate proper power up and power down procedure.

Frontend Software

- ☐ Demonstrate how to load CatalystEX on the workstation.
- ☐ Cover CatalystEX operation. Focus on part build options – Types of support, fill, etc.
- ☐ Demonstrate how to send a part to the printer and managing the print queue.
- ☐ Demonstrate how to use a pack.
- ☐ Cover details of printing.
- ☐ Discuss the do’s and don’ts of packing parts

Controller Software

- ☐ Demonstrate how to download controller software.
- ☐ Inform customer that they will be expected to download future software releases.

Keypad Operation

- ☐ Step customer through all menu selections.
- ☐ Describe function of each selection.

Material

- ☐ Explain the process of Fused Deposition Modeling.
- ☐ Demonstrate the correct way to load and unload material. Have customer load and unload material.
- ☐ Discuss effect of wet material on part quality.
- ☐ Demonstrate how to install modeling base.
- ☐ Explain the effects of building on “used” modeling base.
- ☐ Instruct customer on how to remove a part.

Maintenance

- ☐ Cover contents of the Start-up Kit and the usage of each tool/spare part.
- ☐ Explain how to remove supports and finishing techniques.
- ☐ Cover system maintenance. Stress the importance of proper maintenance.
- ☐ Cover Tip Replacement procedure.

Troubleshooting

- ☐ Show customer the basic components of the head assembly and their function.
- ☐ Demonstrate how to identify and clear head jams (LOE).
- ☐ Inform customer that they will be expected to clear head jams (LOE).
- ☐ Discuss error codes- what they mean and what to do if one is displayed.
- ☐ Cover the process to report system issues/questions.
- ☐ Discuss how to order material etc.
- ☐ Cover warranty and maintenance.
- ☐ Ensure customer is comfortable with using the system.
- ☐ Ask if customer has any concerns or questions.

System Information

(For your records only)

Customer name _____

Customer contact _____

Customer phone _____

Customer e-mail _____

System type_____ S/N _____

BE version _____ FE version _____

Comments:

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 HyperTerminal 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. Liquifier Alignment Rod
- ☐ 8. Filament Guide Alignment Rod (For SST Only)
- ☐ 9. Service Guide (CD and Hardcopy)
- ☐ 10. Maraca CD
- ☐ 11. CatalystEX CD
- ☐ 12. Controller software CD
- ☐ 13. User guide

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 board (See “Controller Board” on page 4 - 14).
- ☐ Power up the system
- ☐ Download the controller software. (See “Backend Download Procedure” on page 9 - 13).
- ☐ Toggle power (quick ‘OFF’ then ‘ON’ with power switch).
- ☐ Enter Head Maintenance. This will cause the system to run the complete homing process.
- ☐ Exit Head Maintenance
- ☐ Load Material.