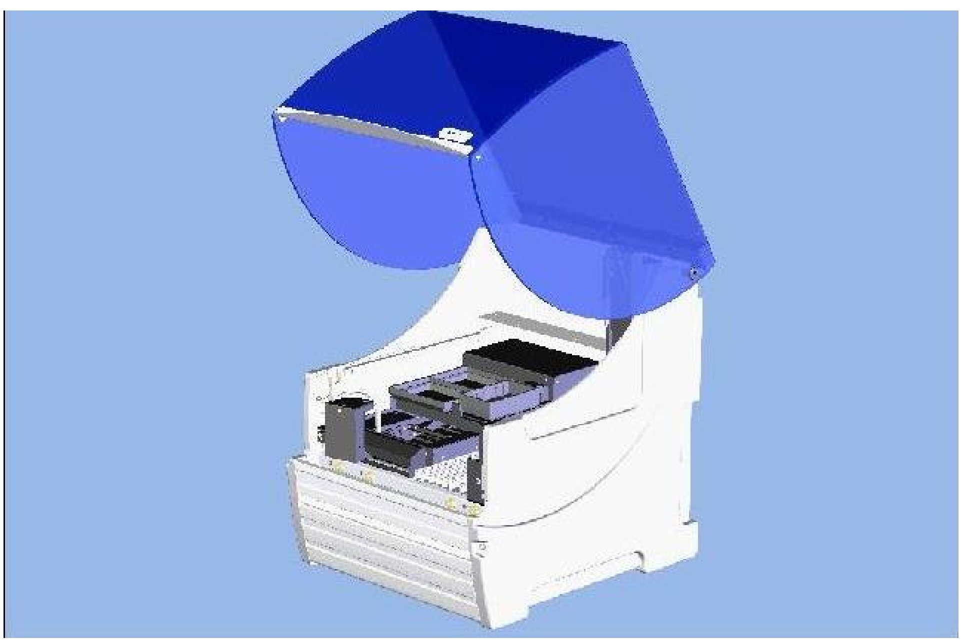
DS2® Automated ELISA System

Service Manual

Part No. 91000250



IMPORTANT: Please read this manual carefully before servicing or adjusting the system.

Revision History

Revision Date:
June 2007
October 2008 Rev. B
September 2011 Rev. C
January 2016 Rev. D

Notice: The *DS2® Automated ELISA System* is covered by a warranty (a copy of which is enclosed in this manual). The customer is required to perform routine maintenance as described in the user's manual on a periodic basis to keep the warranty in effect.

DYNEX Technologies reserves the right to make technical improvements to this equipment and documentation without notice as part of a continuous program of product development. This manual supersedes all previous editions.

The material included in this manual is provided to assist service engineers in the maintenance and repair of the *DS2® Automated ELISA System*. It is assumed that the individual using this manual has sufficient training in the service of analytical instrumentation and is aware of the potential hazards including (but not limited to) electrical hazards, chemical hazards and mechanical hazards.

If this manual is provided to an end user, it is with the understanding that the material included herein is proprietary to DYNEX Technologies, Inc. The user may not provide this material to a third party without the written permission of DYNEX Technologies.

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Preface

The purpose of this manual is to enable a qualified field service engineer to carry out routine maintenance and minor repairs on the DYNEX Technologies *DS2® Automated ELISA System*. In general, the service engineer is expected to make repairs, replace modules and replace electromechanical subassemblies. Printed circuit boards and a few other components are typically replaced as major subassemblies.

This manual is provided to complement the *DS2® Automated ELISA System Operator's Manual* (Part No. 91000200). In some instances, references will be made to the *Operator's Manual*.

In some instances, the supplier of the reagent kit will install the unit. Detailed installation information is provided in Chapter 2 of the *Operator's Manual* as well as Chapter 2 of this manual.

Defective subassemblies may be returned to DYNEX Technologies or your DYNEX Technologies distributor, where comprehensive repair facilities are available.

The service engineer should contact the local DYNEX Technologies service office for additional information.

Warnings and Safety Precautions

The DYNEX Technologies *DS2® Automated ELISA System* is designed to meet all relevant safety codes.

The following information aids in the safe and efficient use of the DS2.

In addition to the warning labels and other cautions previously described in this manual, consider the following:

1. Appropriate precautions must be taken when working with biohazards. Technicians must be trained in the safe handling and clean up of potential blood borne pathogens. Universal precautions, appropriate hygiene, and decontamination of surfaces are recommended. Consult the reagent kit manufacturer for precautions on handling potentially hazardous substances.
2. Appropriate personal safety precautions must be made when opening and closing the DS2 cover. A gas spring holds the tension to keep the cover open. The DS2 cover should be able to be opened 8 inches (approximately 203mm) without falling. If the cover drops instantly above this height then the gas spring should be replaced. The cover may creep down slowly from this point due to the nature of gas springs and this is acceptable. Gas springs will inevitably lose pressure depending on frequency of use, so it is important for the user to take note if the cover begins to give way over time and notify the service provider of this circumstance.
3. When the cover is up and the run has started, do not encroach upon the work area unless prompted by the software for user input of materials or manual intervention.
4. Attend to error messages when the system prompts and stops. These messages indicate a need for user action.
5. Sample tubes must be pushed down in the sample racks to prevent the pipette module from being obstructed.
6. Place the sample racks securely onto the DS2. Push the rack firmly towards the back of the DS2 until the rack clicks in place.
7. Periodically inspect the sample rack springs to ensure proper tube alignment. Replace the springs as necessary.
8. Barcode quality is critical to successful sample tube barcode scanning. Scanning is in accordance with ASTM E1466-92 defining barcode quality, position, and orientation of barcode labels. The use of non-standard barcodes or barcodes with poor print quality may be problematic. **Barcode labels should be applied using a vertical orientation. The barcode label should be oriented so that it faces out of the opening in the sample rack.**
9. Periodic back up of assay and data files is recommended. Copy the files to a disk for storage or archive the data on a secure server

10. Changes made to assay files may impact the suitability and plotting of data using the Levey-Jennings control-charting feature.

The service engineer should pay special attention the following points:

11. If any fluid contains an organic solvent, make sure that the laboratory is well ventilated, so that a build-up of solvent cannot occur. In addition, avoid open flames and sparks.
12. The system should be plugged into a power line that is connected to a true ground. Make certain that all internal grounding cables are connected.
13. The reagents, wash solution etc., may contain compounds that may be hazardous. Always wear safety glasses and protective clothing when working with the washing solution or when the washer is operating (when testing the system, it is recommended that deionized water be used).
14. The microplates and the waste solution may contain materials that present a toxicological, radioactive or biological hazard. If the system is returned to a DYNEX Technologies service facility, make certain that a "Certification of Decontamination" is submitted before working on the unit.
15. Line voltage is present in the Power Supply printed circuit board and lower voltages are present in other components. If the power must be on during testing, take care to avoid contacting exposed components.

Table of Contents

Chapter 1 Introduction to the DS2® Automated ELISA System

1.1 Overview

The *DS2®Automated ELISA System* (Figure 1-1) is a computer-controlled microplate processing and analysis system that performs ELISA assays using protocols that are established via an application program and a personal computer. It is intended for use in clinical, research and industrial laboratories.

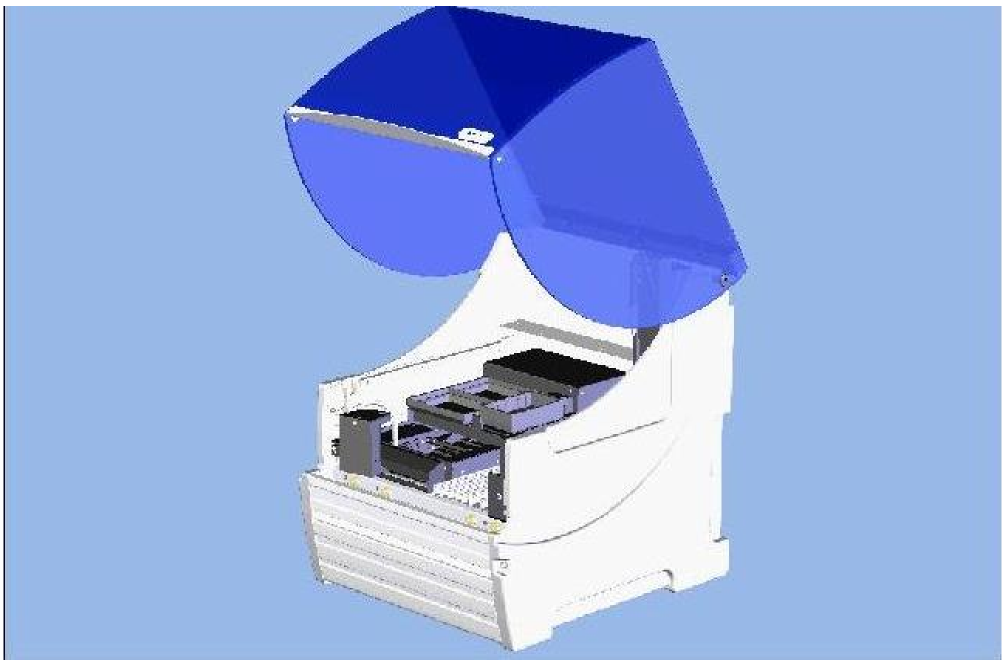


Figure 1-1 D2S® Automated ELISA System

This chapter is designed to provide a broad overview to the system and includes:

- Functional Description and Features of the DS2®Automated ELISA System.
- Steps in an Analysis.
- Major components of the system.
- Introduction to application software.
- Contents of this manual.

1.2 Functional Description and Features

The *DS2® Automated ELISA System* is designed to automate each of the steps in an ELISA assay, including sample, distribution, dilution, addition of reagents, incubation, washing, detection, data processing and reporting. All operations are performed via an assay protocol.

The *DS2® Automated ELISA System* has a number of performance and convenience features, including:

- ESP™ (Electronic Signature Pipetting) for liquid level and clot detection
- Endpoint data analysis to perform qualitative and quantitative data reduction
- Less than 50 second reading time (using dual wavelength mode)
- Less than 30 second reading time (using single wavelength mode)
- On-board self-diagnostics
- Selection of up to six filters
- Single and dual wavelength reading modes
- Small footprint
- A variety of wash protocols can be programmed
- A variety of plate types can be programmed
- Liquid level sensing on waste container, wash buffer container, and sample and reagent fluids.
- Quick dispense
- Aspirating/pipetting speed can be changed for viscous liquids.

1.3 Steps in an Analysis

In a typical assay, the operations shown in Figure 1-2 are performed under computer control. In some cases, two (or more) reagent additions, incubation or wash cycles may be required for an analytical procedure.

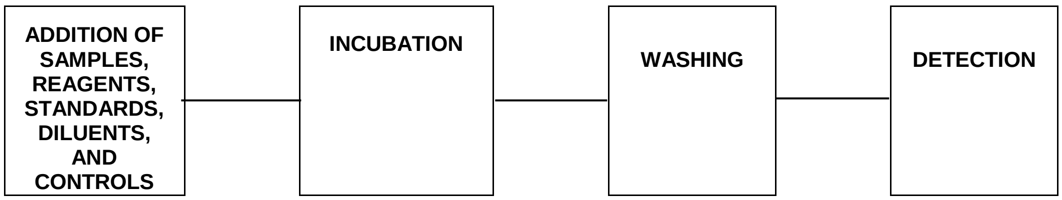


Figure 1-2 Operation Steps of the DS2® Automated ELISA System

1. Addition of Samples, Reagents, Standards, Diluents and Controls to the Plates

The automated pipette is used to withdraw the appropriate amount of sample, reagent, standard, diluent or control from tubes (bottles) that are located in the workspace and add the liquid to the appropriate wells on the test plate or deep well strip. Pipetting is performed by custom-designed, disposable pipette tips to assure pipetting precision and eliminate the possibility of cross contamination.

All movement of the pipette tip, as well as replacement of pipette tips is performed under computer control.

Incubation

Once the sample, reagents, diluents and standards have been added to each well, the microplate may be placed in an incubator module that is set to a specific temperature (from 4°C above ambient to 50°C) for the appropriate period of time. If desired, the microplate can be shaken within the incubator during the incubation. Ambient incubation and shaking may be performed without inserting the microplate into the incubator.

Washing

After the incubation is complete, the microplate is moved to the wash module and is washed. Strips of eight wells of a microplate can be washed simultaneously.

Detection and Calculation

The absorbance (or reader) module measures the OD (optical density, which is also known as absorbance) of each sample. The OD is used to calculate the concentration of the compound of interest for each sample on the microplate. In addition, QC operations on raw data as well as curve fitting can be performed to provide the desired results.

1.4 Major Components of the System

1.4.1 Overview

***Note**: This section is provided to present an overview of the major components of the system. A detailed discussion of each component is presented in Chapters 5-14.*

The *DS2® Automated ELISA System* is an integrated system that consists of a number of modular systems that are controlled via the application software. This section describes each major component. The locations of the principal hardware components of the *DS2®Automated ELISA System* are shown in Figure 1-3.

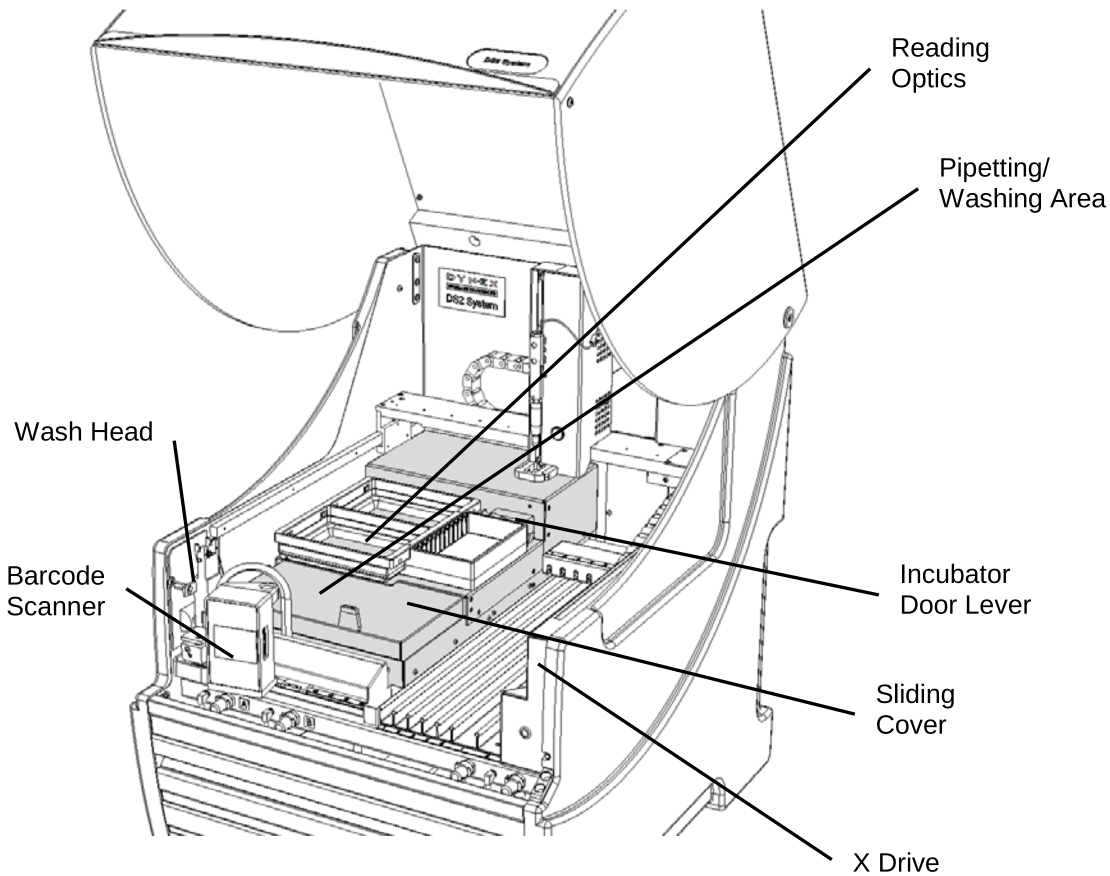
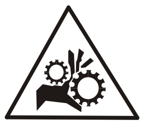


Figure 1-3 Location of Principal Hardware Components

1.5 Description of Hardware Components

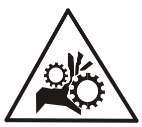
1.5.1 System Cover

The system cover encloses the workspace, arm and pipette module. Dynex recommends that the cover be closed during operation to prevent the arm/pipette module from accidentally contacting an operator or bystander.



***CAUTION**: The system cover prevents accidental contact with the pipette module and/or robotic arm.*

To open the cover, lift the handle until the cover is in the upright position. To close the cover, pull down on the handle until the cover is fully closed. The system cover rests on the side panels when it is fully closed. (Note: when the External Waste Bottle is in use, the cover will not rest on the side panels when fully closed).



***CAUTION**: Pinching hazard. Be sure that your hands and fingers are clear of the cover when closing.*

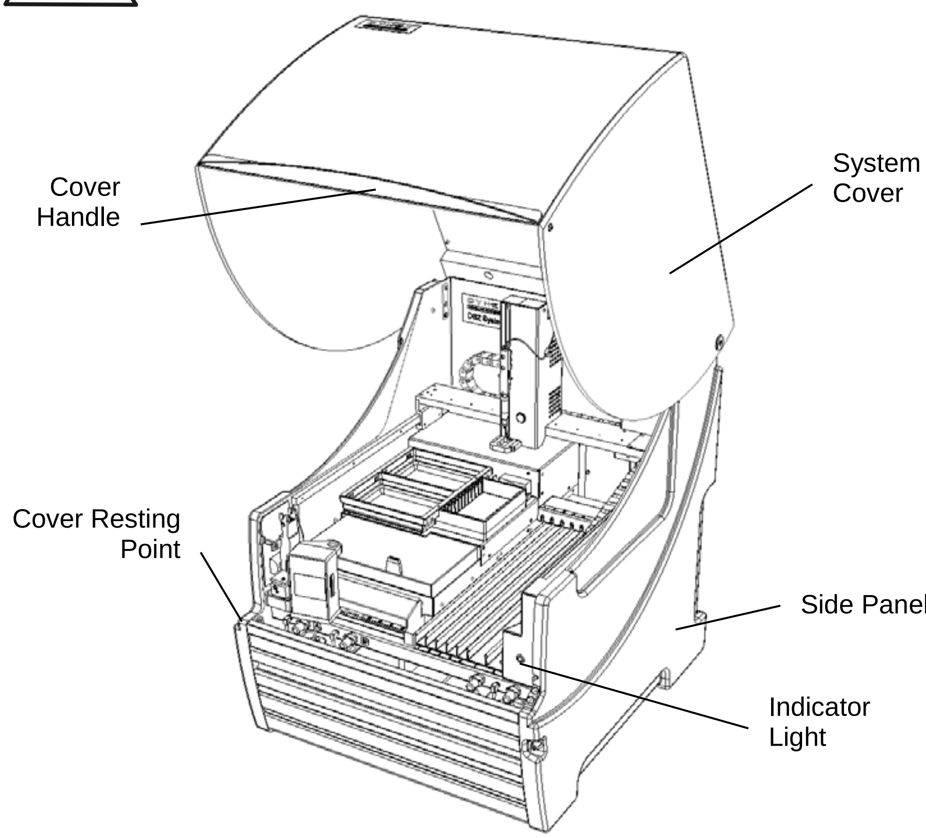


Figure 1-4: External Components of the DS2 System

1.5.2 Workspace Components

- X-Drive, Y-Drive and the Z-Drive/Pipette
- Reader Assembly - contains the Incubation Chamber, Reading Optics (under the Consumables Tray), Shaking Mechanism, and the Pipetting/Washing area (under the sliding cover)
- Barcode Scanner - reads barcode labels on the sample tubes and the position barcodes in-between
- Wash Head - simultaneously washes 8 wells in one column of an 8 x 12 microplate

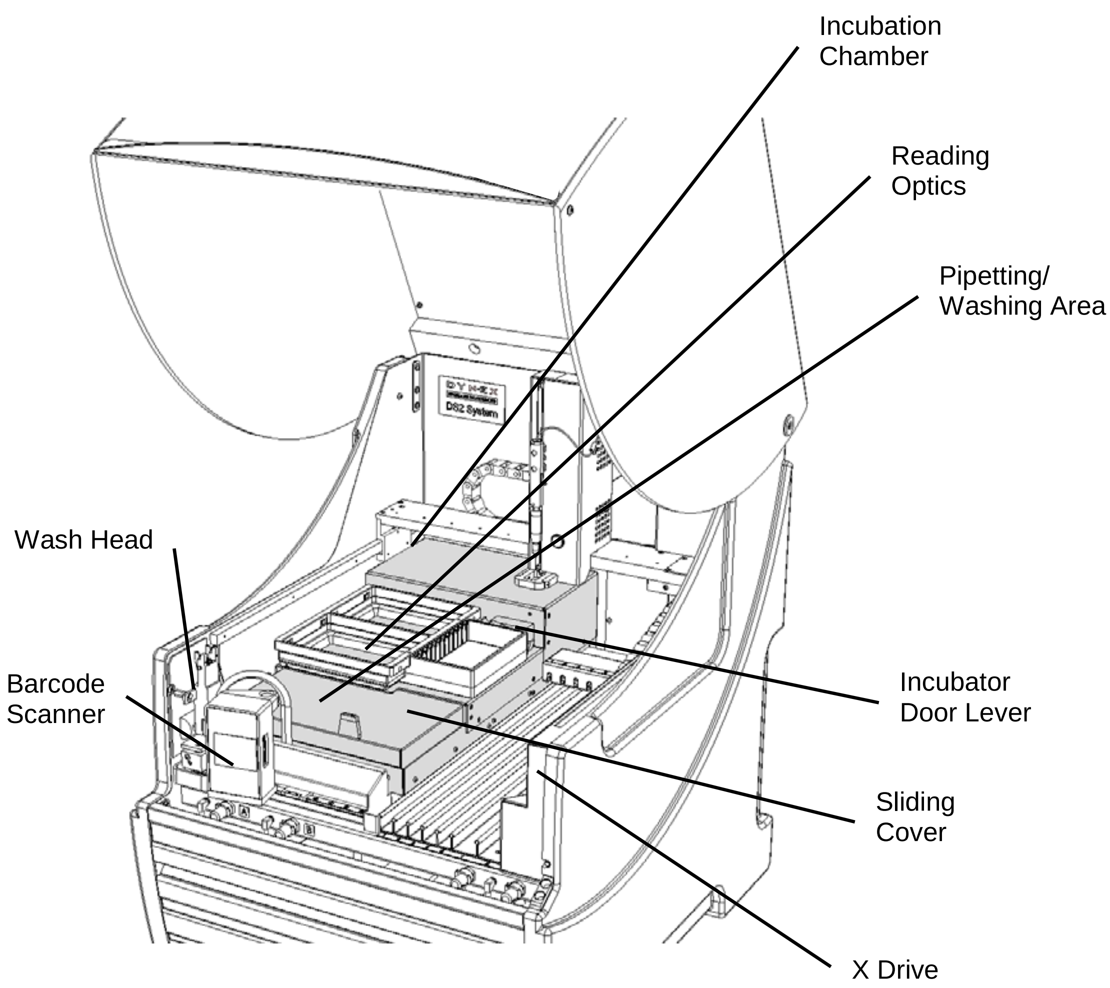


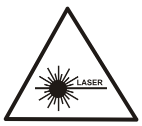
Figure 1-5: Internal Components of the DS2 System

1.5.3 Microplate Incubation Chamber

The assay microplate is automatically transported into the incubation chamber, which holds up to two microplates, during a run when the assay program contains a heated incubation. During an incubation step, the incubator door is closed by the pipetting arm for temperature equilibration.

1.5.4 Barcode Scanner

The barcode scanner reads barcode labels on the sample tubes and the position barcodes in-between. It includes a CDRH Class II laser barcode scanner.



***CAUTION**: The vertical barcode scanner has a maximum radiated power output of 1.0 milliwatt. Do not stare into the beam of the barcode scanner without appropriate protective equipment (e.g. protective glasses). Obey the warning label (shown below) that is attached to the on the front of the barcode scanner.*

1.5.5 Pipette Module

The Pipette Module travels in the *x*-, *y*-, and *z*- directions to pipette samples, controls and standards, dispense reagents, and to perform dilutions. The Pipette Module is also used to slide open and close the cover to the Incubation Chamber, slide the Barcode Reader to the correct sample rack reading position, and pick up/eject the plate Washing Tool.

The pipette module has the following sub-components and functions:

Component	Function(s)
Pipetting (liquid level detection)	Pipettes samples, standards and controls (using disposable sample pipette tips) and reagents (using disposable reagent pipette tips).
	Obtains new pipette tips and discards used tips into the waste bin after use.
Tip Detection	Verifies that a tip has been picked up or ejected.
Wash Head Detection	Verifies that wash head has been picked up or ejected.

The pipetting system of the *DS2 Automated ELISA System* includes ESP™ (Electronic Signature Pipetting) software (optional) and clot detection (optional) for automatic detection of gross pipetting inaccuracies.

1.5.6 Wash Tool

The DS2 utilizes a modular Wash Tool that normally is located in the front left corner of the workspace, but can be picked up by the pipetting arm to wash microplate wells. The wash tool is designed to simultaneously wash 8 wells in one column of an 8 x 12 well microplate. The washing protocol can be defined to wash partially filled plates containing complete columns.

The wash parameters including wash volume, number of cycles, wait time between cycles, and wash fluids are defined during assay programming.

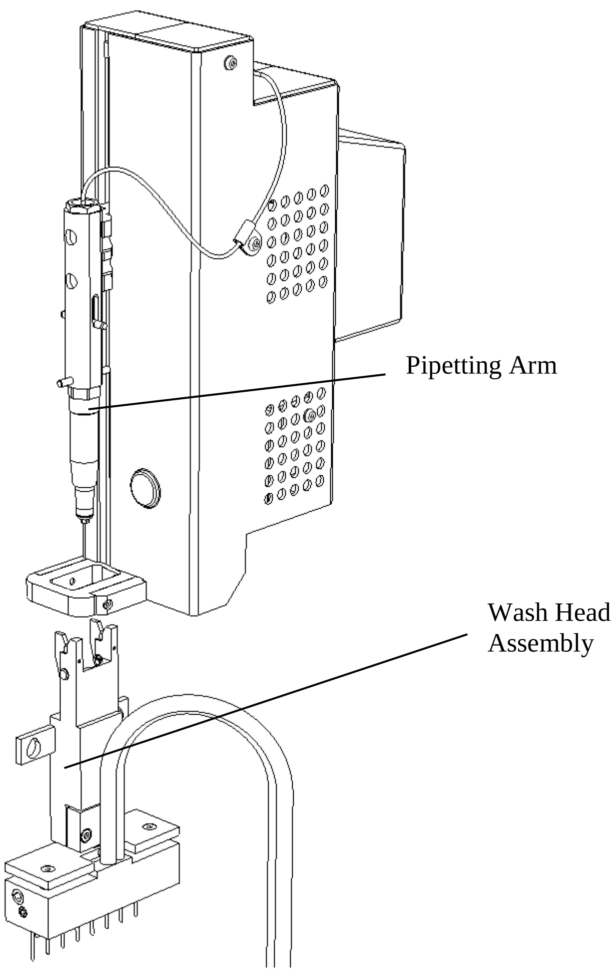


Figure 1-6 Pipetting Arm and Wash Assembly

1.5.7 Wash Head

The wash head in the wash assembly contains two sets of wash pins. The shorter pins (the dispense pins) dispense fluid and the longer pins (the aspirate pins) aspirate fluid. The aspirate pins and the dispense pins are closely spaced so that fluid can be aspirated from and dispensed into wells of a microplate at the same time.

During operation, the wash head assembly is automatically lowered to insert the wash pins into the microplate wells or raised to remove the wash pins from the wells. Lowering the wash head assembly allows the aspiration of the well contents, or allows the performance of a wash cycle at the well bottom. Raising the wash head assembly allows the movement of the wash head to another column for filling or washing.

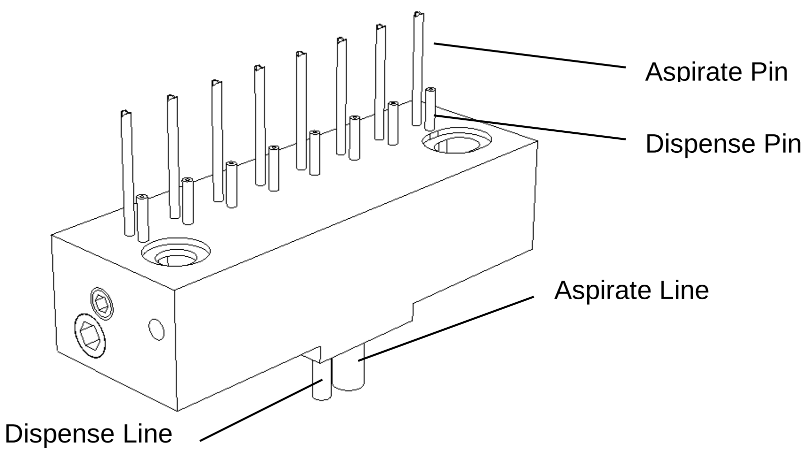


Figure 1-7: Wash Head with Wash Pins

1.5.8 Wash Buffer Containers

Up to three different washing and/or dispensing reagents may be placed in the two wash buffer containers (A and B) and the wash buffer bottle. The wash buffer containers are located at the front of the instrument.

The capacity of wash buffer containers is up to two liters of liquid. Dispensing of wash buffer from a container is controlled by a bottle valve above the wash pump and a dispense valve located near the wash pump. The minimum volume for dispensing required for each wash buffer container is 500 mL.

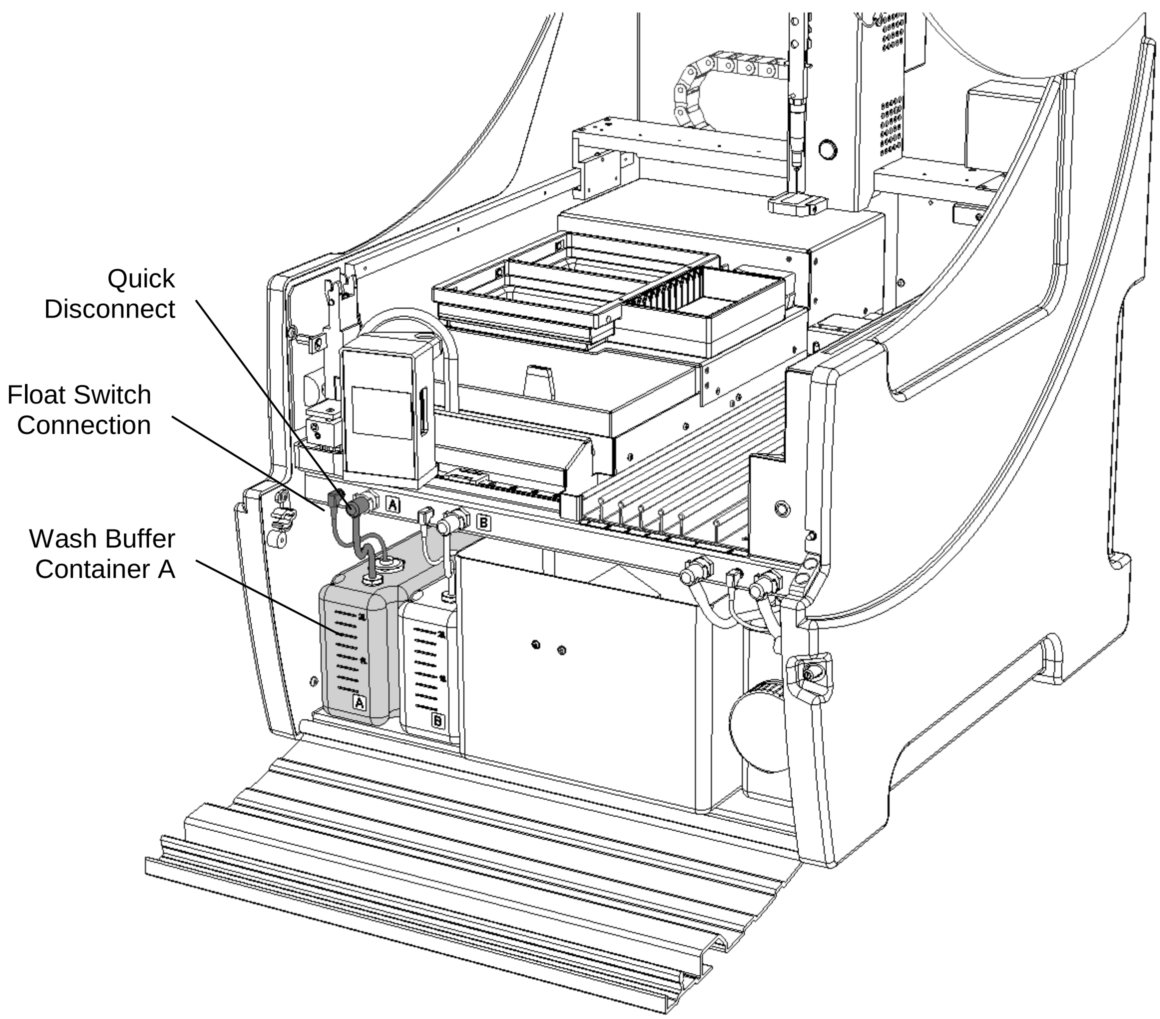


Figure 1-8: Wash Buffer Container A

A quick disconnect fitting and a float switch connector allow easy removal of a wash buffer container from the system.

Disconnect the wash line by pressing on the metal tab of the quick connect fitting and pulling out on the wash line gently to remove it. Disconnect the level sensor by pulling it out of the connector socket.

Fill (or empty) a wash buffer container using the filler cap at the top rear of the container.

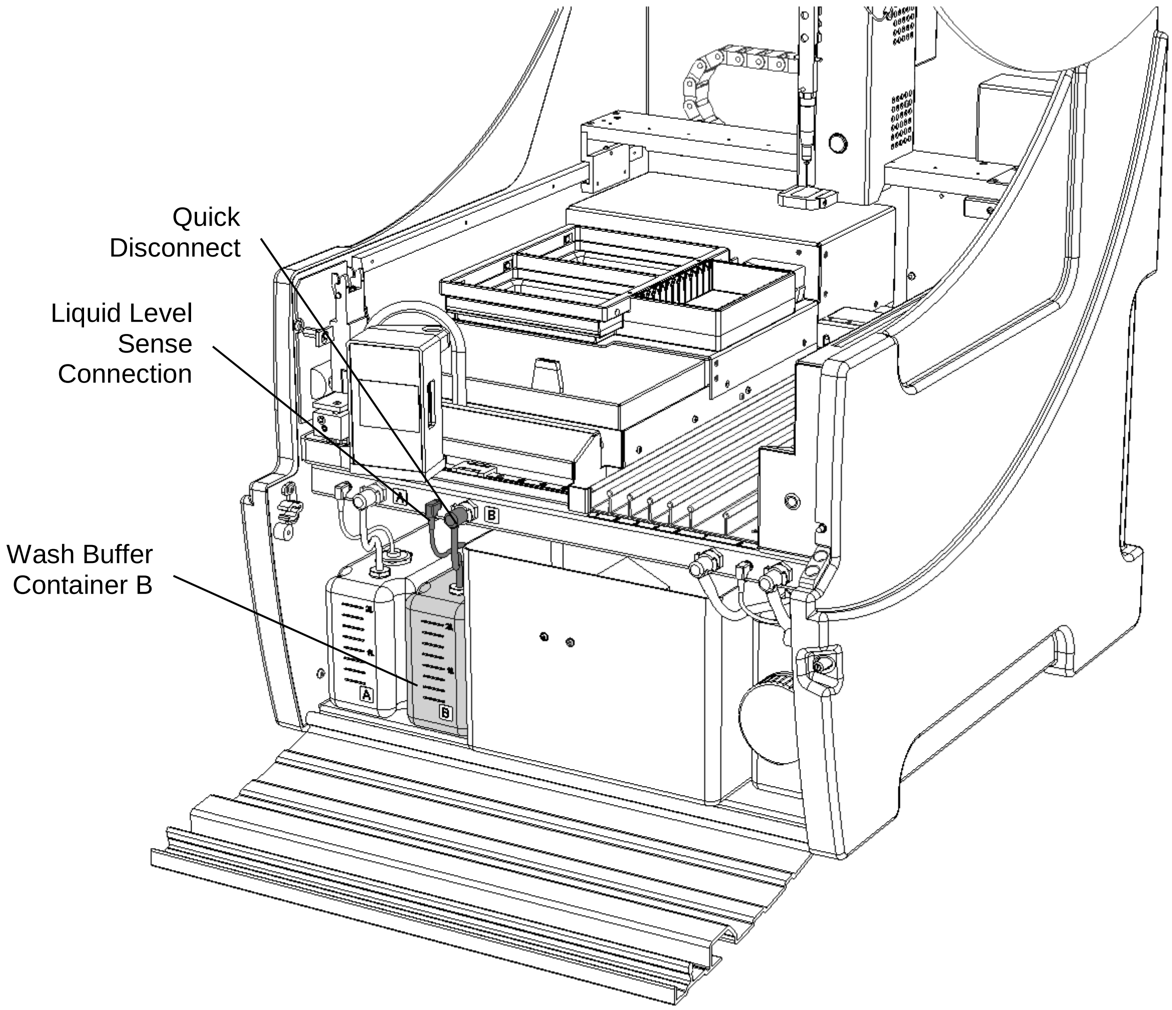


Figure 1-9: Wash Buffer Container B

1.5.9 Wash Head Cleaning Fluid Container

If Wash Head cleaning fluid is required, it can be connected to the system by attaching the Cleaning Fluid bottle, using the supplied tubing, to the Quick Disconnect at the rear of the system.

This third container (C), Wash Head Cleaning Fluid, is also controlled by the Dispense Valve and a third Bottle Valve (C).

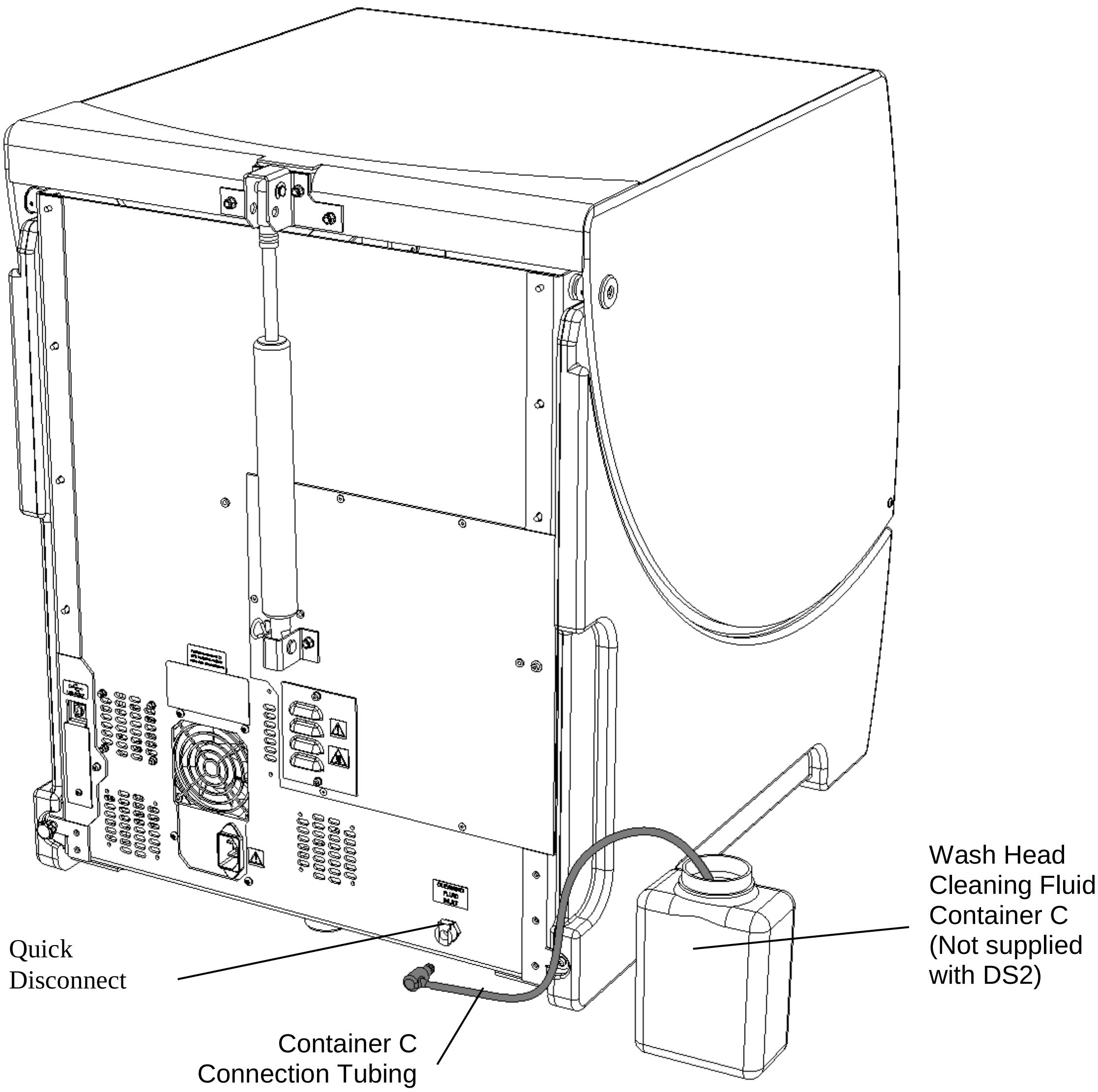


Figure 1-10: Wash Head Cleaning Fluid Container C

1.5.10 Waste Containers

Fluid that is removed during purging and washing is collected in the Liquid Waste Container. Discarded sample and reagent pipette tips are ejected into the Tip Waste Container by the Pipetting Arm. Both waste containers are located at the front of the instrument.

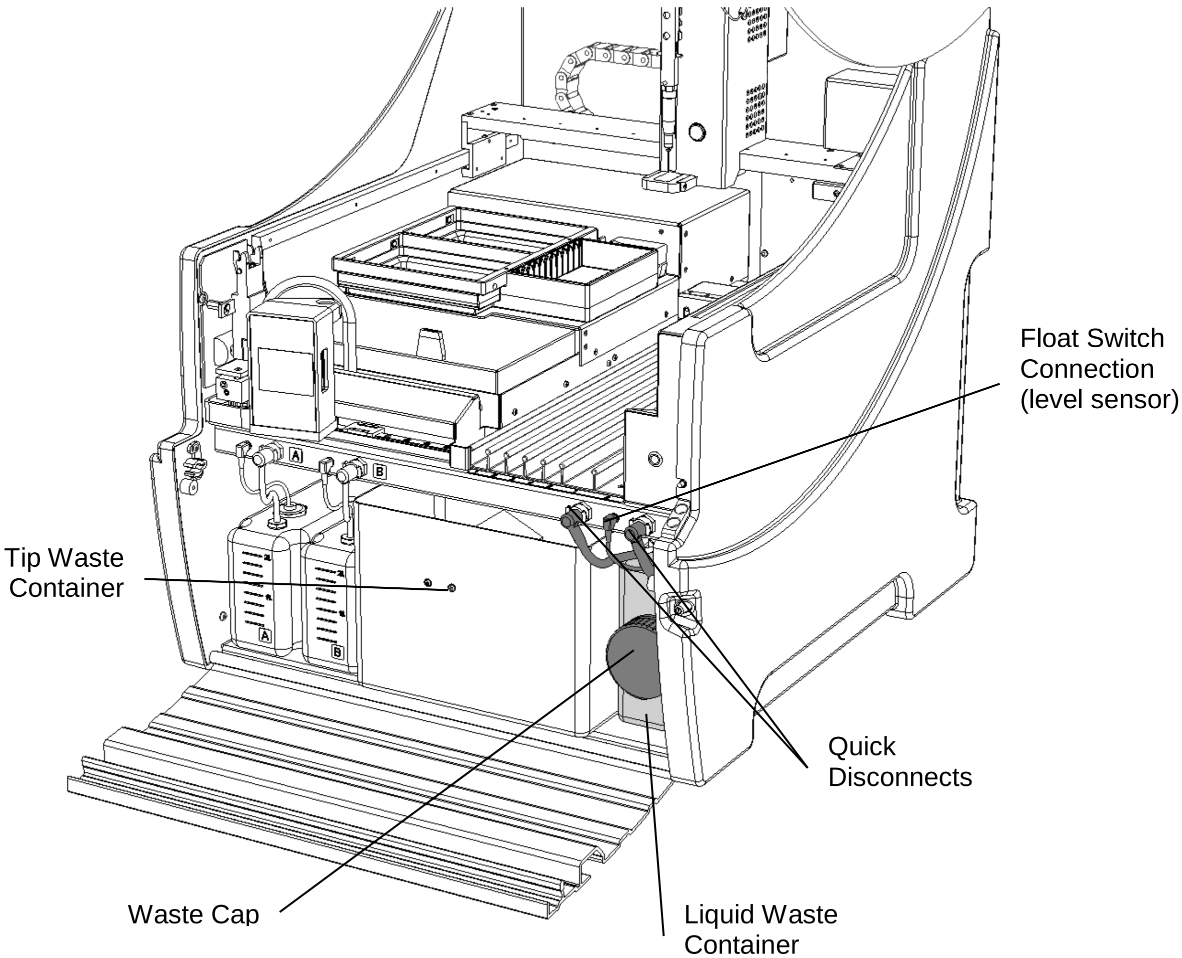


Figure 1-11: Waste Containers

The Liquid Waste Container holds up to one and a half liters of waste. A waste fluid level sensor alerts the operator when the Liquid Waste Container is full and should be emptied.

1.5.11 External Waste Trap

The DS2 External Waste Trap is an optional accessory product designed to prevent damage to the DS2 pump in the event the wash buffer in use on the DS2 instrument is excessively foamy. When wash buffer is excessively foamy, the foam can build up inside the waste bottle. The foam is not dense enough to trigger the waste full sensor and therefore can get aspirated back into the DS2 pump, damaging the pump and sporadically causing failed runs, %CV issues, and potentially other issues with results. The DS2 External Waste trap attaches to the liquid waste bottle inlets to prevent foam from damaging the pump. Installation Instructions for the External Waste Trap are as follows:

1. Install New Cover Stop

Follow the instructions below to install the cover stop required to allow the tubing to exit the system for the External Waste Trap.

Parts required:

Nut Driver

Cover Stop

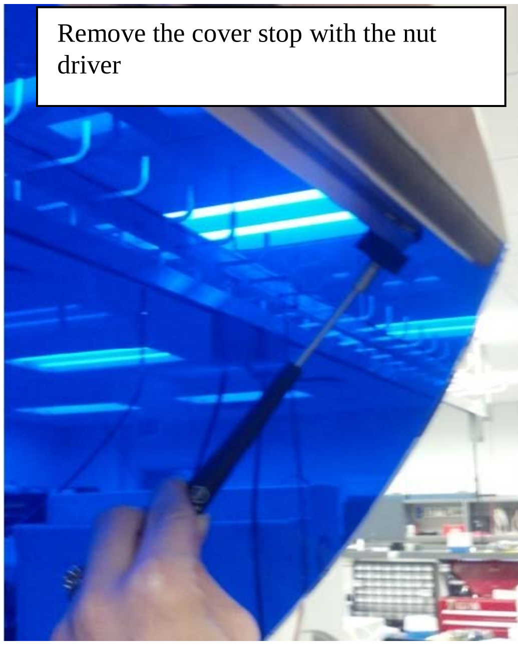
a. Locate the current cover stop. The current cover stop is located on the right side of the DS2 cover. Lift up the DS2 cover to the fully opened position.

Cover Stop position (cover open)

Current Stop position (cover down)

b. Remove the current cover stop using the provided nut driver. Insert the nut driver into the hole on the current cover stop, and twist counter clockwise to release the current cover stop. The screw holding the current cover stop to the DS2 cover will remain in the DS2 cover once the cover stop is removed.

Remove the cover stop with the nut driver



This is how the cover should look once the cover stop has been successfully removed. The screw should remain in the DS2 Cover.

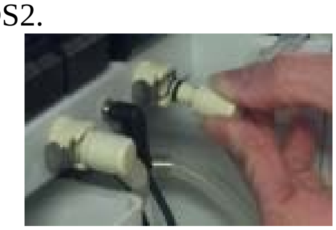
c. Position the screw near the right side of the cover. Then, thread the new cover stop onto the screw, turning the cover stop clockwise until it is tight against the right corner of the cover.

d. Close the DS2 cover. The cover stop should come in contact with the DS2 frame and the cover should remain slightly ajar, as seen in the picture below (New Cover Stop – Cover ajar). If the cover stop is not coming in contact with the DS2 to hold the cover ajar, loosen the cover stop and move it over to the right and retighten.

WARNING: Failure to have the cover stop positioned to hold the cover ajar will cause the tubing exiting the system to be pinched and could result in improper washing.

2. Installation of External Waste Trap
    a. Remove the right waste bottle tubing from the quick release valve.

    b. Attach the male end tubing from the external waste trap into the right quick release valve on the DS2.



WARNING: The waste bottle trap must be connected to the RIGHT waste bottle tubing. Failure to do so will result in improper operation of the waste bottle trap.

    c. Attach the female end tubing from the external waste trap to the male tubing connector coming from the DS2 waste bottle.

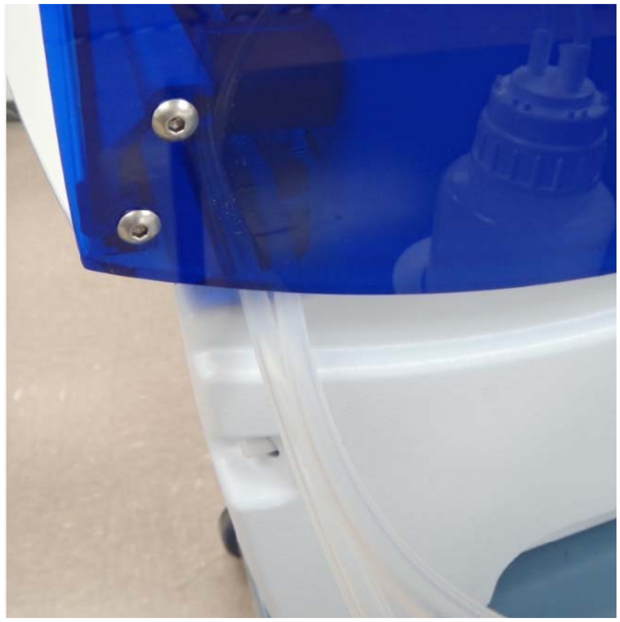
WARNING: Improper tubing connections could cause improper washing. Ensure connections have been made as described in steps b and c and match the picture below.

The tubing should look like the picture below when all connections have been made:

d. Put the external waste trap on the right side of the instrument in the provided holder.

e. Ensure that the tubing has been placed so that it exits the instrument without becoming kinked or pinched by the DS2 cover.

WARNING: If the tubing becomes kinked or pinched by the DS2 cover, improper washing can occur.



1.5.12 Absorbance Module

The Absorbance Module measures the optical density (OD) of the reaction mixture in the microplate wells. The wavelength blank and the wavelength(s) at which the optical density is measured are specified during assay programming.

During operation, each microplate is automatically transported into the Absorbance Module at the rear of the instrument. The optical densities of the wells specified during assay definition are read, the specified calculations (for example, blanking, QC raw data, threshold or curve fitting) are applied, and the calculated results for the microplate wells are reported.

The Reader in the DS2 is able to take readings in two different modes:

- Single - using one test wavelength. This is sufficient for most applications.
- Dual - using a reference wavelength and a test wavelength. A discussion of this mode is presented in the Operator's Manual (page 25).

The Reader allows subtraction of a reference value from well ODs. Air is normally used as the reference, but the absorbance of a reagent solution can also be subtracted from the test result. Blanks may be single wells or an average of multiple wells.

Note: Using the DS2 with six filters Installed and old firmware

For firmware versions up to 1.06, it has been found that installing a filter in position 6 of the DS2 filter wheel and the subsequent assignment in Matrix software will prevent the execution of any assay. Only five filters should be installed. The sixth position in the software setup should be left with a setting of "0", and no sixth filter should be placed on the filter wheel. To resolve this problem, set the sixth position to zero and remove the filter from the sixth position. Dynex recommends upgrading firmware to the latest version so that all six filter positions may be used without problem.

Application Software

The *DS2 Automated ELISA System* is controlled by a personal computer and application software which automates the sample distribution, incubation, reagent addition, washing and detection phases of microplate assays. It also provides the user interface for configuration of the instrument and management of consumables (Figure 1-12).

The software includes an extensive menu of assay definition options that allow you to customize the processing, calculations, QC checks and results format for an assay.

Additional information about the software can be found in the *DS2* Operator's Manual and additional help can be accessed by selecting the **Help** menu.

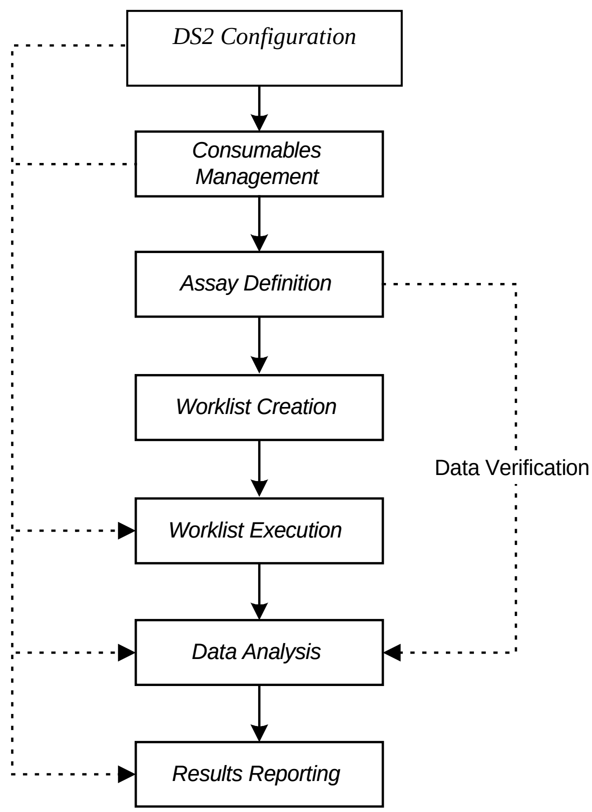


Figure 1-12 Application Software Overview

1.6 Contents of this Manual

This manual contains the following information:

Section A: General Service Information

- **Chapter 2: Installation** - describes how the *DS2 Automated ELISA System* is installed in the customer's facility.
- **Chapter 3: Maintenance and Introduction to Service** - Outlines a series of activities that should be performed on a routine basis and describes the general approach to servicing the system.
- **Chapter 4: Troubleshooting, Self-Test Information and Error Codes** - describes how the service engineer can determine the cause of the immediate problem. In addition, this chapter describes general calibration of the system.
- **Chapter 5: DeeSoft and Calibration** - describes a series of operations that can be performed by the service engineer to control various components of the system manually and describes DeeSoft. These functions can be used to test the modules independently in the system.
- **Chapter 6**: **Removing the Covers** - describes how the top and side covers are removed and how the top cover is realigned when replaced.
- **Chapter 7: Replacing Components –Z/Pipette Assembly** - includes detailed technical information about the Pipette Module and the Z Drive.
- **Chapter 8: The Y Drive Assembly** - discusses how the Y-Drive is removed and how its components are replaced
- **Chapter 9: The X Drive Assembly** - discusses how the X-Drive is removed and how its components are replaced
- **Chapter 10: The Pump** - describes how various components in the Pump are serviced or replaced.
- **Chapter 11: The Barcode Scanner –** describes how the Barcode Scanner is replaced includes detailed technical information about the Incubator Module.
- **Chapter 12: The Reader** - describes how various components in the Reader (also called Absorbance) Module are serviced or replaced.
- **Chapter 13: The Wash Head** - describes how various components in the wash head are serviced or replaced.
- **Chapter 14: Electric and Electronic Components** - includes detailed technical information and service information about a variety of electrical components that are not part of a specific module.

In addition, a series of appendices are included: a list of tools required to service the system, a copy of the user warranty, specifications, and definitions of warning labels that are on the system.

Chapter 2 Installation

2.1 Overview

The DYNEX Technologies *DS2® Automated ELISA System* is normally installed and set up by a DYNEX Technologies representative or a representative of the organization that is supplying the reagent kits.

2.2 Receipt of the System

The *DS2® Automated ELISA System* is normally shipped in a single container. Upon arrival of the system, the customer should inspect the shipment and ensure that all components have arrived in good shape. If damage is observed, either upon arrival of the system or upon unpacking, the customer should immediately make a written claim to the transport company and the organization that shipped the unit. It is advisable to take pictures of the container before opening should there be any evidence of potential damage. Likewise if damage is discovered after opening, pictures will aid the documentation.

A packing list of all components shipped with the system is provided. If any items are missing upon unpacking, the customer should immediately make a written claim to the transport company and the organization that shipped the unit.

2.2.1 Packing List for DS2 Installation

(DYNEX Part Number 62000)

P/N	Description	Qty
13500010	DS2 Automated Instrument	1
50600167	USB Cable/Printer Cable	2
N/A	Power Cord (dependent upon order request configuration)	1
352101800	Cleaning Wire, 0.018 “ (Dispense)	2
352104000	Cleaning Wire, 0.040 “ (Aspirate)	2
62800-132	CD Containing Matrix Software Setup (numbers after the hyphen may change depending on the current version)	1
62810-103	DS2 Toolbox CD (numbers after the hyphen may change depending on the current version)	1
91000200	DS2 Operator’s Manual (this document)	1
92000040	DS2 Operator’s Manual Translation CD	1
N/A	Instrument Configuration Report (Check List)	1
13500560	Wash Buffer Container	2
13500430	Liquid Waste Container	1

P/N	Description	Qty
13500770	Tip Waste Container	1
24900065	Reagent Rack	2
13500501	Sample Rack	5
13500100	8-Way Wash Head Assembly	1
24900081	Purge Tray, Wash Head	1
22500810	Transit Bracket	1
DS2FIX017	Calibration Tool	1
DS2FIX029	Calibration Collar	1
65910	Sample Tips (Four Racks of 108)	1
65921	Reagent Tips (Four Racks of 108)	1
62910 (Partial)	Deep Well Strips (Sample Pack: 12 Strips) *(Standard for Part No. 62910: 250 Strips)*	1
62920	Reagent Tubes, 25 mL (Pack of 10)	1
62930	Reagent Tubes, 15 mL (Pack of 10)	1
65940	Control Vials (Pack of 33)	1
394000100	Purge Tray (1 pack of 3)	3
42000810	Hex Key, 2mm	1
816400700	Tubing, 3mm x 5mm	1 (Meter)
43000491	Elbow Fitting	1
DSFIX044	DS2 Calibration Plate	1
42000070	Hex Key, 2.5mm	1
42000830	Hex Key, 4mm	1
9055720009	Warranty Card	1
95000250	Brochure, DS2 Sample Rack Holder	1
99000750	Label, WEEE Waste Management Directive	1
47000030	O-ring Lubricant	1
N/A	Declaration of Conformity	1
N/A	Customer Installation Report	1

IMPORTANT: *These installation procedures are intended for trained personnel*

Unpacking the Components

1. Obtain a wheeled cart or lift capable of holding the weight of the DS2. Cut the tape around the top of the box and lift up the lid. Remove the pieces of wood, foam, and accessories box from the crate. Squeeze the white butterfly clips at the base of the crate which secure the base to the lid. Remove the lid by lifting up. Lift the DS2 off the base.

CAUTION: *The contents of the container are heavy. Two people are required to lift the DS2 safely. The DS2 should be lifted from the bottom of the instrument. Do not use the cover handle, gas spring or the plastic molded sides to lift the DS2.*

2. Place the DS2 near the bench or table where it will be located.
3. Examine the packaging to verify that all of the materials listed in the packing list have been removed. Store the packaging material for future use.
4. Inspect the DS2 and its components for damage. If damage is observed, contact your shipper or service representative.

2.3 Power Requirement

The system requires ≤360 VA and should be installed on the same power line as the personal computer and printer. It is recommended that a dedicated power line be used for the system. We recommend that the DS2 and computer system be plugged into an Uninterruptible Power Supply of 1000VA/800W output power capacity and 120V nominal output voltage with 10-30 minutes backup time.

2.4 Locating the System in the Laboratory

The system weighs 50 kg (110 lbs) and should be installed on a lab bench that is capable of supporting this weight along with the personal computer, printer and any ancillary equipment. As a minimum, it is suggested that the bench be able to support 70 kg (155lbs). When the system is installed on the bench, at least 2 people should be used to position it. The bench space that is required for the system is approximately:

54 cm (21.3”) wide

75 cm (29.5”) deep

110 cm (43.3”) high

There must be at least 10 cm (3.9”) of space at the rear of the instrument to allow for sufficient ventilation.

Make sure that the system is away from air conditioning vents, heat vents, windows and any other device that can lead to significant temperature change. If organic solvents are used, make sure that there are no open flames or devices that can create sparks in the laboratory.

The system should be positioned on a level surface that does not support other devices that produce vibration (e.g. shakers, centrifuges, etc.).

2.5 Connecting the Computer System

> ***Note**: The computer must meet the minimum requirements indicated below:*

Windows 7 Requirements:

1) Intel Core/Core2/Pentium/Celeron family or compatible processor recommended
2) 2 GHz or higher processor clock speed recommended; 1.8 GHz minimum required
3) 10 GB or larger hard drive with at least 100 MB of free space
4) Microsoft® Windows® 7 Professional operating system (32- or 64-bit)
5) Microsoft® Windows® compatible display adapter (card or built into motherboard) with 32-bit color (Highest setting) at 1024x768 or more pixel resolution
6) 4 gigabyte (GB) of random-access memory (RAM)
7) One unused USB port is required for connecting the computer to the *DS2 Automated ELISA System*
8) Mouse or other pointing device supported by Windows®
9) Microsoft® Windows® compatible CD-ROM or DVD Drive
10) Microsoft® Windows® compatible printer (color recommended) and sound card.
11) Network/LAN connection, 10/100 network interface (Optional)
12) Serial Port (Optional for LIS interfacing)

Windows 8.1 Requirements:

1) Processor: 1 gigahertz (GHz) or faster with support for PAE, NX, and SSE2
2) RAM: 1 gigabyte (GB) (32-bit) or 2 GB (64-bit)
3) Hard disk space: 16 GB (32-bit) or 20 GB (64-bit)
4) Graphics card: Microsoft DirectX 9 graphics device with WDDM driver

Connect the USB Cable provided with the DS2 to the USB communication port on the *DS2® Automated ELISA System* (lower rear of the right panel, Figure 2-1) and to a communications port on the personal computer. Connect the personal computer and the system to the mains.

__Note__: Ensure the USB port on the computer is a USB 2 port (has a black tang) versus a USB 3 port (blue or teal tang). If you have questions regarding the computer port, consult you IT personnel.

***Note**: There are two identical USB cables provided with each DS2 instrument (Part Number 50600167. They are 1.5 meters (~5 ft.) long and have a ferrite bead at each end of the cable. One of these cables **must be used to connect the DS2 to the computer**. Using a different cable can cause communication problems between the DS2 and the computer resulting in intermittent software freezes.*

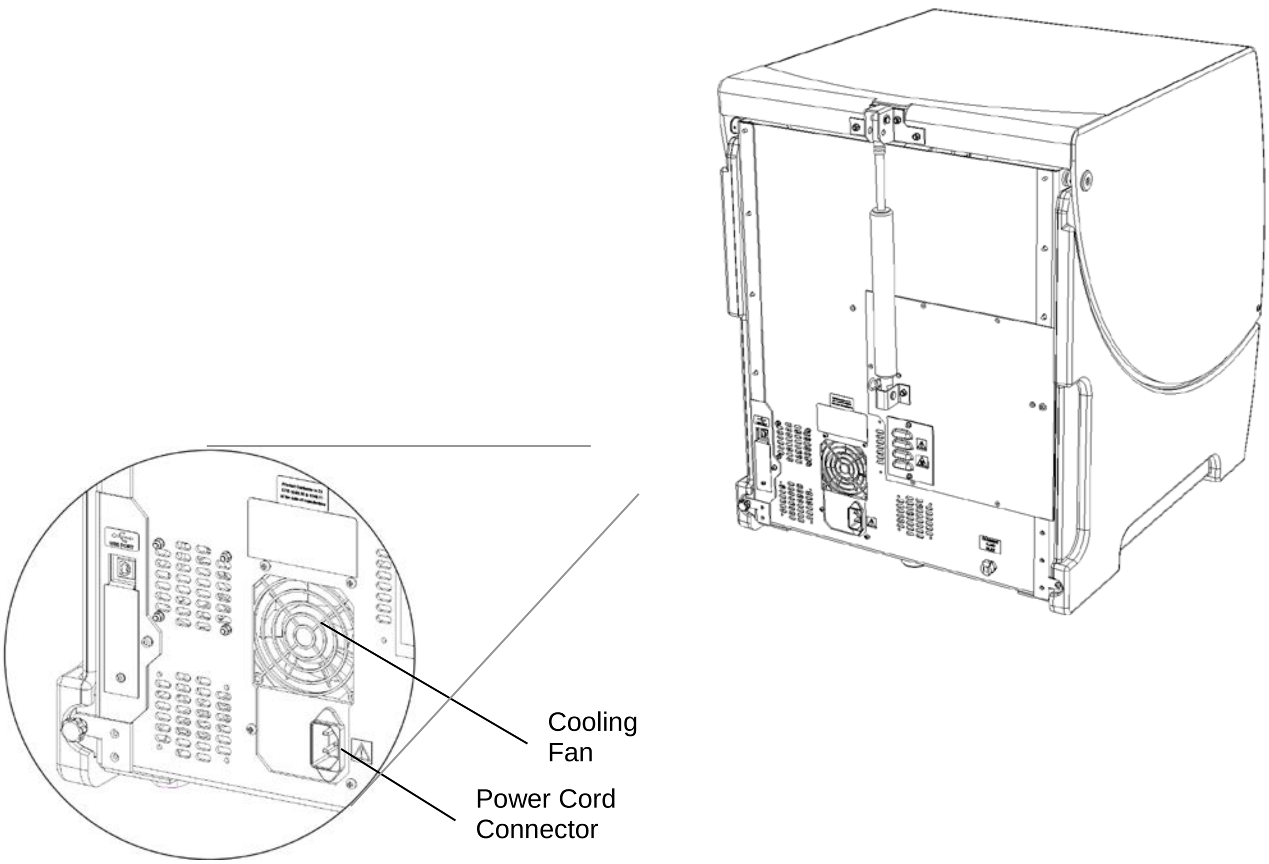


Figure 2-1: Back View of the *DS2 Automated ELISA System*

2.6 Connecting the System Power Cord

The power cord connection to the DS2 is located in the back of the system.

***Note**: Depending upon local electrical codes and electrical service quality, an optional uninterruptible power supply (UPS) may be required in the laboratory. The use of a UPS is optional but recommended.*

***CAUTION:** The* DS2 System *must be connected to a properly grounded electrical outlet. Verify that the electrical outlet is properly grounded.*

Before connecting the power cable, be sure that the system, computer printer and auxiliary components have been connected to each other.

To Connect the Power Cord:

1. Plug the power cord into the connector at the back of the instrument.
2. Connect the other end of the power cord to the laboratory electrical supply outlet.

2.7 Dongle Installation

The use of a dongle will be needed to unlock certain features in future versions of software. The locking of feature(s) provides accountability to Dynex on which customers are using the feature(s). It also ensures that customers have been trained on how to properly use any new features.

To use the dongle license, simply insert the dongle into a valid USB port on your computer. You can tell the dongle is working properly if a static red LED lights up on the dongle like this:

Figure 2-1 Dongle Red LED Light

2.8 Loading the Matrix Application Software

The *DS2® Automated ELISA System* can be used with the following operating systems:

Microsoft® Windows® 7 Professional operating system (32- or 64-bit)
Microsoft® Windows® 8.1

***Note**: Over time, it is possible that new operating systems will be accredited for use. Please review software notes or any bulletins regarding current specifications.*

The Matrix application software is supplied on a CD-ROM disk.

- The installer should open automatically. In the event the installer does not open automatically, navigate to the CD drive and double click the CD. Locate “Setup” on the CD and double click to start the installation wizard.
- In the event the computer system does not have a CD-ROM drive, the software is also available in a folder format for download from MY DYNEX.

A wizard will be presented to lead the operator through the installation and the installer should simply follow the instructions in the wizard. It is recommended that the program be stored in the directory suggested by the wizard (Dynex Technologies/Matrix/Matrix).

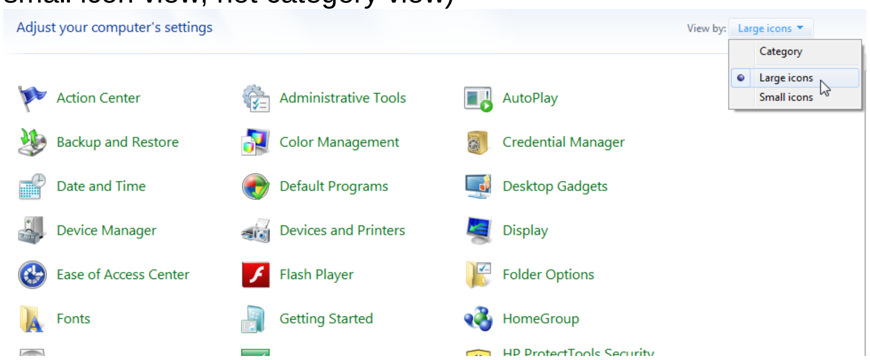
At the conclusion of the installation, remove the CD.

***Note**: A shortcut for the Matrix software will automatically be created and placed on the desktop.*

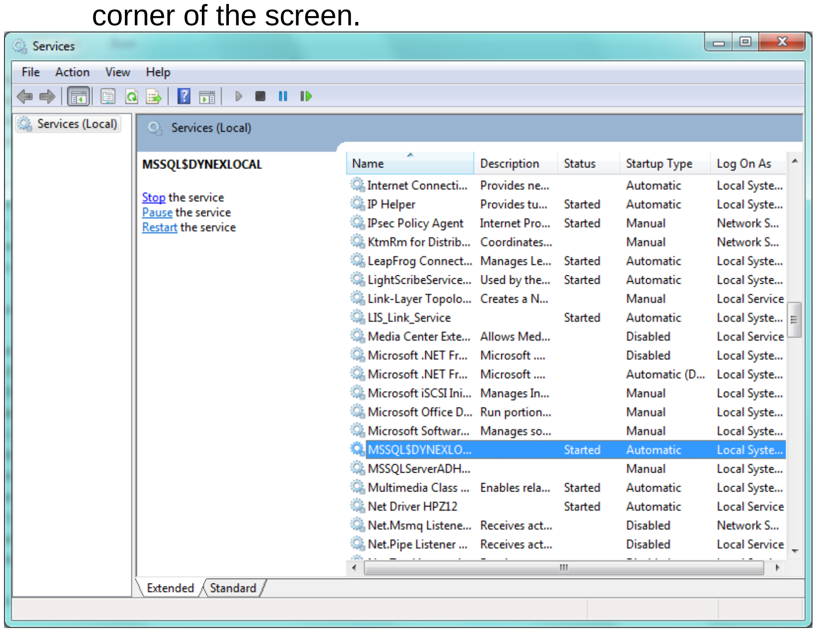
2.9 Upgrading the DS-Matrix Application Software

The following instructions are for upgrading DS-Matrix software versions 1.17 or higher.

1. Create a Database Backup
   This step is a precaution in case something should happen to the database files during installation or deinstallation of the software.
   a. Stop the SQL server
      i. For windows XP, follow the instructions on TB105 to stop the SQL server
      ii. For Windows 7, stop the SQL server through Control Panel (Large or small icon view, not category view)

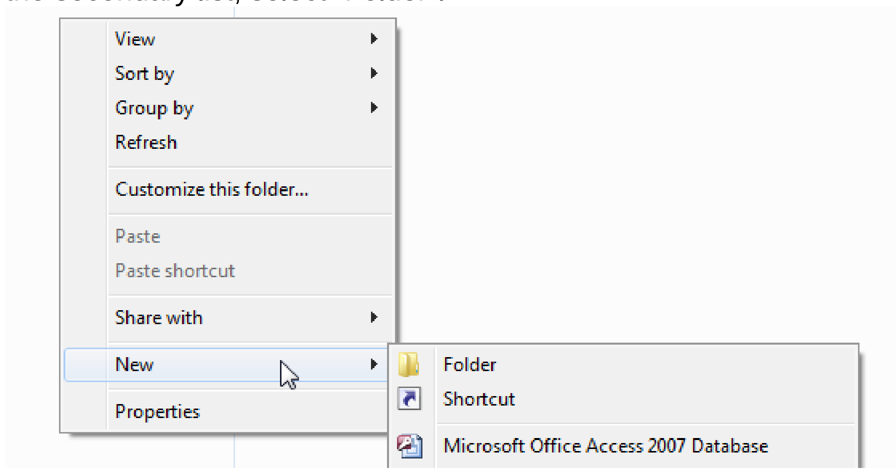


/Administrative Tools/Services. Locate MSSQL$DYNEXLOCAL in the list of services, highlight it, and click "Stop the Service" in the upper left corner of the screen.



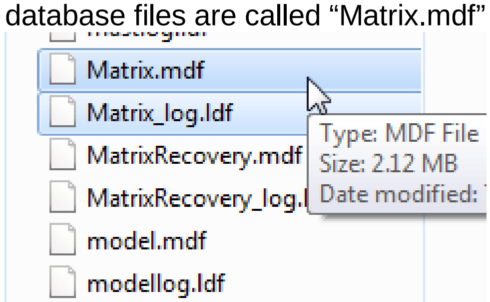
   b. Copy the Database Files
      i. Once the SQL server has been stopped, navigate to C/Program Files/Common Files/Dynex Technologies/Databases/MSSQL$DYNEXLOCAL/Data.

ii. Right click inside the Data folder and select "New" from the list. From the secondary list, select "Folder".



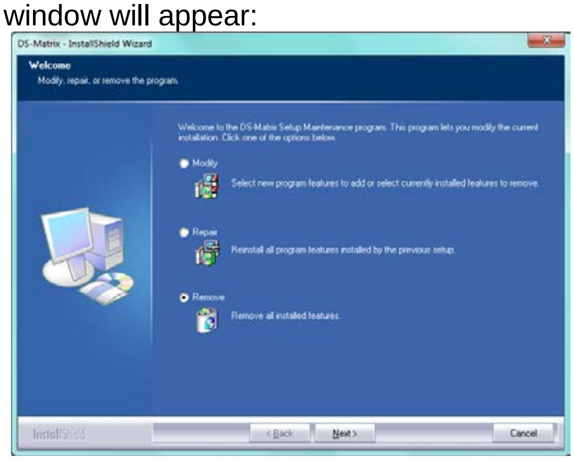
iii. Name the folder "Database Backup (today's date).

iv. Copy the two database files and paste them inside this folder. The database files are called "Matrix.mdf" and "Matrix_log.ldf"



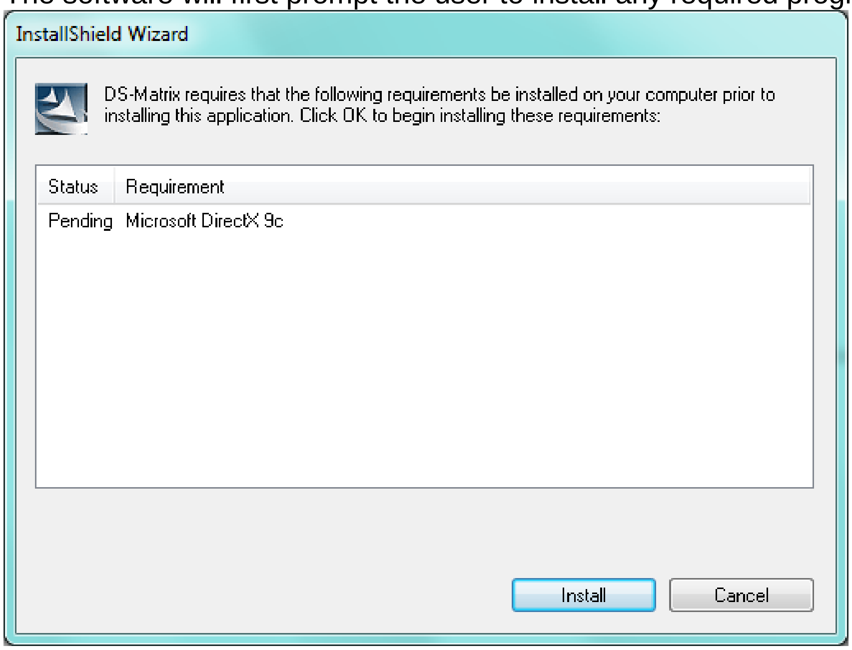
c. Restart the SQL server by following the instructions in step A, only this time choose either the green play button (Windows XP) or "Start the Service" (Windows 7).

2. Uninstall the old version of the DS-Matrix software
   a. Go to the Control Panel (Large or Small icon view, not category view) and choose "Add or Remove Programs" (Windows XP) or "Programs and Features" (Windows 7).
   b. Find DS-Matrix in the list of programs. Double Click on it. The following window will appear:

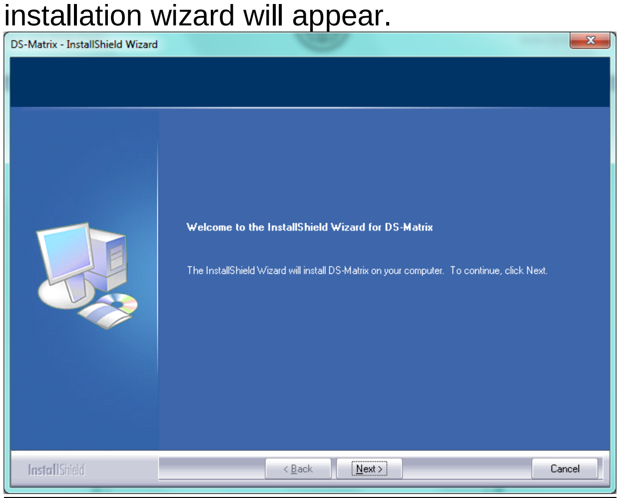


c. Select “Remove” and click “Next”. This will uninstall the current version of the DS-Matrix Software.

3. <u>Install the new version of DS-Matrix Software</u>
   a. If installing from a software CD, the CD should begin to automatically once the CD is inserted into the drive, however you can also look in My Computer and double click the CD location to start the software installation if the CD does not start automatically.
   b. If installing from a folder, double click on setup.exe inside the folder. Make sure the software installation folder is located on the desktop of the computer (not a USB drive). For best results, make sure the folder is unzipped and the files are extracted prior to installation.
   c. The software will first prompt the user to install any required programs.



Click install to install the programs. Once these programs finish installing, an installation wizard will appear.



d. Click “Next”, and continue through the wizard, entering in user information or company information as required. There is no need to change any of the default settings.
e. Click “Finish” when the software has finished installation.

4. <u>Change the Dispense Height setting in the configuration file</u>
   a. The DS-Matrix software should be closed when updating the configuration file. The configuration file is found using the following pathway:
   Program Files/Dynex Technologies/DS-Matrix/MatrixApp.exe.config *(some computers may show this as “MatrixApp.exe”. If this is the case, look at the detail view of the files to make sure you are choosing the configuration file type and not the application file type)*.
   b. Right click on MatrixApp.exe.config and choose the “Open with” option.
   c. Select to open the file with Notepad and click okay.
   d. Scroll down through the configuration file until the setting for “MPDispenseHeightMM” comes into view.
   e. Change the value for this setting from 3.0 to 5.0. Your screen should match the picture below when this has been completed:

```
  "LocalZTravelOffsetMM" defines the default tip position in millimeters
  above the top of a plate when traveling across it.
-->
<add key="LocalZTravelOffsetMM" value="5.0" />
<!--
  "DispenseHeightMM" defines the default tip position in millimeters above
  a fluid at which to dispense fluid when not dispensing to a plate.
-->
<add key="DispenseHeightMM" value="5.0" />
<!--
  "MPDispenseHeightMM" defines the tip position in millimeters above a
  fluid at which to dispense fluid into a microtiter plate.
-->
<add key="MPDispenseHeightMM" value="5.0" />
<!--
  "DWDispenseHeightMM" defines the tip position in millimeters above a
  fluid at which to dispense fluid into a deep well plate/strip.
-->
<add key="DWDispenseHeightMM" value="5.0" />
```

   f. Save the configuration file. Exit the file.

5. <u>Start the DS-Matrix Software</u>
   a. Double click the DS-Matrix software icon.
   b. The software will perform a database backup upon first start up. Click “OK” and the database backup will automatically be performed. This message will not appear again on subsequent software start-ups.
   c. Dynex recommends opening and resaving each assay file following a software upgrade.
      i. Go to File. Choose assay editor.
      ii. Go to File. Choose open. The “Open Assay” dialog box will display.
      iii. The first assay file is automatically selected. Click OK.
      iv. Choose File and Save. The assay file is now saved.
      v. Repeat steps i-iv for each assay file, using the drop down arrow in the “Open Assay” dialog box to select the next assay in the list, until all assay files have been opened and saved.
   d. The software upgrade is now complete.

2.10 Creating a New Customer Database

Rarely is it necessary to create a new database for a customer due to database corruption or software bugs present in older versions of the DS-Matrix software. Please do not attempt to create a new database for a customer without confirming with technical support that this is the best course of action to resolve the customer's problem.

1. Take Screen Captures or pictures of all tabs under Tools/System Configuration.

2. Use TB103 to export all of the customer assays from the DS-Matrix software to the

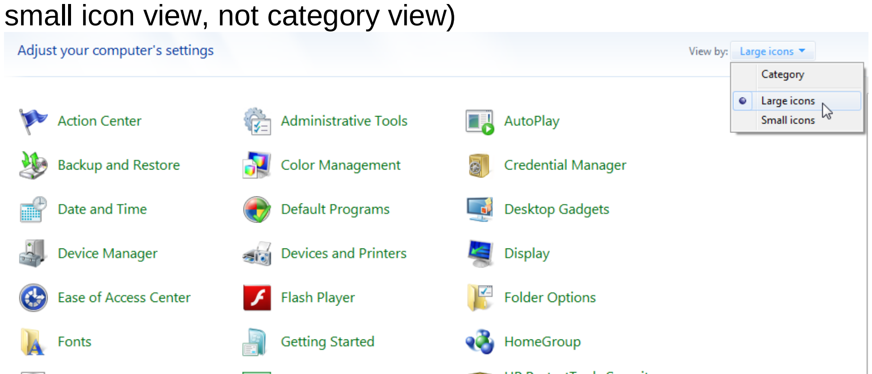
Desktop of the computer. Assays may be exported individually or as a group.

3. Store a copy of the customer's current database in a new folder

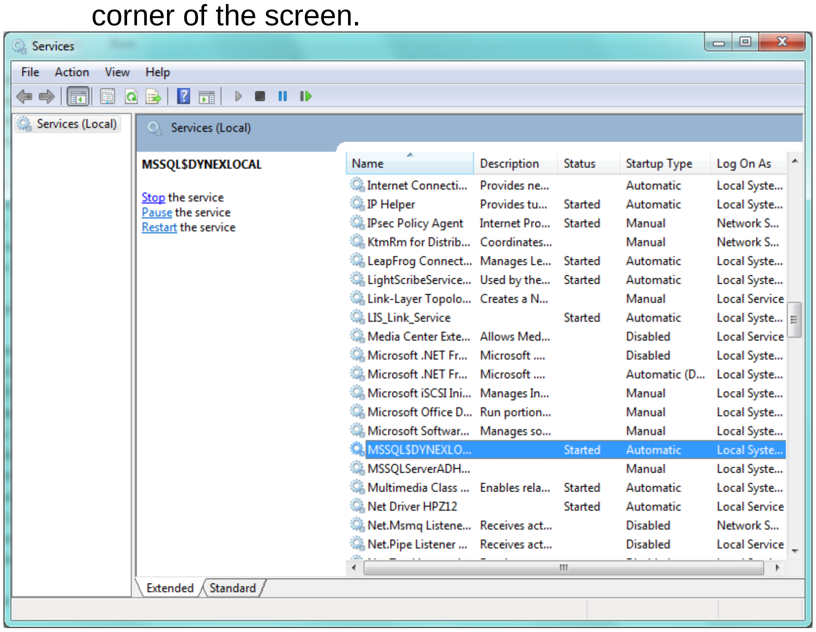
   a. Close the DS-Matrix software and Stop the SQL server

      i. For windows XP, follow the instructions on TB105 to stop the SQL server

      ii. For Windows 7, stop the SQL server through Control Panel (Large or small icon view, not category view)

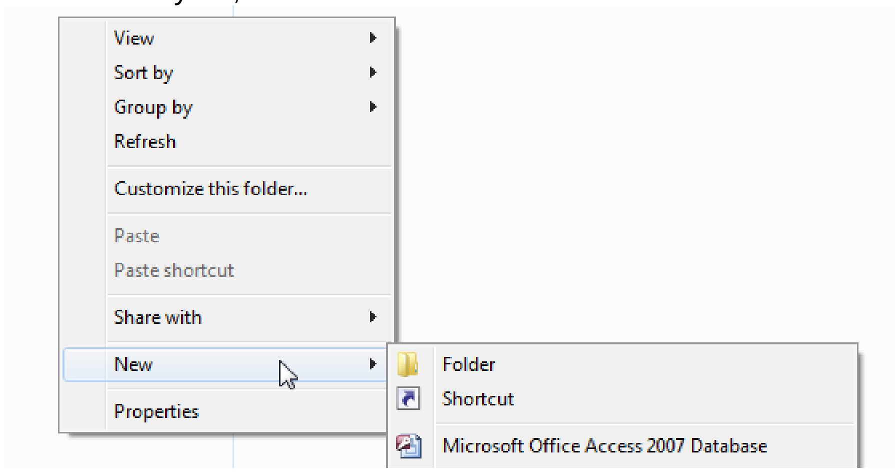


/Administrative Tools/Services. Locate MSSQL$DYNEXLOCAL in the list of services, highlight it, and click "Stop the Service" in the upper left corner of the screen.

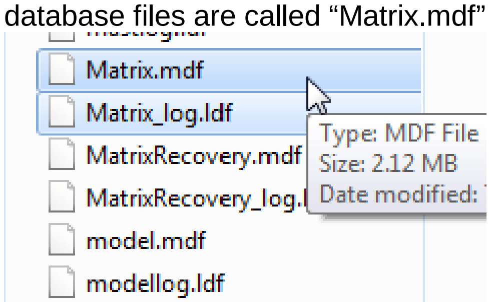


   b. Copy the Database Files

iii. Once the SQL server has been stopped, navigate to C/Program Files/Common Files/Dynex Technologies/Databases/MSSQL$DYNEXLOCAL/Data.
iv. Right click inside the Data folder and select "New" from the list. From the secondary list, select "Folder".



v. Name the folder "Database Backup (today's date).
vi. Cut the two database files and paste them inside this folder. The database files are called "Matrix.mdf" and "Matrix_log.ldf"



c. Restart the SQL server by following the instructions in step A, only this time choose either the green play button (Windows XP) or "Start the Service" (Windows 7).

4. Open the DS-Matrix software. A message will appear asking if the user wishes to create a new database. Click "Yes" in response to this message to create a new database.
5. Reimport the customer's assays using TB103 as a guide
6. Use the screen captures or pictures taken of the tabs in System Configuration and restore all of the customer's database settings.

2.11 Starting the System

***CAUTION:** Power is on to the system whenever the indicator light is illuminated.*

Starting the DS2 System

1. Turn the DS2 System power switch ON.

2. If not already on, turn the power ON for the computer, monitor, and printer.

3. Double-click the **Matrix** shortcut icon or select **Start** > **Dynex Technologies** > **Matrix** > **Matrix** from the Windows *Start* menu program group to present the *Run mode* dialog box (Figure 2-2).

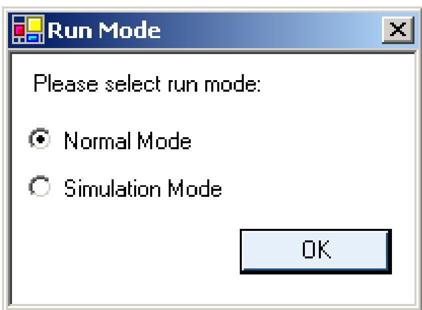


Figure 2-2: Matrix DS2 Run Mode Dialog Box

Select **Normal Mode** to connect to the DS2 operate the DS2 System (**Simulation Mode** is provided to operate the software without connecting to the DS2).

The DS2 performs a series of self tests before the instrument is available for use.

2.12 Initialization

The DS2 instrument will perform a series of initializations before it is ready for use, including picking up and releasing the wash head assembly, opening and closing the incubator door, and moving the microplate carrier to and from the incubation and plate reader chambers.

CAUTION: Do not interrupt the DS2 while it is performing its initialization.

After these steps are successfully completed, the Main Runtime window (Figure 2-3) will be displayed.

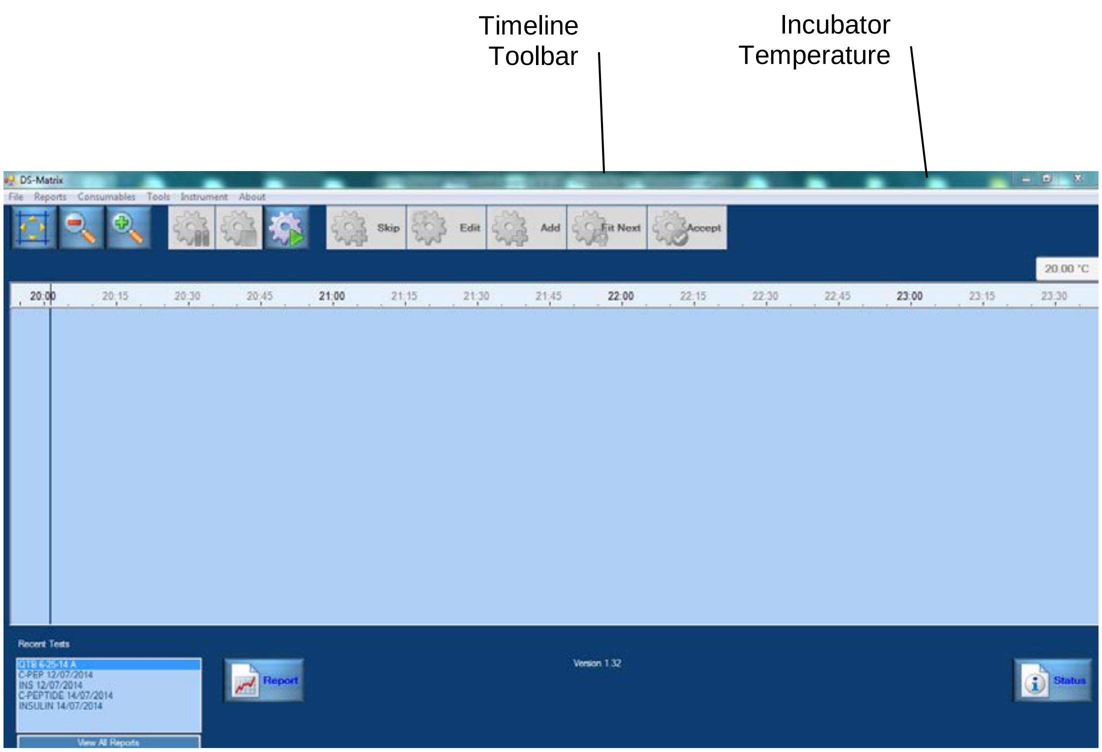


Figure 2-3: Main Runtime Window

The *Timeline* toolbar contains icons for starting and stopping the run, changing the display, and setting run options. Certain functions may not be available depending on the run status.

2.13 Loading the Desired Assay

The Matrix software allows the user to create assay protocols, however frequently assay programs are prepared and supplied by the manufacturer of the assay kits.

Assays are stored in a database. They may be exported as .XML files and then imported locally.

Chapter 3 Maintenance and Introduction to Service

3.1 Overview

This chapter describes:

- User Maintenance - Routine maintenance, cleaning and decontamination activities that should be performed by the user. While this material is included in the operator's manual, it is included here as the service engineer may be required to perform these activities from time to time.
- Cleaning and Decontaminating the System - General comments about servicing the unit.

A detailed discussion about troubleshooting is presented in Chapter 4 (*Troubleshooting*).

WARNING: **THE SAMPLES, REAGENTS, WASH SOLUTION AND/OR THE ASPIRATED WASH SOLUTION MAY CONTAIN TOXIC MATERIALS OR BIOHAZARDS. THE SERVICE ENGINEER MUST ASSUME THAT THESE LIQUIDS AND ANY COMPONENTS THAT COME IN CONTACT WITH THEM ARE HAZARDOUS.**

ENSURE THAT THE SYSTEM HAS BEEN DECONTAMINATED OR TAKE SUITABLE PRECAUTIONS (e.g., WEAR RUBBER GLOVES AND SUITABLE EYE PROTECTION).

IF THE SYSTEM IS SENT BACK TO A DYNEX TECHNOLOGIES FACILITY, THE USER MUST CERTIFY THAT THE UNIT HAS BEEN DECONTAMINATED.

3.2 User Maintenance

3.2.1 Maintenance Schedule

The user is expected to perform a number of tasks on a periodic basis.

> ***Note**: Performing maintenance to the DS2 may expose the operator to hazardous moving parts. Contact DYNEX for proper safety precautions to avoid possible injury.*

The following periodic maintenance procedures are required for the DS2 Automated ELISA System:

Daily Maintenance

1 Empty and clean the tip waste container.
- a) The tip waste container may be disinfected by spray disinfectant or by immersion in a disinfectant solution (70% ethyl or isopropyl alcohol or ammonium disinfectant solutions only). Readily available laboratory cleaners may be used to clean the tip waste container.
- b) The container should not be autoclaved.

> ***Warning**: While the DS2 Automated ELISA System does not present a biohazard, the samples that are used and all parts and consumables in contact with the samples must be considered biohazardous. Always wear protective gloves when handling potentially infectious substances.*

2 Empty and clean the liquid waste container on an as needed basis according to laboratory SOPs.
- a. The liquid waste container should not be autoclaved.
- b. The ends of the tubing with the quick disconnect fittings should be considered contaminated. When moving the waste container, prevent the tubing from swinging and casting off drops of liquid. The quick disconnect fittings may be decontaminated with a spray disinfectant or 70% alcohol.
- c. Calculate the amount of concentrated disinfectant solution required for the amount of waste liquid. Use manufacturer's recommended concentrations.
- d. Carefully open the waste container and add the concentrated disinfectant to the bottle. When opening the liquid waste container, the container should be seated on the bench top so that the cap is pointed toward the ceiling.
- e. Gently mix the liquid contents. Allow the container to sit while the disinfectant works. Follow manufacturer's guidelines for contact time. A mild detergent may be used to remove soil from the interior surfaces of the container.
- f. Empty the contents into a sink or carefully collect for further decontamination as required by laboratory SOPs.
- g. Rinse the container with large amounts of water to remove traces of chemicals.

h. Invert container and allow it to dry for 1 - 2 hours.

> ***Note**: If desired, the waste tip container and the liquid waste container can be disinfected with 70% ethanol or isopropyl alcohol.*

3 Wipe all workspace surfaces with 70% alcohol and a soft, non-fibrous cloth and distilled water to remove the excess alcohol, paying extra attention to the sensor on the wash head, the pipette spigot, and the pipette sensor area.
.
a) Use cotton swabs dampened with solution to get into corners and seams.
b) To clean the blue plastic cover and the outside surfaces of the DS2, we recommend using 70% alcohol or a cleaner such as Windex and a soft lint-free towel.

Ensure the hole in the pipette spigot is free of debris. If debris is present, liquid level detection can be affected. If debris is present, use a clean cleaning wire provided with the DS2 to ream the spigot hole.

Weekly Maintenance

In addition to performing daily maintenance, once a week the wash buffer containers should be cleaned.

1 Empty the wash buffer out of the containers and rinse them thoroughly with distilled water.

2 Add 300 – 400 ml of 70% ethanol or lightly diluted disinfectant to the container. Place the cap firmly on the container. Gently rotate and invert the container so that liquid contacts all inner surfaces. Repeat this several times.

3 Empty the container into a sink. Rinse the container 4 – 5 times with fresh deionized or distilled water (preferably sterile). Allow the bottle to dry inverted overnight

Monthly Maintenance

1. Perform an alcohol flush on the system.

   a. Empty the wash buffer containers and clean them with 70% isopropyl or ethyl alcohol.

   b. Perform a wash assay using bottle A.

   c. Perform a wash assay using bottle B.

   d. Empty the containers and rinse them thoroughly with DI water.

e. Perform a wash assay using bottle A with DI water to remove the alcohol from the system.

f. Perform a wash assay using bottle B with DI water to remove the alcohol from the system.

2. Lubricate the O-rings on the system with lubricant provided with the DS2 (can be performed more often if needed).

Yearly Maintenance

The following operations should be performed by service personnel:

1. Replace the dispense tubing.
2. Replace the aspiration tubing.

> ***Note**: The dispense tubing and aspiration tubing may need to be replaced more frequently than every year, depending upon the frequency of use and the severity of operating conditions.*
>
> *Contact DYNEX TECHNOLOGIES for information on replacement tubing.*

3. Back up Calibration Settings.
4. In DeeSoft select Verify/Run Self-test. Re-calibrate arm as needed.
5. Clean Reader Optics and replace the lamp. Align lamp.
6. Replace fan filter if needed (if your unit does not have a filter for the fan, add this upgrade, bulletin PB0029).
7. Inspect and clean filters.
   a) Using needle nose pliers remove each filter one at a time and inspect for clouding and scratches. **Be careful not to touch the surface of the filters.** If there is a noticeable deterioration that extends to more than 25% of the filter surface (on either side) the filter should be replaced. Use a can of oil-free dry air or nitrogen to remove dust and debris from the filter. A lint-free cloth may be used to remove additional dust or debris.
   b) Use a lint-free cloth to remove dust from the lens under the bulb. **Be cautious not to touch bulb with bare hands or disturb position of bulb.**
8. Inspect and clean the Pipette (collar mechanism, spigot and horizontal opening).
9. The DS2 cover should be able to be opened 8 inches (approximately 203mm) without falling. Check the Gas Spring (technical bulletin 118).
10. Check belt tension on the X-Drive, Y-Drive, and Z-Drive and adjust as required.
11. Check Carrier Plate clips and replace as necessary.

12. Perform washer verification.

13. Perform verification of the reader using the appropriate verification plate.

14. Perform temperature verification on the incubators using the proper verification plate.

15. Check water trap sponge in the pump assembly.

16. Update firmware if needed.

The DS2 PM Kit (Part Number 13002590 available for purchase from Dynex Technologies) contains the following items:

Tubing Replacement Kit
Lamp
Reader Fan Filter
Sponge (for vacuum trap)

Yearly Maintenance Checklist

DS2 -12 Month Maintenance Checklist

DS2 Serial Number:

Reader/Incubator SN:___________ Pipette SN: _________________
Matrix Version: ____________ Operating System: _______________
Main Firmware Version: ________ PAL Firmware Version: ________

Item	Complete	Printout
Power up Self-Test Passed		Y
Back-up Calibration Settings		
Clean Reader Optics		
Reader Lamp and Fan Filter Replaced		
Filters inspected and cleaned		
Inspect and clean the spigot PTFE or horizontal opening		
Inspect the spring clips on each plate carrier and sample rack, replace as needed		
Replace Dispense and Aspirate tubing		
Inspect O-rings on the bottle fittings		
Inspect and Clean Wash head pins and clamp		
Run Tip Pickup/Workspace tests (recalibrate arm as needed)		
Washer Dispense Verification for all bottles		Y
Washer Aspiration/Residual Check		
Reader Verification Test, Upper and Lower Plates		Y
Run the Pipette Check assay		Y

Incubator Check, Upper and Lower Plates		
Cover Height Check		
Recommended ECO/Bulletin Updates		

______________________________ ______________________

Service Engineer Date

3.3 Cleaning and Decontaminating the System

The DYNEX Technologies *DS2 Automated ELISA System* is constructed from materials that are resistant to chemical attack.

Spills should be cleaned up as soon as possible. As a precaution the service engineer should wear gloves before servicing it.

WARNING: MAKE CERTAIN THAT THE POWER CABLE IS DISCONNECTED BEFORE CLEANING THE INSTRUMENT.

To Clean the System:

Clean all external surfaces with a cloth moistened with a mild laboratory detergent or 70% isopropyl or ethyl alcohol. If necessary dilute the detergent according to the manufacturer's instructions before using. When cleaning pay special attention to the pipette spigot and sensor area and the wash head and sensor area. Ensure the pipette spigot hole is clear of debris. Cleaning wires may be used to clean the spigot hole if there is debris in the hole.

To Decontaminate the System:

Wipe all surfaces with a lint-free cloth moistened with a cleaner such as iDecon Detergent disinfectant or a 70 % (by volume) solution of isopropyl or ethyl alcohol.

***Note**: Do not use bleach to clean the DS2.*

Racks should be removed from the instrument and soaked in disinfectant solution for at least 30 minutes or the time recommended by the manufacturer of the disinfectant. Rinse racks thoroughly with distilled or deionized water and dry them thoroughly prior to placing them on the DS2 workspace.

Wipe all external surfaces of the system with a lint-free cloth dampened with distilled water to ensure any excess alcohol is removed.

Allow the DS2 to dry 1-2 hours, or preferably overnight

The system tubing should be flushed with 70% isopropyl or ethyl alcohol using a wash program written in the DS-Matrix software (all customers should have a wash program already loaded in the DS-Matrix software). Rinse the wash buffer containers thoroughly and fill with DI water and repeat the wash program to remove the alcohol from the system. If the system will not be used for an extended period of time, the dispense tubing should be removed from the pinch valves to prevent permanent compression of the tubing.

If dispense or aspiration tips on the wash head become clogged, use the wires supplied with the system to remove any particulate matter from them. If this does not resolve the problem, remove the 4 set screws on the sides of the wash head and soak it standing upright in receptacle with 70% isopropyl or ethyl alcohol up to the spring gap for 15 minutes. Rinse the wash head thoroughly with DI water and replace the screws (use caution when replacing the screws as over tightening the screws can crack the wash head).

If a system is returned to a DYNEX Technologies facility, the customer must decontaminate the system before shipment and a decontamination certificate must be submitted with the unit.

3.4 Servicing the *DS2 Automated ELISA System*

3.4.1 Servicing Modules

The *DS2 Automated ELISA System* does not have any user replaceable module however trained service engineers can easily exchange the reader/incubator, and pipette modules.

When a problem is identified in one of these modules, the normal service operation is to replace the entire module and return the defective one to a service centre. Trained service personnel may elect to repair the reader/incubator on-site; however the pipette module is calibrated and is required to be returned to the factory.

The service engineer is expected to perform the following activities on-site for the DS2:

- Replacement of consumable items, such as the lamp in the detector module.
- Checking tubing for cracks, discoloration or the deposition of solids inside the tubing or on fittings.
- Changing components to meet the need of a different assay (for example, changing a filter).
- Arm calibrations and alignments.
- Use DeeSoft to install modules and test the DS2.
- Troubleshoot and determine the problem and perform the necessary service on-site.

3.5 Updating Firmware using the DFU Program

When new firmware has been released Dynex will notify appropriate technical personnel via a Technical Bulletin. The Bulletin will explain what is being released and why. It will also detail where you can get the update and how to update the DS2. You will need both the firmware update and the Dynex Device Firmware Update (DFU) program. The instructions in the Bulletin supersede the following section.

3.5.1 Install the Dynex DFU program

Ensure you are using DFU program version p1.0c or higher. If you have a previous version installed, uninstall the older version before installing this program.

1. From the computer attached to the DS2, Double click on the Dynex DFU setup program.
2. The InstallShield Wizard will guide you through the installation. You will want to click on the Next button to proceed.
3. The next three Figures below show the License agreement, Customer Information and Setup Type steps. Fill in the required information and click Next at each step to proceed with the installation.

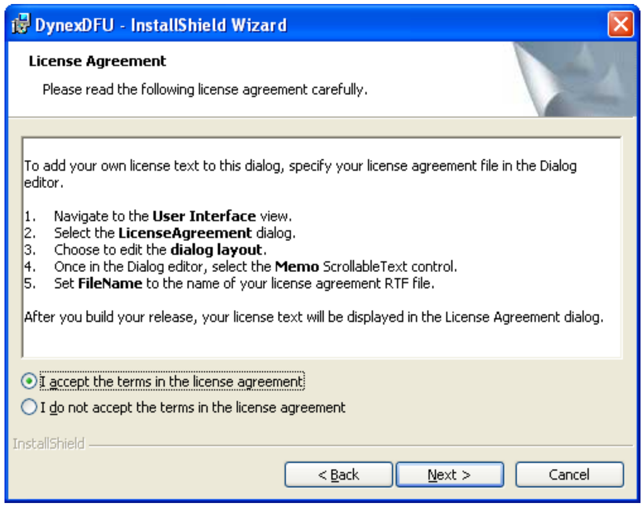


Figure 3-1-License Agreement

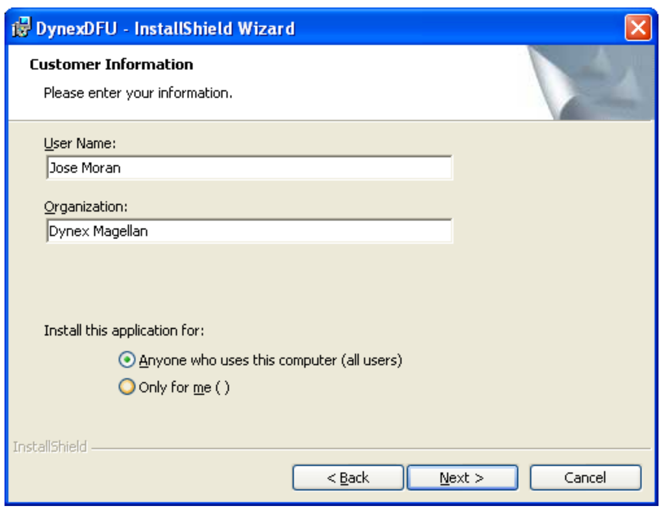


Figure 3-2-Customer Information

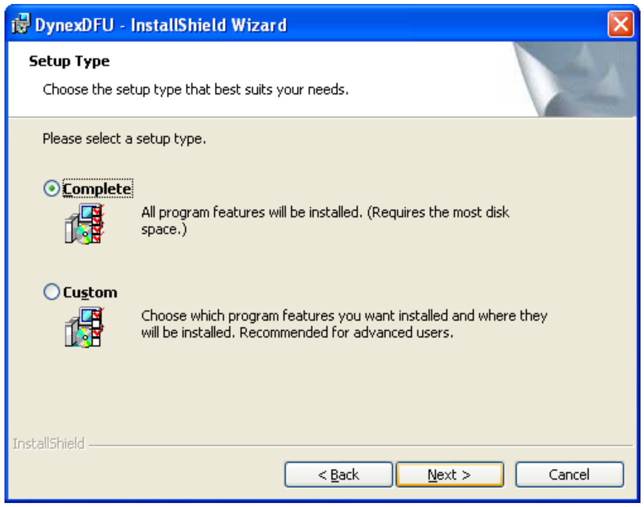


Figure 3-3- Setup Type

4. Click on the Install button to complete the installation.

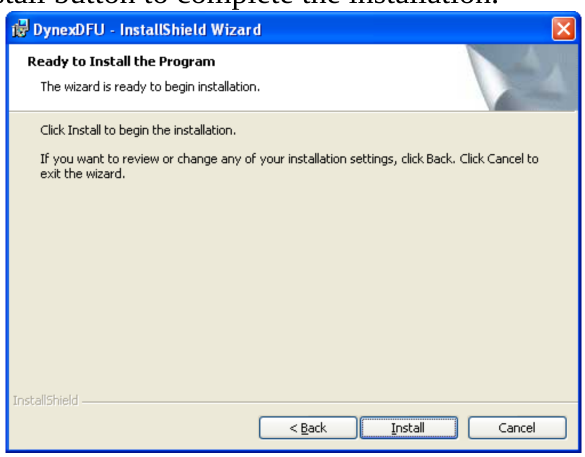


Figure 3-4-Install

3.5.2 Using the Dynex DFU program

The DS2 should be powered up and connected to the computer. Matrix software must not be running.

1. Double click on the program icon from the desktop.

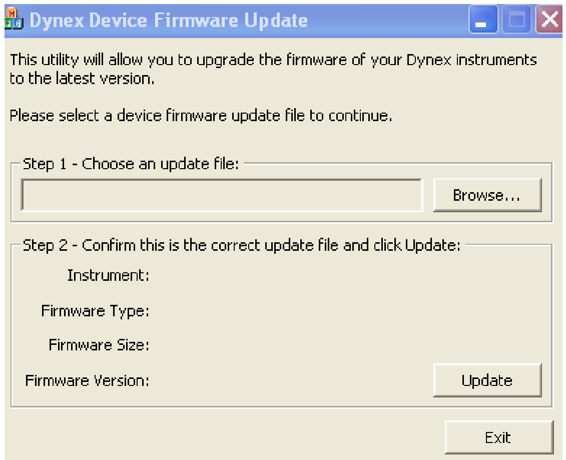


Figure 3-5- Steps 1 and 2

2. From the Update screen, choose the Browse button to find the update file. The file is called “DS2_Release.elf.out.dfu”
3. Once you have chosen the update file, the information will be populated (See Figure 9).

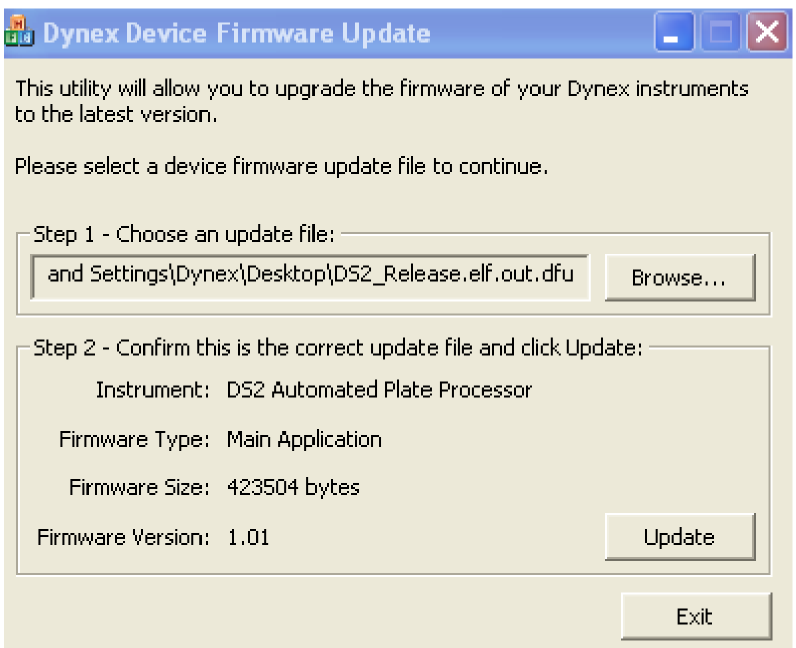


Figure 3-6-Ready to Update

4. Click the Update button and the window in Figure 10 will appear.
5. Click the Upload Update to DS2 button.

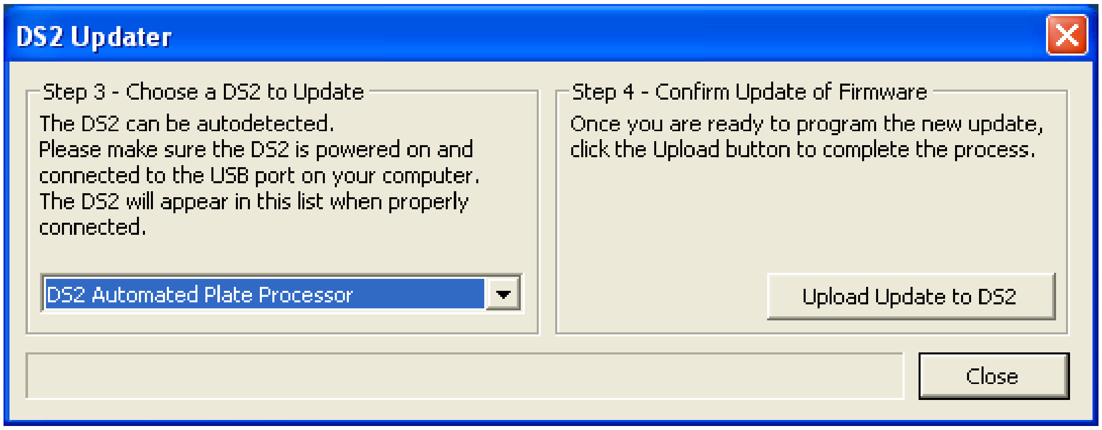


Figure 3-7- Steps 3 and 4

6. The following Hardware Wizard may present itself. Choose the Next button until the installation is complete.

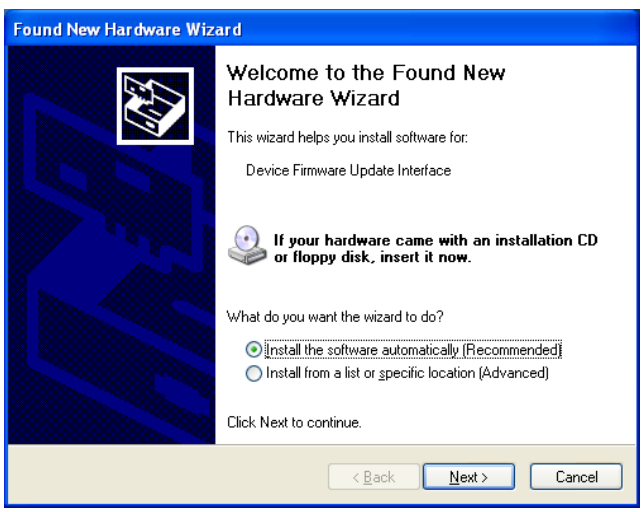


Figure 3-8-DFU Interface Hardware Wizard

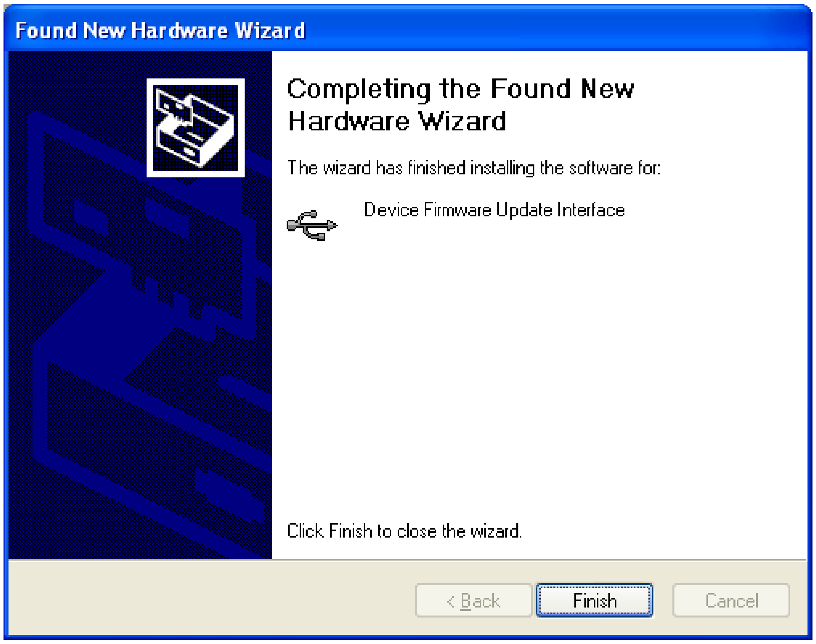


Figure 3-9-Click Finish to Continue

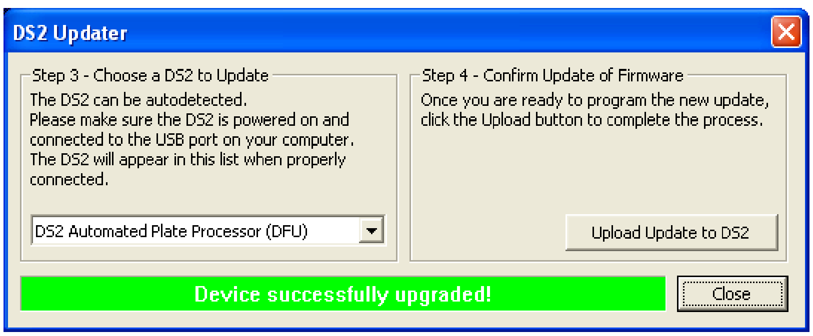


Figure 3-10- DS2 Update is now complete

7. When complete, recycle the power on the DS2 and close the Dynex DFU program.
8. Connect with Matrix and ensure the system passes self-test.
9. Ensure the firmware version displayed on the DS2 self-test report matches the newly installed version.

3.6 Post-Service Checkout Protocol

3.6.1 Role of the Post Service Checkout Protocol

After any service activity, the component(s) that have been replaced should be checked and the yearly testing protocol should be performed to ensure that all components of the system are functioning properly.

3.6.2 Power Down the System

Power down the system and the computer and power then power up again in the normal manner. Perform the Arm Calibration and verify that all systems are operating properly.

3.7 Returning Components

When a component is to be returned to DYNEX Technologies, the user or service engineer is expected to obtain a return authorization number before shipping the unit and must include the Repair Form and Declaration of Decontamination form (Figure 3-11). For international locations, please contact your local DYNEX Technologies facility.

EQUIPMENT IN TRANSIT

IMPORTANT: Please complete this form for each product/instrument that is being returned and attach it to the product prior to it being shipped. If your instrument contains a hard drive, please retain back-up copies of all or any stored files and remove any personal information to comply with HIPPA regulations. The Return Authorization (RA) for your product/instrument is listed below.

To ensure your instrument is received safely and processed correctly, please note the following:

- Please pack the instrument appropriately, using the original materials and instructions from the manual, insuring instrument as needed.
- Return this signed form with the product/instrument. Verifying that the decontamination was completed in accordance with Dynex procedures. Failure to do so will delay repairs until the form is received.
- Place the RA number on the outside of the shipping container and in the attention line. **Failure to do so will delay processing and may cause your instrument to be returned to you COD.**

Contact: Dynex Technical Service, Phone: (800) 288-2354 option #3, Fax: (703) 803-1441

EQUIPMENT DECLARATION

***Return Authorization/Case Number*: ______________________________**
Product/Instrument Model: ____
Serial Numbers: ____
Customer Location Name: ____
Address: ____
City: _________________State/Prov: ______________**Zip Code**: _________
Contact Name: ____
Contact Phone: _________________ Contact Fax: _______________________
Contact e-mail: ____
Brief Description of problem or error:
____
____

CERTIFICATE OF DECONTAMINATION

I certify that the equipment described above has been disinfected/decontaminated with 70% (by volume) solution of alcohol, per Dynex procedure in the manual, which includes all external surfaces and any surface that have come in contact with bio-hazardous materials and/or chemicals. It is clean, dry and fit for transport and poses no health or safety risk to the recipient.

Signed: ____Date:_________________________

Print Name; _______________________________Title:________________________________

(DYNEX Technologies reserves the right to refuse improperly cleaned equipment)

Shipping address: DYNEX Technologies
Attn: (Above return number)
14340 Sullyfield Circle
Chantilly VA 20151-1683

Figure 3-11 Return Form and Declaration of Decontamination

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Chapter 4 Troubleshooting

4.1 Overview

Although the *DS2 Automated ELISA System* consists of a number of discrete components, troubleshooting can be simplified by considering the following guidelines:

- In almost all cases there is a single proximate cause for a problem.
- A fundamental knowledge of each component in the system is extremely useful in diagnosing the problem.
- The availability of critical spare parts in the system is extremely useful. A list of spare parts for the system and necessary supplies is provided in the chapters that describe service for each module.
- If any aspect of the system is changed, run a before and after experiment to verify that the effect of the change is well understood. Do not consider any change as trivial. For example, if the user has changed the brand/model of microplates in use on the system, check that all settings are correct for the new plate in the Plates Database.

A detailed troubleshooting table is presented as part of the on-line help file.

Three types of problems are typically observed:

- Initialization Problems - the system does not power up (refer to the section entitled, Initialization on page 4-2).
- System Problems - the instrument powers up successfully but it does not appear to be functioning properly. In some cases, there is a communication fault; while in other cases, a component of the system is faulty and must be repaired or replaced. Examples of this type of problem include the inability of the system to deliver the desired volume of sample into the wells or the inability of the lamp in the reader module to illuminate (refer to the section entitled, System Problems on page 4-4).
- Application Problems - in some situations, the system appears to be operating in an acceptable manner but invalid assay results are presented. The service engineer should note that there may be a problem with the reagents, the assay protocol, etc. In this situation, it is worthwhile to use standards, independent test solutions or a different assay to verify that the system is functioning properly (refer to the section entitled, Application Problems on page 4-9).

4.2 Initialization

Failures that occur when the system is initially powered up generally fall into two broad categories:

- The Instrument Fails to Power up
- The System Cannot communicate with the Computer
-

4.2.1 The Instrument Fails to Power up

The causes for failure of the instrument to power up are presented in Table 4-1. If the instrument fails to power up, the LED on the front panel will not be lit.

Symptom	Probable Cause	Resolution
The instrument fails to power up.	The power cord is not connected	Check that the cord is plugged into the instrument electrical outlet (bottom rear of right panel).
	Power is not supplied to the system	Verify that the electrical outlet is not controlled by a switch or timer.
		Verify that there is power at the electrical outlet by plugging in and checking another device (for example, the power line circuit is tripped).
	The breaker on the mains power line is tripped	Reset the breaker.
	The power supply is defective	Replace the power supply
	The Controller PCB is defective	Replace the Controller Board set.

Table 4-1 Troubleshooting Failure of the Instrument to Power Up

4.2.2 The System Cannot Communicate with the Computer

When the instrument is powered up and the DS-Matrix software program is loaded, the system goes through an initialization protocol whereby the system and the personal computer establish communication. If the communication cannot be established, an error message is presented.

The causes for failure of the instrument to communicate are presented in Table 4-2.

Symptom	Probable Cause	Resolution
Hardware Link	Hardware not present	Check communication setting.
		Check cables.
		Instrument not powered up.

Table 4-2 Troubleshooting Failure of the Instrument to Communicate with the Computer

4.3 System Problems

> ***Note**: The application program displays a number of messages on the display during the normal operation of the system. If a fault occurs, it is likely that an error message will be presented. These messages are designed to help you locate the cause of the problem, and they often suggest possible solutions.*

4.3.1 Communication Problems

This section describes situations in which information from the computer cannot be transmitted to the system or vice versa.

Table 4-3 Troubleshooting Communication Problems

Symptom	Probable Cause	Resolution
Application Error Matrix caused a General Protection Fault.	A fault has occurred in the program.	Close down the program and Windows and try again. If the problem persists, reload the program.
Checksum Error in File.	A file has become corrupted.	If the file is a test, plate data, or curve data file, recreate it.
Command Failed.	A memory conflict has occurred between applications.	Close down the program Windows and try again.
Command retry error. **Command Time out.**	An error has occurred while sending the commands to a module.	Check the communication settings and cables.
Computer control command error.	The command was not accepted by the module.	Check the communication settings and cables.
Device already/not open.	The command was not accepted by the module	Check the communication settings and cables.
Directory nnn does not exist.	Program could not find the specified directory	Make sure the drive and directory are correct.

Symptom	Probable Cause	Resolution
Error ____ loading DLL ____.	Program could not find the required DLL file	Re-install the program.
Error building DCB.	Program could not find a device.	Check the communication settings and cables
Error importing file nnn. Check that the file is of the correct type.	Program could not open the file you asked for	Check that the file is present and of the correct type.
Error importing SID file.	Program could not open the file you asked for.	Make sure that the file is correctly formatted. See the File Format Conventions section in user's manual.
Error opening file nnn.	Program could not find the file you asked for.	Recreate the file.
Error reading assay.	Program could not open the required assay file because it is not of the correct type.	Change the Reader settings to the type that was used to create the file, or try using the **File** menu, Import facility to import it.
Error setting comm state.	Communication between systems lost	Check the communication settings and cable.
File ___ is not the correct version. File ___ is not a Matrix format file.	The file you have tried to open is not a standard format used by this version of Matrix	Error setting comm state. Try importing the file using the **File** menu Import option.
Hardware link...Hardware not present.	Cable accidentally disconnected	Check the communication settings and cables.
Installation Failure.	During installation, Matrix tried to use a file that was being used by another Windows program.	Close down all other programs and run the Setup program again. If Microsoft Office is running, remove its icon from the Startup group and reload Windows. You can replace Office in the Startup group once Matrix is loaded.

Symptom	Probable Cause	Resolution
Insufficient Memory.	A memory conflict has occurred.	If running a complex test, try to simplify it. If you are running other applications, close them.
Internal Application Error.	A fault has occurred in the program	Try repeating the command or reboot the program
Invalid byte size.		Check the communication settings and cables.
Invalid data file format.	The data file you are trying to open is not a standard format used by Matrix.	To open the file, try using the **File** menu, Import facility.
Module Not Loaded.	This assay contains operations that are not available for your Reader model, or you have selected the wrong Reader.	Remove the unsupported operation, set Matrix up for the correct module or check to see if the correct module is installed.
No timers available.	Matrix cannot run correctly because of memory conflicts	Close down some of the other applications and try again. If the error persists try resetting the PC.
OLE 2.0 Initialization failed.	A fault has occurred in the program	Try repeating the command or reboot the program
Unable to allocate queues.		Check the communication settings and cables

4.3.2 Problems in a Specific Module

For many problems, error messages will be presented on the status line of the Matrix window.

Specific troubleshooting information and error messages for a given module are presented in the chapter that describes the replacement of components for that module. If the service engineer is required to repair the defective module on site (and has the appropriate spare parts) replacement of the component can be performed.

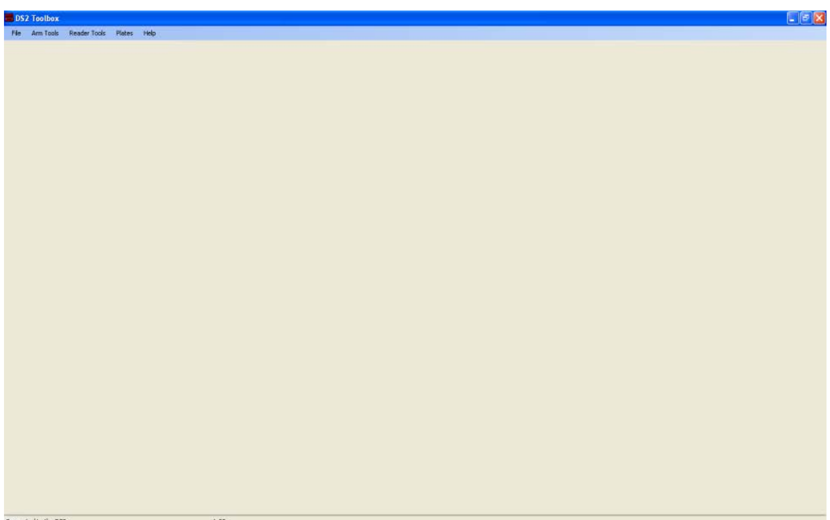
The service engineer can perform a wide variety of operations (such as ejecting a plate from the reader module) via the DeeSoft *DS2* Run Command Console feature, which is described in Chapter 5). In addition, a large number of primary functions (for example, advancing the plate motor one step) can be performed via the advanced manual control feature. Since these operations can be performed independently of an assay, they can be very powerful tools to assist in troubleshooting.

4.3.3 Saving Arm Calibration Values

During calibration of the DS2 Arm, the X – Y – Z coordinates are stored in memory on the instrument's control boards. Periodically, to assist with troubleshooting, Dynex technical support personnel may request that the user send a copy of the calibration values. See Bulletin TB104 for more information.

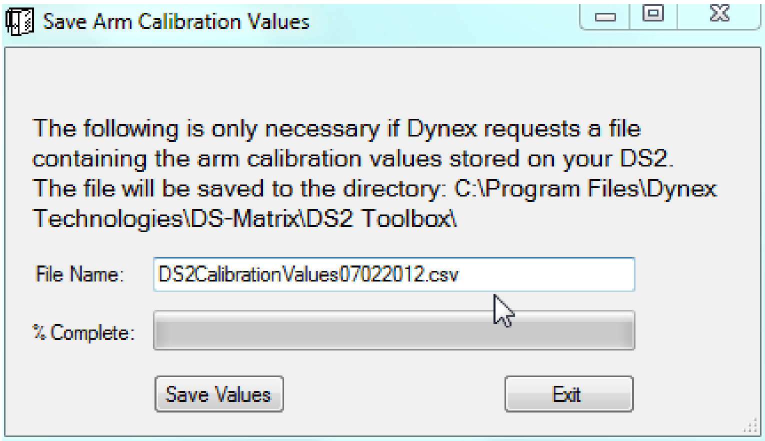
- The DS2 must be turned on and connected to the control computer. The DS-Matrix Software should not be running.

- Double Click the DS2 Toolbox icon. You will see the following screen:

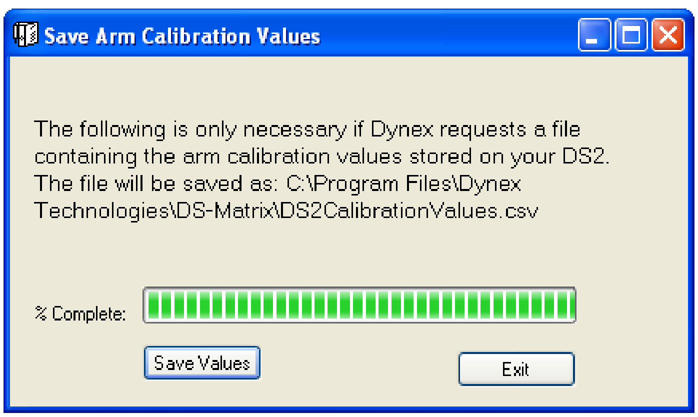


- Click on "Arm Tools", followed by "Save Arm Calibration Values". The following window will open:

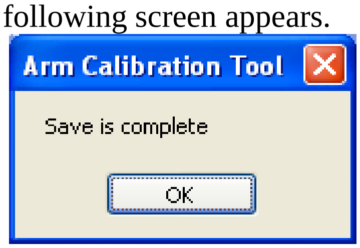
- The default file name DS2CalibrationValues will be in the "File Name" box. Always append the file name with today's date to prevent previously saved values from being overwritten.



- Click the "Save Values" button. The task bar will indicate progress.



- When complete the following screen appears.



- The file may be found at *C:\Program Files\Dynex Technologies\DS-Matrix\DS2 Toolbox*. The filename is ***DS2 CalibrationValues[today'sdate].csv***. It may be opened using MS Excel or it may be sent to Dynex as an attachment.

4.4 Application Problems

Two general types of problems may be noted with the *DS2 Automated ELISA System*:

- **Hardware/Software Problem**: When a hardware or software fault is noted, the service engineer is expected to repair, replace, or remedy the problem as described in this manual. Typically, the system is functioning in a satisfactory manner but a fairly straightforward action is performed (for example, the lamp in the reader module is to be changed).
- **Application Problem**: In some instances, all components of the system are functioning in an acceptable fashion but the reported results are incorrect or are not being reported. In this situation, it may be necessary for the service engineer to determine if there have been any changes in the assay protocol.

> ***Note**: Most application issues are due to small and seemingly trivial changes that are made in the overall assay protocol.*

If it is believed that the problem is due to an application issue, we suggest the following steps:

- Verify that the assay file has not been edited or modified in any way.
- Run standards (if they are not part of the assay protocol)
- If any changes have been made in the assay protocol (for example, different lot, pipette tips from a different lot or manufacturer), run a before and after to determine if the change (no matter how seemingly small) has caused the difficulty.
- If the laboratory prepares wash solutions, reagents, etc., it may be necessary to ensure that the quality of all components of these solutions has remained constant.
- Determine if there has been any change in the laboratory environment or laboratory personnel. While the standard operations that the technician must perform are quite straightforward, a new technician may unwittingly introduce a small difference that can lead to an error.
- Run a different assay on the system. If the results from the new assay are acceptable, investigate the details of the suspect assay.
- Assay problems (%CV issues, suppressed or elevated results) may be due to washer issues. Always ensure the washer is clean and calibrated and that the plate definition is correct (no scratching, excess fluid after aspiration, etc) when troubleshooting assay application problems.

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Chapter 5 Using DeeSoft

5.1 Overview

The DeeSoft program is designed to operate the DS2 for product testing and calibration. It contains a broad range of features to control various aspects of the system and includes a number of operations to allow the service engineer to verify that various components in the system are working appropriately.

DeeSoft is provided to the service engineer on a single CD and is installed on the PC in the same way as other Windows programs are installed. Follow all prompts that are presented during installation.

> ***Note**: DeeSoft was originally developed to assist in manufacturing and original calibration of the system. The program includes a number of features that are not of use to the service engineer and should not be installed onto the customers computer.*

Before installation, make sure you save a copy of the DeeDefaults.vba file found here:

C:\Program Files\DeeSoft\Defaults

to a temporary folder and also save the worklist files that should be carried over to the next release so the DeeSoft application settings are saved and may be recovered as soon as the new version is installed.

Uninstall the previous version of DeeSoft.

If this is a first-time installation the original DeeDefaults.vba file will be found on the DeeSoft CD.

To open DeeSoft:

1. Make certain that that Matrix software is not running. Matrix and DeeSoft cannot run simultaneously.
2. Select **DeeSoft** from the Windows *Start* menu under Dynex Technologies. The *Select communication option* dialog box will be displayed (Figure 5-1).

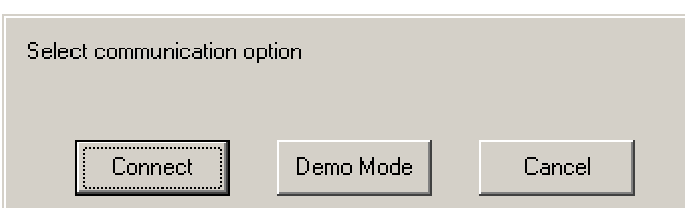


Figure 5-1: The Select communication option dialog box.

3. Select **Connect** to connect the computer to the DS2. If a connection is not established, DeeSoft will go into *Demo Mode*.

The main DeeSoft window is shown in Figure 5-2.

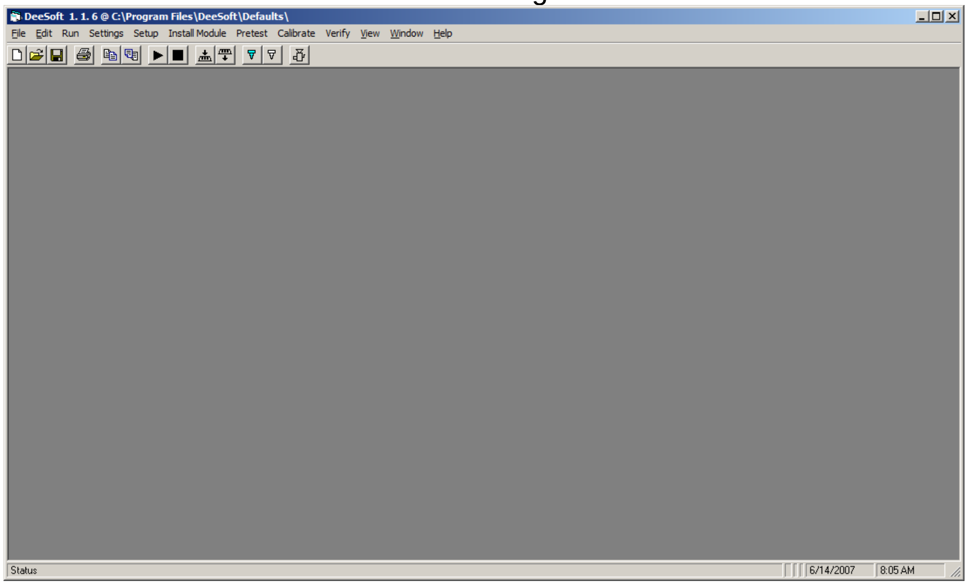


Figure 5-2: The Main DeeSoft Window

Some activities/tests are directly accessed via the menus (Section 5.2) while others are defined by worklists (Section 5.3). This chapter describes those tests that are relevant for the service engineer (a few tests are used for manufacture of the system).

5.2 The Menus

5.2.1 The File Menu

The *File* menu includes:

New worklist - presents a dialog box to generate a new worklist (Figure 5-3). A worklist is a listing of tasks that the system should perform and includes fields for entry of parameters. A detailed discussion about worklists is presented in Section 5.3

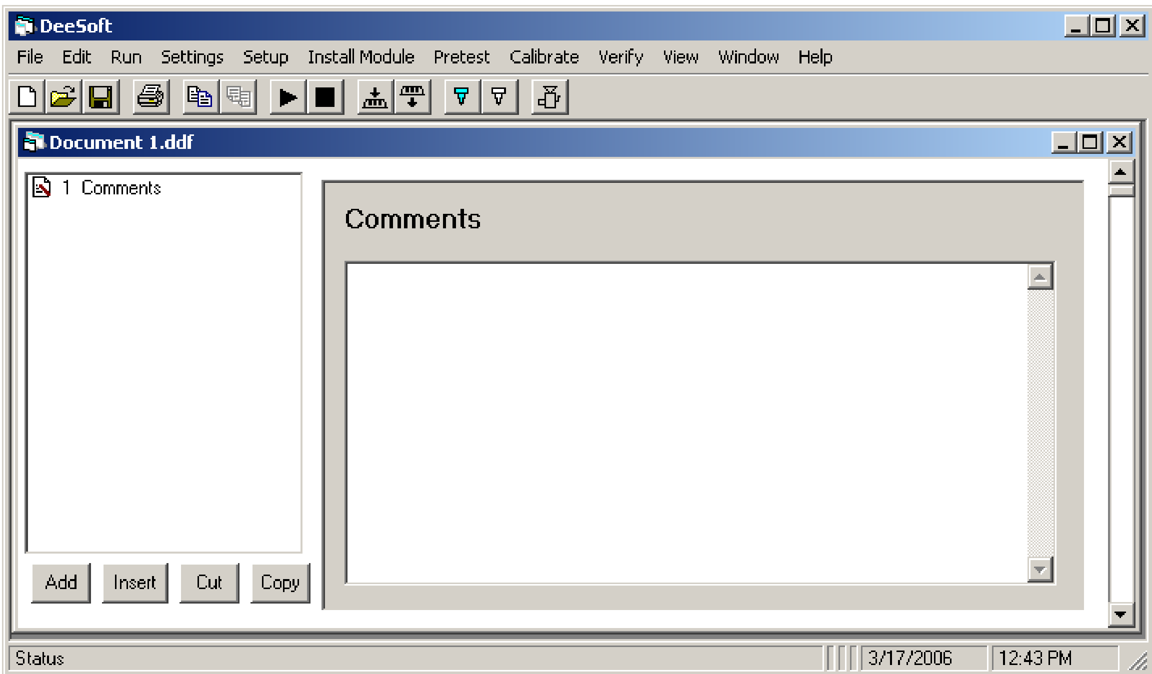


Figure 5-3: New Worklist Dialog Box

New Pipette Calibration - used only for in-house pipette calibration

Open - presents a dialog box that lists all existing worklists (Figure 5-4). Existing worklists are described in detail in Section 5.4.

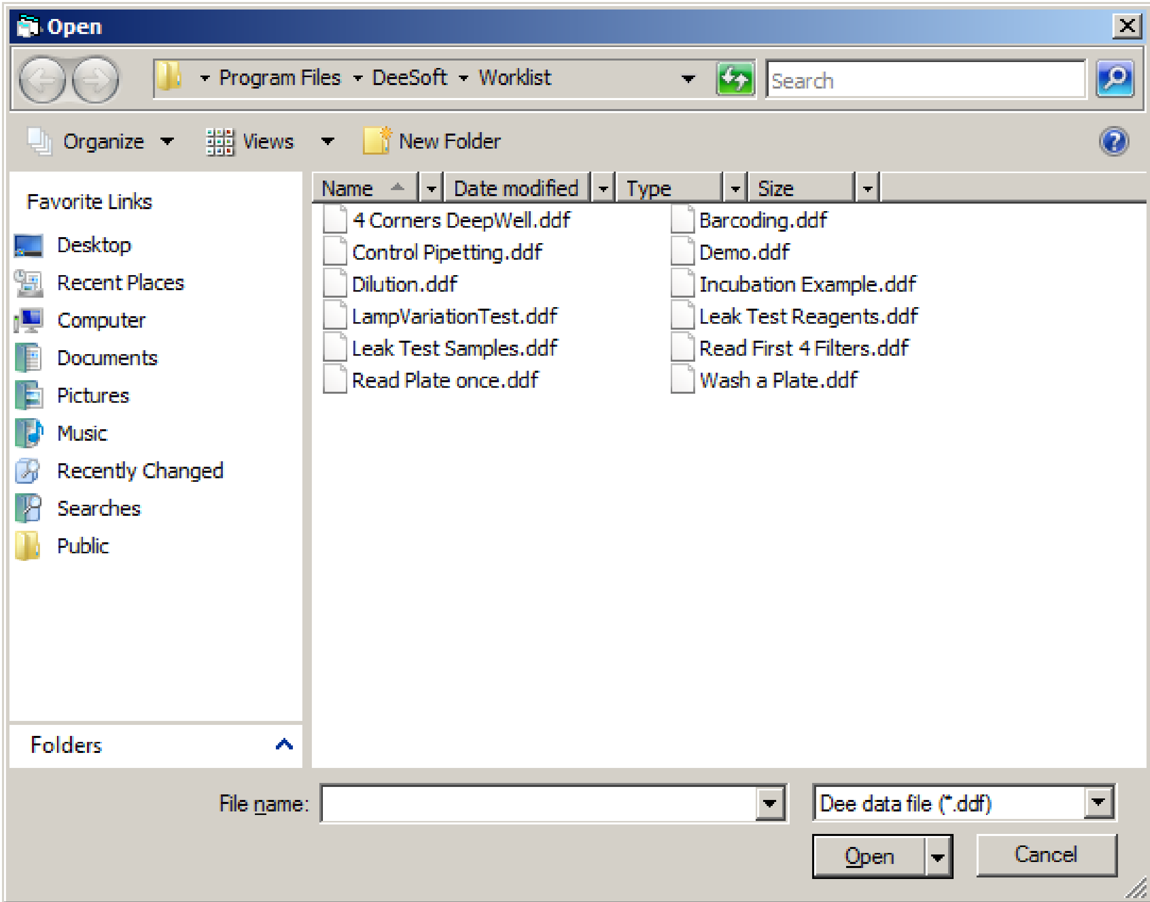


Figure 5-4: Existing Worklists Dialog Box

Close, Save, Save As, Page Setup and **Print** - perform the indicated action on the open worklist and are similar to the commands in other commonly used programs (e.g. Microsoft Word).

5.2.2 The Edit Menu

Copy - will copy data from the currently selected task from cells selected in that task and is useful when designing tasks with repetitive data entry. The copied task can then be placed somewhere else in this worklist or another by using *Add* or *Insert.*

Copy Rotate - will copy data from the currently selected task from cells selected in that task. The data will be rotated 180 degrees. This function is useful when a plate is rotated in the reader.

5.2.3 The Run Menu

Worklist - initiates the active worklist

Barcode reset - initializes the barcode reader.

Command Console - allows the user to enter commands and send them to the DS2. This function is used for debug purposes.

Parallel task simulator - allows the user to enter commands and have them automatically sent to the DS2 on a periodic basis. This function is used for debug purposes.

Scale test and cal - allows user to test and calibrate the scale. This is used in the inhouse pipette calibration process..

Figure 5-5: Scale Test and Calibration Dialog Box

Test Scale will run the scale test using the internal weight in the scale. When the test is complete the result will be presented in the *Error* field.

Calibrate Scale will calibrate the scale using the internal weight in the scale. When the calibration is complete the result will be presented in the *Result* field. A Mettler Toledo scale should be employed.

Lamp Alignment - allow the user get per channel lamp intensity from the reader. This command presents Figure 5-6 to facilitate adjusting the lamp in the reader.

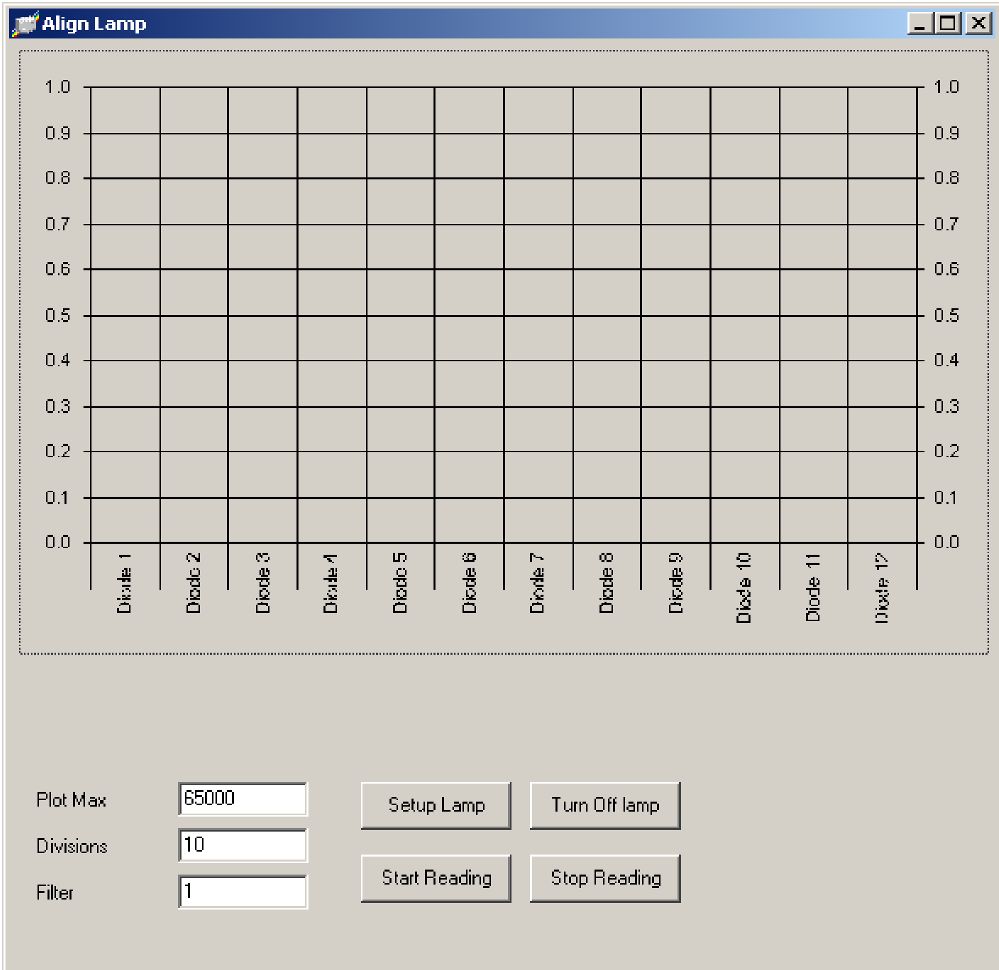


Figure 5-6: Align Lamp Dialog Box

The buttons will allow the user to perform the following operations.

- *Setup Lamp* - will turn the lamp on and set the lamp intensity using the filter specified.
- *Turn Off Lamp* - will turn the lamp off.
- *Start Reading* - will start reading the 12 diodes, the intensity will be displayed in the graph.
- *Stop Reading* - will stop reading for the 12 diodes.
- *Plot Max, Divisions,* will set the limits and divisions of the plot.

Comm 2 Terminal - presents a communications terminal dialog box which is used to send or receive information to debug the barcode scanner.

5.2.4 The Settings Menu

Comm port - sets the communication ports of the DS2 using Figure 5-7. Communication can be set to USB or Comm 1 to Comm 4. If a scale is attached, the communications port for the scale can be set from Comm 1 to Comm 4.

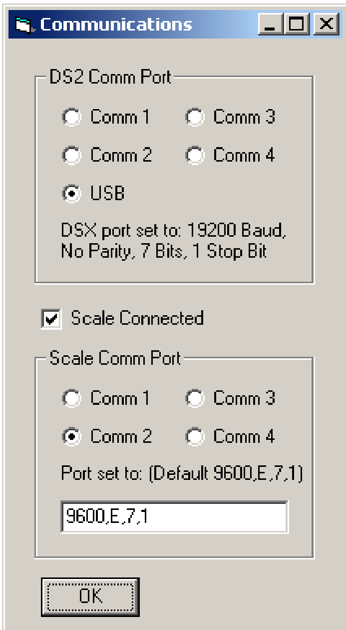


Figure 5-7: Communications Dialog Box

Set Path - sets the file path for Deesoft files and is only used in manufacturing.

DeeSoft Overrides - allows the user to override normal operations in DeeSoft. A detailed description is presented in Section 5.8.

Arm - presents a dialog box that sets the calibration relationships between the calibration feature on the pipette or pipette calibration tool and the final calibration values. A detailed description is presented in Section 5.x.x.

Pipette - presents a number of dialog boxes to set fluid density parameters, PASS/FAIL defaults, Calibration defaults, Verify defaults and Quick Cal defaults. A detailed description is presented in Section 5.12.

5.2.5 The Setup Menu

Set main flash structure - sets up the main flash memory of the instrument with the values that are currently in memory so that these settings will be permanent.

Set serial numbers - allows the engineer to get the serial numbers (Figure 5-8). Each module has a serial number. If a module is changed, the new serial number should be entered.

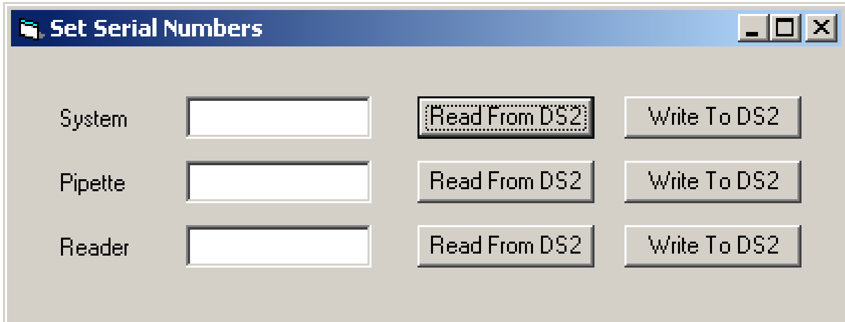


Figure 5-8: Set Serial Number Dialog Box

Set new controller board - sets up the controller board with default calibrations.

Set module type - sets the module type to a reader or pipette.

> ***Note**: Only one module at a time can be plugged.*

Set module version - sets the module data version for either the reader or pipette. This function is for brand new reader or pipette modules that have empty EEproms. These blank memory chips appear to the system as identical "peripherals".

5.2.6 Install Module Menu

Reader-incubator - downloads all the calibrations from the reader-incubator into the DS2 main flash memory. This function is used in production on regular basis but in the field it should be used with caution and only if a reader-incubator module is replaced.

Pipette - downloads all the calibrations from the pipette into the DS2 main flash memory. This function is used in production on regular basis but in the field it should be used with caution and only if a pipette module is replaced.

5.2.7 Pretest Menu

Switches - polls the switches. A detailed discussion of this command is presented in Section 5.13.

Valves - individually activates the washer valves. A detailed discussion of this command is presented in Section 5.13.

Sensors - Checks the wash head detect sensor. A detailed discussion of this command is presented in Section 5.13

5.2.8 Calibrate Menu

This function allows you to save (download) the calibration data to the local computer. This allows you to keep a back-up copy of all the calibration settings in case they are needed in the future if the main sandwich board needs to be replaced.

5.2.8.1 Back-up the DS2 Calibration values

Select Calibrate and Transfer DS2 Calibrations. Select the "Save DS2 Calibrations to Computer" button. Click "Yes" to the warning message. Deesoft will now download the DS2 settings and a "Save As" window appears. Save each file (13 total) as the units serial number and date (e.g. 1DSA0001_7June2008).

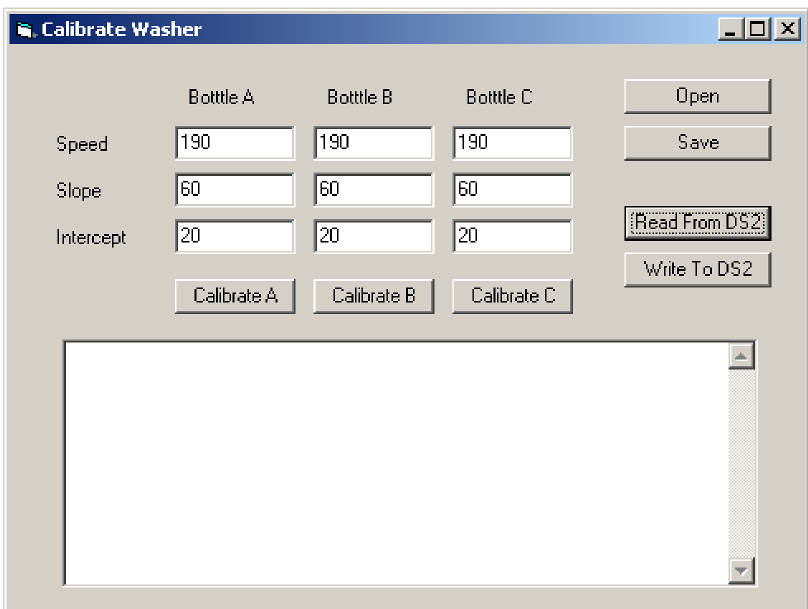
5.2.8.2 Restore the DS2 Calibration values

Select Calibrate and Transfer DS2 Calibrations. Select the "Upload DS2 Calibrations from Computer" button. Click "Yes" to the warning message. Select the appropriate file each time the "Open" window appears. This will occur for each of the 13 files.

> ***Note**: The IO file that is saved is specific to that sandwich board. If restoring values to a different sandwich board, only restore the 12 files, not the IO file.*

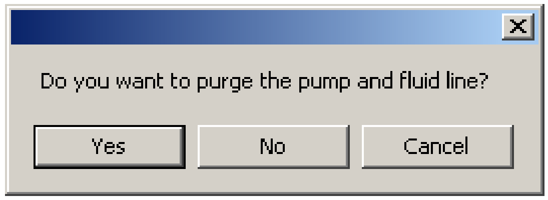
5.2.8.3 Calibrating the Washer

Select "Calibrate / Washer". The following will be displayed:



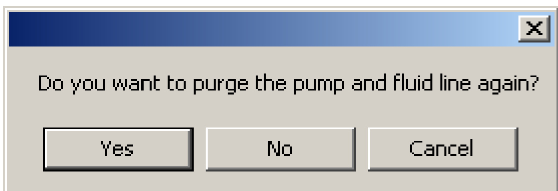
Each of the bottles will be calibrated individually. Fill both the Wash buffer bottles A and B with 1 liter of de-ionized water and load them on the DS2. Ensure the test fixture external bottle is at least half full of de-ionized water and plug it into the fluid connector at the rear of the machine. Ensure the purge tray is in place.

Start with bottle A by pressing "Calibrate A". The following will be displayed:

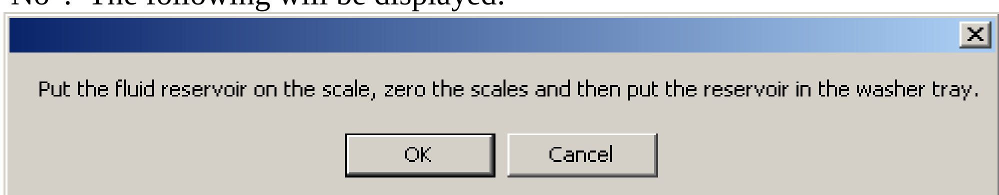


While the dispense pump is running during the next step, manually depress the B and C (Clean) valve tops so that air purges out of the cross piece.

Click “Yes”. The pump will start and fluid will be purged in the purge tray. The following will be displayed:

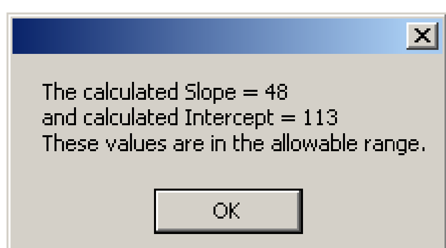


If the lines are not completely purged, click “Yes”. If the lines are completely purged, click “No”. The following will be displayed:

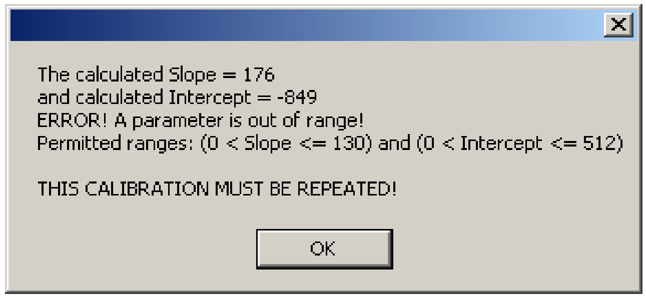


Follow the remaining dialogs. The “washer tray” refers to the upper reader plate carrier. Ensure the wash head dispenses from all 8 pins and that there are 5 dispenses at both the first (low volume) and second (high volume) dispense.

If the calibration is successful, a dialog like below will be presented. Click “OK”. Click “OK” to the “Danger of Overwriting” screen.



If the calibration is unsuccessful, a dialog like below will be presented. The calibration must be repeated.



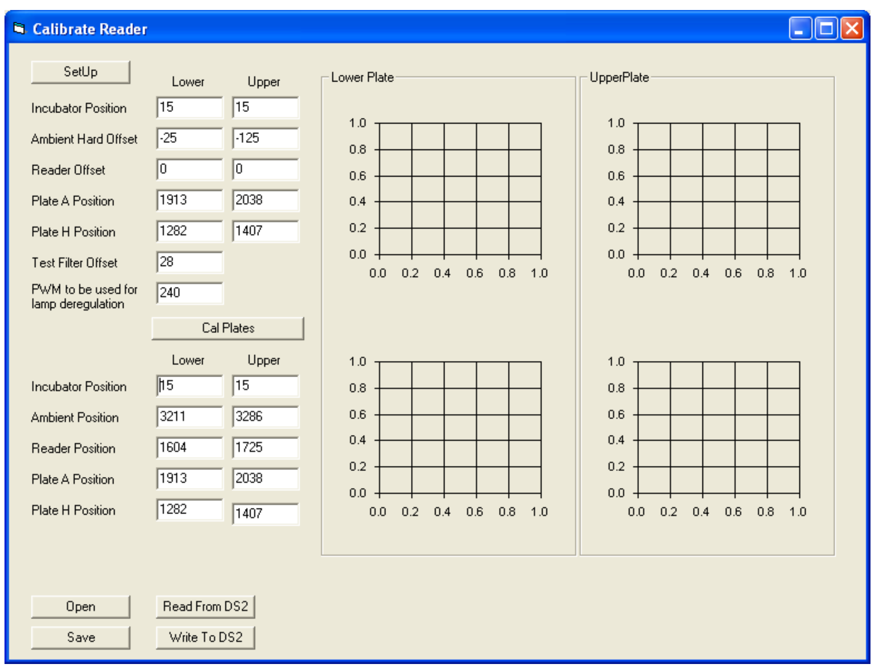
After successfully calibrating bottle A, repeat the procedure above for bottles B and C (Clean).

When all calibrations have been successfully completed, click “Write To DS2”.

Close the “Calibrate Washer” window.

5.2.8.4 Calibrating the Reader

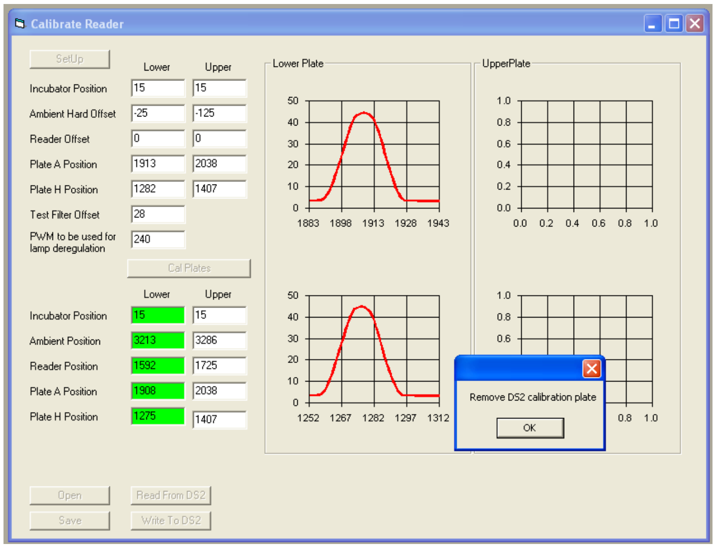
Choose menu item "Calibrate / Reader / Calibrate". The following will be displayed.



Click the “Open” button, select file “Master Reader Calibration.dsr” in the new window, and click “Open”.

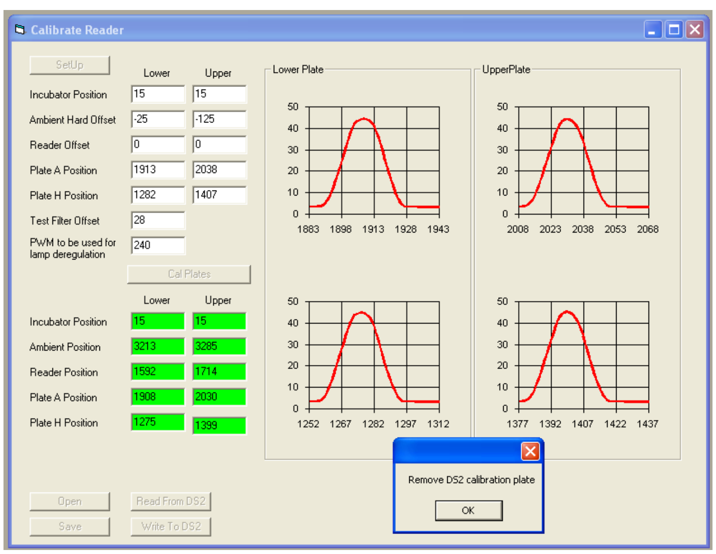
Click the “Cal Plates” button.

When prompted, insert any DS2 or AM Calibration Plate into the lower carrier, close the reader cover, and click “OK”. The reader will proceed to calibrate the lower plate position. When finished, the following will be displayed.

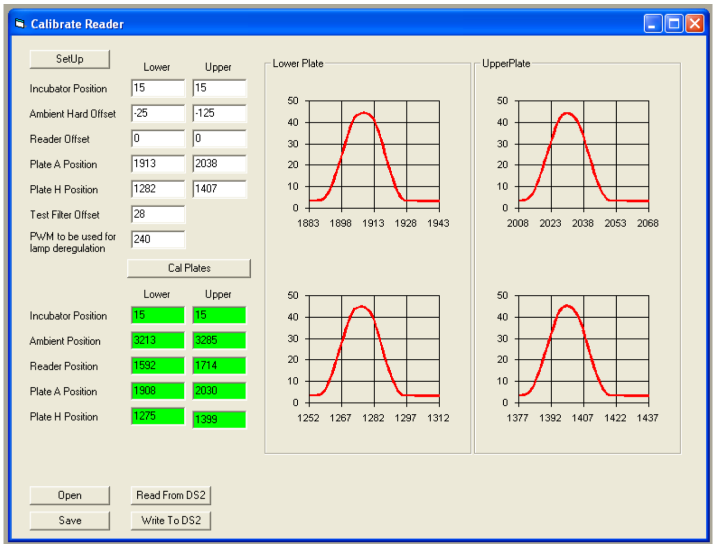


Remove the Calibration Plate, and click “OK”. The following will be displayed.

Insert the same Cal plate into the upper carrier, close the cover, and click “OK”. The reader will proceed to scan the plate. When finished, the following will be displayed.



Remove the Calibration Plate, and click “OK”. The graphs should be similar to below with defined peaks. If the graphs appear similar to the examples, then click “Write to DS2”. If not, then repeat the calibration.

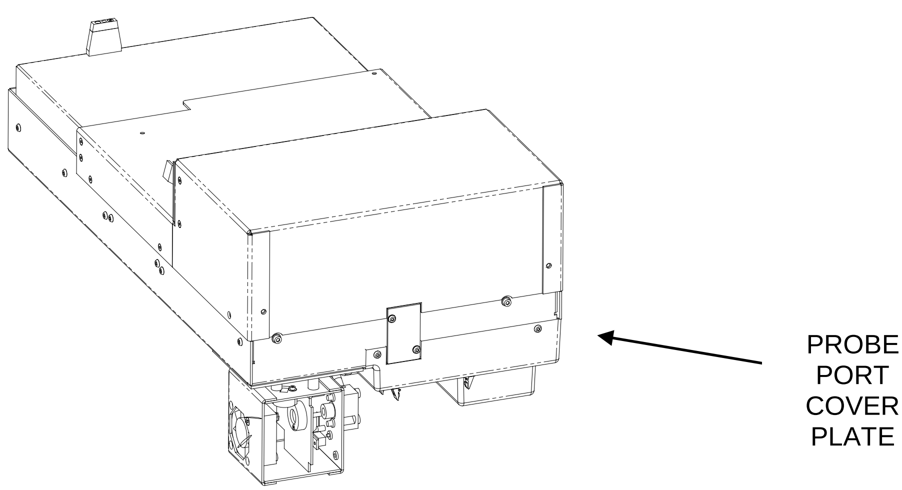


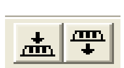
Click the “Save” button.

5.2.8.5 Calibrating the Incubator function

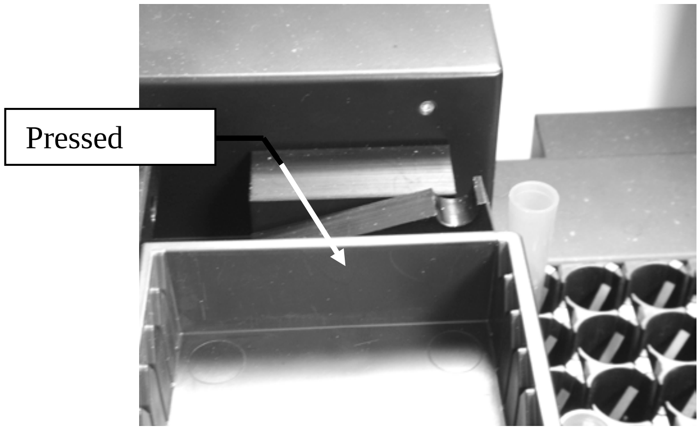
Remove the large panel on the rear of the test fixture chassis to gain access to the back of the reader-incubator.

To calibrate the incubator function of the reader-incubator, you must remove the Calibration Probe port opening cover plate from the unit by removing the two mounting screws as shown below:



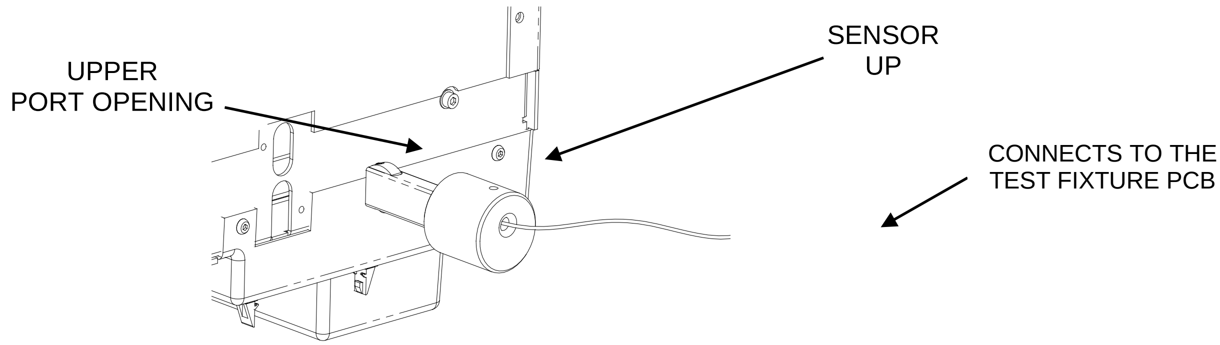
Press the two  buttons on the menu bar to eject both plate carriers to make room for the temperature probe.

Close the incubator by manually pressing the door rocker-arm all the way down on the left side as shown below:

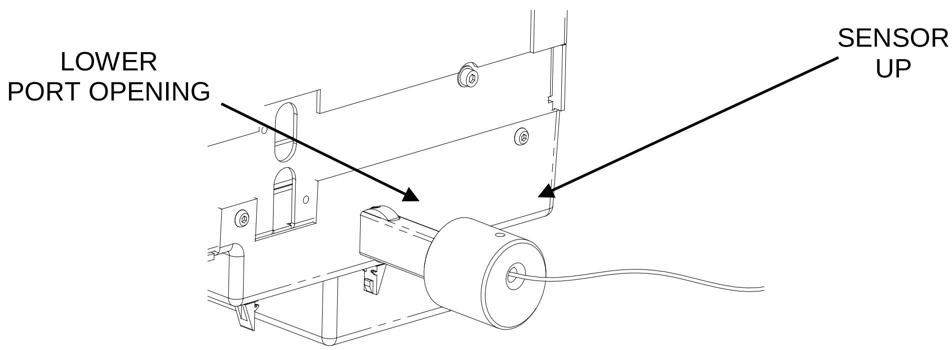


There are three heaters in the unit. Each of them will be calibrated individually in the following order, top first, middle second, and bottom last. This is done using a Calibration Probe that is inserted in the probe port opening. The probe has a sensor on one side and a ball plunger on the other. The sensor must touch the heater that is being calibrated. The diagrams below show the three different configurations.

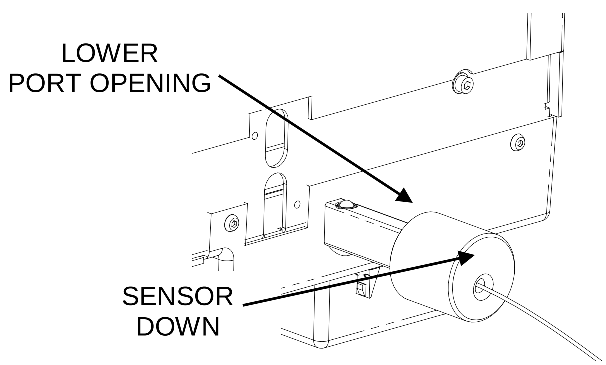
1. TOP HEATER LOCATION – Upper port opening / sensor facing up.



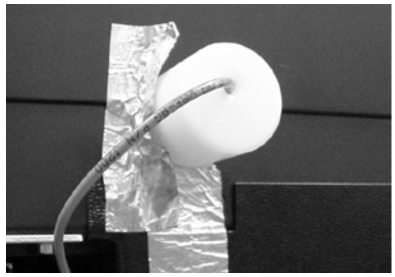
2. MIDDLE HEATER LOCATION – Lower port opening / sensor facing up.



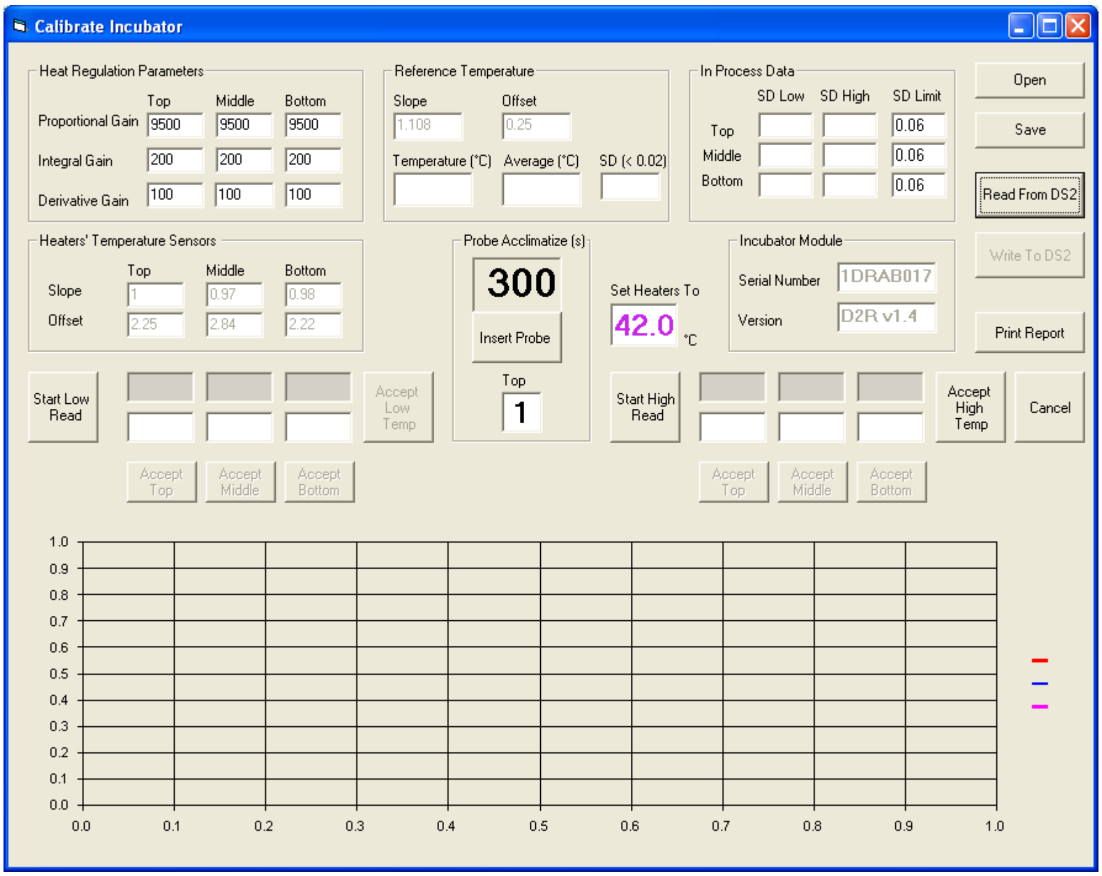
3. BOTTOM HEATER LOCATION – Lower port opening / sensor facing down.



NOTE: Cover the unused port and block the side of the probe with metallic tape as shown.



Choose menu item "Calibrate / Incubator / Temperature Sensor Calibration". The following will be displayed.



Close the reader sliding cover.

Click the “Start Low Read” button.

Start testing the Top Heater by inserting the Calibration Probe into the upper port opening with the sensor facing up, and click the “Insert Probe” button. NOTE: Always cover the unused port with a piece of metallic tape.

After the probe acclimatizes for 300 seconds, the program will attempt to retrieve a valid temperature. This may take a few more minutes. When a valid temperature is recorded, the program will prompt to change the probe location.

Start testing the Middle Heater by inserting the Calibration Probe into the lower port opening with the sensor facing up, and click the "Insert Probe" button. NOTE: Always cover the unused port with a piece of metallic tape.

After the probe acclimatizes for 300 seconds, the program will attempt to retrieve a valid temperature. This may take a few more minutes. When a valid temperature is recorded, the program will prompt to change the probe location.

Start testing the Bottom Heater by inserting the Calibration Probe into the lower port opening with the sensor facing down, and click the "Insert Probe" button. NOTE: Always cover the unused port with a piece of metallic tape.

After the probe acclimatizes for 300 seconds, the program will attempt to retrieve a valid temperature. This may take a few more minutes. When a valid temperature is recorded, the program will prompt to accept ambient temperatures.

Click the "Accept Low Temp" button, and the program will prompt to start reading the high temperatures.

Click the "Start High Read" button.

Start testing the Top Heater by inserting the Calibration Probe into the upper port opening with the sensor facing up, and click the "Insert Probe" button. NOTE: Always cover the unused port with a piece of metallic tape.

After the probe acclimatizes for 900 seconds, the program will attempt to retrieve a valid temperature. This may take a few more minutes. When a valid temperature is recorded, the program will prompt to change the probe location.

Start testing the Middle Heater by inserting the Calibration Probe into the lower port opening with the sensor facing up, and click the "Insert Probe" button. NOTE: Always cover the unused port with a piece of metallic tape.

After the probe acclimatizes for 300 seconds, the program will attempt to retrieve a valid temperature. This may take a few more minutes. When a valid temperature is recorded, the program will prompt to change the probe location.

Start testing the Bottom Heater by inserting the Calibration Probe into the lower port opening with the sensor facing down, and click the "Insert Probe" button. NOTE: Always cover the unused port with a piece of metallic tape.

After the probe acclimatizes for 300 seconds, the program will attempt to retrieve a valid temperature. This may take a few more minutes. When a valid temperature is recorded, the program will prompt to accept ambient temperatures.

Click the "Accept High Temp" button, and the program will prompt to finish the test.

Click the "Finish" button and Click the "Write to DS2" button

5.2.9 Verify Menu

Run Self Test - runs all the DS2 self tests. If all self tests pass, the unit is ready to use. If a self test fails, an option will be provided to continue or not.

Arm - displays Figure 5-9.

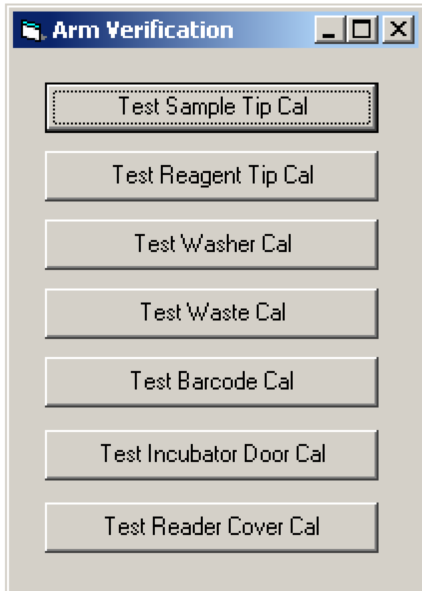


Figure 5-9: Arm Verification Dialog Box

Test Sample Tip Cal, will get and eject four tips from each sample rack.

Test Reagent Tip Cal, will get and eject four tips from each reagent rack.

Test Washer Cal, will pick up and park the wash head.

Test Waste Cal, will eject the tip.

Test Barcode Cal, will engauge and disengauge the barcode reader.

Test Incubator Door Cal, will open and close the incubator door.

Test Reader Cover Cal, will open and close the reader cover.

5.2.10 View Menu, Window Menu, Help Menu

These menus contain standard Windows commands.

5.3 Worklists

5.3.1 What is a Worklist

A worklist is a program to perform specific task or a series of tasks and can be used to simplify repetitive operations during testing of the system. A number of worklists are included in DeeSoft and are described in Section 5.4.

A typical worklist is shown in Figure 5-10.

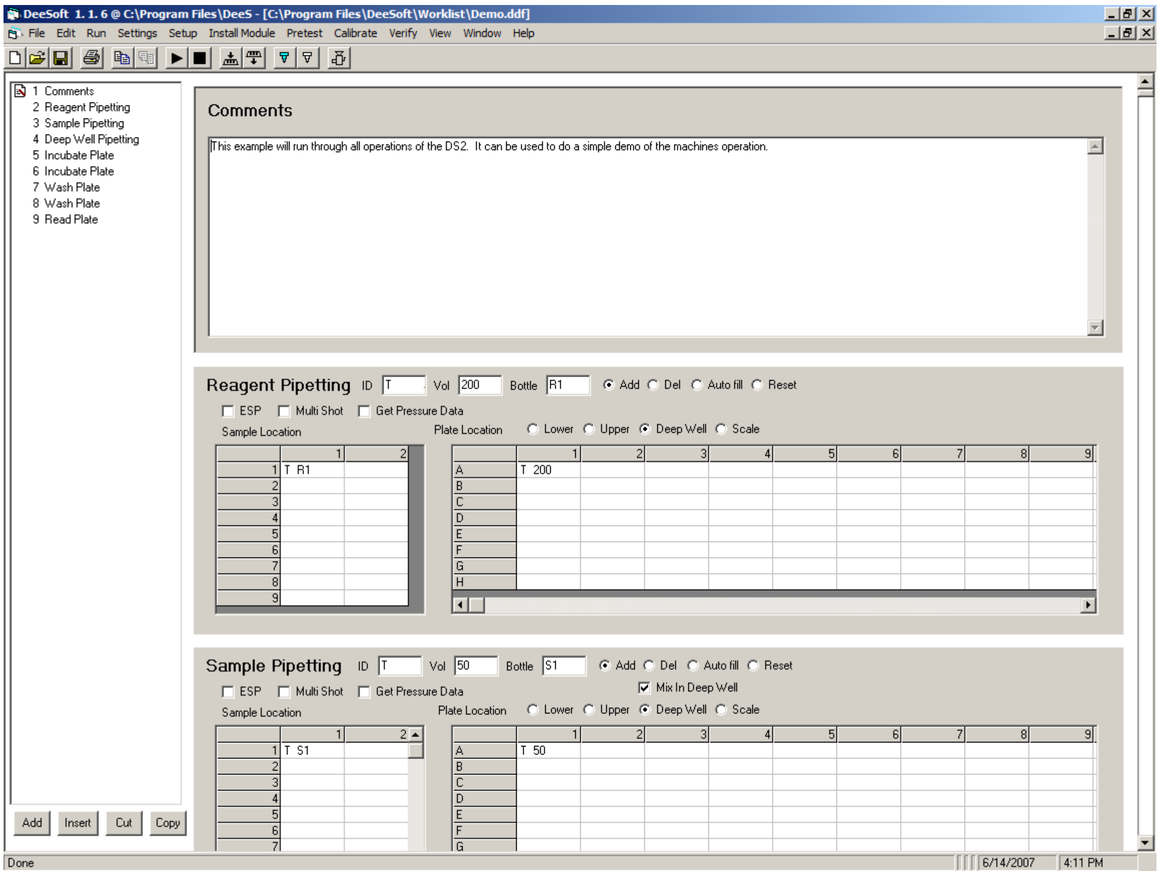


Figure 5-10: A Typical Worklist

The left column of the worklist contains a list of the operations to be performed and the right side contains the actual tasks and their settings on the right. You can click on either the list to access the desired task for editing.

To perform a task, press **Worklist** on the *Run* menu. The worklist will then be executed on a step by step basis and the desired data will be presented. Since the input data and the output data is different for each task, each task will be discussed separately in Section 5.3.2.

5.4 Prepared Worklists

DeeSoft includes a number of standard worklists which can be accessed by selecting **Open** on the *File* menu (Figure 5-37).

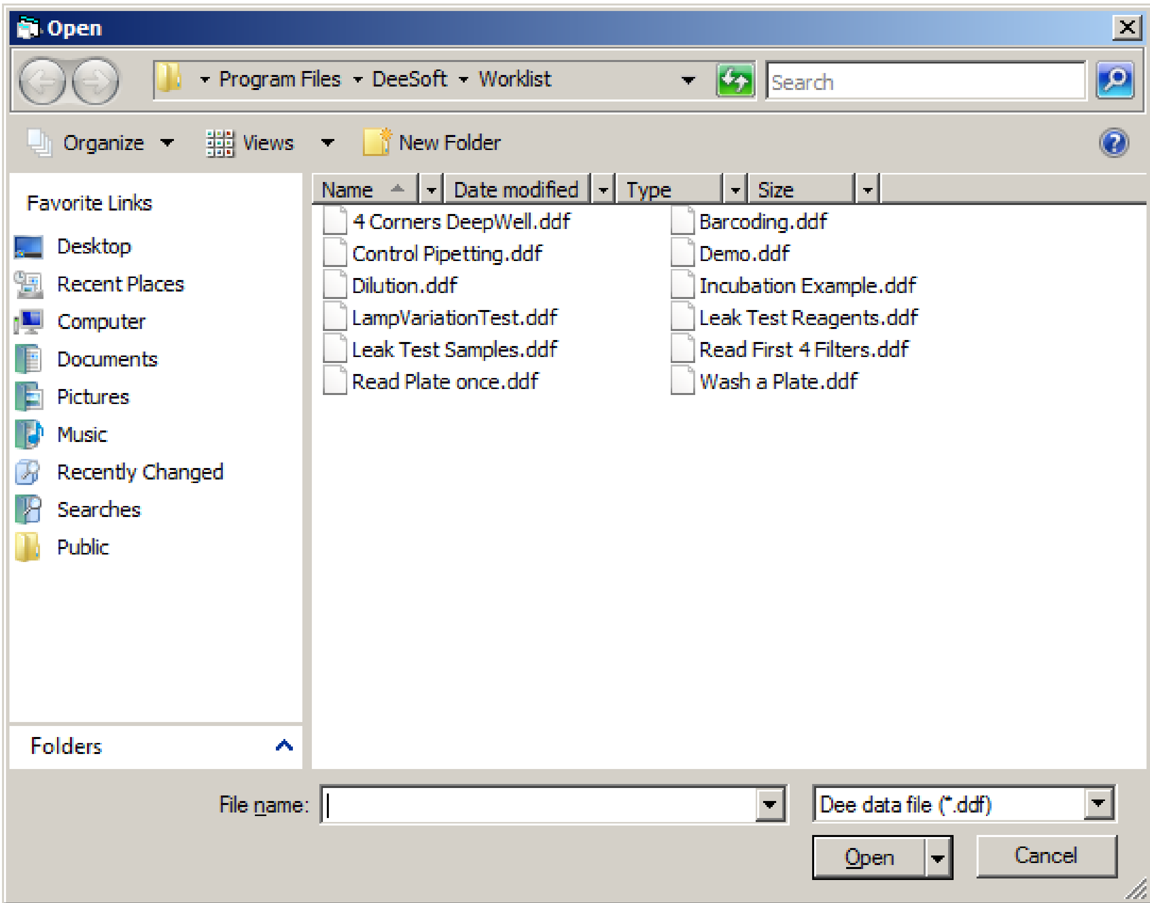


Figure 5-37: Prepared Worklists

This section will describe only those worklists that contain two or more tasks or present a specific task that is derived from one of the basic tasks. For the sake of brevity, the reader should refer to the basic tasks for an explanation of each task. Note that the various parameters in each worklist can be edited as described for the various tasks to meet the specific needs of the service engineer.

5.4.1 4 Corners Deep Well

The **4 Corners Deep Well** worklist (Figure 5-38) is designed to dispense 50 µL from 4 sample locations to the deep well plate using sample tips.

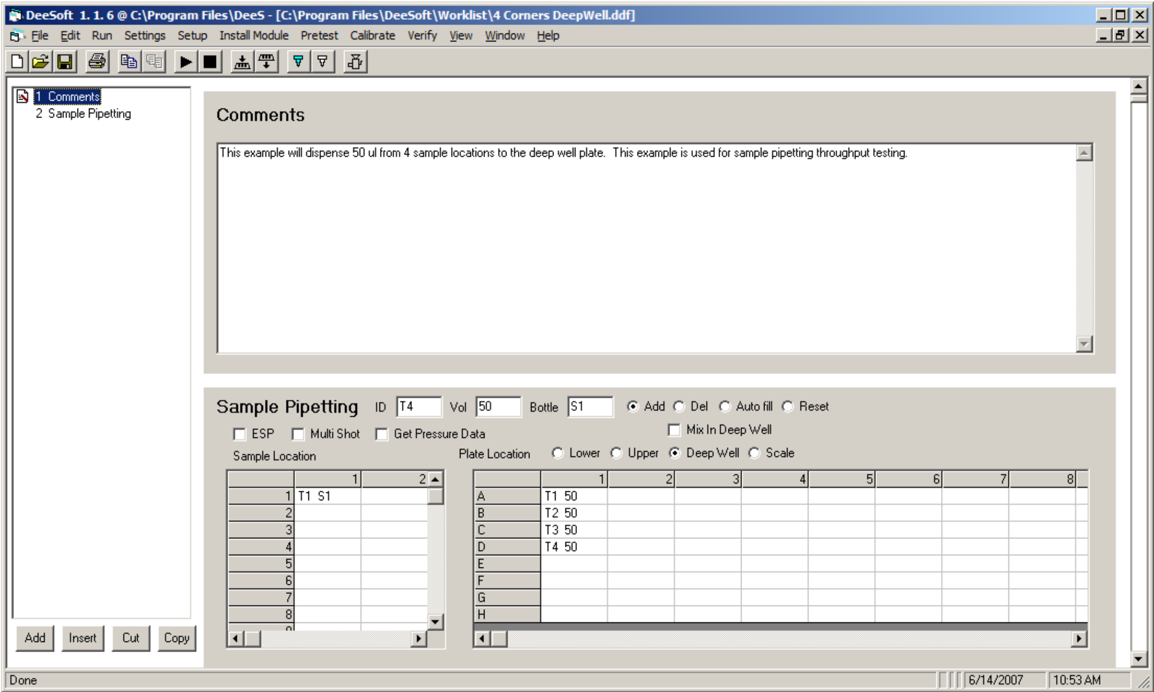


Figure 5-38: 4 Corners Deep Well Worklist

5.4.2 Control Pipetting Worklist

The **Control Pipetting** worklist (Figure 5-39) is designed to pipette 100 µL of fluid from the control rack to the upper plate.

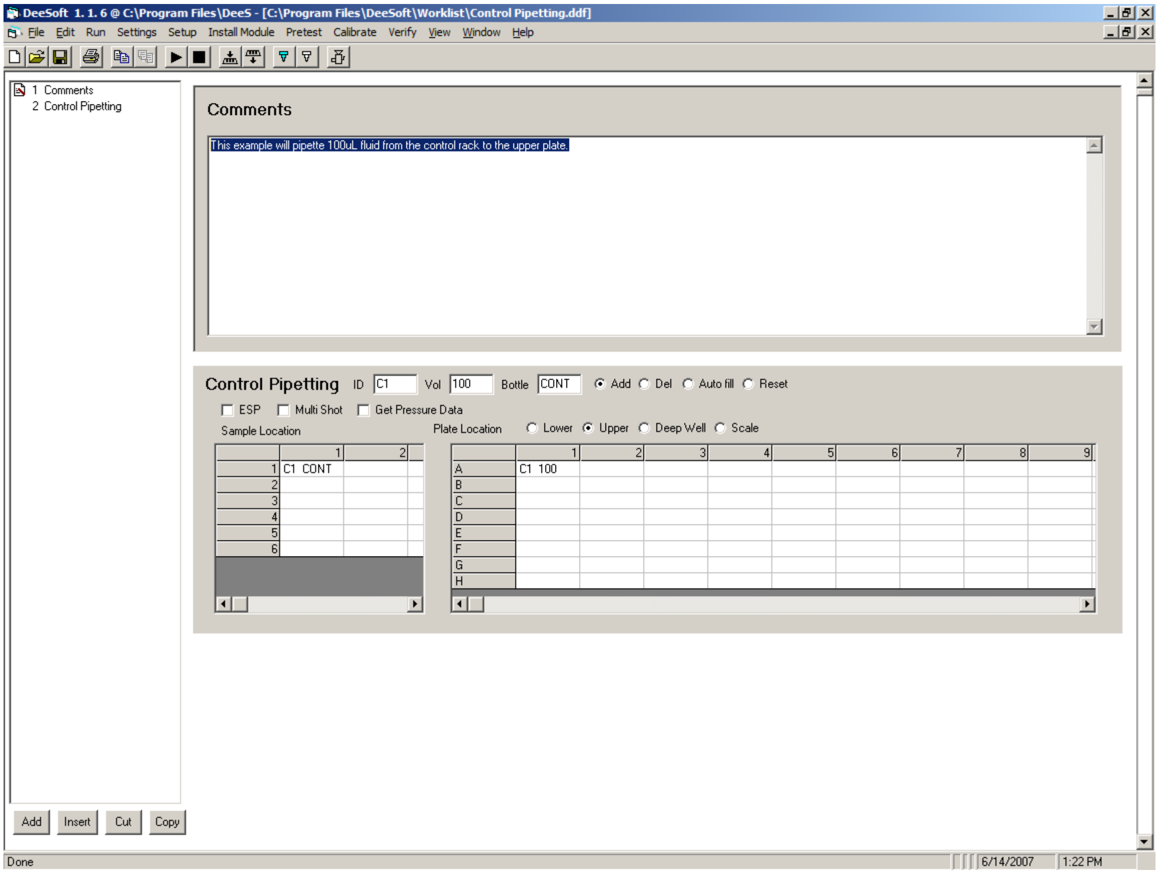


Figure 5-39 Control Pipetting Worklist

5.4.3 The Dilution Worklist

The **Dilution** worklist (Figure 5-40) includes three tasks, pipetting 100 µL of reagent, 200 µL of sample and then pipetting 100 µL of sample to the plate.

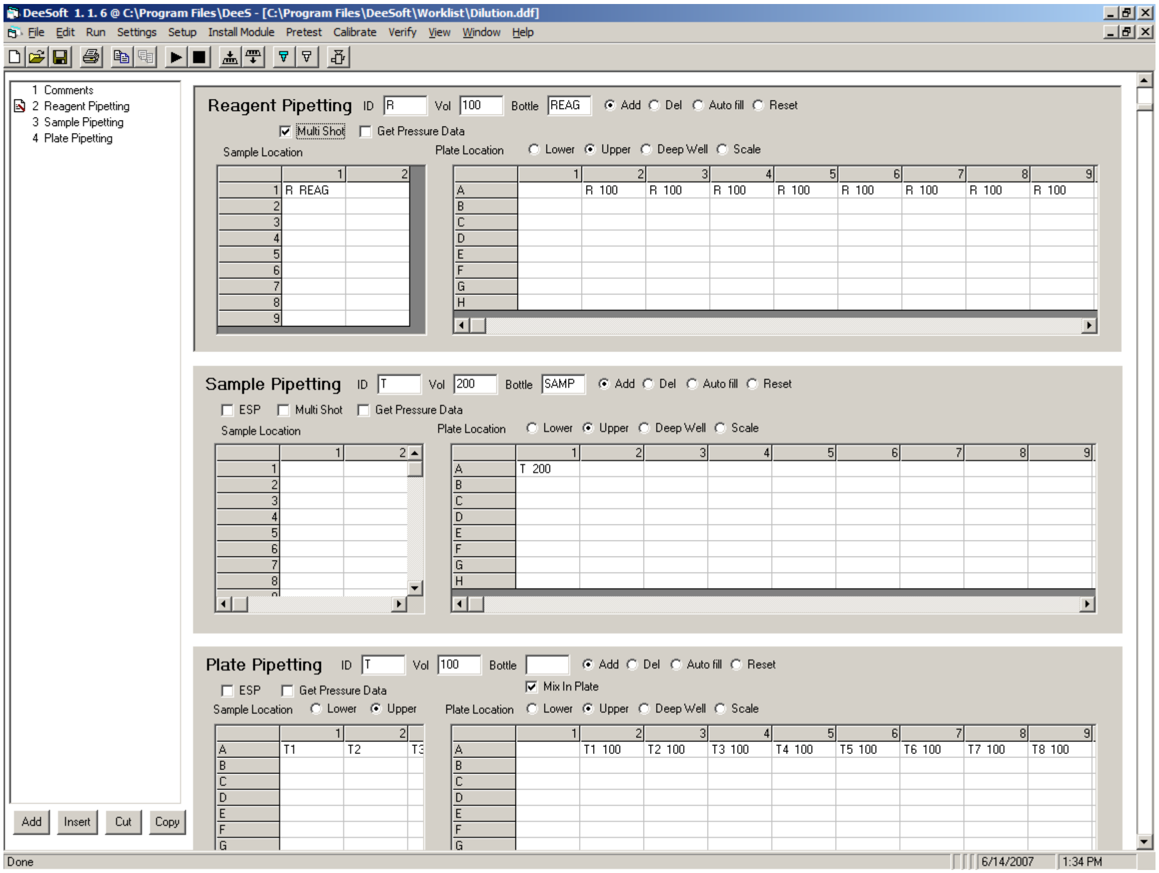


Figure 5-40: Dilution Worklist

5.4.4 Lamp Variation Worklist

The **Lamp Variation** worklist (Figure 5-41) is used to check the lamp output and presents an Excel spreadsheet of the data (Figure 5-42). The various commands perform the operations indicated in the various tasks.

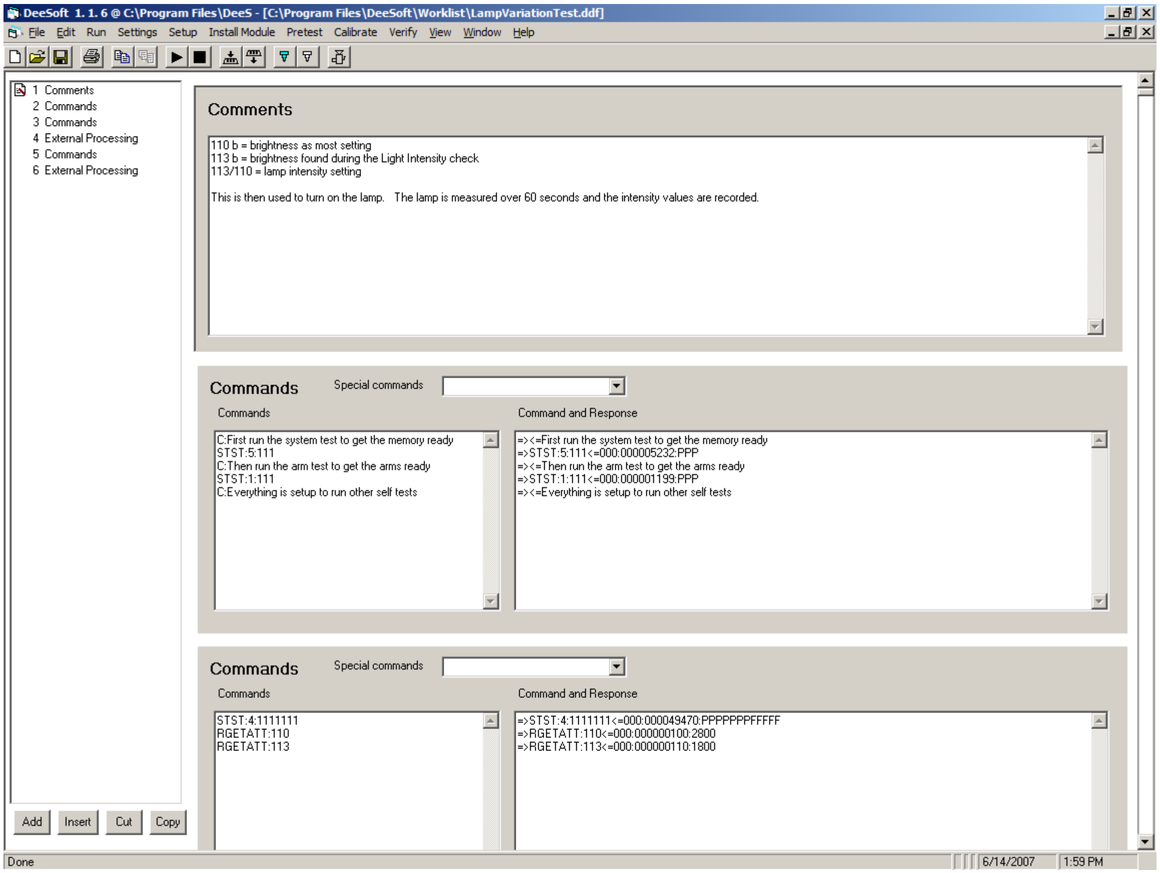
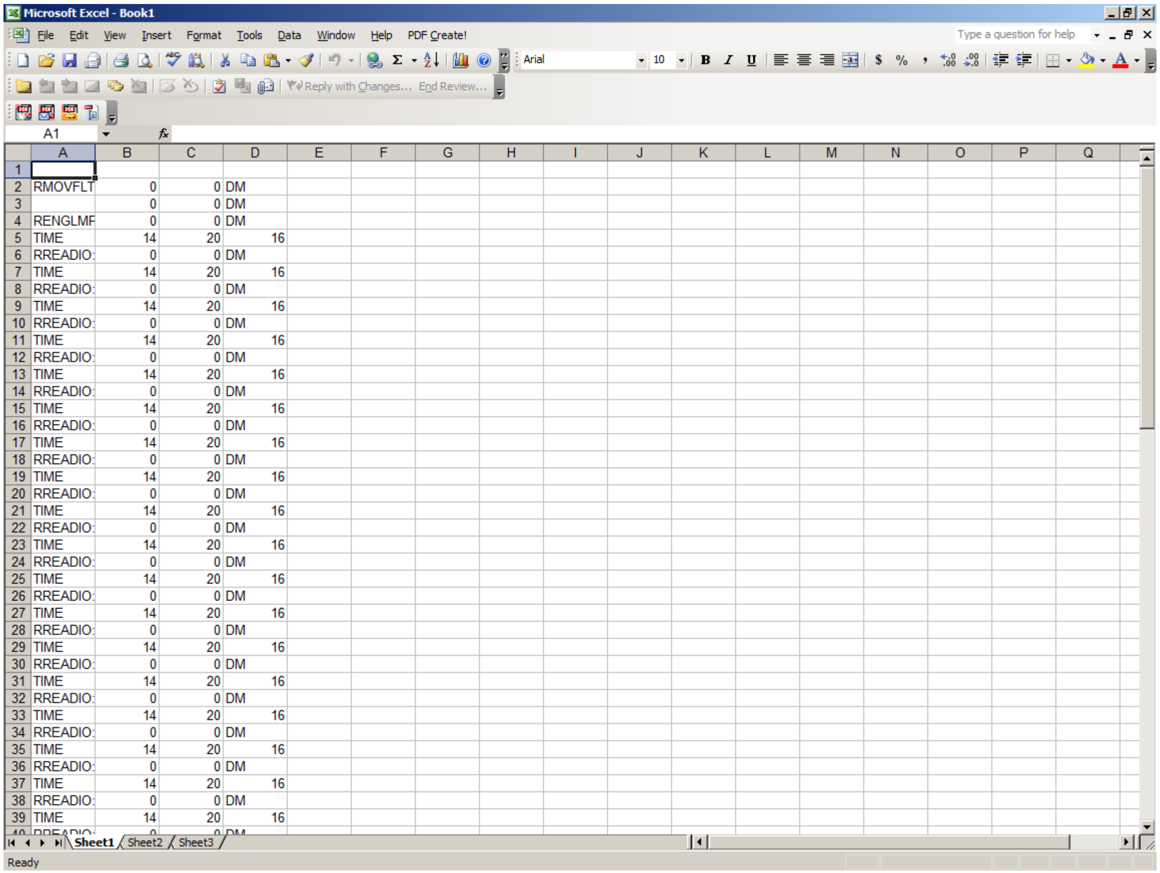


Figure 5-41: Lamp Variation Worklist



	A	B	C	D
1				
2	RMOVFLT	0	0	DM
3		0	0	DM
4	RENGLMF	0	0	DM
5	TIME	14	20	16
6	RREADIO	0	0	DM
7	TIME	14	20	16
8	RREADIO	0	0	DM
9	TIME	14	20	16
10	RREADIO	0	0	DM
11	TIME	14	20	16
12	RREADIO	0	0	DM
13	TIME	14	20	16
14	RREADIO	0	0	DM
15	TIME	14	20	16
16	RREADIO	0	0	DM
17	TIME	14	20	16
18	RREADIO	0	0	DM
19	TIME	14	20	16
20	RREADIO	0	0	DM
21	TIME	14	20	16
22	RREADIO	0	0	DM
23	TIME	14	20	16
24	RREADIO	0	0	DM
25	TIME	14	20	16
26	RREADIO	0	0	DM
27	TIME	14	20	16
28	RREADIO	0	0	DM
29	TIME	14	20	16
30	RREADIO	0	0	DM
31	TIME	14	20	16
32	RREADIO	0	0	DM
33	TIME	14	20	16
34	RREADIO	0	0	DM
35	TIME	14	20	16
36	RREADIO	0	0	DM
37	TIME	14	20	16
38	RREADIO	0	0	DM
39	TIME	14	20	16

Figure 5-42: Excel Spreadsheet from Light Variation Worklist

5.4.5 Leak Test Samples Worklist

The **Leak Test Samples** worklist (Figure 5-43) is used to test leakage of sample tips.

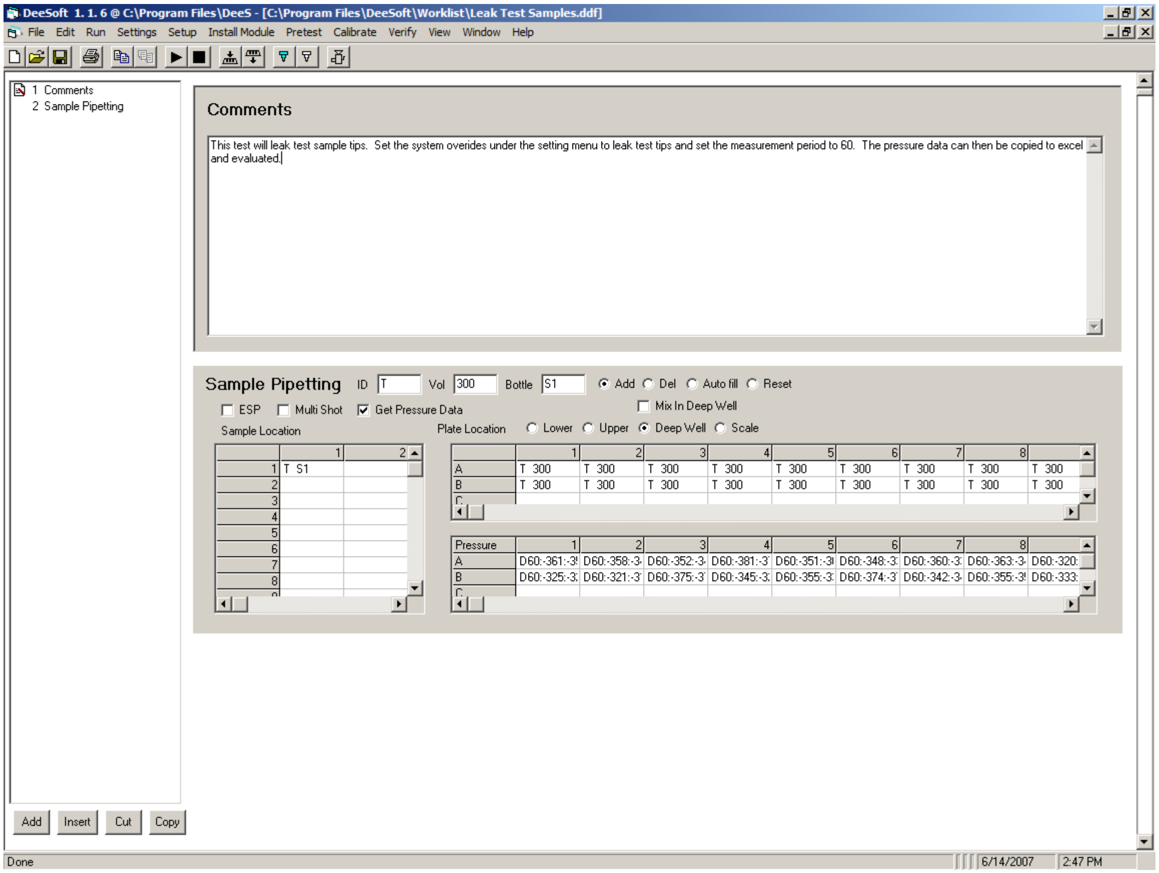


Figure 5-43: Leak Test Samples Worklist

When the worklist is run, the pressure fields in the lower area of the worklist will be populated.

5.4.6 Read Plate Once Worklist

The **Read Plate Once** worklist ((Figure 5-44) is used to read each position in a plate one time and record the results.

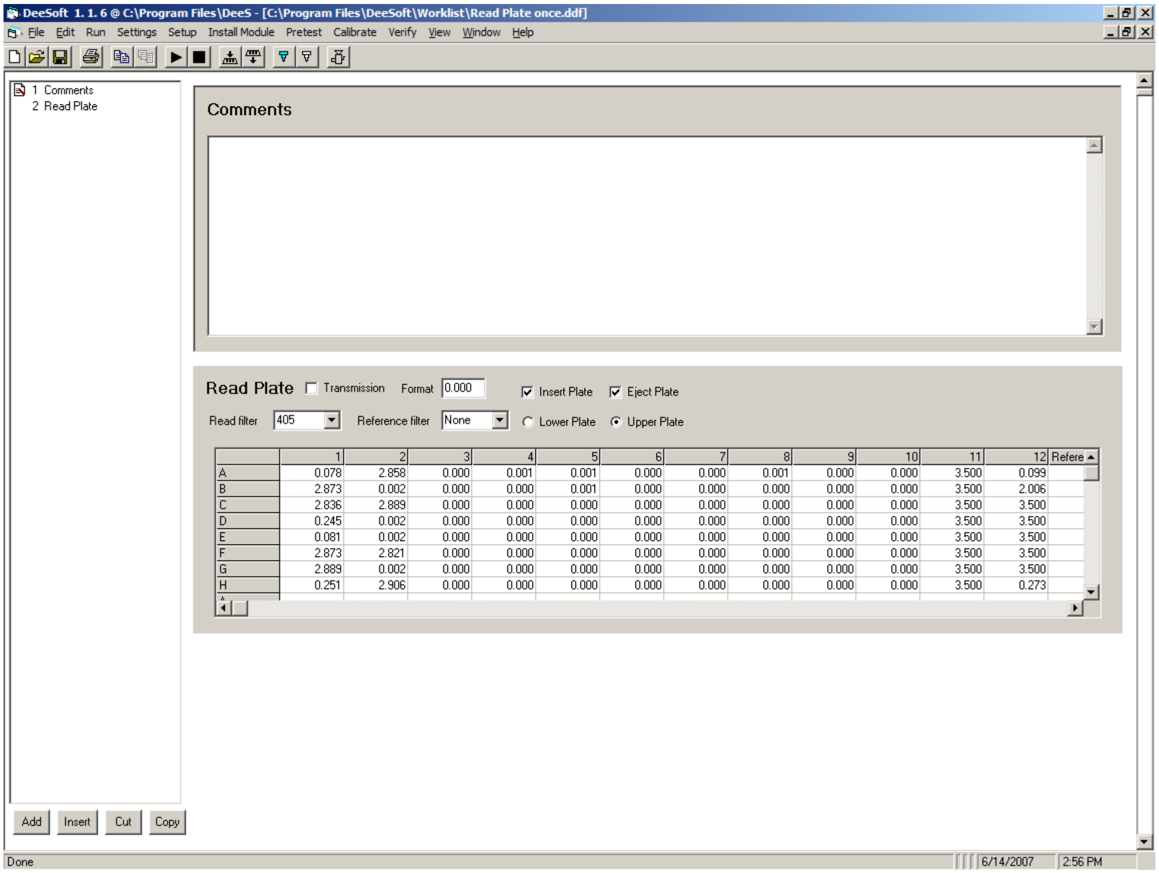


Figure 5-44: Read Plate Once Worklist

5.4.7 Barcoding Worklist

The **Barcoding** worklist (Figure 5-45) is used to collect the barcode from each of the five racks.

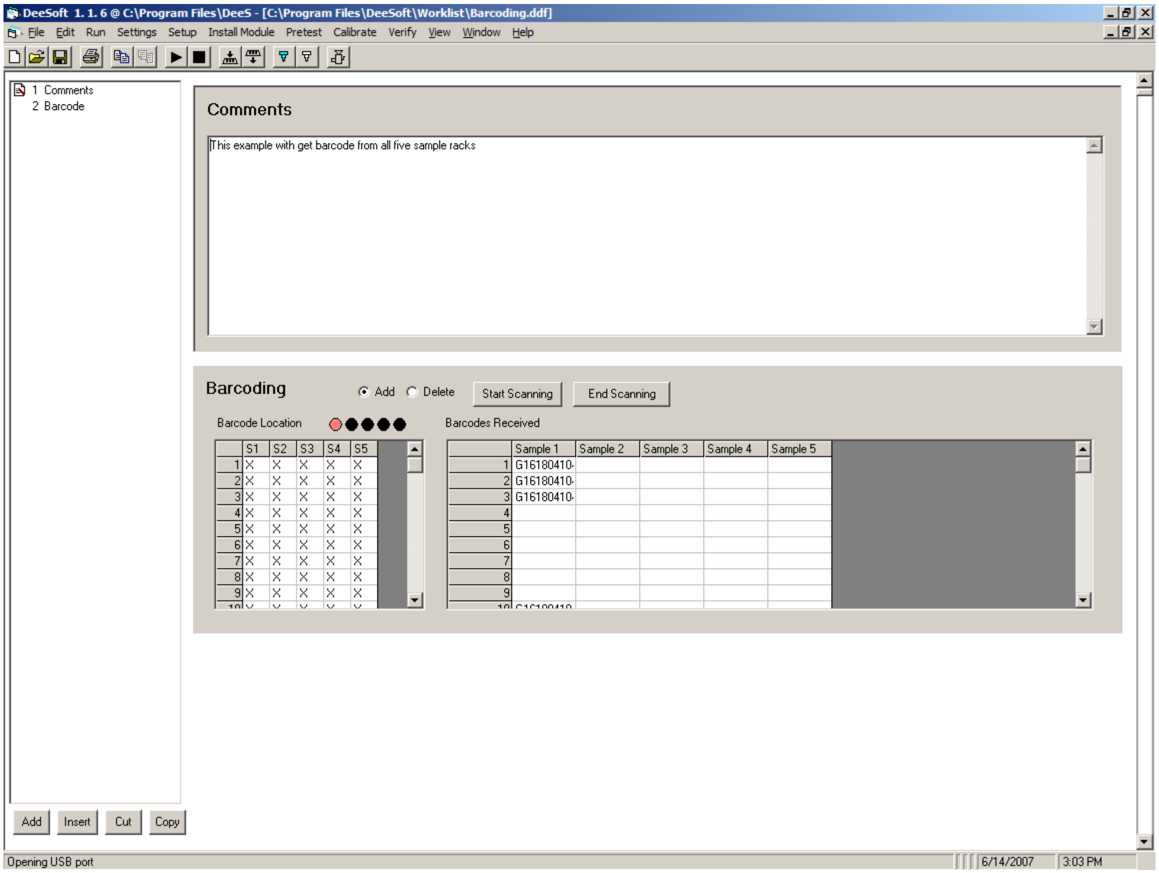


Figure 5-45: The Barcoding Worklist

5.4.8 The Demo Worklist

The **Demo** worklist (Figure 5-46) goes through all of the operations of the DS2.

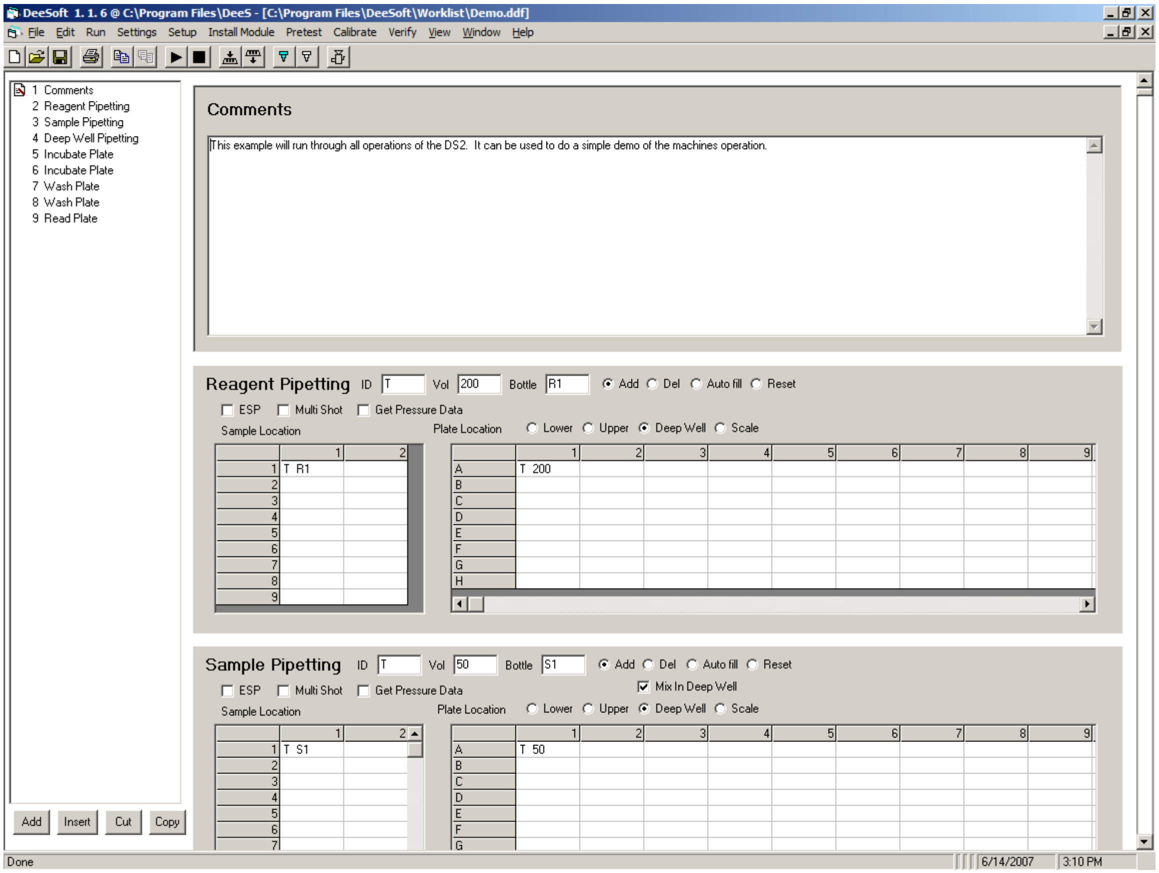


Figure 5-46: The Demo Worklist

When the **Run** command is given, each activity will be performed and the appropriate window will be completed.

5.4.9 Incubation Example Worklist

The **Incubation Example** worklist (Figure 5-47) preheats the heaters for two minutes and then incubates the upper plate for one minute with shaking.

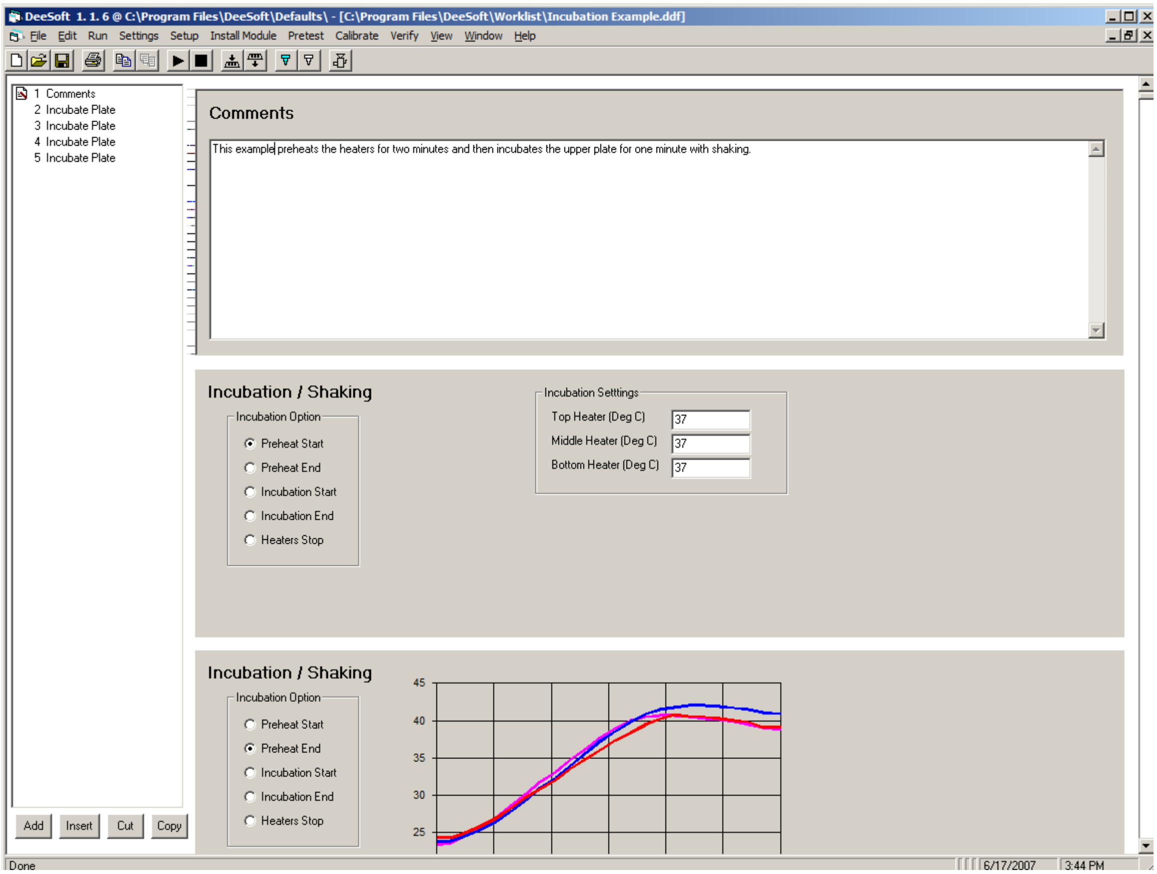


Figure 5-47: Incubation Example Worklist

5.4.10 Leak Test Reagents Worklist

The **Leak Test Reagents** worklist (Figure 5-48) is used to test the reagent tips. Set the system overrides under the setting menu to leak test tips and set the measurement period to 60. The pressure data can then be copied to Excel and evaluated.

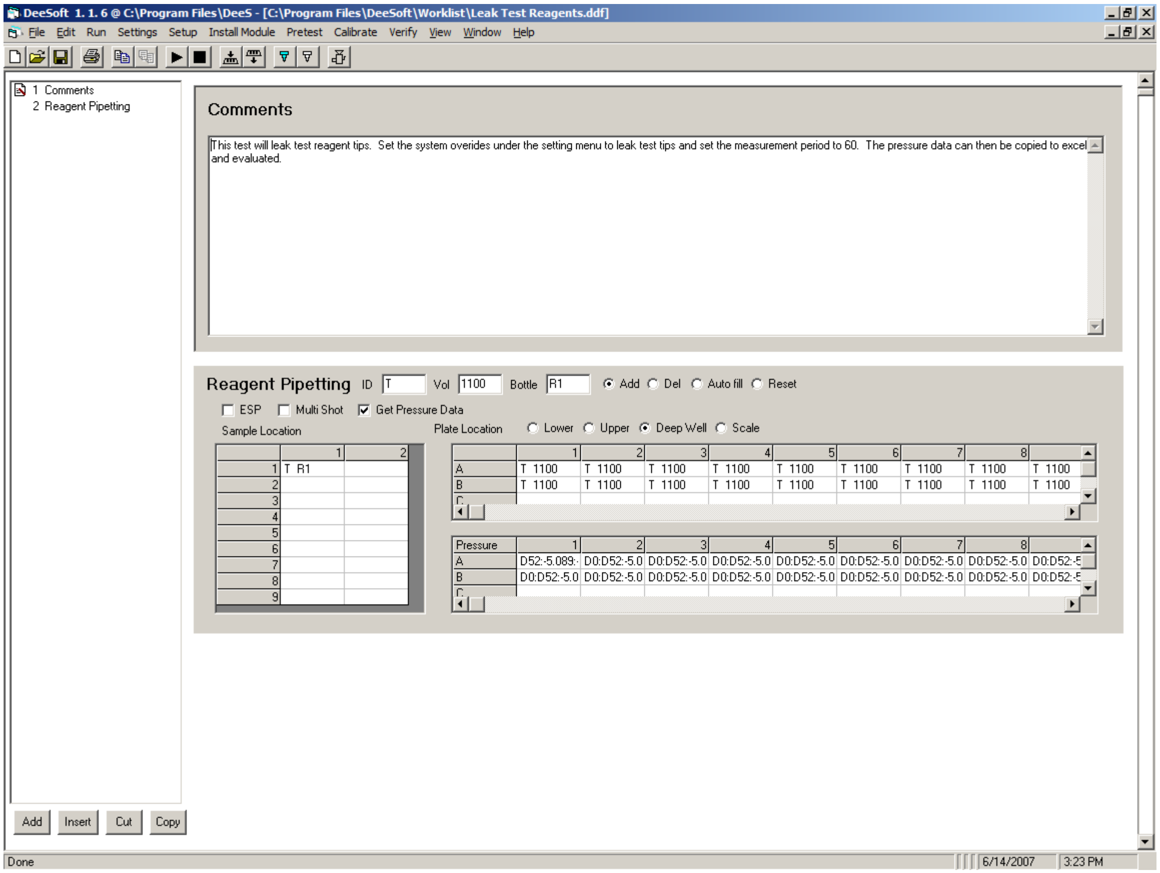


Figure 5-48: Leak Test Reagents Worklist

5.4.11 Read First Four Filters Worklist

The **Read First Four Filters** worklist (Figure 5-49) will read the plate with the first four filters.

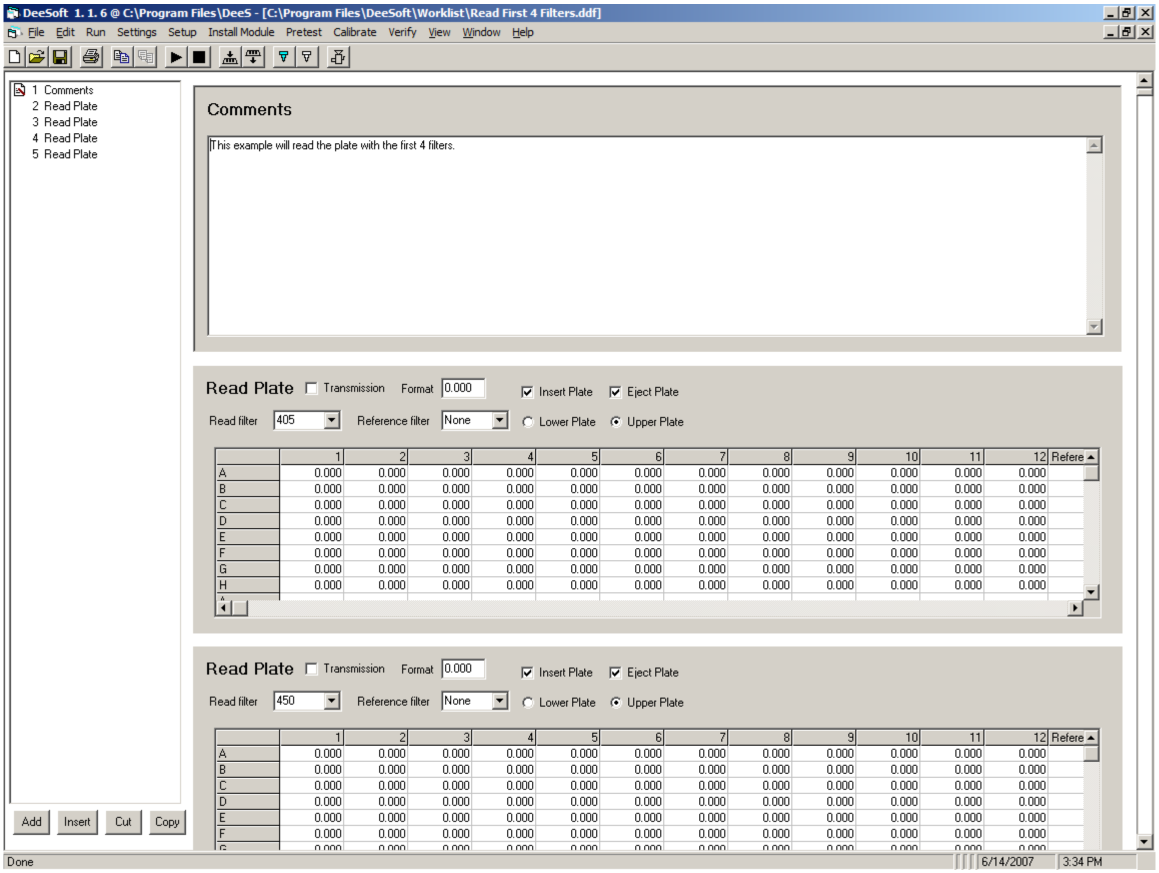


Figure 5-49: Read First Four Filters

5.4.12 The Wash a Plate Worklist

The **Wash a Plate** worklist (Figure 5-50) is used to wash a plate.

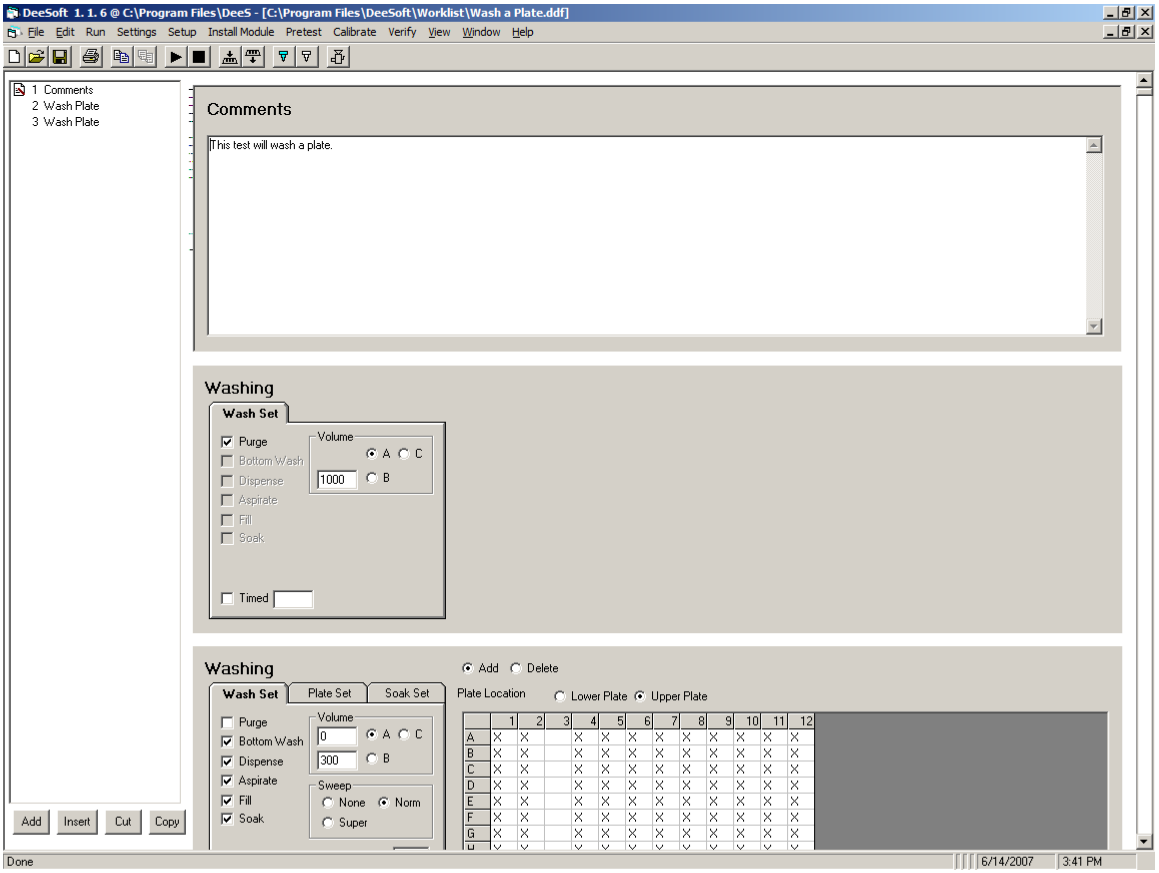


Figure 5-50: The Wash a Plate Worklist

5.5 Align Lamp

This function will allow the user to get the lamp intensity for each of the reader diodes. It facilitates adjusting the lamp in the reader. When this is selected, the *Align Lamp* dialog box (Figure 5-55) is presented.

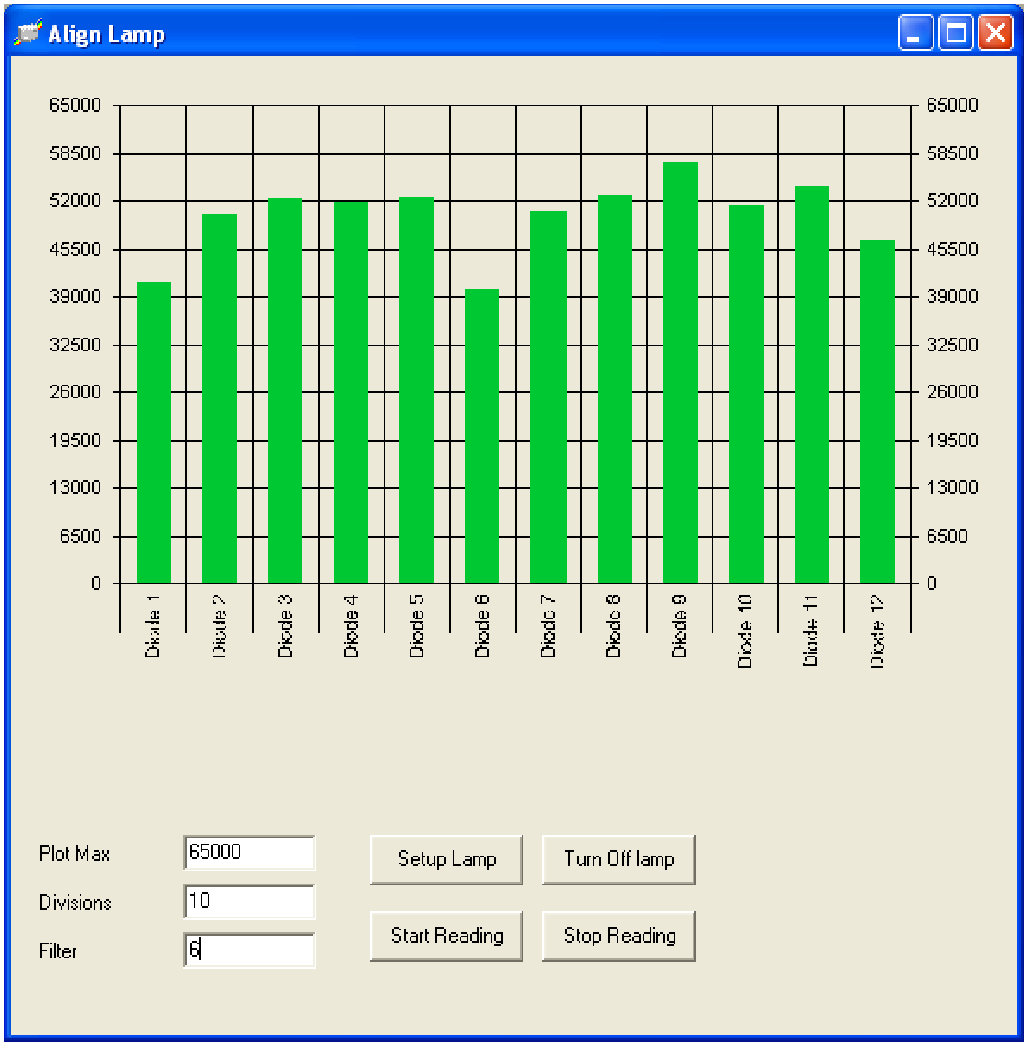


Figure 5-55: The Align Lamp Dialog Box.

The buttons will allow the user to perform the following operations.

- *Setup Lamp*, will turn the lamp on and set the lamp intensity using the filter specified.
- *Turn Off Lamp*, will turn the lamp off.
- *Start Reading*, will start reading for the 12 diodes, they will be displayed in the graph.
- *Stop Reading*, will stop reading for the 12 diodes.

- *Plot Max, Divisions,* will set the limits and divisions of the plot.
- *Filter*, specifies which filter position used for the lamp alignment test.

The technician should first start a self-test to home the system so the software can be aware of the proper coordinates. From the main menu, select Verify -> Run Self Tests.

To perform the lamp alignment, at the main menu, select Run -> Lamp Alignment. For the Filter field, choose an empty filter wheel location (usually 6). Click on the Setup Lamp button. When this is finished, click on Start Reading

The bars representing the light output are color coded. If green, the lamp position assures photo levels between 40,000 and 65,000 across channels. Otherwise, the bars turn red. This feature is to help the operator to align the lamp. It is the operator’s responsibility to visually determine the amount of deviation per channel.

5.6 DeeSoft Overrides

This function will allow the user to override normal operations in DeeSoft. It presents Figures 5-56 to 5-59 to allow the service engineer to set a broad range of general reader functions.

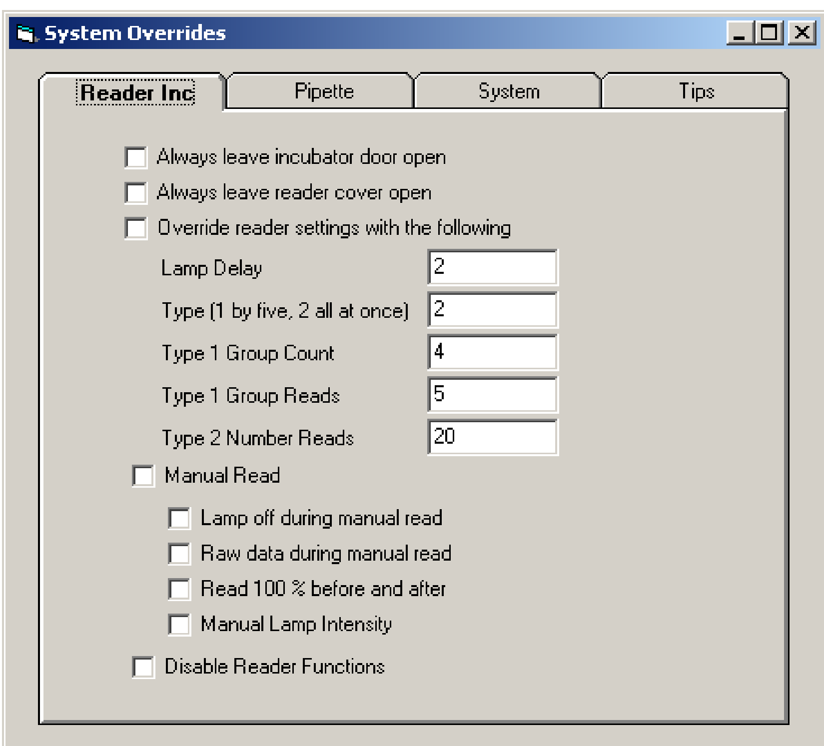


Figure 5-56: Reader Tab - System Overides

On the reader tab, the following overrides can be set.

- *Always leave incubator door open* - this override will leave the incubator door open at all times.
- *Always leave reader cover open* - this override will leave the reader cover open at all times.
- *Override reader setting with the following* - when activated DeeSoft will reset the parameters for the reader. These parameters are *lamp delay, read type, group count, group reads and number of reads.* These variables are described in greater detail in the DS2 IDS specification.
- *Manual Read* - this override will allow all reader functions in DeeSoft instead of using the RREAPLT command.
- *Lamp off during manual read* - the lamp will not be used for this reading. This is used for dark current measurements.
- *Raw data during manual read* - the actual diode readings are returned.
- *Read 100% before and after* - 100% readings will be taken before and after measurements to compensate for lamp drift.
- *Manual lamp intensity* - the lamp intensity will be recalculated instead of using the stored value from the self test.
- *Disable reader functions* - the reader is ignored.

The *Pipette Overrides* tab (Figure 5-57) allows for selecting various pipette overrides.

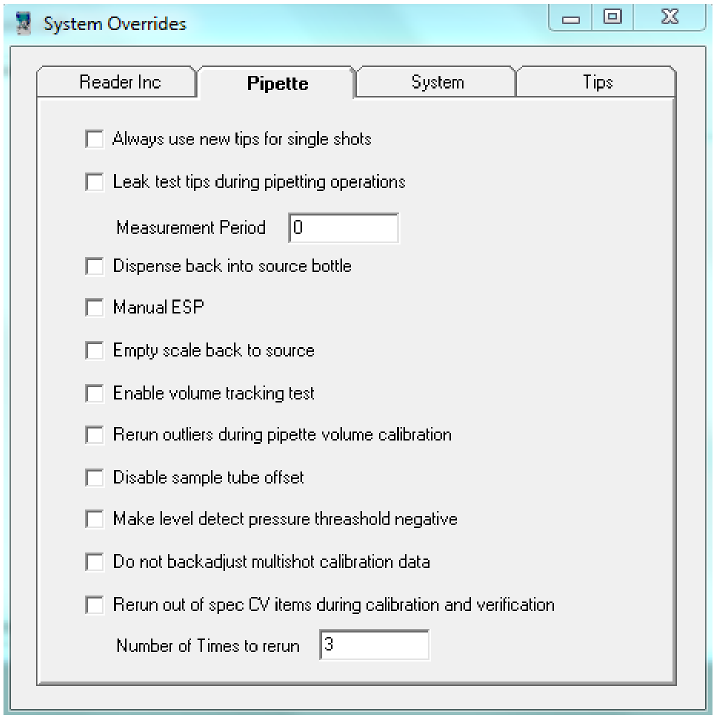


Figure 5-57: Pipette Tab-System Overrides

On the pipette tab the following overrides can be set.

- *Always use new tips for single shots* - new tips will be used during pipetting operations even though the same liquid is being dispensed to multiple destinations.
- *Leak test tips during pipetting operations* - after pipetting liquid the pipette will wait and take pressure readings for the period specified in *Measurement period*. Note: To see the pressure plot, the *Get Pressure Data* checkbox needs to be checked for the particular pipetting task. See: Sample Pipetting or Reagent Pipetting worklist tasks.
- *Dispense back into the source bottle* - this will dispense the aspirated liquid back in to its source bottle.
- *Manual ESP* - all ESP calcuations will be done in DeeSoft.
- *Empty scale back to source* - this will dispense the scale liquid back into the source bottle. Normally scale liquid is disposed into Reagent rack 2 position 1.
- *Enable volume tracking test* - this will enable the volume tracking test. This test checks the accuracy of the predicted fluid level in a bottle using the bottle calibration parameters. It requires a scale and a previously calibrated bottle.
- *Rerun outliers during pipette volume calibration* - if an outlier is observed during pipette calibration it will be rerun once if this function is checked.

- *Disable sample tube offset* - if this is checked the sample tube offset will not be used. The sample tube offset is a correction that moves the aspirate point to the left. It is based on the outside diameter of the bottle which is set in the bottle defaults dialog under *calibration/vessels and fluids/bottle defaults.*
- *Make level detect pressure threshold negative* - if this is checked the detect threshold will be marked with a negative pressure value.
- *Do not back adjust multishot calibration data* – used for in-house pipette calibration.
- *Rerun out of spec CV items during calibration and verification – Number of Times to rerun* – used for in-house pipette calibration.

The *System Overrides* tab (Figure 5-58) is used for editing the flash memory.

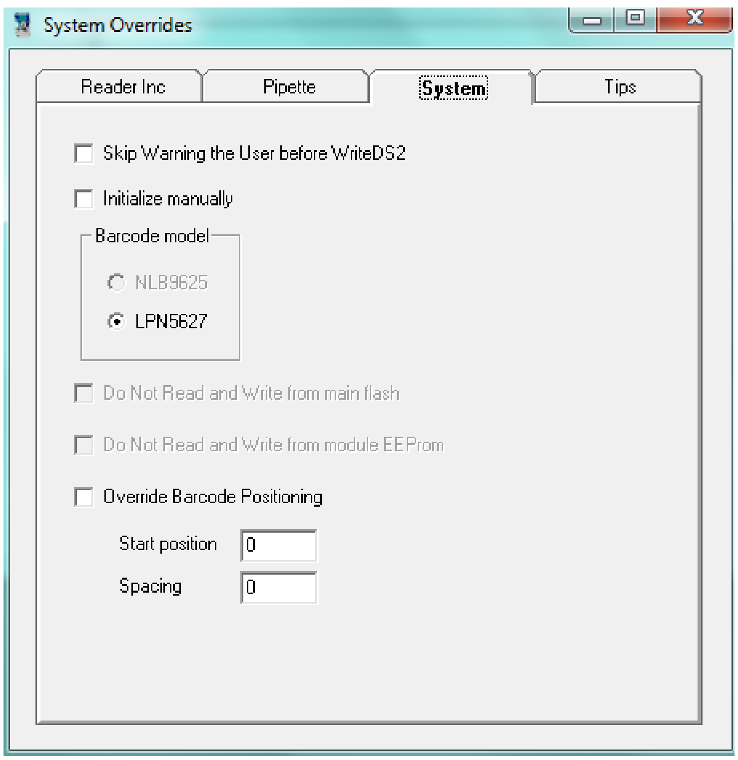


Figure 5-58: System Tab - System Overrides

On the system tab the following overrides can be set.

- *Skip Warning the User before write DS2*- When this option is enabled, the software will not warn the user prior to writing to the DS2. Dynex recommends this option not be enabled (leave unchecked).*Initialize manually* - normally the self tests initialize the instrument. If the self tests are not working correctly this can be used as a work around. This was useful when the self test was being developed. It might be useful as a service tool.

- *Barcode model* - the LPN5627 model is the correct selection. The NLB9625 model is the previous model which is not used.
- *Do not Read and write from main* - For R+D purposes only.
- *Do not Read and write from module EEPROM* - For R+D purposes only.
- *Read and Write from main memory only* - this function changes the memory only. The main flash is not changed.
- *Override barcode position* - this function was useful when the barcode development was being conducted. These settings are now available as *arm attributes*.

The *Tips* tab (Figure 5-59) allows for selection of a variety of tip issues.

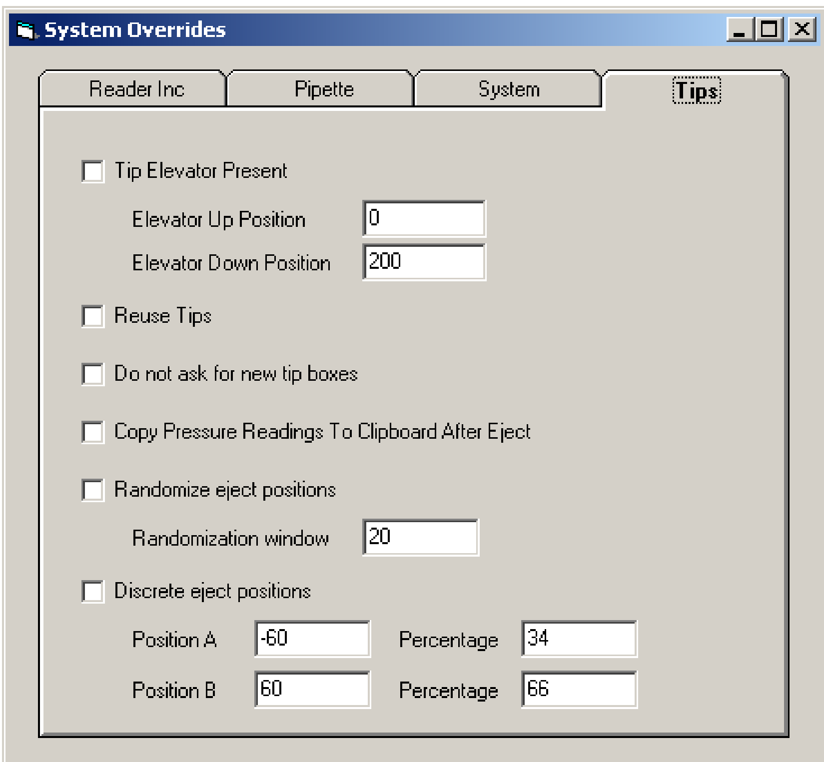


Figure 5-59: Tips Tab System Overrides

On the tips tab the following overrides can be set:.

- *Tip elevator present* - if selected the tip elevator will be used. The tip elevator is installed inplace of the reader. There are two calibration points for the tip elevator the up position and the down postion. This elevator is used for the pipette calibration fixture.
- *Reuse tips* - if selected, the tips will be ejected in the same position as retrieved from the tip elevator.
- *Do not ask for new tip boxes* - if selected, the arm will not stop and ask to reload when the box is used up.

- *Copy pressure readings to clipboard after eject* - if selected, indicates pressure data should be taken after tips are ejected. This feature is useful to determine the correct blowout during tip eject.
- *Randomize eject positions* - if selected, the eject positons will be randomized within this total window.
- *Discrete eject positions* - if selected, two eject positions will be designated by position A and position B. The percentage will determine how often positon A or position B is used.

5.7 Workspace Design Values

The *Workspace Design Values* dialog box, which is accessed via the **Arm** command on the *Settings* menu, is used to set the calibration relationships between the calibration feature on the pipette or pipette calibration tool and the final calibration values. All dimensions are in mm and absolute values with non-fixed origin points.

The *Reader Top* tab (Figure 5-60 and Figure 5-61) serve as examples. All points are in absolute coordinates with a 0,0,0 origin anywhere. In this case we chose to set the calibration hole rear to the origin (i.e. 0,0,0) but it could be any value.

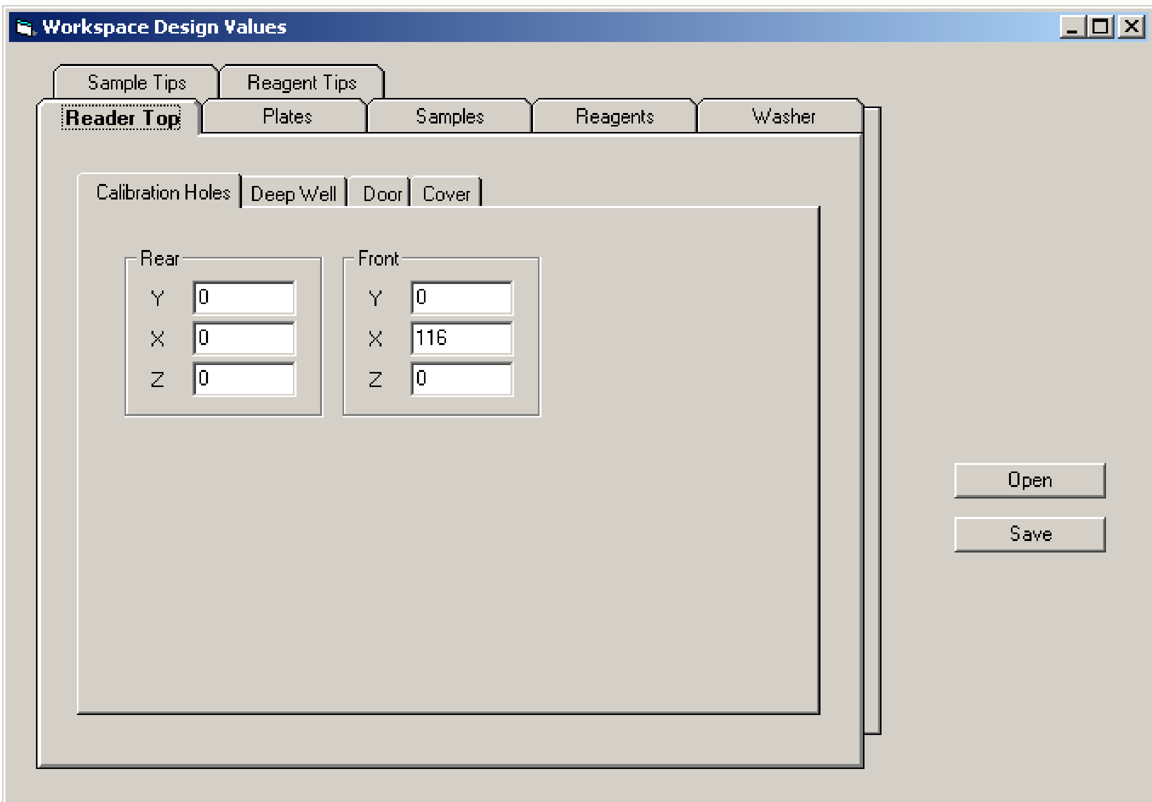


Figure 5-60: Workspace Design Values - Reader Top Tab - Calibration Holes

With the above established coordinate system, the parameters for the deep well is -15.63, 0, -51.25 for datum, -78.77,0,51.25 for Y right and -15.63, 115.75, -51.25 for X Bottom. The door and cover use the same coordinate system.

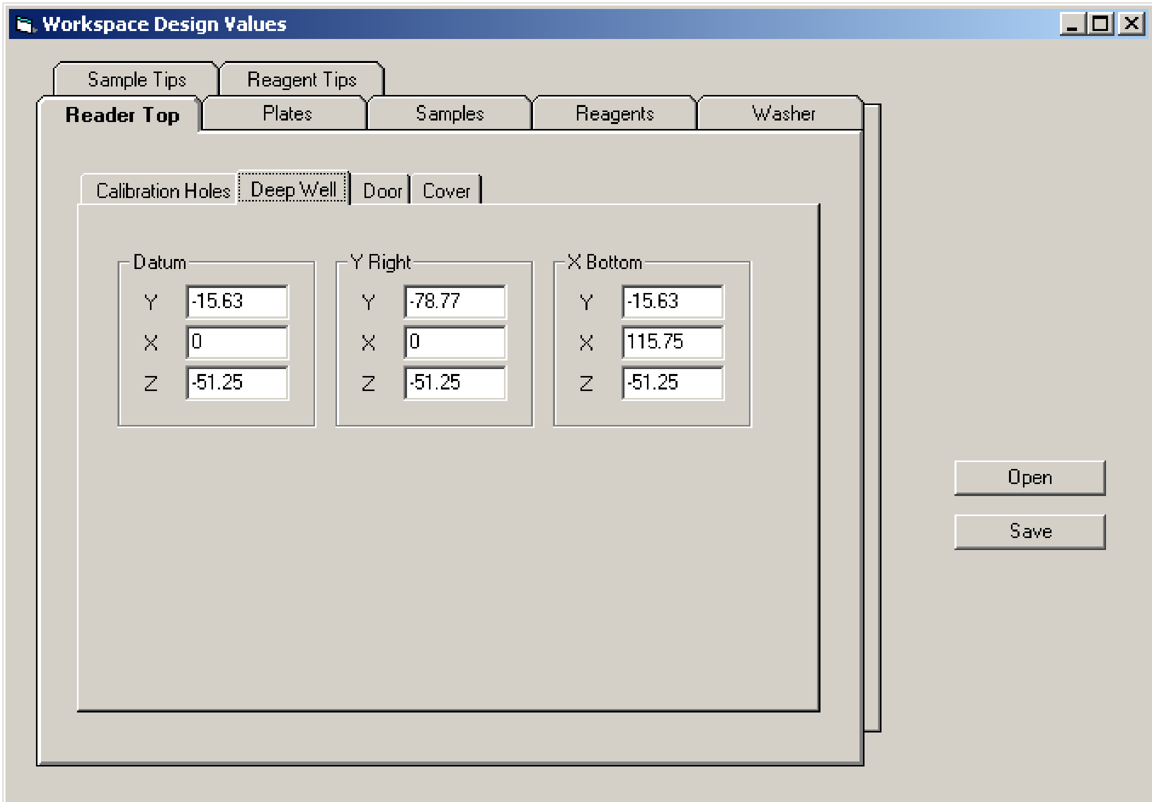


Figure 5-61: Workspace Design Values

This general approach is used for the various tabs.

5.8 Pipette / Fluid Density

The **Pipette/Fluid Density** dialog box (Figure 5-62), which is accessed via the **Pipette** command on the *Settings* menu, is used to set the fluid density for pipette calibration. If water is used, only the temperature is needed.

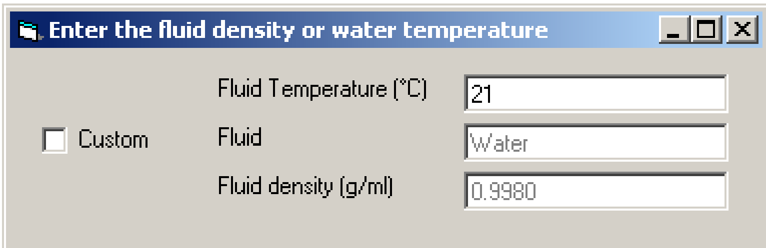


Figure 5-62: Fluid Density Dialog Box

5.9 Pipette Pass/Fail Defaults

The **PASS/FAIL Criteria Defaults** dialog box (Figure 5-63) which is accessed via the **Pipette** command on the *Settings* menu is used to set the pass fail criteria for pipette volume calibration and verification. The values will come up as defaults when a new calibration or verification file is created.

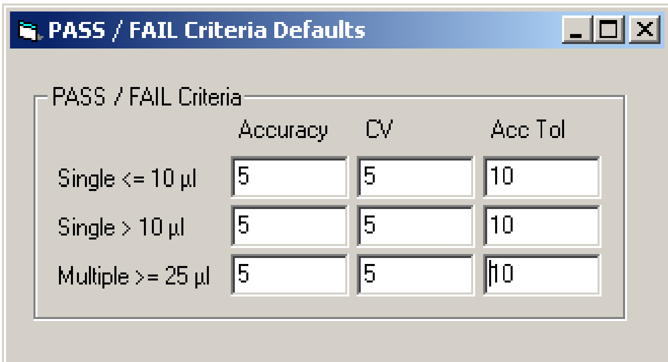


Figure 5-63: Pipette / Pass Fail Defaults Dialog Box

5.10 Pipette / Calibration Defaults

The *Pipette/Calibration Defaults* dialog box (Figure 5-64), which is accessed via the **Pipette** command on the *Settings* menu is used to set the default volumes and attributes for pipette volume calibration.

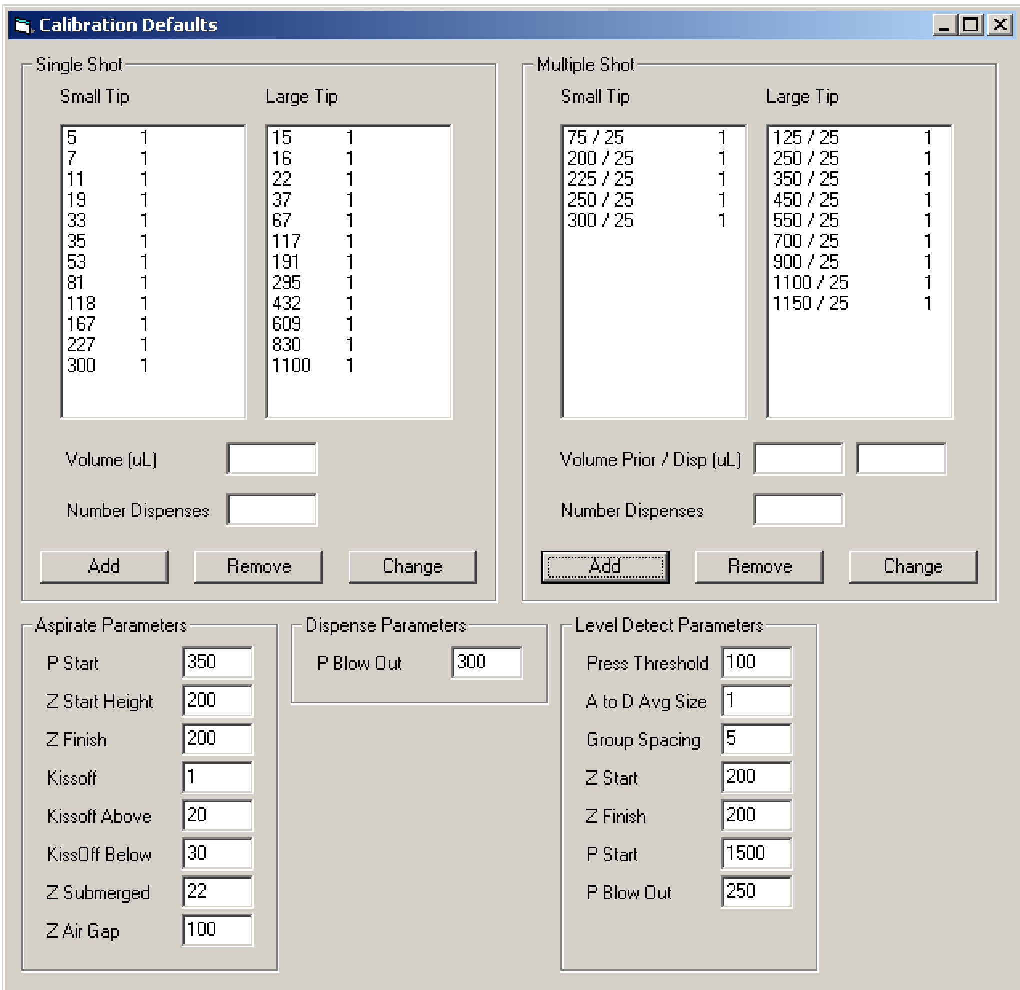


Figure 5-64: Pipette/Calibration Defaults Dialog Box

For single shots, select the item you want to modify, then enter a volume and the number of dispenses and finally press **Add** to add it to the selected list. The number of dispenses is the number of times that the fluid must be dispensed to achieve an average dispense value. At least five dispenses is recommended.

For multiple shots, select the item you want to modify. Enter a volume prior, dispense volume and the number of dispenses. Press **Add** to add it to the selected list. Press **Remove** or **Change** to modify the current selected item. The number of dispenses is the number of times that the fluid must be dispensed to achieve an average dispense value. At least five dispenses is recommended.

The remaining parameters set the defaults for the aspirate, dispense and level detect attributes. These are described in the DS2 IDS. Pipette / Verification Defaults

The **Verification Defaults** dialog box (Figure 5-65), which is accessed via the **Pipette** command on the *Settings* menu, is used to set the default volumes for pipette volume verification. The values are changed in the same manner as the the calibration defaults.

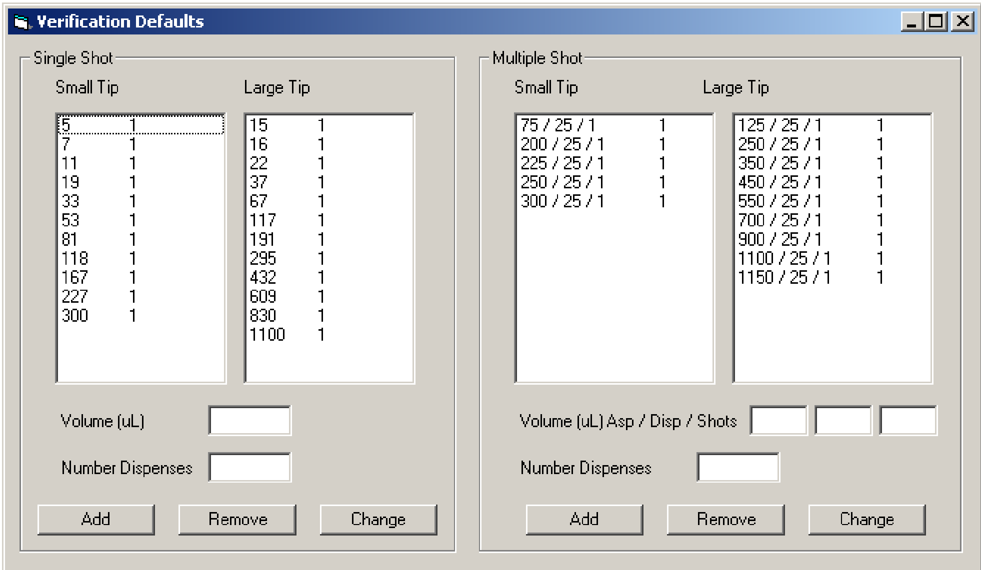


Figure 5-65: Verification Defaults Dialog Box

5.11 Pipette / Quick Cal Defaults

The **Quick Cal Defaults** selection is used only for in-house pipette calibration.

5.12 Switches, Valves, and Sensors Test

To perform the Switches, Valves, and Sensors Test:

1. Unplug the Wash Bottles A, B and Waste Bottle Jack plugs, remove all Samples and Reagent Racks, and close the Main Cover.
2. Select **Switches** on the *Pretest* menu and press the **Start** button. The display window should present all buttons in pink (off) (Figure 5-66).

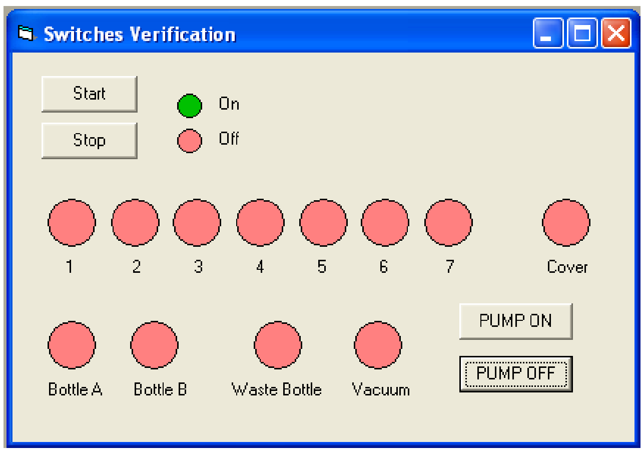


Figure 5-66: Switches Verification

3. Open the Main Cover. The *Cover* button should turn green (Figure 5-67).

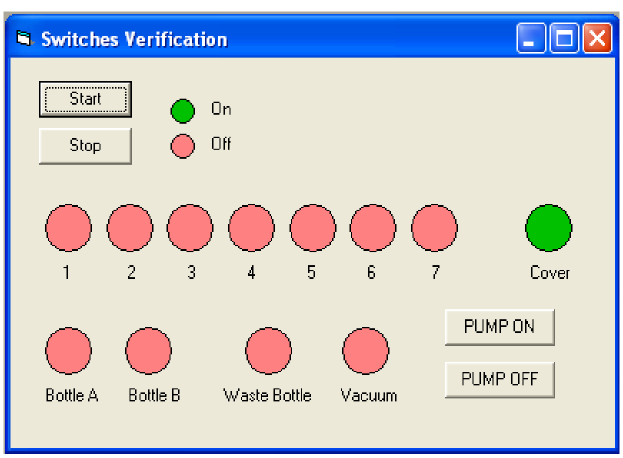


Figure 5-67: Cover Off - Switches Verification

4. Slide a Sample Rack into position number one. The *1* indicator should turn green (Figure 5-68).

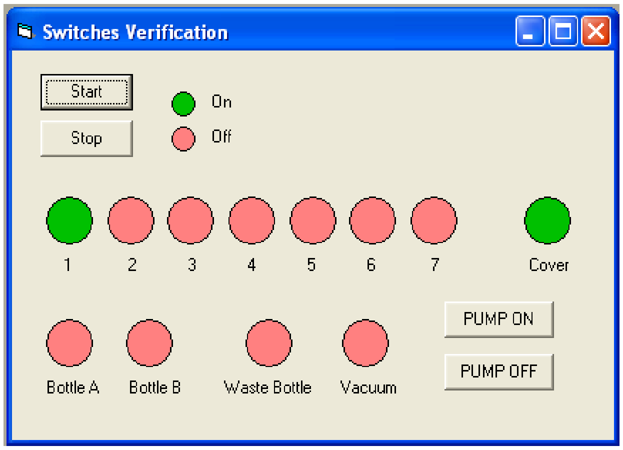


Figure 5-68: Cover Off and Sample Rack 1 in Position - Switches Verification

5. Slide a further four Sample Racks into positions 2, 3, 4 and 5, one at a time. The *2*, *3, 4* and *5* buttons should turn green corresponding to the rack being fitted.

6. Slide both Reagent racks in one at a time. The "6 and 7" buttons should turn green.

7. Plug Wash Bottle A in. The *Bottle A* button should turn green.

8. Plug Wash Bottle B in. The *Bottle B* button should turn green.

9. Plug the Waste Bottle in. The *Waste Bottle* button should turn green.

10. Insure the Waste bottle cap is on tight, click on **Pump On**. The *Vacuum* button should turn green after a few seconds.

11. Click on **Pump off**. The *Vacuum* button should go back to pink (off) after a few seconds. If all tests pass, all the buttons will have turned green.

12. Close the *Switches* window and select **Valves** on the *Pretest* menu.

13. Press **Start** on the *Washer Valves* dialog box (Figure 5-69).

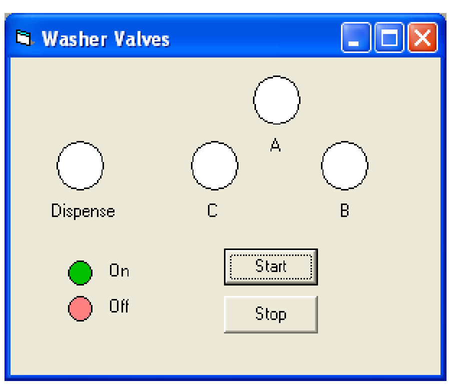


Figure 5-69: Washer Valves Dialog Box

14. The valves will now cycle on and off. Check which valve is activating by touching the valve tops and ensure the action coincides with the displayed buttons (Figure 5-70).

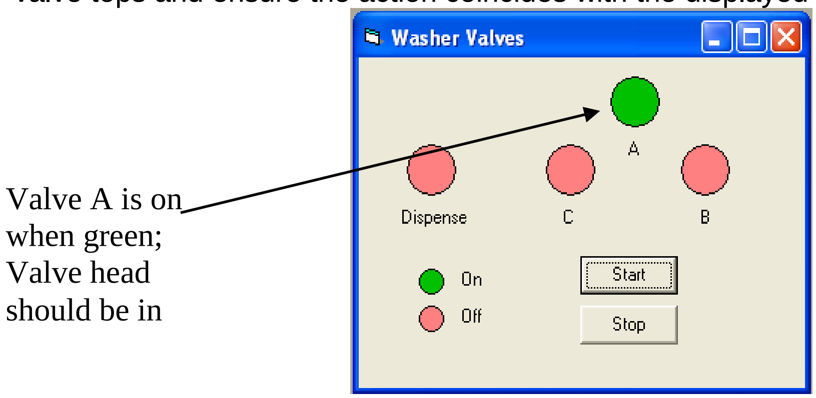


Figure 5-70: Washer Valve Test - In Progress

15. If all tests pass, press **Stop** and close the dialog box.

16. Close the *Valves* window and select **Sensors** on the *Pretest* menu to present the WashHead sensor test window (Fig 5-71).

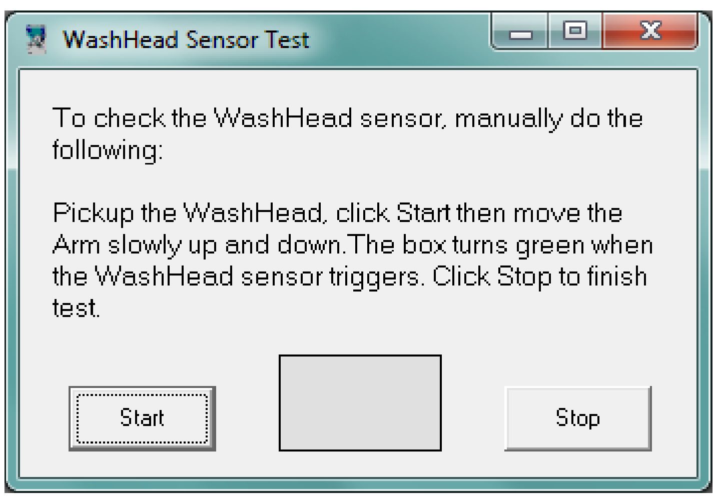


Fig 5-71 WashHead Sensor Test Window

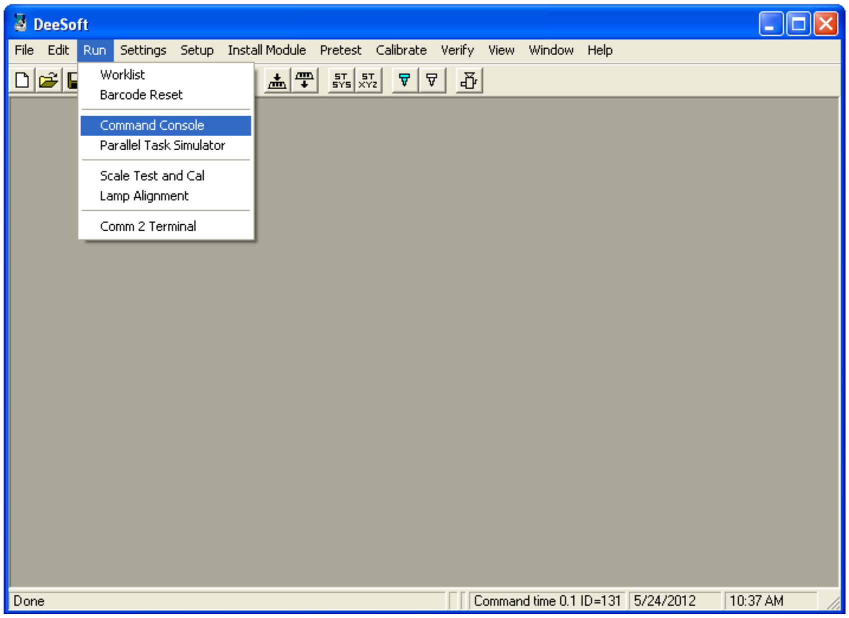
17. Click "Start". Manually move the Pipette to the Wash Head position and engage it. Move the wash head assembly away from the hanging posts and slowly raise the pipette and wash head up to where the wash head just touches the pipette eject plate. Ensure the box in the "WashHead Sensor Test" window changes from red to green. Return the Wash Head to the posts and disengage the pipette. Click "Stop" and close the window.

5.13 Aspiration Pump Vacuum Output Check

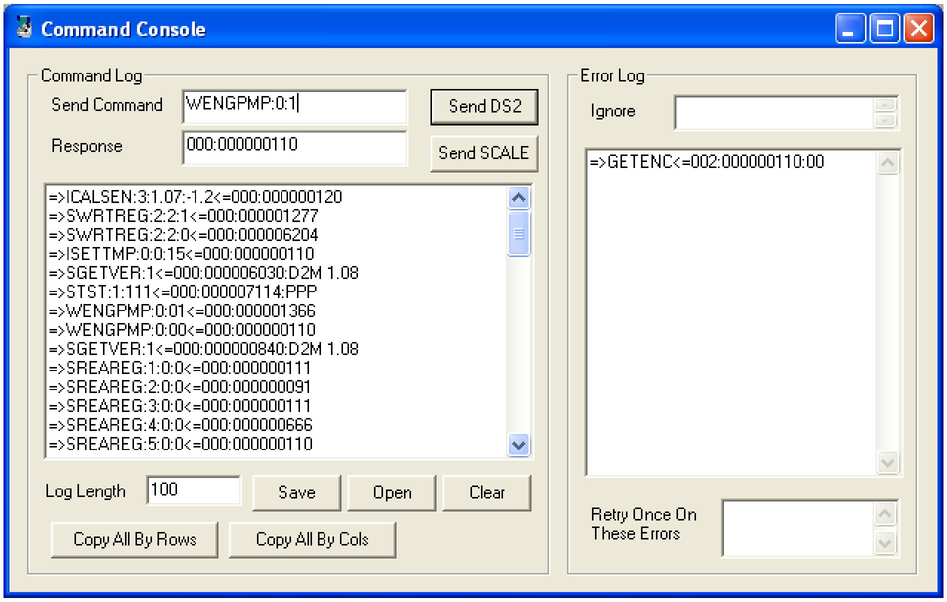
Below is the process to check the vacuum output of the aspiration pump. **This should be completed once a year during the yearly preventive maintenance visit as well as anytime a customer is having CV issues.** If the vacuum relief valve is defective, the system may have the vacuum build up which can cause the aspirate tubing to intermittently collapse on itself and cause the system to not wash properly.

1. The right connector where the waste bottle connects to goes straight through to the vacuum. Connect your manometer to this right most connector on the front workspace (see figure 1).
   a. You can use the tubing from the waste bottle or the tubing on the inside of the workspace that attaches to the right side coupler.

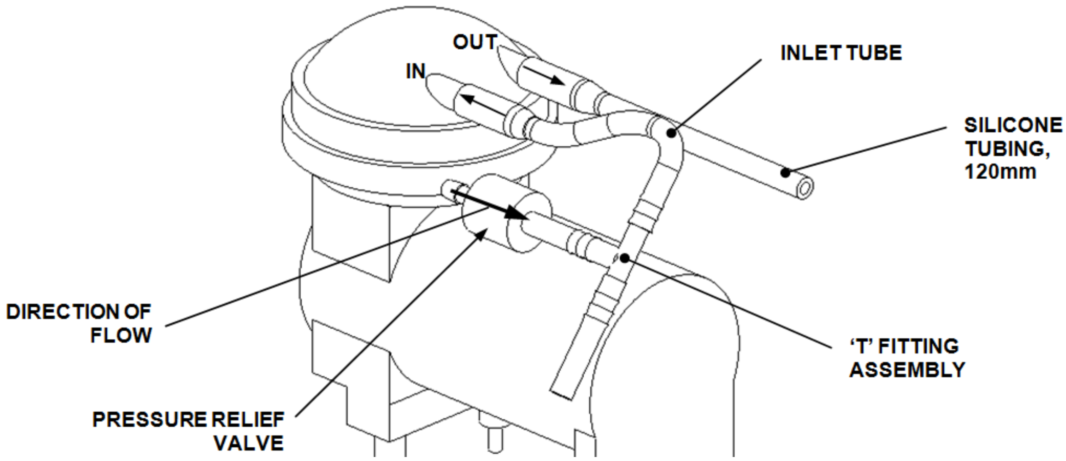
2. Turn on the DS2 and open DeeSoft. Select Run and Command Console.



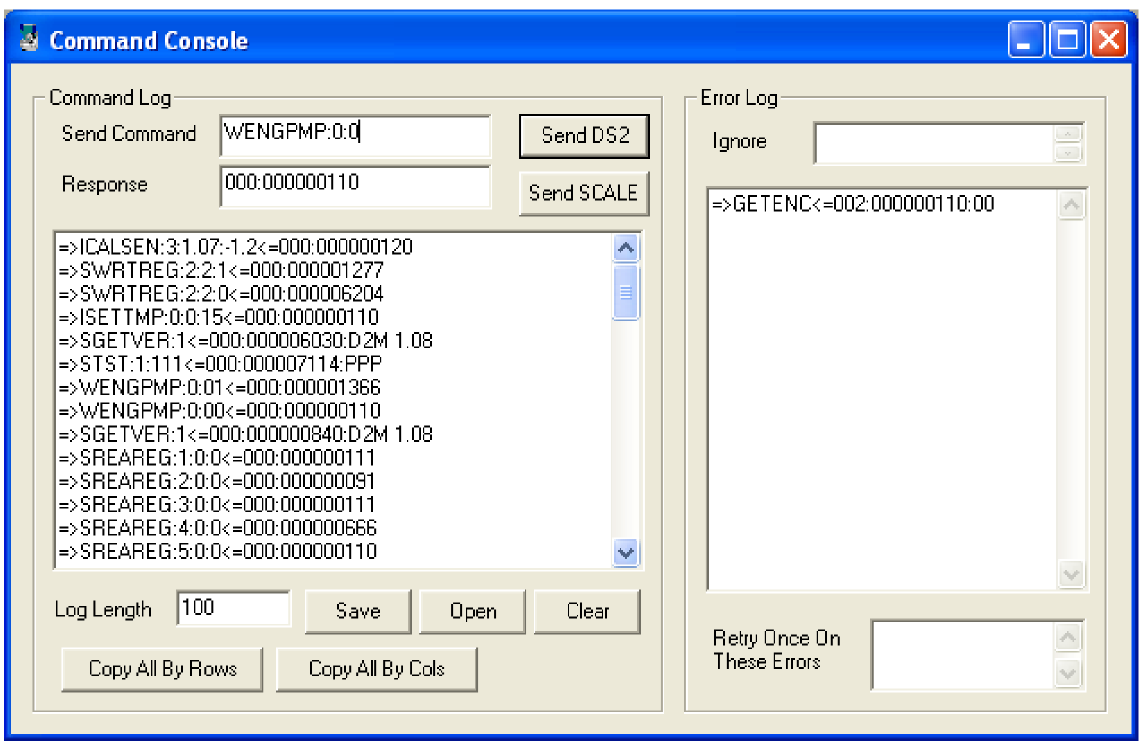
3. To turn the aspirate pump on, on the Send Command field, type “WENGPMP:0:1:” and select the Send DS2 button.



4. Measure the vacuum on the manometer. The reading should be 3PSI +/- .50PSI (see figure 4). If the reading is above 5PSI, replaced the valve and ensure the flow direction is oriented properly.



5. To turn off the pump, in the Command Console type "WENGPMP:0:0" and click the Send DS2 button.



5.14 Run Self-Test

This function will run all the DS2 self tests. If all self tests pass the unit is ready to use. If a self test fails, an option will be provided to allow the operator to indicate if the test should be continued.

5.15 Incubation Test

5.15.1 Upper Plate

To perform the Incubation Test on the Upper Plate:

1. Power up the DS2.
2. Start DeeSoft, and press the **Connect** button.
3. Open the *Incubation Verification Upper* worklist.
4. Select **Verify / Run self tests** The DS2 will now go through initialization.
5. Start Barnstead 2.00.
6. Connect the jack plug of the interface cable to the temperature recorder (Figure 5-71).

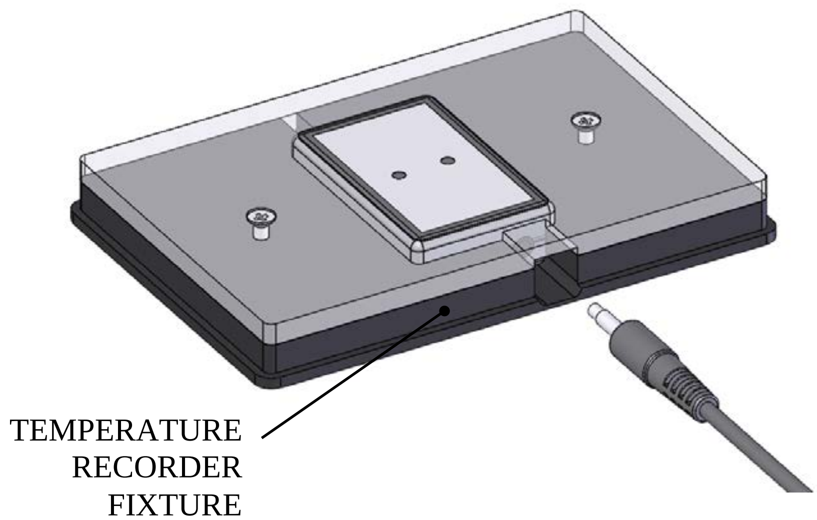


Figure 5-71: Connecting the Jack Plug of the Interface Cable

7. Select *Device / Start Device* and press **Yes** when the prompt appears, to present Figure 5-72.

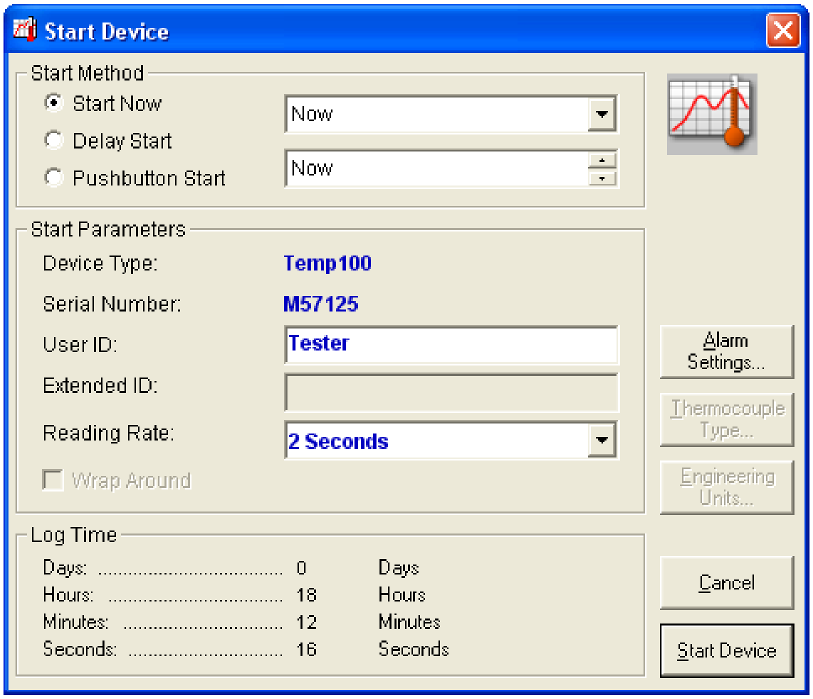


Figure 5-72: Start Device Dialog Box

8. Set *Start Method* to **Start Now.** Enter your name as the User ID and set the *Reading Rate* to 2 Seconds.

9. Select **Start Device**.

10. When the *Device Started* dialog box appears, press **OK** and disconnect the temperature recorder.

11. Insert the Temperature Recorder Fixture into the Upper Plate Carrier.

12. Press **Play** in DeeSoft to run the *Incubation Verification Upper.ddf* work-list. The Incubation period is set to run for 60 minutes.

13. When the incubation period has finished, the upper carrier will move to the out position. Remove the Temperature Recorder Fixture and re-connect it to the Interface Cable.

14. Select *Device / Stop Device* and press **Yes** to stop taking any further readings.

15. Select *Device / Read Device Data*, and press **OK** when the *Device Stopped* prompt appears.

16. Enter the DS2 Reader Serial Number and *Upper* as the file name for the readings as shown in the upper right in Figure 5-73. This figure page shows the readings taken during the Incubation as a plot.

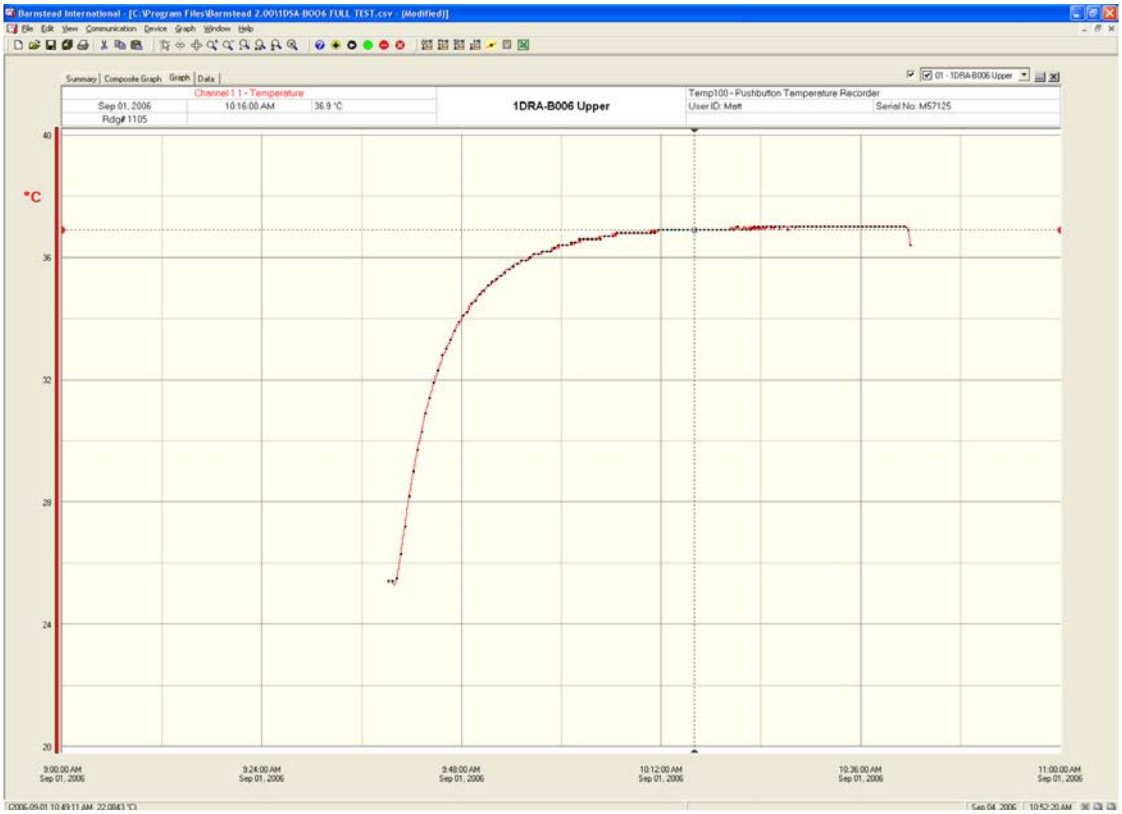


Figure 5-73: Upper Temperature Plot

17. Select **Copy Data to Excel** on the *Graph* menu. The readings will be exported into an Excel Spreadsheet titled *Data Spreadsheet* which will then be displayed.

18. In Excel, open the file *Temperature Validation Macro Rev **xx**.xls*, and press **Enable Macros** if the prompt appears (**xx** is the revision number).

> ***Note**: Ignore the message that appears on the current spreadsheet and return to the Data Spreadsheet.*

19. Press **Ctrl** and **Q** to run the macro. This macro manipulates the exported data to present a Pass / Fail result.

20. If the results indicate *PASS*, then fill in the Serial Numbers for the DS2, the reader, and the plate position being tested (Upper).

21. Select *Print* on the File menu and press **OK** to print out the results, then sign and date the printed page.

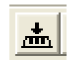
22. Save the spreadsheet as filename: *[Reader Serial Number] Incubator Validation Upper Results.xls*

23. Close Excel.

24. Close the Barnstead 2.00 data file by pressing the **X** button in the upper right corner and selecting **Don't Save**.

5.15.2 Lower Plate

To perform the Incubation Test on the Lower Plate:

1. In DeeSoft, close the *Incubation Verification Upper* worklist and open the *Incubation Verification Lower* worklist.
2. On the menu bar, press the **Lower-plate eject** button. 
3. In Barnstead 2.00, select *Device / Start Device*. Press **Yes** when the prompt appears.
4. Set *Start Method* to **Start Now,** enter your name as User ID and set the *Reading Rate* to 2 Seconds
5. Press **Start Device**.
6. When the *Device Started* dialog box appears, press **OK** and disconnect the temperature recorder.
7. Insert the temperature recorder fixture into the lower plate carrier.
8. Press **Play** in DeeSoft to run the *Incubation Verification Lower* worklist. The Incubation period is set to run for 60 minutes.
9. When the incubation has finished, the lower carrier will move to the out position, Remove the temperature recorder fixture and re-connect it to the interface cable.
10. Select **Stop Device** on the Device menu and press **Yes** to stop taking any further readings.
11. Select “Device / Read Device Data”, and click “OK” when the “Device Stopped” prompt appears.
12. Enter the DS2 Reader Serial Number and “Lower” as the file name for the readings.
13. Select **Copy Data To Excel** on the Graph menu. The readings will be exported into an Excel Spreadsheet titled Data Spreadsheet which will then be displayed.
14. In Excel, open the file **Temperature Validation Macro Rev xx.xls**, and press **Enable Macros** if the prompt appears (**xx** is the revision number).
15. Note: Ignore the message that appears on the current spreadsheet, and return to the “Data Spreadsheet”.
16. Press **Ctrl** and **Q** to run the macro. This macro manipulates the exported data to give a Pass / Fail result.
17. If the results indicate “PASS” then fill in the Serial Numbers for the DS2 and Reader, and the incubator position being tested (Lower).
18. Select **Print** on the File menu and press **OK** to print out the results. Sign and date the printed page.

19. Save the Excel file as filename: [Reader Serial Number] Incubator Validation Lower Results.xls.

20. Close the Barnstead 2.00 and Excel programs.

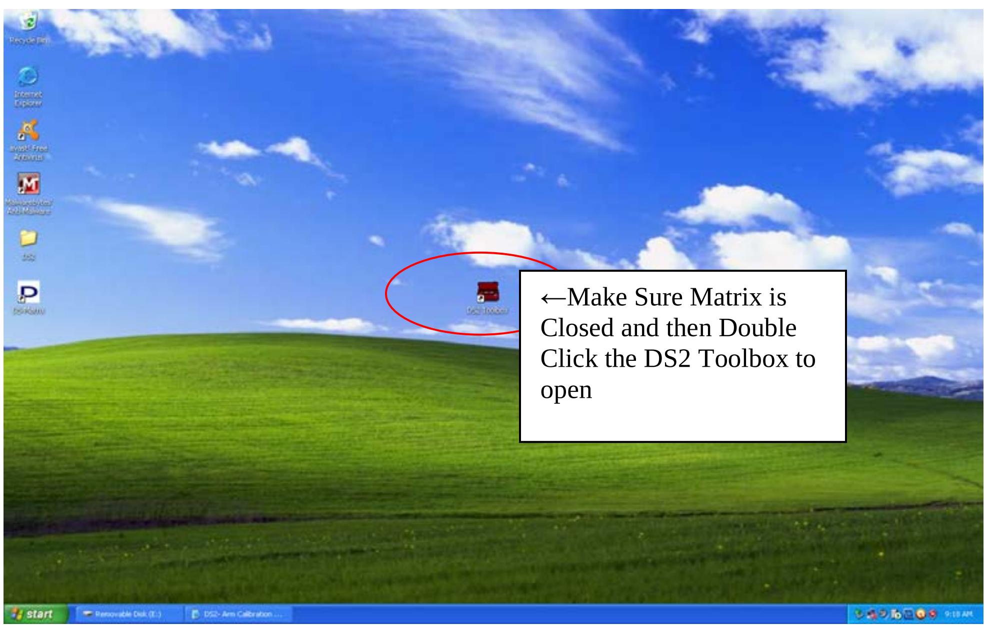
5.16 Calibrating the Arm

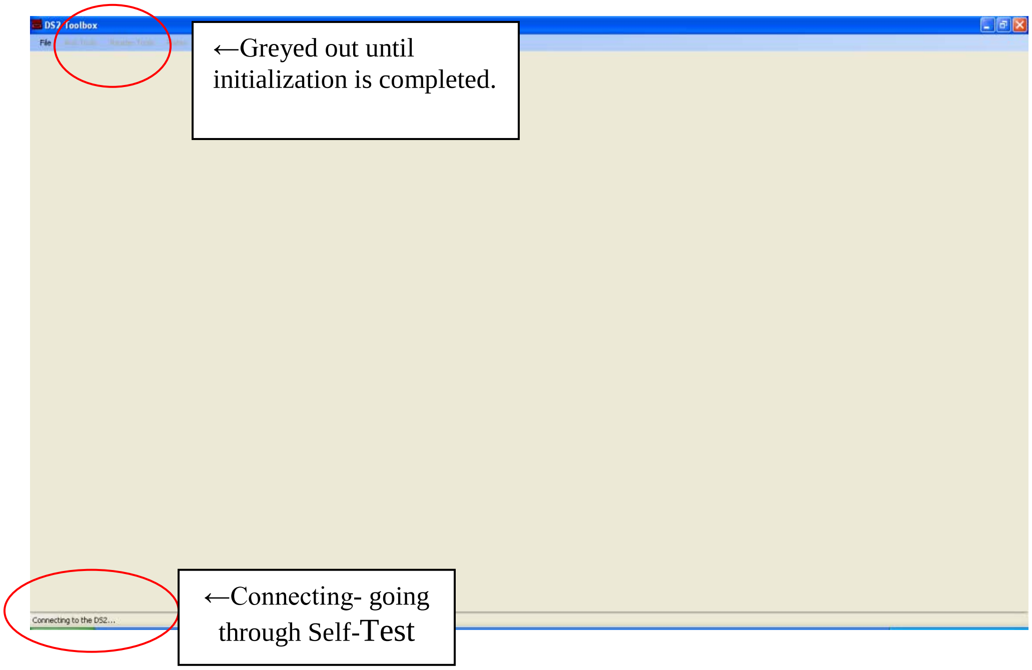
Prior to begining the arm calibration, please read through the precautions below:

1. Please read all message boxes carefully and perform required actions when prompted.

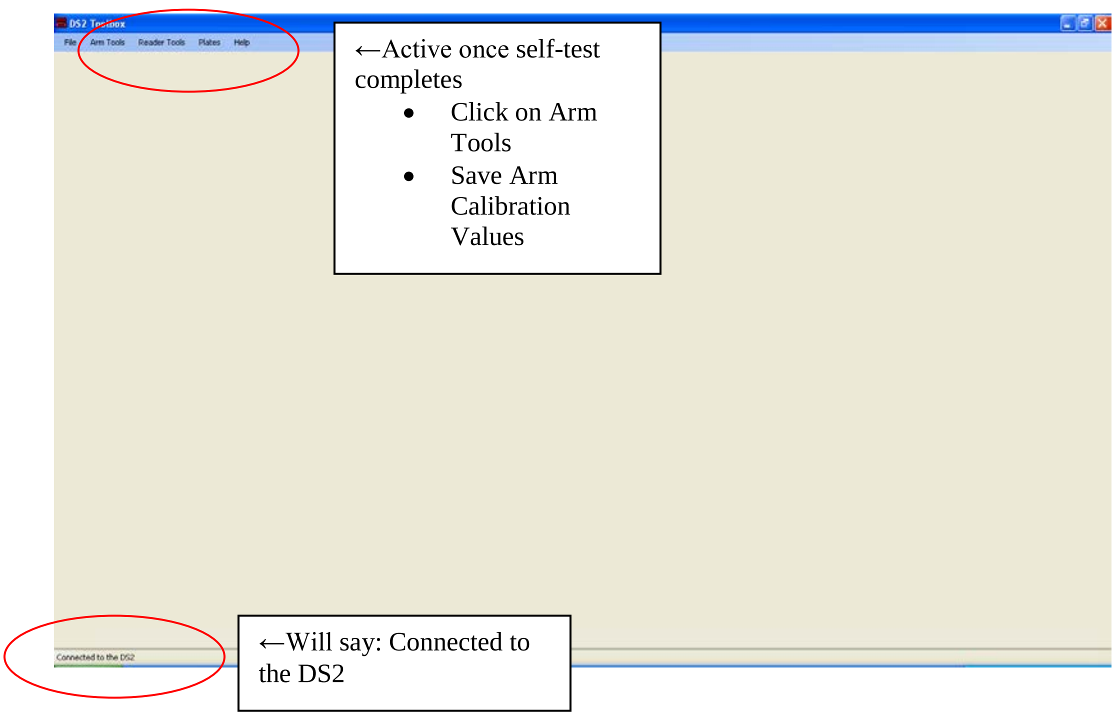
2. If you are using a Windows language version other than United States English, please note that the decimal separator must be set to “decimal” and not “comma”. The DS2 Toolbox Software will not operate properly if the decimal separator is set to “,” instead of “.”

3. When moving the pipette, make sure to grasp the metal pipette spigot, do not use the tubing coming out of the pipette to move the pipette or you will risk damage to the pipette module.

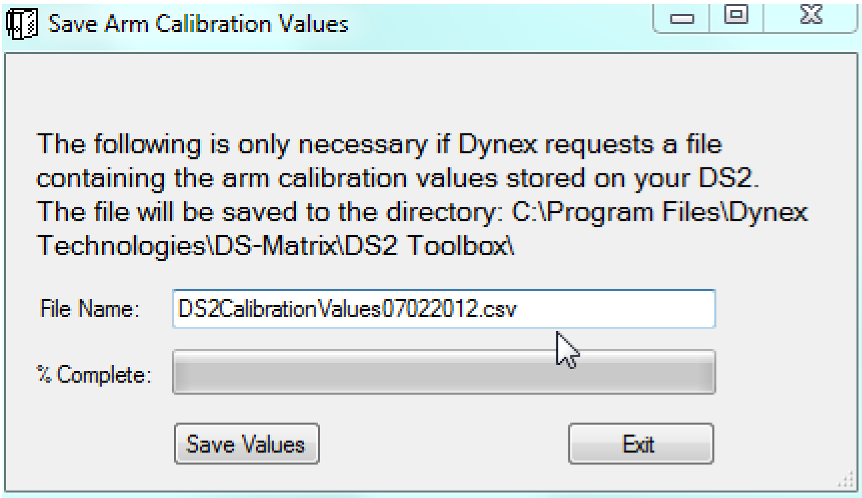




Once the DS2 is successfully connected to the arm calibration software, begin by **saving the arm calibration values** out to a file.

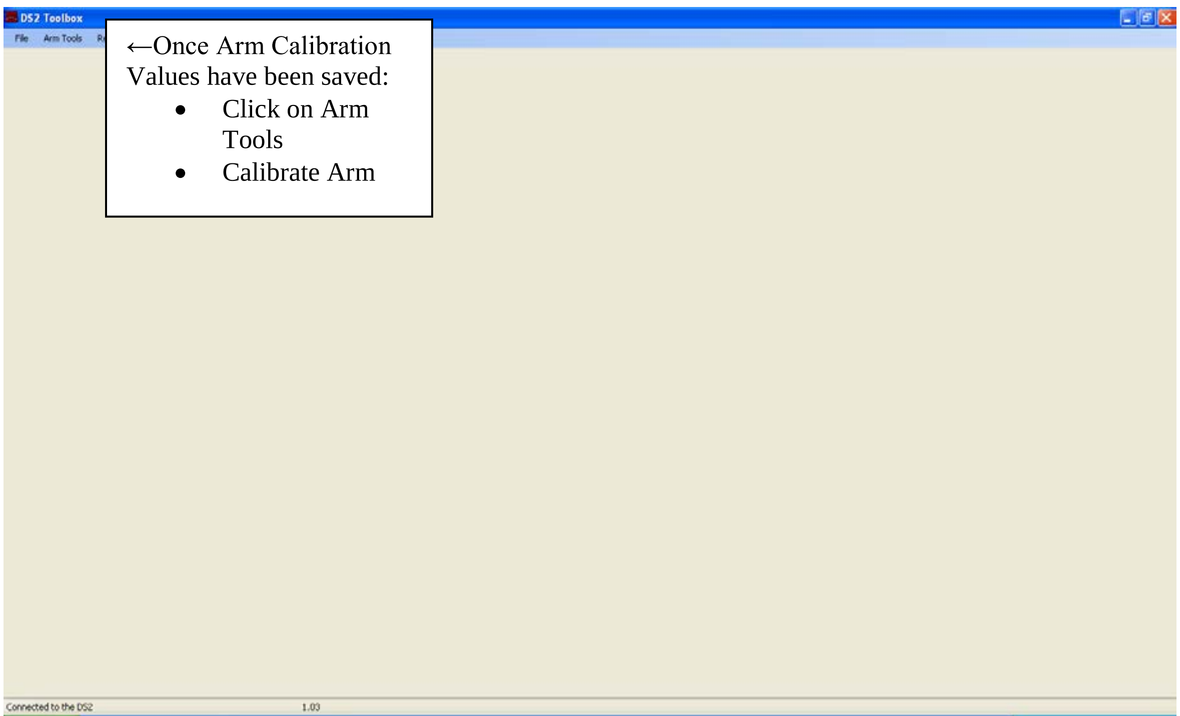


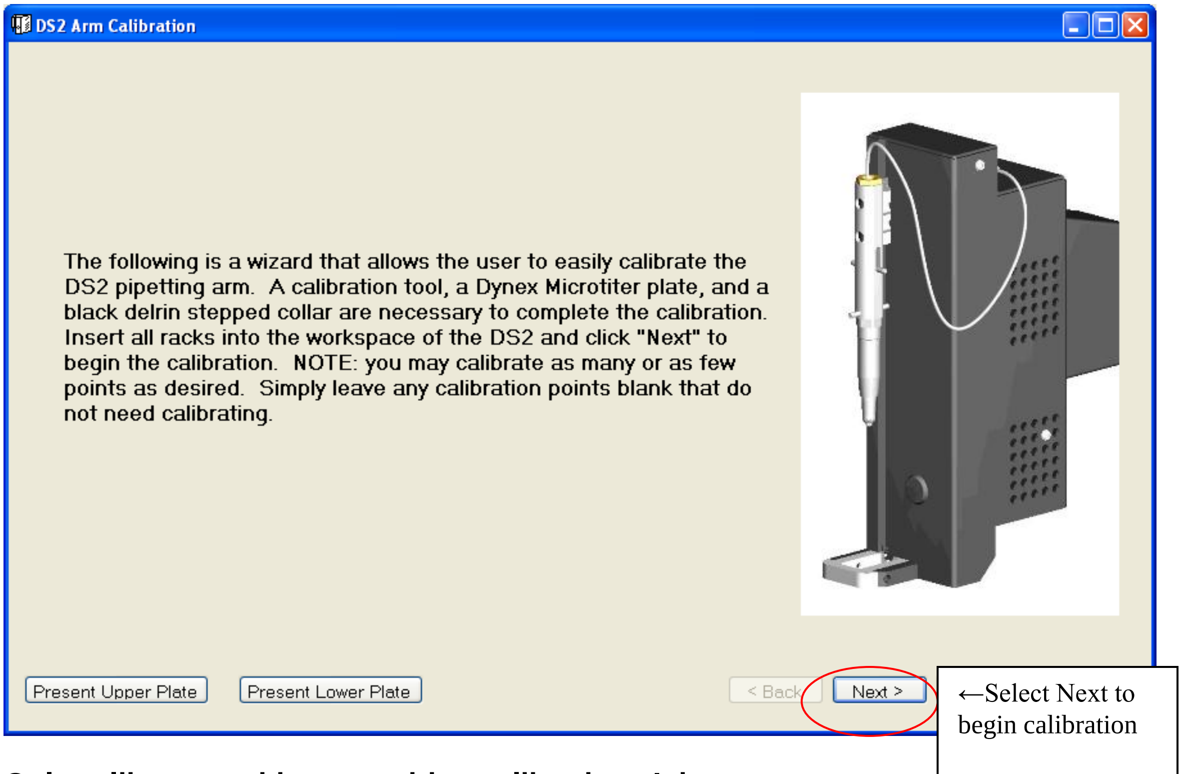
The Save Arm Calibration Values window will appear. The default file name will be "DS2CalibrationValues". Make sure to append this file name with the date (see below) so that the file is easily identifiable and will not overwrite. If you are saving the values multiple times in one day, make sure to append with the date and a unique identifier (a, b, etc).



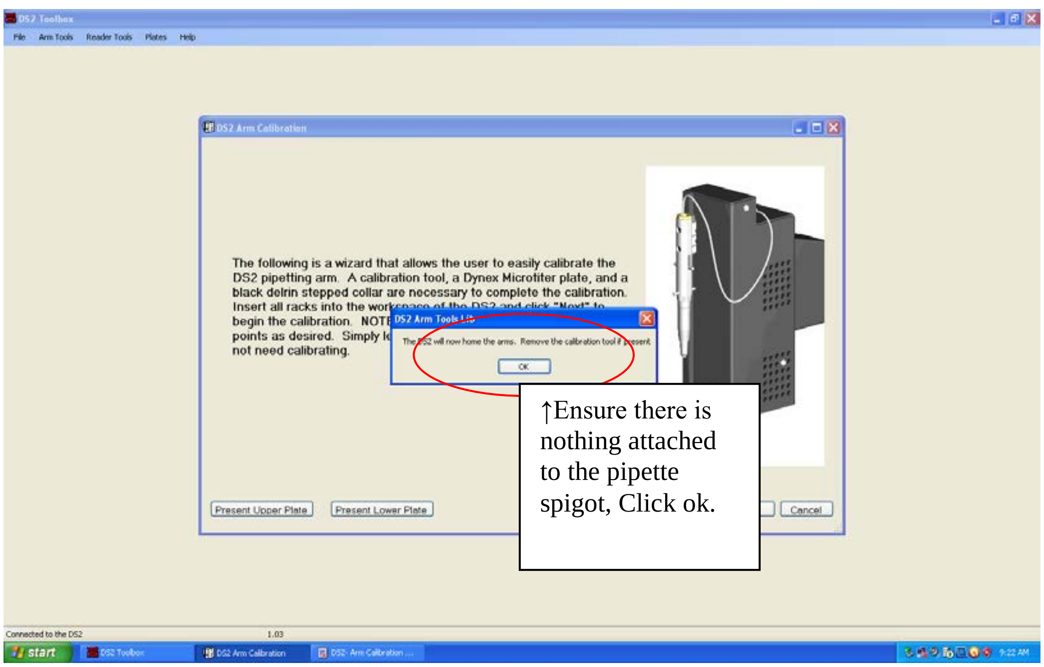
Click Save Values. Once the arm calibration values are saved, click Exit. A file with the values is now saved to C:\Program Files\Dynex Technologies\DS-Matrix\DS2 Toolbox.

Once the values have been saved, begin the Arm Calibration procedure.





Only calibrate positions requiring calibration. It is not necessary to calibrate positions which do not require calibration.

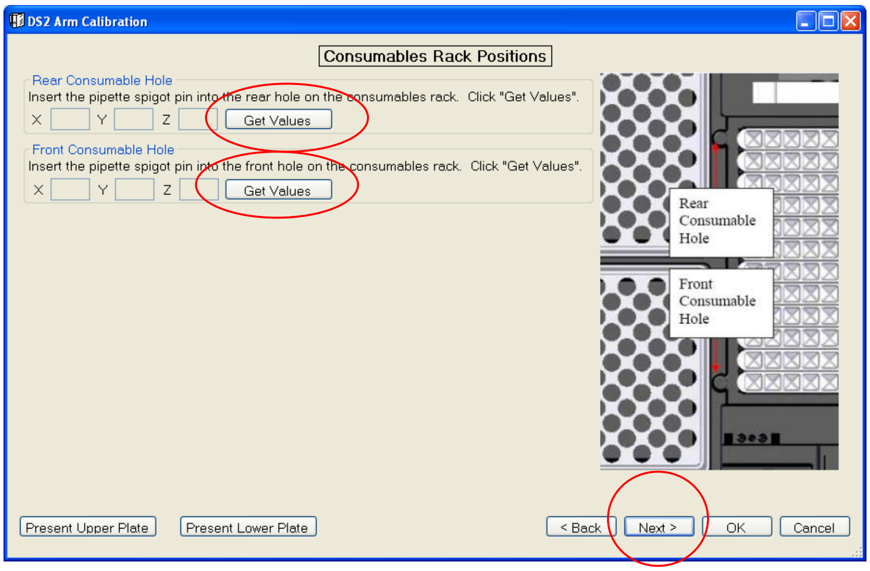


This calibration position is for the **deep well rack positions**.

Calibrate this position if you suspect there are issues pipetting from the deep wells (tip is not centered, pipette does not seem to be finding fluid level accurately), or the incubator door is not completely opening or closing. Calibrating this position calibrates several positions on the instrument platform.

If this position does not require calibration, click **Next**.

To calibrate this position, follow the instructions on the screen and click **Get Values** for each of the two calibration positions. Once the X, Y, and Z values for both positions are populated with values, click **Next** to calibrate other positions or **OK** to finish the calibration.

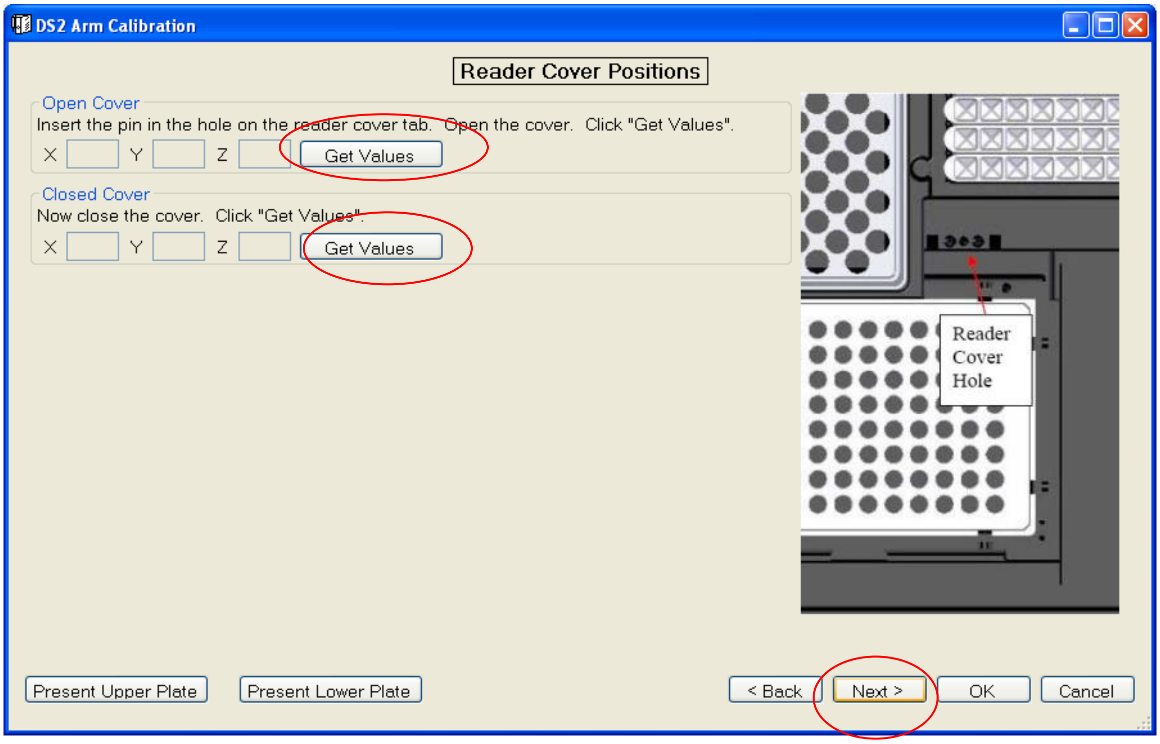


This calibration position is for the **reader cover positions**.

Calibrate this position if the reader cover is not being opened or closed properly.

If this position does not require calibration, click **Next**.

To calibrate this position, follow the instructions on the screen and click **Get Values** for each of the two calibration positions. Once the X, Y, and Z values for both positions are populated with values, click **Next** to calibrate another position or click **OK** to finish calibration and save the values to the DS2.



This calibration position is for the **sample tip (blue tip) pick up positions**.

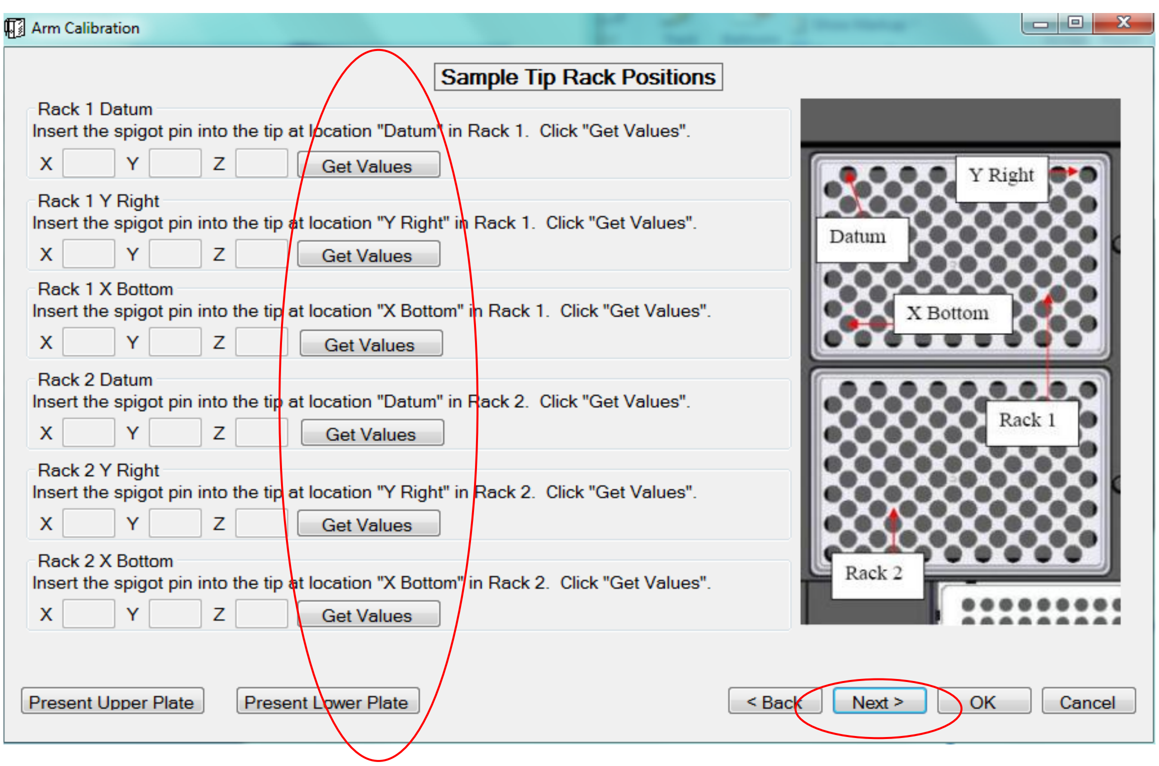
Calibrate this position if the sample tips are not being picked up (spigot is banging between tips), if tips are falling off in transit, or if pipetting issues are suspected.

If this position does not require calibration, click **next**.

Technical Tips:

1. The pipette tip must be put on *very, very, tightly* when performing this calibration. *Failure to put the tip on tightly will result in incorrect calibration and could result in improper pipetting and tips falling off in transit*. I recommend leaving the tip in the rack, bringing the spigot over to the tip rack and using a method similar to when manually pipetting to get the tip on the spigot. Push the spigot into the tip until it cannot go further, then lift the tip up and bring it down firmly in the rack several times to ensure the tip is firmly attached to the spigot. When the tip is on properly it is difficult to remove. Leave the same tip on for all six calibration points.
2. Please note: The X bottom position is not the corner hole, but diagonal from the corner hole.
3. Make sure that the tip containers are placed securely and properly on the deck, otherwise calibration will be affected.

To calibrate this position, make sure there is a tip on the spigot (see technical tips above), remove the tips from the 3 positions in rack one and the three positions in rack 2, leaving them empty so the calibration can be performed with the tip already on the spigot. Follow the instructions on the screen and click **Get Values** for each of the three calibration positions in rack one and each of the three calibration positions in rack 2. Once the X, Y, and Z values for all 6 positions are populated with values, click **Next** to calibrate another position or click **OK** to finish the calibration.



This calibration position is for the **reagent tip pick up positions**.

Calibrate this position if the reagent tips are not being picked up (spigot is banging between tips), if tips are falling off in transit, or if pipetting issues are suspected.

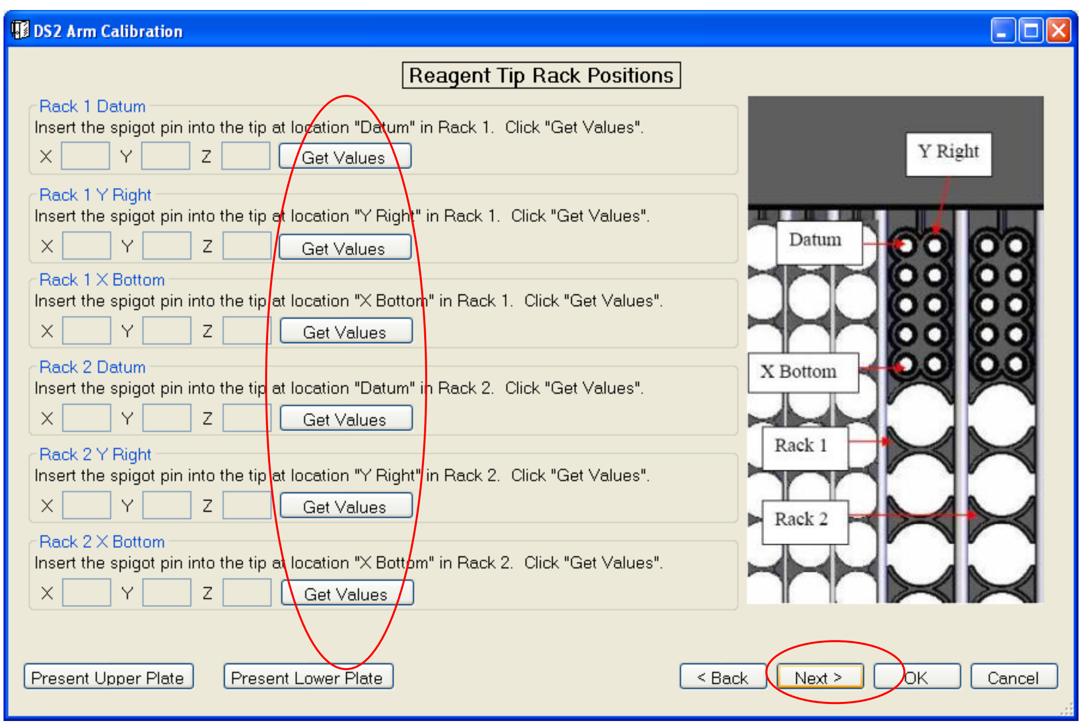
If this position does not require calibration, click **Next**.

Technical Tips:

1. The pipette tip must be put on *very, very, tightly* when performing this calibration. *Failure to put the tip on tightly will result in incorrect calibration and could result in improper pipetting and tips falling off in transit*. I recommend leaving the tip in the rack, bringing the spigot over to the tip rack and using a method similar to when manually pipetting to get the tip on the spigot. Push the spigot into the tip until it cannot go further, then lift the tip up and bring it down firmly in the rack several times to ensure the tip is firmly attached to the spigot. When the tip is on properly it is difficult to remove. Leave the same tip on for all six calibration points.

2. Make sure both of the reagent racks are pushed in all the way and that the rack does not tilt to the left or right when inserting the spigot/tip. If the racks are not properly positioned, the calibration points will be incorrect.

To calibrate this position, make sure there is a tip on the spigot (see technical tips above), remove the tips from the 3 positions in rack one and the three positions in rack 2, leaving them empty so the calibration can be performed with the tip already on the spigot. Follow the instructions on the screen and click **Get Values** for each of the three calibration positions in rack one and each of the three calibration positions in rack 2. Once the X, Y, and Z values for all 6 positions are populated with values, click **Next** to calibrate another position or click **OK** to finish the calibration.



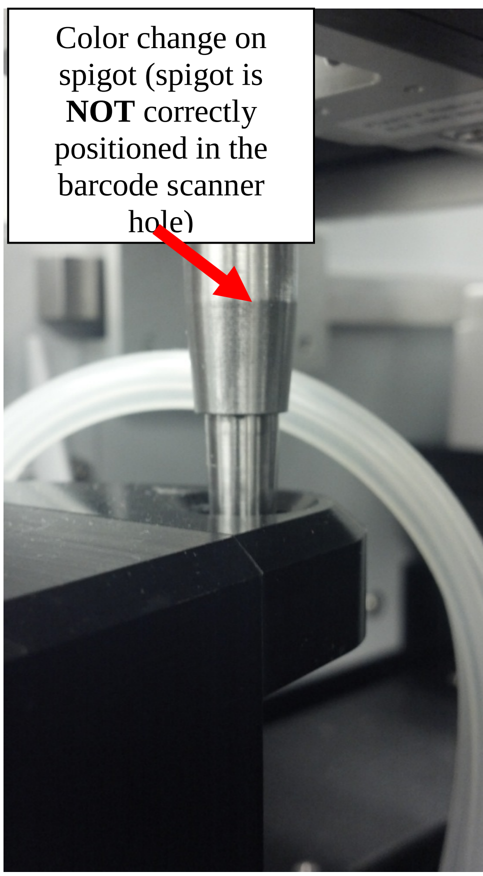
This calibration position is for the **barcode scanner position**.
Calibrate this position if barcode scanner is working (there is a red light), but it not reading barcodes or if the barcode scanner is not clicking back into place once barcode scanning is complete, or if the spigot is not engaging the barcode scanner to scan barcodes.

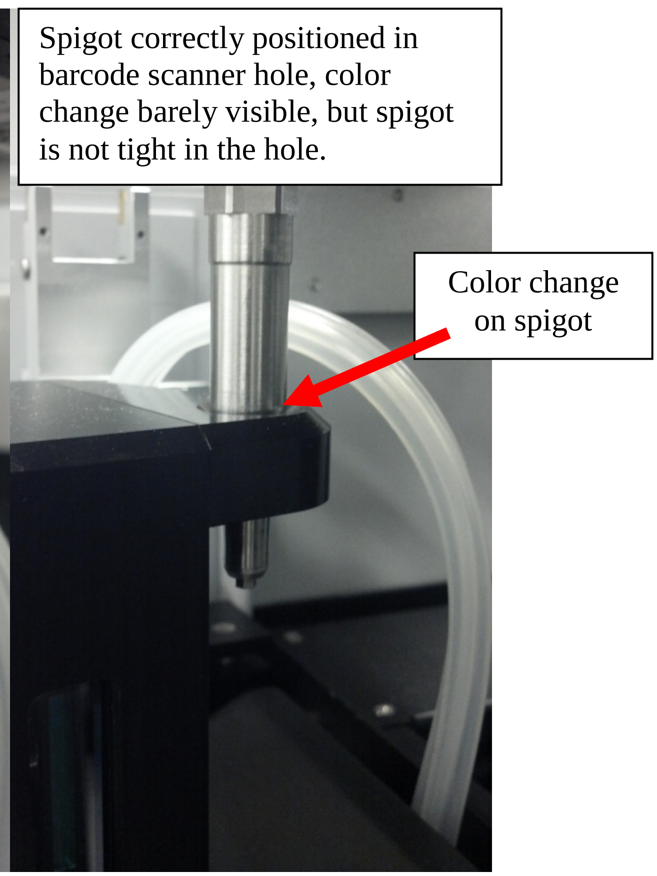
If this position does not require calibration, click **Next**.

Technical Tips:

1. Make sure the barcode scanner is all the way over to the left of the instrument and you can hear it "click" into place. If the scanner is not clicked in all the way to the left, it will not be positioned properly for the calibration and the calibration points will be incorrect.
2. Do not push the spigot so far down in the spigot hole that it is difficult to remove. See below for pictures that show the correct positioning of the spigot for this calibration.

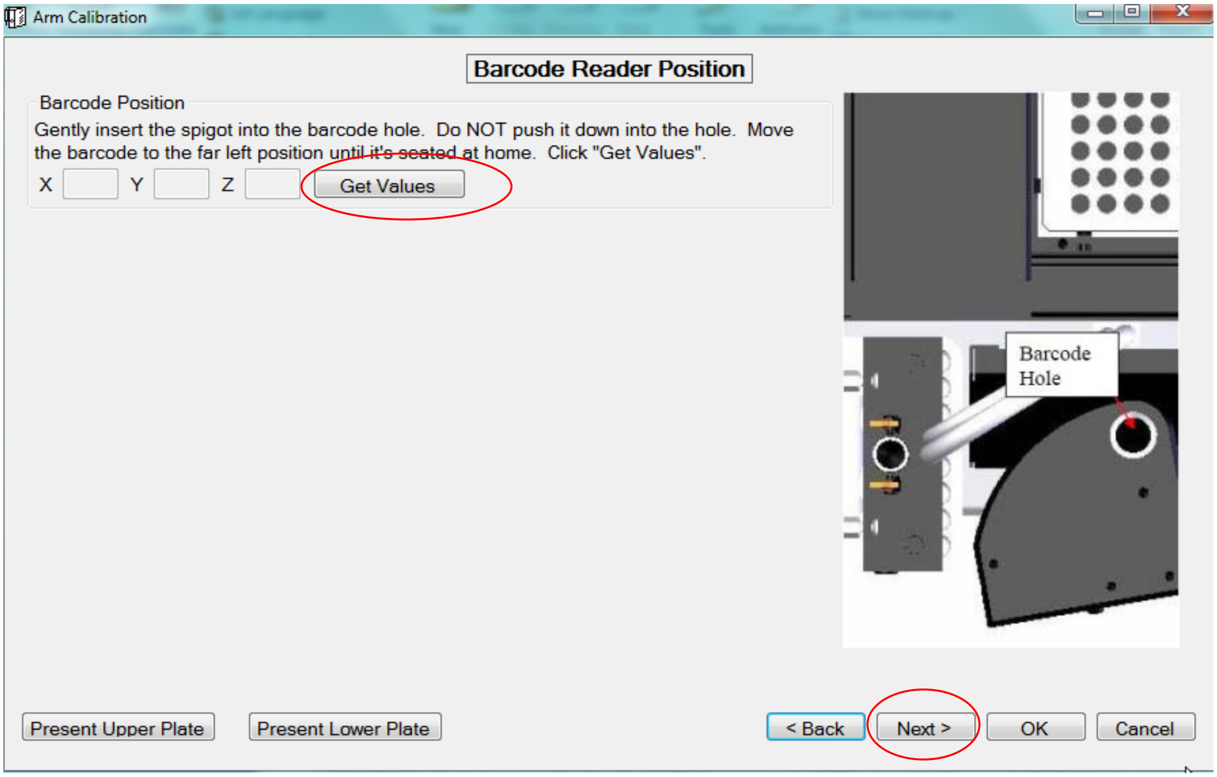
To calibrate this position, make sure the barcode scanner is in the correct starting position (see technical tips above). Look at the spigot and note that there is a *slight* color change in the metal; this is also where the spigot begins to taper from straight to angled (picture 1). Insert the spigot in the hole on the barcode scanner until you can barely see where the color change takes place (picture 2). The spigot should not be tight in the hole. Alternatively, if you have difficulties seeing the color change on the spigot, insert the spigot into the barcode scanner hole all the way and then lift up 1-2mm. Again, the spigot should not be tight in the hole.





Picture 1 **Picture 2**

Once the spigot is correctly positioned correctly in the barcode hole, click **Get Values**. Once the X, Y, and Z are populated with values, click **Next** to calibrate another position or click **OK** to finish the calibration.


Arm Calibration
Barcode Reader Position
Barcode Position
Gently insert the spigot into the barcode hole. Do NOT push it down into the hole. Move the barcode to the far left position until it's seated at home. Click "Get Values".
X
Y
Z
Get Values
Barcode Hole
Present Upper Plate
Present Lower Plate
< Back
Next >
OK
Cancel

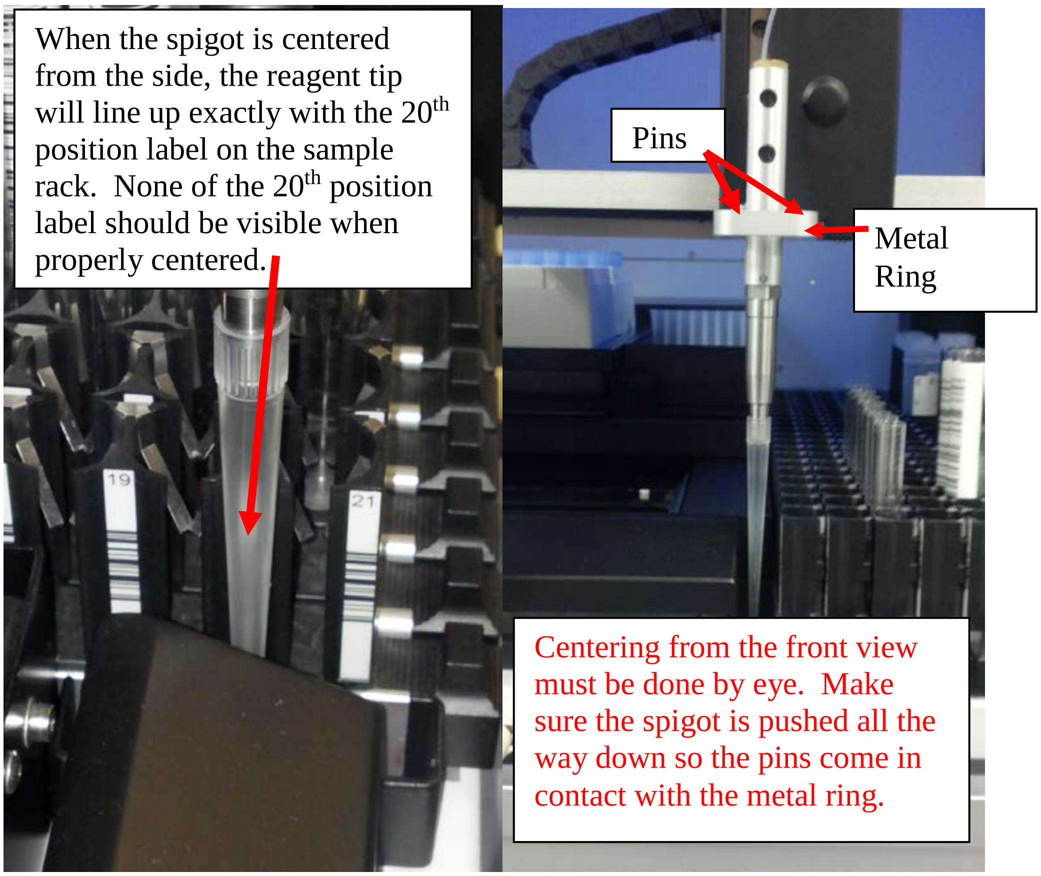
This calibration position is for the **tip eject position**.

Calibrate this position if the tips are not being ejected off the spigot, or if the tips are banging into the instrument deck instead of being ejected.

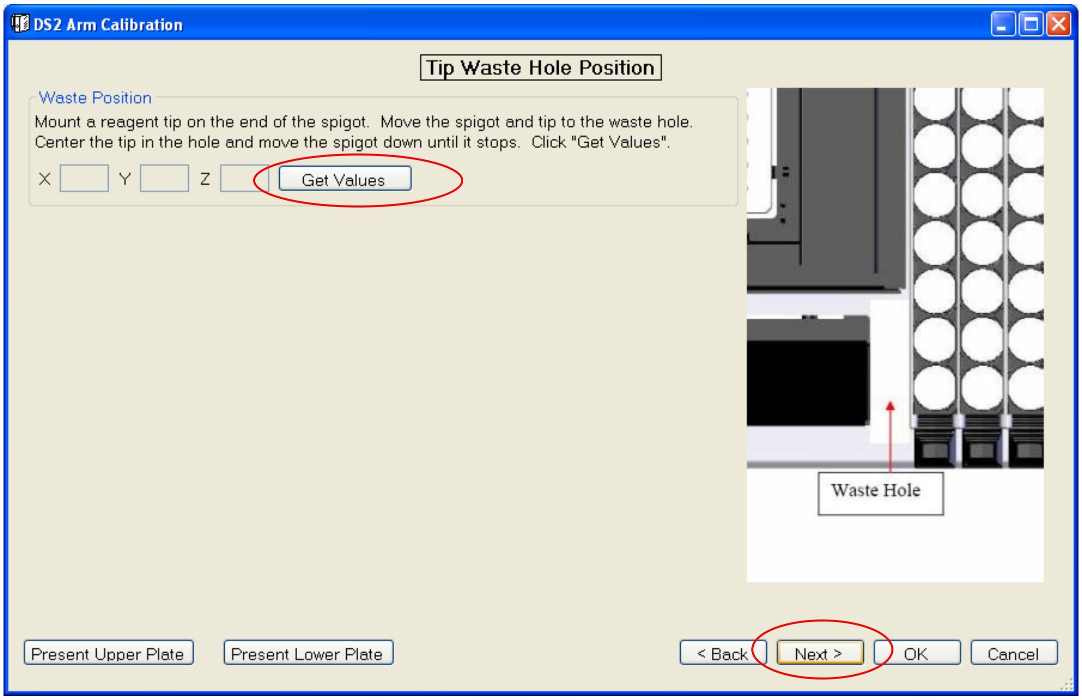
If this position does not require calibration, click **next**.

Technical Tips:

1. For this position, a reagent tip is placed on the spigot to help with correct positioning only. It does not need to be on tightly.
2. Make sure to center the spigot from both the front and the side of the instrument, also ensuring the spigot is pushed down until it stops.



To calibrate this position, follow the instructions on the screen and the technical tips above and click **Get Values**. Once the X, Y, and Z are populated with values, click **Next.**


DS2 Arm Calibration
Tip Waste Hole Position
Waste Position
Mount a reagent tip on the end of the spigot. Move the spigot and tip to the waste hole. Center the tip in the hole and move the spigot down until it stops. Click "Get Values".
X
Y
Z
Get Values
Waste Hole
Present Upper Plate
Present Lower Plate
< Back
Next >
OK
Cancel

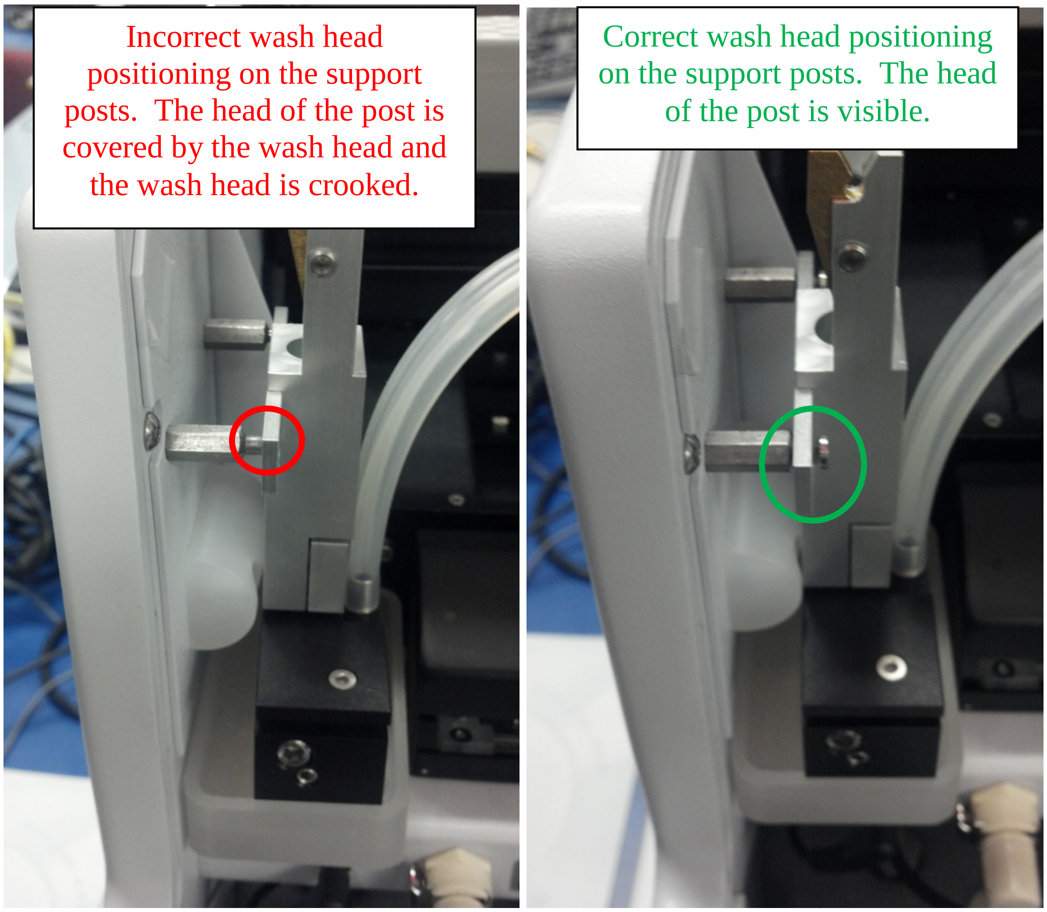
This calibration position is for the **wash head pick up position**.

Calibrate this position if the wash head is not being picked up successfully, or is not being released successfully.

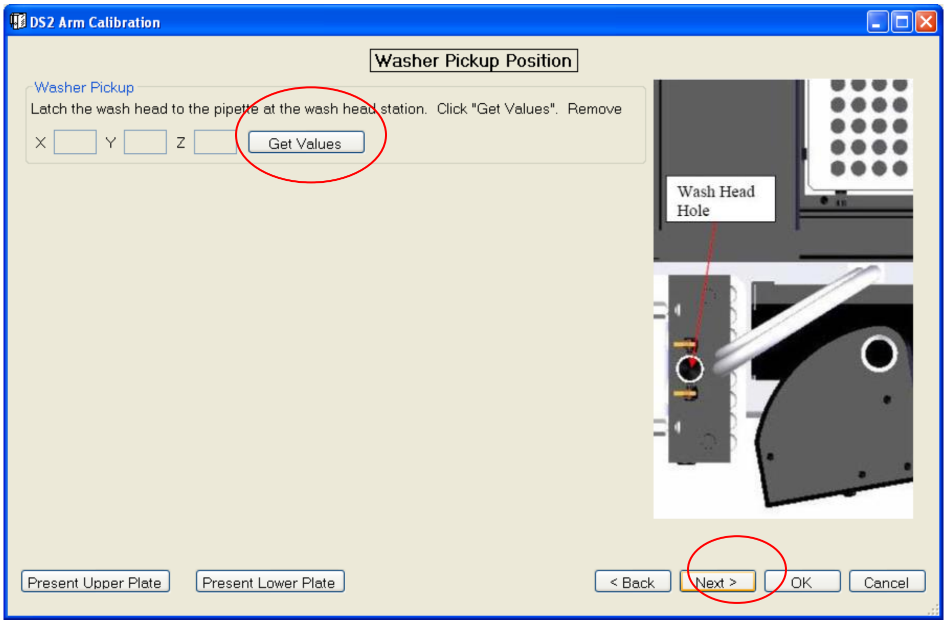
If this position does not require calibration, click **next**.

Technical Tips:

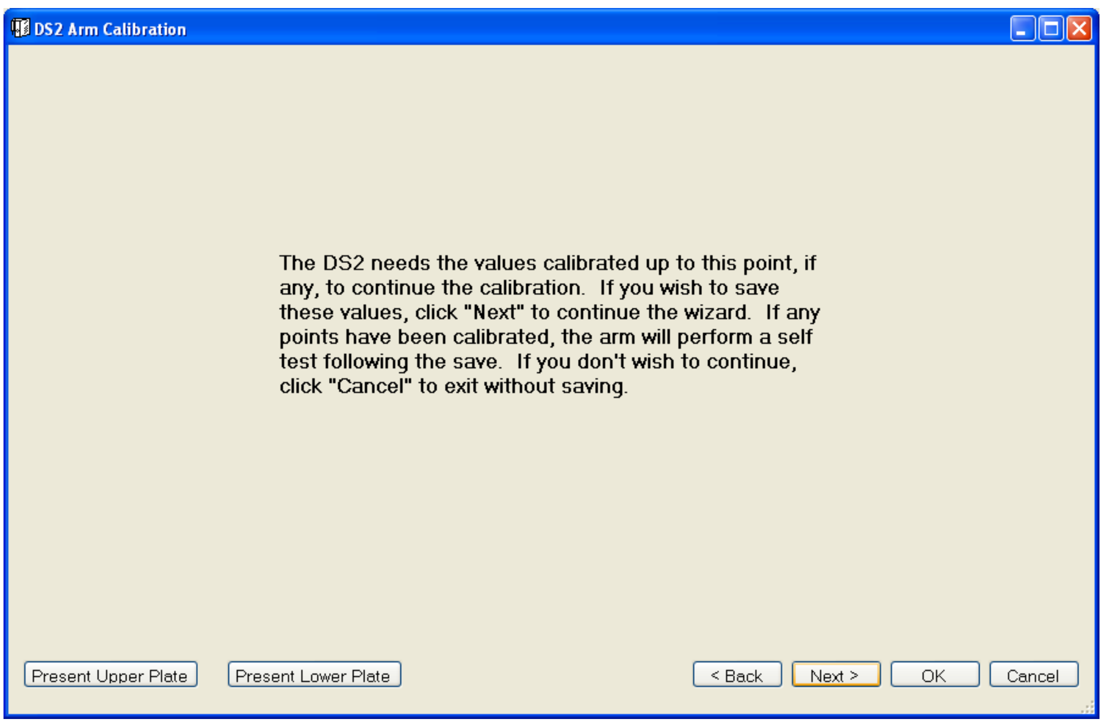
1. Make sure the wash head is positioned correctly on the support posts prior to calibrating this position. Incorrect positioning of the wash head will cause incorrect calibration.



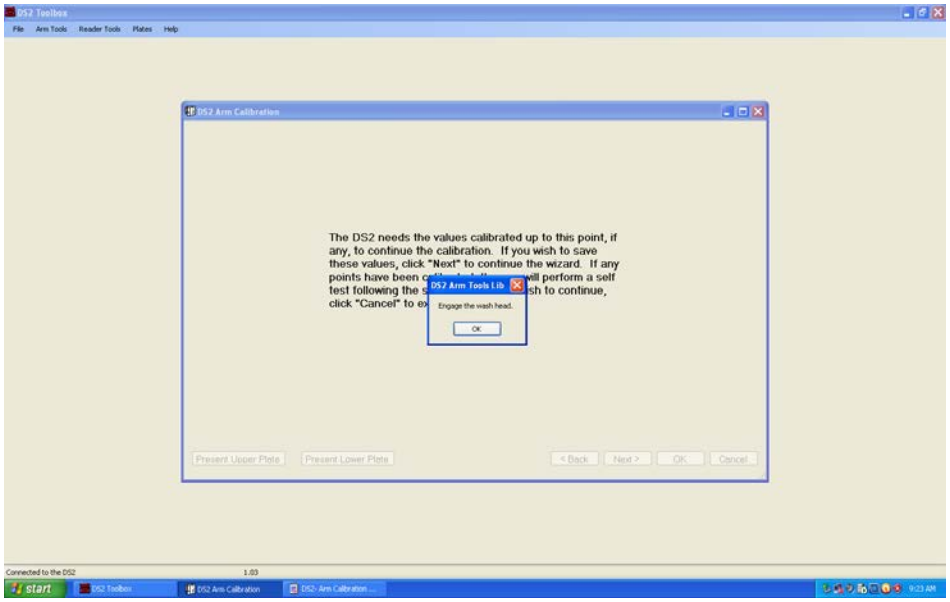
To calibrate this position, make sure the wash head is seated correctly (see technical tips above), follow the instructions on the screen and click **Get Values**. Once the X, Y, and Z values for all 6 positions are populated with values, click **Next.**



When this screen appears, the DS2 is halfway through the calibration wizard. To save any new calibration points, or to continue the wizard to the desired calibration screen, click next.



Engage the wash head when instructed to do so, then click ok.


DS2 Toolbox
File Arm Tools Reader Tools Plates Help
DS2 Arm Calibration
The DS2 needs the values calibrated up to this point, if any, to continue the calibration. If you wish to save these values, click "Next" to continue the wizard. If any points have been c
will perform a self test following the s
sh to continue, click "Cancel" to ex
DS2 Arm Tools Lib
Engage the wash head.
OK
Present Upper Plate
Present Lower Plate
< Back
Next >
OK
Cancel
Connected to the DS2
start
DS2 Toolbox
DS2 Arm Calibration

This calibration position is for the **wash head pin positions in the plate**.

Calibrate this position if the wash head pins are not centered, if the wash head is scratching the bottom of the plate during aspiration, if wash solution is dispensing outside of the plate, if incomplete aspiration is occurring, or if results indicate a washing issue.

If this position does not require calibration, click **next**.

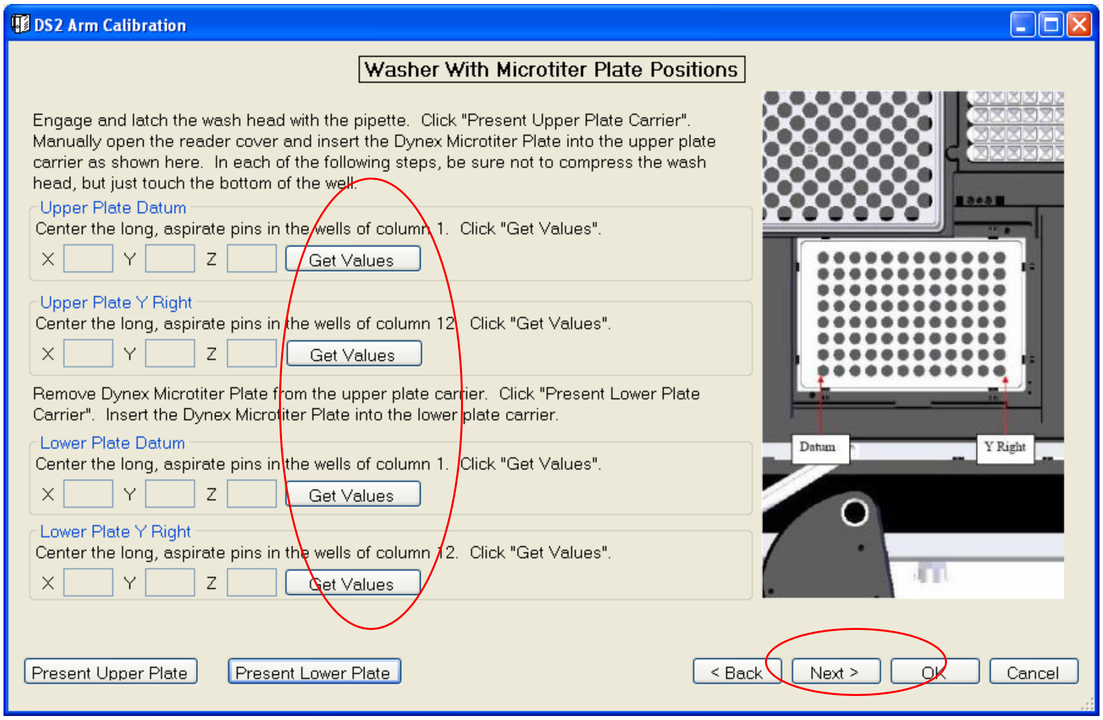
Technical Tips:

1. The spring gap must be kept open when calibrating the wash head positions in the plate. Put sample tips in the spring gap to keep the gap from closing. This will allow the aspiration pins to come in contact with the plate bottom, without compressing the spring. See picture below.

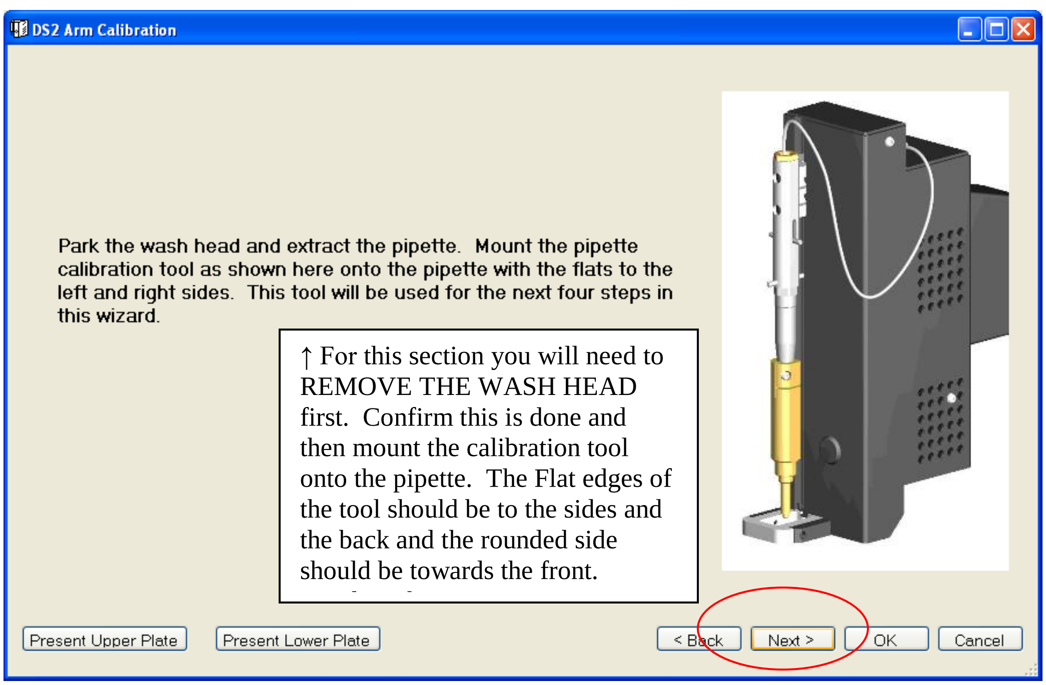
2. Please note: The plate carriers will move if you apply too much force while performing the calibration. Be gentle when inserting the aspiration pins into the white well inserts in the plate, taking care not to move the plate carrier around. If the plate carrier is moved, calibration values will be incorrect.

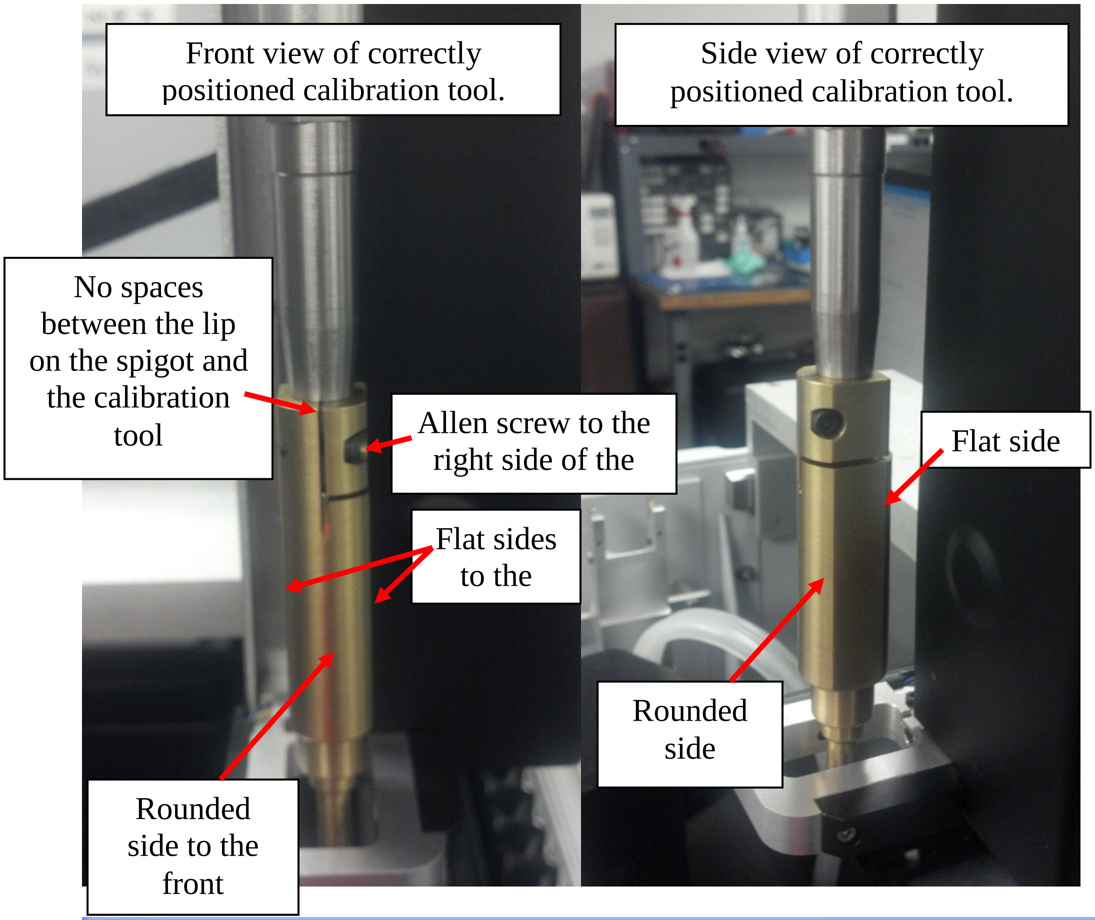
3. Be very careful when clicking “get values”. Make sure that the plate is in the plate carrier corresponding to the “get values” you are clicking. For example, when clicking “Get Values” for Upper Plate Datum, make sure the plate is actually in the Upper Plate carrier.

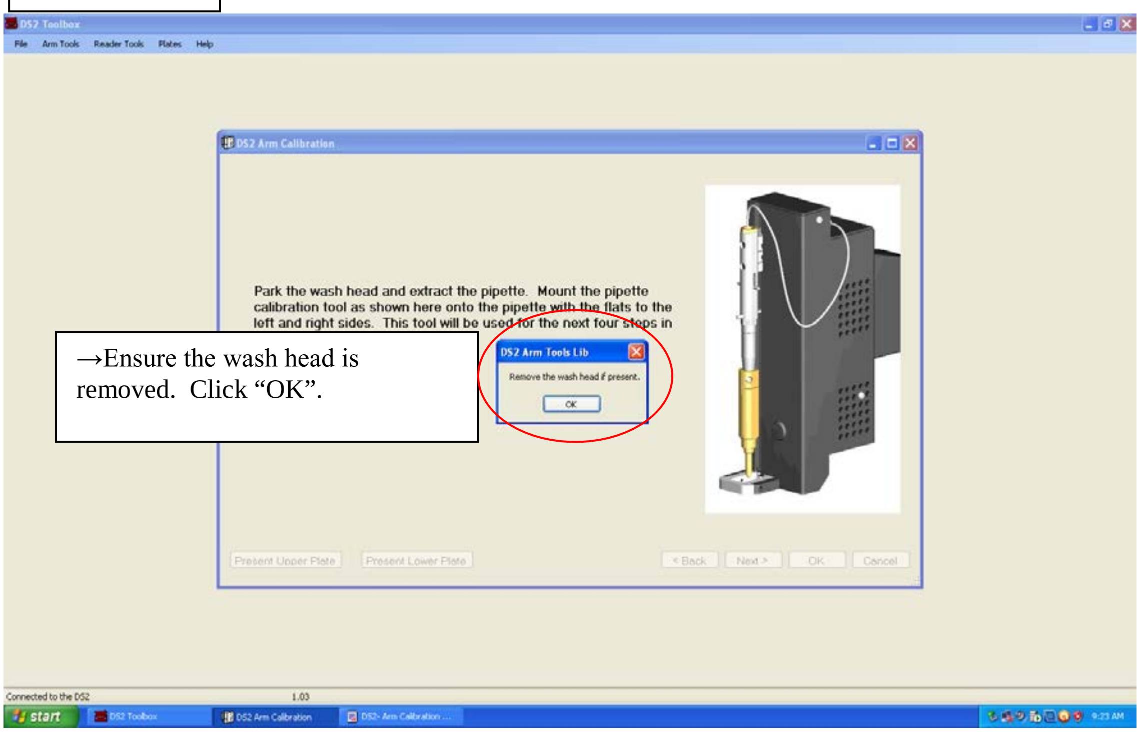
To calibrate this position, use the DS2 Calibration plate. Follow the instructions on the screen and the Technical Tips above when calibrating. Click **Get Values** for the Datum and Y Right positions in the upper plate carrier. Remove the DS2 Calibration plate from the plate carrier and make sure the wash head and pipette are off to the side. Click “Present Lower Plate” at the bottom of the screen. Insert the DS2 Calibration Plate when prompted, taking care not to move the plate carrier. Click “OK” prior to putting the wash head in the plate to avoid damaging the instrument. Click **Get Values** for the Datum and Y Right positions in the lower plate carrier. Once the X, Y, and Z values for all 4 positions are populated with values, click **Next.**

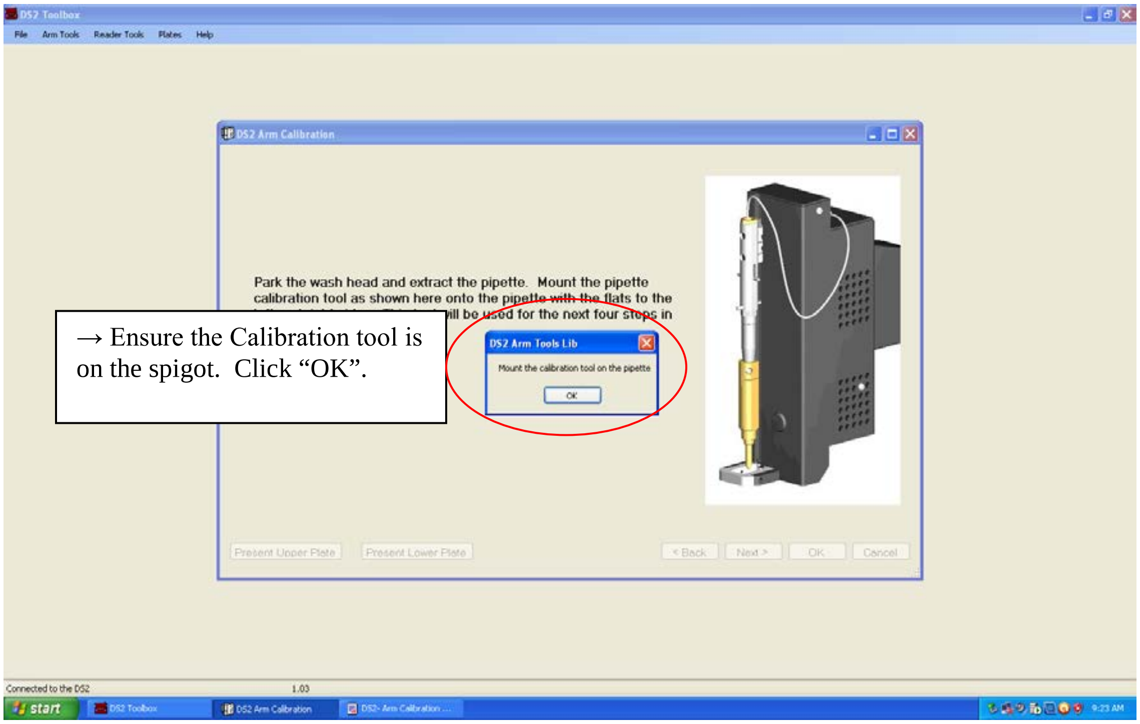


To park the wash head, move the wash head back over and place it on the support posts. Remove the spigot from the wash head by pulling upwards until the pins on the spigot come out of the clamps on the wash head. Once the spigot is removed from the wash head, ensure the wash head is still correctly positioned on the support posts, so there are not wash head pick up issues later on. Reference page 13 of this guide for a picture of correct wash head placement on the support posts.




Front view of correctly positioned calibration tool.
Side view of correctly positioned calibration tool.
No spaces between the lip on the spigot and the calibration tool
Allen screw to the right side of the
Flat sides to the
Rounded side to the front
Flat side
Rounded side


DS2 Toolbox
File Arm Tools Reader Tools Plates Help
DS2 Arm Calibration
Park the wash head and extract the pipette. Mount the pipette calibration tool as shown here onto the pipette with the flats to the left and right sides. This tool will be used for the next four steps in
DS2 Arm Tools Lib
Remove the wash head if present.
OK
Present Upper Plate
Present Lower Plate
< Back
Next >
OK
Cancel
Connected to the DS2
1.03
→Ensure the wash head is removed. Click “OK”.


DS2 Toolbox
File Arm Tools Reader Tools Plates Help
DS2 Arm Calibration
Park the wash head and extract the pipette. Mount the pipette calibration tool as shown here onto the pipette with the flats to the
ill be used for the next four steps in
DS2 Arm Tools Lib
Mount the calibration tool on the pipette
OK
→ Ensure the Calibration tool is on the spigot. Click "OK".
Present Upper Plate
Present Lower Plate
< Back
Next >
OK
Cancel
Connected to the DS2
1.03
start
DS2 Toolbox
DS2 Arm Calibration

This calibration position is for the **sample and reagent tip positions when dispensing fluid to the plate**.

Calibrate this position if the sample/reagent tip is not centered in the well, if fluid is being dispensed outside the well, if the tip is dragging across the top of the well as it dispenses reagent, if the air gap pulled up between wells is not clean (fluid is pulled up instead of air).

If this position does not require calibration, click **next**.

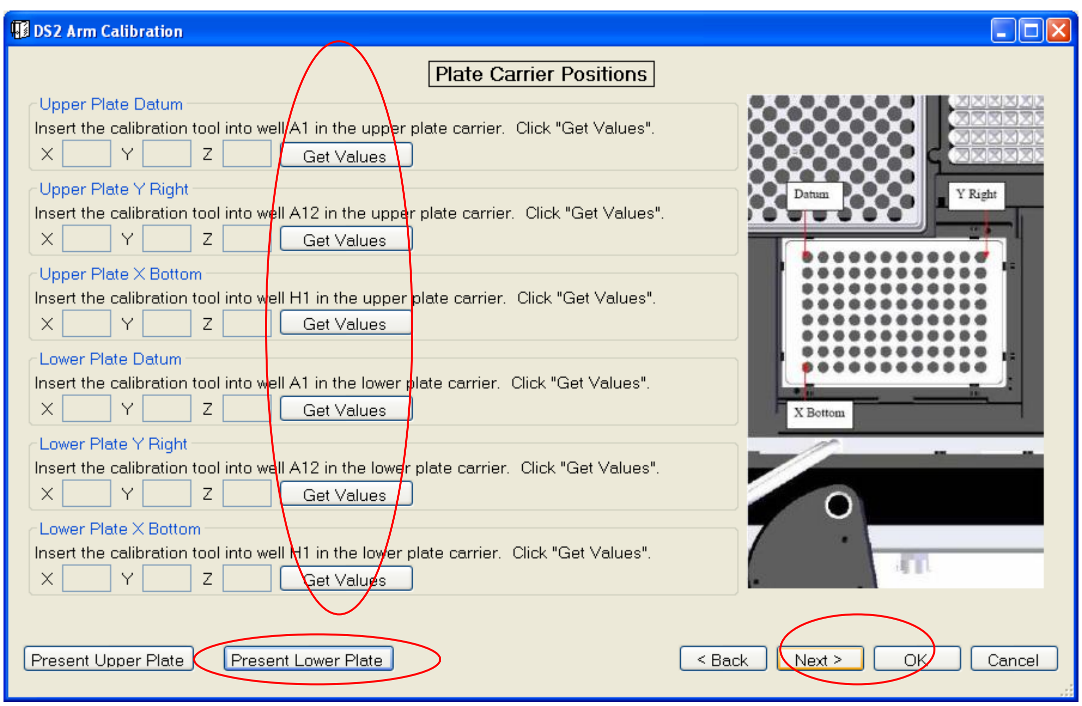
Technical Tips:

1. Please note: The plate carriers will move if you apply too much force while performing the calibration. Be gentle when inserting the calibration tool into the wells in the DS2 Calibration Plate, taking care not to move the plate carrier around. If the plate carrier is moved, calibration values will be incorrect. Make sure the calibration tool is in contact with the bottom of the well for each of the calibration positions.

2. Be very careful when clicking "get values". Make sure that the plate is in the plate carrier corresponding to the "get values" you are clicking. For example, when clicking "Get Values" for Upper Plate Datum, make sure the plate is actually in the Upper Plate carrier.

To calibrate this position, use the DS2 Calibration plate. Remove the DS2 Calibration plate from the instrument, Click "Present Upper Plate", Insert the plate in the upper plate carrier and Click OK.

Follow the instructions on the screen and the Technical Tips above when calibrating. Click **Get Values** for the Datum, Y Right, and X Bottom positions in the upper plate carrier. Remove the DS2 Calibration plate from the plate carrier and make sure the calibration tool and pipette are off to the side and clear of the plate carrier. Click "Present Lower Plate" at the bottom of the screen. Insert the DS2 Calibration Plate when prompted, taking care not to move the plate carrier. Click "OK" prior to putting the calibration tool in the plate to avoid damaging the instrument. Click **Get Values** for the Datum, Y Right, and X Bottom positions in the lower plate carrier. Once the X, Y, and Z values for all 6 positions are populated with values, click **Next.**



This calibration position is for the **sample tube positions**.

Calibrate this position if you suspect the system is not tracking fluid correctly in the sample tubes.

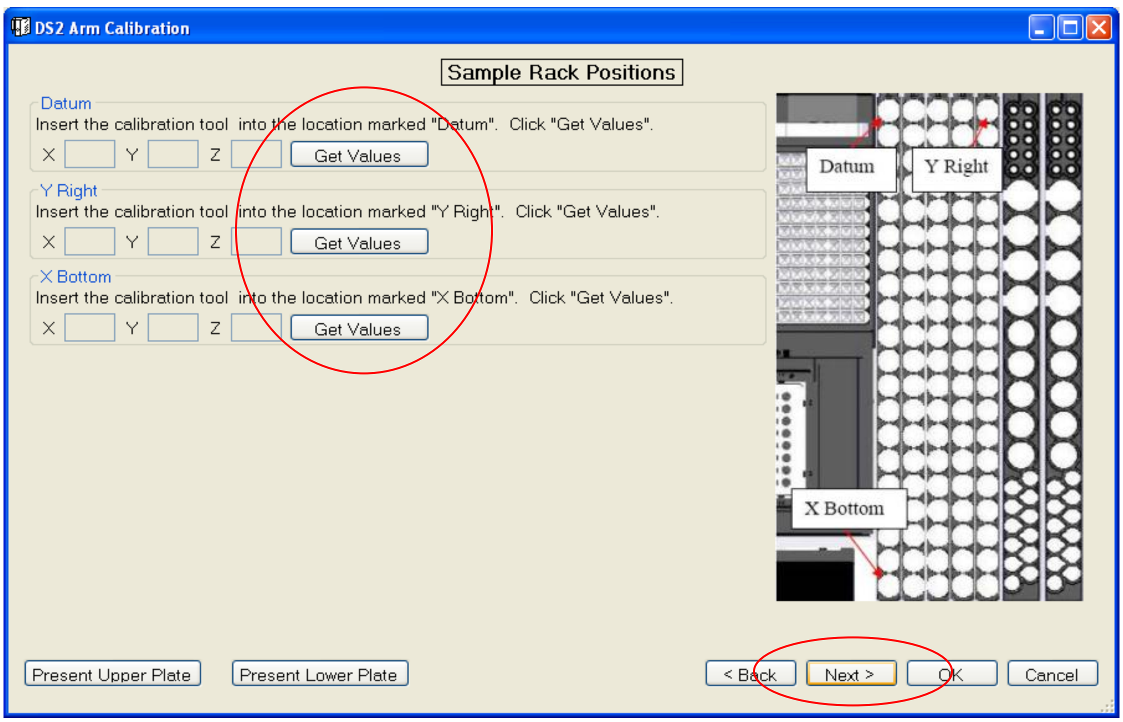
If this position does not require calibration, click **next**.

Technical Tips:

1. Please note: Make sure the calibration tool is touching the bottom of the rack. The lip of the tool can catch on the sample holder and feel like it is down all the way, when actually it is not.

2. Make sure the sample racks are pushed in all the way. If the racks are not positioned correctly, the calibration points will be incorrect. The racks should not move/tilt to the left or right when inserting the tool.

Follow the instructions on the screen and the Technical Tips above when calibrating. Click **Get Values** for the Datum, Y Right, and X Bottom positions. Once the X, Y, and Z values for all 3 positions are populated with values, click **Next.**



This calibration position is for the **reagent tube positions**.

Calibrate this position if you suspect the system is not tracking fluid correctly in the reagent tubes.

If this position does not require calibration, click **next**.

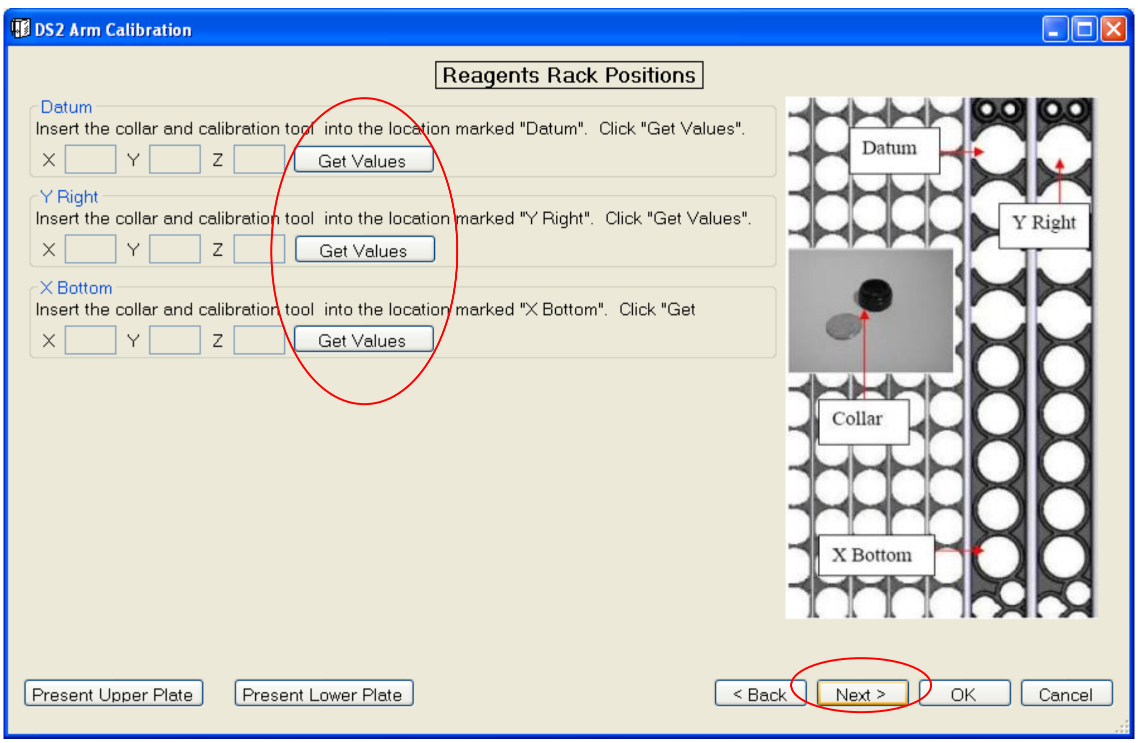
Technical Tips:

1. Please note: This calibration uses the calibration collar. Make sure the calibration collar is inserted and pushed down as far as it will go into the correct reagent tube position.

2. Please note: Make sure the calibration tool is touching the bottom of the rack.

3. Make sure the reagent racks are pushed in all the way. If the racks are not positioned correctly, the calibration points will be incorrect. The racks should not move/tilt to the left or right when inserting the tool.

Follow the instructions on the screen and the Technical Tips above when calibrating. Click **Get Values** for the Datum, Y Right, and X Bottom positions. Once the X, Y, and Z values for all 3 positions are populated with values, click **Next.**



This calibration position is for the **control tube positions**.

Calibrate this position if you suspect the system is not tracking fluid correctly in the control tubes or if the sample tip is not centered in the control tube.

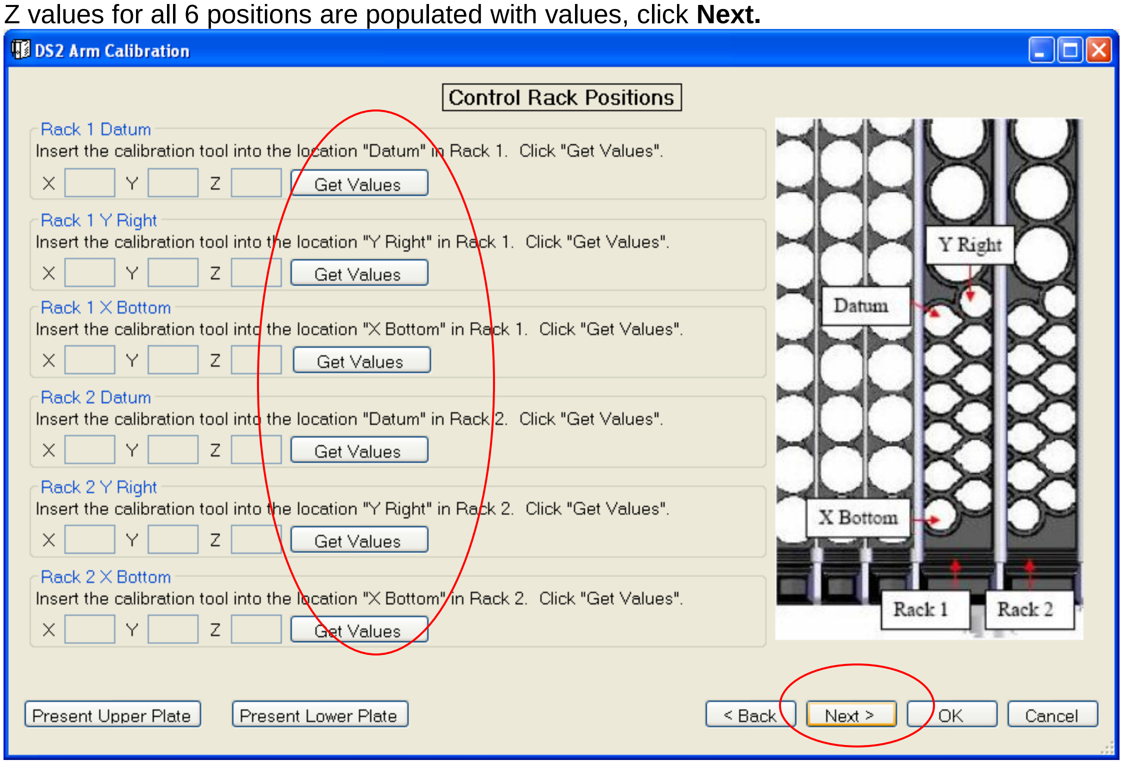
If this position does not require calibration, click **next**.

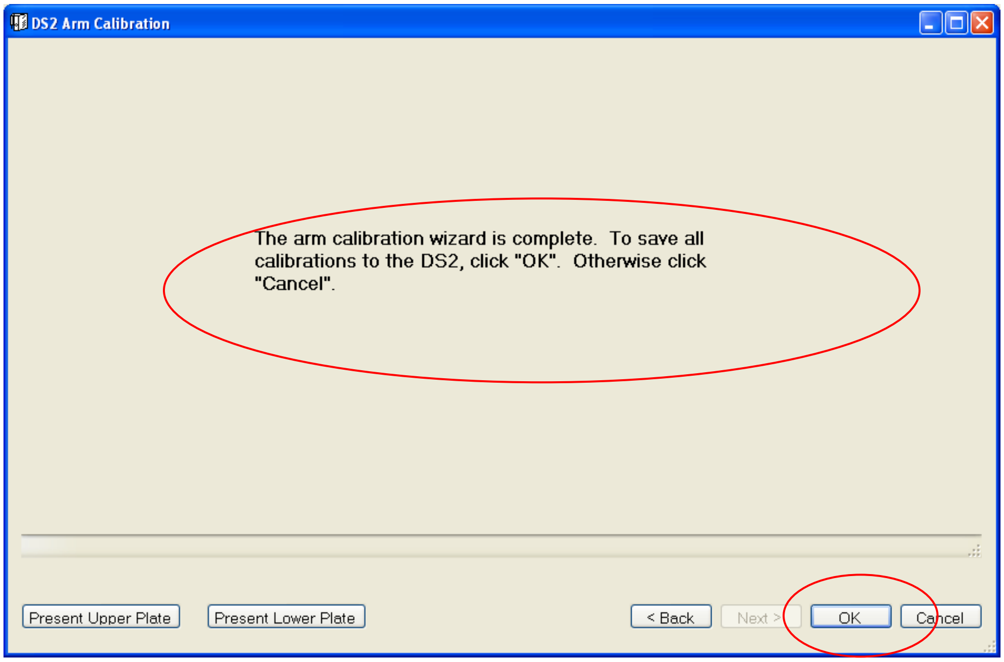
Technical Tips:

1. Please note: Make sure the calibration tool is touching the bottom of the rack.

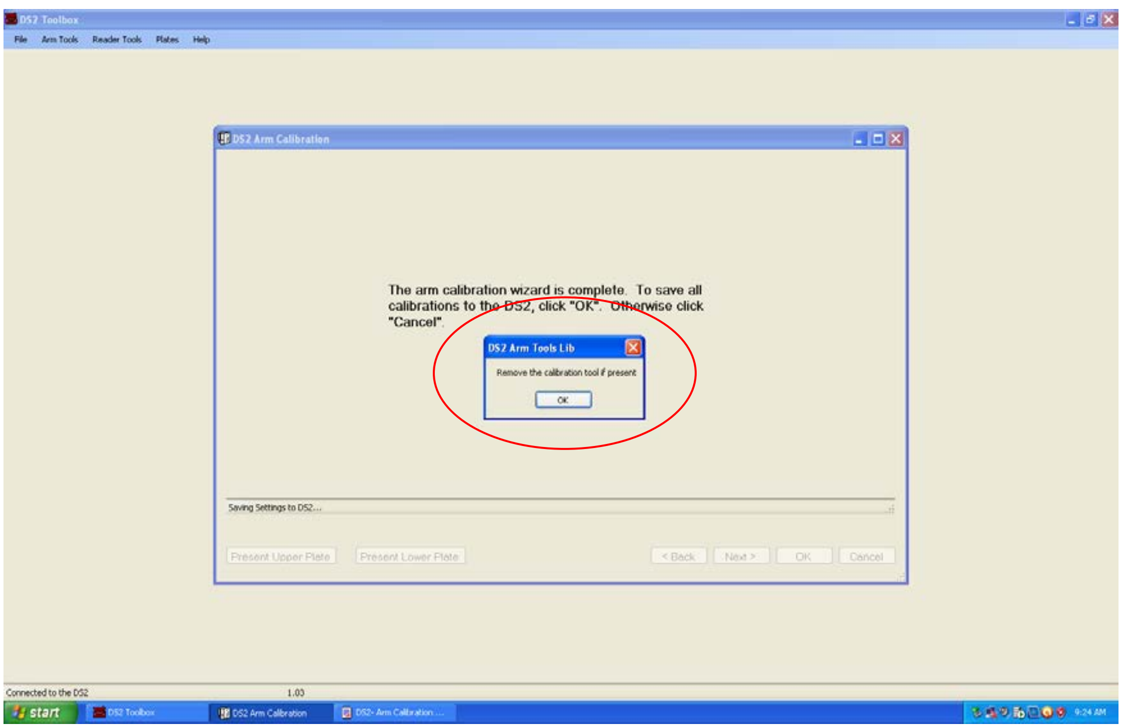
2. Make sure the reagent racks are pushed in all the way. If the racks are not positioned correctly, the calibration points will be incorrect. The racks should not move/tilt to the left or right when inserting the tool.

Follow the instructions on the screen and the Technical Tips above when calibrating. Click **Get Values** for the Datum, Y Right, and X Bottom positions for rack 1 and rack 2. Once the X, Y, and Z values for all 6 positions are populated with values, click **Next.**

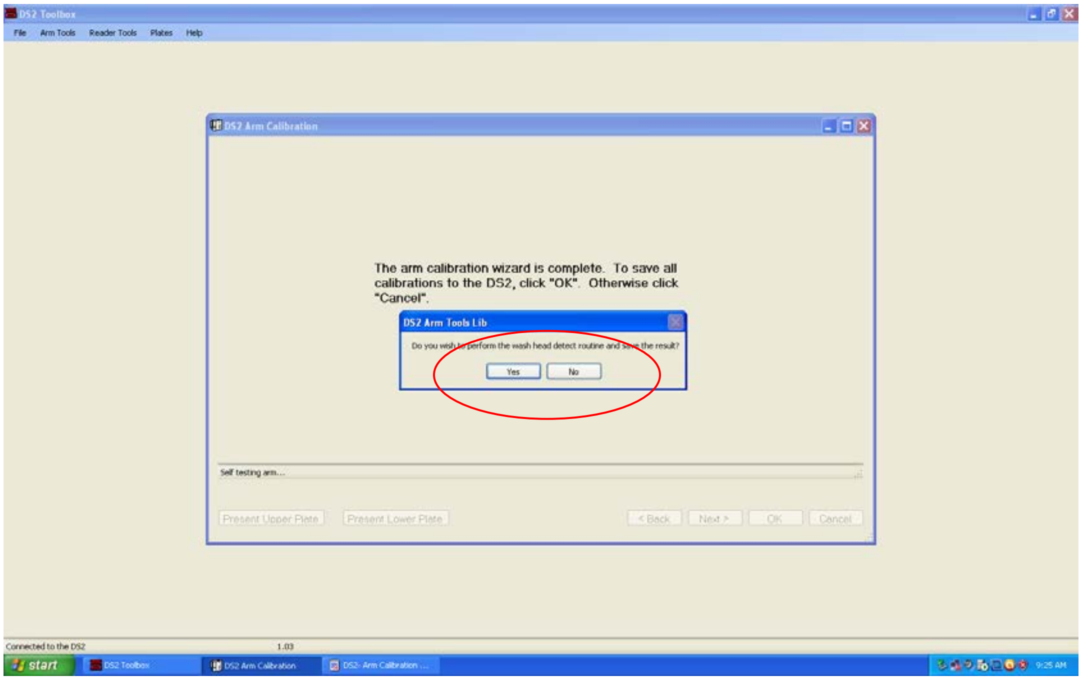


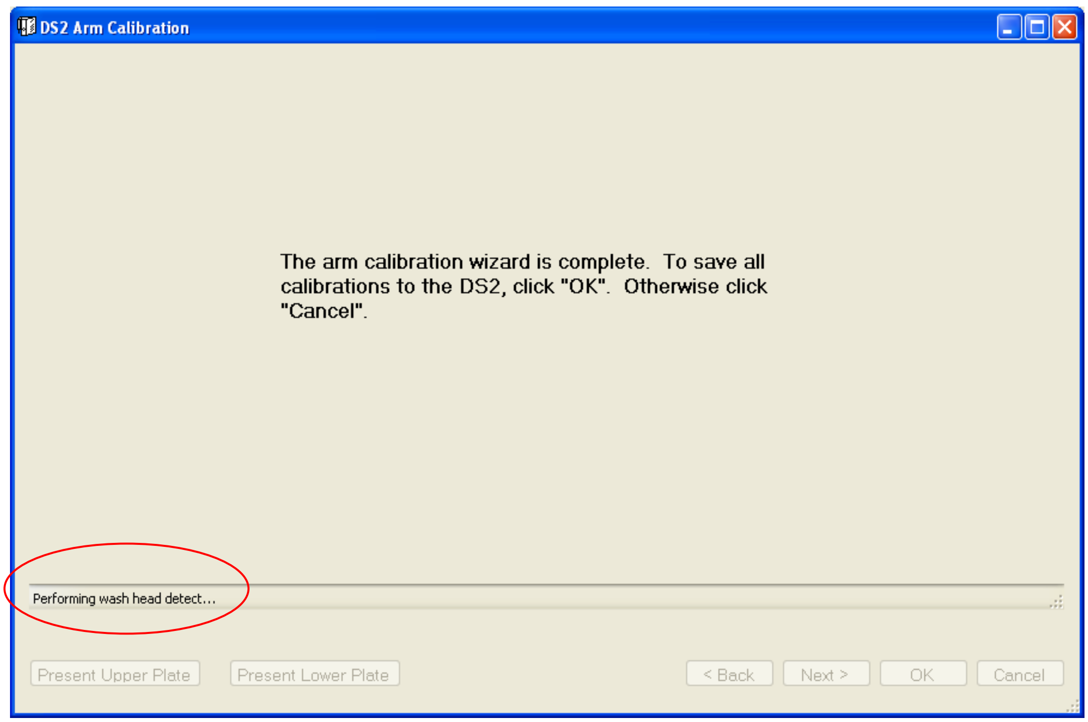


Remove the Calibration tool using the allen wrench. Click OK when done.

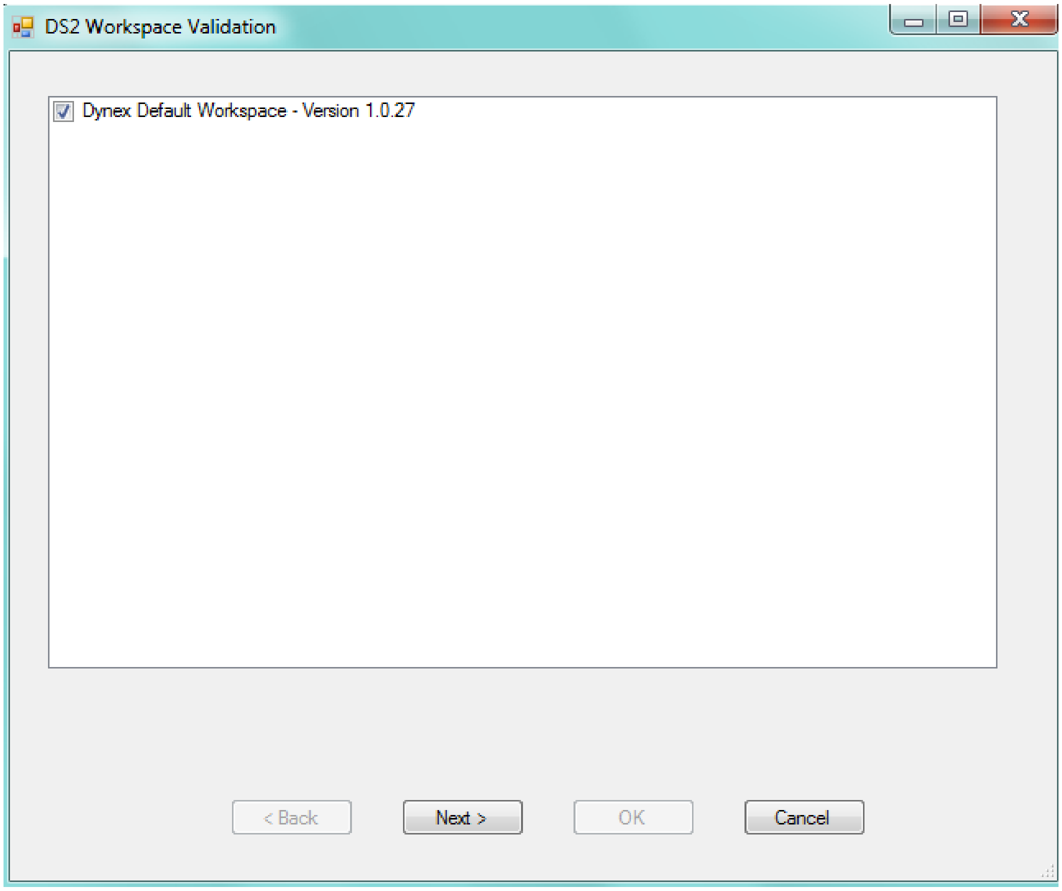


The wash head detect routine calibrates the wash head magnet and sensor positions. Always say “Yes” to perform the wash head detect routine.





Depending on the version of the DS2 toolbox you are running, you may or may not see the following screen after performing the wash head detect routine (Toolbox 1.03 will show this screen):



If you do see this screen, click the “Next” Button. If it result says “Pass”, the calibration is complete. If it the workspace validation fails, click OK to view the report and repeat the arm calibration for any positions detailed in the report. Please note, this workspace validation is only checking for impossible values (like negative numbers); it is not checking that the values are correct or within average expected ranges. If you calibrated the upper plate instead of the lower plate, this validation will pass, but your values for those calibration points will still be incorrect.

Once calibration is complete, save the arm calibration values again following the instructions on page 2. <u>Make sure to use a unique identifier for the file name in addition to the date so the file will not overwrite</u>.

After the arm calibration values have been saved, exit the DS2 Toolbox Software and **open the DS-Matrix software and run the assay from your list of assays called “Installation Assay”.** Choose to run 2 or 3 samples and when the system requests fluids, simply load bottles containing water. Load the plate used for start-up when the software asks for a plate to be loaded on the system. This assay will check the movement of the arm following the calibration. Pay special attention to any positions calibrated while the assay is running to confirm the problem requiring calibration has been resolved.

5.17 XYZ Motion Test

To perform the XYZ Motion Test:

1. Select *Calibrate/System/Motor Ramps* to present the *Motor Ramp Parameters* dialog box (Figure 5-82).

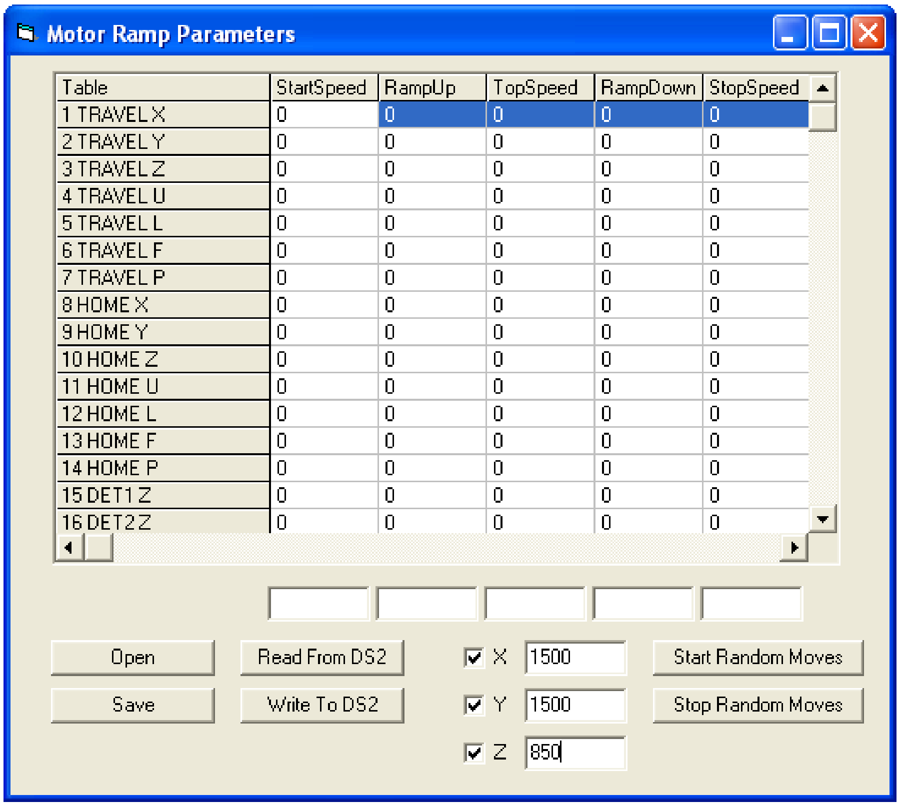


Figure 5-82: Motor Ramp Parameters Dialog Box

2. Set the values for X, Y and Z at the bottom of the screen to 1500, 1500, 850 and verify that the check boxes are checked.

3. Press **Start Random Moves**. The XYZ Arm will start moving to random positions.

4. Allow the DS2 to run for 10 minutes. After 10 minutes, check that the machine is still running and there are no errors.

5. Press **Stop Random Moves** and close the *Motor Ramp Parameters* dialog box.

5.18 Washer Dispense Accuracy Test

To perform the washer dispense accuracy test:

1. Fill both the Wash buffer bottles A and B with 1 L of de-ionized water and install in the DS2. Ensure the test fixture external bottle is at least half full of de-ionized water and plug it into the fluid connector at the rear of the machine.
2. Place an empty flat-bottomed microtiter plate on the scales and re-zero them. Place the Microtiter plate in the upper plate carrier of the DS2.
3. Select the *Washer PrecisionTest* by selecting **Open** on the *File* menu, and selecting *Washer Precision Test* from the list that is presented**.**
4. Follow the on-screen prompts to purge the washer and ensure the wash head dispense line is full of water. The washer will now add 300 µL of water into to each well in the plate.
5. When the filling is complete, remove the plate and immediately weigh it. Enter the weight value into the “Washer Dispense Accuracy test” section under “Bottle A, plate [g]” of the Excel Final Verification Report. The report will indicate if the weight passes or fails.
6. If bottle A passes the verification, proceed with bottles B and C as in 2 & 3 above. In the worklist, under Washer Volume in both washer functions, change the bottle to B (or C as needed) and rerun the worklist. All three bottles must pass the verification. Close the worklist, answering **No** to the *Save* question.

5.19 Washer Residual Volume Accuracy

To perform the washer residual volume accuracy test:

1. Place an empty flat-bottomed microtiter plate on the scales and re-zero them. Place the microtiter plate in the upper plate carrier of the DS2.
2. Select the *Washer Residual VolumeTest* by selecting ***Open*** on the *File* menu, and then selecting **Washer Residual Accuracy Test** from the list that is presented**.**
3. Run the worklist. The washer will dispense 300 µL of water into each well and then aspirate the plate using *Normal sweep*.
4. When the aspiration is complete, remove the plate and immediately weigh it. Enter the weight value into the *Washer Residual Volume Accuracy* section under *Upper Plate Normal Sweep, plate [g]* of the Excel Final Verification Report. The report will indicate if the weight passes or fails.
5. Place the microtiter plate back into the upper plate carrier of the DS2 (Note: Do not re-zero the scales) and select *Super* sweep;
6. Run the worklist. The washer will now dispense 300 µL of water into each well and then aspirate the plate using *Super sweep*. Proceed as before, weighing the plate and entering this value into the “Upper Plate Super Sweep” section.
7. Select the *Present Lower Plate* icon. Place the microtiter plate into the lower plate carrier of the DS2 (Note: Do not re-zero the scales).
8. In the same worklist, change to *Lower* plate, *Normal* sweep. The washer will now dispense 300 µL of water into each well and then aspirate the plate using *Normal sweep*. When the aspiration is complete, remove the plate and immediately weigh it. Enter the weight value into *Lower Plate Normal Sweep, plate [g]*.
9. Place the microtiter plate back into the lower plate carrier of the DS2 (Note: Do not re-zero the scales) and select *Super sweep*; to run the worklist. The washer will now dispense 300 µL of water into each well and then aspirate the plate using *Super sweep*. Proceed as before, weighing the plate and entering this value into the *Lower Plate Super Sweep* section.

All four tests must pass. Close the worklist and answer “No” to the “Save” question.

5.20 Washer Precision Test

To perform the Washer Precision Test:

1. Remove wash bottle A and install the Red Dye solution test bottle, filled with 1 L of Red Dye Solution (mixing ratio of 750 µL of Rayner's red food colour / 500 mL distilled water).
2. Press the **Present Upper Plate** icon. Place a new, empty flat-bottomed microtiter plate in the upper plate carrier of the DS2.
3. Select *Open/Worklist/Washplate.ddf* and run the worklist. The washer will purge the dispense lines with red dye solution and dispense 300 µL into each well of the plate. Close the worklist, answering **No** to the *Save* question.
4. Select *Open/Worklist/Read Plate once.ddf* and run the worklist. The reader will read the plate and the results will be displayed at the bottom of the worklist.
5. Copy the results from the worklist and paste them into the Excel Final Verification Report, under the *Washer OD* section (click the *Washer OD* page tab; then paste the results at A1). Press the *Sheet 1* page tab and verify that the test passed.
6. Close the *Read plate once* worklist, answering **No** to the *Save* question.
7. Remove the Red Dye solution test bottle and replace with wash bottle A. Run the worklist *Wash a plate*, changing the purge volume to 5000 and the sweep type to *None*. While the washer is purging, depress dispense valves B and C momentarily to remove the red dye from these lines. The plate will be washed clean. Remove the plate from the reader and close the worklist, answering *No* to the *Save* question.

5.21 Sample ID Test

To perform the Sample ID Test:

1. Remove all 5 sample racks and slide fixture DS2FIX031 into sample rack position 1.
2. Select *Open/Worklist/Barcoding.ddf* and run the worklist. Press *Start Scanning*. The DS2 will engage the pipette spigot into the barcode scanner.
3. Slide the fixture smoothly all the way out and back in again within 12 seconds. (Note: When the rack is slid out, the arm will position the scanner to the rack being tested; check that this occurs). If the scan is successful, the indicator icon will be solid green. If the scan was unsuccessful, then the indicator icon will be flashing. If this happens, repeat the procedure by sliding the rack out and in slower.
4. If rack position 1 passed, proceed to rack position 2, 3, 4 and 5 until all sample rack positions are tested.
5. If all tests pass, copy the results from the worklist and paste them into the Excel Final Verification Report, under the *Barcodes* section (click the Barcodes page tab, then paste the results at the upper-left in Actual Code Reads). Click the *Sheet 1* page tab and verify that the test passed.
6. f) Click “End Scanning”, then close the worklist, answering “No” to the “Save” question.

5.22 Shake Test

To perform the Shake test:

1. Place the shake test plate into the upper plate carrier with the ferrous strip bracket towards the rear.

2. Select *Open/Worklist/Shake Test.ddf* and run the worklist. The reader shakes the upper plate on the Low setting for 20 seconds.

3. Measure the frequency using the BRECO flex meter. Position the meter's sensor 1 to 2 mm from the plate's ferrous strip during the shake. Take several readings by pressing the red button on the meter and reading the display. Discard the highest and lowest reading, retaining 3 readings for recording. Enter these readings into the *Excel Final Verification Report*, under the *Shake* section (click the *Shake* page tab and record the values in the *Upper plate, low frequency* table).

4. In the worklist, change the frequency to *Mid* and run the worklist again. Repeat step 3, recording these values in the Upper plate, mid frequency table. Change the frequency to *High* and run the worklist again. Repeat step 3, recording these values in the Upper plate, High frequency table.

5. Remove the shake test plate. Press the *Present Lower Plate* icon. Place the shake test plate into the lower plate carrier with the ferrous strip bracket towards the rear.

6. In the worklist, change the plate to *Lower* and the frequency to *Low*. Repeat steps 3 and 4, recording the respective readings in the lower plate table.

7. Click the *Sheet 1* page tab in the Excel Final Verification Report and verify that the tests passed. Remove the shake test plate and close the worklist, answering **No** to the *Save* question.

5.23 Incubation Test

Follow the DS2 Incubator Verification Test Procedure. Indicate a "PASS" in the "Incubation Test" section of the Excel Final Verification Report.

5.23.1 Assay Test

To perform the assay test"

1. Prepare a red dye solution (referenced below) by mixing 300 mL of distilled water with 2.5 mL of Rayner's red food colour (same as the DSX assay test reading solution).

> ***Note**: When filling containers listed below with red dye solution, always use solution from the same batch. The outcome of this test depends on the plate having consistent OD's from one well to the next, therefore the solution in the containers must have the same concentration of dye.*

2. Load the following into the DS2:

Wash Bottle A filled with 1 liter of de-ionized water

Empty Waste Bottle

Tip Waste Container

25 mL Reagent bottle filled with de-ionized water (position 1)

25 mL Reagent bottle filled with red dye solution (position 2)

22 2 mL control bottles filled with red dye solution (positions 1 – 22)

4 Dilution strips (loaded toward front of unit)

10 Reagent Tips in Reagent Rack 1

1 full rack of Sample Tips

8 12mm x 75mm Sample tubes filled with red dye solution in sample rack 1, positions 1 to 8 Microtiter plate in the upper carrier

3. Initialize the system by pressing the *Load Sample Tips* icon and then the *Load Reagent Tips* icon.

4. Select *Open/Worklist/Pipetting.ddf* and run the worklist. The DS2 will now perform the plate preparation (dispense 100 µL of red dye in each well of the Microtiter plate) and perform a plate read.

5. Copy the results of the plate read from the worklist and paste them into the Excel Final Verification Report, under the *Assay Results* section (click the *Assay Results* page tab, then paste the results at A1 under *Plate read before wash w/ 405 filter*).

6. Click the *Sheet 1* page tab and verify that the test passed (under Assay Test *Upper Plate Read*" and *Median Error Range %*) and continue only if it has. Close the worklist, answering **No** to the **Save** question.

7. Open the *Reading and Washing* worklist and press **Play**. The DS2 will now perform the plate processing.

8. Copy the results of the plate read from the worklist and paste them into the Excel Final Verification Report, under the "*Assay Results*" section (click the "**Assay Results**" page tab, then paste the results at A1 under "*Plate read after wash and shake and reagent pipetting w/ 405 filter*").

9. Click the *Sheet 1* page tab and verify that the test passed (under Assay Test *Upper Plate Read after Wash/Shake*") and continue only if it has. Close the worklist, answering **No** to the *Save* question.

10. Print the Final Verification Report; sign and date it and place it into the instrument's envelope.

11. Remove and store all red dye solution containers and partial tip boxes for future use. Remove and discard the Microtiter plate and deep well dilution strips. Empty the waste bottle, the wash bottles and the tip waste container. Power down the DS2 and close DeeSoft.

Chapter 6 Removing the Covers and the Gas Spring

6.1 Gas Spring Retrofit

The DS2 Gas Spring (Part No 42000610), like all gas springs, loses pressure over time. Dynex is introducing a new Adjustable Gas Spring system in order to prolong the functional life of the cover mechanism.

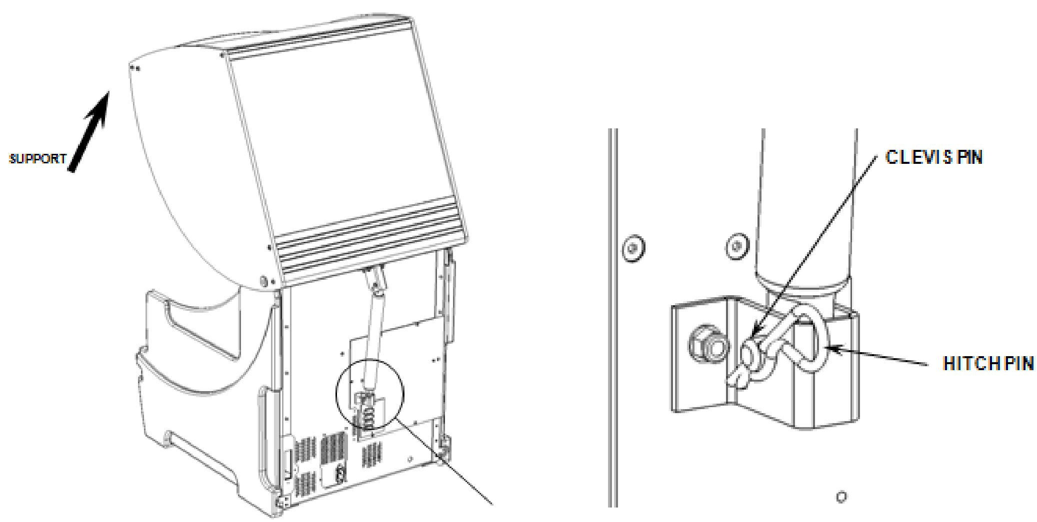
The Gas Spring Retrofit Kit (Part No. 13501510) will include a new gas spring, mounting bracket and hardware. Follow the instructions in this bulletin when replacing your DS2 gas spring.

This gas spring has been incorporated into all DS2 instruments beginning with serial number 1DSA-0564.

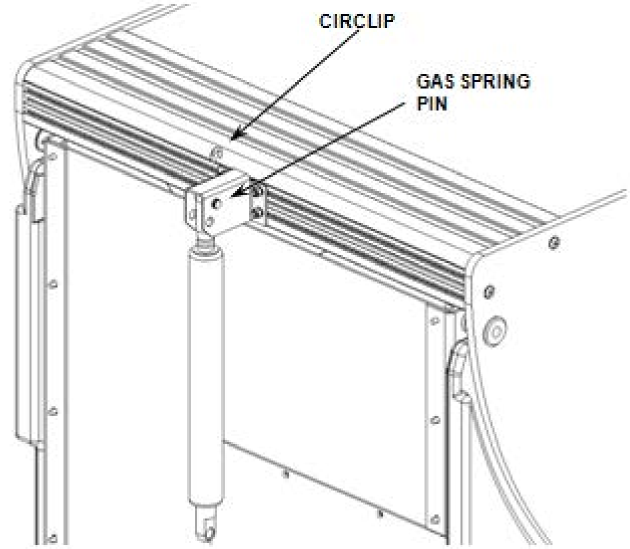
During the annual preventive maintenance visit a cover check is to be performed (TB118). If the cover does not remain open at the recommended height, complete the adjustments described in the following procedure.

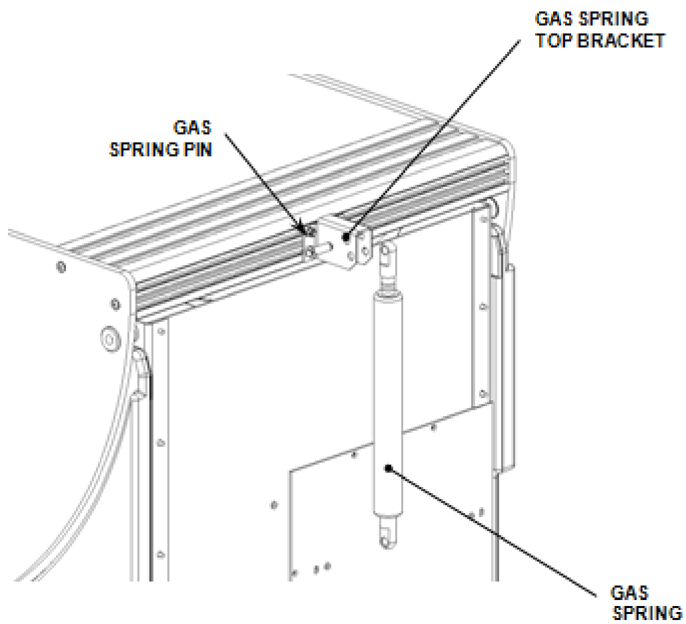
1. With the Cover open and **supported**, remove the Hitch Pin and Clevis Pin from the bottom of the Gas Spring.

   NOTE: ALWAYS SUPPORT THE COVER BEFORE REMOVING THE CLEVIS PIN.

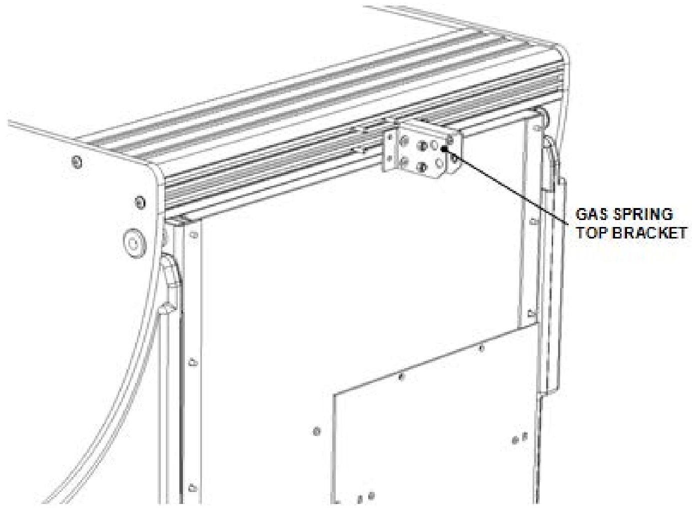


2. Carefully close the Cover and remove one Circlip (312200900) from the Gas Spring Pin (23501041), remove the Pin and Gas Spring and from the Gas Spring Top Bracket.

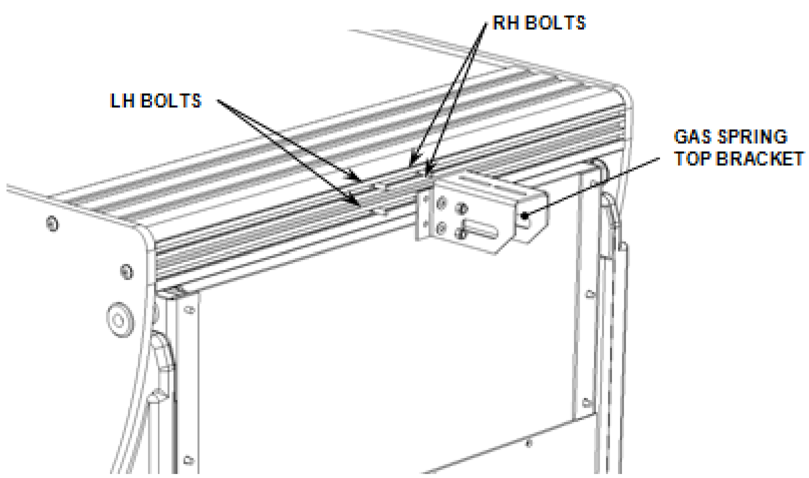




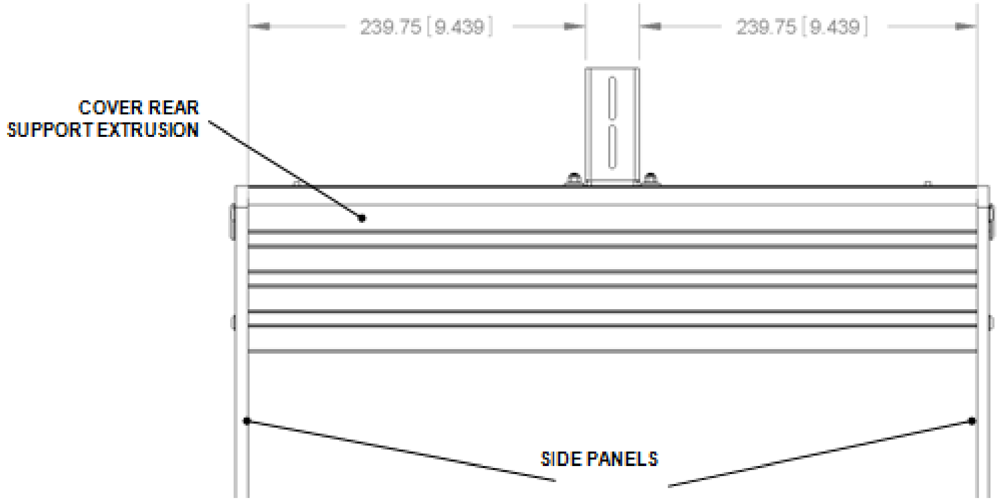
3. Disconnect the existing Gas Spring Top Bracket (22500524) from the Bolts by unscrewing the four M4 Nyloc Nuts (306300400) and removing the four M4 Flat Washers (309300400).



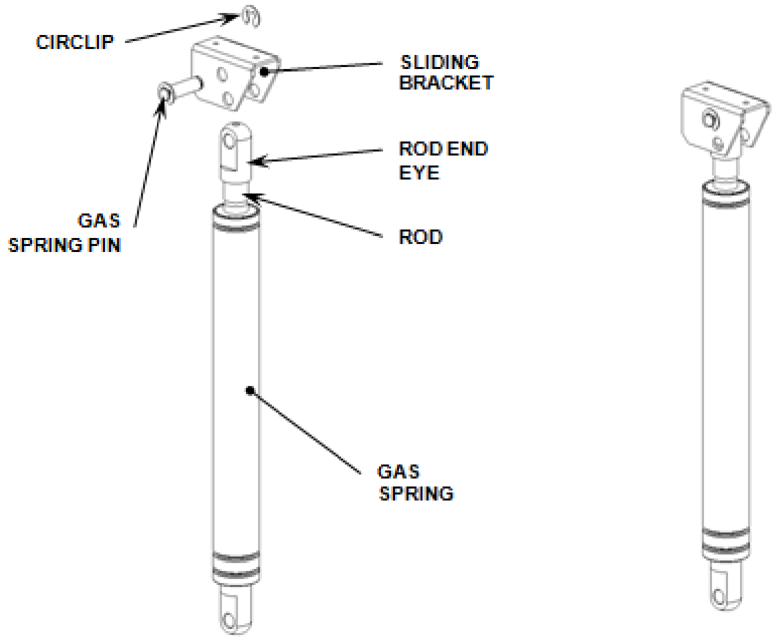
4. Adjust the position of the bolts by sliding the two right hand bolts 7mm [0.0275”] to the right and the two left hand bolts 7mm to the left (The Bolts are free to move within the Extrusion). Locate the new Gas Spring Top Bracket (22500525) over the Bolts and secure using the four M4 Flat Washers (309300400) and the four M4 Nyloc Nuts (306300400). Note: The Gas Spring Top Bracket must be positioned as shown, before fully tightening the nuts.



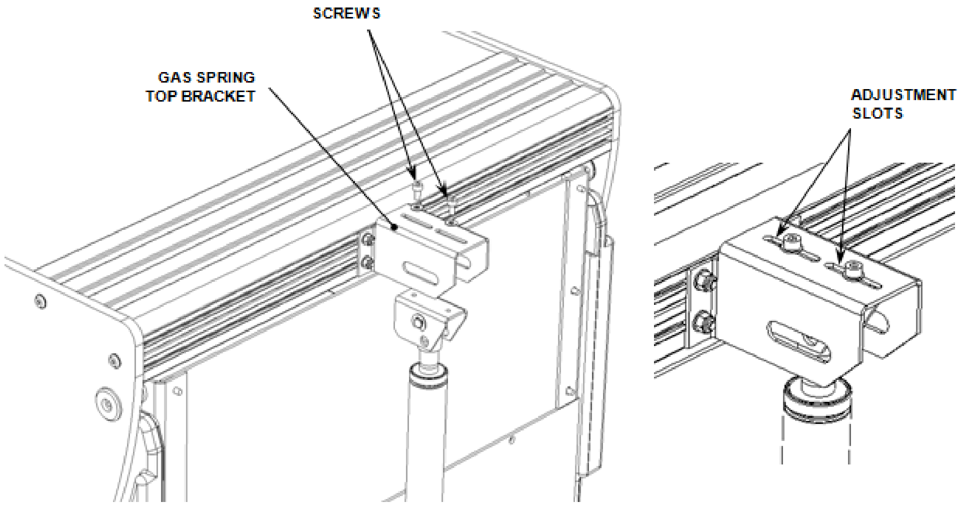
Ensure that the new Gas Spring Top Bracket is central to the Cover Rear Support Extrusion as the Blue Cover Side Panels can vary in width.



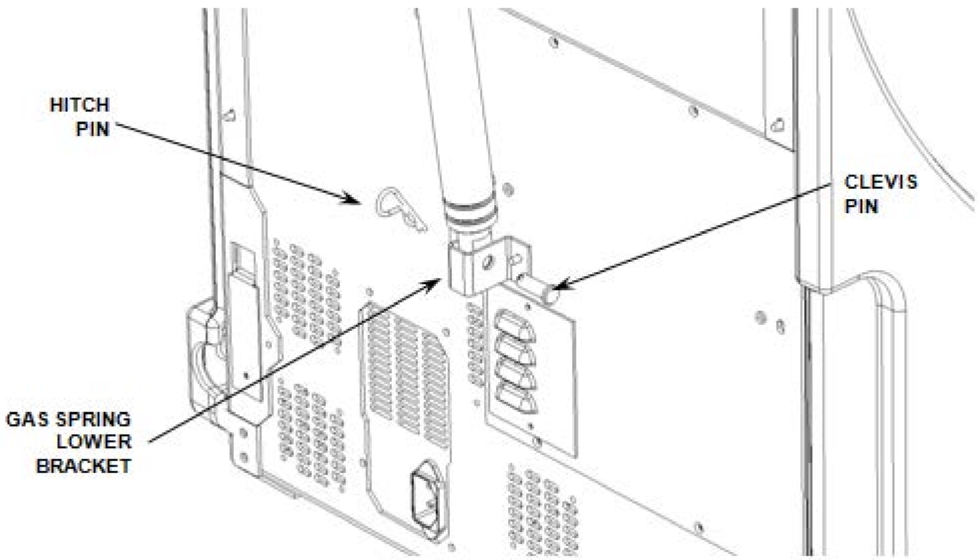
5. Remove the second circlip from the original Gas Spring Pin and fit it in to a groove in the New Gas Spring Pin (23504680). Locate the New Gas Spring (42000611) in to the Gas Spring Sliding Bracket (22502580), slide the pin through the top hole in the Bracket and the eye of the Gas Spring, and fit the second circlip.
NOTE: Orient the gas spring so that the Rod End Eye is attached to the Bracket.



6. Fix the Gas Spring Assembly to the Gas Spring Top Bracket using two M4 x 8 Cap Head Screws (307300408) and two M4 Flat Washers (309300400). Position the Sliding Bracket so that the screws are central to the Adjustment Slots.



7. Raise and support the Blue Cover. Line up the bottom of the Gas Spring with the hole in the Gas Spring Lower Bracket. Fit the Clevis Pin (42000640) through the Bracket and Gas Spring Eye. Secure the Pin in position with the Hitch Pin (42000730).



8. While still supporting the Blue Cover gently close it.

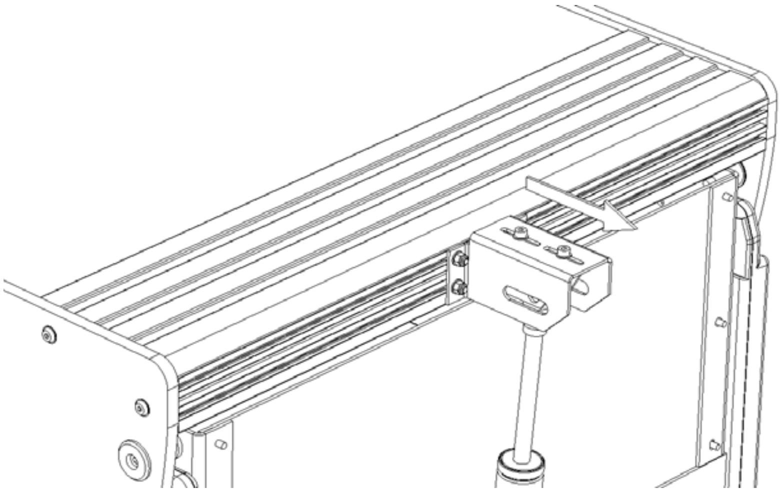
6.2 Adjusting the Gas Spring Force

Each cover can vary in weight; this is due to the tolerance on the width of the Blue Acrylic Panels of the Cover. This weight ranges from 7.3Kg to 9.1Kg which is why the Gas Spring needs adjusting. If a DS2 has an incorrectly adjusted Gas Spring it will not hold the Cover open and it can fall with great force, possibly causing bodily injury and damage to the system.

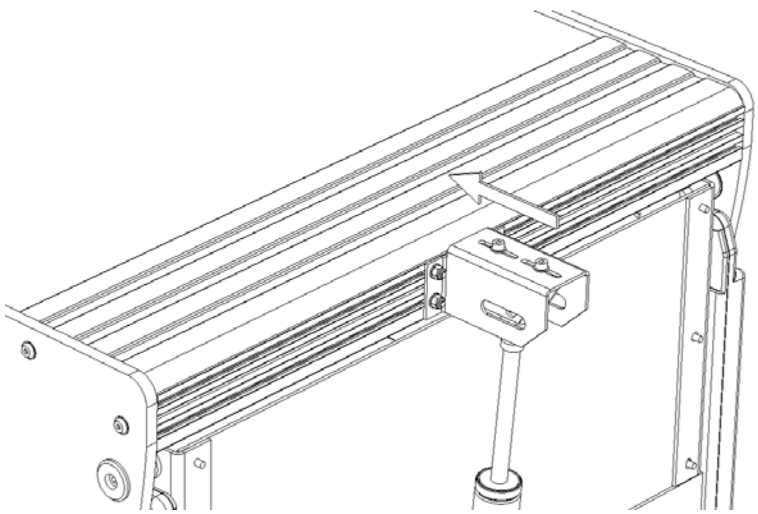
Overview

The following steps must be carried out to ensure correct adjustment of the Gas Spring.

- Ascertain whether the Gas Spring Force is too great or too little for the weight of the Cover.
- To increase the Gas Spring Force the Top Cover Sliding Bracket will need to be adjusted away from the Blue Cover.



- To decrease the Gas Spring Force the Top Cover Sliding Bracket will need to be adjusted towards the Blue Cover.

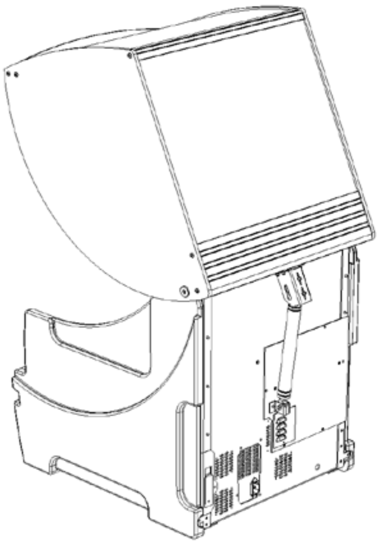


- Test the adjustment of the Gas Spring Brackets.
- Lock the adjustment in-place.

1. Before any adjustments are made check how the cover acts in both the open and closed positions.
   Note: When performing these checks always be ready to stop the cover falling.
2. Lift the cover to the fully open position and let go.
   - If the cover stays open, close it by 100mm [4”] and let go again.
     - If the cover immediately opens with quite a force then the force of the Gas Spring will need reducing.

- If the cover stays in that position then the Gas Spring might not need any adjustment, but the remainder of this procedure must be carried out.

- If the cover falls from the fully open position the force of the Gas Spring needs to be increased.

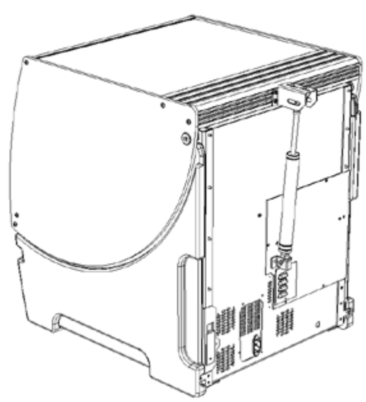


3. Fully close the cover and let go.

   - If the cover stays closed, check the force required to lift it by opening it by 100mm [4”].

     - If this force is more that 1Kg and / or when let go the cover rapidly falls closed again, the force of the Gas Spring will need to be increased.

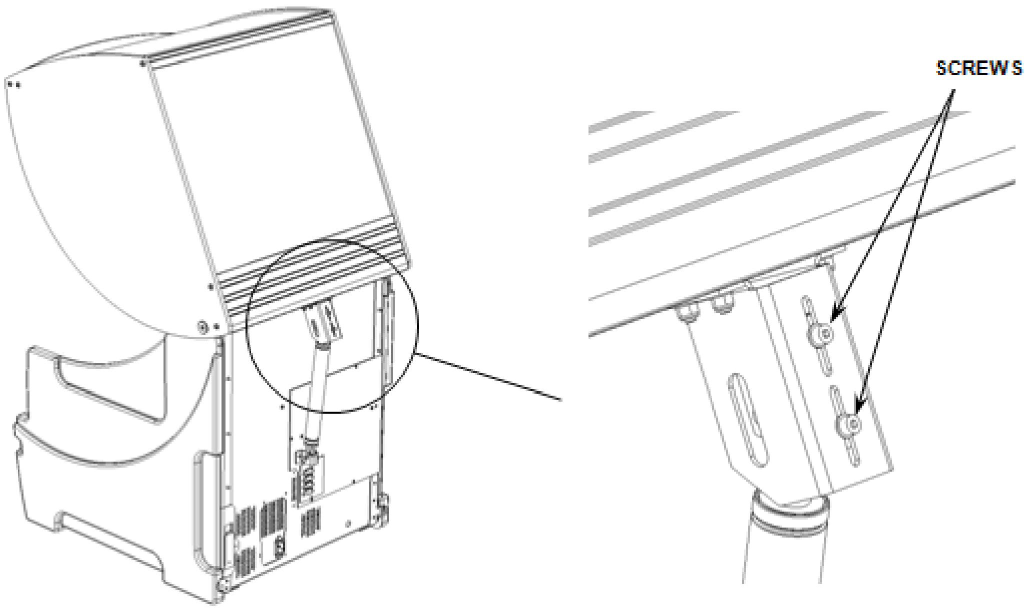
   - If the cover opens from fully closed then the force of the Gas Spring will need reducing.



4. To adjust the force of the Gas Spring open the cover fully and support it in this position. Loosen the two screws holding the Sliding Bracket to the Top Bracket, to allow it to slide.

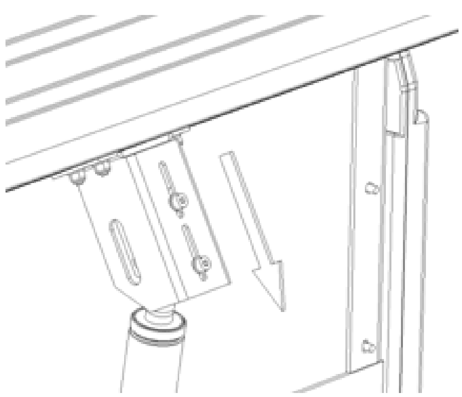
- If the Gas Spring Force needs increasing then gently allow the cover to close, this will move the Sliding Bracket down the adjustment slots.
- If the Gas Spring Force needs decreasing then gently open the cover, this will move the Sliding Bracket up the adjustment slots.

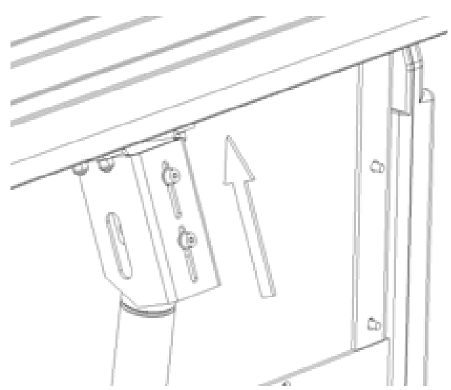
Tighten the two screws using a right angle allen key, to ensure the Sliding Bracket does not slip. Check the new Gas Spring Force by repeating steps 2 & 3.



To **increase** the Gas Spring Force position the Sliding Bracket further down the adjustment slots

To **decrease** the Gas Spring Force position the Sliding Bracket further up the adjustment slots





5. When the Cover has been adjusted correctly the following tests should pass. For each of the tests stabilise the cover by holding it in the test position for a few seconds, this is to remove any acceleration applied to the cover when opening / closing it.

    5.1 Fully close the cover and with no weight applied, it should stay closed.

5.2 Open the cover by 50mm [2”], the cover should slowly drop, taking between 10 and 20 seconds to do so, check that the cover switch is activated.

5.3 In any position between 100mm [4”] open and 100mm [4”] from fully open, the cover should balance.

5.4 With the cover 100mm [4”] from fully open, the cover should slowly move to the open position, without a lot of force.

5.5 With the cover fully open, the cover should not close.

6. When the Cover tests have passed, the adjustment position need to be locked, open the cover fully and support it, then remove the Hitch Pin and Clevis Pin from the bottom of the Gas Spring and close the cover. This is to remove the force applied to the Sliding Bracket by the Gas Spring. Then individually remove the screws and refit them using Loctite 222, tighten the screws using a right angle allen key to ensure the Sliding Bracket does not slip.
7. Open the Cover and replace the Hitch Pin and Clevis Pin.

6.3 Removing the Top Cover

The top cover is connected to the chassis via the two bearings and a gas spring.

To remove the cover:

1. With the Cover Open and **supported** remove the Hitch Pin and Clevis Pin from the bottom of the Gas Spring (Figure 6-1, 6-2).

> ***Note**: Always support the cover before removing clevis pin.*

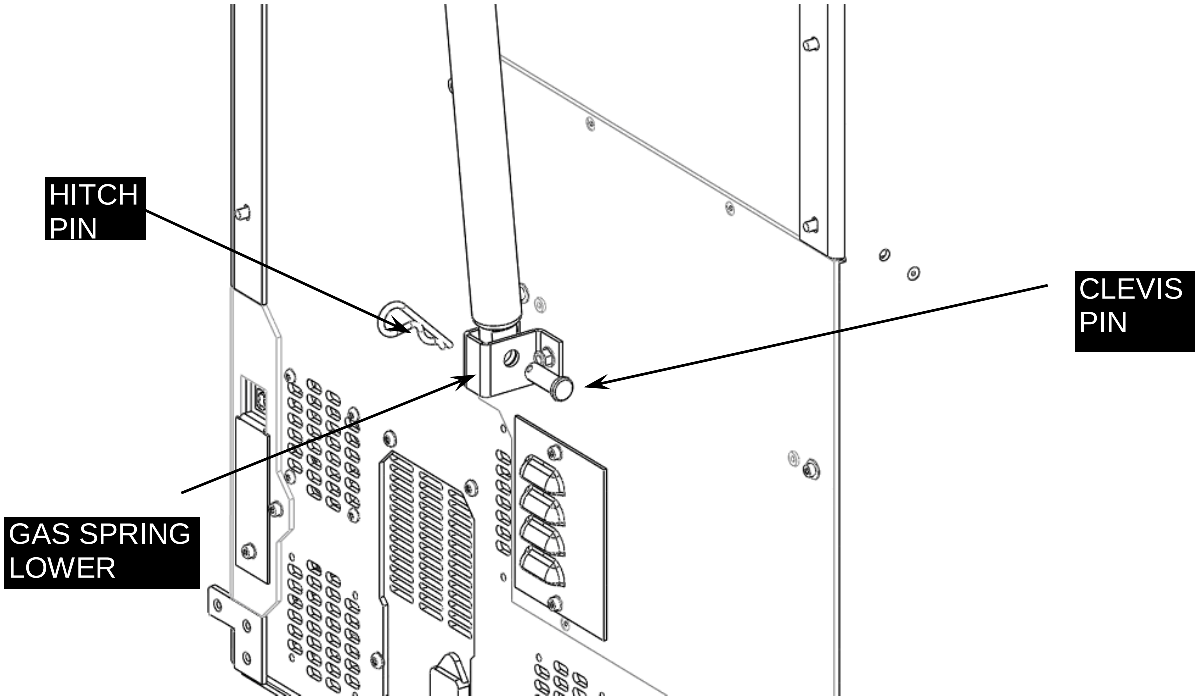


Figure 6-1: Location of Clevis Pin and Hitch Pin

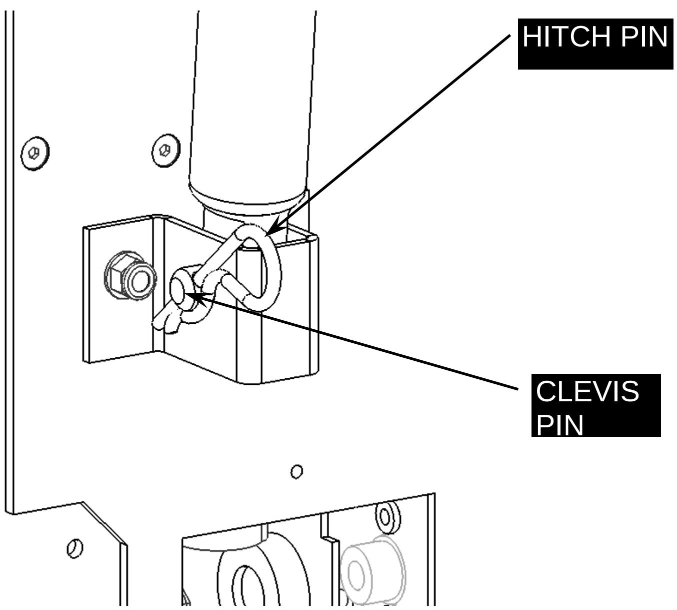


Figure 6-2: Close up of Clevis Pin and Hitch Pin

1. Remove the Circlips that are on the Gas spring pin as shown in Figure 6-3 and Figure 6-4.

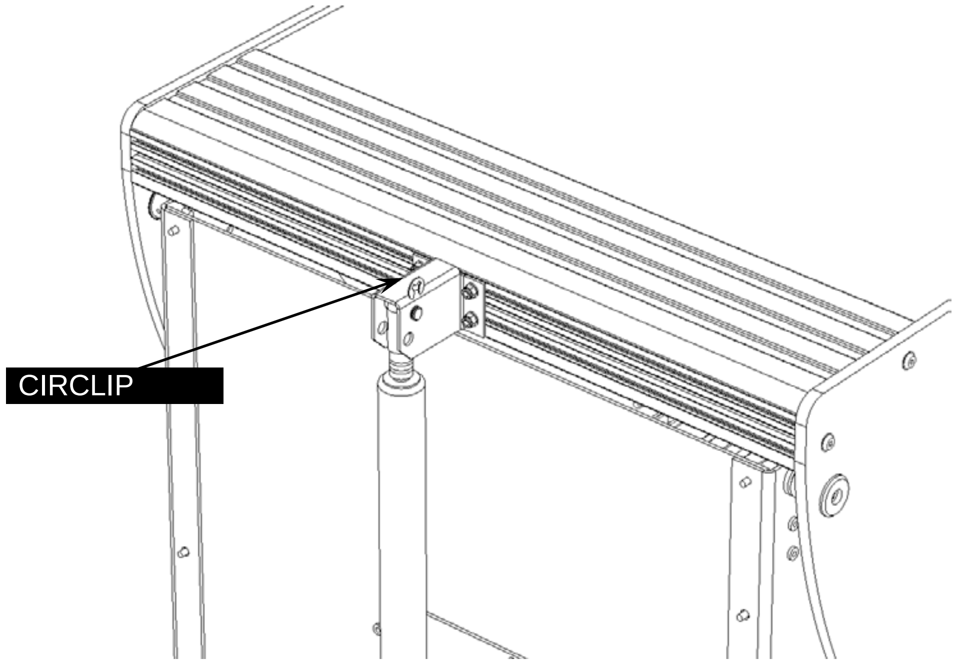


Figure 6-3: Right Circlip

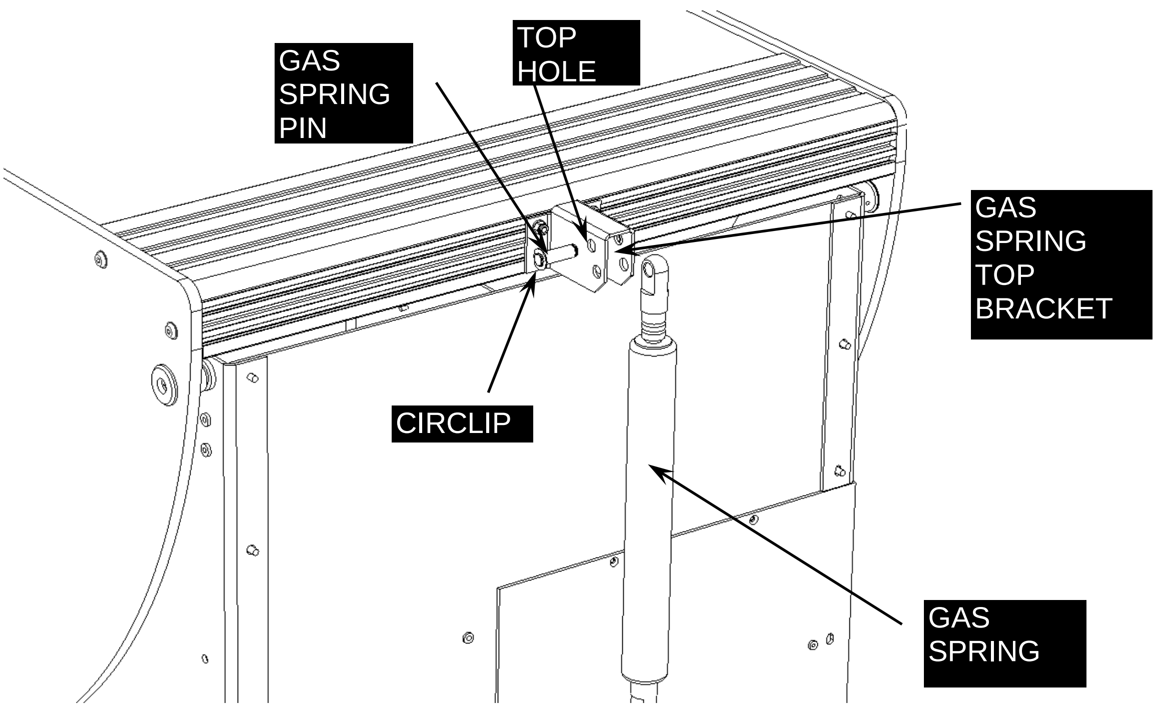


Figure 6-4: Left Circlip and Gas Spring Pin

2. Remove the Socket head screws from the left and right side of the cover as shown in Figure 6-5.

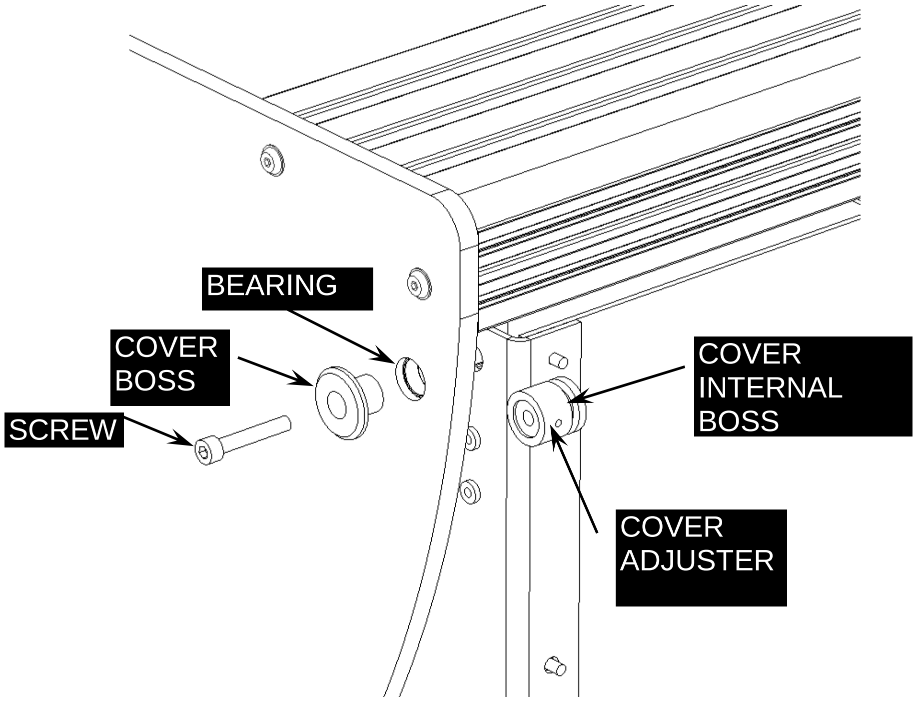


Figure 6-5: Screws for Top Cover

6.4 Replacing the Top Cover

To replace the Top Cover:

1. Remove the protective film from the inside of Blue Cover Assembly and fit two Bearings into the Cover Pivot Holes, one either side of the Cover (Figure 6-6).

> ***Note**: Fit the bearings from the inside of the cover by pressing down on them. Ensure the Bearing flange is flush to the inside face of the Cover.*

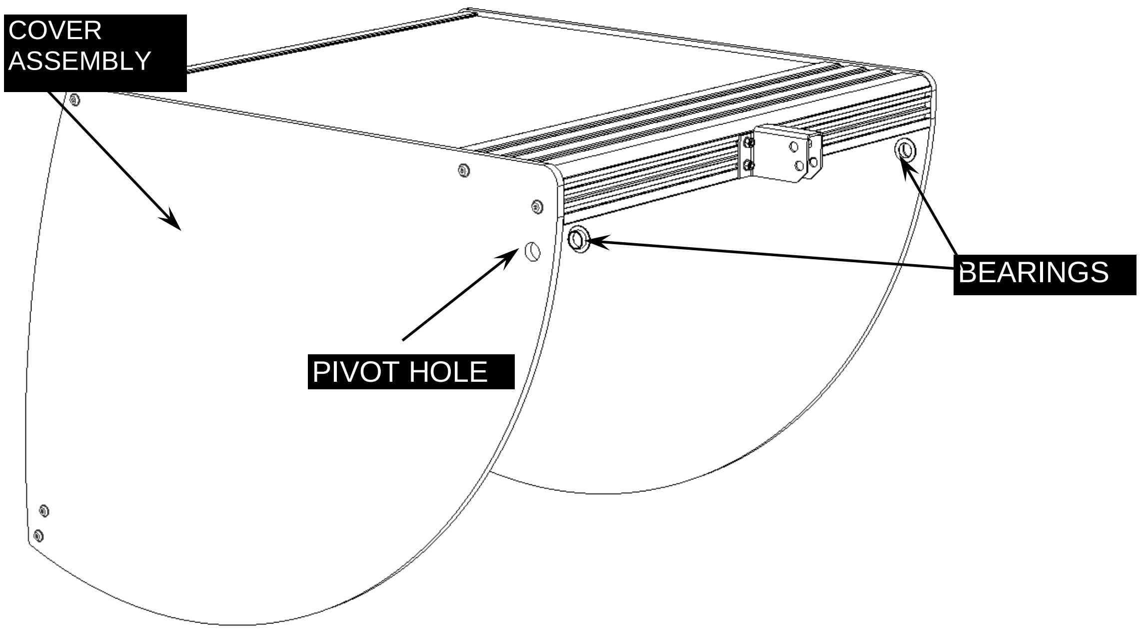


Figure 6-6: Top Cover Assembly

2. Position the Cover onto the Chassis as shown in Figure 6-7.

> ***Note**: Ensure that when positioning the Cover it does not rest on the Cover Switch.*

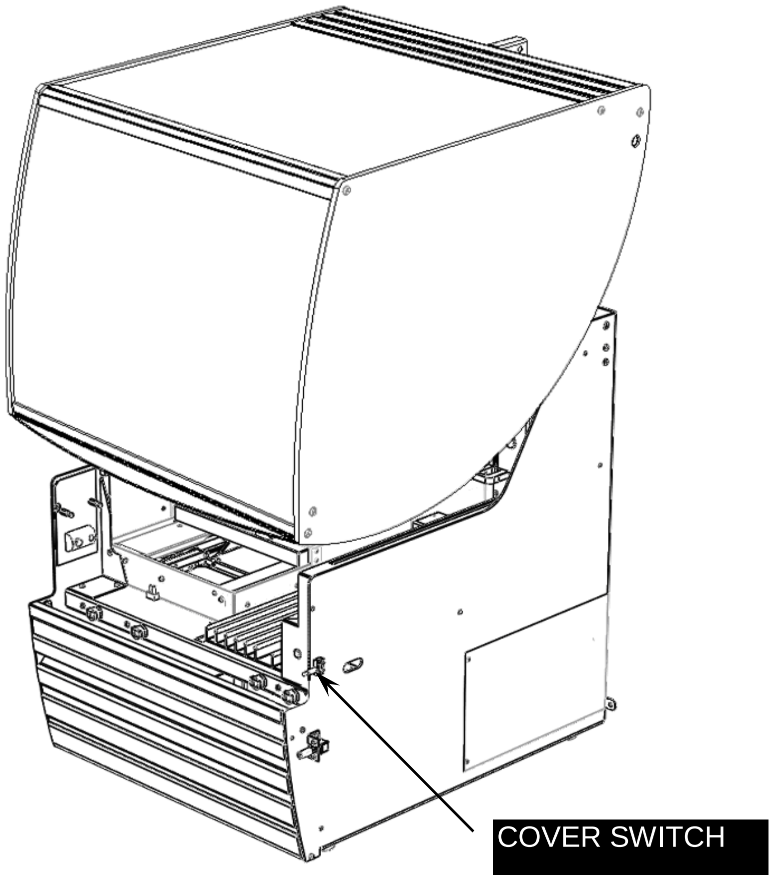


Figure 6-7: Placing the Cover on Chassis

3. Fit a Cover Boss from the outside into the Cover Bearing (Figure 6-8).

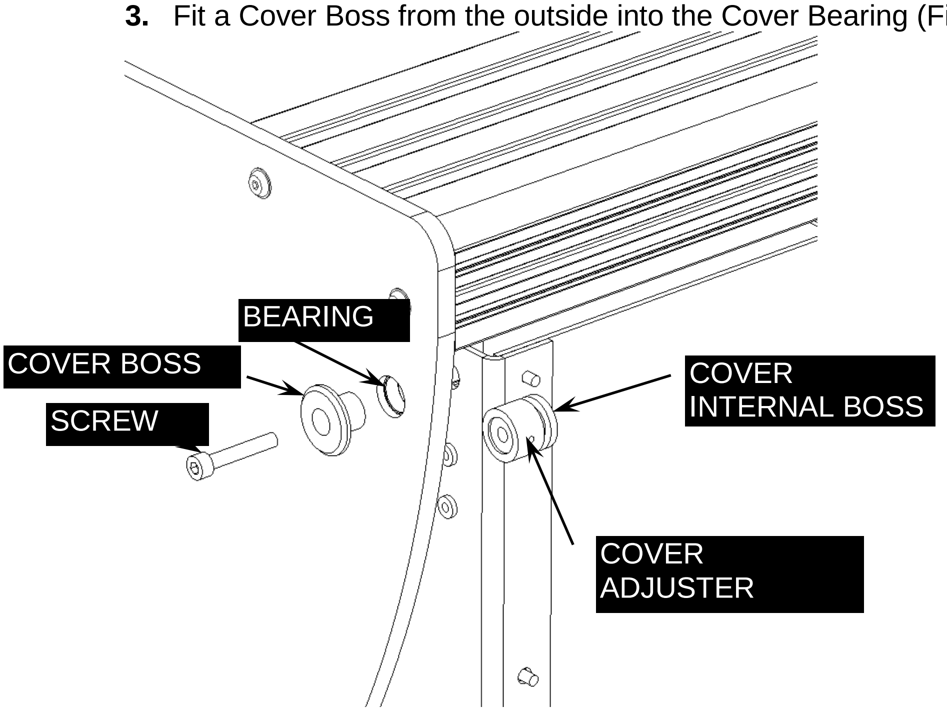


Figure 6-8: Cover Attachment Components

4. **Locate a Cover Adjuster over a Cover Internal Boss and position in-between the inside face of the Cover and the outside of the Chassis so that it lines up with the Cover Boss. Ensure that the flange of the Internal Boss is on the Chassis side.**

5. **Insert one M5x30 Socket Cap Head Screw through the Boss Assembly, lift the Cover** until the Screw can be threaded into the Cover Clamp Plate on the inside of the Chassis. Do not fully tighten the Screw.

6. Repeat the above procedure for the other side of the Cover. Then tighten the two M5x30 Socket Cap Head Screws.

7. Fit an ‘E’ Clip to a groove in the Gas Spring Pin and fit the Gas Spring to the Gas Spring Top Bracket on the Blue Cover.

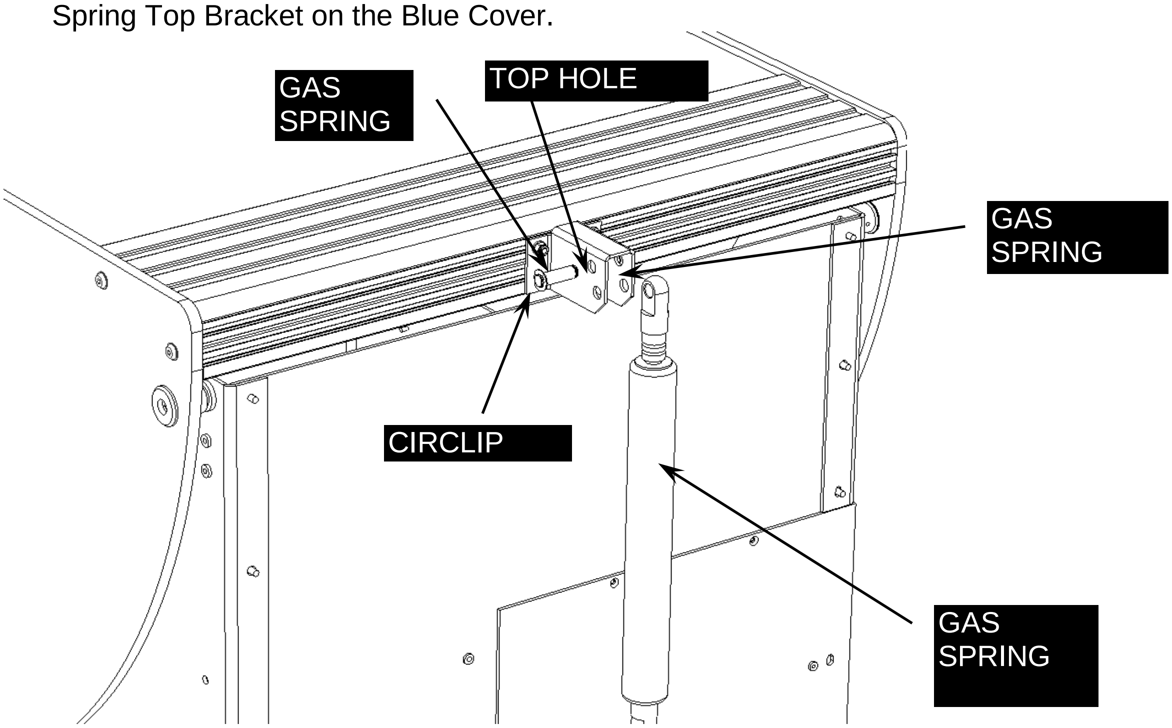


Figure 6-9: Attaching Gas Spring, Part 1

8. Slide the Pin through the top hole in the Bracket and the eye of the Gas Spring. Fit a second ‘E’ Clip to the other groove in the Pin (Figure 6-10).

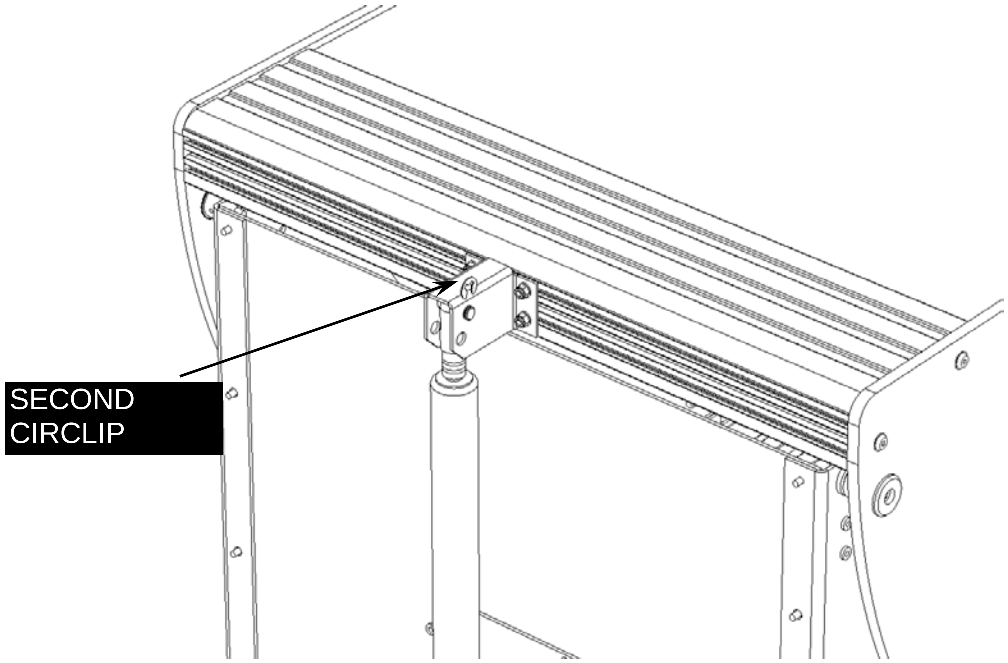


Figure 6-10: Attaching Gas Spring, Part 2

9. Support the Blue Cover and line up the bottom of the Gas Spring with the hole in the Gas Spring Lower Bracket. Fit the Clevis Pin through the bracket and Gas Spring and secure in place with a Hitch Pin (Figure 6-11).

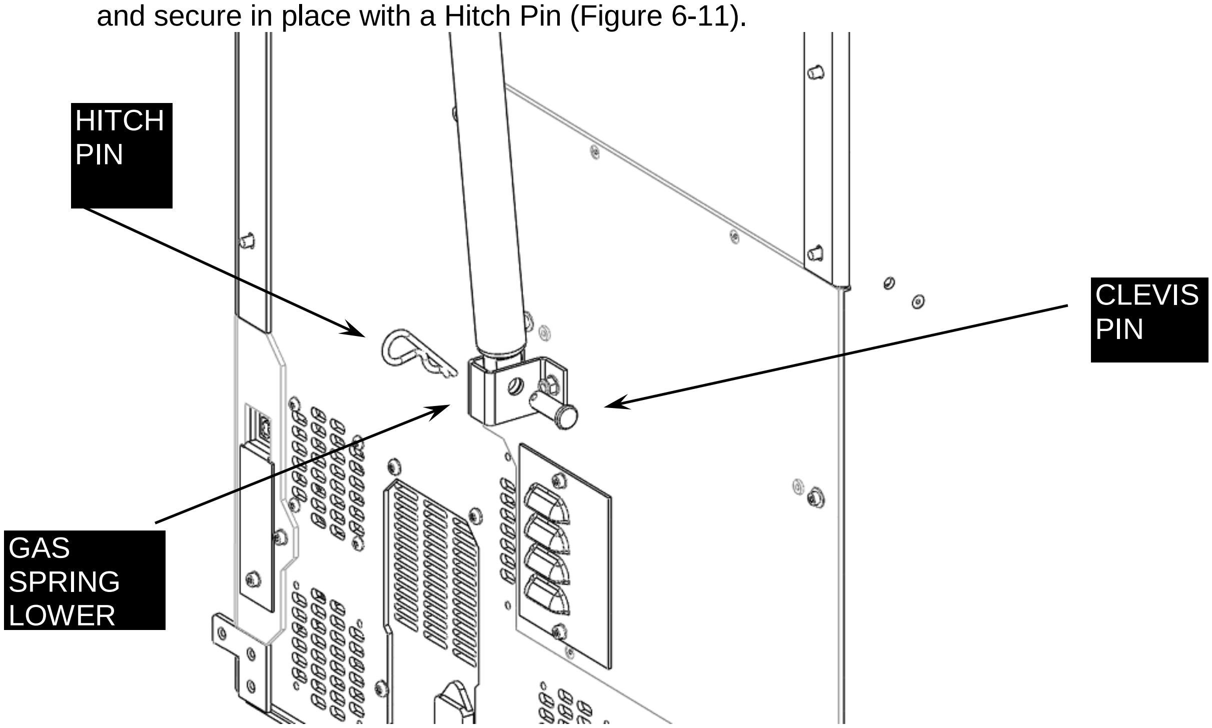


Figure 6-11: Attaching Gas Spring, Part 3

> ***Note**: After the side panels are replaced, align the panels as described in Section 6.5.*

6.5 Replacing the Left Hand Side Panel

The Left Hand side panel is attached to the chassis as shown in Figure 6-12 and 6-13.

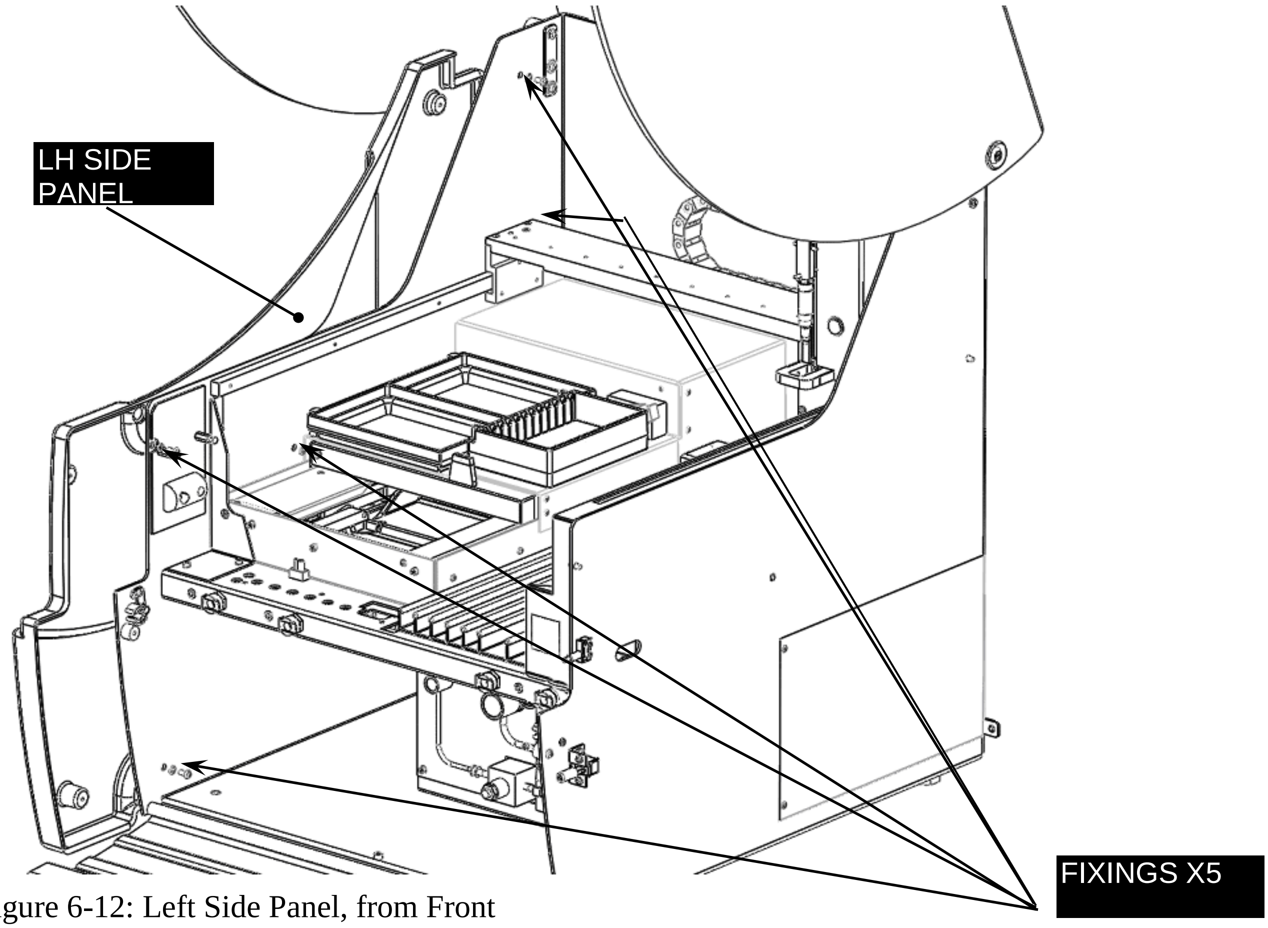


Figure 6-12: Left Side Panel, from Front

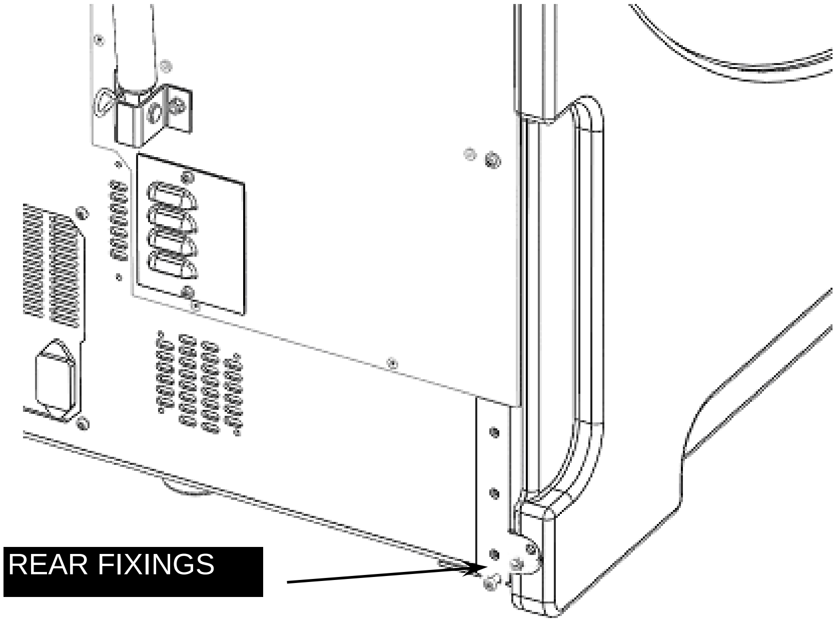


Figure 6-13: Left Hand Side Panel (from Rear)

To attach the Left Hand Panel:

1. Fit a Side Panel Mounting Bracket to the Left hand Side Panel using two M3x6 Button Head Screws and two M3 Internal Tooth Washers.
2. Fit the Left Hand Side Panel to the Chassis by sliding it in from the front. Secure in place using six M4x8 Button Head Screws and six M4 Internal Tooth Washers, five screws and washers fit in the side and one is fitted at the rear of the Chassis. Ensure the screws do not cross-thread.

6.6 Replacing the Right Hand Side Panel

The right hand side panel is attached as shown in Figure 6-14.

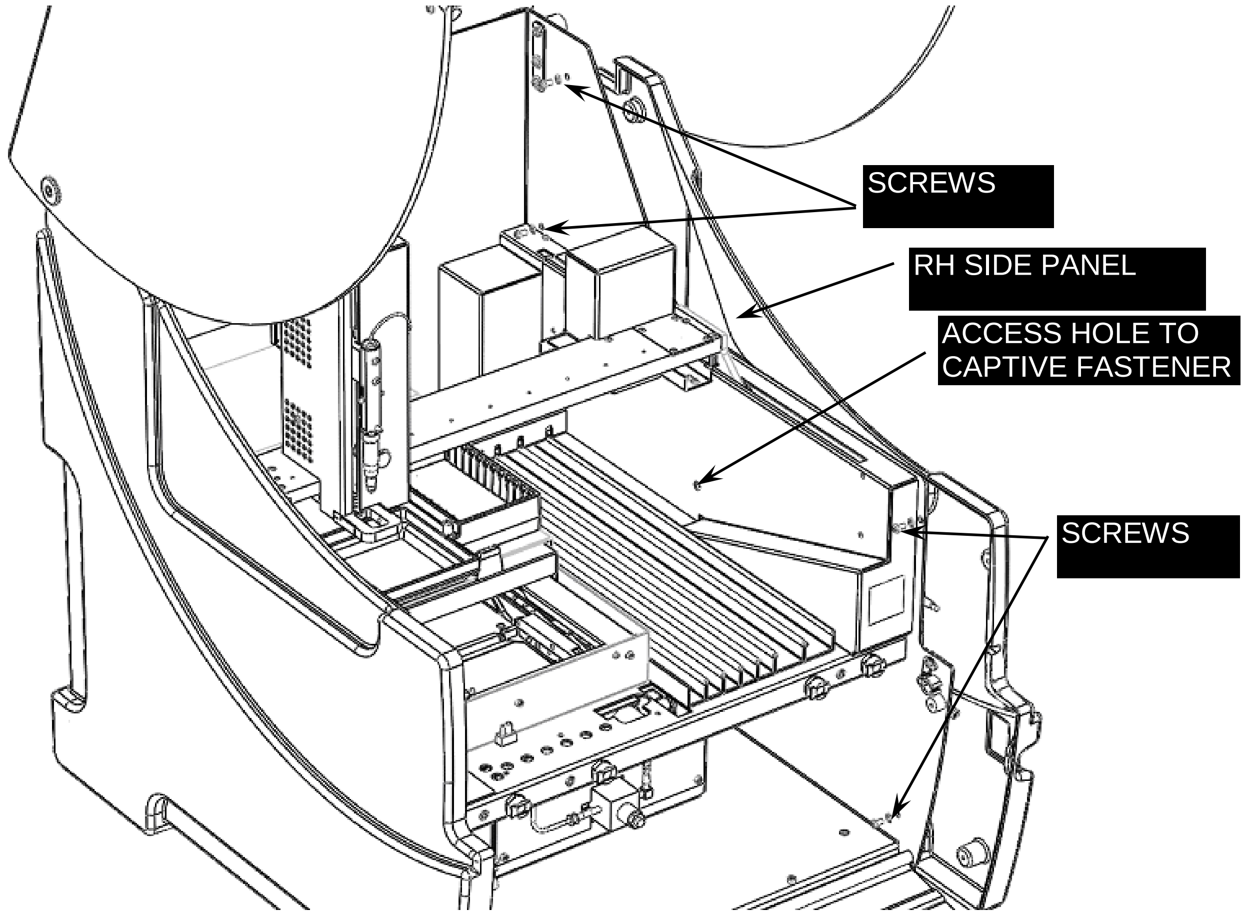


Figure 6-14: Right Hand Side Panel

To attach the right hand side panel:

1. Fit the Right Hand Side Panel to the Chassis using five M4x8 Button Head Screws and five M4 Internal Tooth Washers, four screws and washers fit in the side and one is fitted at the rear of the Chassis.

2. Tighten the captive fastener behind the X cover (use a No.2 Philips screwdriver through the access hole in the X cover). Ensure the screws do not cross-thread.

6.7 Aligning the Front Cover

To align the front cover:

2. Open the front Cover and loosen the four screws holding the Cover Clamp Plates (Figure 6-15, 6-16).

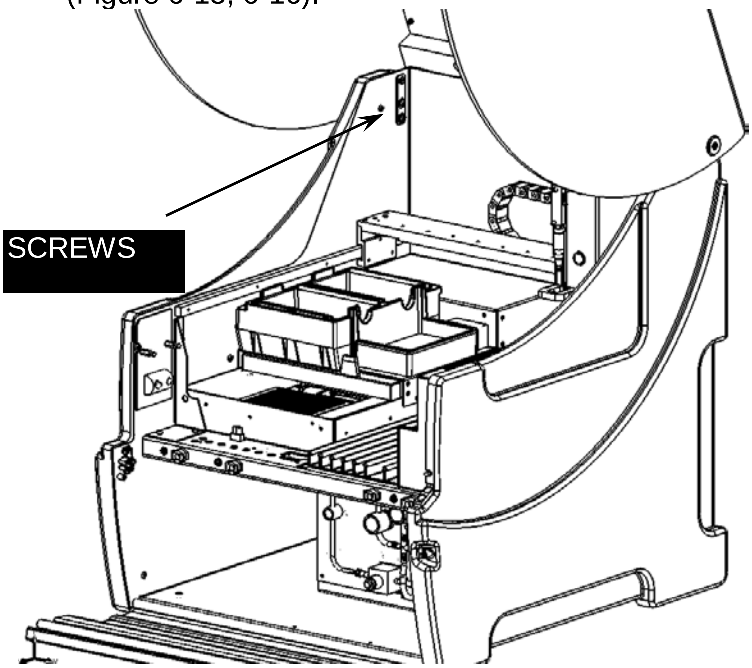


Figure 6-15: Cover Clamp Plates

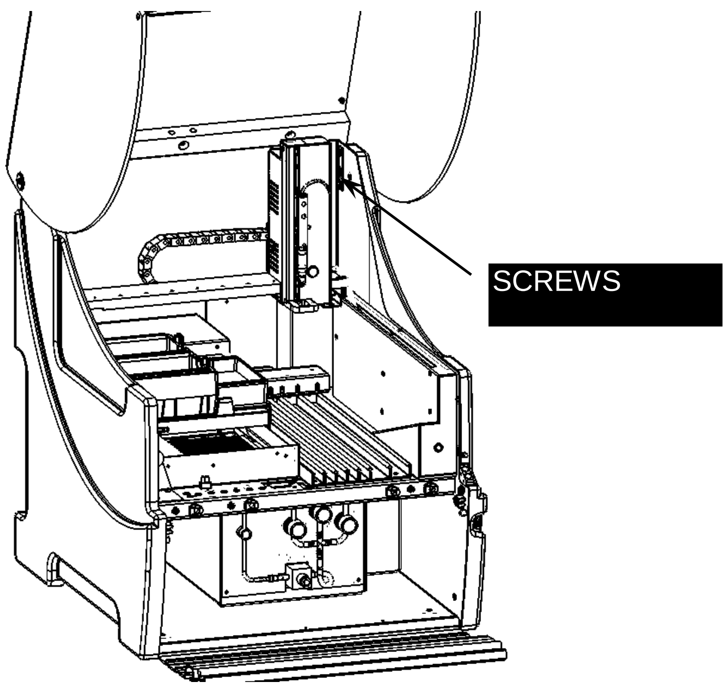


Figure 6-16: Cover Clamp Plates

3. With the Cover Open and **supported** remove the Hitch Pin and Clevis Pin from the bottom of the Gas Spring (Figure 6-17, 6-18).

***Note**: Always support the cover before removing clevis pin.*

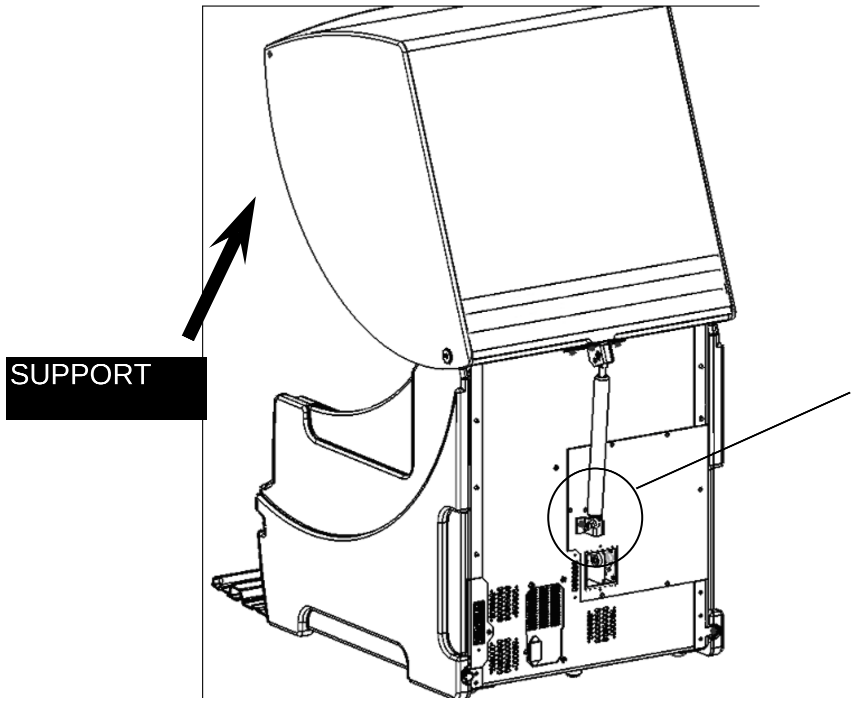


Figure 6-17: Removing Clevis Pin

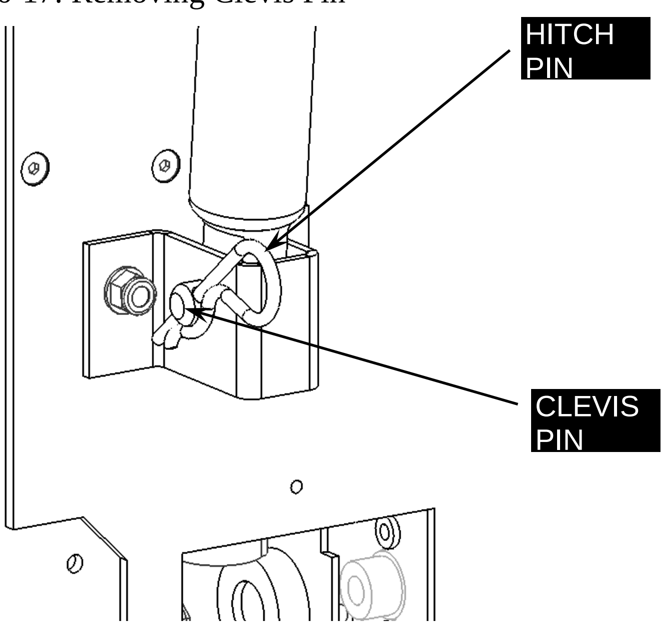


Figure 6-18: Close up of Clevis Pin

4. Close the Cover and loosen one of the Cover hinge screws. The Cover will now be free to adjust up and down, front to back and side to side.

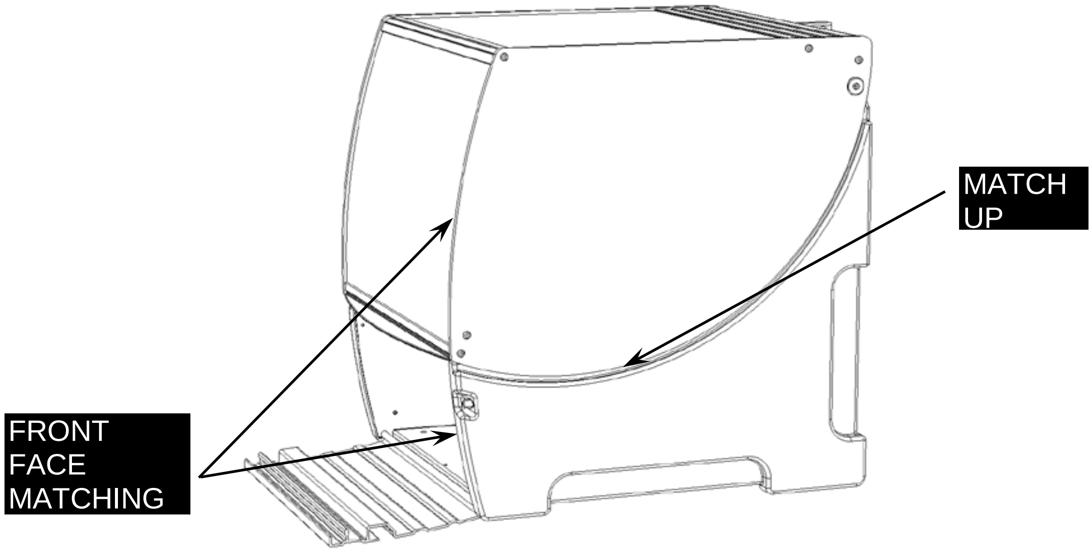


Figure 6-19: Cover Hinge Screw

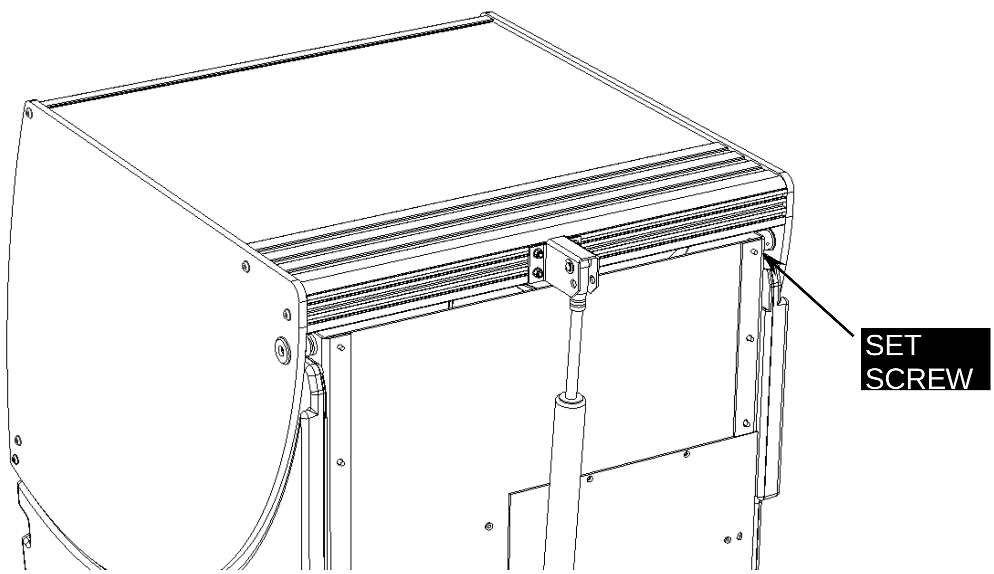


Figure 6-20: Set Screw

5. Check the Cover switch is operating when the Cover is closed (the switch will click when operated). [Not operational at this time]

6. Open the Cover and tighten the four screws in the Cover Clamp Plates.

7. Re-attach the Gas Spring by refitting the Clevis and Hitch pins. Check the Cover opens and closes smoothly; does not scrape the side panels and closes properly.

Chapter 7 Replacing Components - Z/Pipette Assembly

7.1 Overview

This chapter describes the servicing and replacement of the Z/Pipette Assembly.

- **Z/Pipette Assembly**: The Z/pipette assembly is used to withdraw liquids from a variety of sources (for example, samples, standard solutions, etc.) and deliver them to the well plate. In most instances, the pipette assembly should be considered as an integrated unit and replaced in the field as a module. Replacement of the entire assembly is described in Section 7.
- **Z-Drive**: The Z-Drive part of the Z/Pipette assembly is used to position the Pipette Spigot at the appropriate location for a specific task (for example, to move the Pipette Spigot to selected wells to deliver a reagent). The drive assembly includes a number of components that can be replaced by the service engineer (for example, the drive belt, the drive pulley, the drive motor, etc).

This chapter describes the replacement of components for which there is a reasonable expectation that the service engineer may be required to replace. The following conventions are used:

Removal of components that are structural in nature and unlikely to be serviced will not be described.

It is assumed that the service engineer will remove all appropriate cables from an item before it is removed from the system. The service engineer should remove the cable as close as possible to the item to be removed and note the position of the cable for reinstallation.

7.2 Troubleshooting

Troubleshooting information presented in this chapter is for problems that occur after the system has been initialized. The information below assumes that the system is, in general, working properly, except for the defective component (i.e. the X-Drive and Y-Drive are functioning properly but the Z-Drive is not functioning). If all drives are defective, it is probable that the problem is not in the drive mechanism (for example, the door is not closed).

Table 7-1 Troubleshooting the Pipette and Z Axis Assemblies

Symptom	Probable Cause	Resolution
Z-Drive Not Functioning or does not travel correct distance	Z-Drive Belt not in place or defective	Tighten belt or replace belt (refer to section 7.4.6 for the procedure).
	Z Board defective	Replace the Board (refer to section 7.4.5 for the procedure).
	Z-Drive Motor Defective	Replace the Z-Drive Motor (refer to section 7.4.4 for the procedure).
	Z Pulley Misaligned	Align one or both pulleys (refer to section 7.4.9 for the procedure).
Pipette does not withdraw or deposit liquid	Defective Pipette Assembly	Replace the Pipette Assembly (refer to refer to section 7.3 for the procedure).
Pipette dispenses incorrect volume	Pipette Assembly clogged	Remove the blockage.
	Defective Pipette Assembly	Replace the Pipette Assembly (refer to section 7.3 for the procedure).
Pipette does not lift or deposit plates	Defective Pipette Assembly	Replace the Pipette Assembly (refer to section 7.3 for the procedure).
	Defective Z-Drive	See *Z Drive Not Functioning or does not travel correct distance* above.
Pipette does not pick up or eject pipette tips	Defective Pipette Assembly	Replace the Pipette Assembly (refer to section 7.3 for the procedure).
	Defective Z-Drive	See *Z Drive Not Functioning or does not travel correct distance* above.
Pipette does not see sample tips	Tips too opaque for tip sensor to detect	Sample Tips from lots prior to 7098A0 are not suitable for use on the DS2, check tip lot number.

7.3 Replacing the Pipette Assembly

To Remove the Pipette Assembly (Field Replacement):

1. Loosen the Captive screw and unclip the Z drive cover from the back of the Z drive (Figure 7-1).

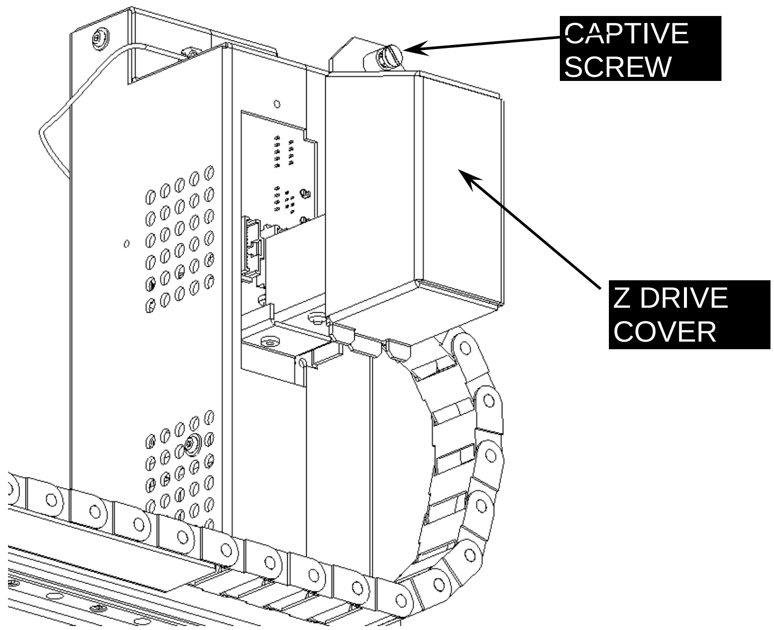


Figure 7-1: Removing the Z Drive Cover

2. Remove the Cables (Figure 7-2)

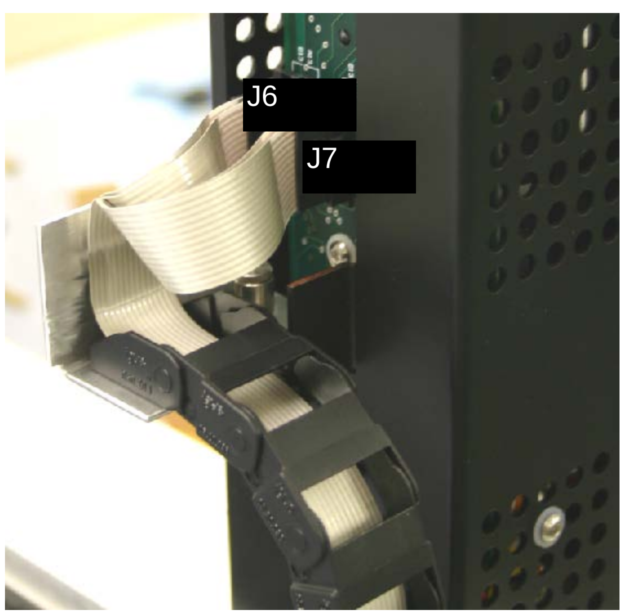


Figure 7-2: Z-Drive Cables

3. Remove the Captive Screw securing the assembly to the end of the Y drive Igus chain (Figure 7-3).

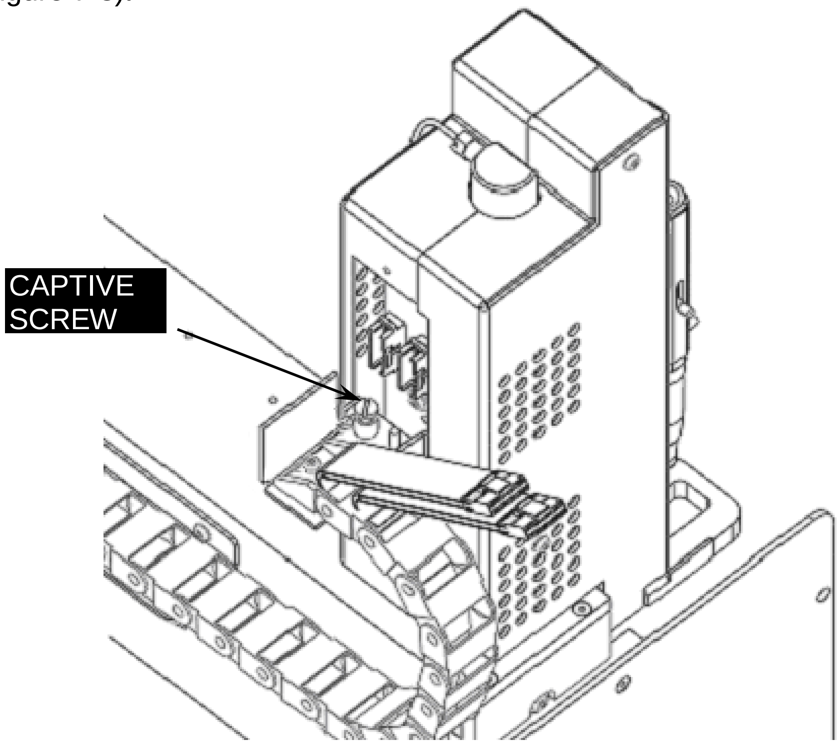


Figure 7-3: Removing the Captive Screw

4. Remove the two screws that attach the assembly to the YZ attachment block (Figure 7-4).

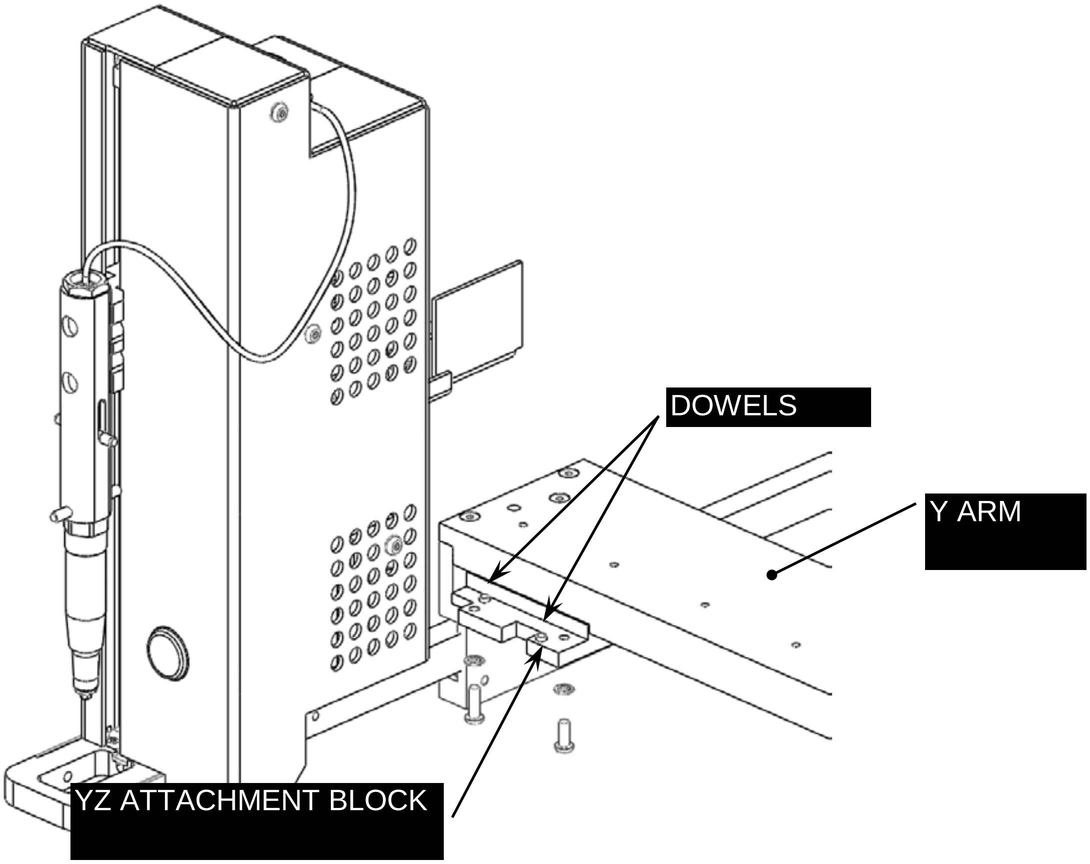


Figure 7-4: Removing the Z/Pipette Assembly

> ***Note**: When the removing or replacing the Z/Pipette Assembly, move the assembly over to the left of the Y Drive Assembly so that the Attachment Block is underneath the cut in the front face of the Y arm.*

7.4 Disassembling the Z-Drive Assembly

> ***Note**: Disturbing the spigot, tubing or syringe mechanisms will require the pipette to be recalibrated so use caution when working with the pipette module.*

7.4.1 Removing the Covers

The Left Hand Cover of the Z-Drive assembly is attached to the Z-Drive Assembly. With two M3 x 6 Button head screws and M3 shakeproof washers.

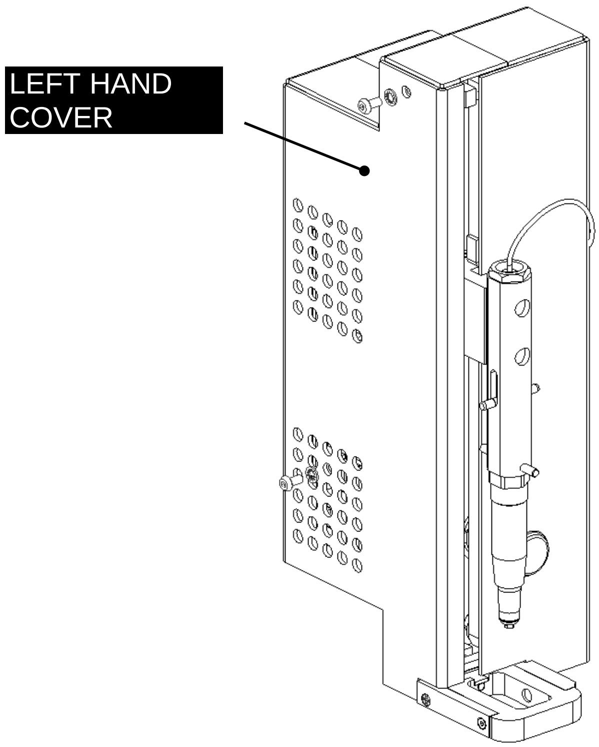


Figure 7-5: Left Hand Cover - Z Drive Assembly

To remove the right hand cover of the Z-Drive assembly, remove the P Clip on the right side, then remove the two M3 x 6 Button head screws and M3 shakeproof washers attaching the cover to the module (Figure 7-6).

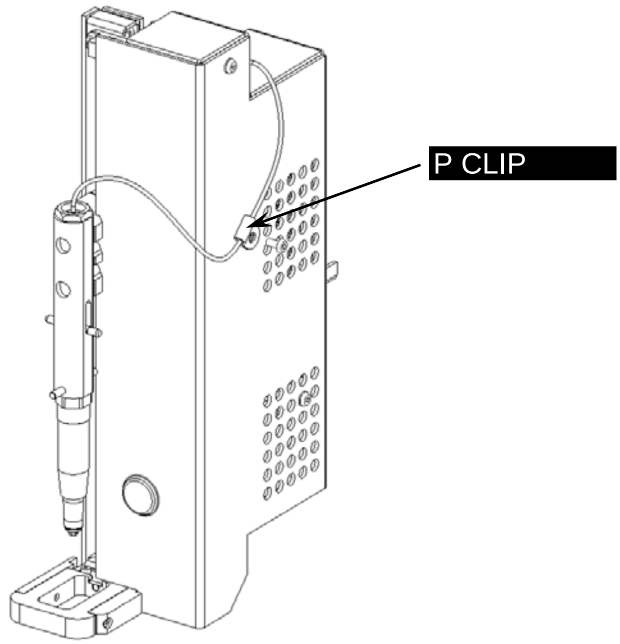


Figure 7-6: Z-Drive Assembly Right Cover

7.4.2 Replacing the Motor and Encoder

The motor and encoder are mounted on the Z-mounting plate as shown in Figure 7-21.

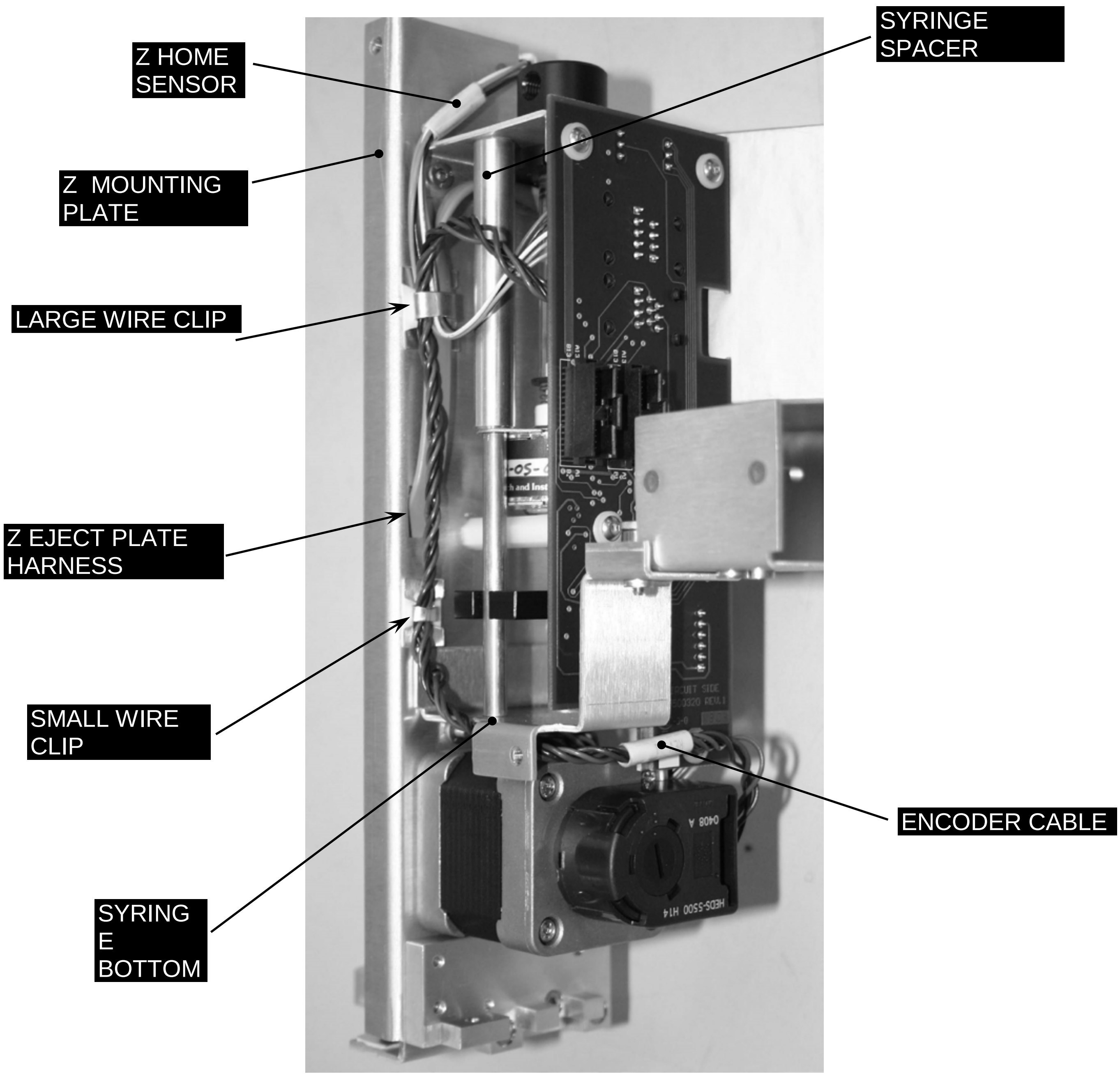


Figure 7-21: Motor and Encoder

To remove the motor and encoder:

1. Remove the four screws that attach the motor to the Z-mounting Plate (Figure 7-22).

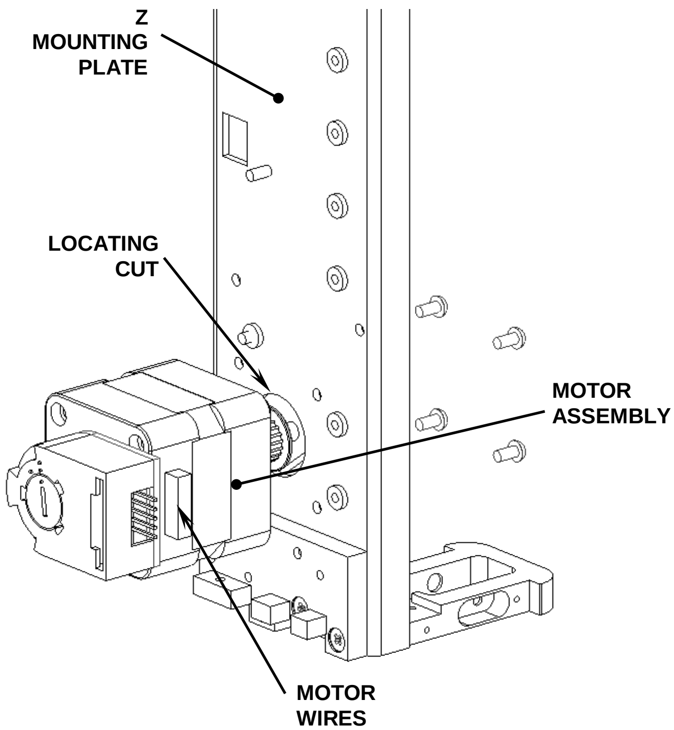


Figure 7-22: Attachment of Motor

2. Put an Allen key into the encoder and by place an upward force on as shown in Figure 7-23 to remove the encoder.

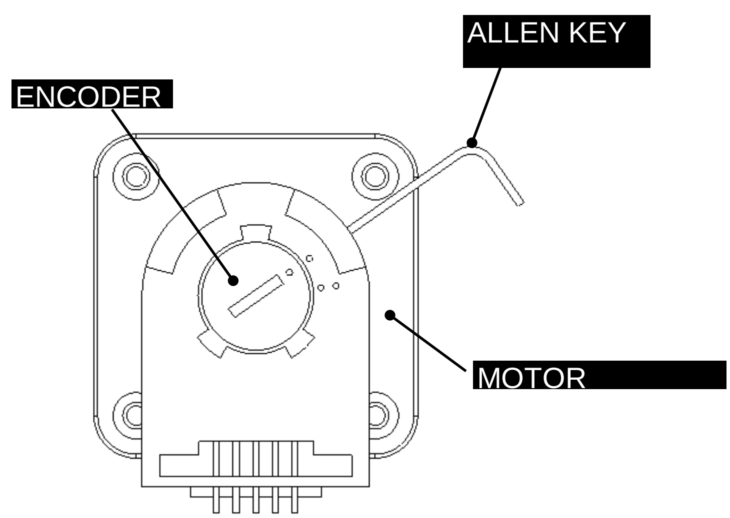


Figure 7-23: Removing the Encoder

3. Remove the Encoder Mounting Plate (Figure 7- 24). The jig (DSXFIX015) shown in the figure is not required for removal, but is required for installation of a new unit.

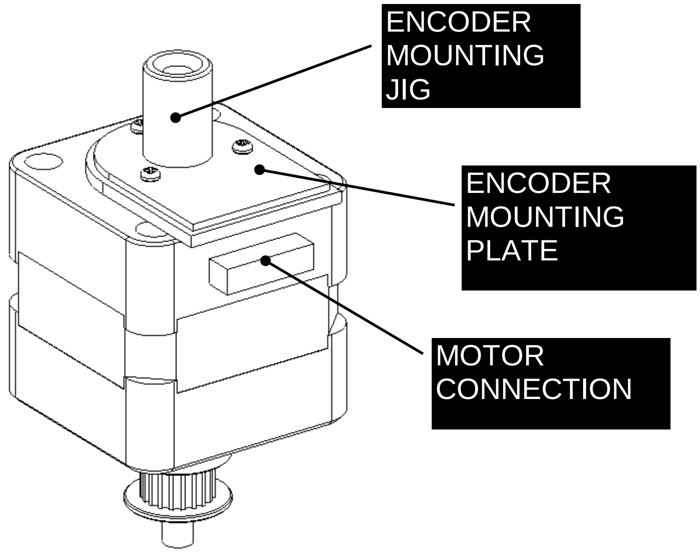


Figure 7-24: Encoder Mounting Plate

4. Remove the Drive Pulley by unscrewing the two set screws (Figure 7-25). The jig (DSXFIX004) shown in the figure is not required for removal, but is required for installation of a new unit.

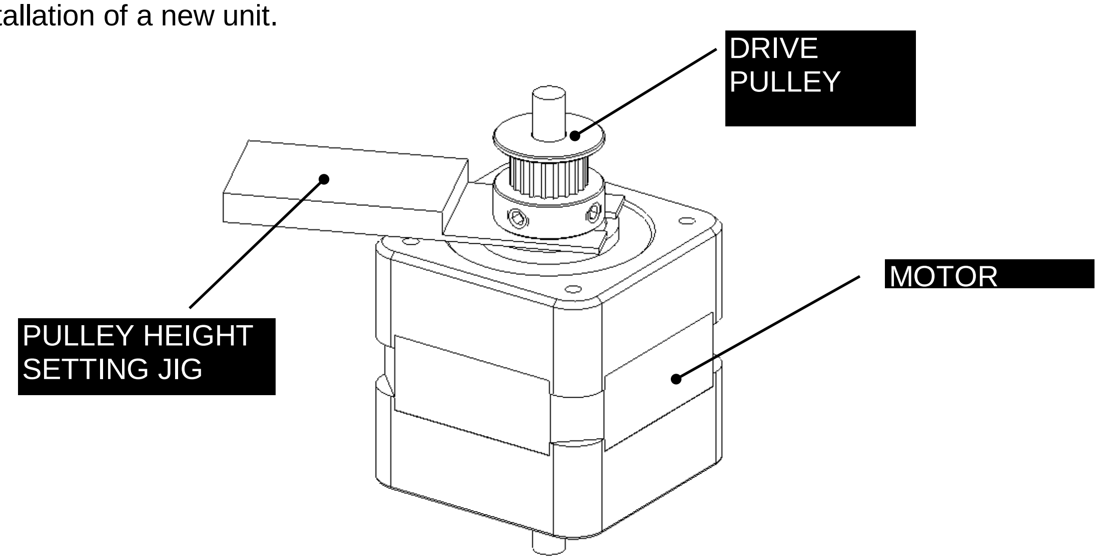


Figure 7-25: Drive Pulley

To Reinstall the Encoder:

1. Attach the encoder mounting plate to the motor using the Encoder Mounting jig (DSXFIX015) and the 3 M1.6x6 Pan Head Screws. Ensure that the mounting plate is centralized around the pulley idler shaft.
2. Install the main part of the Encoder onto the Mounting Plate by snapping it in place.

> ***Note**: Do not remove the Allen key in the encoder (Figure 7-26).*

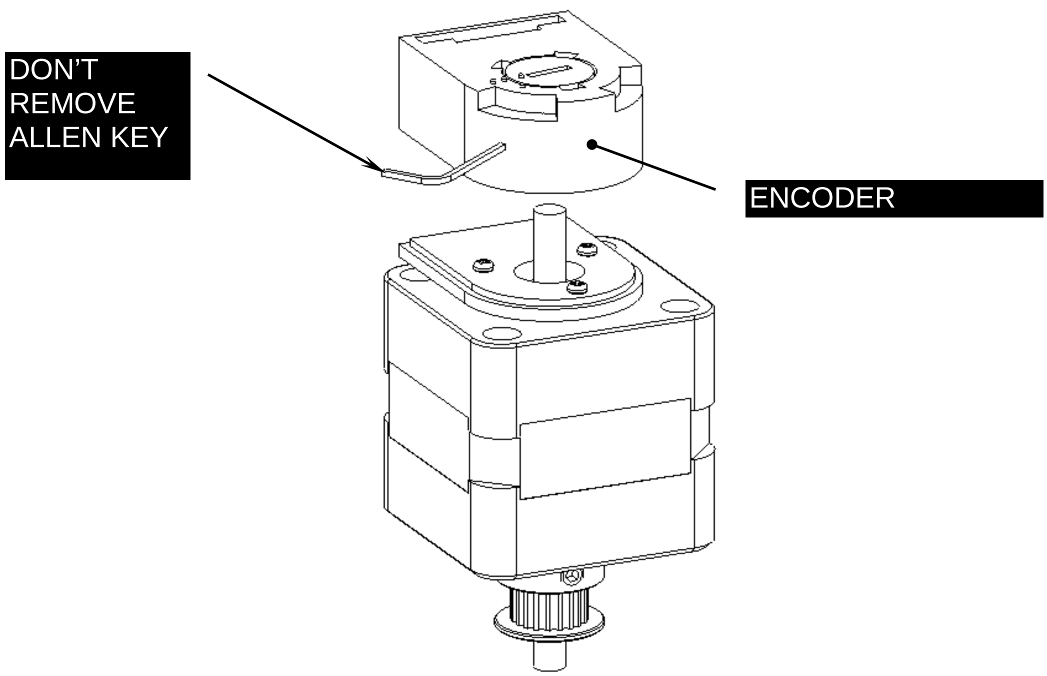


Figure 7-26: Placing Encoder on the Motor

3. Push the Allen Key into the body of the encoder to ensure this it is properly seated into the code wheel hub set screw and then apply a downward force on the end of the Allen Key. This sets the code wheel gap by levering the code wheel hub to its upper position.
4. While continuing to apply a downward force, rotate the Allen Key to the clockwise direction until the hub set screw is tight against the idler shaft (Figure 7-27). Remove the Allen Key by pulling it straight out of the encoder body.

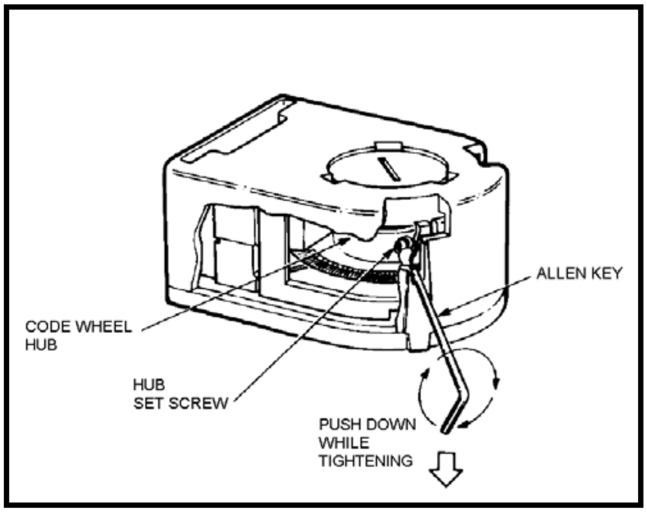


Figure 7-27: Adjusting the Encoder

5. Rotate the encoder cover from the open to the closed position by inserting a small flat blade screwdriver into the notch and rotating.

> ***Note**: The encoder cover is shown below in the closed position.*

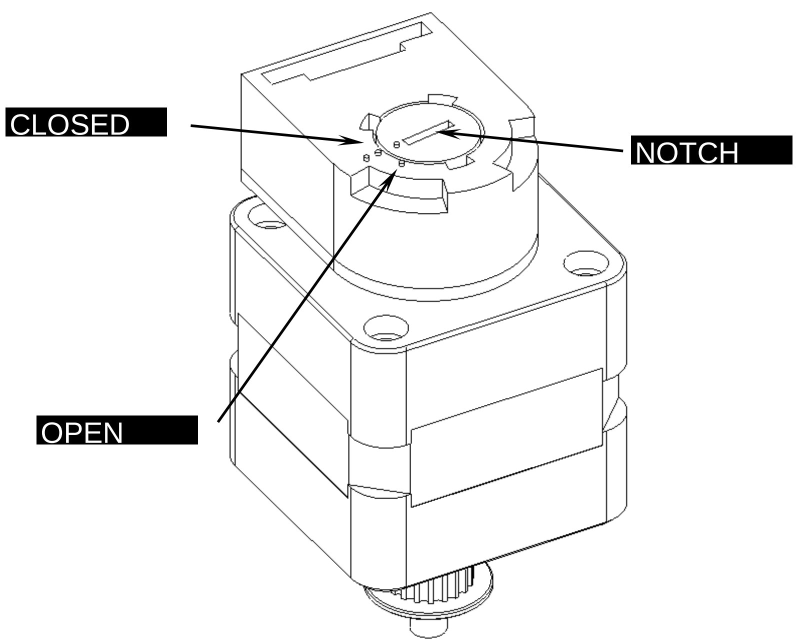


Figure 7-28: Encoder Cover

7.4.3 Replacing the Belt

To replace the Belt:

1. Unscrew the two screws for the Z belt clamp plate (Figure 7-30).

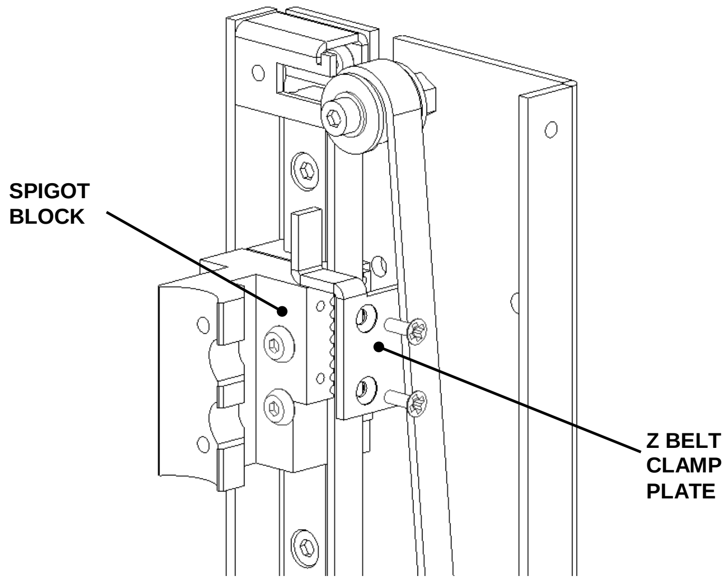


Figure 7-30: Z-Belt Clamp Plate

To install a new belt:

1. Cut a 508mm length of the Gates Rubber belt LL2MR06, 2mm Pitch x 6mm wide and loop it around the Idlers as shown in Figure 7-31 with the two cut ends meeting at the Spigot Block. Fit four teeth from top end and five teeth from the bottom end of the belt into the machined tooth detail in the Spigot Block.

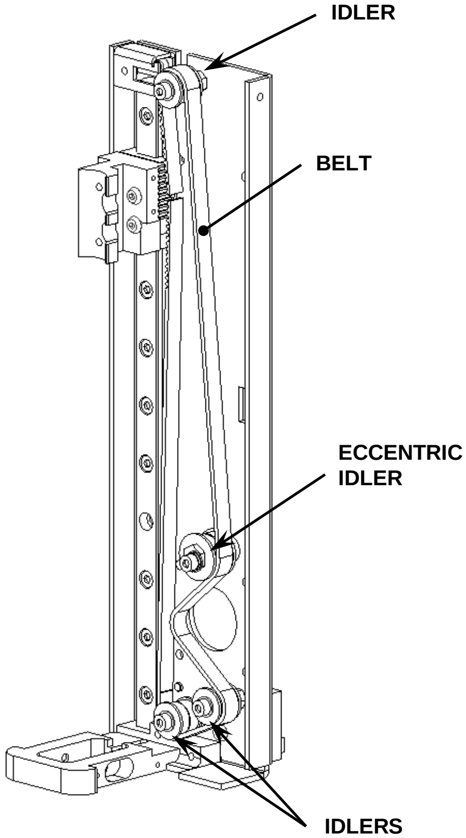


Figure 7-31: Belt Orientation

2. Remove the Force Gauge assembly from the Belt Tensioning Fixture (DS2FIX009) and position the Z Drive onto the fixture so that the back face of the Z Mounting Plate is resting on the left support top face and the Z Locating Plate is resting on the right support top face. Then gently slide the Z Drive over until the manifold top face is touching the inside face of the left support, and the side face of the Z Mounting Plate is touching the support stops (Figure 7-32).

> ***Note**: Field service engineers will use a hand held tension meter in place of the tensioning fixture described below. Place a piece of metallized tape on the belt and hold the meter about ½" from the belt. Gently press on the belt and observe the reading on the meter. An acceptable reading is 62 Hz.*

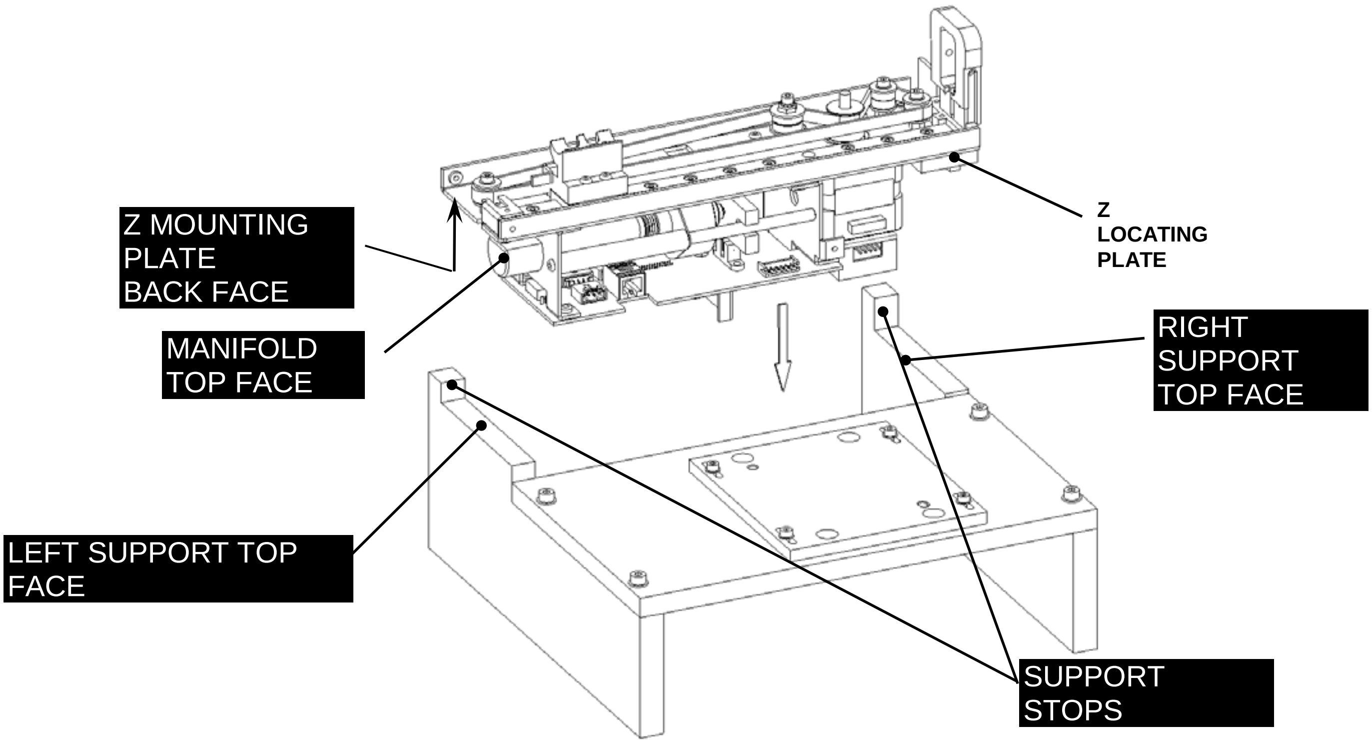


Figure 7-32: Mounting Drive Assembly on Belt Tensioning Fixture

3. Slide the Spigot Block to the top position, fully left and reposition the Force Gauge on the fixture. Angle the gauge assembly and push it forwards and down so the belt hook slightly deflects the belt and the dowels on the gauge assembly fit into the adjuster plate of the fixture. (Figure 7-33).

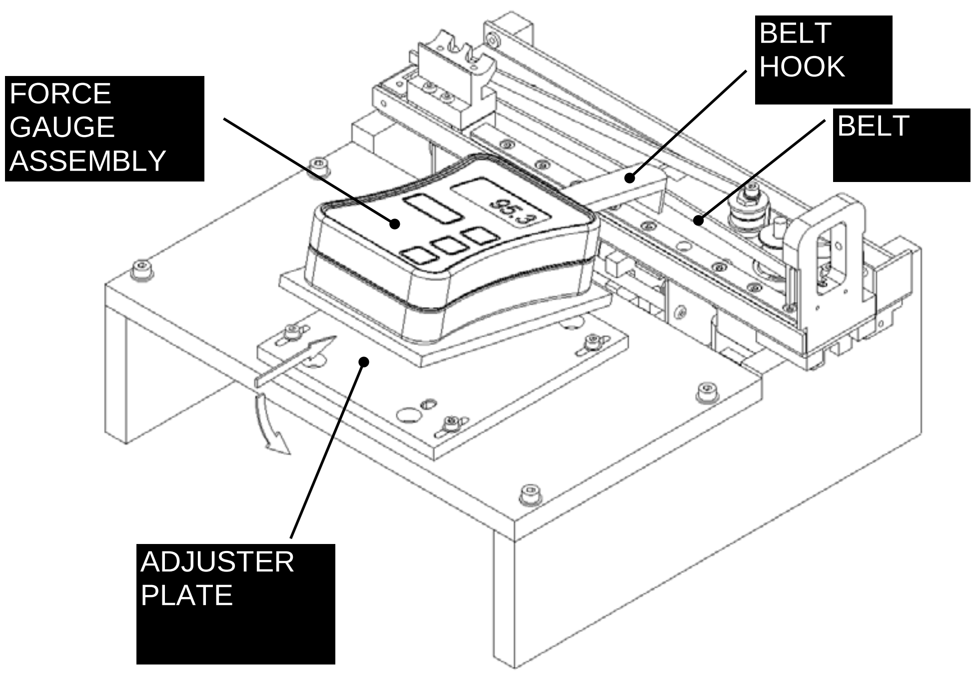


Figure 7-33: Location of Force Gauge Assembly

4. Use an Allen Key to gently push the Belt off the end of the Force Gauge Belt Hook by 1 to 2 mm and then reposition it before taking each force reading. This is to ensure that no sideways force from the belt is being measured.

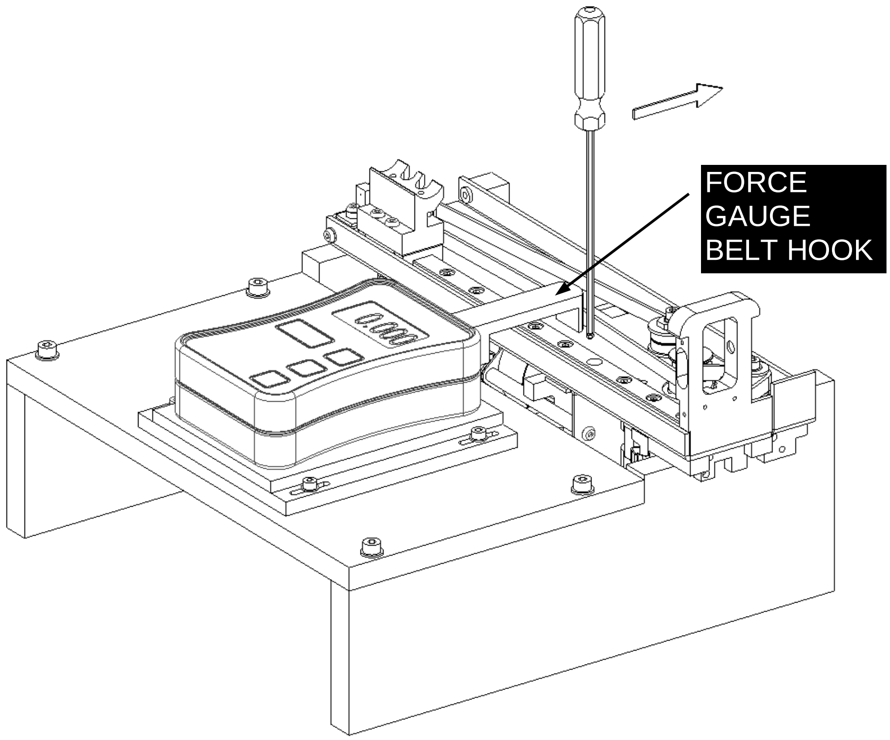


Figure 7-34: Repositioning the Belt

> ***Note**: Before setting the belt tension, the belt must be pre-stretched. Slacken off the Eccentric Idler socket cap screw by ¼ of a turn, and use an 8mm open ended wrench on the hex detail of the Eccentric Idler to rotate the Idler clockwise until the force gauge reads between 0.120 and 0.130Kg (Figure 7-35), then return the Eccentric Idler back to its original position.*

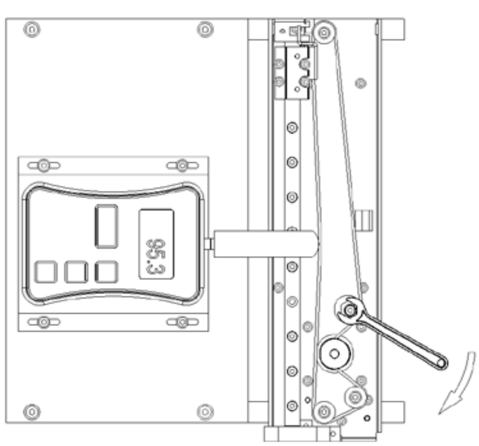


Figure 7-35: Eccentric Idler Cap Screw

5. To set the working tension, rotate the Eccentric Idler clockwise until the force gauge reads between 0.110 and 0.120Kg (Target of 0.115Kg) and tighten the socket cap screw to lock the Eccentric Idler in place.

7.4.4 Replacing the LED, Photodiode Assembly and Proximity Sensor

An overview of the LED photodiode assembly is shown in Figure 7-48

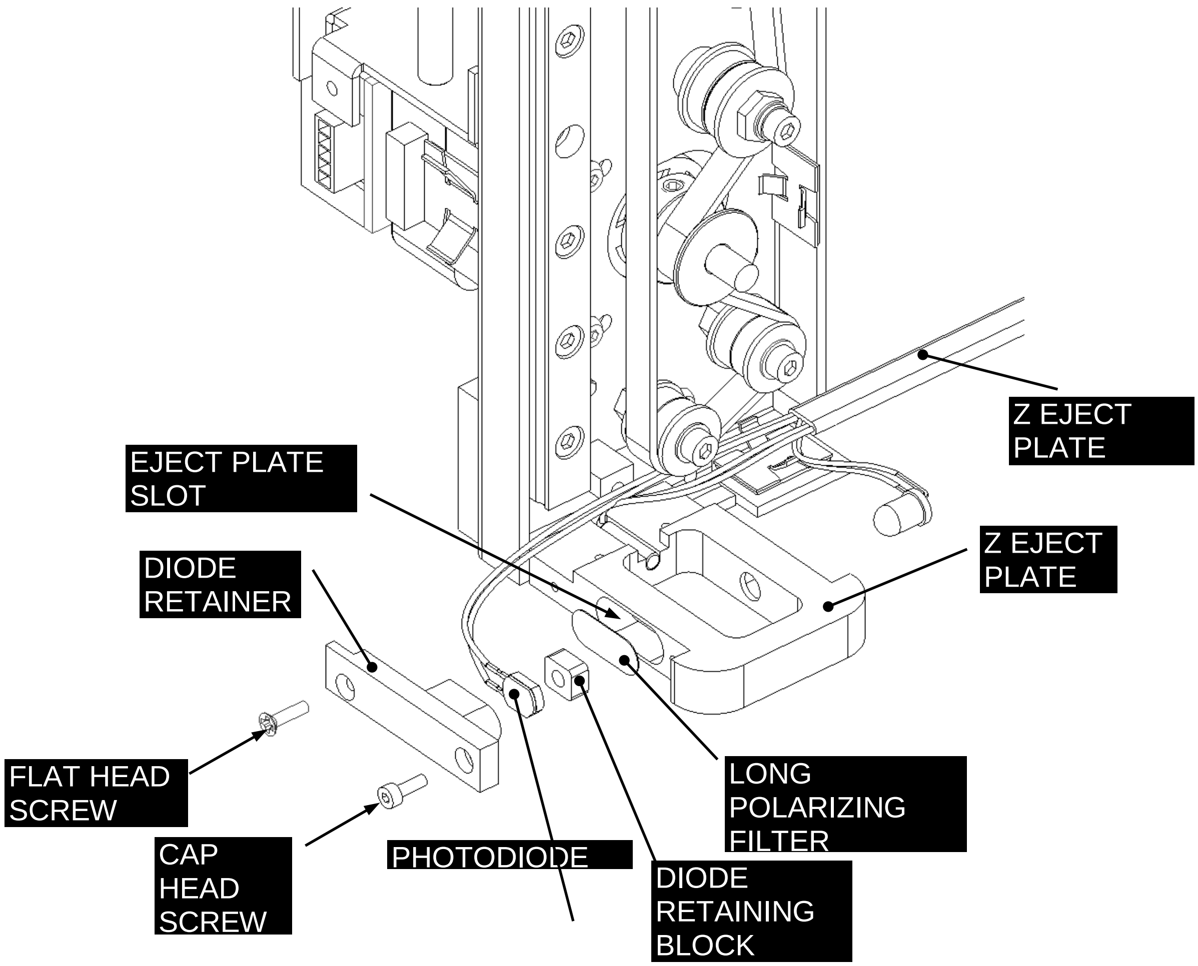


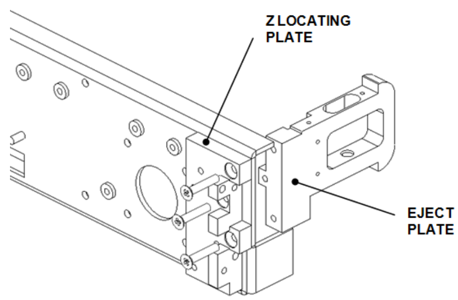
Figure 7-48: Location of LED and Photodiode

To remove the photodiode, remove the two screws that attach the diode retainer (left side facing belt).

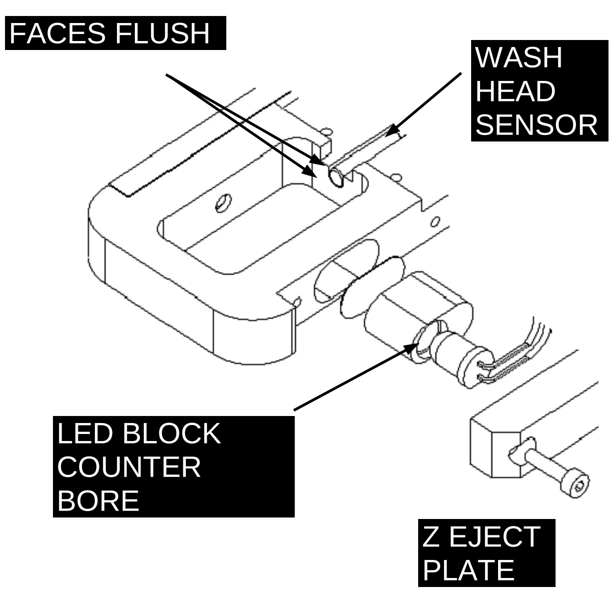
To remove the LED, remove the two screws that attach the LED right side facing the belt.

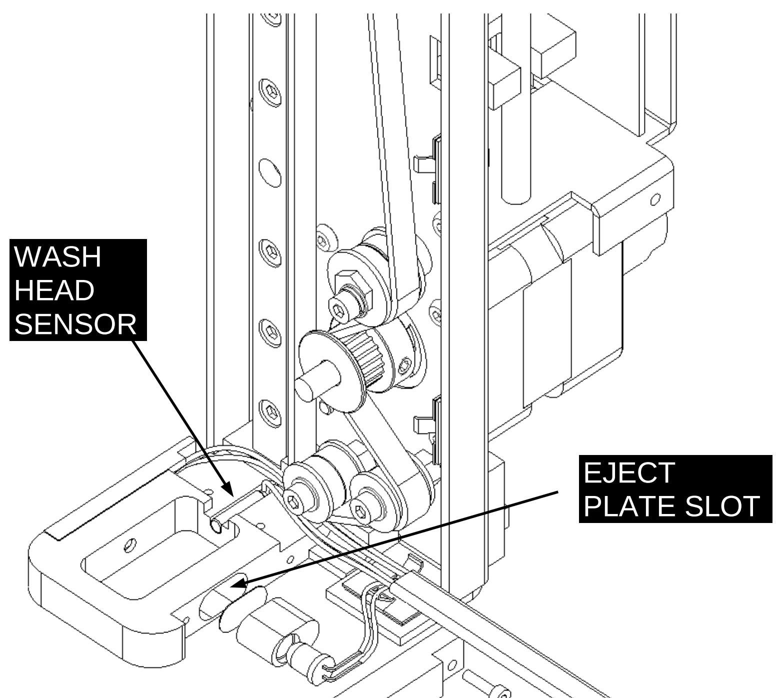
To replace the LED:

> ***Note**: The current pipette Z eject plate harness (for tip and wash head detection), item number 13500541, has a **blue** sensor for the wash head detection. If you are replacing this on older pipettes, ones with a **black** sensor for the wash head detection, you will also need to update the Eject Plate itself, item number 23500214.*
>
> *The Pipette serial number sticker is on the eject plate. You will need to transfer this sticker to the new plate. If unable to do this, ensure you use a sharpie and write the pipette serial number on the new plate.*



1. Locate the LED (part of the Z Eject Plate Harness) into the LED Block with the counter bore facing outwards. Fit the LED and Block into the Eject Plate Slot and clamp in place using the LED Retainer using two M2x8 Cap Head Screws. Position the Proximity Sensor (part of the Z Eject Plate Harness) into the rounded groove in the middle of the Eject Plate, with the end of the sensor flush to the face of the Eject Plate as shown in Figure 7-49.





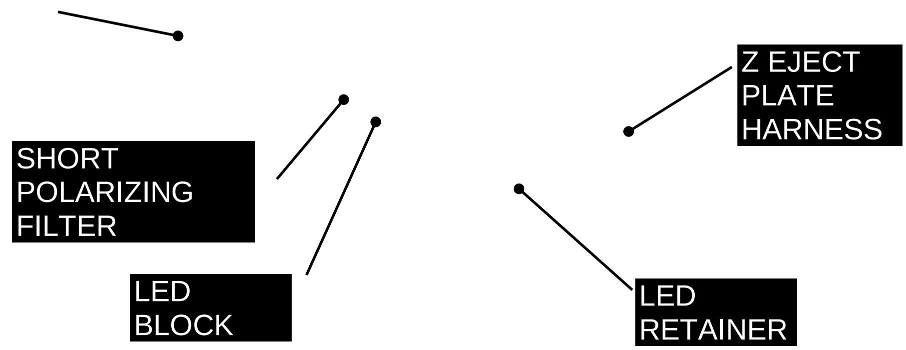


Figure 7-49: Proximity Sensor

2. Route the wires as shown, and clamp the sheathed part of the harness into the bottom small wire clip and attach the LED Shield using two M2x6 Cap Head Screws and Loctite 222.

> ***Note**: Ensure the Harness is not pinched by the LED Shield and that the Belt on the Bottom Idler does not rub the wires.*

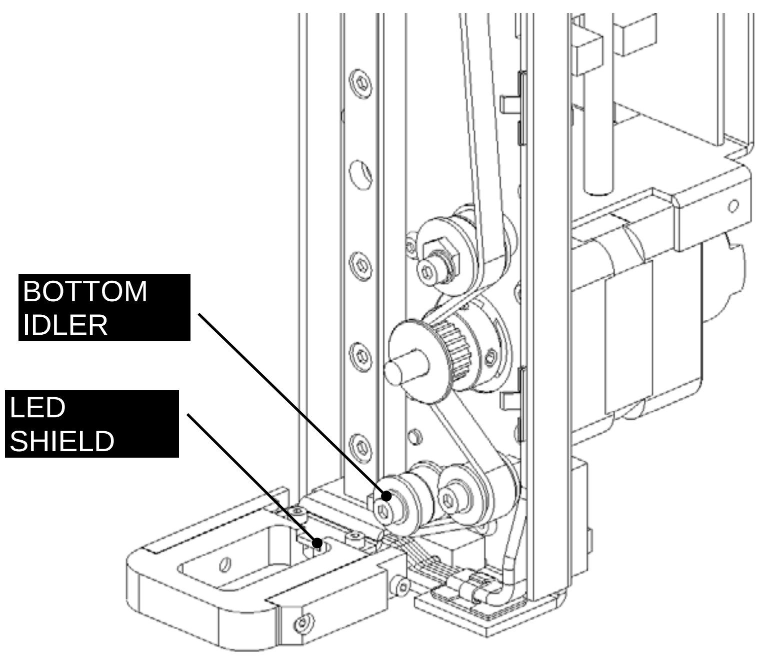


Figure 7-50: LED Shield

3. Run the Z Eject Plate Harness up the side of the Z Mounting Plate and thread the connector through the cut in the plate. Clamp the cable in the wire clips. Ensure that the cable lies flat to the side as it passes the belt idlers (Figure 7-51).

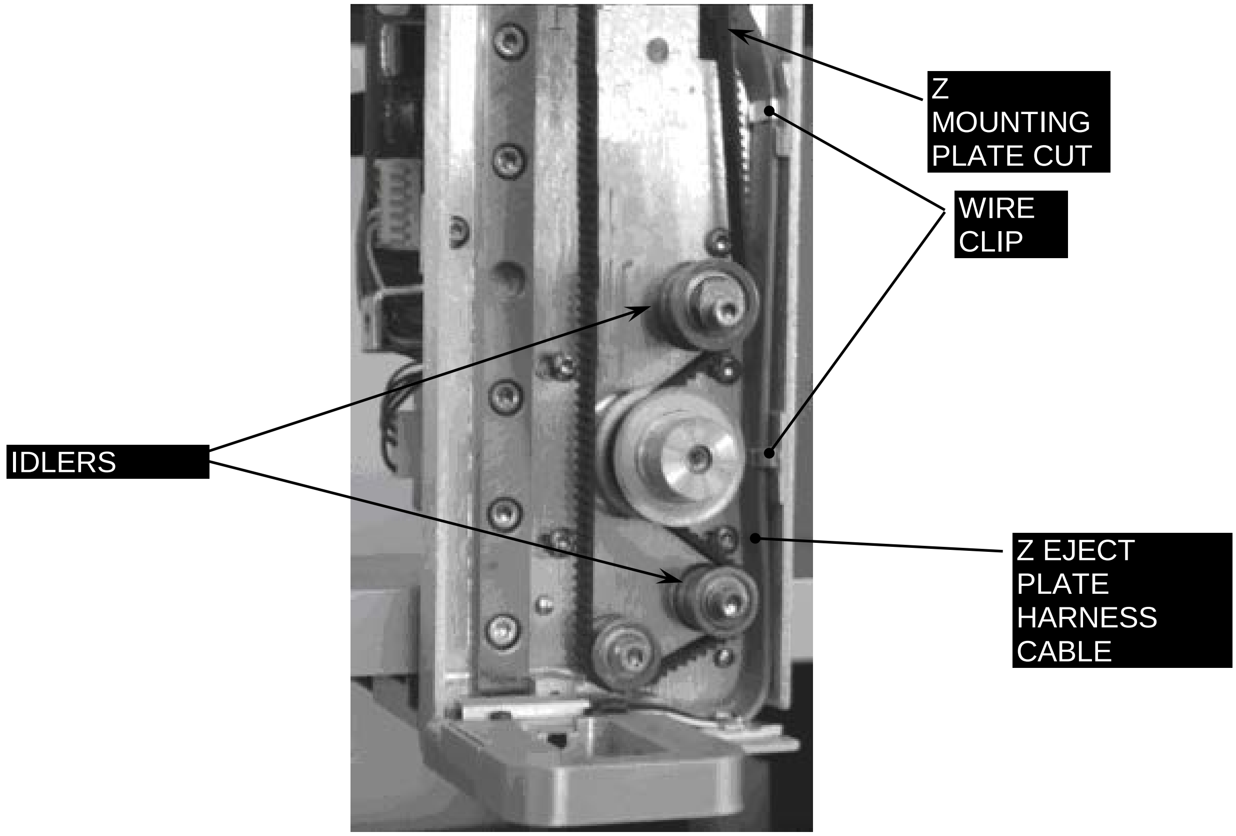


Figure 7-51: Z Eject Plate Harness

4. Mount the Home Sensor to the Z Home Sensor Bracket using one M3x6 Button Head Screw as shown in Figure 7-52.

> ***Note***: ***DO NOT USE LOCTITE ON OPTO-INTERRUPTERS.*** *Thread the opto-interrupter wires through the slot in the mounting plate.*

> ***Note***: *Ensure the Sensor Breaker passes clearly through the Home Sensor.*

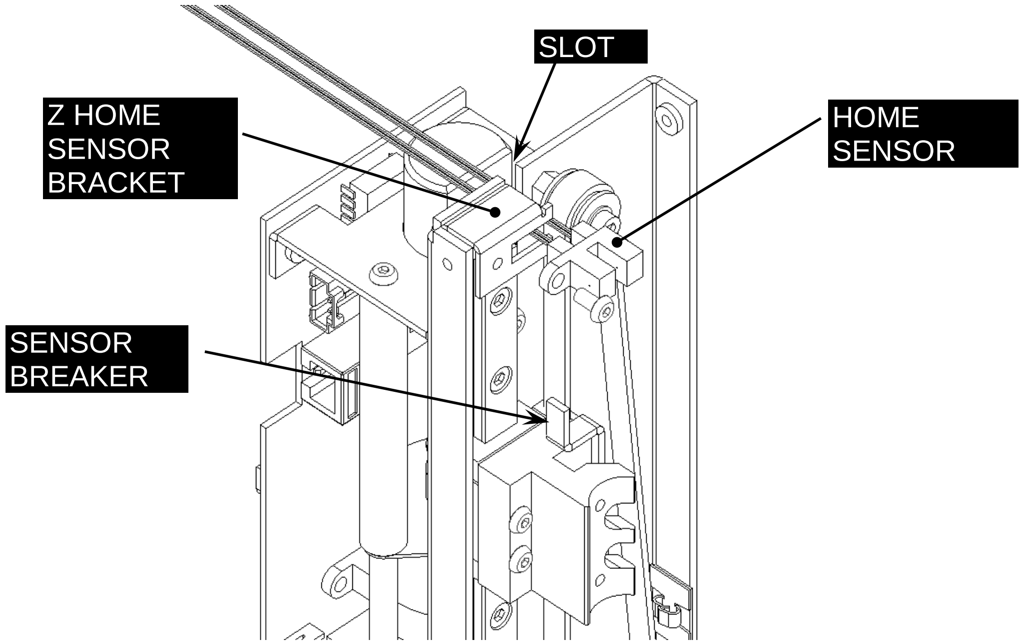


Figure 7-52: Z Home Sensor Breaker

5. Connect the Long Encoder Cable (15500071) in to the encoder (Figure 7-53).

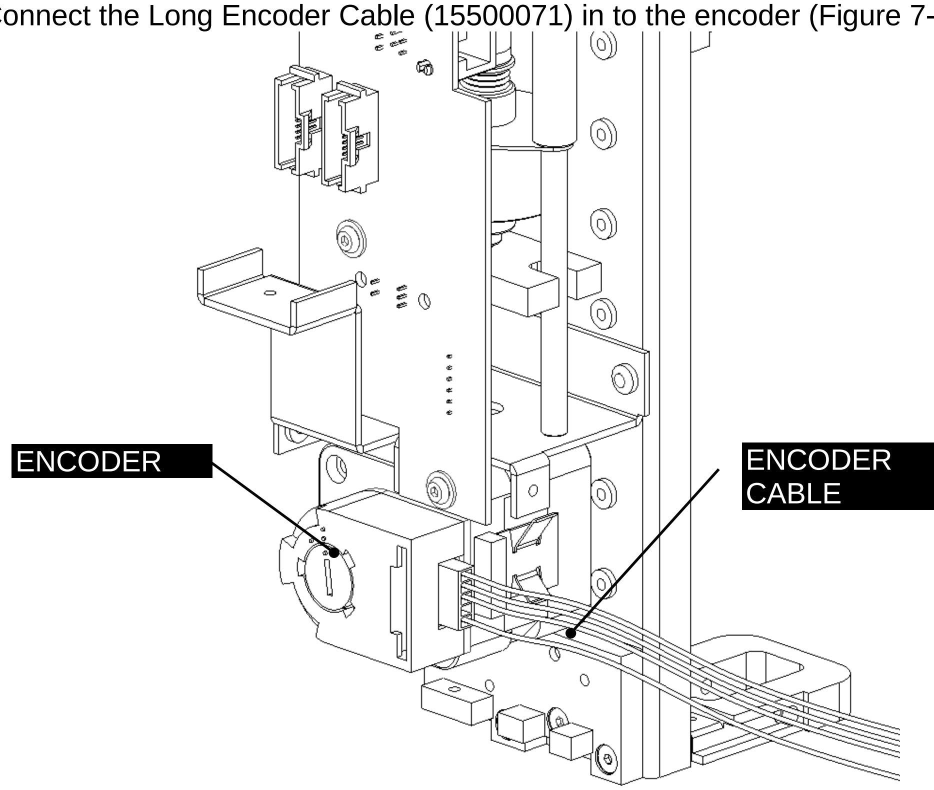


Figure 7-53: Encoder Cable

7.4.5 Replacing Idlers

The idlers are shown in Figure 7-54 and 7-55. To remove an idler, simply remove the screw holding the components in place.

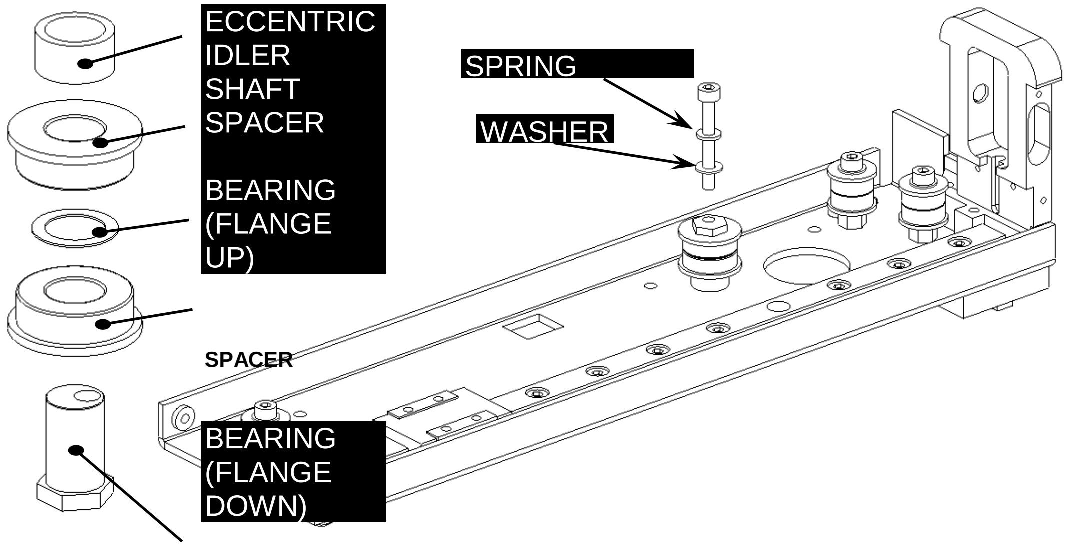


Figure 7-54: Eccentric Idler

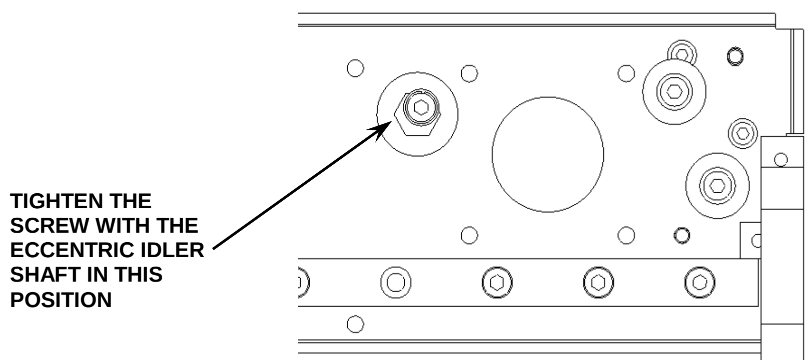


Figure 7-55: Location of Eccentric Idler

To rebuild a Stepped Idler:

1. Screw the Stepped Idler Shaft on to the PEM stud on the Mounting Plate and fix with Loctite 222.

2. Fit an Idler Bearing on to the Idler Pin with the flange facing down, a Stainless Steel Spacer then another Idler Bearing with the flange facing up.

3. Fix in place using a M3x6 Cap Head Screw, an M3 Washers and Loctite

To replace the Eccentric Idler:

1. For the Eccentric Idler Shaft, use one Idler Bearing with the flange facing down, one Stainless Steel Spacer, and a second Idler Bearing with the flange facing up and the Z Eccentric Idler Shaft Spacer (Figure 7-56).

2. Flip over the idler assembly and slide into place on the mounting plate and fix in place using one M3x25 Cap Head Screw, one M3 Spring Washer and one M3 Washer.

3. Tighten the screw with the Eccentric Idler Shaft in the position shown below.

> ***Note**: The Eccentric Idler Shaft only just fits into the spacer, care must be taken when tightening to ensure that it is seated correctly.*

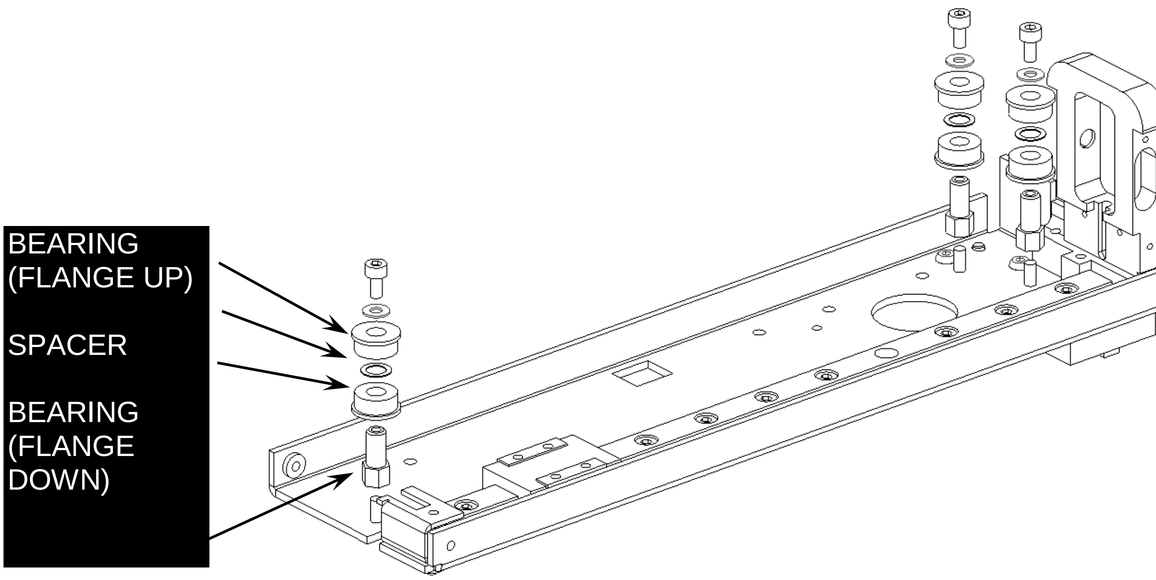


Figure 7-56: Stepped Idler Shaft

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Chapter 8 The Y Drive Assemblies

8.1 Removing the Y Drive Assembly

The Y Drive Assembly is attached to the Y Drive Support Rail just in front of the XY Attachment Plate. (Figure 8-1 and Figure 8-2).

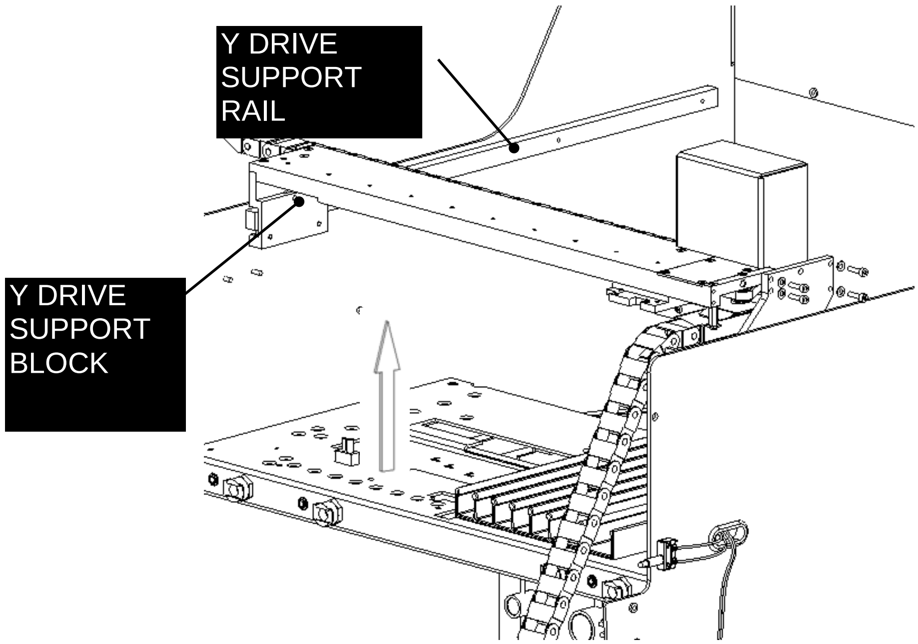


Figure 8-1: Y Drive Support Rail and Support Block

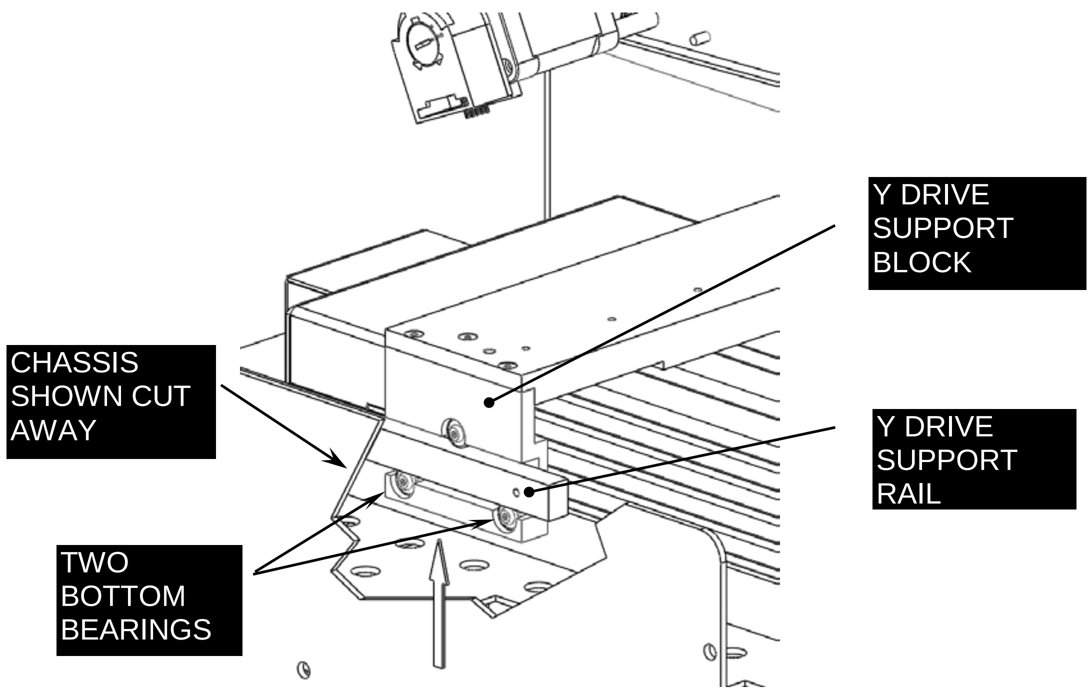


Figure 8-2: Y Drive Support Block Details

To remove the assembly:

1. Remove the cover of the X- Assembly by removing the three screws indicated in Figure 8-3 and 8-4.

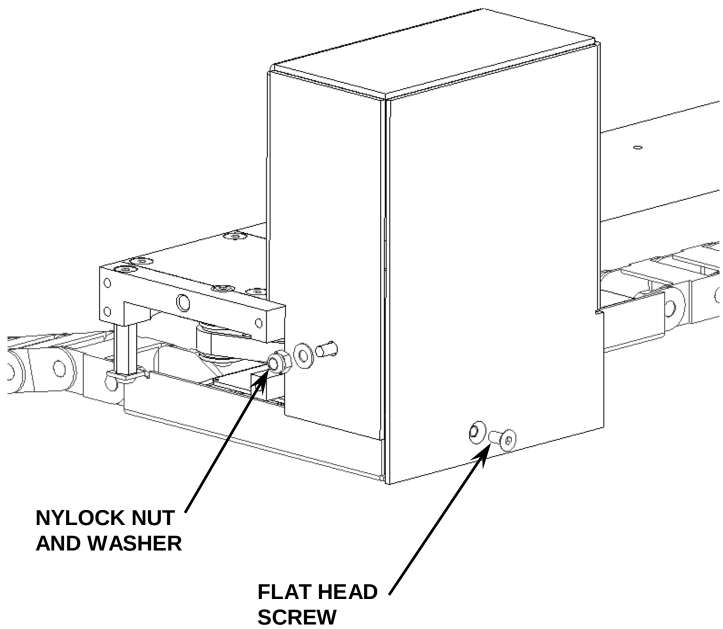


Figure 8-3: Removal of Cover, part A

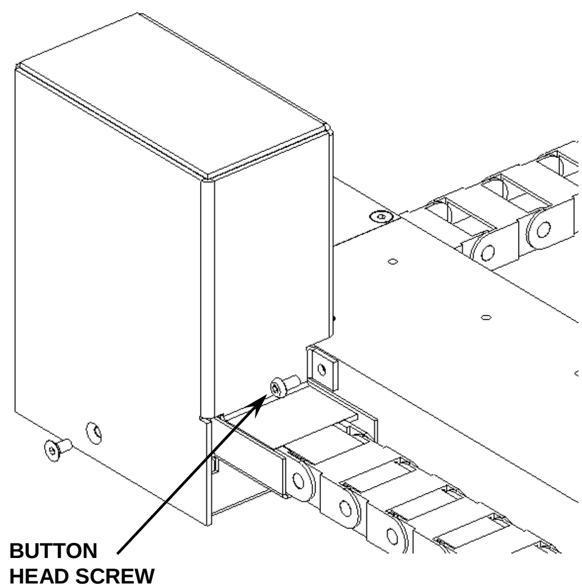


Figure 8-4: Removal of Cover, part B

2. Remove the transition box (see Figure 8-8).

3. Remove the chain mounting bracket for the Y drive on the Z Drive by removing the screw (Figure 8-3).

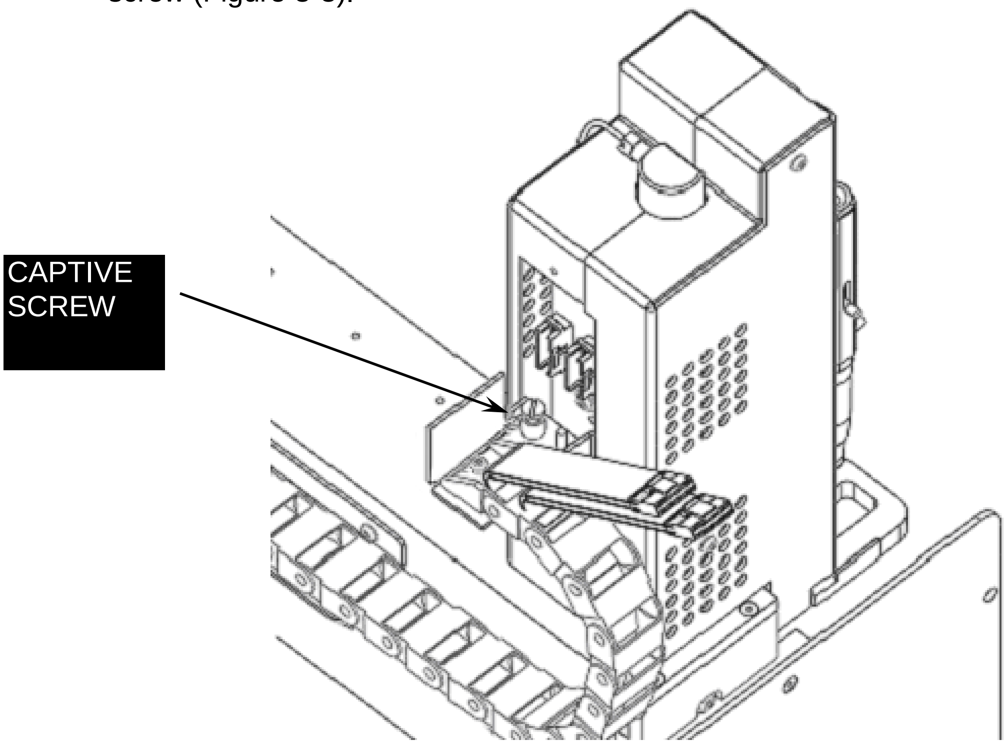


Figure 8-3: Captive Screw for Y Igus Chain

4. Move the Y drive support block to the left end of the arm so that the two bottom bearings are touching the underside of the Y Drive.

5. Remove the two screws indicated in Figure 8-4.

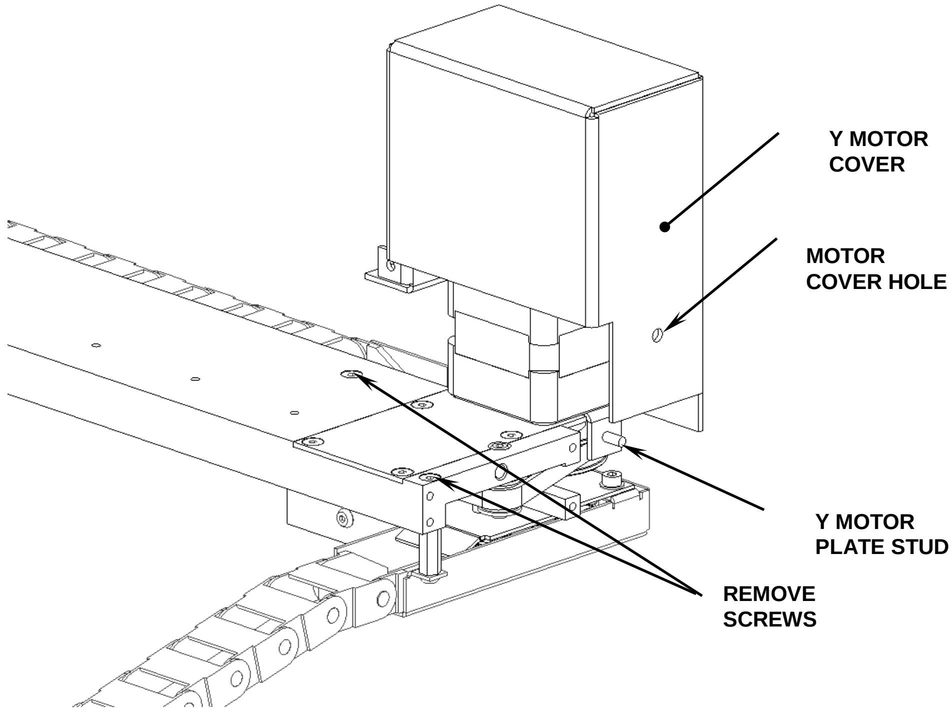


Figure 8-4: Y Axis Support Screws

To replace the assembly:

1. Gently push the left hand side of the chassis to allow the Y Arm to pass the Dowel in the XY Attachment Plate.
2. Locate the dowel into the hole in the end of the Y Arm and loosely fit four M3x12 Cap Head Screws and four M3 Internal Tooth Washers.
3. Lift the Y Drive Support Block on the left end of the arm so the two bottom bearings are touching the underside of the Y Drive Support Rail and then tighten the four screws.

8.2 Replacing Components on the Y Drive Assembly

8.2.1 Replacing the Igus Chain and Flex Cables

To remove the Igus chain:

1. Remove the chain mounting bracket (Figure 8-5).

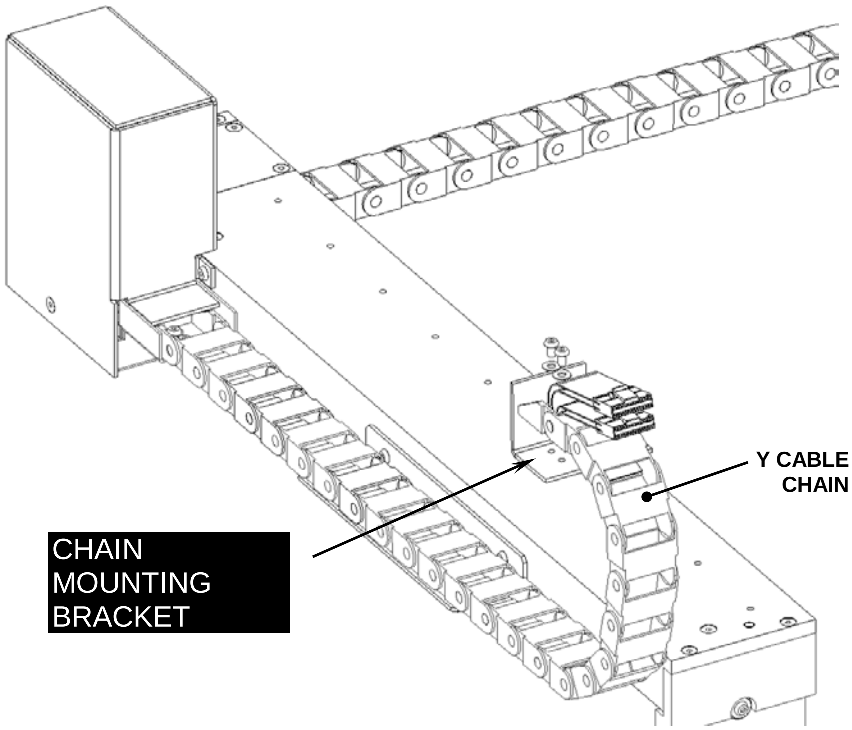


Figure 8-5: Chain Mounting Bracket

2. Remove the Igus Chain Support.

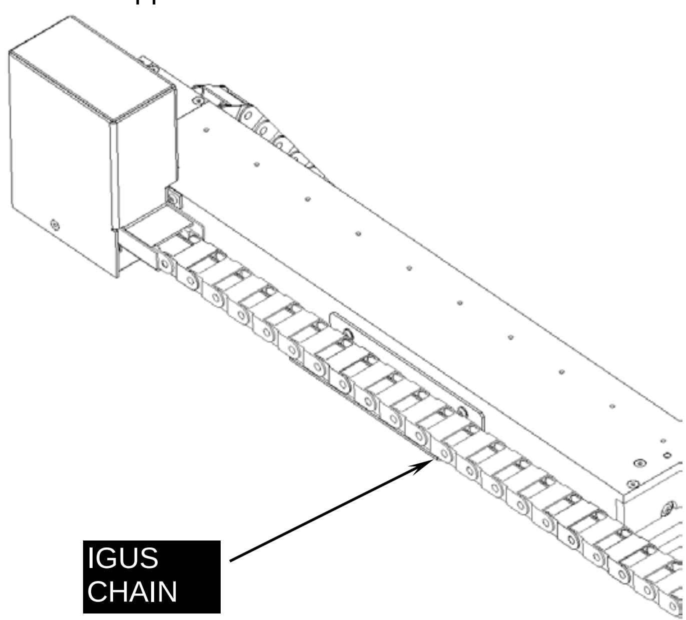


Figure 8-6: Igus Chain Support

3. Remove the transition box assembly from the Y arm by removing the two screws indicated in Figure 8-7.

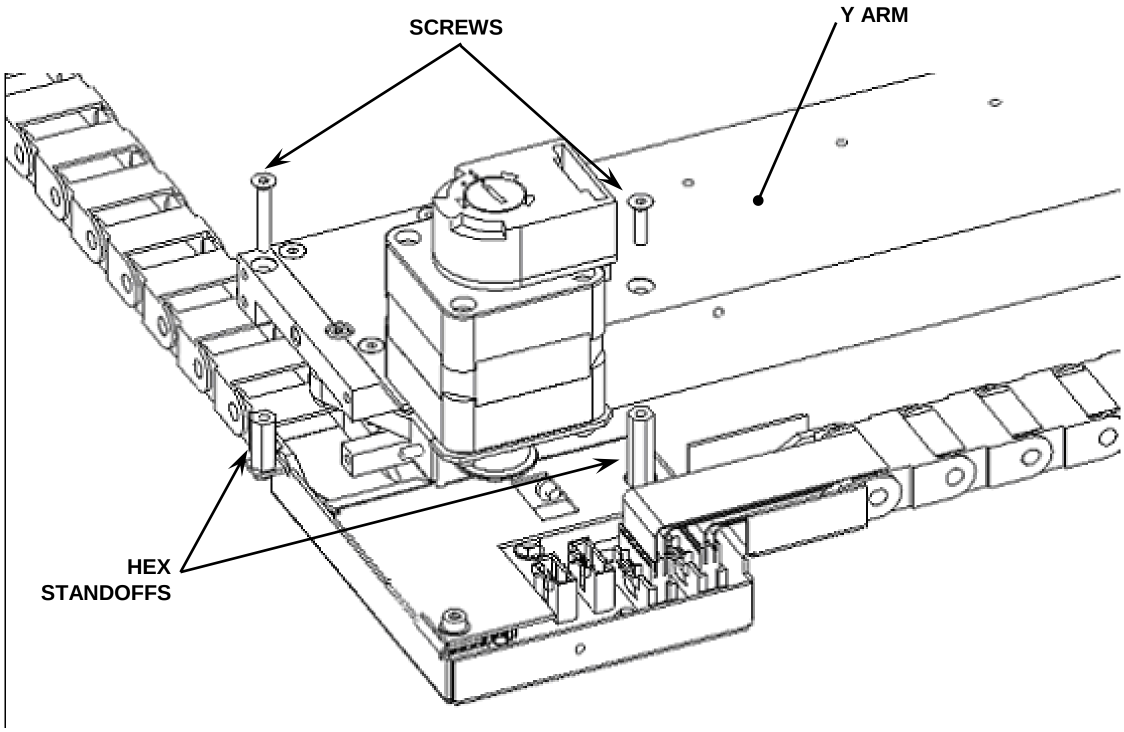


Figure 8-7: Removing the Y-Transition Box

4. Remove the cover of the Y-Transition Box (Figure 8-8).

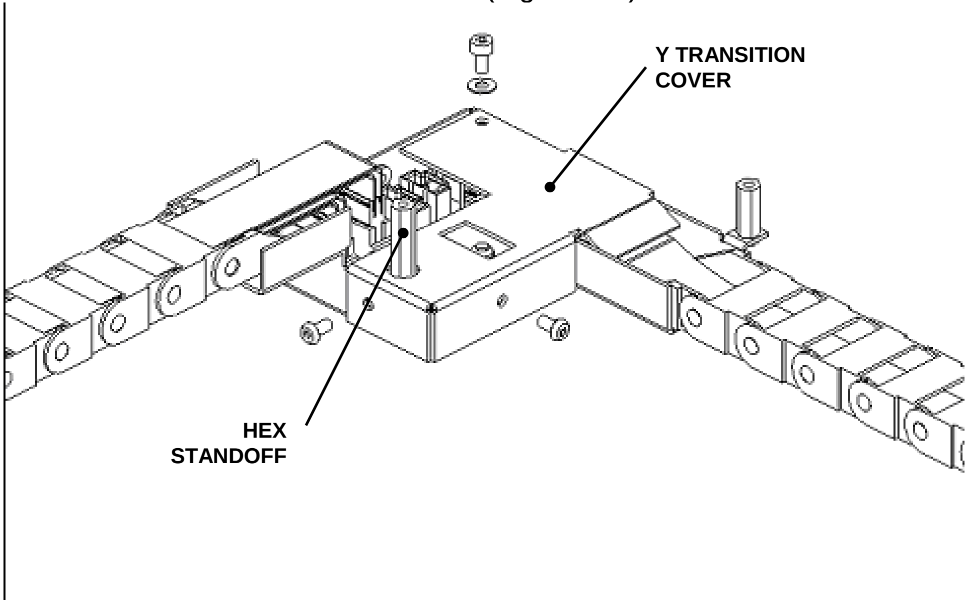


Figure 8-8: Removing Cover of Transition Box

5. Remove the two double flex cables connected to J6 and J7 in Figure 8-9.

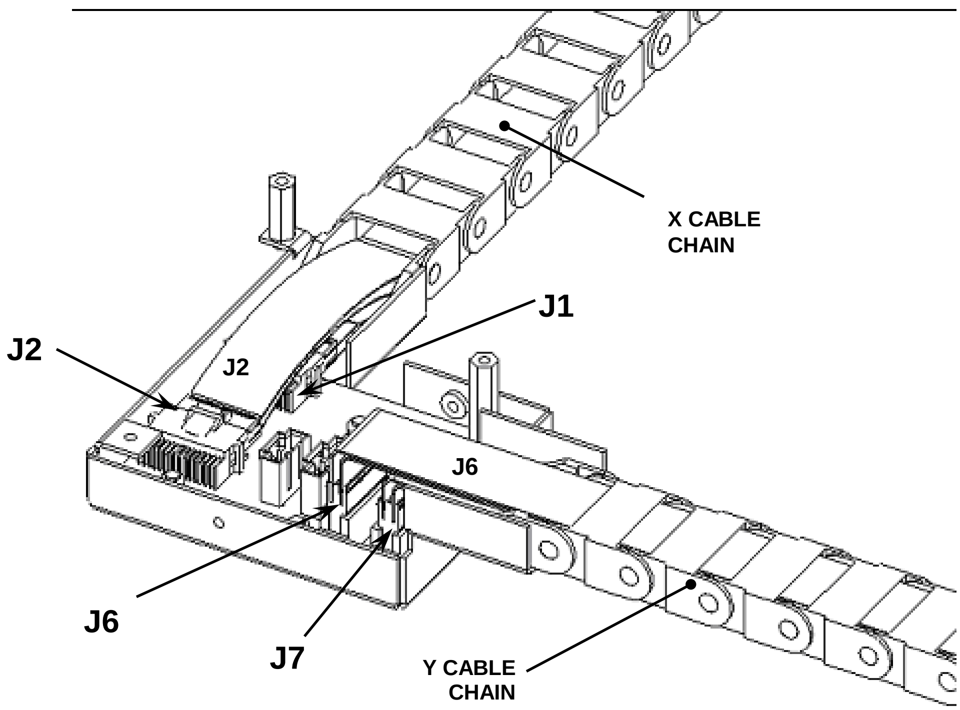


Figure 8-9: Removing the Flex Cables

6. Remove the Y Cable Chain (Figure 8-10).

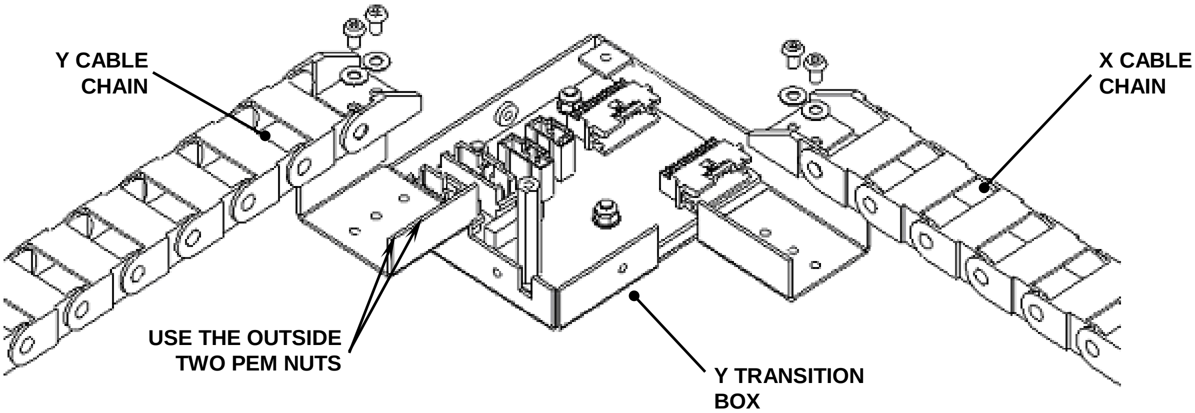


Figure 8-10: Removing the Y Cable Chain

8.2.2 Removing the Y Transition Printed Circuit Board

The Y transition Printed Circuit Board is located in the Y Transition PCB box and attached by three nuts (Figure 8-11).

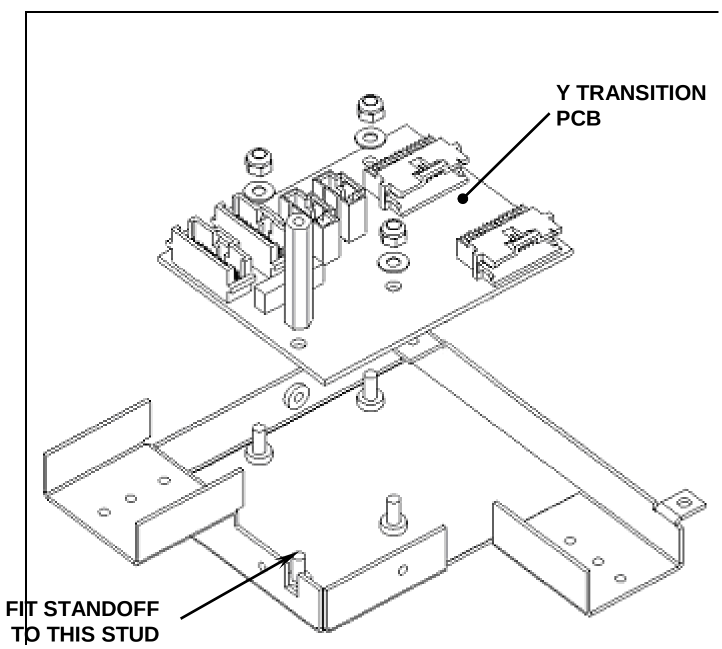


Figure 8-11: Location of Y-Transition Printed Circuit Board

When replacing the board, ensure that the insulation film on the base of the Y-Transition Box is in good condition. The standoff on the PCB should fit the stud indicated in Figure 8-11.

8.2.3 Replacing the Y Belt

To remove the belt:

1. Remove the 4 M3x8 caphead screws attaching the YZ attachment block to the rail block (Figure 8-12 and 8-13).

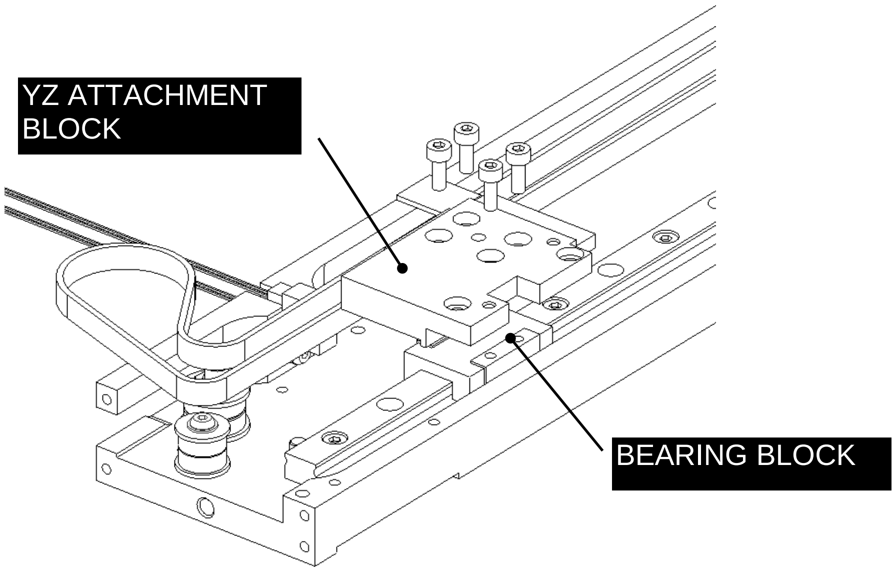


Figure 8-12: Removing the Belt, Part 1

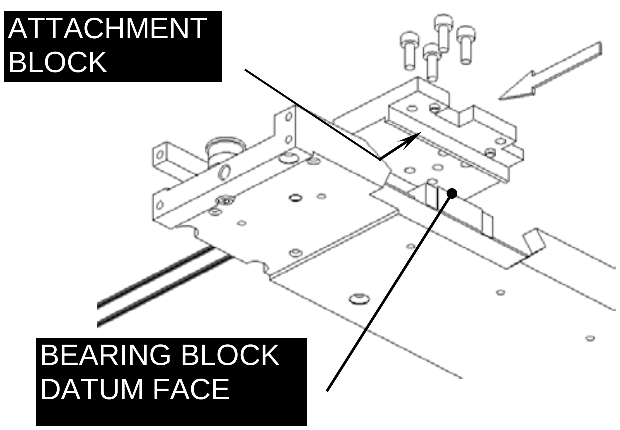


Figure 8-13: Removing the Belt, Part 2

2. Remove the Belt Attachment Bracket (Figure 8-14).

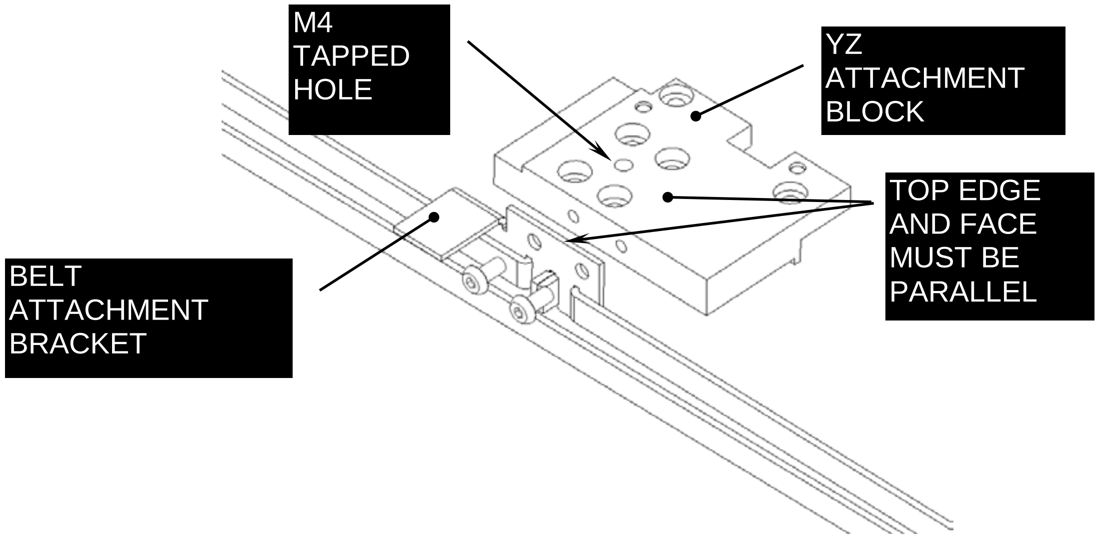


Figure 8-14: Removing Belt Attachment Block

When replacing the XY Attachment Block, check the M4 tapped hole by driving an M4X10 screw through it and then removing it. The top edge of the belt attachment bracket should be parallel to the face of the YZ Attachment Block.

3. Remove the belt from the attachment bracket (Figure 8-15).

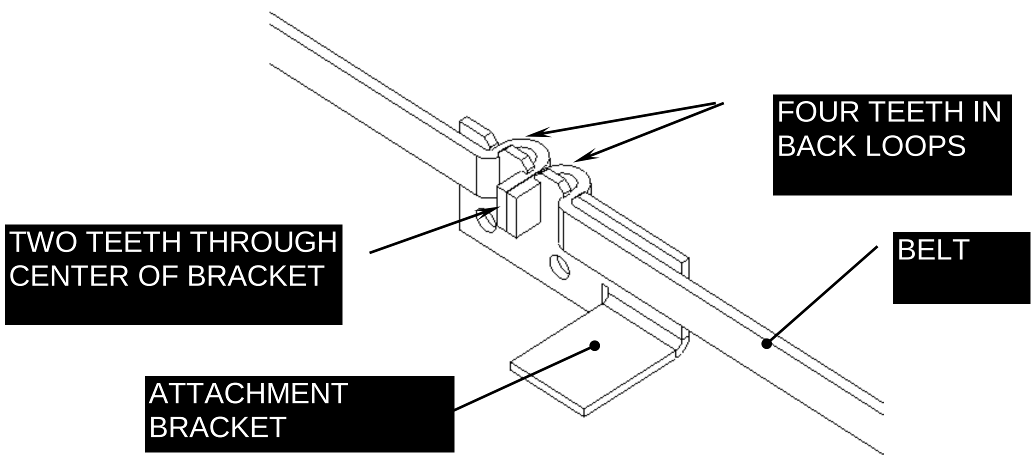


Figure 8-15: Replacing the Belt

To replace the belt:

1. Cut a 1026mm length of the Gates Rubber belt LL2MR06, 2mm Pitch x 6mm wide and fit the two cut ends in to the Y Belt Attachment Bracket with two teeth through the center and four teeth in the back loops as shown in Figure 8-15.

2. Check the M4 tapped hole in the YZ Attachment Block by driving an M4X10 screw through the hole and then removing it. Fix the Y Belt Attachment Bracket to the YZ Attachment Block using two M3x6 Button Head Screws and Loctite 222. Ensure that the top edge of the belt attachment bracket is parallel to the face of the YZ Attachment Block (Figure 8-16).

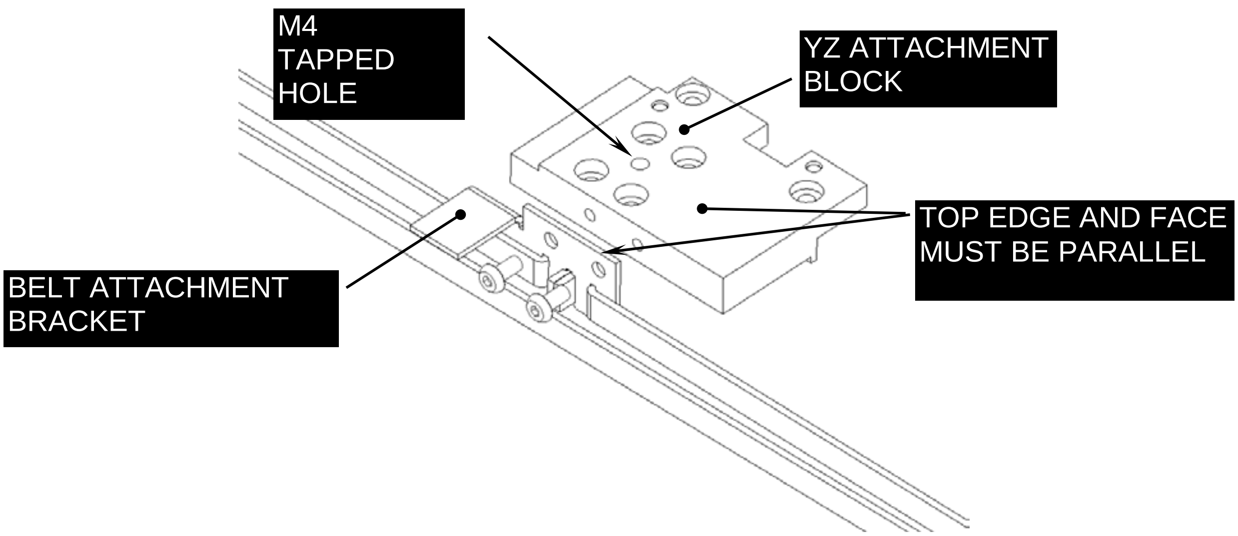


Figure 8-16: Belt Attachment Bracket and Block

3. c) Loosely fix the YZ Attachment Block to the Y Drive Linear Rail Block using four M3x8 Cap Head Screws and Loctite 222. Push the Attachment Block so that the datum face is flush to the datum face of the Bearing Block and using a 10in/lb torque driver to tighten the screws (Figure 8-17 and 8-18).

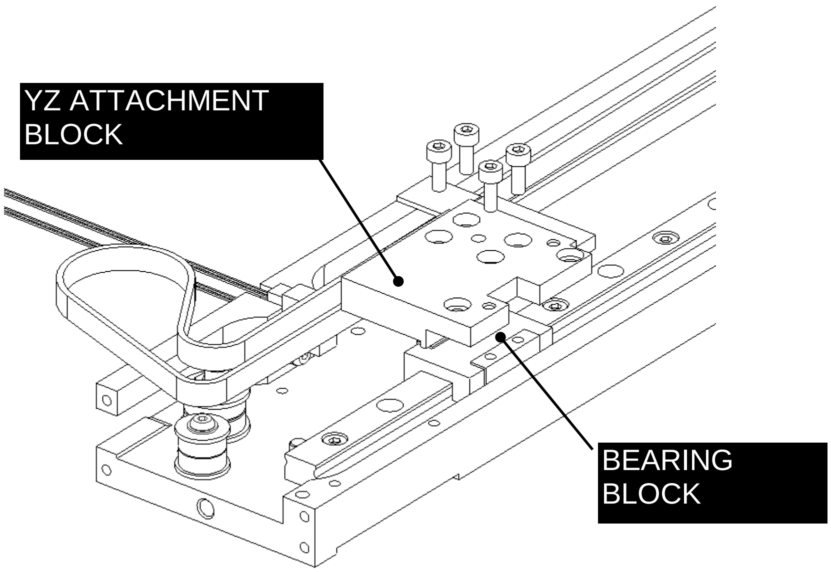


Figure 8-17: Attaching the YZ Attachment Block. Part A

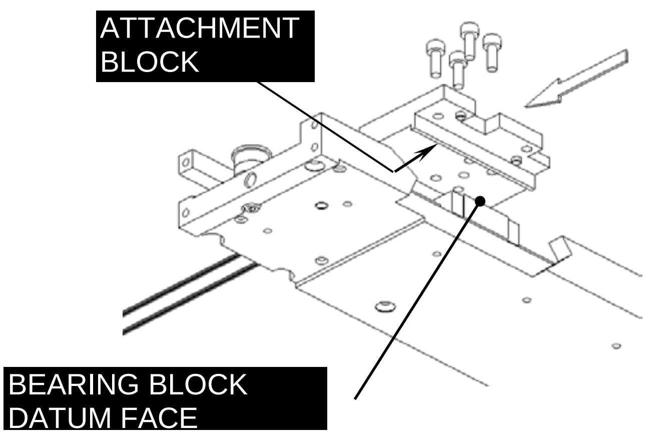


Figure 8-18: Attaching the YZ Attachment Block, Part B

4. Loop the belt around the two Idlers and the Eccentric Idler as shown in Figure 8-19 and 8-20. Slide the YZ Attachment Block up to the end of its travel to check that the Home Flag on the Y Belt Attachment Bracket does not hit the Home Sensor as it passes through it.

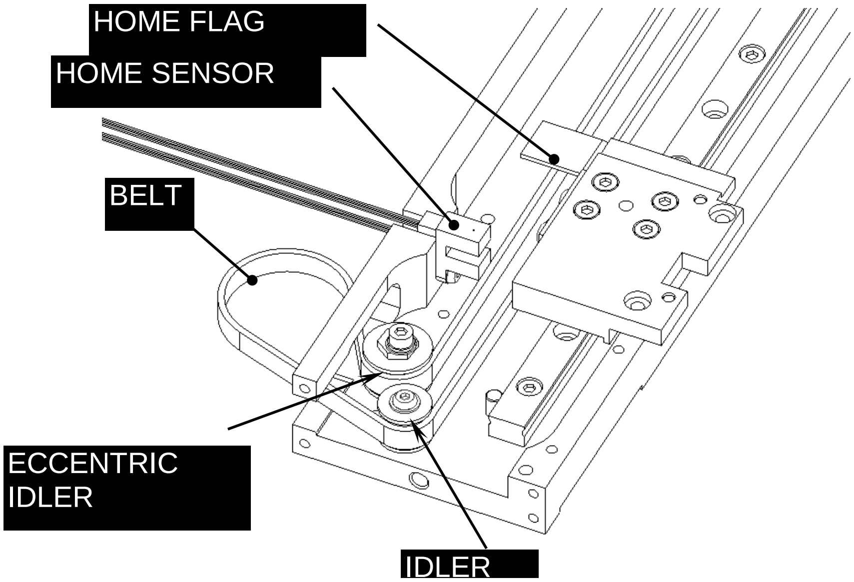


Figure 8-19: Installing the Belt, Part A

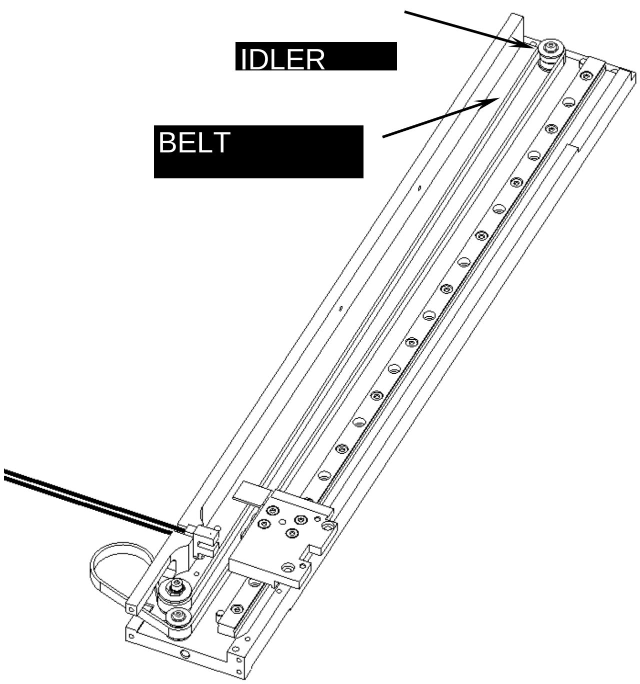


Figure 8-20: Installing the Belt, Part B

5. Hook the Y Motor Pulley into the belt loop and locate the Y Motor Plate in to the recess. Attach to the Y Arm using four M3x6 Flat Head Screws and Loctite 222 (Figure 8-21 and 8-22).

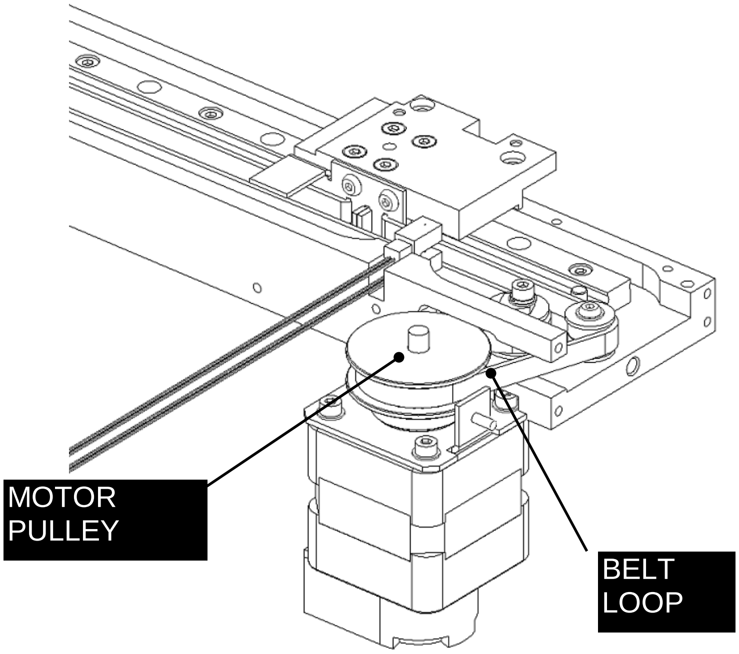


Figure 8-21: Attaching Motor Pulley, Part 1

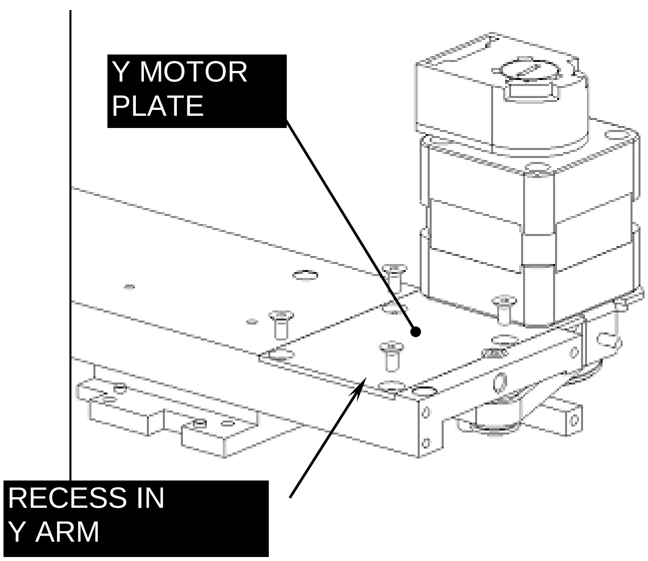


Figure 8-22: Attaching Motor Pulley, Part 2

6. Remove the Force Gauge assembly from the Belt Tensioning Fixture (DS2FIX008) and position the Y Drive onto the fixture so that the top face of the Y arm is resting on the top faces of the fixture supports (Figure 8-23).

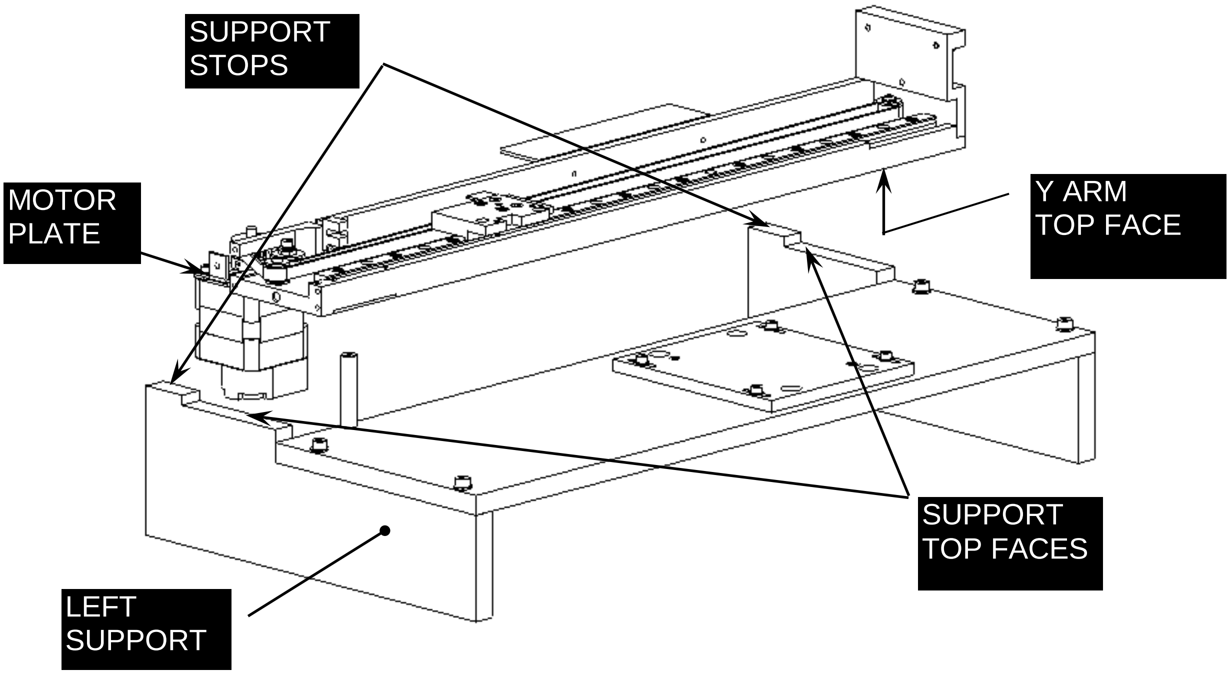


Figure 8-23: Y Assembly on Belt Tensioning Fixture

> ***Note**: Field service engineers will use a hand held tension meter in place of the tensioning fixture described herein. Place a piece of metalized tape on the belt and hold the meter about ½" from the belt. Gently press on the belt and observe the reading on the meter. An acceptable reading is 58 Hz.*

7. Gently slide the Y Drive over, until the motor plate is touching the inside face of the left support, and the back face of the Y arm is touching the support stops.

8. Slide the YZ Attachment Block over to the left until it touches the nylon standoff. To reposition the Force Gauge on the fixture, angle the gauge assembly and push it forwards and down, so the belt hook slightly deflects the belt and the dowels on the gauge assembly fit into the adjuster plate of the fixture (Figure 8-24).

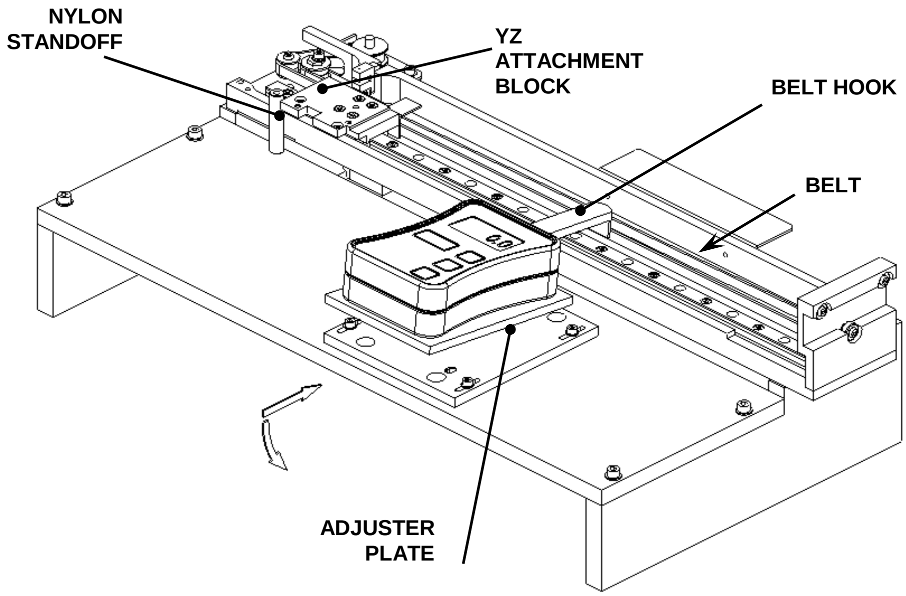


Figure 8-24: Positioning Force Gauge

9. Use an Allen Key to gently push the Belt off the end of the Force Gauge Belt Hook by 1 to 2 mm and then reposition it before taking each force reading. This is to ensure that no sideways force from the belt is being measured (Figure 8-25).

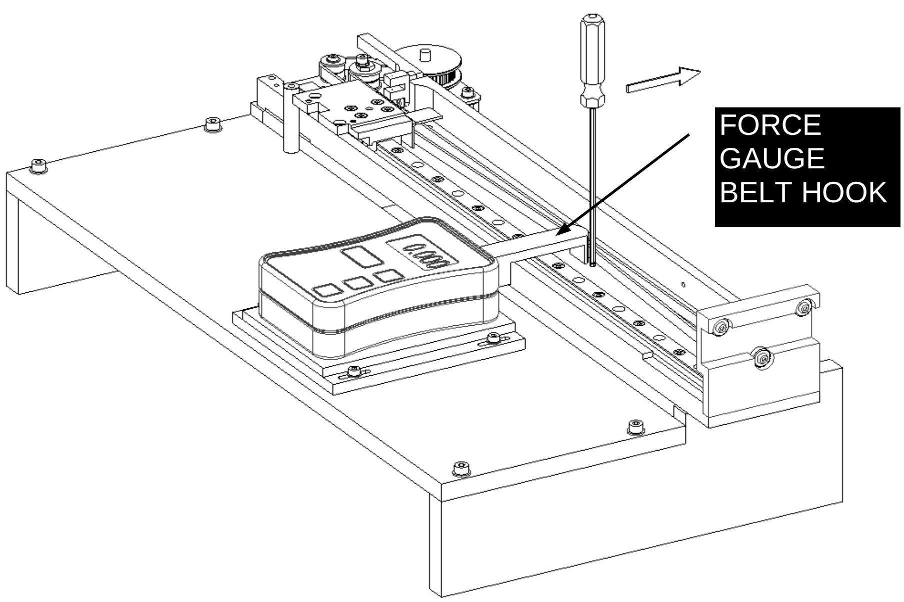


Figure 8-25: Pushing Belt off Belt Hook

> ***Note**: Before setting the belt tension, the belt must be pre-stretched. Slacken off the Eccentric Idler socket cap screw by ¼ of a turn, and use an 8mm open ended wrench on the hex detail of the Eccentric Idler to rotate the Idler clockwise until the force gauge reads between 0.115 and 0.125 Kg, and then return the Eccentric Idler back to its original position (Figure 8-26, 8-27).*

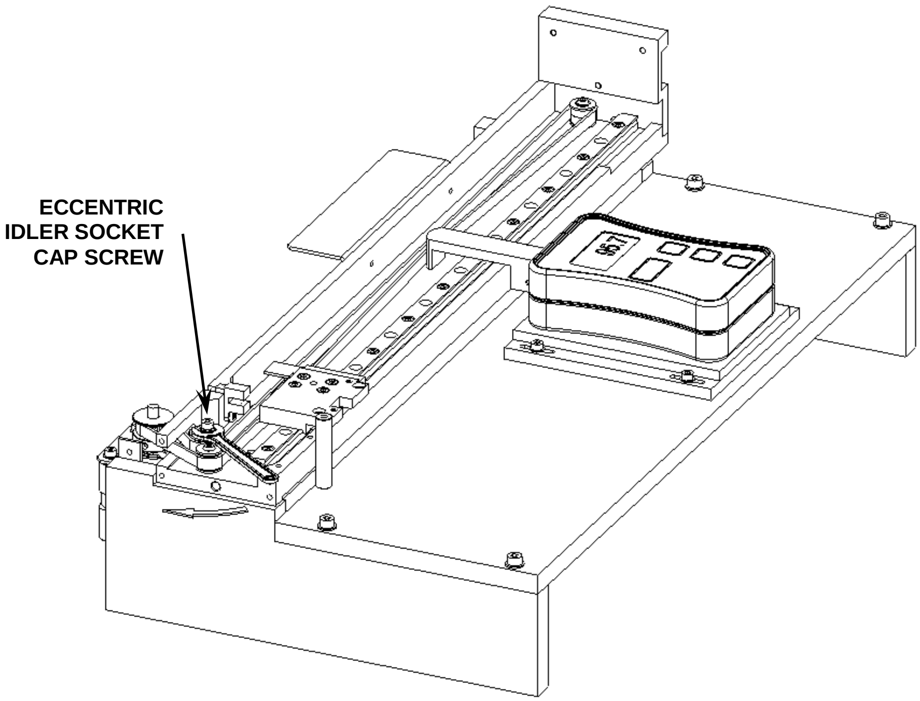


Fig 8-26: Eccentric Idler Socket Cap Screw

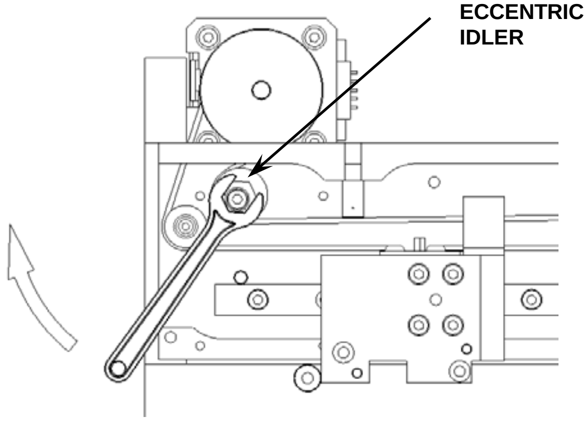


Figure 8-27: Eccentric Idler

10. Set the working tension rotate the Eccentric Idler clockwise until the force gauge reads between 0.105 and 0.115Kg (target of 0.110Kg) and tighten the socket cap screw to lock the Eccentric Idler in place.

Fit a Y PCB Insulation Film over the studs in the Y-Transition Box and locate four spacers onto the studs. Place a Y Transition PCB into the transition box and secure using three M3 Nylock Nuts, three M3 Nylon Washers.

8.2.4 To Replace the Home Sensor

The Home Sensor is located on the Y-arm using one M3 x 6 Button Head Screw (Figure 8-28).

Attach the Home Sensor to the Y Arm using one M3x6 Button Head Screw.

> ***Note**: Do not use Loctite on Opto-Interrupters.*

Route the opto-interrupter wires through the Y Arm as shown.

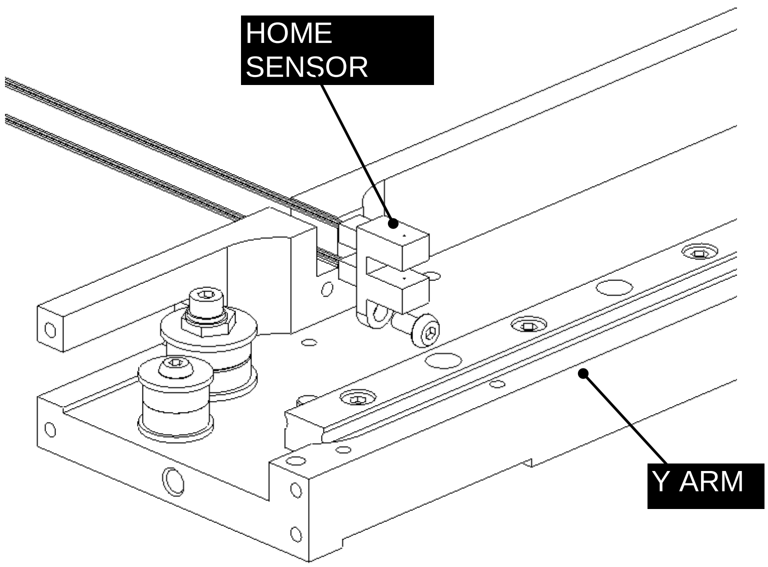


Figure 8-28: Optointerrupter

8.2.5 The Motor and Pulley

To remove the Motor and Pulley:

1. Unhook the Pulley from the belt loop and remove the Motor/Pulley assembly from the Y arm by unscrewing the 4 M3x6 Flat Head Screws (Figure 8-29, 8-30).

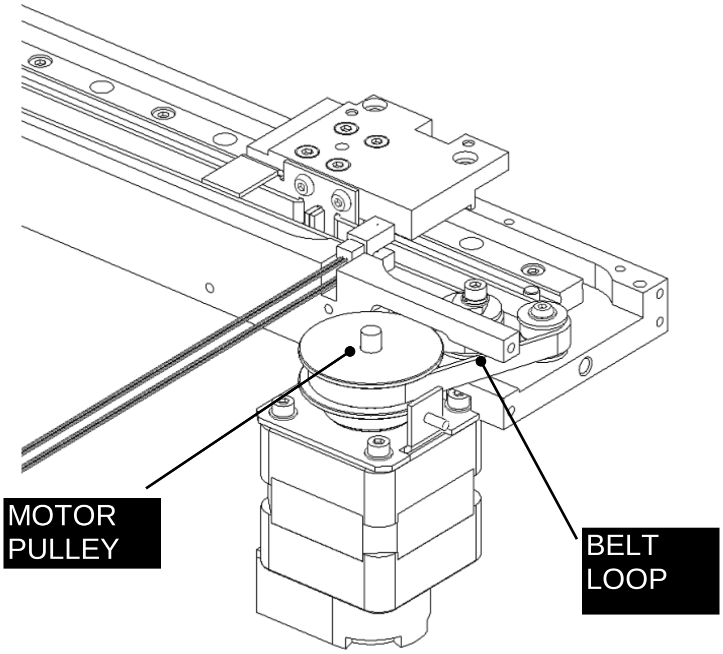


Figure 8-29: Removing the Belt Loop

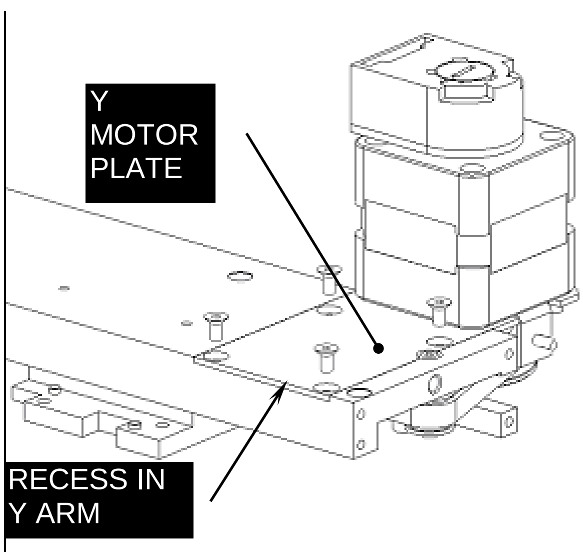


Figure 8-30: Removing the Motor and Encoder

2. Put an Allen key into the encoder and place an upward force on as shown in Figure 8-31 to remove the encoder.

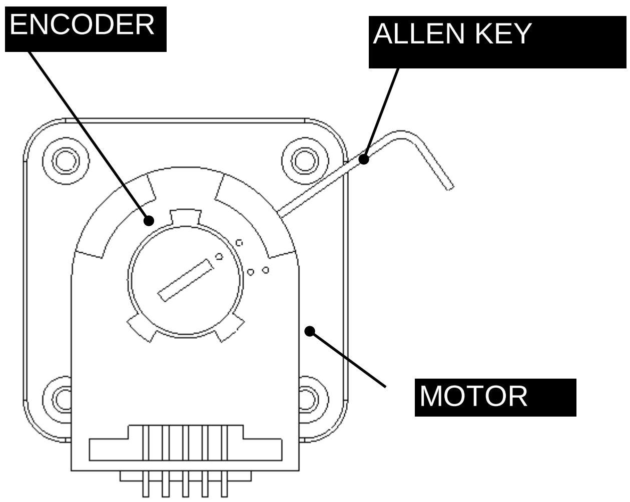


Figure 8-31: Removing the Encoder

3. Remove the Encoder Mounting Plate (Figure 8-32). The jig (DSXFIX015) shown in the figure is not required for removal, but is required for installation of a new unit.

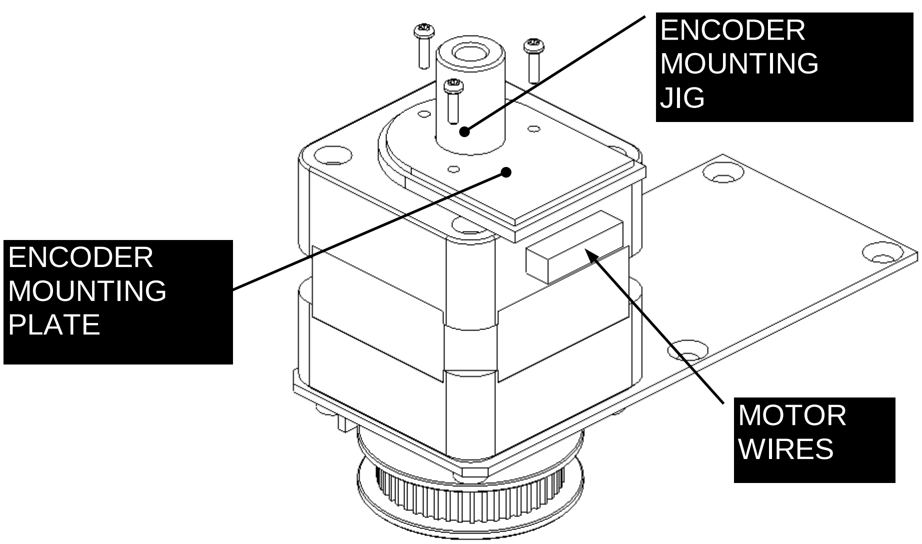


Figure 8-32: Encoder Mounting Plate

4. Remove the Drive Pulley by unscrewing the two set screws (Figure 8-33). The jig (DSXFIX004) shown in the figure is not required for removal, but is required for installation of a new unit.

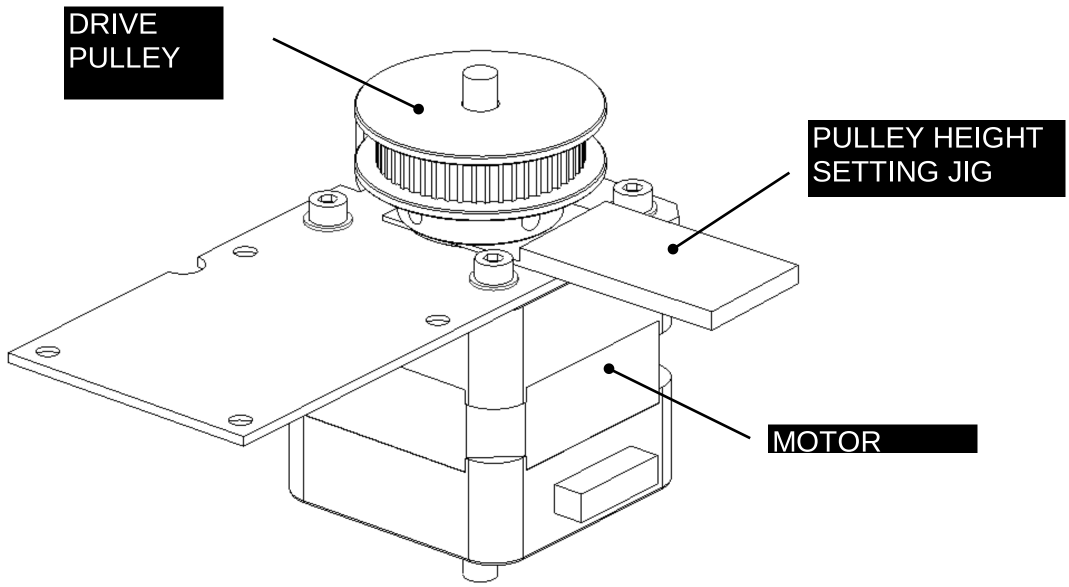


Figure 8-33: Drive Pulley

To Reinstall the Encoder:

1. Attach the encoder mounting plate to the motor using the Encoder Mounting jig (DSXFIX015) and the 3 M1.6x6 Pan Head Screws. Ensure that the mounting plate is centralized around the pulley idler shaft.

2. Install the main part of the Encoder onto the Mounting Plate by snapping it in place.

> ***Note**: Do not remove the Allen key in the encoder (Figure 8-34).*

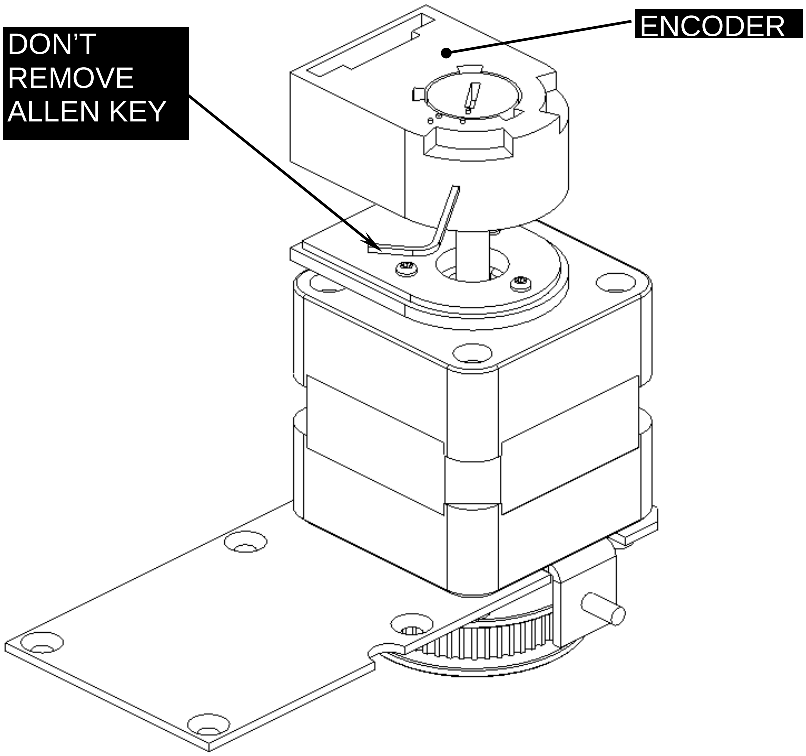


Figure 8-34: Placing Encoder on Motor

3. Push the Allen Key into the body of the encoder to ensure this it is properly seated into the code wheel hub set screw and then apply a downward force on the end of the Allen Key. This sets the code wheel gap by levering the code wheel hub to its upper position.

4. While continuing to apply a downward force, rotate the Allen Key to the clockwise direction until the hub set screw is tight against the idler shaft (Figure 8-35). Remove the Allen Key by pulling it straight out of the encoder body.

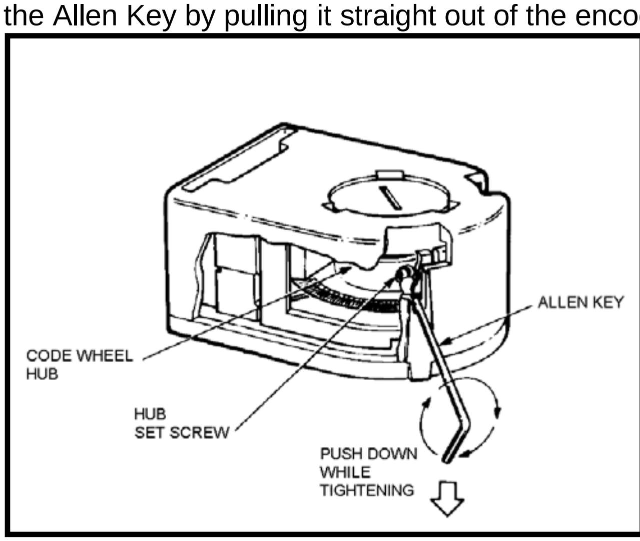


Figure 8-35: Adjusting the Encoder

5. Rotate the encoder cover from the open to the closed position by inserting a small flat blade screwdriver into the notch and rotating.

Note*: The encoder cover is shown below in the closed position.*

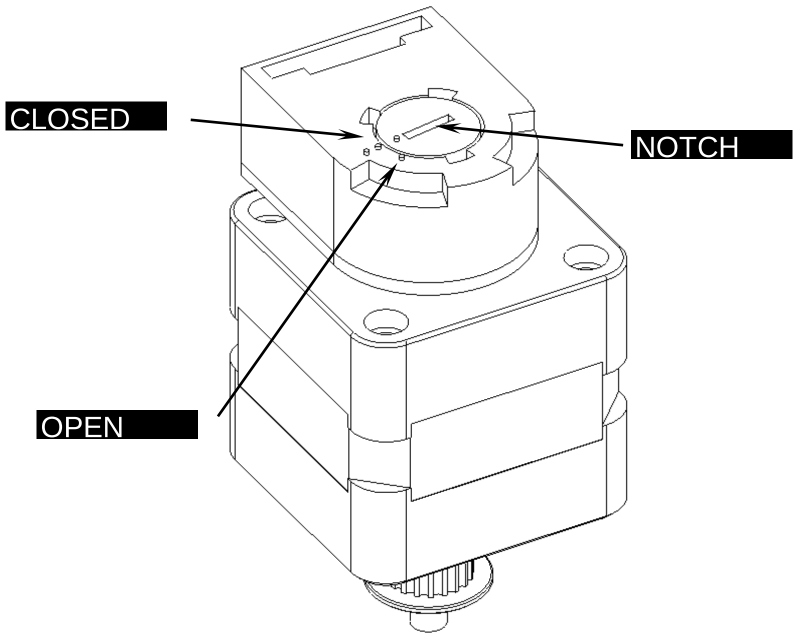


Figure 8-36 Encoder Cover

8.2.6 Refitting the Y Arm Assembly

When replacing the Y arm assembly, the left side should be lifted up so that the +bearings (Figure 8-37) are touching the support rail.

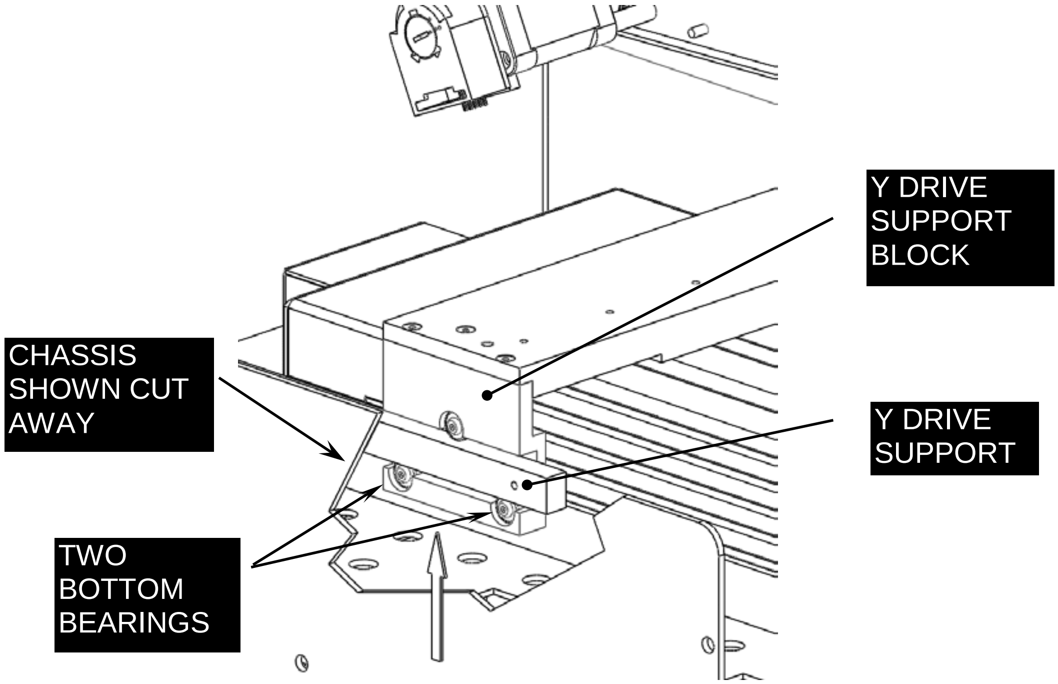


Figure 8-37: Y Drive Support Block Details

Chapter 9 The X Drive Assembly

9.1 Removing the X Drive Cover

The X Drive cover is attached to the unit as shown in Figure 9-1.

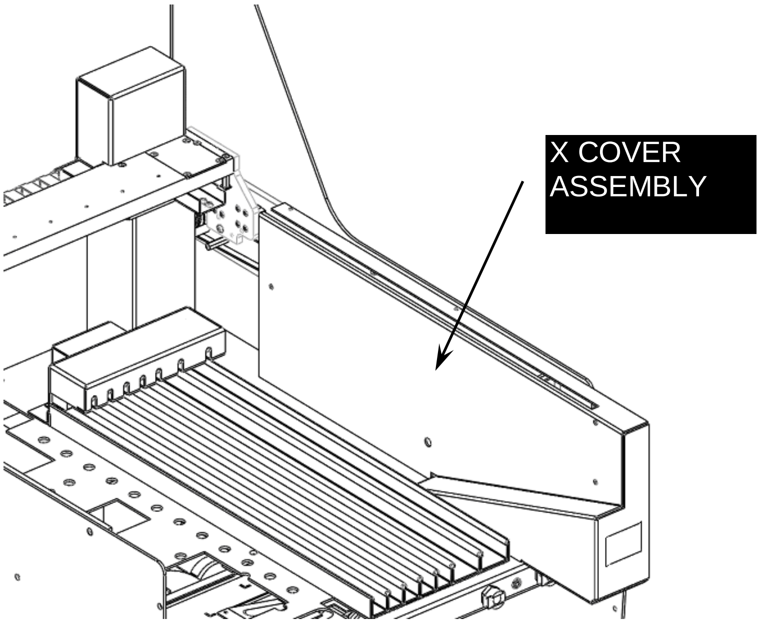


Figure 9-1: X Drive Cover Assembly

To Remove the X Drive Cover:

1. Remove the Button Head Screws (Figure 9-2).

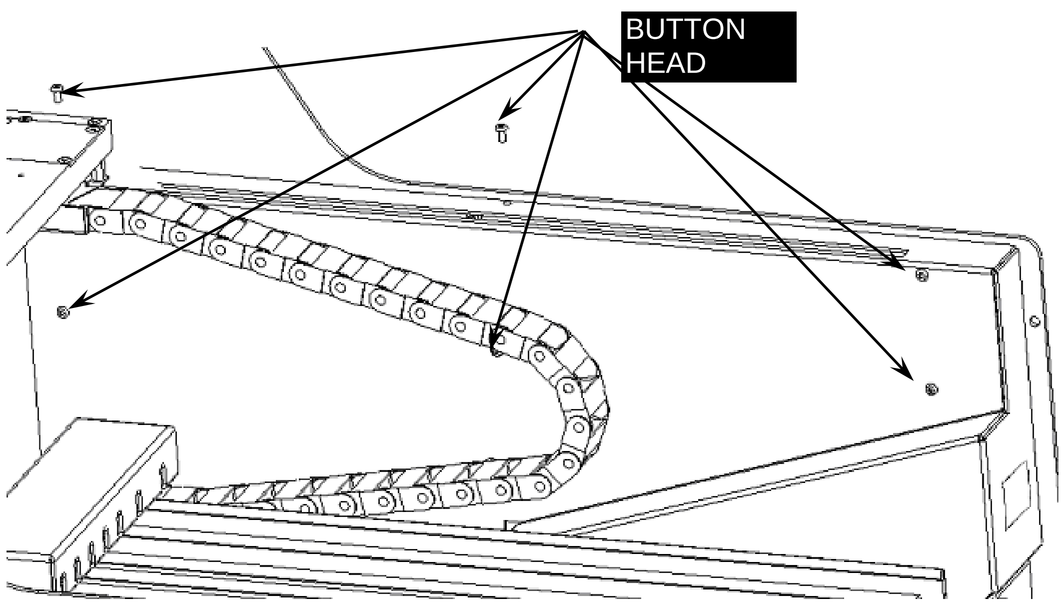


Figure 9-2: Button Head Screws

2. Remove the two M3x8 Cap Head Screws (Figure 9-3).

Note*: The two Cap Head Screws and two Internal Tooth Washers fit from underneath through the Workspace (Figure 9-3).*

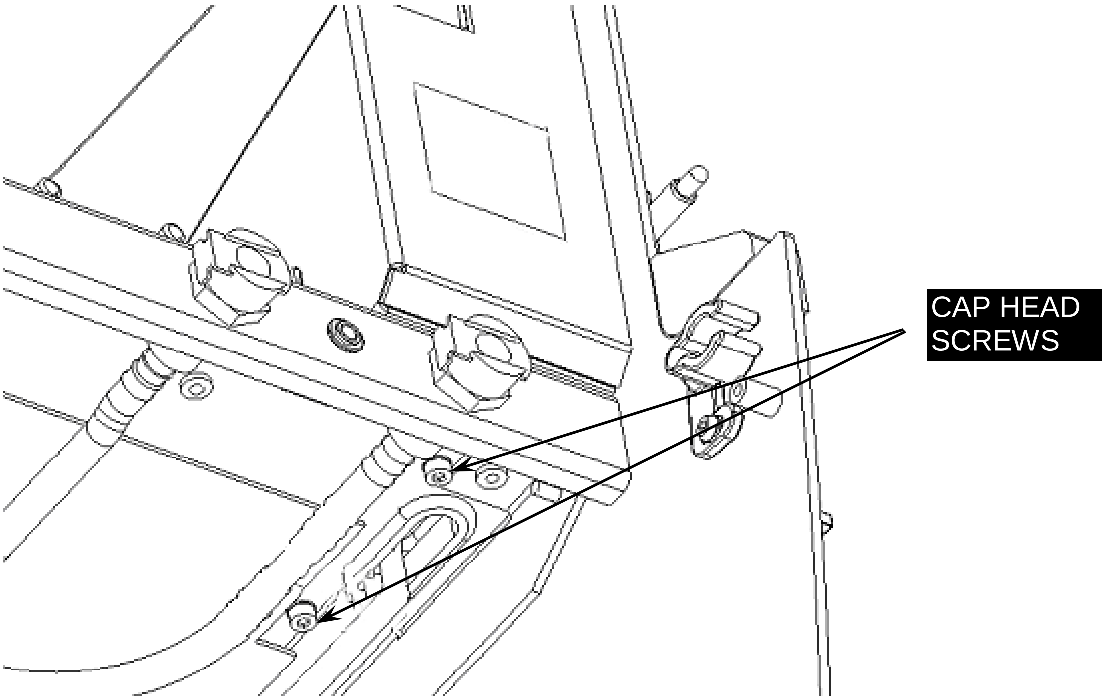


Figure 9-3: Cap Head Screws

3. Disconnect the connector for the illuminated logo.

9.2 Removing the X Drive Assembly

To remove the X-Drive Assembly

1. Remove the Y drive (Chapter 8).
2. Remove sensor (Figure 9-4) by removing the wires and the screws that attach it to the drive assembly.
3. The X drive assembly is mounted to the system using the six PEM Studs on the right hand side of the Chassis (Figure 9-4). When replacing the assembly, slide the X Drive carriage back and forth and ensure the movement is smooth (free of notching).

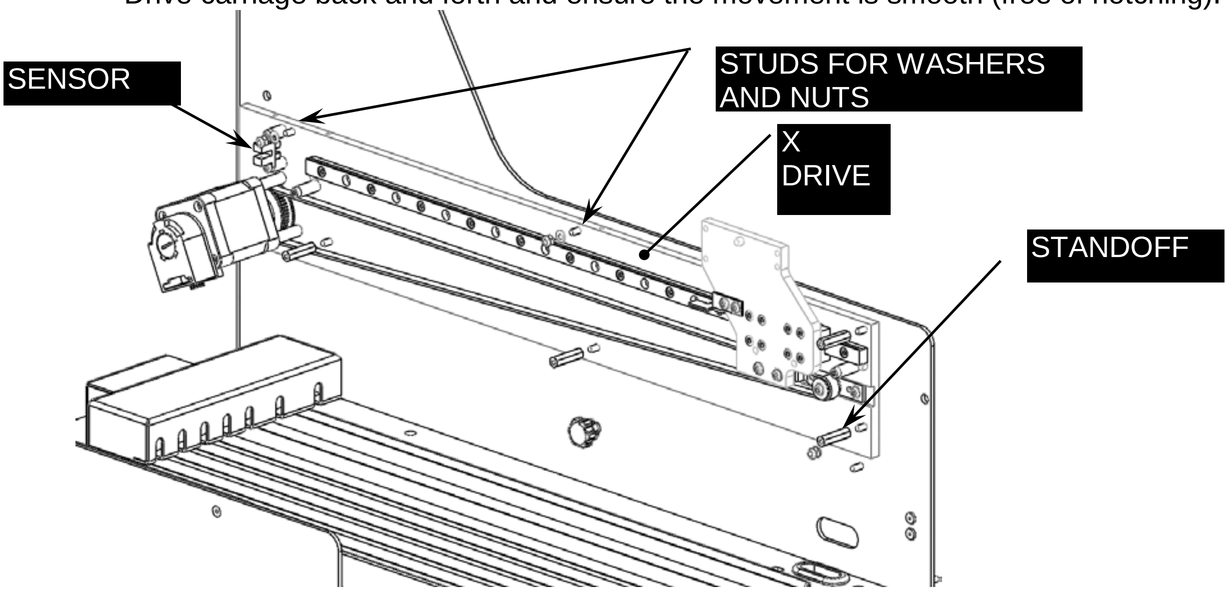


Figure 9-4: Removing the X Drive Assembly

9.3 Removing Components on the X Drive Assembly

9.3.1 Removing the X Belt

Remove the X-belt from the X belt attachment bracket (Figure 9-5).

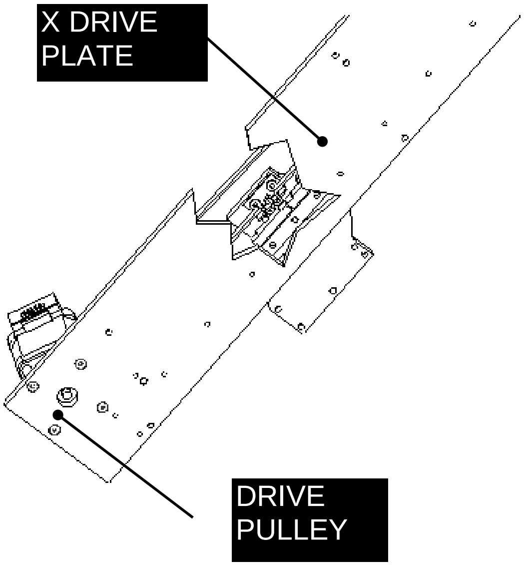


Figure 9-5: X Belt Attachment Bracket (From underneath the X drive)

To replace the belt:

1. Cut a 988mm length of the Gates Rubber belt LL2MR06, 2mm Pitch x 6mm wide and loop it around the motor pulley and fit the two cut ends in to the X Belt Attachment Bracket with two teeth through the centre and four teeth in the back loop (Figure 9-6).

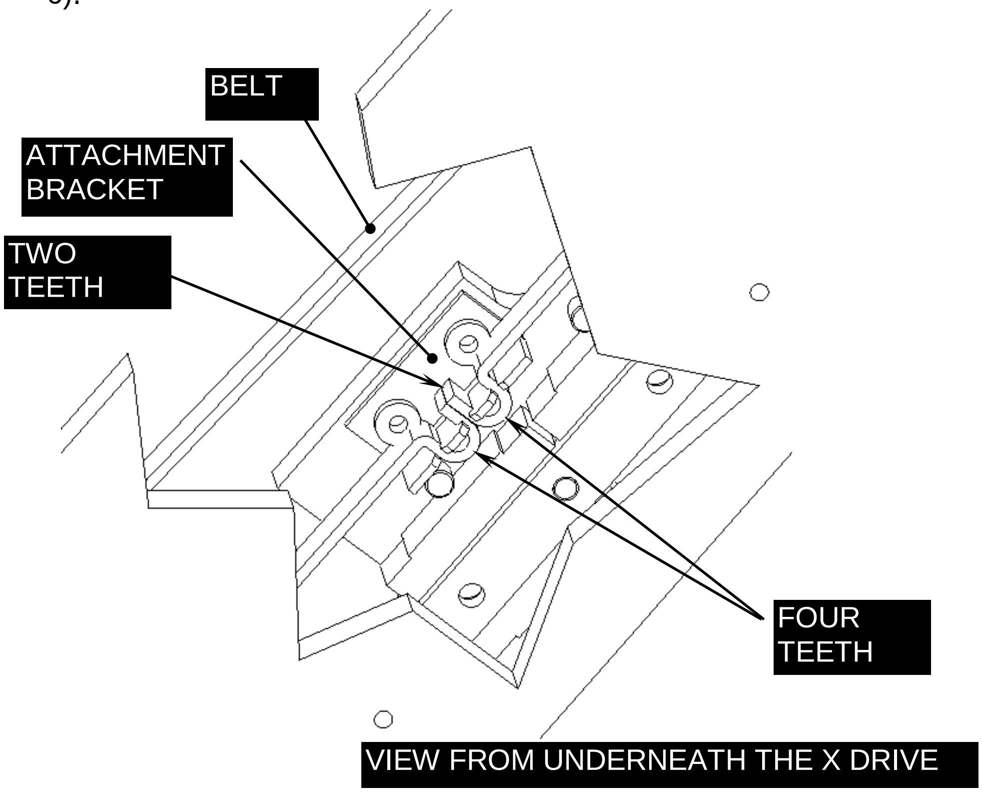


Figure 9-6: Looping Belt onto Attachment Bracket

2. Loop the free end of the belt around the idler bearings (Figure 9-7).

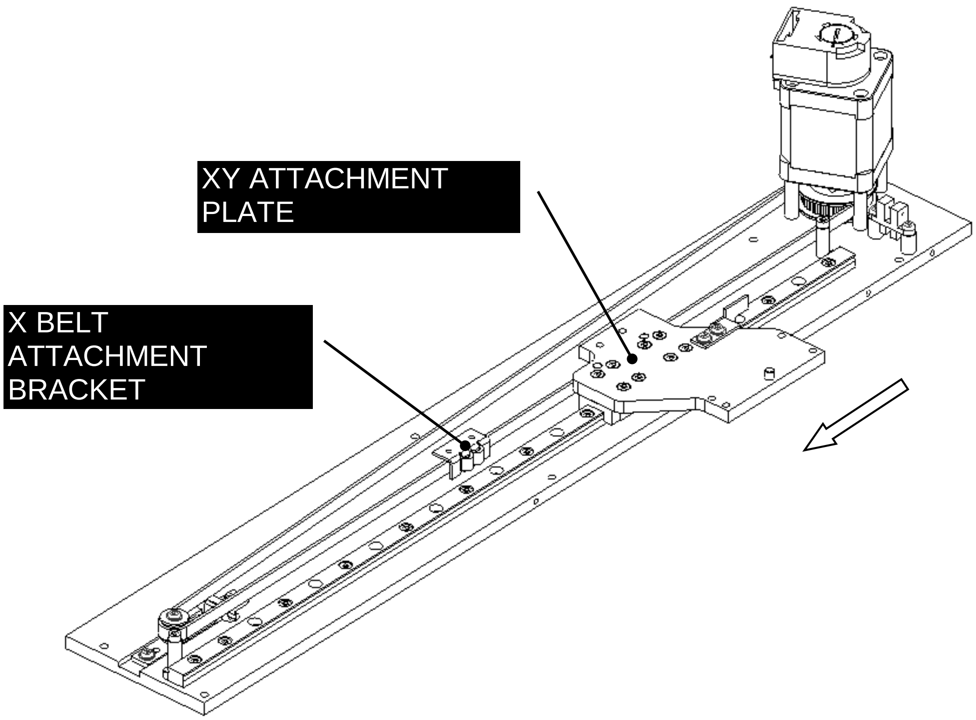


Figure 9-7: XY Attachment Bracket

3. Slide the XY Attachment Plate over the X belt and affix the X Belt Attachment Bracket to the XY attachment plate using two M3x10 Button Head Screws, two M3 Washers and Loctite 222 (Figure 9-8).

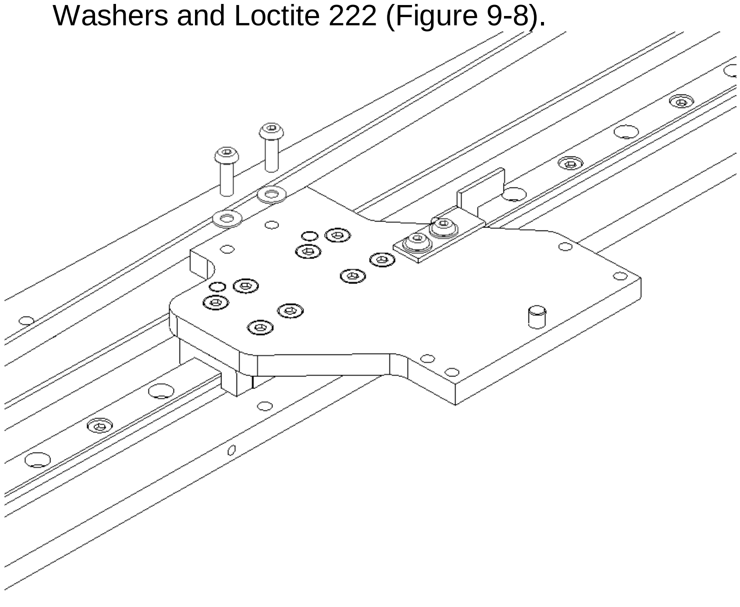


Figure 9-8: Affixing XY Attachment Bracket

4. Slide the XY Attachment Bracket back to the home position (next to the motor).

5. Open the two Toggle Clamps on the X Belt Tensioning Fixture (DS2FIX007), and position the X Drive onto the Fixture by angling the X Drive and sliding it underneath the extension tip of the Force Gauge. Slide the X Drive past the front dowels and lay the X Drive flat. Then push the X Drive back and left until it touches all three dowels. Close the Toggle Clamps to hold the X Drive in place.

> ***Note**: Field service engineers will use a hand held tension meter in place of the tensioning fixture described herein. Place a piece of metallized tape on the belt and hold the meter about ½" from the belt. Gently press on the belt and observe the reading on the meter. An acceptable reading is 57 Hz.*

> ***Note**: Ensure that the X Drive is tight to the dowels when the Clamps are closed.*

> ***Note**: The extension tip of the Force Gauge will flex the belt as the X Drive is positioned.*

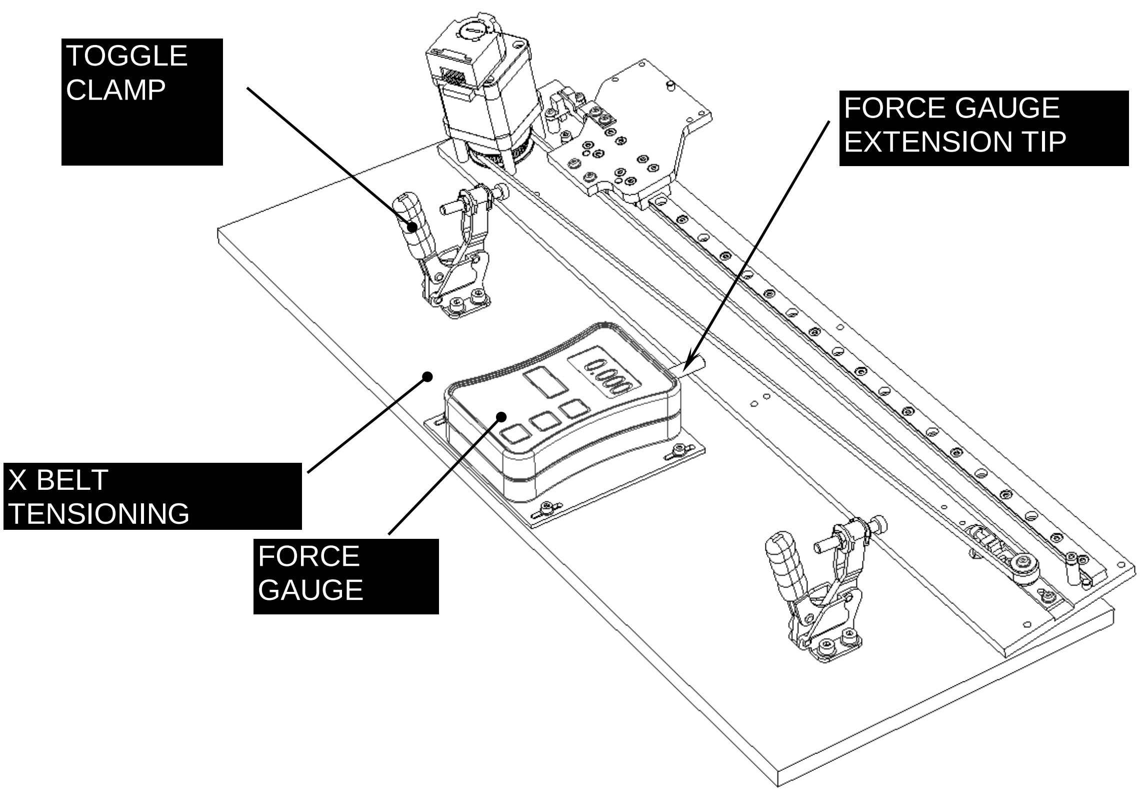


Figure 9-9: Placing the X Drive on the X-Belt Tensioning Fixture

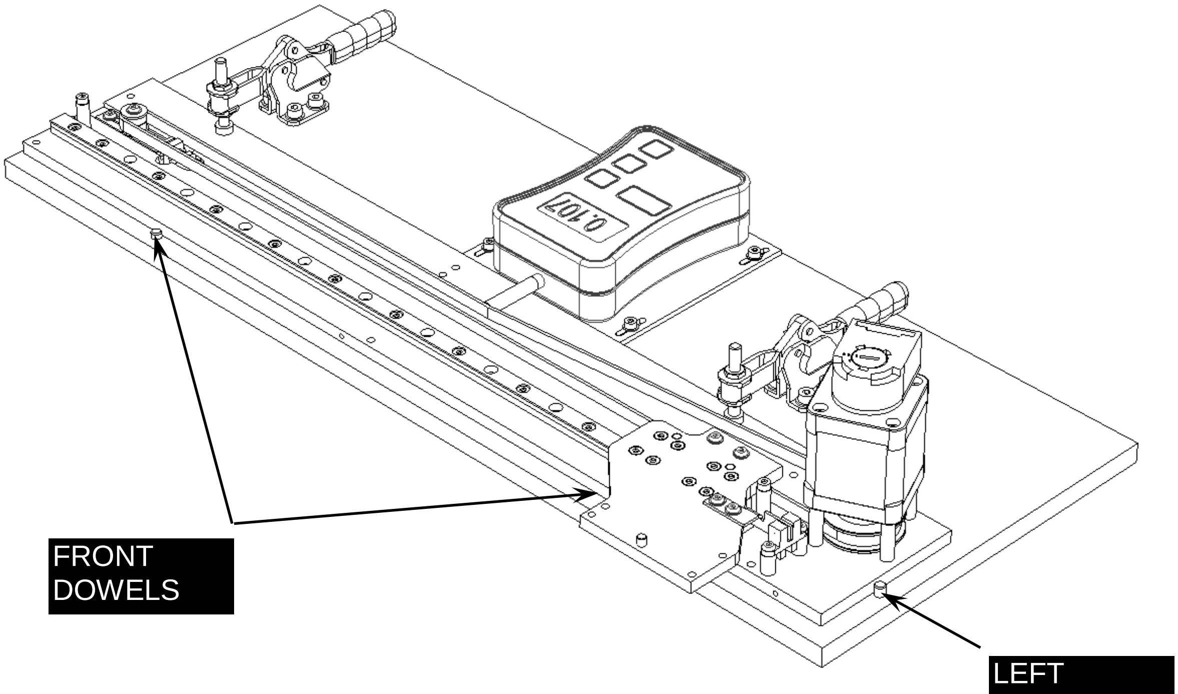


Figure 9-10: Locating X-Drive on Dowels

6. Check that the two M3x6 Button Head Screws holding the Idler assembly are slack and the Idler assembly can slide freely. Gently push the Belt off the end of the Force Gauge Extension Tip, zero the Force Gauge and then reposition the Belt.

> ***Note**: Ensure the Belt is in the center of the Idler Assembly and central around the Force Gauge Extension Tip.*

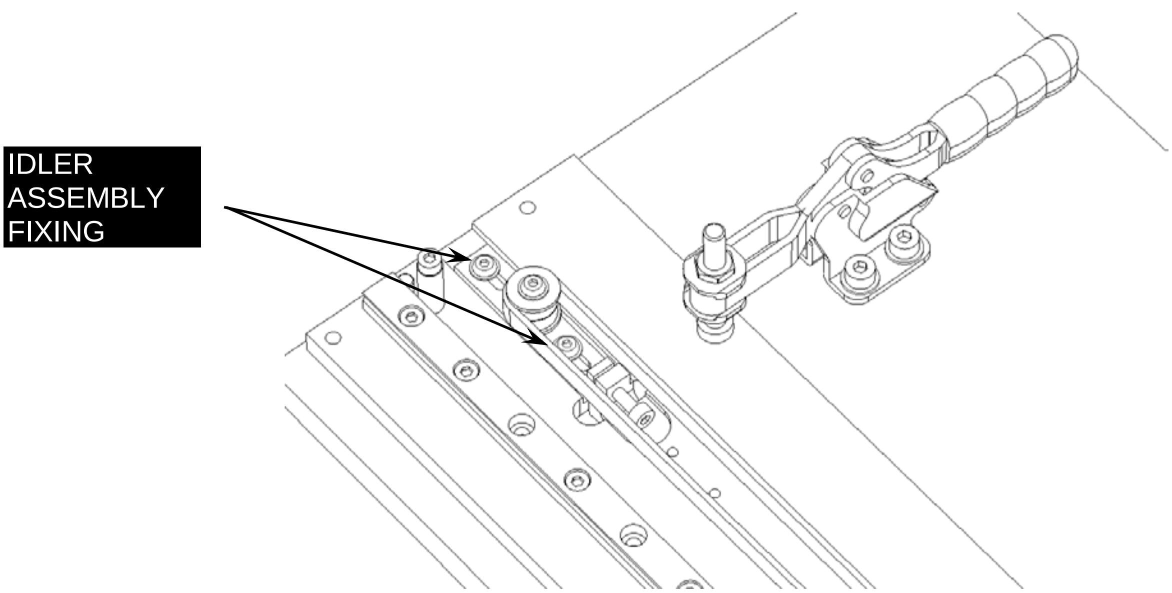


Figure 9-11: Location of Idler Assembly Fixing Screws

7. Before taking each force reading, gently push the Belt off the end of the Force Gauge Extension Tip by 1 to 2 mm and then reposition it (Figure 9-12). This is to ensure that no sideways force from the belt is being measured.

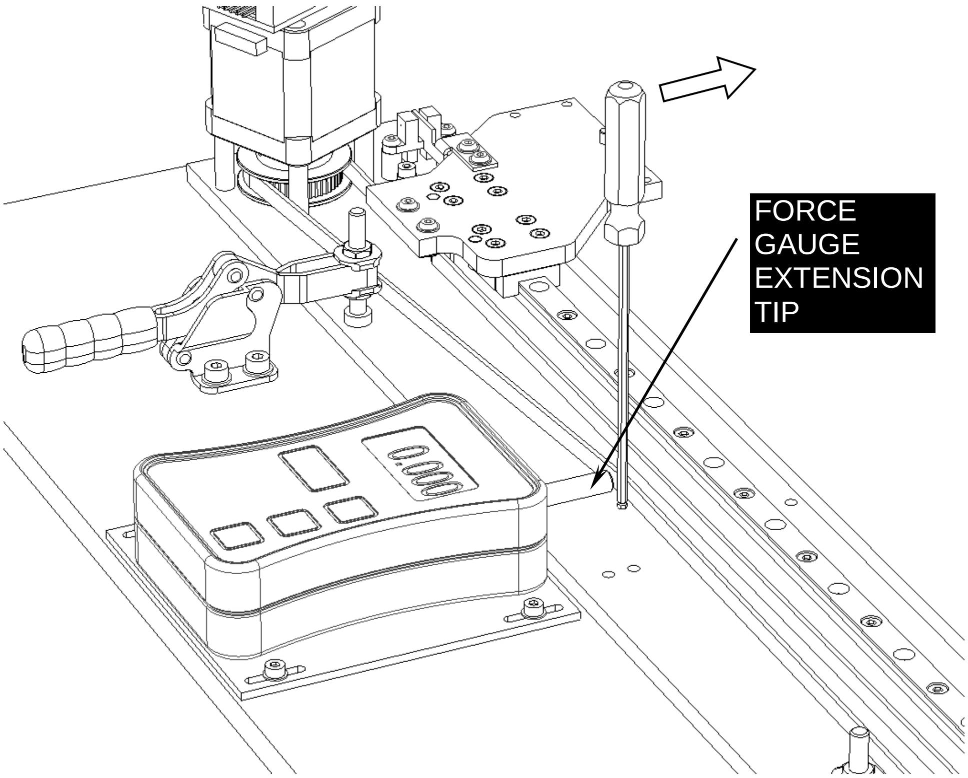


Figure 9-12: Adjusting the Belt

8. Tighten the X Belt Tensioning Screw until the force gauge reads between 0.115 and 0.125 Kg and then slacken off the X Belt Tensioning Screw.

9. Re-tighten the X Belt Tensioning Screw until the force gauge reads between 0.102 and 0.112Kg (target of 0.107 Kg). Tighten the two M3x6 Button Head Screws holding the Idler assembly in place, then one at a time remove these screws and refit them using Loctite 222 (Figure 9-13).

> ***Note**: Use a ball ended Allen key to adjust the X Belt Tensioning Screw.*

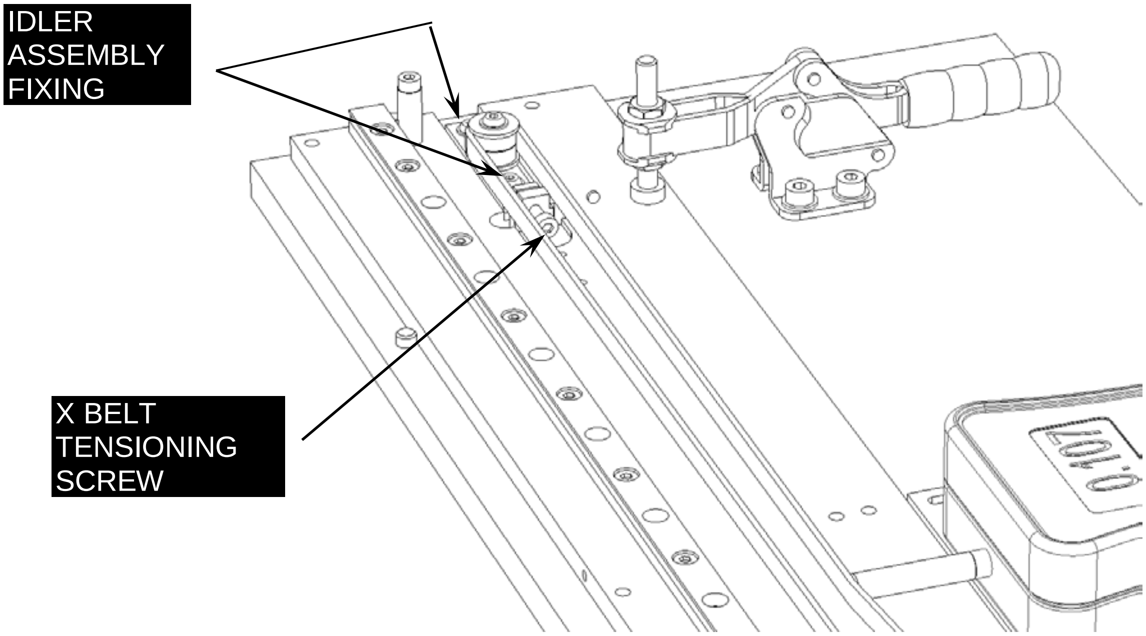


Figure 9-13: Belt Tensioning

10. Remove the X Drive from the Belt Tensioning Fixture and remove the X Belt Tensioning Screw.

9.3.2 Removing Drive Components

The motor and pulley assembly is attached to the X Drive Plate as shown in Figure 9-14.

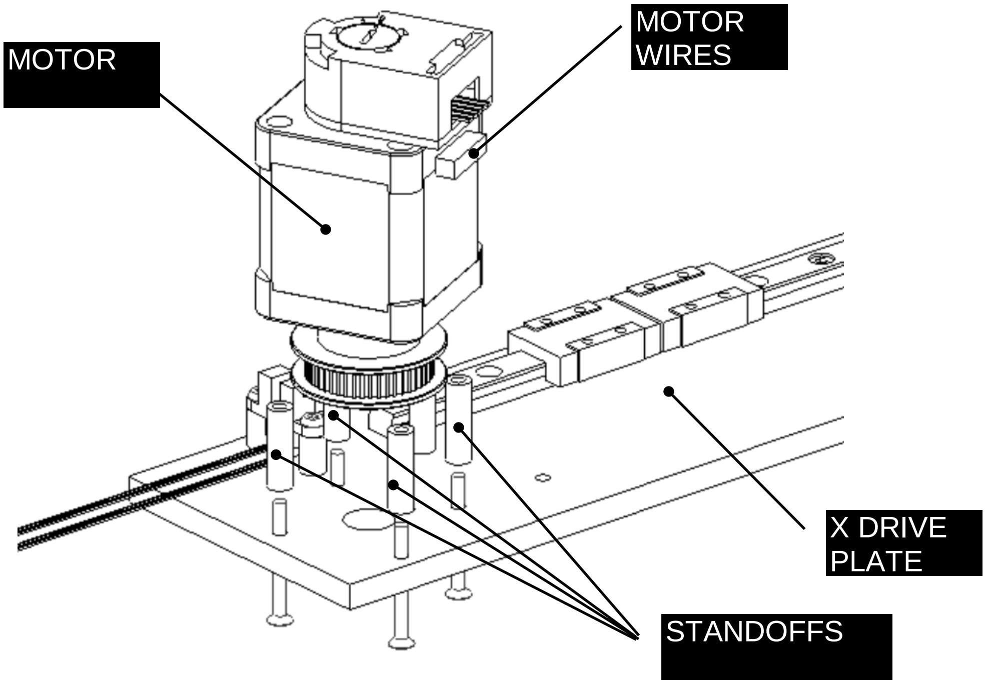


Figure 9-14: The Motor-Pulley Assembly

1. Remove the four flat head screws that attach the assembly to the drive plate.

> ***Note**: When replacing the assembly, ensure that the motor connector is oriented as shown.*

2. Put an Allen key into the encoder and by place an upward force on as shown in Figure 9-15 to remove the encoder.

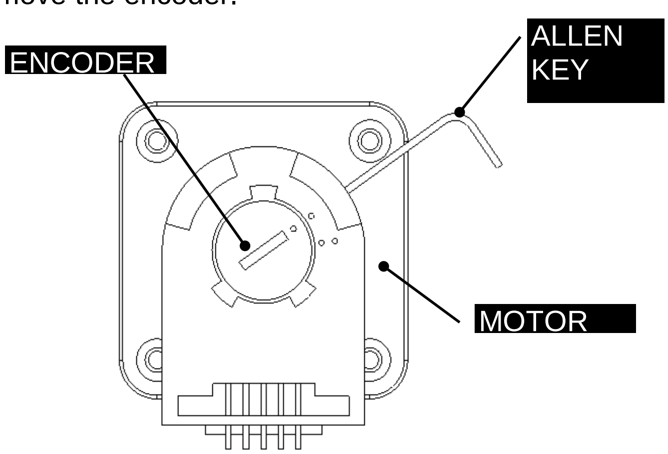


Figure 9-15: Removing the Encoder

3. Remove the Encoder Mounting Plate (Figure 9-16). The jig (DSXFIX015) shown in the figure is not required for removal, but is required for installation of a new unit.

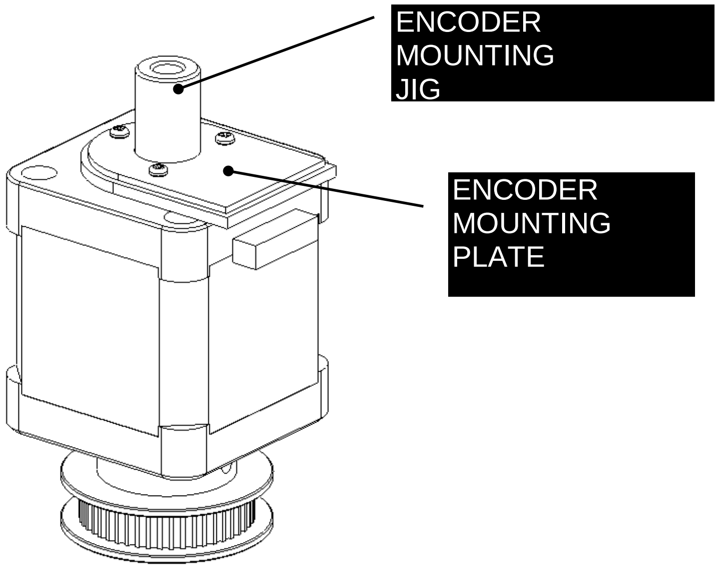


Figure 9-16: Encoder Mounting Plate

4. Remove the Drive Pulley by unscrewing the two set screws.

To replace the Drive Pulley:

1. Attach the 48 Tooth Drive Pulley to the long shaft of the X Motor with the Pulley Height Setting Fixture (DS2FIX004) using two M4x6 Set Screws and Loctite 222 (Figure 9-17).

> ***Note**: Remove and discard any set screws that come with the pulley.*

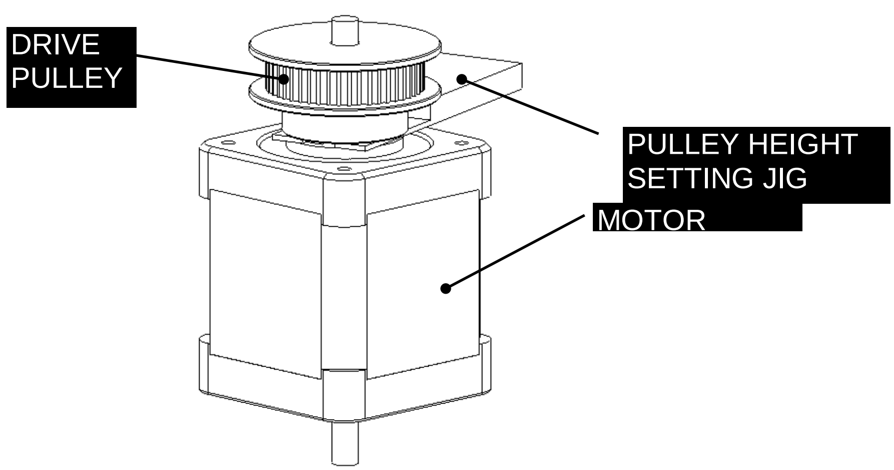


Figure 9-17: Installing the Drive Pulley

To replace the Encoder:

1. Attach the encoder mounting plate to the motor using the Encoder Mounting jig (DSXFIX015) and the 3 M1.6x6 Pan Head Screws. Ensure that the mounting plate is centralized around the pulley idler shaft (Figure 9-18).
2. Install the main part of the Encoder onto the Mounting Plate by snapping it in place.

> ***Note**: Do not remove the Allen key in the encoder (Figure 9-18).*

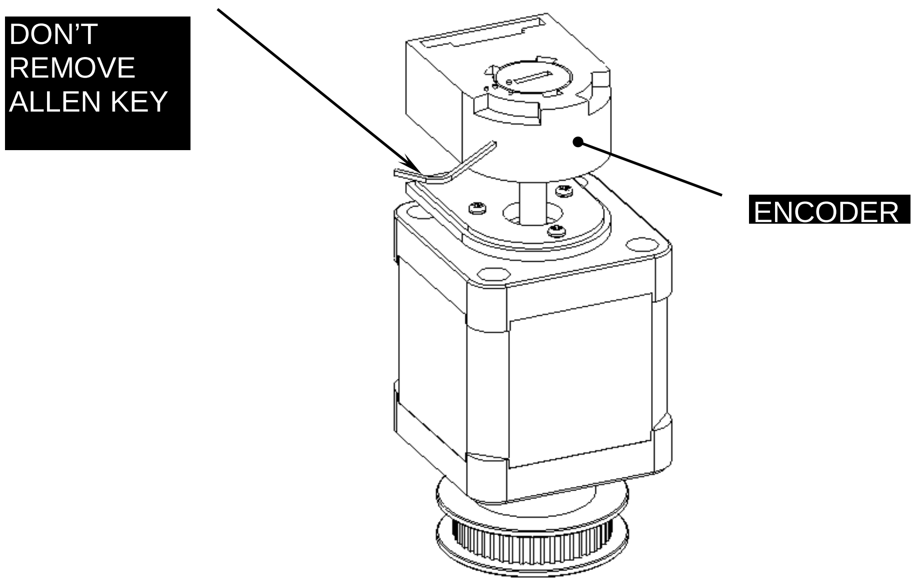


Figure 9-18: Placing Encoder on Motor

3. Push the Allen Key into the body of the encoder to ensure this it is properly seated into the code wheel hub set screw and then apply a downward force on the end of the Allen Key. This sets the code wheel gap by levering the code wheel hub to its upper position.
4. While continuing to apply a downward force, rotate the Allen Key to the clockwise direction until the hub set screw is tight against the idler shaft (Figure 9-19, 9-20). Remove the Allen Key by pulling it straight out of the encoder body.

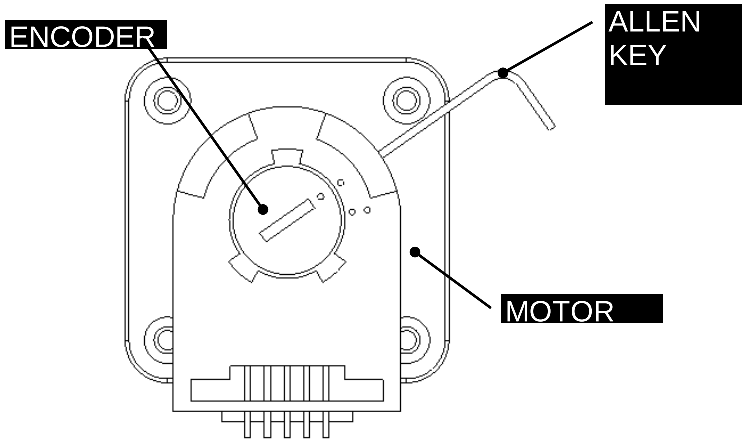


Figure 9-19: Setting the Encoder on the Idler Shaft

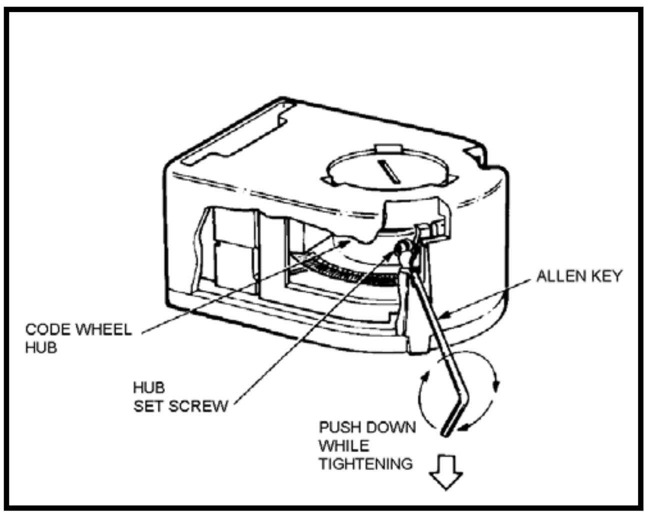


Figure 9-20: Adjusting the Encoder

5. Rotate the encoder cover from the open to the closed position by inserting a small flat blade screwdriver into the notch and rotating it.

> ***Note****: The encoder cover is shown below in the closed position.*

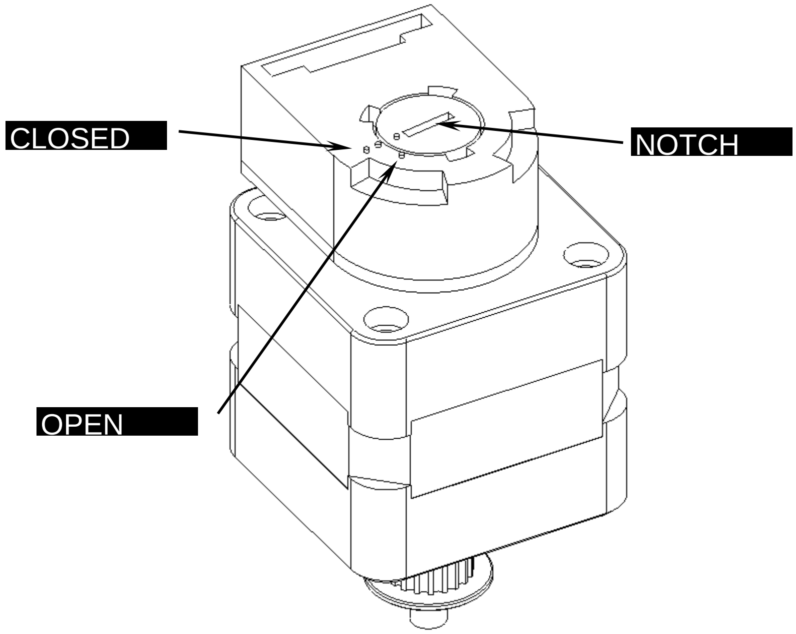


Figure 9-21: Encoder Cover

9.3.3 Replacing the X Home Sensor

The X Home Sensor is shown in Figure 9-22.

To remove the X Home Sensor, remove the two screws that attach it to the X Drive Plate.

When replacing the sensor, use two Spacers and two M3x16 Button Head Screws.

> ***Note***: *Do not use Loctite on opto-interrupters.*

Route the opto-interrupter wires as shown in Figure 9-24.

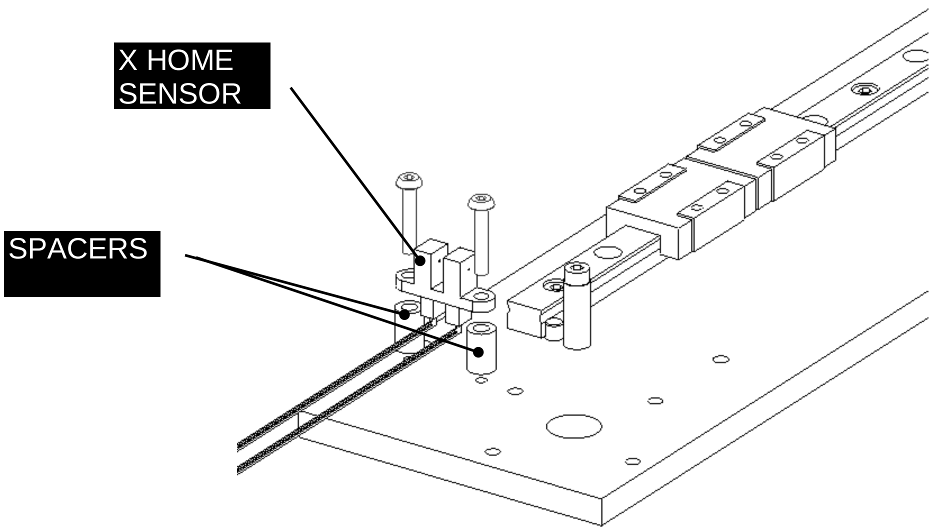


Figure 9-22: X Home Sensor

Install the X Motor assembly to the X Drive Plate using four Standoffs, four M3x30 Flat Head Screws and Loctite 222. Ensure that the motor connector is oriented as shown.

> ***Note***: *Ensure that the Motor Cable is plugged into the Motor head. Place the Idler Pin onto the X Belt Adjustment Bracket with Loctite 222 and tighten down. Fit one Idler Bearing with the flange facing down, one Stainless Steel Spacer onto the Idler Pin.*

Chapter 10 The Pump

> ***Note**: An additional silencer has been added to the DS2 Pump Assembly (item number 13500250) to dampen the pump noise. All systems starting from unit 1DSA1475 will have this design change.*
>
> *For units already in the field, an upgrade kit has been created. Item number for the kit is 13002630.*
>
> *Please contact Dynex Technical Support with any questions*
>
> *(techservice@dynextechnologies.com).*

10.1 Removing the Pump Assembly

The Pump is placed in the system via the square hole in the front divider as shown in Figure 10-1.

To remove the assembly:

1. Unscrew the four Cap Head screws (Figure 10-1) that attach the assembly to the chassis.

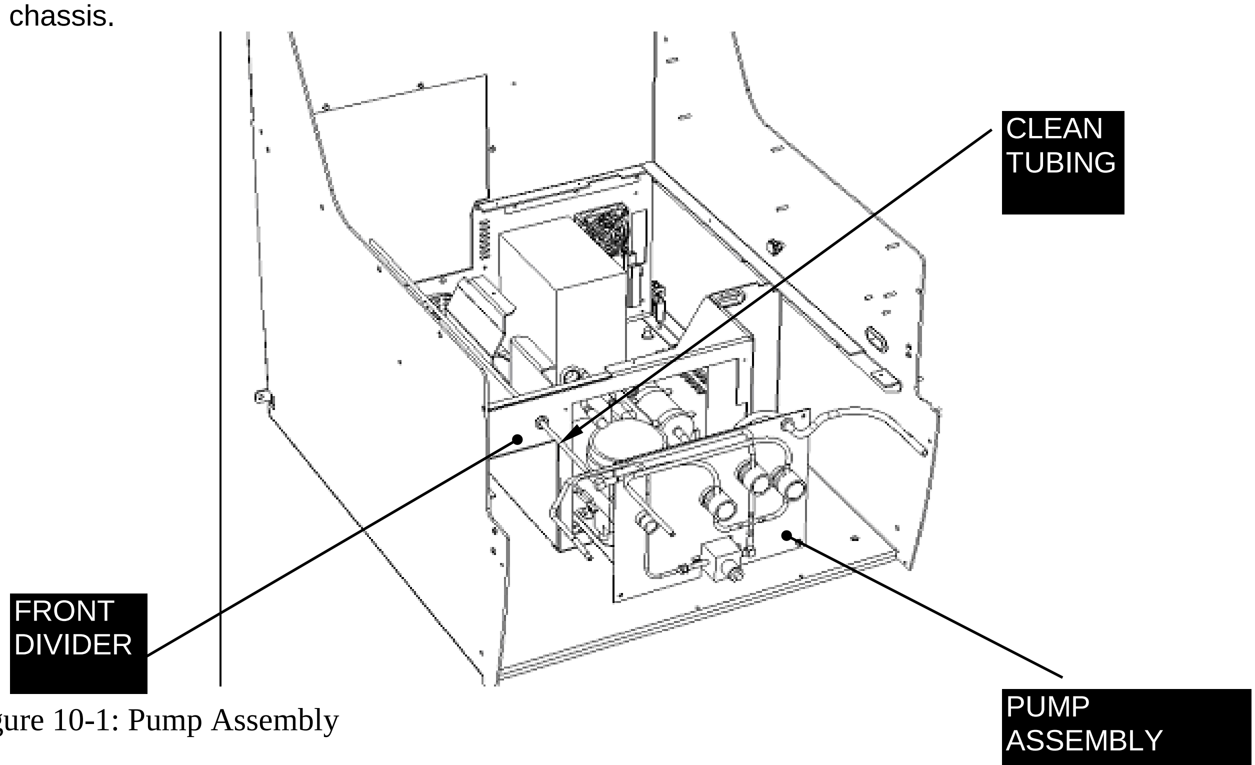


Figure 10-1: Pump Assembly

2. Remove tubing from all pinch valves by pressing on the valve.
3. Disconnect the clean valve tube from the elbow that connects to the tube that goes through the rubber grommet (this tube connects to the quick disconnect tube at the back of the instrument).

4. Disconnect all tubing from the pump module to the system.

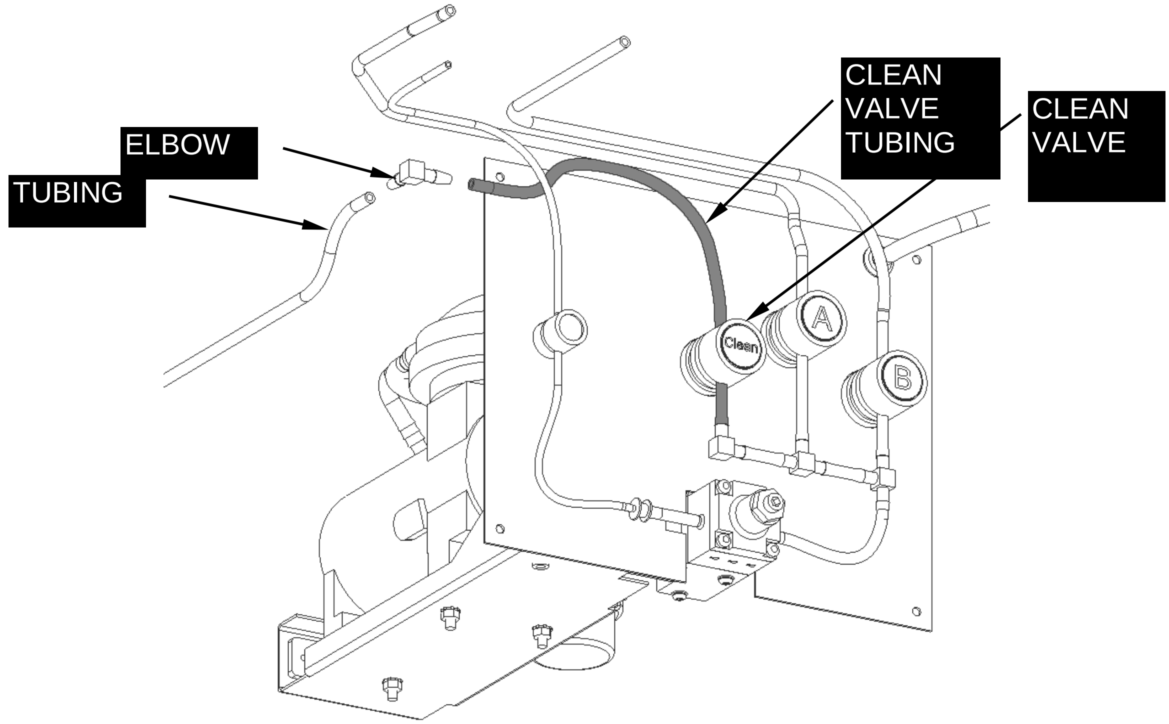


Figure 10-2: Clean Valve Tubing.

When reinstalling the assembly, insert a piece of clean tubing through the grommet in the central divider and connect it to the quick disconnect fitting on the back panel.

10.2 Replacing Components

10.2.1 Tubing

> ***Note**: When replacing components on the pump, check the condition of all tubing and replace cloudy, deformed, and cracked tubing as necessary.*

The overall tubing scheme is presented in Figures 10-2 and 10-3. The length of each tube is indicated in the figure. Silicone tubing should be employed for all connections. The tubing should be replaced as a complete assembly using kit 13002460.

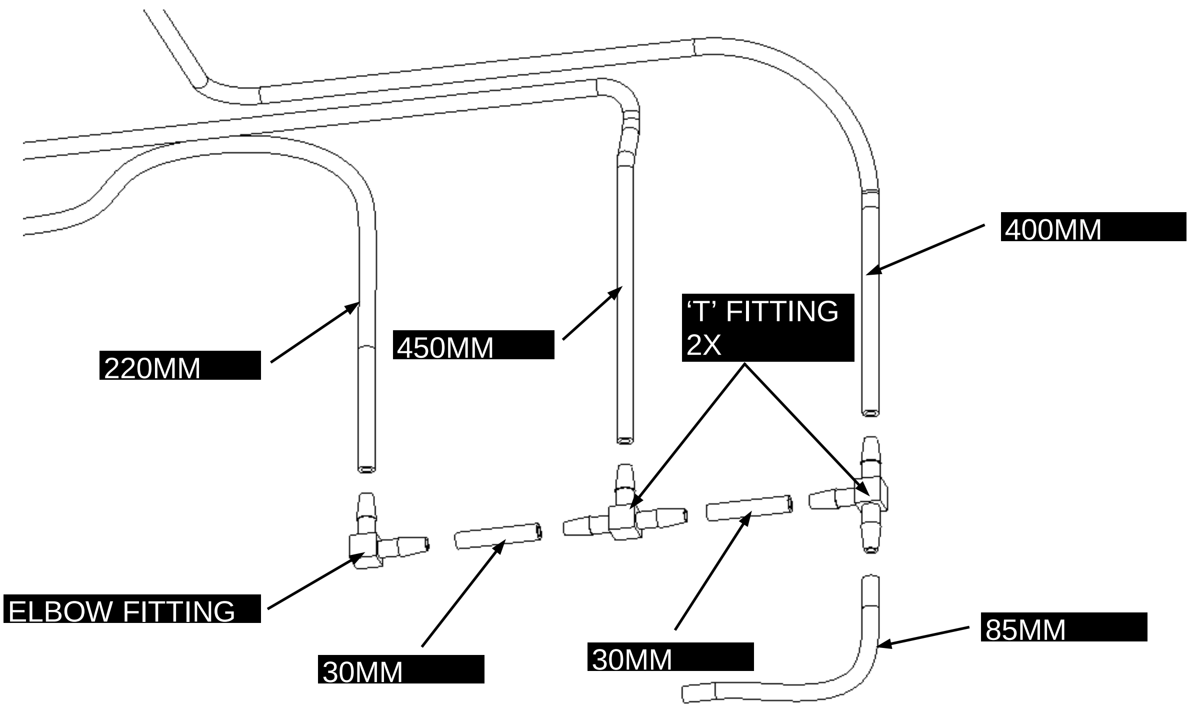
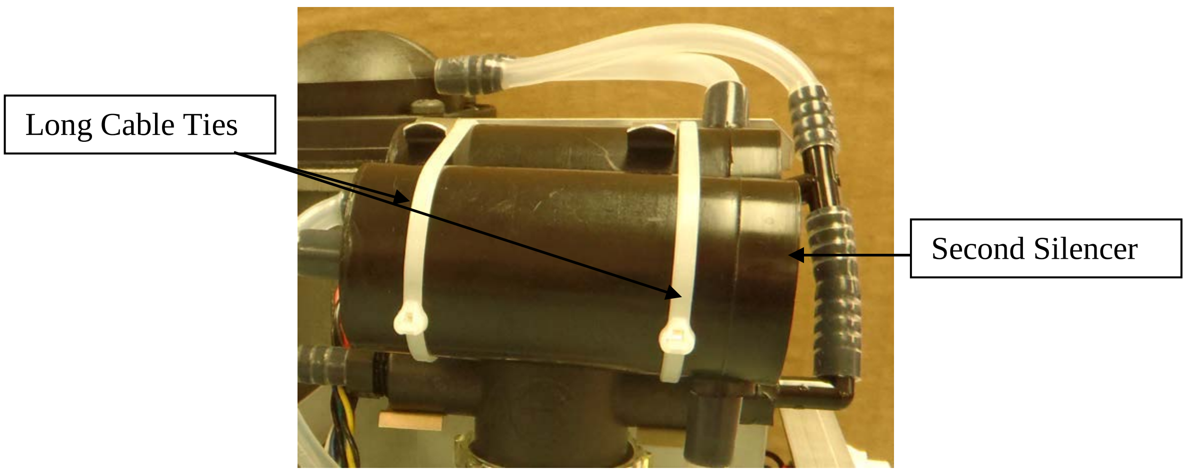


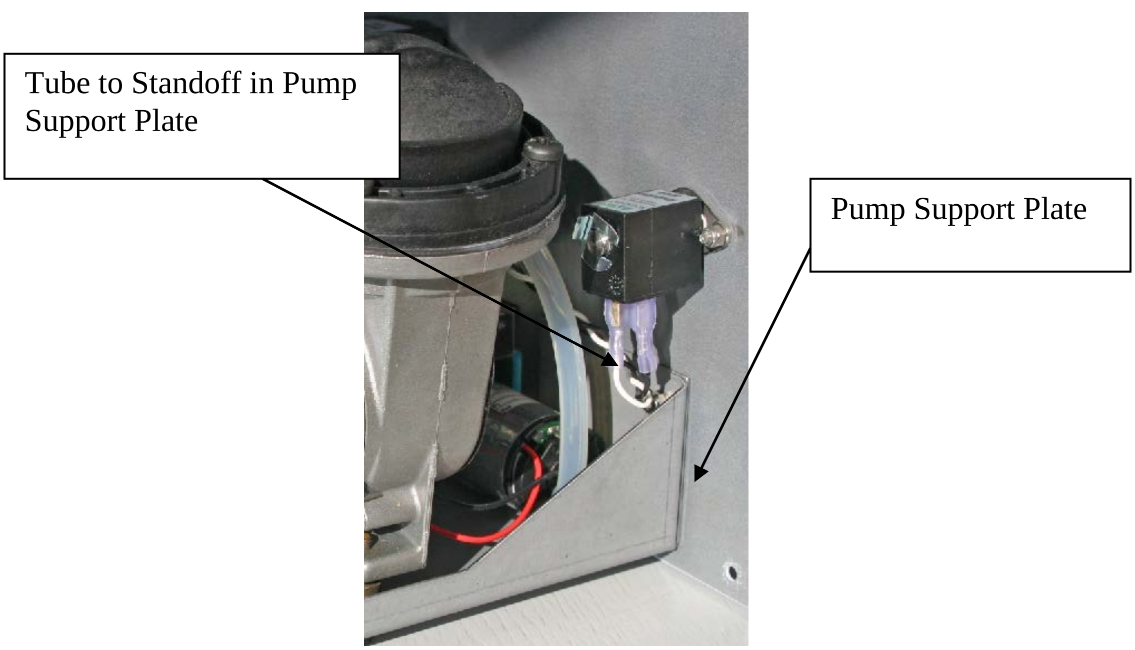
Figure 10-3: Tubing for Pump

10.2.2 Second Silencer Installation Instructions

1. Remove the Pump Assembly from the unit by disconnecting the tubing from both ports of the KNF Pump, removing the tubing from the pinch valves, disconnecting the tubing from the far right waste bottle fitting in the workspace, and removing the four M3X8 Cap Head Screws securing the assembly.
2. Attach the second Silencer (part of kit) to the first Silencer using the two long Cable Ties (part of kit) as shown. NOTE: Orient the second Silencer as shown with the side fitting facing down, and tighten the cable ties firmly. Cut and discard the excess cable tie material.

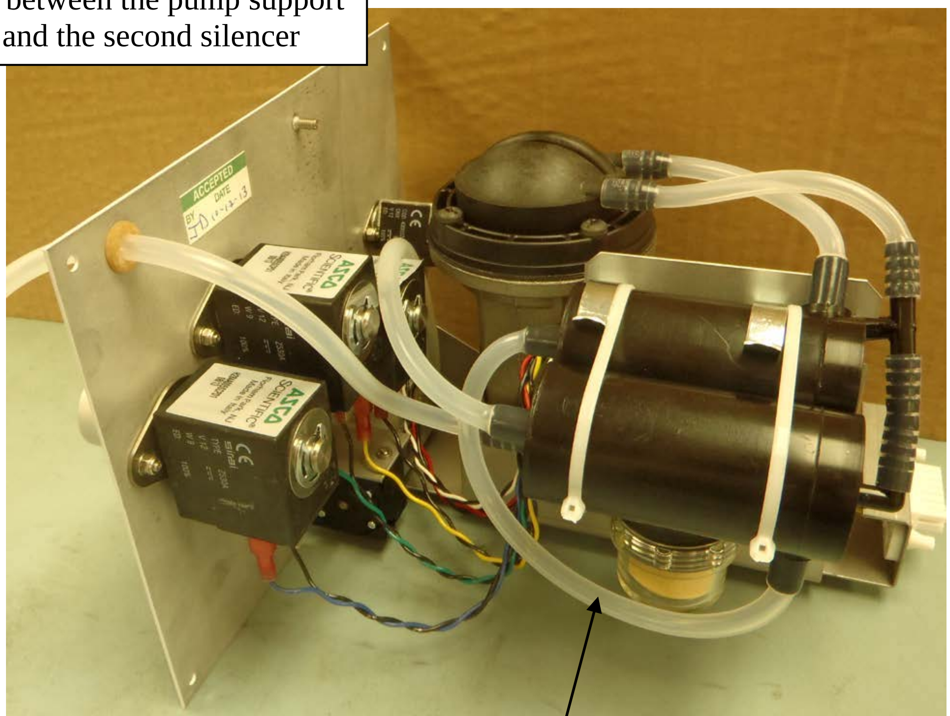


3. Disconnect the tube attached to the standoff in the Pump Support Plate. Attach the 250mm Tube (part of kit) to the standoff in the Pump Support Plate.



4. Attach the longer tube from the Standoff in the Pump Support Plate to the end fitting of the second Silencer. Attach the shorter tube from the end fitting of the first Silencer to the side fitting of the second Silencer.

Tube between the pump support plate and the second silencer



Tube between the first and second silencer

5. Reinstall the Pump Assembly in the unit by reversing the removal process.

10.2.3 Removing the Silencer and Water Trap

The position of the water trap and silencer are shown in Figure 10-5.

Yellow/black – Valve ‘CLEAN’
Green/black – Valve ‘A’
Blue/black – Valve ‘B’

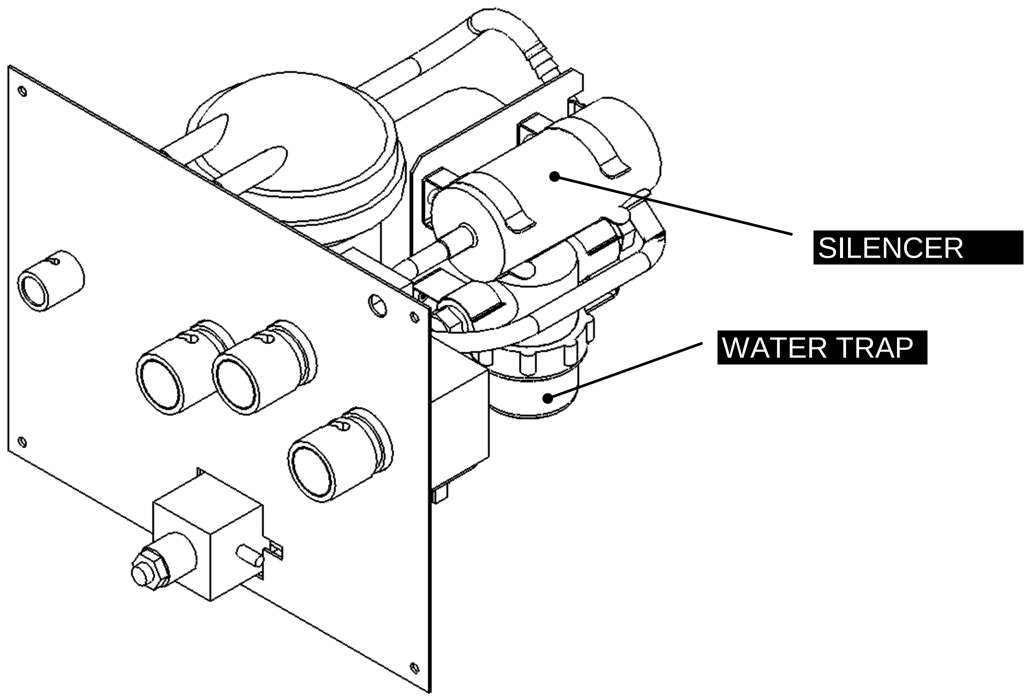


Figure 10-4: Water Trap and Silencer

To remove the Silencer:

1. Unclip the silencer from the two clips.
2. Remove the tubing that connects the silencer to the standoff on the pump support plate.

10.2.4 Replacing the Water Trap

The location of the water trap is indicated in Figure 10-4. It may be necessary to replace the compressed cellulose sponge. To replace the sponge, unscrew the water trap bowl and insert a new sponge.

> ***Note**: If it is necessary to a new trap, discard the filter that is in the trap and insert the sponge.*

10.2.5 Replacing the Aspirate Pump Assembly

The Pump Assembly is attached to the pump support plate via three #8-32 KEP nuts. Place the shock mounts on the legs before fitting the pump (Figure 10-5, 10-6) to the plate.

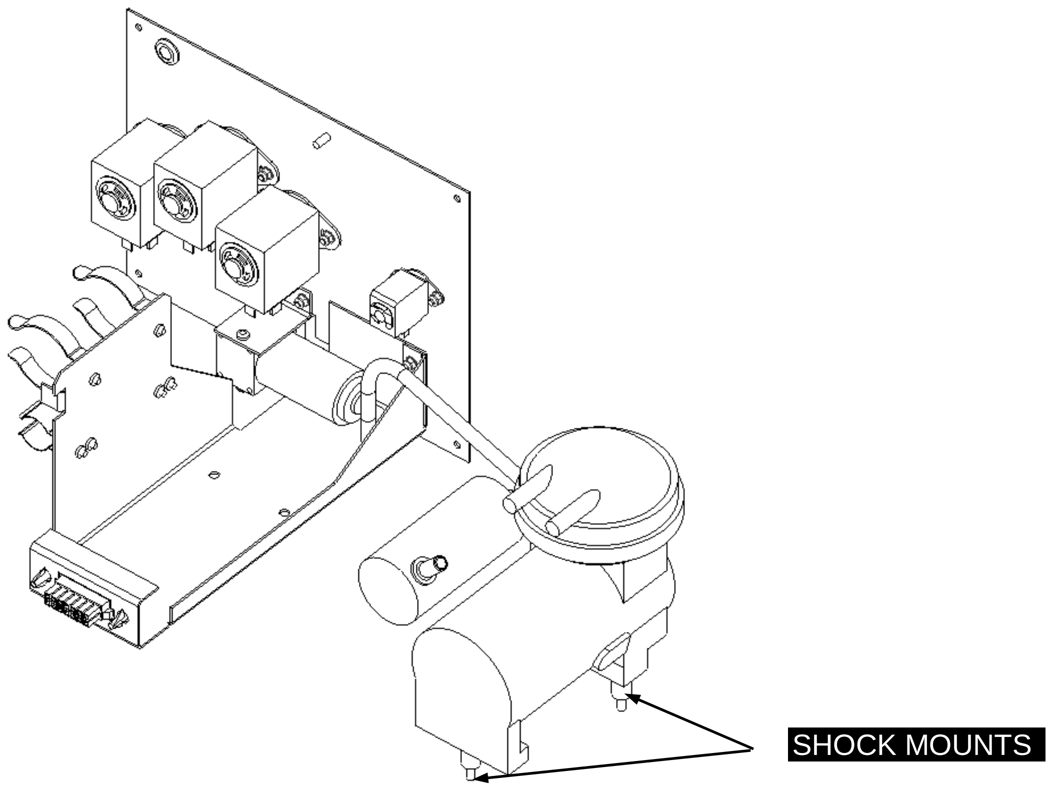


Figure 10-5: Attaching Pump Assembly

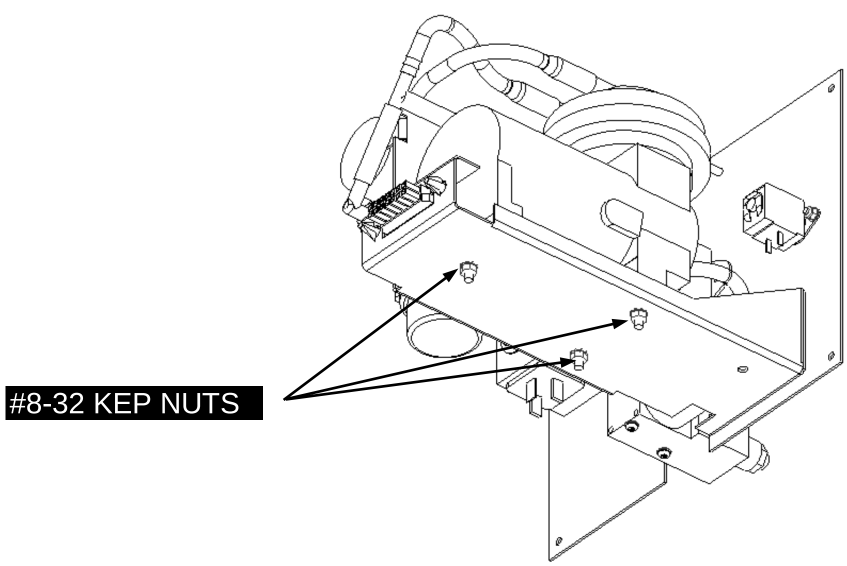


Figure 10-6: Underside of Pump Support Plate

10.2.6 Removing Pinch Valves

To remove the pinch valves:

1. Remove the nuts affixing them to the pump plate (Figure 10-7)

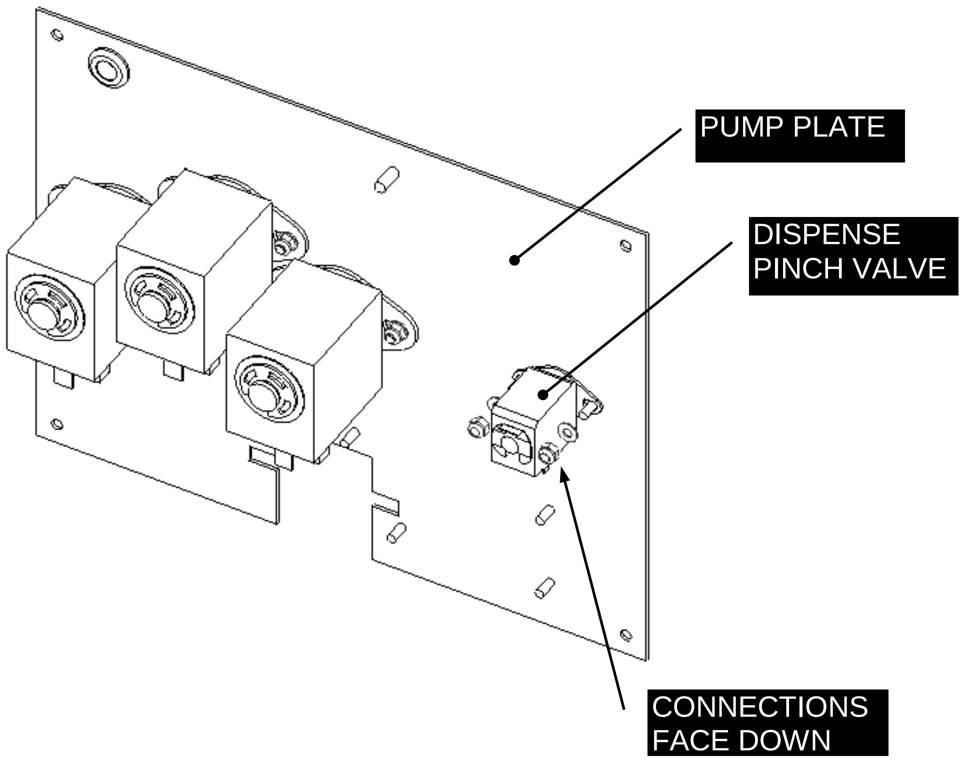


Figure 10-7 Pinch Valves

When replacing the pinch valves:

1. Ensure that the tube slots face to the left

2. Ensure that the connector tabs are facing down

3. Replace the wires as follows:

Yellow/black - CLEAN valve

Green/Black - A Valve

Blue/Black - B Valve

White/Black - DISPENSE Valve

10.2.7 Replacing the Dispense Pump

The Dispense Pump is attached to the bottom of the pump plate as shown in Figure 10-8.

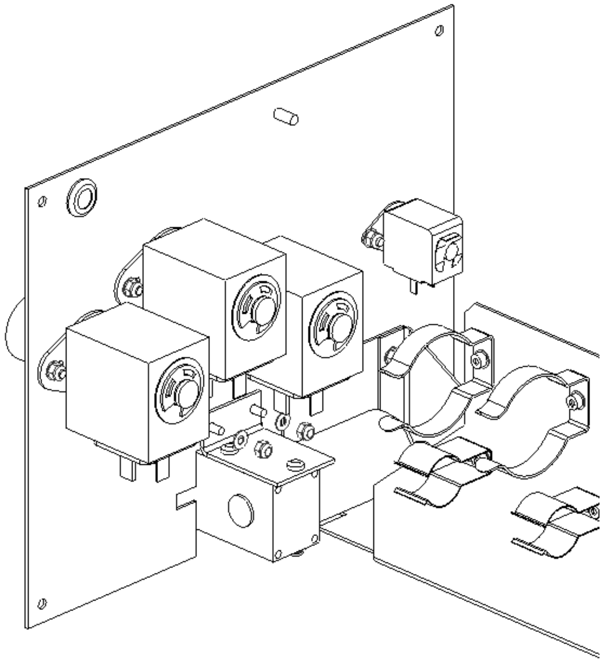


Figure 10-8 Dispense Pump

4. To remove the pump, unscrew the two screws that affix the pump to the pump plate.

To replace the pump:

1. Discard the dust covers from the inlet and outlet connections

2. Attach it to the pump plate by sliding the body of the motor between the support bracket and the pump plate (Figure 10-9).

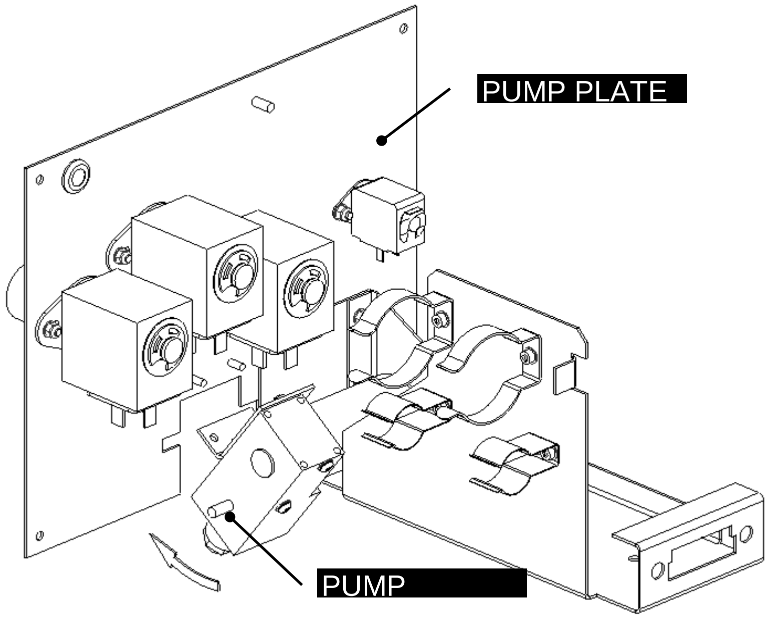


Figure 10-9: Inserting the Dispense Pump

3. Rotate the dispense pump assembly and slide it forward on the mounting studs.

4. Fix the pump in place using two M3 flat washers and 2 M3 Nyloc nuts.

Chapter 11 The Barcode Scanner

WARNING: *Do not look at the output from the laser if power is provided to it unless you are wearing protective eyewear. Hazardous radiation may be provided by the laser which is harmful to the eyes.*

Note*: In 2013 the laser scanner within the Barcode Scanner Assembly was updated to the current model scanner due to the manufacturer discontinuing the prior model. Although the specifications for both scanners are the same the older model was more capable of reading poorly printed or overly dense barcodes.*

If customers have trouble reading the sample tube labels (especially following a barcode scanner replacement), verify that they are following the ASTM-E1466-92 standard for producing barcode labels on sample tubes. It is also possible that sliding the sample racks into position at a slower pace will help.

The last option is to change the focal length of the scanner with respect to each sample rack. You would do this by changing the arm attributes using DeeSoft.

1) *Open DeeSoft and Connect to the DS2.*
2) *Go to Calibrate and Arm Attributes.*
3) *Following the table below, find the Attribute ID and update the Attribute. (IDs 181 and 182 are for the two reagent racks and should be set to the same as sample rack 5).*

ID 176	*Sample Rack 1*	*Default 155*	*Change to 300*
ID 177	*Sample Rack 2*	*Default 230*	*Change to 375*
ID 178	*Sample Rack 3*	*Default 305*	*Change to 450*
ID 179	*Sample Rack 4*	*Default 380*	*Change to 495*
ID 180	*Sample Rack 5*	*Default 455*	*Change to 495*

4) *Close the program, recycle the power on the DS2.*

11.1 Removing the Barcode Scanner

The Barcode Scanner is located on the front of the unit as shown in Figure 11-1.

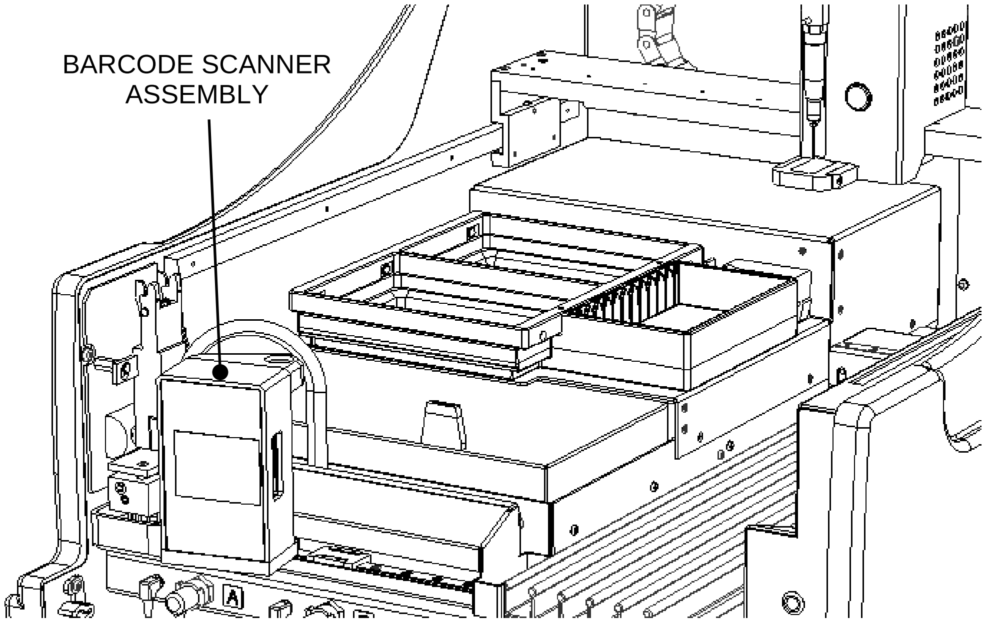


Figure 11-1: Location of Barcode Assembly

To remove the assembly:

1. Remove the three locknuts on the underside of the plate to which the assembly is mounted.
2. Disconnect the cable from the connector below the workspace (Figure 11-2).

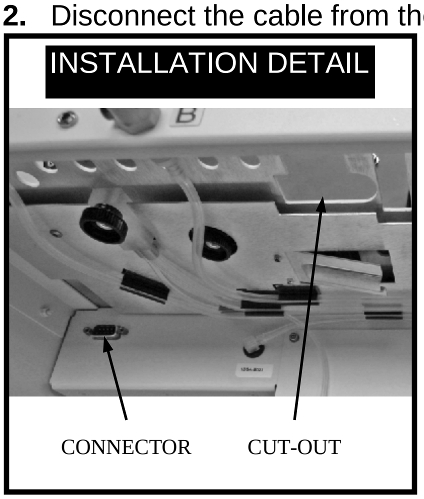


Figure 11-2: Installation Detail for Barcode Scanner

11.2 Replacing the Laser Scanner

To replace the laser scanner:

1. Remove the scanner cover (Figure 11-3) by removing the three M3 x 6 Button Head Screws.

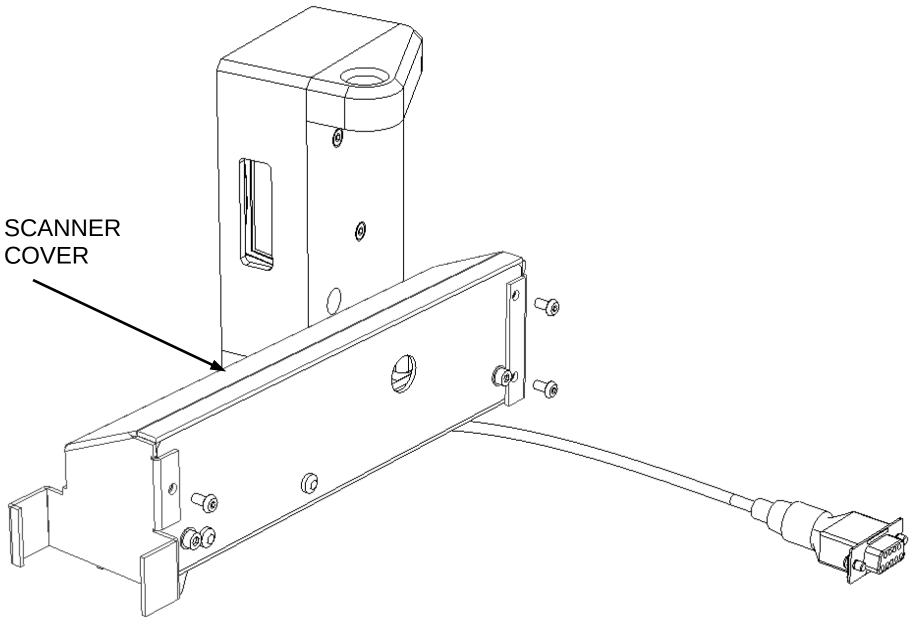


Figure 11-3: Scanner Cover

2. Remove the cable Clip from the underside of the assembly (Figure 11-4).

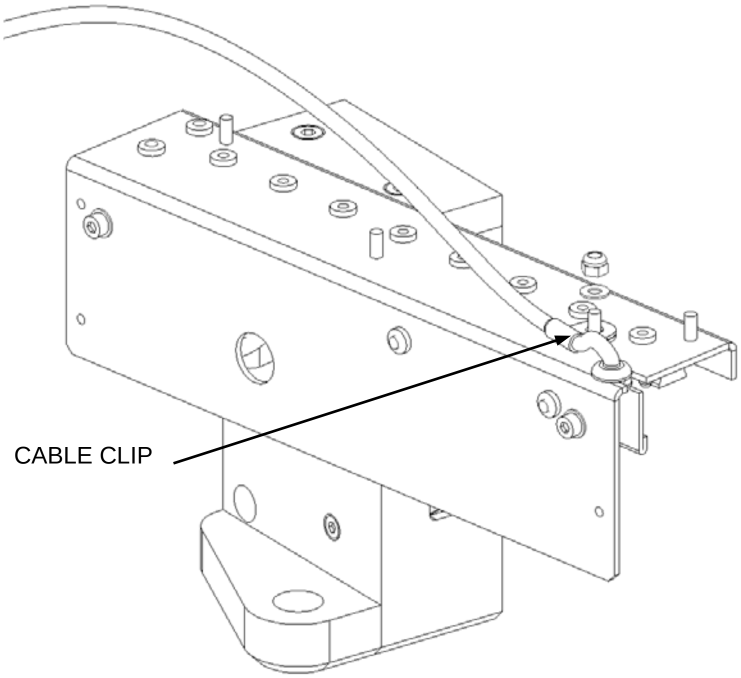


Figure 11-4: Scanner Cable Clip

3. Remove the Scanner Cable Guide by removing the two screws in Figure 11-5. The guide is shown in Figure 11-6.

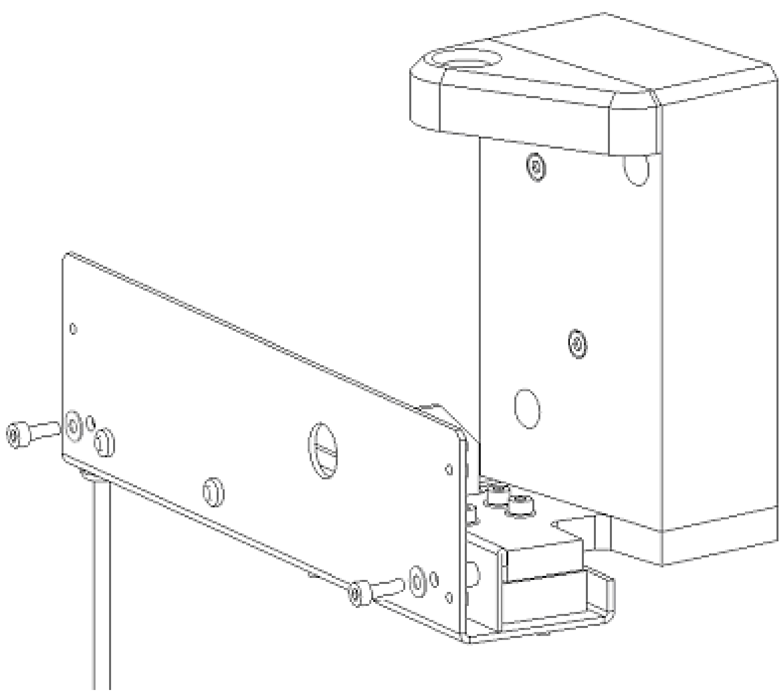


Figure 11-5: Scanner Cable Guide Screws

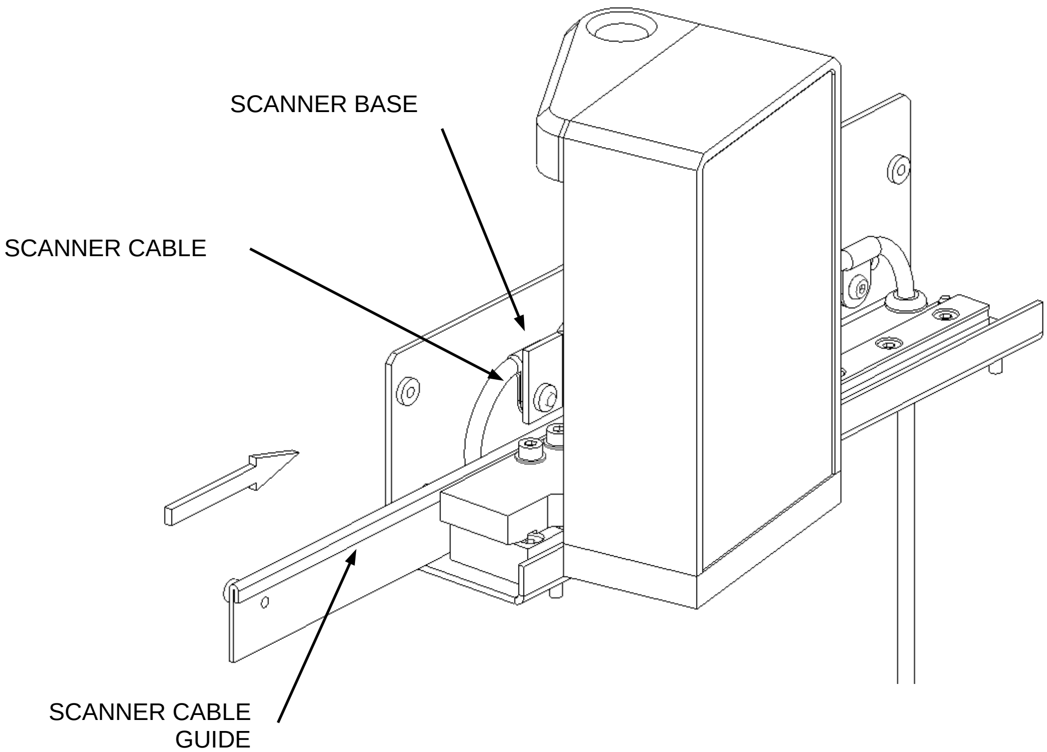


Figure 11-6: Location of Scanner Cable Guide

4. Remove the Laser Scanner Assembly from the Linear Bearing Block by removing the four M3x12 Socket Cap Head Screws (Figure 11-7). The Laser Scanner Assembly is shown in Figure 11-8.

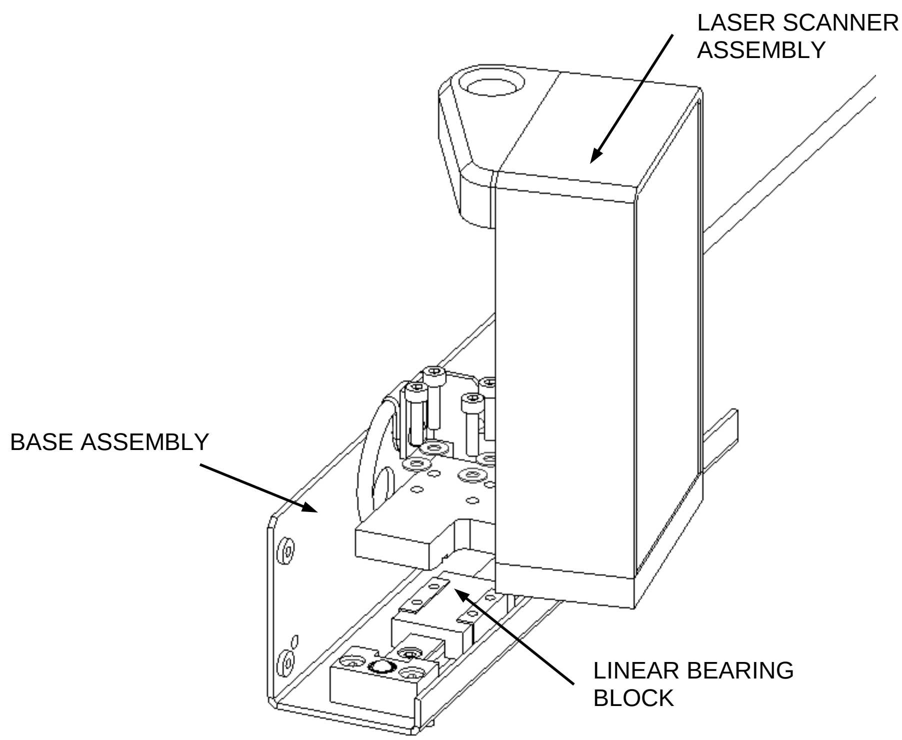


Figure 11-7: Removing the Laser Scanning Assembly from the Base Assembly

> ***Note**: When replacing the assembly, use Loctite 222 on the screws.*

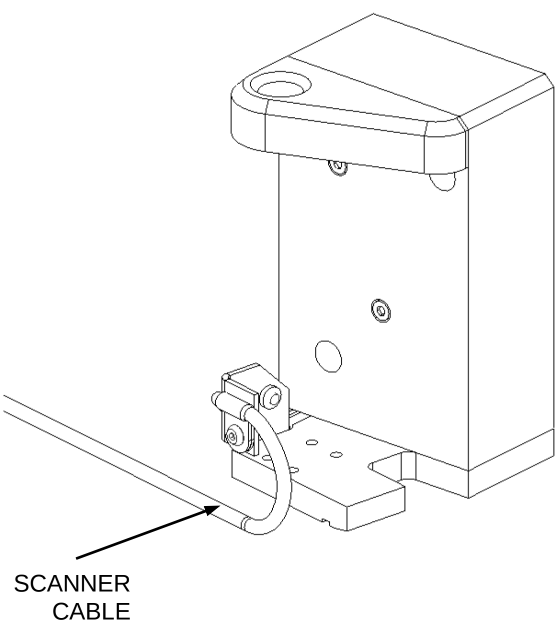


Figure 11-8: Laser Scanner Assembly

5. Remove the two cable clips that attach the cable to the Scanner Mounting Plate.

6. Remove the two M4x12 Socket Cap Head Screws that attach the scanner assembly to the scanner mounting plate (Figure 11-9).

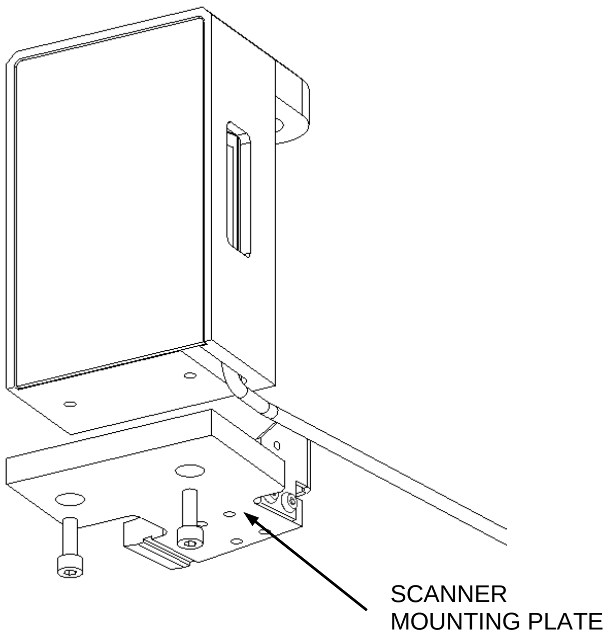


Figure 11-9: Removing the Scanner Mounting Plate

> ***Note**: When replacing the scanner mounting plate, make certain that the cable lies in the Mounting Plate Groove (Figure 11-10).*

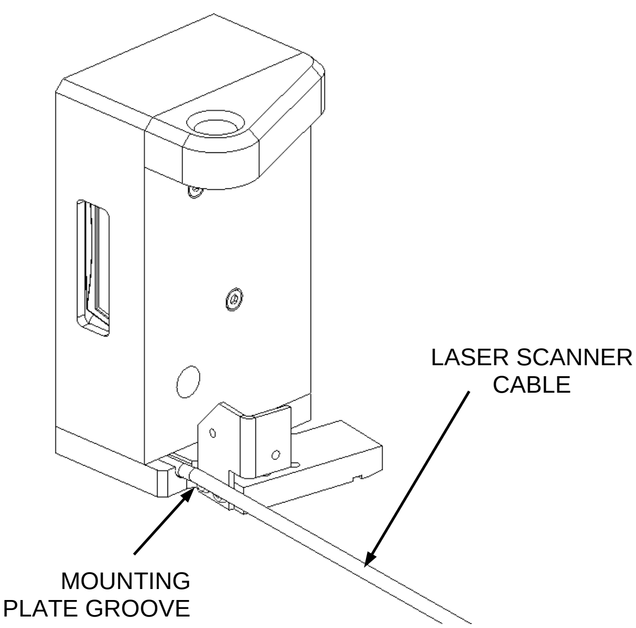


Figure 11-10: Placing the Laser Scanner Cable in the Groove

7. Remove the scanner Cover Plate by removing the two M3 Nyloc Nuts (Figure 11-11).

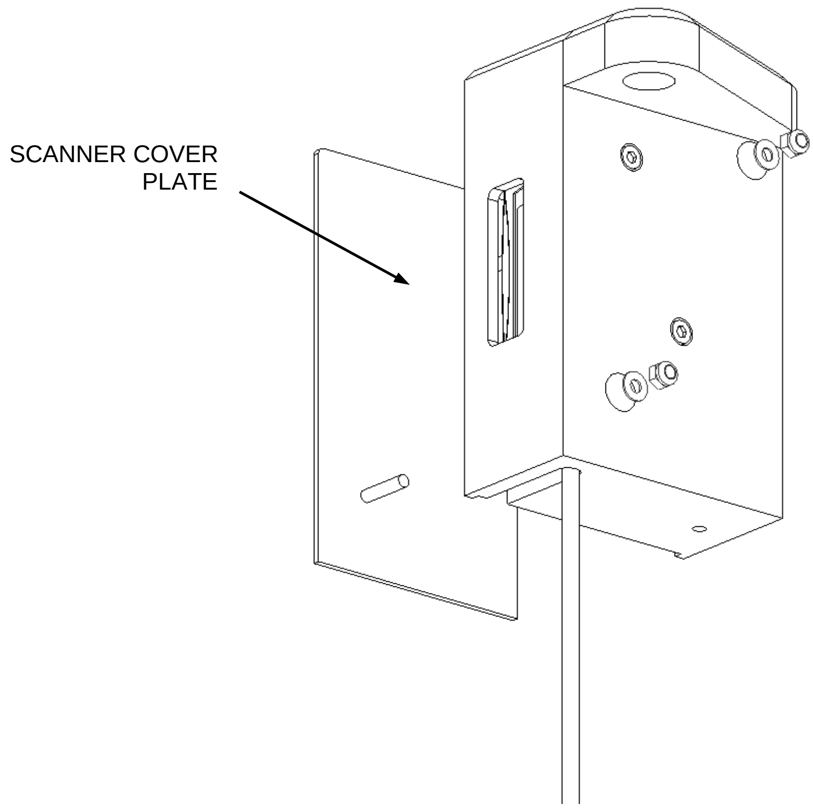


Figure 11-11: Removing the Scanner Cover Plate

8. Remove the two cap head screws that hold the Laser Scanner in position (Figure 11-12). The front view of the assembly is shown in Figure 11-13.

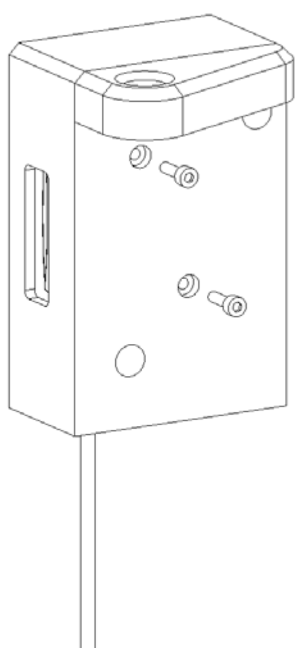


Figure 11-12: Laser Scanner Securing Screws

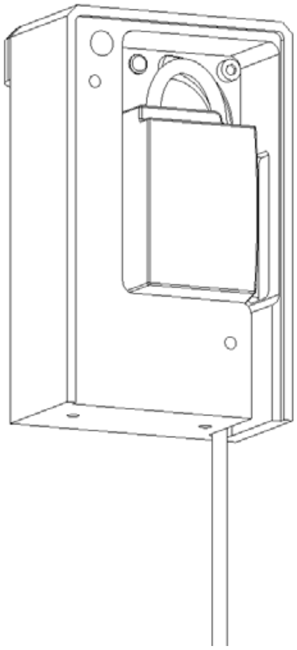


Figure 11-13: Front View Laser Scanner Assembly

	***Note**: When Replacing the Assembly, make certain that the cable lies underneath the scanner and exits via the groove (Figure 11-14).*

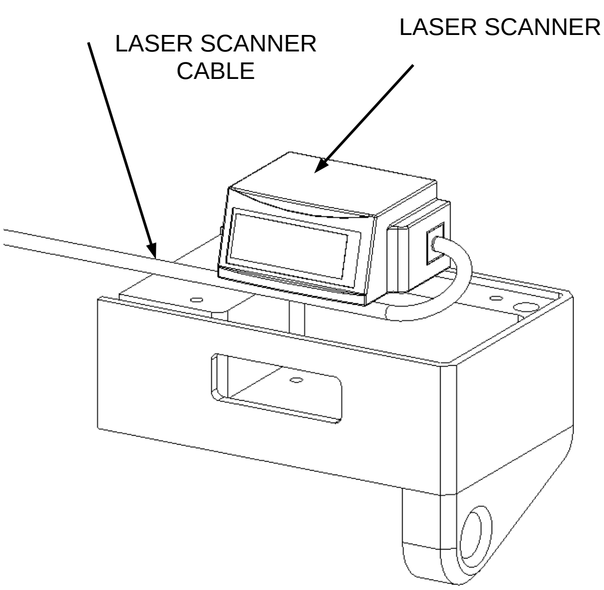


Figure 11-14: Positioning Laser Scanner in Housing

	***Note**: If you are replacing the scanner, place a Ferrite clip-on on the cable and secure in place using two small cable ties as shown in Figure 11-15.*

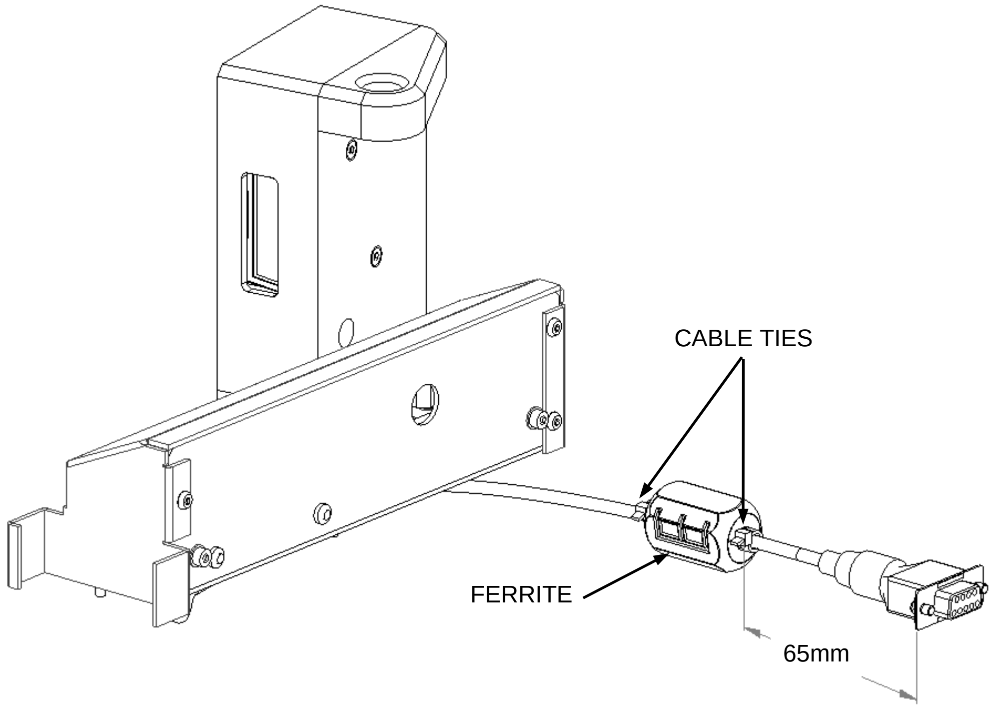


Figure 11-15: Ferrite Clip-on and Cable Ties

Chapter 12 The Reader

12.1 The Reader Assembly

The Reader Assembly includes the Tray Assembly which contains and transports the plates and is shown in Figure 12-1.

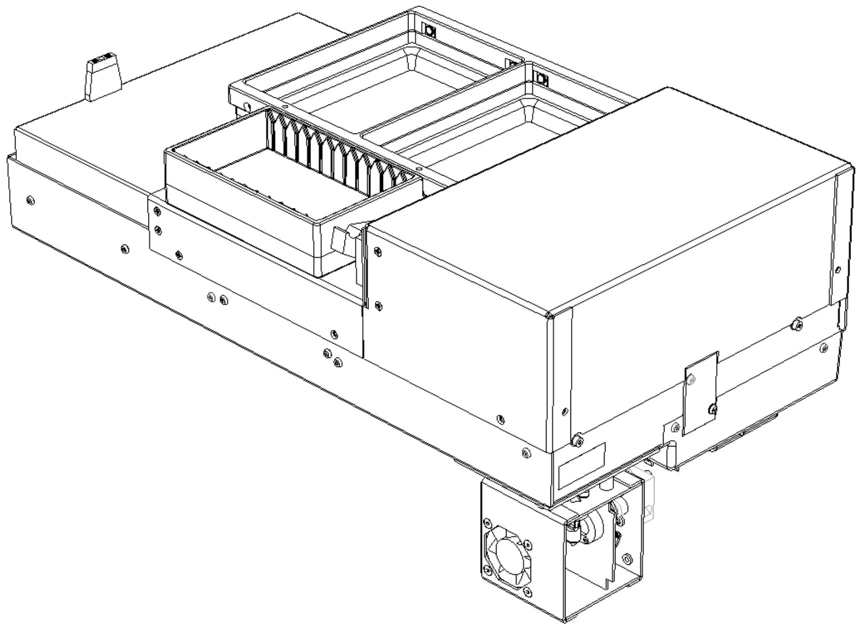


Figure 12-1: The Reader Assembly

To Remove the Reader:

1. Remove the screws that attach the Reader Access Cover from the rear of the system (Figure 12-2).

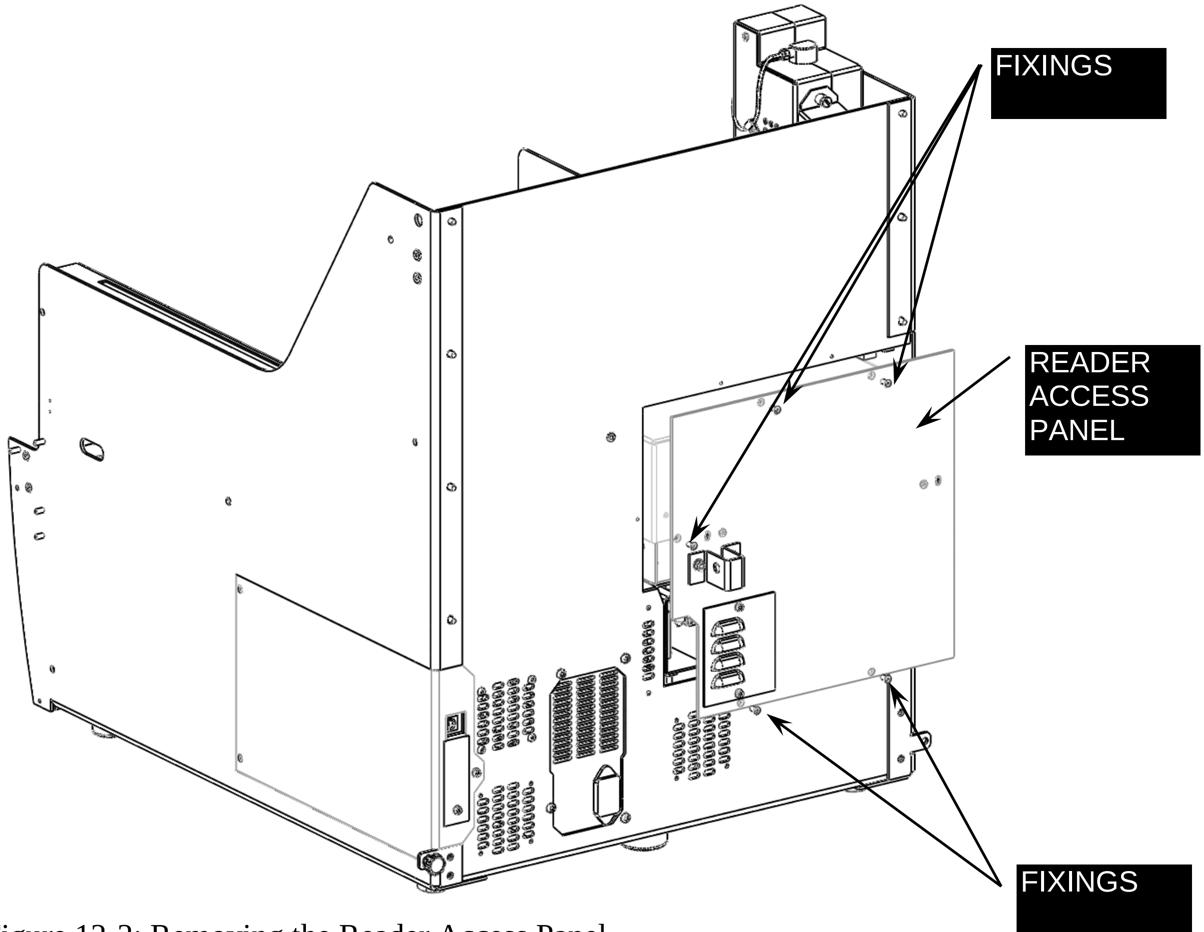


Figure 12-2: Removing the Reader Access Panel

2. Unscrew the knurled thumbnut that attaches the reader to the Workspace Plate (Figure 12-3).

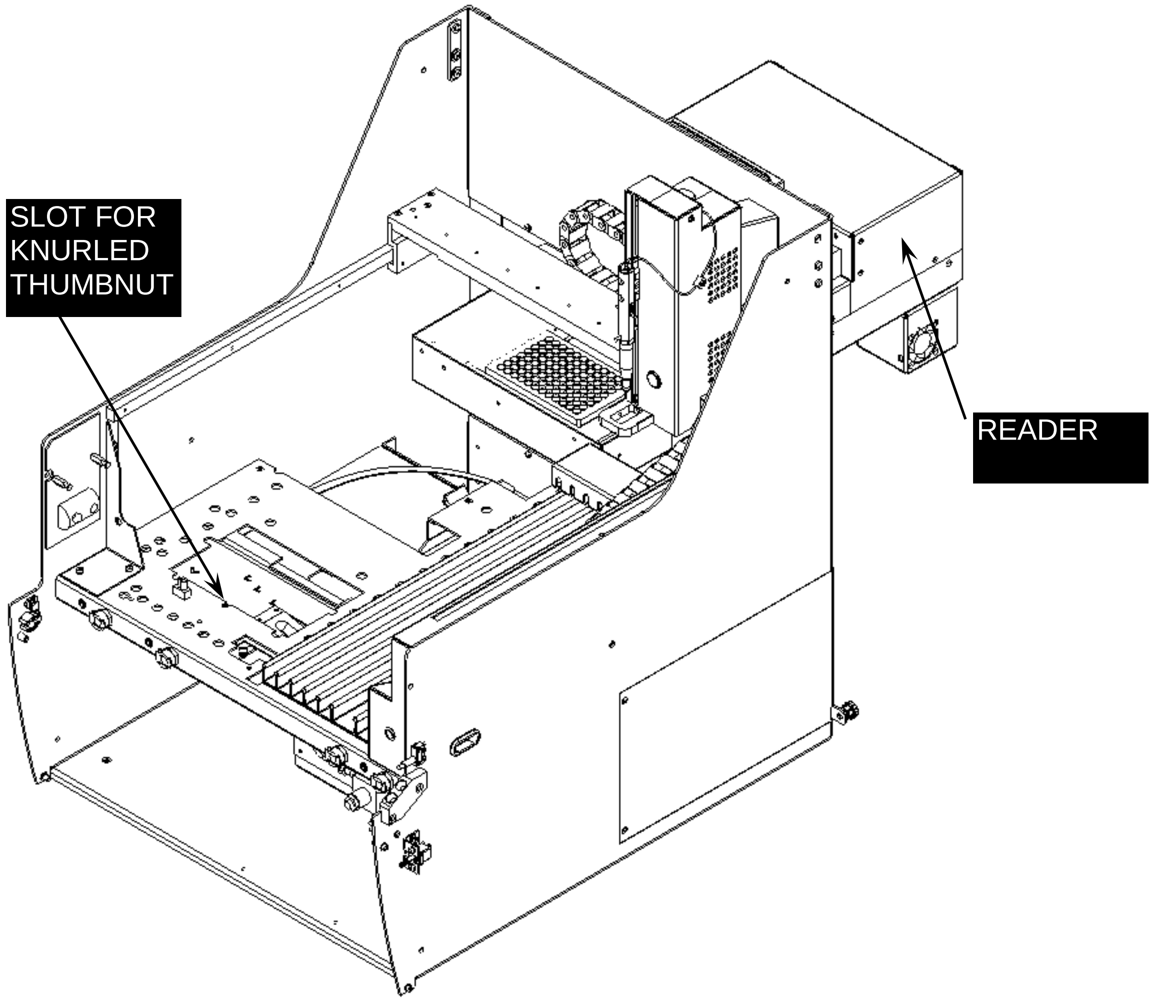


Figure 12-3: Reader Access

3. Remove the cables (Figure 12-4) and gently withdraw the reader from the chassis.

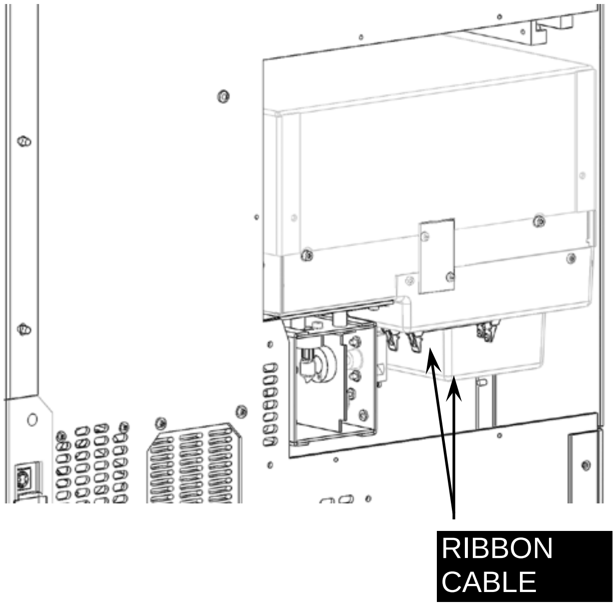


Figure 12-4: Reader Cable Connectors

To replace the reader:

1. Fit the reader assembly in to the chassis through the access hole in the back of the chassis, holding it at a slight angle.
2. Slide it forward until the stud at the front of the reader goes into the slot in the workspace.
3. Sit the reader on the workspace plate and hand tighten the knurled thumb nut to the stud at the front of the reader underneath the workspace plate.

> ***Note**: Do not tighten the Thumbnut as the front to back position of the Reader will be set later.*

4. Attach the 50 pin ribbon cable first; then attach the 40 pin ribbon cable.
5. Replace the reader access plate; then tighten the thumb nut.

12.2 Disassembling the Reader

12.2.1 Removing Covers

To remove the Top Cover Assembly, unscrew the six screws that affix it to the reader (Figure 12-5).

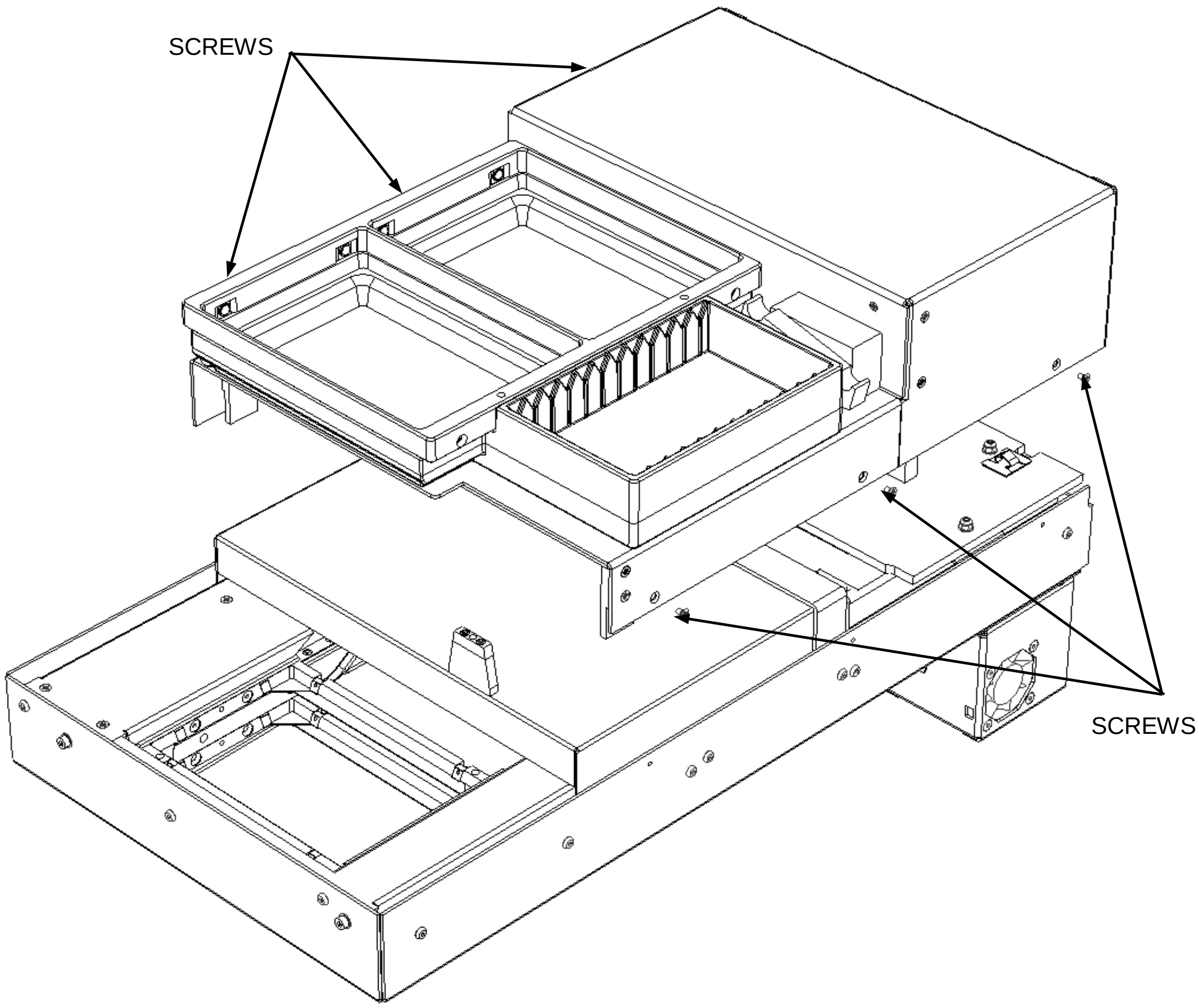


Figure 12-5: Removing the Top Cover

Removing the Sliding Cover

1. To remove the Sliding Cover Assembly, remove the eight screws as shown in Figure 12-6.

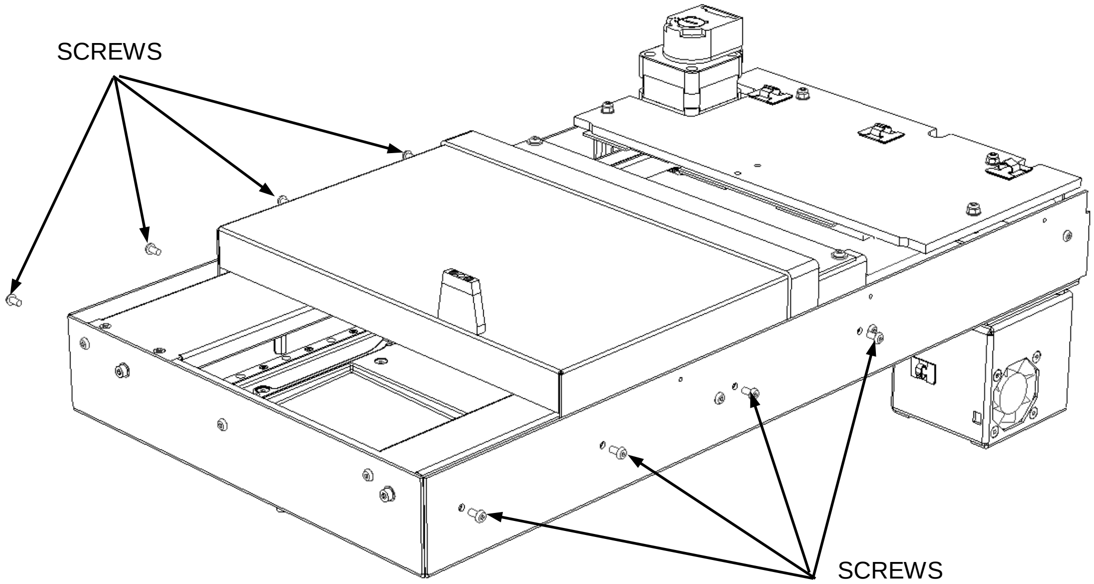


Figure 12-6: Sliding Cover Assembly

2. To replace the sliding cover, slide two cover guide strips into sliding cover assembly (Figure 12-7). Feed the sliding cover assembly down in to the chassis so that the guide strips line up with the four fixing holes in either side of the chassis.

3. Fix in place using eight M3x6 skt btn head Screws.

> ***Note**: Ensure the Sliding Cover slides freely along its travel.*

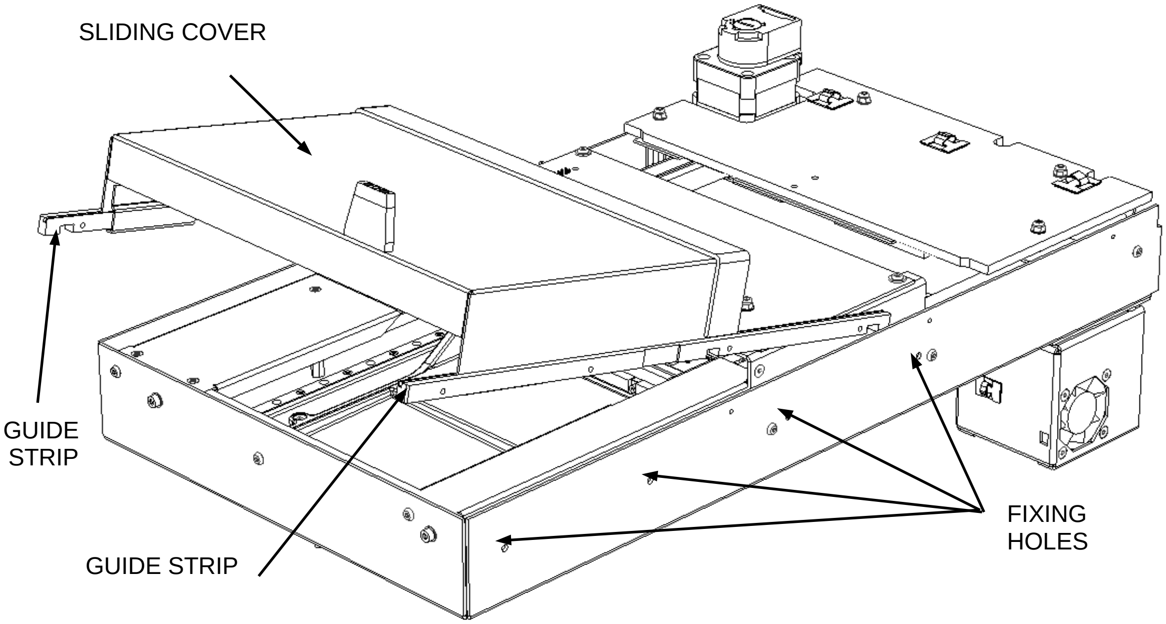


Figure 12-7: Replacing the Sliding Cover

Removing the Left Hand Belt Cover:

1. To remove the left hand belt cover, remove the three Posi Csk screws (Figure 12-8).

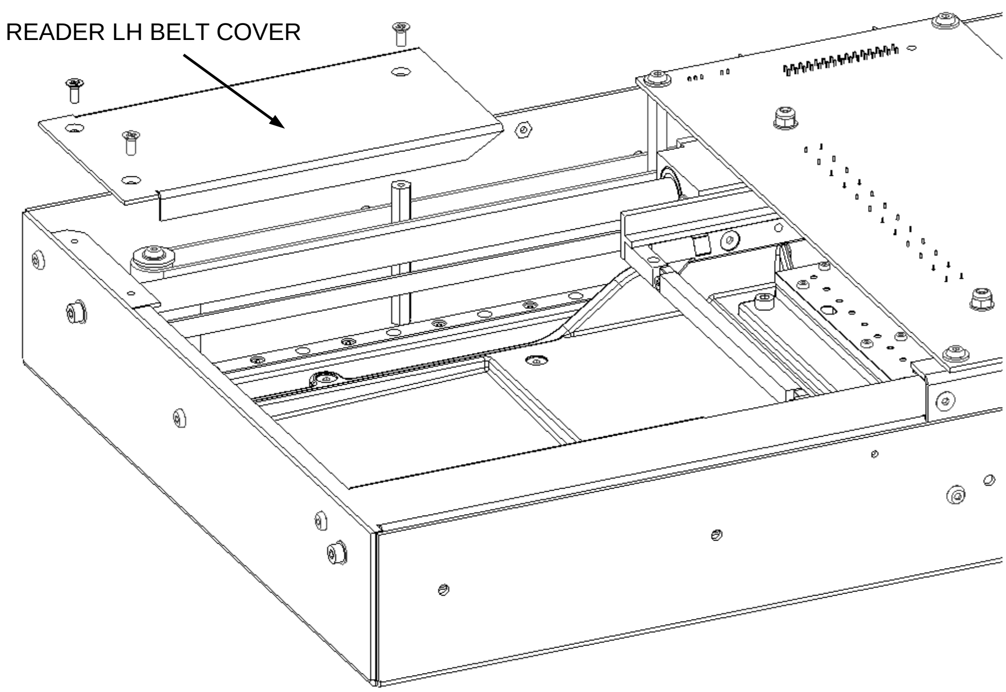


Figure 12-8: Left Hand Belt Cover

> ***Note**: Ensure the Drive clears the Belt Cover when replacing the Cover.*

Removing the Right Hand Belt Cover:

1. To remove the right hand belt cover, remove the M3x6 Skt Csk Screw, two M3x6 Skt Btn Screws and the M3x5 Skt Btn Screw (Figure 12-9).

> ***Note**: When replacing the right hand cover, use Loctite 222.*

> ***Note**: Ensure the Drive clears the Belt Cover when replacing the Cover.*

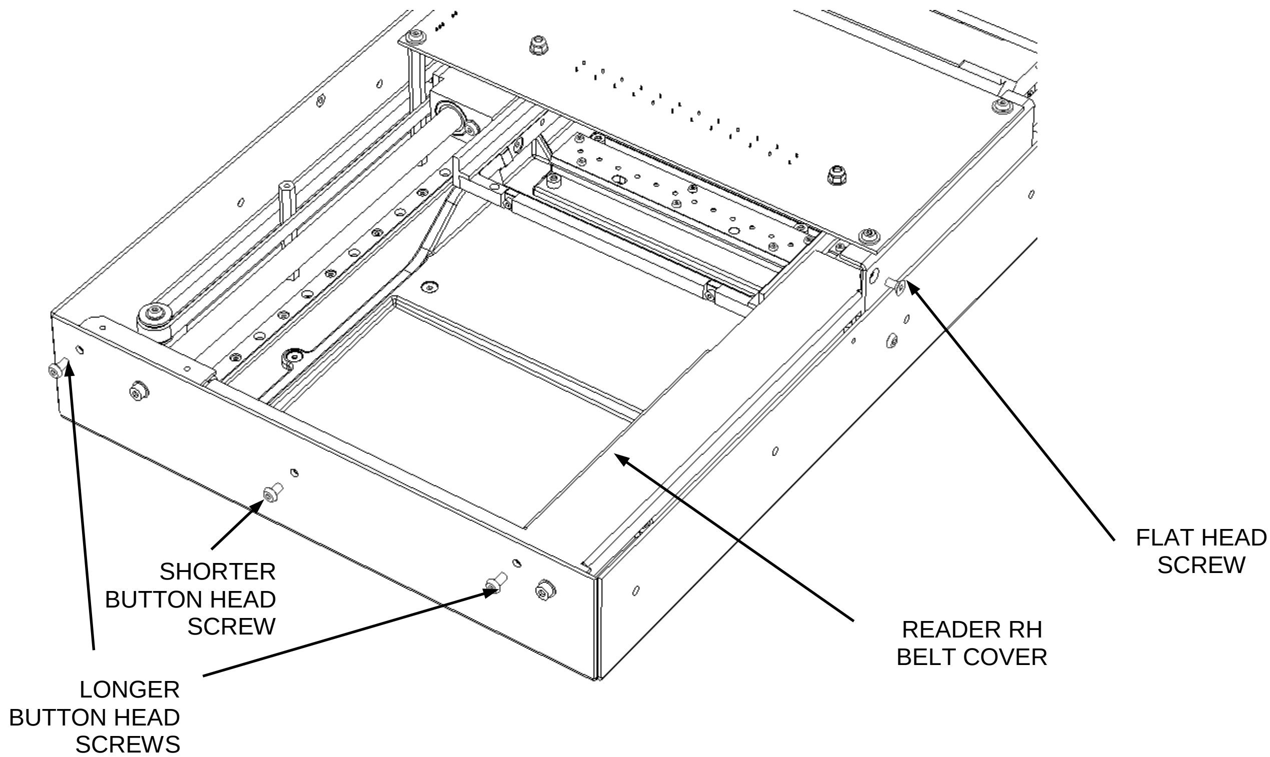


Figure 12-9: Removing the Right Hand Belt Cover

Removing the Lower Cover:

1. The Lower Cover is attached to the back board and the chassis by seven screws as shown in Figure 12-10.

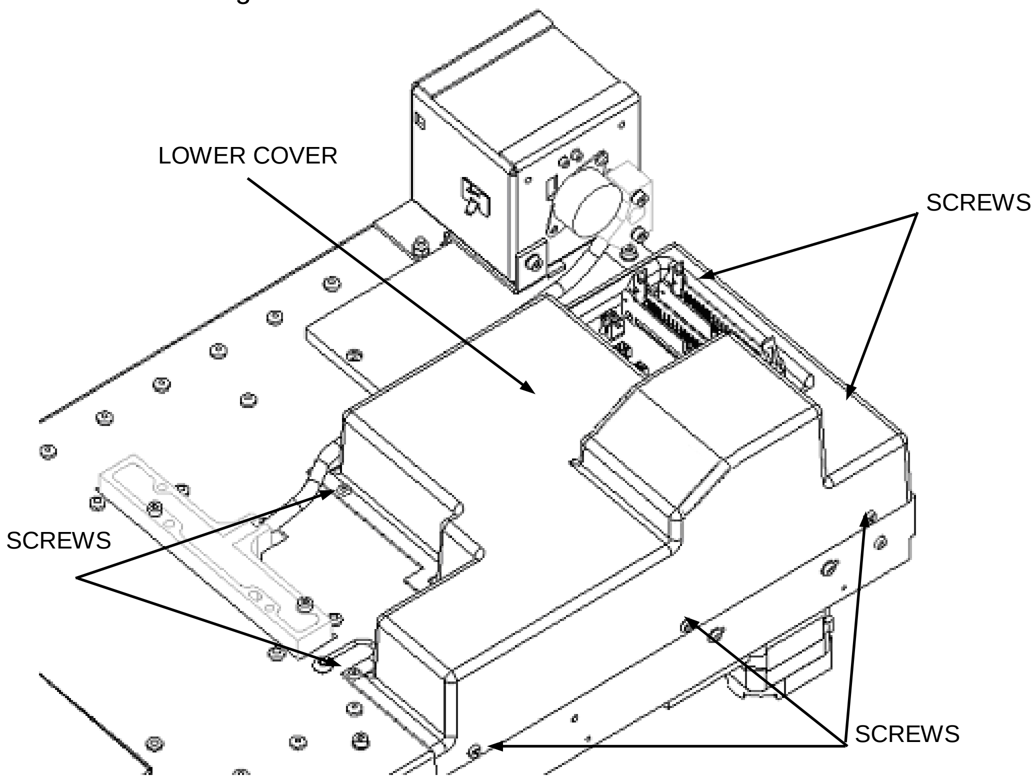


Figure 12-10: Attaching the Lower Cover

12.3 The Optical Components

12.3.1 The Optic Block Assembly

The Optic Block Cover is attached to the underside of the lower Optic Assembly as shown in Figure 12-11.

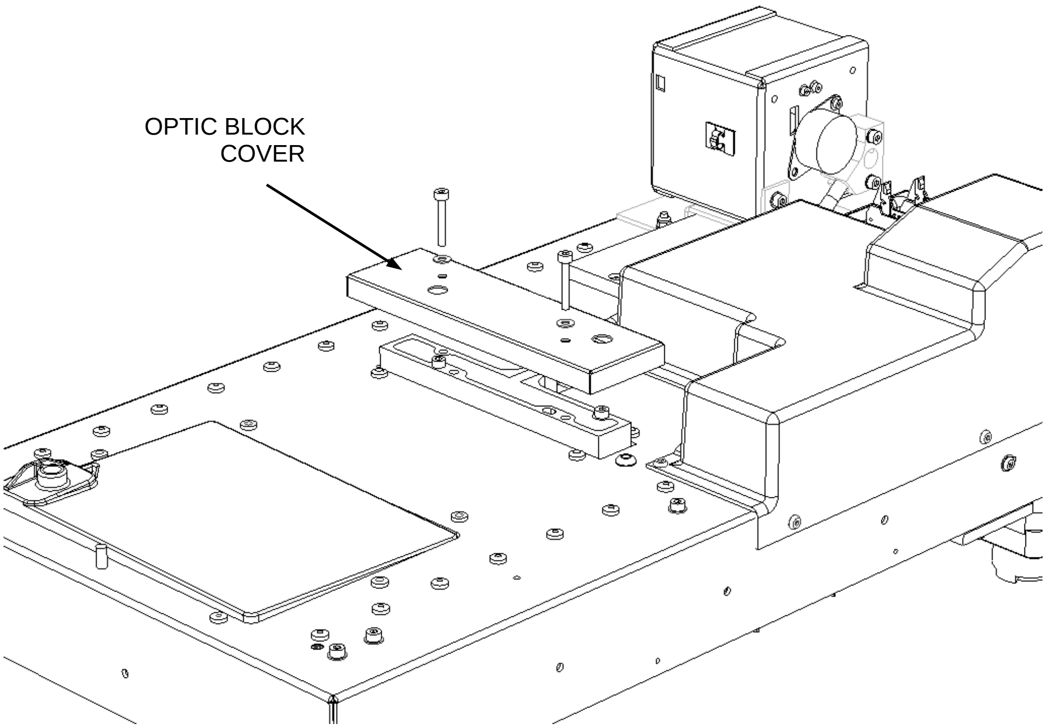


Figure 12-11: Optic Block Assembly

The Reader Diode Board Assembly is attached to the reader via four screws as shown in Figure 12-12.

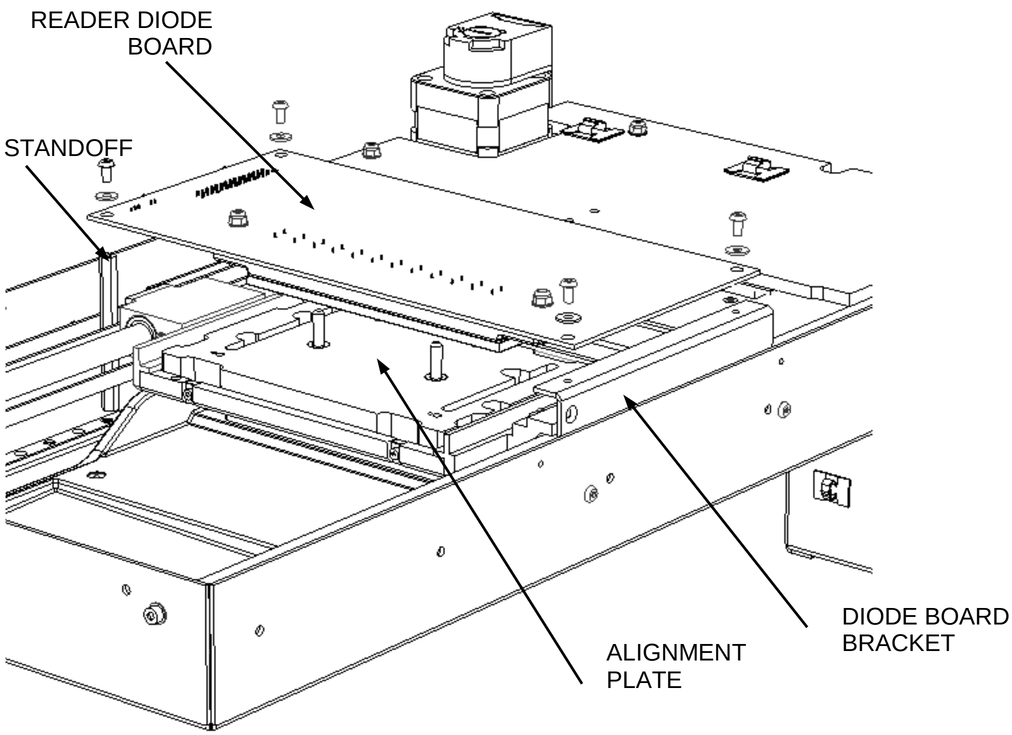


Figure 12-12: Reader Diode Board

When replacing the assembly:

1. Loosely fit the Reader Upper Optics Assembly to the two Standoffs and Diode Board Bracket using four M3x6 Skt Btn Head Screws and Large Plastic Washers.
2. Place the Alignment Plate (DS2FIX001) into the Upper Plate Carrier and position under the Upper Optics.
3. Push the Alignment dowels (DS2FIX004) up through the Lower Optic Block, through the Alignment Plate and into the Upper Optic Assembly. This has aligned the Upper Optics and the four screws can be tightened.
4. Remove all fixtures.

12.3.2 Replacing the Fiber Optic Assembly

The fiber optic bundle is connected to the optics cube and the lower side of the optics block.

To remove the Fiber Optic Bundle:

1. Remove the Fiber Optic Bundle from the Optic Cube as shown in Figure 12-13.

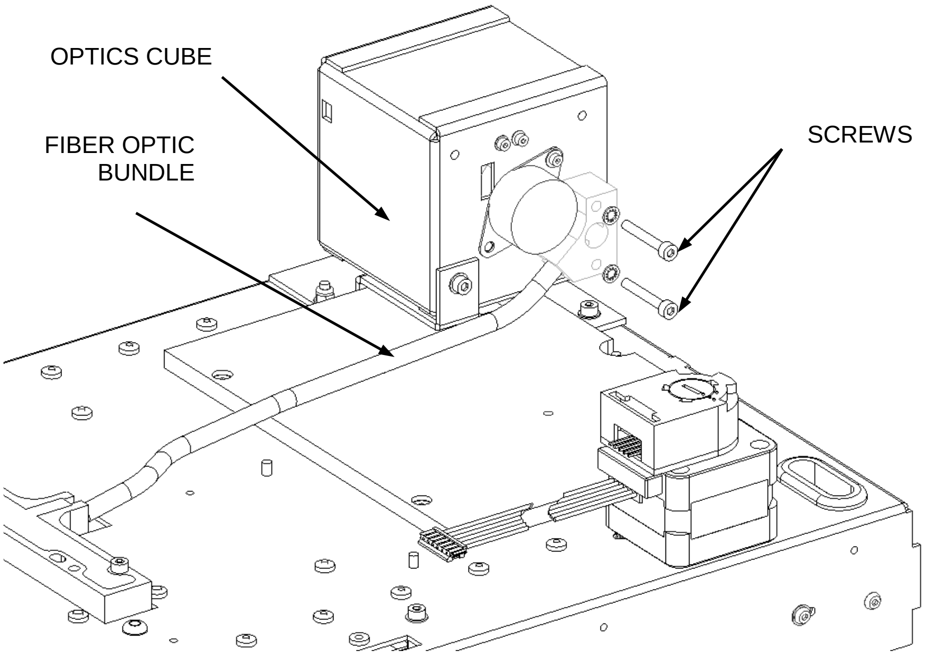


Figure 12-13: Fiber Optics in Optics Cube

2. Remove the Fiber Optic assembly from the lower optical block by removing the two screws as shown in Figure 12-14.

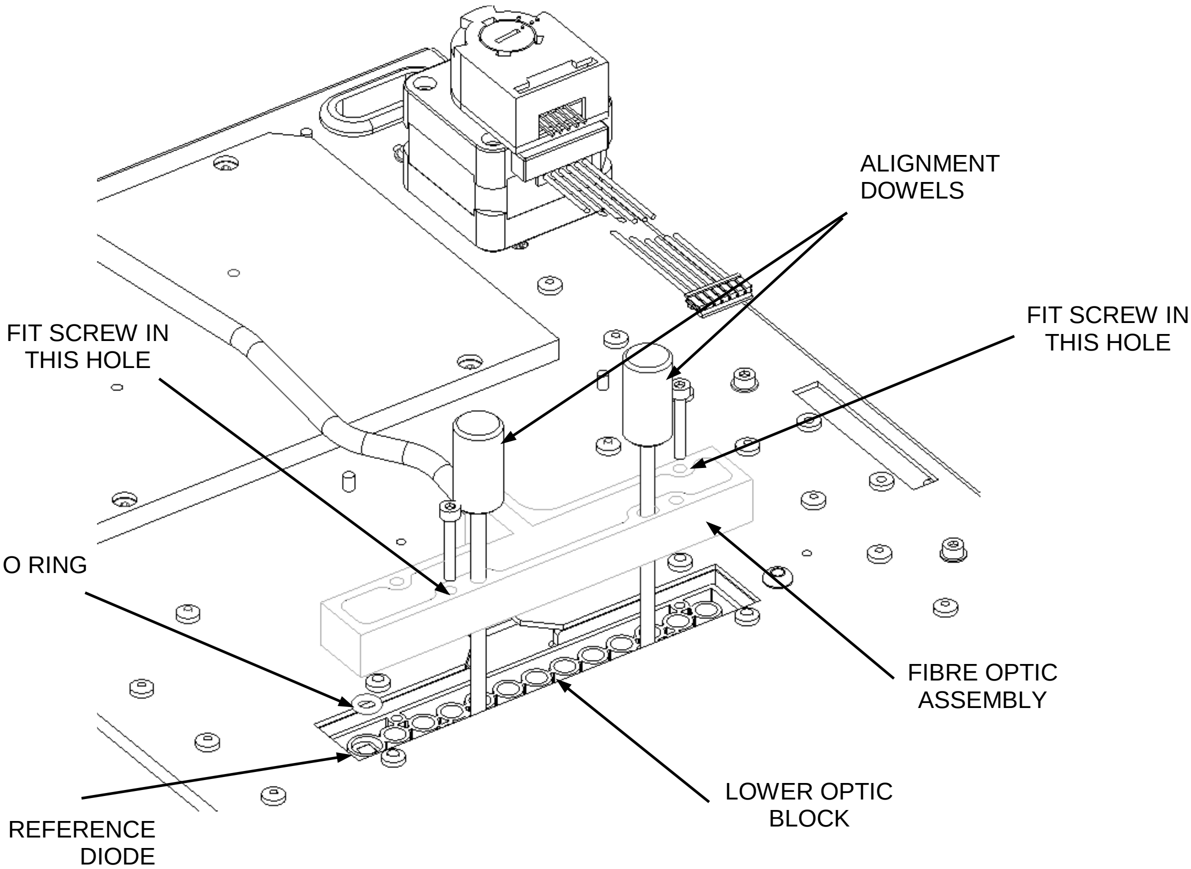


Figure 12-14: Attaching Fiber Optic Assembly to Lower Optical Block

When replacing the fiber optic diode:

1. Fit an O Ring on top of the Reference Diode.
2. Slide two Alignment dowels through the Alignment hole and slot in the Fibre Optic Assembly and Lower Optic Block.
3. Fit the Fibre Optic Assembly to the underside of the lower Optic Block using two M3X20 Skt Cap Screws in the positions shown in Figure 12-14. Do not over tighten the screws.

> ***Note**: When handling the Fiber optic assembly, do not bend it past a 30^o angle*

12.3.3 Replacing the Optics Cube Assembly

The Optics Cube Assembly is mounted as shown in Figure 12-15.

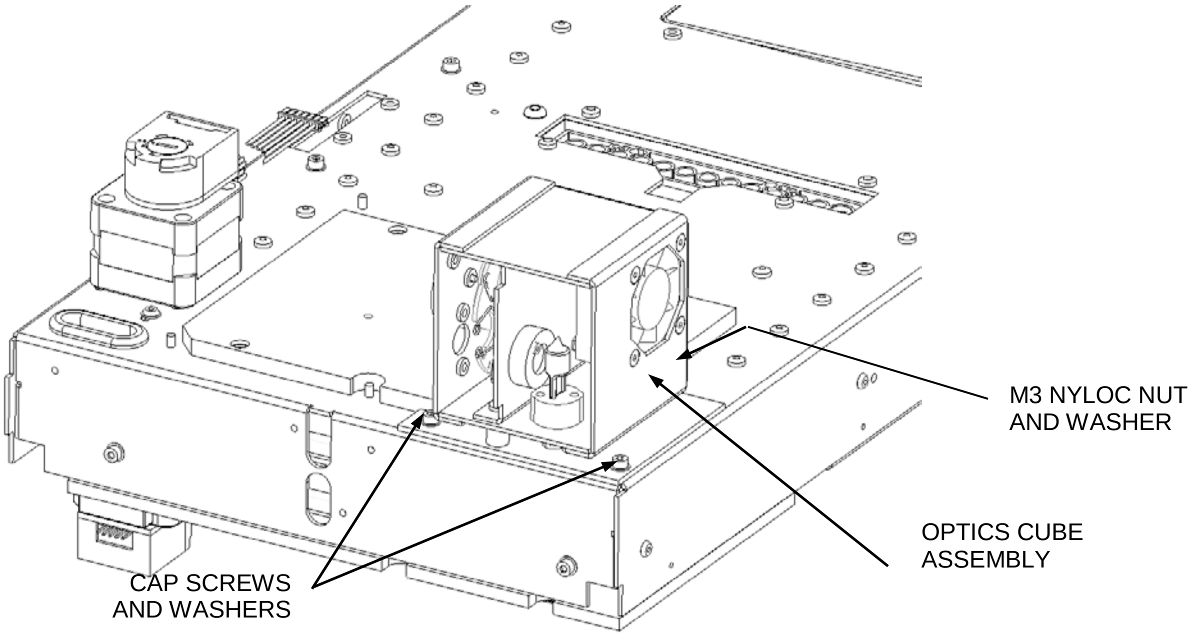


Figure 12-15: Removing the Optics Cube Assembly

> ***Note:*** *Changing the Light bulb is described in the User's Manual.* ***Also, if replacing the optics cube assembly, ensure the filter wheel has been factory calibrated.***

12.3.4 Using the Alignment Plate

The alignment plate is shown in Figure 12-16.

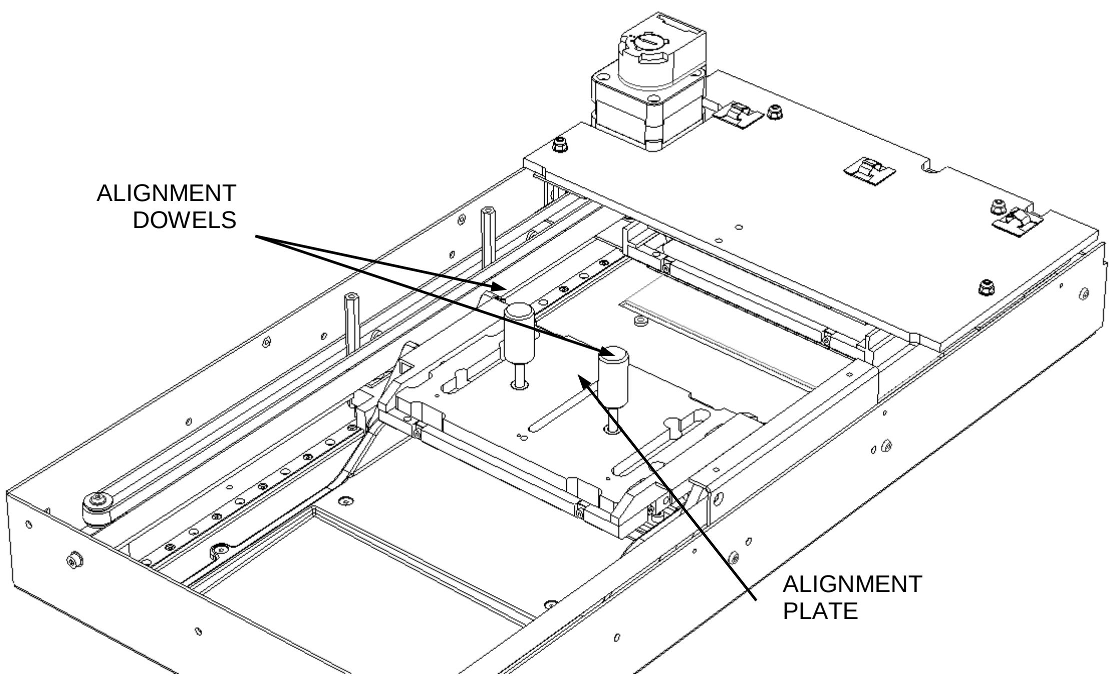


Figure 12-16: The Alignment Plate

To use the plate:

1. Place the Alignment Plate Fixture (DS2FIX001) in the Lower Plate Carrier and line it up over the Optic Block.
2. Push two Alignment Dowels through the Alignment Plate and Optic Block.
3. Tighten all four screws by accessing them through the Alignment Plate.
   Remove the Alignment Plate and Dowels by removing the 4 screws that attach it to the optic block.

12.3.5 Removing the Lower Optics Assembly

The Lower Optics Assembly is attached to the Spill Tray using 4 M3x16 Black Skt screws (Figure 12-17).

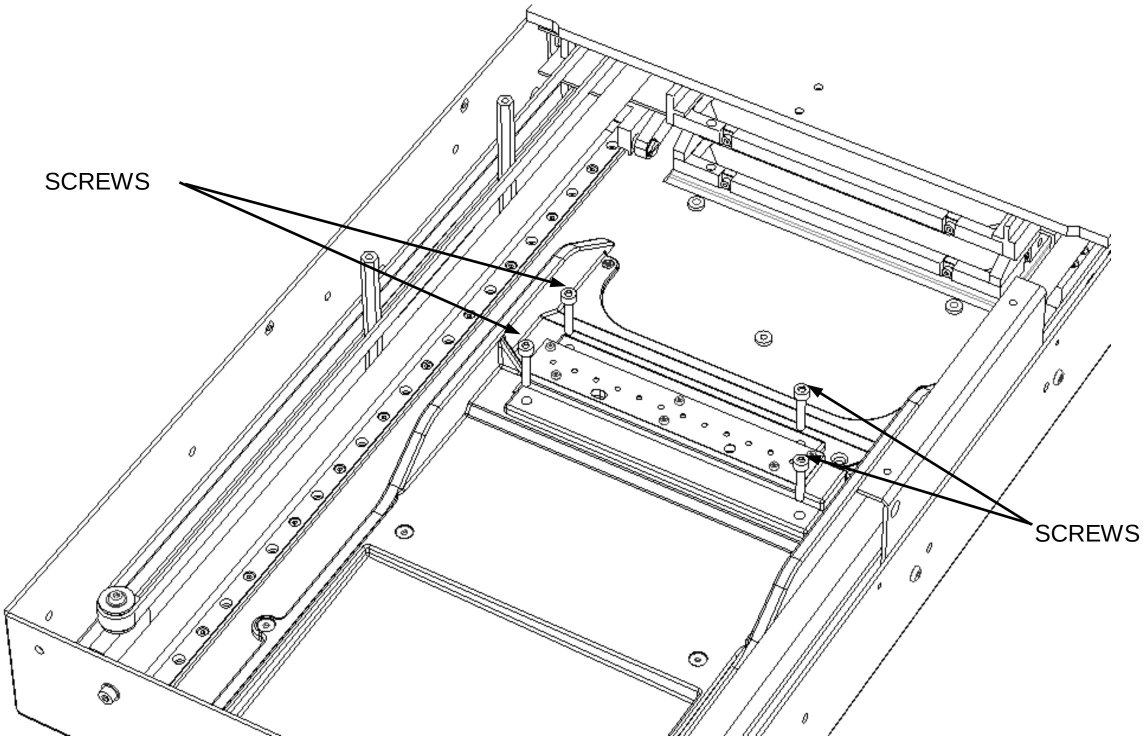


Figure 12-17: Lower Optics Assembly

> ***Note:*** *When replacing the optics, note the slot and recesses as shown in Figure 12-18.*

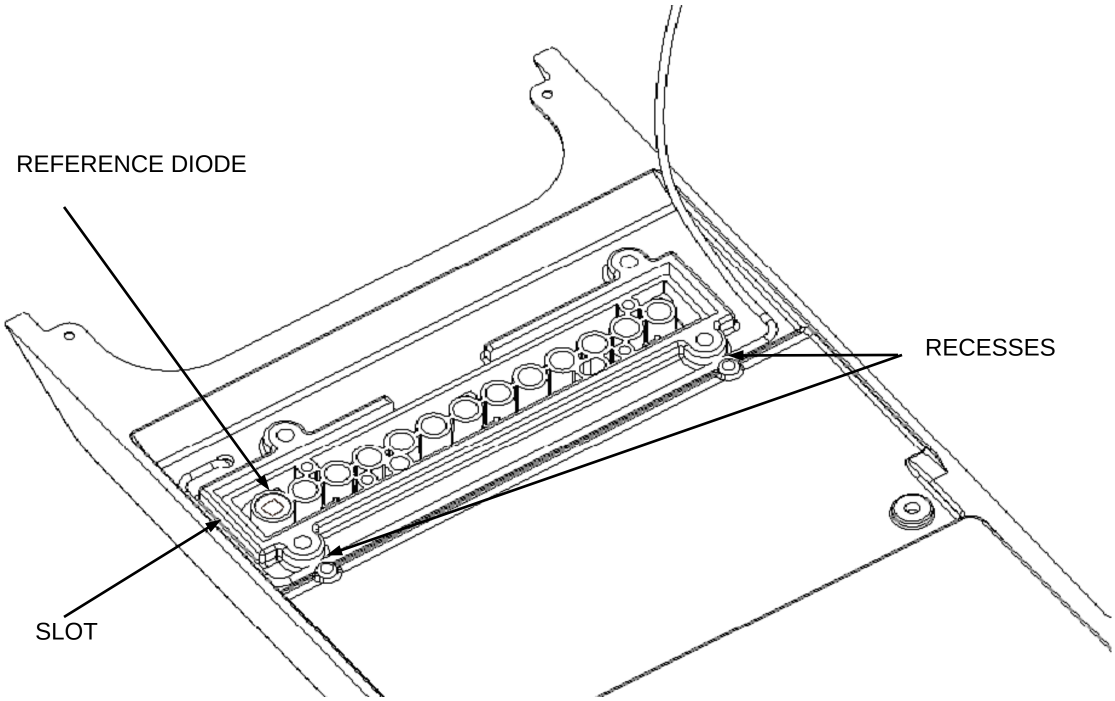


Figure 12-18: Fitting the Lower Optics Block into the Spill Tray

12.3.6 Removing the Spill Tray

The spill tray fits into the chassis as shown in Figure 12-19.

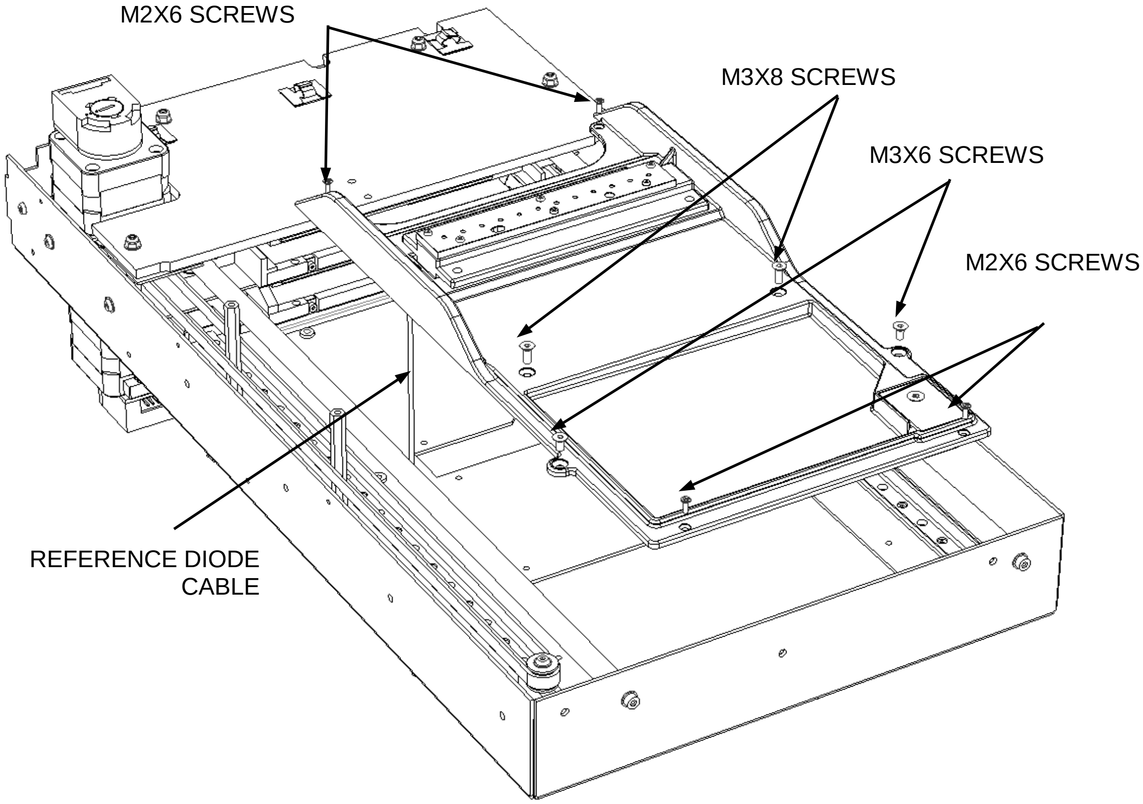


Figure 12-19: Removing the Spill Tray

To replace the Spill Tray:

1. Thread the Reference Diode Cable through the Grommet in the Reader Chassis.
2. Fit the Reader Spill tray to the Chassis using two M3X6 Posi Csk Screws, two M3X8 Posi Csk Screws and four M2X6 Posi Csk Screws.

> ***Note:*** *Ensure the Lower Plate Carrier assembly travels over the ramps of the Reader Spill Tray freely.*

12.4 The Reader Optics

12.4.1 Replacing the Reference Diode

The reference diode is located in the leftmost position of the lower Optics block and is removed as shown in Figure 12-20.

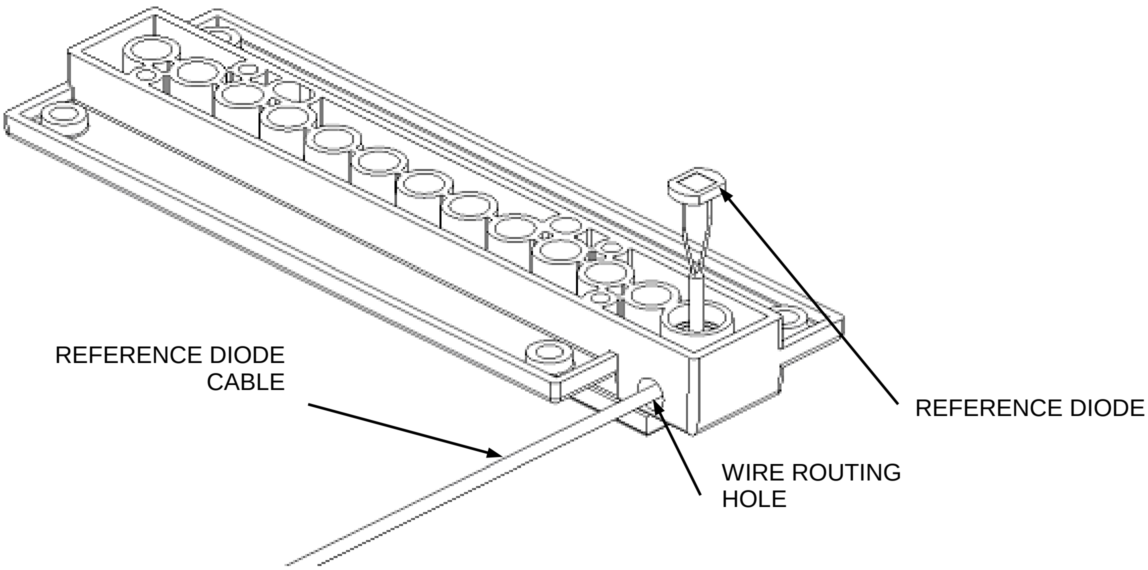


Figure 12-20: Removing the Reference Diode in Position

> ***Note:*** *When replacing the Reference Diode, ensure that it is flush with the lower optics block as shown in Figure 12-21.*

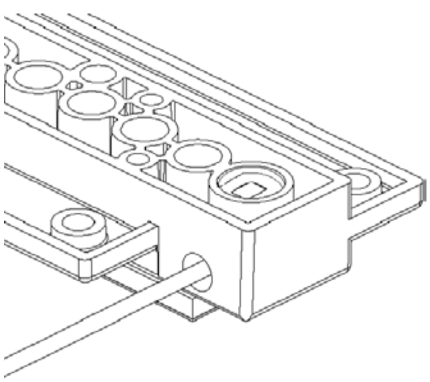


Figure 12-21: Reference Diode in Position

12.4.2 Disassembling the Lower Optics Block

To disassemble the Lower Optics Block, remove the four screws shown in Figure 12-22 (the alignment dowels are not required for disassembly).

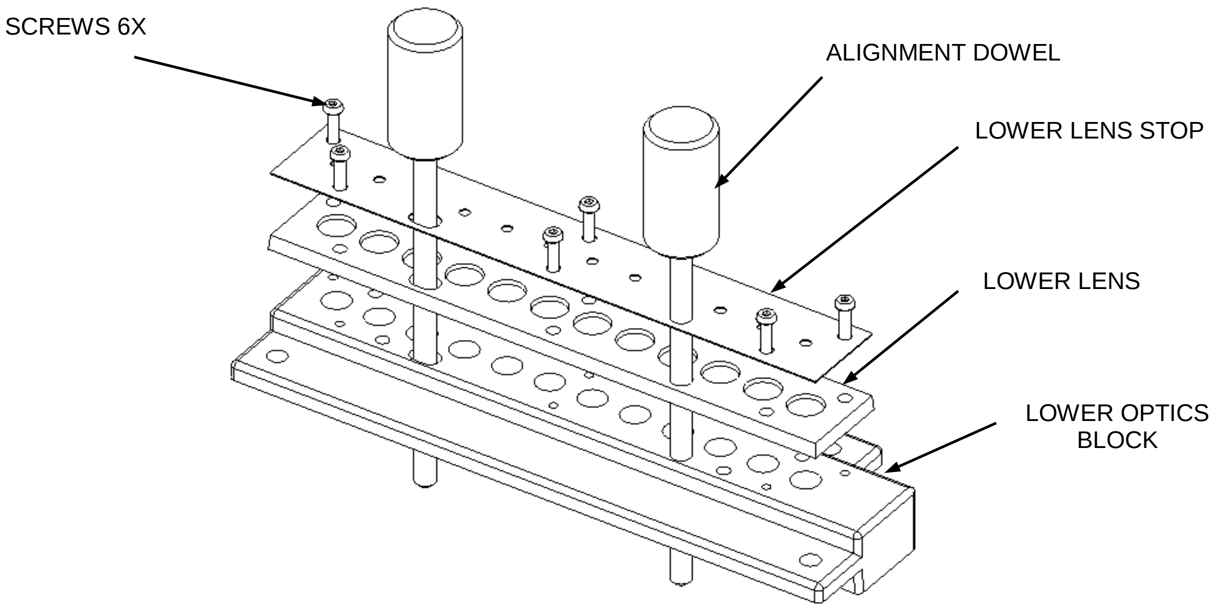


Figure 12-22: Lower Optics Block

To rebuild the Lower Optics Block:

1. Place the Lower Lens Strip on the Lower Optics Block.
2. Place the Lower Lens Stop on top of this.
3. Align all the parts by inserting one 4 mm alignment dowel in the alignment hole and one 4 mm alignment dowel in the alignment slot.
4. Fasten the assembly together using 6 M2x8mm Black Button Head Screws.

12.5 Replacing the Heater Assembly

12.5.1 Removing the Insulation Plate

The Insulation Plate is shown in Figures 12-23 and 12-24.

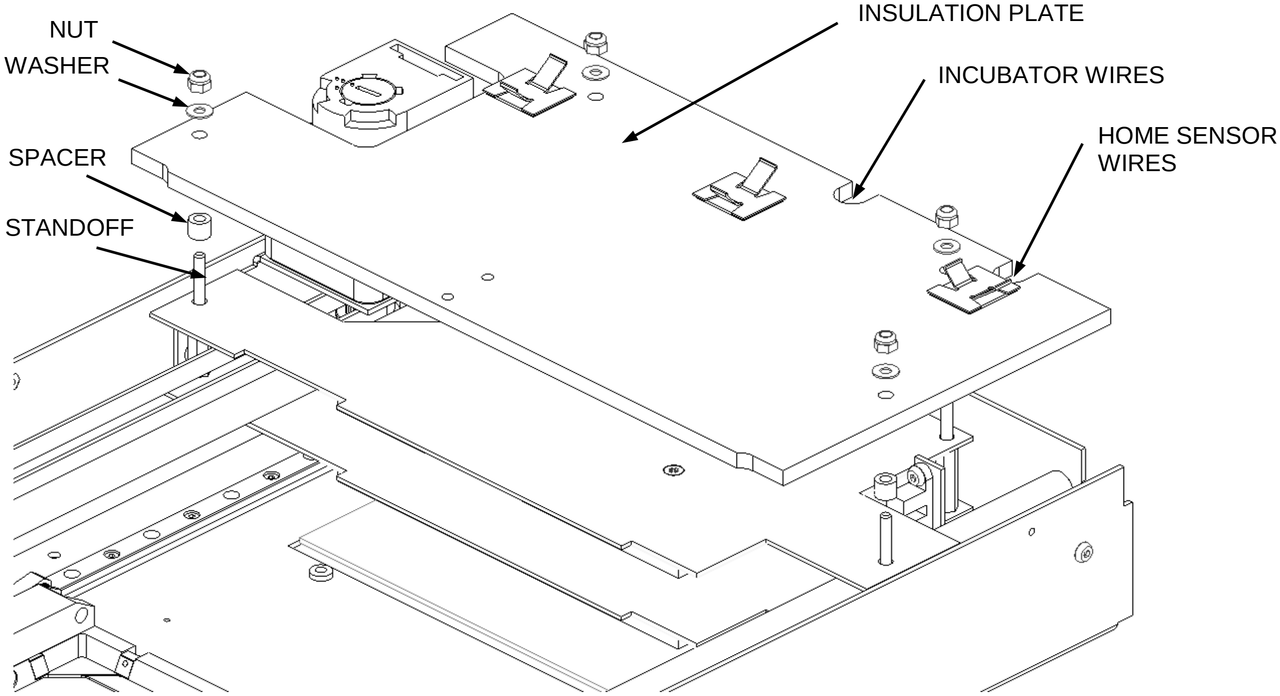


Figure 12-23: Incubation Plate

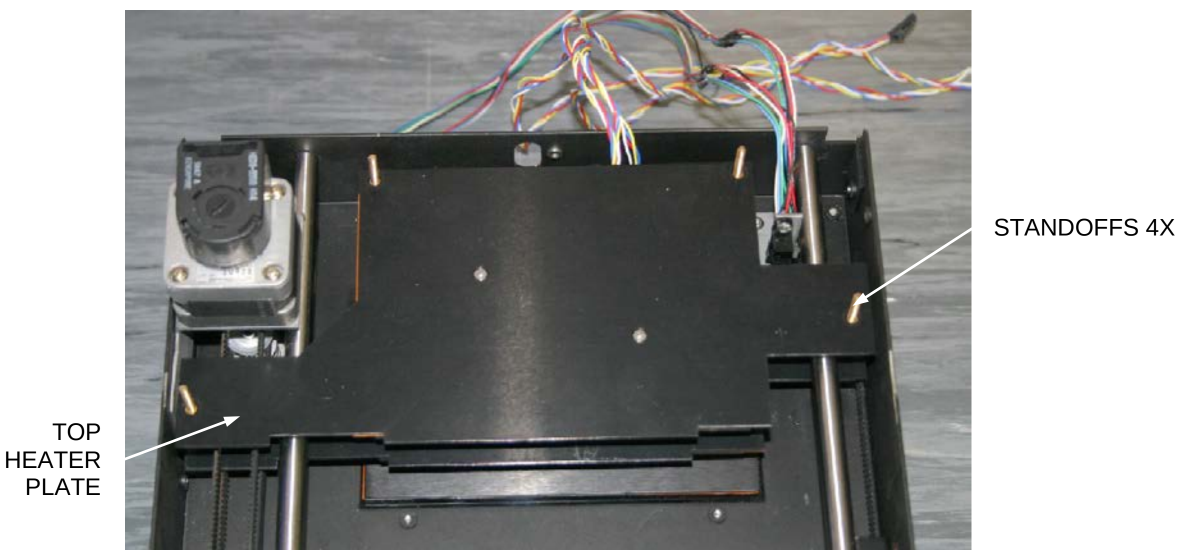


Figure 12-24: Top Heater Plate

To remove the Top Heater Plate assembly (Figure 12-23 and 12-24), remove the four screws that attach it to the body. For replacement, note that the top heater plate is marked with a T.

12.5.2 Removing the Middle Plate

The middle plate can be removed by removing the four standoffs as shown in Figure 12-27.

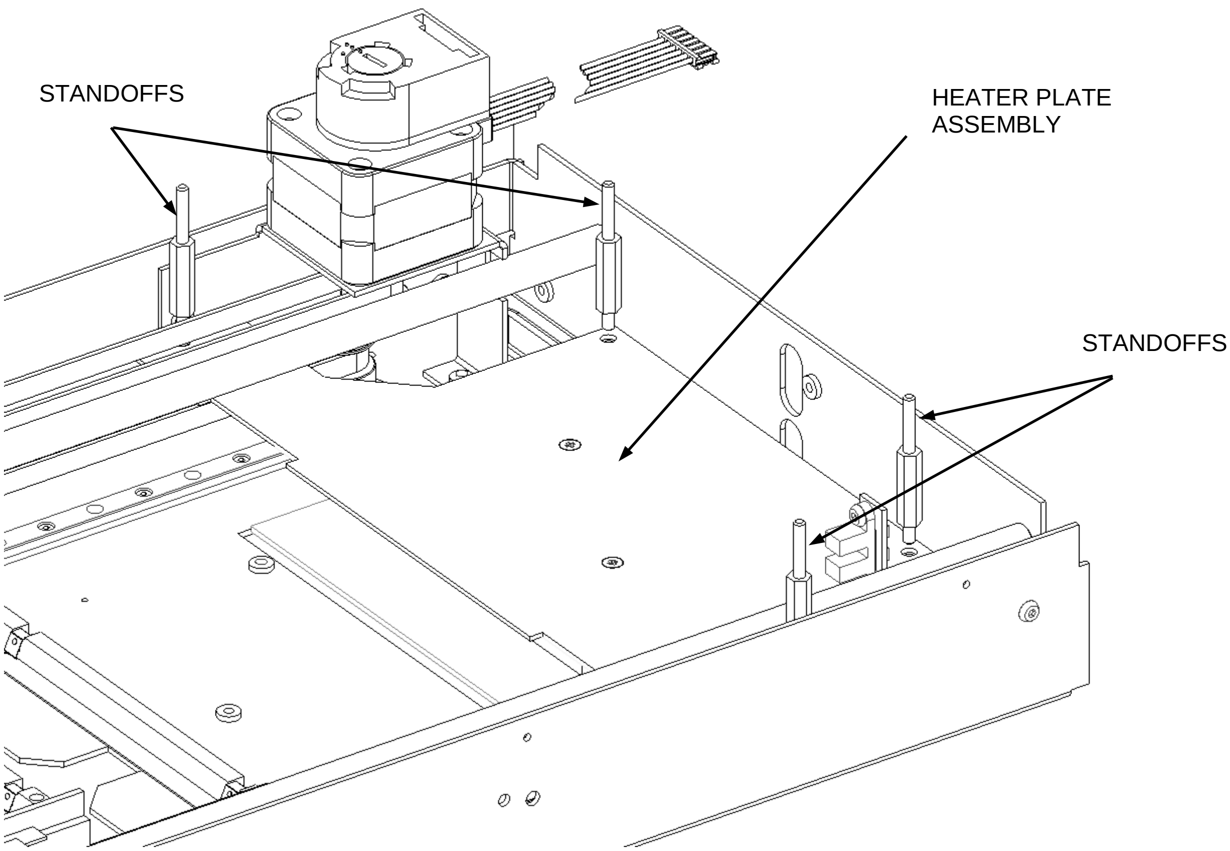


Figure 12-27: Middle Heater Plate Assembly

12.5.3 Disassembling the Heater Plate Assembly

The Heater Plate Assembly is shown in Figure 12-28.

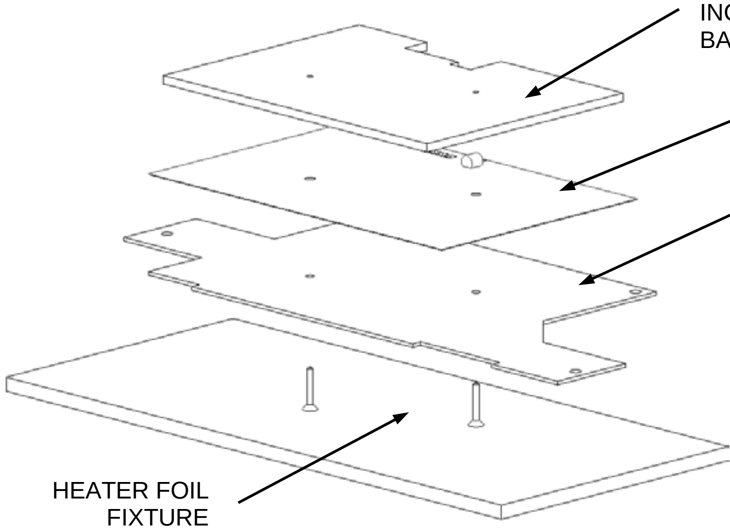


Figure 12-28: Heater Plate Assembly

To reassemble the Heater Plate Assembly:

1. Fit together two Heater Plate Assemblies using two Incubator Plates, two DS2 Heater Foils, two Incubator Backing Plates and four M2.5x4 Posi Csk Screws.
2. Locate one Incubator Plate onto the Heater Foil Fixture (DS2FIX020) with the countersunk holes underneath.
3. Stick one DS2 Heater Foil to the Incubator Plate and stick one Incubator Backing Plate to the DS2 Heater Foil using the fixture to line up the holes.
4. Remove the assembly from the fixture and fix the Incubator Backing Plate to the Incubator Plate using two M2.5x4 Posi Csk Screws.
5. Repeat for the second Heater Plate Assembly.

12.5.4 Bottom Heater Plate Assembly

Remove the Lower Heat Assembly (Figure 12-29) by removing the screws that attach it to the Lower Insulation Plate.

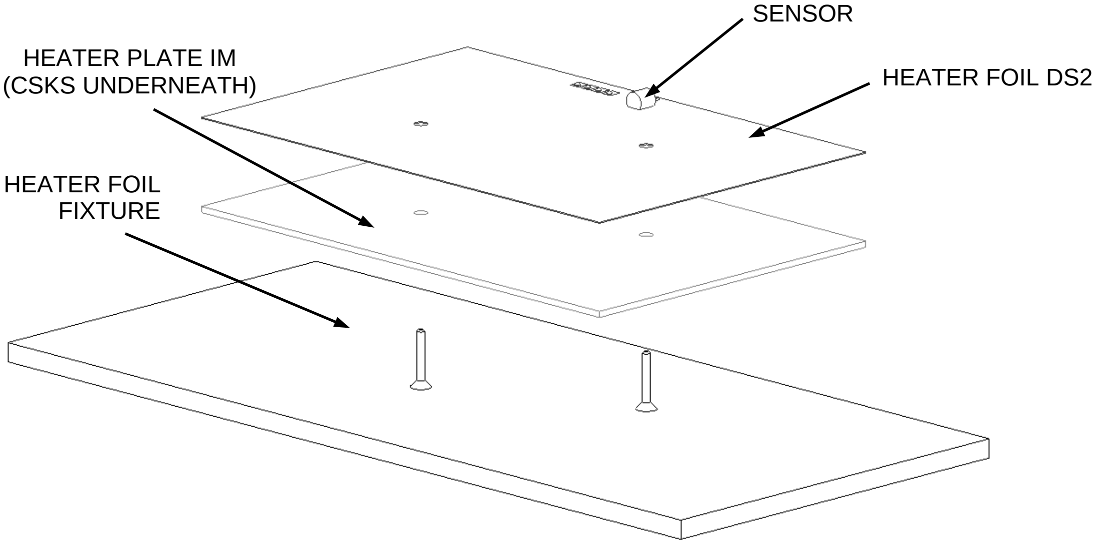


Figure 12-29: Bottom Heater Plate

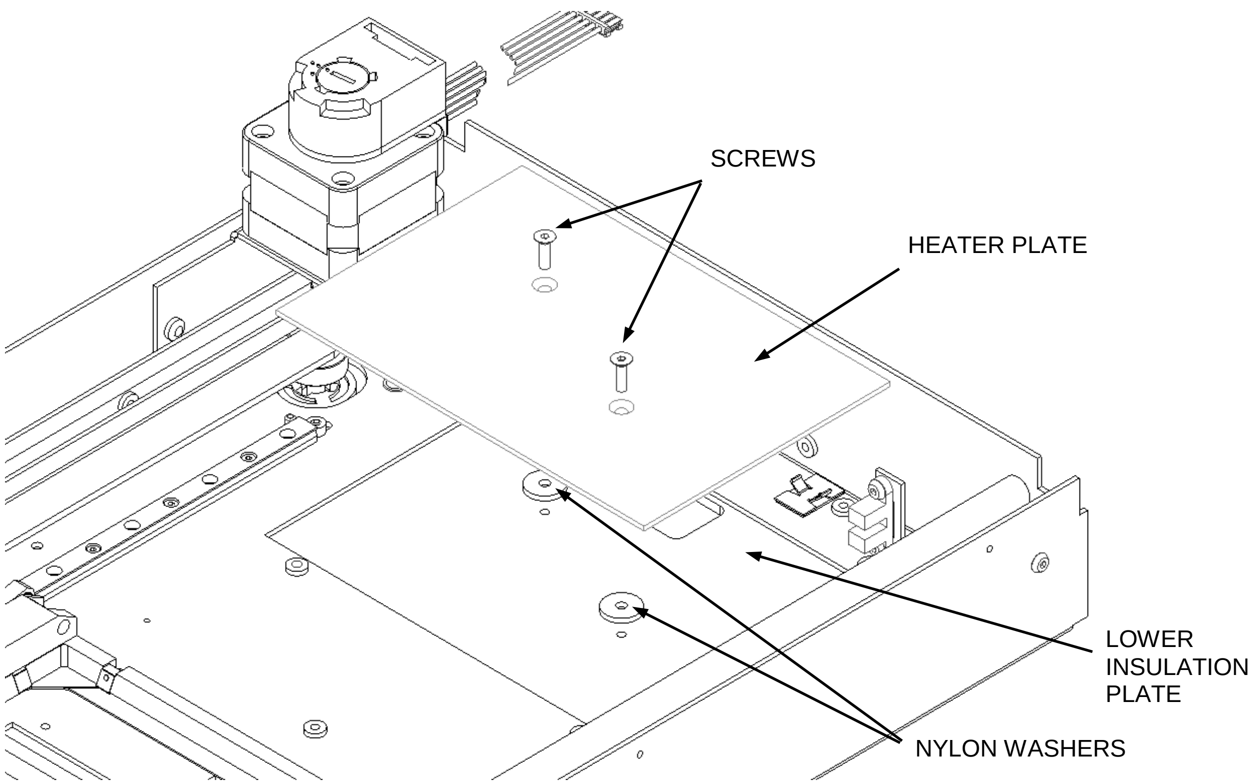


Figure 12-30: Locating Lower Plate Assembly

12.5.5 Removing the Lower Insulation Plate

To remove the Lower Insulation Plate, remove the four screws that attach it to the chassis (Figure 12-31).

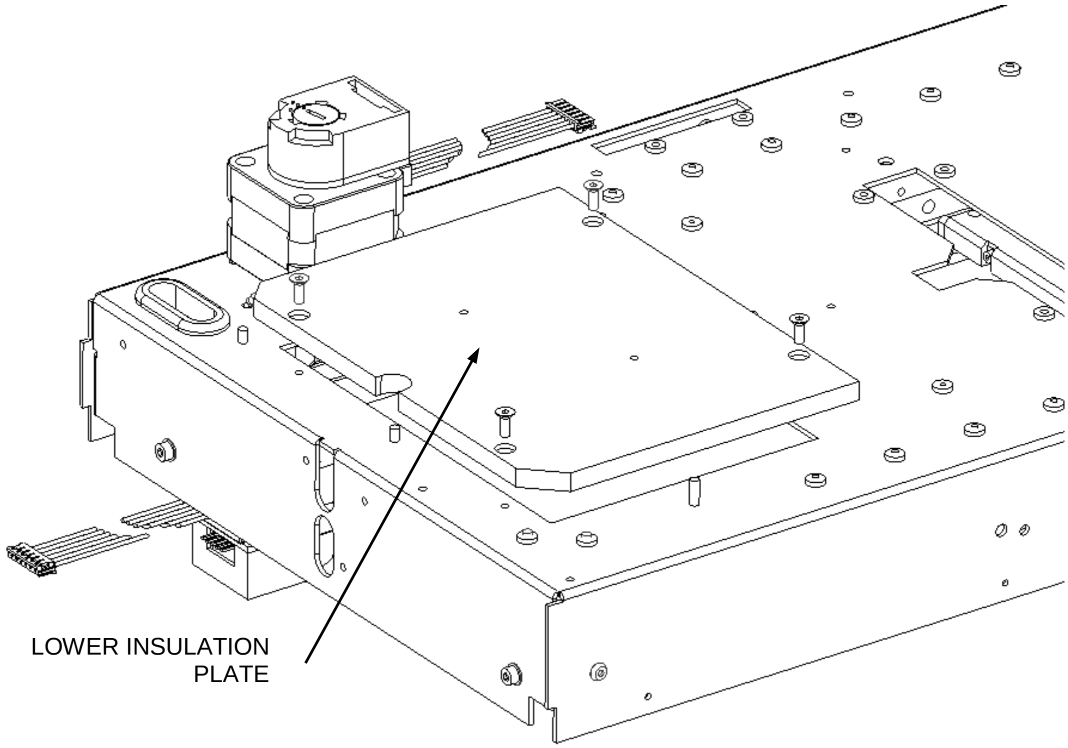


Figure 12-31: Lower Insulation Plate

12.5.6 Removing Belts and Related Components

12.5.6.1 Replacing the Upper Belt Assembly

The Upper Belt Assembly is shown in Figure 12-32.

To remove the belt, remove the belt clamp from the bearing clamp.

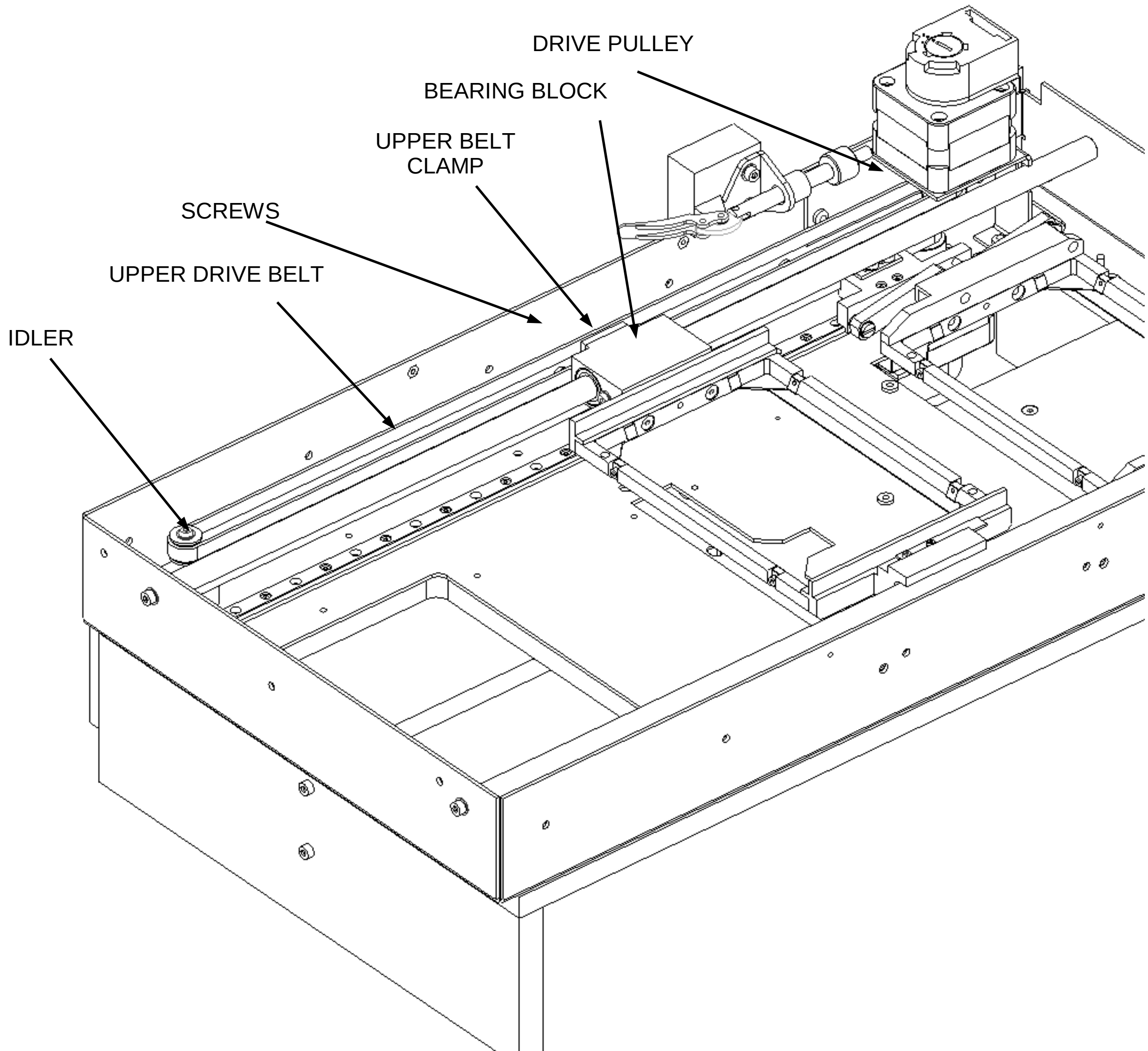


Figure 12-32: Belt Clamp Assembly

To replace the belt:

1. Cut a length of GT2 Belt (800 mm long) for the Upper Drive.
2. Fit the Upper Drive Belt around the Drive Pulley and Idler so that the ends join at the center of the Bearing Block.
3. Fit the Upper Belt Clamp to the Belt. Ensure that there are an equal amount of teeth engaged on each end.
4. Secure the Belt Clamp to the Bearing Block using two M3X8 Skt Csk Screws and Loctite 222.
5. Move both Plate Carrier assemblies to the rear of the Chassis.

> ***Note**: Field service engineers will use a hand held tension meter in place of the tensioning fixture described above. Place a piece of metallized tape on the belt and hold the meter about ½" from the belt. Gently press on the belt and observe the reading on the meter. An acceptable reading is 40 Hz.*

6. Turn on the Upper Force Gauge and re-zero it.
7. Fit the gauge to the Reader Chassis by locating the dowels underneath the Gauge into the corresponding holes in the Belt Tensioning Fixture. Ensure the Gauge is pushing against the inside of the belt (Figure 12-33).
8. Close the Toggle Clamp on the fixture by flipping the Toggle Clamp Lever towards the Motor.

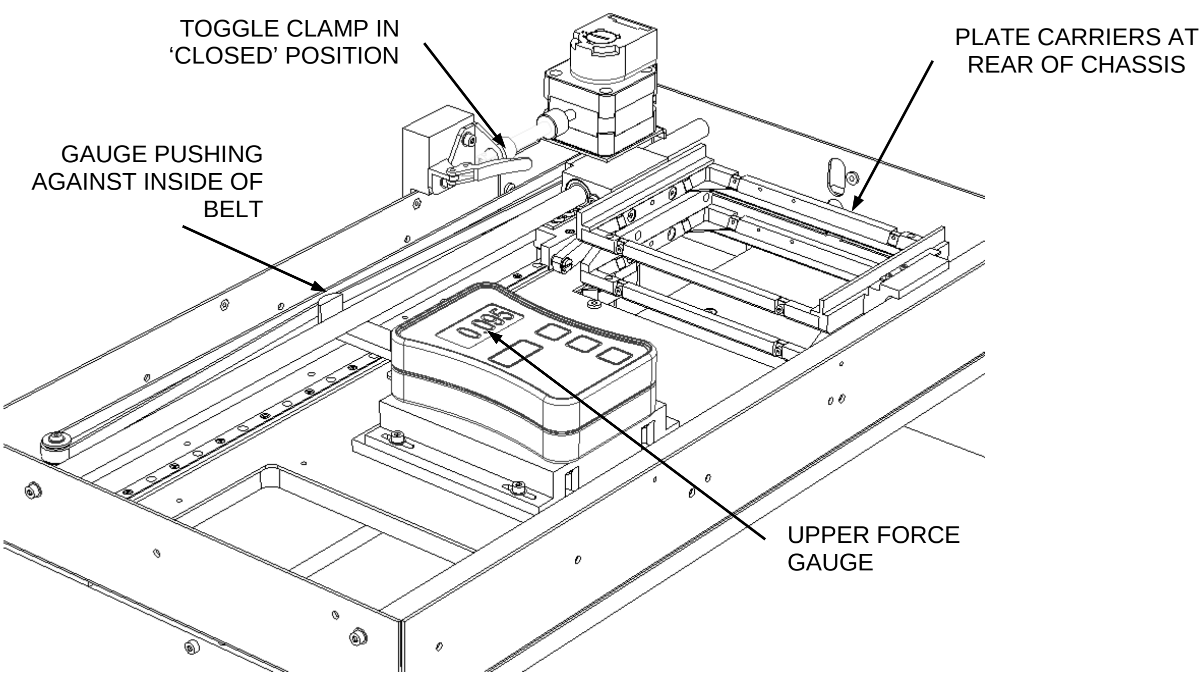


Figure 12-33: Adjusting Belt Clamp

> ***Note:*** *Before taking each force reading, using an Allen Key, gently push the Belt off the end of the Force Gauge Belt Hook by 1 to 2 mm and then reposition it (Figure 12-34) to ensure that no sideways force from the belt is being measured.*

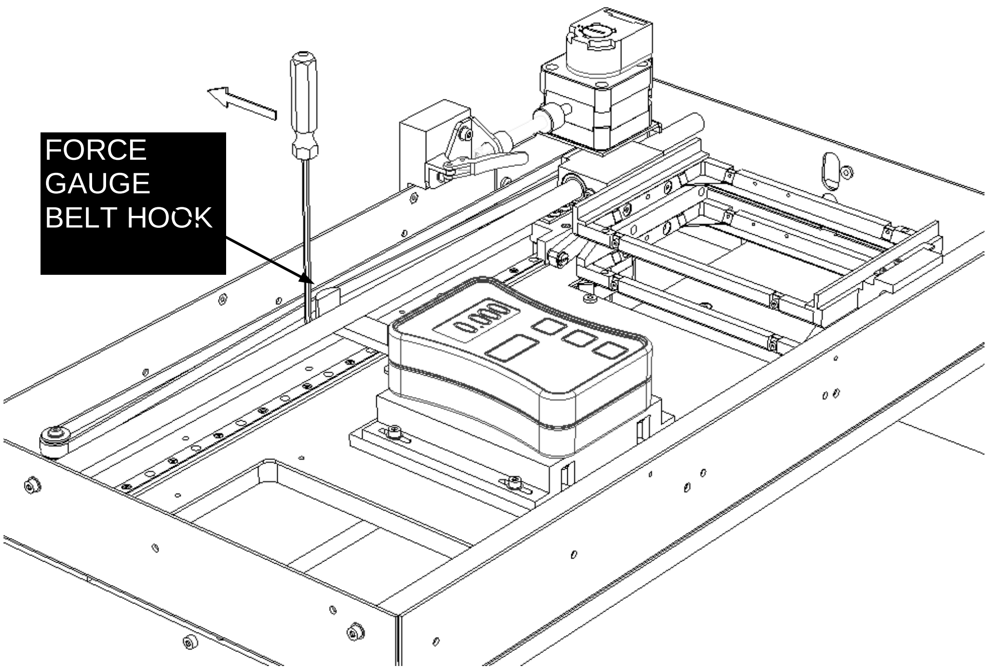


Figure 12-34: Pushing the Belt

9. Before setting the belt tension, the belt must be pre-stretched. Rotate the Thumbscrew on the Toggle Clamp clockwise so that it pushes the Motor towards the rear of the Chassis. When the Gauge reads between 0.100 Kg and 0.110 Kg, return the Motor back to its original position.

10. To set the working tension, rotate the Thumbscrew on the Toggle Clamp clockwise so that it pushes the Motor towards the rear of the Chassis. When the Gauge reads between 0.090 Kg and 0.100 Kg the belt tension is correct (target 0.095 Kg), tighten all three screws fixing the Motor Plate in place to lock the Motor assembly.

11. Unscrew the thumbscrew and check the tension is still correct. Open the Toggle Clamp by flipping the lever then remove the Force Gauge assembly.

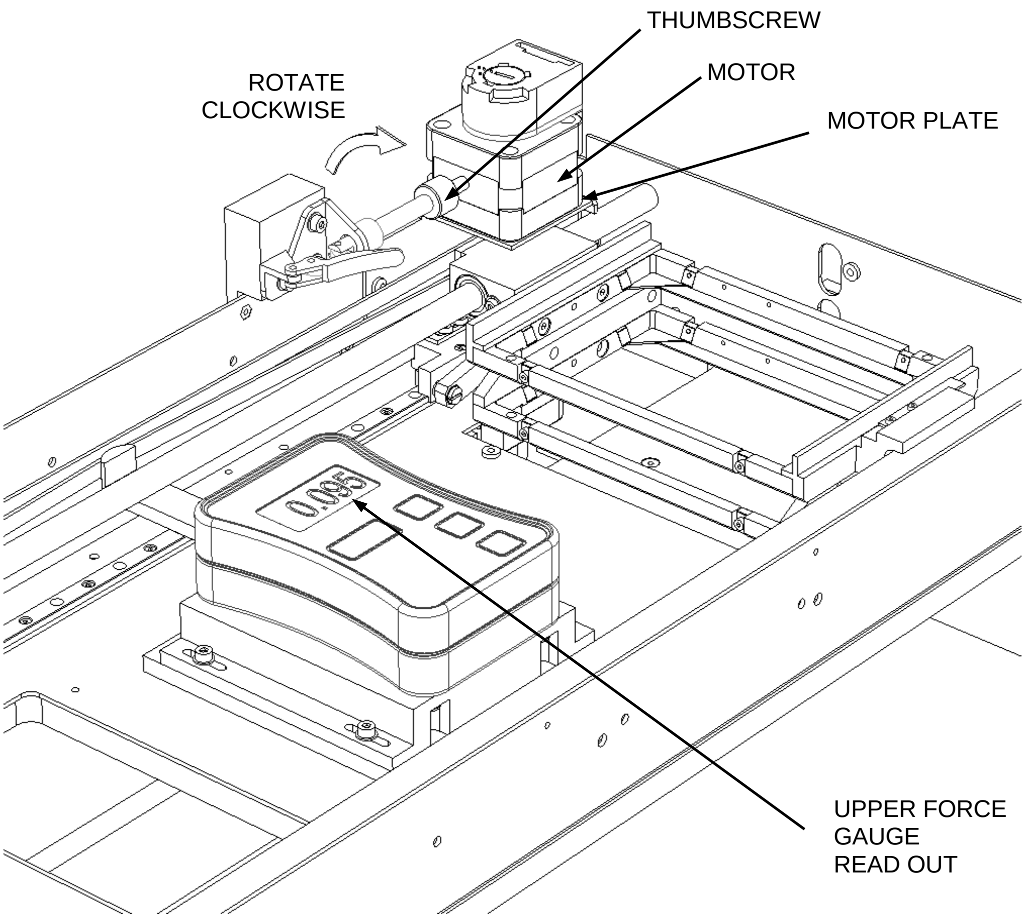


Figure 12-34: Readout

12. One at a time, remove the three screws securing the Motor Plate and refit using Loctite 222.

12.5.6.2 Replacing Optosensors

There are two Optosensors attached to a sensor tree as shown in Figure 12-35. These are mounted on the reader chassis as shown in Figure 12-36.

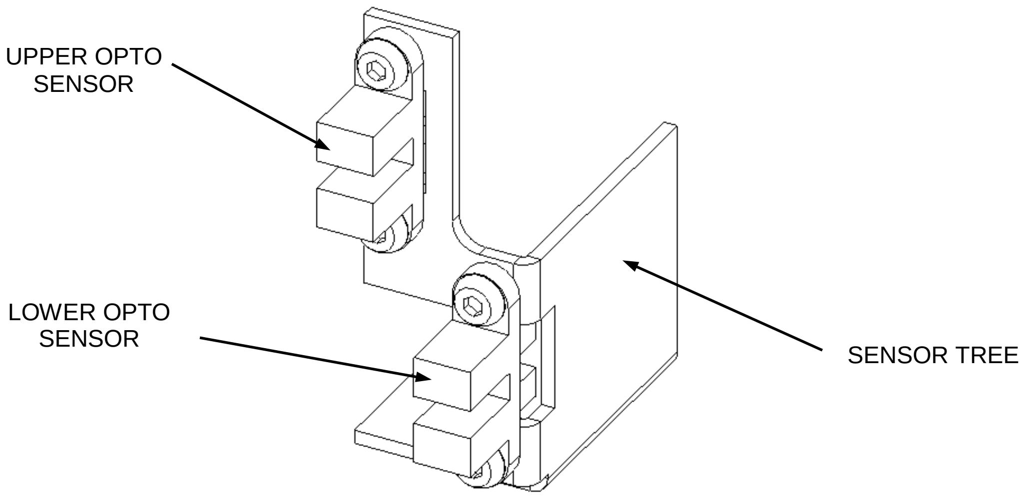


Figure 12-35: Optosensor Tree

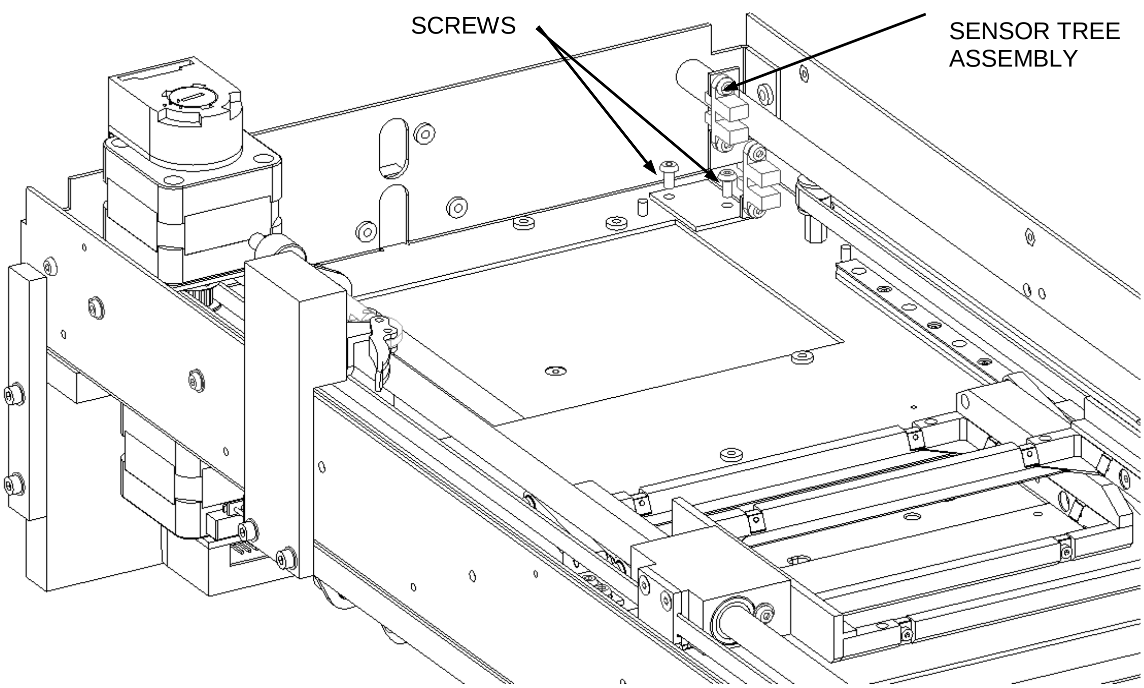


Figure 12-36: Location of Sensor Tree

12.5.6.3 Aligning the Upper Plate

To remove the upper plate, remove the guide shafts shown in Figures 12-37 and 12-38.

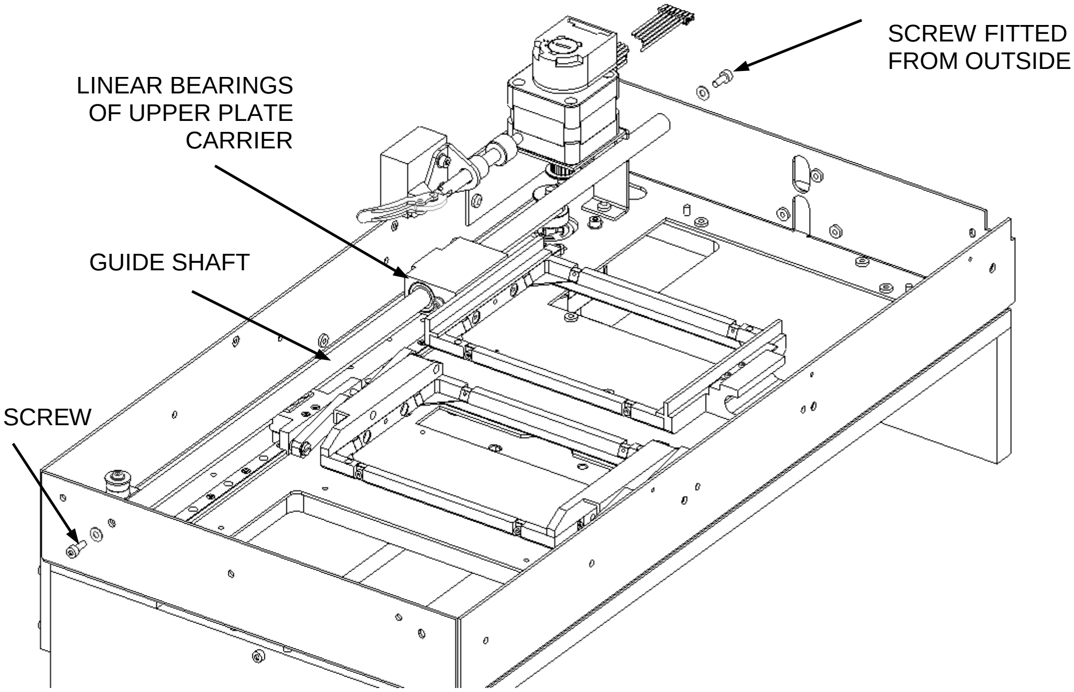


Figure 12-37: Left Guide Shaft

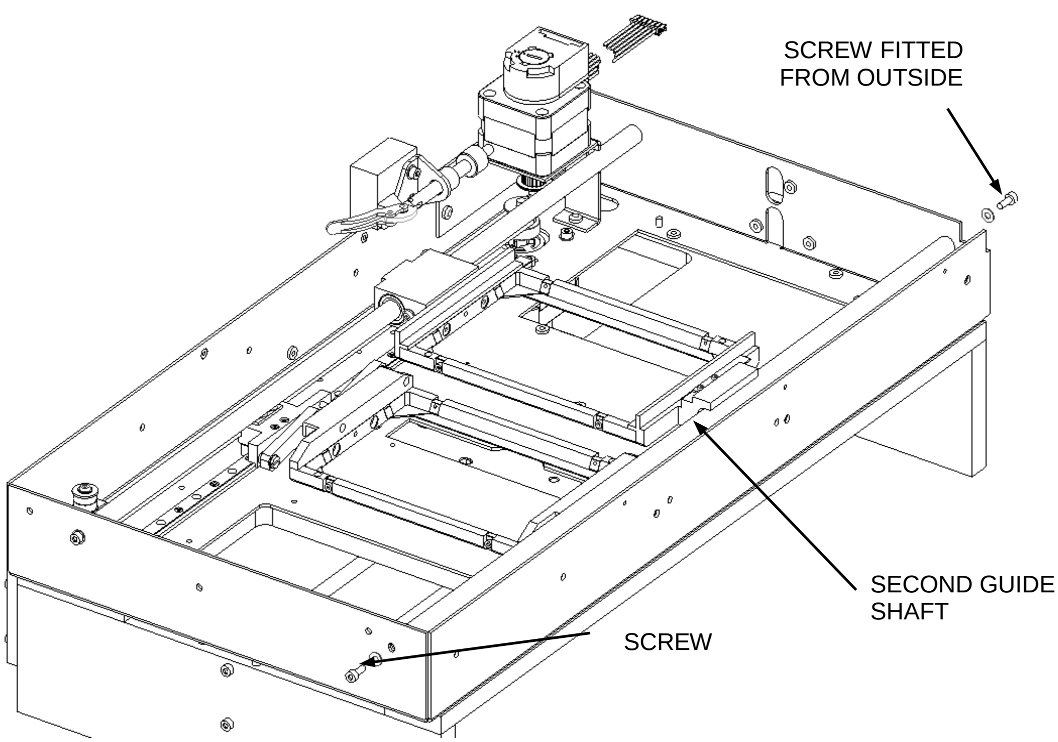


Figure 12-38: Right Guide Shaft

To replace and align the upper plate:

1. Slide a Guide Shaft through the Linear Bearings in the Upper Plate Carrier Assembly.
2. Attach the Guide Shaft to the left side of the chassis (Figure 12-37) using two M3x8 Skt Cap Screws, two M3 Flat Washers and Loctite 222. Leave slightly loose for adjustment.
3. Fit a second Guide Shaft to the right side of the chassis (Figure 12-38) using two M3X8 Skt Cap Screws, two M3 Flat Washers and Loctite 222. Leave screws slightly loose for adjustment.
4. Place a Reader Shaft Height Fixtures (DS2FIX011) underneath each shaft. Position one at the rear and the other at the front of the Chassis.
5. Fit Alignment Plates (DS2FIX001) into both Plate Carriers and move the carriers to the rear of the Chassis.
6. Fit two Alignment Pins (AMFIX004) through the Alignment plates so that the top and bottom carriers align (Figure 12-39).

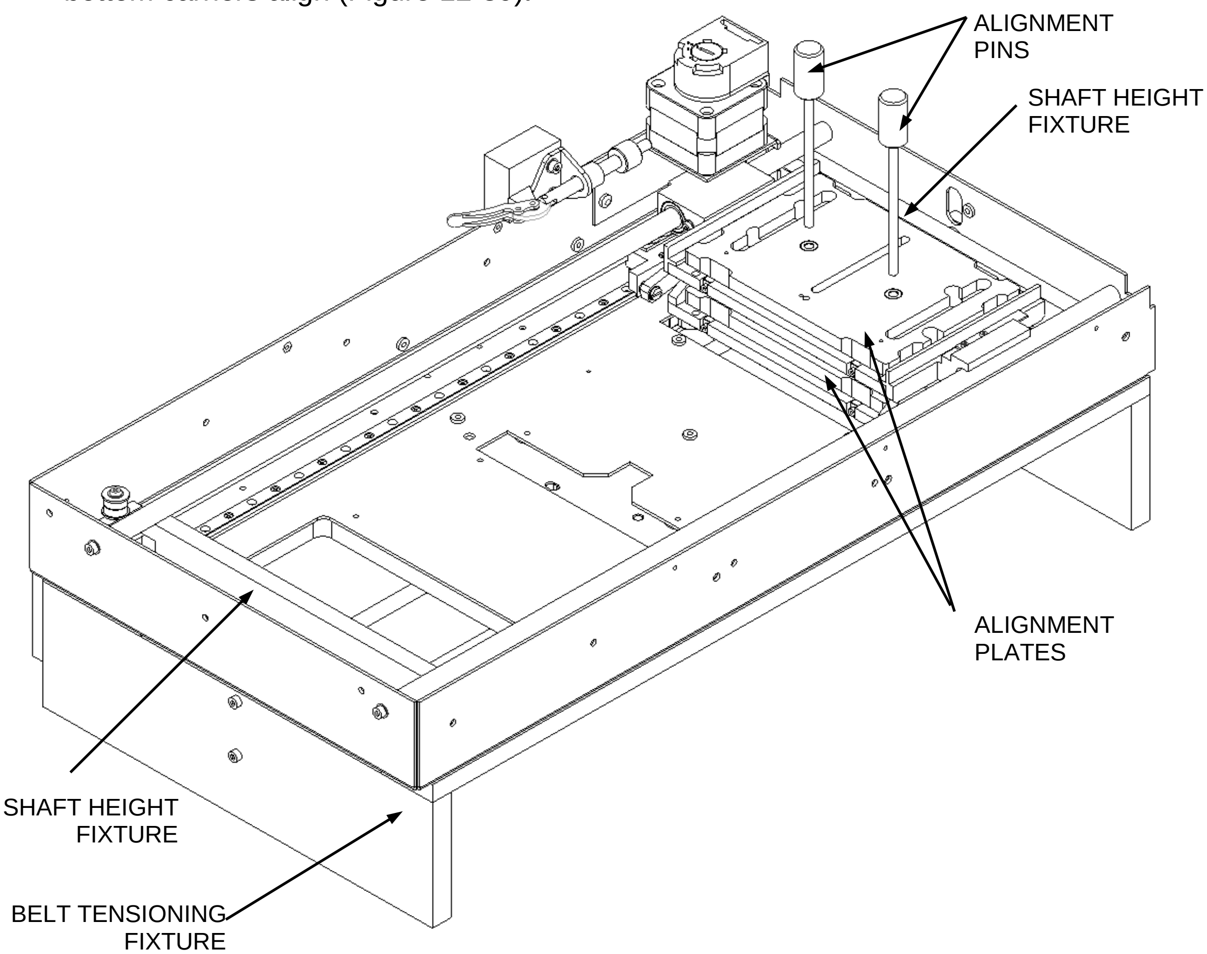


Figure 12-39: Inserting the Alignment Pins

7. Ensure the shafts are sitting on the Height Fixtures and then tighten the two screws that retain the shafts at the rear.

8. Move the Plate Carriers to the front of the Chassis and ensuring the shafts are sitting on the height fixture. Tighten the two Screws that retain the shafts at the front.

9. Fit two M3x5 Skt Btn Screws with Loctite 222 into the return at the rear of the Chassis and check that the Chassis is sitting flat on the Belt Tensioning Fixture.

10. Tighten the two Button Head Screws; then remove the Shaft Height Fixtures, Alignment Pins and Alignment Plates.

12.5.6.4 Replacing the Upper Motor

The Upper Motor assembly is attached to the chassis as shown in Figure 12-40.

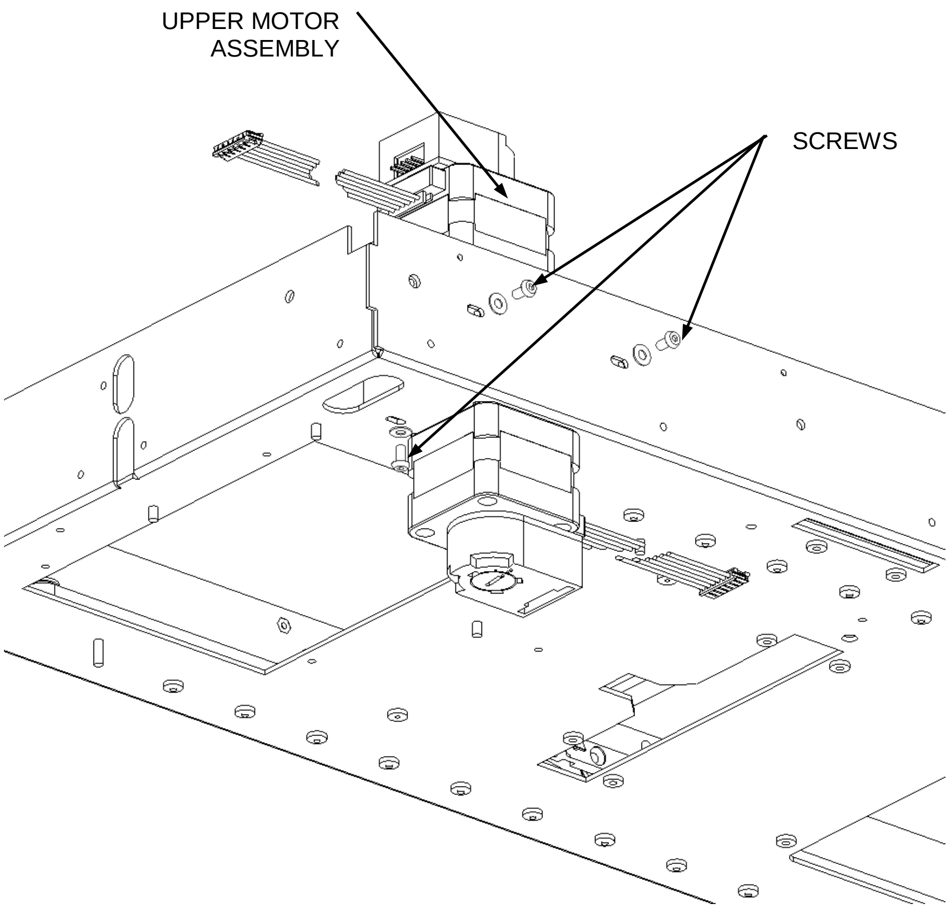


Figure 12-40: Upper Motor Assembly

When replacing the motor assembly:

1. Remove the motor from the Motor Plate (Figure 12-41).

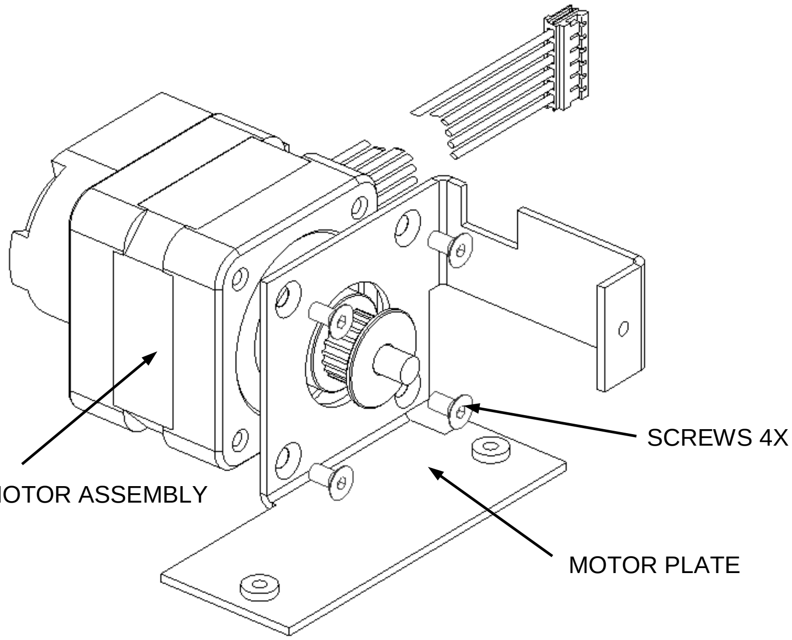


Figure 12-41 Motor and Motor Plate

2. Place an Allen Key into the body of the encoder and unscrew the Hub Set Screw (Figure 12-42)

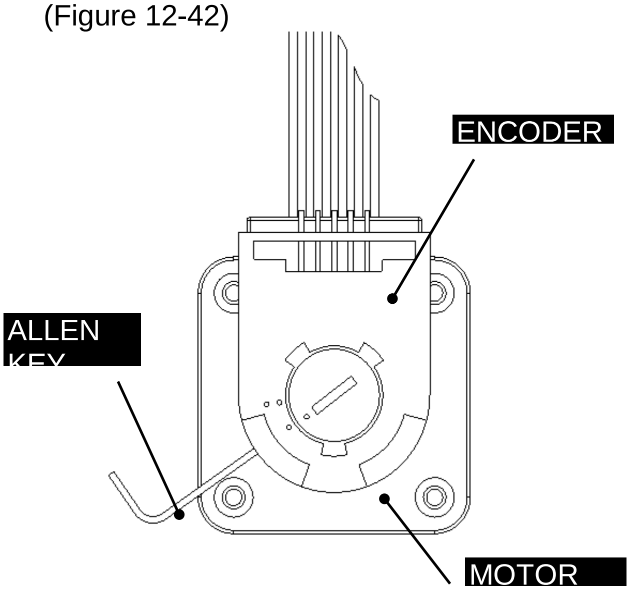


Figure 12-42: Unscrewing Hub Set Screw

> ***Note:*** *When replacing the encoder, push the Allen Key into the body of the encoder to ensure this it is properly seated into the code wheel hub set screw. Then apply a downward force on the end of the Allen Key as shown in Figure 12-43. This sets the code wheel gap by levering the code wheel hub to its upper position.) While continuing to apply a downward force, rotate the Allen Key in a clockwise direction until the hub set screw is tight against the idler shaft. Remove the Allen Key by pulling it straight out of the encoder body.*

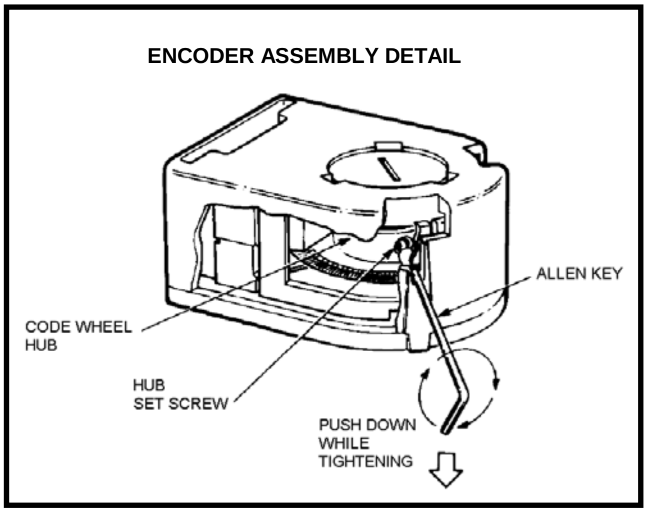


Figure 12-43: Encoder Assembly Detail

3. Remove the main part of the encoder (Figure 12-44) by unsnapping it from the motor assembly.

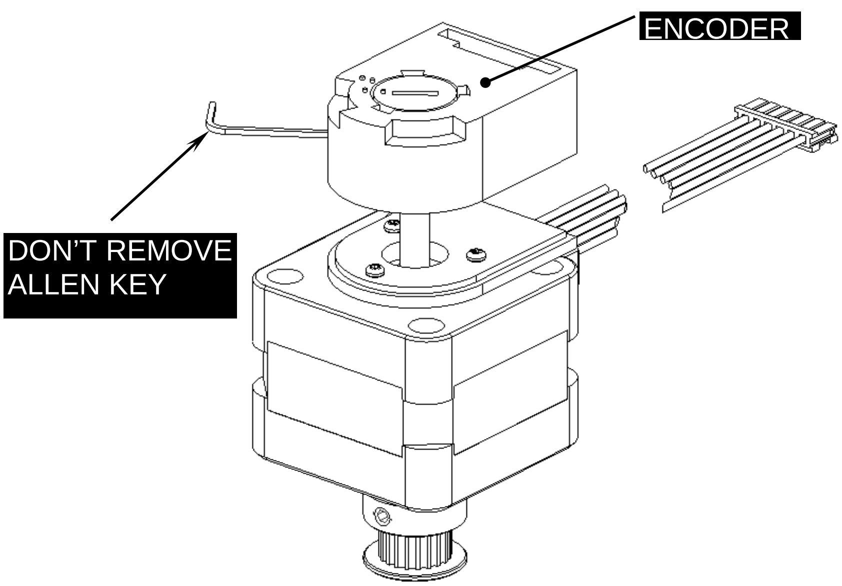


Figure 12-44: Removing the Encoder

4. Remove the Encoder Mounting Plate (Figure 12-45) by removing the three screws (Figure 12-45). The fixture is not required for removal but is needed when reassembling the system. The fixture should be centralized around the pulley idler shaft.

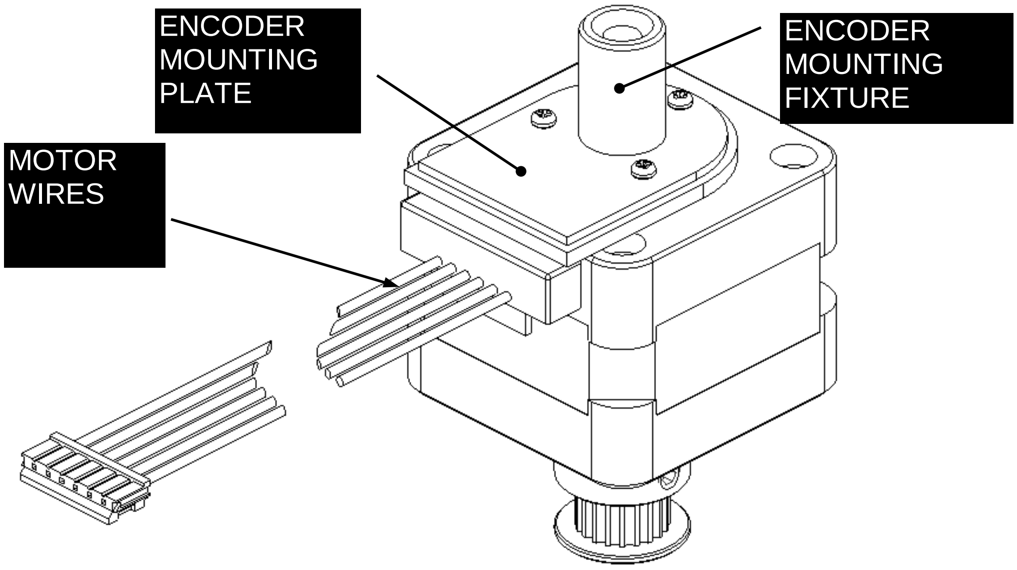


Figure 12-45: The Encoder Mounting Plate

5. Remove the Pulley from the Motor as shown in Figure 12-46. When reassembling the system, secure in place using two M4X6 Skt Set Screws and Loctite 222, Use the Height Setting Fixture (DS2FIX006) to set the pulley at the correct height before tightening screws (remove and discard any Set Screws that come with the Pulley).

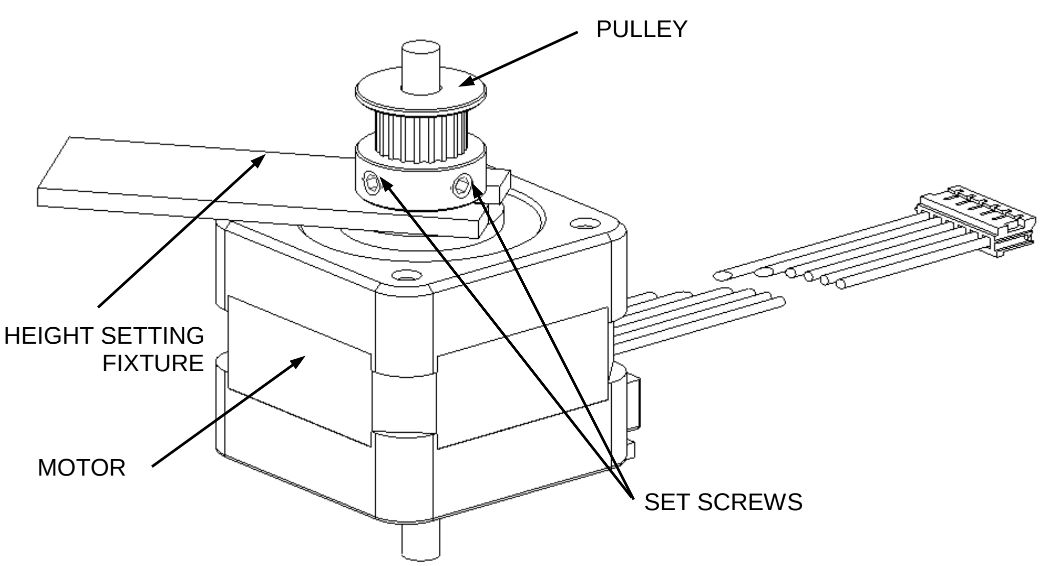


Figure 12-46: Removing the Pulley

12.5.6.5 Replacing the Upper Optics Block

The Reader diode board can be disassembled as described below:

To replace components on the upper diode board:

1. Remove the Upper Optic Assembly from the reader diode board by removing the two screws (Figure 12-47).

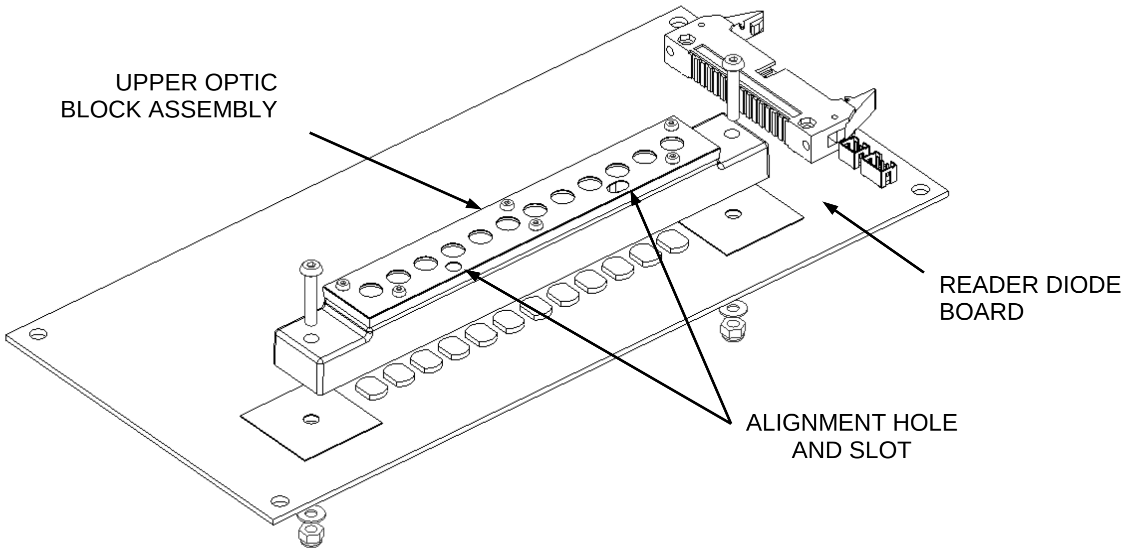


Figure 12-47: Reader Diode Board

2. Remove the two screws that attach the upper lens stop and lens strip from the upper lens block (Figure 12-48). The alignment pins are not required for disassembly.

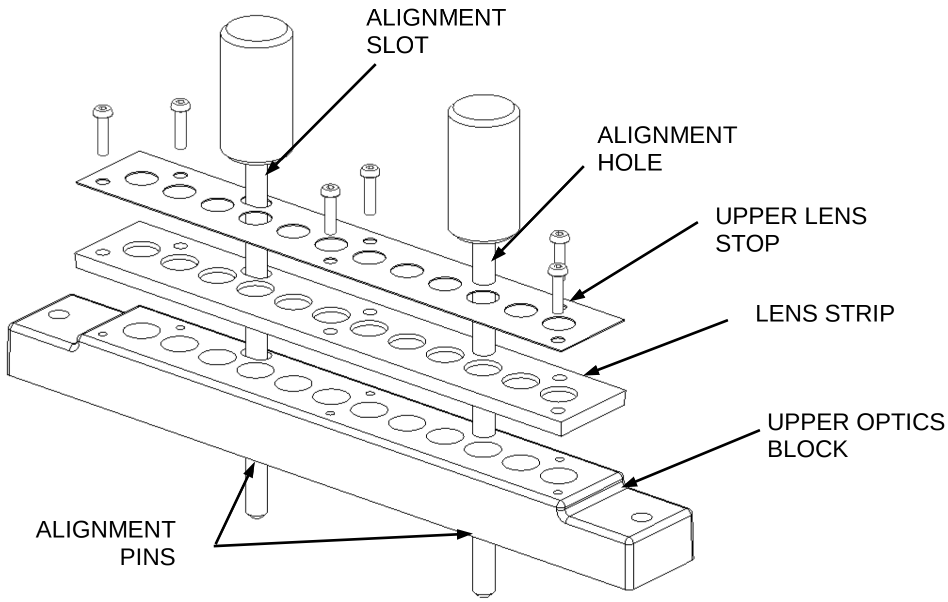


Figure 12-48: Upper Lens block

To rebuild the assembly:

1. Place the Lens Strip on to the Upper Optics Block.
2. Place the Upper Lens Stop on top of the Lens Strip.
3. Align all the parts by inserting one 4 mm Alignment Pin (AMFIX004) in the alignment hole and one 4 mm alignment dowel in the alignment slot.
4. Fasten the assembly together using six M2x8mm Black Btn Head Screws.

12.5.7 The Lower Plate Assembly

12.5.7.1 Removing the Belt

The Lower Belt Assembly is shown in Figure 12-49.

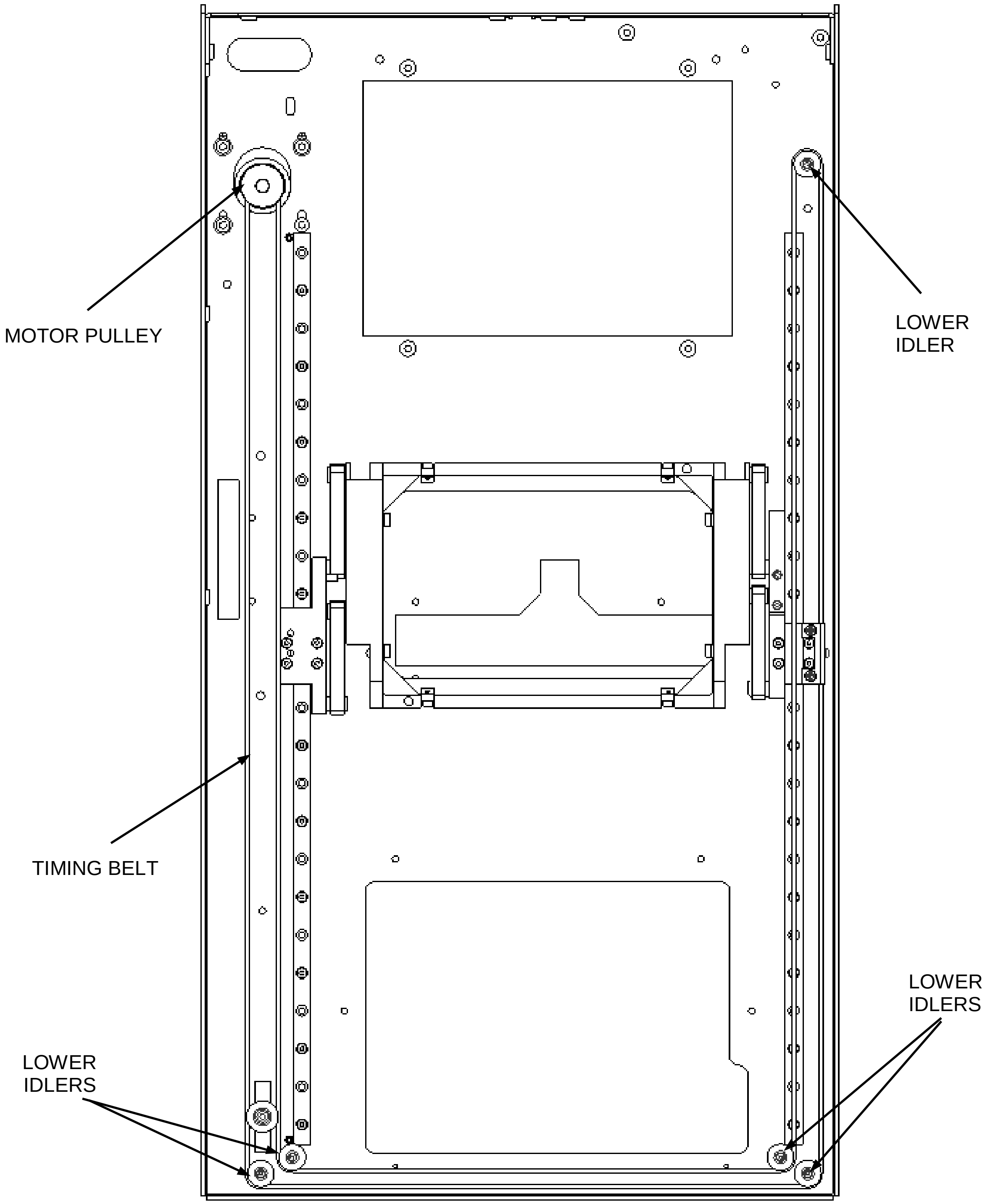


Figure 12-49: Lower Belt Drive

To remove the belt, remove the screws to the belt adjuster (Figure 12-50).

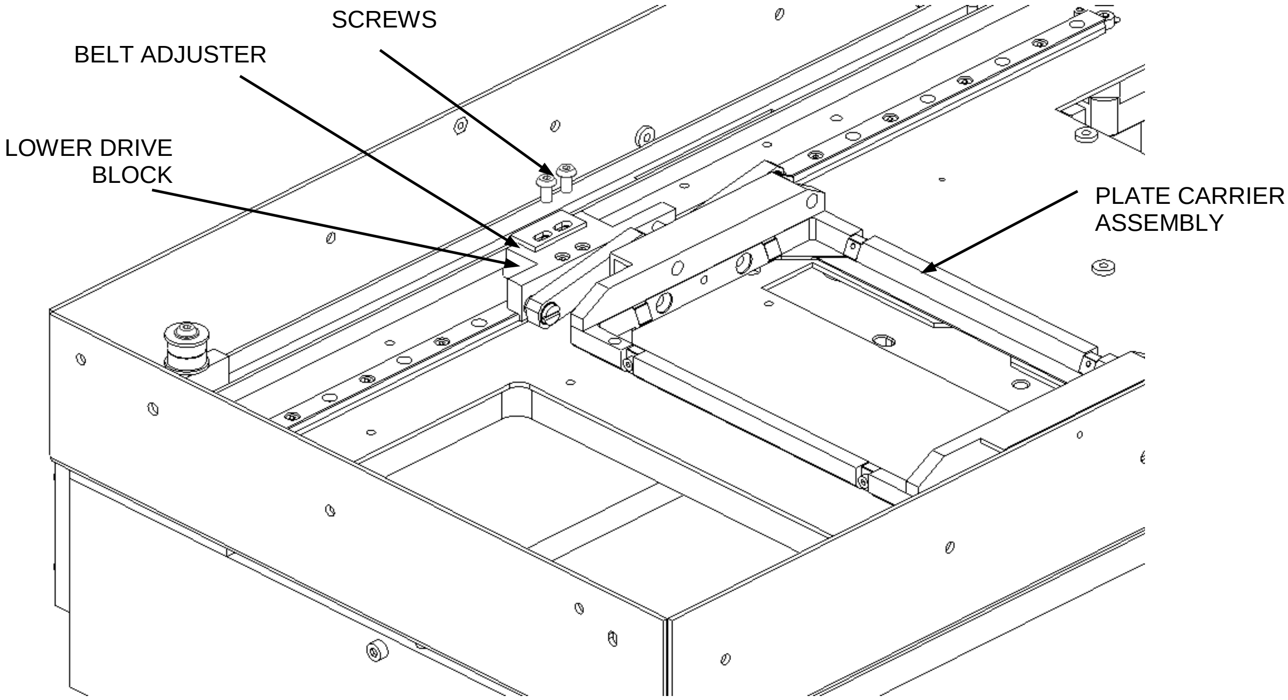


Figure 12-50: Belt Adjuster

To replace the belt:

> ***Note**: Field service engineers will use a hand held tension meter instead of the tensioning fixture described above. Place a piece of metallized tape on the belt and hold the meter about ½" from the belt. Gently press on the belt and observe the reading on the meter. An acceptable reading is 64 Hz.*

1. Place the Reader chassis assembly on the Belt Tensioning Fixture (DS2FIX010000) by pulling back the Lower Toggle Clamp to the open position and place the Reader Chassis Assembly into it (Figure 12-51).

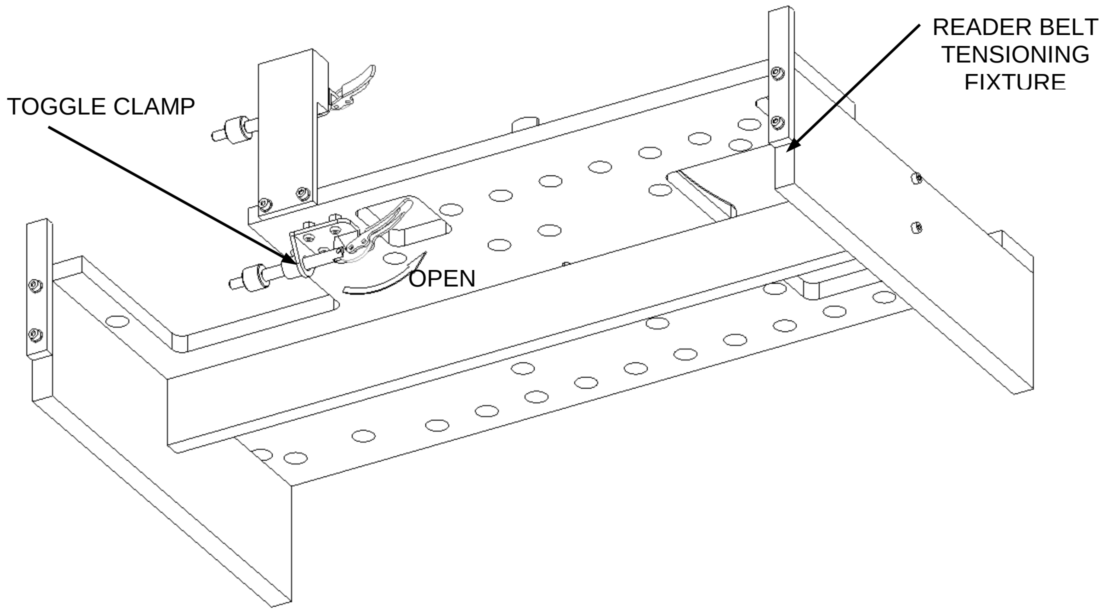


Figure 12-51: Belt Tensioning Fixture

2. The Plate Carrier assembly is shown in Figure 12-52. Ensure the Plate Carrier assembly slides freely from one end of the rails to the other end and the Plate Carrier pivots freely and drops down under its own weight (Figures 12-53 to 12-55).

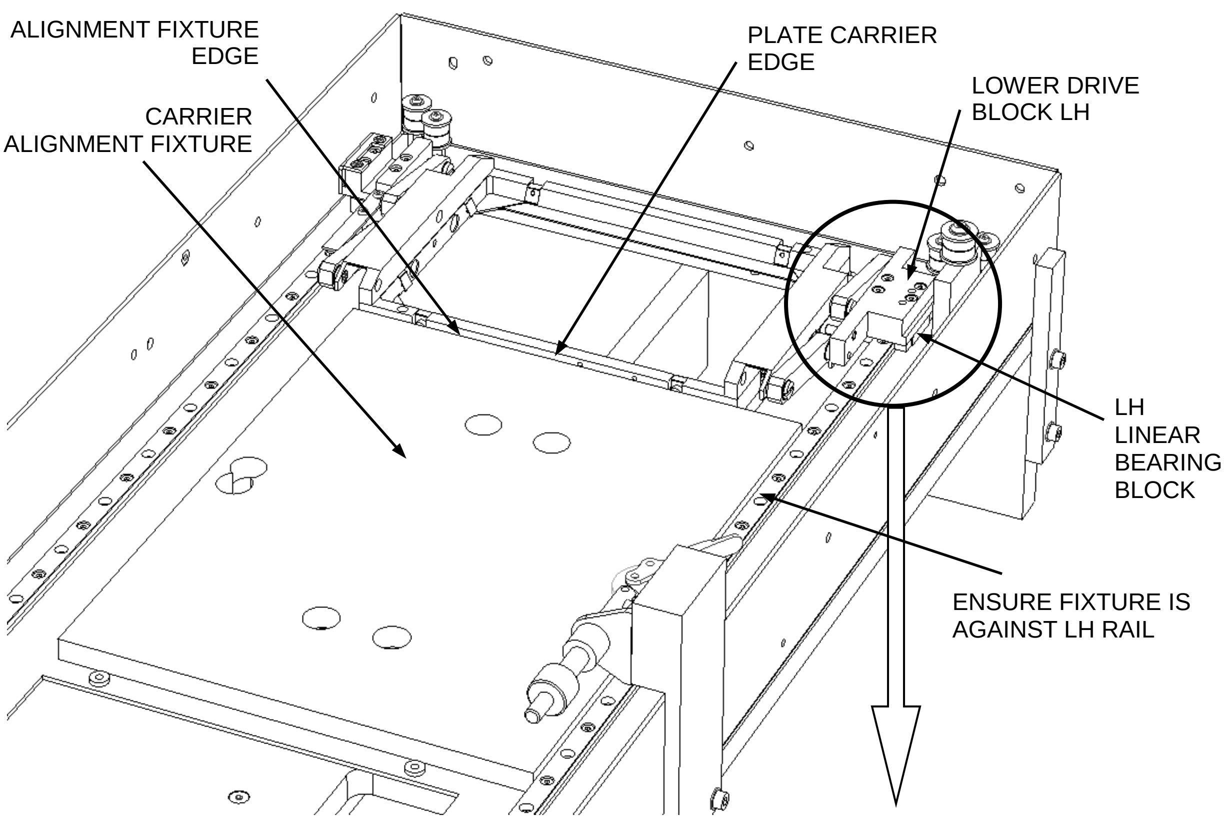


Figure 12-52 Plate Assembly

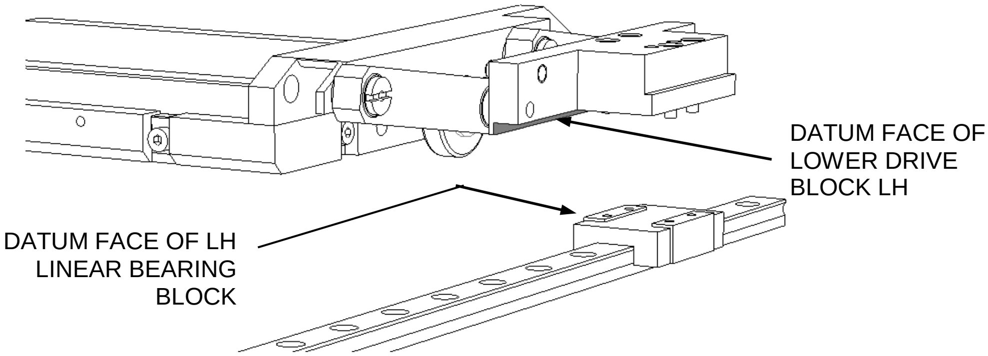


Figure 12-53: Plate Carrier Drop Down

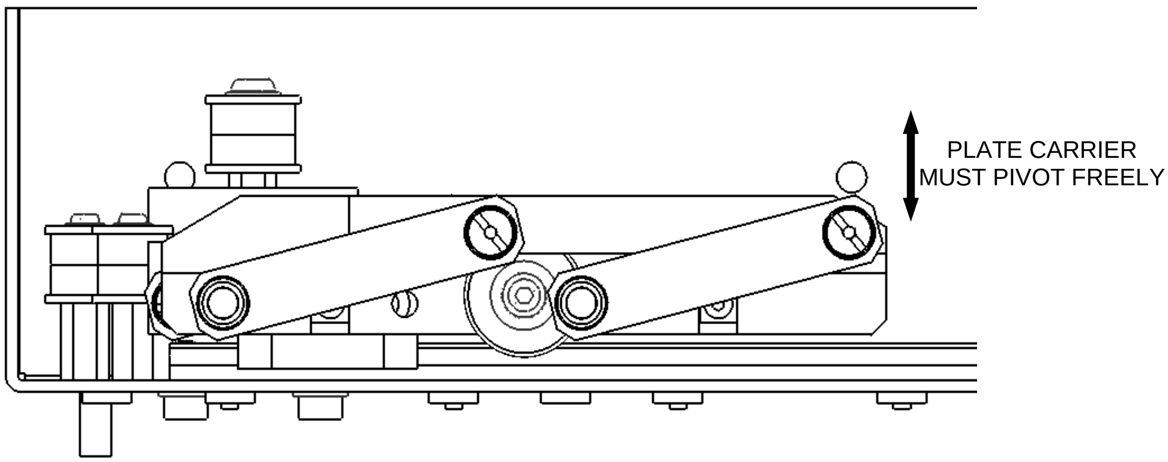


Figure 12-54: Plate Carrier Pivot

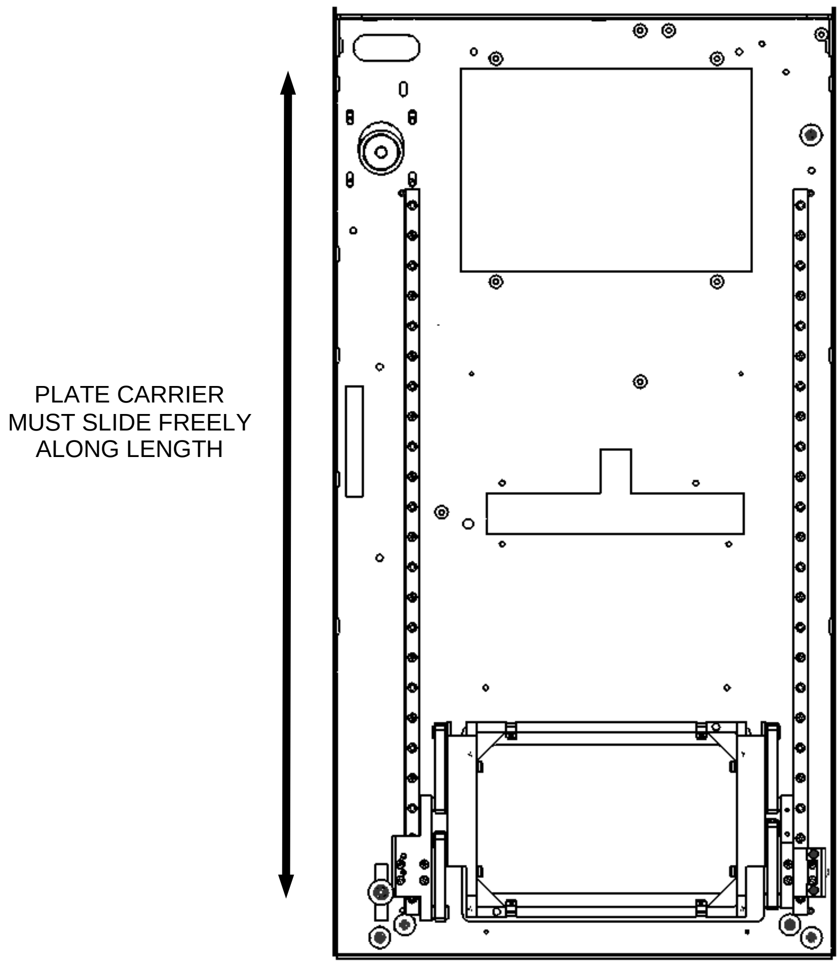


Figure 12-55: Plate Carrier Sliding

3. Wrap the Lower Drive Belt around the Motor Pulley and Idlers as shown in Figure 12-56.

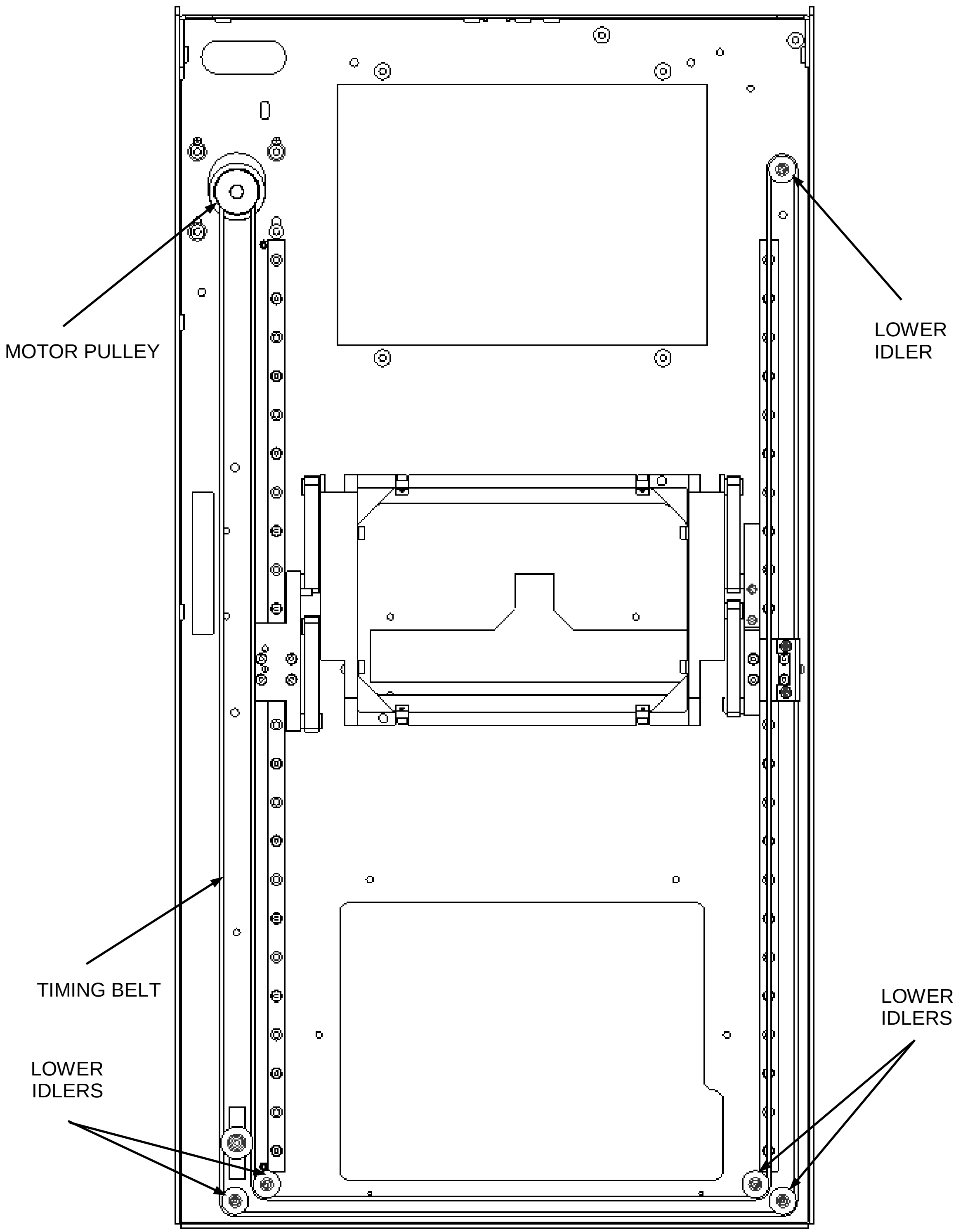


Figure 12-56: Wrapping the Belt around the Pulleys and Idlers

4. Slide the Lower Carrier assembly right to the rear of the Chassis (Figure 12-57).

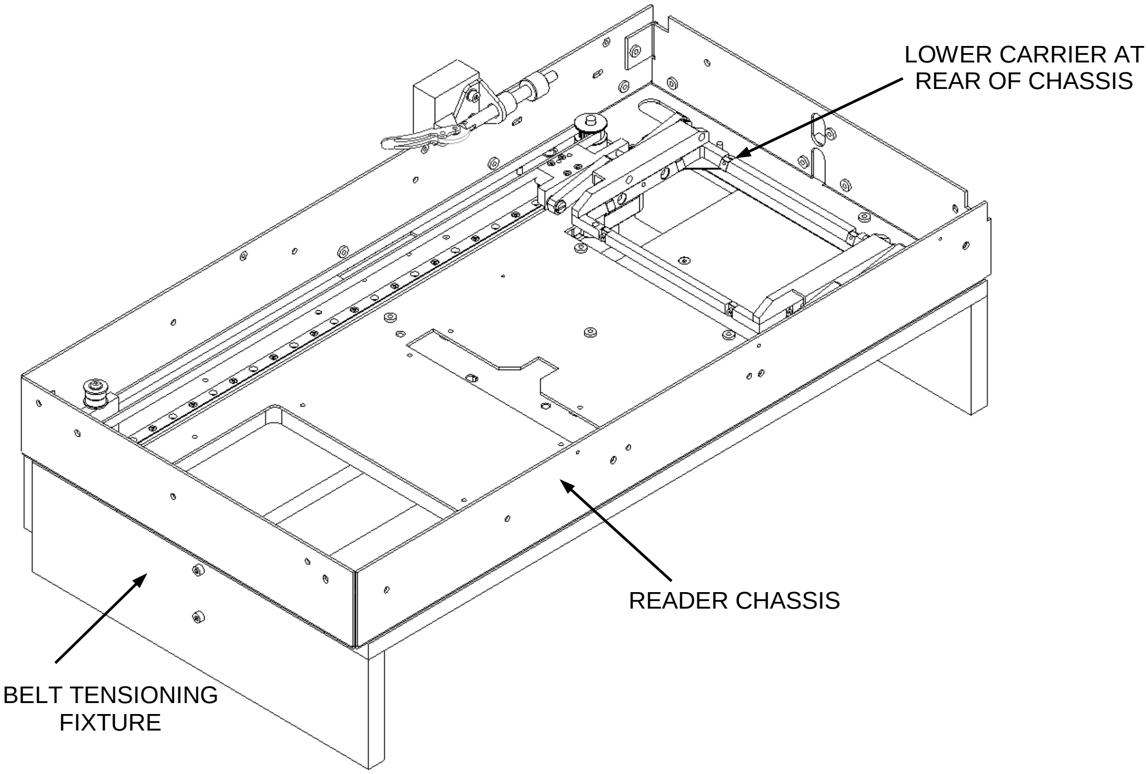


Figure 12-57: Sliding Lower Carrier Assembly

5. Turn on the Lower Force Gauge (Part of DS2FIX010) and re-zero it. Then fit it in to the Reader Chassis by inserting the dowels underneath the Gauge into the corresponding holes in the Belt Tensioning Fixture. The Gauge end piece will push against the inside of the Belt (Figure 12-58).

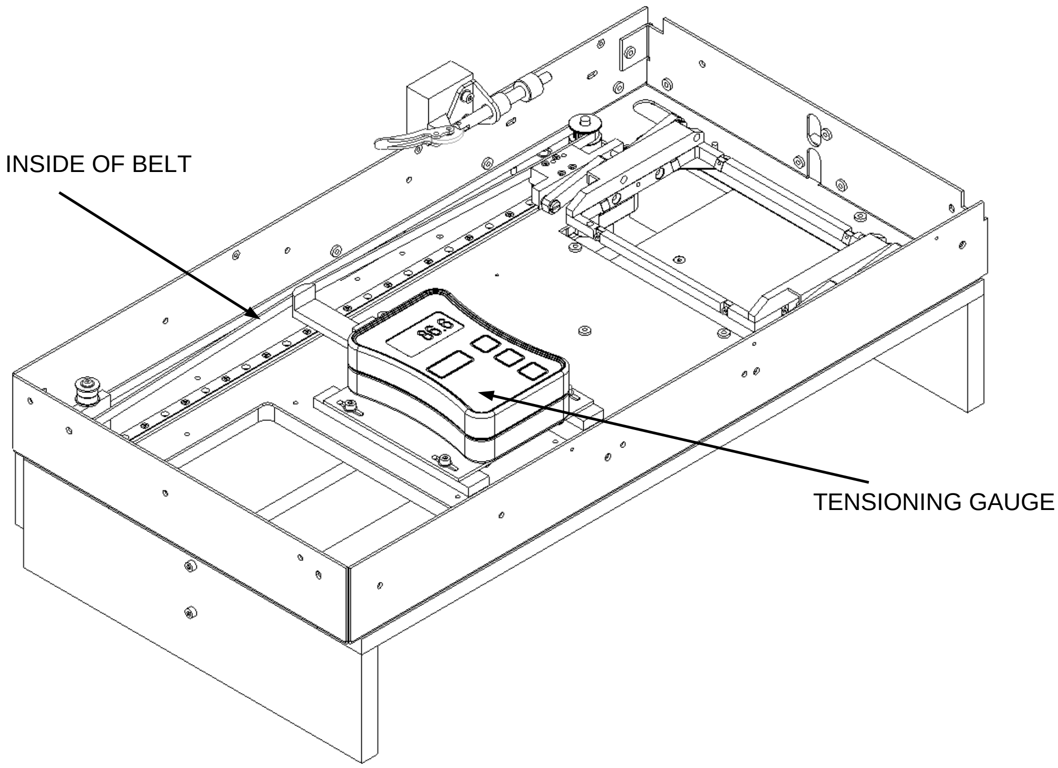


Figure 12-58: Location of Tensioning Gauge

6. Close the Toggle Clamp underneath the fixture by flipping the Toggle Clamp Lever towards the Motor (Figure 12-59).

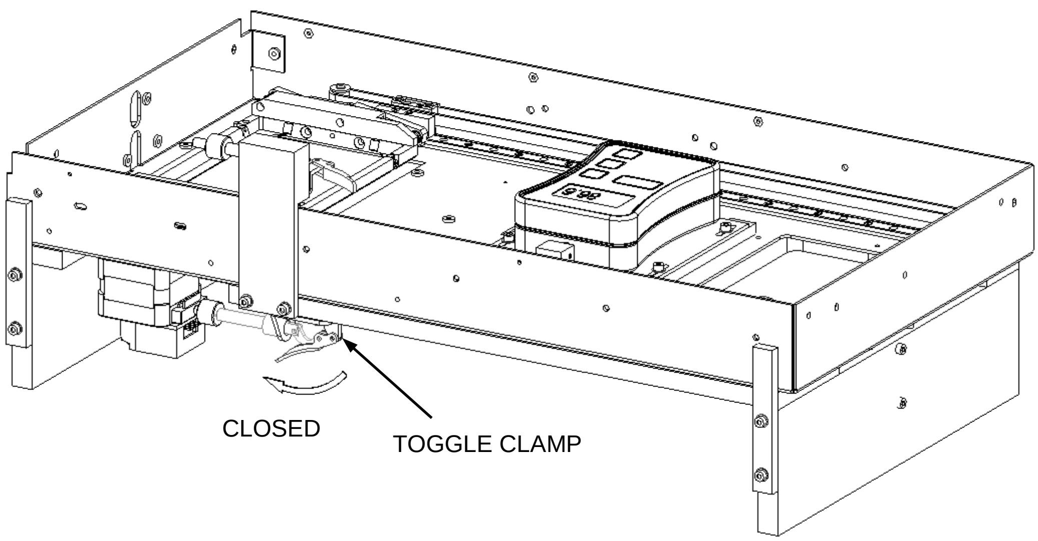


Figure 12-59: Closing Toggle Clamp

7. Before taking each force reading, using an Allen Key, gently push the Belt off the end of the Force Gauge Belt Hook by 1 to 2 mm and then reposition it. This is to ensure that no sideways force from the belt is being measured (Figure 12-60).

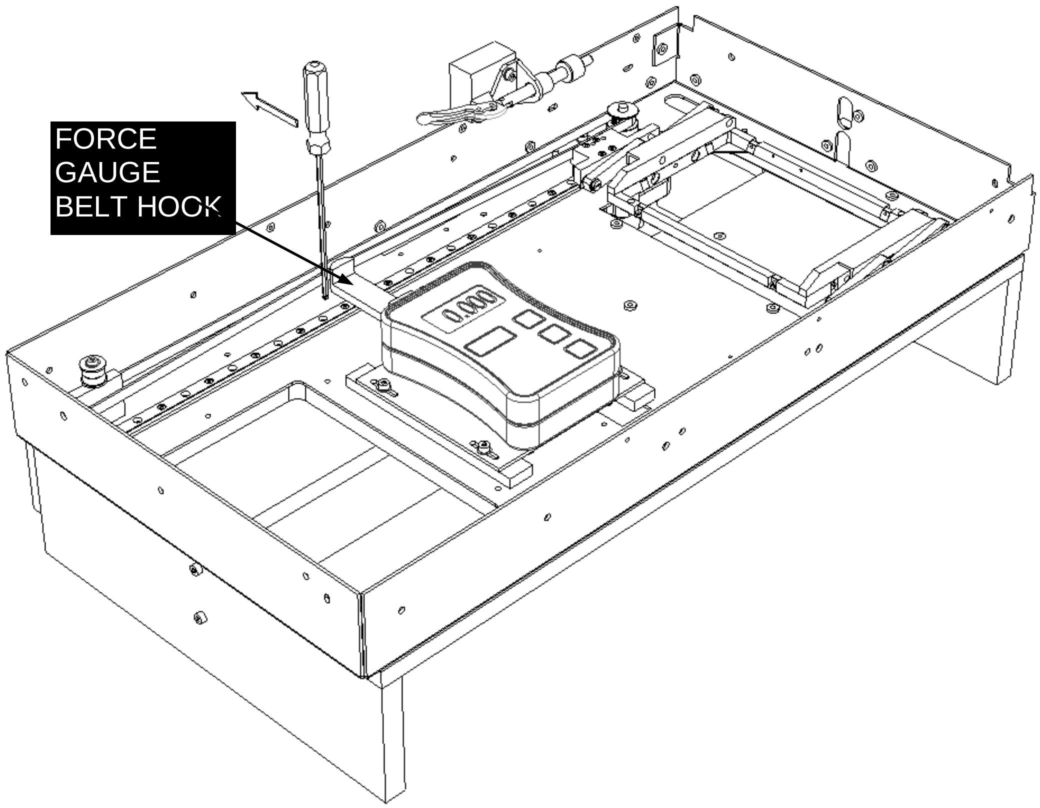


Figure 12-60: Pushing Belt off Belt Hook

> ***Note:*** *Before setting the belt tension, the belt must be pre-stretched. Ensure the four screws securing the Motor are loose enough to let the Motor slide but not so loose they allow the Motor to twist. Rotate the Thumbscrew on the Toggle Clamp clockwise so that it pushes the Motor towards the rear of the Chassis. When the Gauge reads between 0.100 Kg and 0.110 Kg return the Motor back to its original position.*

8. To set the working tension, rotate the Thumbscrew on the Toggle Clamp clockwise so that it pushes the Motor towards the rear of the Chassis (Figure 12-61). When the Gauge reads between 0.090 Kg and 0.100 Kg the belt tension is correct (target 0.095 Kg), tighten all four screws to secure the Motor. Unscrew the thumbscrew and check the tension is still correct. Open the Toggle Clamp by flipping the lever then remove the Force Gauge assembly (Figure 12-62).

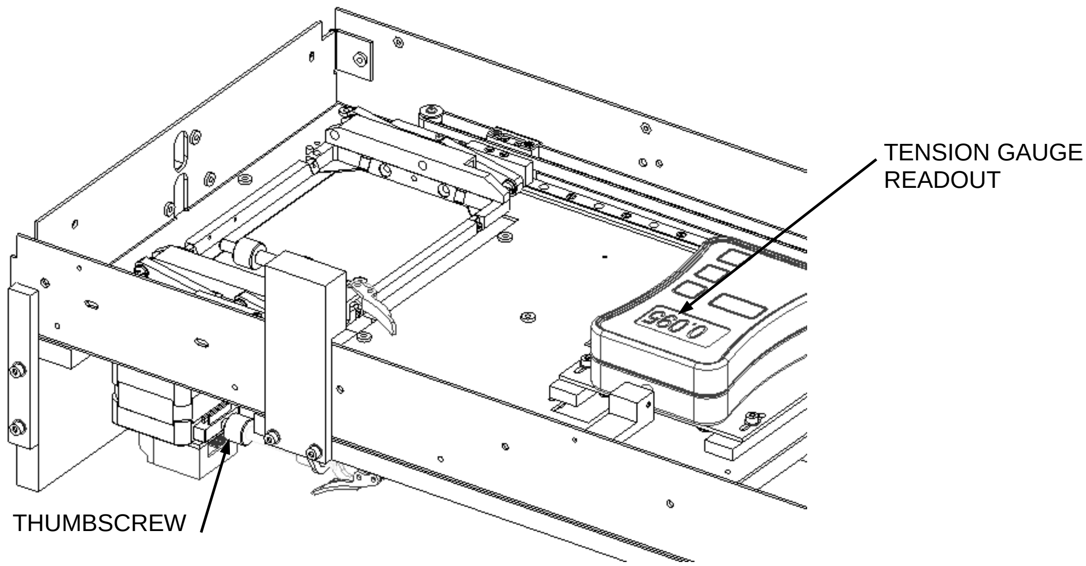


Figure 12-61: Tension Setting Thumbscrew

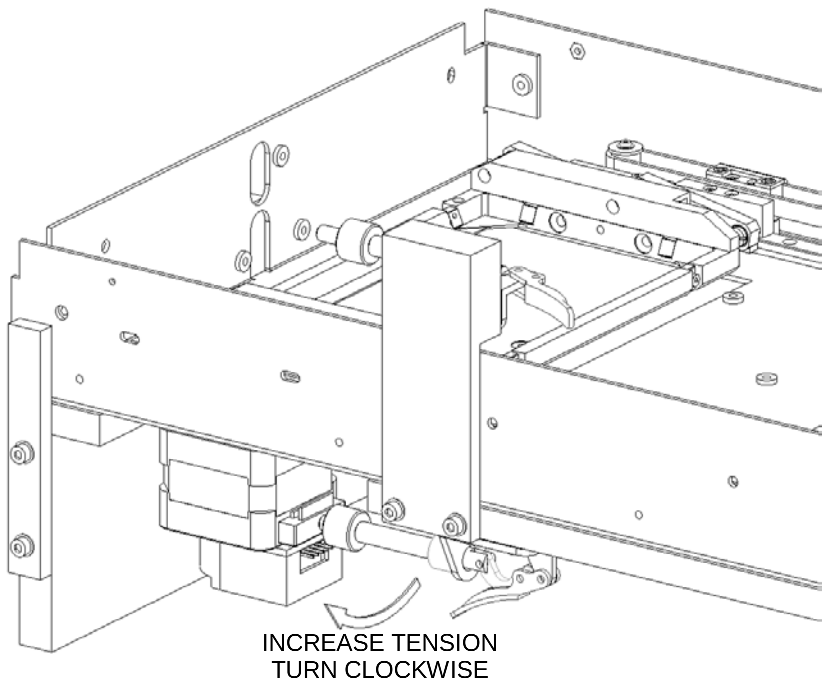


Figure 12-62: Setting the Tension

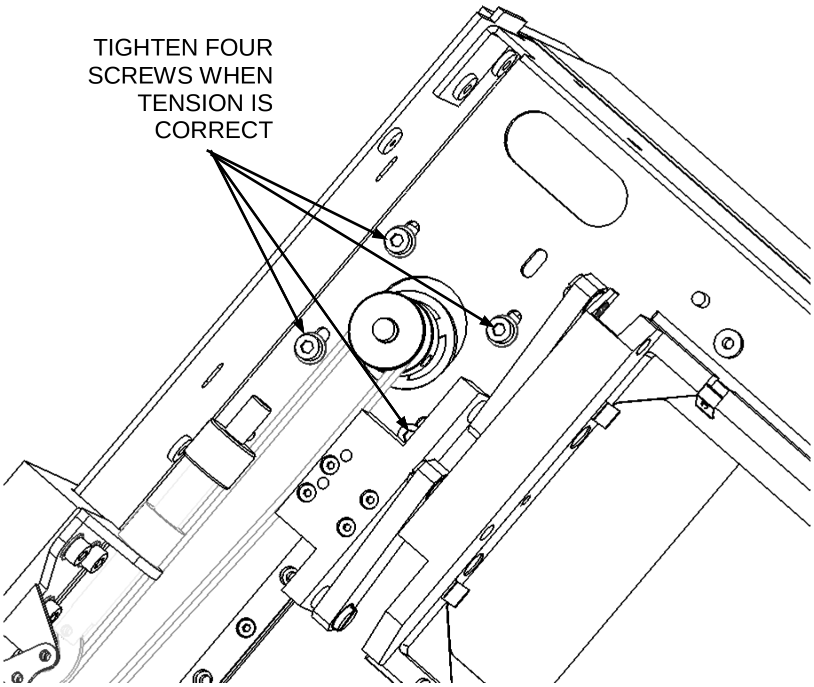


Figure 12-63: Motor Screws

9. One at a time, remove the four screws securing the Motor and refit using Loctite 222.

10. Move the Plate Carrier assembly into the middle of the Chassis and fit the Belt Adjuster to the Lower Drive Block LH (Figure 12-64). The teeth in the Belt Adjuster will engage with the belt and position the Adjuster where it needs to sit. Secure using two M3X6 Skt Btn Screws and Loctite 222.

> ***Note:*** *Do not twist the Plate Carrier assembly when fitting the Belt Adjuster.*

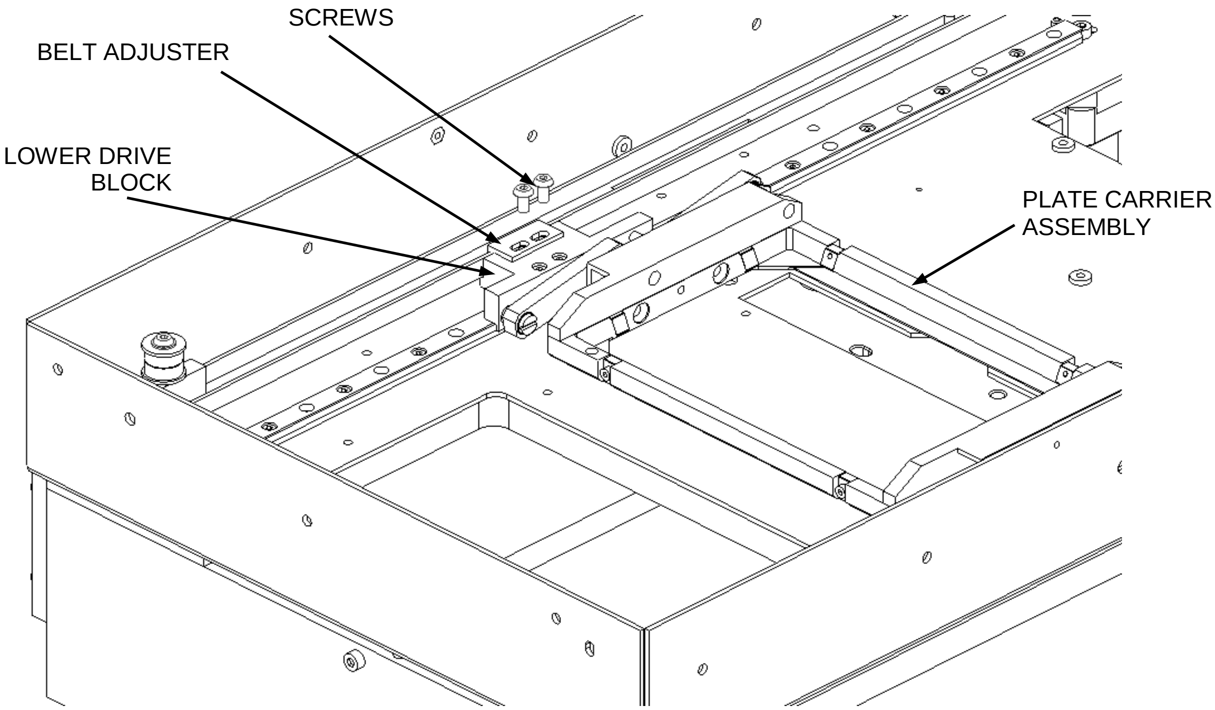


Figure 12-64: Affixing the Belt Adjuster

11. Move the plate Carrier assembly to the front of the Reader Chassis and fit the Carrier Alignment fixture DS2FIX019 into the reader chassis ensuring it is firmly against the left hand linear rail (Figure 12-65). Slide the Plate carrier up to the edge of the fixture to check that fitting the Belt Adjuster in the previous step did not twist the Carrier. Both the Carrier and Fixture edges should line up. If they don't, loosen the screws holding the Belt Adjuster and adjust until they do. Remove the fixture.

Note: *Ensure the Plate Carrier assembly slides freely from one end of the rails to the other end.*

Note: *Ensure the Plate Carrier pivots freely and drops down under its own weight.*

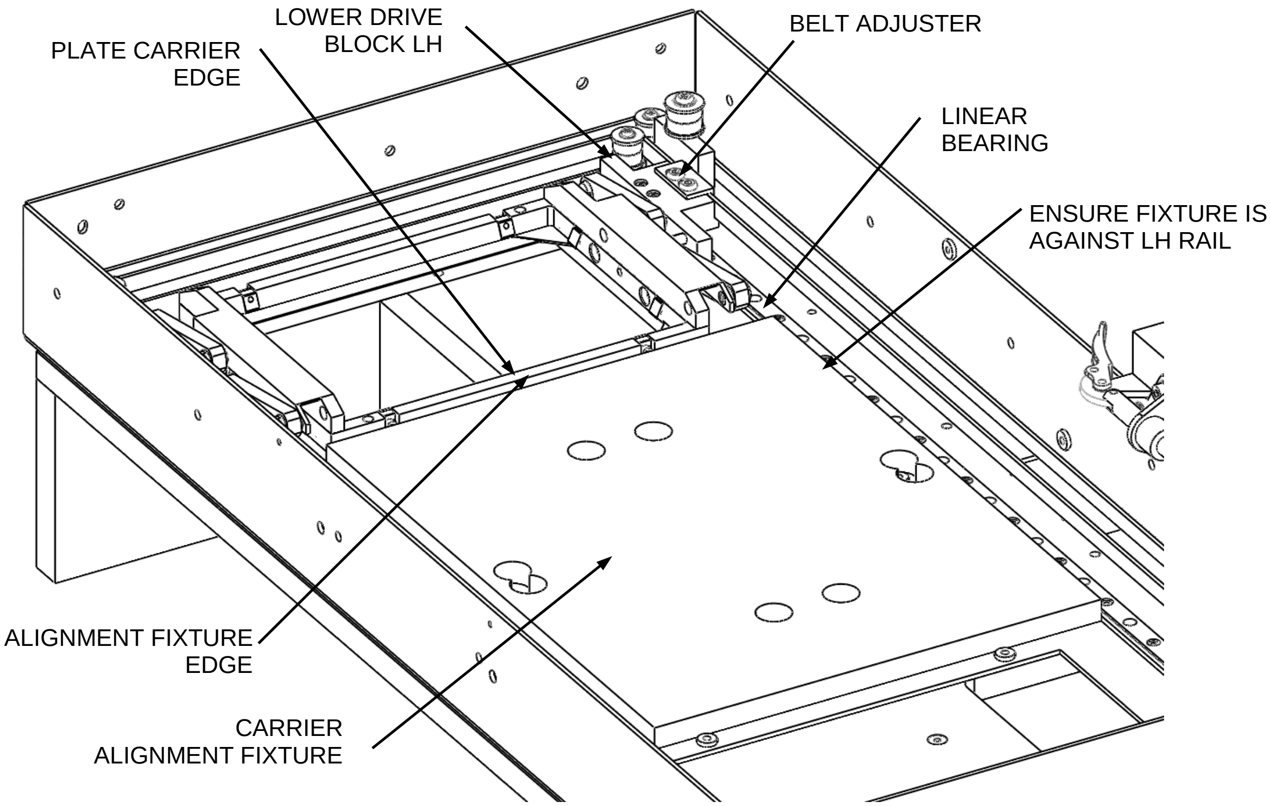


Figure 12-65: Moving Plate Assembly to Front of Chassis

12. Check that the Plate Carrier is still sitting flat by gently tapping the four corners, if the Carrier Bearing Bangs on the Chassis the Carrier is twisted. One at a time slightly rotate (1/8th of a turn) the Female Shoulder Screws by tightening the Posi Csk Screws fixing them to the LH and RH Carrier Supports (Figure 12-66 and 12-67).

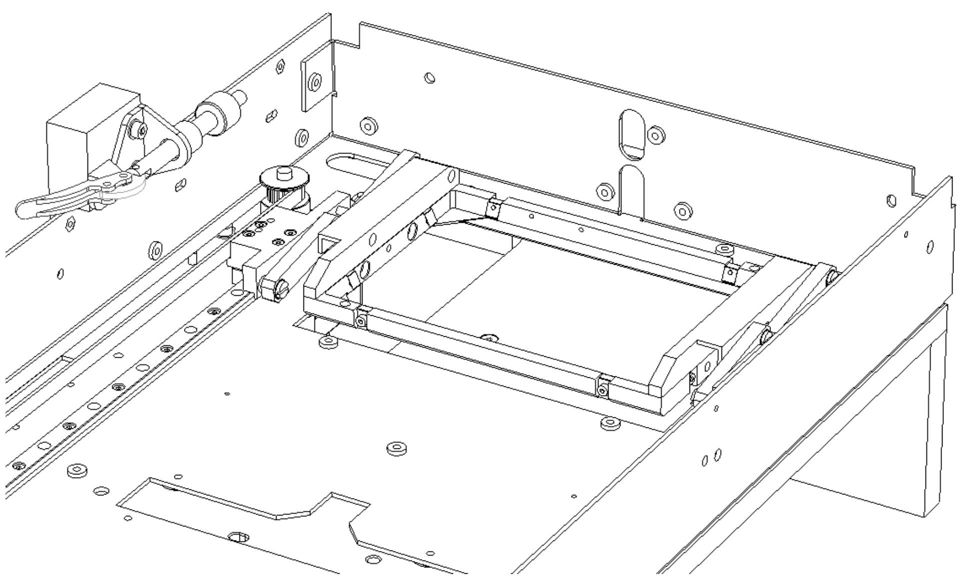


Figure 12-66: Carrier in Front Position

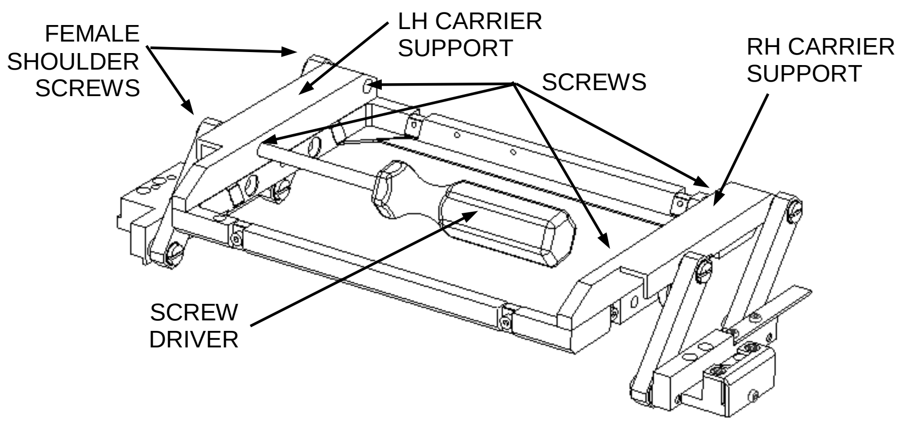


Figure 12-67: Location of Shoulder Screws

Chapter 13 The Wash Head

13.1 Removing the Wash Head

The Wash Head is located on the left side of the system as shown in Figure 13-1.

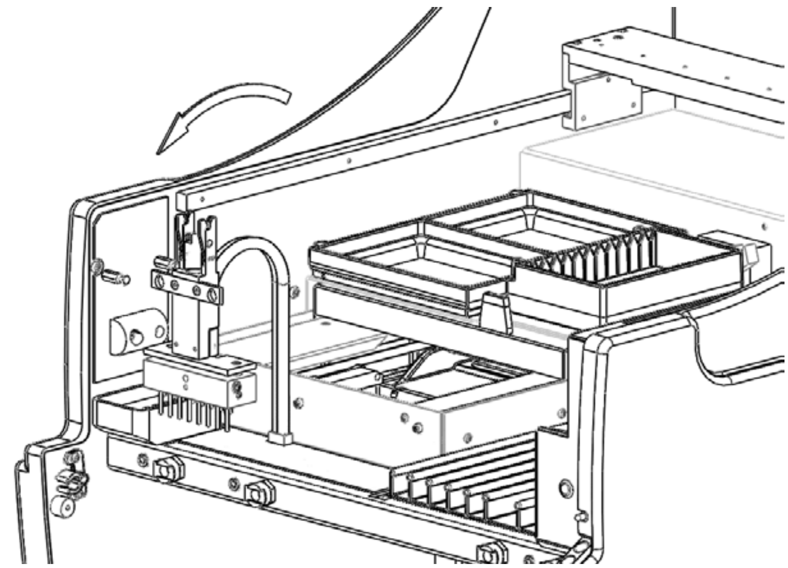


Figure 13-1: Wash Head

To remove the wash head, remove the Wash Head clamps from the pipette spigot by pulling upward on the pipette spigot (Figure 13-2).

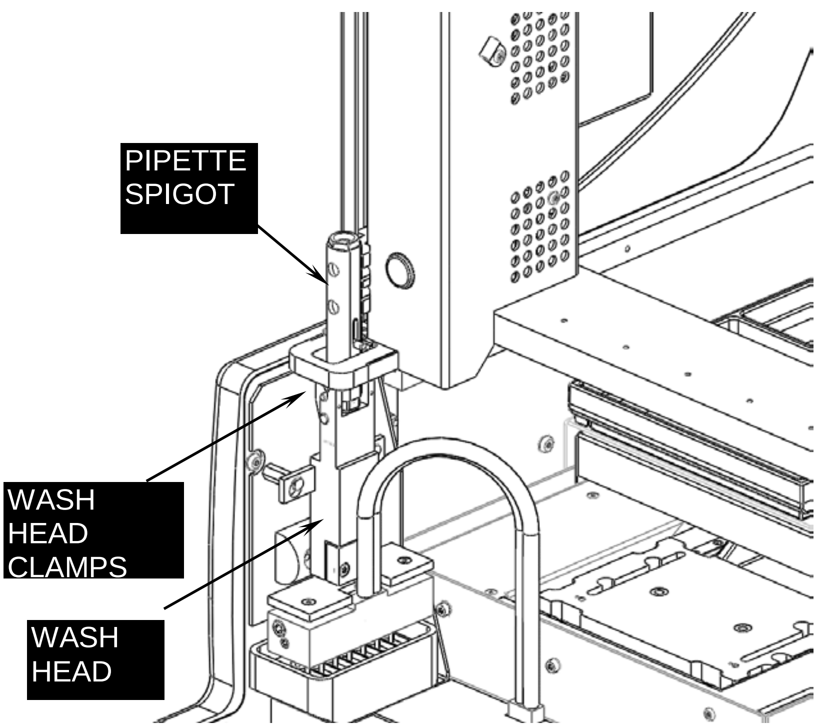


Figure 13-2: Wash Head Clamps and Spigot

To Reinstall and Align the Wash Head:

1. Fit the Twin Bore Silicone Tubing of the Wash Head to the Wash Head Manifold (Figure 13-3).

> ***Note:*** *Ensure the Wash Head is oriented as show below.*

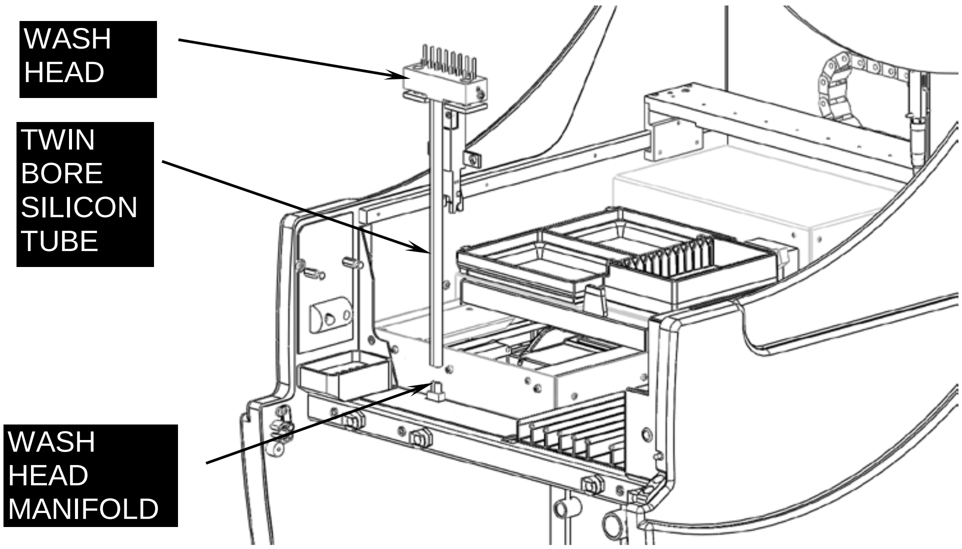


Figure 13-3: Fitting the Tubing into the Wash Head

2. Flip the Wash Head over (Figure 13-4)

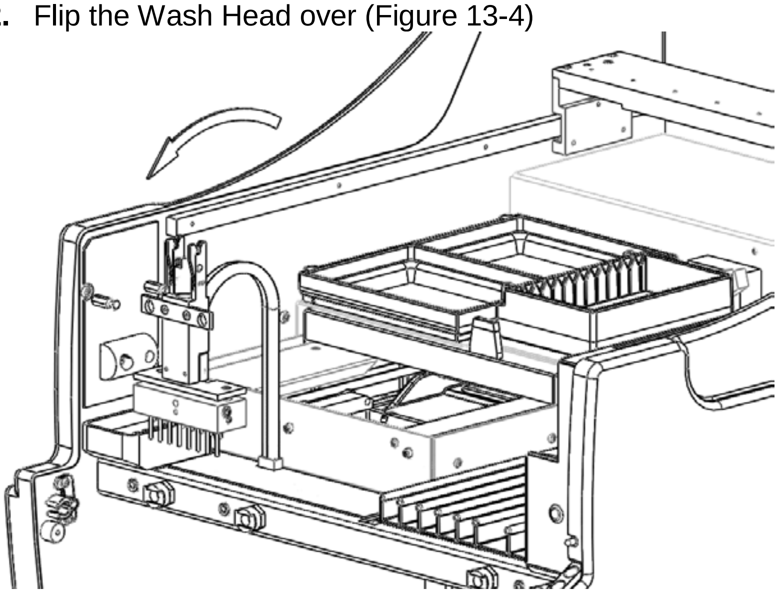


Figure 13-4 Flipping Wash Head

3. Rotate the Wash Head (Figure 13-4) 90 degrees clockwise before placing it onto on to the Wash Head Supports. Ensure the wash head tubing is not twisted or kinked when the wash head is resting on the wash head supports.

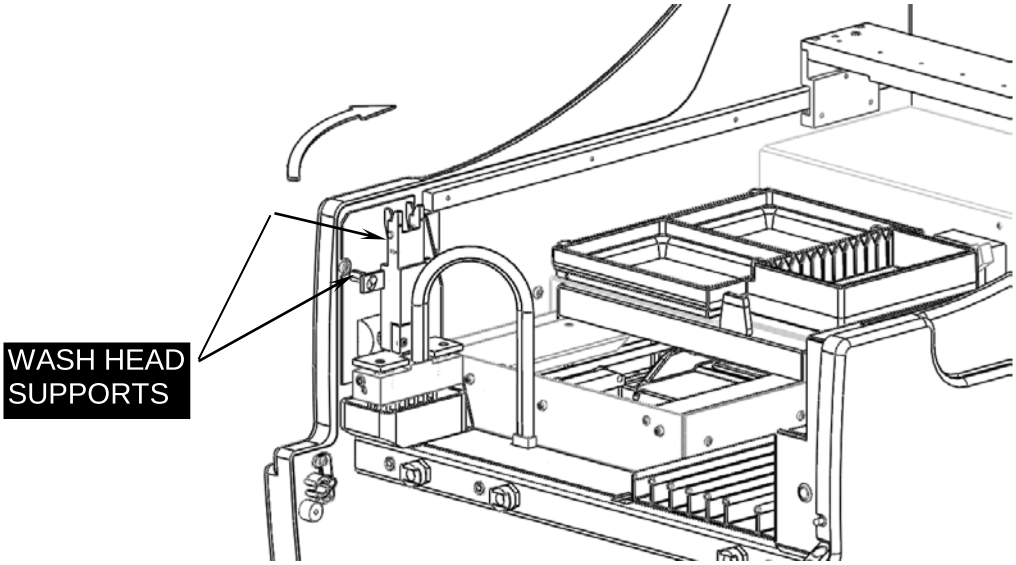


Figure 13-5: Rotating the Wash Head

13.2 Aligning the Wash Head

13.2.1 To Align the Wash Head (using Mftg fixture DS2FIX001):

1. Slide the Upper Plate Carrier in the Reader to the front and fit the Alignment Plate (DS2FIX001) as shown in Figure 13-6.

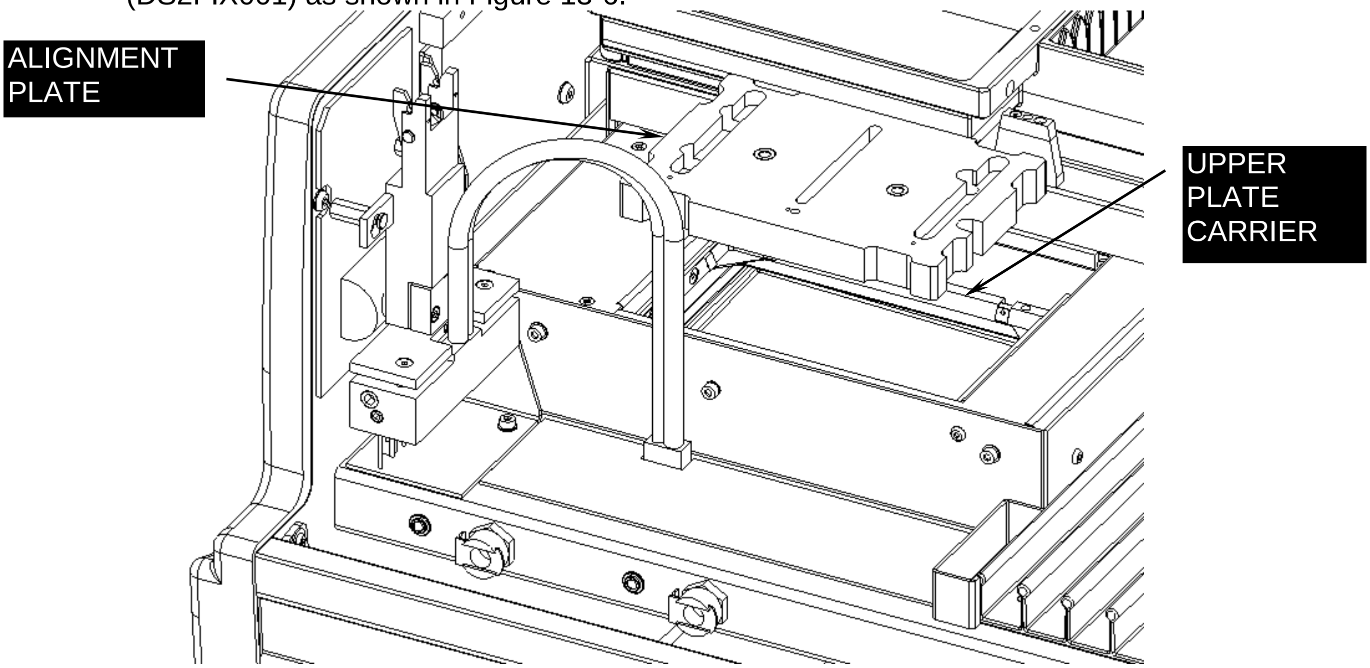


Figure 13-6: Sliding the Wash Head

2. Slide the XYZ Arm to above the Wash Head and engage the Pipette Spigot into the clamps of the Wash Head (Figure 13-7).

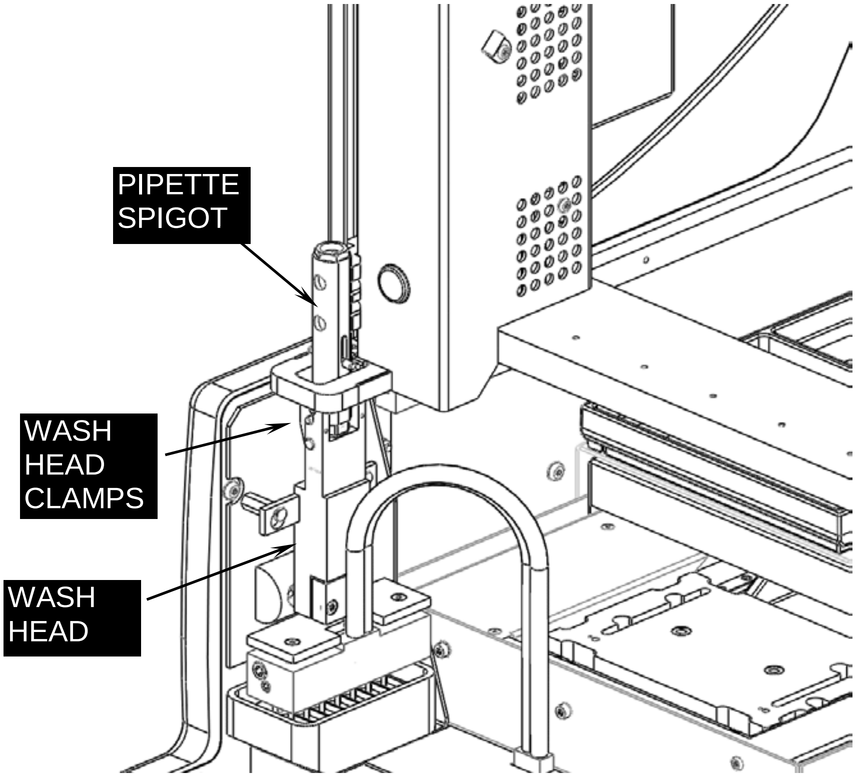


Figure 13-7: Sliding the Arm to above the Wash Head and Clamping the Spigot

3. Use the Pipette Spigot to move the Wash Head around and position the Wash Head above the Alignment Plate.

4. Carefully place the head into the alignment plate (DS2FIX001). The front two Wash Head Tubes fit into the two holes and the remaining tubes fit in to the slot (Figure 13-8).

> ***Note:*** *This is a tight slide fit, so ensure the tubes are aligned with the flat sides of the slot. Do not force the wash head.*

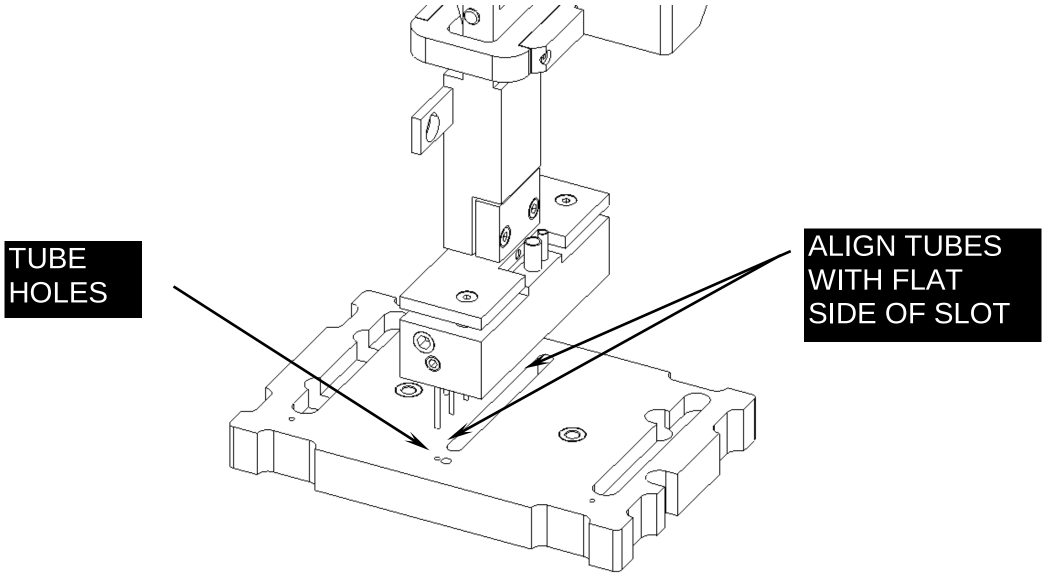


Figure 13-8: Positioning the Wash Head in the Alignment Plate

5. Sit the bottom face of the Wash Head onto the top face of the Alignment Plate and tighten the two screws to fix the Wash Head in position (Figure 13-9). Ensure the Wash Head is still sitting flat against the Alignment Plate.

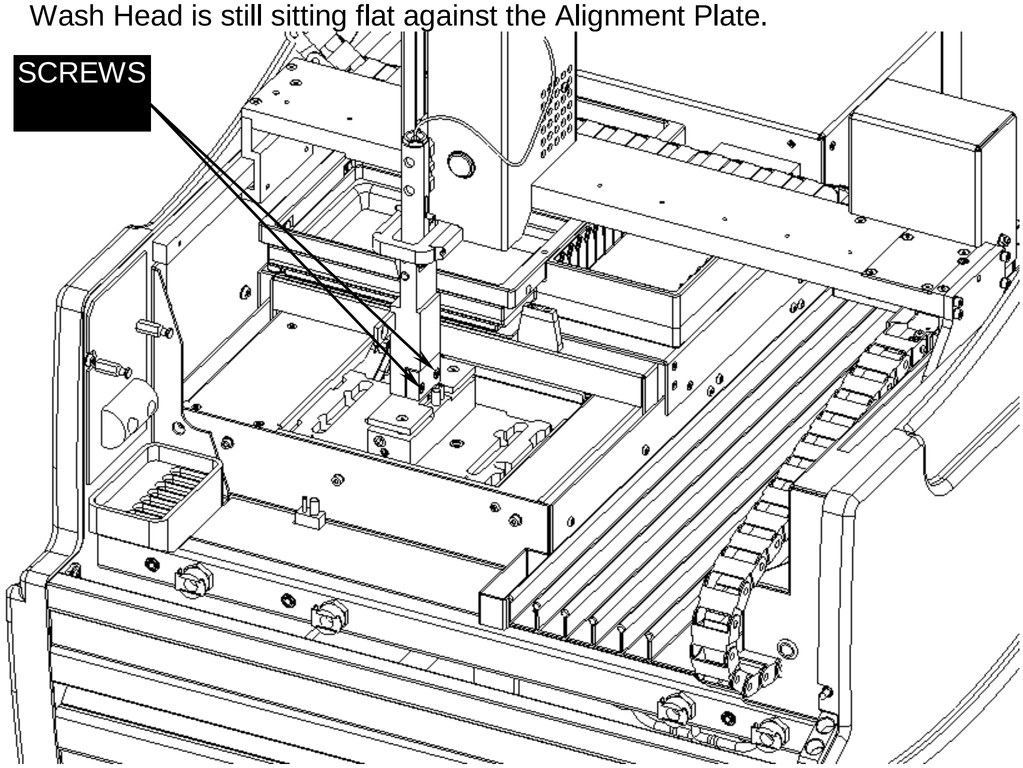


Figure 13-9: Tightening the Wash Head in Position

6. Re-locate the Wash Head onto the Wash Head Supports and disengage the Pipette Spigot.

7. Remove the Alignment Plate from the Upper Plate Carrier.

13.2.2 To Align the Wash Head (using supplied fixture DS2FIX044):

To align the Wash Head, you will need the DS2 Calibration Plate (DS2FIX044) that was included with your DS2 shipment. *See Figure 1.*

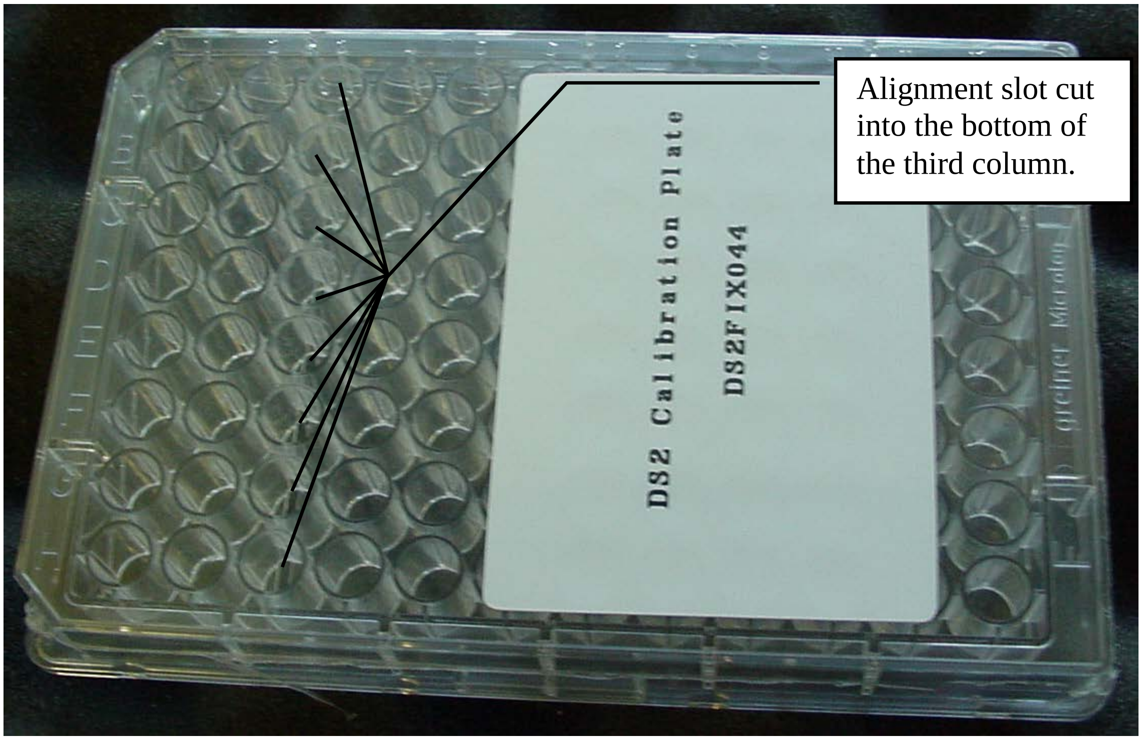


Figure 1

1. Ensure the DS2 is turned off.
2. Loosen the two M3X12 Cap Wash Head Fixing Screws. *See Figure 2.*

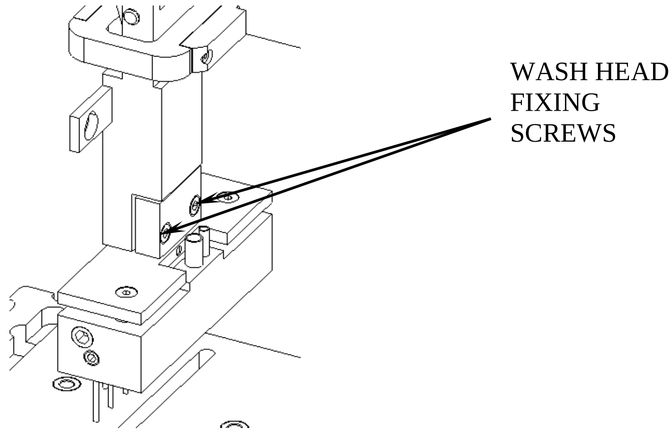


Figure 2

Manually move the Arm so that the Pipette Spigot is positioned above the Wash Head Assembly. Engage the Pipette Spigot into the Wash Head Assembly clamps. *See Figure 3.*

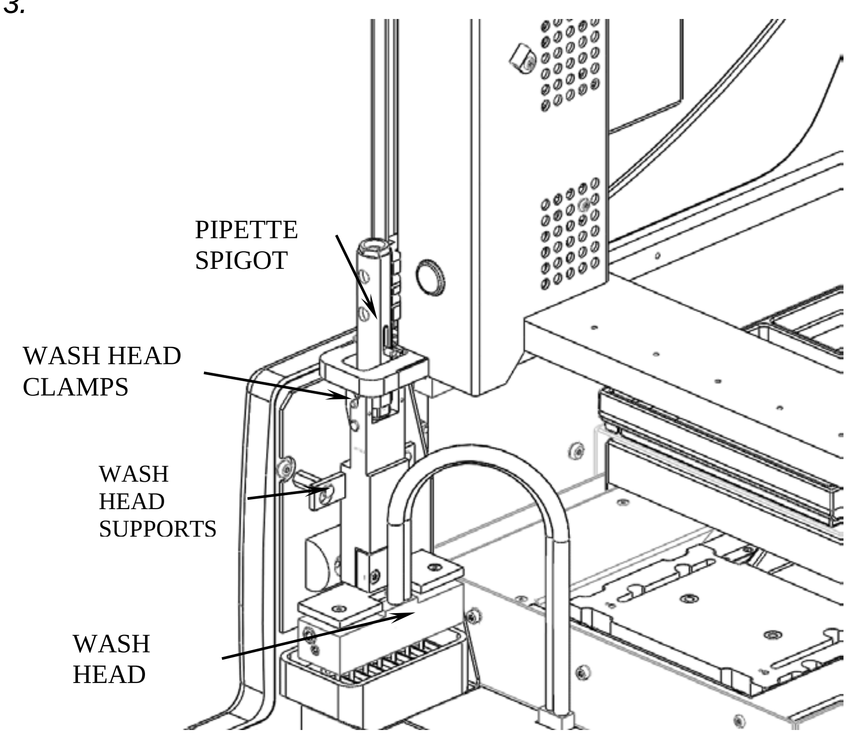


Figure 3

3. Place the DS2 Calibration Plate in the upper plate carrier. Ensure well A1 is in the upper left corner. *See Figure 4.*
4. Use the Arm to position the Wash Head above the Calibration Plate. Carefully lower the Wash Head Aspiration pins into the alignment slot in column 3. *See Figures 4 and 5.*
   NOTE: It is a tight fit, so ensure that the Aspiration pins are aligned with the slot. Do not force the Aspiration pins into the slot.

Figure 4

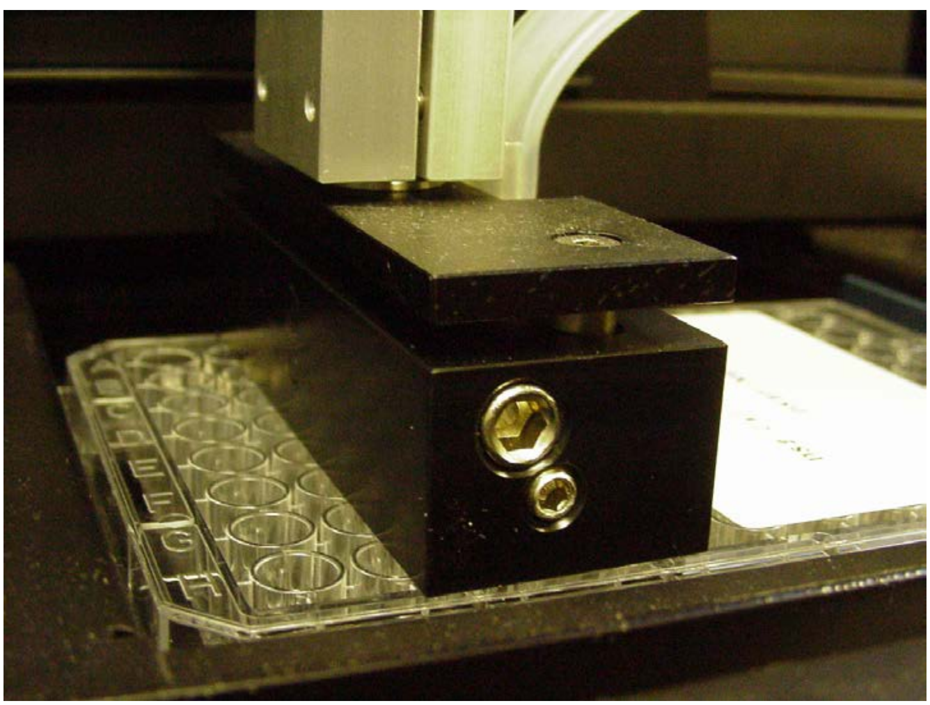


Figure 5

5. Ensure the bottom surface of the Wash Head is resting firmly on the top surface of the Calibration Plate, and tighten the two Wash Head Fixing Screws to fix the Wash Head in position. Prior to tightening the screws completely, ensure that the Wash Head is still flat against the top surface of the Calibration Plate. Hold the wash head in position manually while tightening the screws.
6. Re-locate the Wash Head Assembly onto the Wash Head Supports (see Figure 3), and disengage the Pipette Spigot. Remove the Alignment Plate from the Upper Plate Carrier.
7. To ensure proper calibration and plate definitions following an alignment, run a dispense test and an aspirate test using the customer's test plate to ensure there are no problems with alignment while dispensing, and that fluid is completely removed from the plate without scratching the bottom of the wells during aspiration.

13.3 Disassembling the Wash Head

To Disassemble the Wash Head

1. Remove the Wash Head From the Attachment Body (Figure 13-10).

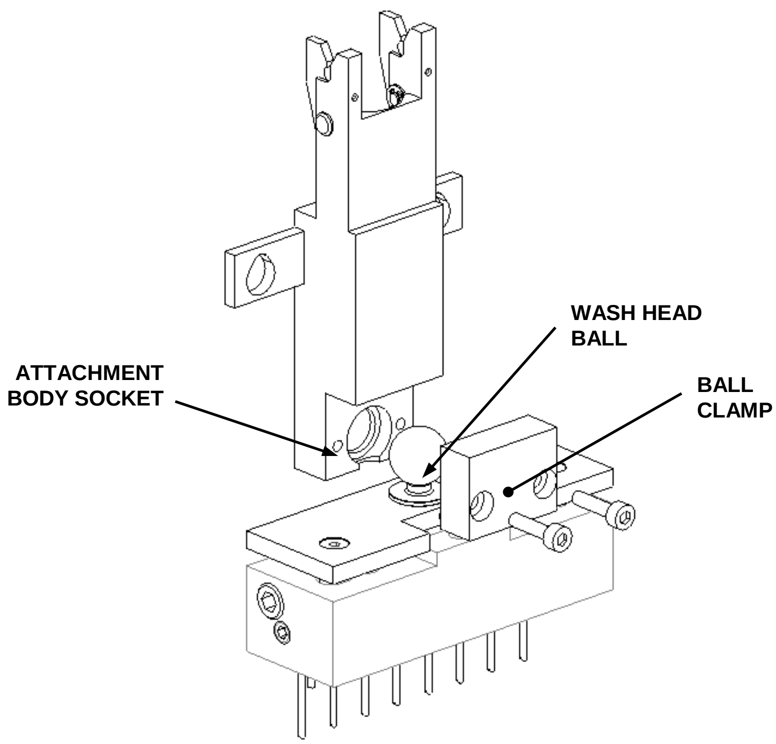


Figure 13-10: Removing the Wash Head from the Attachment Body

> ***Note:*** *When reassembling, do not tighten the screws completely, as adjustment may be needed when the Wash Head is attached to the system.*

2. The Wash Head can be disassembled by removing the two screws on the floating wash head plate (Figure 13-11)

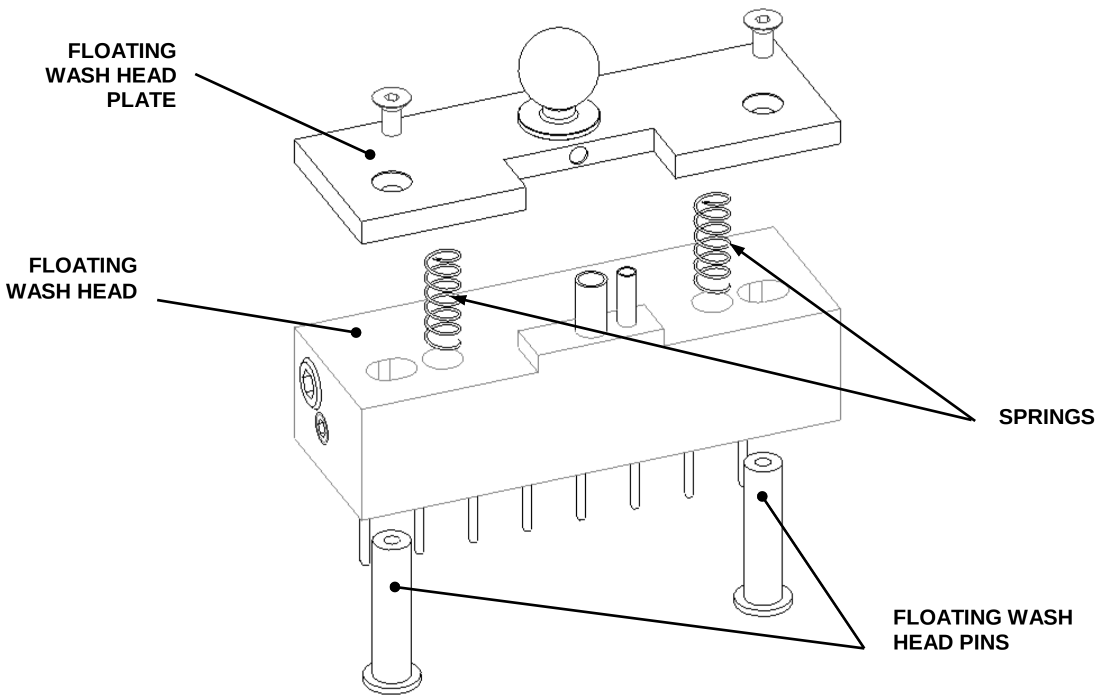


Figure 13-11: Removing the Wash Head Plate

When reassembling the assembly:

> ***Note:*** *Ensure the tops of the pins locate into the recesses in the underside of the Plate.*

> ***Note:*** *Check That the Wash Head moves up and down freely and when released and sits down on the ends of the Floating Wash Head Pins.*

1. Disassembling the Attachment Body
There is a clamp peg and pivot pin on each side of the attachment body (Figure 13-12). The pin should be removed.

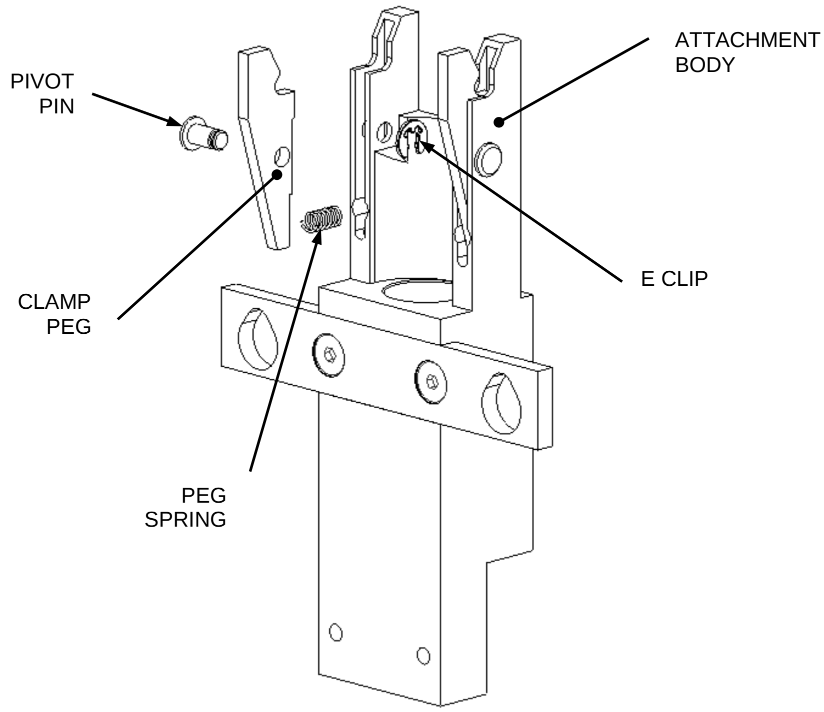


Figure 13-12: Attachment Body

To reassemble the Attachment Body:

1. Fit a Peg Spring (42000470) into the back of the Attachment Body (Figure 13-12).
2. Lightly grease (Dow Corning 44) the through hole in the Clamp Peg (23500770) and insert the Clamp Peg into the slot on the Attachment Body,
3. Slide the Pivot Pin through both parts from the outside and secure in place using an E Clip.
4. Repeat the procedure for the other side.

Note: *Ensure the Clamp Pegs move freely and spring shut.*

5. Insert the pin gauge (DS2FIX013) into one of the peg clamps and adjust the screw until the pin just rotates, then back the Set Screw off 1/8 turn.
6. Repeat for the other side and check that once adjusted the pin is clamped tightly in the pegs.
7. Fit two M2x4 Skt Set Screws into the Attachment body using Loctite 222 (Figure 13-13).
8. Realign if the screws have been removed (Figure 13-9).

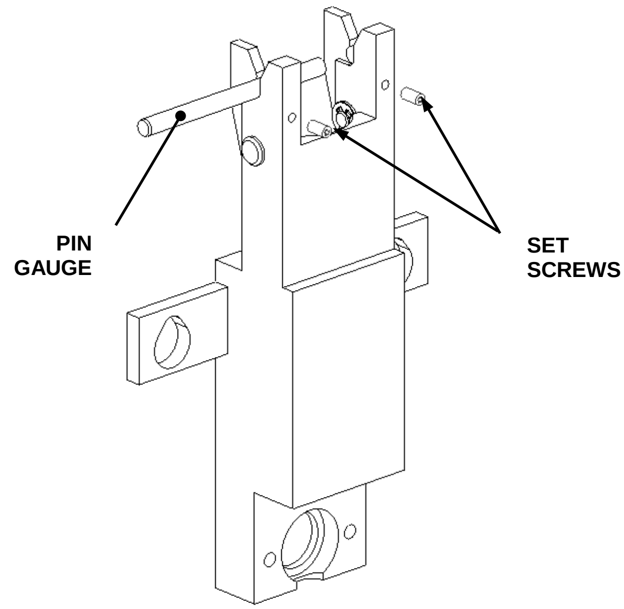


Figure 13-13: Assembling the Attachment Body

If the magnet is removed, it must be replaced as described below:

1. Place a small amount of RTV (GE Type RTV 118) into the bottom of the hole in the side of the Attachment Body and fit a Magnet as shown in Figure 13-14. Wipe off any access RTV.

> ***Note:*** *Ensure that no RTV gets on to the Clamp Peg and the Clamp Peg still moves freely.*

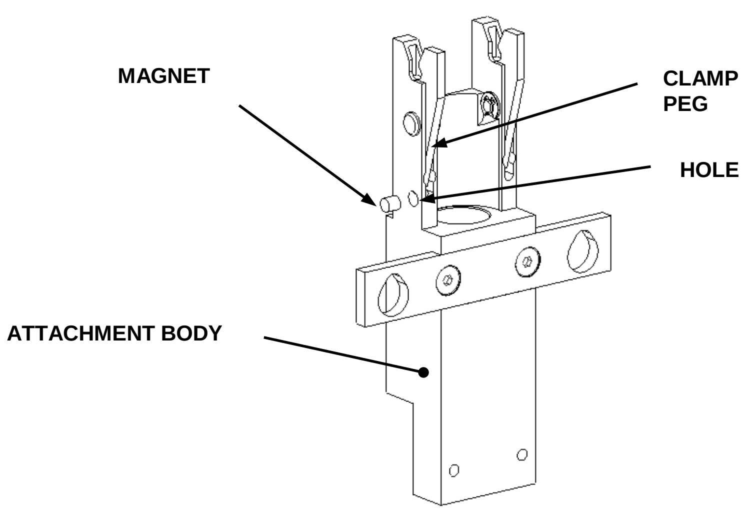


Figure 13-14: Location of the Magnet

Chapter 14 Electric and Electronic Components

14.1 Overview

A number of electric and electronic components are included in the system to control and provide support services, including:

- Power Supply (Section 14.2)
- Fan (Section 14.3)
- I/O Board and Main Board (Section 14.4)
- Power Switch (Section 14.5)
- Cover Switch (Section 14.6)
- Vacuum Switch (Section 14.7)

14.2 The Power Supply

The power supply is located in the left bottom left of the rear panel as shown in Figure 14-1.

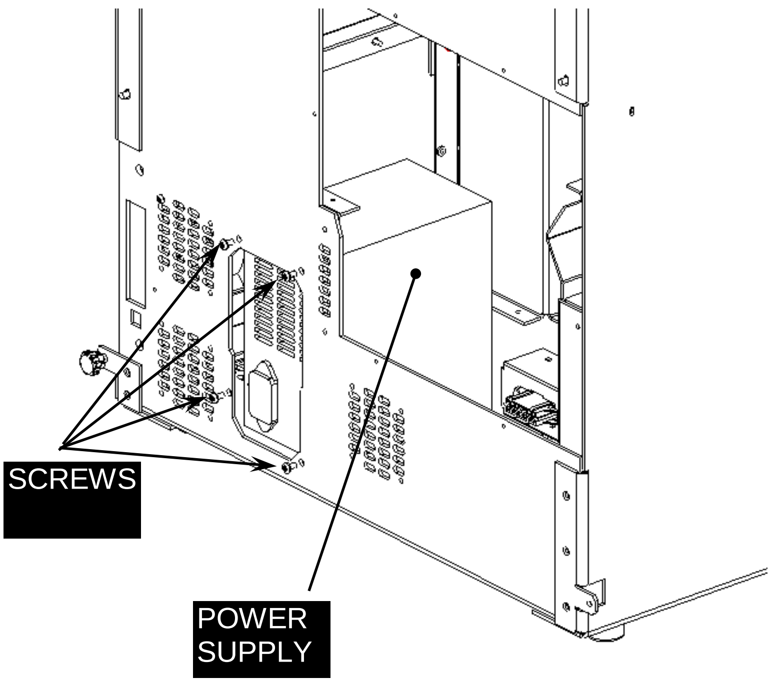


Figure 14-1: Power Supply

If the Power Supply is replaced, use the new version (13500811). This version does not require a ferrite. Replacing the power supply on an older unit may require the use of a Power Supply Plate (22002410) and 3/8” long screws instead of 1/4” long screws.

14.3 The Fan

The Fan is mounted on the back panel as shown in Figure 14-3.

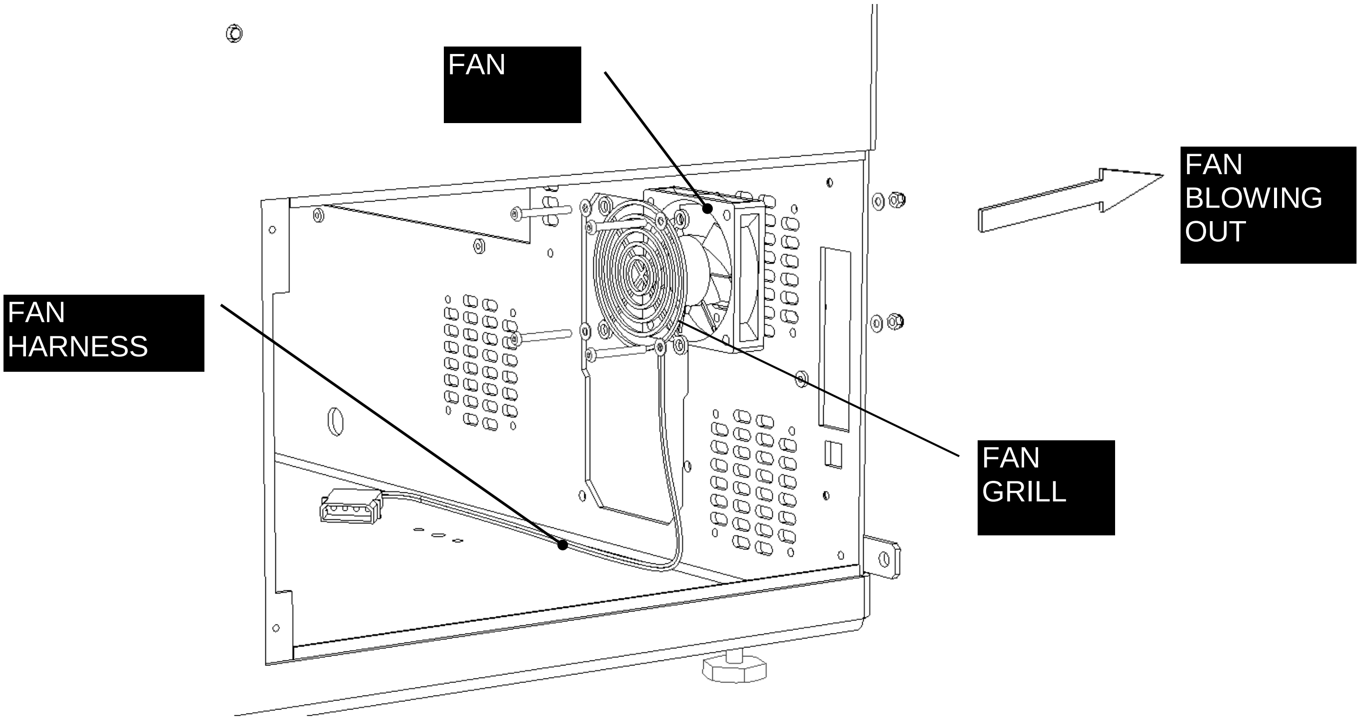


Figure 14-3: Fan

When replacing the Fan, orient it so that air blows out of the chassis and the Fan Grill does not touch the Fan Blades. Do not over tighten screws.

14.4 The I/O Board and Main Board

14.4.1 Removing the Boards

Note: This is a matched board set and each individual board cannot be replaced in the field.

Note: When replacing the boards, ensure you are using the "sandwich" board set which would have been initially setup at the factory. After the initial setup the boards can be used on any DS2 provided the calibration information was backed up, as per instructions in section 5.2.8.

To Remove the Boards:

1. Remove the board door as shown in Figure 14-4.

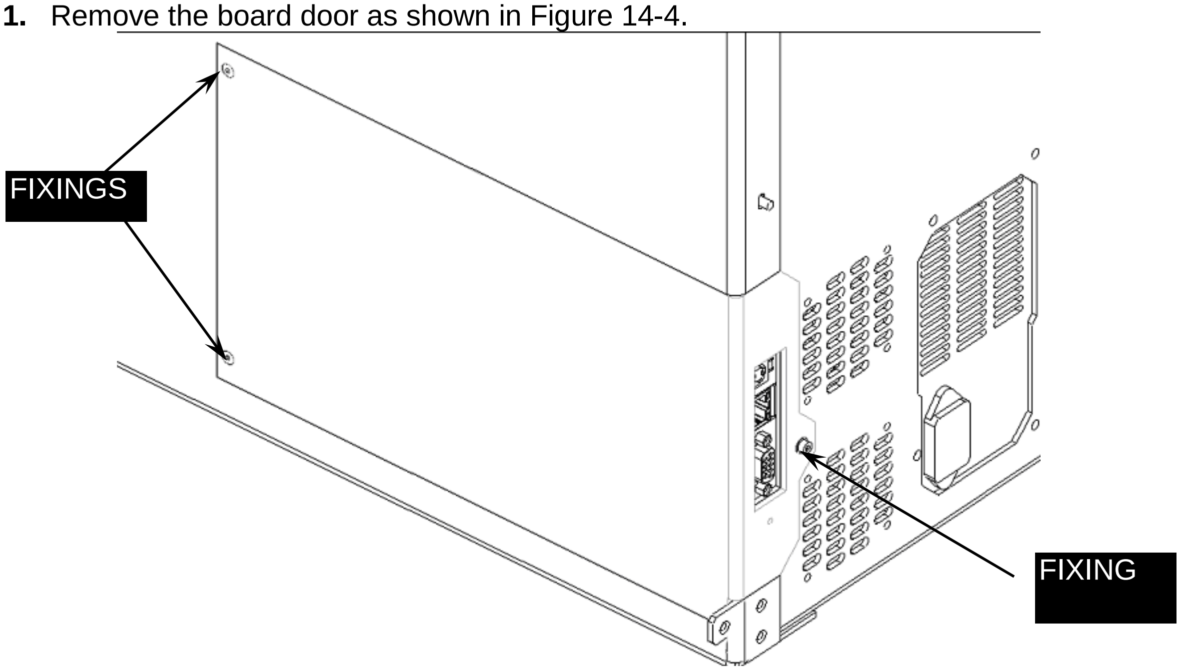


Figure 14-4: Board Door

2. Remove the three fixing screws shown in Figure 14-5.

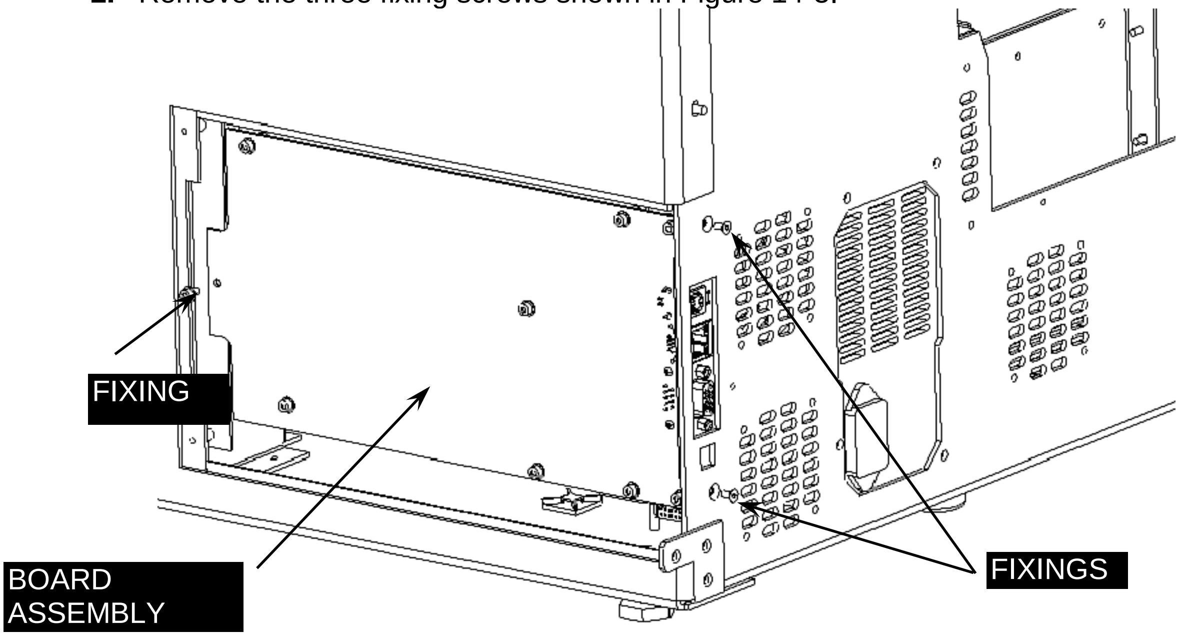


Figure 14-5: Fixing Screws for Board Assembly

3. Remove the I/O board from the processor Board (Figure 14-6).

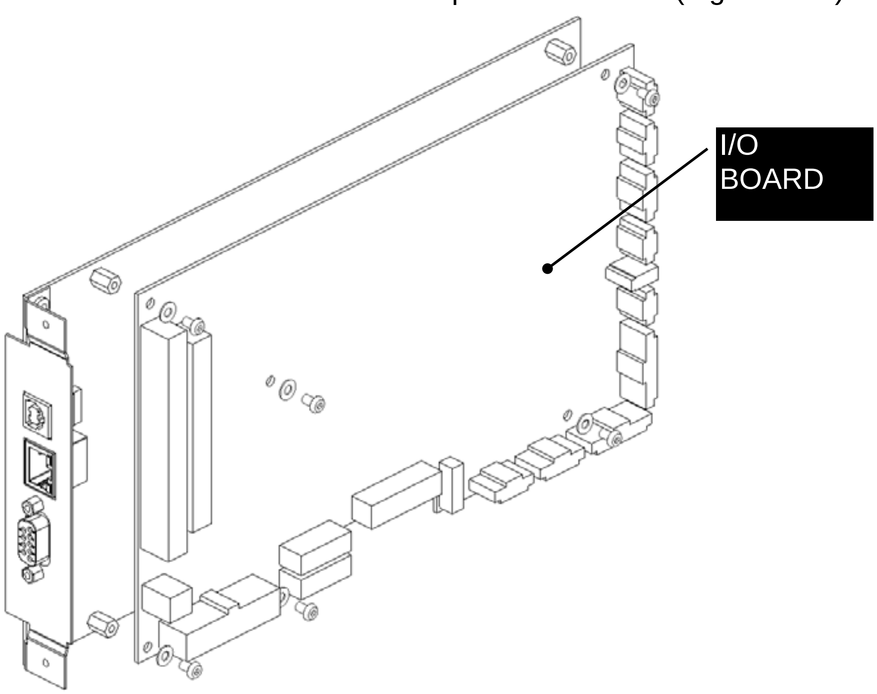


Figure 14-6: Removing I/O board from the Processor Board

When replacing the board assembly, place it by the Board Access Aperture in the chassis as shown in Figure 14-7.

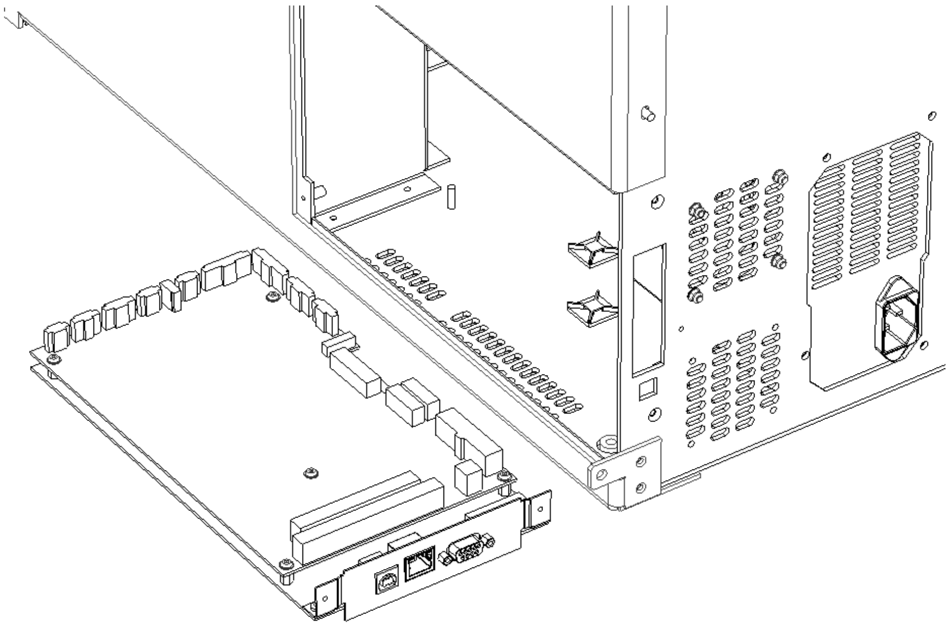


Figure 14-7: Location of Board Assembly for Installation

14.4.2 Replacing the Cables

To replace the Cables:

1. Plug the connectors from the Barcode, Rack Switches, the two Parlex Flex cables and the two power cables from the Power Supply into the I/O board (Figure 14-8)

> ***Note:*** *The Parlex Cables have the numbers J11 and J15 written on them; ensure they correspond with the J11 and J15 numbers on the board.*

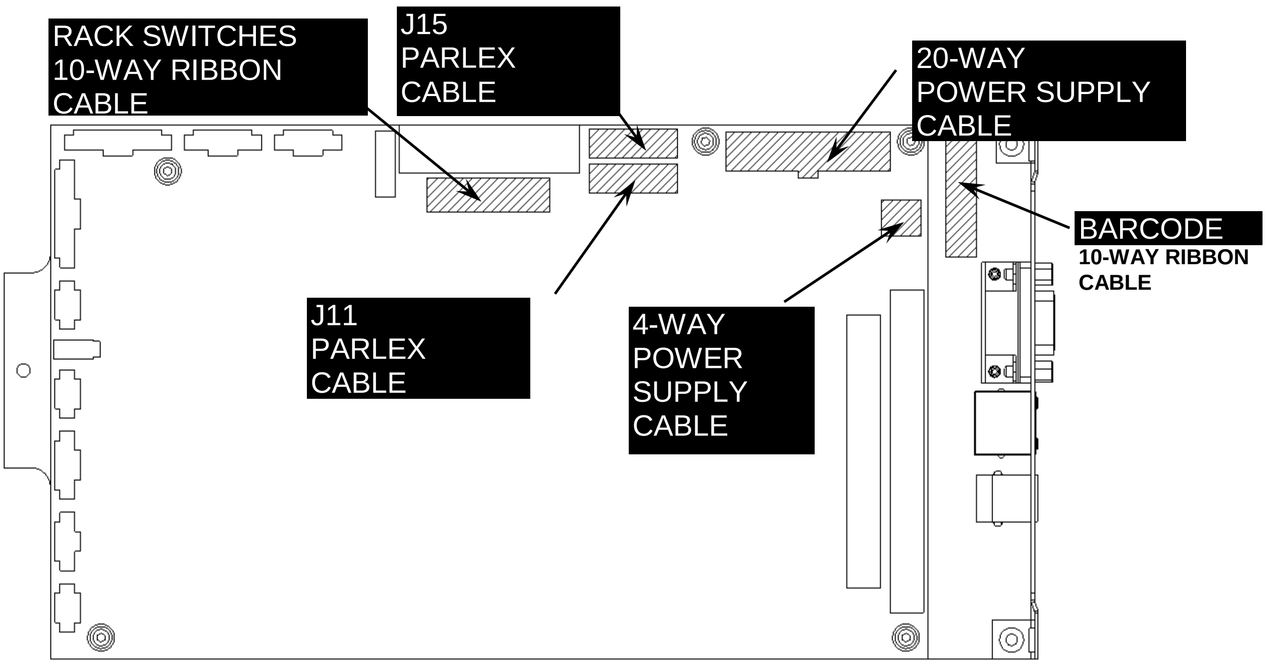


Figure 14-8: Cable Connections, Part 1

2. Plug the connectors from the Float Switch Harness, X Home, X Encoder and X Motor (Figure 14-9).

X HOME
5-WAY
RED/BLACK/WHITE
BLUE/GREEN

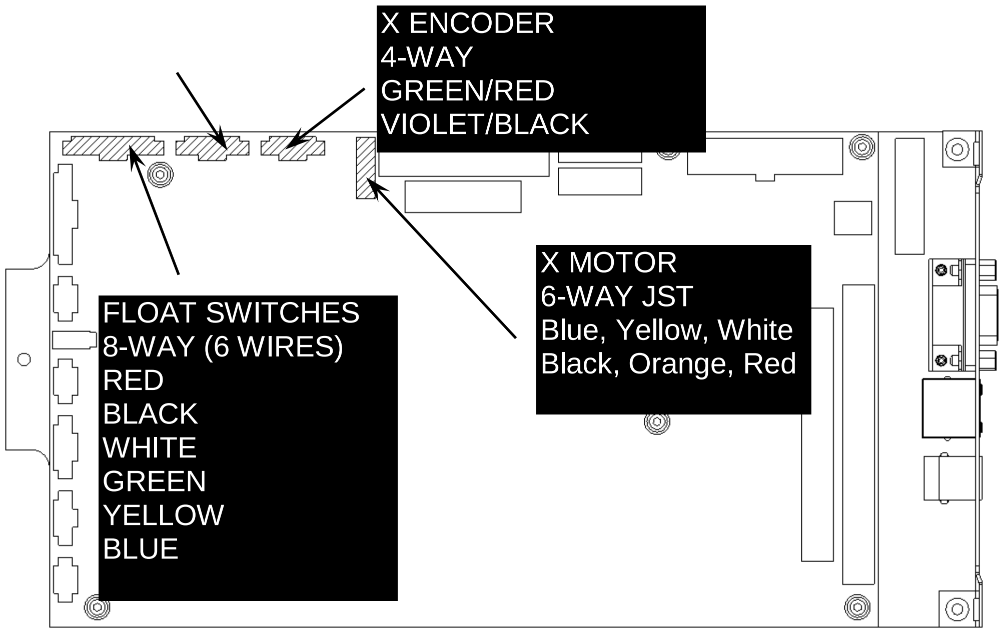


Figure 14-9: Cable Connections, Part 2

3. Plug the connectors from the Pump Assembly into the I/O board (Figure 14-10).

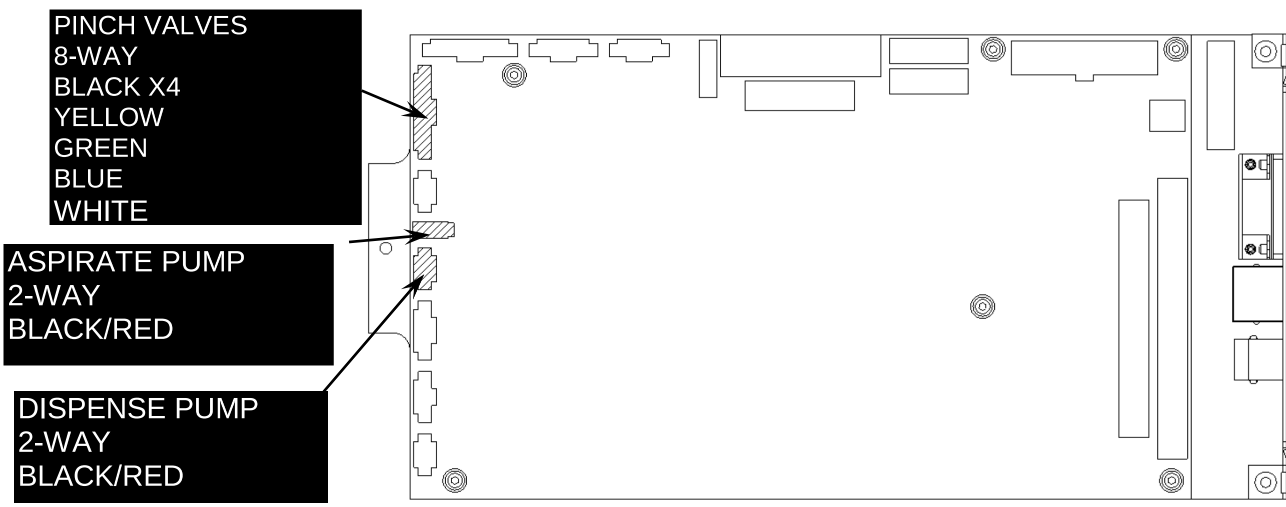


Figure 14-10: Cable Connections, Part 3

4. Plug in the 50- and 40-way ribbon cables into the I/O Board (Figure 14-11).

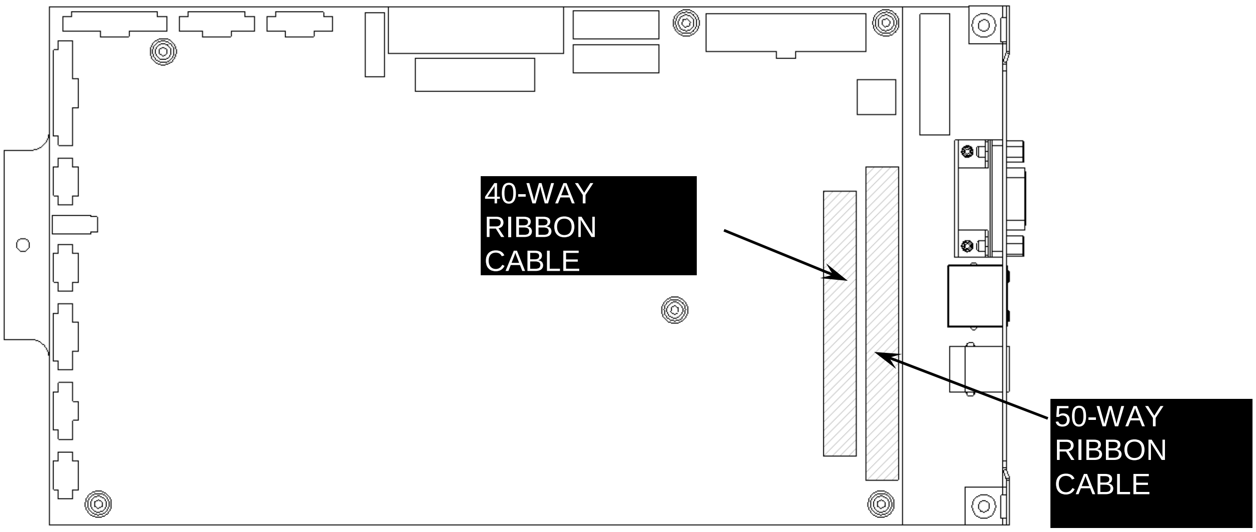


Figure 14-11: Cable Connections, Part 4

5. Plug in the connectors from the Switch Harness (Figure 14-12).

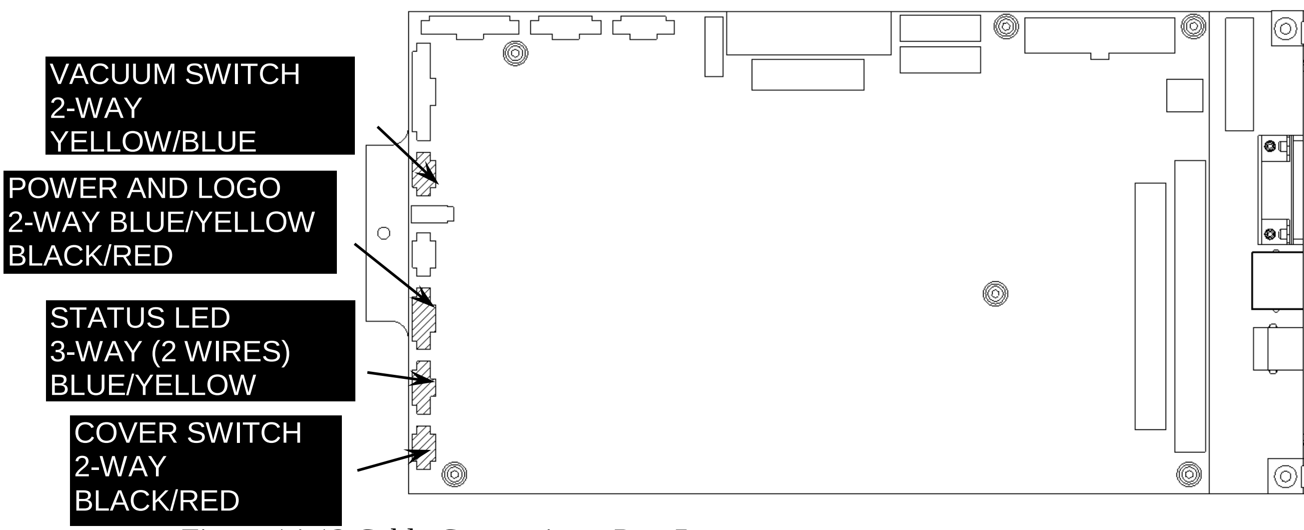


Figure 14-12 Cable Connections, Part 5

14.5 Power Switch

The old style Power Switch assembly (obsolete since June, 2009 and found in serial numbers 1DSA0398 and below) is attached to the two PEM studs at the front of the right hand of the chassis as shown in Figure 14-13.

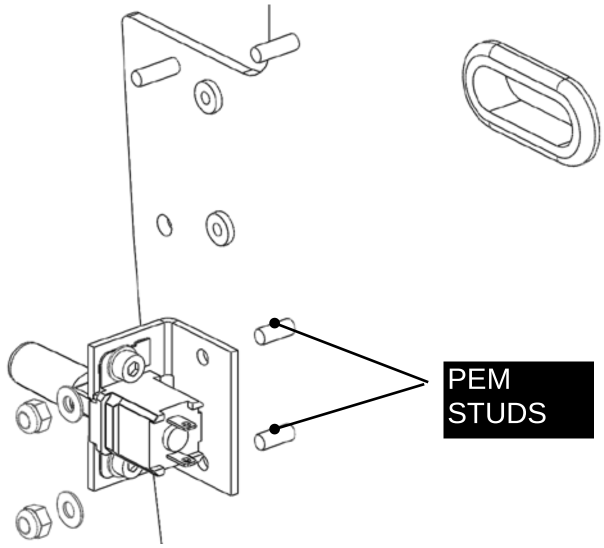
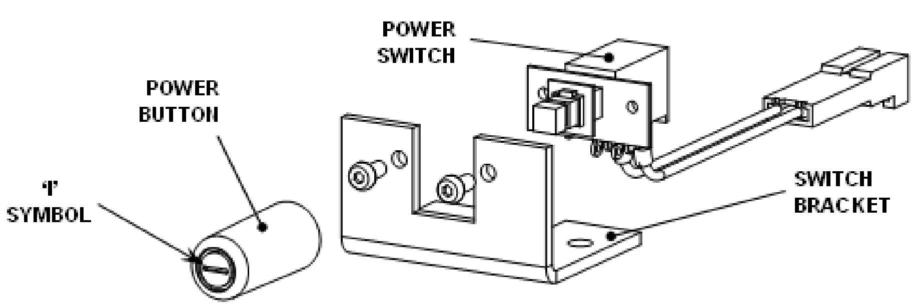


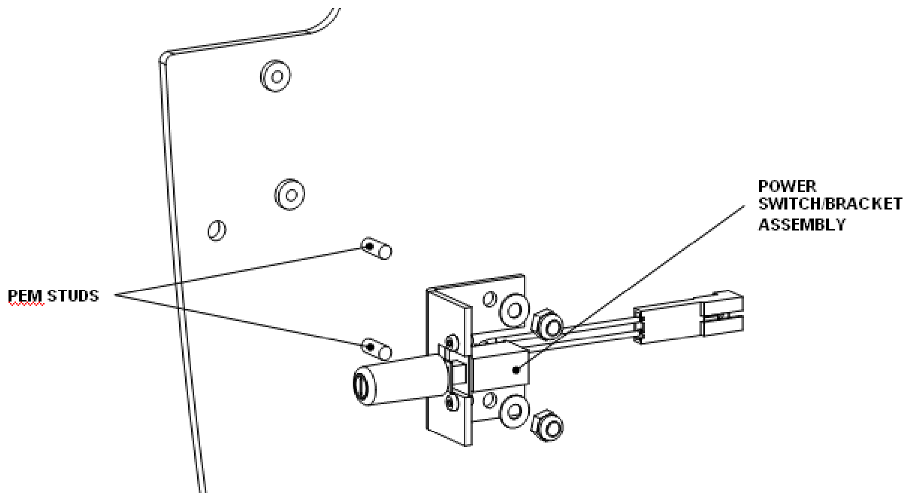
Figure 14-13: Power Switch Assembly

The switch can be removed from the bracket by unscrewing the two screws that attach it.

The current part number for the power switch in serial numbers 1DSA399 and above is 13500671. A new switch bracket, part number 22500851 is required to use the new power switch. The placement of the power switch/bracket assembly, onto the DS2, is still the same.

This change is effective with serial number 1DSA0399, ECO6086.




POWER
SWITCH/BRACKET
ASSEMBLY
PEM STUDS

14.6 Cover Switch

The Cover Switch is used to alert the user that the door is open. **[Not implemented at this time]** It is attached to the chassis as shown in Figure 14-14.

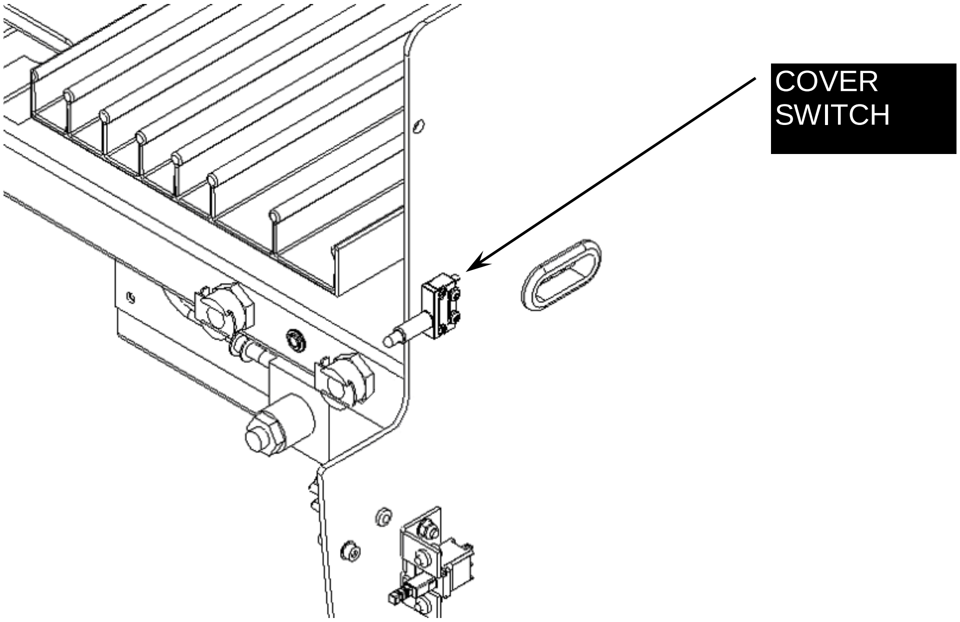


Figure 14-14: Location of Power Switch

> ***Note:*** *Ensure that the Cover Switch is orientated so the plunger is in the lower position.*

14.7 The Vacuum Switch

The vacuum switch is located on the chassis as shown in Figure 14-15.

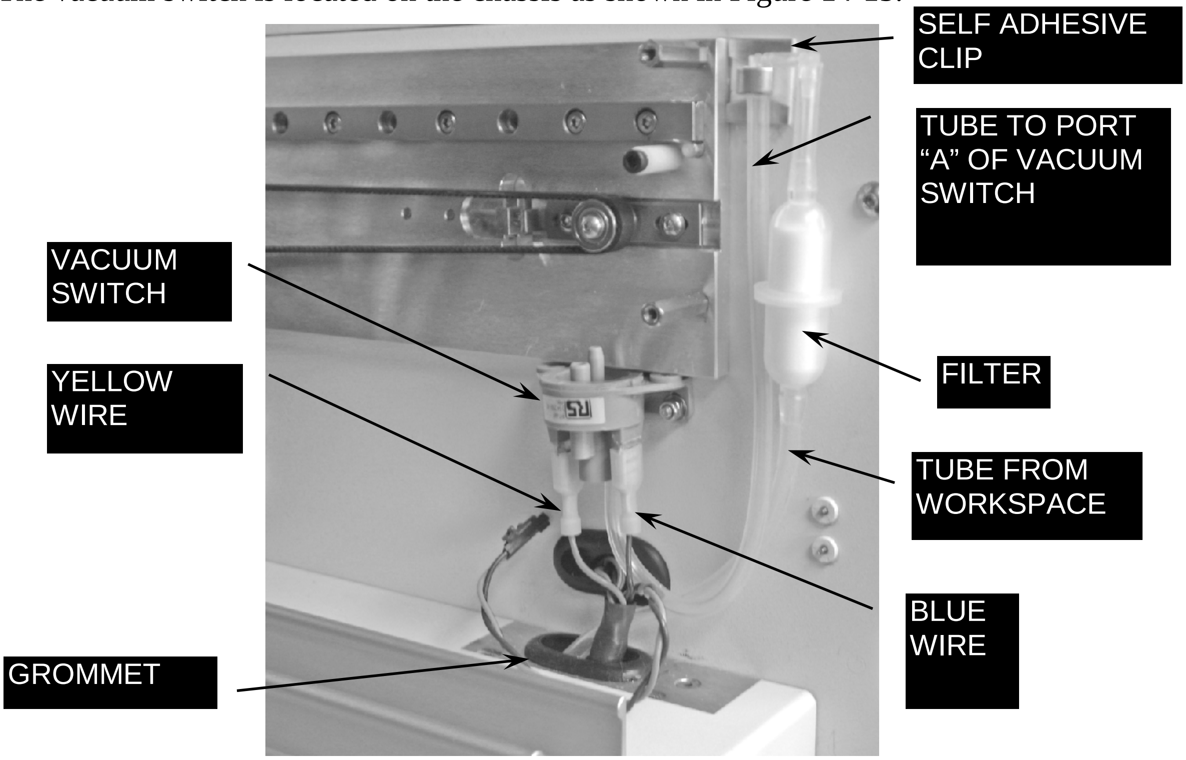


Figure 14-15: Location of Vacuum Switch.

If the vacuum switch is replaced, it should be calibrated via the following procedure before installation.

In the field, the service engineer should connect the switch to a container of water and press on the tubing to create a vacuum using fixture DS2FIX025 (Figure 14-16) and monitor the pressure via DeeSoft as follows:

1. Attach the vacuum switch to the fixture as shown, switch on the digital manometer (set on PSI scale) and the multimeter (set on Ω scale).

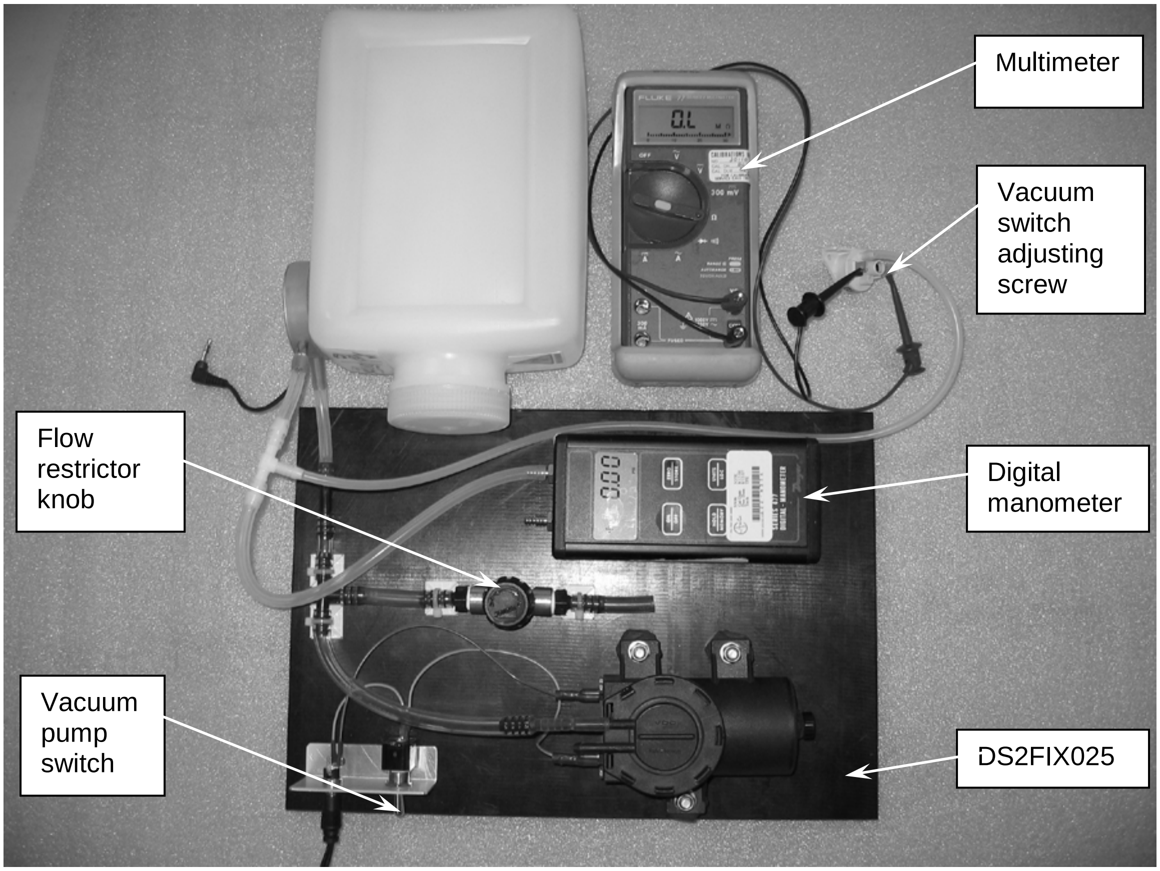


Figure 14-16: Vacuum Pressure Fixture

2. Turn the flow restrictor knob clockwise until it lightly seats, then open 2 full turns.

3. Switch the vacuum pump on and adjust the flow restrictor knob to obtain a vacuum reading of 0.45 psi on the manometer.

4. Observe the multimeter. If it shows continuity (approximately 0 ohms), turn the vacuum switch adjusting screw (using a #0 Posidriv screwdriver) slowly counter-clockwise until the multimeter shows no continuity (O.L.). If the multimeter initially shows no continuity, turn the vacuum switch adjusting screw slowly clockwise until the multimeter shows continuity.

5. With the switch coarse adjustment now completed, turn the flow restrictor knob counter-clockwise until the manometer reads less than 0.43 psi. The multimeter must now read O.L. (no continuity). If it does not, turn the vacuum switch adjusting screw slowly counter-clockwise until the multimeter shows no continuity (O.L.). Slowly turn the flow restrictor knob clockwise and observe the multimeter. When the multimeter display changes from O.L. to 0 ohms, note the reading of the manometer. It must change when the manometer reads between 0.43 and 0.47 psi. If it does not, adjust the vacuum switch adjusting screw and repeat this entire step to obtain this condition.

6. Switch the vacuum pump, manometer and multimeter off, and disconnect the vacuum switch.

The switch is now ready for installation into the DS2.

To install the switch into the system

1. Attach the silicon tube that is protruding through the grommet in the Workspace plate to free end of the In-Line Filter.
2. Attach the free end of the Silicone Tubing from the second Elbow to port “A” on the pre-adjusted Vacuum Switch.
3. Connect the two Spade Connectors from the Switch Harness to the terminals of the Vacuum switch, yellow wire at the front and blue wire at the back.
4. Fit the Vacuum Switch to the two PEM Studs above the Grommet in the Right Hand Side of the Chassis, using two M3 Nyloc Nuts and two M3 Washers.
5. Stick a Small Self Adhesive Clip to the Chassis as shown and clip the In-Line Filter Assembly into it, so that the clip grips around the silicon tube and the large barb on the elbow.

Note: *The top of the clip must be flush with the top of the X plate.*

6. Slide the YZ Attachment Block on the Y Drive fully over to the left so that it is underneath the cut in the front face of the Y Arm.
7. Fit the Z Drive by locating the holes in the Z Locating Plate on to the Dowels in the YZ Attachment Block and fix in place using two M3x8 Skt Cap Screws and two M3 Internal Tooth Washers.

Appendix A Electronic Schematics

Electronic Schematics

The overall electronic schematics are presented in Figure A-1.

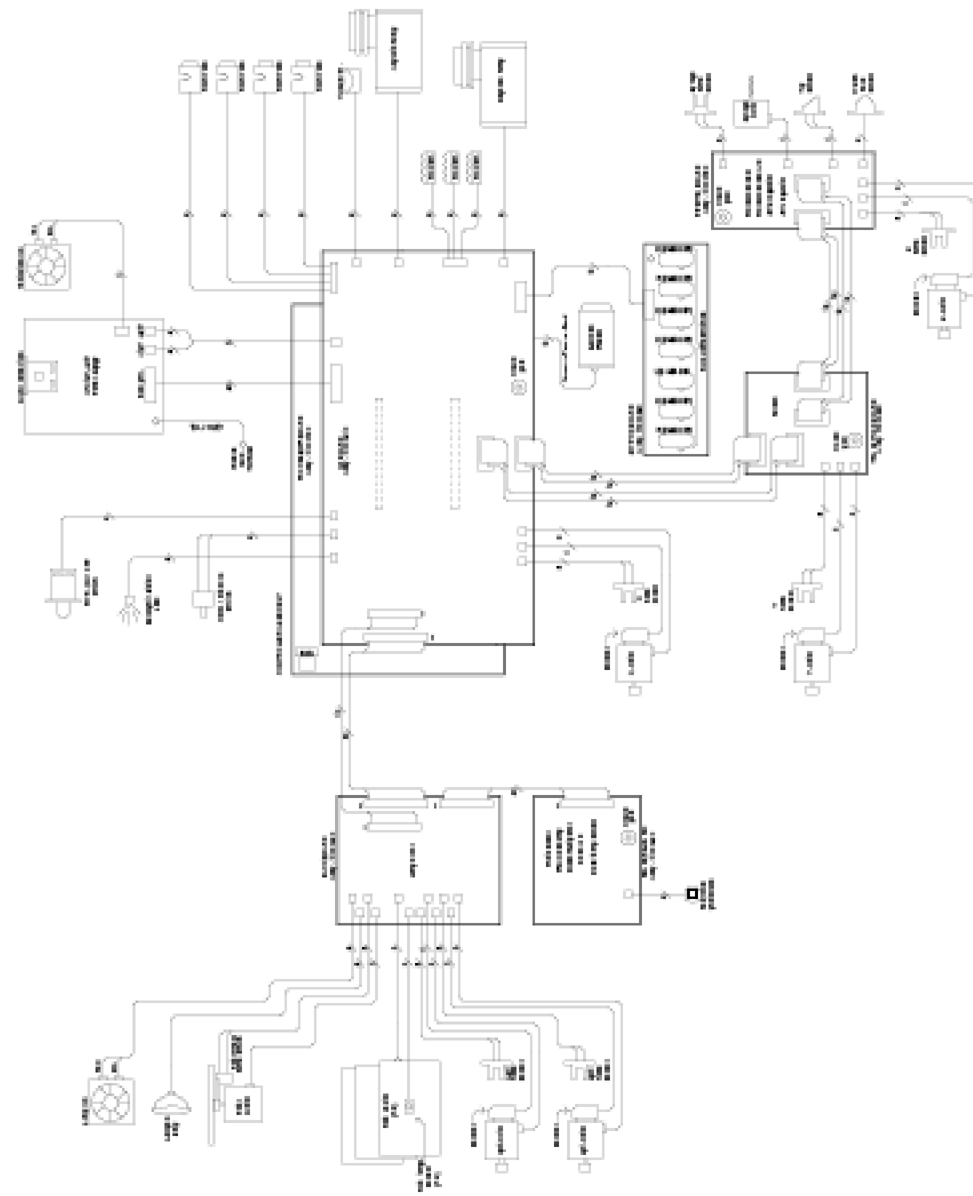


Figure A-1: Electronic Schematics

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Appendix B Recommended Spares List

Spare Parts

Part Number	Item Description	Qty for 5 units	Qty for 10 units	Qty for Svc Kit
24099	Reader Verification Plate	-	-	1
62020	ASSY, READER, DS2	1	2	0
13500004	ASSY, X DRIVE, DS2	1	2	0
13500005	ASSY, Y DRIVE, DS2	1	2	0
62030	ASSY, Z DRIVE and Pipette, DS2	1	2	0
13500100	ASSY, WASH HEAD, DS2	1	2	1
62700	Scanner Module Assembly	1	2	0
13500172	SYRINGE MOTOR, DS2	1	2	1
13002500	Heater Assembly (bottom)	1	2	0
13002510	Heater Assembly (top and middle)	1	2	0
13002560	New Power Supply upgrade kit (needed for units <1DSA0824)	1	2	0
13002590	DS2 Annual Preventative Maintenance Kit (tubing, sponge, filter pad, lamp)	5	20	2
13002610	External Waste Trap Kit, DS2	As	Needed	0
13002630	DS2 Silencer Upgrade Kit	As	Needed	0
13500180	Y HOME SENSOR, DS2	1	2	1
13500200	X HOME SENSOR, DS2	1	2	1
13500210	PLATE DRIVE HOME SENSOR, DS2	2	4	2
13500250	ASSY, PUMP, DS2	1	2	0
13500430	ASSY, WASTE BOTTLE, DS2	1	2	0
13500402	Laser Scanner, DS2	1	2	0
13500480	DS2 CONTROLLER pcb ASSY (dual pcb)	1	3	1
43000590	Optic cube Fan Filter	5	20	2
13002450	Optic cube fan filter upgrade kit	as	needed	1
13002460	DS2 Tubing Replacement Kit	5	20	2
13500541	Z eject plate harness/sensor	1	2	1
46000040	Waste Cap, nalgene	1	2	1
13500493	ASSY, COVER, DS2	1	1	0
13500501	SAMPLE TUBE RACK ASSEMBLY,DS2	5	10	0
13500560	ASSY DISPENSE BOTTLE, DS2	2	4	0
13500811	NEW POWER SUPPLY ASSEMBLY	1	2	0
14000330	ASSY,PCB,BACK BOARD,DS2	1	2	1
13501510	GAS SPRING RETROFIT KIT, DS2	As	Needed	0
14000380	ASSY,PCB,SWITCH BOARD,DS2	1	2	1
14000390	ASSY,PCB,TRANSITION BRD,DS2	1	2	1
14000820	ASSY,READER BOARD,DS2	1	2	1
15500011	X DOUBLE FLEX CABLE, DS2	2	4	2
15500031	Y DOUBLE FLEX CABLE, DS2	2	4	2
15500061	X ENCODER CABLE, DS2	1	2	1

Part Number	Item Description	Qty for 5 units	Qty for 10 units	Qty for Svc Kit
15500090	40 WAY RIBBON CABLE, DS2	1	2	1
15500100	50 WAY RIBBON CABLE,DS2	1	2	1
15500121	BARCODE CABLE, DS2	1	2	1
40000210	Z DRIVE LINEAR RAIL	1	2	1
22500981	Sample Rack Spring, Double, DS2	5	10	5
22500990	Sample Rack Spring, Single, DS2	5	10	5
23501440	Dispense Bottle Cap	1	3	0
40000062	Isolation, Shock Mounts for Aspiration Pump (43000531)	3	6	0
40000260	SF687ZZ BEARING,7X14X5,SS,FLNG	2	4	2
40000270	SMR105ZZ BEARING,5X10X4,SS	3	6	3
40000280	PULLEY,20 TOOTH,DS2	2	4	2
40000340	PULLEY, DRIVE, 48 TOOTH,DS2	2	4	2
41500405	FILTER,405NM,OPSYS MR	1	2	1
41500450	FILTER,450NM,OPSYS MR	1	2	1
41500490	FILTER,490NM,OPSYS MR	1	2	1
41500620	FILTER,620NM,OPSYS MR	1	2	1
42000470	LC-014A-1-MW SPRING,3.05X6.35	2	4	2
42000480	LC-038F-1-M SPRING,10.67X4.37	1	2	2
42000490	LCM-080D-16-S SPRING,7.5X13.8	1	2	2
42000611	GAS SPRING, TENSION, DS2-2010	1	2	0
42000540	CABLE CHAIN,Y DRIVE,DS2	1	2	1
42000530	CABLE CHAIN,X DRIVE,DS2	1	2	1
42000670	18DRE0707 MAGNET,3MM X 3MM OD	1	2	1
42000690	LC-016C-8-S SPRING,COMPRS,SS	2	4	2
43000200	2050-6 FITTING,3/16"X3/32"BARB	1	2	2
43000260	S10506Z530A 12VDC PINCH VALVE	3	6	2
43000270	RT-152, FITTING, REDUCER, "T"	2	4	2
43000320	PML 5094-NF30 12V DC PUMP	1	2	0
43000400	L40-6, FITTING, "L", 5/32", PP	1	2	2
43000420	FLTP-1/4F-LE VACUUM TRAP	1	2	0
43000460	303PPB-3# RELIEF VALVE, 3 PSI	1	2	2
43000480	PMCD160212 FITTING,1/8"BARB,PP	2	4	2
43000491	PMCD230212 ELBOW FITTING, BARB	1	2	2
43000530	(USE 43000531) PUMP,ASPIRATE MRW/DS2	1	2	0
43000531	PUMP ASPIRATE DS2	1	2	0
44000170	COMPRESSED SPONGE, 30MM DIA.	1	2	1
50200410	L7394 LAMP 6V 20W 350 LUMENS	1	2	2
50800161	MOTOR, AXIS DRIVE, SMALL, DS2	1	2	1
50800171	MOTOR, AXIS DRIVE, LARGE, DS2	1	2	1
200207100	CLIP-PLATE HOLDER SS DL1000	8	16	8
200207101	CLIP-PLATE HOLDER SS (W-DIMPLE	8	16	8
352101800	WIRE-CLEANING .018"	2	4	4
352104000	WIRE-CLEANING .040"	2	4	4

Part Number	Item Description	Qty for 5 units	Qty for 10 units	Qty for Svc Kit
354009201	PMCX 16-04-12 FITTING	2	4	2
354020300	ELBOW PMC-23-04-12	2	4	2
358003300	O RING VITON 75O BS0008	1	2	2
394000100	PURGE TRAY-MICROTITER FORM (a)	3	6	2
419010000	ENCODER-INCREM,HEDS-5500-H14	2	3	2
426000900	S10410Z031A 12VDC PINCH VALVE	1	2	2
564400200	SWITCH-VACUUM RS317-443	1	2	2
816400600	GS0400-016,TUBING,SIL.,4X7.2MM (b)	1	2	3
62515250318	P4MEB4 FITTING,"L",1/4NPTXBARB	1	2	2
DS2FIX017	CALIBRATION TOOL, DS2 (c)	1	2	1
DS2FIX029	CALIBRATION COLLAR, DS2 (c)	1	2	1
DS2FIX044	DS2 CALIBRATION PLATE (c)	1	2	1

a = consumable, b= unit is meter, c = too

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