

## Installation and Configuration Guide

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**DCP-252A Dual-Axis Precision Positioner**

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### **Congratulations on your purchase!**

Diamond Engineering's Desktop Antenna Measurement System has been designed to aid in the testing and development of small to medium sized antennas. Using our state of the art software, this system enables you to make many different types of measurements with complete user-definable configuration settings.

This manual will fully assist you with the assembling and configuring as well as teach you how to utilize the many features of your Desktop Antenna Measurement System. To achieve the full functionality of the measurement system, it's expected the user have some working knowledge about the concepts and theories involved in microwaves and antenna design development.

We cannot emphasize the importance of fully reading and understanding this manual before using the equipment to avoid damaging the unit and/or voiding your warranty.

Best regards,

***The Diamond Engineering Team***



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**Diamond Engineering**  
Automated Measurement Systems

**Distributed by:**

**Reliant EMC**

**info@reliantemc.com +1 408 916-5750 www.ReliantEMC.com**



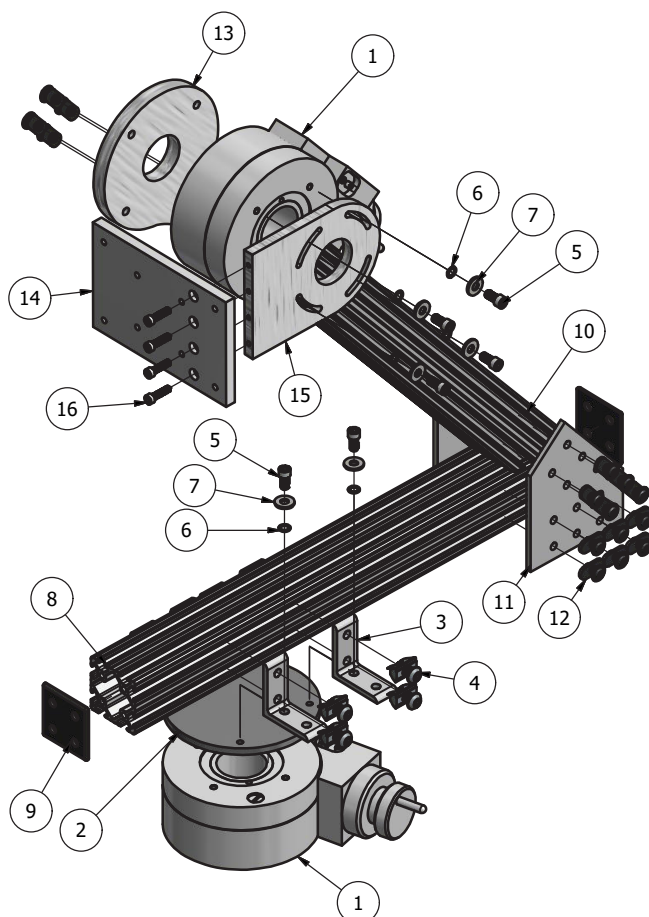
# DCP252A Dual Axis Positioner - Introduction

## Overview

The DCP-252A is a precision 2-axis EL/AZ positioner, which is primarily designed for radar module calibration. AZ and EL stages are stepper motor powered worm gear tables with 0.025 degree native resolution. Each axis has a home sensor which can be used to set pre-calibrated home positions. A high capacity tripod provides stability for the positioner.

## Package Contents

- DCP-252A positioner with dual worm stages
- Two 6-meter integrated motor control cables
- Pre-assembled azimuth stage with 10-inch aluminum plate
- Pre-assembled elevation stage with right-angle mounting bracket
- Optional rotary joint adapter plates (azimuth and elevation)
- 24V 2.5A DC power supply with line cord
- 6-foot USB cable
- Heavy-duty tripod
- Tools (Allen wrench set, laser level, digital level and laser distance finder)
- Setup guide with USB or CD installation media
- DAMS Pro Software Suite license



1. *Rotary table*
2. *Base Plate*
3. *Corner Bracket*
4. *Spring Tab Fastener*
5. *1/4"-20 Socket Screw*
6. *1/4" Round Shim*
7. *1/4" Split Lock Washer*
8. *T-Slot Base Arm*
9. *T-Slot Endcap*
10. *T-Slot Bevelled Arm*
11. *Arm Surface Bracket*
12. *T-Slot Single End-Feed Fastener*
13. *Motor Mounting Bracket*
14. *Array Front Plate*
15. *Array Side Bracket*
16. *10-32 Socket Screw*

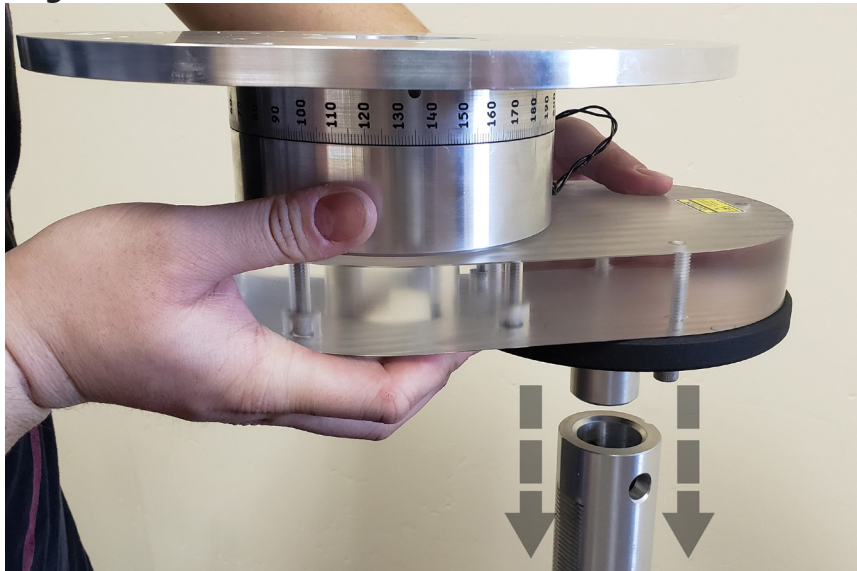
# Mounting the DCP-252A Base Plate on Tripod

## Assembly

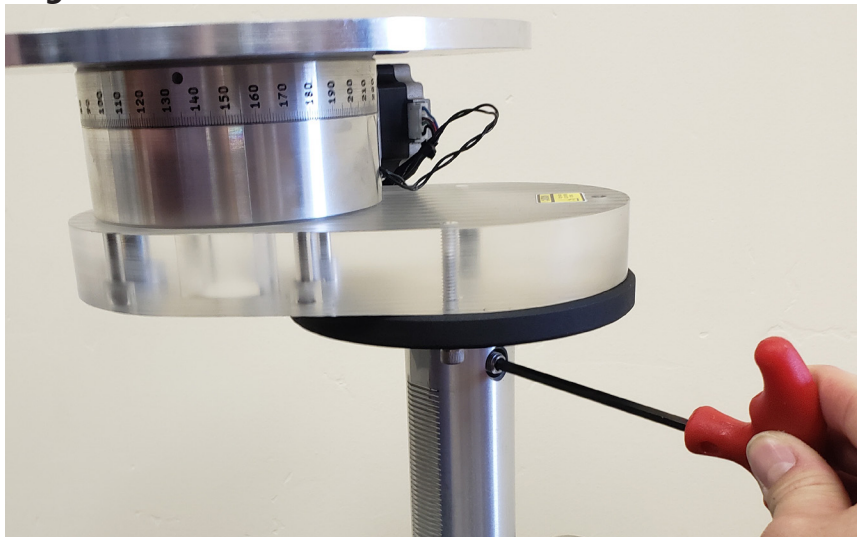
1. Unpack the tripod and expand the leg sections
2. Extend the tripod mast about 3 inches
3. Insert the metal dowel at the base of the positioner into the tripod (see img A)
4. Rotate until the hex set screw is visible
5. Use hex key to tighten mounting plate to tripod as shown below (see img B)

**NOTE:** It is advised to remove plate now to simplify feeding cables through if electing to run them through the base. Simply remove the four 10-32 bolts to reveal unobstructed path. (Alternative route for cables will be covered later.)

Img A



Img B





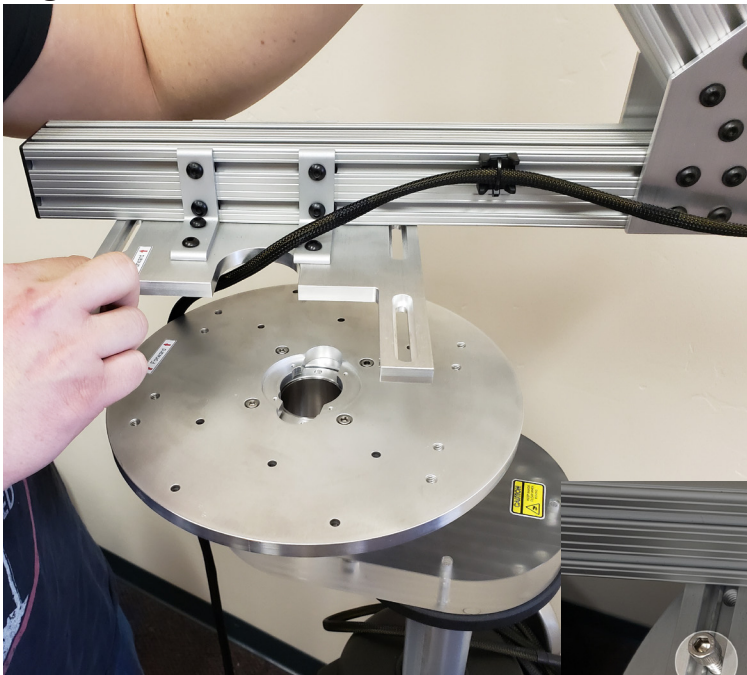
# Mounting DCP-252A Arm on Base Plate

## Assembly

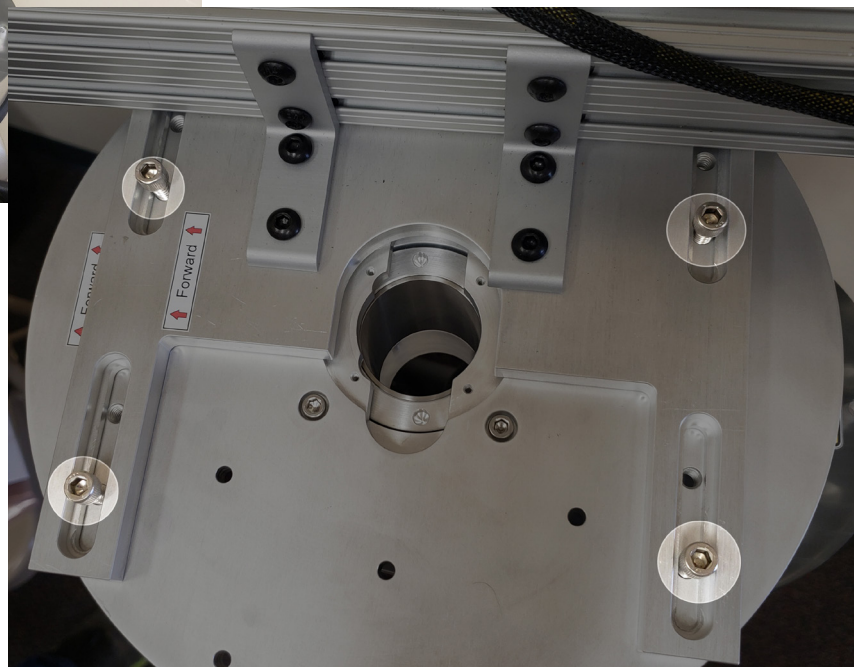
1. If electing to use the optional rotary joint adapter plate, please see next page before moving to step 2.
2. Place entire arm assembly on top of the base plate, align "Forward" labels with each other (while holding arm secure until screws are installed)
3. Install screws (see img C), but don't tighten completely
4. Slide arm to desired location and then tighten the four 1/4"-20 screws (see img C)

**NOTE:** If you've elected to route the cables through the base plate, be mindful to not damage the rotary joint if installed.

Img C



Locations of screws to mount arm to main base plate (requires 4 screws minimum, but 8 are recommended.)



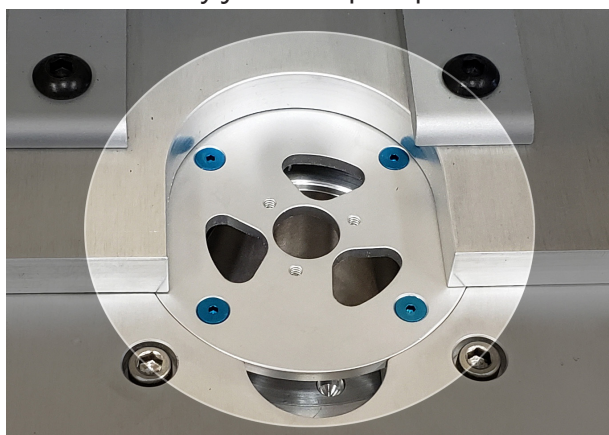
## Optional Rotary Joint Adapter Plates

### Installation of AZ plate

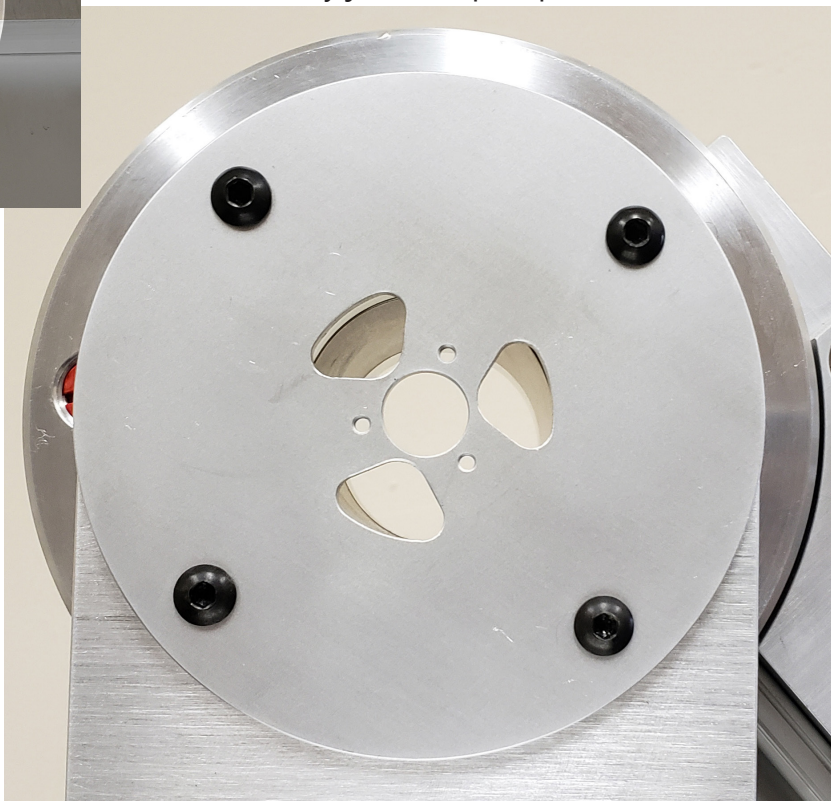
1. To install, fit your rotary joint and affix to plate.
2. Fit adapter plate into the center hole of the base plate, then use the included four flat head 4-40 1/4" screws.
2. Place entire arm assembly on top of the base plate, align "Forward" labels with each other (while holding arm secure until screws are installed)
3. Install screws (see img C), but don't tighten completely
4. Slide arm to desired location and then tighten the four 1/4"-20 screws (see img C)

**NOTE:** If you've elected to route the cables through the base plate, be mindful to not damage the rotary joint if installed. If looking for adapter plate drawings for customizing, please see pages 23 through 25.

Azimuth rotary joint adapter plate



Elevation rotary joint adapter plate

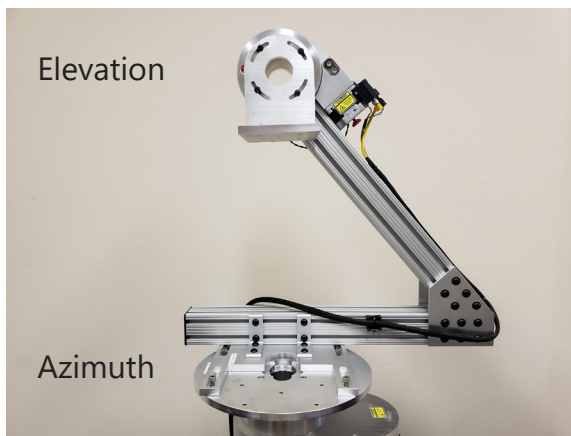


# Connecting the Cables

## Connecting to the DCP252A

1. Align connector pins of yellow motor cable and carefully tighten retaining nut (NOTE: Finger tighten only!)
2. Clip the green/white pair into the matching receptacle located near the yellow connector
3. To manually rotate either axis, utilize the steel knob on the back of the motor

**NOTE:** The red/black pair is an auxiliary pair for an optional max limit switch



Elevation



Azimuth

## Connecting to the Controller

1. Connect yellow motor cable connector (described above)
2. Connect 9-pin serial connector and (optional) tighten retaining screws
3. Repeat for both axes





# Cable Routing Options

## Through base (bottom)

1. As shown in Img D below, remove 10-inch AUT base plate
2. Route RF and motor control cables through acrylic spacer
3. Carefully pull cables through while allowing room to pass through AUT plate
4. Attach rotary joint with provided hardware (optional)
5. Re-attach AUT base plate and arm assembly

**WARNING:** Excessive rotation can cause strain and/or breakage of RF cables. Please be mindful of the route and placement of all cables. **Diamond Engineering will not be held responsible for damaged RF cables.**

Img D



Img E



## Through head (top)

1. Carefully remove right angle mounting bracket and rotary joint adapter plate
2. Route RF cables through rotary stage
3. Attach motor cables to connector box on rotary stage
4. Secure cables using included mounting hardware as shown in img E above

**WARNING:** Excessive rotation can cause strain and/or breakage of RF cables. Please be mindful of the route and placement of all cables. **Diamond Engineering will not be held responsible for damaged RF cables.**

## mmW Extender Mounting - VDI Extenders

### VDI Extender Mounting

The optional mmW extender bracket provides a solid secure mounting point for mmW extenders in order to provide the best centering over the antenna phase center. This bracket will work with both Tx/Rx modules and Rx-only modules. Use the included 1/4"-20 socket head screws to attach the adapter to the elevation bracket and the extender module as shown.



# DAMS Software Installation

## Basic Instructions

\*\*\* Administrator privileges are required. Disregard any Windows 10 incompatibility messages \*\*\*

### Installing Software & Entering License Key

1. Insert the Antenna Measurement Studio CD and Install the software. Press "Yes" to all following prompts.
2. Start the software. You will see at the top it's running in DEMO MODE.
3. Click the arrow next to system options and click "license info" and enter the License Key, it will say its verified.
4. You MUST click the QUIT button to exit and save changes.
5. The software is now fully unlocked and ready to use.

### USB Driver Installation

1. Connect the Windows computer to the internet.
2. Connect the USB cable from the Controller to the PC.
3. Windows XP will ask if you would like to check windows update for the latest driver, press YES. Windows 7/8/10 will automatically check the internet.
4. If the Computer does not offer to use windows update you can select the option to have the computer look in the C:\dams\driver folder to install. The "found new hardware" installation sequence should occur twice. Once for the USB interface and once for the serial port.
5. Start the DAMS software click "Positioner Settings" and press "FIND." It should locate and automatically configure your controller.
6. Enter special settings as shown on next page of this manual for the primary positioner (if using more than one). Press Save then QUIT.
7. If it does not find the controller, check device manager under Ports (COM & LPT). Ensure its not on a COM port higher than COM8. If it is, you'll need to change it to 8 or less.

### Matlab Plotting with Windows 7/8/10 - 64 Bit

When using the DAMS software under 64 Bit versions of windows 7 you must follow the instructions below or the software will show a "could not start matlab engine" error code.

1. Open C:\Program Files\Agilent\Vee Pro Runtime\ (May also be "Program Files (x86)")
2. Right click on Veerun.exe and select "Properties"
3. Select the compatibility tab and check "Run as Administrator"
4. Click OK and restart DAMS Suite. Attempt to test plot a 3D file.
5. If 3D plotting works, go back and de-select "Run as administrator."

# DAMS Software Configuration

## Primary Positioner Configuration

\*\*\* Install DAMS Software from USB drive as instructed in DAMS Manual or quick setup sheet \*\*\*  
To setup the primary positioner, do not have the second positioner connected at this time. Open the DAMS software and press "positioner settings" and set the settings to those shown in the image below, the "FIND" button can be used to identify the COM port - the port must be less than COM8.

## X and Y Axis

<b>Controller</b>	USB/Serial
<b>Gear Ratio</b>	72
<b>Motor Resolution</b>	0.1125
<b>Start Speed</b>	1000
<b>Stop Speed</b>	8000
<b>Slope</b>	8
<b>Holding Current</b>	ON
<b>Mini-Stepping</b>	ON
<b>Run Current</b>	200 (LC4x controllers)
<b>Idle Current</b>	70
<b>Full Spherical Mount</b>	Enabled
<b>Position Tracking</b>	Enabled

*LC4C specific controller commands with above Motor Current / Hold settings*

**Current Setting w/Holding Current:** P200,75,10

**Current Setting w/o Holding Current:** P200,0,10

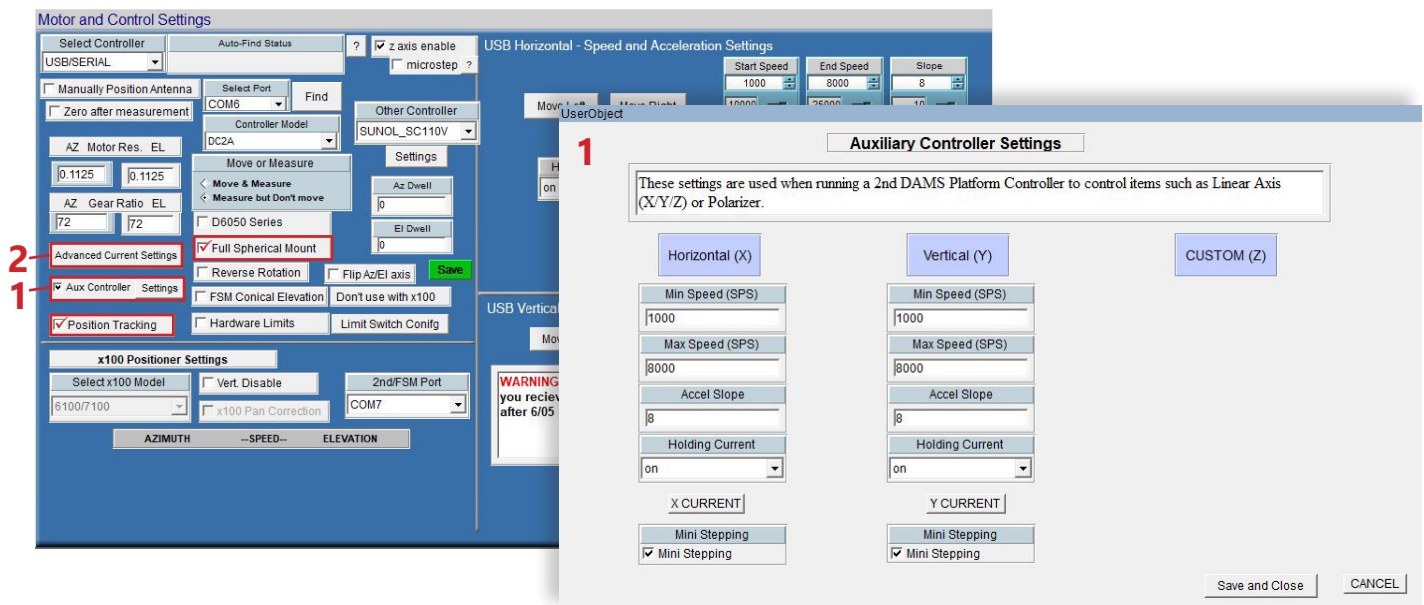
**Step Mode:** H4

# DAMS Software Configuration - 2nd Auxiliary Positioner

## Secondary Positioner Configuration

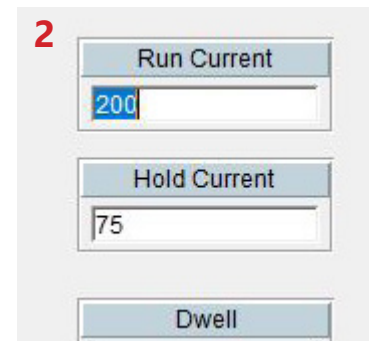
### Identifying the COM port

To setup the secondary positioner, do not connect the USB cable yet! On the PC, open up device manager, then expand the category labeled "Ports (COM & LPT)". Take note of the current USB serial port. Please note: if assigned to a comport greater than 8, please follow the directions on page 28 to manually reassign it). Once completed, you may connect your secondary (auxiliary) positioner.



## X and Y Axis

<b>Controller</b>	USB/Serial
<b>Gear Ratio</b>	72
<b>Motor Resolution</b>	0.1125
<b>Start Speed</b>	1000
<b>Stop Speed</b>	8000
<b>Slope</b>	8
<b>Holding Current</b>	ON
<b>Mini-Stepping</b>	ON
<b>Run Current</b>	200 (LC4x controllers)
<b>Hold Current</b>	70
<b>Full Spherical Mount</b>	Enabled
<b>Position Tracking</b>	Enabled



(Advanced Current Settings Window)

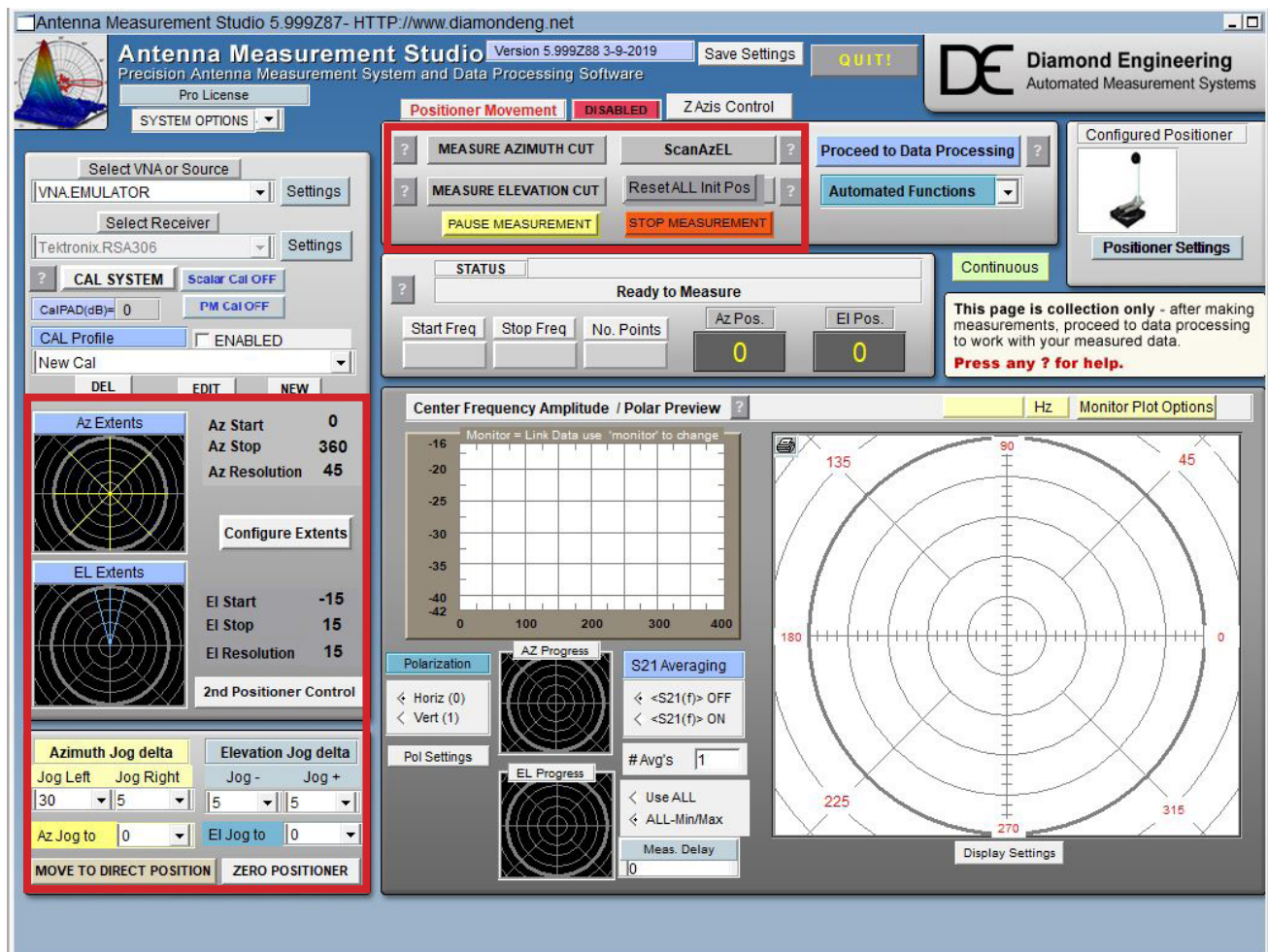


# Single / Primary Positioner Control

## Controlling the Primary Positioner

Detailed information about the DAMS software settings can be found in the DAMS Antenna Measurement Studio users manual.

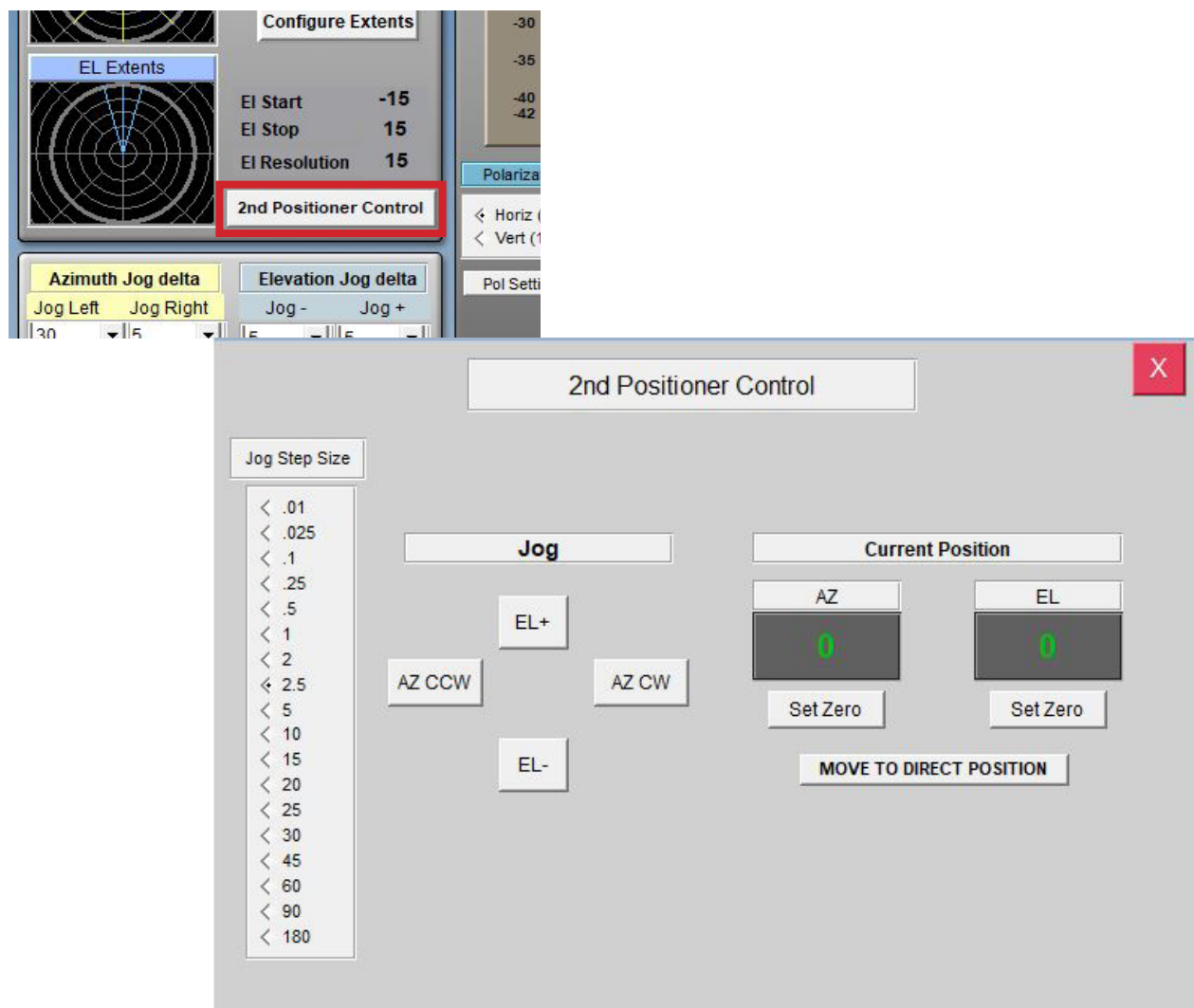
The areas highlighted below can be used to set measurement extents and resolution. You can also manually jog and zero the positioner. The upper area allows you to start, pause or stop your measurements and includes a few common automated measurements.



# AUX / Secondary Positioner Control

## Controlling the Secondary Positioner

Auxiliary or secondary positioners are used to position an antenna, source or receiver to a specific position, the primary positioner will then be used to make a single cut or entire Az/El scan over the configured extents.



# Multi-Positioner Automation

## Multi-Positioner Automation Module

This module is located under Automated Functions on the main page. It will set an auxiliary positioner to a specific position from a list (or dynamically updated file) and perform a full scan using the primary positioner controlled by the main DAMS software page. Since this module has the capability to collect massive amounts of data, the data will be stored directly to disk. Each measured position will then be stored as a separate file containing the magnitude and phase data for the entire frequency range.

See next page for file format examples

The screenshot shows the 'Multi-Positioner Automation' window. It contains a text area with instructions: 'This module automates multi positioner measurements using a fixed source positioner and scanned scounday positioner. A complete scanned dataset will be made for every source position specified. The source positioner will be the positioner configured as AUX. Each loop, or coordinate will execute the "Scan Az-El" command on the front page.' Below this is a 'Source Coordinate List (AZ, EL)' table with two entries: '0: (0, 10)' and '1: (-5, 15)'. To the right, there are fields for 'Source (aux) Position' with 'AZ' set to -2.5 and 'EL' set to 7.5, and a 'Move' button. Further right, there are checkboxes for 'Enabled' and 'Remote File Trigger Mode - Trigger File \dams\command.txt', and a field for 'Single Coordinate File - Trigger File \dams\auxcoord.txt'. At the bottom, there is a 'Data output location' field set to 'C:\DAMS\DataDump\Mylogfile.bt' with a 'Change' button, and a 'Start' button. A 'Measurement Status' box shows 'Idle'.

### Source Coordinate List

Specify a list of source position coordinates from which an entire AZ/EL scan (using the primary positioner) will be made for each pair of coordinates

### Remote File Trigger

In this mode, the software will monitor the file located at C:\dams\command.txt. When the value in this file changes to a 1, the software will move the source positioner to the coordinate located in C:\DAMS\auxcoord.txt and will perform an AZ/EL scan. **Note: Here the coordinate list file is NOT used!**

### Data Output Location

Select a working directory where the log file will be located. The directory where the log file is located is also where all data files will be saved. As noted earlier, a file for each AZ/EL position will be made containing all frequency information for that position.

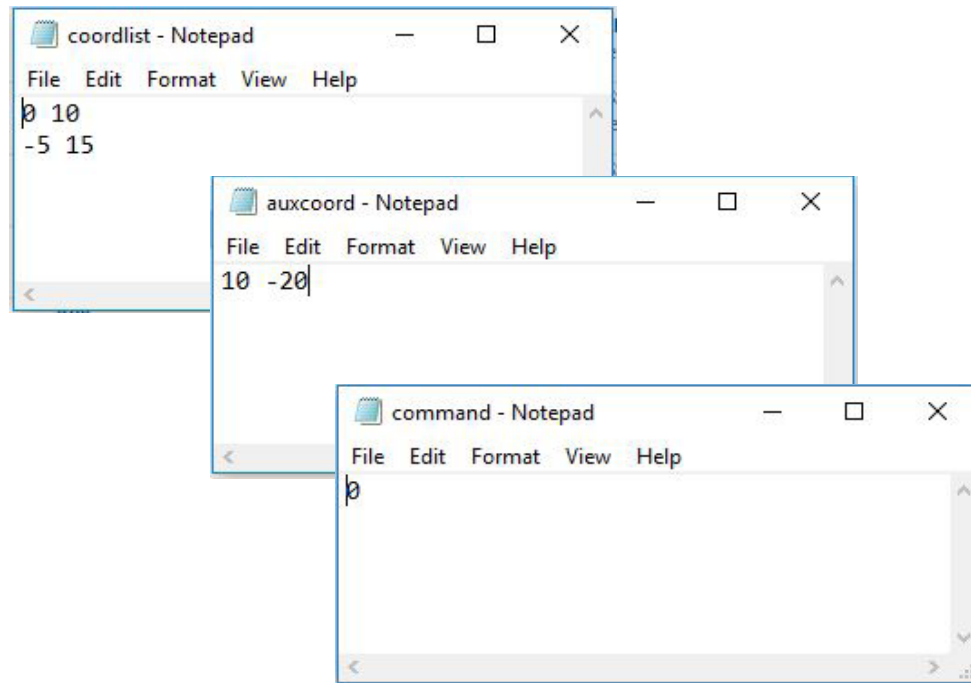
### Status

Displays the current operation being performed.

# Automation Module - File Information

## File Format and Info

The automation module uses various files for operation. The examples below show the expected format and convention for automation files. If the DAMS software cannot read or find the files below, a new file will be created with default values.



### **C:\DAMS\coordlist.txt**

Each row is a pair of tab delimited coordinates - the format is AZ / EL.

### **C:\DAMS\auxcoord.txt**

When using file trigger mode, the software will move the source or AUX positioner to this value. Write destination coordinates here BEFORE changing command.txt.

### **C:\DAMS\command.txt**

When File trigger is enabled and the start button is pressed, the software will read this file once every 0.5 seconds. If the value has changed from a 0 to a 1 the software will begin the measurement sequence. When the sequence is completed, the software will change the value back to 0 so that the source coordinates may be adjusted before beginning the next measurement.

# Automation Module - Exported File Format

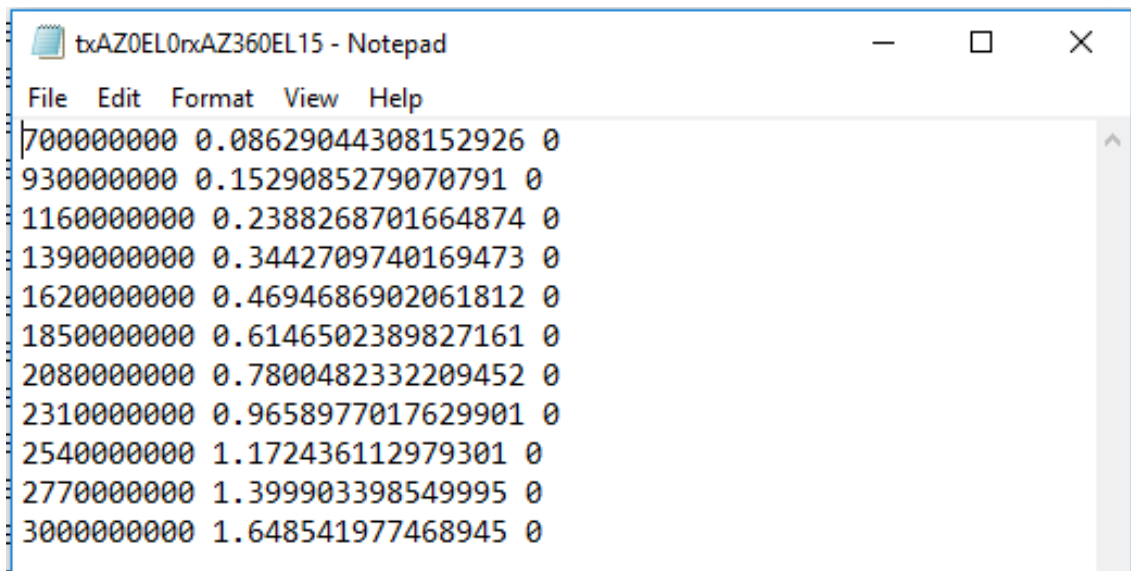
## Individual Coordinate Files

The automation module is designed to save the data directly to the disk instead of being plottable within the DAMS Software, this is because the DAMS software has a ~500K point limit and these measurements can easily exceed that value.

This PC > OS (C:) > DAMS > DataDump

Name	Date modified	Type	Size
txAZ0EL0rxAZ360EL15	3/10/2019 4:59 PM	Text Document	1 KB
txAZ0EL0rxAZ270EL15	3/10/2019 4:59 PM	Text Document	1 KB
txAZ0EL0rxAZ315EL15	3/10/2019 4:59 PM	Text Document	1 KB
txAZ0EL0rxAZ180EL15	3/10/2019 4:59 PM	Text Document	1 KB
txAZ0EL0rxAZ225EL15	3/10/2019 4:59 PM	Text Document	1 KB
txAZ0EL0rxAZ90EL15	3/10/2019 4:59 PM	Text Document	1 KB
txAZ0EL0rxAZ135EL15	3/10/2019 4:59 PM	Text Document	1 KB
txAZ0EL0rxAZ0EL15	3/10/2019 4:59 PM	Text Document	1 KB
txAZ0EL0rxAZ45EL15	3/10/2019 4:59 PM	Text Document	1 KB

**C:\DAMS\coordlist.txt** - Each row is a pair of tab delimited coordinates - the format is AZ EL



```
File Edit Format View Help
700000000 0.08629044308152926 0
930000000 0.1529085279070791 0
1160000000 0.2388268701664874 0
1390000000 0.3442709740169473 0
1620000000 0.4694686902061812 0
1850000000 0.6146502389827161 0
2080000000 0.7800482332209452 0
2310000000 0.9658977017629901 0
2540000000 1.172436112979301 0
2770000000 1.399903398549995 0
3000000000 1.648541977468945 0
```

### Exported File Contents:-

Format space/tab delimited:

(Frequency(Hz)) (Linear Magnitude) (Phase)

## Detailed Motor and Axis Specifications

## Default Settings

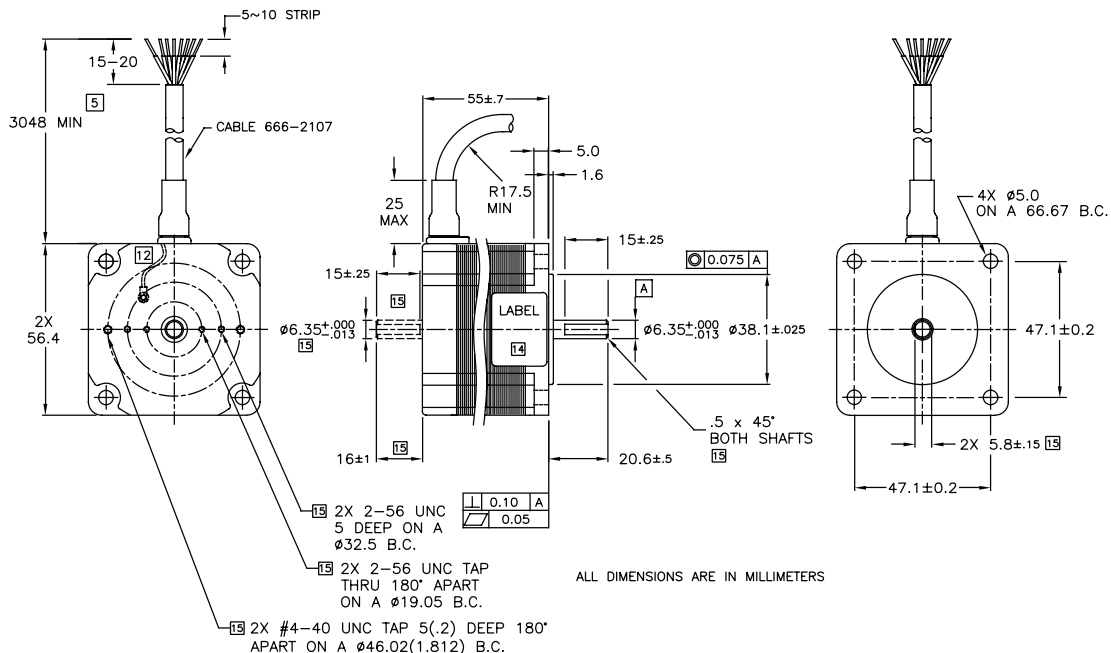
The settings below are recommended speed settings for quiet and efficient movement, ultimately custom settings will be used based on DUT characteristics The values below are for the LC4x series controllers, some adjustment may be necessary for other model controllers

## X and Y Axis

<b>Gear Ratio</b>	72:1
<b>Motor Resolution</b>	1.8 Degree
<b>Step Mode</b>	1/16th step
<b>Motor Current</b>	1.1 Amps
<b>Holding Current</b>	0.44 Amps
<b>Start Speed</b>	1,000 steps per second
<b>End Speed</b>	Up to 10,000 steps per second
<b>Slope</b>	Rate of acceleration from start to end speed
<b>Home Sensor Operation</b>	Normally Closed (ACTIVE HIGH)

*LC4C specific controller commands with above Motor Current / Hold settings*

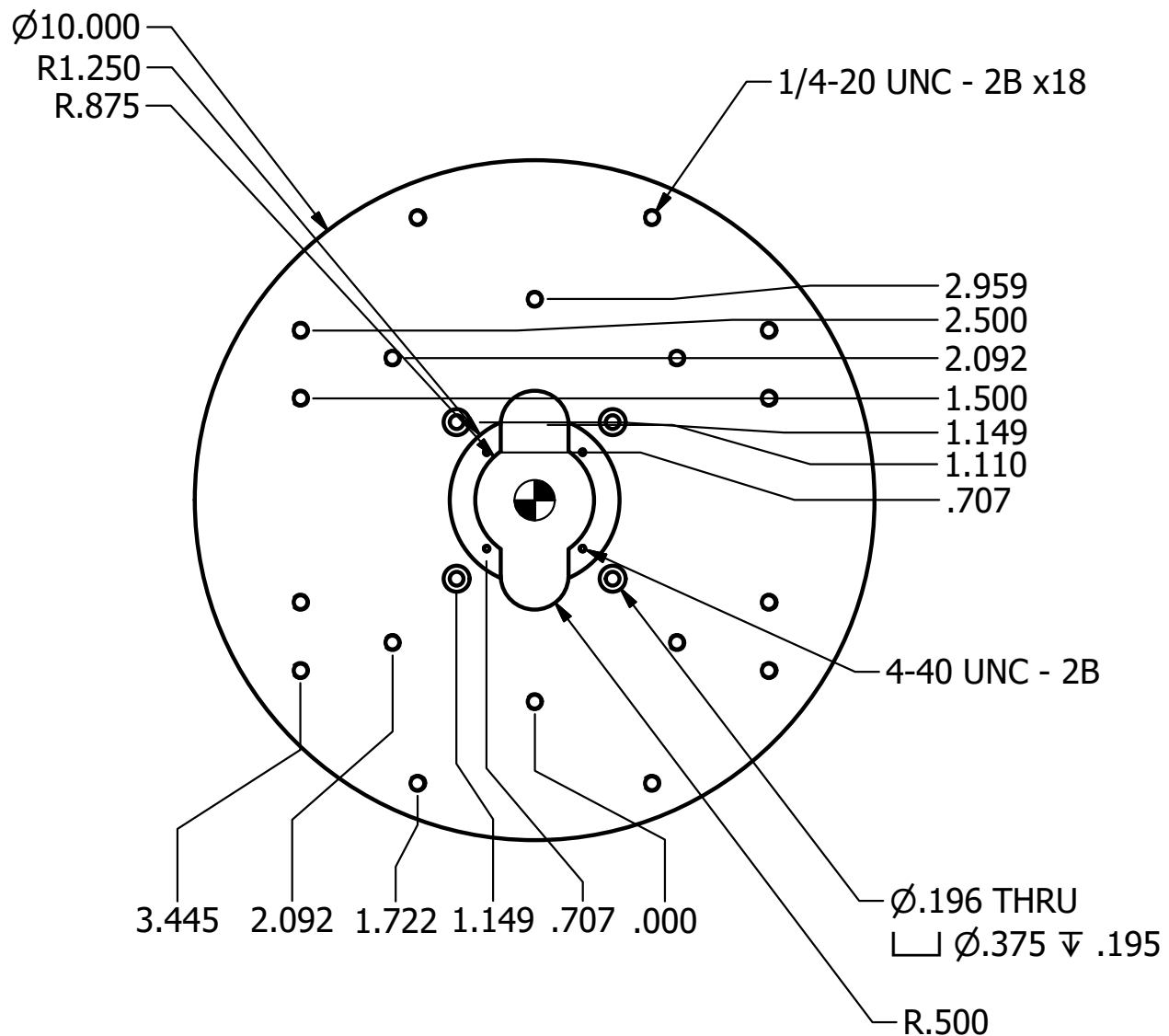
**Current Setting** w/Holding Current: P200,75,10  
**Current Setting** w/o Holding Current: P200,0,10  
**Step Mode:** H4



# Mounting Plate Drawing

## Azimuth Plate Mounting Holes

The AUT mounting plate offers a number of holes for mounting custom AUT Fixtures, use the drawing below for hole spacing and thread sizes. If a digital version of the drawing is needed (DXF, STEP, STL) please contact Diamond Engineering support. Custom plates available for an additional cost.

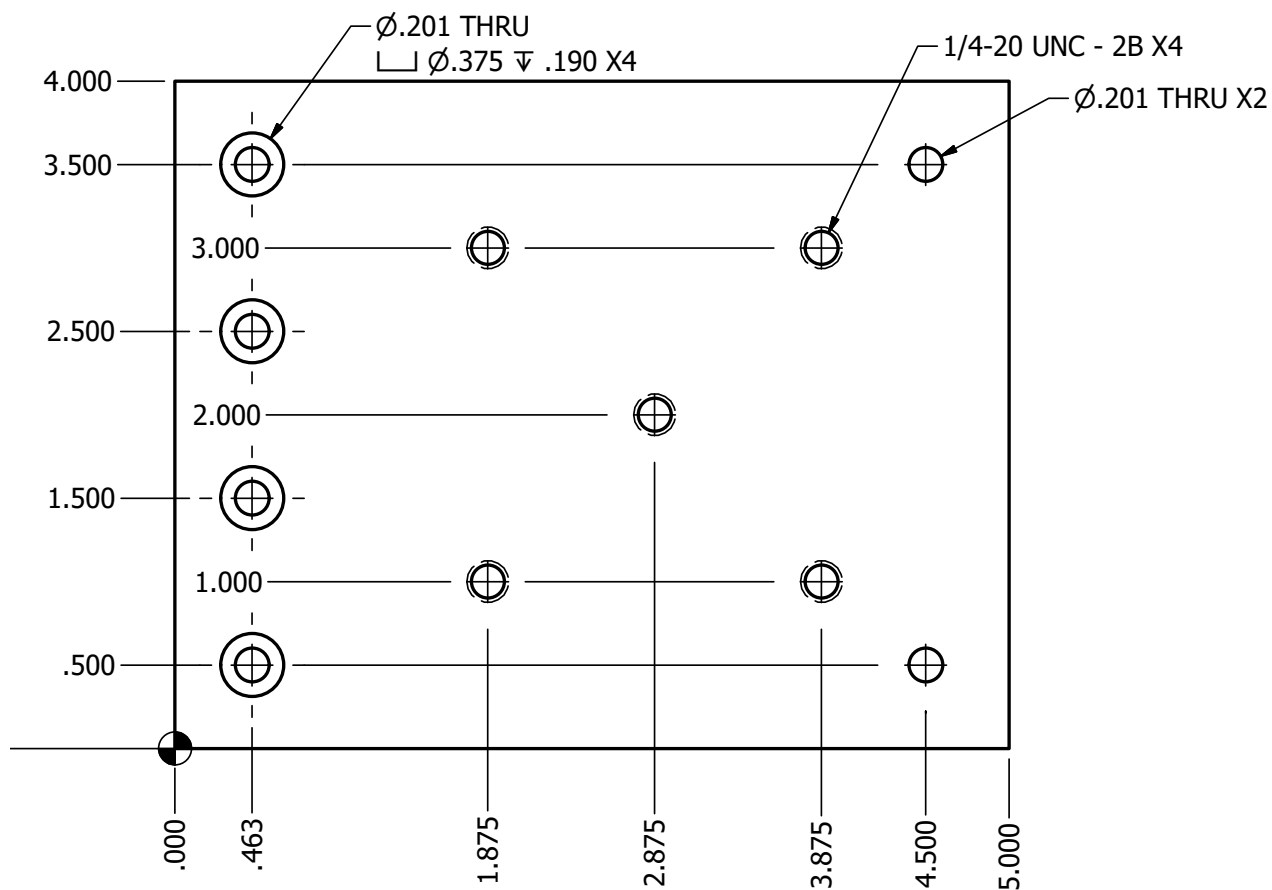




# Mounting Plate Drawing

## Elevation (AUT) Mounting Holes

The upper L-shaped mount has a number of holes to facilitate the mounting of the mmW VNA Extenders or your desired piece of equipment, refer to the drawing below for mounting hole dimensions. Custom mounts available for an additional cost.

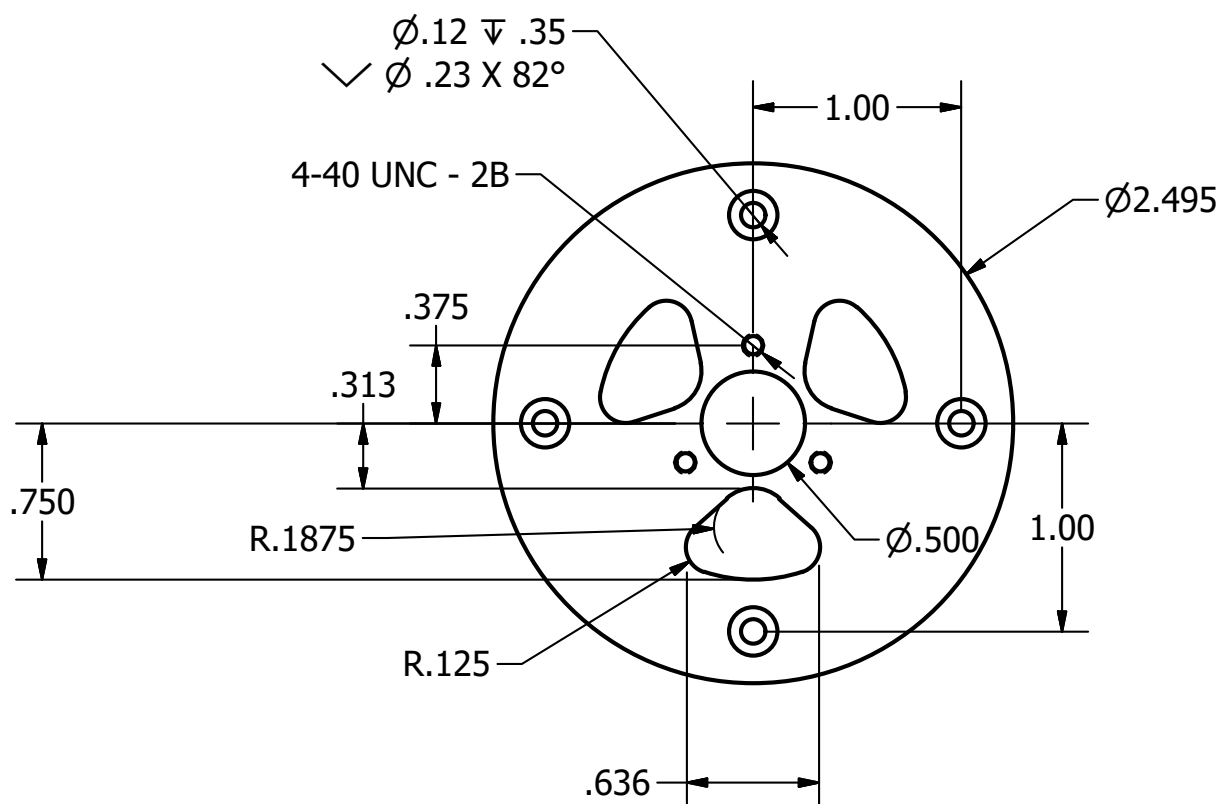




# Adapter Plates

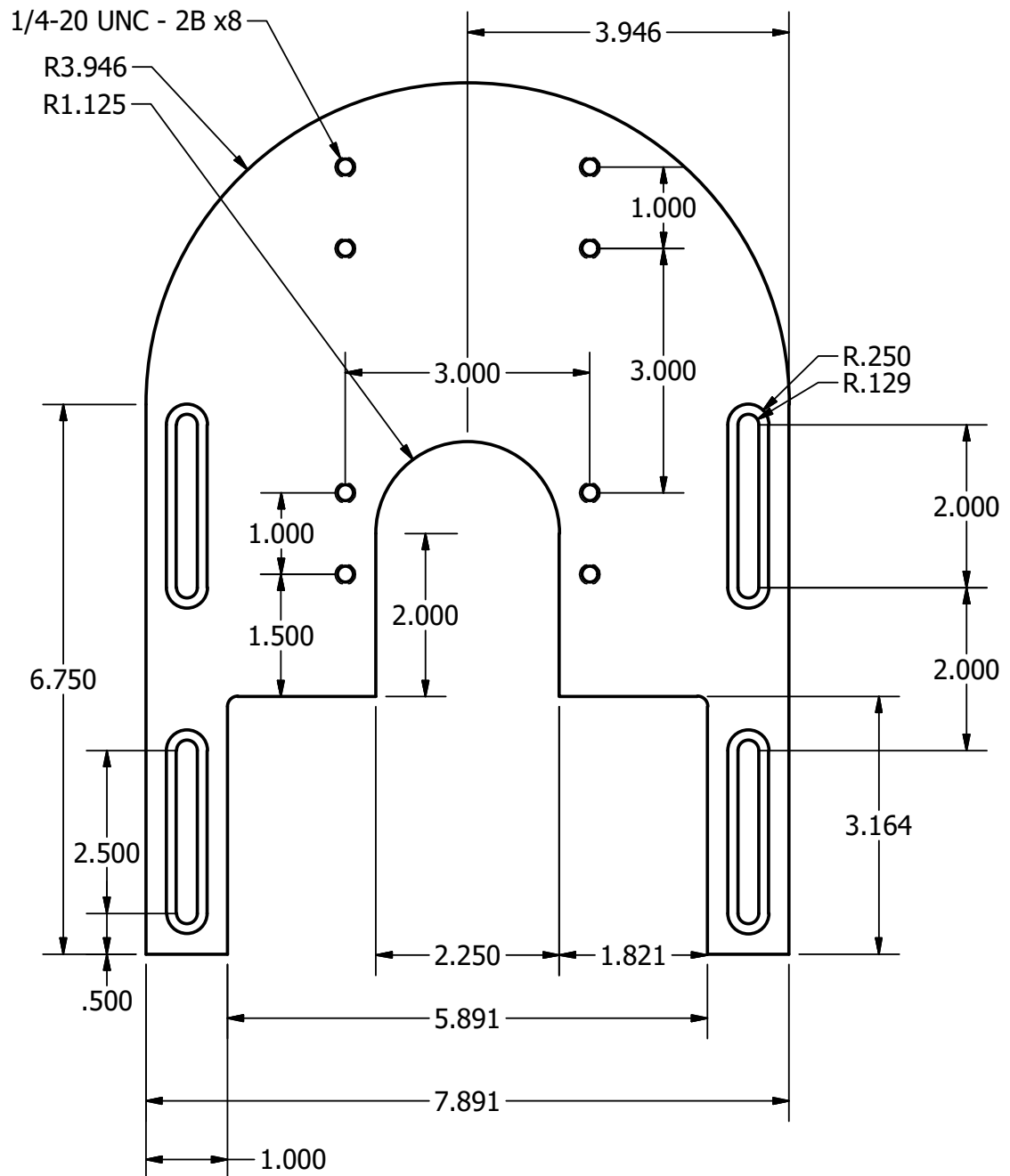
## Rotary Joint Adapter Plate

Two are included with your system. They measure 2.48" in diameter, constructed of 0.12 thick 6061 aluminum. Custom plates available for an additional cost.



## Horseshoe Adapter Plate

This plate includes slots to allow for positioning fine-tuning. It is 3/8" thick 6061 aluminum and includes various hole arrays. Custom plates are available upon request for additional cost.

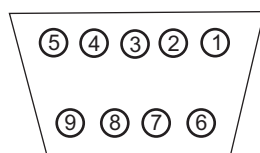


# Controller Pinout

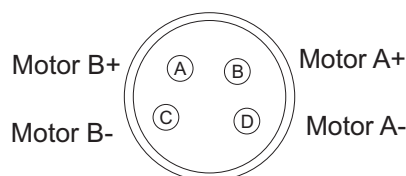
## Controller Pinout (OPT 20. Axis IO)

Your controller includes "Option-20", which provides an Axis I/O connector with access to Home, Limit, User, and Sink functions. The diagram below shows all of the pin connections as well as their internal connection points.

### DAMS Controller Pinout w/Option 20



DB9 - Female



4 Pin F "Pico" series

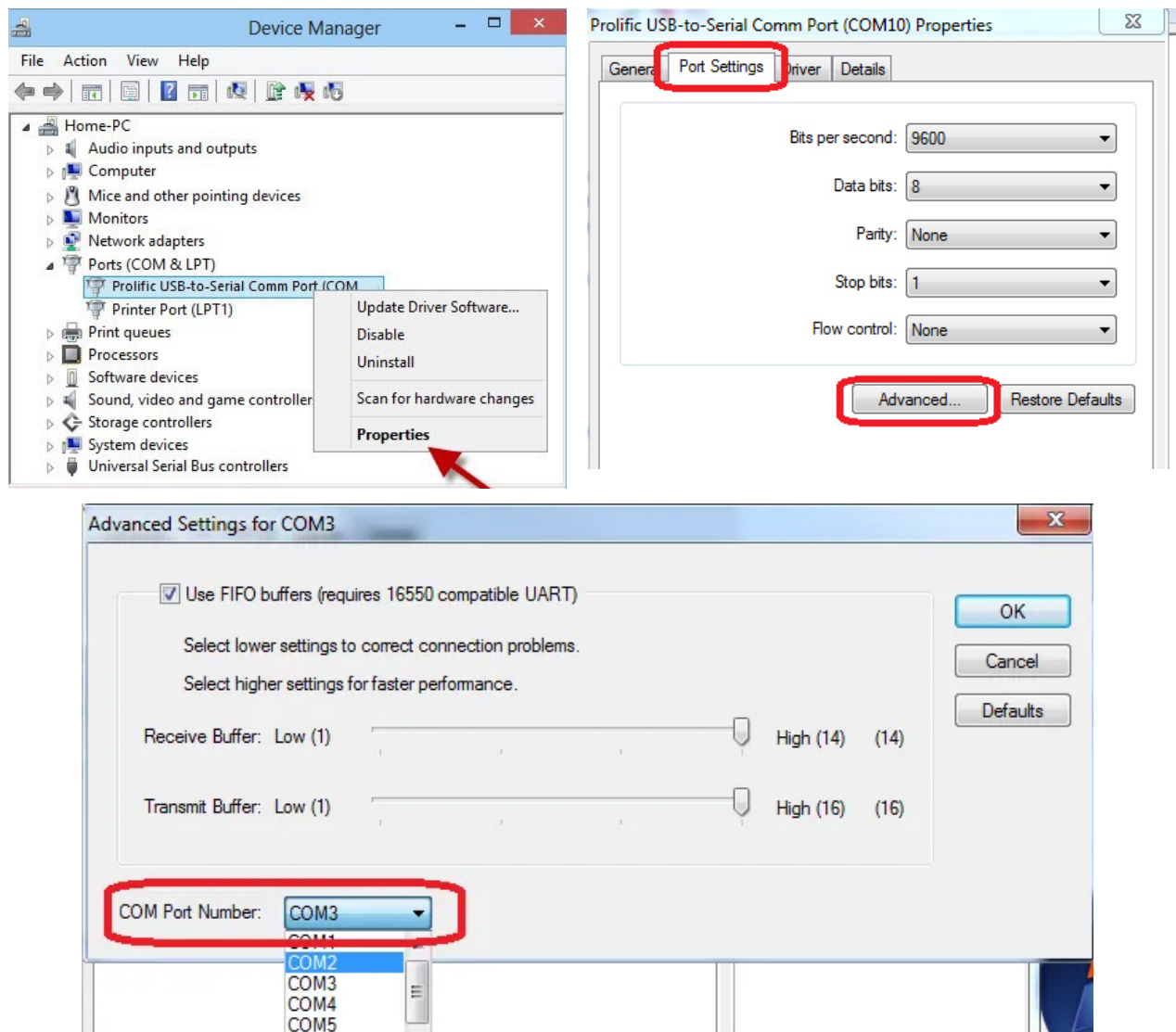
Description	DB9 Pin
5v 30ma	1
Home In	2
Home Ground	3
Limit In	4
Ground	5
User I/O 1	6
Ground	7
500ma MosFET Sink	8
24V Supply	9

# Adjusting COM Port

## Change COM Port

Our software has a COM port limitation which does not allow it to communicate to COM ports greater than 8. If you find your controller and it's assigned to, say, COM 9, please follow the steps below to adjust this.

Start → Control Panel → Device Manager → Expand Ports (COM & LPT) → Right click controller → Properties → Port Settings Tab → Advanced → COM Port Number



# Troubleshooting and Support

## Analyzer Connectivity

The Network Analyzer is connected to the PC using a USB-GPIB Adapter or Ethernet Cable. When there are connectivity issues please check the following.

### Checking Connectivity in Agilent Connection Expert (FOR TCP/IP and GPIB)

1. Check all cables between equipment and PC, ensure all equipment is turned on
2. Look on the USB to GPIB adapter, is the green "READY" light illuminated?
3. On the PC, open the "Agilent Connection Expert" this can be accessed by right clicking the IO Icon located near the system clock.
4. Is the GPIB Adapter and Agilent PNA shown? Do they all have green check marks next to them?
5. If one of the devices is not showing a green check mark, try restarting the instrument, additionally the USB GPIB adapter can be directly connected to the instrument GPIB connection to verify there are no issues with the GPIB cable. Any time the connection is changed you must press the "REFRESH" button in the Agilent connection expert to re-find the instruments.

### If connection expert shows as OK but you are still having connection problems.

1. In the connection expert, note the GPIB Addresses of all instruments
2. Open Start → Programs → Agilent → Vee Pro Runtime → IO Configuration
3. Ensure the GPIB addresses match those shown in the Connection Expert

## Contacting Diamond Engineering

We're happy to assist you! If possible, take screenshots of any errors and provide any details that may be helpful in resolving your issue.



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