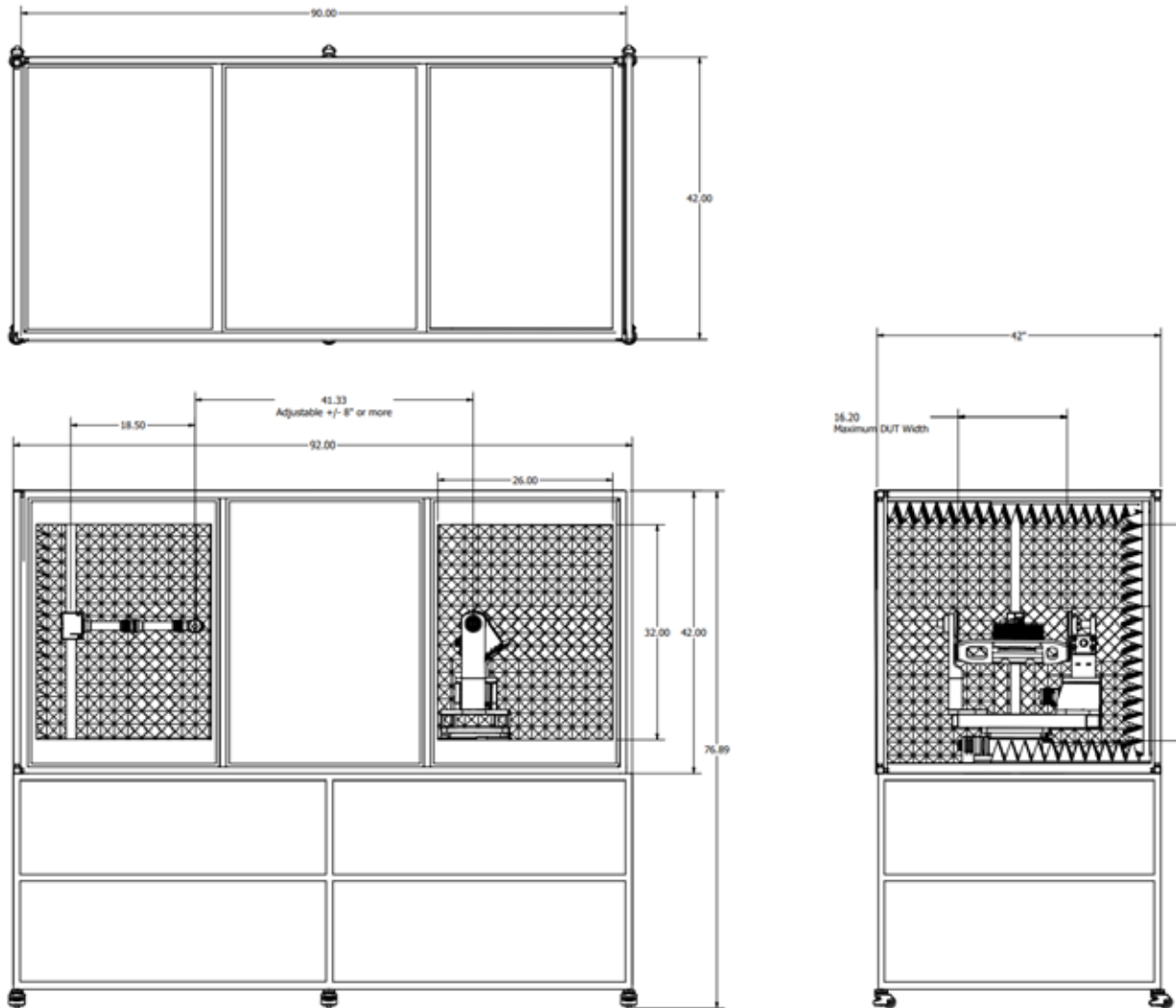




Diamond Engineering

Automated Measurement Systems

Installation and Configuration Guide



PC-9042-NS Portable Anechoic Chamber with positioner



Diamond Engineering

Automated Measurement Systems

Congratulations on your purchase!

Diamond Engineering's measurement and positioning systems have been designed to aid in the testing and development of small to medium sized antennas and radiating devices. 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 new positioner. 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

Table of Contents

| | |
|---|----|
| PC-9042 Portable Chamber - Introduction..... | 7 |
| Unpacking and moving the Chamber..... | 9 |
| Mounting Gimbal to Turntable | 10 |
| Connecting Chamber Halves | 11 |
| Mounting The Controller Base (<i>for self-install units only</i>) | 12 |
| Connecting the Cables..... | 13 |
| RF Feedthrus / LED light switch..... | 14 |
| DUT Mounting Options (Column) | 15 |
| DUT Mounting (Gimbal) | 16 |
| Fans & Lights..... | 17 |
| Optional Rotary Joint Adapter Plates..... | 18 |
| Miscellaneous Notes..... | 19 |
| DAMS Software Installation | 20 |
| DAMS Software Configuration | 21 |
| Single / Primary Positioner Control | 22 |
| Detailed Motor and Axis Specifications..... | 23 |
| General System Specifications..... | 24 |
| Part Drawing: Turntable Mounting Hole Pattern..... | 26 |
| Part Drawing: Turntable Plate Mounting Hole Pattern..... | 27 |
| Part Drawing: Gimbal Mounting Plate Drawing..... | 28 |
| Troubleshooting and Support..... | 29 |



Diamond Engineering

Automated Measurement Systems

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PC-9042 Portable Chamber - Introduction

Overview

The PC-9042 is a 90" x 42" x 42" Portable chamber with integrated positioner for testing devices up to 20 pounds. The chamber has a unique three-section design allowing it to split apart and easily moved through standard office doors. The chamber also features an integrated stationary antenna mast with adjustable Y- and Z-axis positions.

Shipment Contents

- PC-9042 Compact Chamber
- Pre-mounted DC-202 and control cables
- Separately packaged pre-assembled DC-202 gimbal (mounted after unpacking)
- 3-axis controller (2 + 1 Spare)
- 24V 5A DC power supply with line cord
- 6-foot serial cable
- USB to serial adapter
- Tools (allen wrench set and laser level)
- Setup guide and USB resource drive
- DAMS Antenna Measurement Studio software with license Key
- Python control module
- **OPTIONAL:** Rotary Joint adapter plate
- **OPTIONAL:** SPDT Auto-Polarizer Switch

Unpacking and moving the Chamber

IMPORTANT - Follow all notes and information - it is extremely useful to have two people to facilitate the movement of the chamber when not in completely assembled form. The center section is shipped connected to one of the end pieces for added stability.

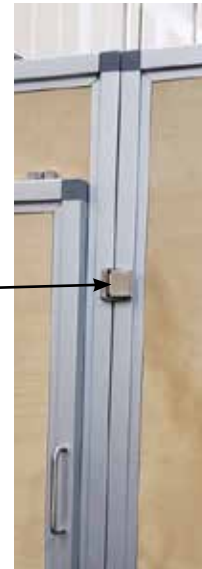
WHEN ROLLING CHAMBER SECTIONS, DO NOT LET WHEELS GET CAUGHT ON ANYTHING. LIFT OVER ANY LIPS OR UNEVEN STEPS.

Unpacking the Chamber

1. Cut Black Strapping and unwrap chamber sections, remove any boxes sitting below sections.
2. SINGLE HALF - Using two people (EST WEIGHT 160 LBS), lift the chamber from the corner supports and place onto floor.
3. DOUBLE HALF - Unclip the 8 draw clamps (two per top, bottom, sides) both sides should be relatively free.
4. Using two people (EST WEIGHT 120 pounds / 160 pounds), lift each chamber from the corner supports and place onto floor.



Draw Clamps



Caster wheels
MUST
be fully retracted
before moving!!



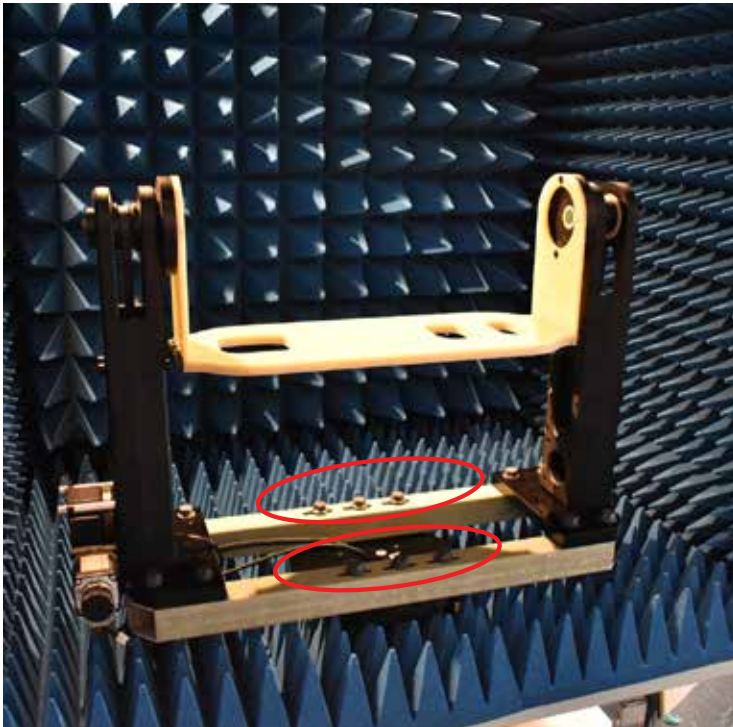
Support Blocks

Mounting Gimbal to Turntable

Assembly

1. It is easiest to install the gimbal before mating the chamber sections. Place gimbal onto turntable and hand thread the 6 fiberglass screws to secure the gimbal - (IMG A)
2. Using a 14mm or 9/16" Wrench, attach the gimbal to the turntable using the 6 included grey fiberglass bolts. **Only tighten 1/8" turn after they make contact!** (IMG B)
3. Connect the Encoder cable to the encoder mounted on the back of the step motor
4. Connect the Gimbal Motor using the 4 Pin connector. (IMG C)

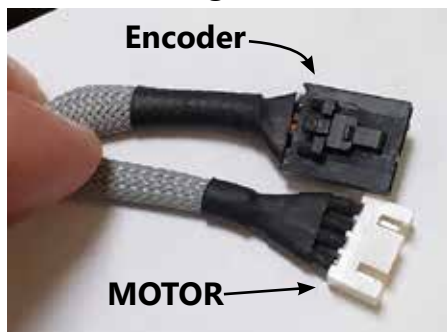
Img A



Img B



Img C



Connecting Chamber Halves

Assembly

1. Ensure chamber halves are free of cables or debris on the mating surfaces.
2. Line up chamber sections as shown, Use the 8 draw clamps circled below to connect each chamber section to one another.



Mounting The Controller Base *(for self-install units only)*

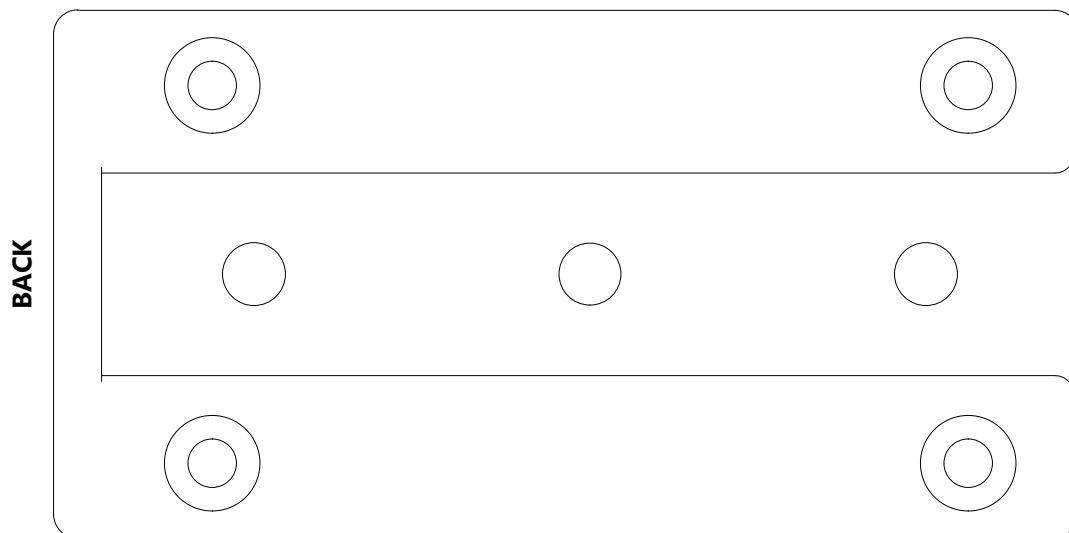
Installation

1. Mount the controller base in the desired location, utilizing the four screw holes which are sized for either #10 wood screws or M6 flathead machine screw.
2. A good location is either on the bottom of the chamber or the rear wall behind the positioner. Drill four separate 3/32" pilot holes, approximately 15mm in depth.

IMPORTANT: Do not drill into absorber!

3. If desired, tape included template (shown below) to the outside of the chamber. Be sure your desired installation location is within reach of the cables. Also be sure connectors are facing the cables.
4. Using the included screws, fasten the controller mount to the chamber with the "back" towards the control cables.
5. Now you can slide the controller all the way onto the mount. You will feel two clicks once it's fully locked into place.

Controller Base Plate Template



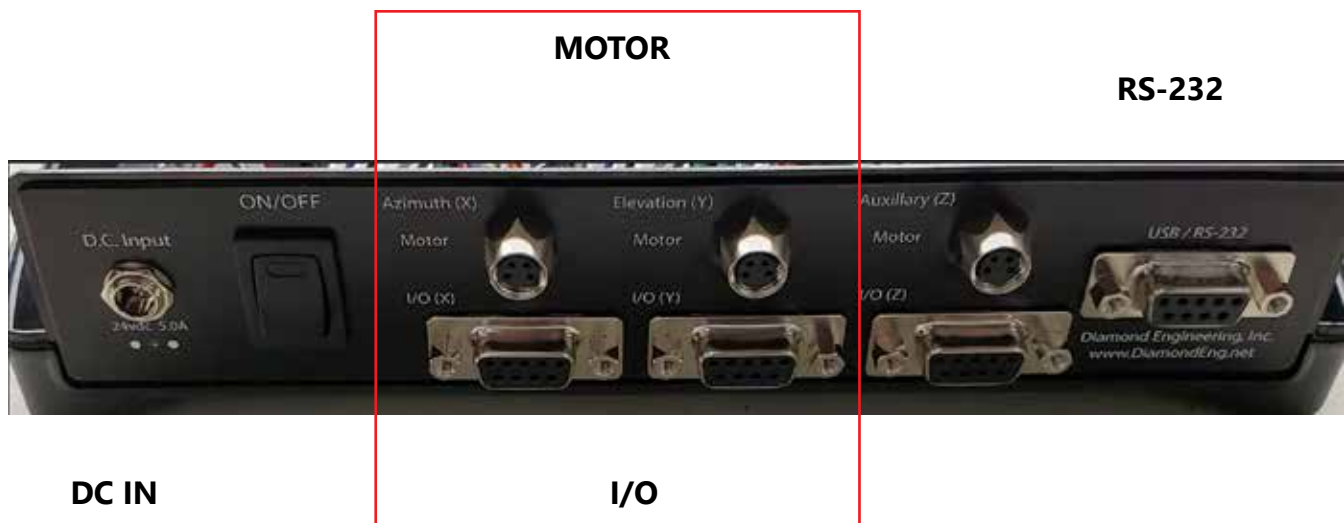
Connecting the Cables

Connecting to the DC202

1. The DC202 should have it's cables pre-connected from the factory
2. You will find the cables wrapped up under the chamber these will be connected to the motor controller.

Connecting to the Controller

1. Slide controller into bracket mounted on bottom of chamber
2. Connect motor cables by inserting into controller then turning small silver piece to secure them.
3. Connect black I/O cables D-DUB 15-pin connectors, tightening both retaining thumbscrews.
4. Connect 9-pin RS232 / serial connector and tighten retaining thumbscrews.
5. Repeat for both axes, ensuring wiring continuity between controller and positioner.



RF Feedthrus / LED light switch

RF Feedthrus

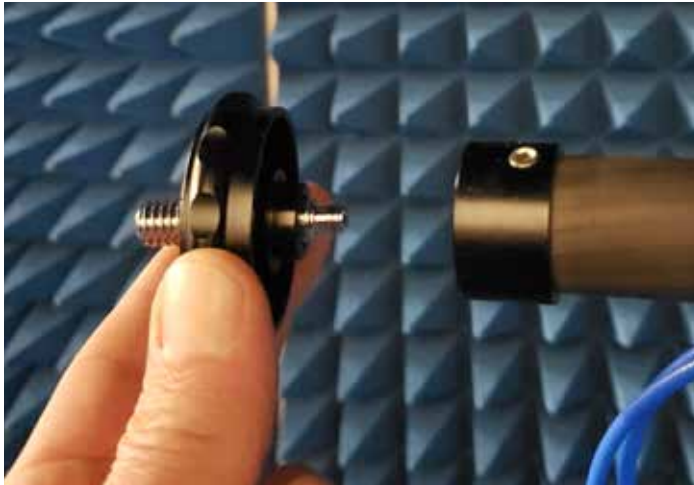
1. Two panels with 2.92mm feedthru connects are provided for easy connection to internal antennas or devices.
2. The Turntable side of the positioner also has a power switch for the internal LED Lighting.



DUT Mounting Options (Column)

Telescopic Column

The fiberglass mast includes at least one telescopic column that is for mounting your DUT. The face of this column includes a 3/8-16 threaded stud which can be removed and flipped to reveal a 1/4-20 threaded stud. Simply unscrew the cap, pull out stud and turn it around as shown in the photo below.

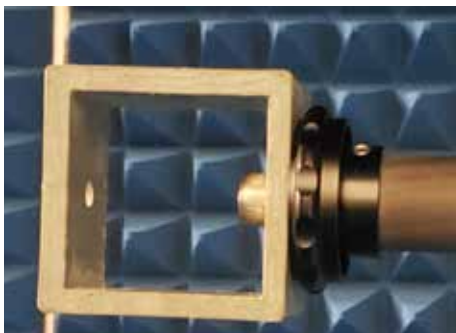


Alternatively, you can also attach a second telescopic column to extend the DUT closer to positioner.



Adapter for Stud or Threaded DUT

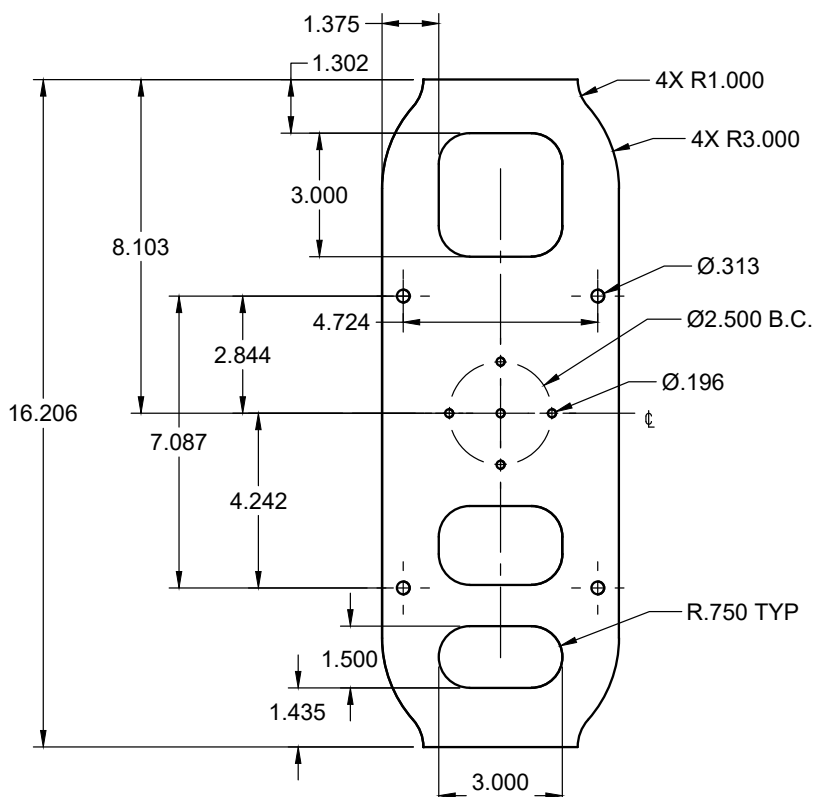
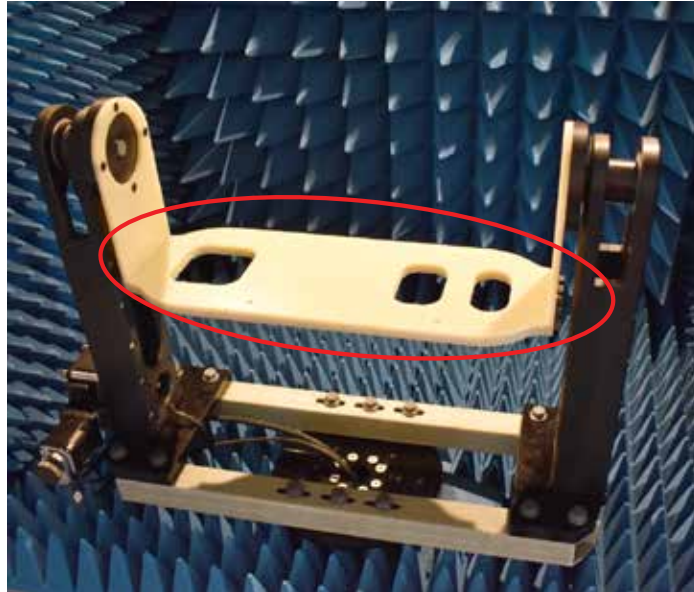
Some DUTs may have studs while others have a threaded hole, so we've included a fiberglass adapter with a screw that can be used to transition the studded end of the telescopic column to accommodate a DUT with up to a 1/4-20 threaded stud. To attach, remove the stud (pictured above) altogether and replace the cap. This will leave a 3/8-16 threaded hole. Using the included screw, attach the square fiberglass adapter. Insert your DUT with 1/4-20 stud and use a wing nut to secure it to this adapter.



DUT Mounting (Gimbal)

DUT Mounting

1. Various mounting holes exist in the gimbal plate for mounting of the AUT
2. Refer to the drawing below for exact dimensions and hole sizes



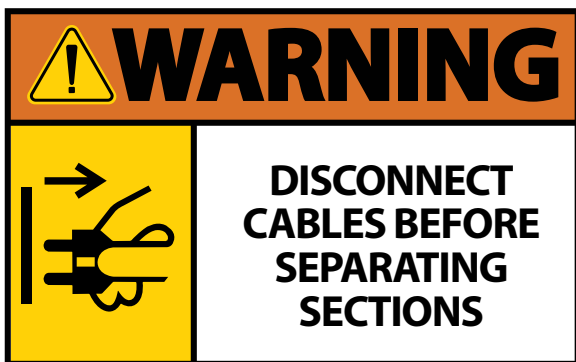
Fans & Lights

IMPORTANT:

EXERCISE CAUTION WITH FAN AND LIGHT WIRING WHEN SEPARATING SECTIONS

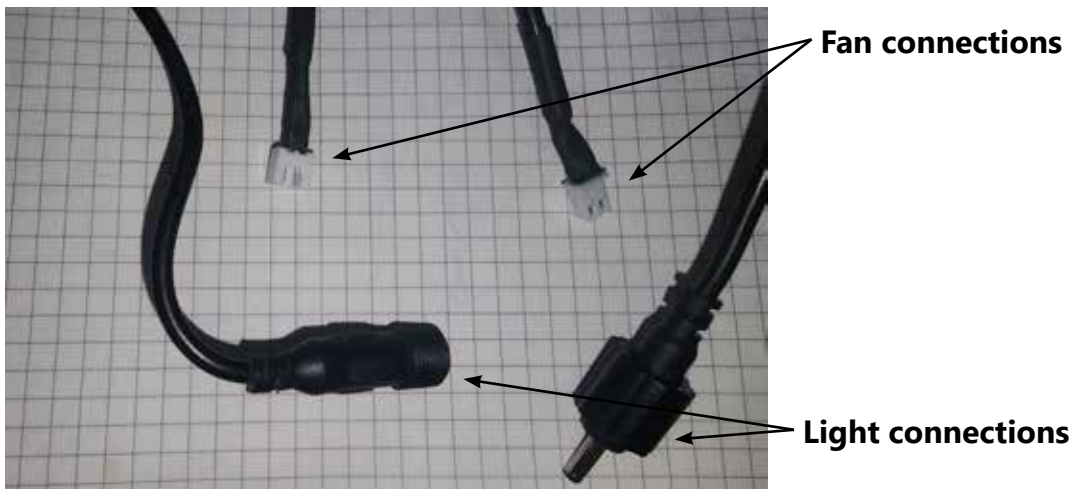
When separating the sections to move them independently, be very careful to disconnect the lights and fans first. The wires extend across all three sections. Under the middle section, the clips holding the wires in place allow the wire to be removed. **Be sure to remove the wires from these clips** if moving sections totally independent of one another.

That is what the warning label below is referring to:



Power Connections

The chamber sections are equipped with inter-linking lights and fans. The power for these is supplied via the power plug and routed under the chamber. Between two sections you'll find matching electrical housings that need to be connected. Connect the pair of electrical housings pictured below.



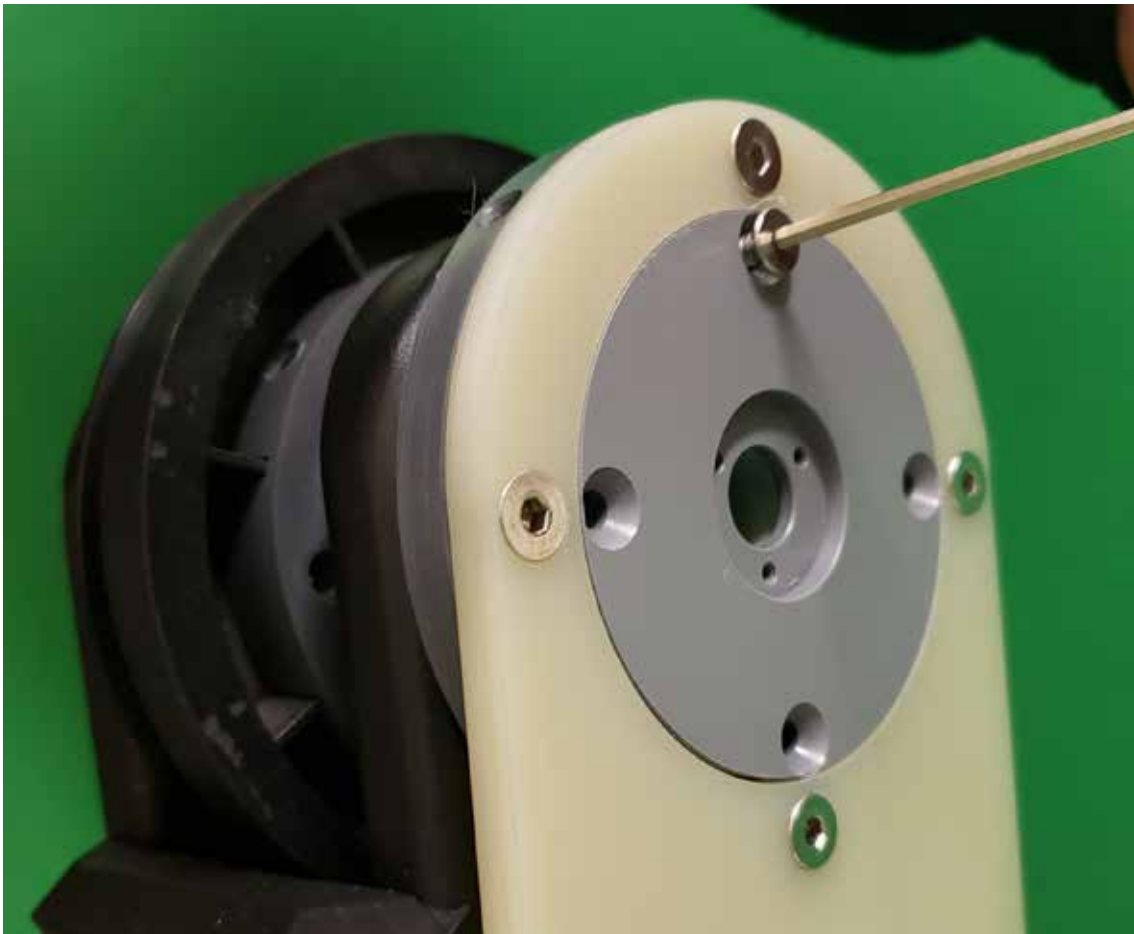
Optional Rotary Joint Adapter Plates

Installation of rotary joint plate *(only included with some systems)*

1. Fasten rotary joint to adapter plate before installing to positioner.
2. Pass RF Cable through center of gimbal hub.
3. Connect RF Cable to rotary joint using torque wrench.
4. Mount adapter plate to gimbal.

NOTE: Examine cable routing through turntable to ensure it has adequate room to flex with rotation of the turntable.

Gimbal rotary joint adapter plate installed



Miscellaneous Notes

Manual Control Knobs

Your system is equipped with two knobs which enable you to manually rotate each axis of the system. Be careful, as the labels warn you, do not turn when powered off or when under holding current. This can lead to incorrect positioning and/or other issues with the encoder. When the knobs are used while the machine is powered off, these movements obviously can not tracked by the software.

Gimbal (Phi) Manual Control Knob



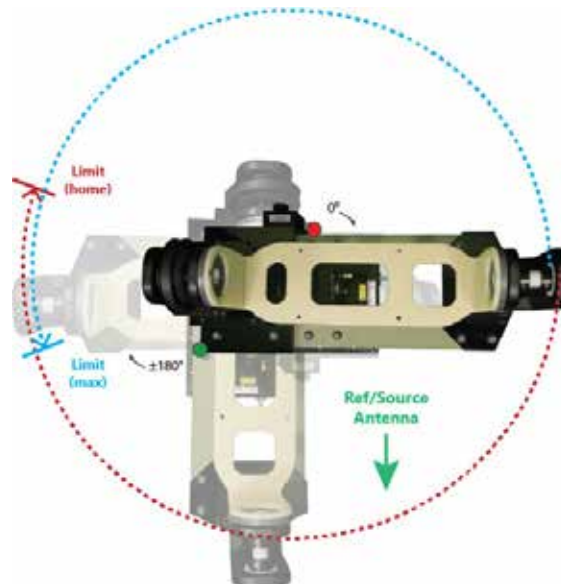
Turntable (Theta) Manual Control Knob



Limit Switches

Your DC202 turntable is equipped with limit switches which prevent the turntable positioner from over-rotating. Over-rotation will cause cables to wrap and destroy them.

The diagram below illustrates the +/- ~185 degree movement capable with the system
Note (DC402 shown below)



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

Positioner Configuration

X and Y Axis

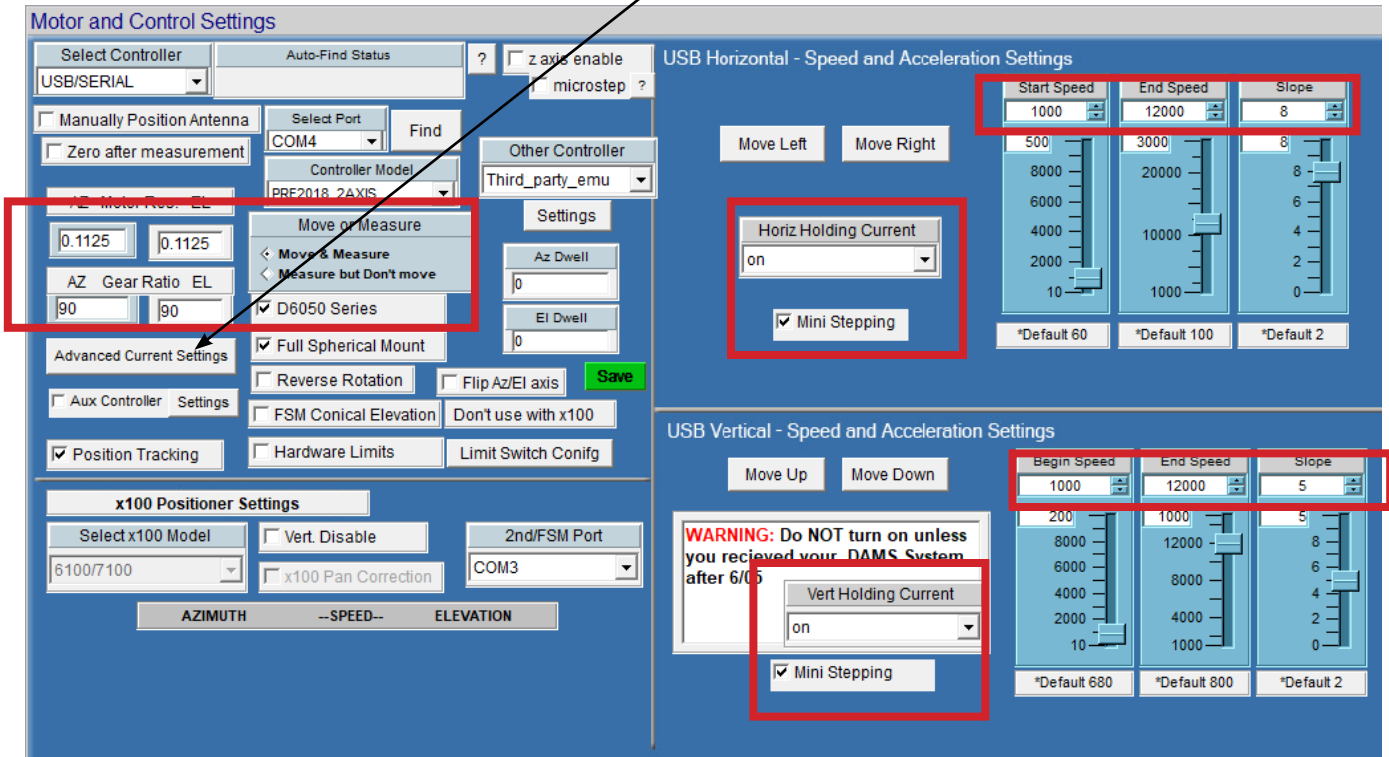
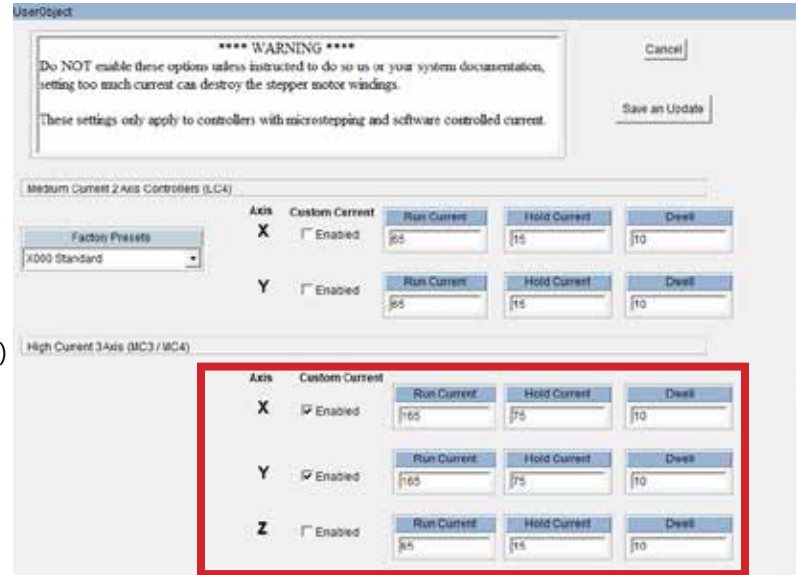
| | |
|-----------------------------|------------------------|
| Controller | USB/Serial |
| Gear Ratio | 90 |
| Motor Resolution | 0.1125 |
| Start Speed | 1000 |
| Stop Speed | 12000 |
| Slope | 8 |
| Holding Current | ON |
| Mini-Stepping | ON |
| Run Current | 160 (MC3B controllers) |
| Idle Current | 70 |
| Full Spherical Mount | Enabled |
| Position Tracking | Enabled |

MC3B specific controller commands with above Motor Current / Hold settings

Current Setting w/Holding Current: P160,75,10

Current Setting w/o Holding Current: P160,0,10

Step Mode: H4

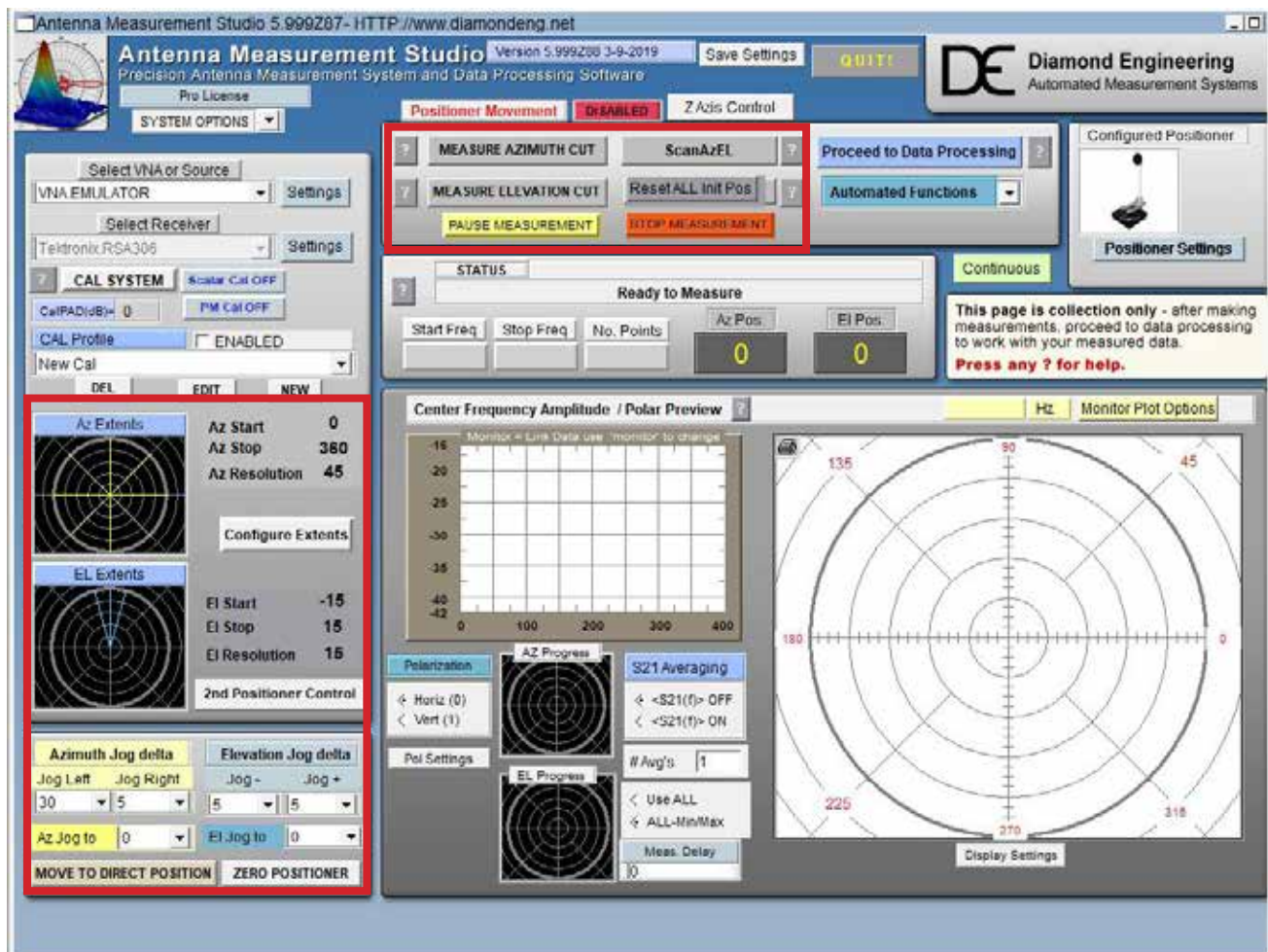


Single / Primary Positioner Control

Controlling the 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.



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 MCxx Series Controllers.

Turntable Axis

| | |
|---------------------------|--|
| Gear Ratio | 90 :1 |
| Motor Resolution | 1.8 Degree |
| Step Mode | 1/16th step or full step |
| Motor Current | 2.0 Amps Max |
| Holding Current | 0.44 Amps |
| Start Speed | 1,000 steps per second @ 1/16th step resolution) |
| End Speed | Up to 12000 steps per second |
| Slope | Rate of acceleration from start to end speed |
| Home /Limit Sensor | Normally Open |
| Encoder | Programmable Quadrature Incremental - 800 CPR |

MC3X specific controller commands with above Motor Current / Hold settings

Current Setting P3,165,75,10
Step Mode: H4

Gimbal Axis

| | |
|---------------------------|--|
| Gear Ratio | 90 :1 |
| Motor Resolution | 1.8 Degree |
| Step Mode | 1/16th step or full step |
| Motor Current | 2.0 Amps |
| Holding Current | 0.44 Amps |
| Start Speed | 1,000 steps per second @ 1/16th step resolution) |
| End Speed | Up to 12,000 steps per second |
| Slope | Rate of acceleration from start to end speed |
| Home /Limit Sensor | Normally Open |
| Encoder | Programmable Quadrature Incremental - 800 CPR |

MC3X specific controller commands with above Motor Current / Hold settings

Current Setting P3,165,75,10
Step Mode: H4

General System Specifications

General

Dimensions

| | |
|-------------------|---|
| Footprint: | 12" x 12" (304 mm x 304 mm) |
| Total Height: | 22.5" (571.5 mm) |
| Clearance Radius: | 18" (914 mm) clearance radius required for full 360° rotation |
| Total Weight: | 42 lbs (19 kg) |

Positioner

Turntable (theta)

| | |
|------------------------------------|---|
| Frequency Ranges (GHz): | n/a |
| Resolution: | 0.02° full step 0.00125° microstep |
| Drivetrain: | 2.0A/phase bipolar stepper motor with worm drive |
| Holding Torque: | 20 ft-lb |
| Movement Range: | 360° continuous or indexed |
| Position Feedback: | 800-line encoder |
| Limits: | Home & Limit (hardware & software) |
| Weight (positioner only): | 16 lbs (7.27 kg) |
| Positioner Max Speed: | 20° per second |
| AUT Mounting Options: ¹ | 3/8"-16 or M6 4-hole pattern for general mounting |
| Composition: | Acrylic turntable with aluminum base |
| Weight Capacity: | 50 lbs (45 kg) |
| RF Rotary Joint: | Optional (SMA, 2.92 mm, 2.4 mm, 1.85 mm or waveguide) |

Gimbal (elevation)

| | |
|------------------------------------|---|
| Frequency Ranges: | n/a |
| Resolution: | 0.02° full step 0.00125 microstep |
| Drivetrain: | 2.0A/phase bipolar stepper motor with belt drive |
| Holding Torque: | 20 ft-lb |
| Movement Range: | 360° continuous or indexed |
| Position Feedback: | 800-line Encoder |
| Limits: | Home (hardware & software) |
| Weight (gimbal only): | 15 lbs (11.7 kg) |
| Gimbal Max Speed: | 20° per second |
| AUT Mounting Options: ¹ | FR4 - Gimbal Tray |
| Composition: | Delrin, ABS, PLA+, fiberglass |
| Weight Capacity: | 20 lbs (18 kg) |
| RF Rotary Joint: | Optional (SMA, 2.92 mm, 2.4 mm, 1.85 mm or waveguide) |

¹ = Custom mounting solutions available upon request

Controller specifications on next page...

Controller

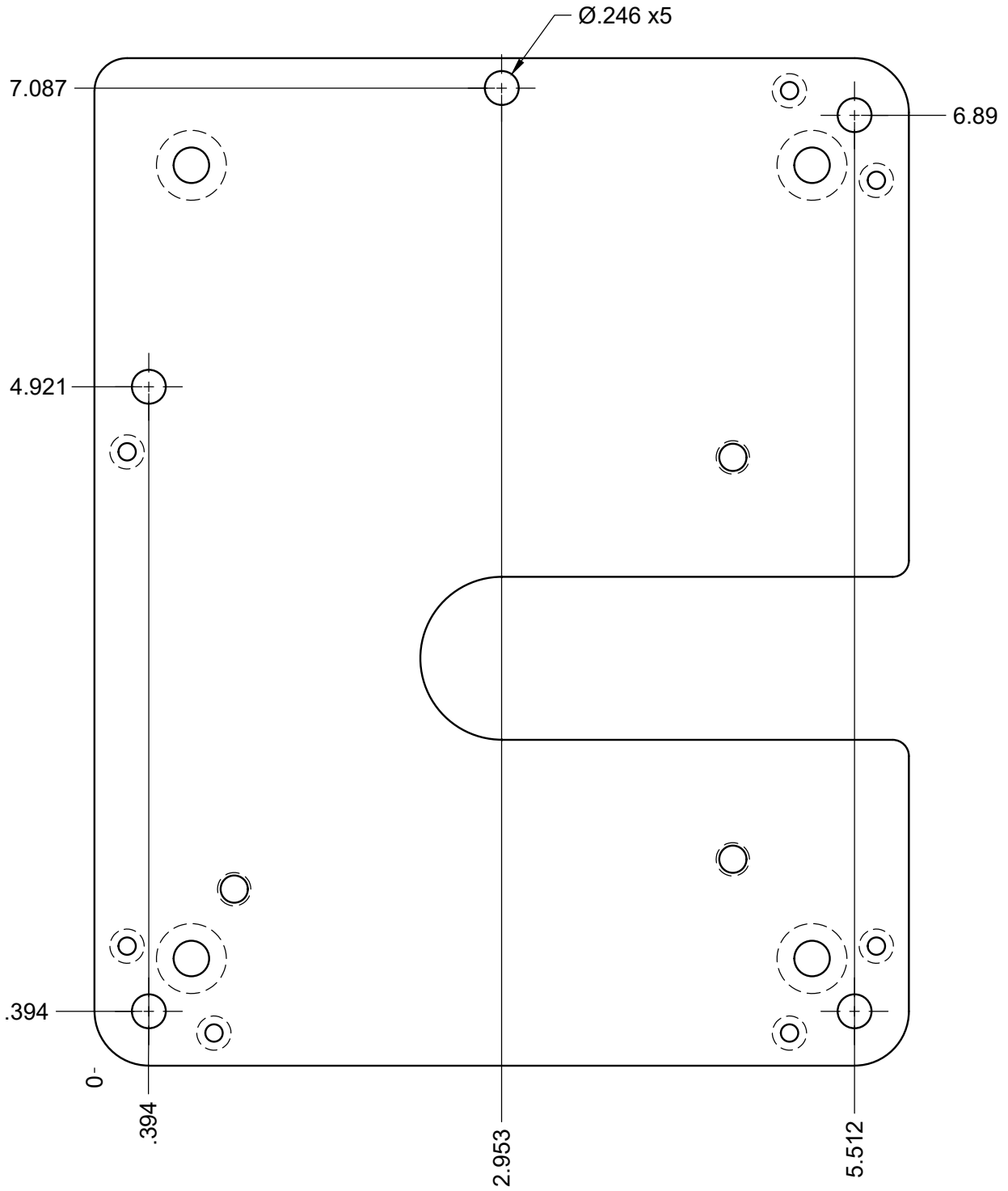
| | |
|-----------------------------|---|
| Controller type: | 3 axis microprocessor based controller |
| Resolution: | Full step through 1/32 microstep |
| Motor Current: | 3.125A per motor phase max |
| Cooling: | convection |
| Motor Connector: | M8 4 Pin + 15 Pin General IO / Encoder |
| Communication Interface: | DB9 RS232 serial port with external USB adapter |
| Communication cable length: | 1 meter |
| Input Voltage: | 24VDC 3A |
| Power Supply (included): | 24VDC 5A - 110/220v input |
| Motor cable length: | 1 meter |

Controller Pinout (DC3A-OPT30)

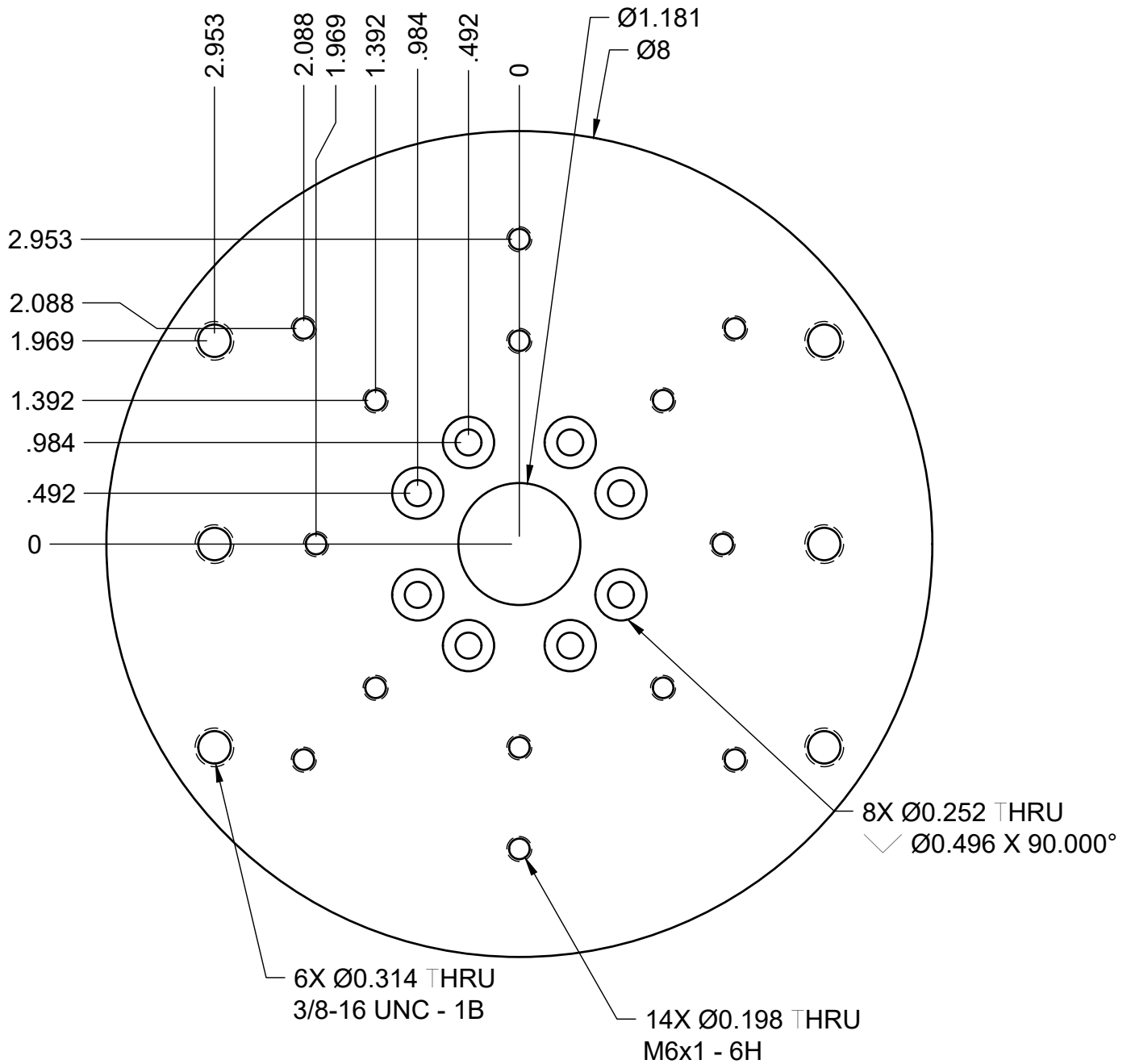
The DC3A-HC controller offers QTY2 2 - 3.125 amp stepper motor drivers, encoder and limit switch inputs

| <u>Description</u> | <u>DB15 Pinout</u> | <u>Controller Pinout</u> |
|--------------------|--------------------|--------------------------|
| 5v 30mA | 1 | J4-5 |
| Home In | 2 | J4-6 |
| Home Ground | 3 | J4-7 |
| Limit In | 4 | J4-3 |
| Ground | 5 | J4-4 |
| User I/O 1 | 6 | J6-1 |
| Ground | 7 | J6-2 |
| 500 mA MosFET Sink | 8 | J4-2 |
| 24V Supply | 9 | J4-1 |
| | 10 | |
| Encoder A | 11 | ENCx - 1 |
| Encoder B | 12 | ENCx - 2 |
| Index | 13 | ENCx - 3 |
| 5v | 14 | ENCx - 4 |
| Ground | 15 | ENCx - 5 |

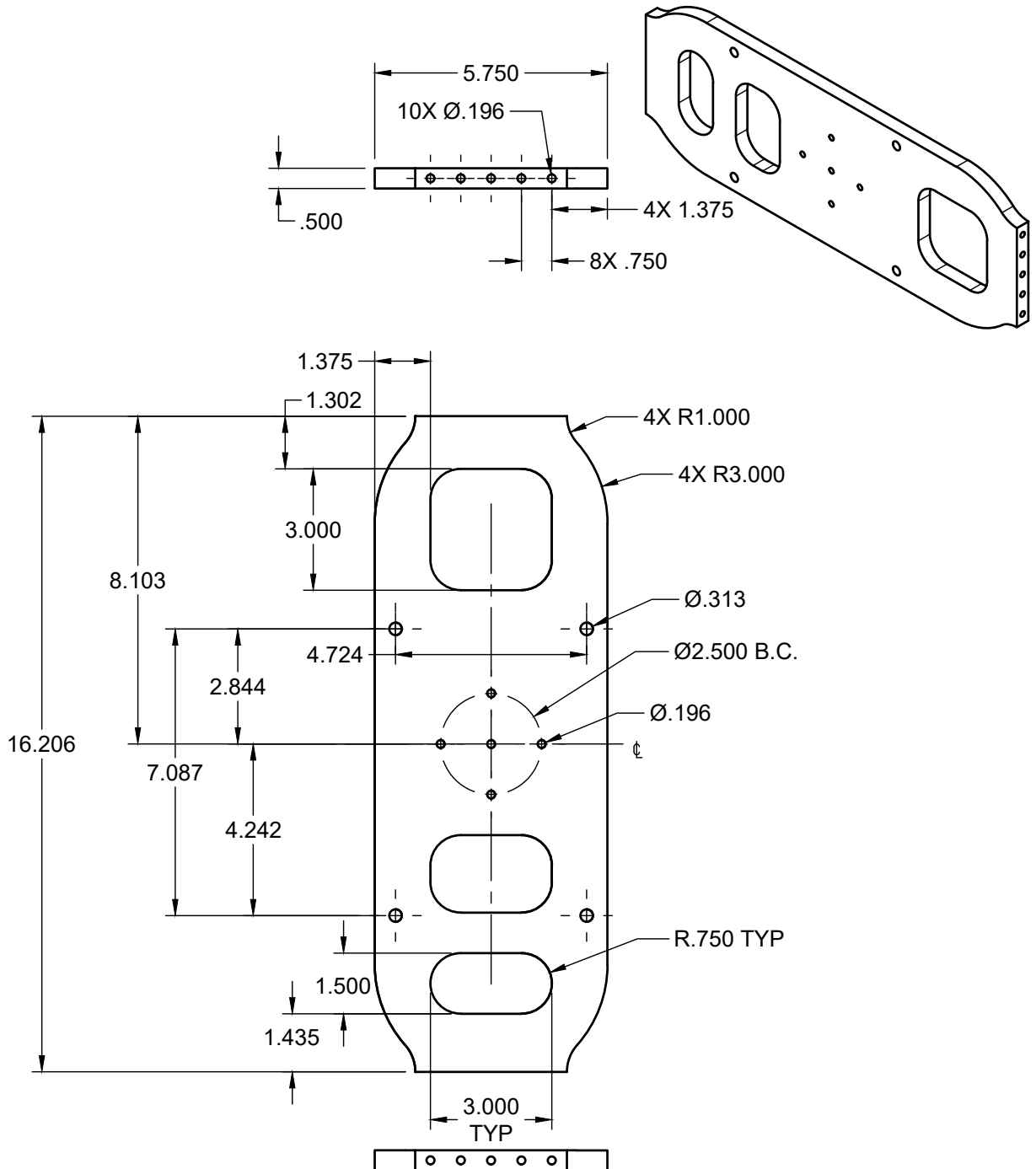
Part Drawing: Turntable Mounting Hole Pattern



Part Drawing: Turntable Plate Mounting Hole Pattern



Part Drawing: Gimbal Mounting Plate Drawing



Troubleshooting and Support

Contact Us

We're always happy to assist you! We encourage you to give us a call or send us an email. It's also very helpful if you're able to take screenshots or photographs of any errors/issues.

Please contact us at one of the methods below:

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