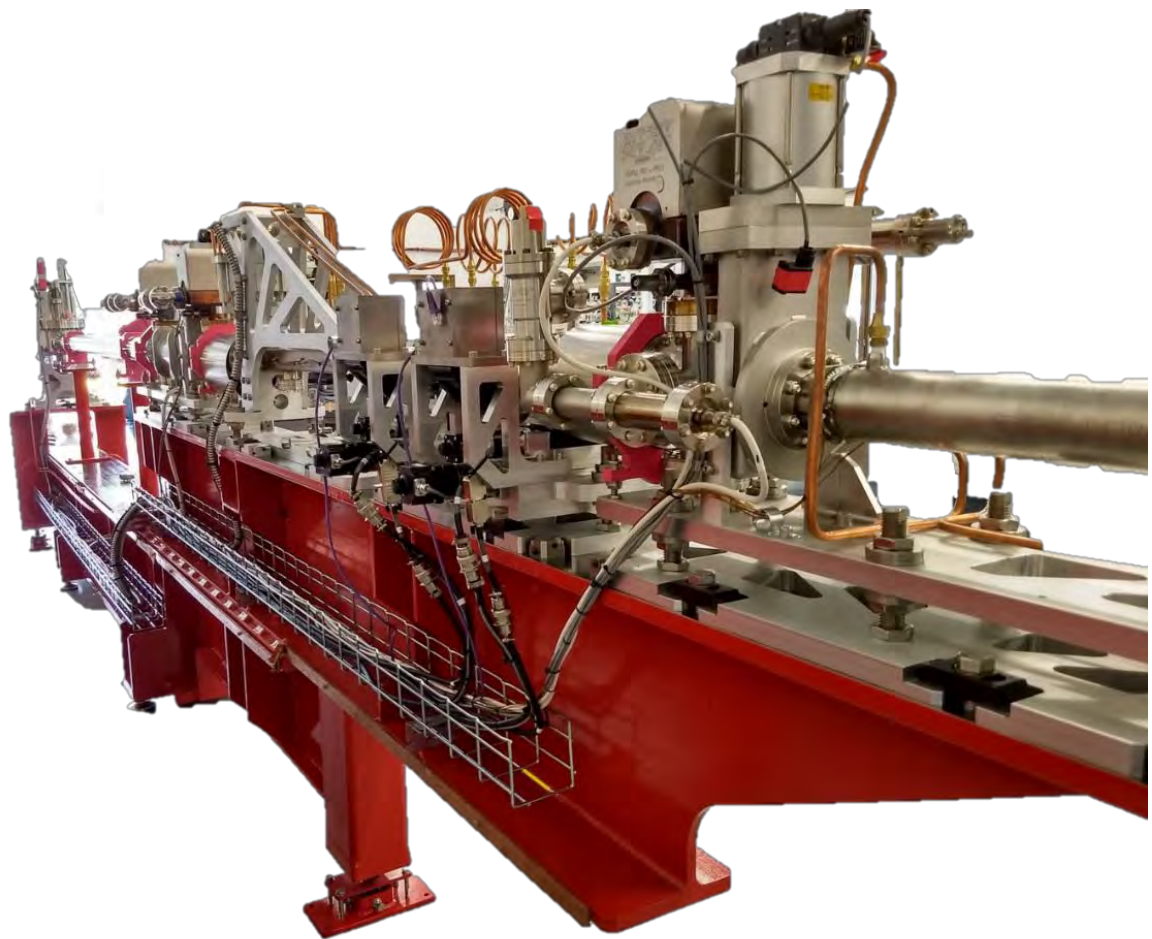


# Synchrotron Instrumentation

High Quality Systems for the Synchrotron Community



2019



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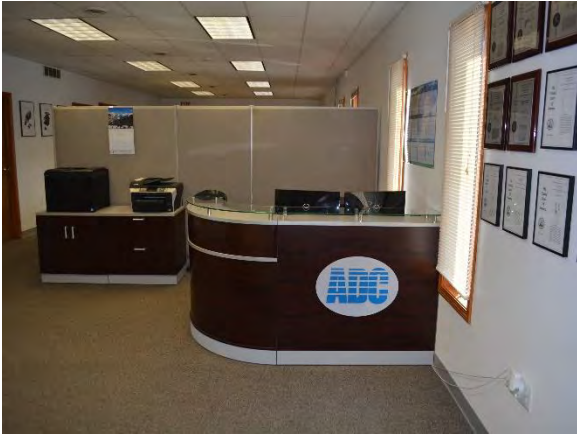
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## Company Overview

### ADC USA, Inc.

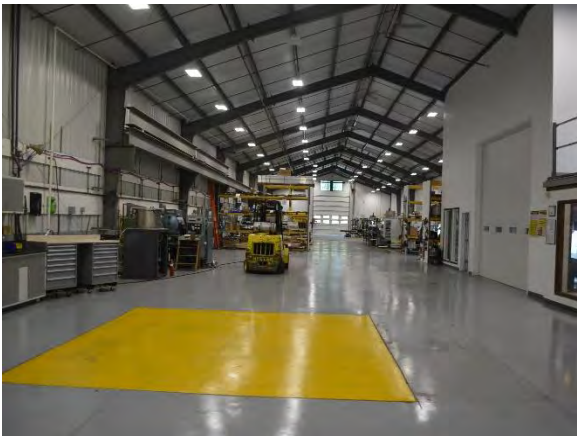
ADC USA, Inc. (ADC) is a leading developer and supplier of complex scientific components and instruments for large government laboratories and corporations around the world.



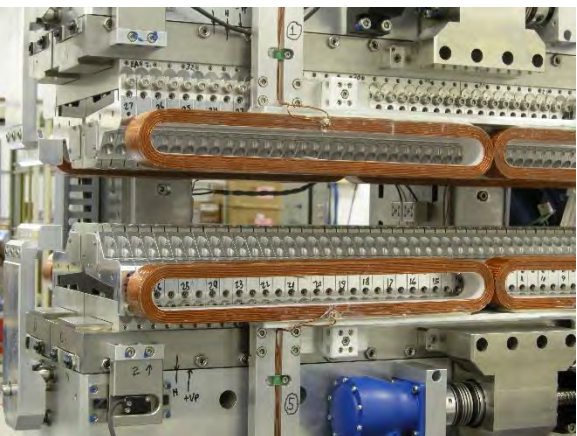
ADC, like many successful companies (and rock bands), got its start in a garage in 1995. Our garage was in Ithaca, NY on the shores of Cayuga Lake and home of Cornell University. ADC has since grown into a worldwide leader in the field of design and manufacturing of complex research instrumentation.

ADC provides machining systems and products to our diverse customers from structural metal fabrication to turn key design products with complex control systems.

We specialize in engineered experimental tables and beamline components.



ADC occupies over 22,000 square feet of space. This includes our in-house machine shop. We use precision equipment to verify each order and are committed to delivering precision machined parts. We are very proud of our shop and the capabilities we can offer because of our state-of-the-art precision CNC milling and CNC turning machines.



Our engineering department works closely with our customers to realize designs that meet their technical requirements. Through an iterative process, we have developed standard designs that can be optimally customized for each new project. Our engineers provide incisive trouble shooting and technical recommendations to our customers resulting in high performing cutting-edge instruments.

## Company History

ADC was incorporated in 1995 starting in a small office at Cornell Business and Technology Park. ADC established itself as a custom design manufacturing prime contractor. In 1995, ADC won its first contract for \$10,700 working with Crouse-Hinds-Cooper Industries. By 1998, ADC had expanded enough to occupy its first building with 3,000 square feet of office and workshop space. The company grew steadily throughout the next decade, always reinvesting in the people and new engineering design, manufacturing and assembly equipment to provide the most cost-effective solutions to our customers.

We have come a long way from our modest beginnings by developing our expertise and capabilities while continuing to provide excellence in products and service. ADC now consists of different departments to make up the framework of our operations: Engineering Design and Analysis, Manufacturing and Planning, Temperature Control/Clean Room Assembly/Testing Facility, Ultra-High Vacuum (UHV) Facility, Metrology Laboratory, Magnetic Measurement Facility (Undulator Testing Facility), and Electronics and Instrumentation. Our comprehensive facilities give our engineers the capacity and freedom to innovate.

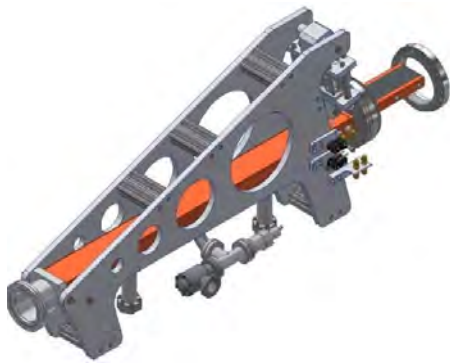
Today, ADC has a worldwide reach. ADC's vision is to be a global leader in the development and manufacturing of innovative products for scientific and research markets.



## Beamline Equipment

### Beamline Components

ADC's designs and services front ends and beamlines. This includes but is not limited to beamline control system; equipment protection system; design of complex brazing and special welding; ray-tracing, including measured optical elements profile; selection of cooling scheme for mirrors and crystals; cryo-cooling design optimization; and operation training. Contact ADC to order. ADC's standard beamline components, as with all of ADC's products, can be customized.



*Emergency Line Stop*



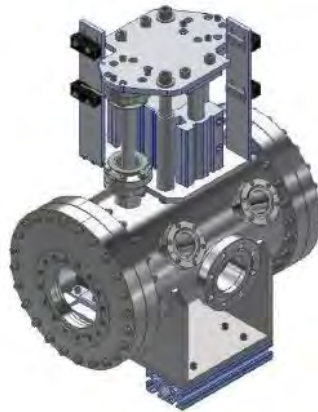
*High Heat Load Primary Aperture*



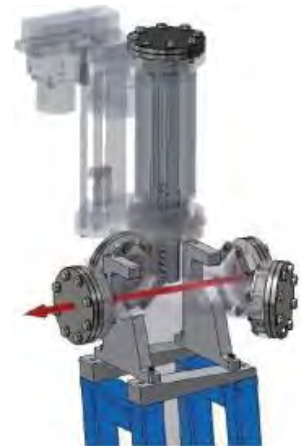
*Secondary and Tertiary Apertures*



*Beam Position Monitor*



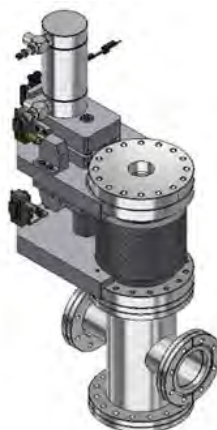
*Bremsstrahlung Safety Shutter*



*Filter Array*



*Fluorescent Screen Assembly*



*Photon Shutter*



*Pentacene Film Growth Instrument*



**Customer:**

CHESS

161 Wilson Laboratory

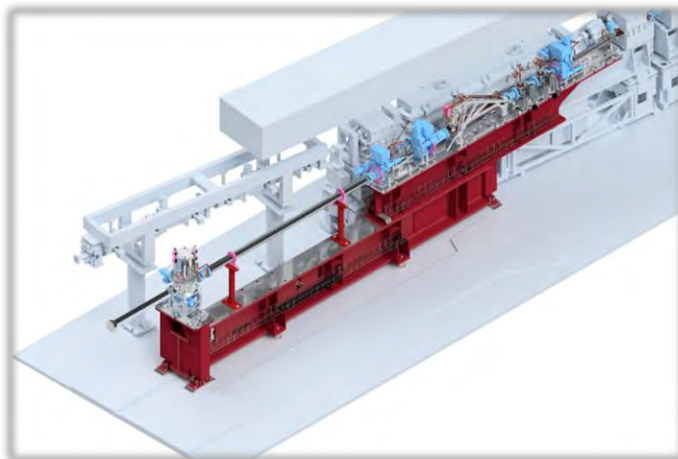
Synchrotron Drive

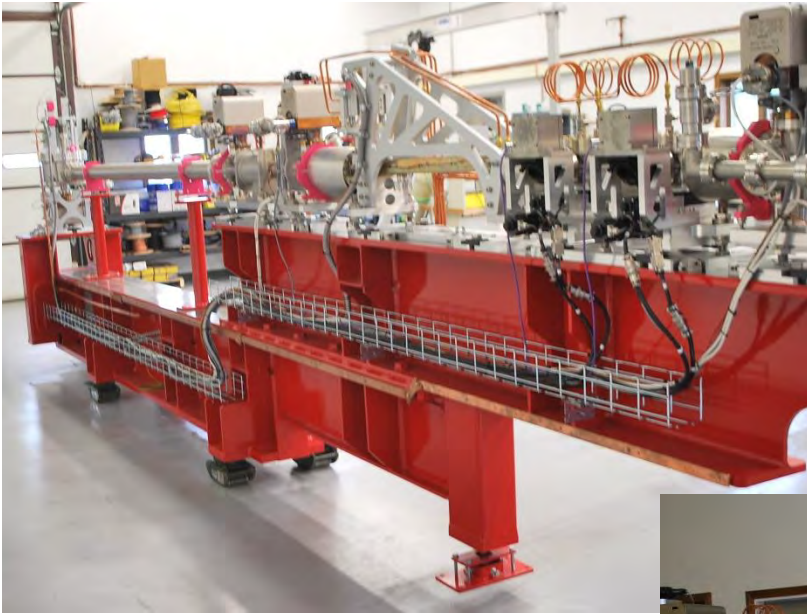
Ithaca, NY 14853



The CHESS-U upgrade project entailed the creation of three new x-ray beamlines with six new experimental stations. ADC designed the three new front-ends. Each front-end is comprised of all components involved in safely transporting the x-ray beams from the storage ring to the first optical enclosure beyond the storage ring shielding wall. This includes all components related to personnel and equipment safety, beam position monitoring, collimators and shielding, water-cooled apertures, and shutters.

To reduce installation time at CHESS, all front-end components were assembled onto a single support beam and precisely aligned. The fully assembled front ends were then tested, pumped down, and baked-out before delivery to CHESS. Off-site alignment at ADC allowed for a final installation which only required positioning of the support beam, and not each individual component. Off-site pumping down and baking also aided in reducing beamline downtime.



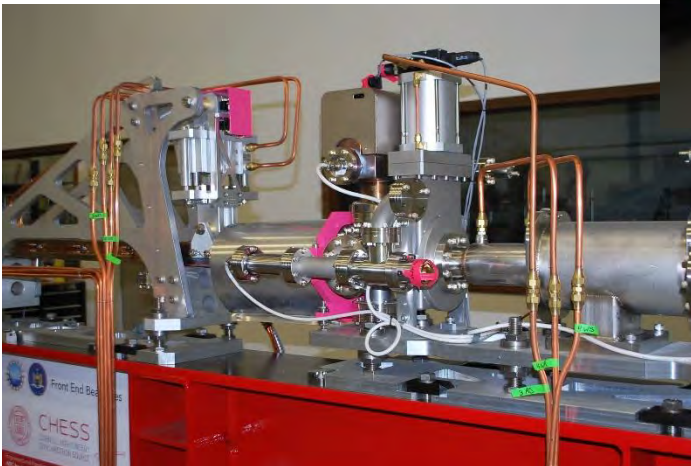


**Overview**

**Bremsstrahlung Shutter**



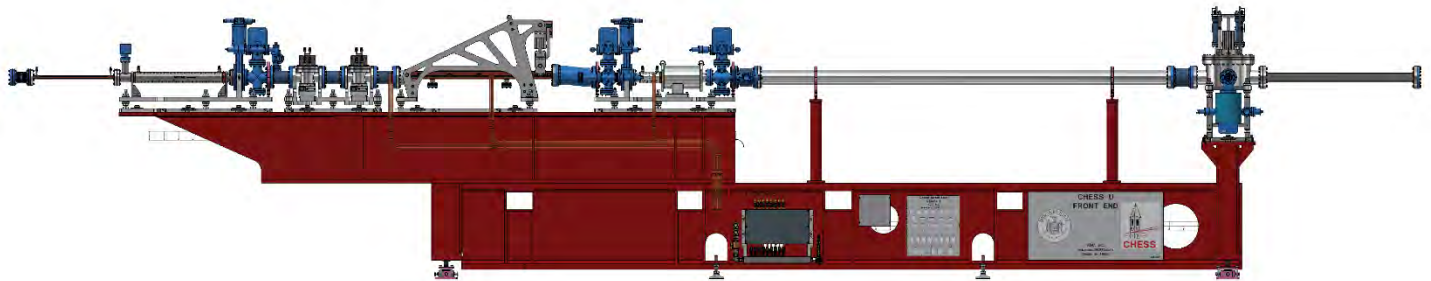
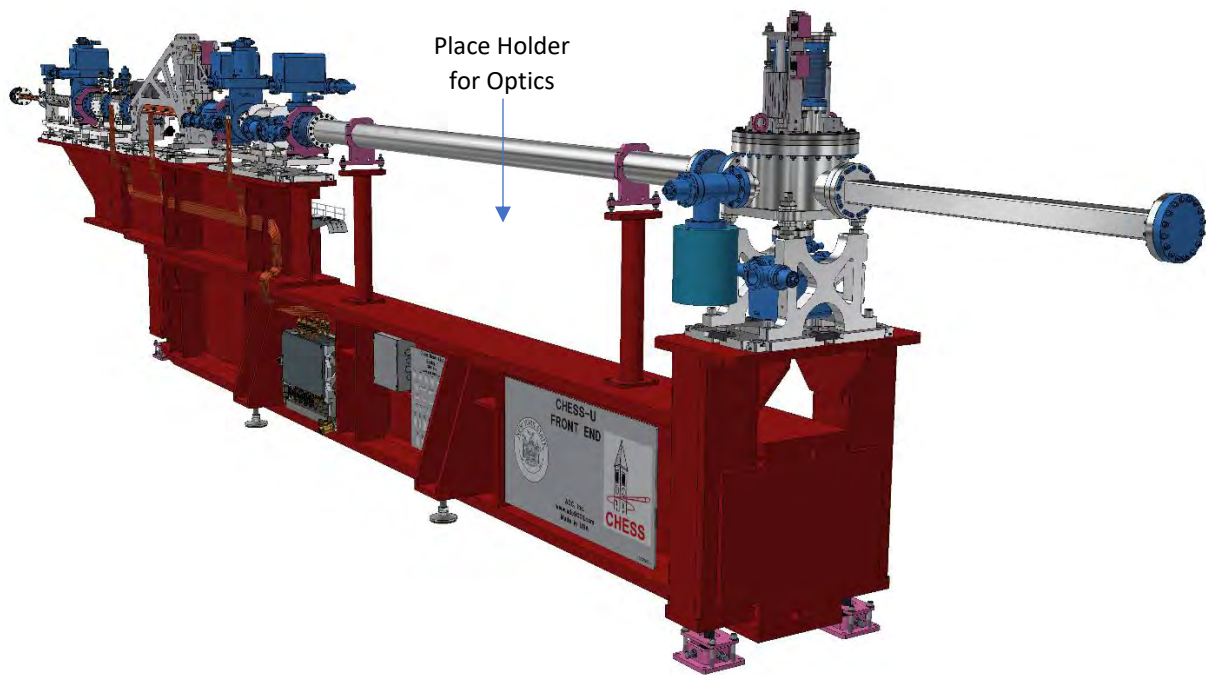
**Secondary Aperture and Collimator**



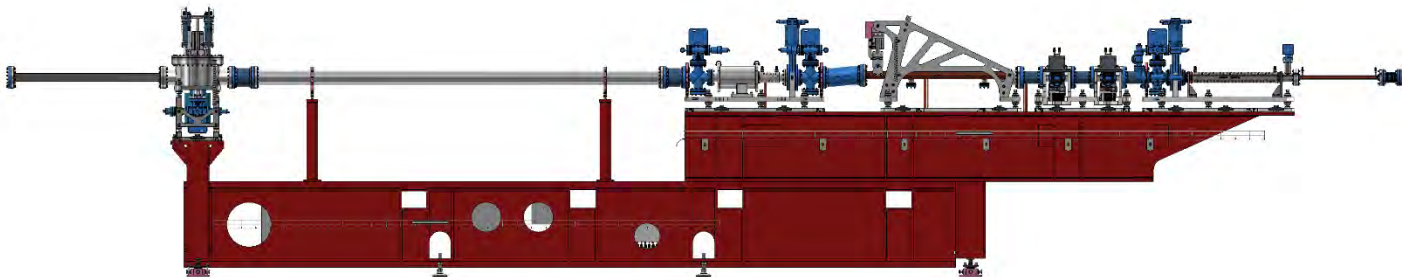
**Linestop**

**Water Cooling and Electrical Panel**

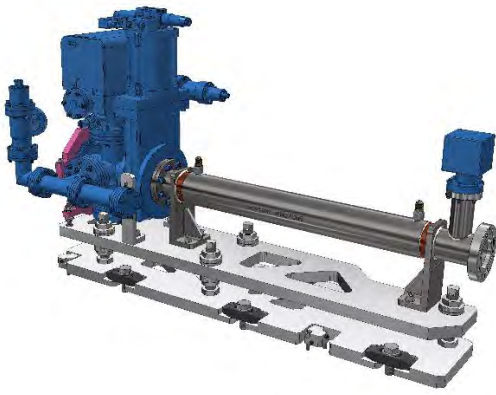




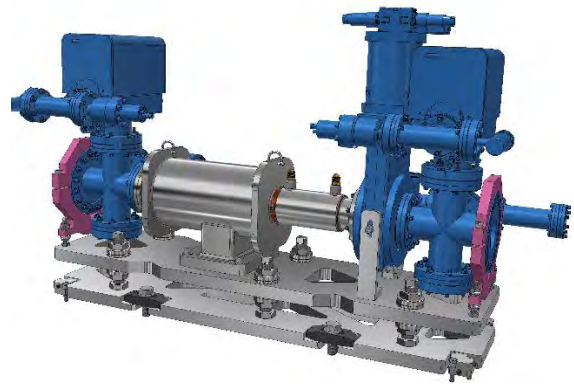
**Inboard Side**



**Outboard Side**



**Primary Aperture**



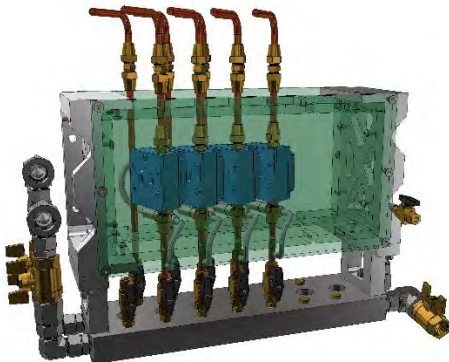
**Secondary Aperture**



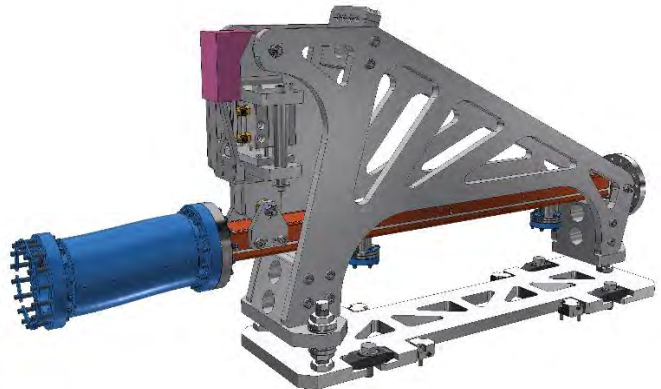
**Video Beam Position Monitor**



**Bremsstrahlung Shutter**



**Cooling Manifold**

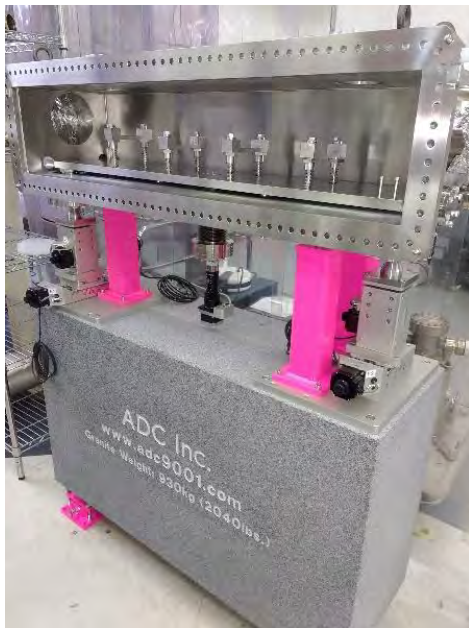


**Linestop**



## Mirror Systems

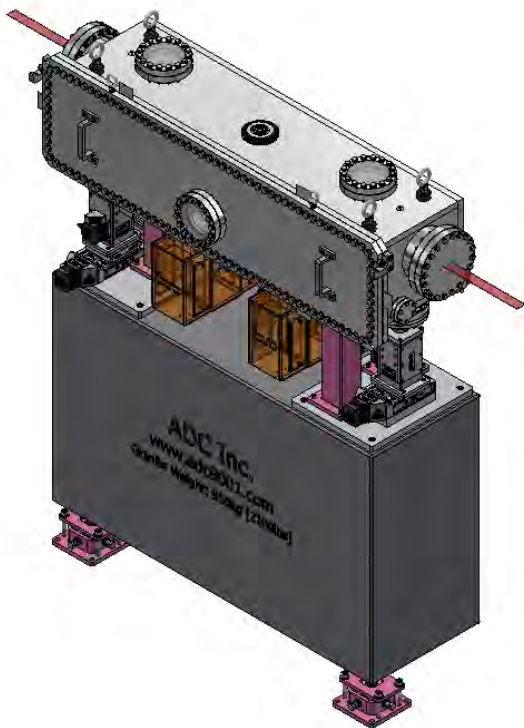
### Focusing Mirror System for Argonne



#### Customer:

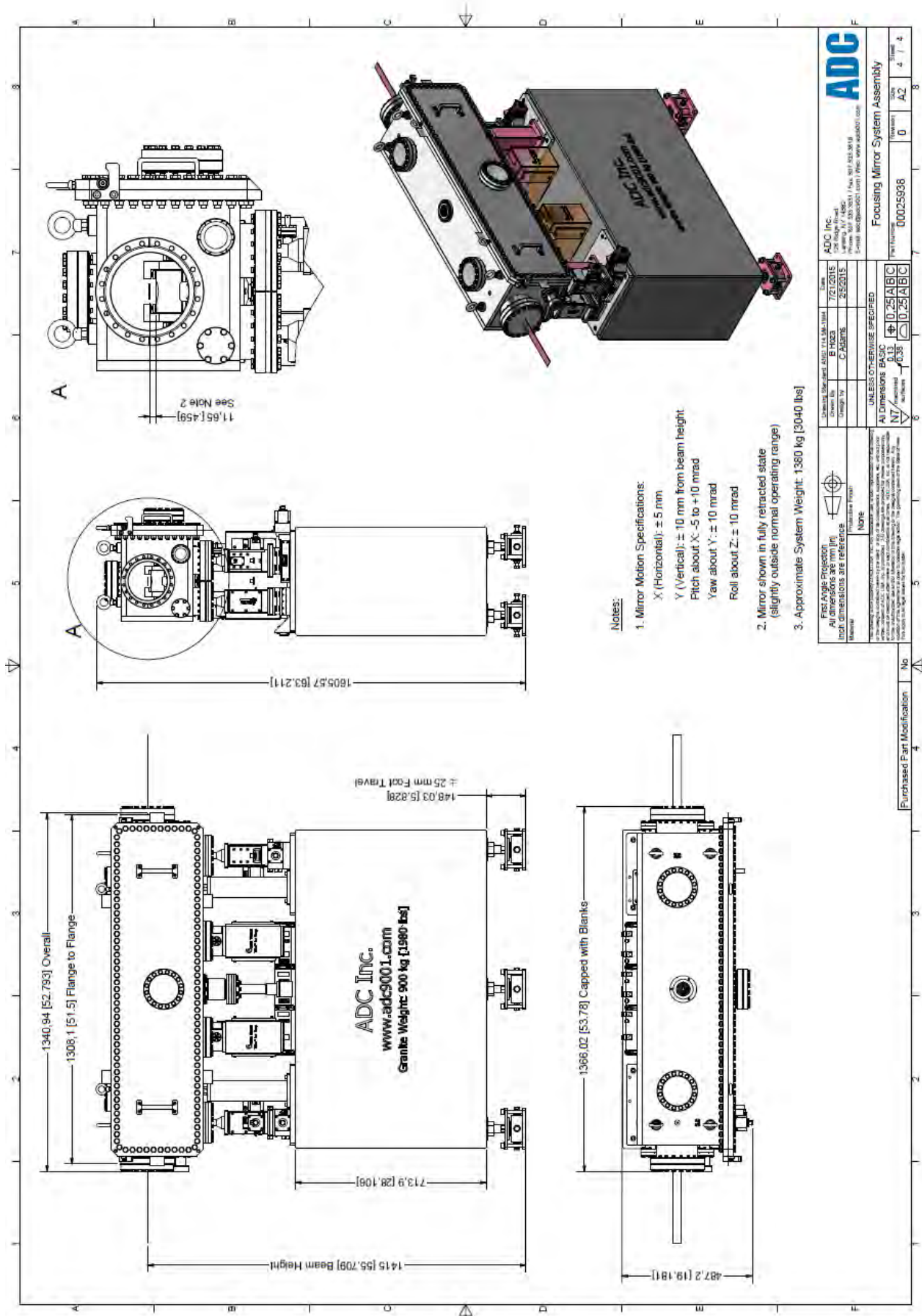
Argonne National Laboratory  
Bldg. 435E 9700 S. Cass Avenue  
Argonne, IL 60439

ADC designed a new upward reflecting focusing mirror system for use at Advanced Photon Source (APS) synchrotron radiation 12BM at sector 12.



The mirror system consists of a large vacuum chamber supported by welded steel posts. This arrangement sits on a granite plinth providing great stability. The vacuum chamber has several flanges for viewports, ion pumps, and other accessories. Within the vacuum chamber is a Single Crystal Silicon mirror. This mirror can be bent to a radius as small as 8 km by using a linear actuator to bend leaf springs within the vacuum chamber resulting in a moment at the ends of the mirror. Additionally, the mirror can be positioned within the vacuum chamber with ADC's 300 series precision jacks and slides. This series utilizes NEMA 23 stepper motors with Renishaw encoders to achieve great accuracy and repeatability. These are arranged in a way to provide 5-axis of movement to position the mirror.

Mirror Motion Specifications		
Axis	Range	Precision
X (Horizontal)	$\pm 5$ mm	5 $\mu$ m
Y (Vertical)	$\pm 10$ mm	5 $\mu$ m
Tilt (about X)	-5 to 10 mrad	2 $\mu$ rad
Yaw (about Y)	$\pm 10$ mrad	5 $\mu$ rad
Roll (about Z)	$\pm 10$ mrad	5 $\mu$ rad



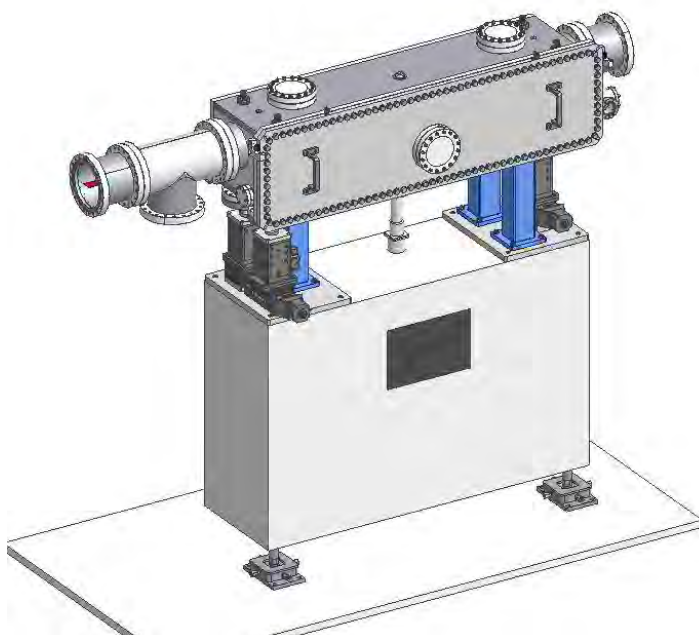


**Customer:**

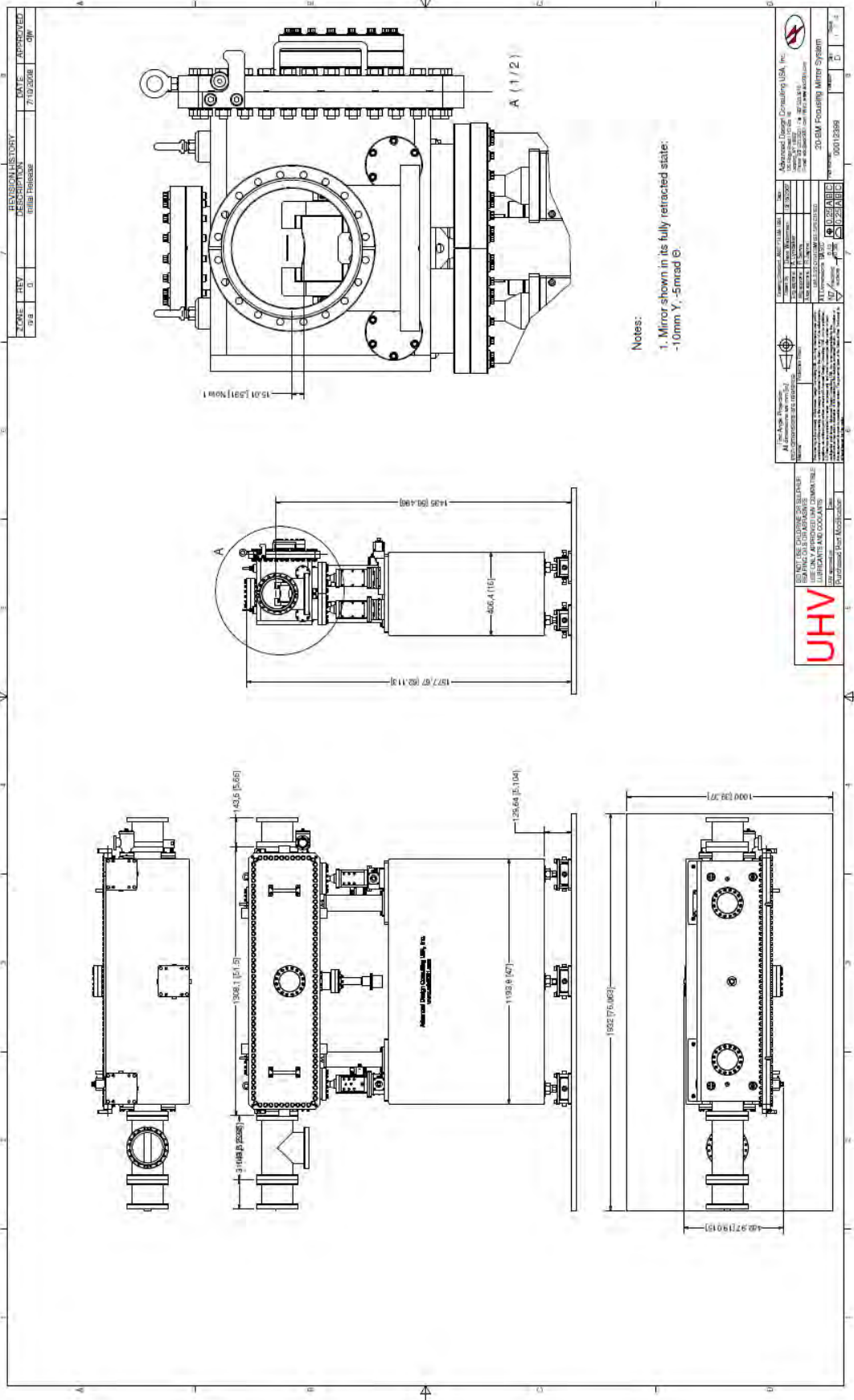
Argonne National Laboratory  
Bldg. 435E 9700 S. Cass Avenue  
Argonne, IL 60439

ADC designed and built a 1100 mm long silicon mirror system to install at Advanced Photon Source (APS). The APS 20-BM mirror system consists these five primary subcomponents provided as an integrated package: the mirror optic itself, its positioning system, the bending mechanism, a vacuum chamber, and the support structure. All subsystems were designed to provide the highest positional stability and structural rigidity with precision motions on all axes.

The 1100 mm long silicon mirror substrate is ground from a single crystal boule and then polished by a specialist synchrotron mirror vendor with over 20 years of experience. To provide horizontal (sagittal) focusing of a wide bend magnet fan, the substrate is ground with a cylindrical recess in its reflecting surface. Gravity deforms the mirror substrate since it is supported only at its ends. To compensate for the gravitational forces, a series of light springs provide an upward force along the length of the mirror. Both finite element analysis and analytical calculations confirmed the adequacy of this compensation scheme which reduced gravity induced deformations to less than 5% of the manufacturing slope errors.



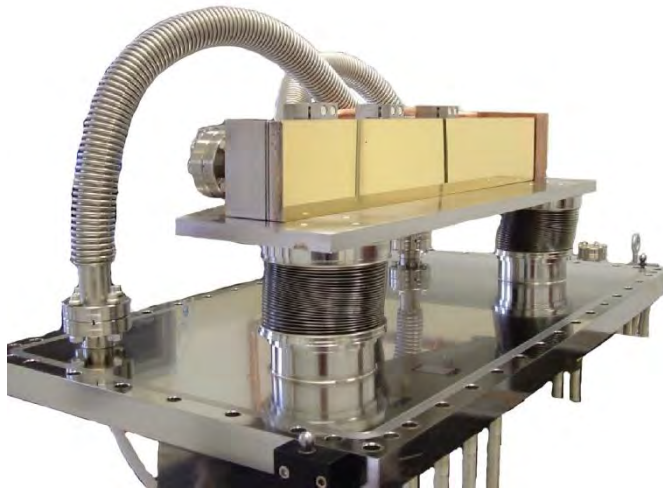
Mirror Motion Specifications		
Axis	Range	Precision
X (Horizontal)	$\pm 5$ mm	5 $\mu$ m
Y (Vertical)	$\pm 10$ mm	1 $\mu$ m
Tilt (about X)	-5 to 10 mrad	2 $\mu$ rad
Yaw (about Y)	$\pm 10$ mrad	5 $\mu$ rad
Roll (about Z)	$\pm 10$ mrad	5 $\mu$ rad





**Customer:**

Brookhaven National Laboratory  
NSLS-II, Bldg. 743  
98 Rochester Street  
Upton, Long Island, NY 11973



The X13A optics consists of an integrally-water-cooled deflection/focusing mirror (M0) followed by a horizontally-dispersing soft x-ray spherical grating monochromator (SGM) and a 22-Hz polarization selection chopper. The M0 mirror, installed and commissioned in mid-2004, provides more stability and higher flux (gain of one order of magnitude) than did the old mirror. The SGM features two diffraction gratings (800 and 1600 grooves/mm), a water-cooled entrance slit, and a movable exit slit. The 22-Hz chopper is synchronized to the switching frequency of the EPW and provides both 22 Hz and 44 Hz signals to the phase-sensitive detector electronics.



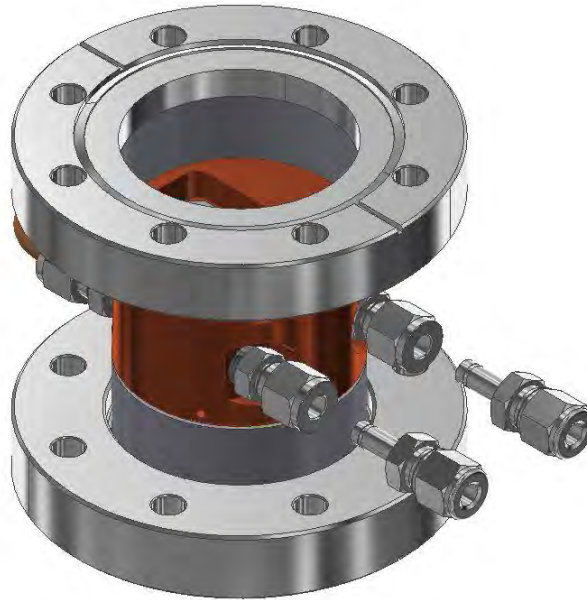
**Customer:**

Brookhaven National Laboratory  
NSLS-II, Bldg. 743  
98 Rochester Street  
Upton, Long Island, NY 11973



ADC collaborated with Case Western Reserve University Center for Synchrotron Biosciences to complete the design of a bendable mirror for the X28C beamline. It is a 50 mm x 100 mm x 1100 mm single crystal silicon with a 43.1 mm radius cylindrical cut, bendable by a toroid from infinite to 1200 m radius. The unique feature of this mirror system is the dual use of Indalloy 51 as both a mechanism for heat transfer and a buoyant support to negate the effects of gravity.





ADC produces beryllium window assemblies that incorporate state-of-the-art bonding of beryllium to OFHC copper. These assemblies typically include TIG-welded lengths of stainless-steel pipe and vacuum flanges.

Better beryllium foil surface finish and/or customization is available upon request.

### *Technical Features-*

Standard Surface Finish: is  $\sim 1.0$  micrometer Ra

Vacuum Tested: Better than  $5 \times 10^{-10}$  torr

Leak Rate: Less than  $2 \times 10^{-10}$  mbar-l / Sec

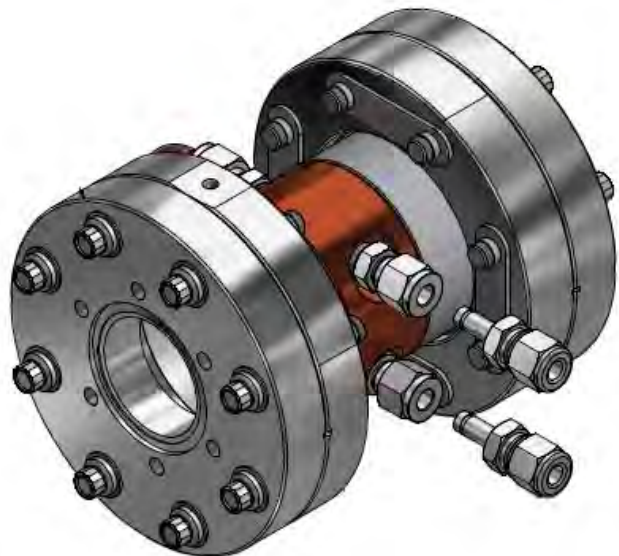
### **Available Window Sizes:**

4", 6", 8", 10"

### **Available Coatings:**

Duracoat, Boron Nitride, or no coating

Customer specifies window opening length and width in millimeters (mm), as well as beryllium thickness in microns ( $\mu\text{m}$ ).



## Ordering Information

Beryllium windows can be ordered with different configurations. All windows are custom built.

Please use the table provided below when ordering.

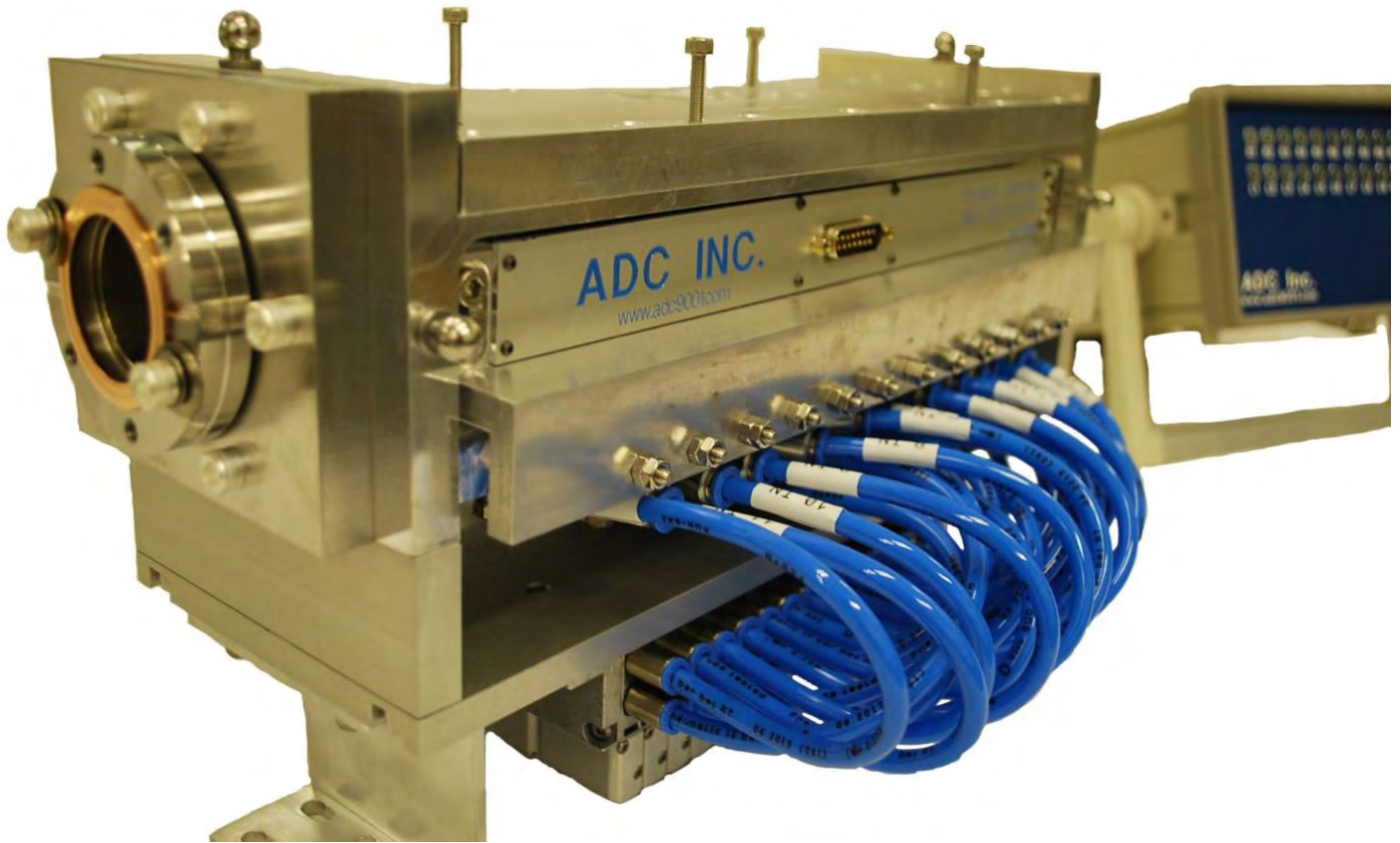
Window Size (in inches)	-4 -6 -8 -10
Opening Length (customer specifies in mm)	-(??)mm
Opening Width (customer specifies in mm)	-(??)mm
Beryllium Thickness (customer specifies in microns)	-(??)μm
No coating	-N
Duracoat	-D
Boron Nitride	-B

BW ( )-( )-( )-( )-( )

For example: to order a 10 Inch Beryllium window, with an opening length of 10 mm, an opening width of 40 mm with a beryllium thickness of 250 microns, and a boron nitride coating, the part number would be:

BW10-10-40-250-B

## Precision X-Ray Attenuator (ABS-300)



ADC has licensed and is offering a Precision Attenuator for Hard X-Rays (ABS-300) that was developed over many years at the synchrotron radiation source PETRA III at DESY. This system will provide the ability for scientists to reduce the incident x-ray flux to any desired value.

### *Technical Features-*

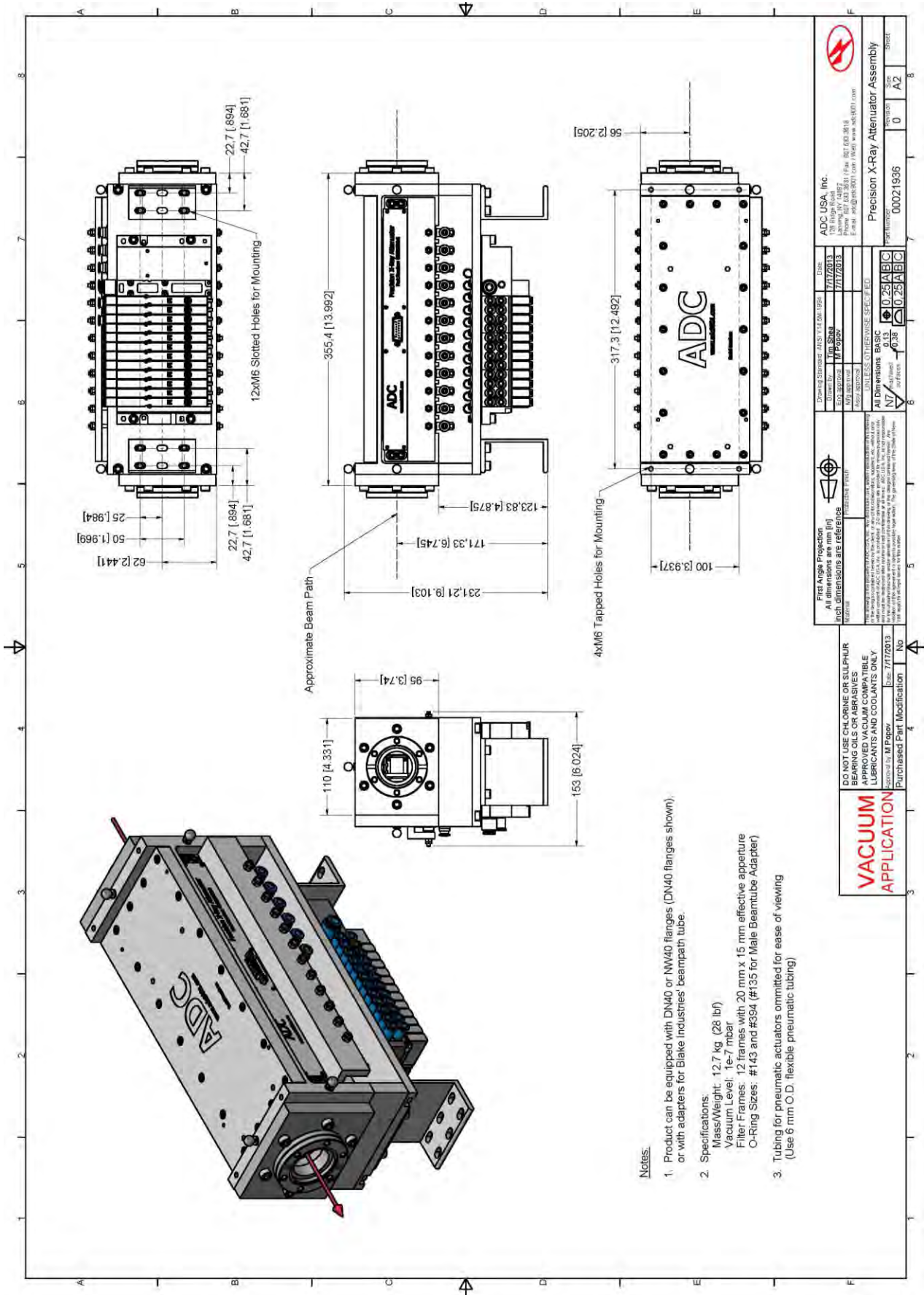
12 Foil carriers, 2.1 cm x 2.1 cm square aperture (20 mm x 15 mm effective aperture)

Foil carriers can be loaded with other items of similar size such as photodiodes

Foils can easily be exchanged for others of different metal and thickness, including calibration foils

Low power electrically controlled

Easy filter/absorber changes (using pressurized air: 3 – 8 bar), speed is adjustable



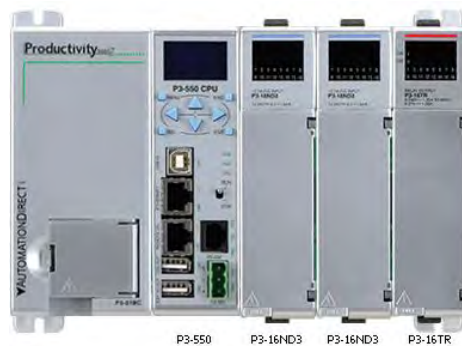
<b>VACUUM APPLICATION</b> DO NOT USE CHLORINE OR SULPHUR BEARING OILS OR ABRASIVES APPROVED VACUUM COMPATIBLE LUBRICANTS AND COOLANTS ONLY General 12, 10 Paper Size: 7/17/2013		<b>First Angle Projection</b> All dimensions are mm (in) inches in parentheses UNLESS OTHERWISE SPECIFIED		Drawing Standard: ANSI Y14.5M-1994 Date: 7/17/2013 Drawn by: J. S. S. S. Checked by: J. S. S. S. Approved by: J. S. S. S.		ADC USA, Inc. 120 Ridge Road Phone: 807 433 3531 Fax: 807 433 3818 E-mail: info@adc9001.com		Precision X-Ray Attenuator Assembly Part Number: 00021936 Sheet: 0 of 1		8	
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## Controller

The ABS-300 precision attenuator is controlled using a Productivity 3000 Programmable Automation Controller but could be operated with other controllers. The Productivity 3000 acts as a slave to the PC and use the MODBUS protocol to interface over the Ethernet port. The Productivity 3000 is a modular system. This application uses two relay inputs and one relay output. Each relay module has a total of sixteen terminals. The computer will act as the master and will run a program developed in LabView. The Productivity 3000 has an address definition loaded; however, the definitions can be customized if needed.

The ABS-300 precision attenuator is of the filter bank rather than wheel type. It is an economical and robust absorber system which can be used in a wide energy range, depending on the choice of filters. The provided filters may easily be swapped for filters of other thicknesses and metals as needed by the researcher. It is high-vacuum capable to  $1e-7$  bar. The filters are moved by means of pneumatic actuators which are located on the outside and are coupled magnetically to the filters inside the vacuum. This means that no vacuum feed-through has been used for this design and that the absorber moves promptly and quickly.

In the presented setup 12 different filters (made from ultrapure aluminum, titanium and copper) can be moved into the beam and small reed-sensors detect success of the movement. The communication with external control systems is in the presented setup done by a stand-alone Productivity 3000 controller (see below). However, any external 24V-toggle signal can be used to drive the single pneumatic actuators, and the reed-sensors are simple switches which can be read by TTL- logics.



Productivity 3000 PLC inside brains of the ABS-CR-01.

1. LabView GUI code containing:
  - a. The ability to toggle any of the 12 filters, i.e., 12 switches on the screen.
  - b. The ability to select which Absorber Configuration 1 or 2; or be able to enter another Absorber Configuration.
  - c. The Absorber Configuration indicates the filter theoretical thickness, i.e., add each filter that is in the stack for a final thickness.
  - d. Ability to monitor the 24 read switches by green LED on the GUI.
  - e. LabView will communicate with the Beckhoff controller using the Modbus communication scheme.
2. Hardware:
  - a. The control box has 24 LEDs mounted on the front panel for easy viewing of the read switches. These are hard wired not software controlled.

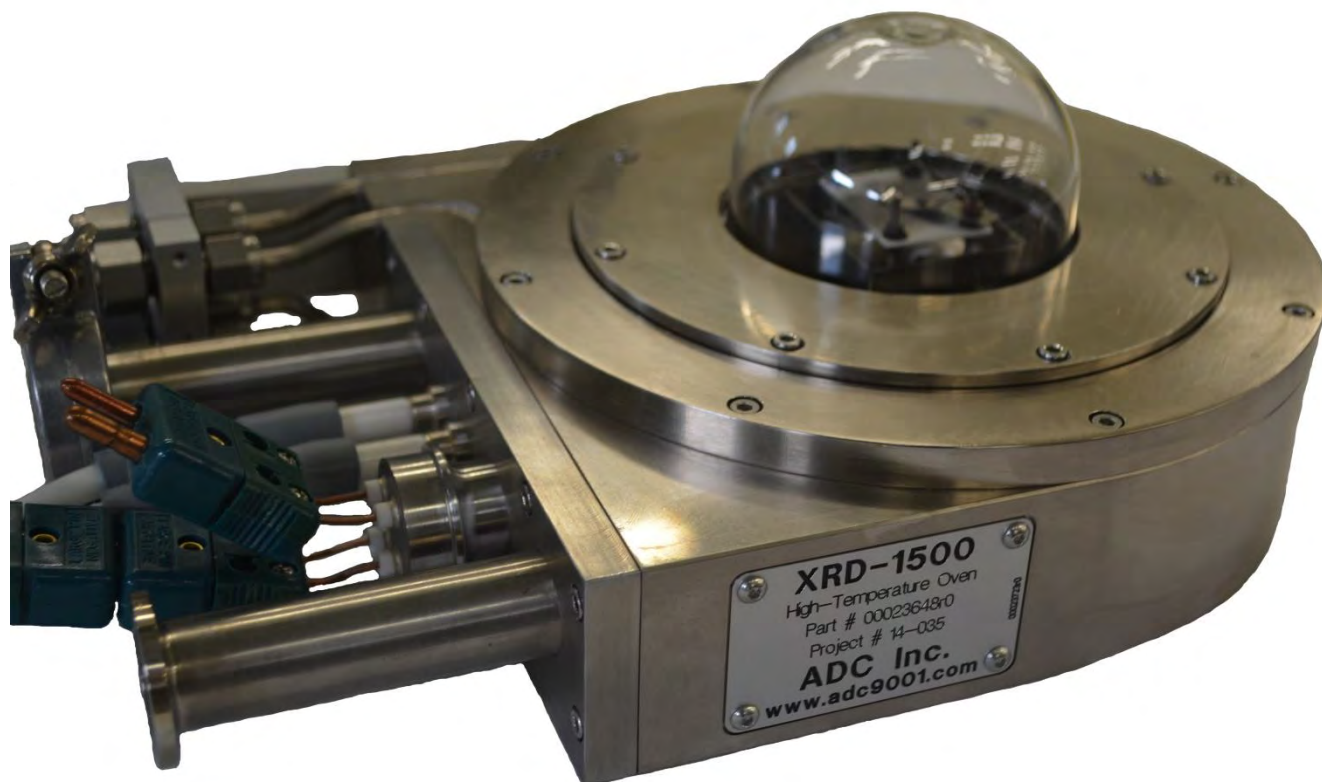
## Ordering Information:

The attenuator can be ordered with different foil configurations. Please use the codes provided below when ordering. Please call or e-mail to ask about any other customization required.

ABS-300-12-(       )-(       )	┌	No foils installed in the carriers (Base System)	- 0
		Type 1 Absorber (5-30 keV)	- 1
		Type 2 Absorber (2.5-20 keV)	- 2
	└	DN40 (Conflate) Flanges	- DN
		NW40 (Formerly KF or QF)	- NW
		Blake Industries beam tube	- BI

For example, a chamber configured for 5-30 keV with DN40 flanges would be denoted by:  
ABS-300-12-1-DN

## X-Ray Oven (XRD-1500)

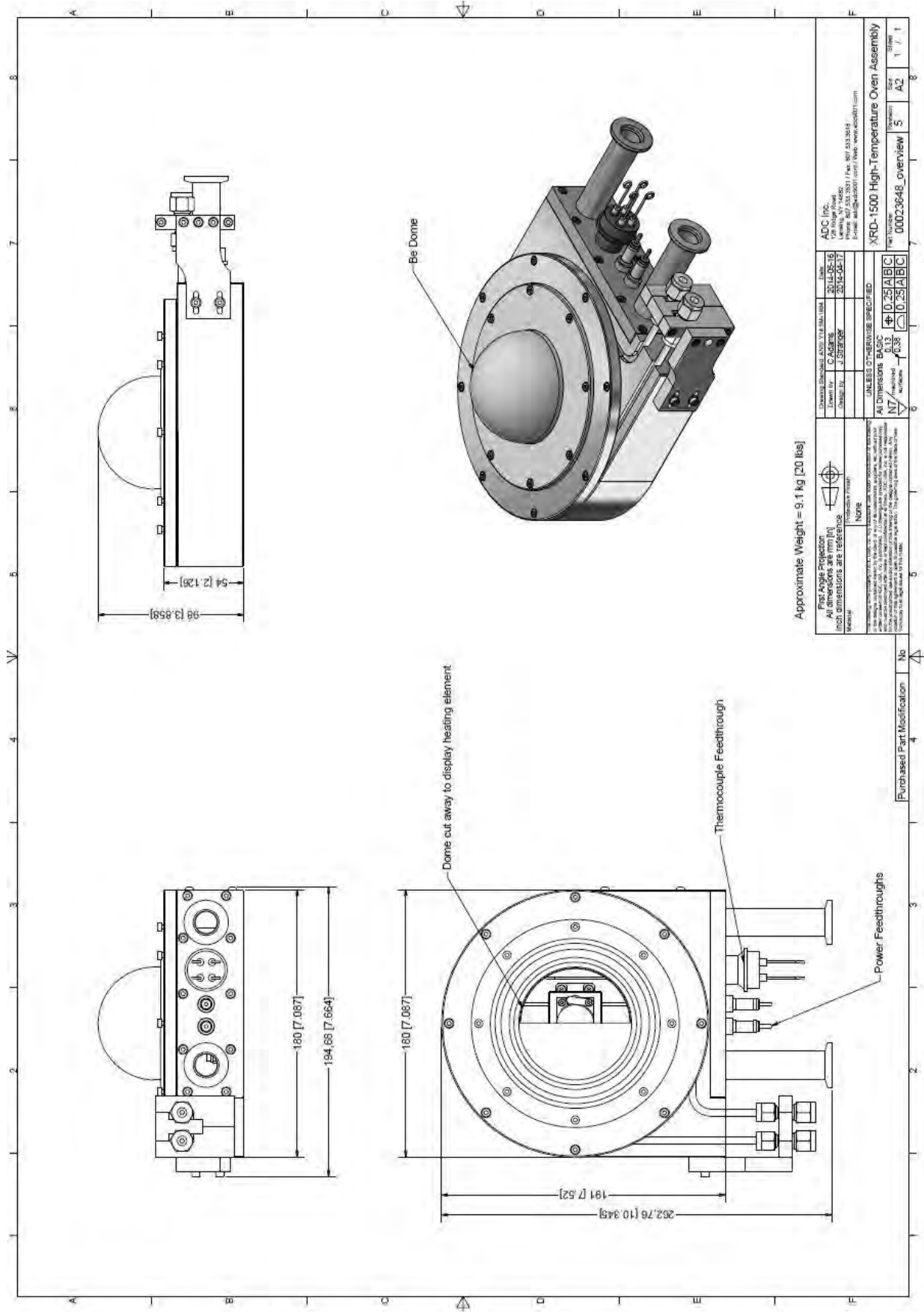


The XRD-1500 is an innovative heating High-Temperature Oven Chamber for in-situ diffraction studies on two, four, six or eight-circle goniometers up to 1500 °C. It fits all common goniometers. The XRD-1500 is exceptionally compact and lightweight. The heating plate design secures a high temperature regularity and respectable position stability at higher temperatures.

### Technical Features-

- Temperature range: up to 1500 °C
- Atmospheres: air, inert gas, vacuum ( $10^{-5}$  mbar)
- Diameter/Height/Weight: 192 mm/98 mm/9.7 Kg
- Operating temperature: 25 °C to 1500 °C
- Gases: Air, O<sub>2</sub>, N<sub>2</sub>, He, other non-hazardous noncorrosive gases
- Temperature measurement: 2 Pt-10% Rh-Pt thermocouples – Type S
- Dome Material Options: Beryllium, Quartz, Aluminum

Contact ADC to order. As with all ADC products, customization is available.



## High Pressure Cryo-Cooler (HPC-201)

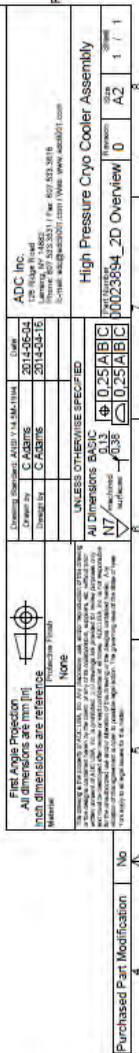


This HPC-201 is based on a process developed by Cornell University scientists Prof. Sol M. Gruner and Dr. Chae Un Kim, which ADC has licensed. This exciting technology enables the simultaneous capture of both amplitude and phase information from single anomalous diffraction (SAD) of a cryocooled protein crystal, thereby providing sufficient data to solve the crystal structure of a protein with an unknown structure. The High Pressure Cryo-Cooler eliminates the need to use cryoprotectants and produces superior results.

### Technical Features-

- Pressurizing Gas: Helium
- Working Pressure: 200 MPa
- Cooling Fluid: LN2 Cryo
- Cooling Temp: 77 K (-196 °C)
- Sample Capacity: 3 (per pressure & cooling cycle)
- Process Time: < 10 min (2 min for pump operation; ~ 5 min under pressure; 1 min freezing)
- ZEISS Microscope: SteREO Discovery.V8
- LN2 Dewar: Taylor-Wharton HC34

Contact ADC to order. As with all ADC products, customization is available.





The Octupole End Station is used for soft X-ray scattering in magnetic dichroism (XMD) experiments. The system is mainly used for three applications, e.g., constant field for the duration of an x-ray absorption scan, point-by-point field reversal for an XMD photon energy scan, and hysteresis loop measurements. The design is based off of a design by Berkeley Lab, which ADC modified and has improved over the years.

### *Technical Features-*

- Peak field magnitude of 1T
- Field uniformity of 5% over 10 mm cube
- Field vector rotatable in any direction
- 8 magnet coils
- Water cooling for 8 coils
- Base frame, kinematic, adjustable, 304 SS,
- Ports for sample, pumping, detector, observation, beamline, vacuum gage, spare
- Detector 3600 rotation goniometer
- Top sample access
- Sample rotation axis
- UHV operation @ 5E-10mbar
- RGA Analysis
- Water flow sensors


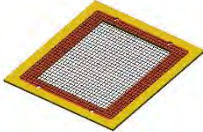
Contact ADC to order. As with all ADC products, customization is available.



## Ion Chambers

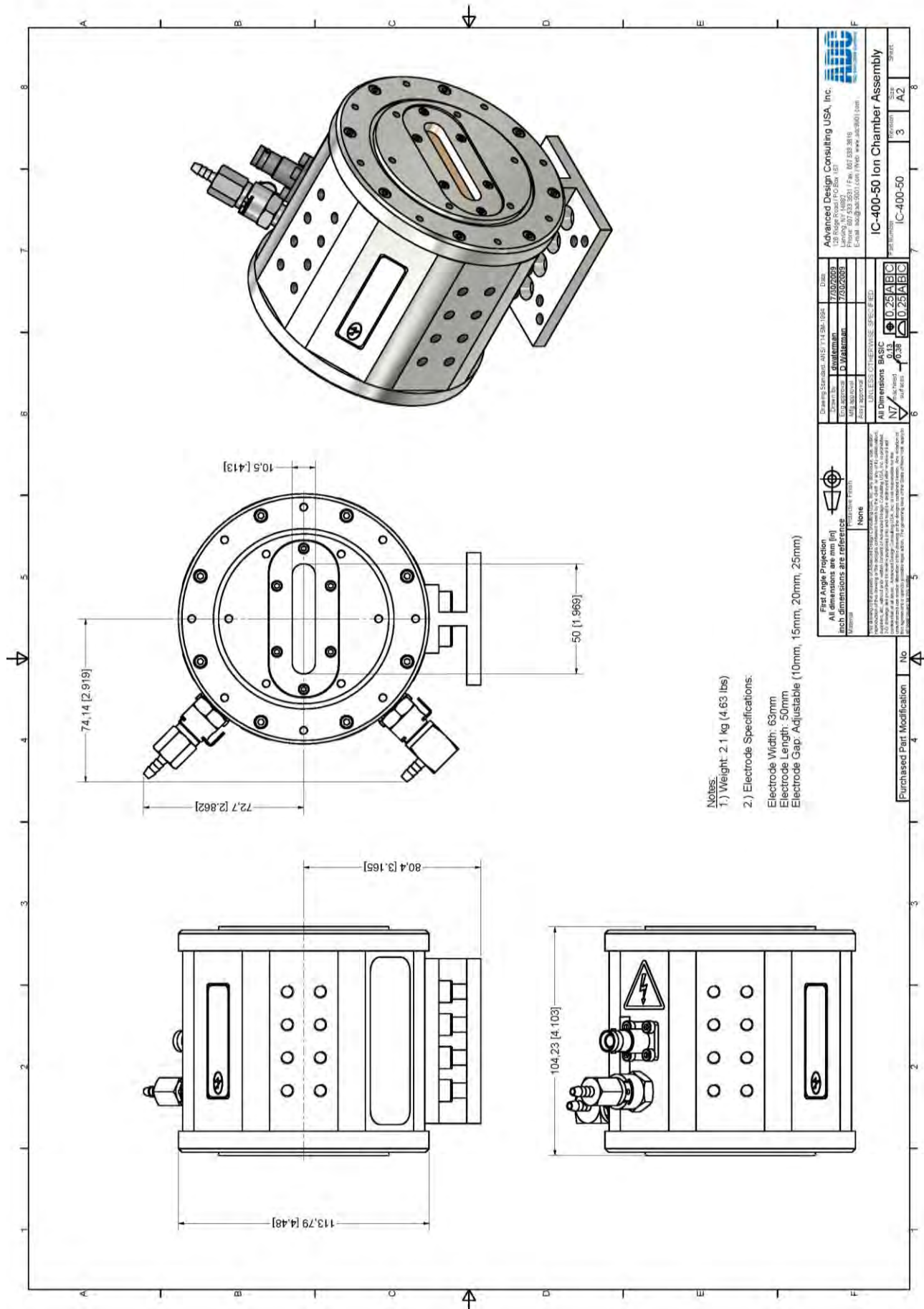
ADC's Ion Chambers are designed for precise, low noise x-ray measurement. The electrodes are constructed of nickel-plated copper, on fiberglass supports, and is all housed within a nickel-plated, aluminum frame. The system can be configured for air, vacuum, or ultra-high vacuum operations, through one of three interfaces.

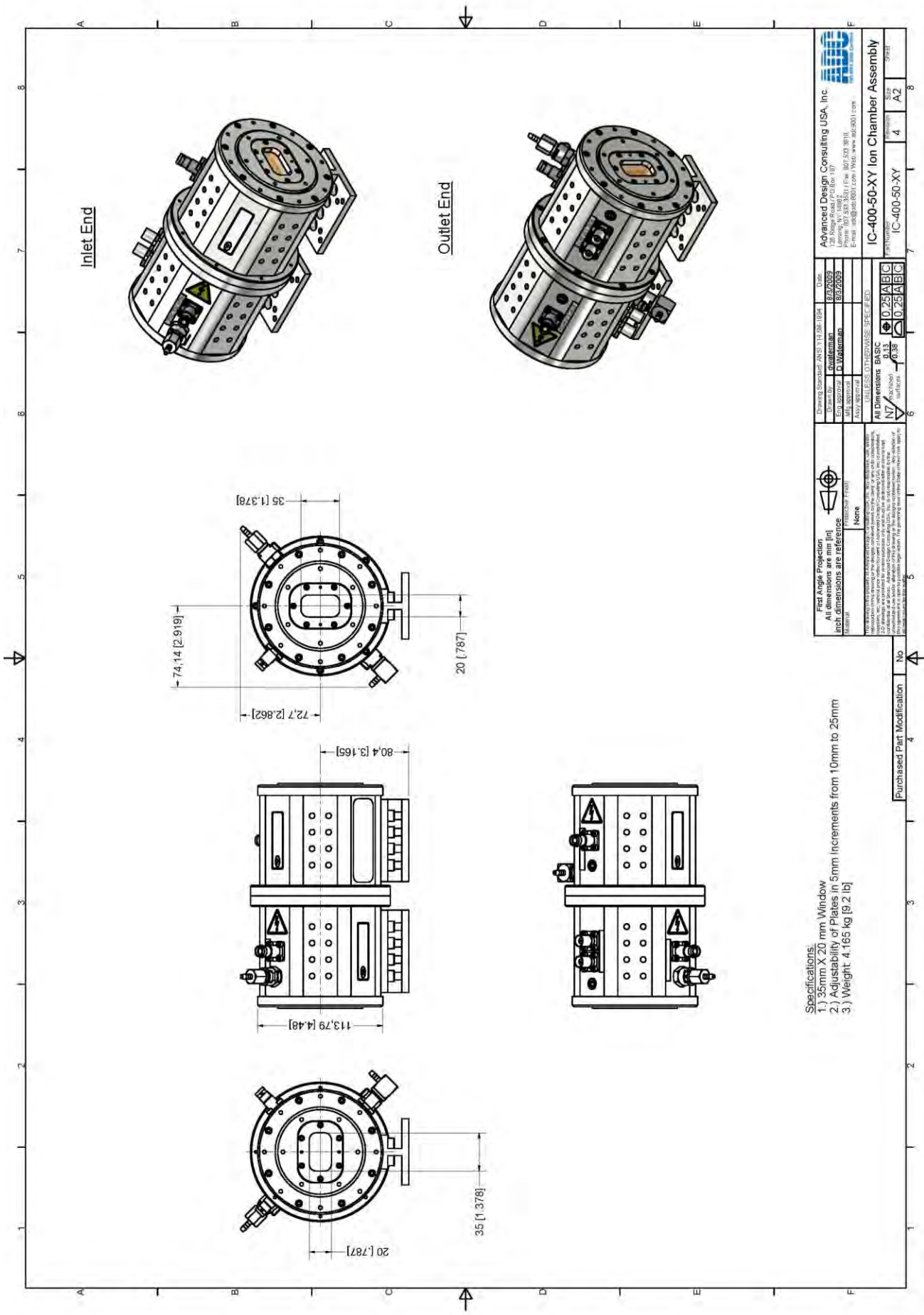
IC-400 Series				IC-500 Series		
						
IC-400-50	IC-400-100	IC-400-200	IC-400-50-XY	IC-500-50	IC-500-100	IC-500-200

<b>Micro Ion Chamber</b>	<b>Gridded Option</b>
	
<b>MIC-205</b>	<b>-G</b>

## Specifications

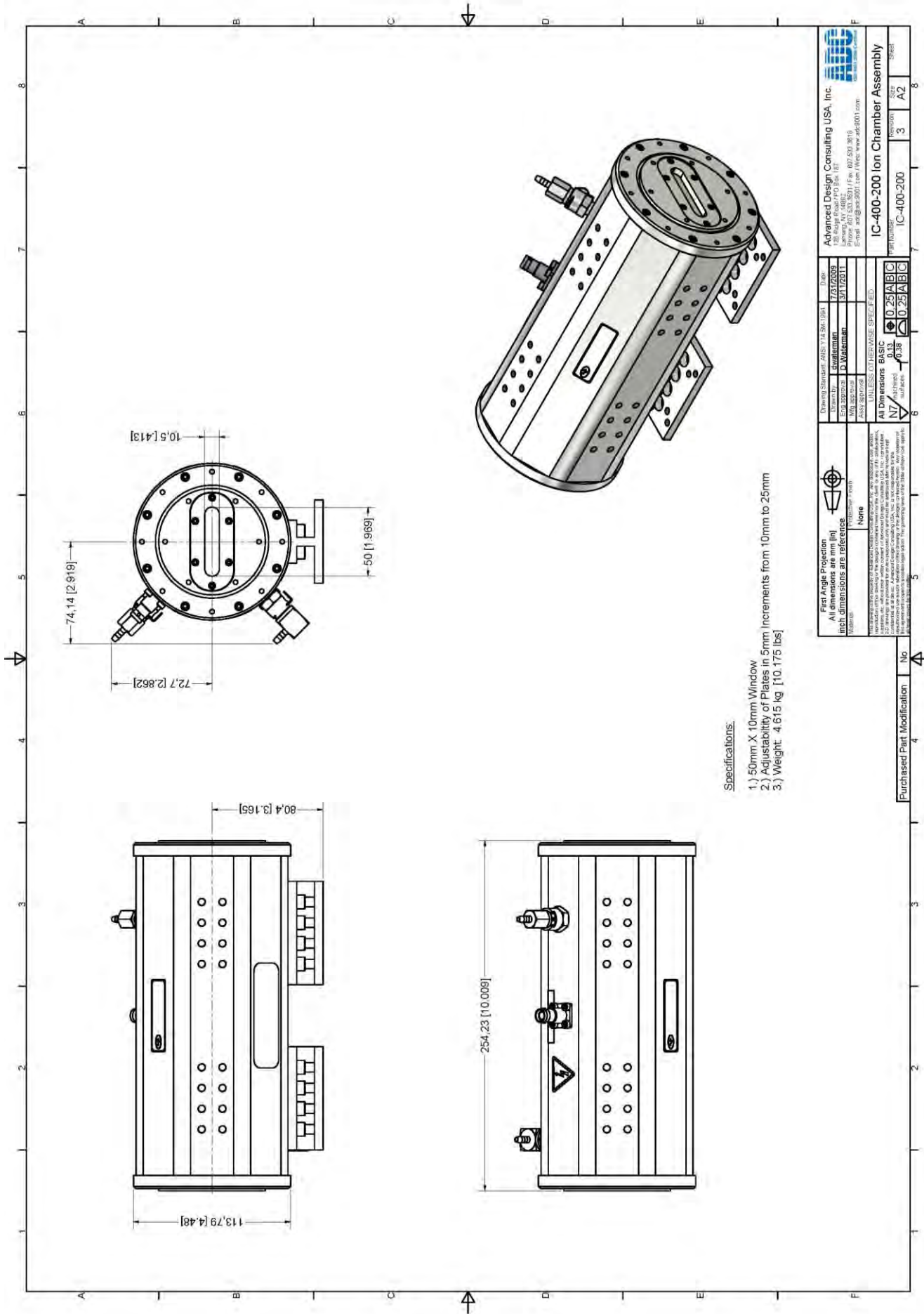
<b>Windows</b>	25 $\mu$ m Kapton foil factory installed + Kapton film kit included: 25, 50, 125 $\mu$ m
<b>Body Material</b>	Aluminum alloy
<b>Electrode Gaps</b>	10, 15, 20, 25 mm (User adjustable)
<b>Electrodes</b>	Gold plated with guard rings
<b>Working pressure</b>	0.7 - 1 .3 Bar Absolute
<b>Operating potential</b>	Up to 1 .7 kV
<b>Maximum pressure drop</b>	< .0375 bar/min
<b>Gas Connectors</b>	<u>Chamber Gas Fitting:</u> Colder MCD 1002, 1/4" hose 'push-to-connect' normally closed. <u>Gas Adapter Insert:</u> Colder MCD2202 1/8" hose barb in-line coupling.
<b>Electrical Connectors</b>	<u>Low Voltage Electrode:</u> Standard 50ohm Female BNC <u>High Voltage Electrode:</u> Standard SHV <u>Gridded Option:</u> Standard SHV
<b>Adapter Kits (ONLY AVAILABLE FOR 400 SERIES)</b>	NW25 IC-400 Adapter Kit, Part Number: 00018716 NW40 IC-400 Adapter Kit, Part Number: 00018718 NW50 IC-400 Adapter Kit, Part Number: 00018722 4.5" IC-400 Conflate Adapter Kit, Part Number: 0016209
<b>Options</b>	<u>Gridded Middle Board:</u> Reduces rise time of the ionization current.



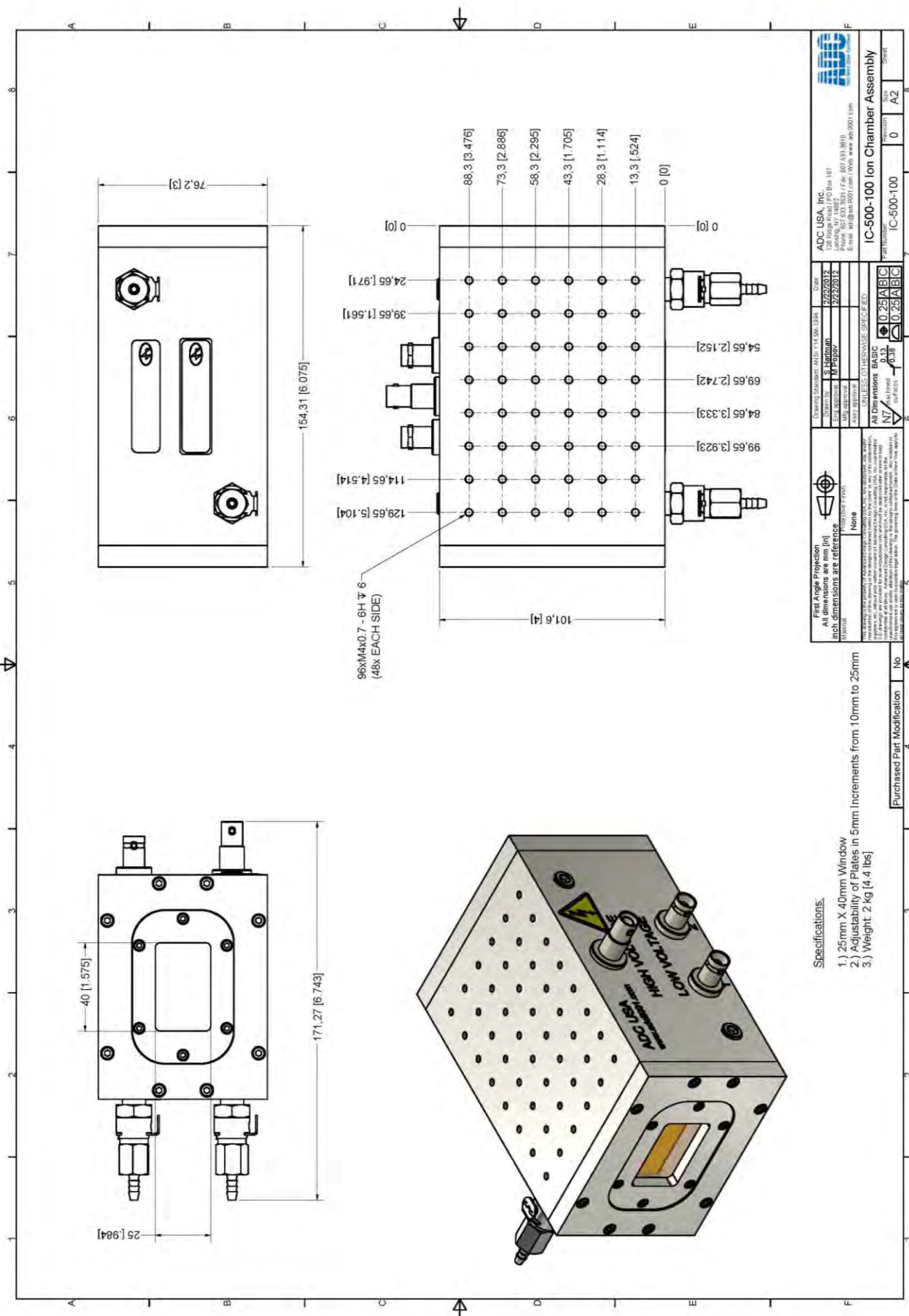


<b>First Angle Projection</b> All dimensions are in inches unless otherwise specified. inch dimensions are reference		Drawing Standard: ANSI Y14.5M-1994 Date: 8/2/2009 Revision: 01/01/2009 All dimensions are in inches unless otherwise specified.	Advanced Design Consulting USA, Inc. 128 Maple Road, P.O. Box 1107 Phone: 802.503.5831 / Fax: 802.503.3811 E-mail: adc@adc9001.com / Web: www.adc9001.com	
Part Name: IC-400-50-XY Ion Chamber Assembly Part Number: IC-400-50-XY		Drawing Title: IC-400-50-XY Drawing Number: 01/01/2009	Part Number: IC-400-50-XY Part Name: IC-400-50-XY Ion Chamber Assembly	









		<b>ADC USA, Inc.</b> 2800 Highway 100, Box 187 Houston, Texas 77051 Phone: (832) 533-3531 / Fax: (832) 533-3511 E-mail: <a href="mailto:info@adc9001.com">info@adc9001.com</a> / Web: <a href="http://www.adc9001.com">www.adc9001.com</a>		<b>IC-500-100 Ion Chamber Assembly</b>		Part Number: <b>IC-500-100</b> Revision: <b>0</b>		Sheet: <b>A2</b>	
Date: <b>2/22/2012</b> Drawn: <b>S. Hagan</b> Checked: <b>M. Pappas</b> Date: <b>2/22/2012</b>		All Dimensions are in inches unless otherwise specified.		Part Number: <b>IC-500-100</b> Revision: <b>0</b>		Sheet: <b>A2</b>		Part Number: <b>IC-500-100</b> Revision: <b>0</b>	
First Angle Projection All dimensions are in inches unless otherwise specified.		UNLESS OTHERWISE SPECIFIED:		Part Number: <b>IC-500-100</b> Revision: <b>0</b>		Sheet: <b>A2</b>		Part Number: <b>IC-500-100</b> Revision: <b>0</b>	
Material: <b>None</b>		Finish: <b>None</b>		Part Number: <b>IC-500-100</b> Revision: <b>0</b>		Sheet: <b>A2</b>		Part Number: <b>IC-500-100</b> Revision: <b>0</b>	

- Specifications:
- 1.) 25mm X 40mm Window
  - 2.) Adjustability of Plates in 5mm increments from 10mm to 25mm
  - 3.) Weight: 2 kg [4.4 lbs]



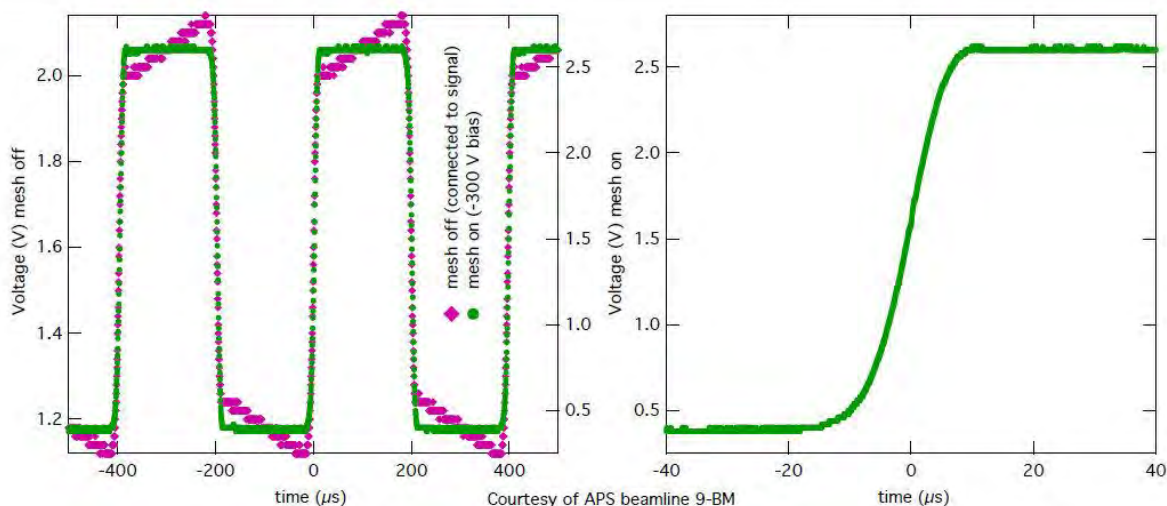
### Gridded Ion Chambers

ADC collaborated with APS/Argonne National Lab to develop a gridded ionization chamber using the present parallel plate ion chamber<sup>1</sup>. The original idea for Gridded Ionization Chambers used in Time Resolved X-Ray Absorption Spectroscopy was described in the Journal of Physics: Conference Series 425 (2013) 092010<sup>2</sup>. Gridded Ionization Chambers improve bandwidth and reduce rise time compared to standard ion chamber designs.

In a parallel plate ion chamber, the ionization current is induced by the presence and locations of ions and electrons within the electric field. The length of the ionization pulse is dependent upon the time that it takes for the ions and electrons to collect on the electrodes. Because of this, the collection speed of standard designs is limited by the velocities of the large, slow moving ions.

Using ADC's new gridded ionization chamber, the ionization current reacts only to the presence of electrons within the electric field while the ion charges are ignored. *Eliminating the effects of the slow-moving ions reduces the rise time by at least 10 orders of magnitude. The overall result is a drastic decrease in the rise time of the ion chamber.* ADC developed this design as an add-in to its entire ion chamber line. To learn about available models, contact ADC to discuss custom applications.

The following shows measurements on the gridded ion chamber done at the APS Spectroscopy Beamline 9-BM. The plot below shows the response to a chopped beam. It shows the improvement when the grid is turned on. Without the grid there is a slow and fast component. With the grid the response time is about 20 microsec.



The XSD Spectroscopy Group operates the bending magnet beamline 9-BM to serve the materials science and chemistry user communities. It provides a focused, tunable x-ray beam for XAFS and XANES experiments with special capabilities for lower energy x-rays.

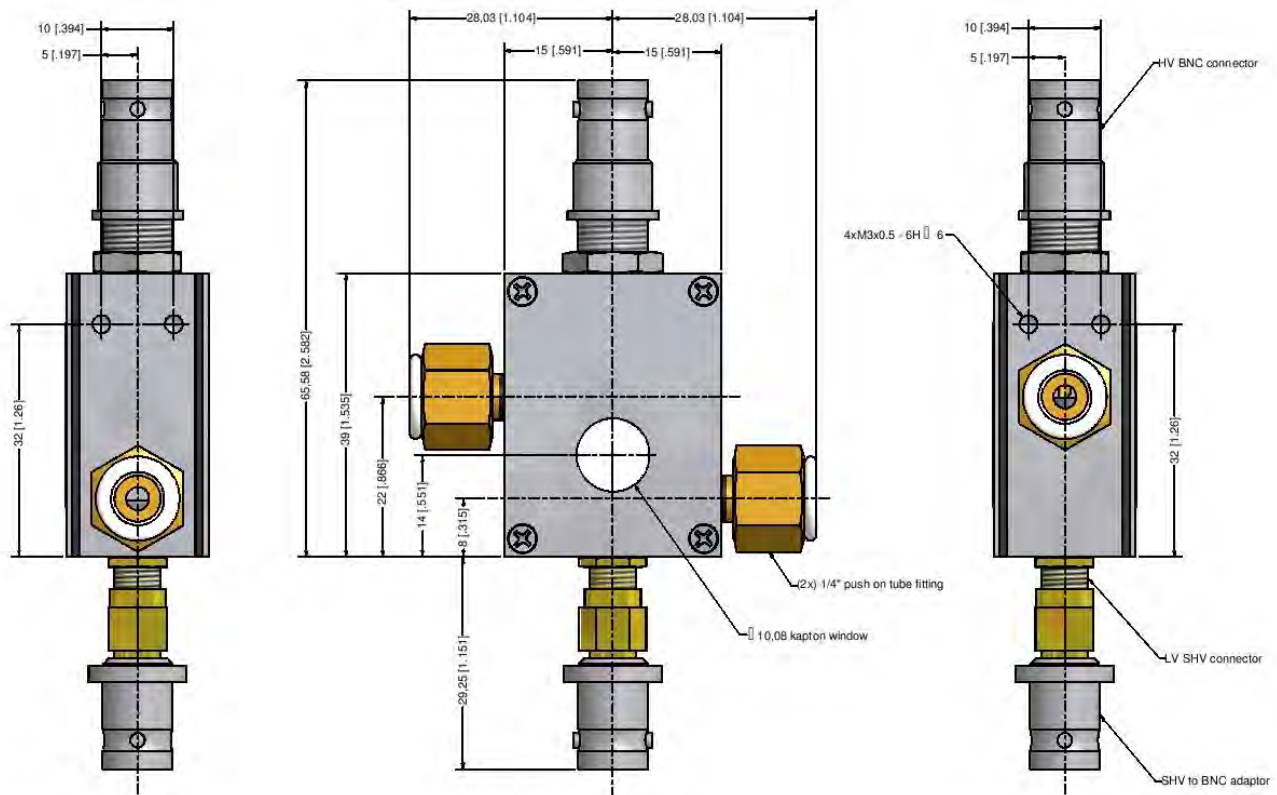
1. 12th International Conference on NEW YORK CITY JULY 6-10, 2015- Synchrotron Radiation Instrumentation (SRI 2015) - Tim Shea, Alex Deyhim
2. Journal of Physics: Conference Series 425 (2013) 092010; Gridded Ionization Chambers for Time Resolved X-Ray Absorption Spectroscopy- O Müller<sup>1</sup>, J Stötzl, D Lützenkirchen-Hecht and R Frahm

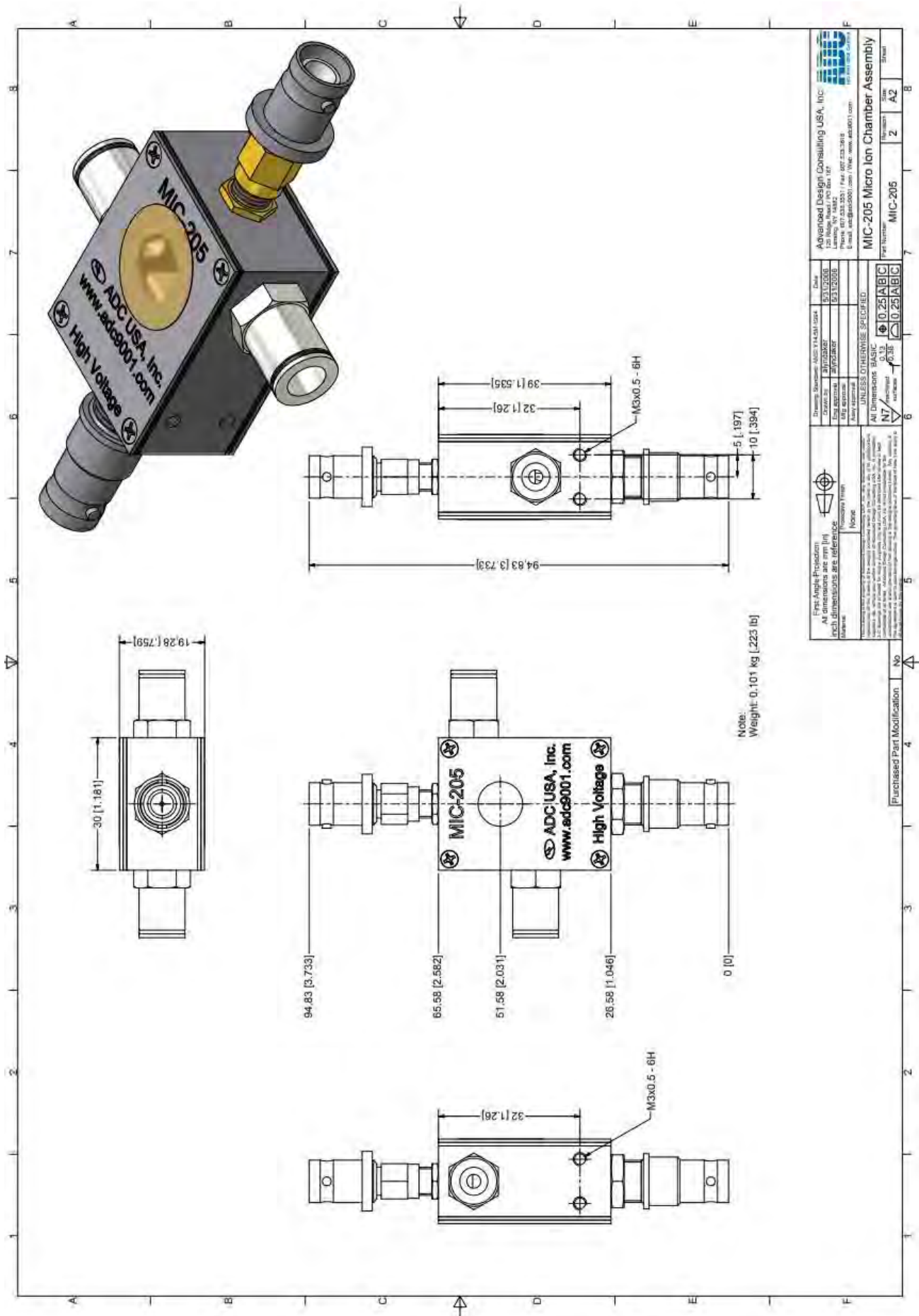
### Micro Ion Chambers (MIC-205)

A small ionization chamber detector was developed for monitoring the intensity of hard X-ray beam for Synchrotron facilities around the world. The small dimensions of the ionization chamber (20 mm along the beam direction and 30 mm perpendicular to it) make it possible to place it very close to the sample.

The housing of the detector is made of stainless steel, nickel-plated copper electrodes; SHV and BNC electrical connectors; and gas connectors.

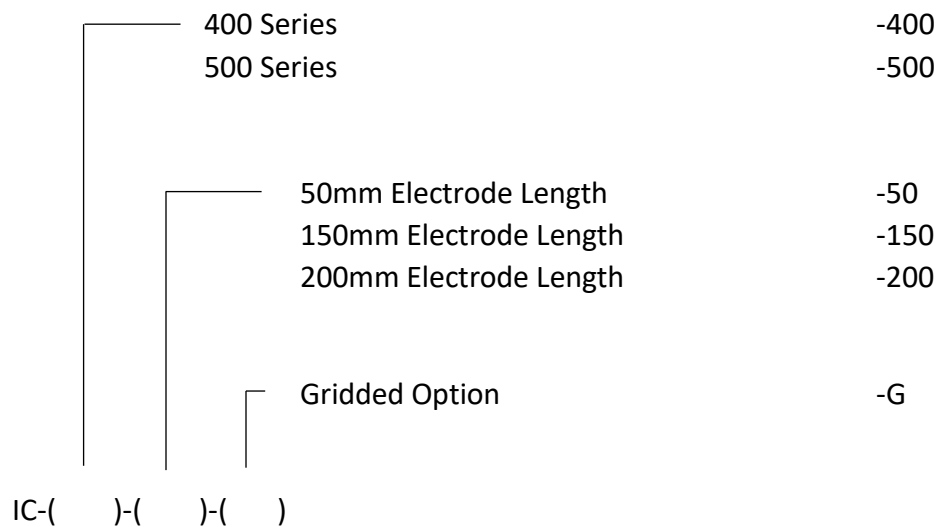
Sparking voltage is approximately 5500 V under the atmospheric environment and leakage rate of gas is less than 2 torr/5 minutes under 10 torr vacuum.





## Ordering Information

Ion Chambers can be ordered with different foil configurations, please use the codes provided below when ordering. Please call or e-mail to ask about customization if the application requires it.



For example, an ion chamber 400 series with a 50mm Electrode length, with the gridded option would be denoted by: IC-400-50-G

**\*The Micro Ion Chamber is denoted by the part number MIC-205\***

## Accelerator Equipment

### Insertion Devices

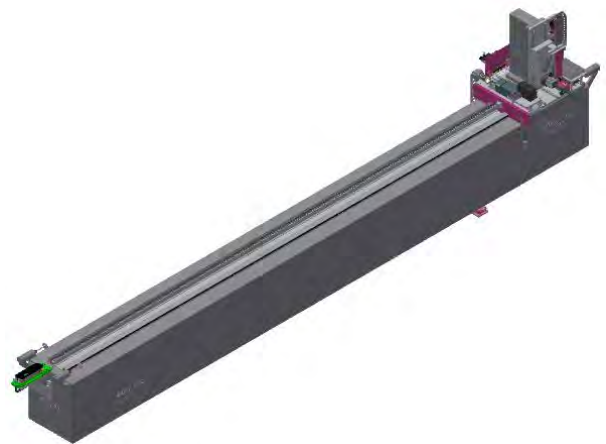
ADC has the capabilities, design, procedures and training staff to provide “Turn-Key” Insertion Devices and Magnetic Measurement Systems complete with in-house and customer site training.



### Magnetic Measurement System

ADC's MMS-8000 represents the culmination of more than 15 years of development and design in the Magnetic Measurement System. The MMS-8000 offers new levels of performance in magnetic research. The MMS-8000 incorporates major advances in data acquisition, temperature control, and low noise magnetic field measurement with  $< 0.5 \mu\text{T}$  resolution, Sampling  $> 100 \text{ Hz}$  and the measurement repeatability  $< 1 \text{ G}$ . The MMS-8000 also provides expanded software functionality within its user-friendly graphical interface. Combining these features provides the highest level of system performance. The MMS-8000 truly represents the next generation of advanced Magnetic Measurement Systems.

ADC Magnetic Measurement System (MMS-8000) consists of two major components: **Hall Probe Mapping Bench** and **Integrated Field Measurement System**.



## Custom Insertion Devices



**CHESS**  
CORNELL HIGH ENERGY  
SYNCHROTRON SOURCE

*CHESS Tapered Undulator*



**ALBA**

*ALBA Synchrotron Wiggler*



**SOLARIS**  
SYNCHROTRON RADIATION  
CENTER

*Synchrotron Radiation  
Center Planar Undulator*



**Canadian Centre canadien  
Light de rayonnement  
Source synchrotron**

*Canada Planar Undulator*



**Australian  
Synchrotron**

*Australian Synchrotron Wiggler*



**BROOKHAVEN  
NATIONAL LABORATORY**

*BNL Cryo In-Vacuum Undulator*



**MAX-lab**

*MAX Lab Hybrid EPU*



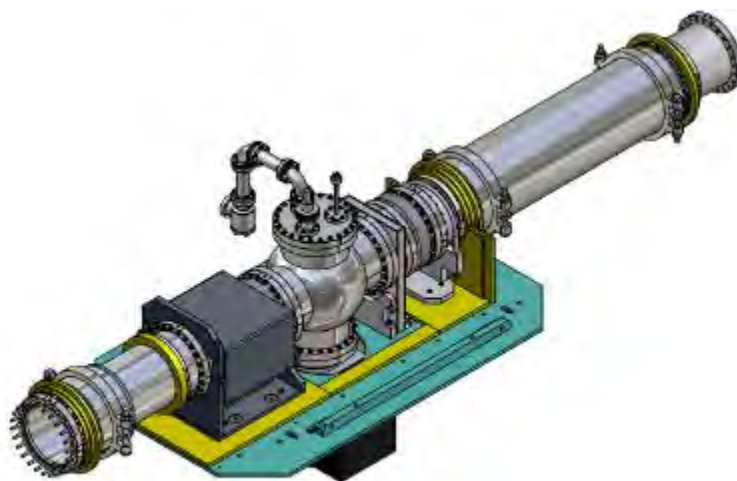
**BROOKHAVEN  
NATIONAL LABORATORY**

*BNL Three-Pole Wiggler*

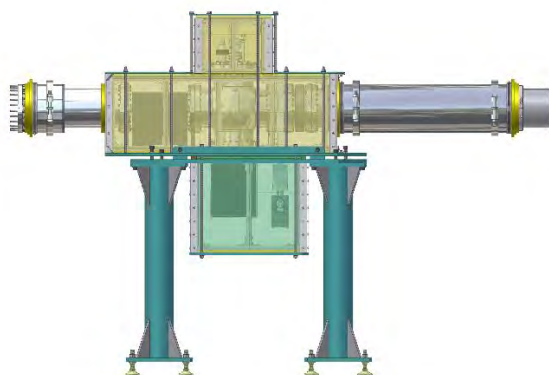


**PAL**

*PAL In- Vacuum Undulator*



ADC delivers high quality beam pipes, used for front and back end synchrotron equipment. The pipes are manufactured to exact customer specifications and requirements and come with or without lead shielding. ADC also delivers customized evacuated flight tubes, used to minimize absorption and stray scattering. The pipes are manufactured to exact customer specifications and requirements and come in fixed or adjustable lengths. In addition to pipes and tubes, ADC offers stands and enclosures to complete the assemblies.



**Customer:**

CHESS

161 Wilson Laboratory

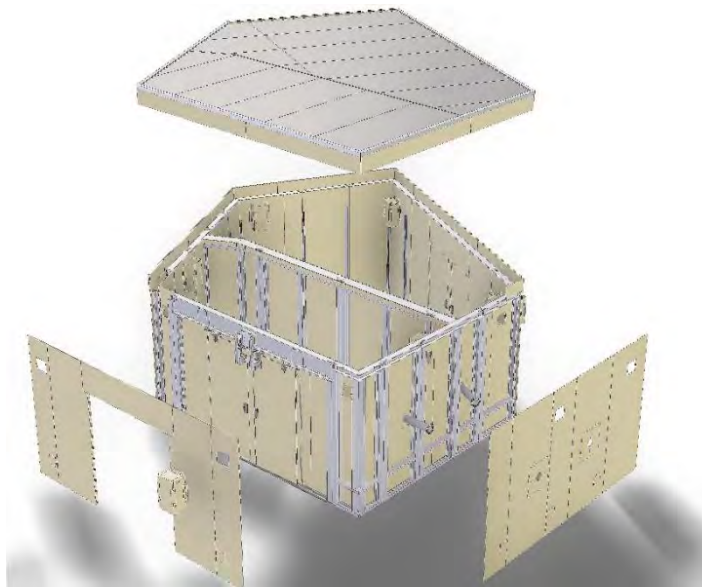
Synchrotron Drive

Ithaca, NY 14853



Cornell's High Energy Synchrotron Source (CHESS) completed significant upgrades to brighten their X-ray source. ADC produced the design and fabrication of two hutches for the first phase and five for the second phase of upgrades. To reduce downtime, ADC is committed to the quickest on-site installation as possible. To reach our installation goals, ADC implemented a highly modular design consisting of 15 wall segments and 13 ceiling segments (pictured below). The hutches were fully assembled and tested at ADC. They were then taken apart and shipped as modular pieces.

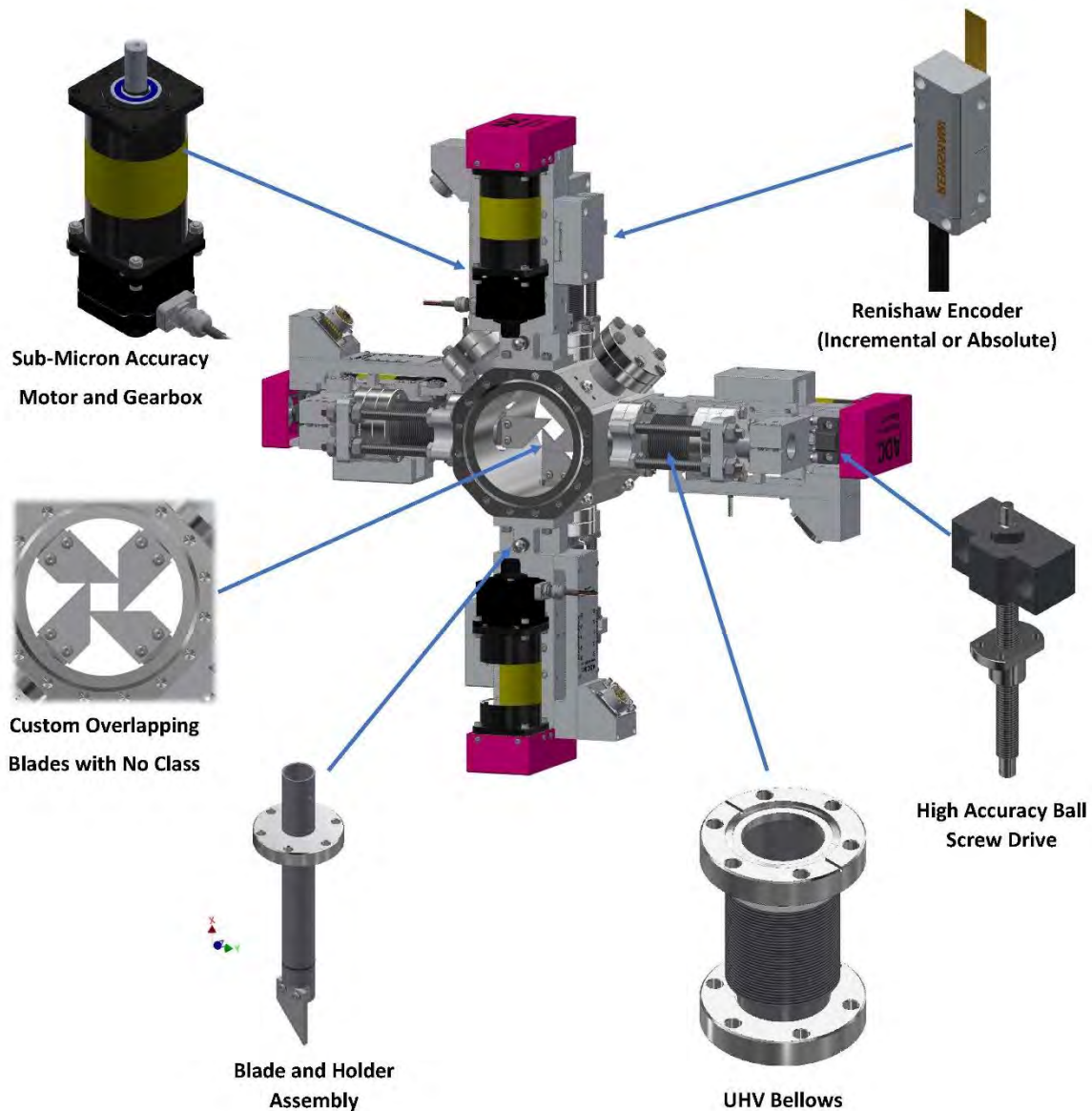
The hutches are designed to be assembled from a self-supporting corner as the starting component. The first segment is placed individually and secured to the corner. After the initial segment is secured, the next segment slides into place using a tab-and-slot connection. Adjacent segments can be secured together via bolted connection at the top and bottom after establishing the tab-and-slot connection. Lifting points are placed in multiple locations to allow positioning by crane. The final assembly is bolted to the floor.







## High Precision Slits



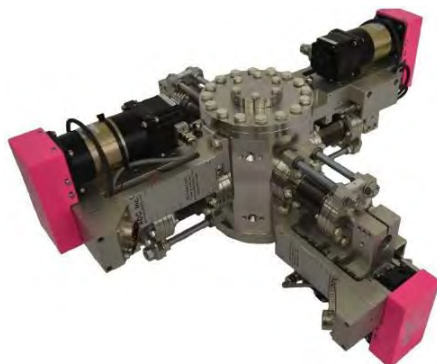
ADC offers a comprehensive line of slits that cover many synchrotron applications from white beam to monochromatic beam. We offer several series of standard slits, as well as many custom designs, fabricated to specific customers' requirements such as: space constraint, heat load, precision, motor/encoder, limit switches, connectors, type of experiments, budget, and schedule.

Our standard slits run the range from in-air monochrome beam to UHV high heat load white beam. In cooperation with CHESS at Cornell, we have developed the very best blade polishing available in the industry today. We have built an extended family of standard slits in application categories though continuous improvement in our designs.

## Custom Slits



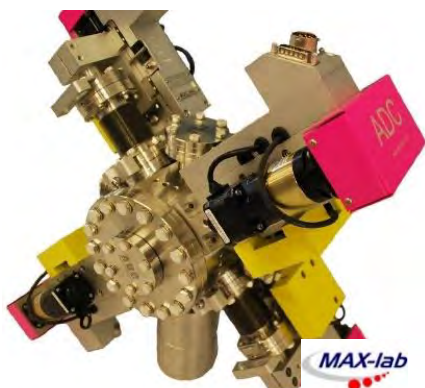
LSU-CAMD Water Cooled UHV



SwissFEL High Precision Slits –  
45 Degree



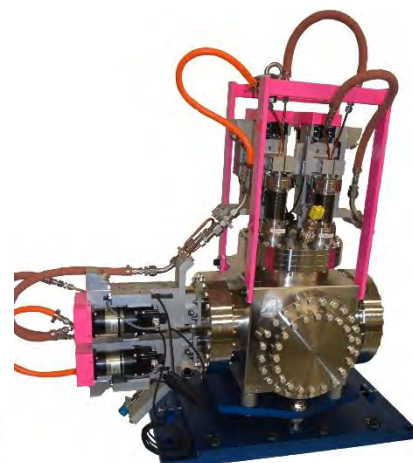
SwissFEL High Precision Slits –  
Curtain Design



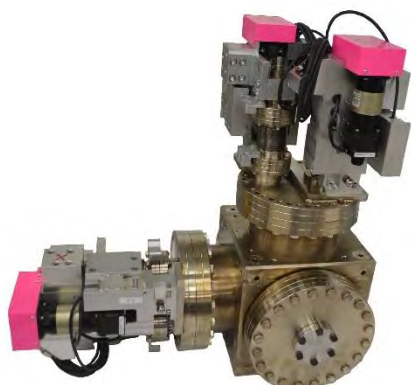
Max IV Lab-Custom UHV Slit



ESRF-High Heat Load Slit



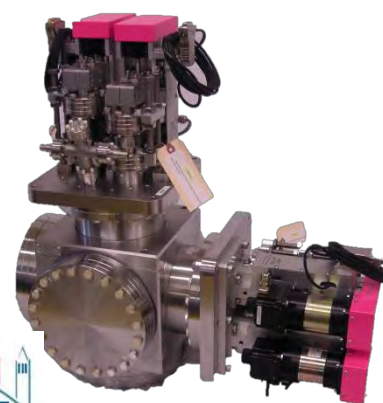
ESRF-High Heat Load UHV Slit  
System



SSRF-Monochromatic UHV Slits



Berkley Lab-UHV Slit Cooled

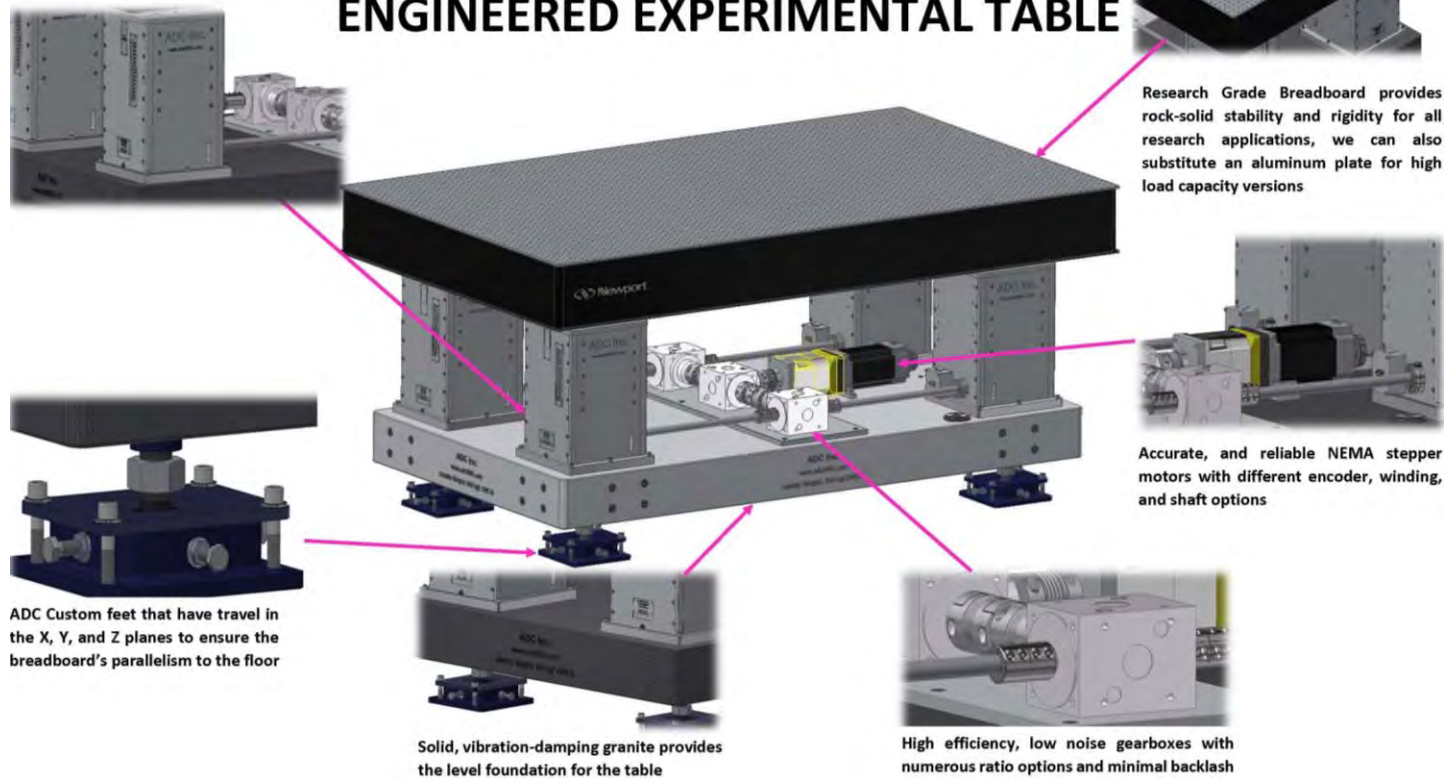


Berkley Lab-UHV Slit Uncooled

## Precision Equipment

### Engineered Experimental Tables (EETs)

Standard high precision lift stages with up to 200mm travel, with more stages available to achieve 6-axis operation, and reach load capacities of 2 ton



These high-tech systems are the new generation precision motorized system with the flexibility to adapt to demanding customer requirements and environments. In today's rapidly evolving science and engineering landscape, engineers and researchers need to manipulate and move large and heavy equipment with micron precision. ADC's High Precision Motorized Engineered Experimental Tables (EETs) are being used at many of world class research facilities around the world. This list includes: NASA, Los Alamos National Lab, Argonne, Brookhaven, SLAC, CHESS, CAMD, ELETTRA, BESSY, MAX Lab, CLS, Spring-8, DLS, DESY and many other world class facilities around the world. These tables are custom designed and are tailored to customer requirements including: Two, Three, Five and Six degrees of freedom.

## Custom Engineered Experimental Tables (EETs)



APS



**BROOKHAVEN**  
NATIONAL LABORATORY

BNL



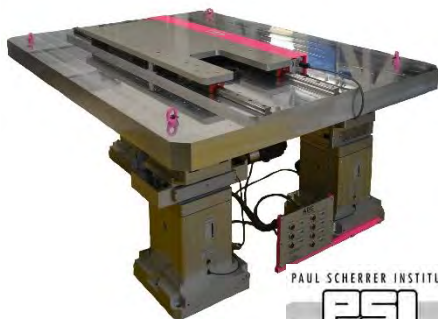
CHESS



Air Force



NSRRC

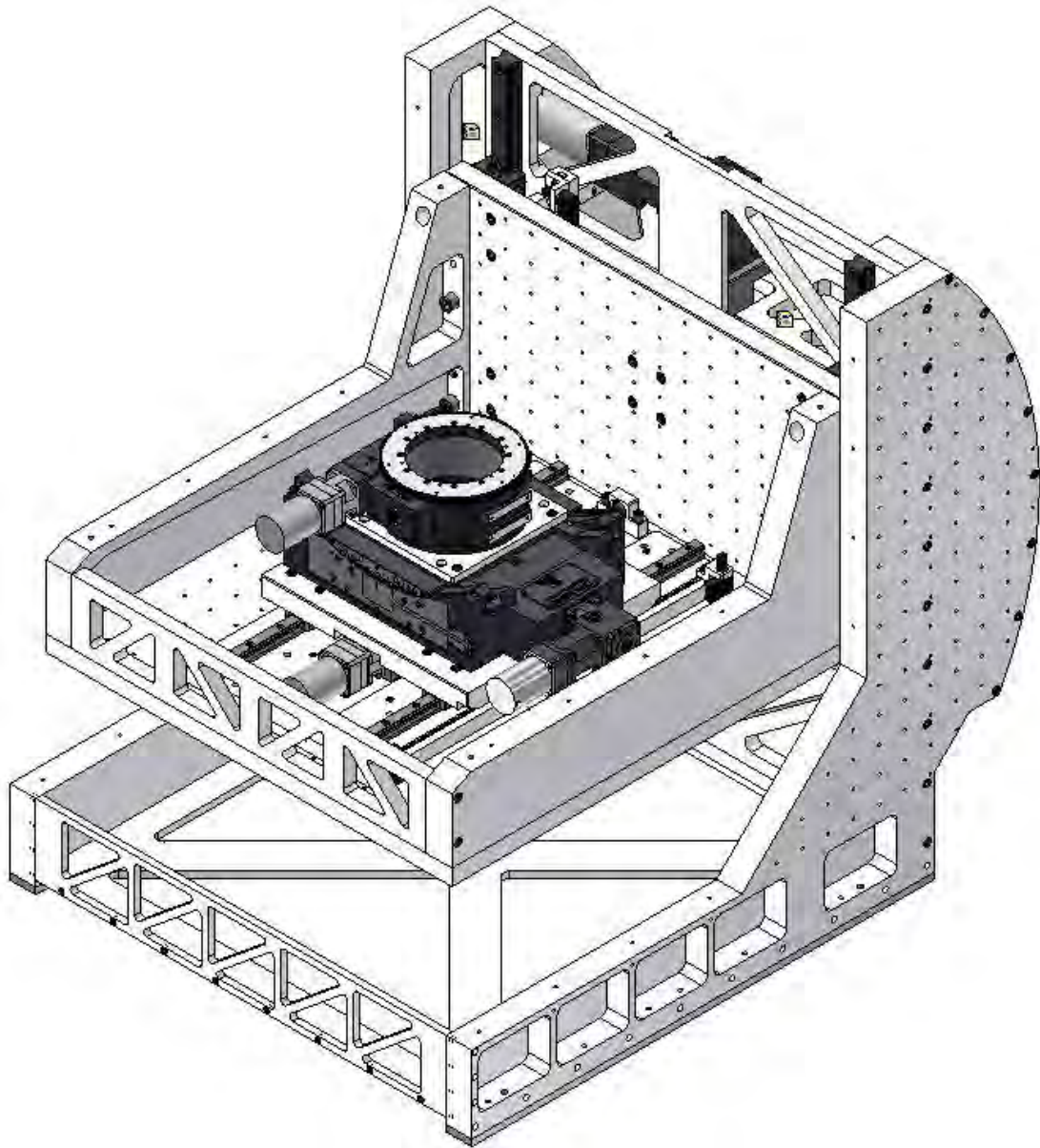


PSI



SLAC





ADC has been a leading supplier of high-quality systems to the synchrotron, neutron, FEL, and high radiation scientific community for over 18 years.

Many of our instruments have been in operation nearly that long in facilities around the world. From slits to undulators, ADC has provided instruments both inside and outside the shield wall.

## Custom Engineered Systems



*Elettra 2-Axis System with Controller*



**SOLARIS**  
NATIONAL SYNCHROTRON  
RADIATION CENTRE

*SOLARIS-3-Axis Motorized System*



*NASA-Positioning System*

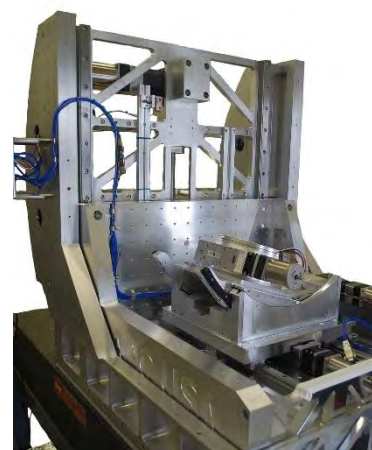


**CHESS**  
CORNELL HIGH ENERGY  
SYNCHROTRON SOURCE

*CHESS-3-Axis Stage Stack*



*APS-Press Manipulation System*



*Colorado-Gimbal System*



**UNIVERSITÉ  
DE GENÈVE**

*XYZ & O Multistage  
UHV Manipulators*



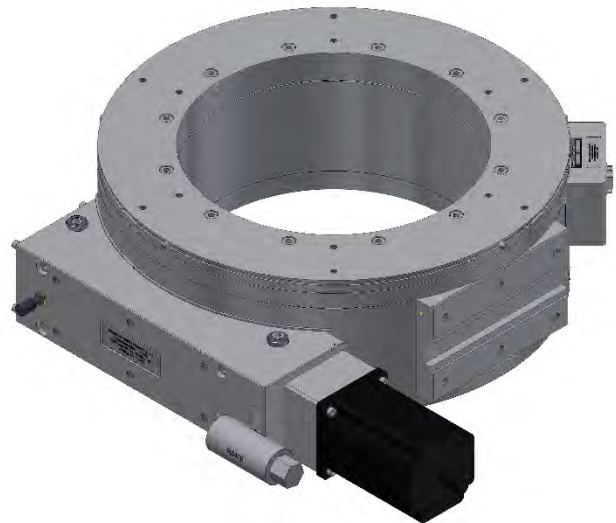
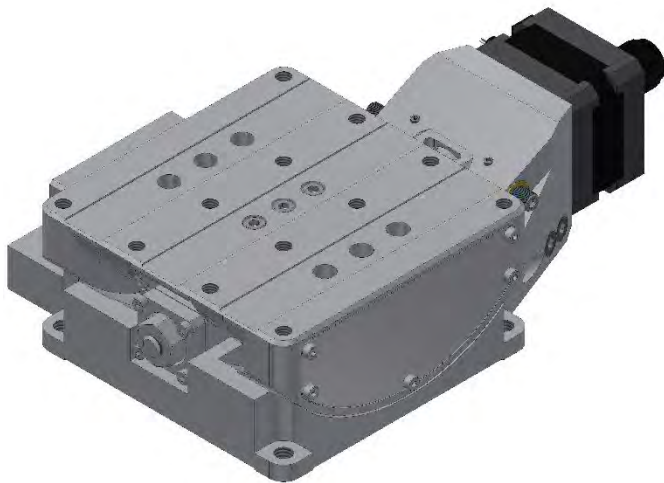
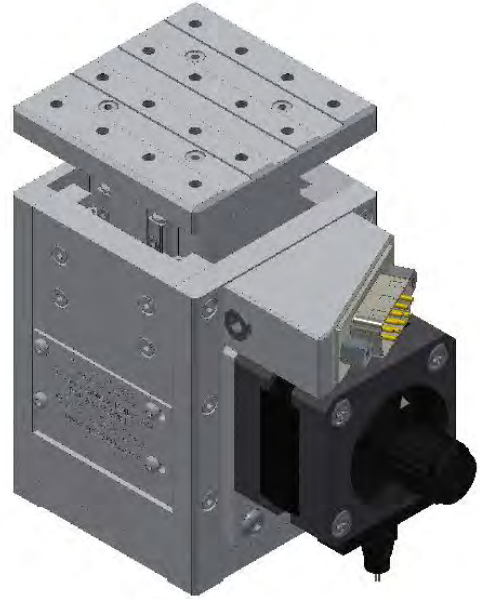
*Spectrometer*



*Cryostat Dilution Refrigerator*

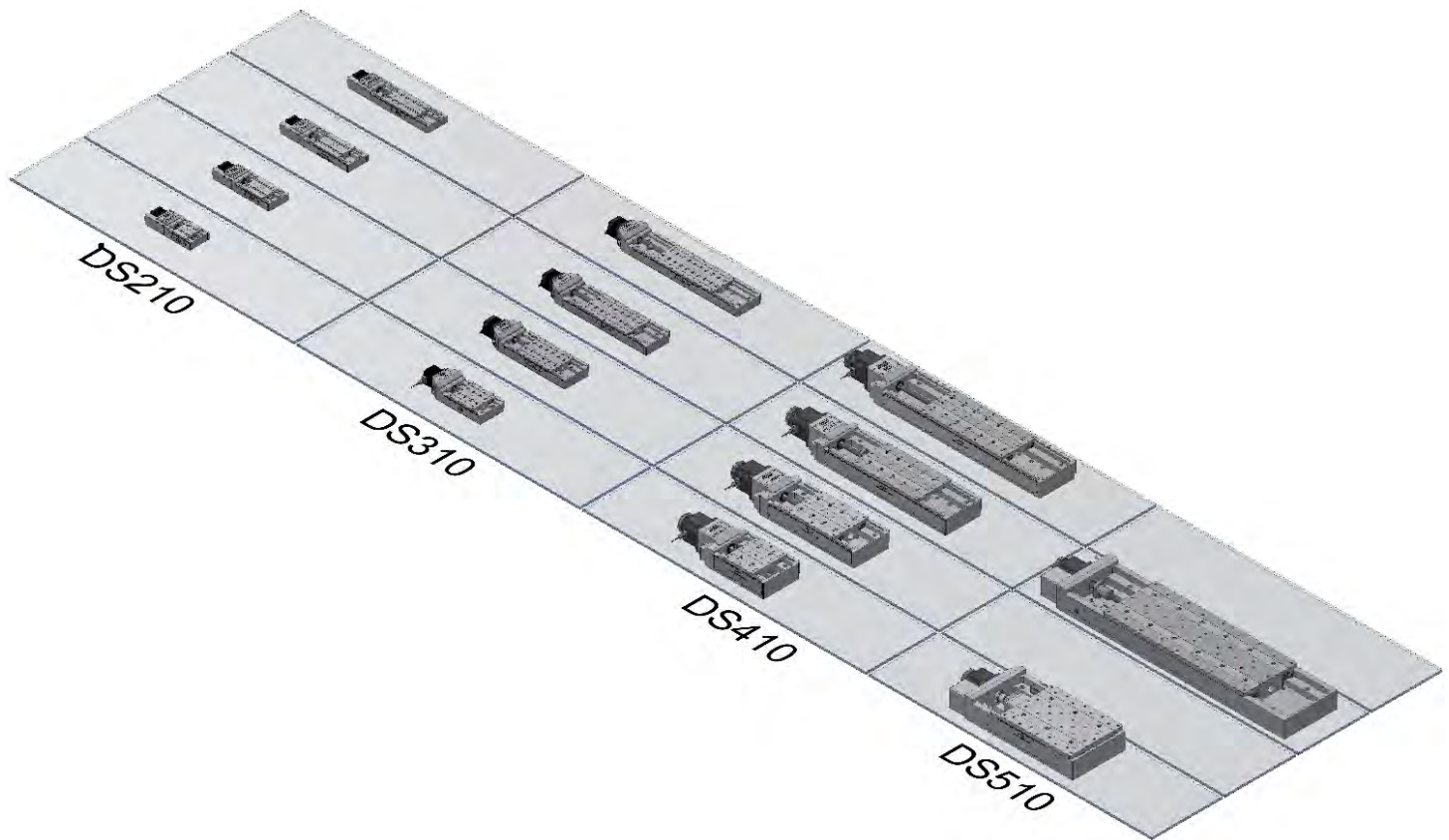
## Motion Stages

ADC manufactures high quality motion control products and systems that are suitable for Semi-conductor, Automation, and Aerospace industries. Our extensive product line includes linear stages (slides), lift stages (jacks), rotation stages, and tilt stages (goniometers).



### Linear Stages

ADC's high precision linear slides provide an accurate and rigid platform for use in any positioning system. The rugged silver anodized aluminum housing features a precision ground base and top plate, each with multiple utility holes for easy integration into the users' system. The stage is driven by a high class preloaded ballscrew coupled to a high torque 200 step per revolution stepper motor which can be run in full, half, or micro stepping mode to meet resolution requirements. Maximum rigidity is assured by preloaded crossed roller linear bearings. Each slide also features two fully adjustable, normally closed limit switches to define the extents of travel.



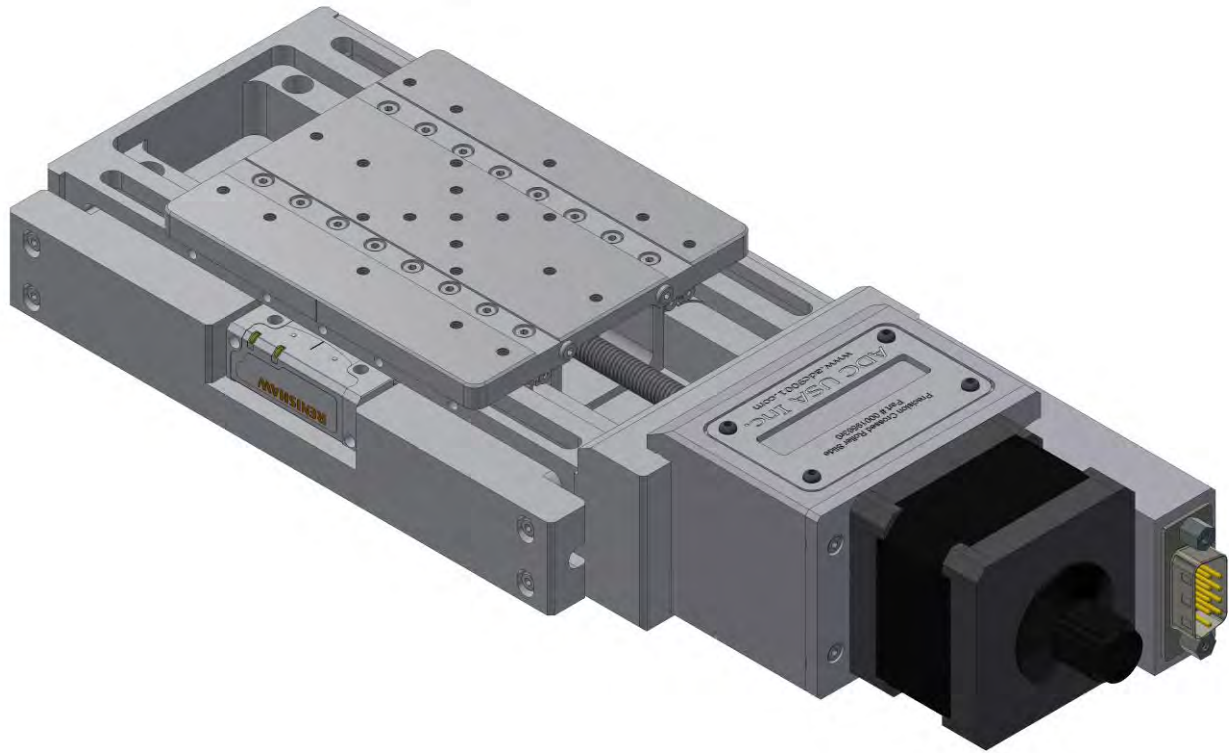
Travels 30-100 mm

1  $\mu\text{m}$  Repeatability

Various Motor Options

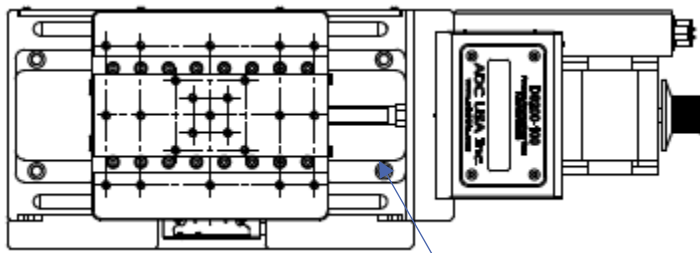
Load Capacity up to 10.5 kg

Ultra-fine Resolution



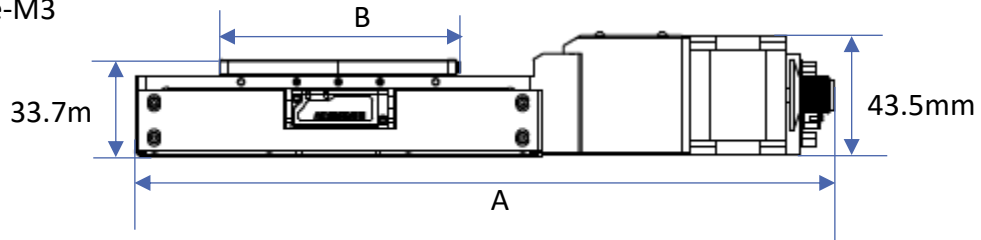
Description	30	50	75	100
Travel (mm)	30	50	75	100
Optional Linear Encoder	Yes	Yes	Yes	Yes
Repeatability ( $\mu\text{m}$ RMS)	1	1	1	1
Lead Accuracy ( $\mu\text{m}/25\text{ mm}$ )	2.5	2.5	2.5	2.5
Trajectory Straightness ( $\mu\text{m}/25\text{ mm}$ )	2.5	2.5	2.5	2.5
Ball Screw Lead (mm)	1	1	1	1
Maximum Speed (mm/sec)	50	50	50	50
Load Capacity (kg)	10.5	10.5	10.5	10.5
Mass (kg)	1.1	1.4	1.6	1.9

Top View

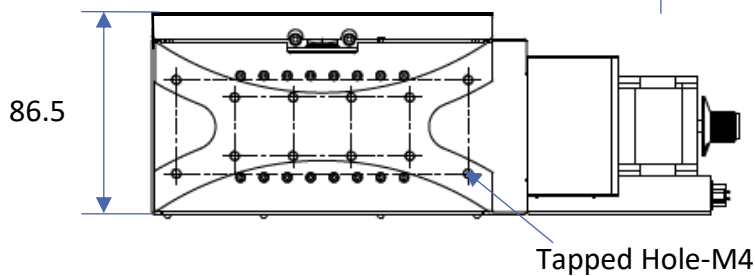


Mounting Through Hole-M3

Side View



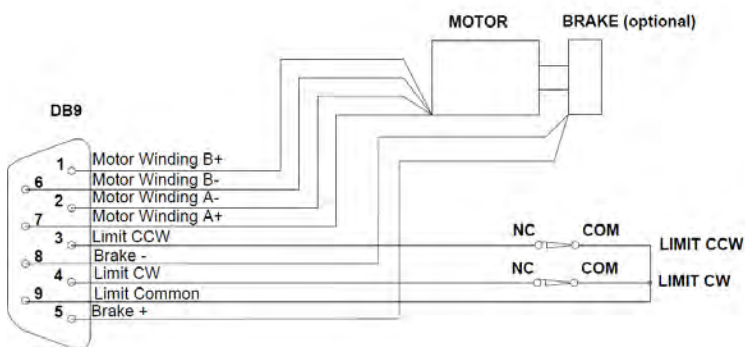
Bottom View



Tapped Hole-M4

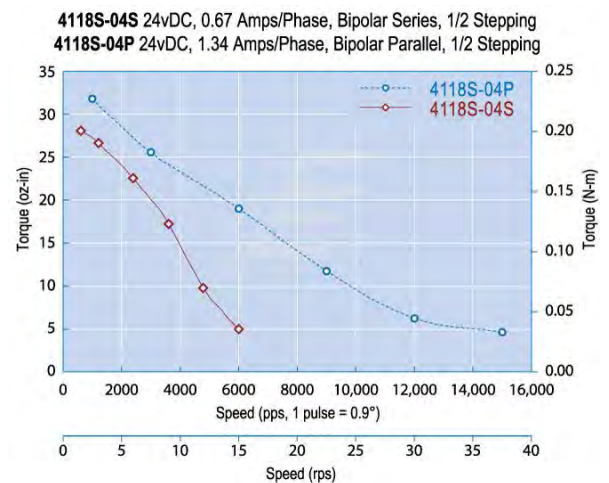
Model	50	100	150	200
A- Total Length (mm)	201.6	251.6	301.6	351.6
B- Stage Length (mm)	55	85	105	135

## ELECTRICAL CONNECTOR



ADC uses a standard male DB-9 Connector for both the motor and limit switches.

## 2-PHASE MOTOR TORQUE GRAPH



## DS210 ORDERING INFORMATION

DS210	-30	-A	-N	-B	-2PH	-G
Series	Model	Air Type	Encoder	Brake	Motor	Gearbox
	-30	-A	-E	-B	-2PH	3:1
	-50	-HV	-N	-N	-5PH	to
	-75				-DC	100:1
	-100					ratio

### Travel Options

-30	30mm Stage Travel
-50	50mm Stage Travel
-75	75mm Stage Travel
-100	100mm Stage Travel

### Air Preparation Options

-A	Standard Air Stage
-HV	High Vacuum Air Stage, $10^{-7}$ torr

### Optical Encoder Options

-E	With Optical Encoder
-N	Without Optical Encoder

### Brake Options

-B	With Brake, 24VDC
-N	Without Brake

### Motor Options

-2PH	Standard 2 Phase Bi-Polar Stepper Motor
-5PH	5 Phase Stepper Motor
-DC	DC Motor

### Gearbox Option

Available from 3:1 to 100:1 ratios

### Example Order

#### DS210-50-A-N-B-2PH

This is an order for a DS210 Precision Crossed Roller Slide with 50 mm travel, in air, with no encoder, with a brake, and a 2-phase motor.

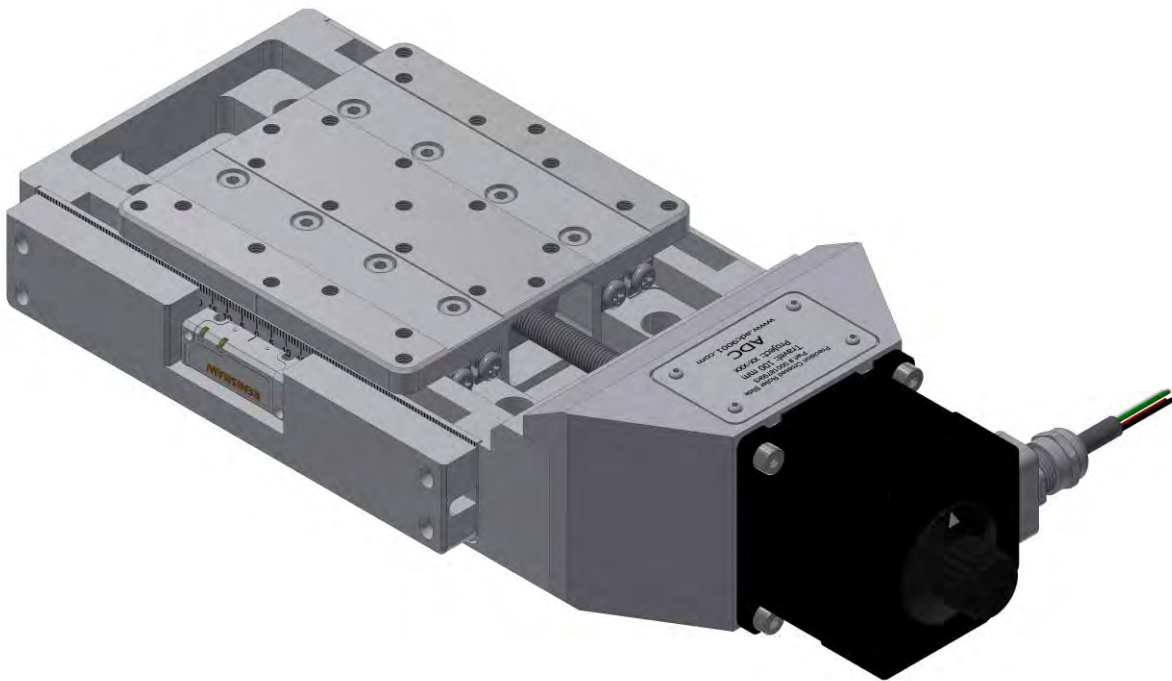
Travels 50-200 mm

1  $\mu\text{m}$  Repeatability

Various Motor Options

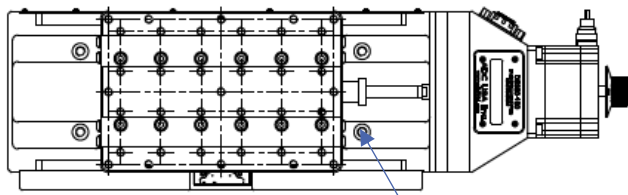
Load Capacity up to 46 kg

Ultra-fine Resolution



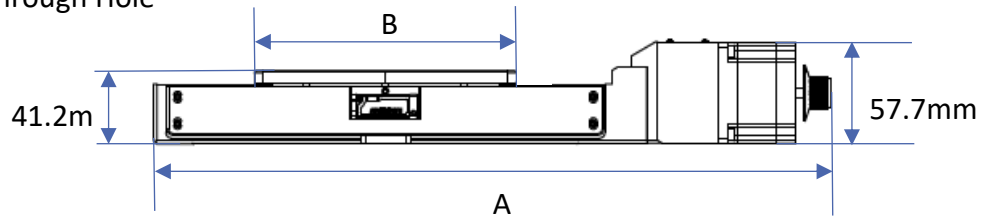
Description	50	100	150	200
Travel (mm)	50	100	150	200
Optional Linear Encoder	Yes	Yes	Yes	Yes
Repeatability ( $\mu\text{m}$ RMS)	1	1	1	1
Lead Accuracy ( $\mu\text{m}/25\text{ mm}$ )	5	5	5	5
Trajectory Straightness ( $\mu\text{m}/25\text{ mm}$ )	4	4	4	4
Ball Screw Lead (mm)	1	1	1	1
Maximum Speed (mm/sec)	25	25	25	25
Load Capacity (kg)	46	46	46	46
Mass (kg)	2.9	4	4.7	5.6

Top View

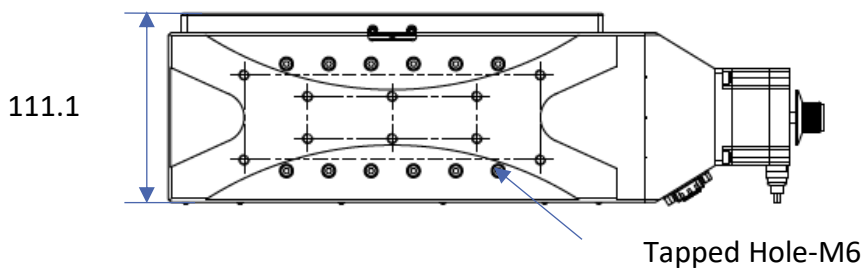


Mounting Through Hole

Side View

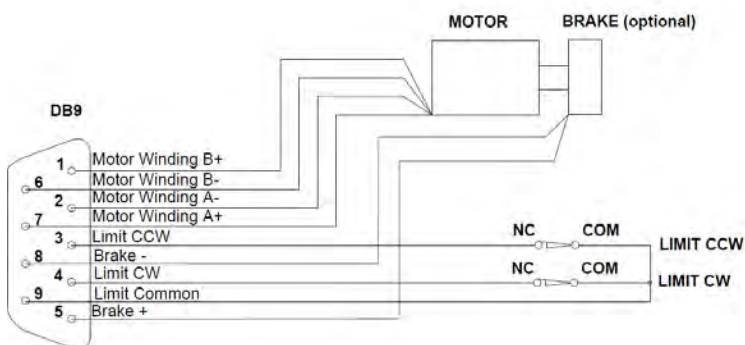


Bottom View



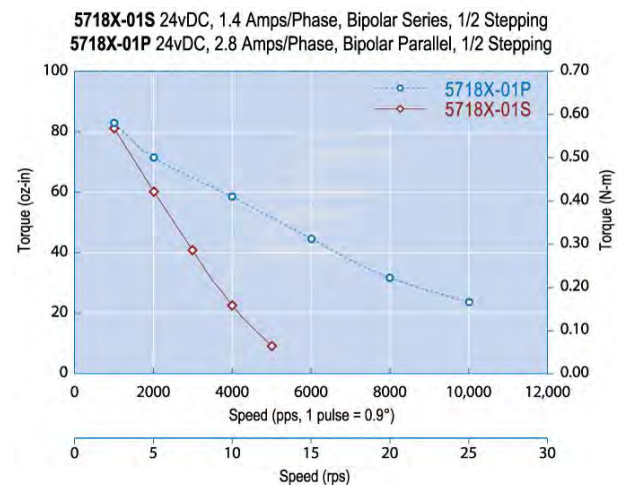
Model	50	100	150	200
A- Total Length (mm)	283	387	483	587
B- Stage Length (mm)	100	150	200	250

## ELECTRICAL CONNECTOR



ADC uses a standard male DB-9 Connector for both the motor and limit switches.

## 2-PHASE MOTOR TORQUE GRAPH



## DS310 ORDERING INFORMATION

DS310	-50	-A	-N	-B	-2PH	-G
Series	Model	Air Type	Encoder	Brake	Motor	Gearbox
	-50	-A	-E	-B	-2PH	3:1
	-100	-HV	-N	-N	-5PH	to
	-150				-DC	100:1
	-200					ratio

### Travel Options

-50	50mm Stage Travel
-100	100mm Stage Travel
-150	150mm Stage Travel
-200	200mm Stage Travel

### Air Preparation Options

-A	Standard Air Stage
-HV	High Vacuum Air Stage, $10^{-7}$ torr

### Optical Encoder Options

-E	With Optical Encoder
-N	Without Optical Encoder

### Brake Options

-B	With Brake, 24VDC
-N	Without Brake

### Motor Options

-2PH	Standard 2 Phase Bi-Polar Stepper Motor
-5PH	5 Phase Stepper Motor
-DC	DC Motor

### Gearbox Option

Available from 3:1 to 100:1 ratios

### Example Order

#### DS310-50-A-N-B-2PH

This is an order for a DS310 Precision Crossed Roller Slide with 50 mm travel, in air, with no encoder, with a brake, and a 2-phase motor.

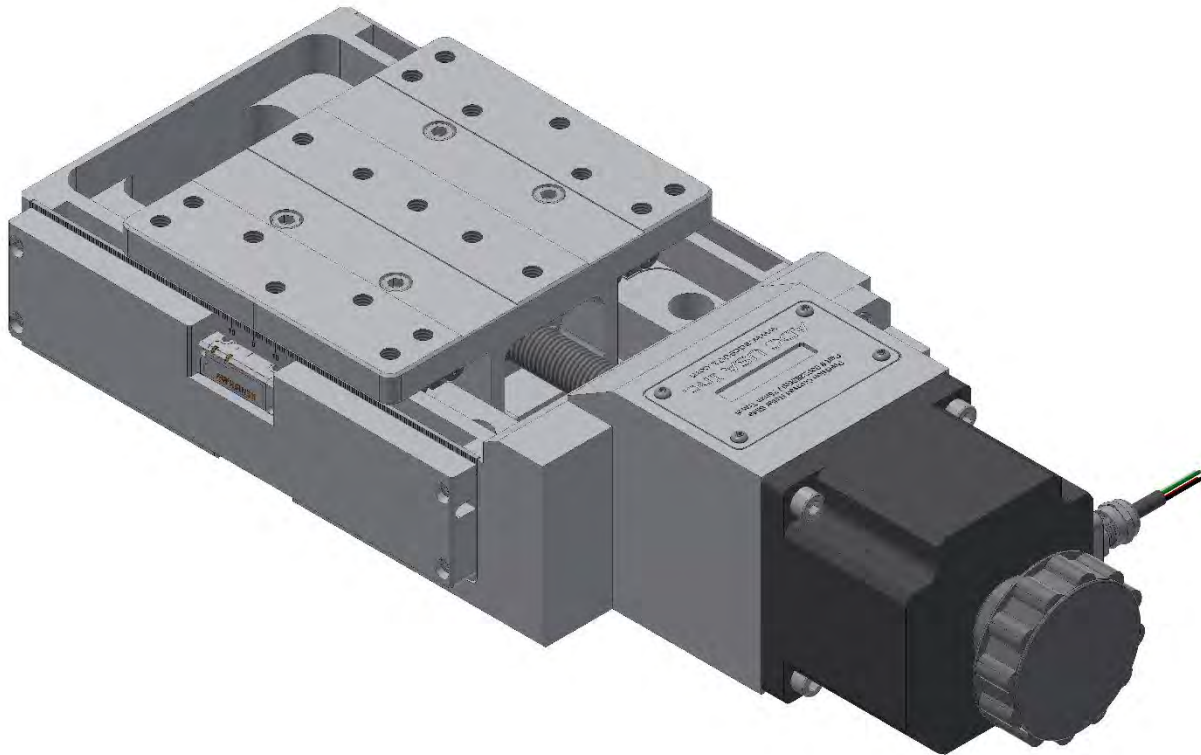
Travels 75-300 mm

1  $\mu\text{m}$  Repeatability

Various Motor Options

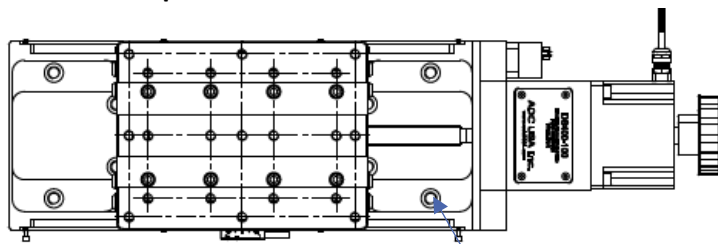
Load Capacity up to 280 kg

Ultra-fine Resolution

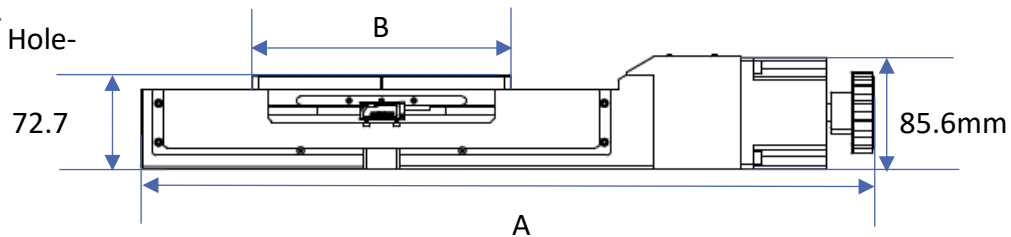


Description	75	150	225	300
Travel (mm)	75	150	225	300
Optional Linear Encoder	Yes	Yes	Yes	Yes
Repeatability ( $\mu\text{m}$ RMS)	1	1	1	1
Lead Accuracy ( $\mu\text{m}/25\text{ mm}$ )	6	6	6	6
Trajectory Straightness ( $\mu\text{m}/25\text{ mm}$ )	5	5	5	5
Ball Screw Lead (mm)	2	2	2	2
Maximum Speed (mm/sec)	40	40	40	40
Load Capacity (kg)	280	280	280	280
Mass (kg)	10	13.3	16	19.7

Top View

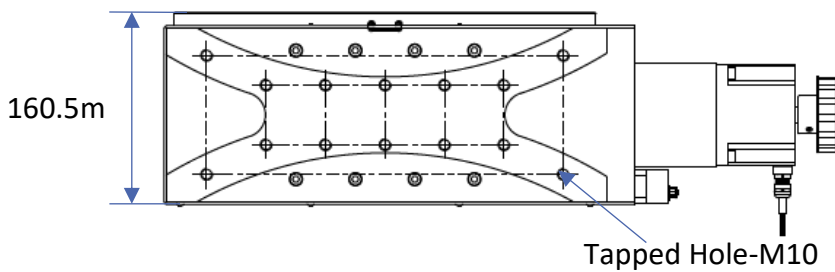


Mounting Through Hole-



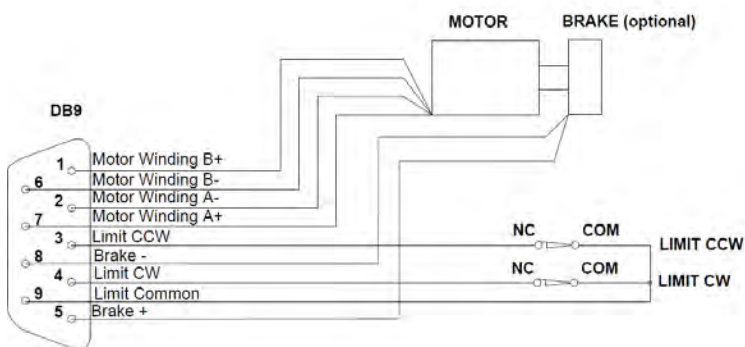
Side View

Bottom View



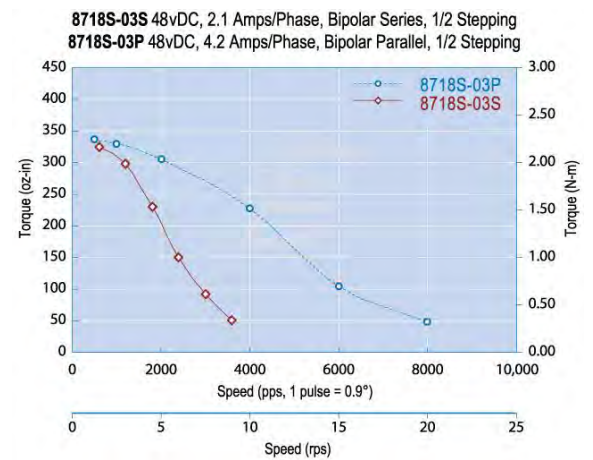
Model	75	150	225	300
A- Total Length (mm)	410.4	566.4	723.9	874.1
B- Stage Length (mm)	125	200	275	350

## ELECTRICAL CONNECTOR



ADC uses a standard male DB-9 Connector for both the motor and limit switches.

## 2-PHASE MOTOR TORQUE GRAPH



## DS410 ORDERING INFORMATION

DS410	-75	-A	-N	-B	-2PH	-G
Series	Model	Air Type	Encoder	Brake	Motor	Gearbox
	-75	-A	-E	-B	-2PH	3:1
	-150	-HV	-N	-N	-5PH	to
	-225				-DC	100:1
	-300					ratio

### Travel Options

-75	75mm Stage Travel
-150	150mm Stage Travel
-225	225mm Stage Travel
-300	300mm Stage Travel

### Air Preparation Options

-A	Standard Air Stage
-HV	High Vacuum Air Stage, $10^{-7}$ torr

### Optical Encoder Options

-E	With Optical Encoder
-N	Without Optical Encoder

### Brake Options

-B	With Brake, 24VDC
-N	Without Brake

### Motor Options

-2PH	Standard 2 Phase Bi-Polar Stepper Motor
-5PH	5 Phase Stepper Motor
-DC	DC Motor

### Gearbox Option

Available from 3:1 to 100:1 ratios

### Example Order

#### DS410-75-A-N-B-2PH

This is an order for a DS410 Precision Crossed Roller Slide with 75 mm travel, in air, with no encoder, with a brake, and a 2-phase motor.

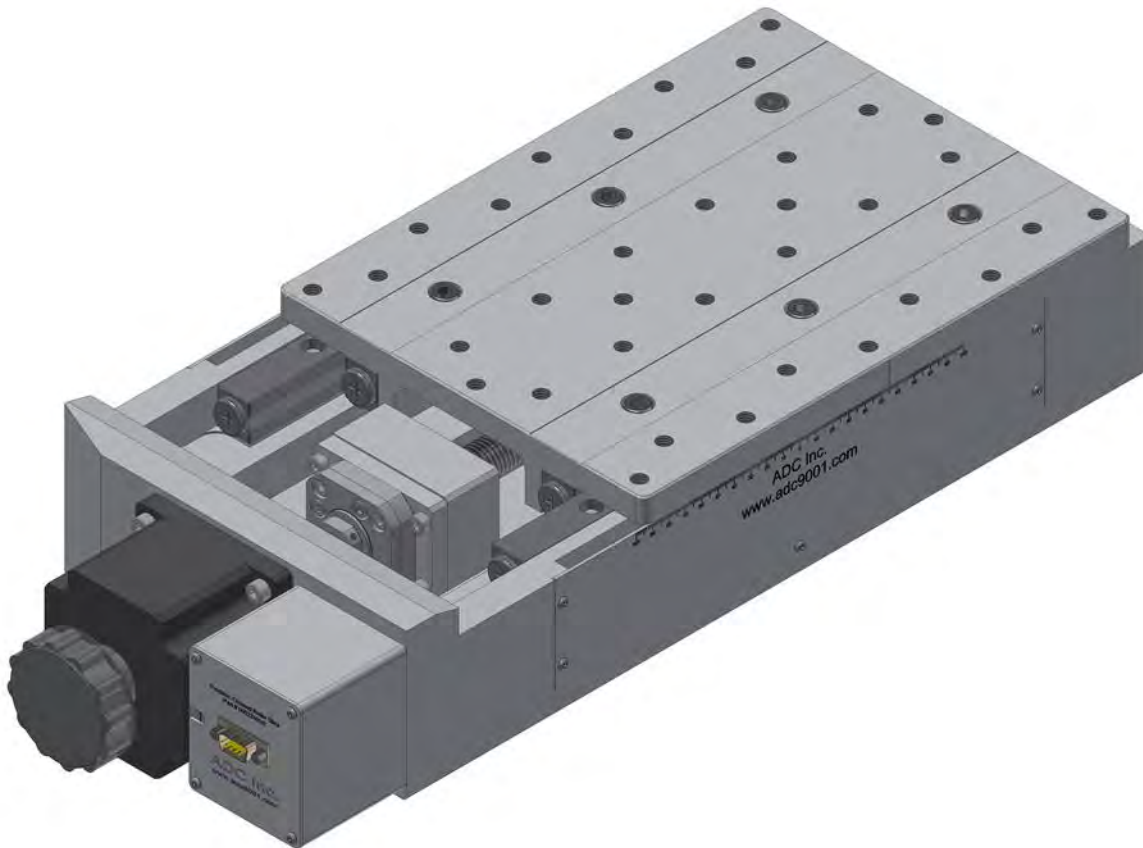
Travels 100-300 mm

1  $\mu\text{m}$  Repeatability

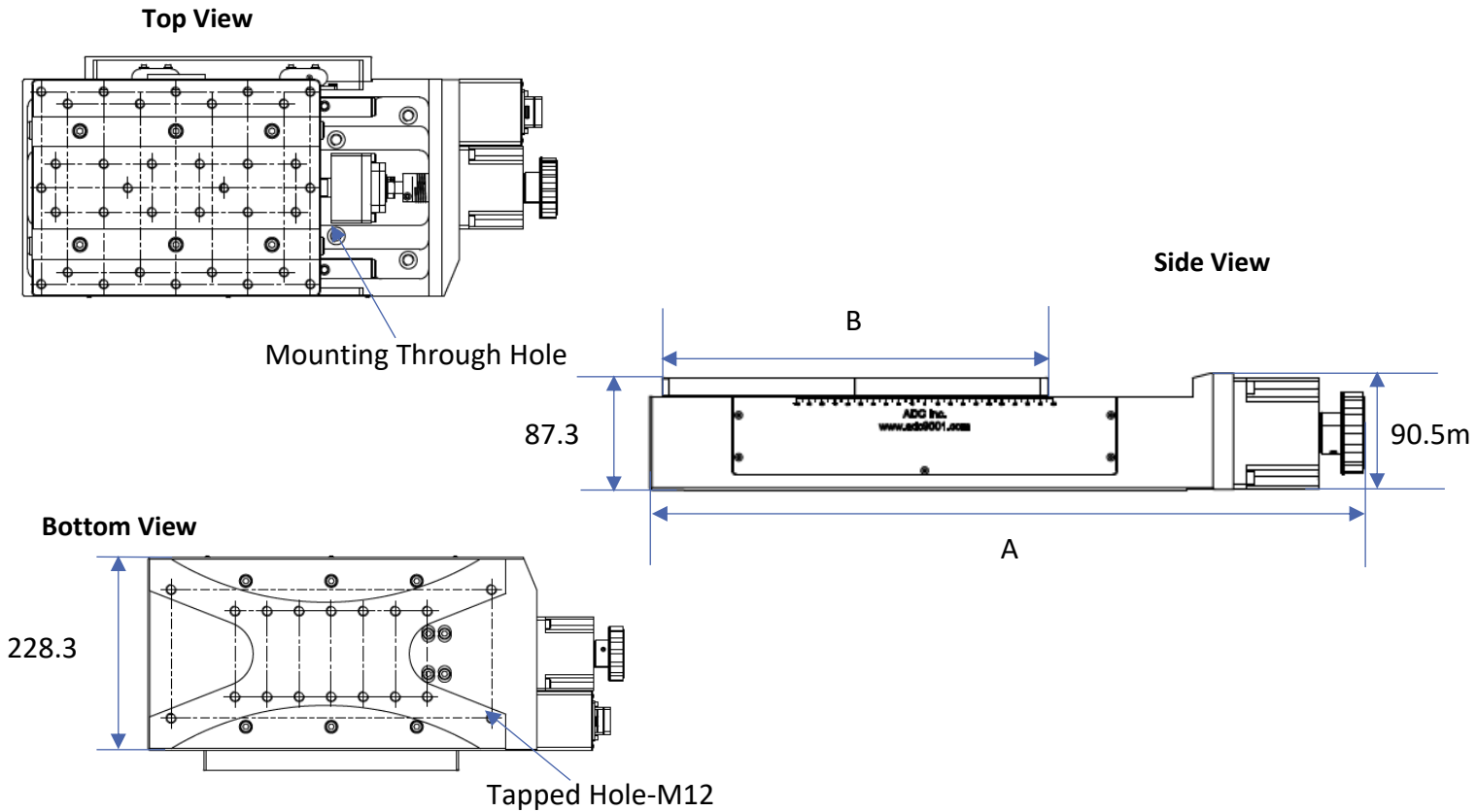
Various Motor Options

Load Capacity up to 575 kg

Ultra-fine Resolution

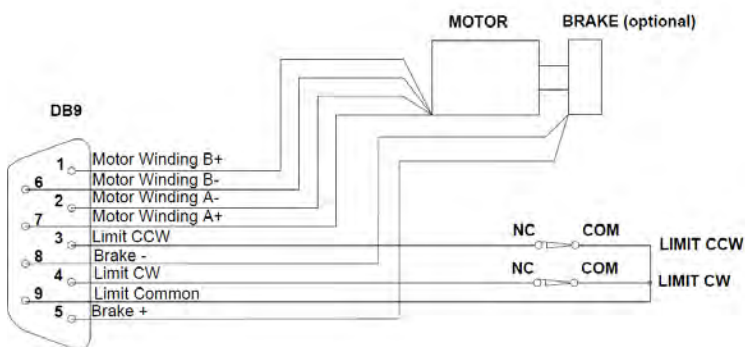


Description	100	300
Travel (mm)	100	300
Optional Linear Encoder	Yes	Yes
Repeatability ( $\mu\text{m}$ RMS)	1	1
Lead Accuracy ( $\mu\text{m}/25\text{ mm}$ )	6	6
Trajectory Straightness ( $\mu\text{m}/25\text{ mm}$ )	5	5
Ball Screw Lead (mm)	3	3
Maximum Speed (mm/sec)	100	100
Load Capacity (kg)	575	575
Mass (kg)	20.5	47.4



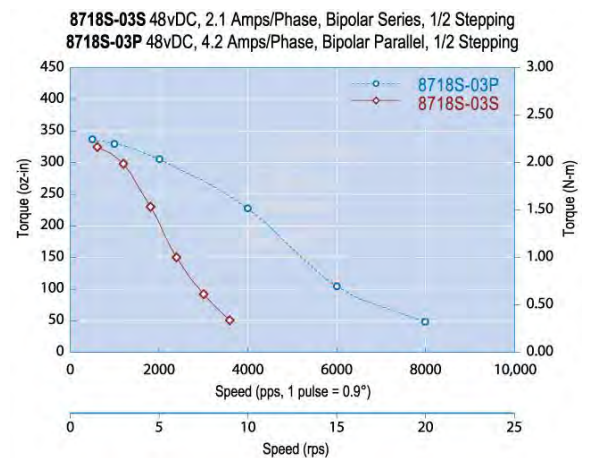
Model	100	300
A- Total Length (mm)	556.6	1065.4
B- Stage Length (mm)	300	600

## ELECTRICAL CONNECTOR



ADC uses a standard male DB-9 Connector for both the motor and limit switches.

## 2-PHASE MOTOR TORQUE GRAPH



## DS510 ORDERING INFORMATION

DS510	-100	-A	-N	-B	-2PH	-G
Series	Model	Air Type	Encoder	Brake	Motor	Gearbox
	-100	-A	-E	-B	-2PH	3:1
	-300	-HV	-N	-N	-5PH	to
					-DC	100:1
						ratio

### Travel Options

-100	100mm Stage Travel
-300	300mm Stage Travel

### Air Preparation Options

-A	Standard Air Stage
-HV	High Vacuum Air Stage, $10^{-7}$ torr

### Optical Encoder Options

-E	With Optical Encoder
-N	Without Optical Encoder

### Brake Options

-B	With Brake, 24VDC
-N	Without Brake

### Motor Options

-2PH	Standard 2 Phase Bi-Polar Stepper Motor
-5PH	5 Phase Stepper Motor
-DC	DC Motor

### Gearbox Option

Available from 3:1 to 100:1 ratios

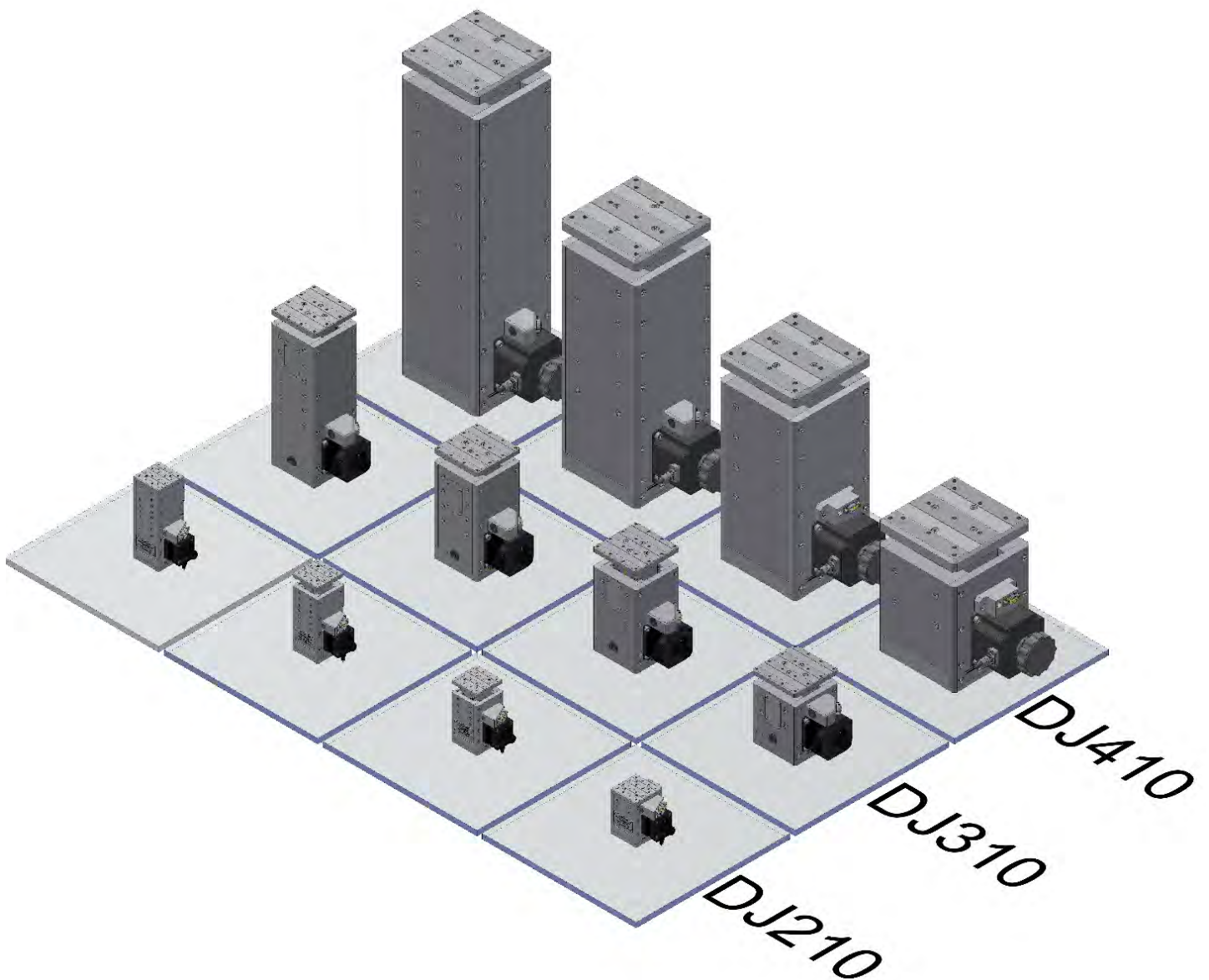
### Example Order

#### DS510-100-A-N-B-2PH

This is an order for a DS510 Precision Crossed Roller Slide with 100 mm travel, in air, with no encoder, with a brake, and a 2-phase motor.

### *Lift Stages*

ADC's high precision jacks provide an accurate and rigid platform for use in any positioning system. The rugged silver anodized aluminum housing features a precision ground base and top plate, each with multiple utility holes for easy integration into the users' system. The stage is driven by a high class preloaded ballscrew coupled to a high torque 200 step per revolution stepper motor which can be run in full, half, or micro stepping mode to meet your resolution requirements. Maximum rigidity is assured by preloaded crossed roller linear bearings. Each slide also features two fully adjustable, normally closed limit switches to define the extents of travel.



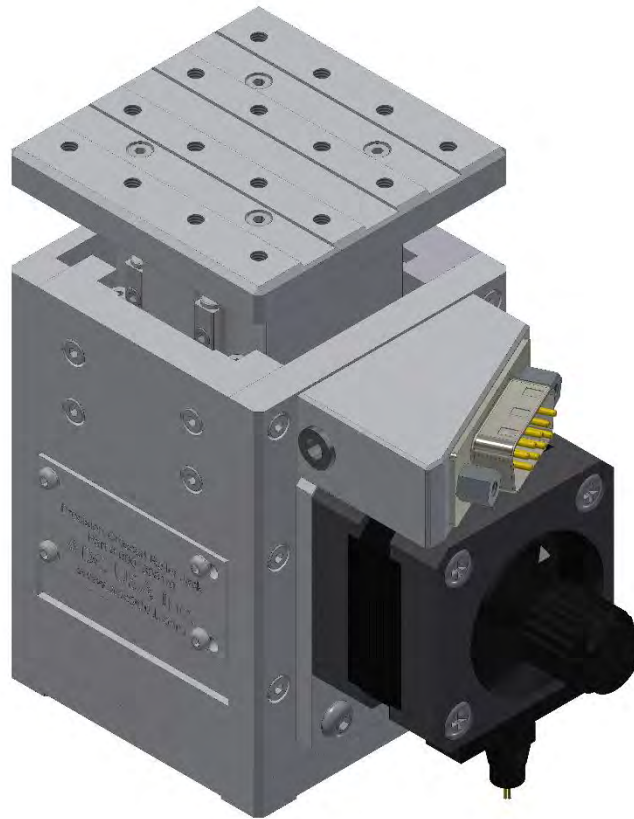
Travels 10-50 mm

2  $\mu$ m Repeatability

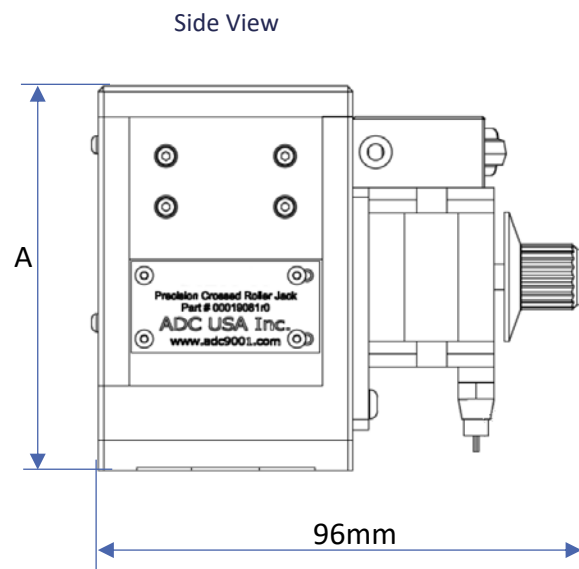
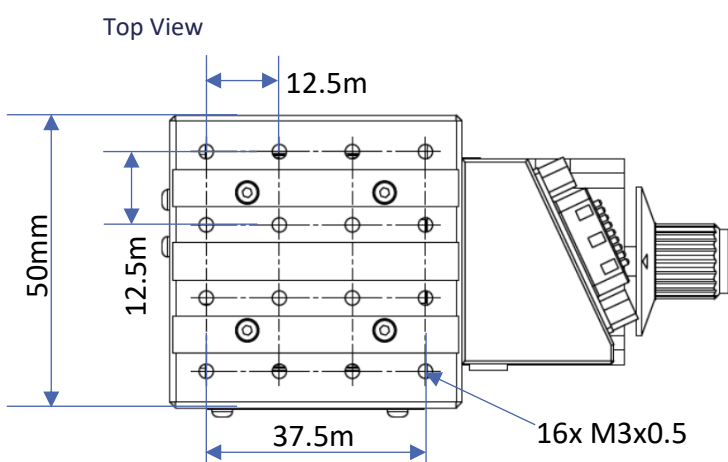
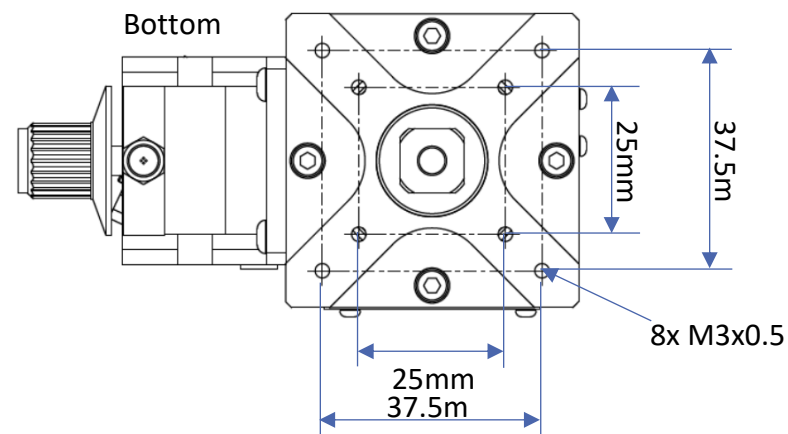
Various Motor Options

Load Capacity up to 31 kg

High Dynamic Performance

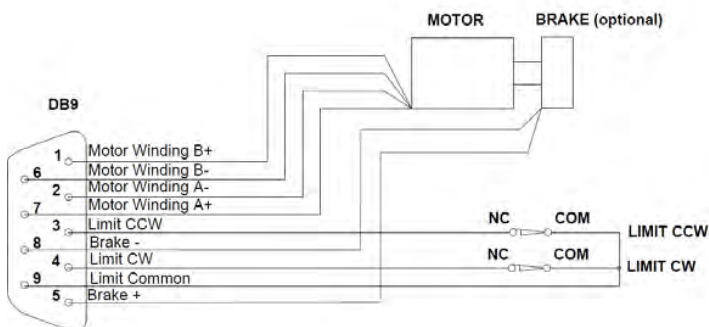


Description	10	25	35	50
Travel (mm)	10	25	35	50
Optional Linear Encoder	No	No	No	No
Repeatability ( $\mu$ m RMS)	2	2	2	2
Lead Accuracy ( $\mu$ m/25 mm)	2.5	2.5	2.5	2.5
Trajectory Straightness ( $\mu$ m/25 mm)	2.5	2.5	2.5	2.5
Ball Screw Lead (mm)	1	1	1	1
Maximum Speed (mm/sec)	25	25	25	25
Load Capacity (kg)	31	31	31	31
Mass (kg)	0.6	.8	1	1.1



Model	10	25	35	50
A- Closed Height (mm)	75.5	89.4	113.9	137.4

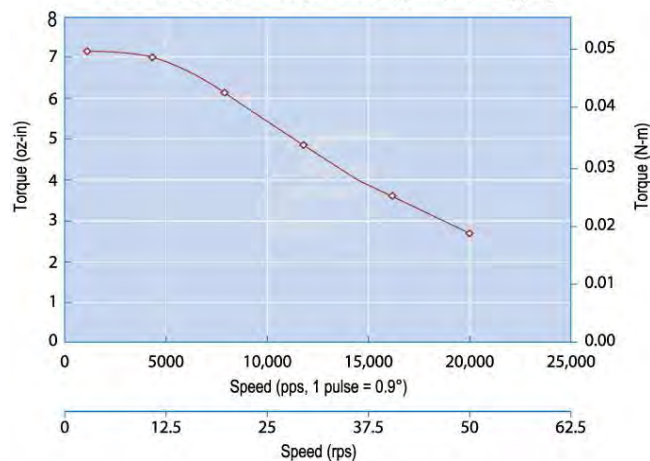
## ELECTRICAL CONNECTOR



ADC uses a standard male DB-9 Connector for both the motor and limit switches.

## 2-PHASE MOTOR TORQUE GRAPH

3518X-04 24vDC, 0.45 Amps/Phase, Bipolar, 1/2 Stepping



## DJ210 ORDERING INFORMATION

DJ210	-50	-A	-N	-B	-2PH	-G
Series	Model	Air Type	Encoder	Brake	Motor	Gearbox
	-10	-A	-N	-B	-2PH	3:1
	-25	-HV		-N	-5PH	to
	-35				-DC	100:1
	-50					ratio

### Travel Options

-10	10mm Stage Travel
-25	25mm Stage Travel
-35	35mm Stage Travel
-50	50mm Stage Travel

### Air Preparation Options

-A	Standard Air Stage
-HV	High Vacuum Air Stage, $10^{-7}$ torr

### Optical Encoder Options

-N	Without Optical Encoder
----	-------------------------

### Brake Options

-B	With Brake, 24VDC
-N	Without Brake

### Motor Options

-2PH	Standard 2 Phase Bi-Polar Stepper Motor
-5PH	5 Phase Stepper Motor
-DC	DC Motor

### Gearbox Option

Available from 3:1 to 100:1 ratios

### Example Order

#### DJ210-50-A-N-B-2PH

This is an order for a DJ210 Precision Crossed Roller Jack with 50 mm travel, in air, with no encoder, with a brake, and a 2-phase motor.

Travels 25-100 mm

1  $\mu\text{m}$  Repeatability

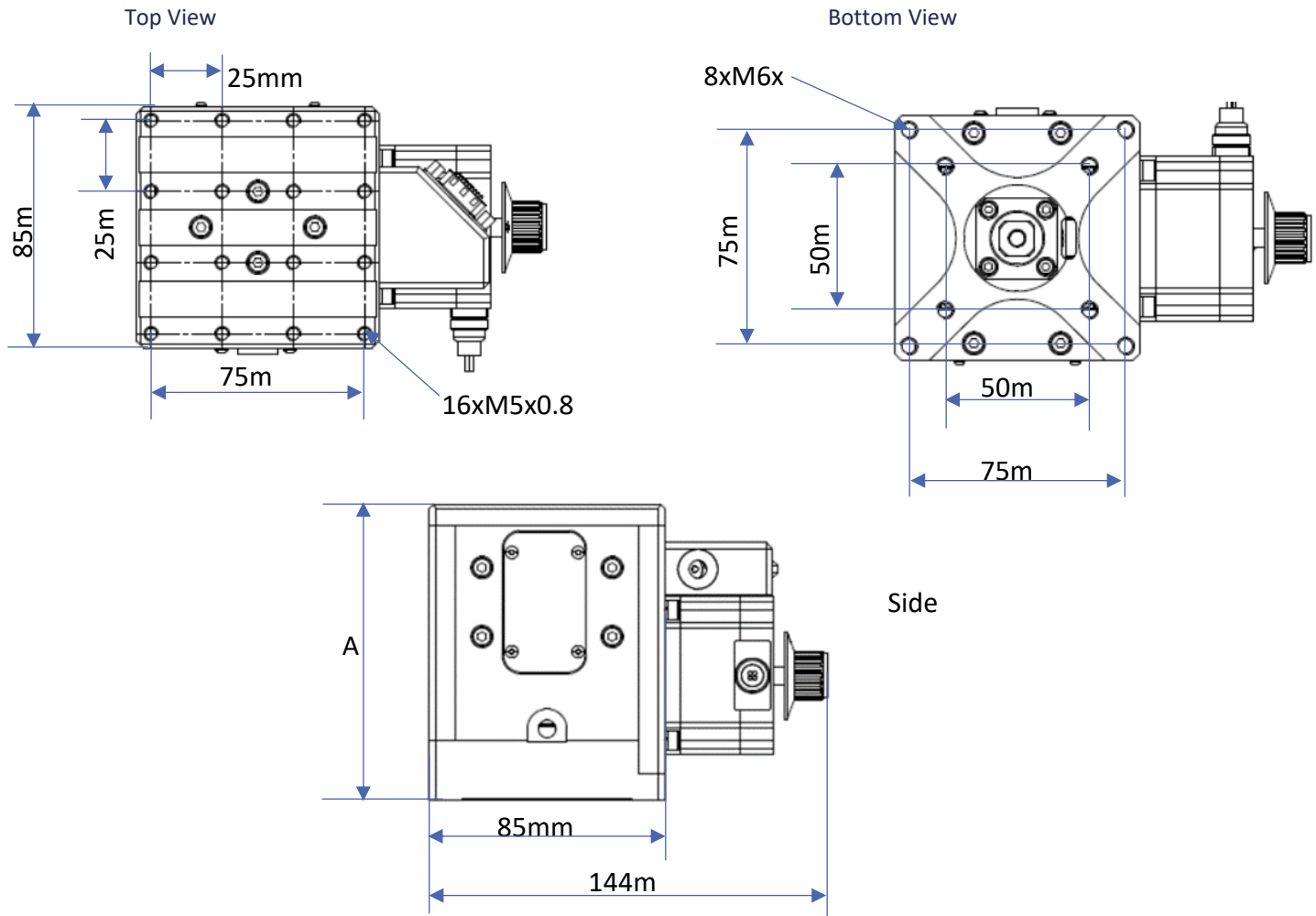
Various Motor Options

Load Capacity up to 46 kg

High Dynamic Performance

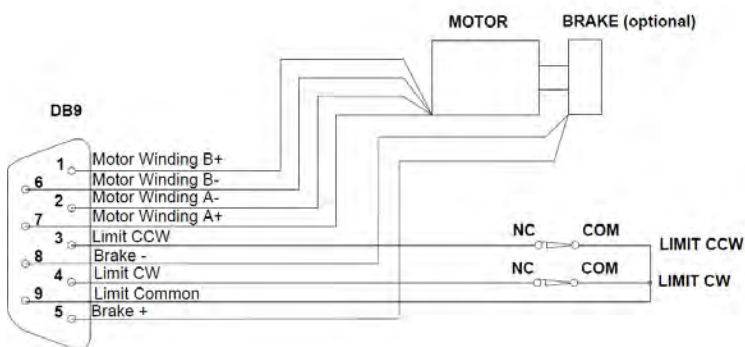


Description	25	50	75	100
Travel (mm)	25	50	75	100
Optional Linear Encoder	Yes	Yes	Yes	Yes
Repeatability ( $\mu\text{m}$ RMS)	1	1	1	1
Lead Accuracy ( $\mu\text{m}/25\text{ mm}$ )	5.0	5.0	5.0	5.0
Trajectory Straightness ( $\mu\text{m}/25\text{ mm}$ )	3.0	3.0	3.0	3.0
Ball Screw Lead (mm)	1.0	1.0	1.0	1.0
Maximum Speed (mm/sec)	12.5	12.5	12.5	12.5
Load Capacity (kg)	46	46	46	46
Mass (kg)	2.6	3.4	3.9	5.1



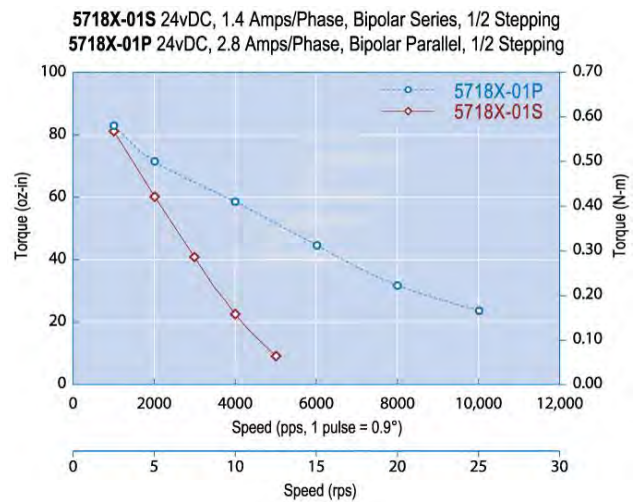
Model	25	50	75	100
A- Closed Height (mm)	75.5	89.4	113.9	137.4

## ELECTRICAL CONNECTOR



ADC uses a standard male DB-9 Connector for both the motor and limit switches.

## 2-PHASE MOTOR TORQUE GRAPH



## DJ310 ORDERING INFORMATION

DJ310	-50	-A	-N	-B	-2PH	-G
Series	Model	Air Type	Encoder	Brake	Motor	Gearbox
	-25	-A	-E	-B	-2PH	3:1
	-50	-HV	-N	-N	-5PH	to
	-75				-DC	100:1
	-100					ratio

### Travel Options

-25	25mm Stage Travel
-50	50mm Stage Travel
-75	75mm Stage Travel
-100	100mm Stage Travel

### Air Preparation Options

-A	Standard Air Stage
-HV	High Vacuum Air Stage, $10^{-7}$ torr

### Optical Encoder Options

-E	With Optical Encoder
-N	Without Optical Encoder

### Brake Options

-B	With Brake, 24VDC
-N	Without Brake

### Motor Options

-2PH	Standard 2 Phase Bi-Polar Stepper Motor
-5PH	5 Phase Stepper Motor
-DC	DC Motor

### Gearbox Option

Available from 3:1 to 100:1 ratios

### Example Order

#### DJ310-50-A-N-B-2PH

This is an order for a DJ310 Precision Crossed Roller Jack with 50 mm travel, in air, with no encoder, with a brake, and a 2-phase motor.

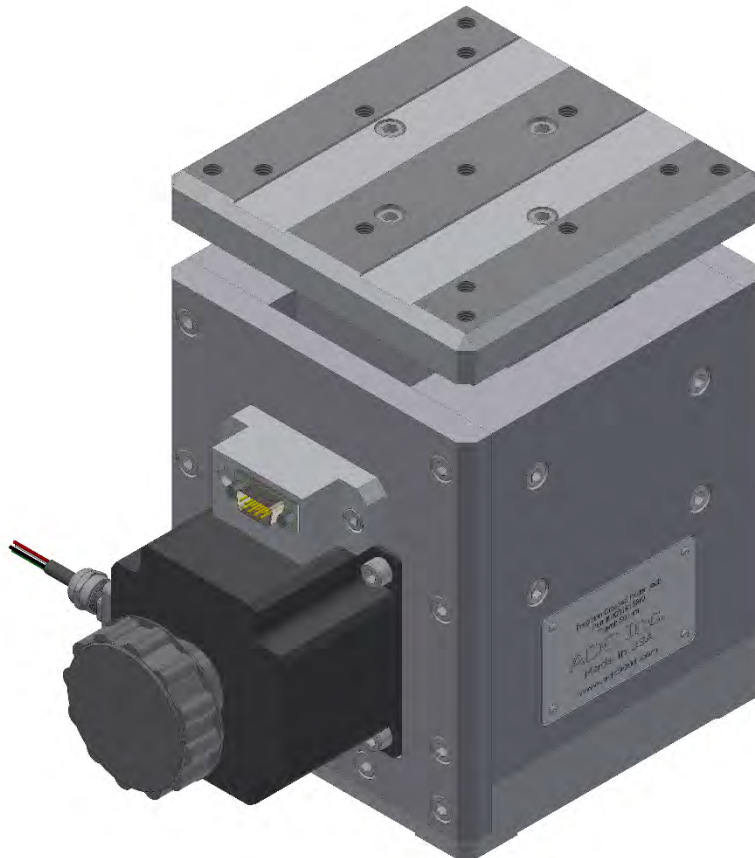
Travels 50-200 mm

1  $\mu$ m Repeatability

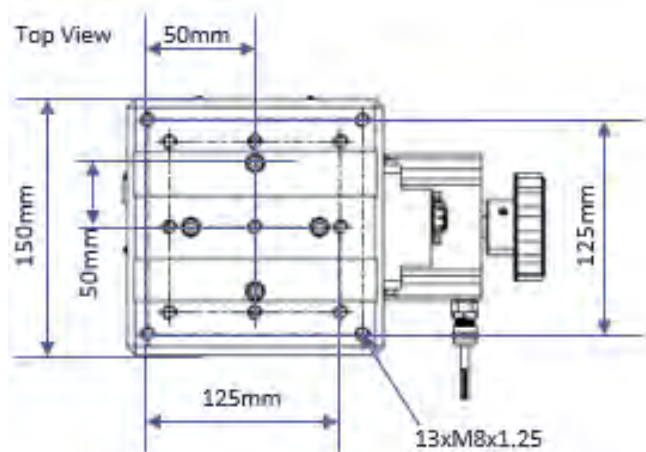
Various Motor Options

Load Capacity up to 46 kg

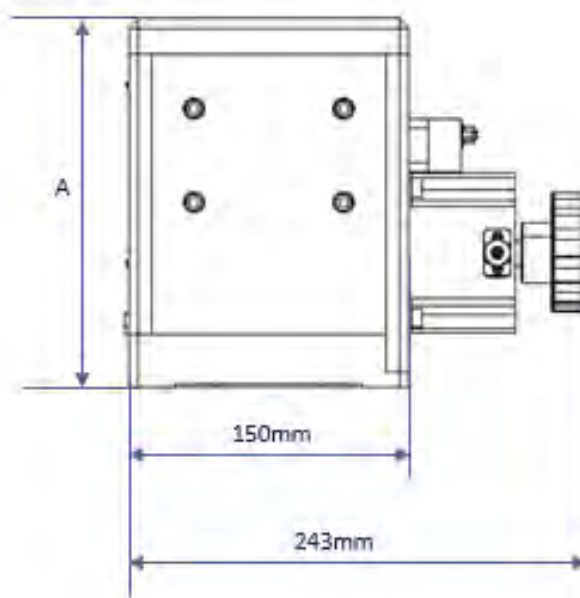
High Dynamic Performance



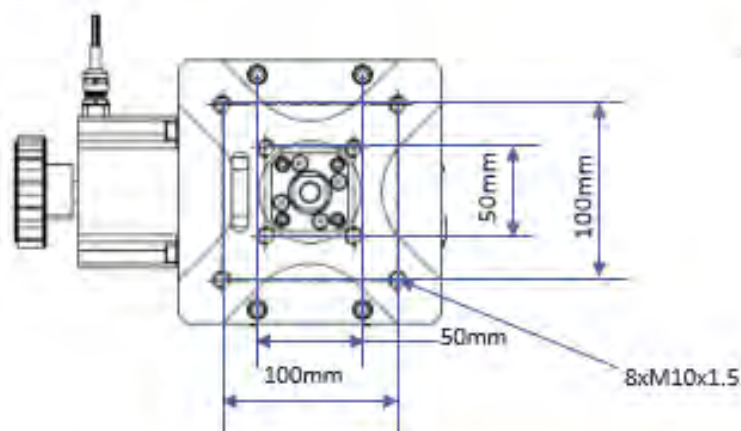
Description	50	100	150	200
Travel (mm)	50	100	150	200
Optional Linear Encoder	Yes	Yes	Yes	Yes
Repeatability ( $\mu$ m RMS)	1	1	1	1
Lead Accuracy ( $\mu$ m/25mm)	5.0	5.0	5.0	5.0
Trajectory Straightness ( $\mu$ m/25mm)	4.0	4.0	4.0	4.0
Ball Screw Lead (mm)	2.0	2.0	2.0	2.0
Maximum Speed (mm/sec)	20	20	20	20
Load Capacity (kg)	280	280	280	280
Mass (kg)	13.6	21.1	25.6	33



Side View

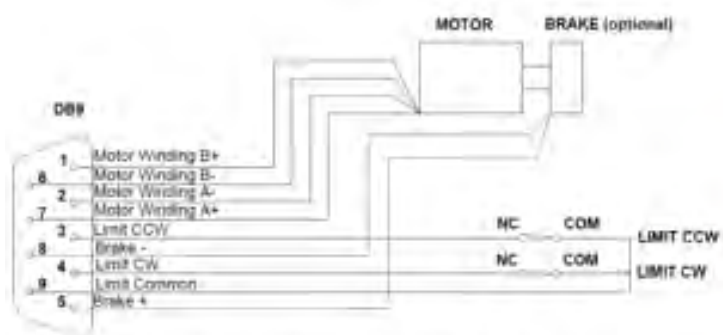


Bottom View



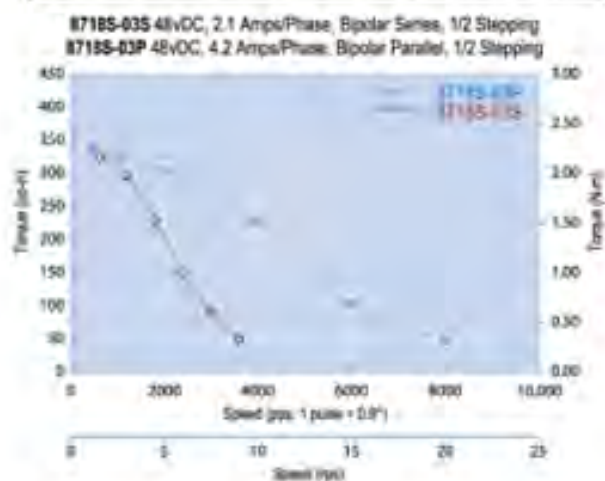
Model	50	100	150	200
A- Closed Height (mm)	196.5	319	394	519

## ELECTRICAL CONNECTOR



ADC uses a standard male DB-9 Connector for both the motor and limit switches.

## 2-PHASE MOTOR TORQUE GRAPH



## DJ410 ORDERING INFORMATION

DJ410	-50	-A	-N	-B	-2PH	-G
Series	Model	Air Type	Encoder	Brake	Motor	Gearbox
	-50	-A	-E	-B	-2PH	3:1
	-100	-HV	-N	-N	-5PH	to
	-150				-DC	100:1
	-200					ratio

### Travel Options

-50	50mm Stage Travel
-100	100mm Stage Travel
-150	150mm Stage Travel
-200	200mm Stage Travel

### Air Preparation Options

-A	Standard Air Stage
-HV	High Vacuum Air Stage, $10^{-7}$ torr

### Optical Encoder Options

-E	With Optical Encoder
-N	Without Optical Encoder

### Brake Options

-B	With Brake, 24VDC
-N	Without Brake

### Motor Options

-2PH	Standard 2 Phase Bi-Polar Stepper Motor
-5PH	5 Phase Stepper Motor
-DC	DC Motor

### Gearbox Option

Available from 3:1 to 100:1 ratios

### Example Order

#### DJ410-50-A-N-B-2PH

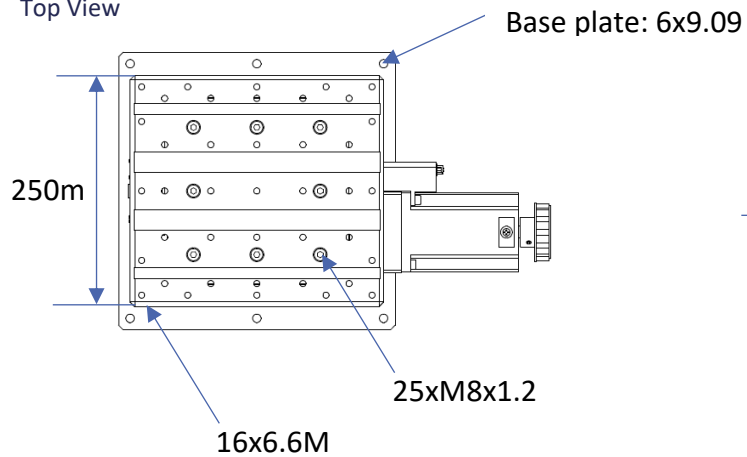
This is an order for a DJ400 Precision Crossed Roller Jack with 50 mm travel, in air, with no encoder, with a brake, and a 2-phase motor.

Travels 50-200 mm  
3  $\mu$ m Repeatability  
Various Motor Options  
High Resolution  
High Dynamic Performance

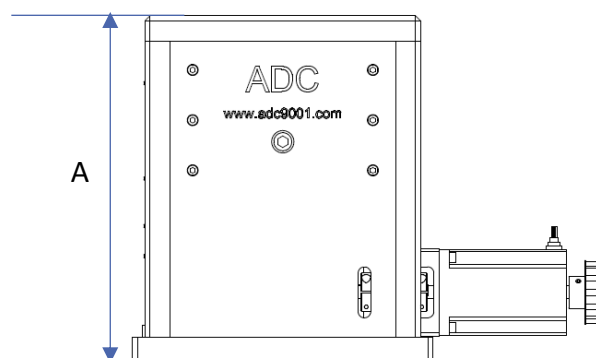


Description	50	100	150	200
Travel (mm)	50	100	150	200
Optional Linear Encoder	Yes	Yes	Yes	Yes
Repeatability ( $\mu$ m RMS)	3	3	3	3
Lead Accuracy ( $\mu$ m/25 mm)	8.3	8.3	8.3	8.3
Trajectory Straightness ( $\mu$ m/25 mm)	10	15	15	20
Travel Resolution (mm/rev)	6.35	6.35	6.35	6.35
Maximum Speed (mm/sec)	5	5	5	5
Load Capacity (kg)	2268	2268	2268	2268
Mass (kg)	76.2	85.4	94.6	103.8

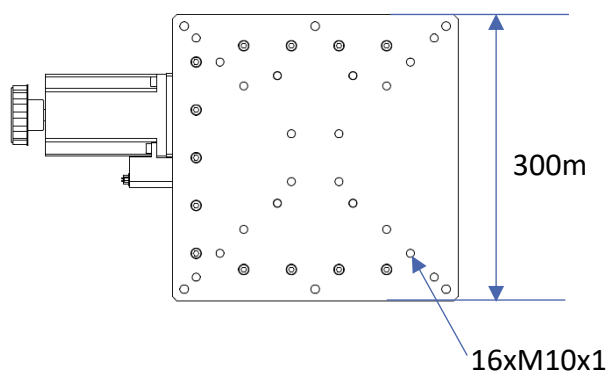
Top View



Side View

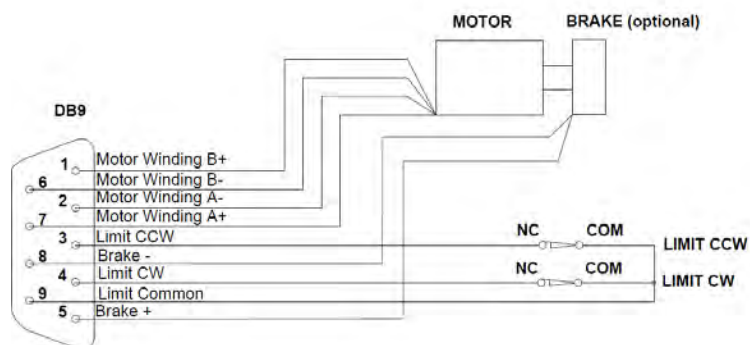


Bottom View



Model	50	100	150	200
Travel (mm)	50	100	150	200
A- Closed Height (mm)	345	410	475	540

## ELECTRICAL CONNECTOR



ADC uses a standard male DB-9 Connector for both the motor and limit switches.

## BJ25 ORDERING INFORMATION

BJ25	-50	-N	-2PH	-G
Series	Model	Encoder	Motor	Gearbox
BJ25	-50	-E	-2PH	3:1
	-100	-N	-5PH	to
	-150		-DC	100:1
	-200			ratio

### Travel Options

-50	50mm Stage Travel
-100	100mm Stage Travel
-150	150mm Stage Travel
-200	200mm Stage Travel

### Optical Encoder Options

-E	With Optical Encoder
-N	Without Optical Encoder

### Motor Options

-2PH	Standard 2 Phase Bi-Polar Stepper Motor
-5PH	5 Phase Stepper Motor
-DC	DC Motor

### Gearbox Option

Available from 3:1 to 100:1 ratios

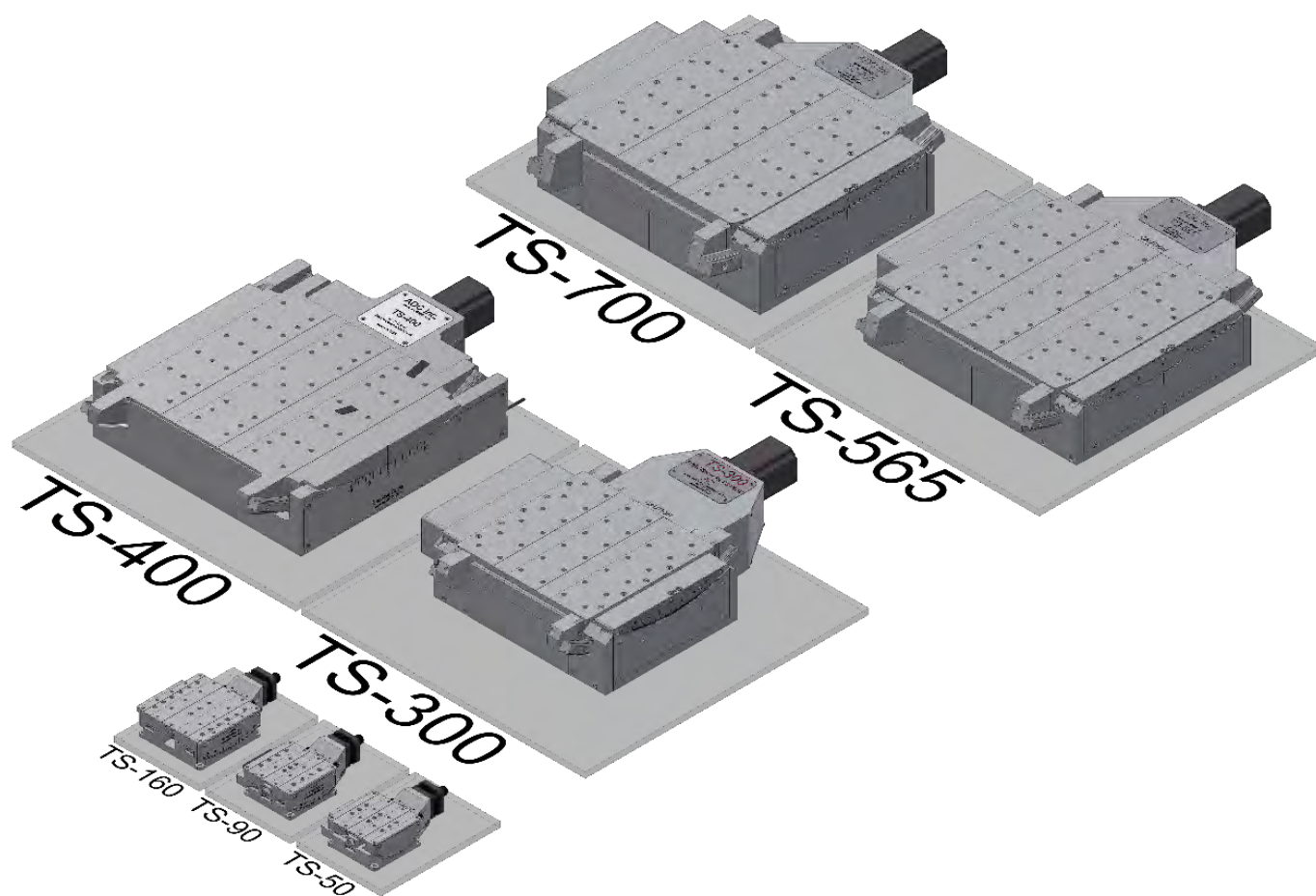
### Example Order

#### BJ25-50-N-2PH

This is an order for a BJ25 Precision Crossed Roller Jack with 50 mm travel, with no encoder, and a 2-phase motor.

### *Tilt Stages/Goniometers*

These tilt stages are based on precision curved guide rails combined with a tangent bar (HD Series) or worm gear drive (LD Series) system providing fine angular resolution and accuracy. The stages can be paired to provide an orthogonal (X-Y) tilt stage system. All tilt stages come standard with a stepper motor.



### TS-LD Series

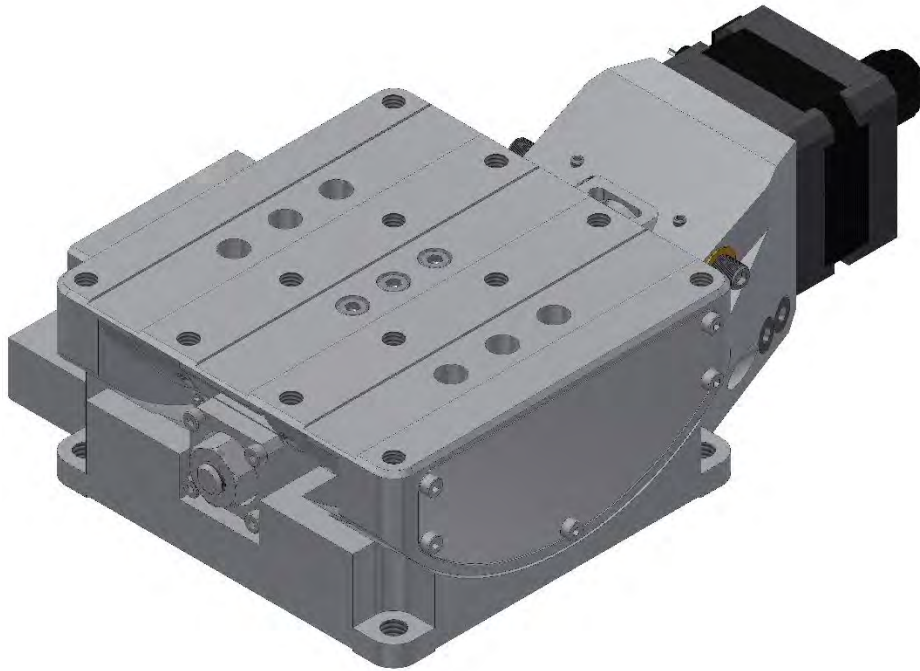
The TS-LD Series tilt stage(s) provide a rigid, accurate motion for general goniometric use. The TS-LD Series is stepper motor driven, guided with curved linear bearings, and has a rugged anodized aluminum body. The top and bottom mounting surfaces are precision ground to provide an optimal interface. The TS-LD Series uses curved crossed roller bearings for the highest possible rigidity and profiled trajectory. The drive mechanism is a precision ground worm wheel segment and stepper motor driven worm.

Travels +/-10°

Load Capacity up to 250 kg

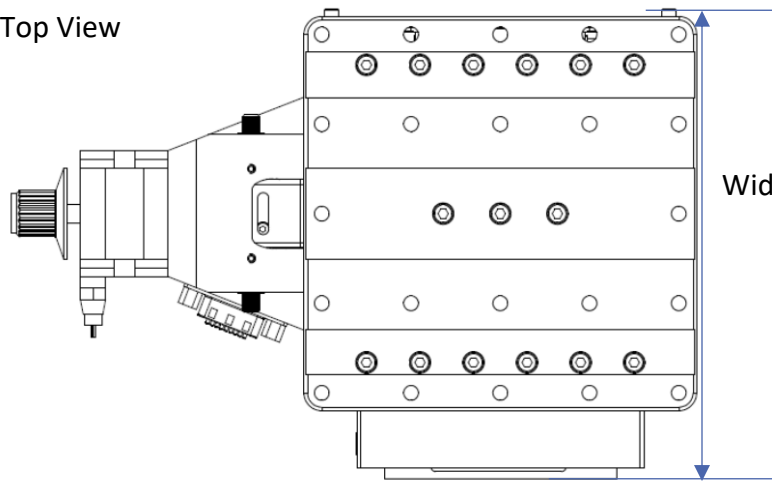
Precision Ground Worm Gear

Incredible Stability

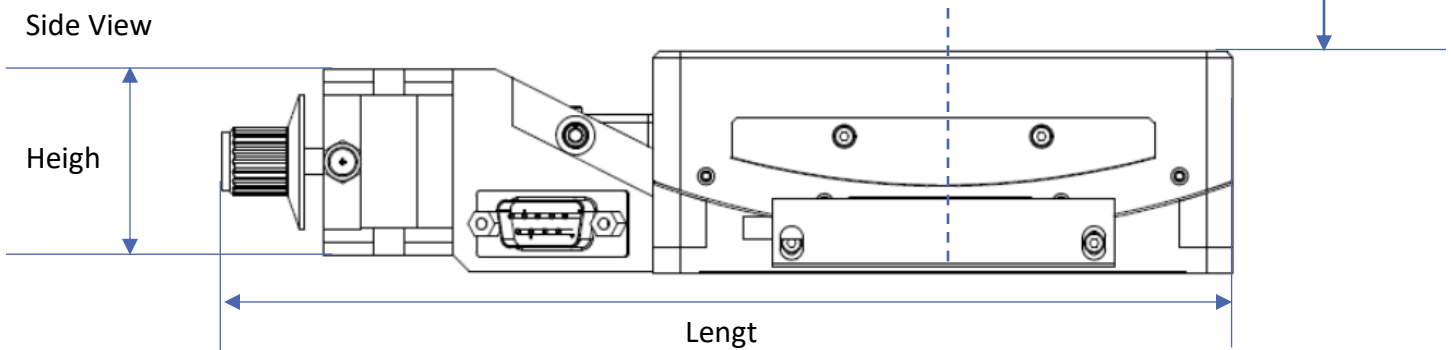


Model	50	90	160
Travel Range (°)	+/-10	+/-10	+/-10
Actuation Mechanism	Worm Gear	Worm Gear	Worm Gear
Gear Reduction	360:1	360:1	360:1
Repeatability (μrad RMS)	280	280	160
Trajectory Straightness (μm/25 mm)	5.0	5.0	5.0
Runnout (μm)	3.0	3.0	15
Full Step Resolution (μrad)	26	28	27
Load Capacity (kg)	84	188	268
Optional Linear Encoder	Yes	Yes	Yes

Top View

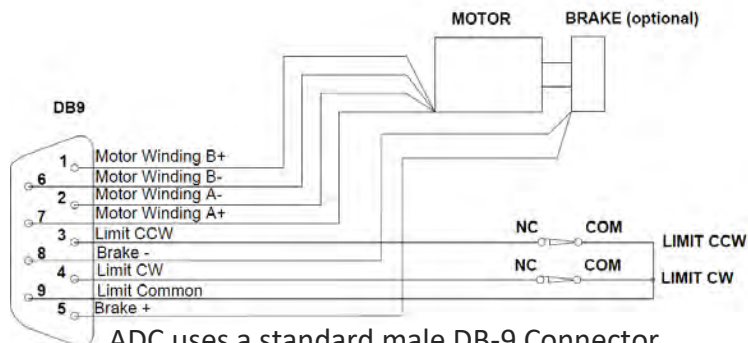


Side View



(mm)	Mounting Surface	Length	Width	Height	A	Curvature of Rails
TS-50	85x85	170	87	41	18	50
TS-90	85x85	170	87	41	59	90
TS-160	110x110	192	112	42	130	160

## ELECTRICAL CONNECTOR



ADC uses a standard male DB-9 Connector for both the motor and limit switches.

### TS-LD Series ORDERING INFORMATION

TS	-LD	-A	-N	-2PH
Series	Model	Air Type	Encoder	Motor
	-50	-A	-E	-2PH
	-90	-HV	-N	-5PH
	-160			-DC

#### Travel Options

-50	+/-10° of Travel
-90	+/-10° of Travel
-160	+/-10° of Travel

#### Air Preparation Options

-A	Standard Air Stage
-HV	High Vacuum Air Stage, 10 <sup>-7</sup> torr

#### Optical Encoder Options

-E	With Optical Encoder
-N	Without Optical Encoder

#### Motor Options

-2PH	Standard 2 Phase Bi-Polar Stepper Motor
-5PH	5 Phase Stepper Motor
-DC	DC Motor

#### Example Order

##### TS-50-A-N-2PH

This is an order for a TS-50 Precision Goniometer with  
10° of travel, in air, without an encoder, and a 2-phase motor.

### TS-HD Series

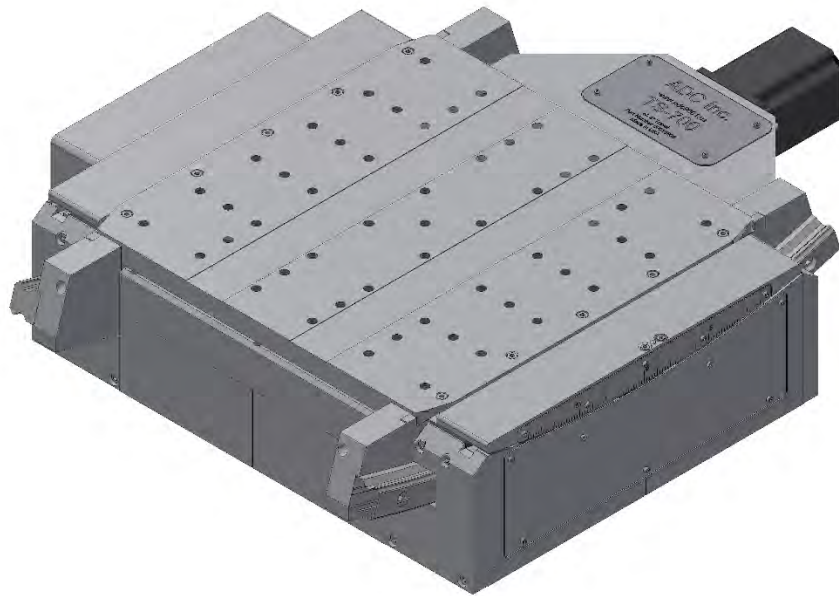
The TS-HD Series tilt stage(s) provide a rigid, accurate motion for general goniometric use. Each stage is stepper motor driven and curved linear bearing guided stages with a rugged anodized aluminum body. The top and bottom mounting surfaces are precision ground to provide an optimal interface. The TS-HD Series uses a tangent bar type mechanism to facilitate the rotary motion. A stepper motor driven linear actuator interfaces to the stage through a limited rotation flexure style bearing. This interface results in a highly resolved, very rigid rotary motion. The stage is guided by preloaded ball type profiled linear rails. An optional optical encoder gives closed loop feedback for the device.

Travels up to  $\pm 8^\circ$

Load Capacity of up to 1600 kg

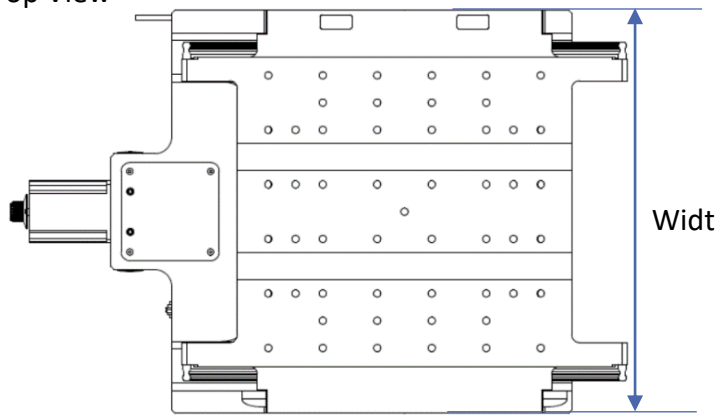
High Resolution

Incredible Stability

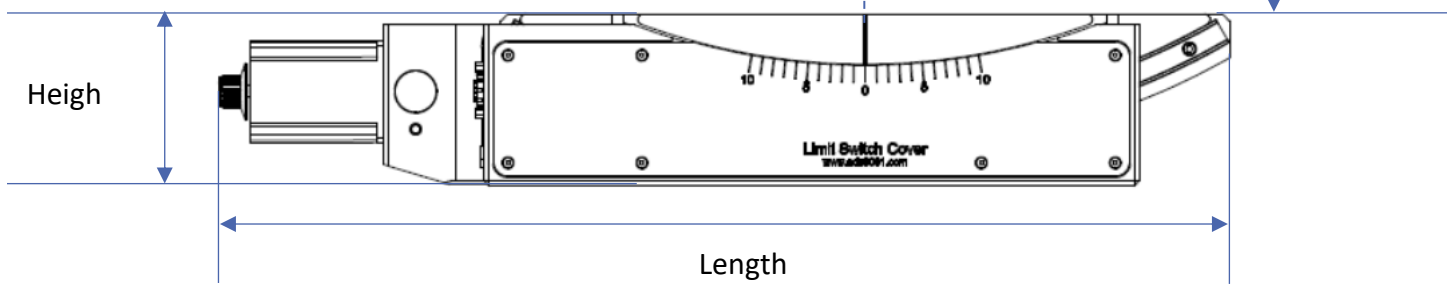


Model	300	400	565	700
Travel Range (°)	$\pm 8$	$\pm 7$	$\pm 4$	$\pm 4$
Actuation Mechanism	Tangent Bar	Tangent Bar	Tangent Bar	Tangent Bar
Repeatability ( $\mu\text{rad RMS}$ )	17	17	80	40
Trajectory Straightness ( $\mu\text{m}/25\text{mm}$ )	20	20	5.0	5.0
Runnout ( $\mu\text{m}$ )	15	15	3.0	3.0
Full Step Resolution ( $\mu\text{rad}$ )	38	29	38	87
Load Capacity (kg)	680	680	680	1624
Mass (kg)	23.3	27	27.3	33.4
Optional Linear Encoder	Yes	Yes	Yes	Yes

Top View

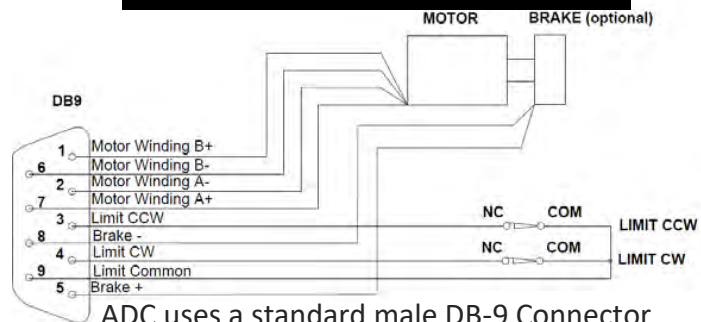


Side View



(mm)	Mounting Surface	Length	Width	Height	A	Curvature of Rails
TS-300	270 x 218	518	347	95	237.3	300
TS-400	284 x 307	566	411	95	337	400
TS-565	300x300	567	337.5	95	501	565
TS-700	300x300	570	636	111	636	700

## ELECTRICAL CONNECTOR



ADC uses a standard male DB-9 Connector for both the motor and limit switches.

## TS-HD ORDERING INFORMATION

TS	-XL	-A	-N	-2PH
Series	Model	Air Type	Encoder	Motor
	-300	-A	-E	-2PH
	-400	-HV	-N	-5PH
	-565			-DC
	-700			

### Travel Options

-300	+/-8° of Travel
-400	+/-7° of Travel
-565	+/-4° of Travel
-700	+/-4° of Travel

### Air Preparation Options

-A	Standard Air Stage
-HV	High Vacuum Air Stage, 10 <sup>-7</sup> torr

### Optical Encoder Options

-E	With Optical Encoder
-N	Without Optical Encoder

### Motor Options

-2PH	Standard 2 Phase Bi-Polar Stepper Motor
-5PH	5 Phase Stepper Motor
-DC	DC Motor

### Example Order

#### TS-300-A-E-2PH

This is an order for a TS-300 Precision Goniometer with 8° of travel, in air, with an encoder, and a 2-phase motor.

### Rotation Stages

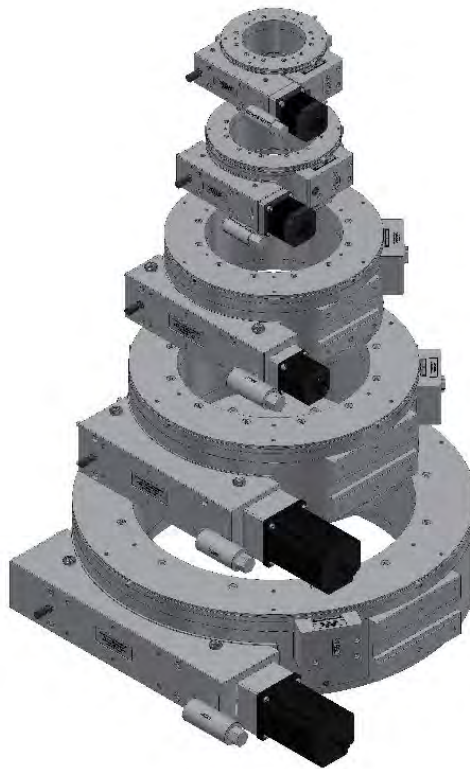
The Precision Mechanical Rotation Stages are built upon an industry leading, preloaded, duplexed angular contact bearing set. These stages not only give an exceptionally high running accuracy but allow for large radial and thrust loads as well. Each stage is driven by a precision ground worm gear set and a high resolution, high torque stepper motor. Backlash is reduced by employing a flexure style shimming technique to preload the worm and worm wheel.

Precision Repeatability

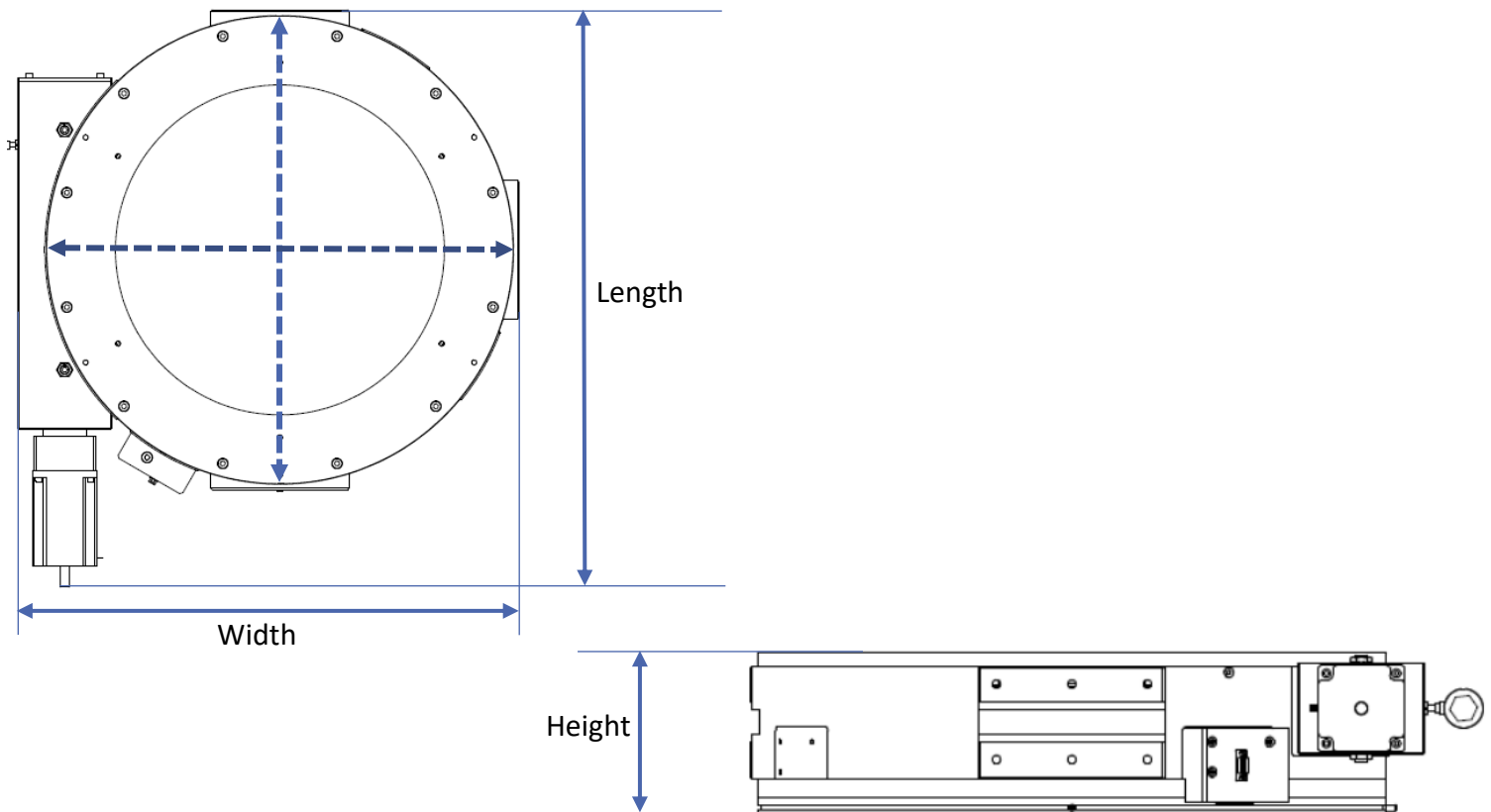
Large Axial Load Capacity

Precision Ground Worm Gear

Minimized Backlash

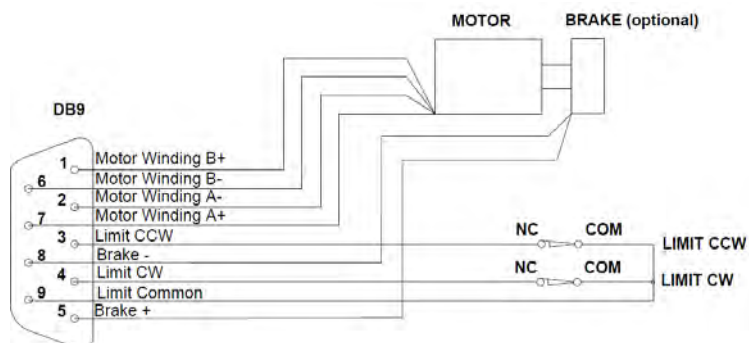


Model	100	200	300	400	500
Travel Range (°)	+/-360	+/-360	+/-360	+/-360	+/-360
Accuracy (μrad)	150	125	125	100	125
Gear Reduction	360:1	356:1	364:1	380:1	260:1
Repeatability (μrad RMS)	1.5	1.0	1.0	1.0	30
Runnout (μm)	7.5	7.5	10	15	15
Load Capacity Radial (kg)	23	39	103	123.5	243.5
Stiffness (μrad/Nm)	1.26	.556	.112	.051	.021
Mass (kg)	4.6	6.8	25.3	48	76
Optional Linear Encoder	Yes	Yes	Yes	Yes	Yes



Model	100	200	300	400	500
Inner Diameter	100	140	215	300	400
Outer Diameter	165.1	209.5	340	450	625
Length	272	294.25	435	610	770
Width	191	239	367.5	500	670
Height	71.75	94.05	147	158.75	158

## ELECTRICAL CONNECTOR



ADC uses a standard male DB-9 Connector for both the motor and limit switches.

## ROTATION STAGE ORDERING INFORMATION

Stage	Model	-A	-N	-B	-2PH	-G
Stage	Model	Air Type	Encoder	Brake	Motor	Gearbox
RS	-100	-A	-E	-B	-2PH	3:1
	-200	-HV	-N	-N	-5PH	to
	-300				-DC	100:1
	-400					ratio
	-500					

### Model Number

-100	100 Model
-200	200 Model
-300	300 Model
-400	400 Model
-500	500 Model

### Air Preparation Options

-A	Standard Air Stage
-HV	High Vacuum Air Stage, $10^{-7}$ torr

### Optical Encoder Options

-E	With Optical Encoder
-N	Without Optical Encoder

### Brake Options

-B	With Brake, 24VDC
-N	Without Brake

### Motor Options

-2PH	Standard 2 Phase Bi-Polar Stepper Motor
-5PH	5 Phase Stepper Motor
-DC	DC Motor

### Gearbox Option

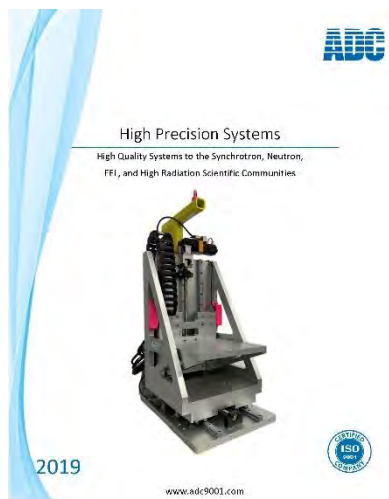
Available from 3:1 to 100:1 ratios

### Example Order

#### RS200-A-N-B-2PH

This is an order for a RS200 Precision Rotation Stage in air, with no encoder, with a brake, and a 2-phase motor.

For more information on ADC's products, go to [adc9001.com](http://adc9001.com) to download all of ADC's catalogs.



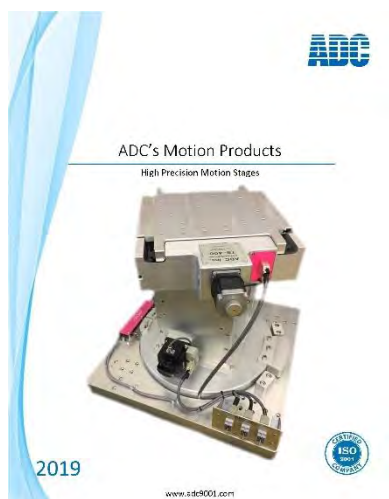
High Precision Systems



High Precision Engineered  
Experimental Tables



Neutron Instrumentation

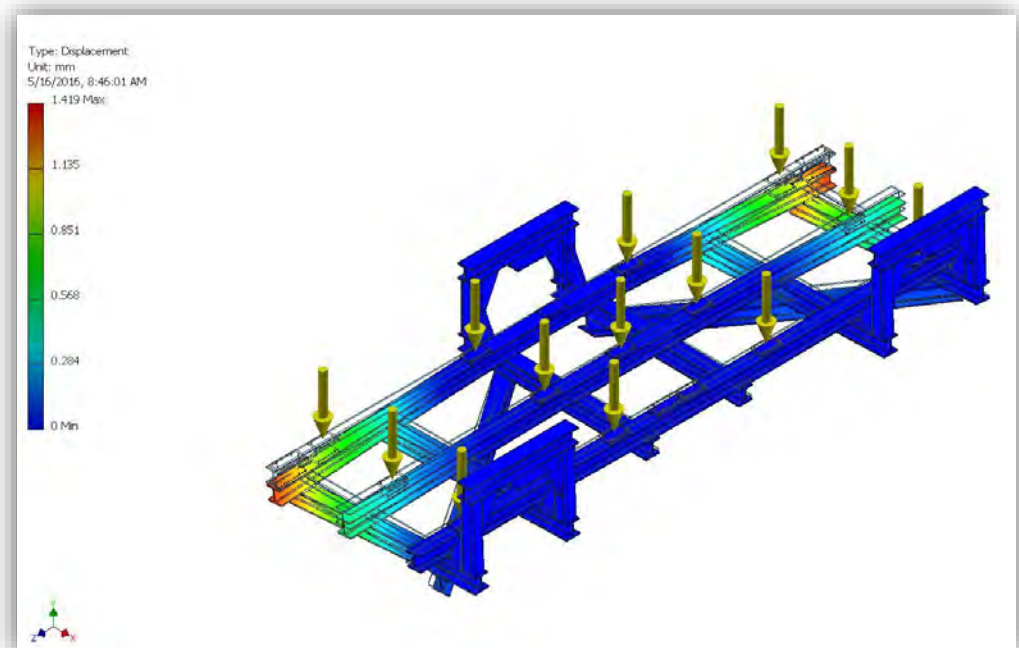


## Company Capabilities

### Engineering Design and Analysis

The Engineering Design and Analysis group is a multi-disciplinary team of engineers with unique training and creativity, and dedication to meeting the needs of our customers. ADC uses the latest computational and graphics software and hardware to approach the most challenging problems in the Aerospace, Automotive, Nuclear, Ultra-High Vacuum, Automated Machinery, Electro-Optical Products, synchrotron, high energy physics, and neutron diffraction communities.

- Finite Element Analysis
- Magnetic Design
- Optics Design
- Conceptual Design
- Materials Selection
- Tooling Design
- Fabrication Specifications
- Virtual Prototyping
- Design Analysis and Optimization
- Detailed Design
- Component Design



## Electronics, Instrumentation and Software

ADC's electrical/software engineers and techs can provide custom circuit design and complete turn-key control systems. Some of our skills include integrated PLC design and programming, analog and digital circuit design, logic design (including PLA and FPGA programming), stepper and servo motor applications, microprocessor, RFID, serial and RF communications, and system controllers. The standard motor controls and driver that we offer is the Aerotech Ensemble™ series controllers. However, many of our customers have requirements for custom integration of these components into a functioning system, fully debugged, documented, and ready for operation. Software skills and development platforms include Microsoft Visual C++, LabView, EPICS, Visual Basic, CNC, and generic PLC (AB, NAIS, GE-Fanuc, Schneider, etc.) and Parker ACR and Accroloop. Our primary skill, however, is the integration of these components into a functioning system, fully debugged, documented, and ready for operation.



## Vacuum Assembly & Testing

ADC is well equipped to handle any stand-alone fabrication and machining requirement. It is often the integration of these talents, combined with higher level assembly and testing, that brings the value added our customers demand. We have developed processes and employ qualified personnel and systems that allow ADC to assemble and test to challenging requirements. Examples include state-of-the-art, high-resolution, extreme-ultraviolet-light (EUV) microscope making measurements in Nano range for Lawrence Berkeley National Laboratory (LBNL); 26 tone, 20-meter-long, 2.3 meter in diameter complex Time-of-Flight Small Angle Neutron Scattering (ToF SANS) instrument for ANSTO, Australia; and Jefferson Lab 12 GeV Upgrade Cavity Parts Project.

ADC utilizes some of the most advanced measurement equipment available to control the requirements that our customer's complex projects require. This is accomplished through the use of Coordinate Measuring Machines (CMM's) equipped with model-based inspection software, providing us with the ability to verify results using customer supplied CAD models, Elcomat 3000 Autocolimator, and Keyence Optical non-contact Micrometer.

## Advanced Manufacturing

ADC provides machining systems and products to our diverse customers from structural metal fabrication to turn key design products with complex control systems. ADC is fully equipped with a CNC precision machine shop. Through application and experience, our ability to fabricate/provide parts for precision vacuum machining equipment has grown immensely. Our process begins with providing quotes based on specific drawing requirements given to us by the customer.

The following are views of ADC manufacturing and major assembly areas.



## Equipment

We use precision equipment to verify each order and are committed to delivering precision machined parts. We are very proud of our shop and the capabilities we can offer because of our state-of-the-art precision CNC milling and CNC turning machines. Equipment used for inspections include a Brown & Sharpe CMM, a Jones & Lamson Optical Comparator, and an extensive selection of gauges. We ensure calibrations are performed and are traceable to meet our standards. Our inspection room is temperature controlled to enable the utmost accuracy and consistency in measurements. We can provide a Certificate of Conformance for all processes as required. These are stored electronically and attached to each job for future reference.



CLAUSING CSG-1224 ASDII SURFACE GRINDER, s/n E1TAJ0079, w/PLC Control, Magnetic Chuck

ADC's precision grinder CSG-1224 is especially suitable for heavy duty grinding. The large spindle is supported by four ball bearings to allow for durability.

## Welding Capabilities

At ADC, we offer full service custom metal fabrication which includes welding services for short and long production run jobs. Our extensive welding capabilities utilize both robotic welding and manual welding in MIG and TIG and mesh welding for wire products. We are experienced in welding aluminum, carbon steel, and stainless-steel materials. We also have complete resistance welding, also known as spot welding capabilities. Our unique welding shop supports our custom metal fabrication process.

The welding services at ADC support our full-service fabrication process with capabilities including:

- Resistance Welding / Spot Welding
- Gas Metal Arc Welding (GMAW) / Metal Inert Gas (MIG Welding) - This semi-automatic or automatic process uses a continuous wire feed.
- Gas Tungsten Arc Welding (GTAW) / Tungsten Inert Gas (TIG Welding) - A manual welding process that is extremely precise, especially useful for welding thin materials.
- Mesh Welding - electric flash butt welding where the two wires are pressed together, and the electric current is activated

### Benefits of TIG Welding

- Superior quality welds
- Welds can be made with or without filler metal
- Precise control of welding variables (heat)
- Free of spatter
- Low distortion

### Benefits of MIG Welding

- All position capability
- Higher deposition rates than SMAW
- Less operator skill required
- Long welds can be made without starts and stops
- Minimal post weld cleaning is required

### Benefits of Mesh Welding

- Wires resist movement
- It is much faster than traditional welding
- It is a high-quality low-cost spot-welding solution



## ADC's Service and Support

ADC takes new approaches to shorten assembly and commissioning times. We create modular construction units which can be installed cost-effectively and extended easily when needed. Our customers can count-on ADC's continued service support after the commissioning stage.

Through intensive technical training sessions and our policy of involving customer personnel at an early stage, we can assure seamless and rapid familiarization with our new technologies. This approach has meant that, in many major projects, our customers have been able to operate their equipment independently and to their satisfaction within a very short period.

ADC Customer Service team provides installation, installation supervision, after sales support and service, troubleshooting and remote diagnostics. We believe that success is in the details and this philosophy delivers high customer satisfaction and instills a strong sense of loyalty. Our friendly and courteous customer service staff is always available for questions and order placement for the key replacement parts to keep ADCs systems running at peak efficiency. Whether it is a small replacement part or a new component, we are committed to the fastest resolution to customer needs.

ADC is uniquely positioned and invested in providing exceptional after-sales support. Available support and services including:

- Installation and start-up
- Service and repair – factory / service center / or onboard
- Service contracts
- Troubleshooting assistance over the phone
- Engineering and technical sales assistance
- Upgrade and retrofit parts and programs
- Spare and replacement parts
- Tailored factory and on-board training
- On-board system and spares analysis



**BUREAU VERITAS**  
Certification



## **ADVANCED DESIGN CONSULTING USA, INC.**

126 RIDGE RD  
LANSING, NY 14882 USA

*Bureau Veritas Certification Holding SAS – UK Branch certifies that the Management System of the above organization has been audited and found to be in accordance with the requirements of the management system standards detailed below*

### **ISO 9001:2015**

*Scope of certification*

**DESIGN, MANUFACTURE, AND DELIVERY OF DEVICES, INTEGRATED SYSTEMS, COMPONENTS AND INSTRUMENTS FOR COMMERCIAL, ACADEMIC, AND GOVERNMENT AGENCIES**

Original cycle start date: **31 December 2014**

Certification / Recertification cycle start date: **31 December 2017**

Subject to the continued satisfactory operation of the organization's Management System, this certificate expires on: **30 December 2020**

**Certificate No. US010798** Version: **1**

**Signed on behalf BVCH SAS – UK Branch**

Certification body address: **5<sup>th</sup> Floor, 66 Prescott Street, London E1 8HG, United Kingdom**  
Local office: **16800 Greenspoint Park Drive, Suite 300S, Houston, TX 77060**

*Further clarifications regarding the scope of this certificate and the applicability of the management system requirements may be obtained by consulting the organization. To check this certificate validity please call: + (800) 937-9311*



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