

# Dynamic Phantoms

Model 008A, 008A-20,18023-A

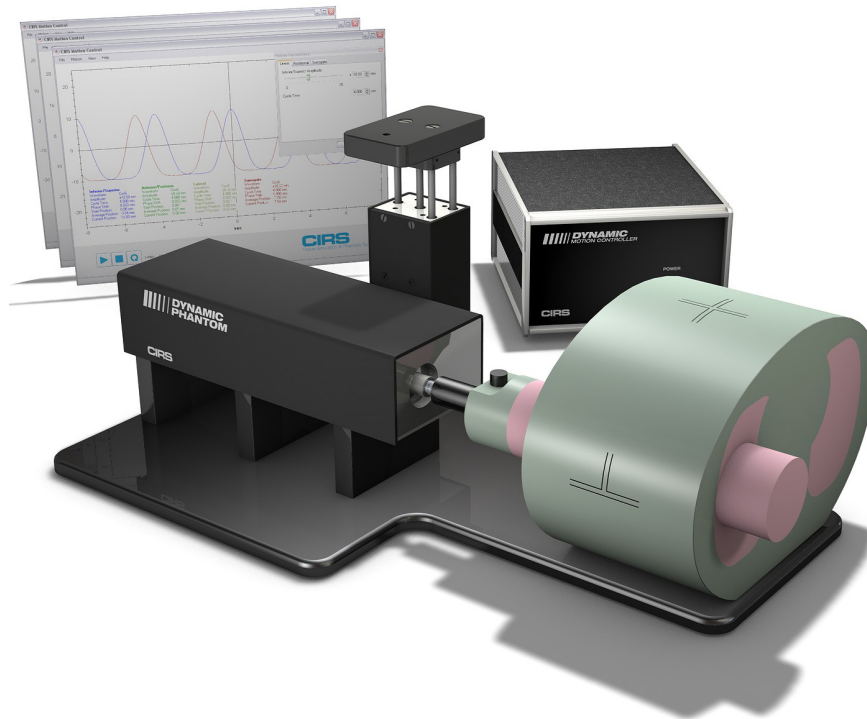


IMAGE ACQUISITION • TREATMENT PLANNING QA • DOSE DELIVERY

## USER GUIDE

# CIRS

900 Asbury Ave • Norfolk, Virginia 23513 • USA • Tel: 757-855-2765 • [WWW.CIRSINC.COM](http://WWW.CIRSINC.COM)

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## Key Features

- Complex 3D tumor motion within the lung
- Sub-millimeter accuracy and reproducibility
- Motion software enables different cycles, amplitudes and wave forms
- Tissue equivalent from 50 keV to 15 MeV
- TLD, MOSFET, micro-chamber and film can be placed within the tumor volume

## Overview

The CIRS Dynamic Phantoms are precision instruments for investigating and minimizing the impact of tumor motion inside the lung (Model 008A Dynamic Thorax and 008A-20). These phantoms provide known, accurate and repeatable three-dimensional motion for guided radiation therapy.

The phantom bodies represent an average human thorax/pelvis in shape, proportion and composition.

**Model 008A** works with a lung-equivalent rod containing a spherical target with or without various detectors that is inserted into the lung-equivalent lobe of the phantom. The body is connected to a motion actuator box that induces three-dimensional target motion through linear translation and rotation of the lung equivalent rod. Motion of the rod itself is radiographically invisible due to its matching density with the surrounding material. The target and its motion, given its density difference, can be resolved. A programmable motion controller is used to drive the motion actuator.

**Model 008A-20** includes only the thorax body and third-axis actuator.

**Model 18023-A** shares some components with the CIRS Model 008A Dynamic Thorax Phantom. As with the Model 008A, target and surrogate motion are independently controlled with CIRS Motion Control Software. The graphical user interface provides an unlimited variety of motions while the key differences between the Model 18023-A and the CIRS Model 008A include the length of phantom body, location of the moving rod within the lung, and the inclusion of ribs.

# Safety

## GENERAL SAFETY NOTICE

Warnings and Cautions are identified throughout this user guide to alert users of dangerous conditions that are created when instructions are not followed. Operation and maintenance personnel must observe all safety regulations. For the purposes of this manual, cautions are identified as situations that can cause damage to the phantom and internal electronics. Warnings are defined as conditions that can cause injury to the operator.

## SAFETY PRECAUTIONS

Below is a list of specific safety precautions detailed in this user guide. Please review these precautions carefully and use care while handling the phantom.



### WARNING:

**HIGH VOLTAGES CAPABLE OF CAUSING DEATH ARE USED IN THIS EQUIPMENT. USE EXTREME CAUTION WHEN OPERATING AND SERVICING THE CONTROLLER. DEENERGIZING THE CONTROLLER BY USING THE POWER SWITCH DOES NOT REMOVE THE 110-250 VAC POWER EXCITATION FROM THE CONTROLLER. THESE VOLTAGES REMAIN PRESENT IN THE CONTROLLER POWER SWITCH AND POWER CONNECTOR UNLESS IT IS DISCONNECTED.**



### WARNING:

**TO REDUCE THE RISK OF FIRE, ELECTRIC SHOCK, OR INJURY WHEN USING THE MOTION CONTROLLER, FOLLOW THESE BASIC PRECAUTIONS:**

- There are no user-serviceable parts inside. Refer servicing to qualified service personnel.
- Use only a grounded 3 prong electrical outlet when connecting this product to a power source. If you do not know whether the outlet is grounded, check with a qualified electrician.
- Do not remove ground prong.
- Do not install or use this product near water, or when you are wet.
- Operate the product securely on a stable surface.
- Set up the product in a protected location where no one can step on or trip over the power cord and the power cord can not be damaged.
- It is recommended that the customer install an AC surge arrestor in the AC outlet to which the Controller is connected. This is to avoid damaging the equipment by local lightning strikes and other electrical surges.
- To prevent overheating, do not block the fan on the rear panel or the ventilation holes located on the rear panel and bottom of the Controller.



### CAUTION:

**PHANTOM ASSEMBLY REQUIRES TWO PEOPLE. ONE PERSON FOR STABILIZING AND A SECOND FOR ASSEMBLING THE PHANTOM. FAILURE TO STABILIZE THE BASE PLATE CAN ALSO RESULT IN DAMAGE TO THE PHANTOM.**

## CLEANING

You can clean the phantom with a soft cloth dampened with water and mild detergent. Do not use disinfectants or solvent-based cleaners or sprays.

# Unpacking Instructions

Model 008A &18023-A



1. Before you open the case check the three **Drop 'N' Tell** indicators on the right side of the case.

**Drop 'N' Tell** shipping damage indicator shows when a case has been dropped in transit and contains potential damaged goods. The sensor displays a red arrow when applied before shipping. If the container receives a shock exceeding 25 G force, the sensor display arrows will change to blue. If the sensor has been activated and is blue, a claim may need to be filed with the carrier. If activated, take extra care in inspecting the components as they are unpacked, assembled and tested.

**Note:** If there is any damage to the packaging case, containers, foam, and components, or operation, immediately contact the carrier and the phantom supplier, and keep all packaging for carrier inspection.



2. Remove wall partition from the case and set aside.



3. Pull phantom body from case.



4. Remove motion controller from case and set aside.



5. Remove cables. (Optional computer is available).




6. Remove the actuator base plate assembly from case.

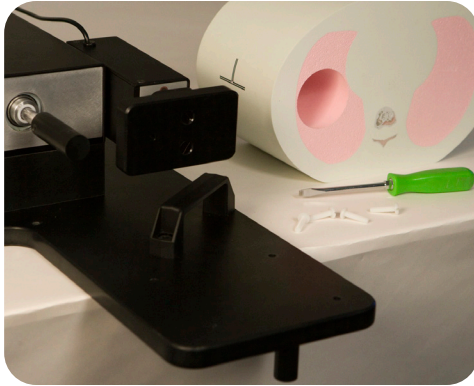


7. Inspect the list of parts before assembly. Refer to specifications on page 13. Verify all parts received. (Parts and packaging may vary.)



# Model 008A &18023-A Assembly Procedure

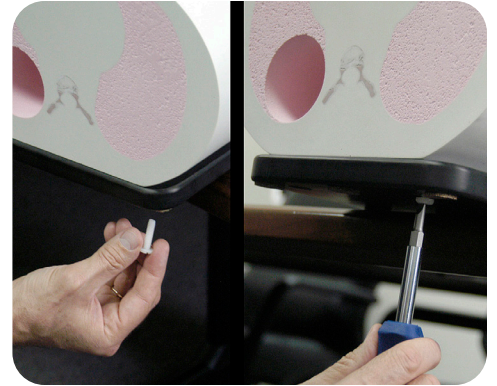
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PHANTOM ASSEMBLY REQUIRES 2 PEOPLE. ONE PERSON FOR STABILIZING AND A SECOND FOR ASSEMBLING THE PHANTOM.  
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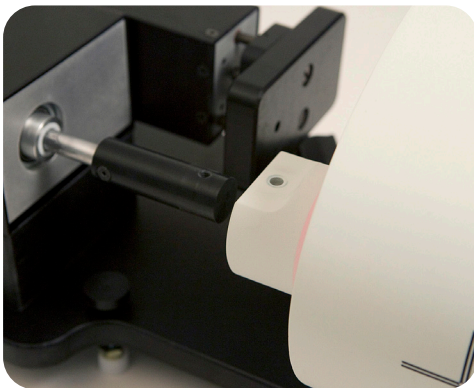
- 1.** Place base plate with actuator assembly on table. Carefully move base plate to overhang table. This allows access to holes for attaching phantom body.



- 2.** Position phantom body on base plate as shown. The rod hole must be on same side and aligned with the rod holder.



- 3.** Place one screw through bottom of base plate and screw into phantom. Continue until all screws are in place. Snug but do not tighten screws to allow minor alignment adjustments in steps 6 and 7.



- 4.** Insert lung rod thru hole in phantom body. Ensure that screw hole on lung rod is aligned with screw hole on actuator rod.



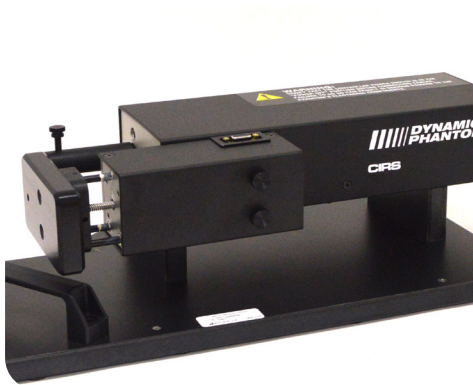
- 5.** Use thumb screw to secure lung rod to actuator rod.



- 6.** Push lung rod towards the motor box. Visually check gap around the rod. It should appear consistent. If not, adjust body left and right until gap is consistent around rod.



- 7.** Repeat step 6 with rod extended out. Check gap on the motor box side of body as well. Adjust phantom body to achieve best fit. Finish tightening the screws on underside of phantom.



- 8.** 3rd axis actuator is shipped in the horizontal position.



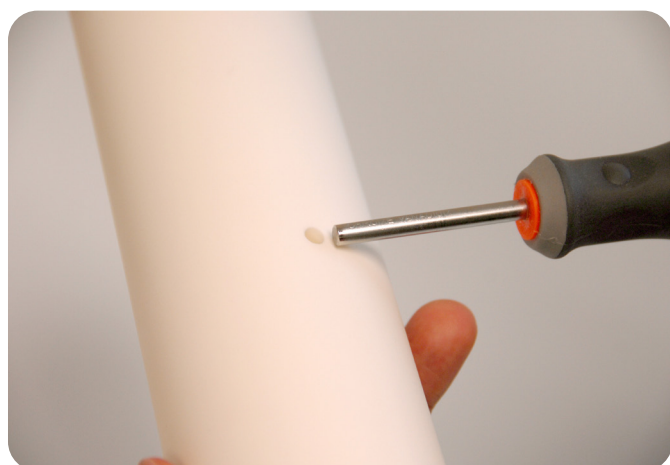
- 9.** Move 3rd axis gating device to vertical position by loosening screws and repositioning as shown.



# Removal of Ball Cube Insert (Optional)



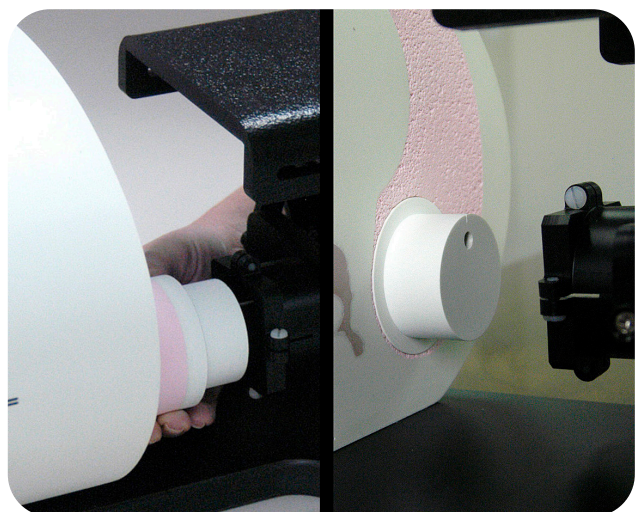
1. CIRS has provided a Ball Cube Removal Tool. Please note precautions on Ball Cube insert packaging.



2. Insert Ball Cube Removal Tool into back of Target Moving Rod at insertion point as shown above.



3. Gently push forward until Ball Cube is removed. Do not use other tools for this purpose as they may damage the surface of the Ball Cube which is fragile.



4. The Model 18023-A and 18043-A rods connect to the motion actuator with cup holders. Insert the lung rod thru the hole of the phantom body. If the body is properly aligned the rod will slip into the cup. Ensure that the pin hole on the rod is aligned with the pin inside the cup.



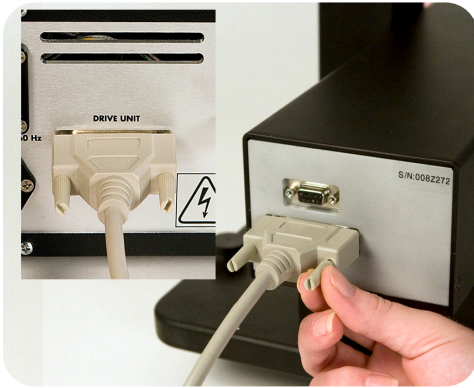
5. Use a screw driver to tighten the 4 nylon screws on the cup.



# Model 008A & 18023-A Cables and Connections



**WARNING:**  
**FOLLOW THE CABLE CONNECTION STEPS AS THEY ARE PRESENTED IN THIS USER GUIDE.**  
**CONNECTING THE CABLES WITH THE CONTROLLER "POWER ON" CAN SERIOUSLY DAMAGE THE PHANTOM'S ELECTRONICS.**



1. Plug the Cable DB25 m/m to back of controller and to back of actuator.



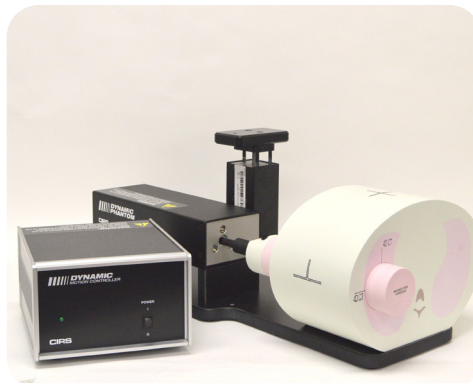
2. Plug the Cable DB9 m/m which leads from gating device to back of actuator.



3. Attach ethernet cable to back of controller.



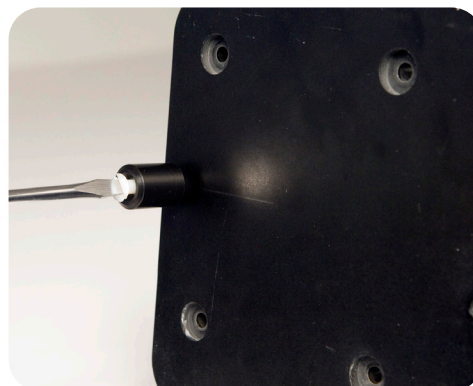
4. Plug power cord into the back of controller. Plug other end of power cord into the wall outlet.



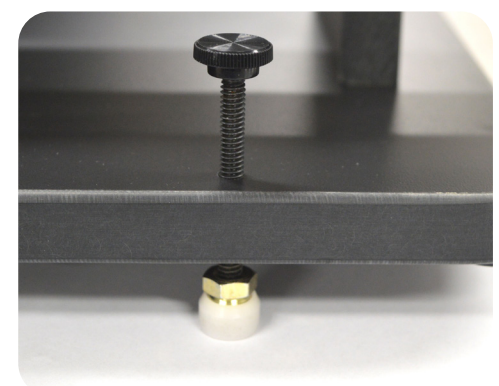
5. The controller and actuator powered and ready for use.



- A. **Adjustable legs kit** (See B and C for mounting)



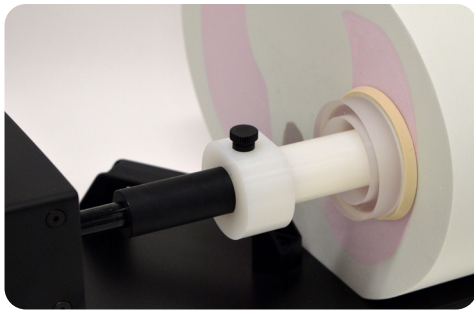
- B. Prior to attaching phantom body, carefully lay base plate with actuator in its side. Attach solid black post to underside of base plate as shown.



- C. Secure remaining 4 adjustable feet to base plate as shown.



# 4D CT QA Insert (Model 008A option)



1. Insert the 4D CT QA moving rod into the rod holder and secure using nylon screws.

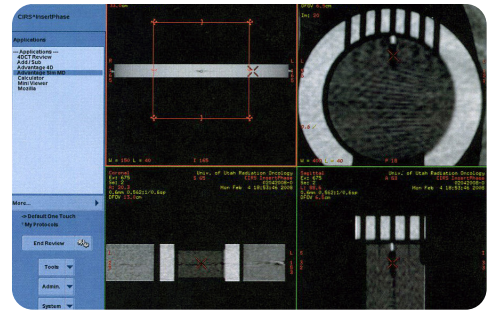
Insert the 4D CT QA static cylinder into the phantom's horizontal hole and secure using the rubber gasket.



Left: IS and AP Tests, Right: IS and LR Tests

2. For IS and AP tests, position static cylinder with square end mark at 9 o'clock using level or machine square.

For IS and LR tests, position static cylinder with square end mark at 12 o'clock using level or machine square.



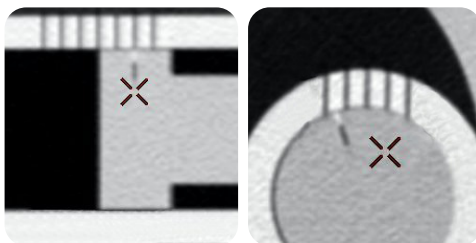
Static position on a preliminary CT scan

3. Run phantom Homing (automatic when powered on). Perform a preliminary CT scan in "home" position without motion in order to verify alignment of moving fiducial to static grid fiducials. The 4D CT QA Moving Rod position may need to be adjusted to ensure proper alignment. Adjustments can be made by changing "Start Position" in the Advanced Motion Parameters window.

4. Static grid fiducials have an increment of 5 mm and provides maximum displacement of  $\pm 15$  mm in IS direction and  $\pm 10$  mm in LR or AP directions. Set motion amplitudes within these limits in increments of 5 mm:

- **For IS:** IS per your choice, LR and AP= 0, start angle 0 or 90 degrees
- **For LR:** IS= 0, LR per your choice, AP= 0, start angle 0 degree
- **For AP:** IS= 0, LR= 0, AP per your choice, start angle 90 degree

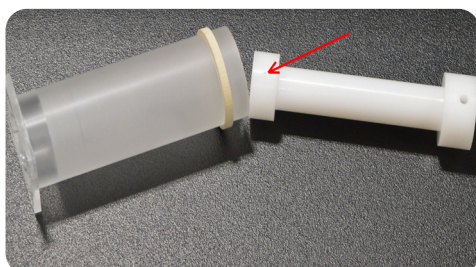
5. Run phantom and perform 4D CT imaging. Obtain test results from the 4D CT sorted images. Report results as the difference (in mm) between the moving and static fiducials when positioned at 0% and 50% phases.



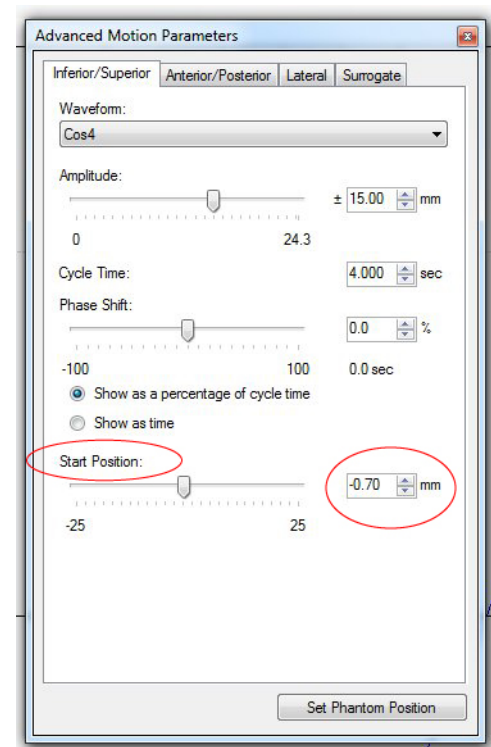
Left: Linear Phase 0% at 10 mm amplitude  
Right: Rotation Phase 50% lateral 5 mm amplitude

6. If the moving fiducial starting position is aligned with the static fiducial during preliminary static CT scan, then the results of 4D CT binning can be checked for the maximum and minimum amplitudes, respectively 0% and 50% phases. Since both static and moving fiducials measure 1 mm in diameter, misalignments as small as 0.5 mm can be easily visualized. The software measurement tool allows precise evaluation of these misalignments. If a discrepancy is discovered, check equipment and/or adjust treatment safety margins.

7. Due to its regular size and cylindrical shape, the moving rod can be used for motion artifact evaluation. The plunger that carries the moving fiducial is cylindrical in shape (45.7 mm diameter x 20.0 mm long) and can be used to investigate artifacts, volumes, and shapes during different breathing motions, including patient-specific motion profiles.



Moving Rod and plunger with fiducial



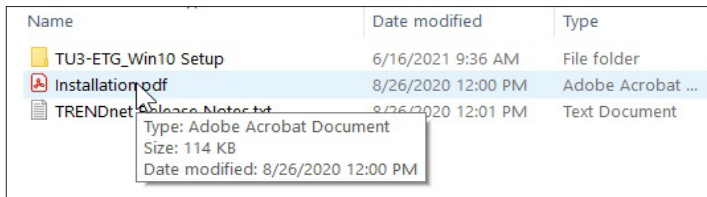
CIRS Motion Software Advanced Motion Param-

# Setup notes for Dynamic Phantoms with controller connecting to a PC using an Ethernet connection:

The following are the recommended steps to install the “USB to Network Adapter” that was shipped with this phantom. The new Network Connection must be setup as a Static IP address in order for the PC to communicate with the motion controller of the phantom.

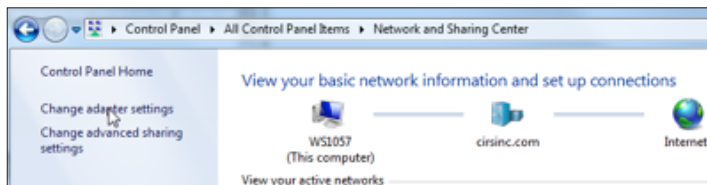
**Note: Steps 5-8 should be followed if the “PC Internal Network Adapter” is used instead of the “USB to Network Adapter”.**

1. To install the necessary driver, unzip the “USB-to-Network Adapter” folder found on the provided USB drive or download the zipped folder from the CIRS website. Unzip to a known location and follow instructions from “Instructions.pdf” document.



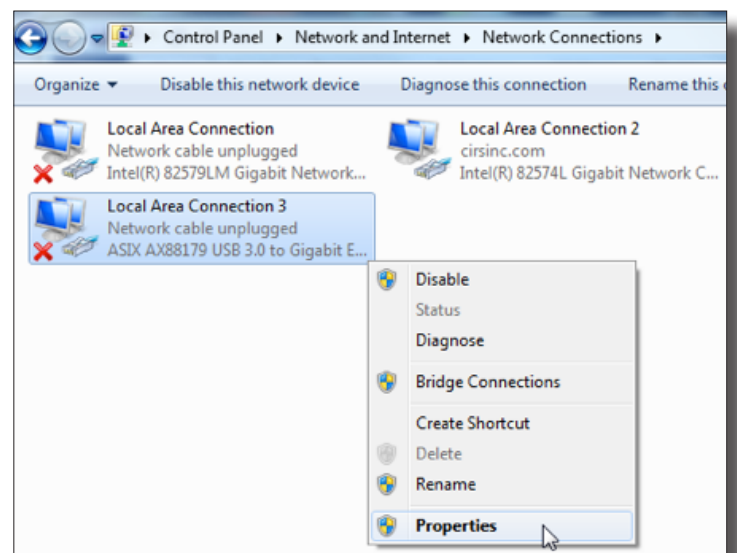
**Note:** The provided “USB to Network Adapter” can act as Plug and Play device on some PC but CIRS recommends doing the installation of the driver as outlined above.

3. From the Control Panel, open the Network and Sharing Center and then select “Change adapter settings”.

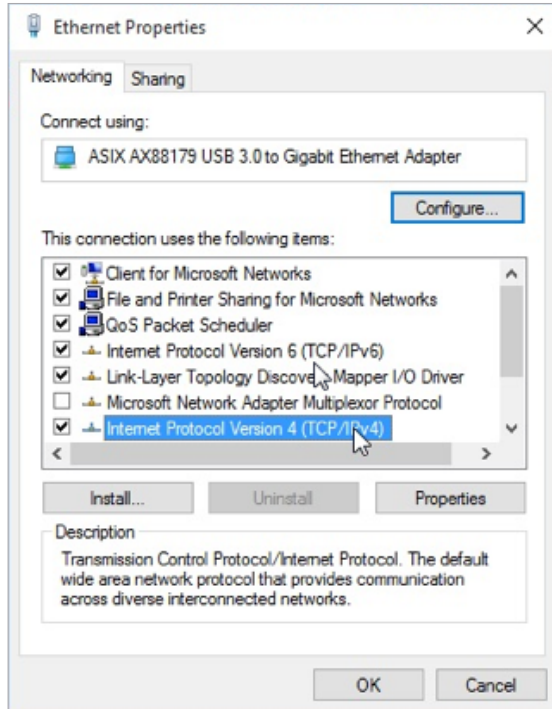


2. Follow the on screen steps and acknowledge all the messages related to driver's installation. Once the driver installation is finished, plug the “USB-to-Network Adapter” into your PC's USB port and acknowledge the Windows installation message. Exit the “USB-to-Network Adapter Software” menu by clicking Exit.

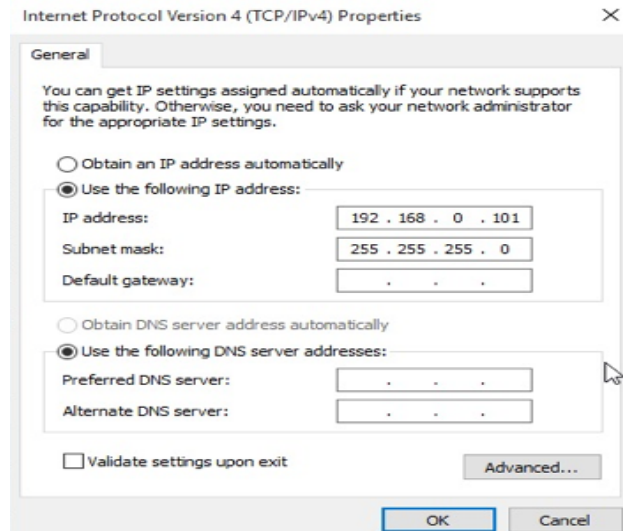
4. Providing that the installation of the “USB-to-Network Card” was successful, the newly installed Network Adapter should show as “ASIX AX88179 USB 3.0 to Gigabit Ethernet Adapter”. Select it's Properties using the right mouse click menu as shown below.



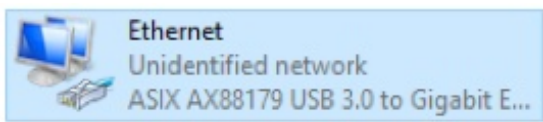
5. Select Internet Protocol Version 4 (TCP/IPv4) and click on properties



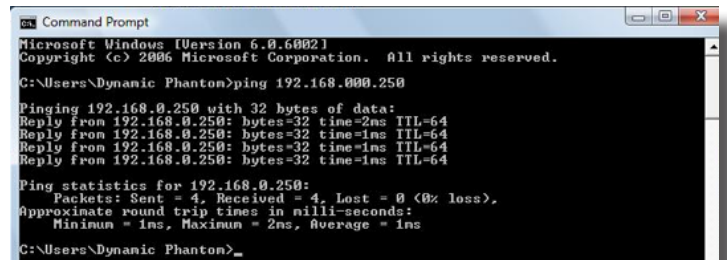
6. In the internet Protocol Version 4 (TCP/IPv4) properties window, change from default "Obtain an IP address automatically" to "Use the following IP address:" Enter "192.168.0.101" as the IP address and "255.255.255.000" as the Subnet mask.  
*Note: If an IP address conflict occurs because IP address 192.168.0.101 is already assigned to another Network Adapter, the user can try any other IP address between 192.168.0.102 and 192.168.0.249.*



7. Once the IP address is entered, click OK. Connect the PC to the Controller using the provided Ethernet cable by inserting one end of the cable in the controller's Ethernet port and the other one in the "USB-to-Network Adapter". Power on the controller. To check that the PC to controller connection was successful, ensure the icon of the "ASIX AX88179 USB 3.0 to Gigabit Ethernet Adapter" in the Control Panel matches the image below. Network Connection can be renamed using the right mouse click menu.



8. A more in depth check of the PC-to-controller communication connection can be done by running a "ping command" in Command Prompt as seen in the image below. To ping the controller, type "ping 192.168.0.250" and press enter. Ping certifies IP-level connectivity to another TCP/IP device. If you receive Ping statistics for IP address 192.168.0.250 (controller IP address) the communication connection between the PC and controller was successful.





# CIRS Motion Control Software

## CIRS MOTION CONTROL SOFTWARE SYSTEM REQUIREMENTS

Windows XP® / Vista / Windows 7/ Windows 8/ Windows 10 (32 and 64 Bit)

Pentium 3® or equivalent

512 MB RAM, 2 MB of available disk space

## INTRODUCTION

CIRS Motion Control is an application which allows you to control the movement of the CIRS Model 008A Dynamic Thorax Phantom and model 008PL Dynamic Platform. With CIRS Motion Control, you can quickly set up a movement based on a library of pre-defined motions, including Sin, Cos4, Cos6, Sawtooth, Sharkfin, Hysteresis ( Model 008A only) and Continuous Drift, Transient Excursion, Persistent Excursion, High-Frequency Excursion, or you can import custom motion data from any tab-delimited or comma- separated text file. CIRS Motion Control also allows you to save any motion to easily access the same parameters for repeated calibration and testing.

## INSTALLATION

The CIRS Motion Control application requires the Trio PC Motion library, which allows the computer to recognize the Trio controller board in the Dynamic Phantom or Platform. To install the Trio PC Motion library, double-click Trio\_PC\_Motion\_ActiveX\_2\_12\_0\_Setup and follow the steps in the InstallShield Wizard.

**To install CIRS Motion Control, double-click MotionControl-Setup or Setup and follow the steps in the Setup Wizard. The Microsoft.NET Framework Version 3.5 is required for the application to run.**

## GENERAL USE

The CIRS Motion Control Software is preinstalled on the optional computer. Help can be launched from **Help Menu**. A copy of the software is included on a USB drive.

CIRS does not support 3rd party equipment. Please refer to the included documents for warranty and service information for the ACER brand computer (computer optional).

The software automatically creates a log file where data about waveform parameters are saved. The log file is usually located under the current user in the Application Data folder. A Windows OS search function can be used to find the log file. Searching hidden files and folders should be enabled.

The log file provides a record of the motion history of the device and can be used as objective evidence that proper QA was performed.

## SOFTWARE USER MANUAL & SOFTWARE UPGRADES

CIRS Motion Control software has an online user manual. After software installation, a copy may be viewed and downloaded using either the “Check for Updates” button from Help Menu and selecting “Motion Control User Manual.pdf” or by pointing a web browser to the CIRS Software Updates webpage: [http://www.cirsinc.com/MotionControlUpdates/Motion\\_Control\\_User\\_Manual.pdf](http://www.cirsinc.com/MotionControlUpdates/Motion_Control_User_Manual.pdf)

If the end-user is offline during use of the phantom, it is recommended that a copy of the CIRS Motion Control User Manual is downloaded and saved. Once a copy of the manual is saved in a known location, the PDF document can be opened and viewed in a window separate from the CIRS Motion Control software window to aid in phantom set up and use.

The user manual is regularly updated to incorporate new information based on the addition and/or modification of features as well as end-user feedback.

CIRS recommends that the end-user routinely check the CIRS Software Update webpage using the “Check for Updates” button from Help Menu. This page indicates the current software version. The latest free software upgrade is posted as soon as it becomes available. Instructions for updating the software are also posted. Please note, controllers with serial numbers containing P136 may experience PC communication failures upon updating Windows OS. If this occurs, CIRS strongly recommends a motion controller update. For details on how to upgrade, refer to the model 008A product brochure.



# Model 008A Specifications

OVERALL DIMENSIONS:	67 cm x 32 cm x 28 cm (26' x 13' 11')
OVERALL WEIGHT:	17.2 kg (37.9 lb)
POWER:	110-250 VAC, 50/60 Hz
AMPLITUDE, IS:	± 25 mm
AMPLITUDE, AP/LR:	± 5 mm
AMPLITUDE, SURROGATE:	± 25 mm
MAX. SURROGATE PLATFORM LOAD	5.4 kg (12 lb)
MOTION ACCURACY:	± 0.1 mm
CYCLE TIME:	1 - ∞ (adjusted based on amplitude)
WAVEFORMS:	sin (t), 1-2cos <sup>4</sup> (t), 1-2cos <sup>6</sup> (t), sawtooth, sharkfin

## INCLUDED WITH MODEL 008A

Part No.	Qty	Component Description
008A	1	Dynamic Thorax Phantom Body with 3D spine (Dosimeter & QA rods not included )
	1	Dynamic Motion Controller with firmware installed (110 - 220V, 50 - 60Hz)
	1	Actuator base plate assembly
	1	3rd axis gating device (mounted to actuator base plate assembly)
	1	CIRS Motion Control Software USB
	1	Cable kit: USB 3.0 Gigabit Ethernet Adapter, Network cable CAT5e, 75', DB 25 male to male cable, DB 9 male to male cable, Power cord
	1	Accessories Kit: 4 in 1 screwdriver, push rod, fasteners pack, 2 spare fuses
	1	Adjustable legs kit: level, 4 adjustable legs with feet, post with screw
	1	User's guide (PDF user guide and catalog included on provided USB)
	1	Carry Case

## OPTIONAL ACCESSORIES

**Note:** Customers must complete their order with the purchase of at least one (1) interchangeable insert option. \*Refer to separate CIRS cavity and plug code list for available chamber cavities.

Part No.	Description
008A-05	MOSFET configured lung equivalent rod with set of 3 target inserts
008A-06-CV*	MICRO CHAMBER configured lung equivalent rod with set of 3 target inserts
008A-08	Radiochromic film configured lung equivalent rod
008A-11	GEL DOSIMETRY configured lung equivalent rod with CIRS Model B-9, Dose Gel Container
008A-12	4D CT QA Device
008A-14	Lung equivalent Imaging Rod with set of 3 target inserts
008A-15	PET/CT configured lung equivalent rod with set of 3 target inserts
008A-17	Adjustable legs kit
008A-19*	Ball Cube configured lung equivalent rod for film dosimetry*
008A-22	SBRT Rod with set of 3 target inserts
008A-24	OSL Dosimetry Rod with 3 cm Target insert
008A-153	Replacement Push Rod
008A-125	Chest plate with reflective 11.5 mm tracker balls
008-18	Model 008 upgrade to 008A
008A-253	Cable CAT5E 150 Feet for Dynamic Phantom (008A, 008M,)

\*Ball cube film sold separately. Contact your local Ashland distributor for more information.

# Warranty

All standard CIRS products and accessories are warranted by CIRS against defects in material and workmanship for a period as specified below. During the warranty period, the manufacturer will repair or, at its option, replace, at no charge, a product containing such defect provided it is returned, transportation prepaid, to the manufacturer. Products repaired in warranty will be returned transportation prepaid.

PRODUCT	WARRANTY PERIOD
Models 008A & 18023-A- Dynamic Phantoms	24 Months

There are no warranties, expressed or implied, including without limitation any implied warranty of merchantability or fitness, which extend beyond the description on the face hereof. This expressed warranty excludes coverage of, and does not provide relief for, incidental or consequential damages of any kind or nature, including but not limited to loss of use, loss of sales or inconvenience. The exclusive remedy of the purchaser is limited to repair, recalibration, or replacement of the product at manufacturer's option.

This warranty does not apply if the product, as determined by the manufacturer, is defective because of normal wear, accident, misuse, or modification.

## NON-WARRANTY SERVICE

If repairs or replacement not covered by this warranty are required, a repair estimate will be submitted for approval before proceeding with said repair or replacement.

## RETURNS

If you are not satisfied with your purchase for any reason, please contact Customer Service or your local distributor prior to returning the product. Visit <http://www.cirsinc.com/distributors/> to find your local distributor. Call 800-617-1177, email [rma@cirsinc.com](mailto:rma@cirsinc.com), or fax an RMA request form to 757-857-0523. CIRS staff will attempt to remedy the issue via phone or email as soon as possible. If unable to correct the problem, a return material authorization (RMA) number will be issued. Non-standard or "customized" products may not be returned for refund or exchange unless such product is deemed by CIRS not to comply with documented order specifications. You must return the product to CIRS within 30 calendar days of the issuance of the RMA. All returns should be packed in the original cases and or packaging and must include any accessories, manuals and documentation that shipped with the product. The RMA number must be clearly indicated on the outside of each returned package. CIRS recommends that you use a carrier that offers shipment tracking for all returns and insure the full value of your package so that you are completely protected if the shipment is lost or damaged in transit. If you choose not to use a carrier that offers tracking or insure the product, you will be responsible for any loss or damage to the product during shipping. CIRS will not be responsible for lost or damaged return shipments. Return freight and insurance is to be pre-paid.

With RMA number, items may be returned to:

**CIRS**  
**Receiving**  
**900 Asbury Ave,**  
**Norfolk, Virginia, 23513 USA**





***NOTES:***

# **CIRS**

**COMPUTERIZED IMAGING  
REFERENCE SYSTEMS, INC.**

900 Asbury Ave  
Norfolk, Virginia 23513 USA

**Toll Free:** 800.617.1177

**Tel:** 757.855.2765

**Fax:** 757.857.0523

**Email** [admin@cirsinc.com](mailto:admin@cirsinc.com)

**[www.cirsinc.com](http://www.cirsinc.com)**

**Technical Assistance**

1.800.617.1177



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