

Guardian™ Workstation - AI-6 Controller -



User's Manual
ORIGINAL INSTRUCTIONS



Newport®
Experience | Solutions

EU DECLARATION OF CONFORMITY

Year  mark affixed: 2016

The Manufacturer:

Newport Corporation
1791 Deere Avenue
Irvine, California 92606
United States of America

With Authorized Representative:

MICRO_CONTROLE Spectra-Physics
9, rue du Bois Sauvage
F-91055 Evry
France

Hereby declares that the product:

Description: "Guardian Workstation"

Function: Vibration Isolation System

Type of equipment: Electrical equipment for measurement, control and laboratory use

Model Numbers: GW-series

- Complies with the applicable provisions of the Directive 2006/42/EC relating to machinery
- Complies with all of the relevant provisions of the Directive 2014/30/EU relating to electromagnetic compatibility (EMC)
- Complies with all of the relevant provisions of the Directive 2014/35/EU relating to electrical equipment designed for use within certain voltage limits (Low Voltage)
- Was designed and built in accordance with the following harmonized standards:
 - BS EN ISO 12100:2010 "Safety of machinery – General principles for design – Risk assessment and risk reduction"
 - BS EN 61326-1:2013, "Electrical equipment for measurement, control and laboratory use – EMC requirements"
 - CISPR 11:2009+A1:2010 Class A Group 1 radiated and conducted emission limits

This declaration of conformity is issued under the sole responsibility of the manufacturer.

Signed for and on behalf of: Newport Corporation

Date: February 10, 2016



James Fisher
VP, Components & Vibration Control
Newport Corporation
1791 Deere Ave, Irvine, CA 92606 USA

Warranty

Newport Corporation warrants that this product will be free from defects in material and workmanship and will comply with Newport's published specifications at the time of sale for a period of one year from date of shipment. If found to be defective during the warranty period, the product will either be repaired or replaced at Newport's option.

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First printing 2016

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Newport Corporation
1791 Deere Avenue
Irvine, CA, 92606
USA

Part No. 90071706, Rev. A

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This section contains information regarding factory service for the source. The user should not attempt any maintenance or service of the system or optional equipment beyond the procedures outlined in this manual. Any problem that cannot be resolved should be referred to Newport Corporation.

Technical Support

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If there are any defects in material or workmanship or a failure to meet specifications, promptly notify Newport's Returns Department by calling 1-800-222-6440 or by visiting our website at www.newport.com/returns within the warranty period to obtain a **Return Material Authorization Number (RMA#)**. Return the product to Newport Corporation, freight prepaid, clearly marked with the RMA# and we will either repair or replace it at our discretion. Newport is not responsible for damage occurring in transit and is not obligated to accept products returned without an RMA#.

E-mail: rma.service@newport.com

When calling Newport Corporation, please provide the customer care representative with the following information:

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- Description of problem (i.e., hardware or software)

To help our Technical Support Representatives diagnose your problem, please note the following conditions:

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- What was the state of the system right before the problem?
- Have you seen this problem before? If so, how often?
- Can the system continue to operate with this problem? Or is the system non-operational?
- Can you identify anything that was different before this problem occurred?

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1 Safety Precautions

1.1 Definitions and Symbols

The following terms and symbols are used in this documentation and also appear on the Guardian Workstation where safety-related issues occur.

1.1.1 General Warning or Caution



Figure 1 General Warning or Caution Symbol

The Exclamation Symbol in the figure above appears in Warning and Caution tables throughout this document. This symbol designates an area where personal injury or damage to the equipment is possible.

1.1.2 Electric Shock



Figure 2 Electrical Shock Symbol

The Electrical Shock Symbol in the figure above appears throughout this manual. This symbol indicates a hazard arising from dangerous voltage. Any mishandling could result in irreparable damage to the equipment, and personal injury or death.

1.1.3 European Union CE Mark



Figure 3 CE Mark

The presence of the CE Mark on Newport Corporation equipment means that it has been designed, tested and certified as complying with all applicable European Union (CE) regulations and recommendations.

1.1.4 Frame or Chassis

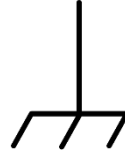


Figure 4 Frame or Chassis Terminal Symbol

The symbol in the figure above appears on the AI-6 Guardian Controller. This symbol identifies the frame or chassis terminal

1.1.5 On



Figure 5 On Symbol

The On Symbol in the figure above represents a power switch position on the Model AI-6 Guardian Controller. This symbol represents a Power On condition.

1.1.6 Off

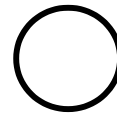


Figure 6 Off Symbol

The Off Symbol in the figure above represents a power switch position on the Model AI-6 Guardian Controller. This symbol represents a Power Off condition. Note – setting the switch on the AI-6 to this position shuts off the power within the AI-6, but the power supply unit and the power cable from the power supply to the AI-6 will remain energized.

1.1.7 Protective Conductor Terminal



Figure 7 Protective Conductor Terminal Symbol

The protective conductor terminal symbol in the above figure identifies the location of the bonding terminal, which is bonded to conductive accessible parts of the enclosure for safety purposes. The intent is to connect it to an external protective earthing system through the power cord.

1.1.8 USB Connector Symbol



Figure 8 USB connector Symbol

The USB connector symbol in the above figure identifies the location of the USB communications connector.

1.1.9 Waste Electrical and Electronic Equipment (WEEE)





Figure 9 WEEE Directive Symbol

This symbol on the product or on its packaging indicates that this product must not be disposed with regular waste. Instead, it is the user responsibility to dispose of waste equipment according to the local laws. The separate collection and recycling of the waste equipment at the time of disposal will help to conserve natural resources and ensure that it is recycled in a manner that protects human health and the environment. For information about where the user can drop off the waste equipment for recycling, please contact your local Newport representative.

1.2 Warnings and Cautions

The following are definitions of the Warnings, Cautions and Notes that are used throughout this manual to call your attention to important information regarding your safety, the safety and preservation of your equipment or an important tip.

	<p>WARNING</p> <p>Situation has the potential to cause bodily harm or death.</p>
---	---

	<p>CAUTION</p> <p>Situation has the potential to cause damage to property or equipment.</p>
---	--

NOTE

Additional information the user or operator should consider.

1.2.1 General Warnings

Observe these general warnings when operating or servicing this equipment:

- Heed all warnings on the unit and in the operating instructions.
- Do not use this equipment in or near water.
- Route power cords and other cables so they are not likely to be damaged.
- Disconnect power before cleaning the equipment. Do not use liquid or aerosol cleaners; use only a damp lint-free cloth.
- Lockout all electrical power sources before servicing the equipment.
- To avoid explosion, do not operate this equipment in an explosive atmosphere.
- Qualified service personnel should perform safety checks after any service.
- The Guardian Workstation is only approved for use in an industrial environment. Use of the product in a residential environment may result in electromagnetic compatibility difficulties due to conducted as well as radiated disturbances.


1.2.2 General Cautions


Observe these cautions when operating or servicing this equipment:


- If this equipment is used in a manner not specified in this manual, the protection provided by this equipment may be impaired.
- Do not block ventilation openings.
- Use only the specified replacement parts.
- Follow precautions for static sensitive devices when handling this equipment.
- This product should only be powered as described in the manual.
- There are no user-serviceable parts inside the Guardian Workstation.
- To prevent damage to the equipment, read the instructions in the equipment manual for proper input voltage.

1.2.3 Summary of Warnings and Cautions

The following general warning and cautions are applicable to this instrument:

	<p>WARNING</p> <p>Before operating the Guardian Workstation, please read and understand all of Section 1.</p>
--	--

	<p>WARNING</p> <p>Do not attempt to operate this equipment if there is evidence of shipping damage or you suspect the unit is damaged. Damaged equipment may present additional hazards to you. Contact Newport technical support for advice before attempting to plug in and operate damaged equipment.</p>
---	---

	<p>WARNING</p> <p>Before cleaning the enclosure of the AI-6 Guardian Controller, the power supply unit, or the enclosure of any attached Modules, the power supply's AC power cord must be disconnected from the wall socket.</p>
---	--



CAUTION

There are no user serviceable parts inside the Guardian Workstation. Work performed by persons not authorized by Newport will void the warranty. For instructions on obtaining warranty repair or service, please refer to Section 6.



WARNING

If this equipment is used in a manner not specified in this manual, the protection provided by this equipment may be impaired.



WARNING

While the AI-6 Guardian Controller's rear panel power switch turns power OFF to the internal electronics, it should not be depended upon to fully disconnect the unit from MAINS power. Disconnect the power supply unit's power cord to fully isolate this equipment from MAINS power. Do not position this equipment so that it is difficult to disconnect the power cord.



CAUTION

Setting the AI-6 Guardian Controller's rear panel power switch to the OFF position shuts off power to the left and right modules and the controller, but the power supply unit and the cable between the power supply unit and the controller will remain energized unless the power supply unit's power cord is isolated from MAINS power.



The Guardian Workstation is intended for use in an industrial laboratory environment. Use of this product in other environments, such as residential, may result in electromagnetic compatibility difficulties due to conducted as well as radiated disturbances.



WARNING

The AI-6 Guardian Controller is intended for use ONLY with Newport Module Assemblies. DO NOT ATTEMPT TO USE THE AI-6 GUARDIAN CONTROLLER WITH UNAPPROVED DEVICES.

1.3 Location of Warnings

1.3.1 AI-6 Guardian Controller Rear Panel

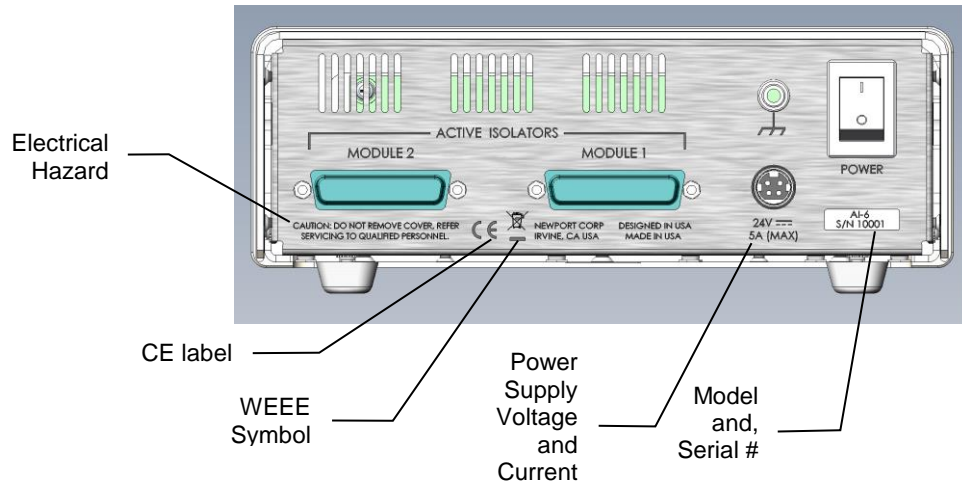


Figure 10 Rear Panel Labels and Warnings (AI-6)

1.3.2 Workstation Labels and Warnings

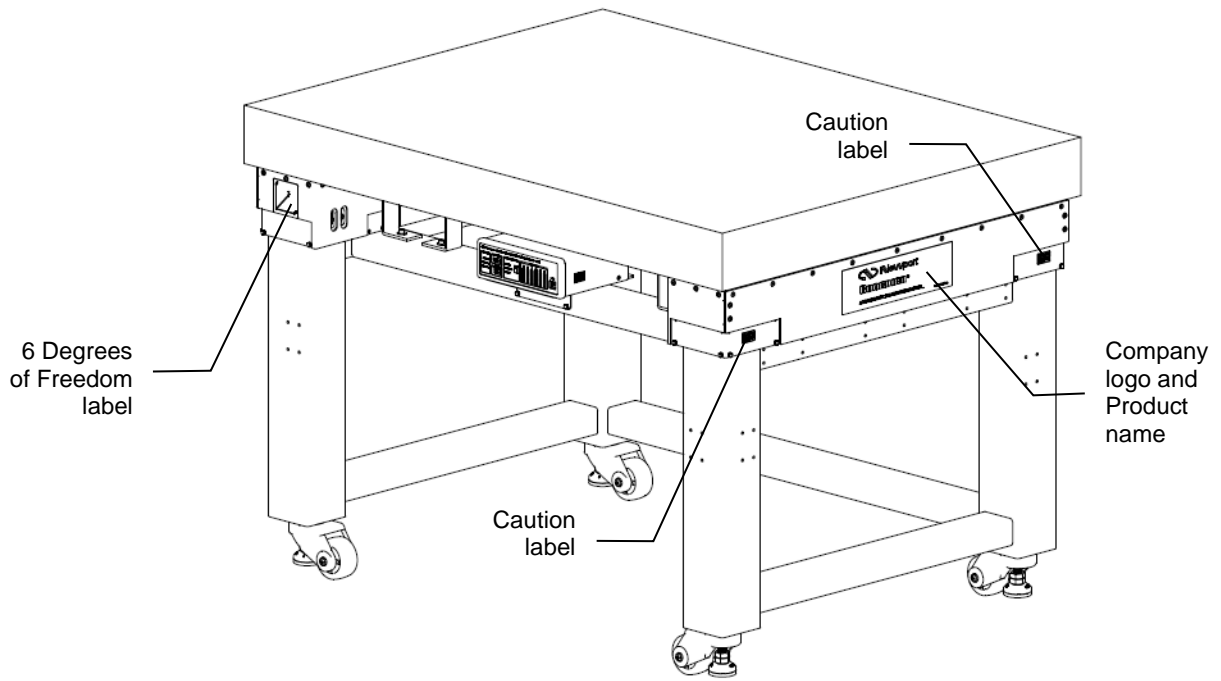


Figure 11 Workstation Labels and Warnings (AI-6, front view)

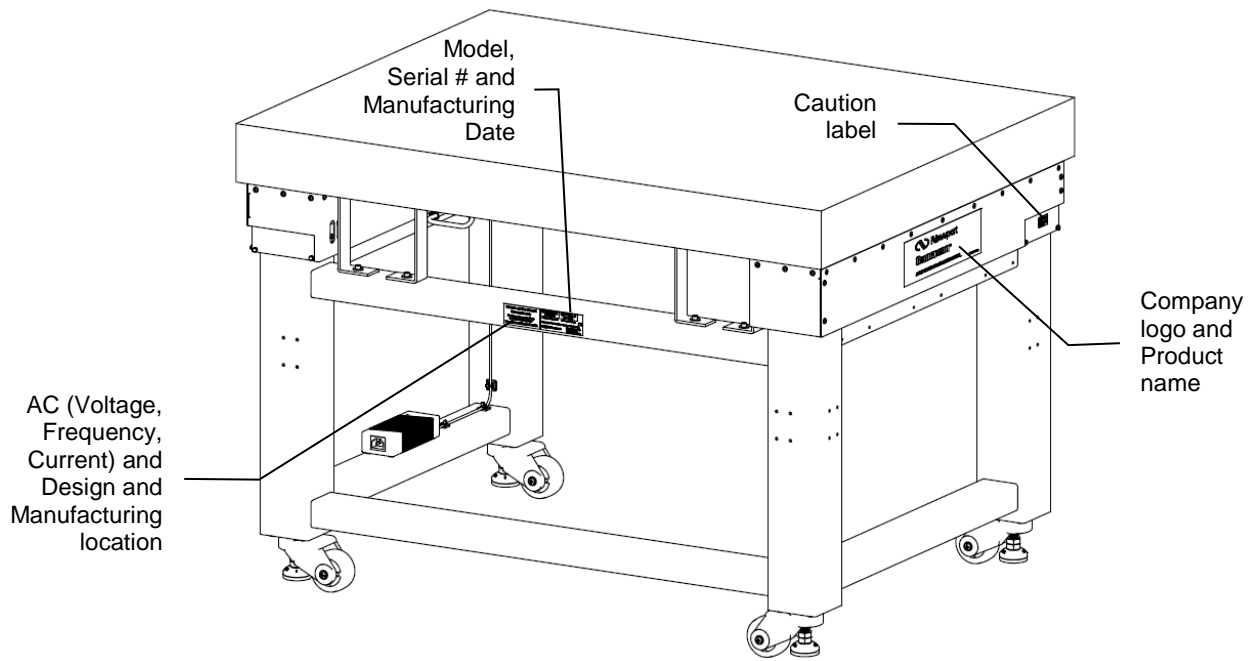


Figure 12 Workstation Labels and Warnings (AI-6, rear view)

2 General Information

2.1 Introduction

The Guardian is a combination of a structurally isolated vibration isolation workstation, electronics that monitor vibrations in real time, and active elements that use the real-time data to suppress the vibration.

The vibration state of a workstation is a critical characteristic, in many cases defining its suitability for the task at hand. Reducing vibration is one of the most important goals of the workstation design. Since the floor is the major source of vibration in most environments, vibration isolation from the floor is the main method of achieving this goal. Guardian includes new and improved CNF (constant natural frequency) spring-based VIBE-X passive vibration isolators that have proven themselves as effective isolation means for microscopes and other vibration-sensitive equipment. However, the isolated platform can experience resonance vibration “bouncing” on these springs with six degrees of freedom; therefore, passive isolation is only effective in reducing vibration at frequencies sufficiently higher than the natural frequencies of this resonance vibration.

Guardian contains two active vibration isolation modules that control all six translational and rotational degrees of freedom of the isolated platform. Active vibration control not only removes the resonance response inherent to the passive system, but provides up to 34 dB (50 times) additional isolation. The isolation starts, typically, from 0.5 Hz and reaches 20 dB (10 times) at 2 Hz. Guardian reduces vibration in a wide frequency range (up to the frequencies where passive isolation is effective enough) without creating any significant resonances at lower frequencies. This performance is illustrated by the transmissibility curve in Figure 1. Moreover, Guardian is capable of reducing vibration coming from acoustic and on-board sources. If the load on the table top changes, the active isolation modules maintain their performance and stability after simple auto-tuning of control gains.

The Guardian system uses a PG grade optical breadboard as the table top. The breadboard is hard mounted on top of the active isolation modules.

2.1.1 Guardian Workstation Models

Part or model numbers	Application
GW3036-PG4-L M-GW3036-PG4-L	Work surface 30 in. by 36 in. Work surface 750 mm by 900 mm Load range 0 lbs. to 190 lbs.*
GW3036-PG4-H M-GW3036-PG4-H	Work surface 30 in. by 36 in. Work surface 750 mm by 900 mm Load range 110 lbs. to 420 lbs.*
GW3648-PG4-H M- GW3648-PG4-H	Work surface 36 in. by 48 in. Work surface 900 mm by 1200 mm Load range 20 lbs. to 320 lbs.*

* Load limits assume symmetric weight distribution of the payload.

Table 1 Guardian Workstation Models

2.2 Specifications

2.2.1 System specifications

Working Surface	400 Series ferromagnetic stainless steel 3/16 in. (4.8 mm) thick with integrated damping layer
Surface Flatness [in. (mm)]	±0.004 (±0.1), over 2 ft. (600 mm) square
Core Design	Trussed honeycomb, vertically bonded closed cell construction; 0.010 in. (0.25 mm) steel sheet material; 0.030 in. (0.76 mm) triple core interface
Active Damping	Patent pending electronic damping technology
Structural Damping	Foam inserts in passive isolators. Constrained layer core, isolated working surface and patented modal damping in the PG grade breadboard
Mounting Holes	1/4-20 holes on 1 in. grid (M6-1.0 holes on 25 mm grid), 0.5 in. borders (12.5 mm borders)
Hole/Core Sealing	Easy clean conical cup 0.75 in. (19 mm) deep, Non-corrosive high impact polymer material

Table 2 Specifications

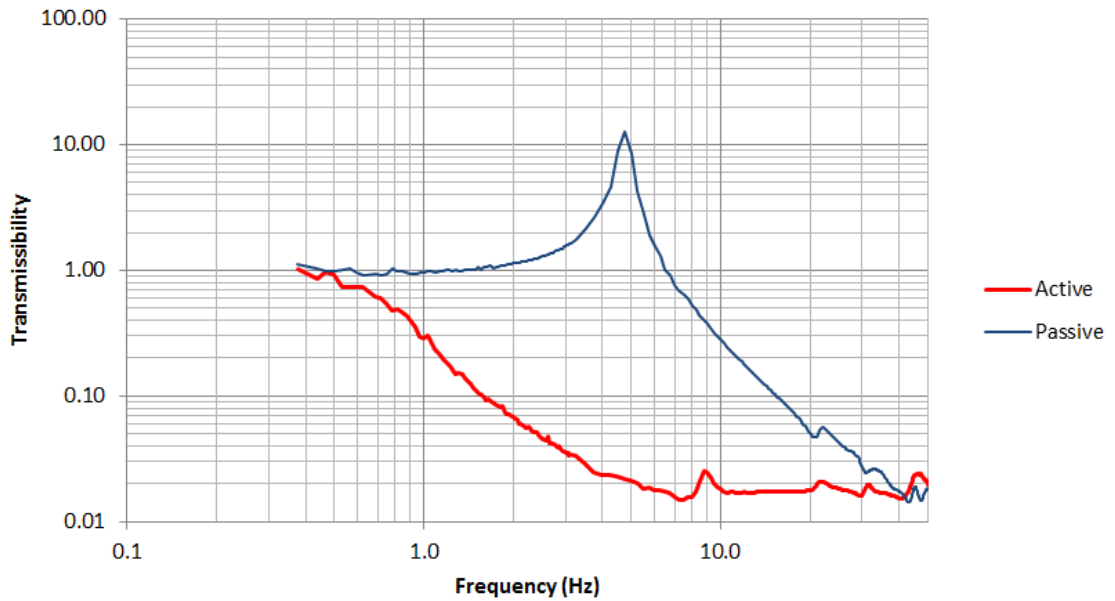


Figure 13 Transmissibility curve (vertical vibration data taken on a GW3036-PG4-L workstation carrying 48 lbs. of load)

2.2.2 AI-6 Guardian Controller Specifications

Input Power	
Voltage	24V \pm 5%
Average Current @ continuous output rating	2.8A
Peak Current @ continuous output rating	3.5A

Table 3 AI-6 Guardian Controller Specifications

2.2.3 System Environmental Specifications

AC Input	100-240VAC, 2.5A 50/60Hz \pm 10%
Chassis Ground	4 mm banana jack
Controller Size (W x L x H) [in. (mm)]	8.4W x 7.2L x 3.19H (213.4W x 182L x 80.9H)
Controller Weight [lb (kg)]	2.8 (1.28)
Module Size (W x L x H) [in. (mm)]	0.98W x 13.55L x 4.22H (24.9W x 344.2L x 107.2H)
Module Weight [lb (kg)]	1.25 (0.56)
Operating Temperature	5 °C to 40 °C
Operating Humidity	< 85% relative humidity non-condensing
Storage Temperature	0 - 60 °C < 85% non-condensing
Altitude	< 3000 m
Electrical Class	1
Installation Category	2
Pollution Degree	2
Use Location	Indoor use only

Table 4 Environmental Specifications

3 Workstation Installation and Setup

3.1 Workstation Unpacking and Handling

It is recommended that the Guardian Workstation be unpacked in a lab environment or work site. Unpack the system carefully. A USB flash drive and a power supply are included with the system. Inspect the box carefully for loose parts. You are urged to save the packaging material in case you need to ship your equipment in the future. Also, do not dispose of the shipping restrains. They are reusable and needed for the integrity of the system during shipment.

3.2 Inspection for Damage

The workstation is carefully packaged at the factory to minimize the possibility of damage during shipping. Inspect the system for external signs of damage or mishandling. Inspect the contents for damage. If there is visible damage to any of the system's components upon receipt, inform the shipping company and Newport Corporation immediately.



WARNING

Do not attempt to operate this equipment if there is evidence of shipping damage or you suspect the unit is damaged. Damaged equipment may present additional hazards to you. Contact Newport technical support for advice before attempting to plug in and operate damaged equipment.

3.3 Parts List

Parts included with the AI-6 Guardian Controller:

- Optical Breadboard and Frame
- Model Series AI-6 Guardian Controller
- Power Supply with power cord (US), 24V/5A, Newport P/N 90075666
- USB Flash Drive (contains Device User's Manual and Software)

- 2 controller cables P/N 90072841
- Active Isolation Modules
- Bubble level, P/N 17530-01
- 15/16" Combo Wrench (Newport P/N 90078020)
- 0.187" Hex Wrench (Newport P/N 4828-05)
- Ramp and shipping restraints

The Guardian Workstation is shipped already assembled (see Figure 14). Inspect the system carefully. If you are missing any hardware or have questions about the hardware you have received, please contact Newport Corporation.

3.4 Placement of the AI-6 Guardian Controller and Power Supply

It is recommended that the AI-6 Guardian Controller be placed under the workstation optical table, as shown in Figure 14. The controller may be relocated to the left or right side as needed by loosening up the two thumb screws holding the bracket to the frame at the bottom of the controller. Cabling may also need to be re-adjusted. Velcro straps/spare tie wraps are provided.

Also, the power supply should be strapped on the lower or upper rear bars of the frame. The power supply can also be relocated to the left or right side as needed. Both the power supply and the controller should not be attached to the optical table itself, as the manual operation of front panel controls will mechanically disturb the normal operation of the system.



Figure 14 Active Isolation Workstation with AI-6 Guardian Controller and power supply

3.5 Removing the Workstation from the Box/Crate

After the cardboard box top, the surrounding cardboard box, and straps are removed, there should be a wood plate on top of the breadboard. Remove this wood plate and unfold the two side flanges at the bottom of the plate to form a ramp. Position it at the bottom of the box to form an inclined ramp (see Figure 15). The workstation has casters so it can be easily rolled on the floor. Raise the leveling feet of the casters up so that they can be moved around. Carefully slide the workstation from the box on the ramp and on the floor and then roll it to its new position in the lab.

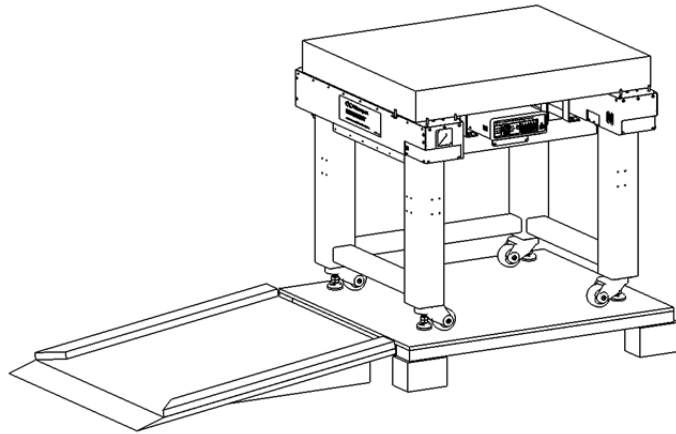


Figure 15 Removing the workstation using the enclosed ramp

If you use a forklift to lift and move the workstation, place the forklift blades below the lower side bars shown in Figure 16. Do not lift the table from its top or by placing the forklift blades at the workstation front or back.

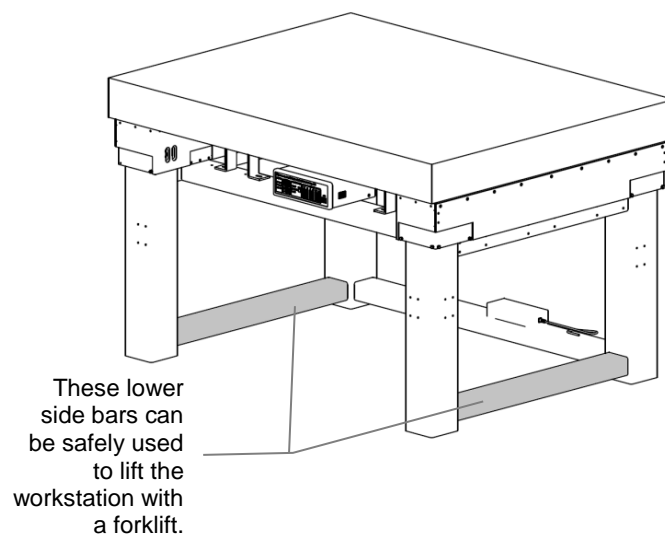


Figure 16 Workstation lower side bars

**WARNING**

The workstation is heavy. Newport recommends that you do not attempt to remove the workstation from its box by yourself. This task should be done by two or more people.

**WARNING**

If using a forklift to move the workstation, place the forklift blades below the lower side bars. Do not use the top bars and do not try to lift the workstation from front or back. Failure to follow these instructions may result in equipment damage or personnel injury due to equipment falling from the forklift.

3.6 Workstation Leveling

**CAUTION**

Power must be disconnected during workstation leveling.

Once the workstation is in its place, remove the protection material from the table. The following are the recommended steps to properly level the workstation.

1. Lower the feet until the wheels are lifted from the floor.
2. Level the frame by adjusting the feet height (Figure 17). Use the enclosed bubble level to make sure the top surface is horizontal. After the feet are adjusted secure them by tightening the lock nuts. A 15/16" Combo Wrench is required. It is enclosed in the User Kit 90078017.

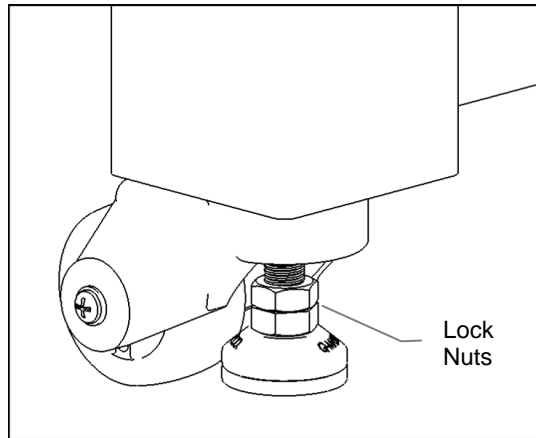


Figure 17 Workstation casters

3. Remove the restraining brackets that secured the table breadboard during shipping (Figure 18). There are 4 restraining brackets under the table top. After the brackets are removed, and sufficient load is placed on the breadboard according to minimum value listed in Table 1 for this particular model, the breadboard will float freely on the modules' springs. A 0.187" Hex Wrench is required. It is enclosed in the User Kit 90078017.

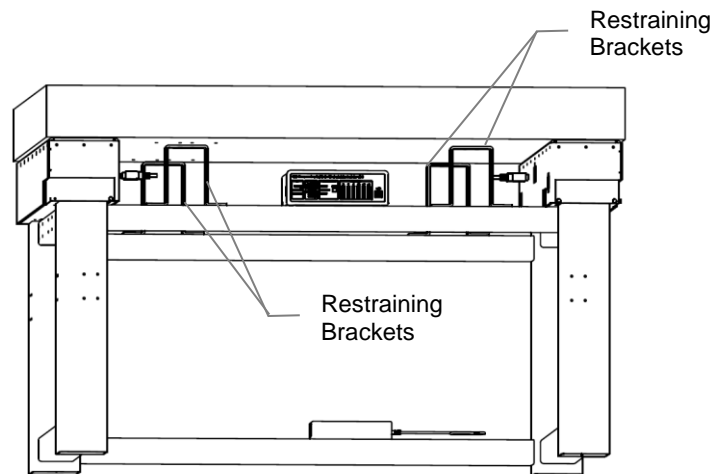


Figure 18 Breadboard restraining brackets

3.7 Loading the Workstation and Leveling the Breadboard



CAUTION

Power must be disconnected during breadboard leveling.

To ensure proper operation and excellent active isolation, your instrumentation should be placed on the top of the workstation such that the breadboard is evenly loaded. If one instrument is used, such as a microscope, it should be positioned in the middle of the breadboard. Generally, the payload should be arranged so that its center of gravity is as close as possible to the central vertical axis of the breadboard.

Do not overload the workstation. If the workstation is overloaded, the isolation modules will reach the stops. If the stops are reached there will be no active isolation.

Perform a fine leveling adjustment of the table top. For this, remove the corner plates from the front corners and the rear right corner (Figure 19). The left rear corner is fixed and cannot be adjusted. It is used as a level reference for the other three corners.

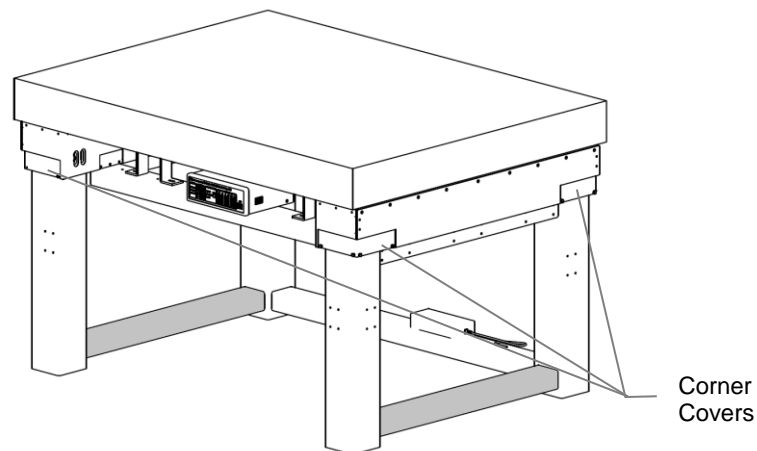


Figure 19 Corner covers

For each corner, loosen up the two lock screws positioned on the inside surface underneath the breadboard and opposite from the corner cover. Use two levelers in front to correct the tilt around the X axis. Use two levelers at right to correct the tilt around the Y axis. Use a screw driver to rotate the corner leveler to adjust the breadboard (Figure 20). Use a bubble level to help

you during this step. You may need to repeat this adjustment if you change the position of the center of gravity of the breadboard by changing or re-arranging the payload. Note that it is highly recommended to position the payload so that the center of gravity is approximately aligned vertically with the center of the breadboard.

Tighten the lock screws after finishing the adjustment. Replace the corner covers.

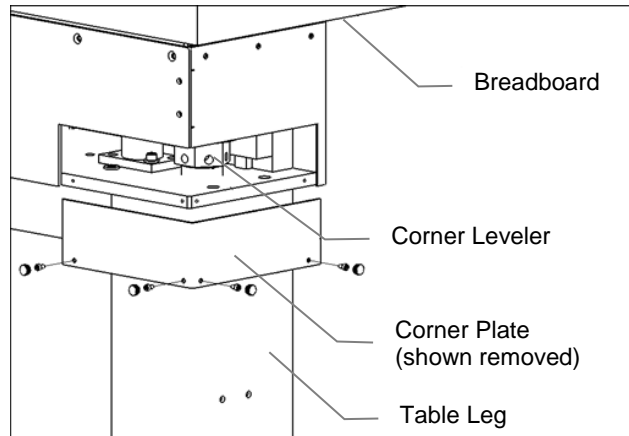


Figure 20 Corner levelers inside the modules

3.8 Electrical Requirements

Before powering the unit for the first time, the following precautions must be followed:

- If you remove the controller from its default position in the workstation, make sure to provide adequate distance between the AI-6 Guardian Controller air vents and adjacent walls for ventilation purposes. A spacing of approximately 2 inches from all surfaces is adequate.
- Power to the Model AI-6 Guardian Controller must only be supplied using an appropriate 24 Volt DC Newport-approved power supply such as the one supplied with the controller. The supplied power supply is auto-ranging and is approved for operation between 100 to 240VAC.
- Verify that the power supply is connected to the controller. The 24V connector has a latch. When properly inserted you should hear a click indicating that the connector was locked.

- To remove the power supply connector from the AI-6 Guardian controller simply pull the connector out from its shell. By pulling the connector the lock will disengage, releasing the connector from its socket. Do not attempt to remove the power supply connector by pulling the cable. This action will result in damage to the power supply connector or cable.

**WARNING**

Do not attempt to power the AI-6 Guardian Controller unit with an unapproved power supply. Failure to do so can cause damage to the AI-6 Guardian Controller unit, fire, or sever injury.

3.9 **Operating Temperature**

The Guardian Workstation is designed for operation in a laboratory environment. Recommended ambient operating temperatures are 20 – 25 °C. Operation at higher or lower ambient temperatures for limited periods (e.g., several hours) will not cause any harm but may slightly reduce the performance.

3.10 **System Diagrams**

Figure 21 shows the recommended connection of the AI-6 Guardian Controller to the Workstation Modules 1 and 2.

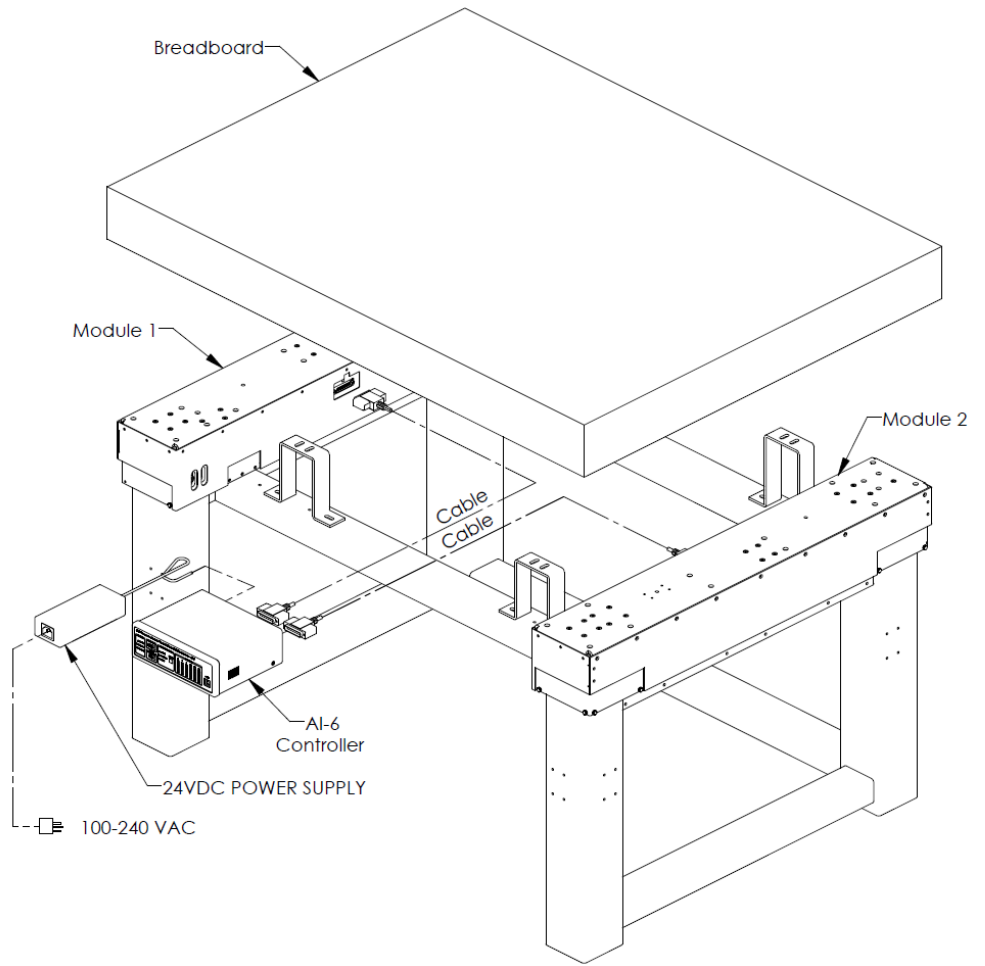


Figure 21 Guardian Workstation wiring diagram

4 AI-6 Controller Operation

	<p style="text-align: center;">WARNING</p> <p>Before operating the AI-6 Guardian Controller, please read and understand all of Section 1.</p>
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4.1 Front Panel

The AI-6 Guardian Controller front panel is arranged for easy operation. Seven distinct indicators and controls are located on the front panel that allows the user to operate the system as well as provide system status. The front panel is shown in Figure 22 below.

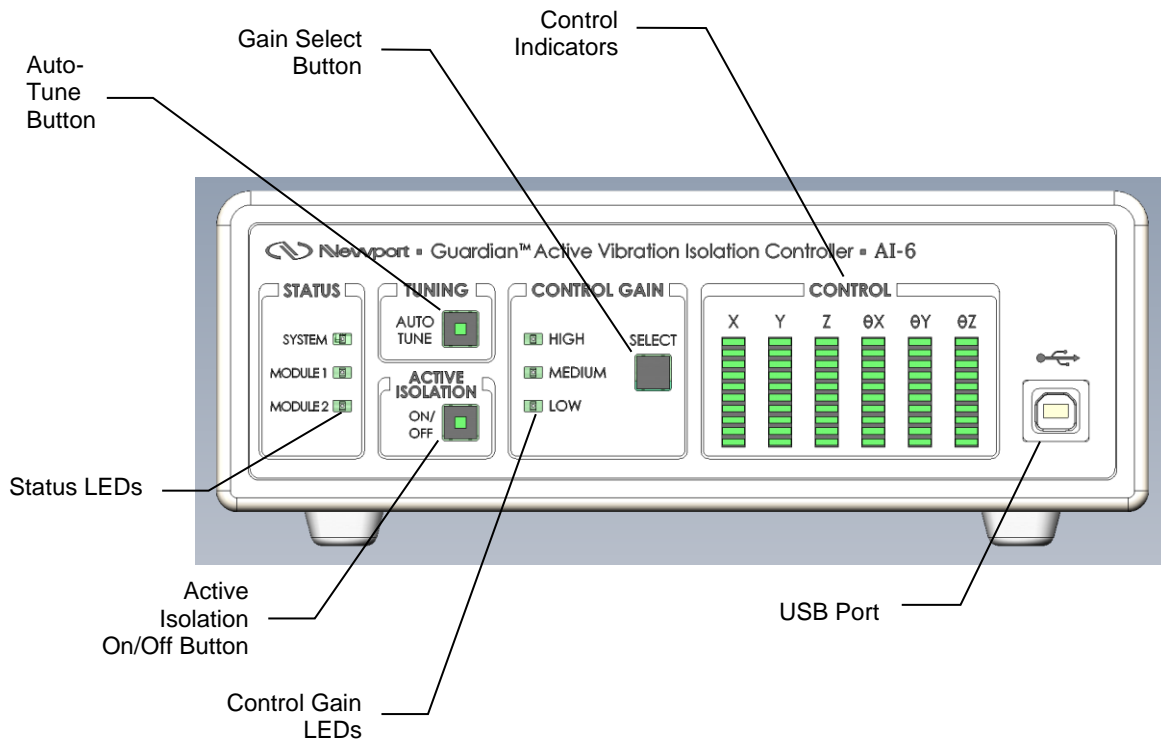


Figure 22 Front Panel Layout.

4.1.1 Status LEDs

The table below shows the meaning of the various colors of SYSTEM, MODULE 1, and MODULE 2 status LED's.

Item	Level	Category	Comment	Module1 LED	Module2 LED	System LED
1	System	Unpowered	Power supply not connected or power switch off	OFF	OFF	OFF
2	System	Unpowered	Defective power supply	OFF	OFF	OFF
3	System	Unpowered	Blown internal fuse	OFF	OFF	OFF
4	System	Powered	No system problem	—	—	Green
5	System	Fault	Critical component failure or main firmware is corrupted	—	—	Red
6	Module 1	Fault	Module disconnected during operation	Red	—	Green
7	Module 1	Fault	Active isolation disabled due to component failure	B-Red	—	Green
8	Module 1	Warning	Active isolation enabled and operating in overload condition	Amber	—	Green
9	Module 1	Fault	Active isolation disabled due to saturation	B-Amber	—	Green
10	Module 1	Tuning	Auto-tuning in progress	B-Green	—	Green
11	Module 1	Isolation	Active isolation enabled (normal operation)	Green	—	Green
12	Module 1	Disabled	Active isolation disabled via software or Module not present when controller was turned ON	OFF	—	Green
13	Module 2	Fault	Module disconnected during operation	—	Red	Green
14	Module 2	Fault	Active isolation disabled due to component failure	—	B-Red	Green
15	Module 2	Warning	Active isolation enabled and operating in overload condition	—	Amber	Green
16	Module 2	Fault	Active isolation disabled due to saturation	—	B-Amber	Green
17	Module 2	Tuning	Auto-tuning in progress	—	B-Green	Green
18	Module 2	Isolation	Active isolation enabled (normal operation)	—	Green	Green
19	Module 2	Disabled	Active isolation disabled via software or Module not present when controller was turned ON	—	OFF	Green

Where B-Red = Blinking Red, B-Amber = Blinking Amber, B-Green = Blinking Green

Table 5 Definition of SYSTEM, MODULE 1, and MODULE 2 status LED's.

4.1.2 Auto-Tune

The auto-tune button allows the user to retune the system. The auto-tuning process can typically take up to 2 minutes. Care must be taken not to disturb the table during this time. If there is equipment on the table that can be a source of non-stationary vibration or noise, it should be shut down. If the table was inadvertently disturbed by mechanical shock or loud noise during the auto-tuning, it is recommended to repeat the process.

Beeping or tonal sounds may be heard from the Modules during the auto-tuning process. Please note that during the auto-tuning process the table may experience higher vibrations than during normal operation.

Note: The Auto-Tune Button LED will stay solid green during auto-tuning. The auto-tuning process can be stopped by depressing the Auto-Tune button for the second time.

Note: If the controller detects a change in the table load or dynamic status, it will recommend auto-tuning to be performed by slowly blinking the Auto-Tune Button LED.

The controller comes pre-set for the optimal performance of the lightly loaded table. If additional load is added to the table or, subsequently, removed from the table, it is recommended to perform auto-tuning. Auto-tuning must also be performed in the following cases:

- Amber blinking for any or all of MODULE 1, and MODULE 2 status LEDs.
- Green blinking Auto-Tune LED.
- Audible sound from any of the Modules.

4.1.3 Active Isolation Button

The Active Isolation button toggles the active isolation feature ON and OFF. Use it to manually turn off the active isolation or to manually turn it on. The same action can be performed from the Guardian application (see Section 5 AI-6 Controller Software).

4.1.4 Control Gain

Select the desired gain by pushing the Control Gain button. The gain settings are High, Medium, and Low. The higher the gain, the better the system performance. However, keep in mind that higher gain settings decrease the gain stability margin. So, if there are moving objects on the table, or if the table load changes often, you might want to set the gain to a more conservative value like Medium or even Low.

The auto-tune process will respect the user gain setting. The controller will find the optimal gain values during auto-tuning process and then will readjust the gains based on the user setting.

4.1.5 Control LED Bar Graphs

The bar graphs are a quick visual dynamic indicator of the AI-6 Guardian Controller output in six degrees of freedom.

4.1.6 USB Interface

The instrument is designed to communicate with standard USB interfaces. The cable required is a USB A/B connection cable.

4.2 Rear Panel

The following figure shows the AI-6 Guardian Controller rear panel.

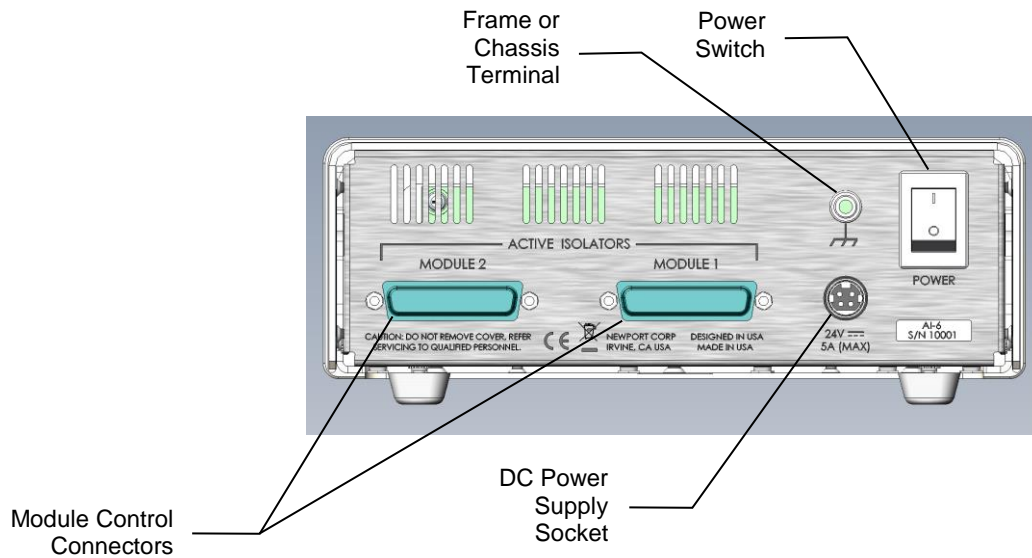


Figure 23 Rear Panel

4.2.1 Power Switch

The rear panel-mounted power switch can be used to turn ON or OFF the AI-6 Guardian Controller. Note that this switch interrupts DC power entering the controller unit; it does NOT deactivate the external power supply unit.

4.2.2 Power Supply Socket

Plug the included the external power supply unit connector into the Power Supply Socket on the rear of the instrument, then the AC power cord into a wall socket.

The power supply is 24V/5A, Newport P/N 90075666.

4.2.3 Module Output Connectors

Two 25 pin connectors labeled MODULE1, and MODULE2 are the connection points for the Guardian active isolation modules.

4.2.4 Frame or Chassis Terminal

This terminal provides access to frame or chassis connection.

5 AI-6 Controller Software

5.1 Overview

The USB flash drive that comes with the Controller provides an installation package for the controller software and USB driver. This application communicates with the Controller through a USB communication interface. The application is designed to allow the user to remotely control all the features supported by the controller.

NOTE

Install the software and USB drivers before connecting the USB cable to the controller for the first time.

Minimum requirements for the computer:

- A personal computer with a high mid-range CPU such as the slower Intel Core2 Duo CPUs, Intel Xeon CPUs, Intel Celeron CPUs, AMD Mobile CPUs, AMD Turion IIs, AMD Opteron Dual Core CPUs, and AMD Athlon Dual-Core CPUs.
 - Intel i5 2.3GHz or higher recommended if the data logging feature will be used.
 - Microsoft Windows XP, Windows 7, Windows 8, or Windows 10 operating systems
 - 4 GB of memory for Windows operating system
 - Hard disk up to 250 GB space may be required if data logging is used
 - USB port (version 1.1 minimum)
 - Display 1024 x 768 high color, 32-bit (minimum)
 - Microsoft Mouse or compatible pointing device
1. Insert the USB flash drive that accompanies the controller in one of your computer's USB ports. To install the USB driver and software

double-click on **SETUP.EXE** file. Follow the on-screen instructions to complete the installation process. For more information refer to the **Readme** file on the USB flash drive.

2. Connect the USB cable to the Controller and power it on.
3. Start the application by clicking on Start → Programs → Newport → Guardian Application.

5.2 Menu

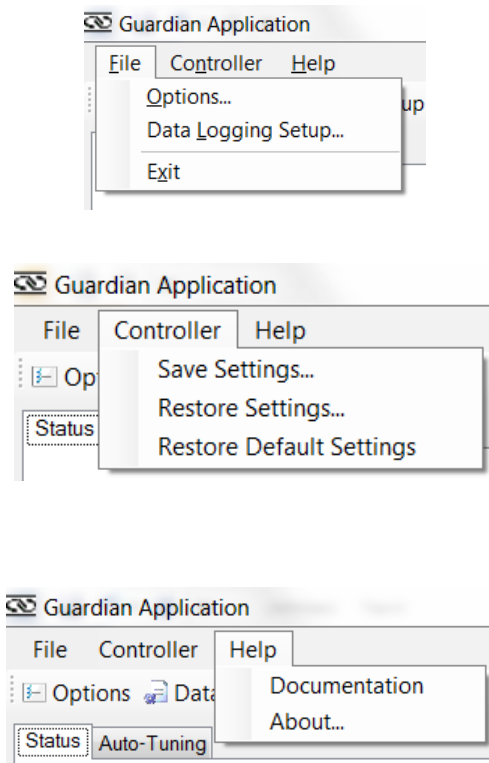


Figure 24 Guardian application menus

5.2.1 File

The File menu contains the Options and the Data Logging Setup menu choices. The Options menu choice opens the Options dialog and the Data Logging Setup menu choice opens the Data Logging Setup dialog. Both of these menu choices have a corresponding button on the tool bar that will open the same dialog. The Options dialog is described in Section 5.3 and the Data Logging Setup dialog is described in Section 5.4.

5.2.2 Controller

This menu item contains Save Settings, Restore Settings and Restore Default Settings.

5.2.2.1 Save Settings

Save the controller settings to a file.

5.2.2.2 Restore Settings

Restore the controller settings from a file.

5.2.2.3 Restore Default Settings

Restore the controller settings to default values.

5.2.3 Help

With the Help Menu you can access the Documentation and the About Screen.

5.2.3.1 Documentation

Clicking on this menu item will open the Docs folder installed in the application folder.

5.2.3.2 About Dialog Window

The application software version number is displayed on this dialog window. Also, the controller data (model name, serial number, firmware version and firmware date) are shown here.

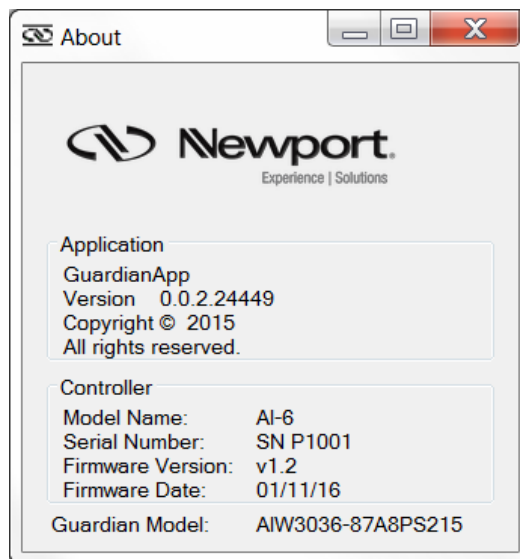


Figure 25 About Dialog Window

5.3 Options

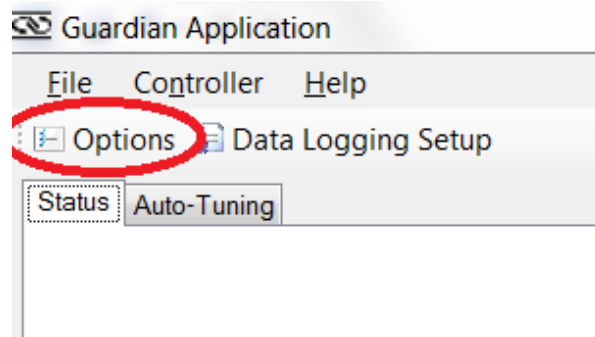


Figure 26 Options button location

The Options button opens the Options screen, as in Figure 27. The same window can be accessed from the main menu (see Section 5.2.1).

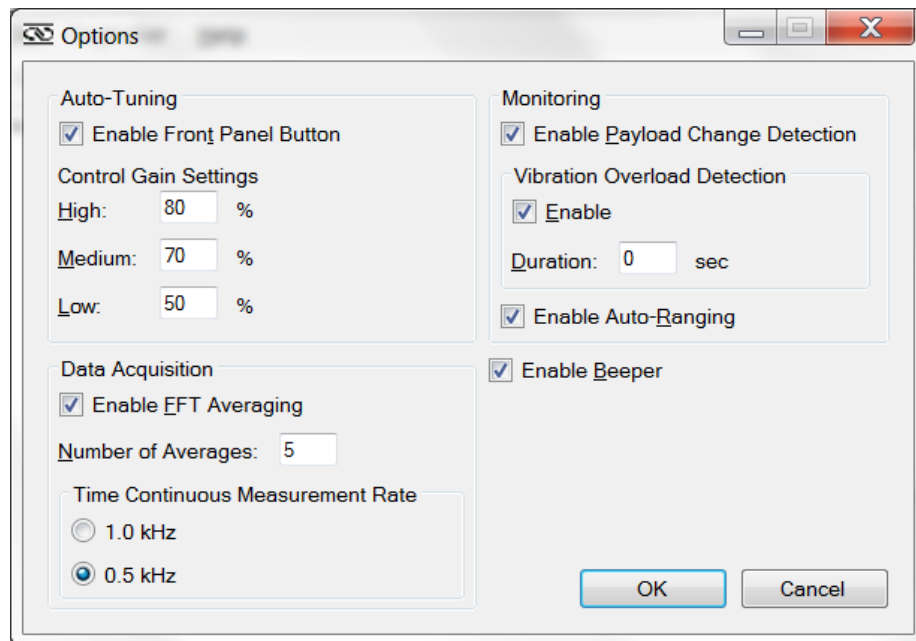


Figure 27 Options Dialog Window

The Options Dialog Window allows the user to customize the controller and the Guardian Application functionality to their requirement. It provides access to the following functions:

5.3.1 Auto-tuning

- **Enable the front panel button.** Uncheck this box to disable initiation of auto-tuning process locally.

Low, Medium and High control loop gain margins. Specify the desired percentage by which the control loop gain is scaled at the end of auto-tuning process. The gain stability margin and the control loop gain have inverse relation. While lower loop gain may be desired if the system is being used in an environment where the payload is continuously changing, such lower gain may also result in reduced active vibration isolation performance. Note that lower gains setting are recommended for add-on Modules on small isolated platforms such as 2 in. and 4 in. thick breadboards.

5.3.2 Data Acquisition

- **Enable FFT averaging.** Uncheck this box to cancel averaging by the application. If this box is not checked, the application will collect either passive or active vibration levels only once.
- **Number of averages.** Specify the number of times passive and active vibration levels are collected, or the FFT has to be averaged.

Time Continuous Measurement Rate. When selecting Time Continuous display in the Auto-Tuning screen the measurement rate can be selected to accommodate your computer speed and the number of tasks running in the background.

5.3.3 Enable Beeper

If this box is checked the unit will beep to give the user audible cues regarding the operation (e.g., button press, system fault).

5.4 Data Logging Setup

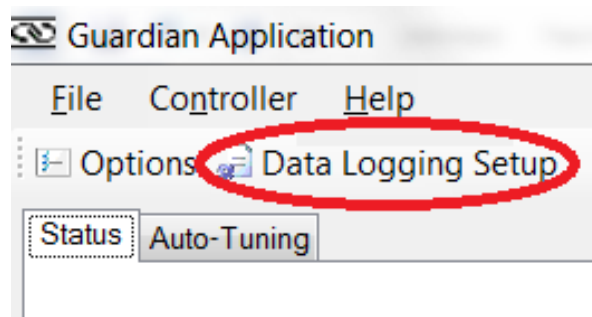


Figure 28 Data Logging button location

The Data Logging Setup button (Figure 28) opens the Data Logging dialog window, as in Figure 29. The same window can be accessed from the main menu (see Section 5.2.1).

Figure 29 Data Logging Dialog Window

5.4.1 Logging Time

The Logging Time group box allows one of three choices to be made: Manual, Absolute Time or Relative Time.

If Manual is selected then data logging will begin when data logging is turned on (via the “Turn Logging On” button) and Time Continuous measuring is in progress. Data logging will end when measuring is stopped or data logging is turned off (via the “Turn Logging Off” button). The Rec. LED will turn red when data is being written to the log file.

If Absolute Time is selected then data logging will begin at the specified Start Date / Time and finish at the specified End Date / Time as long as Time Continuous measuring is in progress and data logging is turned on (via

the “Turn Logging On” button). The Rec. LED will turn red when data is being written to the log file.

If Relative Time is selected then data logging will begin after the specified delay and last for the specified duration as long as Time Continuous measuring is in progress and data logging is turned on (via the “Turn Logging On” button). The Rec. LED will turn red when data is being written to the log file. Note that the delay begins when the “Turn Logging On” button is pressed (even if measuring has not started yet).

5.4.2 Log Folder

The Log Folder group box allows the user to specify a folder location to write the data logging files. A folder path may be typed into the text box or the Browse button may be used to graphically navigate to a folder using a Browse For Folder dialog window. The Browse For Folder dialog window will fill the text box with the proper folder path.

5.5 Tabs

The Guardian Application has two main tabs: Status and Auto-Tuning. The features available in these tabs are explained in the following sections.

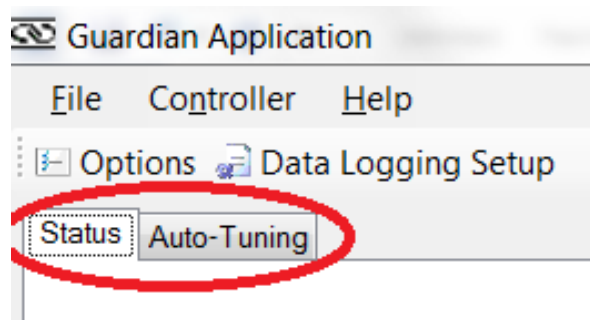


Figure 30 The application tabs

5.6 Status Tab

The Application Starts with the “Status” Tab.

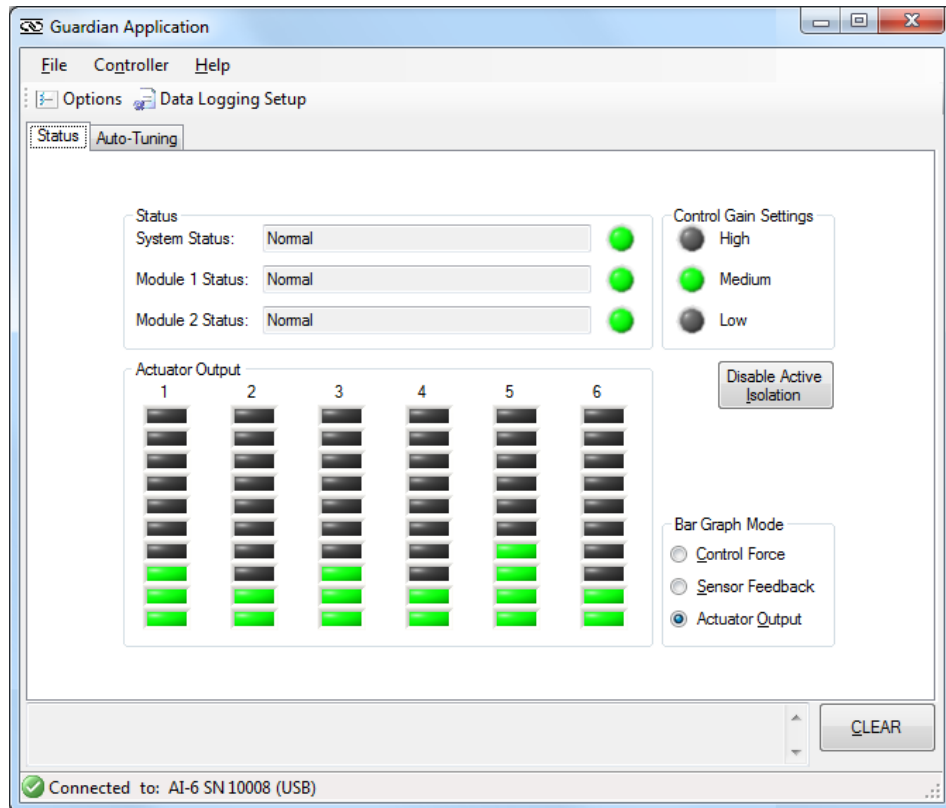


Figure 31 Status Tab, Actuator Output Mode

This tab provides the basic current status of the controller.

The System, Module 1 and Module 2 status LEDs, Control Gain settings and Control bar graphs shown here match the corresponding values on the controller’s front-panel within 0.5 second latency (typical). A text message with a brief description of the status is provided alongside the LEDs.

If the controller generates any errors, they are displayed in the message text box at the bottom of the screen. Note that the software appends a timestamp to the message at the time it is received from the controller. Click on the “Clear” button to delete all messages.

At the bottom of the screen, the Connection status shows that the application is connected to the controller with the corresponding serial number.

If a module is not connected the channel status bar will read: “Module Not Configured”.

5.6.1 Auto-Tuning Tab

This tab provides access to initiating the auto-tuning process remotely, as well as to observe the controller performance.

Control Gain Setting and Auto-Tune Button. Adjust the control gain setting to a desired level (low, medium or high) if necessary and click the “Auto-Tune” button. Clicking the “Auto-Tune” button here is similar to pushing “Auto-Tune” button on the controller’s front-panel.

Enable Active Isolation Button. Clicking the “Enable Active Isolation” or “Disable Active Isolation” button will enable or disable active isolation. If active isolation is enabled, the “Disable Active Isolation” button is visible, and vice-versa.

Measure Passive Button. Click the “Measure Passive” button to record vibration level with active isolation disabled. The software will disable active isolation on all channels and measure vibration levels. Active Isolation LED and Module Status LEDs on front-panel of the controller are turned OFF. The data collected will be averaged over several time frames; the number of averages can be set in the Options window (Section 5.3.2). Active Isolation can be enabled at the end of data acquisition by clicking on the “Enable Active Isolation” button.

Measure Active Button. Click the “Measure Active” button to record vibration level with active isolation enabled (see Figure 33). The software will enable active isolation on all channels and measure vibration levels. Active Isolation LED and Module Status LEDs on front-panel of the controller are turned ON. The data collected will be averaged over several time frames; the number of averages can be set in the Options window (Section 5.3). Active Isolation can be disabled at the end of data acquisition by clicking on the “Disable Active Isolation” button.

Save Graphs Button. Click on “Save Graphs...” button to save the measured data in both HTML and text formats. When the “Save Graphs...” button is clicked the user is presented with a dialog to specify or browse to a folder path. This folder path is used to store three files which are generated at this time (a HTML file, a Time Response text file, and a FFT text file). The HTML file name is the same as the folder name, but with the “.html” extension. The HTML file contains some textual headings and two images (a Time Response graph and FFT graph) on each channel that is configured. The Time Response text file name is the folder name followed by “ – Time” and the FFT text file is the folder name followed by “ – Freq”. Both of these text files use the “.txt” extension. The format of these two files is tab delimited text, with seven columns, where the first row is the heading of each column. The first column contains the value of the X axis (time in seconds or frequency in Hz), and the next six columns are the passive and active Y axis data values for channels 1 – 3.

FFT or Time Response. Both passive and active vibration levels can be displayed in either frequency domain or time domain. Select either FFT or Time Response from the pull-down menu for the desired view (Figure 32). The FFT resolution is 0.12 Hz and sampling rate fixed at 0.5 kHz..

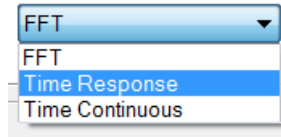


Figure 32 Plot type combo box

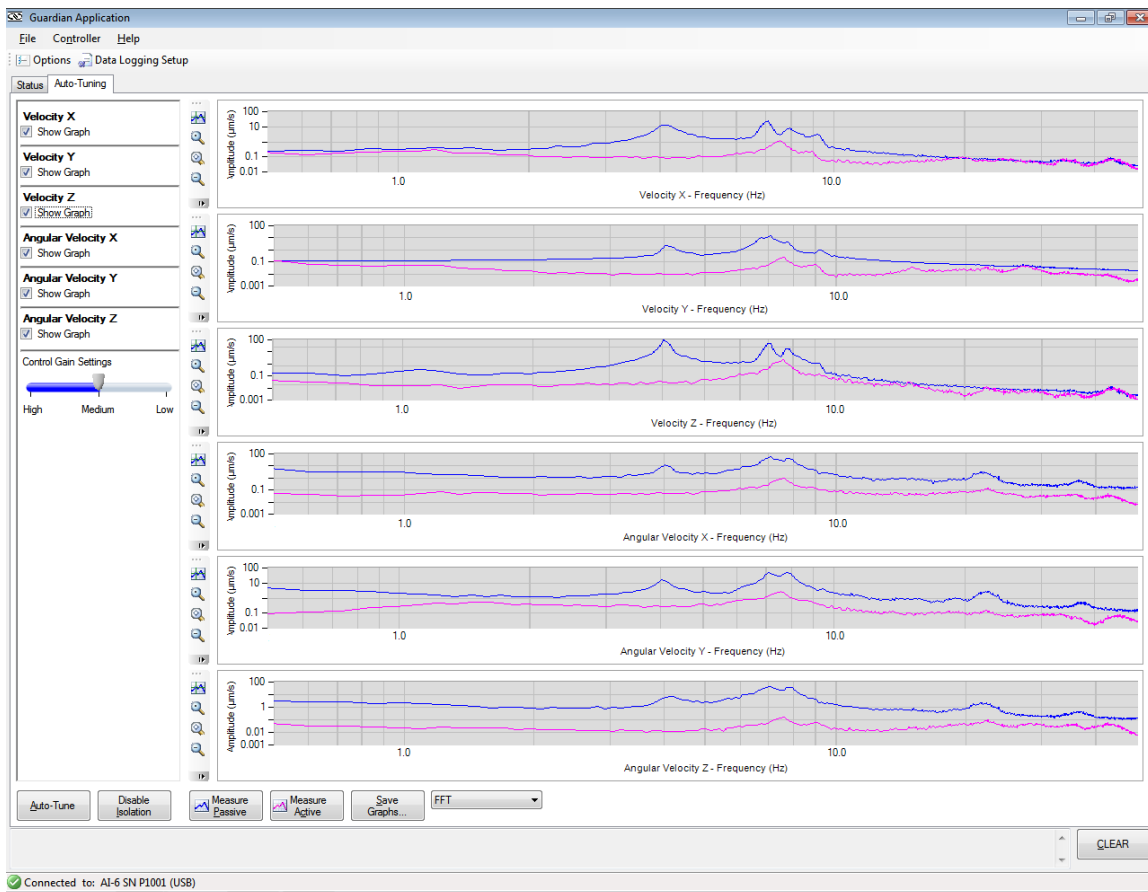


Figure 33 Auto-Tuning Screen with FFT Mode and 6 Degrees of Freedom selected

In FFT mode the application can average the measurements. The number of averages is set in the “Options” screen (Section 5.3.2).

In either mode, the user can check the “Show Graph” box to display up to six channels (see Figure 34 and **Error! Reference source not found.**).

In FFT or Time Response mode, when clicking the “Measure Passive” button, the graphs show a blue waveform corresponding to the passive data sampled by the controller. When clicking the “Measure Active” button, the graphs show a magenta waveform superimposed over the passive waveform. This is useful for checking the performance of the system.

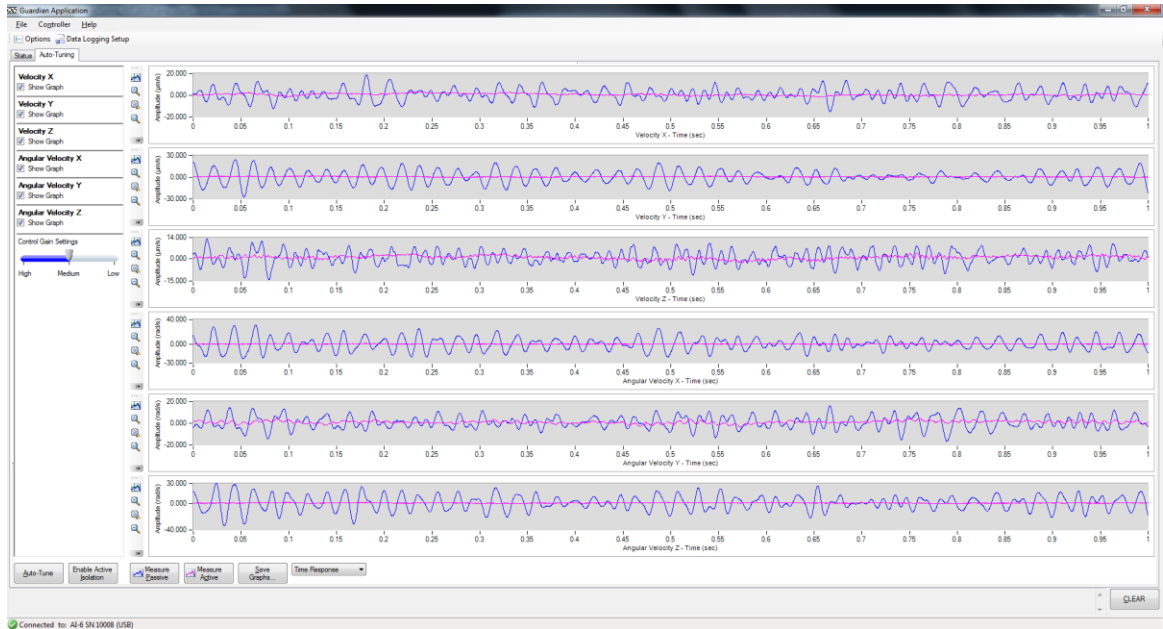


Figure 34 Auto-Tuning Screen with Time Response and 6 Degrees of Freedom selected

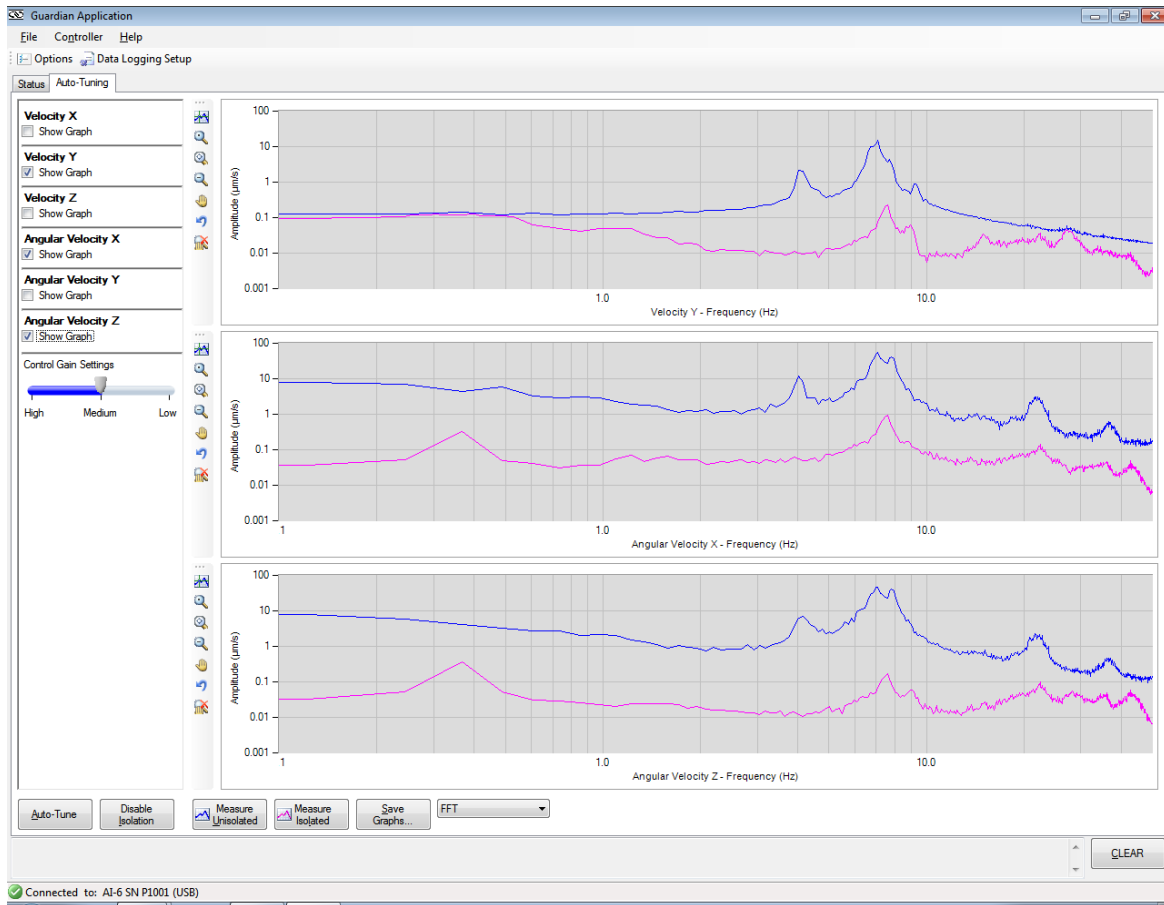


Figure 35 Auto-Tuning Screen with FFT Mode and 3 Degrees of Freedom selected

Time Continuous. Both passive and active vibration level data can be displayed in Time Continuous mode, similar to an oscilloscope. Enable the “Show Graph” box for showing either channel graph. Depending on your computer speed and number of tasks running in the background, choose Time Continuous Measurement Rate in the Options window (Section 5.3.2). The highest rate is 1.0 kHz and the lowest is 0.5 kHz.

In Time Continuous mode, the controller takes 5,000 samples per channel and displays them on the corresponding graph. Each measurement acquisition time depends on the measurement rate set in Options. For example, if the measurement rate is set on 1 kHz, the controller will collect 5,000 samples (per channel) in 5 seconds. Every 5 seconds, a new set of 5,000 points is displayed until the user clicks the Stop button.

The table below shows the acquisition time for each measurement rate.

Time Continuous Measurement Rate	Acquisition time
1 kHz	5 sec
0.5 kHz	10 sec

Table 6 Acquisition time for each measurement rate

Use the “Stop” button to end the continuous measurement.

During continuous measurement, the application continuously adjusts the Y-axis for each graph. If this adjustment is not desired, click the “Fixed Range” button. The Fixed Range button will change to “Auto Range” and the graphs will show a default Y-axis scale. The user can return to auto range by clicking the Auto Range button.

In Time Continuous mode the graphs show either active or passive vibration data or both. To measure vibration data with active isolation, click on “Measure Active” button. The graph will display continuous magenta waveforms as in Figure 36. These waveforms can be superimposed on passive waveforms if passive measurements were taken prior to active measurements.

NOTE

USB communication errors may occur due to (a) slow computer or (b) USB traffic from other devices on the same port (e.g., USB hub with and other peripherals). In this scenario, lowering the Time Continuous Measurement Rate to 0.5 kHz (default, see Options window) may alleviate the problem. Otherwise try a faster computer with a dedicated USB port.

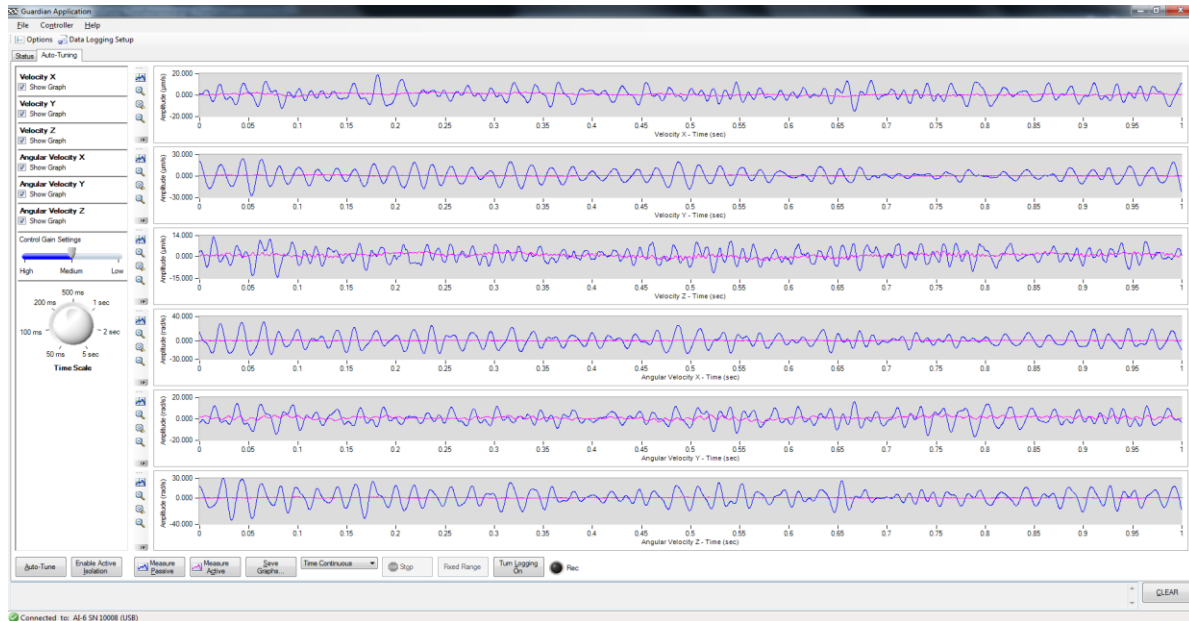


Figure 36 Time Continuous with Active and Passive Isolation measurements

Graph Buttons. Use the buttons on the left side of each graph (Figure 37) to study the displayed data.

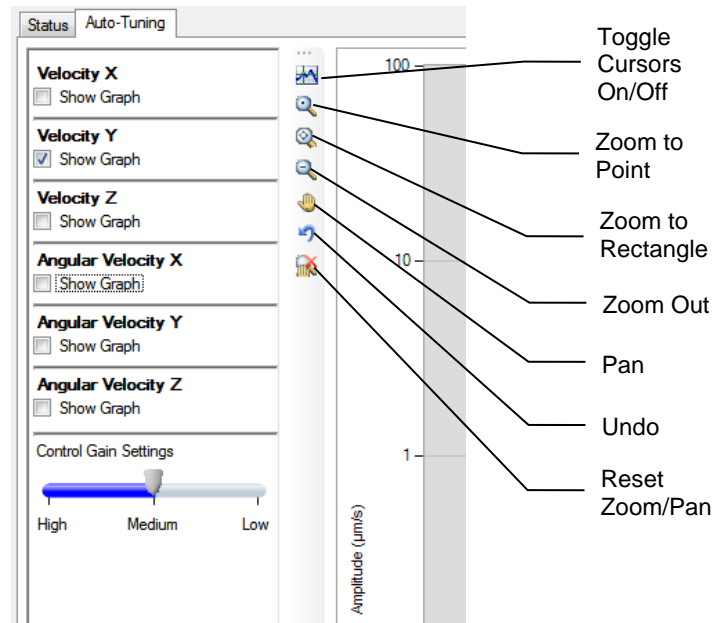


Figure 37 Graph Buttons

- Enable Cursors. Use this feature to bring up two cursors on either graph. The cursors can be “grabbed” with the mouse and moved on the X or Y-axis. The cursor position is displayed on the graph in an x,y format.
- Zoom to Point. Click anywhere on the graph to zoom around that position.
- Zoom to Rectangle. Draw a rectangle on the graph. The graph will be expanded at the rectangle size.
- Zoom Out. Zoom out by clicking on the graph.
- Pan. The mouse pointer changes to a palm. Use it to “grab” the graph and move it.
- Undo. This button undoes the last operation.
- Reset Zoom/Pan. This button resets the graph back to its original form.

Time Scale Knob. The time scale knob (Figure 38) allows you to change the X-axis of all the graphs the same as you would with an oscilloscope. The unit takes 5000 samples from all three channels and sends them to the PC. If the Time Continuous Measurement Rate is 1 kHz set in Options (see Section 5.3.2), the total acquisition time is 5 seconds. If the knob is set to maximum (fully clockwise, Figure 38), the graphs will display all 5000 samples. Rotating the knob counter-clockwise will set the graphs’ maximum time to the knob setting.

If the Time Continuous Measurement Rate is set to 0.5 kHz, the system will read 5000 samples every 10 seconds. The maximum setting of the Time Scale Knob is 5 seconds.

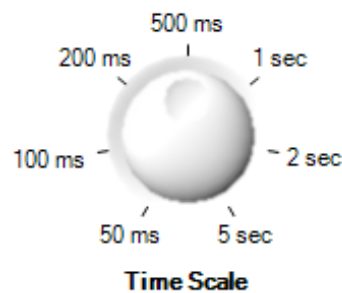


Figure 38 Time Scale Knob

Control Gain Settings Slider. The control gains can be adjusted with the slider in the Auto-Tuning window (see Figure 39).

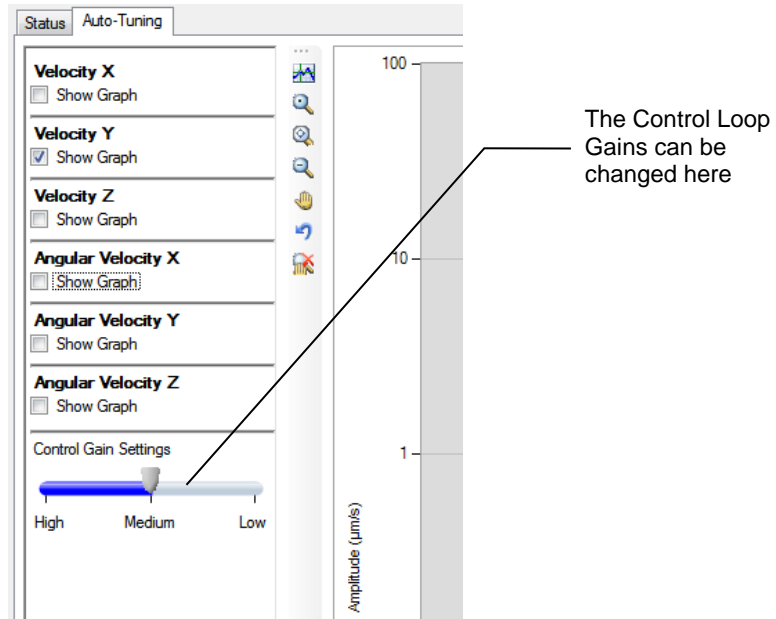


Figure 39 Control Gain Settings

6 Maintenance and Service



CAUTION

There are no user serviceable parts inside the Guardian Workstation. Work performed by persons not authorized by Newport Corporation will void the warranty.

6.1 Enclosure Cleaning



WARNING

Before cleaning the enclosure of the AI-6 Guardian Controller, the Power Supply Unit's AC power cord must be disconnected from the wall socket.

The source enclosure should only be cleaned with a mild soapy water solution applied to a damp lint-free cloth. Do not use an acetone or alcohol solution; this will damage the finish of the enclosure.

6.2 Obtaining Service

The AI-6 Guardian Controller, Power Supply Unit and the modules contain no user serviceable parts. To obtain information regarding factory service, contact Newport Corporation or your Newport representative. Please have the following information available:

1. Instrument model number (on the rear panel)
2. Instrument serial number (on rear panel)
3. Description of the problem.

If the instrument is to be returned to Newport Corporation, you will be given a Return Number, which you should reference in your shipping documents. Please fill out a copy of the service form, located on the following page, and have the information ready when contacting Newport Corporation. Return the completed service form with the instrument.

6.3 Service Form



Newport[®]
Experience | Solutions

Newport Corporation
U.S.A. Office: 800-222-6440
FAX: 949/253-1479

Name _____ **Return Authorization #** _____
(Please obtain RA # prior to return of item)

Company _____
(Please obtain RA # prior to return of item)

Address _____ Date _____

Country _____ Phone Number _____

P.O. Number _____ FAX Number _____

Item(s) Being Returned:

Model # _____ Serial # _____

Description _____

Reason for return of goods (please list any specific problems):

7 Repackaging for Shipment

7.1 Steps for Workstation Repackaging

1. Mount the restraining brackets (Figure 18).
2. Place packaging/protective material on the breadboard and around the workstation legs.
3. Unlock the feet by rotating the locking nut counter-clockwise (Figure 17).
4. Lift the feet by rotating them clockwise, until the wheels touch the floor and the workstation can roll freely.
5. Position the ramp that was supplied with the system, such that it forms an inclined plane between the floor and the box (Figure 15).
6. Roll the workstation up the ramp until it is in the box and secure it in place.
7. Lower the feet so the caster wheels don't touch the floor and roll around.
8. Position the ramp on top of the breadboard.
9. Add fillers so that the workstation is secure during transport.
10. Strap the system to the wood pallet.
11. Close the box.

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