



## GNL18-Z8 - April 30, 2024

Item # GNL18-Z8 was discontinued on April 30, 2024. For informational purposes, this is a copy of the website content at that time and is valid only for the stated product.

### 1- AND 2-AXIS MOTORIZED GONIOMETER STAGES



OVERVIEW

Features

- Pure Rotational Motion About a Virtual Point
- 1° Graduation Marks on Side
- Backlash-Free Spring-Loaded Design
- Fully Lockable
- Single Axis and XY Configurations
- DC Motorized with Z812B\* Actuator
- Manual Goniometer Stages Also Available

Item #	GNL10-Z8/(M)	GNL18-Z8/(M)	GNL20-Z8/(M)
Distance to Point of Rotation	1.00" (25.4 mm)	1.75" (44.5 mm)	1.00" (25.4 mm)
Rotation	±8°	±5°	±5° / ±8°
Accuracy	10 arcmin (0.167°)	10 arcmin (0.167°)	10 arcmin (0.167°)
Load Capacity	0.50 lbs (0.227 kg)	0.50 lbs (0.227 kg)	0.50 lbs (0.227 kg)
Goniometer Dimensions (W x D x H)	1.50" x 1.50" x 0.75" (38.1 mm x 38.1 mm x 19.1 mm)		1.50" x 1.50" x 1.50" (38.1 mm x 38.1 mm x 38.1 mm)
Base Plate Dimensions (W x D x H)	Imperial Goniometers: 1.50" x 2.50" x 0.20" Metric Goniometers: 38.1 mm x 62.7 mm x 5.1 mm		
Body Material	Anodized Aluminum		

A goniometer or goniometric stage is a device used to rotate an object precisely, within a small angular range, about a fixed point in space. Goniometers are similar to linear stages, but, rather than providing linear movement, the stage partially rotates about a fixed point above the mounting surface of the stage. In our two product lines, the distance from the point of rotation to the mounting surface was designed so that two different goniometer models may be stacked in an XY configuration and both stages will rotate about the same point. Our motorized goniometers use our Z812B\* DC Servo Actuator for enhanced, automated, angular positioning of the top plate.

Our goniometers offer unobstructed, pure rotational motion about their point of rotation over the angle of rotation (see image to the right). The compact, stackable design allows one model to be fastened to the top plate of another aligning their points of rotation. In the GNL series, the GNL10/(M) mounts atop the GNL18/(M). These two axis stage setups can be purchased as a single package [Item # GNL20/(M)] at a cost savings.

The precision dovetail design, accompanied by a backlash-free lead screw and a vernier scale, provides accurate and repeatable positioning. A side mounted setscrew can be used to lock the platform in position.

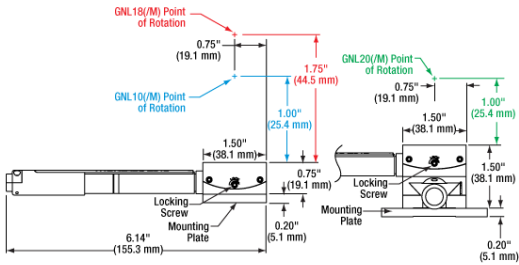
The GNL series goniometers provide an array of twelve 4-40 (M2.5) and sixteen 6-32 (M4) taps for mounting. See below for mounting hole positions.

The KDC101 DC Servo Controller is the ideal driver for the Z8 and Z9 series actuators. The unit is fully compatible with our new Kinesis® software package and our legacy APT™ Control Software, both of which can be downloaded here. Please see the *Motion Control Software* tab for more information.

The Z812B\* DC servo motors shipped with these stages are provided with 1.6' (0.5 m) of cable. An 8' (2.5 m) extension cable, PAA632, is also available.

\*This previous generation actuator is no longer available for individual sale. If a replacement is required, the Z912B actuator can be used.

Click for Details Mounting



Click to Enlarge  
Goniometer Dimensions

Options

SPECS

Goniometer Specifications

Item #	GNL10(M)	GNL18(M)	GNL20(M)
Distance to Point of Rotation	1.00" (25.4 mm)	1.75" (44.5 mm)	1.00" (25.4 mm)
Rotation	±8°	±5°	±5° / ±8°
Accuracy	10 arcmin (0.167°)		
Load Capacity	0.50 lbs (0.227 kg)		
Goniometer Dimensions (W x D x H)	1.50" x 1.50" x 0.75" (38.1 mm x 38.1 mm x 19.1 mm)		1.50" x 1.50" x 1.50" (38.1 mm x 38.1 mm x 38.1 mm)
Base Plate Dimensions (W x D x H)	Imperial Goniometers: 1.50" x 2.50" x 0.20"		
	Metric Goniometers: 38.1 mm x 62.7 mm x 5.1 mm		
Body Material	Anodized Aluminum		

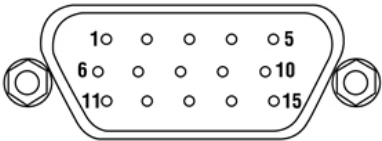
Actuator Specifications

Item #	Z812B <sup>a</sup>
Travel	12 mm (0.47")
Motor Type	DC Servo
Motor Drive Voltage	12 V
Max Recommended Current	80 mA
Lead Screw Pitch	1.0 mm
Calculated Resolution	29 nm <sup>b</sup>
Repeatability	<8 μm
Backlash (with Preload)	<8 μm
Feedback	Hall Effect Encoder
Encoder Counts per Rev. of the Lead Screw	34,555
Planetary Gearhead Ratio	67.49:1
Limit Switches	Electromechanical
Speed Range	0.050 to 2.6 mm/s
Operating Temperature	41 - 104 °F (5 - 40 °C)
Cable Length	1.6' (0.5 m)
Compatible Controller	KDC101

- a. This previous generation actuator is no longer available for individual sale. If a replacement is required, the Z912B actuator can be used.
- b. At 2.6 mm/sec, velocity ripple and distortion of the acceleration/deceleration profile may occur. For improved control, the max velocity should be limited to 2.3 mm/sec.

PIN DIAGRAMS

Z812B\* DC Servo Motor Output  
D-type Male



Pin	Description	Pin	Description
1	Ground	9	Ident Resistor
2	Forward Limit Switch	10	5 V Encoder Supply

3	Reverse Limit Switch	11	Encoder Channel A
4	Not Connected	12	Not Connected
5	Motor -	13	Encoder Channel B
6	Not Connected	14	Not Connected
7	Motor +	15	Not Connected
8	Not Connected		

\*This previous generation actuator is no longer available for individual sale. If a replacement is required, the Z912B actuator can be used.

SMART PACK

Smart Pack

- Reduce Weight of Packaging Materials
- Increase Usage of Recyclable Packing Materials
- Improve Packing Integrity
- Decrease Shipping Costs



Click to Enlarge  
GNL10-Z8  
Packaging

Thorlabs' Smart Pack Initiative is aimed at waste minimization while still maintaining adequate protection for our products. By eliminating any unnecessary packaging, implementing packaging design changes, and utilizing eco-friendly packaging materials for our customers when possible, this initiative seeks to improve the environmental impact of our product packaging. Products listed above are now shipped in re-engineered packaging that minimizes the weight and the use of non-recyclable materials.<sup>b</sup> As we move through our product line, we will indicate re-engineered packages with our Smart Pack logo.

Item #	% Weight Reduction	CO <sub>2</sub> -Equivalent Reduction <sup>a</sup>
GNL10-Z8	7.92%	0.05 kg
GNL10/M-Z8	7.92%	0.09 kg
GNL18-Z8	29.80%	0.17 kg
GNL18/M-Z8	7.92%	0.12 kg

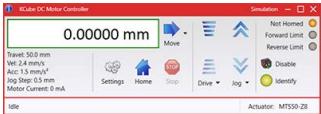
- Travel-based emissions reduction calculations are estimated based on the total weight reduction of packaging materials used for all of 2013's product sales, traveling 1,000 miles on an airplane, to provide general understanding of the impact of packaging material reduction. Calculations were made using the EPA's shipping emissions values for different modes of transport.
- Some Smart Pack products may show a negative weight reduction percentage as the substitution of greener packaging materials, such as the Greenwrap, at times slightly increases the weight of the product packaging.

MOTION CONTROL SOFTWARE

Thorlabs offers two platforms to drive our wide range of motion controllers: our Kinesis<sup>®</sup> software package or the legacy APT<sup>™</sup> (Advanced Positioning Technology) software package. Either package can be used to control devices in the Kinesis family, which covers a wide range of motion controllers ranging from small, low-powered, single-channel drivers (such as the K-Cubes<sup>™</sup> and T-Cubes<sup>™</sup>) to high-power, multi-channel, modular 19" rack nanopositioning systems (the APT Rack System).

The Kinesis Software features .NET controls which can be used by 3rd party developers working in the latest C#, Visual Basic, LabVIEW<sup>™</sup>, or any .NET compatible languages to create custom applications. Low-level DLL libraries are included for applications not expected to use the .NET framework. A Central Sequence Manager supports integration and synchronization of all Thorlabs motion control hardware.

Our legacy APT System Software platform offers ActiveX-based controls which can be used by 3rd party developers working on C#, Visual Basic, LabVIEW<sup>™</sup>, or any Active-X compatible languages to create custom applications and includes a simulator mode to assist in developing custom applications without requiring hardware.



Kinesis GUI Screen

By providing these common software platforms, Thorlabs has ensured that users can easily mix and match any of the Kinesis and APT controllers in a single application, while only having to learn a single set of software tools. In this way, it is perfectly feasible to combine any of the controllers from single-axis to multi-axis systems and control all from a single, PC-based unified software interface.



APT GUI Screen

The software packages allow two methods of usage: graphical user interface (GUI) utilities for direct interaction with and control of the controllers 'out of the box', and a set of programming interfaces that allow custom-integrated positioning and alignment solutions to be easily programmed in the development language of choice.

A range of video tutorials is available to help explain our APT system software. These tutorials provide an overview of the software and the APT Config utility. Additionally, a tutorial video is available to explain how to select simulator mode within the software, which allows the user to experiment with the software without a controller connected. Please select the *APT Tutorials* tab above to view these videos.

Software

Kinesis Version 1.14.44

The Kinesis Software Package, which includes a GUI for control of Thorlabs' Kinesis and APT<sup>™</sup> system controllers.

Also Available:

Software

APT Version 3.21.6

The APT Software Package, which includes a GUI for control of Thorlabs' APT<sup>™</sup> and Kinesis system controllers.

Also Available:



## APT TUTORIALS

The APT video tutorials available here fall into two main groups - one group covers using the supplied APT utilities and the second group covers programming the APT System using a selection of different programming environments.

**Disclaimer:** The videos below were originally produced in Adobe Flash. Following the discontinuation of Flash after 2020, these tutorials were re-recorded for future use. The Flash Player controls still appear in the bottom of each video, but they are not functional.

Every APT controller is supplied with the utilities APTUser and APTConfig. APTUser provides a quick and easy way of interacting with the APT control hardware using intuitive graphical control panels. APTConfig is an 'off-line' utility that allows various system wide settings to be made such as pre-selecting mechanical stage types and associating them with specific motion controllers.

### APT User Utility

The first video below gives an overview of using the APTUser Utility. The OptoDriver single channel controller products can be operated via their front panel controls in the absence of a control PC. The stored settings relating to the operation of these front panel controls can be changed using the APTUser utility. The second video illustrates this process.

[APT User - Overview](#)   [APT User - OptoDriver Settings](#)

### APT Config Utility

There are various APT system-wide settings that can be made using the APT Config utility, including setting up a simulated hardware configuration and associating mechanical stages with specific motor drive channels. The first video presents a brief overview of the APT Config application. More details on creating a simulated hardware configuration and making stage associations are present in the next two videos.

[APT Config - Overview](#)   [APT Config - Simulator Setup](#)   [APT Config - Stage Association](#)

### APT Programming

The APT Software System is implemented as a collection of ActiveX Controls. ActiveX Controls are language-independant software modules that provide both a graphical user interface and a programming interface. There is an ActiveX Control type for each type of hardware unit, e.g. a Motor ActiveX Control covers operation with any type of APT motor controller (DC or stepper). Many Windows software development environments and languages directly support ActiveX Controls, and, once such a Control is embedded into a custom application, all of the functionality it contains is immediately available to the application for automated operation. The videos below illustrate the basics of using the APT ActiveX Controls with LabVIEW, Visual Basic, and Visual C++. Note that many other languages support ActiveX including LabWindows CVI, C++ Builder, VB.NET, C#.NET, Office VBA, Matlab, HPVVEE etc. Although these environments are not covered specifically by the tutorial videos, many of the ideas shown will still be relevant to using these other languages.

### Visual Basic

Part 1 illustrates how to get an APT ActiveX Control running within Visual Basic, and Part 2 goes on to show how to program a custom positioning sequence.

[APT Programming Using Visual Basic - Part 1](#)   [APT Programming Using Visual Basic - Part 2](#)

### LabVIEW

Full Active support is provided by LabVIEW and the series of tutorial videos below illustrate the basic building blocks in creating a custom APT motion control sequence. We start by showing how to call up the Thorlabs-supplied online help during software development. Part 2 illustrates how to create an APT ActiveX Control. ActiveX Controls provide both Methods (i.e. Functions) and Properties (i.e. Value Settings). Parts 3 and 4 show how to create and wire up both the methods and properties exposed by an ActiveX Control. Finally, in Part 5, we pull everything together and show a completed LabVIEW example program that demonstrates a custom move sequence.

[APT Programming Using LabVIEW - Part 1: Accessing Online Help](#)   [APT Programming Using LabVIEW - Part 2: Creating an ActiveX Control](#)   [APT Programming Using LabVIEW - Part 3: Create an ActiveX Method](#)  
[APT Programming Using LabVIEW - Part 4: Create an ActiveX Property](#)   [APT Programming Using LabVIEW - Part 5: How to Start an ActiveX Control](#)

The following tutorial videos illustrate alternative ways of creating Method and Property nodes:

[APT Programming Using LabVIEW - Create an ActiveX Method \(Alternative\)](#)   [APT Programming Using LabVIEW - Create an ActiveX Property \(Alternative\)](#)

### Visual C++

Part 1 illustrates how to get an APT ActiveX Control running within Visual C++, and Part 2 goes on to show how to program a custom positioning sequence.

[APT Programming with Visual C++ - Part 1](#)   [APT Programming with Visual C++ - Part 2](#)

### MATLAB

For assistance when using MATLAB and ActiveX controls with the Thorlabs APT positioners, click [here](#).

To further assist programmers, a guide to programming the APT software in LabVIEW is also [available here](#).

Part Number	Description	Price	Availability
GNL10/M-Z8	Large Motorized Goniometer, 25.4 mm Distance to Point of Rotation, ±8°, Metric	\$941.98	Lead Time
GNL18/M-Z8	Large Motorized Goniometer, 44.5 mm Distance to Point of Rotation, ±5°, Metric	\$951.11	Today
GNL20/M-Z8	Large Motorized Dual-Axis Goniometer, 25.4 mm Distance to Point of Rotation, Metric	\$1,891.95	Lead Time
GNL10-Z8	Large Motorized Goniometer, 1" Distance to Point of Rotation, ±8°	\$941.98	Today
GNL18-Z8	Large Motorized Goniometer, 1.75" Distance to Point of Rotation, ±5°	\$951.11	Today
GNL20-Z8	Large Motorized Dual-Axis Goniometer, 1" Distance to Point of Rotation	\$1,891.95	Lead Time

K-Cube™ DC Servo Motor Controller



- ▶ Front Panel Velocity Wheel and Digital Display for Controlling Motorized Stages or Actuators
- ▶ Two Bidirectional Trigger Ports to Read or Control External Equipment
- ▶ Interfaces with Computer Using Included USB Cable
- ▶ Fully Compatible with Kinesis® or APT™ Software Packages
- ▶ Compact Footprint: 60.0 mm x 60.0 mm x 49.2 mm (2.42" x 2.42" x 1.94")
- ▶ Power Supply Not Included (See Below)



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KCH601 USB Controller Hub (Sold Separately)  
with Installed K-Cube and T-Cube™ Modules  
(T-Cubes Require the KAP101 Adapter)

Thorlabs' KDC101 K-Cube Brushed DC Motor Controller provides local and computerized control of a single motor axis. It features a top-mounted control panel with a velocity wheel that supports four-speed bidirectional control with forward and reverse jogging as well as position presets. A backlit digital display is also included that can have the backlit dimmed or turned off using the top-panel menu options. The front of the unit contains two bidirectional trigger ports that can be used to read a 5 V external logic signal or output a 5 V logic signal to control external equipment. Each port can be independently configured.

The unit is fully compatible with our new Kinesis software package and our legacy APT control software. Please see the *Motion Control Software* tab for more information.

Please note that this controller does not ship with a power supply. Compatible power supplies are listed below. Additional information can be found on the main KDC101 DC Servo Motor Controller page.

Part Number	Description	Price	Availability
KDC101	K-Cube Brushed DC Servo Motor Controller (Power Supply Not Included)	\$757.51	Today

Compatible Power Supplies



- ▶ Individual Power Supply
  - ▶ KPS201: For K-Cubes™ or T-Cubes™ with 3.5 mm Jacks
- ▶ USB Controller Hubs Provide Power and Communications
  - ▶ KCH301: For up to Three K-Cubes or T-Cubes
  - ▶ KCH601: For up to Six K-Cubes or T-Cubes



Click to Enlarge  
The KPS201 Power Supply Unit



Click for Details  
Each KPS201 power supply includes one region-specific adapter, which can be selected upon checkout.

The KPS201 power supply outputs +15 VDC at up to 2.66 A and can power a single K-Cube or T-Cube with a 3.5 mm jack. It plugs into a standard wall outlet.

The KCH301 and KCH601 USB Controller Hubs each consist of two parts: the hub, which can support up to three (KCH301) or six (KCH601) K-Cubes or T-Cubes, and a power supply that plugs into a standard wall outlet. The hub draws a maximum current of 10 A; please verify that the cubes being used do not require a total current of more than 10 A. In addition, the hub provides USB connectivity to any docked K-Cube or T-Cube through a single USB connection.

For more information on the USB Controller Hubs, see the full web presentation.

Part Number	Description	Price	Availability
KPS201	15 V, 2.66 A Power Supply Unit with 3.5 mm Jack Connector for One K- or T-Cube	\$39.54	Today
KCH301	USB Controller Hub and Power Supply for Three K-Cubes or T-Cubes	\$586.89	Today
KCH601	USB Controller Hub and Power Supply for Six K-Cubes or T-Cubes	\$710.31	Today