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THORLABS

TPA101 - October 27, 2016
Item # TPA101 was discontinued on October 27, 2016. For informational purposes, this is a copy of the website content at that time and is valid only for the stated product.

T-CUBE POSITION SENSING DETECTOR (PSD) CONTROLLER

► **Auto Alignment in Closed-Loop Mode**
► **Position Measurement in Open-Loop Mode**
► **USB Plug-and-Play with Full Software Control Suite**

Detectors Available Separately

2D Lateral
Effect PSD

Segmented
Quadrant PSD

TPA101
Power Supply
Sold Separately

PDP90A

PDQ80A

Hide Overview

O V E R V I E W

Features

- Auto Alignment of Beam to Center of Sensor when in Closed-Loop Mode
- Beam Position Measurement when in Open-Loop Mode
- LED Crosshair Position Display
- USB and Manual Control Interfaces
- Voltage Outputs for Sum, Difference, and Feedback Signals
- Flexible Software Suite (See *Motion Control Software* Tab)
- Compact T-Cube Footprint: 60 mm x 60 mm x 47 mm (2.4" x 2.4" x 1.8")

The TPA101 T-Cube Beam Position Aligner interfaces with our range of Quadrant and Lateral Effect Sensor Heads (see the *Typical Application* tab above for more information) and can be used either to measure the position of the beam on the sensor (in Open-Loop mode) or to generate a signal that can be used as the feedback input for an automated beam steering element (in Closed-Loop mode).

When operating in Closed-Loop mode, the proportional, integral, and differential (PID) constants can be adjusted to fine tune the response of the feedback loop to changes in the target position. The TPA101 uses floating-point arithmetic that allows a greater range of PID coefficients to be used in the control loop, resulting in higher precision and lower noise (see Appendix B of the manual for details). This increases the range of actuators that can be stabilized using the controller. Furthermore, the unit incorporates a notch filter that can be used to counteract the

Item #	TPA101
X & Y Difference / Position Demand Outputs	-10 to 10 V, SMA Connectors
Sum Output	0 to 10 V, SMA Connector
Quadrant Detector Input	6-Pin HRS Connector[a]
Closed-Loop Bandwidth	Up to 1 kHz[b]
Open-Loop Bandwidth (-3.0 dB)	100 kHz
Dimensions (W x D x H)	60 mm x 60 mm x 47 mm (2.4" x 2.4" x 1.8")
Weight	160 g (5.5 oz)

- See *Pin Diagrams* tab for details.
- When driving KPZ101 Piezo Controllers at 10% FSD (Full Scale Deflection), the bandwidth is 200 Hz.

Click to Enlarge
Top View of the TPA101 T-Cube

Click to Enlarge
Back View of the TPA101 T-Cube (See the *Pin Diagrams* Tab for More Information)

natural resonance of the specific mechanical system in which the unit is being used, and can stabilize actuators that are prone to mechanical resonances, such as piezo mirror gimbal mounts.

The output signal generated can be used to steer the center of the beam's power density to the center of the sensor head. When combined with the KPZ101 K-Cube Piezo Drivers, this unit is ideal for such closed-loop beam-steering applications. Please contact Tech Support for details on how the TPA101 can be used with sensors from other manufacturers.

Like all members of the T-Cube family, the footprint has been kept to a minimum [60 mm x 60 mm x 47 mm (2.4" x 2.4" x 1.8")], and the unit can be mounted directly to the optical table next to the detector and steering elements under control, thereby minimizing drive cable lengths while providing a convenient location to control the experiment manually via the top panel controls. The base plate in the T-Cube contains a 1/4" (M6) clearance slot.

Operation
The TPA101 T-Cube can be controlled by the manual interface on the top of the unit or via a USB connection to a computer running the included APT™ software (see *Motion Control Software* tab) or ActiveX command modules. Both interfaces allow the TPA101 to be operated in either an open- or closed-loop mode. The open-loop mode is used to measure the position of the beam on the detector. When in this mode, the T-Cube generates a left-minus-right X difference signal, a bottom-minus-top Y difference signal, and a sum signal.

In the closed-loop mode, a DSP processor inside the TPA101 runs two independent feedback loops that generate X and Y position demand outputs for use as the input to the beam steering element being used to center the beam on the detector. The beam position information (open-loop mode) or feedback signals (closed-loop mode) are available via SMA connectors on the side of the unit. When the unit is controlled via the USB interface, the open-loop output of the unit is also exported digitally to the computer. Please note that stable closed-loop operation can only be achieved with continuous wave (CW) lasers. The TPA101 T-Cube is not recommended for use with pulsed lasers.

Power Supply Options
The TPA101 T-Cube, which does not ship with a power supply, can be powered using a TPS002 power supply. The TPS002 power supply plugs into a standard wall outlet and provides +15 VDC, -15 VDC, and +5 VDC for up to two T-Cubes. The TPA101 is also compatible with the KCH301 and KCH601 USB Controller Hubs. A KAP101 Adapter Plate is required to use the TPA101 with a USB Controller Hub.

Compact Motion Control Modules
K-Cube Controllers[a]
Brushed DC Servo Motor Controller
Brushless DC Servo Motor Controller
Stepper Motor Controller
Single-Channel Piezo Controller
Solenoid Controller
T-Cube Controllers[a]
Single-Channel Strain Gauge Reader[b]
Dual-Channel NanoTrak Auto-Aligner[b]
Quadrant Detector[b]

- K-Cube and T-Cube modules are fully compatible with one another.

Detectors and Sensors		
T-Cube Beam Position Aligner	Lateral Effect Position Sensor	Quadrant Position Detectors

[Hide Pin Diagrams](#)

PIN DIAGRAMS

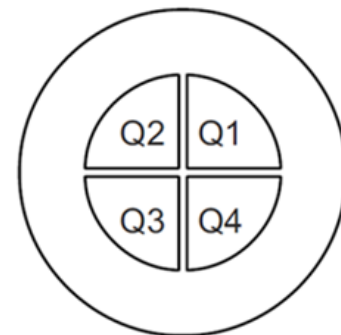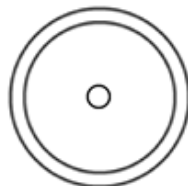## Detector In - HIROSE HR10A-7R-6S
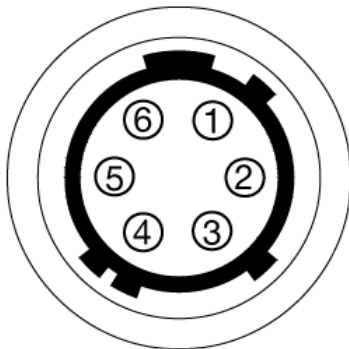
Detector In - Pin Assignments

Pin	Description
1	X-Axis [Q2 + Q3] - [Q1 + Q4] (-10 to +10 V)
2	Y-Axis [Q1 + Q2] - [Q3 + Q4] (-10 to +10 V)
3	SUM [Q1 + Q2 + Q3 + Q4] (0 to +10 V)
4	+V (+15 V, 15 mA Max)
5	Common
6	-V (-15 V, 15 mA Max)

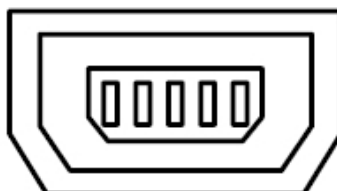## Photodiode Detail

SUM, LV OUT XDIFF, and LV OUT YDIFF

SMA Female

3 connectors output signals proportional to the total amount of light hitting the detector (SUM), left-minus-right (LV OUT XDIFF), & top-minus-bottom (LV OUT YDIFF) for X- and Y-axis alignment.
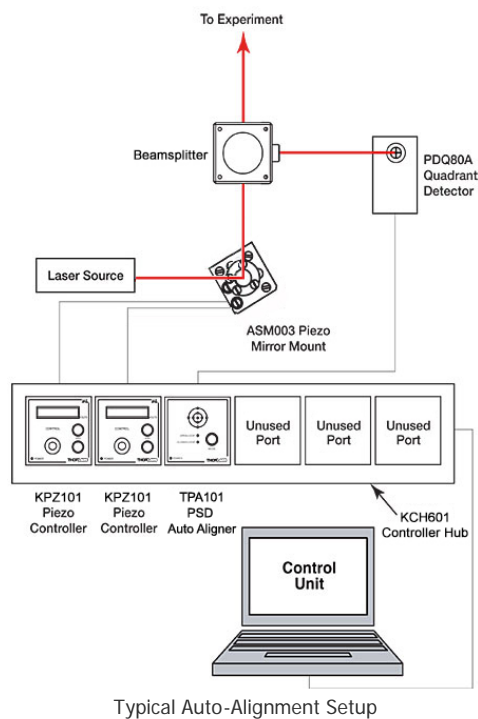
Computer Connection

USB Mini-B*

* 2 m (6.6') USB type Mini-B to type A cable included.

Hide Typical Application

T Y P I C A L   A P P L I C A T I O N

To Experiment

Beamsplitter

PDQ80A
Quadrant
Detector

Laser Source

ASM003 Piezo
Mirror Mount

KPZ101   KPZ101   TPA101   Unused   Unused   Unused
Piezo   Piezo   PSD   Port   Port   Port
Controller   Controller   Auto Aligner

KCH601
Controller Hub

Control
Unit

Typical Auto-Alignment Setup

A basic auto-alignment schematic is shown to the left. It consists of a PDQ80A Photodiode Sensor, a TPA101 Beam Position Aligner, two KPZ101 Piezo Drivers, ASM003 Piezo-Actuated 2-Axis Mirror Mount, a laser source, and a computer.

Together, the system is used to position and maintain the laser beam so that it is located at the center of the detector array with respect to the beam's power density.

It should be noted that when used with older versions of the former generation TPZ001 T-Cubes (i.e., Rev. 1; the revision number is displayed on the LED screen when the T-Cube is booted), the piezo cubes must be connected to the beam position aligner using two external SMA connectors even if a KCH301 or KCH601 Controller Hub or former generation TCH002 Controller Hub is being used. If KPZ101 K-Cubes or Rev. 2 TPZ001 T-Cubes are used with a controller hub, the SMA to SMA cables are not needed.

[Hide Motion Control Software](#)

MOTION CONTROL SOFTWARE

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

Our legacy APT System Software platform is available by clicking on the link below. It features ActiveX-based controls which can be used by 3rd party developers working on C#, Visual Basic, LabVIEW or any Active-X compatible languages to create custom applications, and includes a simulator mode to assist in developing custom applications without requiring hardware.

The Kinesis Software features new .NET controls which can be used by 3rd party developers working in the latest C#, Visual Basic, LabVIEW 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.

By providing these common software platforms, Thorlabs has ensured that users can easily mix and match any of the APT and Kinesis 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.
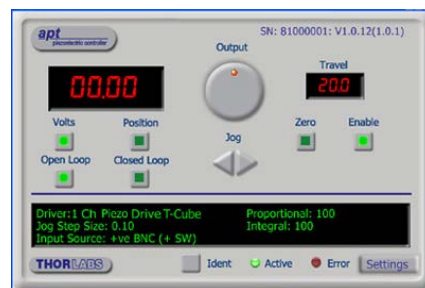
APT GUI Screen

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 are 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, which are also available on the software CD included with the controllers.

Software
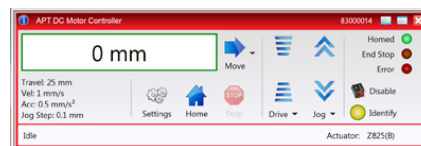
APT Version 3.16.0

The APT Software Package, which

Software

Kinesis Version 1.7.0

The Kinesis Software Package, which

Kinesis GUI Screen

includes a GUI for control of Thorlabs' APT™ and Kinesis® system controllers.

includes a GUI for control of Thorlabs' Kinesis and APT™ system controllers.

Also Available:

Also Available:

• Communications Protocol

• Communications Protocol

Hide APT Tutorials

APT TUTORIALS

These videos illustrate some of the basics of using the APT System Software from both a non-programming and a programming point of view. There are videos that illustrate usage of the supplied APT utilities that allow immediate control of the APT controllers out of the box. There are also a number of videos that explain the basics of programming custom software applications using Visual Basic, LabView and Visual C++. Watch the videos now to see what we mean.

 Click here to view the video tutorial

To further assist programmers, a guide to programming the APT software in LabView is also available.

 Click here to view the LabView guide

Hide T-Cube Position Sensing Detector (PSD) Controller

T-Cube Position Sensing Detector (PSD) Controller

Power supply sold separately below.

Part Number	Description	Price	Availability
TPA101	Customer Inspired!T-Cube PSD Auto Aligner (Power Supply Not Included)	$773.00	Today

Hide Compatible Power Supplies

Compatible Power Supplies

▶ ±15 V/5 V Power Supply
  ▶ TPS002: For up to Two K-Cubes or T-Cubes
▶ 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
  ▶ KAP101: Adapter Plate for Connecting 60 mm Wide T-Cubes to KCH Series Hubs
  ▶ KAP102: Adapter Plate for Connecting 120 mm Wide T-Cubes to KCH Series Hubs

Click to Enlarge

The TPS002 supplies power for up to two K-Cubes or T-Cubes. The cubes still need to be connected to a computer individually via a USB cable.

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.

A KAP101 or KAP102 Adapter Plate (sold separately) is required for each T-Cube to operate on the KCH301 or KCH601 controller hub. The KAP101 is designed to

adapt 60 mm wide T-Cubes to the hubs, while the KAP102 is designed to adapt 120 mm wide T-Cubes to the hubs.

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

Please note that our KPS101 Power Supply is not compatible with the controller on this page since it does not offer reversible polarity.

Part Number	Description	Price	Availability
TPS002	±15 V/5 V Power Supply Unit for up to Two K-Cube or T-Cubes	$105.00	Today
KCH301	USB Controller Hub and Power Supply for Three K-Cubes or T-Cubes	$475.00	Lead Time
KCH601	USB Controller Hub and Power Supply for Six K-Cubes or T-Cubes	$575.00	Today
KAP101	Adapter Plate for KCH Series Hubs and 60 mm Wide T-Cubes	$55.00	Today
KAP102	Adapter Plate for KCH Series Hubs and 120 mm Wide T-Cubes	$60.00	Today