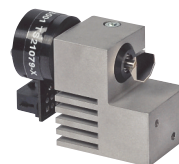


Galvanometer Mirror Systems

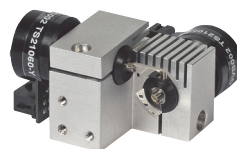
The GVS Series Scanning Galvanometer Mirror Systems are high-speed mirror positioning systems designed for integration into OEM or custom laser beam steering applications. Each system includes a single- or dual-axis galvo motor/mirror assembly, together with associated driver cards and heat sinks. A low noise, linear power supply (GPS011) and a motor/mirror assembly heatsink (GHS003) are available separately.

Motor/Mirror Assembly

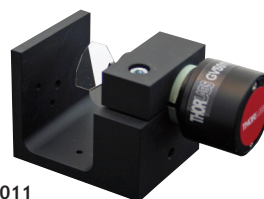
The galvo consists of a galvanometer-based scanning motor with an optical mirror mounted on the shaft and a detector that provides positional feedback to the control board. The moving magnet design for the GVS series of galvanometer motors was chosen over a stationary magnet and rotating coil design in order



GVS001
Single-Axis Galvo
for Small Beams



GVS002
Dual-Axis Galvo
for Small Beams



GVS011
Single-Axis Galvo
for Large Beams



GVS012
Dual-Axis Galvo
for Large Beams

Features

- 1D and 2D Systems for Small (5 mm) and Large (10 mm) Beam Diameters
- Moving Magnet Motor Design for Faster Response
- High-Precision Optical Mirror Position Detection
- Analog PD Control Electronics with Current Damping and Error Limiter
- Protected Silver Mirror Coating Provides >95% Reflectance in the 450 nm to 2 μ m Range

to provide the fastest response times and the highest system resonant frequency. The position of the mirror is encoded using an optical sensing system located inside of the motor housing.

Due to the large angular acceleration of the rotation shaft, the size, shape, and inertia of the mirrors become significant factors in the design of high-performance galvo systems. Furthermore, the mirror must remain rigid (flat) even when subjected to large accelerations. All these factors have been precisely balanced in our galvo systems in order to match the characteristics of the galvo motor and maximize system performance.

Specifications

GALVANOMETER MIRROR SYSTEM SPECIFICATIONS

Beam Diameter (Max)	GVS001/002: 5 mm GVS011/012: 10 mm
Wavelength Range	450 nm to 2 μ m
Damage Threshold	150 W/cm ²
Motor and Position Sensor Linearity	99.9%
Scale Drift (Max)	40 ppm/°C
Zero Drift (Max)	10 μ rad/°C
Repeatability	15 μ rad
Resolution (Typical)	0.0008° (15 μ rad)
Average Current	1 A
Peak Current	GVS001/002: 5 A GVS011/012: 10 A
Coil Resistance	2.2 Ω \pm 10%
Coil Inductance	150 μ H \pm 10%
Maximum Scan Angle (Mechanical Angle)	GVS001/002: \pm 12.5° GVS011/012: \pm 20°
Motor Weight	GVS001/002: 50 g GVS011/012: 94 g
Operating Temperature Range	0 to 40 °C
Optical Position Sensor Output Range	40 to 80 μ A

System Operation

The servo driver must be connected to a DC power supply, the galvo motor, and an input voltage source (the monitoring connection is optional). For continuous scanning applications, a function generator with a square or sine wave output is sufficient for scanning the galvo mirror over its entire range. For more complex scanning patterns, a programmable voltage source should be used. The ratio between the input voltage and the mirror position can be switched among 0.5, 0.8, and 1. For the GVS001 and GVS002 systems, when set to 0.8, the ± 10 V input will rotate the mirror over its full range of $\pm 12.5^\circ$. For the GVS011 and GVS012 systems, the ± 10 V input produces the full angular range of $\pm 20^\circ$ with a scaling factor of 0.5. The control circuit also provides monitoring outputs that allow the user to track the position of the mirror. In addition, voltages proportional to the drive current being supplied to the motor and the difference between the command position and the actual position of the mirror are supplied by the control circuit.

Closed-Loop Mirror Positioning

The angular orientation (position) of the mirror is optically encoded using an array of photocells and a light source, both of which are integrated into the interior of the galvanometer housing. Each mirror orientation corresponds to a unique ratio of signals from the photodiodes, which allows for the closed-loop operation of the galvo mirror system.

The GVS001 and GVS002 systems can be driven to scan their full mechanical range of $\pm 12.5^\circ$ at a frequency of 100 Hz when using a square wave control input voltage or at 350 Hz when using a sine wave. For a single small-angle step of 0.2° , it takes the mirror 300 μ s to come to rest at the command position.

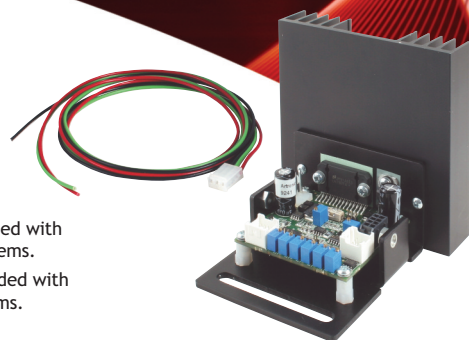
The GVS011 and GVS012 systems can be driven to scan their full $\pm 20^\circ$ range at a frequency of 65 Hz when using a square wave control input voltage and 130 Hz when using a sine wave. For the same 0.2° small angle, the step response is 400 μ s.

For all systems, the maximum scan frequency is 1 kHz and the angular resolution is 0.0008° (15 μ rad).

For more information or to place an order, contact one of our Customer Support Specialists at 973-300-3000 or visit www.thorlabs.com.

Driver Board with Heatsink

One unit included with single-axis systems.
Two units included with dual-axis systems.



Servo Driver Board

The Proportional Derivative (PD) servo driver circuit interprets the signals from the optical position detecting system inside the motor and then produces the drive voltage required to rotate the mirror to the desired position. The scanner uses a non-integrating, Class 0 servo that is ideal for use in applications that require vector positioning (e.g., laser marking), raster positioning (printing or scanning laser microscopy), and some step-and-hold applications. Furthermore, the proportional derivative controller gives excellent dynamic performance. The circuit includes an additional current term to ensure stability at high accelerations. The same driver board is used in all our galvo systems.

Power Supply

The optional GPS011 low noise, linear power supply is compatible with all our galvo systems and has been designed to minimize electrical interference for maximum system resolution. It allows two servo driver cards to be powered at once and comes with two power cables, each 2 m long. It delivers ± 15 VDC, 3 A, and can be used with either 115 V or 230/240 V mains inputs. If the application does not demand the highest resolution, then a standard switch mode supply may be used.



GPS011
Galvo System
Power Supply

Pricing	ITEM #	METRIC ITEM #	DESCRIPTION	PRICE*
	GVS001	-	1D Small Beam Galvo System	\$925.00
	GVS002	-	2D Small Beam Galvo System	\$1,895.00
	GVS011	GVS011/M	1D Large Beam Galvo System	\$1,365.00
	GVS012	GVS012/M	2D Large Beam Galvo System	\$2,775.00
	GPS011	-	Linear Power Supply	\$450.00
*For other currencies, please visit www.thorlabs.com				

We also offer Galvo System Accessories. Please see our website for details.