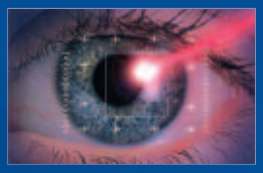
Cambridge Technology

MOVING LIGHT, YEARS AHEAD.™

Optical Scanning Components

- TECHNOLOGY
- PERFORMANCE
- QUALITY
- VALUE
- RANGE OF PRODUCTS
- APPLICATIONS EXPERTISE



www.camtech.com

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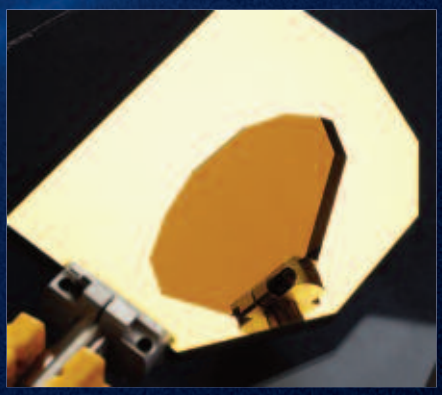
Moving Light, Years Ahead.™

From the day we invented galvanometer scanning over 40 years ago to the present times, Cambridge Technology has been perfecting the state-of-the-art in scanning technology, always staying one generation ahead of market requirements. Whether your primary need is speed, stability, cost, reliability, size, precision, quality, or performance, Cambridge Technology can provide a scanning solution optimized to your specific application.



With step times as fast as 100 µsec and galvo RMS frequencies up to 2kHz (up to 12kHz with our resonant scanners), we design and manufacture products for every application – from the smallest medical hand piece scanner to the largest scanner used in airborne LIDAR applications. You'll find Cambridge Technology products in a wide variety of industries and applications, including:

- **Materials Processing** – High speed laser marking, engraving, coding, drilling, welding, micromachining, cutting,
- **Semiconductor Metrology and Processing** – Mask and wafer inspection, memory repair, resistor trimming, via drilling
- **Medical Diagnostics and Treatment** – Ophthalmology, OCT, aesthetic laser treatments, vision correction, digital radiography
- **Biomedical Systems** – Scanning microscopes, fluorescence imaging, DNA analysis, microarray scanners, capillary electrophoresis.
- **Laser Projection** – Image projection, CAD/CAM projection, laser entertainment, information displays.
- **Imaging and Printing** – 3D Imaging, high resolution printing

CAMBRIDGE TECHNOLOGY

Moving Light, Years Ahead.

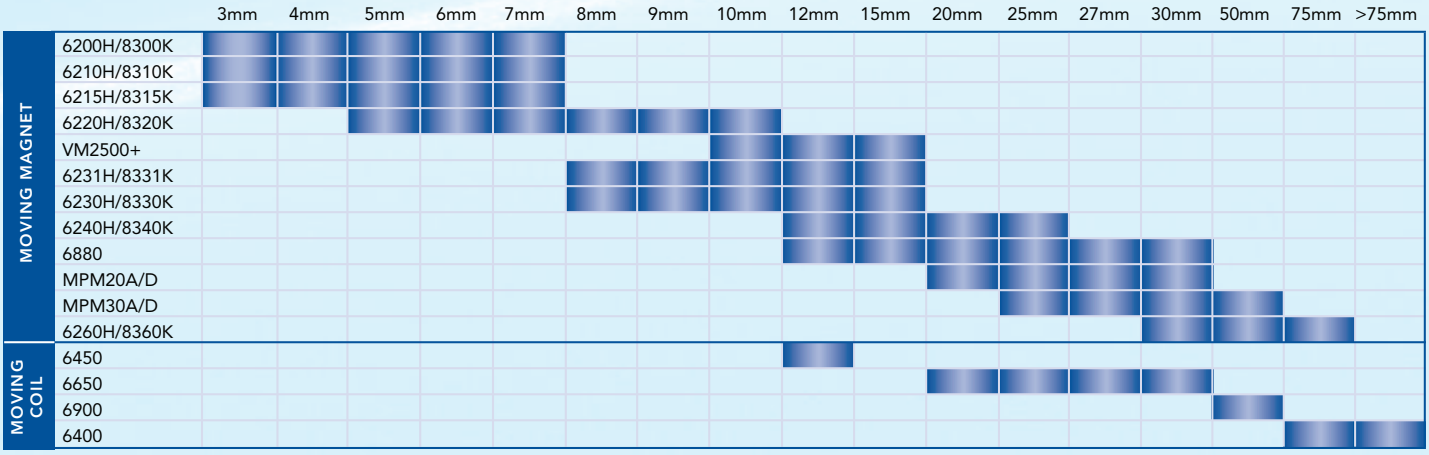
Cambridge Technology Galvanometers

Cambridge Technology provides the market's broadest range of galvanometer options to meet the specific needs of your application. We manufacture the world's largest and the world's smallest galvos as well as a large number of sizes in between. We offer a variety of rotor architectures, position detector and servo technologies, mirror, and controller technologies allowing you to pick your galvanometer scanning price/performance point with razor sharp precision. Our knowledgeable and experienced sales team stands ready to assist you in finding the optimum configuration for your application.

Our award winning 62xxH line of galvanometers cost-effectively provides extraordinary performance in a wide range of industrial, biomedical, display, and semiconductor applications. Our patented optical position detector set new standards for accuracy, stability and repeatability when it was introduced several years ago. It remains the gold standard in cost-effective performance to this day. Suitable for steering beam diameters from <3mm to over 100mm, and with over a half million in operation today, the 62xx line of galvanometers is the ideal solution for the majority of applications.

Our 83xxK family of galvanometers is our next step up in positional stability. Created in response to emerging requirements for "affordable stability", the 83xxK provides 1/3 the thermal drift of the 62xxH family, and half the dither. This performance is nearly equal to what you would find with high-end digital encoder galvanometers, but at analog galvo prices. The 83xxK family, for beam diameters ranging from <3mm through 100mm, is ideal for demanding yet cost-sensitive applications such as PV scribing, deep engraving, wafer marking, and additive manufacturing.

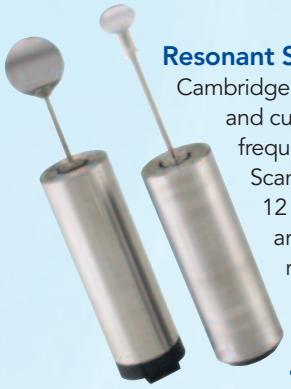
Recommended Galvos by Aperture



The exact pairing of galvo to mirror depends primarily on performance requirements, mirror substrate material, and cost considerations

Galvanometer Accuracy

Specification	Definition	Best CTI Performance
Linearity	Position accuracy as a function of the location in the optical field	99.9%
Step Response	Small angle position settling time measured from command start, to the galvo 99% settled position.	100usec
Short Term Repeatability	Ability to return to the original position, even after a full-field move	1 microradian
Scale Drift	Optical position amplitude variation as a function of temperature	15ppm/°C
Zero Drift	Optical position center variation as a function of temperature	5 µrad/°C



Resonant Scanners

Cambridge Technology has been providing standard and customized versions of these fixed-frequency, variable amplitude Resonant Scanners at frequencies between 100Hz and 12 kHz for many years. Resonant scanners are an ideal solution for applications that require:

- Long life in various environments
- High speeds over large scan angles
- No lubrication or particulate generation
- Low power consumption and heat dissipation
- Small size and weight

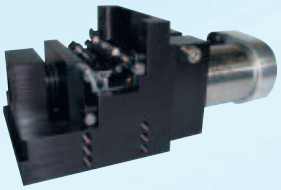
Open Loop and Specialty Galvo Motors

Cambridge Technology has been providing scanning solutions to customers around the world for over 40 years. Throughout this time, certain unique galvo architectures have been developed or customized for special applications and can add to your scanning options. Our open-loop, flexure-based, moving coil and rotary actuators are the building blocks of many OEM systems.

Lightning II

For the Ultimate in speed and positional stability, our Lightning II platform combines our state-of-the-art digital encoder galvanometers with the next generation in scanning servo and control technology. The Lightning II subsystem has taken speed and accuracy to a new category of performance and is ideal for highly demanding applications such as via hole drilling, web processing, etc. Further details can be found in our companion brochure: Lightning II.

Dynamic Focusing Module

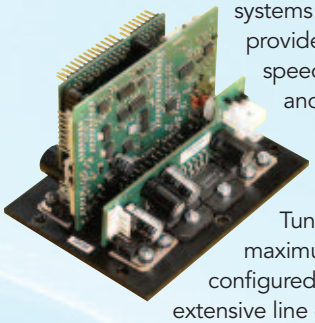


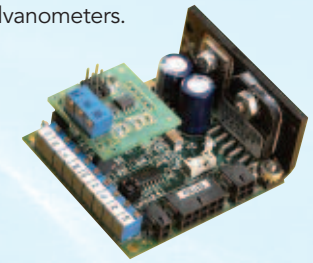
Our field-proven DFM Z-axis actuator provides the ultimate in modularity and flexibility. Whether your application requires a larger field than can economically be provided with a F-theta lens, or a dynamically changing focal plane to follow contours or to focus at varying workpiece depths, the modularity of Cambridge Technology's DFM enables you to choose lens type, positioning relative to the fixed objective, field size and focal distance; all synchronous with XY galvo motion and orchestrated by our EC1000 or SC500 controllers.

Servo Drivers

Cambridge Technology Proprietary Servo Topologies and Designs Provide Maximum Galvo System Performance

Cambridge Technology offers a wide variety of analog and digital servo drivers to meet your application needs including single and dual axis, compact, low cost, high precision and high power options to optimize your systems design. Our Digital servo drivers provide extraordinarily fast marking speeds, real-time parametric reporting and remote support and include self-tuning State-space versions as well as our software-tuned Lightning Digital servo with our TuneMaster™ software. Designed for maximum flexibility, each driver can be configured to operate with most of our extensive line of precision closed loop galvanometers.



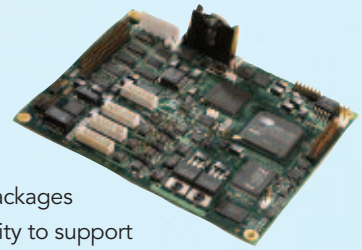


Easy System Integration and Reliable Operation

Cambridge Technology servos incorporate comprehensive status monitoring and system conditioning circuits deployed during power up, power down and all moves, large and small, to ensure consistent and reliable system control and to guard against potential system damage. For system debug and integration with other hardware, the servos provide position, velocity and error output signals. Several error states are detected including over-position, excess RMS power, loss of position detector signal, and loss of power. In the event that a fault is detected, the electronics will immediately signal a fault condition and shutdown the positioning system in a safe and controlled manner.

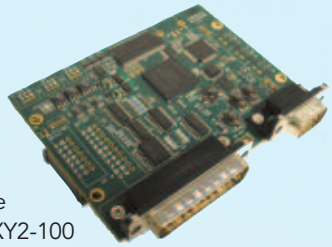
EC1000 – Ethernet-based Standalone Embedded Digital Controller

The EC1000 is the next generation in galvo-steered laser control systems. This compact, fully integrated dual system-on-a-chip (SoC) control system is ideal for deployment into modern factory environments with distributed automation.



- State-of-the-Art, Dual-SoC embedded computer, marking and micro-vector engine
- Operates as a network appliance with or without a host PC
- DLL API interface to third-party and user application software packages
- RTC Emulation capability to support existing customer software
- Ethernet host computer interface to download or stream jobs, and to monitor real-time status
- On-board flash memory and USB port for job storage and media portability
- Dynamic 16 bit analog or digital 3-axis galvanometer command outputs for CTI servo systems
- Synchronous laser control for pulse, intensity, and gating for Fiber, YAG, CO2 and other lasers
- Separate I/O "rear panel" board to simplify integration and for packaging modularity
- Also available in a packaged configuration (SM1000) for integrator applications

SC500 – Sub-Compact Scanning System Controller

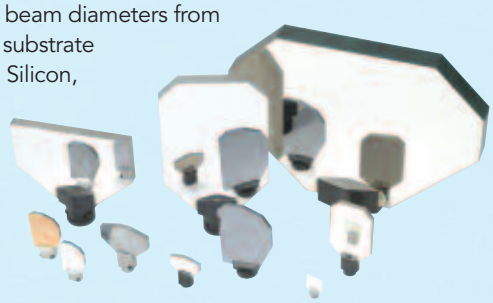


The cost-effective SC500 Controller's Sub-Compact (9.9cm x 7.6cm) integrates the functions of a controller and XY2-100 receiver into a small form-factor package to minimize the controller space required in scanning subsystems. The SC500 Includes 3 axis (XYZ) of analog control eliminating the need for external XY2-100 receiver cards, as well as 3-Axis (XYZ) XY2-100 output with status monitoring and a RTC-compatible API to preserve existing user programs.

- Buffered USB 2.0 connection to the host computer
- Direct cable-level interface for IPG lasers
- 3-Axis XY2-100 output with status monitoring
- Marking on-the-fly support
- Opto-isolated digital inputs and outputs
- Analog laser power control
- Also available in a packaged configuration (SM500) for integrator applications
- Software programmable laser control connector pinout

Mirrors

We offer a wide selection of precision machined and mounted X and Y mirrors for beam diameters from 3 mm to 75 mm in substrate materials including Silicon, Fused Silica and BK-7. Our in-house capabilities for designing, manufacturing and coating lightweighted Beryllium, and Silicon Carbide mirrors provide you with the ultimate in scanning performance at a price/performance advantage. FEA simulation-designed for minimal inertia with maximum stability, resulting in optimum scanning performance and quality mirrors for single and multi-axis optical scanning applications.



We offer a wide variety of enhanced metallic coatings as well as dielectric coatings for specific wavelengths such as:

- 10.6µm
- 9.4 µm
- 1064nm
- 532nm
- 355nm
- Wideband dielectric from 450nm to 675nm
- Other wide-band, dual-band and custom dielectric coatings

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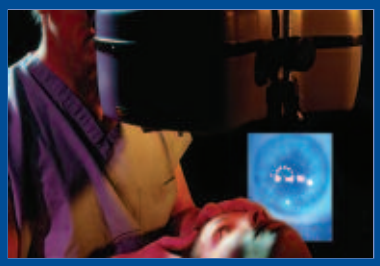

Contact Cambridge Technology to learn more about our comprehensive line of products.

Components

2-Axis Scan Heads

Scan Control

3-Axis Scanning Systems

Lightning II Digital Scanning Platform

Cambridge Technology

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