

The products discussed in this User Guide are intended for development and prototyping purposes as **OEM** subsystems for incorporation into customer's prototypes and end products. Therefore, they do not comply with the appropriate requirements of FDA 21 CFR, section 1040.10 and 1040.11 for complete laser products.



LASER TRACKING AND SCAN MODULE DEMONSTRATOR KIT (DEMO-01)

mirrorcle
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Mirrorcle Technologies, Inc.

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Introduction

- The **Laser Tracking and Scan Module Demonstrator Kit** is a plug-and-play kit with a **MEMS-mirror based Scan Module**, **USB MEMS Controller**, and a **Photosensor**.
 - Part Number: **DEMO-01**
- The kit is designed to demonstrate the capabilities of Mirrorcle's MEMS mirror technology in an integrated optical scan head (**Scan Module**) as supported by a **USB MEMS Controller with Windows based applications and SDKs**. Users may programmatically steer and modulate a laser over a field of regard of $\sim 32^\circ \times 32^\circ$. In conjunction with the Photosensor it offers additional capabilities of tracking and imaging which are showcased in the included Applications.

Laser Tracking and Scan Module Demonstrator Kit



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What does the DEMO-01 Kit do?

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It Displays Vector Content

- **Vector Graphics Laser Projection (VGLP)** - Scanning text, arbitrary shapes, and vector content that can be streamed to the controller via USB from a Windows PC, or wirelessly from an Android device (requires Android Development Kit Add-On)
- VGLP is the **most efficient methodology for projecting** high contrast and high brightness content onto arbitrary surfaces. See more information on VGLP and Mirrorcle's Playzer here.



- **Application Areas:**

- Laser marking, 3D printing, Dynamic Lighting, HUDs

It Images

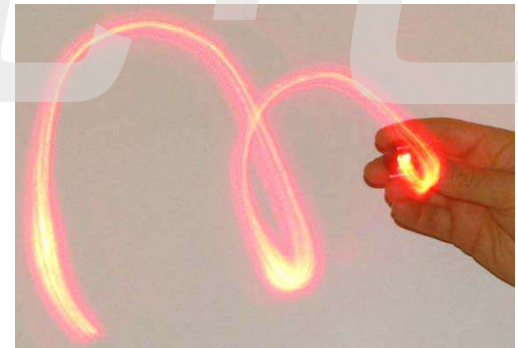
- Rasters laser-beam lines over a user-prescribed area and reports reflected brightness from each targeted 'pixel'.
- "Single-pixel Camera" principle, with own illumination for each pixel.
- User can control number of lines, size and offset of the raster scan, line speeds and other parameters.



- Application Areas:
 - 3D Metrology, biomedical imaging, robot vision, LIDAR

It Tracks

- Searches, acquires and tracks a retro-reflective marker and reports beam direction to user.
- “Paints” the object (marked with retroreflective tape) with a laser beam and sticks the laser “paint” to the object as it moves while in field of view.
- If marker is lost from field of view a new search starts.



- Application Areas:
 - Laser based Tracking, AR/VR headset, Gaming

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What does DEMO-01 include?

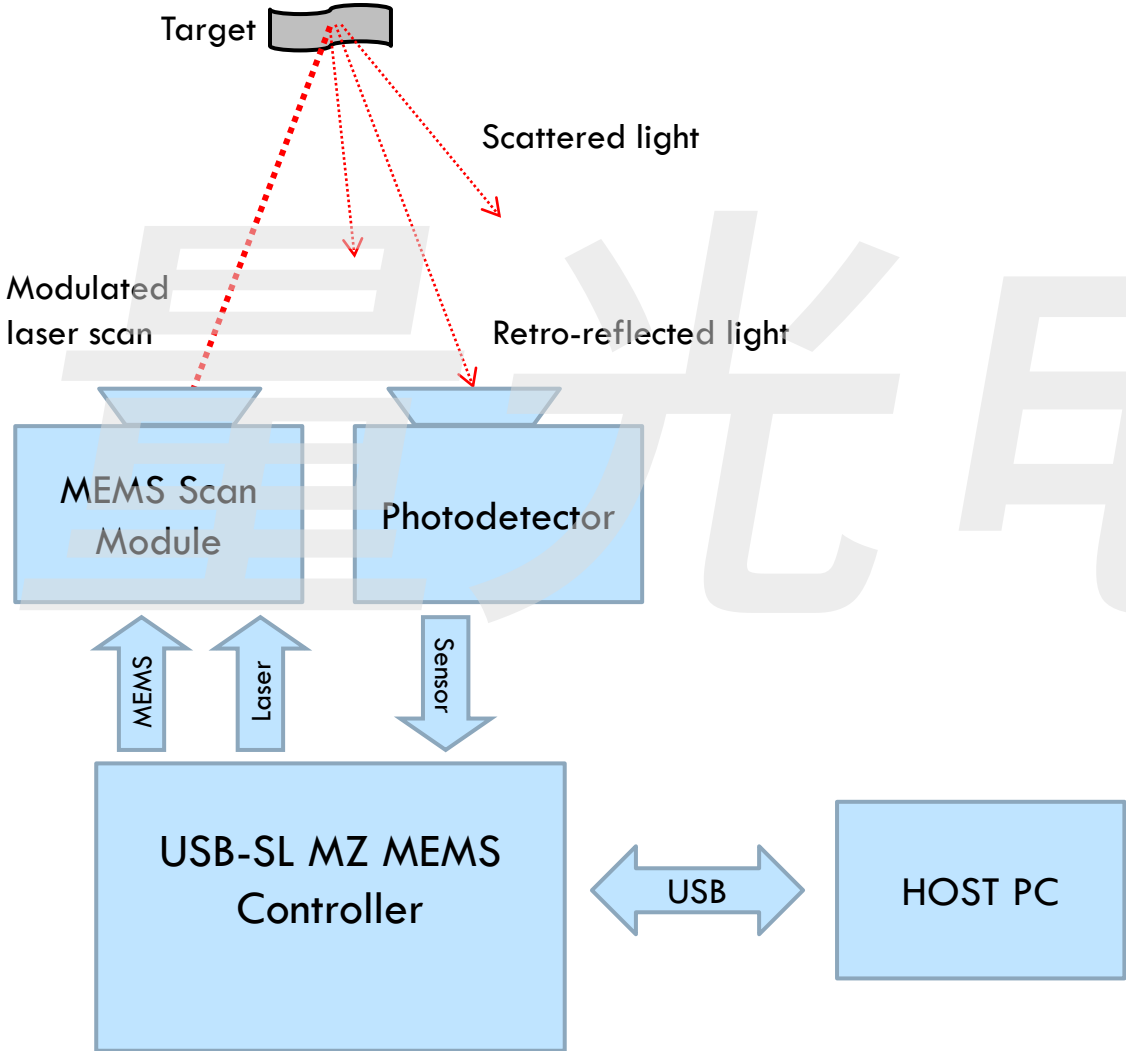
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Demonstrator Kit - Contents

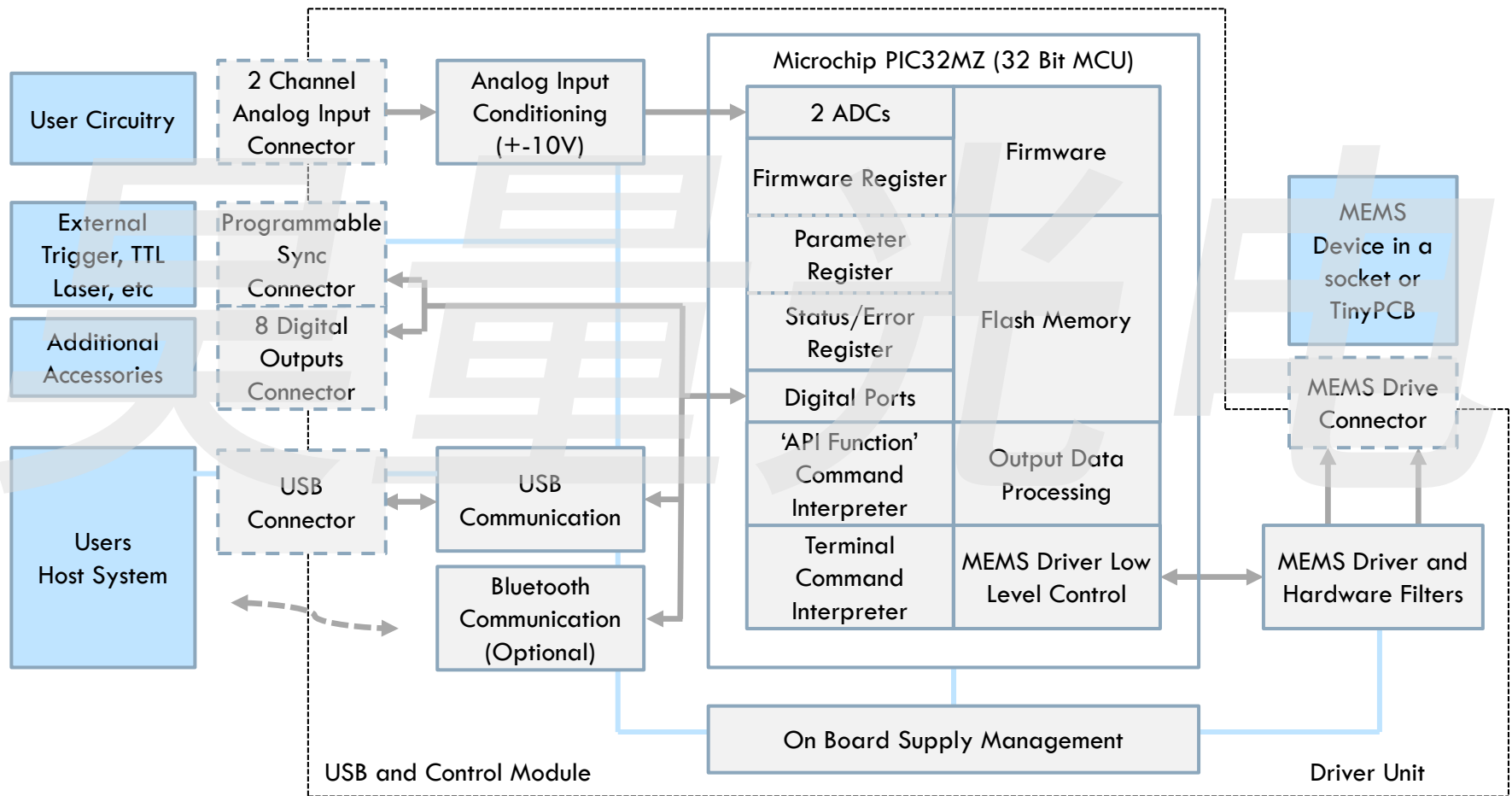
- EaZy4.0R **Scan Module** - optomechanical cell with MEMS mirror, laser and optics, designed to be driven by USB MEMS Controller (below)
 - MEMS Mirror: A7M10.2-1000AL
 - Red Laser module
 - Wide Angle Lens and optics with 32° optical FoV
- **Photosensor** with optical filter and 60° FoV lens, pigtailed cable
- USB-SL MZ **USB MEMS Controller**
 - PIC32MZ MCU and Embedded MEMS driver
 - USB powered and controlled by USB (software API) commands
- Mirrorcle **Software Suite** comprehensive documentation
 - Windows Applications, 3 SDKs
 - Software **Support Hours**



Block Diagram



USB MEMS Controller “USB-SL MZ”



USB MEMS Controller vs. MEMS Driver

- A Controller converts software input commands to 8 high voltage outputs to command X,Y positions as well as to 8 low voltage digital outputs (trigger pins or M output). Mirrorcle's USB-SL MZ MEMS Controller is designed for plug-and-play simplicity and is paired with an expansive, open application programming interface (API) for users to interact with the Controller and develop their own applications.
 - Mirrorcle's USB-SL MZ MEMS Controller design is based on Microchip's PIC32MZ MCU
- A MEMS Driver (here fully integrated inside the Controller) converts low voltage input commands (e.g. analog -10V to +10V from 2 inputs X,Y or digital SPI) to 4 high voltage outputs to command X,Y positions. Use of a MEMS Driver (as a general Mirrorcle product for OEM customers) instead of a Controller requires bench-top lab equipment such as function generators or a data acquisition (DAQ) card.

Mirrorcle Software Suite - Applications

Mirrorcle Software Suite (“MSS”) has Windows Applications and software development kits (SDKs)

□ **MirrorcleDemo**

- Console application specifically designed to demonstrate key modes of operation of the DEMO-01 Kit with its displaying, imaging, and tracking capabilities.

□ **MirrorcleDraw**

- Powerful Windows application to fully control the MEMS Mirror. (E.g. freehand and polyline sketches, parameterized mathematical curves, import of data files, text or clock output modes, raster patterns with various settings and a function generator with various settings)

□ **MirrorcleLinearRaster**

- Creates uniform velocity linear raster scans and controls the number of lines, points per line, line scan times, rotation etc. Possible to export raster scan data files (.kpt and .smp).

□ **MirrorcleListDevices**

- Scans the COM ports of the computer and provides a table of connected MTI devices with their properties.

□ **MTIDevice-Demo**

- Executable made from C++ SDK example code by the use of MTIDevice and MTIDataGenerator function calls.

For information on compatibility with other platforms such as Linux and other Add-On options, contact

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Mirrorcle Software Suite - SDKs

□ C++ based Software Development Kit

- The Software Development Kit (SDK) of the Mirrorcle Software Suite allows users to develop their own applications.
- C++ API - The interface provides classes and functions for analog output, control of laser output, sample rate, filter settings, amplitude, device communication, etc.
- An example Visual C++ project is provided to illustrate the use of the API and several ways of driving devices in point-to-point, rastering, and other modes.



□ Matlab-based Software Development Kit

- Similar to the C++ version, this is a Matlab-based software development kit (SDK) allows the user the fastest and easiest route to development of micromirror applications. Multiple examples included.



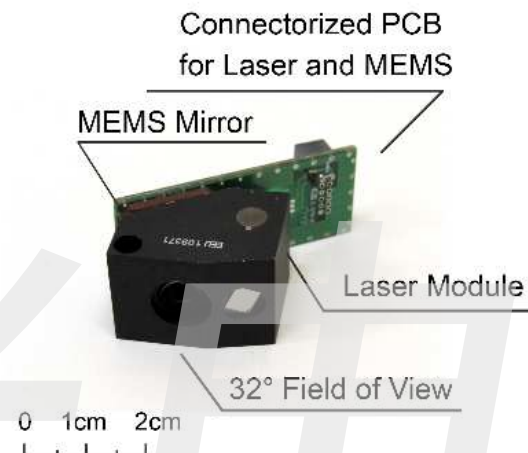
□ LabView-based Software Development Kit

- Includes multiple examples of content generation (and content importing) and driving of MEMS mirror devices from National Instruments LabView software.
- **This SDK does not include Tracking-related functionality, only MEMS Mirror control – it is included in this suite for general purposes.**

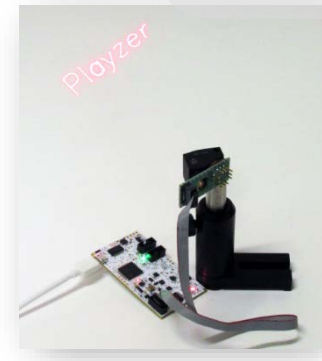


EaZy4.0R Scan Module

- **MEMS Mirror:** A7M10.2-1000AL
- **Bandwidth:** ~2400Hz in LPF-based driving
- **FoR:** Approx. 32° x 32° Field of Regard
- **Wavelength:** Single laser diode source in:
 - Red (~638nm), up to 25mW CW power
- **Divergence (half angle):** <2.5mrad
- **Repeatability:** <0.005° each axis
- **MEMS Interface:**
 - 10-pin 0.05" Samtec connector, mates with all Mirrorcle MEMS Controllers and Drivers outputs
- **Laser Interface:**
 - Shares 10-pin MEMS Interface connector (see above)
 - Direct access to Laser Diode terminals by header pins
 - Requires separate laser driver to control
- **Recommended Driving Parameters:**
 - Vbias = 90V
 - VdifferenceMax = 140V
 - HardwareFilterBw = 2400Hz

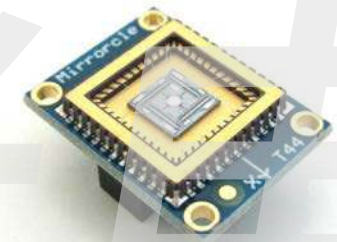


Example application of a Scan Module in Vector Graphics Laser Projection (VGLP)



MEMS Mirror Device - A7M10.2-1000AL

- EaZy4.0 Scan Modules are powered by Mirrorcle's fast **dual-axis quasi-static** MEMS Mirror A7M10.2-1000AL
- Key features:
 - 1mm Diameter (clear aperture)
 - Aluminum thin film coating, very **high optical quality**
 - Gimbal-less design optimized for **point-to-point** optical beam scanning
 - **Fast** resonant frequency in both axes above 4 kHz
 - Positional precision at least 14 bits on each axis
 - **Highly repeatable** with no detectable de-gradation over time (>50,000 hr lifetime)



A7M10.2-1000AL-TINY48.4-NW
Example

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Pricing and Availability

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Pricing and Availability

- Contact sales@mirrorcletech.com for a formal quotation with most up to date pricing and lead time
- Typical lead time is 2-3 Weeks

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Thank You for Choosing

Additional Resources:

- [Mirrorcle MEMS Mirror Technical Overview](#)
- [Mirrorcle Software Suite – Applications Guide](#)
- [Mirrorcle Software Suite – SDK Documentation](#)

