A fast, simple and high-quality solution

Marking Flexibility

- Fast, permanent, high-quality marking for metals, plastics, resins and other materials
- Easy integration with vision and SQL client for a complete traceability solution
- Direct connectivity with vision for position compensation and mark inspection
Material Flexibility
Fast, high-quality marking for any application

The MX-Z2000H Series is great for either deep or shallow engraving in metals, marking on plastics/resins or plastic films, and for fine processing. Mark anything from electronic parts to automotive parts.

The MX-Z2000H series offers great benefits in many areas
Efficiently marks various materials, including:

- Metals
- Plastics & resins
- Plastic film

• Two operating modes meet the application marking demands
• Enhanced 3D marking features
• G-DAC enables high-speed, clear marking

Deep engraving in metal | Shallow engraving in metal | Marking on plastics and resins
Marking on plastic films | Fine processing | Fine marking
Geometric Flexibility
Marking 3D objects is simple, even on cones and spheres

High-precision z-axis flexibility
Clean marking is now possible for 3D surfaces - including stepped, sloped, curved, conical and spherical surfaces - without the need for additional software.

Laser marking samples

The focus point can be moved 170±10mm for the MX-Z2000H, and 220±10mm for the MX-Z2050H/Z2055H.
Vision Inspection Flexibility
Find the part, mark it, and inspect it in the same place

The perfect solution for applications requiring proper product orientation before marking, the inspection of markings done, like 2D code, characters, images, etc.

**Typical marking process**
Various devices and processes were required. Cost and labor for the design, implementation and execution were high.

**Omron’s solution**
All processes are consolidated in one single step. Design, implementation, and execution are greatly simplified.

**Benefits**
- Reduces the number of cameras from two to one
- No positioning mechanisms required for proper part orientation
- Product indexing reduced from three steps to one
- Overall cycle time - position compensation, marking and inspecting product - reduced by a third
- System design (electro-mechanical, software) and even hardware required is greatly reduced

**Direct finder link**
The MX-Z2000H series enables direct connectivity between the vision system and the laser marker that traditionally required PLC processing. This means, there is no need for a PLC to do the linking between the vision system and the laser marker.
**Fast, Reliable Quality**

Two operating modes provide fine detail to deep engraving

<table>
<thead>
<tr>
<th>1. Fine detail mode</th>
<th>2. Deep marking mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>(using the standard mode)</td>
<td>(using the optional Energy Enhancement - EE mode)</td>
</tr>
<tr>
<td>Our exclusive flexible pulse control (up to 1MHz, adjustable 1 - 20 pulses) enables optimum marking and processing for a variety of materials and applications, even materials or applications that require heated marking/processing, etc.</td>
<td>Deep engraving of metal, rough polishing, and other energy-intense processing becomes possible with an expanded and enhanced flexible pulse control, which provides pulse streams of up to 30 pulses.</td>
</tr>
</tbody>
</table>

**G-DAC**

Mark clearly and cleanly fast!

G-DAC stands for the OMRON-developed Galvano Dynamic Acceleration Control. The G-DAC feature adjusts the laser marking speed for optimum performance, based on the marking details. This speed flexibility enables high-speed, clean marking.

**Faster marking G-DAC**

<table>
<thead>
<tr>
<th>With G-DAC</th>
<th>Without G-DAC</th>
</tr>
</thead>
<tbody>
<tr>
<td>54ms</td>
<td>116ms</td>
</tr>
</tbody>
</table>

Workpiece: Aluminium
Letter height: 1mm

Note: Marking conditions: 100kHz, 100% power; Aluminium material

**High quality marking at the same speed**

<table>
<thead>
<tr>
<th>Without G-DAC</th>
<th>With G-DAC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Note: Laser conditions: 100kHz, 100%; Workpiece: Aluminium</td>
<td></td>
</tr>
</tbody>
</table>
Operation Flexibility
increases throughput with less effort

Flexible integration for external control

**EtherNet/IP™ compatibility**

The MX-Z2000H series is compatible with various kinds of external control. Built-in I/O connections, RS-232C, Ethernet, and Ethernet/IP™ simplify programming to control the system from a PLC.

Marking for short production runs with multiple products

**Data can be shared with external storage**

Small runs of multiple products require markings specific to each product run. The marking data is massive and it is usually saved on an Ethernet server. The MX-Z2000H series offers capability to access such marking data and apply it to the specific product being run on the specific line.

Edit marking data directly on the laser marker or using the offline software

**Editing data**

There is no need to buy separate editing software, or a computer to edit data. Data editing functionality is built right into the laser marker itself, simplifying the process.

**Offline editing software is standard**

You can also use a separate computer if you choose, to create and edit the print data, including graphics, with the same functionality as is built into the laser marker.

- **Editing data offline**
  Create and edit the marking data directly.

- **Editing fonts and logos**
  Optimize fonts, logos (graphics), and pattern data directly.
Durability and safety
Withstands severe environmental conditions and meets domestic and International Standards

Durable IP65 laser head
Stable operation even in dusty or wet environments

The laser head (where the laser light is emitted) has a double glass cover to keep dust and moisture away and ensure air-tightness.

IP65 means dust-proof and wash-down protected, compatible with IEC60529.

Protection against water
5: Protection from water, up to water projected by a nozzle against the enclosure from any direction.

Protection against solid objects
6: Complete protection from dust.

The double glass cover makes it easier and safer to change the glass.

Built-in safety relay circuit
Meets safety requirements and standards

When building a product to meet the ISO 13849-1 (JIS-B9705-1) criteria, safety measures must be provided for the total complete system in which the laser marker is installed. The MX-Z2000H series provides an internal interlock circuit with 2 safety relays within the controller. When sending an emergency stop signal from an external controller to the interlock terminals will absolutely stop the power supply to the laser.

Meets domestic and international standards and regulations

In order to facilitate international trading and improving the user safety, the laser marker has been developed to meet domestic and international safety standards and regulations.

Note: For details on standards and certifications met, see specifications on page 18.
Fiber Laser Technology
All-fiber lasers provide high quality, high stability, long life

Offering a long life laser with high quality and stability
Typical solid-state lasers use mirrors to resonate and amplify the laser, and then Q-switching to output the laser. However, this approach makes it difficult to achieve a high quality and flexible laser. It also leaves something to be desired in the areas of reliability and durability. Omron’s unique Master Oscillator Power Amplifier (MOPA) achieves high quality, high stability, long life and flexibility by eliminating the resonator configuration and using the MOPA approach.

Omron MOPA fiber laser
- Wide range of pulse repetition frequency settings
- High flexibility for setting the pulse width and shape
- High beam quality, high stability, long life

Typical solid-state laser
- Pulse width depends on the repetition frequency
- The laser diode is always on, accelerating deterioration
- Durability issues of the Q switch, mirrors, etc.

Typical fiber laser
- Difficult to achieve a high peak output
- Narrow range of pulse repetition frequency settings
- Pulse width depends on frequency

High beam quality
The closer the beam is to a perfect circle, the higher the quality of the laser. Omron lasers have a very round, high quality beam, as shown to the left.

Corrects for lens distortion
Precision positioning is now possible for fine detail, and processing area distortion is minimized. Coordinate correction is provided to eliminate errors based on installation.

High position resolution

Coordination correction

Marking a scale

Marking of electronic parts in a tray
Flexible Vision Technology
The vision option increases the power of the MX-Z2000H series laser markers even easier to use

The vision option solves three main concerns before marking, during and after marking is done:
1. Correct positioning of part before marking
2. Inspection of markings
3. Monitoring of process while marking
1. Position-Compensated Marking

Complete two key tasks in a single step

Before vision systems were integrated into marking applications, it was necessary to have either a jig or a mechanism to position product properly before it could be laser marked. The vision option working in conjunction with the laser marker eliminates this need.

**Benefits**

The camera confirming and compensating for the workpiece position makes position-compensation mechanisms unnecessary. Jigs are not required even for multiple product types. The vision option contributes to both cost reductions and system simplification.

**Application example**

To mark a product in the same area every time, an image processing system measures the position reference, transfers the coordinates to the laser marker. The laser marker then adjusts to etch, compensate and mark in the correct place. After the laser marking is completed, the image processing system can also read a 2D code or any other inspection of the data or images just marked on the product.
2. Inspection and reading 2D codes
Consolidate to a single process

After marking is completed, inspection is required to ensure the markings meet the quality standards and make system corrections. In other cases data and images of what is being marked must be saved for traceability purposes.

Typically, the orientation marking and inspections are being done in several steps, which increase the cycle time. Omron offers a unique solution where the cycle time is dramatically decreased as the whole process (position correction, marking and inspection) is done in one step.

Application examples

2D codes marked on printed circuit boards must be inspected for proper readability before they go through the manufacturing process.

2D codes (Data Matrix) inspection on an engine block or a spark plug are required for proper traceability.

Multiple inspections can be done simultaneously. In this example, an Integrated Circuit is properly oriented, and several inspections are carried out: Counting the number pins, measurement of the distance between pins is within specifications, inspection of the marking quality and making sure the surface is clear of debris or manufacturing imperfections.
3. Display and Monitoring
A large screen simplifies marking monitoring and provides visibility of a larger area

Benefits
- Confirm the mark position easily on the monitor for easy visualization
- Flexibility to choose the lens and lighting that best fits for your application

Choose the right lens for the required field of view
For example, when using the MX-9151 camera attachment, you can use the FZ-S2M camera and FH vision controller. Then, depending on the application needs select the most suitable camera lenses. The following images are illustrating a perspective viewing 15mm integrated chips using various sized lenses.

Choose the most suitable lighting for your application
Choose the mounting position. Adjust the angle with the mounting brackets.
Using a high brightness bar light and a wide model. (Diffusion plates also available.)
Position-correction, marking and 2D code inspection without the need of a PLC

This solution is perfect for applications, which do not require data tracking or PLC management for the laser marker and the vision system. The direct connectivity between the laser marker and the vision system allow the functionality for position correction as the laser marker requests the coordinates from the vision system. Once the laser marker obtains the product position, it begins marking and when it is done, the laser marker instructs the vision system to inspect the 2D code marking and issue an output if marking is OK or not.

System configuration for position-compensation and 2D inspection
Laser Marker Solutions

Position-correction, marking and multiple inspection including 2D code reading

Ideal for applications requiring multiple vision inspection beyond 2D code reading, such as optical character recognition, shape pattern, date code, or other simple inspection at an affordable cost.

Vision system
Multiple inspections, multiple cameras, one vision controller.

Smart cameras
Multiple inspections, one smart camera.

System configuration for position-compensation and multiple inspection (including 2D code)
Configure your traceability system
A complete solution for position correction, marking, inspection and traceability

Store marking data, and other data to a database, etc. Simplify both traceability and preventive maintenance. The MX-Z2000H series together with a vision system can be easily networked with a machine controller equipped with an SQL server to collect inspection data and store it in a database for traceability purposes.
Ordering Information

Laser Marker

<table>
<thead>
<tr>
<th>Model</th>
<th>Laser class/power</th>
<th>Working distance</th>
<th>Cable Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>MX-Z2000H-V1</td>
<td>Class 4, 20W</td>
<td>170±10mm</td>
<td>Fiber 4.5m, Laser head control/power 5m</td>
</tr>
<tr>
<td>MX-Z2050H-V1</td>
<td>Class 4, 20W</td>
<td>170±10mm</td>
<td>Fiber 4.5m, Laser head control/power 5m</td>
</tr>
<tr>
<td>MX-Z2055H-V1</td>
<td>Class 4, 20W</td>
<td>170±10mm</td>
<td>Fiber 4.5m, Laser head control/power 5m</td>
</tr>
</tbody>
</table>

Vision option device configuration

1. Position compensation/reading 2D codes/all inspections
   - MX-Z2000H
     - MX-9150 camera attachment
     - FH-2050 series vision system
     - F2-SC/F2-S
     - CCD camera - 300K pixels, color/black & white
     - MX-915A-F2 camera mount
   - Standard
     - FH-3050 series vision system
     - F2-SCM2/F2-SSM2
     - FZ CMOS camera - 5M pixels, color/black & white
     - 3Z4S-LE SV-EXR
     - FZ-SC/FZ-S
     - Smart camera
   - 3Z4S-LE SV-0813V
     - lens: f=8mm
   - 3Z4S-LE SV-1214V
     - lens: f=12mm
   - 3Z4S-LE SV-1614V
     - lens: f=16mm
   - 3Z4S-LE SV-2514V
     - lens: f=25mm
   - 3Z4S-LE SV-3518V
     - lens: f=35mm
   - 3Z4S-LE SV-5018V
     - lens: f=50mm
   - 3Z4S-LE SV-1214H
     - High Speed
     - lens: f=12mm, high resolution
   - 3Z4S-LE SV-2514H
     - lens: f=25mm, high resolution

2. Reading 2D codes/simple inspections
   - MX-Z2000H
     - MX-9151 camera attachment
     - FH-5050 series vision system
     - F2-SCM2/F2-SSM2
     - FZ CMOS camera - 5M pixels, color/black & white
     - 3Z4S-LE SV-0813V
     - lens: f=8mm
     - 3Z4S-LE SV-1214V
     - lens: f=12mm
     - 3Z4S-LE SV-1614V
     - lens: f=16mm
     - 3Z4S-LE SV-2514V
     - lens: f=25mm
     - 3Z4S-LE SV-3518V
     - lens: f=35mm
     - 3Z4S-LE SV-5018V
     - lens: f=50mm
     - 3Z4S-LE SV-1214H
     - High Speed
     - lens: f=12mm, high resolution
     - 3Z4S-LE SV-2514H
     - lens: f=25mm, high resolution

*: Blank = color; M = black & white
*: 0 = NPN; 5 = PNP
Lens selection criterion
(Distance between the camera and the workpiece)

1. Lens selection
   When selecting a lens, follow the lens selection criterion table and the camera optical charts. Select the best camera and lens for your application based on the optical table and your vision area needs. The extension tubes may also be needed. The optical charts are included in the catalog for the camera being used.

2. Lighting
   The FL-XBK1 mounting bracket is required to mount the lighting bar to the camera attachment. You may also need the FL-XC□ lighting extension cable (1m-25m), depending on the distance between the lighting bar and the lighting controller.

3. Power supply, misc.
   A 24VDC power supply is required for the lighting and the vision system or smart camera. Select the appropriate power supply based on the power consumption of the devices. Your device configuration may also require a touch finder, LCD monitor, etc. Be sure to consider all needed devices when selecting the power supply, camera cables, Ethernet cables, and so on.

Refer to the appropriate product catalogs for details.
## Laser Marker Specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>MX-Z2000HV1</th>
<th>MX-Z2050HV1</th>
<th>MX-Z2053HV1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Processing laser</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type</td>
<td>Fiber laser wavelength: 1,064nm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Laser class</td>
<td>IEC 60825 class 4, FDA (CQRH) part 1B/10 class IV</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average output</td>
<td>20W (Fiber laser transmitter output)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Laser output mode</td>
<td>Standard mode/EE mode*2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Repetition frequency</td>
<td>Standard mode 10 to 1,000kHz in 0.1 kHz steps/EE mode*2 10 to 100kHz in 0.1 kHz steps</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pulse train width (pattern) setting</td>
<td>Standard mode 7.5ns–300ns (15 patterns); EE mode*2 150ns–450ns (3 patterns)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Optical specifications</strong></th>
<th>MX-9302</th>
<th>MX-9301</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>External dimensions</td>
<td>160×160mm</td>
<td>220×100mm</td>
<td></td>
</tr>
<tr>
<td>Working distance</td>
<td>170 to 190mm</td>
<td>220 to 100mm</td>
<td></td>
</tr>
<tr>
<td>Scanning specifications</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scan speed</td>
<td>1–12,000mm/s</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Marking resolution</td>
<td>2μm</td>
<td>4μm</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Detail of marking</strong></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Text</td>
<td>original / OCR-A / OCR-B / SEMI / LM font / True Type font</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bar code</td>
<td>CODE39 / CODE128 / JIS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Code</td>
<td>QR code / DataMatrix</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3D shape</td>
<td>Slant / step / cylinder / truncated cone / sphere</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Image and CAD importing</td>
<td>BMP/JPG/PNG/DOCX</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| **Settings** | | | |
| No. of data/blocks | Marking data: 10,000.; blocks: 2,048 | | |
| Text setting | 0.1mm–120mm | | |

| **Cables** | | | |
| Marker head control cable | 4.5m minimum bending radius: 100mm | | |
| Marker head power supply cable | 5m minimum bending radius: 100mm | | |

<table>
<thead>
<tr>
<th><strong>External interface</strong></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Terminal block and I/O connector</td>
<td>Terminal block input 20pins (NPN/PNP compatible); terminal block 14pins (NPN/PNP compatible)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>U/O connector</td>
<td>37pins (NPN/PNP compatible); interlock terminal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Serial communications</td>
<td>RS-232C/RS-422A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethernet communication</td>
<td>Ethernet10BASE-T/T100BASE-TX/10BASE-T / EtherCAT*2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power supply voltage</td>
<td>100 to 120VAC, 50/60Hz; 200 to 240VAC, 50/60Hz</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Over voltage category</td>
<td>CAT II</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power consumption</td>
<td>at 100VAC: maximum 390VA, at 200VAC: maximum 420VA</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| **Ambient conditions** | | | |
| Operating ambient temperature/humidity | 0 to 40°C, 35 to 85%RH (no condensation) | | |
| Storage ambient temperature/humidity | -10 to 60°C (no freezing); 35 to 85%RH (no condensation) | | |
| Installation environment | Indoor, 1000m, max | | |
| Temperature | 20±5°C | | |
| Relative humidity | 35 to 85%RH (no condensation) | | |

*1 Large beam diameter for coarse marking
*2 EE mode: Energy Enhanced mode (optional)
*3 The operating temperature may be limited due to their processing conditions. When using the laser continuously or close to continuously for laser processing etc, please contact OMRON in advance.
*4 The head of this product is constructed for environmental protection. Under the conditions specified in IEC 60825-1 (US CE0201), and is not guaranteed under any other conditions.
*5 Do not use the USB interfaces for anything other than their specified applications.
*6 The following environment is required for use of the offline editing software and font logo editor
- Computer with a USB 2.0 or 1.1 port, Microsoft Windows® 8/Windows® 7, Available hard disk space: 1GB, min. Display resolution: 1,024x768, min.
# Camera Attachment Specifications

<table>
<thead>
<tr>
<th>Camera attachment</th>
<th>MX-9150</th>
<th>MX-9151</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compatible laser markers</td>
<td>MX-915A-FQ2</td>
<td>MX-915A-FQ2</td>
</tr>
<tr>
<td>Compatible camera mounts</td>
<td>MX-915A-FQ2</td>
<td>MX-915A-FQ2</td>
</tr>
<tr>
<td>Compatible cameras (C-mount)*1</td>
<td>FZ-SC</td>
<td>FZ-SC</td>
</tr>
<tr>
<td></td>
<td>FZ-S</td>
<td>FZ-S</td>
</tr>
<tr>
<td></td>
<td>FZ-SCM</td>
<td>FZ-SCM</td>
</tr>
<tr>
<td></td>
<td>FH-SC05R</td>
<td>FH-SC05R</td>
</tr>
<tr>
<td>Compatible lighting (recommended)*2</td>
<td>FL-BR5020W</td>
<td>FL-BR5020W</td>
</tr>
<tr>
<td></td>
<td>FL-BR9120W</td>
<td>FL-BR9120W</td>
</tr>
<tr>
<td>Ambient operating temperature</td>
<td>0-40°C</td>
<td>0-40°C</td>
</tr>
<tr>
<td>Ambient operating humidity</td>
<td>35-85%RH (no condensation)</td>
<td>35-85%RH (no condensation)</td>
</tr>
<tr>
<td>Ambient storage temperature</td>
<td>-10-60°C (no freezing)</td>
<td>-10-60°C (no freezing)</td>
</tr>
<tr>
<td>Dimensions</td>
<td>W218mm x H60mm x D449 mm (except protrusions)</td>
<td>W218mm x H60mm x D449 mm (except protrusions)</td>
</tr>
<tr>
<td>Weight</td>
<td>Abt. 2.5kg (camera attachment only)</td>
<td>Abt. 2.5kg (camera attachment only)</td>
</tr>
</tbody>
</table>

*1 Also compatible with the MX-Z2000H series and MX-Z2000G series laser markers. Consult with your sales representative for details.

*2 The image output from the camera is a mirror image. Mirror image processing must be performed by the camera controller.

*3 The FQ2 cannot correct the mirror image, meaning that the mirror image will remain as is. The FH can correct the mirror image under the trapezoidal distortion correction heading.

*4 The image captured by the camera will show some distortions, such as being diagonally off or off the optical axis. The marked image on the screen may therefore look distorted or off-center.

*5 Provide a separate 24VDC power supply for the lighting.

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**MX-9150, MX-9151**

![Diagram of MX-9150, MX-9151](image-url)
Controllers & I/O
• Machine Automation Controllers (MAC) • Motion Controllers
• Programmable Logic Controllers (PLC) • Temperature Controllers • Remote I/O

Robotics
• Industrial Robots • Mobile Robots

Operator Interfaces
• Human Machine Interface (HMI)

Motion & Drives
• Machine Automation Controllers (MAC) • Motion Controllers • Servo Systems
• Frequency Inverters

Vision, Measurement & Identification
• Vision Sensors & Systems • Measurement Sensors • Auto Identification Systems

Sensing
• Photoelectric Sensors • Fiber-Optic Sensors • Proximity Sensors
• Rotary Encoders • Ultrasonic Sensors

Safety
• Safety Light Curtains • Safety Laser Scanners • Programmable Safety Systems
• Safety Mats and Edges • Safety Door Switches • Emergency Stop Devices
• Safety Switches & Operator Controls • Safety Monitoring/Force-guided Relays

Control Components
• Power Supplies • Timers • Counters • Programmable Relays
• Digital Panel Meters • Monitoring Products

Switches & Relays
• Limit Switches • Pushbutton Switches • Electromechanical Relays
• Solid State Relays

Software
• Programming & Configuration • Runtime