Smart and effortless plastic welding

We are introducing a new plastic welding system with a galvano scanner which neither requires a robot or X-Y stage for moving the laser source, the optical part, and the laser emitting unit nor a control system to coordinate the three parts.

The VL-W1 series incorporates all necessary components. Our all-in-one system reduces the resources for installing and operating a complex system.

The VL-W1 series proves that using a laser plastic welding system can be smart and effortlessly.
Applications of the laser welding system VL-W1

- Electrical sensors
- Electronic control unit
- Waterproofed display device
Equipped with galvano scanner

The VL-W1 offers compact dimensions. Furthermore, the galvano scanning system uses the galvano mirror built in the laser head to scan the laser, thus eliminating the need to move the head. It does not require a robot or X-Y stage and therefore reduces the need for resources when designing a complex system.

Conventional laser plastic welding system

Galvano scanning laser plastic welding system

Power correction for curved sections

With normal laser output, the heat tends to accumulate more at curved sections than at straight sections. This may lead to uneven welding results. The VL-W1 series optimizes the laser output at curved sections to achieve a uniform welding result even at complex welding patterns.

Digital galvano system

The digital galvano system boasts significantly better temperature characteristics than the analog systems. A change in the surrounding temperature does not lead to deviations of the beam position as with analog galvano systems. This way, a stable production quality is ensured.
High-quality welding

The VL-W1 series is equipped with our original, high-performance fiber laser developed based on the technologies we have accumulated through the manufacture of laser marking systems. This fiber laser achieves high-quality welding results.

Laser quality M² < 1.1

The VL-W1 series has achieved M² < 1.1 using original fiber laser technology. M² is a numeric value which indicates the quality of the laser beam. The closer this value is to 1.0, the higher the quality of the laser beam.

Laser output stability within ±3%

The fiber laser emits a beam with stable output regardless of the temperature fluctuation of the laser diodes. The laser output stays stable immediately after power ON until production operation halt. Thus, a high production quality is ensured.

Fiber laser oscillation principle

The fiber laser is a type of solid-state laser that uses an optical fiber as an amplification medium. Since light can be amplified inside an extremely thin fiber core, a laser light with a high beam quality can be obtained.

Parallel light

The combination of the high-quality M² < 1.1 beam and our proven optical design has realized a parallel light beam with minimal beam widening. This allows working on different planes and enables a precise laser beam emission even very close to the edge of parts.

Variable beam diameter

The variable beam diameter mechanism enables the adjustment of the beam diameter between 0.7 and 2.0mm. Therefore the desired welding width can be set without replacing the optical parts.

Panasonic: Parallel light on different planes

Conventional Nd:YAG laser

-15mm Base position +15mm

Panasonic VL laser

Workpiece

Light intensity distribution

Fiber laser beam

Transmission fiber

Excitation LD light

Light of excited laser diodes

Fiber amplification

Fiber sheath

Fiber core (Yb)

Different beam diameters

ø0.7mm ø1.0mm ø1.5mm ø2.0mm

Beam diameter adjusting scale
Laser output power monitoring

The VL-W1 series features a high-performance monitor in its head. It monitors the laser output power accurately at real-time during welding. This is extremely useful for recording and managing the laser output power.

**High-speed sampling: 10ms**

The laser output power can be captured and read out in 10ms intervals immediately after the emission starts.

**Measurement precision: ±2%**

Our high-performance components ensure a high measurement precision of ±2%.

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Real-time power meter

The data measured by the high-performance power meter can be output in real time in three different ways. This function is useful for production and quality management.

**Voltage output**

1 to 5 V

**Current output**

4 to 20 mA

**Serial output**

Ethernet

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Quality management with measurement results

This functionality sends a notification to an external device when the laser power exceeds the preset upper or lower limit during emission. It supports you in adhering to the required quality standards.
Easy operation

The operation with the color touch panel (optional) is easy to use. The LC display allows an intuitive operation.

**Step 1: Draw welding seam**
You can draw a workpiece’s contour easily on the special screen. Patterns such as “Line,” “Circle,” “Arc” or “Rectangle” can also be combined.

**Step 2: Check position**
The laser position can be checked with the red pointer. This function ensures accurate positioning.

**Step 3: Set parameters**
There are three basic parameters to be set: “Laser power,” “Scan speed” and “Scanning frequency.” With “Detail,” you can make fine adjustments.

**CAD data import function**
Complex patterns can be produced with CAD software and imported to the VL-W1. If you need a quick response to a change in design this is the right answer.

**Spiral function**
The spiral width can be flexibly changed in the longitudinal or transverse direction. An appropriate pattern can be easily set according to the workpiece and the required laser energy. Even thick welding seams are no problem with the spiral function.
Enhanced safety functions

ISO 11553-1 compliance
A shutter blocks the laser beam and an interlock terminal shuts off the power supply of the laser oscillator. Both are implemented as separate interfaces to configure a double safe system.

Removable fiber unit
The fiber unit can be detached and removed from the laser head. This allows easy installation of the equipment and facilitates the maintenance.

Comfortable maintenance functions

Error log display
The error log data can also be saved.

I/O monitor function
You can check the I/O states during the welding process in real time.

Convenient onsite adjustment

Adjustment of overlapping start and end points
This function adjusts the overlap amount at the start and end points of the laser beam.

Adjustment of distance between workpieces
The distance between workpieces can be adjusted using the software. This is especially useful when welding parts with different heights use the same welding pattern.

Sequence editing
If part sections warp or show sink marks, the welding sequence can be changed.

Guide laser
The red visible beam of the guide laser helps to confirm the welding position in different ways.
**Laser plastic welding principle**

Laser welding joins plastic pieces by emitting laser radiation and generating heat at the boundary surface without using any adhesive. The laser beam must pass through the laser transparent (upper) material, and then will be absorbed by the laser absorbing (lower) material.

![Diagram of laser plastic welding process]

**Laser welding in Panasonic products**

Laser welding machines achieve excellent seals and produce no powder dust and minimal burrs. Our company uses the laser welding equipment in its own product manufacturing processes. Some examples are shown below.

**Compatible plastic materials**

<table>
<thead>
<tr>
<th>Plastic materials</th>
<th>Strong weld</th>
<th>Weak weld</th>
<th>No weld</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABS</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>ASA</td>
<td></td>
<td></td>
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<tr>
<td>MABS</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>PA6</td>
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<td></td>
<td></td>
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<tr>
<td>PA6i</td>
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<tr>
<td>PA12</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>PBT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PBT/ASA</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PC/ABS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PE-LD</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>PE-HD</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>PEEK</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>PES</td>
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<td>PET</td>
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<td>PMMA</td>
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<td>POM</td>
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<td>PPS</td>
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<td>PVC</td>
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<td></td>
<td></td>
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<tr>
<td>SAN</td>
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</tr>
</tbody>
</table>

Note: Natural material on beam transparent side; black-colored (carbon black) material on laser absorbing side.

Plastic materials that can be laser-welded are primarily thermoplastic materials. Even if the materials are divided in laser transmitting and laser absorbing materials, both can be welded, provided the laser transparent side has a laser transmittance of at least 15% to 20%. The material on the laser transparent side does not necessarily have to be translucent.

If you have any questions regarding the compatibility of materials, please consult our company.
**Head**

Laser radiation indicator
Laser pointer emission port

**Controller**

**VL-W1500 / VL-W11506**

Head control cable
Fiber cable
Head power supply cable

**VL-W1A00 / VL-W1A06**

Head power supply cable
Head control cable
Fiber cable

**Touchpanel LP-ADP40 (sold separately)**

Controller connection cable
M4 mounting nut depth 6 (for left and right sides)

*The CAD data can be downloaded from our website.*
### Specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>Model No.</th>
<th>VL-W1500</th>
<th>VL-W1A00</th>
<th>VL-W1506</th>
<th>VL-W1A06</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laser output power</td>
<td></td>
<td>50W</td>
<td>100W</td>
<td>50W</td>
<td>100W</td>
</tr>
<tr>
<td>Output power at workpiece</td>
<td>Yb fiber laser; (\lambda = 1070\text{nm}), class 4, CW oscillation</td>
<td>45W ±5%</td>
<td>90W ±5%</td>
<td>45W ±5%</td>
<td>90W ±5%</td>
</tr>
<tr>
<td>Guide laser, pointer</td>
<td>Red semiconductor laser; (\lambda = 655\text{nm}); class 2 laser; Maximum output 1mW or less</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scanner</td>
<td>Digital galvano scanner</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Setting range (X, Y)</td>
<td></td>
<td>200 × 200mm</td>
<td>400 × 400mm</td>
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<td></td>
</tr>
<tr>
<td>Working distance (base position ± preset range)</td>
<td></td>
<td>315 ±15mm</td>
<td>665 ±15mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scan speed</td>
<td></td>
<td>Maximum 3000mm/s</td>
<td></td>
<td></td>
<td></td>
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<td>Registration files</td>
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<td>2048 files</td>
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<td>Importable graphic data (file format)</td>
<td>VEC, DXF, HPGL, BMP, JPEG</td>
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<tr>
<td>Welding geometry</td>
<td></td>
<td>Straight line, circle, arc, quadrilateral, fixed point</td>
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<tr>
<td>External memory device</td>
<td></td>
<td>USB media</td>
<td></td>
<td></td>
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<tr>
<td>I/O ports</td>
<td></td>
<td>I/O terminal block, I/O connector, interlock connector, power data output (RS232C)/shutter closing output terminal</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Serial communication interface</td>
<td></td>
<td>RS232C (for system control, for power data), Ethernet (for system control)</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Cooling method</td>
<td></td>
<td>Head: air cooling, controller: forced air cooling</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power supply</td>
<td></td>
<td>90–132V AC or 180–264V AC, 50/60Hz (automatic switching)</td>
<td></td>
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<tr>
<td>Power consumption</td>
<td>max. 580VA (at 100V AC), max. 720VA (at 200V AC)</td>
<td>max. 740VA (at 100V AC), max. 830VA (at 200V AC)</td>
<td>max. 580VA (at 100V AC), max. 720VA (at 200V AC)</td>
<td>max. 740VA (at 100V AC), max. 830VA (at 200V AC)</td>
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</tr>
<tr>
<td>Ambient temperature</td>
<td></td>
<td>0 to +40°C (head, controller)</td>
<td></td>
<td></td>
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<tr>
<td>Storage temperature</td>
<td></td>
<td>-10 to +60°C (head, controller)</td>
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<td></td>
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</tr>
<tr>
<td>Ambient humidity</td>
<td></td>
<td>35 to 85% RH (head, controller)</td>
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<tr>
<td>Degree of protection</td>
<td></td>
<td>IP54 (IEC) (only for connected head section)</td>
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<tr>
<td>Supplied cable</td>
<td></td>
<td>Controller power supply cable: 3 ±0.1m, ø7mm for CE standard, ø9mm for PSE/CSA/UL standards</td>
<td>Head power supply cable: 5.5 ±0.1m, ø11mm</td>
<td>Head control cable: 5.5 ±0.1m, ø12mm</td>
<td></td>
</tr>
<tr>
<td>Fiber cable</td>
<td></td>
<td>5 ±0.2m, ø7mm, minimum bend radius: 50mm</td>
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<tr>
<td>Net weight</td>
<td>Head</td>
<td>28kg</td>
<td>35kg</td>
<td>28kg</td>
<td>35kg</td>
</tr>
<tr>
<td></td>
<td>Controller</td>
<td>12kg</td>
<td>11kg</td>
<td>12kg</td>
<td>11kg</td>
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<tr>
<td>Main unit display language</td>
<td></td>
<td>Japanese/English</td>
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<td></td>
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<tr>
<td>Supplied software</td>
<td></td>
<td>Laser Processing Utility_VL-W1 (logo data conversion software, logo data editing software)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supported OS</td>
<td></td>
<td>Microsoft® Windows® 7 Professional (32bit/64bit) (Japanese/English/Simplified Chinese)</td>
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</tr>
</tbody>
</table>

### Reliable support in all stages

Panasonic conducts preliminary tests with the customer’s application and offers support in developing clamping units. We provide extensive support to ensure safe and reliable laser welding from the developing stage to the serial production.

**Preliminary test**  
Verification of laser welding results using test pieces

**Installation and operation**  
Support until first start-up of operation

**Production test**  
Laser welding test during current production

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### Test piece

- **Tensile test**
- **Airtightness test**
- **Test equipment**