Unique one process solution: Laser sintering and milling.

The LUMEX Avance-25 is a single machine platform integrating a fiber laser for state of the art metal sintering and a machining center for performing high accuracy, high speed milling.

Revolution of metal processing.

Metal laser sintering is a technique that uses a laser beam to sinter metal powder into a variety of forms. Conventional metal laser sintering has certain limitations on machining accuracy and surface smoothness and requires a large number of post-processing stages, such as electrical discharge processing and milling stages. The LUMEX Avance-25 performs both metal laser sintering and end-mill finish milling alternately, which provides molds with dimensional accuracy and surface smoothness at almost the same level as machining centers do. Furthermore, the LUMEX Avance-25 performs deep rib machining, which conventional machining centers cannot perform.

Significantly reducing the required production time of mold dies.

The LUMEX Avance-25 eliminates conventional processes, such as mold die splitting, electrical discharge processing, electrode designing, the fabrication of additional cooling water pipes, and assembly and adjustment work, thus greatly reducing the required time of mold die designing and processing. The LUMEX Avance-25 powerfully supports the quick launching of new products and high-mix low-volume production.

Changing common knowledge for mold die making.

The conventional production of mold dies requires advanced skills, such as mold die splitting, electrical discharge processing along with electrode designing for deep rib formation, and the arrangement of internal water pipes. The LUMEX Avance-25 fabricates complicated mold dies at a stretch without splitting them. The LUMEX Avance-25 leads to a fundamental change in common knowledge for mold die making.

Advanced sintering functionality - future proof versatility.

The LUMEX Avance-25 sinters workpieces at near net shape, 3D objects with complex interior structures and creates components with hollows, 3D meshes and free form surfaces. This unique and dynamic production platform is attracting interest from every manufacturing sector looking for new solutions for components and products that currently have no cost effective, reliable method of manufacture.
Revolutionary, unique and dynamic production platform
Creating components with complex internal cooling pipes and performing porous sintering with ease. Rapid production of high performance mold dies.

No splitting: Create mold die parts in one

The **LUMEX Avance-25** performs the sintering of complicated mold dies without splitting them, thus eliminating assembly and adjustment stages and making it possible to produce mold dies with no dimensional errors that may be caused by conventional assembly processes.

- Conventional work method
- Metal laser sintering and hybrid milling

Porous sintering for gas venting

The **LUMEX Avance-25** can freely make sintering density changes for the placement of porous structures and air permeability control without restrictions, thus performing gas venting more effectively than any other machine. Users can expect the reduction of resin filling time, prevention of uneven filling, and elimination of gas burning.
Performing the sintering of deep ribs with no electrical discharge processing

The LUMEX Avance-25 builds up laminations of layers by metal laser sintering and cuts them at high speed, thus making it possible to perform the high-precision machining of deep ribs and thin ribs. The LUMEX Avance-25 allows metal sintering without using electrical discharge processing.

A 60% reduction in working hours required for designing through to machining

The LUMEX Avance-25 can machine a number of mold dies without splitting them, thus not requiring electrical discharge processing, assembly, or adjustment work. The LUMEX Avance-25 greatly reduces the required time of designing and computer-aided machining (CAM) time. The LUMEX Avance-25 saves the required designing time and CAM processing time of mold dies by approximately 23% and 90%, respectively, even if the mold dies have a large number of deep ribs, and reduces the required machining time by at least 50%. The LUMEX Avance-25 saves a total of 61.5% of metal manufacturing time compared with the conventional work method.

Creation of internal cooling pipes and structures

The LUMEX Avance-25 makes possible the creation of integrated cooling pipes internally on any component, mold or die. Compared to conventional post process cooling pipes, those created on the LUMEX are far superior and efficient at cooling, contributing to a significant reduction in injection molding time.

- 3D placement of cooling water pipes inside mold dies
- Excellent cooling effect: Cooling effect improvement by 30% with a 40% reduction in cooling time.

Resin temperature distribution

Conventional water pipes 3D cooling water pipes

Comparison of mold die production

Conventional work method

- Mold die designing 18.0%
- Electrode designing 23.0%
- Material rough machining 59.0%
- Lathe machining
- Grinding
- NC processing
- MC processing
- Electrical discharge processing
- Wire machining, and others

13.9% 10.2%
2.4% 12.0%

Designing: 23% reduction
Data production: 90% reduction
Machining: 90% reduction

A 61.5% reduction in working hours required for designing through to machining.
Contributing to a significant time reduction and quality improvement.

The LUMEX Avance-25 significantly reduces the required designing and production time of mold dies. Manufacturers can expect a reduction in molding time but also quality improvements in their molds from the 3D placement of water pipes in the mold dies and porous sintering. The LUMEX Avance-25 realizes new molding solutions that conventional mold dies could not.

Mold die production

Reducing the required time of work to 1/2 and the cost to 1/2 of conventional work methods.

The LUMEX Avance-25 designs core mold dies with deep holes and ribs without splitting the mold dies. The LUMEX Avance-25 can make effective use of 3D CAD design data consistently. Furthermore, no electrical discharge processing is required, which greatly reduces the required time of mold die production.

Molding cycle

The 3D placement of water pipes in mold dies enables highly efficient cooling within a short time.

The LUMEX Avance-25 can freely build cooling pipes three-dimensionally into mold dies, and provide excellent cooling efficiency, thus realizing a molding cycle reduction and contributing to productivity improvements.

Production Examples

Manufacturing highly functional complicatedly shaped dies of integrated construction with ease.

The LUMEX Avance-25 is a standalone machine that manufactures high-function dies in a single process with cooling water pipes placed three dimensionally inside the dies. The dies manufactured by the LUMEX Avance-25 are the same with those manufactured by machining centers in dimensional precision, surface smoothness, and life. Furthermore, the LUMEX Avance-25 performs surface treatment, such as nitride treatment and embossed treatment as well. The LUMEX Avance-25 is effective to improvements in the precision of injection molding and molding cycle shortening.

Fan (cavity and core)
Material: Matsuura Steel I

Electric screwdriver (head)
Material: Matsuura Steel I

Connector
Material: Matsuura Steel I

EV electrical component
Material: Matsuura Steel I
Ideal for molding products that cannot be manufactured by conventional milling and customized products.

The LUMEX Avance-25 makes it possible to mold products in shapes that cannot be formed in conventional methods, such as products with deep ribs, 3D meshes, hollows, free-form surfaces, or porous structures to be built into desired positions in a single process. The LUMEX Avance-25 can be used to manufacture customized products, such as artificial bones.

Molding quality

The LUMEX Avance-25 can place porous structures freely, thus making effective gas venting possible and improving the quality of molds. The LUMEX Avance-25 can make porous structures for gas venting in any places, thus preventing molding problems, such as gas burning, weld line formation, and shrinkage and contributing to quality improvements.

<table>
<thead>
<tr>
<th>No gas extraction</th>
<th>Gas extraction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extraction speed (mm/s)</td>
<td></td>
</tr>
<tr>
<td>30 35 40 45 50 55 60 65 70 75 80 85</td>
<td></td>
</tr>
<tr>
<td>With no gas extraction (Extraction rate: 21.0 l/min)</td>
<td></td>
</tr>
</tbody>
</table>

Data provided by OPM Laboratory Co., Ltd.

Improvement in cooling efficiency

- Conventional water pipe
  - Cooling period of 30 seconds
- 3D cooling water pipe
  - Cooling period of 20 seconds
  - Molding cycle shortened by 20%
Repeating metal laser sintering and high-speed milling to form metal powder into shapes.

The **LUMEX Avance-25** repeats metal laser sintering and high-speed, high-precision milling to form metal powder into shapes and makes deep ribs with no electric discharge processing in a single process. The **LUMEX Avance-25** provides molds with dimensional accuracy and surface smoothness at almost the same level as machining centers do.

1. **Squeezing**

Metal powder as sintering material is laminated to a thickness of 0.05 mm on the base plate located on the table.

2. **Laser sintering**

The **LUMEX Avance-25** irradiates the laser beam to sinter the metal powder into the product shape to be bonded to the processing table. After the metal powder is sintered, the **LUMEX Avance-25** squeezes and supplies metal powder with a thickness of 0.05 mm to form the next layer and sinter all the laminated layers. Steps 1 and 2 are repeated 10 times. When the thickness reaches 0.5 mm (0.019 in.), the **LUMEX Avance-25** goes to the stage of milling.

**Automatic settings for squeezing range** (Patent pending)

The **LUMEX Avance-25** is provided with a function to set a squeezing range along with the feed speed of the squeezing blade for efficient work. The settings can be manipulated intuitively with icons and buttons displayed on the touch panel.
3. Milling

The end mill performs the high-speed milling of the contour of the mold highly precisely to a finish. The LUMEX Avance-25 does not cut the product to a finish after all the sintering of the product is finished. Instead, the LUMEX Avance-25 repeats the sintering and milling of the product to construct the bottom layer to the top layer, no matter how the internal shape is complicated.

Break-in milling function for squeezing overloads

In a rare case, laser sintering causes an undulating upper surface to a workpiece. If this occurs, the squeezing blade can come in contact with the surface at the time of spreading metal powder, in which case the alarm function of the LUMEX Avance-25 may stop the operation of the LUMEX Avance-25. To avoid this, the LUMEX Avance-25 is provided with a break-in milling function that automatically cuts and removes the protrusions on the surface so that the LUMEX Avance-25 can continue operating.

Automatic tool changing function to replace broken tools

If the tool in use is damaged, this function will automatically replace the tool with a reserved one so that the LUMEX Avance-25 can continue operating.
Functions

Reliable specifications to achieve high-speed, high-precision machining.

The **LUMEX Avance-25** consists of Matsuura’s time-proven machining center combined with a metal laser sintering function.

The specifications of the **LUMEX Avance-25** realize high-speed, high-precision machining.

---

**Yb Fiber Laser (400 W)**

The **LUMEX Avance-25** incorporates a high-efficiency Yb fiber laser of high beam quality. The beam diameter can be reduced to realize high-power, high-resolution processing. The Yb fiber laser in combination with Matsuura’s galvanometer mirror performs finer sintering. Furthermore, the Yb fiber laser ensures ease of maintenance.

---

**High-speed spindle (45,000min⁻¹)**

The **LUMEX Avance-25** incorporates Matsuura’s time-proven high-speed, high-rigidity oil-air lubricated spindle that rotates at 45,000 min⁻¹ and a 1/10 taper special BT20 tool shank.

---

**Linear motor drive**

The **LUMEX Avance-25** incorporates a linear motor provided with Matsuura’s unique control technology to perform high-speed feeding (X/Y: 60 m/min (2.36 ipm) and 30 m/min (1.18 ipm)) and attains high-precision machining.

---

**Sintering table**

Metal laser sintering is processed at this stage. The upper surface of the table is heated to alleviate rapid temperature changes resulting from laser sintering, thus increasing the sintering precision of the **LUMEX Avance-25**.
Oxygen concentration and temperature display

The metal powder in the chamber becomes very hot during the sintering process. Therefore, the chamber is filled with inert gas, such as nitrogen. The concentration and temperature of the oxygen in the chamber are strictly controlled and displayed on the control panel. The LUMEX Avance-25 is provided with a safety function that will alert errors, if any, and stop the operation of the LUMEX Avance-25.

Supply of sintering material

Sintering material (metal powder) is supplied automatically regardless of whether the LUMEX Avance-25 is in sintering or milling operation. It makes it possible to set up tools externally when the chamber is filled with nitrogen so that work efficiency will be improved.

Tool magazine

The LUMEX Avance-25 incorporates a tool magazine that can accommodate 20 milling tools. The LUMEX Avance-25 also incorporates an automatic measuring device to measure the length of a tool when the tool is mounted to the spindle. The tool magazine makes it possible to set up tools externally when the chamber is filled with nitrogen so that work efficiency will be improved.

CCD camera

The LUMEX Avance-25 incorporates a high-precision CCD camera with dedicated software. Matsuura’s visual sensing with feedback technology realizes unprecedentedly high-precision laser sintering.

Squeezing unit

The squeezing unit is used to supply sintering material (metal powder) to the sintering table. It is possible to specify the operating range of the squeezing unit, which enables speedy squeezing without waste. [Patent pending]
Operability

Intuitive, Ergonomic Interface

The **LUMEX Avance-25** employs the **I-Tech Avance**, a new system dedicated to metal laser sintering and hybrid milling. The touch panel of the **LUMEX Avance-25** can display 3D models, thus ensuring high operability.

Operation panel

The operation panel placed on the front side of the machine is used for NC control with the new system **I-Tech Avance**. The operation panel is of touch panel type displaying 3D models, and realizes excellent operability. The **LUMEX Avance-25** does not incorporate external switches that are unused while the **LUMEX Avance-25** is in automatic sintering or milling operation. All switches necessary for setup and milling checks are concentrated into the hard switch blocks inside the panel.

Operation screen

The operation screen is a 15-inch touch panel with function and purpose buttons located on the bottom of the screen and submenu buttons on the right-hand side. The operation screen has a user-friendly design.
Run monitor screen

The **LUMEX Avance-25** allows the monitoring of sintering images and a variety of data, such as NC data and process data at the time of laser sintering and milling. The NC data screen displays the progress of machining and tool information. The process data screen shows the process of laser sintering and milling in a tree, ranging from the first layer to the nth layer.

Machine operation screen

This screen is used to help the operator set machine tools in the machine. The left-hand side of the screen displays a tool list sent from a CAD/CAM system. The operator selects sintering tools on the left-hand side of the screen and sets them on the right-hand side of the screen. Then the machine recognizes and displays the tools on the right-hand side of the screen. Besides, the machine operation screen allows tool life management, coordinate system, squeezing coordinate value, and speed settings.

Project management screen

The project management screen is used to manage and select sintering projects. Data on sintering projects can be transferred from external devices (e.g., USB memory sticks) and LANs. A thumbnail display function is provided so that the final sintering image of each project will be displayed.

Maintenance screen

The maintenance screen allows a variety of function settings, such as basic galvano controller basic settings and PLC parameter settings, and makes PLC status monitoring possible. Besides, the screen can display check items on ATC, daily, and periodical inspections and tool information. The process data screen shows the process of laser sintering and milling in a tree, ranging from the first layer to the nth layer.
### Movement And Ranges

- **X-Axis Travel (Table Left/Right)** mm (in.) 260 (10.23)
- **Y-Axis Travel (Table Back/Forth)** mm (in.) 260 (10.23)
- **Z-Axis Travel (Head Up/Down)** mm (in.) 100 (3.93)
- **W-Axis Travel (Material Layer Sintering Blade)** mm (in.) 522 (20.55)
- **Distance from Table to Spindle End** mm (in.) -10 - 90 (-0.39 - 3.54)

### Table

- **Table Working Surface** mm (in.) 270 × 270 (10.62 × 10.62)
- **Table Loading Capacity** kg (lb.) 90 (198)
- **Max. Table Size** mm (in.) 246 × 246 (9.68 × 9.68)
- **Table Surface Configuration** M6(P1) × 50mm Pitch × 24
- **Distance from Floor to Table Surface** mm (in.) 980 (38.58)

### Spindle

- **Spindle Speed Range** min⁻¹ 450 - 45000
- **Spindle Bearing Inner Dia.** mm φ25
- **Spindle End 1/10 Taper** No. 20
- **Spindle Max. Torque** N・m 0.7
- **Spindle Air Blow** YES

### Feedrate

- **Rapid Traverse Rate (X/Y/Z)** mm/min (ipm) 60000 / 60000 / 30000 (2,362.2 / 2,362.2 / 1,181.1)
- **Feedrate (X/Y)** mm/min (ipm) 1 - 60000 (0.03 - 2,362.2)
- **Feedrate (Z)** mm/min (ipm) 1 - 30000 (0.03 - 1,181.1)
- **Feedrate Max. Acceleration (X/Y/Z)** G 1.0 / 1.0 / 0.5

### Automatic Tool Changer

- **Type Of Tool Shank** Matsuzawa Special #20
- **Pull Stud** Matsuzawa Special #20
- **Tool Storage Capacity** PCS. 20
- **Max. Tool Diameter** mm φ10
- **Max. Tool Length (Conditions Attached)** mm Specified: Matsuzawa Special
- **Max. Tool Length** mm 180
- **Tool Max. Protrusion Length from Tool Holder: A** mm 8 ≤ 3 × 6 ≤ 3,4,6,8,10
- **Tool Max. Protrusion Length from Tool Holder: B** mm 8 ≤ 30 ≤ " 50
- **Max. Tool Weight** kg (lb.) 0.25 (0.55) (Including holder)
- **Tool Changing Time (Tool To Tool)** sec 25
- **Tool Changing Time (Tip To Tip)** sec 30
- **Tool Changing Method** Fixed Address

### Motors

- **Spindle Motor** Uaasih-05Emu21 kW AC 2.3 / 3.3
- **Feed Motors**
  - Z-Axis: 1Fh3050-2W300-05a40 kW AC 5.0
  - Z-Axis: 1Fh3050-4Sa00-05a40 kW AC 2.0
  - Z-Axis: 1Fh3150-4Sa00-05a40 kW AC 1.0
  - U-Axis: Model Sgmp-084a2d kW AC 0.85
  - W-Axis: Model Sgma-044a2d kW AC 0.4
  - Tool Magazine Motor: Model Sgma-034a2d kW AC 0.2
  - Material Feed Motor kW AC 0.03
  - Feed Axis Grease Auto Feeder Motor kW AC 0.025
  - Oil Cooler (Spindle)/Linear Motor Cooling Motor kW AC 0.75

### Laser

- **Type** Yb Fiber Laser
- **Oscillator Output Range** W 40 - 400
- **Beam Mode Quality Value (M2)** < 1.1
- **Beam Spread Angle (Full Width)** mrad 0.5
- **Wavelength** nm 1070 ± 5

### Laser Scanning Module

- **Scanning Module X-Axis And Y-Axis** Galvano Scanner System
- **Z-Axis** Linear Translator
- **Applicable Laser Wavelength** nm 1070 ± 5
- **Max. Input Laser Power** W 400
- **Drive Power Supply** DC 24V

### Power Supply

- **Electrical Power Supply** kVA 39 (varies with option configuration)
- **Power Supply Voltage** V AC 200/220±10%
- **Transformer required if supply voltage is other than above**
- **Power Supply Frequency** Hz 50 / 60 ± 1
- **Compressed Air Supply** MPa 0.6 - 0.93
- **Volume Of Compressed Air To Be Supplied** NL/min 500 (Atmospheric Pressure)
- **Tank Capacity** L
- **Machine Size** (From Floor) mm (in.) 2050 (80.70)
- **Floor Space** (Incl. Maintenance Area) mm (in.) 3200 W × 4650 D (125.98 W × 183.07 D) (varies with option configuration)
- **Mass Of Machine** kg (lb.) 4500 (9900)
**Peripheral device**

Nitrogen gas generator
The nitrogen gas generator is used to generate nitrogen to be filled into the chamber in laser sintering process. The nitrogen gas generator can separate and provide nitrogen from the atmosphere within a short time whenever required. The nitrogen gas generator is so compact that it will be easy to find a place to locate the nitrogen gas generator.

Chiller
The chiller is used to cool the laser oscillator and prevent equipment damage resulting from heat radiation.

**Machine Optional Specifications**

- **Spindle Speed Per Min**
  - 60000min⁻¹ (6 dia. Straight Shank)
  - 6 dia. Straight Shank, SS5000-S60000, 2.0-kW motor with grease filled (Simultaneously select atc for 6 dia. Straight Shank use)

- **Number of Tools Accommodated**
  - 20 Tool (Dia. 6 Straight Shank, Address Code)
  - Select spindle for 6 dia. Straight Shank as well

- **Power Supply Frequency**
  - Frequency 50Hz

- **Language**
  - Plate Display English Overseas Standard
  - Plate Display German

- **European Safety Regulation**
  - CE Mark Specifications

- **Material**
  - Powder Material 10kg Unit
  - Iron Powder Auto Collector

- **Fume Collector**
  - Auto Measure/Tool Breakage
  - Sinter Form Cutting Program/Cam Soft

- **Metal Parts**
  - Special Machine Color (NC Box: Specified Separately)
  - Special Machine Color (NC Box: Std.)
  - Special Machine Color (NC Box: Same)

- **Frequency**
  - 50Hz

- **Accuracy**
  - Positioning Accuracy (X/Y/Z) ±0.0025 (0.000039)
  - Repetitability (X/Y/Z) ±0.001 (0.000039)

- **Machine Capabilities**
  - X-Axis Thrust: 4 (4000 N)
  - Y-Axis Thrust: 2.3 (2300 N)
  - Z-Axis Thrust: 0.38 (380 N)

- **Standard Accessories**
  - 01. Total Enclosure Guard + Top Side Cover
  - 02. Door Interlock
  - 03. Oil Temperature Controller
  - 04. Air Dryer
  - 05. Linear Motor Cooler
  - 06. Scale Feedback X/Y/Z: Heidenhain (absolute)
  - 07. Z-Axis Balance Cylinder
  - 08. Nitrogen Gas Separator
  - 09. Interior Temperature Sensor
  - 10. Oxygen Densitometer
  - 11. Galvanor Scanner/Laser Controller
  - 12. CCD Camera/Image Processor
  - 13. Feed Axis Great Auto Feeder X/Y/Z-Axis Guide Only
  - 14. Spindle Integrated Run Meter
  - 15. Laser Integrated Run Meter
  - 16. Preheating Heater/Controller
  - 17. Sensor for Auto Tool Measurement (Contact type)
  - 18. Work Lighting Apparatus
  - 19. 3-Tier Pallet (Red/Yellow/Green from Top)
  - 20. Sinter Form Cutting Program/Cam
  - 21. Sinter Form Cutting Program/Cam Soft

**Metal Powder Material**

- **Material**
  - SUS316l Matsuura Stainless 316L
  - SUS630 Matsuura Stainless 630
  - Ti-6Al-4V Matsuura Titanium 6AI4V (*1)
  - Ti-6Al-7Nb Matsuura Titanium 6AI7Nb (*1)
  - Maraging Matsuura Maraging I
  - Steel Matsuura Steel I
  - Pure Titanium Matsuura Titanium 00 (**)
  - Sinter Form Cutting Program/Cam

* Use only specified sintering materials. Order required sintering materials from Matsuura Machinery Corporation.

**OPTION**

- **Fume Collector**
  - The fume collector eliminates fume (metal vapor agglomerate) and odor generated at the time of laser processing. The fume collector eliminates flux, oil, and adhesive ingredients, thus preventing clogging.

- **Cyclone Cleaner**
  - Unused material (metal powder) can be collected and reused. Usually, such material is collected manually. If the cyclone cleaner as an optional device is mounted to the LUMEX Avance-25, however, the LUMEX Avance-25 will collect the material automatically with the cyclone cleaner promptly and powerfully.
Products are subject to all applicable export control laws and regulations.