

LASER WELDING FOR MOULD REPAIR

SWA 150-300



System Description

Machine designed and constructed for making modifications and repairs on moulds damaged by wear or use.

The use of a laser for material infill has revolutionized the conventional mould welding techniques, allowing repairs without resorting to preheating the dies and with an inconsequential heat contribution during the filling material deposit process. This allows to avoid classic collateral damage caused by TIG welding such as: geometric distortions, burning of the edges and decarbonization. The properties of the laser beam make it possible to weld complex zones such as deep and narrow grooves or inner and outer edges. All steels, bronze and copper alloys, aluminum and titanium can be welded. The hardness of the welding layers can reach very high values depending on the type of filler wire used.

The simple operating procedures and perfect visual control of the infill through the stereomicroscope make this technology accessible to everyone, without having to resort to highly qualified engineers.

The SWA 150-300 unit is powered by a flash lamp-pumped Nd:YAG laser generator with laser pulse transmission through optical fiber and is equipped with a system for movement along the motorized x, y, and z axes controlled by a joystick and button panel.

The laser source has been designed to guarantee high operating stability at both low and high power; fiber transport of the laser pulse provides a smaller beam diameter along with high stability of the laser spot, both in the initial transients and at various thermal loads of the laser source.

The fully integrated cooling system is suitable for both small infill operations and extended use.

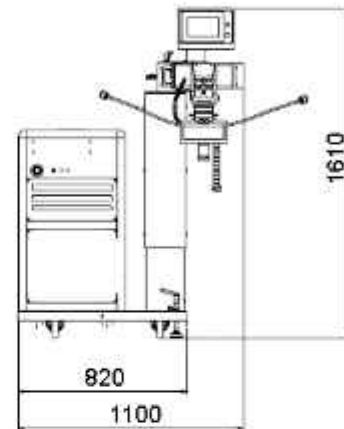
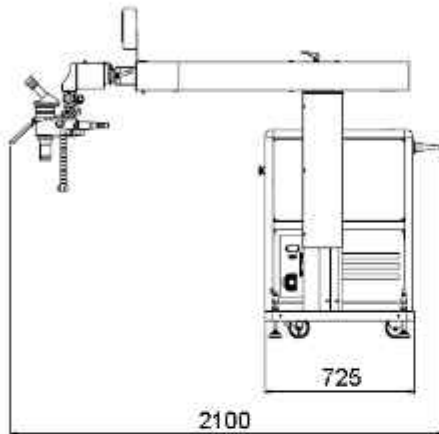


Technical data

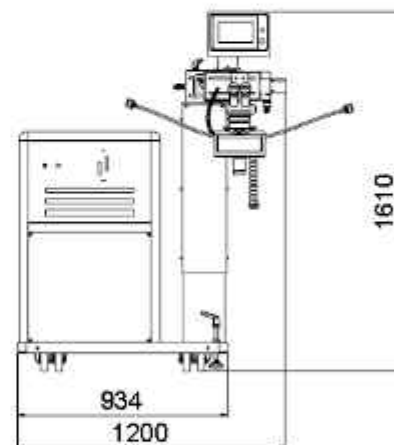
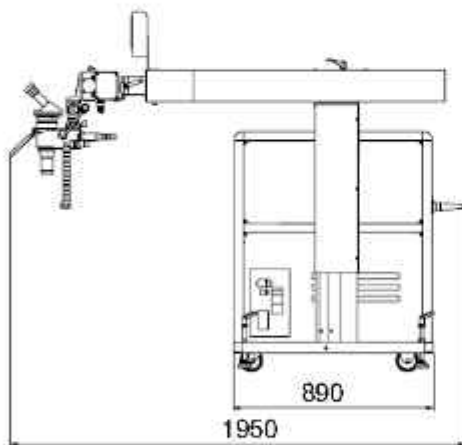


	SWA 150	SWA 300
Laser source		
Source type	Nd: YAG (flash lamp)	Nd: YAG (flash lamp)
Wavelength	1064 mm	1064 mm
Average laser power (max)	150 W	300 W
Peak laser power (max)	10.6 kW	12 kW
Laser pulse energy (max)	75 J	150 J
Laser pulse duration	0.3 - 25 ms	0.3 - 25 ms
Shot frequency (*)	0 - 100 Hz	0 - 200 Hz
Spot diameter (with 800 um fiber)	0.6 - 2 mm	0.6 - 2 mm
Laser beam transport	Fiber-coupled	Fiber-coupled
Incorporated cooling	water/air Deionized water 5 liters	water/air Deionized water 10 liters
Welding head		
Focusing head	120 mm	120 mm
Viewing system	Leica binocular	Leica binocular
SWA System		
Laser class of the machine	CLASS 4 LASER	CLASS 4 LASER
Movement speed	0-20 mm/s	0-20 mm/s
Laser electric power supply (max)	400 V 50/60Hz 3ph 3.5 kW	400 V 50/60Hz 3ph 8 kW
Laser absorbed current (max)	9 A	15 A
SWA system power supply	230V 50/60Hz 1ph 1kW	230V 50/60Hz 1ph 1kW
SWA absorbed current (max)	5 A	5 A
Noise	55 db	55 db
Weight	270 kg	310 kg

Dimensions l x d x h:	SWA 150	SWA 300
Machine with the axes closed	1100 x 2100 x 1470 mm	1200 x 1950 x 1470 mm
Machine with the axes open and display raised:	+ 640 mm max. in height + 850 mm max. in depth	+ 640 mm max. in height + 850 mm max. in depth



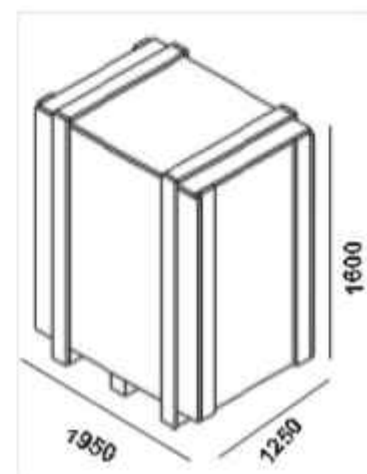
SWA 150 Dimensions



SWA 300 Dimensions

Package weight and dimensions: WOOD CRATE

SWA 150 : Mass 426 kg
SWA 300 : Mass 466 kg



Main components of the laser generator



Resonator:

- Long service life of the flash lamp
- Laser beam stability



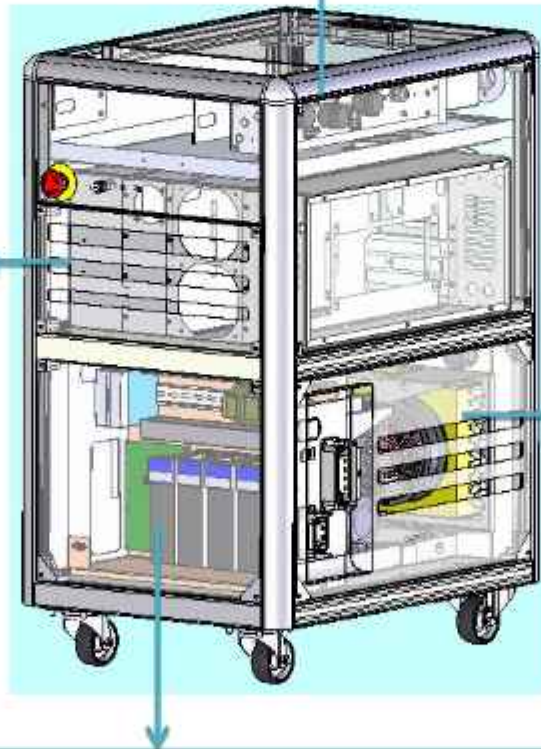
Electrical rack:

- High reliability
- High efficiency



Internal cooling system:

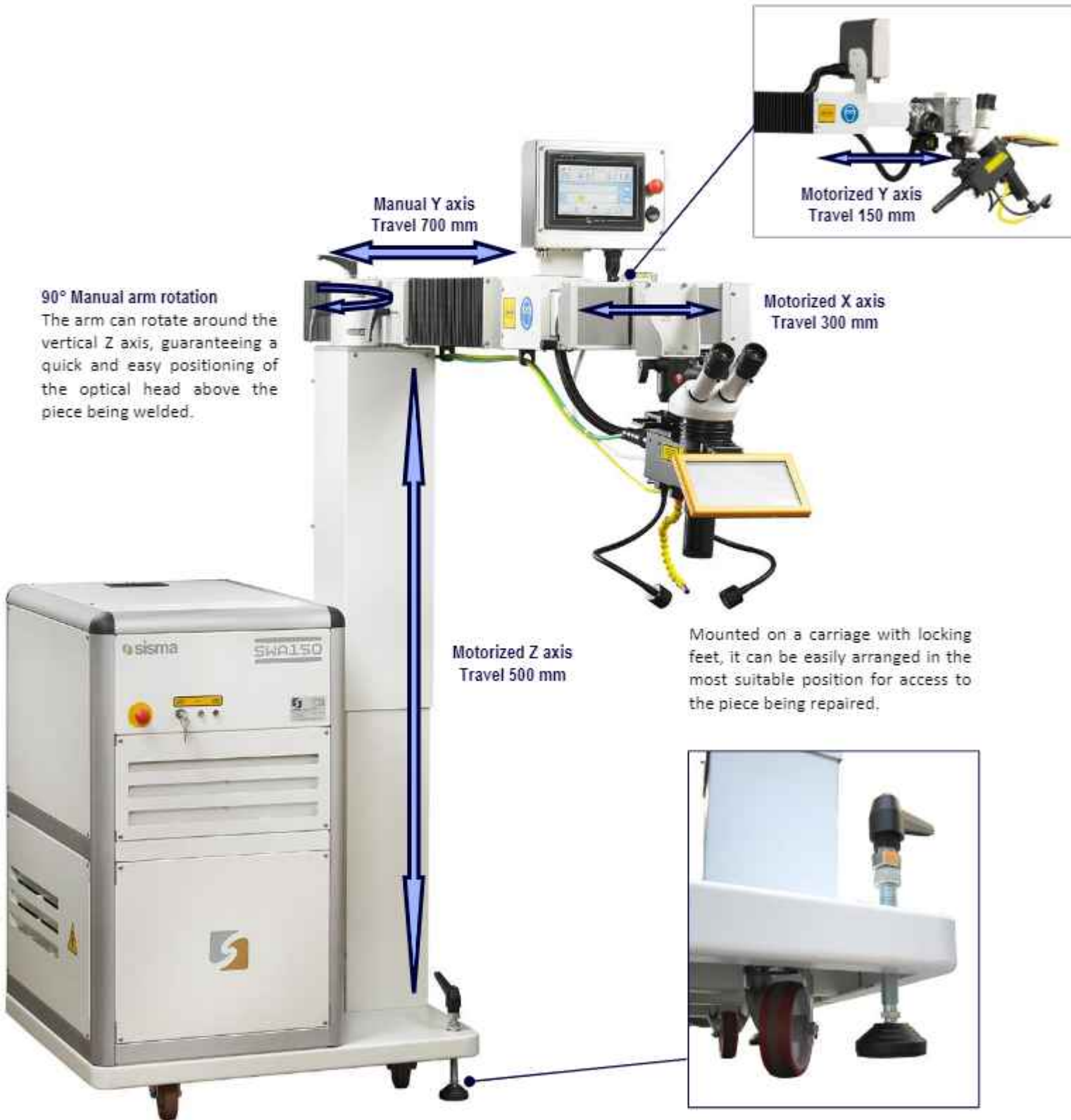
- Easy maintenance: replacement of deionized water and deionized filters
- Air-Water Cooling (Working range 15°C – 35°C)



AXIS CONTROLLER
4-Axis Control system: X,Y,Z and R (spindle) with various interpolated functions

Flexibility of the SWA system

The "SWA" is designed for welding and repairing small and large pieces and moulds. The laser transport in optical fiber provides great flexibility without significant power loss.



SWA Welding head

The optical fiber is connected to a welding head. The optical fiber is fixed to a spherical support mounted on the X axis with 300 mm travel and Y axis with 150 mm travel.

Equipped with:

- F120 lens
- optical stereomicroscope with **10x** magnification
- motorized zoom that allows the operator to change the welding diameter from 0.6 mm to 2 mm (down to 0.3 mm with 400 um fiber and limiting the average power)
- two adjustable cool LED spotlights

Protective gas dispenser and welding fumes suction:

- a hose for the service gas necessary to guarantee good oxidation-free welding with management of the pre/post-welding opening times to save gas
- a hose for suction with synchronized management of the suction unit (optional) to reduce noise and consumption of the suction unit.

Safety:

- an LCD optical shutter for light emitted from the plasma (in compliance with international safety standards)
- filter for protection against the laser beam inside the microscope
- front window for protection against laser radiation



Great positioning flexibility:



Welding head rotation $0 \pm 90^\circ$

Stereomicroscope with 360° rotation

Welding head tilt $0 \pm 45^\circ$

Control display

All the machine parameters, welding programs and various functions are managed by the color touch-screen display. Up to **250 welding programs** can be stored on the display.



The display is fixed on an adjustable hinge that allows to reduce overall dimensions and vibrations during transport.

Control console

Console characteristics

- Welding parameters:
- Power
 - Pulse duration
 - Frequency
 - Laser pulse diameter
 - Program selection (button 1 and 2 pressed simultaneously)

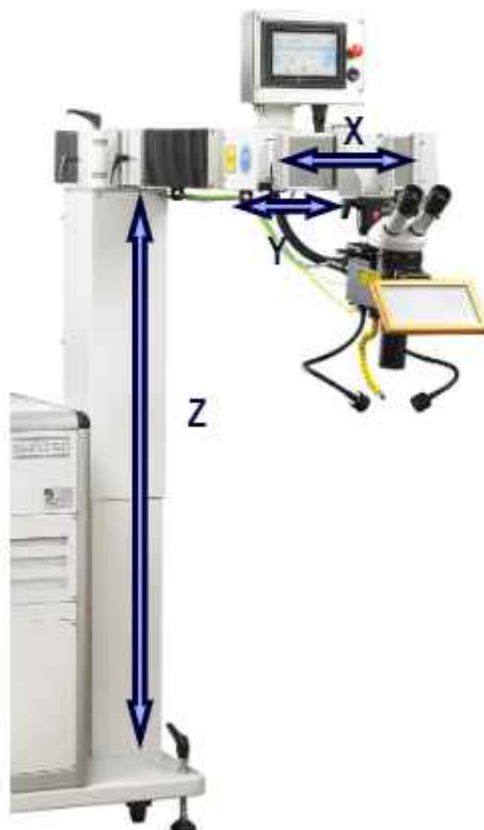


The connection cable enables the control console to be positioned near the work area.

Magnet supports to fix the console to metal surfaces

The shot parameters can be modified from the console. The parameter selected on the console using the appropriate buttons is indicated on the display by a small flashing indicator. The numerical value can be changed using the knob.

This allows the operator to set the laser parameters such as Power, Frequency, Welding Diameter and Pulse Length and select the welding programs.



The 3 motorized axes can be managed from the console. The axes are controlled by three brushless motors and respective drivers that enable precise positioning and simple programming. Edges and welding paths can be followed easily. The machine is equipped with an IPS (intelligent positioning system), with which it is possible to identify a working plane; in this case when moving in the x and y axes the z is managed automatically to keep the focal plane constant. The movement precision enables welding even on circumferential paths and acquired paths.



Safety warnings for use of the "Class 4" Laser Generator

Since the Class 4 is always operative when running the system, the User must strictly follow the directions of the Operator's Manual provided.

In short:

- the passive safety devices (guards and windows with certified safety glass) must not be removed
- the active safety devices must not be bypassed
- appropriate safety glasses must be used as personal protective equipment (PPE) in all the situations provided for by the standards and specified in the Operator's Manual.
- the work must be carried out in a closed and protected environment as provided for by the regulations.

! The following safety glasses must be worn: D LB10 at 1060-1070 nm (see standard UNI EN 207)

The Laser generator model SWA 150-300 is a Class 4 Nd-Yag (Neodymium-Yag) generator with a wavelength of 1064 nm and maximum average power of 150-300 W. This generator can only be used in combination with operating machines suited to guarantee operator protection with this type of laser generator. It is strictly prohibited to use the generator model SWA 150-300 in combination with operating machines having protections for generators with maximum average power less than 150W or 300W or wavelength different from that specified. When an operating machine is applied to the laser generator, the user is required to carefully read the Operator's Manual of the machine.

International Standard IEC 825-1 : 1993-11 Safety of laser products - Part 1 : Equipment classification, requirements and user's guide

European Standard EN 60825-1 : 1994-03, Italian Standard CEI EN 60825-1

which are equivalent in the 3 areas: In Italy with regard to:

- Safety precautions
- Hazards incidental to laser operation
- Procedures for hazard control

the recommendations contained in the following guides must also be followed:

Guides CEI 3849 R and 3850 R: Guides for the use of laser products.

In other countries the corresponding guides in force must be followed.

OPERATOR'S MANUAL

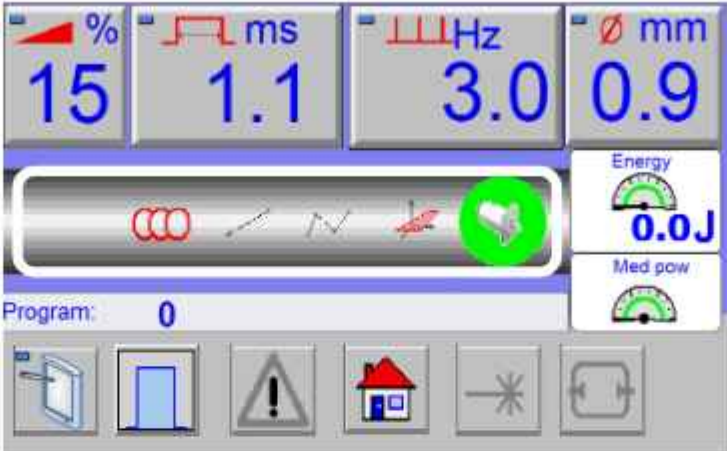
- The appropriate Operator's Manual of the welding laser with suggestions for first-level maintenance for the entire equipment. All laser safety requirements are detailed according to the standard CEI EN 60825-1

MACHINE CONTROL SOFTWARE

Working page

Laser parameters setting

Operating functions



Energy and average Power indication

- Other functions:
- Stored programs management
 - Selection of laser pulse type
 - Alarms in progress
 - Return to main menu
 - Laser activation - Lamp switch-on

From the working page, the operator can store a large number of user-defined programs that can be called-up again at a later time. Each user program is identified by a number (Program 1, Program 2, etc.) and a title.

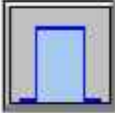
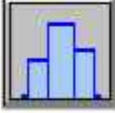
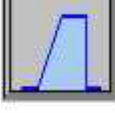
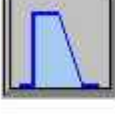
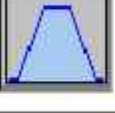
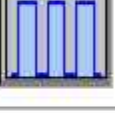
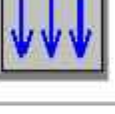
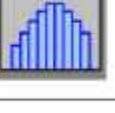
Laser pulse type selection (Other functions)



Pulse Shaping

For complex welding operations, the "Pulse Shaping" function can be used to form specific pulse shapes. This allows optimization of the welding processes on some materials, guaranteeing a correct thermal cycle of heating, melting and cooling.

Laser pulse types available:

	<p>Single rectangular pulse mode</p>
	<p>Three-section modular pulse mode</p>
	<p>Ramp-up mode: an initial ramp is added to the single rectangular pulse</p>
	<p>Ramp-down mode: a final ramp is added to the single rectangular pulse</p>
	<p>Ramp-up and down mode: an initial ramp and final ramp are added to the single pulse</p>
	<p>The laser emission includes 3 identical pulses spaced consecutively</p>
	<p>Expanded scale single pulse mode: single pulse with power halved for better resolution at lower powers</p>
	<p>Modular pulse shaper mode (a maximum of 20 sections can be set)</p>

The number and type of pulses available may depend on the model of the machine. Some pulse types are optional.

Through appropriate functions, customized pulses can be formed with 3 or 20 sections.

**Operating Functions Page
(with some process examples)**



Activation of the measurement function

000.0 mm

X: 0000.0 mm

Y: 0000.0 mm

Z: 0000.0 mm

STARTING POINT

1. Measurement

The MEASUREMENT function can be useful in order to quickly determine the distance between two points or, for example, to obtain an estimate of the filling thickness.

In order to perform a measurement, move the X, Y and Z axes to the starting point and press the "STARTING POINT" button. Then move the axes, and the distances along each axis will be displayed (total distance and distance along each axis).



2. OVERLAP

The OVERLAP function allows the laser to fire with equidistant laser spots, where the distance of the shots is calculated automatically based on the set spot diameter and overlap factor.



3. LINE

The LINE function is used whenever the work requires movement along a straight path. After acquiring the two points that identify the path to be followed and enabling the function, the system will always move along the trajectory defined by the previously acquired points.



Function: line welding
Mould type: Plastic material mould

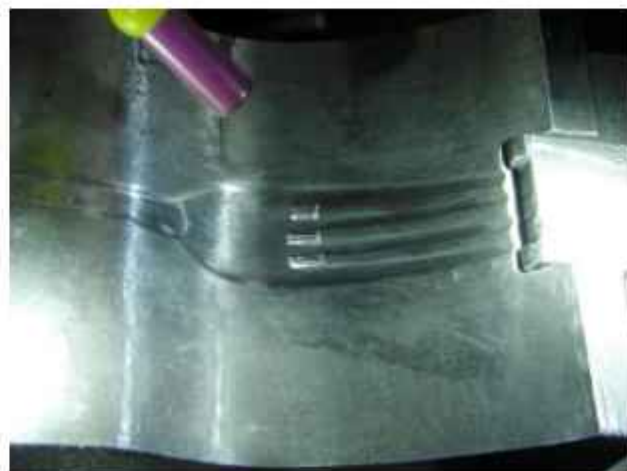


FILL (included in the LINE function)

The FILL function is useful for filling more or less extensive areas, of variable shapes, with filling material. In particular, it allows the operator to perform straight welds side by side and equally spaced.



Process: Reconstruction of wall with thickness 0.3
Mould type: Plastic moulding



Process: welding of parallel lines
Mould type: Metal moulding



4. Path

The PATH mode is useful whenever you would like to follow a predefined path and/or facilitate the operator during the filling on curves.

To do this, just acquire some points (max. 256) of the curve/path, then by enabling the PATH function the operator can follow the path using the joystick to regulate the translation speed and direction, without the risk of going off the identified path.



Process: Reconstruction of a damaged area
Mould type: Die casting



5. Oblique plane

The OBLIQUE PLANE mode is particularly useful when the operator has to work with oblique planes, on which he must move along the X and Y axes, but at the same time keep the working focal length constant in order to keep the laser radiation focused on the piece being processed. This function allows the operator, through the acquisition of three points on the plane, to operate the welding head using the joystick on the X and Y axes only, while the management of the Z axis is automatically handled by the axis control system.



Process: Reconstruction of a damaged area
Mould type: Die casting



Process: Repair of an inclined surface
Mould type: Plastic material mould



Process: Repair of an inclined surface
Mould type: Plastic material mould



6. Center-point circumference and three-point circumference functions

The circumference functions allow the operator to perform welds along a circular path. The circumference along which the laser must move can be defined in two ways:

- 1: acquisition of the center of the circumference and one point on the circumference itself
- 2: acquisition of three points on the circumference

If the circumference function is enabled (center-point or for three points), the commands for the **SCALING** function appear on the display. These commands allow the operator to increase or reduce the radius of the circumference by a settable amount. The center of the circumference remains unchanged, allowing the filling of circular crowns.

The **CIRCUMFERENCE** function can be used in combination with the **OBLIQUE PLANE** function to perform circular welds on flat but non-horizontal surfaces.



Function: circular welding of AISI 316L steel component
Component type: Coffee maker base



Function: injector hole closure
Detail type: Injector for plastic material



7. SEMI-AUTOMATIC mode

allows the operator to do the following:

- enable/disable the movement of an axis (X, Y, Z and spindle)
- set a fixed movement speed for each axis (X, Y, Z and spindle), releasing it from the progressive control of the joystick.

When enabled, the semi-automatic movement becomes operational as soon as the shots are activated. When the shot control is released (regardless of whether you are using the joystick or pedal), the axis will move manually as controlled by the joystick.

These settings are quite useful because they allow you to set constant speeds for movement along each axis when the laser shot is activated.



8. Axis motors maximum speed limits setting

The operator can set the maximum movement speeds for the axes X, Y and Z during both the laser emission phase and the simple translation phase. These parameters must be set based on the operator's dexterity and experience and his familiarity with the joystick.

Maximum speed increase with joystick at limit stop

Enabling this function allows the operator to work with the joystick at low speed during welding and short displacements, but at maximum speed for long translations.

If the function is activated, when the lever of the joystick is moved to the limit stop (along the X or Y axes) without pressing the shot command, the axes will move at the maximum allowed speed.

Direction of rotation Fractions of a rotation Speed



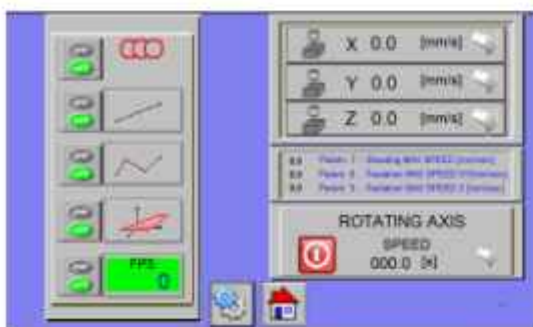
9. MANDREL Parameters setting

To perform welds on tubes or pieces with a circular profile, a rotating spindle (optional) is used which rotates the piece during the welding, working in sync with the laser.

The spindle is quite easy to use, since you just need to set its direction of rotation and speed.



Function: Circular welding on steel
Component type: Pressure switches



FPS function (First Pulses Suppression)

This function improves the regularity of the first shots which are usually more energetic than the later ones; this behavior is typical of lasers, due to thermal stabilization of the optical components which occurs during the first few seconds of operation.

The FPS function can be set in automatic mode or managed manually by the operator either from the touch screen or by means of the pedal or joystick.

ACCESSORIES:

INSTALLABLE LENSES:

694694L F200 Focal lens kit
To increase the distance from the piece



695198L 90° Optical transfer unit for the welding head



615685L Spacer for lens suited for welding inside hollow areas



695178L Magnetic support for SWA console

ASPIRATOR:



TBH Fumes suction unit with cartridge pre-filter unit. Complete with HEPA + active carbons combined filter and pre-filter. Max. suction volume: 260 m³/h. Power supply 230 V 50/60 Hz single phase



292603L Adjustable spherical support with magnetic base plate
Ø spherical support 158 mm
Ø magnet 100 mm
Maximum weight 7 kg
Maximum weight at 90° 2 kg

OPTIONALS:



695421L Circular LED spotlight kit



694667L Rotating spindle
Minimum diameter 2 mm
Maximum diameter 80 mm
Maximum piece weight 5 kg
Spindle adjustable from 0° to 90°



292407L Compact digital camera IC 80HD



292220L Laser safety glasses for users of the welding systems. Lenses: Aquamarine-colored glass
Frame can be worn over

normal eyeglasses.
Safety code: LB10 @ 1060-1070 nm

GUARANTEE

The Manufacturer: SISMA SpA - Via Dell'Industria, 1 – 36013 PIOVENE
ROCCHETTE (VI) - ITALY
Tel. 0445/595511 - Fax 0445/595595

GUARANTEES

the machine: _____

model: _____

Serial number: _____

Date of manufacture: _____

for a period of one year, with operation for one work shift per day.

Those parts which consist of commercial components manufactured by third persons are not covered by this guarantee but are covered by the guarantee of their original manufacturer. The guarantee starts from the moment the machine is shipped. The guarantee is only recognised if the machine is used correctly according to the instructions provided in the manual on its use and on periodic maintenance to be carried out. Any defects or breakages which take place in the period for which the machine is guaranteed will be repaired or replaced free of charge by SISMA at their factory in SCHIO. Any defective parts replaced by SISMA will be removed after they have been replaced by the aforementioned. Any expenses incurred in transport and shipping of replacement parts are the responsibility of the client. In the event that SISMA work should be required to ensure operation and/or replacement of defective parts, any expenses incurred by this will be covered by SISMA though the client is liable for any expenses incurred in travelling and transfer.

Any other possible technical operations carried out by SISMA personnel will be agreed according to the case in question.

Not included in the guarantee are any materials to be consumed or any materials used in periodic maintenance or parts which have been damaged by incorrect use of the machine. Repairs and/or replacements carried out while the guarantee is still in force do not imply extension of the guarantee. Recognition of the guarantee renders null and void any request for compensation for any oversight in manufacture.

On behalf of the legal representative
Ing. Guglielmo Cavalcabò

Remote service

Using devices such as a PC, tablet or smartphone, immediate support can be provided without having to physically intervene on the machines:
Machine check, tests, parameter modification, firmware upgrade



REMOTE SERVICE MANAGEMENT



Advantages:

- Reduced support costs and travel expenses
- Fewer phone calls and emails
- Reduction of downtime
- Greater Customer satisfaction

Applications



Material	Ø welding wire recommended min/max	Ø welding wire recommended min/max
Steel	0.2 - 0.6 mm	0.2 - 0.8 mm
Copper	0.2 - 0.5 mm	0.2 - 0.6 mm
Aluminum		

Photo gallery: Process examples

Repair of mould for plastic material





Repair of mould for glass injection

Repair of mould for die-casting



Repair of mould for rubber injection

Reconstruction of various worn areas



Repair of aluminum components

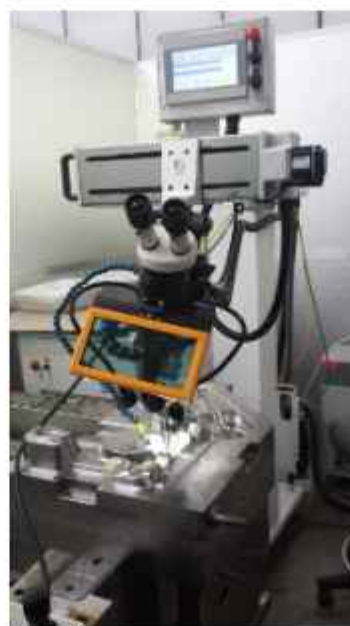


Repair of component for chain machine

Customer installations







WELDING WIRES AVAILABLE (in Blister or Coil):



Our specialists are able to recommend or provide welding wires based on the material of the Customer's mould or component.

For tool and mould steels

Filler Metal	Application For	materials	Diam.
LASER 10 M	Martensitic Cr-Mn laser welding wire with anticorrosion properties. Polishable, erodable, nitrable, etchable and heat treatable. Hardenable up to the 2. layer. For repairs of plastic, blowing- and injection moulds, also for compression moulding dies. Hardness 1-st layer approx. 48-56 HRC.	1.2343	0,1
		1.2344	0,2
		1.2082	0,3
		1.2083	0,4
		1.2367	0,5
		1.2606	0,6
		and similar steels	0,8
LASER 12 M	Cr-Ni-Mo-Mn filler metal with a lowered c-content. Including stabilizing elements to moderate hard carbide rims. Hardable up to the 2. layer, polishable, erodable, nitrable, etchable and heat treatable. For repairs of plastic and injection moulds color synchronous for 2-5% nickeliferous tool steels. The welding deposit is resistant to alternating temperatures. Hardness 1-st layer approx. 360-420 HB.	1.2713	0,1
		1.2714	0,2
		1.2740	0,3
		1.2743	0,4
		1.2744	0,5
		1.2747	0,6
		1.2764	0,8
		1.2766	
		1.2767	
and similar steels			
LASER 14 M	Cr-Mo-Mn filler metal. Covered carbon and silicon content. Additional elements which reduce the development of carbides. Polishable, erodable, nitrable, etchable and heat treatable. The laser welding deposit has synchronous structural and treatment properties as the parent steel. Hardness 1 st layer approx. 360-400 HB.	1.2311	0,1
		1.2312	0,2
		1.2162	0,3
		1.2738	0,4
		and similar steels	0,5
			0,6
	0,8		
LASER 15 M	Mo-Mn- filler metal with a lowered c-content and silicon content. Minimized chromium content below 0,15 %, therefore nearly chromium and carbide free. Polishable, erodable, nitrable, etchable and heat treatable. Hardness 1- st layer approx. 300-360 HB. Welding deposit is softer and brighter than filler metal Laser 14 M.	1.2162	0,2
		1.2311	0,3
		1.2312	0,4
		1.2738	0,5
		and similar steels	0,6

Filler Metal	Application For	materials	Diam.
LASER 16	Cr-Ni-Mo-Mn filler metal. Heat-, rust-rg, non hardenable welding deposit, strain-hardening by pressure and impacts. Polishable, erodable can not be nitrated or chromium-plated. For basic, intermediate and joining layers different tool steels. Hardness 1-st layer approx 320-370 HB. Stretching up to 33%. Tensile strength 820-880 N/qmm	For different tool steels	0,3 0,4 0,5 0,6
LASER 18	Ni-basis laser filler metal with Cr-Mo-Mn-Fe-Nb and elements to avoid hard carbide transitions. Rust-, acid-, heatresisting and extremely cold resisting. Erodable and polishable. Can not be nitrated or chromium-plated. For elastic basic, intermediate and joining Layers. Crack safe welding of different steels and cast iron: GS, GG-GGG 70. Hardness 1-st layer approx. 220-250 HB. Stretching up to 46%!! Tensile strength approx. 700-760 N/qmm ² .	For different tool steels	0,1 0,2 0,3 0,4 0,5 0,6 0,8
LASER 20	Cr-Mo-Mn-V filler metal for hot-work steels. Polishable, erodable, nitrable, etchable and heat treatable. Hardenable till approx 58 HRC. For plastic moulds, blowing and injection moulds. Hardness 1-st layer approx. 46-52 HRC. Unproblematic machining and resisting to thermal shocks.	1.2343 1.2344 1.2360 1.2362 and similar steels	0,2 0,25 0,3 0,4 0,5 0,6
LASER 22	Co-Cr-Mo-Mn-W-Fe filler metal for tempering-, hardening steels and hot-work with universal properties. For nitrated steels, has edge stability and is resisting towards acid. Can not be chromium-plated. Polishable, delayed erodability. Small thermal changeability of the structure. Hardness 1-st layer approx. 24-36 HRC. Increase of hardness by compression stress and dynamic compression stress till 35% !! Stretching approx. 18-25%.	For different tool steels	0,1 0,2 0,3 0,4 0,5 0,6
LASER 24	Cr-Mo-V-W filler metal with stabilizing elements. Air hardenable and shock hardenable. Edge stable and resistant at elevated temperatures. Qualificatorily chromium-platable, it is polishable, erodable, nitrable, etchable and temperable good heat conducting properties. For Aluminium diecasting forging dies, slide tools. Hardness 1-st layer approx. 56-59 HRC. Hardenable up to approx. 58 HRC.	1.2343 1.2344 1.2362 1.2363 1.2367 and similar steels	0,25 0,3 0,4 0,5 0,6
LASER 25	Cr-Mo-Mn-Ti filler metal with low c-content. Because of the extreme wear resistant properties and also of high toughness suitable for repair or production of hot working steels, as plastic, pressure casting tools. High abrasive, mechanical, thermal strength. Hardness 1st layer approx. 42 - 50 HRC.	1.2080 1.2083 1.2343 1.2344 and similar steels	0,2 0,3 0,4 0,5 0,6 0,8
LASER 26	Martensitic chromium filler metal with elements for structure stabilization. Polishable, erodable, nitrable, etchable and heat treatable. Can not be chromium-plated. Hardness of 1-st layer approx. 48-54 HRC can differ, depending on the extent of mingling. Hardenable up to approx. 60 HRC.	STAVAX 1.2083 1.2316 1.4115 1.4120 and similar steels	0,1 0,15 0,2 0,3 0,4 0,5 0,6 0,8

Filler Metal	Application For	materials	Diam.
LASER 28	Cr-Mn-Al-Ti universal filler metal for cold-cutting steels and tempering steels. Nitrable, crack resistant and abrasionproof, induction and flame gardenable. Very suitable for closing edges of plastic blowing moulds. Hardness 1-st layer approx. 56-60 HRC can differ, depending on the extent of mingling. Hardenable up to approx. 62 HRC.	1.2842 1.2762 1.2743 1.2721 1.2710 and similar steels	0,25 0,3 0,4 0,5 0,6
LASER 30	Cr-Mn-Mo-V-W filler metal with extreme tough-hardened and wear resistant properties. For cold work steels with approx. 5% chromium. Crack resistant and hardenable. Edge stable, nitrable, erodable, chromium-platable and heat treatable. Hardness 1-st layer approx. 56-60 HRC can differ, depending on the extent of mingling. Hardenable up to approx. 62 HRC.	CARMO CALMAX 1.2358 1.2363 and similar steels	0,2 0,3 0,4 0,5 0,6 0,8
LASER 32	Cr-Mn-Si-V filler metal with elements for structure stabilization. The welding deposit is similar to the 12% chromium-cold cutting steels. Can not be chromium-plated. Nitrable and erodable. Hardness 1-st layer approx. 58-60 HRC can differ, depending on the extent of mingling. Hardenable up to approx. 62 HRC.	1.2379 1.2080 1.2436 1.2601 and similar steels	0,1 0,2 0,3 0,4 0,5 0,6 0,8
LASER 34	Cr-Mn-Mo-V filler metal with fast hardening properties. High tenacity and edge retention. For fast repairs of cutting tools. Nitrable, erodable and chromium-platable, air- and flame hardenable. Hardness 1-st layer approx. 56-59 HRC can differ, depending on the extent of mingling. Hardenable up to approx. 60 HRC.	1.2379 1.2080 1.2436 1.2601 and similar steels	0,25 0,3 0,4 0,5 0,6
LASER 36	Ni-Co-Mo filler metal especially for aluminium- and zinc diecasting moulds. Martensitic welding deposit is crack resistant and very tough. Hardness increase of the welding deposit up to 50-54 HRC after thermal treatment. Can not be chromium-plated. Hardness 1-st layer approx. 40-46 HRC, can differ, depending an the extent of mingling.	1.2343 1.2344 and similar steels	0,2 0,3 0,4 0,5 0,6
LASER 38	Cr-Ni-Mo filler metal for basic and joining or different Cr-Ni steels. Rust- acid resisting. Polishable and erodable. Suitable for buffer layers on hard materials. Hardness 1-st layer 300-350 HB. Streching max. approx. 35%. Tensile strength approx. 720-760 N/mm ² .	1.4301 1.4541 1.4571 and similar steels	0,2 0,3 0,4 0,5 0,6
LASER 50	Cr-Mo-W-Si filler metal for aluminium- and zinc diecasting moulds, especially 5% chromium steels, also for plastic moulds on worn edges, if hardness and tenacity should be achieved. Can not be gardened and limited chromium-platet. Resistant to effects of temperature. Hardness 1-st layer approx. 52-58 HRC, can differ, depending on the extent of mingling. Hardenable up to approx. 60 HRC. Softened approx. 230 HB at 770°C.	1.2343 1.2344 1.2311 1.2312 1.2738 1.2767 and similar steels	0,1 0,15 0,2 0,3 0,4 0,5 0,6 0,8
LASER 56	Cr-Mo-Mn filler metal for 17 % martensitic Cr steel. Rust and wear resistant. Polishable, erodable, nitrable, etchable and heat treatable. Can not be chromium-plated! For fiber glass consolidated plastics and blowing moulds. Welding deposit is crack-free and harmonises with basic material tn the melting zone. Hardness 1- st layer approx. 50-58 HRC, can differ depending on the extant of mingling.	STAVAX MOLDMAX 1.2316 1.4115 1.4120 1.4122 and similar steels	0,3 0,4 0,5 0,6

Filler Metal	Application For	materials	Diam.
LASER 58	Cr- Filler metal with low c-content. Free of nickell Rust and high wear resistant. Well compatible and crack resistant with 12-17 % Cr. steels. Polishable, erodable, nitrable, etchable and heat treatable. Can not be chromium-plated! Ideal repair alloy for tough hardened mold steels. Hardness 1- st layer approx. 48-56 HRC	STAVAX MOLDMAX 1.4015 1.4021 1.4028 1.4031 1.4037 and similar steels	0,2 0,3 0,4 0,5 0,6

For copper/brass and Aluminium

LASER 40	Cu-Ag-Cr-Fe, best heat and electricity conducting properties. By low cooling (-20°). The hardness of the welding deposit increase up to 30%. For joining of copper and bronzes with steels. Hardness 1-st layer approx. 70-90 HB. Stretching approx. 25-35%. Tensile strength approx. 290-340 N/qmm ² .	Electrolytical copper and different copper materials	0,2 0,3 0,4 0,5
LASER 41 Loy	Cu-Ni-Si- filler metal with good heat conducting properties. By low cooling -20° the hardness increase up to 30%. Hardness 1-st layer approx. 60-84 HB Stretching approx. 23-32% Tensile strength approx. 200-280 N/qmm	Ampcoloy Moldmax and different copper materials	0,3 0,4 0,5
LASER 42	Al-Mn-Cu-Cr-Fe filler metal. Multi alloy bronze with excellent dry running properties on steels and good heat conductive. For crack- and pore-free weldings. Direct build-up layers without the junctions taking the hardening with minimum contraction. Also suitable for joining cracks on mould cooling channels. Hardness 1-st layer on steel approx. 220-280 HB. Hardness 1-st layer on bronze 200-240 HB. By low cooling hardness increase up to approx. 30%!!	For welding on steels, cast steels, cast iron joining of bronzes	0,2 0,3 0,4 0,5 0,6 0,8
LASER 44 AL	Al filler metal for repairs of aluminium casting moulds, fine flowing. For build up and joining layers of all aluminium alloys.	Al-alloy from F 30	0,3 0,4 0,5 0,6
LASER 45 AL	Al filler metal for aluminium alloys with up to 7 % silicon, when similarity of colour is required. Hardness 1-st layer on steel approx. 90-140 HB	AlSi 3 AlSi 5 AlSi 7	0,4 0,5 0,6
LASER 46 AL	Al special filler metal for aluminium wrought alloys. Property of changing of state by age-, hot-, or cold compression hardening. Hardness depends on the degree of mingling with the parent metal.	Al-alloys from F 28	0,3 0,4 0,5 0,6
LASER 47 AL	Al filler metal for pure aluminium 99,5 % or higher. Suitable for crack free welding on Cu-, Zr-, Mn- and Mg- alloyed aluminium basic material. Hardness 1-st layer on steel approx. 70-110 HB.	Al 99,5 Al 99,8	0,4 0,6
LASER 48	Ti -filler metal, for joining and build-up layers on titanium materials. Fe- content <0,15%. Suitable for laboratory and medicine requirements.	3.7025 3.7035 3.7065 and similar	0,3 0,5