create your future

Sodick



Linear Premium Die-sinker EDM Range

AL40G+/AL60G+/AL80G+

The World's First 10-Year Positioning Accuracy Guarantee



In the last 20 years since Sodick launched the world's first linear motor driven EDM the company has shipped nearly 60,000 such machines, which have won international recognition for their technical superiority.

The new die sinker AL-G+ series provide improved machining accuracy, speed and quality, from roughing and semi-finishing through to finishing, as a result of a range of new technologies including the latest EDM controls and electrical discharge circuits.

In addition, the machines benefit from a highly rigid structure, with temperature sensors installed throughout the machine body, to minimise the effect of temperature changes during high speed machining.

Large, easy-to-operate,19-inch touch panels come as standard, while the LN Professional Artificial Intelligence program ensures ideal machining conditions at all times, enabling the AL-G+ series to be operated optimally by both beginners and experts alike.

Ease of access is provided by the three-sided, automated, vertical drop machining tank, which enables the incorporation of a wide variety of automation technologies.

Sodick die sinker EDM Series has greatly changed the standards of manufacturing and is still evolving.

Positioning Accuracy
10 years guarantee



Efficient Energy Conservation with Advanced Pump Technology

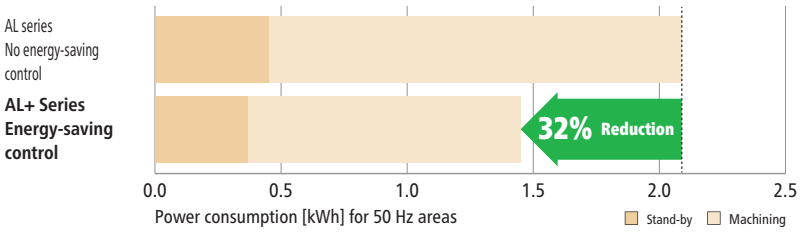
A newly developed energy-saving pump system has been integrated into the dielectric tank. This intelligent monitoring system helps reduce the pump drive energy required for flushing. As a result, the AL+ series achieves an impressive over 30% reduction in power consumption, including standby, compared to the conventional models.

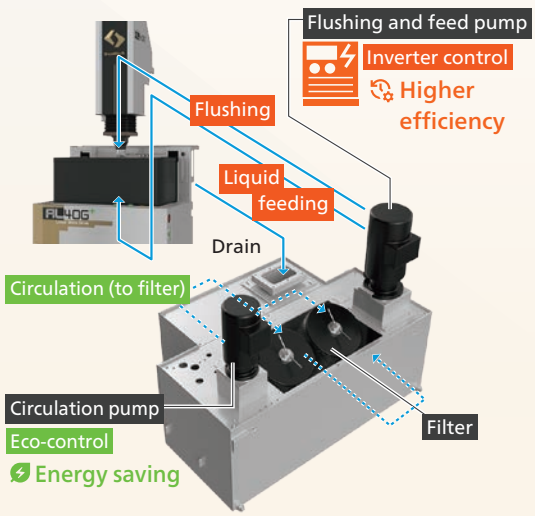
AL+ series

Energy-saving performance

Environment

- copper-electrode: ϕ10, workpiece: steel, machining depth: 1mm
- 1 cycle: Stand-by operation 15 minutes (25%), Machining 45 minutes (75%)







Core Technology

Five core technologies developed in-house for achieving the world's highest quality machining

Starting with the development of electrical discharge circuits, Sodick has continued to make untiring efforts in the research and development of advanced EDMs. Sodick's philosophy has been the pursuit of the highest level of accuracy, speed and versatility of machining in order to provide the highest quality products to its customers.

Sodick's: Power Supply Units, Discharge Units, Linear Motors, Motion Controllers and Fine Ceramic Components have evolved as its five core technologies. These developments have positioned Sodick at the pinnacle of EDM technologies.

Tech 1 & 2 *NC Power Supply Unit + Discharge Unit*

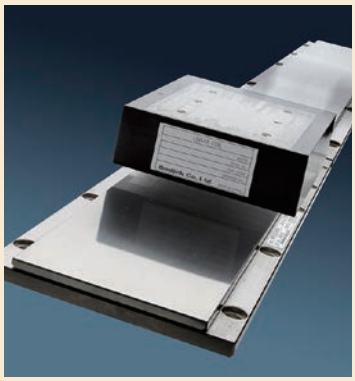
Sodick AL-G+ sinker EDM series features the latest **"SP" power supply unit**, which is capable of high-speed, high-precision and high-efficiency machining. The user interface benefits from a 19" colour touch screen for ease of use and operation.

TMM 4 circuit can provide up to 50% more cutting voltage than the conventional machine. The BSN4 circuit is another new feature to improve the quality and speed of finishing cut, by controlling the ON time with nano-seconds.



Tech 3 *Linear Motor*

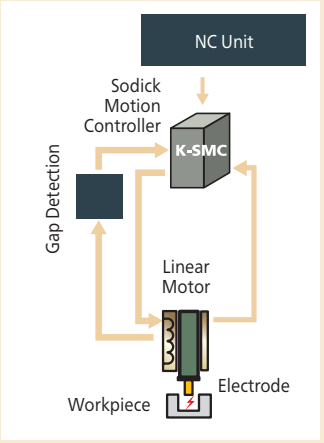
The most outstanding features of the Sodick in-house developed and manufactured **Linear Motors** are high-speed axis motion and quick response, which result from wear-free motion and without the need for old-fashioned ball screws. Conventional drive systems use ball screws to convert the rotational motion of the motor into the linear motion of the axis stroke, leading to the unavoidable deterioration in response of high speed servo motors due to back-lash and mechanical lost motion. However linear motors directly provide motion to each axis without converting rotational movements of motor to linear motion.



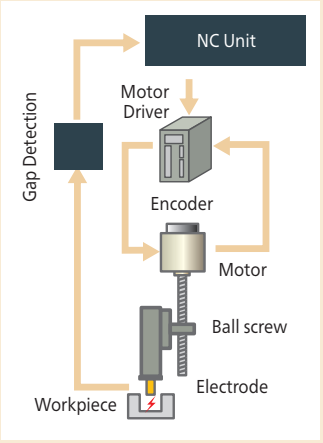
Tech 4 *Motion Controller + Absolute Linear Scales*

The latest **Sodick Motion Controller** "K-SMC" is adopted on AL-G+ series, which features even shorter response time of 0.4 to 1 micro-second. The Motion Controller is developed in the U.S.A by Sodick's own R&D division, located in the Silicon Valley specifically to meet and surpass the demanding requirements of the EDM Process for today and the future. It is integrated into the machine's generator and controls the axes motion and monitors the changes in the spark gap.

With the introduction of new advanced **absolute linear glass scales** the need for referencing has been removed. Therefore, ensuring total positional control at all times and reduced setting up time.



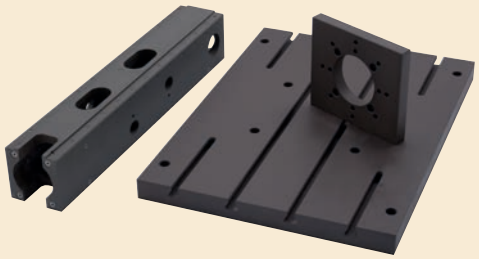
Linear Motor Drive



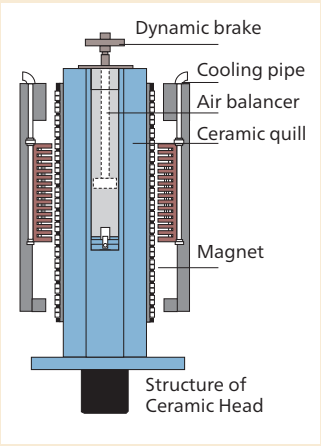
Conventional Ball Screw

Tech 5 *Ceramic Components + Ceramic Quill*

In major components, such as quill and table, the Sodick Die Sinker EDM series is equipped with **in-house made ceramic material**, which has been carefully researched and is considered as the best material for use in high-end EDM machines.



The **ceramic quill** developed by Sodick featuring lightweight, high rigidity and no thermal deformation is driven on both sides by linear motors in a symmetrical manner (Sodick patent) and enables extremely accurate and smooth motion without causing deviation or distortion of the slideways.

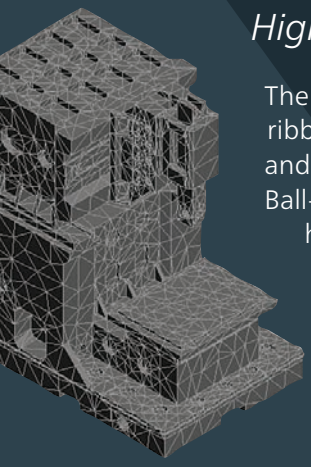


Advantages Of Ceramic Material

1. When it is used in moving components, such as the quill, the low density is effective in weight reduction, leading to increased dynamic response, resulting in superior machined surface quality.
2. The low co-efficient of linear thermal expansion minimises the thermal deformation caused by changing temperature during the cutting process ensuring high accuracy.
3. The excellent electrical insulation enables even very low discharge energy used during finishing to be effectively conducted between electrode and workpiece.
4. Stability of the ceramic material is unaffected by time.

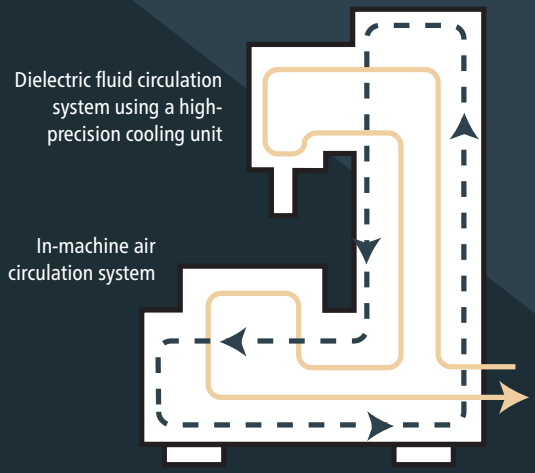
Advanced Machine Design:

High Rigidity Structure

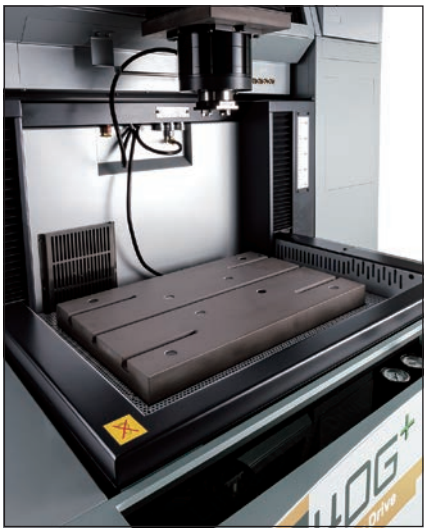


The machine cast construction is designed with heavily ribbed sections to provide superior long-term rigidity and stability. The surfaces to which the THK SSR Type Ball-Type Linear Guideways, are mounted on scraped by hand surfaces to ensure a perfectly flat surface and outstanding machine geometry.

Furthermore, the machine has in-machine air & dielectric circulation system to maintain the internal and external temperature of casting.



Standard Features



Working Area

AL-G+ range is designed for even easier access and user-friendly operation. It employs automatic three-sided rise and fall tank and NC operation panel, flushing level/pressure adjustment knobs and remote-controller are positioned at front of the machine, which makes possible an even larger open space at the work-tank.

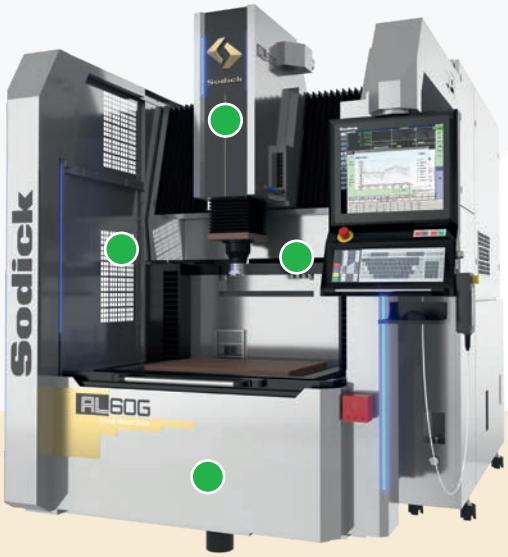
Thanks to the wide-open side, it is easy to install a Robot beside the machine and organize an automation system. A further benefit of the new ergonomic design, is that a Robot can be positioned either side of the machine as standard.

TH COM

The AL-G+ series is equipped with the new precision thermal compensation system "TH COM"* as standard.

Temperature sensors are installed throughout the machine body and the CNC records the temperature fluctuation. It automatically compensates the axes movements to minimise the thermal displacement.

*To make the most of the function, it is required to install the machine under Sodick designated environment.

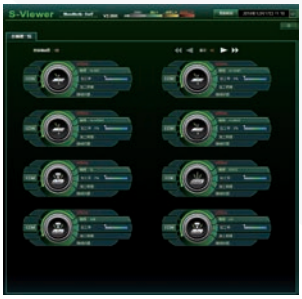




The recorded temperature data can be displayed on the controller.

S-Viewer

S-Viewer can be connected to multiple machines. It accesses NC units to acquire data and accumulate it in the server, allowing the data to be monitored on Web browser on PC or smart phones.





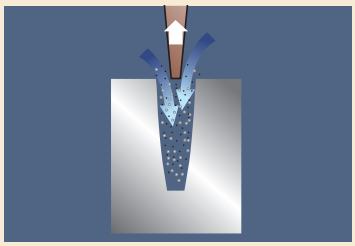


Advantages Of Linear Motor Drive System

No Flushing Operations

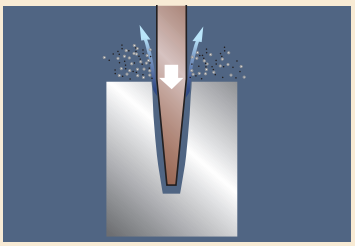
The linear motor drive mechanism generates an ultra high-speed pumping effect efficiently removing chips, gas and carbon which exist between the electrode and the work piece. Therefore, machining can be performed without the need for flushing.

Linear motor-based machining (without flushing)



RAPID JUMP

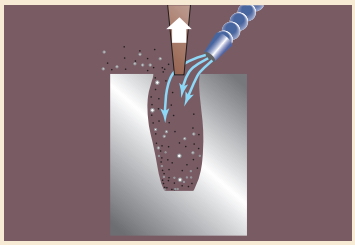
The rapid upward motion generates negative pressure between the electrode and the workpiece surface, where dielectric fluid rushes in together with chips, gas and tar.



RAPID DOWN

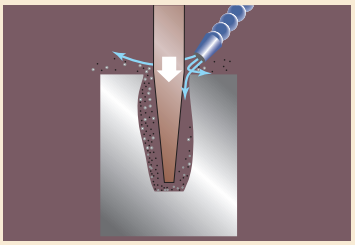
The chips, gas and tar existing between the electrode and the workpiece are efficiently ejected together with the dielectric fluid.

Ball screws-based machining (with flushing)



JUMP

Uneven flow of flushing results in not only residual chips, gas, and tar, but also uneven concentration of dielectric fluid



DOWN

The residual chips, gas, and tar cause se-condary discharge, leading to unstable gap conditions, discharge spots or excessive discharge.

Highly Rigid Linear Guide

In order to ensure very accurate straight motion in each axis, high-quality linear rails are used. These rails are fixed in position on manually scraped surfaces for optimum accuracy.

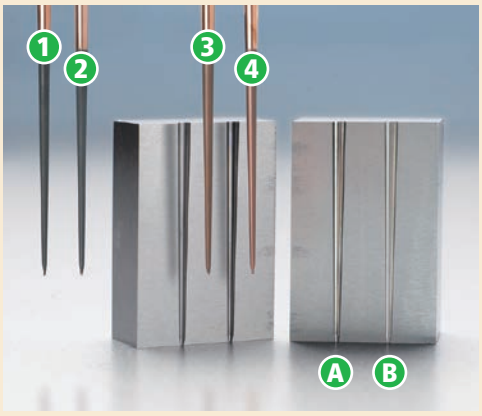
Long Pin Gate Machining

Mirror and matte finishing

Workpiece Material	Steel (HRC50 – 53)
Machining Depth	30mm (Tapered 1°/side)
Pilot Hole	ϕ 0.80 × 27 mm + ϕ 0.30 × 3 mm
Outlet Diameters	ϕ 0.50 mm
Electrode Material	Cu
No. of Electrodes	Roughing (Mirror and matte finish): 1 Semi-Finishing (Mirror and matte finish): 1 Finishing (Mirror finish): 1 (Total 3 / hole) (Matte finish): 1 (Total 3 / hole)
Electrode undersize	0.05 mm/side

Surface finish (Mirror finish) **Ra 0.08 µm**
(Matte finish) **Ra 0.15 µm**

Machining Time (Mirror finish) **2h 25m**
(Matte finish) **1h 39m**



Machining hole (Left A)
Mirror finish

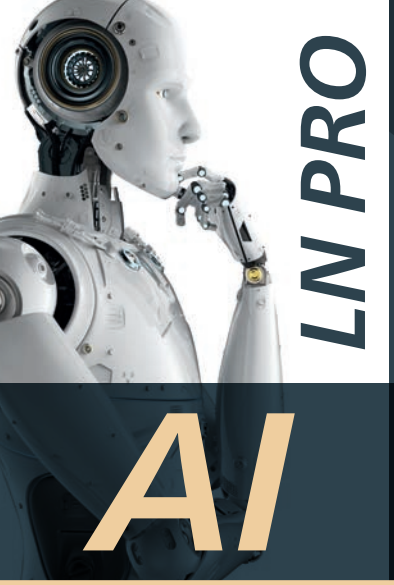
Electrode

1. Roughing Electrode
2. Semi-Finishing Electrode
3. (Mirror finish) Finishing Electrode

Machining hole (Right B)
Matte finish

Electrode

1. Roughing Electrode
2. Semi-Finishing Electrode
4. (Matte finish) Finishing Electrode



LN PRO

AI

LN Professional AI

"LN Professional AI" offers a wide range of applicable cutting patterns to suit various machining requirements. For each machining pattern, optimum machining conditions and axis motions are available and NC programs are automatically generated by the AI database, maximising the capability of linear motors.



Regular condition search screen



Graphite electrode condition search screen

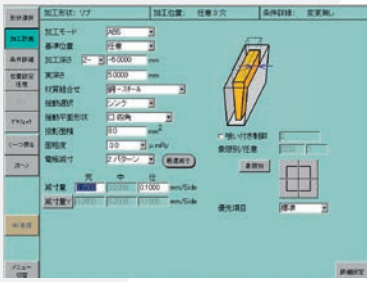
A wide variety of applicable machining patterns

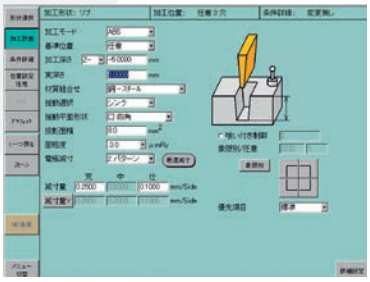
LN Professional offers a wide range of applicable cutting patterns to respond to various kinds of machining needs. For each machining pattern, optimum machin¬ing conditions and axis motions are available. Different kinds of machining can be performed through simple operations without depending on operator's skill and experience.

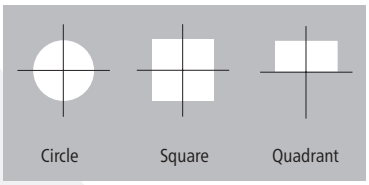
Easy to enter machining data

For each machining pattern, the user-friendly graphic is displayed for easy recognition of the state. It allows every operator to enter machining data easily, whilst minimising input errors.

If the core pin pattern is selected, for example, it automatically generates the most suitable machining conditions and axis motions required.











Multifunctional position setting

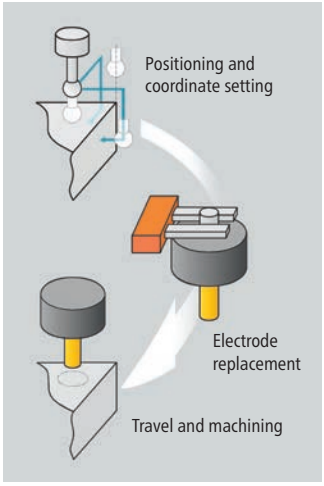
A multiple-piece machining process can be easily programmed (with lattice, circle or shape options).

Furthermore, electrode's travel length and machining orders can be programmed or changed easily.



User-friendly graphic display

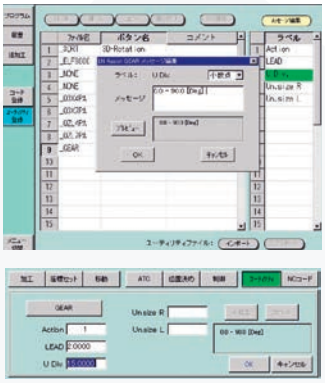
For each machining pattern, the user-friendly graphic allows operators to enter the machining plan, including electrode and work-piece materials, cutting depth and surface finish easily and minimising input errors.



Sophisticated programmes can be created easily

A series of machine operations can be performed through pressing or clicking on buttons without any specialised knowledge of NC code. Sophisticated programmes can be created easily through simple selection of the entries, such as machining, coordinate setting, travel, changing electrodes using ATC, positioning and electrode offset.



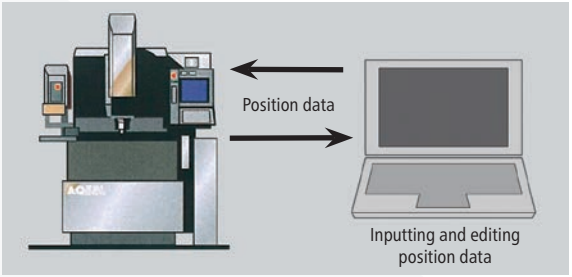


Saving original programmes

Customer's original NC programmes can be saved through simple operations, with header comments or remarks. Since the NC programmes incorporating experienced operator's know-how can be saved, it is possible to pass on the in-house know-how to the next generation.

Importing position data and EPX file

The position data can be input and edited in text format on a personal computer without the need for dedicated software. Furthermore, epx data can be imported from 3D CAD files directly to machine controller.

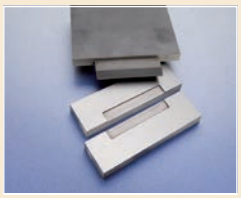




Simple NC Programmes

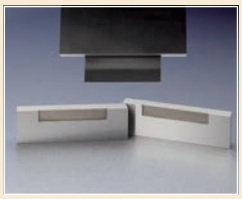
Short and simple NC programs describing machining conditions and offset values can be output or freely customised. Also, they can be easily applied to profile machining.

Latest Case Studies



Titanium Rib Machining

Workpiece Material	Titanium Alloy
Machining Depth	5 mm
Electrode Material	Gr TTK8
Electrode Size	0.7 mm x 30 mm
Surface Finish	Ra 2.09 µm
Machining Time	52m 57s
Electrode Wear	Tips 0.764 mm



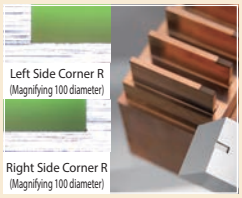
Inconel Rib Machining

Workpiece Material	Inconel
Machining Depth	5 mm
Electrode Material	Gr TTK8
Electrode Size	0.7 mm x 30 mm
Surface Finish	Ra 1.75 µm
Machining Time	15m 17s
Electrode Wear	Tips 0.005 mm



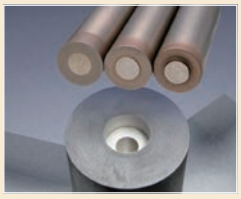
Multi-hole Machining by Intricate Electrode

Workpiece Material	Stainless steel
Machining Depth	5 mm
Electrode Material	Cu
Electrode Size	ϕ 4.0 mm x 9 positions (× 2)
Surface Finish	Ra 0.072 µm (Rz 0.41 µm)
Electrode Wear	Finishing 0.002 mm (Bottom)



Smallest Corner R Machining

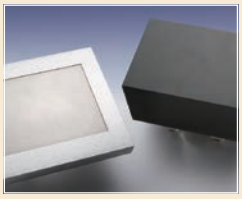
Workpiece Material	Stainless steel
Machining Depth	0.3 mm
Electrode Material	Cu
Electrode Size	1.0 mm x 2.5 mm (× 6)
Surface Finish	Rz 0.5 µm
Machining Time	1h 4m 25s
Bottom Corner R	4 µm



Copper Tungsten x WC

Machining Time Reduced by 28%

Examples of Machining by "TPC4" includes SP Power Supply	
Workpiece Material	WC
Lower Hole Flushing	0.1 MPa
Machining Depth	7.5 mm
Pilot Hole	ϕ 7.5 mm
Electrode Material	CuW
Electrode Size	ϕ 15 mm × 3
Undersize	0.04 mm/side
Surface finish	Rz 3.8 µm
Total Machining Time	1h 52m 41s, reduced by 28% compared to a conventional
Electrode Wear	Roughing 1.43mm Semi-Finishing 0.22mm Finishing 0.04mm



100 x 150 mm Electrode Finishing

Finishing with Uniform Surface Quality (BSN4)	
Workpiece Material	Stainless steel
Flushing	None
Machining Depth	0.2 mm
Electrode Material	Graphite (TTK-5), (1 finishing)
Electrode Size	100 × 150 mm
Undersize	0.15 mm/side
Surface finish	Rz 4.8 µm
Total Machining Time	21h 20m

The machining data indicated here is based on Sodick's specified conditions, machining environment and measurement standards.

New SP Power Supply Improves Machining Performance

The new SP power supply more than doubles motor control response speed, while the quality and speed of electrical discharge machining overall have benefited from the development of new controls and circuits, including: up to 50% more cutting voltage on rough cutting (TMM4 circuit), increased semi-finishing speed (TPC4 control) and improved quality and speed of the finishing cut through accurate pulse control (BSN4 circuit).

Electrodes - Workpiece	Feature Description
Copper - Steel	Enhanced motor control response and the development of the BSN4 finishing circuit **increases the machining speed**
Copper Tungsten – WC	The development of the TMM4 circuit **increases the machining speed for** copper-tungsten/carbide
Copper Graphite – WC	Improved control resolution of the SGF function Added support for copper-graphite (CuGr) increases the machining speed
Copper - Aluminum	SGF control adopted for aluminum to **increase the machining speed**

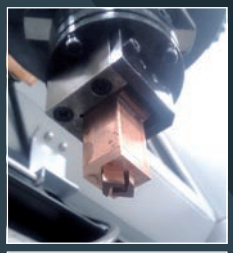
Machining Speed

WC and Steel Materials

Improved by 20%

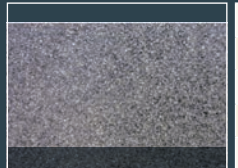
Types of Machining	New Function	Feature Description
Rough Machining	TMM4 circuit	High-speed machining of WC materials achieved using short-pulse high-peak current
Semi-finishing	TPC4 control	High-speed in the intermediate finishing area by improving fitness to narrow gaps
Finishing	BSN4 circuit	Uniform and high-speed discharge in the finishing area by accurate pulse control, for machined surfaces free of irregularities

BSN4 Machining Time improved by 21% High-speed finishing with uniform surface quality







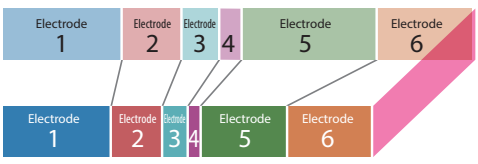


Machined Surfaces with Fewer Irregularities

Electrode Material	Copper
Electrode Size	Discharge area approx. 10 mm dia.
Undersize	0.20 mm/side
Machining Depth	1 mm
Workpiece Material	Steel (SKD-61)
Cutting conditions	Generated by LN Professional
Surface finish	Rz 1.0 µm / Ra 0.11 µm

LN Pro AI + TMM4 Machining Time Reduced by 21% (Copper – WC)

Conventional total machining time



21% Faster

LN Pro AI total machining time



Electrode Material	Copper (6 finishing)
Electrode Size	12 mm dia.
Undersize	0.15 mm/side
Jet Pressure	0.1 MPa
Pilot Hole	2 mm dia.
Machining Depth	10 mm
Workpiece material	WC (G3)
Cutting conditions	Generated by LN Professional
Surface finish	Rz 5.6 µm / Ra 0.79 µm

Options

High Precision Rotary Head, C axis

The Sodick Rotary Head (C axis) "SEC10" offers 1/1,000,000 of standard resolution. It enables high precision indexing with direct-drive and continuous rotation (20rpm), expanding the machining capabilities.

SCR-72P, the rotary head with higher rotation speed of up to 2,000rpm (resolution of 1/720,000) is also available.



	SEC-10	SCR72P
Resolution	1/1,000,000	1/720,000
Max. spindle speed	2 – 20 rpm	2,000 rpm
Max. current	80 A	40 A
Flushing through Axis	as standard	as standard

Shuttle ATC

A linear electrode changer is available on the AL-G+ range of machines. This allows multi-electrode operations to be achieved in unattended mode.

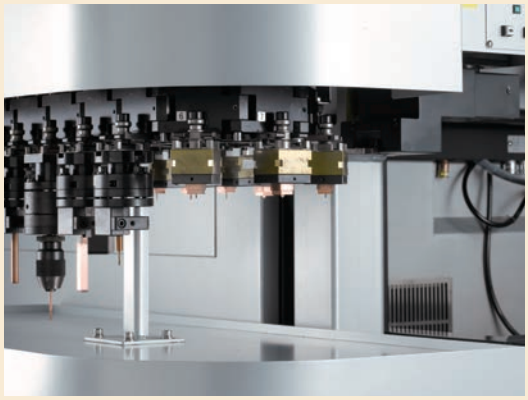
As standard the Shuttle ATC is mounted on the right hand side of work tank. If a second Shuttle ATC is required, it can be mounted on the left hand side.



Max. electrode size (W x D x H)	75 x 75 x 200 mm (incl. electrode holder)
Max. electrode weight	3 kg
Number of positions per Shuttle ATC	4 (AL40G+) 6 (AL60G+, AL80G+)

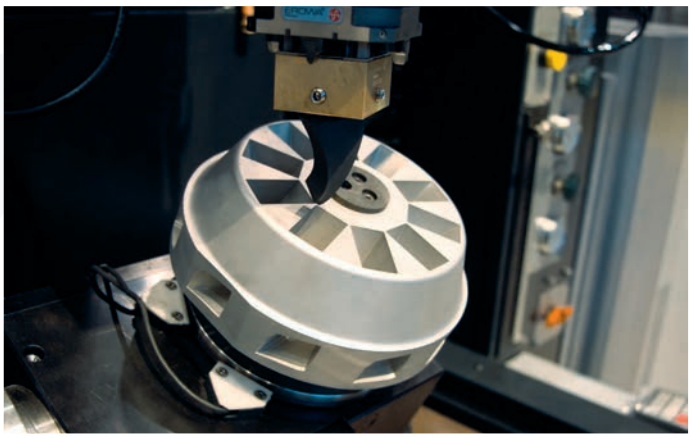
Large Capacity ATC

Sodick also offers a 16/32-position automatic tool changer. Operators can easily arrange an automation program with LN Professional software and ensure fully unattended operation.



AL40G+/ AL60G+/ AL80G+	
Number of stations	16/32 positions
Max. electrode size (W x D mm)	ø 75 x 200 (using 1 position) ø 250 x 200 (using 4 positions)
Max. electrode weight (kg)	10

8-axis Simultaneous Technology



Sodick has always developed their own controls and this has allowed the company to develop, an 8-axis simultaneous control. No other EDM manufacturers are able to offer this feature. Multi axis EDM machining is mainly used in the aerospace and medical industries but also can be used for part manufacture. The capability to clamp the workpiece once and then execute complex operation enhances productivity and accuracy.

(SP-E controller required)

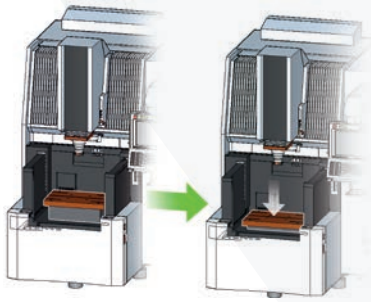
Automation System

Thanks to the automatic 3-sided drop tank, access for automation is made easy. The installation of a robot on either side of the machine to realize 24/7 unattended operation is possible. And the efficient automated production is simplified and more cost effective.





Table Down



Extended working height is available as a factory option by lowering the ceramic table for bigger workpiece or rotary tables.

- AL40G+: 50 mm or 100 mm table down
- AL60G+/ AL80G+: 50 mm table down

Machine Specifications

Machine			AL40G+	AL60G+	AL80G+
Work Table Size (W x D)			600 x 400 mm (Ceramic)	750 x 550 mm (Ceramic)	1,100 x 700 mm (Ceramic)
Work Tank Inner Dimensions (W x D x H)			750 x 620 x 350mm	950 x 740 x 450mm	1,400 x 950 x 500 mm
Work Tank Fluid Level (Min to Max)			100 to 300 mm	150 to 400 mm	150 to 450 mm
Work Tank Capacity			190 Liters	330 Liters	690 Liters
X Axis Travel			400 mm	600 mm	850 mm
Y Axis Travel			300 mm	420 mm	520 mm
Z Axis Travel			270 mm	370 mm	420 mm
Distance from clamp chuck to table top	Automatic	EROWA COMBI EROWA ITS	150 to 420 mm	200 to 570 mm	250 to 670 mm
		3R COMBI 3R MACRO	133 to 403 mm	183 to 553 mm	233 to 653 mm
	Manual		150 to 420 mm	200 to 570 mm	250 to 670 mm
Max Weight of Electrode			50 kg	50 kg	100 kg
Max Workpiece Weight			550 kg	1,500 kg	3,000 kg
Distance from Floor to Table Top			830 mm	850 mm	840 mm
Machine Tool Dimensions (W x D x H)			1,675 x 2,600 x 2,330 (Includes a Power Supply and Dielectric Tank)	1,875 x 2,930 x 2,570 (Includes a Power Supply and Dielectric Tank)	2,160 x 3,225 x 2,900 (Includes a Power Supply and Dielectric Tank)
Machine Tool Weight			4,100 kg (Includes a Power Supply and Dielectric Tank)	5,350 kg (Includes a Power Supply and Dielectric Tank)	9,800 kg (Includes a Power Supply and Dielectric Tank)
Air Pressure			0.65 MPa	0.65 MPa	0.65 MPa
Air Flow			100NL/min	100NL/min	100 NL/min
Total Power Input			3-phase, 50/60 Hz, 10 kVA	3-phase, 50/60 Hz, 10 kVA	3-phase, 50/60 Hz, 11 kVA

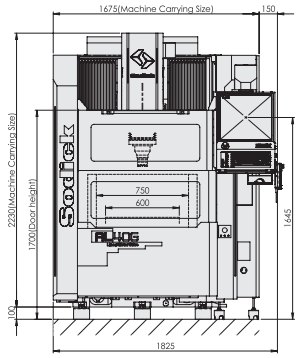
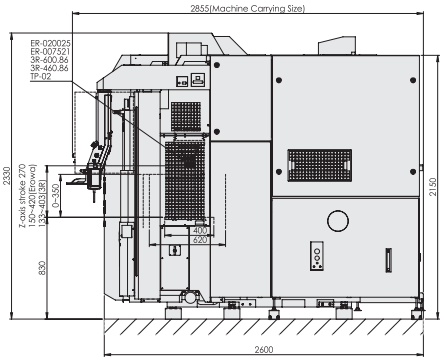
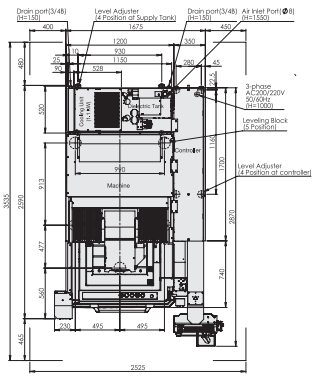
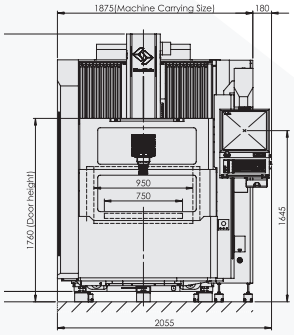
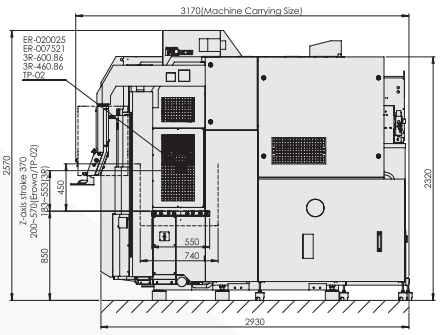
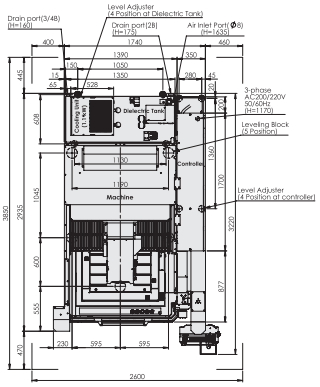
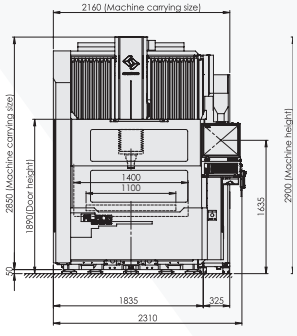
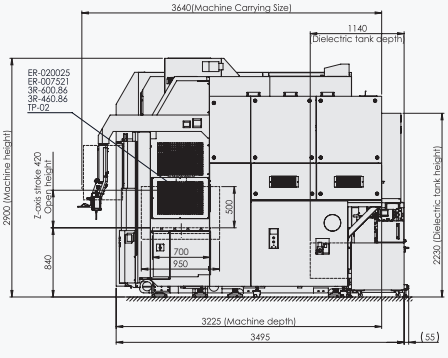
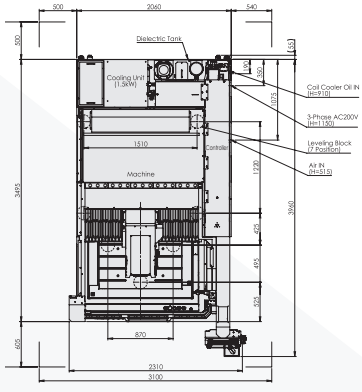
Dielectric tank	AL40G+	AL60G+	AL80G+
Dielectric Fluid	Oil	Oil	Oil
Dielectric Tank Capacity	285 Liters	465 Liters	845 Liters
Required Amount	330 Liters	560 Liters	1,000 Liters
Filtration	Replaceable Paper Filters	Replaceable Paper Filters	Replaceable Paper Filters

CNC Power Supply SP/SP-E

Max. machining current	40 A (AL80G+ = 80 A)	Offset settings storage capacity	1000 conditions (H000 to H999)
Discharging power supply unit	Optimum pulse control for TMM 4 power supply (SGF, BSN4, SVC)	Programme sequence number assignment	N000000000 to N999999999
Power requirement	200/220 V 50/60 Hz	Sub-programme nesting levels	50
CNC unit	Multi-tasking OS, M4-LINK system	Q command nesting levels	7
User's memory capacity	Saving 30MB	Number of co-ordinates	60
Memory device	SSD card, External USB stick	Simultaneous control axes	4 axes (Max. 8 axes with SP-E)
Input format	External memory, Touch panel, Keyboard,	Min. drive unit	0.01µm
Display type	19" TFT-LCD (XGA)	Min. input command	0.001µm
Character set	Alphanumeric and symbols	AJC speed XY axes	Max. 10 m/min
Keyboard	Standard 101-key, Function key	AJC speed Z axis	Max. 36 m/min
Remote controller (standard)	Standard jog (switchable), Assist A0 to A3, Clamp / unclamp,etc.	Max. feed rate	Max. 6 m/min
Positioning command	Incremental and absolute	Position detection mechanism	Full closed loop (Linear scales)
Max. input command	±999999.999 / ±99999.9999 / ±999.99999 (switchable)	Drive mechanism	Linear motor
Machining condition storage capacity	1000 conditions (C000 to C999)	Compensations	Pitch error, plane pitch error and torque corrections for each axis

The dielectric chillers on Sodick machines contain either fluorinated greenhouse gas R410A or 407C.
Specifications are subject to change without prior notice due to continual research and developments

Machine Layout

	Front View	Side View	Top View
AL40G+			
AL60G+			
AL80G+			

All CE spec machines have external transformer with dimension of ca. 650 x 460 x 540mm

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