

**5<sup>TH</sup>** GENERATION LINEAR EDM



Picture shows non-CE machine

**AP1L**  
**AP3L**

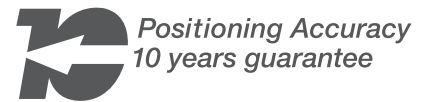
Linear Motor Drive High  
Precision Die Sinking EDM



**Sodick**

**Nano&Solution**

# The World's First 10-Year Positioning Accuracy Guarantee



Utilising the linear motor drive system, Sodick die-sinker EDMs and wire-cut EDMs have enabled difficult machining operations that were not possible with conventional ball screw-type EDMs, resulting in the cumulative shipment of more than 27,000 units by early 2011.

The linear motor-driven EDM, eliminates the need for ball screws and allows for non-contact motion. Use of the Linear Motor removes the deterioration in machining accuracy caused by the worn ball screw assemblies throughout the machine life. Sodick's confidence in the performance and accuracy of their machines over a 10 year period allows them to be the only manufacturer to offer a 10 year positioning accuracy guarantee on all their Linear EDM Machines.

**Sodick Die Sinker EDM Series Has Greatly Changed The Standards Of Manufacturing and Is Still Evolving.**

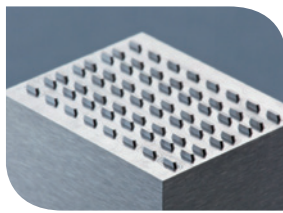


# Sodick's Linked Process: Manufacturing of Side-View LED

## 1: Core Pin Block



HS430L



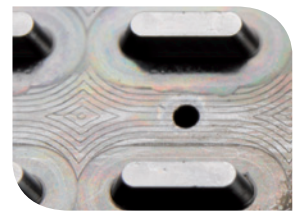
2 workpieces with 64 pins each are processed by single tool achieving surface finish of 0.028 $\mu$ mRa.

Workpiece: ELMAX (HR60) | 20x20x25 mm  
Spindle: Max. 40,000 rpm  
Cutting Tool: cBN Radial  $\phi$  0.5, R 0.02  
Cutting Time: 5 min 14sec/piece  
Bottom Corner Radius: < 0.03 mm

## 2: Drilling Of Start Hole



K3BL



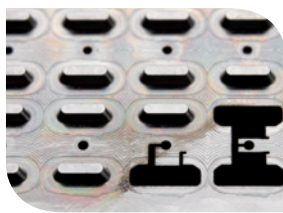
32 start-holes are made by K3BL on a workpiece. Thanks to the oil dielectric, workpiece is protected from corrosion/rust.

Workpiece: ELMAX (HR60) | Height of 20 mm  
Electrode Material: Cu Pipe | Cutting Time: 4 min/hole  
Electrode Size:  $\phi$  0.3mm, length of 300 mm  
Electrodes: 11 electrodes/32 holes  
Finished Hole:  $\phi$  0.37~0.38mm | Accuracy:  $\pm$ 3 $\mu$ m

## 3: Cut-off of Core Pins



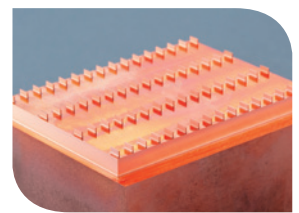
AP250L



Total 64 core pins are cut off by the AP250L, the high-precision wire cut EDM with oil dielectric. Thanks to the oil dielectric, workpiece is protected from corrosion/rust.

Workpiece: ELMAX (HR60) | Height of 20 mm  
Wire Electrode:  $\phi$  0.1 mm | Cutting Time: 19 min per pin  
Surface Finish:  $\phi$  0.11 $\mu$ mRa | Accuracy:  $\pm$ 1 $\mu$ m

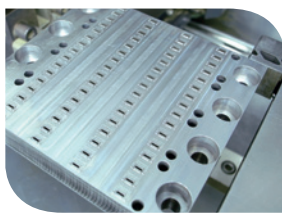
## 4: Electrode for Core Plate



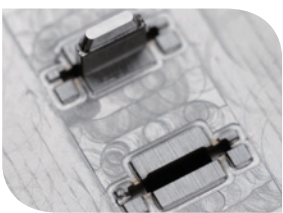
An electrode with 64 pins for core plate is processed by the HS430L.

Workpiece: Cu | Spindle: Max. 30,000 rpm  
Cutting Tool: Ball end mill, R 0.25  
No. of Cutting Tool: 1  
Cutting Time: 8min 54sec/piece

## 5: Apertures



AP250L



Total 64 apertures are cut off by AP250L.

Workpiece: ELMAX (HRC 60) | Height of 15 mm  
Wire Electrode:  $\phi$  0.1 mm | Cutting Time: 19 min/contour  
Surface Finish:  $\phi$  0.11 $\mu$ mRa | Accuracy:  $\pm$ 1 $\mu$ m

## 6: Finishing of Apertures



AP3L



Corner edges of apertures are finished by the AP3L, the super-high precision sink EDM using the electrode which has been made in process step 4.

Workpiece: ELMAX (HRC 60) | Height of 15 mm  
Wire Electrode:  $\phi$  0.1 mm | Cutting Time: 19 min/die  
Surface Finish:  $\phi$  0.11 $\mu$ mRa | Accuracy:  $\pm$ 1 $\mu$ m



# 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.

## NC Power Supply Unit + Discharge Unit

Tech 1+2

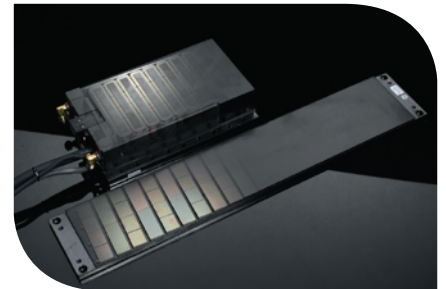
The Sodick Die Sinker EDM Series features Sodick's latest "LN2 series" power supply unit, which is capable of high-speed, high-precision and high-efficiency machining. The outstanding performance of the LN2 series power supply is controlled by a modern in-house designed NC system running on Windows Operating System. The user interface benefits from a 15" colour touch screen for ease of use and operation.



## Linear Motor

Tech 3

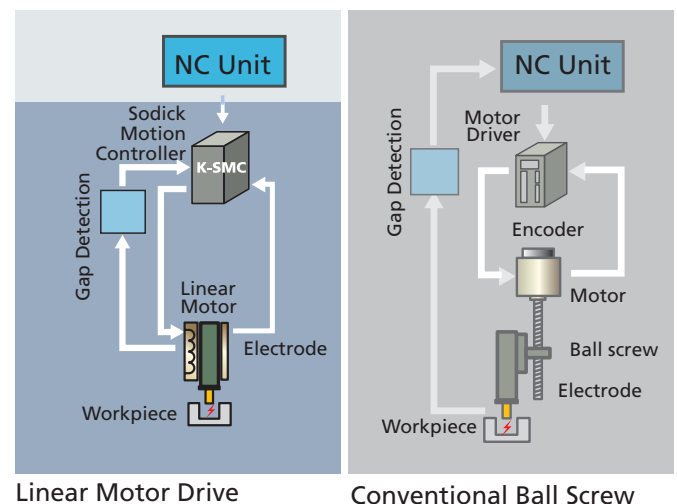
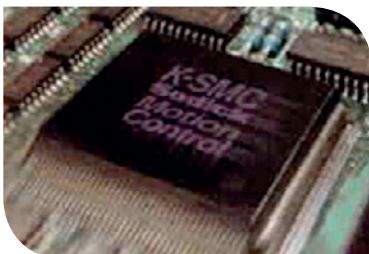
The most outstanding features of the Sodick in-house developed and manufactured Linear Motors are high-speed axis motion and quick response, which result from wear-free motion and without the need for old-fashioned ball screws. Conventional drive systems use ball screws to convert the rotational motion 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.



## Motion Controller

Tech 4

In order to achieve maximum performance with a linear motor, the K-SMC motor controller is also developed in-house and incorporates Sodick control know-how accumulated over the years. The feedback from the spark gap is directly input in to the K-SMC board allowing for instantaneous adaptation of the sparking conditions.





## Ceramic Components

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.

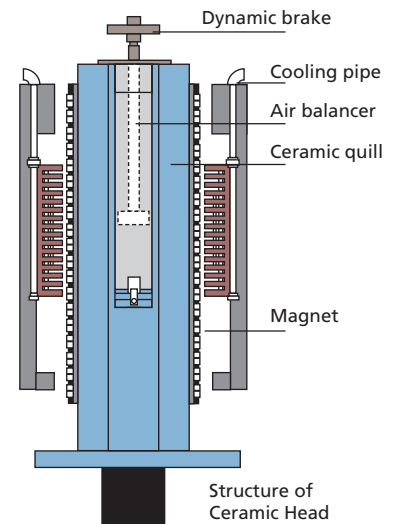


### Advantages Of Ceramic Material

- 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.

### Ceramic Quill

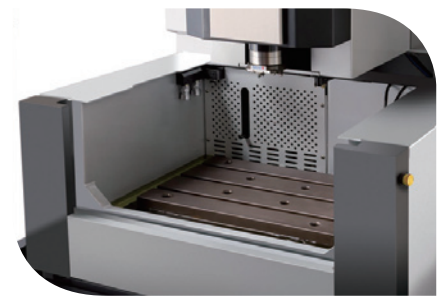
The ceramic quill developed by Sodick featuring lightweight, high rigidity and no thermal deformation is driven on both sides by linear motors in a symmetrical manner (Sodick patent) and enables extremely accurate and smooth motion without causing deviation or distortion of the slideways.



## Machine Construction

### Automatic Tank Door

The new AP range is designed for even easier access and user-friendly operation. It employs automatic rise and fall tank, which makes possible an even larger open space at the worktank. Dielectric filling and draining time is much reduced for quicker machine setup time. Thanks to the wide open side, it is easy to install a Robot beside the machine and organize an automation system.



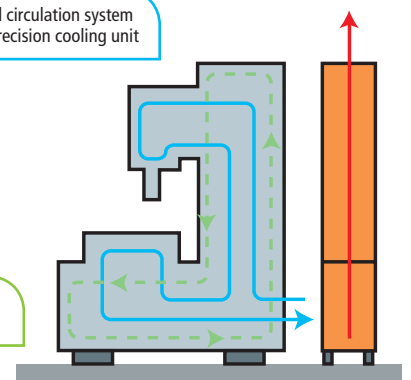
With the heat sources separated from the machine and the waste heat released from the upper portion, the heat transfer to the machine body can be minimized.

### Thermally Stable Machine Construction

By circulating the dielectric fluid through the critical components of the machine in combination with a controlled force air flow, the machine body is harmonised with the room temperature. The internal and external temperatures of the casting are uniformed, and the optimally-designed covers assist the efficient temperature control. The Aero Harmonic System in the machine minimises the thermal influence from various production environments.

Dielectric fluid circulation system using a high-precision cooling unit

In-machine air circulation system

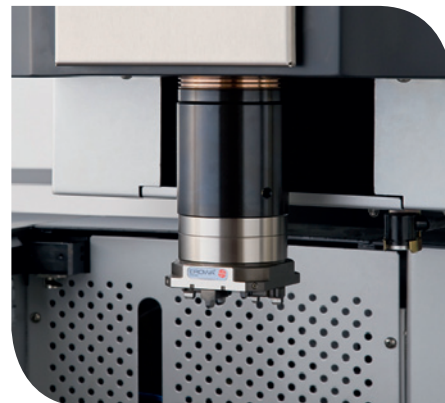


# Options

## Super-High Precision Rotary Head, "R Head"

Sodick's in-house made super-high precision rotary head "R Head" is designed and developed only for the Sodick AP sinker EDM range. The spindle is capable of rotation speed up to 2,000rpm with resolution of 1,048,576 divisions.

Resolution	1,048,576 division
Min. increment	1.24sec(0.00034°)
Positioning Speed	5 sec/rotation
Spindle Speed	1 - 2,000 rpm
Max. Electrode Weight	5 kg



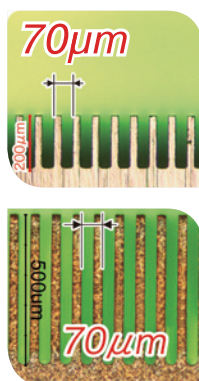
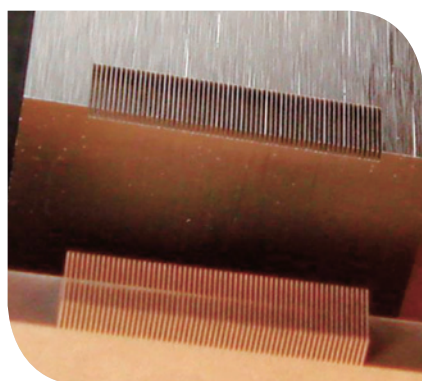
## Automatic Tool Changers

Automatic Tool Changer (ATC) is available on AP1L and AP3L. 8-station ATC is available on AP1L and 24 or 48-station ATC is available on AP3L.

Furthermore, both machines are compatible with Robot system as an electrode changer and a workpiece changer, which allows un-attended operation for even longer time.

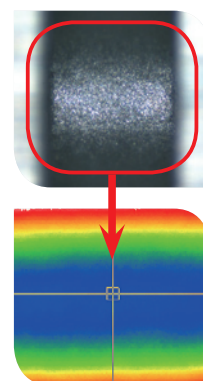
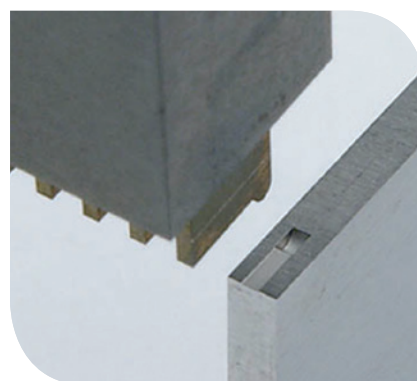


# Machining Samples



Micro Comb Electrode

Electrode material	CuW
Workpiece	Steel
Number of teeth	60
Tooth width	45µm
Cutting depth	0.2mm
Pitch width	70µm



Punch Marking

Electrode material	CuW
Workpiece	WC
Machining time	24min
Surface finish	0.28µmRa
Cutting depth	0.6mm
Electrode Undersize	50µm/ side

# Specification

Machine Tool	AP1L	AP3L
Ceramic table dimensions	360 x 220 mm	500 x 350 mm
Worktank dimensions (W x D x H)	503 x 349 x 250 mm	760 x 538 x 260 mm
Dielectric level (min~max, mm)	80~200 mm	80~210 mm
X-/Y-/Z- axis travel	200 x 120 x 200 mm	300 x 250 x 250 mm
Step resolution	0.0001 mm	0.0001 mm
Max. electrode weight	5 kg	5 kg
Max. workpiece weight	25 kg	200 kg
Distance from floor to table top	940 mm	915 mm
Machine tool dimensions (W x D x H) Incl. power supply and dielectric tank	1360 x 1920 x 2030 mm	1555 x 1945 x 1990 mm
Machine installation space (WxD) (including maintenance space)	2000 x 2280 mm	1555 x 2455 mm
Machine weight	3100 kg	4000 kg
Controlled axis	4	4
Air pressure	0.65 MPa	0.65 MPa
Resolution C Axis (optional)	0.00034°	0.00034°
Rotational speed C Axis (optional)	1~2,000	1~2,000

Dielectric Tank	AP1L	AP3L
External dimensions (W x D x H)	1095 x 435 x 785	1280 x 480 x 980
Dielectric fluid	Oil	Oil
Capacity (l)	120	150
Filtration method	Replaceable paper filter (MF-1530P)	Replaceable paper filter (MF-1530P)

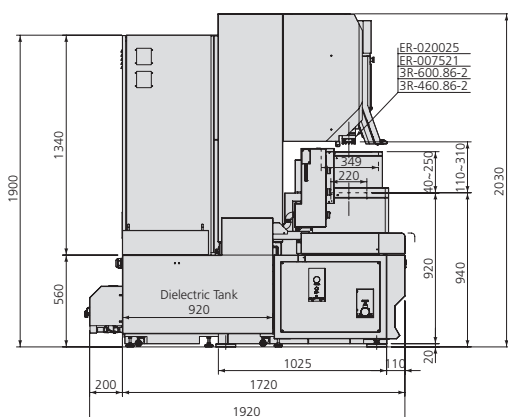
CNC Power Supply LN2/LN20			
Max. machining current	20A (AP1L = 10A)	Offset settings storage capacity	1000 conditions (H000 to H999)
Discharging power supply unit	Optimum pulse control for TMM 3 power supply (SGF Plus, SVC circuit)	Programme sequence number assignment	N000000000 to N999999999
Power requirement	200/220 V 50/60 Hz	Sub-programme nesting levels	50
CNC unit	Multi-tasking OS, KSMC-LINK system	Q command nesting levels	8
User's memory capacity	Editing: 100,000 block Saving: 30 MB	Number of co-ordinates	60
Memory device	CF card, External memory	Simultaneous control axes	Max 4 axes (Max 6 axes, 8 axes/LN20)
Input format	External memory, Touch panel, Keyboard,	Min. input command	0.1 µm
Display type	15" TFT-LCD (XGA)	Min. drive unit	0.1 µm
Character set	Alphanumeric and symbols	AJC speed	X, Y axis Z axis Max. 10 m/min Max. 36 m/min
Keyboard	Standard 101-key, Function key	Jog feed rate	X, Y, Z axis Max. 6 m/min
Remote Controller (Standard)	Standard jog (switchable), Assist A0 to A3, Clamp / unclamp, etc.	Control system	Full closed loop (Linear scales)
Positioning command	Incremental and absolute	Drive mechanism	Linear motor
Max. input command	±999999.999 / ±99999.9999 / ±999.99999 (switchable)	Compensation	Separated to each axes / Backlash and Torque compensation
Machining conditions storage capacity	1000 conditions	Editing	2-screen simultaneous display, Background editing
Graphics	XY plane, XY-YZ plane, 3D, Background graphics, Orbit shape graphics, Discharge graph, etc.		

\*1 Please select the appropriate clamping chuck for your system.

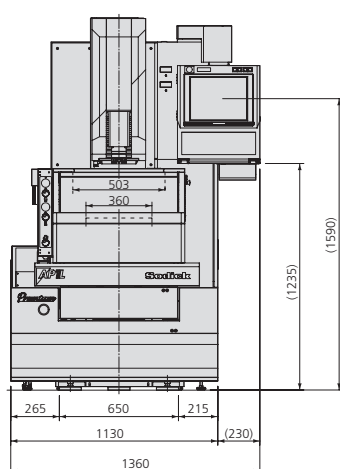
· Selection: LN2/LN20. Please consult sales representatives for more details.  
· Specifications are subject to change without prior notice due to continual research and development.

# AP1L

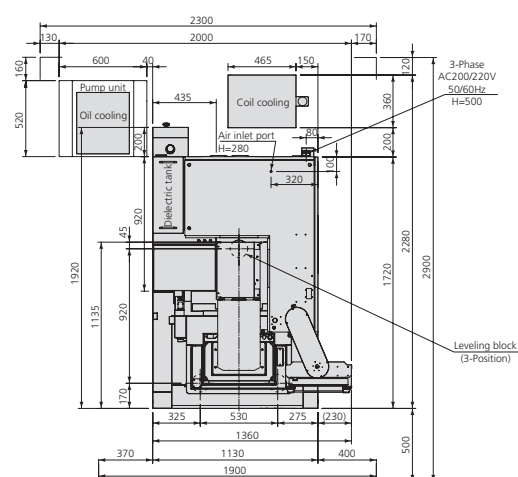
Side



Front

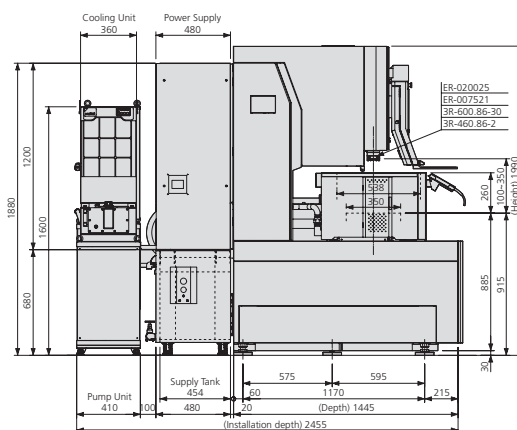


Top View

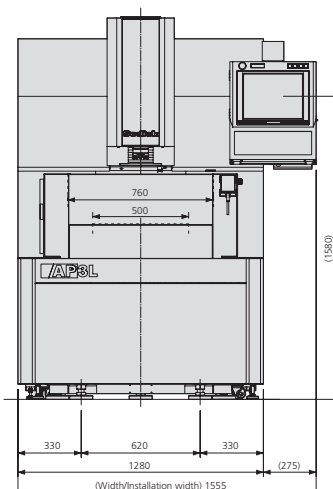


# AP3L

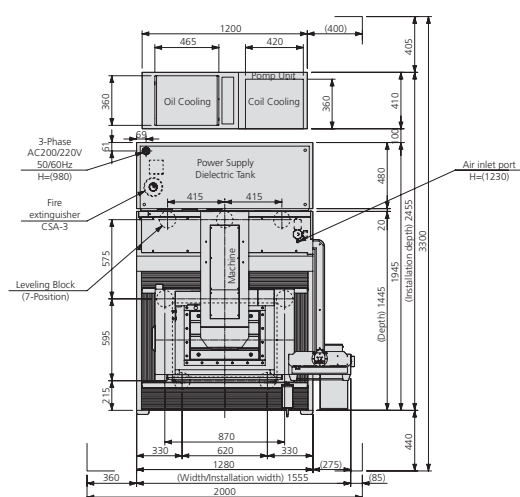
Side



Front



Top View



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

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