for a greener tomorrow

MITSUBISHI ELECTRIC
Changes for the Better

FACTORY AUTOMATION

MITSUBISHI NC EDM SYSTEMS
EA-S Series

EA-S
series

GLOBAL IMPACT OF MITSUBISHI ELECTRIC

Through Mitsubishi Electric's vision, "Changes for the Better" are possible for a brighter future.

Changes for the Better

We bring together the best minds to create the best technologies. At Mitsubishi Electric, we understand that technology is the driving force of change in our lives. By bringing greater comfort to daily life, maximizing the efficiency of businesses and keeping things running across society, we integrate technology and innovation to bring changes for the better.

Mitsubishi Electric is involved in many areas including the following

Energy and Electric Systems
A wide range of power and electrical products from generators to large-scale displays.

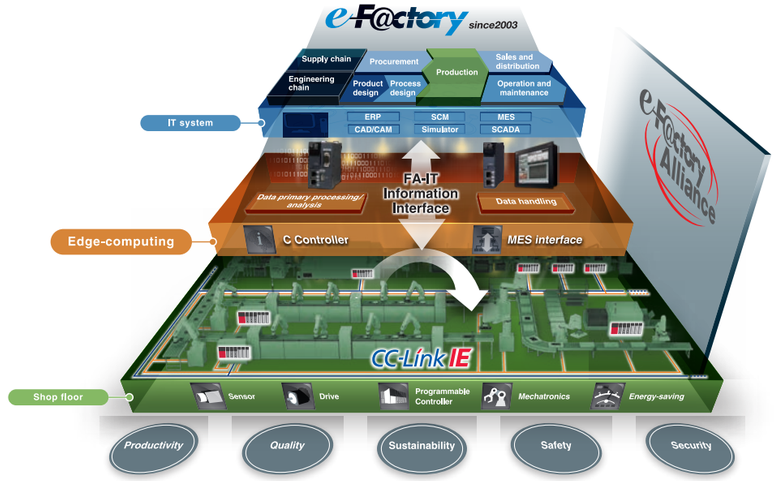
Electronic Devices
A wide portfolio of cutting-edge semiconductor devices for systems and products.

Home Appliance
Dependable consumer products like air conditioners and home entertainment systems.

Information and Communication Systems
Commercial and consumer-centric equipment, products and systems.

Industrial Automation Systems
Maximizing productivity and efficiency with cutting-edge automation technology.

Mitsubishi Electric continues the challenge to be the only one FA machine and systems supplier delivering total customer satisfaction.



Mitsubishi Electric is a world-leading general electrical and electronic products manufacturer with wide-ranging business reach, from appliances for the home to systems used in outer space. Global-scale business development is in five business domains: heavy electrical machinery and systems, industrial automation, information and communication systems, electronic devices, and home appliances. Producing general electrical machinery for over 90 years, as Mitsubishi Electric's Factory Automation Systems Business Group, we have supported manufacturing in Japan, China, and Asia, and around the globe. In doing so, we have accumulated and refined technologies for FA control, drive control, automation, and manufacturing that are utilized to expand and improve a vast product lineup, such as controllers, drives, and automation and power distribution control products. In addition to product components like those listed above, we are quick to propose systems such as e-F@ctory and iQ Platform as solutions for production site innovation. As a comprehensive supplier of FA products and systems, Mitsubishi Electric will continue to respond to the voice of customers and deliver products of the utmost quality throughout the world.

INDEX

EA-S Series

The history of Mitsubishi Electric EDMs is the history of electrical-discharge machining

1964

Thyristor power supply
Hydraulic servo method
DM201
1964

DM500+DE90T
1965

Transistor pulse power supply
DM250+DE30T
1967

DM100
1971

DM300N+EP120M
1972

DK700
1974

DK280
1976

DK140
1978

DK360NC
1980

M35K
1986

Ultralow-wear power supply
(slope control method)
M25KC4
1986

16bit CNC
M55C6
1982

M25C3
1982

M55
1982

M35C2
1982

Motor servo method
M30
1982

M85KW
1987

M115K
1988

EML20
1988

M35J
1989

M35S
1989

M65E
1990

32bit CNC
FUZZY control
V35F
1991

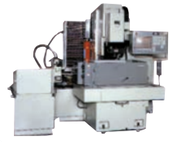
EX30
1996

EX8
1995

VX20
1995

VX10
1994

ADMAQ-E
1994



NS powder specification
VP35F
1992

EDSCAN8E
1996

64bit CNC
EA12E
1999

EA8
1999

VA10
2001

Thermal displacement compensation
MA2000
2001

EA8P
2004

FP-V power supply
(tungsten carbide machining circuit)
EA12V
2004

EA28V
2007

Ultrafine matte finish circuit (NP2 circuit)
EA8PV
2006

2015

EA12S
2015

EA8S
2014

EA8PV ADVANCE
2008

EA28V ADVANCE
2008

ADVANCE control unit
EA12V ADVANCE
2008

EA-S Series

EA-S Series

Line-up/Machining Samples

Compact machine
EA8S

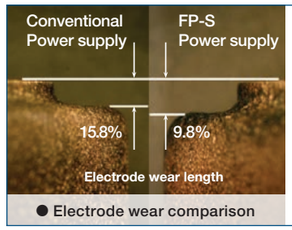
Automatic elevation tank
C-axis (option)

Front door specifaication
C-axis (option)

High-productivity machine
EA12S

Automatic elevation tank
C-axis (option)

Front door specifaication
C-axis (option)

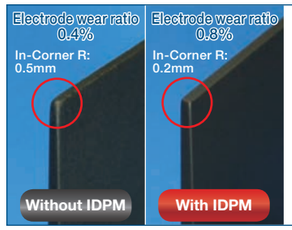


● Electrode wear comparison

Tungsten Carbide machining circuit is standard equipment

Model	EA8S
Electrode	Copper tungsten
Workpiece	Tungsten carbide
Roughness	Rz:1.8μm/Ra:0.25μm
Accuracy	±0.010mm

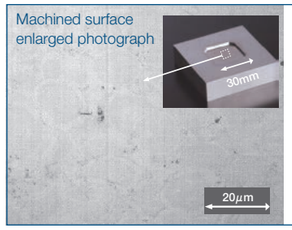
- Tungsten carbide machining circuit is equipment on the FP-S power supply.
- Optimum machining conditions and programs can be created using ESPERADVANCE



High speed and low wear electrode machining with IDPM and SS JUMP 5

Model	EA12S
Electrode	Graphite (TTK5)
Workpiece	Steel (STAVAX)
Roughness	Rz:8.4μm/Ra:1.1μm
Accuracy	±0.010mm

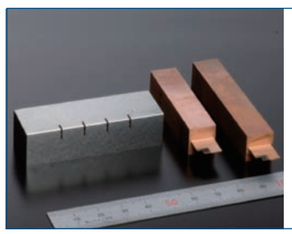
- High speed machining with IDPM+SS jump (Depth: 40mm, Rough: 1.6hour)
- Low electrode wear machining with IDPM (electrode length wear reduced up to 50%)



Glossy surface finishing (Available contact area : twice as conventional model)

Model	EA8S
Electrode	Copper
Workpiece	Steel (STAVAX)
Roughness	Rz:1.0μm/Ra:0.15μm
Accuracy	±0.010mm

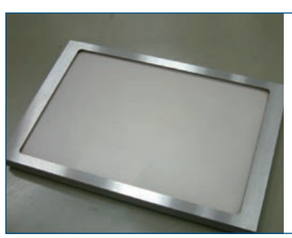
- High quality glossy surface by GM2 circuit.
- Uniform surface is achieved by SS jump 5.



Rib machining (Machining time : 50% improvement)

Model	EA8S
Electrode	Copper
Workpiece	Steel (STAVAX)
Roughness	Rz:6.0μm/Ra:0.8μm
Accuracy	±0.010mm

- High-speed machining is realized using SS jump 5
- Reduced the number of electrode(3→2) by low wear machining with Narrow gap circuit



Machining time of the tablet size can reduce 50%

Model	EA12S
Electrode	Copper
Workpiece	Steel (STAVAX)
Roughness	Rz:7.4μm/Ra:1.2μm
Accuracy	±0.015mm

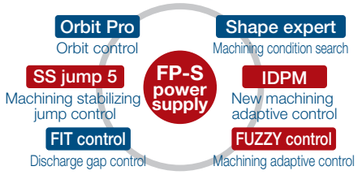
- Stable machining which reduce the load during large-area machining by SS jump5.
- Achieve a stabilization of the cutting of the post-process by Initial machining control

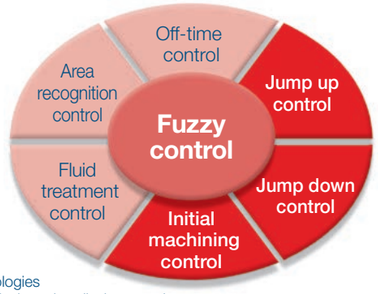
Functions and Features

Integration of highly evolved technology and ADVANCE control
Compatible with various types of EDM machining

Highly evolved technology

High-speed machining is realized using advanced machining control





IDPM
- Intelligent Digital Power Master: Adaptive control to be integrated ever developed technologies
- Integrated Discharge Power Monitor: Adaptive control to reduce abnormal discharge with detecting discharge pulse

Machining adaptive control: IDPM

Faster machining and low electrode wear are realized when using graphite electrode

●Wear using graphite electrode reduced up to 80% by IDPM

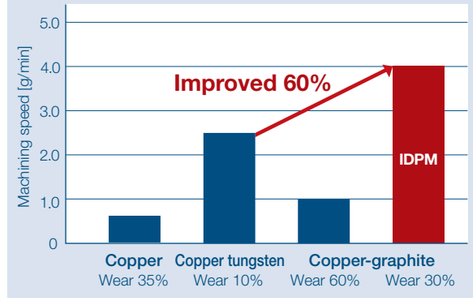
■Electrode wear comparison for 15x15mm and 40mm depth

*Compared to conventional Mitsubishi Electric EDM (EA Series)

- Less wear of corner shape of electrode
- Smooth electrode surface

Improved Productivity of Tungsten Carbide Machining

●Machining speed is improved up to 60% with using IDPM and copper-graphite electrode

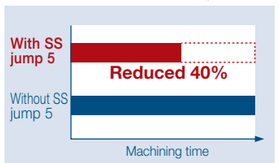


*Machining performance may vary depending on machine specifications and electrode materials

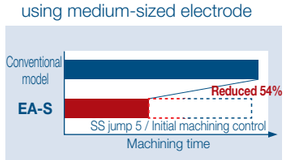
Machining stabilizing jump control: SS jump 5

Jump control suitable for various shapes is realized by optimizing smoothing of jump up operation and speed / acceleration control

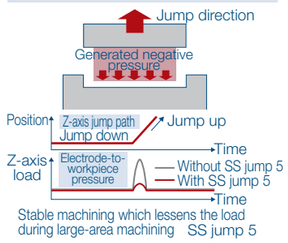
●Machining time is reduced up to 40% by optimizing smoothing of simultaneous 2 or 3 axes operation and speed/acceleration control



●Machining time reduced for the uniform fine finish machining using medium-sized electrode

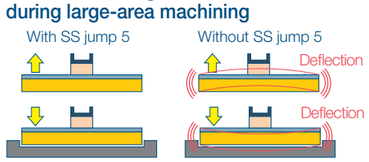


*Compared to conventional Mitsubishi Electric EDM (EA Series)



Stable machining which lessens the load during large-area machining SS jump 5

Stable machining which lessens the load during large-area machining



Machining adaptive control: Initial machining control

Faster machining is realized with improved initial machining control for the start of machining after rough milling

●Machining time reduced up to 50% for the start of machining after rough milling

Easy-to-use control (ADVANCE control unit)

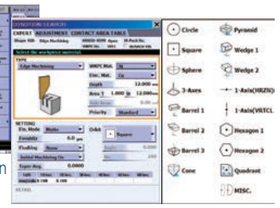
Ergonomic design

●Easy-to-view screen (15-inch)
●Intuitive operations by touch-panel control
●User-friendly keyboard and mouse

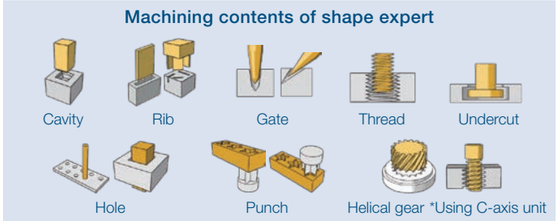
Programming (ESPERADVANCE)

●Simple table-format programming
●Machining conditions and programs suitable for various shapes can be created (shape expert)

Machining program screen



Machining condition search screen

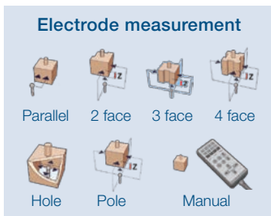


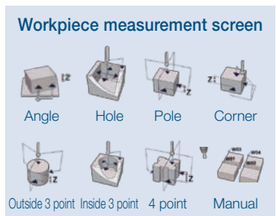
Electrode and workpiece measurements

●Electrode alignment with electrode measurement screen
●Coordinate value setting with workpiece measurement screen

Electrode measurement screen

Workpiece measurement screen

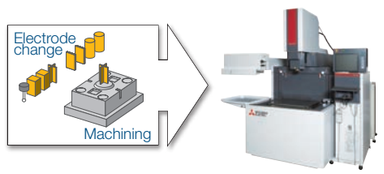




Automation

LS-10T/20T (Automatic Tool Changer)

●Continuous operation is possible using many electrode changes by automatic took changer



Electrode/Workpiece automatic changing unit specification (two EDMs using a robotic system)

●Continuous operation possible by many electrode and workpiece changes by robotic system

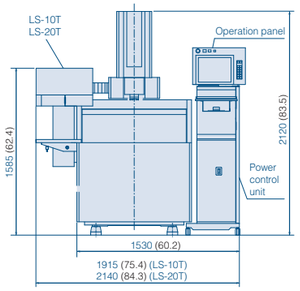
Product Introduction

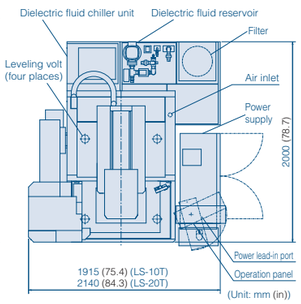
EA8S
Compact machine

Phote:Automatic elevation tank
C-axis(option)

Phote:Front door specification
C-axis (option)

Automatic elevation tank





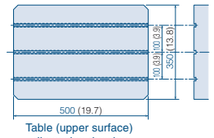
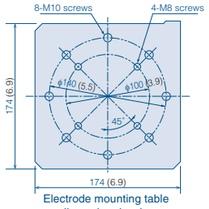


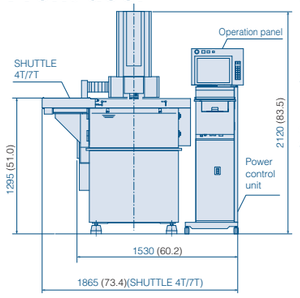
Table (upper surface) dimension drawing

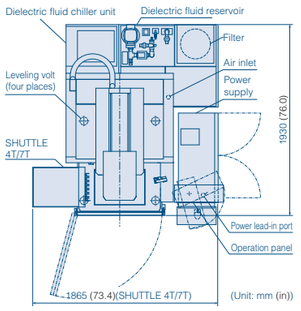


Electrode mounting table dimension drawing

*The EROWA/3R electrode holder is used when the C-axis/automatic clamp (option) is provided.

Front door





Standard functions
- Super-low-wear circuit (SC circuit)
- Tungsten carbide machining circuit
- Fine matte finish circuit (PS circuit)
- Glossy mirror finish circuit (GM2 circuit)
- Narrow gap circuit
- SS jump 5 (machining stabilizing jump control)
- DNC H/W, FTP, DNC S/W
- IDPM (machining adaptive control)

Options
- Highly rigid C-axis
- Automatic clamp
- Shuttle-type ATC *1
- LS-10T ATC/LS-20T ATC *2
- Z-axis linear scale
- XY-axis linear scale
- High-function manual operation box
- LED light
- Emission/suction automatic changeover *3
- Dielectric fluid distributor
- FP120S
- FP-V power supply extension unit

*1 Mountable only for machine with front door
*2 Mountable only for machine with automatic elevation tank.
*3 It is recommended option for using flushing on machine with ATC.

Standard delivery entrance

		Width [mm (in)]	Height [mm (in)]
Automatic elevation tank	Without ATC	1120 (44.1)	2150 (84.6)
	LS-10T ATC specifications	1505 (59.3)	2150 (84.6)
	LS-20T ATC specifications	1730 (68.1)	2150 (84.6)
Front door	Without ATC	1120 (44.1)	2150 (84.6)
	Shuttle-4T ATC specifications	1285 (50.6)	2150 (84.6)
	Shuttle-7T ATC specifications	1455 (57.3)	2150 (84.6)

Standard machine specifications

Model		EA8SM Automatic elevation tank	EA8SM Front door
Machine unit	Dimensions (W×D×H) [mm (in)]	1530×2000×2120 (60.2×78.7×83.5)	1530×1920×2120 (60.2×75.6×83.5)
	Total system weight [kg (lb.)]	2000 (4409)	
Machine travels (X×Y×Z)	[mm (in)]	300×250×250 (11.8×9.8×9.8)	
Spindle	Distance between table and electrode mounting surface [mm (in)]	150 to 400 (5.9 to 15.7)	
	Max. electrode weight [kg (lb.)]	25 (55)	
Working tank	Method	Automatic elevation tank	Hinge open-close
	Inner dimensions (W×D×H) [mm (in)]	800×520×300 (31.5×20.5×11.8)	
	Fluid level adjustment range (from top of table) [mm (in)]	85 to 250 (3.3 to 9.8)	110 to 250 (4.3 to 9.8)
Table	Dimensions (W×D) [mm (in)]	500×350 (19.7×13.8)	
	Max. workpiece dimensions (W×D×H) [mm (in)]	770×490×200 (30.3×19.3×7.9)	
	Distance between floor and top of table [mm (in)]	900 (35.4)	
	Max. workpiece weight [kg (lb.)]	550 (1213)	
	T-slot	Three slots at 12-100mm pitch	
Dielectric fluid reservoir	Capacity (initial dielectric fluidsupply amount) [ℓ (gal.)]	260 (68.7) (270(71.3))	260 (68.7)
	Filtering method	One fine paper filter	
	Dielectric fluid chiller unit	Unit cooler	

Distance between table and electrode mounting surface

	EROWA ITS50	3R MACRO	3R Combi	
			MACRO	Jr
C-aixs [mm (in)]	150 to 400 (5.9 to 15.7)	133 to 383 (5.2 to 15.1)	133 to 383 (5.2 to 15.1)	143 to 393 (5.6 to 15.5)
Automatic clamp [mm (in)]	150 to 400 (5.9 to 15.7)	148 to 398 (5.8 to 15.7)	148 to 398 (5.8 to 15.7)	158 to 408 (6.2 to 16.1)

C-axis/ATC (option)

				EROWA ITS	EROWA COMBI	3R MACRO	3R Combi
C-axis		Max. electrode weight	10 (22) *3 [kg (lb.)]	○	○	○	○
		Speed	1 to 30 [min-1]				
ATC	LS-10T*2	Max. electrode dimensions	54×54×200 [mm (in)] (2.1x2.1x7.9)	○	–	○	○
		Max. electrode weight	5kg (11lb.) / electrode *5 Magazine total: 20kg (44lb.)				
	LS-20T*2	Max. electrode dimensions	54×54×200 [mm (in)] (2.1x2.1x7.9)	○	–	○	○
		Max. electrode weight	10kg (22lb.) / electrode *5 Magazine total: 40kg (88lb.)				
	Shuttle-4T*1	Max. electrode dimensions	70×70×100 [mm (in)] (2.8x2.8x3.9)	○	–	○	–
		Max. electrode weight	5kg (11lb.) / electrode Magazine total: 20kg (44lb.)				
	Shuttle-7T*1	Max. electrode dimensions	35×35×100*4 [mm (in)] (1.4x1.4x3.9)	–	–	–	○
		Max. electrode weight	5kg (11lb.) / electrode *4 Magazine total: 10kg (22lb.)				

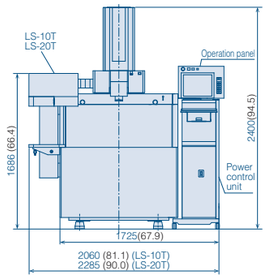
*1 Mountable only for machine with front door
*2 Mountable only for machine with automatic elevation tank
*3 For Compact of EROWA COMBI and MACRO Jr of 3R Combi, the weight is 2.5kg (5.5lb.)/ electrode.
*4 When using four electrodes, the dimensions are 70×70×100(mm) [2.8×2.8×3.9(in)], the magazine total is 10kg (22lb.).
*5 For MACRO of 3R Combi, the weight is 5kg (11lb.)/ electrode, and is 2.5kg (5.5lb.)/ electrode with MACRO Jr.

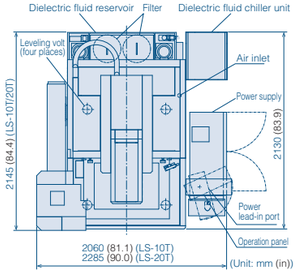
EA12S
High-productivity machine

Phote:Automatic elevation tank
C-axis(option)

Phote:Front door specification
C-axis (option)

Automatic elevation tank





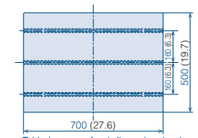
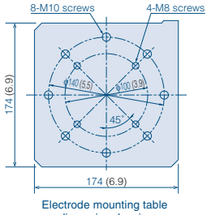


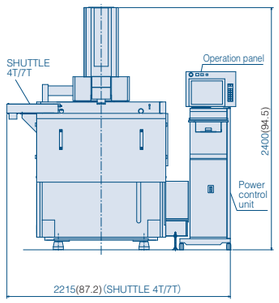
Table (upper surface) dimension drawing

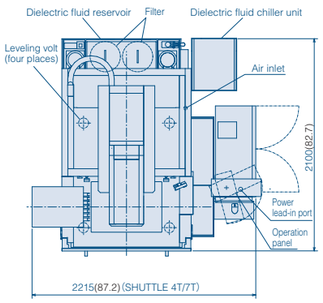


Electrode mounting table dimension drawing

*The EROWA/3R electrode holder is used when the C-axis/automatic clamp (option) is provided.

Front door





Standard functions
- Super-low-wear circuit (SC circuit)
- Tungsten carbide machining circuit
- Fine matte finish circuit (PS circuit)
- Glossy mirror finish circuit (GM2 circuit)
- Narrow gap circuit
- Z-axis linear scale
- SS jump 5 (machining stabilizing jump control)
- DNC H/W, FTP, DNC S/W
- IDPM (machining adaptive control)

Options
- Highly rigid C-axis
- Automatic clamp
- LS-10T ATC/LS-20T ATC
- XY-axis linear scale
- High-function manual operation box
- LED light
- Emission/suction automatic changeover *1
- Dielectric fluid distributor
- FP120S
- FP-V power supply extension unit

*1 It is recommended option for using flushing on machine with ATC.

Standard delivery entrance

		Width [mm (in)]	Height [mm (in)]
Automatic elevation tank	Without ATC	1320 (52.0)	2445 (96.3)
	LS-10T ATC specifications	1655 (65.2)	2445 (96.3)
	LS-20T ATC specifications	1880 (74.0)	2445 (96.3)
Front door	Without ATC	1560 (61.4)	2445 (96.3)
	Shuttle-4T ATC specifications	1855 (73.0)	2445 (96.3)
	Shuttle-7T ATC specifications	1855 (73.0)	2445 (96.3)

Standard machine specifications

Model		EA12SM Automatic elevation tank	EA12SM Front door
Machine unit	Dimensions (W×D×H) [mm (in)]	1725×2130×2400 (67.9×83.9×94.5)	1920×2100×2400 (75.6×82.7×94.5)
	Total system weight [kg (lb.)]	3500 (7716)	3400 (7496)
Machine travels	(X×Y×Z) [mm (in)]	400×300×300 (15.7×11.8×11.8)	
Spindle	Distance between table and electrode mounting surface [mm (in)]	200 to 500 (7.9 to 19.7)	300 to 600 (11.8 to 23.6)
	Max. electrode weight [kg (lb.)]	50 (110)	
Working tank	Method	Automatic elevation tank	Vertical front door
	Inner dimensions (W×D×H) [mm (in)]	950x700x450 (31.5x20.5x11.8)	1050x700x450x (41.3x20.5x11.8)
	Fluid level adjustment range (from top of table) [mm (in)]	80 to 400 (3.1 to 15.7)	180 to 400 (7.1 to 15.7)
Table	Dimensions (W×D) [mm (in)]	700×500 (27.6×19.7)	
	Max. workpiece dimensions (W×D×H) [mm (in)]	900×650×350 (35.4×25.6×13.8)	
	Distance between floor and top of table [mm (in)]	900 (35.4)	
	Max. workpiece weight [kg (lb.)]	1000 (2205)	
	T-slot	Three slots at 12-160mm pitch	
Dielectric fluid reservoir	Capacity (initial dielectric fluid supply amount) [ℓ (gal.)]	360 (95.1) (470 (124.2))	550 (145.3) (590 (155.9))
	Filtration method	Two fine paper filters	
	Dielectric fluid chiller unit	Unit cooler	

Distance between table and electrode mounting surface

	EROWA ITS50	3R MACRO	3R Combi	
			MACRO	Jr
Highly rigid C-aixs [mm (in)]	200 to 500 (7.9 to 19.7)	183 to 483 (7.2 to 19.0)	183 to 483 (7.2 to 19.0)	193 to 493 (7.6 to 19.4)
Automatic clamp [mm (in)]	200 to 500 (7.9 to 19.7)	198 to 498 (7.8 to 19.6)	198 to 498 (7.8 to 19.6)	208 to 508 (8.2 to 20.0)

C-axis/ATC (option)

				EROWA ITS	EROWA COMBI	3R MACRO	3R Combi
C-axis		Max. electrode weight	50 (110) *3 [kg (lb.)]	○	○	○	○
		Speed	1 to 30 [min-1]				
ATC	LS-10T*2	Max. electrode dimensions	54×54×200 [mm (in)] (2.1x2.1x7.9)	○	–	○	○
		Max. electrode weight	5kg (11lb.) / electrode *5 Magazine total: 20kg (44lb.)				
	LS-20T*2	Max. electrode dimensions	54×54×200 [mm (in)] (2.1x2.1x7.9)	○	–	○	○
		Max. electrode weight	10kg (22lb.) / electrode *5 Magazine total: 40kg (88lb.)				
	Shuttle-4T*1	Max. electrode dimensions	70×70×100 [mm (in)] (2.8x2.8x3.9)	○	–	○	○
		Max. electrode weight	5kg (11lb.) / electrode Magazine total: 20kg (44lb.)				
	Shuttle-7T*1	Max. electrode dimensions	35×35×100*4 [mm (in)] (1.4x1.4x3.9)	–	–	–	○
		Max. electrode weight	5kg (11lb.) / electrode *4 Magazine total: 10kg (22lb.)				

*1 Mountable only for machine with front door
*2 Mountable only for machine with automatic elevation tank
*3 For Compact of EROWA COMBI and MACRO Jr of 3R Combi, the weight is 2.5kg (5.5lb.)/ electrode.
*4 When using four electrodes, the dimensions are 70×70×100(mm) [2.8×2.8×3.9(in)], the magazine total is 10kg (22lb.).
*5 For MACRO of 3R Combi, the weight is 5kg (11lb.)/ electrode, and is 2.5kg (5.5lb.)/ electrode with MACRO Jr.

Power Supply and Control Specifications/Options

Power Supply and Control Specifications

	Model	EA8SM Automatic elevation tank	EA8SM Front door	EA12SM Automatic elevation tank	EA12SM Front door
Power supply unit	Power supply model	FP80S			
	Maximum machining current peak [A]	80			
	Standard machining circuits and functions	Transistor pulse circuit (TP circuit) Super-low-wear circuit (SC, α-SC circuit) Fine matte finish circuit (PS circuit) Glossy mirror finish circuit (GM2 circuit) Fuzzy control, SS jump 5			
	Power supply method	Resistor-less, low heat generating, compact, power regenerating type energy-saving power supply method			
	Cooling method	Indirect cooling			
Control unit	Control unit	C31EA-2			
	Input method	Keyboard, USB flash memory, network			
	Pointing device	Touch panel, mouse			
	Display	15-inch color TFT-LCD touch screen			
	Display characters	Alphanumeric characters			
	Number of controlled axes	Maximum four axes			
	Setting (command) unit	XYZ···0.0001mm, C (rotary axis)···0.0001deg			
	Minimum drive unit	XYZ···0.0001mm, C (rotary axis)···0.0001deg			
	Manual feed	High-speed, low-speed, inching 0.001mm/0.01mm extension mode (high-speed/low-speed) Maximum feedrate XYZ: 2000mm/min			

Control unit functions

C31 (Advance control unit) control unit functions

NC functions	Corner chamfer command	Maintenance functions
Year, month, date display	Linear angle command	Maintenance check
Character string replace function	Backlash compensation	Alarm display (with troubleshooting guidance)
Teaching function	Pitch error compensation	
Machining start time designation function	Soft limit (inside/outside prohibit)	e-manual (electronic manual)
	Reference block	System update over web
Various timers	Automatic zero point return	Automatic positioning functions
Automatic return	Electrode multiple deviation compensation (Electrode rotation compensation)	Edge positioning
Start point return		Hole center positioning
Axis rotation	Machining functions	Pole center positioning
Program support function	Fuzzy Pro Plus adaptive control	Electrical-discharge positioning
E.S.P.E.R ADVANCE	Machining results graph, machining results table	Width center positioning
E.S.P.E.R ADVANCE Navigator		Slot center positioning
Memory operation	Machining condition expert	3-point center positioning
Offset	Master Pack	2 to 4 face positioning
Coordinate value read	Orbit machining	Repeated positioning
Time read	Taper machining	Check functions
Workpiece coordinate system (106 coordinates)	Lateral machining	Graphics (machining shape drawing)
	Automatic coreless machining	Single block
Coordinate rotation	3D machining	Dry run
Figure rotation	Side servo machining	Block delete
Axis change	Offset machining	3D graphic check
Mirror image	Inclined machining	3D viewer (Parasolid data display)
Scales for XY-axis	Contour machining (spindle required)	EPX format data read
Function computations	C-axis machining (C-axis required)	
Corner R command		

Options

Main option correspondence table ◎:Standard equipment ○:Can be added after installation ●:Cannot be added after installation ×:Not available

				EA8SM Automatic elevation tank	EA8SM Front door	EA12SM Automatic elevation tank	EA12SM Front door
Machine unit	Lubricant	Automatic lubricant unit		◎		◎	
	Scale	Scale feedback specifications	Z-axis	●		◎	
			XY-axis	●		●	
	Thermal displacement compensation system			×		×	
	Granite table *1			●		×	
	High-function manual operation box			○		○	
	LED light			○		○	
Dielectric fluid system	Cooler	Dielectric fluid chiller unit (unit cooler)		◎		◎	
	Fluid system	Dielectric fluid automatic supply/drain		◎		◎	
		Emission/Suction automatic changeover *2		●		●	
		Programmable flushing nozzle selection, automatic changeover		×		×	
		Dielectric fluid distributor		○		○	
Power supply	Main power supply	FP80S		◎		◎	
		FP120S		●		●	
	Special power supply	SP power supply (for tungsten carbide machining)		●		●	
		NP2 circuit		×		×	
		Narrow gap circuit		◎		◎	
		FP-V power supply extension unit		○		○	

*1 Table height is 70mm (standard is 50mm), distance between table and electrode mounting surface becomes short by 20mm.
*2 It is recommended option for using flushing on machine with ATC.
*3 Select the chuck from the following types. (3R-MACRO, 3R-Combi, EROWA-ITS, EROWA-COMBI)
*4 The external signal output (M code with answer) is necessary for attaching external equipment which requires an answer signal.
*5 LAN cable should be all straight wiring type with shielding connector, category 5 (100BASE-TX compliant), STP (four shielded twisted pair).
A switchable hub that can ground the shielded LAN cable should be used.

					EA8SM Automatic elevation tank	EA8SM Front door	EA12SM Automatic elevation tank	EA12SM Front door
Head side tooling	Highly rigid C-axis *3				○		○	
	High-accuracy built-in spindle				×		×	
	Automatic clamp *3				○		○	
	Removable holder (3R-16M-MACRO-R specifications)				○		○	
	Large electrode adaptor				×		×	
ATC	Shuttle	4T	3R MACRO		×	●	×	●
			3R Combi		×	×	×	●
			EROWA ITS		×	●	×	●
		7T	3R MACRO		×	×	×	×
			3R Combi		×	●	×	●
			EROWA ITS		×	×	×	×
	LS	10T	3R MACRO		●	×	●	×
			3R Combi		●	×	●	×
			EROWA ITS		●	×	●	×
		20T	3R MACRO		●	×	●	×
			3R Combi		●	×	●	×
			EROWA ITS		●	×	●	×
Control unit	Communication	External signal output (M code)			○		○	
		External signal output (M code with answer) *4			○		○	
		DNC H/W *5			◎		◎	
		FTP			◎		◎	
		DNC S/W			◎		◎	
		Robot connection interface			●		●	
Software	Electronic manual (e-manual)				◎		◎	
	Built-in scheduler				×		×	
	Anti-virus protection				○		○	
	Power saving function				×		×	
Display	Run timer				○		○	
	3-color warning light				○		○	
Others	Instruction manual (paper edition)				○		○	
Paint color designation					×		×	

Power Facility Capacity

Model	EA8SM Automatic elevation tank / EA8SM Front door		EA12SM	
Power supply	FP80S	FP120S	FP80S	FP120S
Maximum machining current average[A]	60	100	60	100
Maximum machining current peak[A]	80	120	80	120
Dielectric fluid chiller unit[kW]	1.74	3.5	1.74	3.5
Total input capacity[kVA]*1	6.5	9.5	7.0	10.0
Machine's generated heating value[kW]*2, *3	3.9	5.7	4.2	6.0

*1 Add 5[kVA] for total input capacity with SP power supply specification
*2 Reference value (heating value (kW) = Total input capacity (kVA) × 0.6)
*3 Add 3[kW] for machine's generated heating value with SP power supply specification

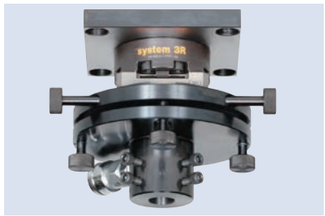
Network Connection Specifications (FTP and DNC S/W)

Data such as NC programs, machining conditions and variables can be exchanged between a personal computer and EDM.
One IP address must be prepared for each EDM within the user's in-house network.

Required specifications	Image		Supplement
Operate on the EDM side, and receive data from personal computer	Data transmission	Standard (DNC H/W)	Use EDM's Explorer and receive data in the common HDD on the EDM side. After that, data I/O operations are required.
Operate on the EDM side, and send data directly to the EDM's NC	Data transmission	Standard (FTP)	Data can be received only using data I/O operation.
Operate on the personal computer side, and send data to the EDM	Data transmission	Standard (DNC H/W)	The personal computer's Explorer and the EDM's common HDD are used. After that, data I/O operations are required for the EDM.
Operate on the personal computer side, and send data directly to the EDM's NC	Data transmission	Standard (DNC S/W)	Commercially available DNC software must be installed on the personal computer side. Refer to DNC specifications operation for details.

Head side tooling *Select tooling

Removable holder



3R-16M-MACRO-R specifications

Automatic clamp

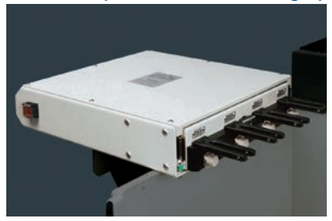
Clamp spindle side holder with air chuck
(photo shows EROWA ITS50 chuck specifications)

High-accuracy built-in C-axis(EA ADVANCE, MA/EA)

Highly accurate helical machining and index machining are possible
Compatible with fluid emission from spindle center
(photo shows 3R MACRO chuck specifications)

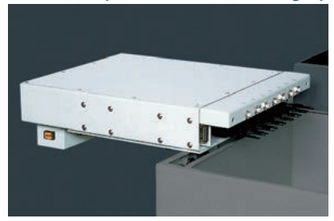
ATC

Shuttle-4T(automatic tool changer)



Change up to four electrodes
Compatible with continuous machining using multiple electrodes

Shuttle-7T(automatic tool changer)



Change up to seven electrodes (only Combi specifications)
Compatible with continuous machining using multiple electrodes

LS-10T (automatic tool changer)

Change up to 10 electrodes
Compatible with continuous machining using many electrodes

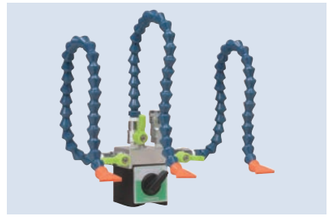
LS-20T(automatic tool changer)

Change up to 20 electrodes
Compatible with continuous machining using many electrodes

Dielectric fluid system, etc.

Dielectric fluid distributor

Sprays dielectric fluid between workpiece and electrode during pitch machining.



Distributes dielectric fluid into three flows and sprays onto machining section.

LED light

Power supply of DC24V for the LED light.

High-function manual operation box

Standard manual operation box

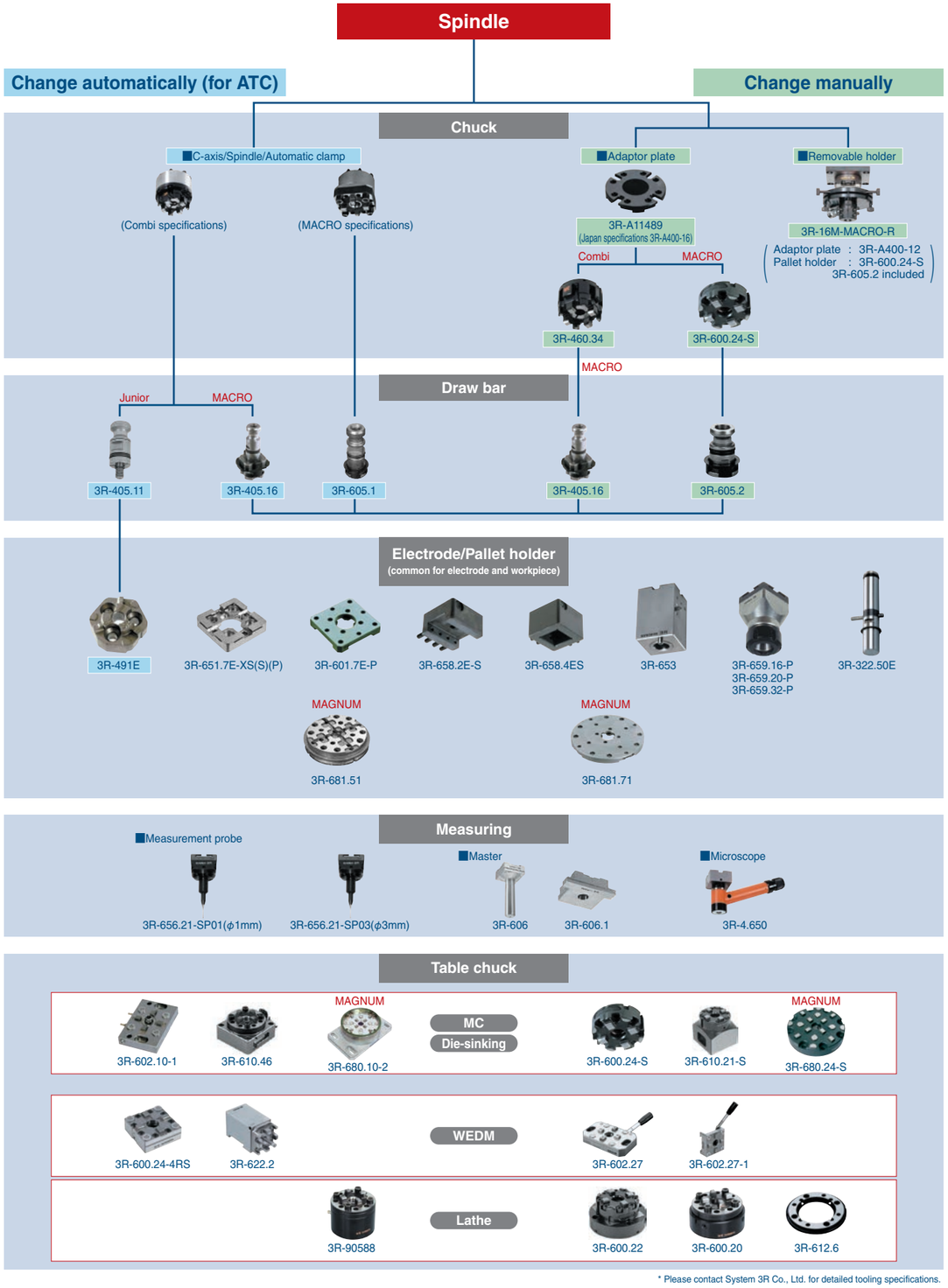
LCD display improves workability.
Workpiece coordinates can be set from manual operation box.
Jog feedrate can be changed between 50 and 150% with override function.

3-color warning light

Indicates machine operation status.

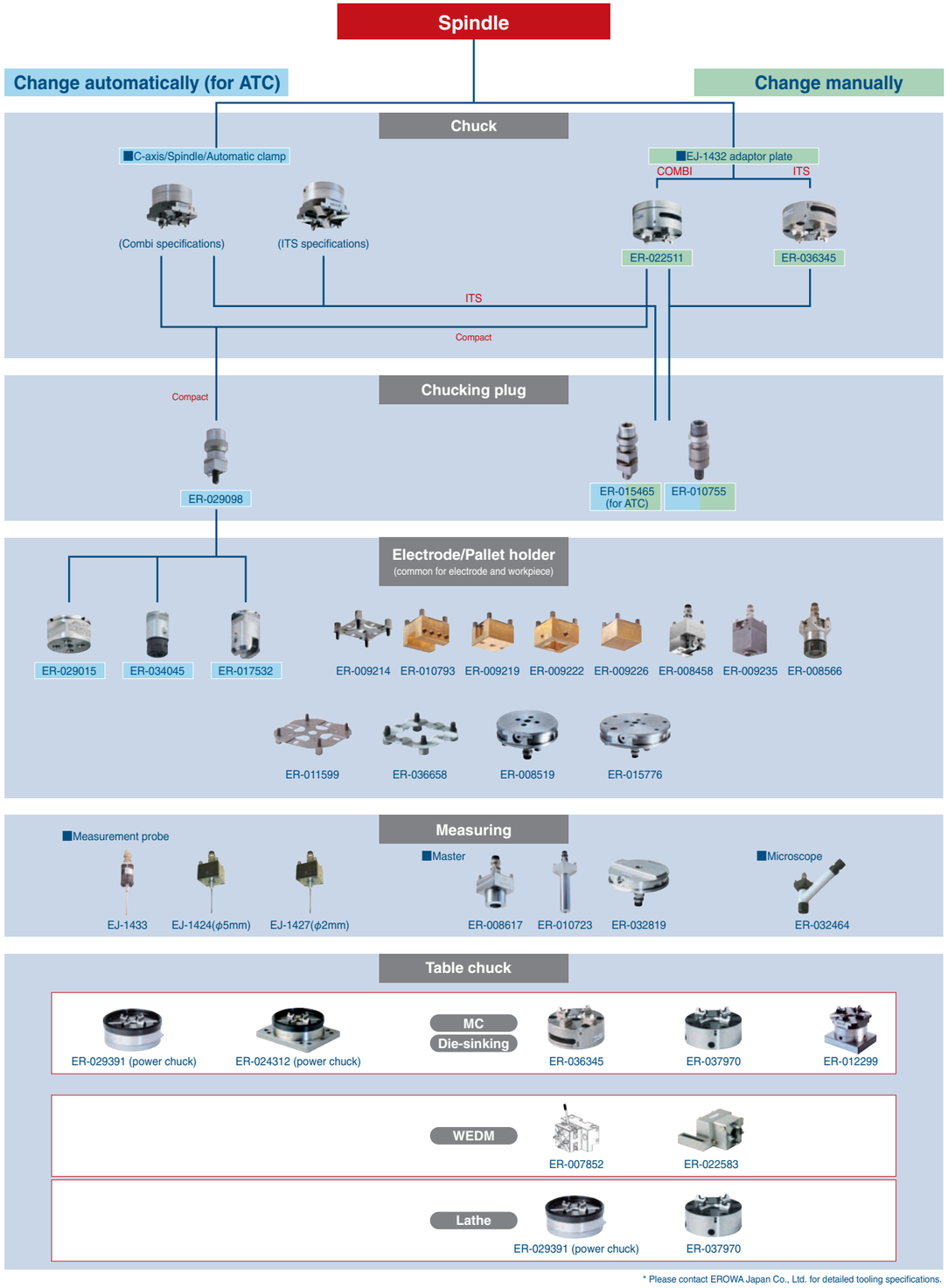
Tooling

System 3R System Chart



* Please contact System 3R Co., Ltd. for detailed tooling specifications.

EROWA System Chart



* Please contact EROWA Japan Co., Ltd. for detailed tooling specifications.

Preparation for Machine Installation/Cautions

Preparation for Machine Installation

Machine installation checklist

Determining the machining details

Check each item, and make sure that no item or order is overlooked.

1) Determine the workpiece	
2) Determine the machining site	
3) Determine the pre-processing site	
4) Determine the post-processing site	

Preparation of installation fixtures

1) Plan the installation fixtures	
2) Prepare or manufacture the fixtures	

Preparation of tooling and electrode

It normally takes one to two months for tooling delivery, so please place orders as early as possible

1) Determination of tooling and electrode	
2) Order, preparation or manufacture	

Training of programmers and operators

1) Select the programmers and operators	
2) Apply for training seminars	

Confirmation of foundation and power-supply work

If there is any possibility of radio disturbance, investigate it prior to starting work.

1) Confirmation of floor area	
2) Confirmation of environment (constant-temperature dust-proof room, measure for radio disturbance, prevention of external noise)	
3) Confirmation of foundation floor	
4) Foundation work	
5) Primary wiring for power lead-in	
6) Grounding work	
7) Air piping work	

Confirmation of delivery path

Check the path inside and outside the factory to avoid any trouble during delivery.

1) Traffic restrictions to factory		
Road width		
Entry road		
2) Factory entrance and width of gate in factory	(m)	
Factory building entrance dimensions (height × width)	(m)	
3) Constant-temperature dust-proof room entrance dimensions (height × width)	(m)	

Cautions
The standard delivery entrance dimensions for standard shipment delivery are given on the product line-up page.
If the entrance is smaller than the standard delivery entrance, a machine with different dimensions can be shipped.
* Please contact a Mitsubishi Electric representative for details (a separate estimate will be issued).
Note that delivery may not be possible in some cases depending on the dimensions.

File applications to fire department

The applications must be filed before the EDM is installed.

1) Confirm the dielectric fluid amount	
2) File applications to fire department (EDMs already installed must also be filed.)	
•Application for "Facility using fire" (fluid amount less than 400ℓ)	
•Application for "Low volume hazardous material storage and handling site" (fluid amount more than 400ℓ and less than 2,000ℓ)	
•Application for "General handling site" (fluid amount 2,000ℓ or more)	

The required applications differ according to country and region; please contact your nearest fire department for details.

Oil for EDMs

Always use dielectric fluid which has a flash point of 70°C or more.
Prepare the following dielectric fluid when operating the EDMs.

■Dielectric fluid example <JX Nippon Oil & Energy Metal Work EDF-K2>

Table of dielectric fluid properties

Item \ Product brand	Metal Work EDF-K2
Density g/cm³ (@15:)	**0.770**
Flash point : (PM)	**93**
Kinematic viscosity mm²/s (@40:)	**2.2**
Appearance	**Clear and colorless**

*Please contact the manufacturer for the Material Safety Data Sheet (SDS/MSDS).

■Dielectric fluid example (Showa Shell Sekiyu Shell Paraol 250)

Table of dielectric fluid properties

Item \ Product brand	Shell Paraol 250
Density g/cm³ (@15℃)	0.797
Flash point ℃ (PM)	92
Kinematic viscosity mm²/s (@40℃)	2.42
Appearance	Clear and colorless

*Please contact the manufacturer for the Material Safety Data Sheet (SDS/MSDS).

Installation conditions

1. Installation site

①Constant-temperature dust-proof room
· Recommended room temperature 20±1°C (68°F±2)
· Usable temperature range 5 to 35°C (41°F to 95°F)
Temperature fluctuation will directly affect machine accuracy. To maintain performance accuracy, select a place with minimal temperature fluctuation.
Note that an environment where the temperature fluctuates by 3°C (5°F) or more within 24 hours, or 1°C (2°F) or more within one hour can adversely affect machining accuracy. Make sure that the machine body is not subject to direct wind from air-conditioners or to direct sunlight.
· Dust-free location is recommended.
Install a EDM in an environment with no corrosive gases, such as acid or salt, or mist, and with low levels of dust.
Grinding dust can adversely affect the machine's linear scales and ball screws.
Pay special attention to installation location to avoid this hazard (separate from grinding machine, or install in separate room, etc.).
· Humidity Within 30 to 75%RH (with no dew condensation).
· Temperature range during transportation and storage
-25 to 55°C (-13°F to 131°F) (when power is not connected).

②Tolerable vibration of floor
EA8S/12S, EA28V ADVANCE, EA40/50 ADVANCE specification
· Select a floor where vibration or impact will not be conveyed.
· As a reference, the vibration level should have a max. amplitude of 5μm or less at a 10 to 20Hz frequency.
MA2000, EA8PS/12PS
· Select a floor where vibration or impact will not be conveyed.
· As a reference, the vibration level should have a max. amplitude of 2μm or less at a 10 to 20Hz frequency.
* Consult with the contractor or vibration measuring instrument manufacturer for details on the measuring method.

③Foundation
· The floor should be concrete with a thickness of 400mm (15.7") or more so it can sufficiently withstand the system's weight.

④Room construction
· The room where the EDM is to be installed must be a non-flammable or fire-proof structure. Please contact your local fire department for details.

⑤Ventilation of combustible vapors
· Install a ventilator to effectively remove combustible vapors and fine powders.

2. Machine heating value

Use the equipment capacity to calculate the EDM's heating value required for designing a constant-temperature room.

Heating value (kW)
= Equipment capacity (kVA) x 0.6
Example: For EA12S + FP80V, 7.0kVA x 0.6 = 4.2kW

The above value is a guideline. Consult with the constant-temperature room manufacturer for details.

3. Power-supply equipment

• Primary wiring
Normal machining : 3-phase 200/220VAC±10% 60Hz, 3-phase 200VAC±10% 50Hz
High-accuracy machining : 3-phase 200/220VAC±4% 60Hz, 3-phase 200VAC±4% 50Hz
An automatic voltage regulator (AVR) should be used if voltage fluctuations exceed that value above
Do not power on in instantaneous power failure occurrence that exceeds 20msec.
A single-phase AC night power source for the automatic fire extinguisher : 100VAC±10%(50/60Hz)
• Power capacity
Facility capacity [kVA] = Total power input (Machine input + power supply input + dielectric fluid chiller unit input) [kVA]
Refer to page 11 for details on the machine, power supply and dielectric fluid chiller unit
• No-fuse breaker and earth-leakage breaker
When selecting a no-fuse breaker or earth-leakage breaker for the primary side of the EDM, calculate the total facility capacity, and select the breaker using the following table as a reference.

Total facility capacity [kVA]	No-fuse breaker	Earth-leakage breaker
~12	NF50-CV(50A)	NV50-CV(50A)
12~22	NF100-CV(100A)	NV100-CV(100A)
22~33	NF225-CV(150A)	NV225-CV(150A)

The breakers in the table allow for the rush current of the transformer in the power supply panel.
• Selecting the power input cable size
The following table is a guide for calculating the appropriate power cable size to use based on total capacity. The cable size should be sufficient to allow some leeway.

Total facility capacity [kVA]	Cable size [mm²]	Total facility capacity [kVA]	Cable size [mm²]
~9	5.5	15~21	22.0
9~12	8.0	21~28	30.0
12~15	14.0		

4. Grounding work

The EDMs must always be grounded to prevent external noise, radio disturbance and earth leakage.
Install a EDM in an environment with no corrosive gases, such as acid or salt, or mist, and with low levels of dust.
· Common grounding can be used if noise from other devices will not enter through the common grounding; the grounding cable must be connected independently to the grounding location (Fig. 2).
· Use a 14mm² grounding wire.

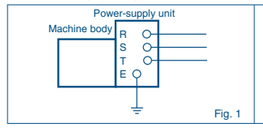


Fig. 1

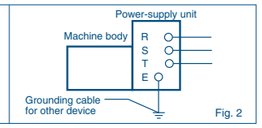


Fig. 2

5. Primary air equipment

The standard EA12S specifications do not require an air source, but an air supply must be prepared when using the optional high-accuracy built-in C-axis etc.
· Hose diameter : 1/4 hose (hose sleeve outer diameter: φ9.0 (0.35"))
· Pressure : 0.5 to 0.7MPa (72.5 to 101.5psi)
(0.6MPa (87) or more when using EROWA tooling specifications)
· Flow rate : 27ℓ/min or more (2.65cu.ft./min.)

6. Shield room

Install a shield room if the EDM affects televisions or other communication facilities in the area. Observe the following points when installing the EDM in the shield room.
1. Ground the EDM in the shield room (Fig. 3).
2. If the EDM cannot be grounded in the shield room, connect the EDM's grounding cable to the shield room's grounding terminal (through bolt) as shown in Fig. 4.
3. Consult with a Mitsubishi Electric representative for details on installing a shield room.

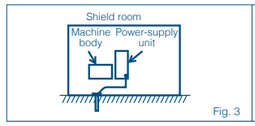


Fig. 3

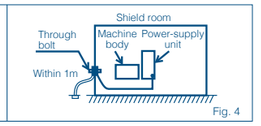


Fig. 4

Precautions for selecting earth-leakage breaker

To prevent malfunctions caused by the external noise from control units, etc., a filter is installed for the power-supply input. By grounding one end of this filter, an earth-leakage current of approx. 30 to 40mA passes through the filter. A highly sensitive earth-leakage breaker (sensitivity current 30mA) could malfunction. Thus, a medium-sensitivity earth-leakage breaker (sensitivity current 100 to 200mA) is recommended for the EDM. Class C grounding (grounding resistance of 10Ω or less) is recommended for the EDM. Even if the sensitivity current is 200mA, the contact voltage will be 2V or less, and no problems will occur in preventing electric shock (application of tolerable contact current Class 2, 25V or less).

Refrigerant for dielectric fluid chiller

The dielectric fluid chiller unit includes a fluorinated greenhouse gas R407C or R410A (for booster power). Please use only the specified refrigerant (R407C or R410A), when servicing the dielectric fluid chiller unit. The use of any refrigerant other than that specified will cause mechanical failure, system malfunction or unit breakdown. In the worst case, this could lead to a serious impediment to securing product safety.

Disposal

The dielectric fluid, dielectric fluid filter, etc. are industrial waste. These must be disposed of following national and local laws and ordinances.

Harmonic distortion

If there is harmonic distortion in the power supply, the machine operation could be affected even if the voltage does not fluctuate. In addition, the harmonic current could flow from the EDM to the power system and adversely affect peripheral devices. If the effect of the harmonic distortion causes problems, install a harmonic suppression filter or take other measures.

Recommended sliding surface lubricants

Use the following lubricant for sliding surface

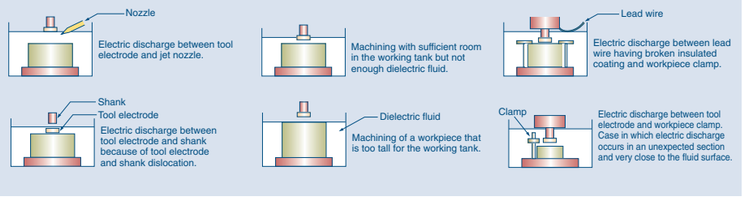
As of March 2014

Manufacturer	Product name
Exxon Mobil	Mobil DTE26

Cautions

Preventing fires and accidents with EDMs

Never attempt the following operation methods. These are extremely hazardous.



- Ensure that the upper part of the workpiece is submerged by 50mm (1.97in) or more (FP60EA, FP60MA, FP80V) or 100mm (3.94in) or more (FP100EA, FP120V) from the surface of the dielectric fluid
- Never conduct spray machining as there is a risk of fire
- Do not use equipment that produces heat or sparks such as heating systems, welding machines, or grinding machinery near the EDM
- Always keep the area clean and tidy, and do not store flammable materials near the EDM
- Install an extra fire extinguisher in addition to the automatic fire extinguisher enclosed with the EDM
- Ensure that the area is sufficiently ventilated
- Monitoring automatic operation : For safety purposes, make sure an operator is always present during operation, even if various safety devices are equipped, so that appropriate actions can be taken

Safety measures

A dielectric fluid temperature detector, fluid level detector, abnormal machining detector and automatic fire extinguisher, standard equipment, and a flame-resistant metal hose is used. A tank which has passed the type test of electrical-discharge machine of Hazardous Materials Safety Techniques Association is used (for tank capacities less than 2,000ℓ, tanks which have passed a voluntary water leakage test). Note that the safety devices must be periodically inspected. Refer to the instruction manual (safety manual) when using the EDM.

Automatic fire extinguisher

When heat is detected, a light-water solution is automatically sprayed to extinguish the fire. Machining also stops automatically at this time.
A separate 100VAC power supply is required for the automatic fire extinguisher.

Dielectric fluid temperature and fluid level detector

Machining is automatically stopped when the dielectric fluid temperature reaches approx.
60℃, or when the fluid level drops during machining.

Terms of warranty

1. Terms of warranty

This will differ according to country and region of sale; please contact a Mitsubishi Electric representative for details.

2. Coverage

(1)Terms of repairment free of charge
Parts labor and travel are included free of charge when the failure occurs during normal use for the stated Terms of the warranty (based on proper usage and maintenance as described in the operations manual and sales agreement).
Coverage exceptions:
①When a failure occurs that was caused by a machine modification that directly affects the machine's functioning or accuracy.
②When a failure occurs caused by the use of non-standard parts, consumables or lubricants.
③When a failure occurs caused by a natural disaster such as lighting, earthquake or storms and flooding.
④When the use of non-recommended consumables or aftermarket parts are used such as filters or flushing nozzles.
(2)Exclusion of loss in opportunity and secondary loss from warranty liability
Regardless of the gratis warranty term, Mitsubishi shall not be liable for compensation to:
①Damages caused by any cause found not to be the responsibility of Mitsubishi.
②Loss in opportunity, lost profits incurred to the user by Failures of Mitsubishi products.
③Special damages and secondary damages whether foreseeable or not, compensation for accidents, and compensation for damages to products other than Mitsubishi products.
④Replacement by the user, maintenance of on-site equipment, start-up test run and other tasks.

3. Post Warranty / Expected Service Life

After the warranty period expires, all standard service rates and travel expenses will apply.
Normal service life expectancy is 11 years after installation, but there may be some cases where discontinued electrical parts such as semiconductors and motors will reduce this period.

MEMO

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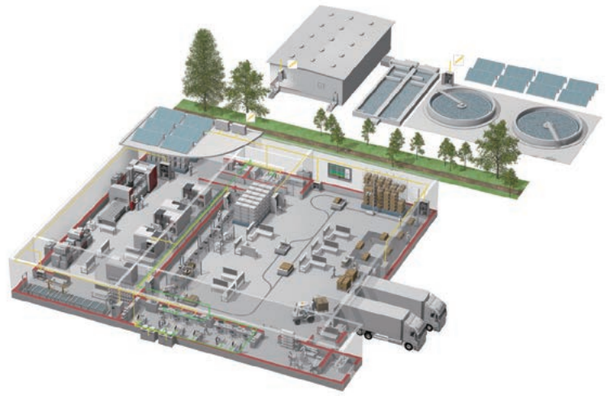

Mitsubishi Electric offers a wide range of automation equipment from PLCs and HMIs to CNC and EDM machines.

A NAME TO TRUST

Since its beginnings in 1870, some 45 companies use the Mitsubishi name, covering a spectrum of finance, commerce and industry.

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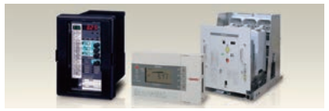
Mitsubishi Electric Corporation is active in space development, transportation, semi-conductors, energy systems, communications and information processing, audio visual equipment and home electronics, building and energy management and automation systems, and has 237 factories and laboratories worldwide in over 121 countries.

This is why you can rely on Mitsubishi Electric automation solution - because we know first hand about the need for reliable, efficient, easy-to-use automation and control in our own factories.

As one of the world's leading companies with a global turnover of over 4 trillion Yen (over $40 billion), employing over 100,000 people, Mitsubishi Electric has the resource and the commitment to deliver the ultimate in service and support as well as the best products.

Low voltage: MCCB, MCB, ACB



Medium voltage: VCB, VCC

Power monitoring, energy management

Compact and Modular Controllers

Inverters, Servos and Motors

Visualisation: HMIs

Numerical Control (NC)

Robots: SCARA, Articulated arm

Processing machines: EDM, Lasers, IDS

Transformers, Air conditioning, Photovoltaic systems

* Not all products are available in all countries.

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