

partner

M-300



MORI SEIKI



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partner
M-300

M-300A1

Aiming for improved productivity and flexibility, the M-300 brings a new level of automation to the factory.

Diversified market needs have spurred the creation of production systems with both high productivity and machining flexibility. The productivity of a special-purpose machine must join with the flexibility of systems designed for wide-variety, small-lot production and rapid response to changing production quantities. This combination will form the core of the efficient FA (Factory Automation) line. In this production line, machining centers must achieve an unheard-of level of productivity and efficiency.

Mori Seiki has readily reacted to this market trend by developing the Partner M-300 vertical machining center. The M-300 helps you create an innovative FA line with high productivity, machining flexibility, and system-expansion capability.

partner **m-300**

4-side machining capability with a vertical machine construction (M-300A)

Compact design (floor space of the M-300A2: 4.8m² (52ft²)) and highly rigid construction

Speedy positioning with a rapid traverse rate of 24m/min (944.9ipm)

Powerful Direct Drive Spindle with a maximum 6,000 min⁻¹ spindle speed

High-speed Automatic Tool Changer (tool to tool: 1.5 sec./chip to chip: 4.3 sec.)

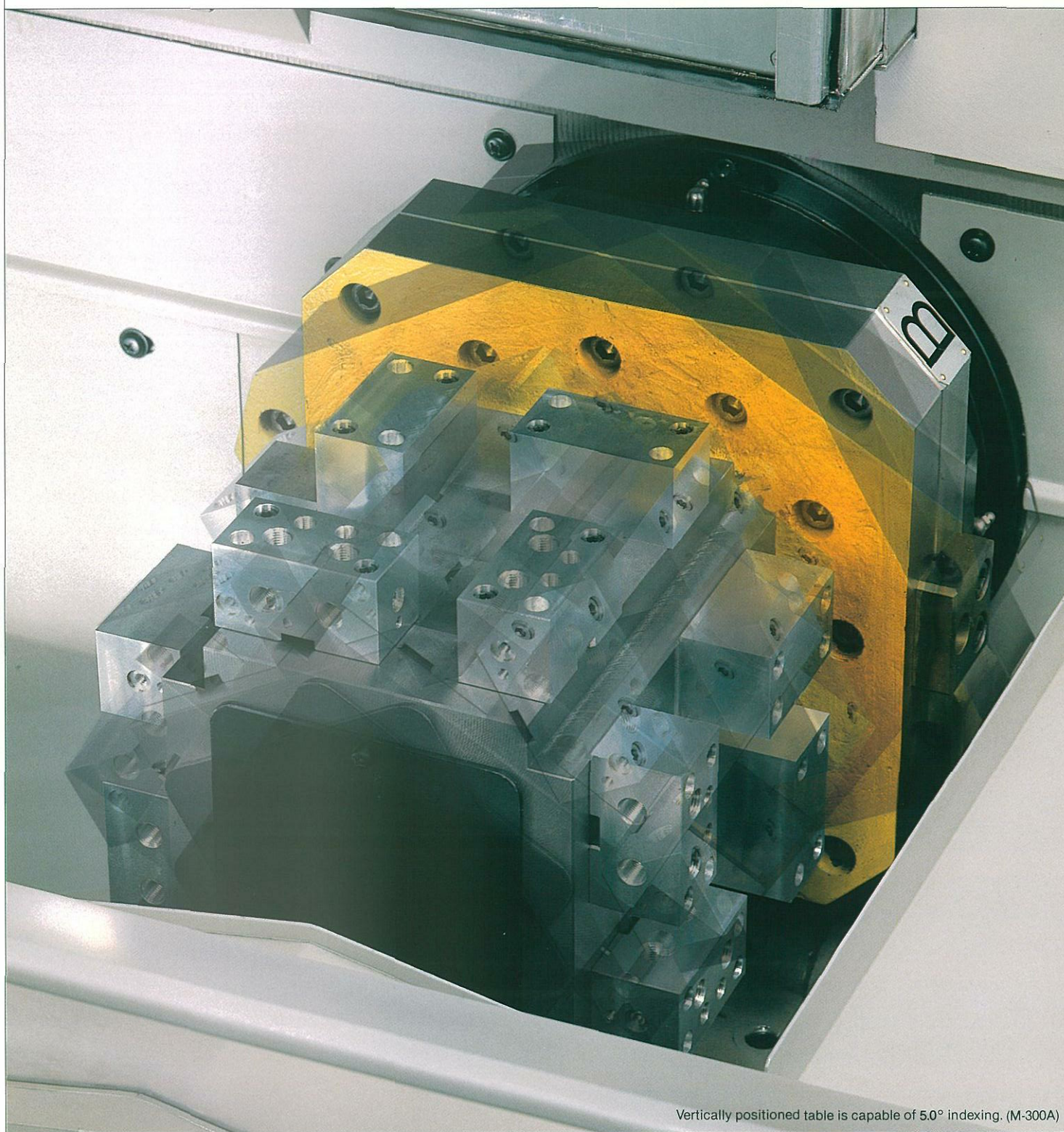
Pitch-transfer pallet change system for a flexible transfer line (M-300A2/B2)

High-precision index table with powerful clamping force

Perfect chip disposal and minimized thermal displacement for unmanned operation

System-expansion flexibility to form an automated line

***Four-side machining by a vertical machining center
is now possible with the original indexing table***



Vertically positioned table is capable of 5.0° indexing. (M-300A)

System-expansion flexibility results from a variety of available machines and leads to increased productivity

Innovative construction and functions

Featuring the same range of machining functions as the horizontal machining center, the M-300 combines precision and flexibility in machining in its super-compact body. Unlike conventional vertical machining centers, the M-300 is capable of four-side machining, thanks to Mori Seiki's unique indexing table. Its streamlined workpiece-supply system, quick and accurate positioning, perfect chip-disposal design, and flexible production line formed according to the type of machining work together for unmanned, efficient production.

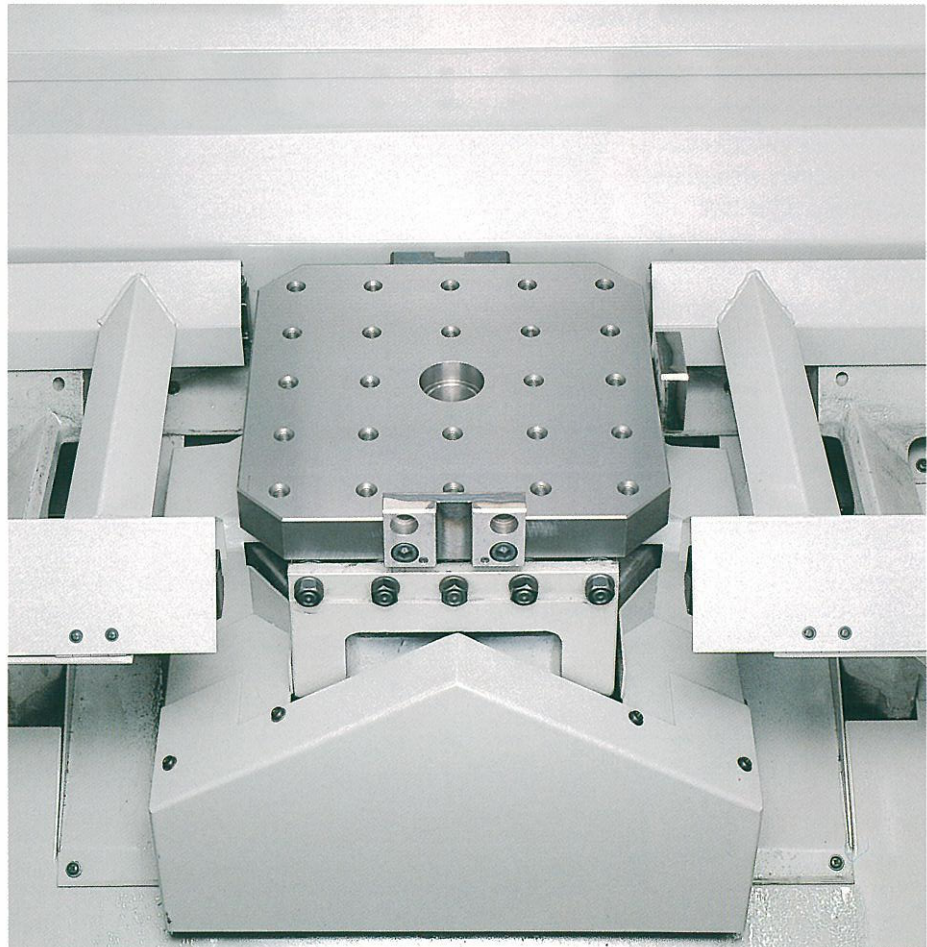
System-expansion flexibility

The M-300A and M-300B can be connected not only to each other but also to the Partner Series NC lathes and other machine tools, depending on the kind of machining. A fixed table makes it easy to design the workpiece transfer system and to establish a compact production line capable of handling a wide variety of jobs.* Even when used independently, the M-300 achieves high-precision machining and offers the highest productivity in its class, due to a unique spindle design, efficient thermal-displacement devices, and high-speed ATC (Automatic Tool Changer) and APC (Automatic Pallet Changer). The M-300 is especially great in handling small precision-parts machining and light-alloy machining.

*Refer to the MORI HEPS B/M-300 (High Efficiency Production System), page 12.

M-300 Series Models

Model	Table positioning	APC	Application
M-300A1	Positioned vertically	2 pallets	Used independently
M-300A2		For flexible production system (transfer line included)	Used as part of an automated manufacturing line
M-300A3		—	Used independently
M-300A4		For flexible production system (transfer line included)	Used as part of an automated manufacturing line
M-300B2	Positioned horizontally	For flexible production system (transfer line included)	Used as part of an automated manufacturing line

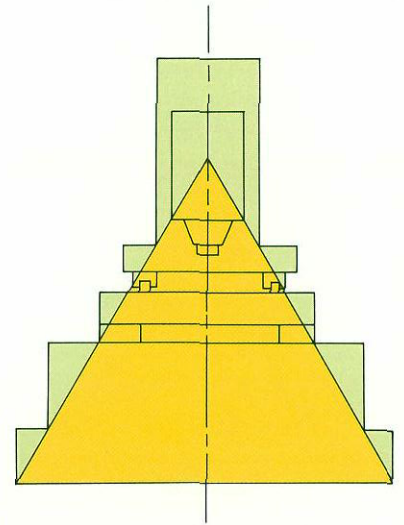


Horizontally positioned table of the M-300B

Innovative mechanisms, compact design, and rigid construction together achieve high-precision machining

HIGHLY RIGID CONSTRUCTION

The M-300's compact body (floor space of the M-300A2: 4.8m² (52ft²)) features a triangular construction, and its column and bed are made of thick, heavy metal. This assures stable machining by minimizing both machining tremor and forces of repulsion. The specially designed, extremely rigid ball guide greatly increases productivity by allowing a rapid traverse rate of 24m/min (944.9ipm).



The M-300's triangular construction assures stable, high-precision machining.

M-300A

The most advanced technology gives the spindle the power to upgrade speed and precision

POWERFUL DIRECT DRIVE SPINDLE (DDS)

The spindle motor of the M-300 is built compactly into the spindle head and directly rotates the spindle. This *Direct Drive Spindle (DDS)* uses neither gears nor belts to eliminate vibration, giving the M-300 a high efficiency of rotation and a wide range of spindle speed (1,100 min⁻¹ —6,000 min⁻¹). High-speed machining is available at a maximum of 6,000 min⁻¹ (AC5.5kW)*. A greaselubricant system and powerful fan cooler ensure that the spindle temperature doesn't exceed 10°C (50°F) above room temperature.

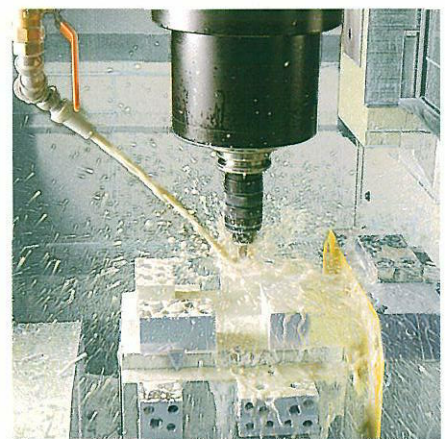
The ceramic spindle taper also contributes to long-term, high-precision machining.

*10,000 min⁻¹ optionally available (AC7.5/5.5kW)



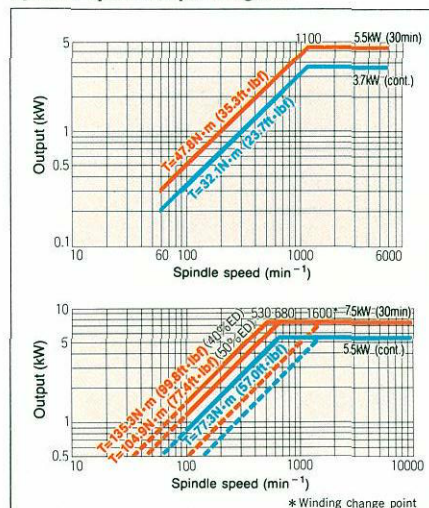
HIGH-SPEED, HIGH-PRECISION TAPPING

Built-in Direct Synchronous Sensor (DSS) enables the spindle motor to control spindle rotation as accurately as a servomotor can and synchronizes the spindle with the Z-axis servomotor. The DSS performs high-precision tapping with tap holders that have a simpler mechanism than conventional tap holders. Capable of a maximum 3,000 min⁻¹ spindle speed, the M-300 handles tapping on aluminum die casting.



High-speed tapping of 3,000 min⁻¹ is available.

Spindle speed/output diagram



Prompt, reliable tool change and a speedy, accurate table index promote efficient machining

HIGH-SPEED AUTOMATIC TOOL CHANGER (chip to chip: 4.3 sec.)

The ATC (Automatic Tool Changer) uses the fixed address, random access system with 20 standard-equipped tools (option: 30/40/62/82*). With the M-300's ATC, programming is easy and tool change is always fast and reliable (tool to tool: 1.5 sec.). To further improve reliability the ATC incorporates a simple cam mechanism which reduces the number of mechanical parts and electric outlets. It also incorporates a traction-drive motor for magazine rotation. The ATC is placed on the left side of the machine for easy operation and maintenance.

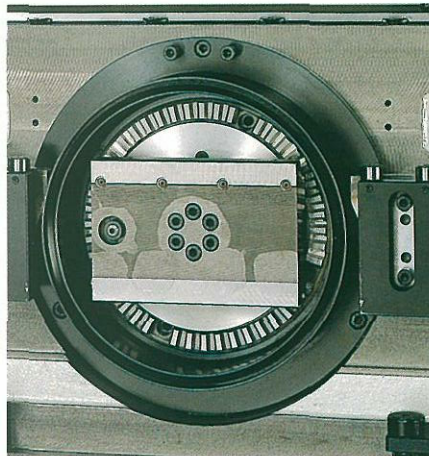
* 62/82 -tool option not available for the M-300A2/B2.



Standard-equipped with 20 tools, the ATC has a simple cam mechanism and assures high-speed tool change.

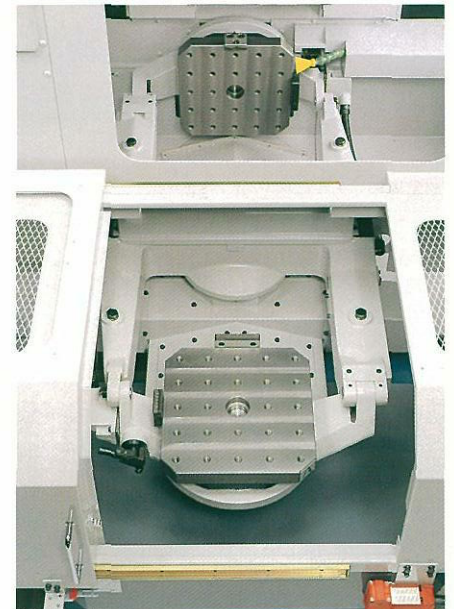
HIGH-PRECISION TABLE INDEX (M-300A)

Mori Seiki's special curvic coupling ensures a high-precision table index. The M-300's fast, precise positioning, high returning-accuracy, and high rigidity greatly increase machining efficiency. A powerful clamping force of 33.3kN (7,470lbf) assures stable heavy cutting. Hardened-steel reinforces the backs of the pallets carrying and transferring the workpiece.



Mori Seiki's curvic coupling assures an accurate table index. (M-300A)

- Coupling diameter: $\varnothing 210\text{mm}$ ($\varnothing 8.3''$)
- Clamping force: 33.3kN (7,470lbf)
- Index angle: 5.0° (option: 0.001°)
- Index accuracy: $\pm 2''$
- Repeatability: $\pm 1''$
- Index time: 5 sec. (90°)
6 sec. (180°)

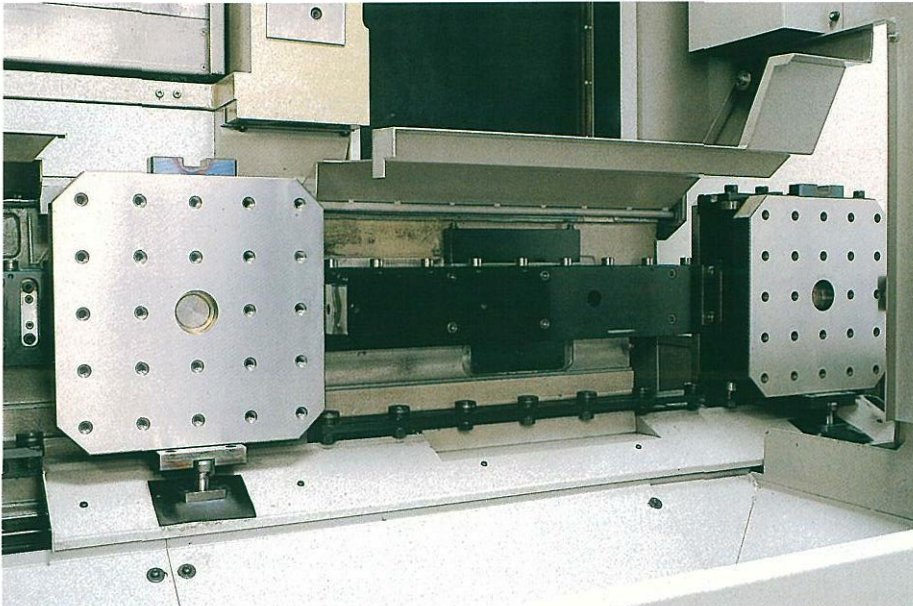


With the compactly designed APC, the M-300 brings high productivity even when used independently. (M-300A1)

FRONT TURN PALLET CHANGER (M-300A1)

Even when used independently, the M-300 heightens productivity by reducing setup time. The front turn pallet change system uses a 180°- swing arm to replace workpieces. It firmly places the pallet on the coupling and smoothly carries the finished workpiece to the setup position (replacing time: 10 sec.). The pallet can be manually rotated at the setup position so that workpieces can be easily loaded on and unloaded from a four-side clamping block.

Uniquely designed APC further heightens productivity by saving time, space, and labor



APC with a unique pitch transfer system makes possible the prompt replacement of workpieces. (M-300A2)



M-300A4 equipped with space saving 10-station pallet pool. Optional magazines can be added to hold up to 82 tools for over night unmanned.

PITCH TRANSFER PALLET CHANGER

(M-300A2/300B2)

Due to its special fixed table, the M-300 can quickly change pallets by using a unique pitch transfer system. In this system, a pallet equipped with a workpiece waits next to the workpiece being machined. When the machining is over, it promptly slides into the machining position to replace the finished workpiece with a new one, thus losing no time between machinings. Pallet transfer units and pallet tilters are all designed to construct an automated line.

HIGH-PERFORMANCE PALLET POOL

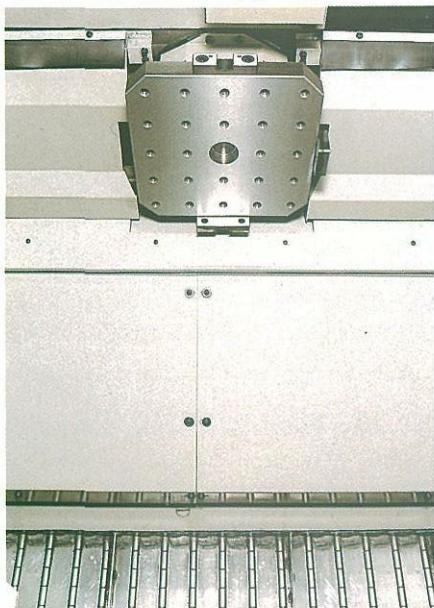
(M-300A4)

The M-300A4 can be equipped with a space-saving, pallet pool (10 pallets). It takes only 20 seconds to change pallets, and while they are being changed, tools can also be replaced. During night hours, unattended operation on different kinds of workpieces is possible.

Automatic compensation function and user-oriented design support the high level of machine performance

PERFECT CHIP DISPOSAL (M-300A)

When the vertically attached pallet rotates, chips and coolant naturally fall into the chip pocket. This design, together with the complete cover and the placement of the three axes' guideways over the site of machining, solves all the problems caused by chips produced in an automatic machining process and eliminates thermal distortion of the workpiece. An optional chip conveyor will promptly discharge the contents of the chip pocket to outside the machining area.



AUTOMATIC PALLET-ROTATION CENTER COMPENSATION

The M-300 uses the magnetic sensor to automatically compensate pallet-center shifting caused by thermal displacement from the X-axis. A sensor placed on the bed detects the position of a magnetic object attached to the saddle. The high-speed skip function measures thermal displacement and compensates, thus achieving precision machining. (Compensation accuracy: $\pm 0.002\text{mm}$ ($\pm 0.00008''$))

EASY MAINTENANCE DESIGN

The NC unit and electrical cabinet are built into the machine to save space and are designed for reliable unattended operation. In addition, unit parts which require daily inspection, such as the pneumatic unit and lubricating oil tank, are all located in the rear of the machine for easy maintenance.

EASY ACCESS OPERATION PANEL

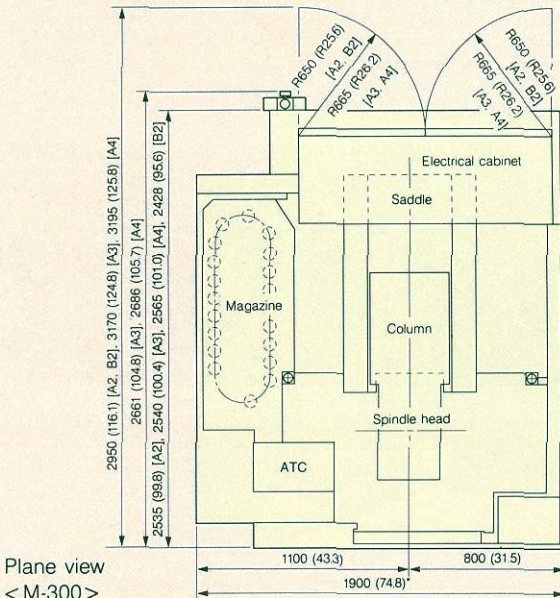
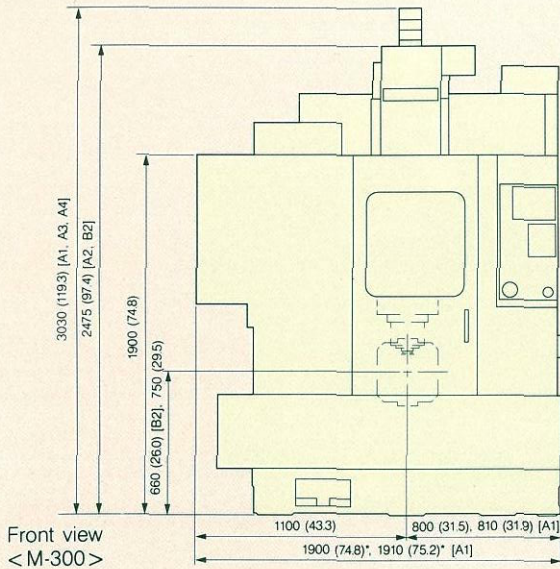
The smart key layout and clear CRT of the operation panel enable anyone to use the M-300 with confidence. The CRT notifies the operator of operational mistakes, machine trouble, and incorrect input data, thus keeping disruptions in machining to a minimum.



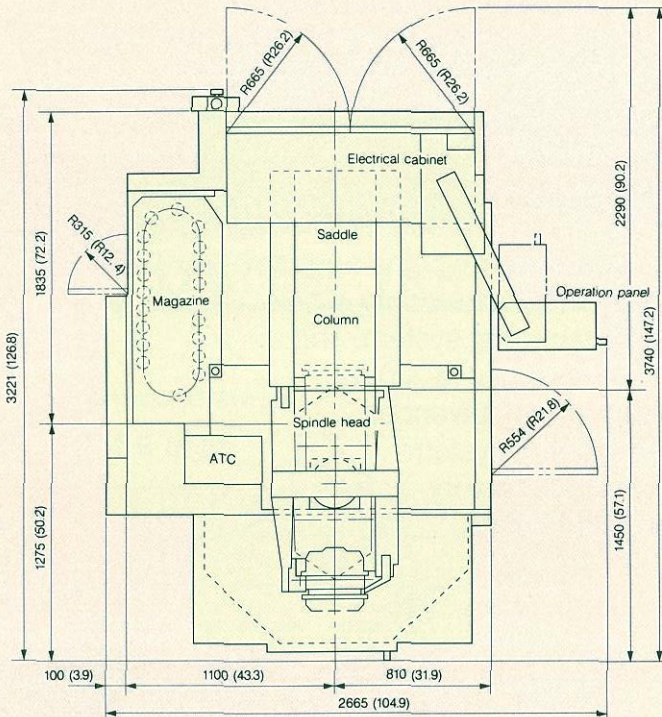
(M-300A1)

Installation Drawing mm (in.)

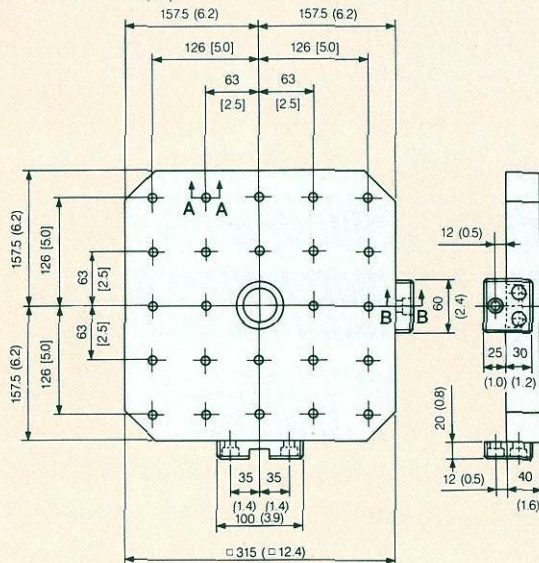
*The super-compact design is
a great space-saver*
(Floor space of the M-300A2: 4.8m² (52ft²))



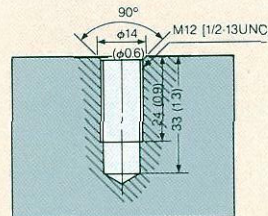
*Including coolant tank: 2010 (79.1) [A1], 2080 (81.9) [A3], 2000 (78.7) [A4]



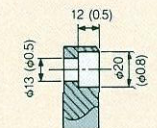
Pallet Dimensions mm(in.)



Work clamping
screw hole (A-A)



Work clamping
screw hole (B-B)



In A2 and B2 types if the workpieces come out of the frame of the pallet, they interfere with the cover.

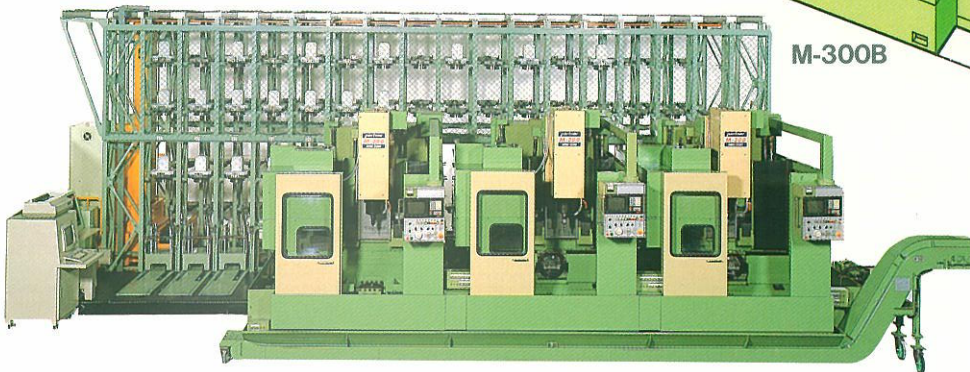
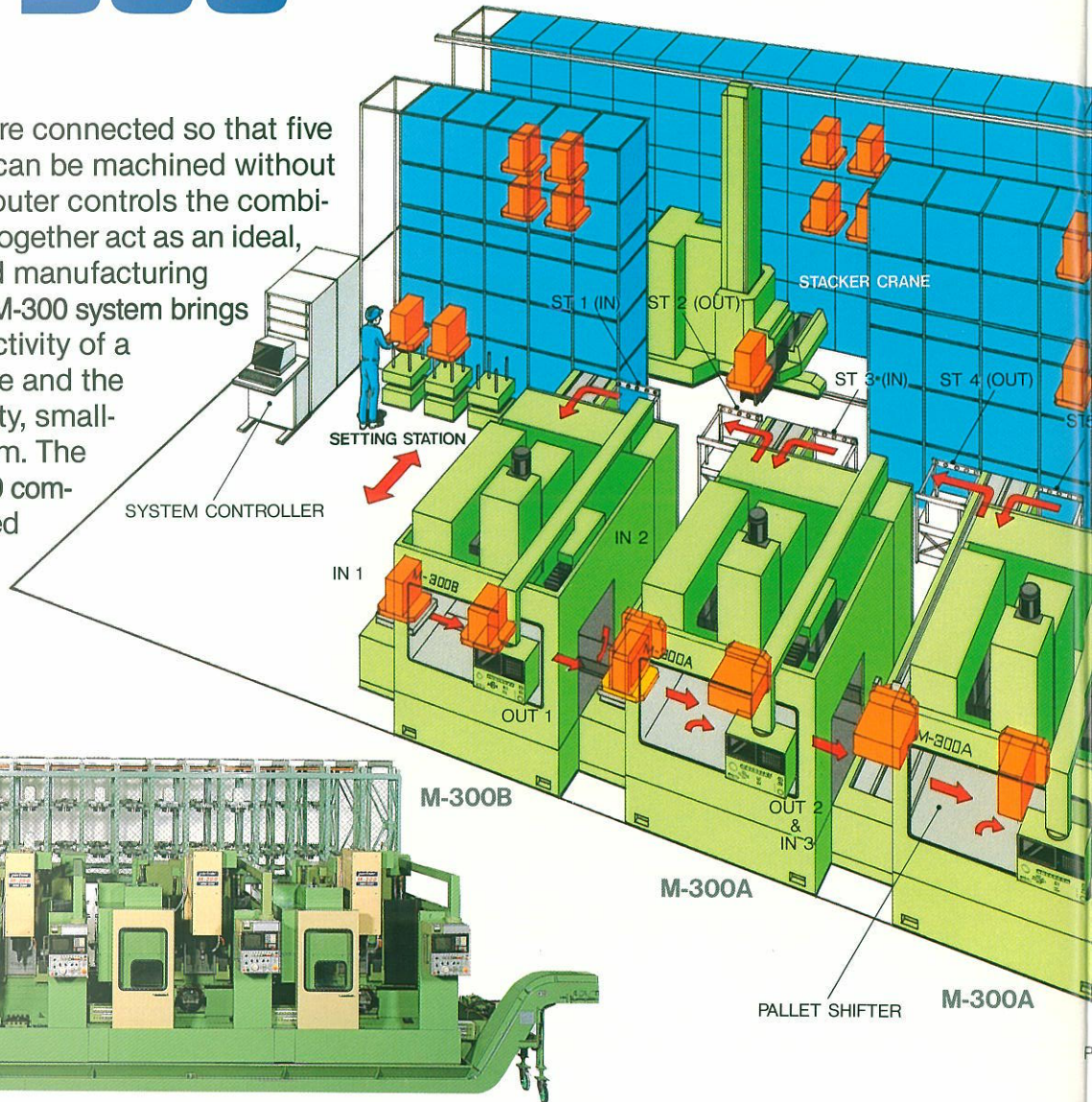
• [] originally designed in inch specifications.
• Figures in inches are converted from metric measurements.

MORI HEPS B

MORI SEIKI HIGH EFFICIENCY PRODUCTION SYSTEM

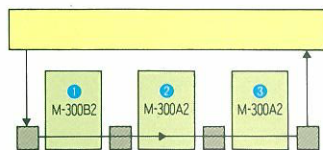
M-300

The M-300A and 300B are connected so that five sides of the workpiece can be machined without repositioning. The computer controls the combination of M-300s which together act as an ideal, space-saving automated manufacturing line. The MORI HEPS B/M-300 system brings together the high productivity of a special-purpose machine and the flexibility of a wide-variety, small-lot manufacturing system. The MORI HEPS B and M-300 combine to form an advanced manufacturing system responsive to factory automation needs.



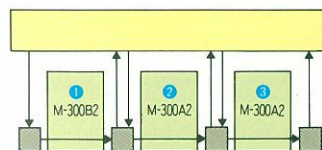
MORI HEPS B/M-300 consists of the M-300A2/B2, a pallet stacker, pallet transfer units, and the central control system (host computer). According to the type of workpiece and production quota, the most appropriate production line can be flexibly formed and automatically controlled by the host computer. As seen below, four kinds of line mode are available when three

units are used: linked line, independent line, compound line I, and compound line II. When the production quota is reduced, the M-300 can be disconnected from the line and used independently or linked with another line so that the system achieves the highest productivity. If production quotas are increased, new lines can be flexibly and economically added.



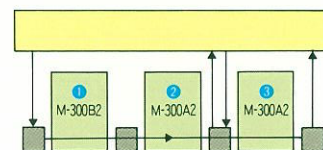
[Linked line]

No.1, No.2, and No.3 units are linked, and the pallet is circulated from one to another.



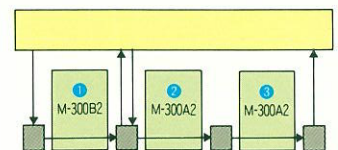
[Independent line]

Each machine is independently connected to the pallet stacker.



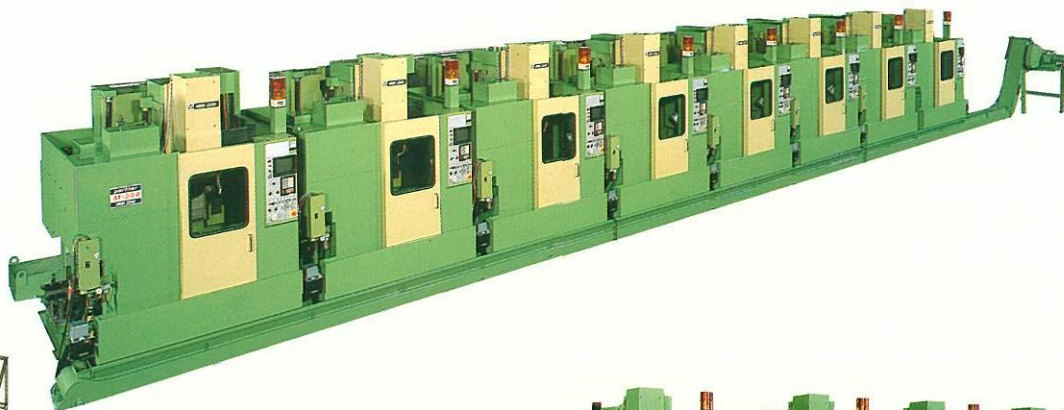
[Compound line I]

No.1 and No.2 units are connected, and No.3 unit works independently.

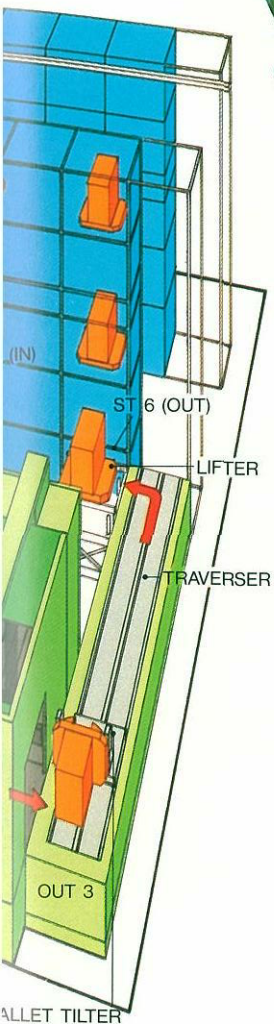


[Compound line II]

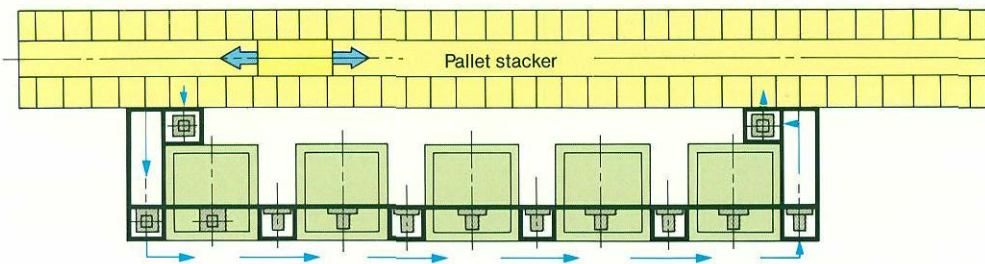
No.1 unit works independently, and No.2 and No.3 units are connected.



SYSTEM VARIATION

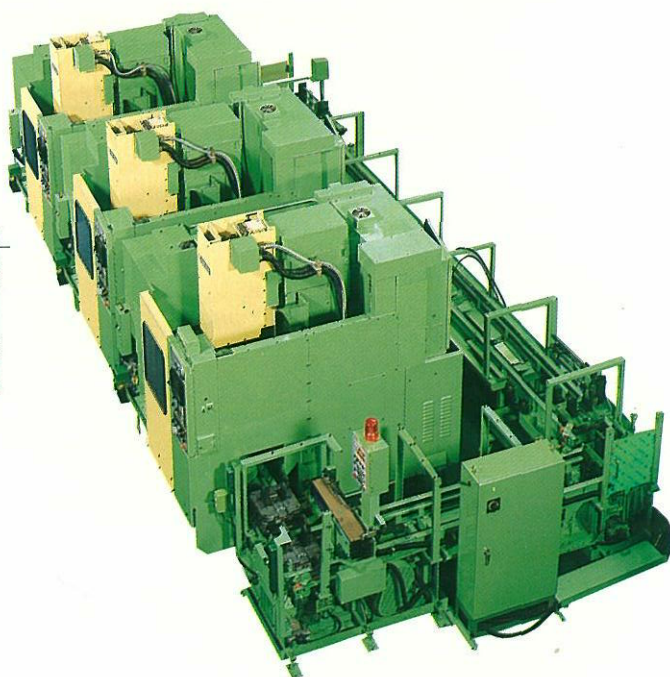
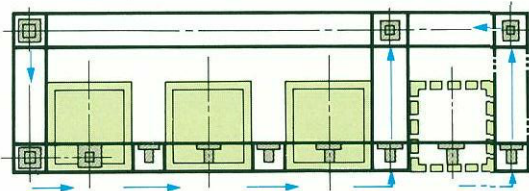


The MORI HEPS B consisting of 5 units



Linked line connected to a conventional pallet conveyor

Refer to the picture on the right



Machine specifications

Item		M-300A1	M-300A3	M-300A4	M-300A2	M-300B2
Travel	X-axis travel (Longitudinal movement of column) mm (in.)	400 (15.7)				
	Y-axis travel (Cross movement of column) mm (in.)	300 (11.8) [400 (15.7)]				
	Z-axis travel (Vertical movement of spindle head) mm (in.)	495 (19.5)				
	Distance from pallet surface to spindle gage plane mm (in.)	20—325 (0.8—12.8)				
	Distance from pallet center to spindle gage plane mm (in.)	125—620 (4.9—24.4)				
	Distance from table surface to spindle gage plane mm (in.)	—				
Table	Working surface mm (in.)	315 x 315 (12.4 x 12.4)				
	Table loading capacity kg (lb.)	150 (330)				
	Minimum table indexing angle	5° [Rotary table: 0.001°]				
Spindle	Max. spindle speed min ⁻¹	6,000 [10,000]				
	Type of spindle taper hole	7/24 Taper, No. 40				
Feedrate	Rapid traverse rate mm/min (ipm)	24,000 (944.9)				
	Feedrate mm/min (ipm)	1—5,000 (0.01—196.9)				
ATC	Type of tool shank	MAS BT-40 [CAT-40]				
	Toolstrage capacity	20 [30/40/62/82]			20 [30/40]	
	Max. tool diameter <without adjacent tools> mm (in.)	90 (3.5) <110 (4.3)>				
	Max. tool length mm (in.)	250 (9.8)	265 (10.4)			
	Max. tool mass kg (lb.)	8 (17.6)				
	Method of tool selection	Fixed address, shorter route access				
Motor	Spindle drive motor (30 min./cont.) kW (HP)	5.5/3.7 (7.5/5) [7.5/5.5 (10/7.5)]				
	Feed motor <X/Y/Z> kW (HP)	1.0/1.0/2.1				
Power source	Electrical power supply kVA	20.5 [23.2]* ²		22.5 [25.2]* ²	19.5/27.5 [25.4/31.4](30 min./max.)* ³	
Tank capacity	Coolant tank capacity L (gal.)	200 (52.8)	175 (46.2)	200 (52.8)	112 (29.6)	
Machine size	Floor space mm (in.)	2,665 x 3,221 (104.9 x 126.8)	2,080 x 2,661 (81.9 x 104.8)	2,000 x 2,686 (78.7 x 105.7)	1,900 x 2,535 (74.8 x 99.8)	1,900 x 2,428 (74.8 x 95.6)
	Mass of machine kg (lb.)	7,270 (15,994)	6,500 (14,300)			

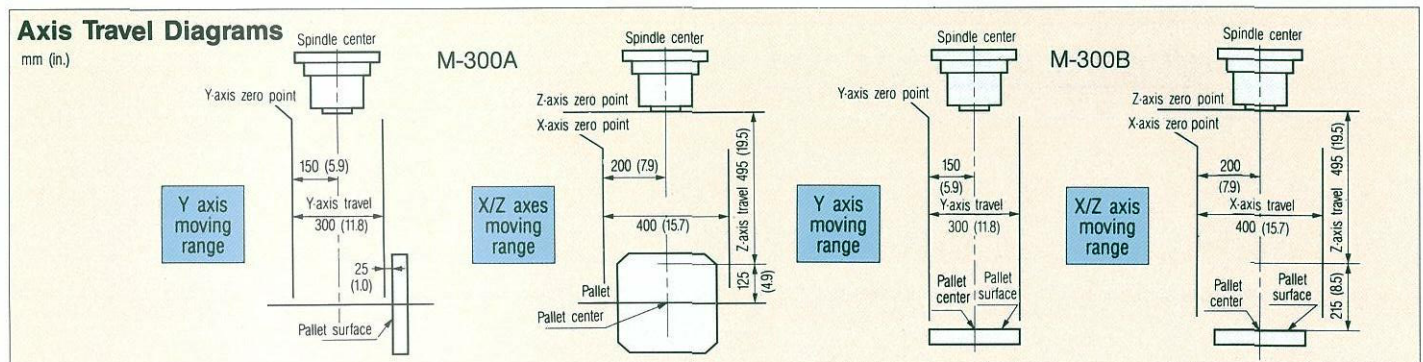
[] Option

*1 At 60Hz. *2 Adding 0.8kVA with rotary table. *3 Determine cable size based on the maximum capacity and the transformer based on the 30 min rating capacity.

•Figures in inches are converted from metric measurements. •Design and specifications subject to change without notice.

•Mori Seiki is not responsible for differences between the information in the catalog and the actual machine.

Standard features		Optional features	
<ul style="list-style-type: none"> •Coolant system (A1, A3, A4) •Built-in worklight •Leveling block •Hand tools 	Safety features <ul style="list-style-type: none"> •Full cover •Door interlock system (incl. mechanical lock) Front door/Setup station door (A1) •Door interlock system Magazine door/Setup station door (A4)/ Chip disposal port 	<ul style="list-style-type: none"> •Coolant tank (A2, B2) •Rotary table (A1, A2, A3, A4) •Chip conveyor outside machine •Oil shot system •Oil mist system •Air blow system •Oil-hole drill coolant system •High-pressure coolant system •Some options are not available in particular regions. For details contact Mori Seiki. 	<ul style="list-style-type: none"> •Signal indicator/buzzer •Chip removable coolant system •Through-spindle coolant system •Position block for tooling •Z-axis zero point setting tool •Alignment indicator arbor •Linear indicator arbor



NC unit specifications

Item		MSC-516
Controls	Simultaneous controlled axes	3 axes: X·Y·Z Simultaneously controllable axes: 3 axes (positioning and linear interpolation), 2 axes (circular interpolation)
	Least command increment	X·Y·Z: 0.001 mm (0.0001")
	Least input increment	X·Y·Z: 0.001 mm (0.0001")
Spindle functions	Spindle speed command	S5 digit direct command
	Spindle speed override	50 – 120% (in 10% increments)
Feed functions	Feedrate override	0 – 150% (in 10% increments)
	Dwell	Stop time command: G04
	Zero return	Return to machine zero point: G27 – G30
	Pulse handle feed	Manual pulse generator: 0.001, 0.01, 0.1 mm/pulse (0.0001", 0.001", 0.01"/pulse)
	Manual jog feed	0 – 1,260 mm/min (0 – 50 ipm) (15 steps)
	Dry run	Moves at jog feedrate regardless of feed command
	Rapid traverse rate override	F0 (fine feed), 25/50/100%
Tool functions	Tool number command	T4-digit
	Tool length measurement	Offset value entered when soft key is pressed
	Cutter radius offset	G40 – G42
	Tool length offset	G43·G44·G49
	Tool position offset	G45 – G48
	Number of tool offsets	99 sets (length, radius geometry and wear offset)
Programming functions	Absolute/Incremental programming	G90/G91
	Canned cycle	G73·G74·G76·G80 – G89
	Decimal point input	Inputs values with decimal point
	Inch/Metric conversion	G20/G21
	Circular interpolation by radius programming	Specifying by radius R instead of I, J, and K commands
	Sub-program	Up to 4 nestings
	Work coordinate system selection	G54 – G59
	Local/Machine coordinate system	G52/G53
	Maximum programmable dimension	± 99,999.999 mm (± 9,999.9999")
M function	M3-digit	
Tape functions	Input code	ISO/EIA automatic discrimination
	I/O interface	RS-232-C
	Part program storage	40 m (131')
	Number of stored programs	63
	Search function	Sequence number search, Program number search, Address search
Other functions	MDI/CRT unit	9" CRT, Keyboard for data input, Soft-keys
	Uni-directional approach	Positioning is always executed in uni-direction by G60 command
	Programmable data input	Tool offset amount and work offset are entered by programming G10
	Expanded program editing	Copy, move, insert and change of NC program
	Synchronized tapping	Rigid tap function
	Custom macro	82 common variables
	Pattern cycle	Hole position on line, circle and square (G300 – G305) Finishing shape for circle and square (G306 – G309)
	Stored stroke check 1	Overtravel controlled by software
	Background editing	Part program storage and editing during automatic operation
	Help function	Alarm contents and operation display
	Running time/Parts number display	Running time and parts number under automatic operation is displayed
	Load meter display	Spindle and servo motor's loads are displayed on screen
	Stored pitch error compensation	Pitch error compensation up to 128 positions for each axis
	Program restart	Designates restart block sequence number
	Mirror image	Reverse of axis movements (X, Y, Z-axis: Setting screen X, Y-axis: M function)
Self-diagnostic function	Self-diagnostic test	
Options	Additional part program storage capacity (in total)	80/160/320/640/1,280/2,560/5,120 m (262'/525'/1,050'/2,100'/4,200'/8,400'/16,800')
	Additional registered programs (in total)	125/200/400/1,000
	Additional number of tool offsets (in total)	200/400/499/999
	Others	<ul style="list-style-type: none"> ● Additional controlled axes (additional axes: max. 8) ● Helical interpolation ● Polar coordinate interpolation ● Cylindrical interpolation ● Addition of optional block skip switches ● Tool life management ● Playback function ● Handle interruption ● Stored stroke check 2 ● Arbitrary angle, chamfer, corner R designation ● F1-digit feed ● Scaling ● Coordinate system rotation

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MORI SEIKI



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MORI SEIKI CO., LTD.

- Head Office 362 Idono-cho, Yamato-Koriyama City, Nara 639-11, Japan
Phone: (07435) 3-1121 Telex: 72-5522-785 Fax.: (07435) 2-8713
- Nara No. 1 Plant 362 Idono-cho, Yamato-Koriyama City, Nara 639-11, Japan
Phone: (07435) 3-1121
- Nara No. 2 Plant 106 Kita Koriyama-cho, Yamato-koriyama City, Nara 639-11, Japan
Phone: (07435) 3-1125
- Iga Plant 201 Midai, Iga-cho, Ayama-gun, Mie 519-14, Japan
Phone: (0595) 45-4151

MORI SEIKI G.m.b.H.

- Head Office Antoniusstrasse 14, 73249 Wernau, F.R. Germany
Phone: 07153-934-0 Fax.: 07153-934-220

Technical Centers

- Stuttgart: Antoniusstrasse 14, 73249 Wernau, F.R. Germany
Phone: 07153-934-0 Fax.: 07153-934-220
- Düsseldorf: Siemensring 19, 47877 Willich 1, F. R. Germany
Phone: 02154-9245-0 Fax.: 02154-9245-81

MORI SEIKI (UK) LTD.

- Head Office & Technical Center Michigan Drive, Tongwell, Milton Keynes, MK15 8HQ, England
Phone: 01908-618040 Fax.: 01908-618033

MORI SEIKI FRANCE S.A.

- Head Office & Technical Center Rue des Châtaigniers, Zone Industrielle d'Ormes-Saran,
45140 ORMES, France
Phone: 38-74-88-99 Fax: 38-74-72-56

MORI SEIKI ITALIANA S.R.L.

- Head Office & Technical Center Via Cusago, 190/10, 20153 Milano, Italy
Phone: 02-4894921 Fax.: 02-4891448

MORI SEIKI ESPAÑA S.A.

- Head Office & Technical Center Calle de la Electrónica, Bloque B, Nave 9 Poligono Industrial
"La Ferreria" 08110 Montcada i Reixac (Barcelona), Spain
Phone: 3-575-36-46 Fax.: 3-575-08-47

MORI SEIKI SINGAPORE PTE LTD

- Head Office & Technical Center 70 Toh Guan Road, Jurong East Industrial Estate, Singapore 608835
Phone: 560-5011 Fax.: 567-6234

Representative Office

- Jakarta

MORI SEIKI (THAILAND) CO., LTD.

- Head Office & Technical Center 29/22-24 (Room # S32-33-34 Royal City Avenue) Soi
Soonvijai-Rama 9, Rama 9 Road Kwaeng Bangkapi, Khet
Hueykwang Bangkok 10310, Thailand
Phone: 2-203-0974 Fax.: 2-203-0978

MORI SEIKI (TAIWAN) CO., LTD.

- Head Office & Technical Center No. 8, Kong 8th Road, Linkou No. 2 Industrial District,
Linkou Hsiang, Taipei Hsien, Taiwan, R.O.C.
Phone: 02-603-1701 Fax.: 02-603-1706

MORI SEIKI U.S.A., INC.

- Head Office 9145 Currency Street, Irving, Texas 75063
Phone: 214-929-8321 Fax.: 214-929-8226

Technical Center

- Dallas: 9145 Currency Street, Irving Texas 75063
Phone: 214-929-8321 Fax.: 214-929-8226
- Los Angeles: 115 West Victoria Street, Long Beach, California 90805
Phone: 310-537-0711 Fax.: 310-537-4543
- Chicago: 5655 Meadowbrook Drive, Rolling Meadows, Illinois 60008
Phone: 847-593-5400 Fax.: 847-593-5433
- Detroit: 26842 Haggerty Road, Farmington Hills, Michigan 48331
Phone: 810-553-2802 Fax.: 810-553-0294
- Cincinnati: 4920 Olympic Blvd., Erlanger, Kentucky 41018
Phone: 606-282-8200 Fax.: 606-282 8340
- Boston: 1455 Concord Street, Framingham, Massachusetts 01701
Phone: 508-788-0044 Fax.: 508-872-1527
- New Jersey: 600-E Corporate Court, South Plainfield, New Jersey 07080
Phone: 908-757-2900 Fax.: 908-757-2730
- Mexico Representative Office:
Av. Insurgentes Sur 1802-5 Piso, Col. La Florida,
C.P. 01030, México D.F.
Phone: 5-662-3622 Fax.: 5-662-3873
- São Paulo Representative Office:
Rua República do Iraque, 1432 (Campo Belo) 04611-002
Sao Paulo, SP, Brasil
Phone: 011-536-4959 Fax.: 011-531-1624
- Representative Office Charlotte, Toronto, Erie, San Francisco, Minneapolis

- Overseas Offices
 Sydney, Shanghai