MICRO DYNAMICS

VERTICAL MACHINING CENTER

Compact, Durable, Powerful,
Strong and Accurate

MEGA
TERA
SERIES

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MACHINING CENTER

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TERA
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Spindle Speed 15,000 rpm 20,000 rpm

Spindle Power* 31 kW 35 kW

Rapid Traverse 52 m/min

Tool to Tool 1.9 sec

Look Ahead 2,700 block

*Peak based on 25% Duty Cycle.

Micro Dynamics® Vertical Machining Center Line opens a new era in multi-purpose and versatile machining centers. Compact, durable, powerful, strong and accurate, the **MEGA/TERA Series** starts a revolution in the market: the smallest C-frame machines provide powerful and precise results for manufacturers of dies and molds, aerospace, automotive, semi-conductor, job shops and general machine sectors.

The **MEGA/TERA Series** has been designed with the latest in technology being utilized throughout the machine with productivity in mind. From its EtherNet/IP architecture for easy automation and integration into systems and cells, to its Motion Control for fast and smooth operations used in all industries, the **MEGA/TERA Series** has quickly become one of the industries leading machine tool lines of Vertical Machining Centers.

POWERFUL integrated Micro Dynamics® Spindle.

THERMAL COMPENSATION DYPEC® Dynamic Predictive Error Compensation.

COMPACT design with small footprint.

RIGID TAP up to 6,000 rpm.

FAST Mitsubishi CNC M830W.

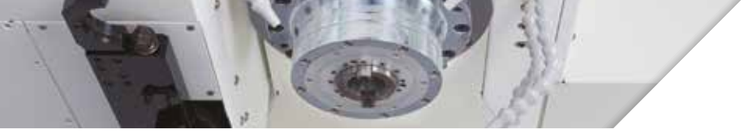
PC BASED HMI allows user friendly functions.

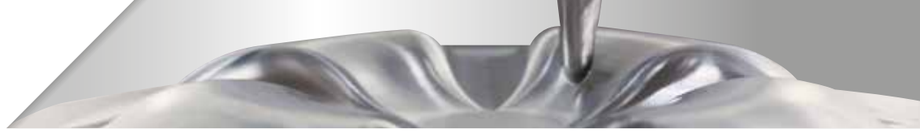
STRONG FC300 Meehanite© casting.

15” TOUCHSCREEN ergonomically friendly.

RELIABLE highest quality mechanical and electrical components.

INTEGRATED AUTOMATION EtherNet/IP networked I/O.





SPINDLE

15,000 ~ 18,000 / 20,000 rpm Speed

31 kW / 35 kW* Power

141 Nm / 119 Nm* Torque

1,200 kgf Clamping Force

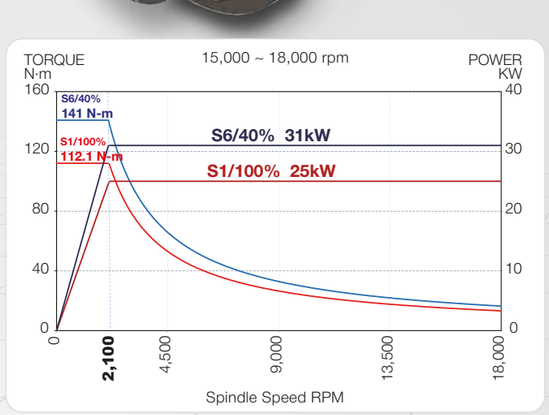
1.5 sec Acc. 0 – 12K

1.8 sec Dec. 12K – 0

* With Optional 20,000 rpm Spindle

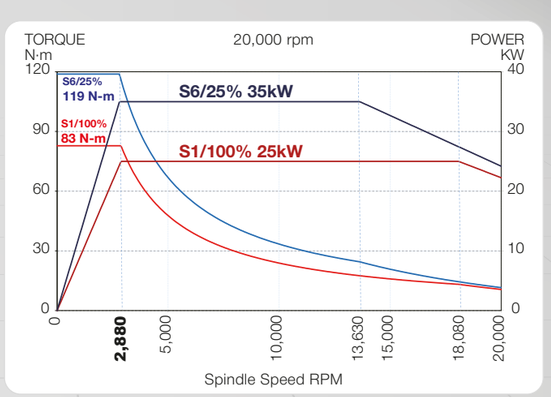
- Powerful integrated 40 taper dual contact spindle.
- Maintenance free 15,000 ~ 18,000 rpm spindle requires no added oil or grease.
- ATE® motor integrated with hybrid ceramic angular contact bearings.
- Micro Dynamics® drawbar has been rigorously tested to sustain more than 2 million cycles.
- For all applications, from heavy duty to high speed machining.
- Highest productivity under any conditions and complexities.
- CTS (Coolant Through Spindle) designed to sustain up to 100 bar (1,500 psi).*

* CTS preparation is standard equipment, CTS system is optional.



40 Taper Dual Contact
15,000 ~ 18,000 rpm Spindle

All Micro Dynamics® spindles are built with all shelf standard bearings which can be replaced without removing the rotor. This makes all machines simple and fast to maintain. Rebuild costs are very low due to the availability of the parts and the short service time.



40 Taper Dual Contact
20,000 rpm Spindle

Micro Dynamics® optional 20,000 rpm spindle, available on all models, delivers 35 kW of power and 119 Nm of torque. This allows for fine finishes while still achieving high material removal rates in a wide range of material types.

MOLD & DIE

The **MEGA/TERA Series** has been refined through years of research and development of new technologies that greatly enhance the machines for the rigors of the Mold and Die industry.

- Advanced Motion Control technology that benefits the production of Mold and Die components.
- Highest quality components to ensure fast and smooth cutting strategies.
- 4G SSS (G05P20000) Motion Control processing speed of up to 270,000 blocks per minute.
- DYPEC® Thermal Compensation. Real time thermal growth compensation, monitoring every few milliseconds, with 0.1 microns compensations to ensure accuracies during long cycle times.

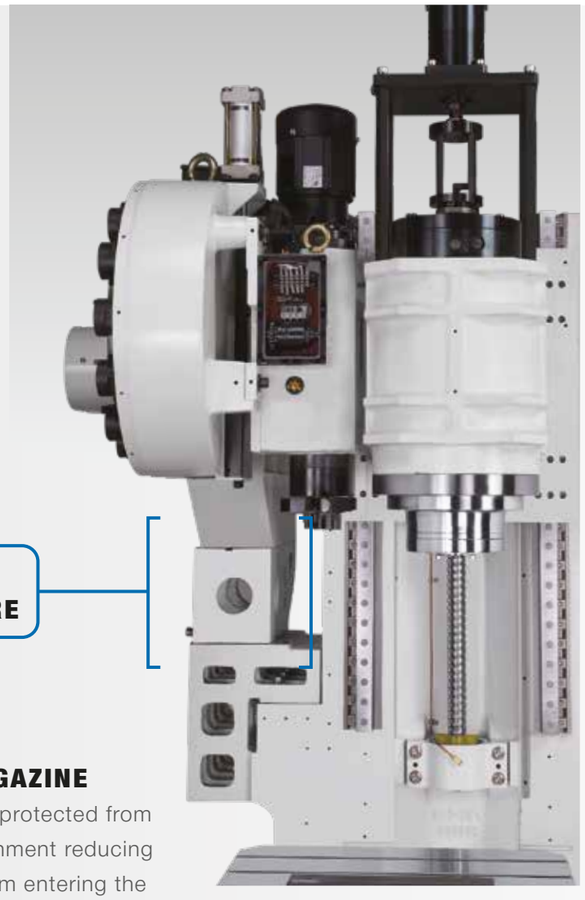
AUTOMATIC TOOL CHANGER

The **MEGA/TERA Series** is equipped with a high-speed double arm tool changer with a 40-tool magazine*. The magazine is integrated on the machine with an isolated structure, eliminating vibrations to the column, thus improving accuracy and finishes. The dual speed double arm allows the operator to adjust the speed of the tool changes for oversized, heavy tools and probes, to ensure accuracy and reliability. The ATC recovery function in HMI is a standard feature that assists the operator in recovering the position of the arm and the tool.

ATC SPEED:

1.9 sec Tool to Tool

3.2 sec Chip to Chip



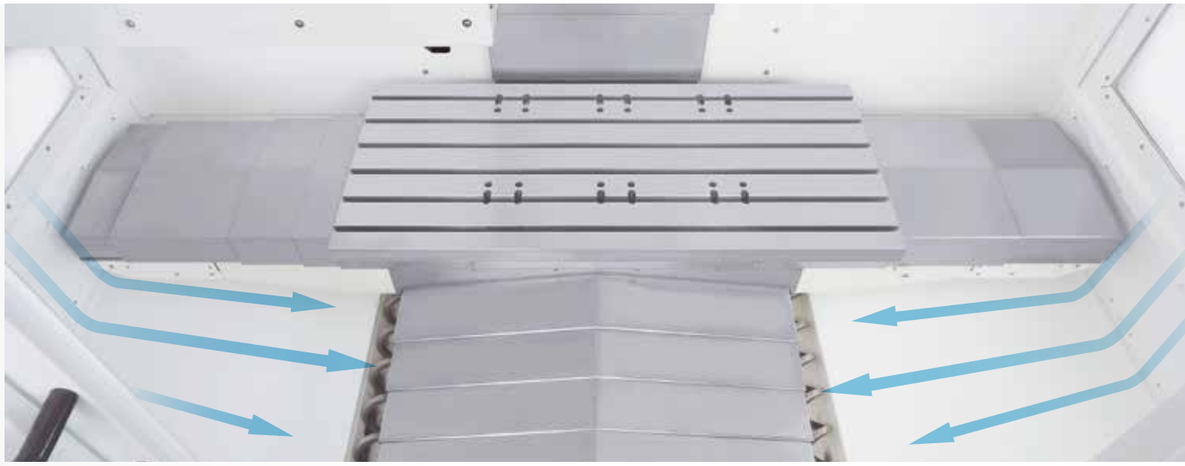
FULL COVER MAGAZINE

The tool magazine is protected from the machining environment reducing chips and coolant from entering the magazine area.

ATC REAR OPERATION PANEL* and door allow access for loading, unloading and inspection of tools while the machine is in operation. Tools can be called up either by tool number or by pocket number. During manual operation the machine will continue the cycle without interruption until ATC door is closed and the key is switched to automatic.

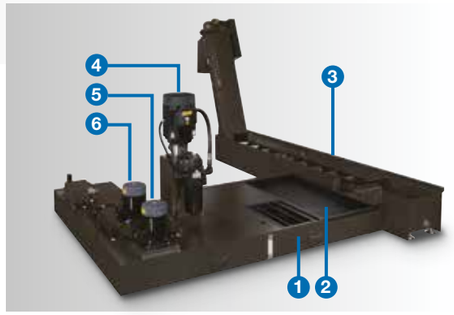
* Except MEGA 30V and TERA 40V.

CHIP MANAGEMENT SYSTEM



The chip management system includes base wash, dual augers and chip conveyor, virtually eliminating chip build-up. Coolant falls along the inside perimeter flushing chips down to the dual augers which evacuate chips to the front conveyor. All mounting hardware is bolted from the outside leaving a clean surface for chip evacuation.

Triple protection on linear guides which helps keeps chips and contaminates away from critical areas and ball screws: bottom cover, top cover and telescopic cover.



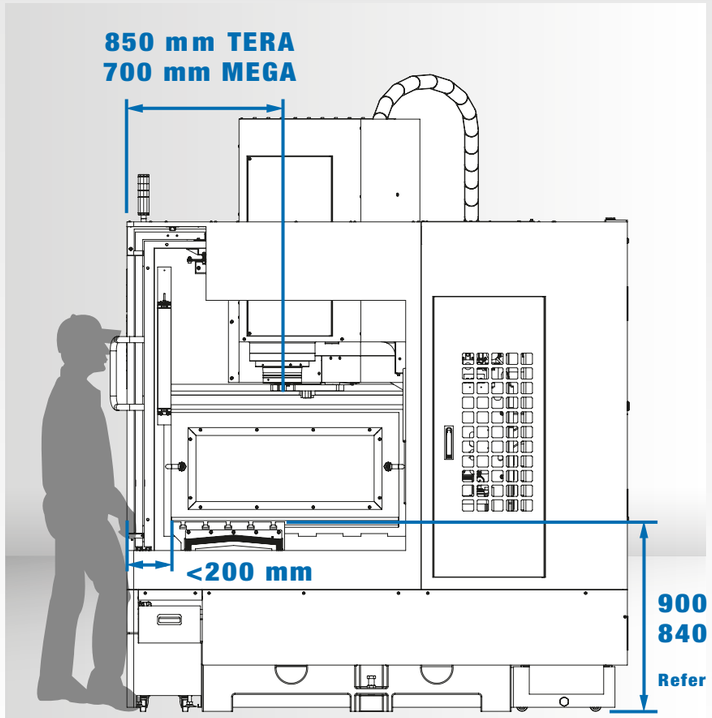
MODULAR COOLANT/CHIP SYSTEM

1. Filter Chip Basket
2. Filter Chip Pan
3. Chip Conveyor
4. CTS Pump Option
5. Base Wash Pump
6. Coolant Pump

REVERSIBLE CONVEYOR standard in all MEGA/TERA Series. Rear chip conveyor available under request.

ERGONOMICS

MEGA/TERA Series is ergonomically designed for operator and maintenance convenience. The large wide front door can be opened with one hand. There are three LED lights, two in the sides and one over the work area.



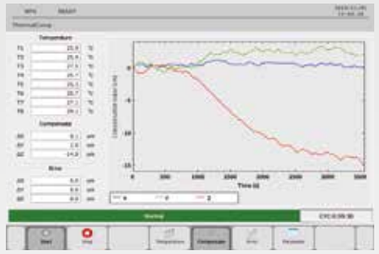
The distance from the door to the table is less than 200 mm for easy setup and part loading. The reach for operator access to the spindle is greatly reduced.

Headstock service door to facilitate access is standard on all models.

Two axes motion operator panel offers flat, tilting and swivel control.

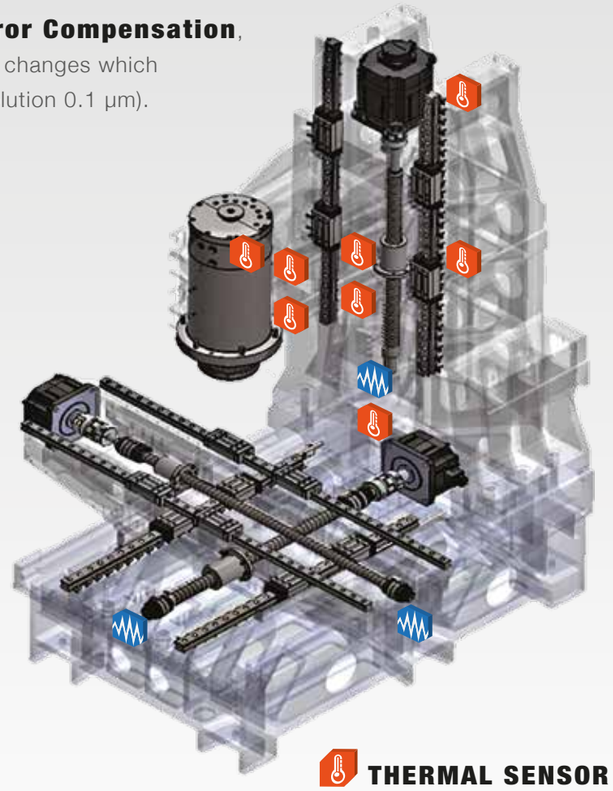
DYPEC® THERMAL COMPENSATION

DYPEC®, Dynamic Predictive Error Compensation, corrects position error caused by thermal changes which improves accuracy and part finishes (resolution 0.1 µm).

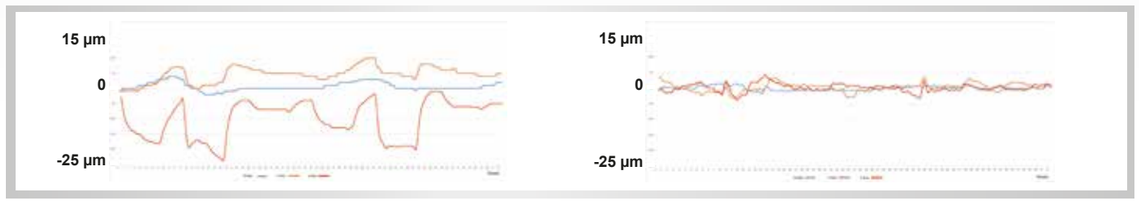


DYPEC® software chart in HMI

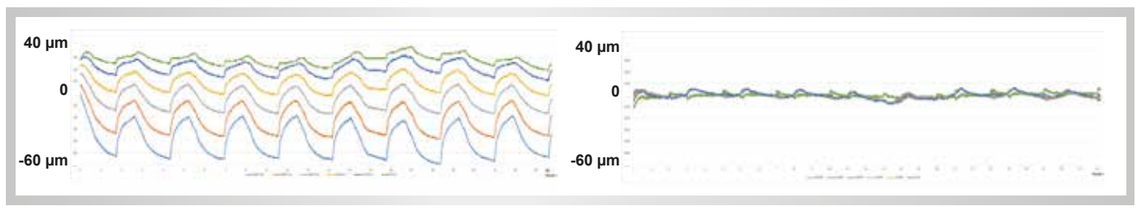
DYPEC® mirror milling with ball end mill



* Optional



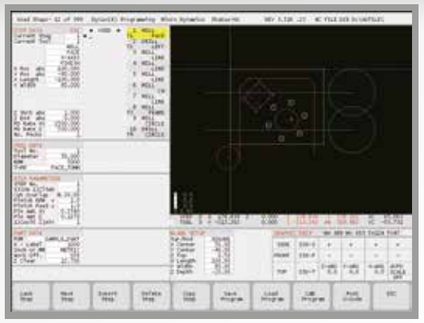
Static error before and after DYPEC® compensation (48 hours test).



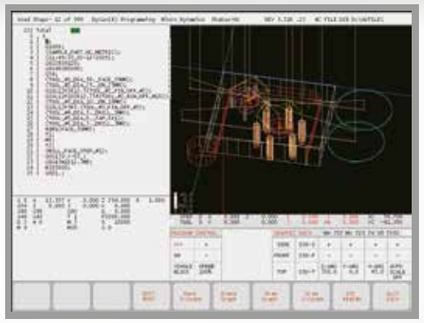
Dynamic axis error before and after DYPEC® compensation (36 hours test).

MICRO DYNAMICS HMI

The Windows embedded HMI CNC gives the user the ability to create or add apps to make it flexible to operate and automate the machine. Operator can load, run or edit any program from any device: internal HMI memory, PC hard drive or external USB device.

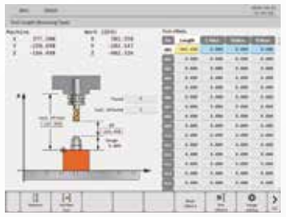


G-Code automatically generated



DYCON® Dynamic Conversational Program is a new software for the operator to generate G-Code very fast by answering menu questions and getting graphical tool path verification.

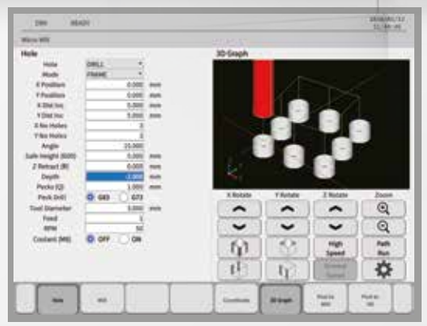
PART SETUP



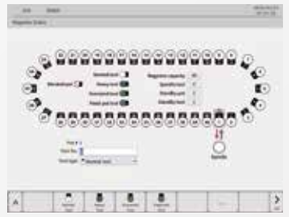
TOOL SETUP

PART/TOOL PROBE

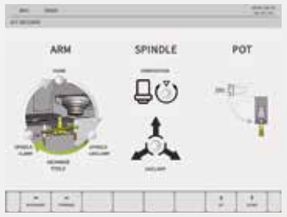
The **MEGA/TERA Series** features Mitsubishi CNC M800 Control which is well suited to high-speed, high-accuracy machining and multi-axis, multi-part system control. Mitsubishi's tool path graphics verification makes it easier for end users to check G-Code program before machining.



MICRO MILL® is an interface that allows any operator to easily perform milling and drilling operations without using G-Code.



MAGAZINE MONITOR



ATC Recovery function allows the operator to recover the tool changer.

APC Recovery function allows the operator to recover the pallet changer.

Micro Dynamics® features:

- Mitsubishi CNC M800 series.
- 15" Touchscreen display.
- 2,700 Block Look Ahead.
- 20 GB Data Server.
- 1,000 Programs in editing memory.
- 999 Sets in tool compensation.
- DXF import.
- 54 Sets work offsets.
- 400 Sets tool life management.
- 700 Sets macro variable.
- 64 Bit microprocessor.
- 2,048 KB Program memory.
- Main and subprograms can be edited and run as one file.
- Programs can be run from the front side USB or the hard drive.
- 3D circular interpolation.
- G-Code guidance.
- Helical interpolation.
- NURBS interpolation. (*)
- Programmable in-position check.
- Scaling.
- Simple programming (NAVI mill conversational programming).
- 4G SSS Control (Super Smooth Surface).
- Tolerance control.
- Spiral/conical interpolation.
- Tool Center Point Control.
- 3D tool radius compensation.
- Workpiece position offset for rotary axis.
- Inverse time feed.
- Polar coordinate command.
- Upgradable to 5 axes simultaneous control. (*)

(*) Optional for U.S. market only.

MEGA 20VAPC

SERVO DRIVEN PALLET CHANGER

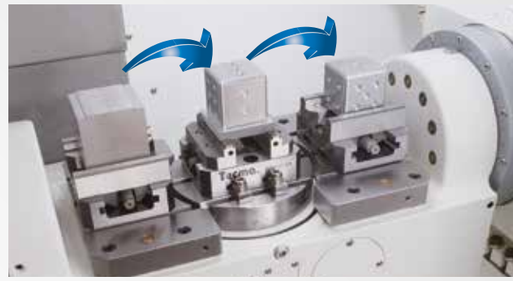
Dual pallet changer MEGA 20VAPC is designed for high production. The servo driven pallet changer switches tables in 8.5 sec. With the APC recovery function in the HMI the operator can easily perform maintenance of the pallet changer.

Pressurized cones

MEGA 30VT / TERA 50VT

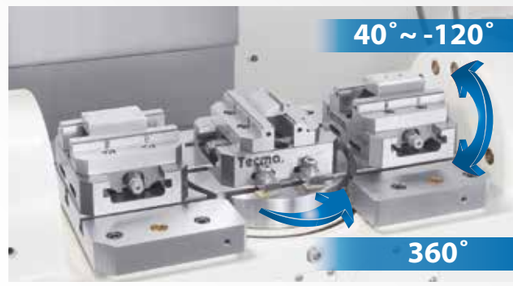
The MEGA 30VT and TERA 50VT are Micro Dynamics's five-axis trunnion (4+1) table machines with hydraulic brakes. The design allows the user to load three vises or can be used as a 500 x 300 mm work table with a 220 mm diameter face plate* in MEGA 30VT and 720 x 400 mm work table with a 320 mm diameter face plate* in TERA 50VT.

For automation the through hole of the rotary table allows for the plumbing of hydraulics, pneumatics or other devices. A true five-axis simultaneous version is available as an option.

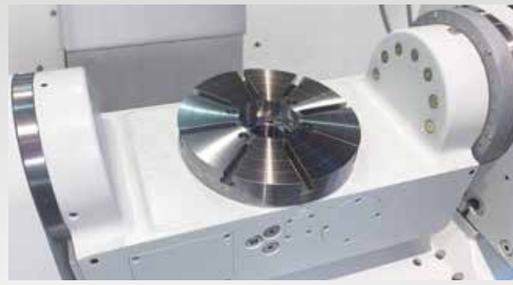


MACHINE 6 SIDES IN ONE LOAD

Left vise: cut dove tail.
Central vise: 5-side machining.
Right vise: finish dove tail.



Titling axis and Rotary axis motion ranges.



* 300 mm and 350 mm diameter face table available for MEGA 30VT.
* 500 mm diameter face table available for TERA 50VT.

MACHINING CAPACITY

FACE MILL

MATERIAL REMOVAL:
780 cc/min

SPINDLE LOAD:
87%

- Tool: **63 mm Face Mill**
- Material: 1050 Steel
- Cut: 50 mm x 6 mm
- Feedrate: 2,600 mm/min
- Spindle Speed: 2,200 rpm

END MILL

MATERIAL REMOVAL:
368 cc/min

SPINDLE LOAD:
47%

- Tool: **32 mm End Mill**
- Material: 1050 Steel
- Cut: 32 mm x 5 mm
- Feedrate: 2,300 mm/min
- Spindle Speed: 3,800 rpm

DRILL

MATERIAL REMOVAL:
866 cc/min

SPINDLE LOAD:
87%

- Tool: **45 mm Drill**
- Material: 1050 Steel
- Diameter Cut: 45 mm
- Cutting Depth: 35 mm
- Feedrate: 550 mm/min
- Spindle Speed: 2,400 rpm

TAP

SPINDLE LOAD:
46%

- Tool: **33 x 3 mm Tap**
- Material: 1050 Steel
- Feedrate: 348 mm/min
- Spindle Speed: 128 rpm

Factory Conditions

FACTORY TEST

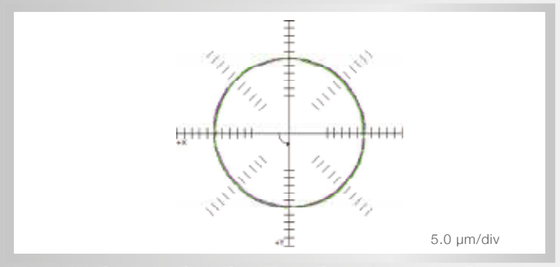
Micro Dynamics standard factory tests for all models includes the circle, diamond, square cutting test, as well as milling, drilling, tapping and the heavy milling test based on below parameters:

- Tool: 50 mm End Mill
- Material: 1050 Steel
- Cutting Width: 22 mm
- Cutting Depth: 7 mm
- Feedrate: 1,400 mm/min
- Spindle Speed: 1,100 rpm
- Load: 40%

ACCURACY

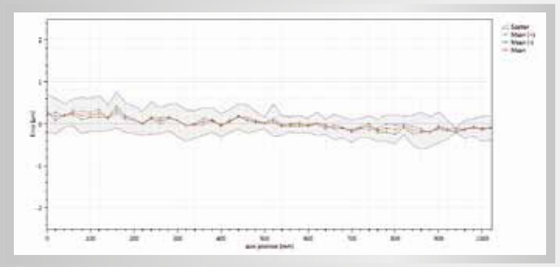
Micro Dynamics circle, diamond, square cutting test is done on all machines prior to shipment at 2 m/min with a maximum tolerance under 5 microns.

- XY, XZ and YZ Double Ball Bar Test Results at 2 m/min under 5 microns.
- X, Y and Z Axis Laser Compensation under 5 microns.
- 4th and 5th Axis Laser Compensation under 10 arcsecs.



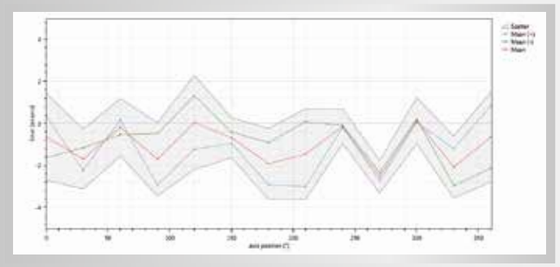
E.g. XY Double Ball Bar Test Results under 5 microns.

16% Squareness 6.3 µm/m
16% Backlash X ← -0.3 µm → 0.9 µm
13% Reversal spikes X ← -0.8 µm → -0.4 µm
12% Cyclic error Y ↑ 0.8 µm ↓ 0.7 µm
10% Lateral play X ← 0.8 µm → 0.4 µm
Circularity 2.7 µm



E.g. X Axis Laser Compensation under 5 microns.

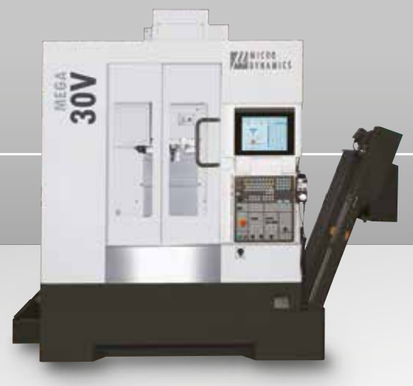
Linear X - Analysis features	VDI 3441
Name	**Value (µm)**
Maximum reversal (U max)	0.2
Maximum scatter (Ps max)	0.8
Positional uncertainty (P)	1.4
Positional deviation (Pa)	0.5
Mean reversal	0.1
Mean scatter (Ps mean)	0.5



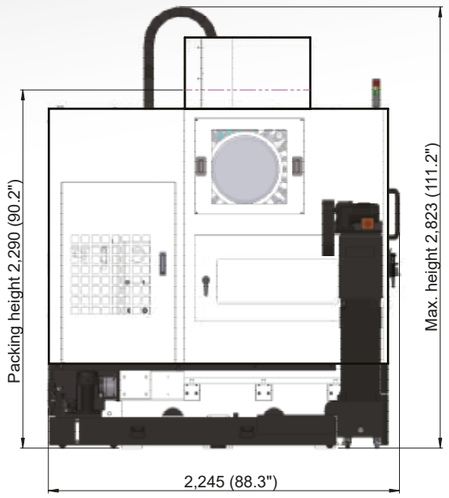
E.g. 5th Axis Laser Compensation under 10 arcsecs.

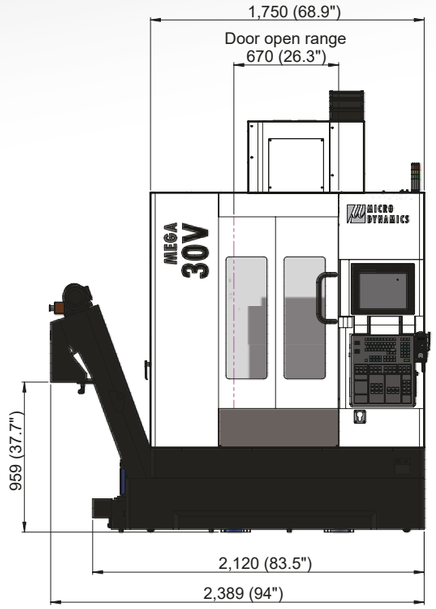
Angular C - Analysis features	VDI 3441
Name	**Value (arcsecs)**
Maximum reversal (U max)	3.1
Maximum scatter (Ps max)	2.1
Positional uncertainty (P)	5.9
Positional deviation (Pa)	2.7
Mean reversal	1.5
Mean scatter (Ps mean)	1.5

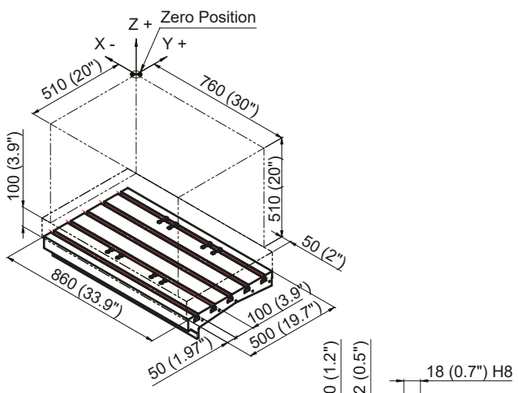
MEGA 30V

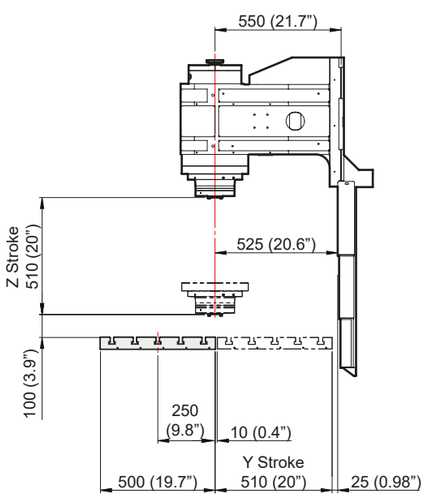


MACHINE DIMENSIONS



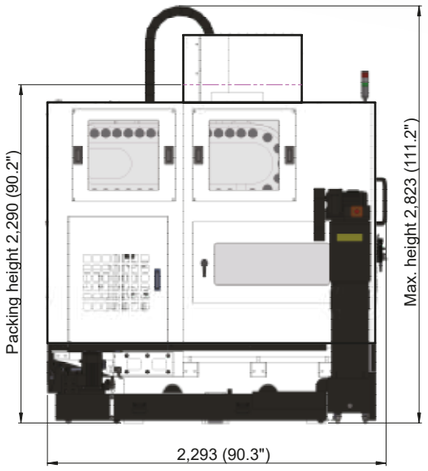


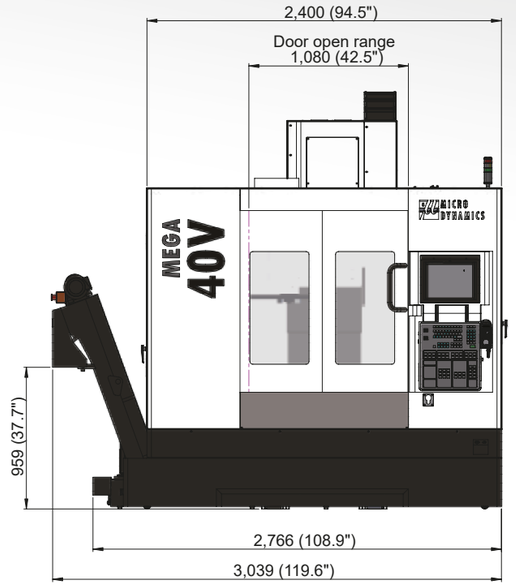


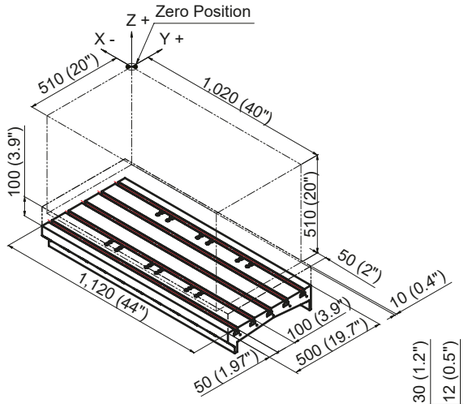


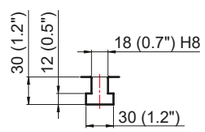
MEGA 40V

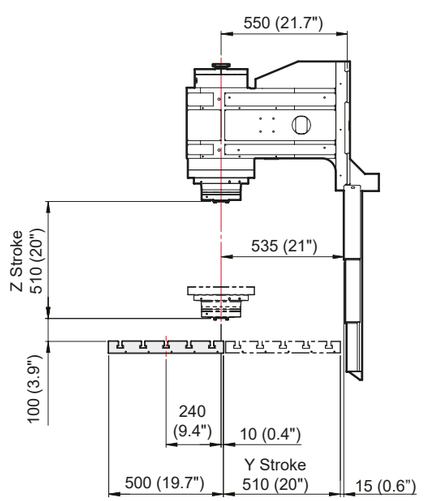
MACHINE DIMENSIONS





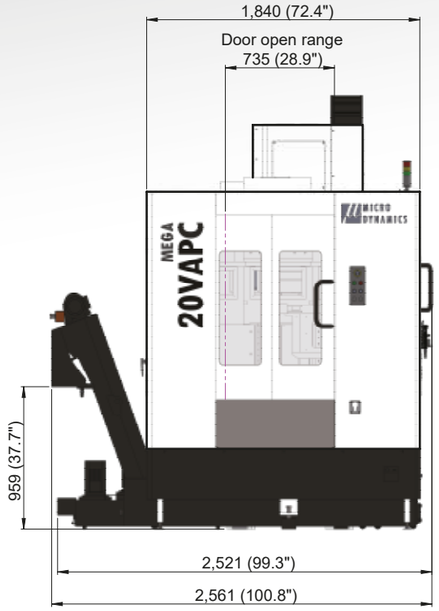


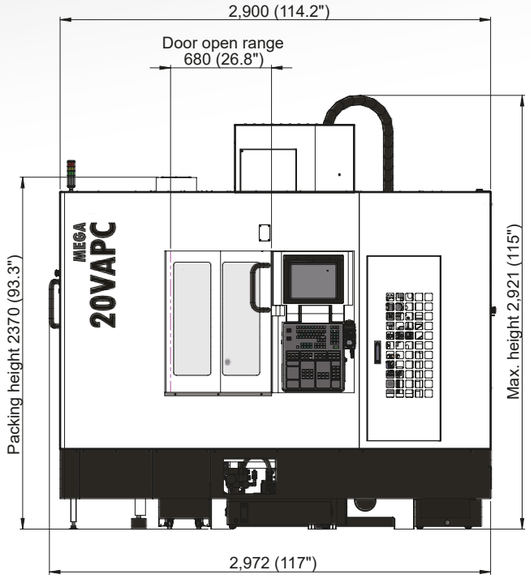


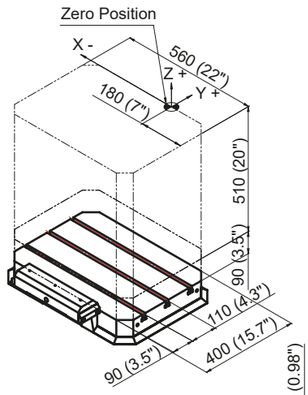


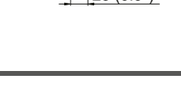
MEGA 20VAPC

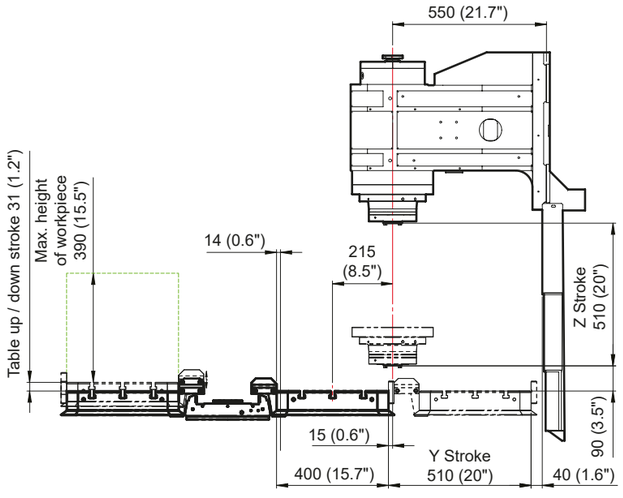
MACHINE DIMENSIONS





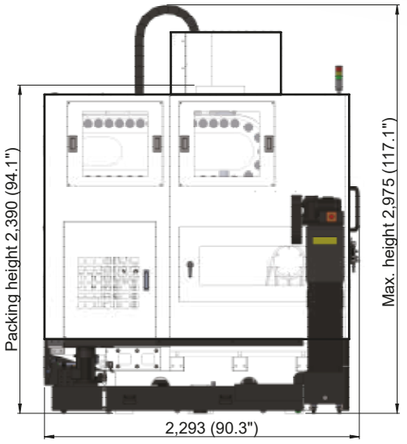


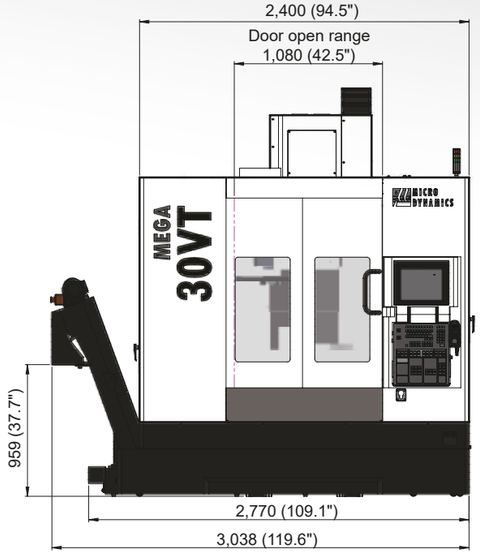


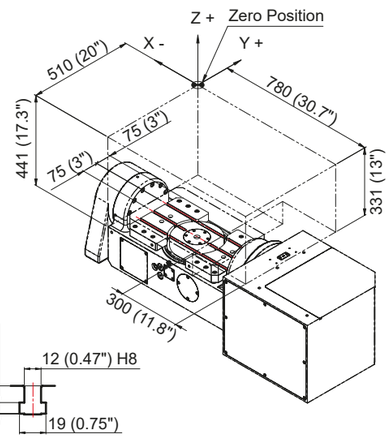


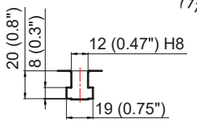
MEGA 30VT

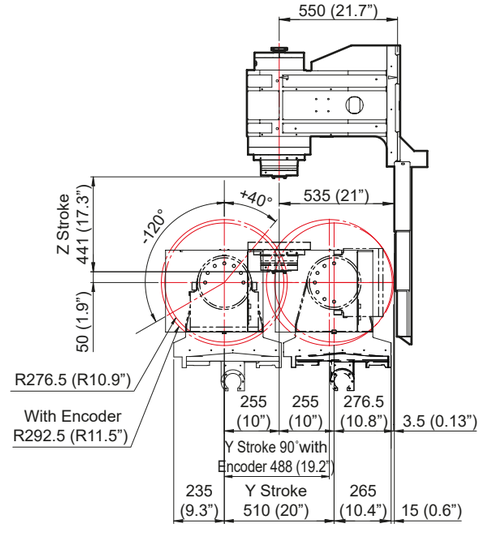
MACHINE DIMENSIONS





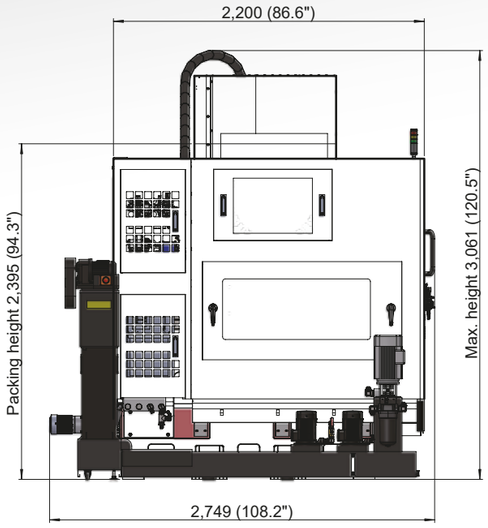


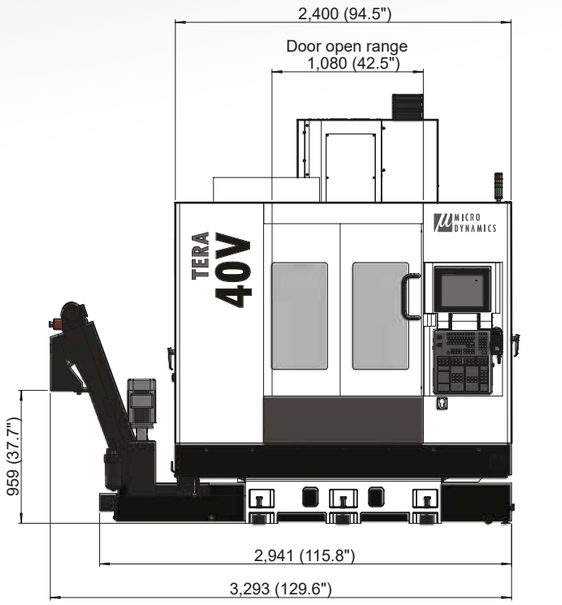


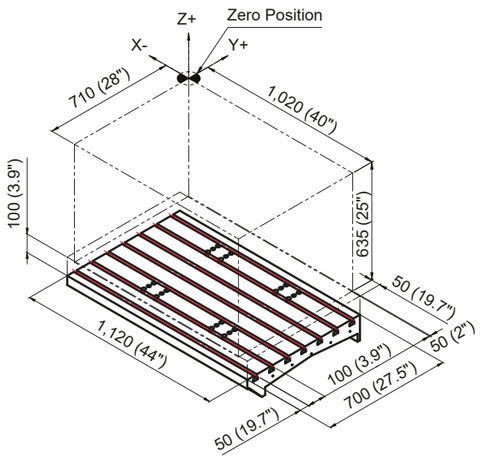


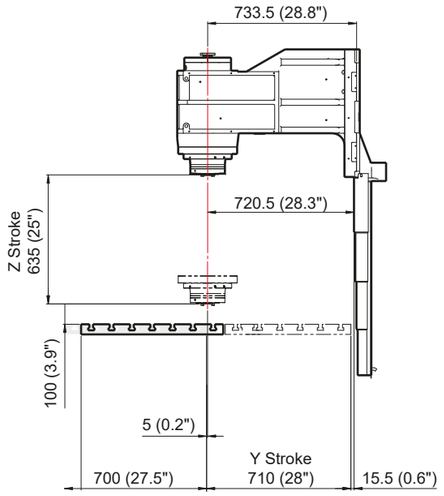
TERA 40V

MACHINE DIMENSIONS



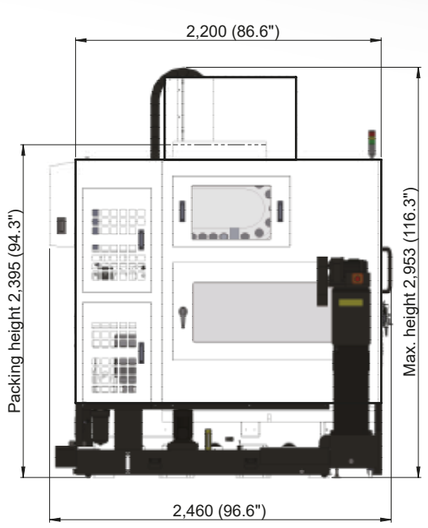


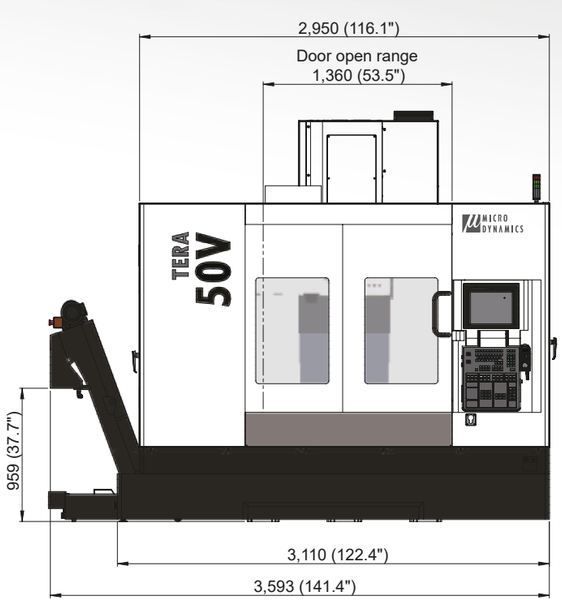


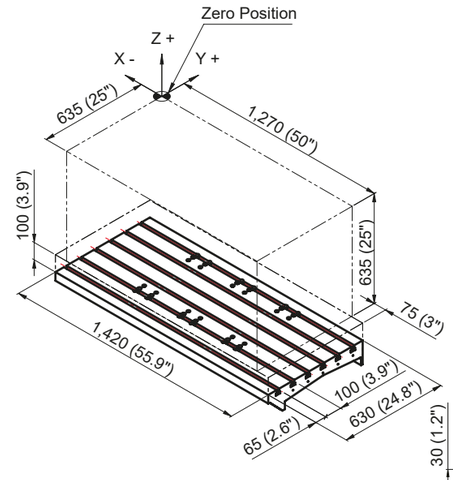


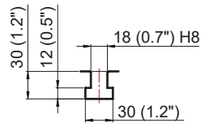
TERA 50V

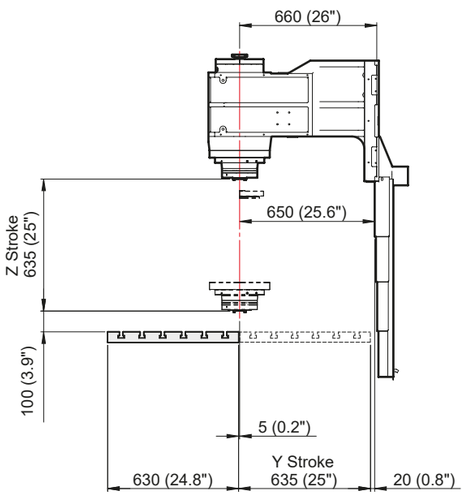
MACHINE DIMENSIONS





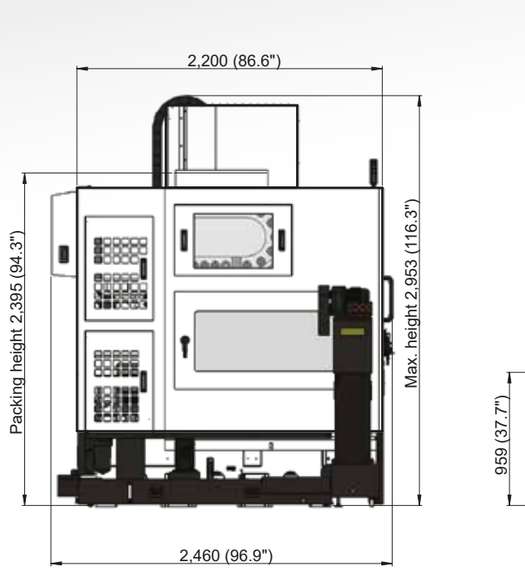


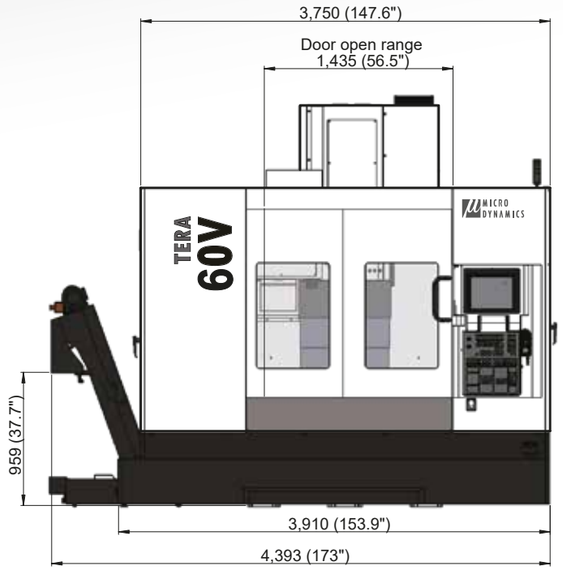


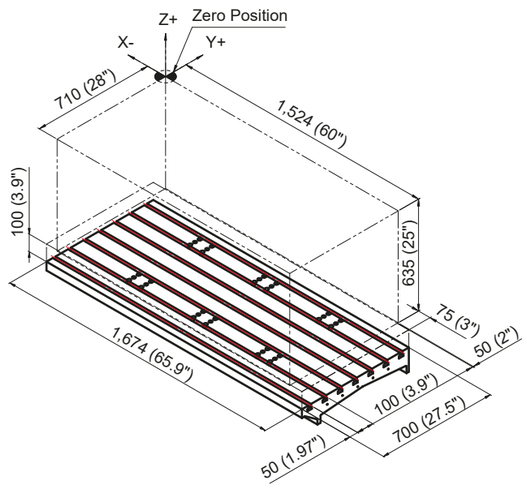


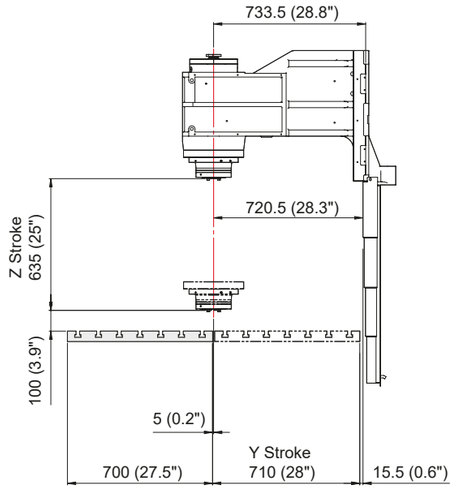
TERA 60V

MACHINE DIMENSIONS



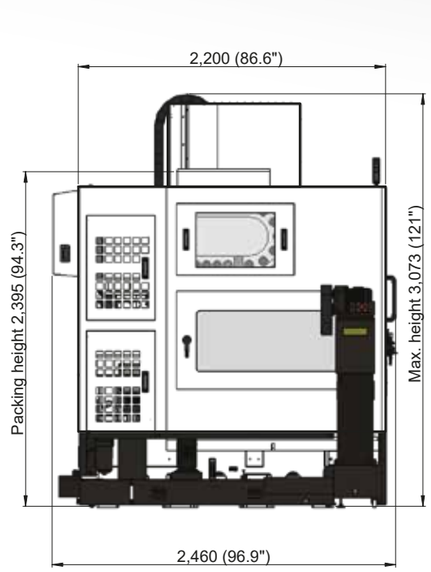


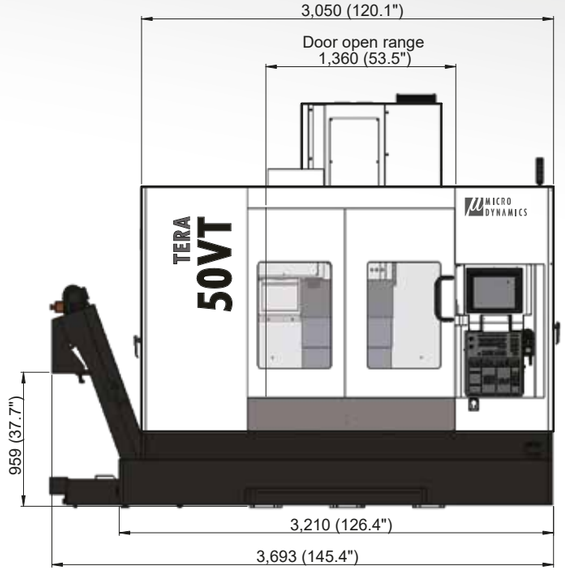


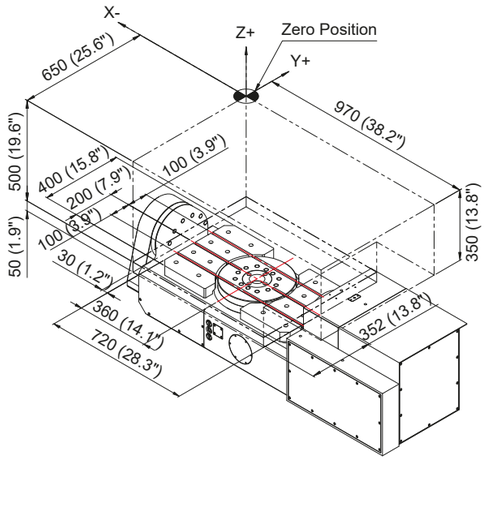


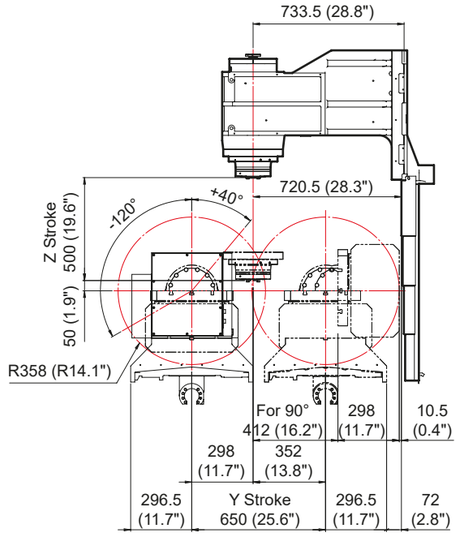
TERA 50VT

MACHINE DIMENSIONS







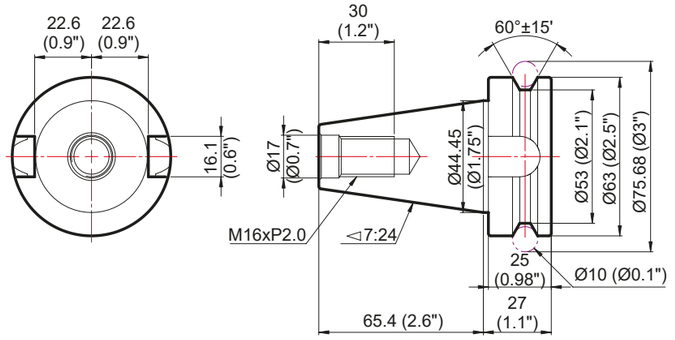


EQUIPMENT

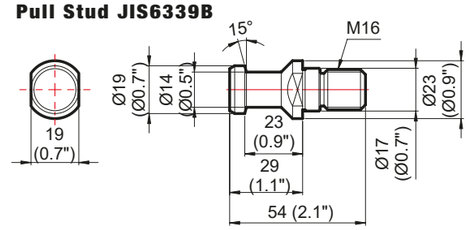
SERIES / MODELS	MEGA				TERA			
	30V	40V	20VAPC	30VT	40V	50V	60V	50VT
15,000 rpm Built-in Spindle	●	●	●	●	●	●	●	●
18,000 rpm Built-in Spindle	○	○	○	○	○	○	○	○
20,000 rpm Built-in Spindle	○	○	○	○	○	○	○	○
DYPEC® Thermal Compensation	●	●	●	●	●	●	●	●
DYPEC® Ball Screws Pitch Error Compensation	○	○	○	○	○	○	○	○
Tool Magazine Capacity - 30	●	–	–	–	●	–	–	–
Tool Magazine Capacity - 40	–	●	●	●	–	●	●	●
15" Touchscreen Display	●	●	●	●	●	●	●	●
Micro Dynamics® HMI	●	●	●	●	●	●	●	●
Full Chip Enclosure	●	●	●	●	●	●	●	●
Scraper Type Lift-up Chip Conveyor	●	●	●	●	●	●	●	●
Chain Type Lift-up Chip Conveyor	○	○	○	○	○	○	○	○
Rear Exit Lift-up Chip Conveyor*	○	○	○	○	●	○	○	○
Twin Chip Augers	●	●	●	●	●	●	●	●
CTS Preparation (without Rotary Union)	●	●	●	●	●	●	●	●
20-Bar (290 psi) / 40-Bar (580 psi) / 70-Bar (1,000 psi) CTS	○	○	○	○	○	○	○	○
Metal Coolant Ring	○	○	○	○	○	○	○	○
ATC Magazine Panel	–	●	●	●	–	●	●	●
Tool Magazine LED	–	●	●	●	–	●	●	●
Automatic Power Off	●	●	●	●	●	●	●	●
Safety Door	●	●	●	●	●	●	●	●
Spinning Window	○	○	○	○	○	○	○	○
CE-Conformity Package	○	○	○	○	○	○	○	○
X/Y/Z Axis Linear Scale (Fagor / Heidenhain)	○	○	○	○	○	○	○	○
A/C Axis Rotary Scale (Fagor / Heidenhain)	–	–	–	○	–	–	–	○
Automatic Door (Pneumatic / Servo)	○	○	○	○	○	○	○	○
Tool Measurement / Workpiece Measurement	○	○	○	○	○	○	○	○
Column Riser*	○	○	○	○	○	○	○	○
Disc Type Oil Skimmer	○	○	○	○	○	○	○	○
4th Axis Pre-wiring	○	○	○	○	○	○	○	○
300 mm (11.8") / 350 mm (13.7") Diameter Face Table	–	–	–	○	–	–	–	–
500 mm (19.6") Diameter Face Table	–	–	–	–	–	–	–	○
8 M-Codes (M20 ~ M27)	●	●	●	●	●	●	●	●
Extra 8 M-Codes (M130 ~ M137)	○	○	○	○	○	○	○	○
Oil Mist Collector	○	○	○	○	○	○	○	○
Transformer	○	○	○	○	○	○	○	○
Manuals / Tool Kit / Foundation Kit	●	●	●	●	●	●	●	●

* Factory order ● Standard ○ Optional

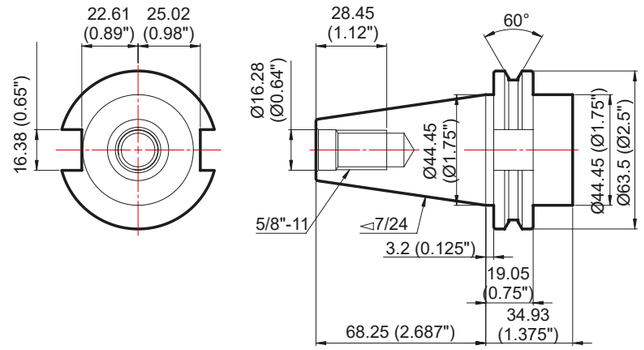
Tool Shank BT40



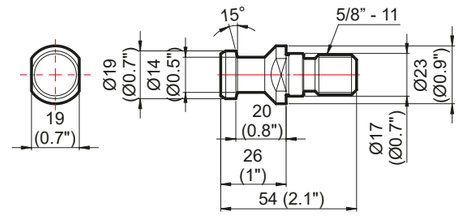
Pull Stud JIS6339B



Tool Shank CAT40



Pull Stud DIN69872A



SPECIFICATIONS

ITEM		UNIT	MEGA 30V	MEGA 40V	MEGA 20VAPC	MEGA 30VT	TERA 40V	TERA 50V	TERA 60V	TERA 50VT
TRAVEL	X Axis	mm	760	1,020	600	780	1,020	1,270	1,524	970
	Y Axis	mm	510	510	510	510	710	635 / 710	710	650 / 710 (90°)
	Z Axis	mm	510	510	510	439	635	635	635	500
	A Axis (Tilting Axis)	deg	N/A			40° ~ -120°	N/A			40° ~ -120°
	C Axis (Rotary Axis)	deg	N/A			360°	N/A			360°
	Spindle Nose to Table Surface	mm	100 ~ 610	100 ~ 610	90 ~ 600	50 ~ 489	100 ~ 735	100 ~ 735	100 ~ 735	50 ~ 500
	Spindle Center to Column Front	mm	550				733	660 / 733	733	733
TABLE	Table Size	mm	860 × 500	1,120 × 500	560 x 400	ø220 (500 x 300)	1,120 x 700	1,420 x 630 / 1,420 x 700	1,674 x 700	ø320 (720 x 400)
	Min. Table Index Unit	deg	N/A			0.001°	N/A			0.001°
	Max. Table Load	kg	800	1,000	200 x 2	150 (0°~45°) / 85 (45°~90°)	1,500	1,500	2,000	200 (0°~45°) / 150 (45°~90°)
	Table Height (from the Ground)	mm	840	840	950	1,108	900	900	900	1,205
SPINDLE	Spindle Taper		40 Taper Dual Contact							
	I.D. of Spindle Bearing	mm	ø70							
	Max. Cutting Torque	Nm	141							
	Spindle Speed	rpm	50 ~ 15,000 (Opt. 20,000)							
	Max. Speed for Rigid Tapping	rpm	6,000							
FEEDRATE	Rapid Feedrate - X Axis	m/min	52	52	52	48	52	52	52	48
	Rapid Feedrate - Y Axis	m/min	52	52	52	48	52	52	52	48
	Rapid Feedrate - Z Axis	m/min	48	48	48	48	48	48	48	48
	Rapid Feedrate - A (Tilting) Axis	rpm	N/A			25	N/A			33
	Rapid Feedrate - C (Rotary) Axis	rpm	N/A			33	N/A			66
	Cutting Feedrate	m/min	0 ~ 20							
ATC	Magazine Capacity		30	40			30	40		
	Tool Selection		Bi-Direction / Random							
	Tool Shank Type		BT40 / CAT40 / DIN40							
	Pull Stud Type		BT40 / CAT40 / DIN40							
	Max. Tool Diameter x Length	mm	ø75 × 240	ø75 × 300	ø75 × 250	ø75 × 300				
	Without Adjacent Tool	mm	ø150							
	Max. Tool Weight	kg	7							
PERIPHERAL	Power Consumption (220V/3PH)	KVA	30				40			
	Pneumatic Supply	L/min (ANR)	300 (0.6MPa)							
	Cutting Coolant Pump Motor	kW	1.1							
	Base Wash Pump Motor	kW	0.75				1.1			
	CTS Pump Motor (Opt.)	kW	3							
	Coolant Tank Capacity	L	250	300	300	300	350	400	400	400
	Foot Print Size (W x D)	mm	2,389 × 2,245	3,039 x 2,293	2,561 x 2,972	3,039 x 2,293	3,293 x 2,749	3,593 x 2,460	4,393 x 2,460	3,693 x 2,460
	Machine Height (H)	mm	2,823	2,823	2,921	2,975	3,061	2,953	2,953	3,073
	Packing Size (W x D x H)	mm	2,750 x 2,300 x 2,550	3,300 x 2,310 x 2,550	3,200 x 2,200 x 2,550	3,300 x 2,310 x 2,550	3,300 x 2,310 x 2,550	3,900 x 2,310 x 2,550	4,250 x 2,310 x 2,550	4,050 x 2,450 x 2,550
	Machine Net Weight	kg	4,520	5,620	6,460	6,070	7,200	7,500	8,000	8,200
	Machine Gross Weight	kg	4,710	5,850	6,780	6,300	7,600	7,900	8,400	8,600
	Positioning Accuracy / Full Stroke	mm	0.005 (VDI 3441)							
	Repeatability Accuracy	mm	0.003							

MICRO DYNAMICS

info@microdynamicsfa.com
www.microdynamicsfa.com

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