

**VMX650FX**  
**5 Axis High Performance Machine Center**



The VMX650FX 5 axis traveling column machine center features a table size of Ø650 mm, and a work envelope size applicable for complicated simultaneous contouring required for high accuracy machining applications. Superior +/- 3 microns machine accuracy increases profits and reduces scrap. This machine is designed to support the aerospace, medical, molding, automotive and other advanced industries.

The VMX650FX series is engineered using a Traveling Column to provide rigidity, accuracy, power, and durability, in production of 5 axis machined parts. The VMX650FX series also offers the options of adding a **“Pallet Pool”**, and Pneumatic or Hydraulic programmable doors. Also available is “Through table Hydraulic or Pneumatic” clamping. For ease of automation and “Lights Out” operation all features are M-Code programmable. The machine is controlled by a **FANUC 31i-B5 control**. Features include simultaneous X,Y, Z, A, and C motion, to produce the most sophisticated 5 axis parts. High Precision 35/45/45mm roller linear guides are matched with robust Ø45mm pre-tensioned **C2** class ball screws delivering reliable accuracy on X/Y/Z Axes. A [Heidenhain rotary encoder](#) is included with the A axis tilting rotary for your most demanding applications. The Dual Contact CAT.40 spindle features tool holding with two face clamping enabling rigid machining while reducing tool wear. An optional HSK A63 spindle is also offered.

The **NEW VMX650FX** has a 21.5” touch screen monitor, our backlit Jupiter control panel, and features our QWERTY keyboard. Operators can easily monitor and control operations, increasing part quality, reducing training time, and increasing SAFETY by simplifying machine operation.

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**VMX650FX SERIES STANDARD FEATURES:**

- ❖ **Fanuc 31i-B5 with a 21.5" Color Touch Screen**
  - Dynamic Collision Monitoring Software
  - Tool Center Point (TCP) & (TCPM)
  - Smart rigid Tapping
- ❖ Rotary Table Diameter Ø650x520 mm (Ø25.59" x 20.47")
  - Max Work Size Ø650 mm (21.17") Height 460 mm (18.11")
  - Max Table Load 300kg/ 300kg (661.39 lbs./ 661.39 lbs.)
  - X/ Y/ Z Axis Travel,700/ 560/ 475mm (27.56"/ 22.05"/ 18.70")
  - Tilt Axis (B Axis), Swiveling Range -90~ +120°; with *Heidenhain ECN Rotary Encoder*
  - Rotary Axis (C Axis) 360°; with *Heidenhain ECN Rotary Encoder*
- ❖ Max Spindle Power 33 kW (44.25 hp), 166Nm (122,43 ft-lb), S6-15%
  - Max Spindle Speed 15,000rpm, DDS, Dual Contact CAT #40
  - Fanuc ai Spindle Motor, Fanuc ai Amplifiers and Servo Motors with Absolute Positioning Encoders,
  - Air Purge/Air Sealed for Spindle Protection
  - Tool Air Blast and Coolant Flush Beside Spindle
  - Spindle Oil Chiller
  - Spindle Air Purge
- ❖ C2 Class Accuracy Ballscrew and Precision Roller PACK Linear Guides
- ❖ X/ Y/ Z Axis Rapid 36/ 36 / 36 m/min (1417/ 1417/ 1417 ipm)
- ❖ Side Mount Swing Arm Type ATC – DC CAT 40 & HSK 63 tool pots, 48 Tool Pockets Standard, with 60, & 120 available
  - Max Tool Dia. Ø75/125mm, Tool Length 250mm, Tool Weight 8 kg
  - Grease Lubrication
  - Automatic Centralized Lubrication System
  - Spindle Oil Chiller
  - Full Cabinet Enclosure with Multi Layers Safety Vision Panels EN12417
  - Coolant Tank 500L (132 Gallons)
  - Coolant Pumps, Two Pumps, Spindle Ring Flushing Pump and Side Flushing Pump
  - Heat Exchanger
  - Portable MPG, Air Gun and Washing Gun, LED Work Light, Three Status Indicator Light



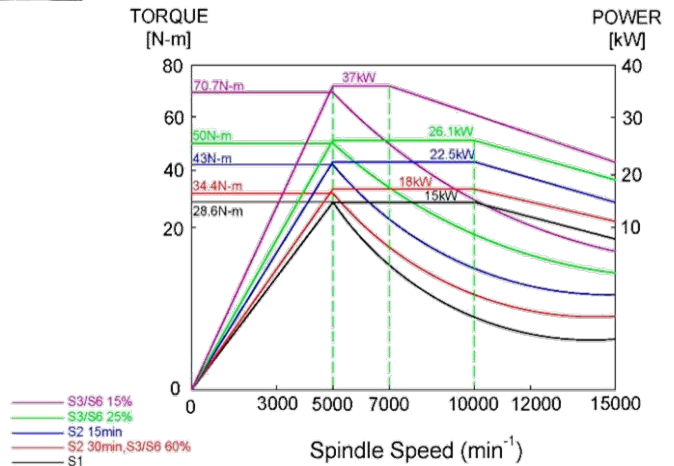
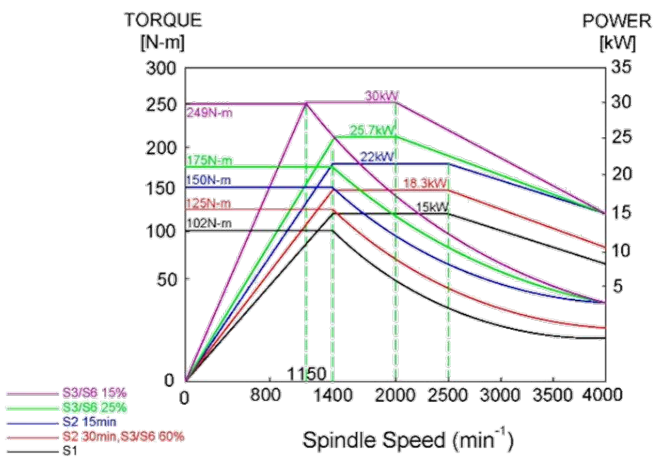
# VMX650FX

## 5 Axis High Performance Machine Center

### HIGH PERFORMANCE SPINDLE:

- High efficiency isolated **direct drive spindle reduces thermal displacement** and improves spindle precision stability and reliability.
- Direct drive spindle provides better transmission efficiency and **dynamic balancing** for higher speed drilling and tapping accuracy.
- Spindle air purge is standard to prevent spindle bearings from coolant and chip contamination.
- Direct drive spindle and short nose type big spindle cartridge Ø160mm, front 3 (2) angular contact bearings and rear 2 bearings, and **spindle nose run out 1um feature** provide high precision and maximum rigidity.
- **Direct-Drive Spindle** available with speeds up to **15,000, 20,000rpm or a built-in spindle motor of 24,000rpm** provide a wide range of machining conditions. Apply different spindle power and torque to meet the needs of various materials, such as stainless steel, light alloy steel, and even exotic alloys to ensure machining rigidity and tool life.
- The **spindle is constructed with P4 grade high-precision ceramic bearings**, and the long-span design reduces thermal displacement and provides high axial rigidity and radial rigidity. The spindle speed is 15,000rpm, which is suitable for high-speed machining technology and provides high-precision surface and contour machining.
- Spindle air curtain is a standard accessory to prevent coolant and/or chips from entering of the spindle, improving the reliability and longevity.

### SPINDLE POWER AND TORQUE OUTPUT

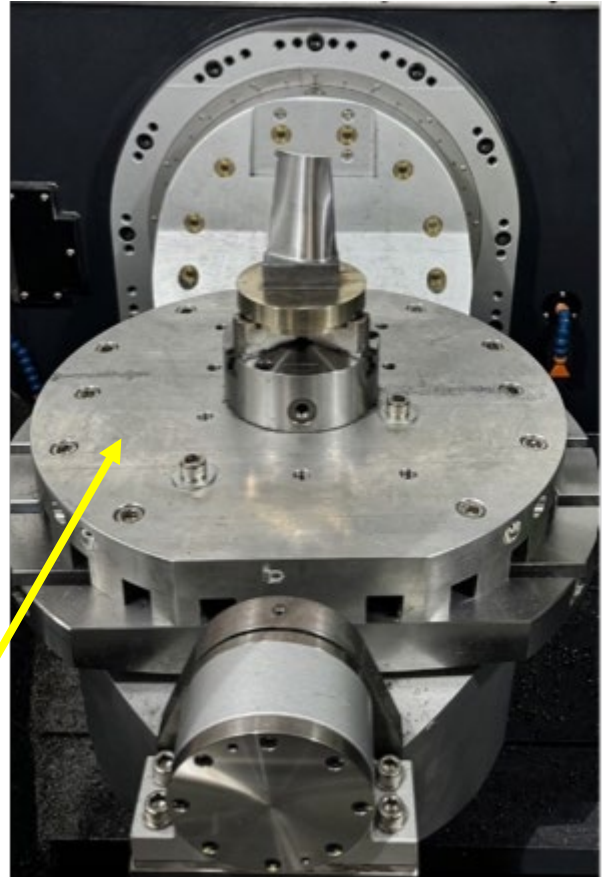
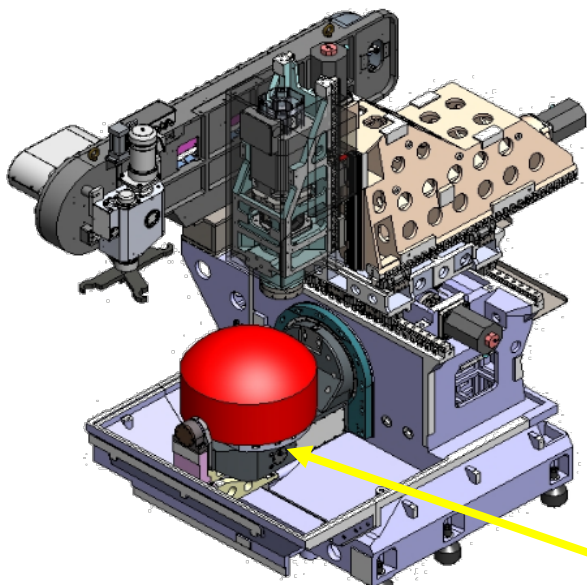


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**CONTINUOUS 5X TABLE WITH DDM TILT AND ROTARY TABLE**

- High Precision and efficiency Tilt/Rotary Table.
- Installed with super precision [Heidenhain rotary encoder](#) (standard feature).
- High speed 60/100 rpm for precision accuracy is provided.
- Kinematic calibration software is included with the VMX650FX series to ensure accuracy.
- Simultaneous five axis operation with five axis TCP (*Tool Center Point*) correction for high precision contouring is included.

Trunnion rotary table features a “**Direct Drive, High Torque Motor**” for simultaneous machining with precision tolerance. Rotary table diameter of Ø650mm allows large part sizes with auto tool interference detection. Automation can be integrated with a Robotics system through the Robot interface and Rotary Table Rotary Joint Connectors



**5 X Machined Engine Blade  
of 316SS**

Swiveling range Tilt-Axis Travel: **+90° ~ -120°**  
Max Part Size Diameter x Height: **Ø690mm x 460mm**  
Max Part Weight 0°/90° Detron: **300kg**  
X/ Y/ Z, Axis Travel: 700mm/ 560mm/ 475mm

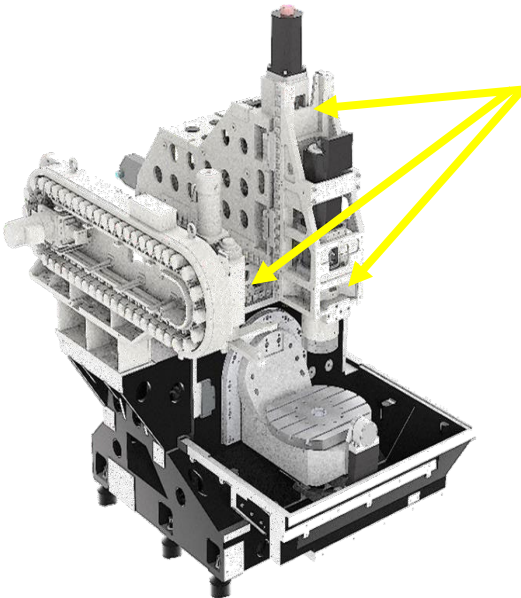
## Large Working Area

Strategic design allows for real-world usability of full travel relative to centers of B/C rotation. Taller column construction permits full Z axis clearance and max part height of 12.9”.

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## Machine Accuracy (mm) Summary

	ISO 10791-2 STANDARD		JUPITER ACCURACY
<b>Straightness full stroke</b>	X	0.02	0.008
	Y	0.015	0.008
	Z	0.015	0.008
<b>Squareness</b>	X-Y	0.02 / 500	0.008 / 500
	Y-Z	0.02 / 500	0.008 / 500
	X-Z	0.02 / 500	0.008 / 500
<b>Positioning Accuracy</b>	X	0.02	0.006
	Y	0.016	0.006
	Z	0.016	0.006
<b>Repeatability</b>	X	0.008	0.004
	Y	0.006	0.004
	Z	0.006	0.004
<b>Spindle run-out on table</b>		0.02 / 300	0.01 / 300
<b>Spindle run-out</b>	At base	0.01	0.004
	At 300mm	0.02	0.008
<b>Circularity</b>	CW	-	0.008
	CCW	-	0.008



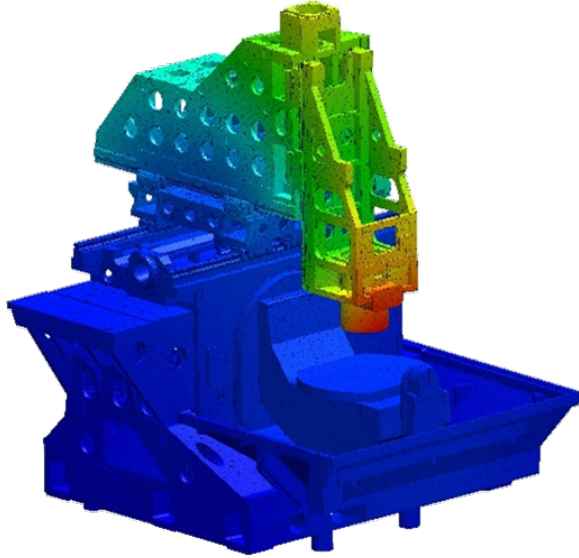
### Ball Screws and Axis Drives

Each axis is driven by high precision PMI C2 double-nut ball screw or Tsubaki single-nut hollow ball screw. All ball screws are centered between the guide ways. The ball screws are pre-tensioned and supported at both ends with angular contact thrust bearings. All axes are connected directly to FANUC A.C. digital servo drive motors without the use of gears or belts to eliminate backlash.

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<b>VMX650 SERIES SPECIFICATIONS</b>		<b>5F E</b>	<b>5AX P</b>	<b>5AX M</b>
<b>FEED</b>				
Rapid Traverse X/ Y/ Z	m/min	36/ 36/ 36		
Max Acceleration X/Y/Z	G	0.4/ 0.4/ 0.7		
Cutting Feed Rate	mm/min (ipm)	1 -10,000 (0.04 - 394)		
Transmission		Direct		
Axial Motor (X Axis)	kW / HP	4.0 (5.36)		
Axial Motor (Y Axis)	kW / HP	4.0 (5.36)		
Axial Motor (Z Axis)	kW / HP	4.0 (5.36)		
Axial Motor (A Axis)	kW / HP	9.0 (12.07)		
Axial Motor (C Axis)	kW / HP	3.0 (4.02)		
Ball Screw Diameter / Pitch	mm (inch)	45 / 12 (1.77/ 0.47)		
Positioning Accuracy*	mm (inch)	0.01 (0.0004)	0.007 (0.00027)	0.005 (0.0002)
Repeatability Accuracy*	mm (inch)	0.005 (0.0002)	0.005 (0.0002)	0.004 (0.00016)
<b>Guide Ways</b>				
Type (All Axes)		Roller Linear Guide Ways		
Way Size (X axis)	mm (inch)	45 (1.77)		
Way Size (Y axis)	mm (inch)	45 (1.77)		
Way Size (Z axis)	mm (inch)	45 (1.77)		
Blocks on Guide Ways (X/Y/Z)		6 / 4 / 4		
Axial Thrust Force (X Axis)	N	11,519 (2,589.57)		
Axial Thrust Force (Y Axis)	N	11,519 (2,589.57)		
Axial Thrust Force (Z Axis)	N	11,519 (2,589.57)		
<b>Coolant System</b>				
Coolant Tank Capacity	L (gal)	500 (132)		
Nozzle Coolant & Flush Pump	Bar (psi)	3.5 (50.76)		
<b>General</b>				
Machine Size	mm (inch)	W: 3,178 (125.12) x D: 4612 (181.58)		
Height	mm (inch)	3,040 (119.68)		
Weight	kg (lb.)	8,600 (18,960)		
<b>Power Requirements</b>				
Electrical	380V / 60 Hz	3 Phase / 45KVA		
Air		5.5 CFM @ 100 psi		

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**ENGINEERING BY DESIGN AND FEA**

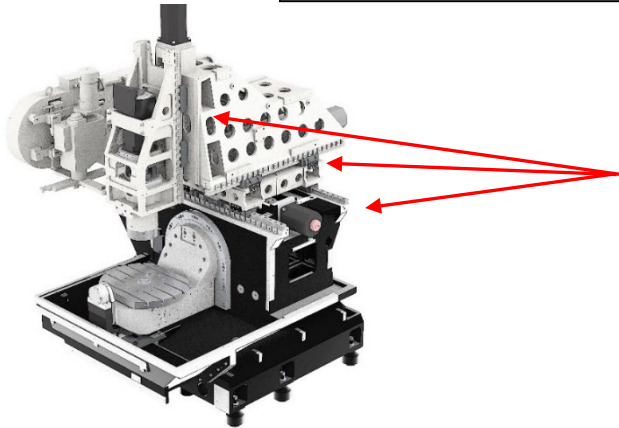
**Complete Engineering Analysis**

FEA techniques are used to analyze structure deformation and stress on the machine, assuring optimal structure composition. FEA analysis results show our machine stiffness is 5.83kgf/um, which is more than 2X the normal stiffness standards of 2.5kgf/um.

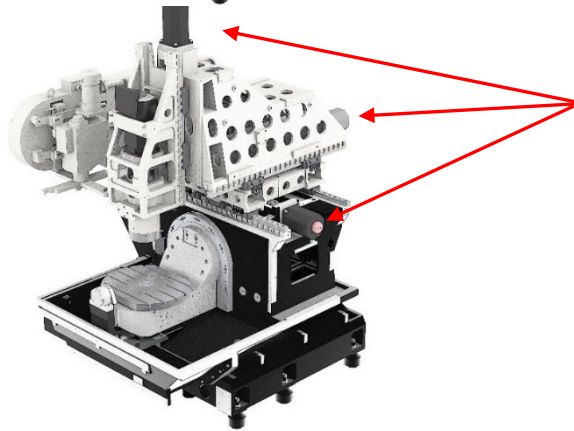
**One-Piece High Rigidity Structure**

Made of a singular joint structure between the base and column with much greater rigidity than other bolt-joined type structures

**THERMAL STABILITY PROVIDED BY COOLING  
STRUCTURE, LINEAR GUIDES & BALL SCREWS**



Structure Circulation Cooling of X/Y/Z Linear Guides enhances thermal stability during long run periods.



The use of Optional **coolant through ball screws**, provides thermal stability improving accuracy and reducing scrap, which increases profits.

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***EACH JMT MACHINE IS 100% LASER TESTED AND CALIBRATED***

Final machine tests and laser calibration are performed on every machine. Geometric accuracy is verified (Straightness, Perpendicularity, Flatness and Squareness). Finally, Circularity is checked by ball-bar test. Test results are stored and provided to customers upon request, at no charge.



Laser calibration is based on full travel.

1. Laser calibration can vary depending on temperature, pressure, humidity, etc.
2. Proper foundation and specified environment conditions are required.

**Summarized Laser Calibration Accuracy**

Item	X-axis	Y-axis	Z-axis	A-axis	C-axis
Positioning Accuracy	2.081µm	5.008µm	5.354µm	6.53 Arc Sec	3.786 Arc Sec
Repeatability	1.347µm	4.791µm	4.120µm	0.80 Arc Sec	2.304 Arc Sec



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**VMX650FX SERIES**

## **CONTROL SYSTEM FEATURES**

Fanuc 31iB5 Plus Control, 5 Axis Simultaneous Control, High resolution 21.5 Color LCD monitor

- Graphic Display (R094) USB Port
- PCMCIA
- Part Program storage 4M byte / Sub program - 10 folds nested.
- Max. 1,000 registerable programs expansion / AI Contour Control II (1,000 block preview) (r094) / Simultaneously controlled axes expansion Max. 5 axes
- Tool radius and Tool nose radius compensation
- Tool length compensation (G43, 44, 49) / Increment system C 0.0001mm, 0.0001deg, 0.00001inch
- Copy and merge edit functions (expanded edit) / Background Editing
- Multi part program editing / Exact stop Mode (G61-G09) / Circular interpolation
- Helical interpolation / Input/output interface (RS232C)
- Reference point returns (G27-G30) / Rigid tapping
- Feed per minute / feed per revolution (G95) / Absolute/incremental programming (G90, 91) / Inch/metric conversion.
- Programmable Data Input G10 / Decimal point programming
- Custom macro-B / pocket calculator type custom macro b
- Tool life management (R094) / Dwell (revolutions or seconds) / Automatic tool offset.
- Tool Center Point control (R098)
- Canned cycles for drilling, boring, and tapping (G73, 74, 76, 80-89,)
- Standard tool offsets of 400, additional tool offsets can be offered. (R094), / Mirror image Each axis
- Tool offset memory C (R904) / Backlash compensation.
- Interpolation type pitch error compensation / Program protect key.
- Self-diagnostic functions
- Keyboard type manual data input (MDI) Skip (G31)

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**CONTROL SYSTEM FEATURES CONTINUED:**

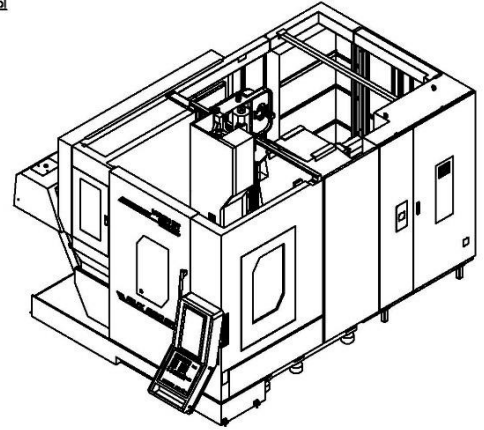
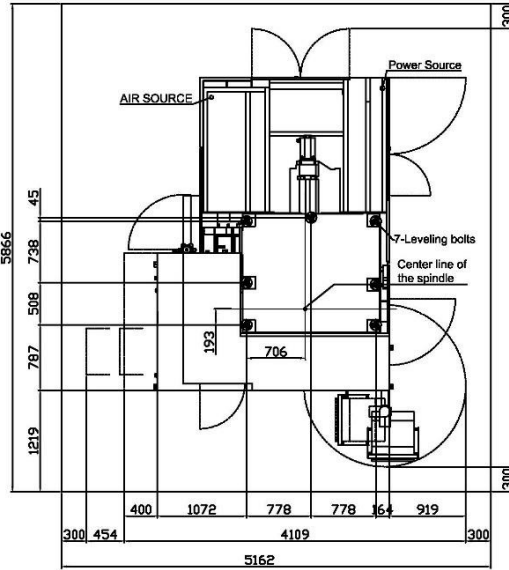
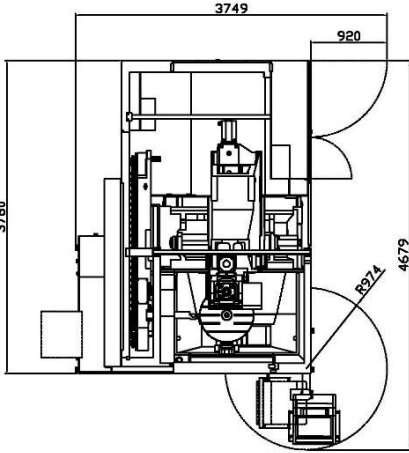
- Manual pulse generator
- Run hour and parts count display / Spindle speed override.
- Automatic acceleration/deceleration/ Rapid traverse override
- Coordinate system setting (G92) / Feed rate override.
- Addition of workpiece coordinate system 48 pairs / Jog override 0 - 655.34%
- Enhanced Embedded Ethernet function / Jog feed.
- Run hour and parts count display / Parts counter display.
- On-screen spindle load meter display / PCMCIA card attachment
- 32000 STEPS LADDER / DUAL POSITION FEEDBACK
- Machining time stamp
- Built-in 3D interference check
- Tool geometry size data 100-pairs
- 5-axis machining condition setting function / Fast data server
- Dynamic graphic display function / Tool life management
- Manual handles retrace.
- Auxiliary function output in the program restart / Quick program restart
- Jerk control
- NURBS interpolation / Smooth tolerance control TWP kit
- 3-dimensional rotary error compensation / High-speed smooth TCP
- 3-dimensional cutter compensation / Work setting error compensation / iHMI basic function
- iHMI set-up guidance / iHMI machining cycle

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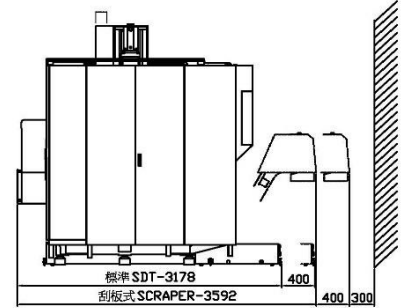
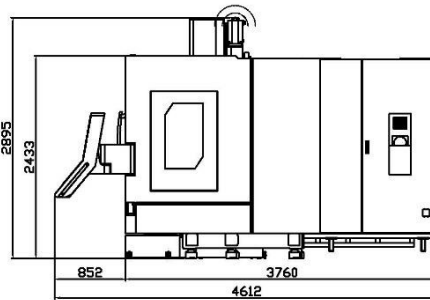
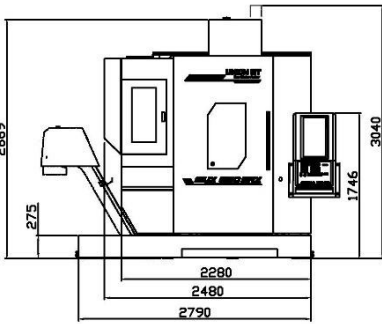
**VMX650FX SERIES**  
**Machine Dimensions**

**ROTARY TABLE**

MUX650 外型尺寸圖  
 APPROX. WEIGHT :8600 kg

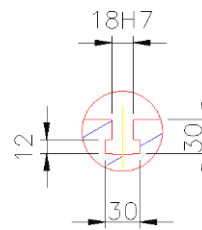
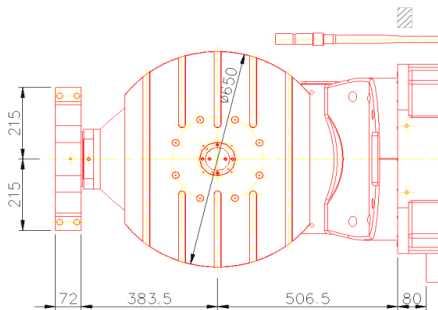


MUX650	選配機型 MODEL	面寬 WIDTH	深度 DEPTH	高度 HEIGHT
機床尺寸	標準 STD	3178	4612	3040
MACHINE SIZE	刮板式 SCRAPER	3592	4612	3040
佔地尺寸	標準 STD	4709	5866	3040
FLOOR SIZE	刮板式 SCRAPER	5162	5866	3040



**Table Ø650 x 520mm**

**T Slot 18H7**



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**Other Standard Features:**

**Separate Roll Out Coolant Tank**

A 500 Liter tank with coolant chiller is used to prevent heat transfer from material cutting or chips in the coolant to the machine base casting.

**Coolant through Spindle (CTS) and Preparation Kit (Option)**

The CTS spindle is optional. Hollow spindle, spindle motor, rotary joint and M codes are assigned. Versatile coolant pressure options including 20 bar, 50 bar, or 70 bar are available. Pumps and filters are not included in the CTS preparation kit.

**Lubrication**

Automatic centralized greased lubrication is provided to all roller guide ways and ball screws. Grease lubrication is more environmentally friendly than oil lubrication because the very thin grease film can be retained on surface of guide ways and ball screws. Furthermore, grease will not pollute water-based coolant, so there is no need to use an additional oil skimmer, therefore extending the life cycle of coolant.

**Remote MPG**

Handheld "Manual Pulse Generator" (MPG) lets each axis move in increments of x1, x10 or x100 for easy fixture or part alignment.

**Chip Conveyor**

Different types of chip conveyors can be chosen based on customer application.

The enclosed shield incline angle is designed to ensure chips fall into the conveyer. Multiple chip wash down channels provide coolant flow to wash the chips out of corners.

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**Jupiter Exclusive Operation Panel**

Designed by machinists for machinists. Jupiter's exclusive operation panel not only looks the part with its fully backlit keys but provides all the information and access you need at your fingertips for lightning-fast response. The Fanuc 15" LCD touchscreen provides menu driven access for all the deep data and smartphone type controls if that's your preference.



Additional control switches for automation, door, etc.

For more information, contact:

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