MICROCUT
THE CHALLENGER

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MCU-5X
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MCU-5X
5-Axis Vertical Machining Center

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Semi-Gantry Type 5-Axis Simultaneous Machining Center

Brand New Design with Upgrade Performance brings high precision and high speed simultaneous 5-Axis machining

M CU-5X is designed for complex and multi surface contour machining. The series has working capacity ideal for medium-size workpiece and offers superior performance in all aspects of milling - consistency, accuracy, and power, therefore serving as a critical asset to all industries. The upgraded gantry type design presents compact structure with maximum working area reserved.

- **Aerospace industry**
- **Mechanical engineering**
- **Die & Mold**
- **Medical engineering**
- **Automobile**

Advanced Gantry Design

Precise and rigid, the 5-Axis semi-gantry type simultaneous machining center offers high rigidity to endure high-speed and process-intensive machining. Ideal for any complex jobs with various material.

Side-mounted ATC

Arm type ATC with 24/32/48/60 tool capacity provides reliable and fast tool changing with short T-T time to the machining efficiency.

Large working area with free characteristics

Three guideways are built above the entire working area.
The working space is large for free movement and easy for loading /unloading parts.

Easy chip removal

Chip guiding design for optimum chip removal

High rigid roller type linear guideway

All axes equipped with large diameter roller (dia. 45mm) type linear guideway, featuring rigidity structure and high-speed movement

Spindle

Various spindles for selection:
• In-line: 12000/15000rpm
• Motorized: 18000/24000rpm

High torque driven table

C axis torque-driven table is capable of loading 600kg
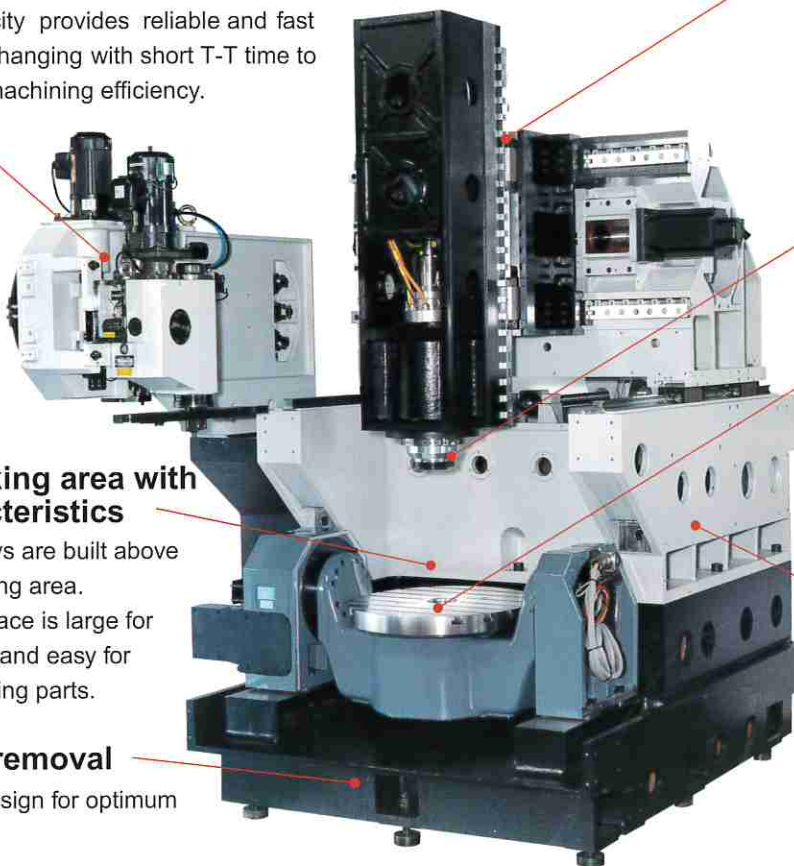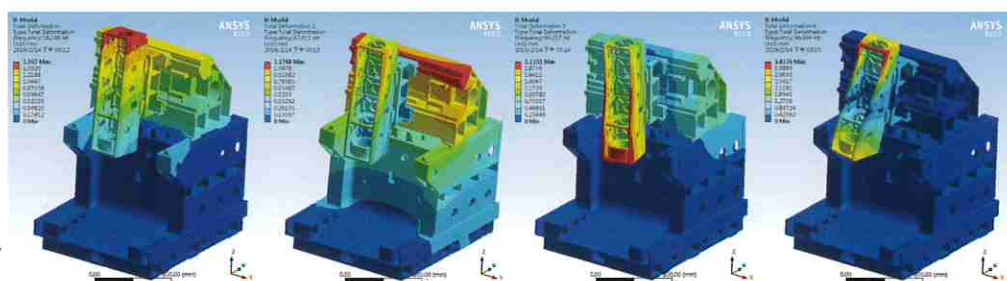
High rigid gantry construction

Machine base with gantry contruction is made of Meehanite licensed casting with stress released, offering hardness 180-220 HB. Effectively prevents vibration and offers high precision and excellent stability.

Optimized 5-Axis Machine Structure

All structural components and the whole machine frame of MCU-5X were analyzed by ANSYS mechanical system and Finite Element Method (FEM) to ensure structural optimization.

ANSYS Modal Simulation

Ballscrew

C3 double-nuts high precision guideways

X/Y/Z axes are equipped with C3 class dia. 40mm double-nuts high precision ballscrews, providing high axial accuracy and less deformation under axial force. All the ballscrew nuts are preloaded to avoid tensile deformation, and ballscrews are pre-tensioned for thermal compensation.
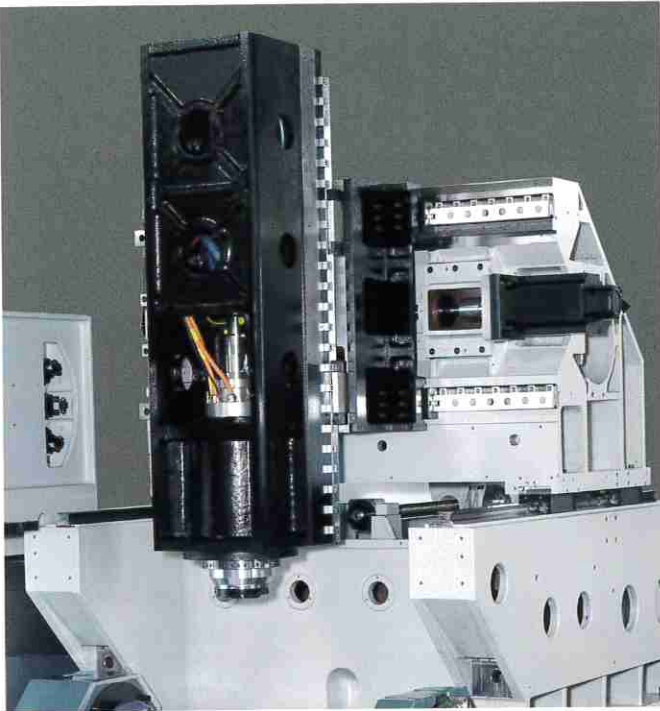
Maximum load support

All axes are equipped with 2 linear guideways and each linear guideway is fitted with 2 blocks. The design provides superior rigidity and increases stability for faster cutting feed rate.

AC Servo Motor

X/Y/Z axes are directly driven by AC servo motors, providing rapid traverse of 36 M/min.

MiCROCUT Powerful 5 Axis Machining Center

Distinctive Features

- Rigid gantry design for unparalleled geometrical precision and accurate dynamics
- Wide selection of spindles for HSM application
- 12000/15000rpm In-line spindle or high-speed 18000/24000rpm motorized built-in spindle
- AC servo motor provides extremely high torque, power and axis force
- Gantry and stress-released structure offers high rigidity, high precision and excellent stability
- The solid and rigid machine frame is made from Meehanite licensed casting
- Collision protection
- Roller type linear guideways on 3 axes
- C3 double-nuts high class precision ballscrews
- Table with high accuracy rotary axis driven by high torque motor
- Maximum table load of 600 kg
- High precision encoders on A axis & C axis
- Side-mounted 24, 32, 48 or 60 tools ATC for quick tool change if required
- Fully enclosed guarding
- Safety operator protection design
- 4+1 or 5 axes simultaneous machining function
- Automatic grease lubrication timing control and protection
- Ideal chip removal solution
- High pressure coolant system supports chips removal rate and reduces the thermal cutting influence on tool wear
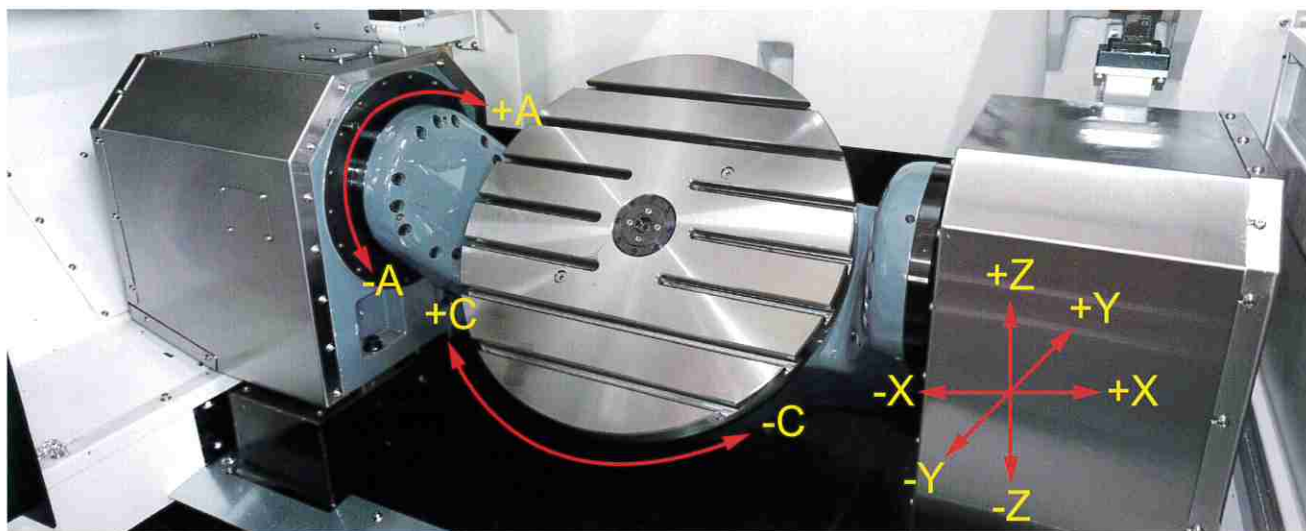- Integration of patented technology – Smart Machining Technology (SMT)

Table

- Large space for free movement
- Table diameter of 600mm x 500mm height
- Large loading capacity of 600kg
- Capable of swing & rotate in U shape
- Absolute angle encoders on A axis & C axis

• A axis
  - Provides tilting range of +120 to -120 degree
  - Driven by worm-gear with hydraulic brake system providing high torque and excellent durability
  - Alternative torque built-in motor as option

• C axis
  - With rotary axis tolerances of ±5"
  - Driven by high torque built-in motors, at 90rpm with hydraulic brake system providing repeatability accuracy and positioning accuracy

Rotary and Tilting Axes

ROTARY AXIS SPECS

TABLE (ROTATION DISK)	ø600	min
MOTOR TABLE RATIO	1/1	
SLOTS DIEMENSION	n'7dim. 14/75mm	
CLAMPING SYSTEM	Hydraulic	
CLAMPING PRESSURE	60	BAR
CLAMPING TORQUE AT 50Bar	1200	Nm
RATED TORQUE (S1)	393	Nm
MAX.TORQUE (S6)	707	Nm
POWER TO BE DISSIPATED	2990	W
TABLE MAX ROTATIONS	90	RPM
MOMENT OF INERTIA	2.5	kgm2
MAX ALLOWABLE THRUST	22000	N
MAX ADMISSIBLE LOAD	600	Kg

ENCODER SPECS

TYPE	RCN226(CNC Heidenhain)
SYSTEM ACCURACY	±5"

TILTING AXIS SPECS

MOTOR/SURFACE PLATE RATIO	180/1	
AXIS ROTATION MAX SPEED	16.6RPM	
ANGLE MIN.MOVEMENT	0.001"	
POSITIONING ACCURACY	±30"	
WORKING TORQUE	1638	Nm
BRAKING SYSTEM	Hydraulic	
BRAKING TORQUE AT 50 Bar	2900	Nm

MOTOR

TYPE	Heidenhain QSY 55B155B EcoDyn	
TRANSMITION	whil belt	
SIZE	5	
NOMINAL TORQUE	13	Nm
MAX SPEED	3000 RPM	

ENCODER SPECS

TYPE	RCN226(CNC Heidenhain)
SYSTEM ACCURACY	±5"

WORKING STROKE	±120'	
BRCTM400 WEIGHT	560	kg

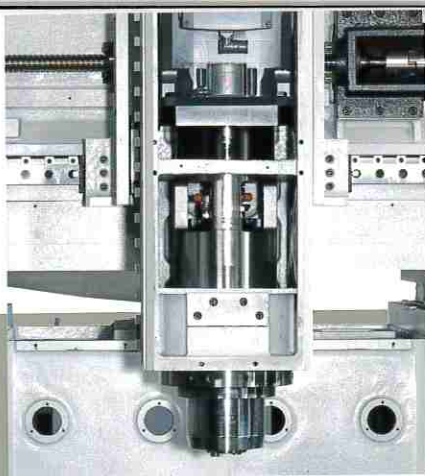*Hydraulic and pneumatic power supplied from table center.*
- *3x Hydraulic connections at 80 bar*
- *1x Pneumatic connection at 6 bar*
- *Standard preparation for the machine integration.*
- *Simplifies the demanding clamping process in 5-axis applications*

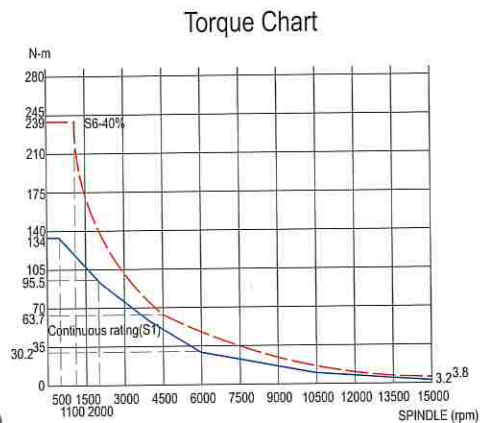*High precision angle encoder fit on A-axis and C-axis.*

Spindle

A wide selection of spindles:

18000/24000 rpm high power core-cooled motorized spindle, and 12000/15000 rpm in-line direct drive spindle. The cutting tool are securely drawn into the spindle by the preloaded spring package of the integrated power draw bar. The coolant through spindle (CTS) system with 20bar high pressure pump assists not only to extend tool life, but also to maximize machine efficiency on performance of higher cutting speed, chip clearing during deep-hole drilling and blind-pocket milling.

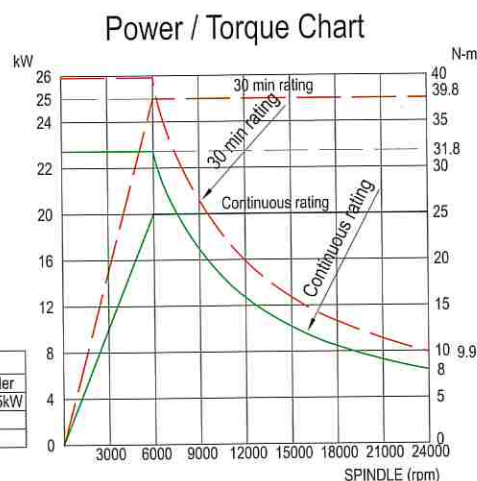## Spindle Power-Torque Output Charts

12000/15000rpm In-line Spindle

Power Chart

Torque Chart

Torque / Horsepower Chart Data				
Spindle Taper	ISO	BT40	Spindle Motor	SIEMENS 1PH8133-1LG02-3MA1
		CAT40	Motor Output	20/30 kW
	DIN	DIN 69871	Gear Ratio	-
Spindle Speed	15000 RPM		Pulley Ratio	1:1

18000/24000rpm Motorized Spindle

Power / Torque Chart

Power / Torque Chart Data				
Spindle Taper	ISO	-	Spindle Motor	Kessler
		-	Motor Output	20/25kW
	DIN	HSK-A63	Gear Ratio	-
Spindle Speed	24000RPM		Pulley Ratio	-

Working area

Motorized built-in spindle

The size range will vary depending on spindle

In-line spindle

The size range will vary depending on spindle

Magazine

24T carousel type tool magazine

60T chain type tool magazine

- Uses side-mounted 24 (std), 32, 48 or 60 (opt) tools ATC
- Creates less interference with working area
- Uses cam-type gear box system

Tool changer

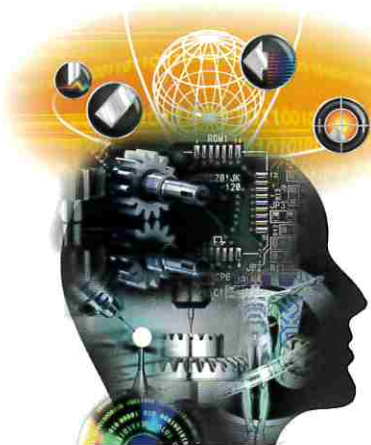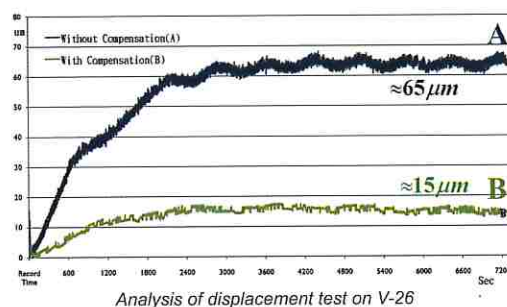|		
Magazine capacity:		24/32/48/60 Tools
Tool-to-tool time:		
	[24T]	1.51(50Hz) / 1.25(60Hz)
	[32/48/60T]	1.94(50Hz) / 1.64(60Hz)
Maximum tool length:		300 mm
Maximum tool diameter:		ø78 mm
Maximum tool diameter with cooresponding adjacent pocket use:		ø120 mm
Maximum tool weight:		7 kg
Maximum loading weight:	[24T] 120Kg [48T] 240Kg	[32T] 160Kg [60T] 300Kg

Smart Machining Technology

With the concept of energy and cost efficiency, MICROCUT sustained monitoring the machining performance develops a series of outstanding functions to make machines work with smooth finished surface machining and close tolerance within a shorter period of time. Smart Machining Technology (SMT) provides the solutions for spindle vibration, thermal displacement and deformation as well as other exceptional applications for all production needs.

Tool-tip Positioning Control

Direct displacement measure and real-time monitoring and compensation technology

To overcome the spindle thermal growth caused under high-speed running of spindle bearing and motor winding, an embedded displacement measuring system of built-in spindle feeds the deviation data back to CNC, and reacts by real-time compensation for the expansion of the spindle.

Analysis of displacement test on V-26

Without compensation
With compensation

With compensation, the displacement of tool tip is reduced from 65μm to 15μm.
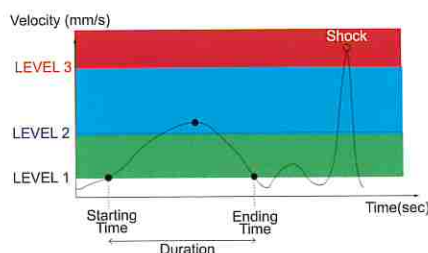
Accuracy improved

5~6 times!

Spindle Vibration Supervision

Spindle vibration monitoring and real-time control technology

With an embedded motion sensor in spindle, the mechanism directly monitors spindle condition and intelligently reacts according to different levels of spindle vibration. The latest recording with capacity up to 12000 sets is also a beneficial index for chatter-free control.

Three levels for spindle vibration monitoring:

- Level 1: shows the warning message to notify operator.
- Level 2: shows the error message and reduces spindle speed and feed rate
- Level 3: machine shut down immediately to prevent crash.

Metal Removal Rate Optimization
Maximal metal removal rate, cutting force and chatter-free machining

This function determines the optimal cutting condition by taking into consideration the limitations of the machine, characteristics of the tool and workpiece, controller and motor capability. The loading of the spindle and feed drives are monitored online and automatically controlled. Tool and workpiece conditions are integrated into the system to evaluate and further optimize the cutting condition. Chattering during machining can be avoided by evaluating the information fro m MRRO with the feedback from the spindle vibration sensor system.

The Maximum Efficiency in Metal Removal Rate and Processing Time

Configuration: Spindle speed 1563rpm; Machining feed rate 2200mm/min

Function On/OFF	Spindle Load (%)	Time(S)	Surface Roughness (µm)	Metal Removal Rate (cm³/min)
MRRO OFF	44	197	0.548	133.6
MRRO ON	42	170	0.491	152.8
Comparison	-0.45%	-13.7%	-10.4%	14.3%

Overall performance improved

Prolong Tool Life Under Spindle Overload

Configuration: Spindle speed 1563rpm; Machining feed rate 2200mm/min

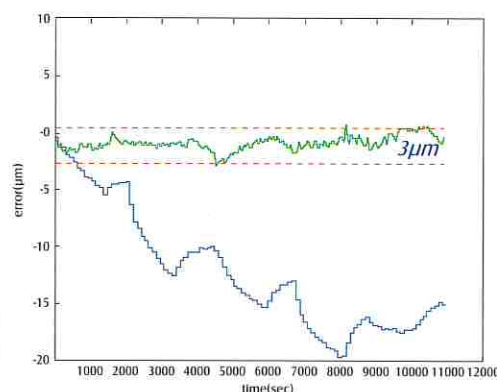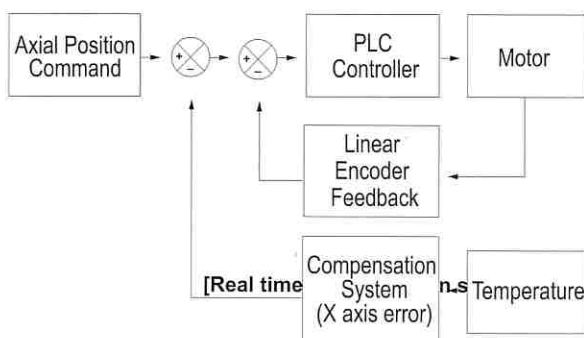| Function On/OFF	Spindle Load (%)	Time(S)	Surface Roughness (µm)	Metal Removal Rate (cm³/min)
MRRO OFF	110	79	1.412	337.6
MRRO ON	95	85	0.543	270.7
Comparison	-13.6%	+7.5%	-61.5%	-19.8%

Surface Roughness improved 61.5%
Spindle load decrease 13.6%

Axial Accuracy Control
A machine thermo monitoring and compensation technology

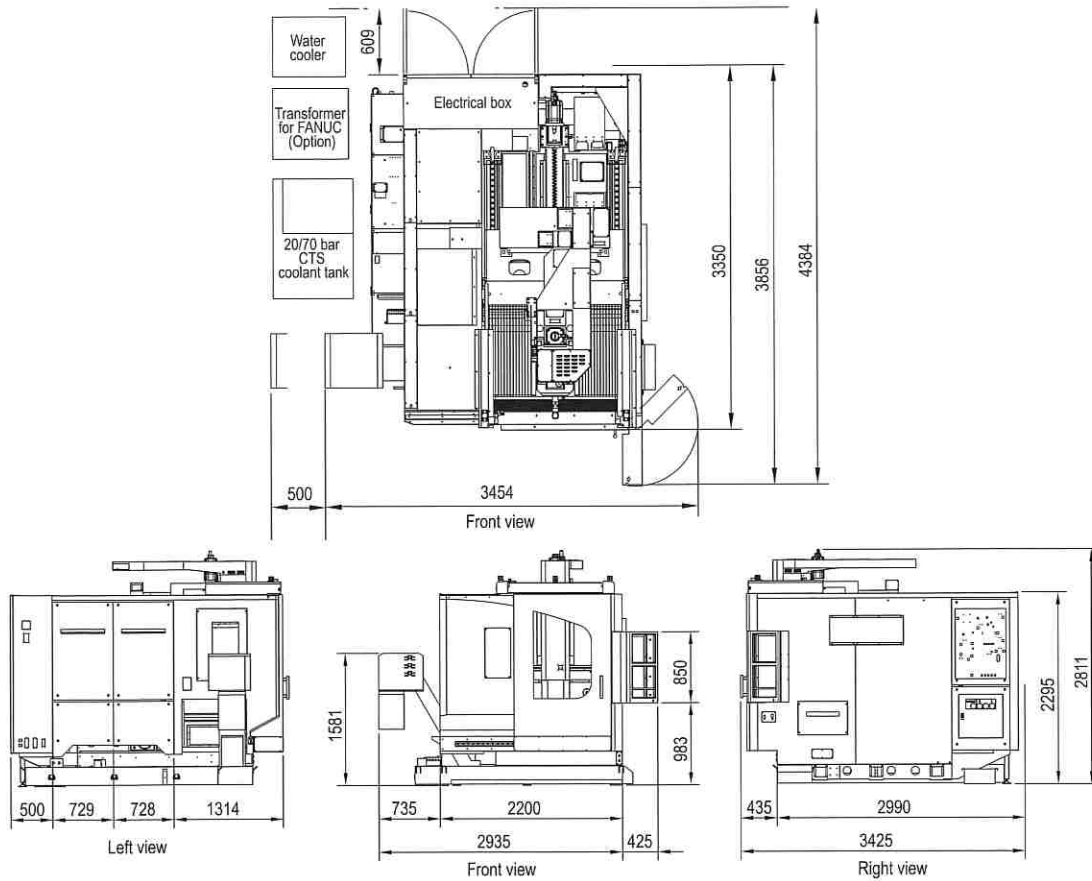To prevent the poor machining accuracy induced by thermal error, an integrated thermal sensor is mounted on machine to monitor machine temperature. AAC is activated once temperature runs too high, where by the mechanism provides axial compensation to prevent thermal deformation and to achieve high machining accuracy.
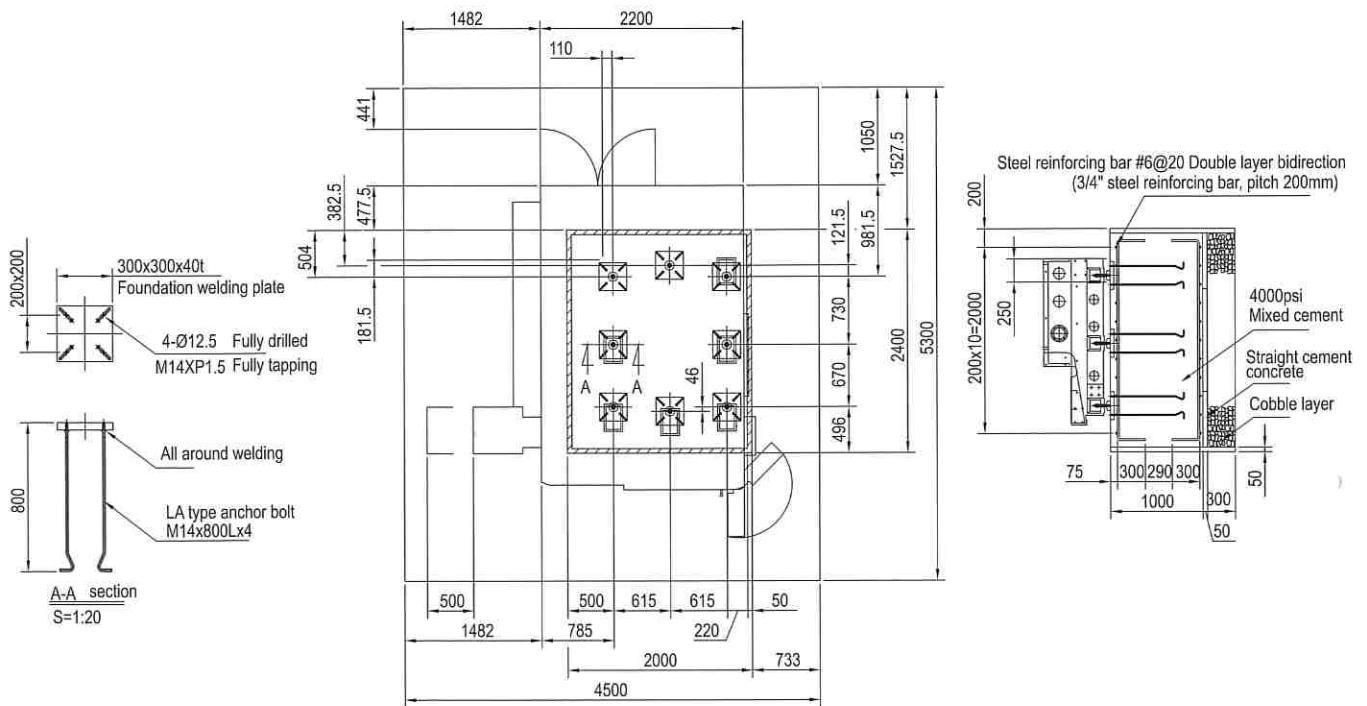

[Thermal error before and after compensation]

Thermal error reduced 20µm → 3µm

Layout Drawing

Water cooler

Transformer for FANUC (Option)

20/70 bar CTS coolant tank

Electrical box

609

3350
3856
4384

500 · 3454
Front view

1581

500 · 729 · 728 · 1314
Left view

735 · 2200 · 425
2935
Front view

850
983

435 · 2990
3425
Right view

2295
2811

Foundation Drawing

1482 · 2200

110

441

382.5
477.5
504
181.5

200x200

300x300x40t
Foundation welding plate

4-Ø12.5 Fully drilled
M14XP1.5 Fully tapping

All around welding

800

LA type anchor bolt
M14x800Lx4

A-A   section
S=1:20

1050
1527.5
121.5
981.5
730
670
496
2400
5300
46

500 · 500 · 615 · 615 · 50
1482 · 785 · 220
2000 · 733
4500

Steel reinforcing bar #6@20 Double layer bidirection
(3/4" steel reinforcing bar, pitch 200mm)

200
200x10=2000
250

4000psi
Mixed cement

Straight cement
concrete

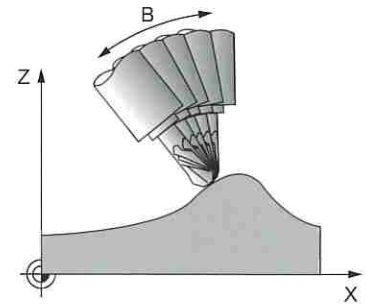Cobble layer

75 · 300 · 290 · 300
1000 · 300
50
50

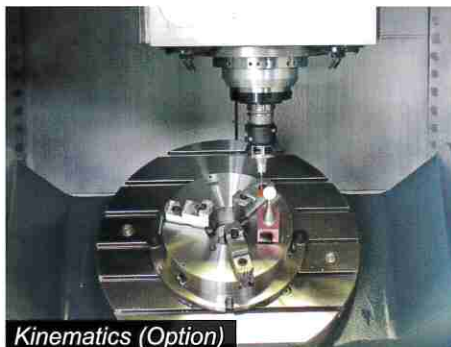# Advanced Control Technology & Abundant Functions
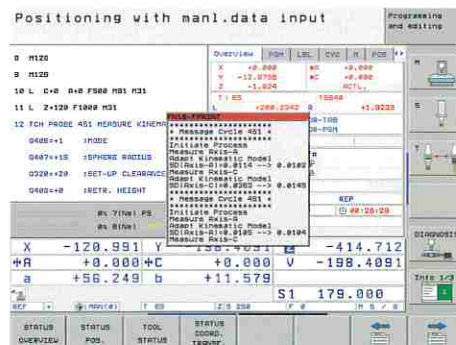## Meet complex high-speed machining

- CNC control Heidenhain iTNC530 HSCI
- 15.1" TFT monitor , and Fanuc is also available with option of Fanuc 0iMD 10.4" LCD or Siemens 840DSL
- Block process time of 0.5ms
- NC program memory 32GB on SSDR solid state disk
- USB port   • Ethernet network
- Look ahead of 1024 block
- 3D tool length compensation function
- Dynamic collision monitoring (DCM) function
- 5-axis machining (TCPM) function   • Smar T.NC
- Different M code selection for table difference loading weight
- Controller with integrated dual-safety technology (meets European Standard EN13849-1 & EN 13849-2)
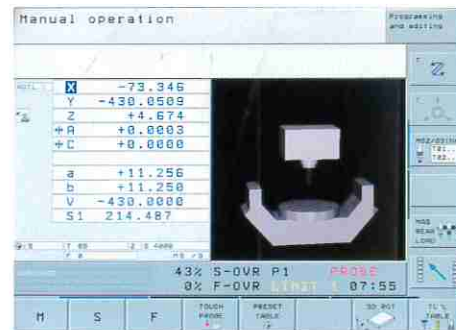- SIEMENS 840DSL control available upon request

5-axis machining (TCPM) function

Kinematics (Option)

Positioning with manl.data input

Workpiece probe (Option)

Manual operation

Laser probe

Tool laser measurement

- Laser measures tool diameter, radius, length and shape
- Measurement during tool rotation to ensure perfect compensating and higher part accuracy

TECHNICAL DATA

Description		Unit	MCU-5X	
ADVANCED GANTRY DESIGN				
HIGH DYNAMIC TABLE	Rotary table top diameter	mm	600	
	Tilting axis A	degree	+120 / -120	
	Rotary axis C	degree	360	
	T-slots (number x width x pitch)	mm	7 x 14 x 75	
	Max. table load	kg	600	
LINEAR TRAVEL	X axis	mm	600	
	Y axis	mm	600	
	Z axis	mm	500	
IN-LINE SPINDLE	Spindle taper		ISO40	
	Tooling		HSK A63/BT/DIN/CAT40	
	Spindle speed	rpm	12000 / 15000(opt.)	
	Motor output	kW	20/30	
	Spindle nose to rotary table clamping surface	mm	135~635	
MOTORIZED SPINDLE	Spindle taper		HSK-A63	
	Spindle housing diameter	mm	170	
	Motor output	kW	20/25	
	Motor torque	Nm	32/40	
	Spindle speed	rpm	18000 / 24000(opt.)	
	Spindle nose to rotary table	mm	182~682	
LINEAR GUIDEWAY	X axis distance	mm	500	
	Y axis distance	mm	1150	
	Z axis distance	mm	295	
TOOL MAGAZINE	ATC type		Carousel type	Chain type
	Magazine capacity		24(std.)	32/48/60(opt.)
	Tool shank		HSK A63/BT/DIN/CAT40	
	Max. tool length	mm	300	
	Max. tool diameter	mm	78	
	Max. tool diameter with adjacent station empty	mm	120	
	Max. tool weight	kg	7	
	Max. loading weight	kg	120	160/240/300
	Tool changing time(T-T)	sec	1.51(50Hz) 1.25(60Hz)	1.94(50Hz) 1.64(60Hz)
FEED RATE	X/Y/Z axes rapid feed	m/min	36/36/36	
	A axis max. speed	rpm	16.6	
	C axis max. speed	rpm	90	
	Acceleration X/Y/Z	m/s²	7	
ACCURACY	Positioning accuracy	mm	0.005	
	Repeatability	mm	±0.0025	
MACHINE DATA	Length	mm	3015	
	Width	mm	5050	
	Height	mm	3000	
	Floor space	mm	4200x5800	
	Weight	kg	9000	

Specifications are subject to change without notice.

Standard accessories

- Heidenhain iTNC530 HSCI controller, including software option 1 & 2, DCM collision functions or Siemens 840D SL controller
- 5 axes simultaneous machining or 5 faces machining
- Direct drive spindle (12000rpm)
- Coolant through spindle with high pressure pump 20 bar (built-in type)
- Side mounted arm type ATC (24T)
- Central lubrication
- Chip conveyor
- High pressure chip flush system
- Heat exchanger
- Water gun
- Work light
- Lamp of cycle finish and alarm
- Ethernet
- Tool kit, leveling bolts, pads and nuts
- EMC and safety module for machine with H.H. controller
- Portable MPG
- CE Marking declaration conformity for EU countries

Optional accessories

- Linear scale for three axes
- Robot for automatic operation
- Reference ball for Kinematic
- Direct drive spindle (15000rpm)
- Built-in spindle (18000/24000rpm)
- Side mounted arm type ATC (32/48/60T)
- CTS coolant tank(20/70bar)
- Air conditioner for electrical cabinet
- Oil skimmer
- Workpiece setting probe
- Tool setting probe
- EMC filter
- Remote Control System