

# VL1600D Vertical CNC Machining Center

## Technical Information

Version:TRJG-2021-A1



### 1.The main structure of the machine tool

VL1600D vertical machining center is mainly composed of bed, column, saddle, worktable, headstock, tool magazine, machine tool control system, cooling system, chip removal device, lubrication system, electrical cabinet, etc., and is equipped with full enclosed protection guard.

The electric cabinet is installed on the side of the column, the operation button station is fixed on the front right of the protection guard. The tool magazine (mechanical arm) is installed at the upper left of the column.

There are rollers at the bottom of the cooling box, which are placed under the machine tool and can be moved as a whole during cleaning. The cooling box is equipped with a chain type chip conveyor. The overall layout is compact, elegant, easy to operate, and small in footprint.

### 2.Machine tool purpose and scope of use

VL1600D vertical machining center is a modern machining machine with automatic tool change device and CNC three-axis linkage control system. It can be clamped once and automatically and continuously complete the milling, drilling, boring, reaming, and tapping of parts. It is suitable for the processing of various planes, holes, and complex-shaped surfaces in medium quantity production, especially for porous small box parts, which are more convenient, shorten production

cycle, and improve processing accuracy. It is one of the ideal processing equipment for technological transformation of defense industry, tractor, light industry, automobile manufacturing, textile machinery and machine tool industry.

### 3.Main features of machine tool

- 1) The maximum speed of the spindle is 6000rpm, with stable accuracy, good rigidity and low temperature rise. Equipped with a surrounding cooling device to ensure excellent rotation accuracy and cooling effect;
- 2) The main spindle is driven by a digital servo motor, and the motor is directly connected to the main spindle through a coupling. The main motor power is 15/20.4KW, which enables the main spindle to obtain a speed range of 20~6000rpm, improves the transmission efficiency and reduces energy loss;
- 3) The X, Y, and Z are all driven directly by a servo motor and a high-rigidity ball screw . The screw support form adopts a structure with one end fixed and the other end stretched.so it has a pre-stretching function, which can improve the transmission rigidity and positioning accuracy of the machine tool, and the stability of the repeat positioning accuracy, and improve the thermal stability of the machine tool;
- 4) X, Y, and Z axis supporting guides are all high-precision linear guide way, with low friction, high positioning accuracy and fast response speed;
- 5) Tool change device is imported from Taiwan , with reliable performance and short tool change time;
- 6) The machine tool is equipped with a fully enclosed protective guard, and is designed according to ergonomics, and the operation is comfortable and pleasant;
- 7) The major castings have been researched and strengthened by software analysis for many times, and have undergone three aging treatments (two thermal aging and one vibration aging). The high-quality castings have excellent rigidity, which guarantees the excellent precision and lasting stability of the machine tool;
- 8) The Z-axis is driven by a super-horsepower motor, which eliminates the defects of mechanical balance and excessive current value, prevents the backlash of mechanical balance from affecting the quality of the processed parts, and increases the matching and corresponding speed of the three axes;
- 9) Divide the electrical cabinet into the system part, the strong current part, and the weak current part; separate the power line and the signal line; effectively ground the system, effectively avoid external interference from the system, enable the machine tool to run continuously and reliably, and improve the cost-effectiveness of the machine tool .

## 4.VL1600D structure characteristics

### 1).Bed structure

The base is the foundation of the entire machine tool and the main supporting part of the saddle and the column. To ensure that the parts supported on it have good accuracy and rigidity, the base is required to have sufficient rigidity. The base of the machine tool adopts an inverted T-shaped integral closed box structure. This structure can not only strengthen the rigidity of the base itself, but also enhance the rigidity of the guide rail. A considerable number of partitions are arranged on the inner wall of the base to further enhance the rigidity of the base.

### 2).Column structure

The column is the supporting part of the headstock, which not only has to bear the cutting force in all directions, but also has high torsion and bending rigidity. For this reason, the column adopts an inverted Y-shaped column with a super-large joint surface. The thickness is thickened and the cavity is provided with higher longitudinal and transverse ring ribs and torsion-resistant reinforced cross ribs, so that the column has higher torsion and bending rigidity. The distance between the linear guide way surface and the column surface is small, and the force is more reasonable and stable.

### 3).Spindle head structure

The spindle head guide rail is a linear rolling guide way, which is beneficial to improve the movement accuracy and contact rigidity. The spindle adopts VOLIS(Taiwan)direct-driven spindle unit, which has high speed and large output power. The motor drives the main spindle through a coupling, and the speed range is 20 to 6000 rpm. The center of gravity of the spindle head is at back side, and the torsion and bending resistance is greatly enhanced.

### 4).Saddle structure

In order to improve the contact rigidity and accuracy, the saddle adopts linear guide ways. The starting friction and the movement friction are very low, and the difference between the two is very small. This not only improves the rigidity and accuracy, but also improves the dynamic and static friction characteristics of the machine tool's guide way. Improve the ability to resist crawling. There are multiple reinforcing ribs inside the saddle. The slide block is fixed by perforating long holes to keep the structure, and the concentrated parts of the force are strengthened, the overall strength is greatly improved, and the torsion resistance is excellent.

## 5.Machine working environment

- 1) Power supply: 380V±10%, three-phase AC, 50Hz±1%.
- 2) Air source pressure: 0.6MPa~0.8MPa.
- 3) Environment temperature: 5°C~40°C. The environment temperature around the

machine should be 0°C to 40°C (32°F to 104°F). In order to ensure the machine Long-term stable and reliable processing accuracy, it is recommended to use the machine tool in an environment of

20±2°C, under other temperature environments or the temperature changes greatly, the accuracy will be reduced.

- 4) Relative humidity: ≤85%
- 5) Altitude ≤1000m.
- 6) Environment: Do not place in an environment with excessive dust, acid gas, corrosive gas or salt.
- 7) Avoid direct sun or radiation exposure.
- 8) Avoid abnormal vibration.
- 9) The machine must be grounded separately.

**6. Technical Parameter and Equipment for VL1600D, standard**

Item		Unit	VL1600D	
Standard controller			FANUC 0i MF plus	
Travel	X axis travel (work table)	mm	<b>1600</b>	
	Y axis travel (saddle)	mm	760	
	Z axis travel (spindle head)	mm	760	
	Distance from spindle nose to table	mm	100-860	
	Distance from spindle center to column cover	mm	780	
Work table	Table size(Length×width)	mm	1800×760	
	Max. table load	kg	1500	
	T slot size (width×distance×quantity)	mm	18×125×5	
Spindle	Spindle taper		<b>BT50(45degree pull stud)</b>	
	Max. spindle speed	rpm	<b>6000 (direct driven )</b>	
	Spindle motor power ( continual working/Max)	kW	<b>15/20.4</b>	
	Spindle torque (continual working/Max)	N.m	<b>143/259</b>	
X/Y/Z	Rapid traverse (X/Y/Z)	mm/min	20000	
	Max. cutting feed rate (X/Y/Z)	mm/min	1-10000	
ATC	ATC type		Arm type	
	Tool capacity	pcs	24	
	Max. tool diameter	mm	Φ110/φ220	
	Max. too length	mm	350	
	Max. tool weight	kg	20	
Accuracy	VDI/DGQ3441	Full travel positioning accuracy	mm	P0.012
		Repeatability accuracy	mm	Ps0.010
Air pressure		MPa	0.6-0.8	
Supply voltage & frequency			3 /PE, AC380V, 50Hz	
Power requirement		kVA	40	
Machine size(length/width/height)		mm	4500×4300×3350	
Machine weight		kg	13500	

**7. Main parts brand**

No.	Name	Model	Quan.	Memo
1	Controller	FANUC 0iMF Plus	1 set	FANUC (Japan)

2	Bearing	40TAC72CDDGSUHPN7C	10 set	NSK (Japan)
3	Bearing	40TAC90CDDGSUHPN7C	5set	NSK (Japan)
4	X ball screw	Dia.50mm, pitch 12mm	1set	PMI(Taiwan)
5	Y ball screw	Dia 50mm, pitch10mm	1set	THK(Japan)
6	Z ball screw	Dia. 50mm,pitch10mm	1set	THK(Japan)
7	Spindle	BT50-6000rpm	1set	VOLIS(TAIWAN)
8	X linear guide way	45 ball type	2PCS	THK(Japan)/ REXROTH(Germany)
9	Y linear guide way	45 ball type	4PCS	THK(Japan)/ REXROTH(Germany)
10	Z linear guide way	45 roller type	2PCS	THK(Japan)/ REXROTH(Germany)
11	ATC	24 Arm type	1set	Gifu(Taiwan)
12	Heat exchange machine	MEA-25N-01M5-1237C	2sets	HAOSCH(Germany )
13	Spindle chiller	MCO-15C/X-02C4K2M5Q6R1 9Z-3407C	1set	HAOSCH(Germany )
14	Low-voltage circuit breaker	BW100EAG-3P100	1piece	FUJI(Japan)
15	Miniature Circuit Breaker	DPNK10A2P	3pcs	SCHNEIDER(France)
16	AC contactor	LC1D09M7C	7pcs	SCHNEIDER(France)
17	Small relay	MY2N-D2-J 24VDC	1pcs	OMRON(Japan)

## 8. Standard Configuration :

- 1.rigid tapping
- 2.full enclosure guard
- 3.spindle air sealing
- 4.machining air blowing device
- 5.working area light

- 6.3.color indication light
- 7.portable MPG
- 8.coolant system
- 9.automatic lubrication system
- 10.pneumatic unit
- 11.heat exchanger for electric cabinet
- 12.air gun flushing function
13. transformer
- 14.water gun flushing function
- 15.tool kit
16. automatic power off
- 17.adjustable level bolts and foundation blocks
- 18.spindle chiller
- 19.operation manual
- 20.safety door interlock
- 21.swivel type operation box
22. Customized operation panel
- 23.Low and high power separated electric cabinet
24. Double coil type chip conveyor with buckets+1 set chain type chip conveyor
25. FANUC Oi-MF plus absolute type 1 controller system
  - 10.4"LCD
  - High quality machining package (AICC II,jerk control,smooth tolerance control,machining quality evel adjustment function)
- 26.arm type ATC 24 pcs
- 27.BT50 direct driven spindle 6000rpm

## 9. FANUC Oi MF Plus main specifications

### **Basic specifications list**

Item	Specification
<b>Standard configuration of system software and hardware</b>	
Controller: FANUC Series Oi-Model F Plus	Type1,10.4" color LCD, Separable type MDI, 1 path, 2 slot
Interface (Hardware)	ATA Flashcard socket/USB socket (beside LCD Display) ; One RS232/RJ45/USB socket( board Back of LCD Display. One RJ45 socket
Pitch error compensation of interpolation type	
High-speed & high-quality machining package	<ul style="list-style-type: none"> <li>● AI contour control II</li> <li>● Smooth tolerance control</li> <li>● Jerk control</li> <li>● Machining quality level adjustment function</li> </ul>
Manual hand retract	Manual handle feed 1-unit is required
Multi-step skip	
AI contour control II	The number of preview blocks is max.200
Macro executor	

Macro executor+C language executor	
Custom software	6M
FANUC PICTURE executor (software)	
Processing preparation support function	
Part program storage size	2M
Number of registerable programs	Expansion 1: Max.1000 programs
Machining condition selecting function	Need AI contour control I or II
Dynamic graphic display	
One touch macro call	
Expansion of PMC symbol, comment and information capacity	512Kbyte
<b>Controlled axis</b>	
Max. total number of control axes(axis/spindle)	7 (7/2)
Machine groups	1
Controlled path	1 path
Max. simultaneously controlled axes	Max. 4 axes
Axis control by PMC	Not available on Cs axes
Cs contouring control	
Max. simultaneously controlled axes (in each path)	Max. 4 axes
Tandem control	
Torque control	
Control axis detach	
Increment system	IS-A, IS-B
Increment system C	0.0001mm、0.0001deg、0.00001inch
High precision program command	Included in Increment system A to E
Flexible feed gear	Optional DMR
HRV3 control	HRV3+
Inch/metric conversion	
interlock	
Machine lock	
Emergency stop	
Overtravel	
Stored stroke check 1	
Stored limit external setting	
Stored stroke check 2,3	
Stored limit check before move	
Mirror image	
Follow-up	
Servo off/Mechanical handle	
Position switch	
<b>Operation</b>	
Automatic operation	
MDI operation	

DNC operation	Included in RS232C interface.
DNC operation with memory card	CF card and PCMCIA Card Attachment is required
Schedule function	
Program number search	
Sequence number search	
Sequence number comparison and stop	
Program restart	
Manual intervention and return	
Wrong operation prevention	
Retraction for Rigid tapping	
Buffer register	
Dry run	
Single block	
Manual continuous feed (JOG)	
Manual reference position return	
Reference position setting without DOG	
Reference point setting with mechanical stopper	
Reference position shift	
Manual handle feed 2/3-units	2 or 3
Manual handle feed rate	×1, ×10, ×100
Handle interruption	
Incremental feed	
Jog and handle simultaneous mode	
<b>Interpolation functions</b>	
Nano interpolation	
Positioning	G00 (Linear interpolation type positioning is possible)
Single direction positioning	G60
Exact stop mode	G61
Tapping mode	G63
Cutting mode	G64
Exact stop	G09
Li near interpolation	
Circular interpolation	
Dwell (Second designation)	
Cylindrical interpolation	
Helical interpolation	Circular interpolation plus max. 2 axes linear interpolation
Thread cutting, synchronous cutting	Spindle serial output is required.
Multi threading	For M system, included in Thread cutting, synchronous cutting
Continuous threading	For M system, included in Thread cutting, synchronous cutting
Skip	G31
High-speed skip	

Torque limit skip	
Reference position return	G28
Reference position return check	G27
2nd reference position return	
3rd/4th reference position return	
Normal direction control	
Index table indexing	
<b>Feed function</b>	
Rapid traverse rate (Increment system B)	Max. 999.999m/min (1 $\mu$ m)
Rapid traverse rate (Increment system C)	Max. 99.9999m/min (0.1 $\mu$ m) Included in Increment system C
Rapid traverse override	F0, 25, 50, 100%
Feed per minute	
Feed per revolution	
Without position coder feed per revolution	Included in constant surface speed control.
Without position coder constant surface speed control	Included in constant surface speed control.
Tangential speed constant control	
Cutting feedrate clamp	
Automatic acceleration/deceleration	Rapid traverse: linear Cutting feed: exponential, linear
Rapid traverse bell-shaped acceleration/deceleration	
Linear acceleration/deceleration after cutting feed interpolation	
Bell-shaped acceleration/deceleration after cutting feed interpolation	
Smart overlap	
Linear acceleration/deceleration before cutting feed	Included in AI contour control I or II
Feedrate override	0-100%
One-digit F code feed	
Inverse time feed	
Jog override	0-150%
Override cancel	
External deceleration	
Automatic corner deceleration	Included in AI contour control I or II
Feedrate control with acceleration in circular interpolation	
Bell-type acceleration/deceleration before look ahead interpolation	Included in AI contour control I or II
Rigid tapping bell-shaped acceleration/deceleration	Rigid tapping is required.
Rapid traverse block overlap	
<b>Program input</b>	

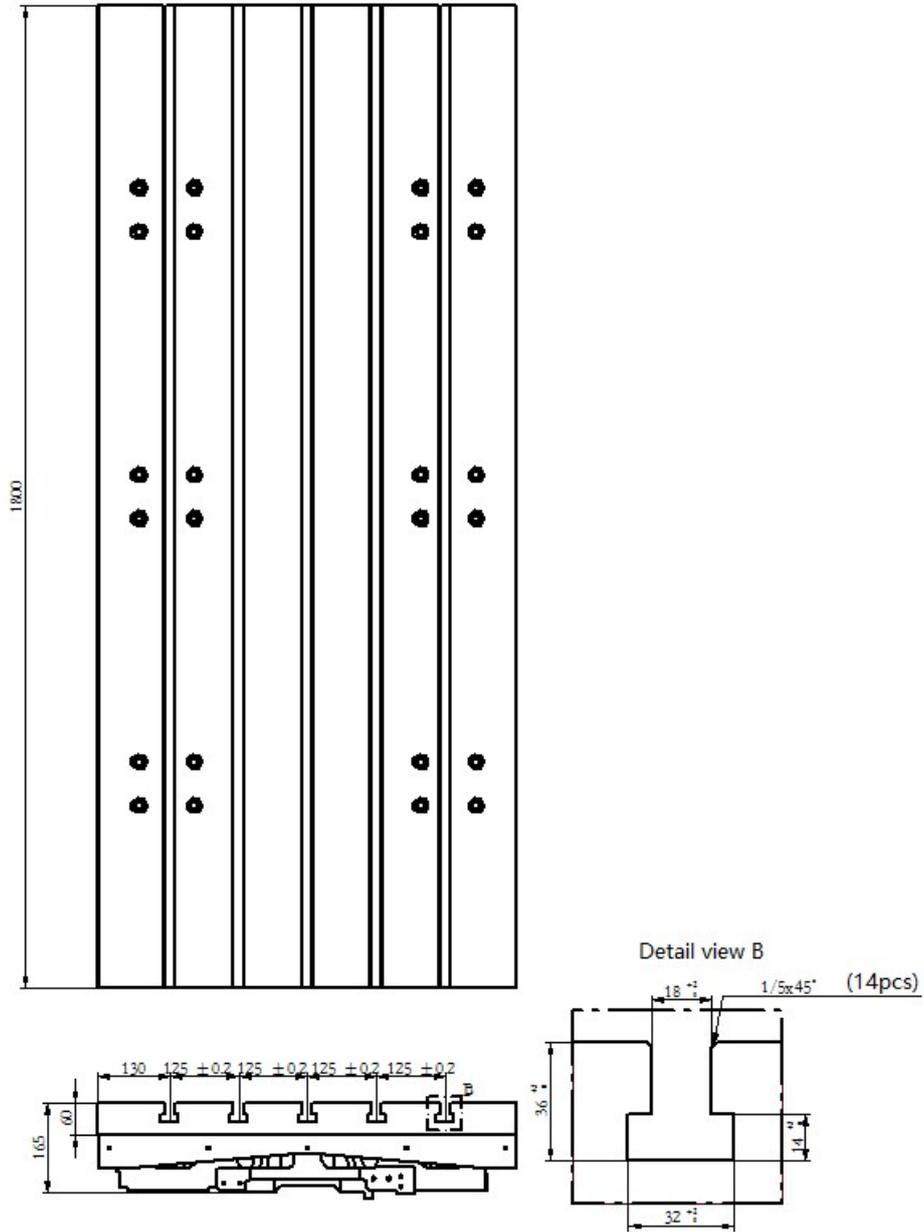
Tape code	EIA/ISO
Label skip	
Parity check	Horizontal and vertical parity
Control in/out	
Optional block skip	9
Max. programmable dimension	±9 digit (R,I,J and K is ±12digit )
Program file name	32 characters
Sequence number	N8 digit
Absolute/incremental programming	Combined use in the same block
Decimal point programming / pocket calculator type decimal point programming	
Input unit 10 time multiply	
Diameter/Radius programming	
Plane selection	G17、 G18、 G19
Rotary axis designation	
Rotary axis roll-over	
Polar coordinate command	
Coordinate system setting	
Automatic coordinate system setting	
Workpiece coordinate system	G52 - G59
Workpiece coordinate system preset	
Addition of workpiece coordinate system	48 pairs
Direct input of workpiece origin offset value measured	
Manual absolute on and off	
Optional chamfering corner R	
Programmable data input	G10
Sub program call	10 folds nested
Custom macro	
Addition of custom macro common variables	#100 - #199、 #500 - #999
Custom macro common variables between each path	Only for more than 2 path control. Included in Custom macro
Interruption type custom macro	
Canned cycle for drilling	
Circular interpolation by R programming	R,I,J,K 12digit
Automatic corner override	
Scaling	
Coordinate system rotation	
Programmable mirror image	
G code preventing buffering	
Tape format for FS10/11	
Small-hole peck drilling cycle	
Pattern data input	

Interruption type custom macro	
<b>Auxiliary/Spindle speed function</b>	
Auxiliary function	M8 digit
2nd auxiliary function	B8 digit
Auxiliary function lock	
High-speed M/S/T/B interface	
Multiple command of auxiliary function	5
Spindle speed function	S5 digit , binary output
Spindle serial output	S5 digit , serial output
Spindle analog output	S5 digit , analog output, up to 1 spindle
Constant surface speed control	
Spindle override	0 - 120%
Spindle orientation	1 spindle Spindle serial output is required
Spindle output switching function	1 spindle Spindle serial output is required.
Spindle synchronous control(Single)	Spindle serial output is required. Analog spindle is not available.
Rigid tapping	
FSSB high-speed rigid tapping	Analog spindle is not available
<b>Tool function/Tool compensation</b>	
Tool function	T8 digit
Tool offset pairs	400-pairs
Tool offset memory C	Distinction between geometry and wear, or between cutter and tool length compensation
Tool length offset	
Tool offset	
Tool radius • Tool nose radius compensation	
Tool length measurement	
Automatic tool length measurement	
Tool life management	
Extended tool life management	
<b>Accuracy compensation function</b>	
Backlash compensation	
Backlash compensation for each rapid traverse and cutting feed	
Smooth backlash compensation	
Smart backlash compensation	
<b>Editing operation</b>	
Part program storage size	512Kbyte
Number of registerable programs	400pcs
Part program editing	
Extended part program editing	
Password function	

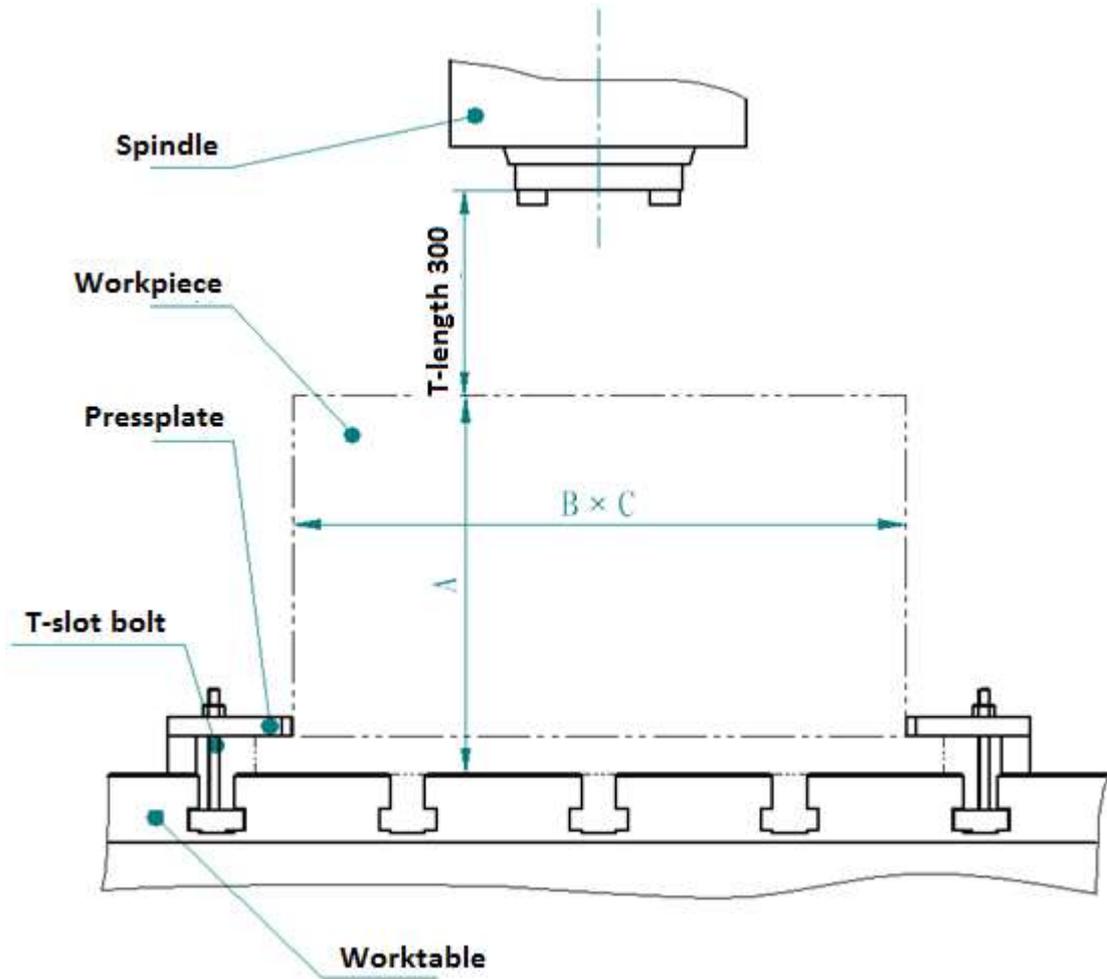
Playback	
Background editing	
Multi part program editing	Including background editing only available on 15" and 10.4" display unit
Memory card program edit & operation	Max. 63 programs. The tool on PC is required to convert and store files to memory card
High speed program management	
<b>Setting and display</b>	
Status display	
Clock function	
Current position display	
Program comment display	Program name 31 characters
Parameter setting and display	
Parameter check sum function	
Alarm display	
Alarm history display	
Operator message history display	
Operation history display	
Run hour and parts count display	
Actual cutting feedrate display	
Display of spindle speed and T code at all screens	
Directory display of floppy cassette	
Operating monitor screen	
Current position display	
Servo setting screen	
Spindle setting screen	
Display servo wave form	
Maintenance information screen	
Trouble Shooting function	
Software operator's panel	
Software operator's panel general purpose switch	Software operator's panel is required.
Extended software operator's panel general purpose switch	Included in software operator's panel general purpose switch
Multi-language display	25 types
Dynamic display language switching	
Data protection key	4 types
Screen eraser function	Manual or Automatic
Parameter set supporting screen	
Help function	
Self-diagnosis function	
Periodic maintenance screen	
Display of hardware and software configuration	
Servo information screen	

Spindle information screen	Included in spindle serial output
Graphic function	
CNC screen display	CNC Application Development Kit is necessary
Power consumption monitor	
<b>Data input/output</b>	
RS232C interface	Ch.1; Ch.2
External tool offset	
External machine zero point shift	
External message	
External data input	Including External tool offset, External machine zero point shift, and External message
External key input	
External workpiece number search	9999
External program number search	1~9999
Memory card input/output	
USB memory input/output	
Screen hard copy	
Power Mate CNC manager	
External I/O device control	
Automatic data backup	
<b>Interface function</b>	
Embedded Ethernet	
Enhanced Embedded Ethernet function	Included in Embedded Ethernet
<b>Others</b>	
Status output signal	NC ready, servo ready, automatic operation, automatic operation start lamp, feed hold, reset, NC alarm, distribution end, rewinding, inch input, cutting, in position, thread cutting, tapping, etc.
PMC system	PMC ladder function : 24,000 、 Ladder Dividing Management Function 、 I/O Link i DI/DO points: DI/DO 2048/2048 points 、 1st level execution cycle of ladder : 4ms/8ms 、 PMC multi-language message display function 、 Multi-language display of signal comment 、 Extended PMC ladder instruction function、 PMC Function Block function
Control power	DC24V±10%
Ambient temperature of NC unit	During operation: 0°C~58°C During storage: -20°C~60°C
Ambient humidity	Long term : 10 to 75% (with no dew condensation) Short term (within one month) : 10 to 95% (with no dew condensation)
Vibration resistance	Base on IEC68-2-6 standard

10. Worktable dimension



11. Machining range (※ The data may be changed due to the update of technology, SKYMASTER will reserve the right of final interpretation):



Model	Max. processing height A(mm)	Max. processing size B×C (mm)
VL1600D	510	1600×760

12. Spindle power and torque diagram (※ The data may be changed due to the update of technology, SKYMASTER will reserve the right of final interpretation):

