

FA1050S: Machine Overview

FANUC 31MA CNC Machine Control

FCD600 Cast Iron Column for
Unsurpassed Vibration Dampening

Heavy Duty Box Guideway Machine
Construction in All Machining Axes

Dual Y-Axis Ball Screws to Support Heavy
Cutting Conditions

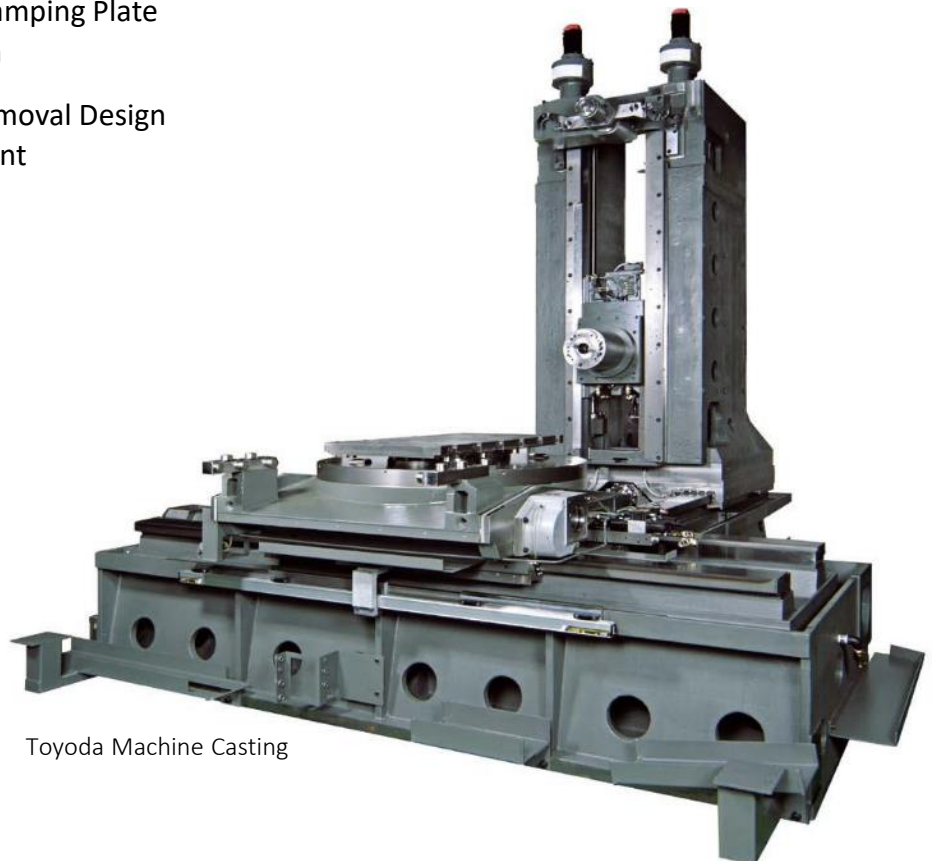
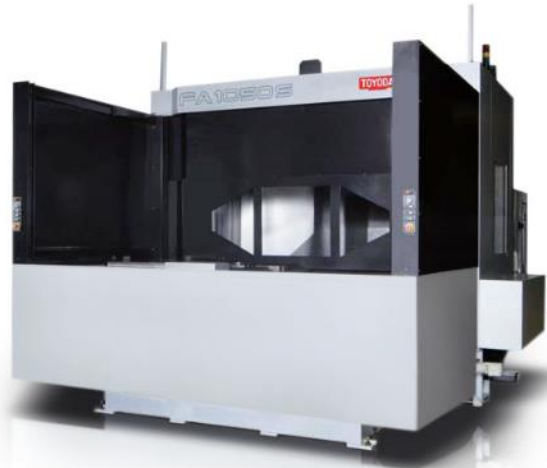
Overhead Style ATC System with Simple
Swing Arm Type Tool Change

Side by Side Shuttle Type Pallet Exchange
System with Vertical Door Enclosure

Machine Weight of 76,200lbs Engineered
with FEM Analysis to Reduce Vibration

Robust Full Contact Table Clamping Plate
with Dual Cylinder Actuation

Side Discharge Type Chip Removal Design
for Efficient Chip Management



Toyoda Machine Casting

Machine Envelope and Travels

Table Cross Travel (X Axis)	63.0" (1,600 mm)
Spindle Head Vertical Travel (Y Axis)	55.1" (1,400 mm)
Column Travel (Z Axis)	45.2" (1,150 mm)
Max Workpiece Swing	∅ 72.8" X 61" (∅ 1,850 X 1,550 mm)
Rapid Traverses (X, Y and Z Axes)	944 ipm (24 M / min)
Spindle Gauge Line	7.9" ~ 53.1" (200 ~ 1,350 mm)
Spindle Center to Top Face of Pallet	2.0" ~ 47.2" (50 ~ 1,200 mm)

Machine Pallet

Pallet Size	41.3" x 41.3" (1,050 x 1,050 mm)
Rotary Table Increments	1 Degree
Maximum Work Load on the Pallet	6,600 lbs. (3,000 kg)
Pallet Height from Floor	51.2" (1,300 mm)

Spindle Specifications

Spindle Speed (Direct Drive)	50 ~ 8,000 RPM
Spindle Speed (Geared - Optional)	50 ~ 6,000 RPM
Spindle Speed (Direct Drive - Optional)	50 ~ 15,000 RPM
Spindle Bearing ID 8,000 RPM (Roller Type)	4.33" (110 mm)
Spindle Bearing ID 15,000 RPM (Ceramic Type)	4.72" (120 mm)
Spindle Drive Motor	50 HP (37 kW) for 30 min. / 40 HP (30 kW) cont.

Tooling and Magazine

Spindle Nose Taper	CAT 50
Type of Stored Tool	Holder: CAT #50 V-Flange / Pullstud: MAS Type I P50T
Standard Tool Storage Capacity	Sixty (60)
Maximum Tool Size (Diameter x Length)	∅10.63" Cylindrical / 15.75" Boring x 31.5" (∅270 / 400 x 800 mm)
Maximum Tool Weight	77 lbs. (35 kg)
Tool – Tool Change Time	2.0 sec. (33 lbs / 15 kg)
Tool Selection	Random

Machine Accuracy

Linear Position Accuracy (w/out scales)	± .00012" (.003 mm) full stroke
Linear Repeatability (w/out scales)	± .00008" (.002 mm)
Rotary Table Index Accuracy (w/out scales)	± 3.5 arc Seconds, ± 2.0 arc Seconds Repeatability

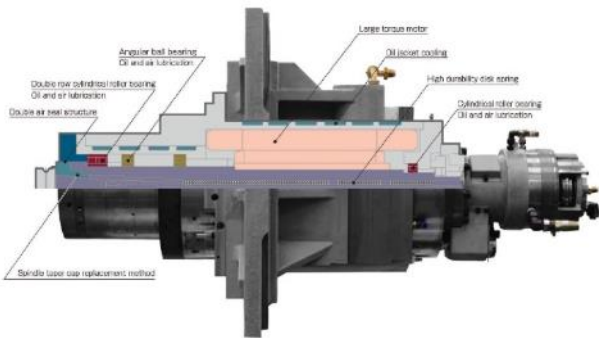
Machine Dimensions and Requirements

Power Capacity (208V)	79kVA
Standard Floor Space	191" X 301" (4,856 x 7,652 mm)
Standard Net Weight	61,100 lbs. (27,710 kg)

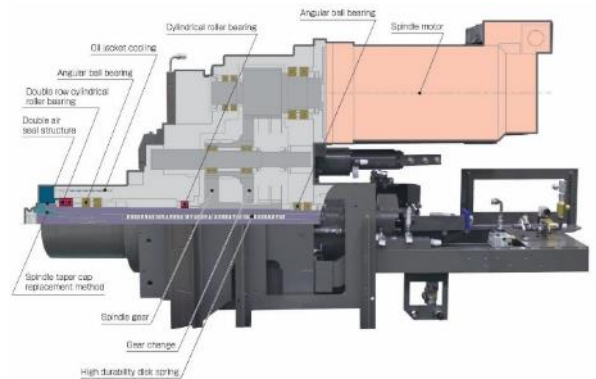
Spindle Options

- 50HP - 8,000 RPM - 744ft.lbs High Torque Direct Drive
- 50HP - 15,000 RPM - 395ft.lbs High Torque Direct Drive
- 60HP - 6,000 RPM – 963ft.lbs Gear Drive Spindle
- HSKA100 Modification (60 Tool Magazine)
- Big Plus Modification

Toyota 8,000RPM 50HP High Torque Spindle



Toyota 6,000RPM 60HP Gear Driven Spindle



- Dual Cylindrical Roller Bearing
- Industry Leading 76in³ MRR
- 110mm Bearing Inner Diameter
- Removable Spindle Taper Design



- Four Front Spindle Bearings
- 963 ft.lbs Torque
- 110mm Bearing Inner Diameter
- Dual Cylindrical Roller Bearing

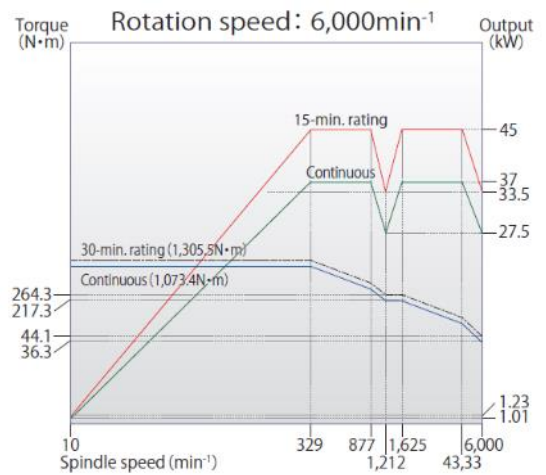
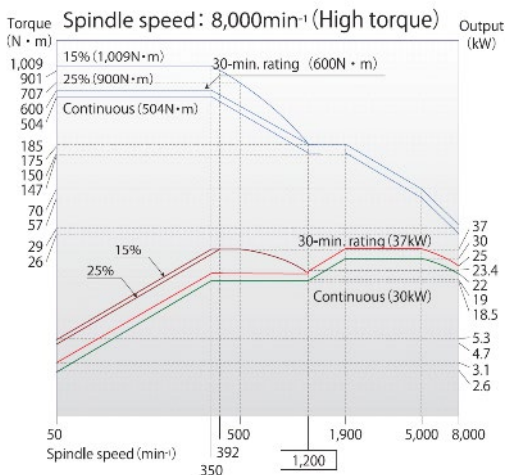
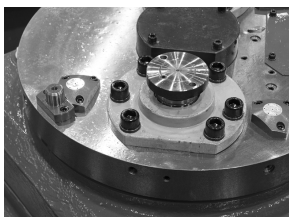
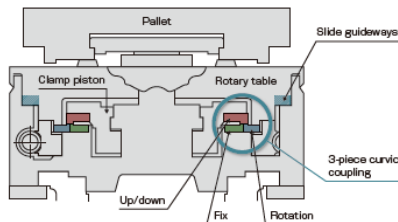


Table & Pallet Options

- One Degree (1°) Positioning Rotary Indexing Table
- Full NC B-Axis Table
- One (1) Bolt Hole Pallet Spec
- One (1) T-Slotted Pallet Specification, In Lieu of Bolt Hole Pattern



Toyoda Pallet Locating



Toyoda Full Plate Clamping



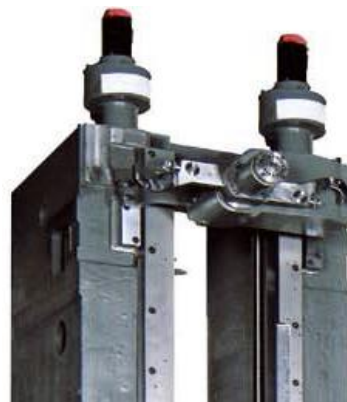
Toyoda Table Carriage

Tool Storage and Retrieval

- Sixty (60) Chain Type Tool Storage Magazine (#50 Taper)
- One Hundred Twenty-One (121) Chain Type Tool Storage Magazine (#50 Taper)
- One Hundred Ninety (190) Chain Type Tool Storage Magazine (#50 Taper)
- Two Hundred Forty (240) Chain Type Tool Storage Magazine (#50 Taper)
- Three Hundred Eighty-Four (384) Tool Storage Matrix Magazine (#50 Taper)
- Tool ID System with Read / Write Head for Matrix Magazine (Requires OP20T Option)
- Tool ID System with Read / Write for Chain Style Magazine (Requires OP20T Option)



Tool Matrix Magazine



Overhead Tool Change Design

Coolant Systems / Options

Machine Coolant Tank and Chip Conveyor: Isolated Re-Circulating Coolant Supply Unit, Including 300 Gallon Coolant Reservoir with (2) Pumps for Flood Coolant and Chip Wash. The System Includes a Take Up Type Hinged Belt Chip Conveyor.

Coolant-Thru-Spindle System: 300 PSI Pump, Large Bag Filter, Pressure Differential Switch to Provide Control Alarm, An Additional Float Switch, Solenoid Valve, and an Additional Coolant Pump (9 GPM @ 300 PSI). Includes all Machine Side Components (Drawbar, Rotary Coupling, and Various Valves, Piping Arrangements, Lines and Related Components).

High Pressure Coolant-Thru-Spindle: (Up To 1,000 PSI) 8.5 GPM Pump with Relief Valve Calibrated for 500 ~ 1,000 PSI, In Lieu of 300 PSI Pump. Manually Adjustable. A Relief Valve for 200 - 500 PSI is Available Upon Request at Time of Order. The System Includes High Pressure Coolant Lines, Fittings and a Nitrogen Charged Pulsation Suppressor to Dampen Vibration (Must Purchase CTS Spindle Option).

High Volume Chip Removal System: A Toyoda Service Engineer Will Evaluate Your Unique Chip Concerns and Provide Additional Piping, Hoses, Special Augers (if needed), Nozzles, Shower Intervals (if Overhead Shower is Purchased), and Extra Coolant Guns. Price Includes Engineer's On-Site Visit, Parts Labor and Training.

Overhead Coolant Shower
Magnetic Chip Conveyor Package
Combined CTS Flow and Pressure Monitor
Hand Held Splash Gun at APC
Air Blow by Nozzle – 125 PSI Max

Probing Options

Renishaw OMP60:

OMP60 Kit, Probe and Styli w/ Inspection Plus Software

Renishaw RMP60:

RMP60 Kit, Probe and Styli w/ Inspection Plus Software

Renishaw TRS2 Laser Broken Tool Detection
BK Micro In Magazine Broken Tool Detection
Toyoda Gap Elimination / Broken Tool Detection
Renishaw NC4 Laser System

Automatic Measurement of Tool Length, Diameter, and Broken Tool Detection Probe Head Mounted in the Lower Right Hand Corner of Work Envelope. Some Axis Stroke is Effected with this Option.

Multi Step Skip Function

Required when more than one of the following; Toyoda Conductive System, Spindle Probe, Tool Measure System Installations is Ordered

High Accuracy Options

Encoder Linear Positioning Accuracy without Scales ($\pm 0.0012''$)

Encoder Linear Repeatability without Scales ($\pm 0.0006''$)

Linear Scale Feedback for X, Y and Z Axes ($\pm 0.0006''$ Accuracy, $\pm .00004''$ Repeatability)

Encoder Positioning and Repeatability NC B Axis Table (± 7 Arc Sec, ± 3.5 Arc Sec)

Rotary Scale Feedback for B Axis Table (± 3.5 Arc Sec Positioning, ± 2.0 Arc Sec Repeatability)

Toyoda Metalcutting Cells

Automating the metal cutting process can bring production to a whole new level of efficiency and profitability. Run multiple machines from a central PC to automate production scheduling, slash set-up times, reduce labor costs and improve throughput. Depending on your production requirements, numerous combinations of loading stations, machining centers and pallet storage styles are possible. Toyoda software and hardware can easily be upgraded or expanded at any time.

Multi Level Flexible Pallet Automation (FPA)

This modular design has the same features as FMS (above) with either two or three levels to add more pallet storage in the same floor space. A two-level FPA can even be expanded to three levels should future production volumes require it. The welded construction, linear guideways and high-speed RGV support high rates of acceleration.



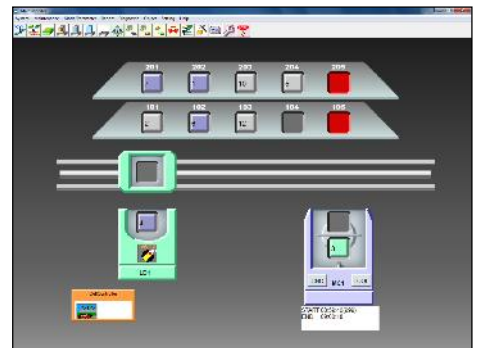
Toyoda Flexible Pallet Automation

Modular, Expandable, Upgradeable

Using pre-engineered, modular components, an initial cell installation can be modest—even a single machine—so you can profit from increased production right away. As production grows, so can the system with more machines and greater handling capacity.

Powerful Cell Management

The basic function of a cell controller is to select and execute the part program, then return the pallet and finished workpiece back to the operator’s loading station or storage rack. Toyoda’s Mach-III Cell Controller goes beyond these basics to make the system both user-friendly and extremely powerful. Mach-III has DNC capabilities, tool management, production monitoring, production scheduling, performance diagnostics, maintenance support, and more.



Toyoda FPA Software Status Screen



Toyoda Single Machine Cell

Standard Training Provided with Machine Purchase

Basic Programmer Training

Basic Programming Training Class which is intended for the first time programmer with basic machining knowledge. Teaching of the machine axes, all codes, block format and program composition are covered by writing sample programs.

Per Machine: Two (2) Persons Included per Machine
 Class Length: Five (5) Days / Eight (8) Hours per Day

Maintenance Training

Toyoda Maintenance Training Classes offer the maintenance man intensive instruction of theory of operation, troubleshooting, and preventive maintenance.

Per Machine: Two (2) Persons Included per Machine
 Class Length: Four (4) Days / Eight (8) Hours per Day

Special Options Training

Toyoda Options Class offering specific instruction on OP Supporter, Adaptive Control, Auto Tool Length Measurement, Rigid Tap and 8-Digit Tool Code.

Per Machine: Two (2) Persons Included per Machine
 Class Length: One (1) to Two (2) Days / Eight (8) Hours per Day

Standard Documentation Provided with Machine Purchase

MANUAL NAME	MEDIA	QTY
Maintenance	TMU - CD	1
Programming	TMU - CD	1
Tooling	TMU - CD	1
Operation	TMU - CD	1
Hydraulic / Pneumatic	TMU - CD	1
Parts	TMU - CD	1
Touch Sensor (If Option Purchased)	TMU - CD	1
Fanuc Operation and Programming	GE INFOLINK - CD	1
Parameters	GE INFOLINK - CD	1
Spindle Manual	GE INFOLINK - CD	1
Digital AC Servo Maintenance	GE INFOLINK - CD	1
Conveyor Operation	TMU - CD	1
Electrical Drawings	TMU - CD & Hard Copy	1
31i Ladder	TMU - CD & Hard Copy	1

FANUC Control Options

Part Program Storage Options

- Part Program Storage Capacity 128 Kbyte (Includes 250 Registerable Programs)
- Part Program Storage Capacity 256 Kbyte (Includes 500 Registerable Programs)
- Part Program Storage Capacity 512 Kbyte (Includes 1000 Registerable Programs)
- Part Program Storage Capacity 1,024 Kbyte (Includes 1000 Registerable Programs)
- Part Program Storage Capacity 2,048 Kbyte (Includes 1000 Registerable Programs)
- Part Program Storage Capacity 4,096 Kbyte (Includes 1000 Registerable Programs)
- Part Program Storage Capacity 8,192 Kbyte (Includes 1000 Registerable Programs)

Tool Offsets and Management

- Tool Offset Pairs – 99 Sets
- Tool Offset Pairs – 200 Sets
- Tool Offset Pairs – 400 Sets
- Tool Offset Pairs – 499 Sets
- Tool Offset Pairs – 999 Sets
- Tool Offset Pairs – 2,000 Sets
- Tool Life Management - 128 Sets
- Tool Life Management - 512 Sets
- 3-Dimensional Tool Compensation
- Operation Supporter – OP20P
(See OP Supporter Supplement for Additional Options)
- Operation Supporter – OP20T
(See OP Supporter Supplement for Additional Options)
- Operation Supporter – OP20A
(See OP Supporter Supplement for Additional Options)

Workpiece Coordinate Systems

- Rotary Dynamic Fixture Offsets
- Workpiece Coordinate System – 48 Sets
- Workpiece Coordinate System – 300 Sets

High Speed Machining Options

- AI Precision Control II
(Reduces Block Processing Time to 2ms, Increases Buffer to 200 blocks)
- High Speed Processor - Requires AI Precision Control II.
(Reduces Block Processing Time to .4ms, Increases Buffer to 600 blocks)
- 1,000 Block Look-Ahead Upgrade
Requires AI Precision Contour Control II with High Speed Processor
- Nano Smoothing
- Smooth Interpolation
- NURBS Interpolation

FANUC Control Options

I/O Devices

- 1,024 Meg (1 Gig) Data Server
- Data Server Buffer Mode (Requires Data Server)
- High Speed Serial Bus (Requires Customer Supplied PC)
- High Speed Serial Bus (Includes PC and Industrial Enclosure)
- Remote Buffer with Serial Board
- External Reader/ Puncher Connection / 25 Pin RS232 Port

Interpolation Options

- Cylindrical Interpolation
- Involute Interpolation
- Conical / Spiral Interpolation
- Polar Coordinate Interpolation
- Hypothetical Axis Interpolation

Operation Support Functions

- Manual Handle Interruption
- Machining Time Stamp
- Optional Block Skip Addition by Push Button Switch (2 - 9 by Push Button)
- Sequence Number Comparison and Stop
- Graphic Display

Programming Support Functions

- Automatic Corner Override
- Chamfering Corner R
- Polar Coordinate Command
- Programmable Mirror Image
- F1 - Digit Feedrate
- Scaling Via G50 / G51
- Single Direction Positioning
- Inverse Time Feed
- Inclination Compensation
- Adaptive Control Function (Macro, not a Function of OP Supporter)
- Adaptive Control Function (Requires OP20T)
- Adaptive Control Function with Condition Management (Requires OP20T)

FANUC 31i CNC Standard CONTROL FEATURES

160m / 64k (Memory)	Machine Condition Selection Function (Selection 1-10 of Precision Settings)
2 nd Reference Position Return	Machine Lock
63 Registerable Programs	Maintenance Information Screen
Absolute / Incremental Programming	Manual Absolute On and Off
Actual Cutting Feedrate Display	Manual Intervention and Return
Alarm Display	Manual Reference Position Return
Automatic Acceleration / Deceleration	Maximum Programmable Dimension (+/- 9 digit, R, J, K: +/- 12 digit)
Automatic Coordinate System Setting	MDI Operation
Automatic Operation (Memory)	MDI Unit
Automatic Tape Code EIA / ISO Recognition	Memory Card Input / Output
Auxiliary Function Lock	Multiple Command of Auxiliary Function
Axes Names (X, Y, Z, U, V, W, A, B, C)	Operating Monitor Display
Backlash Compensation	Operation History Display
Backlash Compensation for Each Rapid Traverse and Cutting Feed	Optional Block Skip 1
Basic Function	Over Travel
Buffer Register	Override Cancel
Circular Interpolation	Parameter Setting and Display
Circular Interpolation by R Programming	Parameter Setting Support Display
Clock Function	Parity Check
Control In / Control Out	Part Program Editing
Coordinate System Setting	Periodic Maintenance Screen
Current Position Display	Plane Selection
Cutting Feedrate Clamp	PMC Function
Cutting Mode	Positioning
Data Protection Key	Program Display
Decimal point programming / Calculator Type Decimal Point Programming	Program File Name (32 Letters)
Diameter / Radius Programming	Program Number Search
Digital Servo Function	Program Protect
Display of Hardware and Software Configuration	Programmable Data Input
DNC Operation by Memory Card	Programmable Parameter Input
Dry Run	Rapid Traverse Override
Dwell	Rapid Traverse Rate (Least Input Increment B)
Emergency Stop	Reference Position Return (G28)
Erase CRT Screen Display	Reference Position Return Check (G27)
Exact Stop	Reference Position Setting without Dog
Exact Stop Mode	Reference Position Shift
Expanded Axes Name	Rotary Axis Designation
Extended Part Program Editing	Rotary Axis Roll-over
External Key Input	Screen Hard Copy
External Work Piece Number Search	Self-diagnosis Function
Failure Diagnosis	Semi Automatic Tool Length Measurement
Feed for Reference Position Setting	Sequence Number
Feed Per Minute	Sequence Number Search
Feedrate Override	Servo Information Display
Flexible Feed Gear	Servo Off / Mechanical Handle Feed
Follow-Up	Servo Waveform Display
Help Function	Single Block
High Speed M / S / T Interface	Spindle Speed Function
HRV Control	Status Display
Incremental Feed	Status Output Signal
Input Unit 10 Time Multiply	Stored Stroke Check 1
Integrated Ethernet	Sub Program Call
Interlock	Tangential Speed Constant Control
Jog Feed	Tool Function (T8-Digit): Limited to Max. Pocket #
Jog Override	Tool Length Compensation
Label Skip	Torque Limit Skip
Least Input Increment	Touch Panel Control
Linear Acceleration / Deceleration after Cutting Feeding Interpolation	Waiting Function
Linear Interpolation	Wrong Operation Prevention Function

FANUC 31i CNC Additional Toyota Packaged CONTROL FEATURES

10.4" Color LCD with Touch Panel
250 Registerable Programs
3rd / 4th Reference Position Return
99 Tool Offsets
Addition of Custom Macro Common Variables (#100 – #199, #500 – #900)
AI Contour Control I
Automatic Corner Deceleration
Bell-Shaped Acceleration / Deceleration After Cutting Feed Interpolation
Bell-Shaped Acceleration / Deceleration Look Ahead Interpolation
Bidirectional Pitch Error Compensation
C Language Executer Additional SRAM
C Language Executer
Canned Cycle For Drilling
Control Axis Detach
Controlled Axes Expansion
Coordinate System Rotation
Custom Macro
Custom Software Capacity 2MB
Direct Input of Work Piece Origin Offset Value Measured
External Data Input
Feedrate Clamp Based on Arc Radius
Helical Interpolation
High-Speed HRV Function
Inch / Metric Conversion
Manual Handle Feed
Multi-Language Display (English)
Part Program Storage Capacity (Total of all Paths) 128 Kbyte
Position Switch
Power-mate CNC Manager
PROFIBUS
Program Restart
Reader / Puncher Interface
Rigid Tapping
Run Hour and Parts Count Display
Simultaneously Controlled Axes Expansion
Spindle Orientation
Spindle Output Switching Function
Spindle Serial Output
Stored Pitch Error Compensation
Stroke Limit Check Before Move
Tandem Control
Tape Format for FS 15
Tool Offset Memory C
Work Piece Coordinate System (G52 – G59)
Work Piece Coordinate System Preset