High-Efficiency CO_2 LASER with Wide Usage

FANUC

LASER C series

Compact CO_2 LASER with High Reliability, High Performance and High Functionality

FANUC LASER C series

C1000*i*-C/C2000*i*-C/C3000*i*-C/C4000*i*-C/C6000*i*-C

FANUC LASER C series *i*-MODEL C is designed for Series 30*i*/31*i*-LB, which is compact, high-performance and highly-reliability carbon-dioxide LASER applicable to cut metallic and non-metallic materials.
Newly, C3000*i*-C optimized for sheet metal cutting was added to the line-up.

Mach
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High Efficiency and Economy

Minimizing Downtime

- Superior RF Discharge Excitation
  - –High conversion efficiency
  - –Stable LASER output
- High-Efficiency Turbo Blower
  - –Compact with large blowing capacity by high speed rotation
  - –Employment of FANUC Built-in Spindle Motor
- Power Saving Functions
  - –Quick Power Saving state
  - –Eco Power Saving state
- LASER Gas Saving Function

Minimizing Downtime

Highly Reliable Design

Minimizing Downtime

- RF Discharge Excitation with High Reliability and High Safety
  - –All-solid-state LASER power supply
  - –Compact and high efficiency by latest MOSFETs
- Easy Maintenance
  - –Screen of maintenance information history power compensation coefficient, run hour/ maintenance time of parts etc.
  - –Automatic Leakage Check Function
  - –Automatic Power Supply Adjustment Function
  - –Support Function for Start-Up after Turbo Oil Exchange
- Conformity to Safety Standards
  - –EC directive (CE Marking)
  - –FDA (U.S.)

Tuning for Dedicated

- Tools for Dedicated Functi
  - –Nano CNC system
  - –C Language Executor
  - –Real-Time Custom Ma
  - –Personal Computer Fu
- Customization
  - –Cutting condition data

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C3000*i*-C

C6000*i*-C

High-Speed High-Precision Cutting

Machining Performance

- High-Speed Cutting Functions
  - –High-Speed High-Precision Cutting Function
- High-Precision Cutting Functions
  - –Edge Cutting Function
  - –LASER Power Control Function
  - –Enhancement of pulse frequency command range
- High-Efficient Cutting Functions
  - –Cutting Condition Setting Function
  - –Gap Control Function

Ease of Use

Superior Control Functions

Ease of Use

- Oscillator Control
  - –Direct Oscillator Control by CNC
  - –LASER Power Feedback Control
  - –Minute LASER Output Control and Calibration Function
  - –LASER Cutting Condition Control
  - –Power Failure Restart Function

System

Ease of Use

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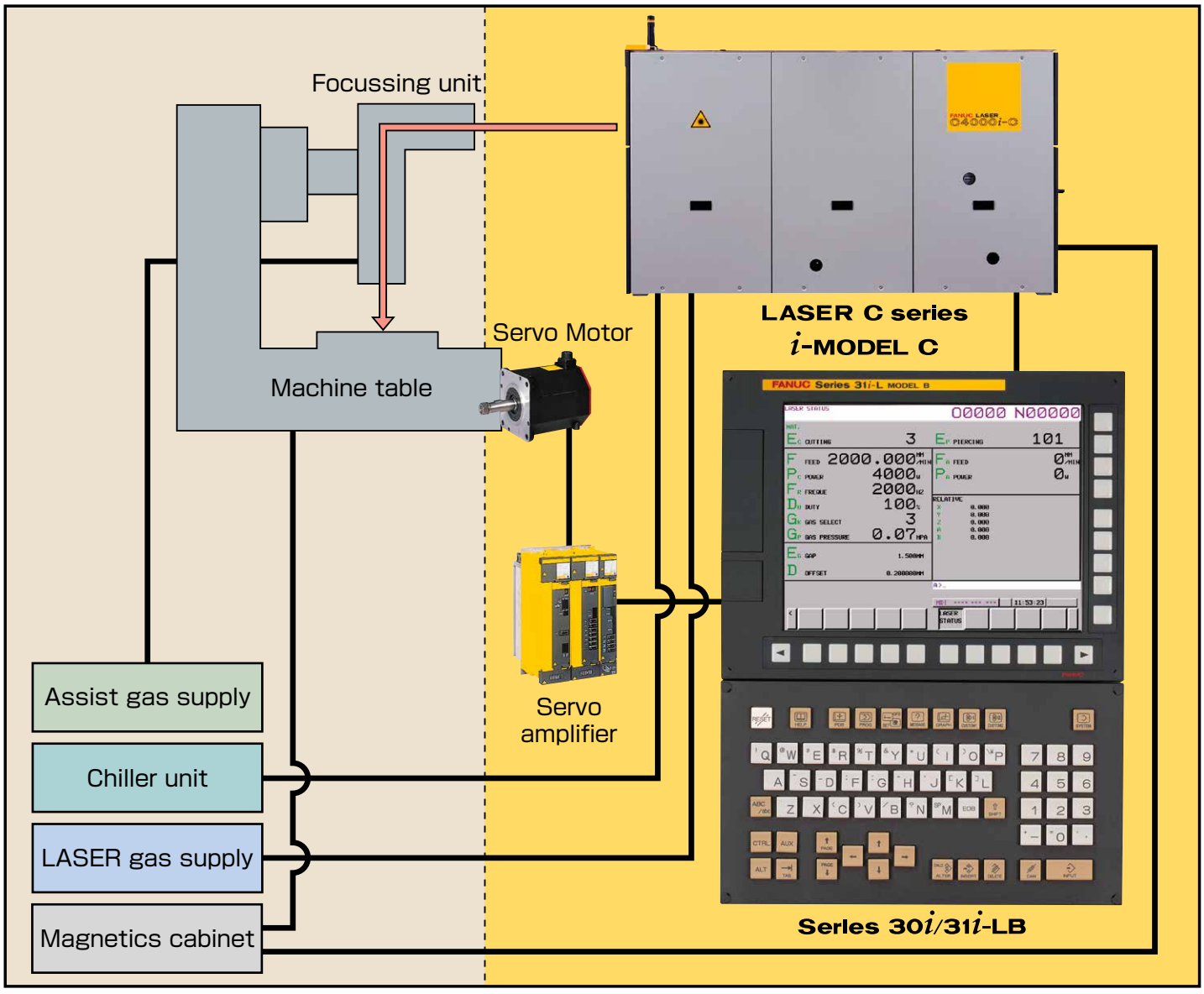
settings

System Configuration

FANUC LASER C series is supplied together with FANUC CNC and servo motors, which makes it easy for customers to construct high-performance LASER cutting machines. FANUC LASER C series is compact, high-performance and high-reliability carbon-dioxide LASER. Five models —C1000*i*-C, C2000*i*-C, C3000*i*-C, C4000*i*-C, and C6000*i*-C — are available to tailor output to your processing needs. They are specifically developed to cut metallic and non-metallic materials. Pumped at 2MHz with RF discharge using all-solid-state LASER power supply, the LASER oscillator became compact, efficient, and stable. Moreover, the fast axial gas flow produces the optimum beam quality for the cutting process.
FANUC Series 30*i*/31*i*-LB realizes high-speed, high-precision LASER cutting with FANUC LASER C series.
FANUC AC SERVO MOTOR *αi* series, which is the most widely used in the world, also improves stable process together with the most advanced digital servo controlling technology.

System Configuration

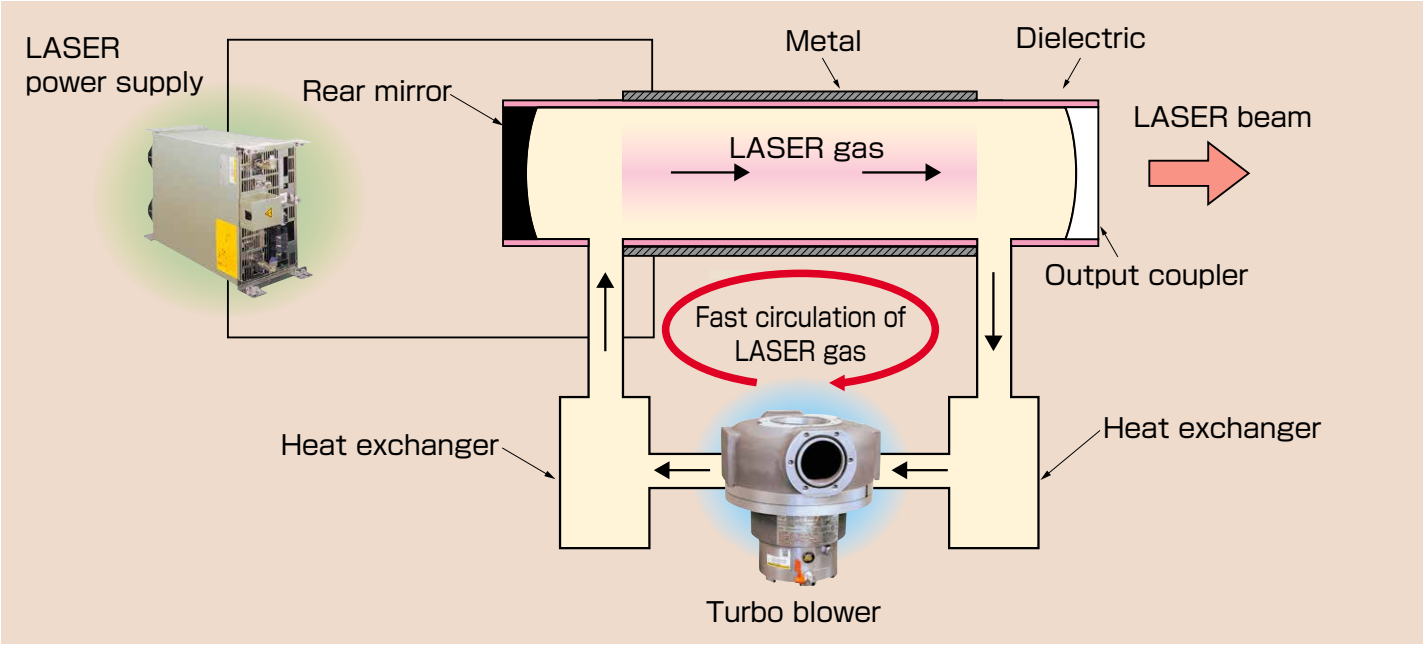


High Efficiency and Economy

Minimizing Downtime

Superior RF Discharge Excitation and High-Efficiency Turbo Blower

Using RF discharge excitation has brought about improved oscillation efficiency as well as output power stability. It also produces safety of operation due to low discharge voltage and high reliability due to non-contamination of LASER gas which is possible only by adopting the external electrode structure as in FANUC LASER C series. The RF discharge excitation, stable and uniform one by nature, produces excellent pulsing characteristics. The transistorization using high power MOSFET, the first achievement at this power level, has also improved reliability.

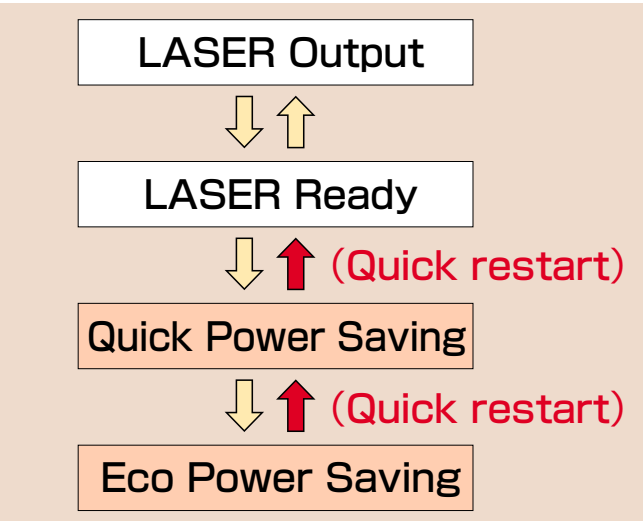


FANUC LASER C series are equipped with high speed rotation Turbo Blower to achieve fast LASER gas circulation. Turbo blower design is optimized by use of FANUC Built-in Spindle Motor. Precise tuning of rotator and strict inspections enabled high speed rotation, and thus realizing the light weight, compact and large capacity Turbo Blower.

Power Saving Functions

During LASER idle time, such as exchanging works, designing layout, and press processing on turret punch press machine, electric power consumption becomes lower by moving into the power saving states, in which LASER power supplies and turbo blowers of LASER oscillator are controlled in power saving conditions.

Two power saving states are available. One is Eco Power Saving state, in which electric power consumption is dramatically saved and the other is Quick Power Saving state, in which LASER cutting can be restarted quickly. Therefore, according to the customers' choices, electric power consumption will be saved with these power saving functions. Assuming a cutting ratio of 50%, the effect of the power saving is about 20% with Power Saving Functions.



Superior Control Functions

Ease of Use

Direct Oscillator Control by CNC

A CNC unit can be connected directly to control the LASER oscillator. The CNC unit constantly checks the status of the LASER oscillator during operation from startup to termination and automatically keeps the oscillator ready with the optimum operating conditions. The CNC unit also automatically controls other parameters that affect beam output, such as LASER gas pressure.
In *i*-model C, the enhancement of oscillator control sequence enabled to reduce the start-up time and shut down time of oscillator by half to the conventional model.
i-model C will contribute to increase the utilization rates of the LASER cutting machine.

Power Failure Restart Function

In case that power failure is detected, CNC stores the operating status of the LASER oscillator. After power recovers, CNC analyses the optimal restart sequence for the LASER oscillator to realize the minimum time restart, according to the operating status just before the power failure occurs.
In addition, by using this funciton together with UPS and retry processing function, it is possible to minimize the downtime caused by power failure, realizing high utilization ratio of LASER machine.

Minute LASER Output Control and Calibration Function

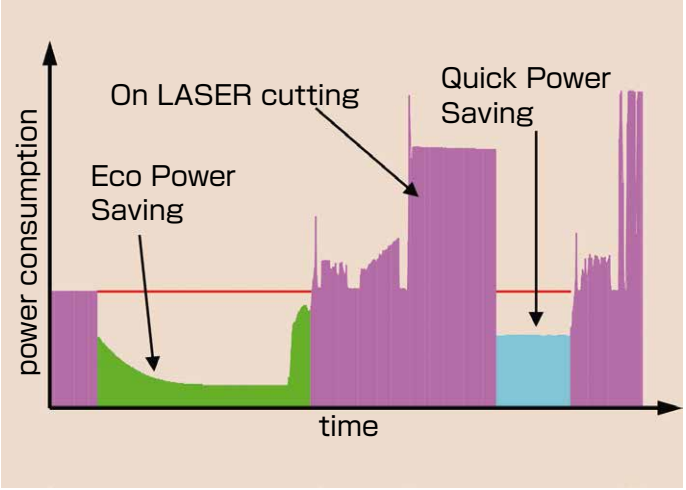
Stable minute LASER output, which is needed for LASER marking, is achieved with enhanced control of LASER power supplies.
In addition, Calibration Function for minute LASER output realizes stable LASER marking process over long periods, not to be affected by change of oscillator condition or exchange of mirrors.

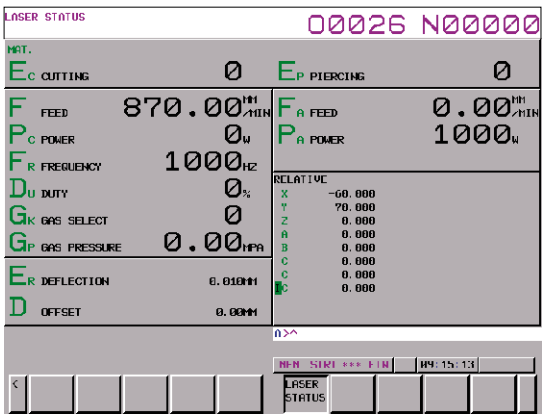
Power Consumption Monitor

CNC always monitors the condition of the LASER oscillator, and outputs estimated power consumption value. Using this power consumption value, the LASER machine can display the total power consumption and the utilization rate of the LASER machine, which will support the users to reduce the power consumption by their programming.

LASER Cutting Condition Control

Full automatic process is provided by programming, including automatic shutter open/close, output beam on/off, assist gas start /stop, output power, and pulse output (frequency and duty).
In addition, the commanded LASER output value, pulse frequency, pulse duty and actual output power value are displayed on the CNC screen.



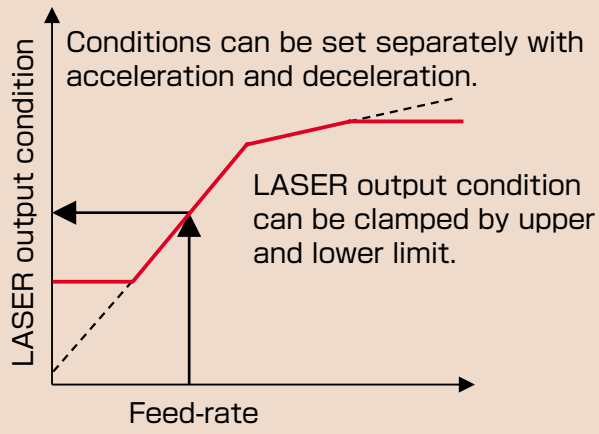


High-Speed High-Precision Cutting

Machining Performance

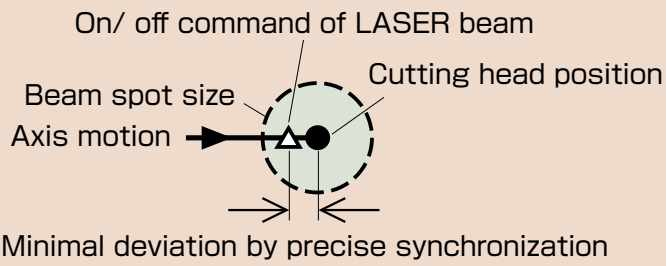
LASER Power Control Function

LASER output conditions (Peak power, Pulse Frequency, Pulse duty) are weighed corresponding to feed-rate commanded in a part program. Uniform cutting result can be obtained by controlling power, frequency and duty at acceleration and deceleration caused by machine axes.
Power control conditions can be switched in 2 stages according to feed-rate. LASER output conditions can be clamped by upper and lower limits. Furthermore, power control conditions can be set separately for acceleration and deceleration.



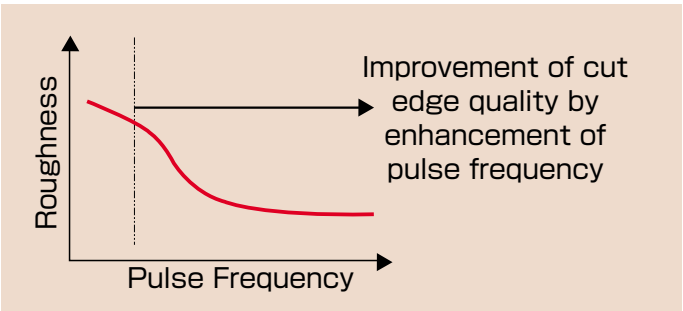
High-Speed High-Precision Cutting Function

Extreme high-precision synchronization between axis command and beam on/off command is realized. In high speed cutting, deviation between cutting head position and beam on/off command increases. The function minimizes the deviation sufficiently smaller than the beam spot size.



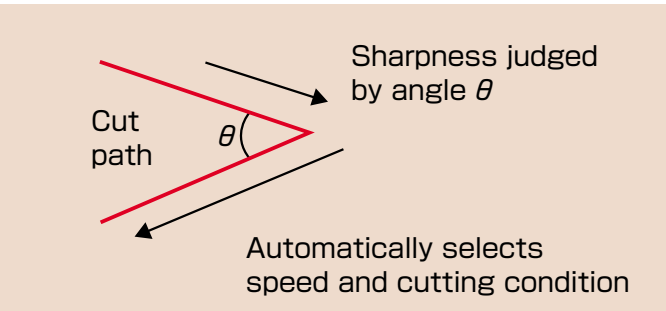
Enhancement of Pulse Frequency

The maximum command frequency of LASER power has been enhanced from 2,000Hz to 32,767Hz. Enhancement of pulse frequency is effective in the improvement of the cut edge quality and decreasing dross.



Edge Cutting Function

On detection of sharp angles in the cut path, automatic acceleration/deceleration is performed with appropriate cutting condition, thus enabling sharp-edge cutting.



Tuning for Dedicated System

Ease of Use

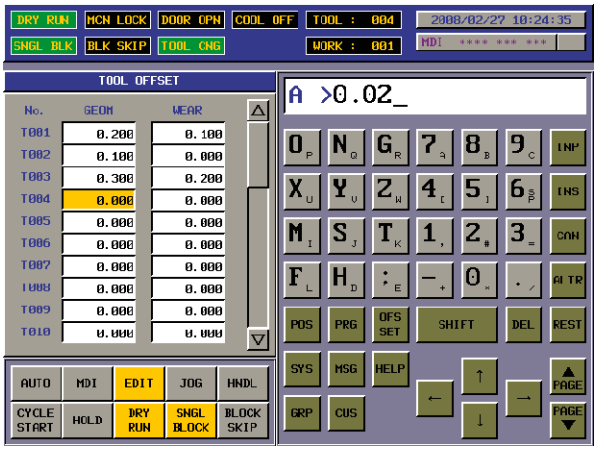
Nano CNC System

High-precision cutting Achieved by Coordination between "High-Precision Operation in Nanometers" and "State-of-the-Art Servo Technology" Nano interpolation that computes position commands for the digital servo control unit in nanometers, SERVO HRV Control and SPINDLE HRV Control for which the control cycle is made faster, and FANUC AC SERVO MOTOR αi series with a high-resolution pulse coder are used as standard and make up "Nano CNC System," which achieves high-speed, high-precision cutting.

C Language Executor

Machine tool builders can create their own operation screens.

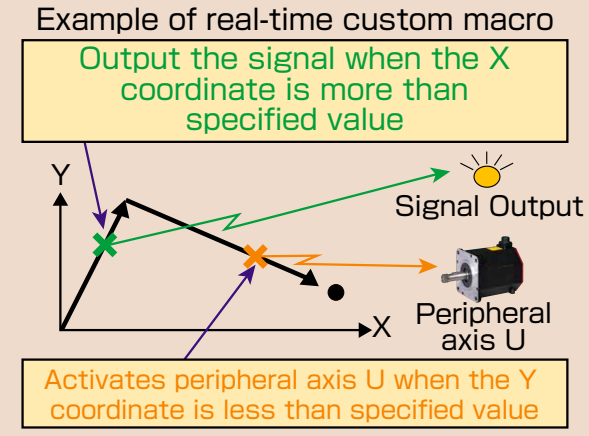
- C language is used ANSI functions and CNC and PMC functions for programming.
- High-level tasks to which high execution priority is assigned can monitor signal.



Real-Time Custom Macro

Signals and peripheral axes can be controlled from machining programs.

- A macro statement can be executed in real time in synchronization with a machining program.
- Signals can be input and output by using DI/DO variables.
- Operation that the signal status is used as a trigger can simply be created.
- Macro variables can dynamically be read and written.
- Operation that position information of a system variable is used as a trigger can be created.
- Multiple real-time macro statements can be executed concurrently.
- Peripheral axis control can be written in the same program during machining.



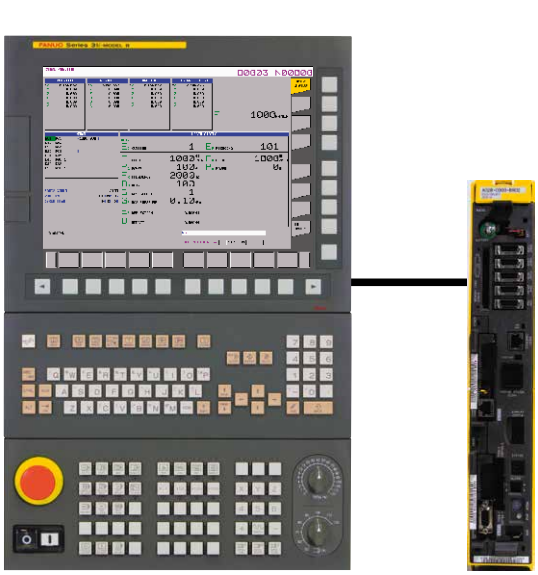
Personal Computer Function

The best combination between a CNC and personal computer is realized by transferring bulk data via an original high-speed interface. Unique dedicated applications can be realized easily by personal computer function, and the machine tools can meet special needs for machine tool customers.

Feature Various commercially application software and hardware are available

Application Best fit for flexibility with computer applications, such as tool file management by utilizing database

OS Windows® Embedded Standard 2009
Windows® Embedded Standard 7



PANEL i

Highly Reliable Design

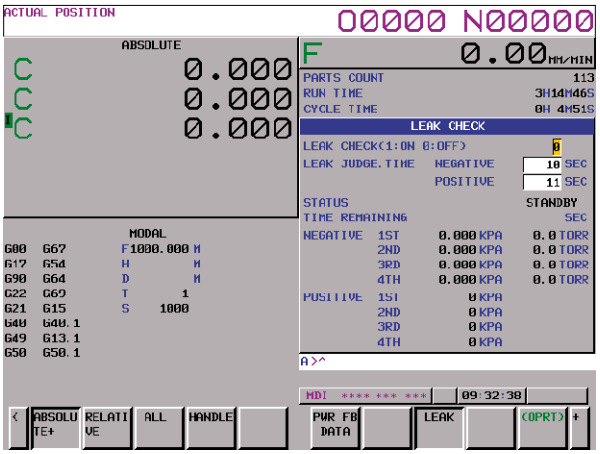
Minimizing Downtime

High Reliability

The thermal deformation of the resonator is suppressed by using low thermal expansion material. The indirect cooling structure exhibits excellent corrosion resistance.
The ceramic coating and external electrode structure are adopted to the discharge tubes, in order to protect them mechanically and to decrease the contamination into the LASER gas.
The LASER power supply is all-sollid-state type using the latest MOSFETs.
All these factors contribute to the high reliability.

Easy Maintenance

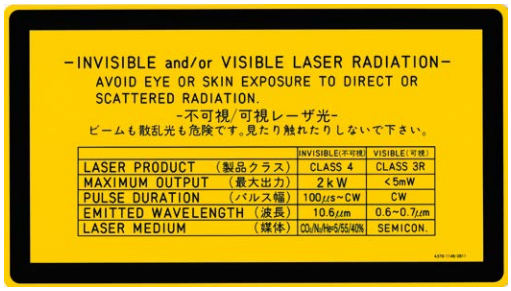
The history of power compensation coefficient, current/ voltage of LASER power supplies, status of LASER, and run hour/maintenance time of fundamental parts are displayed on the CNC screen.
The Automatic Leakage Check Function exhausts the resonator chamber to vacuum and displays the change of inside pressure over time.
The Automatic Power Supply Adjustment Function automates the adjustment after replacement of LASER power supplies.
After the LASER is turned on, decrease of output power is always monitored. When it exceeds a certain preset level, a warning is displayed on the CNC screen to urge mirror cleaning.
In addition, newest techniques such as the oil mist decomposition element, dust collection unit and so on, have reduced the frequency of mirror cleaning interval and the high-precision-machined mirror stage has simplified mirror adjustment.



Automatic leakage check screen

High Safety

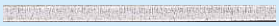
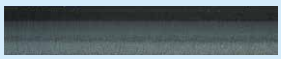
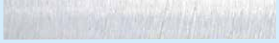
FANUC LASER C series products comply with the EC directive (CE Marking) and U.S. standards (FDA) under the LASER radiation control for health and safety that apply to manufactures of LASER products.
Warning labels and certification label such as the ones shown down side are affixed permanently on each LASER product.
Using RF discharge excitation produces safety of operation due to low discharge voltage and skin effect by RF current.



Utility Plan for the Object

Machining Performance

Corresponding to the cutting materials and thicknesses, LASER models can be selected to achieve the best cutting performance.
(Cutting performance of the LASER machine might be limited depending on its configuration.)

	Mild steel	Stainless steel	Aluminum
C1000*i*-C	 800mm/min 9mmthk  1600mm/min 4.5mmthk	 1200mm/min 3mmthk  2600mm/min 2mmthk	 1600mm/min 2mmthk 4000mm/min 1mmthk
C2000*i*-C	 550mm/min 22mmthk  2400mm/min 6mmthk	 500mm/min 10mmthk  1000mm/min 6mmthk	 600mm/min 6mmthk  2000mm/min 3mmthk
C3000*i*-C	 700mm/min 19mmthk  3000mm/min 6mmthk 10000mm/min 1mmthk	 900mm/min 10mmthk  2000mm/min 6mmthk 9500mm/min 1mmthk	 1800mm/min 4mmthk 12000mm/min 1mmthk
C4000*i*-C	 550mm/min 28mmthk  3000mm/min 6mmthk	 800mm/min 12mmthk  1800mm/min 6mmthk	 2000mm/min 6mmthk  3000mm/min 4mmthk
C6000*i*-C	 550mm/min 32mmthk  2400mm/min 12mmthk	 600mm/min 16mmthk  1200mm/min 12mmthk	 1200mm/min 10mmthk  2600mm/min 6mmthk

Specifications

Standard specification of LASER oscillator

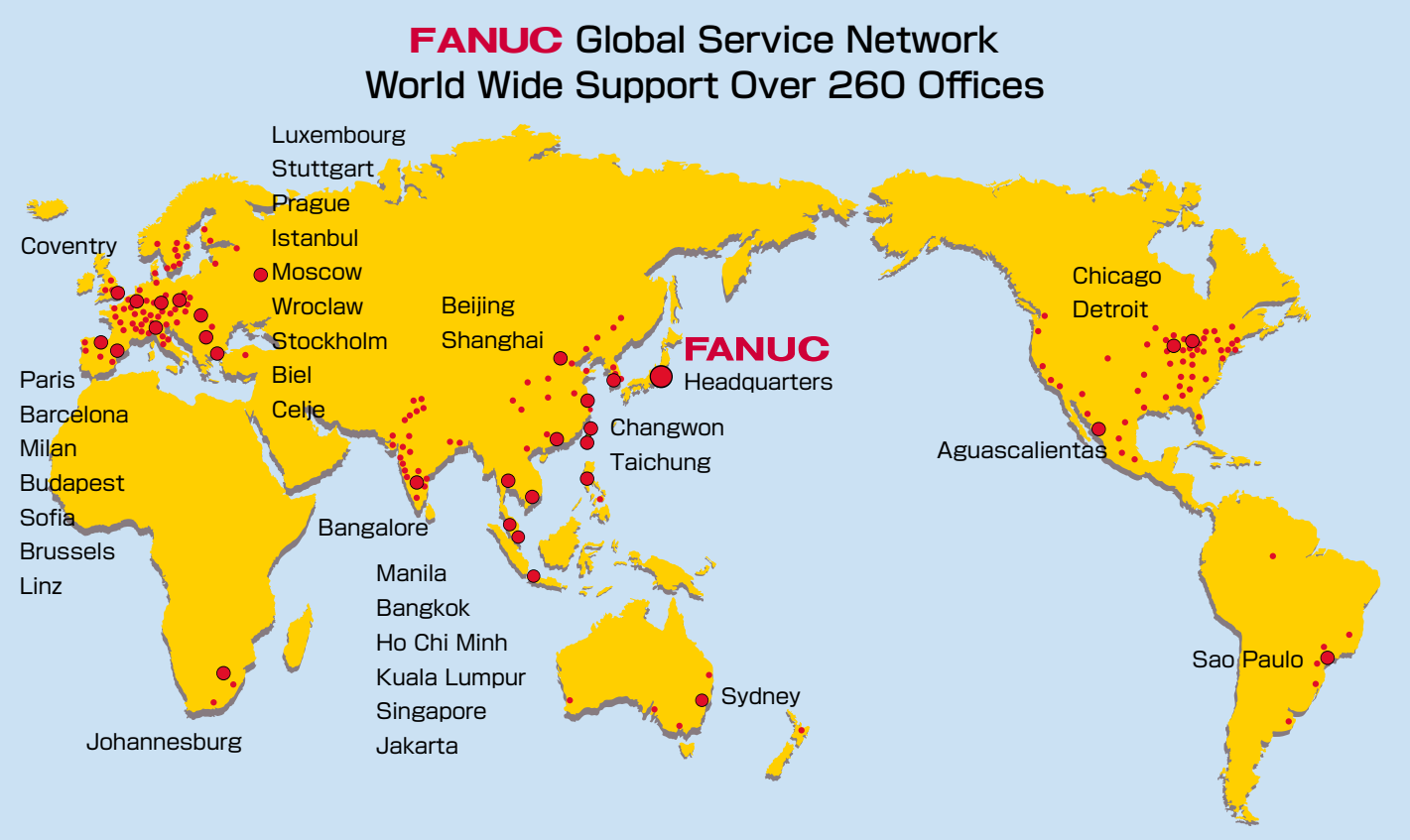
Items		Contents							
Model		C1000*i*-C	C2000*i*-C		C3000*i*-C		C4000*i*-C		C6000*i*-C
Optical path length			Short	Long	Short	Long	Short	Long	
System principle		RF discharge excitation fast axial gas flow							
Structure		Integrated type (Note1) (oscillator and power supply)							
LASER rated output (W)		1000	2000		3000		4000		6000
LASER maximum output (W)		1000	2500		3000		4000		6000
Maximum pulse power command (W)		1000	2700 Note 2)		3200 Note 2)		4000		7000 Note 2)
Output stability		±1% Note 3)			±2% Note 3)				
LASER wavelength		10.6μm							
Beam mode		Low order mode							
Beam diameter at exit (mm)		<φ20	<φ27	<φ24	<φ22	<φ19	<φ27	<φ24	<φ28
Polarization		45° linear			Circular	90° linear	Circular	90° linear	
Beam divergence angle (full angle)		2mrad or less							
Pulse frequency		5 to 5000Hz	5 to 32767Hz		5 to 10000Hz		5 to 32767Hz		
Pulse duty		0 to 100%							
LASER gas Note4)		Gas A	Gas B						
Gas consumption rate (L/Hr)		Approx. 10							Approx. 20
Cooling water	Water rate (L/min)	40	75		120		160		250
	Circulated water pressure	0.5MPa or less gauge pressure							
	Water temperature/ Water temperature stability	20 to 30℃/±1℃			20 to 30℃/±2℃				
	Recommended cooling capacity (kW)	11	22		33		44		66
Input power supply		AC200V+10%、-15% 50/60Hz±1Hz or AC220V+10%、-15% 60Hz±1Hz or AC230V+5%、-10% 60Hz±1Hz							
Power supply capacity (kVA)		18	33		44		55		75
Mass (kg)		350 30 (pump)	700		750		900		1300

Note 1) In C1000*i*-C, the vacuum pump is placed outside of the main unit.
Note 2) Within limited pulse duty
Note 3) At rated power with LASER power feedback during 8 hours.
Note 4) Gas A /Pre-mixed gas of CO_2:N_2:He (volume ratio, N_2 balance) 5:55:40% ±5% or less for each composition
Gas B /Pre-mixed gas of CO_2:N_2:He (volume ratio, He balance) 5:35:60% ±5% or less for each composition

Maintenance and Customer Support

Worldwide Customer Service and Support

FANUC operates customer service and support network worldwide through subsidiaries and affiliates. FANUC provides the highest quality service with the prompt response at any location nearest you.



FANUC ACADEMY

FANUC ACADEMY operates training courses for daily, periodic, and preventive maintenance including mirror cleaning procedure of CO_2 LASER oscillator.

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LASER C(E)-26a, 2021.9, Printed in Japan