NC Integrated Controller
Machine Automation Controller NJ/NY Series
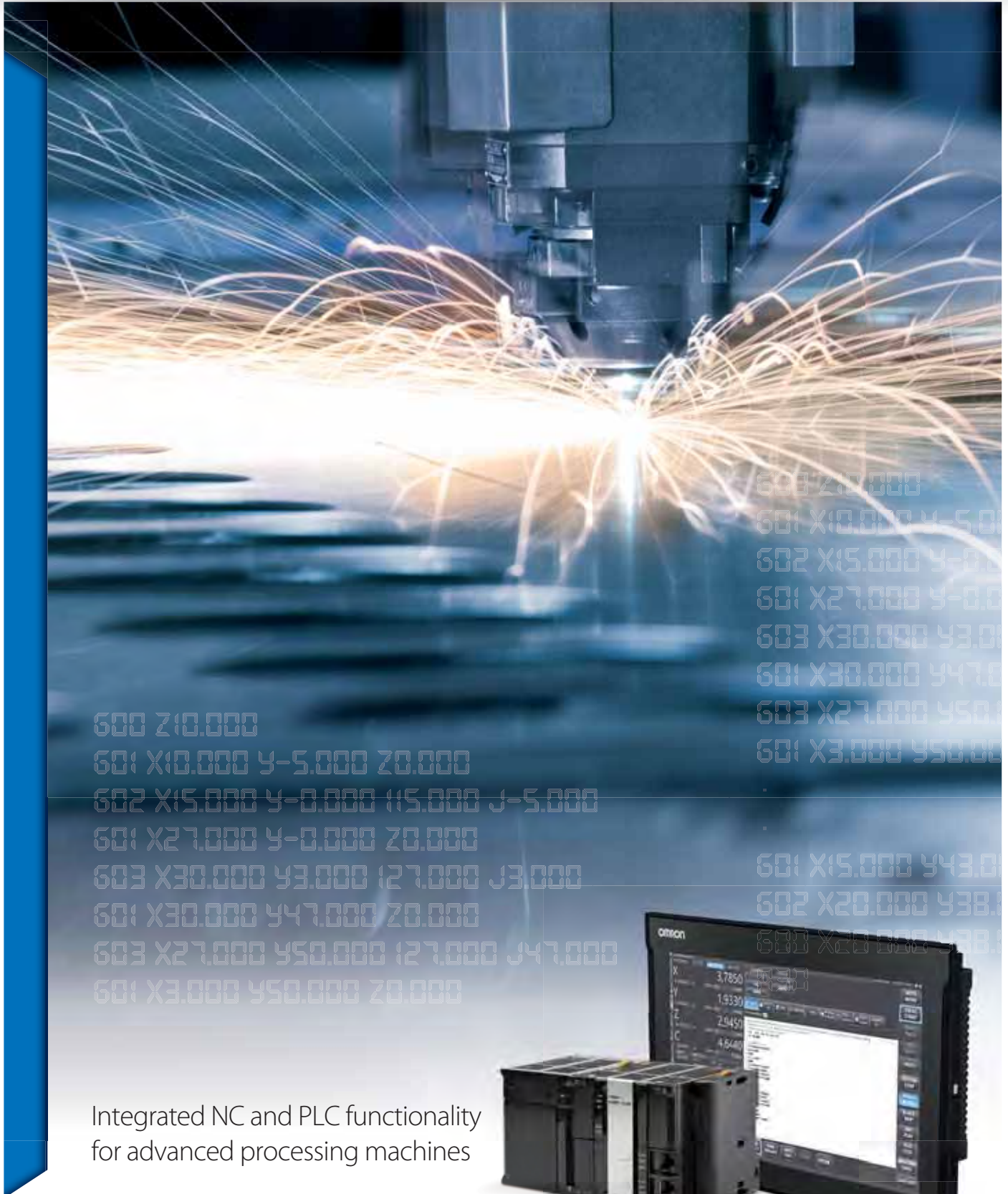
Integrated NC and PLC functionality
for advanced processing machines

OMRON

sysmac
always in control

NC Integrated Controller brings further of multi-purpose processing machines

With changes in consumer's needs and advancement of technologies, products with more diverse and complicated shapes and materials are increasing. Along with the changes in products, manufacturing sites are facing challenges of achieving more difficult processing at higher productivity rates.

To meet customer's challenges of the future manufacturing, Omron offers a solution to maximize the throughput of multi-purpose machines that handle multiple processes.

Three benefits from NC Integrated Controller

NC and PLC functionality fully synchronized at high speed	Minimize machine cycle time
Versatile NC functions	Simplify complex profiling
One software for NC setting and PLC programming	Optimize engineering time

Experience new manufacturing with the NJ/NY NC Integrated Controller at the heart.

Sysmac Automation Platform

NJ/NY Series NC Integrated Controller

development

sysmac
always in control

Minimize machine cycle time
NC and PLC functionality fully synchronized at high speed

Efficient control of processing and other processes is crucial to performance and productivity of a multi-purpose machine which handles multiple processes.
The NC integrated controller provides both NC and PLC functionality and synchronize all devices at high speed, significantly reducing the machine cycle time.

Improved synchronization

Conventional system PLC+NC

As CPU control cycles are not synchronized, communications jitter occurs

PLC   Communications jitter   NC controller
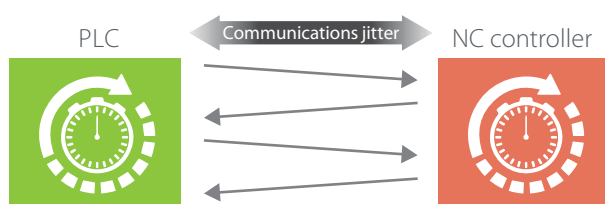
NC Integrated Controller

NC functionality and PLC functionality are fully synchronized in the same task period

NJ/NY NC Integrated Controller

PLC functionality   NC functionality

PATENT PENDING

A
Loader

Control cycle as you designed

Programs for both PLC and NC are executed in the same task period, which enables processes to be synchronized with the cycle as you designed
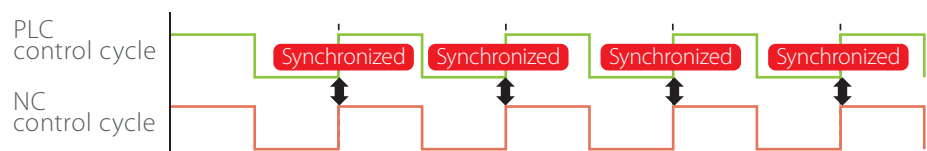
Conventional system

Two control cycles are inconsistent
(Communications jitter must be taken into consideration)

PLC control cycle

NC control cycle

Inconsistent   Inconsistent
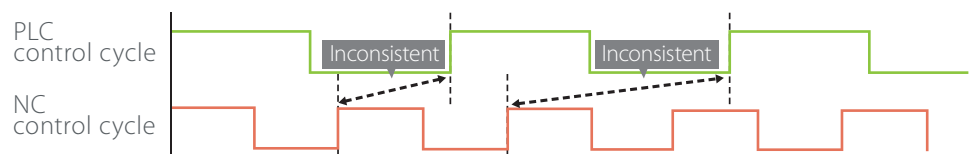
NC Integrated Controller

Two control cycles are fully synchronized

PLC control cycle

NC control cycle

Synchronized Synchronized   Synchronized   Synchronized

D Grinding

A Unloader

C Handling

B Cutting

B Cutting

Machine Automation Controller
NJ/NY NC Integrated Controller

B Cutting

C Handling

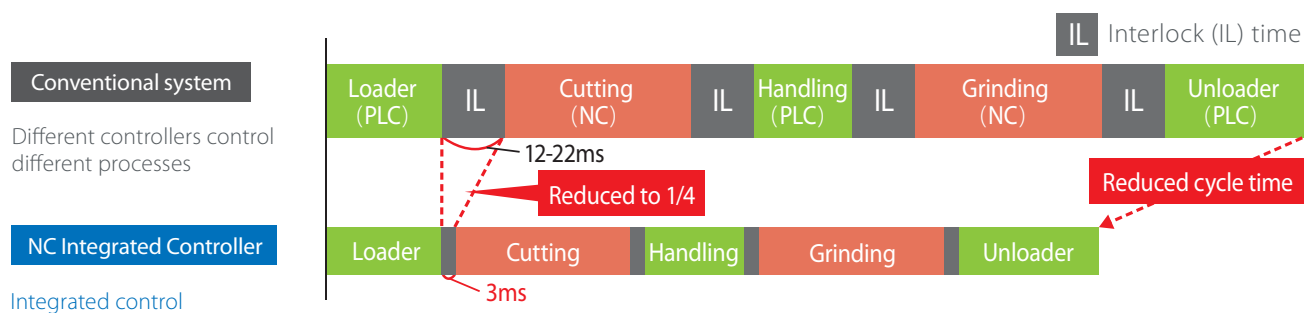**A** Loader · Unloader

D Grinding
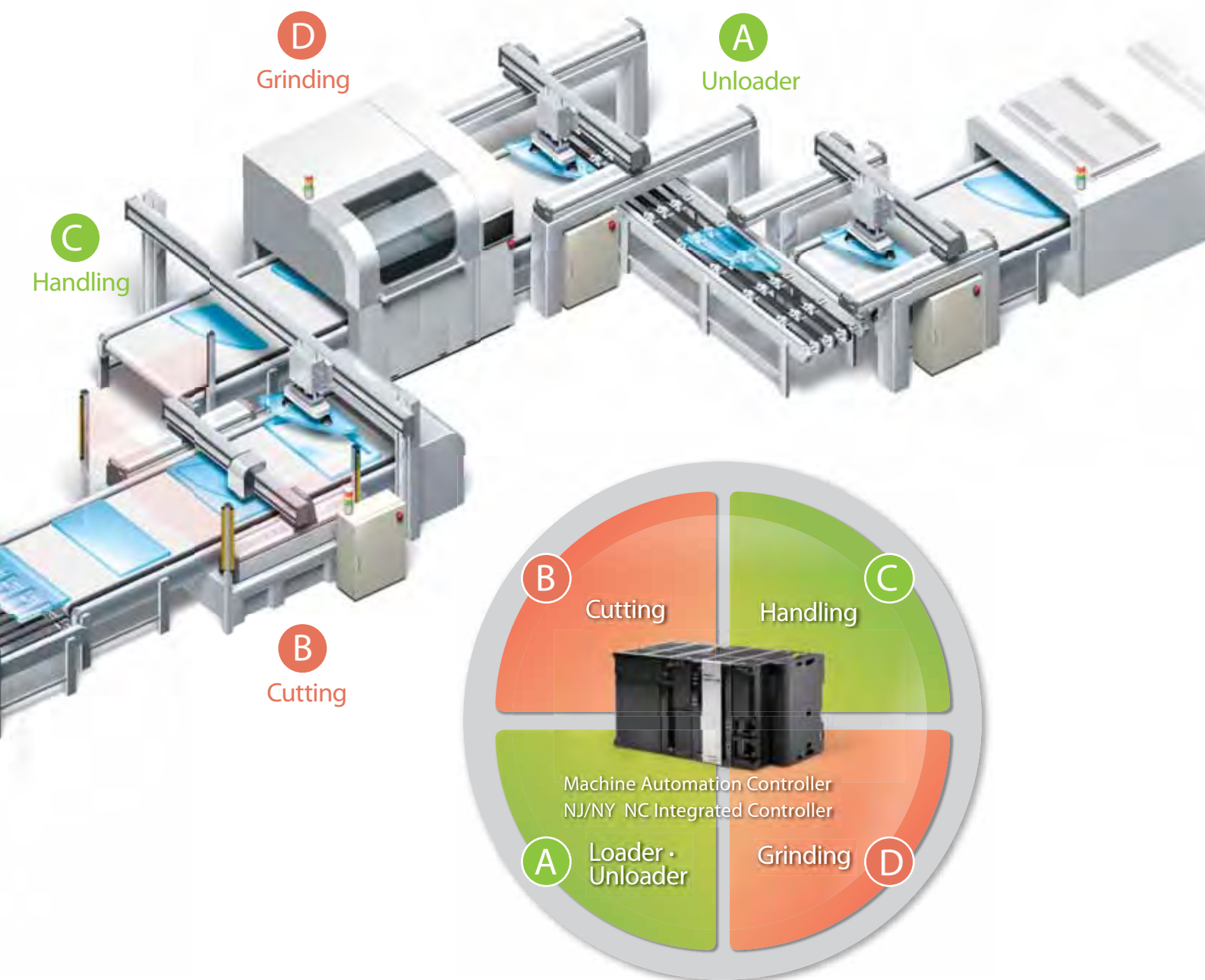
High-speed synchronization reduces interlock time

Interlock time between NC (processing) and PLC (other processes) will be reduced to 1/4* as compared to when separate controllers are used. Cycle time of a multi-purpose machine that generates many interlocks can be reduced. ＊The NY Series is used under our measurement conditions.

PATENT PENDING

IL Interlock (IL) time

Conventional system									
Loader (PLC)	IL	Cutting (NC)	IL	Handling (PLC)	IL	Grinding (NC)	IL	Unloader (PLC)	

Different controllers control different processes

12-22ms

Reduced to 1/4

Reduced cycle time

NC Integrated Controller				
Loader	Cutting	Handling	Grinding	Unloader

Integrated control

3ms

Simplify complex profiling
Versatile NC functions

G-Code reduces time required to design and program complex profiling.

Conventional controller

Processing programs are designed based on CAD data. Programming using PLC instructions and debugging are required for each figure

CAD screen
(example)

Program design

Exploding components into lines
Types of lines: straight line, arc, free curve
Target positions of lines
Travel velocities
Transition path between figures, etc.

NC Integrated Controller

CAD/CAM software makes design easy

CAD/CAM

```
G00 Z10.000
G01 X10.000 Y-5.000 Z0.000
G02 X15.000 Y-0.000 I15.000 J-5.000
G01 X27.000 Y-0.000 Z0.000
G03 X30.000 Y3.000 I27.000 J3.000
G01 X30.000 Y47.000 Z0.000
G03 X27.000 Y50.000 I27.000 J47.000
G01 X3.000 Y50.000 Z0.000


G01 X15.000 Y43.000 Z0.000
G02 X20.000 Y38.000 I15.000 J38.000
G00 X20.000 Y38.000 Z10.000
M30
```

NC program in G-Code
(example)

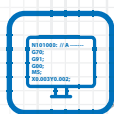| Parameter setting	Automatic generation	Transferred
① Parameters are set using CAD/CAM software	② NC program in G-Code is generated	③ Program is transferred to NC integrated controller

Cutting

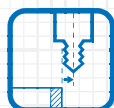## NC functions for complex profiling applications

G-Code
G-Code NC programming language allows manual programming on operation software and use in combination with any CAD/CAM software

High-speed control
Logic sequence, motion control and NC functionality with the fastest cycle time of 500 µs

Cutter compensation 2D
Tool diameter and shape compensation, matching the cutting point exactly as specified in G-Code
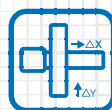
Lookahead
Future instructions are analyzed in advance, movements are blended and optimized in speed and acceleration for a better performance
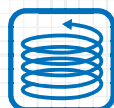
Block Retrace
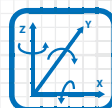Path can be reverted in order to remove the tool from cutting area

Compensation
High-precision processing by compensating position of NC motors

3D interpolation
Helical, spiral and conical interpolation for 3D profiling
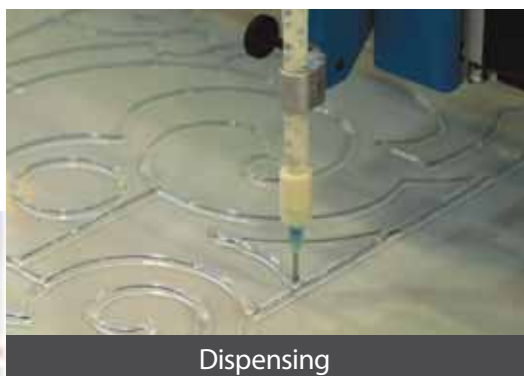
Coordinate systems
Various profiling using machine coordinate system, workpiece coordinate system, and local coordinate system

Milling

Grinding

Dispensing
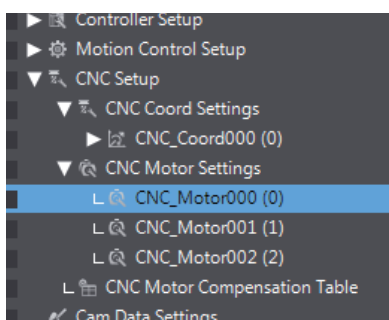
Sewing

Optimize engineering time
One software for NC setting and PLC programming

The Sysmac Studio provides a true Integrated Development Environment (IDE) for configuration, programming, monitoring, and 3D simulations. Programming based on IEC standard and PLCopen® Function Blocks (FBs) for motion control cuts programming time. FBs for NC control make program structure simple, even for synchronization between NC process and others.

NC setting

Ladder programming

Integrated

Integrated Development Environment Sysmac Studio
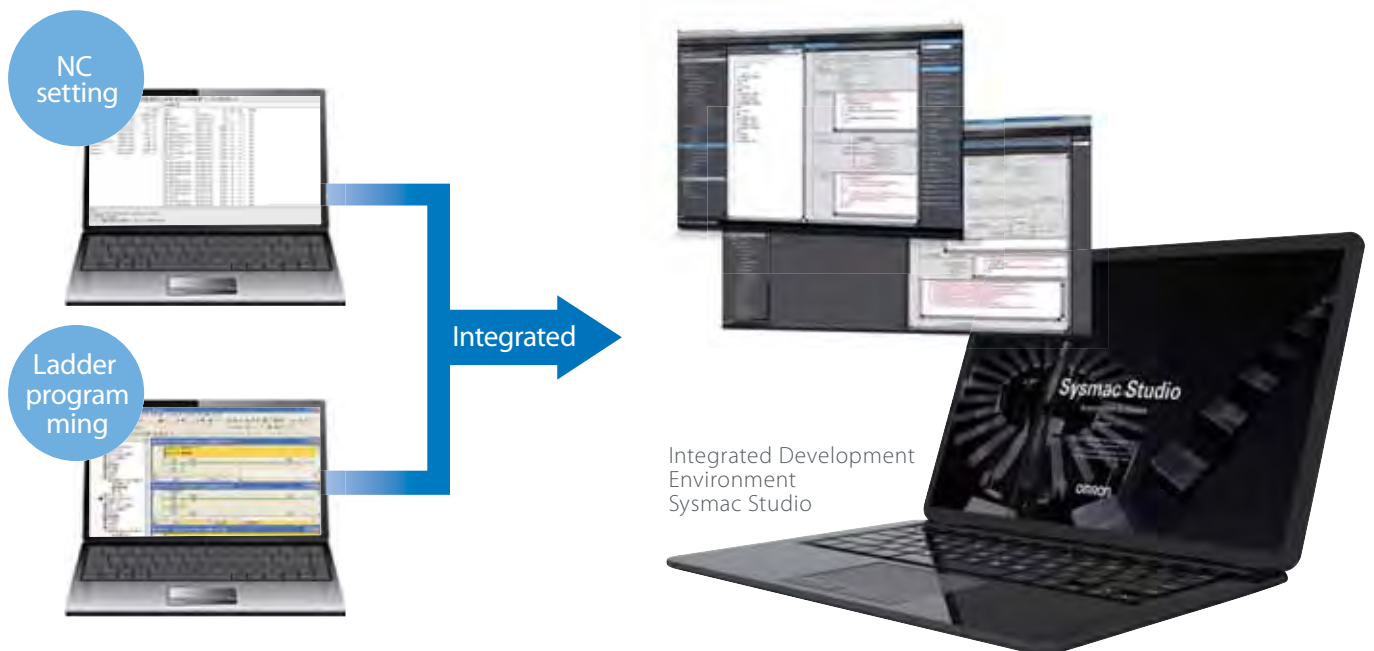
Intuitive user interface reduces configuration time

Easy to find NC settings

▶ Controller Setup
▶ Motion Control Setup
▼ CNC Setup
   ▼ CNC Coord Settings
      ▶ CNC_Coord000 (0)
   ▼ CNC Motor Settings
      L CNC_Motor000 (0)
      L CNC_Motor001 (1)
      L CNC_Motor002 (2)
   L CNC Motor Compensation Table
▶ Cam Data Settings

Parameter setting by device
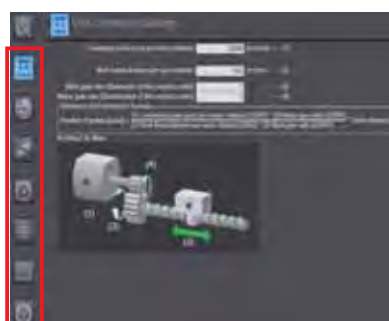
Description of parameters
Description with graphics gives parameter details

A choice of two controllers

▶ For specific purpose machines

A modular controller suitable for machines programmed for NC

Combine with general-purpose HMI and your own PLC
Traditional reliability and robustness
Up to 16 synchronous axes, including NC processing and
motion control

Machine Automation Controller
NJ NC Integrated Controller

▶ For general purpose machines

A panel PC provides general-purpose HMI functionality that allows machine users to edit NC programs

Reliable and robust industrial panel PC
Omron's unique CNC Operator for editing NC programs and
performing functions
Comes equipped with Windows OS, running Windows
applications while performing motion control
Up to 32 synchronous axes, including NC processing and
motion control
Intel® Core™ i7-4700EQ processor

Industrial Panel PC
NY NC Integrated Controller

Graphic user interface for NC - CNC Operator

Operation software for PC to use NC functionality

Customizable software allows adding functionality by users
(Requires Microsoft Visual Studio)

Total solution to maximize machine throughput

Integration and functionality

Sysmac is an integrated automation platform dedicated to providing complete control and management of your automation plant. At the core of this platform, the controller series offers synchronous control of all machine devices and advanced functionality. This multidisciplinary concept allows you to simplify solution architecture, reduce programming and optimize productivity.

Robot
Omron Adept Technologies Inc. robot

EtherNet/IP™

I/O
NX I/O

Sensing
ZW-7000
Displacement Sensor

N-Smart
Fiber/
Laser/
Contact Sensor/
Sensor Communications Unit

Vision
FH Vision System

IO-Link Master
Photoelectric Sensor
Proximity Sensor

IO-Link
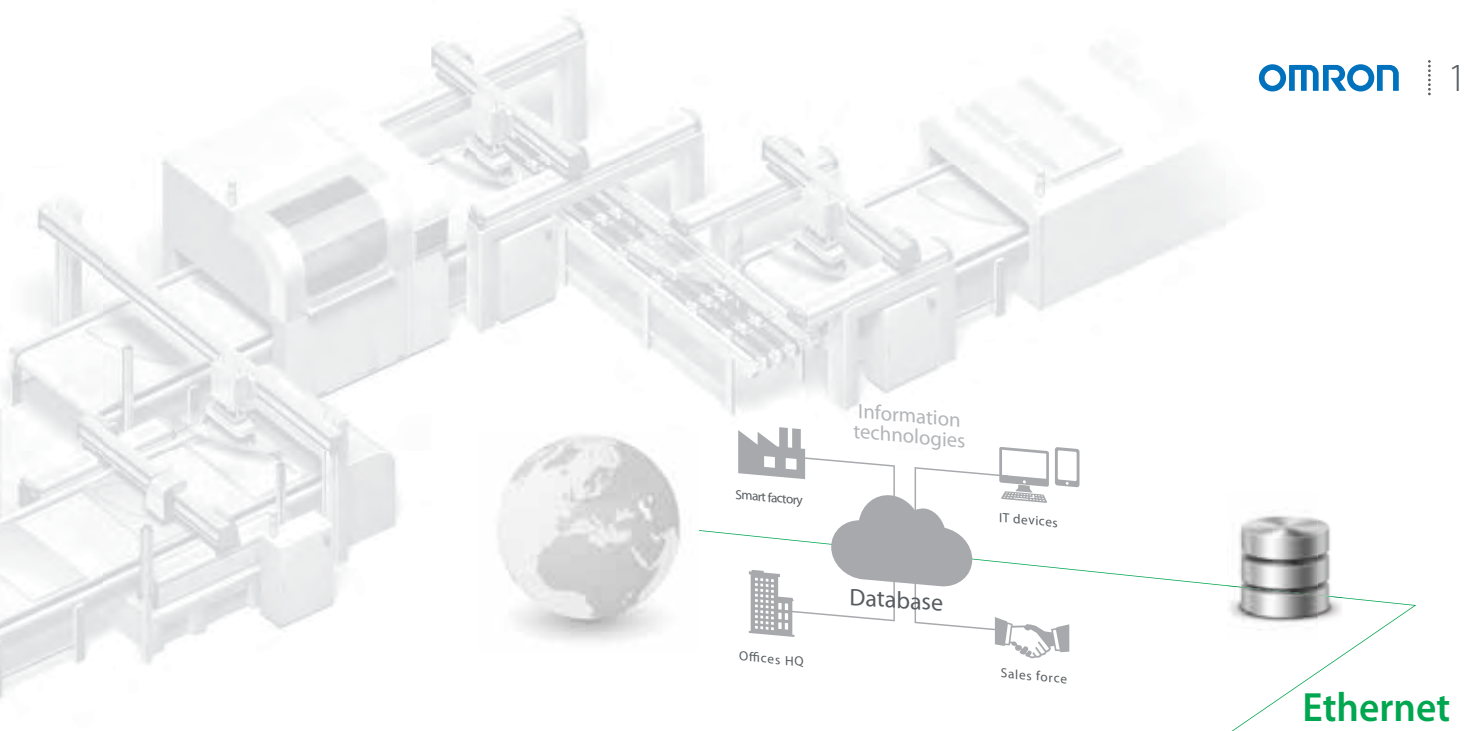
✓Integrated machine controller
Logic sequence, motion, safety, I/O, vision, and NC in one. One integrated controller offers speed, flexibility and scalability of software centric architecture without compromising on the traditional reliability and robustness that you have come to expect from Omron PLCs.

✓Perfect match between fast machine control and data plant management·
Built-in ports: Machine control network EtherCAT® and factory automation network EtherNet/IP™. The two networks with one connection purpose is the perfect match between fast real time machine control and data plant management.

✓A wide range of products for complete production lines
Our industry-leading lineup: Input (photoelectric/proximity/vision sensors, switches), Logic (PLCs, controllers), Output (servo systems, inverters, relays), and Safety.
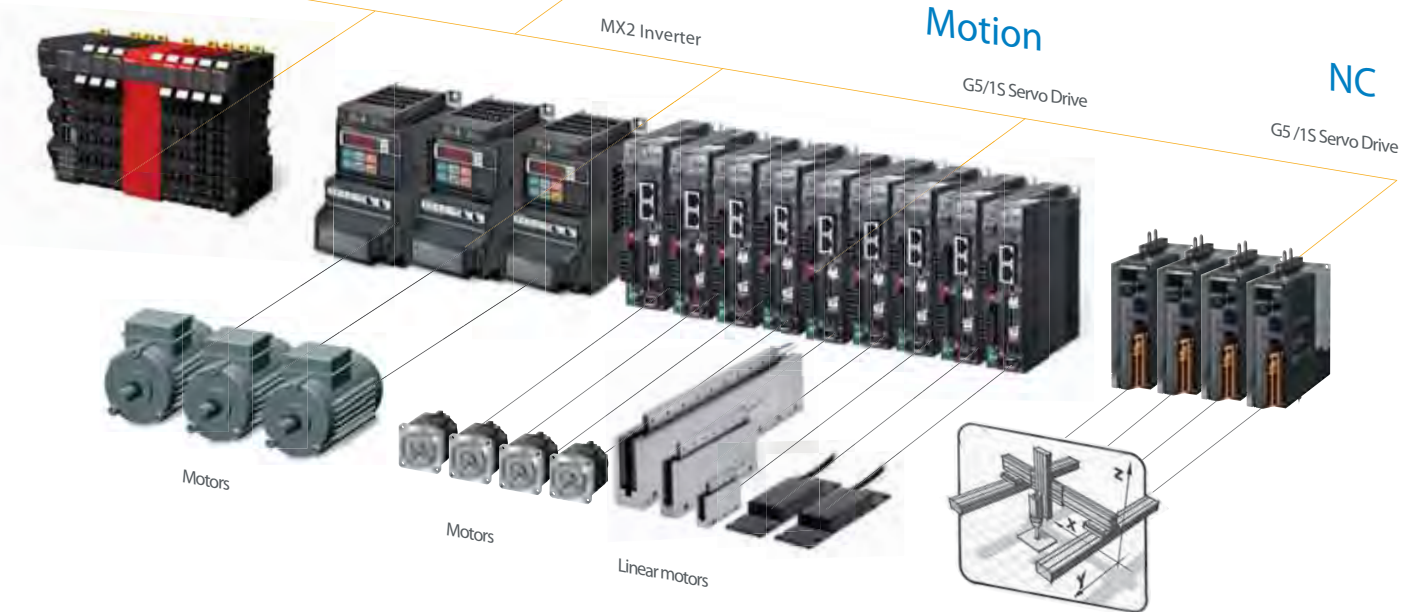
Information technologies

Smart factory

IT devices

Database

Offices HQ

Sales force

Ethernet

Sysmac Library

IPC Machine Controller
NY NC Integrated Controller

Machine Automation Controller
NJ NC Integrated Controller

Safety

NX Safety

EtherCAT

MX2 Inverter

Motion

G5/1S Servo Drive

NC

G5 /1S Servo Drive

Motors

Motors

Linear motors

sysmac
always in control

Product family

MACHINE CONTROLLER		

15.4' inch   **12.1' inch**

Product name	NJ/NY series NC Integrated Controller				
Model	NY532-5400-□				NJ501-5300
Hardware	Industrial Panel PC				Modular controller
Display	15.4' inch		12.1' inch		-
Storage	128 GB SSD MLC	64 GB SSD SLC	128 GB SSD MLC	64 GB SSD SLC	-
Operating system	Windows Embedded Standard 7 – 64 bit				-
Task	Multi-tasking program				
Control functionality	• Logic sequence • Motion • NC				
Number of axes — Max. synchronous axis	32				16
Synchronous axes per channel	4				
Number of channels	8				4
Fastest cycle time	500 µs				
Software tool — Integrated Development Environment	Sysmac Studio: • Ladder, Structured Text, In-Line ST • IEC61131-3 • PLCopen for Motion Control and Safety • G/M Code				
Graphic user interface	CNC operator: • G/M Code				
Interpolation functions — Compensation	Tool Radius/Length, Cross, LeadScrew				
Interpolation	Linear, Circular, Helical, Conical, Spiral				
Coordinate system	MCS, WCS, LCS, Mirror, Scaling, Rotation, Plane Selection…				
Others	FeedRate Control, Accel/Decel Control,Lookahead, Machine Lock, Dry Run, Back Trace…				
Program capacity	40 MB				20 MB
NC program buffer	64 MB				20 MB
Memory card	SD and SDHC				
Built-in port	Ethernet, EtherNet/IP, EtherCAT, USB 3.0/2.0, DVI,RS-232C				EtherNet/IP, EtherCAT, USB
EtherCAT slaves	192				
Mounting	On panel				DIN rail
Global standards	EU Directives, cULus, RCM and KC Registration				

SOFTWARE

	INTEGRATED DEVELOPMENT ENVIRONMENT		OPERATION SOFTWARE	
Product name	**Sysmac Studio**		**CNC Operator License ***	**CNC Operator Software Development Kit**
Model	**SYSMAC-SE2□□□**		**SYSMAC-RTNC0001L**	**SYSMAC-RTNC0101D**
Functions	• Sysmac Studio is the Integrated Development Environment to configure, program and maintain all Sysmac Controllers and devices. • One single project file for the entire machine. • Intuitive IDE for logic, motion, safety, robotics, drives, vision, HMI and networks NC. • Reduce engineering and maintenance costs by using Omron libraries and IAGs. Develop your own libraries. • IEC-61131-3 compliant. • PLCopen FBs for motion and safety. • G/M Code available • Advanced functions for CAM editing, Drive tuning, 3D simulation, libraries and namespaces, vision algorithms, HMI design and complete machine maintenance. • Full Digital Machine development enviroment including: EtherNet/IP, EtherCAT, IO-Link, SQL and FTP. • Offline Simulation for logic, motion, robotics, safety and vision. • Advanced security function with 32 digit security password.		• G-Code File Editor • Execution monitor Active G/M code display • Command terminal • Jogging, homing	• The CNC Operator Software Development Kit provides a • environment for customization of CNC Operator.

* One CNC Operator License (SYSMAC-RTNC0001L) is bundled with a CPU Unit. Purchase additional licenses if required.

G-CODE

Code	Function	Code	Function	Code	Function
G00	Rapid Positioning	G41	Tool Compensation, Left	G58	5th work coordinate system
G01	Liner Interpolation	G42	Tool Compensation, Right	G59	6th work coordinate system
G02	Circular Interpolation in CW direction	G43	Tool Offset, Positive	G61	Exact Stop Mode
G03	Circular Interpolation in CCW direction	G44	Tool Offset, Negative	G64	Continuous-path Mode
G04	Dwell	G49	Cancels Tool Offset	G68	Enables rotation
G09	Exact Stop	G50	Cancel Scaling	G69	Disables rotation
G17	X-Y Plane Selection	G51	Scaling	G74	Left-handed Tapping Cycle
G18	Z-X Plane Selection	G50.1	Cancel Mirroring	G80	Fixed Cycle Cancel
G19	Y-Z Plane Selection	G51.1	Mirroring	G84	Tapping Cycle
G20	Inch Input	G52	Local Coordinate System Set	G90	Absolute command
G21	Metric Input	G53	Dimension Shift Cancel	G91	Incremental command
G28	Return to Reference Point	G54	1st work coordinate system	G98	Fixed Cycle Return to Initial Level
G30	Return to 2nd, 3rd or 4th Reference Point	G55	2nd work coordinate system	G99	Fixed Cycle Return to R Point Level
G31	Skip Function	G56	3rd work coordinate system	G500	Enables Multi-block Acceleration/Deceleration Rate
G40	Cancels Tool Compensation	G57	4th work coordinate system	G501	Disables Multi-block Acceleration/Deceleration Rate

SERVOMOTORS/LINEAR MOTORS/DRIVES

Product name	G5 Servo Drives		1S Servo Drives	
Type	Built-in EtherCAT Communications		Built-in EtherCAT Communications	
100 VAC Applicable motor capacity/force	50 to 400 W		100 to 400W	
200 VAC Applicable motor capacity/force	50 W to 15 kW		100 to 3kW	
400 VAC Applicable motor capacity/force	400 W to 15 kW		600 to 3kW	
Applicable servomotor	G5 rotary servomotor, G5 linear motor		1S servomotor	
Control mode	Position, speed and torque control		Position, speed and torque control	
Safety approvals	• ISO13849-1 (PL-c,d) • EN61508 (SIL2) • EN62061 (SIL2) • IEC61800-5-2 (STO)		• ISO13849-1 (PL-e/PL-d) • EN61508 (SIL3/SIL2) • EN62061 (SIL3/SIL2) • IEC61800-5-2 (STO)	
Full closed loop	Built-in		No	
Ordering information	G5 Series Catalog (Cat. No.I815)		1S Series Catalog (Cat. No.I821)	

Product name	G5 Servomotors		1S Servomotors	
Rated rotation speed	3,000 r/min	2,000 r/min	3,000 r/min	2,000 r/min
Momentary maximum rotation speed	4,500 to 6,000 r/min	3,000 r/min	5000 to 6000 r/min	3000 r/min
Rated torque	0.16 to 15.9 Nm	1.91 to 23.9 Nm	0.318 to 9.55N·m	4.77 to 14.3 N·m
Capacity	50 W to 5 kW	400 W to 5 kW	100W to 3 kW	400W to 3kW
Applicable servo drive	G5 Servo Drive (for rotary servomotor)		1S Servo Drive	
Encoder resolution	20-bit incremental/ 17-bit absolute	20-bit incremental/ 17-bit absolute	23-bit absolute	23-bit absolute
Protective structure	IP67	IP67	IP67	IP67
Ordering information	G5 Series Catalog (Cat. No.I815)		1S Series Catalog (Cat. No.I821)	

Product name	G5 Servomotors		1S Servomotors
Rated rotation speed	1,500 r/min	1,000 r/min	1,000 r/min
Momentary maximum rotation speed	2,000 to 3,000 r/min	2,000 r/min	2000 r/min
Rated torque	47.8 to 95.5 Nm	8.59 to 57.3 Nm	8.59 to 28.7 N·m
Capacity	7.5 to 15 kW	900 W to 6 kW	900 W to 3kW
Applicable servo drive	G5 Servo Drive (for rotary servomotor)		1S Servo Drive
Encoder resolution	17-bit absolute	20-bit incremental/ 17-bit absolute	23-bit absolute
Protective structure	IP67	IP67	IP67
Ordering information	G5 Series Catalog (Cat. No.I815)		1S Series Catalog (Cat. No.I821)

I/O

Series	NX	GX
Type	Modular I/O	Block I/O
Communications interface	EtherCAT	EtherCAT
Number of connectable units	• 63 units max. • Input: 1,024 bytes max., output: 1,024 bytes max.	One expansion unit can be connected with one digital I/O terminal (16 inputs + 16 outputs)
I/O types	• Digital I/O • Analog I/O • Encoder input • Pulse output • Temperature input • Safety	• Digital I/O • Analog I/O • Encoder input • Expansion unit
Features	• Over 100 models of I/O units including position interface, temperature inputs and integrated safety • High-speed I/O units synchronized with the EtherCAT cycle • NsynX technology provides deterministic I/O response with nanosecond resolution • Detachable front connector with push-in type screw-less terminals in all NX I/O units • Up to 32 digital inputs or outputs	• Wide variety of lineup: digital I/O, analog I/O, and encoder input units • Easy maintenance: removable I/O terminal • Easy set-up: automatic and manual address setting
Mounting	DIN track	DIN track
Ordering information	NX-series I/O System Catalog (Cat. No.R183)	GX Series Data Sheet

SAFETY

Product name	NX Safety CPU Unit	NX Safety Input Unit	NX Safety Output Unit
Network	FSoE – Safety over EtherCAT	FSoE – Safety over EtherCAT	FSoE – Safety over EtherCAT
Applicable Standards	EN ISO 13849-1, 2 (PLe/Safety Category 4), IEC 61508 (SIL3), EN 62061 (SIL CL3), EN 61131-2	EN ISO 13849-1, 2 (PLe/Safety Category 4), IEC 61508 (SIL3), EN 62061 (SIL CL3), EN 61131-2	EN ISO 13849-1, 2 (PLe/Safety Category 4), IEC 61508 (SIL3), EN 62061 (SIL CL3), EN 61131-2
Programming	• IEC 61131-3 standard • PLCopen Function Blocks for Safety	---	---
Number of safety master connections	32/128	---	---
Number of safety input/output points	---	• 4 points • 8 points	• 2 points • 4 points
Number of test output points	---	2 points	---
Terminal block	---	Screwless clamping terminal block	Screwless clamping terminal block
Features	• Freely mixing with standard NX I/O • Reusable certified programs • NX variables sharing in the NJ controller project	• Freely mixing with standard NX I/O • The 4-point unit can be directly connected with OMRON non-contact switches and singlebeam sensors • I/O data monitoring in the NJ controller project	• Freely mixing with standard NX I/O • The 2-point unit is characterized by large output breaking current of 2.0 A • I/O data monitoring in the NJ controller project
Mounting	DIN track	DIN track	DIN track
Ordering information	NX-SL/SI/SO Data Sheet		