OMRON

AUTOMATION & SAFETY

Sysmac Family Brochure

Integrated Machine Automation Control

sysmac
always in control

Sysmac Family Brochure

One complete machine automation solution integrates Logic, Motion, Vision, Safety, Robotics, Sensing, and Enterprise. The Sysmac family of products continues to grow, while remaining true to its roots as One Controller, with One Connection, programmed using One Software.

Controller

NJ1/NJ3/NJ5 CPU Units

NX7 CPU Units

NX/NJ-Series
- One CPU for Logic, Motion, Vision, Safety, Robot, Database Connectivity, and Semiconductor Communication
- Scalable motion control: CPUs for 0, 2, 4, 8, 16, 32, 64, 128, and 256 axes
- One event log for controller, field devices, and network
- Selectable cycle times: .125/.25/.5/1/2/4/8 ms
- Centralized variable database
- EtherCAT and EtherNet/IP ports embedded
- Project encryption to serial number
- Scalable application size: CPUs for 64, 192, or 512 EtherCAT nodes
- NJ CPUs support most CJ-series I/O units

PLCopen CONFORMITY LEVEL
No. 0041
ST
12.06.2012
Datatypes supported: 17 of 26

PLCopen motion control

P. 4

Network I/O

NX I/O & Safety

NX-Series
- Over 70 models of I/O units including position interface, temperature inputs and integrated safety
- High-speed I/O units synchronized with the EtherCAT cycle
- NX Bus technology provides deterministic I/O response with nanosecond resolution
- Flexible system lets you freely mix safety controller and safety I/O units with standard NX I/O
- Automatic backup/restore of all I/O unit parameters
- Detachable terminal blocks with screwless cage clamps
- Safety Function Blocks conforming to IEC 61131-3 standard programming
- PLCopen Function Blocks for safety

P. 12

Visualization

NA HMI

NA-Series
- Widescreen format: 7, 9, 12, and 15 inch
- Sysmac Studio integration and variable sharing
- USB Host & Slave, Dual Ethernet, Serial, and SD/SDHC
- Extensive Vector Graphics Library
- Word, Excel, PDF, and Video Playback
- VB.Net customization

P. 16

Servo

G5 servo drive
- High-response frequency of 2 kHz
- Built-in safety conforming ISO13849-1 Performance Level d
- High accuracy provided by 20 bit encoder
- Advanced vibration suppression functions

G5 servo motor
- Power range from 50 W to 15 kW
- IP67 protection
- Low cogging torque

Linear Servo
- Ironless and iron-core motor types
- 3rd Party linear and rotary motor control
- Safety conforming ISO13849-1 PL-d
- High-response frequency of 2 kHz
- Real time auto-tuning
- Advanced tuning algorithms (vibration suppression, velocity and torque feedforward, friction compensation, disturbance observer)

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Inverter

MX2 V1

- Power range up to 15 kW
- Torque control in open loop
- 200% starting torque
- Dual rated VT 120%/1 min and CT 150%/1 min
- Drive Programming

RX V1

- Power range up to 132 kW
- Sensor-less and closed-loop vector control
- High starting torque in open-loop (200% at 0.3 Hz)
- Full torque at 0 Hz in closed-loop
- Dual rated VT 120%/1 min and CT 150%/1 min
- Drive Programming

Vision and sensing

FQ-M Series and FH Series Vision Solutions

- Designed for High Speed Motion Interface
- Fast and powerful Object Recognition
- Network Connectivity allows ease of I/O mapping
- Smart Calibration provides simple coordinate interface
- Vision Sensor provides compact solution
- Vision System includes quad core processing for inspection advantage

ZW Measurement Sensor

- Compact and lighter weight fiber displacement sensor
- Stable measurements for any material with same mounting position
- Robust sensor head structure

N-Smart Sensors

E3NX-FA Fiber Sensors
- One amplifier with over 300 compatible fiber head options

E3NC-L Compact Laser Sensors
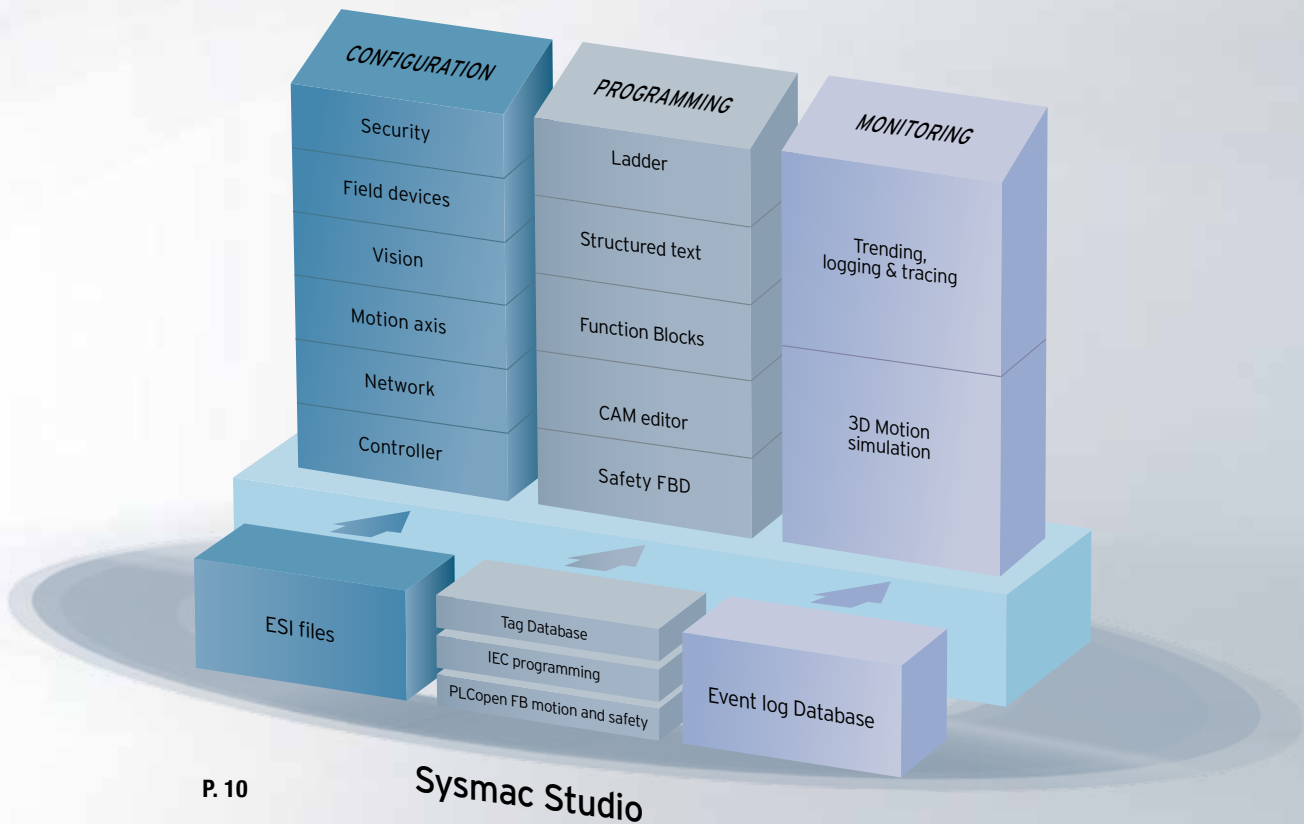- 2 types of heads are available for long distance or small spot detection

E3NC-S Ultra-compact CMOS Laser Sensors
- Stable detection of glossy and matte-black workpieces with the industry's smallest sensor head*

*Based on February 2013 OMRON investigation

CONFIGURATION
- Security
- Field devices
- Vision
- Motion axis
- Network
- Controller

PROGRAMMING
- Ladder
- Structured text
- Function Blocks
- CAM editor
- Safety FBD

MONITORING
- Trending, logging & tracing
- 3D Motion simulation

- ESI files
- Tag Database
- IEC programming
- PLCopen FB motion and safety
- Event log Database

Sysmac Studio

One Controller
Logic, Motion, Vision, and Safety in one

One controller through one connection and one software is how we define the Sysmac automation platform. The Sysmac Machine Automation Controller (MAC) is a single robust Controller that integrates PLC logic, Motion control, Vision processing, Safety function blocks, Robot kinematics, and Database connectivity. This unique architecture drastically reduces machine tact time, and programming complexity, improving performance and speeding development.

Machine control
- Complete integration of Logic, Motion, Vision and Safety
- Synchronous control of all machine network devices
- Primary periodic and Event Tasks with Task execution time monitor
- Modular systems by enabling/disabling EtherCAT Nodes
- Project revision handling with roll-back/roll-forward

System robustness
- One event log for controller, field devices and networks
- Complete RAS functions: Transmission frame error check, timeout, bus diagnosis, Watchdog (WDT), memory check, and topology check, etc.

FailSafe Design
Avoid equipment damage with managed shutdown and fast boot-up

Maintenance Friendly
Connect via USB, Ethernet, or SD card for troubleshooting and project upload/download

Motion control
- Up to 64 axis control
- Single axis moves and multi-axis interpolation
- Selectable Primary Cycle Time: 125µs, 250µs to 8ms (in 250µs increments)
- Electronic gearing and camming synchronization
- On-the-fly electronic CAM changes
- Full control of axes group position, linear and circular interpolation
- Control of up to 8 Delta robots in 2 or 4 Delta robots in 1 ms
- Integrated robotics FB library for Delta-3 control

Lock-Down Security
Protect intellectual property with serial number specific project encryption

intel Powerful Intel MPU

Optimized for industrial environments and a
Realtime Operating System (OS)

Hardware design
• Architecture based on Intel® Atom™ Processor
• The most compact controller in its class
• Built-in USB port and SD card slot
• Fan-less cooling (NJ-series CPUs)

OMRON
NJ501-1500

Factory & Enterprise Network
• Programming
• Other Machine controllers
• HMI / SCADA
• IT systems
• Standard Protocols and Services:
  TCP/IP, FTP, NTP, SNMP
• CIP protocol
• DB_Connection FB's: SQL Client

EtherNet/IP™

Machine Network
• Servos
• Inverters
• Robotics
• Vision systems
• Distributed I/O
• Measurement Sensors

EtherCAT®

• Battery backup for variable memory
• IEC 61131-3 standard Ladder, Structured Text,
  and Inline ST
• PLCopen Function Blocks for Motion Control

PLCopen
CONFORMITY LEVEL

No. 0041
ST
12.06.2012

Datatypes supported: 17 of 26

PLCopen
motion
control

Unit type

CPU Series	CPU Type	Program capacity	Local I/O Expansion	Total I/O Capacity	Cycle Time	EtherCAT Slaves	Motion axes	Cam Tables	Special Functions
NJ-Series	NJ101	3MB	2,560 points using CJ I/O	8,960 with NX I/O	1/2/4 ms	64	-	160	‹None›
							2		
	NJ301	5MB		66,560 with NX I/O	.5/1/2/4 ms	192	4		
							8		
							16	640	SQL / Semi / Robot
	NJ501	20MB					32		SQL / Robot
							64		SQL / Robot
NX-Series	NX701	80MB	*Future capability with NX I/O	64,000 with NX I/O	.125/.25/.5/ 1/2/4/8 ms	512	128		‹None›
							256		

One Connection
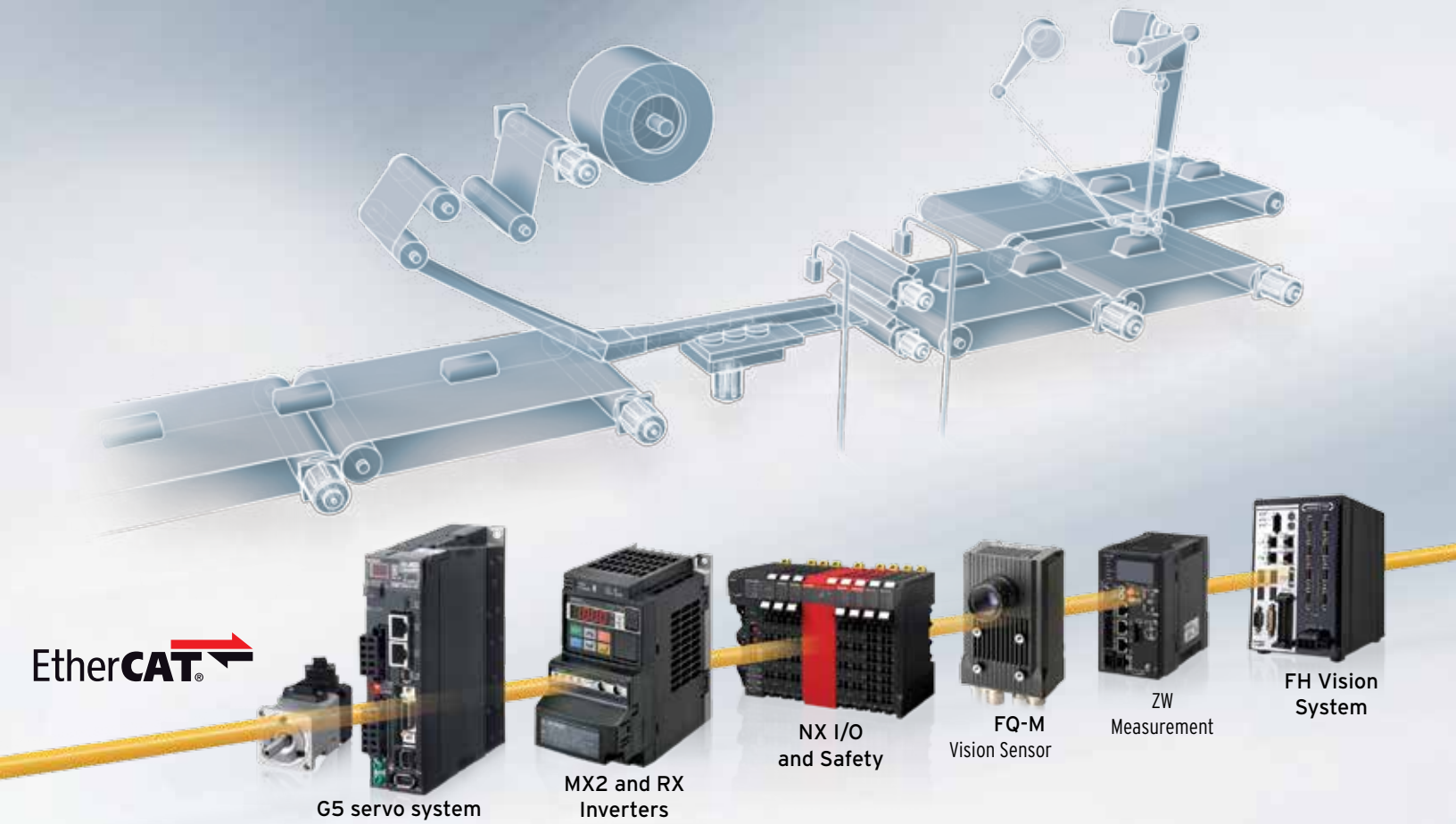## Ethernet for Enterprise and Machine Networking

Through Ethernet, the Sysmac Machine Automation Controller (MAC) connects to both Enterprise and Machine level devices. With the built-in EtherNet/IP port, access the machine HMI, programming software, other machines, or databases. The EtherCAT machine network allows real-time control of devices such as I/O, Servos, Inverters, Vision and Smart Sensors.

VISUALIZATION

EtherNet/IP™

Built-In EtherNet/IP:

- » EtherNet/IP for peer to peer communications
- » SQL Client for fast data read and write to SQL servers
- » FTP Server for access to SD card on CPU
- » TCP/IP and UDP/IP Socket Services
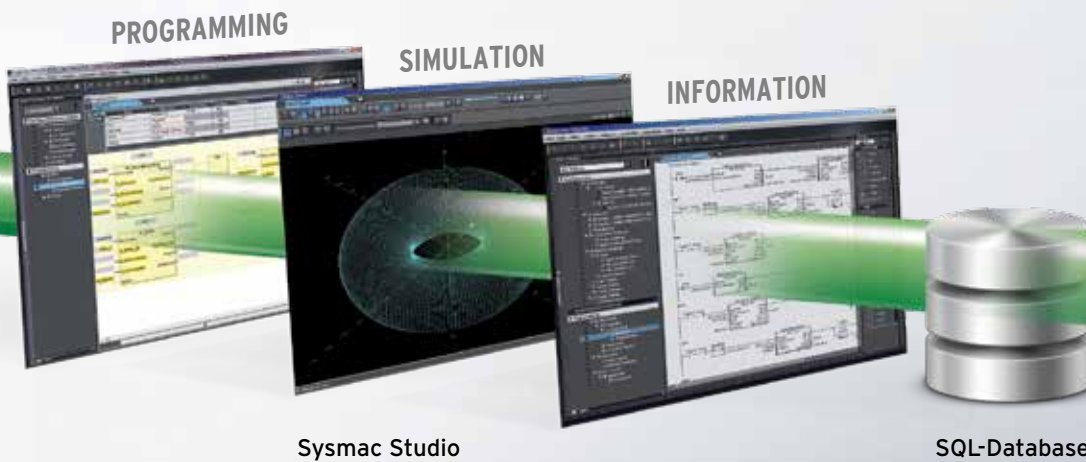- » NTP clock synchronizing
- » SNMP Simple Network Management Protocol

![EtherCAT]

G5 servo system

MX2 and RX Inverters

NX I/O and Safety

FQ-M Vision Sensor

ZW Measurement

FH Vision System

EtherCAT: the optimal machine network

» Selectable Maximum Nodes: 64, 192, 512

» Fastest in class machine network on the market

» Noise immunity to stringent Omron standards

» Embedded in Omron servo drive, inverter, safety, vision sensor and I/O

» Uses standard STP Ethernet cable with RJ45 connectors

Integrated Machine Safety

» FSoE – FailSafe over EtherCAT

» Flexible system configuration with distributed safety I/O

» Single variable database includes Safety I/O

» PLCopen Function Blocks for Safety programming

PROGRAMMING

SIMULATION

INFORMATION

Sysmac Studio

SQL-Database

PLCopen motion control

PLCopen safety

MathWorks Partner

ORACLE®

IBM DB2

MySQL

Microsoft® SQL Server

EtherCAT
The optimal machine network

EtherCAT is the fastest industrial network for machine automation, connecting to I/O, servos, inverters, vision and smart sensors. It is Ethernet-based, fast, deterministic and highly efficient in terms of data transmission. All EtherCAT slave devices have dual ports, enabling line topology without extra hardware like switches, hubs, or routers.

Key features

- High synchronisation accuracy using a distributed clock mechanism.
- Fastest in class network on the market with 100 µs refresh time and less than 1 µs jitter
- Easy setup with automatic address assignment for nodes
- Standard Ethernet cables and connectors
- FSoE - FailSafe over EtherCAT

Slave clock
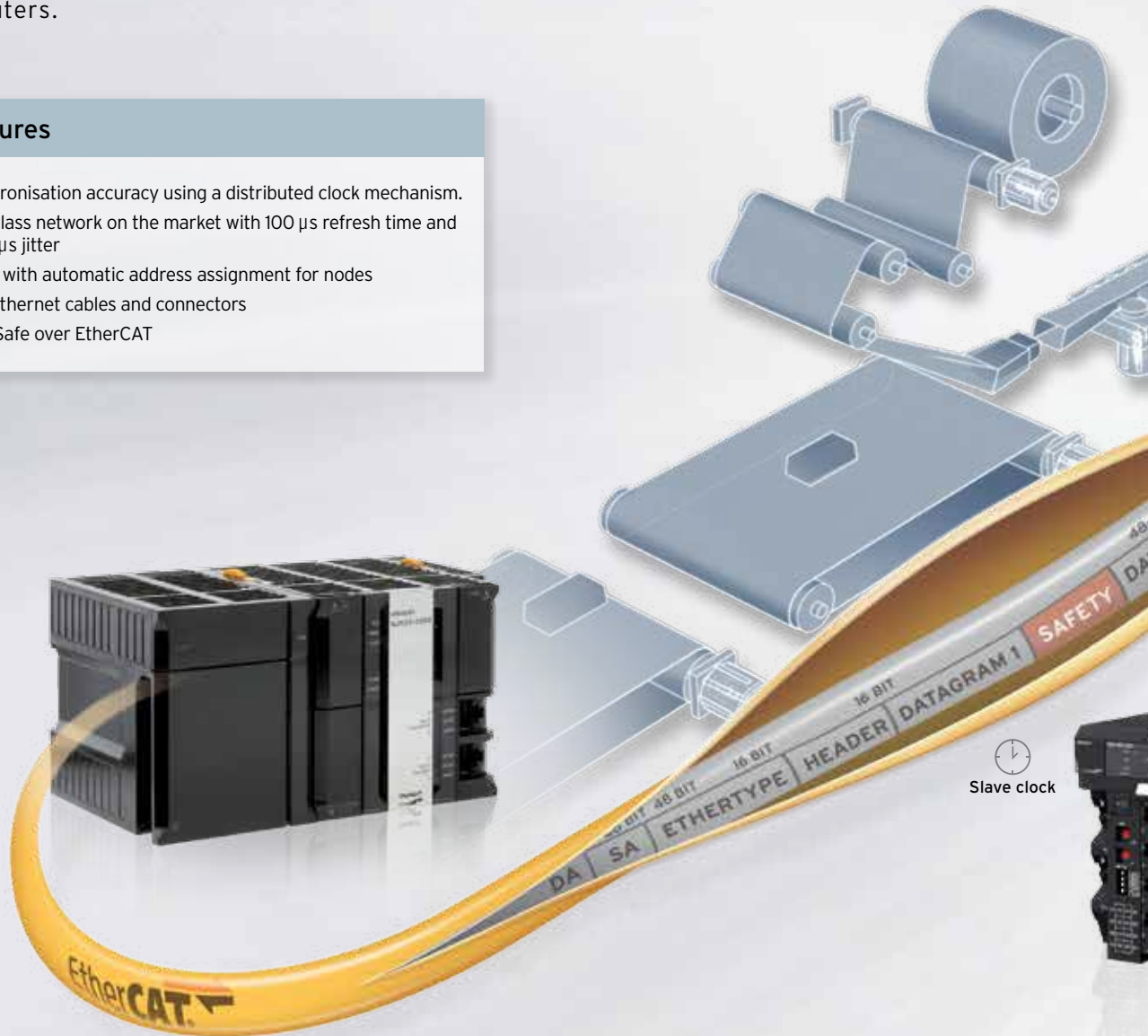
EtherCAT is Industrial Ethernet

The EtherCAT Telegram is contained in the Ethernet Data section of the IEEE 802.3 Ethernet frame. The frame travels through the media at 100 Mbps in full duplex mode.

FailSafe over EtherCAT (FSoE)

Seamless integration of the safety into machine automation. The FSoE frame is included in the EtherCAT process data. This system provides a flexible solution with distributed safety I/O.

Slave clock

Slave clock

Slave clock

Slave clock

NX Safety controller

"On-the-fly" data exchange

The slave devices extract and/or insert data on the fly. This method assures the highest possible throughput.

Simple cabling: 100Base-TX

EtherCAT uses standard 100BASE-TX Ethernet communication very efficiently, over standard shielded Ethernet cables and connectors. No need for network switches. No need for network switches in line topology.

Distributed clocks

The EtherCAT node slave measures the time difference between incoming and returning frame - timestamp-. With these timestamps the master can determine the propagation delay offset to the individual slave accurately. This mechanism ensures accurate synchronisation between devices with less than 1 µs jitter.

Flexible topology

With two EtherCAT ports on all devices, no additional switches are required to create a linear network. EtherCAT junction slaves can be used to build tree and star topologies, which provides section segregation isolation.

One Software
Sysmac Studio for machine creators

The Sysmac Studio software suite programs and configures all Sysmac related hardware, including the NX/NJ Machine Automation Controller (MAC), G5 Servos, MX2 and RX Inverters, FQ-M Vision, NX I/O, NX Safety Controller, N-Smart sensors, and NA HMI. The Sysmac Studio Integrated Development Environment (IDE) provides a single interface for configuration, programming, simulation, and commissioning, all with a common variable database. This environment allows machine creators direct access to all elements of their system, eliminating all traditional data synchronization bottlenecks between control disciplines during development. This IDE also boasts unique features such as built-in 3D Simulation and Vision Sensor setup options, critical in cutting programming and debug time.
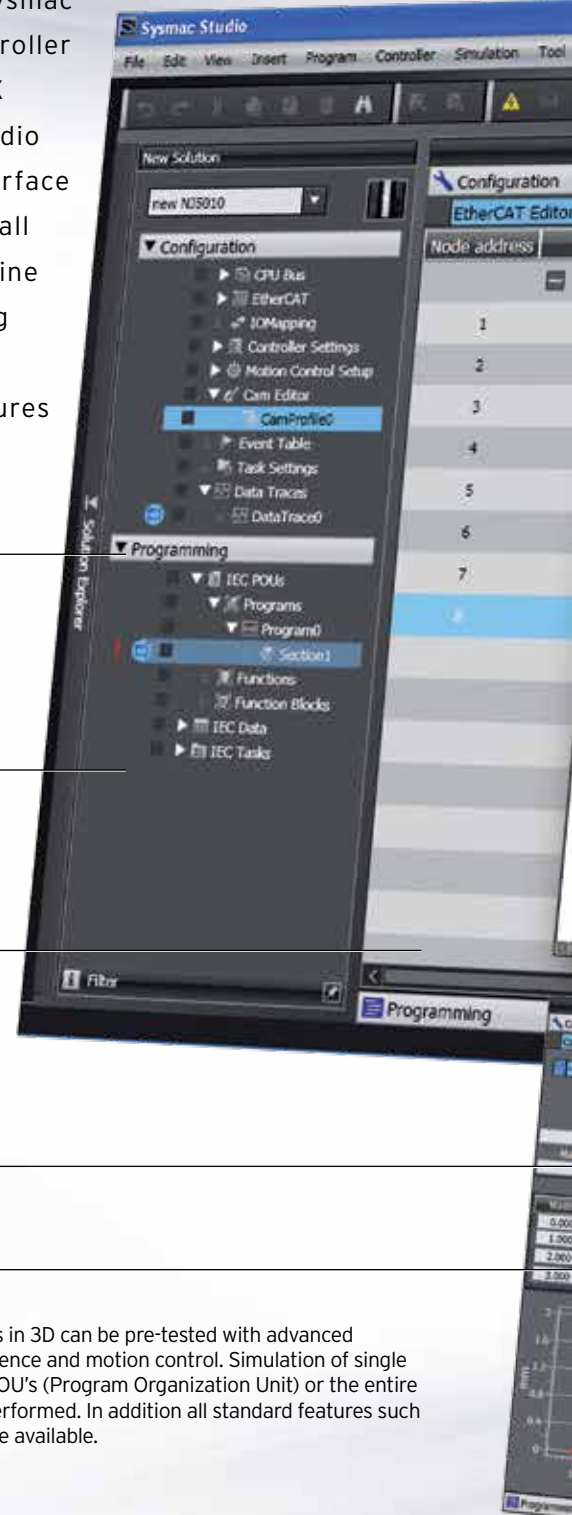
SQL server configuration
Simple setup and testing of log on to Microsoft and Oracle SQL servers.

Design and operability
Unified design environment is provided for programming, configuration and monitoring. It also offers intuitive navigation between control modes.

Configuration and monitoring for servo system
Parameter setting, monitoring and data trace for servo drive and inverter.

Motion control
The graphical CAM editor allows quick implementation of complex motion profiles. CAM tables can be modified on the fly. A PLCopen Function Blocks for the Motion Control library are available to implement general purpose motion control.

Simulation
Motion trajectories in 3D can be pre-tested with advanced simulation of sequence and motion control. Simulation of single Function Blocks, POU's (Program Organization Unit) or the entire program can be performed. In addition all standard features such as Break & Step are available.

Synchronized data tracing
Easy system tuning thanks to integrated and synchronised data tracing of motion commands, position and speed feedback and I/O status and values.

Programming

Multi-tasking and fully compliant to IEC 61131-3 standard. The program editor includes smart support functions such as syntax error check and distinct color segregation of variables and symbols. ST instructions can be directly written in Ladder programs thanks to in-line ST function.

Integrated safety programming

The Function Block Diagram editor includes 79 safety FB/FUN. Conforms to IEC 61131-3 standard programming and PLCopen Function Blocks for Safety*.

* Approved soon

NX I/O
Speed and accuracy for machine performance

Based on an internal high-speed bus, the NX I/O can be controlled with microsecond accuracy and with nanosecond resolution. The I/O range consists of over 70 models including position interface, temperature inputs and integrated safety.

EtherCAT connectivity
- Distributed clock to ensure I/O response with less than 1 μs jitter
- FailSafe over EtherCAT (FSoE)

EtherNet/IP Slave
- Slave device on any 3rd party master
- Enables stand-alone NX Safety control

EtherCAT or EtherNet/IP coupler
- Up to 1024 byte input / 1024 byte output
- Automatic backup/restore of all I/O unit parameters[*1]

Digital I/O
- 4, 8 or 16 points
- Standard, high-speed and Time-Stamp[*2] models

NX I/O Features

- Deterministic I/O response with nanosecond resolution[*2]
- Digital I/O: high-speed and time-stamp models
- Analog I/O: high performance models offer 10 μs conversion time per channel and 1:30000 resolution
- Detachable terminal block with screwless cage clamps
- On/Offline configuration, simulation, and unified troubleshooting in the Sysmac Studio software
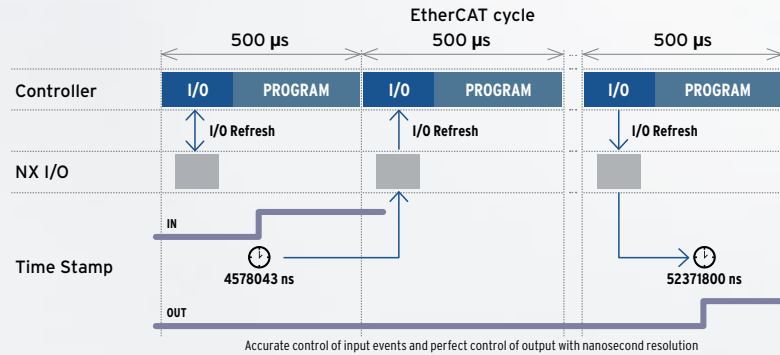
- High signal density; up to 16 I/O points in 12 mm width

NX Bus

The new NX Bus allows for fast and accurate machine control. This is accomplished due to:

- EtherCAT distributed clock
- High-speed I/O synchronization[2]
- I/O with Time-Stamp function[2] (accuracy < 1 **µs**)

Time-Stamp Sequence Example

	EtherCAT cycle		
	500 µs	500 µs	500 µs

Controller: I/O | PROGRAM — I/O | PROGRAM — I/O | PROGRAM

I/O Refresh | I/O Refresh | I/O Refresh

NX I/O

IN

Time Stamp **4578043 ns**   **52371800 ns**

OUT

Accurate control of input events and perfect control of output with nanosecond resolution

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Analog I/O
- +/-10V voltage and 4-20 mA current signals
- 2, 4 or 8 channels per input unit
- 2 or 4 channels per output unit
- Standard and high-performance models

Safety I/O
- Up to 8 safety input points per unit
- Free allocation of the Safety I/O units on the internal high speed bus.

Position Interface
- Encoder input units for connection of external axes to the Sysmac system
- Incremental and absolute encoder support
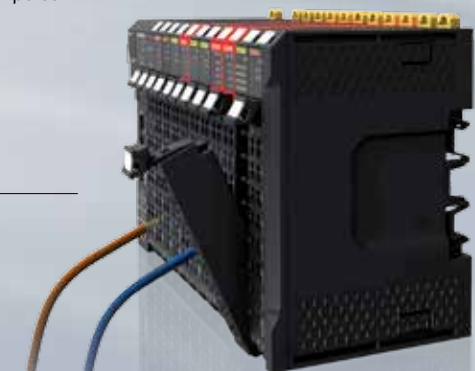- Positioning control unit with pulse train output

Temperature
- Thermocouple or RTD inputs, 2 or 4 per unit

End Cover
- Included with coupler

- Detachable terminal block with screwless cage clamps allows for easy pre-wiring, testing and system maintenance

NX Safety Control
Integrated safety into machine automation

The Sysmac Automation platform integrates a safety solution within our one connection and one software concept. One connection is realized though the use of FailSafe over EtherCAT -FSoE- protocol. The one software is the Sysmac Studio true Integrated Development Environment (IDE) for configuration, programming and maintenance. The NX safety system consists of safety controller and safety I/O units. Both the safety controller and safety I/O can be freely distributed in an I/O rack throughout the network, mixing them in any combination with standard NX I/O. The NX Safety Controller can be used stand-alone as an EtherNet/IP slave.

EtherCAT telegram

NX Safety controller
- The safety controller variables are part of the controller project
- Flexibility and reusability of the programming code

Safety over

NX Safety features

- The NX safety controller can be used stand-alone as an EtherNet/IP slave
- The safety controller meets PLe according to the ISO 13849-1 and SIL3 according to IEC 61508
- Flexible system architecture lets you freely mix safety controller and safety I/O units with standard NX I/O
- Integration in One software, Sysmac Studio
- Certified programs can be reused, which reduces the amount of verification work

Functional Safety Type Approved

TÜVRheinland

FS

ISO 13849-1, PLe

IEC 61508, SIL3

Note: Scheduled to be certificated soon.

- Integrated Development Environment in Sysmac Studio provides one common software for hardware configuration, programming and maintenance of the Sysmac platform
- 79 safety FB/FUN conforming to IEC 61131-3 standard programming
- PLCopen Function Blocks for safety*

EtherNet/IP

NX/NJ Controller

Sysmac Studio

FailSafe over EtherCAT frame

| CDM | Safe data | CRC_0 | Safe data | CRC_1 | ... | Conn ID |

- Up to 8 safety input points per unit
- Flexible connectivity to a wide selection of safety devices
- I/O data monitoring in the controller project

*Approved soon

Visualization

The NA series human machine interface (HMI) provides direct access and visualization into the entire Sysmac platform solution. Programmed within the same software as the rest of the solution allows users to create intuitive visually expressive interfaces with no integration effort. Built-in troubleshooting capabilities minimize downtime, while VB.Net allows users to customize with infinite possibilities.

One Project

- Save controller and HMI to a single file
- Complete machine revision control
- Common environment work-flow
- Configure individual users with multiple access levels

One Tag Database

Share NJ Controller Variables (Tags) in the machine interface application using "Intelli sense"

Multimedia Display

Present machine system data clearly and effectively using rich media, including PDF, video, and other user files like Microsoft® Word and Excel.

Intuitive Environment

- Object centric properties, animations, events and actions
- Page Editor for object hierarchy
- Rotate, resize, and align

Complete System Simulation

- Integrated simulation of logic, motion, and visualization
- No hardware required for development

Flexible Customization

- VB.NET scripting for advanced function
- Intelligent Application Gadget (IAG) Libraries for code reuse

Wide screen displays:
7, 9, 12, 15 inch

Black or silver bezel

Sysmac platform visual look

Edge to edge design

RUN indicator

LED backlit function keys

Resistive touch screen...ideal for environments where operators wear gloves and water proofing is needed

1	USB slave (Tool port)	4	2 Ethernet ports, one for factory one for office network
2	2x USB	5	SD Card slot
3	1 Serial*	6	24V DC

* NA system version 1.00 supports the serial port using VB.NET code.

G5 Servo System
At the heart of every great machine

Great machines are born from a perfect match between control and mechanics. G5 gives you that extra edge to build more accurate, faster, smaller and safer machines.

EtherCAT®

EtherCAT connectivity
- Compliant with CoE -CiA402 Drive profile-
- Cyclic Synchronous Position, Velocity and Torque modes
- Embedded Gear Ratio, Homing and Profile Position mode
- Distributed clock to ensure high precision synchronisation (< 1 us)

Safety conformance
- PL-d according ISO13849-1
- STO: IEC61800-5-2
- SIL2 according to EN61508

G5 servo system features

- Compact size servo drives with EtherCAT connectivity built-in
- High-response frequency of 2 kHz
- Load vibration suppression and dual feedback control
- Embedded Safety conforming ISO13849-1 Performance Level d
- Advanced tuning algorithms (Anti-vibration function, torque feedforward, disturbance observer)
- Wide range of servo motors
- Voltage 120, 230 and 460 VAC
- Power from 50 W to 15 KW
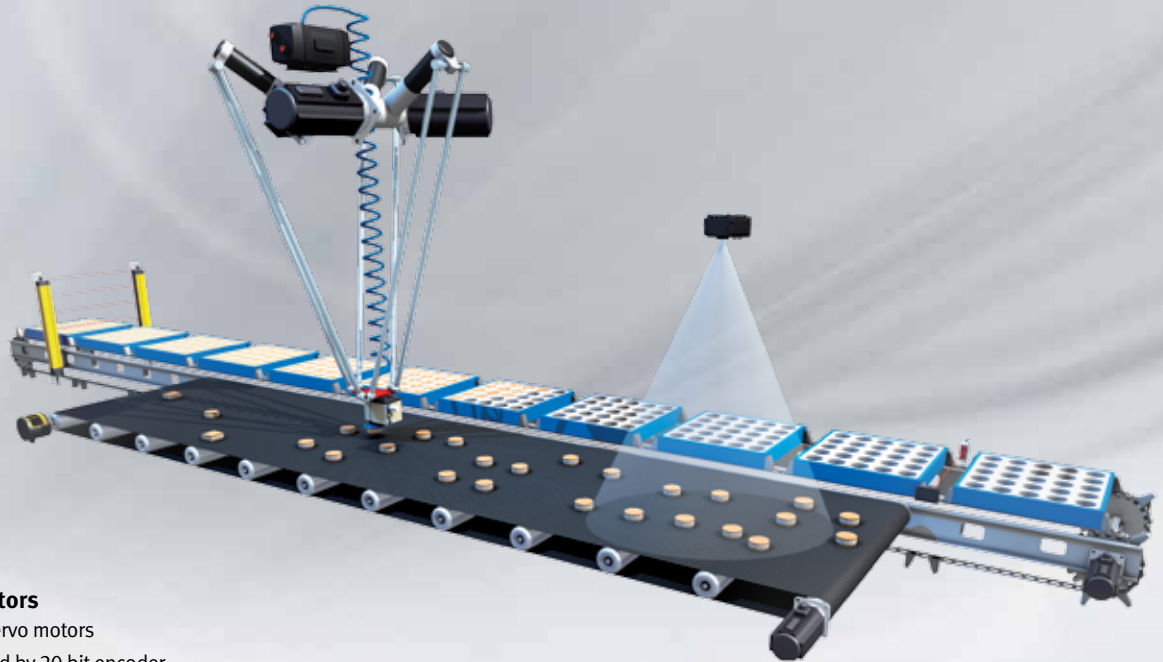
Improved rotary motors

- Low cogging torque servo motors
- High accuracy provided by 20 bit encoder
- IP67 for all motors and connectors
- Large range of motors from 0.16 Nm up to 96 Nm nominal torque (224 Nm peak)

High Speed Linear Motors

- Iron-core & Iron-less components
- Stand alone external axis
- 3 & 4 axis gantry systems
- Up to 5 ms max speed with 1μ repeatability

MX2 V1 and RX V1 Inverter
## Fast response inverter for Machine Control

Thanks to its advanced design and algorithms, the MX2 inverter provides smooth control down to near zero speed, plus precise operation for cyclic operations and torque control capability in open loop. The RX series combines high performance, application functionality and customization to match the precise requirements. Both, the MX2 and RX inverter series are fully integrated within the Omron Sysmac Studio software.

Torque control in open loop
• Ideal for low to medium torque applications

Quick response to load fluctuation
• Stable control without decreasing machine speed improves quality and productivity

MX2 V1

EtherCAT®
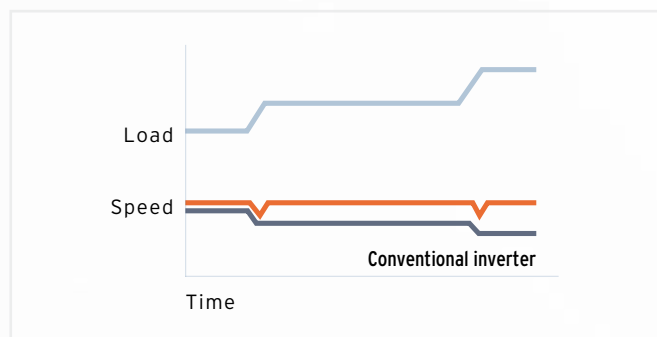
MX2 V1 features

• Power range up to 15 kW
• Torque control in open loop, ideal for low to medium torque applications
• 200% starting torque near stand-still operation (0.5 Hz)
• Double rating VT 120%/1 min and CT 150%/1 min
• IM and PM motor control
• Indexer functionality
• Drive Programming
• 24 VDC backup supply for control board and communications
• Built-in application functionality (i.e Brake control)
• PID for process control

Motor efficiency control

- Double rating VT 120%/1 min and CT 150%/1 min
- Energy saving function

RX V1

EtherCAT®

200% starting torque

- Near stand-still operation
- High starting torque in open loop
- Control of fast cyclic loads

(Example of Speed vs. Torque Characteristics: RX series V1 type)
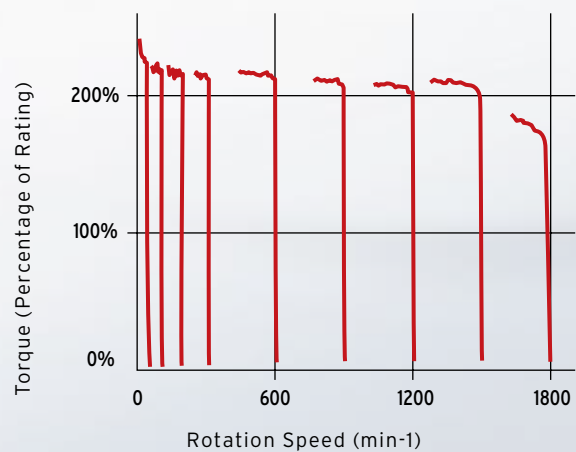
RX V1 features

- Power range up to 132 kW
- Sensor-less and closed-loop vector control
- High starting torque in open-loop (200% at 0.3 Hz)
- Full torque at 0 Hz in closed-loop
- Dual rated VT 120%/1 min and CT 150%/1 min
- Indexer functionality
- Drive Programming
- Built-in application functionality (i.e ELS - Electronic Line Shaft)

FQ-M Vision Sensor
Designed for object tracking

The FQ-M series is a vision sensor designed specifically for pick and place applications. It comes with EtherCAT embedded and can be configured and monitored from Sysmac Studio software. The FQ-M series is compact, fast and includes an incremental encoder input for easy tracking and calibration.

EtherCAT®

Connectivity
• EtherCAT port for object tracking
• Ethernet port for advanced configuration and monitoring
• Encoder input for accurate "on the fly tracking" and easy calibration
• Automatic strobe timing control

Performance
• Up to 5000 pieces per minute with 360 degree rotation
• Stable and robust detection under changeable environmental conditions

FQ-M features

• Made specifically for tracking applications
• Designed to work within Sysmac integrated automation with embedded EtherCAT and integrated software tool
• Smart camera with EtherCAT: camera, image processing and connectivity in one
• Vision sensor with encoder input for tracking function
• Calibration function of the complete system
• Can inspect a wide range of objects
• Sysmac Studio software for vision system operation and setting

EtherCAT.

Ethernet

Design

- Camera and image processing in one
- Standard C-mount lenses; choose the field of view and focus distance you need
- Variety of industrial connector types (angled, straight) for correct mounting

One Software

- Fully integrated within Sysmac Studio
- Intuitive and icon driven set-up and configuration
- Trending and logging function
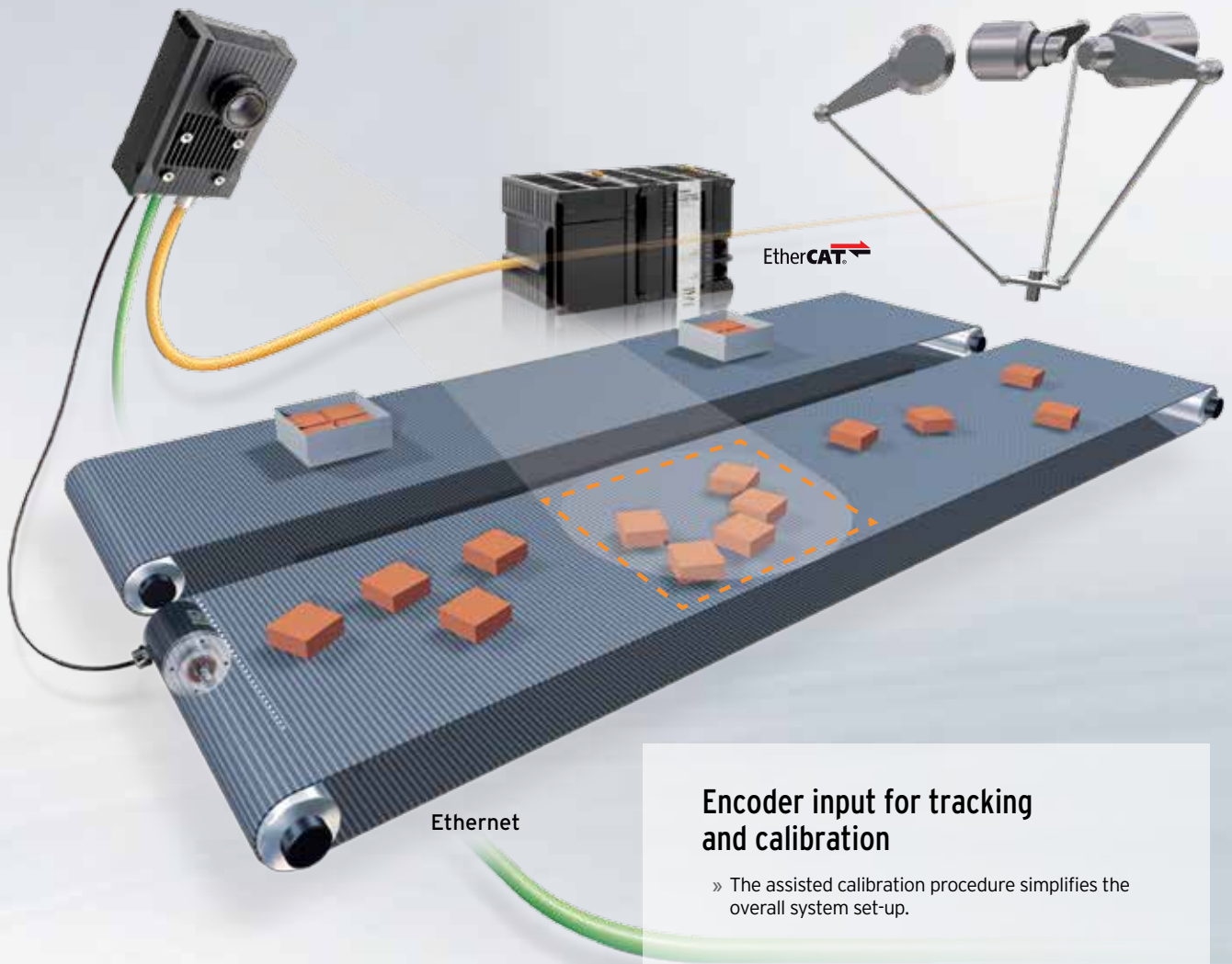
Encoder input for tracking and calibration

» The assisted calibration procedure simplifies the overall system set-up.

» Objects that overlap within more than one field of view are segregated and its data is ignored.

First shot: The position and orientation data of pieces 1, 2 and 3 are sent to the controller.

Second shot: Only the position and orientation data of piece 4 are sent to the controller.

FH Vision System
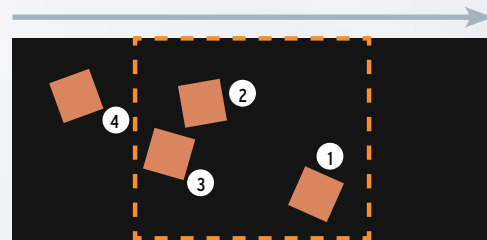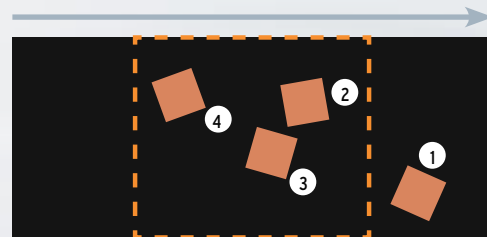## Machine vision tailored for pick & place

The FH Vision System is optimized to detect the position and orientation of any object at high speed and with high accuracy. This provides a new generation of image processing technologies within an intuitive user interface optimized for positioning applications. The built-in EtherCAT communications enable reliable and easy networking with motion control, increasing the overall machine performance.

Stable measurements under changing conditions
- Differences of the work piece
- Dust and dirt
- Changing ambient environment

Alignment and quality inspection in one system
- Inspection of scratches and defects
- Detection of dirty or overlapping objects
- Edge and corner breakage inspection
- Automatic calibration for robots, XY, and UVW stages

Shape based object positioning:
- Separation of attached objects
- Detection of partially hidden objects
- Compensation for rounded or broken edges

Flexible camera installation
- Use different fields of vision
- Install at any angle

Features

- Easy and guided setup using the Application Wizard
- Simple auto-calibration with the picker
- High-speed cameras and positioning algorithm
- Simultaneous quality inspection
- EtherCAT connectivity built in
- NPN / PNP output in one controller

ZW Measurement Sensor
Ultra-compact, Lightweight sensor measures any material

The ZW confocal fiber displacement sensor delivers stable, non-contact in-line measurements of height, thickness and other dimensions. It solves the problems of traditional laser triangulation sensors: deviation between different material with inclination tolerance. The compact sensing head has no electronic parts to eliminate problems of installation space and mutual interference, electrical/magnetic noise, temperature rise and mechanical positioning. The EtherCAT interfaces integrates height and position coordinates for profile mapping.

- Ultra-compact sensing head: 24x24mm weighs only 105g
- High flexibility fiber optic cable from sensor to controller - up to 32m
- Mount sensing head one time - no need to re-tune for changing materials
- Separate amplifier provides white LED light source, spectroscope and processor to convert reflected color light to distance
- Stable measurements for any material - glass, stainless steel, mirror, white ceramic and PCB substrates
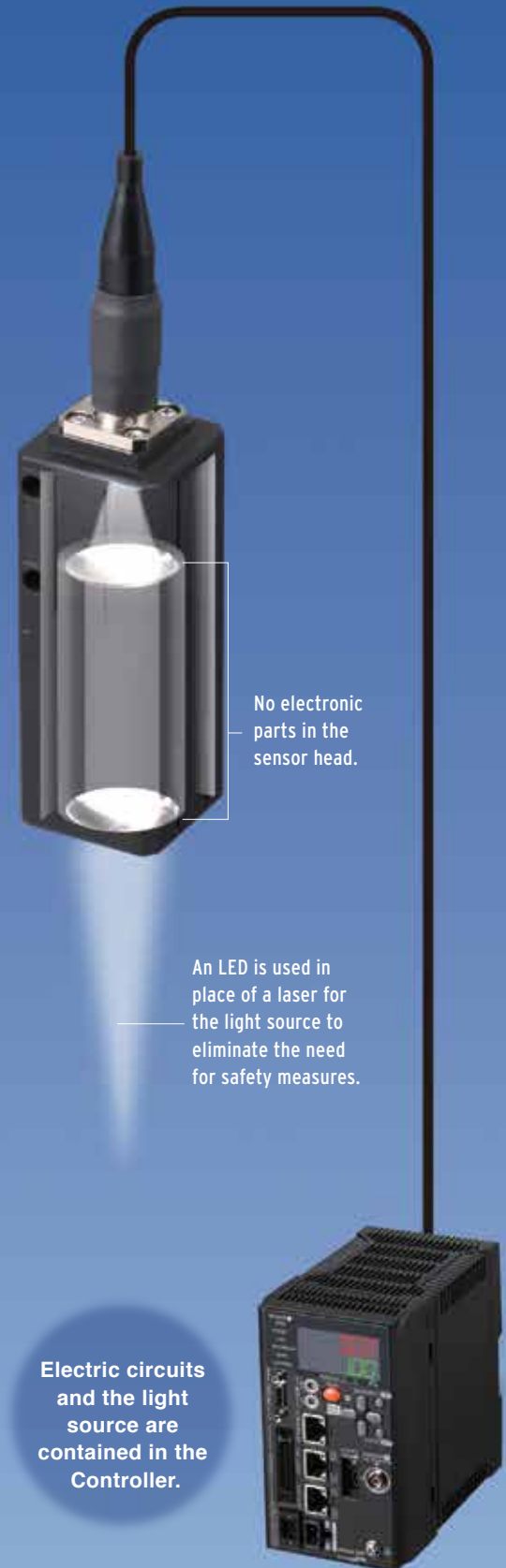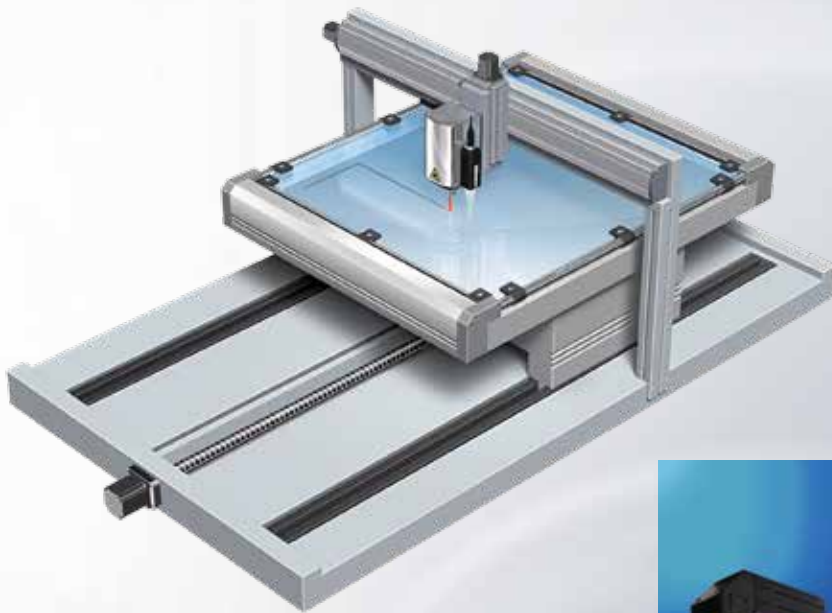
No electronic parts in the sensor head.

An LED is used in place of a laser for the light source to eliminate the need for safety measures.

Electric circuits and the light source are contained in the Controller.

N-Smart Sensors
Customized Sensor Arrays on EtherCAT

The Sysmac family includes Omron's advanced N-Smart sensor solution. The N-Smart sensors are building blocks to a fully customizable Fiber and Laser sensor array that fits any application and communicates seamlessly to your machine controller over EtherCAT. The N-Smart solution is simple and dependable, ideal for high-speed workpieces and high-precision position feedback control. Onsite maintenance is improved with clearly readable high-contrast displays on each sensor. Setup without software using built-in push buttons.

E3NX-FA
Fiber Amplifier Units

E3NC-S
Ultra-compact CMOS
Laser Sensors

N-Smart Amplifier Units
Easy application with consistent operating procedures.

E3NC-L
Compact
Laser Sensors

E3NW
Sensor
Communications Units

N-Smart
Presence / Detection / Measurement

Applications with Many Sensors:
More convenience and even lower costs with a network.

EtherCAT®
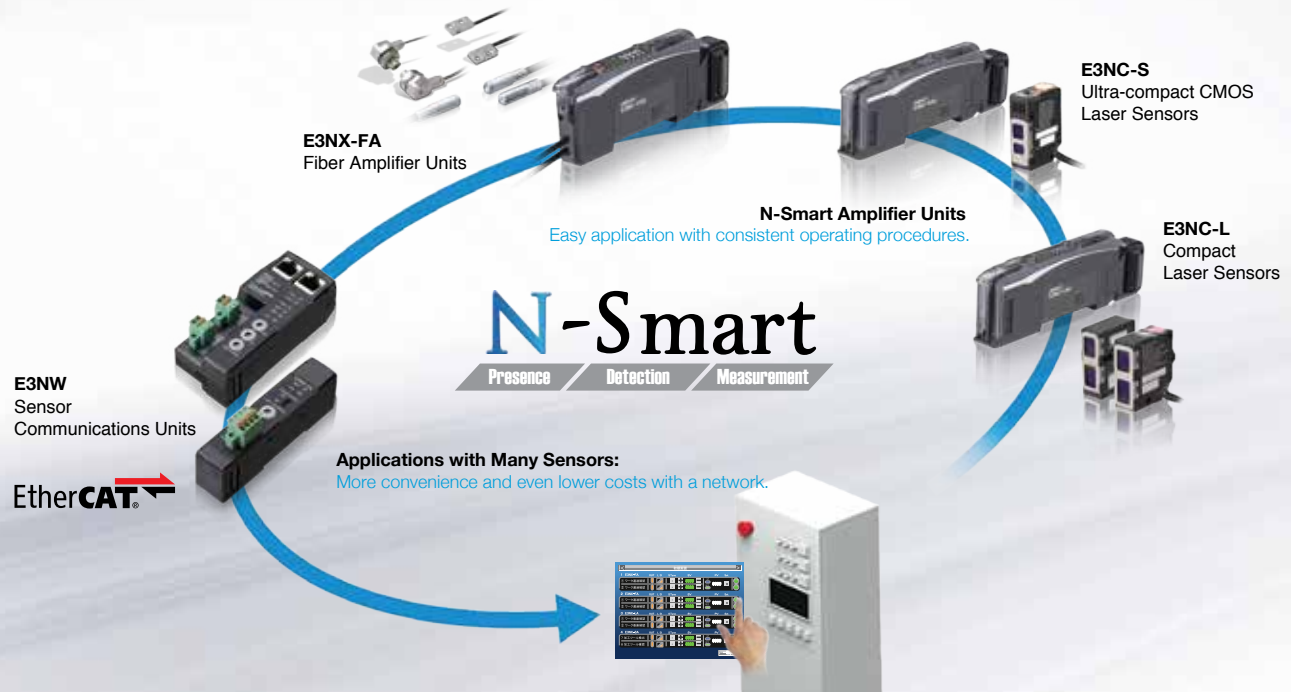
Features

- Ultra-easy Advanced Smart Tuning with the push of a button
- More dependable detection of high-speed targets
- Predictive Maintenance to reduce downtime
- Highly visible white LED display, an industry first
- E3NX-FA has 1.5x the sensing distance of conventional amplifiers

Master

E3NW-ECT
Sensor Communications Unit

EtherCAT®

···Max 30
Sensors*2

Inter-Unit Network
DS-Bus[*1]
PAT.P

···Max 10
Sensors

···Max 10
Sensors

···Max 8
DS Units
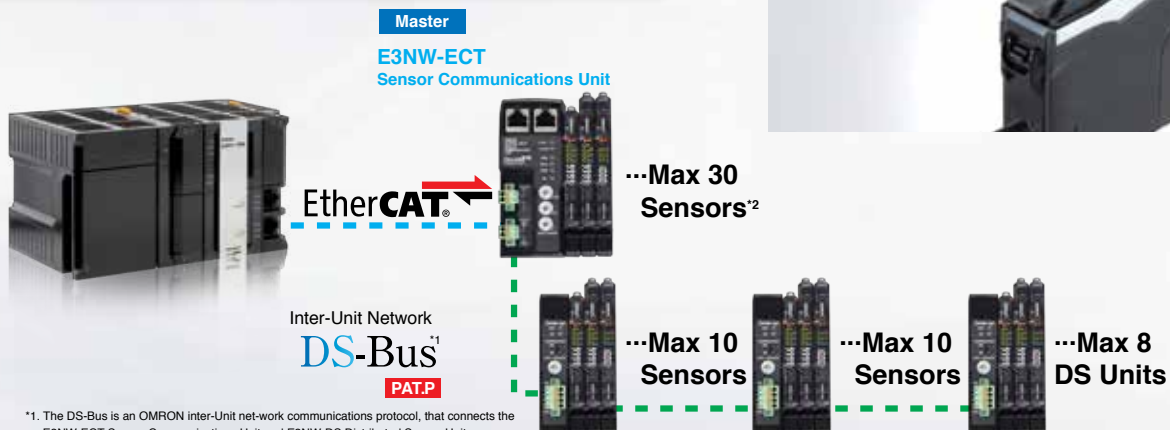
*1. The DS-Bus is an OMRON inter-Unit net-work communications protocol, that connects the E3NW-ECT Sensor Communications Unit and E3NW-DS Distributed Sensor Units.
*2. Each E3NW Node supports a maximum of 30 total sensors, including DS-Bus sensors.

30µs[1]

Optimum Settings Achieved Even in Super-high-speed Mode

More Dependable Detection of High-speed Workpieces

The N-Smart solution enables super high-speed 30µs response time. This allows for more stable detection of faster workpieces than with conventional models.[2]
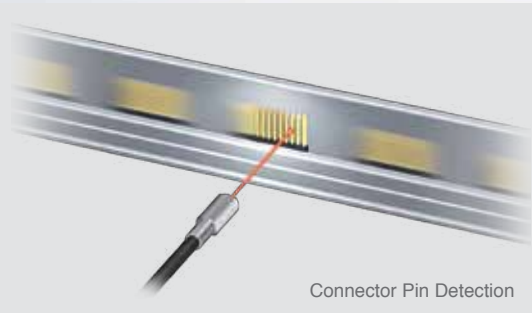
Connector Pin Detection

[1]. Model with 1 output: 30 µs, model with 2 outputs: 32 µs.
[2]. E3X-HD.

Increased dynamic range for improved detection stability

×1/2000 ←——————————————————————————— **×1** ——→ **×20**

Excessive Incident Level
▶ **Incident light reduced.**

Insufficient Incident Level
▶ **Incident light increased.**
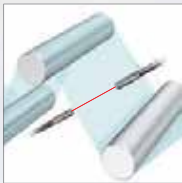
Saturation Distance: **1.2 mm**

For E32-T11R Fiber Unit

Stable Detection Even for 1.5-mm Differences in Levels

E3NC-S
Ultra-compact CMOS Laser Sensors

For Small Workpieces and Long-Distance Detection

E3NC-L
Compact Laser Sensors

E3NX-FA
Fiber Amplifier Units

Advanced Performance for Ultra-stable, Ultra-easy Detection

Semiconductor communications

Cost-effective

The NJ series SECS/GEM CPU Unit integrates machine control and host communications, reducing time, cost, and complexity.

Simple connection
No separate computer, special communications Unit or software required

Save space in equipment
Direct connection of CPU Unit to host

No annual support contract
Reducing running costs

HOST

HSMS communications

One CPU

EtherCAT

Previously
Separate computer or special communications unit is required.
HSMS/SECSII communications
Separate computer + SECS software
Machine Controller
Vision Sensor   Servo Drive I/O   Inverter

SEMI standards-full-GEM support

Non-GEM	E30 GEM	GEM300 E39 OSS E87 CMS, E40 PJM, E94 CJM, E90 STS	Application Model
E5 SECS II			Message Definition
E4 SECS I	E37 HSMS-SS		Logical Protocol
	TCP/IP		
RS-232C	Ethernet		Physical Protocol

⬚ Supported by NJ501-1340

Easy Design

User-friendly SECS/GEM Configurator facilitates project design.

Programming with variables
No need to specify memory addresses

One CPU Unit
No communications between separate computer and machine controller required

Quick SECS/GEM setting
Easy setting with SECS/GEM Configurator

SECS/GEM Configurator screen

sysmac
always in control
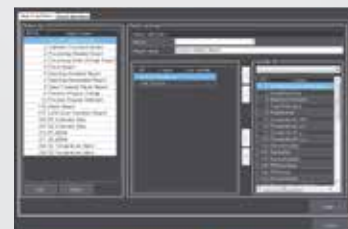
SECS/GEM Setting Example (Alarm Report)

Equipment	GEM scenario	HOST

Easy setup with SECS/GEM Configurator!

Previously

(1) Alarm Report Send (S5, F1) is sent to HOST.

```
S5,F1 Alarm  Report Send
L,3
 1. <ALCD>
 2. <ALID>
 3. <ALTX>
```

(3) Event Report Send (S6, F11) is sent to HOST after receiving S5, F2.

```
S6,F11 Event Repot Send
L,3
 1. <DATAID>
 2. <CEID>
 3. L,a
    1. L,2
       1. <RPTID1>
       2. L,b
          1. <V1>
            :
          2. <Vb>
```

(1) Define S5, F1
Just enter required parameters.

SECS/GEM Configurator screen

12	Temperature1_L
13	Temperature1_LL
100	AlarmsEnabled
101	AlarmsSet
104	EventsEnabled

(3) Set GEM scenario
By setting Event IDs to send when an alarm occurs or is cleared, the Controller automatically sends S6, F11. (No communications program is required.)

S5,F1 Alarm Report Send →

← S5,F2 Alarm Report Acknowledge

S6,F11 Event Report Send →

← S6,F12 Event Report Acknowledge

(2) Response (S5, F2) received from HOST

(4) Response (S6, F12) received from HOST

Service and Support

OMRON Automation Competence Centers and technical offices across the World

- ◻ Automation Competence Center
- ● Application Engineer
- ○ Channel Partner
- ☎ Tsunagi laboratory

COMPETENCE

OMRON

Design

Our wide network of machine automation specialists will help you select the right automation architecture and products to meet your requirements.

Proof of concept

As your project matures, make use of our Automation Centers to test and catch-up with technology trends in motion, robotics, networking, safety, quality control, etc. Make use of our Tsunagi (connectivity) laboratory to interface, test and validate your complete system with our new machine network (EtherCAT) and factory network (EtherNet/IP).

We will assign a dedicated application engineer to assist with initial programming and proof testing of the critical aspects of your automation system. Our application engineers have in-depth expertise in and knowledge of networks, PLCs, motion, safety and HMIs when applied to machine automation.

Map labels:

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Oregon City
Salt Lake City
Eden Prairie
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Milwaukee
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Val D'or
Montreal
Quebec City
Sherbrooke
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Commissioning

Our worldwide service and support network makes the export of your product simple. All our products are global products, meeting global standards – CE, cULus, NK, LR. We will support you on-site with your customer anywhere in the world.

Serial production

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