OMRON
INDUSTRIAL AUTOMATION

# One Fieldbus Network EtherCAT®


Omron247.com/EtherCAT

# One Network at the Core of Machine Automation

## Ethernet for Control Automation Technology: EtherCAT®

Tired of the network trade-offs you had to make in the past:
Distance for speed, number of devices for performance, precision for ease-of-use?

We heard you. Now you can change those compromises to gain flexibility and operating efficiency.

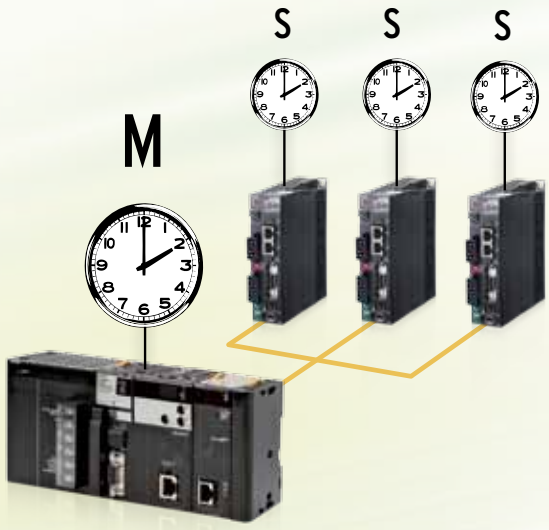
Omron Industrial Automation now introduces EtherCAT as the premier machine control network with a full line of automation products that delivers unparalleled network performance (capable of updating 40 axis in 276 microseconds), using standard Ethernet cables and supported by over 1,300 companies world-wide.

Installation is finally back to basics with no routers, no switches, and no hubs. EtherCAT is capable of Line, Star, Ring topologies; 100 meters between nodes; and possible expansion at each node all contribute to maximum network flexibility for machine design.

At full-duplex and over 90 percent bandwidth, EtherCAT delivers nearly double the performance of the closet network competitor.

### Distributed clock synchronization

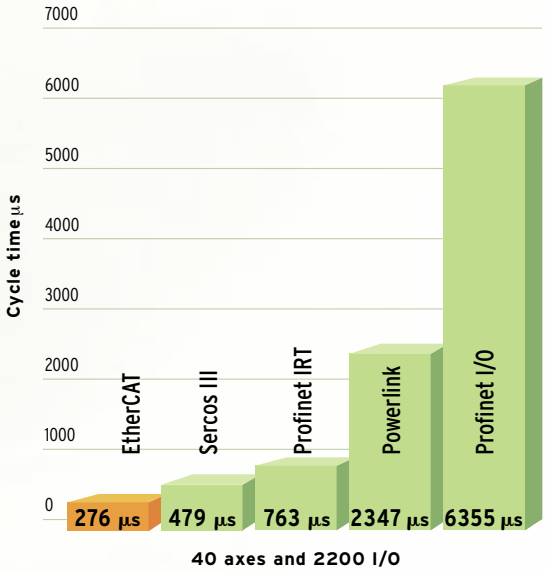
» With the distributed clock system, all servos in an EtherCAT application can be synchronized within a microsecond tolerance




### Ethernet optimized for machine control

» EtherCAT is a real-time Ethernet based network optimized for machine control with unrivalled performance.

» The diagram below shows the cycle time of several Ethernet based networks under the same test conditions




Note: Refer to www.ethercat.org for complete test details

# One Network Delivers a New Control Foundation

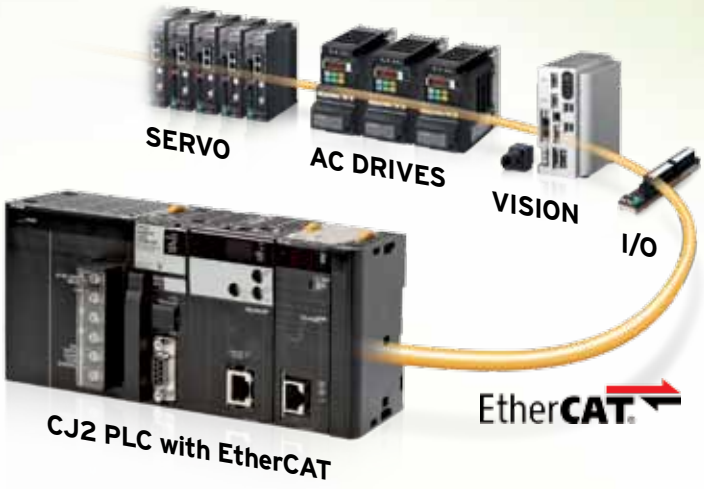
## Omron Industrial Automation Past Reflects The Future

More than 50,000 machine builders worldwide have first-hand experience with Omron's commitment delivering first-class machine automation. Over 50 years, Omron built a solid reputation for long-lasting product quality, ease of use, simplicity of integration and operation, and exceptional value.

Amazing results are no accident. It comes as a result of phenomenal execution and tireless dedication making your automation project a success. When we claim your machine works, it works!

EtherCAT is now available to achieve your highest expectations on precision, performance and consistency. Limited only by your imagination, the network will NOT become the bottleneck of your next machine design. Choices include an integrated scalable PLC platform or a stand-alone version for machine control.

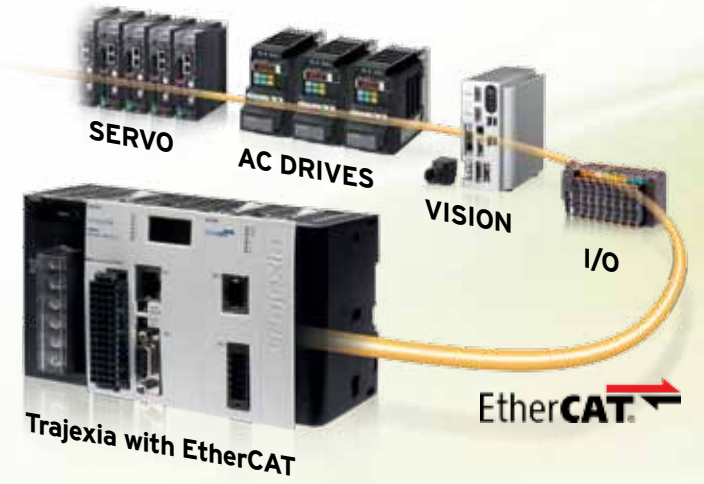
**Works as Designed, Delivers as Promised.**




### Complete and compact machine controller

Logic and motion control integrated in the CJ2 PLC platform. Control of 16 axes; positioning with linear and circular interpolation

- Scalable and modular solution
- Simplified programming
- Precise motion functionality made simple
- One Machine network




### Total freedom in motion control

Flexible and dedicated motion controller. Control up to 64 axes with advanced functions including registration, cams and gearing. Intuitive and easy to program or debug applications

- Stand-alone and scalable motion controller
- Powerful motion control
- Intuitive and powerful engineering
- One Machine network

# PLC-based Position Control with EtherCAT

## Complete and compact machine controller

In a compact form, you can have a complete and powerful position control system when combining the Omron CJ2 PLC, the CJ1W-NC□8□ (EtherCAT) unit and the G5 servo drives with EtherCAT built-in. This solution controls up to 16 servo axes in independent and coordinated motion such as linear and circular interpolation, as well as control of up to 64 I/O devices which includes I/O, AC Drives, vision for complete automation system.


**Scalable and modular solution**
- CJ1 and CJ2 family CPUs available
- EtherCAT masters for 2, 4, 8 and 16 axes
- Wide range of CJ PLC modules

EtherNet/IP

**One machine network**
- Servo
- AC Drive
- Vision system
- Distributed I/O


EtherCAT Node Status


G5 Servo Template

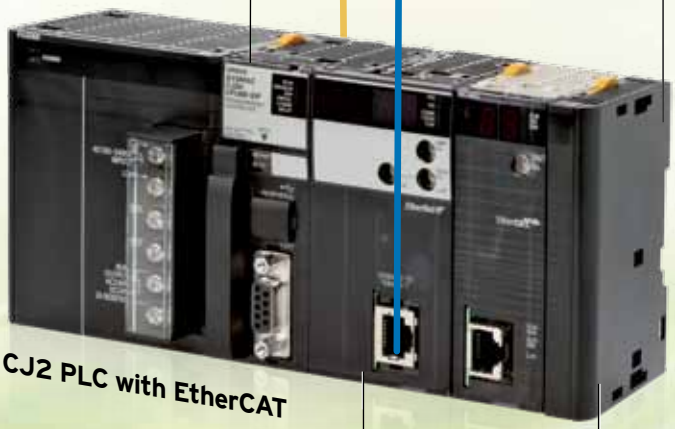

MX2 AC Drive Template


FZM1 Vision Template

**Complete Omron Architecture Solutions - operator interface to EtherCAT**

This full solution includes the NS-Series Operator Interface Terminals, available with pre-made templates for EtherCAT communication to I/O, Servo, Vision, and Drives.

These templates can be dropped into user projects and scaled or customized, providing an instant interface for system troubleshooting and maintenance, minimizing development time.


CJ2 PLC with EtherCAT

**Simplified programming**
- Complete machine control from CJ PLC program
- PLCopen motion function blocks

**Precise motion functionality made simple**
- Position control of up to 16 axes
- Circular and linear interpolation
- Position registration capture
- Up to 4 parallel tasks can run on the NC, each can have up to 500 steps.
- This local sequencer reduces PLC complexity and increases motion performance

PLCopen motion control

## PLC-based Position Control with EtherCAT

- Position controller supporting up to 16 servo axes
- 64 nodes includes I/O, AC Drives, and vision devices
- Compact unit compatible with CJ2 PLCs
- Circular and linear interpolation
- Linear and infinite axes
- Position registration capture
- 3 zone outputs (cam outputs or PLS) per axis
- Certified PLCopen motion control function blocks: Part 1 and 2
- Support for servo, AC drive, vision system and I/O in a single EtherCAT network
- Ladder logic programming
- Programmable sequences
- Comprehensive diagnostics

## Ethernet Network Cables

**EtherCAT Connector (RJ45 to RJ45)**

| Length | Model |
|---|---|
| 0.3 m | XS5W-T421-AMD-K |
| 0.5 m | XS5W-T421-BMD-K |
| 1 m | XS5W-T421-CMD-K |
| 2 m | XS5W-T421-DMD-K |
| 3 m | XS5W-T421-EMD-K |
| 5 m | XS5W-T421-GMD-K |
| 10 m | XS5W-T421-JMD-K |
| 15 m | XS5W-T421-KMD-K |

**SOFTWARE NOTES:** Versions required for EtherCAT functionality
* CX-DRIVE requires v2.3 or higher
** CX-ONE requires v4.1 or higher (includes CX-DRIVE, CX-Programmer)

## Software for CJ2 and NC□8□ - CX-Drive, CX-ONE

| Category | Applicable Products | Description | Model |
|---|---|---|---|
| Drive software | G5 servos and MX2 AC drives | CX-DRIVE V2.□ Software for Pro* | CX-DRIVE-V2X |
| Automation software | CJ2 PLCs and TJ2 motion controller | CX-ONE V4 DVD, 1 license, DVD**<br>(NC□8□ uses CX-Programmer v9.31 or higher) | CXONE-AL01D-V4 |

## Reference List

| PLC CPU item description | Model |
|---|---|
| CJ2M CPUs | CJ2M-CPU□ |
| CJ2H CPUs (Support for CST and CSV from v1.4) | CJ2H-CPU□ |
| Power supply for CJ PLC system, 100-240 VAC | CJ1W-PA20□ |
| Power supply for CJ PLC system, 24 VDC | CJ1W-PD02□ |
| **CJ EtherCAT Master unit description** | **Model** |
| Position controller unit - EtherCAT Master - 4 axes + 64 nodes (Support for CST and CSV from v1.3) | CJ1W-NC482 |
| Position controller unit - EtherCAT Master - 8 axes + 64 nodes (Support for CST and CSV from v1.3) | CJ1W-NC882 |
| Position controller unit - EtherCAT Master - 16 axes + 64 nodes (Support for CST and CSV from v1.3) | CJ1W-NCF82 |
| Position controller unit - EtherCAT Master - 2 axes | CJ1W-NC281 |
| Position controller unit - EtherCAT Master - 4 axes | CJ1W-NC481 |
| Position controller unit - EtherCAT Master - 8 axes | CJ1W-NC881 |
| Position controller unit - EtherCAT Master - 16 axes | CJ1W-NCF81 |
| **PLC I/O units description** | **Model** |
| Refer to Omron247.com website for details of available CJ1 I/O units | CJ1W-□□□□□ |

# Trajexia with EtherCAT

## Total freedom in motion control

The stand-alone Trajexia controller TJ2-MC64, together with an EtherCAT master TJ2-ECT, provides a significant improvement in machine performance and accuracy allowing you to run your machines faster. Controlling all 64 axes with a minimum system cycle time and with the use of 64 bit integers, Trajexia TJ2 ensures the fastest operation at the highest accuracy. It is ideal for highly-demanding packaging, printing and textile machines. As you would expect, a wide choice of best-in-class actuators are available to meet your needs in terms of size, performance and reliability.


**Powerful motion control**
- Single axis moves and multi-axes interpolation
- Electronic cams and gearboxes
- Control of SCARA and Delta robots

Ethernet

**One machine network**
- Servo
- AC Drive
- Vision system
- Distributed I/O

Trajexia with EtherCAT

**Superior visualization with simplified functionality**
- Operator interface terminals from 5.7 to 15-inch TFT/CFT or LED
- Superb resolution up to 1024 x 768

**Intuitive and powerful programming**
- Motion BASIC programming
- Dedicated motion commands

**Stand-alone and scalable motion controller**
- Freedom to choose the machine PLC
- Scalability with EtherCAT masters for 4, 16 and 64 axes
- Built-in EtherNet/IP

trajexia

EtherNet/IP

## Trajexia with EtherCAT Features

- Powerful control of 64 axes
- Scalability provided by the 3 versions of EtherCAT masters; 4, 16 and 64 axes
- Linear, circular, helical or spherical interpolation, electronic cams and gearboxes
- Control of SCARA and Delta robots
- Multi-tasking controller capable of running up to 22 tasks simultaneously
- Open communication – Serial and Ethernet/IP built-in, PROFIBUS-DP, DeviceNet and CANopen options
- Reuse of engineering code, compatible programming with existing Stand-alone and PLC-based Trajexia CPUs
- Support for servo, AC Drive, vision system and I/O in a single EtherCAT network

**SOFTWARE NOTES:** Versions required for EtherCAT functionality
* CX-DRIVE requires v2.3 or higher
** CX-ONE requires v4.1 or higher (includes CX-DRIVE, CX-Programmer, and CX-MotionPro)
*** TJ2 Trajexia programmed through CX-MotionPro integrated tool or Trajexia Studio stand-alone tool.

## Software for TJ2 Trajexia - CX-Drive, CX-ONE, Trajexia Studio Series

| Category | Applicable Products | Description | Model |
|---|---|---|---|
| Drive software | G5 servos and MX2 AC drives | CX-DRIVE V2.☐ Software for Pro* | CX-DRIVE-V2X |
| Automation software | CJ2 PLCs and TJ2 motion controller | CX-ONE V4 DVD, 1 license, DVD** | CXONE-AL01D-V4 |
| Controller software | TJ2 motion controller | Trajexia Studio stand-alone software, V1.3.3 or higher*** (TJ2 uses Trajexia Studio v1.3.3 or higher) | TJ1-STUDIO |

## Reference List

| Trajexia controller items description | Model |
|---|---|
| Trajexia motion controller Unit, up to 64 axes | TJ2-MC64 |
| Power supply for Trajexia system, 100-240 VAC | CJ1W-PA202 |
| Power supply for Trajexia system, 24 VDC | CJ1W-PD022 |
| **EtherCAT master description** | **Model** |
| Trajexia EtherCAT master unit (up to 4 servo drives) | TJ2-ECT04 |
| Trajexia EtherCAT master unit (up to 16 servo drives) | TJ2-ECT16 |
| Trajexia EtherCAT master unit (up to 64 servo drives) | TJ2-ECT64 |
| **Optional units description** | **Model** |
| Trajexia flexible axis unit (for 2 analog or pulse stations) | TJ1-FL02 |
| Trajexia DeviceNet slave unit | TJ1-DRT |
| Trajexia PROFIBUS-DP slave unit | TJ1-PRT |
| Trajexia CANopen unit | TJ1-CORT |

# Accurax G5 servo system

## At the heart of every great machine

Great machines are born from a perfect match between electronics and mechanics. Accurax G5 gives you that extra edge to build more accurate, faster, smaller and safer machines. You will benefit from an almost 25 percent reduction in motor weight, and gain 50 percent cabinet space.

**Up to 50% cabinet size reduction**

- 40% smaller drive
- Extra 10% saving thanks to side by side mounting


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 synchronization



**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)
- 50 W to 15 kW
- 120, 240 and 480 VAC

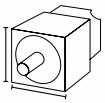
### G5 Servo Features

- Compact size servo drives with EtherCAT connectivity built-in
- High-response frequency of 2 kHz
- Load vibration suppression
- Embedded safety conforming to ISO13849-1 Performance Level D STO SIL2 stop category 3
- Advanced tuning algorithms (Anti-vibration function, torque feedforward, disturbance observer)
- Wide range of linear and rotary servo motors
- 2 registration inputs
- Dual feedback position control (full-closed loop)

## Rotary Motors Reference List

| Rotary servo motor specifications | | | | | | Servo drive specifications | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Speed (rpm)** | **Voltage** | **Flange (mm)** | **Rated Torque** | **Capacity** | **Motor Model** | **Drive Model** | **W** | **D** | **H** |
| 3000 | 230 V | 40x40 | 0.16 Nm | 50 W | R88M-K05030(**H/T**)-(**B**)S2 | R88D-KN01H-ECT | 40 | 132 | 150 |
| | | | 0.32 Nm | 100 W | R88M-K10030(**H/T**)-(**B**)S2 | R88D-KN01H-ECT | | | |
| | | 60x60 | 0.64 Nm | 200 W | R88M-K20030(**H/T**)-(**B**)S2 | R88D-KN02H-ECT | | | |
| | | | 1.3 Nm | 400 W | R88M-K40030(**H/T**)-(**B**)S2 | R88D-KN04H-ECT | 55 | | |
| | | 80x80 | 2.4 Nm | 750 W | R88M-K75030(**H/T**)-(**B**)S2 | R88D-KN08H-ECT | 65 | 172 | |
| | | 100x100 | 3.18 Nm | 1 kW | R88M-K1K030(**H/T**)-(**B**)S2 | R88D-KN15H-ECT | 86 | | |
| | | | 4.77 Nm | 1.5 kW | R88M-K1K530(**H/T**)-(**B**)S2 | R88D-KN15H-ECT | | | |
| | 400 V | 100x100 | 2.39 Nm | 750 W | R88M-K75030(**F/C**)-(**B**)S2 | R88D-KN10F-ECT | 92 | 172 | 150 |
| | | | 3.18 Nm | 1 kW | R88M-K1K030(**F/C**)-(**B**)S2 | R88D-KN15F-ECT | | | |
| | | | 4.77 Nm | 1.5 kW | R88M-K1K530(**F/C**)-(**B**)S2 | R88D-KN15F-ECT | | | |
| | | | 6.37 Nm | 2 kW | R88M-K2K030(**F/C**)-(**B**)S2 | R88D-KN20F-ECT | 94 | 195 | 198 |
| | | 120x120 | 9.55 Nm | 3 kW | R88M-K3K030(**F/C**)-(**B**)S2 | R88D-KN30F-ECT | 130 | 213 | 250 |
| | | 130x130 | 12.7 Nm | 4 kW | R88M-K4K030(**F/C**)-(**B**)S2 | R88D-KN50F-ECT | | | |
| | | | 15.9 Nm | 5 kW | R88M-K5K030(**F/C**)-(**B**)S2 | R88D-KN50F-ECT | | | |
| 2000 | 230 V | 130x130 | 4.77 Nm | 1 kW | R88M-K1K020(**H/T**)-(**B**)S2 | R88D-KN10H-ECT | 86 | 172 | 150 |
| | | | 7.16 Nm | 1.5 kW | R88M-K1K520(**H/T**)-(**B**)S2 | R88D-KN15H-ECT | | | |
| | 400 V | 100x100 | 1.91 Nm | 400 W | R88M-K40020(**F/C**)-(**B**)S2 | R88D-KN06F-ECT | 92 | 172 | 150 |
| | | | 2.86 Nm | 600 W | R88M-K60020(**F/C**)-(**B**)S2 | R88D-KN06F-ECT | | | |
| | | 130x130 | 4.77 Nm | 1 kW | R88M-K1K020(**F/C**)-(**B**)S2 | R88D-KN10F-ECT | | | |
| | | | 7.16 Nm | 1.5 kW | R88M-K1K520(**F/C**)-(**B**)S2 | R88D-KN15F-ECT | | | |
| | | | 9.55 Nm | 2 kW | R88M-K2K020(**F/C**)-(**B**)S2 | R88D-KN20F-ECT | 94 | 195 | 198 |
| | | | 14.3 Nm | 3 kW | R88M-K3K020(**F/C**)-(**B**)S2 | R88D-KN30F-ECT | 130 | 213 | 250 |
| | | 176x176 | 19.1 Nm | 4 kW | R88M-K4K020(**F/C**)-(**B**)S2 | R88D-KN50F-ECT | | | |
| | | | 23.9 Nm | 5 kW | R88M-K5K020(**F/C**)-(**B**)S2 | R88D-KN50F-ECT | | | |
| 1500 | 400 V | 176x176 | 47.8 Nm | 7.5 kW | R88M-K7K515C-(**B**)S2 | R88D-KN75F-ECT | 233 | 334 | 250 |
| | | 220x220 | 70.0 Nm | 11 kW | R88M-K11K015C-(**B**)S2 | R88D-KN150F-ECT | 261 | 271 | 450 |
| | | | 95.5 Nm | 15 kW | R88M-K15K015C-(**B**)S2 | R88D-KN150F-ECT | | | |
| 1000 | 230 V | 130x130 | 8.59 Nm | 900 W | R88M-K90010(**H/T**)-(**B**)S2 | R88D-KN15H-ECT | 86 | 172 | 150 |
| | 400 V | 130x130 | 8.59 Nm | 900 W | R88M-K90010(**F/C**)-(**B**)S2 | R88D-KN15F-ECT | 92 | 172 | 150 |
| | | 176x176 | 19.1 Nm | 2 kW | R88M-K2K010(**F/C**)-(**B**)S2 | R88D-KN30F-ECT | 130 | 213 | 250 |
| | | | 28.7 Nm | 3 kW | R88M-K3K010(**F/C**)-(**B**)S2 | R88D-KN50F-ECT | | | |
| | | | 43.0 Nm | 4.5 kW | R88M-K4K510C-(**B**)S2 | R88D-KN50F-ECT | | | |
| | | | 57.3 Nm | 6 kW | R88M-K6K010C-(**B**)S2 | R88D-KN75F-ECT | 233 | 334 | 250 |

**Flange dimensions**

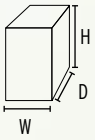


**Motor model type designation detail**

**H=** 230 V and Incremental Encoder
**T=** 230 V and Absolute Encoder
**F=** 400 V and Incremental Encoder
**C=** 400 V and Absolute Encoder

**B=** Motor with Brake (Blank=No brake)

**Drive dimensions**



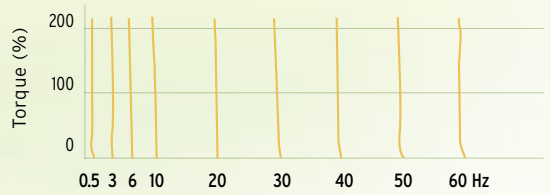
# MX2 AC Drives

## Born to drive machines

Thanks to the advanced design and algorithms, the MX2 provides smooth control down to zero speed, plus precise operation for cyclic operations and torque control capability in open loop. The MX2 is fully integrated within the Omron automation solutions.

**Frequency Response vs. Torque Variation**

(Example with 7.5 kW 4-pole motor)




**200% starting torque**
- Near stand-still operation (0.5 Hz)
- Smooth control of high inertia loads
- Control of fast cyclic loads


**Torque control in open loop**
- Ideal for low to medium torque control applications
- Can replace a flux vector AC Drive or servo drive in suitable systems

EtherCAT®

**EtherCAT connectivity**
- Optional EtherCAT communications module
- Compliant with CoE-CiA402 Drive profile
- Velocity Mode

**Quick response to load fluctuation**
- MX2 provides accurate speed control with less than 2% error at 1Hz
- Stable control without lowering machine speed

**Special motors**
- High speed motors up to 1000 Hz

## MX2 Features

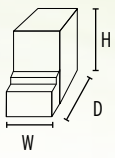
- Torque control in open loop, ideal for low to medium torque applications
- 200% starting torque near stand-still operation (0.5 Hz)
- Specialized motor control for PM motor and high-speed motors up to 1000 Hz
- One parameter auto-tuning just by entering the kW rating of the motor
- Simple positioning functionality built in

## Reference List

**AC Drive specifications**

| Voltage | Variable Torque | | Constant Torque | | Drive Model | EtherCAT Communication Module | W | D | H |
|---|---|---|---|---|---|---|---|---|---|
| | Motor (kW) | Output current | Motor (kW) | Output current | | | | | |
| Single-phase 200 V | 0.2 | 1.2 A | 0.1 | 1.0 A | 3G3MX2-AB001 | 3G3AX-MX2-ECT | 68 | 141 | 128 |
| | 0.4 | 1.9 A | 0.2 | 1.6 A | 3G3MX2-AB002 | | | | |
| | 0.55 | 3.5 A | 0.4 | 3.0 A | 3G3MX2-AB004 | | | 155 | |
| | 1.1 | 6.0 A | 0.75 | 5.0 A | 3G3MX2-AB007 | | 108 | 202,5 | |
| | 2.2 | 9.6 A | 1.5 | 8.0 A | 3G3MX2-AB015 | | | | |
| | 3.0 | 12.0 A | 2.2 | 11.0 A | 3G3MX2-AB022 | | | | |
| Three-phase 200 V | 0.2 | 1.2 A | 0.1 | 1.0 A | 3G3MX2-A2001 | 3G3AX-MX2-ECT | 68 | 141 | 128 |
| | 0.4 | 1.9 A | 0.2 | 1.6 A | 3G3MX2-A2002 | | | | |
| | 0.55 | 3.5 A | 0.4 | 3.0 A | 3G3MX2-A2004 | | | 145 | |
| | 1.1 | 6.0 A | 0.75 | 5.0 A | 3G3MX2-A2007 | | | 178 | |
| | 2.2 | 9.6 A | 1.5 | 8.0 A | 3G3MX2-A2015 | | 108 | 203 | |
| | 3.0 | 12.0 A | 2.2 | 11.0 A | 3G3MX2-A2022 | | | | |
| | 5.5 | 19.6 A | 3.7 | 17.5 A | 3G3MX2-A2037 | | 140 | | |
| | 7.5 | 30.0 A | 5.5 | 25.0 A | 3G3MX2-A2055 | | | 187 | 260 |
| | 11 | 40.0 A | 7.5 | 33.0 A | 3G3MX2-A2075 | | | | |
| | 15 | 56.0 A | 11 | 47.0 A | 3G3MX2-A2110 | | 180 | 207 | 296 |
| | 18.5 | 69.0 A | 15 | 60.0 A | 3G3MX2-A2150 | | 220 | | 350 |
| Three-phase 400 V | 0.75 | 2.1 A | 0.4 | 1.8 A | 3G3MX2-A4004 | 3G3AX-MX2-ECT | 108 | 176 | 128 |
| | 1.5 | 4.1 A | 0.75 | 3.4 A | 3G3MX2-A4007 | | | 203 | |
| | 2.2 | 5.4 A | 1.5 | 4.8 A | 3G3MX2-A4015 | | | | |
| | 3.0 | 6.9 A | 2.2 | 5.5 A | 3G3MX2-A4022 | | | | |
| | 4.0 | 8.8 A | 3.0 | 7.2 A | 3G3MX2-A4030 | | | | |
| | 5.5 | 11.1 A | 4.0 | 9.2 A | 3G3MX2-A4040 | | 140 | | |
| | 7.5 | 17.5 A | 5.5 | 14.8 A | 3G3MX2-A4055 | | | 187 | 260 |
| | 11 | 23.0 A | 7.5 | 18.0 A | 3G3MX2-A4075 | | | | |
| | 15 | 31.0 A | 11 | 24.0 A | 3G3MX2-A4110 | | 180 | 207 | 296 |
| | 18.5 | 38.0 A | 15 | 31.0 A | 3G3MX2-A4150 | | | | |

**Drive dimensions**
(With Communication Module)



# FZM1 vision system

## Machine vision tailored for pick & place

The FZM1 Vision System is optimized to detect the position and orientation of any object at high speed and with high accuracy. The FZM1 provides a new generation of image processing technologies and 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.

EtherCAT®

**Stable measurements under changing conditions**

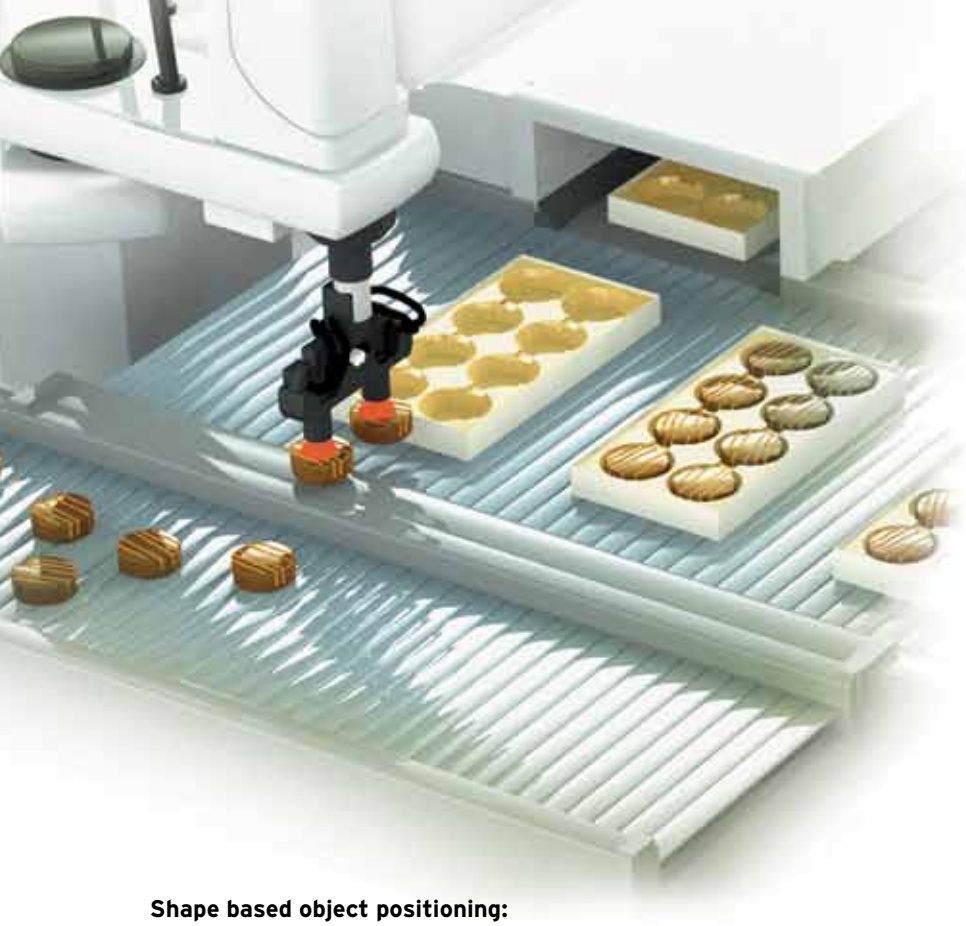
- Differences of the work piece
- Dust and dirt
- Changing ambient environment


**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

**Flexible camera installation**

- Use different fields of vision
- Install at any angle



**Shape based object positioning:**

- Separation of attached objects
- Detection of partially hidden objects
- Compensation for rounded or broken edges

## FZM1 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

## Reference List

| Controller description | Model |
|---|---|
| FZM1 controller with EtherCAT, Two cameras, NPN Output | FZM1-350-ECT |
| FZM1 controller with EtherCAT, Two cameras, PNP Output | FZM1-355-ECT |

| Camera and Monitor description | Model |
|---|---|
| High-speed Monochrome camera, 300000 pixels | FZ-SH |
| High-speed Color camera, 300000 pixels | FZ-SHC |
| Digital Monochrome camera, 300000 pixels | FZ-S |
| Digital Color camera, 300000 pixels | FZ-SC |
| Digital Monochrome camera, 2 million pixels | FZ-S2M |
| Digital Color camera, 2 million pixels | FZ-SC2M |
| LCD Monitor | FZ-M08 |

## Motion and Vision Convergence

The convergence of Motion and Vision is rapidly occurring in the automation marketplace. Control designers are mixing these technologies to replace manual switchover, provide a higher level of protection from improper pick-and-place and make adjustments before actuation.

The standard quality control approach of inspect and reject is still common, but for some demanding dynamic applications, it has moved to inspect and correct for the optimal solution.

Although these technologies are vastly different [Motion: Position, velocity and torque; Vision: Lighting, lensing and pattern recognition] when combined, it leads to exciting results.

EtherCAT is uniquely qualified to marry these two technologies in the same system because of the ease of integration and network performance. Omron Industrial Automation's vision offerings inspect positional details for pick-and-place and robotic applications up to 250 frames per second and will not disrupt axis control; also, motion controllers now reach 40 axes in less than 274 microseconds on the same system.

As EtherCAT unfolds as the premier fieldbus network for high-speed integration and vision/motion capabilities continue to expand, it broadens the scope of MOVi Applications in Machine Control. Omron Industrial Automation is the only vendor that brings all of these technologies together within reach of small and medium size manufacturers. Your success applying MOVi capabilities is based on manufacturing efficiencies proven in our own factories and in installations around the world.

Explore these evolving technologies for your future plans.

# GX Series Block I/O

## High-speed remote I/O terminals for CJ2

An extensive line-up of digital I/O terminals, analog I/O terminals and encoder input terminals are available for EtherCAT connectivity with all CJ2 PLCs. The wiring type of the digital I/O terminal can be either screw terminal block or e-CON formats—it's your choice.

EtherCAT®

### GX I/O Features

- Easy installation and wiring: All modules have EtherCAT connectivity built-in
- Simple setup: EtherCAT node addresses can be easily set with a simple rotary switch
- The allocation area of the remote I/O terminal is automatically decided by simply setting the node address
- High-speed input
- The digital I/O terminals are equipped with high-speed input functionality, ON/OFF delay of 200 μs max.
- Digital input filter prevents malfunction when status is unstable due to chattering or noise. User-selectable input filter values are 0 ms, 0.5 ms, 1 ms (default), 2 ms, 4 ms, 8 ms, 16 ms and 32 ms

### Reference List

| Unit description | Specification, modules with EtherCAT | Model |
|---|---|---|
| 16 NPN inputs | 24 VDC, 6 mA, 1-wire connection, expandable | GX-ID1611 |
| 16 PNP inputs | 24 VDC, 6 mA, 1-wire connection, expandable | GX-ID1621 |
| 16 NPN outputs | 24 VDC, 500 mA, 1-wire connection, expandable | GX-OD1611 |
| 16 PNP outputs | 24 VDC, 500 mA, 1-wire connection, expandable | GX-OD1621 |
| 8 inputs and 8 outputs, NPN | 24 VDC, 6 mA input, 500 mA output, 1-wire connection | GX-MD1611 |
| 8 inputs and 8 outputs, PNP | 24 VDC, 6 mA input, 500 mA output, 1-wire connection | GX-MD1621 |
| 16 NPN inputs | 24 VDC, 6 mA, 3-wire connection | GX-ID1612 |
| 16 PNP inputs | 24 VDC, 6 mA, 3-wire connection | GX-ID1622 |
| 16 NPN outputs | 24 VDC, 500 mA, 3-wire connection | GX-OD1612 |
| 16 PNP outputs | 24 VDC, 500 mA, 3-wire connection | GX-OD1622 |
| 8 inputs and 8 outputs, NPN | 24 VDC, 6 mA input, 500 mA output, 3-wire connection | GX-MD1612 |
| 8 inputs and 8 outputs, PNP | 24 VDC, 6 mA input, 500 mA output, 3-wire connection | GX-MD1622 |
| 16 relay outputs | 250 VAC, 2 A, 1-wire connection, expandable | GX-OC1601 |
| 4 analog inputs, current/voltage | ±10 V, 0-10 V, 0-5 V, 1-5 V, 4-20 mA | GX-AD0471 |
| 2 analog outputs, current/voltage | ±10 V, 0-10 V, 0-5 V, 1-5 V, 4-20 mA | GX-DA0271 |
| 2 encoder open collector inputs | 500 kHz Open collector input | GX-EC0211 |
| 2 encoder line-driver inputs | 4 MHz Line driver input | GX-EC0241 |

# SmartSlice

## Plug-and-Play I/O for Trajexia

SmartSlice I/O units extend Trajexia's I/O capability with digital and analog I/O units, ranging from basic relay outputs to configurable temperature inputs. All SmartSlice units feature screwless 'push-in' I/O wiring, detachable I/O connector, and hot-swap capability. The SmartSlice EtherCAT "coupler" automatically scans the connected I/O units at startup. The Trajexia controller with EtherCAT master will automatically map the detected I/O data to its designated I/O allocations.

### SmartSlice I/O Features

- Up to 64 I/O units per station
- Automatic I/O assignment
- Easy configuration backup
- Hot-swap with auto-restore
- Optional address setting

### Reference List

| Unit description | Specification | Model |
|---|---|---|
| SmartSlice EtherCAT coupler | SmartSlice EtherCAT coupler | GRT1-ECT |
| End plate | one unit required per bus interface | GRT1-END |
| 4 NPN inputs | 24 VDC, 6 mA, 3-wire connection | GRT1-ID4 |
| 4 PNP inputs | 24 VDC, 6 mA, 3-wire connection | GRT1-ID4-1 |
| 8 NPN inputs | 24 VDC, 4 mA, 1-wire connection + 4xG | GRT1-ID8 |
| 8 PNP inputs | 24 VDC, 4 mA, 1-wire connection + 4xV | GRT1-ID8-1 |
| 4 AC inputs | 110 VAC, 2-wire connection | GRT1-IA4-1 |
| 4 AC inputs | 230 VAC, 2-wire connection | GRT1-IA4-2 |
| 4 NPN outputs | 24 VDC, 500 mA, 2-wire connection | GRT1-OD4 |
| 4 PNP outputs | 24 VDC, 500 mA, 2-wire connection | GRT1-OD4-1 |
| 4 PNP outputs with short-circuit protection | 24 VDC, 500 mA, 3-wire connection | GRT1-OD4G-1 |
| 4 PNP outputs with short-circuit protection | 24 VDC, 2 A, 2-wire connection | GRT1-OD4G-3 |
| 8 NPN outputs | 24 VDC, 500 mA, 1-wire connection + 4xV | GRT1-OD8 |
| 8 PNP outputs | 24 VDC, 500 mA, 1-wire connection + 4xG | GRT1-OD8-1 |
| 8 PNP outputs with short-circuit protection | 24 VDC, 500 mA, 1-wire connection + 4xG | GRT1-OD8G-1 |
| 2 relay outputs | 240 VAC, 2 A, normally-open contacts | GRT1-ROS2 |
| 2 analog inputs, current/voltage | ±10 V, 0-10 V, 0-5 V, 1-5 V, 0-20 mA, 4-20 mA | GRT1-AD2 |
| 2 analog outputs, voltage | ± 10 V, 0-10 V, 0-5 V, 1-5 V | GRT1-DA2V |
| 2 analog outputs, current | 0-20 mA, 4-20 mA | GRT1-DA2C |
| 2 Pt100 inputs | Pt100, 2-wire or 3-wire connection | GRT1-TS2P |
| 2 Pt1000 inputs | Pt1000, 2-wire or 3-wire connection | GRT1-TS2K |
| 2 Thermocouple inputs | Types B, E, J , K, N, R, S, T, U, W, PL2, with cold junction compensation | GRT1-TS2T |

Note: SmartSlice EtherCAT coupler is only supported by Trajexia

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# EtherCAT® Primer

| Category | Description | Category | Description |
|---|---|---|---|
| Name | • Ethernet for Control Automation Technology (EtherCAT) | Organization | • www.ethercat.org<br>• Over 1300 members<br>• IEC, ISO and SEMI Standard<br>• Deployed since 2003 with 1000s of available products |
| Media | • RJ45 Connectors; Standard CAT5, CAT5E, CAT6, CAT7 Cabling | Address | • EtherCAT allows 0-65535 devices to be connected. Note: Omron Products have 0-99 as a valid address. |
| Topology | • Line, Star, Ring - no hubs, switches or routers; Note: Omron currently supports Line topology | Distance | • The Fast Ethernet physics (100BASE-TX) enables a cable length of 100 m between two devices. |
| Time Synchronization | • Low jitter that meets the specifications of IEEE 1588 without additional hardware.<br>• Within 1 microsecond for accurate coordinated motion & I/O | Applications | • High-speed packaging, presses, molding, test bed, textile, robotics, material handling and logistics.<br>• Can be used for motion, I/O, vision, safety, AC drives |
| Safety | • IEC standard 61518 describes Safety over EtherCAT (SoE). SoE meets requirements of Safety Integrity Level 3.<br>• To achieve higher safety, SoE adds in safety information to the standard EtherCAT frame. Note: Currently under development. | Configuration | • Set node #, connect Ethernet cable, Auto Configures Available<br>• Use ESI File Per Slave Device |
| Speed | • 2 x 100 MPS Full-Duplex<br>• 1000 Digital I/O in 30 microseconds<br>• 40 Axis in 274 microseconds<br>• 2x faster than Sercos III, 3x faster than Profinet IRT | Protocols | • Master/Slave, Master/Master, Slave/Slave; CAN Open over EtherCAT (CoE)<br>• Standard Ethernet frames, supports HTTP, FTP, TCP/IP Note: Omron Supports Master/Slave |


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