OMRON

CK3E-series

Programmable Multi-Axis Controller

Hardware
User's Manual

CK3E-1□10

Programmable Multi-Axis Controller

I610-E1-02

NOTE

No patent liability is assumed with respect to the use of the information contained herein. Moreover, because OMRON is constantly striving to improve its high-quality products, the information contained in this manual is subject to change without notice. Every precaution has been taken in the preparation of this manual. Nevertheless, OMRON assumes no responsibility for errors or omissions. Neither is any liability assumed for damages resulting from the use of the information contained in this publication.

Trademarks

- Sysmac and SYSMAC are trademarks or registered trademarks of OMRON Corporation in Japan and other countries for OMRON factory automation products.
- Microsoft, Windows, Windows Vista, Excel, and Visual Basic are either registered trademarks or trademarks of Microsoft Corporation in the United States and other countries.
- EtherCAT® is registered trademark and patented technology, licensed by Beckhoff Automation GmbH, Germany.
- ODVA, CIP, CompoNet, DeviceNet, and EtherNet/IP are trademarks of ODVA.
- The SD and SDHC logos are trademarks of SD-3C, LLC.

Other company names and product names in this document are the trademarks or registered trademarks of their respective companies.

Copyrights

Microsoft product screen shots reprinted with permission from Microsoft Corporation.

Introduction

Thank you for purchasing a CK3E-series Programmable Multi-Axis Controller.

This manual contains information that is necessary to use the CK3E-series Programmable Multi-Axis Controller. Please read this manual and make sure you understand the functionality and performance of the CK3E-series Programmable Multi-Axis Controller before you attempt to use it in a control system.

Keep this manual in a safe place where it will be available for reference during operation.

Intended Audience

This manual is intended for the following personnel, who must also have knowledge of electrical systems (ie: be of the rank of electrical engineer or equivalent).

- Personnel in charge of introducing FA devices.
- Personnel in charge of designing FA systems.
- Personnel in charge of installing and maintaining FA devices.
- Personnel in charge of managing FA facilities.

Applicable Products

This manual covers the following products.

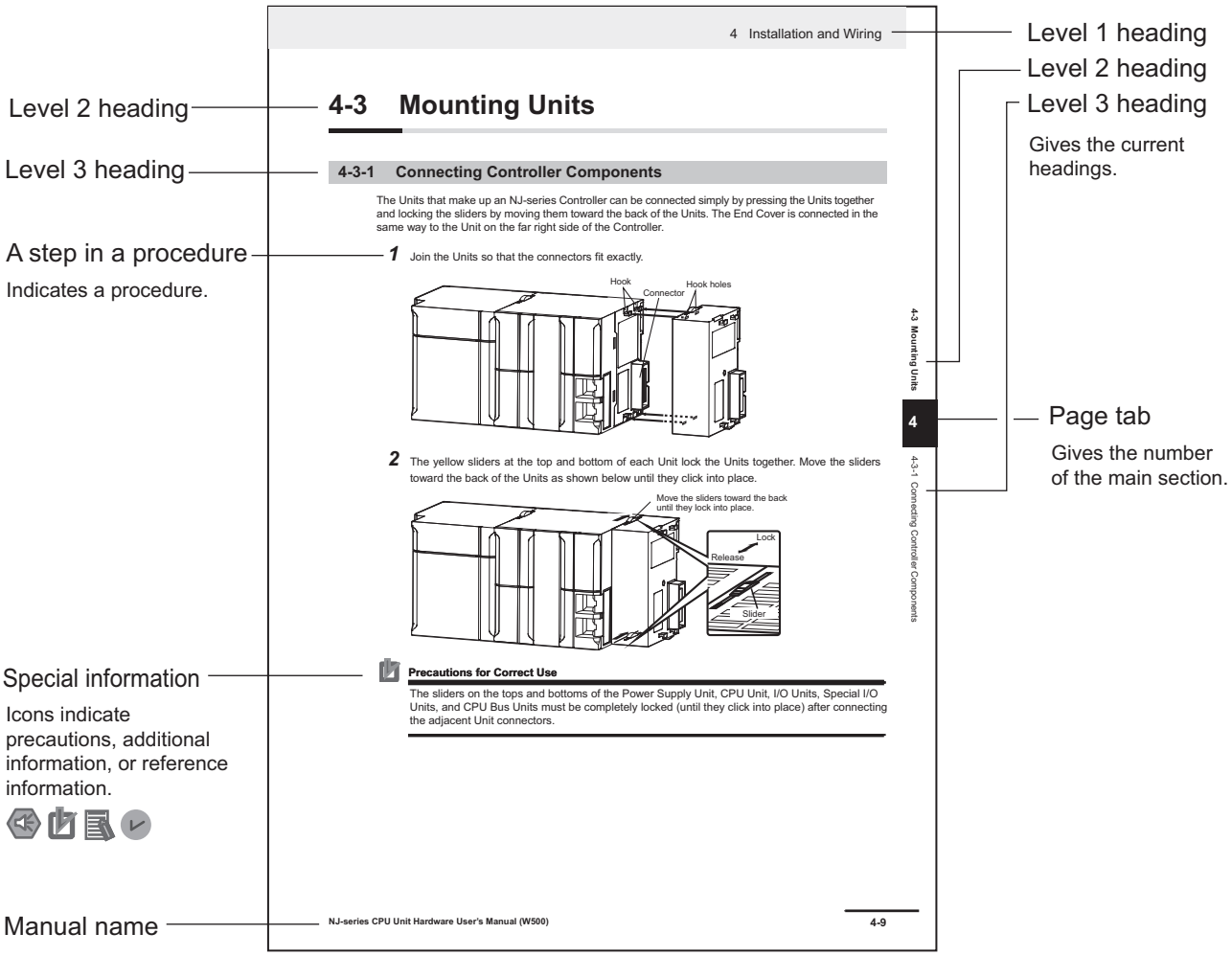
- CK3E-series Programmable Multi-Axis Controller

  Model CK3E-□□□□

Manual Structure

Page Structure and Icons

The following page structure and icons are used in this manual.



Note This illustration is provided as a sample only. It may not literally appear in this manual.

Special Information

Special information in this manual is classified as follows:

Precautions for Safe Use

Precautions on what to do and what not to do to ensure safe usage of the product.

Precautions for Correct Use

Precautions on what to do and what not to do to ensure correct operation and performance.

Additional Information

Additional information to read as required.

This information is provided to increase understanding or make operation easier.

Note References are provided to more detailed or related information.

CONTENTS

Section 6 Inspection and Maintenance

Appendices

Index

Terms and Conditions Agreement

Warranty, Limitations of Liability

Warranties

- **Exclusive Warranty**

  Omron's exclusive warranty is that the Products will be free from defects in materials and workmanship for a period of twelve months from the date of sale by Omron (or such other period expressed in writing by Omron). Omron disclaims all other warranties, express or implied.

- **Limitations**

  OMRON MAKES NO WARRANTY OR REPRESENTATION, EXPRESS OR IMPLIED, ABOUT NON-INFRINGEMENT, MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OF THE PRODUCTS. BUYER ACKNOWLEDGES THAT IT ALONE HAS DETERMINED THAT THE PRODUCTS WILL SUITABLY MEET THE REQUIREMENTS OF THEIR INTENDED USE.

  Omron further disclaims all warranties and responsibility of any type for claims or expenses based on infringement by the Products or otherwise of any intellectual property right.

- **Buyer Remedy**

  Omron's sole obligation hereunder shall be, at Omron's election, to (i) replace (in the form originally shipped with Buyer responsible for labor charges for removal or replacement thereof) the non-complying Product, (ii) repair the non-complying Product, or (iii) repay or credit Buyer an amount equal to the purchase price of the non-complying Product; provided that in no event shall Omron be responsible for warranty, repair, indemnity or any other claims or expenses regarding the Products unless Omron's analysis confirms that the Products were properly handled, stored, installed and maintained and not subject to contamination, abuse, misuse or inappropriate modification. Return of any Products by Buyer must be approved in writing by Omron before shipment. Omron Companies shall not be liable for the suitability or unsuitability or the results from the use of Products in combination with any electrical or electronic components, circuits, system assemblies or any other materials or substances or environments. Any advice, recommendations or information given orally or in writing, are not to be construed as an amendment or addition to the above warranty.

See http://www.omron.com/global/ or contact your Omron representative for published information.

Limitation on Liability; Etc

OMRON COMPANIES SHALL NOT BE LIABLE FOR SPECIAL, INDIRECT, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, LOSS OF PROFITS OR PRODUCTION OR COMMERCIAL LOSS IN ANY WAY CONNECTED WITH THE PRODUCTS, WHETHER SUCH CLAIM IS BASED IN CONTRACT, WARRANTY, NEGLIGENCE OR STRICT LIABILITY.

Further, in no event shall liability of Omron Companies exceed the individual price of the Product on which liability is asserted.

Application Considerations

Suitability of Use

Omron Companies shall not be responsible for conformity with any standards, codes or regulations which apply to the combination of the Product in the Buyer's application or use of the Product. At Buyer's request, Omron will provide applicable third party certification documents identifying ratings and limitations of use which apply to the Product. This information by itself is not sufficient for a complete determination of the suitability of the Product in combination with the end product, machine, system, or other application or use. Buyer shall be solely responsible for determining appropriateness of the particular Product with respect to Buyer's application, product or system. Buyer shall take application responsibility in all cases.

NEVER USE THE PRODUCT FOR AN APPLICATION INVOLVING SERIOUS RISK TO LIFE OR PROPERTY OR IN LARGE QUANTITIES WITHOUT ENSURING THAT THE SYSTEM AS A WHOLE HAS BEEN DESIGNED TO ADDRESS THE RISKS, AND THAT THE OMRON PRODUCT(S) IS PROPERLY RATED AND INSTALLED FOR THE INTENDED USE WITHIN THE OVERALL EQUIPMENT OR SYSTEM.

Programmable Products

Omron Companies shall not be responsible for the user's programming of a programmable Product, or any consequence thereof.

Disclaimers

Performance Data

Data presented in Omron Company websites, catalogs and other materials is provided as a guide for the user in determining suitability and does not constitute a warranty. It may represent the result of Omron's test conditions, and the user must correlate it to actual application requirements. Actual performance is subject to the Omron's Warranty and Limitations of Liability.

Change in Specifications

Product specifications and accessories may be changed at any time based on improvements and other reasons. It is our practice to change part numbers when published ratings or features are changed, or when significant construction changes are made. However, some specifications of the Product may be changed without any notice. When in doubt, special part numbers may be assigned to fix or establish key specifications for your application. Please consult with your Omron's representative at any time to confirm actual specifications of purchased Product.

Errors and Omissions

Information presented by Omron Companies has been checked and is believed to be accurate; however, no responsibility is assumed for clerical, typographical or proofreading errors or omissions.

Safety Precautions

Definition of Precautionary Information

The following notation is used in this manual to provide precautions required to ensure safe usage of the CK3E-series Programmable Multi-Axis Controller.

The safety precautions that are provided are extremely important to help ensure safety. Always read and heed the information provided in all safety precautions.

The following notation is used.

⚠WARNING	Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury. Additionally, there may be severe property damage.
⚠ Caution	Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury, or property damage.

Symbols

	The circle and slash symbol indicates operations that you must not do. The specific operation is shown in the circle and explained in text. This example indicates that disassembling is prohibited.
	The triangle symbol indicates precautions (including warnings). The specific operation is shown in the triangle and explained in text. This example indicates a precaution against electric shock.
	The triangle symbol indicates precautions (including warnings). The specific operation is shown in the triangle and explained in text. This example indicates a general precaution.
	The filled circle symbol indicates operations that you must do. The specific operation is shown in the circle and explained in text. This example shows a general precaution for an action you must carry out.

WARNING

⚠ WARNING

During Power Supply

Do not attempt to take any Unit apart.

In particular, high-voltage parts are present in the product while power is supplied or immediately after power is turned OFF. Touching any of these parts may result in electric shock. There are sharp parts inside the Unit that may cause injury.

Fail-safe Measures

Provide safety measures in external circuits to ensure safety in the system if an abnormality occurs due to malfunction of the system due to other external factors affecting operation.

Not doing so may result in serious accidents due to incorrect operation.

Emergency stop circuits, interlock circuits, limit circuits, and similar safety measures must be provided in external control circuits.

You must take fail-safe measures to ensure safety in the event of incorrect, missing, or abnormal signals caused by broken signal lines, momentary power interruptions, or other causes. Not doing so may result in serious accidents due to incorrect operation.

The use of an Uninterruptible Power Supply (UPS) allows normal operation to continue even if a momentary power interruption occurs, possibly resulting in the reception of an erroneous signal from an external device affected by the momentary power failure. Take external fail-safe measures. Where necessary, monitor the power supply voltage on the system for external devices and use it as an interlock condition.

Unintended behavior may occur when an error occurs in internal memory of the product. As a countermeasure for such problems, external safety measures must be provided to ensure safe operation of the system.

The Controller will turn OFF all outputs from Output Units in the following cases. The slaves will operate according to the settings in the slaves.

- If a power supply error occurs
- If the power supply connection becomes faulty
- When a CPU error (watchdog timer error) or CPU reset occurs
- If a Controller error in the major fault level occurs
- While the Controller is in startup status until RUN mode is entered after the power is turned ON.
- If a system initialization error occurs

External safety measures must be provided to ensure safe operation of the system in such cases.

To ensure safe use of the Controller, correctly make the limit settings for the position, speed, acceleration, jerk, current, and following error, as well as the encoder loss detection.

For devices that move in a vertical direction, use a motor brake to prevent them from falling down when the servo control is stopped.

Transferring

Always confirm the safety status at the destination before you transfer a user program, configuration data, or setup data from POWER PMAC IDE.

The devices or machines may perform unexpected operations regardless of the operating mode of the Controller.

After you transfer the user program, the Controller is restarted and communications with the EtherCAT slaves are cut off. During that period, the slave outputs behave according to the slave specifications.

The time that communications are cut off depends on the EtherCAT network configuration.

Before you transfer the user program, confirm that the system will not be adversely affected.

Test Run

Before you start a Test Run, make sure that the operation parameters are set correctly.

Actual Operation

Check the user program, servo algorithm, data, and parameter settings for proper execution before you use them for actual operation.

Cautions

⚠ Caution

Design

To control the motor safely and correctly, the servo algorithm design and gain setting work must be performed by engineers who understand control theories and the specifications of this product.

Test Run

When you perform a test run, take fail-safe measures and run the motor at a sufficiently low speed to ensure safety.

Downloading

Before you download a project written in C language, execute the re-initialization command ($$$***).

If you download a validated program to a different product, check the operation of the program again on the product because it may have different settings.

Precautions for Safe Use

Transporting

- Do not drop the Controller or expose it to abnormal vibration or shock. Doing so may result in the Controller malfunctioning or burning.

Mounting

- Be sure that the connectors and other items with locking devices are correctly locked into place before use.

Installation

- Always connect to a ground of 100 Ω or less when installing the Controller.

Wiring

- Follow the instructions in this manual to correctly perform terminal block and connector wiring and insertion. Double-check all wiring and connector insertion before turning ON the power supply.
- If the external power supply to a slave has polarity, connect it with the correct polarity. If the polarity is reversed, current may flow in the reverse direction and damage the connected devices regardless of the operation of the Controller.
- Before you connect a computer to the Controller, disconnect the power supply plug of the computer from the AC outlet. Also, if the computer has an FG terminal, make the connections so that the FG terminal has the same electrical potential as the FG on the product. A difference in electrical potential between the computer and Controller may cause a failure or malfunction.
- Do not pull on the cables or bend the cables beyond their natural limit.
- Do not place heavy objects on top of the cables or other wiring lines. Doing so may break the cables.
- Always use power supply wires with sufficient wire diameters to prevent voltage drop and burning. Make sure that the current capacity of the wire is sufficient. Otherwise, excessive heat may be generated. When cross-wiring terminals, the total current for all the terminals will flow in the wire. When wiring cross-overs, make sure that the current capacity of each of the wires is not exceeded.
- Do not allow wire clippings, shavings, or other foreign material to enter the Controller. Otherwise, Controller burning, failure, or malfunctions may occur. Cover the Controller or take other suitable countermeasures, in particular when carrying out wiring work.

Power Supply Design

- In the system, only use the power supply within the rated supply capacity range specified in this manual.

Turning ON the Power Supply

- It takes approximately several tens of seconds to enter RUN mode after the power supply is turned ON. During that time, outputs will be OFF or the values will be as according to settings in the Unit or slaves. Also, external communications will not be able to be performed. Implement fail-safe circuits so that external devices do not operate incorrectly.

- Surge current occurs when the power supply is turned ON. When selecting fuses or breakers for external circuits, consider the above precaution and allow sufficient margin in shut-off performance. Refer to this manual for surge current specifications.

Actual Operation

- Build a program such that the Sys.Status flag is constantly monitored and safe operations are taken if any errors occur.

Turning OFF the Power Supply

- Do not turn off the power supply or remove the USB memory device while the Controller is accessing the USB memory device. Data may become corrupted, and the Controller will not operate correctly if it uses corrupted data.
- Always turn OFF the power supply before you attempt any of the following.

  Connecting cables or wiring the system

  Connecting or disconnecting the connectors
- Do not disconnect the cable or turn OFF the power supply to the product when downloading data or programs from the Support Software. You may be unable to download the correct data, which could result in malfunctions.
- Do not turn OFF the power supply to the Controller while the built-in flash memory is being written. Data may become corrupted, and the Controller may not operate correctly.

Operation

Confirm that no adverse effects will occur in the system before you attempt any of the following.

- Changing the operating mode of the Controller (including changing the setting of the Startup Mode)
- Changing the user program or settings
- Changing set values or present values

EtherCAT Communications

- Make sure that the communications distance, number of nodes connected, and method of connection for EtherCAT are within specifications.

  Do not connect EtherCAT communications to EtherNet/IP, a standard in-house LAN, or other networks. An overload may cause the network to fail or malfunction.
- If the Fail-soft Operation parameter is set to stop operations, process data communications will stop for all slaves when an EtherCAT communications error is detected in a slave. For this reason, if Servo Drives are connected, the Servos for all axes will be turned OFF. At that time, the Servo Drive will operate according to the Servo Drive specifications. Make sure that the Fail-soft Operation parameter setting results in safe operation when a device error occurs.
- If noise occurs or an EtherCAT slave is disconnected from the network, any current communications frames may be lost. If frames are lost, slave I/O data is not communicated, and unintended operation may occur. The slave outputs behave according to the slave specifications. For details, refer to relevant manuals for each slave.
- When an EtherCAT slave is disconnected or disabled, communications will stop and control of the outputs will be lost not only for the disconnected slave, but for all slaves connected after it. Confirm that the system will not be adversely affected before you disconnect or disable a slave.
- You cannot use standard Ethernet hubs or repeater hubs with EtherCAT communications. If you use one of these, a major fault level error or other error may occur.

- EtherCAT communications are not always established immediately after the power supply is turned ON. Use the system-defined variables and the EtherCAT Coupler Unit device variables in the user program to confirm that I/O data communications are established before attempting control operations.
- If you need to disconnect the cable from an EtherCAT slave during operation, first reset the EtherCAT and EtherCAT slaves that are connected after it to the Init state, then disconnect the EtherCAT slave.
- For EtherCAT and EtherNet, use the connection methods and cables that are specified in this manual. Otherwise, communications may be faulty.
- Make sure that all of the slaves to be restored are participating in the network before you reset the EtherCAT Master Function Module. If any slave is not participating when any of these errors is reset, the EtherCAT Master Function Module may access a slave with a different node address than the specified node address, or the error may not be reset correctly.
- There is a time lag between the moment when this Controller sends a command value to the EtherCAT type Servo Drive and the moment when it receives the feedback value. Perform servo control taking this time lag into consideration.

EtherNet/IP Communications

- Unexpected operation may result if inappropriate data link tables are set. Even if appropriate data link tables have been set, confirm that the controlled system will not be adversely affected before you transfer the data link tables. The data links start automatically after the data link tables are transferred.
- If EtherNet/IP tag data links (cyclic communications) are used with a repeating hub, the communications load on the network will increase. This will increase collisions and may prevent stable communications. Do not use repeating hubs on networks where tag data links are used. Use Ethernet switches instead.
- Make sure to use the communications distance, number of nodes connected, and method of connection for EtherNet/IP within specifications. Do not connect EtherNet/IP communications to EtherCAT or other networks. An overload may cause the network to fail or malfunction.

Motion Control

- The motor is stopped if communications are interrupted between POWER PMAC IDE and the Controller during a Test Run. Connect the communications cable securely and confirm that the system will not be adversely affected before you perform a Test Run.
- EtherCAT communications are not always established immediately after the power supply is turned ON. Use the system-defined variables in the user program to confirm that communications are established before attempting control operations.
- When you create a servo algorithm, take fail-safe measures in the user program which includes the servo algorithm.

Unit Replacement

- After replacing the Controller, make sure that the required data, including the user program, configurations, settings, and values of variables, has been transferred to the Controller that was replaced, as well as to externally connected devices before restarting operation.

Upgrading the Power PMAC IDE

- After you upgrade a project file created with an older version of the Power PMAC IDE for use with a newer version of Power PMAC IDE, perform a test run before use to check that the project file was upgraded correctly.

Maintenance

- Do not attempt to disassemble, repair, or modify the Controller. Doing so may result in a malfunction or fire.
- Do not use corrosive chemicals to clean the Controller. Doing so may result in a failure or malfunction of the Controller.
- Dispose of the product according to local ordinances as they apply.

Precautions for Correct Use

Storage and Installation

- Follow the instructions in this manual to correctly perform installation.
- Do not operate or store the Controller in the following locations. Doing so may result in burning, in operation stopping, or in malfunction.
  a) Locations subject to direct sunlight
  b) Locations subject to temperatures or humidity outside the range specified in the specifications
  c) Locations subject to condensation as a result of severe changes in temperature
  d) Locations subject to corrosive or flammable gases
  e) Locations subject to dust (especially iron dust) or salts
  f) Locations subject to exposure to water, oil, or chemicals
  g) Locations subject to shock or vibration
- Take appropriate and sufficient countermeasures when installing the Controller in the following locations.
  a) Locations subject to strong, high-frequency noise
  b) Locations subject to static electricity or other forms of noise
  c) Locations subject to strong electromagnetic fields
  d) Locations subject to possible exposure to radioactivity
  e) Locations close to power lines
- Install the Controller away from sources of heat and ensure appropriate ventilation. Not doing so may result in a malfunction, operations halting, or burning.
- Before touching a Unit, be sure to first touch a grounded metallic object in order to discharge any static build-up.

Wiring

- Always ensure the rated supply voltage is connected to the Controller.

Task Settings

- If a Task Period Exceeded error occurs, shorten the programs to fit in the task or increase the setting of the task period.

Operation

- Do not disconnect the communications cable while the system is running. Doing so may result in a failure or malfunction of the system.

Motion Control

- Do not download motion control settings during a Test Run.

EtherCAT Communications

- Set the Servo Drives to stop operation if an error occurs in EtherCAT communications between the Controller and a Servo Drive.
- Always use the specified EtherCAT slave cables. If you use any other cable, the EtherCAT master or the EtherCAT slaves may detect an error and one of the following may occur.
  a) Continuous refreshing of process data communications will not be possible.
  b) Continuous refreshing of process data communications will not end during the set cycle.

USB Device

- Always use USB memory devices that comply with the USB standards.

Regulations and Standards

Conformance to EU Directives

Applicable Directives

- EMC Directives

Concepts

● EMC Directives

OMRON devices that comply with EU Directives also conform to the related EMC standards so that they can be more easily built into other devices or the overall machine. The actual products have been checked for conformity to EMC standards.*1

Whether the products conform to the standards in the system used by the customer, however, must be checked by the customer. EMC-related performance of the OMRON devices that comply with EU Directives will vary depending on the configuration, wiring, and other conditions of the equipment or control panel on which the OMRON devices are installed. The customer must, therefore, perform the final check to confirm that devices and the overall machine conform to EMC standards.

*1. Applicable EMC (Electromagnetic Compatibility) standards are as follows:
EMS (Electromagnetic Susceptibility): EN 61326
EMI (Electromagnetic Interference): EN 61326 (Radiated emission: 10-m regulations).

● Conformance to EU Directives

The CK3E-series Controllers comply with EU Directives. To ensure that the machine or device in which the CK3E-series Controllers are used complies with EU Directives, the following precautions must be observed.

- The CK3E-series Controllers must be installed within a control panel.
- You must use SELV power supply for the DC power supplies that are connected as the Unit power supplies and I/O power supplies for the CK3E-series Controllers.

  We recommend that you use the OMRON S8JX-series Power Supplies. EMC standard compliance was confirmed for the recommended Power Supplies.
- CK3E-series Controllers that comply with EU Directives also conform to the Common Emission Standard (EN 61326). Radiated emission characteristics (10-m regulations) may vary depending on the configuration of the control panel used, other devices connected to the control panel, wiring, and other conditions.

  You must therefore confirm that the overall machine or equipment in which the CK3E-series Controllers are used complies with EU Directives.
- This is a Class A product (for industrial environments). In a residential environment, it may cause radio interference. If radio interference occurs, the user may be required to take appropriate measures.
- Attach a clamp core to the Ethernet communications cable. Refer to *Recommended Clamp Core and Attachment Procedure* on page 4-18 for details of the procedure to attach the clamp core.

Software Licenses and Copyrights

This product incorporates certain third party software. The license and copyright information associated with this software is available at http://www.fa.omron.co.jp/nj_info_e/.

Related Manuals

The following manuals are related. Contact your OMRON representative for information on how to procure these manuals. Use these manuals for reference.

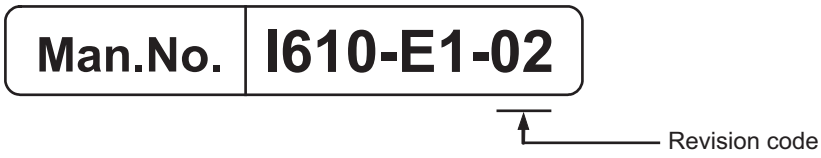
Manual name	Cat.No.	Application	Description
CK3E-series Programmable Multi-Axis Controller Hardware User's Manual	I610	Learning the basic specifications of the CK3E-series Programmable Multi-Axis Controller, including introductory information, design, installation, and maintenance. Mainly hardware information is provided.	An introduction to the entire CK3E-series system is provided along with the following information. • Features and System Configuration • Specifications • Part Names and Functions • Mounting and Wiring • Error Processing • Inspection and Maintenance
Power PMAC User's Manual	O014	Learning the features and usage examples of the CK3E-series Programmable Multi-Axis Controller.	The following information is provided on the CK3E-series Programmable Multi-Axis Controller. • Basic functions • Setup examples • Programming examples
Power PMAC Software Reference Manual	O015	Learning how to program a CK3E-series Programmable Multi-Axis Controller.	The following information is provided on the CK3E-series Programmable Multi-Axis Controller. • Details of commands • Details of data structure
Power PMAC IDE User Manual	O016	Learning how to operate Power PMAC IDE, the integrated development environment of the Controller.	Describes the operating procedures of Power PMAC IDE, and examples of how to start the system.
Power PMAC-NC-16 Quick Start Manual	O017	Understanding the basic usage of Power PMAC-NC16 quickly.	Describes a Quick setup procedure to run Power PMAC-NC16 on a desktop PC by using an example.
Power PMAC-NC16 .ini Configuration Manual	O018	Constructing an application for CNC machines by using Power PMAC-NC16.	Describes how to set up "PowerPmacNC.ini", the setup data file to be loaded when Power PMAC-NC16 starts.
Power PMAC-NC16 Software User Manual	O019	Learning about usage and features of Power PMAC-NC16, Support Software required when using the Controller for CNC machines.	The following information is provided on Power PMAC-NC16. • How to use the software • Features included in the software • Features that can be customized
Power PMAC-NC16 Mill G-Code Manual	O020	Creating programs for CNC machines by using Power PMAC-NC16.	Describes the basic G-code set and the instructions that can be used for Power PMAC-NC16.

Terms and Acronyms

Term or acronym	Description
PMAC	The acronym for Programmable Multi-Axis Controller.
Motion control	Motion control can achieve intended operation by providing a target value to the axis to be controlled, or by controlling state transitions.
Axis	A functional unit within the Motion Control Function Module. An axis is assigned to the drive mechanism in an external Servo Drive, etc.
NC	The acronym for Computerized Numerical Control. A method to numerically control machining processes in production by using computers. CNC has been further automatized over conventional numerical control machine tools (NC machine tools).
G-code	A type of language used to create NC programs.
CPU	Central Processing Unit. Hardware that executes instructions from computer programs.
Modbus/TCP	A protocol used for the Modbus communication on TCP/IP.
EtherCAT	The acronym for Ethernet for Control Automation Technology. EtherCAT is the real-time Ethernet protocol standards.
ENI file	ENI is the acronym for EtherCAT Network Information. The ENI file contains the network configuration information related to EtherCAT slaves.
ESI file	ESI is the acronym for EtherCAT Slave Information. The ESI file contains information unique to the EtherCAT slaves in XML format.
CIP	The acronym for Common Industrial Protocol. An industrial standard protocol used for networks such as EtherNet/IP and DeviceNet.
EDS	The acronym for Electronic Data Sheet. A text file that contains the EtherNet/IP slave setting information.
Originator	A node that makes a request for opening a connection when a tag data link connection is opened in an EtherNet/IP network.
Target	A node that receives a request for opening a connection when a tag data link connection is opened in an EtherNet/IP network.
RPI	The acronym for Requested Packet Interval. Represents a data refresh period set for each connection between originators and targets on an EtherNet/IP network.

Revision History

A manual revision code appears as a suffix to the catalog number on the front and back covers of the manual.



Revision code	Date	Revised content
01	August 2016	Original production
02	August 2020	• Made changes accompanying the addition of EtherNet/IP functions. • Corrected mistakes.

Sections in this Manual

1

Features and System Configuration

This section describes the features and system configuration of the Programmable Multi-Axis Controller.

1-1 Features

The CK3E-series is the Programmable Multi-Axis Controller that supports the EtherCAT master functions.

The CK3E-series Programmable Multi-Axis Controller has the following features.

Fast Multi-Axis Control

The Controller uses Programmable Multi-Axis Controller, developed by Delta Tau Data Systems, Inc., a manufacturer specializing in motion controllers.

It allows for multi-axis control of up to 32 axes per unit (when CK3E-1410 is used), and the fast control which motion control period is 250 μs or more.

Constructing Systems with Greater Flexibility

Programs can be written in G-code, C language, or Programmable Multi-Axis Controller specific language for the Controller. Such function design flexibility allows you to create functions that are optimized for your equipment.

Various EtherCAT-compatible products such as vision sensors and I/O as well as motion controls can be connected, allowing you to construct original systems to suit the equipment.

Compactness

The Controller is compact and has less wiring due to the use of the EtherCAT network, which helps to downsize devices.

Additional Information

What is EtherCAT?

EtherCAT is an Ethernet (IEEE802.3) compliant, open, and super-fast industrial network system. Each node achieves a short communications cycle time by transmitting Ethernet frames at high speed. A mechanism that allows sharing of clock information enables high-precision synchronized control with low communications jitter.

1-2 Introduction to the System Configurations

The following shows the configurations of motion control systems using a Programmable Multi-Axis Controller. The basic configurations include the EtherCAT network configuration, Ethernet network configuration, and Support Software.

EtherCAT Network Configuration

By using the EtherCAT master communications port on the Programmable Multi-Axis Controller, EtherCAT slaves such as servo drives, frequency inverters, machine vision systems, digital and analog I/O, and other general-purpose slaves can be connected.

The Controller also supports EtherCAT Slave Terminals. The EtherCAT Slave Terminal helps you to save space and construct flexible systems using a broad range of types of NX Units.

However, when OMRON NX-series EtherCAT Coupler Units are used for the EtherCAT Slave Terminal, only limited models and unit versions of EtherCAT Coupler Units can be connected. Refer to *A-2 Restrictions on Using the OMRON NX-Series EtherCAT Coupler Unit* on page A-3.

Ethernet Network Configuration

The Ethernet communications port on the Programmable Multi-Axis Controller supports the EtherNet/IP protocol. It can be connected to devices such as a PLC or a programmable terminal that supports the EtherNet/IP protocol.

The Ethernet communications port can also be used for Modbus-TCP communications.

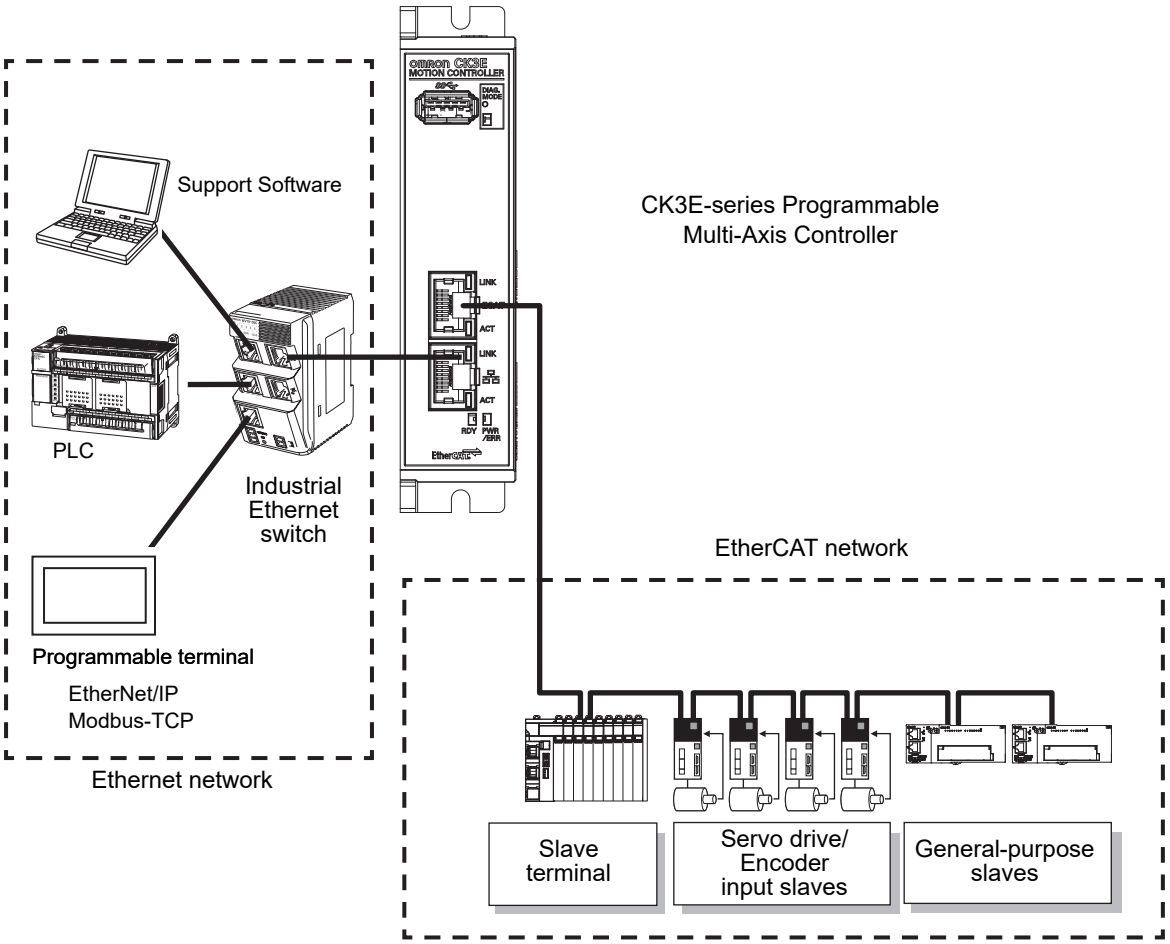
The EtherNet/IP communications are available only when the CPU Unit serves as a target and require an originator.

If the originator in use is an NJ/NX-series CPU Unit, refer to the *NJ/NX-series CPU Unit Built-in EtherNet/IP™ Port User's Manual* (Cat. No. W506) for details.

EtherNet/IP communications require configuring the connection settings of the CPU Unit. Refer to the *Power PMAC IDE User Manual* (Cat. No. O016) for how to configure the settings.

Support Software

Connect a personal computer with the Support Software installed to the Programmable Multi-Axis Controller via the Ethernet network. Refer to *1-3 Support Software* on page 1-5 for details of the Support Software.


Support Software
PLC
Industrial
Ethernet
switch
Programmable terminal
EtherNet/IP
Modbus-TCP
Ethernet network
CK3E-series Programmable
Multi-Axis Controller
EtherCAT network
Slave
terminal
Servo drive/
Encoder
input slaves
General-purpose
slaves

1-3 Support Software

The following table shows the Support Software used to configure, monitor, program, and debug the Programmable Multi-Axis Controller.

Software Name		Application	How to Procure
Power PMAC IDE*1		This computer software is used to configure the Controller, create user programs, and debug the programs.	This is free software. Contact your OMRON representative for information on how to procure.
Power PMAC-NC16	Power PMAC-NC16 SDK	This computer software is used to control working machines and other CNC machines with the Controller. Use this software when you want to customize the HMI screen. The product contains extension source codes used for customization.	This is non-free software. Contact your OMRON representative for information on how to procure.
	Power PMAC-NC16 Runtime	This computer software is used to control working machines and other CNC machines with the Controller. Use this software when you do not customize the HMI screen.	This is non-free software. Contact your OMRON representative for information on how to procure.

*1. Use Power PMAC IDE Ver.2.2 or a later version.

1-4 Application Procedure

This section describes the procedure to construct a motion control system by using the Multi-Axis Controller.

No.	Step		Description	Reference
1	Preparation before carrying out work	Check for specification compatibility	Check whether the system is compatible with specifications of the Programmable Multi-Axis Controller. • General specifications • Mounting direction	*2-1-2 General Specifications* on page 2-3
		Selection of peripheral devices	Select peripheral devices to be used for the Programmable Multi-Axis Controller.	*2-2 Specifications of Peripherals* on page 2-6
		Preparation of Support Software	Procure and install the Support Software required for the system.	*1-3 Support Software* on page 1-5
2	Mounting and wiring of the Programmable Multi-Axis Controller	Mounting	Mount the Programmable Multi-Axis Controller.	*4-3 Mounting the Programmable Multi-Axis Controller* on page 4-5
		Wiring	Connect the unit power supply of the Programmable Multi-Axis Controller.	*4-4 Power Supply Wiring* on page 4-7
3	Settings and wiring of the EtherCAT slave hardware.	Node address settings	Use the hardware switches on all of the EtherCAT slaves in the network to set the node addresses.	Refer to the manual for the EtherCAT slave.
		Mounting	Mount EtherCAT slaves.	Refer to the manual for the EtherCAT slave.
		Wiring	Wire EtherCAT slaves. • Wiring of the unit power supply • I/O wiring	Refer to the manual for the EtherCAT slave.
4	Wiring of the EtherCAT communication and grounding of the system		Ground and wire the EtherCAT communication cable.	*4-5 Laying the EtherCAT Network* on page 4-10 *4-8 Grounding* on page 4-20
5	Preparation for setting the Programmable Multi-Axis Controller	Creation of a new project	Connect the computer with the Support Software installed to the Programmable Multi-Axis Controller. Then start Power PMAC IDE and create a new project.	Refer to “Power PMAC IDE User Manual” for details.
		Initialization of the Controller	Initialize the Programmable Multi-Axis Controller by using Power PMAC IDE.	Refer to “Power PMAC IDE User Manual” for details.
6	Turning the Power ON		Turn on the power to the devices configuring the system.	---
7	Construction of the EtherNet/IP network*1	Settings of the originator device	Configure the originator device settings.	Refer to the manual for the originator device (the *NJ/NX-series CPU Unit Built-in EtherNet/IP™ Port User’s Manual* (Cat. No. W506) when the NJ/NX Series is used) for details.
		Settings of the connection	Configure the connection settings.	Refer to the *Power PMAC IDE User Manual* (Cat. No. O016) for details.

No.	Step		Description	Reference
8	Construction of the Ether-CAT network	Installation of ESI files	Install the ESI files of EtherCAT slaves to be connected to EC-Engineer.	Refer to “Acontis EC-Engineer manual” for details. For information on the ESI file, refer to the manual for the Ether-CAT slave.
		EtherCAT slave settings	Configure the EtherCAT communication settings by using EC-Engineer. Then, create an ENI file used to download the configured settings to the Programmable Multi-Axis Controller.	Refer to “Acontis EC-Engineer manual” for details.
		Activation of the EtherCAT network	Download the ENI file to the Programmable Multi-Axis Controller by using Power PMAC IDE. Make sure that the ENI file has been correctly downloaded, and then activate the EtherCAT network.	Refer to “Power PMAC IDE User Manual” for details.
9	Settings of the Programmable Multi-Axis Controller operation	Programming	Create user programs on Power PMAC IDE.	Refer to “Power PMAC User’s Manual” and “Power PMAC Software Reference Manual” for details.
		Motor settings	Set the motor operations for the Programmable Multi-Axis Controller by using Power PMAC IDE.	Refer to “Power PMAC IDE User Manual” for details.
10	Transferring project data and checking the operation		Transfer the created project data and check that operations work as expected.	Refer to “Power PMAC IDE User Manual” for details.

*1. Perform settings only when EtherNet/IP is used.

2

Specifications

This section describes the specifications of the Programmable Multi-Axis Controller and configuration devices.

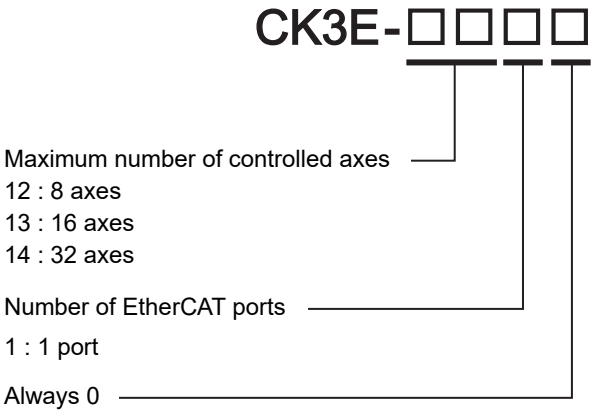
2-1 Programmable Multi-Axis Controller

The following provides the models and major specifications of the Programmable Multi-Axis Controller and configuration devices.

2-1-1 Model

Model Naming

CK3E-series Programmable Multi-Axis Controller model names are assigned according to the following rule.



Model List

Model	Specifications		
	Memory	Port	Maximum number of controlled axes
CK3E-1210	Main memory: 1 GB Flash memory: 1 GB	Ethernet port: 1 EtherCAT port: 1	8 axes
CK3E-1310			16 axes
CK3E-1410			32 axes

2-1-2 General Specifications

Item		Specifications		
		Model CK3E-1210	Model CK3E-1310	Model CK3E-1410
Enclosure		Mounted in a panel		
Grounding methods		Ground of 100 Ω or less		
Dimensions (height × depth × width)		130.4 × 28.6 × 170.9 mm (H × D × W)		
Weight		540 g or less		
Unit power supply rated voltage		24 VDC (20.4 to 26.4 VDC)		
Unit power current consumption		660 mA or less		
Operating environment	Ambient operating temperature	0 to 45°C		
	Ambient operating humidity	10 to 95% RH (without condensation and icing)		
	Atmosphere	Must be free of corrosive gases.		
	Ambient storage temperature	-25 to +70°C (without condensation and icing)		
	Vibration resistance	Conforms to IEC 60068-2-6. 5 to 8.4 Hz with 3.5-mm amplitude, 8.4 to 150 Hz, acceleration of 9.8 m/s^2 each in X, Y, and Z directions 100 min (10 sweeps of 10 min each = 100 min total)		
	Shock resistance	Conforms to IEC 60068-2-27, 147 m/s^2, 3 times each in X, Y, and Z directions		
Applicable standards *1		cULus, EU: EN 61326, RCM, KC, EAC		

*1. For the latest applicable standards for each model, visit the OMRON website (www.fa.omron.co.jp or www.ia.omron.com), or contact your OMRON representative.

2-1-3 Features and Performance Specifications

Item			Specifications		
			Model CK3E-1210	Model CK3E-1310	Model CK3E-1410
Memory			Main memory: 1 GB Flash memory: 1 GB		
External terminals			[Communications connector] For EtherCAT communications • RJ45 × 1 (Shield supported) For Ethernet communications • RJ45 × 1 (Shield supported)		
			[Power supply input terminal] For unit power supply × 1		
			[USB port] For external memory connection, USB 3.0 host × 1 Type A		
Motion control	Maximum number of controlled axes		8 axes	16 axes	32 axes
	Motion control period		250 μs or more		
	Control method		Issuing control commands using EtherCAT communications		
EtherCAT communications specifications	Communications protocol		EtherCAT protocol		
	Baud rate		100 Mbps		
	Physical layer		100BASE-TX (IEEE 802.3)		
	Topology		Line, daisy chain, and branching		
	Transmission media		Twisted-pair cable of category 5 or higher (double-shielded cable with aluminum tape and braiding)		
	Transmission distance		Distance between nodes: 100 m or less		
	Maximum number of slaves		32		
	Range of node addresses that can be set		1 to 32		
Ethernet communications specifications	Baud rate		1 Gbps/100 Mbps		
	Physical layer		1000BASE-T/100BASE-TX		
	Frame length		1,514 bytes max.		
	Media access method		CSMA/CD		
	Modulation		Baseband		
	Topology		Star		
	Transmission media		Twisted-pair cable of category 5, 5e, or higher (shielded cable)*1		
	Maximum transmission distance between Ethernet switch and node		100 m		
	Maximum number of cascade connections		There are no restrictions if an Ethernet switch is used.		
	EtherNet/IP tag data link (cyclic communications)*2	Number of connections	32		
		Requested packet interval (RPI)	1 to 1,000 ms (0.5 ms units)		
		Allowed communications bandwidth per Unit	3,200 pps*3		
		IO connection size	Input: 504 bytes max. Output: 504 bytes max.		
	EtherNet/IP CIP message service *2	UCMM (unconnected message)	Number of servers that can perform communications simultaneously: 32		
	EtherNet/IP conformance test		CT17 compliant		

Item		Specifications		
		Model CK3E-1210	Model CK3E-1310	Model CK3E-1410
USB port	Physical layer	USB 3.0 compliant, type A connector. Output voltage: 5 V, 0.9 A max.		
	Transmission distance	3 m max.		

*1. Always use shielded cables for EtherNet/IP communications.

*2. EtherNet/IP is available only for targets and not available for originators. EtherNet/IP is available only for PMAC firmware revision version 2.6.0 or later whose date of production is September 25th, 2020 or later (Lot number 25920 and later). Use Power PMAC IDE Ver.4.4.1 or a later version.

*3. Represents Packet Per Second and indicates the number of sent or received packets that can be processed in a second.

2-2 Specifications of Peripherals

2-2-1 USB Memory Device

The following shows details of the recommended USB memory device.

OMRON is not responsible for the operation, performance, or write life of any other USB memory devices.

Recommended USB memory	Description
Model FZ-MEM2G	OMRON USB memory device (2 GB)
Model FZ-MEM8G	OMRON USB memory device (8 GB)

You can use the USB memory device for the following applications.

- Uploading data
- Downloading data
- Saving relevant data

2-2-2 Power Supply

The following shows details of the recommended power supply.

Recommended power supply: Model S8JX series (OMRON)

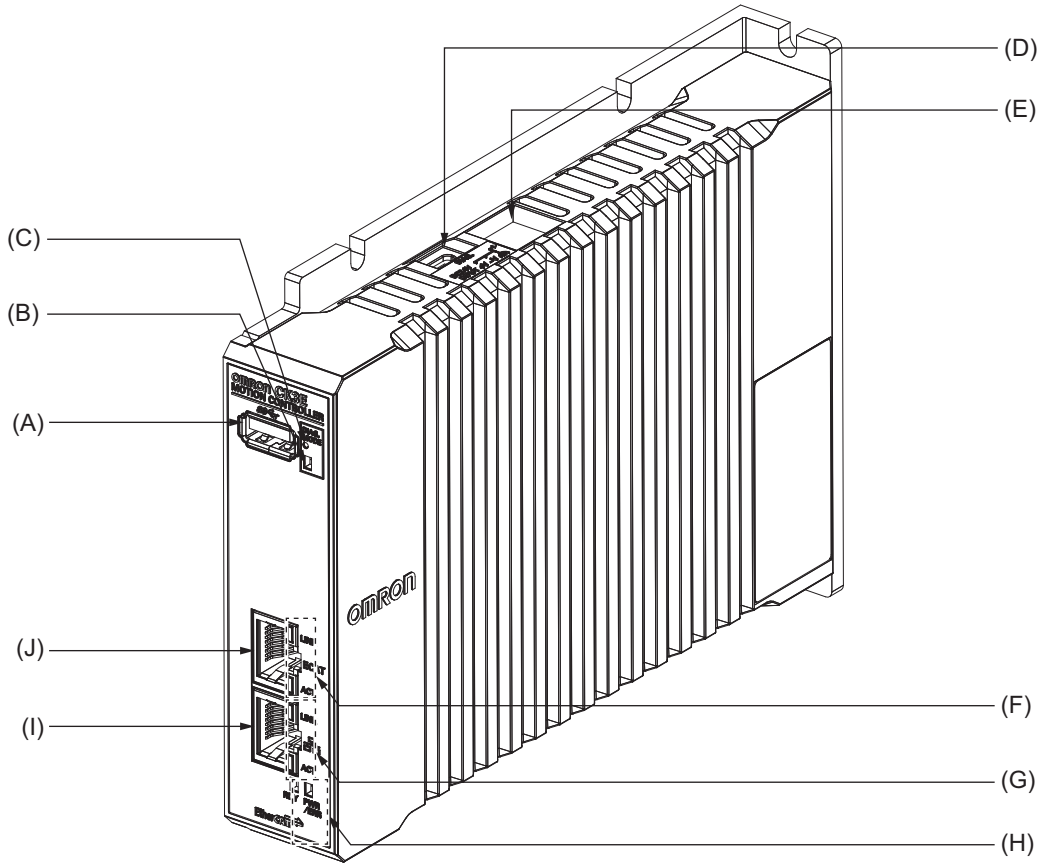
For specifications and manuals of Model S8JX, visit the OMRON website (http://www.fa.omron.co.jp/products/family/1989/lineup.html).

3

Part Names and Functions

This section describes the names and functions of the Programmable Multi-Axis Controller.

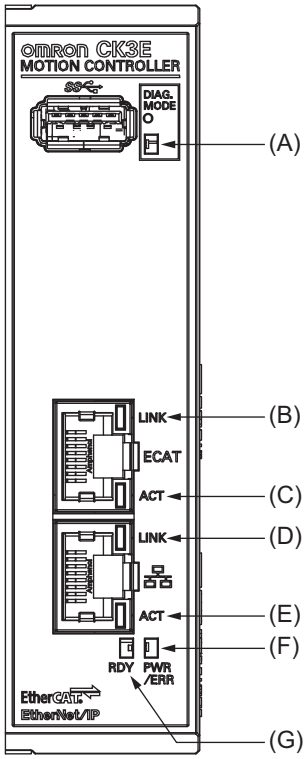
3-1 Part Names



Letter	Name	Function
(A)	USB 3.0 connector	The connector of USB 3.0 interface, used to connect a USB memory device.
(B)	Maintenance mode LED	Not used. Used for maintenance.
(C)	Maintenance mode enter button	Not used. Used to enter Maintenance mode. The user does not use it.
(D)	USB 2.0 connector	Not used. Used for maintenance. The user does not use it.
(E)	Power supply connector	Connects to the Unit power supply.
(F)	EtherCAT communications port operation indicators	Show the operation status of EtherCAT.
(G)	Ethernet communications port operation indicators	Show the operation status of Ethernet.
(H)	Unit operation indicators	Show the operation status of the Unit using multiple indicators.
(I)	Ethernet communications connector	Connects to an Ethernet network communications cable.
(J)	EtherCAT communications connector	Connects to an EtherCAT network communications cable.

3-2 Operation Indicators

The Programmable Multi-Axis Controller is equipped with indicators to show the current operations status of the Unit.

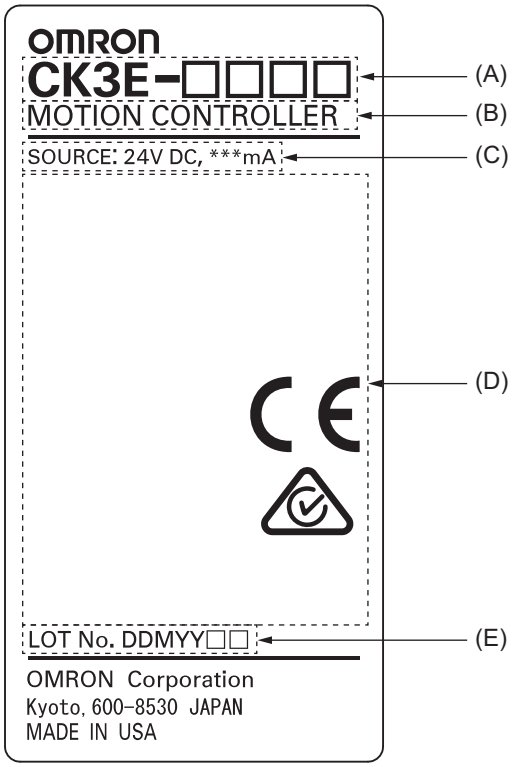


The operating statuses corresponding to colors and status of the indicators are shown below.

Letter	Indicator	Color	Status	Description
(A)	DIAG.MODE	Green	Lit	Not used.
(B)	ECAT LINK	Orange	Lit	The EtherCAT link is established.
			Not lit	The EtherCAT link is not established.
(C)	ECAT ACT	Yellow	Lit	The EtherCAT link is established.
			Flashing	Data communications are in progress after the EtherCAT link is established. Flashes every time data is sent or received.
			Not lit	The EtherCAT link is not established.
(D)	Ethernet LINK	Green/ Orange	Lit in green	The Ethernet link is established at 1 Gbps.
			Lit in orange	The Ethernet link is established at 100 Mbps.
			Not lit	The Ethernet link is not established.
(E)	Ethernet ACT	Yellow	Lit	The Ethernet link is established.
			Flashing	Data communications are in progress after the Ethernet link is established. Flashes every time data is sent or received.
			Not lit	The Ethernet link is not established.
(F)	PWR/ERR	Green/Red	Lit in green	Power is supplied to the Unit.
			Lit in red	Watchdog or another hardware error
			Not lit	Power is not supplied to the Unit.
(G)	RDY	Green	Lit	Power is supplied to the Unit, and the Unit is in operation-ready status.
			Not lit	Power is not supplied to the Unit, or initial processing is in progress.

3-3 ID Information Indication Label

The ID information indication label provides information relevant to the Programmable Multi-Axis Controller.



Item	Name	Description
(A)	Model	Refer to *2-1-1 Model* on page 2-2.
(B)	Product name	Motion Controller
(C)	Power supply rating	Details of power supply rating
(D)	Standard logos	Logos used to represent applicable standards
(E)	Lot number	Information on the date of manufacturing. The lot number of the C3KE-series Programmable Multi-Axis Controller is specified in the form of DDMYY□□,where “DD” is the day, “M” is the month, and “YY” is the year the product is manufactured. “□□” is a character used by OMRON. For “M”, digits “1” to “9” respectively represent January to September, “X” represents October, “Y” November, and “Z” December.

4

Mounting and Wiring

This section describes the procedures for mounting the Programmable Multi-Axis Controller, wiring the power supply used for the Programmable Multi-Axis Controller, and wiring the Programmable Multi-Axis Controller.

4-1 Processing at Power ON and Power OFF

4-1-1 Power ON Operation

Once the power supply to the Power Supply Unit starts, the Programmable Multi-Axis Controller enters the program operation ready status after the following time elapses.

In addition, when the unit is in the operation-ready status, the RDY LED lights up.

● Programmable Multi-Axis Controller Startup Time at Power ON

It takes approximately 40 to 60 seconds for the Programmable Multi-Axis Controller to start up.

Since the startup time is affected by the slave/unit configuration, confirm it on an actual device.

4-1-2 Power OFF Operation

This section describes how to perform the power OFF operation if a user program attempts to write data to the USB memory, or if the user program is to be downloaded to the built-in flash memory.

Writing to the USB Memory

If the power is interrupted while a user program is writing data to the USB memory, the data may be corrupted.

Confirm that no data is being written before you turn OFF the power supply.

Downloading to the Built-In Flash Memory

When you download a user program from the Power PMAC IDE, the data is once stored in the CPU cache before it is saved into the Programmable Multi-Axis Controller.

This means that, if you turn OFF the power supply immediately after starting the save operation, the Programmable Multi-Axis Controller cannot complete the transfer of the data from the cache to the built-in flash memory, which may result in a save operation failure or corruption of the saved data.

If the data is corrupted, issue a re-initialization command ($$$***) from the Power PMAC IDE, and download the program again.

If the Programmable Multi-Axis Controller fails to connect to the Power PMAC IDE, refer to *5-3-3 Initialization of the Programmable Multi-Axis Controller* on page 5-8 and implement initialization.

● Procedure to Download to the Built-in Flash Memory

Use the following procedure to download the user program to the built-in flash memory.

The procedure can be used for any firmware revision of the PMAC firmware.

1 Download the user program from the Power PMAC IDE.

2 At the Power PMAC IDE terminal, execute the **save** command.

3 Establish an SSH connection, and execute the **sync** command from the terminal that you connected to.

4 Wait for at least 5 seconds and turn OFF the power supply.

● Procedure to Download to the Built-in Flash Memory (Version 2.5 or Later)

For PMAC firmware revision version 2.5 or later, you can also use the following procedure to store the user program into the built-in flash memory.

1 Download the user program from the Power PMAC IDE.

2 At the Power PMAC IDE terminal, enter **Sys.SyncSave=1**.

3 At the Power PMAC IDE terminal, execute the **save** command.

Wait until the save completed notification is displayed on the Power PMAC IDE.

4 At the Power PMAC IDE terminal, enter Sys.**SyncSave=0**.

5 Wait for at least 5 seconds and turn OFF the power supply.

4-2 Fail-safe Circuits

⚠ Caution

- Provide safety measures in external circuits to ensure safety in the system if an abnormality occurs due to malfunction of the system due to other external factors affecting operation. Not doing so may result in serious accidents due to incorrect operation.
- Emergency stop circuits, interlock circuits, limit circuits, and similar safety measures must be provided in external control circuits.
- You must take fail-safe measures to ensure safety in the event of incorrect, missing, or abnormal signals caused by broken signal lines, momentary power interruptions, or other causes.
- The use of an Uninterruptible Power Supply (UPS) allows normal operation to continue even if a momentary power interruption occurs, possibly resulting in the reception of an erroneous signal from an external device affected by the momentary power failure. Take external fail-safe measures. Where necessary, monitor the power supply voltage on the system for external devices and use it as an interlock condition.
- Unintended behavior may occur when an error occurs in internal memory of the product. As a countermeasure for such problems, external safety measures must be provided to ensure safe operation of the system.
- The Controller will turn OFF all outputs from Output Units in the following cases. The slaves will operate according to the settings in the slaves.

  a) If a power supply error occurs

  b) If the power supply connection becomes faulty

  c) If a CPU error (watchdog timer error) or CPU reset occurs

  d) If a Controller error in the major fault level occurs

  e) While the Controller is on standby until RUN mode is entered after the power is turned ON

  f) If a system initialization error occurs

As a countermeasure for these problems, external safety measures must be provided to ensure safe operation of the system.

- To ensure safe use of the Controller, correctly make the limit settings for the position, speed, acceleration, jerk, current, and following error, as well as the encoder loss detection.
- For devices that move in a vertical direction, use a motor brake to prevent them from falling down when the servo control is stopped.

4-3 Mounting the Programmable Multi-Axis Controller

4-3-1 Mounting the Programmable Multi-Axis Controller

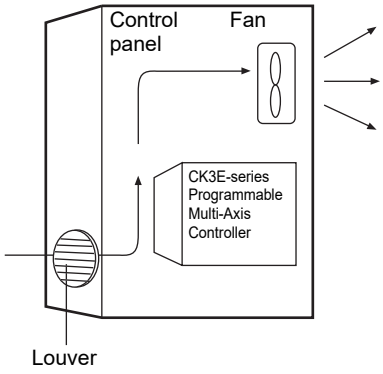
● Installation in Cabinets or Control Panels

When installing the Programmable Multi-Axis Controller in a cabinet or control panel, consider the ambient temperature, accessibility for operation and maintenance, noise immunity, as well as the mounting direction.

● Temperature Control

The allowable ambient operating temperature range of the Programmable Multi-Axis Controller is 0 to 45°C. When necessary, take the following steps to maintain the appropriate temperature.

- Provide sufficient space for adequate air flow.
- Do not install the Controller directly above equipment that generates a large amount of heat such as heaters, transformers, or high-capacity resistors.
- If the ambient temperature exceeds 45°C, install a cooling fan or air conditioner.

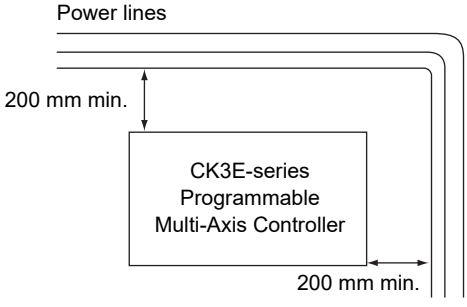


● Accessibility for Operation and Maintenance

- To ensure safe access for operation and maintenance, move the Controller as far away as possible from high-voltage equipment and electrical machinery.
- It will be easy to operate the Controller if it is mounted at a height of 1,000 to 1,600 mm above the floor.

● Improving Noise Resistance

- Do not mount the Controller in a control panel containing high-voltage equipment.
- Install the Controller at least 200 mm away from power lines.



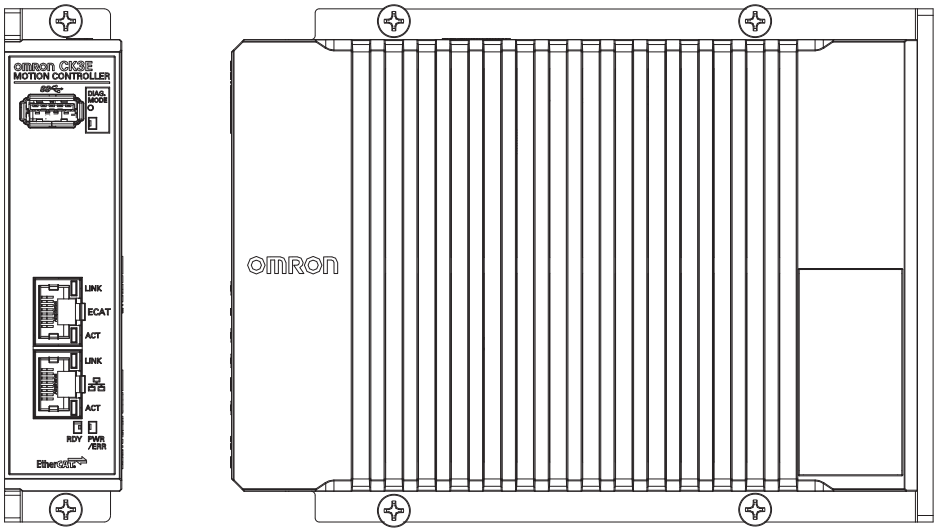
- Ground the mounting plate between the Controller and the mounting surface.

4-3-2 Mounting Direction in Control Panels

The Programmable Multi-Axis Controller can be installed facing the front or sideways.

The Controller must be mounted in an upright position to provide appropriate cooling.

Front mounting Sideways mounting



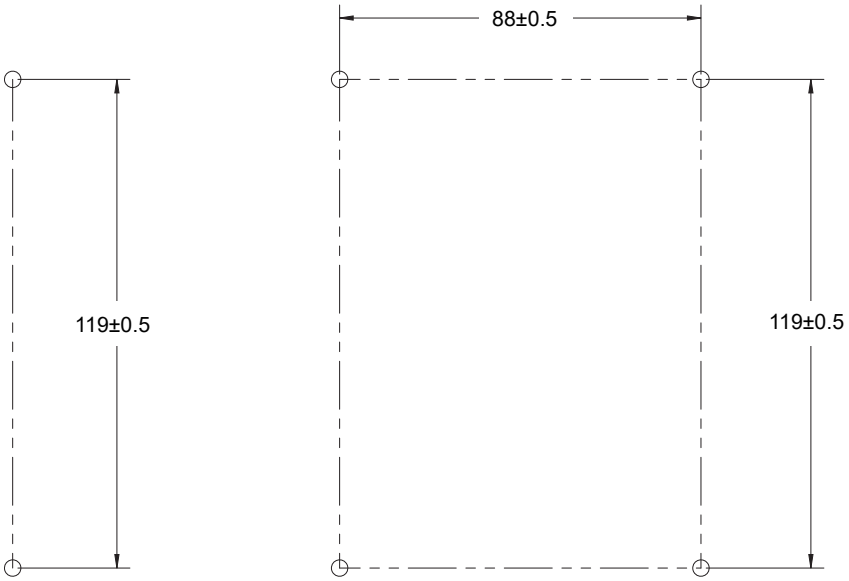
4-3-3 Mounting Method in Control Panels

The following shows the mounting method of the Programmable Multi-Axis Controller. It is recommended that M4 screws be used for mounting.

1 Create holes for the screws used to mount the Programmable Multi-Axis Controller.

The screw positions are as follows.

Front mounting Sideways mounting



2 Insert the screws into the designated positions to mount the Programmable Multi-Axis Controller.

3 Tighten the screws with 1.2 N-m torque to secure.

4-4 Power Supply Wiring

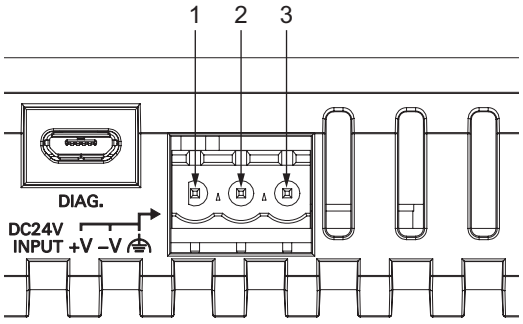
4-4-1 Power Supply Connector Specifications

The following power supply connector is used for the Programmable Multi-Axis Controller.

One power supply connector is included in the Programmable Multi-Axis Controller package.

Model	Manufacturer
MVSTBW 2.5/3-ST-5,08 (1792760)	Phoenix Contact

The following shows the pin assignment of the power supply connector used for the Programmable Multi-Axis Controller.



Pin	Description
1	24 VDC
2	0 VDC
3	Functional ground terminal

4-4-2 Wiring the Power Supply Connector

Compatible Wires

Wires that can be connected to terminal holes of the power supply connector are bar terminals attached to twisted wires, twisted wires, and solid wires.

Select a power supply conductor by considering voltage drops and heat due to the cable length within your installation environment. The following table provides information about the conductors that are compatible with this connector.

Wire type	Conductor cross-sectional area	Conductor length (stripping length)
Solid wire	0.2 to 2.5 mm^2	7 mm
Twisted wire	0.2 to 2.5 mm^2	7 mm
Twisted wire with bar terminal, without plastic sleeve	0.25 to 2.5 mm^2	7 mm
Twisted wire with bar terminal, with plastic sleeve	0.25 to 2.5 mm^2	7 mm

Grounding

The type of ground terminal on the Programmable Multi-Axis Controller is a functional ground terminal.

A functional ground terminal takes protective measures for device and system functions, including prevention of noises from external sources, and prevention of noises from devices or equipment that may have harmful effects on other devices or equipment.

- Ground to 100 Ω or less, and as possible use a separate ground from those of other devices.
- If using an independent ground is not possible, then use a common ground. Connect to the ground pole of the other device.
- Never use a common ground particularly with a motor, inverter, or other type of high-power equipment. Use an independent ground so that they do not affect each other.
- To reduce the risk of receiving an electric shock, do not connect devices to ground poles to which multiple devices are connected.
- Use a ground pole as close to the Programmable Multi-Axis Controller as possible and keep the ground line as short as possible.

Tools Used

Use a flat-head screwdriver to connect and remove wires.

The recommended screwdriver is as follows.

Model	Manufacturer
SZF 0-0,4X2,5	Phoenix Contact

Procedure for Wiring the Power Supply Connector

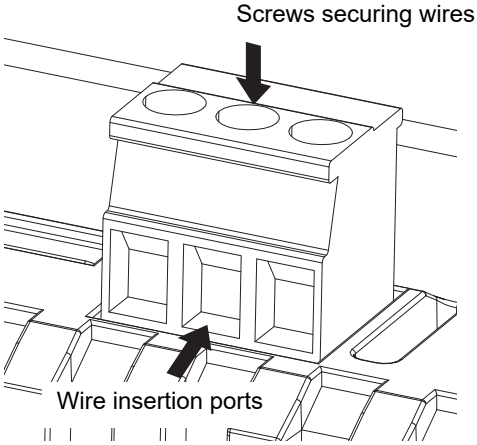
The following shows the procedure for wiring the power supply connector.

1 Peel off the sheath from the power supply cable.

The stripping length is 7 mm if a bar terminal is not used.

If a bar terminal is used, the stripping length must be determined according to the specification of the bar terminal.

2 Loosen the screws securing wires on the top of the power supply connector to release the wire insertion ports.



3 Insert the wires and tighten the screws.

Tighten the screws with 0.5 to 0.6 N-m torque.

Do not apply force to the cable after connecting the wires.

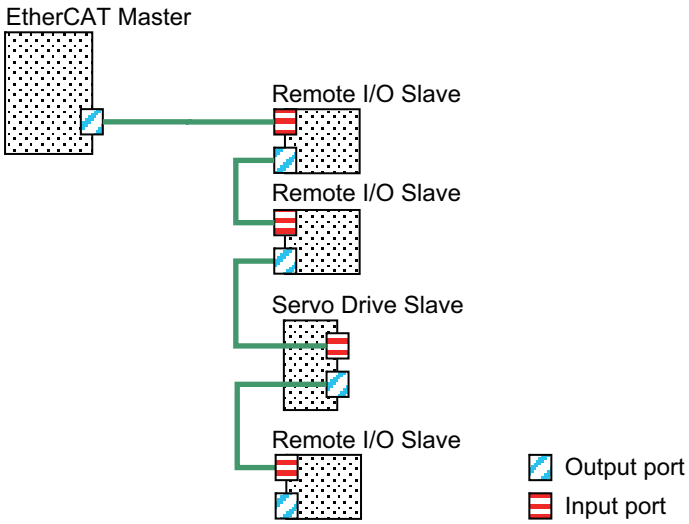
4-5 Laying the EtherCAT Network

This section describes how to install EtherCAT networks.

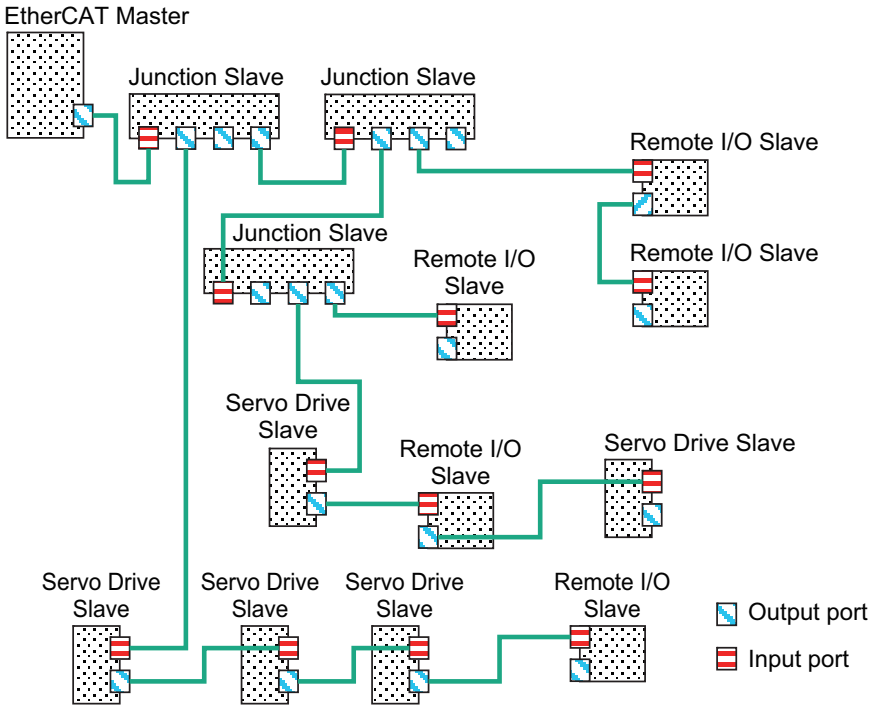
4-5-1 Supported Network Topologies

The Programmable Multi-Axis Controller can be connected using daisy chain connections with no branching, or with branching connections using Junction Slaves. Examples of topology without branching and with branching (Junction Slaves) are shown below.

● No Branching



● Branching



4-5-2 Installation Precautions

Basic precautions for the installation of EtherCAT networks are provided below.

Precautions when Installing a Network

- When you install an EtherCAT network, take sufficient safety precautions and follow the standards and specifications. (Refer to JIS X5252 or to electrical facility technical references.)
  An expert well versed in safety measures and the standards and specifications should be asked to perform the installation.
- Do not install EtherCAT network equipment near sources of noise. If the network must be installed in an area with noise, take steps to address the noise, such as placing equipment in metal cases.

Precautions when Installing Communications Cables

- Check the following items on the communications cables that are used in the network.
  a) Are there any breaks?
  b) Are there any shorts?
  c) Are there any connector problems?
- When you connect the cable to the communications connectors on devices, firmly insert the communications cable connector until it locks in place.
- Do not lay the communications cables together with high-voltage lines.
- Do not lay the communications cable near devices that generate noise.
- Do not lay the communications cables in locations subject to high temperatures or high humidity.
- Do not lay the communications cables in locations subject to excessive dirt and dust or to oil mist or other contaminants.
- There are limitations on the bending radius of communications cables. Check the specifications of the communications cable for the bending radius.

4-5-3 Installing EtherCAT Communications Cables

Ethernet communications cables and connectors are used to connect the EtherCAT port of Programmable Multi-Axis Controller with EtherCAT slaves.

Use a straight, shielded twisted-pair cable (double shielding with aluminum tape and braiding) of Ethernet category 5 (100BASE-TX) or higher. Following products are recommended.

Cable with Connectors

● Sizes and Conductor Pairs: AWG 27 × 4 Pairs

Product name	Manufacturer	Cable length [m]*1	Model	Contact information
Cable with Connectors on Both Ends (RJ45/RJ45) Standard RJ45 plugs type	OMRON Corporation	0.3	XS6W-6LSZH8SS30CM-Y*2	OMRON Customer Service Center
		0.5	XS6W-6LSZH8SS50CM-Y*2	
		1	XS6W-6LSZH8SS100CM-Y*2	
		10	XS6W-6LSZH8SS1000CM-Y*2	

*1. For the latest list of the Cables, refer to the *Industrial Ethernet Connectors Catalog* (Cat. No. G019).

*2. The Cables are single-shielded, but the communication and noise characteristics are ensured to satisfy the standard values.

● Sizes and Conductor Pairs: AWG 22 × 2 Pairs

Product name	Manufacturer	Cable length [m]*1	Model	Contact information
Cable with Connectors on Both Ends (RJ45/RJ45) Rugged RJ45 plugs type	OMRON Corporation	0.3	XS5W-T421-AMD-K	OMRON Customer Service Center
		0.5	XS5W-T421-BMD-K	
		1	XS5W-T421-CMD-K	
		2	XS5W-T421-DMD-K	
		5	XS5W-T421-GMD-K	
		10	XS5W-T421-JMD-K	
Cable with Connectors on Both Ends (M12/M12) Shield Strengthening Connector cable M12/Smartclick Connectors	OMRON Corporation	0.5	XS5W-T421-BM2-SS	
		1	XS5W-T421-CM2-SS	
		2	XS5W-T421-DM2-SS	
		3	XS5W-T421-EM2-SS	
		5	XS5W-T421-GM2-SS	
		10	XS5W-T421-JM2-SS	
Cable with Connectors on Both Ends (M12 /RJ45) Shield Strengthening Connector cable M12/Smartclick Connectors Rugged RJ45 plugs type	OMRON Corporation	0.5	XS5W-T421-BMC-SS	
		1	XS5W-T421-CMC-SS	
		2	XS5W-T421-DMC-SS	
		3	XS5W-T421-EMC-SS	
		5	XS5W-T421-GMC-SS	
		10	XS5W-T421-JMC-SS	

*1. For the latest list of the Cables, refer to the *Industrial Ethernet Connectors Catalog* (Cat. No. G019).

Cables and Connectors

● Sizes and Conductor Pairs: AWG 24 × 4 Pairs

Part name	Manufacturer	Model	Contact information
Cables	Hitachi Metals, Ltd.	NETSTAR-C5E SAB 0.5 × 4P*1	Planning Department, Kanetsu Co., Ltd.
	Kuramo Electric Co., Ltd.	KETH-SB*1	Kuramo Electric Co., Ltd.
	SWCC Showa Cable Systems Co., Ltd.	FAE-5004*1	SWCC Showa Cable Systems Co., Ltd.
	JMACS Japan Co., Ltd.	IETP-SB*1	JMACS Japan Co., Ltd.
RJ45 Connectors	Panduit Corporation	MPS588*1	Panduit Corporation US Headquarters

*1. We recommend that you use combinations of the above Cables and Connectors.

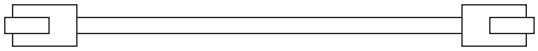
● Sizes and Conductor Pairs: AWG 22 × 2 Pairs

Part name	Manufacturer	Model	Contact information
Cables	Kuramo Electric Co., Ltd.	KETH-PSB-OMR*1	Kuramo Electric Co., Ltd.
	SWCC Showa Cable Systems Co., Ltd.	FAE-5002*1	SWCC Showa Cable Systems Co., Ltd.
	JMACS Japan Co., Ltd.	PNET/B*1	JMACS Japan Co., Ltd.
RJ45 Assembly Connectors	OMRON Corporation	XS6G-T421-1*1	OMRON Customer Service Center

*1. We recommend that you use combinations of the above Cables and Connectors.

Attaching the Connectors to the Cable and Pin Assignments

Use straight wiring to attach the connectors to the communications cable.



Pin No.	Wire color	Wire color	Pin No.
1	White-Green	White-Green	1
2	Green	Green	2
3	White-Orange	White-Orange	3
4	Blue	Blue	4
5	White-Blue	White-Blue	5
6	Orange	Orange	6
7	White-Brown	White-Brown	7
8	Brown	Brown	8
Hood	Shield	Shield	Hood

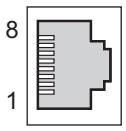
*1. Connect the cable shield to the connector hood at both ends of the cable.

*2. There are two connection methods for Ethernet: T568A and T568B. The T568A connection method is shown above, but the T568B connection method can also be used.

● Connector Specifications

Item	Specification
Electrical characteristics	Conforms to IEEE 802.3 standards.
Connector structure	RJ45 8-pin modular connector (Conforms to ISO 8877.)

● Pin Assignments



Pin No.	Signal name	Abbreviation	Signal direction
1	Transmission data +	TD+	Output
2	Transmission data –	TD–	Output
3	Reception data +	RD+	Input
4	Not used.	---	---
5	Not used.	---	---
6	Reception data –	RD–	Input
7	Not used.	---	---
8	Not used.	---	---
Hood	Frame ground	FG	---

4-6 Laying the Ethernet Network

4-6-1 Installation Precautions

Basic precautions for the installation of Ethernet networks are provided below.

Precautions when Installing a Network

- When you install an Ethernet network, take sufficient safety precautions and follow the standards and specifications. (Refer to JIS X5252 or to electrical facility technical references.)

  An expert who is well trained in safety measures, standards and specifications should be asked to perform the installation.
- Do not install Ethernet network equipment near sources of noise.

  If the network must be installed in an area subject to noise, take steps to address the noise, such as placing equipment in metal cases.

Precautions when Installing Communications Cables

- Check the following items on the communications cables that are used in the network.
  a) Are there any breaks?
  b) Are there any shorts?
  c) Are there any connector problems?
- When you connect the cable to the communications connectors on devices, firmly insert the communications cable connector until it locks into place.
- Do not lay the communications cables together with high-voltage lines.
- Do not lay the communications cable near devices that generate noise.
- Do not lay the communications cables in locations subject to high temperatures or high humidity.
- Do not lay the communications cables in locations subject to excessive dirt and dust or to oil mist or other contaminants.
- There are limitations on the bending radius of communications cables. Check the specifications of the communications cable for the bending radius.

4-6-2 Installing Ethernet Networks

The following products are recommended as devices to be used to configure an Ethernet network.

Ethernet Switches

Manufacturer	Model	Function
OMRON Corporation	Model W4S1-03B	Priority control (QoS): Control data of EtherNet/IP is prioritized. Failure detection: Broadcast storm, LSI error detection (for W4S1-05C only), 10/100BASE-TX, Auto-Negotiation Number of ports (Model W4S1-03B:3, Model W4S1-05B:5, Model W4S1-05C:5)
	Model W4S1-05B	
	Model W4S1-05C	
Cisco Systems Inc.	Contact the manufacturer.	
CONTEC Co., Ltd.	Contact the manufacturer.	
Phoenix Contact	Contact the manufacturer.	

Twisted-pair Cables, Connectors

● Sizes and Conductor Pairs: AWG 24 × 4 Pairs (for 1000BASE-T/100BASE-TX)

Part name	Manufacturer	Model	Contact
Cables	Hitachi Metals, Ltd.	NETSTAR-C5ESAB 0.5 × 4P*1	Planning Department, Kanetsu Co., Ltd.
	Kuramo Electric Co., Ltd.	KETH-SB*1	Kuramo Electric Co., Ltd.
	SWCC Showa Cable Systems Co., Ltd.	FAE-5004*1	SWCC Showa Cable Systems Co., Ltd.
RJ45 Connectors	Panduit Corporation	MPS588*1	Panduit Corporation Osaka office, Japan branch

*1. We recommend that you use combinations of the above-mentioned Cables and Connectors.

● Sizes and Conductor Pairs: AWG 22 × 2 Pairs (for 100BASE-TX)

Part name	Manufacturer	Model	Contact
Cables	Kuramo Electric Co., Ltd.	KETH-PSB-OMR*1	Kuramo Electric Co., Ltd.
	SWCC Showa Cable Systems Co., Ltd.	FAE-5002*1	SWCC Showa Cable Systems Co., Ltd.
	JMACS Japan Co., Ltd.	PNET/B*1	JMACS Japan Co., Ltd.
RJ45 Assembly Connectors	OMRON Corporation	Model XS6G-T421-1*1	OMRON Customer Service Center

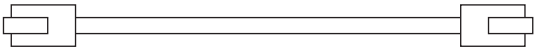
*1. We recommend that you use combinations of the above-mentioned Cables and Connectors.

● Size and conductor pairs: 0.5 mm × 4 Pairs (for 100BASE-TX)

Part name	Manufacturer	Model	Contact
Cables	Fujikura Ltd.	F-LINK-E 0.5 mm × 4 Pairs	Planning Department, Kanetsu Co., Ltd.
RJ45 Connectors	Panduit Corporation	MPS588	Panduit Corporation Osaka office, Japan branch

Attaching the Connectors to the Cable and Pin Assignments

Use straight wiring to attach the connectors to the communications cable.



Pin No.	Wire color	Wire color	Pin No.
1	White-Green	White-Green	1
2	Green	Green	2
3	White-Orange	White-Orange	3
4	Blue	Blue	4
5	White-Blue	White-Blue	5
6	Orange	Orange	6
7	White-Brown	White-Brown	7
8	Brown	Brown	8
Hood	Shield	Shield	Hood

*1. Connect the cable shield to the connector hood at both ends of the cable.

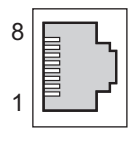
*2. There are two connection methods for Ethernet: T568A and T568B. The T568A connection method is shown above, but the T568B connection method can also be used.

● Connector Specifications

Item	Specification
Electrical characteristics	Conforms to IEEE 802.3 standards.
Connector structure	RJ45 8-pin modular connector (Conforms to ISO 8877.)

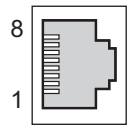
● Pin Assignments

Physical layer standards: 100BASE-TX



Pin No.	Signal name	Abbreviation	Signal direction
1	Transmission data +	TD+	Output
2	Transmission data −	TD-	Output
3	Reception data +	RD+	Input
4	Not used.	---	---
5	Not used.	---	---
6	Reception data −	RD-	Input
7	Not used.	---	---
8	Not used.	---	---

Physical layer standards: 1000BASE-T



Pin No.	Signal name	Abbreviation	Signal direction
1	Communication data DA+	BI_DA+	Input/output
2	Communication data DA-	BI_DA-	Input/output
3	Communication data DB+	BI_DB+	Input/output
4	Communication data DC+	BI_DC+	Input/output
5	Communication data DC-	BI_DC-	Input/output
6	Communication data DB-	BI_DB-	Input/output
7	Communication data DD+	BI_DD+	Input/output
8	Communication data DD-	BI_DD-	Input/output

Recommended Clamp Core and Attachment Procedure

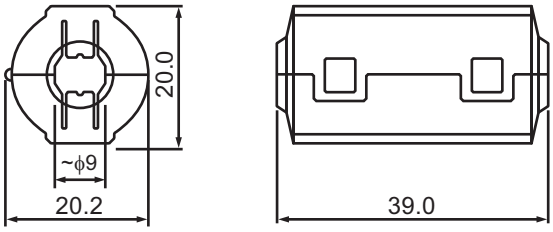
An Ethernet communications error may occur even when the recommended cable and RJ45 connector are used. In that case, attach a clamp core to the Ethernet communications cable.

The following shows the recommended clamp core and the procedure to attach it. The EU Directive (EN 61326) ensures the compliance of the recommended clamp core in the state where it is attached using the recommended procedure.

● Recommended Clamp Core Model

Manufacturer	Product name	Model
NEC TOKIN	Clamp core	ESD-SR-160

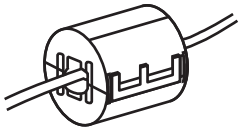
● Dimensions of the Recommended Product



● Recommended Attachment Procedure

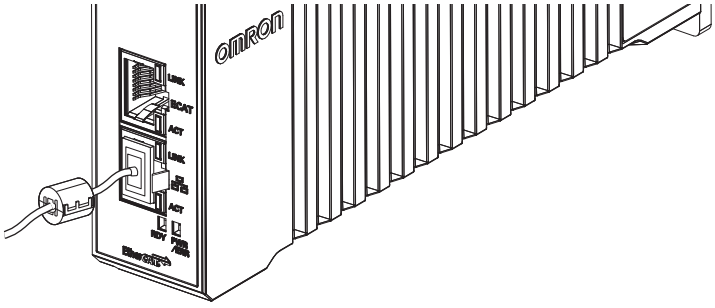
(a) Attaching the clamp core to the cable

Make one loop with the Ethernet communications cable as shown in the figure below.



(b) Attachment position

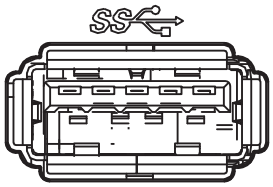
Secure the clamp core to the Ethernet communications cable close to the Ethernet communications connector as shown in the figure below.



4-7 USB Memory Device Connection

Connect a USB memory device to the USB host port (Type A) on the Programmable Multi-Axis Controller to upload and download data as well as to save relevant data.

Refer to *2-2-1 USB Memory Device* on page 2-6 for information on the recommended USB memory devices.



4-8 Grounding

This section describes the earthing methods and precautions.

4-8-1 Considerations for Earthing Methods

Local potential fluctuations due to lightning or noise occurred by power devices will cause potential fluctuations between ground terminals of devices. This potential fluctuation may result in device malfunction or damage.To prevent this, it is necessary to suppress the occurrence of a difference in electrical potential between ground terminals of devices. You need to consider the earthing methods to achieve this objective.

The recommended earthing methods are given in the following table.

Specification of communications cables for EtherCAT and EtherNet	Earthing methods			
	Equipotential bonding system	Star earthing		Daisy chain
		Connecting devices and noise sources to separate earth electrodes	Connecting devices and noise sources to a common earth electrode	
The cable shield connected to the connector hood at both ends of the communications cable	Recommended	Recommended	Not recommended	Not recommended

Additional Information

- In a country or region where the earthing method is regulated, you must comply with the regulations. Refer to the applicable local and national ordinances of the place where you install the system, or other international laws and regulations.
- When using Ethernet switches, ask the Ethernet switch manufacturer for information on the environmental resistance of the Ethernet switch to use, the grounding between Ethernet switches, or the specifications of cables.

4-8-2 Earthing Methods

Each of these earthing methods is given below.

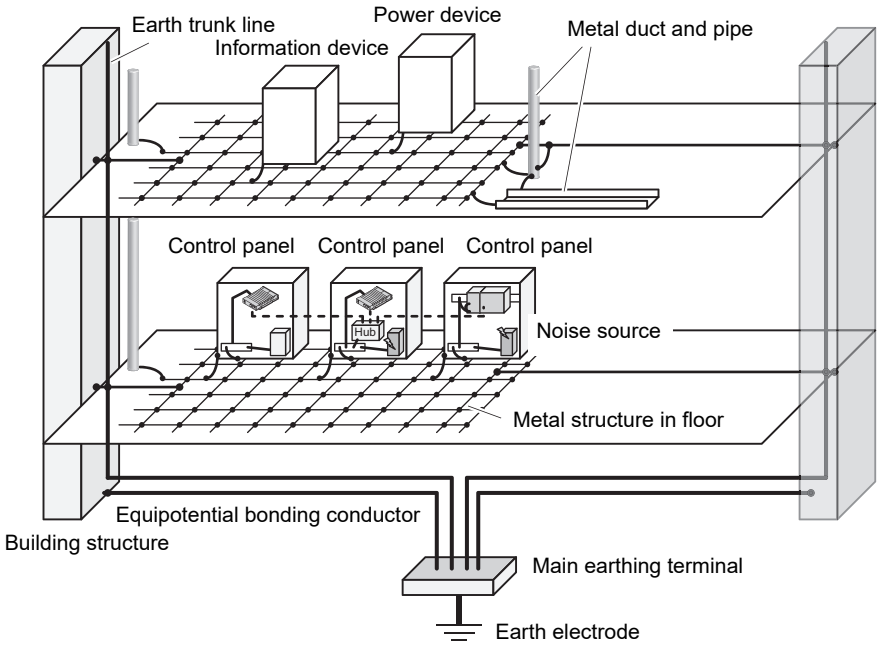
Equipotential Bonding System

Equipotential bonding is an earthing method in which steel frames and building structures, metal ducts and pipes, and metal structures in floors are connected together and make connections to the earth trunk line to achieve a uniform potential everywhere across the entire building. We recommend this earthing method.

The following figure shows an example of an equipotential bonding system.

Connect the main earthing terminal and building structures together with equipotential bonding conductors and embed the mesh ground line in each floor.

Connect the ground line of each control panel to the equipotential bonding system.



Star Earthing

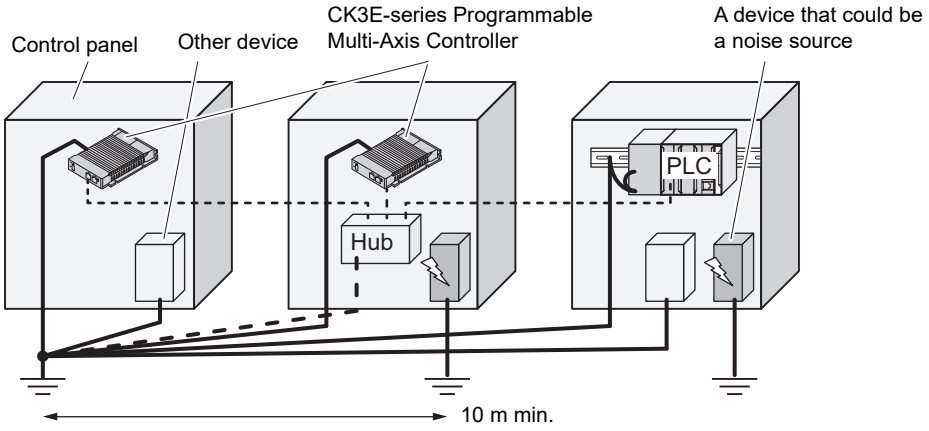
If the earthing method used for the building is not equipotential bonding or the earthing system is unknown, choose (a) from among the earthing methods given below.

(a) Connecting devices and noise sources to separate earth electrodes

This is an earthing method to separately ground an earth electrode of the device that is connected with a communications cable or other devices and an earth electrode of a high-power device that could be a noise source, such as a motor or inverter.

Each earth electrode must be grounded to 100 Ω or less.

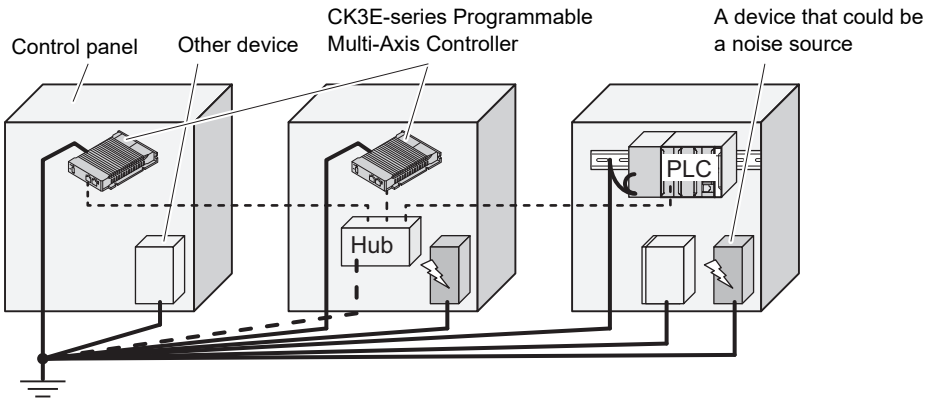
Connect the ground lines of the device that is connected with a communications cable and other devices as a bundle to a single earth electrode. Be sure that the earth electrode is separated by a minimum of 10 m from any other earth electrode of a device that could be a noise source.



(b) Connecting devices and noise sources to a common earth electrode

This is an earthing method to connect the device that is connected with a communications cable, other devices, and a device that could be a noise source, to a common earth electrode.

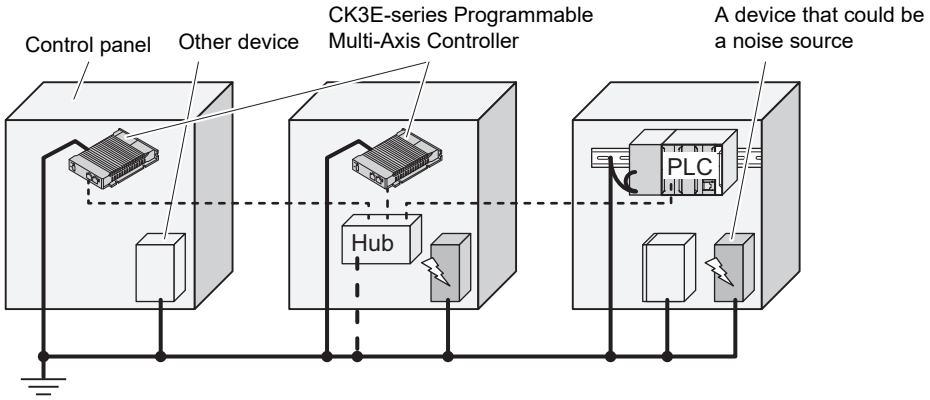
This earthing method is not recommended because the device that could be a noise source may interfere electromagnetically with other devices.



Daisy Chain

This is an earthing method to connect the device that is connected with a communications cable, other devices, and a device that could be a noise source using a daisy-chain topology to a common earth electrode.

This earthing method is not recommended because the device that could be a noise source may interfere electromagnetically with other devices.



5

Error Processing

This section describes the procedures for checking errors that may occur during operation of the Programmable Multi-Axis Controller and taking corrective actions for the errors.

5-1 Classification of Errors

The errors in the Programmable Multi-Axis Controller are classified into the following two major categories.

- **Fatal errors in the Programmable Multi-Axis Controller**

  Errors that occurred as the result of the Programmable Multi-Axis Controller being disabled.

- **Non-fatal errors in the Programmable Multi-Axis Controller**

  Errors that can be detected and managed by the Programmable Multi-Axis Controller itself that is still operating.

5-2 Using the Indicators to Check Errors

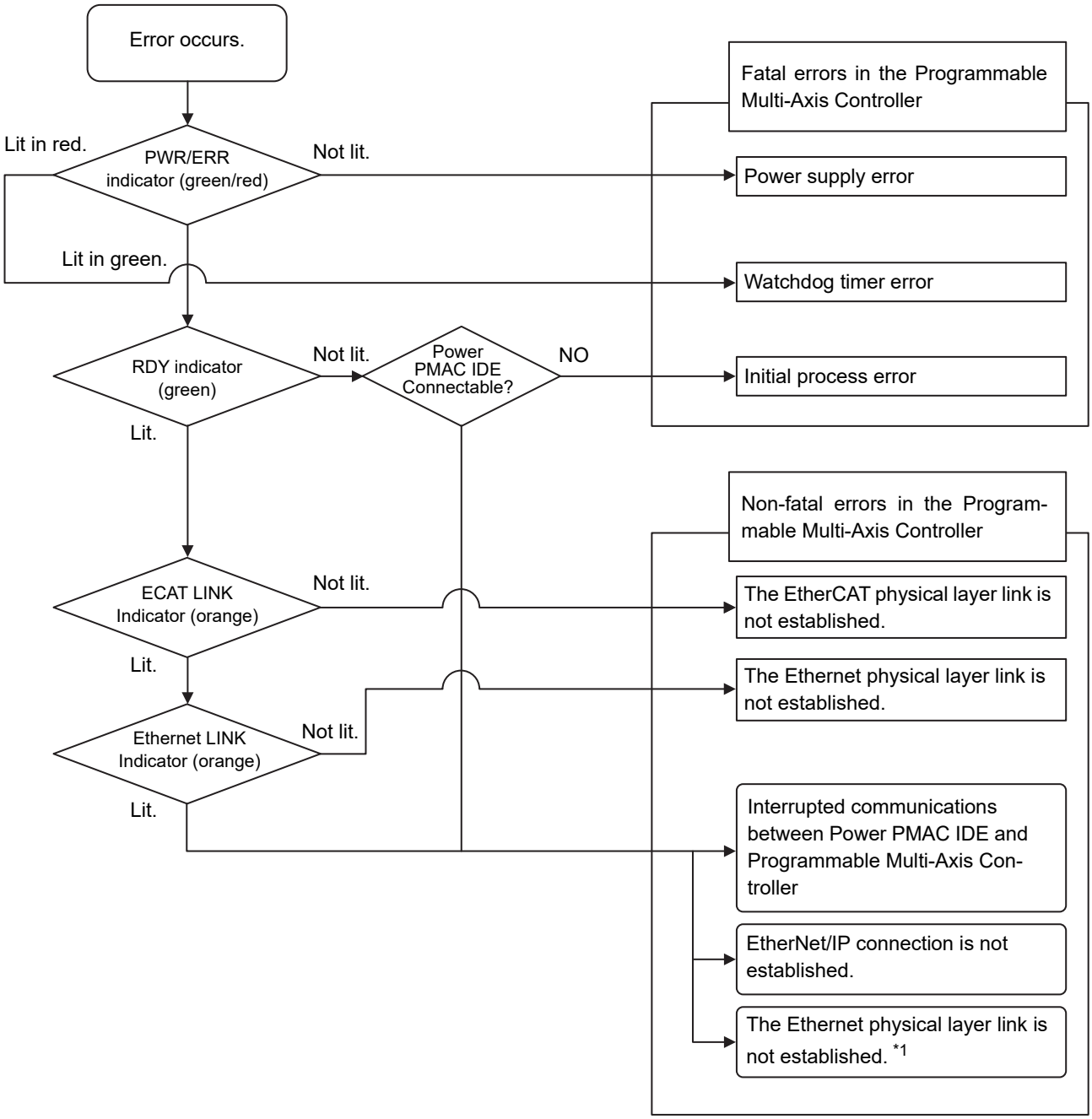
5-2-1 Indicator Types

The following shows the indicators on the Programmable Multi-Axis Controller and their functions.

Indicator	Function
ECAT LINK	Shows the link status of EtherCAT communications.
ECAT ACT	Shows the data communications status of EtherCAT communications.
Ethernet LINK	Shows the link status of Ethernet communications.
Ethernet ACT	Shows the data communications status of Ethernet communications.
PWR/ERR	Shows the power supply status to the Unit and the error status.
RDY	Shows whether the Unit is in operation-ready status.

5-2-2 Procedure for Determining Errors

When an error occurs in the Programmable Multi-Axis Controller, use the following flowchart to check the indicators and determine whether the error is “fatal” or “non-fatal”.



*1. For the details on errors that cannot be determined solely by checking the indicators, check the Sys.status register. Refer to *5-4-1 Sys.Status Register List* on page 5-9 for the Sys.Status flag.

5-3 Corrective Actions for Errors

5-3-1 Fatal Errors in the Programmable Multi-Axis Controller

For fatal errors in the Programmable Multi-Axis Controller, take the following corrective actions depending on the nature of the error.

Details	Cause	Corrective action
Power supply error	The unit's input power is not supplied.	Check the following items and adequately supply adequate power to the unit. • Is the power turned on? • Is the power cable wired correctly? • Is the power cable free of damage?
	The unit's input power voltage is outside the permissible range.	Check the following items and adjust the voltage so that it falls within the permissible range. • Is the power voltage within the specification range? • Is the power capacity sufficient? • Is the power supply failing?
	The power supply unit of the Programmable Multi-Axis Controller failed.	If the error still persists even after the above corrective actions have been taken, replace the Programmable Multi-Axis Controller.
Watchdog timer error	Intrusion of noise	Check the FG, power supply lines, communications lines, and other noise entry paths, and implement noise-related countermeasures as required.
	Illegal user program	Refer to *5-3-3 Initialization of the Programmable Multi-Axis Controller* on page 5-8, and execute re-initialization.
	Software watchdog trip caused by the insufficient task processing time or failed task interruption.	For details, refer to the following manuals. • Power PMAC User's Manual • Power PMAC Software Reference Manual
	A momentary power interruption occurred in the Programmable Multi-Axis Controller during operation caused by a momentary power interruption of the unit's power supply.	Take appropriate measures to ensure that the specified power with the rated voltage and frequency is supplied in places where the power supply is unstable.
	The Programmable Multi-Axis Controller failed.	Replace the Programmable Multi-Axis Controller.
Initial process error	Intrusion of noise	Check the FG, power supply lines, communications lines, and other noise entry paths, and implement noise-related countermeasures as required.
	The Programmable Multi-Axis Controller failed.	Replace the Programmable Multi-Axis Controller.

5-3-2 Non-fatal Errors in the Programmable Multi-Axis Controller

For non-fatal errors in the Programmable Multi-Axis Controller, take the following corrective actions depending on the nature of the error.

Details	Cause	Corrective action
The EtherCAT physical layer link is not established.	The Ethernet cable used for EtherCAT communications is broken or the specified cable is not being used.	If the Ethernet cable is broken or if the specified cable was not used, replace the cable.
	A connector on the Ethernet cable used for EtherCAT communications is disconnected, the contact is faulty, or parts are faulty.	Reconnect the connector and check to ensure it is mated correctly.
	Noise	Check noise entry paths, and implement noise-related countermeasures as required.
	Power is not supplied to the first slave connected to the Programmable Multi-Axis Controller.	Supply power to the slave.
	A slave within the EtherCAT network configuration failed.	Replace the slave.
	The Programmable Multi-Axis Controller failed.	Replace the Programmable Multi-Axis Controller.
The Ethernet physical layer link is not established.	The Ethernet cable used for Ethernet communications is broken or the specified cable is not being used.	If the Ethernet cable is broken or if the specified cable was not used, replace the cable.
	A connector on the Ethernet cable used for Ethernet communications is disconnected, the contact is faulty, or parts are faulty.	Reconnect the connector and check to ensure it is mated correctly.
	Noise	Check noise entry paths, and implement noise-related countermeasures as required.
	Power is not supplied to the Ethernet switch connected to the Programmable Multi-Axis Controller.	Supply power to the Ethernet switch.
	A device within the Ethernet network configuration failed.	Replace the device.
	The Programmable Multi-Axis Controller failed.	Replace the Programmable Multi-Axis Controller.

Details	Cause	Corrective action
Interrupted communications between Power PMAC IDE and Programmable Multi-Axis Controller	The Ethernet cable used for Ethernet communications between Power PMAC IDE and Programmable Multi-Axis Controller is disconnected and then reconnected while communications are being established, which caused communications to be interrupted.	If communications are interrupted between Power PMAC IDE and Programmable Multi-Axis Controller while Ethernet communications are established between them, the communications cannot be reestablished simply by rectifying the problem that interrupted the communications. To reestablish the communications, you need to click **Communication Setup** in Power PMAC IDE and restart communications.
	The power to the Ethernet switch between Power PMAC IDE and Programmable Multi-Axis Controller is turned OFF and then ON while communications are being established, which caused communications to be interrupted.	
	The power to Programmable Multi-Axis Controller is turned OFF and then ON while communications are being established, which caused communications to be interrupted.	
	Communications are temporarily interrupted by noise.	Check noise entry paths, and implement noise-related countermeasures as required. Then reestablish communications between Power PMAC IDE and Programmable Multi-Axis Controller. To reestablish the communication, you need to restart Power PMAC IDE or reestablish the communications by using Power PMAC IDE.
EtherNet/IP connection is not established.	If the originator in use is an NJ/NX-series CPU Unit, you can use Network Configurator to identify the cause and corrective action. Refer to the *NJ/NX-series CPU Unit Built-in EtherNet/IP^{TM} Port User's Manual* (Cat. No W506), 16-2 Checking Status with the Network Configurator for details. Refer to *5-5 Connection Status Code List and Corrective Actions* on page 5-14 for error codes detected by the CK3E.	

5-3-3 Initialization of the Programmable Multi-Axis Controller

If the Programmable Multi-Axis Controller fails to connect to the Power PMAC IDE, you can use a USB memory to initialize the Programmable Multi-Axis Controller to the factory default state.

Use the following procedure to carry out this process.

1 USB memory preparation

Prepare a blank USB memory formatted in FAT32. The recommended USB memory is listed in *2-2-1 USB Memory Device* on page 2-6.

2 Folder creation

Use a computer to create an empty folder named *PowerPmacFactoryReset* on the USB memory root.

3 With the power OFF, mount the above USB memory to the Programmable Multi-Axis Controller.

4 When the power to the Programmable Multi-Axis Controller is turned ON, the Programmable Multi-Axis Controller will be initialized to the factory default.

5 Connect the Power PMAC IDE, and issue a save command.

6 Turn the power OFF, and remove the USB memory.

5-4 Sys.Status Register

5-4-1 Sys.Status Register List

If an error cannot be identified with indicators, confirm the error status in the Sys.Status register.

If an error occurs during operation, check the Sys.Status register with the user program and take suitable action to avoid dangerous operation.

The Sys.Status register is not saved in the built-in flash memory, so it is deleted if the power goes OFF.

Sys.Status can be checked on the Power PMAC IDE; select **Status** - **Global Status** on it.

The Sys.Status register is 32-bit data consisting of the following bits.

Bit	Name	Description
16-31	---	
15	CK3WHWChange	The registers are disabled in the CK3E-series. The values are always 0.
14	CK3WConfigErr(bit2)	
13	CK3WConfigErr(bit1)	
12	CK3WConfigErr(bit0)	
11	FlashSizeErr	The user program size exceeds the built-in flash memory capacity.
10	BufSizeErr	The buffer size exceeds the built-in RAM capacity.
9	AbortAll	In stop status after *Abort all* input
8	NoClocks	Cannot detect a phase clock or a servo clock.
7	Default	Factory default
6	FileConfigErr	System file setting error
5	HWChangeErr	The register is disabled in the CK3E-series. The value is always 0.
4	ConfigLoadErr	Error in saved settings
3	ProjectLoadErr	User Project File Read Error
2	PwrOnFault	Read error when power is turned ON or during reset (bit 3 to 6 logical OR)
1	WDTFault (bit 1)	Real-time interruption software watchdog timer error
0	WDTFault (bit 0)	Background software watchdog timer error

5-4-2 Details of Flags

● FlashSizeErr

Register name	Sys.FlashSizeErr		
Description	The user program size exceeds the built-in flash memory capacity.		
Range	0 to 1		
Details	0: No error 1: The user program size exceeds the built-in flash memory capacity.		
Detection timing	When save command is issued		
Recovery	Re-issue save command.		
Effects	Save command is invalidated.		
Cause and correction	**Cause (Assumed cause)**	**Correction**	**Prevention**
	The user program size is too large.	Reduce the size of the user program. Or, delete the backup file.	None
Precautions/Remarks	None		

● BufSizeErr

Register name	Sys.BufSizeErr		
Description	The buffer size set in the user program exceeds the built-in RAM capacity.		
Range	0 to 1		
Details	0: No error 1: Buffer size exceeds the built-in RAM capacity.		
Detection timing	When power is turned ON or the Controller is rest.		
Recovery	Cycle the power supply, or issue reset command ($$$)		
Effects	The buffer size is changed to the default value.		
Cause and correction	**Cause (Assumed cause)**	**Correction**	**Prevention**
	The buffer size set in the user program is too large.	Reduce the buffer size.	None
Precau-tions/Remarks	None		

● AbortAll

Register name	Sys.AbortAll		
Description	Stop by *Abort all* input		
Range	0 to 1		
Details	0: No stop by *Abort all* input. 1: Stopped by *Abort all* input, or stopped in the past by *Abort all* input.		
Detection timing	With *Abort all* input		
Recovery	Cycle the power supply, or issue reset command ($$$)		
Effects	Operation continues		
Cause and correction	**Cause (Assumed cause)**	**Correction**	**Prevention**
	Abort all was input.	None	None
Precau-tions/Remarks	None		

● NoClocks

Register name	Sys.NoClocks		
Description	Cannot detect a phase clock or a servo clock.		
Range	0 to 1		
Details	0: No error 1: Cannot detect a phase clock or a servo clock.		
Detection timing	When power is turned ON or the Controller is reset.		
Recovery	Cycle the power supply, or issue reset command ($$$)		
Effects	Cannot enable the motor.		
Cause and correction	**Cause (Assumed cause)**	**Correction**	**Prevention**
	The clock-related register is overwritten by the user program.	If the error no longer occurs after the re-initialization command ($$$***) is executed, review the user program.	None
	The Programmable Multi-Axis Controller failed.	If the error still persists even after the above corrective actions have been taken, replace the Programmable Multi-Axis Controller.	None
Precau-tions/Remarks	None		

Default

Register name	Sys.Default		
Description	Initialized to the factory default setting.		
Range	0 to 1		
Details	0: No error 1: Cases below • In the factory default state, or initialized to the factory default state by a re-initialization command ($$$***). • Configuration changed after save command was issued.		
Detection timing	When power is turned ON or the Controller is reset.		
Recovery	Cycle the power supply, or issue reset command ($$$)		
Effects	Operation continues		
Cause and correction	**Cause (Assumed cause)**	**Correction**	**Prevention**
	Re-initialization command ($$$***) was issued.	None	None
	ConfigLoadErr occurred.	Check the corrective action for each error.	None
Precautions/Remarks	None		

FileConfigErr

Register name	Sys.FileConfigErr		
Description	System file setting error		
Range	0 to 1		
Details	0: No error 1: System file setting error		
Detection timing	When power is turned ON or the Controller is reset.		
Recovery	Cycle the power supply, or issue reset command ($$$)		
Effects	Operate with default settings.		
Cause and correction	**Cause (Assumed cause)**	**Correction**	**Prevention**
	System file settings are incorrect.	If the re-initialization command ($$$***) is executed, and the error no longer occurs, review the user program.	None
	The Programmable Multi-Axis Controller failed.	If the error still persists even after the above corrective actions have been taken, replace the Programmable Multi-Axis Controller.	None
Precautions/Remarks	None		

ConfigLoadErr

Register name	Sys.ConfigLoadErr		
Description	Read error in saved settings		
Range	0 to 1		
Details	0: No error 1: System file setting error		
Detection timing	When power is turned ON or the Controller is reset.		
Recovery	Cycle the power supply, or issue reset command ($$$)		
Effects	Operate with default settings.		
Cause and correction	**Cause (Assumed cause)**	**Correction**	**Prevention**
	Settings are incorrect.	If the re-initialization command ($$$***) is executed, and the error no longer occurs, review the settings.	None
	The Programmable Multi-Axis Controller failed.	If the error still persists even after the above corrective actions have been taken, replace the Programmable Multi-Axis Controller.	None
Precau-tions/Remarks	None		

ProjectLoadErr

Register name	Sys.ProjectLoadErr		
Description	User Project File Read Error		
Range	0 to 1		
Details	0: No error 1: User Project File Read Error		
Detection timing	When power is turned ON or the Controller is reset.		
Recovery	Cycle the power supply, issue reset command ($$$), or download the project		
Effects	Operate with default settings.		
Cause and correction	**Cause (Assumed cause)**	**Correction**	**Prevention**
	The project file is corrupted.	After executing the re-initialization command ($$$***), download the project file again.	If the unit power supply is turned OFF while saving the project file, the project file may be corrupted. Do not turn OFF the power supply while saving.
	An illegal project file was downloaded.	Identify the cause from the output window, and make corrections to the project file. After the corrections, execute the re-initialization command ($$$***), and download the project file again.	None
	The Programmable Multi-Axis Controller failed.	If the error still persists even after the above corrective actions have been taken, replace the Programmable Multi-Axis Controller.	None
Precau-tions/Remarks	None		

● PwrOnFault

To know whether the error has occurred when the power is turned ON or at reset with one bit, the value in PwrOnFault becomes 1 when any of Sys.FileConfigErr, Sys.HWChangeErr, Sys.ConfigLoadErr, or Sys.ProjectLoadErr is “1”.

● WDTFault

Register name	Sys.WDTFault		
Description	*Software Watchdog Timer Error* Status		
Range	0 to 3		
Details	Sys.WDTFault shows the software watchdog timer operation status with 2-bit data. Bit0: Background software watchdog timer error 0: No background watchdog timer error has occurred. 1: Background watchdog timer error has occurred. Bit1: Real-time interruption software watchdog timer error 0: No real-time interruption watchdog timer error has occurred. 1: Real-time interruption watchdog timer error has occurred. Refer to the *Power PMAC User Manual* for details of the software watchdog timer.		
Detection timing	During operation		
Recovery	Cycle the power supply, issue reset command ($$$) or re-initialization command ($$$***)		
Effects	User program: Stops Hardware: Enters reset state		
Cause and correction	**Cause (Assumed cause)**	**Correction**	**Prevention**
	Background software watchdog timer error occurred. • Real-time interruption process took too long, and the background process could not be implemented at the interval set in the Sys.WDTReset register.	• Review the user program. • Review the Sys.WDTReset register value.	None
	Real-time interruption software watchdog timer error generated. • Real-time interruption process could not be implemented at the interval set in the Sys.BgWDTReset register.	• Review the user program. • Review the Sys.BgWDTReset register value.	None
Precautions/Remarks	None		

5-5 Connection Status Code List and Corrective Actions

This section describes how to identify the cause of an error by the connection status of the tag data link and how to troubleshoot the error. The connection status can be monitored by the device monitor function of the Network Configurator. Refer to the *NJ/NX-series CPU Unit Built-in EtherNet/IP™ Port User's Manual* (Cat. No W506), 16-2 Checking Status with the Network Configurator for details.

Connection status		Error cause		Corrective action example
General Status (hex)	Additional Status (hex)			
00	0000	Normal status code	The connection has been opened and the tag data link is communicating normally.	---
01	0106	Duplicate consumers	Attempted to open multiple connections for single-consumer data.	If you change the scanner while a tag data link is established, restart the PMAC.
01	0112	Error code returned from target	The RPI value is invalid.	If a single connection is connected to multiple originators, check if the RPI values are not different.
01	0114	Error code returned from target	The Vendor ID and Product Code did not match when the connection was opened.	Check if the originator did not specify a target device model that was different from the model of the target device actually connected.
01	0115	Error code returned from target	The Device Type did not match when opening connection.	Check if the originator did not specify a target device model that was different from the model of the target device actually connected.
01	0116	Error code returned from target	The Major/Minor Revisions did not match when opening connection.	Check if the revision in the EDS file in use matches the revision of the device.
01	0117	Error code returned from target	The tag set specified in the connection's target variables does not exist.	Check that the tag settings are correct with the EtherNet/IP setting tool.
01	011A	Error code returned from target	The number of connections is more than 32.	Does not occur.*1
01	0127	Error code returned from target	The connection size is different between the originator and target.	Check if the connection size of the target matches the connection size of the originator.
01	0128			
01	012F	Error code returned from target	The application path is different between the originator and target.	Check that the setting values for the target variable and originator variable are correct with the EtherNet/IP setting tool.
01	0203	Error code generated by originator	The connection timed out.	Timeout of tag data link communication from the target occurred. Check the power supply to and cable wiring of the devices on the path including the target and switch. If the cause is a decrease in performance due to heavy load, review the performance design by increasing the timeout value, RPI, or etc.

Connection status		Error cause		Corrective action example
General Status (hex)	Additional Status (hex)			
01	0204	Error code generated by originator	The connection open process timed out.	The target did not respond. Check the power supply to and cable wiring of the devices on the path including the target and switch.
01	0302	Error code generated by originator or returned from target	The total pps of the entire EtherNet/IP settings is more than 3,200.	Review the EtherNet/IP settings so that pps does not exceed the limit.

*1. If the number of connections is more than 32, *Tag Data Link Timeout* will occur repeatedly. If the controller log contains repetitive *Tag Data Link Timeout* records, check if the number of connections is appropriate.

6

Inspection and Maintenance

This section describes the procedures for the cleaning, inspection, and maintenance of the Programmable Multi-Axis Controller.

6-1 Cleaning and Maintenance

6-1-1 Cleaning

Perform the following cleaning procedures periodically to ensure the Programmable Multi-Axis Controller is maintained in optimum operating condition.

- During daily cleaning, wipe off dust and dirt using a soft, dry cloth.
- If any dust or dirt remains even after wiping using a soft, dry cloth, wipe over with a cloth that has been wet with a sufficiently diluted detergent (2%) and wrung dry.
- Smudges may remain on the Unit from gum, vinyl, or tape that was left on for a long time. Remove the smudges when cleaning.

6-1-2 Periodic Inspections

The Programmable Multi-Axis Controller can deteriorate under adverse environmental conditions. Periodic inspections are thus required to ensure that the required conditions are being maintained.

Inspection is recommended at least once every six months to a year, but more frequent inspections will be necessary in adverse environments.

Take immediate steps to correct the situation if any of the conditions in the following table are not met.

Periodic Inspection Items

No.	Item	Inspection details	Criteria	Correction
1	External power supply	Check for voltage fluctuations at the power supply terminals.	The voltage must be within the allowable voltage fluctuation range.	Take necessary steps to bring the voltage of the supplied power to within the allowable voltage fluctuation range.
2	Ambient environment	Check the ambient temperature. (Inside the control panel if the Controller is in a control panel.)	0 to 45°C	Use a thermometer to check the temperature and ensure that the ambient temperature remains within the allowed range of 0 to 45°C.
		Check the ambient humidity. (Inside the control panel if the Controller is in a control panel.)	Relative humidity must be 10% to 95% with no condensation.	Use a hygrometer to check the humidity and ensure that the ambient relative humidity remains between 10% and 95%. Make sure that no condensation forms due to rapid changes in temperature.
		Check that the Controller is not in direct sunlight.	Not in direct sunlight	Protect the Controller if necessary.
		Check for accumulation of dirt, dust, salt, metal powder, etc.	No accumulation	Clean and protect the Controller if necessary.

No.	Item	Inspection details	Criteria	Correction
2	Ambient environment	Check for water, oil, or chemical sprays hitting the Controller.	No spray	Clean and protect the Controller if necessary.
		Check for corrosive or flammable gases in the area of the Controller.	No corrosive or flammable gases	Check by smell or use a sensor.
		Check the level of vibration or shock.	Vibration resistance and shock resistance must be within specifications.	Install cushioning or shock absorbing equipment if necessary.
		Check for noise sources near the Controller.	No significant noise sources	Either separate the Controller and noise source or protect the Controller.
3	Mounting and wiring status	Check that cable connectors are fully inserted and locked.	No looseness	Fully inserted and lock the connectors.
		Check for damaged external wiring cables.	No visible damage	Check visually and replace cables if necessary.

Tools Required for Inspections

Required Tools

- Flat-head screwdriver
- Phillips screwdriver
- Voltage tester or digital voltmeter
- Industrial alcohol and clean cotton cloth
- Antistatic gas duster

Tools Required Occasionally

- Oscilloscope
- Thermometer and hygrometer

6-2 Maintenance Procedures

This section describes the procedures for backing up the Programmable Multi-Axis Controller data and replacing a Unit.

6-2-1 Unit Replacement Precautions

Note the following when replacing any faulty Unit.

- Do not replace a Unit until the power is turned OFF.
- Check the new Unit to ensure that there are no errors.
- If you return a faulty Unit for repair, describe the problem in as much detail as possible and enclose this description with the Unit.

6-2-2 Backup

Back up the Programmable Multi-Axis Controller data so that the data can be restored when a failure or other problems occur.

Use Power PMAC IDE to create a backup file. Power PMAC IDE is also used to restore the backup file to the Programmable Multi-Axis Controller.

For details of the backup and restoration procedures, refer to “Power PMAC IDE User Manual”.

6-2-3 Unit Replacement

Procedure for Replacing the Programmable Multi-Axis Controller

The following describes the basic procedure for replacing the Programmable Multi-Axis Controller.

No.	Step	Description	Reference
1	Turn OFF power to the devices	Turn OFF power to the Motion Controller. Take measures to ensure that there are no effects on the peripheral devices, and then turn OFF power to the Motion Controller.	---
2	Disconnect cables	Disconnect the cables connected to the Programmable Multi-Axis Controller.	---
3	Replace the Programmable Multi-Axis Controller	Replace the Programmable Multi-Axis Controller with a new Controller, connect the cables, and turn ON power to the Motion Controller and EtherCAT devices.	---
4	Connect with IDE	Connect the Programmable Multi-Axis Controller and the Power PMAC IDE online through Ethernet.	---
5	Initialize the Programmable Multi-Axis Controller	In the Terminal window, input the re-initialization command ($$$***), and initialize the Programmable Multi-Axis Controller.	---
6	Read the EtherCAT ENI file	In Power PMAC IDE, click **Delta Tau** – **Tools** – **System Setup** – **Master[0] Deactivated** in order. Click the **Browse** button, and read the backed-up ENI file into Power PMAC IDE.	Only when using EtherCAT
7	Write to the EtherCAT ENI file	Click the **Download ENI file** button, and write the ENI file to the Programmable Multi-Axis Controller.	Only when using EtherCAT

No.	Step	Description	Reference
8	Read the project file	Read out the backed-up project file in Power PMAC IDE.	The EtherNet/IP settings are contained in the project file.
9	Write to the project file	Right-click the project name, click **Build and Download All Programs**, and write the project file to the Programmable Multi-Axis Controller.	---
10	Execute save	In the Terminal window, input the save command, and save the program in the built-in flash memory.	---
11	Execute reset	In the Terminal window, input the reset command $$$, and reset the Programmable Multi-Axis Controller.	---

Procedure to Replace an EtherCAT Slave

If you use EtherCAT, use the following procedure to replace an EtherCAT slave.

No.	Step	Description	Reference
1	Turn OFF power to the devices	Take measures to ensure that there are no effects on the peripheral devices, and then turn OFF power to the Motion Controller and all EtherCAT slaves.	---
2	Replace the EtherCAT Slave	For the EtherCAT slave replacement method, refer to the relevant manuals for each slave. Replace with a new Unit, turn ON power to the EtherCAT slave, and then turn ON power to the Motion Controller.	Refer to the manual for each EtherCAT slave for details.

A

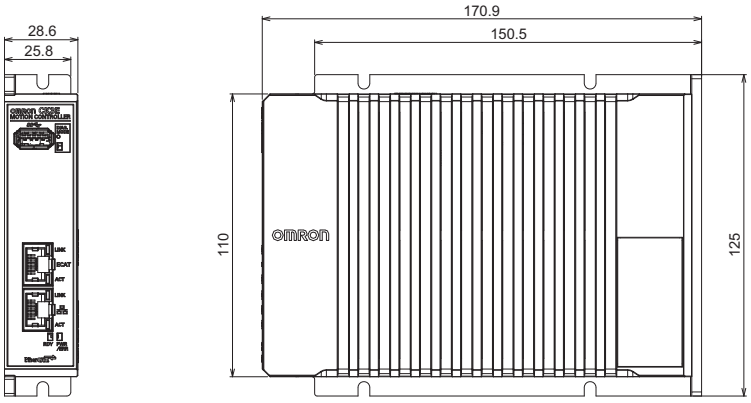
Appendices

The following provides the dimension diagram, and restrictions on using the OMRON EtherCAT Coupler Unit.

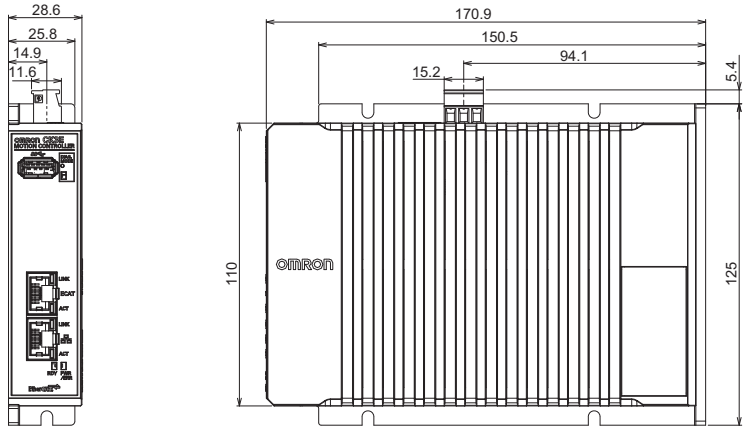
A-1 Dimension Diagram

The following shows the dimension diagrams of the Programmable Multi-Axis Controller. The unit of dimension is millimeter.

● Main Body Only

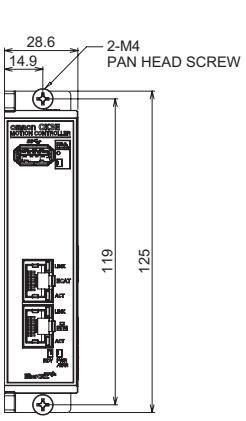


● With Power Connector

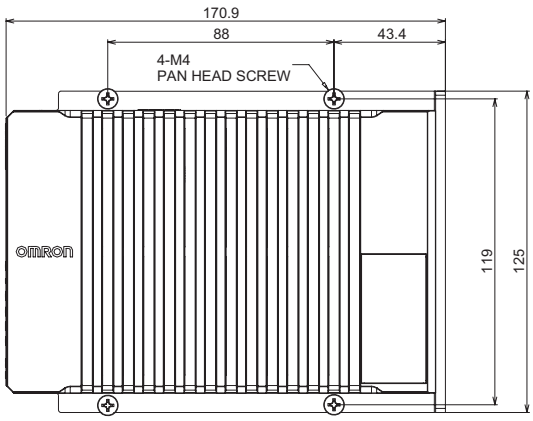


● Mounting Dimensions

Front mounting



Sideways mounting



A-2 Restrictions on Using the OMRON NX-Series EtherCAT Coupler Unit

When OMRON NX-series EtherCAT Coupler Units are used as slaves of the Programmable Multi-Axis Controller as the EtherCAT master, the following models and unit versions of EtherCAT Coupler Units can be connected.

Model	Unit version	Connectable/Unconnectable
Model NX-ECC203	Ver. 1.4 or later	Connectable
	Ver. 1.3 or earlier	Unconnectable
Model NX-ECC202	All versions	
Model NX-ECC201	All versions	

A-3 Supported CIP Objects

The supported CIP objects are as shown below.

Object name	Function	Reference
Identity object	Retrieves the product information of the CK3E.	*A-3-1 Identity Object (Class ID: 01 Hex)* on page A-4
Assembly object	Joins the I/O data of the CK3E.	*A-3-2 Assembly Object (Class ID: 04 Hex)* on page A-5
TCP/IP interface object	Configures the TCP/IP interface.	*A-3-3 TCP/IP Interface Object (Class ID: F5 Hex)* on page A-6
Ethernet link object	Retrieves various information on the Ethernet link.	*A-3-4 Ethernet Link Object (Class ID: F6 Hex)* on page A-8

A-3-1 Identity Object (Class ID: 01 Hex)

The Identity object is intended to retrieve the product information of the CK3E.

Service Code

Service code (hex)	Parameter name	Description	Supported services	
			Classes	Instances
01	Get_Attribute_All	Reads the values of all attributes.	Supported	Supported
05	Reset	0: Restart	Not supported	Supported
0E	Get_Attribute_Single	Reads the value of the specified attribute.	Supported	Supported

Class ID and Instance ID

The class ID and instance ID are as shown below.

ID type	Value (hex)
Class ID	01
Instance ID	01

Attribute ID

The attribute IDs for instances are as shown below.

Attribute ID (hex)	Parameter name	Description	Attribute	Data type	Value (hex)
01	Vendor ID	Vendor ID	Read	UINT	002F (always)
02	Device Type	Device type	Read	UINT	000E (always)
03	Product Code	Product code	Read	UINT	*1
04	Revision	CIP revision	Read	Struct	---
	Major Revision	Major revision	Read	USINT	01
	Minor Revision	Minor revision	Read	USINT	02
05	Status	status	Read	WORD	*2

Attribute ID (hex)	Parameter name	Description	Attribute	Data type	Value (hex)
06	Serial Number	Serial number	Read	UDINT	Set value
07	Product Name	Product name	Read	SHORT_ STRING	Set value

*1. Product code

Model	Product code (hex)
CK3E-1210	0BE5
CK3E-1310	0BE6
CK3E-1410	0BE7

*2.Status

Status	Value (hex)
The I/O connection is not established	0000
The I/O connection is established in RunMode	0060
The I/O connection is established in IdleMode	0070

A-3-2 Assembly Object (Class ID: 04 Hex)

The Assembly object is intended to join the I/O data of the CK3E.

Service Code

Service code (hex)	Parameter name	Description	Supported services	
			Classes	Instances
0E	Get_Attribute_Single	Reads the value of the specified attribute.	Supported	Supported
10	Set_Attribute_Single	Writes the value of the specified attribute.	Not supported	Supported

Class ID and Instance ID

The class ID and instance ID are as shown below.

ID type	Value (hex)
Class ID	04
Instance ID	ED: Listen Only Heartbeat Assembly EE: Input Only Heartbeat Assembly 300, 304, 308 to 37C (in 4 increments): Output Assembly 301, 305, 309 to 37D (in 4 increments): Input Assembly

Attribute ID

The attribute IDs for instances are as shown below.

● Attribute ID for Output Assembly

Attribute ID (hex)	Parameter name	Description	Attribute	Data type	Value (hex)
03	Data	Output data	Read and write	ARRAY of BYTE	0 to 504 byte data
04	Size	Output data size	Read	UINT	0 to 1F8

● Attribute ID for Input Assembly

Attribute ID (hex)	Parameter name	Description	Attribute	Data type	Value (hex)
03	Data	Input data	Read and write	ARRAY of BYTE	0 to 504 byte data
04	Size	Input data size	Read	UINT	0 to 1F8

A-3-3 TCP/IP Interface Object (Class ID: F5 Hex)

The TCP/IP Interface object is intended to configure the TCP/IP interface.

Service Code

Service code (hex)	Parameter name	Description	Supported services	
			Classes	Instances
01	Get_Attribute_All	Reads the values of all attributes.	Supported	Supported
0E	Get_Attribute_Single	Reads the value of the specified attribute.	Supported	Supported
10	Set_Attribute_Single	Writes the value of the specified attribute.	Not supported	Supported

Class ID and Instance ID

The class ID and instance ID are as shown below.

ID type	Value (hex)
Class ID	F5
Instance ID	01

Attribute ID

The attribute IDs for instances are as shown below.

Attribute ID (hex)	Parameter name	Description	Attribute	Data type	Value (hex)
01	Status	IP address setting status of the interface	Read	DWORD	00000001 (always)
02	Configuration Capability	Controller configurations and setup that can be set to the interface.	Read	DWORD	00000000 (always)
03	Configuration Control	Sets the method to used to set the IP address when the interface starts.	Read	DWORD	00000000 (always)
04	Physical Link Object	Path to the physical link object	Read	Struct	---
	Path Size	Path size	Read	UINT	0002 (always)
	Path	Fixed path	Read	Padded EPATH	20F62401 (always)
05	Interface Configuration	Interface configuration	Read	Struct	---
	IP Address	IP address	Read	UDINT	Set value
	Network Mask	Subnet mask	Read	UDINT	Set value
	Gateway Address	Default gateway	Read	UDINT	Set value
	Name Server	Primary name server	Read	UDINT	Set value
	Name Server 2	Secondary name server	Read	UDINT	Set value
	Domain Name	Domain name	Read	STRING	Set value
06	Host Name	Host name	Read	STRING	Set value
08	TTL Value	TTL value	Read	UINT	01 (always)
09	Mcast Config	Multicast configuration	Read	Struct	---
	Alloc Control	Multicast address allocation method	Read	USINT	00 (always)
	Reserved	Reserved	Read	USINT	00 (always)
	Num Mcast	Number of multicast addresses	Read	UINT	01 (always)
	Mcast Start Addr	Start multicast addresses	Read	UDINT	Set value
0D	Encapsulation Inactivity Timeout	Encapsulation inactivity timeout time	Read and write	UINT	Set value (120 seconds by default)

A-3-4 Ethernet Link Object (Class ID: F6 Hex)

The Ethernet link object is intended to retrieve various information on the Ethernet link.

Service Code

Service code (hex)	Parameter name	Description	Supported services	
			Classes	Instances
01	Get_Attribute_All	Reads the values of all attributes.	Supported	Supported
0E	Get_Attribute_Single	Reads the value of the specified attribute.	Supported	Supported
4C	Get_and_Clear	Specifies attribute 4, 5, 12, or 13 and resets the attribute to 0.	Not supported	Supported

Class ID and Instance ID

The class ID and instance ID are as shown below.

ID type	Value (hex)
Class ID	F6
Instance ID	01

Attribute ID

The attribute IDs for instances are as shown below.

Attribute ID (hex)	Parameter name	Description	Attribute	Data type	Value (hex)
01	Interface Speed	Gives the baud rate for the interface.	Read	UDINT	Current value
02	Interface Flags	Gives the status of the interface.	Read	DWORD	*1
03	Physical Address	Gives the MAC address of the interface.	Read	ARRAY OF USINT	Current value of the MAC address

Attribute ID (hex)	Parameter name	Description	Attribute	Data type	Value (hex)
04	Interface Counters	Path to the physical link object	Read	Struct	---
	In Octets	The number of octets received through the interface.	Read	UDINT	Current value
	In Unicast Packets	The number of unicast packets received through the interface.	Read	UDINT	Current value
	In NonUnicast Packets	The number of packets besides unicast packets received through the interface.	Read	UDINT	Current value
	In Discards	The number of packets discarded after received by the interface	Read	UDINT	Current value
	In Errors	The number of incoming packets that had errors.	Read	UDINT	Current value
	In Unknown Protos	The number of incoming packets that were of an unknown protocol.	Read	UDINT	0 (always)
	Out Octets	The number of octets sent through the interface.	Read	UDINT	Current value
	Out Unicast Packets	The number of unicast packets sent through the interface.	Read	UDINT	Current value
	Out NonUnicast Packets	The number of packets besides unicast packets sent through the interface.	Read	UDINT	Current value
	Out Discards	The number of discarded sent packets.	Read	UDINT	Current value
	Out Errors	The number of sent packets that had errors.	Read	UDINT	Current value

Attribute ID (hex)	Parameter name	Description	Attribute	Data type	Value (hex)
05	Media Counters	Media counters for communications ports	Read	Struct	---
	Alignment Errors	Number of frames received that were not octets in length.	Read	UDINT	Current value
	FCS Errors	Number of frames received that did not pass the FCS check.	Read	UDINT	Current value
	Single Collisions	Number of frames sent successfully with only one collision.	Read	UDINT	Current value
	Multiple Collisions	Number of frames sent successfully with two or more collisions.	Read	UDINT	Current value
	SQE Test Errors	Number of times a SQE test error message was generated.	Read	UDINT	0 (always)
	Deferred Transmissions	The number of frames for which the first attempt to send was delayed because the media was busy.	Read	UDINT	Current value
	Late Collisions	The number of collisions detected in packets that were sent after 512 bit times.	Read	UDINT	Current value
	Excessive Collisions	The number of frames that failed to be sent because of excessive collisions.	Read	UDINT	Current value
	MAC Transmit Errors	The number of frames that failed to be sent due to an internal MAC sublayer transmission error.	Read	UDINT	Current value
	Carrier Sense Errors	The number of times the carrier sense condition was lost.	Read	UDINT	Current value
	Frame Too Longs	The number of frames received that exceeded the maximum allowed frame size.	Read	UDINT	Current value
	MAC Receive Errors	The number of frames that could not be received through the interface due to an internal MAC sublayer reception error.	Read	UDINT	Current value
07	Interface Type	Interface type	Read	USINT	02 (always)
0B	Interface Control	List of settings supported by the interface	Read	Struct	---
	Capability Bits	Settings supported by the interface	Read	DWORD	*2
	Speed/Duplex Array Count	The number of interface speed/duplex lists	Read	USINT	00 (always)

Attribute ID (hex)	Parameter name	Description	Attribute	Data type	Value (hex)
0C	HC Interface Counters	Counters related to packet transmission and reception on high capacity interfaces	Read	Struct	---
	HCInOctets	The number of octets received through the interface. This counter is the 64-bit edition of In Octets.	Read	ULINT	Current value
	HCInUnicastPkts	The number of unicast packets received through the interface. This counter is the 64-bit edition of In Unicast Packets.	Read	ULINT	Current value
	HCInMulticastPkts	The number of multicast packets received through the interface.	Read	ULINT	Current value
	HCInBroadcastPkts	The number of broadcast packets received through the interface.	Read	ULINT	Current value
	HCOutOctets	The number of octets sent through the interface. This counter is the 64-bit edition of Out Octets.	Read	ULINT	Current value
	HCOutUnicastPkts	The number of unicast packets sent through the interface. This counter is the 64-bit edition of Out Unicast Packets.	Read	ULINT	Current value
	HCOutMulticastPkts	The number of multicast packets sent through the interface.	Read	ULINT	Current value
	HCOutBroadcastPkts	The number of broadcast packets sent through the interface.	Read	ULINT	Current value

Attribute ID (hex)	Parameter name	Description	Attribute	Data type	Value (hex)
0D	HC Media Counters	High capacity media counters for communications ports	Read	Struct	---
	HCStatsAlignmentErrors	The number of frames received that were not octets in length. This counter is the 64-bit edition of Alignment Errors.	Read	ULINT	Current value
	HCStatsFCSErrors	The number of frames received that did not pass the FCS check. This counter is the 64-bit edition of FCS Errors.	Read	ULINT	Current value
	HCStatsInternalMacTransmitErrors	The number of frames that failed to be sent due to a MAC sublayer transmission error. This counter is the 64-bit edition of MAC Transmit Errors.	Read	ULINT	Current value
	HCStatsFrameTooLongs	The number of frames received that exceeded the maximum allowed frame size. This counter is the 64-bit edition of Frame Too Long.	Read	ULINT	Current value
	HCStatsInternalMacReceiveErrors	The number of frames that could not be received through the interface due to a MAC sublayer reception error. This counter is the 64-bit edition of MAC Receive Errors.	Read	ULINT	Current value
	HCStatsSymbolErrors	The number of frames that could not be received through the interface due to an internal MAC sublayer symbol error.	Read	ULINT	Current value

*1. Details on Interface Flags

Bit	Name	Description
0	Link Status	FALSE: The link is down. TRUE: The link is up.
1	Half/Full Duplex	FALSE: Half duplex TRUE: Full duplex
2 to 4	Negotiation Status	00 hex: Auto-negotiation is in progress. 01 hex: Auto-negotiation and speed detection failed. 02 hex: Auto-negotiation failed, but speed detection succeeded. 03 hex: Speed and duplex mode negotiation succeeded. 04 hex: Auto-negotiation was not attempted.

*2.Details on Capability Bits

Bit	Name	Description
0	Manual Setting Requirement Reset	Always FALSE
1	Auto-negotiate	Always TRUE
2	Auto-MDIX	Always TRUE
3	Manual Speed/Duplex	Always FALSE

I

Index

Index

OMRON Corporation **Industrial Automation Company**
Kyoto, JAPAN
Contact: www.ia.omron.com

Regional Headquarters
OMRON EUROPE B.V.
Wegalaan 67-69, 2132 JD Hoofddorp
The Netherlands
Tel: (31)2356-81-300/Fax: (31)2356-81-388

OMRON ELECTRONICS LLC
2895 Greenspoint Parkway, Suite 200
Hoffman Estates, IL 60169 U.S.A.
Tel: (1) 847-843-7900/Fax: (1) 847-843-7787

OMRON ASIA PACIFIC PTE. LTD.
No. 438A Alexandra Road # 05-05/08 (Lobby 2),
Alexandra Technopark,
Singapore 119967
Tel: (65) 6835-3011/Fax: (65) 6835-2711

OMRON (CHINA) CO., LTD.
Room 2211, Bank of China Tower,
200 Yin Cheng Zhong Road,
PuDong New Area, Shanghai, 200120, China
Tel: (86) 21-5037-2222/Fax: (86) 21-5037-2200

Authorized Distributor:

Cat. No. I610-E1-02 0820