

**SCARA Robots
YRC Series**

CE marking

**SUPPORTING
SUPPLEMENT MANUAL**

OMRON

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Introduction

Thanks for purchasing the OMRON robot controller YRC.

This manual describes the CE marking for the YRC. When shipping the YRC to Europe or when using it in Europe, always read this manual thoroughly to use the controller correctly.

This manual describes only the items related to CE marking. For operations and programming of the robot controller, refer to the user's manuals that come with the robot controller. For information on the warranty, also refer to the user's manual that come with the robot controller.

Even after reading this manual, keep it in a safe, easily accessible place so that it can be referred to when needed.

- This manual should be used with the robot and controller and considered an integral part of them.
- When the robot and controller are moved, transferred, or sold, send this manual to the new user along with the robot and controller. Be sure to explain to the new user the need to read through this manual.
- Specifications of the robot and controller models other than standard models may be omitted in this manual. In that case, refer to the specifications of standard models.
- For details on specific operation of the robot controller, refer to the user's manuals that come with the robot controller.

NOTES

- The contents of this manual are subject to change without prior notice.
- While every effort has been made to ensure the contents of this manual are correct, please contact us if you find any part of this manual to be unclear, confusing or inaccurate.
- This manual does not serve as a guarantee of any industrial property rights or any other rights and does not grant a license in any form. Please acknowledge that we bear no liability whatsoever for any problems involving industrial property rights which may arise from the contents of this manual.

OMRON EUROPE, B.V.

Safety Guide

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1. Safety information

Before using the OMRON robot controller, be sure to read this manual and related manuals, and follow their instructions to use the robot controller safely and correctly.

Warnings and cautions listed in this manual relate to OMRON robot controllers. To ensure safety of the user's final system that includes OMRON robots and controllers, please take appropriate safety measures as required by the user's individual system.

Industrial robots are highly programmable machines that provide a large degree of freedom in movement. To use OMRON robots and controllers safely and correctly, be sure to comply with the safety instructions and precautions described in this chapter. Failure to take necessary safety measures or incorrect handling may result not only in trouble or damage to the robot and controller, but also in serious accidents involving injury or death to personnel (robot installer, operator, or service personnel).

This manual describes safety precautions and operating points using the following symbols and signal words.

**DANGER**

"DANGER" INDICATES AN IMMINENTLY HAZARDOUS SITUATION WHICH, IF NOT AVOIDED, WILL RESULT IN DEATH OR SERIOUS INJURY.

**WARNING**

"WARNING" INDICATES A POTENTIALLY HAZARDOUS SITUATION WHICH, IF NOT AVOIDED, COULD RESULT IN DEATH OR SERIOUS INJURY.

**CAUTION**

"CAUTION" indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury or damage to the equipment or loss of data.

**NOTE**

Explains key points in the operation in a simple and clear manner.

Use any of the following approaches to this manual when installing, operating and adjusting the OMRON robot and/or controller so that you can quickly refer to this manual when needed.

1. Keep the printed version of this manual (available for an additional fee) handy for ready reference.
2. View the CD-ROM version of this manual on your PC screen.
3. Print out the necessary pages of this manual from the CD-ROM and keep them handy for ready reference.

To use OMRON robots and controllers safely and correctly, always comply with the safety rules and instructions. Please note, however, this supplementary manual cannot cover all items regarding safety. So it is extremely important that the operator or user have knowledge of safety and make correct decisions regarding safety.

2. Particularly important cautions

Particularly important cautions for handling and operating the robot and controller are described below. Additional cautions are also described in each chapter. Be sure to comply with those instructions to ensure safety.

2.1 System design safety points



DANGER

- OMRON ROBOT CONTROLLERS AND ROBOTS ARE DESIGNED AND MANUFACTURED FOR GENERAL-PURPOSE INDUSTRIAL EQUIPMENT. THEY SHOULD NOT BE USED IN THE FOLLOWING APPLICATIONS:
 - MEDICAL EQUIPMENT OR SYSTEMS WHICH WILL AFFECT HUMAN LIFE
 - EQUIPMENT DESIGNED TO CARRY OR TRANSPORT PERSONS
 - EQUIPMENT OR SYSTEMS WHICH WILL SERIOUSLY AFFECT SOCIETY OR PUBLIC POLICY
 - USE IN ENVIRONMENTS SUBJECT TO VIBRATION, SUCH AS VEHICLES AND SHIPS
- EACH ROBOT CONTROLLER HAS AN EMERGENCY STOP INPUT TERMINAL TO TRIGGER EMERGENCY STOP. USING THIS TERMINAL, CONFIGURE A SAFETY CIRCUIT SO THAT THE SYSTEM INCLUDING THE ROBOT CONTROLLER WILL WORK SAFELY.



WARNING

- TO CHECK THE OPERATING STATUS OF THE ROBOT CONTROLLER, REFER TO THIS MANUAL AND RELATED USER'S MANUAL. BUILD THE SYSTEM INCLUDING THE ROBOT CONTROLLER SO THAT IT WILL ALWAYS WORK SAFELY.
- INSTALL A SIGNAL LIGHT (SIGNAL TOWER, ETC.) AT AN EASY-TO-SEE POSITION SO THAT THE OPERATOR WILL KNOW THE STOP STATUS OF THE ROBOT (TEMPORARY STOP, EMERGENCY STOP, ERROR STOP, ETC.).



CAUTION

- Do not bundle control lines or communication cables together or in close contact with the main power supply circuit or power lines. As a general rule, separate them by at least 100mm. Failure to follow this instruction may cause malfunctions due to noise.

2.2 Installation safety points



WARNING

- ALWAYS GROUND THE GROUND TERMINAL OF THE POWER TERMINAL BLOCK TO AVOID ELECTRICAL SHOCK.
- SECURELY INSTALL THE CONNECTORS INTO THE ROBOT CONTROLLER, AND WHEN WIRING THE CONNECTORS, MAKE THE CRIMP, PRESS-CONTACT OR SOLDER CONNECTIONS CORRECTLY, USING THE TOOL SPECIFIED BY THE MANUFACTURER.
- ALWAYS SHUT OFF ALL PHASES OF THE POWER SUPPLY EXTERNALLY BEFORE STARTING INSTALLATION OR WIRING WORK. FAILURE TO SHUT OFF ALL PHASES MAY CAUSE ELECTRICAL SHOCK OR PRODUCT DAMAGE.
- OMRON ROBOTS AND ROBOT CONTROLLERS ARE NOT DESIGNED TO BE EXPLOSION-PROOF. DO NOT USE THEM IN LOCATIONS EXPOSED TO INFLAMMABLE GASES, GASOLINE OR SOLVENT THAT COULD CAUSE EXPLOSION OR FIRE. FAILURE TO OBSERVE THIS INSTRUCTION MAY CAUSE SERIOUS ACCIDENTS INVOLVING INJURY OR DEATH, OR LEAD TO FIRE.
- USE THE ROBOT CONTROLLER WITHIN THE ENVIRONMENT SPECIFICATIONS LISTED IN THIS MANUAL. USING THE CONTROLLER IN AN ENVIRONMENT OUTSIDE THE SPECIFICATION RANGE MAY CAUSE ELECTRICAL SHOCK, MALFUNCTIONS, PRODUCT DAMAGE OR DETERIORATED PERFORMANCE.
- INSTALL THE ROBOT CONTROLLER AND PROGRAMMING BOX AT A LOCATION OUTSIDE THE ROBOT'S WORKING ENVELOPE YET WHERE IT IS EASY TO OPERATE THE ROBOT AND VIEW ITS MOTION.
- INSTALL THE CONTROLLER IN LOCATIONS WITH ENOUGH SPACE TO PERFORM WORK (TEACHING, INSPECTION, ETC.) SAFELY. LIMITED SPACE NOT ONLY MAKES IT DIFFICULT TO PERFORM WORK, BUT CAN ALSO BE A CAUSE OF INJURY.
- INSTALL THE ROBOT CONTROLLER IN A STABLE, LEVEL LOCATION AND SECURE IT FIRMLY. AVOID INSTALLING THE ROBOT CONTROLLER UPSIDE DOWN OR IN A TILTED POSITION.
- PROVIDE SUFFICIENT CLEARANCE AROUND THE ROBOT CONTROLLER FOR GOOD VENTILATION. POOR VENTILATION MAY CAUSE MALFUNCTION, BREAKDOWN OR FIRE.
- NEVER DIRECTLY TOUCH THE CONDUCTIVE SECTIONS AND ELECTRONIC PARTS OTHER THAN THE CONNECTORS, ROTARY SWITCHES, AND DIP SWITCHES ON THE OUTSIDE PANEL OF THE ROBOT CONTROLLER.
- SECURELY TIGHTEN THE SCREWS ON THE L-SHAPED BRACKETS TO INSTALL THE ROBOT CONTROLLER. IF NOT SECURELY TIGHTENED, THE SCREWS MAY BECOME LOOSE CAUSING THE CONTROLLER TO DROP.
- SECURELY INSTALL EACH CONNECTION CABLE CONNECTOR INTO THE RECEPTACLES OR SOCKETS. POOR CONNECTIONS MAY CAUSE EQUIPMENT MALFUNCTIONS.

2.3 Wiring safety points



WARNING

- ALWAYS SHUT OFF ALL PHASES OF THE POWER SUPPLY EXTERNALLY BEFORE STARTING INSTALLATION OR WIRING WORK. FAILURE TO SHUT OFF ALL PHASES MAY CAUSE ELECTRICAL SHOCK OR PRODUCT DAMAGE.



CAUTION

- Make sure that no foreign matter such as cutting chips or wire scraps enter the robot controller. Malfunctions, breakdown or fire may result if they have entered.
- Always store the cables connected to the robot controller in a conduit or clamp them securely in place. If the cables are not stored in a conduit or properly clamped, excessive play or movement or mistakenly pulling on the cable may damage the connector or cables, and poor cable contact may cause equipment malfunctions.
- Do not modify the cables and do not place any heavy object on them. Handle them carefully to avoid damage. Damaged cables may cause malfunction or electrical shock.
- If there is a possibility that the cables connected to the robot controller may be damaged, protect them with a cover, etc.
- Do not apply excessive loads or impacts to the connectors when making cable connections. The connector pins may become bent or the internal PC board may be damaged.
- When disconnecting the cable from the robot controller, detach by gripping the connector itself and not by tugging on the cable. Loosen the screws on the connector (if fastened with the screws), and then disconnect the cable. Detaching by pulling on the cable itself may damage the connector or cables, and poor cable contact may cause equipment malfunctions.

2.4 Start-up and maintenance safety points



DANGER

- NEVER ENTER THE ROBOT'S WORKING ENVELOPE WHILE THE ROBOT IS OPERATING OR THE MAIN POWER IS TURNED ON. FAILURE TO FOLLOW THIS INSTRUCTION MAY CAUSE SERIOUS ACCIDENTS INVOLVING INJURY OR DEATH. INSTALL A SAFETY ENCLOSURE OR A GATE INTERLOCK WITH AN AREA SENSOR TO KEEP ALL PERSONS AWAY FROM THE ROBOT'S WORKING ENVELOPE.
- WHEN IT IS NECESSARY TO OPERATE THE ROBOT WHILE YOU ARE WITHIN THE ROBOT MOVEMENT RANGE SUCH AS FOR TEACHING OR MAINTENANCE/INSPECTION TASKS, ALWAYS CARRY THE PROGRAMMING BOX WITH YOU SO THAT YOU CAN IMMEDIATELY STOP THE ROBOT OPERATION IN CASE OF AN ABNORMAL OR HAZARDOUS CONDITION. INSTALL AN ENABLE DEVICE IN THE EXTERNAL SAFETY CIRCUIT IS NEEDED. ALSO SET THE ROBOT MOVING SPEED TO 3% OR LESS. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY CAUSE SERIOUS ACCIDENTS INVOLVING INJURY OR DEATH.
- CHECK THE FOLLOWING POINTS BEFORE OPERATING THE ROBOT:
 - NO ONE IS WITHIN THE ROBOT'S WORKING ENVELOPE.
 - THE PROGRAMMING BOX IS AT THE SPECIFIED POSITION.
 - THERE IS NO ABNORMAL STATE IN THE ROBOT AND RELATED DEVICES.



WARNING

- ONLY PERSONNEL TRAINED IN SAFETY AND ROBOT OPERATION MAY OPERATE THE ROBOT. OPERATION BY ANY PERSON WHO HAS NOT RECEIVED THE PROPER TRAINING IS VERY DANGEROUS AND MUST BE AVOIDED.
- THE ROBOT AND ROBOT CONTROLLER ARE NOT DESIGNED TO BE EXPLOSION-PROOF. DO NOT USE THEM IN LOCATIONS EXPOSED TO INFLAMMABLE GASES, GASOLINE OR SOLVENT THAT COULD CAUSE EXPLOSION OR FIRE. FAILURE TO FOLLOW THIS INSTRUCTION MAY CAUSE SERIOUS ACCIDENTS INVOLVING INJURY OR DEATH, OR LEAD TO FIRE.
- DO NOT TOUCH ANY ELECTRICAL TERMINAL OF THE ROBOT CONTROLLER. DOING SO MAY CAUSE ELECTRICAL SHOCK OR EQUIPMENT MALFUNCTIONS.
- ALWAYS CONNECT THE ROBOT AND ROBOT CONTROLLER IN THE CORRECT COMBINATION. USING THEM IN AN INCORRECT COMBINATION MAY CAUSE FIRE OR BREAKDOWN.
- ALWAYS SHUT OFF ALL PHASES OF THE POWER SUPPLY EXTERNALLY BEFORE CLEANING OR TIGHTENING THE TERMINAL SCREWS. FAILURE TO SHUT OFF ALL PHASES MAY CAUSE ELECTRICAL SHOCK, PRODUCT DAMAGE OR MALFUNCTIONS.
- DO NOT TOUCH THE ROBOT CONTROLLER AND ROBOT DURING OPERATION. SOME PARTS IN THE ROBOT CONTROLLER OR ROBOT ARE HOT DURING OPERATION. TOUCHING THEM MAY CAUSE BURNS.
- DO NOT HANDLE OR OPERATE THE ROBOT CONTROLLER OR PROGRAMMING BOX WITH WET HANDS. TOUCHING THEM WITH WET HANDS MAY RESULT IN ELECTRICAL SHOCK OR BREAKDOWN.
- IMMEDIATELY TURN OFF POWER IF UNUSUAL ODORS, NOISE OR SMOKE ARE NOTICED DURING OPERATION. CONTINUOUS OPERATION UNDER SUCH A CONDITION MAY RESULT IN ELECTRICAL SHOCK, FIRE OR BREAKDOWN. STOP USING AND CONTACT OUR SALES OFFICE OR SALES REPRESENTATIVE.

- DO NOT DISASSEMBLE OR MODIFY ANY PART IN THE ROBOT CONTROLLER AND PROGRAMMING BOX. DO NOT OPEN ANY COVER. FAILURE TO FOLLOW THIS INSTRUCTION MAY CAUSE ELECTRICAL SHOCK, BREAKDOWN, MALFUNCTION, INJURY, OR FIRE.
- IF A COMPONENT USED IN THE ROBOT OR CONTROLLER NEEDS TO BE REPLACED OR REPAIRED, ALWAYS FOLLOW THE INSTRUCTIONS FROM OMRON. INSPECTION AND MAINTENANCE OF THE CONTROLLER OR ROBOT BY ANY PERSON WHO DOES NOT HAVE THE REQUIRED KNOWLEDGE AND EXPERTISE IS DANGEROUS AND MUST BE AVOIDED.
- WHEN PERFORMING MAINTENANCE OR INSPECTION OF THE ROBOT CONTROLLER UNDER OUR INSTRUCTIONS, WAIT AT LEAST 30 MINUTES FOR THE YRC SERIES AFTER TURNING THE POWER OFF. SOME COMPONENTS IN THE ROBOT CONTROLLER MAY BE HOT OR STILL RETAIN A HIGH VOLTAGE SHORTLY AFTER OPERATION, SO BURNS OR ELECTRICAL SHOCK MAY OCCUR IF THOSE PARTS ARE TOUCHED.
- DURING STARTUP OR MAINTENANCE WORK, DISPLAY AN EASY TO UNDERSTAND SIGN OR MESSAGE ON THE PROGRAMMING UNIT OR OPERATION PANEL TO PREVENT ANYONE OTHER THAN PERSONNEL FOR THAT WORK FROM MISTAKENLY OPERATING A START OR SELECTOR SWITCH. IF NEEDED, TAKE OTHER MEASURES SUCH AS LOCKING THE COVER ON THE OPERATION PANEL.
- DECIDE ON "WORK INSTRUCTIONS" IN CASES WHERE PERSONNEL MUST WORK WITHIN THE ROBOT'S WORKING ENVELOPE TO PERFORM STARTUP OR MAINTENANCE WORK. MAKE SURE THE WORKERS KNOW THESE "WORK INSTRUCTIONS" WELL.



CAUTION

- When using ferrite cores for noise elimination, fit them to the power cable as close to the robot controller and/or the robot as possible, to prevent malfunctions due to noise.
- Back up the robot controller internal data in an external storage device. The robot controller internal data (programs, point data, etc.) may be lost or deleted for unexpected reasons. Always make a backup of the internal data.
- Do not use thinner, benzene, and alcohol to wipe clean the surface of the programming box. The surface sheet may be damaged or printed letters or marks might be erased. Use a soft, dry cloth and gently wipe the surface.
- Do not use a hard or pointed object to operate the keys on the programming box. Malfunction or breakdown may result if the keys are damaged. Use your fingers to operate the keys.
- Do not insert any SD memory card other than specified into the SD memory card slot of the programming box. Malfunction or breakdown may result if a wrong memory card is used.
- Do not leave the SD memory card inserted into the programming box. Doing so may cause malfunction or breakdown. Insert the SD memory card into the programming box only when making a data backup or loading the backup data.

2.5 Safety precautions during robot operation



DANGER

- NEVER ENTER THE ROBOT'S WORKING ENVELOPE WHILE THE ROBOT IS OPERATING OR THE MAIN POWER IS TURNED ON. FAILURE TO FOLLOW THIS INSTRUCTION MAY CAUSE SERIOUS ACCIDENTS INVOLVING INJURY OR DEATH. INSTALL A SAFEGUARD (SAFETY ENCLOSURE) OR A GATE INTERLOCK WITH AN AREA SENSOR TO KEEP ALL PERSONS AWAY FROM THE ROBOT'S WORKING ENVELOPE.
- WHEN IT IS NECESSARY TO OPERATE THE ROBOT WHILE YOU ARE WITHIN THE ROBOT MOVEMENT RANGE, SUCH AS FOR TEACHING OR MAINTENANCE/INSPECTION TASKS, ALWAYS CARRY THE PROGRAMMING BOX WITH YOU SO THAT YOU CAN IMMEDIATELY STOP THE ROBOT OPERATION IN CASE OF AN ABNORMAL OR HAZARDOUS CONDITION. INSTALL AN ENABLE DEVICE IN THE EXTERNAL SAFETY CIRCUIT AS NEEDED. ALSO SET THE ROBOT MOVING SPEED TO 3% OR LESS. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY CAUSE SERIOUS ACCIDENTS INVOLVING INJURY OR DEATH.



WARNING

- ONLY PERSONNEL TRAINED IN SAFETY AND ROBOT OPERATION MAY OPERATE THE ROBOT. OPERATION BY ANY PERSON WHO HAS NOT RECEIVED THE PROPER TRAINING IS VERY DANGEROUS AND MUST BE AVOIDED.

2.6 Precautions for disposal



CAUTION

- When disposing of this product discard it as industrial waste. Take appropriate measures in compliance with legal regulations in your country or entrust its proper disposal to a company authorized to handle industrial waste.

3. Safety measures for robots

3.1 Safety measures for SCARA type robots

1. Safety measures during transportation:

To ensure safety, use the eyebolts that come with the robot.
Refer to the robot user's manual for details.

2. Protective measures against electrical shock:

Use the protective ground terminal to ensure safety.
Refer to the robot user's manual for details.

4. Motor overload precautions

Since abnormal operation (such as overload) of the motor is detected by software, the controller parameters must be set correctly to match the motor type used in the robot connected to the controller.

Prior to shipping, the controller parameters are preset to match the robot model to be used. However, please check the robot model again when connecting it to the controller.

5. Warning labels and marks

5.1 Warning labels

The warning labels shown below are affixed to the controller. To use the OMRON robot and controller safely and correctly, be sure to observe the instructions and caution on the labels.

1. "Read Instruction Manual" label



This label means that important information you must know is described in the manual.

Before using the controller, be sure to read this manual carefully.

When in particular configuring an external safety circuit or connecting a power supply to the controller, read this manual carefully and follow the instructions.

Connectors have a particular orientation, so insert each connector in the correct direction.

5.2 Warning marks

The following warning marks are shown on the controller. To use the OMRON robot and controller safely and correctly, be sure to observe the instructions and caution of the marks.

1. "Electric Hazard" mark



This mark indicates that a high voltage is present.

This mark warns you of possible electrical shock. Do not touch the terminal block and connectors to avoid electrical shock.

2. "CAUTION" mark



This label means that important information you must know is described in the manual.

Before using the controller, be sure to read this manual carefully.

When in particular configuring an external safety circuit or connecting a power supply to the controller, read this manual carefully and follow the instructions.

Connectors have a particular orientation, so insert each connector in the correct direction.

3. "High Temperature Hazard" mark



Indicates that the area around this mark may become very hot.

Heatsinks and regenerative unit become hot during and shortly after operation. Do not touch them to avoid burns.

6. Industrial robot operating and maintenance personnel

Operators or persons who handle the robot such as for teaching, programming, movement check, inspection, adjustment, and repair must receive appropriate training and also have the skills needed to perform the job correctly and safely. They must read the user's manual carefully to understand its contents before attempting the robot operation.

Tasks related to industrial robots (teaching, programming, movement check, inspection, adjustment, repair, etc.) must be performed by qualified persons who meet requirements established by local regulations and safety standards for industrial robots.

7. Make daily and periodic inspections

Always make sure that daily and periodic inspections are performed, and make a pre-work check to ensure there are no problems with the robot or related equipment. If a problem or abnormality is found, then promptly repair it or take other measures as necessary.

Chapter 1

CE MARKING

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1. CE Marking

This section provides a basic description of how the YRC series comply with CE marking. Differences in the basic specifications between CE marking compliant controllers and standard controllers are as follows:

■ Main specifications of CE Marking compliant controller

	CE Marking compliant controller
Service mode	Provided
Programming box	PB (enable switch compatible specifications)

2. Safety standards

2.1 Cautions regarding compliance with EC Directives

The OMRON robot (robot and controller) is not, in itself, a robot system. The OMRON robot is just one component that is incorporated into the customer's system (built-in equipment), and we declare that OMRON robots conform to the EC Directives only within the scope of built-in equipment. This does not therefore guarantee that OMRON robots conform to EC Directives in cases where the robot is used independently. Customers who incorporate a OMRON robot into their final system which will be shipped to, or used, in the EU, should therefore verify that the overall system is compliant with EC Directives.

● Differences between OMRON robots (robot and controller) and robot systems

A OMRON robot (robot and controller) is just one component in a robot system, and is not, in itself, a robot system.

This is because a OMRON robot does not include the "end effector(s)" or "any equipment, devices, or sensors required for the robot to perform its tasks", as defined in "Industrial Robot system" of the ISO 10218-1: 2011 Standard - Clause 3.11.

2.2 Applicable EC Directives and their related standards

The tables below show directives and related standards applied to OMRON robots.

■ YRC robot controller

EC Directive	Related Standards
Machinery Directive 2006/42/EC	EN ISO12100 : Safety of machinery - General principles for design - Risk assessment and risk reduction EN ISO10218-1 : Robots and robotic devices - Safety requirements for industrial robots - Part 1: Robots EN60204-1 : Safety of machinery - Electrical equipment of machines - Part 1: General requirements
EMC Directive 2004/108/EC	EN 55011 : Industrial, scientific and medical equipment - Radio-frequency disturbance characteristics - Limits and methods of measurement EN 61000-6-2 : Electromagnetic compatibility (EMC) - Part6-2: Generic standards - Immunity for industrial environments

2.3 Robots subject to CE Marking

This CE marking manual is applied to the following robot series:

Controller	Robot Name
YRC	SCARA type robots : XG series, X series, XC/XG tiny series, XC series, XS series, XP series

2.4 Cautions regarding the official language of EU countries

For equipment that will be installed in EU countries, the language used for the manuals, warning labels, operation screen characters and CE declarations is English only.

Warning labels only have pictograms or else include warning messages in English. In the latter case, messages in Japanese or other languages might be added.

3. Usage conditions

The following description gives major operating conditions for OMRON robot series products.

- **EMC (Electromagnetic compatibility)**

OMRON robot series products are designed for use in industrial environments.

(Applicable definition relating to the EMC Directive: Refer to the EN61000-6-2 Standard, Clause 1 "Scope".)

In order to conform to the EMC Directive, the customer must evaluate the finished product (entire system) and take necessary countermeasures. Refer to EMC countermeasures for single units of OMRON robots, which are described in the next chapter in this manual.

- **Installation conditions**

- **Protective structure**

OMRON robots are classified as built-in equipment and have a "**Class I**" protective structure against electrical shock.

The robot and controller must therefore be grounded properly to prevent possible electrical shock. For details, refer to the controller user's manual and the robot user's manual.

- **Enclosure**

The robot controller case is not designed as an enclosure that conforms to the EN60204-1 Standard. Suitable protection should therefore be provided to prevent the danger of electrical shock due to inadvertent contact and ambient environment problems (dust, water, etc.).

- **Insulation co-ordination**

Regarding insulation co-ordination, OMRON robots and controllers are designed to meet the following conditions:

Overvoltage category II Pollution degree 2

Take proper countermeasures as needed if the robot or controller is used in environments more severe than these levels.

- **Explosion-proof**

- **OMRON robots and robot controllers are not designed to meet explosion-proof specifications.**

Do not use them in environments exposed to flammable gases, gasoline, or solvents which could cause explosion or fire.

Chapter 2 YRC series

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1. System overview

1.1 System overview

The YRC series controllers are designed for use with a SCARA robot. Applications also include various inspection instruments, sealers and spray equipment utilizing linear and circular interpolation.

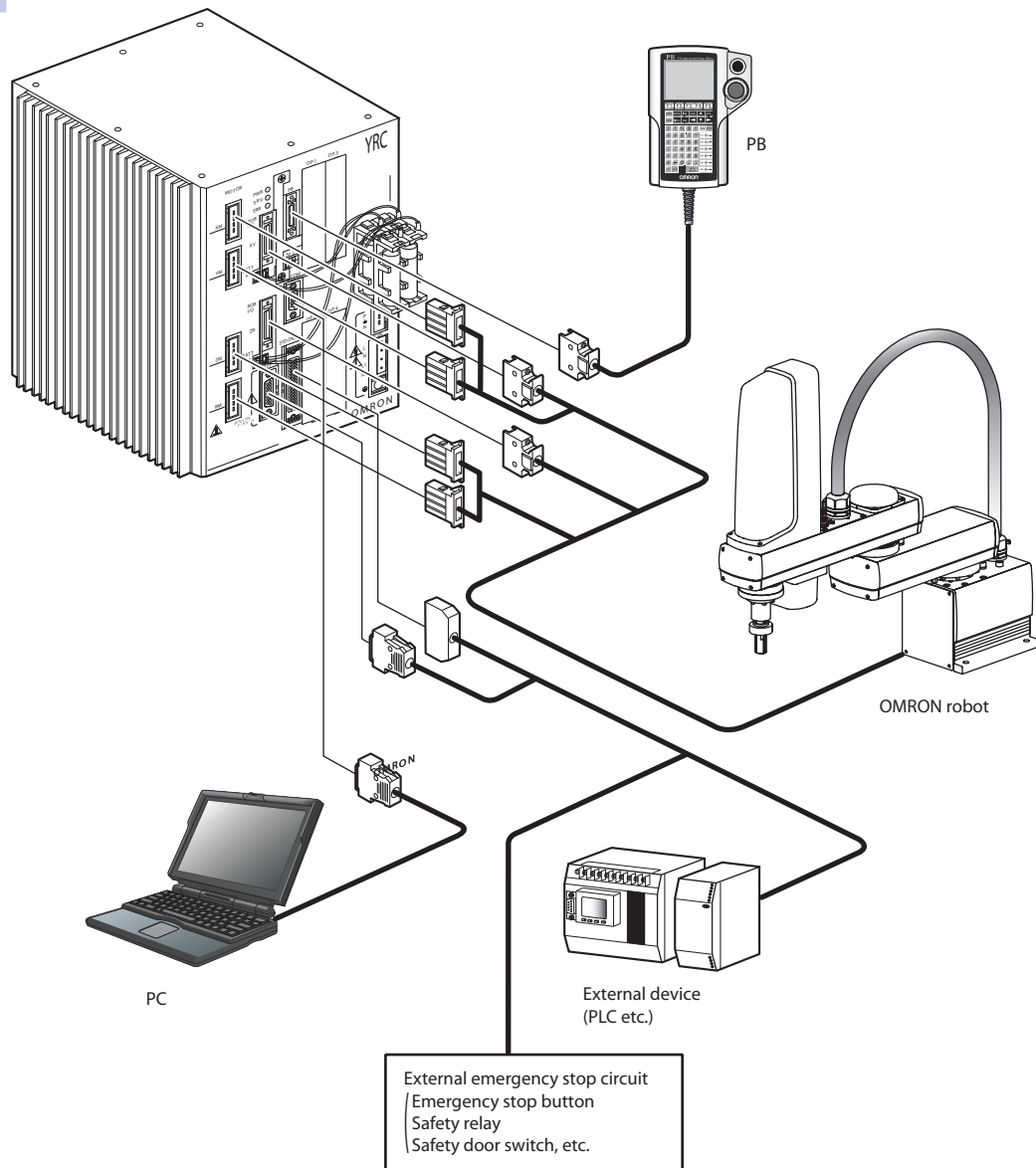
1.1.1 Main system configuration

■ YRC robot controller

Example: R6YXG500

All the axes on the robot controller are used as the main robot axes.

System for controlling one robot



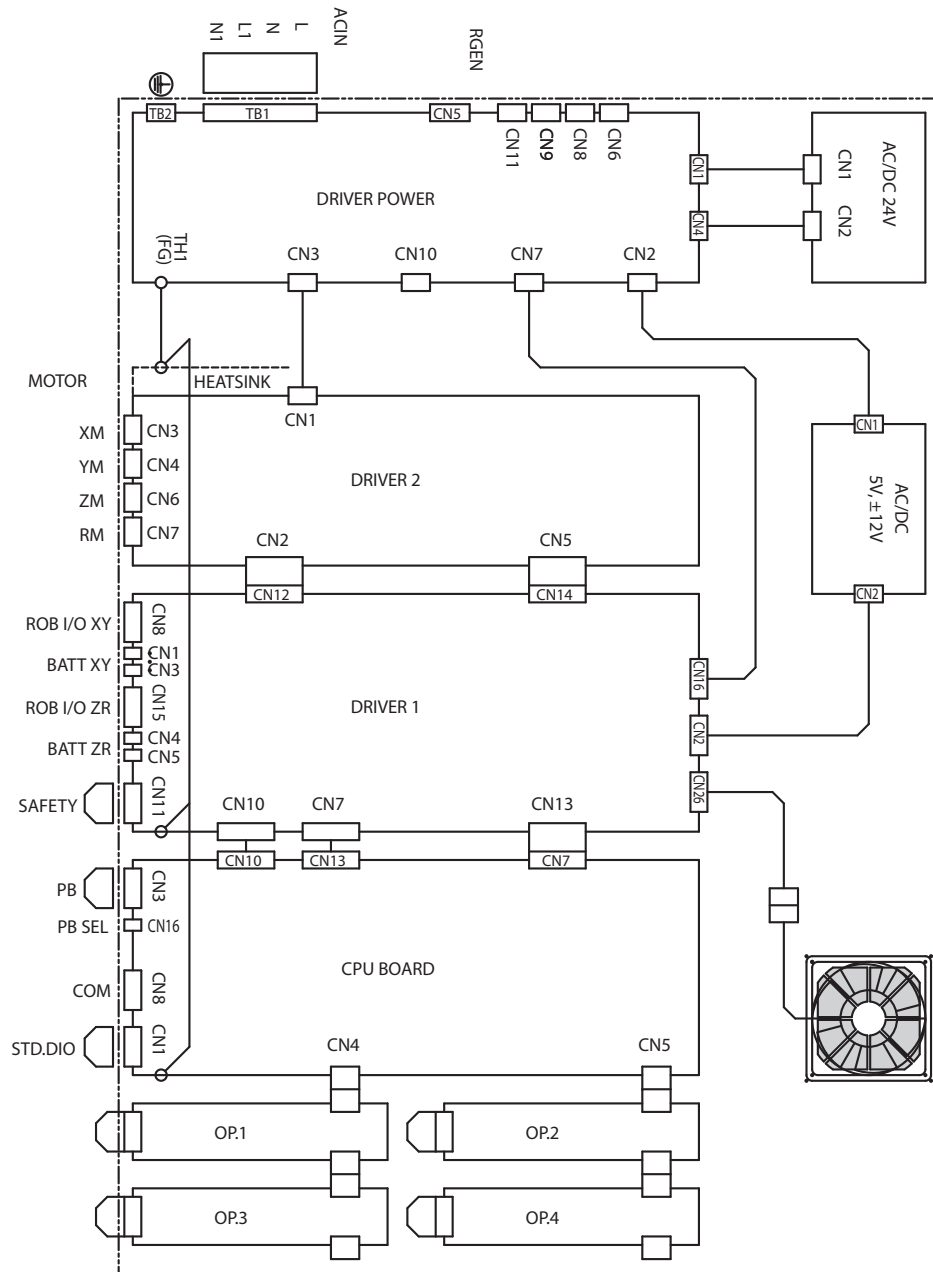
1.2 Control system configuration

1.2.1 Basic configuration

The basic block diagram of the YRC robot controller system is shown below.

■ YRC basic block diagram

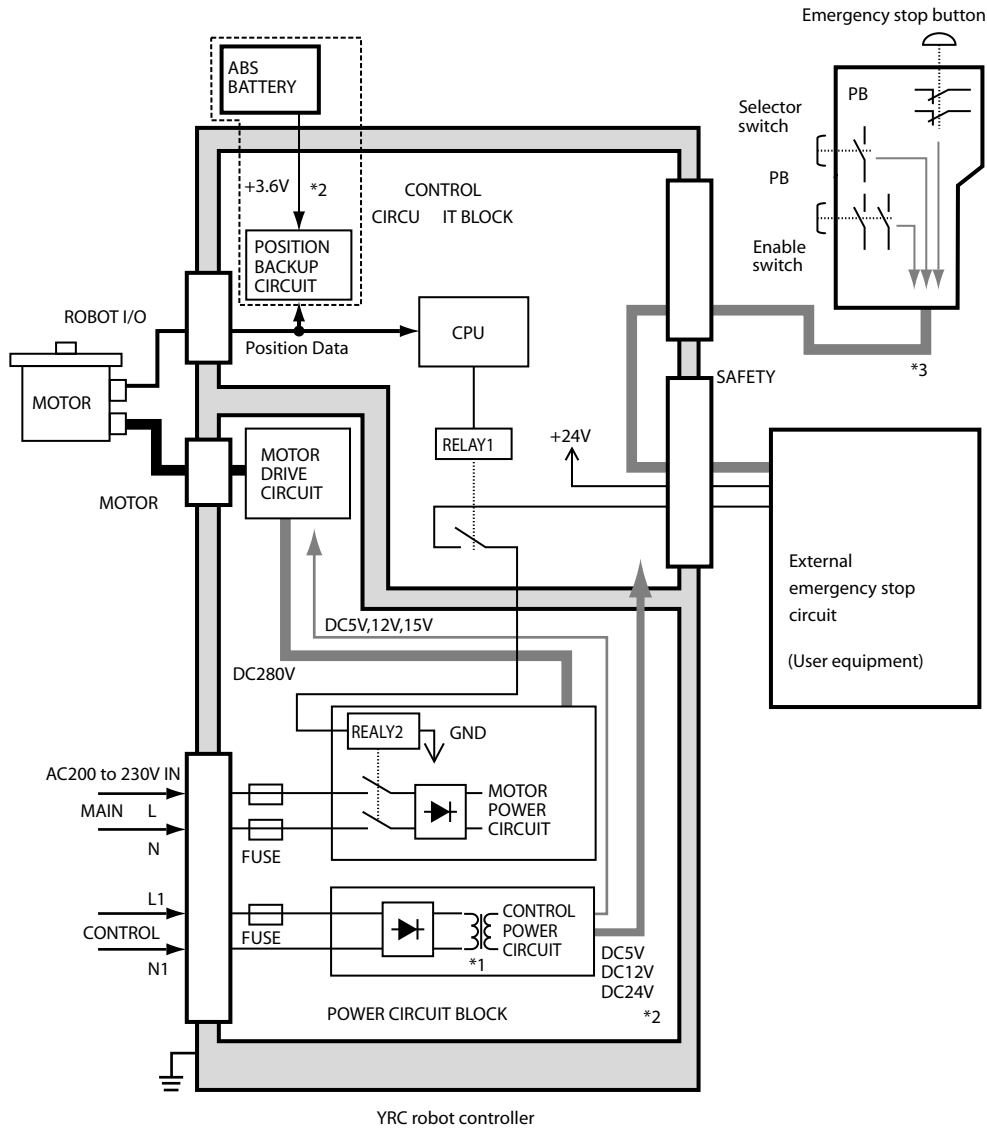
Basic block diagram



1.2.2 Power supply and emergency stop system circuit configuration

The control system's power supply system and emergency stop system circuit block diagram are shown below.

Power supply and emergency stop circuit block diagram



*1) The input power and each control power are insulated by the insulated transformer.

*2) The 0V line for the 3.6VDC, 5VDC, 12VDC and 24VDC is not connected to the protective earth.

*3) Refer to the PB connector input/output signal table for the wiring diagram from the PB.

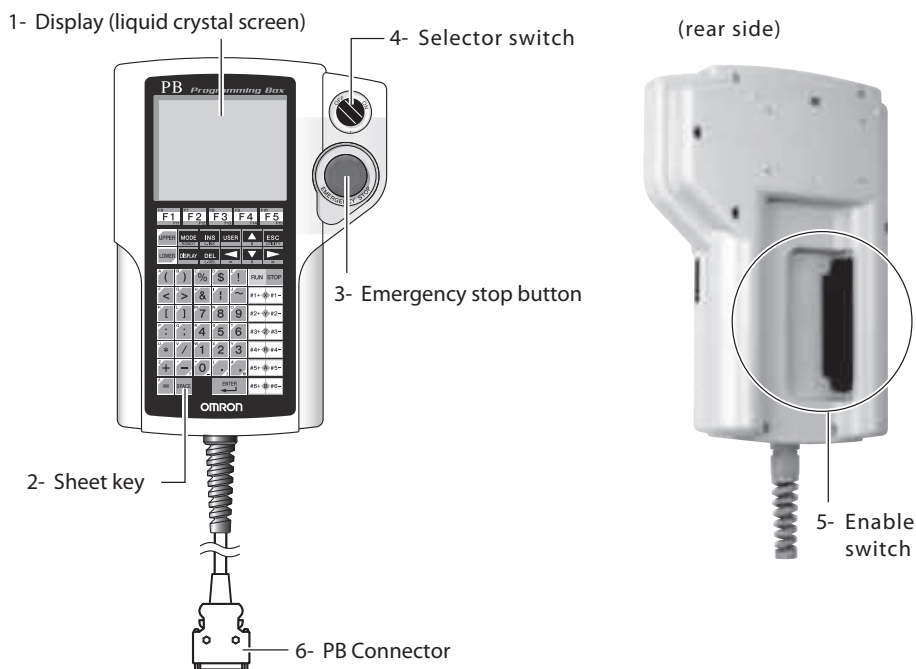
1.3 Programming box (PB)

The programming box (PB) is a hand-held unit specifically designed to connect to the controller, in order to perform various operations. The PB allows all operations including manual operation of the robot, programming and editing, teaching, and parameter setting.

1.3.1 Part names and functions

The PB has an emergency stop button and an enable switch. The contact outputs of these can be used to connect to the emergency stop circuit of the entire equipment via the SAFETY connector on the controller. The PB also has a selector switch which can be used according to the customer's specifications and applications.

PB (Programming Box)



Main Functions

No.	Part name	Function
1	Display (liquid crystal screen)	This is a liquid crystal display (LCD) with 40 characters × 15 lines, showing various types of information. The screen brightness is adjustable.
2	Sheet keys	These keys are used to operate a robot or input programs. The sheet keys are classified into 3 main types: function keys, control keys and data keys.
3	Emergency stop button	Pressing this button during operation immediately stops robot movement. This is a contact B (normally closed) type switch. The XA1E-BV302R made by IDEC is used.
4	Selector switch	This switch can be used as needed by wiring to the PB SEL connector on the YRC. Turning on this switch opens the contact, and turning it off closes the contact. The switch ON/OFF function is disabled if not wired.
5	Enable switch	This is a 3-position switch designed in consideration of safety. Pressing this switch to the middle position only enables robot operation. This switch is disabled when LOCKIN1 to 4 of the SAFETY connector are not wired. Configure an external safety circuit so that the state of this switch determines the robot operating state as follows: Switch released : Emergency stop state Switch in middle position : Operable state Switch pressed : Emergency stop state The HE2B-M200PB made by IDEC is used.
6	PB connector	Use this connector to connect the PB programming box to the robot controller.

1.3.2 PB connector

The PB has an emergency stop button and an enable switch. The contact outputs of these can be used to connect to the emergency stop circuit of the entire equipment via the SAFETY connector on the controller. This section describes signal connections.



CAUTION

- Do not change or modify the cable and connector. Along with the input/output signals for the programming box, the PB connector includes signals used to configure an external safety circuit, and so changing or modifying the cable and connector is very dangerous.
- Always configure an external safety circuit by using the SAFETY connector. Although the PB has an emergency stop button and an enable switch, they do not function independently because the controller is designed on the assumption that an external safety circuit is configured.

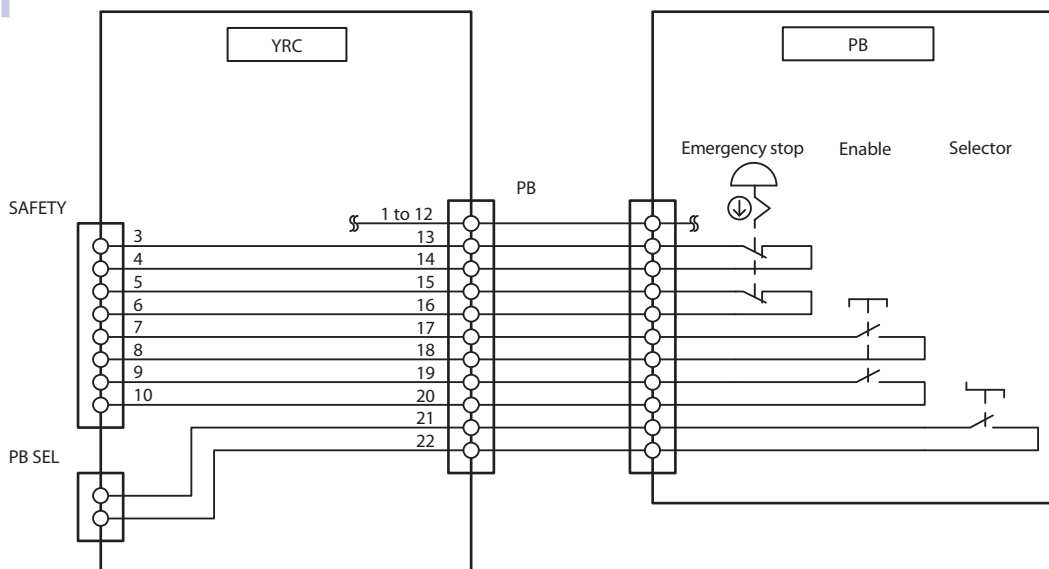
YRC robot controller

Each pin of the PB connector on the PB is connected to each pin of the SAFETY connector and PB SEL connector.

Pin to pin connections are as follows:

PB	PB connector pin No.	Connected connector	Connector pin No.	Name	
Emergency stop contact: Line 1	13	Connected to SAFETY connector	3	E-STOPIN1	
	14		4	E-STOPIN2	
Emergency stop contact: Line 2	15		5	E-STOPIN3	
	16		6	E-STOPIN4	
Enable contact: Line 1	17		7	LCKIN1	
	18		8	LCKIN2	
Enable contact: Line 2	19		9	LCKIN3	
	20		10	LCKIN4	
Selector switch	21		Connected to PB SEL connector	–	KEY1
	22			–	KEY2

Circuit diagram



1.4 SERVICE mode

This section describes SERVICE mode.

1.4.1 What is SERVICE mode?

SERVICE mode is used to perform work using the PB within the safety enclosure of the robot system.

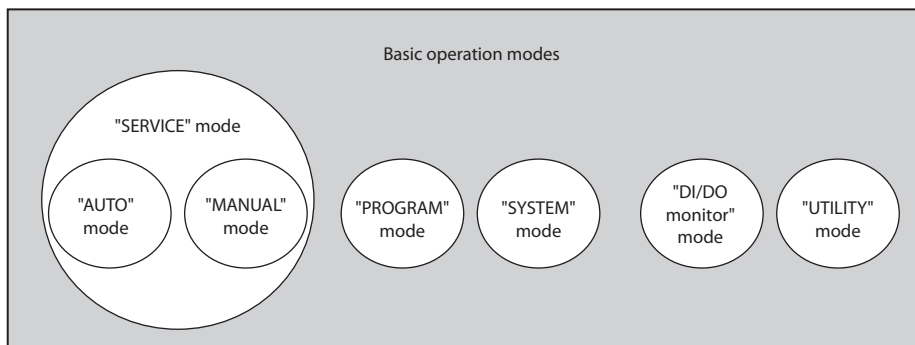
This mode is enabled only when the controller is set to SAFE mode. The CE marking compliant controllers are set to SAFE mode at the time when they are shipped.



CAUTION

The CE marking compliant controllers are always set to SAFE mode.

Basic operation mode



SERVICE mode includes AUTO and MANUAL modes in the basic operation mode, and is selected by opening (turning OFF) the DI02 contact (SERVICE mode input). Normal mode is maintained as long as the DI02 contact is closed (ON). If a serial I/O option board is installed, SERVICE mode is entered when either one of SI02 or DI02 is open (OFF). (Normal mode is entered only when both SI02 and DI02 contacts are closed.)

When the DI02 contact is open (OFF), the controller is in SERVICE mode with the operation level, operating speed limit, and exclusive control of the operating devices specified by the SERVICE mode parameters. The following functions can be selected in SERVICE mode.

1. Robot is controlled only by PB operation.
2. Automatic operation is prohibited.
3. Robot operating speed is set to below 3% of the maximum speed.
4. Robot operation is possible only by hold-to-run control.
(The Hold-to-Run function allows the robot to move (including program execution) only during the time that the PB operation key is kept pressed.)

In SAFE mode setting, therefore, the operations in AUTO mode and MANUAL mode differ from those in normal mode, depending on the SERVICE mode parameter settings.



WARNING

RESTRICTION ON THE ROBOT MOVING SPEED IS NOT A SAFETY-RELATED FUNCTION. TO REDUCE THE RISK OF COLLISION BETWEEN THE ROBOT AND WORKERS, THE USER MUST TAKE THE NECESSARY PROTECTIVE MEASURES SUCH AS ENABLE DEVICES ACCORDING TO RISK ASSESSMENT BY THE USER.



NOTE

- The robot pauses when the SERVICE mode input is changed during program operation or jog movement.
- The NPN/PNP specifications for DI02 are determined as follows:
YRC Determined by STD.DIO setting.
- Current capacity of at least 7mA is required for DI02 input.
- When the YRC controller is set to SAFE mode, it always enters the SERVICE mode state unless power is supplied to STD.DIO from the external 24 V power supply. To cancel this state by software, set the "Watch on STD.DIO DC24V" parameter to "INVALID".

1.4.2 Flow for enabling the SERVICE mode functions

- Controller is set to SAFE mode.
- SERVICE mode parameters have been set.

↓

- Open (turn OFF) the DI02 contact.
(If a serial I/O option board is installed, SERVICE mode is entered when either one of SI02 or DI02 is open (OFF).)

↓

- Controller enters SERVICE mode with the operation level, operating speed limit, and exclusive control of the operation devices specified by the SERVICE mode parameters.

Refer to the next section for the SERVICE mode parameter settings.

1.4.3 SERVICE mode parameter settings

There are the following three parameters for SERVICE mode.

1. SERVICE mode level
2. Operating speed limit during SERVICE mode
3. Operation device control during SERVICE mode

These parameter settings determine the operation level, operating speed limit, and exclusive control of the operation devices during SERVICE mode.

Even after editing the SERVICE mode parameters, the present settings still remain enabled until the controller power is turned off unless the edited parameters are saved.

For how to set the SERVICE mode parameters, refer to the controller user's manual.



WARNING

CHANGING THE SERVICE MODE PARAMETERS FROM THEIR DEFAULT SETTINGS IS LIKELY TO INCREASE THE RISK TO PERSONNEL OPERATING OR MAINTAINING THE ROBOT. THESE PARAMETERS CAN BE CHANGED IF THE CUSTOMER ASSUMES RESPONSIBILITY, BUT EXTRA CAUTION SHOULD BE TAKEN TO ENSURE SAFETY.

1. SERVICE mode level

The SERVICE mode level can be selected to enable or disable the Hold-to-Run function and to permit or prohibit the operation in AUTO mode.

The Hold-to-Run function allows the robot to move (including program execution) only during the time that the PB operation key is kept pressed.

Setting	Description	
	Hold-to-Run function	AUTO mode operation
Level 0	Disabled	Permitted
Level 1	Enabled	Permitted
Level 2	Disabled	Prohibited
* Level 3	Enabled	Prohibited

* Default setting

2. Limitations on operating speed during SERVICE mode

The maximum robot operating speed can be specified.

Setting	Description
* <3%	Robot operating speed is limited to below 3% of maximum speed.
<100%	Robot operating speed is not limited.

*Default setting

3. Operation device control during SERVICE mode

The operation device can be specified.

Setting	Description
* PB	Only PB operation is enabled.
PB/DI	PB and dedicated input are enabled.
PB/COM	PB and online commands are enabled.
ALL	PB, dedicated input, and online command operation device are enabled.

*Default setting



CAUTION

Dedicated input is SI when a serial board is connected.

2. EMC countermeasure examples

Regarding EMC Directive, the customer's final product (entire system) including the OMRON robot must provide the necessary countermeasures. We at OMRON determine a model for single units of OMRON robots (controller, robot, and peripheral device) and verify that it complies with the relevant standards of EMC Directive.

In order to ensure the customer's final product (entire system) complies with EMC Directive, the customer should take appropriate EMC countermeasures. Typical EMC countermeasures for a single unit of OMRON robot are shown for reference.



CAUTION

The following description and circuits are typical countermeasures used when the robot and controller are tested under OMRON installation conditions. When the robot and controller are used while installed in the customer's system, the actual test results may differ depending on installation conditions.

2.1 YRC robot controller

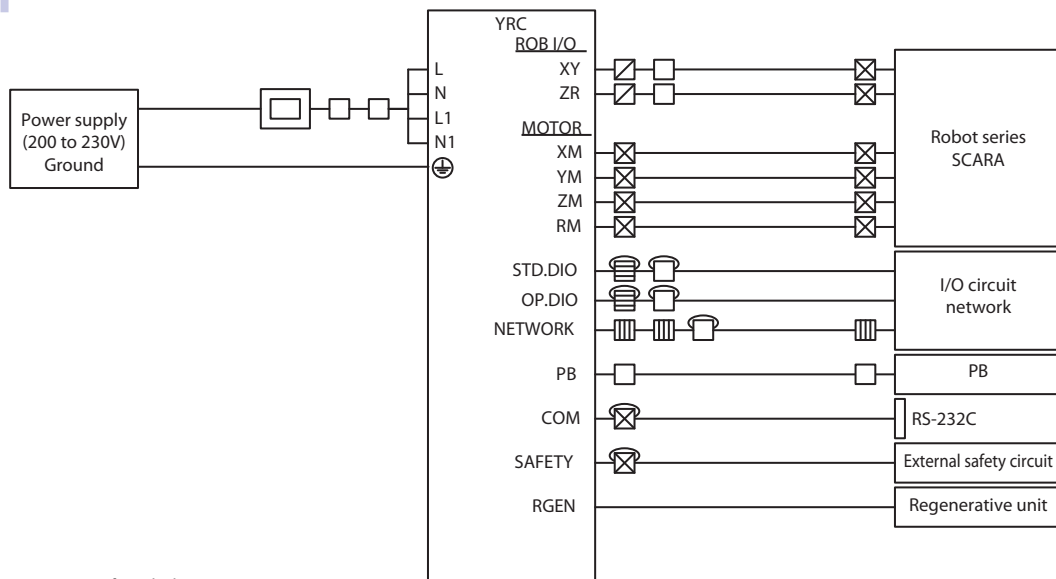
2.1.1 Configuration



CAUTION

As shown in the following figure, the ferrite cores and noise filter on the controller side should be placed as close to the controller body as possible. The ferrite cores on the robot side should be placed as close to the robot body as possible.

Typical component layout for EMC countermeasures



Meaning of symbols

	: Noise filter	NF2020A-UP : SOSHIN ELECTRIC CO., LTD.
	: Ferrite core	ZCAT3035-1330 : TDK
	: Ferrite core	ZCAT2132-1130 : TDK
	: Ferrite core	ZCAT2032-0930 : TDK
	: Ferrite core	TFT-274015S : Takeuchi Kogyo Co., Ltd.
	: Ferrite core	SFT-72SNB-026K : Takeuchi Kogyo Co., Ltd.
	: Ferrite core	1 turn
	: Ferrite core	2 turns

2.1.2 Countermeasure components

■ Surge absorber

The YRC can be used without an external surge absorber. However, to further enhance surge resistance, install a surge absorber on the AC power line.

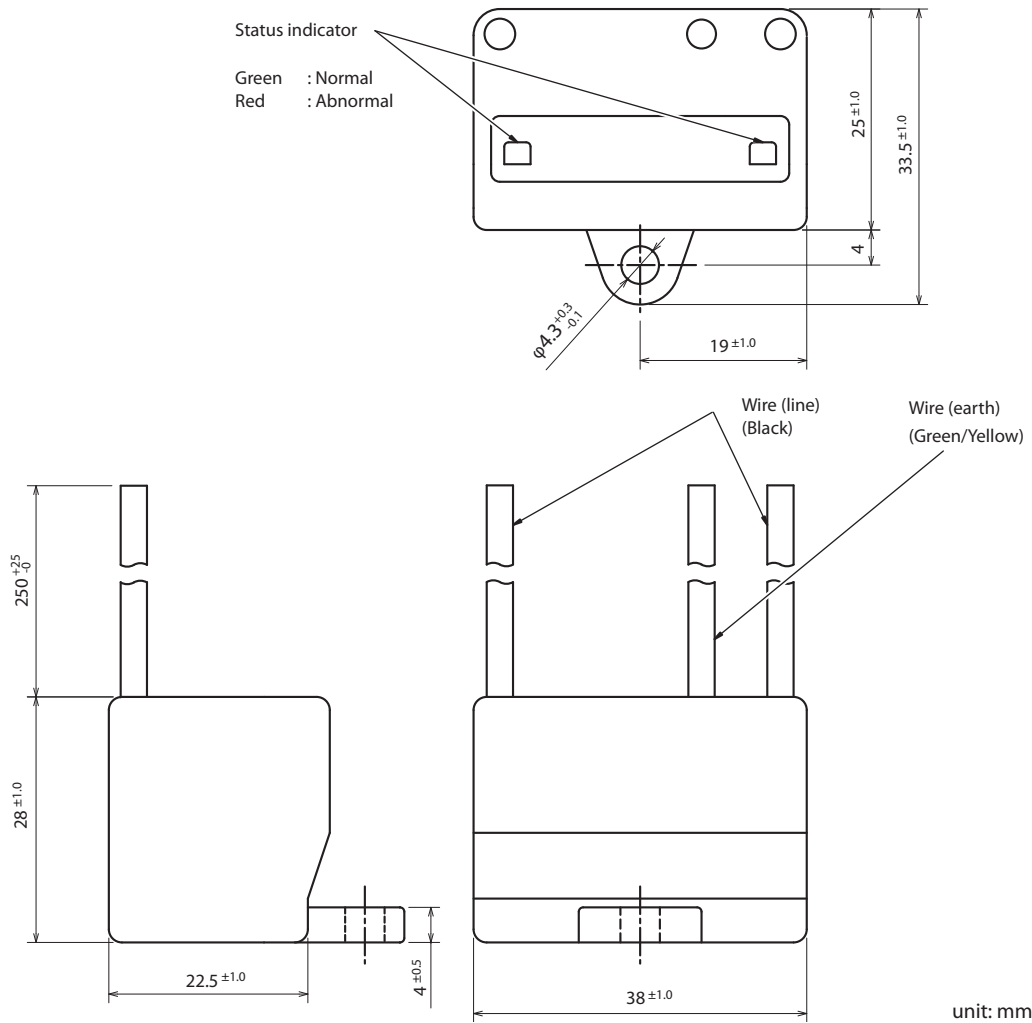
A recommended surge absorber is shown below.

● Recommended surge absorber

Manufacturer : SOSHIN ELECTRIC CO., LTD.

Type No. : LT-C12G801WS

Dimensional outline



■ Noise filter

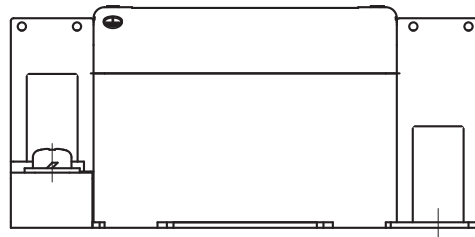
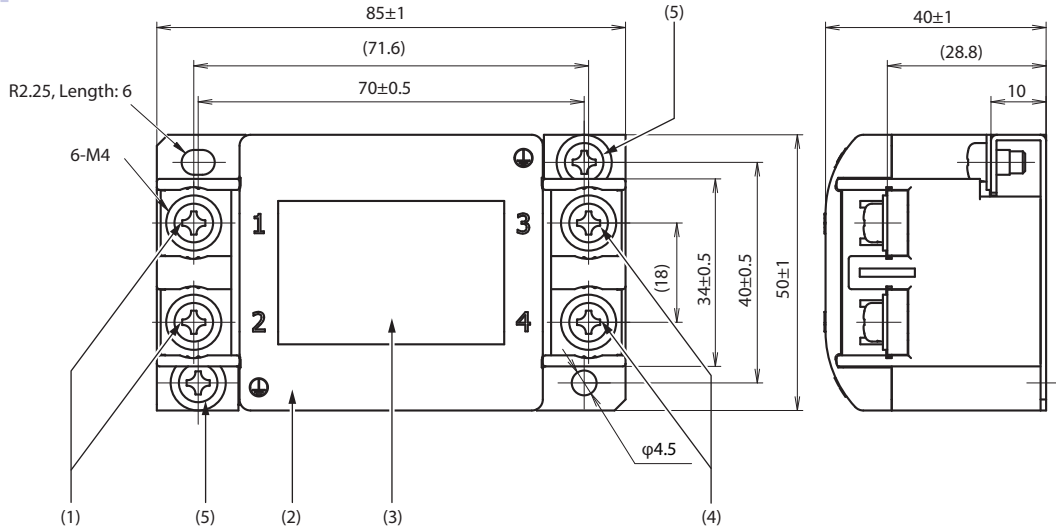
Always install an external noise filter on the AC power line.
A recommended noise filter is shown below.

● Recommended noise filter

Manufacturer : SOSHIN ELECTRIC CO., LTD.

Type No. : NF2020A-UP

Dimensional outline



No.	Part name	Note
(1)	Input terminal	M4
(2)	Case	PBT
(3)	Name plate	
(4)	Output terminal	M4
(5)	Earth terminal	M4

unit: mm

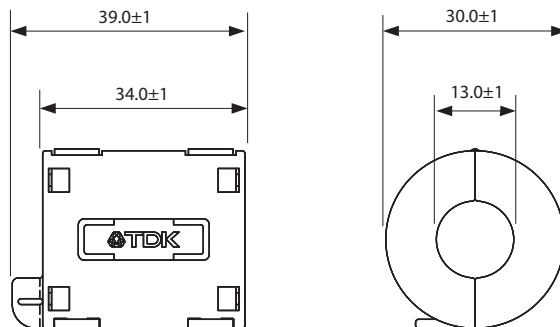
Ferrite core

Install ferrite cores according to the customer's final product (entire system).
Recommended ferrite cores are shown below.

Recommended ferrite core 1

Manufacturer : TDK
Type No. : ZCAT3035-1330

Dimensional outline

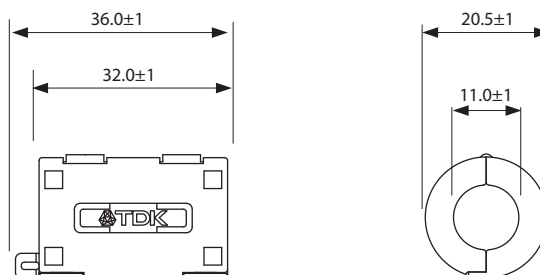


unit: mm

Recommended ferrite core 2

Manufacturer : TDK
Type No. : ZCAT2132-1130

Dimensional outline

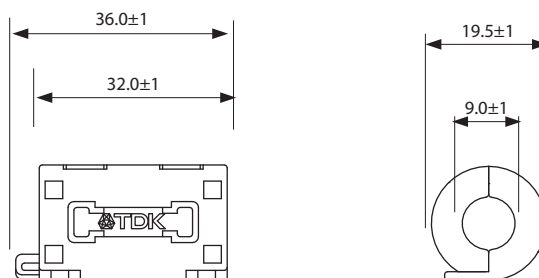


unit: mm

Recommended ferrite core 3

Manufacturer : TDK
Type No. : ZCAT2032-0930

Dimensional outline



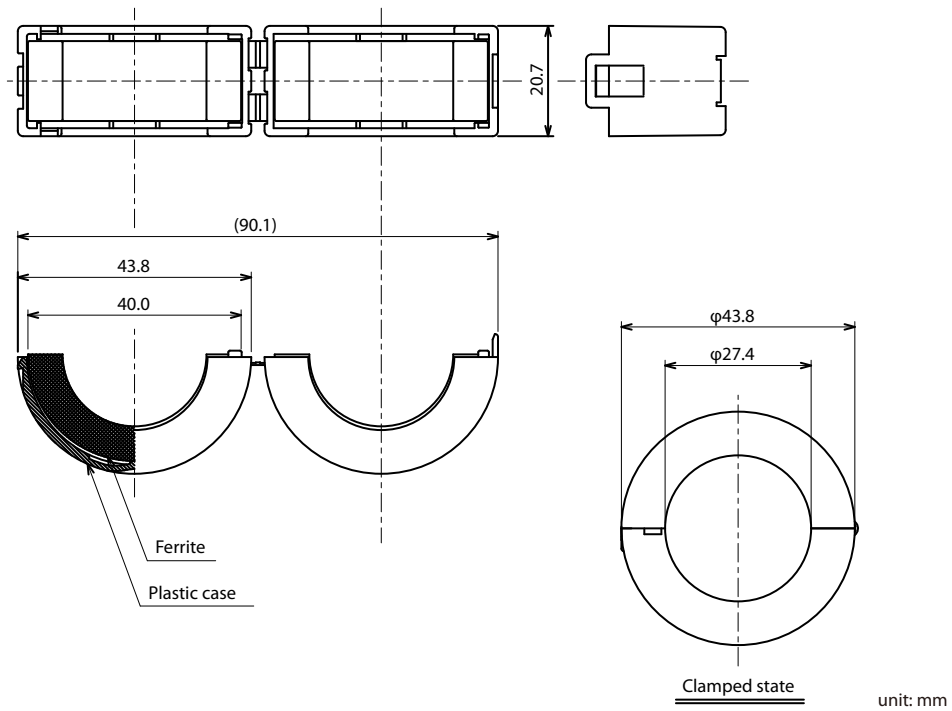
unit: mm

- Recommended ferrite core 4

Manufacturer : Takeuchi Kogyo Co., Ltd.

Type No. : TFT-274015S

Dimensional outline

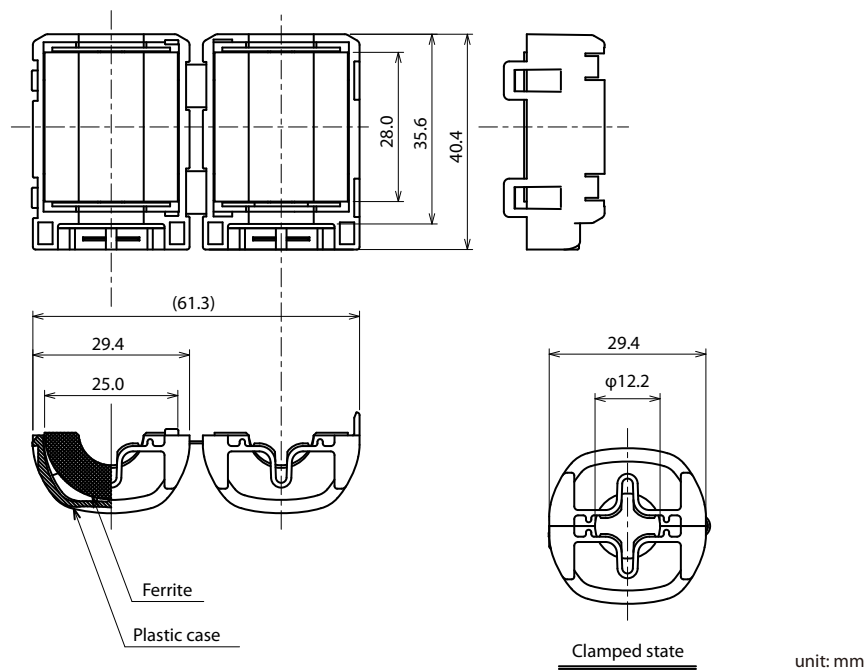


- Recommended ferrite core 5

Manufacturer : Takeuchi Kogyo Co., Ltd.

Type No. : SFT-72SNB-026K

Dimensional outline



3. External safety circuit examples

This section describes category-specific safety circuit configuration examples using the PB.

Customers should install the appropriate safety measures for their system by referring to the circuit example for each controller, in order to use the robots more safely.

3.1 Performance level

To comply with the machinery directives, the "performance level (PL)" required of the safety circuit must be evaluated. Performance levels (PL) are determined by the following parameters:

- **Major factors that determine performance levels**

1. Category
2. MTTFd (Mean Time To Dangerous Failure)
3. DCavg (Average Diagnostic Coverage)
4. CCF (Common Cause Failure) : Checklist score > 65 ?
(Please obtain the data on each component from the component manufacturer.)

The performance level (PL) of a safety circuit is determined by the following flow.

- **Flow for determining performance levels**

1. Determine the "performance level (PLr) required of the safety circuit" by means of risk assessment.
2. Configure the safety circuit that satisfies the requirements of the category that meets PLr.
3. Calculate the safety circuit's "performance level (PL)" from the MTTFd, DCavg, and CCF of the devices used for the safety circuit, and then make sure that the calculated PL is equal to or higher than the "performance level (PLr) required of the safety circuit" ($PLr \leq PL$).

In the customer's final system, the performance level (PLr) required of the safety circuit should be determined by means of risk assessment, and then the safety circuit with the corresponding performance level (PL) should be configured.

- **Safety parts subject to performance level calculation**

The table below shows the safety parts and B10d reference values.



CAUTION

Please obtain the latest information from the parts manufacturers.

	Parts name	Model name	Maker	B10d
PB	Emergency stop button	XA1E-BV302R	IDEC	1×10^5
	Enable switch	HE2B-M200PB	IDEC	1×10^5

3.2 Circuit examples for the YRC

The following shows category-specific safety circuit configuration examples for the YRC. Customers should install the appropriate safety measures for their system by referring to these safety circuit configuration examples in order to use the robots more safely.

The example shown here provide the following input/output signals.

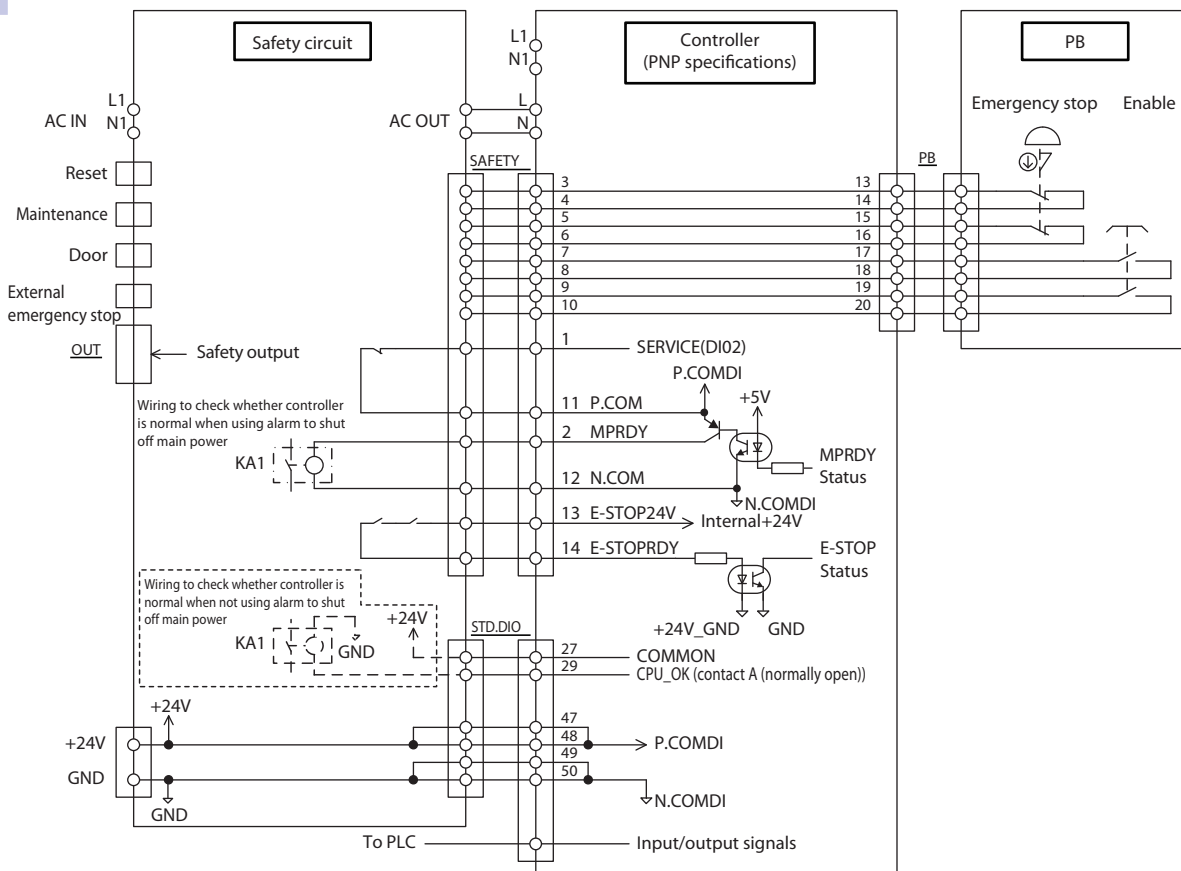
Input	Reset switch, maintenance mode switch, door switch, and external emergency stop
Output	Programming box emergency stop output and enable output



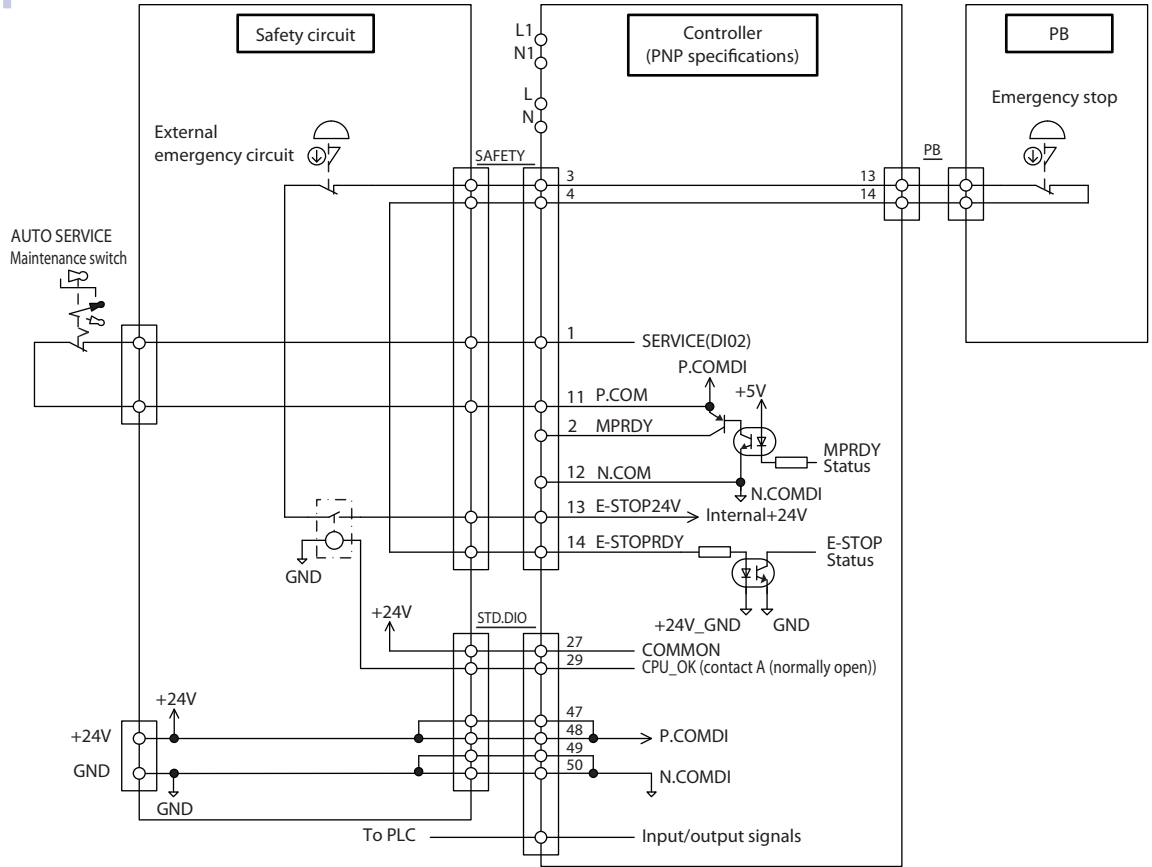
CAUTION

The controller status output signals of the parallel I/O and serial I/O, such as alarm signals, should be monitored by the host device.

Overall connection diagram (with enable switch)



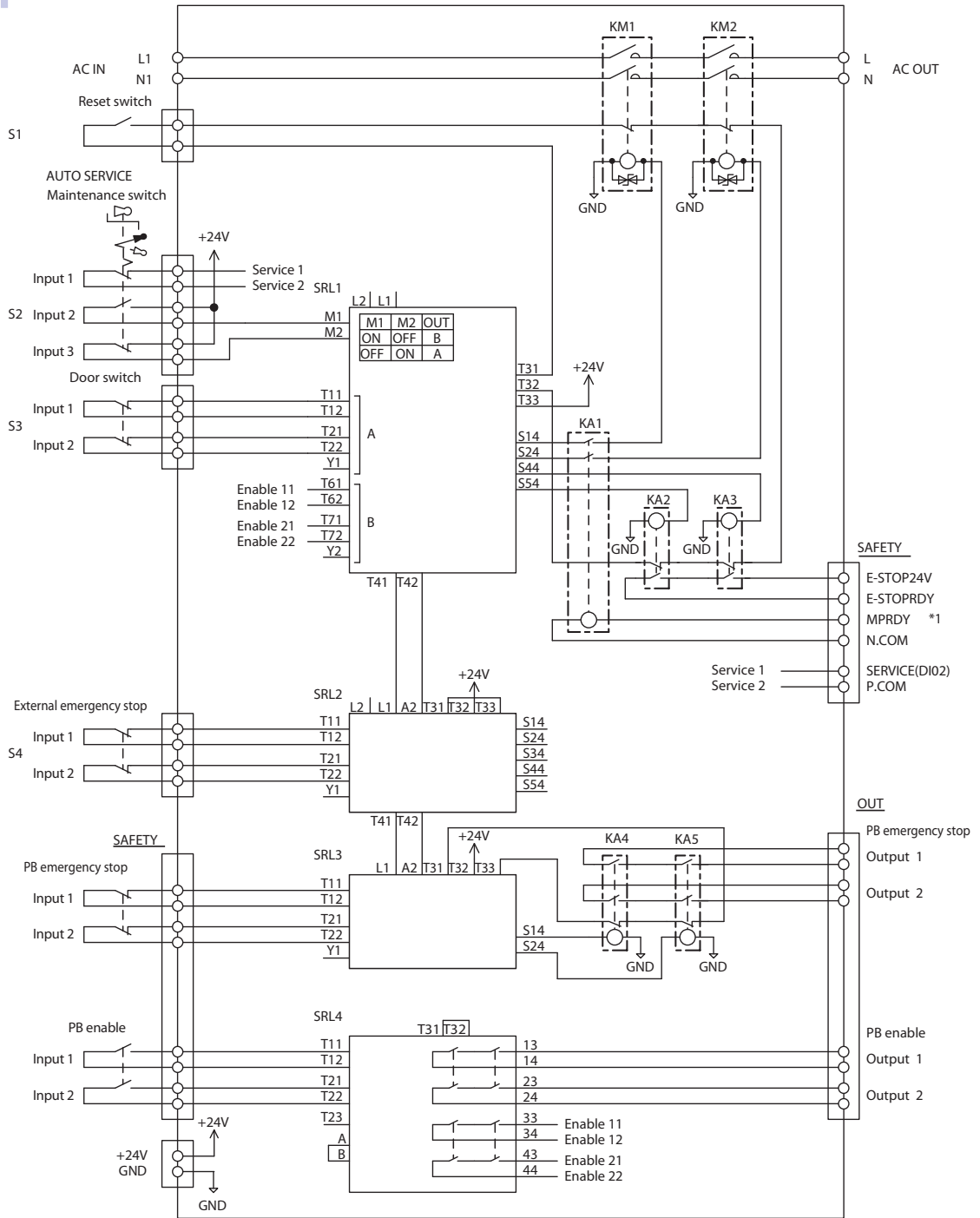
Reference: Connection diagram without enable switch (category B)



3.2.1 Category 4

A safety circuit configuration example of category 4 is shown below.

Category 4 safety circuit example



*1: Wiring to check whether the controller is normal when using an alarm to shut off the main power

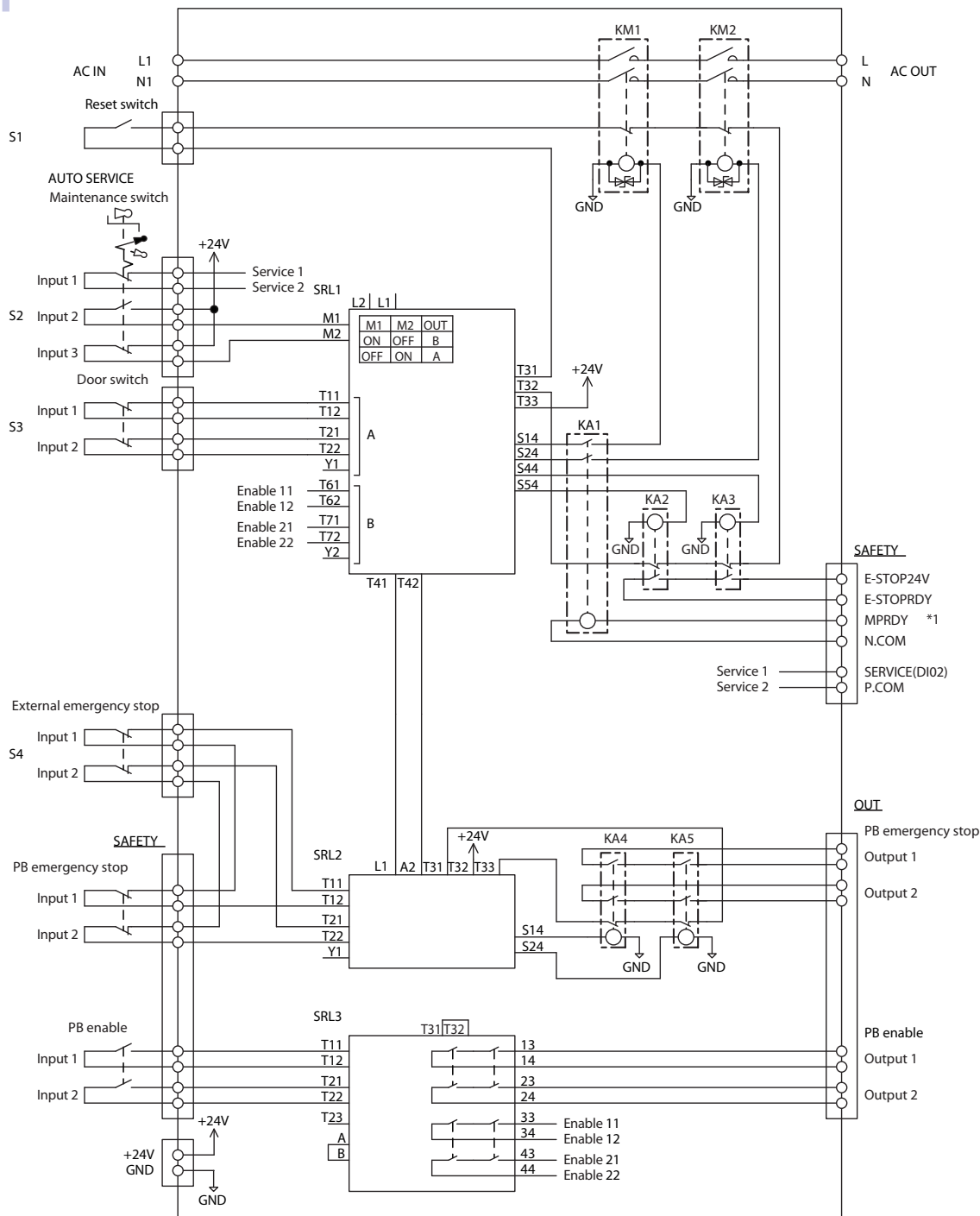
Parts list

Circuit No.	Part name	Type No.	Manufacturer
S1	Reset switch	A22 series	OMRON
S2	Key selector switch	A22 TK series	OMRON
S3	Safety door switch	D4 series	OMRON
S4	Emergency stop switch	A22E series	OMRON
KM1, 2	Contactors (mirror contact)	LC1-D18	Schneider Electric
KA1 to 5	Safety relay	G7SA-3A1B	OMRON
	Socket for safety relay	P7SA-10F-ND	OMRON
SRL1	Safety relay unit	G9SX-GS226	OMRON
SRL2	Safety relay unit	G9SX-AD322	OMRON
SRL3	Safety relay unit	G9SX-BC202	OMRON
SRL4	Safety relay unit	G9SA-GS501	OMRON

3.2.2 Category 3

A safety circuit configuration example of category 3 is shown below.

Category 3 safety circuit example



*1: Wiring to check whether the controller is normal when using an alarm to shut off the main power

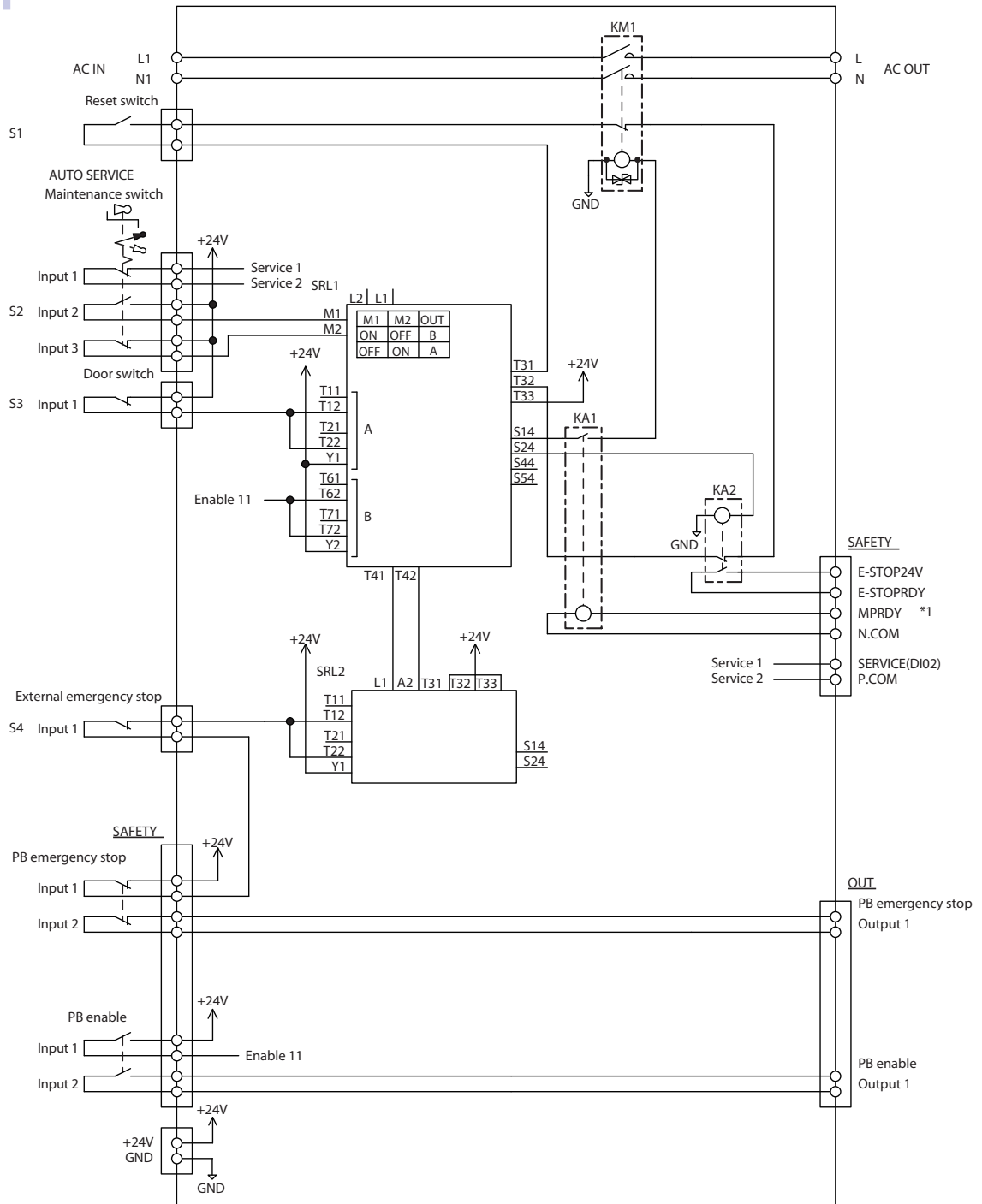
Parts list

Circuit No.	Part name	Type No.	Manufacturer
S1	Reset switch	A22 series	OMRON
S2	Key selector switch	A22 TK series	OMRON
S3	Safety door switch	D4 series	OMRON
S4	Emergency stop switch	A22E series	OMRON
KM1, 2	Contactors (mirror contact)	LC1-D18	Schneider Electric
KA1 to 5	Safety relay	G7SA-3A1B	OMRON
	Socket for safety relay	P7SA-10F-ND	OMRON
SRL1	Safety relay unit	G9SX-GS226	OMRON
SRL2	Safety relay unit	G9SX-BC202	OMRON
SRL3	Safety relay unit	G9SA-501	OMRON

3.2.3 Category 2

A safety circuit configuration example of category 2 is shown below.

Category 2 safety circuit example



*1: Wiring to check whether the controller is normal when using an alarm to shut off the main power

Parts list

Circuit No.	Part name	Type No.	Manufacturer
S1	Reset switch	A22 series	OMRON
S2	Key selector switch	A22 TK series	OMRON
S3	Safety door switch	D4 series	OMRON
S4	Emergency stop switch	A22E series	OMRON
KM1	Contactor (mirror contact)	LC1-D18	Schneider Electric
KA1, 2	Safety relay	G7SA-3A1B	OMRON
	Socket for safety relay	P7SA-10F-ND	OMRON
SRL1	Safety relay unit	G9SX-GS226	OMRON
SRL2	Safety relay unit	G9SX-BC202	OMRON

3.2.4 Overview of circuit operation

This section describes an overview of the circuit operation for each safety circuit configuration example shown in the previous sections.

1. During AUTO mode

The main power is supplied only when the enable switch is disabled, the controller is in a normal state (MPRDY is ON) with no internal alarms occurring, and also all the following conditions are met:

Conditions

- Maintenance mode switch is in AUTO (M1: open, M2: closed)
- Door switch's NC contact is closed.
- External emergency stop button's NC contact is closed.
- PB emergency stop button's NC contact is closed.



CAUTION

Connect the PB terminator or PB to the PB connector on the controller front panel. If the PB connector on the controller front panel is open, an emergency stop occurs.

2. During maintenance

The main power is supplied only when the door switch is disabled, the controller is in a normal state (MPRDY is ON) with no internal alarms occurring, and also all the following conditions are met:

Conditions

- Maintenance mode switch is in SERVICE (M1: closed, M2: open)
- External emergency stop button's NC contact is closed.
- PB emergency stop button's NC contact is closed.
- PB enable switch's NO contact is closed.



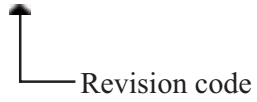
CAUTION

Always disconnect the PB terminator from the PB connector on the controller front panel and connect the PB to the PB connector.

Revision history

A manual revision code appears as a suffix to the catalog number on the front cover manual.

Cat. No. I156E-EN-01



The following table outlines the changes made to the manual during each revision.

Revision code	Date	Description
01	August 2010	Original production
02	December 2012	Minor changes

OMRON

Authorized Distributor: