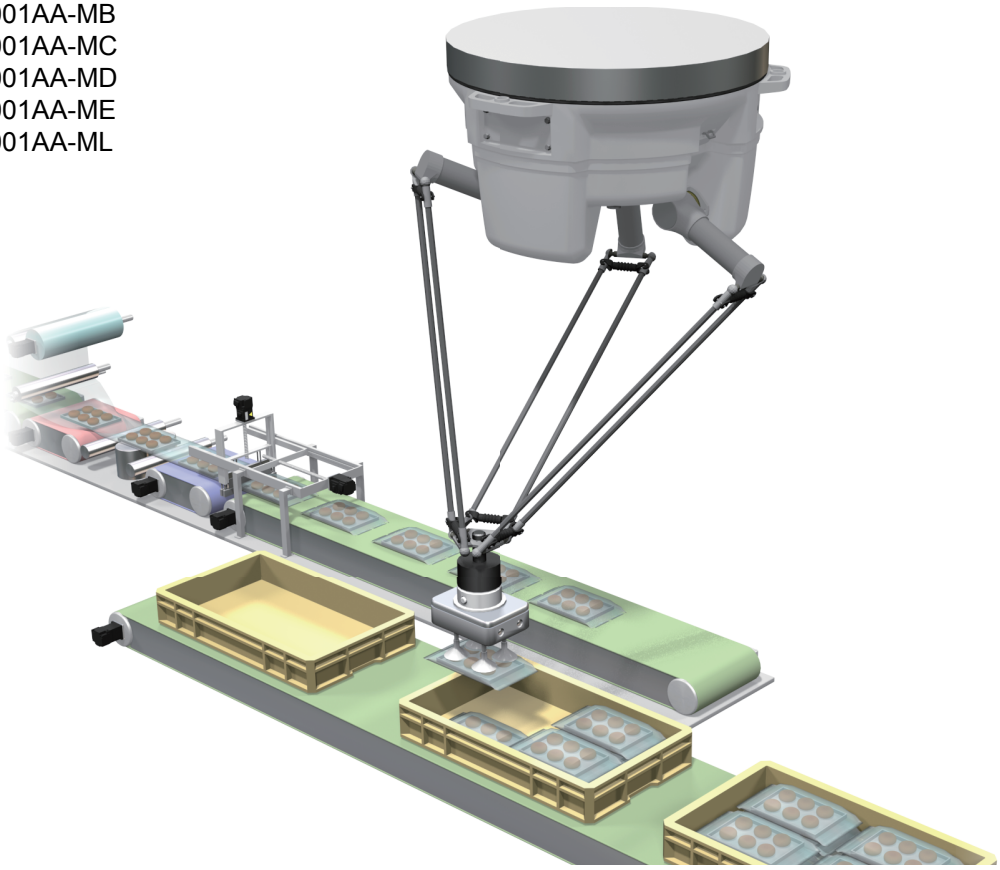
MITSUBISHI ELECTRIC

FA Application Package
iQ Monozukuri HANDLING

Instruction Manual

- AP20-HDL001AA-MA
- AP20-HDL001AA-MB
- AP20-HDL001AA-MC
- AP20-HDL001AA-MD
- AP20-HDL001AA-ME
- AP20-HDL001AA-ML



iQ Monozukuri

SAFETY PRECAUTIONS

(Read these precautions before using this product.)

Before using this product, please read this manual and the relevant manuals carefully and pay full attention to safety to handle the product correctly.

The precautions given in this manual are concerned with this product only. Refer to the MELSEC iQ-R Module Configuration Manual for a description of the PLC system safety precautions.

In this manual, the safety precautions are classified into two levels: "⚠ WARNING" and "⚠ CAUTION".

⚠ **WARNING**	Indicates that incorrect handling may cause hazardous conditions, resulting in death or severe injury.
⚠ **CAUTION**	Indicates that incorrect handling may cause hazardous conditions, resulting in minor or moderate injury or property damage.

Under some circumstances, failure to observe the precautions given under "⚠ CAUTION" may lead to serious consequences.

Observe the precautions of both levels because they are important for personal and system safety.

Make sure that the end users read this manual and then keep the manual in a safe place for future reference.

[Design Precautions]

⚠ WARNING

- Configure safety circuits external to the programmable controller to ensure that the entire system operates safely even when a fault occurs in the external power supply or the programmable controller. Failure to do so may result in an accident due to an incorrect output or malfunction.
  (1) Emergency stop circuits, protection circuits, and protective interlock circuits for conflicting operations (such as forward/reverse rotations or upper/lower limit positioning) must be configured external to the programmable controller.
  (2) When the programmable controller detects an abnormal condition, it stops the operation and all outputs are:
    - Turned off if the overcurrent or overvoltage protection of the power supply module is activated.
    - Held or turned off according to the parameter setting if the self-diagnostic function of the CPU module detects an error such as a watchdog timer error.
  (3) All outputs may be turned on if an error occurs in a part, such as an I/O control part, where the CPU module cannot detect any error. To ensure safety operation in such a case, provide a safety mechanism or a fail-safe circuit external to the programmable controller. For a fail-safe circuit example, refer to "General Safety Requirements" in the MELSEC iQ-R Module Configuration Manual.
  (4) Outputs may remain on or off due to a failure of a component such as a relay and transistor in an output circuit. Configure an external circuit for monitoring output signals that could cause a serious accident.
- In an output circuit, when a load current exceeding the rated current or an overcurrent caused by a load short-circuit flows for a long time, it may cause smoke and fire. To prevent this, configure an external safety circuit, such as a fuse.
- Configure a circuit so that the programmable controller is turned on first and then the external power supply. If the external power supply is turned on first, an accident may occur due to an incorrect output or malfunction.

[Design Precautions]

⚠ WARNING

- For the operating status of each station after a communication failure, refer to manuals relevant to the network. Incorrect output or malfunction due to a communication failure may result in an accident.
- When connecting an external device with a CPU module or intelligent function module to modify data of a running programmable controller, configure an interlock circuit in the program to ensure that the entire system will always operate safely. For other forms of control (such as program modification, parameter change, forced output, or operating status change) of a running programmable controller, read the relevant manuals carefully and ensure that the operation is safe before proceeding. Improper operation may damage machines or cause accidents.
- Especially, when a remote programmable controller is controlled by an external device, immediate action cannot be taken if a problem occurs in the programmable controller due to a communication failure. To prevent this, configure an interlock circuit in the program, and determine corrective actions to be taken between the external device and CPU module in case of a communication failure.
- Do not write any data to the "system area" and "write-protect area" of the buffer memory in the module. Also, do not use any "use prohibited" signals as an output signal from the CPU module to each module. Doing so may cause malfunction of the programmable controller system. For the "system area", "write-protect area", and the "use prohibited" signals, refer to the user's manual for the module used.
- If a communication cable is disconnected, the network may be unstable, resulting in a communication failure of multiple stations. Configure an interlock circuit in the program to ensure that the entire system will always operate safely even if communications fail. Failure to do so may result in an accident due to an incorrect output or malfunction.
- To maintain the safety of the programmable controller system against unauthorized access from external devices via the network, take appropriate measures. To maintain the safety against unauthorized access via the Internet, take measures such as installing a firewall.
- Configure safety circuits external to the programmable controller to ensure that the entire system operates safely even when a fault occurs in the external power supply or the programmable controller. Failure to do so may result in an accident due to an incorrect output or malfunction.
- If safety standards (ex., robot safety rules, etc.,) apply to the system using the module, servo amplifier and servomotor, make sure that the safety standards are satisfied.
- Construct a safety circuit externally of the module or servo amplifier if the abnormal operation of the module or servo amplifier differs from the safety directive operation in the system.
- Do not remove the SSCNETⅢ cable while turning on the control circuit power supply of modules and servo amplifier. Do not see directly the light generated from SSCNETⅢ connector of the module or servo amplifier and the end of SSCNETⅢ cable. When the light gets into eyes, you may feel something wrong with eyes. (The light source of SSCNETⅢ complies with class1 defined in JISC6802 or IEC60825-1.)

[Design Precautions]

⚠ CAUTION

- Do not install the control lines or communication cables together with the main circuit lines or power cables. Keep a distance of 100 mm or more between them. Failure to do so may result in malfunction due to noise.
- During control of an inductive load such as a lamp, heater, or solenoid valve, a large current (approximately ten times greater than normal) may flow when the output is turned from off to on. Therefore, use a module that has a sufficient current rating.
- After the CPU module is powered on or is reset, the time taken to enter the RUN status varies depending on the system configuration, parameter settings, and/or program size. Design circuits so that the entire system will always operate safely, regardless of the time.
- Do not power off the programmable controller or do not reset the CPU module during the setting registration. Doing so will make the data in the flash ROM undefined. The data need to be set in the buffer memory and to be written to the flash ROM again. Doing so may cause malfunction or failure of the module.
- When changing the operating status of the CPU module from external devices (such as remote RUN/STOP), select "Do Not Open by Program" for "Opening Method" in the module parameters. If "Open by Program" is selected, an execution of remote STOP causes the communication line to close. Consequently, the CPU module cannot reopen the communication line, and external devices cannot execute the remote RUN.

[Installation Precautions]

⚠ WARNING

- Shut off the external power supply (all phases) used in the system before mounting or removing the module. Failure to do so may result in electric shock or cause the module to fail or malfunction.

[Installation Precautions]

⚠ CAUTION

- Use the programmable controller in an environment that meets the general specifications in the manual "Safety Guidelines" included in the base unit. Failure to do so may result in electric shock, fire, malfunction, or damage to or deterioration of the product.
- To mount a module, place the concave part(s) located at the bottom onto the guide(s) of the base unit, and push in the module until the hook(s) located at the top snaps into place. Incorrect mounting may cause malfunction, failure, or drop of the module.
- To mount a module with no module fixing hook, place the concave part(s) located at the bottom onto the guide(s) of the base unit, push in the module, and fix it with screw(s).
- When using the programmable controller in an environment of frequent vibrations, fix the module with a screw.
- Tighten the screws within the specified torque range. Undertightening can cause drop of the screw, short circuit, or malfunction. Overtightening can damage the screw and/or module, resulting in drop, short circuit, or malfunction.
- When using an extension cable, connect it to the extension cable connector of the base unit securely. Check the connection for looseness. Poor contact may cause incorrect input or output.
- When using an SD memory card, fully insert it into the memory card slot. Check that it is inserted completely. Poor contact may cause malfunction.
- Securely insert an extended SRAM cassette into the cassette connector of a CPU module. After insertion, close the cassette cover and check that the cassette is inserted completely. Poor contact may cause malfunction.
- Do not directly touch any conductive parts and electronic components of the module, SD memory card, extended SRAM cassette, or connector. Doing so may cause malfunction or failure of the module.

[Wiring Precautions]

⚠ WARNING

- Shut off the external power supply (all phases) used in the system before installation and wiring. Failure to do so may result in electric shock or damage to the product.
- After installation and wiring, attach the included terminal cover to the module before turning it on for operation. Failure to do so may result in electric shock.

[Wiring Precautions]

⚠ CAUTION

- Individually ground the FG and LG terminals of the programmable controller with a ground resistance of 100 ohm or less. Failure to do so may result in electric shock or malfunction.
- Use applicable solderless terminals and tighten them within the specified torque range. If any spade solderless terminal is used, it may be disconnected when the terminal screw comes loose, resulting in failure.
- Check the rated voltage and signal layout before wiring to the module, and connect the cables correctly. Connecting a power supply with a different voltage rating or incorrect wiring may cause fire or failure.
- Connectors for external devices or coaxial cables must be crimped or pressed with the tool specified by the manufacturer, or must be correctly soldered. Incomplete connections may cause short circuit, fire, or malfunction.
- Securely connect the connector to the module. Poor contact may cause malfunction.
- Do not install the control lines or communication cables together with the main circuit lines or power cables. Keep a distance of 100 mm or more between them. Failure to do so may result in malfunction due to noise.
- Place the cables in a duct or clamp them. If not, dangling cable may swing or inadvertently be pulled, resulting in damage to the module or cables or malfunction due to poor contact. Do not clamp the extension cables with the jacket stripped. Doing so may change the characteristics of the cables, resulting in malfunction.
- Check the interface type and correctly connect the cable. Incorrect wiring (connecting the cable to an incorrect interface) may cause failure of the module and external device.
- Tighten the terminal screws or connector screws within the specified torque range. Undertightening can cause drop of the screw, short circuit, fire, or malfunction. Overtightening can damage the screw and/or module, resulting in drop, short circuit, fire, or malfunction.
- When disconnecting the cable from the module, do not pull the cable by the cable part. For the cable with connector, hold the connector part of the cable. For the cable connected to the terminal block, loosen the terminal screw. Pulling the cable connected to the module may result in malfunction or damage to the module or cable.
- Prevent foreign matter such as dust or wire chips from entering the module. Such foreign matter can cause a fire, failure, or malfunction.
- A protective film is attached to the top of the module to prevent foreign matter, such as wire chips, from entering the module during wiring. Do not remove the film during wiring. Remove it for heat dissipation before system operation.
- Programmable controllers must be installed in control panels. Connect the main power supply to the power supply module in the control panel through a relay terminal block. Wiring and replacement of a power supply module must be performed by qualified maintenance personnel with knowledge of protection against electric shock. For wiring, refer to the MELSEC iQ-R Module Configuration Manual.
- For Ethernet cables to be used in the system, select the ones that meet the specifications in the user's manual for the module used. If not, normal data transmission is not guaranteed.

[Startup and Maintenance Precautions]

⚠ WARNING

- Do not touch any terminal while power is on. Doing so will cause electric shock or malfunction.
- Correctly connect the battery connector. Do not charge, disassemble, heat, short-circuit, solder, or throw the battery into the fire. Also, do not expose it to liquid or strong shock. Doing so may cause the battery to generate heat, explode, ignite, or leak, resulting in injury or fire.
- Shut off the external power supply (all phases) used in the system before cleaning the module or retightening the terminal screws, connector screws, or module fixing screws. Failure to do so may result in electric shock or cause the module to fail or malfunction.

[Startup and Maintenance Precautions]

⚠ CAUTION

- When connecting an external device with a CPU module or intelligent function module to modify data of a running programmable controller, configure an interlock circuit in the program to ensure that the entire system will always operate safely. For other forms of control (such as program modification, parameter change, forced output, or operating status change) of a running programmable controller, read the relevant manuals carefully and ensure that the operation is safe before proceeding. Improper operation may damage machines or cause accidents.
- Especially, when a remote programmable controller is controlled by an external device, immediate action cannot be taken if a problem occurs in the programmable controller due to a communication failure. To prevent this, configure an interlock circuit in the program, and determine corrective actions to be taken between the external device and CPU module in case of a communication failure.
- Do not disassemble or modify the modules. Doing so may cause failure, malfunction, injury, or a fire.
- Use any radio communication device such as a cellular phone or PHS (Personal Handyphone System) more than 25 cm away in all directions from the programmable controller. Failure to do so may cause malfunction.
- Shut off the external power supply (all phases) used in the system before mounting or removing the module. Failure to do so may cause the module to fail or malfunction.
- Tighten the screws within the specified torque range. Undertightening can cause drop of the component or wire, short circuit, or malfunction. Overtightening can damage the screw and/or module, resulting in drop, short circuit, or malfunction.
- After the first use of the product, do not mount/remove the module to/from the base unit, and the terminal block to/from the module, and do not insert/remove the extended SRAM cassette to/from the CPU module more than 50 times (IEC 61131-2 compliant) respectively. Exceeding the limit of 50 times may cause malfunction.
- After the first use of the product, do not insert/remove the SD memory card to/from the CPU module more than 500 times. Exceeding the limit may cause malfunction.
- Do not touch the metal terminals on the back side of the SD memory card. Doing so may cause malfunction or failure.
- Do not touch the integrated circuits on the circuit board of an extended SRAM cassette. Doing so may cause malfunction or failure.
- Do not drop or apply shock to the battery to be installed in the module. Doing so may damage the battery, causing the battery fluid to leak inside the battery. If the battery is dropped or any shock is applied to it, dispose of it without using.

[Startup and Maintenance Precautions]

⚠ CAUTION

- Startup and maintenance of a control panel must be performed by qualified maintenance personnel with knowledge of protection against electric shock. Lock the control panel so that only qualified maintenance personnel can operate it.
- Before handling the module, touch a conducting object such as a grounded metal to discharge the static electricity from the human body. Failure to do so may cause the module to fail or malfunction.
- Before testing the operation, set a low speed value for the speed limit parameter so that the operation can be stopped immediately upon occurrence of a hazardous condition.
- Confirm and adjust the program and each parameter before operation. Unpredictable movements may occur depending on the machine.
- When using the absolute position system function, on starting up, and when the module or absolute position motor has been replaced, always perform a home position return.
- Before starting the operation, confirm the brake function.
- Do not perform a megger test (insulation resistance measurement) during inspection.
- After maintenance and inspections are completed, confirm that the position detection of the absolute position detection function is correct.
- Lock the control panel and prevent access to those who are not certified to handle or install electric equipment.

[Operating Precautions]

⚠ CAUTION

- When changing data and operating status, and modifying program of the running programmable controller from an external device such as a personal computer connected to an intelligent function module, read relevant manuals carefully and ensure the safety before operation. Incorrect change or modification may cause system malfunction, damage to the machines, or accidents.
- Do not power off the programmable controller or reset the CPU module while the setting values in the buffer memory are being written to the flash ROM in the module. Doing so will make the data in the flash ROM and SD memory card undefined. The values need to be set in the buffer memory and written to the flash ROM and SD memory card again. Doing so also can cause malfunction or failure of the module.
- Note that when the reference axis speed is specified for interpolation operation, the speed of the partner axis (2nd, 3rd, or 4th axis) may exceed the speed limit value.
- Do not go near the machine during test operations or during operations such as teaching. Doing so may lead to injuries.

[Disposal Precautions]

⚠ CAUTION

- When disposing of this product, treat it as industrial waste.
- When disposing of batteries, separate them from other wastes according to the local regulations. For details on battery regulations in EU member states, refer to the MELSEC iQ-R Module Configuration Manual.

[Transportation Precautions]

⚠ CAUTION

- When transporting lithium batteries, follow the transportation regulations. For details on the regulated models, refer to the MELSEC iQ-R Module Configuration Manual.
- The halogens (such as fluorine, chlorine, bromine, and iodine), which are contained in a fumigant used for disinfection and pest control of wood packaging materials, may cause failure of the product. Prevent the entry of fumigant residues into the product or consider other methods (such as heat treatment) instead of fumigation. The disinfection and pest control measures must be applied to unprocessed raw wood.

[Precautions on Introduction of User Programs]

⚠ CAUTION

- To utilize the application program (example) and the screens (example) for an actual system, sufficiently confirm that the program and the screens will not cause system control problems on user's own responsibility. Examine the positions where interlock conditions are required in a target system and add them.
- Mitsubishi Electric Corporation cannot be held responsible for any damages or problems which may occur as a result of using the application program and the screens.
- The application program and screens provided by Mitsubishi Electric Corporation may be changed without any notice.

CONDITIONS OF USE FOR THE PRODUCT

(1) Mitsubishi programmable controller ("the PRODUCT") shall be used in conditions;
i) where any problem, fault or failure occurring in the PRODUCT, if any, shall not lead to any major or serious accident; and
ii) where the backup and fail-safe function are systematically or automatically provided outside of the PRODUCT for the case of any problem, fault or failure occurring in the PRODUCT.

(2) The PRODUCT has been designed and manufactured for the purpose of being used in general industries.
MITSUBISHI SHALL HAVE NO RESPONSIBILITY OR LIABILITY (INCLUDING, BUT NOT LIMITED TO ANY AND ALL RESPONSIBILITY OR LIABILITY BASED ON CONTRACT, WARRANTY, TORT, PRODUCT LIABILITY) FOR ANY INJURY OR DEATH TO PERSONS OR LOSS OR DAMAGE TO PROPERTY CAUSED BY the PRODUCT THAT ARE OPERATED OR USED IN APPLICATION NOT INTENDED OR EXCLUDED BY INSTRUCTIONS, PRECAUTIONS, OR WARNING CONTAINED IN MITSUBISHI'S USER, INSTRUCTION AND/OR SAFETY MANUALS, TECHNICAL BULLETINS AND GUIDELINES FOR the PRODUCT.
("Prohibited Application")
Prohibited Applications include, but not limited to, the use of the PRODUCT in;
- Nuclear Power Plants and any other power plants operated by Power companies, and/or any other cases in which the public could be affected if any problem or fault occurs in the PRODUCT.
- Railway companies or Public service purposes, and/or any other cases in which establishment of a special quality assurance system is required by the Purchaser or End User.
- Aircraft or Aerospace, Medical applications, Train equipment, transport equipment such as Elevator and Escalator, Incineration and Fuel devices, Vehicles, Manned transportation, Equipment for Recreation and Amusement, and Safety devices, handling of Nuclear or Hazardous Materials or Chemicals, Mining and Drilling, and/or other applications where there is a significant risk of injury to the public or property.

Notwithstanding the above, restrictions Mitsubishi may in its sole discretion, authorize use of the PRODUCT in one or more of the Prohibited Applications, provided that the usage of the PRODUCT is limited only for the specific applications agreed to by Mitsubishi and provided further that no special quality assurance or fail-safe, redundant or other safety features which exceed the general specifications of the PRODUCTs are required. For details, please contact the Mitsubishi representative in your region.

INTRODUCTION

Thank you for purchasing the "iQ Monozukuri" product.
This manual describes the design, procedures before operation, functions, and programming required for constructing a system using this application. Before using this product, please read this manual and the relevant manuals carefully and develop familiarity with the functions and performance of this application to design the product correctly.
To utilize the program introduced in this manual for an actual system, sufficiently confirm that the program will not cause system control problems.

CONTENTS

RELEVANT MANUALS

Manual name [manual number]	Description	Available form
MELSEC iQ-R Motion Controller User's Manual [IB-0300235]	Motion CPU modules, SSCNETⅢ cables and serial ABS synchronous encoder cable, troubleshooting, etc.	Print book e-Manual PDF
MELSEC iQ-R Motion Controller Programming Manual (Common) [IB-0300237]	Multi-CPU system configuration, performance specifications, common parameters, auxiliary/application functions, and error lists, etc.	Print book e-Manual PDF
MELSEC iQ-R Motion Controller Programming Manual (Program Design) [IB-0300239]	Functions of motion SFC, programming, and debugging, etc.	Print book e-Manual PDF
MELSEC iQ-R Motion Controller Programming Manual (Positioning Control) [IB-0300241]	Servo parameters, positioning instructions, and device lists, etc.	Print book e-Manual PDF
MELSEC iQ-R Motion Controller Programming Manual (Advanced Synchronous Control) [IB-0300243]	Synchronous control parameters for performing synchronous control, and device lists, etc.	Print book e-Manual PDF
MELSEC iQ-R Motion Controller Programming Manual (Machine Control) [IB-0300309]	Machine control parameters for performing machine control, machine positioning data, and device lists, etc.	Print book e-Manual PDF

This manual does not include information on restrictions of use such as combination with modules or PLC CPUs.
Please make sure to read the user's manual of the corresponding products before using this application package.

Point

e-Manual refers to the Mitsubishi FA electronic book manuals that can be browsed using a dedicated tool.
e-Manual has the following features:

- Required information can be cross-searched in multiple manuals.
- Other manuals can be accessed from the links in the manual.
- The hardware specifications of each part can be found from the product figures.
- Pages that users often browse can be bookmarked.

TERMS

Unless otherwise specified, this manual uses the following terms.

Term	Description
Add-on library	A library file for adding on a function that is not included in the standard operating system for motion CPU modules. Install it in a motion CPU module in the same way as the operating system.
Simplified robot	A robot that operates with machine control
Joint coordinate system	A coordinate system that each machine configuration axis has
Joint axis	An axis assigned to the joint part of a simplified robot
Stroke limit for each joint axis	The stroke limit for each machine configuration axis
Cycle Stop	A function that stops a series of operations of the device at a fixed position after a stop request is issued
Coordinate transformation	Processing in the machine library that transforms data specified with an XYZ coordinate system to the coordinates of machine configuration axes when a control point of the simplified robot in the XYZ coordinate space is positioned
Temporary license	A license for using the application before getting an official license. The temporary license is available for two months (from the registration date of the temporary license to the same day in the month after next).
Rotating axis	An axis that drives the rotating arm
Linear axis	An axis that drives the linear arm (slider)
XYZ stroke limit	The movable range of the control point on the base coordinate system
Tool coordinate system	A coordinate system where the control point is set as the home position
Tool transformation	A function that shifts the control point position in accordance with the tip tool
Handling	Motion of carrying an object
Emergency Stop	A function that immediately stops operation of the device
Vision system	A system that calculates the size, deviation, color, and other information of a target object by processing images captured with a camera, to output data and results
Vision Tracking	Motion of checking the position of a workpiece on the conveyor and acquiring it at the speed synchronized with the conveyor.
Base coordinate system	A coordinate system set to the bottom of the base of the robot
Base transformation	A function that offsets the base coordinate of the robot
Machine control	A function that controls a simplified robot (link configuration) with a motion CPU module
Machine types	Types of simplified robot configuration
Machine library	An add-on library for performing coordinate transformation in accordance with the configuration of the simplified robot, or performing other functions
Link configuration	A machine configuration where multiple links (joints) are combined
World coordinate system	A coordinate system set to the ground or work floor
GOT	The abbreviation for the Graphic Operation Terminal

REQUESTING AND REGISTERING A LICENSE KEY

To use the application, register a license key to the CPU module.

Before starting up the system, follow the "License Key Request Instructions" supplied with this product to get a license key.

1. The following information is required to request a license key.

• Application information (product name, model, and product ID)

This information is described in the "License Certificate" supplied with this product.

• Hardware information (model and serial number)

The model and serial number (manufacturing information for MELSEC iQ-R series) of the CPU module to be used. For how to check the manufacturing information and firmware version, refer to the following.

MELSEC iQ-R Module Configuration Manual

2. Register the license key to the CPU module before creating an application program.

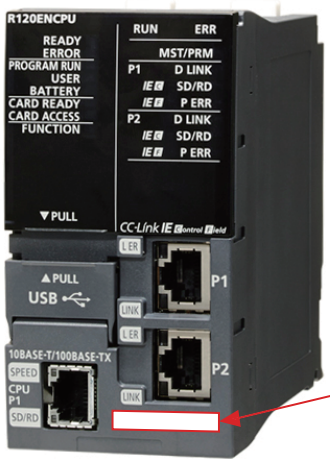
For the registration procedure, refer to the following.

☞ Page 24 SETTING AND PROCEDURE BEFORE OPERATION

3. Attach the supplied "iQ Monozukuri seal" on the CPU module for which a license key has been registered.

For the position to attach the seal, refer to the following.

Position where the seal is attached: Above the PULL on the LED cover

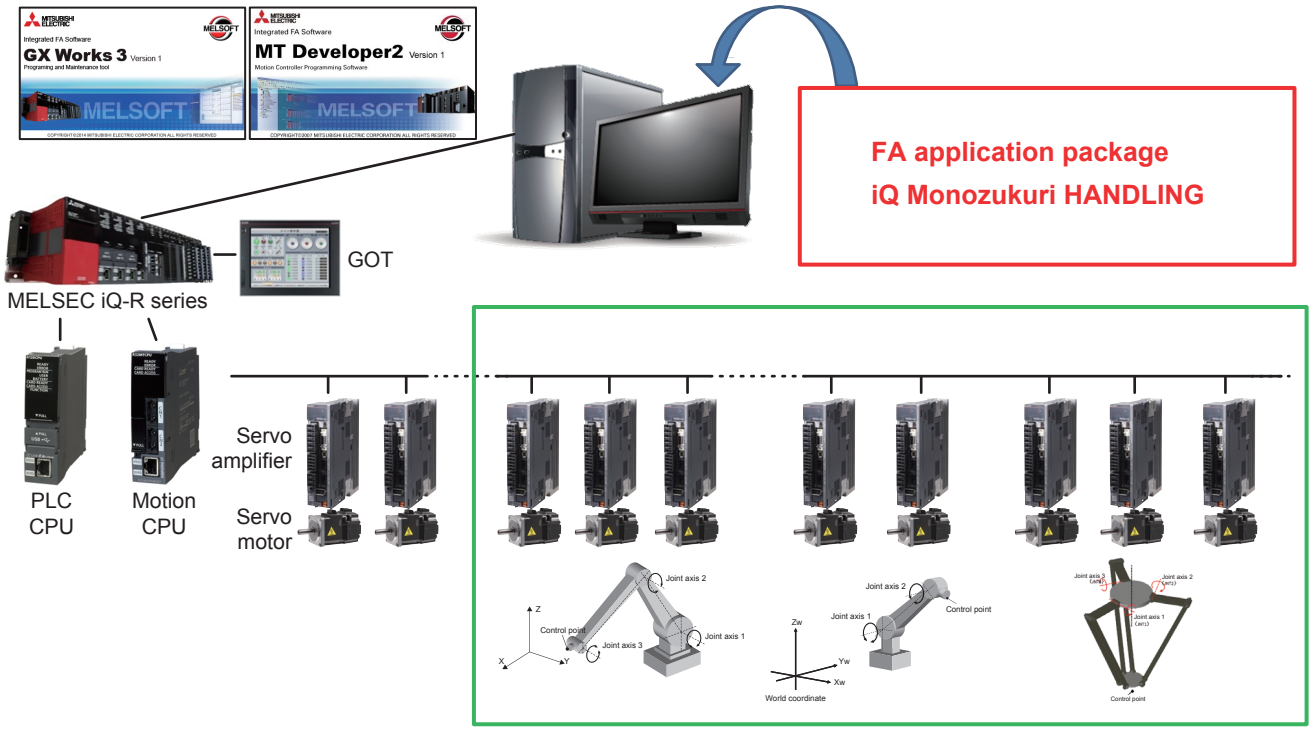


Position where the seal is attached: Below the Ethernet port P2

1 OVERVIEW

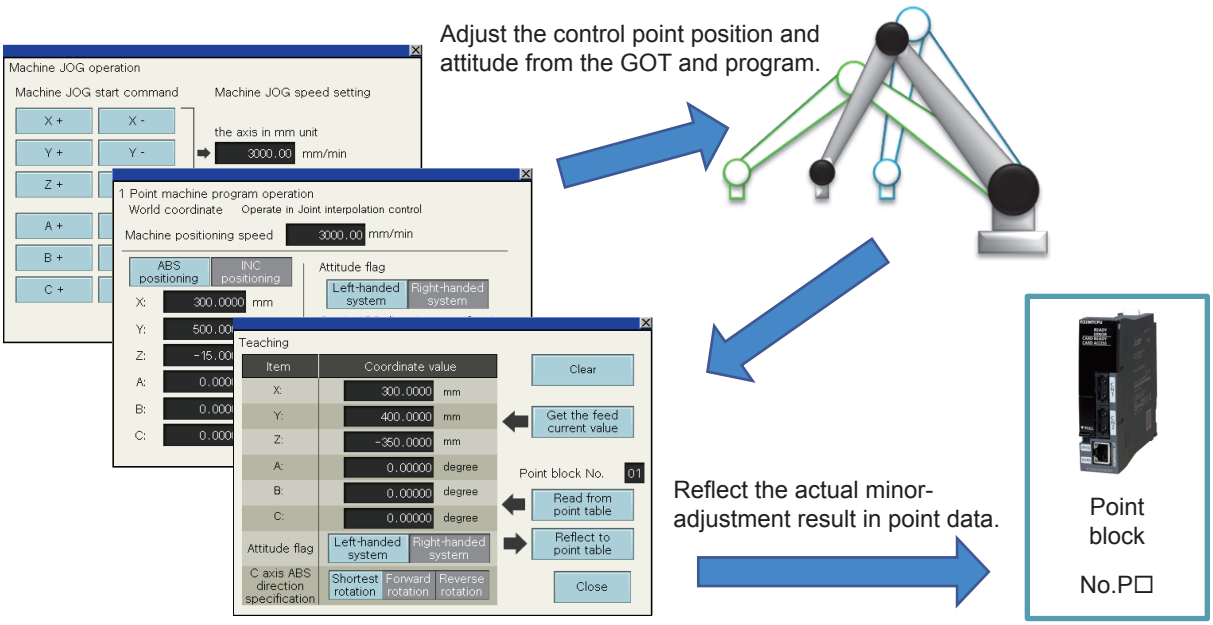
1.1 Handling Application Package

The "Handling Application Package" provides machine libraries for controlling the simplified robot (link configuration), application examples (programs and GOT screens), machine program support tool, machine control simulator, and machine attitude monitor. The simplified robot can be developed by installing a machine library in the motion CPU module and used to create applications for transportation purposes in addition to motion control such as positioning and synchronous control.



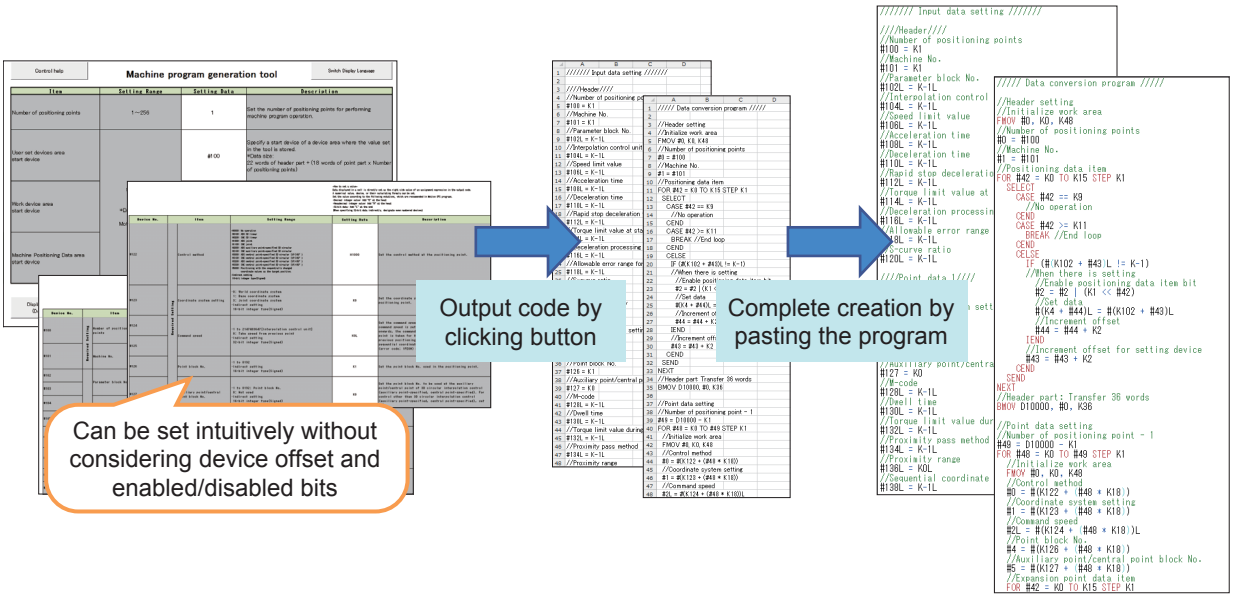
GOT screen example

The following provides screen examples related to the startup of each axis, machine operation, and machine adjustment.



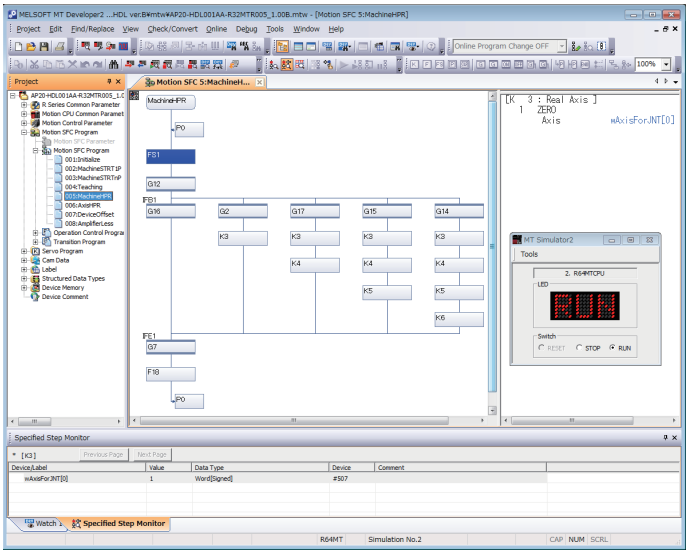
Machine program support tool

This tool supports the creation of a motion SFC program for performing machine program operation.



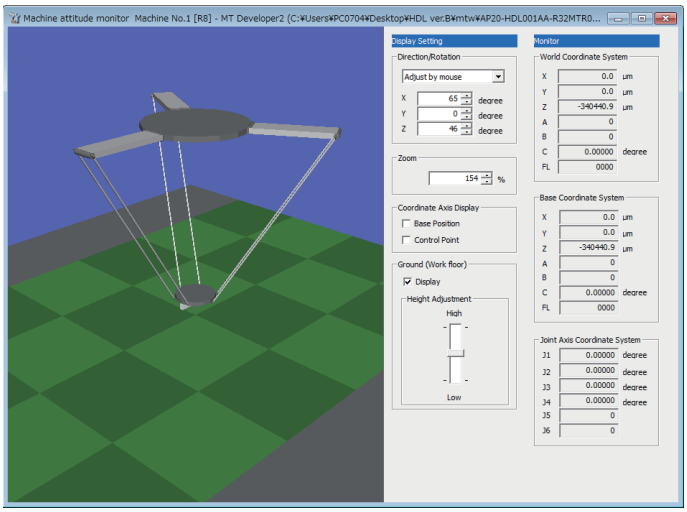
Machine control simulator

This function enables simulation based on machine libraries with MELSOFT MT Works2. Operations of a simplified robot can be simulated without a Motion CPU module.



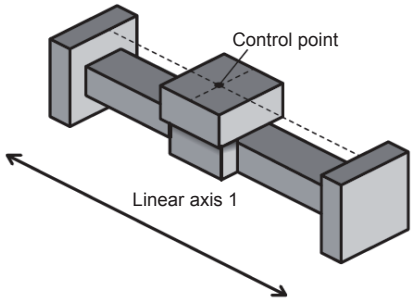
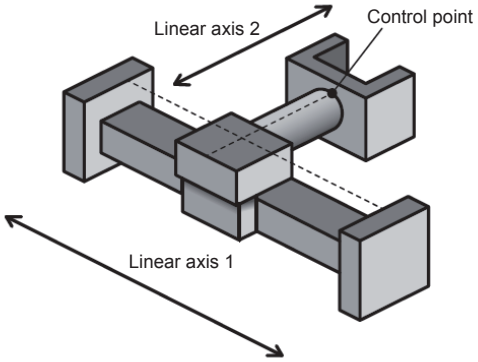
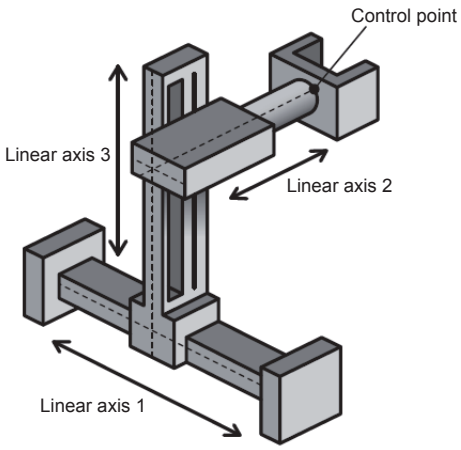
Machine attitude monitor

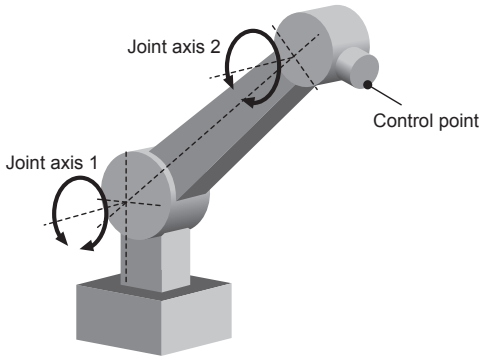
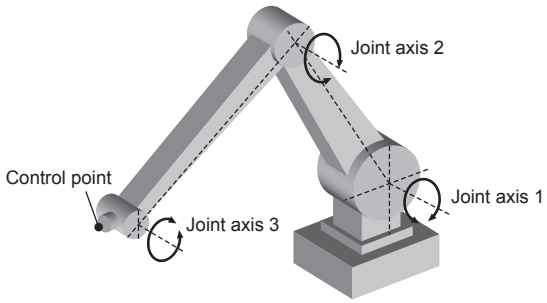
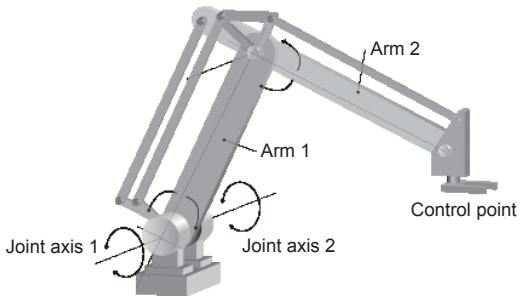
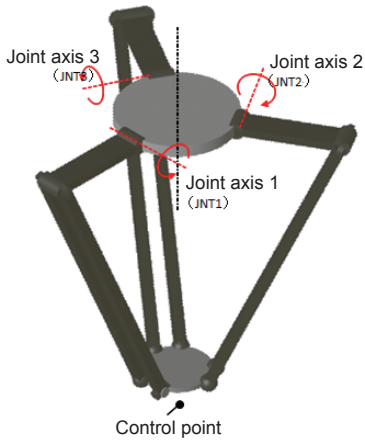
This function enables displaying an image of the simplified robot controlled by machine libraries in the monitor function of MELSOFT MT Works2.

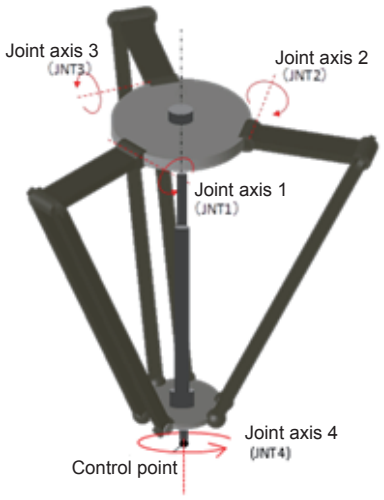


1.2 Machine Library

The following shows the machine libraries provided with the handling application package. A simplified robot can be developed by installing a machine library depending on the machine.
For details on the specifications, refer to the user's manual of each machine library.

Machine type	Use	Mechanism
R1	1-axis Cartesian	
R2	2-axis Cartesian	
R3	3-axis Cartesian	

Machine type	Use	Mechanism
R4	2-axis vertical articulated	
R5	3-axis vertical articulated	
R6	2-axis vertical articulated (parallel linkage)	
R7	3-axis configuration parallel link	

Machine type	Use	Mechanism
R8	3-axis configuration parallel link (with rotating axis)	

1.3 Product Configuration

This product is the application package for the MELSEC iQ-R series which uses the machine libraries of the motion CPU module. Select and prepare MELSEC iQ-R power supply modules, base units, PLC CPUs, motion CPU modules, I/Os, intelligent modules, driving devices such as servo amplifiers, and GOTs appropriate to the system used.

Products in the iQ Monozukuri HANDLING package

AP20-HDL001AA-M□

Check that all the products in the following table are included in a package.

Name	Quantity	Remarks
Before Using the Product	1	
END-USER SOFTWARE LICENSE AGREEMENT	1	
License Certificate	1	
License Key Request Instructions	1	Refer to the following. ☞ REQUESTING AND REGISTERING A LICENSE KEY
iQ Monozukuri seal*1	1 license × 2	Refer to the following. ☞ REQUESTING AND REGISTERING A LICENSE KEY
HANDLING package (DVD-ROM)	1	For details, refer to the following. ☞ Page 22 Files in DVD-ROM

*1 Two (one spare) iQ Monozukuri seals are supplied with one license.

Files in DVD-ROM

The following table describes the composition of the files in the DVD-ROM (HANDLING package) included in this package.

Folder				File name*1	File type (Extension)	Description	Required application
Package root	Manual	English		bcnb62005851eng*	PDF file (.pdf)	iQ Monozukuri HANDLING Instruction Manual (English)	Adobe Reader
					e-Manual file (.ema)		e-Manual Viewer
		Japanese		bcnb62005850*	PDF file (.pdf)	iQ Monozukuri HANDLING Instruction Manual (Japanese)	Adobe Reader
					e-Manual file (.ema)		e-Manual Viewer
		Simplified Chinese		bcnb62005852chn*	PDF file (.pdf)	iQ Monozukuri HANDLING Instruction Manual (Chinese (Simplified))	Adobe Reader
					e-Manual file (.ema)		e-Manual Viewer
	Lib_mtw	mcntype□*2	Library	McnType□*2	Add-on library (.adm)	Add-on library and instruction manual of each machine library	MELSOFT MT Works2
			Manual	Storage of Japanese, English, Simplified Chinese, and Traditional Chinese	PDF file (.pdf)		Adobe Reader
	Lib_gx3			HDL_Control_R_****	Application library (.mslm)	FB library used in the HANDLING application	MELSOFT GX Works3
	Project			AP20-HDL001AA-R16_****	GX Works3 project file (.gx3)	Projects for combined operation with program examples of MELSOFT MT Works2	MELSOFT GX Works3
				AP20-HDL001AA-R32MTR□_****2	MT Works2 project file (.mtw)	Programs (example) for operating the simplified robot in accordance with each machine library	MELSOFT MT Works2
				AP20-HDL001AA-GT27nnS_****	GT Designer3 project file (.GTX)	Screens (example) for performing machine operation and adjustment in combination with programs (example)	MELSOFT GT Designer3
	Tools	MachineControlSupport		HDLPointSetTool	Tool (.xlsm)	Positioning point setting support tool	Microsoft® Excel®
				HDLMachineProgGeneration Tool	Tool (.xlsm)	Machine program generation tool	Microsoft® Excel®
		LicRegSupport		LicRegSupport	Tool (.xlsm)	License key registration support tool	Microsoft® Excel®
				AP20-HDL001AA_R16_LicWrite	GX Works3 project file (.gx3)	Programs for registering a license key to the CPU module	MELSOFT GX Works3
	MTW2_ext			Setup	Setup file (.exe)	Setup file of MT Works2 machine control simulator and machine attitude monitor	MELSOFT MT Works2
	—			AP20-HDL001AA	Text file (.txt)	Version information	—

1 "" indicates their versions.

*2 "□" indicates the three-digit machine library number.

1.4 Applicable Hardware and Software

The following table lists applicable models and versions of the engineering tool.

Item	Model
PLC CPU module	R**CPU, R**ENCPU Use the module with a firmware version of "25" or later.
Motion CPU module	R16MTCPU, R32MTCPU, R64MTCPU Use the module with a software version of "11" or later for the main unit OS. Use the module with a software version of "12" or later for the main unit OS when using Vision Tracking. Use the module with a software version of "15" or later for the main unit OS when using WAIT-ON/OFF and point arrival notification.
Sequencer engineering software	MELSOFT GX Works3 Version 1.045X or later*1
Motion controller engineering software	MELSOFT MT Works2 Version 1.146C or later*1 Use MELSOFT MT Works2 of version 1.150G or later when using WAIT-ON/OFF or point arrival notification with the machine control simulator function.
Display machine creation software	MELSOFT GT Works3 Version 1.190Y or later*1

*1 The projects included in this product are created with the specified version.

2 SETTING AND PROCEDURE BEFORE OPERATION

2.1 Registering a License Key

To use this application package, register a license key to the PLC CPU module that executes applications. Follow the steps below to register a license key.

Point

To execute the application before getting a license key, use a temporary license.
The temporary license is valid for two months (from the registration date of the temporary license to the same day in the month after next).
For how to register a temporary license, refer to the following.
☞ Page 133 Temporary License Registration

Items to be prepared

Item	Description
Product ID	Numbers that are described in the "License Certificate" 123-123456789
License key	Follow the "License Key Request Instructions" to get a license key. 11AA12AB13AC14AD21BA22BB23BC24BD31CA32CB33CC34CD41DA42DB43DC44DD
License key registration project (AP20-HDL001AA_R16_LicWrite.gx3)	A project for registering a license key to the PLC CPU module. It is included in the supplied DVD. <FB> FormatLicense (Macro type) HDL_LicenseWrite (Macro type)
License key registration support tool (LicRegSupport.xlsm)	A tool that generates a license key registration program (ST instructions). It is included in the supplied DVD. When the operating environment for Microsoft Office is not installed, register the license key manually without this tool. [Operating environment] Microsoft Office 2010, Microsoft Office 2013, Microsoft Office 2016

Creating and executing the program

1. Opening the license key registration project (AP20-HDL001AA_R16_LicWrite.gx3).

Copy the license key registration project (AP20-HDL001AA_R16_LicWrite.gx3) in the supplied DVD to a folder in the personal computer, and open the file.

The project is created for the R16CPU. When using a model other than R16CPU, change the model.

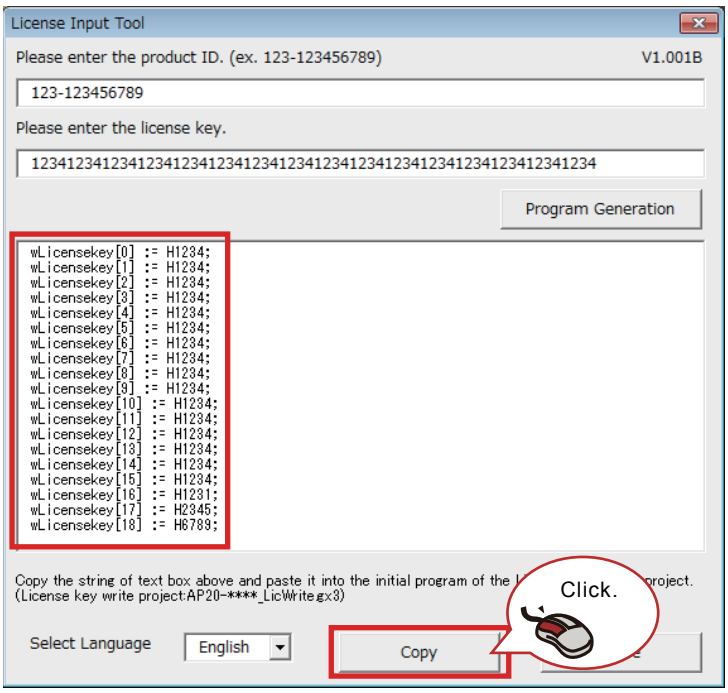
* Make sure that no module is mounted on other than the CPU slot. When registering a license key to multiple PLC CPU modules, register it one by one.

2. Preparing the program using the license key registration support tool

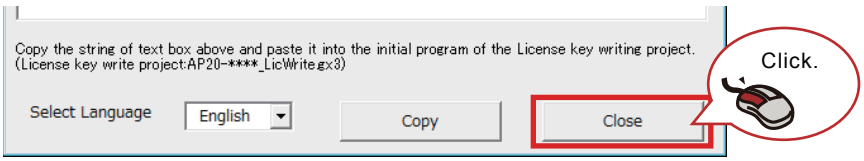
When this tool is not used, follow the procedure described in "3. Editing the initial program".

- Copy the license key registration support tool (LicRegSupport.xlsm) in the supplied DVD to a folder in the personal computer, and open the file. When the file is read-only, clear the read-only status. When the macro is disabled, enable it.
- Input the product ID and license key, and press the [Program Generation] button.

- The program in ST language is output. Press the [Copy] button. The output program is copied to the clipboard.



- Follow the steps described in "3. Editing the initial program" to edit the program. After editing the program, press the [Close] button to end the tool.



Precautions

Any operation in Excel is disabled while the license key registration support tool is being used. End the tool after using it.

3. Editing the initial program

Select "Program" → "Initial" in the Navigation window and open the registered program. (Program name: Initial)

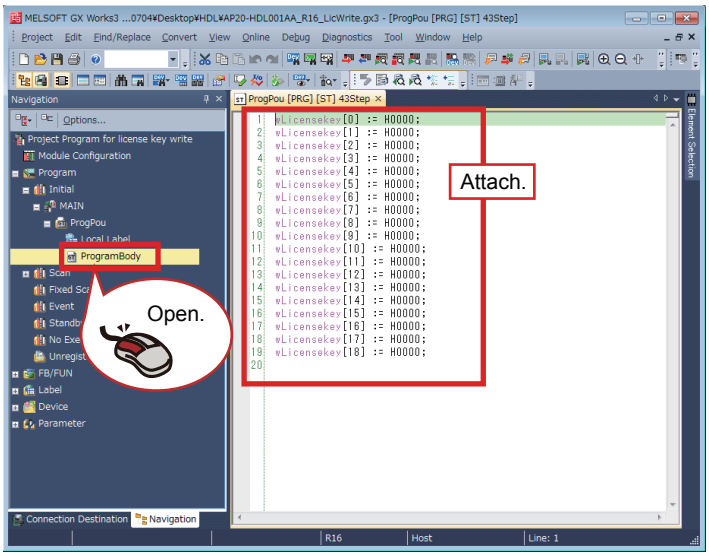
Set the license key to the license key label (wLicenseKey) of the initial program.

■ Setting with the license key registration support tool

When the license key registration support tool is not used, refer to "Manual setting".

Press the [Copy] button to copy the program in ST language which is output to the license key registration support tool to the clipboard.

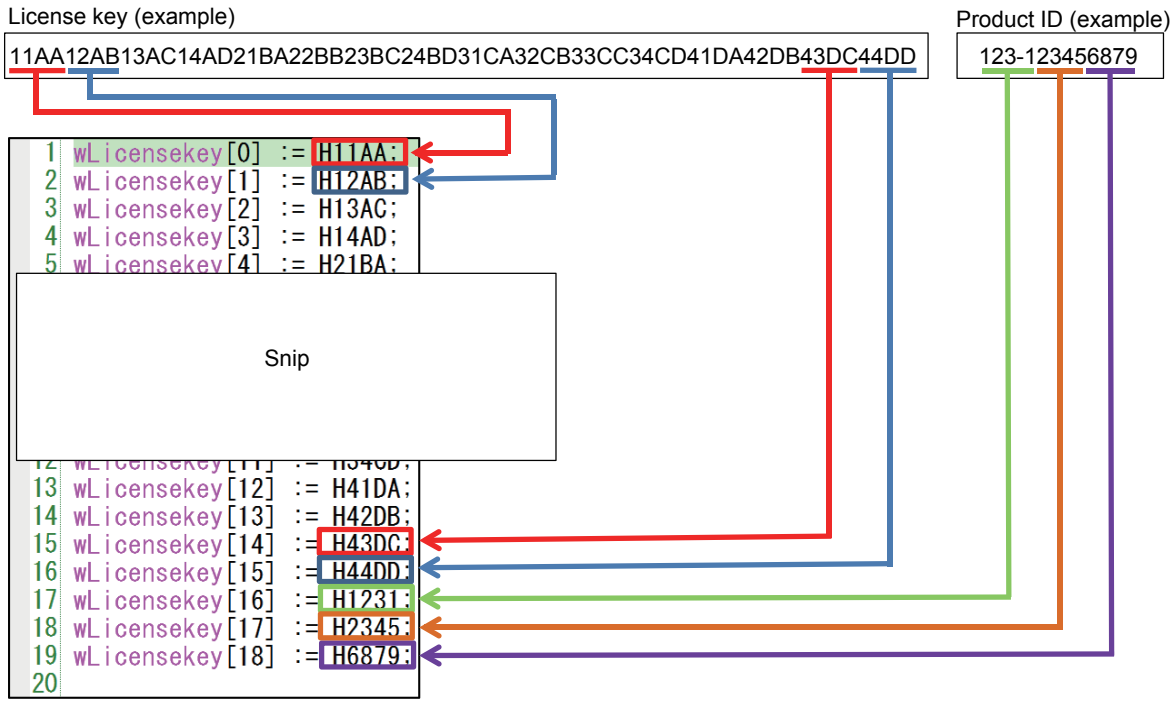
Select all of the existing ST program and paste the copied program in the initial program.



After pasting the program, follow the procedure described in "4. Writing and executing the program".

■ Manual setting

Refer to the following example to set the license key and product ID to the initial program.



4. Writing and executing the program

Write the created program to the PLC CPU module and execute it.

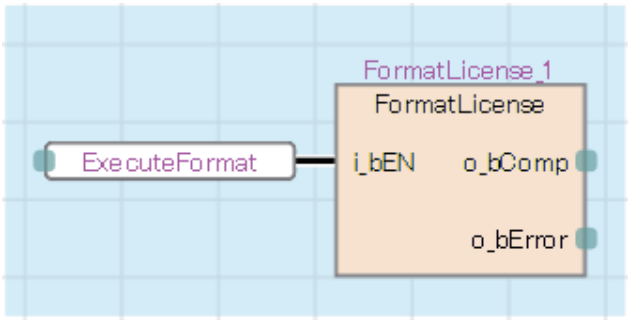
- Select "Convert" → "Rebuild All" from the menu and convert all the program created in step 3. When an error occurs, check the details and correct the program.
- Select "Online" → "Write to PLC" from the menu and write all the program to the PLC CPU module.
- Set the PLC CPU module to the RUN state and execute the scan program. Select "Program" → "Scan" in the Navigation window and open the registered program. (Program name: LicenseWrite) The scan program includes the function block (FormatLicense) for formatting the license key registration area and the function block (HDL_LicenseWrite) for writing the license key.

Point

- When registering the license key to the PLC CPU module for the first time, format the license key registration area. Format it before registering the license key.
- When another license of iQ Monozukuri has been registered, register the license without formatting it.
- When the temporary license has already been registered, the expiration date is cleared by registering the obtained license key.

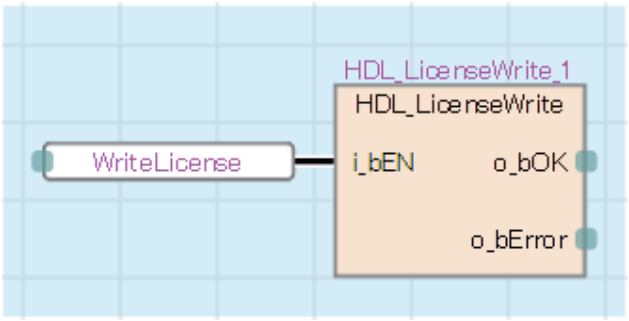
■ Formatting the license key registration area

Turn on the execution flag (ExecuteFormat) of the function block (FormatLicense) in the scan program. Normal completion (o_bComp) or Error completion (o_bError) becomes TRUE. At the error completion, check the PLC CPU error details.
Turn off the execution flag (ExecuteFormat) after checking the output of the function block.



■ Registering the license key

Turn on the execution flag (WriteLicense) of the function block (HDL_LicenseWrite) in the scan program. Normal completion (o_bOK) or Error completion (o_bError) becomes TRUE. At the error completion, refer to Troubleshooting. (☞ Page 28 Troubleshooting)
When Normal operation (o_bOK) turns on, the license key registration is completed. Turn off the execution flag (WriteLicense).

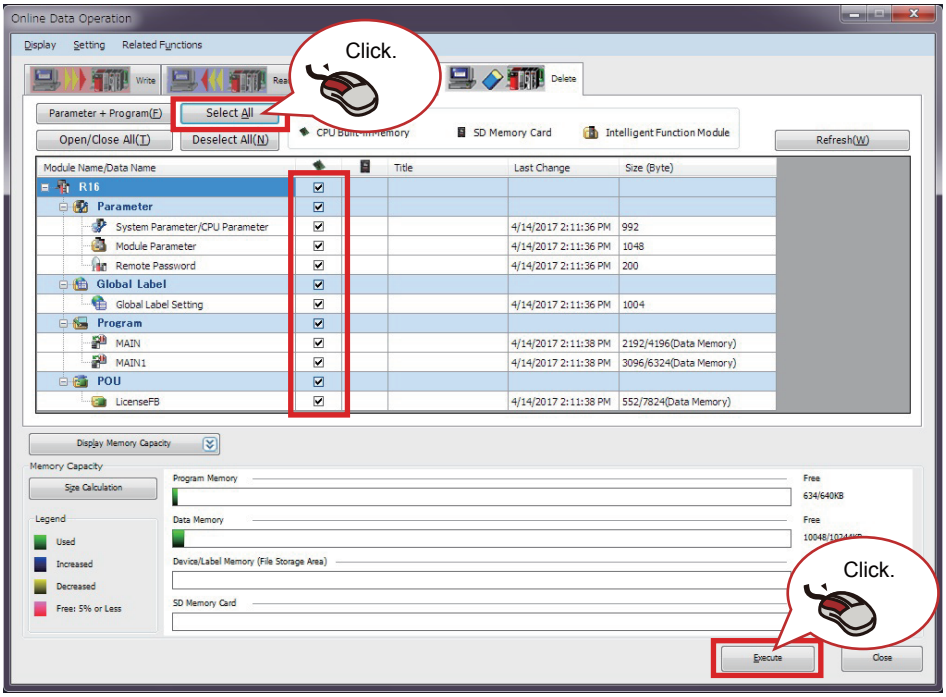


5. Deleting the license key registration program

After the license key registration has been completed, delete the program in the PLC CPU module.

Select "Online" → "Delete PLC Data" from the menu and select the [Select All] button in the "Online Data Operation" window to delete the program.

The license key registration project is not used after the registration. Save it as necessary and end it.



Troubleshooting

The following table lists errors that occur during the license key registration and corrective actions.

Error details	Cause	Corrective action
After "HDL_LicenseWrite" has been executed, Error completion (o_bError) turns on and Normal completion (o_bOK) remains off.	• The license key registration area has never been formatted. • The license key outside the range of the memory was trying to be written.	Format the license key registration area using "FormatLicense" and register the license key using "HDL_LicenseWrite". Using "FormatLicense" deletes other registered license keys. Register them again.
After "HDL_LicenseWrite" is executed, neither of Normal completion (o_bOK) and Error completion (o_bError) turns on.	• The PLC CPU module is not in the RUN state. • "Macro type" is not specified for "FB type" of the license key registration FB.	• Set the PLC CPU module to the RUN state. • Specify "Macro type" for "FB type" of the license key registration FB.

Precautions

- The license key is held after the power-off since it is written to the device data storage file.
- If the data memory has been reset by operating the CPU memory of GX Works3, registration information of all registered license keys will be lost.
- If the license key registration area of the device data storage file has been operated with the SLMP or FTP server function, the license information may be lost.
- For the license key registration FB, set "FB type" to "Macro type".

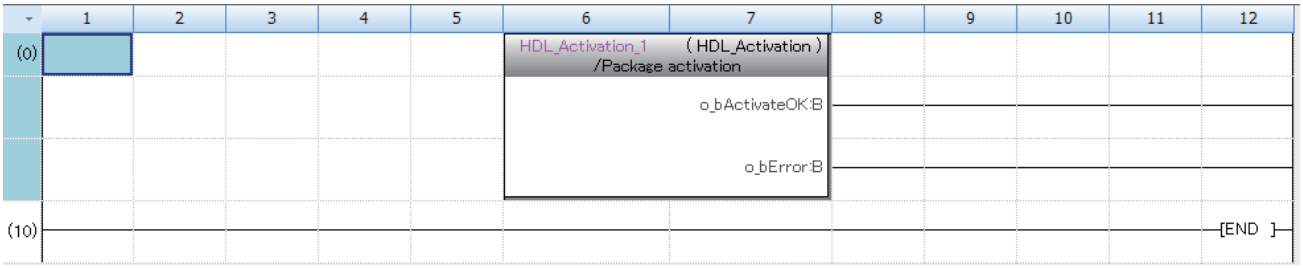
2.2 Certifying the License Key

To use the add-on library supplied with this application package, certify the registered license key.
For the license certification, arrange the function block in the scan program of the user program.

Item	Description
License certification FB (HDL_Activation)	This FB certifies the license. It is provided with the application library HDL_Control_R_****.mslm. Set "FB type" to "Macro type" before using this function block.

Arrangement of the license certification FB (HDL_Activation) in the user program

Before moving the machine configuration axes in the user program, execute the license certification FB (HDL_Activation). The license certification FB cannot be executed normally in programs other than the scan program. The license certification FB (HDL_Activation) is executed by arranging it only.
For details on the method of registering the library with the license certification FB, refer to the following.
☞ Page 32 Registering and Installing a Library



Precautions

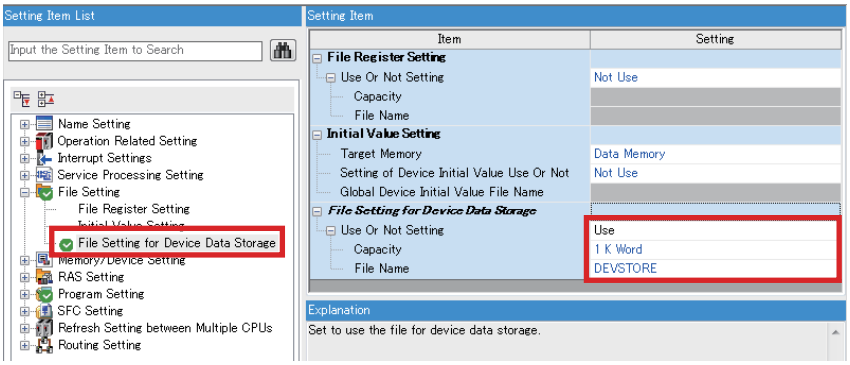
When a machine library is used in a motion CPU module without license has not been certified, a minor error 1FE1H (details code: 0D01H) occurs in the motion CPU module when the machine is operated.

CPU parameter setting of the user program

Select "Parameter" → CPU module → "CPU Parameter" in the Navigation window to open the setting item window.
Select "File Setting" — "File Setting for Device Data Storage" in the CPU parameter window.
Set "Use Or Not Setting" to "Use".

Precautions

- This package uses addresses 0 to 1023 (1K word) of the data storage file (DEVSTORE.QST). When using the device data storage file, set the file to 2K words or more and use the address 1024 or later.
- If data is accidentally written to the addresses 0 to 1023 of the data storage file, license information may be lost. In this case, register the license again.
- In the program examples included in this package, "Access from External Device" is enabled for the global label. To disable "Access from External Device" after writing a program example to the CPU module, reset the memory. When the memory is reset, registration information of all registered license keys will be lost. Register the license keys again.



Operation check of user program certification

Write the user program to the PLC CPU module and check the operation of the license certification FB (HDL_Activation).
When the license key is normally certified, Normal completion (o_bActivateOK) becomes TRUE.
When Error completion (o_bError) turns on, check "Troubleshooting".
After checking the normal operation, attach the "iQ Monozukuri seal" on the CPU module. (☞ REQUESTING AND REGISTERING A LICENSE KEY)

Troubleshooting

The following table lists errors that occur during the license certification and corrective actions.

Error details	Cause	Corrective action
"o_bActivateOK" of "HDL_Activation" is not TRUE but "o_bError" is TRUE.	The license key of the corresponding application package is not registered.	Register the license key. (☞ Page 24 Registering a License Key)
	The expiration date of the temporary license (two months) passed.	Get and register the license key. (☞ Page 24 Registering a License Key)
The CPU module outputs the error code (2840H) and stops.	"Not Use" is set to "File Setting for Device Data Storage".	Set "File Setting for Device Data Storage" to "Use" in the CPU parameter and write the CPU parameter. (☞ Page 29 Certifying the License Key)
The CPU module outputs the error code (3100H) and stops.	The firmware version of the PLC CPU module is not "25" or later.	Update the firmware version of the PLC CPU module to "25" or later.
The PLC CPU module outputs the error code (32FFH) and stops.	An incorrect license key is registered. 1) The product ID, PLC CPU module model, or manufacturing information at the request is incorrect. 2) The license key is trying to be certified with a PLC CPU module that is not requested.	1) Delete the registered license key using "FormatLicense" and register the correct license key. 2) Delete the registered license key from the PLC CPU module where data is accidentally written by using "FormatLicense" and register the license key in the requested PLC CPU module. Using "FormatLicense" deletes other registered license keys. Register them again.

Replacing method of the module

■ When replacing the PLC CPU module

To replace the CPU module, a new license key is required.

For the new license key, please contact your local Mitsubishi Electric representative.

■ When replacing a module other than the PLC CPU module (such as a Simple Motion module)

No specific operation is required. Refer to the manual of the module to replace the module.

2.3 Registering and Installing a Library

Registering an application library

The license certification FB is provided in the application library of HDL_Control_R_****.mslm.

For details on the method of registering an application library with the extension "mslm" in GX Works3, refer to the following.

GX Works3 Operating Manual

Installing an add-on library

A machine library is provided in the format of an add-on library with the extension "adm".

For details on installing an add-on library, refer to the following.

MELSEC iQ-R Motion Controller Programming Manual (Common)

2.4 Machine Control Simulator and Machine Attitude Monitor

How to install the machine control simulator and machine attitude monitor

■Check the following items before installation.

- Log on to the personal computer as a user with the Administrator authority (manager authority).
- For installation, use a computer where MELSOFT MT Works2 with the version 1.140W or later is installed. (Install MELSOFT MT Works2 of version 1.150G or later when using WAIT-ON/OFF or point arrival notification.)
- Before installation, close all the applications operated on Microsoft® Windows® Operating System. When the machine control simulator and machine attitude monitor are installed while other applications are operated, the product may not operate normally.

1. Execute "Package root\MTW2_ext\Setup.exe" of the supplied DVD.
2. Select the required items by following the instructions on the window.

How to uninstall the machine control simulator and machine attitude monitor

Uninstall "MT Developer2 MT Developer2 Extension Function (iQ Monozukuri HANDLING)" from the Control Panel of Windows®. When "MT Developer2" is uninstalled, "MT Developer2 Extension Function (iQ Monozukuri HANDLING)" is uninstalled as well.

How to use the machine control simulator and machine attitude monitor

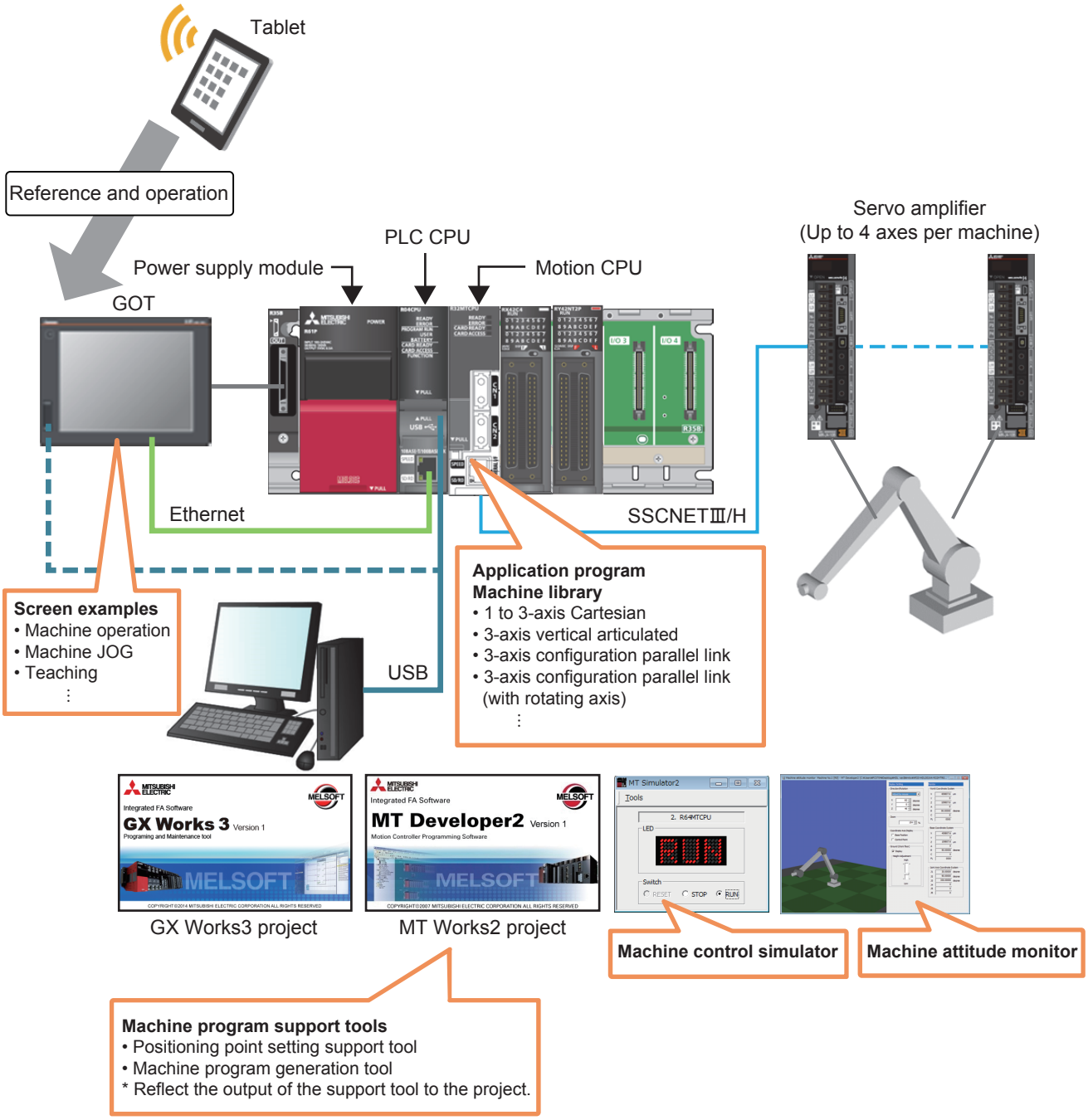
The machine control simulator enables simulation based on machine libraries by starting simulation using MT Developer2 on the personal computer where "MT Developer2 Extension Function (iQ Monozukuri HANDLING)" is installed. If it is not installed, a moderate error 30FAH (machine configuration error) with details code 0102H (machine type setting error) occurs when simulation is started. License key certification is not required for the simulation only.

The machine attitude monitor can be started from the machine monitor in MT Developer2 on the personal computer where "MT Developer2 Extension Function (iQ Monozukuri HANDLING)" is installed. For details, refer to the help of MT Developer2.

3 SYSTEM CONSTRUCTION

3.1 System Configuration Example

The following figure shows the system configuration example of this application.



MEMO

4 PROGRAM EXAMPLES FOR MACHINE CONTROL

Program examples are provided as one of the components of this package with the purpose of simple startup of machine control.
These program examples can be used with the screen examples in the package.
Since they are used to operate the simplified robot in accordance with the machine library, customize them (by utilizing the program) according to the customer's usage environment.
The following describes a program example for performing operations from the startup of use axis to machine positioning control in each machine library.
The project for the machine type R8 supports the program example for Vision Tracking. The following describes the overview of Vision Tracking and differences from projects for other machine types (R1 to R7) including individual setting and processing of the program example for Vision Tracking.

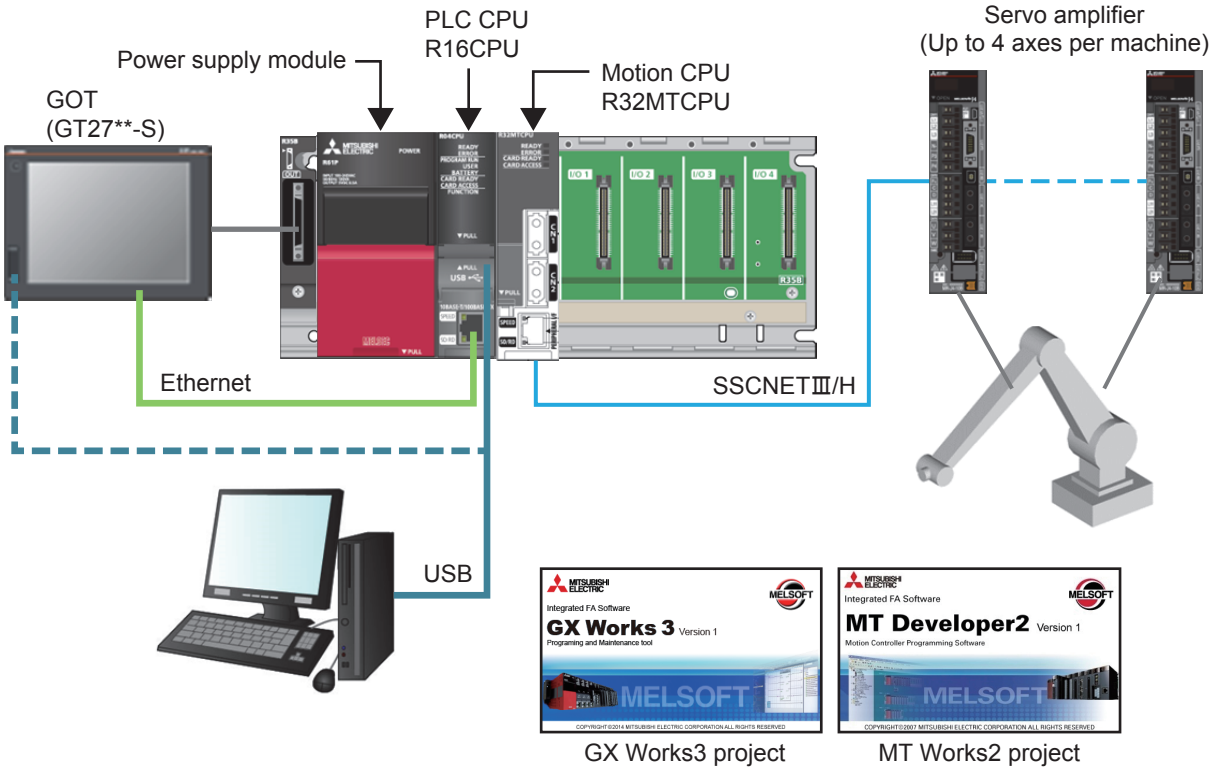
Precautions

To utilize this program for an actual system, sufficiently confirm that the program will not cause system control problems on user's own responsibility. Examine the positions where interlock conditions are required in a target system and add them.

4.1 System Configuration

Basic configuration

The following shows the system configuration required for machine control startup of this program example.

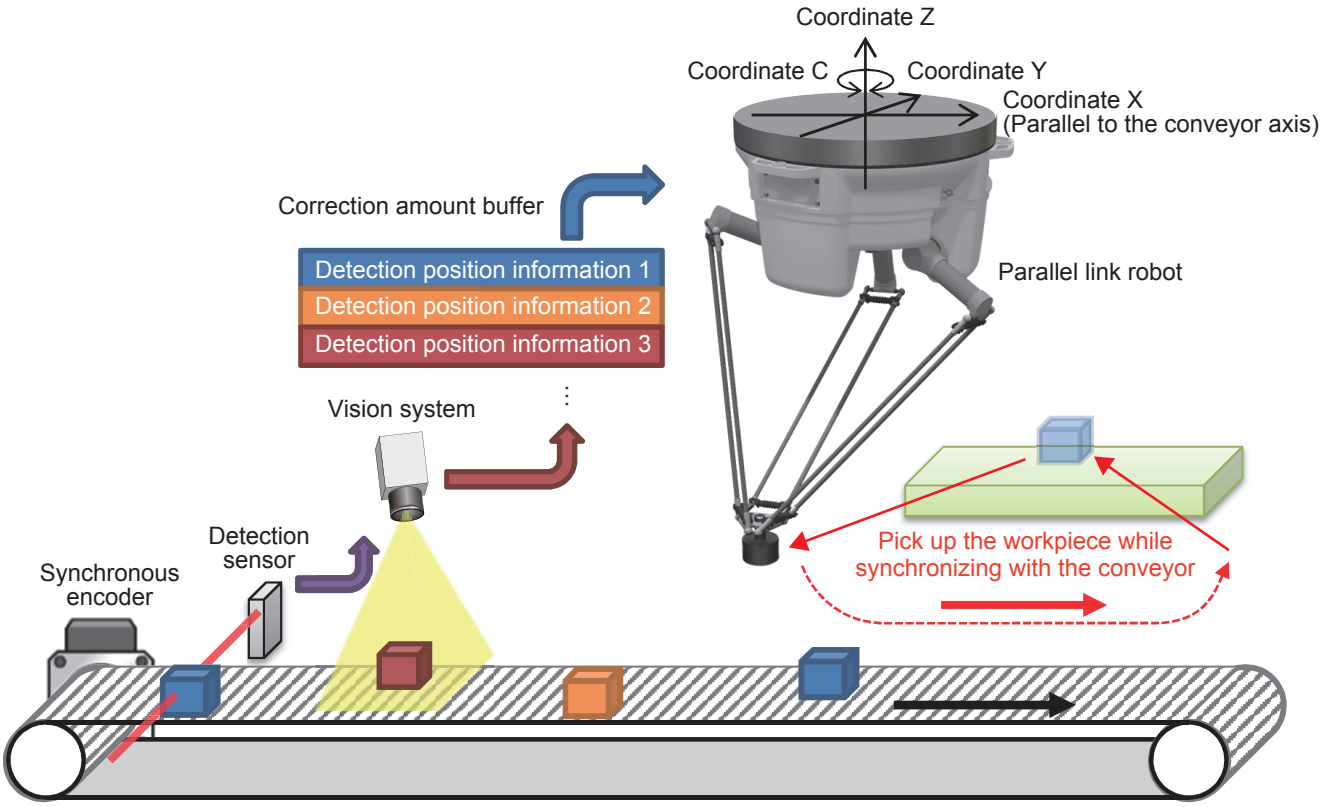


GX Works3 project　　MT Works2 project

Configuration for Vision Tracking

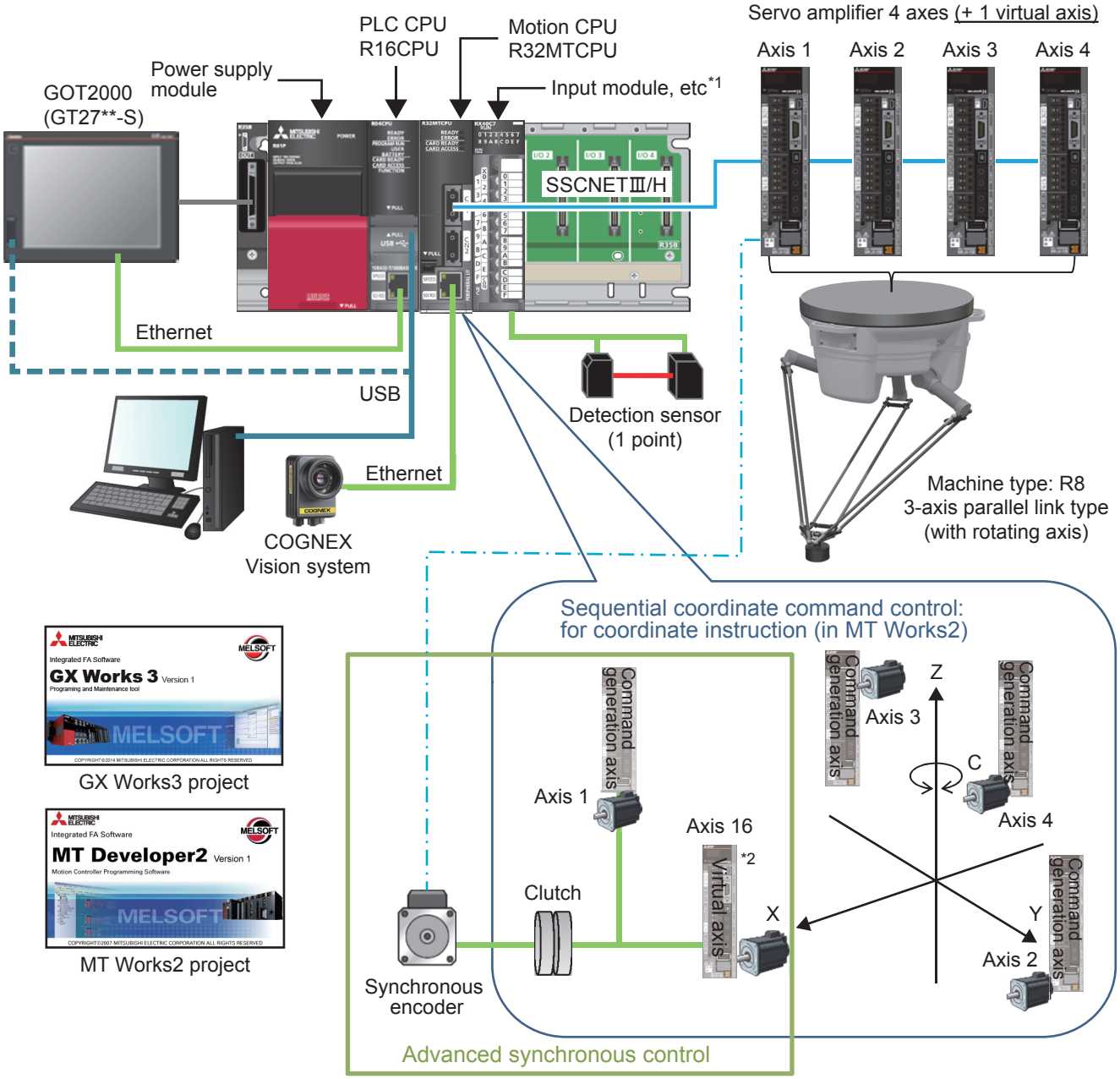
■System overview

Vision Tracking is the motion consists of the robot mechanism and vision sensor to check the position of a workpiece on the conveyor and acquire it at the speed synchronized with the conveyor. Since the robot moves to the acquisition position in consideration of the correction amount acquired from the vision sensor, it can transport workpieces in array without stopping the conveyor.



■System configuration

The project for R8 supports the Vision Tracking program example. The system configuration of the project for R8 is as follows.
A synchronous encoder, virtual axis, and command generation axis are added to the basic configuration.
The synchronous encoder is set to be connected to axis 1 via the amplifier. Since the virtual axis and command generation axis are virtual servo amplifier/motor operated in the Motion CPU, actual machine and wiring are unnecessary.



*1 This module has not been set in the project. Set the module depending on the user system.
*2 Although the actual servo amplifier and servo motor are unnecessary, axis assignment is required.

As described in the system overview, this program is based on the assumption that the transfer direction of the workpiece transfer conveyor is parallel to the X-coordinate system. Therefore, set the X-coordinate command axis used for sequential coordinate command control as the virtual axis, and perform the control by adding the moved amount of the conveyor to the moved amount of the command generation axis.
If the conveyor transfer direction is parallel to another coordinate system, perform the base transformation in the machine parameter or change the synchronous control setting of the corresponding coordinate system command axis with reference to the figure above. For details of this control, refer to the following.

☞ Page 48 Program Processing

4.2 Project Configuration

Language

The following languages are used in this program.

- Program comment: English (Only the outline is described in Japanese as well.)
- Label comment: Japanese, English, Chinese (Simplified)

List of projects

■GX Works3 project

The following project can be used in common in the machine libraries. The language is "Ladder".

Project name*1	Description
AP20-HDL001AA-R16_****.gx3	Common to all machine libraries

1 "" indicates their versions.

■MT Works2 project

Select a project depending on the machine library to be used.

All devices are arranged in the "R standard arrangement method".

Project name*1	Description
AP20-HDL001AA-R32MTR001_****.mtw	For R1
AP20-HDL001AA-R32MTR002_****.mtw	For R2
AP20-HDL001AA-R32MTR003_****.mtw	For R3
AP20-HDL001AA-R32MTR004_****.mtw	For R4
AP20-HDL001AA-R32MTR005_****.mtw	For R5
AP20-HDL001AA-R32MTR006_****.mtw	For R6
AP20-HDL001AA-R32MTR007_****.mtw	For R7
AP20-HDL001AA-R32MTR008_****.mtw	For R8

1 "" indicates their versions.

■GT Works3 project

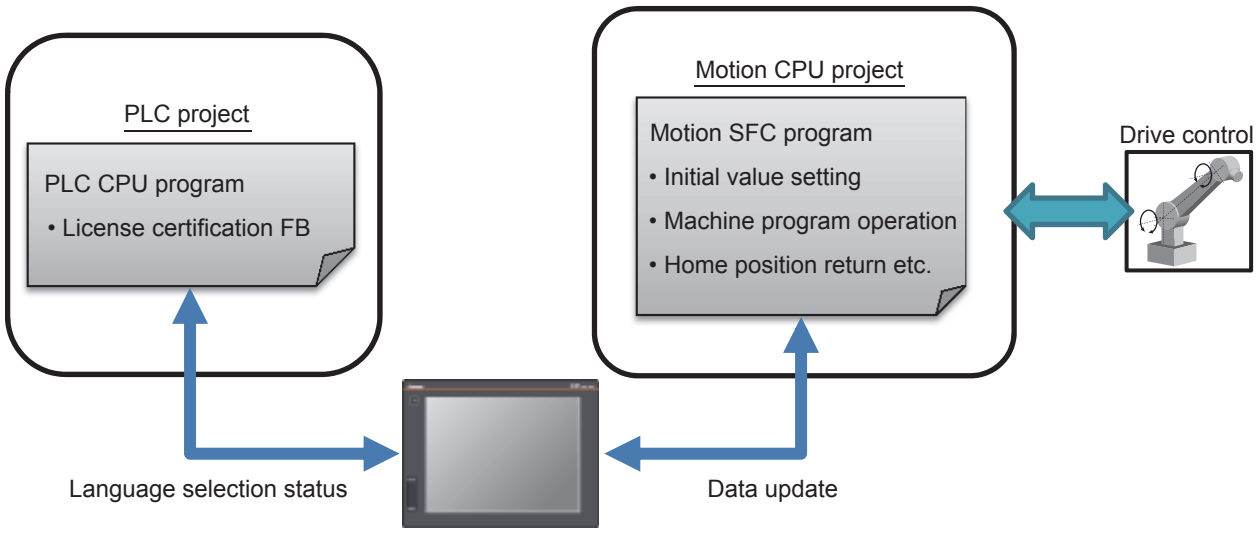
Project name*1	Description
AP20-HDL001AA-GT27nnS_****.GTX	Common to all machine libraries

1 "" indicates their versions.

For details on the GT Works3 project, refer to the following.

☞ Page 84 SCREENS FOR MACHINE CONTROL PROGRAM EXAMPLES

Operation overview



4.3 Common Parameters of R Series in GX Works3 Project

System parameter

■I/O assignment setting

Item	Setting
Base	R35B
Power supply module	R61P
CPU slot	PLC CPU: R16CPU
Slot 0	Motion CPU: R32MTCPU

PLC CPU parameter

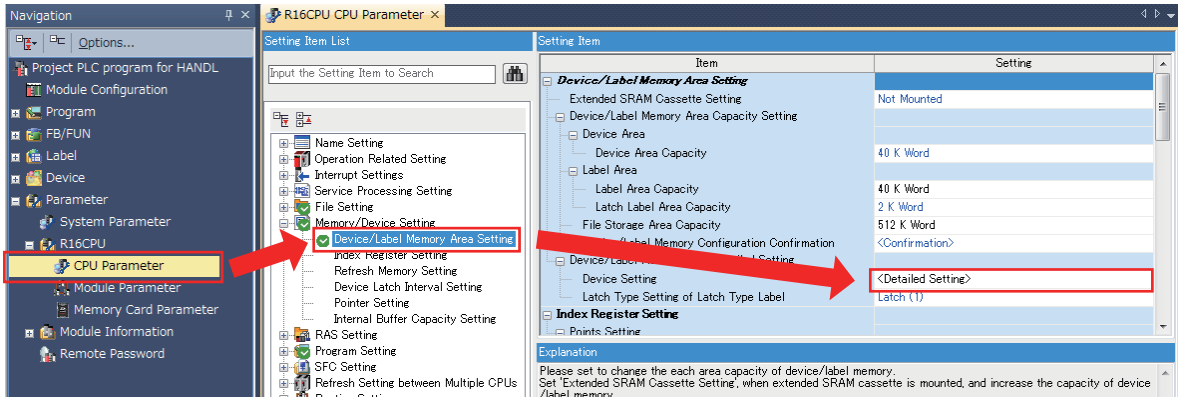
■CPU parameter

To retain the language selection setting in this system, set D100 (label name: wHMI_Language) in the latch setting.

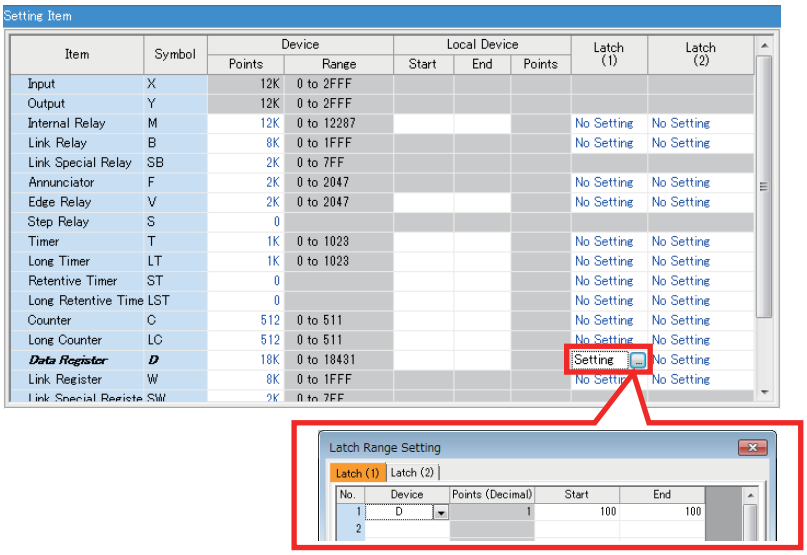
When changing the label assignment in the user system, change the latch setting.

How to change the latch setting

1. CPU Parameter → Device/Label Memory Area Setting → Device/Label Memory Area Detailed Setting → Device Setting → <Detailed Setting>



2. Set D100 in the latch (1) setting window of data register D.



Program

The FB for license certification is arranged. For the details, refer to the following.

☞ REQUESTING AND REGISTERING A LICENSE KEY

4.4 Common Parameters of R Series in MT Works2 Project

CPU parameter

■Device-related settings

To retain the taught point block data and machine program operation settings in this system, set the following devices in the latch settings.

When changing the label assignment in the user system, change the latch setting.

Device	No. of points	Use
#6000 to #6279	280	Point block data (20 points of coordinate values and postures)
#1100 to #1339	240	Point data (Control method, command speed, torque limit value, proximity pass valid setting, proximity range, M-code, dwell time, point block No., auxiliary point/central point block No.)
# 517	1	Number of positioning points
# 518	1	Selected point data No.
M100 to M112	13	Previous point speed inheritance valid flag
M120 to M132	13	Torque limit value during operation valid flag
# 12095	1	bit0: Vision Tracking initial startup processing flag
#12060 to #12065	6	Vision Tracking screen Position information setting
#12070 to #12079	10	Vision Tracking screen Operation setting

Motion CPU common parameter

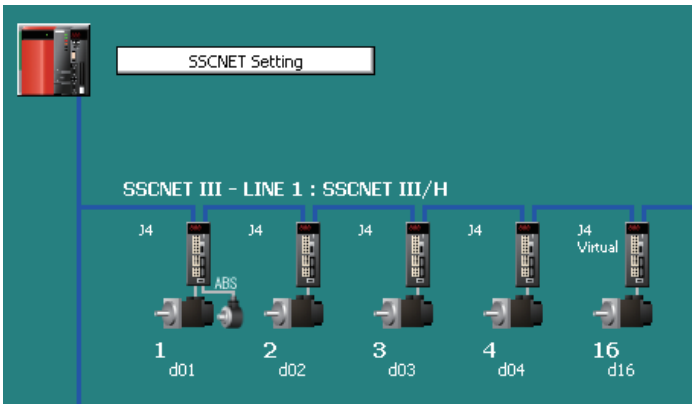
■Basic setting

- The operation cycle setting is set to "default setting". In the project for the machine type R8, the operation cycle is set to "0.888ms" in consideration of the number of axes used in the program example of Vision Tracking.
- To perform the machine control, "Used" is set in the machine control setting.

■Servo network setting

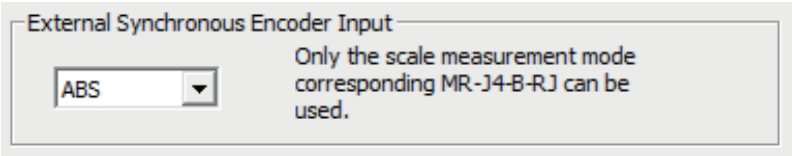
The number of axes used in each machine type is set in the left-justified format from axis 1 (station No. d01).

The example shown in the figure below is for the machine type R8. The virtual axis used in Vision Tracking is set to axis No. 16 (station No. d16) in the right-justified format.



File name	Machine type	Axis No. (station No.)				
		Axis 1 (d01)	Axis 2 (d02)	Axis 3 (d03)	Axis 4 (d04)	Axis 16 (d16)
AP20-HDL001AA-R32MTR001_****.mtw	R1	Implemented	—	—	—	—
AP20-HDL001AA-R32MTR002_****.mtw	R2	Implemented	Implemented	—	—	—
AP20-HDL001AA-R32MTR003_****.mtw	R3	Implemented	Implemented	Implemented	—	—
AP20-HDL001AA-R32MTR004_****.mtw	R4	Implemented	Implemented	—	—	—
AP20-HDL001AA-R32MTR005_****.mtw	R5	Implemented	Implemented	Implemented	—	—
AP20-HDL001AA-R32MTR006_****.mtw	R6	Implemented	Implemented	—	—	—
AP20-HDL001AA-R32MTR007_****.mtw	R7	Implemented	Implemented	Implemented	—	—
AP20-HDL001AA-R32MTR008_****.mtw	R8	Implemented*1	Implemented	Implemented	Implemented	Virtual axis

*1 The external synchronous encoder for conveyor used in Vision Tracking is set as follows via the amplifier. Review the settings depending on the usage environment.



■High-speed input request signal

The sensor for mark detection is set.

* This setting is used for the program example of Vision Tracking.

Item	Setting 1
Signal type	1: Bit device
Device	X50
Input module	—
Axis No.	—
Input signal	—
High-speed input request signal detection direction	0: Leading edge
High-speed input request signal accuracy	0: General
High-speed input request signal compensation time	0 [μs]
High-speed input request signal valid flag	M6
High-speed input request signal status	(Omitted)
High-speed input request signal control cycle setting	0: Operation cycle

■Mark detection

The mark detection is set to latch the data when a workpiece is detected.

* This setting is used for the program example of Vision Tracking.

Item	Setting 1
High-speed input request signal	1
Mark detection process compensation time	K0 [μs]
Mark detection data	1: Motion control data
Axis No.	Axis 1
Set data	18: Synchronous encoder axis current value
Device	—
Data type	—
Estimate calculation	—
Ring counter value	—
Mark detection data storage device	#12004L
Mark detection data range (upper value)	K0.0000 [mm]
Mark detection data range (lower value)	K0.0000 [mm]
Mark detection mode setting	3: Ring buffer mode
Number of detections	K8
Device	—
Mark detection counter	#12000
Mark detection current value monitor device	#12002L

■Vision system parameter

The vision system parameter is set to acquire the compensation amount of the workpiece.

* This setting is used for the program example of Vision Tracking.

The setting is necessary for connecting the In-Sight® vision system manufactured by Cognex Corporation via the Motion CPU. Review the setting according to the vision system and connected CPU.

[Ethernet communication line setting]

Item	Setting 1
Vision system No.	1
IP address	10.0.50.100
For Telnet communication	23
For TCP/IP communication	3000
User name	admin
Password	(Omitted)
Status storage device	dVS_StatusStorage_Setting
Error flag	bVS_ErrorDetection

[Vision program operation setting]

Item	Setting 1
Program No.	1
Vision system No.	1
Vision program name	Worksearch1
Status storage device	wVS_ProgramStatusStorage
Read value cell	(Not necessary to set)
Read value storage device	(Not necessary to set)
Image data storage device	stVS_ImageDataStrage.leCoordinateX

Motion control parameter

■Axis setting parameter

The parameters shown within the red box are changed from the default setting in accordance with the machine type and the actual machine to be connected.

The example shown in the figure below is for machine type R8. Change the upper/lower stroke limit in accordance with the actual machine.

Item	Axis1	Axis2	Axis3	Axis4	Axis16
	MR-J4(W)-B (-RJ)	MR-J4(W)-B (-RJ)	MR-J4(W)-B (-RJ)	MR-J4(W)-B (-RJ)	MR-J4-B Virtual
Fixed Parameter	Set the fixed parameters for each axis and their data is fixed based on the mechanical system, etc.				
Unit Setting	2:degree	2:degree	2:degree	2:degree	0:mm
Number of Pulses/Rev.	20000[pulse]	20000[pulse]	20000[pulse]	20000[pulse]	20000[pulse]
Movement Amount/Rev.	0.20000[degree]	0.20000[degree]	0.20000[degree]	0.20000[degree]	2000.0[µm]
Backlash Compensation	0.00000[degree]	0.00000[degree]	0.00000[degree]	0.00000[degree]	0.0[µm]
Upper Stroke Limit	90.00000[degree]	90.00000[degree]	90.00000[degree]	350.00000[degree]	0.0[µm]
Lower Stroke Limit	270.00000[degree]	270.00000[degree]	270.00000[degree]	10.00000[degree]	0.0[µm]
Command In-position	0.00100[degree]	0.00100[degree]	0.00100[degree]	0.00100[degree]	10.0[µm]
Sp. Ctrl. 10x Mult. for Deg.	0:Invalid	0:Invalid	0:Invalid	0:Invalid	-

AP20-HDL001AA-R32MTR001_****.mtw

Item	Axis 1	Axis 2	Axis 3	Axis 4
Unit setting	0: mm	—	—	—
Upper stroke limit	100000000.0[µm]	—	—	—
Lower stroke limit	-100000000.0[µm]	—	—	—

AP20-HDL001AA-R32MTR002_****.mtw

Item	Axis 1	Axis 2	Axis 3	Axis 4
Unit setting	0: mm	0: mm	—	—
Upper stroke limit	100000000.0[µm]	100000000.0[µm]	—	—
Lower stroke limit	-100000000.0[µm]	-100000000.0[µm]	—	—

AP20-HDL001AA-R32MTR003_****.mtw

Item	Axis 1	Axis 2	Axis 3	Axis 4
Unit setting	0: mm	0: mm	0: mm	—
Upper stroke limit	100000000.0[µm]	100000000.0[µm]	100000000.0[µm]	—
Lower stroke limit	-100000000.0[µm]	-100000000.0[µm]	-100000000.0[µm]	—

AP20-HDL001AA-R32MTR004_****.mtw

Item	Axis 1	Axis 2	Axis 3	Axis 4
Unit setting	2: degree	2: degree	—	—
Upper stroke limit	90.00000[degree]	90.00000[degree]	—	—
Lower stroke limit	270.00000[degree]	270.00000[degree]	—	—

AP20-HDL001AA-R32MTR005_****.mtw

Item	Axis 1	Axis 2	Axis 3	Axis 4
Unit setting	2: degree	2: degree	2: degree	—
Upper stroke limit	90.00000[degree]	90.00000[degree]	90.00000[degree]	—
Lower stroke limit	270.00000[degree]	270.00000[degree]	270.00000[degree]	—

AP20-HDL001AA-R32MTR006_****.mtw

Item	Axis 1	Axis 2	Axis 3	Axis 4
Unit setting	2: degree	2: degree	—	—
Upper stroke limit	90.00000[degree]	90.00000[degree]	—	—
Lower stroke limit	270.00000[degree]	300.00000[degree]	—	—

AP20-HDL001AA-R32MTR007_****.mtw

Item	Axis 1	Axis 2	Axis 3	Axis 4
Unit setting	2: degree	2: degree	2: degree	—
Upper stroke limit	90.00000[degree]	90.00000[degree]	90.00000[degree]	—
Lower stroke limit	270.00000[degree]	270.00000[degree]	270.00000[degree]	—

AP20-HDL001AA-R32MTR008_****.mtw

Item	Axis 1	Axis 2	Axis 3	Axis 4
Unit setting	2: degree	2: degree	2: degree	2: degree
Upper stroke limit	90.00000[degree]	90.00000[degree]	90.00000[degree]	350.00000[degree]
Lower stroke limit	270.00000[degree]	270.00000[degree]	270.00000[degree]	10.00000[degree]

Item	Axis 16 (virtual)
Unit setting	0: mm
Upper stroke limit	0.0[μm]
Lower stroke limit	0.0[μm]

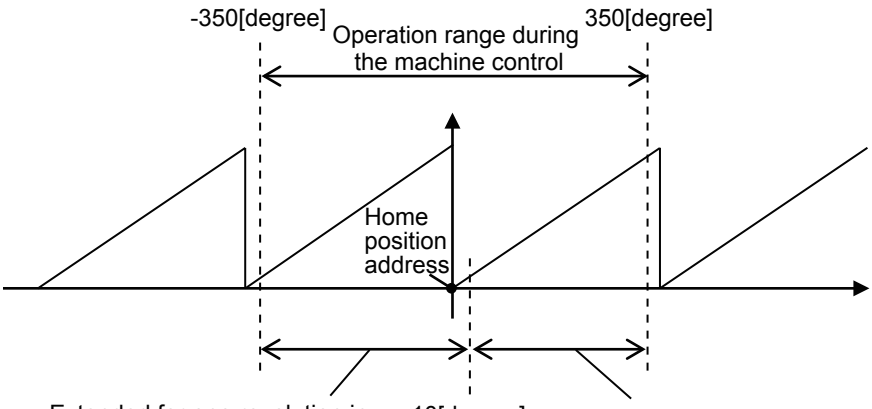
Precautions

Axis 4 used in the project for machine type R8 is set as shown below.

- Stroke limit range: 10.00000 to 350.00000 [degree]
- Home position return address: 0.00000 [degree]

The operation range of axis 4 during machine operation is as shown below (-350 to 350 [degree]).

*Note that the operation range is extended for one revolution in the reverse direction by the machine parameter.



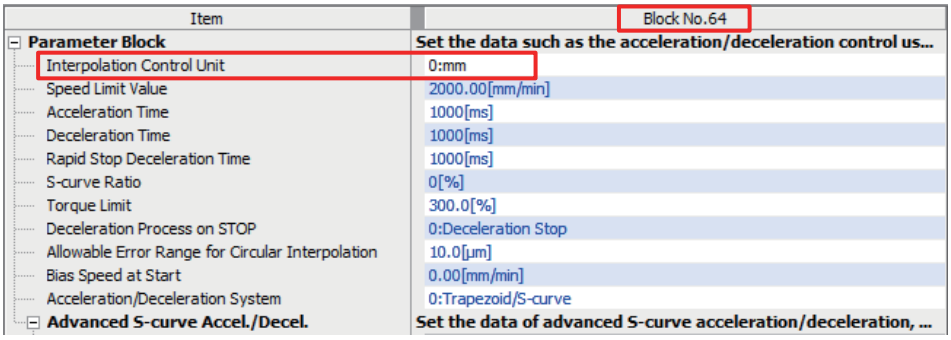
Except in the machine operation, the operation range is according to the axis setting parameter (10 to 350 [degree]).

Except in the machine operation, control the axis after moving it within the software stroke limit range by JOG operation or other operations.

■Parameter block

In this program example, the machine uses the parameter block No. 64.

In the machine types R1 to R8, the interpolation control unit is "0: mm". The values other than those within the red box are the default setting.



Item	Block No.64
Parameter Block	Set the data such as the acceleration/deceleration control us...
Interpolation Control Unit	0:mm
Speed Limit Value	2000.00[mm/min]
Acceleration Time	1000[ms]
Deceleration Time	1000[ms]
Rapid Stop Deceleration Time	1000[ms]
S-curve Ratio	0[%]
Torque Limit	300.0[%]
Deceleration Process on STOP	0:Deceleration Stop
Allowable Error Range for Circular Interpolation	10.0[μm]
Bias Speed at Start	0.00[mm/min]
Acceleration/Deceleration System	0:Trapezoid/S-curve
Advanced S-curve Accel./Decel.	Set the data of advanced S-curve acceleration/deceleration, ...

■Synchronous control parameter

* This setting is used for the program example of Vision Tracking.

[Input axis parameter]

• Command generation axis

The setting of the command generation axis is used for the coordinate instruction in the sequential coordinate command control. Settings other than below are changed from the initial values.

Item	Axis 1	Axis 2	Axis 3	Axis 4
Valid setting	1: Valid			
Unit setting	0: mm			2: degree
JOG operation parameter block setting	64			

• Synchronous encoder axis

The synchronous encoder setting is used for synchronization with the conveyor. Settings other than below are changed from the initial values.

Item	Axis 1
Type	101: Via servo amplifier
Connected axis No.	1
Position unit	0: mm
Number of decimal places for position	4
Speed unit	1: min
Number of decimal places for speed	2

[Output axis parameter]

The output axis setting is used for the coordinate instruction of the sequential coordinate command control (addition of the correction amount and conveyor moved amount). Settings other than below are changed from the initial values.

• Synchronous control module setting

Item	Axis 16
Main input axis type	201: Command generation axis
Main input axis No.	1
Auxiliary axis type	801: Synchronous encoder axis
Auxiliary axis No.	1
Composite auxiliary axis gear	1: Input+
Auxiliary axis clutch control setting ON control mode	4: Address mode
Auxiliary axis clutch control setting OFF control mode	2: Clutch command leading edge
Output axis synchronous control parameter block No.	64

• Synchronous control initial position parameter

Item	Axis 16
Cam axis position restoration object	1: Cam reference position restoration
Setting method of cam axis current value per cycle	1: Initial setting value of cam axis current value per cycle
Cam axis current value per cycle (Initial setting)	0.0 μm

Precautions

This program is based on the assumption that the conveyor is moving in the X-coordinate increasing direction. Change the "Composite auxiliary axis gear" to match the conveyor moving direction (increasing direction of the synchronous encoder) and X-coordinate increasing direction during the machine control.

■Machine control parameter

[Machine common parameter]

The machine common parameters used for machine positioning control are set as follows.

- Setting No. 1 is the point block data (12 points) used in continuous operation during the machine operation.
- Setting No. 2 is a point block for 1-point positioning and temporarily storing the teaching data.
- Setting No. 3 is the point block used in the Vision Tracking.

Change the point block setting and device setting as necessary.

When the setting No. 1 or 3 is changed, change the latch setting. (Otherwise the teaching data can no longer be retained after reset.)

Setting No.	Point block setting				Device setting	
	Start	End	Number of point blocks	Required device point number (word number)	Start	End
1	P1	P20	20	280	#6000	#6279
2	P8192	P8192	1	14	#8000	#8013
3	P8191	P8191	1	14	#8014	#8027

[Machine parameter]

In this program example (.mtw), one program is provided for each machine type.

Change the machine axes and add machines as necessary. The setting values in each project are shown below.

Machine parameters not described in this section are 0 (default value). Change the machine parameters in accordance with the actual machine.

Machine type	Joint axis				Arm length [mm]				Option setting				Machine speed setting
	JNT1	JNT2	JNT3	JNT4	L1	L2	L3	L4	A1	A2	A3	A4	Parameter block specification
R1	Axis 1	—	—	—	—	—	—	—	—	—	—	—	64
R2	Axis 1	Axis 2	—	—	—	—	—	—	—	—	—	—	64
R3	Axis 1	Axis 2	Axis 3	—	—	—	—	—	—	—	—	—	64
R4	Axis 1	Axis 2	—	—	300	—	—	—	—	—	—	—	64
R5	Axis 1	Axis 2	Axis 3	—	300	300	—	—	—	—	—	—	64
R6	Axis 1	Axis 2	—	—	300	300	—	—	—	—	—	—	64
R7	Axis 1	Axis 2	Axis 3	—	150	400	100	40	—	—	—	—	64
R8	Axis 1	Axis 2	Axis 3	Axis 4	150	400	100	40	—	—	—	H1	64

Precautions

- For the tool transformation coordinate Z of machine type R4, the setting range is 0.1 to 99999999.9 [μm]. Since the default value is outside the range, it is set as 10000.0 [μm] in this program example.
- Option settings A3 and A4 for the machine type R8 are C axis stroke extension setting. For details of the setting, refer to the following.

Machine Library (Machine Type R8) User's Manual

4.5 Program Processing

The following table lists the motion SFC programs.

No.	Program name	Description	Task	Automatic start
1	Initialize	Initial parameter setting	Normal	Yes
2	MachineSTRT1P	1 Point machine program operation	Normal	Yes
3	MachineSTRTnP	Continuous operation	Normal	Yes
4	Teaching	Teaching	Normal	Yes
5	MachineHPR	Machine home position return	Normal	Yes
6	AxisHPR	Single axis home position return	Normal	Yes
7	DeviceOffset	Offset device amount calculation	Normal	Yes
8	AmplifierLess	Amplifier-less operation	Normal	No
20	VT_Main	Vision Tracking: Main processing	Normal	Yes
21	VT_VisionSensor	Vision Tracking: Sensor processing	Normal	No
22	VT_Machine	Vision Tracking: Machine control	Normal	No
23	VT_DataUpdate	Vision Tracking: Command coordinate update processing	Event (Fixed cycle: 0.888 ms)*1	No

*1 It is recommended to set the operation cycle for the fixed cycle setting of the event task. Review the settings depending on the user system.

Precautions

- Vision Tracking is a program example supported by the machine type R8. Therefore, Motion SFC programs from No. 20 to 23 exist only in the project for R8.
- Vision Tracking uses command generation axes. The servo program No. used in the command generation axis program is assigned as follows. (Only in the project for R8.)

[Command generation axis program assignment]: Used
[Command generation axis program]: 2250 to 2299

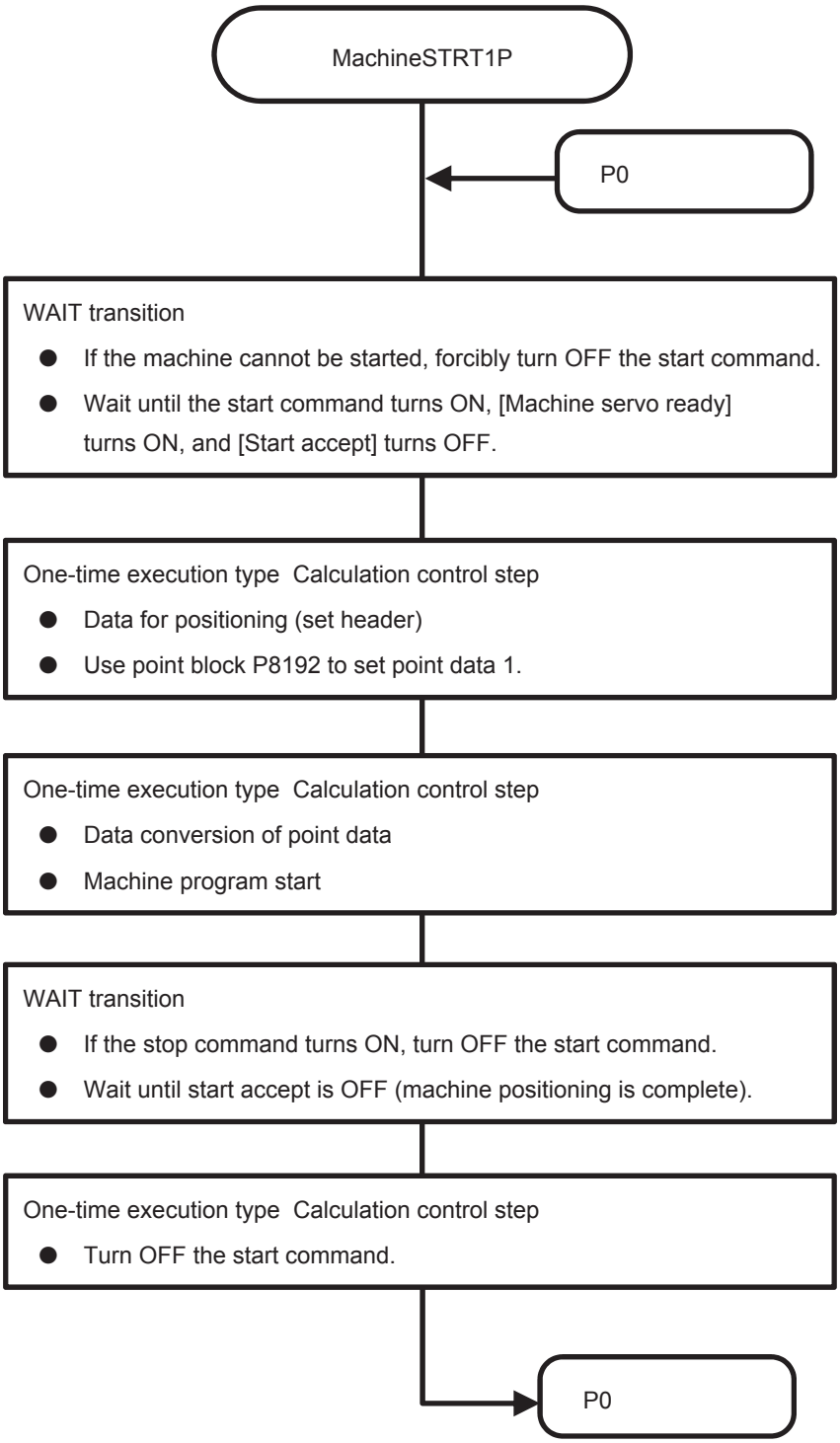
Initialize (Initial parameter setting)

Initial values of each device are set.

Classification	Item	Label name	Setting value	Remarks
Machine	Machine No.	wMachineNo	0	Displayed in increments of 1 on GOT
	1 Point positioning speed	dPointData_CommandSpeed	1	Unit: 0.01 mm/min
	1 Point positioning control method	wPointData_ControlMethod	4096	4096: ABS joint interpolated motion
	JOG speed (mm) of each machine	st8MachineControlDevice[].dMachine JOG_SpeedSetting_mm	1	Unit: 0.01 mm/min Initialization of implementation machine only
	JOG speed (degree) of each machine	st8MachineControlDevice[].dMachine JOG_SpeedSetting_degree	1	Unit: 0.01 degree/min Initialization of implementation machine only
Single axis	Axis No.	wAxisNo	0	Displayed in increments of 1 on GOT
	JOG speed of each axis	d64JOG_SpeedSettingRegister[]	1	Unit: Depends on the setting of the axis unit Initialization of implementation axis only * Not initialized if communication with the servo amplifier is not established during shifting of motion CPU from STOP → RUN.
Positioning	Final positioning point	wNumOfPositioningPoint	1	Initialized only if the value is less than 1. In other cases, latch storage is performed.
	Point block specification during teaching	wTeachingDataNo	0	Displayed in increments of 1 on GOT
	Stop continuous operation command	bMachineStop_Continuous	ON	—
	Each point torque limit value	dTorqueLimitValue[]	-1	-1: Torque limit is not used * Initialized only when torque limit usage bit is OFF
	Operation state	wOperationStatus	0	K0: Initialized while the operation is stopped

MachineSTRT1P

When the [Start] switch is touched on the 1 Point machine program operation window, the 1 Point machine positioning starts.

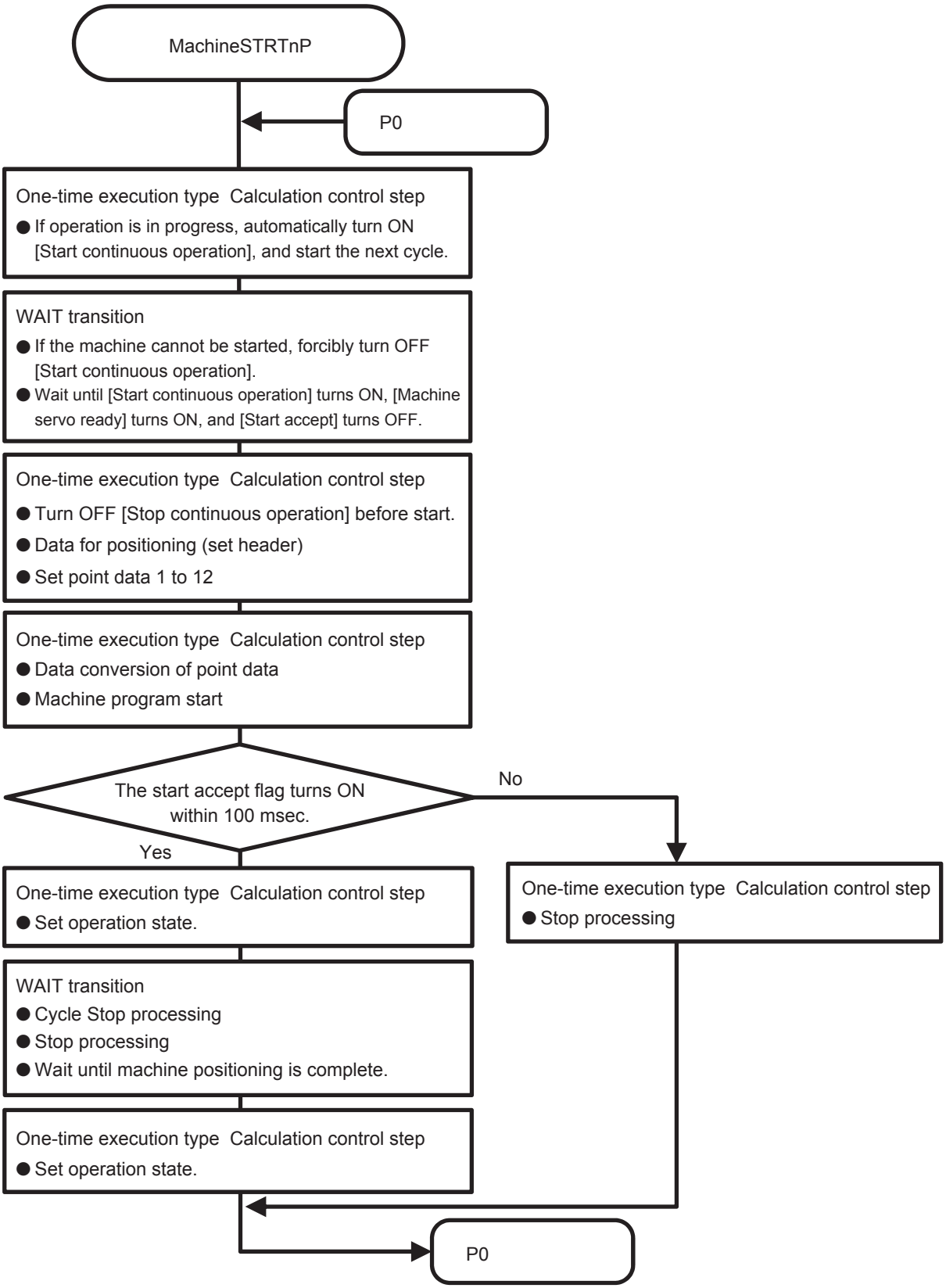


Restriction

- The coordinate system setting of the point block is fixed as world coordinate.
- The positioning data item setting is fixed as parameter block No. 64 of the machine parameter. Set the contents of the parameter block with MT Develper2.

MachineSTRTnP

When the [Start continuous operation] switch is touched on the Machine Operation screen, continuous operation starts.

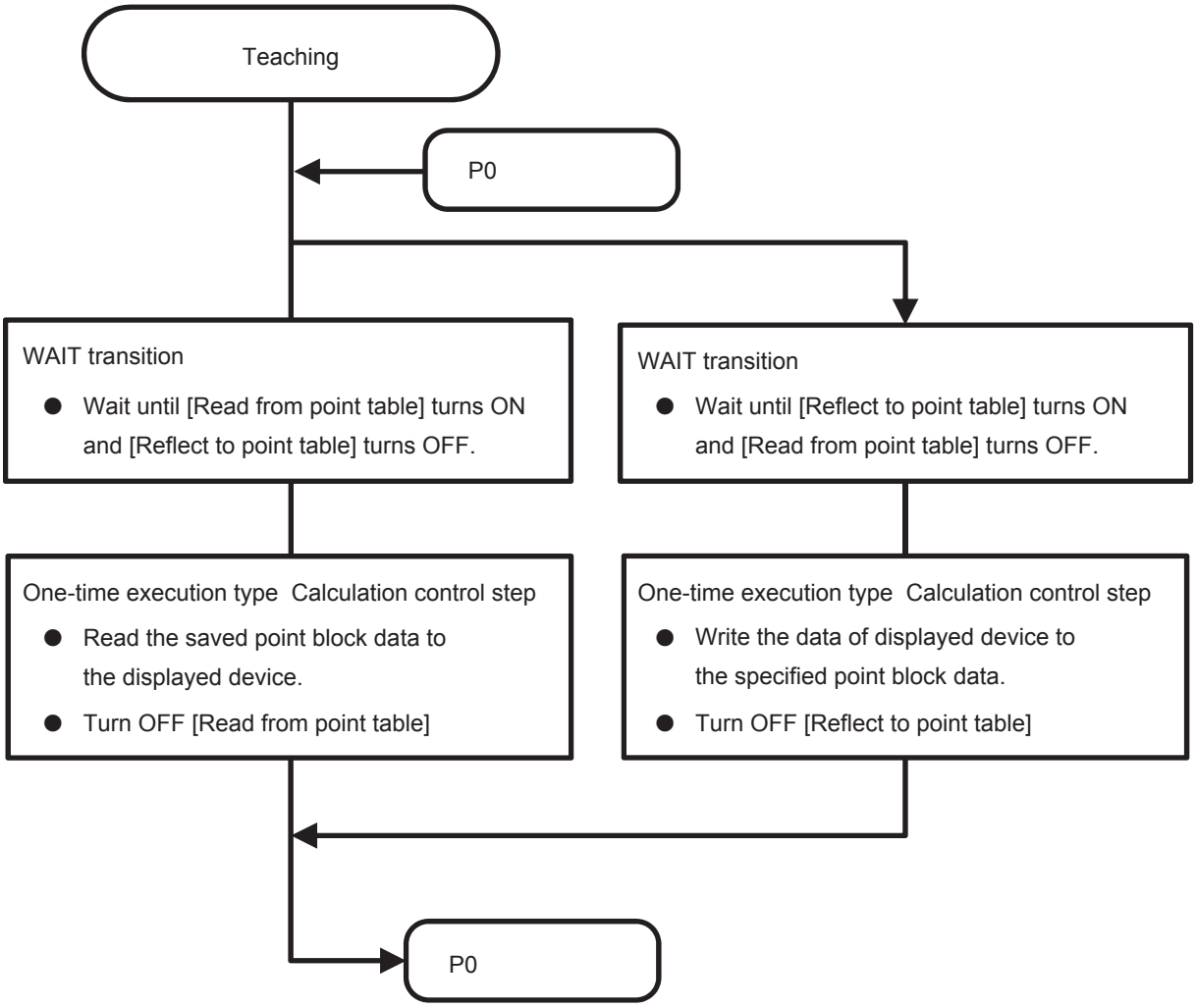


Restriction

- The coordinate system setting of the point block is fixed as world coordinate.
- The positioning data item setting is fixed as parameter block No. 64 of the machine parameter. Set the contents of the parameter block with MT Develper2.

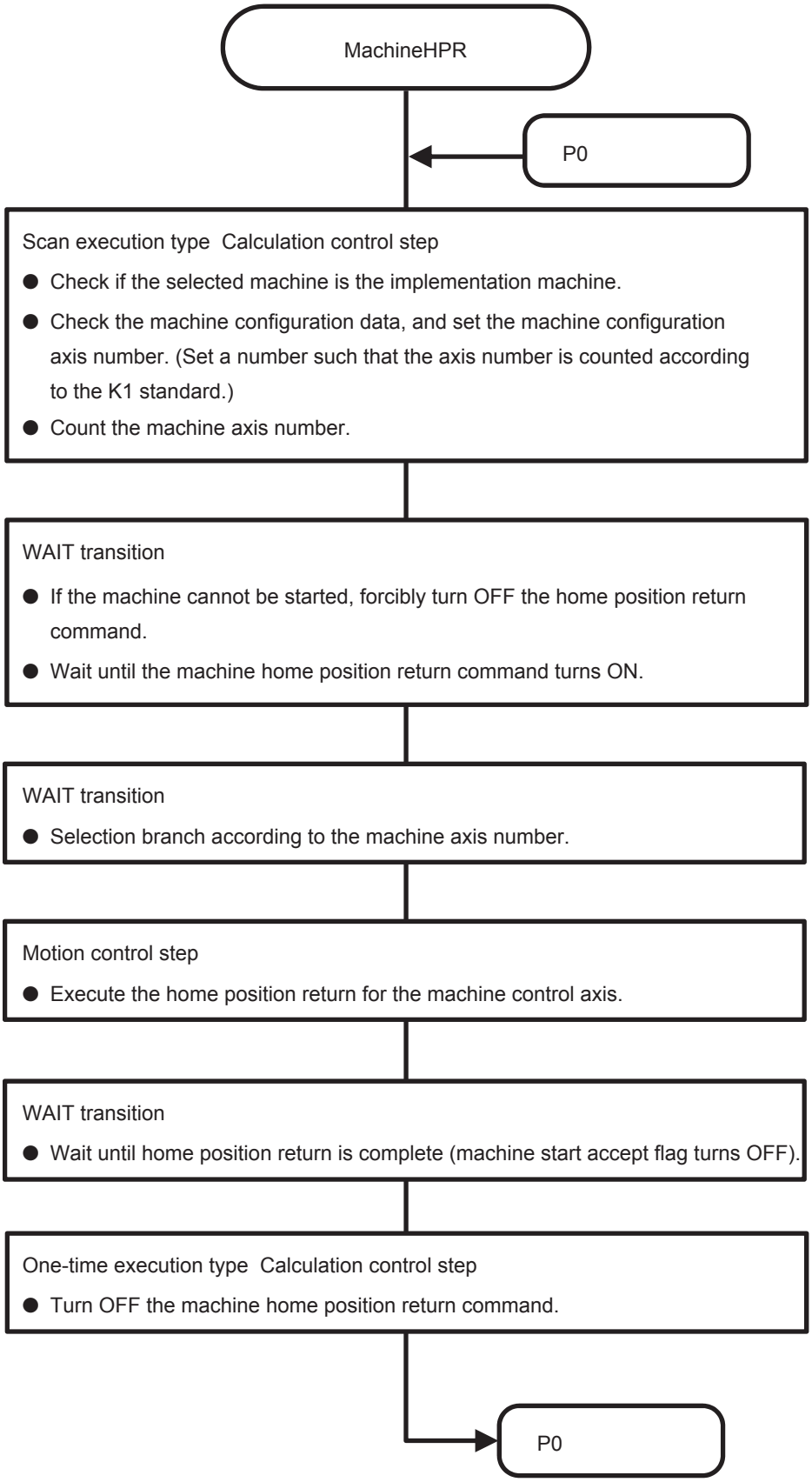
Teaching

When the [Read from point table] switch is touched on the Teaching window, the point block data is read and displayed on the setting screen. When the [Reflect to point table] switch is touched, the setting value is written to the specified point block.



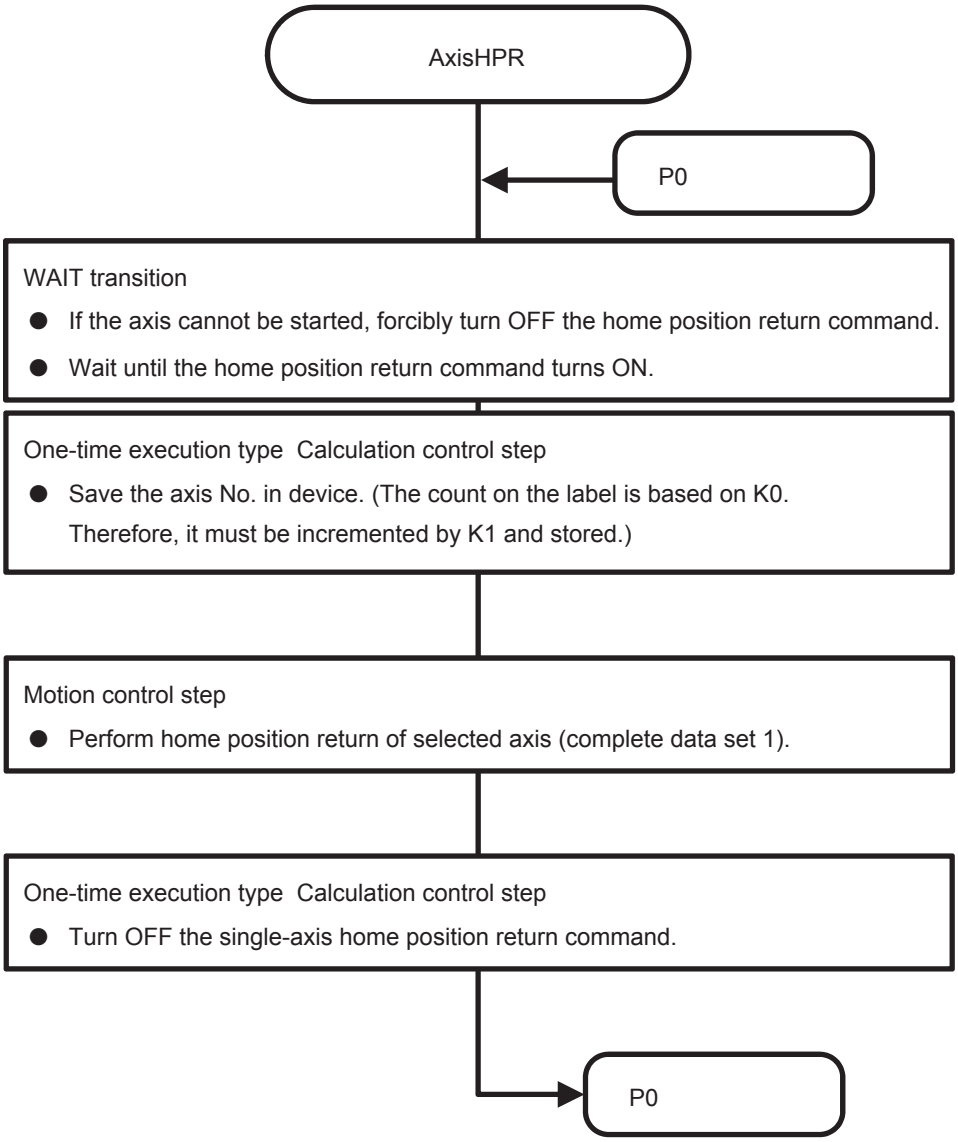
MachineHPR

When the [Machine home position return] switch is touched on the Servo axis setting screen, batch home position return (complete data set 1) is performed for the machine configuration axes.



AxisHPR

When the [Home position return] switch is touched on the Servo axis setting screen, home position return (complete data set 1) is performed for the selected axis.

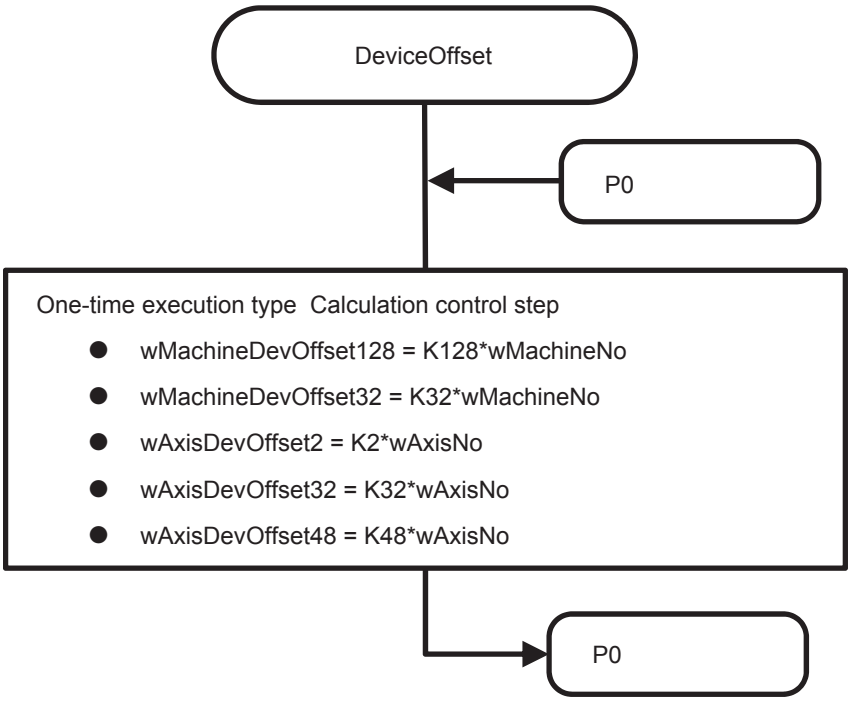


DeviceOffset

The offset device amount is calculated according to the selected machine No. and axis No.
The machine control device is calculated as shown below.

Ex.
"[Rq.2240] Machine error reset command (M43616+32m)"
* m: Machine No. -1
Perform a 32 integer multiple offset according to the machine No. with M43616 as the reference device. This offset amount is always calculated in the motion SFC program because it needs to be changed according to the type of device and selected axis/machine No.

Differences in access to axis/machine No. device		
	MT Works2 project	**GT Works3 project**
Access to each axis/machine No.	Structure, array type	Offset function
Offset specification	Specify axis/machine No. as subscript	Specify offset device value

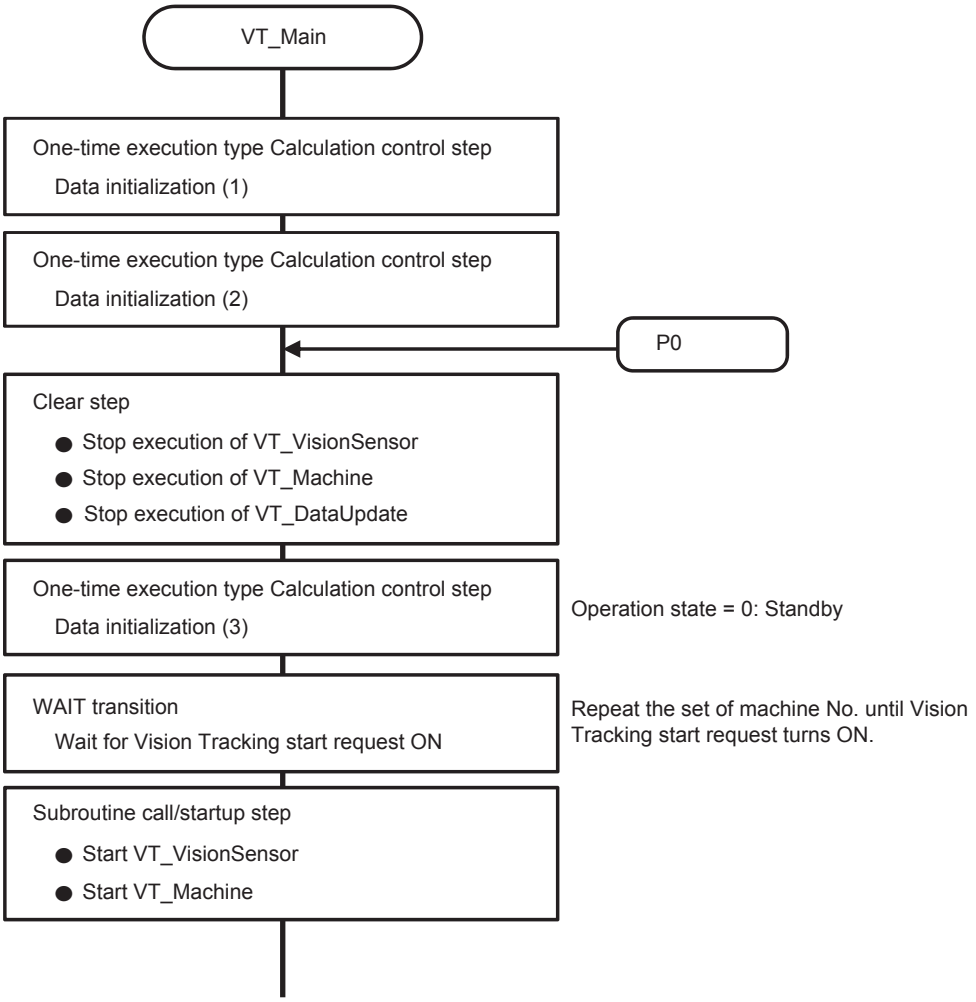


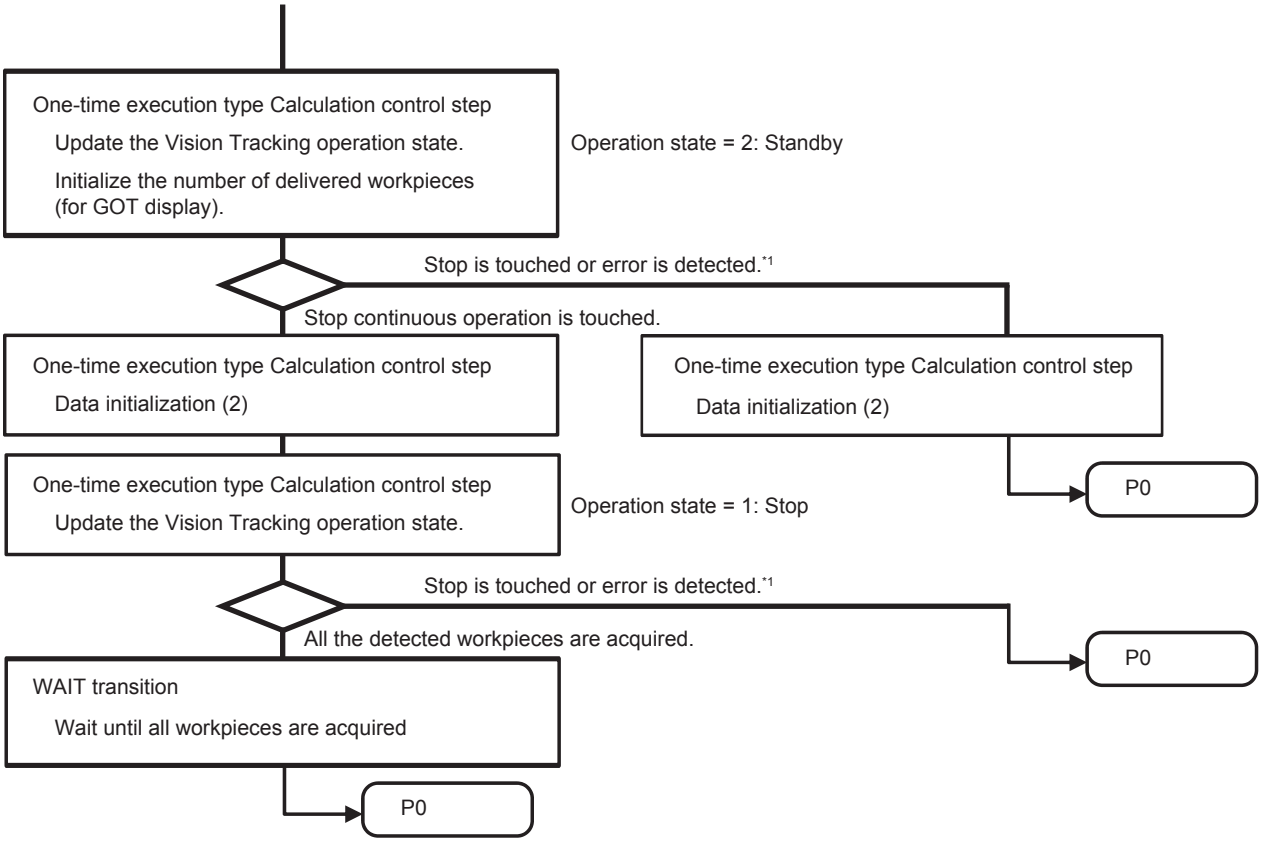
AmplifierLess

The amplifier-less operation mode is set in this system. Since it is not automatically started in the default setting, change the automatic start setting to "Yes" in the motion SFC parameter before writing the program to set the amplifier-less operation mode.
This program is the same as the program described in the "Amplifier-less operation function" in the following manual.
MELSEC iQ-R Motion Controller Programming Manual (Common)

VT_Main

The main processing of Vision Tracking is performed. Data initialization and start/interruption of each subroutine by input from the GOT are performed.





*1 The branch condition is as follows:
[Input from the GOT]
Machine stop command is ON.
[Motion CPU internal data]
Vision system error flag is ON.
Machine error detection flag is ON.
Error detection flag of the virtual flag and command generation flag to be used is ON.
Machine servo ready OFF

■Data initialization (1)

Initialize the data that needs to be initialized only once after the system is started, including the user setting data and latch data. The following table lists the data to be initialized. The event task allow instruction (EI) is also executed in this operation step.

Item	Label name	Value	Remarks
Vision system No.	wVisionSystemNo	1	—
Vision program No.	wVisionProgramNo	1	—
X-axis instruction virtual axis No. -1	- (For indirect specification of the array)	15	The right side of the calculation is specified as axis No. -1 in the program.
X-axis instruction command generation axis No. -1	- (For indirect specification of the array)	0	
Y-axis instruction command generation axis No. -1	- (For indirect specification of the array)	1	
Z-axis instruction command generation axis No. -1	- (For indirect specification of the array)	2	
C-axis instruction command generation axis No. -1	- (For indirect specification of the array)	3	
Vision Tracking distance setting*1	stDistanceSetting	—	For each member of the structure, refer to the following.
Distance between detection sensor and vision sensor	dBetweenSensorAndVS	1000	[× 0.1μm]
Distance between the detection sensor and standby position	.dBetweenSensorAndMcnStandbyPos	1000	[× 0.1μm]
Correction amount for acquisition position	dAcquisitionPositionCorrectionAmount	0	[× 0.1μm]
Vision Tracking operation setting*1	stDistanceSetting	—	For each member of the structure, refer to the following.
Movement amount of acquisition	.dMovementAmount	1000	[× 0.1μm]
Operation speed	.dOperationSpeed	1	[× 0.01mm/min]
Adsorption time	.wAdsorbTime	0	[ms]
Desorption time	.wDesorptionTime	0	[ms]
Standby position point block No.	.wPtBlkNo_Standby	1	—
Above the desorption position point block No.	.wPtBlkNo_DesorptionUpper	1	—
Desorption position point block No.	.wPtBlkNo_DesorptionLower	1	—
Vision Tracking adsorption signal	bVT_AdsorbSignal	OFF	—
Vision Tracking initial startup processing flag	bVT_InitialFuncComplete	ON	For the latch data initialization check
Vision system error flag	bVS_ErrorDetection	OFF	Vision system related data • Ethernet communication line setting • Vision program operation setting
Vision system_status storage device	w2VS_StatusStorage[0]	0	
Vision system_error code	w2VS_StatusStorage[1]	0	
Vision system_program status storage device	wVS_ProgramStatusStorage	0	

*1 Since this is latch data, initialization is performed only at the first startup.

■Data initialization (2)

Initialize the data that needs to be initialized whenever the system is started or operation is stopped. The following table lists the data to be initialized.

Item	Label name	Value	Remarks
High-speed input request signal valid flag	bHighSpdInputReqSignalValid	OFF	—
Vision Tracking start request	bVT_StartCommand	OFF	—
Vision Tracking end request	bVT_EndCommand	ON	—

■Data initialization (3)

Initialize the data that needs to be initialized whenever the system is started or operation is stopped. The following table lists the data to be initialized.

Item	Label name	Value	Remarks
Vision system ready flag for Vision Tracking	bVT_VisionsystemReady	OFF	—
Machine ready flag for Vision Tracking	bVT_MachineReady	OFF	—
Vision Tracking operation state	wVT_OperationStatus	0	—
Mark detection counter	wNumberOfMarkDetectionsCounter	0	[time(s)]
Mark detection data storage device	wMarkDetectionDataStorage_Init	0	*1
Vision system ready flag for Vision Tracking	bVT_VisionsystemReady	OFF	—
Vision trigger counter	wNumberOfVisionTriggerCounter	0	[time(s)]
Vision system_trigger position	dVS_TriggerIssuePosition	0	[× 0.1μm]
Vision correction amount	wVT_CorrectionAmount_Init	0	*2
Machine ready flag for Vision Tracking	bVT_MachineReady	OFF	—
Machine control process counter	wNumberOfMachineProcessCounter	0	[time(s)]
Machine control process counter (for GOT display)	wNumberOfMachineProcessCounterGOT	0	[time(s)]
Machine acquisition start position	dMachineStartPosition	0	[× 0.1μm]
Synchronous control start command (for virtual axis)	b64SynchronousControlStartSignal [#11960L*3]	OFF	—

*1 To reset the whole mark detection data storage device (d8MarkDetectionDataStorage), the same data block transfer command (FMOV) is used with the above label for initialization.

*2 To reset the whole vision correction amount (st8VT_CorrectionAmount), the same data block transfer command (FMOV) is used with the above label for initialization.

*3 As a subscript of the array label, virtual axis No. -1 is stored in #11960L before the initialization.

■Operation state

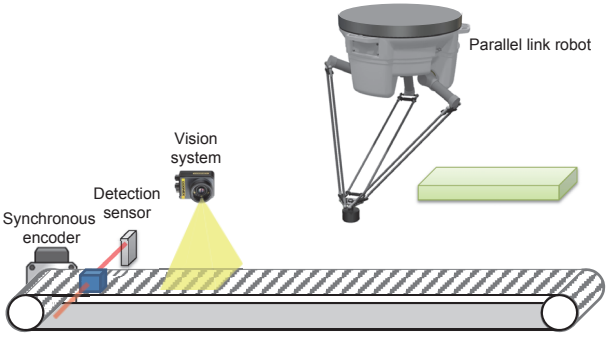
The operation state of Vision Tracking is represented as the numerical value of 0 to 2. The relationship with operation start/end request bit is as follows.

Status	Operation state	Start request	End request	Remarks
Standby	0	OFF	ON	Waiting for the start request
Stopped	1	OFF	ON	Operation is stopped after all the detected workpieces are acquired.
Operating	2	ON	OFF	Vision Tracking is in progress.

■Overview of Vision Tracking processing

The following describes the processing overview of the program example using illustrations.

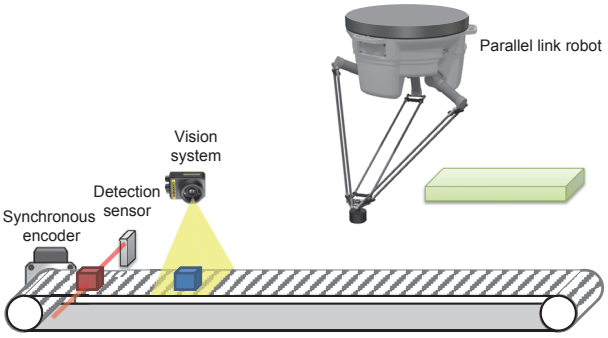
1. When the sensor detects a workpiece, the data is latched and counter is incremented by the mark detection function.



Data		Sensor	Vision system			Machine
Counter		1	0			0
Latch data	–	Conveyor position	X compensation amount	Y compensation amount	θ compensation amount	–
	+0	950	0	0	0	
	+1	0	0	0	0	
	+2	0	0	0	0	
	+3	0	0	0	0	
	+4	0	0	0	0	
	+5	0	0	0	0	
	+6	0	0	0	0	
	+7	0	0	0	0	

Since the counters of the sensor and vision system do not match, the vision trigger position is calculated from the data (+0) of sensor and sensor distance.

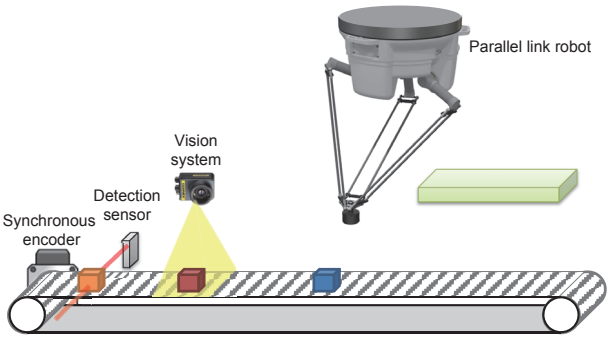
2. The vision system captures an image when the workpiece reaches the vision trigger position. The data is stored and counter is incremented.



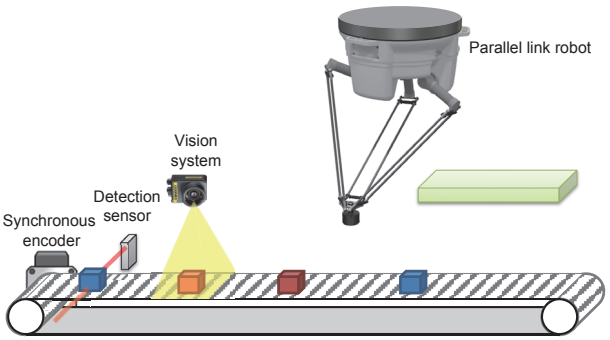
Data		Sensor	Vision system			Machine
Counter		2	1			0
Latch data	–	Conveyor position	X compensation amount	Y compensation amount	θ compensation amount	–
	+0	950	-50	1	0	
	+1	1950	0	0	0	
	+2	0	0	0	0	
	+3	0	0	0	0	
	+4	0	0	0	0	
	+5	0	0	0	0	
	+6	0	0	0	0	
	+7	0	0	0	0	

In the same way as the step 1, the sensor detects the workpiece again, and the data is latched and counter is incremented.
Since the counters of the sensor and vision system do not match, the vision trigger position is calculated from the data (+1) of sensor and sensor distance.
Since the counters of vision system and machine do not match, the acquisition start position of the machine is calculated.

3. The processing of the step 2 is repeated.

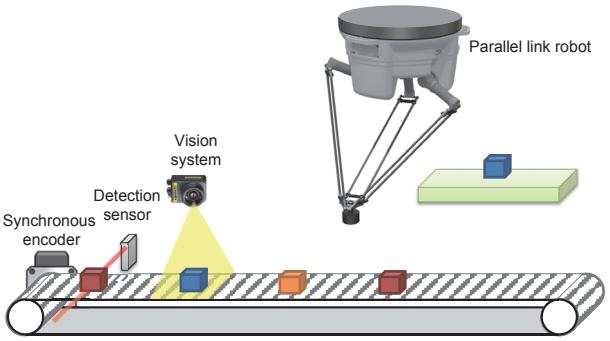


Data		Sensor	Vision system			Machine
Counter		3	2			0
Latch data	–	Conveyor position	X compensation amount	Y compensation amount	θ compensation amount	–
	+0	950	-50	1	0	
	+1	1950	0	10	3	
	+2	2030	0	0	0	
	+3	0	0	0	0	
	+4	0	0	0	0	
	+5	0	0	0	0	
	+6	0	0	0	0	
	+7	0	0	0	0	



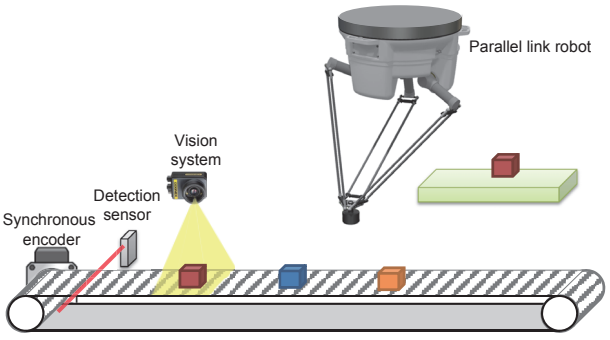
Data		Sensor	Vision system			Machine
Counter		4	3			0
Latch data	–	Conveyor position	X compensation amount	Y compensation amount	θ compensation amount	–
	+0	950	-50	1	0	
	+1	1950	0	10	3	
	+2	3030	30	-15	-1	
	+3	4000	0	0	0	
	+4	0	0	0	0	
	+5	0	0	0	0	
	+6	0	0	0	0	
	+7	0	0	0	0	

4. When a workpiece reaches the acquisition start position of the machine, the machine acquires the workpiece in synchronization with the conveyor, transports it to the commanded position, and increments the counter.



Data		Sensor	Vision system			Machine
Counter		5	4			1
Latch data	–	Conveyor position	X compensation amount	Y compensation amount	θ compensation amount	–
	+0	950	-50	1	0	
	+1	1950	0	10	3	
	+2	3030	30	-15	-1	
	+3	4000	0	5	-5	
	+4	4980	0	0	0	
	+5	0	0	0	0	
	+6	0	0	0	0	
	+7	0	0	0	0	

5. If the adjacent counters do not match, the vision system determines that the workpiece is left and continues the processing. If the adjacent counters match, the vision system determines that no workpiece is left and shifts to the standby state.



Data		Sensor	Vision system			Machine
Counter		5	5			2
Latch data	–	Conveyor position	X compensation amount	Y compensation amount	θ compensation amount	–
	+0	950	-50	1	0	
	+1	1950	0	10	3	
	+2	3030	30	-15	-1	
	+3	4000	0	5	-5	
	+4	4980	-20	0	2	
	+5	0	0	0	0	
	+6	0	0	0	0	
	+7	0	0	0	0	

Precautions

- After the operation start request of Vision Tracking is issued, the line open processing of the vision system is performed. The target machine starts moving to the standby position. The vision tracking operation starts from the workpiece detected after these two initial motion processes are completed. The workpieces that have passed through the sensor before the start request (initial motion completion) are not acquired.
- The detection data can be stored for up to eight workpieces between the detected sensor and vision system and between the vision system and machine acquisition position. If nine or more workpieces are accumulated within the above intervals, the oldest detection data is overwritten and some workpieces may not be acquired. In such a case, review the used device and the followings.

1) Upper limit change of sensor detection times: Number of setting times of the mark detection setting

2) Upper limit change of vision sensor detection times: Vision trigger counter (wNumberOfVisionTriggerCounter) rounding processing*1

3) Upper limit change of machine control processing times: Machine control processing counter (wNumberOfMachineProcessCounter) rounding processing*2

*1 Check and change the processing in the operation control step at the end of Motion SFC program (VT_VisionSensor).

*2 Check and change the processing in the operation control step at the end of Motion SFC program (VT_Machine).

VT_VisionSensor

Perform the connection and processing of the vision sensor used in Vision Tracking.

Configure the workpiece positioning setting and other settings of the necessary data on the vision sensor with the dedicated software (In-Sight® Explorer). For details, refer to the following.

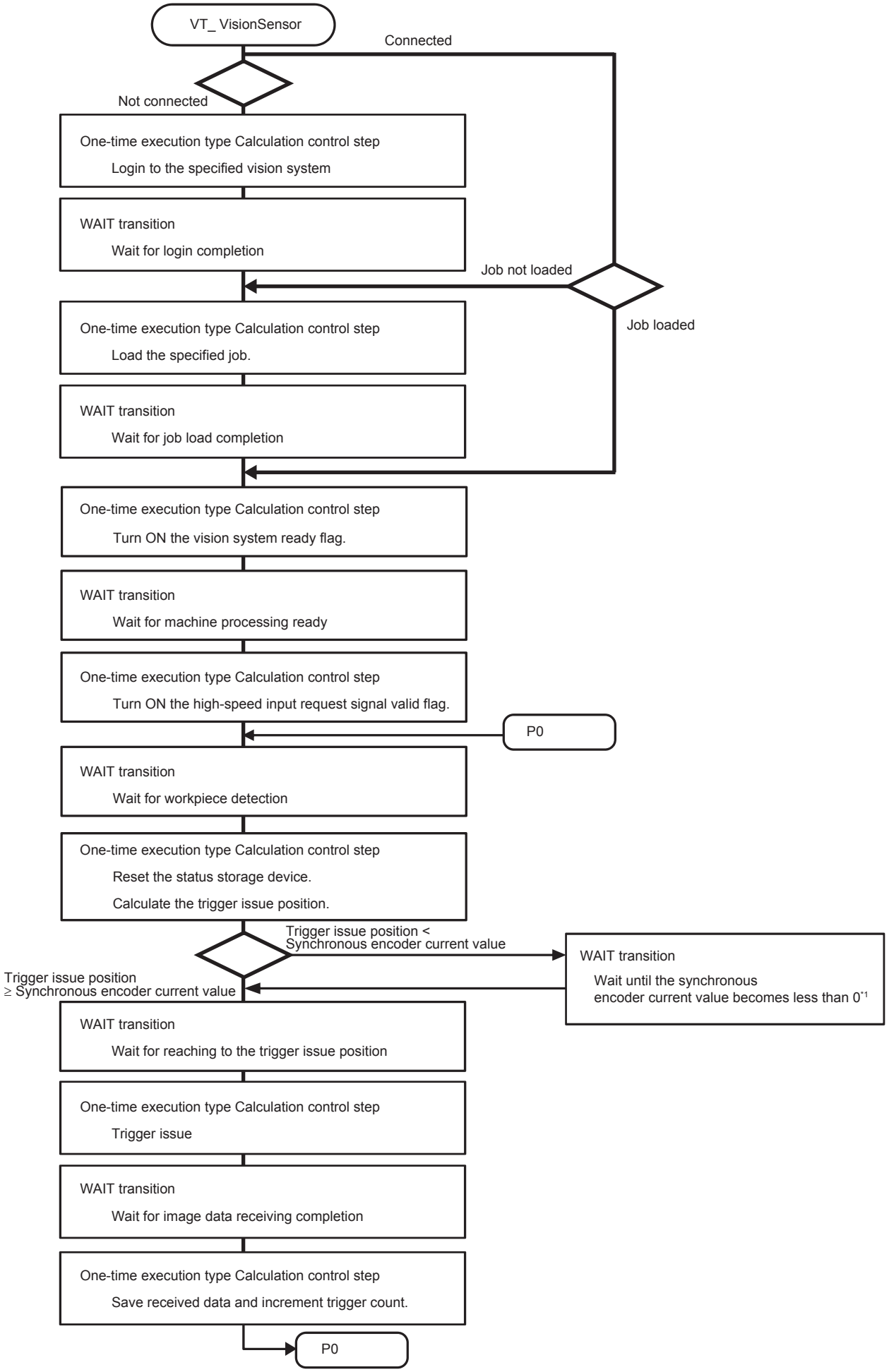
MELSEC iQ-R Motion Controller Programming Manual (Common)

In this program example, the image data storage device is set in the vision program operation setting. Configure the settings to acquire the correction amount of X, Y, and θ with the above vision sensor dedicated software.

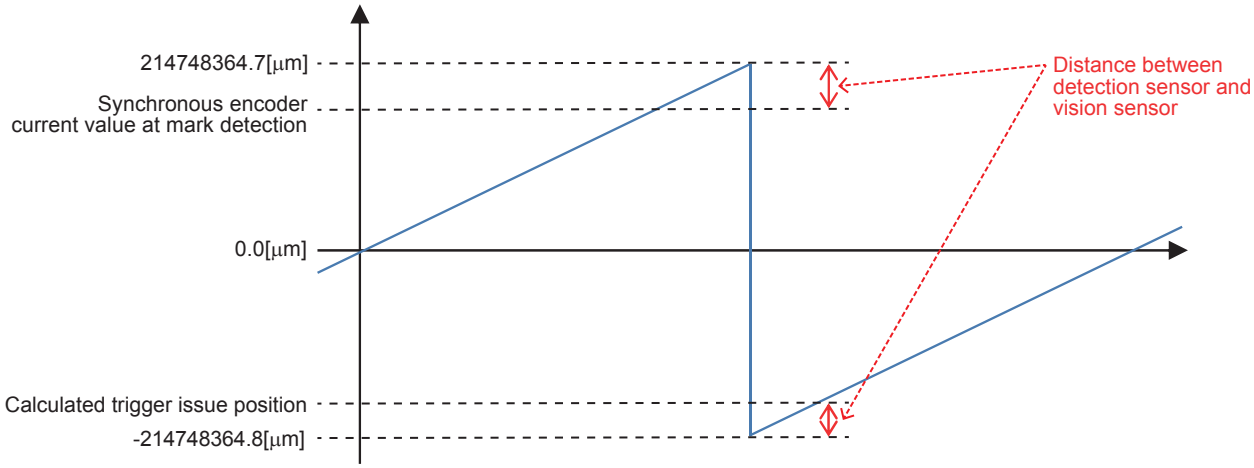
Point

This program is based on the assumption that In-Sight® vision system manufactured by Cognex Corporation is connected to the Motion CPU PERIPHERAL I/F, and the vision system dedicated functions are used in the Motion SFC program.

The vision sensor can be used via other PLC CPUs. In such a case, review the program to perform the correction using the data (correction amount) acquired from the example of the process overview.

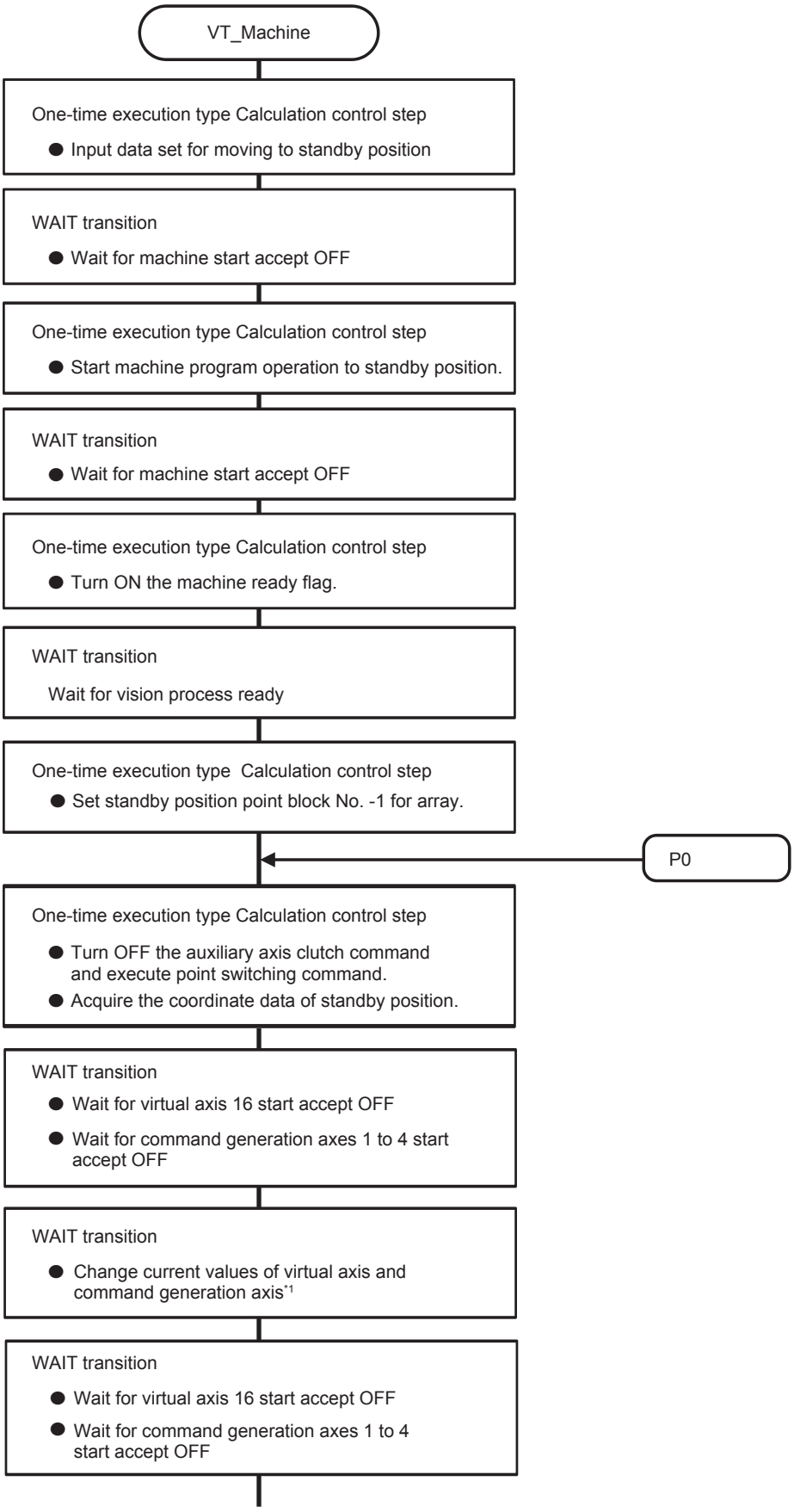

VT_ VisionSensor
Connected
Not connected
One-time execution type Calculation control step
Login to the specified vision system
WAIT transition
Wait for login completion
Job not loaded
Job loaded
One-time execution type Calculation control step
Load the specified job.
WAIT transition
Wait for job load completion
One-time execution type Calculation control step
Turn ON the vision system ready flag.
WAIT transition
Wait for machine processing ready
One-time execution type Calculation control step
Turn ON the high-speed input request signal valid flag.
P0
WAIT transition
Wait for workpiece detection
One-time execution type Calculation control step
Reset the status storage device.
Calculate the trigger issue position.
Trigger issue position <
Synchronous encoder current value
WAIT transition
Wait until the synchronous
encoder current value becomes less than 0*1
Trigger issue position
≥ Synchronous encoder current value
WAIT transition
Wait for reaching to the trigger issue position
One-time execution type Calculation control step
Trigger issue
WAIT transition
Wait for image data receiving completion
One-time execution type Calculation control step
Save received data and increment trigger count.
P0

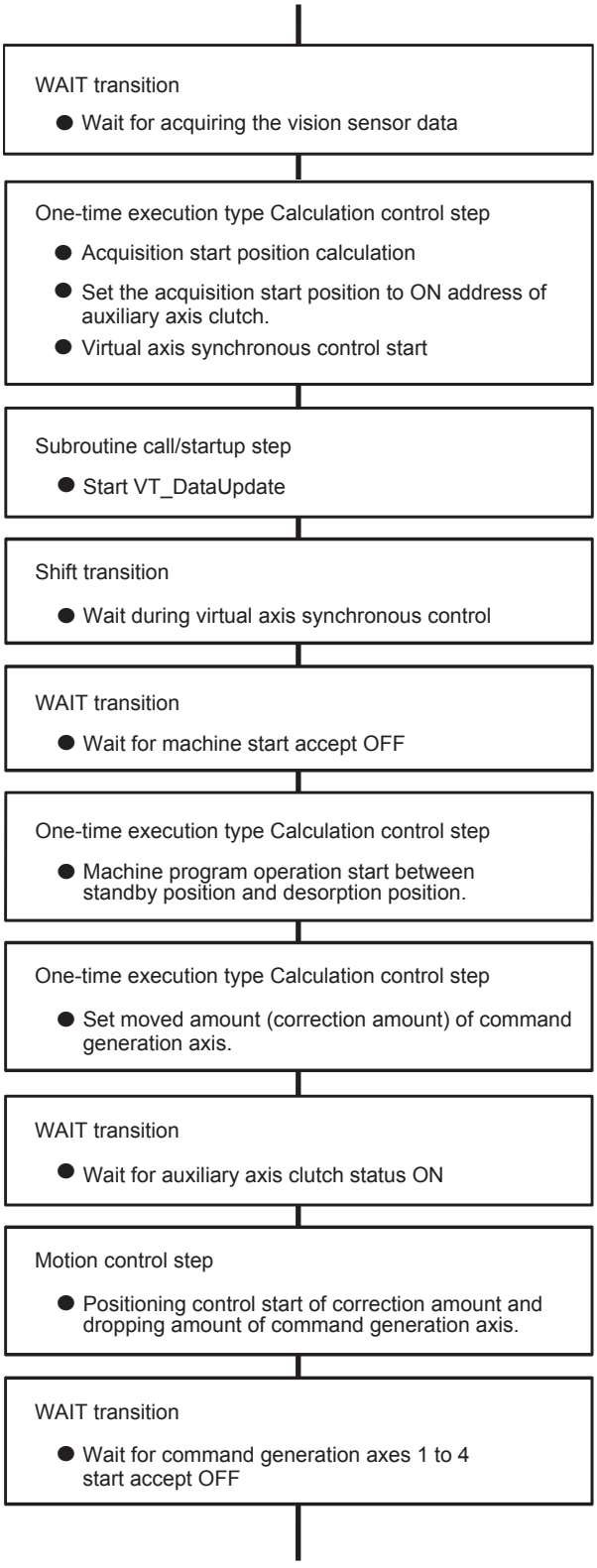
*1 The "trigger issue position" is the sum of "synchronous encoder current value (at mark detection)" and "distance between detection sensor and vision sensor". As a result, "trigger issue position" is more than "synchronous encoder current value". At the transition of waiting for trigger issue position, the vision trigger is issued when "synchronous encoder current value" is more than "trigger issue position".
If the above condition is not satisfied, the calculated "trigger issue position" exceeds the maximum value of 32-bit data.
(If it exceeds 214748364.7 [μm] which is the maximum value of 32-bit data, it becomes -214748364.8 [μm].)
In such a case, "synchronous encoder current value" is compared with the trigger issue position after it exceeds the maximum value of 32-bit data.

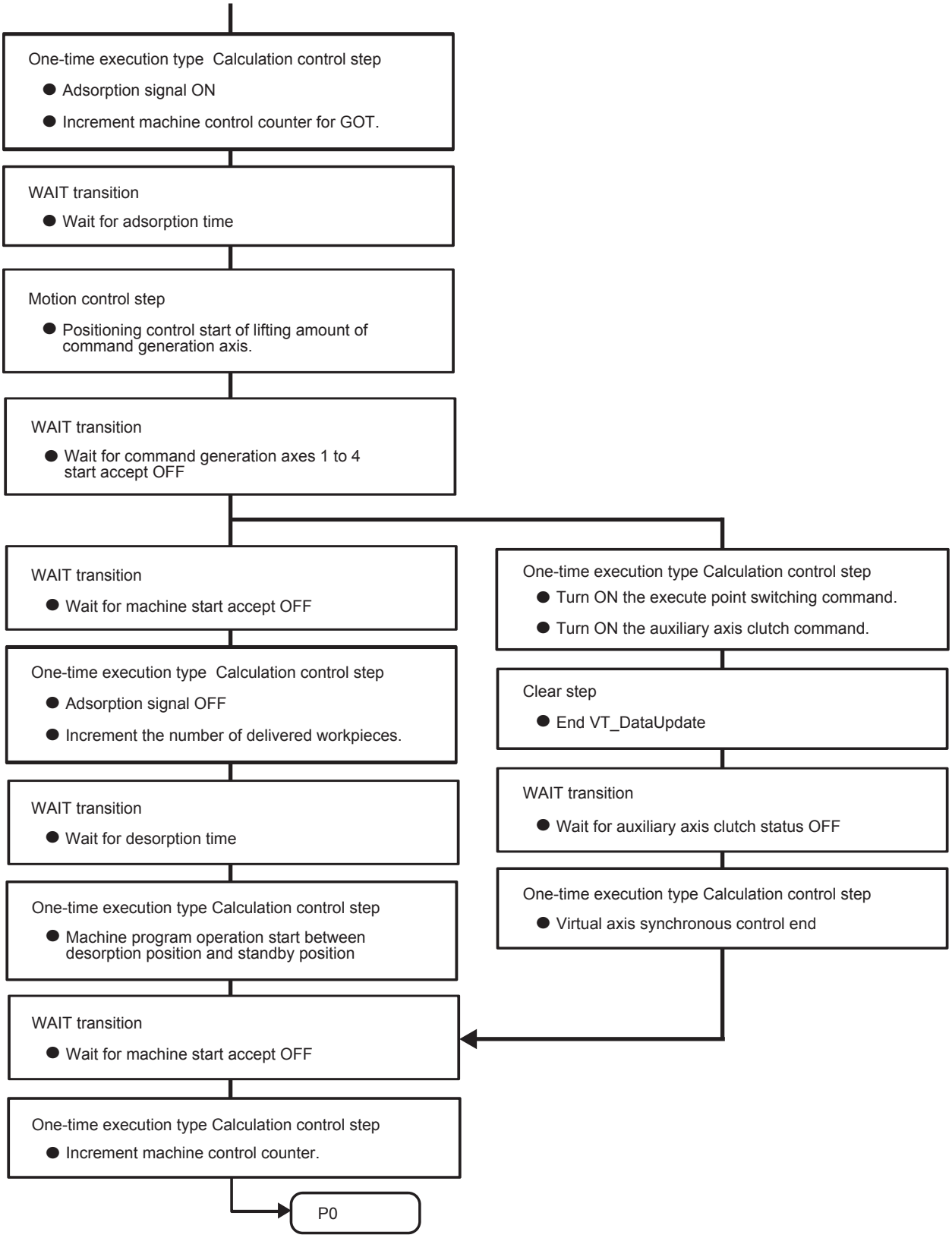


VT_Machine

The machine control of the machine type R8 used for Vision Tracking is performed.




WAIT transition
● Wait for acquiring the vision sensor data
One-time execution type Calculation control step
● Acquisition start position calculation
● Set the acquisition start position to ON address of auxiliary axis clutch.
● Virtual axis synchronous control start
Subroutine call/startup step
● Start VT_DataUpdate
Shift transition
● Wait during virtual axis synchronous control
WAIT transition
● Wait for machine start accept OFF
One-time execution type Calculation control step
● Machine program operation start between standby position and desorption position.
One-time execution type Calculation control step
● Set moved amount (correction amount) of command generation axis.
WAIT transition
● Wait for auxiliary axis clutch status ON
Motion control step
● Positioning control start of correction amount and dropping amount of command generation axis.
WAIT transition
● Wait for command generation axes 1 to 4 start accept OFF



*1 The current values are changed as follows:
Virtual axis 16: Standby position coordinate X
Command generation axis 1: 0.0μm
Command generation axis 2: Standby position coordinate Y
Command generation axis 3: Standby position coordinate Z
Command generation axis 4: Standby position coordinate C

VT_DataUpdate

The point data used for sequential coordinate command control is updated.

The data of each coordinate system is updated as follows. Since the feed current value is updated in operation cycle, it is recommended to operate this program as an event task in operation cycle.

Update coordinate system (structure flag)	Reference axis	Reference data
X	Virtual axis 16	Feed current value
Y	Command generation axis 2	Feed current value
Z	Command generation axis 3	Feed current value
A	—	0 (fixed)
B	—	0 (fixed)
C	Command generation axis 4	Feed current value
FL1	—	0 (fixed)

4.6 List of Devices and Labels to be Used

The labels used in this program example are shown below.

The following labels are referred from the GOT. When the following label groups are changed, import the exported CSV file with the GOT project.

HDL_MTW_PositioningSignalLabel (Positioning dedicated signal)

The positioning dedicated signals assigned in the motion controller is assigned to the labels. For the devices whose data type is assigned to the label of structure, refer to the following.

MELSEC iQ-R Motion Controller Programming Manual (Positioning Control)

	Class	Label Name	Data Type		Constant	Device	English(Target)
1	VAR_GLOBAL	bPLC_Ready	Bit	...		M30000	PLC ready flag
2	VAR_GLOBAL	bMotionSFC_Debugging	Bit	...		M30038	Motion SFC debugging flag
3	VAR_GLOBAL	bSpeedSwitchingPointSpecified	Bit	...		M30040	Speed switching point specified flag
4	VAR_GLOBAL	bAllAxisServoON	Bit	...		M30042	All axes servo ON command
5	VAR_GLOBAL	bJOG_OperationSimultaneousStart	Bit	...		M30048	JOG operation simultaneous start command
6	VAR_GLOBAL	bAllAxesServoON_AcceptFlag	Bit	...		M30049	All axes servo ON accept flag
7	VAR_GLOBAL	bManualPLG_1EnableFlag	Bit	...		M30051	Manual pulse generator 1 enable flag
8	VAR_GLOBAL	bManualPLG_2EnableFlag	Bit	...		M30052	Manual pulse generator 2 enable flag
9	VAR_GLOBAL	bManualPLG_3EnableFlag	Bit	...		M30053	Manual pulse generator 3 enable flag
10	VAR_GLOBAL	bOperationCycleOver	Bit	...		M30054	Operation cycle over flag
11	VAR_GLOBAL	b64StartAccept	Bit(0..63)	...		M30080	Start accept flag
12	VAR_GLOBAL	b64SpeedChangeAcceptingFlag	Bit(0..63)	...		M30144	Speed change accepting flag
13	VAR_GLOBAL	b64AutomaticDecelerating	Bit(0..63)	...		M30208	Automatic decelerating flag
14	VAR_GLOBAL	b64SpeedChange0Accepting	Bit(0..63)	...		M30272	Speed change "0" accepting flag
15	VAR_GLOBAL	b64ControlLoopMonitorStatus	Bit(0..63)	...		M30336	Control loop monitor status
16	VAR_GLOBAL	st64AxisStatus	stAxisStatus(0..63)	...		Detail Setting	Axis status(First address:M32400)
17	VAR_GLOBAL	st64AxisCommandSignals	stAxisCommandSignals(0..63)	...		Detail Setting	Axis command signals(First address:M34480)
18	VAR_GLOBAL	bActualCoordinateAcceptFlag	Bit	...		M43584	Actual coordinate value accept flag
19	VAR_GLOBAL	st8MachineCommandSignals	stMachineCommandSignals(0..7)	...		Detail Setting	Machine command signals(First address:M4361
20	VAR_GLOBAL	st8MachineStatus	stMachineStatus(0..7)	...		Detail Setting	Machine status(First address:M43904)
21	VAR_GLOBAL	st64AxisMonitorDevices	stAxisMonitorDevices(0..63)	...		Detail Setting	Axis monitor devices(First address:D32000)
22	VAR_GLOBAL	d64JOG_SpeedSettingRegister	Double Word[Signed](0..63)	...		D35120	JOG speed setting register
23	VAR_GLOBAL	st8MachineControlDevice	stMachineControlDevice(0..7)	...		Detail Setting	Machine control device(First address:D52896)
24	VAR_GLOBAL	st8MachineMonitorDevice	stMachineMonitorDevice(0..7)	...		Detail Setting	Machine monitor device(First address:D53168)
25	VAR_GLOBAL	bAmplifierLessStatus	Bit	...		SM508	Amplifier-less operation status
26	VAR_GLOBAL	wSSC_Status	Word[Signed]	...		SD508	SSCNET control (Status)
27	VAR_GLOBAL	wSSC_Command	Word[Signed]	...		SD803	SSCNET control (Command)

HDL_MTW_UserDeviceLabel (User device)

The devices used in this program example are assigned. Since the assigned devices use the user device area, review the assignment depending on the usage condition. For the devices whose data type is assigned to the label of structure, refer to the following.

☞ Page 71 Other devices to be used

	Class	Label Name	Data Type		Constant	Device	English(Target)
1	VAR_GLOBAL	wMachineNo	Word[Signed]	...		#500	Machine No.
2	VAR_GLOBAL	wAxisNo	Word[Signed]	...		#501	Axis No.
3	VAR_GLOBAL	wAxisDevOffset2	Word[Signed]	...		#502	Axis Device Offset K2
4	VAR_GLOBAL	wAxisDevOffset32	Word[Signed]	...		#503	Axis Device Offset K32
5	VAR_GLOBAL	wAxisDevOffset48	Word[Signed]	...		#504	Axis Device Offset K48
6	VAR_GLOBAL	wMachineDevOffset128	Word[Signed]	...		#505	MachineDeviceOffset_K128
7	VAR_GLOBAL	wMachineDevOffset32	Word[Signed]	...		#506	MachineDeviceOffset_K32
8				...			
9	VAR_GLOBAL	wAxisForJNT	Word[Signed](0..3)	...		#507	Axis number for JNT
10	VAR_GLOBAL	wMachineAxesConfigAnalysis	Word[Signed](0..3)	...		#511	Machine axes configuration analysis
11	VAR_GLOBAL	wNumberOfAxesForMachine	Word[Signed]	...		#516	Number of Axis for machine
12				...			
13	VAR_GLOBAL	dPointData_CommandSpeed	Double Word[Signed]	...		#1000	1 Point machine program operation Command speed
14	VAR_GLOBAL	wPointData_ControlMethod	Word[Signed]	...		#1002	1 Point machine program operation Coordinate Control method
15	VAR_GLOBAL	dPointData_CoordinateX	Double Word[Signed]	...		#8000	1 Point machine program operation Coordinate X
16	VAR_GLOBAL	dPointData_CoordinateY	Double Word[Signed]	...		#8002	1 Point machine program operation Coordinate Y
17	VAR_GLOBAL	dPointData_CoordinateZ	Double Word[Signed]	...		#8004	1 Point machine program operation Coordinate Z
18	VAR_GLOBAL	dPointData_CoordinateA	Double Word[Signed]	...		#8006	1 Point machine program operation Coordinate A
19	VAR_GLOBAL	dPointData_CoordinateB	Double Word[Signed]	...		#8008	1 Point machine program operation Coordinate B
20	VAR_GLOBAL	dPointData_CoordinateC	Double Word[Signed]	...		#8010	1 Point machine program operation Coordinate C
21	VAR_GLOBAL	uwPointData_StructureFlagFL1	Word[Unsigned]/Bit String[16-bit]	...		#8012	1 Point machine program operation Structure Flag1
22				...			
23	VAR_GLOBAL	wNumOfPositioningPoint	Word[Signed]	...		#517	Number of positioning points
24	VAR_GLOBAL	wPointDataNo	Word[Signed]	...		#518	Point Data No.
25	VAR_GLOBAL	wOperationStatus	Word[Signed]	...		#519	Status of continuous operation(0=During stop, 1=During cycle stop, 2=During operation)
26	VAR_GLOBAL	wControlMethod	Word[Signed](0..12)	...		#1100	Control method
27	VAR_GLOBAL	dCommandSpeed_Continuous	Double Word[Signed](0..12)	...		#1120	Command speed for continuous operation
28	VAR_GLOBAL	dTorqueLimitValue	Double Word[Signed](0..12)	...		#1150	Torque limit value during operation
29	VAR_GLOBAL	dProximityPass	Double Word[Signed](0..12)	...		#1180	Enable proximity pass
30	VAR_GLOBAL	dProximityPassRange	Double Word[Signed](0..12)	...		#1210	Proximity pass range
31	VAR_GLOBAL	dM_Code	Double Word[Signed](0..12)	...		#1240	M-code
32	VAR_GLOBAL	dDwellTime	Double Word[Signed](0..12)	...		#1270	Dwell time
33	VAR_GLOBAL	wPointBlockNo	Word[Signed](0..12)	...		#1300	Point block No.
34	VAR_GLOBAL	wAux_CentralPointBlockNo	Word[Signed](0..12)	...		#1320	Auxiliary point/central point block No.
35				...			
36	VAR_GLOBAL	wTeachingDataNo	Word[Signed]	...		#520	Teaching data No.
37	VAR_GLOBAL	st20PointBlockCoordinate	stPointBlockCoordinate(0..19)	...		Detail Setting	Coordinate data of point block
38				...			
39	VAR_GLOBAL	bMachineStart_1P	Bit	...		X1	Start 1 point machine program operation
40	VAR_GLOBAL	bMachineStart_Continuous	Bit	...		X21	Start continuous operation
41	VAR_GLOBAL	bMachineStop_Continuous	Bit	...		X22	Stop continuous operation
42	VAR_GLOBAL	bReadTeachingData	Bit	...		X41	Read from point block data
43	VAR_GLOBAL	bWriteTeachingData	Bit	...		X42	Write into point block data
44	VAR_GLOBAL	bMachineHPR_Command	Bit	...		X5	Home Position Return for Machine
45	VAR_GLOBAL	bAxisHPR_Command	Bit	...		X6	Home position Return for each axis
46	VAR_GLOBAL	bTakeSpeedFromPreviousPoint	Bit(0..12)	...		M100	Enable to take speed from previous point
47	VAR_GLOBAL	bTorqueLimitDuringOperation	Bit(0..12)	...		M120	Enable torque limit during operation

HDL_MTW_VisionTracking (User device for Vision Tracking)

The devices used in this Vision Tracking program example are assigned to the labels.

Since the assigned devices until No. 35 use the user device area, review the assignment depending on the usage condition.

For the devices whose data type is assigned to the label of structure, refer to the following.

☞ Page 71 Other devices to be used

The devices after No. 35 include positioning dedicated signals assigned for the advanced synchronous control. For the devices whose data type is assigned to the label of structure, refer to the following.

📖MELSEC iQ-R Motion Controller Programming Manual (Positioning Control)

* This label group is set only in the project for R8. When using this label group in other projects, import and export the labels.

	Class	Label Name	Data Type		Constant	Device	English(Target)
1	VAR_GLOBAL	bVT_InitialFuncComplete	Bit	...		#12095.0	Vision tracking initialized check flag
2	VAR_GLOBAL	bVT_StartCommand	Bit	...		M0	Vision tracking start flag
3	VAR_GLOBAL	bVT_EndCommand	Bit	...		M1	Vision tracking end flag
4	VAR_GLOBAL	bVT_AdsorbSignal	Bit	...		M2	Vision tracking adsorb signal
5	VAR_GLOBAL	wVisionSystemNo	Word[Signed]	...		#12050	Vision system number
6	VAR_GLOBAL	wVisionProgramNo	Word[Signed]	...		#12051	Vision program number
7	VAR_GLOBAL	stDistanceSetting	stVT_DistanceSetting	...		Detail Setting	Vision tracking distance setting
8	VAR_GLOBAL	stOperationSetting	stVT_OperationSetting	...		Detail Setting	Vision tracking operation setting
9				...			
10	VAR_GLOBAL	bHighSpdInputReqSignalValid	Bit	...		M6	High-speed input request signal valid flag
11				...			
12	VAR_GLOBAL	d8MarkDetectionDataStorage	Double Word[Signed](0..7)	...		#12004	Mark detection data storage device
13	VAR_GLOBAL	wMarkDetectionDataStorage_Init	Word[Signed]	...		#12004	Mark detection data storage device (Initialize)
14	VAR_GLOBAL	wNumberOfMarkDetectionsCounter	Word[Signed]	...		#12000	Number of mark detections counter
15	VAR_GLOBAL	dMarkDetectionDataMonitor	Double Word[Signed]	...		#12002	Mark detection current value monitor device
16				...			
17	VAR_GLOBAL	w2VS_StatusStorage	Word[Signed](0..1)	...		#12030	Vision system status storage device
18	VAR_GLOBAL	dVS_StatusStorage_Setting	Double Word[Signed]	...		#12030	Vision system status storage device (for parameter setting)
19	VAR_GLOBAL	bVS_ErrorDetection	Bit	...		M5	Vision system error flag
20	VAR_GLOBAL	wVS_ProgramStatusStorage	Word[Signed]	...		#12032	Vision system program status storage device
21	VAR_GLOBAL	stVS_ImageDataStrage	stVT_CorrectionAmount	...		Detail Setting	Vision system image data storage device
22				...			
23	VAR_GLOBAL	bVT_VisionSystemReady	Bit	...		M10	Vision system ready flag for vision tracking
24	VAR_GLOBAL	bVT_MachineReady	Bit	...		M11	Machine ready flag for vision tracking
25	VAR_GLOBAL	wVT_OperationStatus	Word[Signed]	...		#12090	Vision tracking operation status
26	VAR_GLOBAL	wNumberOfVisionTriggerCounter	Word[Signed]	...		#12091	Number of vision trigger counter
27	VAR_GLOBAL	wNumberOfMachineProcessCounter	Word[Signed]	...		#12092	Number of machine control processing counter
28	VAR_GLOBAL	wNumberOfMachineProcessCounterGOT	Word[Signed]	...		#12093	Number of machine control processing counter(for GOT representation)
29	VAR_GLOBAL	uwNumberOfVT	Word[Unsigned]/Bit String[16-bit]	...		#12094	Delivered number
30	VAR_GLOBAL	dVS_TriggerIssuePosition	Double Word[Signed]	...		#12096	Vision system trigger position
31	VAR_GLOBAL	dMachineStartPosition	Double Word[Signed]	...		#12098	Machine acquisition operation start position
32				...			
33	VAR_GLOBAL	st8VT_CorrectionAmount	stVT_CorrectionAmount(0..7)	...		Detail Setting	Vision correction amount
34	VAR_GLOBAL	wVT_CorrectionAmount_Init	Word[Signed]	...		#12110	Vision correction amount (Initialize)
35				...			
36	VAR_GLOBAL	stSequentialCoordinateCmdCtrlPtBlk	stPointBlockCoordinate	...		Detail Setting	Vision tracking coordinate for sequential coordinate command control
37				...			
38	VAR_GLOBAL	st64CmdGenerationAxisStatus	stCmdGenerationAxisStatus(0..63)	...		Detail Setting	Command generation axis status
39	VAR_GLOBAL	st64CmdGenerationAxisCommandSignals	stCmdGenerationAxisCommandSignal(0..63)	...		Detail Setting	Command generation axis command signal
40	VAR_GLOBAL	st12SyncEncoderAxisStatus	stSyncEncoderAxisStatus(0..11)	...		Detail Setting	Synchronous encoder axis status
41	VAR_GLOBAL	st12SyncEncoderAxisCommandSignal	stSyncEncoderAxisCommandSignal(0..11)	...		Detail Setting	Synchronous encoder axis command signal
42	VAR_GLOBAL	st64OutputAxisStatus	stOutputAxisStatus(0..63)	...		Detail Setting	Output axis status
43	VAR_GLOBAL	st64OutputAxisCommandSignal	stOutputAxisCommandSignal(0..63)	...		Detail Setting	Output axis command signal
44	VAR_GLOBAL	b64SynchronousControlSignal	Bit(0..63)	...		M40000	Synchronous control signal
45	VAR_GLOBAL	b64SynchronousAnalysisCompleteSignal	Bit(0..63)	...		M40080	Synchronous analysis complete signal
46	VAR_GLOBAL	b64SynchronousControlStartSignal	Bit(0..63)	...		M43440	Synchronous control start signal
47	VAR_GLOBAL	bSynchronousAnalysisRequestSignal	Bit(0..63)	...		M43520	Synchronous analysis request signal
48				...			
49	VAR_GLOBAL	st64ServoInputAxisMonitorDevice	stServoInputAxisMonitorDevice(0..63)	...		Detail Setting	Servo input axis monitor device
50	VAR_GLOBAL	st64ServoInputAxisControlDevice	stServoInputAxisControlDevice(0..63)	...		Detail Setting	Servo input axis control device
51	VAR_GLOBAL	st64CmdGenerationAxisMonitorDevice	stCmdGenerationAxisMonitorDevice(0..63)	...		Detail Setting	Command generation axis monitor device
52	VAR_GLOBAL	st64CmdGenerationAxisControlDevice	stCmdGenerationAxisControlDevice(0..63)	...		Detail Setting	Command generation axis control device
53	VAR_GLOBAL	st12SyncEncoderAxisMonitorDevice	stSyncEncoderAxisMonitorDevice(0..11)	...		Detail Setting	Synchronous encoder axis monitor device
54	VAR_GLOBAL	st12SyncEncoderAxisControlDevice	stSyncEncoderAxisControlDevice(0..11)	...		Detail Setting	Synchronous encoder axis control device
55	VAR_GLOBAL	st64OutputAxisMonitorDevice	stOutputAxisMonitorDevice(0..63)	...		Detail Setting	Output axis monitor device
56	VAR_GLOBAL	st64OutputAxisControlDevice	stOutputAxisControlDevice(0..63)	...		Detail Setting	Output axis control device

Other devices to be used

The following table lists devices other than above used in this program and device areas assigned for the structures in HDL_MTW_UserDeviceLabel (User device) and HDL_MTW_VisionTracking (User device for Vision Tracking).

Device	SFC program for use	Use
#52L	Initialize	FOR statement counter
#51	Initialize	Storage of the servo amplifier implementation information
#54L	MachineSTRT1P	Selected machine number (array type label subscript)
#56L	MachineSTRTnP	Selected machine number (array type label subscript)
#0 to #49	MachineSTRT1P MachineSTRTnP	Machine program work device area
#100 to #337		Machine program user setting device area
D10000 to D10539		MCNST device area
#58L	Teaching	Selected point block data No.
#70L	MachineHPR	Selected machine number (array type label subscript)
#72L to 76L	MachineHPR	FOR statement counter for machine axis search
#78	MachineHPR	Temporary storage of the machine axes configuration data
#80L	AxisHPR	Selected axis number (array type label subscript)
#82	AxisHPR	Selected axis No. (for K program)
X50	VT_VisionSensor	High-speed input request signal setting No. 1 device
#11000 to #11049	VT_Machine	Machine program work device area
#11050 to #11125	VT_Machine	Machine program user setting device area
#11200 to #11361	VT_Machine	MCNST device area
#11950L	VT_Machine	Selected machine number (array type label subscript)
#11952L	VT_VisionSensor	Vision trigger counter (array type label subscript)
#11954L	VT_Machine	Point block No. (array type label subscript)
#11956L	VT_Machine	Machine processing counter (array type label subscript)
#11960L	VT_Machine	Coordinate X: virtual axis No. -1
#11962L	VT_Machine	Coordinate X: command generation axis No. -1
#11964L	VT_Machine	Coordinate Y: command generation axis No. -1
#11966L	VT_Machine	Coordinate Z: command generation axis No. -1
#11968L	VT_Machine	Coordinate C: command generation axis No. -1
#11970L	VT_Machine	Coordinate X: target position/moved amount
#11972L	VT_Machine	Coordinate Y: target position/moved amount
#11974L	VT_Machine	Coordinate Z: target position/moved amount
#11976L	VT_Machine	Coordinate C: target position/moved amount

Label group	Label name	Data type (structure)	Device	Description
HDL_MTW_UserDeviceLabel	st20PointBlockCoordinate	stPointBlockCoordinate(0..19)	#6000 to #6279	Point block coordinate data (Point block setting No. 1 in the machine common parameter)
HDL_MTW_VisionTracking	stDistanceSetting	stVT_DistanceSetting	#12060 to #12064	Vision Tracking distance setting
	stOperationSetting	stVT_OperationSetting	#12070 to #12079	Vision Tracking operation setting
	stVS_ImageDataStrage	stVT_CorrectionAmount	#12034 to #12045	Vision system_image data storage device
	st8VT_CorrectionAmount	stVT_CorrectionAmount(0..7)	#12110 to #12205	Vision correction amount
	stSequentialCoordinateCmd CtrlPtBlk	stPointBlockCoordinate	#8014 to #8027	Sequential coordinate command for Vision Tracking (Point block setting No. 3 in the machine common parameter)

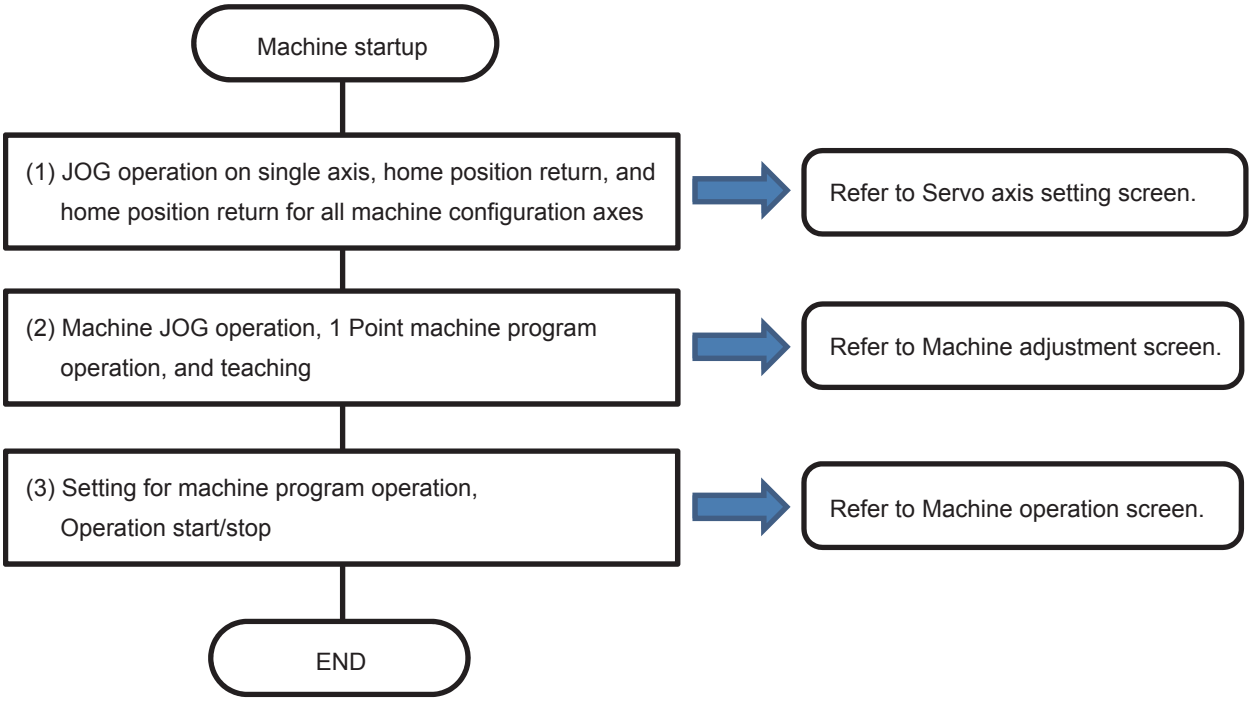
4.7 Operation Procedure of Application Program Example

Follow the steps below to start operation.

For the function details of each screen, refer to the following.

☞ Page 84 SCREENS FOR MACHINE CONTROL PROGRAM EXAMPLES

When starting the machine for the first time, the startup process is as shown below.

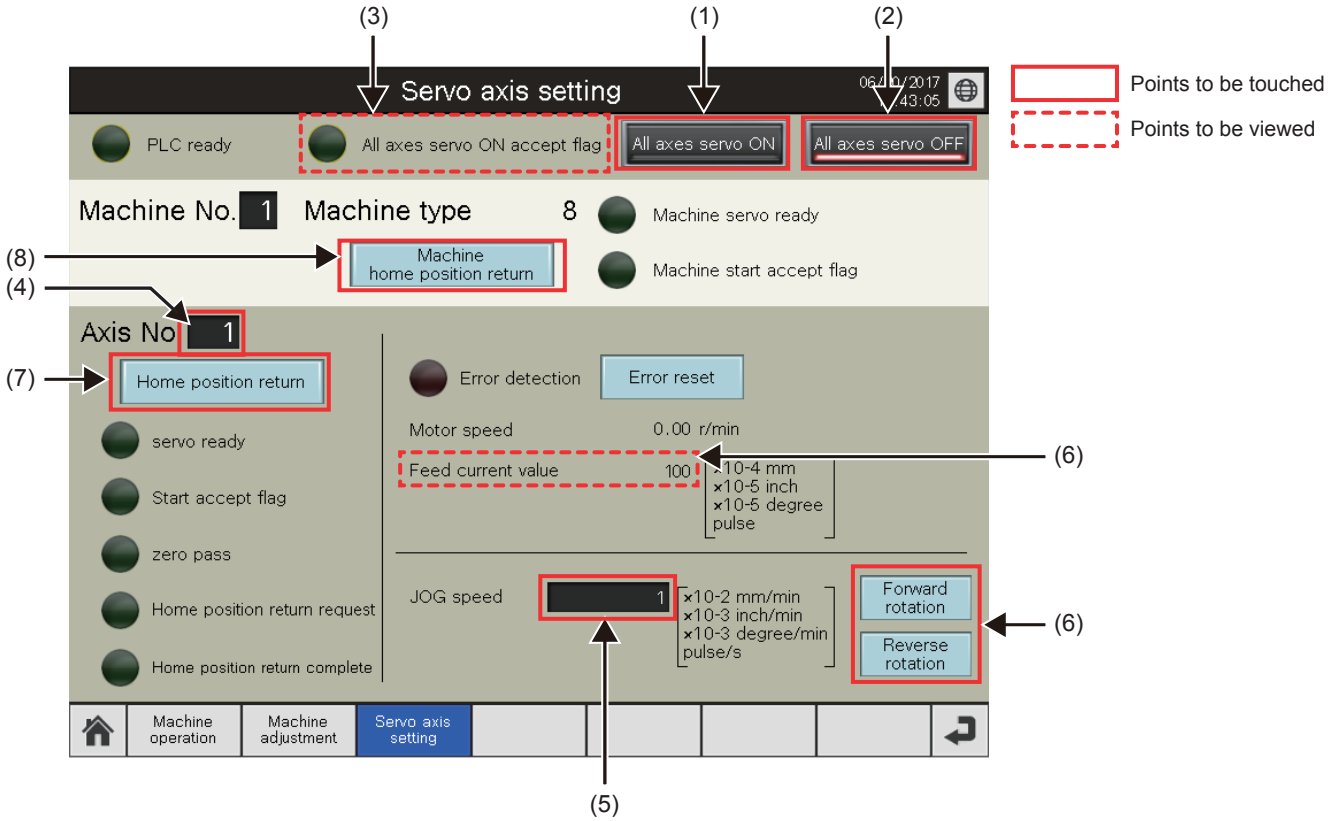


When starting up the machine for the second time and thereafter, the above procedure can be skipped as necessary.

Ex.

If the home position and teaching data have been retained, the machine operation starts instantaneously.

Servo axis setting screen



(1) To set all axes in the servo-on status, touch [All axes servo ON].

(2) To set all axes in the servo-off status, touch [All axes servo OFF].

(3) To check the servo on status of all axes, check the [All axes servo ON accept flag].

(4) To change the axis No. for which single-axis operation is to be performed, touch the numerical display of [Axis No.].

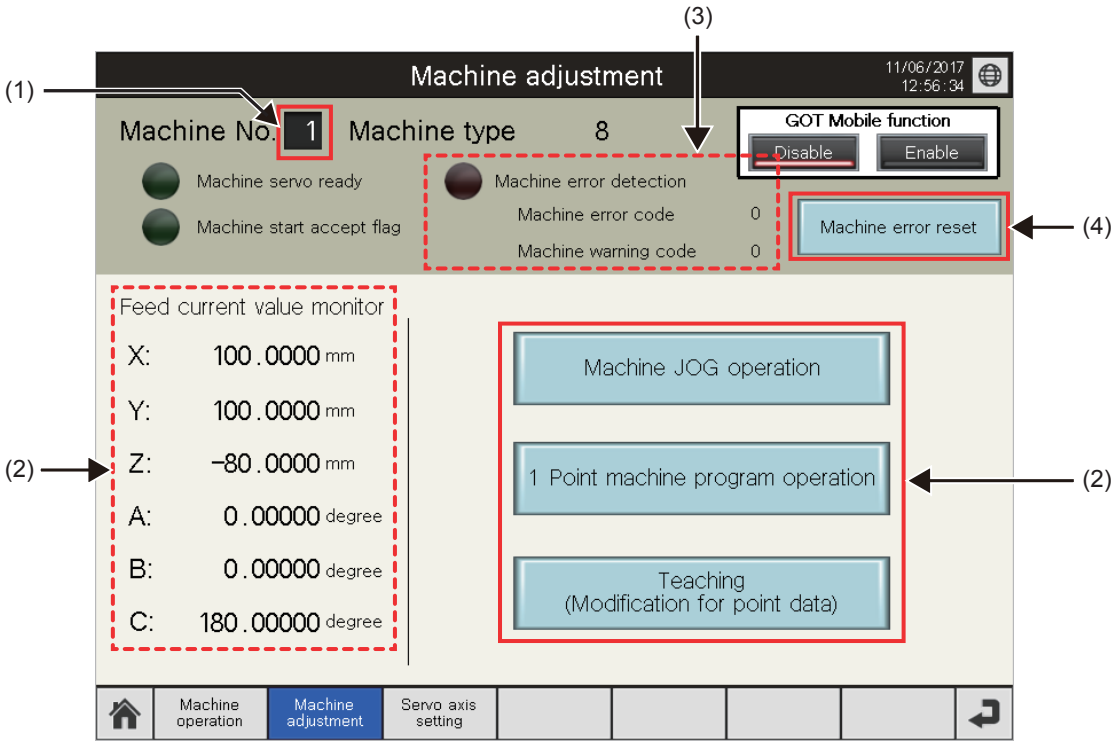
(5) To change the JOG speed, touch the numerical display of [JOG speed].

(6) To perform single-axis JOG operation, touch Forward rotation or Reverse rotation while checking the feed current value.

(7) To perform home position return for a single axis, touch [Home position return].

(8) To perform home position return simultaneously for all machine configuration axes, touch [Machine home position return].

Machine adjustment screen



(1) To change the machine No. for which adjustment is to be performed, touch the numerical display of [Machine No.].

(2) To adjust the machine, perform machine JOG operation, 1 Point machine program operation, and teaching while checking the feed coordinate position. (☞ Page 75 Machine JOG operation window screen)

(3) When checking the machine error, check the machine error detection lamp, error code, and warning code.

(4) After removing the cause of the error, touch Machine error reset to clear the machine error.

Point

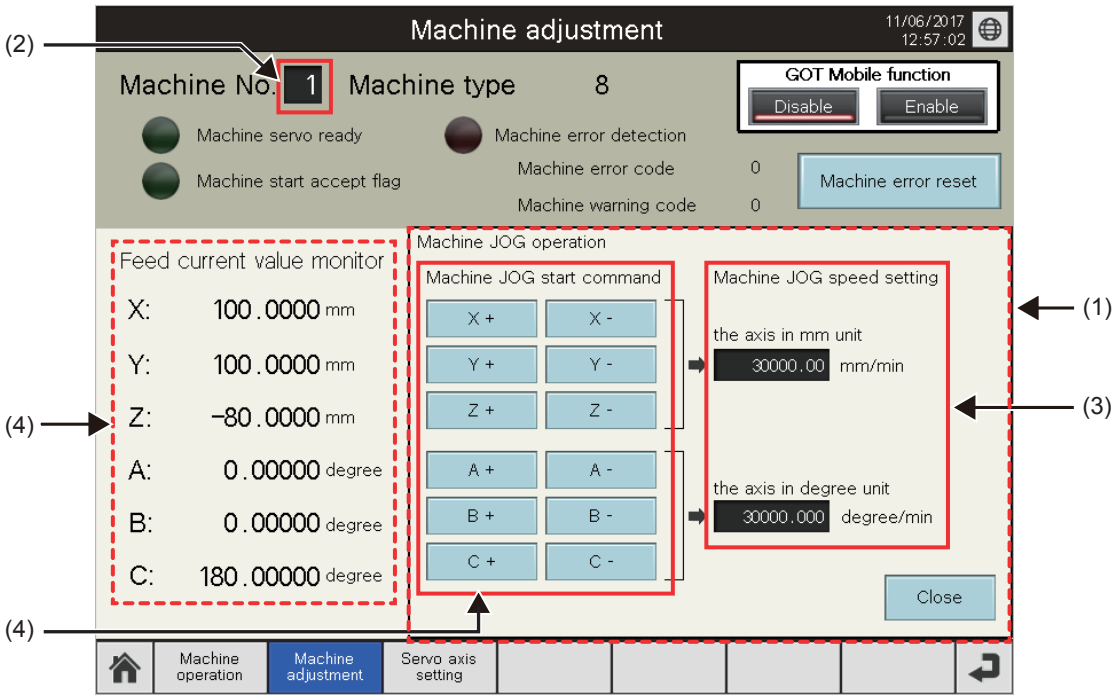
When a switch in (2) is touched, the pop-up window of the GOT mobile is displayed over the screen whether the GOT mobile function is enabled or disabled. The operation authority can be acquired and display position can be switched. For the details, refer to the following.

📖GT Designer3 (GOT2000) Screen Design Manual

Precautions

Even if the error is cleared by touching Error reset, the error display of the dot matrix LED on the motion controller is not cleared. Clear the error separately from [Motion CPU error batch monitor] of MT Developer2.

Machine JOG operation window screen



(1) Settings and operations related to the machine JOG operation are performed on the machine JOG operation window screen.

(2) To change the machine No. for which adjustment is to be performed, touch the numerical display of [Machine No.].

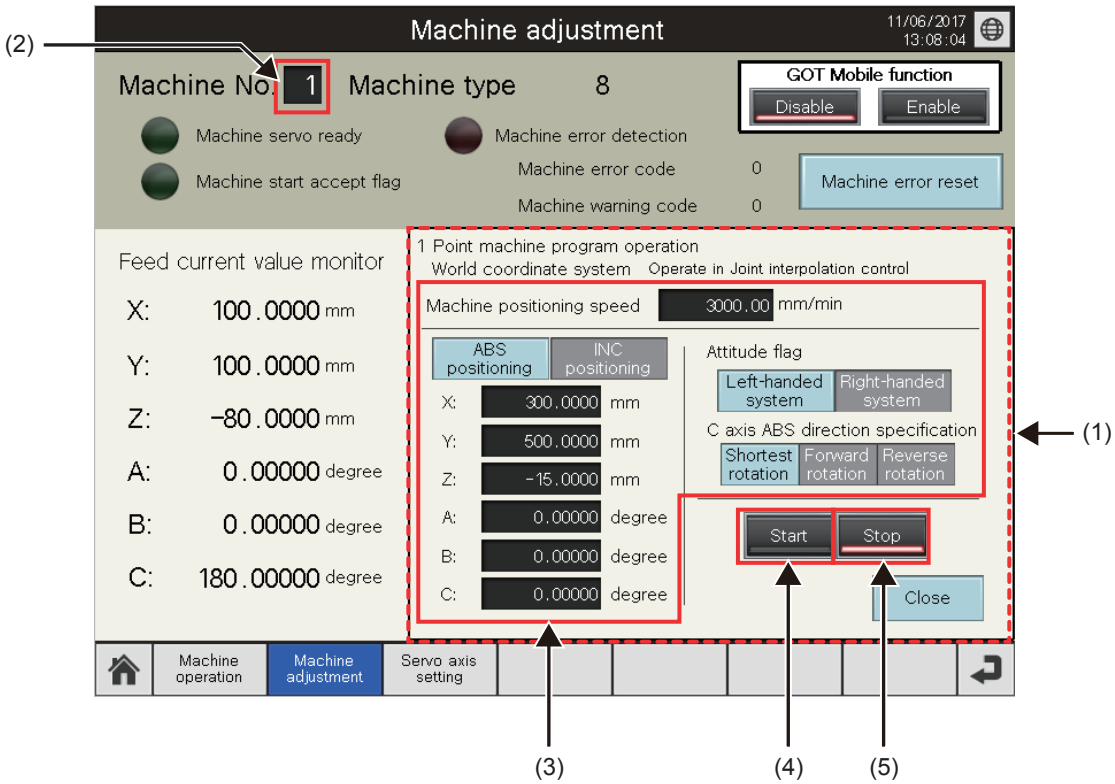
(3) To set the machine JOG speed, touch the speed numerical display of the axis in mm unit (coordinates X to Z) and the axis in degree unit (coordinates A to C).

(4) To move each coordinate at the specified JOG speed, touch the machine JOG start command of each coordinate while checking the feed coordinate position.

Precautions

When the machine No. is changed, the JOG speed setting switches to the setting of each machine.

1 Point machine program operation window screen



(1) Settings and operations of the 1 Point machine program operation are performed on the 1 Point machine program operation window screen.

(2) To change the machine No. for which adjustment is to be performed, touch the numerical display of [Machine No.].

(3) To change the 1 Point machine positioning data, touch the positioning speed, target coordinate/movement amount, attitude flag, and C axis ABS direction specification.

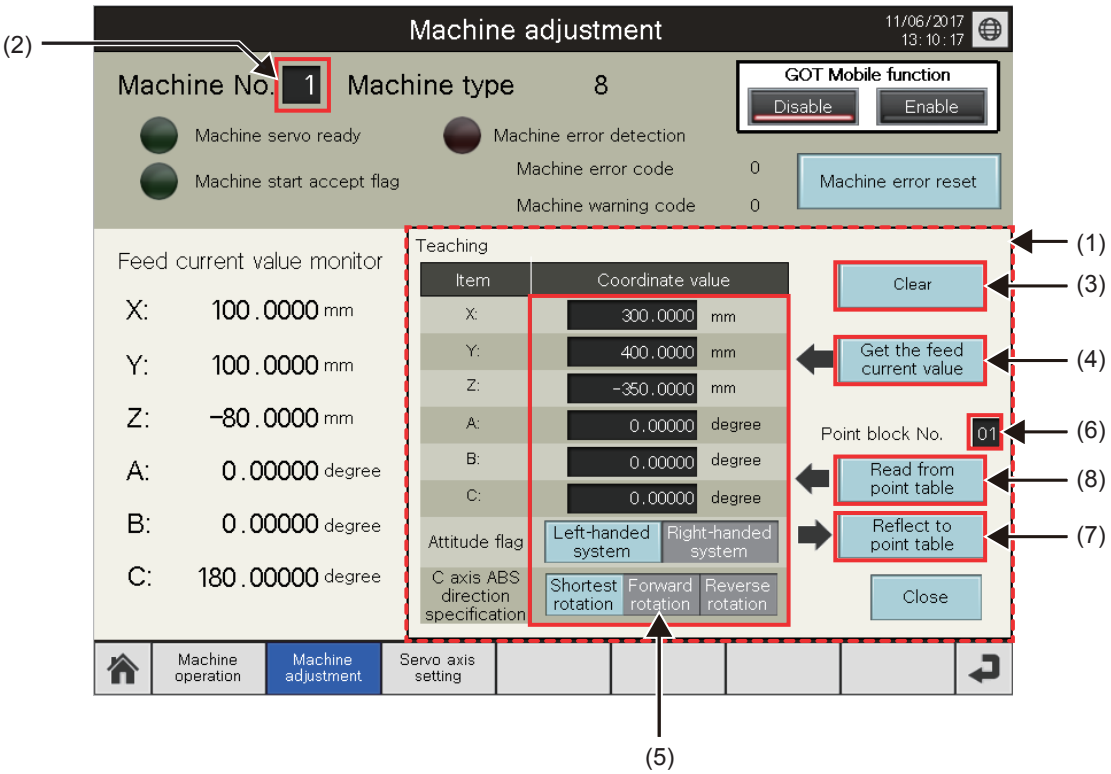
(4) To start the 1 Point machine program operation, touch [Start].

(5) To stop the operation, touch [Stop].

Precautions

- The 1 Point machine positioning data is common in all machines.
- The machine No. cannot be changed during startup.
- The joint interpolated motion control is applicable to the 1 Point machine positioning. Although the axes are moved to the end coordinates, the route may not be a straight line.

Teaching window screen



(1) Referral and editing of point block data are performed on the Teaching window screen.

(2) To change the machine No., touch the numerical display of [Machine No.].

(3) To clear the displayed teaching data, touch [Clear].

(4) To teach the feed coordinates position of the selected machine, touch [Get the feed current value].

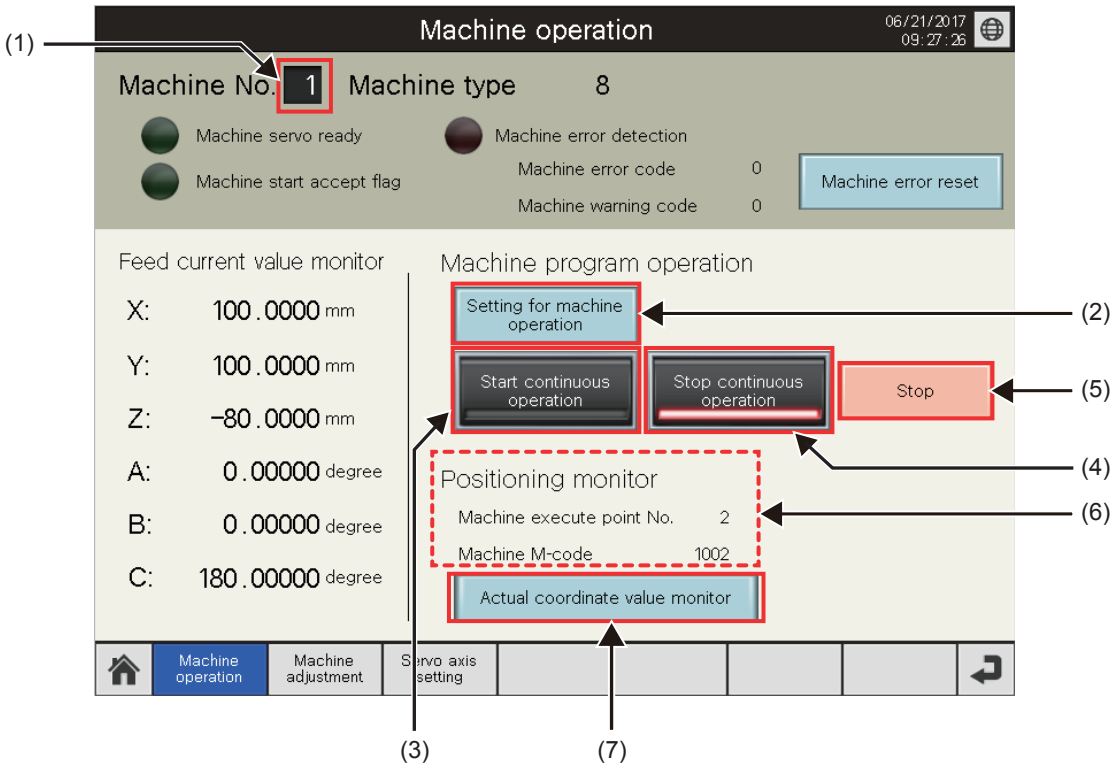
(5) Change the coordinate values, attitude flag, and C axis ABS direction specification as necessary.

(6) To specify the storage destination of the teaching data, touch the numerical display of [Point block No.].

(7) To save the teaching data, touch [Reflect to point table].

(8) To read the teaching data, touch [Read from point table].

Machine operation screen



(1) To change the machine No. to be operated, touch the numerical display of [Machine No.].

(2) To set the operation contents, touch [Setting for machine operation]. (☞ Page 79 Machine program operation setting window screen)

(3) To perform repeated operation of the set operation contents, touch [Start continuous operation].

(4) To move up to the final positioning point and then stop, touch [Stop continuous operation].

(5) To stop immediately, touch [Stop].

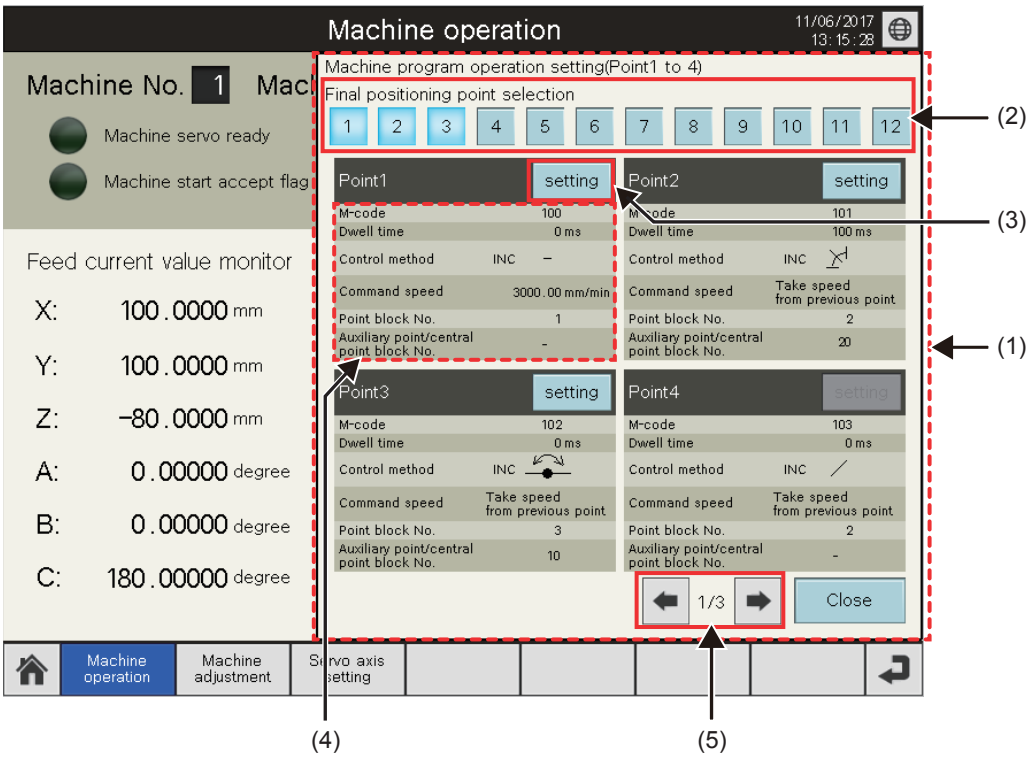
(6) To check the points being executed, check [Positioning monitor].

(7) To monitor the actual coordinates including the effect of the residual pulse of the servo amplifier, touch [Actual coordinate value monitor]. The actual coordinate value monitor window screen is overlapped and displayed.

Precautions

The machine No. can be changed only when the machine is stopped.

Machine program operation setting window screen



(1) When [Setting for machine operation] is touched on the Machine operation screen, the machine program operation setting window is overlapped and displayed.

(2) Touch each number of the final positioning point selection, and set the number of positioning points in the range of 1 to 12.

(3) Touch [Setting] of each positioning point, and then set the positioning point data. (☞ Page 80 Point setting window screen)

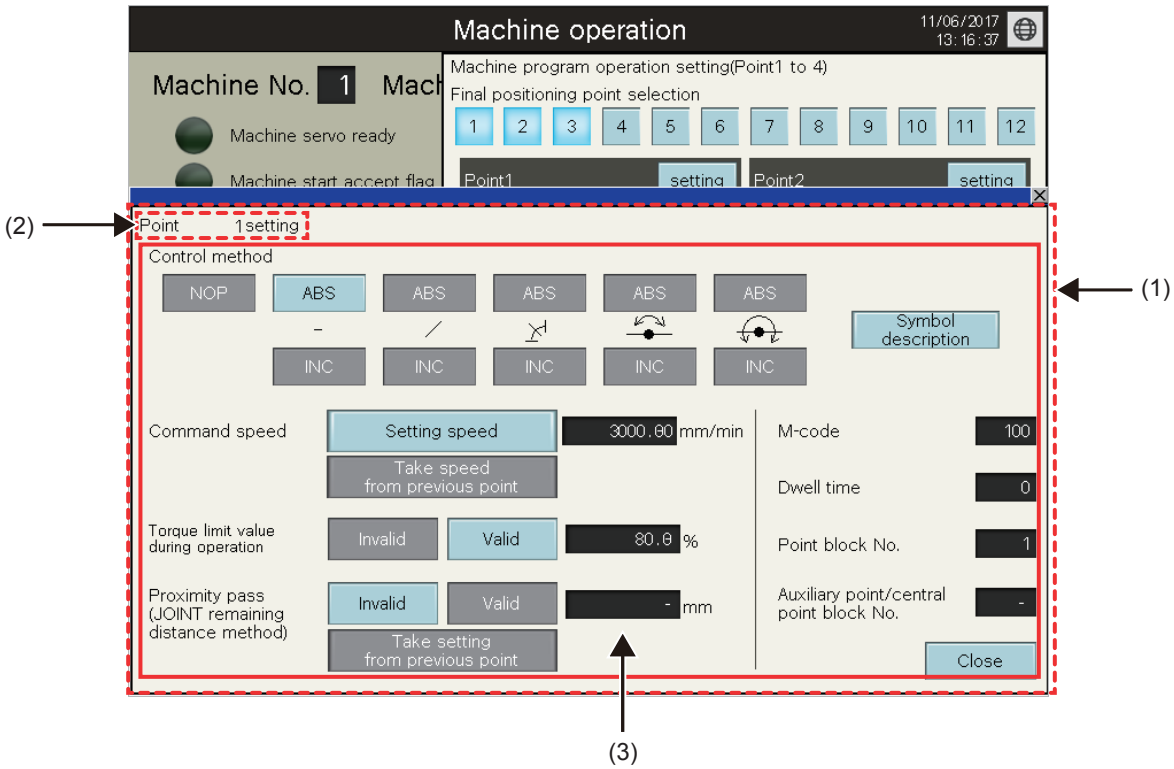
(4) Check the positioning point setting contents of each point.

(5) Touch the Move page switch to move to the setting screen of the positioning points that are not displayed.

Precautions

- The setting for machine operation can be changed only when the machine is stopped.
- Some of the settings are not displayed on this screen.

Point setting window screen



(1) When [Setting] for each point is touched on the Machine program operation setting window, the point setting screen is overlapped and displayed.

(2) The point number being edited is displayed at the top left of the overlapping window.

(3) Set the various types of operation data.

4.8 Operation Procedure of Vision Tracking Program Example

Follow the steps below to start operation.

For the function details of each screen, refer to the following.

☞ Page 84 SCREENS FOR MACHINE CONTROL PROGRAM EXAMPLES

* The Vision Tracking function is supported in the project for R8. In other projects, some of the screens and switches described below are not displayed.

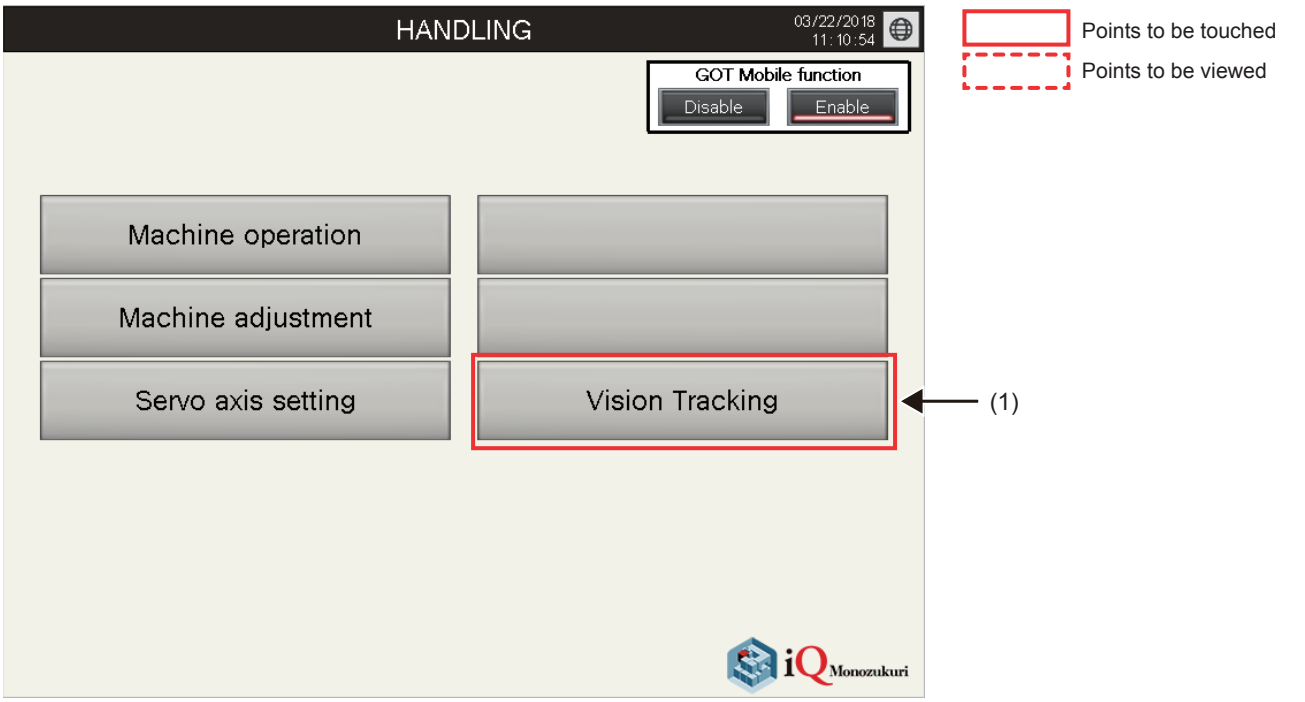
Precautions

For the operation such as the startup of the axis to be used and teaching for the point block data, refer to the following.

☞ Page 72 Operation Procedure of Application Program Example

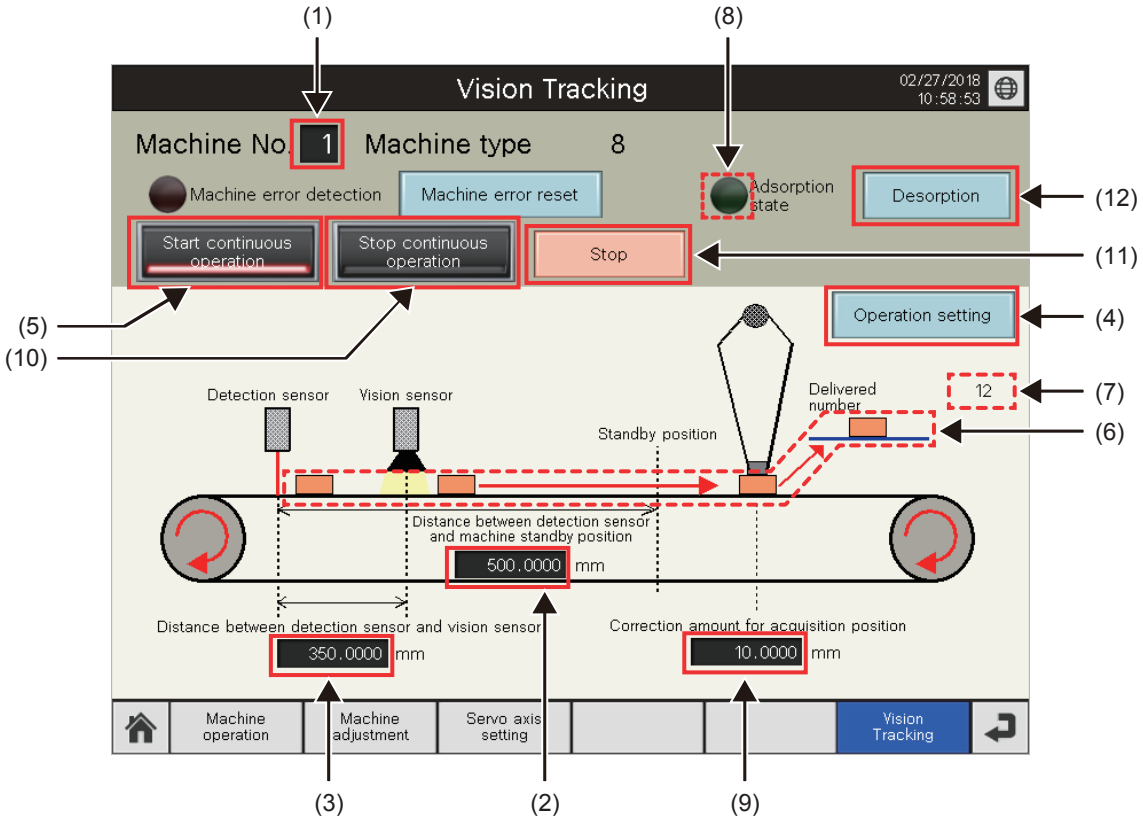
This section describes the procedure for starting up the Vision Tracking with the home position return and point blocks set.

Home screen



(1) Write the project data to the PLC CPU, Motion CPU, and GOT. After starting up the system, touch the [Vision Tracking] switch to open the Vision Tracking screen.

Vision Tracking screen



(1) Set the machine No. to be controlled by the Vision Tracking. If the machine No. has been set in the machine adjustment, the setting will be inherited.

(2) Set the distance between the detection sensor and machine standby position on the conveyor.

(3) Set the distance between the detection sensor and vision sensor on the conveyor.

(4) Touch the [Operation setting] switch to open the Operation setting window screen and configure the operation setting. For the operation of the Operation setting window screen, refer to the following.

☞ Page 83 Operation setting window screen

(5) After the setting is completed, touch the [Start continuous operation] switch. Note that the machine mechanism starts moving to the standby position when the operation is started.*1

(6) During the operation, the workpiece images are turned on and off in conjunction with the operations such as detection of the workpiece, vision sensor processing, and machine control.

(7) The number of delivered workpieces is displayed. This value is retained even after the operation ends, and reset when the operation is started.

(8) The [Adsorption state] lamp turns on according to the adsorption signal.

(9) Correct the deviation of the coordinate X (horizontal to the conveyor) at the workpiece acquisition position. Since this data is reflected instantly, use it for minor adjustment. (When the amount of deviation is large, review the setting value of (2) and the Vision sensor settings.)

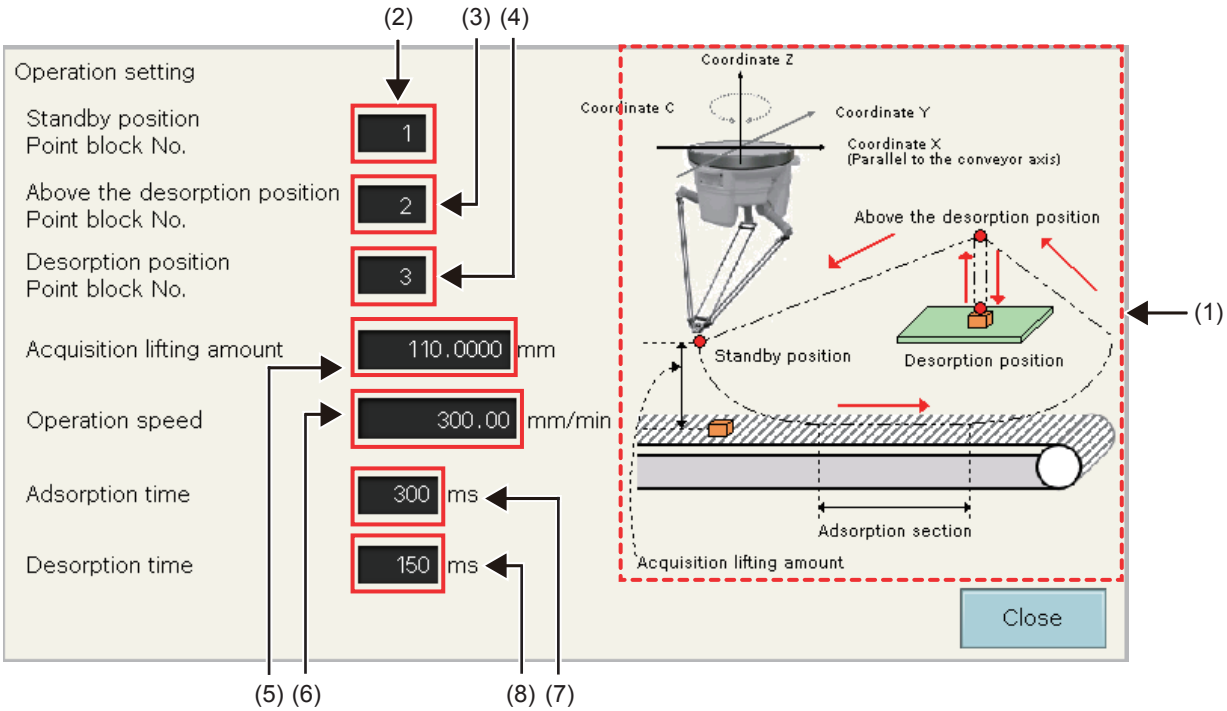
(10) To end the operation, touch the [Stop continuous operation] switch. The operation stops after the machine acquires the workpieces detected by the detection sensor before this switch is touched.

(11) To stop the operation while it is running or ending, touch the [Stop] switch. The operation stops immediately. (When the machine control axis is running, the operation decelerates and stops.)

(12) When the operation is stopped during the adsorption, the adsorption signal remains ON (adsorption state). By touching the [Desorption] switch after the workpiece is moved to a safe position on the Machine adjustment screen, the desorption signal turns OFF (desorption state).

*1 Start the conveyor separately. This program example does not control the conveyor.

Operation setting window screen



(1) This area shows the contents of the setting items. Set the following items (2) to (8) referring to this area.

(2) Set the machine initial position and standby position to wait for the workpiece. The positions are specified with the point block No. Set the coordinate position on the teaching window screen of the Machine adjustment screen.

(3) Set the position above where the workpiece is desorbed.

(4) Set the position where the workpiece is desorbed.

(5) Set the movement amount of workpiece acquisition. When the machine moves to acquire the workpiece from the standby position, the machine descends according to the setting value while synchronizing with the conveyor, and ascends by the equivalent amount after acquiring the workpiece.

(6) Set the operation speed of machine control. While the machine is synchronizing with the conveyor, it operates at the conveyor speed.*1

(7) Set the time for acquiring (adsorbing) the workpiece. After descending for acquisition, the machine stays for the adsorption time. (At this time, the machine moves in the conveyor direction synchronizing with the conveyor.)

(8) Set the time for releasing the workpiece at the desorption position. After the machine reaches the desorption position, the desorption signal turns OFF and the machine waits for the setting time.

*1 This program example does not control the conveyor. Set the conveyor speed separately.

5 SCREENS FOR MACHINE CONTROL PROGRAM EXAMPLES

The following screen examples correspond to the program examples for machine control.
Customize them (by utilizing the program) in accordance with the customer's usage environment just as the program examples.

Precautions

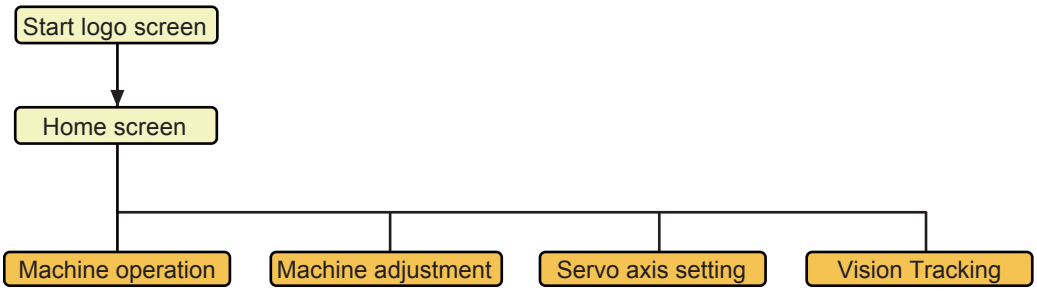
- To utilize these screen examples for an actual system, sufficiently confirm that the screens will not cause system control problems on user's own responsibility. Examine the positions where interlock conditions are required in a target system and add them.
- There are slight differences in color and layout between the actual screens and the screens described in this chapter.
- In the mobile screen, displayed color and layout may differ depending on the browser used. Adjust the color and layout depending on the usage environment.

5.1 Screen Layout

Screen transition (All screens)

The following shows the screen transition of all screens.

- When the GOT is started, the start logo screen appears first. For details, refer to "Page 90 Start logo screen".
- After the start logo screen has appeared, the Home screen appears. However, when the GOT is started for the first time, the Language Setting window screen appears after the start logo screen has appeared. For details of the operation of when the GOT is started for the first time, refer to "Page 90 Operation to be performed when the GOT is started for the first time".
- For the screen transition common in all screens, refer to "Page 85 Screen transition (Common)".
- The Vision Tracking screen is displayed only when the Vision Tracking program example (project for R8) is used.



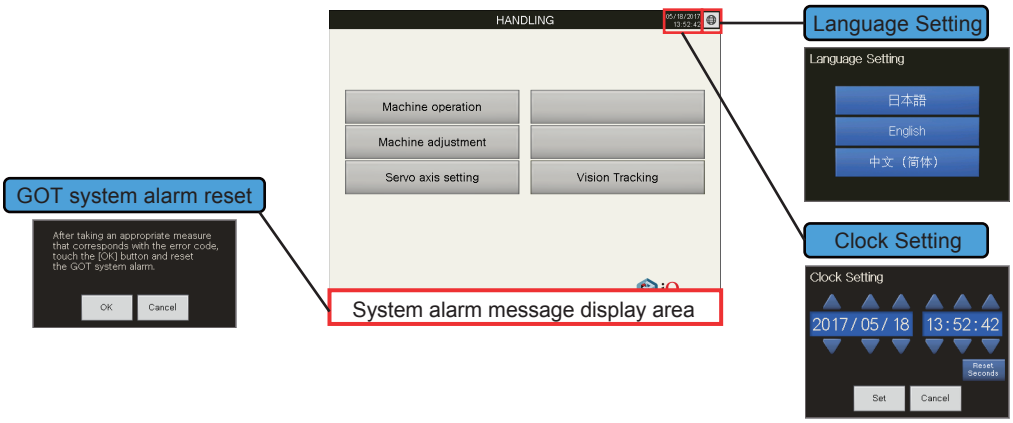
Point

When a window screen has been displayed and the screen is switched to another main screen, the window screen will be closed and switched to the touched main screen.

Screen transition (Common)

The following shows the screen transition common in all screens.

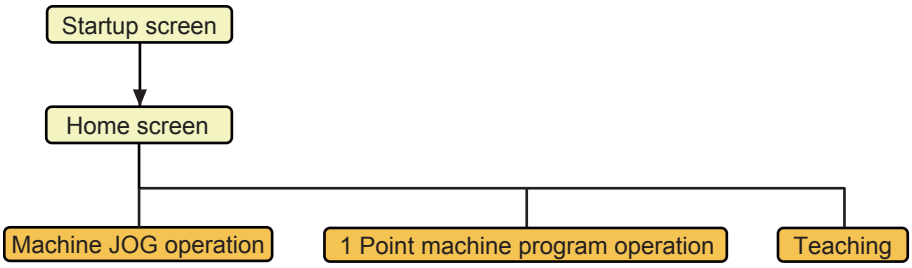
- Touching the globe mark switch displays the Language Setting window screen for language switching.
- Touching the date and time display area displays the Clock Setting window.
- When a GOT system alarm has occurred, touching the system alarm message display area that is to be displayed at the bottom of the screen displays the GOT system alarm reset window screen.



Screen transition (Mobile screen)

The following shows the screen transition of the mobile screen.

- When the GOT is started, the logo screen appears first. Touching the screen switches the screen to the Home screen.
- Switch the screen to each operation screen from the Home screen.
- Each operation screen can also be switched to another operation screen.
- When the operational authority is not acquired, the machine JOG operation screen, 1 Point machine program operation screen, and teaching screen cannot be operated. For acquiring the operational authority, refer to GOT Mobile function enable/disable area on "Page 91 Home screen" and Setting for using the GOT Mobile function on "Page 112 Mobile Screen".



5.2 Basic Screen Layout

The following shows the basic layout of a main screen.

(1) Title display area	(2) Date and time display area	(3) Language setting area
(4) Function area		
(5) Main menu display area		
(6) System alarm message display area		

(1) Title display area

The title bar is displayed. For details, refer to "Page 88 Title bar".

(2) Date and time display area

The current date (upper side) and time (lower side) are displayed. Touch this display area to display the Clock Setting window screen.

For details of the Clock Setting window screen, refer to "Page 90 Window screens common to all screens".

(3) Language setting area

Touch the globe mark switch to display the Language Setting window screen.

For details of the Language Setting window screen, refer to "Page 89 Window screens common to all screens".

(4) Function area

The screen of each function is displayed.

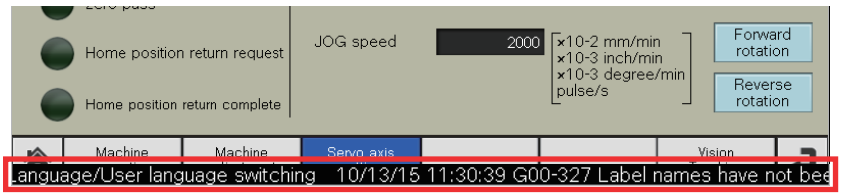
For details, refer to "Page 91 Base Screen".

(5) Main menu display area

The screen transition switches to display each main screen are displayed.

For details of the main menu switches, refer to "Page 88 Main menu".

(6) System alarm message display area



When a GOT system alarm occurs, a system alarm is displayed overlapping the bottom of the screen that is being displayed.

For details on the GOT system alarms, refer to "Page 89 GOT system alarm".

5.3 Description of Common Items

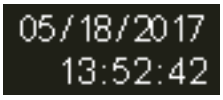
Definitions of character colors

The following table lists colors used for numerical values and characters displayed as setting values or current values.

Character colors	Background colors	Description	Example
White	Black	The value of the target data which can be changed using the key windows to be displayed when the display area is touched	Machine No. 1
Black	—	Value of the target data which cannot be changed by operating the GOT	Machine type 8

Switch

The following table lists switches used in common.

Display	Description
	Touch this switch to display the Language Setting window screen.
	Touch this switch to display the Clock Setting window screen.

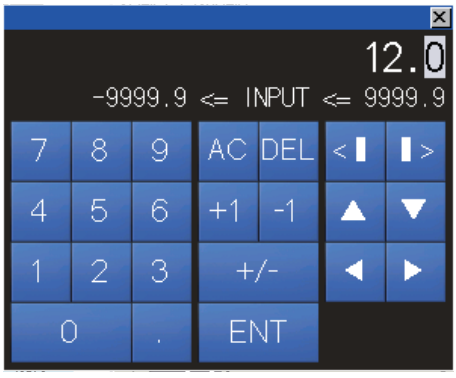
Key window

Use the following user creation key windows for inputting numerical values.

Object	Type of key window	Window screen
Numerical value input	Decimal key window	W-30010

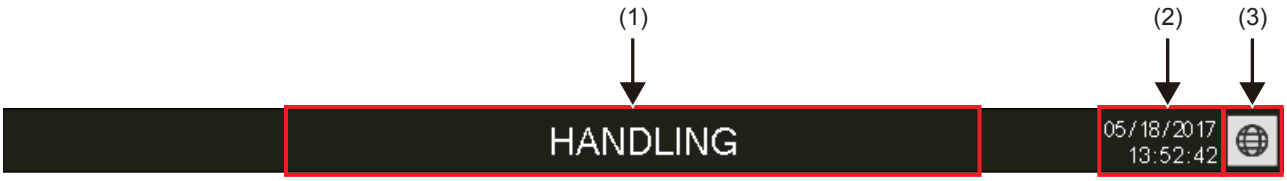
Numerical value input (Decimal key window)

Numerical values (decimal numbers) can be input using the numeric keypad. The input range is displayed at the bottom of the input value area.



Title bar

The title bar is displayed as follows in all screens.

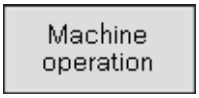


- The title of the currently-displayed screen is displayed in (1).
- The date and time are displayed in (2). When the date and time display area is touched, the Clock Setting window screen appears. On the window screen, year, month, date, hour, minute, and second can be changed. For details of the Clock Setting window screen, refer to "Page 90 Window screens common to all screens".
- Touching the globe mark switch in (3) displays the Language Setting window screen. The display language can be switched. For details of the Language Setting window screen, refer to "Page 89 Window screens common to all screens".

Main menu

Touching a switch with a main screen name jumps to the corresponding screen.
The blue switch indicates the screen being displayed.
<Main menus>

<List of switches>

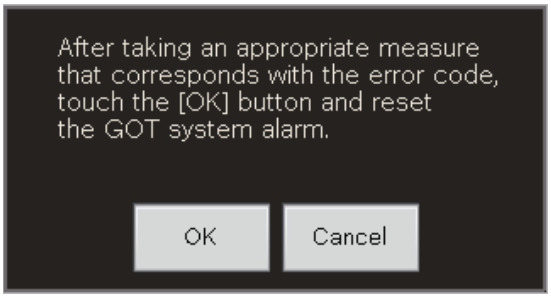
Display	Description
	Touch this switch to return to the Home screen.
	Touch this switch to jump to each screen. When a switch other than the one of the screen being displayed is touched, the switch color changes to blue and the screen of the touched switch is displayed. The switches on the Vision Tracking screen are displayed only when the Vision Tracking program example (project for R8) is used.
	Touch this switch to return to the previous screen. Up to 10 previous screens are kept in the screen history. No operation is performed if an attempt is made to return to a previous screen that is older than the maximum 10 screens in the screen history.

GOT system alarm

If a GOT system alarm has occurred, a system alarm message pops up at the bottom of the screen as follows. The system alarm message is displayed running from right to left of the screen at a low speed in the order of the occurrence date and time, comment, and detailed information.

The GOT system alarm message is displayed in the language set in the Language Setting window screen. If no PLC CPU has been connected or the PLC CPU is off when the GOT is started, a GOT system alarm message is displayed in English.

When a GOT system alarm has occurred, touching the system alarm message display area displays the GOT system alarm reset window.



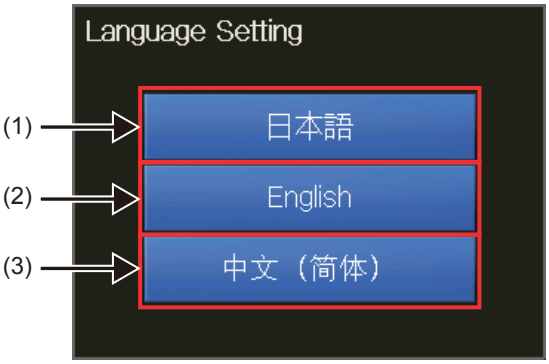
- Touch the [OK] switch when you reset the system alarm. The system alarm that cannot be reset is not cleared even though the [OK] switch is touched.
- Touch the [Cancel] switch when you do not reset the system alarm.
- Even though the main screen is switched while the GOT system alarm reset window screen is being displayed, the GOT system alarm reset window screen is not closed but still displayed.

Window screens common to all screens

The following explains window screens common to all screens.

Language Setting window screen

The language displayed on the screen can be switched.



(1) Switch for switching to Japanese

The language switches to Japanese when this switch is touched.

(2) Switch for switching to English

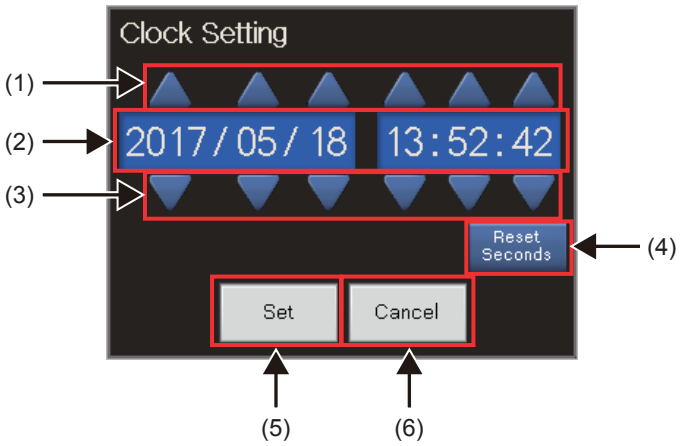
The language switches to English when this switch is touched.

(3) Switch for switching to Chinese (Simplified)

The language switches to Chinese (Simplified) when this switch is touched.

Clock Setting window screen

This screen is used to change the current date and time.



(1) Date/time data addition switch

Touch an addition switch (year, month, date, hour, minute, second) to add one to each value.

(2) Date and time setting

The date and time (year, month, date, hour, minute, and second) can be set.

The following shows the input range of each item.

- Year: 2000 to 2099, Month: 01 to 12, Date: 01 to 31
- Hour: 00 to 23, Minute: 00 to 59, Second: 00 to 59

(3) Date/time data subtraction switch

Touch a subtraction switch (year, month, date, hour, minute, and second) to subtract one from each value.

(4) 0 Set switch

Touch the [Reset seconds] switch to set the second to 00.

(5) [Set] switch

Touch this switch to set the current date and time and close the window screen.

(6) [Cancel] switch

Touch this switch to close the window screen without reflecting the set date and time.

Point

If the date and time that does not exist (example: 2016/2/30) is set, the setting is not reflected and window screen is closed. At that time, a GOT system alarm occurs and "The value input as clock data is out of range." is displayed in the system alarm message display area.

5.4 When the GOT is Started

Start logo screen

In the start logo screen that is to be displayed when the GOT is started, the iQ Monozukuri logo appears at the center of the screen.

Operation to be performed when the GOT is started for the first time

When the GOT is started for the first time, the Language Setting window screen appears after the start logo screen has appeared. Select a language.

For details of the Language Setting window screen, refer to "Page 89 Language Setting window screen".

5.5 Base Screen

The following table lists base screens.

Screen No.	Screen title	Description	Reference
30000	Home	Home screen	Page 91
30050	Header	Title bar	Page 88
30100	Machine operation	Machine operation screen	Page 93
30200	Machine adjustment	Machine adjustment screen	Page 96
30300	Servo axis setting	Servo axis setting screen	Page 98
30600	Vision Tracking	Vision Tracking screen	Page 102

Point

• Display when the control unit is mm

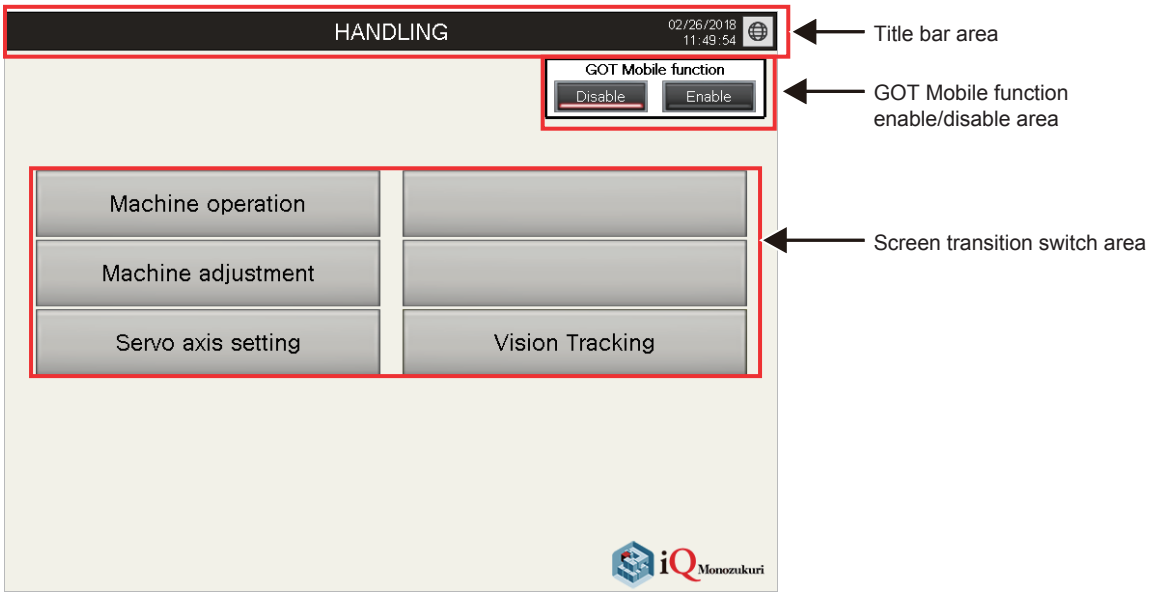
In MT Works2, the feed coordinate value is displayed in [0.1 μm].

On the GOT screen, the feed coordinate value is displayed in [0.0001 mm].

(This setting can be changed based on the setting of decimal digits automatic adjustment in GT Designer3.)

Home screen

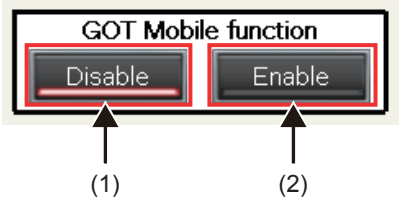
After the GOT is started, the Home screen appears first. Touch a switch to switch to each screen.



Title bar area

In the Home screen, the application package name, "HANDLING", is displayed at the center of the title bar.

GOT Mobile function enable/disable area



(1) GOT Mobile function disable switch

Touch this switch to prohibit acquisition of the operational authority from devices other than the master GOT and disable the guaranteed time of operational authority.

(2) GOT Mobile function enable switch

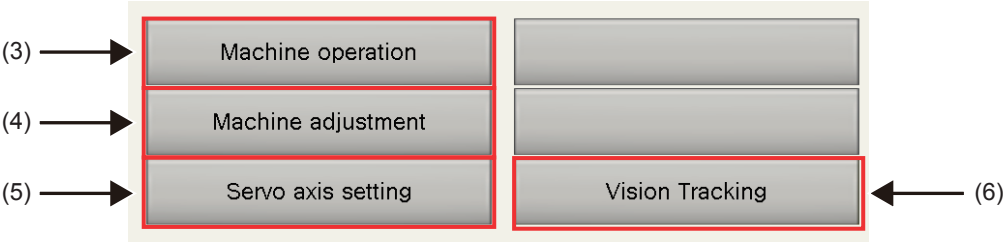
Touch this switch to allow acquisition of the operational authority from the devices other than the master GOT. When acquisition of the operational authority from devices other than the master GOT is allowed, the screen cannot be switched to another screen.

Point

- For the details of the screen, refer to "Page 112 Mobile Screen".
- Check that the mobile device is not in operation before disabling the GOT Mobile function. Even if the GOT Mobile function is disabled, the switch being operated in the mobile screen continues operation until the operation ends.

Screen transition switch area

Touch a switch while the GOT Mobile function is disabled to switch the corresponding screen. For disabling the GOT Mobile function, refer to the "Page 92 GOT Mobile function enable/disable area".



(3) Machine operation switch

Touch this switch to switch to the "Machine operation" screen.

(4) Machine adjustment switch

Touch this switch to switch to the "Machine adjustment" screen.

(5) Servo axis setting switch

Touch this switch to switch to the "Servo axis setting" screen.

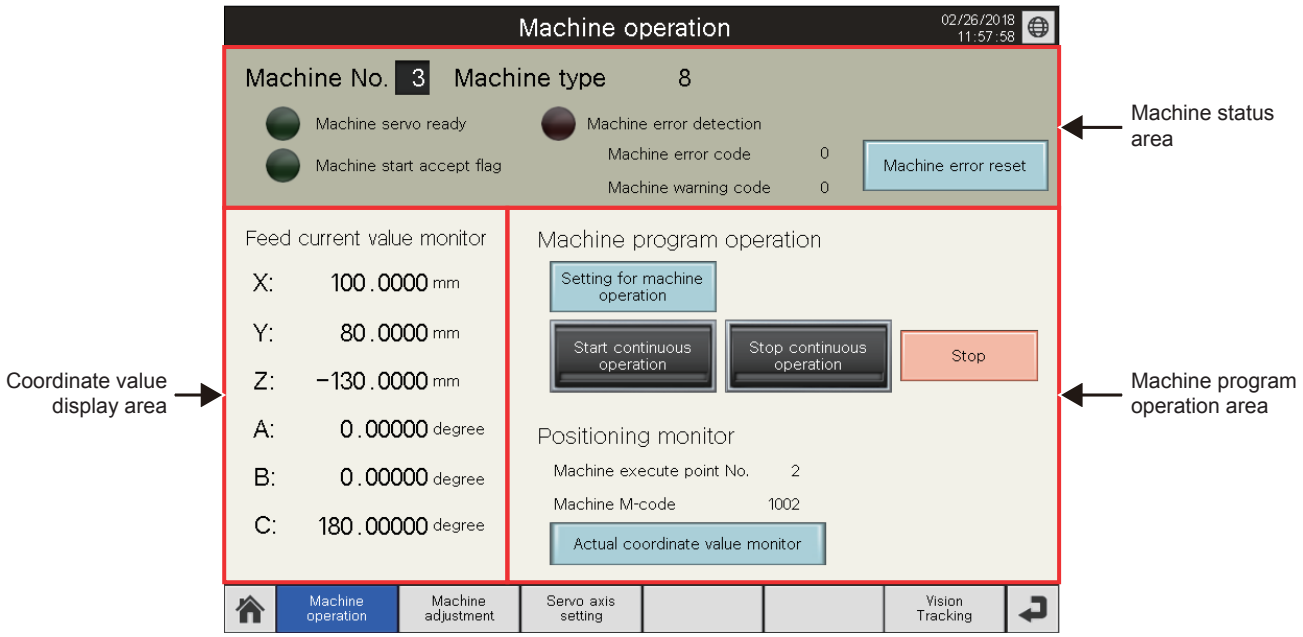
(6) Vision Tracking

Touch this switch to switch to the "Vision Tracking" screen.

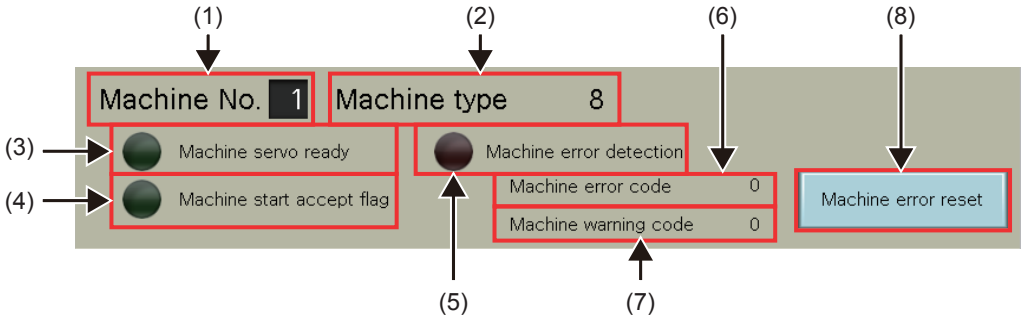
This switch is displayed only when the Vision Tracking program example (project for R8) is used.

Machine operation screen

This screen is used to set, start, or stop the machine program operation of the simplified robot. The coordinate positions and machine program operation status during operation can be monitored.



Machine status area



(1) Machine No.

Enter the machine No. to be controlled. The machine No. entered here is set and monitored on this screen. The machine No. cannot be changed while the GOT Mobile function is enabled.

(2) Machine type

The machine type is displayed. If a machine No. that has not been set is entered, "NONE" is displayed.

(3) Machine servo ready

The machine servo ready status is monitored.

(4) Machine start accept flag

The machine start accept flag status is monitored.

(5) Machine error detection

The machine error detection status is monitored.

(6) Machine error code

A machine error code is displayed.

(7) Machine warning code

A machine warning code is displayed.

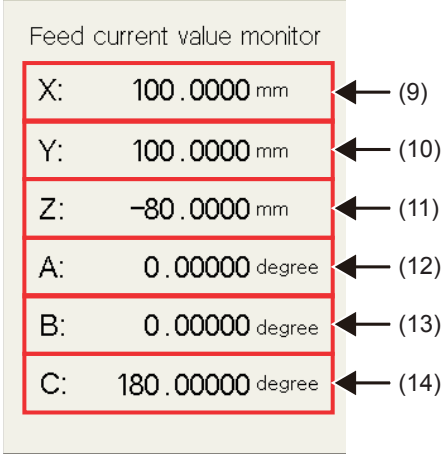
(8) Machine error reset switch

The machine error and machine warning are reset.

Point

The machine status area is common to the Machine operation screen and the Machine adjustment screen.

Coordinate value display area



(9) Feed coordinate position: X

The feed coordinate value: X of world coordinate is displayed.

(10) Feed coordinate position: Y

The feed coordinate value: Y of world coordinate is displayed.

(11) Feed coordinate position: Z

The feed coordinate value: Z of world coordinate is displayed.

(12) Feed coordinate position: A

The feed coordinate value: A of world coordinate is displayed.

(13) Feed coordinate position: B

The feed coordinate value: B of world coordinate is displayed.

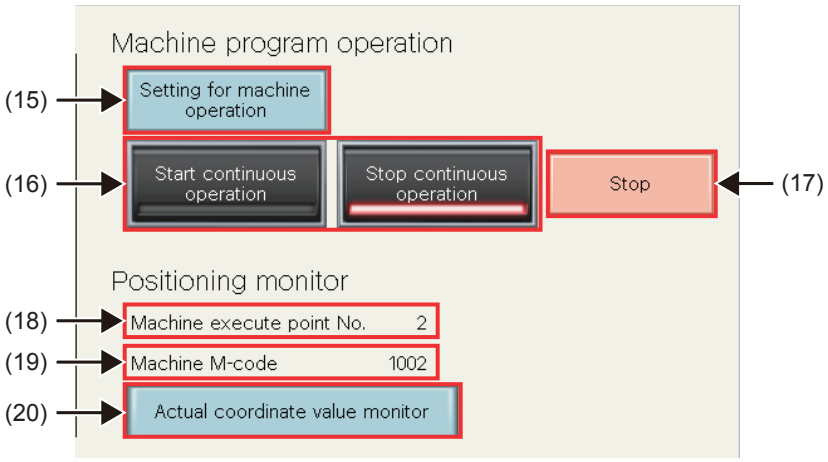
(14) Feed coordinate position: C

The feed coordinate value: C of world coordinate is displayed.

Point

The coordinate value display area is common to the Machine operation screen and the Machine adjustment screen.

Machine program operation area



(15) Setting for machine operation switch

Touch this switch to display the Machine program operation setting window screen. For details on the Machine program operation setting window screen, refer to "Page 105 Machine program operation setting window screen".

(16) Continuous operation switches (Start/Stop)

Touch the [Start continuous operation] switch to start the machine program operation.

Touch the [Stop continuous operation] switch to perform Cycle Stop of the machine program operation (up to the end point).

Depending on the operation state, the lamp at the bottom of the switch lights up in red. The lighting pattern is shown below.

Status	Start continuous operation switch	Stop continuous operation switch
Operating	ON	OFF
During Cycle Stop	Flashing	ON
Stopped	OFF	ON

(17) Stop switch

Touch this switch to gradually stop the running machine.

(18) Machine execute point No.

The machine execute point No. is displayed.

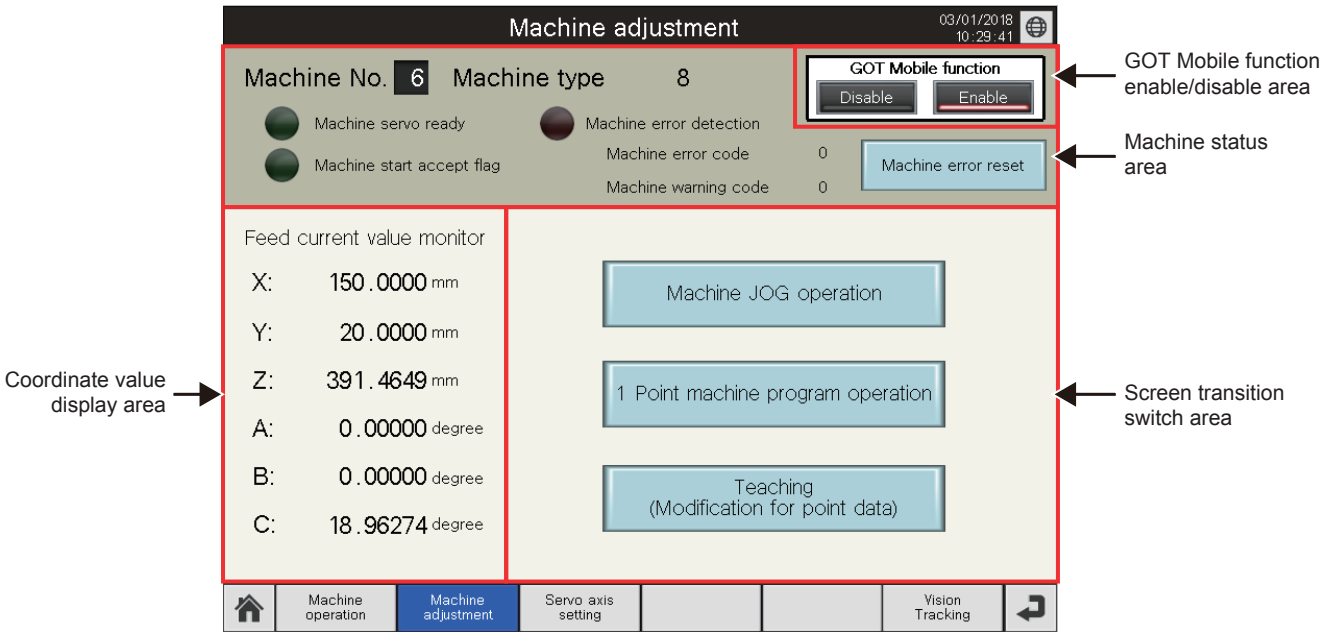
(19) Machine M-code

The machine M-code is displayed.

(20) Actual coordinate value monitor switch

Touch this switch to display the actual coordinate value monitor window screen. For details on the actual coordinate value monitor window screen, refer to "Page 110 Actual coordinate value monitor window screen".

Machine adjustment screen



GOT Mobile function enable/disable area

This is common with the Home screen. For details, refer to the GOT Mobile function enable/disable area in "Page 91 Home screen".

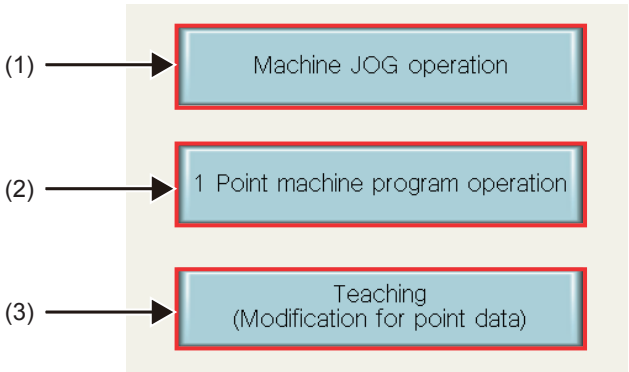
Machine status area

This is common with the Machine operation screen. For details, refer to the machine status area in "Page 93 Machine operation screen".

Coordinate value display area

This is common with the Machine operation screen. For details, refer to the coordinate value display area in "Page 93 Machine operation screen".

Screen transition switch area



(1) Machine JOG operation switch

Touch this switch to display the Machine JOG operation window screen. For details on the Machine JOG operation window screen, refer to "Page 107 Machine JOG operation window screen".

(2) 1 Point machine program operation switch

Touch this switch to display the 1 Point machine program operation window screen. For details on the 1 Point machine program operation window screen, refer to "Page 108 1 Point machine program operation window screen".

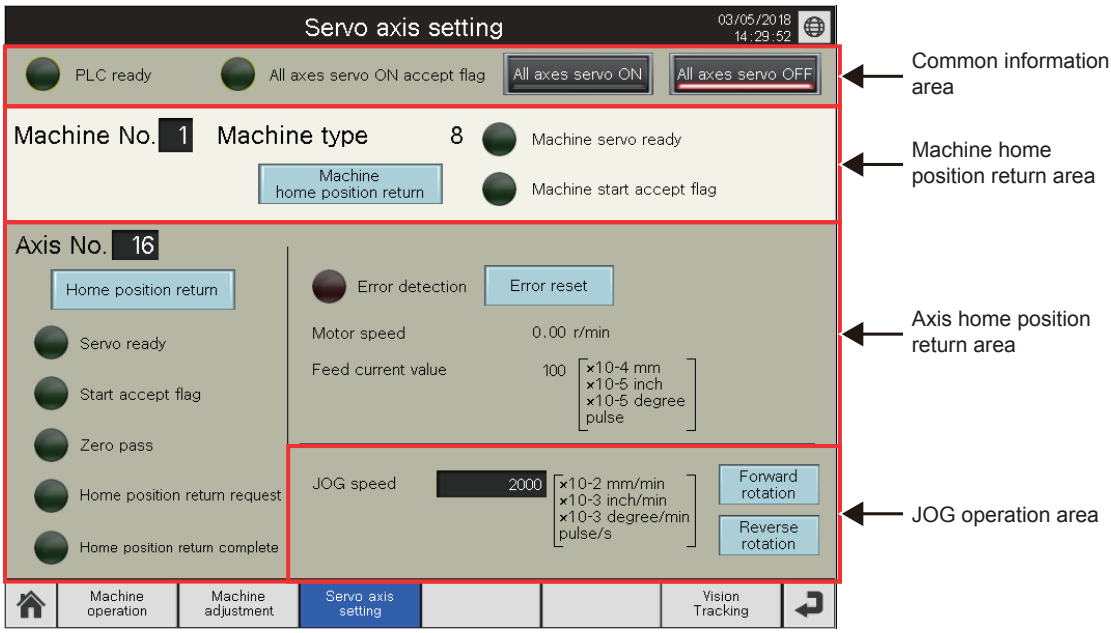
(3) Teaching (point data editing) switch

Touch this switch to display the Teaching window screen. For details on the Teaching window screen, refer to "Page 109 Teaching window screen".

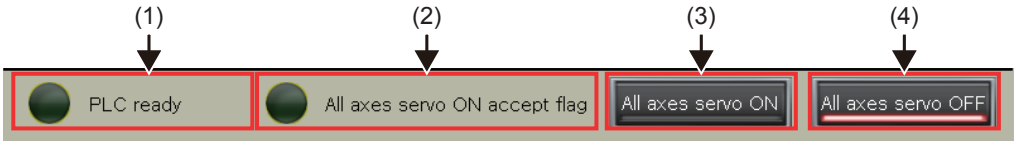
Point

The system alarm message display is disabled while the pop-up window of the GOT network interaction function is displayed.

Servo axis setting screen



Common information area



(1) PLC ready

The PLC ready status is displayed.

(2) All axes servo ON accept flag

The all axes servo ON accept flag status is displayed.

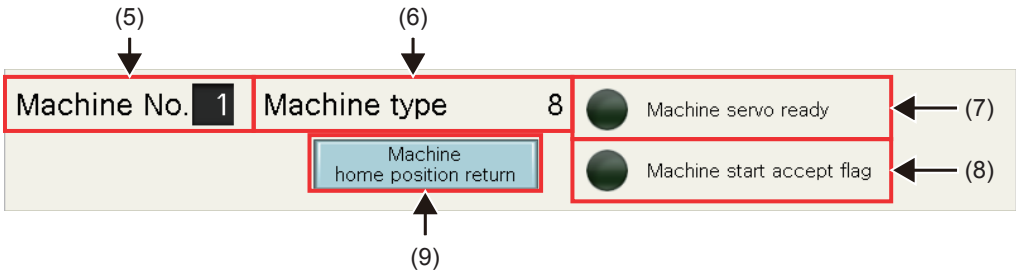
(3) All axes servo ON switch

Touch this switch to set the all axes servo ON command.

(4) All axes servo OFF switch

Touch this switch to reset the all axes servo ON command.

Machine home position return area



(5) Machine No.

Enter the machine No. to be controlled. The machine No. entered here is set and monitored within this area.

(6) Machine type

The machine type is displayed. If a machine No. that has not been set is entered, "NONE" is displayed.

(7) Machine servo ready

The machine servo ready status is monitored.

(8) Machine start accept flag

The machine start accept flag is monitored.

(9) Machine home position return switch

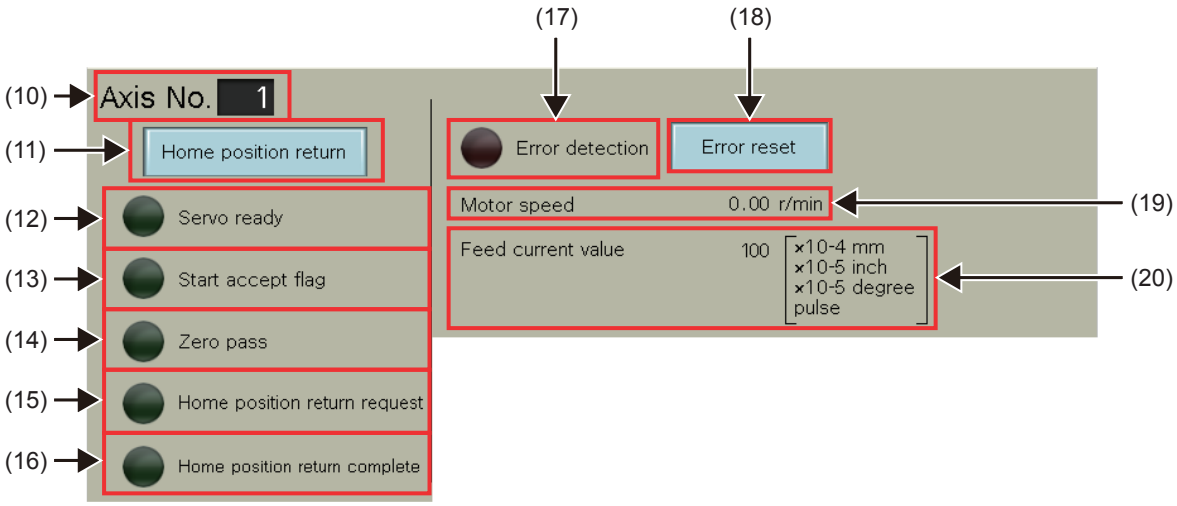
Touching this switch starts the batch home position return of the machine configuration axes.

Note that multiple axes may start operating depending on the home position return method of the machine configuration axes.

Point

In the program example for machine control, all home position return methods are data set 1. Thus, the axis does not operate and the current position is the home position.

Axis home position return area



(10) Axis No.

Enter the axis No. to be controlled. The axis No. entered here is set and monitored within this area.

(11) Home position return switch

Touching this switch starts the home position return. Note that the axis may start moving depending on the home position return method.

Point

In the program example for machine control, all home position return methods are data set 1. Thus, the axis does not operate and the current position is the home position.

(12) Servo ready

The servo ready status is monitored.

(13) Start accept flag

The start accept flag status is monitored.

(14) Zero pass

The zero pass status is monitored.

(15) Home position return request

The home position return request status is monitored.

(16) Home position return complete

The home position return complete status is monitored.

(17) Error detection

The error detection status is monitored.

(18) Error reset switch

The error and warning are reset.

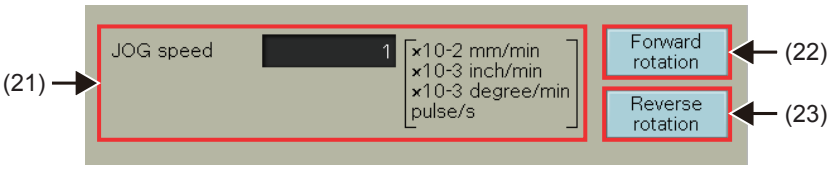
(19) Motor speed

The motor speed is monitored.

(20) Feed current value

The feed current value is displayed. Data without decimal point are displayed. Read the data according to the control unit of the target axis.

JOG operation area



(21) JOG speed

Enter the JOG speed without decimal point. Enter the data according to the control unit of the target axis.

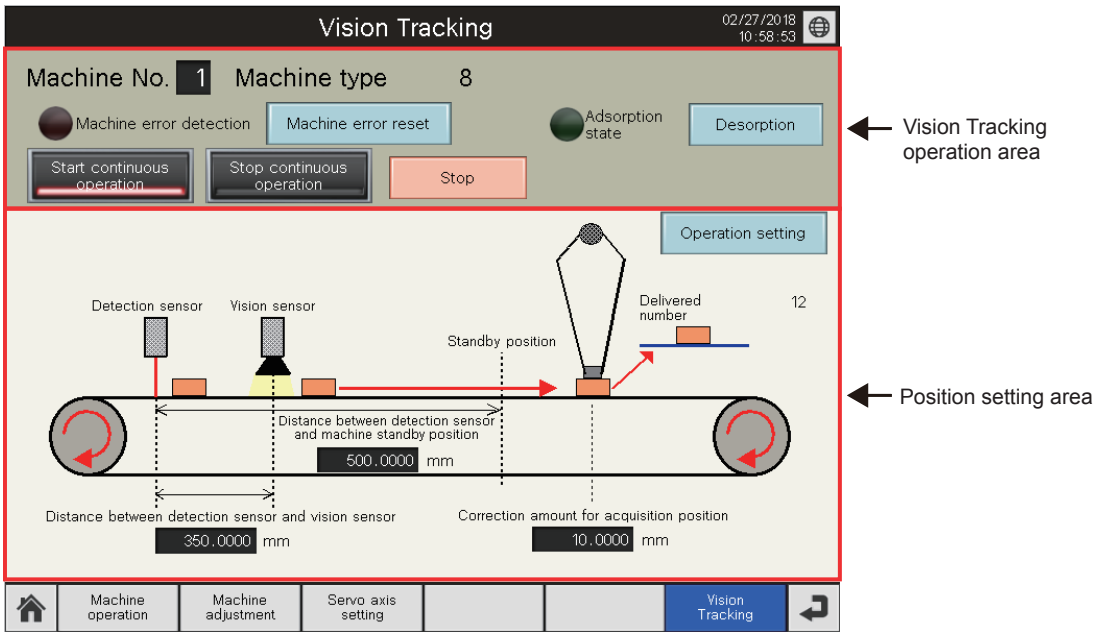
(22) Forward rotation JOG switch

JOG operation is performed in the forward-rotation direction while this switch is touched.

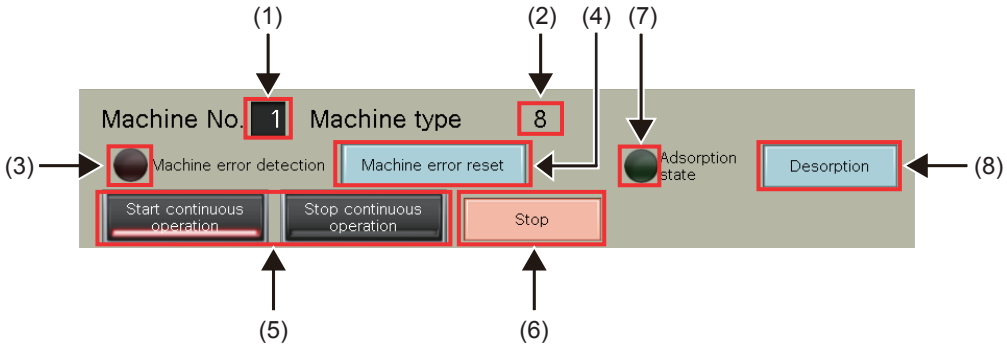
(23) Reverse rotation JOG switch

JOG operation is performed in the reverse-rotation direction while this switch is touched.

Vision Tracking screen



Vision Tracking operation area



(1) Machine No.

Enter the machine No. to be controlled. The machine No. entered here is set and monitored on this screen.

(2) Machine type

The machine type is displayed. If a machine No. that has not been set is entered, "NONE" is displayed.

(3) Machine error detection

The machine error detection status is monitored.

(4) Machine error reset switch

The machine error and machine warning are reset.

(5) Operation switches (Start/Stop)

Touch the [Start continuous operation] switch to start the Vision Tracking operation.

Touch the [Stop continuous operation] switch to perform Cycle Stop of the Vision Tracking operation. (All the detected workpieces are tracked.)

Depending on the operation state, the lamp at the bottom of the switch turns on in red. The lighting patterns are shown below.

Status	[Start continuous operation] switch	[Stop continuous operation] switch
Operating	ON	OFF
During Cycle Stop	Flashing	ON
Stopped	OFF	ON

(6) Stop switch

Touch this switch to gradually stop the running machine.

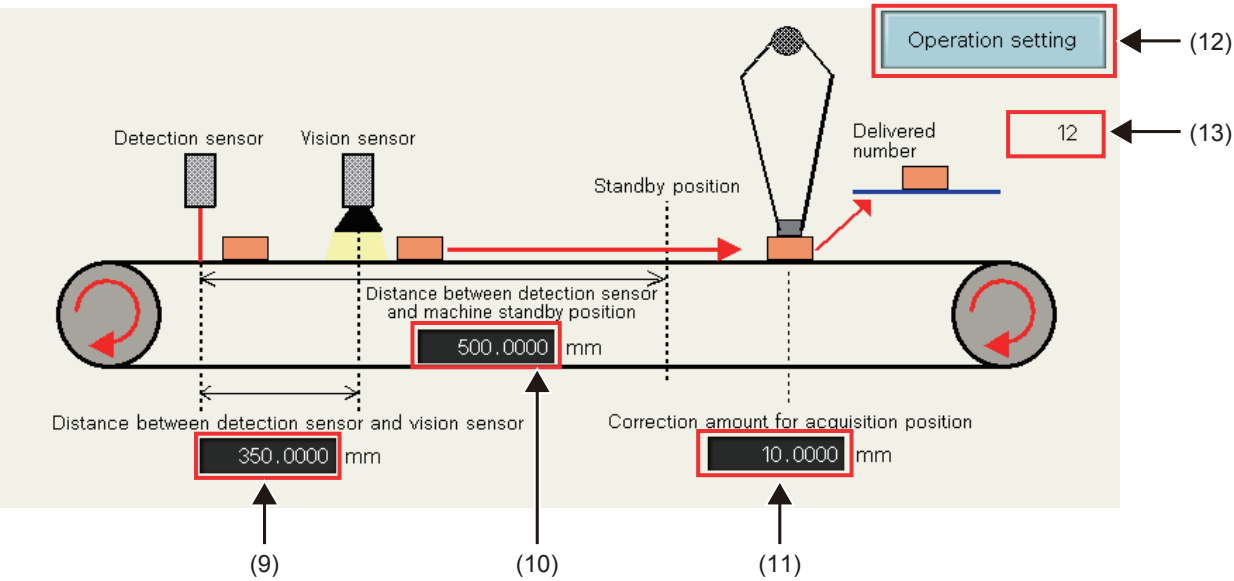
(7) Adsorption state

The adsorption state of the workpiece is monitored.

(8) Desorption switch

The workpiece is desorbed.

Position setting area



(9) Distance between detection sensor and vision sensor

Set the distance between the detection sensor and vision sensor.

(10) Distance between detection sensor and machine standby position

Set the distance between detection sensor and machine standby position.

(11) Correction amount for acquisition position

Set the X-coordinate correction amount at workpiece acquisition.

(12) Operation setting switch

Touch this switch to display the operation setting window screen. For details of the Operation setting window screen, refer to "Page 111 Operation setting window screen".

(13) Delivered number

The number of delivered workpieces is displayed. It is reset to 0 when the operation is started.

5.6 Window Screen

The following table lists window screens.

Screen No.	Screen title	Description		Reference
30000	GOT system alarm reset	GOT system alarm reset window screen		Page 104
30001	Language setting	Language Setting window screen		Page 89
30002	Clock setting	Clock Setting window screen		Page 90
30007	Footer 1	Main menu		Page 88
30010	Key window (Dec)	Numerical input [Decimal key window]		Page 87
30201	Machine program drivesetting 1/3	Machine program operation setting window screen	Positioning points 1 to 4	Page 105
30202	Machine program drivesetting 2/3		Positioning points 5 to 8	
30203	Machine program drivesetting 3/3		Positioning points 9 to 12	
30204	Point setting	Point setting window screen		Page 106
30205	Machine JOG drive	Machine JOG operation window screen		Page 107
30206	1point machine program drive	1 Point machine program operation window screen		Page 108
30207	Teaching	Teaching window screen		Page 109
30208	Control method	Control method symbol description window screen		Page 110
30209	Actual coordinate value	Actual coordinate value monitor window screen		Page 110
30601	Vision Tracking Setting	Operation setting window screen		Page 111

Point

• Display when the control unit is mm

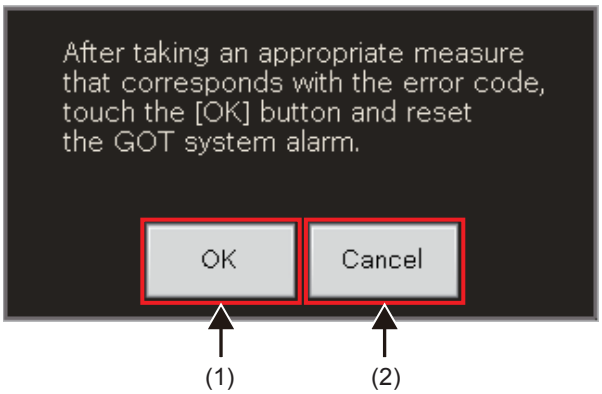
In MT Works2, the feed coordinate value is displayed in [0.1 μm].

On the GOT screen, the feed coordinate value is displayed in [0.0001 mm].

(This setting can be changed based on the setting of decimal digits automatic adjustment in GT Designer3.)

GOT system alarm reset window screen

This screen is used to reset a GOT system alarm.



When a GOT system alarm has occurred, touching the system alarm message display area (bottom of the screen) displays this screen.

(1) OK switch

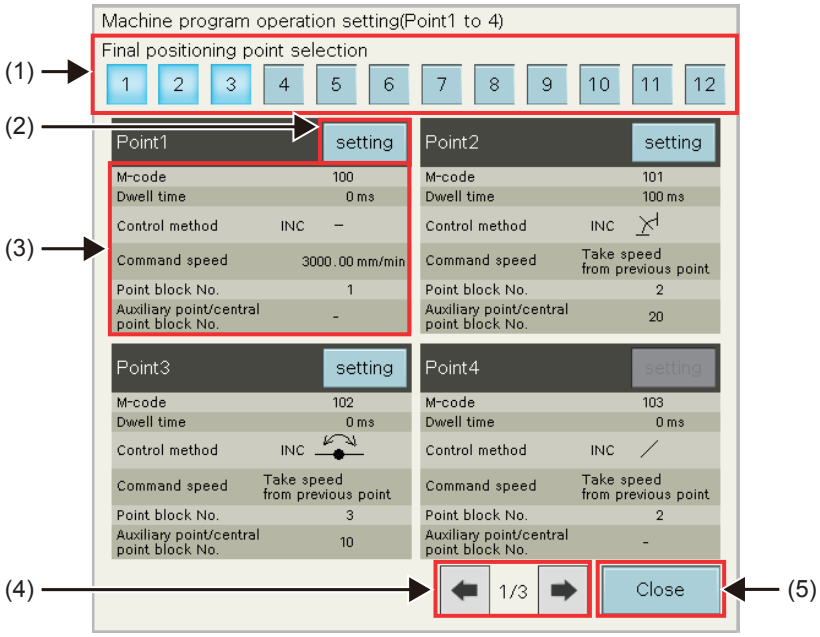
Touch this switch to reset the system alarm and closes the window screen.

(2) Cancel switch

Touch this switch to close the window screen without resetting the system alarm.

Machine program operation setting window screen

This window screen is used to set the operation pattern of continuous operation. Touch the [Setting for machine operation] switch on the Machine operation screen to display this screen.
Page 1/3 displays positioning point Nos. 1 to 4, page 2/3 displays positioning point Nos. 5 to 8, and page 3/3 displays positioning point Nos. 9 to 12.



(1) Final positioning point selection

Set the number of positioning points of the machine program operation in the range of 1 to 12.
Setting items can be set and changed for the positioning points (positioning point numbers for which the lamp is lit up) that are set here.

(2) Positioning point setting switch

This switch is enabled only for the positioning point numbers equal to or lower than the positioning point number set in (1) Final positioning point selection, and setting items can be set and changed. The switch for the other positioning point numbers is disabled, and setting items cannot be set and changed.
Touching an enabled switch displays the point setting window screen. For details on the point setting window screen, refer to "Page 106 Point setting window screen".

(3) Positioning point setting contents

The following six items are displayed from among the contents set in the corresponding point No.

- M-code
- Dwell time
- Control method
- Command speed
- Point block No.
- Auxiliary point/central point block No.

(4) Move page switches

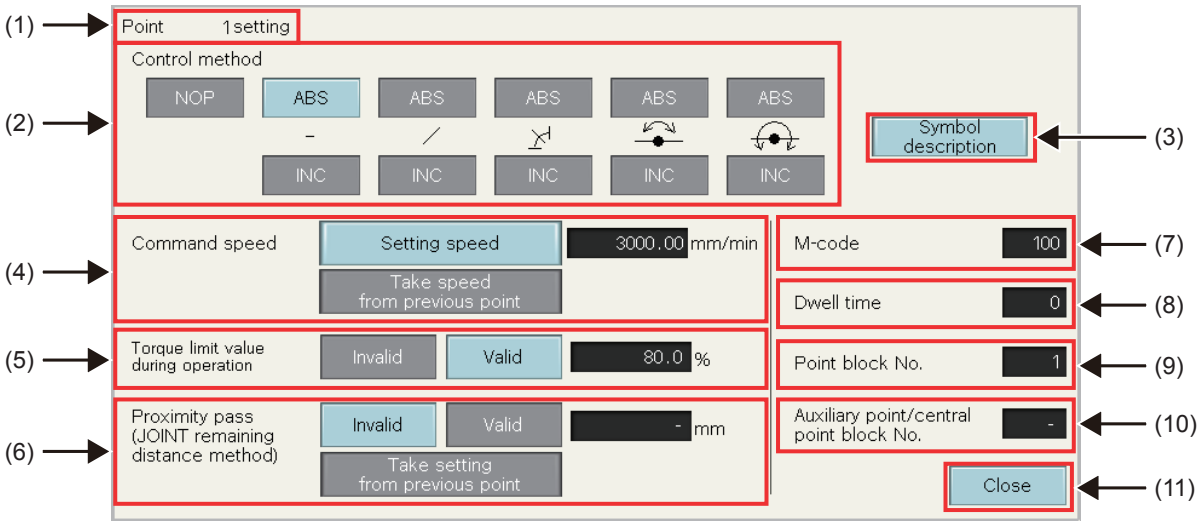
Touch these switches to move a page. Use the [←] switch to move to the previous page, and the [→] switch to move to the next page.

(5) Close switch

Touch this switch to close the window.

Point setting window screen

This window screen is used to set the contents of each positioning point in continuous operation. Touching the [Setting] switch on the Machine program operation setting window displays this screen.



(1) Setting point No.

The positioning point No. that has been set is displayed.

(2) Control method

Select the control method. Check the details of each symbol by touching the [Symbol description] switch described in (3). When this switch is touched, only the corresponding item is set to the selected status.

(3) Control method symbol description

Touch this switch to display the Control method symbol description window screen. For details on the Control method symbol description window screen, refer to "Page 110 Control method symbol description window screen".

(4) Command speed

Set the command speed.

If [Setting speed] has been selected, set the speed.

If [Take speed from previous point] has been selected, speed setting is not required. ("-" (hyphen) is entered in the field.)

In the Point 1 setting, [Take speed from previous point] cannot be selected because there is no previous point.

(5) Torque limit value during operation

Set the torque limit value during operation.

If [Valid] has been selected, set the torque limit value.

If [Invalid] has been selected, the setting of the torque limit value is not required. ("-" (hyphen) is entered in the input field.)

(6) Proximity pass

Set the proximity pass (JOINT remaining distance method).

If [Valid] has been selected, set the proximity range.

If [Invalid] has been selected, it is not necessary to set the proximity range. ("-" (hyphen) is entered in the field).

If [Take setting from previous point] has been selected, the proximity range setting is not required. ("-" (hyphen) is entered in the field.)

If the proximity pass has never set from the beginning of the program, the proximity pass method is set to "0: Invalid", and proximity pass is not performed.

(7) M-code

Set the M-code. If you do not want to output the M-code, set "-1".

(8) Dwell time

Set the dwell time. If you do not want to use the dwell time, set "-1".

(9) Point block No.

Set the point block No. that is the positioning target point.

(10) Auxiliary point/central point block No.

Set the point block No. to be specified as the auxiliary point or central point during circular interpolation.

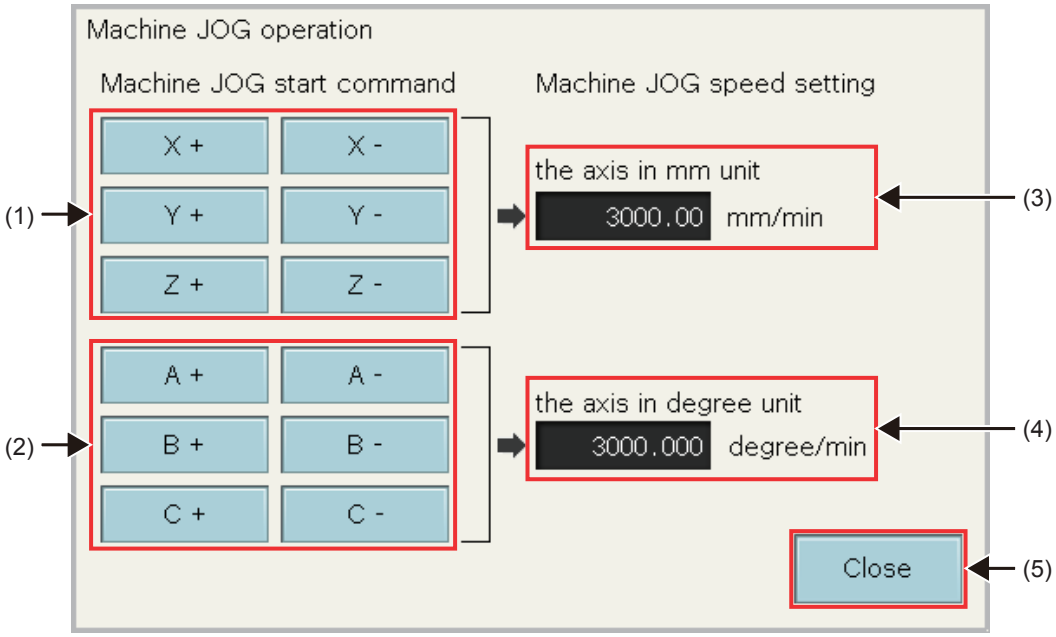
If other than circular interpolation is selected in (2) Control method, this setting is not required. ("-" (hyphen) is entered in the field.)

(11) Close switch

Touch this switch to close the window.

Machine JOG operation window screen

This window screen is used to set and perform operations related to the machine JOG operation. Touch the [Machine JOG operation] switch on the Machine adjustment screen to display this screen.



(1) Machine JOG start command (coordinates X, Y, and Z)

Start JOG operation in the coordinates X, Y, and Z.

The operation direction is decided by the coordinate system and ± symbol described on each switch (+: Forward rotation JOG -: Reverse rotation JOG).

JOG operation is performed while the switch is touched, and gradually stops when the switch is released.

(2) Machine JOG start command (coordinates A, B, and C)

Start JOG operation in the coordinates A, B, and C.

The operation direction is decided by the coordinate system and ± symbol described on each switch (+: Forward rotation JOG -: Reverse rotation JOG).

JOG operation is performed while the switch is touched, and gradually stops when the switch is released.

(3) Machine JOG speed (the axis in mm unit)

Set the machine JOG speed for the coordinates X, Y, and Z.

(4) Machine JOG speed (the axis in degree unit)

Set the machine JOG speed for the coordinates A, B, and C.

(5) Close switch

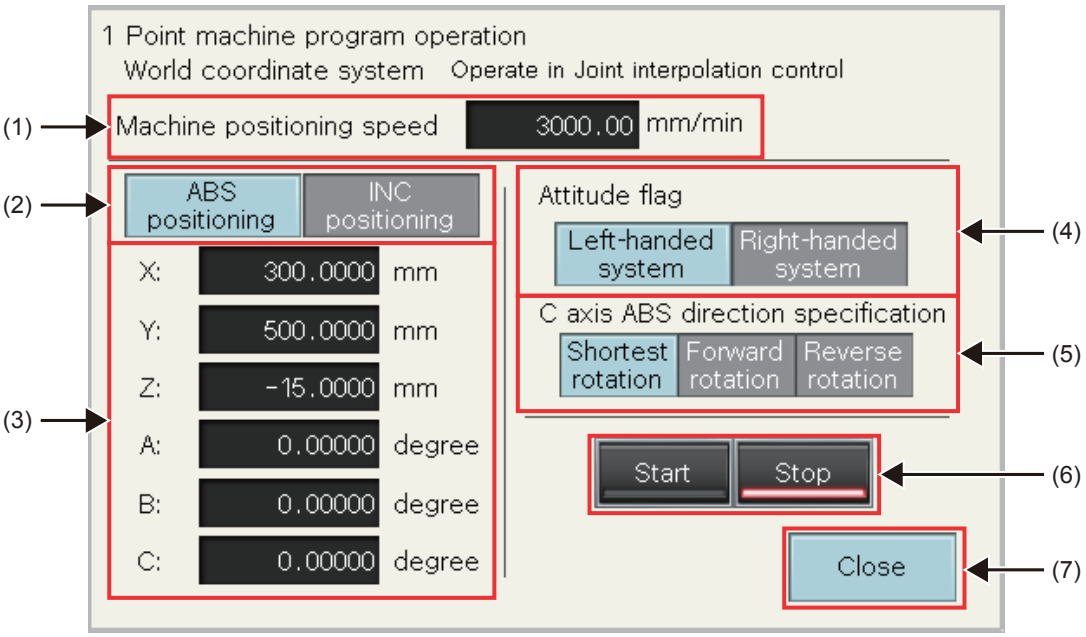
Touch this switch to close the window.

Point

When the operational authority is not acquired, the machine JOG operation window screen cannot be operated. For acquiring the operational authority, refer to GOT Mobile function enable/disable area on "Page 91 Home screen" and Setting for using the GOT Mobile function on "Page 112 Mobile Screen".

1 Point machine program operation window screen

This window screen is used to perform machine program operation for 1 Point only. Touch the [1 Point machine program operation] switch on the Machine adjustment screen to display this screen.



(1) Machine positioning speed

Enter the machine positioning speed.

(2) Control method

Set the control method. In the above setting, the machine program operation is fixed to world coordinate-specified joint interpolation control.

Set either of the target coordinate or moved amount for the use of data to be entered in (3) by selecting ABS (positioning) or INC (positioning).

(3) Target coordinates/moved amount

Set the target coordinates/moved amount of each coordinate system.

(4) Attitude flag

Set the attitude flag.

* This setting is valid only for machine types R4, R5, and R6. The setting is ignored for other machine types.

(5) C axis ABS direction specification

Set the C axis ABS direction specification.

* This setting is valid only for machine type R8. The setting is ignored for other machine types.

(6) Start/Stop switch

Touch the [Start] switch to start the machine program operation for the set coordinates/moved amount.

Touch the [Stop] switch to gradually stop the machine program operation.

(7) Close switch

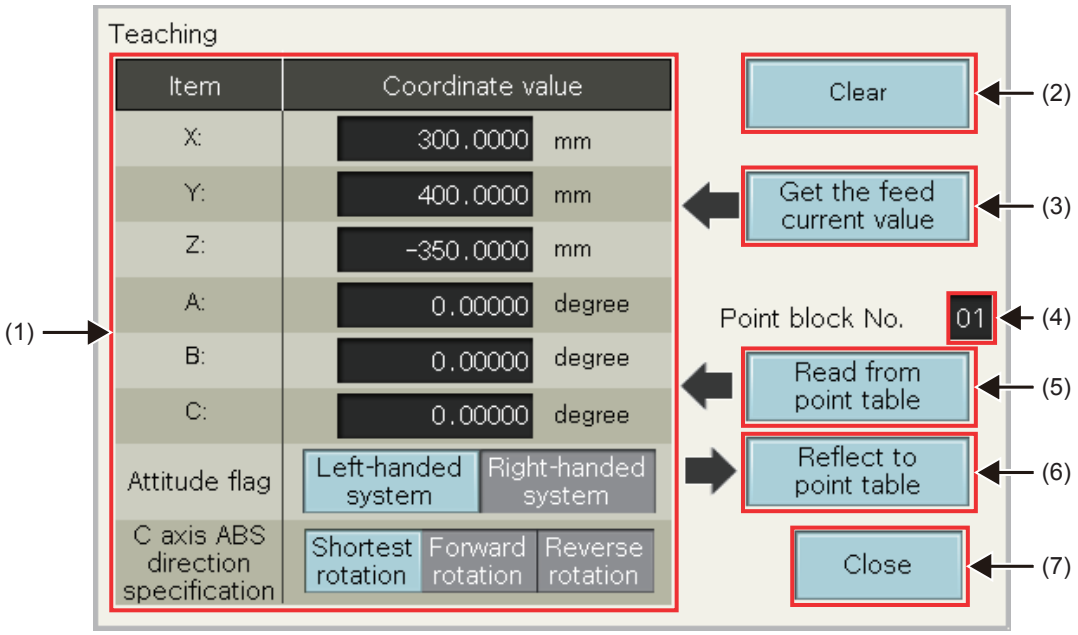
Touch this switch to close the window.

Point

When the operational authority is not acquired, the 1 Point machine program operation window screen cannot be operated. For acquiring the operational authority, refer to GOT Mobile function enable/disable area on "Page 91 Home screen" and Setting for using the GOT Mobile function on "Page 112 Mobile Screen".

Teaching window screen

This window screen is used to reference and edit the point block data. Teaching is also possible by acquiring the machine position information and reflecting it to the point block data. Touching the [Teaching (point data editing)] switch on the Machine adjustment screen displays this screen.



(1) Teaching data area

The point block data such as the data of each coordinate system and structure flag can be edited.

Touch the switches on the right side to cite the specific data. The cited data can be edited.

(2) Clear set value switch

Touch this switch to clear the data in the teaching area in (1).

(3) Get the feed current value switch

Touch this switch to reflect the current feed coordinate value in the teaching area in (1). Since the attitude flag and C axis ABS direction specification are not updated at this time, set them as necessary.

(4) Point block No.

Set the point block No. that is the target of (5) Point block reading and (6) Point block writing.

(5) Read point block switch

Touch this switch to reflect the point block data specified in (4) Point block No. in the teaching area in (1).

(6) Write point block switch

Touch this switch to reflect the data of the teaching area in (1) to the point block data specified in (4) Point block No.

(7) Close switch

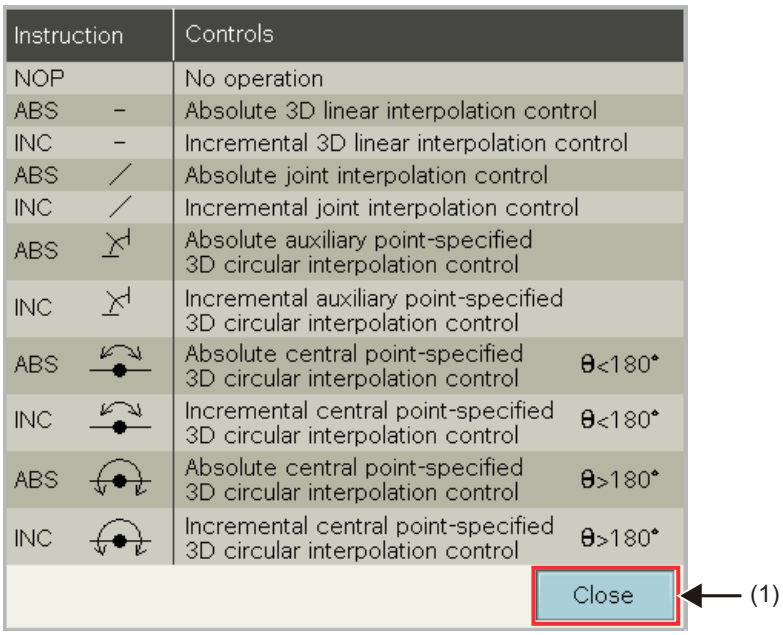
Touch this switch to close the window.

Point

When the operational authority is not acquired, the teaching window screen cannot be operated. For acquiring the operational authority, refer to GOT Mobile function enable/disable area on "Page 91 Home screen" and Setting for using the GOT Mobile function on "Page 112 Mobile Screen".

Control method symbol description window screen

This window screen displays the details of the symbols displayed in the control method. Touching the [Symbol description] switch on the Point setting window screen displays this screen.

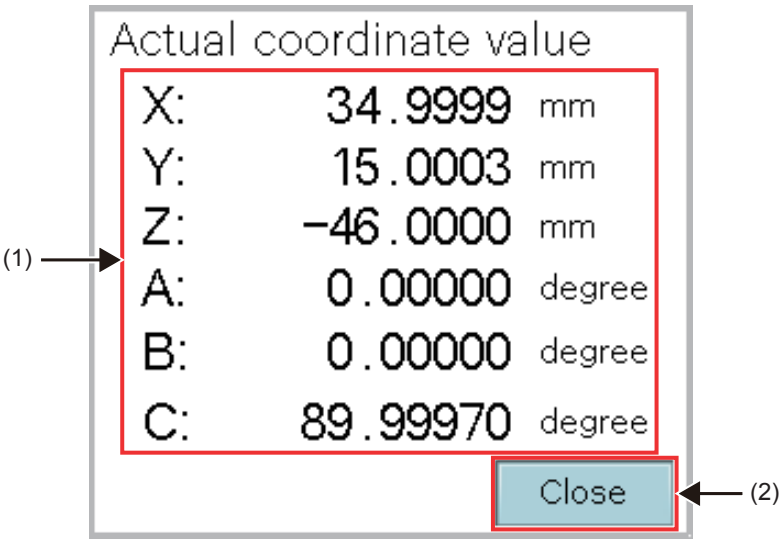


(1) Close switch

Touch this switch to close the window.

Actual coordinate value monitor window screen

This window screen is used to monitor the coordinate values calculated from the feedback position (pulse unit) of the motor encoder.



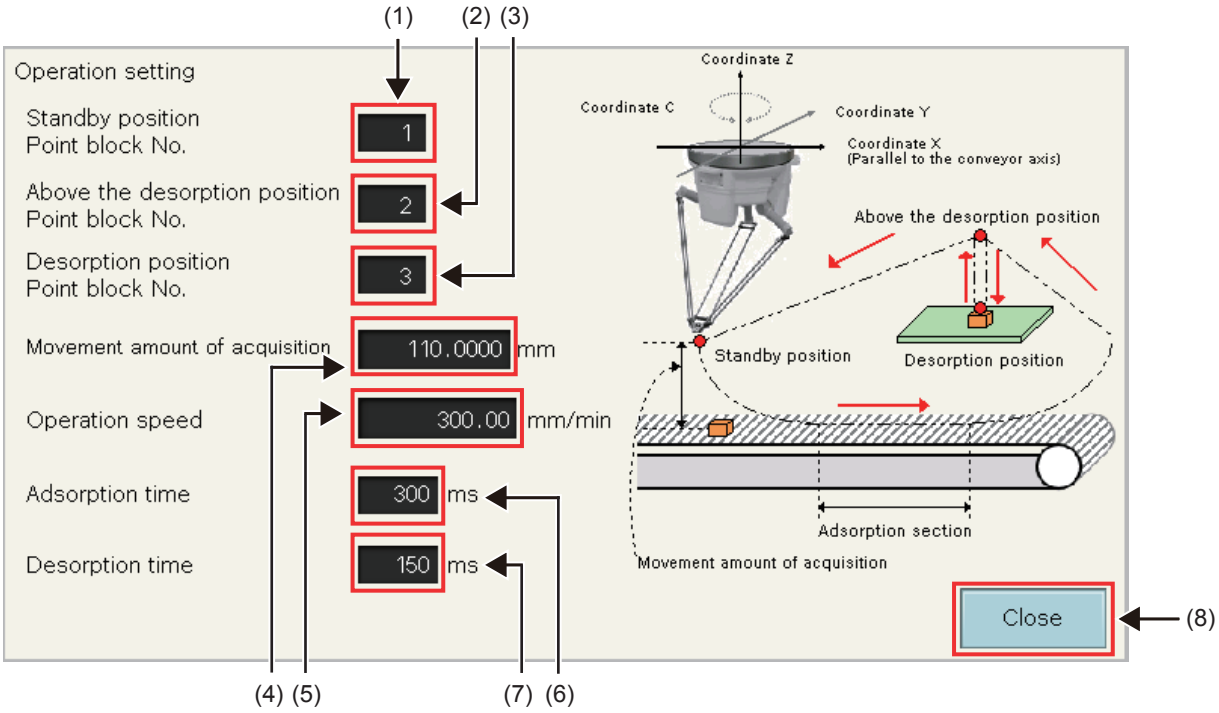
(1) Actual coordinate value display area

The actual coordinate values of world coordinate is displayed.

(2) Close switch

Touch this switch to close the window.

Operation setting window screen



(1) Standby position Point block No.

Set the point block No. for the standby position.

(2) Above the desorption position Point block No.

Set the point block No. for the desorption position.

(3) Desorption position Point block No.

Set the point block No. for the desorption position.

(4) Movement amount of acquisition

Set the lifting amount at workpiece acquisition.

(5) Operation speed

Set the operation speed of the machine.

(6) Adsorption time

Set the workpiece adsorption time (standby time after acquisition lifting).

The conveyor moved amount within the standby time after movement amount of acquisition is the adsorption section.

(7) Desorption time

Set the workpiece desorption time (standby time at desorption position).

(8) Close switch

Touch this switch to close the window.

5.7 Mobile Screen

The following table lists mobile screens.

Screen No.	Screen title	Description	Reference
30000	Machine JOG drive(Mobile)	Machine JOG operation mobile screen	Page 114
30010	1P machine program drive(Mobile)	1 Point machine program operation mobile screen	
30020	Teaching(Mobile)	Teaching mobile screen	
30200	Home(Mobile)	Home mobile screen	Page 113
32767	Splash	Screen displayed at client connection	—

Setting for using the GOT Mobile function

CoreOS with the version L or later is required for using the GOT Mobile function.
For the details of the function, refer to sections related to the GOT Mobile function in the following manual.
GT Designer3 (GOT2000) Screen Design Manual

IP address setting

■For a wireless LAN access point

- The IP address of the GOT standard Ethernet is 192.168.3.18 in this project. Set the IP address of the wireless LAN access point as follows.
  LAN side IP address: 192.168.3.1
  IP address for assignment: 192.168.3.2
- If the IP address duplicates with other Ethernet devices, change the fourth octet only. (Example: 192.168.3.1 → 192.168.3.10)
- When accessing to the GOT, enter 192.168.3.18/index.html?autofit=true in the address bar on the browser. The mobile screen is displayed in the width of the browser. When the IP address of the GOT standard Ethernet is changed, change the IP address to be entered in the address bar as well.

■For the wireless LAN function (GT25-WLAN)

- In this project, the network name is HANDLING and IP address is 192.168.4.20 for the wireless LAN function. Set the IP address of the information devices such as a tablet as follows.
  Default gateway: 192.168.4.1
  IPv4 address: 192.168.4.2
- If the IP address duplicates with other wireless LAN devices, change the fourth octet only. (Example: 192.168.4.1 → 192.168.4.10)
- When accessing to the GOT, enter 192.168.4.20/index.html?autofit=true in the address bar on the browser. The mobile screen is displayed in the width of the browser. When the IP address of the wireless LAN function is changed, change the IP address to be entered in the address bar as well.

License registration for the GOT Mobile function

Register the license number to the GOT to use the GOT Mobile function. For how to register the license number, refer to the following.
GOT2000 Series User's Manual (Utility)

Administrator

- Administrator name: Admin
- The password is not set. Set the password as necessary.

Exclusive control of operational authority

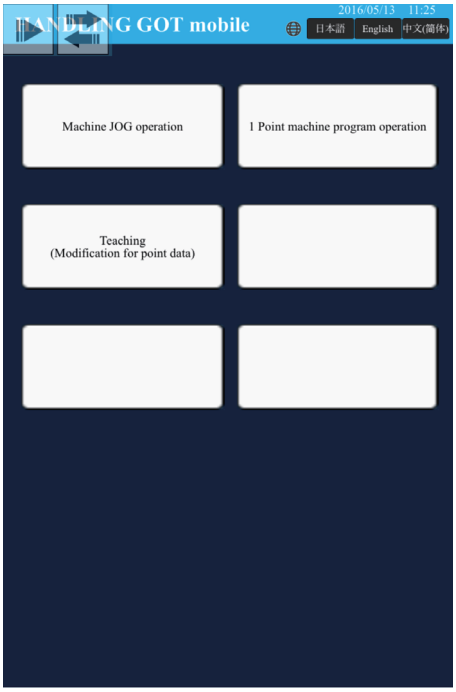
- The exclusive control of operational authority is performed to prevent unexpected operations by operators in remote locations. When acquiring the operational authority, check that no operator is performing operation.
- In this project, the guaranteed time of the operational authority after the last operation is 3600 seconds. To allow other operators to acquire the operational authority, release the operational authority. Change the guaranteed time of the operational authority depending on the situation.
- The guaranteed time of the operational authority can be disabled by prohibiting the GOT Mobile function with the switch in the GOT Mobile function enable/disable area on the Home screen and Machine adjustment screen of the GOT.
- The IP address of the GOT used to manage the operational authority is set to 192.168.3.18 by the GOT network interaction function. When the IP address of the GOT standard Ethernet is changed, change the IP address of the GOT used to manage the operational authority as well.

Screen size

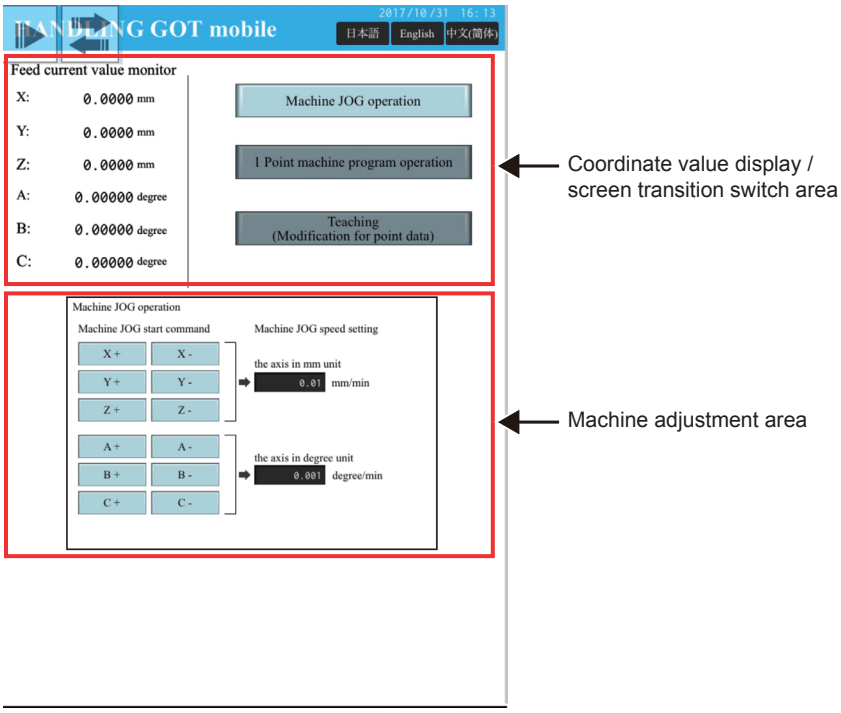
The resolution of the mobile screen is 720 × 1280. The lower part of the screen may cut off or a margin may appear depending on the screen size of the tablet.

Home screen

Touching the switch on the Home screen switches the screen to the corresponding operation screen.



Mobile operation screen



Coordinate value display / screen transition switch area

The operation method is the same as the Machine adjustment screen. For details, refer to the coordinate value display area and screen transition switch area of "Page 96 Machine adjustment screen".

Machine adjustment area

Touching the screen transition switch switches the screen to the corresponding operation screen. The operation method is the same as the GOT. For the details, refer to the following.

☞ Page 107 Machine JOG operation window screen
☞ Page 108 1 Point machine program operation window screen
☞ Page 109 Teaching window screen

Point

- The stop operation may not be performed due to communication delay or interruption depending on the network environment. Fully grasp the circumstances of the field site and ensure safety when performing remote control. Prepare an emergency stop switch as necessary.
- When changing the language in the pop-up window of the GOT network interaction function displayed on the lower part of the mobile screen, change the language setting of the mobile device.

5.8 List of Scripts

Script type	Reference method	Script number	Overview	Trigger type
Project	[Common] → [Script] → [Script] → [Project] tab	30000	Initial setting	Startup (GB40)
		30003	Clock Setting	While ON (GB30001)
		30017	Machine type display control	Always
		30018	GOT Mobile function setting	Startup (GB40)
		30019	Get the feed current value	Always
		30020	Vision Tracking information setting	Always
Screen	Immediately below W-30204	30012	Auxiliary point/central point display control	Always
		30014	Command speed display control	Always
		30015	Torque limit display control	Always
		30016	Proximity pass display control	Always
		30021	Vision Tracking state setting	Always
Object	GD30060 inside W-30002	—	Date and time setting	Startup (GB40)

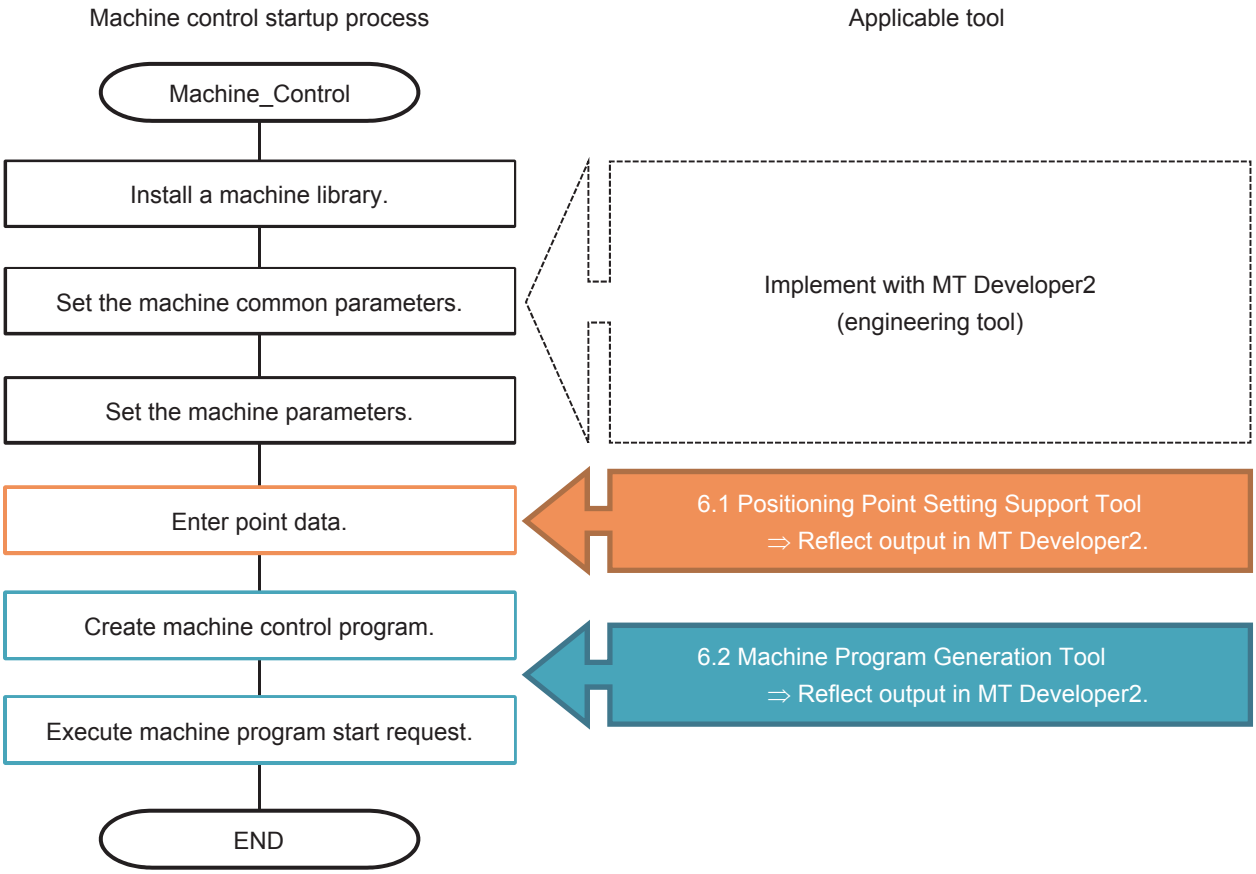
5.9 List of Devices to be Used

Some devices set as switches and lamps in screens may also be set in the common settings including scripts. When these devices need to be changed in a batch, using [Batch Edit] is recommended. For details of [Batch Edit], refer to "GT Designer3 (GOT2000) Help".

Type	Device number	Use
Bit	GB40	Always ON
Bit	GB30000	Language holding script
Bit	GB30001	Clock Setting window screen display script (Initial setting (clock setting)) trigger
Bit	GS512.b0	Time change information
Bit	GB30100 to GB30112	Auxiliary point/central point block No. display flag
Bit	GB30200	Machine type "NONE" display flag
Bit	GB40000	"Get the feed current value" switch ON/OFF flag
Bit	GB46000	Point setting "Command speed" input status flag
Bit	GB46001	Point setting "Torque limit value during operation" input status flag
Bit	GB46002	Point setting "Proximity pass" input status flag
Bit	GB46003	Vision Tracking valid flag
Bit	GB46004	Vision Tracking operation state
Bit	GB46005	Vision Tracking workpiece position 1 to Vision Tracking workpiece position 4
Bit	GB47000	Point 1 "Setting" touch flag
Bit	GB50000	Device (VGB) assignment start
Word	GD30000	Base screen switching device
Word	GD30001	Overlap window screen 1 switching device
Word	GD30004	Overlap window screen 2 switching device
Word	GD30007	Overlap window screen 3 switching device
Word	GD30010	Overlap window screen 4 switching device
Word	GD30013	Overlap window screen 5 switching device
Word	GD30016	Superimposed window 1 switching device
Word	GD30018	Superimposed window 2 switching device
Word	GD30021	Language switching device
Word	GD30031	System signal 1-1
Word	GD30041	System signal 2-1
Word	GD30060 to GD30065	Date and time adjustment switch
Word	GD50000	Device (VDG) assignment start
Word	GS513 to GS516	Time after change
Word	GS650 to GS652	Current time
Word	GS1899	GOT Mobile function Momentary switch forcibly OFF time
Word	GS1796	GOT Mobile function Operational authority management control
Word	VGD0	GOT Mobile setting Screen switching device
Word	VGD21	GOT Mobile setting Language switching device
Word	VGD22	GOT Mobile setting Client No. notification device
Word	VGD23	GOT Mobile setting Client IP address notification device
Word	VGD25	GOT Mobile setting Operational authority state control device
Word	VGD26	GOT Mobile setting Operational authority notification device

6 MACHINE PROGRAM SUPPORT TOOL

To control the simplified robot by using the machine control function of a MELSEC iQ-R-compatible motion controller, the following machine control program is required in addition to the servo motor startup program including home position return. This application package provides support tools to create a program.
Each tool supports Japanese, English, and Simplified Chinese. Select the language in the tool.



Compatible versions

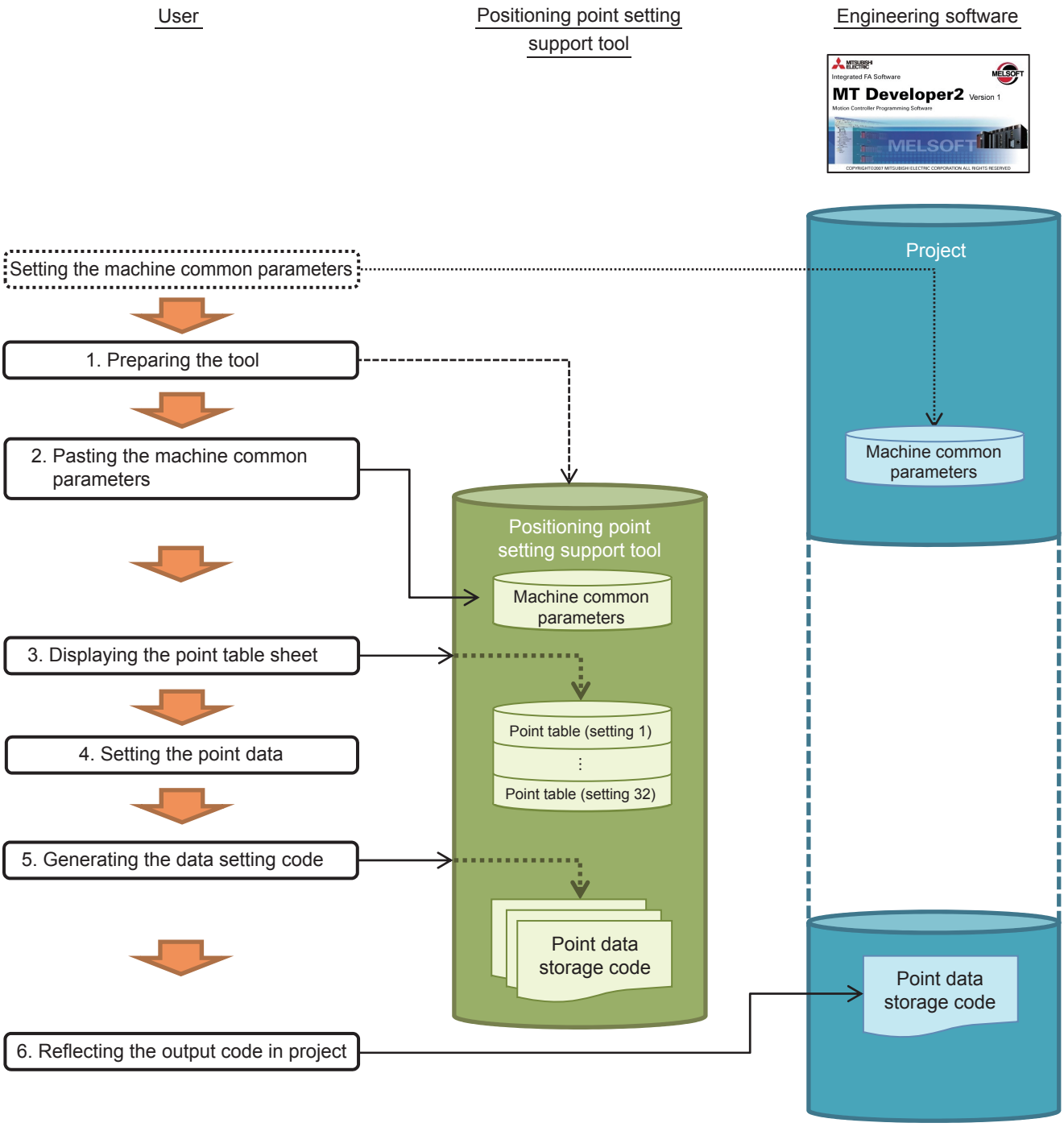
- Operation environment (personal computer): Conforms to the MT Works2 operation environment.
- Microsoft Office: Supports Excel 2010 or later compatible with the macro function-enabled book (.xlsm).

6.1 Positioning Point Setting Support Tool

This tool is used to generate a program for setting the point block data.
By embedding the output codes in the motion SFC program, a program can be easily created for the initial setting (during initial startup) and initialization (during startup at initialization request) of the point block data.
A point table can be created from the settings of the machine common parameters, and each point data can be set without calculating the offset of the device.

Setting and procedure

The following describes the procedure of displaying the point table and creating the point data storage program by using this tool.
The flowchart shows the procedure with this tool.



1. Preparing the tool

This tool consists of the following file.

File name	File type
HDLPointSetTool.xlsm	Excel file (macro function-enabled book)

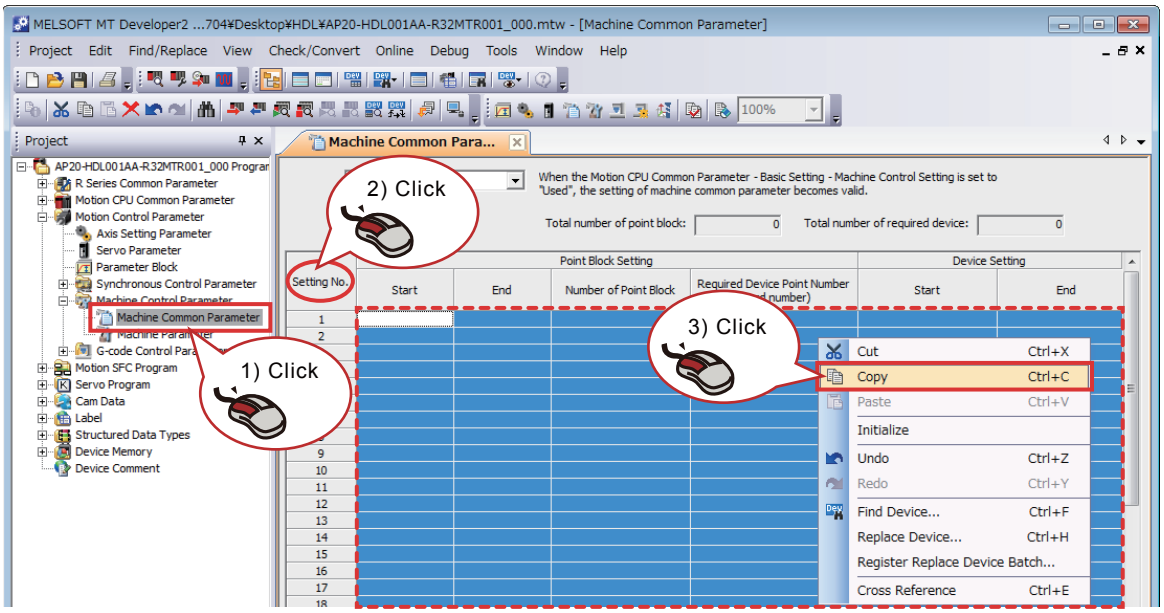
* Enable the macros when using this tool.

2. Pasting the machine common parameters

From the MT Developer2 project tree, open [Motion Control Parameter] - [Machine Control Parameter] - [Machine Common Parameter].

Click the [Setting No.] block at the top left of the table under the opened tab (on the right screen) to select the entire table.

Copy the table being selected either from the right-click menu on the selected area or by using the shortcut key [Ctrl + C].



Open the tool, and paste the machine common parameters on the same setting screen in the [PARAM] sheet.

When pasting the machine common parameters, either press the [Paste parameter] button on the sheet, or use the [Ctrl + V] shortcut key when the sheet has been displayed.

Do not copy or cut other than the machine common parameters before pasting.

Restriction

- The machine common parameters cannot be changed with this tool. When editing the parameters, use MT Developer2 and paste the edited data by following the procedure described above.
- When using this tool, set the number of point blocks per one setting between 1 and 256. To set more than 256 points, divide the setting No. (When all 32 settings are used, up to 8192 points can be set (256 points × 32 settings).)

3. Displaying the point table sheet

In the [Jump] column, press the [Setting □] (□: 1 to 32) button to view the point table sheet generated on the basis of the parameters pasted in step 2.

The point table is displayed in the format of (Vertical) point No. × (Horizontal) Coordinate/Joint axis No.

4. Setting the point data

Set the point data in a 32-bit integer type (with sign).

Set the structure flag in a 16-bit integer type. It is recommended to enter a hexadecimal number as the structure flag.

For details on the points during data setting, refer to the following.

☞ Page 130 Points of Data Setting in the Machine Program Support Tool

Precautions

Data can be copied and pasted from another file or another sheet.

However, data including combined cells cannot be pasted.

5. Generating the data setting code

Output the program to substitute data set in the point table into the device which has been assigned.

When the [Program Output] button is pressed, the code for data setting is generated.

At this time, the selected range of data is output. Therefore, select the data to be output by following the methods described below.

• To output the entire range

The entire range can be selected either by pressing the [Select All] button, or with the [Ctrl + A] shortcut key.

• To output in the range of a column or row

The specified range can be selected by selecting the first cell, and then clicking the last cell while keeping the [Shift] key pressed.

• To output a plurality of specific cells

Several ranges can be set by selecting with the mouse while keeping the [Ctrl] key pressed.

The following two items are available as optional functions during output. Set the following items as necessary.

• Coordinate comment output setting

If a check box of the coordinate comment is selected, the coordinates of the storage data are added as a comment after each substitution expression of the output code. This function is useful to revise a program directly.

When the check mark is removed, the comment after the substitution expression is not output.

• Title of point block data

A title for each setting No. can be set in the [Comment] column. The entered contents are added to the comment of the code output results (after the setting No. of the first row).

The generated codes are copied to the clipboard without being displayed in the tool.

(When the [Program Output] button is pressed, processing is performed from code generation → copying.)

Precautions

If another data is copied or cut after program output, the clipboard is overwritten, and the output code is erased. When the output code is ready to be pasted, press the [Program Output] button again and acquire the code.

6. Reflecting the output code in project

When a code is generated in step 5, it is already copied.

Paste it as is to the motion SFC program of MT Developer2.

Point

In cases such as when the number of characters of the data to be substituted is large, the codes output in step 5 (total of column A) may have a size larger than the program size (32761 byte) that can be described in a single calculation step.

In such a case, paste the output codes by dividing into several calculation steps.

Maintenance

■Changing the setting values directly inside the program

When changing the generated program, correct the substitute program with reference to the comments in the program, or the device No. specified in the point table of the tool.

Precautions

A discrepancy may occur between the data set in this tool and the data set in the program.

To eliminate the discrepancy, reflect the changes of the program in the tool side as necessary.

■Changing with the tool

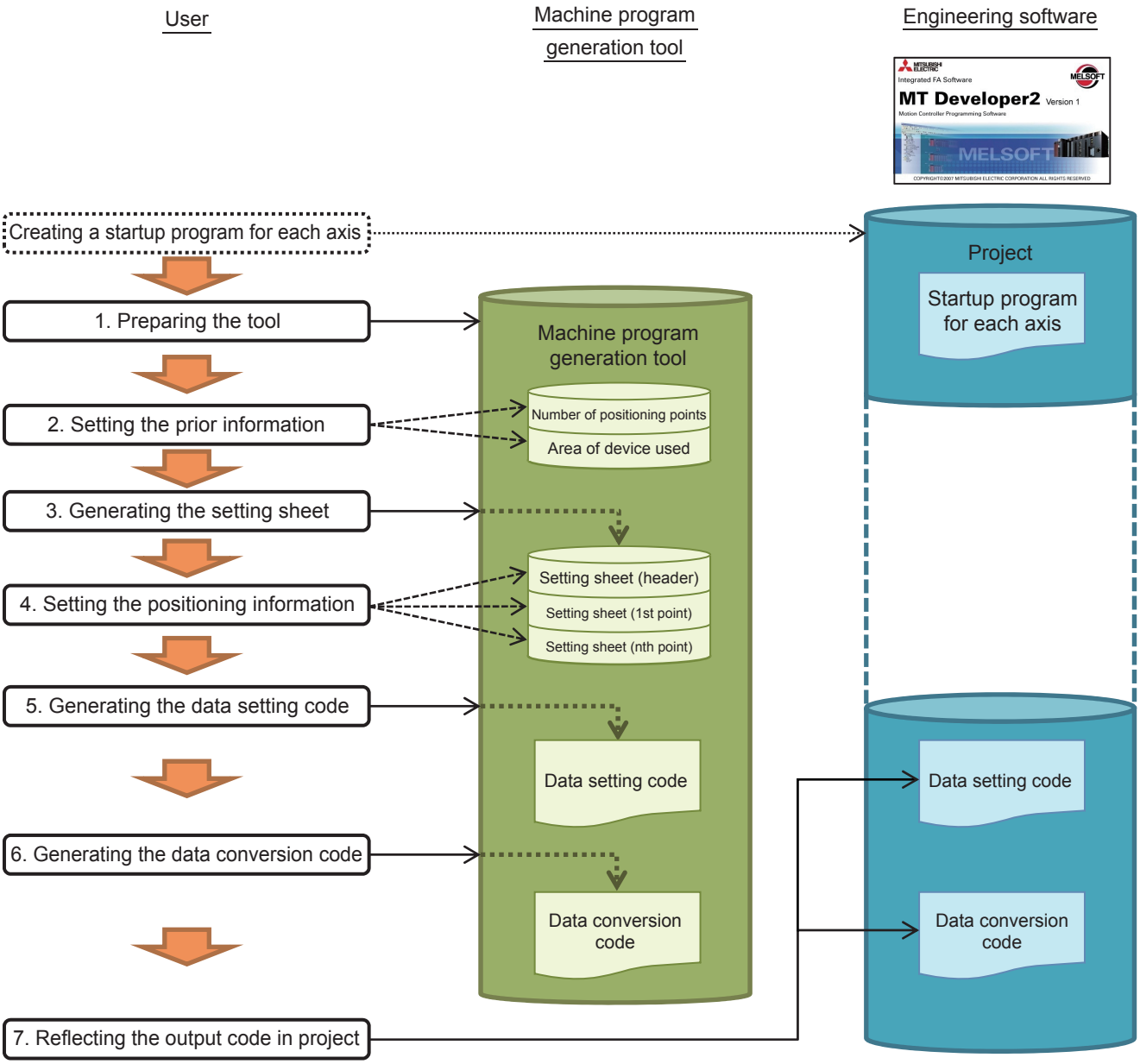
Set the data and reflect them in the project again. (☞ Page 118 Setting and procedure)

6.2 Machine Program Generation Tool

This tool is used to automatically generate the program for the machine program operation start request (MCNST).
By embedding the output codes in the motion SFC program, a system using a machine library can be easily started up.

Setting and procedure

The following describes the procedure of creating a motion SFC program for the machine program operation start request (MCNST) by using this tool.
The flowchart shows the procedure with this tool.



1. Preparing the tool

This tool consists of the following file.

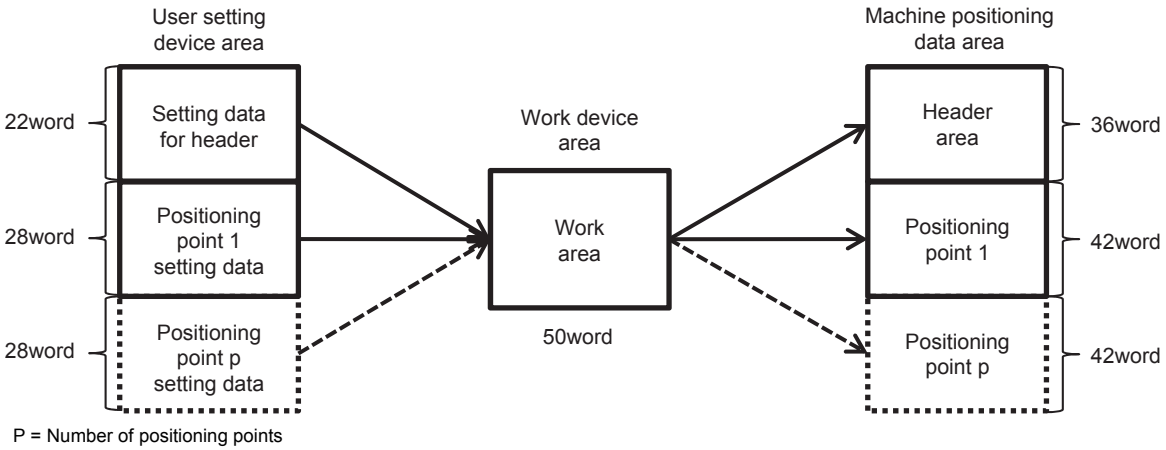
File name	File type
HDLMachineProgGenerationTool.xlsm	Excel file (macro function-enabled book)

* Enable the macros when using this tool.

2. Setting the prior information

As a preliminary preparation for data setting, set the following four items.

No.	Setting item	Setting range	Initial value	Details
1	Number of positioning points	1 to 256	1	Specify the number of positioning points operating in the machine program operation start command (MCNST).
2	User setting device area First device	Word device (1 word): Data register (D) or motion register (#)	#100	Specify a start device of a device area where the value set in the tool is stored.
3	Work device area First device		#0	Specify the start of a work device area for converting the user setting device area to the machine positioning data area.
4	Machine positioning data area First device		D10000	Specify the start device of the machine positioning data area specified in the machine program operation start request (MCNST).



Restriction

- Only the data register (D) or motion register (#) can be set in No. 2 to 4.
- Set an even-numbered device in No. 2 to No. 4.

Precautions

The device range is checked based on the maximum upper/lower limit value that can be set in the parameters.
Note that the device range may differ from that is set in the parameters.

3. Generating the setting sheet

The following sheets are displayed by pressing the [View setting sheet] button in the tool.

- Input_Header

This sheet is used to set the common items of the positioning data.
One such sheet is displayed in one file.

- Input_PointData □ (□: Positioning point No.)

This sheet is used to set the data of each point of the positioning data.
The sheets for the number of positioning points set in item No. 1 of step 2 are displayed.

4. Setting the positioning information

In the sheets generated in step 3, set the information required for positioning control.

In this tool, data displayed on Excel is used as the setting value.

Therefore, calculations based on functions of Excel and data setting based on cell reference are available.

For details on the points during data setting, refer to the following.

☞ Page 130 Points of Data Setting in the Machine Program Support Tool

• Input_Header

Set the positioning information (header part) common to all sheets.

[Required setting items]

No.	Item
1	Number of positioning points
2	Machine No.

[Optional setting items]

No.	Item
3	Parameter block No.
4	Interpolation control unit
5	Speed limit value
6	Acceleration time
7	Deceleration time
8	Rapid stop deceleration time
9	Torque limit value at start
10	Deceleration processing on STOP input
11	Allowable error range for circular interpolation
13	S-curve ratio

• Input_PointData □ (□: Positioning point No.)

Set the information (point data part) used in the corresponding positioning points.

[Required setting items]

No.	Item
1	Control method
2	Coordinate system setting
3	Command speed
4	Point block No.
5	Auxiliary point/central point block No.

[Optional setting items]

No.	Item
6	M-code
7	Dwell time
8	Torque limit value during operation
9	Proximity pass - Proximity pass method
10	Proximity pass - Proximity range
12	Sequential coordinate command control smoothing time constant
14	WAIT-ON/OFF (WAIT-ON/OFF setting)
15	WAIT-ON/OFF (Device number)
17	Point arrival notification (Point arrival notification setting)
18	Point arrival notification (Device number)
19	Point arrival notification (Notification setting value)

5. Generating the data setting code

The following sheet is generated by pressing the [Code generation for data setting] button in the tool.

If the generated sheet name exists in the same file, delete the sheet once and then generate the code again.

• Code_DataInput

The codes for storing the user setting data in the user setting device area is output to this sheet.

One such sheet is generated in one file.

6. Generating the data conversion code

The following sheet is generated by pressing the [Code generation for data conversion] button in the tool.

If the generated sheet name exists in the same file, delete the sheet once and then generate the code again.

• Code_DataConvert

The program for substituting the data of the user setting device area with the data for machine program operation is output to this sheet.

The codes of the machine program operation start command (MCNST) are included in this sheet and commented out as default. ("//" is added at the beginning of the sentence.) To enable the codes, delete the "//" from the beginning of the sentence.

One such sheet is generated in one file.

7. Reflecting the output code in project

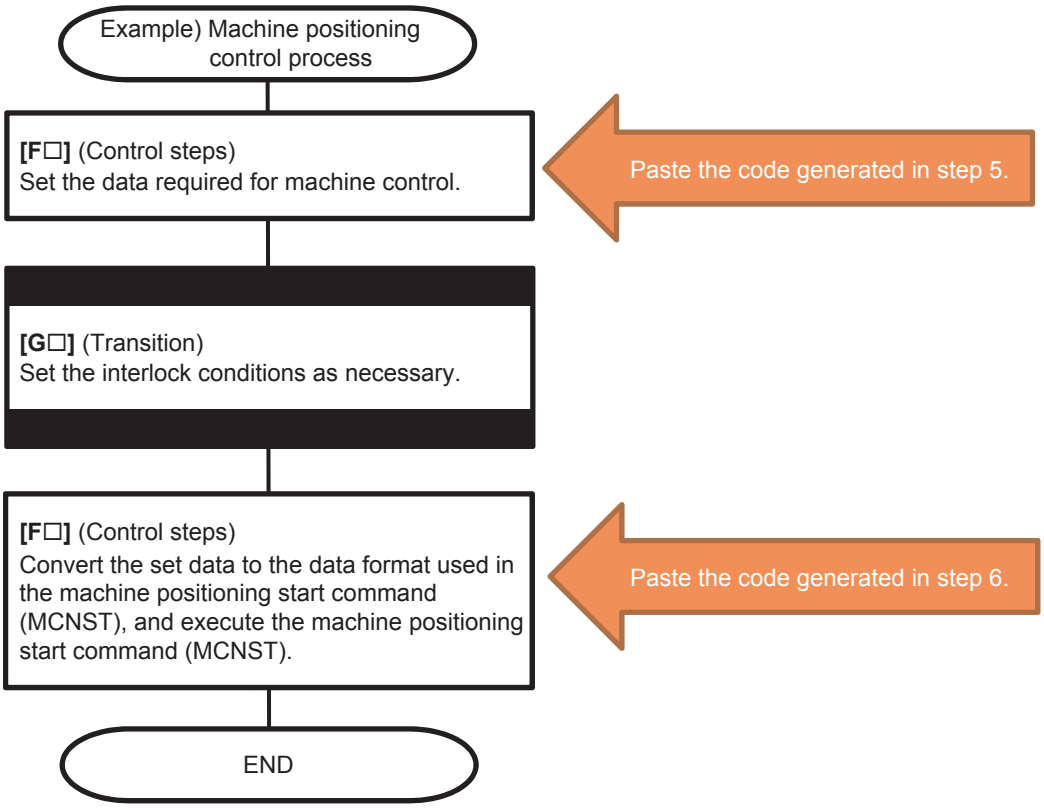
The program codes that can be used in the control step [F□] of the motion SFC program are specified in column A of the sheets generated in steps 5 and 6.

Select and copy column A of each sheet, and paste it to the control step [F□] with reference to the example shown below.

Perform programming so that the codes generated in step 6 are processed after processing of the codes generated in step 5.

Precautions

If the number of positioning points is large, the program output in step 5 may exceed the maximum data length (65531 bytes) of the calculation step. In such a case, split the output program and then paste it into several calculation steps to proceed with programming.



Maintenance

■Changing the "Setting value"

To change the settings after generating and reflecting the program, follow the two methods described below.

• When using this tool

Generate the codes and reflect them in the project again. (☞ Page 121 Setting and procedure)

• When correcting the program directly (without using this tool)

Change the setting value (right side) substituted into a predetermined device with reference to the comments (settings) in the data setting codes output in step 5 of "Setting and procedure".

Since the data conversion codes output in step 6 of "Setting and procedure" do not depend on the setting values, correction is not needed.

Precautions

If the program is directly changed, a discrepancy may occur between the data set in this tool and the data set in the program. To eliminate the discrepancy, reflect the changes of the program in the tool side.

■Changing the "Device area"

Generate the codes and reflect them in the project again. (☞ Page 121 Setting and procedure)

When using the search and substitution functions of MT Developer2, be sure to thoroughly understand and confirm the program contents (such as device indirect specification and internal processing), and then implement the operation under the responsibility of the customer.

Generated codes

The following describes the codes generated with this tool.

Although corrections and maintenance are primarily unnecessary, if the generated codes are to be directly edited, refer to the following.

■Code_DataInput

The substitution processing of data to be set in the user setting device area is generated with this tool.

Refer to the program (including the comments) that is actually generated.

■Code_DataConvert

The processing of the output codes is as shown below. The data of the header part is converted in the first half, while the data of the point data part is converted in the second half.

The data setting examples are described for each part. Check them along with the explanations.

Overview of data setting in the header part

1. Perform 0 clear for the work area.

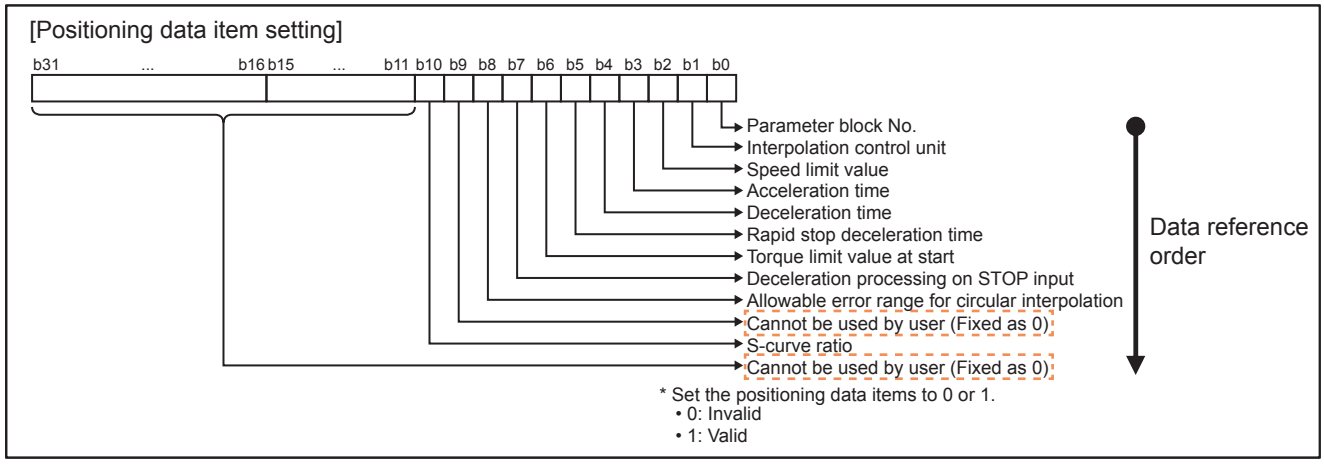
2. The required setting items are stored as shown below.

[Reference source] User setting device area

[Storage destination] Work area

- Number of positioning points (Device offset: Reference source + 0, Storage destination + 0)
- Machine No. (Device offset: Reference source + 1, Storage destination + 1)

3. In the loop processing, sequentially check the optional setting items within the loop processing starting from the item at the bit 0 side among the positioning data items. (Refer to the following figure.)



If the setting is not invalid (-1), turn ON the corresponding bit of the positioning data item setting, and save it as a positioning data item. Thereafter, perform two-word offset for the reference-source device and storage-destination device.

When the setting is invalid (-1), or for an item that cannot be used by the user, the data is not stored and two-word offset is performed only for the reference-source device. (Since the data to be set needs to be closely stored, offset is not performed for the storage-destination device.)

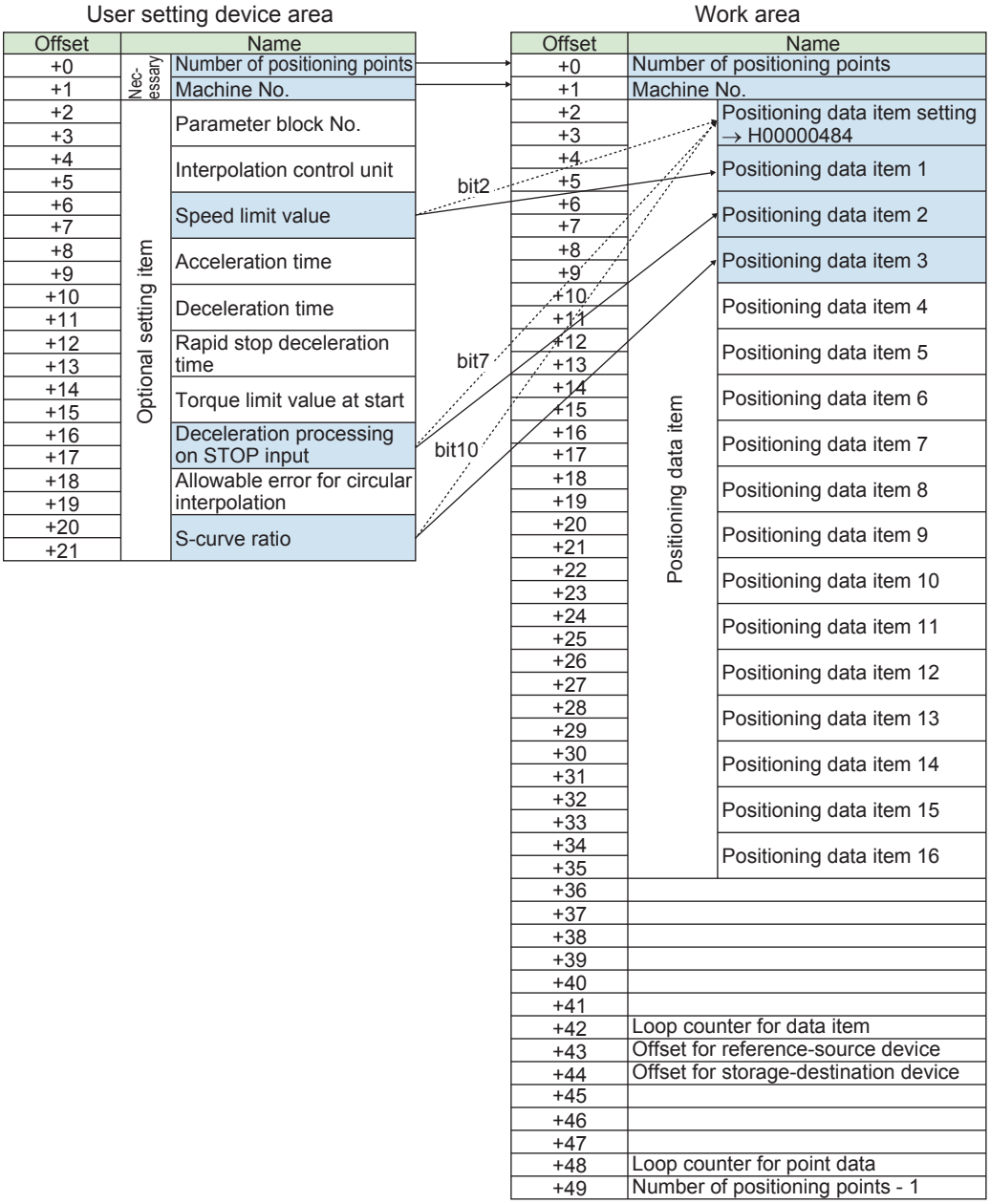
[Reference source] User setting device area

[Storage destination] Work area

- Positioning data item setting (Device offset: Reference source +2 to 21, Storage destination +2 to 35)

Ex.

The work area storage status when the meshed items are set in the user setting device area



4. Transfer the data (36 words) of the prepared header part in a batch as shown below.

[Reference source] Work area (Device offset: +0 to 35)

[Storage destination] Machine positioning data area (Device offset: +0 to 35)

Overview of data setting in the point data part

1. Acquire the number of positioning points - 1 for the loop counter, and repeat the subsequent steps (2 to 4) as many times as the number of positioning points.

2. Perform 0 clear for the work area.

3. The required setting items are stored as shown below.

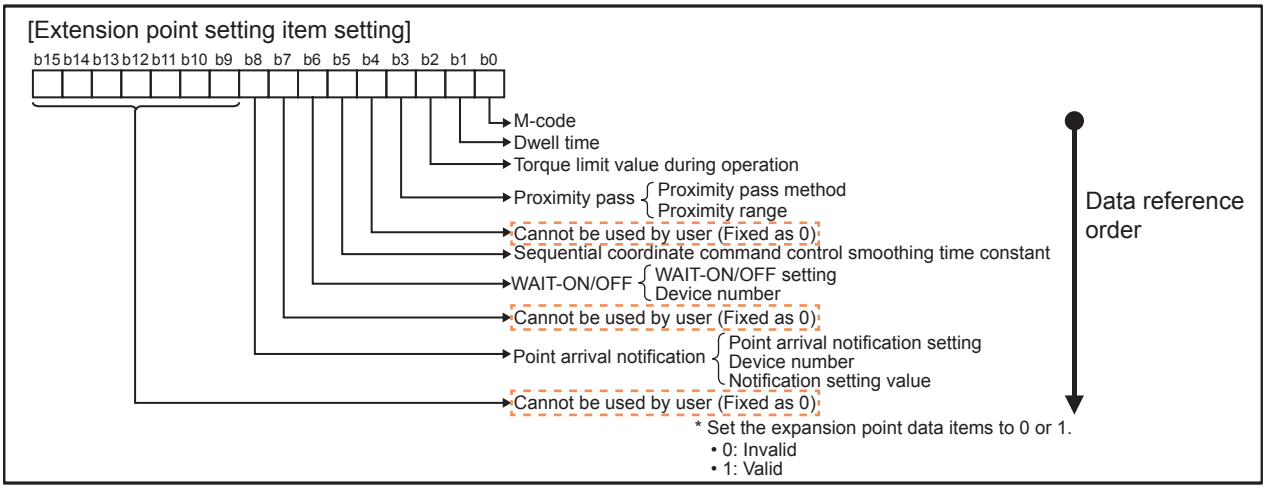
[Reference source] User setting device area

[Storage destination] Work area

- Control method (Device offset: Reference source + 22 (+28 × p), Storage destination + 0)
- Coordinate system setting (Device offset: Reference source + 23 (+28 × p), Storage destination + 1)
- Command speed (Device offset: Reference source + 24, 25 (+28 × p), Storage destination + 2, 3)
- Point block No. (Device offset: Reference source + 26 (+28 × p), Storage destination + 4)
- Auxiliary point/central point block No. (Device offset: Reference source + 27 (+28 × p), Storage destination + 5)

*p: Point data No. -1

4. In the loop processing, sequentially check the optional setting items within the loop processing starting from the item at the bit 0 side among the extension point setting items. (Refer to the following figure.)



If the setting is not invalid (-1), turn ON the corresponding bit of the positioning data item setting, and save it as a positioning data item. Thereafter, perform two-word offset for the reference-source device and storage-destination device.

When the setting is invalid (-1), or for an item that cannot be used by the user, the data is not stored and two-word offset is performed only for the reference-source device. (Since the data to be set needs to be closely stored, offset is not performed for the storage-destination device.)

* Turn ON the proximity pass bit when the proximity pass method is other than "Take setting from previous point (-1)". The data of the proximity range is not stored when the proximity pass method is "Take setting from previous point (-1)", but the data is stored when the proximity pass method is other than "Take setting from previous point (-1)".

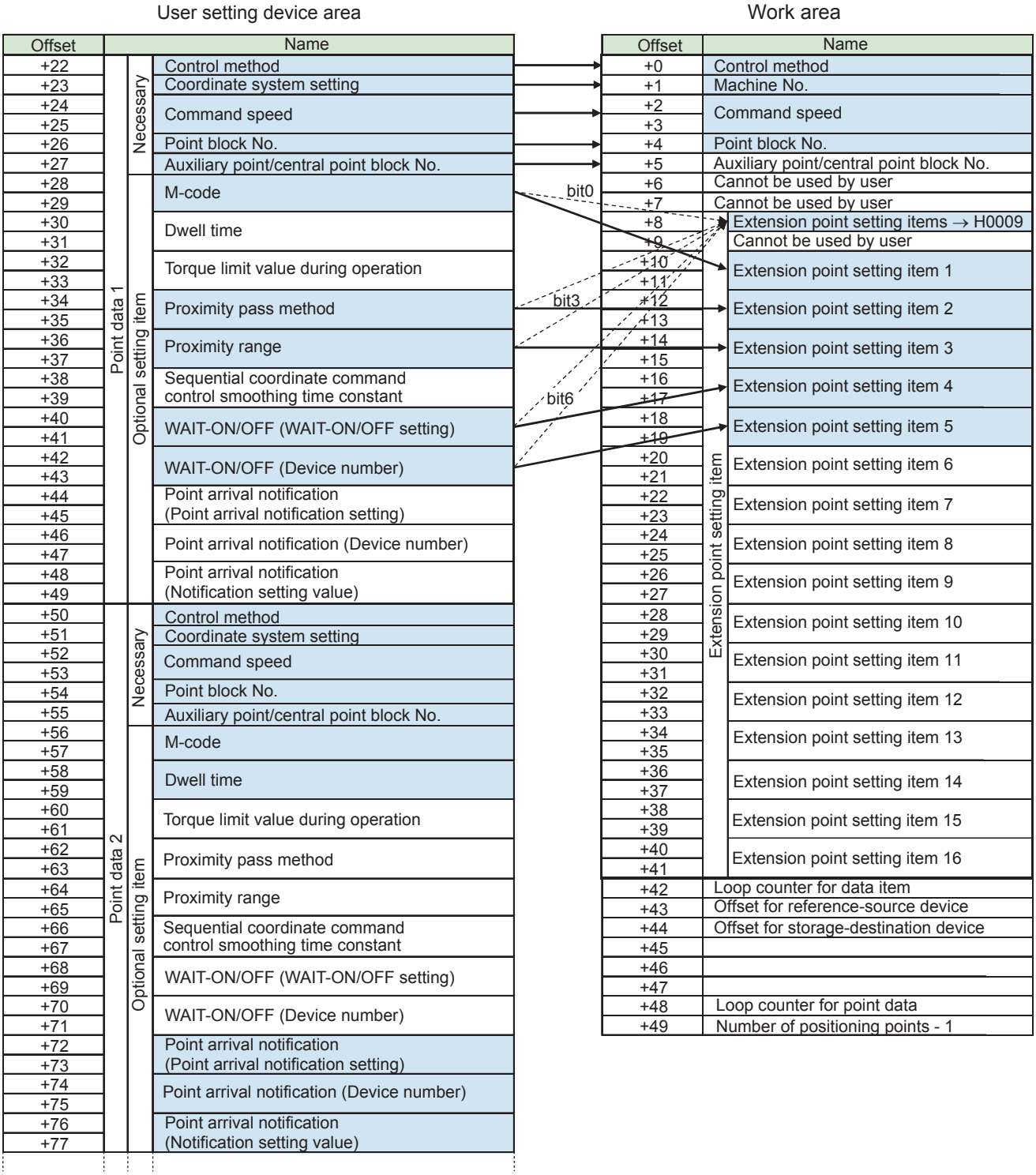
[Reference source] User setting device area

[Storage destination] Work area

- Extension point setting item setting (Device offset: Reference source + 28 (+28 × p) to 49 (+28 × p), Storage destination + 8 to 41)

Ex.

The work area storage status when the meshed items are set in the user setting device area



5. Transfer the data (42 words) of the prepared point data part in a batch as shown below.

[Reference source] Work area (Device offset: +0 to 41)

[Storage destination] Machine positioning data area (Device offset: +36 (+28 × p) to 77 (+28 × p))

6.3 Points of Data Setting in the Machine Program Support Tool

Descriptions based on data type

For 16-bit data: Set the numerical value (integer) and device as is.
For 32-bit data: Clarify the data type by specifying an "L" at the end of the numerical value (integer) and device. If the data type is omitted, the processing is performed by assuming the smallest type that the data can have. Specify an even-numbered device when specifying the device.

Numerical value input

It is recommended to specify a "K" before a decimal number. (It can be omitted.)
Always specify an "H" before a hexadecimal number. (It cannot be omitted.) If an "H" is omitted and only a numerical value is specified, the processing will be performed by assuming a decimal number, and if an alphabet is included, an error will occur during program conversion on MT Developer2.

Device (including indirect specification) input

Devices can be specified. When setting devices, check the data size described in "Descriptions based on data type".
Indirect specification of the device No. is also possible.

Excel calculation

The functions of Excel can be used to set the calculation results as the input value.
In such a case, the processing is performed such that the data displayed in the cell is the substitution value during code output.

Calculation expression

The substitution calculation expression to be used in the motion SFC program can be specified.
The following table shows entry examples based on the above points.
The data used as program output (displayed in the tool) are underlined.

Data type	16-Bit integer type	32-Bit integer type
Numerical value	K1234,K-1,5678,H1FE0, etc.	1234L,K-1L,5678,H10001FE0, etc.
Device (including device articulation specification)	D1234,D(D200+K10), etc.	D1234L,D(D200+K10)L, etc.
Excel calculation	="K"&SUM(100,20,3) [Display result]K123 ="K"&MIN(A1:A100) [Display result]K-10, etc.	="K"&SUM(100,20,3)&"L" [Display result]K123L ="K"&MAX(A1:A100)&"L" [Display result]K5678L, etc.
Calculation expression	SHORT(D100L),K100+(D10*K20), etc.	LONG(D100),K100L+(D10L*K20), etc.

Precautions

- Range checking is not performed for the entered data. If data that is outside the range or incorrect data is set, an error will occur either during program conversion in MT Developer2, or during the machine program operation start request in the motion CPU module.
- If the setting data is blank (not entered), the following operations are performed.

Positioning point setting support tool: "0" is added on the right side of the substitution expression.
Machine program generation tool: The right side of the substitution expression becomes blank, and an error will occur during program conversion in MT Developer2.

- If the combination status of the cells within the tool is changed (such as when data is pasted from one Excel file to another), the output results may become erroneous (blank). When pasting data, paste only the values not to change the combination status.

MEMO

APPENDIX

Appendix 1 Functional Restrictions by Version

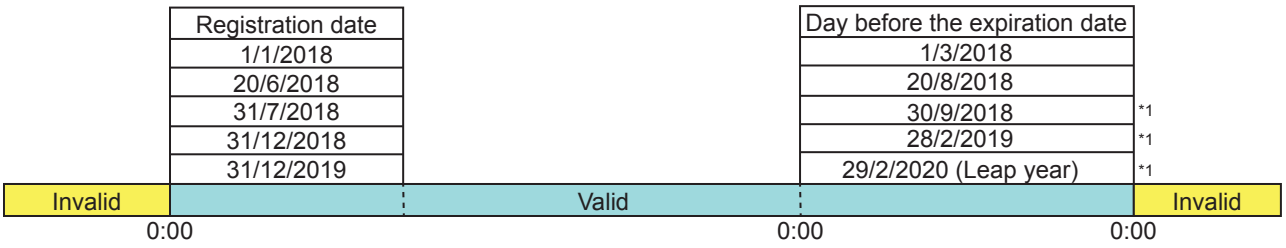
Available functions depend on the version of the application package.

The following table shows combinations of each version and function.

Function	Version	Reference
Machine control simulator and machine attitude monitor	1.002C	Page 32 Machine Control Simulator and Machine Attitude Monitor
Machine adjustment from the GOT Mobile		Page 84 SCREENS FOR MACHINE CONTROL PROGRAM EXAMPLES
Program Example for Vision Tracking	1.003D	Page 35 PROGRAM EXAMPLES FOR MACHINE CONTROL Page 84 SCREENS FOR MACHINE CONTROL PROGRAM EXAMPLES
WAIT-ON/OFF and point arrival notification setting with the machine program generation tool	1.004E	Page 117 MACHINE PROGRAM SUPPORT TOOL
Availability of a temporary license before a license key is obtained		Page 24 SETTING AND PROCEDURE BEFORE OPERATION

Appendix 2 Temporary License Registration

When using this application package before getting a license key, register a temporary license by following the steps below. The temporary license is valid for two months (from the registration date of the temporary license to the same day in the month after next).



*1 If the same day does not exist in the month after next, it is valid until the last day of the month.

Items to be prepared

Item	Description
License key registration project (AP20-HDL001AA_R16_LicWrite.gx3)	A project for registering a license key to the PLC CPU module. It is included in the supplied DVD. <FB> FormatLicense (Macro type) HDL_TempLicenseWrite (Macro type)

Clock setting of the PLC CPU module

Set the clock data (the current date and time) on "Clock Setting" of GX Works3.

For the clock setting, refer to the following.

GX Works3 Operating Manual

Executing the program

1. Executing the temporary license registration program

Copy the license key registration project (AP20-HDL001AA_R16_LicWrite.gx3) in the supplied DVD to a folder on the personal computer, then open the file.

The project is created for the R16CPU. When using a model other than R16CPU, change the model.

* When registering a license key to multiple PLC CPU modules, register it one by one.

2. Writing and executing the program

Write the program to the PLC CPU module and execute it.

- Select "Online" → "Write to PLC" from the menu and write all the program to the PLC CPU module.
- Set the PLC CPU module to the RUN state and execute the scan program. Select "Program" → "Scan" in the Navigation window and open the registered program. (Program name: LicenseWrite) The scan program includes the function block (FormatLicense) for formatting the license key registration area, the function block (HDL_LicenseWrite) for writing the license key, and the function block (HDL_TempLicenseWrite) for writing the temporary license.

Point

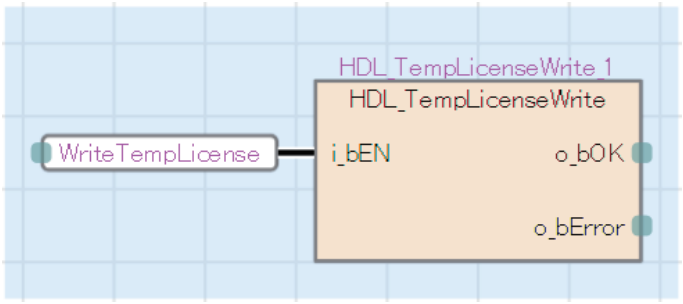
- When registering the temporary license to the PLC CPU module for the first time, format the license key registration area. Format it before registering the license key.
- When another license of iQ Monozukuri has been registered, register the license without formatting it.

■ Registering the temporary license

Turn on the execution flag (WriteTempLicense) of the function block (HDL_TempLicenseWrite) in the scan program. Normal completion (o_bOK) or Error completion (o_bError) becomes TRUE. At the error completion, refer to Troubleshooting.

(☞ Page 135 Troubleshooting)

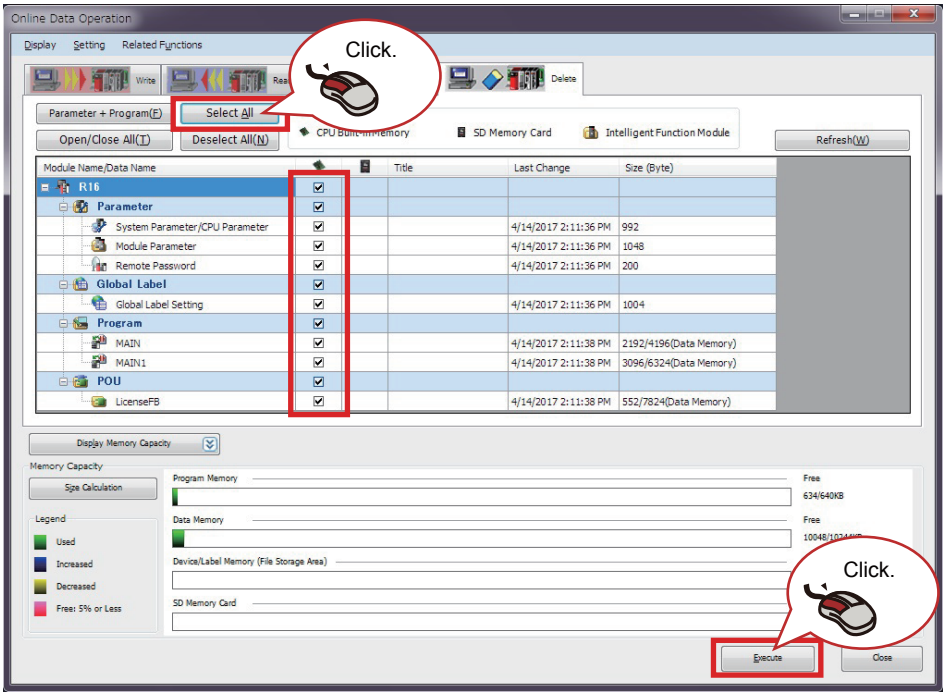
When Normal operation (o_bOK) turns on, the license key registration is completed. Turn off the execution flag (WriteTempLicense).



3. Deleting the program

After the temporary license registration has been completed, delete the program in the PLC CPU module.

Select "Online" → "Delete PLC Data" from the menu and select the [Select All] button in the "Online Data Operation" window to delete the program.



Troubleshooting

The following table lists errors that occur during the temporary license registration and corrective actions.

Error details	Cause	Corrective action
After "HDL_TempLicenseWrite" is executed, Error completion (o_bError) turns on and Normal completion (o_bOK) remains off.	• The license key registration area has never been formatted. • The license key outside the range of the memory was about to be written.	Format the license key registration area by using "FormatLicense" and register the temporary license by using "HDL_TempLicenseWrite". Using "FormatLicense" deletes other registered license keys. Register them again.
	The temporary license of the same product has already been registered.	<When the temporary license is valid> Continue to use the temporary license. <When the temporary license is expired> Get a license and register the license key by using "HDL_LicenseWrite".
After "HDL_TempLicenseWrite" is executed, neither Normal completion (o_bOK) nor Error completion (o_bError) turns on.	• The PLC CPU module is not in the RUN state. • "Macro type" is not specified for "FB type" of the license key registration FB.	• Set the PLC CPU module to the RUN state. • Specify "Macro type" for "FB type" of the license key registration FB.

Precautions

- The temporary license is written to the device data storage file, and thus retained after power off.
- If the license key registration area of the device data storage file is operated with SLMP or the FTP server function, license information may be lost.
- For the license key registration FB, set "FB type" to "Macro type".

A

REVISIONS

* The manual number is given on the bottom left of the back cover.

Revision date	*Manual number	Revision
August 2017	BCN-B62005-851-A	First edition
November 2017	BCN-B62005-851-B	■Added functions Machine control simulator, machine attitude monitor, and GOT screen examples (Machine adjustment from the GOT Mobile) ■Added or modified parts TERMS, REQUESTING AND REGISTERING A LICENSE KEY, Section 1.1, 1.3, 1.4, 2.2, 2.4, 3.1, 4.2, 4.4, 4.6, 4.7, Chapter 5, Section 5.1, 5.5, 5.6, 5.7, 5.8, Chapter 6, Appendix 1
March 2018	BCN-B62005-851-C	■Added functions Program Example for Vision Tracking ■Added or modified parts TERMS, Section 1.3, 1.4, Chapter 4, Section 4.1, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8, 5.1, 5.2. 5.3, 5.5, 5.6, 5.8, 5.9, Appendix 1
October 2018	BCN-B62005-851-D	■Added functions Availability of a temporary license before a license key is obtained ■Changed functions WAIT-ON/OFF and point arrival notification setting with the machine program generation tool ■Added or modified parts TERMS, 1.4, 2.1, 2.2. 6.2, Appendix 1, Appendix 2

WARRANTY

Please check the following product warranty details before using this product.

(1) Software included in this product

Check "END-USER SOFTWARE LICENSE AGREEMENT" (BCN-EP2005-0001) included in this product.

(2) Hardware included as a system component of this system

Check the product warranty details of each hardware.

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BCN-B62005-851-D(1810)

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