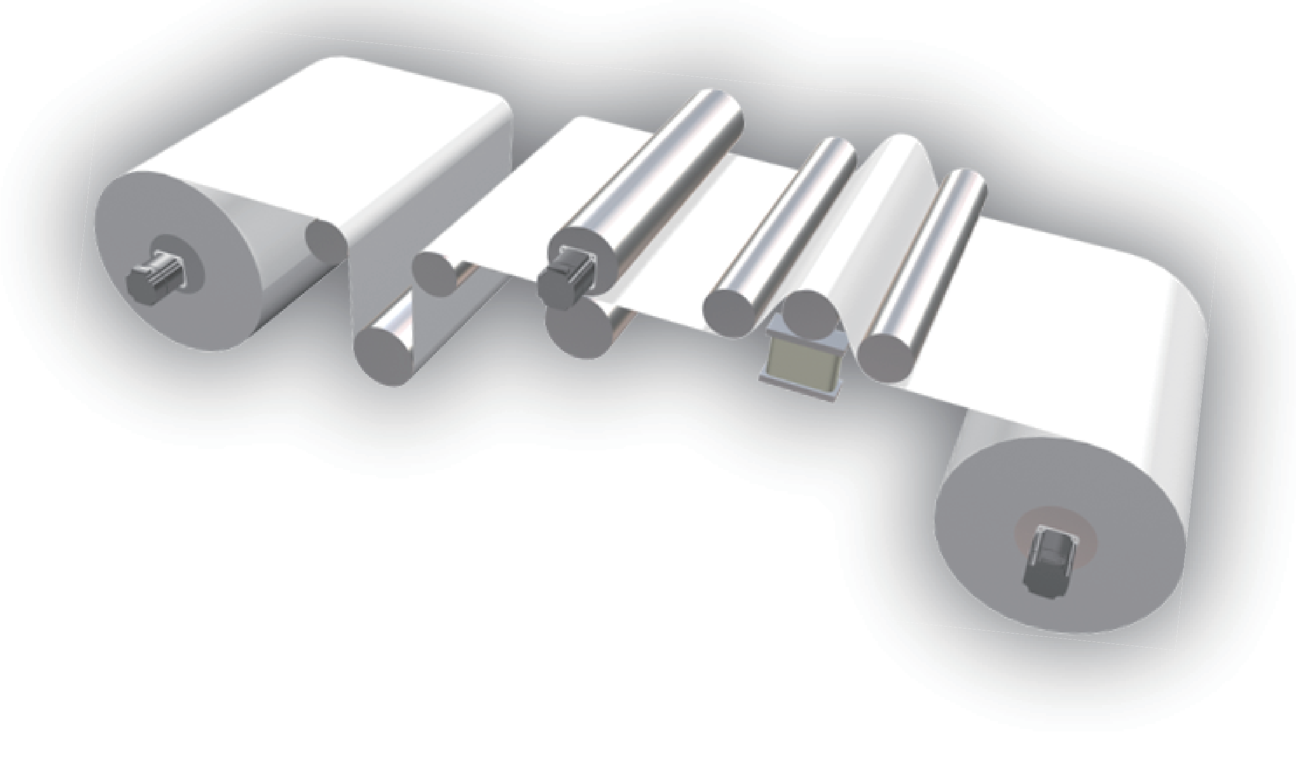
MITSUBISHI ELECTRIC

FA Application Package
iQ Monozukuri CONVERTING

Instruction Manual

- AP20-CNV002AA-MA
- AP20-CNV002AA-MB
- AP20-CNV002AA-MC
- AP20-CNV002AA-MD
- AP20-CNV002AA-ME
- AP20-CNV002AA-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 user's manual of the CPU module to use 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) Configure external safety circuits, such as an emergency stop circuit, protection circuit, and protective interlock circuit for forward/reverse operation or upper/lower limit positioning.
  (2) The programmable controller stops its operation upon detection of the following status, and the output status of the system will be as shown below.
    - 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) Also, 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 the user's manual of the CPU module to use.
  (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.
- 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.

⚠WARNING

- 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.
  (1) Machine home position return is controlled by two kinds of data: a home position return direction and a home position return speed. Deceleration starts when the near-point dog signal turns on. If an incorrect home position return direction is set, motion control may continue without deceleration. To prevent machine damage caused by this, configure an interlock circuit external to the programmable controller.
  (2) When the module detects an error, the motion slows down and stops or the motion suddenly stops, depending on the stop group setting in parameter. Set the parameter to meet the specifications of a positioning control system. In addition, set the home position return parameter and positioning data within the specified setting range.
  (3) Outputs may remain on or off, or become undefined due to a failure of a component such as an insulation element and transistor in an output circuit, where the module cannot detect any error. In a system that the incorrect output could cause a serious accident, configure an external circuit for monitoring output signals.
- 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 Multiple CPU system 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.
- Reset the CPU module after changing the parameters. Failure to do so may cause malfunction because the previous parameter settings remain in 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.
- 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.
- 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.
- Mitsubishi 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 MELSEC iQ-R Ethernet/CC-Link IE User's Manual (Startup). 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 can 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.

⚠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 value 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 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.
- 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

• RD77MS, RD77GF

Manual name [manual number]	Description	Available form
MELSEC iQ-R Simple Motion Module User's Manual (Startup) [IB-0300245]	Specifications, procedures before operation, system configuration, wiring, and operation examples of the Simple Motion module	Print book e-Manual PDF
MELSEC iQ-R Simple Motion Module User's Manual (Application) [IB-0300247]	Functions, input/output signals, buffer memory addresses, parameter settings, programming, and troubleshooting of the Simple Motion module	Print book e-Manual PDF
MELSEC iQ-R Simple Motion Module User's Manual (Advanced Synchronous Control) [IB-0300249]	Functions and programming for the synchronous control of the Simple Motion module	Print book e-Manual PDF
MELSEC iQ-R Simple Motion Module User's Manual (Network) [IB-0300307]	Functions, parameter settings, troubleshooting, and buffer memory of CC-Link IE Field Network	Print book e-Manual PDF

• RD78G(S)

Manual name [manual number]	Description	Available form
MELSEC iQ-R Motion Module User's Manual (Startup) [IB-0300406ENG]	Specifications, procedures before operation, system configuration, and wiring of the Motion module	Print book e-Manual PDF
MELSEC iQ-R Motion Module User's Manual (Network) [IB-0300426ENG]	Functions, parameter settings, troubleshooting, and buffer memory of CC-Link IE TSN	Print book e-Manual PDF
MELSEC iQ-R Motion Module User's Manual (Application for Simple Motion Mode) [IB-0300572ENG]	Functions, I/O signals, buffer memory, parameter settings, programming, and troubleshooting of the Simple Motion mode	Print book e-Manual PDF
MELSEC iQ-R Motion Module User's Manual (Advanced Synchronous Control for Simple Motion Mode) [IB-0300575ENG]	Functions and programming for the synchronous control of the Simple Motion mode	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
Out-feed	Indicates the section between a rewinding reel and a feed roll.
Out-feed roll	Rolls installed in the out-feed section. Out-feed rolls are driven by clutches, brakes, and servo motors. The tension of a web material after being processed can be controlled with a high degree of accuracy.
Accumulator	This mechanism accumulates web materials without stopping lines at the replacement of unwinding/rewinding rolls on the line that has been continuously operating.
Actuator	A drive or control mechanism such as a clutch, brake, or motor installed on an unwinder axis or rewinder axis
Under-roll	This term indicates the method of driving/braking the roll in contact with the reel without driving/braking the unwinder/rewinder axis. This roll is the one installed under the reel.
In-feed	Indicates the section between an unwinding reel and a feed roll.
In-feed roll	Rolls installed in the in-feed section. In-feed rolls are driven by clutches, brakes, and servo motors. The tension of a web material at the upstream of the processing can be controlled with a high degree of accuracy.
Weight dancer	This dancer applies a load to the dancer roll to give a tension to a material.
Air clutch Air brake	A clutch/brake that transmits a torque by crimping the friction plate with air
Feed roll	A driving roll for feeding a web material Feed rolls need to be designed not to generate a slip between the roll and a material. Feed roll is also called nip roll or pinch roll.
Automatic pastor	This mechanism automatically replaces and pastes an old roll with a new roll without stopping the line at the replacement of unwinding/rewinding rolls on the line that has been continuously operating. This mechanism is also called automatic reel changer or automatic splicer.
Open-loop control	This control regulates the reel torque with winding diameter detection to maintain the tension constantly.
Broken line taper	The taper tension control that does not use a single taper ratio from the initial diameter to the final diameter but changes the taper ratio with the intermediate winding diameter
Guide roll	This roll is used for changing the direction and preventing a material from swinging when the material is fed. Guide roll is also called follower roll because the roll is not driven by a motor but rotated by a material traveling.
Tension during acceleration	The tension caused by the inertia of a web material or roll at the startup of the machine. The tension at the unwinder side increases and the tension at the rewinder side decreases.
Inertia compensation control	Because of the inertia of the reel, the tension at the unwinder side increases and the tension at the rewinder side decreases at the startup of the machine. The tension at the unwinder side decreases and the tension at the rewinder side increases when the machine decelerates. To reduce the fluctuation of the tension, this control increases or decreases the braking torque or rewinding torque when the machine is started or stopped.
Geared motor	The motor that is integrated with a speed reducer. If the reduction ratio of a servo motor with a speed reducer is too large, the servo motor is not suitable for torque control.
Old axis sudden stop	To suddenly stop the reel at the side where unwinding is completed in the automatic reel changing/unwinding mechanism. Some control equipment has a fixed power supply with a short-time rating inside.
Proximity switch	A non-contact switch that operates when an object to be detected comes close to the switch. This switch is sometimes used as a rotation signal for a reel or feed roll.
Closed-loop control	This control automatically regulates outputs depending on the difference of a target value and detected value.
Deceleration gain	The control ratio to reduce the tension fluctuation caused by the inertia of the reel during deceleration of the machine
Tension during deceleration	The tension caused by the inertia of the reel during deceleration of the machine. The tension at the unwinder side decreases and the tension at the rewinder side increases.
Corner diameter	The winding diameter that becomes a corner point where the taper ratio changes in the broken line taper.
Converting	To process a web material. The machine for this purpose is called converting machine.
Converting simulator	A function to simulate the operation of the tension control on a personal computer.
Differential transformer	This transformer detects the tension by measuring the displacement of a spring dancer or detects the winding diameter by measuring the movement of a touch lever. A movable iron core has been installed between the primary coil and the secondary coil so that a voltage of the secondary coil depending on the iron core position can be acquired.
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).

Term	Description
Follower roll	A roll that is not driven by a motor
Elevator roll	A follower roll in the accumulator. Users can accumulate or pick up a material by lifting up and down the spindles of multiple elevator rolls.
New axis preset	To set the initial value of the torque required for a new axis just after being switched in the automatic reel change control
Simple Motion module	A Simple Motion module and a Motion module that operates in the Simple Motion mode
Stop roll	The roll that has been installed at the opening of the accumulator at the unwinder side or the opening of the accumulator at the rewinder side to keep a material during the replacement of the reel
Stall torque	A constant torque that is to be given while the machine is working or after the machine has stopped
Spring dancer	To give a tension to a material by the expansion and contraction of the spring installed in the dancer roll
Sliding tension	To prevent a sudden change of the tension by gradually decreasing the actual command value even when a set value suddenly decreases. Such a gradual decrease can be adjusted.
Braking torque	The brake torque to be applied to the unwinder reel. Dividing this value by the unwinder radius determines the unwinder tension value.
Cumulative thickness calculation method	To detect the winding diameter with the product of the set material thickness and the rotation amount of the reel
Integral time	When the tension deviation is small and this value is kept for a while, control outputs are changed to decrease the tension deviation. Integral time indicates the integration time constant at that time.
Positive unwinding	To drive an unwinding reel for the initial paper feed operation or to drive an unwinding reel with a motor when the preparatory reel (new axis) is accelerated in the automatic reel change operation to adjust the peripheral speed.
Turning arm	A winding reel support for changing the positions of multiple unwinding reels or rewinding reels and switching the current axis with a new axis. This is also called turret arm.
Sensor	A tension detector, proximity switch, or pulse generator in the tension control
Turret	This mechanism rotates to change the unwinder axis/rewinder axis. The fixing mechanisms (lock pin, latch, and brake for fixing) are equipped.
Bamboo shape	This shape indicates the conditions in which the end surface of a rewound material is irregular and a winding core is protruded. The taper tension control is performed to prevent the conditions.
Multi-axis proportioning control	To proportion control outputs of each axis based on the signal of one control equipment in a simultaneous multi-axis rewinding/unwinding mechanism
Touching lever	This lever detects a travel angle of the roll in contact with the reel using the movement of the lever and acquires signals proportional to the winding diameter. A differential transformer or potentiometer detects the movement of the lever.
Touch roll	This mechanism contacts the adhesion tape and workpieces at the workpiece change.
Dancer roll	A follower roll that moves its axis upward and downward or rightward and leftward. In the dancer roll system, the tension of a material is determined depending on the load applied to a roll axis.
Straight line taper	To control a machine using a constant tension taper ratio from an initial diameter to the last diameter in the taper tension control. (To control without changing the taper ratio)
Constant tension control	This control performs rewinding/unwinding with a constant tension regardless of winding diameter changes.
Constant torque control	This control performs rewinding/unwinding with a constant torque regardless of winding diameter changes. This control is one of the taper tension controls.
Taper tension	To gradually decrease the tension as the reel diameter becomes larger in rewinding.
Taper tension ratio	Gradual decrease ratio of the tension. (Minimum diameter tension - Maximum diameter tension)/Minimum diameter tension
Electro-pneumatic converter	This device is used for controlling air clutches and air brakes to gain the air pressure proportional to an input electric signal.
Tension meter	This device amplifies a faint signal from a tension detector to acquire a tension signal output and displays its value.
Transmitted torque	Torque transmitted from the input axis of a clutch to an output axis. When the clutch has slipped, this torque is equal to the control torque of the clutch.
Torque tension control	To control the tension of a material by adjusting the rotation torque of a roll. The tension control is based on the torque control.
Draw control	Multiple feed rolls are installed to fasten the peripheral speed of the latter part a bit and to operate a machine in a certain increase rate (draw ratio).
Nip roll	Refer to "Feed roll".
Powder clutch Powder brake	Electromagnetic clutch/brake that transmits the torque by filling fine iron powder between an input rotating body and output rotating body (or stationary body) and giving magnetism to the powder
Back tension	The tension to remove slacks of materials or the tension applied to the opposite side of the feeding direction
Pulse generator	A pulse generator is used for detecting the rotation speed of the feed roll with the winding diameter detector in the ratio calculation method. The generator is also called rotary encoder.

Term	Description
Hunting	Hunting phenomenon in the feedback control
Hysteresis clutch Hysteresis brake	A non-contact electromagnetic clutch/brake that uses the hysteresis characteristics of a non-magnetized permanent magnet
Winding diameter detection in the ratio calculation method	In this calculation method, the rotation speed of the feed roll is divided by the rotation speed of the winding reel to calculate the winding diameter.
Proportionality gain	The ratio of the direct response of control outputs to the control deviation
Pillow block	A support board of the bearing for supporting a roll for tension detection. The height from the installation face to the support core is called center height.
Pinch roll	Refer to "Feed roll".
Feedback	To input a tension detection value into the control system in the closed loop control for tension detection.
Deadband	The deviation band for stabilizing the tension. In the closed loop control that controls outputs depending on the deviation of a target value and a detected value, the corrective control is not performed when a deviation is small.
Pre-drive	The preparatory operation to adjust the peripheral speed of the preparatory reel to the line speed in the automatic reel change machine
Brake torque	Refer to "Braking torque".
Press roll	This roll is for crimping the web material on the winding reel with the web material of the under-roll in the circumferential surface drive (braking) rewinding (unwinding) machine.
Bellofram type air cylinder	A bellows type air cylinder is for improving responsiveness and reducing friction resistance in the method in which a load is applied to the dancer roll using an air cylinder.
Flat roll	To rewind materials in a flat shape (not round circle). Flat winding is used for rewinding of lithium batteries or others.
Potentiometer	This device detects a rotation angle by applying a constant voltage between fixed terminals of a variable resistor and measuring the voltage of a slide terminal.
Mechanical loss compensation	To prevent rolling resistance from affecting the control tension when the winding reel has the rolling resistance.
Reel change	The operation to change the roll of the unwinder/rewinder axis.
Rotary encoder	Refer to "Pulse generator".
FB	The abbreviation for a function block
GOT	The abbreviation for 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

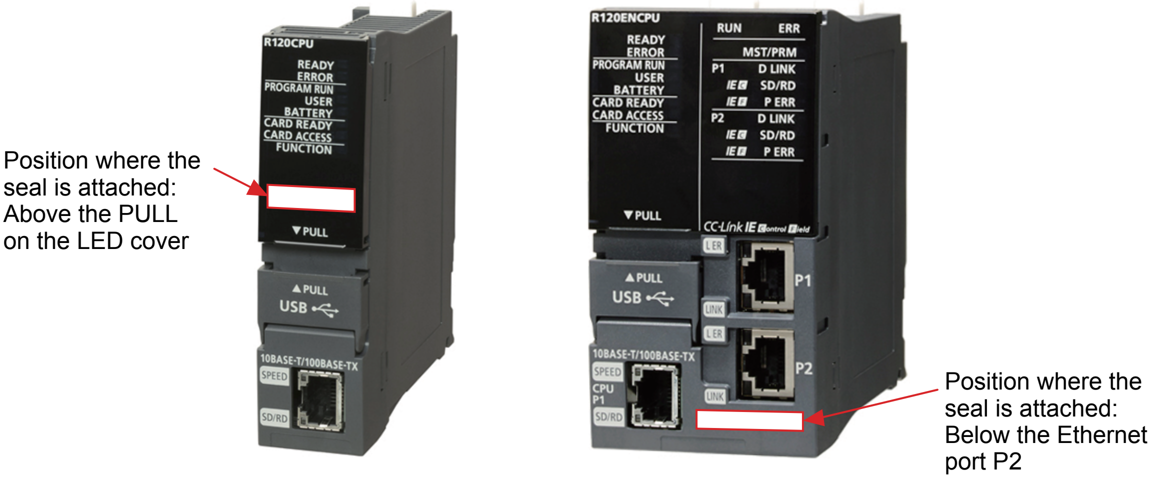
2. Register the license key to the CPU module before creating an application program.

For the registration procedure, refer to the following.

Page 30 SETTING AND PROCEDURE BEFORE OPERATION

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

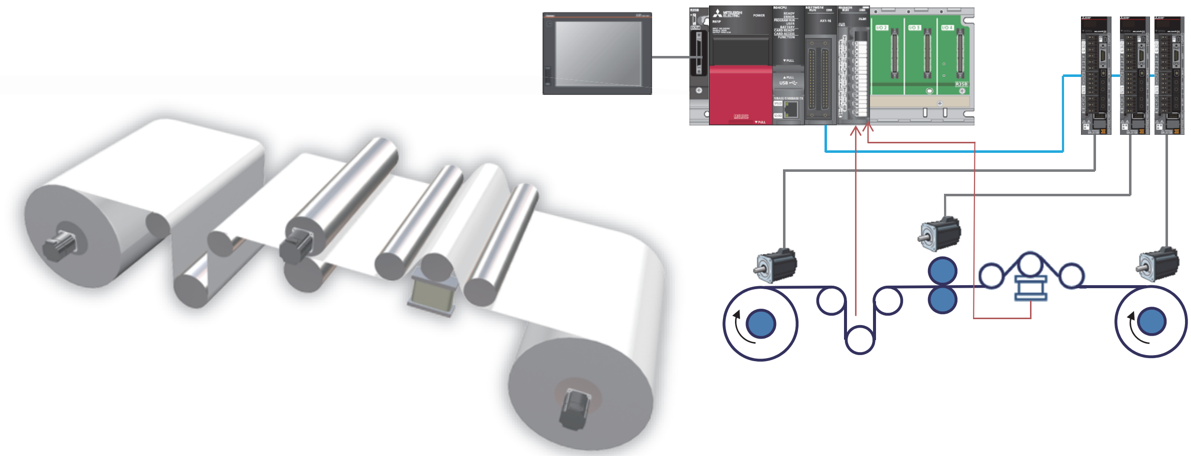
For the position to attach the seal, refer to the following.



1 OVERVIEW

1.1 Converting Application Package

The "converting application package" provides a FB library of the standard functions used for converting control and application examples of the library (programs and GOT screens).
Users can easily create applications by programming with the libraries required for the system used and utilizing application screens.

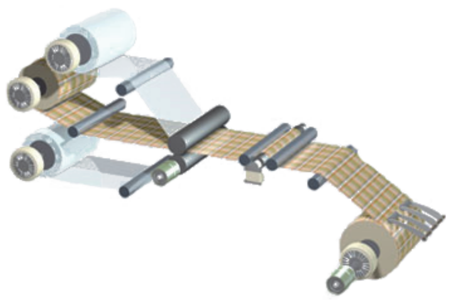


1.2 Application Examples

This application package can be used for controlling a wide range of machines to execute the following rewinder/unwinder controls.

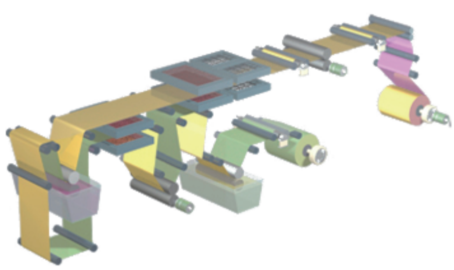
Laminator

This machine laminates both sides of a base material with films and rewinds the material.



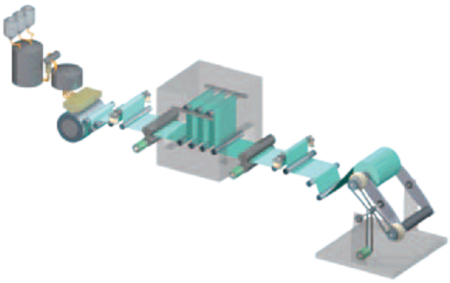
Coater

This machine applies a coating agent on films and rewinds the material.



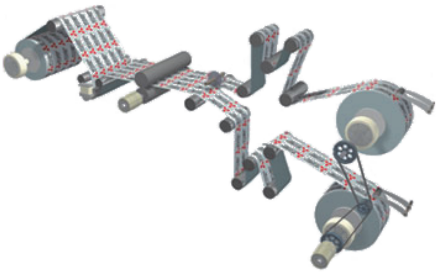
Film forming machine

This machine melts resin with a solvent to form a film.



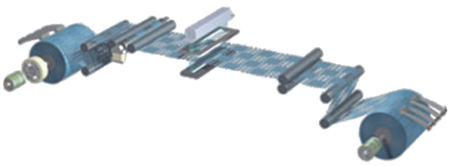
Slitter

This machine slits a material such as film, paper, and metal with knives in a specified width and rewinds the material.



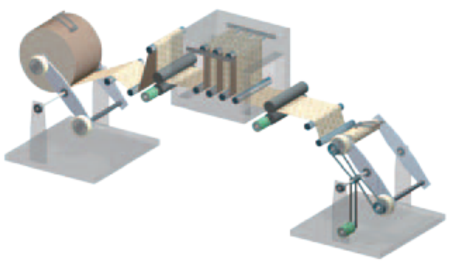
Inspection equipment

This equipment finds defects on the surface of a material such as film, paper, and metal with inspection cameras.



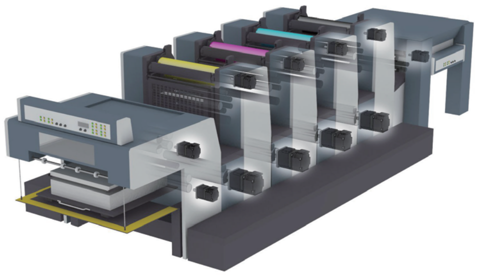
Rewinding equipment

This equipment creates multiple small rolls from a large roll.



Printing machine

This machine unwinds a roll paper and produces newspaper, magazines, or others.

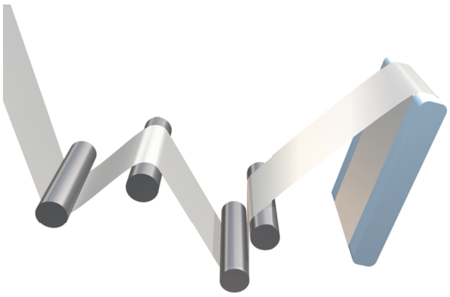


Packaging machine

This machine unwinds a packaging film to pack foods, cosmetics, or others.

Flat rewinder

This machine rewinds the material of lithium batteries or others with a flat type roll.

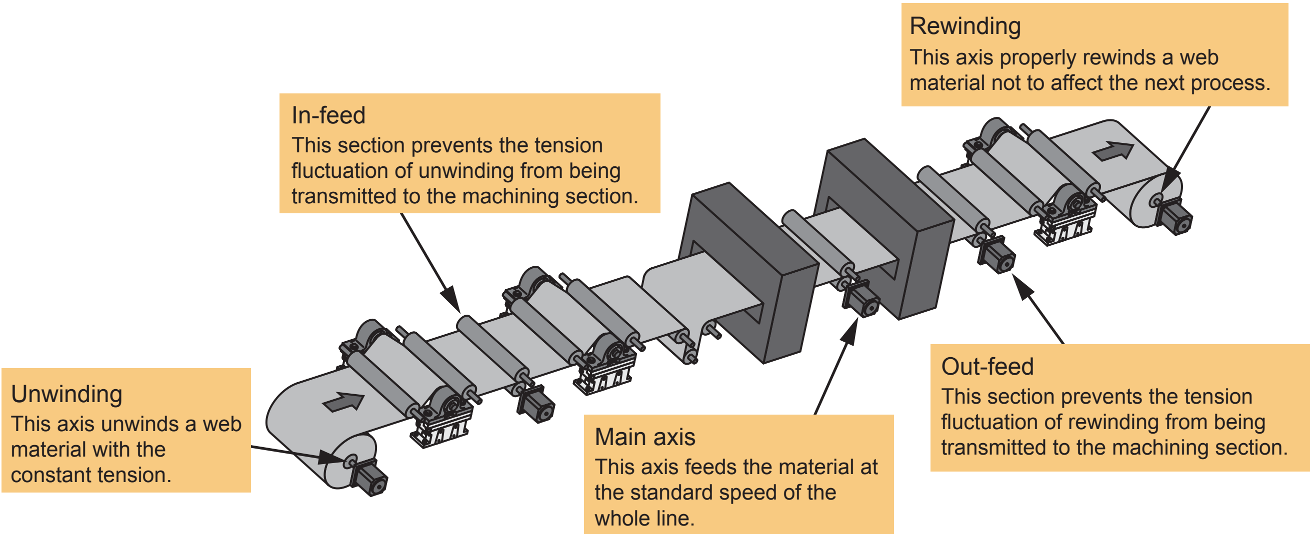


1.3 Converting

"Converting" is to process a web material.

Role of each part of a converting line

The following figure shows the role of each part of a converting control line.

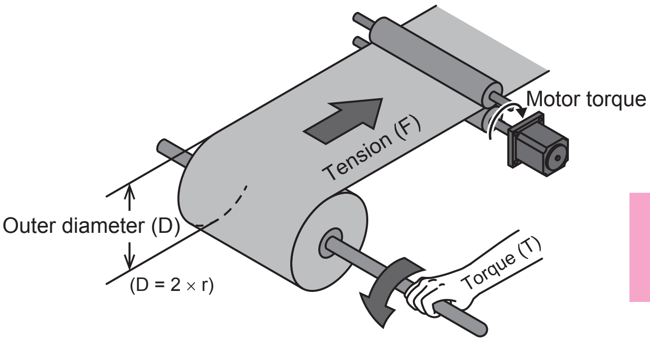


Relation among tension, torque, and winding diameter

This section describes the relation between the tension and the torque for feeding a web material. The term "torque" means the force to be applied on the rotary shaft. When a web material is fed out, it is fed rightward because the regenerative torque of the roll shaft is weaker than the motor torque.

In this case, the tension (F) applied on the material is determined depending on the regenerative torque (T) on the weaker side.

The following shows the relation between the torque (T) and the tension (F) at that time:



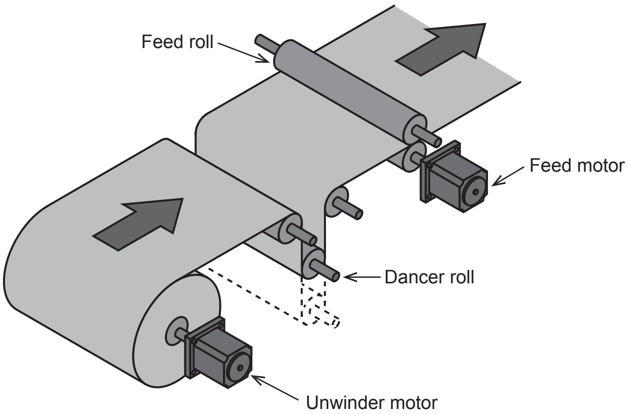
$$\text{F (Tension)} = \frac{\text{T (Torque)}}{\text{r (Radius)}}$$

Tension control methods

There are mainly two tension control methods, the method using speed control and the method using torque control.
Select a proper method for actual use conditions.

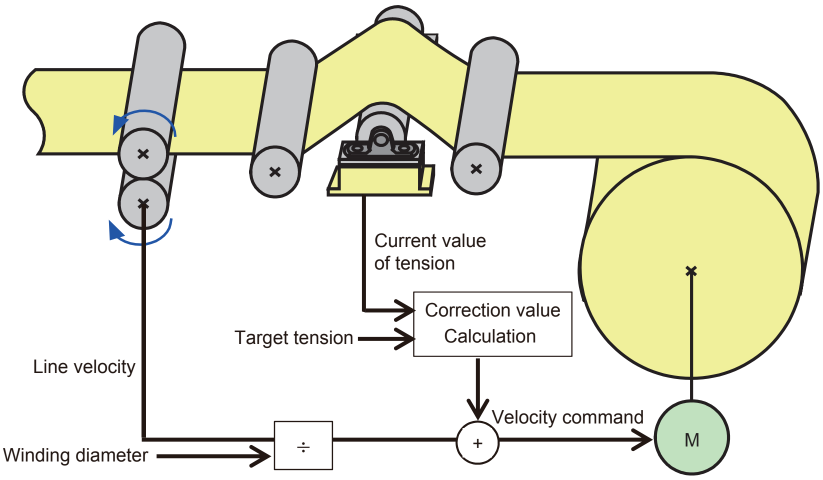
Speed control

In speed control, the speed of feeding a material is controlled to stabilize the tension. To control the tension of a material, it is necessary to change the pressurization of the dancer roll and correct the speed with the tension feedback value using tension detectors.



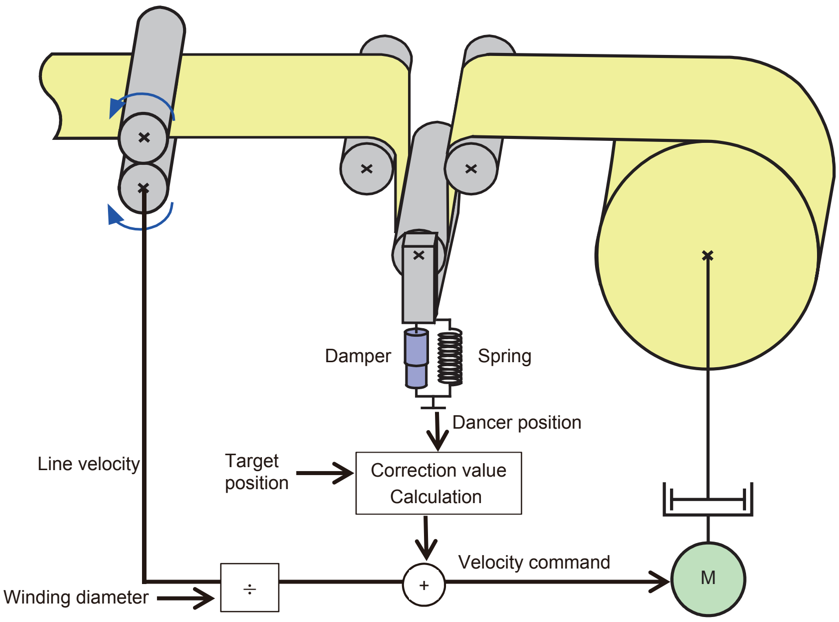
■Speed control using tension detectors

- Speed control can be performed in a simple configuration.
- The tension accuracy of the speed control is superior to the one of the dancer control.
- The tension stability is rather low.
- The controllability considerably changes depending on the material characteristics.



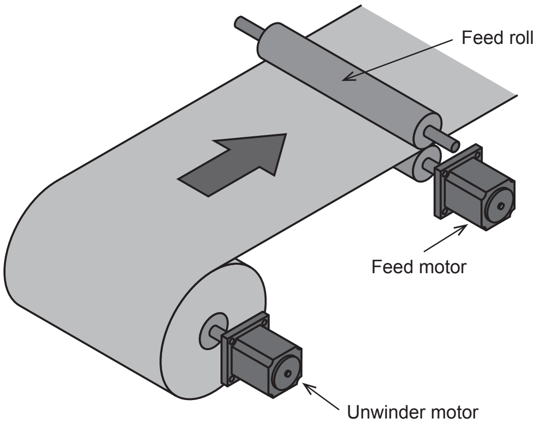
■Speed control using dancer rolls

- The tension stability is high even in acceleration/deceleration.
- Synchronization can be easily achieved even though the path is long.
- Dancer rolls absorb shocks.
- The tension accuracy depends on the air pressure and machine mechanism.



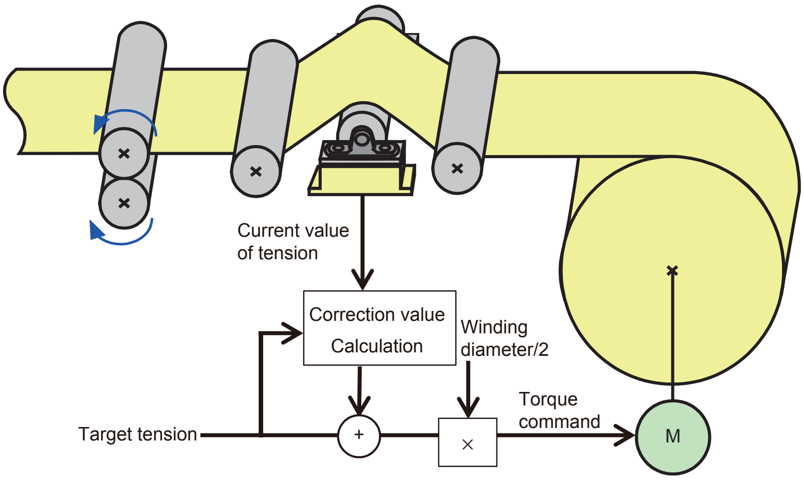
Torque control

In torque control, only the torque required to control the tension working on a web material is controlled, and the friction resistance and inertia torque are corrected depending on the actual equipment and operation patterns.



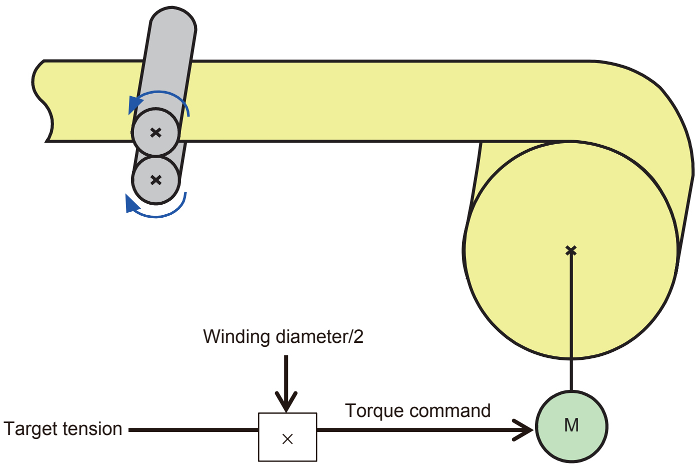
■Torque control using tension detectors

- The tension control accuracy is high.
- The operation at a constant speed is stable.
- Correction control is required in acceleration/deceleration.
- When the path is long, the response speed is low.



■Torque control without tension detectors

- Speed control can be performed in a simple configuration.
- Stable torque control is achieved without being affected by abrupt disturbance.
- Correction control is required in acceleration/deceleration.
- The absolute accuracy of the tension is low.



1.4 Product Configuration

This product is the CONVERTING package for MELSEC iQ-R series.
Select and prepare MELSEC iQ-R power supply modules, base units, PLC CPUs, Simple Motion modules, I/Os, intelligent modules, servo amplifiers, driving devices such as inverters, and GOTs appropriate to the system used.

Products in the iQ Monozukuri CONVERTING package

AP20-CNV002AA-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	
iQ Monozukuri seal[*1]	Number of licenses × 2	
Converting package (DVD-ROM)	1	For details, refer to the following. ☞ Page 26 Files in DVD-ROM

*1 There are two iQ Monozukuri seals included for each license (one spare seal).

1.5 Files in DVD-ROM

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

Folder			File name[*1]	File type (Extension)	Description	Required application
Package root/ RD77MS	Manual	English	bcnb62005740eng*	PDF file (.pdf)	iQ Monozukuri CONVERTING Instruction Manual (English)	Adobe Reader
			bcnb62005740eng*	e-Manual file (.ema)		e-Manual Viewer
		Japanese	bcnb62005739*	PDF file (.pdf)	iQ Monozukuri CONVERTING Instruction Manual (Japanese)	Adobe Reader
			bcnb62005739*	e-Manual file (.ema)		e-Manual Viewer
		Simplified Chinese	bcnb62005741chn*	PDF file (.pdf)	iQ Monozukuri CONVERTING Instruction Manual (Chinese (Simplified))	Adobe Reader
			bcnb62005741chn*	e-Manual file (.ema)		e-Manual Viewer
	Lib		CNV_TensionControl_R_****	Application library (.mslm)	FB library for converting applications	MELSOFT GX Works3
	Project	Basic	AP20-CNV002AA-R16-77MS16_****	GX Works3 project file (.gx3)	Programs (example) for unwinding (speed winding) and rewinding (torque winding), the basic converting applications	MELSOFT GX Works3
			AP20-CNV002AA-GT27nnV_****	GT Designer3 project file (.GTX)	Screens (example) for unwinding (speed winding) and rewinding (torque winding), the basic converting applications	MELSOFT GT Works3
		FlatWind	AP20-CNV002AA-R16-77MS16_FlatWind_****	GX Works3 project file (.gx3)	Programs (example) for flat type rewinding	MELSOFT GX Works3
			AP20-CNV002AA-GT27nnV_FlatWind_****	GT Designer3 project file (.GTX)	Screens (example) for flat type rewinding	MELSOFT GT Works3
	LicRegSupport		LicRegSupport	Tool (.xlsm)	License key registration support tool	Microsoft Excel
			AP20-CNV002AA_R16_LicWrite	GX Works3 project file (.gx3)	Programs for registering a license key to the CPU module	MELSOFT GX Works3
	Simulator		setup	Setup file (.exe)	Setup file for the converting simulator	MELSOFT GX Works3
	—		AP20-CNV002AA	Text file (.txt)	Version information	—

Folder			File name*1	File type (Extension)	Description	Required application
Package root/ RD77GF	Manual	English	bcnb62005740eng*	PDF file (.pdf)	iQ Monozukuri CONVERTING Instruction Manual (English)	Adobe Reader
			bcnb62005740eng*	e-Manual file (.ema)		e-Manual Viewer
		Japanese	bcnb62005739*	PDF file (.pdf)	iQ Monozukuri CONVERTING Instruction Manual (Japanese)	Adobe Reader
			bcnb62005739*	e-Manual file (.ema)		e-Manual Viewer
		Simplified Chinese	bcnb62005741chn*	PDF file (.pdf)	iQ Monozukuri CONVERTING Instruction Manual (Chinese (Simplified))	Adobe Reader
			bcnb62005741chn*	e-Manual file (.ema)		e-Manual Viewer
	Lib		CNV_TensionControl_R_****	Application library (.mslm)	FB library for converting applications	MELSOFT GX Works3
	Project	Basic	AP20-CNV002AA-R16-77GF16_****	GX Works3 project file (.gx3)	Programs (example) for unwinding (speed winding) and rewinding (torque winding), the basic converting applications	MELSOFT GX Works3
			AP20-CNV002AA-R16-77GF16_CCINV_****	GX Works3 project file (.gx3)	Programs (example) for unwinding (speed winding) and rewinding (torque winding) using an inverter, the basic converting applications	MELSOFT GX Works3
			AP20-CNV002AA-GT27nnV_****	GT Designer3 project file (.GTX)	Screens (example) for unwinding (speed winding) and rewinding (torque winding), the basic converting applications	MELSOFT GT Works3
		FlatWind	AP20-CNV002AA-R16-77GF16_FlatWind_****	GX Works3 project file (.gx3)	Programs (example) for flat type rewinding	MELSOFT GX Works3
			AP20-CNV002AA-GT27nnV_FlatWind_****	GT Designer3 project file (.GTX)	Screens (example) for flat type rewinding	MELSOFT GT Works3
	LicRegSupport		LicRegSupport	Tool (.xlsm)	License key registration support tool	Microsoft Excel
			AP20-CNV002AA_R16_LicWrite	GX Works3 project file (.gx3)	Programs for registering a license key to the CPU module	MELSOFT GX Works3
	—		AP20-CNV002AA	Text file (.txt)	Version information	—
Package root/ RD78G(S)	Manual	English	bcnb62005740eng*	PDF file (.pdf)	iQ Monozukuri CONVERTING Instruction Manual (English)	Adobe Reader
			bcnb62005740eng*	e-Manual file (.ema)		e-Manual Viewer
		Japanese	bcnb62005739*	PDF file (.pdf)	iQ Monozukuri CONVERTING Instruction Manual (Japanese)	Adobe Reader
			bcnb62005739*	e-Manual file (.ema)		e-Manual Viewer
		Simplified Chinese	bcnb62005741chn*	PDF file (.pdf)	iQ Monozukuri CONVERTING Instruction Manual (Chinese (Simplified))	Adobe Reader
			bcnb62005741chn*	e-Manual file (.ema)		e-Manual Viewer
	Lib		CNV_TensionControl_R_****	Application library (.mslm)	FB library for converting applications	MELSOFT GX Works3
	Project	Basic	AP20-CNV002AA-R16-78G16_****	GX Works3 project file (.gx3)	Programs (example) for unwinding (speed winding) and rewinding (torque winding), the basic converting applications	MELSOFT GX Works3
			AP20-CNV002AA-GT27nnV_****	GT Designer3 project file (.GTX)	Screens (example) for unwinding (speed winding) and rewinding (torque winding), the basic converting applications	MELSOFT GT Works3
		FlatWind	AP20-CNV002AA-R16-78G16_FlatWind_****	GX Works3 project file (.gx3)	Programs (example) for flat type rewinding	MELSOFT GX Works3
			AP20-CNV002AA-GT27nnV_FlatWind_****	GT Designer3 project file (.GTX)	Screens (example) for flat type rewinding	MELSOFT GT Works3
	LicRegSupport		LicRegSupport	Tool (.xlsm)	License key registration support tool	Microsoft Excel
			AP20-CNV002AA_R16_LicWrite	GX Works3 project file (.gx3)	Programs for registering a license key to the CPU module	MELSOFT GX Works3
	—		AP20-CNV002AA	Text file (.txt)	Version information	—

Folder		File name[*1]	File type (Extension)	Description	Required application
MELSOFT iQ AppPortal	iQAP_Data	setup	Setup file (.exe)	Installer of this application package data for the integrated management tool	MELSOFT iQ AppPortal

1 "" indicates their versions.

1.6 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 (R16CPU or a PLC CPU with higher capacity and specifications is recommended.) Use the module with a firmware version of "25" or later. When using the RD78G(S), use the module with a firmware version of "44" or later.
Simple Motion module	RD77MS, RD77GF, RD78G(S) Use the RD78G(S) with a firmware version of "16" or later.
Engineering environment (controller)	MELSOFT GX Works3 Version 1.076E or later
Engineering environment (GOT)	MELSOFT GT Works3 Version 1.220E or later
Application integration management software	MELSOFT iQ AppPortal Version 1.23Z or later

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 298 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-CNV002AA_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) CNV_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 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

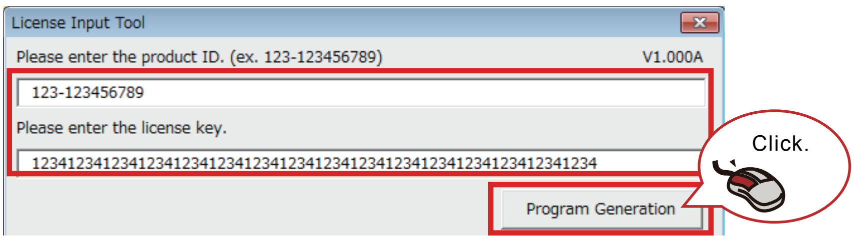
1. Opening the license key registration project (AP20-CNV002AA_R16_LicWrite.gx3).

Copy the license key registration project (AP20-CNV002AA_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.
* When registering a license key to multiple PLC CPU modules, register it one by one.

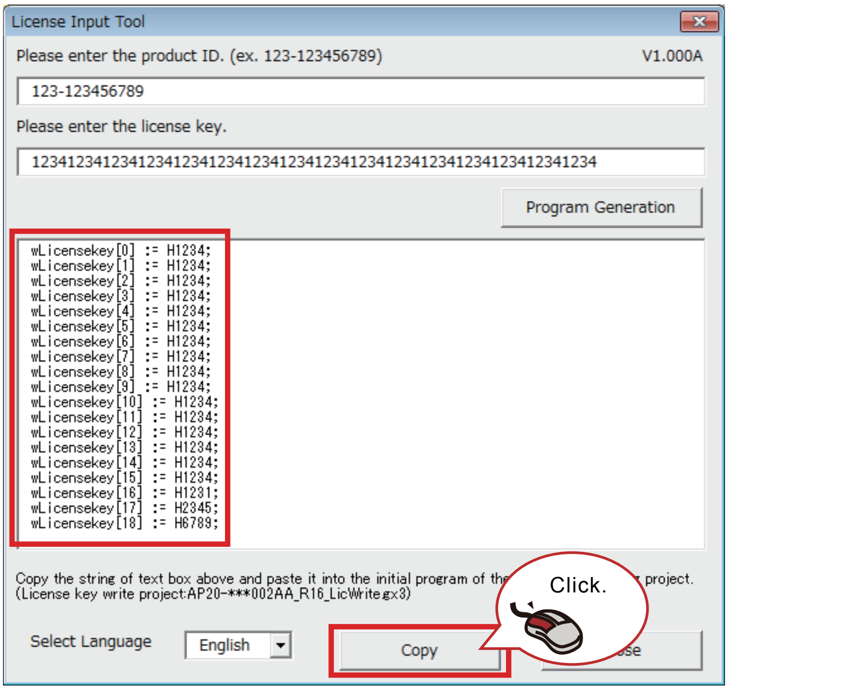
2. Preparing the program using the license key registration support tool

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

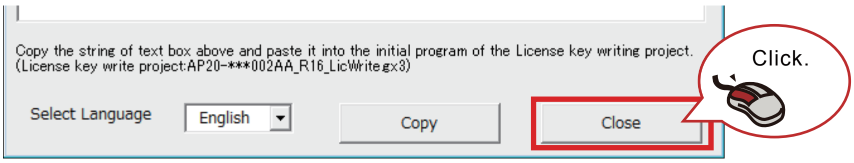
- Copy the license key registration support tool (LicRegSupport.xlsm) in the supplied DVD to a folder in the personal computer, and open the file. When the file is read-only, clear the read-only status. When the macro is disabled, enable it.
- Input the product ID and license key, and press the [Program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

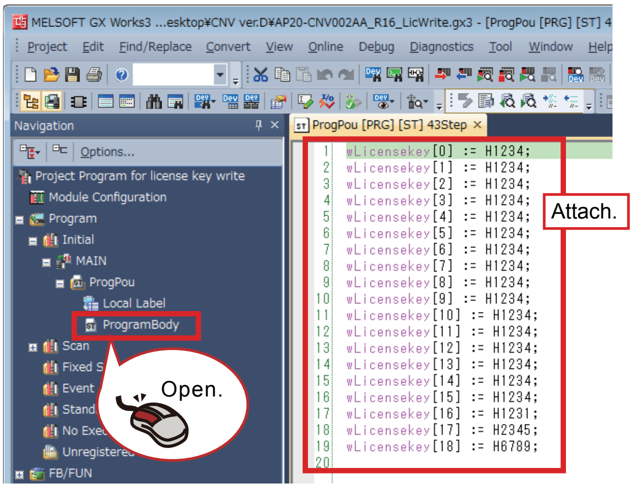
Set the license key to the license key label (wLicensekey) of the initial program.

■ 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.

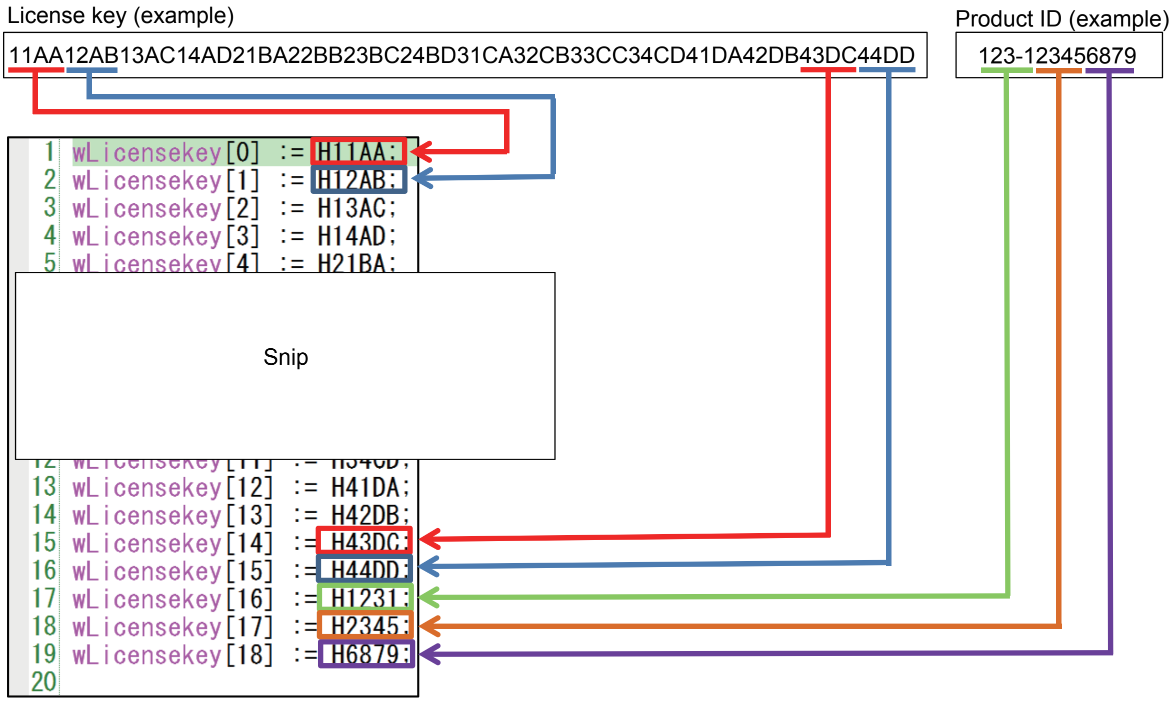
Select all of the existing ST program and paste the copied program in the initial program.



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.

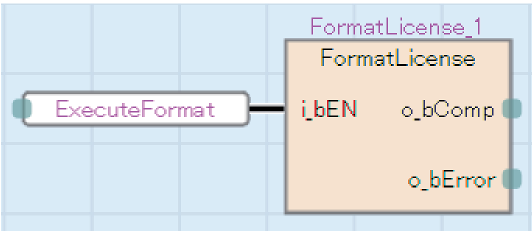
- Select "Convert" → "Rebuild All" from the menu and convert all the program created in step 3. When an error occurs, check the details and correct the program.
- Select "Online" → "Write to PLC" from the menu and write all the program to the PLC CPU module.
- Set the PLC CPU module to the RUN state 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 (CNV_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.

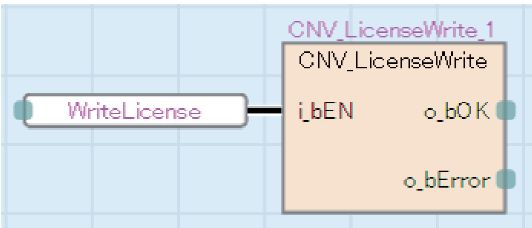
■ Formatting the license key registration area

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 (CNV_LicenseWrite) in the scan program. Normal completion (o_bOK) or Error completion (o_bError) becomes TRUE. At the error completion, refer to Troubleshooting. (☞ Page 34 Troubleshooting)
When Normal operation (o_bOK) turns on, the license key registration is completed. Turn off the execution flag (WriteLicense).

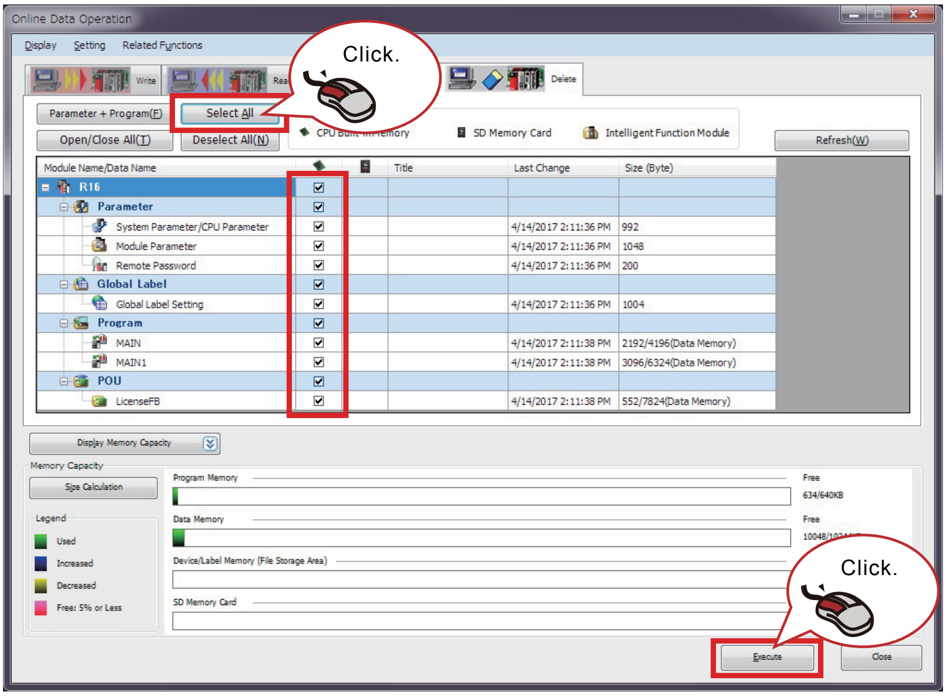


5. Deleting the license key registration program

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 "CNV_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 "CNV_LicenseWrite". Using "FormatLicense" deletes other registered license keys. Register them again.
After "CNV_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

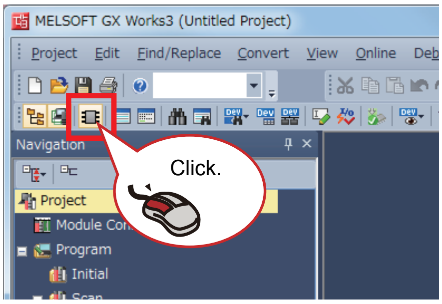
- The license key is held after the power-off since it is written to the device data storage file.
- If the data memory has been reset by operating the CPU memory of GX Works3, registration information of all registered license keys will be lost.
- If the license key registration area of the device data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

2.2 Registering the FB Library

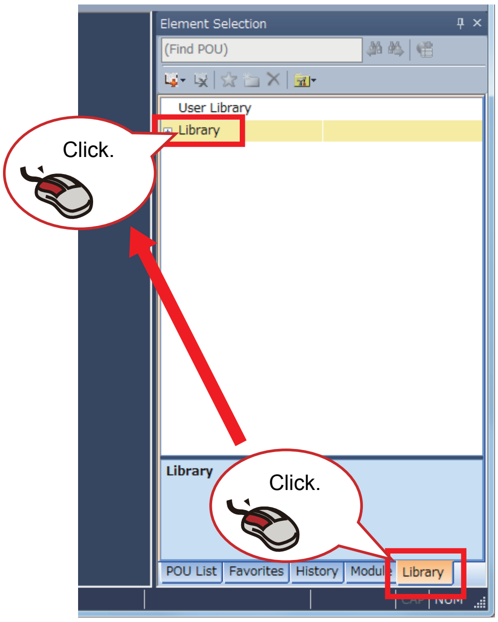
The following describes the procedure for registering the FB library in the list. For the library file name and details of the library, refer to Page 47 FB LIBRARY.

1. Copy the library file (*.mslm) in the supplied DVD to anywhere in a personal computer.

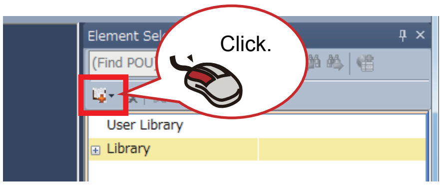
2. Start GX Works3, select "Project" → "New", and click the [Element Selection] icon.



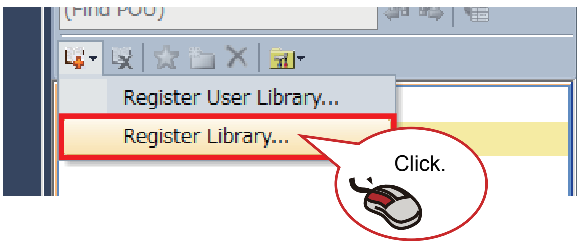
3. The Element Selection window appears. Click the Library tag and select the Library.

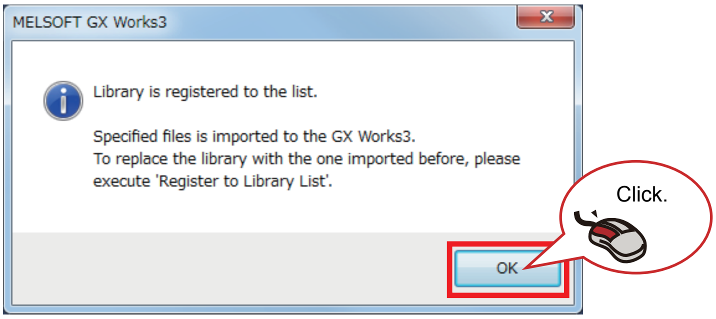


4. Click the [Register to Library List] icon.



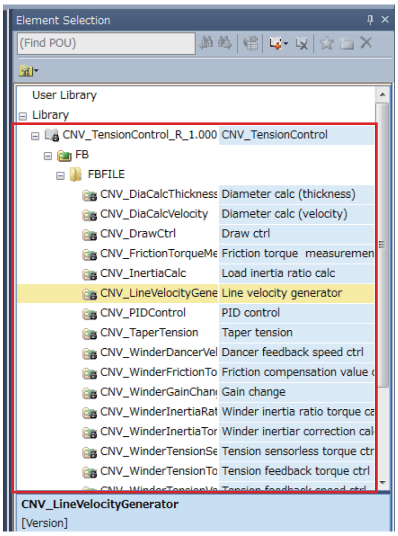
5. Click [Register Library].



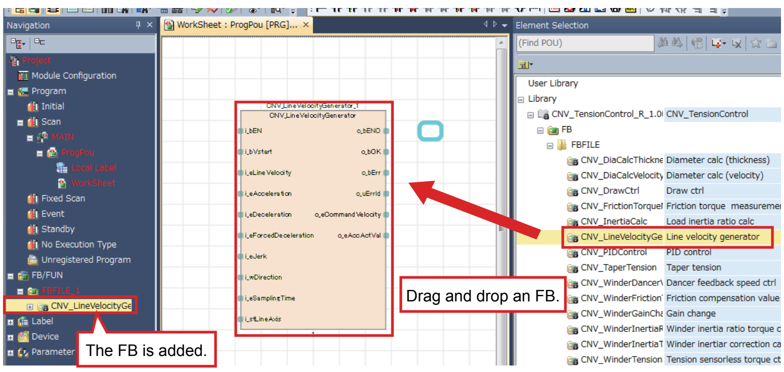


6. The dialog box shown on the left appears. Click the [OK] button.

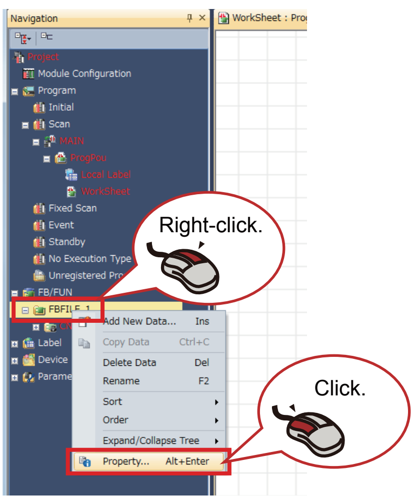
7. The "Register Library to Library List" window appears. Select the library file (*.mslm) copied in the personal computer and click the [Open] button.



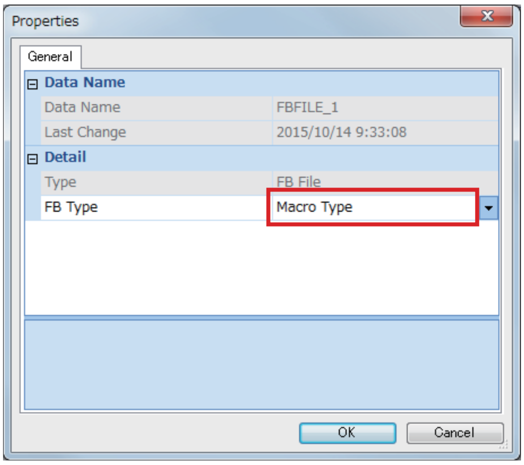
8. Imported FBs are displayed in the Element Selection window.



9. Select the FB to be used from the Element Selection window, and drag and drop it into the work window. The FB is added in the Navigation window.



10. Open [Property].



11. Select a FB type.

Point

When the subroutine type is set as the FB type, the size of programs can be reduced but the processing speed becomes slow. Fixed cycle execution is recommended for some FBs. Check the fixed cycle interval setting.

2.3 Updating Library Elements

The procedure for updating the library elements differs depending on the type of the programming language.
For details on the procedure for updating the library elements, refer to the following.
📖GX Works3 Operating Manual
If the elements of a library imported to a project cannot be updated, delete the library elements (FBs and structures) in the Navigation window, and then drag and drop FBs of a new version into the Navigation window. Unless the old library elements in the Navigation window are deleted, the update cannot be performed.

Replacement when updating a project of version 1.010L or earlier to 1.011M or later

Library change	Replacement method
Change the data type of the variables AxisNo. and StartIO in the AXIS_REF structure to word [unsigned].	Change the variable data type of I/O No. and axis No. to word [unsigned]. Correct the data type error in the type conversion instruction so that the data type matches.

2.4 Certifying the License Key

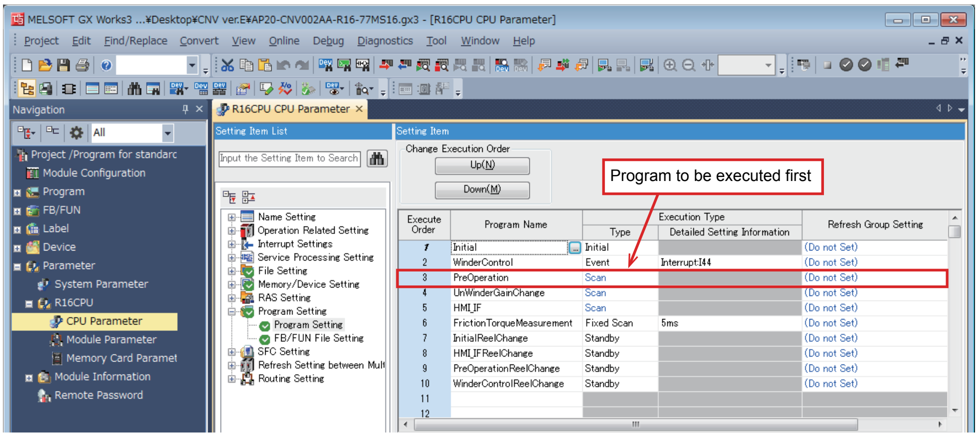
To use the FB library supplied with this application package, certify the registered license key.
For the license key certification, arrange the function block in the scan program of the user program.

Item	Description
License certification FB (CNV_Activation)	This FB certifies the license. It is supplied with the FB library. Set "FB type" to "Macro type" before using this function block.

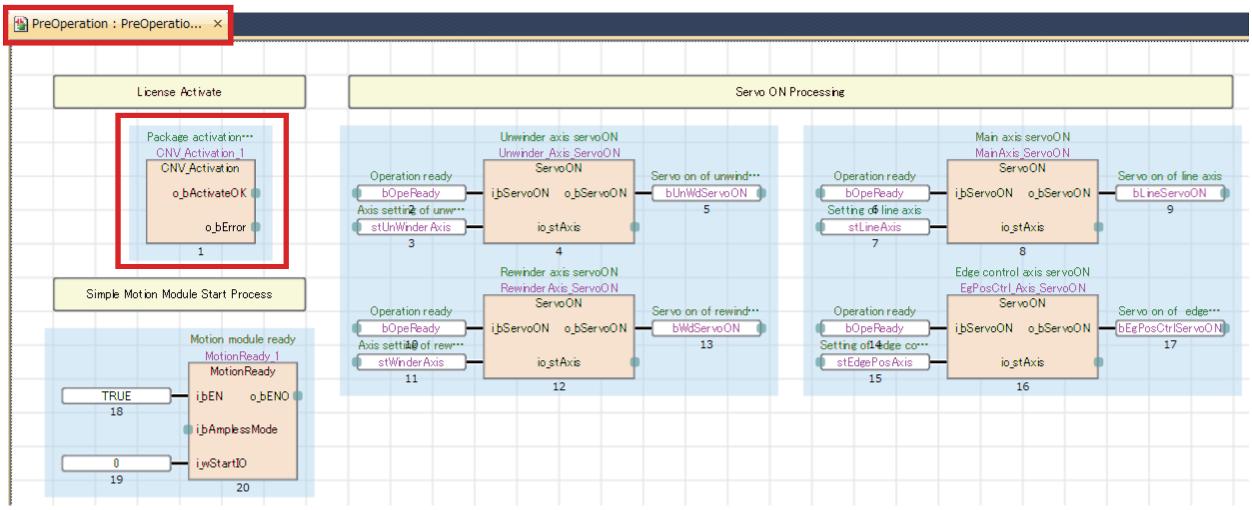
Arrangement of the license certification FB (CNV_Activation) in the user program

The license certification FB (CNV_Activation) must be executed before the library FBs.
Place it at the front of the user-created GX Works3 project scan program.
If there are multiple scan programs, place it in the program to be executed first.
The license certification FB does not operate correctly in non-scan programs.
The license certification FB is executed by arranging it only.

■How to check the program to be executed first



■Placement in the license certification FB scan program

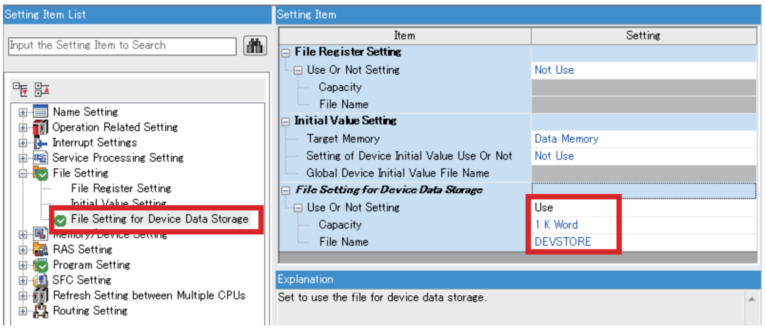


CPU parameter setting of the user program

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 this package program example, "access from external devices" is enabled in the global label. After writing the program example to the CPU module, reset the memory when disabling "access from external devices". If the memory has been reset, registration information of all registered license keys will be lost. In such a case, register the licenses 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 (CNV_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 key certification and corrective actions.

Error details	Cause	Corrective action
"o_bActivateOK" of "CNV_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 30 Registering a License Key)
	The expiration date of the temporary license (two months) passed.	Get and register the license key. (☞ Page 30 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 39 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.

2.5 Converting Simulator

Installing the converting simulator

■Check the following before installation.

- Log on to a personal computer as a user with the administrator authority.
- Before installation, close all running applications on the Microsoft® Windows® Operating System. If the converting simulator is installed while other applications are running, the product may not run normally.

1. Execute "Packageroot\RD77MS\Simulator\setup.exe" included in the supplied DVD.

2. Select the necessary information according to the instructions shown on the screen.

Uninstalling the converting simulator

Uninstall the converting simulator setting from the control panel of Windows®.

Executing the converting simulator

For how to use the converting simulator, refer to the following.

☞ Page 280 CONVERTING SIMULATOR

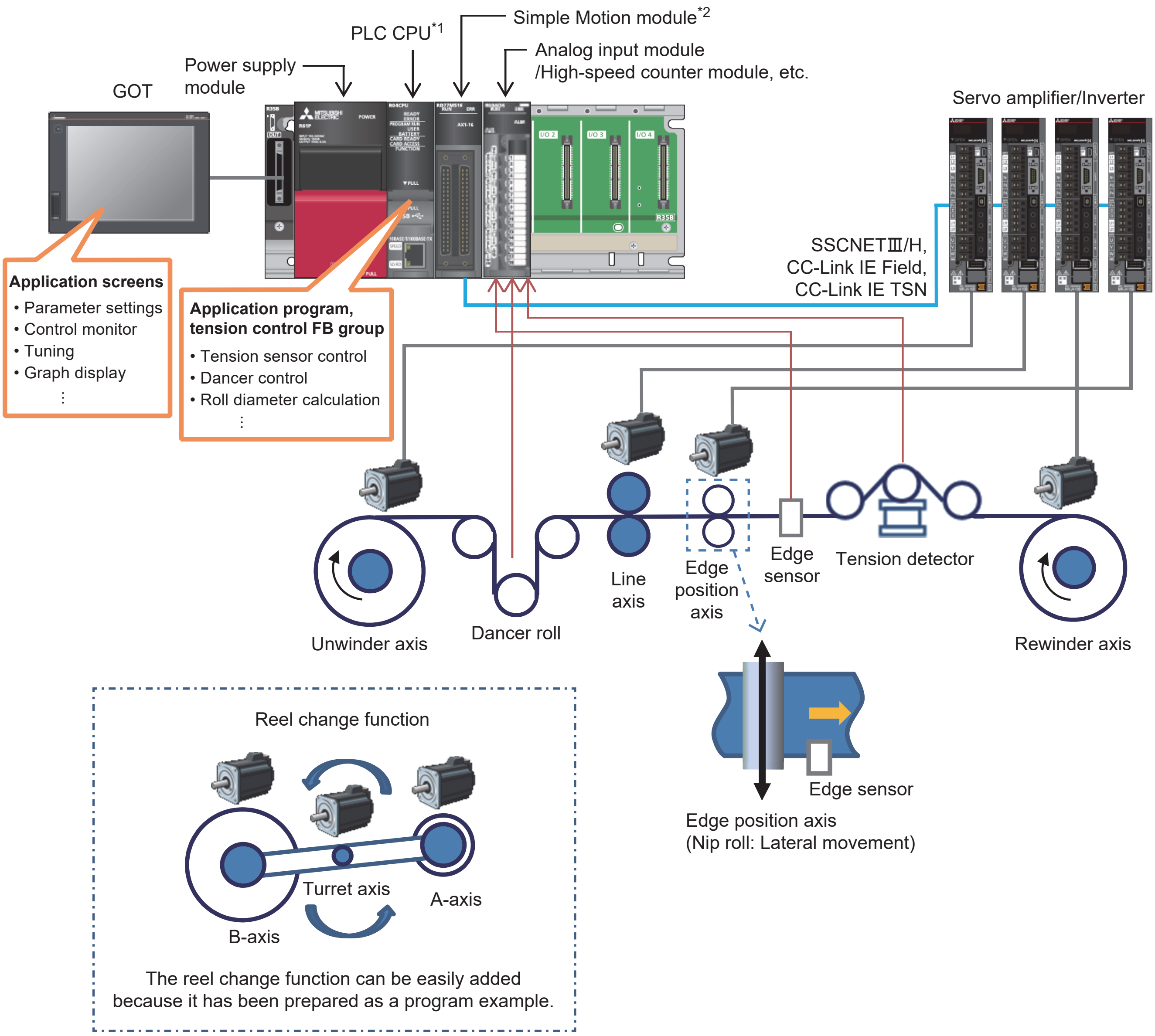
The converting simulator can be run by starting the system simulation from GX Works3 on the personal computer where the converting simulator setting is installed. If the converting simulator setting is not installed, the converting simulator does not run. However, the normal system simulation can be performed. When only performing simulation, license key certification is not required.

For details of the operation method, refer to help of the converting simulator.

3 SYSTEM CONSTRUCTION

3.1 System Configuration Example

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



*1 For this package, the R16CPU or a PLC CPU with higher capacity and specifications is recommended.

*2 When using the Motion module RD78G, set the Simple Motion mode.

For the Simple Motion mode, refer to the following manuals.

📖MELSEC iQ-R Motion Module User's Manual (Startup)

📖MELSEC iQ-R Motion Module User's Manual (Network)

📖MELSEC iQ-R Motion Module User's Manual (Application for Simple Motion Mode)

📖MELSEC iQ-R Motion Module User's Manual (Advanced Synchronous Control for Simple Motion Mode)

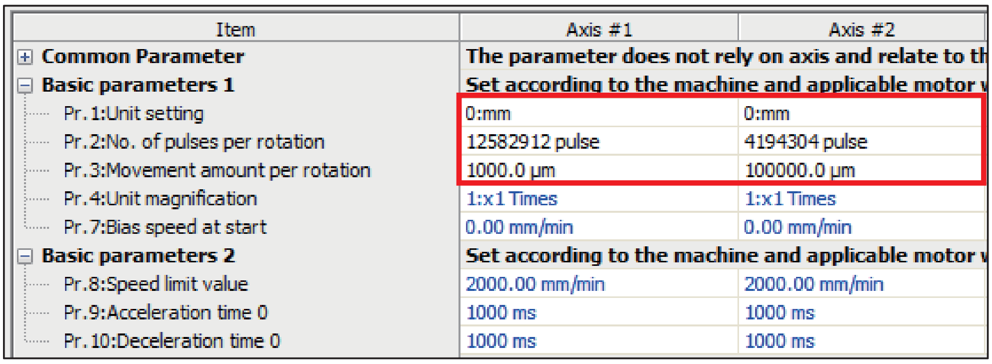
3.2 Electronic Gear Setting

In this FB, the velocities of the unwinder and rewinder axes are calculated in units of [r/min] and the velocities of the line and intermediate axes are calculated in units of [m/min]. Set the electronic gear of the Simple Motion module as follows.

- Unwinder axis, rewinder axis: 1 [mm] (1000.00 [μm]) for 1 rotation of the equipment
- Line axis, intermediate axis: Travel distance per rotation of the motor [μm] (Roller circumference/Gear ratio)

<Setting example>

- Unwinder axis (Axis 1): Gear ratio of the machine/motor = 1/3 (Motor: 4194304 [pulse/r])
- Line axis (Axis 2): Gear ratio of the perimeter of the machine roll (500 [mm])/motor = 1/5 (Motor: 4194304 [pulse/r])



Item	Axis #1	Axis #2
Common Parameter	The parameter does not rely on axis and relate to th	
Basic parameters 1	Set according to the machine and applicable motor w	
Pr.1:Unit setting	0:mm	0:mm
Pr.2:No. of pulses per rotation	12582912 pulse	4194304 pulse
Pr.3:Movement amount per rotation	1000.0 μm	100000.0 μm
Pr.4:Unit magnification	1:x1 Times	1:x1 Times
Pr.7:Bias speed at start	0.00 mm/min	0.00 mm/min
Basic parameters 2	Set according to the machine and applicable motor w	
Pr.8:Speed limit value	2000.00 mm/min	2000.00 mm/min
Pr.9:Acceleration time 0	1000 ms	1000 ms
Pr.10:Deceleration time 0	1000 ms	1000 ms

<Command unit>

- Unwinder axis 1.00 [r/min] → Motion command 1.00 [mm/min]
- Line axis 1.00 [m/min] → Motion command 1000.00 [mm/min]

Precautions

The above setting example is applied also when the RD78G(S) and the amplifier MR-J5 are connected.

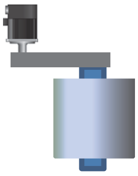
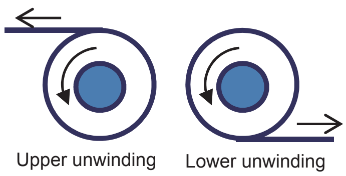
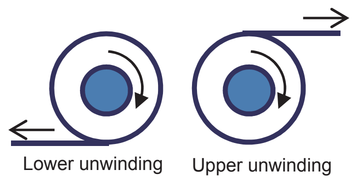
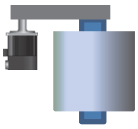
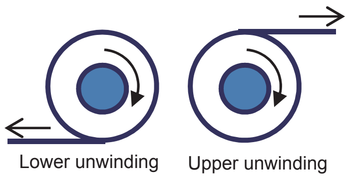
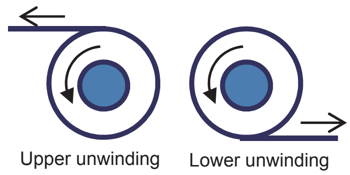
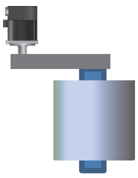
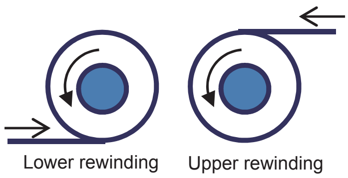
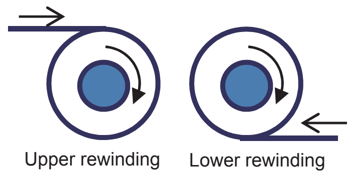
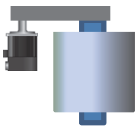
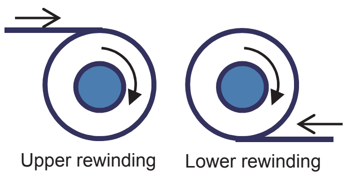
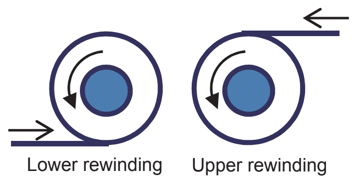
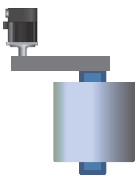
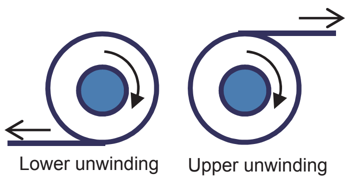
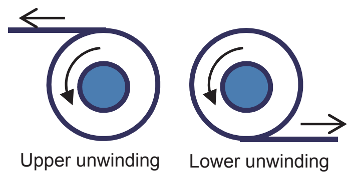
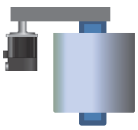
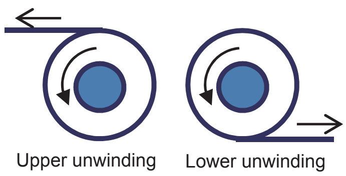
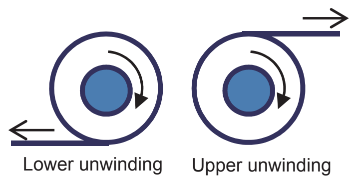
For the setting of the MR-J5, refer to the following.

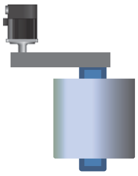
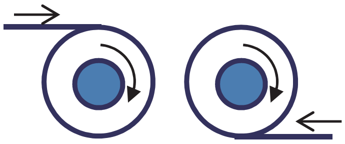
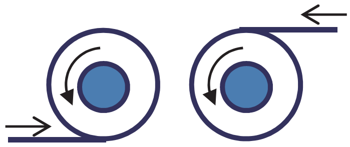
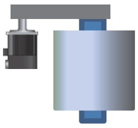
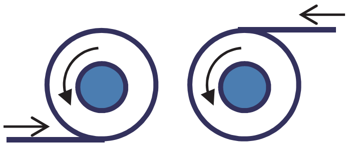
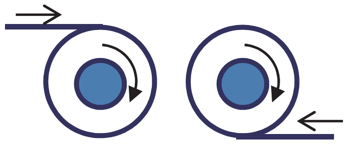
📖MELSEC iQ-R Motion Module User's Manual (Startup)

3.3 Rotation Direction Setting

Set the rotation direction in the servo parameter depending on the equipment used so that unwinding/rewinding is performed in the forward direction. Set WinderType[*1]: 0 for the unwinder axis and WinderType[*1]: 1 for the rewinder axis. To switch upper unwinding and lower unwinding, or upper rewinding and lower rewinding with a single machine, switch WinderType[*1] between 0 and 2, or 1 and 3.
Rewinding can be performed with the unwinder axis or unwinding can be performed with the rewinder axis issuing a minus (-) speed command to the line speed input of the FB.

*1 WinderType (FB winding method setting)

FB input (Winding method)	Installation direction of the motor	Servo parameter PA14 (POL)	
		0 (Forward direction: CCW (Counterclockwise direction))	1: (Forward direction: CW (Clockwise direction))
WinderType: 0 (Forward unwinding)			
			
WinderType: 1 (Forward rewinding)			
			
WinderType: 2 (Backward unwinding)			
			

FB input (Winding method)	Installation direction of the motor	Servo parameter PA14 (POL)	
		0 (Forward direction: CCW (Counterclockwise direction))	1: (Forward direction: CW (Clockwise direction))
WinderType: 3 (Backward rewinding)		 Upper rewinding Lower rewinding	 Lower rewinding Upper rewinding
		 Lower rewinding Upper rewinding	 Upper rewinding Lower rewinding

4 FB LIBRARY

This FB library is designed for the tension control using the Simple Motion module.

4.1 Functions of the FB Library

List of FBs

The following table lists the FBs in the FB library (CNV_TensionControl_R).

No.	Item	FB name	Description	Rewinder/unwinder control					Intermediate axis control	Flat roll	Reference
				Speed mode			Torque mode				
				Tension sensor	Dancer	No sensor	Sensor	No sensor			
01	Tension control	CNV_WinderTensionVelocityCtrl	Tension sensor feedback velocity control	◎	—	—	—	—	—	—	Page 53
		CNV_WinderDancerVelocityCtrl	Dancer feedback velocity control	—	◎	—	—	—	—	—	Page 56
		CNV_WinderTensionTorqueCtrl	Tension sensor feedback torque control	—	—	—	◎	—	—	—	Page 59
		CNV_WinderTensionSensorlessCtrl	Tension sensorless torque control	—	—	—	—	◎	—	—	Page 63
		CNV_TensionSensorlessVelocityCtrl	Tension sensorless velocity control	—	—	◎	—	—	△	—	Page 66
02	Tension control (intermediate axis)	CNV_FeedTensionVelocityCtrl	Tension sensor feedback velocity control	—	—	—	—	—	△	△	Page 70
		CNV_FeedDancerVelocityCtrl	Dancer feedback velocity control	—	—	—	—	—	△	△	Page 73
		CNV_DrawCtrl	Draw control	—	—	—	—	—	◎	—	Page 76
03	Velocity generator	CNV_LineVelocityGenerator	Line velocity generator	◎	◎	◎	◎	◎	◎	—	Page 78
04	Roll diameter calculation	CNV_DiaCalcVelocity	Roll diameter calculation (Velocity ratio method)	○	○	○	○	○	—	—	Page 80
		CNV_DiaCalcThickness	Roll diameter calculation (web thickness integration method)	○	○	○	○	○	—	—	Page 82
		CNV_DiaCalcFeed	Roll diameter calculation (feeding length method)	○	○	○	○	○	—	—	Page 85
05	Torque compensation	CNV_WinderInertiaTorque	Inertia compensation torque calculation	—	—	△	△	△	—	—	Page 88
		CNV_InertiaCalc	Load inertia ratio calculation	—	—	△	△	△	—	—	Page 90
		CNV_WinderInertiaRatioTorque	Inertia compensation torque calculation (Motor inertia ratio)	—	—				—	—	Page 92
		CNV_InertiaEstimation	Inertia estimation	—	—	△	△	△	—	—	Page 94
		CNV_InertiaTorqueCalc	Inertia compensation torque calculation (Inertia estimation value)	—	—				—	—	Page 96
		CNV_WinderFrictionTorque	Friction compensation torque calculation	—	—	—	◎	◎	—	—	Page 88
		CNV_FrictionTorqueMeasurement	Friction torque measurement	—	—	—	◎	◎	—	—	Page 101
		CNV_TensionDeviationMeasurement	Tension deviation measurement	—	—	△	△	△	—	—	Page 104

No.	Item	FB name	Description	Rewinder/unwinder control					Intermediate axis control	Flat roll	Reference
				Speed mode			Torque mode				
				Tension sensor	Dancer	No sensor	Sensor	No sensor			
06	Tuning function	CNV_WinderGainChange	Gain change	△	△	—	△	△	—	—	Page 109
		CNV_TaperTension	Taper tension calculation	△	—	—	△	△	—	—	Page 111
		CNV_PIDControl	PID control (with tension PI gain auto tuning)	▲	▲	—	▲	—	▲	—	Page 115
07	Additional function	CNV_EdgePositionCtrl	Edge position control	△	△	△	△	△	—	△	Page 118
		CNV_WebBreakDetect	Web break detection	△	△	△	△	△	—	△	Page 121
08	Flat roll	CNV_FlatWindingCamMeasurement	Cam generation for flat roll (Measurement method)	—	—	—	—	—	—	○	Page 124
		CNV_FlatWindingCamCalc	Cam generation for flat roll (Calculation method)	—	—	—	—	—	—	○	Page 127
09	Filters	STD_Lowpass1	Low-pass filter	▲	▲	▲	▲	▲	—	—	Page 129
		STD_AverageValueFilter	Moving average filter	△	△	△	△	△	—	—	Page 131
		STD_Limiter	Limiter	▲	▲	▲	▲	▲	—	—	Page 132
		STD_TableInterpolation	Table interpolation (2000 points)	▲	▲	▲	▲	▲	—	—	Page 134
		STD_Table50Interpolation	Table interpolation (50 points)	▲	▲	▲	▲	▲	—	—	Page 136
		STD_RampGenerator	Ramp generator	△	△	△	△	△	—	—	Page 138
99	Activation	CNV_Activation	License activation	◎	◎	◎	◎	◎	◎	◎	Page 39

◎: FB required for control

○: Any of these FBs is required for control.

▲: ◎ Used in FB (depending on the intended use)

△: Used depending on the intended use

Version history

The following table shows the version history of the FB library (CNV_TensionControl_R).

Version	Description
1.000A	First edition
1.001B	• CNV_DiaCalcFeed (Roll diameter calculation (feeding length method)) has been added. • CNV_EdgePositionCtrl (Edge position control) has been added. • CNV_WebBreakDetect (Web break detection) has been added. • RD77GF has been supported and initial value settings for Execution cycle have been deleted. • In velocity has been added as an output label in CNV_LineVelocityGenerator (Line velocity generator).
1.003D	• STD_RampGenerator (Ramp generator) has been added.
1.004E	FBs have been added. • CNV_Activation (License activation) • CNV_FeedTensionVelocityCtrl (Tension sensor feedback velocity control (Intermediate axis)) • CNV_FeedDancerVelocityCtrl (Dancer feedback velocity control (Intermediate axis)) • CNV_FlatWindingCamMeasurement (Cam generation for flat roll (Measurement method)) • CNV_FlatWindingCamCalc (Cam generation for flat roll (Calculation method))
1.006G	The following FBs have been modified. • CNV_Activation (License activation) • CNV_FlatWindingCamMeasurement has been supported simulation. • CNV_FlatWindingCamCalc has been supported simulation. • CNV_PIDControl (PID control (with tension PI gain auto tuning)) • STD_AverageValueFilter (Moving average filter) • CNV_DiaCalcFeed (Roll diameter calculation (feeding length method)) • CNV_EdgePositionCtrl (Edge position control) • CNV_LineVelocityGenerator (Line velocity generator)
1.007H	• Number of friction toque table points of CNV_WinderFrictionTorque (Friction compensation torque calculation) has been changed from 2000 to 50. • Number of measuring points of CNV_FrictionTorqueMeasurement (Friction torque measurement) has been changed from 2000 to 50. • Friction torque table structure has been added.
1.008J	• CNV_Activation (License activation) has supported the temporary license.
1.009K	The following FBs have been modified. • CNV_WinderGainChange (Gain change) • CNV_InertiaCalc (Load inertia ratio calculation)
1.010L	The following FBs have been added. • CNV_TensionDeviationMeasurement (Tension deviation measurement) • CNV_TensionSensorlessVelocityCtrl (Tension sensorless velocity control) • STD_Table50Interpolation (Table interpolation (50 points)) • CNV_InertiaEstimation (Inertia estimation) • CNV_InertiaTorqueCalc (Inertia compensation torque calculation (Inertia estimation value)) The following FBs have been modified. • The input label of the tension correction value has been added to CNV_WinderTensionTorqueCtrl (Tension sensor feedback torque control). • The input label of the tension correction value has been added to CNV_WinderTensionSensorlessCtrl (Tension sensorless torque control). • CNV_DiaCalcThickness (Roll diameter calculation (web thickness integration method)) • CNV_DiaCalcFeed (Roll diameter calculation (feeding length method)) • CNV_FrictionTorqueMeasurement (Friction torque measurement) • CNV_InertiaCalc (Load inertia ratio calculation)

Version	Description
1.011M	The data type of AXIS_REF structure in the following FBs have been changed. • CNV_WinderTensionVelocityCtrl • CNV_WinderDancerVelocityCtrl • CNV_WinderTensionTorqueCtrl • CNV_WinderTensionSensorlessCtrl • CNV_TensionSensorlessVelocityCtrl • CNV_FeedTensionVelocityCtrl • CNV_FeedDancerVelocityCtrl • CNV_DrawCtrl • CNV_LineVelocityGenerator • CNV_DiaCalcThickness • CNV_DiaCalcFeed • CNV_InertiaEstimation • CNV_FrictionTorqueMeasurement • CNV_EdgePositionCtrl • CNV_FlatWindingCamMeasurement • CNV_FlatWindingCamCalc The following FBs have been modified. • CNV_TensionDeviationMeasurement • CNV_WebBreakDetect
1.012N	The following FBs have been modified to support the RD78G(S). • CNV_WinderTensionVelocityCtrl • CNV_WinderDancerVelocityCtrl • CNV_WinderTensionTorqueCtrl • CNV_WinderTensionSensorlessCtrl • CNV_TensionSensorlessVelocityCtrl • CNV_FeedTensionVelocityCtrl • CNV_FeedDancerVelocityCtrl • CNV_DrawCtrl • CNV_LineVelocityGenerator • CNV_DiaCalcThickness • CNV_DiaCalcFeed • CNV_InertiaEstimation • CNV_FrictionTorqueMeasurement • CNV_EdgePositionCtrl • CNV_FlatWindingCamMeasurement • CNV_FlatWindingCamCalc

Restrictions and precautions common to all FBs

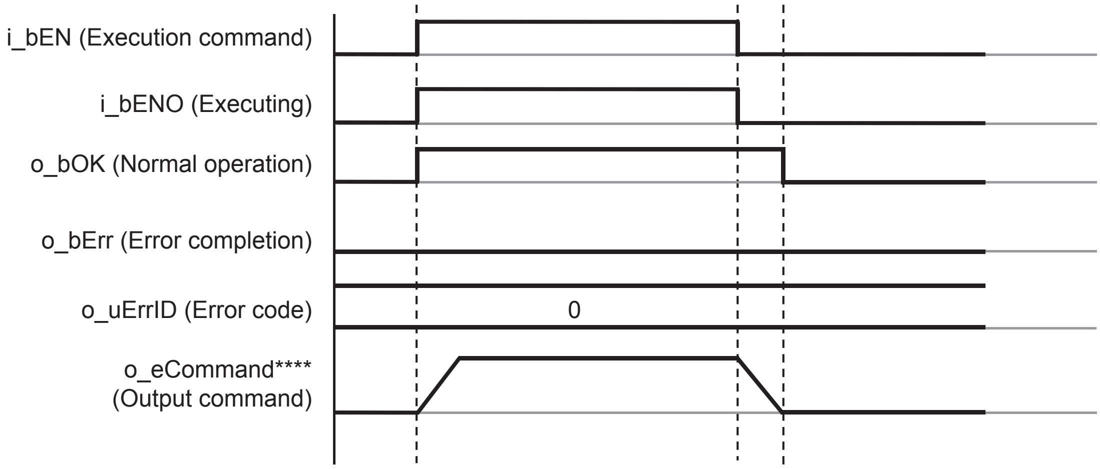
- The number of FB steps in a program varies depending on the CPU model to be used and I/O definitions.
- When combining macro and subroutine types in the program, use the R**CPU or R**ENCPU with a firmware version of "26" or later.
- When using the RD78G(S), use the module with a firmware version of "44" or later.
- For FBs with the following restriction or precaution: "Execute this FB in a fixed cycle."
  When using the FBs in the RD77MS and RD77GF, executing them in Motion calculation cycle event task (I44: Inter-module synchronization) is recommended.
  When using the FBs in the RD78G(S), executing them in the calculation cycle of the RD78G(S) is recommended.
  For the calculation cycle setting of the RD78G(S), refer to the following.
  📖MELSEC iQ-R Motion Module User's Manual (Startup)

Operation timing

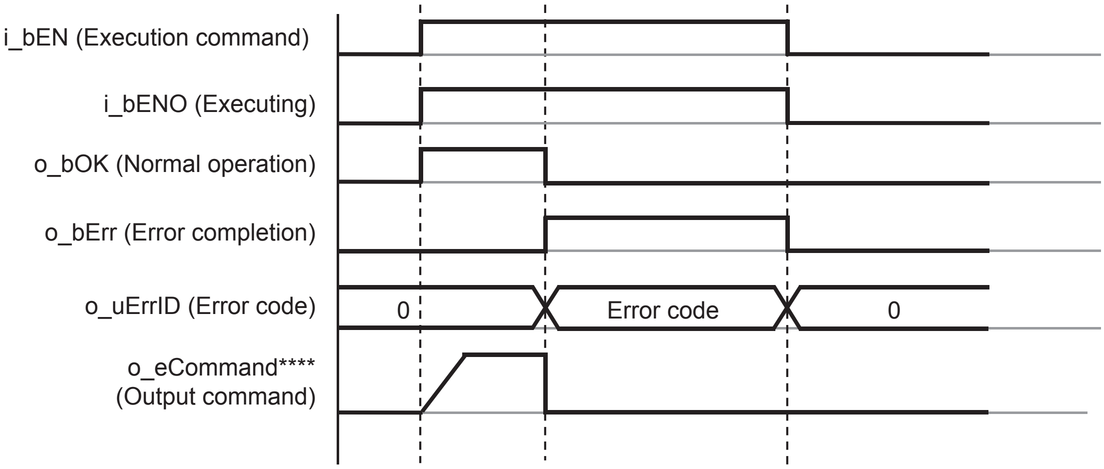
The following figure shows the operation timing at start/stop in this FB.

- Real-time execution

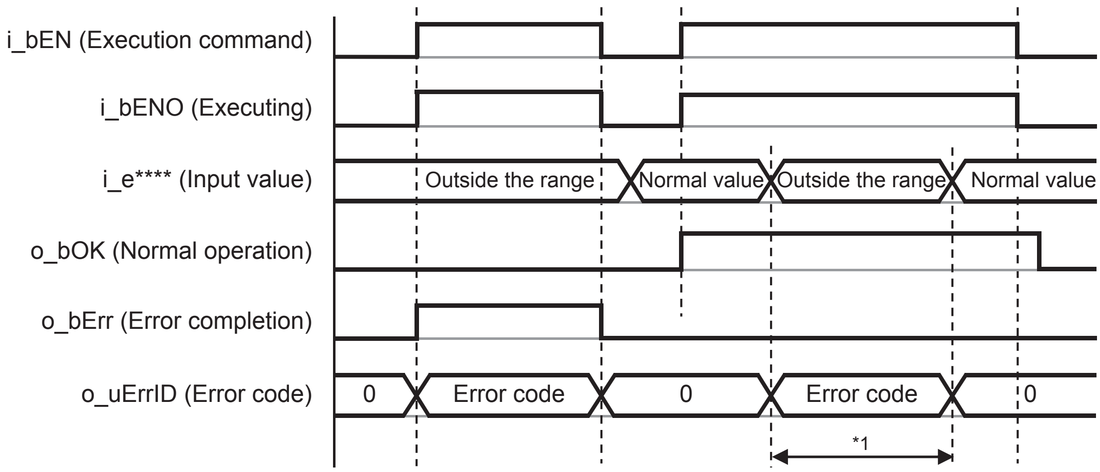
[Normal operation]



[Error completion]



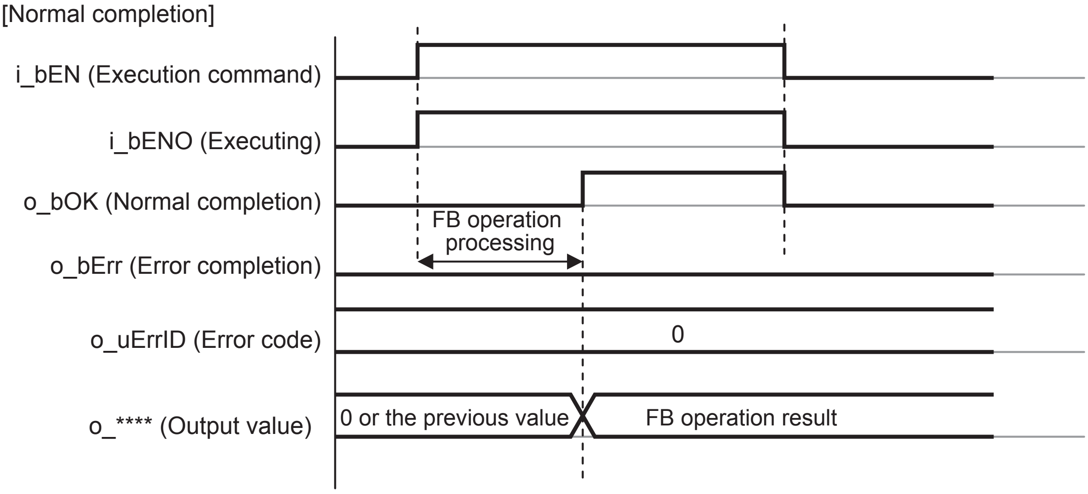
[When a value input to the FB is outside the range]



*1 When a value outside the range is input during normal operation, an error code is output but the operation continues using the previous normal value.
After that, when a normal value is input, the error code is cleared.

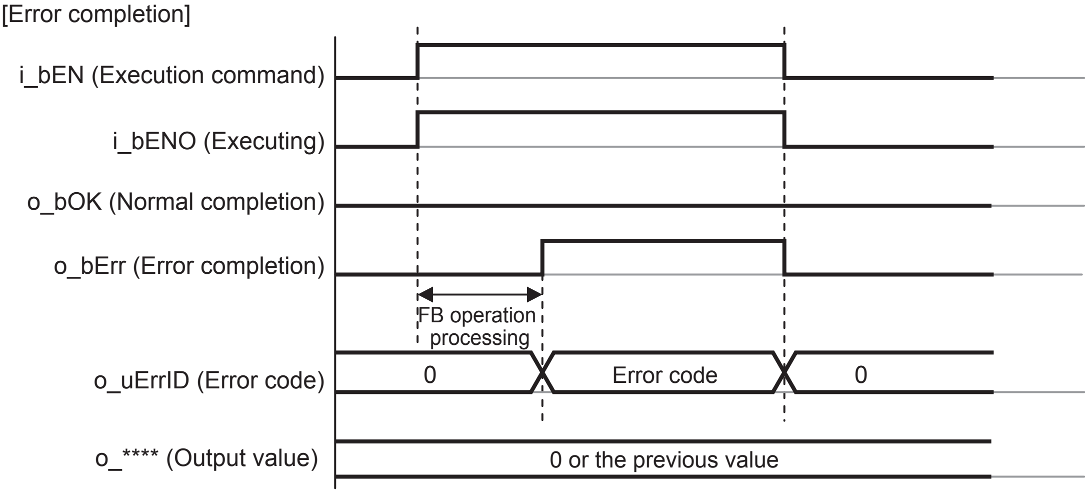
• Pulsed execution (multiple scan execution type)

[Normal completion]



*Hold i_bEN (Execution command) on until o_bOK (Normal completion) turns on.

[Error completion]



*When i_bEN (Execution command) is turned off before o_bOK (Normal completion) or o_bErr (Error completion) turns on, stop the FB operation processing and end it with o_bOK (Normal completion) or o_bErr (Error completion) that remains off.

Point

The FB stop processing due to the PLC CPU error is not performed.
When the operation setting at an error detection is set to continue (default: stop) in the CPU parameter, the FB does not stop due to a CPU error. To stop the FB when a CPU error occurs, use the FB with the operation at an error detection sets to stop in the CPU parameter.

4.2 Details of the FB Library

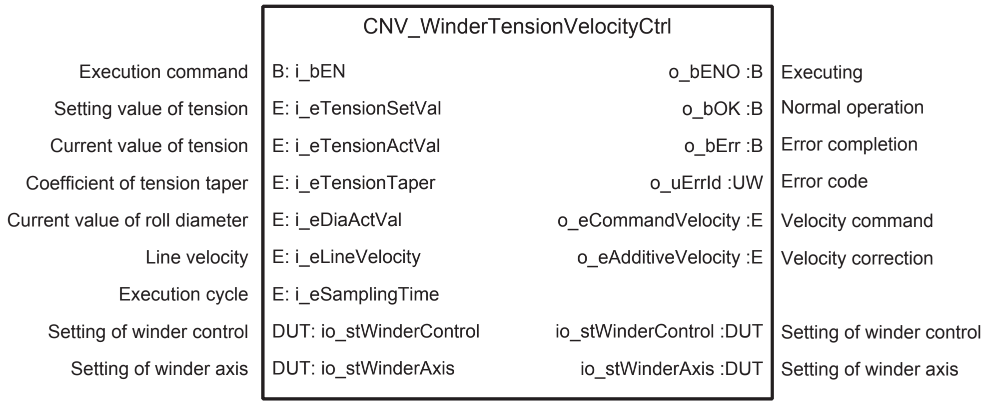
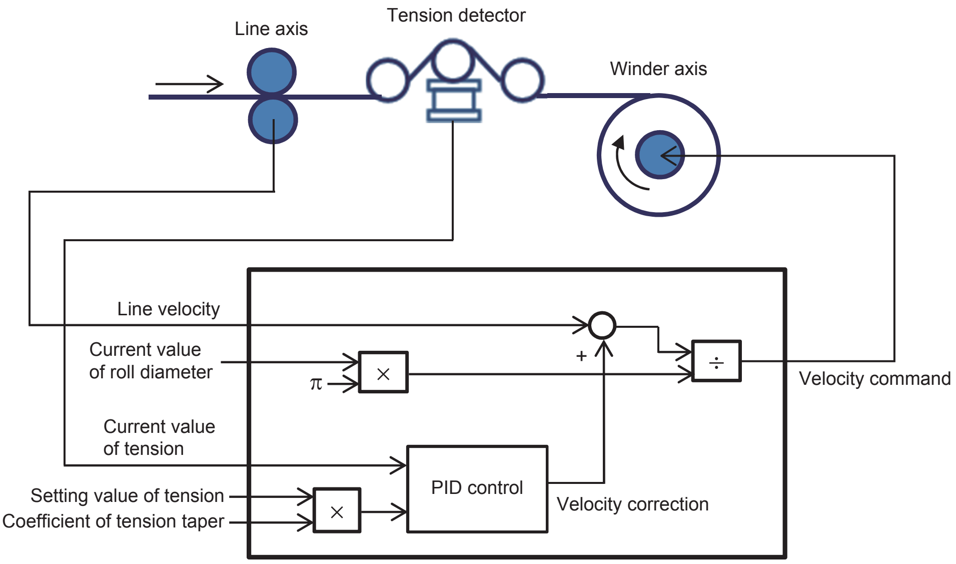
This section describes the details of each FB.

CNV_WinderTensionVelocityCtrl (Tension sensor feedback velocity control)

Name

CNV_WinderTensionVelocityCtrl

Function overview

Item	Description	
Function overview	This FB executes the PID control according to the value detected by the tension detector and controls the velocity so that the tension reaches the specified tension.	
Symbol		
Applicable hardware and software	Applicable module	RD77MS, RD77GF, RD78G(S)
	Applicable CPU	MELSEC iQ-R series CPU module
	Engineering software	GX Works3
Number of steps	4559 steps (For the macro type)	
FB dependence	CNV_PIDControl	
Function description	The velocity is calculated according to the roll diameter so that the rewinder velocity (roll circumferential velocity) reaches the line velocity, the velocity correction value is calculated by the PID control with the deviation of the tension setting value of tension detector value, and the value is output as a command velocity to the servo amplifier. 	
Compiling method	Macro type, subroutine type	
FB operation type	Real-time execution	
Restrictions and precautions	Execute this FB in a fixed cycle.	

Labels

■Input labels

Name	Label name	Data type	Read timing*1	Setting range	Initial value	Description
Execution command	i_bEN	Bit	⊓	—	—	On: The FB is activated. Off: The FB is stopped.
Setting value of tension	i_eTensionSetVal	Single precision real number	⊓	0.0<=	—	Input the target value of tension [N].
Current value of tension	i_eTensionActVal	Single precision real number	⊓	—	—	Input the value of the tension detector [N].
Coefficient of tension taper	i_eTensionTaper	Single precision real number	⊓	0.0<=	1.0	Taper coefficient of the set tension value (1.0 = 100%)
Current value of roll diameter	i_eDiaActVal	Single precision real number	⊓	0.0 <	—	Input the current value of the roll diameter [mm].
Line velocity	i_eLineVelocity	Single precision real number	⊓	—	—	Input the current value of the line velocity [m/min].
Execution cycle	i_eSamplingTime	Single precision real number	↑	0.0 <	—	Execution cycle [ms] of the program for executing the FB

*1 ⊓: Always, ↑: Only when the FB is started

■Output labels

Name	Label name	Data type	Value to be held*1	Description
Executing	o_bENO	Bit	—	Turns on while Execution command is on.
Normal operation	o_bOK	Bit	—	Turns on while the FB is normally operating.
Error completion	o_bErr	Bit	—	Turns on when an error has occurred in the FB.
Error code	o_uErrId	Word [Unsigned]	—	The error code of the error that has occurred in the FB is stored. (Refer to "Page 289 List of Error Codes".)
Velocity command	o_eCommandVelocity	Single precision real number	—	Velocity command value of FB calculation results [r/min]
Velocity correction	o_eAdditiveVelocity	Single precision real number	—	Velocity correction determined by PID calculation [m/min]

*1 ○: The value is held after the FB stops. —: The value is cleared after the FB stops.

■I/O labels

Name	Label name	Data type	Description
Setting of winder control	io_stWinderControl	WINDER_REF	Refer to the following.
Setting of winder axis	io_stWinderAxis	AXIS_REF	

Setting of winder control (WINDER_REF structure)

Name	Label name	I/O	Data type	Read timing*1	Setting range	Initial value	Description
Winding method	wWinderType	IN	Word [Signed]	⊓	0 to 3	—	Rewinding/unwinding setting 0: Forward unwinding 1: Forward rewinding 2: Backward unwinding 3: Backward rewinding (For details, refer to "Page 45 Rotation Direction Setting".)
Proportionality gain	eKp	IN	Single precision real number	⊓	0.0<=	—	PID control Proportionality gain [(m/min)/N]
Integral time	eTi	IN	Single precision real number	⊓	0.0<=	—	PID control Integral time [ms]
Differential time	eTd	IN	Single precision real number	⊓	0.0<=	—	PID control Differential time [ms]
Upper limit	ePidUpperLimit	IN	Single precision real number	⊓	Lower limit value <	—	PID output Upper limit value [m/min]

Name	Label name	I/O	Data type	Read timing*1	Setting range	Initial value	Description
Lower limit	ePidLowerLimit	IN	Single precision real number	⊓	Upper limit value >	—	PID output Lower limit value [m/min]
Setting of deadband	ePidDeadBand	IN	Single precision real number	⊓	0.0<=	—	PID control Setting of deadband [N]
Amplitude of auto tuning	eMrly	IN	Single precision real number	⊓	0.0 <	1.0	Amplitude at auto turning [N]
Start auto tuning	bAtStart	IN	Bit	⊓	—	—	On: The auto turning is started.
Auto tuning response	wAtResponse	IN	Word [Signed]	⊓	1 to 7	3	1 (Weak) ⇔ 7(Strong)
Enable auto tuning	bAtValEN	IN	Bit	⊓	—	—	On: The PID control is performed with auto tuning results. Off: The PID control is performed with setting values.
Normal completion of auto tuning	bAtComp	OUT	Bit	—	—	—	On: Turns on when the auto tuning is normally completed. Off: Turn off when Start auto tuning turns off.
Hysteresis of auto tuning results	eTehys	OUT	Single precision real number	—	—	—	Hysteresis of auto tuning results [N]
Proportionality gain of auto tuning results	eAtKp	OUT	Single precision real number (to be held)	—	—	—	Proportionality gain of auto tuning results [(m/min)/N]
Integral time of auto tuning results	eAtTi	OUT	Single precision real number (to be held)	—	—	—	Integral time of auto tuning results [ms]

Setting of winder axis (AXIS_REF structure)

Name	Label name	I/O	Data type	Read timing*1	Setting range	Initial value	Description
Axis number	AxisNo	IN	Word [Unsigned]	↑	0 to the maximum number of axes of the module used	—	Axis number (0: Only the command operation. The Simple Motion module does not send output to the servo amplifier.)
Start I/O number	StartIO	IN	Word [Unsigned]	↑	0H to FEH	—	Installation address of the Simple Motion module (Upper three digits of four digits (hexadecimal))

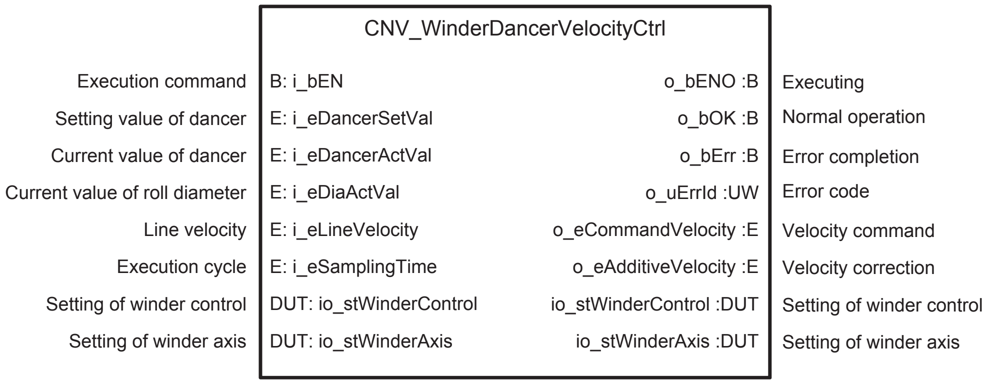
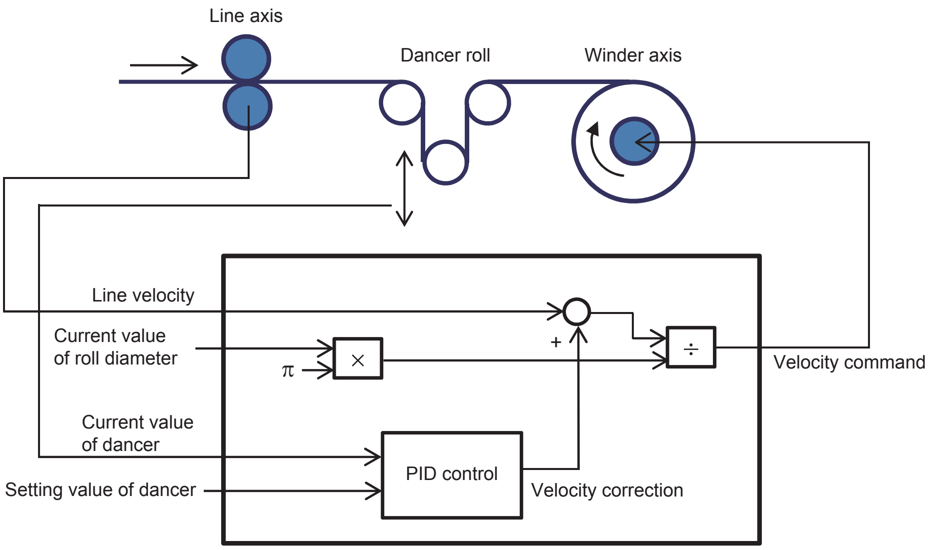
*1 ⊓: Always, ↑: Only when the FB is started

CNV_WinderDancerVelocityCtrl (Dancer feedback velocity control)

Name

CNV_WinderDancerVelocityCtrl

Function overview

<table>
<tr><th>Item</th><th colspan="2">Description</th></tr>
<tr><td>Function overview</td><td colspan="2">This FB detects the position of the dancer roll and controls the velocity to reach the target position.</td></tr>
<tr><td>Symbol</td><td colspan="2">
</td></tr>
<tr><td rowspan="3">Applicable hardware and software</td><td>Applicable module</td><td>RD77MS, RD77GF, RD78G(S)</td></tr>
<tr><td>Applicable CPU</td><td>MELSEC iQ-R series CPU module</td></tr>
<tr><td>Engineering software</td><td>GX Works3</td></tr>
<tr><td>Number of steps</td><td colspan="2">4486 steps (For the macro type)</td></tr>
<tr><td>FB dependence</td><td colspan="2">CNV_PIDControl</td></tr>
<tr><td>Function description</td><td colspan="2">The velocity is calculated depending on the outer diameter of the roll so that the rewinder velocity (roll circumferential velocity) reaches the line velocity, the velocity correction value is calculated by the PID control with the deviation of the current value of the dancer to the set dancer position, and the value is output as a command velocity to the servo amplifier.

</td></tr>
<tr><td>Compiling method</td><td colspan="2">Macro type, subroutine type</td></tr>
<tr><td>FB operation type</td><td colspan="2">Real-time execution</td></tr>
<tr><td>Restrictions and precautions</td><td colspan="2">Execute this FB in a fixed cycle.</td></tr>
</table>

Labels

■Input labels

Name	Label name	Data type	Read timing*1	Setting range	Initial value	Description
Execution command	i_bEN	Bit	⊓	—	—	On: The FB is activated. Off: The FB is stopped.
Setting value of dancer	i_eDancerSetVal	Single precision real number	⊓	—	—	Input the target position of the dancer roll [mm or degree].
Current value of dancer	i_eDancerActVal	Single precision real number	⊓	—	—	Input the current value of the dancer roll [mm or degree].
Current value of roll diameter	i_eDiaActVal	Single precision real number	⊓	0.0 <	—	Input the current value of the roll diameter [mm].
Line velocity	i_eLineVelocity	Single precision real number	⊓	—	—	Input the current value of the line velocity [m/min].
Execution cycle	i_eSamplingTime	Single precision real number	↑	0.0 <	—	Execution cycle [ms] of the program for executing the FB

*1 ⊓: Always, ↑: Only when the FB is started

■Output labels

Name	Label name	Data type	Value to be held*1	Description
Executing	o_bENO	Bit	—	Turns on while Execution command is on.
Normal operation	o_bOK	Bit	—	Turns on while the FB is normally operating.
Error completion	o_bErr	Bit	—	Turns on when an error has occurred in the FB.
Error code	o_uErrId	Word [Unsigned]	—	The error code of the error that has occurred in the FB is stored. (Refer to "Page 289 List of Error Codes".)
Velocity command	o_eCommandVelocity	Single precision real number	—	Velocity command value of FB calculation results [r/min]
Velocity correction	o_eAdditiveVelocity	Single precision real number	—	Velocity correction determined by PID calculation [m/min]

*1 ○: The value is held after the FB stops. —: The value is cleared after the FB stops.

■I/O labels

Name	Label name	Data type	Setting range	Description
Setting of winder control	io_stWinderControl	WINDER_REF	—	Refer to the following.
Setting of winder axis	io_stWinderAxis	AXIS_REF	—	

Setting of winder control (WINDER_REF structure)

Name	Label name	I/O	Data type	Read timing*1	Setting range	Initial value	Description
Winding method	wWinderType	IN	Word [Signed]	⊓	0 to 3	—	Rewinding/unwinding setting 0: Forward unwinding 1: Forward rewinding 2: Backward unwinding 3: Backward rewinding (For details, refer to "Page 45 Rotation Direction Setting".)
Proportionality gain	eKp	IN	Single precision real number	⊓	0.0<=	—	PID control Proportionality gain [(m/min)/mm or (m/min)/degree]
Integral time	eTi	IN	Single precision real number	⊓	0.0<=	—	PID control Integral time [ms]
Differential time	eTd	IN	Single precision real number	⊓	0.0<=	—	PID control Differential time [ms]
Upper limit	ePidUpperLimit	IN	Single precision real number	⊓	Lower limit value <	—	PID output Upper limit value [m/min]

Name	Label name	I/O	Data type	Read timing*1	Setting range	Initial value	Description
Lower limit	ePidLowerLimit	IN	Single precision real number	⊓	Upper limit value >	—	PID output Lower limit value [m/min]
Setting of deadband	ePidDeadBand	IN	Single precision real number	⊓	0.0<=	—	PID control Setting of deadband [mm or degree]
Amplitude of auto tuning	eMrly	IN	Single precision real number	⊓	0.0 <	1.0	Amplitude at auto turning [mm or degree]
Start auto tuning	bAtStart	IN	Bit	⊓	—	—	On: The auto turning is started.
Auto tuning response	wAtResponse	IN	Word [Signed]	⊓	1 to 7	3	1 (Weak) ⇔ 7(Strong)
Enable auto tuning	bAtValEN	IN	Bit	⊓	—	—	On: The PID control is performed with auto tuning results. Off: The PID control is performed with setting values.
Normal completion of auto tuning	bAtComp	OUT	Bit	—	—	—	On: Turns on when the auto tuning is normally completed. Off: Turn off when Start auto tuning turns off.
Hysteresis of auto tuning results	eTehys	OUT	Single precision real number	—	—	—	Hysteresis of auto tuning results [mm or degree]
Proportionality gain of auto tuning results	eAtKp	OUT	Single precision real number (to be held)	—	—	—	Proportionality gain of auto tuning results [(m/min)/mm or (m/min)/degree]
Integral time of auto tuning results	eAtTi	OUT	Single precision real number (to be held)	—	—	—	Integral time of auto tuning results [ms]

Setting of winder axis (AXIS_REF structure)

Name	Label name	I/O	Data type	Read timing*1	Setting range	Initial value	Description
Axis number	AxisNo	IN	Word [Unsigned]	↑	0 to the maximum number of axes of the module used	—	Axis number (0: Only the command operation. The Simple Motion module does not send output to the servo amplifier.)
Start I/O number	StartIO	IN	Word [Unsigned]	↑	0H to FEH	—	Installation address of the Simple Motion module (Upper three digits of four digits (hexadecimal))

*1 ⊓: Always, ↑: Only when the FB is started

CNV_WinderTensionTorqueCtrl (Tension sensor feedback torque control)

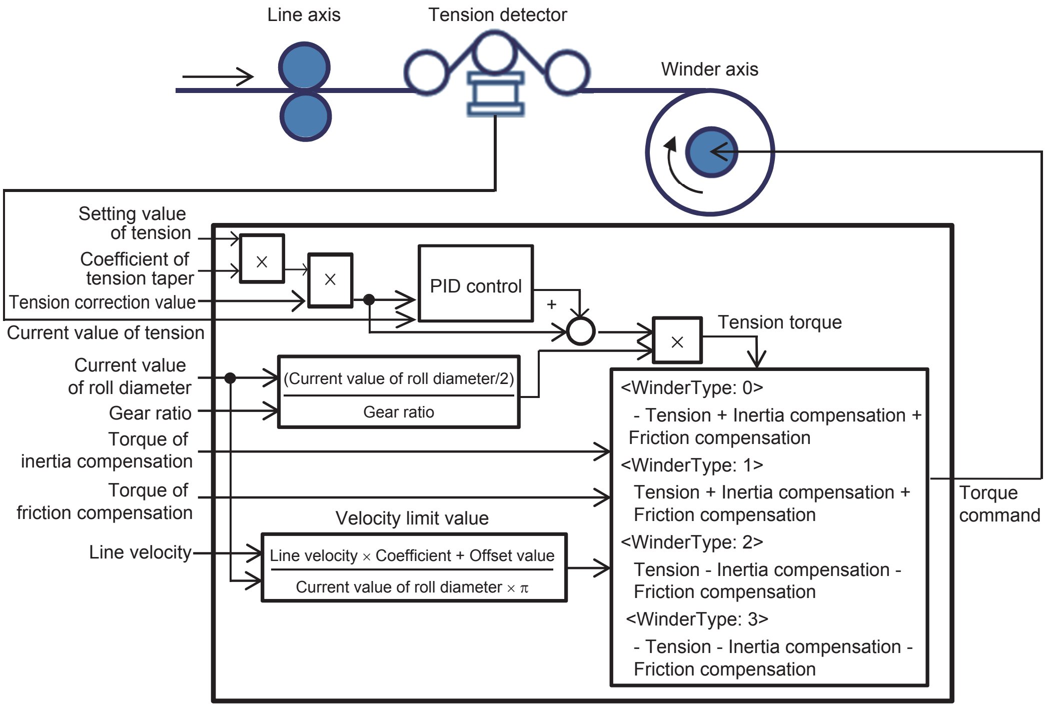
Name

CNV_WinderTensionTorqueCtrl

Function overview

<table>
<tr><th>Item</th><th colspan="2">Description</th></tr>
<tr><td>Function overview</td><td colspan="2">This FB performs the PID control according to the value detected by the tension detector and controls the torque so that the torque reaches the set tension value.</td></tr>
<tr><td>Symbol</td><td colspan="2">
<table>
<tr><td></td><td colspan="2">CNV_WinderTensionTorqueCtrl</td><td></td></tr>
<tr><td>Execution command</td><td>B: i_bEN</td><td>o_bENO :B</td><td>Executing</td></tr>
<tr><td>Setting value of tension</td><td>E: i_eTensionSetVal</td><td>o_bOK :B</td><td>Normal operation</td></tr>
<tr><td>Current value of tension</td><td>E: i_eTensionActVal</td><td>o_bErr :B</td><td>Error completion</td></tr>
<tr><td>Coefficient of tension taper</td><td>E: i_eTensionTaper</td><td>o_uErrId :UW</td><td>Error code</td></tr>
<tr><td>Current value of roll diameter</td><td>E: i_eDiaActVal</td><td>o_eCommandTorque :E</td><td>Torque command value</td></tr>
<tr><td>Torque of inertia compensation</td><td>E: i_eInertiaTrq</td><td>o_eAdditiveTorque :E</td><td>Torque correction value</td></tr>
<tr><td>Torque of friction compensation</td><td>E: i_eFrictionTrq</td><td>o_eVelocityLimit :E</td><td>Velocity command</td></tr>
<tr><td>Line velocity</td><td>E: i_eLineVelocity</td><td></td><td></td></tr>
<tr><td>Coefficient of velocity limit</td><td>E: i_eVelocityAdj</td><td></td><td></td></tr>
<tr><td>Offset of velocity limit</td><td>E: i_eVelocityOffset</td><td></td><td></td></tr>
<tr><td>Execution cycle</td><td>E: i_eSamplingTime</td><td></td><td></td></tr>
<tr><td>Tension correction value</td><td>E: i_eTensionAdjVal</td><td></td><td></td></tr>
<tr><td>Setting of winder control</td><td>DUT: io_stWinderControl</td><td>io_stWinderControl :DUT</td><td>Setting of winder control</td></tr>
<tr><td>Setting of winder axis</td><td>DUT: io_stWinderAxis</td><td>io_stWinderAxis :DUT</td><td>Setting of winder axis</td></tr>
</table>
</td></tr>
<tr><td rowspan="3">Applicable hardware and software</td><td>Applicable module</td><td>RD77MS, RD77GF, RD78G(S)</td></tr>
<tr><td>Applicable CPU</td><td>MELSEC iQ-R series CPU module</td></tr>
<tr><td>Engineering software</td><td>GX Works3</td></tr>
<tr><td>Number of steps</td><td colspan="2">4836 steps (For the macro type)</td></tr>
<tr><td>FB dependence</td><td colspan="2">CNV_PIDControl</td></tr>
</table>

Item	Description
Function description	The tension torque is calculated according to the roll diameter, the deviation of the tension setting value to the tension detector value is multiplied by the tension correction value that is determined by the PID control, and the calculated value is output as a torque command to the servo amplifier.



Item	Description
Compiling method	Macro type, subroutine type
FB operation type	Real-time execution
Restrictions and precautions	Execute this FB in a fixed cycle.

Labels

■Input labels

Name	Label name	Data type	Read timing*1	Setting range	Initial value	Description
Execution command	i_bEN	Bit	⊓	—	—	On: The FB is activated. Off: The FB is stopped.
Setting value of tension	i_eTensionSetVal	Single precision real number	⊓	0.0<=	—	Input the target value of tension [N].
Current value of tension	i_eTensionActVal	Single precision real number	⊓	—	—	Input the value of the tension detector [N].
Coefficient of tension taper	i_eTensionTaper	Single precision real number	⊓	0.0<=	1.0	Taper coefficient of the set tension value (1.0 = 100%)
Current value of roll diameter	i_eDiaActVal	Single precision real number	⊓	0.0 <	—	Input the current value of the roll diameter [mm].
Torque of inertia compensation	i_eInertiaTrq	Single precision real number	⊓	—	—	Torque of inertia compensation [N·m] (Motor axis conversion)
Torque of friction compensation	i_eFrictionTrq	Single precision real number	⊓	0.0<=	—	Torque of friction compensation [N·m] (Motor axis conversion)
Line velocity	i_eLineVelocity	Single precision real number	⊓	—	—	Input the current value of the line velocity [m/min].
Coefficient of velocity limit	i_eVelocityAdj	Single precision real number	⊓	0.0<=	1.0	Coefficient of velocity limit (1.0 = Line velocity × 100%)
Velocity limit Offset value	i_eVelocityOffset	Single precision real number	⊓	0.0<=	—	Offset of velocity limit [m/min]
Execution cycle	i_eSamplingTime	Single precision real number	↑	0.0 <	—	Execution cycle [ms] of the program for executing the FB
Tension correction value	i_eTensionAdjVal	Single precision real number	⊓	—	—	Input the correction value of the tension deviations from free roller [N]

*1 ⊓: Always, ↑: Only when the FB is started

■Output labels

Name	Label name	Data type	Value to be held*1	Description
Executing	o_bENO	Bit	—	Turns on while Execution command is on.
Normal operation	o_bOK	Bit	—	Turns on while the FB is normally operating.
Error completion	o_bErr	Bit	—	Turns on when an error has occurred in the FB.
Error code	o_uErrId	Word [Unsigned]	—	The error code of the error that has occurred in the FB is stored. (Refer to "Page 289 List of Error Codes".)
Torque command value	o_eCommandTorque	Single precision real number	—	Torque command value of the FB calculation results [N·m] (Motor axis conversion)
Torque correction value	o_eAdditiveTorque	Single precision real number	—	Tension correction value determined by PID calculation [N]
Velocity limit value	o_eVelocityLimit	Single precision real number	—	Velocity limit value of FB calculation results [r/min] (Equipment conversion)

*1 ○: The value is held after the FB stops. —: The value is cleared after the FB stops.

■I/O labels

Name	Label name	Data type	Setting range	Description
Setting of winder control	io_stWinderControl	WINDER_REF	—	Refer to the following.
Setting of winder axis	io_stWinderAxis	AXIS_REF	—	

Setting of winder control (WINDER_REF structure)

Name	Label name	I/O	Data type	Read timing*1	Setting range	Initial value	Description
Winding method	wWinderType	IN	Word [Signed]	⊓	0 to 3	—	Rewinding/unwinding setting 0: Forward unwinding 1: Forward rewinding 2: Backward unwinding 3: Backward rewinding (For details, refer to "Page 45 Rotation Direction Setting".)
Gear ratio	eWinderGearRatio	IN	Single precision real number	↑	0.0 <	—	Gear ratio (Motor side/load side)
Rated torque	eWinderRatedTrq	IN	Single precision real number	↑	0.0 <	—	Rated torque of motor [N·m]
Proportionality gain	eKp	IN	Single precision real number	⊓	0.0<=	—	PID control Proportionality gain [N/N]
Integral time	eTi	IN	Single precision real number	⊓	0.0<=	—	PID control Integral time [ms]
Differential time	eTd	IN	Single precision real number	⊓	0.0<=	—	PID control Differential time [ms]
Upper limit	ePidUpperLimit	IN	Single precision real number	⊓	Lower limit value <	—	PID output Upper limit value [N]
Lower limit	ePidLowerLimit	IN	Single precision real number	⊓	Upper limit value >	—	PID output Lower limit value [N]
Setting of deadband	ePidDeadBand	IN	Single precision real number	⊓	0.0<=	—	PID control Setting of deadband [N]

Setting of winder axis (AXIS_REF structure)

Name	Label name	I/O	Data type	Read timing*1	Setting range	Initial value	Description
Axis number	AxisNo	IN	Word [Unsigned]	↑	0 to the maximum number of axes of the module used	—	Axis number (0: Only the command operation. The Simple Motion module does not send output to the servo amplifier.)
Start I/O number	StartIO	IN	Word [Unsigned]	↑	0H to FEH	—	Installation address of the Simple Motion module (Upper three digits of four digits (hexadecimal))

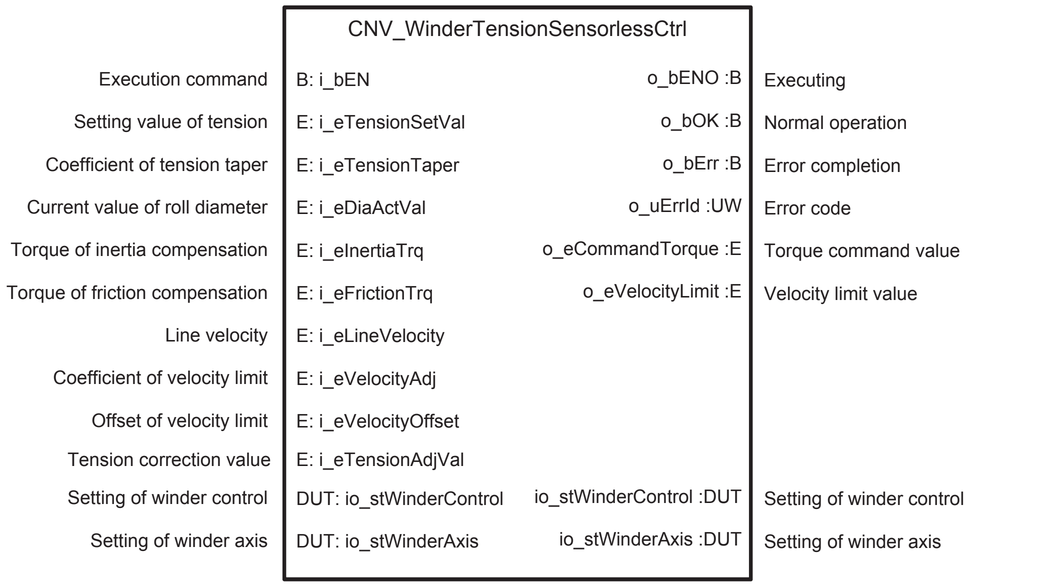
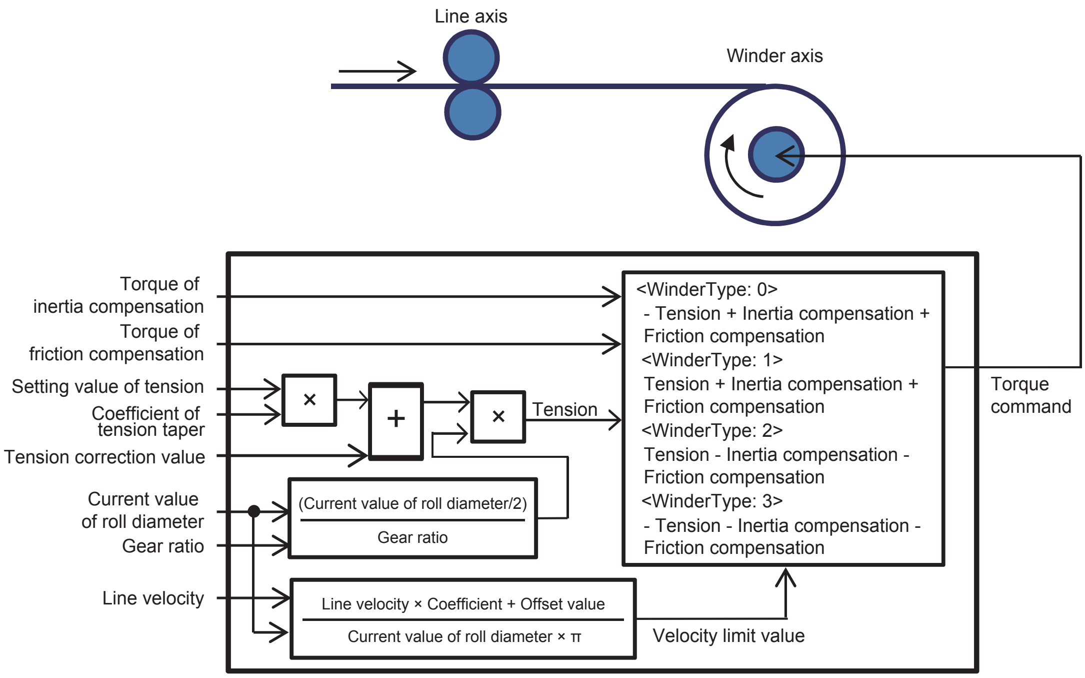
*1 ⊓: Always, ↑: Only when the FB is started

CNV_WinderTensionSensorlessCtrl (Tension sensorless torque control)

Name

CNV_WinderTensionSensorlessCtrl

Function overview

Item	Description	
Function overview	This FB performs the torque control without sensors to control the tension in unwinding and rewinding.	
Symbol		
Applicable hardware and software	Applicable module	RD77MS, RD77GF, RD78G(S)
	Applicable CPU	MELSEC iQ-R series CPU module
	Engineering software	GX Works3
Number of steps	1801 steps (For the macro type)	
FB dependence	None	
Function description	The command torque is calculated from the roll diameter and compensation torque/tension correction value so that the tension reaches the set tension in unwinding and rewinding, and it is output to the servo amplifier. 	

Item	Description
Compiling method	Macro type, subroutine type
FB operation type	Real-time execution
Restrictions and precautions	Execute this FB in a fixed cycle.

Labels

■Input labels

Name	Label name	Data type	Read timing*1	Setting range	Initial value	Description
Execution command	i_bEN	Bit	⊓	—	—	On: The FB is activated. Off: The FB is stopped.
Setting value of tension	i_eTensionSetVal	Single precision real number	⊓	0.0<=	—	Input the target value of tension [N].
Coefficient of tension taper	i_eTensionTaper	Single precision real number	⊓	0.0<=	1.0	Taper coefficient of the set tension value (1.0 = 100%)
Current value of roll diameter	i_eDiaActVal	Single precision real number	⊓	0.0 <	—	Input the current value of the roll diameter [mm].
Torque of inertia compensation	i_eInertiaTrq	Single precision real number	⊓	—	—	Torque of inertia compensation [N·m] (Motor axis conversion)
Torque of friction compensation	i_eFrictionTrq	Single precision real number	⊓	0.0<=	—	Torque of friction compensation [N·m] (Motor axis conversion)
Line velocity	i_eLineVelocity	Single precision real number	⊓	—	—	Input the current value of the line velocity [m/min].
Coefficient of velocity limit	i_eVelocityAdj	Single precision real number	⊓	0.0<=	1.0	Coefficient of velocity limit (1.0 = Line velocity × 100%)
Offset of velocity limit	i_eVelocityOffset	Single precision real number	⊓	0.0<=	—	Offset of velocity limit [m/min]
Tension correction value	i_eTensionAdjVal	Single precision real number	⊓	—	—	Input the correction value of the tension deviations from free roller [N]

*1 ⊓: Always, ↑: Only when the FB is started

■Output labels

Name	Label name	Data type	Value to be held*1	Description
Executing	o_bENO	Bit	—	Turns on while Execution command is on.
Normal operation	o_bOK	Bit	—	Turns on while the FB is normally operating.
Error completion	o_bErr	Bit	—	Turns on when an error has occurred in the FB.
Error code	o_uErrId	Word [Unsigned]	—	The error code of the error that has occurred in the FB is stored. (Refer to "Page 289 List of Error Codes".)
Torque command value	o_eCommandTorque	Single precision real number	—	Torque command value of the FB calculation results [N·m] (Motor axis conversion)
Velocity limit value	o_eVelocityLimit	Single precision real number	—	Velocity limit value of FB calculation results [r/min] (Equipment conversion)

*1 ○: The value is held after the FB stops. —: The value is cleared after the FB stops.

■I/O labels

Name	Label name	Data type	Setting range	Description
Setting of winder control	io_stWinderControl	WINDER_REF	—	Refer to the following.
Setting of winder axis	io_stWinderAxis	AXIS_REF	—	

Setting of winder control (WINDER_REF structure)

Name	Label name	I/O	Data type	Read timing*1	Setting range	Initial value	Description
Winding method	wWinderType	IN	Word [Signed]	⊓	0 to 3	—	Rewinding/unwinding setting 0: Forward unwinding 1: Forward rewinding 2: Backward unwinding 3: Backward rewinding (For details, refer to "Page 45 Rotation Direction Setting".)
Gear ratio	eWinderGearRatio	IN	Single precision real number	↑	0.0 <	—	Gear ratio (Motor side/load side)
Rated torque	eWinderRatedTrq	IN	Single precision real number	↑	0.0 <	—	Rated torque of motor [N·m]

Setting of winder axis (AXIS_REF structure)

Name	Label name	I/O	Data type	Read timing*1	Setting range	Initial value	Description
Axis number	AxisNo	IN	Word [Unsigned]	↑	0 to the maximum number of axes of the module used	—	Axis number (0: Only the command operation. The Simple Motion module does not send output to the servo amplifier.)
Start I/O number	StartIO	IN	Word [Unsigned]	↑	0H to FEH	—	Installation address of the Simple Motion module (Upper three digits of four digits (hexadecimal))

*1 ⊓: Always, ↑: Only when the FB is started

CNV_TensionSensorlessVelocityCtrl (Tension sensorless velocity control)

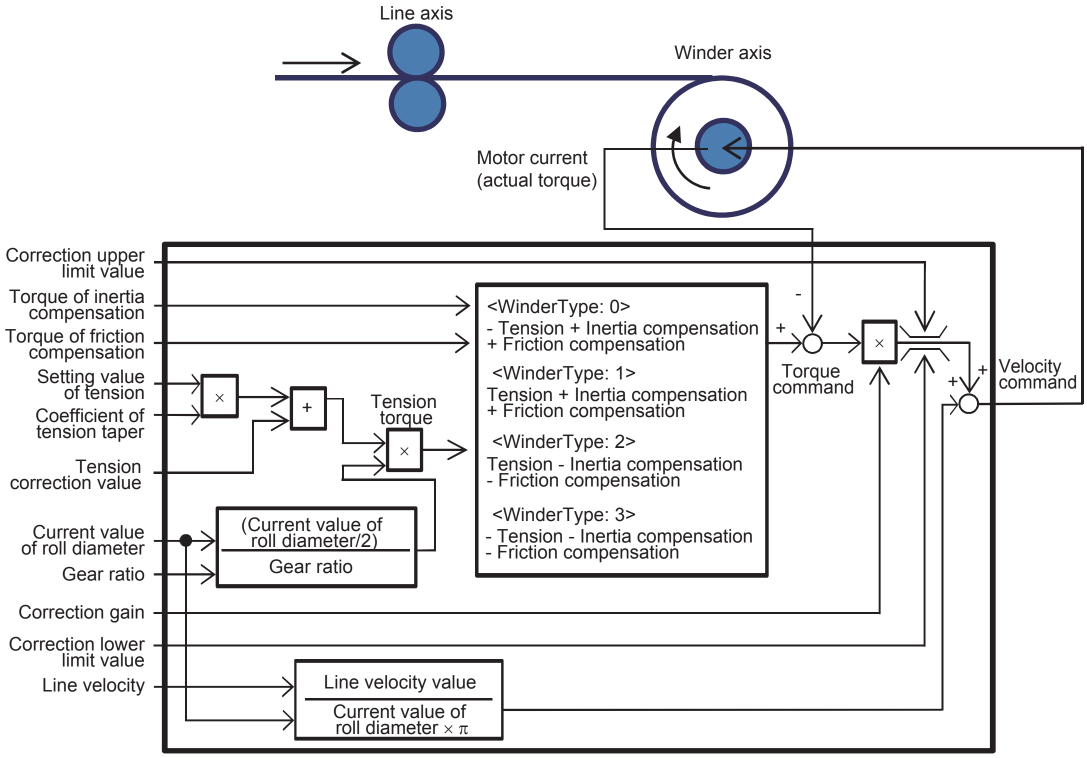
Name

CNV_TensionSensorlessVelocityCtrl

Function overview

<table>
<tr><th>Item</th><th colspan="2">Description</th></tr>
<tr><td>Function overview</td><td colspan="2">This FB performs the velocity control without sensors to control the tension in unwinding and rewinding.
The velocity command is corrected by the deviation of the command torque and actual torque.</td></tr>
<tr><td>Symbol</td><td colspan="2">
<table>
<tr><td></td><td colspan="2">CNV_TensionSensorlessVelocityCtrl</td><td></td></tr>
<tr><td>Execution command</td><td>B: i_bEN</td><td>o_bENO :B</td><td>Executing</td></tr>
<tr><td>Setting value of tension</td><td>E: i_eTensionSetVal</td><td>o_bOK :B</td><td>Normal operation</td></tr>
<tr><td>Coefficient of tension taper</td><td>E: i_eTensionTaper</td><td>o_bErr :B</td><td>Error completion</td></tr>
<tr><td>Current value of roll diameter</td><td>E: i_eDiaActVal</td><td>o_uErrId :UW</td><td>Error code</td></tr>
<tr><td>Torque of inertia compensation</td><td>E: i_eInertiaTrq</td><td>o_eCommandVelocity :E</td><td>Velocity command</td></tr>
<tr><td>Torque of friction compensation</td><td>E: i_eFrictionTrq</td><td></td><td></td></tr>
<tr><td>Line velocity</td><td>E: i_eLineVelocity</td><td></td><td></td></tr>
<tr><td>Tension correction value</td><td>E: i_eTensionAdjVal</td><td></td><td></td></tr>
<tr><td>Execution cycle</td><td>E: i_eSamplingTime</td><td></td><td></td></tr>
<tr><td>Velocity control setting</td><td>DUT: i_stVelocityControl</td><td></td><td></td></tr>
<tr><td>Setting of winder control</td><td>DUT: io_stWinderControl</td><td>io_stWinderControl :DUT</td><td>Setting of winder control</td></tr>
<tr><td>Setting of winder axis</td><td>DUT: io_stWinderAxis</td><td>io_stWinderAxis :DUT</td><td>Setting of winder axis</td></tr>
</table>
</td></tr>
<tr><td rowspan="3">Applicable hardware and software</td><td>Applicable module</td><td>RD77MS, RD77GF, RD78G(S)</td></tr>
<tr><td>Applicable CPU</td><td>MELSEC iQ-R series CPU module</td></tr>
<tr><td>Engineering software</td><td>GX Works3</td></tr>
<tr><td>Number of steps</td><td colspan="2">2305 steps (For the macro type)</td></tr>
<tr><td>FB dependence</td><td colspan="2">None</td></tr>
</table>

Item	Description
Function description	The command velocity is calculated from the roll diameter and line velocity so that the tension reaches the set tension in unwinding and rewinding, and it is output to the servo amplifier. The velocity is corrected with the deviation of the torque command value and torque feedback value calculated from the tension setting and torque compensation.



Item	Description
Compiling method	Macro type, subroutine type
FB operation type	Real-time execution
Restrictions and precautions	• Execute this FB in a fixed cycle. • Set the parameter PB25 (Function selection B-1) of the servo amplifier to 0h (enable model application control selection) and use the FB. • Set the parameter PA08 (Auto tuning mode) of the servo amplifier to 0003h (manual mode) and use the FB.

Labels

■Input labels

Name	Label name	Data type	Read timing*1	Setting range	Initial value	Description
Execution command	i_bEN	Bit	⎍	—	—	On: The FB is activated. Off: The FB is stopped.
Setting value of tension	i_eTensionSetVal	Single precision real number	⎍	0.0 <=	—	Input the target value of tension [N].
Coefficient of tension taper	i_eTensionTaper	Single precision real number	⎍	0.0 <=	1.0	Taper coefficient of the set tension value (1.0 = 100%)
Current value of roll diameter	i_eDiaActVal	Single precision real number	⎍	0.0 <	—	Input the current value of the roll diameter [mm].
Torque of inertia compensation	i_eInertiaTrq	Single precision real number	⎍	—	—	Torque of inertia compensation [N·m] (Motor axis conversion)
Torque of friction compensation	i_eFrictionTrq	Single precision real number	⎍	0.0 <=	—	Torque of friction compensation [N·m] (Motor axis conversion)
Line velocity	i_eLineVelocity	Single precision real number	⎍	—	—	Input the current value of the line velocity [m/min].
Tension correction value	i_eTensionAdjVal	Single precision real number	⎍	—	—	Input the correction value of the tension deviations from free roller [N]
Velocity control setting	i_stVelocityControl	VEL_CTRL_REF	—	—	—	Refer to the velocity control setting.
Execution cycle	i_eSamplingTime	Single precision real number	↑	0.0 <	—	Execution cycle [ms] of the program for executing the FB

*1 ⎍: Always, ↑: Only when the FB is started

Velocity control setting (VEL_CTRL_REF structure)

Name	Label name	I/O	Data type	Read timing*1	Setting range	Initial value	Description
Correction gain	eAdjustGain	IN	Single precision real number	⎍	0.0 <=	—	Gain [(r/min)/%] for velocity correction value calculated from deviation of the command torque and actual torque. Velocity control (no correction) is performed when this value is set to 0, and control close to torque control is performed when the value is increased.
Correction upper limit value	eUpperLimit	IN	Single precision real number	⎍	Lower limit value <	—	Speed correction upper limit value [r/min] calculated from deviation of the command torque and actual torque. When the correction value exceeds this value, the correction is performed with this value.
Correction lower limit value	eLowerLimit	IN	Single precision real number	⎍	Upper limit value >	—	Speed correction limit value [r/min] calculated from deviation of the command torque and actual torque. When the correction value is lower than this value, the correction is performed with this value.
Velocity integral compensation	eAmpVIC	IN	Single precision real number	↑	0.1 to 1000.0	33.7	Set the same value as the parameter PB10 (Velocity integral compensation) of the servo amplifier [ms].

*1 ⎍: Always, ↑: Only when the FB is started

■Output labels

Name	Label name	Data type	Value to be held*1	Description
Executing	o_bENO	Bit	—	Turns on while Execution command is on.
Normal operation	o_bOK	Bit	—	Turns on while the FB is normally operating.
Error completion	o_bErr	Bit	—	Turns on when an error has occurred in the FB.
Error code	o_uErrId	Word [Unsigned]	—	The error code of the error that has occurred in the FB is stored. (Refer to "Page 289 List of Error Codes".)
Velocity command	o_eCommandVelocity	Single precision real number	—	Velocity command value of FB calculation results [r/min]

*1 ○: The value is held after the FB stops. —: The value is cleared after the FB stops.

■I/O labels

Name	Label name	Data type	Setting range	Description
Setting of winder control	io_stWinderControl	WINDER_REF	—	Refer to the following.
Setting of winder axis	io_stWinderAxis	AXIS_REF	—	

Setting of winder control (WINDER_REF structure)

Name	Label name	I/O	Data type	Read timing*1	Setting range	Initial value	Description
Winding method	wWinderType	IN	Word [Signed]	⎍	0 to 3	—	Rewinding/unwinding setting 0: Forward unwinding 1: Forward rewinding 2: Backward unwinding 3: Backward rewinding (For details, refer to "Page 45 Rotation Direction Setting".)
Gear ratio	eWinderGearRatio	IN	Single precision real number	↑	0.0 <	—	Gear ratio (Motor side/load side)
Rated torque	eWinderRatedTrq	IN	Single precision real number	↑	0.0 <	—	Rated torque of motor [N·m]
Rotation direction selection	uAmpPol	IN	Word [Unsigned]	↑	0,1	0	Set the same value as the parameter PA14 (POL) of the servo amplifier. When the value other than 1 is set, the operation is performed regarding the value as 0.

*1 ⎍: Always, ↑: Only when the FB is started

Setting of winder axis (AXIS_REF structure)

Name	Label name	I/O	Data type	Read timing[*1]	Setting range	Initial value	Description
Axis number	AxisNo	IN	Word [Unsigned]	↑	1 to the maximum number of axes of the module used	—	Axis number
Start I/O number	StartIO	IN	Word [Unsigned]	↑	0H to FEH	—	Installation address of the Simple Motion module (Upper three digits of four digits (hexadecimal))

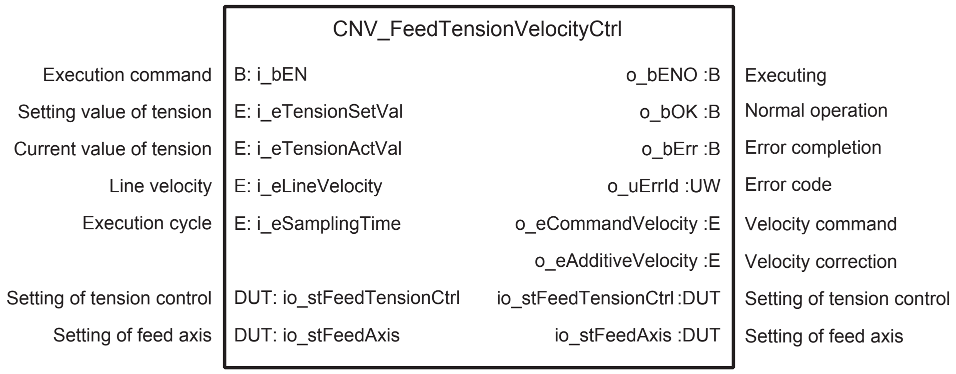
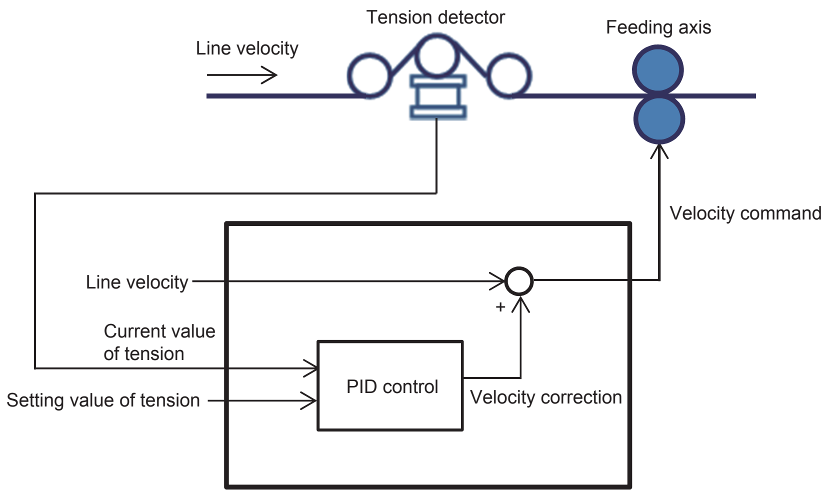
*1 ⊓: Always, ↑: Only when the FB is started

CNV_FeedTensionVelocityCtrl (Tension sensor feedback velocity control (Intermediate axis))

Name

CNV_FeedTensionVelocityCtrl

Function overview

Item	Description	
Function overview	This FB executes the PID control according to the value detected by the tension detector and controls the velocity so that the tension reaches the specified tension.	
Symbol		
Applicable hardware and software	Applicable module	RD77MS, RD77GF, RD78G(S)
	Applicable CPU	MELSEC iQ-R series CPU module
	Engineering software	GX Works3
Number of steps	4403 steps (For the macro type)	
FB dependence	CNV_PIDControl	
Function description	The velocity correction is performed to the line speed with the PID control output according to a deviation between a setting value of tension and value of the tension detector, and the value is output as a command velocity to the servo amplifier.  * The velocity correction value is "-" when the tension detection is performed in the downstream side of the feeding axis.	
Compiling method	Macro type, subroutine type	
FB operation type	Real-time execution	
Restrictions and precautions	• Execute this FB in a fixed cycle. • Set the electronic gear of the Simple Motion module for a feeding length per motor rotation of the feed axis calculated with the roll circumference and reduction ratio.	

Labels

■Input labels

Name	Label name	Data type	Read timing*1	Setting range	Initial value	Description
Execution command	i_bEN	Bit	⊓	—	—	On: The FB is activated. Off: The FB is stopped.
Setting value of tension	i_eTensionSetVal	Single precision real number	⊓	0.0 <=	—	Input the target value of tension [N].
Current value of tension	i_eTensionActVal	Single precision real number	⊓	—	—	Input the value of the tension detector [N].
Line velocity	i_eLineVelocity	Single precision real number	⊓	—	—	Input the current value of the line velocity [m/min].
Execution cycle	i_eSamplingTime	Single precision real number	↑	0.0 <	—	Execution cycle [ms] of the program for executing the FB

*1 ⊓: Always, ↑: Only when the FB is started

■Output labels

Name	Label name	Data type	Value to be held*1	Description
Executing	o_bENO	Bit	—	Turns on while Execution command is on.
Normal operation	o_bOK	Bit	—	Turns on while the FB is normally operating.
Error completion	o_bErr	Bit	—	Turns on when an error has occurred in the FB.
Error code	o_uErrId	Word [Unsigned]	—	The error code of the error that has occurred in the FB is stored. (Refer to "Page 289 List of Error Codes".)
Velocity command	o_eCommandVelocity	Single precision real number	—	Velocity command value of FB calculation results [m/min]
Velocity correction	o_eAdditiveVelocity	Single precision real number	—	Velocity correction determined by PID calculation [m/min]

*1 ○: The value is held after the FB stops. —: The value is cleared after the FB stops.

■I/O labels

Name	Label name	Data type	Setting range	Description
Setting of tension control	io_stFeedTensionCtrl	WINDER_REF	—	Refer to the following.
Setting of feed axis	io_stFeedAxis	AXIS_REF	—	

Setting of tension control (WINDER_REF structure)

Name	Label name	I/O	Data type	Read timing*1	Setting range	Initial value	Description
Sensor position	bSensorPos	IN	Bit	⊓	—	—	On: Downstream side of the feeding axis Off: Upstream side of the feeding axis
Proportionality gain	eKp	IN	Single precision real number	⊓	0.0 <=	—	PID control Proportional gain [(m/min)/N]
Integral time	eTi	IN	Single precision real number	⊓	0.0 <=	—	PID control Integral time [ms]
Differential time	eTd	IN	Single precision real number	⊓	0.0 <=	—	PID control Differential time [ms]
Upper limit	ePidUpperLimit	IN	Single precision real number	⊓	Lower limit value <	—	PID output Upper limit value [m/min]
Lower limit	ePidLowerLimit	IN	Single precision real number	⊓	Upper limit value >	—	PID output Lower limit value [m/min]
Setting of deadband	ePidDeadBand	IN	Single precision real number	⊓	0.0 <=	—	PID control Setting of deadband [N]
Amplitude of auto tuning	eMrly	IN	Single precision real number	⊓	0.0 <	1.0	Amplitude at auto turning
Start auto tuning	bAtStart	IN	Bit	⊓	—	—	On: The auto turning is started.

Name	Label name	I/O	Data type	Read timing[*1]	Setting range	Initial value	Description
Auto tuning response	wAtResponse	IN	Word [Signed]	⊓	1 to 7	3	1 (Weak) ⇔ 7(Strong)
Enable auto tuning	bAtValEN	IN	Bit	⊓	—	—	On: The PID control is performed with auto tuning results. Off: The PID control is performed with setting values.
Normal completion of auto tuning	bAtComp	OUT	Bit	—	—	—	On: Turns on when the auto tuning is normally completed. Off: Turn off when Start auto tuning turns off.
Hysteresis of auto tuning results	eTehys	OUT	Single precision real number	—	—	—	Hysteresis of auto tuning results [N]
Proportional gain of auto tuning results	eAtKp	OUT	Single precision real number (to be held)	—	—	—	Proportional gain of auto tuning results [(m/min)/N]
Integral time of auto tuning results	eAtTi	OUT	Single precision real number (to be held)	—	—	—	Integral time of auto tuning results [ms]

Setting of feed axis (AXIS_REF structure)

Name	Label name	I/O	Data type	Read timing[*1]	Setting range	Initial value	Description
Axis number	AxisNo	IN	Word [Unsigned]	↑	0 to the maximum number of axes of the module used	—	Axis number (0: Only the command operation. The Simple Motion module does not send output to the servo amplifier.)
Start I/O number	StartIO	IN	Word [Unsigned]	↑	0H to FEH	—	Installation address of the Simple Motion module (Upper three digits of four digits (hexadecimal))

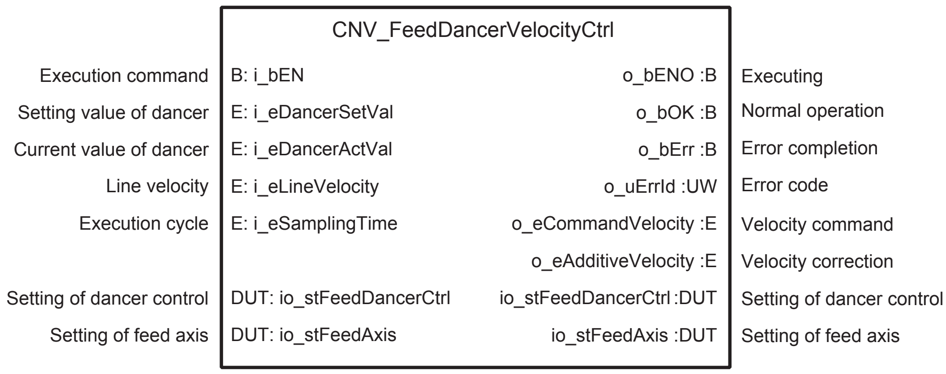
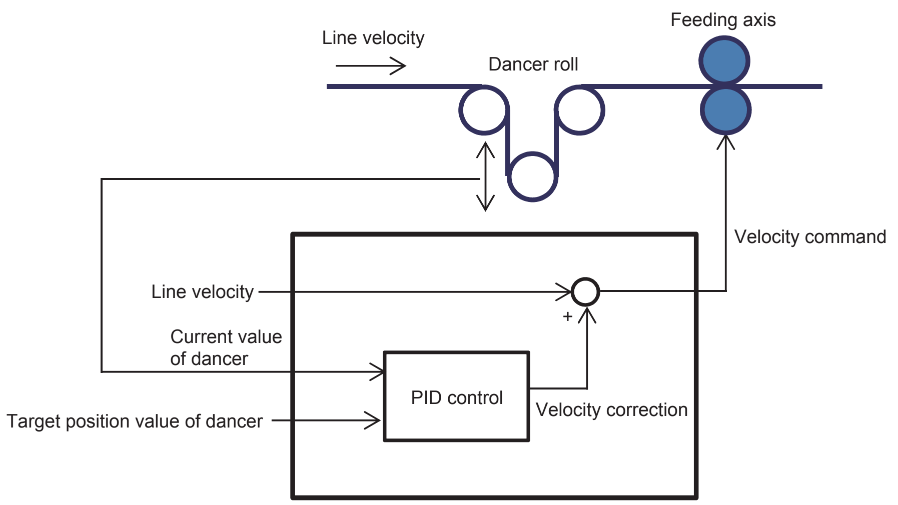
*1 ⊓: Always, ↑: Only when the FB is started

CNV_FeedDancerVelocityCtrl (Dancer feedback velocity control (Intermediate axis))

Name

CNV_FeedDancerVelocityCtrl

Function overview

Item	Description	
Function overview	This FB detects the position of the dancer roll and controls the velocity to reach the target position.	
Symbol		
Applicable hardware and software	Applicable module	RD77MS, RD77GF, RD78G(S)
	Applicable CPU	MELSEC iQ-R series CPU module
	Engineering software	GX Works3
Number of steps	4371 steps (For the macro type)	
FB dependence	CNV_PIDControl	
Function description	The velocity correction is performed to the line velocity with the PID control output according to a deviation between a target value of dancer and current value of dancer, and the value is output as a command velocity to the servo amplifier.  * The velocity correction value is "-" when the dancer position detection is performed in the downstream side of the feeding axis.	
Compiling method	Macro type, subroutine type	
FB operation type	Real-time execution	
Restrictions and precautions	• Execute this FB in a fixed cycle. • Set the electronic gear of the Simple Motion module for a feeding length per motor rotation of the feed axis calculated with the roll circumference and reduction ratio.	

Labels

■Input labels

Name	Label name	Data type	Read timing*1	Setting range	Initial value	Description
Execution command	i_bEN	Bit	⊓	—	—	On: The FB is activated. Off: The FB is stopped.
Setting value of dancer	i_eDancerSetVal	Single precision real number	⊓	—	—	Input the target position of the dancer roll [mm or degree].
Current value of dancer	i_eDancerActVal	Single precision real number	⊓	—	—	Input the current value of the dancer roll [mm or degree].
Line velocity	i_eLineVelocity	Single precision real number	⊓	—	—	Input the current value of the line velocity [m/min].
Execution cycle	i_eSamplingTime	Single precision real number	↑	0.0 <	—	Execution cycle [ms] of the program for executing the FB

*1 ⊓: Always, ↑: Only when the FB is started

■Output labels

Name	Label name	Data type	Value to be held*1	Description
Executing	o_bENO	Bit	—	Turns on while Execution command is on.
Normal operation	o_bOK	Bit	—	Turns on while the FB is normally operating.
Error completion	o_bErr	Bit	—	Turns on when an error has occurred in the FB.
Error code	o_uErrId	Word [Unsigned]	—	The error code of the error that has occurred in the FB is stored. (Refer to "Page 289 List of Error Codes".)
Velocity command	o_eCommandVelocity	Single precision real number	—	Velocity command value of FB calculation results [m/min]
Velocity correction	o_eAdditiveVelocity	Single precision real number	—	Velocity correction determined by PID calculation [m/min]

*1 ○: The value is held after the FB stops. —: The value is cleared after the FB stops.

■I/O labels

Name	Label name	Data type	Setting range	Description
Setting of dancer control	io_stFeedDancerCtrl	WINDER_REF	—	Refer to the following.
Setting of feed axis	io_stFeedAxis	AXIS_REF	—	

Setting of dancer control (WINDER_REF structure)

Name	Label name	I/O	Data type	Read timing*1	Setting range	Initial value	Description
Sensor position (dancer installation)	wSensorPos	IN	Bit	⊓	—	—	On: Downstream side of the feeding axis Off: Upstream side of the feeding axis
Proportionality gain	eKp	IN	Single precision real number	⊓	0.0 <=	—	PID control Proportional gain [(m/min)/mm or (m/min)/degree]
Integral time	eTi	IN	Single precision real number	⊓	0.0 <=	—	PID control Integral time [ms]
Differential time	eTd	IN	Single precision real number	⊓	0.0 <=	—	PID control Differential time [ms]
Upper limit	ePidUpperLimit	IN	Single precision real number	⊓	Lower limit value <	—	PID output Upper limit value [m/min]
Lower limit	ePidLowerLimit	IN	Single precision real number	⊓	Upper limit value >	—	PID output Lower limit value [m/min]
Setting of deadband	ePidDeadBand	IN	Single precision real number	⊓	0.0 <=	—	PID control Setting of deadband [mm or degree]
Amplitude of auto tuning	eMrly	IN	Single precision real number	⊓	0.0 <	1.0	Amplitude at auto turning
Start auto tuning	bAtStart	IN	Bit	⊓	—	—	On: The auto turning is started.

Name	Label name	I/O	Data type	Read timing*1	Setting range	Initial value	Description
Auto tuning response	wAtResponse	IN	Word [Signed]	⊓	1 to 7	3	1 (Weak) ⇔ 7(Strong)
Enable auto tuning	bAtValEN	IN	Bit	⊓	—	—	On: The PID control is performed with auto tuning results. Off: The PID control is performed with setting values.
Normal completion of auto tuning	bAtComp	OUT	Bit	—	—	—	On: Turns on when the auto tuning is normally completed. Off: Turn off when Start auto tuning turns off.
Hysteresis of auto tuning results	eTehys	OUT	Single precision real number	—	—	—	Hysteresis of auto tuning results [mm or degree]
Proportional gain of auto tuning results	eAtKp	OUT	Single precision real number (to be held)	—	—	—	Proportional gain of auto tuning results [(m/min)/mm or (m/min)/degree]
Integral time of auto tuning results	eAtTi	OUT	Single precision real number (to be held)	—	—	—	Integral time of auto tuning results [ms]

Setting of feed axis (AXIS_REF structure)

Name	Label name	I/O	Data type	Read timing*1	Setting range	Initial value	Description
Axis number	AxisNo	IN	Word [Unsigned]	↑	0 to the maximum number of axes of the module used	—	Axis number (0: Only the command operation. The Simple Motion module does not send output to the servo amplifier.)
Start I/O number	StartIO	IN	Word [Unsigned]	↑	0H to FEH	—	Installation address of the Simple Motion module (Upper three digits of four digits (hexadecimal))

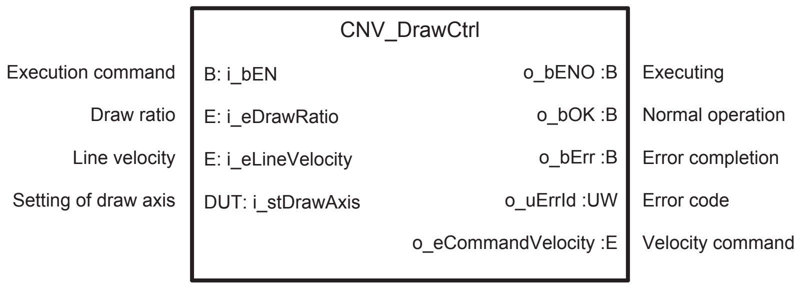
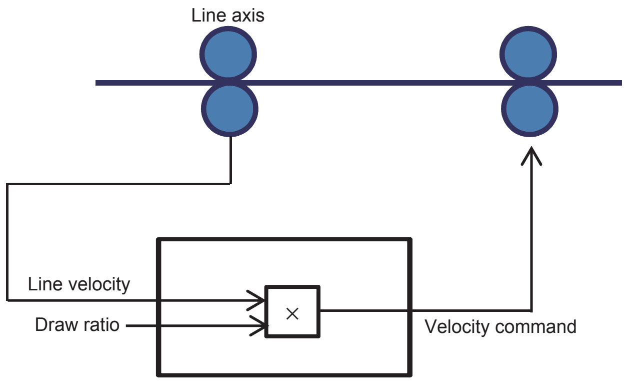
*1 ⊓: Always, ↑: Only when the FB is started

CNV_DrawCtrl (Draw control)

Name

CNV_DrawCtrl

Function overview

Item	Description	
Function overview	This FB controls the velocity of the intermediate axis in unwinding/rewinding lines.	
Symbol		
Applicable hardware and software	Applicable module	RD77MS, RD77GF, RD78G(S)
	Applicable CPU	MELSEC iQ-R series CPU module
	Engineering software	GX Works3
Number of steps	1342 steps (For the macro type)	
FB dependence	None	
Function description	The command velocity to the line velocity (draw ratio) at the draw ratio is output to the servo amplifier. 	
Compiling method	Macro type, subroutine type	
FB operation type	Real-time execution	
Restrictions and precautions	When combining with the FB that executes in the fixed cycle, Motion calculation cycle event task (I44: Inter-module synchronization) is recommended.	

Labels

■Input labels

Name	Label name	Data type	Read timing[*1]	Setting range	Initial value	Description
Execution command	i_bEN	Bit	⊓	—	—	On: The FB is activated. Off: The FB is stopped.
Draw ratio	i_eDrawRatio	Single precision real number	⊓	0.0<=	—	Draw ratio (1.0 = Line velocity × 100%)
Line velocity	i_eLineVelocity	Single precision real number	⊓	—	—	Line velocity [m/min]
Setting of draw axis	i_stDrawAxis	AXIS_REF	↑	—	—	Refer to the following.

Setting of draw axis (AXIS_REF structure)

Name	Label name	I/O	Data type	Read timing[*1]	Setting range	Initial value	Description
Axis number	AxisNo	IN	Word [Unsigned]	↑	0 to the maximum number of axes of the module used	—	Axis number (0: Only the command operation. The Simple Motion module does not send output to the servo amplifier.)
Start I/O number	StartIO	IN	Word [Unsigned]	↑	0H to FEH	—	Installation address of the Simple Motion module (Upper three digits of four digits (hexadecimal))

*1 ⊓: Always, ↑: Only when the FB is started

■Output labels

Name	Label name	Data type	Value to be held[*1]	Description
Executing	o_bENO	Bit	—	Turns on while Execution command is on.
Normal operation	o_bOK	Bit	—	Turns on while the FB is normally operating.
Error completion	o_bErr	Bit	—	Turns on when an error has occurred in the FB.
Error code	o_uErrId	Word [Unsigned]	—	The error code of the error that has occurred in the FB is stored. (Refer to "Page 289 List of Error Codes".)
Velocity command	o_eCommandVelocity	Single precision real number	—	Draw control Velocity command value [m/min]

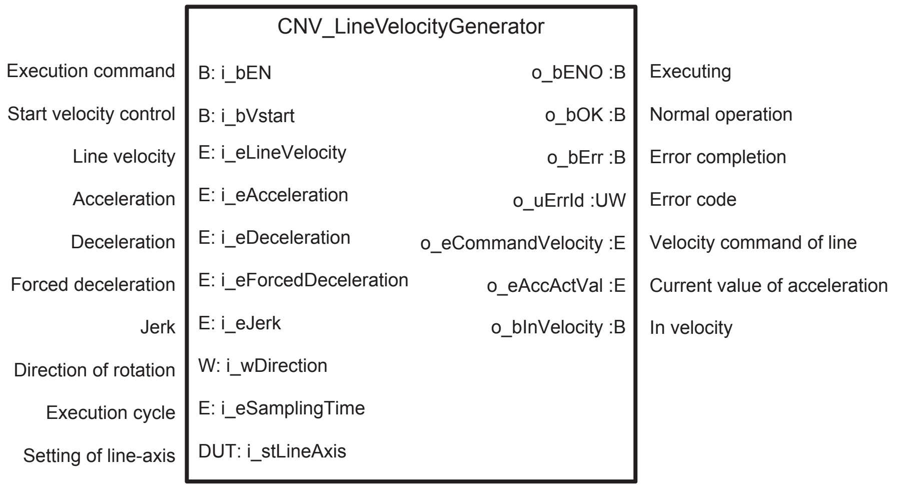
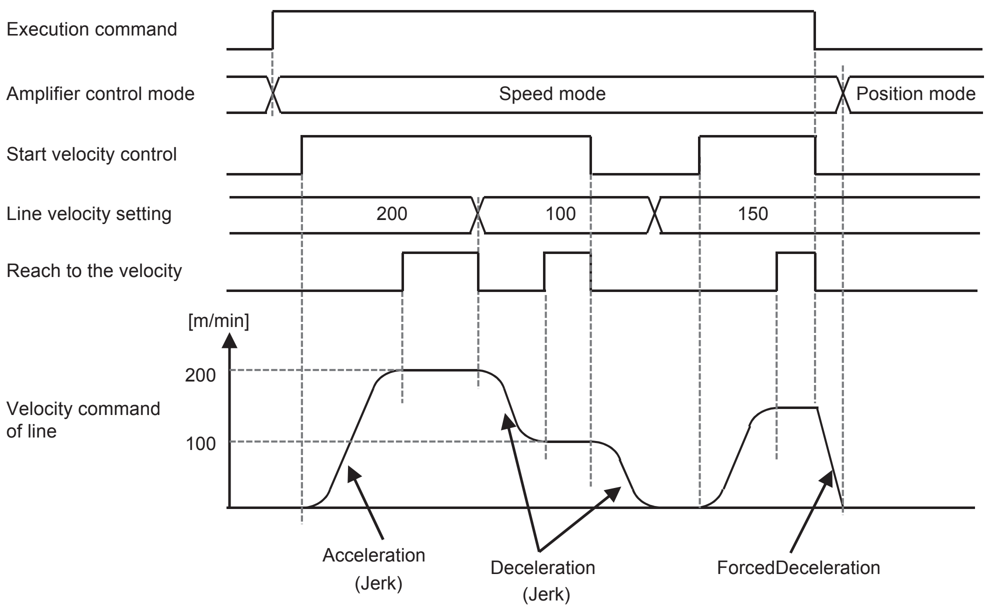
*1 ○: The value is held after the FB stops. —: The value is cleared after the FB stops.

CNV_LineVelocityGenerator (Line velocity generator)

Name

CNV_LineVelocityGenerator

Function overview

Item	Description	
Function overview	This FB controls the velocity of the standard axis (line axis) in unwinding and rewinding lines.	
Symbol		
Applicable hardware and software	Applicable module	RD77MS, RD77GF, RD78G(S)
	Applicable CPU	MELSEC iQ-R series CPU module
	Engineering software	GX Works3
Number of steps	2252 steps (For the macro type)	
FB dependence	None	
Function description	• When Execution command turns on, the mode of the corresponding axis is changed to the speed mode. (A value other than "0" is set for the axis number setting of the corresponding axis) • The velocity is controlled at the set line velocity when Start velocity control turns on.  * When Axis number is set to "0", only the velocity is generated.	
Compiling method	Macro type, subroutine type	
FB operation type	Real-time execution	
Restrictions and precautions	• Execute this FB in a fixed cycle. • Although the line velocity setting is always imported, the change to forward or backward cannot be made. If it is changed, control is performed at the previous line velocity setting. Before changing the line velocity setting to forward or backward, set the line velocity setting to 0.	

Labels

■Input labels

Name	Label name	Data type	Read timing*1	Setting range	Initial value	Description
Execution command	i_bEN	Bit	⊓	—	—	On: The FB is activated. Off: The FB is stopped.
Start velocity control	i_bVstart	Bit	⊓	—	—	On: The velocity control is started. Off: The velocity control is stopped.
Line velocity	i_eLineVelocity	Single precision real number	⊓	—	—	Line velocity setting [m/min]
Acceleration	i_eAcceleration	Single precision real number	⊓	0.0 <	—	Acceleration setting [(m/min)/s]
Deceleration	i_eDeceleration	Single precision real number	⊓	0.0 <	—	Deceleration setting [(m/min)/s]
Forced deceleration	i_eForcedDeceleration	Single precision real number	⊓	0.0 <	—	Forced deceleration setting [(m/min)/s]
Jerk	i_eJerk	Single precision real number	⊓	0.0<=	—	Jerk setting [(m/min)/s^2]
Direction of rotation	i_wDirection	Word [Signed]	⊓	0.1	—	0: Forward 1: Backward
Execution cycle	i_eSamplingTime	Single precision real number	↑	0.0 <	—	Execution cycle [ms] of the program for executing the FB
Setting of line-axis	i_stLineAxis	AXIS_REF	↑	—	—	Refer to the following.

Setting of line axis (AXIS_REF structure)

Name	Label name	I/O	Data type	Read timing*1	Setting range	Initial value	Description
Axis number	AxisNo	IN	Word [Unsigned]	↑	0 to the maximum number of axes of the module used	—	Axis number (0: Only the command operation. The Simple Motion module does not send output to the servo amplifier.)
Start I/O number	StartIO	IN	Word [Unsigned]	↑	0H to FEH	—	Installation address of the Simple Motion module (Upper three digits of four digits (hexadecimal))

*1 ⊓: Always, ↑: Only when the FB is started

■Output labels

Name	Label name	Data type	Value to be held*1	Description
Executing	o_bENO	Bit	—	Turns on while Execution command is on.
Normal operation	o_bOK	Bit	—	Turns on while the FB is normally operating.
Error completion	o_bErr	Bit	—	Turns on when an error has occurred in the FB.
Error code	o_uErrId	Word [Unsigned]	—	The error code of the error that has occurred in the FB is stored. (Refer to "Page 289 List of Error Codes".)
Velocity command of line	o_eCommandVelocity	Single precision real number	—	Velocity command of line [m/min]
Current value of acceleration	o_eAccActVal	Single precision real number	—	Current value of acceleration [m/s^2]
In velocity	o_bInVelocity	Bit	—	Turns on when the velocity reaches the set velocity.

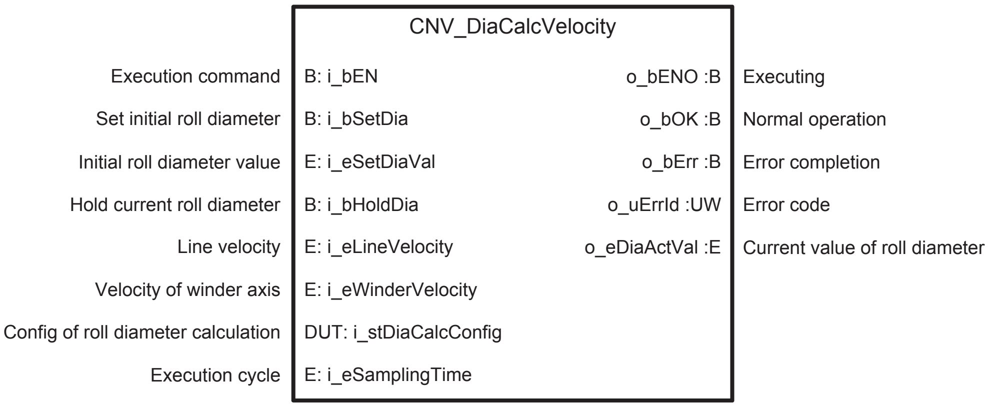
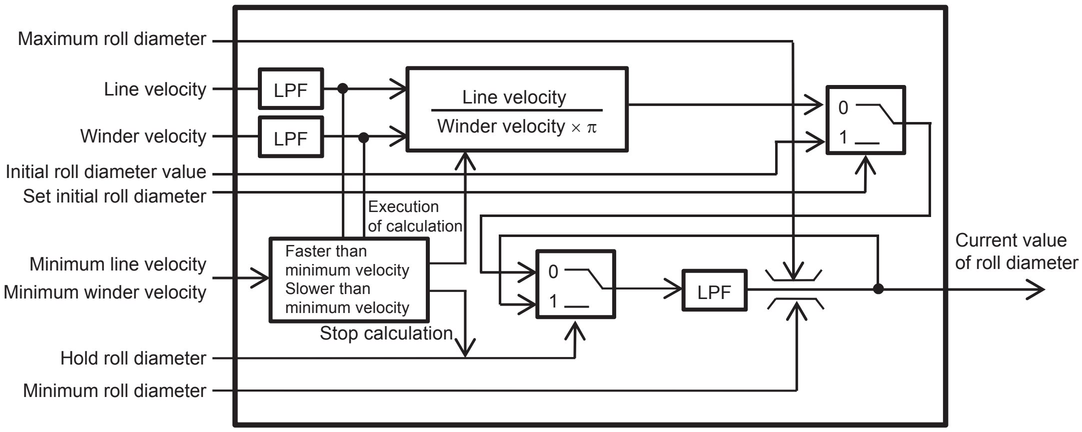
*1 ○: The value is held after the FB stops. —: The value is cleared after the FB stops.

CNV_DiaCalcVelocity (Roll diameter calculation (Velocity ratio method))

Name

CNV_DiaCalcVelocity

Function overview

Item	Description	
Function overview	This FB calculates the current roll diameter (outer diameter) from the velocity ratio of the winder velocity and line velocity.	
Symbol		
Applicable hardware and software	Applicable module	RD77MS, RD77GF, RD78G(S)
	Applicable CPU	MELSEC iQ-R series CPU module
	Engineering software	GX Works3
Number of steps	3641 steps (For the macro type)	
FB dependence	STD_Lowpass1 STD_Limiter	
Function description	The estimate value of the roll diameter is calculated from the ratio of the line velocity and winder velocity, and rapid changes of the roll diameter are prevented with the lowpass filter. When each velocity is slower than the prescribed velocity, updating of the roll diameter stops. 	
Compiling method	Macro type, subroutine type	
FB operation type	Real-time execution	
Restrictions and precautions	Execute this FB in a fixed cycle.	

Labels

■Input labels

Name	Label name	Data type	Read timing*1	Setting range	Initial value	Description
Execution command	i_bEN	Bit	⊓	—	—	On: The FB is activated. Off: The FB is stopped.
Set initial roll diameter	i_bSetDia	Bit	⊓	—	—	On: Initial roll diameter → Current value of roll diameter Off: Velocity ratio calculation result → Current value of roll diameter
Initial roll diameter value	i_eSetDiaVal	Single precision real number	⊓	Refer to the right description.	—	Initial value of roll diameter [mm] (Minimum roll diameter to maximum roll diameter)
Hold current roll diameter	i_bHoldDia	Bit	⊓	—	—	On: The velocity ratio calculation stops. (The current value is held.) Off: Velocity ratio calculation result → Current value of roll diameter
Line velocity	i_eLineVelocity	Single precision real number	⊓	—	—	Current value of line velocity [m/min]
Velocity of winder axis	i_eWinderVelocity	Single precision real number	⊓	—	—	Current value of winder velocity [r/min]
Config of roll diameter calculation	i_stDiaCalcConfig	DIA_CALC_REF	—	—	—	Refer to the following.
Execution cycle	i_eSamplingTime	Single precision real number	↑	0.0 <	—	Execution cycle [ms] of the program for executing the FB

Config of roll diameter calculation (DIA_CALC_REF structure)

Name	Label name	Data type	Read timing*1	Setting range	Initial value	Description
Maximum roll diameter	MaxDia	Single precision real number	↑	Refer to the right description.	—	Maximum value and minimum value of roll diameter [mm] (0.0 < Minimum diameter < Maximum diameter)
Minimum roll diameter	MinDia	Single precision real number	↑		—	
Minimum line velocity	MinLineVelocity	Single precision real number	↑	0.0<=	—	Minimum line velocity for roll diameter calculation [m/min]
Minimum winder velocity	MinWinderVelocity	Single precision real number	↑	0.0<=	—	Minimum winder velocity for roll diameter calculation [r/min]
Filter of line velocity	LineVelocityLPF	Single precision real number	⊓	0.0<=	—	Filter time constant of line velocity [ms]
Filter of winder velocity	WinderVelocityLPF	Single precision real number	⊓	0.0<=	—	Filter time constant of winder velocity [ms]
Filter of roll diameter calculation	DiaCalcLPF	Single precision real number	⊓	0.0<=	—	Filter time constant of roll diameter calculation results [ms]

*1 ⊓: Always, ↑: Only when the FB is started

■Output labels

Name	Label name	Data type	Value to be held*1	Description
Executing	o_bENO	Bit	—	Turns on while Execution command is on.
Normal operation	o_bOK	Bit	—	Turns on while the FB is normally operating.
Error completion	o_bErr	Bit	—	Turns on when an error has occurred in the FB.
Error code	o_uErrId	Word [Unsigned]	—	The error code of the error that has occurred in the FB is stored. (Refer to "Page 289 List of Error Codes".)
Current value of roll diameter	o_eDiaActVal	Single precision real number	○	The calculation result of the roll diameter [mm] is stored.

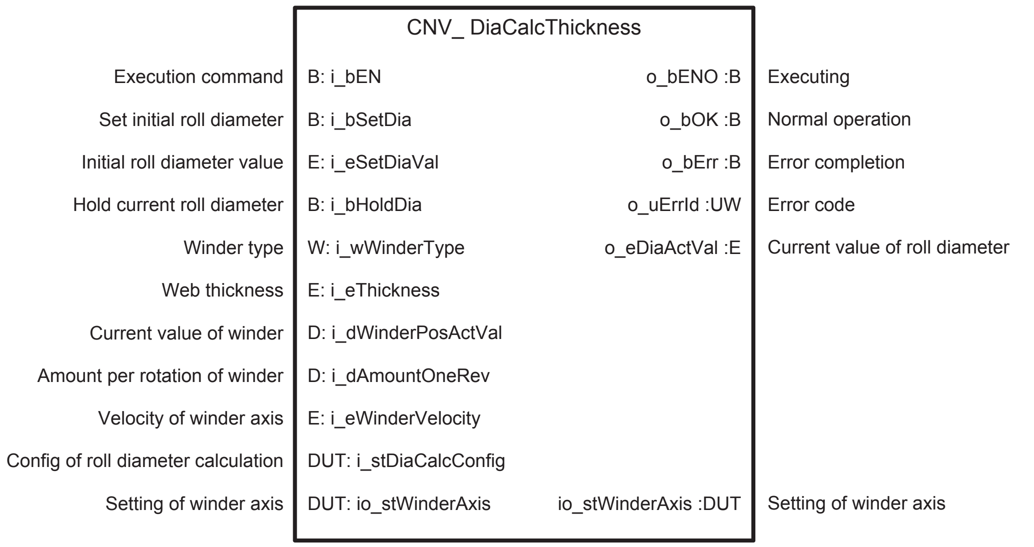
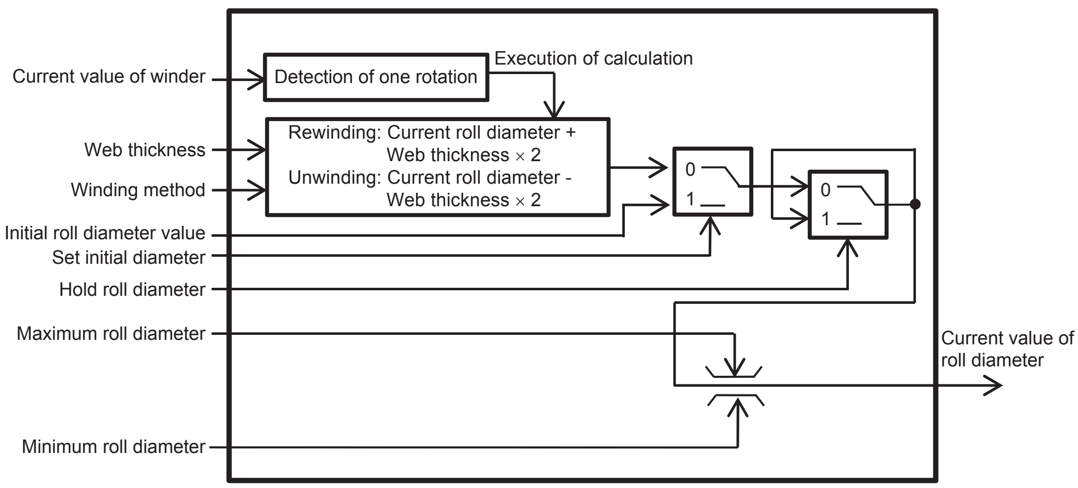
*1 ○: The value is held after the FB stops. —: The value is cleared after the FB stops.

CNV_DiaCalcThickness (Roll diameter calculation (web thickness integration method))

Name

CNV_DiaCalcThickness

Function overview

<table>
<tr><th>Item</th><th colspan="2">Description</th></tr>
<tr><td>Function overview</td><td colspan="2">This FB calculates the roll diameter from the web thickness and the rotation amount of the winder axis.</td></tr>
<tr><td>Symbol</td><td colspan="2">
</td></tr>
<tr><td rowspan="3">Applicable hardware and software</td><td>Applicable module</td><td>RD77MS, RD77GF, RD78G(S)</td></tr>
<tr><td>Applicable CPU</td><td>MELSEC iQ-R series CPU module</td></tr>
<tr><td>Engineering software</td><td>GX Works3</td></tr>
<tr><td>Number of steps</td><td colspan="2">2031 steps (For the macro type)</td></tr>
<tr><td>FB dependence</td><td colspan="2">STD_Limiter</td></tr>
<tr><td>Function description</td><td colspan="2">The roll diameter is calculated by adding/subtracting (Web thickness × 2) to/from the initial roll diameter for the first rotation. From the second rotation, the roll diameter is calculated by adding/subtracting (Web thickness × 2) to/from the current roll diameter every time the winder axis rotates.

</td></tr>
<tr><td>Compiling method</td><td colspan="2">Macro type, subroutine type</td></tr>
<tr><td>FB operation type</td><td colspan="2">Real-time execution</td></tr>
<tr><td>Restrictions and precautions</td><td colspan="2">—</td></tr>
</table>

Labels

■Input labels

Name	Label name	Data type	Read timing*1	Setting range	Initial value	Description
Execution command	i_bEN	Bit	⊓	—	—	On: The FB is activated. Off: The FB is stopped.
Set initial roll diameter	i_bSetDia	Bit	⊓	—	—	On: Initial roll diameter → Current value of roll diameter Off: Cumulative value of web thickness → Current value of roll diameter
Initial roll diameter value	i_eSetDiaVal	Single precision real number	⊓	Refer to the right description.	—	Initial value of roll diameter [mm] (Minimum roll diameter to maximum roll diameter)
Hold current roll diameter	i_bHoldDia	Bit	⊓	—	—	On: The cumulative calculation of web thickness stops. (The current value is held.) Off: Cumulative value of web thickness → Current value of roll diameter
Winding method	i_wWinderType	Word [Signed]	⊓	0 to 3	—	Rewinding/unwinding setting 0: Forward unwinding 1: Forward rewinding 2: Backward unwinding 3: Backward rewinding (For details, refer to "Page 45 Rotation Direction Setting".)
Web thickness	i_eThickness	Single precision real number	⊓	0.0 <	—	Web thickness [mm]
Current value of winder	i_dWinderPosActVal	Double word [Signed]	⊓	—	—	Current rotational position of the winder axis (Input a value only when the axis number is 0.)
Amount per rotation of winder	i_dAmountOneRev	Double word [Signed]	↑	0 <	—	Travel distance per rotation of winder axis (Input a value only when the axis number is 0.)
Velocity of winder axis	i_eWinderVelocity	Single precision real number	⊓	—	—	Current value of winder velocity [r/min] (Input a value only when the axis number is 0.)
Config of roll diameter calculation	i_stDiaCalcConfig	DIA_CALC_REF	—	—	—	Refer to the following.

Config of roll diameter calculation (DIA_CALC_REF structure)

Name	Label name	Data type	Read timing*1	Setting range	Initial value	Description
Maximum roll diameter	MaxDia	Single precision real number	↑	Refer to the right description.	—	Maximum value and minimum value of roll diameter (0.0 < Minimum diameter < Maximum diameter)
Minimum roll diameter	MinDia	Single precision real number	↑		—	
Minimum winder velocity	MinWinderVelocity	Single precision real number	↑	0.0<=	—	Minimum winder velocity for roll diameter calculation [r/min]

*1 ⊓: Always, ↑: Only when the FB is started

■Output labels

Name	Label name	Data type	Value to be held*1	Description
Executing	o_bENO	Bit	—	Turns on while Execution command is on.
Normal operation	o_bOK	Bit	—	Turns on while the FB is normally operating.
Error completion	o_bErr	Bit	—	Turns on when an error has occurred in the FB.
Error code	o_uErrId	Word [Unsigned]	—	The error code of the error that has occurred in the FB is stored. (Refer to "Page 289 List of Error Codes".)
Current value of roll diameter	o_eDiaActVal	Single precision real number	○	The calculation result of the roll diameter [mm] is stored.

*1 ○: The value is held after the FB stops. —: The value is cleared after the FB stops.

■I/O labels

Name	Label name	Data type	Setting range	Description
Setting of winder axis	io_stWinderAxis	AXIS_REF	—	Refer to the following.

Setting of winder axis (AXIS_REF structure)

Name	Label name	I/O	Data type	Read timing*1	Setting range	Initial value	Description
Axis number	AxisNo	IN	Word [Unsigned]	↑	0 to the maximum number of axes of the module used	—	Axis number (Set "0" for using an axis other than the motion control axis.)
Start I/O number	StartIO	IN	Word [Unsigned]	↑	0H to FEH	—	Installation address of the Simple Motion module (Upper three digits of four digits (hexadecimal))

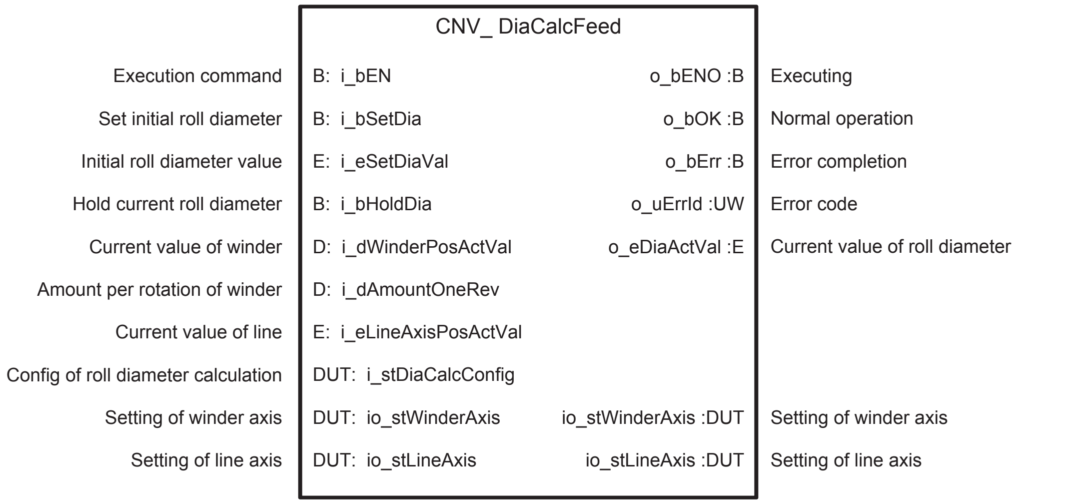
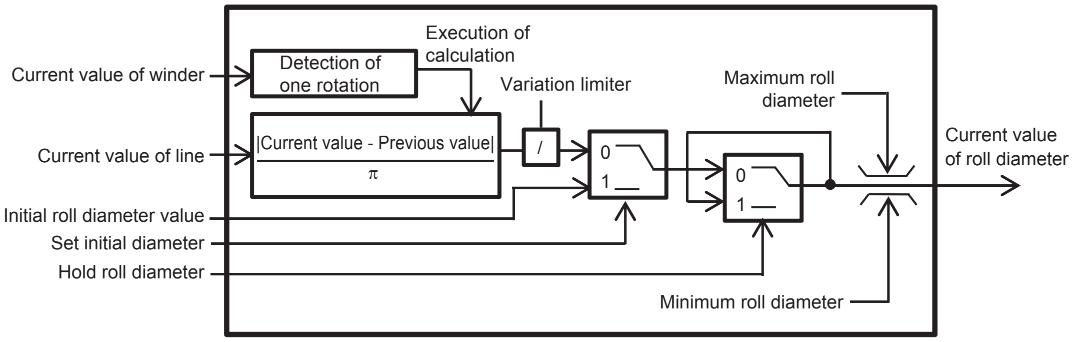
*1 ∏: Always, ↑: Only when the FB is started

CNV_DiaCalcFeed (Roll diameter calculation (feeding length method))

Name

CNV_DiaCalcFeed

Function overview

Item	Description	
Function overview	This FB calculates the current roll diameter (outer diameter) from the feeding length of the line axis (main axis) per rotation of the winder axis.	
Symbol		
Applicable hardware and software	Applicable module	RD77MS, RD77GF, RD78G(S)
	Applicable CPU	MELSEC iQ-R series CPU module
	Engineering software	GX Works3
Number of steps	1550 steps (For the macro type)	
FB dependence	STD_Limiter	
Function description	This FB measures the perimeter of the roll (circumference) and calculates the current roll diameter (outer diameter) from the feeding length of the line axis per rotation of the winder axis. 	
Compiling method	Macro type, subroutine type	
FB operation type	Real-time execution	
Restrictions and precautions	—	

Labels

■Input labels

Name	Label name	Data type	Read timing*1	Setting range	Initial value	Description
Execution command	i_bEN	Bit	⊓	—	—	On: The FB is activated. Off: The FB is stopped.
Set initial roll diameter	i_bSetDia	Bit	⊓	—	—	On: Initial roll diameter → Current value of roll diameter Off: Feeding length calculation result → Current value of roll diameter
Initial roll diameter value	i_eSetDiaVal	Single precision real number	⊓	Refer to the right description.	—	Initial value of roll diameter [mm] (Minimum roll diameter to maximum roll diameter)
Hold current roll diameter	i_bHoldDia	Bit	⊓	—	—	On: The feeding length calculation stops. (The current value is held.) Off: Feeding length calculation result → Current value of roll diameter
Current value of winder	i_dWinderPosActVal	Double word [Signed]	⊓	—	—	Current rotational position of the winder axis (Input a value only when the axis number is 0.)
Amount per rotation of winder	i_dAmountOneRev	Double word [Signed]	↑	0 <	—	Travel distance per rotation of winder axis (Input a value only when the axis number is 0.)
Current value of line	i_eLineAxisPosActVal	Single precision real number	⊓	—	—	Current value of line axis [mm] (Input a value only when the axis number is 0.)
Config of roll diameter calculation	i_stDiaCalcConfig	DIA_CALC_REF	—	—	—	Refer to the following.

Config of roll diameter calculation (DIA_CALC_REF structure)

Name	Label name	Data type	Read timing*1	Setting range	Initial value	Description
Maximum roll diameter	MaxDia	Single precision real number	↑	Refer to the right description.	—	Maximum value and minimum value of roll diameter [mm] (0.0 < Minimum diameter < Maximum diameter)
Minimum roll diameter	MinDia	Single precision real number	↑		—	
Variation limit value	DiaVariationLimit	Single precision real number	↑	0<=	10.0	Variation limit value of operation result per rotation [mm] When "0" is set, the variation limit is disabled.

*1 ⊓: Always, ↑: Only when the FB is started

■Output labels

Name	Label name	Data type	Value to be held*1	Description
Executing	o_bENO	Bit	—	Turns on while Execution command is on.
Normal operation	o_bOK	Bit	—	Turns on while the FB is normally operating.
Error completion	o_bErr	Bit	—	Turns on when an error has occurred in the FB.
Error code	o_uErrId	Word [Unsigned]	—	The error code of the error that has occurred in the FB is stored. (Refer to "Page 289 List of Error Codes".)
Current value of roll diameter	o_eDiaActVal	Single precision real number	○	The calculation result of the roll diameter [mm] is stored.

*1 ○: The value is held after the FB stops. —: The value is cleared after the FB stops.

■I/O labels

Name	Label name	Data type	Setting range	Description
Setting of winder axis	io_stWinderAxis	AXIS_REF	—	Refer to the following.
Setting of line axis	io_stLineAxis	AXIS_REF	—	Refer to the following.

Setting of axis (AXIS_REF structure)

Name	Label name	I/O	Data type	Read timing[*1]	Setting range	Initial value	Description
Axis number	AxisNo	IN	Word [Unsigned]	↑	0 to the maximum number of axes of the module used	—	Axis number (Set "0" for using an axis other than the motion control axis.)
Start I/O number	StartIO	IN	Word [Unsigned]	↑	0H to FEH	—	Installation address of the Simple Motion module (Upper three digits of four digits (hexadecimal))

*1 ⊓: Always, ↑: Only when the FB is started

CNV_WinderInertiaTorque (Inertia compensation torque calculation)

Name

CNV_WinderInertiaTorque

Function overview

Item	Description
Function overview	This FB calculates the torque compensation value during acceleration/deceleration from the roll value, machine inertia value, and motor inertia value.
Symbol	CNV_WinderInertiaTorque Execution command — B: i_bEN — o_bENO :B — Executing Current value of roll diameter — E: i_eDiaActVal — o_bOK :B — Normal operation Maximum roll diameter — E: i_eMaxDia — o_bErr :B — Error completion Roll inside diameter — E: i_eInsideDia — o_uErrId :UW — Error code Roll width — E: i_eWidth — o_eInertiaTrq :E — Torque of inertia compensation Roll density — E: i_eDensity Machine inertia — E: i_eJMachine Motor inertia — E: i_eJMotor Gear ratio — E: i_eGearRatio Acceleration of line — E: i_eAccActVal Coefficient of accelerating compensation — E: i_eAccAdj Coefficient of decelerating compensation — E: i_eDecAdj
Applicable hardware and software	Applicable module: RD77MS, RD77GF, RD78G(S) Applicable CPU: MELSEC iQ-R series CPU module Engineering software: GX Works3
Number of steps	715 steps (For the macro type)
FB dependence	None
Function description	The following calculation formulas are used to calculate the total inertia and roll angular acceleration, and then the torque of the inertia compensation during acceleration/deceleration. $\text{Roll weight [kg]} = \frac{\pi \cdot \text{Specific gravity} \cdot \text{Roll width} \cdot \left(\text{Current value of roll diameter}^2 - \text{Roll inside diameter}^2\right)}{4}$ $\text{Roll inertia [kgm}^2\text{]} = \text{Roll weight} \cdot \frac{\left(\text{Current value of roll diameter}^2 + \text{Roll inside diameter}^2\right)}{8 \cdot \text{Gear ratio}^2}$ $\text{Total inertia [kgm}^2\text{]} = \frac{\text{Machine inertia}}{\text{Gear ratio}^2} + \text{Roll inertia} + \text{Motor inertia}$ $\text{Angular acceleration of roll [rad/s}^2\text{]} = 2 \cdot \frac{\text{Acceleration of line} \cdot \text{Gear ratio}}{\text{Current value of roll diameter}}$ Torque of inertia compensation [N·m] = Total inertia • Angular acceleration of roll • The units of input values are converted. ([mm] → [m], [ms] → [s], [mm/s] → [m/s]) • When the acceleration of the line is positive, the inertia compensation torque is multiplied by the coefficient of accelerating compensation. When the acceleration of the line is negative, the torque is multiplied by the coefficient of decelerating compensation.
Compiling method	Macro type, subroutine type
FB operation type	Real-time execution

Item	Description
Restrictions and precautions	Execute this FB in a fixed cycle.

Labels

■Input labels

Name	Label name	Data type	Read timing*1	Setting range	Initial value	Description
Execution command	i_bEN	Bit	⊓	—	—	On: The FB is activated. Off: The FB is stopped.
Current value of roll diameter	i_eDiaActVal	Single precision real number	⊓	Refer to the right description.	—	Current value of roll-diameter [mm] (Roll inside diameter to maximum roll diameter)
Maximum roll diameter	i_eMaxDia	Single precision real number	↑	Refer to the right description.	—	Maximum roll diameter [mm] (larger than roll inside diameter)
Roll inside diameter	i_eInsideDia	Single precision real number	↑	Refer to the right description.	—	Roll inside diameter [mm] (0.0 < Roll inside diameter < Maximum roll diameter)
Roll width	i_eWidth	Single precision real number	⊓	0.0<=	—	Roll width [mm]
Roll density	i_eDensity	Single precision real number	⊓	0.0<=	—	Roll density [kg/m^3]
Machine inertia	i_eJMachine	Single precision real number	⊓	0.0<=	—	Machine inertia [kgm^2]
Motor inertia	i_eJMotor	Single precision real number	⊓	0.0<=	—	Motor inertia [kgm^2]
Gear ratio	i_eGearRatio	Single precision real number	⊓	0.0 <	—	Gear ratio (Motor side/load side)
Acceleration of line	i_eAccActVal	Single precision real number	⊓	—	—	Acceleration of line [m/s^2]
Coefficient of accelerating compensation	i_eAccAdj	Single precision real number	⊓	0.0<=	—	Compensation coefficient of inertia compensation torque in acceleration [1.0 = 100%]
Coefficient of decelerating compensation	i_eDecAdj	Single precision real number	⊓	0.0<=	—	Compensation coefficient of inertia compensation torque in deceleration [1.0 = 100%]

*1 ⊓: Always, ↑: Only when the FB is started

■Output labels

Name	Label name	Data type	Value to be held*1	Description
Executing	o_bENO	Bit	—	Turns on while Execution command is on.
Normal operation	o_bOK	Bit	—	Turns on while the FB is normally operating.
Error completion	o_bErr	Bit	—	Turns on when an error has occurred in the FB.
Error code	o_uErrId	Word [Unsigned]	—	The error code of the error that has occurred in the FB is stored. (Refer to "Page 289 List of Error Codes".)
Torque of inertia compensation	o_eInertiaTrq	Single precision real number	—	Calculation results of inertia compensation torque [N·m] are stored. (Motor axis conversion)

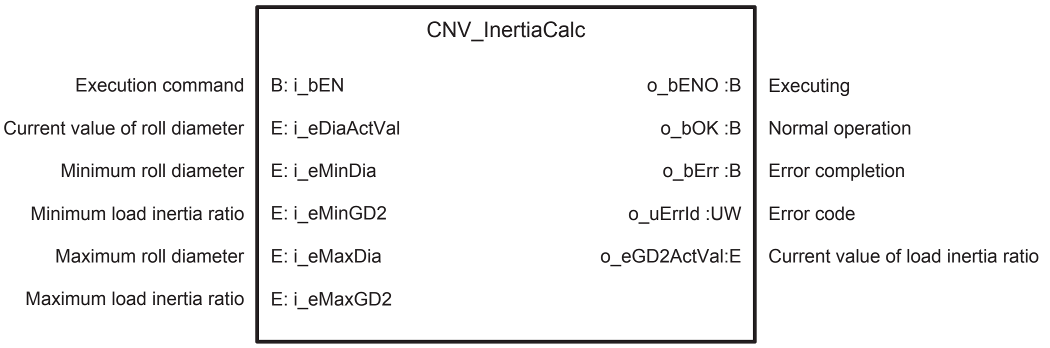
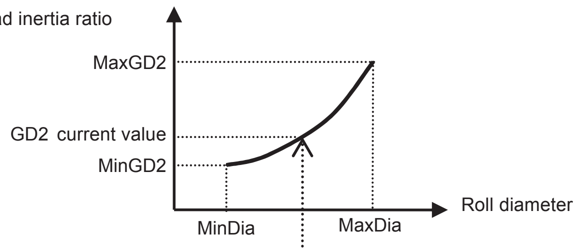
*1 ○: The value is held after the FB stops. —: The value is cleared after the FB stops.

CNV_InertiaCalc (Load inertia ratio calculation)

Name

CNV_InertiaCalc

Function overview

Item	Description	
Function overview	This FB calculates the load inertia ratio of the current value of the roll diameter to the winder motor axis.	
Symbol		
Applicable hardware and software	Applicable module	RD77MS, RD77GF, RD78G(S)
	Applicable CPU	MELSEC iQ-R series CPU module
	Engineering software	GX Works3
Number of steps	453 steps (For the macro type)	
FB dependence	None	
Function description	With the load inertia ratio of each of the minimum/maximum diameters, the load inertia ratio to the current value of the roll diameter is calculated based on the following graph (Quartic function). The calculated load inertia ratio current value can be used as the input of the inertia compensation torque calculation (motor inertia ratio) FB. 	
Compiling method	Macro type, subroutine type	
FB operation type	Real-time execution	
Restrictions and precautions	—	

Labels

■Input labels

Name	Label name	Data type	Read timing*1	Setting range	Initial value	Description
Execution command	i_bEN	Bit	⊓	—	—	On: The FB is activated. Off: The FB is stopped.
Current value of roll diameter	i_eDiaActVal	Single precision real number	⊓	Refer to the right description.	—	Current value of roll-diameter [mm] (Minimum roll diameter to maximum roll diameter)
Minimum roll diameter	i_eMinDia	Single precision real number	↑	0.0 <	—	Minimum value of roll diameter (= Winder axis diameter) [mm]
Minimum load inertia ratio	i_eMinGD2	Single precision real number	↑	0.0 <	—	Load inertia ratio without rolls [Multiplier] (Motor side/load side)
Maximum roll diameter	i_eMaxDia	Single precision real number	↑	i_eMinDia <	—	Maximum roll diameter [mm]
Maximum load inertia ratio	i_eMaxGD2	Single precision real number	↑	i_eMinGD2 <	—	Load inertia ratio of maximum roll diameter [Multiplier] (Motor side/load side)

*1 ⊓: Always, ↑: Only when the FB is started

■Output labels

Name	Label name	Data type	Value to be held*1	Description
Executing	o_bENO	Bit	—	Turns on while Execution command is on.
Normal operation	o_bOK	Bit	—	Turns on while the FB is normally operating.
Error completion	o_bErr	Bit	—	Turns on when an error has occurred in the FB.
Error code	o_uErrId	Word [Unsigned]	—	The error code of the error that has occurred in the FB is stored. (Refer to "Page 289 List of Error Codes".)
Current value of load inertia ratio	o_eGD2ActVal	Single precision real number	—	The calculation results of load inertia ratio [Multiplier] is stored (Motor side/load side).

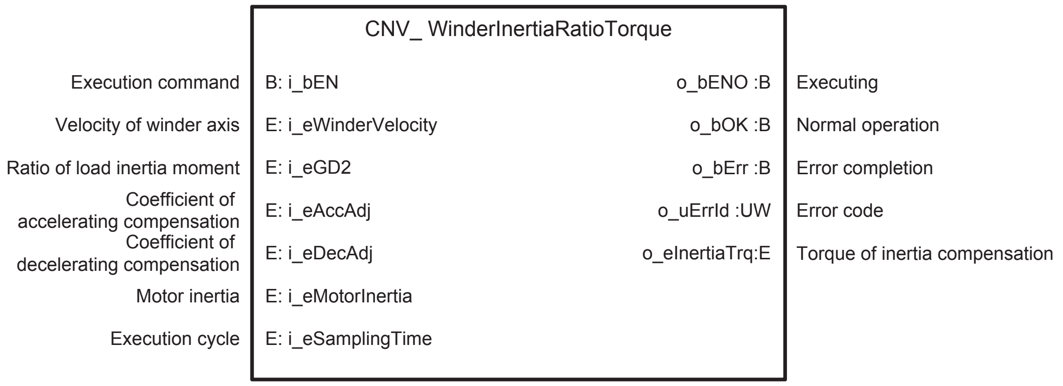
*1 ○: The value is held after the FB stops. —: The value is cleared after the FB stops.

CNV_WinderInertiaRatioTorque (Inertia compensation torque calculation (Motor inertia ratio))

Name

CNV_WinderInertiaRatioTorque

Function overview

Item	Description	
Function overview	This FB calculates the torque of inertia compensation in acceleration/deceleration with the total inertia value calculated from the velocity of the winder axis and the ratio of load inertia moment.	
Symbol		
Applicable hardware and software	Applicable module	RD77MS, RD77GF, RD78G(S)
	Applicable CPU	MELSEC iQ-R series CPU module
	Engineering software	GX Works3
Number of steps	451 steps (For the macro type)	
FB dependence	None	
Function description	The acceleration is calculated from the velocity of the winder axis, and the torque of inertia compensation in acceleration/deceleration is calculated using the following formula. Torque of inertia compensation = (1.0 + Ratio of load inertia moment) × Motor inertia × Angular acceleration of roll When the acceleration of the line is positive, the inertia compensation torque is multiplied by the coefficient of accelerating compensation. When the acceleration of the line is negative, the torque is multiplied by the coefficient of decelerating compensation. The output of the load inertia ratio calculation FB can be used for the input of the load inertia moment ratio.	
Compiling method	Macro type, subroutine type	
FB operation type	Real-time execution	
Restrictions and precautions	Execute this FB in a fixed cycle.	

Labels

■Input labels

Name	Label name	Data type	Read timing*1	Setting range	Initial value	Description
Execution command	i_bEN	Bit	⎍	—	—	On: The FB is activated. Off: The FB is stopped.
Velocity of winder axis	i_eWinderVelocity	Single precision real number	⎍	—	—	Motor velocity of the winder axis [r/min]
Ratio of load inertia moment	i_eGD2	Single precision real number	⎍	0.0 <	—	Current value of the ratio of load inertia moment [Multiplier] (Motor side/load side)
Coefficient of accelerating compensation	i_eAccAdj	Single precision real number	⎍	0.0<=	1.0	Compensation coefficient of inertia compensation torque in acceleration [1.0 = 100%]
Coefficient of decelerating compensation	i_eDecAdj	Single precision real number	⎍	0.0<=	1.0	Compensation coefficient of inertia compensation torque in deceleration [1.0 = 100%]
Motor inertia	i_eMotorInertia	Single precision real number	↑	0.0 <	—	Motor inertia [kgm^2]
Execution cycle	i_eSamplingTime	Single precision real number	↑	0.0 <	—	Execution cycle [ms] of the program for executing the FB

*1 ⎍: Always, ↑: Only when the FB is started

■Output labels

Name	Label name	Data type	Value to be held*1	Description
Executing	o_bENO	Bit	—	Turns on while Execution command is on.
Normal operation	o_bOK	Bit	—	Turns on while the FB is normally operating.
Error completion	o_bErr	Bit	—	Turns on when an error has occurred in the FB.
Error code	o_uErrId	Word [Unsigned]	—	The error code of the error that has occurred in the FB is stored. (Refer to "Page 289 List of Error Codes".)
Torque of inertia compensation	o_eInertiaTrq	Single precision real number	—	Calculation results of inertia compensation torque [N·m] are stored.

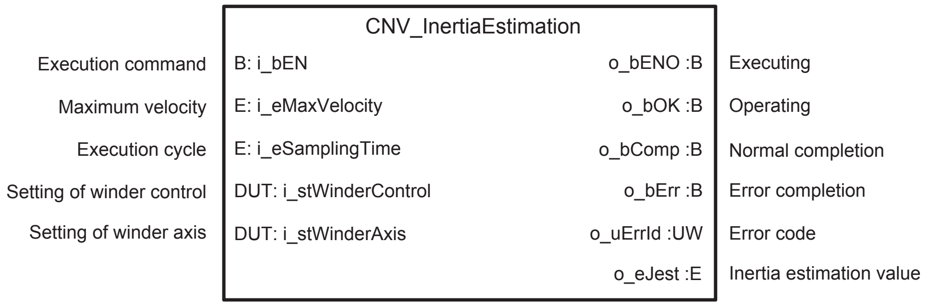
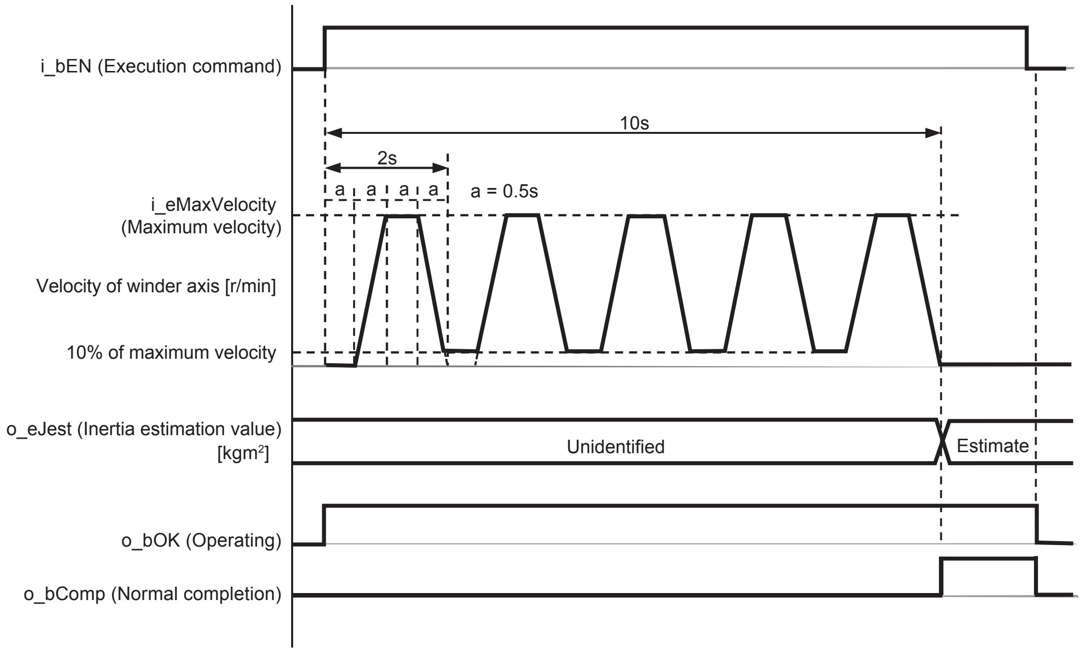
*1 ○: The value is held after the FB stops. —: The value is cleared after the FB stops.

CNV_InertiaEstimation (Inertia estimation)

Name

CNV_InertiaEstimation

Function overview

<table>
<tr><th>Item</th><th colspan="2">Description</th></tr>
<tr><td>Function overview</td><td colspan="2">This FB estimates the inertia value from acceleration of axis and motor current value by vibrating the winder axis.</td></tr>
<tr><td>Symbol</td><td colspan="2">
</td></tr>
<tr><td rowspan="3">Applicable hardware and software</td><td>Applicable module</td><td>RD77MS, RD77GF, RD78G(S)</td></tr>
<tr><td>Applicable CPU</td><td>MELSEC iQ-R series CPU module</td></tr>
<tr><td>Engineering software</td><td>GX Works3</td></tr>
<tr><td>Number of steps</td><td colspan="2">2448 steps (For the macro type)</td></tr>
<tr><td>FB dependence</td><td colspan="2">None</td></tr>
<tr><td>Function description</td><td colspan="2">The winder axis is accelerated and decelerated with maximum velocity (i_eMaxVelocity) and 10% of the maximum velocity five times to estimate the inertia value of the winder axis from the motor torque value.
The estimated inertia value can be used as the input of inertia compensation torque calculation (inertia estimation value) FB.
[Operation timing]

</td></tr>
<tr><td>Compiling method</td><td colspan="2">Macro type, subroutine type</td></tr>
<tr><td>FB operation type</td><td colspan="2">Real-time execution</td></tr>
<tr><td>Restrictions and precautions</td><td colspan="2">Execute this FB in a fixed cycle.
When the acceleration/deceleration torque is low, the accuracy of the inertia estimation value decreases. (Reference: ±5% or more)</td></tr>
</table>

4

Labels

■Input labels

Name	Label name	Data type	Read timing*1	Setting range	Initial value	Description
Execution command	i_bEN	Bit	⊓	ON, OFF	—	On: The FB is activated. Off: The FB is stopped.
Maximum velocity	i_eMaxVelocity	Single precision real number	↑	0.0 <	—	Maximum velocity [r/min] when the winder axis is vibrated
Execution cycle	i_eSamplingTime	Single precision real number	↑	0.0 <	—	Execution cycle [ms] of the program for executing the FB (Use with the value of 30.0 ms or less.)
Setting of winder control	i_stWinderControl	WINDER_REF	↑	—	—	Refer to the setting of winder control.
Setting of winder axis	i_stWinderAxis	AXIS_REF	↑	—	—	Refer to the setting of winder axis.

Setting of winder control (WINDER_REF structure)

Name	Label name	I/O	Data type	Read timing*1	Setting range	Initial value	Description
Gear ratio	eWinderGearRatio	IN	Single precision real number	↑	0.0 <	—	Gear ratio (Motor side/load side)
Rated torque	eWinderRatedTrq	IN	Single precision real number	↑	0.0 <	—	Rated torque of motor [N·m]
Rotation direction selection	uAmpPol	IN	Word [Unsigned]	↑	0, 1	0	Set the same value as the parameter PA14 (POL) of the servo amplifier. When the value other than 1 is set, the operation is performed regarding the value as 0.

Setting of winder axis (AXIS_REF structure)

Name	Label name	I/O	Data type	Read timing*1	Setting range	Initial value	Description
Axis number	AxisNo	IN	Word [Unsigned]	↑	1 to the maximum number of axes of the module used	—	Axis number
Start I/O number	StartIO	IN	Word [Unsigned]	↑	0H to FEH	—	Installation address of the Simple Motion module (Upper three digits of four digits (hexadecimal))

*1 ⊓: Always, ↑: Only when the FB is started

■Output labels

Name	Label name	Data type	Value to be held*1	Description
Executing	o_bENO	Bit	—	On: While Execution command is on Off: Execution command is off.
Operating	o_bOK	Bit	—	Turns on while the FB is normally operating.
Normal completion	o_bComp	Bit	—	This device turns on when the inertia estimation is completed. This device turns off when Execution command (i_bEN) turns off.
Error completion	o_bErr	Bit	—	Turns on when an error has occurred in the FB.
Error code	o_uErrId	Word [Unsigned]	—	The error code of the error that has occurred in the FB is stored. (Refer to "Page 289 List of Error Codes".)
Inertia estimation value	o_eJest	Single precision real number	○	Inertia value [kgm^2] of the winder axis estimated from motor acceleration at vibration and current value.

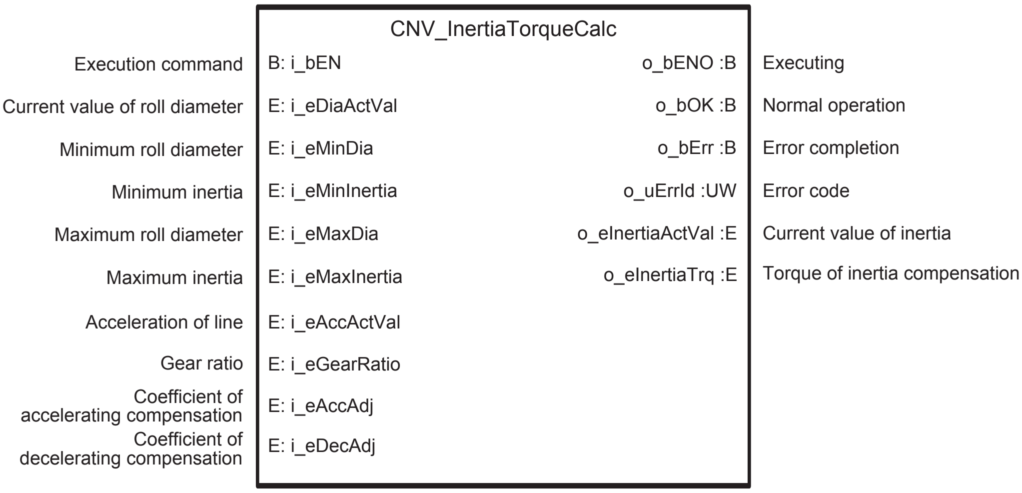
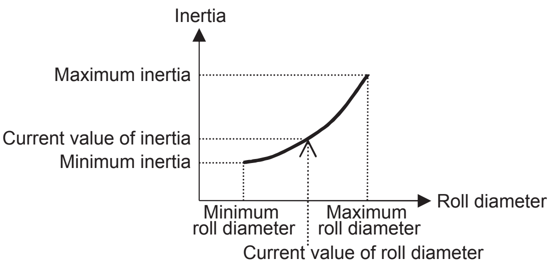
*1 ○: The value is held after the FB stops. —: The value is cleared after the FB stops.

CNV_InertiaTorqueCalc (Inertia compensation torque calculation (Inertia estimation value))

Name

CNV_InertiaTorqueCalc

Function overview

<table>
<tr><th>Item</th><th colspan="2">Description</th></tr>
<tr><td>Function overview</td><td colspan="2">This FB calculates the inertia value and inertia compensation torque for the current value of the roll diameter from the inertia value of the maximum roll diameter and minimum roll diameter.</td></tr>
<tr><td>Symbol</td><td colspan="2">
</td></tr>
<tr><td rowspan="3">Applicable hardware and software</td><td>Applicable module</td><td>RD77MS, RD77GF, RD78G(S)</td></tr>
<tr><td>Applicable CPU</td><td>MELSEC iQ-R series CPU module</td></tr>
<tr><td>Engineering software</td><td>GX Works3</td></tr>
<tr><td>Number of steps</td><td colspan="2">756 steps (For the macro type)</td></tr>
<tr><td>FB dependence</td><td colspan="2">None</td></tr>
<tr><td>Function description</td><td colspan="2">From the inertia of the minimum diameter and maximum diameter, the inertia of the current value of the roll diameter is calculated based on the following graph (Quartic function) and the inertia compensation torque is calculated for the acceleration and gear ratio.
For the input of minimum inertia and maximum inertia, the output of inertia estimation FB can be used.


$$\text{Torque of inertia compensation [N•m]} = 2 \cdot \frac{\text{Current value of inertia} \cdot \text{Acceleration of line} \cdot \text{Gear ratio}}{\text{Current value of roll diameter}}$$</td></tr>
<tr><td>Compiling method</td><td colspan="2">Macro type, subroutine type</td></tr>
<tr><td>FB operation type</td><td colspan="2">Real-time execution</td></tr>
<tr><td>Restrictions and precautions</td><td colspan="2">—</td></tr>
</table>

Labels

■Input labels

Name	Label name	Data type	Read timing*1	Setting range	Initial value	Description
Execution command	i_bEN	Bit	⊓	—	—	On: The FB is activated. Off: The FB is stopped.
Current value of roll diameter	i_eDiaActVal	Single precision real number	⊓	Refer to the right description.	—	Current value of roll-diameter [mm] (Minimum roll diameter to maximum roll diameter)
Minimum roll diameter	i_eMinDia	Single precision real number	↑	0.0 <	—	Minimum value of roll diameter (= Winder axis diameter) [mm]
Minimum inertia	i_eMinInertia	Single precision real number	↑	0.0 <	—	Inertia [kgm^2] without roll
Maximum roll diameter	i_eMaxDia	Single precision real number	↑	i_eMinDia <	—	Maximum roll diameter [mm]
Maximum inertia	i_eMaxInertia	Single precision real number	↑	i_eMinInertia <	—	Inertia [kgm^2] of maximum roll diameter
Acceleration of line	i_eAccActVal	Single precision real number	⊓	—	—	Acceleration of line [m/s^2]
Gear ratio	i_eGearRatio	Single precision real number	↑	0.0 <	—	Gear ratio (Motor side/load side)
Coefficient of accelerating compensation	i_eAccAdj	Single precision real number	⊓	0.0 <=	—	Compensation coefficient of inertia compensation torque in acceleration [1.0 = 100%]
Coefficient of decelerating compensation	i_eDecAdj	Single precision real number	⊓	0.0 <=	—	Compensation coefficient of inertia compensation torque in deceleration [1.0 = 100%]

*1 ⊓: Always, ↑: Only when the FB is started

■Output labels

Name	Label name	Data type	Value to be held*1	Description
Executing	o_bENO	Bit	—	Turns on while Execution command is on.
Normal operation	o_bOK	Bit	—	Turns on while the FB is normally operating.
Error completion	o_bErr	Bit	—	Turns on when an error has occurred in the FB.
Error code	o_uErrId	Word [Unsigned]	—	The error code of the error that has occurred in the FB is stored. (Refer to "Page 289 List of Error Codes".)
Current value of inertia	o_eInertiaActVal	Single precision real number	—	Operation results of inertia value [kgm^2] are stored.
Torque of inertia compensation	o_eInertiaTrq	Single precision real number	—	Calculation results of inertia compensation torque [N·m] are stored.

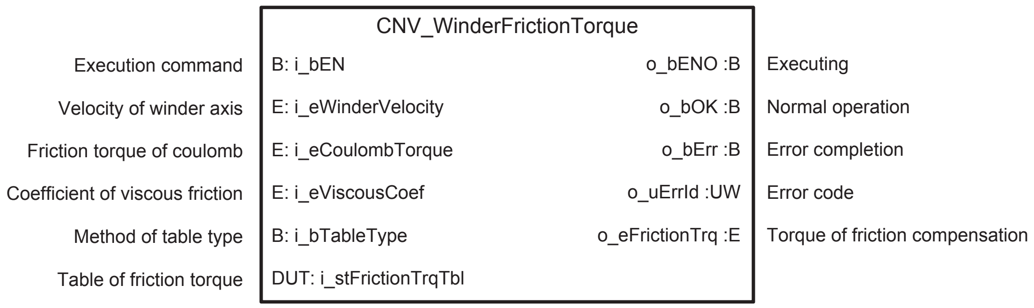
*1 ○: The value is held after the FB stops. —: The value is cleared after the FB stops.

CNV_WinderFrictionTorque (Friction compensation torque calculation)

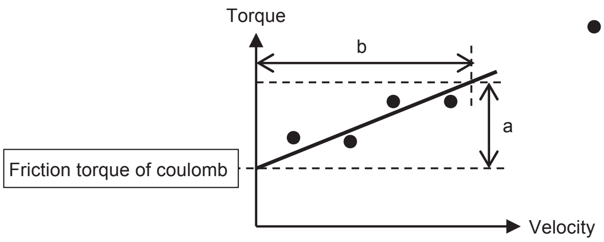
Name

CNV_WinderFrictionTorque

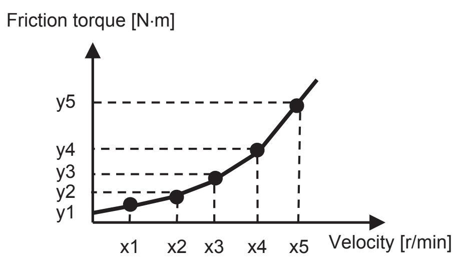
Function overview

<table>
<tr><th>Item</th><th colspan="2">Description</th></tr>
<tr><td>Function overview</td><td colspan="2">This FB calculates the torque of friction compensation.</td></tr>
<tr><td>Symbol</td><td colspan="2">
</td></tr>
<tr><td rowspan="3">Applicable hardware and software</td><td>Applicable module</td><td>RD77MS, RD77GF, RD78G(S)</td></tr>
<tr><td>Applicable CPU</td><td>MELSEC iQ-R series CPU module</td></tr>
<tr><td>Engineering software</td><td>GX Works3</td></tr>
<tr><td>Number of steps</td><td colspan="2">613 steps (For the macro type)</td></tr>
<tr><td>FB dependence</td><td colspan="2">None</td></tr>
<tr><td>Function description</td><td colspan="2">(1) Calculation method: When i_bTableType is off
The friction torque is calculated based on the set values of the coulomb friction and the coefficient of viscous friction.

Winder velocity × Friction coefficient + Friction torque of coulomb

* When either one of the values of the friction coefficient and coulomb friction torque is unclear, set with the actual measured value of the motor torque of the winder axis (without rolls).


● Actual measured value of motor torque
A coefficient is calculated from the inclination of the torque based on the actual measured value.
(If the inclination of the torque is not a straight line, calculate a coefficient using the table interpolation FB, etc.)
$\text{Friction coefficient} = \frac{a}{b}$

(2) Data table method: When i_wTableType is on
The friction torque is calculated with the setting data table.

</td></tr>
<tr><td>Compiling method</td><td colspan="2">Macro type, subroutine type</td></tr>
<tr><td>FB operation type</td><td colspan="2">Real-time execution</td></tr>
<tr><td>Restrictions and precautions</td><td colspan="2">• Since the FBs of Ver1.001B or earlier and Ver1.002C or later have different friction torque table structures, the old data table cannot be used after the version is updated from Ver1.001B or earlier to Ver1.002C or later. When updating the version, change the data type of the label used for the friction torque table (XY_TABLE_REF → FRIC_TABLE_REF) or create a new label.
• When creating a data table with the friction torque measurement FB, use the versions in the following combinations.
This FB Ver1.001B or earlier → [CNV_FrictionTorqueMeasurement] Ver1.004E or earlier
This FB Ver1.002C or later → [CNV_FrictionTorqueMeasurement] Ver1.005F or later</td></tr>
</table>

Labels

■Input labels

Name	Label name	Data type	Read timing*1	Setting range	Initial value	Description
Execution command	i_bEN	Bit	⊓	—	—	On: The FB is activated. Off: The FB is stopped.
Velocity of winder axis	i_eWinderVelocity	Single precision real number	⊓	—	—	Velocity of winder axis [r/min]
Friction torque of coulomb	i_eCoulombTorque	Single precision real number	⊓	0.0<=	—	Friction torque of coulomb [N·m]
Coefficient of viscous friction	i_eViscousCoef	Single precision real number	⊓	0.0<=	—	Coefficient of viscous friction [1.0 = 100%]
Method of table type	i_bTableType	Bit	⊓	—	—	On: Table type Off: Calculation method
Table of friction torque	i_stFrictionTrqTbl	FRIC_TABLE_REF	↑	—	—	Refer to the following.

Table of friction torque (FRIC_TABLE_REF structure)

Name	Label name	Data type	Read timing*1	Setting range	Initial value	Description
Number of points	NumPoint	Single precision real number	↑	2 to 50	—	Number of points
Winder velocity (X-coordinate)	eWinderVelocity [0]	Single precision real number	↑	—	—	First point in the X-coordinate [r/min]
	eWinderVelocity [1]	Single precision real number	↑	eWinderVelocity [0] <	—	Second point in the X-coordinate [r/min]
	⋮	Single precision real number	↑	⋮	—	⋮
	eWinderVelocity [NumPoint-1]	Single precision real number	↑	eWinderVelocity [NumPoint-2] <	—	nth point in the X-coordinate [r/min]
Friction torque (Y-coordinate)	eFrictionTrq [0]	Single precision real number	↑	—	—	First point in the Y-coordinate [N·m]
	eFrictionTrq [1]	Single precision real number	↑	—	—	Second point in the Y-coordinate [N·m]
	⋮	Single precision real number	↑	—	—	⋮
	eFrictionTrq [NumPoint-1]	Single precision real number	↑	—	—	nth point in the Y-coordinate [N·m]

*1 ⊓: Always, ↑: Only when the FB is started

■Output labels

Name	Label name	Data type	Value to be held*1	Description
Executing	o_bENO	Bit	—	Turns on while Execution command is on.
Normal operation	o_bOK	Bit	—	Turns on while the FB is normally operating.
Error completion	o_bErr	Bit	—	Turns on when an error has occurred in the FB.
Error code	o_uErrId	Word [Unsigned]	—	The error code of the error that has occurred in the FB is stored. (Refer to "Page 289 List of Error Codes".)
Torque of friction compensation	o_eFrictionTrq	Single precision real number	—	Calculation results of torque of friction compensation [N·m] are stored.

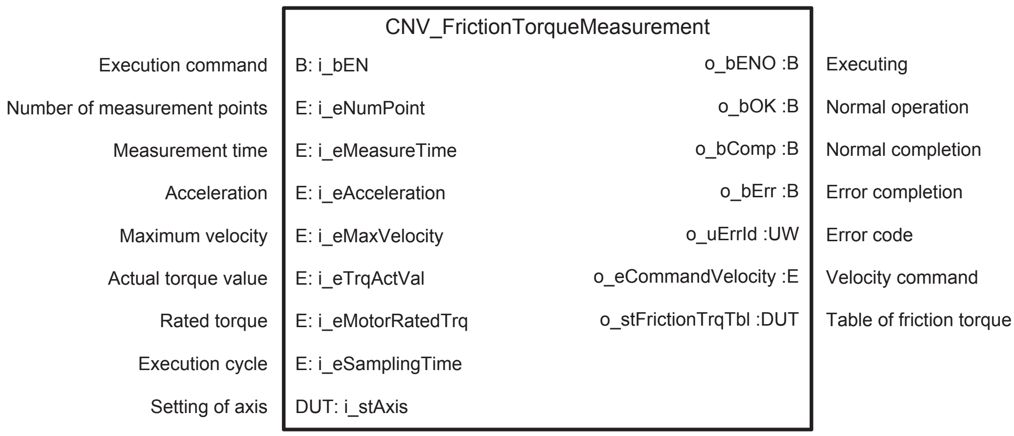
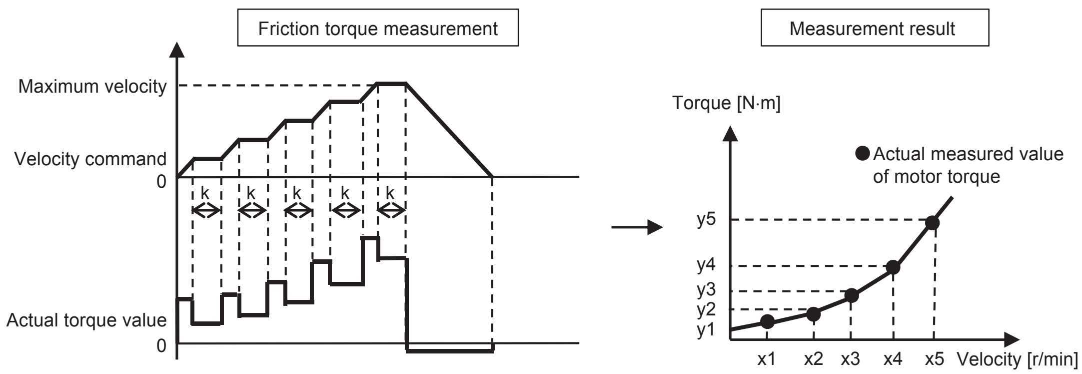
*1 ○: The value is held after the FB stops. —: The value is cleared after the FB stops.

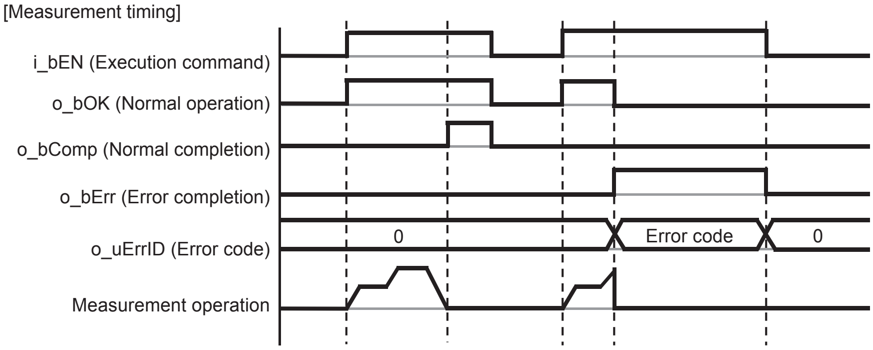
CNV_FrictionTorqueMeasurement (Friction torque measurement)

Name

CNV_FrictionTorqueMeasurement

Function overview

<table>
<tr><th>Item</th><th colspan="2">Description</th></tr>
<tr><td>Function overview</td><td colspan="2">This FB measures the friction torque.</td></tr>
<tr><td>Symbol</td><td colspan="2">
</td></tr>
<tr><td rowspan="3">Applicable hardware and software</td><td>Applicable module</td><td>RD77MS, RD77GF, RD78G(S)</td></tr>
<tr><td>Applicable CPU</td><td>MELSEC iQ-R series CPU module</td></tr>
<tr><td>Engineering software</td><td>GX Works3</td></tr>
<tr><td>Number of steps</td><td colspan="2">2138 steps (For the macro type)</td></tr>
<tr><td>FB dependence</td><td colspan="2">None</td></tr>
<tr><td>Function description</td><td colspan="2">The friction torque is measured for the number of measurement points between 0 to the maximum velocity.


The machine accelerates by (Maximum velocity/Number of measurement points).
This FB stops when the torque value is measured (average value of the measurement time (k))
and the friction torque is measured at the maximum velocity.
[Measurement timing]

</td></tr>
<tr><td>Compiling method</td><td colspan="2">Macro type, subroutine type</td></tr>
<tr><td>FB operation type</td><td colspan="2">Real-time execution</td></tr>
</table>

Item	Description
Restrictions and precautions	• Execute this FB in a fixed cycle. • Since the FBs of Ver1.004E or earlier and Ver1.005F or later have different friction torque table structures, the old data table cannot be used after the version is updated from Ver1.004E or earlier to Ver1.005F or later. When updating the version, change the data type of the label used for the friction torque table (XY_TABLE_REF → FRIC_TABLE_REF) or create a new label. • When using the friction torque table of this FB in the friction compensation torque calculation FB, use the versions in the following combinations. This FB Ver1.004E or earlier → [CNV_ WinderFrictionTorque] Ver1.001B or earlier This FB Ver1.005F or later → [CNV_ WinderFrictionTorque] Ver1.002C or later

Labels

■Input labels

Name	Label name	Data type	Read timing*1	Setting range	Initial value	Description
Execution command	i_bEN	Bit	⊓	—	—	On: The FB is activated. Off: The FB is stopped.
Number of measurement points	i_eNumPoint	Single precision real number	↑	2 to 50	—	Number of velocity measurement points
Measurement time	i_eMeasureTime	Single precision real number	↑	0.0 <	—	• Constant time at each velocity measurement point [ms] • When the time shorter than the execution cycle is set, the time is measured in the execution cycle.
Acceleration	i_eAcceleration	Single precision real number	↑	0.0 <	—	Acceleration at measurement operation [(r/min)/s]
Maximum velocity	i_eMaxVelocity	Single precision real number	↑	0.0 <	—	Maximum velocity at measurement operation [r/min]
Actual torque value	i_eTrqActVal	Single precision real number	⊓	0.0 <	—	Current value of motor torque [N·m] (Input a value only when the axis number is 0.)
Rated torque	i_eMotorRatedTrq	Single precision real number	↑	0.0 <	—	Rated torque of motor [N·m]
Execution cycle	i_eSamplingTime	Single precision real number	↑	0.0 <	—	Execution cycle [ms] of the program for executing the FB
Setting of axis	i_stAxis	AXIS_REF	—	—	—	Refer to the following.

Setting of measurement axis (AXIS_REF structure)

Name	Label name	I/O	Data type	Read timing*1	Setting range	Initial value	Description
Axis number	AxisNo	IN	Word [Unsigned]	↑	0 to the maximum number of axes of the module used	—	Axis number (0: Only the command operation. The Simple Motion module does not send output to the servo amplifier.)
Start I/O number	StartIO	IN	Word [Unsigned]	↑	0H to FEH	—	Installation address of the Simple Motion module (Upper three digits of four digits (hexadecimal))

*1 ⊓: Always, ↑: Only when the FB is started

■Output labels

Name	Label name	Data type	Value to be held*1	Description
Executing	o_bENO	Bit	—	Turns on while Execution command is on.
Normal operation	o_bOK	Bit	—	Turns on while the FB is normally operating.
Normal completion	o_bComp	Bit	—	This device turns on when the measurement is normally completed. This device turns off when Execution command (i_bEN) turns off.
Error completion	o_bErr	Bit	—	Turns on when an error has occurred in the FB.
Error code	o_uErrId	Word [Unsigned]	—	The error code of the error that has occurred in the FB is stored. (Refer to "Page 289 List of Error Codes".)
Velocity command	o_eCommandVelocity	Single precision real number	—	Velocity command [r/min] at measurement operation
Table of friction torque	o_stFrictionTrqTbl	FRIC_TABLE_REF	○	Refer to the following.

Table of friction torque (FRIC_TABLE_REF structure)

Name	Label name	Data type	Value to be held*1	Description
Number of points	NumPoint	Single precision real number	○	Number of points
Winder velocity (X-coordinate)	eWinderVelocity [0]	Single precision real number	○	First point in the X-coordinate [r/min]
	eWinderVelocity [1]	Single precision real number	○	Second point in the X-coordinate [r/min]
	⋮	⋮	⋮	⋮
	eWinderVelocity [NumPoint-1]	Single precision real number	○	nth point in the X-coordinate [r/min]
Friction torque (Y-coordinate)	eFrictionTrq [0]	Single precision real number	○	First point in the Y-coordinate [N·m]
	eFrictionTrq [1]	Single precision real number	○	Second point in the Y-coordinate [N·m]
	⋮	⋮	⋮	⋮
	eFrictionTrq [NumPoint-1]	Single precision real number	○	nth point in the Y-coordinate [N·m]

*1 ○: The value is held after the FB stops. —: The value is cleared after the FB stops.

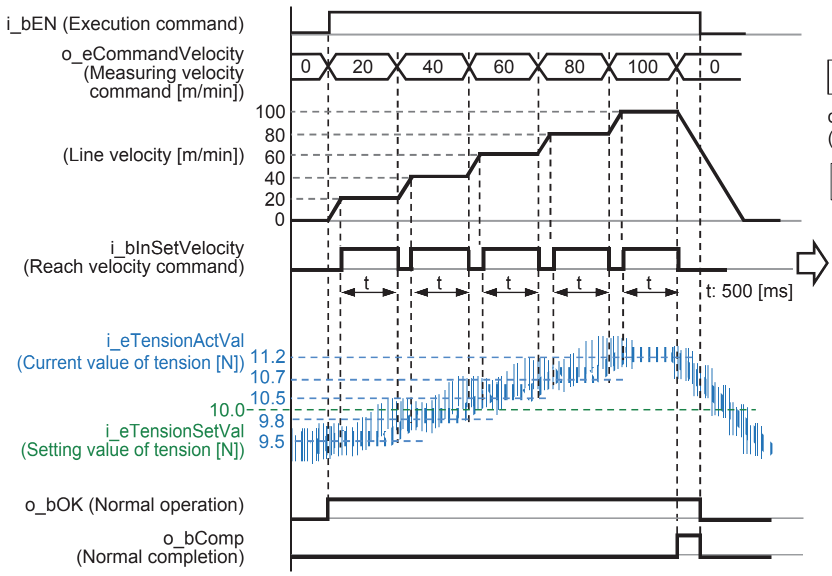
CNV_TensionDeviationMeasurement (Tension deviation measurement)

Name

CNV_TensionDeviationMeasurement

Function overview

Item	Description	
Function overview	This FB creates the tension correction data table to correct the deviations (difference of the setting value and current value) due to mechanical loss of free roll at line operation. The difference between the tension setting value and tension current value is calculated with each velocity for the set number of measuring points from 0 to maximum line velocity, and the data table of tension correction value for each speed is created.	
Symbol	CNV_TensionDeviationMeasurement Execution command — B: i_bEN — o_bENO :B — Executing Number of measuring points — E: i_eNumPoint — o_bOK :B — Normal operation Measurement time — E: i eMeasureTime — o_bComp :B — Normal completion Maximum velocity — E: i_eMaxVelocity — o_bErr :B — Error completion Setting value of tension — E: i_eTensionSetVal — o_uErrId :UW — Error code Current value of tension — E: i_eTensionActVal — o_eCommandVelocity :E — Velocity command Reach velocity command — B: i_bInSetVelocity — o_stTensionAdjTbl :DUT — Tension correction value table Execution cycle — E: i_eSamplingTime	
Applicable hardware and software	Applicable module	RD77MS, RD77GF, RD78G(S)
	Applicable CPU	MELSEC iQ-R series CPU module
	Engineering software	GX Works3
Number of steps	454 steps (For the macro type)	
FB dependence	None	

<table>
<tr><th>Item</th><th>Description</th></tr>
<tr><td>Function description</td><td>
The tension deviations (setting value and current value) due to mechanical loss of free roller at line operation can be measured.
When the execution command is turned on with each parameter set in the input labels, the command velocity, which accelerates from 0 to (maximum line velocity ÷ number of measuring points), is output, the difference of the tension setting value and tension current value is measured (calculating the average value of measurement time) with each measuring point, and is output as tension correction value table.
The output tension correction value table can be used as input of the tension correction value for tension sensorless torque control FB by combining with the table interpolation FB.
During the deviation measurement (while this FB is operating), set the input label i_eTensionAdjVal (Tension correction value) of the tension sensorless torque FB which operates the winder axis to 0.
When the execution command is turned off during the measurement, the number of points measured until the measurement is stopped and completed, and the table is output.
■Measurement operation example
When the operation is performed with the following settings:
• i_eNumPoint (Number of measuring points): 5 [points]
• i_eMaxVelocity (Maximum line velocity): 100 [m/min]
• i_eMeasureTime (Measurement time): 500 [ms]
• i_eTensionSetVal (Tension setting value): 10 [N]
[Measurement timing]


Measurement result
o_stTensionAdjTbl
(Tension correction value table)
<table>
<tr><td>NumPoint</td><td>5</td></tr>
</table>
<table>
<tr><th>eTableX (Line velocity)</th><th>eTableY (Tension correction value)</th></tr>
<tr><td>20.0</td><td>0.5</td></tr>
<tr><td>40.0</td><td>0.2</td></tr>
<tr><td>60.0</td><td>-0.5</td></tr>
<tr><td>80.0</td><td>-0.7</td></tr>
<tr><td>100.0</td><td>-1.2</td></tr>
</table>
</td></tr>
<tr><td>Compiling method</td><td>Macro type, subroutine type</td></tr>
<tr><td>FB operation type</td><td>Real-time execution</td></tr>
<tr><td>Restrictions and precautions</td><td>Execute this FB in a fixed cycle.</td></tr>
</table>

How to use

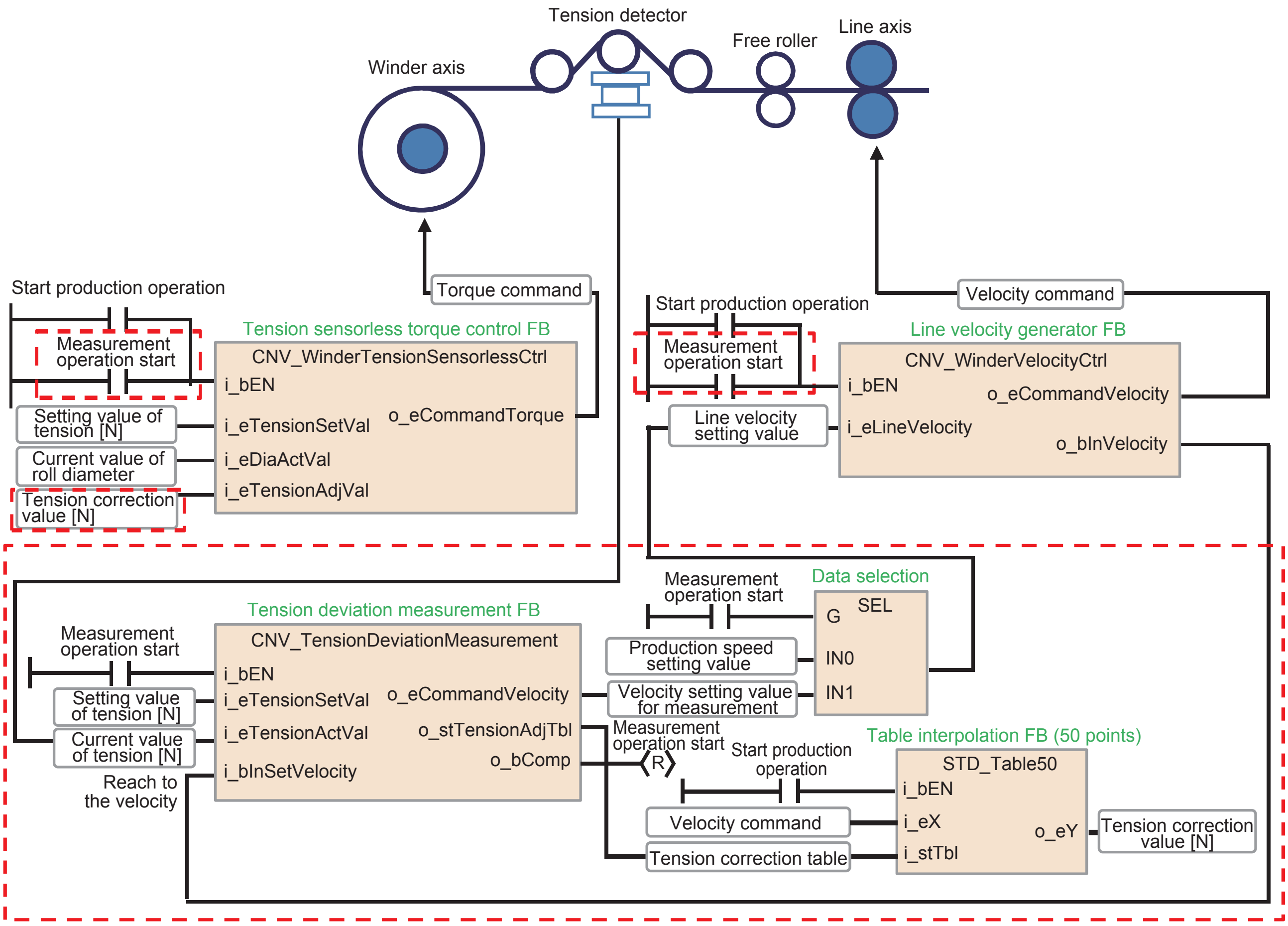
The following shows the program example to compensate the tension deviation at the operation using the tension sensorless torque control FB and tension sensor feedback torque control FB.

Add the following circuit for measurement and tension correction surrounded by dashed lines to the program which controls the normal line operation (production operation). (Arrange the FB to the program executed in a fixed cycle.)

Calculate the tension deviation (difference of setting value and current value) with "Measuring operation start", and create "Tension correction value table".

To improve the accuracy of tension, calculate the tension correction value for the line speed with table compensation (50 points) FB and use it as the tension correction value of the tension sensorless torque control FB or tension sensor feedback torque control FB.

In the following example, the output of table compensation FB (50 points) is input to the tension correction value of the tension sensorless torque control FB to set the tension correction value to 0 during measuring operation.



Labels

■Input labels

Name	Label name	Data type	Read timing*1	Setting range	Initial value	Description
Execution command	i_bEN	Bit	⊓	ON, OFF	—	On: The FB is activated. Off: The FB is stopped.
Number of measuring points	i_eNumPoint	Single precision real number	↑	2 to 50	—	0 to number of velocity measuring points at maximum line velocity
Measurement time	i_eMeasureTime	Single precision real number	↑	0.0 <	—	• Measurement time at each velocity point [ms] • When the time shorter than the execution cycle is set, the time is measured in the execution cycle.
Maximum velocity	i_eMaxVelocity	Single precision real number	↑	0.0 <	—	Measuring maximum line velocity [m/min]
Setting value of tension	i_eTensionSetVal	Single precision real number	↑	0.0 <	—	Setting value of tension [N]
Current value of tension	i_eTensionActVal	Single precision real number	⊓	—	—	Current value of tension [N]
Reach velocity command	i_bInSetVelocity	Bit	⊓	ON, OFF	—	Turn on when the actual line velocity reaches each measuring point. The measurement is started after this input is turned on. The average value of the sampled value with measurement time is stored to the data table.
Execution cycle	i_eSamplingTime	Single precision real number	↑	0.0 <	—	The execution cycle of the FB is input. Fixed cycle interval time of fixed cycle program or inter-module synchronization is specified [ms].

*1 ⊓: Always, ↑: Only when the FB is started

■Output labels

Name	Label name	Data type	Value to be held*1	Description
Executing	o_bENO	Bit	—	On: While Execution command is on Off: Execution command is off.
Normal operation	o_bOK	Bit	—	Turns on while the FB is normally operating.
Normal completion	o_bComp	Bit	—	This device turns on when the measurement is normally completed. This device turns off when Execution command (i_bEN) turns off.
Error completion	o_bErr	Bit	—	Turns on when an error has occurred in the FB.
Error code	o_uErrId	Word [Unsigned]	—	The error code of the error that has occurred in the FB is stored. (Refer to "Page 289 List of Error Codes".)
Velocity command	o_eCommandVelocity	Single precision real number	—	Measuring command velocity [m/min]
Tension correction value table	o_stTensionAdjTbl	XY_TABLE50_REF	○	Velocity [r/min] and tension correction value [N] with it (Refer to XY_TABLE50_REF.)

Tension correction value table (XY_TABLE50_REF structure)

Name	Label name	Data type	Value to be held[*1]	Description
Number of measuring points	NumPoint	Single precision real number	○	Number of measuring points
Line velocity (X-coordinate)	eTableX [0]	Single precision real number	○	First point in the X-coordinate [m/min]
	eTableX [1]	Single precision real number	○	Second point in the X-coordinate [m/min]
	⋮	⋮	⋮	⋮
	eTableX [NumPoint-1]	Single precision real number	○	nth point in the X-coordinate [m/min]
Tension correction value (Y-coordinate)	eTableY [0]	Single precision real number	○	First point in the Y-coordinate [N]
	eTableY [1]	Single precision real number	○	Second point in the Y-coordinate [N]
	⋮	⋮	⋮	⋮
	eTableY [NumPoint-1]	Single precision real number	○	nth point in the Y-coordinate [N]

*1 ○: The value is held after the FB stops. —: The value is cleared after the FB stops.

CNV_WinderGainChange (Gain change)

Name

CNV_WinderGainChange

Function overview

Item	Description	
Function overview	This FB calculates the velocity gain value in response to the ratio of load inertia moment.	
Symbol	CNV_WinderGainChange Execution command — B: i_bEN / o_bENO :B — Executing Ratio of load inertia moment (GD2) — E: i_eGD2 / o_bOK :B — Normal operation GD2 in maximum inertia — E: i_eGD2nom / o_bErr :B — Error completion VG2 in maximum inertia — E: i_eVG2nom / o_uErrId :UW — Error code Velocity gain factor (α) — E: i_eAlpha / o_eGD2out :E — Output of GD2 o_eVG2out :E — Output of VG2	
Applicable hardware and software	Applicable module	RD77MS, RD77GF, RD78G(S)
	Applicable CPU	MELSEC iQ-R series CPU module
	Engineering software	GX Works3
Number of steps	385 steps (For the macro type)	
FB dependence	None	
Function description	The velocity control gain is adjusted at the maximum inertia, and GD2nom and VG2nom at that time are used as the input values. The velocity gain factor α is set to 0 by default. When the response speed is low, gradually increase the value of α. VG2 is calculated using the load inertia moment ratio (GD2) as the input value and used as the output value. $VG2 = (1 - \alpha) \times \dfrac{1 + GD2}{1 + GD2nom} VG2nom + \alpha \times VG2nom$	
Compiling method	Macro type, subroutine type	
FB operation type	Real-time execution	
Restrictions and precautions	—	

4

Labels

■Input labels

Name	Label name	Data type	Read timing*1	Setting range	Initial value	Description
Execution command	i_bEN	Bit	⊓	—	—	On: The FB is activated. Off: The FB is stopped.
Ratio of load inertia moment	i_eGD2	Single precision real number	⊓	0.0 <	—	Current inertia ratio [Multiplier] (Motor side/ load side)
GD2 in maximum inertia	i_eGD2nom	Single precision real number	↑	0.0 <	—	Inertia ratio in maximum inertia (Maximum roll diameter) [Multiplier] (Motor side/load side)
VG2 in maximum inertia	i_eVG2nom	Single precision real number	↑	0.0 <	—	Velocity control gain in maximum inertia (Maximum roll diameter) [rad/s]
Velocity gain factor	i_eAlpha	Single precision real number	⊓	0 to 1.0	—	Response coefficient

*1 ⊓: Always, ↑: Only when the FB is started

■Output labels

Name	Label name	Data type	Value to be held*1	Description
Executing	o_bENO	Bit	—	Turns on while Execution command is on.
Normal operation	o_bOK	Bit	—	Turns on while the FB is normally operating.
Error completion	o_bErr	Bit	—	Turns on when an error has occurred in the FB.
Error code	o_uErrId	Word [Unsigned]	—	The error code of the error that has occurred in the FB is stored. (Refer to "Page 289 List of Error Codes".)
Output of GD2	o_eGD2out	Single precision real number	—	Current inertia ratio [Multiplier] (Motor side/load side)
Output of VG2	o_eVG2out	Single precision real number	—	Calculation results of proper VG2 [rad/s]

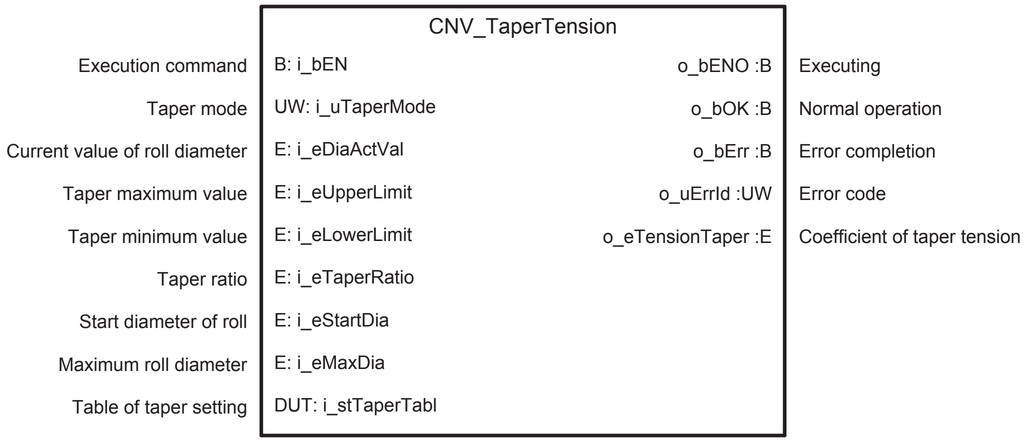
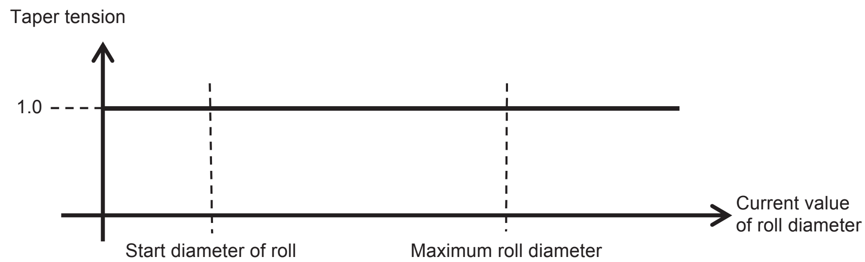
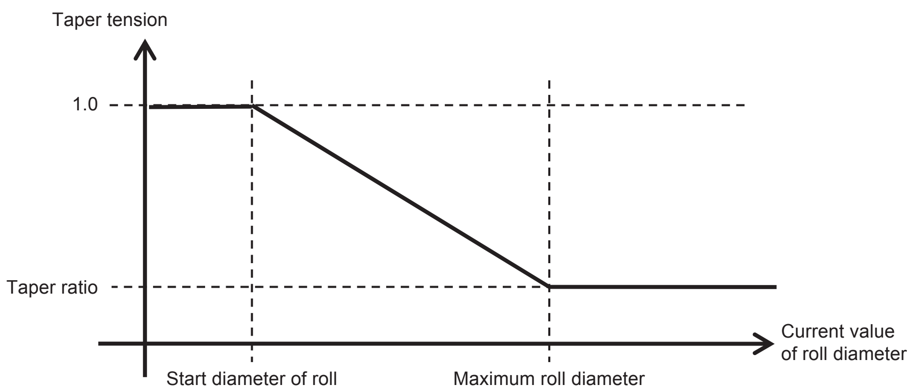
*1 ○: The value is held after the FB stops. —: The value is cleared after the FB stops.

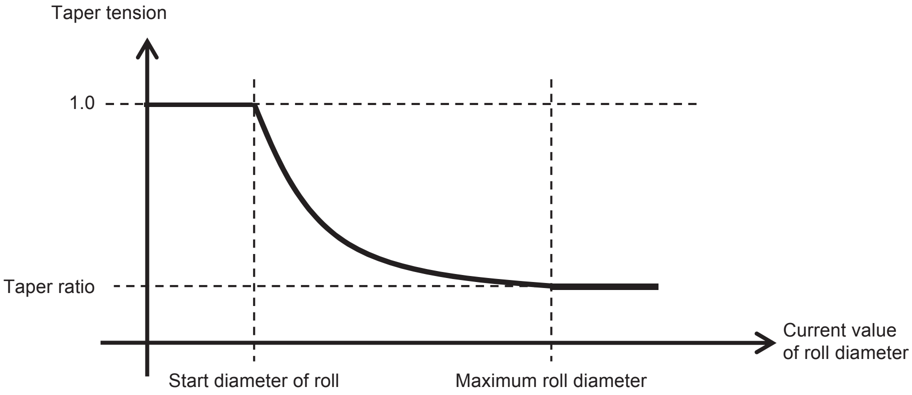
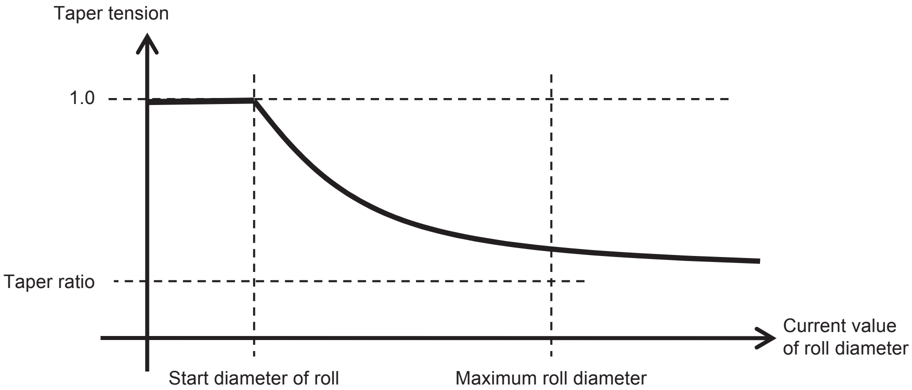
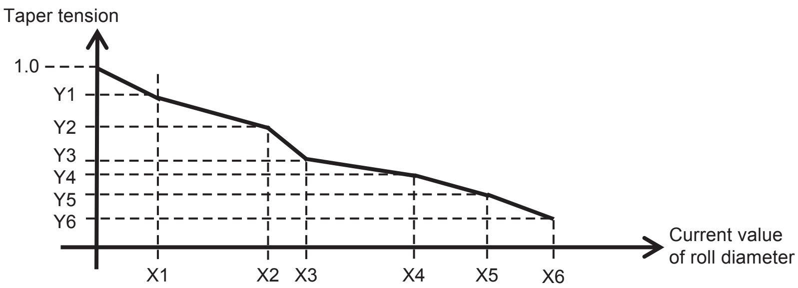
CNV_TaperTension (Taper tension calculation)

Name

CNV_TaperTension

Function overview

Item	Description	
Function overview	This FB calculates the coefficient of taper tension in response to the roll diameter.	
Symbol		
Applicable hardware and software	Applicable module	RD77MS, RD77GF, RD78G(S)
	Applicable CPU	MELSEC iQ-R series CPU module
	Engineering software	GX Works3
Number of steps	1715 steps (For the macro type)	
FB dependence	STD_TableInterpolation	
Function description	■No taper (TaperMode: 0) 	
	■Linear taper characteristic (TaperMode: 1) 	

<table>
<tr><th>Item</th><th>Description</th></tr>
<tr><td rowspan="3">Function description</td><td>■Hyperbolic taper characteristic 1 (TaperMode: 2)

</td></tr>
<tr><td>■Hyperbolic taper characteristic 2 (TaperMode: 3)

</td></tr>
<tr><td>■Data table characteristic (TaperMode: 4)

</td></tr>
<tr><td>Compiling method</td><td>Macro type, subroutine type</td></tr>
<tr><td>FB operation type</td><td>Real-time execution</td></tr>
<tr><td>Restrictions and precautions</td><td>For the data table characteristic, set the current values of the roll diameter (X-coordinate) in ascending order and 2000 or less points.</td></tr>
</table>

Labels

■Input labels

Name	Label name	Data type	Read timing*1	Setting range	Initial value	Description
Execution command	i_bEN	Bit	⊓	—	—	On: The FB is activated. Off: The FB is stopped.
Taper mode	i_uTaperMode	Word [Unsigned]	↑	0 to 4	—	0: No taper 1: Linear taper characteristic 2: Hyperbolic taper characteristic 1 3: Hyperbolic taper characteristic 2 4: Data table characteristic
Current value of roll diameter	i_eDiaActVal	Single precision real number	⊓	0.0 <	—	Current value of roll-diameter [mm]
Taper maximum value	i_eUpperLimit	Single precision real number	↑	Minimum value to 1.0	—	Taper maximum value [1.0 = 100%]
Taper minimum value	i_eLowerLimit	Single precision real number	↑	0.0 to Maximum value	—	Taper minimum value [1.0 = 100%]
Taper ratio	i_eTaperRatio	Single precision real number	↑	0.0 to 1.0	—	Taper ratio [1.0 = 100%]
Start diameter of roll	i_eStartDia	Single precision real number	↑	0.0 <	—	Start diameter of roll [mm]
Maximum roll diameter	i_eMaxDia	Single precision real number	↑	Start diameter of roll <	—	Maximum roll diameter [mm]
Table of taper setting	i_stTaperTabl	XY_TABLE_REF	↑	—	—	Refer to the following.

Table of taper setting (XY_TABLE_REF structure)

Name	Label name	Data type	Read timing*1	Setting range	Initial value	Description
Number of points	NumPoint	Single precision real number	↑	2 to 2000	—	Number of points
Roll diameter (X-coordinate)	eTableX [0]	Single precision real number	↑	—	—	First point in the X-coordinate [mm]
	eTableX [1]	Single precision real number	↑	eTableX [0] <	—	Second point in the X-coordinate [mm]
	⋮	Single precision real number	↑	⋮	—	⋮
	eTableX [NumPoint-1]	Single precision real number	↑	eTableX [NumPoint-2] <	—	nth point in the X-coordinate [mm]
Taper ratio (Y-coordinate)	eTableY [0]	Single precision real number	↑	—	—	First point in the Y-coordinate [1.0 = 100%]
	eTableY [1]	Single precision real number	↑	—	—	Second point in the Y-coordinate [1.0 = 100%]
	⋮	Single precision real number	↑	—	—	⋮
	eTableY [NumPoint-1]	Single precision real number	↑	—	—	nth point in the Y-coordinate [1.0 = 100%]

*1 ⊓: Always, ↑: Only when the FB is started

■Output labels

Name	Label name	Data type	Value to be held*1	Description
Executing	o_bENO	Bit	—	Turns on while Execution command is on.
Normal operation	o_bOK	Bit	—	Turns on while the FB is normally operating.
Error completion	o_bErr	Bit	—	Turns on when an error has occurred in the FB.
Error code	o_uErrId	Word [Unsigned]	—	The error code of the error that has occurred in the FB is stored. (Refer to "Page 289 List of Error Codes".)
Coefficient of taper tension	o_eTensionTaper	Single precision real number	—	The coefficient of taper tension is stored. [1.0 = 100%]

*1 ○: The value is held after the FB stops. —: The value is cleared after the FB stops.

CNV_PIDControl (PID control (with tension PI gain auto tuning))

Name

CNV_PIDControl

Function overview

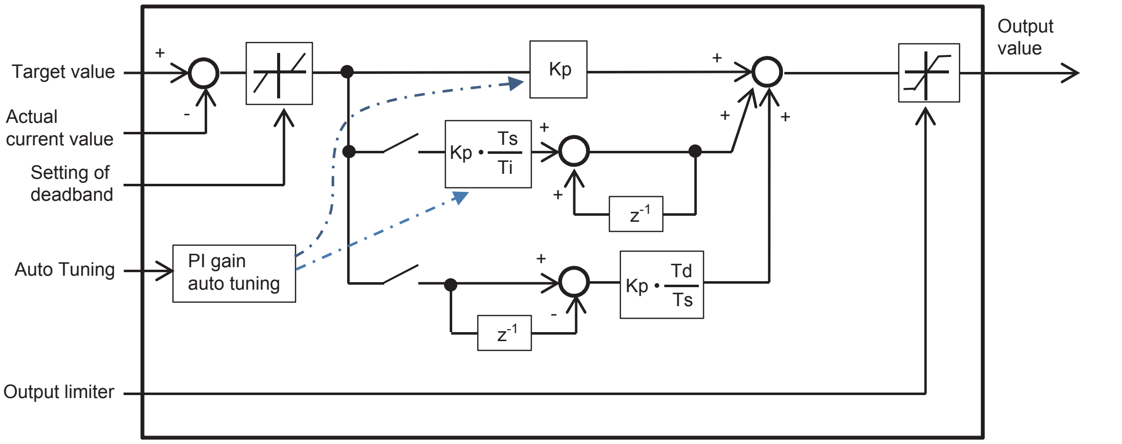
Item	Description
Function overview	This FB executes the PID control.
Symbol	

	CNV_PIDControl		
Execution command	B: i_bEN	o_bENO :B	Executing
Hold integral variable	B: i_bIntFreeze	o_bOK :B	Normal operation
Initialize integral variable	B: i_bIntInit	o_bErr :B	Error completion
Enable proportionality	B: i_bPRelease	o_uErrId :UW	Error code
Enable integration	B: i_bIRelease	o_eOutput :E	Output PID
Enable differential	B: i_bDRelease	o_bAtComp :B	Normal completion of auto tuning
proportionality gain	E: i_eKp	o_eAtKp :E	proportionality gain of auto tuning results
Integral time	E: i_eTi	o_eAtTi :E	Integral time of auto tuning results
Differential time	E: i_eTd	o_eTehys :E	Hysteresis of auto tuning results
Actual current value	E: i_eActVal		
Target value	E: i_eSetVal		
Setting of deadband	E: i_eDeadBand		
Output upper limit	E: i_eHighLimit		
Output lower limit	E: i_eLowLimit		
Amplitude of auto tuning	E: i_eMrly		
Start auto tuning	B: i_bAtStart		
Auto tuning response	W: i_wAtResponse		
Enable auto tuning	B: i_bAtValEN		
Execution cycle	E: i_eSamplingTime		

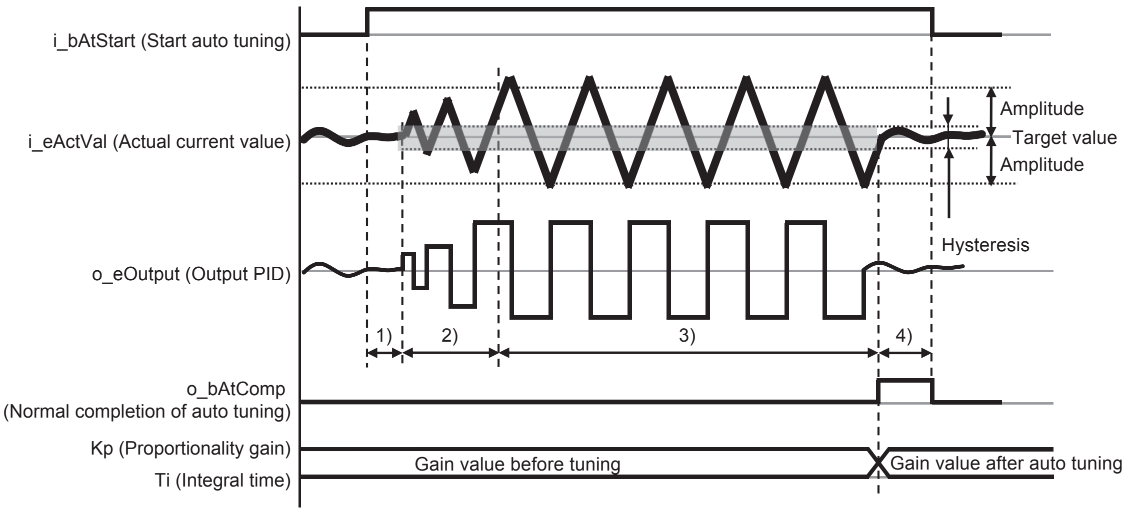
Applicable hardware and software	Applicable module	RD77MS, RD77GF, RD78G(S)
	Applicable CPU	MELSEC iQ-R series CPU module
	Engineering software	GX Works3
Number of steps	1479 steps (For the macro type)	
FB dependence	None	

4

<table>
<tr><th>Item</th><th>Description</th></tr>
<tr><td>Function description</td><td>The PID control shown in the following block diagram is executed.



[Timing to perform auto tuning on the PI control gain]



1) Turning on i_bAtStart (start auto tuning) stops the PID control and calculates the hysteresis width from the noise size of i_eActVal (actual current value).
2) e_Output (output PID) gradually increases so that the amplitude of i_eActVal (actual current value) is equal to i_eMrly (amplitude setting value).
3) Oscillation is generated with the amplitude of i_eMrly (amplitude setting value) and a proper Kp (proportionality gain) and Ti (integral time) are calculated.
4) o_bAtComp (normal completion of auto tuning) turns on and the PID control is restarted with the gain value of auto tuning results. Turning off i_bAtStart (start auto tuning) turns off o_bAtComp (normal completion of auto tuning).</td></tr>
<tr><td>Compiling method</td><td>Macro type, subroutine type</td></tr>
<tr><td>FB operation type</td><td>Real-time execution</td></tr>
<tr><td>Restrictions and precautions</td><td>Execute this FB in a fixed cycle.</td></tr>
</table>

Labels

■Input labels

Name	Label name	Data type	Read timing*1	Setting range	Initial value	Description
Execution command	i_bEN	Bit		—	—	On: The FB is activated. Off: The FB is stopped.
Hold integral variable	i_bIntFreeze	Bit		—	—	On: The manipulated amount in the integral control is held.
Initialize integral variable	i_bIntInit	Bit		—	—	Off: The manipulated amount in the integral control is reset.
Enable proportionality	i_bPRelease	Bit		—	—	On: The proportional control is enabled.
Enable integration	i_bIRelease	Bit		—	—	On: The integral control is enabled.
Enable differential	i_bDRelease	Bit		—	—	On: The differential control is enabled.

Name	Label name	Data type	Read timing*1	Setting range	Initial value	Description
Proportionality gain	i_eKp	Single precision real number	⊓	0.0<=	—	Proportionality gain
Integral time	i_eTi	Single precision real number	⊓	0.0<=	—	Integral time [ms]
Differential time	i_eTd	Single precision real number	⊓	0.0<=	—	Differential time [ms]
Actual current value	i_eActVal	Single precision real number	⊓	—	—	Actual current value
Target value	i_eSetVal	Single precision real number	⊓	—	—	Target value
Setting of deadband	i_eDeadBand	Single precision real number	⊓	0.0<=	—	Setting of deadband
Output upper limit	i_eHighLimit	Single precision real number	⊓	Output lower limit <	—	Output upper limit
Output lower limit	i_eLowLimit	Single precision real number	⊓	Output upper limit >	—	Output lower limit
Amplitude of auto tuning	i_eMrly	Single precision real number	⊓	0.0 <	1.0	Amplitude at auto turning
Start auto tuning	i_bAtStart	Bit	⊓	—	—	On: The auto turning is started.
Auto tuning response	i_wAtResponse	Word [Signed]	⊓	1 to 7	3	1 (Weak) ⇔ 7(Strong)
Enable auto tuning	i_bAtValEN	Bit	⊓	—	—	On: The PID control is performed with auto tuning results. Off: The PID control is performed with setting values.
Execution cycle	i_eSamplingTime	Single precision real number	↑	0.0 <	—	Execution cycle [ms] of the program for executing the FB

*1 ⊓: Always, ↑: Only when the FB is started

■Output labels

Name	Label name	Data type	Value to be held*1	Description
Executing	o_bENO	Bit	—	Turns on while Execution command is on.
Normal operation	o_bOK	Bit	—	Turns on while the FB is normally operating.
Error completion	o_bErr	Bit	—	Turns on when an error has occurred in the FB.
Error code	o_uErrId	Word [Unsigned]	—	The error code of the error that has occurred in the FB is stored. (Refer to "Page 289 List of Error Codes".)
Output PID	o_eOutput	Single precision real number	—	The output value of PID control is stored.
Normal completion of auto tuning	o_bAtComp	Bit	—	On: Turns on when the auto tuning is normally completed. Off: Turn off when Start auto tuning turns off.
Proportionality gain of auto tuning results	o_eAtKp	Single precision real number	○	Proportionality gain of auto tuning results
Integral time Auto tuning results	o_eAtTi	Single precision real number	○	Integral time of auto tuning results [ms]
Hysteresis of auto tuning results	o_eTehys	Single precision real number	○	Hysteresis of auto tuning results

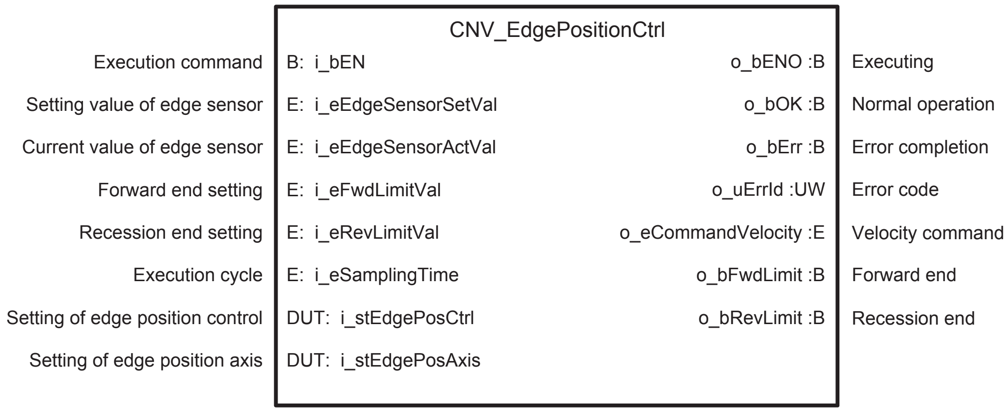
*1 ○: The value is held after the FB stops. —: The value is cleared after the FB stops.

CNV_EdgePositionCtrl (Edge position control)

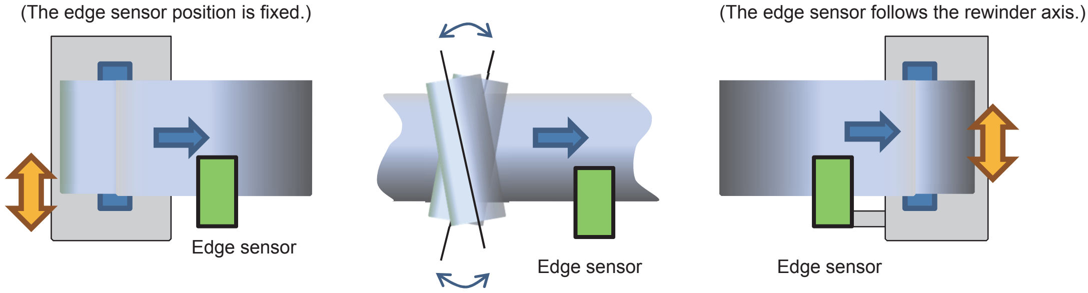
Name

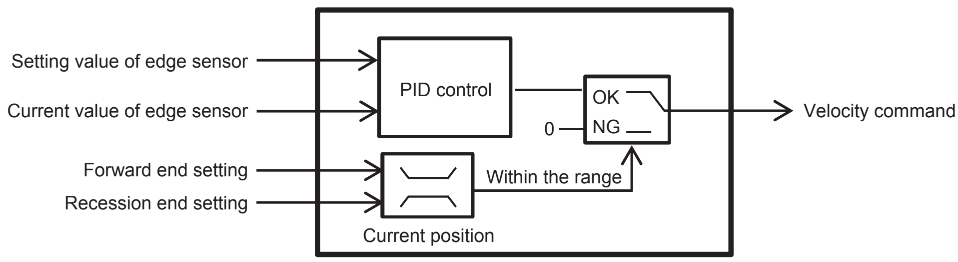
CNV_EdgePositionCtrl

Function overview

<table>
<tr><th>Item</th><th colspan="2">Description</th></tr>
<tr><td>Function overview</td><td colspan="2">This FB detects the position of the edge sensor and controls the velocity to reach the target position.</td></tr>
<tr><td>Symbol</td><td colspan="2">
</td></tr>
<tr><td rowspan="3">Applicable hardware and software</td><td>Applicable module</td><td>RD77MS, RD77GF, RD78G(S)</td></tr>
<tr><td>Applicable CPU</td><td>MELSEC iQ-R series CPU module</td></tr>
<tr><td>Engineering software</td><td>GX Works3</td></tr>
<tr><td>Number of steps</td><td colspan="2">4643 steps (For the macro type)</td></tr>
<tr><td>FB dependence</td><td colspan="2">CNV_PIDControl</td></tr>
<tr><td>Function description</td><td colspan="2">This FB calculates the velocity for the position correction with the PID control so that an edge position of a web material will be the intermediate value (target value) of the edge sensor, and outputs the velocity as a velocity command in the speed mode to the servo amplifier.

● When the unwinder axis moves (The edge sensor position is fixed.)
● When the intermediate axis moves*1
● When the rewinder axis moves (The edge sensor follows the rewinder axis.)





*1 To correct the position according to a roller angle of the intermediate axis, set the electric gear unit setting to "0:mm".
(Example) Rotating 45 degree per rotation of the motor (4194304 pulse)
→ Pr.2:No. of pulse per rotation: 4194304 pulse, Pr.3:Movement amount per rotation: 45000.0 μm</td></tr>
<tr><td>Compiling method</td><td colspan="2">Macro type, subroutine type</td></tr>
<tr><td>FB operation type</td><td colspan="2">Real-time execution</td></tr>
<tr><td>Restrictions and precautions</td><td colspan="2">Execute this FB in a fixed cycle.</td></tr>
</table>

Labels

■Input labels

Name	Label name	Data type	Read timing*1	Setting range	Initial value	Description
Execution command	i_bEN	Bit	⊓	—	—	On: The FB is activated. Off: The FB is stopped.
Setting value of edge sensor	i_eEdgeSensorSetVal	Single precision real number	⊓	—	—	Input the target position of the edge sensor [mm].
Current value of edge sensor	i_eEdgeSensorActVal	Single precision real number	⊓	—	—	Input the current value of the edge sensor [mm].
Forward end setting	i_eFwdLimitVal	Single precision real number	⊓	Recession end <	—	Edge position Forward end position [mm] The velocity control in the + direction stops.
Recession end setting	i_eRevLimitVal	Single precision real number	⊓	Forward end >	—	Edge position Recession end position [mm] The velocity control in the - direction stops.
Execution cycle	i_eSamplingTime	Single precision real number	↑	0.0 <	—	Execution cycle [ms] of the program for executing the FB
Setting of edge position control	i_stEdgePosCtrl	EdgePos_REF	—	—	—	Refer to Setting of edge position control.
Setting of edge position axis	i_stEdgePosAxis	AXIS_REF	—	—	—	Refer to Setting of edge position axis.

Setting of edge position control (EdgePos_REF structure)

Name	Label name	I/O	Data type	Read timing*1	Setting range	Initial value	Description
Direction of operation	bDirection	IN	Bit	↑	—	—	Off: Sensor value+ → Command velocity- On: Sensor value+ → Command velocity+
Proportionality gain	eKp	IN	Single precision real number	⊓	0.0<=	—	PID control Proportionality gain [(mm/s)/mm]
Integral time	eTi	IN	Single precision real number	⊓	0.0<=	—	PID control Integral time [ms]
Differential time	eTd	IN	Single precision real number	⊓	0.0<=	—	PID control Differential time [ms]
Upper limit	ePidUpperLimit	IN	Single precision real number	⊓	Lower limit value <	—	PID output Upper limit value [mm/s]
Lower limit	ePidLowerLimit	IN	Single precision real number	⊓	Upper limit value >	—	PID output Lower limit value [mm/s]
Setting of deadband	ePidDeadBand	IN	Single precision real number	⊓	0.0<=	—	PID control Setting of deadband [mm]

Setting of edge position axis (AXIS_REF structure)

Name	Label name	I/O	Data type	Read timing*1	Setting range	Initial value	Description
Axis number	AxisNo	IN	Word [Unsigned]	↑	0 to the maximum number of axes of the module used	—	Axis number (0: Only the command operation. The Simple Motion module does not send output to the servo amplifier.)
Start I/O number	StartIO	IN	Word [Unsigned]	↑	0H to FEH	—	Installation address of the Simple Motion module (Upper three digits of four digits (hexadecimal))

*1 ⊓: Always, ↑: Only when the FB is started

■Output labels

Name	Label name	Data type	Value to be held*1	Description
Executing	o_bENO	Bit	—	Turns on while Execution command is on.
Normal operation	o_bOK	Bit	—	Turns on while the FB is normally operating.
Error completion	o_bErr	Bit	—	Turns on when an error has occurred in the FB.
Error code	o_uErrId	Word [Unsigned]	—	The error code of the error that has occurred in the FB is stored. (Refer to "Page 289 List of Error Codes".)
Velocity command	o_eCommandVelocity	Single precision real number	—	Velocity command value of FB calculation results [mm/s]
Forward end	o_bFwdLimit	Bit	—	The edge position axis is at the forward end.
Recession end	o_bRevLimit	Bit	—	The edge position axis is at the recession end.

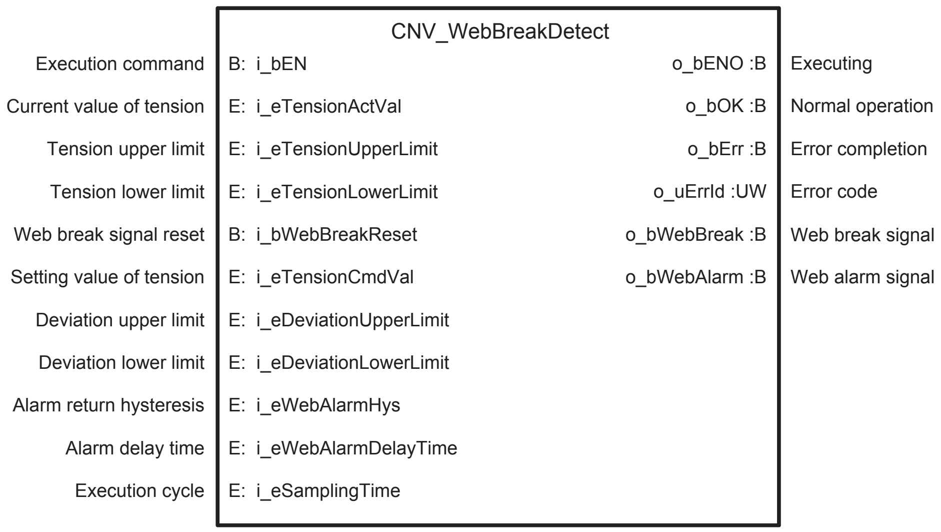
*1 ○: The value is held after the FB stops. —: The value is cleared after the FB stops.

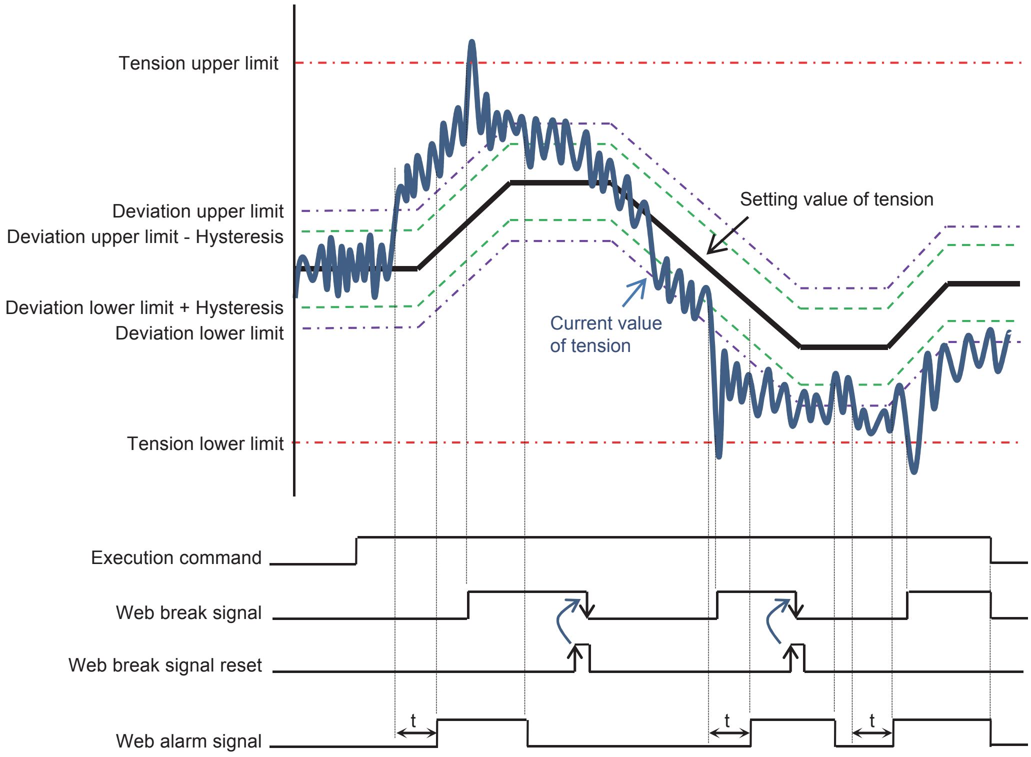
CNV_WebBreakDetect (Web break detection)

Name

CNV_WebBreakDetect

Function overview

Item	Description	
Function overview	This FB detects a web break.	
Symbol		
Applicable hardware and software	Applicable module	RD77MS, RD77GF, RD78G(S)
	Applicable CPU	MELSEC iQ-R series CPU module
	Engineering software	GX Works3
Number of steps	590 steps (For the macro type)	
FB dependence	None	

Item	Description
Function description	This FB detects a web break using the upper/lower limit values provided for the tension detection value*1. • Web break detection: Turns on when the tension detection value is equal to or larger than the upper limit value or equal to or smaller than the lower limit value, and turns off when Web break reset signal is input after the tension detection value becomes normal. • Web alarm signal: Turns on when the tension deviation is equal to or larger than the upper limit value or equal to or smaller than the lower limit value after the alarm delay time has elapsed, and turns off when the tension deviation is equal to or smaller than "Upper limit value - Hysteresis value" or equal to or larger than "Lower limit value + Hysteresis value". [Detection timing]  t: Alarm delay time
Compiling method	Macro type, subroutine type
FB operation type	Real-time execution
Restrictions and precautions	Execute this FB in a fixed cycle.

*1 For the dancer control or tension sensorless torque control, the current value of dancer or motor torque value can be used as a tension detection value.

Control type	Tension detection value	Tension command value
Tension sensor feedback velocity control	Current value of tension	Setting value of tension × Coefficient of tension
Dancer feedback velocity control	Current value of dancer	Setting value of dancer
Tension sensor feedback torque control	Current value of tension	Setting value of tension × Coefficient of tension
Tension sensorless torque control	Motor torque value	Torque command value

Labels

■Input labels

Name	Label name	Data type	Read timing*1	Setting range	Initial value	Description
Execution command	i_bEN	Bit	⊓	—	—	On: The FB is activated. Off: The FB is stopped.
Current value of tension	i_eTensionActVal	Single precision real number	⊓	—	—	Input the value of the tension detector [N].
Tension upper limit	i_eTensionUpperLimit	Single precision real number	⊓	Tension lower limit <	—	Tension upper limit value for web break detection [N]
Tension lower limit	i_eTensionLowerLimit	Single precision real number	⊓	Tension upper limit >	—	Tension lower limit value for web break detection [N]
Web break signal reset	i_bWebBreakReset	Bit	⊓	—	—	Resets a web break output.
Setting value of tension	i_eTensionCmdVal	Single precision real number	⊓	—	—	Input the tension (detection target) command value [N].
Deviation upper limit	i_eDeviationUpperLimit	Single precision real number	⊓	Deviation lower limit <	—	Upper limit value of deviation (Current value - Command value) for web alarm [N]
Deviation lower limit	i_eDeviationLowerLimit	Single precision real number	⊓	Deviation upper limit >	—	Lower limit value of deviation (Current value - Command value) for web alarm [N]
Alarm return hysteresis	i_eWebAlarmHys	Single precision real number	⊓	0.0 ≤	—	Hysteresis width at detection of a web alarm signal [N]
Alarm delay time	i_eWebAlarmDelayTime	Single precision real number	⊓	0.0 ≤	—	Delay time at detection of a web alarm signal [ms]
Execution cycle	i_eSamplingTime	Single precision real number	↑	0.0 <	—	Execution cycle [ms]

*1 ⊓: Always, ↑: Only when the FB is started

■Output labels

Name	Label name	Data type	Value to be held*1	Description
Executing	o_bENO	Bit	—	Turns on while Execution command is on.
Normal operation	o_bOK	Bit	—	Turns on while the FB is normally operating.
Error completion	o_bErr	Bit	—	Turns on when an error has occurred in the FB.
Error code	o_uErrId	Word [Unsigned]	—	The error code of the error that has occurred in the FB is stored. (Refer to "Page 289 List of Error Codes".)
Web break signal	o_bWebBreak	Bit	—	Turns on when the current value of tension is equal to or larger than the upper limit value or equal to or smaller than lower limit value. The status of this label is held until a web break reset signal turns on.
Web alarm signal	o_bWebAlarm	Bit	—	Turns on when the current value of tension is equal to or larger than the upper limit value or equal to or smaller than the lower limit value for the delay time, and turns off when the current value of tension returns to a value specified with the hysteresis width.

*1 ○: The value is held after the FB stops. —: The value is cleared after the FB stops.

CNV_FlatWindingCamMeasurement (Cam generation for flat roll (Measurement method))

Name

CNV_FlatWindingCamMeasurement

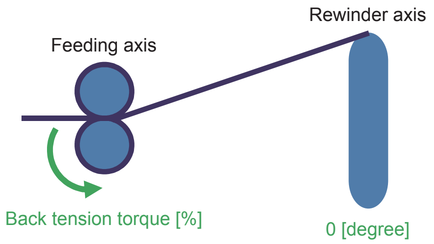
Function overview

Item	Description	
Function overview	This FB generates a cam pattern using travel distances of the winder axis and feed axis for one rotation of the winder axis.	
Symbol	(see symbol below)	
Applicable hardware and software	Applicable module	RD77MS, RD77GF, RD78G(S)
	Applicable CPU	MELSEC iQ-R series CPU module
	Engineering software	GX Works3
Number of steps	2305 steps (For the macro type)	
FB dependence	None	

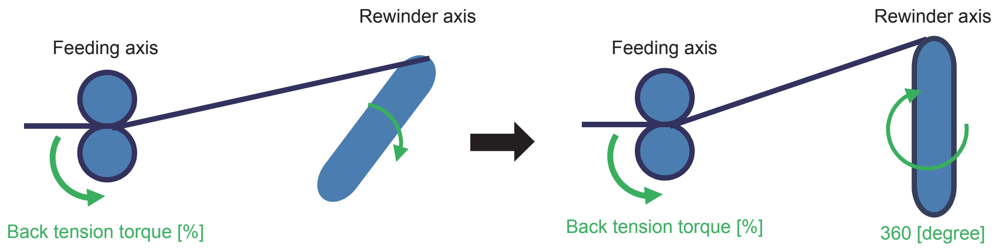
Symbol:

	CNV_FlatWindingCamMeasurement		
Execution command	B: i_bEN	o_bENO :B	Executing
Start measurement	B: i_bStart	o_bOK :B	Normal operation
Winder velocity	E: i_eWinderVelocity	o_bErr :B	Error completion
Back tension torque	E: i_eBackTensionTrq	o_uErrId :UW	Error code
Cam No.	UW: i_uCamNo	o_bComp :B	Measurement completed normally
Cam resolution	UW: i_uCamResolution	o_dCamCyclLength :D	Cam axis length per cycle
Setting of winder axis	DUT: i_stWinderAxis		
Setting of feed axis	DUT: i_stFeedAxis		

<table>
<tr><th>Item</th><th>Description</th></tr>
<tr><td>Function description</td><td>This function collects position data with the following operation and generates a cam pattern for the flat roll to the setting cam No.
■ Execution command is on.
After a rewinder axis has been positioned in 0 [degree], this function gives a tension using the feeding axis to a material with the tension (back tension torque [%]) that does not loosen the material.



■ Start measurement is on.
This function rotates the rewinder axis once at the winder velocity [r/min], collects the current values of feeding axis and rewinder axis that are rotating every 360 [degree] ÷ Cam resolution pitch, and stores the collected values in the input X and output Y of the coordinate cam table.



Coordinate cam table
<table>
<tr><th>No.</th><th>Feeding axis current value (input value X) [mm]</th><th>Rewinder axis current value (output value Y) [degree]</th></tr>
<tr><td>0th point</td><td>0.0</td><td>0.0</td></tr>
<tr><td>1st point</td><td>0.3</td><td>0.5</td></tr>
<tr><td>2nd point</td><td>0.7</td><td>1.0</td></tr>
<tr><td>⋮</td><td>⋮</td><td>⋮</td></tr>
<tr><td>nth point coordinate number</td><td>256.8
(Cam length per cycle)</td><td>360.0</td></tr>
</table>
</td></tr>
<tr><td>Compiling method</td><td>Macro type, subroutine type</td></tr>
<tr><td>FB operation type</td><td>Real-time execution</td></tr>
<tr><td>Restrictions and precautions</td><td>• Set the winder velocity so that the time taken for one rotation is longer than the product of the scan time for FB execution and the cam resolution.
<Setting example>
When the scan time is 10 [ms] and the cam resolution is 5000
10[ms] × 5000 = 50000[ms] = 50[s] = 0.833[min]
→ Set the velocity to equal to or less than 1/0.833 = 1.2 [r/min].
*When the velocity equal to or more than 1.2 [r/min] is set, a cam pattern is not generated normally.
• This FB uses the positioning data No. 100 for the positioning control of the rewinder axis. Do not use the positioning data No. 100 of the axis number set to the rewinder axis in user programs. For the acceleration/deceleration time, this FB uses "[Pr.27] Acceleration 3" and "[Pr.30] Deceleration 3". (Initial value: 1000 ms) When setting the acceleration/deceleration time, change these parameters.
• When positioning the rewinder axis in user programs, use the SET/RST instruction instead of the OUT instruction so that the Y output for the positioning start can be turned on or off in both of user programs and this FB.
• This FB uses index register Z18 and Z19. Do not use them in an interrupt program.</td></tr>
</table>

Labels

■Input labels

Name	Label name	Data type	Read timing*1	Setting range	Initial value	Description
Execution command	i_bEN	Bit	⊓	—	—	On: The FB is activated. Off: The FB is stopped.
Start measurement	i_bStart	Bit	⊓	—	—	Start measurement is started.
Winder velocity	i_eWinderVelocity	Single precision real number	↑	0.0 <	1.0	Winder velocity [r/min] at the measurement
Back tension torque	i_eBackTensionTrq	Single precision real number	↑	0.0 <=	10.0	Back tension torque [%] of the feeding axis at the measurement
Cam No.	i_uCamNo	Word [Unsigned]	↑	Refer to the description.	1	Cam No. to be generated 1 to 256 (RD77MS) 1 to 1024 (RD77GF) 1 to 256 (RD78G(S))
Cam resolution	i_uCamResolution	Word [Unsigned]	↑	Refer to the description.	256	Resolution per cam rotation (coordinate number) 2 to 2048 (RD77MS) 2 to 65535 (RD77GF) 2 to 2048 (RD78G(S))
Setting of winder axis	i_stWinderAxis	AXIS_REF	↑	—	—	Refer to the setting of winder axis/feed axis.
Setting of feed axis	i_stFeedAxis	AXIS_REF	↑	—	—	Refer to the setting of winder axis/feed axis.

Setting of winder axis/feed axis (AXIS_REF structure)

Name	Label name	I/O	Data type	Read timing*1	Setting range	Initial value	Description
Axis number	AxisNo	IN	Word [Unsigned]	↑	1 to the maximum number of axes of the module used	—	Axis number
Start I/O number	StartIO	IN	Word [Unsigned]	↑	0H to FEH	—	Installation address of the Simple Motion module (Upper three digits of four digits (hexadecimal))

*1 ⊓: Always, ↑: Only when the FB is started

■Output labels

Name	Label name	Data type	Value to be held*1	Description
Executing	o_bENO	Bit	—	Turns on while Execution command is on.
Normal operation	o_bOK	Bit	—	Turns on while the FB is normally operating.
Error completion	o_bErr	Bit	—	Turns on when an error has occurred in the FB.
Error code	o_uErrId	Word [Unsigned]	—	The error code of the error that has occurred in the FB is stored. (Refer to "Page 289 List of Error Codes".)
Measurement completed normally	o_bComp	Bit	—	Turns on when measurement or cam generation is normally completed.
Cam axis length per cycle	o_dCamCyclLength	Double word [Signed]	○	A rewinder axis circumference at the measurement (total travel distance of the feeding axis) is stored [× 0.1 μm]. Use this value for the cam control length per cycle.

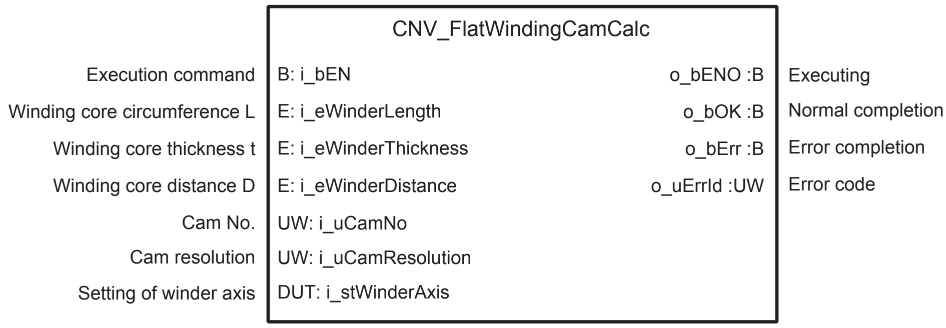
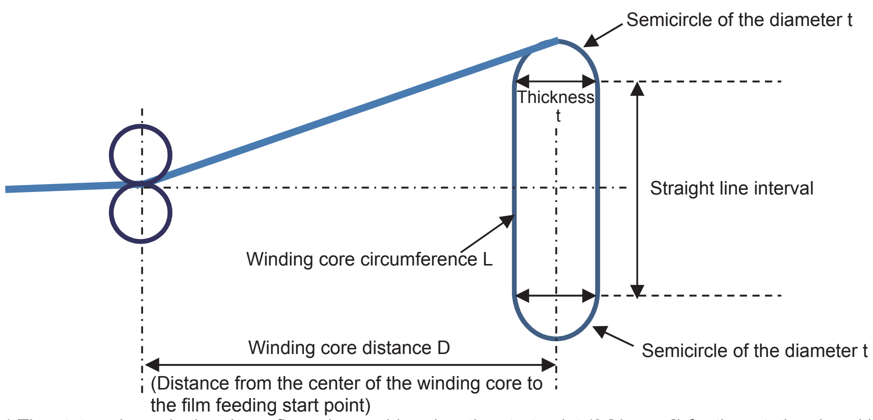
*1 ○: The value is held after the FB stops. —: The value is cleared after the FB stops.

CNV_FlatWindingCamCalc (Cam generation for flat roll (Calculation method))

Name

CNV_FlatWindingCamCalc

Function overview

<table>
<tr><th>Item</th><th colspan="2">Description</th></tr>
<tr><td>Function overview</td><td colspan="2">This FB calculates the film feed amount for each angle (each coordinate) from the winding core dimensions and position of the winder axis to generate a cam pattern.</td></tr>
<tr><td>Symbol</td><td colspan="2">
</td></tr>
<tr><td rowspan="3">Applicable hardware and software</td><td>Applicable module</td><td>RD77MS, RD77GF, RD78G(S)</td></tr>
<tr><td>Applicable CPU</td><td>MELSEC iQ-R series CPU module</td></tr>
<tr><td>Engineering software</td><td>GX Works3</td></tr>
<tr><td>Number of steps</td><td colspan="2">2026 steps (For the macro type)</td></tr>
<tr><td>FB dependence</td><td colspan="2">None</td></tr>
<tr><td>Function description</td><td colspan="2">A cam pattern for flat roll with a constant feed speed is generated by setting the following parameters.


* The status shown in the above figure is considered as the start point (0 [degree]) for the rotational position of the winding core to create the cam table.</td></tr>
<tr><td>Compiling method</td><td colspan="2">Macro type, subroutine type</td></tr>
<tr><td>FB operation type</td><td colspan="2">Pulsed execution (multiple scan execution type)</td></tr>
<tr><td>Restrictions and precautions</td><td colspan="2">—</td></tr>
</table>

Labels

■Input labels

Name	Label name	Data type	Read timing*1	Setting range	Initial value	Description
Execution command	i_bEN	Bit	⊓	—	—	On: The FB is activated. Off: The FB is stopped.
Winding core circumference L	i_eWinderLength	Single precision real number	↑	0.0 <	—	Circumference of a winding core [mm]
Winding core thickness t	i_eWinderThickness	Single precision real number	↑	0.0 <	—	Thickness of a winding core (width) [mm]
Winding core distance D	i_eWinderDistance	Single precision real number	↑	0.0 <	—	Distance between the center of the winding core and the film feeding start point [mm]
Cam No.	i_uCamNo	Word [Unsigned]	↑	Refer to the description.	1	Cam No. to be generated 1 to 256 (RD77MS) 1 to 1024 (RD77GF) 1 to 256 (RD78G(S))
Cam resolution	i_uCamResolution	Word [Unsigned]	↑	Refer to the description.	256	Resolution per cam rotation (coordinate number) 2 to 2048 (RD77MS) 2 to 65535 (RD77GF) 1 to 256 (RD78G(S))
Setting of winder axis	i_stWinderAxis	AXIS_REF	↑	—	—	Refer to the rewinder axis.

Rewinder axis (AXIS_REF structure)

Name	Label name	I/O	Data type	Read timing*1	Setting range	Initial value	Description
Axis number	AxisNo	IN	Word [Unsigned]	↑	1 to the maximum number of control axes of the module used	—	Axis number to be controlled
Start I/O number	StartIO	IN	Word [Unsigned]	↑	0H to FEH	—	Installation address of the Simple Motion module (Upper three digits of four digits (hexadecimal))

*1 ⊓: Always, ↑: Only when the FB is started

■Output labels

Name	Label name	Data type	Value to be held*1	Description
Executing	o_bENO	Bit	—	Turns on while Execution command is on.
Normal completion	o_bOK	Bit	—	Turns on when cam generation is normally completed.
Error completion	o_bErr	Bit	—	Turns on when an error has occurred during cam generation.
Error code	o_uErrId	Word [Unsigned]	—	The error code of the error that has occurred in the FB is stored. (Refer to "Page 289 List of Error Codes".)

*1 ○: The value is held after the FB stops. —: The value is cleared after the FB stops.

STD_Lowpass1 (Low-pass filter)

Name

STD_Lowpass1

Function overview

<table>
<tr><th>Item</th><th colspan="2">Description</th></tr>
<tr><td>Function overview</td><td colspan="2">Primary lowpass filter</td></tr>
<tr><td>Symbol</td><td colspan="2">STD_Lowpass1
Execution command | B: i_bEN | o_bENO :B | Executing
Reset | B: i_bReset | o_bOK :B | Normal operation
Input value | E: i_eInput | o_bErr :B | Error completion
Reset value | E: i_eSetValue | o_uErrId :UW | Error code
Filter time constant | E: i_eTimeConstant | o_eOutput :E | Output of filter
Execution cycle | E: i_eSamplingTime</td></tr>
<tr><td rowspan="3">Applicable hardware and software</td><td>Applicable module</td><td>RD77MS, RD77GF, RD78G(S)</td></tr>
<tr><td>Applicable CPU</td><td>MELSEC iQ-R series CPU module</td></tr>
<tr><td>Engineering software</td><td>GX Works3</td></tr>
<tr><td>Number of steps</td><td colspan="2">379 steps (For the macro type)</td></tr>
<tr><td>FB dependence</td><td colspan="2">None</td></tr>
<tr><td>Function description</td><td colspan="2">The lowpass filter processing is executed with the following calculation formulas. The gain of filter is Gain and the condition variable is Drp in the formulas.
Gain = Execution cycle/Filter time constant
Drp ← Drp + Gain • (Input value - Drp)
Output of filter ← Drp</td></tr>
<tr><td>Compiling method</td><td colspan="2">Macro type, subroutine type</td></tr>
<tr><td>FB operation type</td><td colspan="2">Real-time execution</td></tr>
<tr><td>Restrictions and precautions</td><td colspan="2">Execute this FB in a fixed cycle.</td></tr>
</table>

Labels

■Input labels

Name	Label name	Data type	Read timing[*1]	Setting range	Initial value	Description
Execution command	i_bEN	Bit	⊓	—	—	On: The FB is activated. Off: The FB is stopped.
Reset	i_bReset	Bit	⊓	—	—	On: The reset value is output to the filter output value.
Input value	i_eInput	Single precision real number	⊓	—	—	Input to the filter
Reset value	i_eSetValue	Single precision real number	⊓	—	—	Filter reset value
Filter time constant	i_eTimeConstant	Single precision real number	⊓	0.0<=	—	Time constant of filter [ms]
Execution cycle	i_eSamplingTime	Single precision real number	↑	0.0 <	—	Execution cycle [ms] of the program for executing the FB

*1 ⊓: Always, ↑: Only when the FB is started

■Output labels

Name	Label name	Data type	Value to be held*1	Description
Executing	o_bENO	Bit	—	Turns on while Execution command is on.
Normal operation	o_bOK	Bit	—	Turns on while the FB is normally operating.
Error completion	o_bErr	Bit	—	Turns on when an error has occurred in the FB.
Error code	o_uErrId	Word [Unsigned]	—	The error code of the error that has occurred in the FB is stored. (Refer to "Page 289 List of Error Codes".)
Output of filter	o_eOutput	Single precision real number	—	The output of filter is stored.

*1 ○: The value is held after the FB stops. —: The value is cleared after the FB stops.

STD_AverageValueFilter (Moving average filter)

Name

STD_AverageValueFilter

Function overview

Item	Description	
Function overview	Moving average filter	
Symbol	STD_AverageValueFilter Execution command — B: i_bEN … o_bENO :B — Executing Input value — E: i_eInput … o_bOK :B — Normal operation Filter time constant — E: i_eTimeConstant … o_bErr :B — Error completion Execution cycle — E: i_eSamplingTime … o_uErrId :UW — Error code o_eOutput :E — Output of filter	
Applicable hardware and software	Applicable module	RD77MS, RD77GF, RD78G(S)
	Applicable CPU	MELSEC iQ-R series CPU module
	Engineering software	GX Works3
Number of steps	507 steps (For the macro type)	
FB dependence	None	
Function description	This FB outputs the input value on which the moving average processing is performed with the average number of (Filter time constant/Execution cycle).	
Compiling method	Macro type, subroutine type	
FB operation type	Real-time execution	
Restrictions and precautions	• Set the averaging number (Filter time constant/Execution cycle) to 2000 or less. • Execute this FB in a fixed cycle.	

Labels

■Input labels

Name	Label name	Data type	Read timing*1	Setting range	Initial value	Description
Execution command	i_bEN	Bit	⊓	—	—	On: The FB is activated. Off: The FB is stopped.
Input value	i_eInput	Single precision real number	⊓	—	—	Input to the filter
Filter time constant	i_eTimeConstant	Single precision real number	⊓	0.0 <=	—	Time constant of filter [ms]
Execution cycle	i_eSamplingTime	Single precision real number	↑	0.0 <	—	Execution cycle [ms] of the program for executing the FB

*1 ⊓: Always, ↑: Only when the FB is started

■Output labels

Name	Label name	Data type	Value to be held*1	Description
Executing	o_bENO	Bit	—	On: While Execution command is on Off: Execution command is off.
Normal operation	o_bOK	Bit	—	When this device is on, it indicates that the filter processing is being executed.
Error completion	o_bErr	Bit	—	Turns on when an error has occurred in the FB.
Error code	o_uErrId	Word [Unsigned]	—	The error code of the error that has occurred in the FB is stored. (Refer to "Page 289 List of Error Codes".)
Output of filter	o_eOutput	Single precision real number	—	The output of filter is stored.

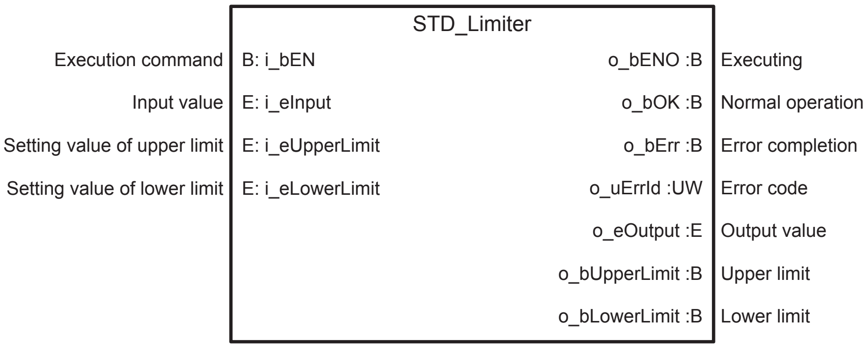
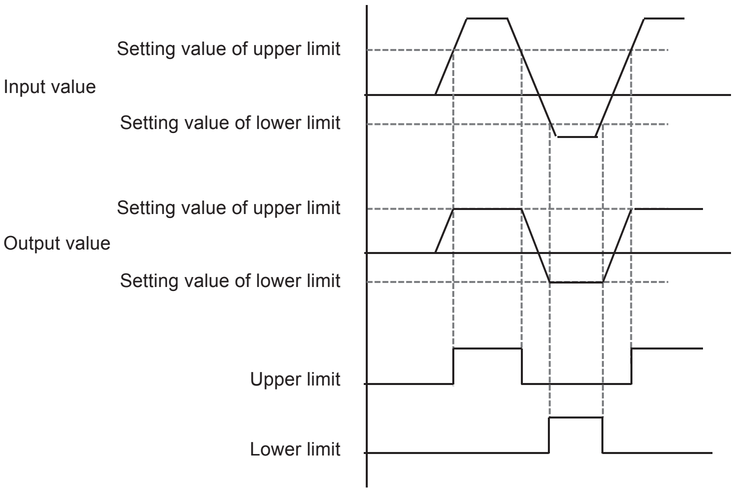
*1 ○: The value is held after the FB stops. —: The value is cleared after the FB stops.

STD_Limiter (Limiter)

Name

STD_Limiter

Function overview

Item	Description	
Function overview	This FB outputs the input value after the upper/lower limit control.	
Symbol		
Applicable hardware and software	Applicable module	RD77MS, RD77GF, RD78G(S)
	Applicable CPU	MELSEC iQ-R series CPU module
	Engineering software	GX Works3
Number of steps	325 steps (For the macro type)	
FB dependence	None	
Function description	The input value is limited with the setting values of upper/lower limit and output. 	
Compiling method	Macro type, subroutine type	
FB operation type	Real-time execution	
Restrictions and precautions	—	

Labels

■Input labels

Name	Label name	Data type	Read timing*1	Setting range	Initial value	Description
Execution command	i_bEN	Bit	⊓	—	—	On: The FB is activated. Off: The FB is stopped.
Input value	i_eInput	Single precision real number	⊓	—	—	Input value
Setting value of upper limit	i_eUpperLimit	Single precision real number	⊓	Lower limit <	—	Upper limit value
Setting value of lower limit	i_eLowerLimit	Single precision real number	⊓	Upper limit >	—	Lower limit value

*1 ⊓: Always, ↑: Only when the FB is started

■Output labels

Name	Label name	Data type	Value to be held*1	Description
Executing	o_bENO	Bit	—	On: While Execution command is on Off: Execution command is off.
Normal operation	o_bOK	Bit	—	When this device is on, it indicates that the filter processing is being executed.
Error completion	o_bErr	Bit	—	Turns on when an error has occurred in the FB.
Error code	o_uErrId	Word [Unsigned]	—	The error code of the error that has occurred in the FB is stored. (Refer to "Page 289 List of Error Codes".)
Output value	o_eOutput	Single precision real number	—	The input value limited with the upper/lower limit values is stored.
Upper limit	o_bUpperLimit	Bit	—	When this device is on, it indicates that the input value is equal to or larger than the upper limit value.
Lower limit	o_bLowerLimit	Bit	—	When this device is on, it indicates that the input value is equal to or smaller than the lower limit value.

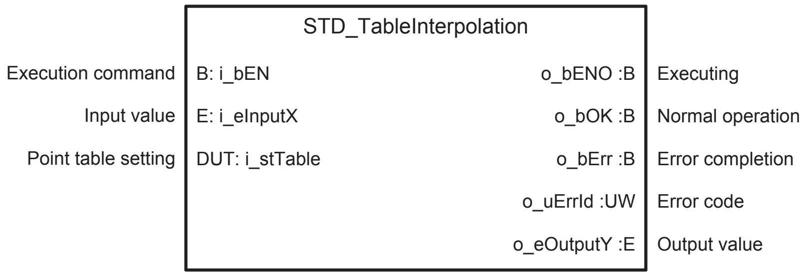
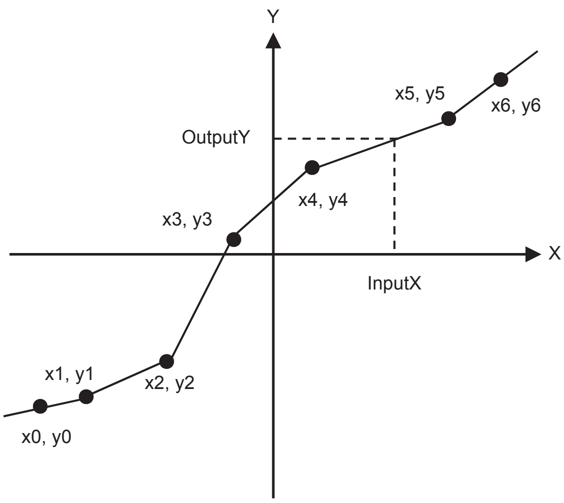
*1 ○: The value is held after the FB stops. —: The value is cleared after the FB stops.

STD_TableInterpolation (Table interpolation (2000 points))

Name

STD_TableInterpolation

Function overview

Item	Description	
Function overview	This FB calculates the output value (Y) in response to the input value (X) using the X and Y point tables.	
Symbol		
Applicable hardware and software	Applicable module	RD77MS, RD77GF, RD78G(S)
	Applicable CPU	MELSEC iQ-R series CPU module
	Engineering software	GX Works3
Number of steps	501 steps (For the macro type)	
FB dependence	None	
Function description	The output value in response to the input value is calculated as shown in the figure below. 	
Compiling method	Macro type, subroutine type	
FB operation type	Real-time execution	
Restrictions and precautions	Set the X-coordinate values in ascending order and 2000 or less points.	

Labels

■Input labels

Name	Label name	Data type	Read timing*1	Setting range	Initial value	Description
Execution command	i_bEN	Bit	⊓	—	—	On: The FB is activated. Off: The FB is stopped.
Input value	i_eInputX	Single precision real number	⊓	—	—	Input value
Point table setting	i_stTable	XY_TABLE_REF	↑	—	—	Refer to XY_TABLE_REF.

XY_TABLE_REF structure

Name	Label name	Data type	Read timing*1	Setting range	Initial value	Description
Number of points	NumPoint	Single precision real number	↑	2 to 2000	—	Number of points
X-coordinate value	eTableX [0]	Single precision real number	↑	—	—	First point in the X-coordinate
	eTableX [1]	Single precision real number	↑	eTableX [0] <	—	Second point in the X-coordinate
	⋮	Single precision real number	↑	⋮	—	⋮
	eTableX [NumPoint-1]	Single precision real number	↑	eTableX [NumPoint-2] <	—	nth point in the X-coordinate
Y-coordinate value	eTableY [0]	Single precision real number	↑	—	—	First point in the Y-coordinate
	eTableY [1]	Single precision real number	↑	—	—	Second point in the Y-coordinate
	⋮	Single precision real number	↑	—	—	⋮
	eTableY [NumPoint-1]	Single precision real number	↑	—	—	nth point in the Y-coordinate

*1 ⊓: Always, ↑: Only when the FB is started

■Output labels

Name	Label name	Data type	Value to be held*1	Description
Executing	o_bENO	Bit	—	On: While Execution command is on Off: Execution command is off.
Normal operation	o_bOK	Bit	—	When this device is on, it indicates that the filter processing is being executed.
Error completion	o_bErr	Bit	—	Turns on when an error has occurred in the FB.
Error code	o_uErrId	Word [Unsigned]	—	The error code of the error that has occurred in the FB is stored. (Refer to "Page 289 List of Error Codes".)
Output value	o_eOutputY	Single precision real number	—	The table output value in response to the input value is stored.

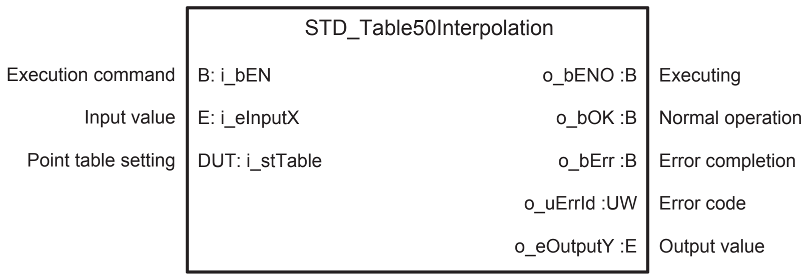
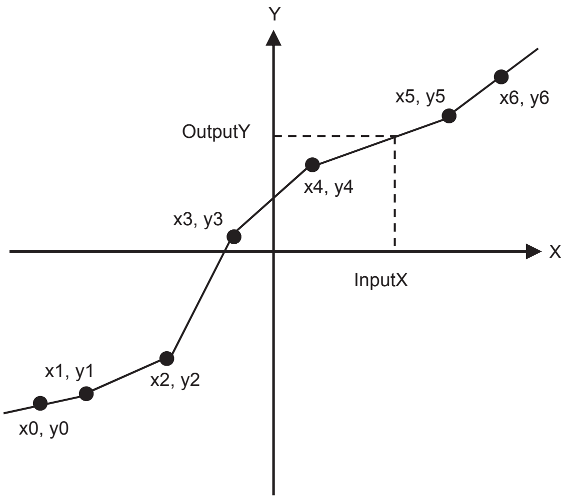
*1 ○: The value is held after the FB stops. —: The value is cleared after the FB stops.

STD_Table50Interpolation (Table interpolation (50 points))

Name

STD_Table50Interpolation

Function overview

<table>
<tr><th>Item</th><th colspan="2">Description</th></tr>
<tr><td>Function overview</td><td colspan="2">This FB calculates the output value (Y) in response to the input value (X) using the X and Y point tables.</td></tr>
<tr><td>Symbol</td><td colspan="2">
</td></tr>
<tr><td rowspan="3">Applicable hardware and software</td><td>Applicable module</td><td>RD77MS, RD77GF, RD78G(S)</td></tr>
<tr><td>Applicable CPU</td><td>MELSEC iQ-R series CPU module</td></tr>
<tr><td>Engineering software</td><td>GX Works3</td></tr>
<tr><td>Number of steps</td><td colspan="2">633 steps (For the macro type)</td></tr>
<tr><td>FB dependence</td><td colspan="2">None</td></tr>
<tr><td>Function description</td><td colspan="2">The output value in response to the input value is calculated as shown in the figure below.

</td></tr>
<tr><td>Compiling method</td><td colspan="2">Macro type, subroutine type</td></tr>
<tr><td>FB operation type</td><td colspan="2">Real-time execution</td></tr>
<tr><td>Restrictions and precautions</td><td colspan="2">Set the X-coordinate values in ascending order and 50 or less points.</td></tr>
</table>

Labels

■Input labels

Name	Label name	Data type	Read timing*1	Setting range	Initial value	Description
Execution command	i_bEN	Bit	⊓	—	—	On: The FB is activated. Off: The FB is stopped.
Input value	i_eInputX	Single precision real number	⊓	—	—	Input value
Point table setting	i_stTable	XY_TABLE50_REF	↑	—	—	Refer to XY_TABLE50_REF.

XY_TABLE50_REF structure

Name	Label name	Data type	Read timing*1	Setting range	Initial value	Description
Number of measuring points	NumPoint	Single precision real number	↑	2 to 50	—	Number of measuring points
X-coordinate value	eTableX [0]	Single precision real number	↑	—	—	First point in the X-coordinate
	eTableX [1]	Single precision real number	↑	eTableX [0] <	—	Second point in the X-coordinate
	⋮	Single precision real number	↑	⋮	—	⋮
	eTableX [NumPoint-1]	Single precision real number	↑	eTableX [NumPoint-2] <	—	nth point in the X-coordinate
Y-coordinate value	eTableY [0]	Single precision real number	↑	—	—	First point in the Y-coordinate
	eTableY [1]	Single precision real number	↑	—	—	Second point in the Y-coordinate
	⋮	Single precision real number	↑	—	—	⋮
	eTableY [NumPoint-1]	Single precision real number	↑	—	—	nth point in the Y-coordinate

*1 ⊓: Always, ↑: Only when the FB is started

■Output labels

Name	Label name	Data type	Value to be held*1	Description
Executing	o_bENO	Bit	—	On: While Execution command is on Off: Execution command is off.
Normal operation	o_bOK	Bit	—	When this device is on, it indicates that the filter processing is being executed.
Error completion	o_bErr	Bit	—	When this device is on, it indicates that an error has occurred in the FB.
Error code	o_uErrId	Word [Unsigned]	—	The error code of the error that has occurred in the FB is stored. (Refer to "Page 289 List of Error Codes".)
Output value	o_eOutputY	Single precision real number	—	The table output value in response to the input value is stored.

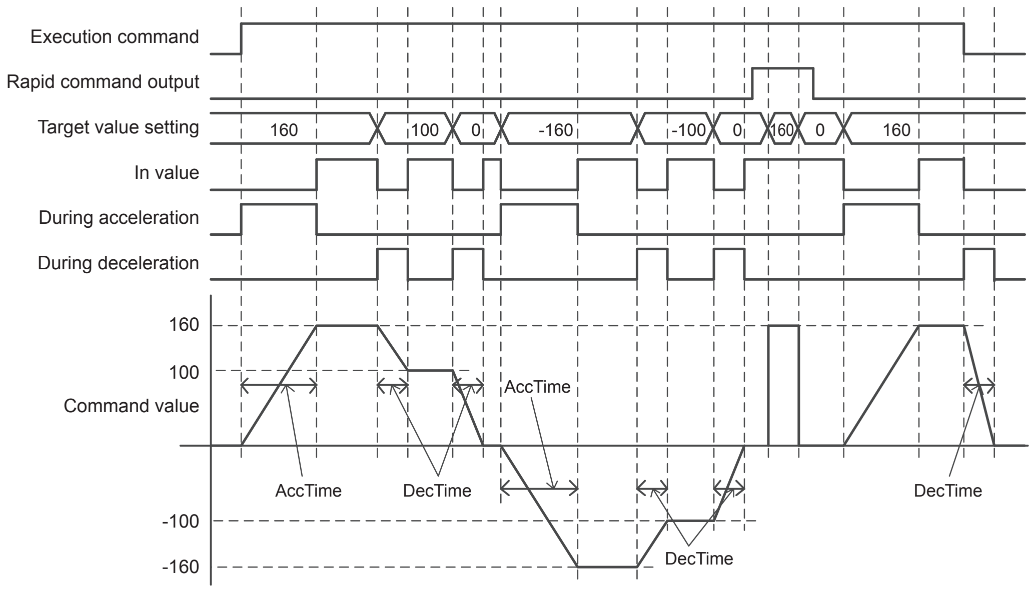
*1 ○: The value is held after the FB stops. —: The value is cleared after the FB stops.

STD_RampGenerator (Ramp generator)

Name

STD_RampGenerator

Function overview

<table>
<tr><th>Item</th><th colspan="2">Description</th></tr>
<tr><td>Function overview</td><td colspan="2">This FB generates a changeable command value with acceleration/deceleration times to reach the target value.</td></tr>
<tr><td>Symbol</td><td colspan="2">STD_RampGenerator
Execution command — B: i_bEN — o_bENO :B — Executing
Target value — E: i_eTargetValue — o_bOK :B — Normal operation
Acceleration time — E: i_eAccTime — o_bErr :B — Error completion
Deceleration time — E: i_eDecTime — o_uErrId :UW — Error code
Rapid command output — B: i_bTargetThrough — o_eCommandValue :E — Command value
Execution cycle — E: i_eSamplingTime — o_bInValue :B — In value
o_bAccelerating :B — During acceleration
o_bDecelerating :B — During deceleration</td></tr>
<tr><td rowspan="3">Applicable hardware and software</td><td>Applicable module</td><td>RD77MS, RD77GF, RD78G(S)</td></tr>
<tr><td>Applicable CPU</td><td>MELSEC iQ-R series CPU module</td></tr>
<tr><td>Engineering software</td><td>GX Works3</td></tr>
<tr><td>Number of steps</td><td colspan="2">664 steps (For the macro type)</td></tr>
<tr><td>FB dependence</td><td colspan="2">None</td></tr>
<tr><td>Function description</td><td colspan="2">

When Rapid command output is on, the target value is output to the command value without acceleration/deceleration processing.</td></tr>
<tr><td>Compiling method</td><td colspan="2">Macro type, subroutine type</td></tr>
<tr><td>FB operation type</td><td colspan="2">Real-time execution</td></tr>
<tr><td>Restrictions and precautions</td><td colspan="2">Execute this FB in a fixed cycle.</td></tr>
</table>

Labels

■Input labels

Name	Label name	Data type	Read timing*1	Setting range	Initial value	Description
Execution command	i_bEN	Bit	⊓	—	—	On: The FB is activated. Off: The FB is stopped.
Target value	i_eTargetValue	Single precision real number	⊓	—	—	Target value setting
Acceleration time	i_eAccTime	Single precision real number	⊓	0.0<=	—	Setting of the acceleration time [ms] taken to reach the target value
Deceleration time	i_eDecTime	Single precision real number	⊓	0.0<=	—	Setting of the deceleration time [ms] taken to reach the target value
Rapid command output	i_bTargetThrough	Bit	⊓	—	—	On: The target value is output as the command value. Off: Acceleration time and deceleration time are used to determine the command value.
Execution cycle	i_eSamplingTime	Single precision real number	↑	0.0<	—	Execution cycle [ms] of the program for executing the FB

*1 ⊓: Always, ↑: Only when the FB is started

■Output labels

Name	Label name	Data type	Value to be held*1	Description
Executing	o_bENO	Bit	—	Turns on while Execution command is on.
Normal operation	o_bOK	Bit	—	Turns on while the FB is normally operating.
Error completion	o_bErr	Bit	—	Turns on when an error has occurred in the FB.
Error code	o_uErrId	Word [Unsigned]	—	The error code of the error that has occurred in the FB is stored. (Refer to "Page 289 List of Error Codes".)
Command value	o_eCommandValue	Single precision real number	—	Command value
In value	o_bInValue	Bit	—	Turns on when the speed reaches the target value.
During acceleration	o_bAccelerating	Bit	—	Turns on during acceleration.
During deceleration	o_bDecelerating	Bit	—	Turns on during deceleration.

*1 ○: The value is held after the FB stops. —: The value is cleared after the FB stops.

5 APPLICATION PROGRAM EXAMPLE

For the system to perform unwinding and rewinding, three application program examples are provided.

- Controlling all axes including the unwinder and rewinder axes by using the servo amplifier ··· Basic
- Adding the reel change part for the roll change to the basic system ··· Reel change
- Controlling the unwinder and rewinder axes by using the inverter ··· Inverter

The following table lists the devices used in each application program example.

Program example	Unwinder /rewinder axis	Main axis/ edge position axis	Turret axis*1	Network	Project name (GX Works3)	Project name (GT Works3)	Reference
Basic	Servo amplifier	Servo amplifier	—	SSCNETⅢ/H	AP20-CNV002AA-R16-77MS16_****.gx3*2	AP20-CNV002AA-GT27nnV_****.GTX*2	• Page 141 System Configuration • Page 147 Operation Specifications • Page 148 Control specifications • Page 148 Program configuration • Page 150 Parameter • Page 150 Program processing • Page 159 ExamplePrgCtrl FB • Page 161 Operation procedure
				CC-Link IE Field	AP20-CNV002AA-R16-77GF16_****.gx3*2		
				CC-Link IE TSN	AP20-CNV002AA-R16-78G16_****.gx3*2		
Reel change	Servo amplifier	Servo amplifier	Servo amplifier	SSCNETⅢ/H	AP20-CNV002AA-R16-77MS16_****.gx3*2		• Page 141 System Configuration • Page 147 Operation Specifications • Page 163 Control specifications • Page 167 Program configuration • Page 169 Parameter • Page 176 Program processing • Page 183 ExamplePrgReelChange FB • Page 187 Operation procedure
				CC-Link IE Field	AP20-CNV002AA-R16-77GF16_****.gx3*2		
				CC-Link IE TSN	AP20-CNV002AA-R16-78GF16_****.gx3*2		
Inverter	Inverter (I/O mode)	Servo amplifier	—	CC-Link IE Field	AP20-CNV002AA-R16-77GF16_CCINV_****.gx3*2		• Page 141 System Configuration • Page 147 Operation Specifications • Page 196 Control specifications • Page 196 Program configuration • Page 198 Parameter • Page 200 Program processing • Page 206 INVExample FB • Page 214 Operation procedure

*1 It used only when a reel change is provided.
*2 "*****" indicates their versions.

Precautions

When diverting the application program (example) into the actual system, take the following actions on user's own responsibility.

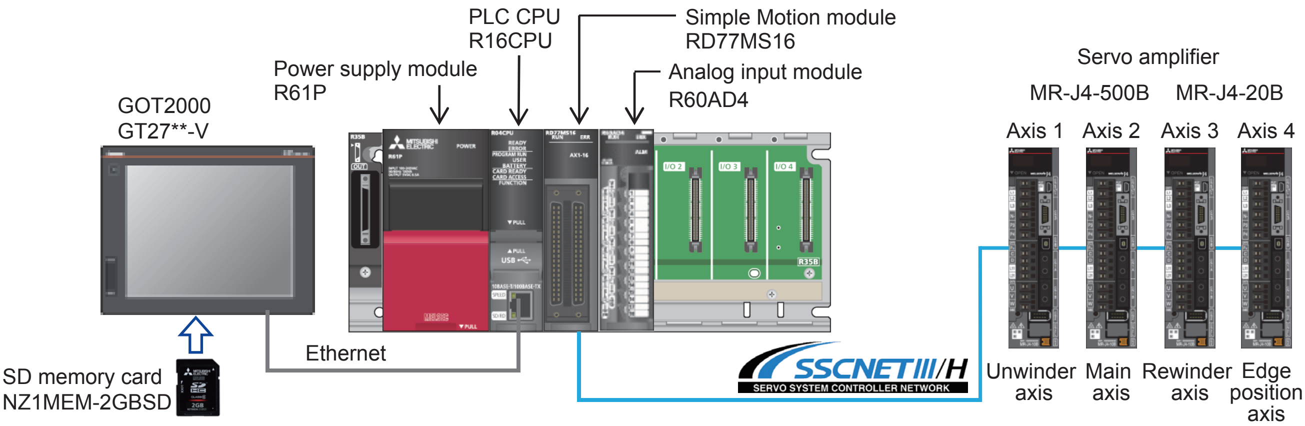
- Sufficiently confirm that the screens will not cause system control problems.
- Examine the positions where interlock conditions are required and add them.
- Change the initial values of variables and constants as necessary.

5.1 System Configuration

System configuration

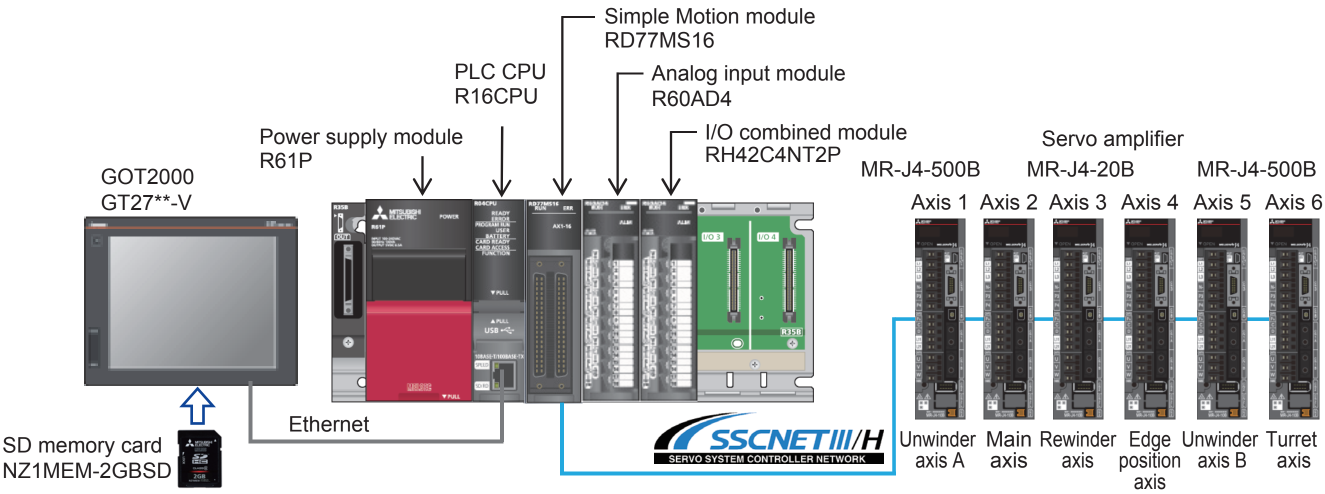
■AP20-CNV002AA-R16-77MS16_****.gx3 (SSCNETⅢ/H)

[Basic]



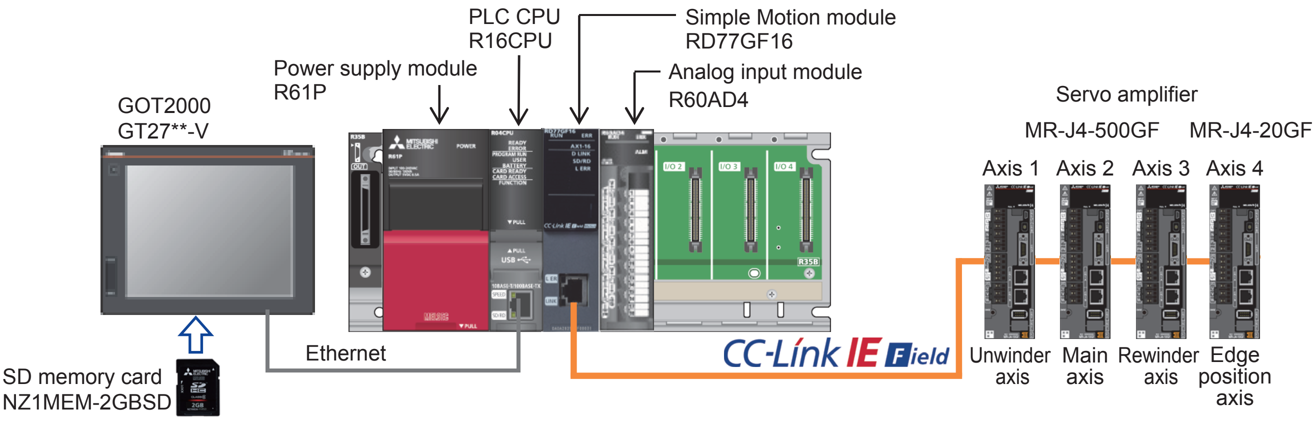
[Reel change]

An unwinder axis and a turret axis for the roll change are added in the [Basic] system.



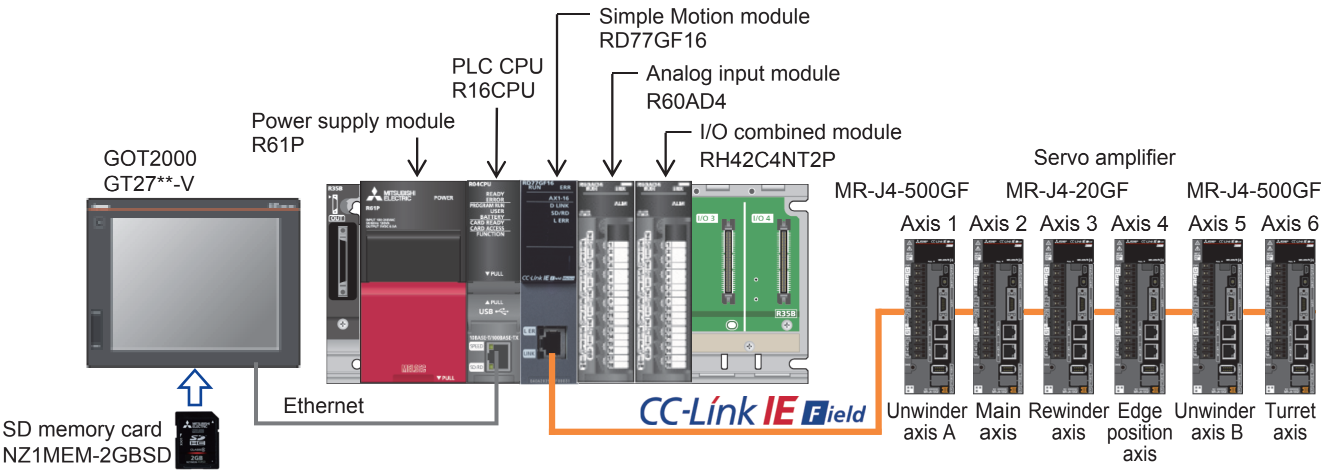
■AP20-CNV002AA-R16-77GF16_****.gx3 (CC-Link IE Field)

[Basic]



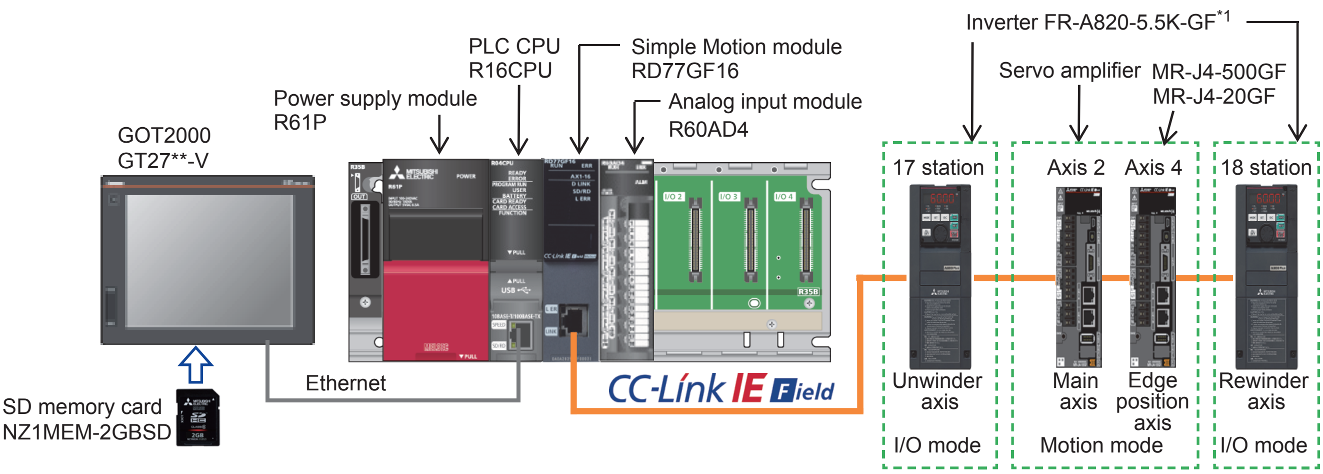
[Reel change]

An unwinder axis and a turret axis for the roll change are added in the [Basic] system.



■AP20-CNV002AA-R16-77GF16_CCINV_****.gx3 (When using an inverter in CC-Link IE Field)

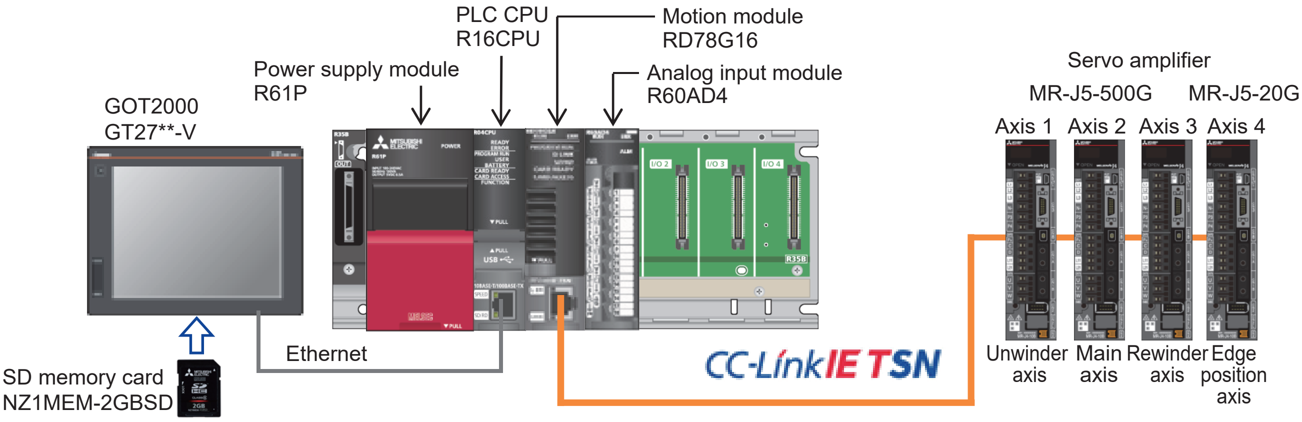
[Inverter]



*1 Any of FR-A8AP/FR-A8APR/FR-A8AL/FR-A8TP is required as the built-in encoder connection option.

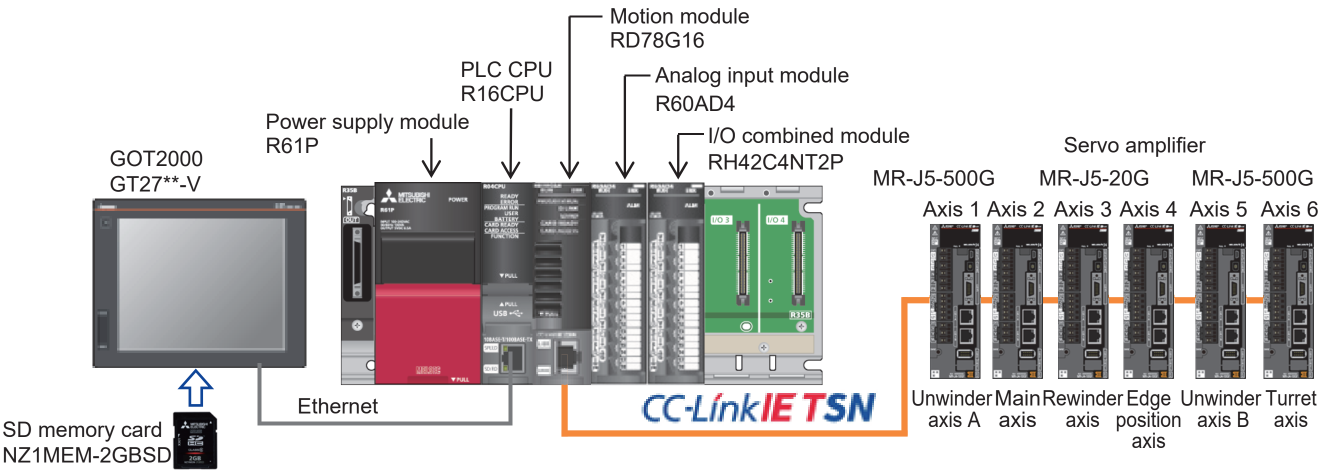
■AP20-CNV002AA-R16-78G16_****.gx3 (CC-Link IE TSN)

[Basic]



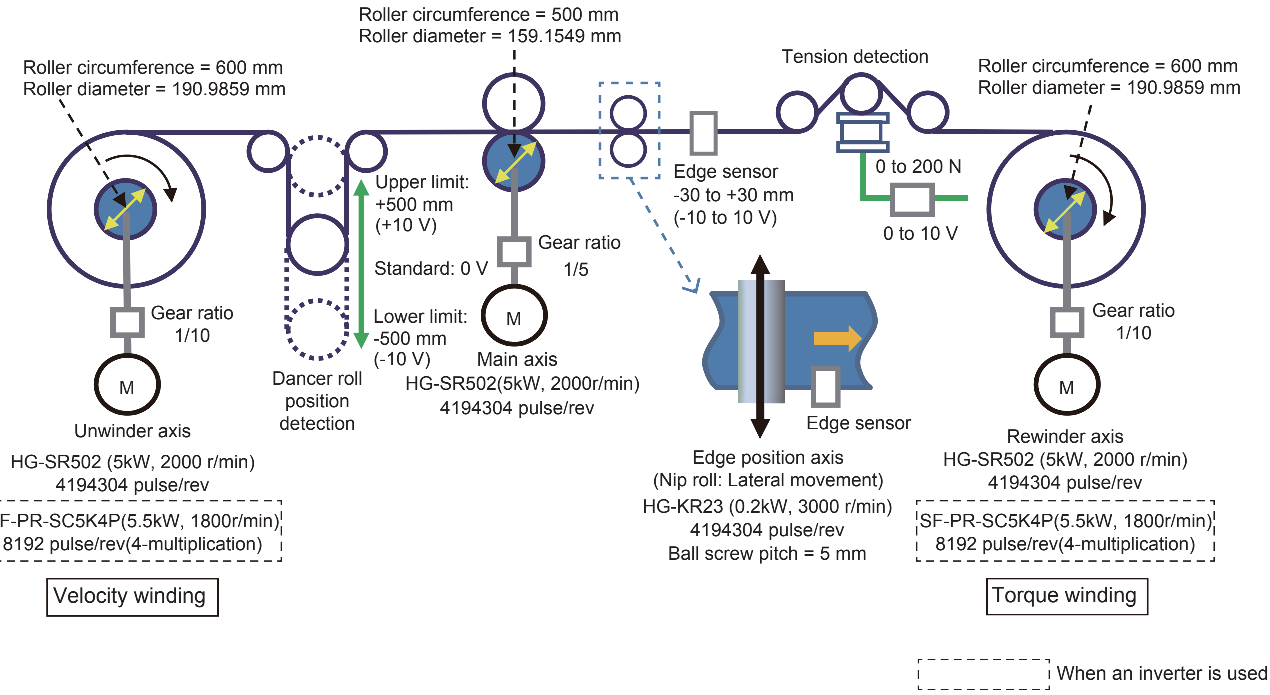
[Reel change]

An unwinder axis and a turret axis for the roll change are added in the [Basic] system.



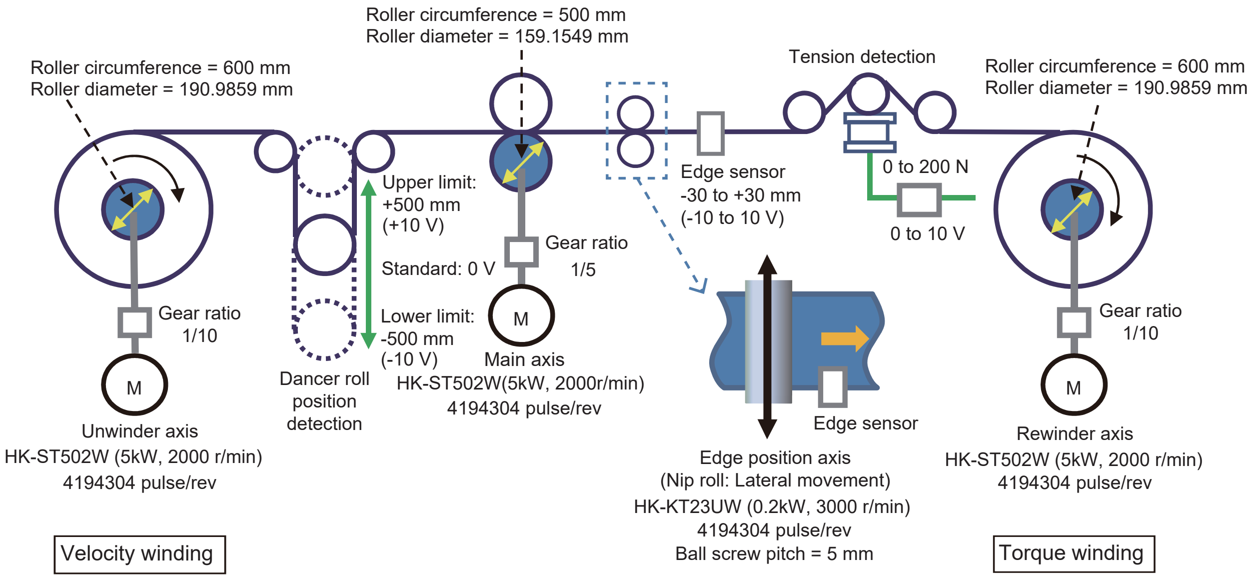
Equipment configuration

[Basic (RD77MS, RD77GF)] [Inverter (RD77GF)]



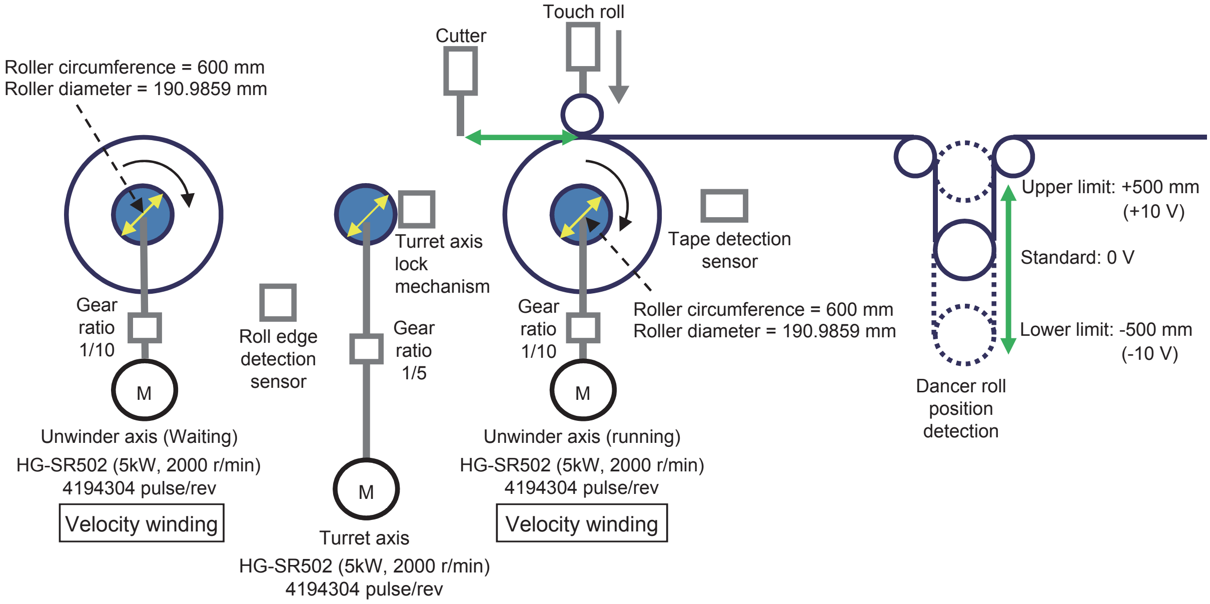
[Basic (RD78G(S))]

The configuration is the same as [Basic (RD77MS, RD77GF)] except for the motor model.



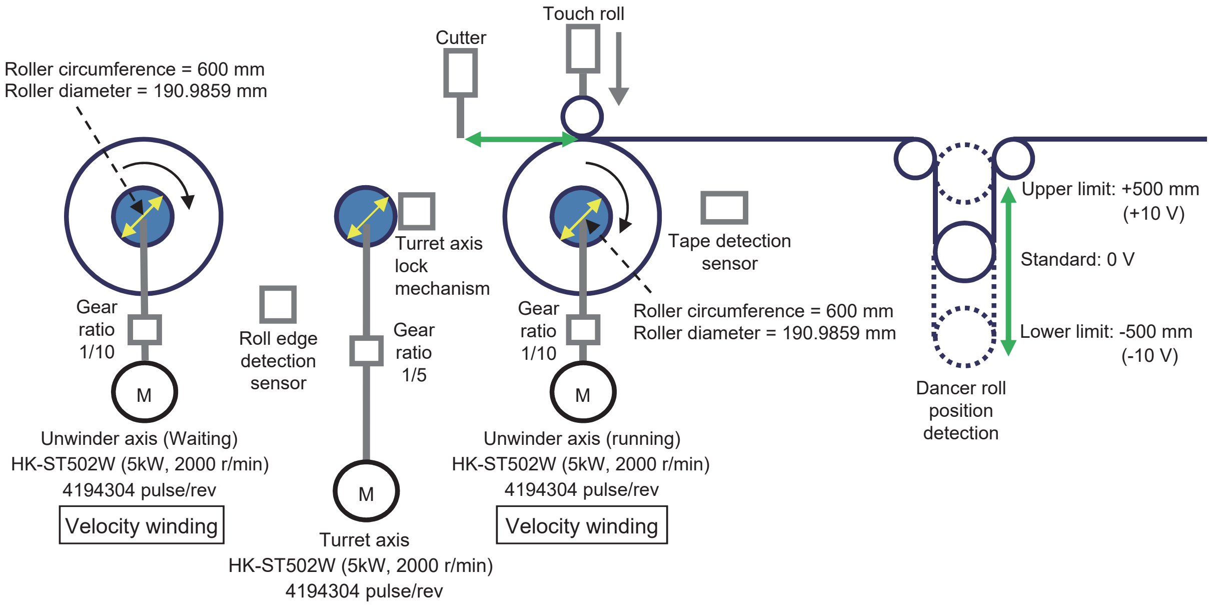
[Reel change (RD77MS, RD77GF)]

The following figure shows the configuration of the reel change part. The reel change part is added in the [Basic] system.



[Reel change (RD78G(S))]

The configuration is the same as [Reel change (RD77MS, RD77GF)] except for the motor model.

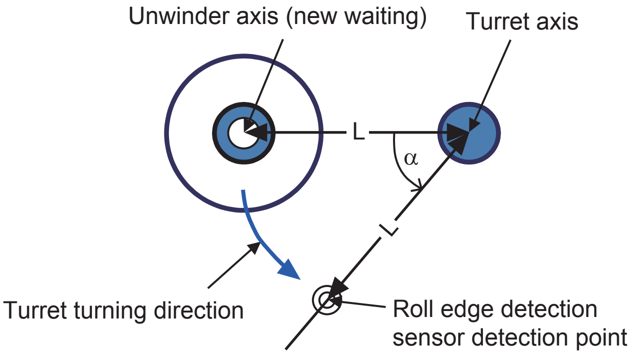


The following shows the positional relations between the unwinder axis and sensors in the reel change mechanism.

- Positions of the unwinder axis, turret axis, and roll edge detection sensor

Distance between the turret axis and unwinder axis (new waiting): L = 1200 mm

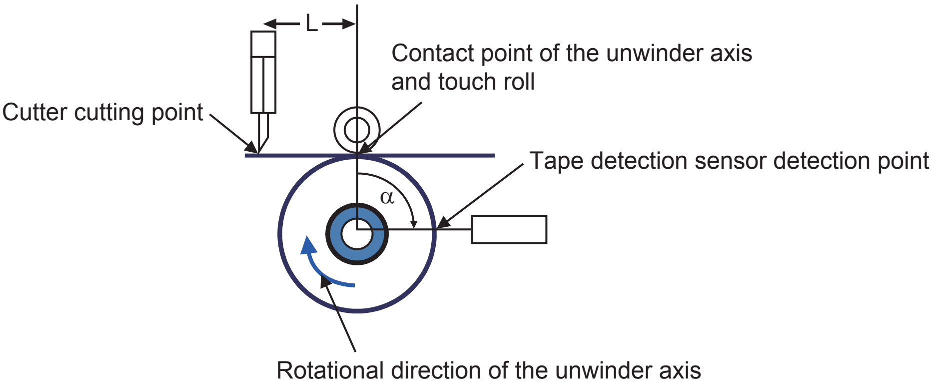
Installation angle of the roll edge detection sensor α = 40 degrees



- Positions of the cutter, touch roll, and tape detection sensor

Distance between the cutting point and contact point of the touch roll: L = 300 mm

Angle between the contact point of the touch roll and the detection point of the tape detection sensor: α = 90 degrees



5.2 Operation Specifications

The following shows the operation specifications for each application program example.

- Line operation velocity: 0 to 100 m/min
- Line operation acceleration: 20 (m/min)/s, jerk: 20 (m/min)/s^2
- Material: Plastic film (PET)
- Film thickness: 0.05 mm
- Film width: 1000 mm
- Film specific gravity: 1350 kg/m^3
- Minimum roll diameter: 200 mm
- Maximum roll diameter: 1000 mm
- Set tension: 100 N
- Mechanical inertia of the rewinder axis: 0.611 kg·m^2
- Turret axis turning speed: 3 r/min (180 degrees/10 s)*1

*1 It used only when a reel change is provided.

5

5.3 Basic

Control specifications

The tension control is started by a start signal and continuously operates until the diameter of the rewind web material reaches the set rewinding diameter.

Item	Unwinder axis	Main axis	Rewinder axis	Edge position axis
Axis number	1	2	3	4
Control mode	Velocity	Velocity	Torque	Velocity
Detector	Dancer roll	—	Tension detector	Edge sensor
Tension gain auto tuning	○	—	○	—
Winding diameter calculation	Web thickness integration method	—	Feeding length method	—
Taper tension	None	—	Table method	—
Direction	Upper unwinding	—	Upper rewinding	—
Inertia compensation, friction compensation	—	—	○	—
Control cycle	0.888 ms (RD77MS)/1.0 ms (RD77GF)/1.0 ms (RD78G(S))			

Program configuration

This application program does not have maintenance functions, such as home position return and JOG operation.
Create the functions as needed.

Language

The following languages are used in this program.

- Program comment: English
- Label comment: Japanese, English, Chinese (Simplified)

List of programs

Program name	Description	Execution type	Describing method
Initial	Initial parameter setting	Initial	ST
WinderControl	Tension control main processing • Main axis control • Unwinder axis control (speed control) • Rewinder axis control (torque control) • Edge position axis control • Web break detection	Event (I44) (RD77MS, RD77GF) Fixed cycle (1 ms) (RD78G(S))	FBD
PreOperation	Preparing operation, line operation control • Servo ON/OFF • Reset error • Start line operation	Scan	FBD
HMI_IF	Touch panel I/O processing	Scan	ST
UnWinderGainChange	Unwinder axis gain change	Scan	FBD
FrictionTorqueMeasurement	Rewinder axis mechanical loss torque measurement	Fixed cycle (5 ms)	FBD

FB

■CNV_TensionControl_R (Refer to "Page 47 FB LIBRARY".)

Item	FB name	Description	Program
Activation	CNV_Activation	License activation	PreOperation
Tension control	CNV_WinderDancerVelocityCtrl	Dancer feedback velocity control	WinderControl
	CNV_WinderTensionTorqueCtrl	Tension sensor feedback torque control	WinderControl
Velocity generator	CNV_LineVelocityGenerator	Line velocity generator	WinderControl
Roll diameter calculation	CNV_DiaCalcThickness	Roll diameter calculation (Web thickness integration method)	WinderControl
	CNV_DiaCalcFeed	Roll diameter calculation (feeding length method)	WinderControl
Torque compensation	CNV_WinderInertiaTorque	Inertia compensation torque calculation	WinderControl
	CNV_InertiaCalc	Load inertia ratio calculation	UnWinderGainChange
	CNV_WinderFrictionTorque	Friction compensation torque calculation	WinderControl
	CNV_FrictionTorqueMeasurement	Friction torque measurement	FrictionTorqueMeasurement
Tuning function	CNV_WinderGainChange	Gain change	UnWinderGainChange
	CNV_TaperTension	Taper tension calculation	WinderControl
	CNV_PIDControl	PID control (with tension PI gain auto tuning)	WinderControl
Additional function	CNV_EdgePositionCtrl	Edge position control	WinderControl
	CNV_WebBreakDetect	Web break detection	WinderControl
Filters	STD_Lowpass1	Low-pass filter	WinderControl
	STD_AverageValueFilter	Moving average filter	WinderControl
	STD_Limiter	Limiter	WinderControl
	STD_TableInterpolation	Table interpolation	WinderControl

■ExamplePrgCtrl (Refer to "Page 159 ExamplePrgCtrl FB".)

FB name	Description	Describing method	Program
MotionReady	Simple Motion module start processing	ST	PreOperation
ServoON	Servo ON processing	ST	PreOperation
MotionErrorReset	Error reset processing	ST	PreOperation
DancerPos	Dancer position A/D value conversion processing	ST	WinderControl
TensionAD	Tension detector A/D value conversion processing	ST	WinderControl
GainPrChg	Gain parameter servo amplifier write processing [RD77MS, RD77GF]	ST	UnWinderGainChange [RD77MS, RD77GF]
GainPrChg_RD78	Gain parameter servo amplifier write processing [RD78G(S)]	ST	UnWinderGainChange [RD78G(S)]
WinderSpdMonitor	Real rotation speed display processing (rewinder axis)	ST	WinderControl
EdgePos	A/D value conversion processing at the edge sensor detection position	ST	WinderControl

Parameter

For the settings of the parameter, refer to the project.

Precautions

In this application program, the emergency stop and limit function with external signals are disabled. To utilize this application program, change the settings depending on the system used.

Program processing

Initial (Initial parameter setting)

Set event task starts, each variable's initial value, and constants.

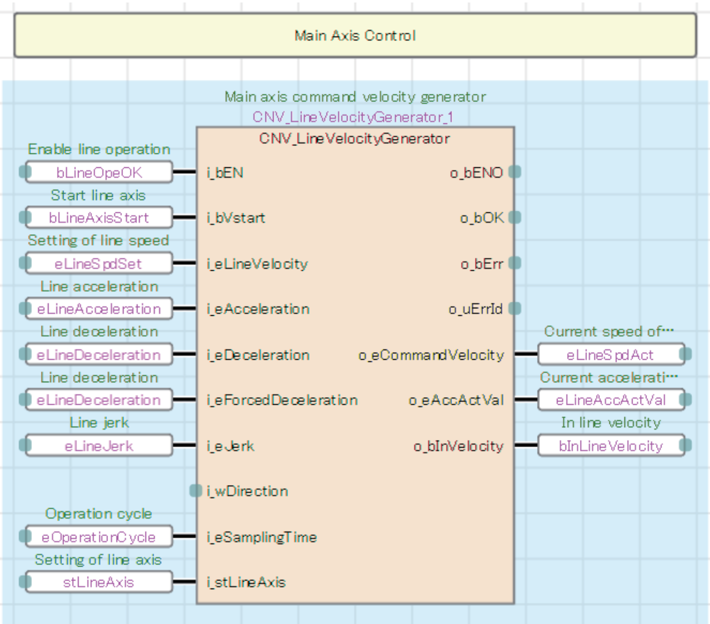
- Setting of execution cycle
- Setting of unwinder axis
- Setting of main axis
- Setting of rewinder axis
- Setting of edge position axis
- Web break detection parameter

WinderControl (Tension control main processing)

■Main axis control

When Enable line operation (bLineOpeOK) turns on, the main axis command velocity generation FB (CNV_LineVelocityGenerator) is started.

Once the FB is started, the mode of the set main axis is changed to the speed mode, and the operation starts at the set velocity (acceleration, deceleration) when Start line axis (blineAxisStart) turns on.

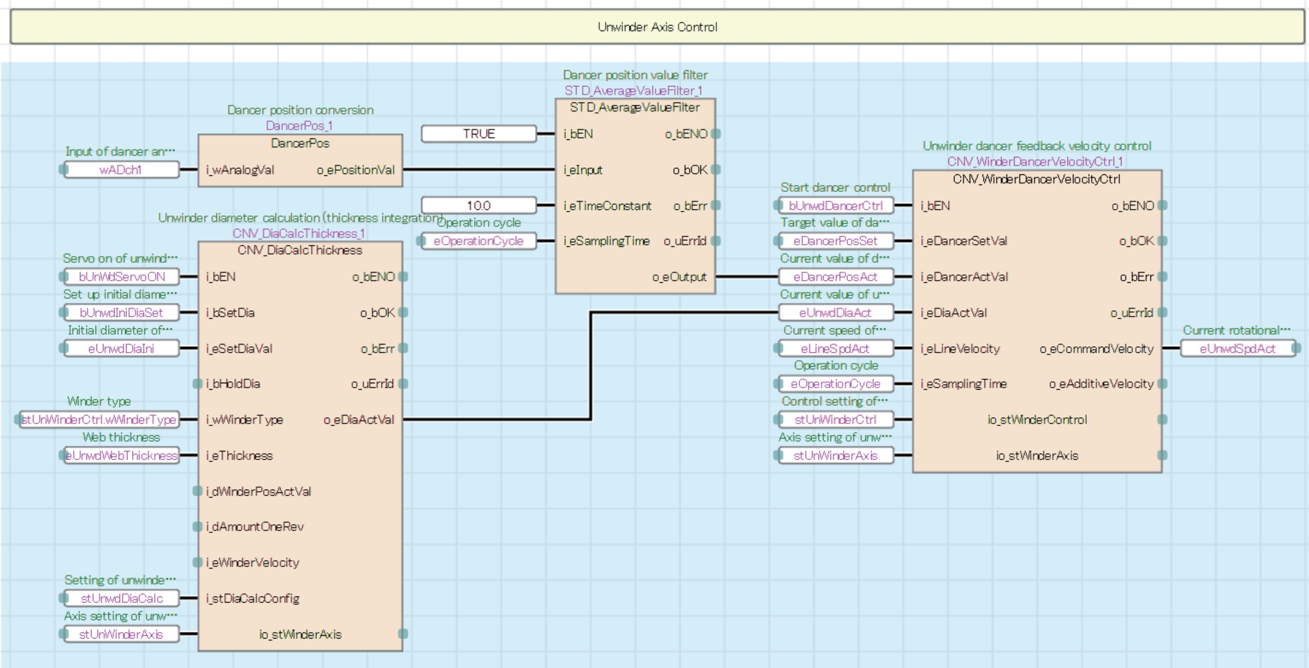


■Unwinder axis control

When Start dancer control (bUnwdDancerCtrl) turns on, the dancer feedback velocity control FB (CNV_WinderDancerVelocityCtrl) is started.

The dancer detection analog value is converted into a position, filtered with the moving average filter (10 ms), and input in the feedback value of the velocity control FB. The velocity is controlled to make the dancer position reach the target position.

Every time the unwinder axis rotates, the roll diameter calculation (Web thickness integration method) FB decrements the thickness value and calculates the current winding diameter. The current winding diameter is input in the velocity control FB, and the velocity is controlled to make the circumferential velocity reach the line velocity.



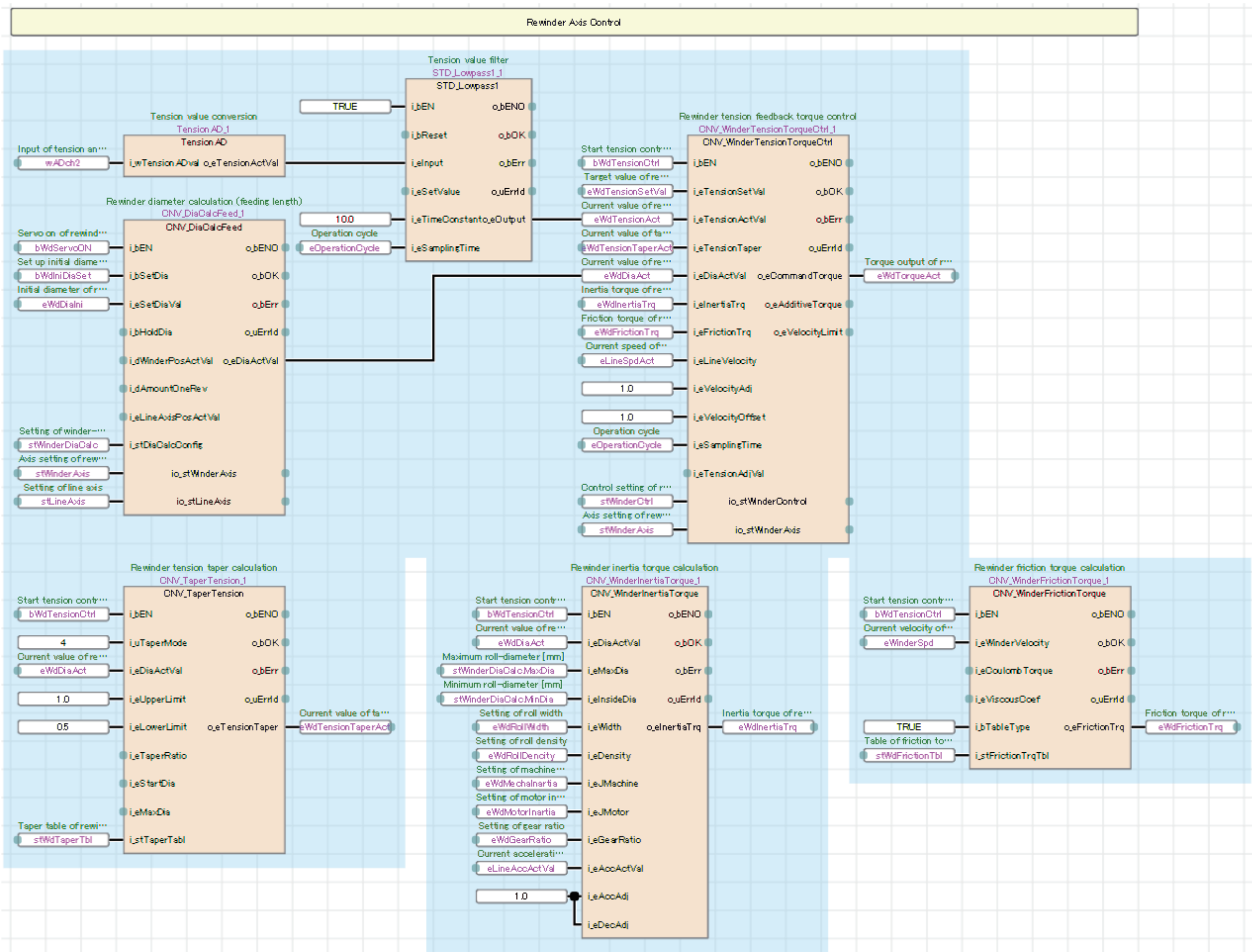
5

■Rewinder axis control

When Start tension control of rewinder (bWdTensionCtrl) turns on, the tension sensor feedback torque control FB (CNV_WinderTensionTorqueCtrl) is started.

The tension detection analog value is converted into a tension value, filtered with the lowpass filter (10 ms), and input in the feedback value of the torque control FB. The torque is controlled to make the tension detection value reach the target value.

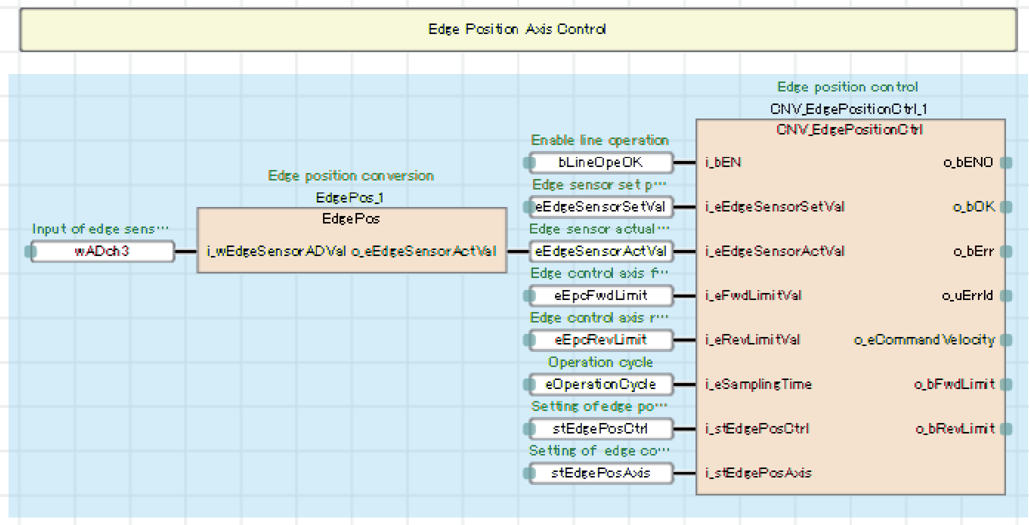
The roll diameter calculation (feeding length) FB calculates the current winding diameter from the feeding length of the main axis per rotation of the unwinder axis and the diameter is input in the torque control FB. The torque is controlled with the command torque of the set tension x (Current winding diameter/2).



■Edge position axis control

When Enable line operation (bLineOpeOK) turns on, the edge position control FB (CNV_EdgePositionCtrl) started.

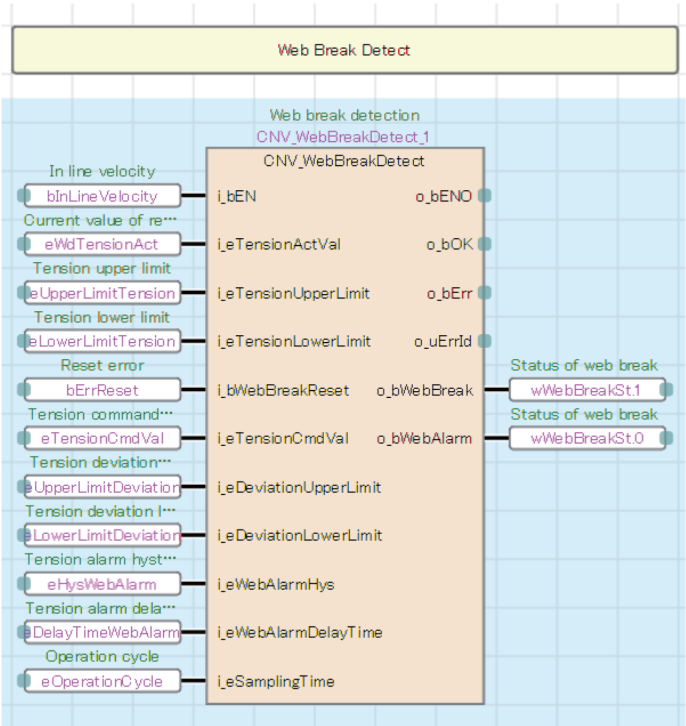
The edge sensor analog value is converted into an edge position, and the velocity is controlled so that the edge position reaches the target position.



■Web break detection

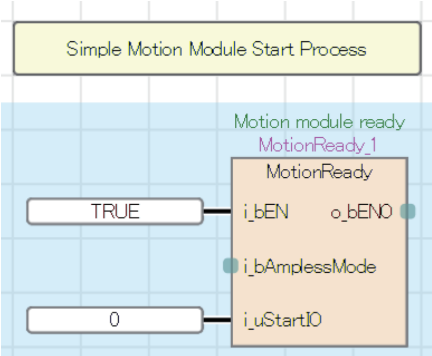
When the line speed is equal to the set velocity (bInLineVelocity), the web break detection FB (CNV_WebBreakDetect) is started.

A web break detection is output (turns on) when the current value of tension is equal to or larger than the upper limit value or equal to or smaller than the lower limit value.



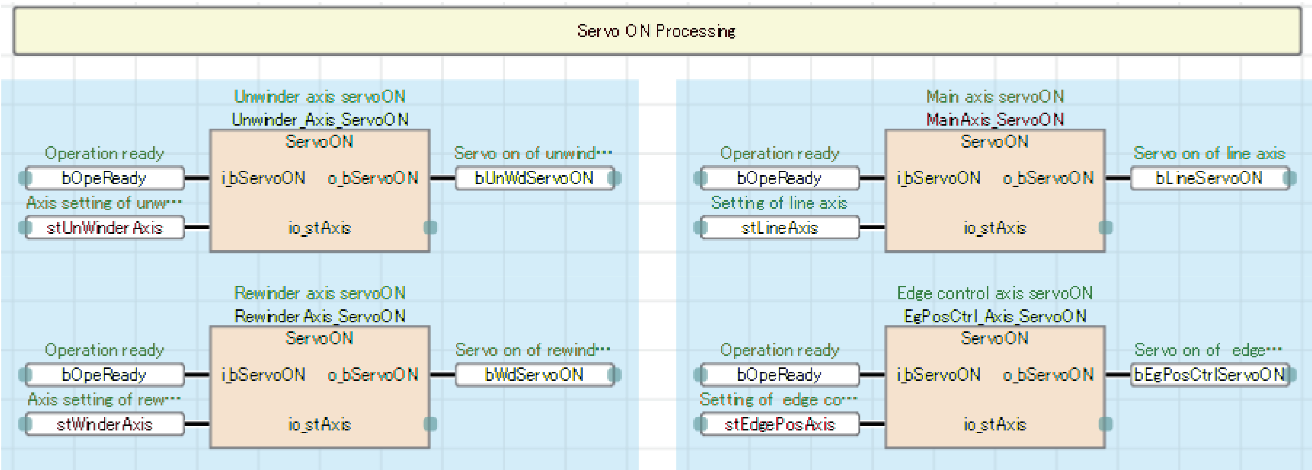
■Simple Motion module start processing

Always ON while the CPU is running



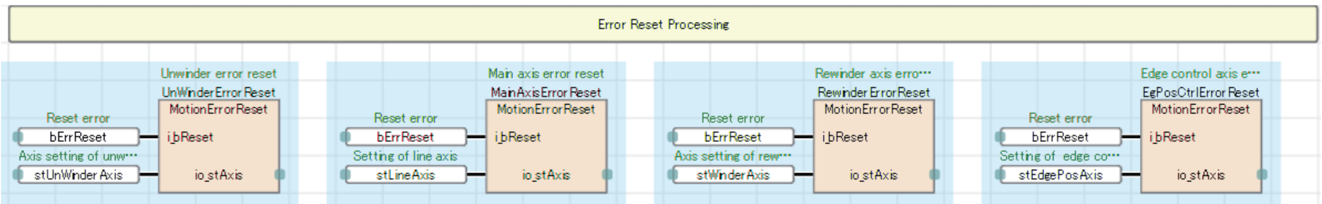
■Servo ON processing

When Preparing operation (bOpeReady) turned on in the GOT screen, the servo ON processing is performed.



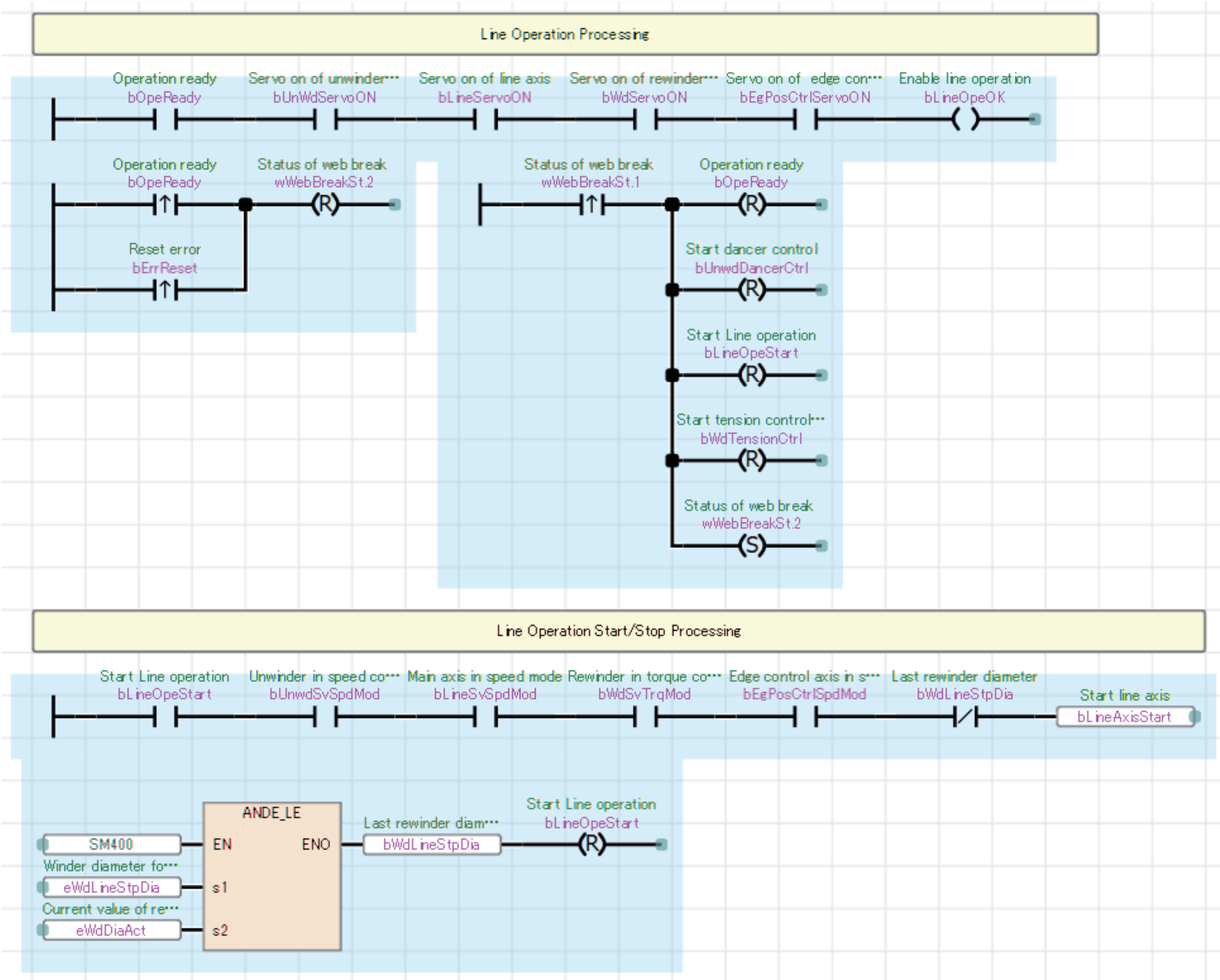
■Error reset processing of each axis

Reset errors of the axis used.



■Line operation start processing

When Start Line operation (bLineOpeStart) turns on in the GOT screen and the current rewinder diameter is equal to or smaller than the rewinder diameter for stopping line, the line operation starts.



HMI_IF (Touch panel I/O processing)

The processing for displaying the GOT screen is performed.

```
//HMI_IF

//////////////////// Servo Status Monitor //////////////////////////////
(* Save index registers *)
wBkp_Z19:=Z19;
wBkp_Z18:=Z18;
```

Backs up the index register values.

```
(* Unwinder Servo Status Monitor *)
Z19:=stUnWinderAxis.StartIO;
Z18:=(stUnWinderAxis.AxisNo-1)*100;
```

Indexes the start I/O number and axis number for specifying the buffer memory addresses of the Simple Motion module of the unwinder axis.

```
IF U0Z19¥G2477Z18.7 THEN
    wUnwdSvSt:=2;//Alarm
ELSIF U0Z19¥G2477Z18.1 THEN
    wUnwdSvSt:=1;//Servo ON
ELSE
    wUnwdSvSt:=0;
END_IF;
```

Un\G2477: Md.108 Servo status 1

Servo state of unwinder (wUnwdSvSt)
Alarm: 2,
Servo ON: 1,
Servo OFF: 0

```
OUT(U0Z19¥G2477Z18.2 AND NOT U0Z19¥G2477Z18.3,bUnwdSvSpdMod);//Speed Mode
```

Unwinder in speed control mode

```
(* Main Axis Servo Status Monitor *)
Z19:=stLineAxis.StartIO;
Z18:=(stLineAxis.AxisNo-1)*100;
```

Indexes the start I/O number and axis number for specifying the buffer memory addresses of the Simple Motion module of the main axis.

```
IF U0Z19¥G2477Z18.7 THEN
    wLineSvSt:=2;//Alarm
ELSIF U0Z19¥G2477Z18.1 THEN
    wLineSvSt:=1;//Servo ON
ELSE
    wLineSvSt:=0;
END_IF;
```

Un\G2477: Md.108 Servo status 1

Servo state of main axis (wLineSvSt)
Alarm: 2,
Servo ON: 1,
Servo OFF: 0

```
OUT(U0Z19¥G2477Z18.2 AND NOT U0Z19¥G2477Z18.3,bLineSvSpdMod);//Speed Mode
```

Main axis in speed mode

```
(* Rewinder Axis Servo Status Monitor *)
Z19:=stWinderAxis.StartIO;
Z18:=(stWinderAxis.AxisNo-1)*100;
```

Indexes the start I/O number and axis number for specifying the buffer memory addresses of the Simple Motion module of the rewinder axis.

```
IF U0Z19¥G2477Z18.7 THEN
    wWdSvSt:=2;//Alarm
ELSIF U0Z19¥G2477Z18.1 THEN
    wWdSvSt:=1;//Servo ON
ELSE
    wWdSvSt:=0;
END_IF;
```

Un\G2477: Md.108 Servo status 1

Servo state of rewinder (wWdSvSt)
Alarm: 2,
Servo ON: 1,
Servo OFF: 0

```
OUT(NOT U0Z19¥G2477Z18.2 AND U0Z19¥G2477Z18.3,bWdSvTrqMod);//Torque Mode
```

Rewinder in torque control mode

```
fbWinderSpdMonitor.i_stAxisNo.AxisNo:=stWinderAxis.AxisNo;
fbWinderSpdMonitor.i_eGearRatio:=eWdGearRatio;
fbWinderSpdMonitor();
eWdSpdAct:=fbWinderSpdMonitor.o_eWinderActVelocity;//Rewinder Speed Monitor
```

Rewinder axis
Start of FB for monitoring the current velocity

```
eTensionCmdVal:=eWdTensionSetVal*eWdTensionTaperAct;//Command Tension Monitor
U0Z19¥G32779 := REAL_TO_INT(eWdTensionSetVal *10.0);//Target value of rewinder tension
```

Tension setting for the simulator

```
(* Edge Position Control Axis Servo Status Monitor *)
Z19:=stEdgePosAxis.StartIO;
Z18:=(stEdgePosAxis.AxisNo-1)*100;

IF U0Z19¥G2477Z18.7 THEN
    wEgPosCtrlSvSt:=2;//Alarm
    ELSIF U0Z19¥G2477Z18.1 THEN
    wEgPosCtrlSvSt:=1;//Servo ON
    ELSE
    wEgPosCtrlSvSt:=0;
END_IF;
OUT(U0Z19¥G2477Z18.2 AND NOT U0Z19¥G2477Z18.3,bEgPosCtrlSpdMod);//Speed Mode

DFROM(TRUE,stEdgePosAxis.StartIO,(2400+(stEdgePosAxis.AxisNo-1)*100),1,dEgPosCtrlPosActVal);
eEgPosCtrlPosActVal:=DINT_TO_REAL(dEgPosCtrlPosActVal)/10000.0;//Position Monitor

(* Load index registers *)
Z19:=wBkp_Z19;
Z18:=wBkp_Z18;

//////////////// Control data Set ///////////////
(* Winder Control *)
stWinderCtrl.eWinderRatedTrq:=eWdRatedTrq;
stWinderCtrl.eWinderGearRatio:=eWdGearRatio;
```

Indexes the start I/O number and axis number for specifying the buffer memory addresses of the Simple Motion module of the edge position axis.

Un\G2477: Md.108 Servo status 1
Edge position axis status (wEgPosCtrlSvSt)
Alarm: 2,
Servo ON: 1,
Servo OFF: 0

Edge position axis in speed control mode

Edge position axis Current value monitor

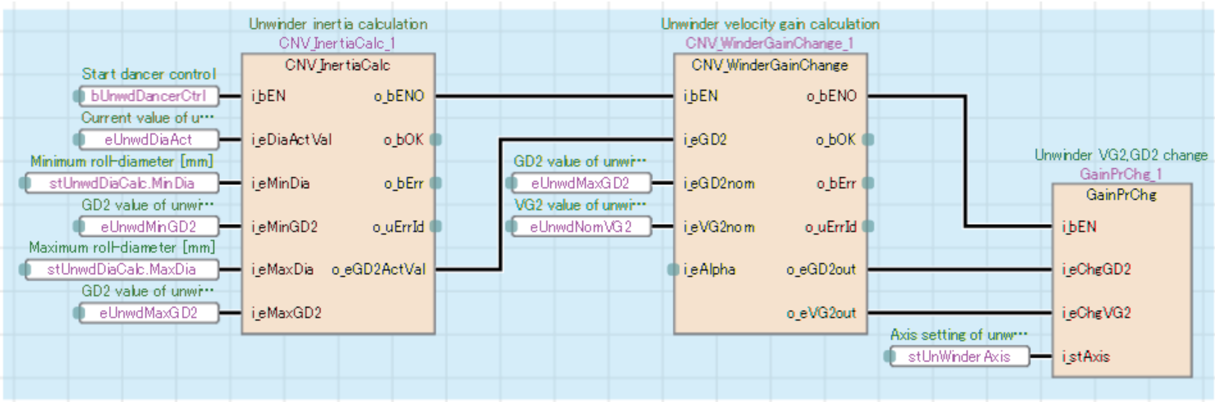
Reads the backed up index register values.

Inputs the rated torque and gear ratio of the rewinder axis.

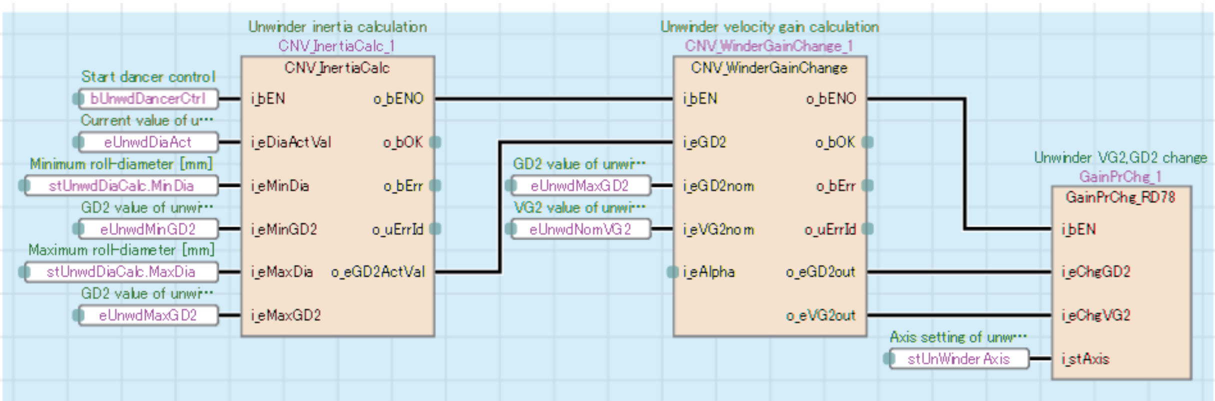
UnWinderGainChange (Unwinder axis gain change)

The velocity gain of the servo parameter is changed according to the load inertia change caused by the roll diameter change in the unwinder axis.

[RD77MS, RD77GF]

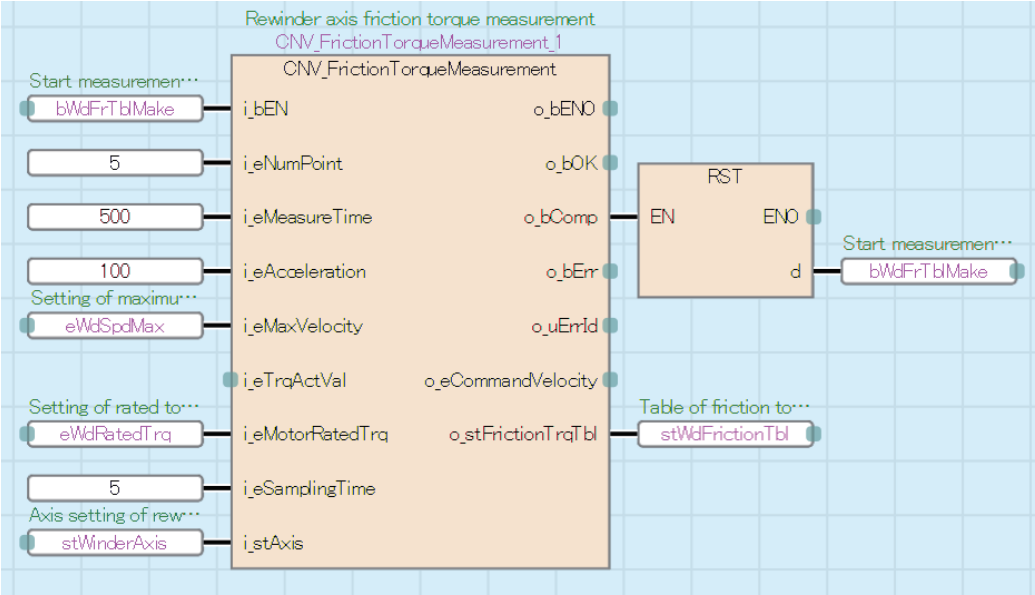


[RD78G(S)]



FrictionTorqueMeasurement (Rewinder axis mechanical loss torque measurement)

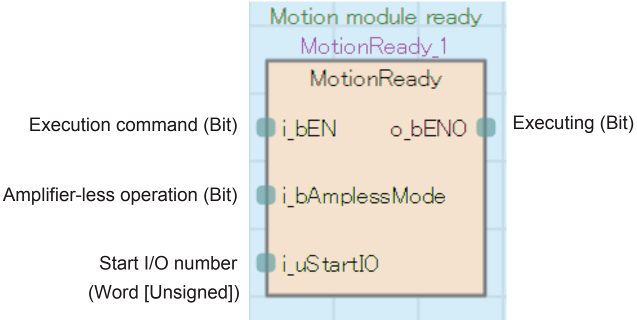
When the START switch (bWdFrTblMake) in the GOT screen is touched, the torque of the rewinder axis is measured without rolls installed (five points of up to the maximum rotation speed) and the torque table for mechanical loss torque compensation is created.



ExamplePrgCtrl FB

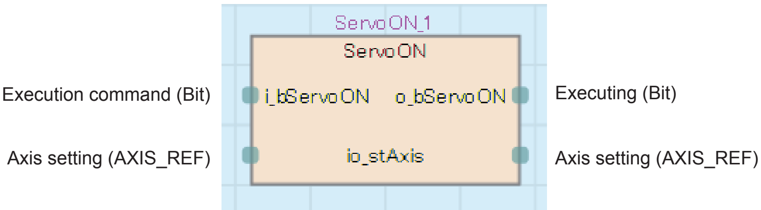
MotionReady

This FB starts the Simple Motion module for the start I/O number setting.
To perform the amplifier-less operation, turn on i_bAmplessMode to start the module.
However, this FB does not support the amplifier-less operation of the RD78G(S).



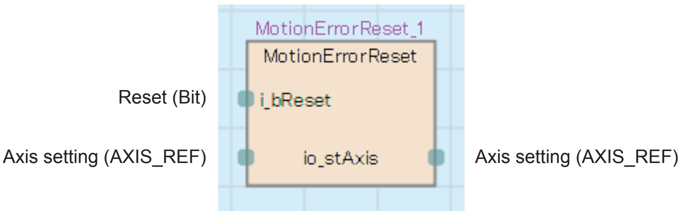
ServoON

This FB performs the servo ON processing for the corresponding axis in the axis setting.



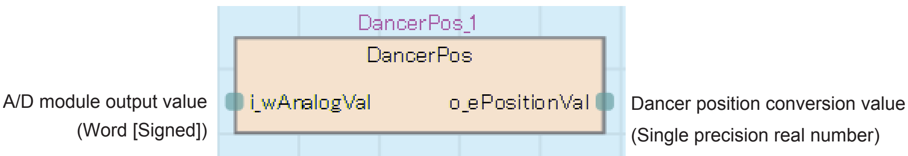
MotionErrorReset

This FB performs the motion error reset processing for the corresponding axis in the axis setting.



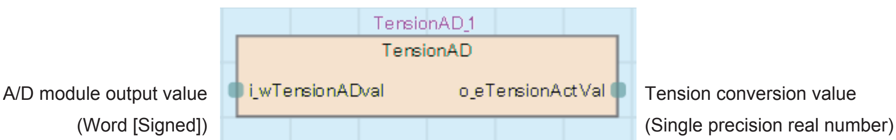
DancerPos

This FB converts an A/D output value into a dancer position (single precision real number).



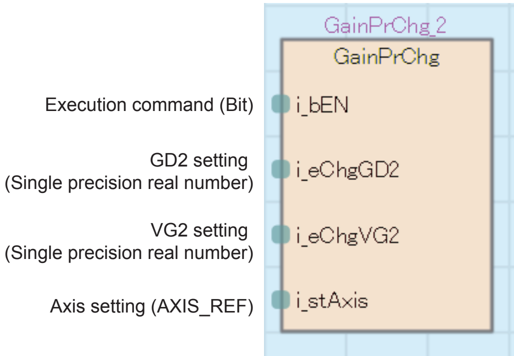
TensionAD

This FB converts an A/D output value into a tension value (single precision real number).



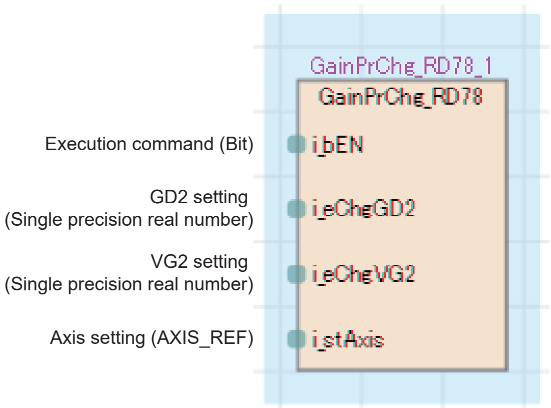
GainPrChg

In the RD77MS and RD77GF, this FB changes the values in the servo parameter PB06 (Ratio of load inertia moment GD2) and PB09 (Velocity gain VG2) of the corresponding axis in the axis setting to set values.



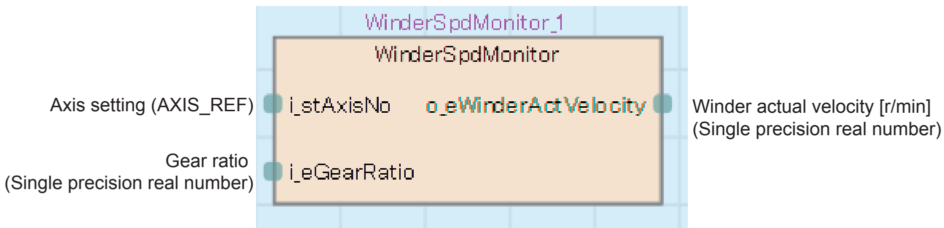
GainPrChg_RD78

In the RD78G(S), this FB changes the values in the servo parameter PB06 (Ratio of load inertia moment GD2) and PB09 (Velocity gain VG2) of the corresponding axis in the axis setting to set values.



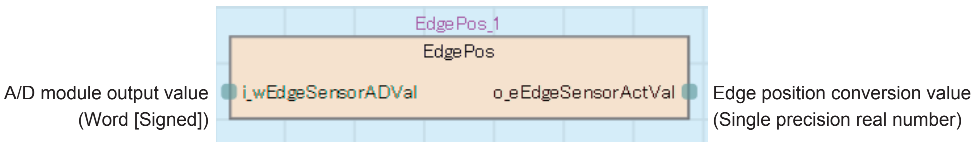
WinderSpdMonitor

This FB calculates the current rewinder velocity of the rewinder axis of the corresponding axis in the axis setting.



EdgePos

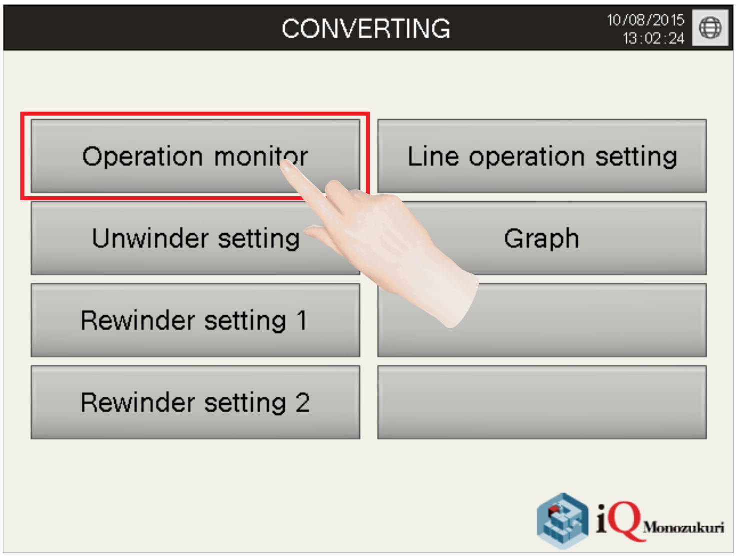
This FB converts an A/D output value into an edge position (single precision real number).



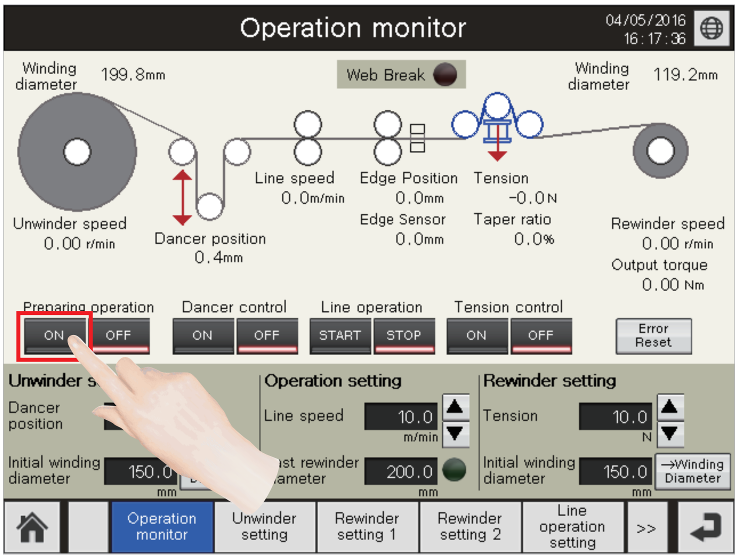
Operation procedure

Start the operation with the following procedure.

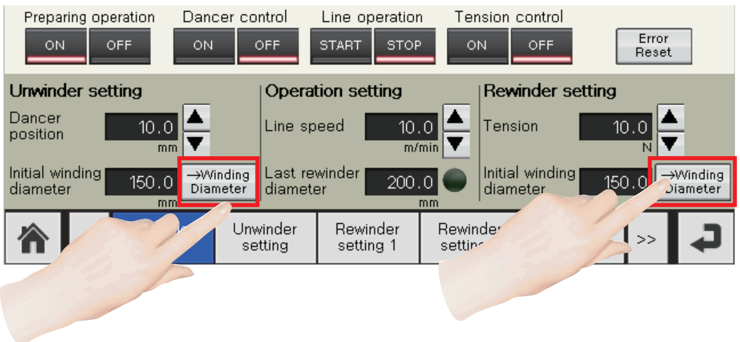
(For the function details of windows, refer to "6 GOT APPLICATION SCREEN EXAMPLES".)



1. Write project data to the PLC CPU and GOT and start the system. Touch the Operation monitor window.

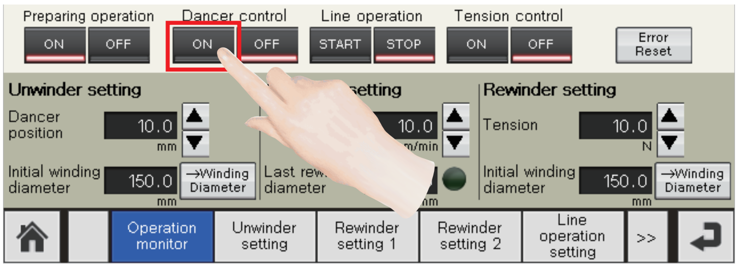


2. Touch the [ON] switch of Preparing operation. Turning on of Preparing operation sets all axis in the servo-on status and starts the main axis in the speed control mode.

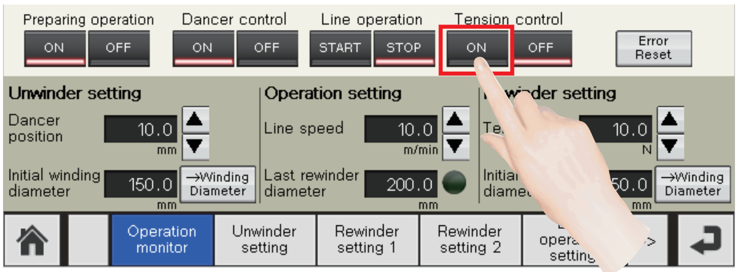


3. Touch the [→Winding Diameter] switch. The initial winding diameter is set as the winding diameter (current value).

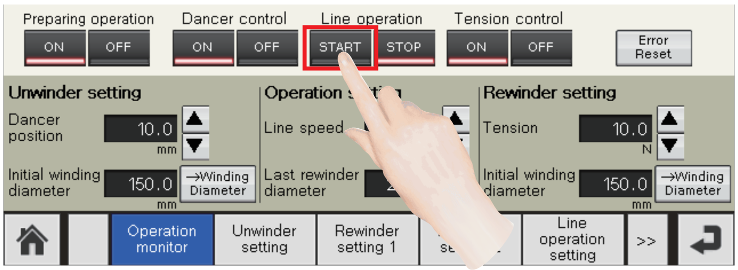
5



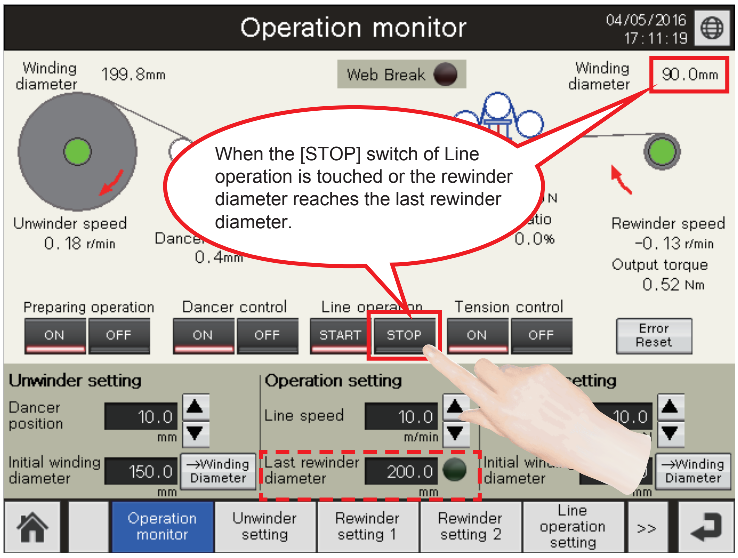
4. Touch the [ON] switch of Dancer control. Turning on of Dancer control starts the unwinder axis in the speed control mode and moves the dancer to the set position.



5. Touch the [ON] switch of Tension control. Turning on of Tension control starts the rewinder axis in the torque control mode and sets the tension setting value as the set tension.



6. Touch the [START] switch of Line operation. The operation starts at the set line speed and the edge position control starts in the speed control mode.



7. The line operation stops when the [STOP] switch of Line operation is touched or the rewinder diameter reaches the last rewinder diameter.

5.4 Reel Change

An unwinder axis and a turret axis for the roll change are added in the [Basic] system for this control.
The project of the provided program example contains the program for the reel change but it is a standby program. To use the reel change function, change the program setting.
Axis settings for the added two axes are not set. Configure the system setting/network setting, axis parameter setting, and positioning data setting of the Simple Motion module.

Control specifications

Axis operation specifications

Use the unwinder axis (Axis No. 1) as Unwinder axis A, and add Unwinder axis B and a turret turning axis.
Start the tension control by using a start signal. When the rewinder diameter reaches the set rewinding diameter, rotate the turret turning axis to replace the unwinder axis.

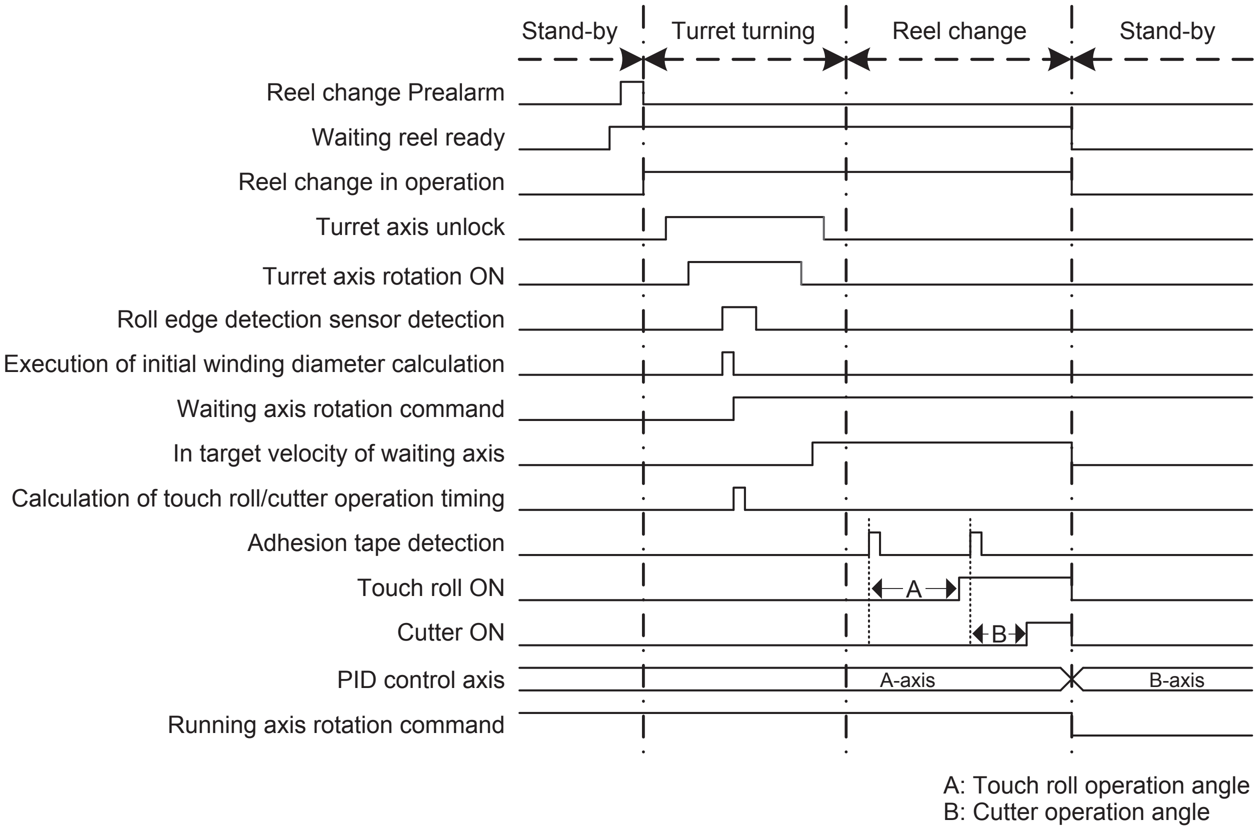
Item	Unwinder axis A	Unwinder axis B	Turret turning axis
Axis number	1	5	6
Control mode	Velocity	Velocity	Position
Detector	Dancer roll	Dancer roll	—
Tension gain auto tuning	○	○	—
Winding diameter calculation	Web thickness integration method	Web thickness integration method	—
Taper tension	None	None	—
Direction	Upper unwinding	Upper unwinding	—
Inertia compensation, friction compensation	—	—	—
Control cycle	0.888 ms (RD77MS)/1.0 ms (RD77GF)/1.0 ms (RD78G(S))		

I/O devices

The following table lists the I/O devices for each function.

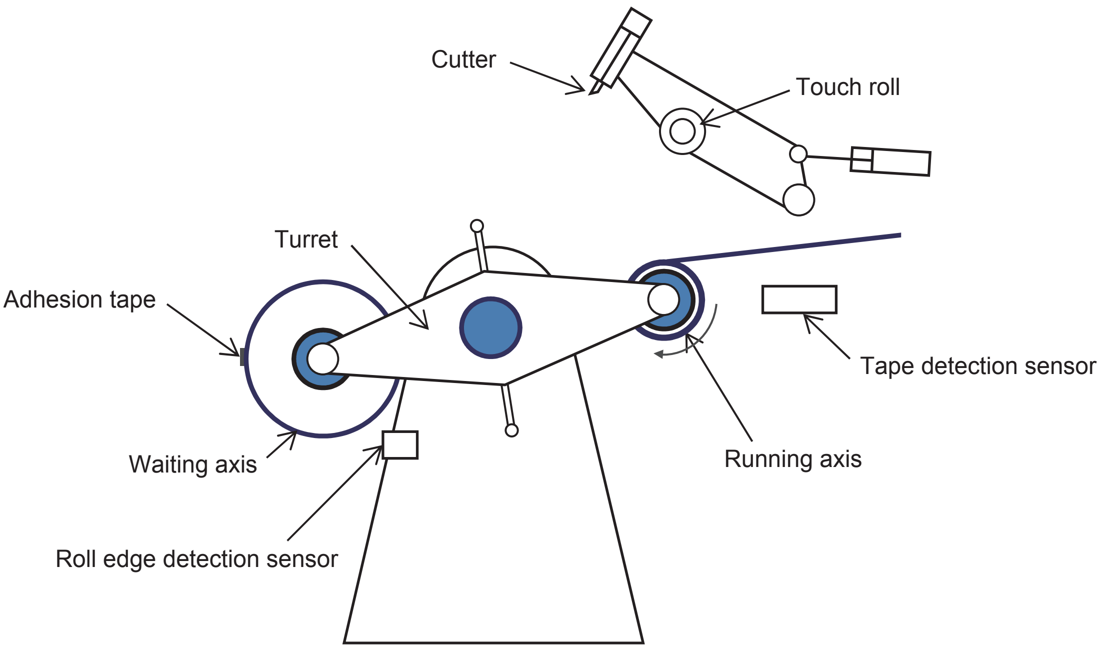
Type	Function	Device
Input	Roll edge detection sensor	X30
	Tape detection sensor	X31
Output	Turret axis unlock request	Y30
	Touch roll operation request	Y31
	Cutter operation request	Y32
	Reel change prealarm	Y33
	Reel change alarm output	Y34
	Paste / Cut warning	Y35
	Unwinder axis initial diameter calculation error	Y36
	Cutter operating information creation error	Y37

Operation timing

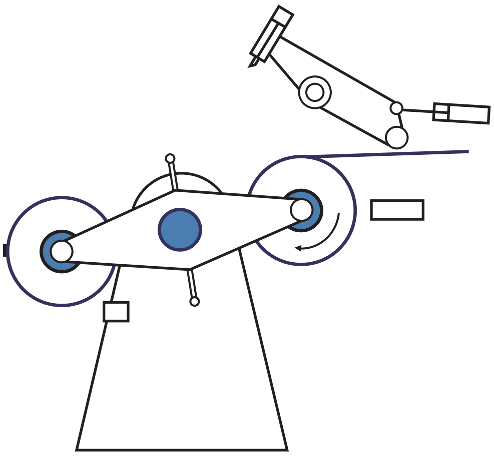
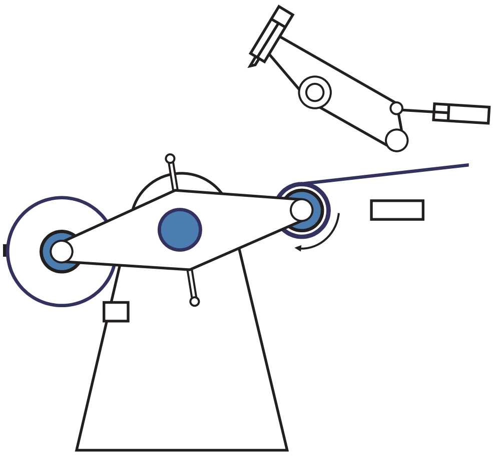
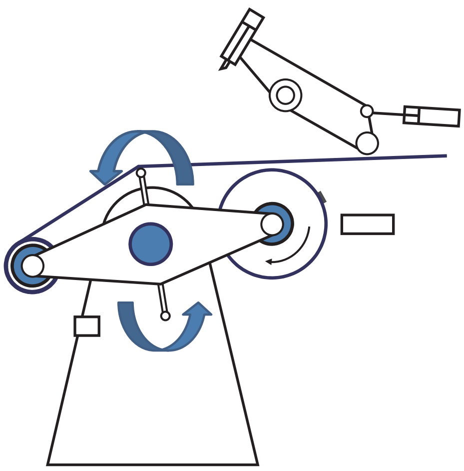


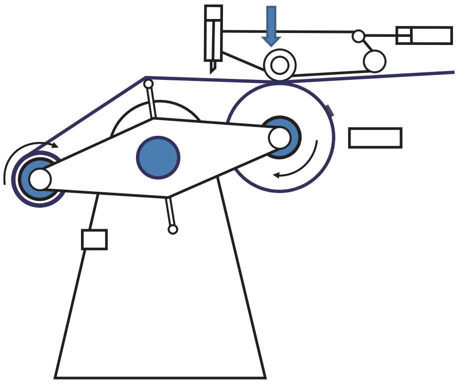
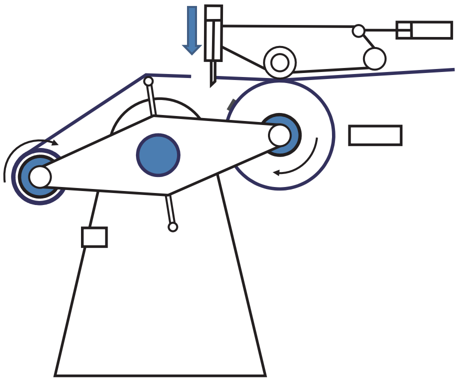
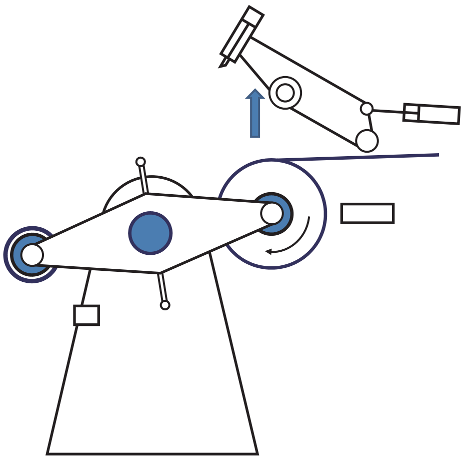
Procedure

The following figure shows the configuration of the reel change equipment.



The following describes the procedure for operating the reel change equipment.

Status	Operation figure	Description
Stand-by		1. During unwinding operation of the running axis • Set a new roll to the waiting axis and touch the [ON] switch of Waiting reel ready. • When the running axis diameter is equal to or smaller than the turn notification diameter, the PreAlarm lamp turns on.
Turret turning		2. Determination of the turret turning condition Determine whether to rotate the turret when the running axis diameter is equal to or smaller than the diameter at the start of the reel change or when the [Reel change forced execution] switch is touched. • When Waiting reel ready is on, the reel change operation is started and the reel change status changes to [Turret turning]. • When Waiting reel ready is off, the reel change operation is not performed and the line operation is stopped. The reel change status remains [Stand-by].
		3. Turret turning The equipment operates in the following order. 1) The Reel change start lamp turns on. 2) The turret lock is unlocked. 3) The turret axis starts rotating.
		4. Calculations of the waiting reel diameter and timing to descend the touch roll/cutter • After the turret axis starts rotating, the waiting axis diameter and the position to descend the touch roll/cutter (roll rotation position) are calculated. • The waiting axis starts rotating at a peripheral velocity corresponding to the line speed based on the calculated diameter.
		5. Determination of the turret turning completion The equipment operates in the following order. After completion of the operation, the reel change status changes to [Reel change]. 1) The turret rotates to the rotation end position and stops. 2) Lock the turret lock. The reel change operation can be stopped before completion of the turret rotation. When the operation is stopped, manually perform the required operations such as rotating and stopping of the turret operation.

Status	Operation figure	Description
Reel change		6. Touch roll operation The touch roll descends after the tape detection sensor turns on and the tape passes under the touch roll.
		7. Cutter operation After the touch roll descends in the step 6., the tape detection sensor operation triggers to rotate the waiting axis by the cutter operation angle and to cut a workpiece with the cutter. If the tape is not detected even after one revolution of the waiting axis after the touch roll descends, the cutter works because it determined that the adhesive tape has adhered to a workpiece. In this case, the paste/cut warning is displayed. (This warning occurs when the touch roll descends before the tape passes under the touch roll.)
		8. Post processing • Return the touch roll and cutter to their waiting positions. • Switch the PID control axis from the running axis to waiting axis. • Waiting reel ready turns off. • Decelerate and stop the running axis.[*1] • The start signal turns off. When the operation is completed, the reel change status changes to [Stand-by].
Stand-by	Same as the above	Return to step 1.. (The waiting axis and running axis are switched.)

*1 To safely perform the reel change in the waiting status, use the STO function of servo amplifiers.

Program configuration

Language

The following languages are used in this program.

- Program comment: English
- Label comment: Japanese, English, Chinese (Simplified)

List of programs

Program name	Description	Execution type	Describing method
InitialReelChange	Initial parameter setting	Initial	ST
ReelChange	Reel change	Event	Ladder
WinderControlReelChange	Tension control main processing: for reel change • Main axis control • Unwinder axis (running axis/waiting axis) control (speed control) • Rewinder axis control (torque control) • Edge position control • Web break detection	Event (I44) (RD77MS, RD77GF) Fixed cycle (1 ms) (RD78G(S))	FBD
PreOperationReelChange	Preparing operation, line operation control • Servo ON/OFF • Reset error • Start line operation	Scan	FBD
HMI_IFReelChange	Touch panel I/O processing	Scan	ST
UnWinderGainChange	Unwinder axis gain change	Scan	FBD
FrictionTorqueMeasurement	Rewinder axis mechanical loss torque measurement	Fixed cycle (5 ms)	FBD

FB

■CNV_TensionControl_R (Refer to "Page 47 FB LIBRARY".)

Item	FB name	Description	Program
Activation	CNV_Activation	License activation	PreOperationReelChange
Tension control	CNV_WinderDancerVelocityCtrl	Dancer feedback velocity control	WinderControlReelChange
	CNV_WinderTensionTorqueCtrl	Tension sensor feedback torque control	WinderControlReelChange
Velocity generator	CNV_LineVelocityGenerator	Line velocity generator	WinderControlReelChange
Roll diameter calculation	CNV_DiaCalcThickness	Roll diameter calculation (Web thickness integration method)	WinderControlReelChange
	CNV_DiaCalcFeed	Roll diameter calculation (Feeding length method)	WinderControlReelChange
Torque compensation	CNV_WinderInertiaTorque	Inertia compensation torque calculation	WinderControlReelChange
	CNV_InertiaCalc	Load inertia ratio calculation	UnWinderGainChange
	CNV_WinderFrictionTorque	Friction compensation value calculation	WinderControlReelChange
	CNV_FrictionTorqueMeasurement	Friction torque measurement	FrictionTorqueMeasurement
Tuning function	CNV_WinderGainChange	Gain change	UnWinderGainChange
	CNV_TaperTension	Taper tension calculation	WinderControlReelChange
	CNV_PIDControl	PID control (with tension PI gain auto tuning)	WinderControlReelChange
Additional function	CNV_EdgePositionCtrl	Edge position control	WinderControlReelChange
	CNV_WebBreakDetect	Web break detection	WinderControlReelChange
Filters	STD_Lowpass1	Low-pass filter	WinderControlReelChange
	STD_AverageValueFilter	Moving average filter	WinderControlReelChange
	STD_Limiter	Limiter	WinderControlReelChange
	STD_TableInterpolation	Table interpolation	WinderControlReelChange
	STD_RampGenerator	Ramp generator	WinderControlReelChange

■ExamplePrgCtrl (Refer to "Page 159 ExamplePrgCtrl FB".)

FB name	Description	Describing method	Program
MotionReady	Simple Motion module start processing	ST	PreOperationReelChange
ServoON	Servo ON processing	ST	PreOperationReelChange
MotionErrorReset	Error reset processing	ST	PreOperationReelChange
DancerPos	Dancer position A/D value conversion processing	ST	WinderControlReelChange
TensionAD	Tension detector A/D value conversion processing	ST	WinderControlReelChange
GainPrChg	Gain parameter servo amplifier write processing	ST	UnWinderGainChange
WinderSpdMonitor	Real rotation speed display processing (rewinder axis)	ST	WinderControlReelChange
EdgePos	A/D value conversion processing at the edge sensor detection position	ST	WinderControlReelChange

■ExamplePrgReelChange (Refer to "Page 183 ExamplePrgReelChange FB".)

FB name	Description	Describing method	Program
CalcTouchRollCutterAngle	Touch roll & cutter operating angle calculation	ST	WinderControlReelChange
DiaCalcTurretAngle	Roll diameter calculation (turret angle method)	ST	WinderControlReelChange

Parameter

Module information

To use the reel change, add the I/O module (RH42C4NT2P) with the slot No.2 and the start I/O number 0030H.

Precautions

To add a new module, setting the inter-module synchronization function to "Not Use" in "Inter-module Synchronization Setting" is required. Return the setting after adding a new module.

CPU parameter

■Program settings

To use the reel change program example, change the program execution type as follows.

[RD77MS, RD77GF]

Execute Order	Program Name	Execution Type		Refresh Group Setting	Device/File Use or not
		Type	Detailed Setting Information		
1	Initial	Initial		(Do not Set)	<Detailed Setting>
2	WinderControl	Event	Interrupt:I44	(Do not Set)	<Detailed Setting>
3	PreOperation	Scan		(Do not Set)	<Detailed Setting>
4	UnWinderGainChange	Scan		(Do not Set)	<Detailed Setting>
5	HMI_IF	Scan		(Do not Set)	<Detailed Setting>
6	FrictionTorqueMeasurement	Fixed Scan	5ms	(Do not Set)	<Detailed Setting>
7	InitialReelChange	Standby		(Do not Set)	<Detailed Setting>
8	WinderControlReelChange	Standby		(Do not Set)	<Detailed Setting>
9	PreOperationReelChange	Standby		(Do not Set)	<Detailed Setting>
10	HMI_IFReelChange	Standby		(Do not Set)	<Detailed Setting>
11					

Execute Order	Program Name	Execution Type		Refresh Group Setting	Device/File Use or not
		Type	Detailed Setting Information		
1	Initial	Standby		(Do not Set)	<Detailed Setting>
2	WinderControl	Standby		(Do not Set)	<Detailed Setting>
3	PreOperation	Standby		(Do not Set)	<Detailed Setting>
4	UnWinderGainChange	Scan		(Do not Set)	<Detailed Setting>
5	HMI_IF	Standby		(Do not Set)	<Detailed Setting>
6	FrictionTorqueMeasurement	Fixed Scan	5ms	(Do not Set)	<Detailed Setting>
7	InitialReelChange	Initial		(Do not Set)	<Detailed Setting>
8	WinderControlReelChange	Event	Interrupt:I44	(Do not Set)	<Detailed Setting>
9	PreOperationReelChange	Scan		(Do not Set)	<Detailed Setting>
10	HMI_IFReelChange	Scan		(Do not Set)	<Detailed Setting>
11					

[RD78G(S)]

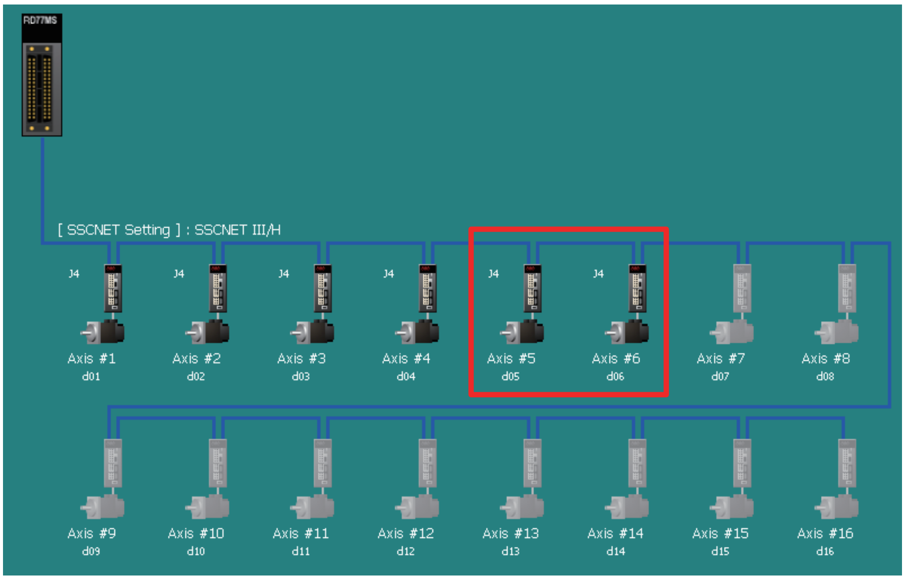
Execute Order	Program Name	Execution Type		Refresh Group Setting	Device/File Use or not
		Type	Detailed Setting Information		
1	Initial	Initial		(Do not Set)	<Detailed Setting>
2	WinderControl	Fixed Scan	1ms	(Do not Set)	<Detailed Setting>
3	PreOperation	Scan		(Do not Set)	<Detailed Setting>
4	UnWinderGainChange	Scan		(Do not Set)	<Detailed Setting>
5	HMI_IF	Scan		(Do not Set)	<Detailed Setting>
6	FrictionTorqueMeasurement	Fixed Scan	5ms	(Do not Set)	<Detailed Setting>
7	InitialReelChange	Standby		(Do not Set)	<Detailed Setting>
8	HMI_IFReelChange	Standby		(Do not Set)	<Detailed Setting>
9	PreOperationReelChange	Standby		(Do not Set)	<Detailed Setting>
10	WinderControlReelChange	Standby		(Do not Set)	<Detailed Setting>
11					

Execute Order	Program Name	Execution Type		Refresh Group Setting	Device/File Use or not
		Type	Detailed Setting Information		
1	Initial	Standby		(Do not Set)	<Detailed Setting>
2	WinderControl	Standby		(Do not Set)	<Detailed Setting>
3	PreOperation	Standby		(Do not Set)	<Detailed Setting>
4	UnWinderGainChange	Scan		(Do not Set)	<Detailed Setting>
5	HMI_IF	Standby		(Do not Set)	<Detailed Setting>
6	FrictionTorqueMeasurement	Fixed Scan	5ms	(Do not Set)	<Detailed Setting>
7	InitialReelChange	Initial		(Do not Set)	<Detailed Setting>
8	HMI_IFReelChange	Fixed Scan	1ms	(Do not Set)	<Detailed Setting>
9	PreOperationReelChange	Scan		(Do not Set)	<Detailed Setting>
10	WinderControlReelChange	Scan		(Do not Set)	<Detailed Setting>
11					

Adding the axis settings

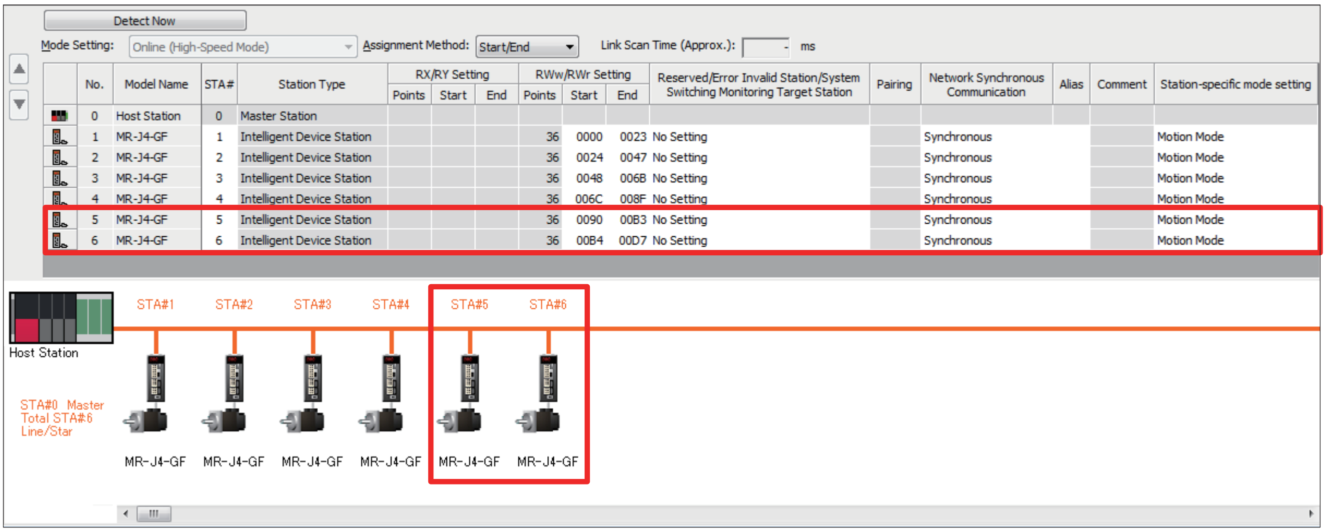
■AP20-CNV002AA-R16-77MS16_****.gx3 (SSCNETⅢ/H)

Add Axis 5 (Unwinder axis B) and Axis 6 (Turret axis) in the system setting of the Simple Motion module setting as follows.



■AP20-CNV002AA-R16-77GF16_****.gx3 (CC-Link IE Field)

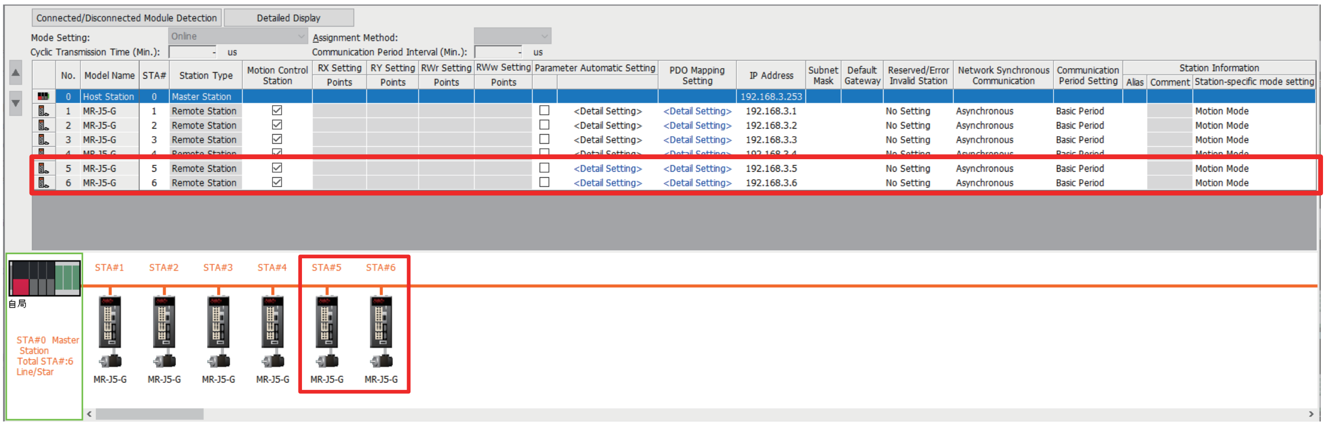
Add Axis 5 (Unwinder axis B) and Axis 6 (Turret axis) in the network configuration settings as follows.



No.	Model Name	STA#	Station Type	RX/RY Setting Points	RX/RY Setting Start	RX/RY Setting End	RWw/RWr Setting Points	RWw/RWr Setting Start	RWw/RWr Setting End	Reserved/Error Invalid Station/System Switching Monitoring Target Station	Pairing	Network Synchronous Communication	Alias	Comment	Station-specific mode setting
0	Host Station	0	Master Station												
1	MR-J4-GF	1	Intelligent Device Station				36	0000	0023	No Setting		Synchronous			Motion Mode
2	MR-J4-GF	2	Intelligent Device Station				36	0024	0047	No Setting		Synchronous			Motion Mode
3	MR-J4-GF	3	Intelligent Device Station				36	0048	006B	No Setting		Synchronous			Motion Mode
4	MR-J4-GF	4	Intelligent Device Station				36	006C	008F	No Setting		Synchronous			Motion Mode
5	MR-J4-GF	5	Intelligent Device Station				36	0090	00B3	No Setting		Synchronous			Motion Mode
6	MR-J4-GF	6	Intelligent Device Station				36	00B4	00D7	No Setting		Synchronous			Motion Mode

■AP20-CNV002AA-R16-78G16_****.gx3 (CC-Link IE TSN)

Add Axis 5 (Unwinder axis B) and Axis 6 (Turret axis) in the network configuration settings as follows.



■Parameter, positioning data

This following shows the positioning data and parameters that need to be changed from their default values for Axis 5 and Axis 6 to be added for the reel change program example.

Precautions

In this application program, the emergency stop and limit function with external signals are disabled. To utilize this application program, change the settings depending on the system used.

- AP20-CNV002AA-R16-77MS16_****.gx3 (SSCNETⅢ/H)

Item	Axis #5	Axis #6
Common parameters	**The parameter does not rely on axis and relate to the whole system.**	
Pr.82:Forced stop valid/invalid selection	1:Invalid	
Pr.24:Manual pulse generator/Incremental Sync. ENC input selection	0:A-phase/B-phase Mode (4 Multiply)	
Pr.89:Manual pulse generator/Incremental Sync. ENC input type selection	1:Voltage Output/Open Collector Type	
Pr.96:Operation cycle setting	0000h:0.888ms	
Pr.97:SSCNET Setting	1:SSCNET III/H	
Pr.150:Input terminal logic selection	**Set the logic of external input signal (upper/lower limit signal, stop signal, proximity dog signal, external com...**	
Pr.151:Manual pulse generator/Incremental Sync. ENC input logic selection	0:Negative Logic	
Pr.152:Maximum number of control axes	0	
Pr.153:External input signal digital filter setting	**Set digital filter for each input signal.**	
Pr.155:Q series compatible function setting	**Set valid/invalid for Q series compatible function.**	
Basic parameters 1	**Set according to the machine and applicable motor when system is started up (It will be valid according to PL...**	
Pr.1:Unit setting	0:mm	2:degree
Pr.2:Number of pulses per rotation	4194304 pulse	4194304 pulse
Pr.3:Movement amount per rotation	1000.0 μm	72.00000 degree
Pr.4:Unit magnification	1:x1 Times	1:x1 Times
Pr.7:Bias speed at start	0.00 mm/min	0.000 degree/min
Basic parameters 2	**Set according to the machine and applicable motor when system is started up.**	
Pr.8:Speed limit value	200.00 mm/min	144000.000 degree/min
Pr.9:Acceleration time 0	1000 ms	1000 ms
Pr.10:Deceleration time 0	1000 ms	1000 ms
Detailed parameters 1	**Set according to the system configuration when the system is started up.(It will be valid according to PLC rea...**	
Pr.11:Backlash compensation amount	0.0 μm	0.00000 degree
Pr.12:Software stroke limit upper limit value	0.0 μm	0.00000 degree
Pr.13:Software stroke limit lower limit value	0.0 μm	0.00000 degree
Pr.14:Software stroke limit selection	0:Apply Software Stroke Limit on Feed Current Value	0:Apply Software Stroke Limit on Feed Current Value
Pr.15:Software stroke limit valid/invalid setting	1:Invalid	0:Valid
Pr.16:Command in-position width	10.0 μm	0.10000 degree
Pr.17:Torque limit setting value	300.0 %	300.0 %
⋮	⋮	⋮
Pr.81:Speed-position function selection	0:Speed-position Switching Control (INC Mode)	0:Speed-position Switching Control (INC Mode)
Pr.116:FLS signal selection : Input type	15:Invalid	15:Invalid
Pr.116:FLS signal selection : Input terminal	00h:No Setting	00h:No Setting
Pr.117:RLS signal selection : Input type	15:Invalid	15:Invalid
Pr.117:RLS signal selection : Input terminal	00h:No Setting	00h:No Setting
Pr.118:DOG signal selection : Input type	15:Invalid	15:Invalid
Pr.118:DOG signal selection : Input terminal	00h:No Setting	00h:No Setting
Pr.119:STOP signal selection : Input type	15:Invalid	15:Invalid
Pr.119:STOP signal selection : Input terminal	00h:No Setting	00h:No Setting
Detailed parameters 2	**Set according to the system configuration when the system is started up(Set as required).**	
Pr.25:Acceleration time 1	1000 ms	1000 ms
Pr.26:Acceleration time 2	1000 ms	1000 ms
Pr.27:Acceleration time 3	1000 ms	1000 ms
Pr.28:Deceleration time 1	1000 ms	1000 ms
Pr.29:Deceleration time 2	1000 ms	1000 ms
Pr.30:Deceleration time 3	1000 ms	1000 ms
Pr.31:JOG speed limit value	200.00 mm/min	360.000 degree/min
Pr.32:JOG operation acceleration time selection	0:1000	0:1000
⋮	⋮	⋮
HPR basic parameters	**Set the values required for carrying out HPR control (Valid when the PLC ready signals ON).**	
Pr.43:HPR method	0:Proximity Dog Method	6:Data Set Method
Pr.44:HPR direction	0:Forward Direction (Address Increase Direction)	0:Forward Direction (Address Increase Direction)
Pr.45:HP address	0.0 μm	0.00000 degree
Pr.46:HPR speed	0.01 mm/min	0.001 degree/min
Pr.47:Creep speed	0.01 mm/min	0.001 degree/min
Pr.48:HPR retry	0:Do Not Retry HPR with Limit Switch	0:Do Not Retry HPR with Limit Switch
HPR detailed parameters	**Set the values required for carrying out HPR control (Valid when the PLC ready signals ON).**	
Pr.50:Setting for the movement amount after proximity dog ON	0.0 μm	0.00000 degree
Pr.51:HPR acceleration time selection	0:1000	0:1000
Pr.52:HPR deceleration time selection	0:1000	0:1000
Pr.53:HP shift amount	0.0 μm	0.00000 degree
Pr.54:HPR torque limit value	300.0 %	300.0 %
Pr.55:Operation setting for incompletion of HPR	1:Positioning Control is Executed	1:Positioning Control is Executed

• AP20-CNV002AA-R16-77GF16_****.gx3 (CC-Link IE Field)

Item	Axis #5	Axis #6
Common parameters	The parameter does not rely on axis and relate to the whole system.	
Pr.82:Forced stop valid/invalid selection	1:Invalid	
Pr.96:Operation cycle setting	0022h:1.00ms	
Pr.152:Maximum number of control axes	0	
Basic parameters 1	Set according to the machine and applicable motor when system is started up (It will be valid according to PLC rea	
Pr.100:Connected device	MR-J4-GF	MR-J4-GF
Pr.101:Virtual servo amplifier setting	0:Use Real Servo Amplifier	0:Use Real Servo Amplifier
Pr.1:Unit setting	0:mm	2:degree
Pr.2:Number of pulses per rotation	41943040 pulse	4194304 pulse
Pr.3:Movement amount per rotation	1000.0 µm	72.00000 degree
Pr.4:Unit magnification	1:x1 Times	1:x1 Times
Pr.7:Bias speed at start	0.00 mm/min	0.000 degree/min
Basic parameters 2	Set according to the machine and applicable motor when system is started up.	
Pr.8:Speed limit value	200.00 mm/min	144000.000 degree/min
Pr.9:Acceleration time 0	1000 ms	1000 ms
Pr.10:Deceleration time 0	1000 ms	1000 ms
Detailed parameters 1	Set according to the system configuration when the system is started up.(It will be valid according to PLC ready si	
Pr.11:Backlash compensation amount	0.0 µm	0.00000 degree
Pr.12:Software stroke limit upper limit value	0.0 µm	0.00000 degree
Pr.13:Software stroke limit lower limit value	0.0 µm	0.00000 degree
Pr.14:Software stroke limit selection	0:Apply Software Stroke Limit on Feed Current Value	0:Apply Software Stroke Limit on Feed Current Value
Pr.15:Software stroke limit valid/invalid setting	1:Invalid	0:Valid
Pr.16:Command in-position width	10.0 µm	0.10000 degree
Pr.17:Torque limit setting value	300.0 %	300.0 %
⋮	⋮	⋮
Pr.119:STOP signal selection : Input type	2:Buffer Memory	2:Buffer Memory
Detailed parameters 2	Set according to the system configuration when the system is started up(Set as required).	
Pr.25:Acceleration time 1	1000 ms	1000 ms
Pr.26:Acceleration time 2	1000 ms	1000 ms
Pr.27:Acceleration time 3	1000 ms	1000 ms
Pr.28:Deceleration time 1	1000 ms	1000 ms
Pr.29:Deceleration time 2	1000 ms	1000 ms
Pr.30:Deceleration time 3	1000 ms	1000 ms
Pr.31:JOG speed limit value	200.00 mm/min	360.000 degree/min
Pr.32:JOG operation acceleration time selection	0:1000	0:1000
Pr.33:JOG operation deceleration time selection	0:1000	0:1000
⋮	⋮	⋮
HPR parameters	Set the parameters required for HPR, which are not set on the driver (servo amplifier) side (Valid when the PLC re	
Pr.44:HPR direction	0:Forward Direction (Address Increase Direction)	0:Forward Direction (Address Increase Direction)
Pr.45:HP address	0.0 µm	0.00000 degree
Pr.46:HPR speed	0.01 mm/min	0.001 degree/min
Pr.51:HPR acceleration time selection	0:1000	0:1000
Pr.52:HPR deceleration time selection	0:1000	0:1000
Pr.55:Operation setting for incompletion of HPR	1:Positioning Control is Executed	1:Positioning Control is Executed

• AP20-CNV002AA-R16-78G16_****.gx3 (CC-Link IE TSN)

Item	Axis #5	Axis #6
Common parameters	The parameter does not rely on axis and relate to the whole system.	
Pr.82:Forced stop valid/invalid selection	1:Invalid	
Pr.152:Maximum number of control axes	0	
Pr.156:Manual pulse generator smoothing time constant	0 ms	
Servo network composition parameters	Set the device to be used and the network according to the system configuration. (It will be valid after the p	
Connected device	MR-J5-G	MR-J5-G
Pr.141:IP address specification	192.168.3.5	192.168.3.6
Pr.142:Multidrop number	0	0
Pr.101:Virtual servo amplifier setting	0:Use Real Servo Amplifier	0:Use Real Servo Amplifier
Pr.140:Driver command discard detection setting	1:Detection Valid	1:Detection Valid
Basic parameters 1	Set according to the machine and applicable motor when system is started up (It will be valid according to F	
Pr.1:Unit setting	0:mm	2:degree
Pr.2:Number of pulses per rotation	41943040 pulse	4194304 pulse
Pr.3:Movement amount per rotation	1000.0 µm	72.00000 degree
Pr.4:Unit magnification	1:x1 Times	1:x1 Times
Pr.7:Bias speed at start	0.00 mm/min	0.000 degree/min
Basic parameters 2	Set according to the machine and applicable motor when system is started up.	
Pr.8:Speed limit value	200.00 mm/min	144000.000 degree/min
Pr.9:Acceleration time 0	1000 ms	1000 ms
Pr.10:Deceleration time 0	1000 ms	1000 ms
Detailed parameters 1	Set according to the system configuration when the system is started up.(It will be valid according to PLC re	
Pr.11:Backlash compensation amount	0.0 µm	0.00000 degree
Pr.12:Software stroke limit upper limit value	0.0 µm	0.00000 degree
Pr.13:Software stroke limit lower limit value	0.0 µm	0.00000 degree
Pr.14:Software stroke limit selection	0:Apply Software Stroke Limit on Feed Current Value	0:Apply Software Stroke Limit on Feed Current Value
Pr.15:Software stroke limit valid/invalid setting	1:Invalid	0:Valid
Pr.16:Command in-position width	10.0 µm	0.10000 degree
Pr.17:Torque limit setting value	300.0 %	300.0 %
⋮	⋮	⋮
Pr.81:Speed-position function selection	0:Speed-position Switching Control (INC Mode)	0:Speed-position Switching Control (INC Mode)
Pr.116:FLS signal selection : Input type	15:Invalid	15:Invalid
Pr.117:RLS signal selection : Input type	15:Invalid	15:Invalid
Pr.118:DOG signal selection : Input type	15:Invalid	15:Invalid
Pr.119:STOP signal selection : Input type	15:Invalid	15:Invalid
Detailed parameters 2	Set according to the system configuration when the system is started up(Set as required).	
Pr.25:Acceleration time 1	1000 ms	1000 ms
Pr.26:Acceleration time 2	1000 ms	1000 ms
Pr.27:Acceleration time 3	1000 ms	1000 ms
Pr.28:Deceleration time 1	1000 ms	1000 ms
Pr.29:Deceleration time 2	1000 ms	1000 ms
Pr.30:Deceleration time 3	1000 ms	1000 ms
Pr.31:JOG speed limit value	200.00 mm/min	360.000 degree/min
Pr.32:JOG operation acceleration time selection	0:1000	0:1000
⋮	⋮	⋮
HPR basic parameters	Set the values required for carrying out HPR control (Valid when the PLC ready signals ON).	
Pr.44:HPR direction	0:Forward Direction (Address Increase Direction)	0:Forward Direction (Address Increase Direction)
Pr.45:HP address	0 pulse	0 pulse
Pr.46:HPR speed	1 pulse/s	1 pulse/s
Pr.51:HPR acceleration time selection	0:1000	0:1000
Pr.52:HPR deceleration time selection	0:1000	0:1000
Pr.55:Operation setting for incompletion of HPR	1:Positioning Control is Executed	1:Positioning Control is Executed

• Positioning data of Axis 6

No.	Operation pattern	Control method	Axis to be interpolated	Acceleration time No.	Deceleration time No.	Positioning address	Arc address	Command speed	Dwell time	M-code	M-code ON signal output timing	ABS direction in degrees	Interpolation speed designation method
1	0:END	01h:ABS Linear 1	-	0:1000	0:1000	180.00000 degree	0.00000 degree	1080.000 degree/min	0 ms	0	0:Use the setting value of M-code ON signal output timing	1:ABS Clockwise	0:Use the setting value of Interpolation speed designation method
	<Positioning Comment>												
2	0:END	01h:ABS Linear 1	-	0:1000	0:1000	0.00000 degree	0.00000 degree	1080.000 degree/min	0 ms	0	0:Use the setting value of M-code ON signal output timing	1:ABS Clockwise	0:Use the setting value of Interpolation speed designation method
	<Positioning Comment>												
3													
	<Positioning Comment>												

Program processing

InitialReelChange (Initial parameter setting)

Set event task starts, each variable's initial value, and constants.

The running axis is handled as A-axis and the waiting axis is handled as B-axis at power-on.

- Setting of execution cycle
- Setting of unwinder axis
- Setting of main axis
- Setting of rewinder axis
- Setting of edge position axis
- Web break detection parameter
- Setting of unwinder axis (A-axis/B-axis)
- Setting of turret axis
- Setting of reel change

ReelChange (Reel Change)

Two axes are controlled as the unwinding waiting axis and unwinding running axis.

This program operates the turret turning axis, turret lock, touch roll, and auxiliary of cutter required for the reel change operation are operated.

During automatic operation, the PreAlarm signal is output when the winding diameter is smaller than "Turn notification diameter". When the winding diameter is smaller than "Diameter at reel change start", the reel change operation is automatically started.

During manual operation, the reel change function is unavailable. Maintenance operations such as JOG operation and turret unlock can be performed.

The following shows the program processing of the reel change.

The input operation and display on the GOT is described in [ ].

Processing	Description
Preparing operation control of unwinder axis A (Preparing operation control of unwinder axis B)	Performs the following processing (1) to (4). (1) Preparing operation Turns on/off the preparing operation of the unwinder axis A with Preparing operation [ON]/[OFF]. (2) Automatic operation mode (The unwinder axis A is the unwinding waiting axis.) Turns on/off the preparing operation of the unwinder axis A with A-axis [ON]/[OFF] of Servo ON/OFF. (3) Automatic operation mode (The unwinder axis A is the unwinding running axis.) The preparing operation of the unwinder axis A is always on. (The A axis [ON]/[OFF] operation of Servo ON/OFF is ignored.) (4) Manual operation mode Turns on/off the preparing operation of the unwinder axis A with A-axis [ON]/[OFF] of Servo ON/OFF. (For the preparing operation control of the unwinder axis B, replace A with B in the above description.)
Preparing operation control of turret axis	Performs the following processing (1) to (3). (1) Preparing operation Turns on/off the preparing operation of the turret axis with Preparing operation [ON]/[OFF]. (2) Manual operation mode The preparing operation of the turret axis is always on. (The turret [ON]/[OFF] operation of Servo ON/OFF is ignored.) (3) Manual operation mode Turns on/off the preparing operation of the turret axis with Preparing operation [ON]/[OFF] of Servo ON/OFF.
Unwinder axis A JOG operation (Unwinder axis B JOG operation)	When the following condition is satisfied, the operation of JOG operation A-axis [Forward]/[Reverse] sets the JOG speed of the unwinder axis A and turns on the forward/reverse command. • When the unwinder axis A is not under the dancer control (For the JOG operation of the unwinder axis B, replace A with B in the above description.)
Turret axis JOG operation	When all of the following conditions are satisfied, the operation of turret [Forward]/[Reverse] sets the JOG speed of the turret and turns on the forward/reverse command. • The turret unlock output is on. • Operation mode [Manual]

Processing	Description
Operation mode setting	Performs the following processing (1) and (2). (1) Automatic operation mode switching Switches the operation mode to [Auto] when the following conditions are satisfied. • Operation mode [Auto] • The turret lock of the auxiliary is [Lock]. • The touch roll of the auxiliary is [Up]. • The cutter of the auxiliary is [Up]. • The unwinder running axis is in the servo-on status. • The turret axis is in the servo-on status. (2) Manual operation mode switching Switches the operation mode to [Manual] when the following conditions are satisfied. • Operation mode [Auto]
Automatic mode initialization	When the following condition is satisfied, Waiting reel ready is turned to [OFF] and Reel change status is changed to [Waiting status]. • The operation status is initialized.
Reel change status bit creation	Creates each bit for the initialization mode, waiting mode, turret turning mode, and reel change mode from Reel change status.
Creation the data for display	Creates Reel change status and Unwinding reel status running axis as the data for the GOT display.
Prealarm determination	Performs the following processing (1) and (2). (1) Turns on the prealarm (Y33) when the following condition is satisfied. • The unwinder running axis diameter is equal to or smaller than the turn notification diameter. (2) Turns off the prealarm (Y33) when any of the following conditions is satisfied. • Reel change status [Turret turning] • Prealarm [Reset]
Reel status check	Turns on the reel change start condition satisfaction when the following conditions are satisfied. • The diameter of the unwinder running axis is equal to or smaller than the diameter at reel change start. • [Reel change forced execution] is on.
Turret turning start determination	Performs the following processing (1) to (5). (1) Operation mode Auto, Turret turning start Turns the reel change status to [Turret turning] when all of the following conditions are satisfied. • The reel change start condition satisfaction is on. • [Waiting reel ready] is on. • The operation mode is [Auto]. • The line speed reaches the set velocity. (2) Operation mode [Auto], unwinder waiting axis preparing OFF Turns on the turret axis rotation disabling when the following condition is satisfied. • Waiting reel ready is off. (3) [Reel change start] ON Turns on the reel change start output (Y34) when the following condition is satisfied. • The reel change start condition satisfaction is on. (4) [Reel change start] OFF Turns off the reel change start output (Y34) when any of the following conditions is satisfied. • Start signal is [Reset]. • Reel change operation completion (5) Reel change operation start determination Turns on the reel change operation start when all of the following conditions are satisfied. • The reel change start condition satisfaction is on. • Waiting reel ready is on.
Creation of turret axis rotation start request	Turns on the turret axis rotation start request when all of the following conditions are satisfied. • Reel change status [Turret turning] • The turret axis is in the servo-on status. • The turret axis rotation completion position arrival is off.

Processing	Description
Turret turning command control	Performs the following processing (1) to (5). (1) Turret turning command ON Turns on the turret axis auto rotation command when all of the following conditions are satisfied. • Reel change status [Turret turning] • Turret unlock output ON • The turret axis rotation completion position arrival is off. • Operation mode [Auto] • Turret axis in servo-on (2) Turret A-axis position movement Turns on the turret axis forward rotation A-axis position request on any of the following conditions. • The turret axis auto rotation command is on and the unwinder running axis is the running axis B. • Turret: FWD turning [A-axis position] with the operation mode [Manual] (3) Turret B-axis position movement Turns on the turret axis forward B-axis position request on any of the following conditions. • The turret axis auto rotation command is on and the unwinder running axis is the running axis A. • Turret: FWD turning [B-axis position] with the operation mode [Manual] (4) Turret stop Turns on the turret axis positioning stop request on any of the following conditions. • Operation mode [Manual] • Turret [STOP] (5) Creation of the data for display Creates the current angle of the turret.
Calculation of the waiting axis diameter	Performs the following processing (1) to (3). (1) Calculation of the unwinder waiting axis diameter Calculates the initial winding diameter of the unwinding waiting axis using the unwinder axis diameter calculation FB when the following conditions are satisfied. Creates the rotation speed per 1ms of the unwinder axis, and turns on the unwinder axis diameter calculation completion. • Roll edge detection (X30) is on. (2) Diameter calculation err ON Turns on Diameter calculation err on any of the following conditions. • The initial winding diameter of the unwinder waiting axis is smaller than the minimum roll diameter. • The initial winding diameter of the unwinder waiting axis is larger than the maximum reel diameter. • The unwinder axis initial diameter calculation error is on. (3) Diameter calculation err OFF Turns off the diameter calculation error when the following conditions are satisfied. • The reel change error reset is on.
Touch roll & cutter down position calculation	Performs the following processing (1) to (3). (1) Touch roll operation position calculation Creates the position calculation with the touch roll operation position correction and the one with the cutter operation position correction with using the touch roll operation position calculation FB when the following condition is satisfied. • The unwinder axis diameter calculation completion is on. (2) Cutter angle calculation err ON Turn on the cutter angle calculation error when the following condition is satisfied. • The FB error of touch roll & cutter down position calculation is on. (3) Cutter angle calculation err OFF Turn off the cutter angle calculation error when the following condition is satisfied. • The reel change error reset is on.
Pre-drive request creation	Performs the following processing (1) and (2). (1) Pre-drive command ON Turns on the pre-drive command when the following condition is satisfied. • The unwinder axis diameter calculation completion is on. (2) Pre-drive command OFF Turns off the pre-drive command when the following condition is satisfied. • The reel change completion is on.
Unwinder axis A winding diameter setting (Unwinder axis B winding diameter setting)	Performs the following processing (1) to (3). (1) Unwinder waiting axis diameter setting Sets the unwinder waiting axis initial winding diameter to the diameter of the unwinder axis A and turns on the unwinder axis A initial setting completion when all of the following conditions are satisfied. • The pre-drive command is on. • The unwinder running axis is B-axis. (2) Hold roll diameter Turns on the unwinder axis A current roll diameter hold when the following condition is satisfied. • The pre-drive command is on. (3) Unwinder running axis diameter setting Sets the initial unwinder diameter to the diameter of the unwinder axis A when all of the following conditions are satisfied. • Initial winding diameter of the unwinder setting [→Winding diameter] • The unwinder running axis is the unwinder axis A. (For the unwinder axis B winding diameter setting, reverse A and B in the description above.)

Processing	Description
Unwinder axis A start command creation (Unwinder axis B start command creation)	Performs the following processing (1) to (5). (1) Start dancer control Turns on the unwinder axis A rotation command when all of the following conditions are satisfied. • The dancer control is [ON]. • The unwinder running axis is A-axis. • The unwinder axis A rotation command is off. • Unwinder axis A servo ON (2) Pre-drive start Turns on the unwinder axis A rotation command when all of the following conditions are satisfied. • The unwinder axis A initial setting completion is on. • Operation mode [Auto] • The unwinder running axis is B-axis. • The dancer control start is on. • Unwinder axis A servo ON (3) Unwinder axis A rotation command is held in itself when the operation mode is [Auto]. Turns on the unwinder axis A rotation command when all of the following conditions are satisfied. • The unwinder axis A rotation command is on. • Operation mode [Auto] • The unwinder running axis is A-axis. • The dancer control start is on. • Unwinder axis A servo ON (4) Operation with the operation mode [Manual] Turns on the unwinder axis A rotation command when all of the following conditions are satisfied. • The dancer control is [ON]. • The unwinder axis A rotation command is on. • Operation mode [Manual] • The unwinder running axis is A-axis. • Unwinder axis A servo ON (5) Unwinder axis A rotation command OFF with the operation mode [Auto] Turns off the unwinder axis A rotation command when all of the following conditions are satisfied. • The reel change completion is on. • Operation mode [Auto] • The unwinder running axis is B-axis. (For the unwinder axis B start command creation, replace A with B, B with A in the description above.)
Creation of the unwinder waiting axis in velocity information	Turns on the pre-drive command when the following condition is satisfied. • The speed of the waiting axis reaches the pre-driving speed.
Creation of the turret turning completion information	Performs the following processing (1) to (3). (1) Turret axis rotation completion Turns on the turret axis rotation completion position arrival when the following condition is satisfied. • Turret axis positioning completion (2) Turret axis rotation completion Turns on the turret axis rotation completion when the following conditions are satisfied. • The turret axis rotation completion position arrival is on. • The turret unlock output is off. • The turret axis auto rotation command is off. • Reel change status [Turret turning] (3) Reel change operation determination Turn the operation mode to [Reel change status] when every following condition is satisfied. • Operation mode [Auto] • The turret axis rotation completion is on. • The calculation completion in the turret axis rotation is on. • The pre-drive in velocity is on. • The reel change operation start is on. • Reel change status [Turret turning]
Tape detection check	Turns on the tape error detection when the following condition is satisfied. • Tape sensor detection (X31) does not turn on even though the unwinder waiting axis rotates once after the reel change status becomes [Reel change status].
Creation of the touch roll operation command	Performs the following processing (1) and (2). (1) Tape detection position record Records the unwinder waiting axis position as the tape detection position for the touch roll when the following condition is satisfied. • Tape sensor detection (X31) turns on for the first time after becoming the reel change status. (2) Touch roll operation Turns on the auto touch roll down when the following condition is satisfied. • Angle rotation of the unwinder waiting axis from the tape detection position for the touch roll with the touch roll operation position correction

Processing	Description
Cutter operation	Performs the following processing from (1) to (3). (1) Paste / Cut warning and cutter operation Turns on the Paste / Cut warning and the auto cutter down when the following condition is satisfied. • The auto touch roll down is on. • Tape sensor detection (X31) does not turn on even though the unwinder waiting axis rotates twice from the tape sensor detection position for the touch toll. (2) Cutter operation Turns on the auto cutter down when the following conditions are satisfied. • The auto touch roll down is on. • Tape sensor detection (X31) turns on within two rotations of the unwinder waiting axis (unwinder axis B) from the tape sensor detection position for the touch roll. • Angle rotation of the unwinder waiting axis from the tape sensor detection position for the touch roll position with the cutter operation position correction (3) Cutter operation completion Turns on the cutter operation completion when the following conditions are satisfied. • The unwinder axis (unwinder axis B) rotates for 0.9 after the auto cutter down becomes on.
Reel change operation completion determination	The reel change completion turns on when the following condition is satisfied. • The cutter operation completion is on.
Creation of the unwinder axis selection information	Changes the unwinder running axis to the unwinder waiting axis, and the unwinder waiting axis to the running axis. • The reel change completion is on.
Creation of the unwinder axis diameter	Creates the current value of the unwinder diameter of the unwinder running axis.
Creation of the unwinder waiting axis diameter	Creates the current value of the unwinder waiting axis diameter.
Creation of the unwinder axis velocity	Creates the current unwinder rotation speed of the unwinder running axis.
Creation of the unwinder waiting axis angle information	Creates the angle of the unwinder waiting axis.
Creation of the unwinder waiting axis stop information	Turns on the unwinder waiting axis stop when the following conditions are satisfied. • The speed of the unwinder waiting axis is 0.
PID control setting of the unwinder axis	Performs the following processing. • Sets the PID gain of the unwinder running axis as the setting value from the GOT. • Set 0 to the PID gain of the unwinder running axis. (The PID operation is not performed.)
Reel replacement completion determination	Turns on the reel change operation start and turns the operation mode to [Initialization] when all of the following conditions are satisfied. • The reel change completion is on. • The unwinder waiting axis stop is on.
Request of the line stop at an error occurrence	Performs the following processing (1) and (2). (1) Line stop with the operation mode [Auto] Turns on the reel change error line stop when any of the following condition is satisfied and the operation mode is [Auto]. • The turret axis rotation disabling is on. • The cutter angle calculation error is on. • The diameter calculation error in on. • The tape detect error is on. • The unwinder axis A servo error is on. • The unwinder axis B servo error is on. • The turret axis servo error is on. (2) Line stop with the operation mode [Manual] Turns on the reel change error line stop every following condition is satisfied. • The diameter of the unwinder running axis becomes equal to or smaller than the diameter at reel change start. • Operation mode [Manual]
Reset error	Performs the following processing (1) and (2). (1) Reel change error reset Turns on the reel change error reset when the following condition is satisfied. • Reel change error [Reset] (2) Reel change warning reset Turns on the reel change warning reset when the following condition is satisfied. • Reel change warning [Reset]

Processing	Description
Turret axis operation	Performs the following processing (1) to (3). (1) Turret axis home position setting Sets the home position of the turret axis and the turret turning speed when all of the following conditions are satisfied. • Operation mode [Manual] • Turret: Home position setting [Execution] (2) Turret axis positioning command Sets the turret turning speed, sets the turret target position to 0°, and starts positioning when the following condition is satisfied. • The turret axis forward rotation A-axis position request is on. Sets the turret turning speed, sets the turret target position to 180°, and starts positioning when the following condition is satisfied. • The turret axis forward rotation B-axis position request is on. (3) Turret axis stop command Sends the positioning stop command to the turret axis when the following condition is satisfied. • The turret axis positioning stop request is on.
Creation of the auxiliary operation command	Performs the following processing (1) to (3). (1) Turret unlock output (Y30) control Performs the following processing from 1) to 4). 1) Manual ON Turns on the turret unlock output (Y30) when all the following conditions are satisfied. • Operation mode [Manual] • Auxiliary·Turret lock [Unlock] operation 2) Auto ON Turns on the turret unlock output (Y30) when all the following conditions are satisfied. • Operation mode [Auto] • Operation state [Turret turning] • The turret axis rotation start request is on. 3) Manual OFF Turns off Turret unlock output (Y30) when all of the following conditions are satisfied. • Operation mode [Manual] • Auxiliary: Turret lock [Lock] operation 4) Auto OFF Turns off the turret unlock output (Y30) when every following condition is satisfied. • Operation mode [Auto] • Operation state [Turret turning] • The turret axis rotation completion position arrival is on. (2) Touch roll down output (Y31) control Performs the following processing from 1) to 4). 1) Manual ON Turns on the touch roll down output (Y31) when all of the following conditions are satisfied. • Operation mode [Manual] • Auxiliary: Touch roll [Down] operation 2) Auto ON Turns on the touch roll down output (Y31) when all of the following conditions are satisfied. • Operation mode [Auto] • The auto touch roll down is on. 3) Manual OFF Turns off the touch roll down output (Y31) all of the following conditions are satisfied. • Operation mode [Manual] • Auxiliary: Touch roll [Up] operation 4) Auto OFF Turns off the touch roll down output (Y31) all of the following conditions are satisfied. • Operation mode [Auto] • The auto touch roll down is off. (3) Cutter down output (Y32) control Performs the following processing from 1) to 4). 1) Manual ON Turns on the cutter roll down output (Y32) all of the following conditions are satisfied. • Operation mode [Manual] • Auxiliary: Cutter [Down] operation 2) Auto ON Turns on the cutter roll down output (Y32) all of the following conditions are satisfied. • Operation mode [Auto] • The auto cutter down is on. 3) Manual OFF Turns off the cutter roll down output (Y32) all of the following conditions are satisfied. • Operation mode [Manual] • Auxiliary: Cutter [Up] operation 4) Auto OFF Turns off the cutter roll down output (Y32) all of the following conditions are satisfied. • Operation mode [Auto] • The auto cutter down is off.

WinderControlReelChange (Tension control main processing: for reel change)

The program for the reel change is added to the WinderControl program.

■Main axis control (Main Axis Control)

Refer to "Page 150 Main axis control".

■Unwinder axis control

Two axes, the unwinding running axis and unwinding waiting axis, are controlled.

The ReelChange program performs the processing for switching the two axes.

■Rewinder axis control (Rewinder Axis Control)

Refer to "Page 152 Rewinder axis control".

■Edge position axis control (Edge Position Axis Control)

Refer to "Page 153 Edge position axis control".

■Web break detection (Web Break Detect)

Refer to "Page 153 Web break detection".

PreOperationReelChange (Preparing operation, line operation control)

The program for the reel change is added to the PreOperation program.

■Simple Motion module start processing (Simple Motion Module Start Process)

Refer to "Page 154 Simple Motion module start processing".

■Servo ON processing (Servo ON Processing)

When Preparing operation (bOpeReady) turned on in the GOT screen, all axes (Axis 1 to 6) changes to servo ON.

For the unwinder axis and turret axis, the ReelChange program individually performs the servo ON processing.

■Error reset processing of each axis (Error Reset Processing)

Reset errors of the axis used.

■Line operation start processing (Line Operation Processing, Line Operation Start/Stop Processing)

"The reel change line stop request is off" of the ReelChange program is added as a line start condition of the PreOperation program.

HMI_IFReelChange (Touch panel I/O processing)

The processing for displaying data related to the reel change such as the turn notification diameter setting and JOG operation on the GOT screen to the HMI_IF program.

UnWinderGainChange (Unwinder axis gain change)

Refer to "Page 157 UnWinderGainChange (Unwinder axis gain change)".

FrictionTorqueMeasurement (Rewinder axis mechanical loss torque measurement)

Refer to "Page 158 FrictionTorqueMeasurement (Rewinder axis mechanical loss torque measurement)".

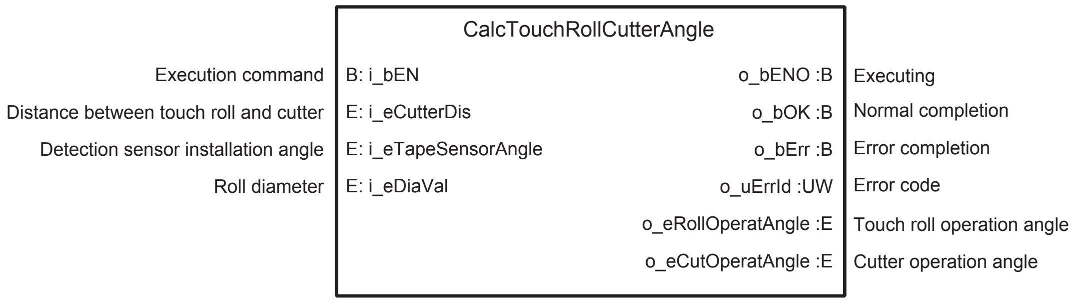
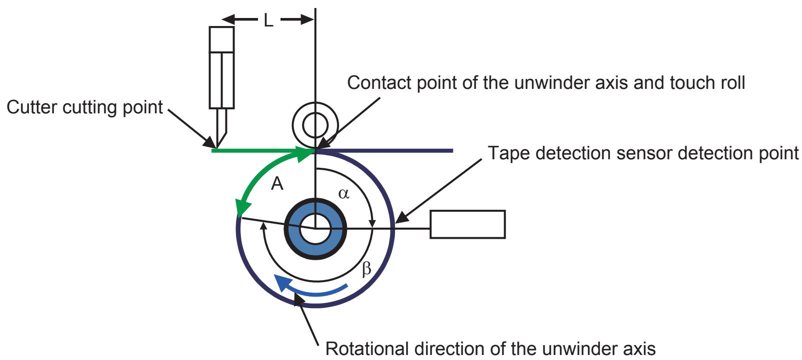
ExamplePrgReelChange FB

CalcTouchRollCutterAngle (Touch roll & cutter operating angle calculation)

■Name

CalcTouchRollCutterAngle

■Function overview

<table>
<tr><th>Item</th><th colspan="2">Description</th></tr>
<tr><td>Function overview</td><td colspan="2">This FB detects the tape position and calculates the rotation angle of the unwinder axis where the touch roll and cutter start operating.</td></tr>
<tr><td>Symbol</td><td colspan="2">
</td></tr>
<tr><td rowspan="3">Applicable hardware and software</td><td>Applicable module</td><td>RD77MS, RD77GF, RD78G(S)</td></tr>
<tr><td>Applicable CPU</td><td>MELSEC iQ-R series CPU module</td></tr>
<tr><td>Engineering software</td><td>GX Works3</td></tr>
<tr><td>Description language</td><td colspan="2">ST language</td></tr>
<tr><td>Number of steps</td><td colspan="2">221 steps (For the macro type)</td></tr>
<tr><td>FB dependence</td><td colspan="2">None</td></tr>
<tr><td>Function description</td><td colspan="2">The following shows the I/O values for this FB.


■ L: Touch roll - Cutting point distance
This distance is between the contact point of the unwinder axis and the touch roll and the cutting point of the cutter. This distance is A in the figure.
■ α: Tape detection sensor installation angle
This angle is between the contact point of the unwinder axis and the touch roll and the tape detection sensor detection point of the adhesion tape of the unwinder axis.
■ β: Cutter operation angle
This angle is between the detection point of the tape detection sensor and the operation point of the cutter.
■ One revolution - α: Touch roll operation angle
This angle is between the detection point of the tape detection sensor and the operation point of the touch roll.</td></tr>
<tr><td>Compiling method</td><td colspan="2">Macro type, subroutine type</td></tr>
<tr><td>FB operation type</td><td colspan="2">Pulse-execution type</td></tr>
<tr><td>Restrictions and precautions</td><td colspan="2">—</td></tr>
</table>

5

■Labels

- Input labels

Name	Label name	Data type	Read timing*1	Setting range	Initial value	Description
Execution command	i_bEN	Bit	↑	—	—	On: The FB is activated. Off: The FB is stopped.
Distance between touch roll and cutter	i_eCutterDis	Single precision real number	↑	0.0<=	—	Distance between the touch roll and cutter [mm]
Detection sensor installation angle	i_eTapeSensorAngle	Single precision real number	↑	0.0 to 360.0	—	Tape detection sensor installation angle to the touch roll [degree]
Roll diameter	i_eDiaVal	Single precision real number	↑	0.0<	—	Waiting axis roll diameter [mm]

*1 ⎍: Always, ↑: Only when the FB is started

- Output labels

Name	Label name	Data type	Value to be held*2	Description
Executing	o_bENO	Bit	—	On: While Execution command is on Off: Execution command is off.
Normal completion	o_bOK	Bit	—	When this device is on, it indicates that the processing is normally completed.
Error completion	o_bErr	Bit	—	When this device is on, it indicates that an error has occurred in the FB.
Error code	o_uErrId	Word [Unsigned]	—	The error code of the error that has occurred in the FB is stored. (Refer to "Page 289 List of Error Codes".)
Touch roll operation angle	o_eRollOperatAngle	Single precision real number	—	Handling 360 degrees as 1, return the value obtained by the formula "360 degrees - α" in the function description figure.
Cutter operation angle	o_eCutOperatAngle	Single precision real number	—	Handling 360 degrees as 1, return the value of β in the function description figure.

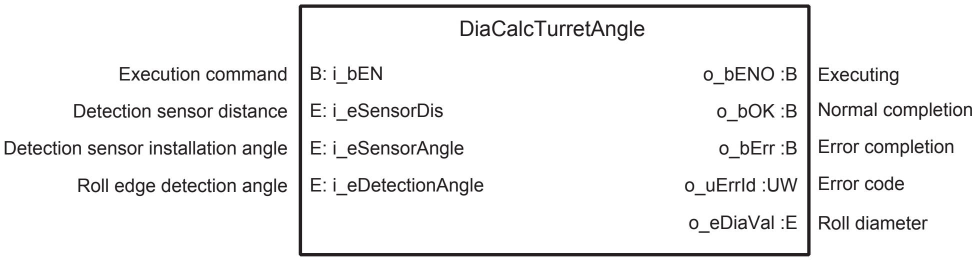
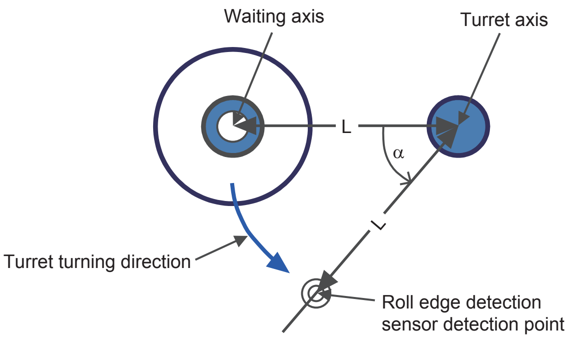
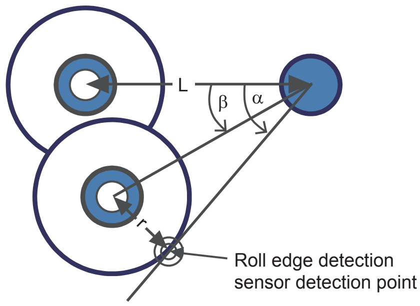
*2 ○: The value is held after the FB stops. —: The value is cleared after the FB stops.

DiaCalcTurretAngle (Roll diameter calculation (turret angle method))

■Name

DiaCalcTurretAngle

■Function overview

Item	Description	
Function overview	This FB calculates the roll diameter of the waiting axis from the turret turning angle at the reel change operation.	
Symbol		
Applicable hardware and software	Applicable module	RD77MS, RD77GF, RD78G(S)
	Applicable CPU	MELSEC iQ-R series CPU module
	Engineering software	GX Works3
Description language	ST language	
Number of steps	223 steps (For the macro type)	
FB dependence	None	
Function description	The following shows the I/O values for this FB.   ■ L: Detection sensor distance This distance is between the roll edge detection sensor and the turret axis. This distance must be the same as the distance between the turret axis and waiting axis. ■ α: Detection sensor installation angle This angle is between the fixed position of the waiting axis and the roll diameter detection sensor, handling the turret axis as the top. ■ β: Rotation angle where the roll edge has approached the detection sensor ■ r: Roll radius This value can be obtained by the formula "r = 2(L • sin ((α-β)/2))" because the roll radius is handled as the base of an isosceles triangle with the turret axis as the top. The roll diameter is 2r.	
Compiling method	Macro type, subroutine type	
FB operation type	Pulse-execution type	
Restrictions and precautions	—	

■Labels

- Input labels

Name	Label name	Data type	Read timing*1	Setting range	Initial value	Description
Execution command	i_bEN	Bit	↑	—	—	On: The FB is activated. Off: The FB is stopped.
Detection sensor distance	i_eSensorDis	Single precision real number	↑	1.0 to 5000.0	—	Distance between the roll edge detection sensor and turret axis [mm]
Detection sensor installation angle	i_eSensorAngle	Single precision real number	↑	1.0 to 179.0	—	Degree between the waiting axis and roll edge detection sensor [degree]
Roll edge detection angle	I_eDetectionAngle	Single precision real number	↑	1.0 to 179.0	—	Angle at the roll edge detection [degree]

*1 ⎍: Always, ↑: Only when the FB is started

- Output labels

Name	Label name	Data type	Value to be held*2	Description
Executing	o_bENO	Bit	—	On: While Execution command is on Off: Execution command is off.
Normal completion	o_bOK	Bit	—	When this device is on, it indicates that the processing is normally completed.
Error completion	o_bErr	Bit	—	When this device is on, it indicates that an error has occurred in the FB.
Error code	o_uErrId	Word [Unsigned]	—	The error code of the error that has occurred in the FB is stored. (Refer to "Page 289 List of Error Codes".)
Roll diameter	o_eDiaVal	Single precision real number	—	The calculation result of the roll diameter is stored. [mm]

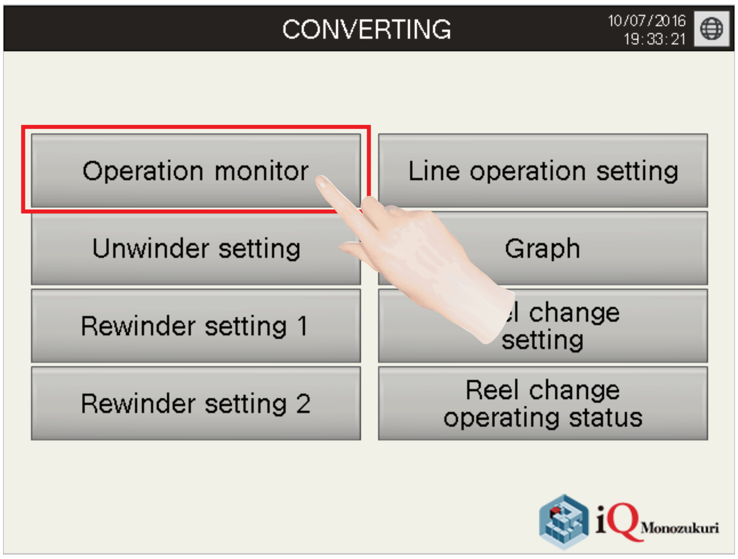
*2 ○: The value is held after the FB stops. —: The value is cleared after the FB stops.

Operation procedure

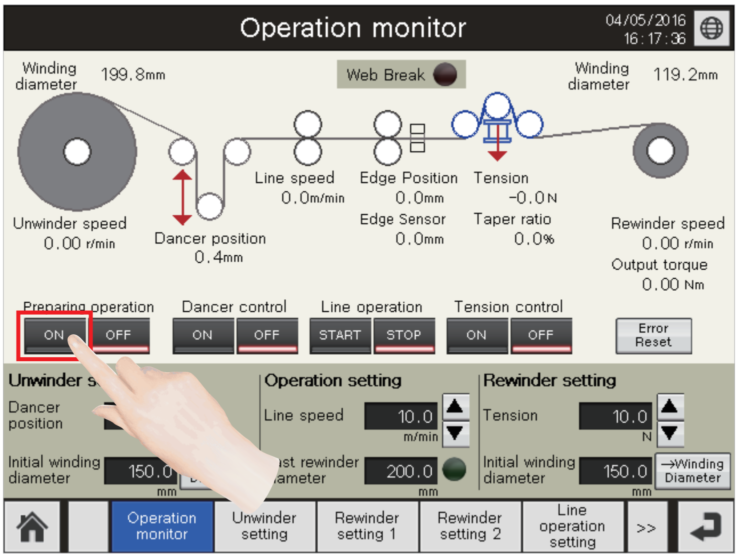
Start/stop procedure

Start the operation by following the steps below.

(For the function details of each screen, refer to "Page 215 GOT APPLICATION SCREEN EXAMPLES".)

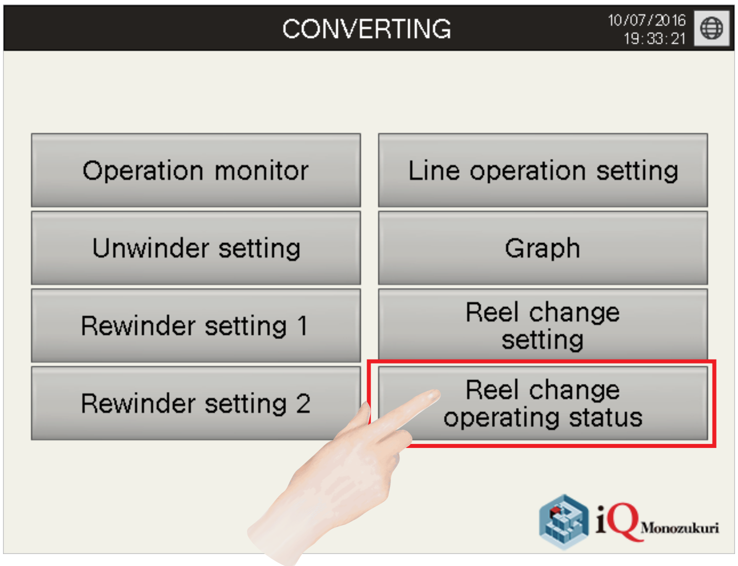


1. Write project data to the PLC CPU and GOT and start the system. Touch the [Operation monitor] switch.

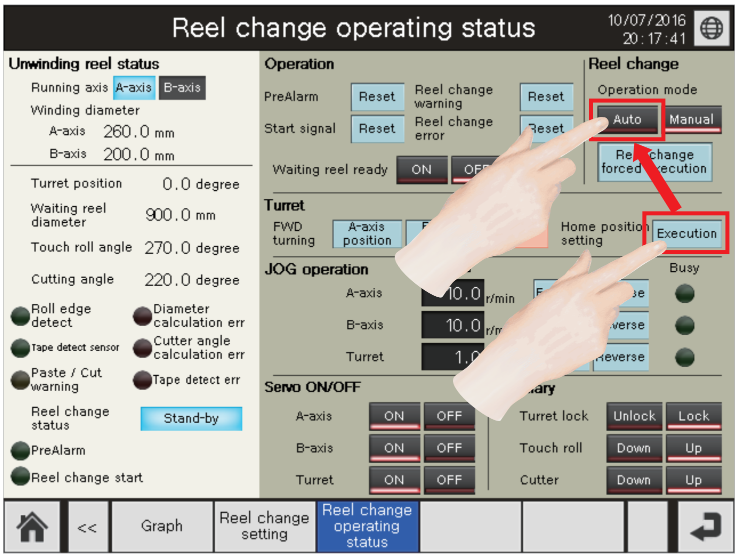


2. Touch the [ON] switch of Preparing operation. Turning on of Preparing operation sets all axis (including the turret axis and unwinding waiting axis) in the servo-on status and starts the main axis in the speed control mode. The initial value of the unwinding running axis is A-axis.

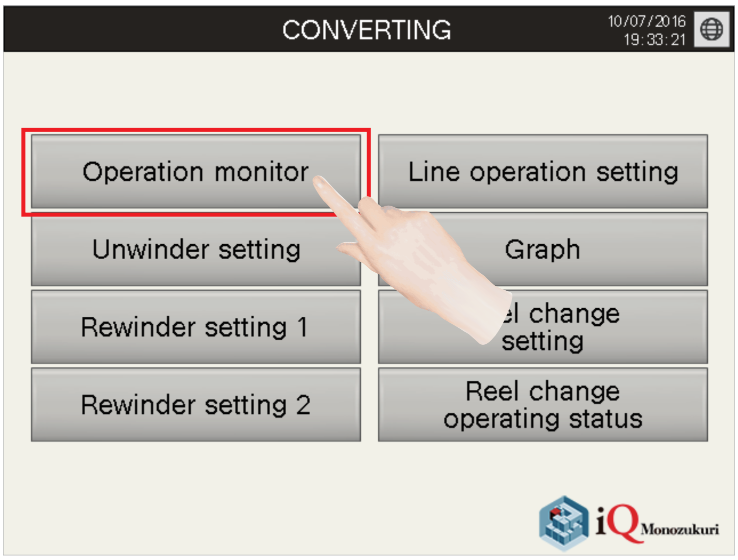
3. Return to the start screen and touch the [Reel change operating status] switch.

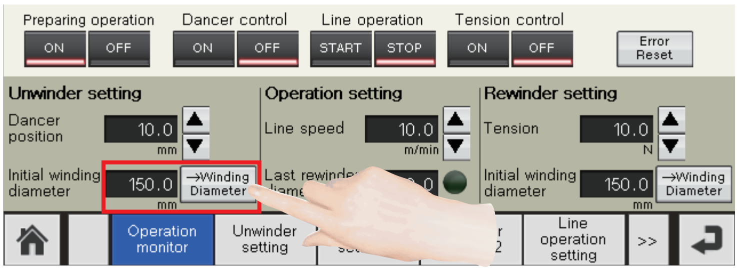


4. Touch the [Execution] switch of Home position setting to set the initial position of the turret axis, and touch the [Auto] switch of Operation mode.

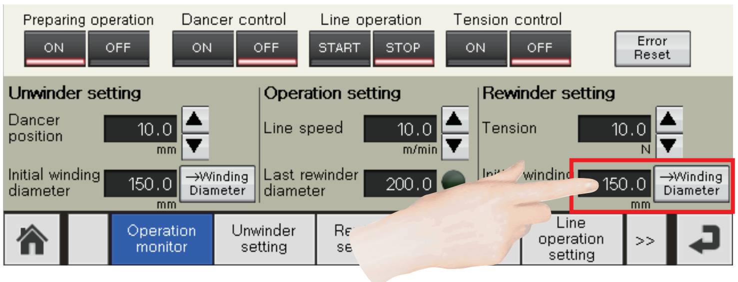


5. Return to the start screen and touch the [Operation monitor] switch.

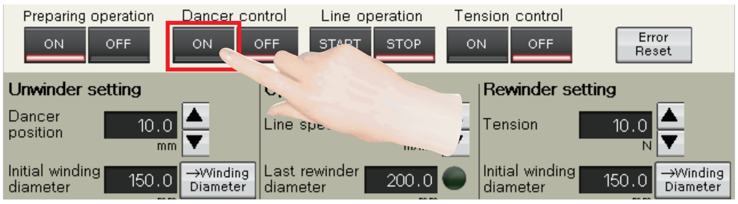




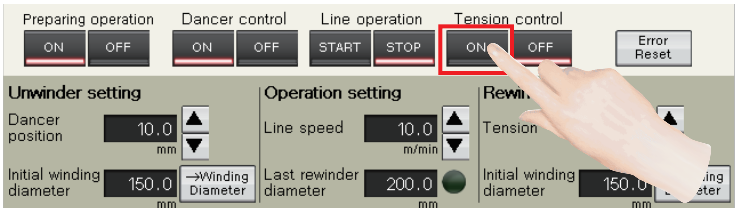
6. Input the winding diameter of A-axis as the initial winding diameter in the unwinder settings. Touching the [→Winding Diameter] switch sets the winding diameter of the unwinder axis.



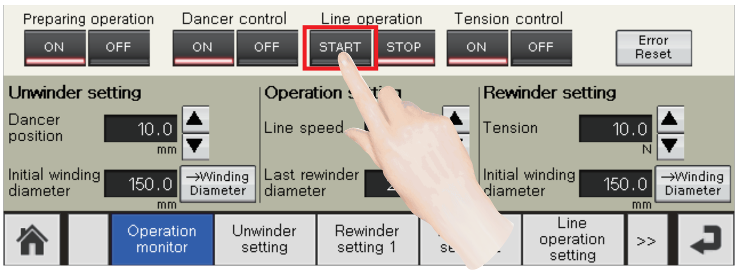
7. Also, input the rewinder axis winding diameter as the initial winding diameter in the rewinder settings. Set the rewinder axis winding diameter with the [→Winding Diameter] switch.



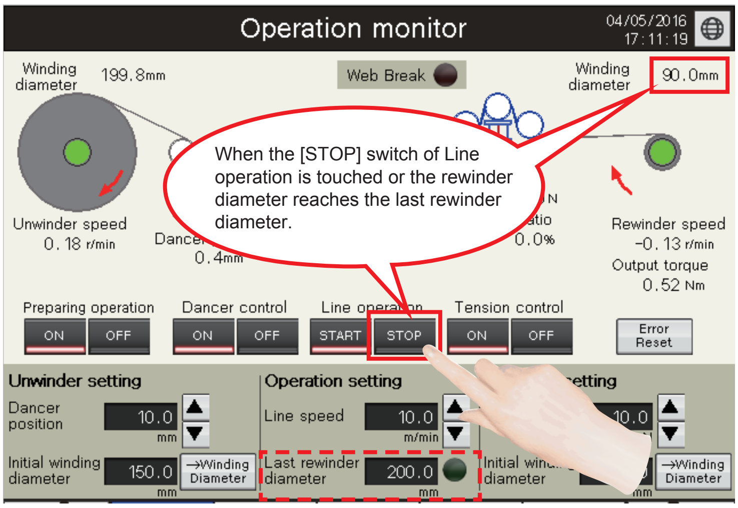
8. Touch the [ON] switch of Dancer control. Turning on of Dancer control starts the unwinder axis in the speed control mode and moves the dancer to the set position.



9. Touch the [ON] switch of Tension control. Turning on of Tension control starts the rewinder axis in the torque control mode and sets the tension setting value as the set tension.



10. Touch the [START] switch of Line operation. The operation starts at the set line speed and the edge position control starts in the speed control mode.



11. The line operation stops when the [STOP] switch of Line operation is touched or the rewinder diameter reaches the last rewinder diameter.

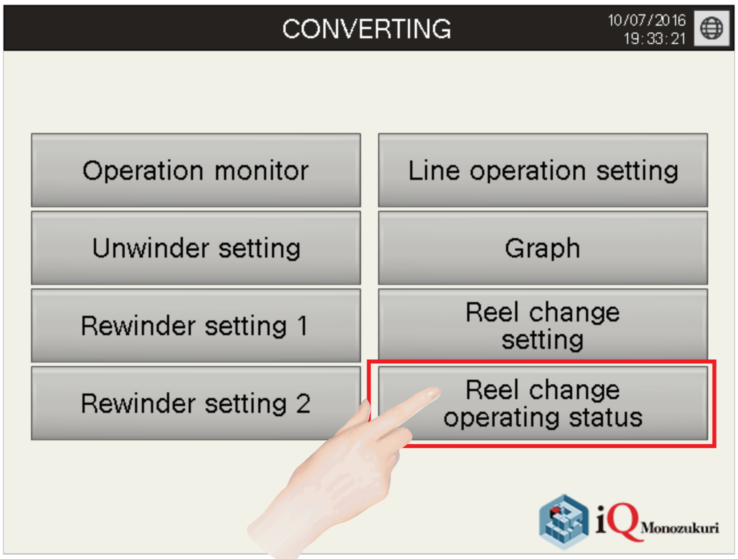
5

Reel change operation

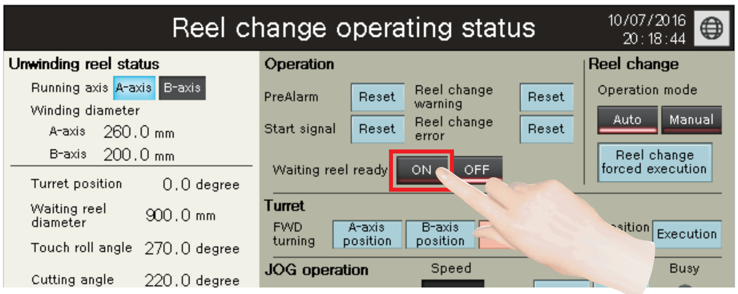
Perform the reel change of the unwinder axis by the following procedure.

Point

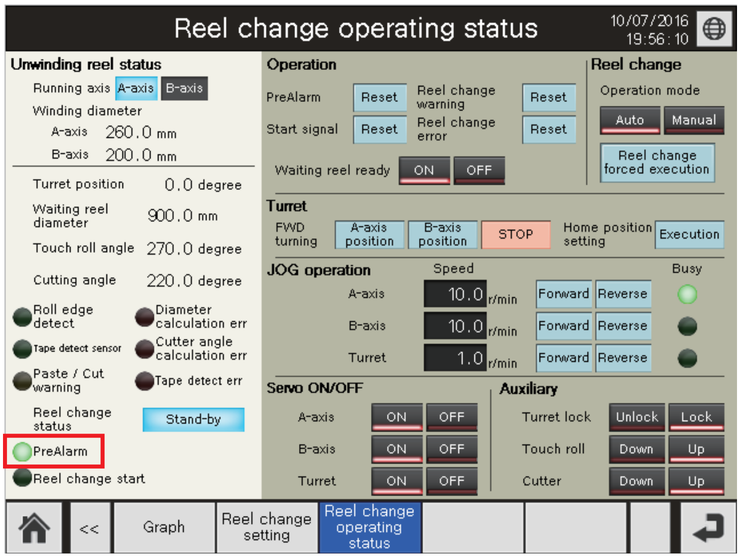
Switch the operation mode to "Auto" before the reel change operation.



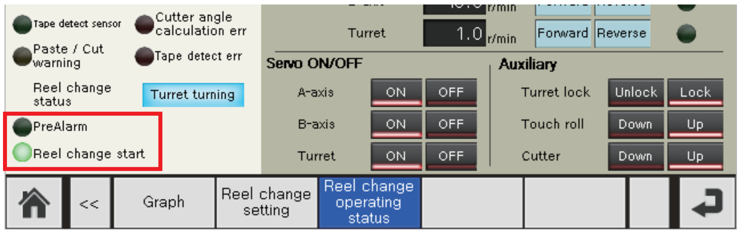
1. Touch the [Reel change operating status] switch on the start screen.



2. Prepare the unwinding waiting axis for operation and touch the [ON] switch of Waiting reel ready.



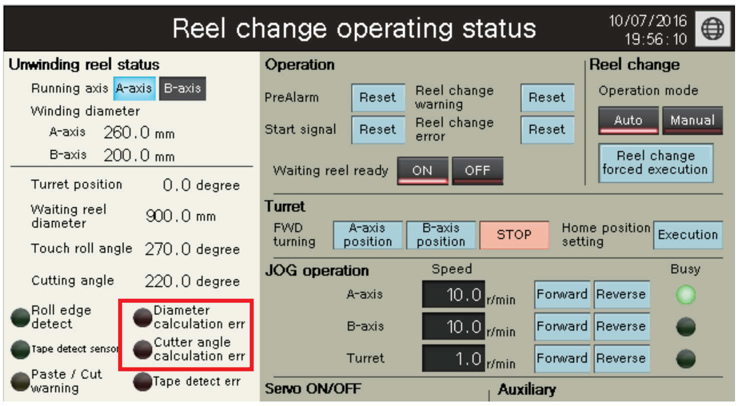
3. When the diameter of the unwinding running axis reaches the turn notification diameter, the PreAlarm lamp turns on. Touching the [Reset] switch of PreAlarm turns off this lamp.



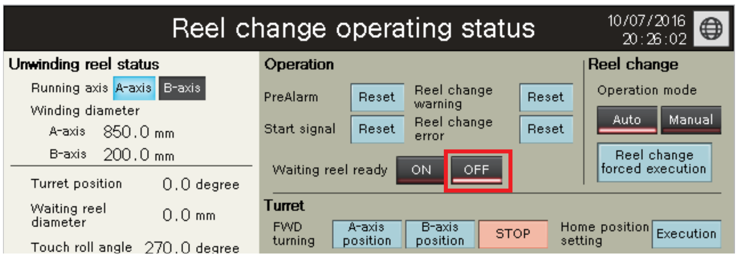
4. The reel change is started when the diameter of the unwinding running axis reaches the diameter at reel change start or the [Reel change forced execution] switch is touched. When the reel change is started, the PreAlarm lamp turns off and the Reel change start lamp turns on. Touching the [Reset] switch of Start signal turns off this lamp.

Point

If the operation in step 2 has not been completed until this step, the turret does not rotate and the line operation is stopped. (The operation of when the [STOP] switch of Line operation on the Operation monitor screen is touched will be performed.)



5. The turret rotates, the unwinding waiting reel diameter, touch roll operation angle, and cutter operation angle are calculated, and then the waiting axis starts operating. When the calculation fails, the Diameter calculation err lamp or Cutter angle calculation err lamp turns on. The reel change operation is interrupted and the line operation is stopped when the turret rotation is completed.



6. When the turret rotation and acceleration of the waiting axis are completed, the touch roll and cutter operate in order and the reel change is performed. At the same time, the waiting axis performs the dancer control as the running axis. The running axis is changed to the waiting axis and decelerates to stop.

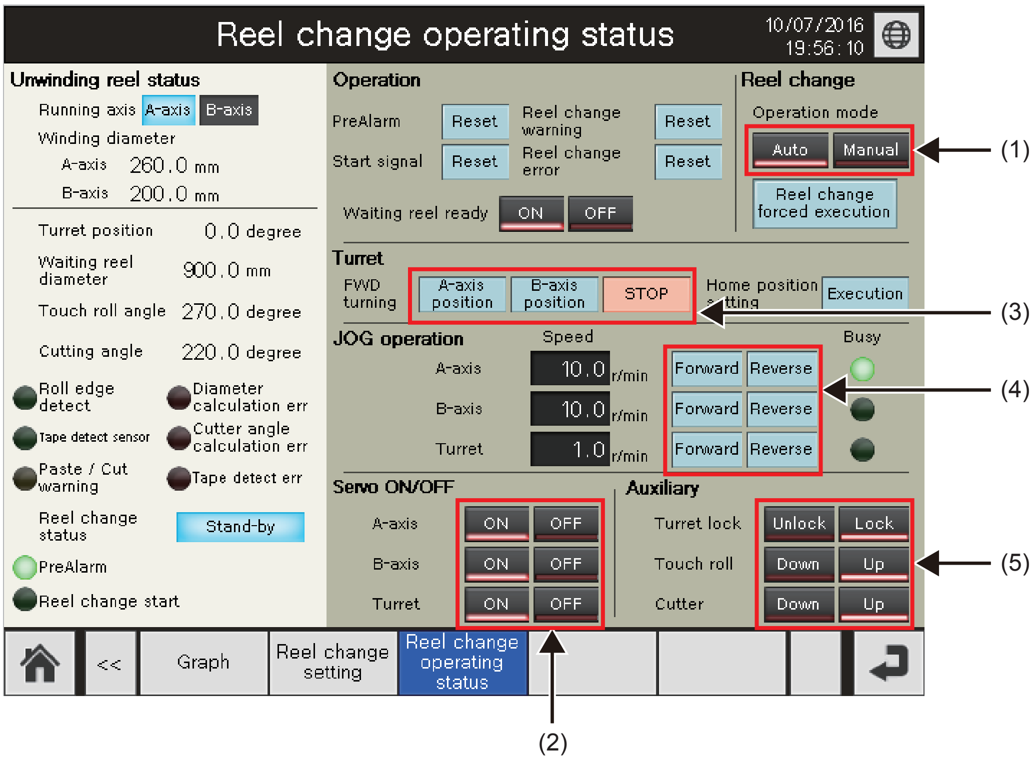
7. The [OFF] switch of Waiting reel ready turns on.

Manual operation

On the Reel change operating status screen, turning on the [Manual] switch of Operation mode enables the manual operation. "Manual" is set after the system is started.

When "Manual" is selected, the JOG operation, servo ON/OFF, and auxiliary operation of the unwinding waiting axis and turret axis are available.

■Reel change operating status screen



(1) Touch the [Manual] switch of Operation mode to turn on the manual mode.

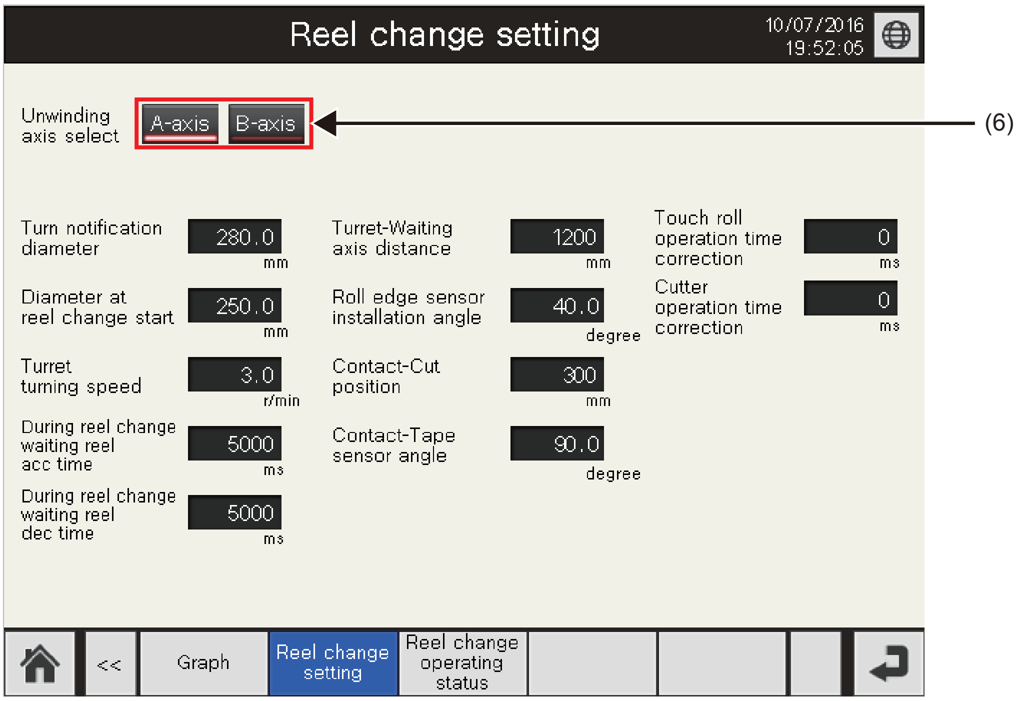
(2) The servo ON/OFF operation of each axis can be performed. When the operation mode is "Manual", the servo ON/OFF operation can be enabled. Turning on of Preparing operation on the Operation monitor screen sets all axis in the servo-on status. Turning off it sets all axis in the servo-off status.

(3) The rotating operation of the turret can be performed. When the [A-axis position] switch is turned on, the turret rotates forward to move A-axis to the running axis position (dancer operation position). When the [B-axis position] switch is turned on, the turret rotates forward to move B-axis to the running axis position.

(4) The JOG operation of each axis can be performed. The JOG operation of the turret axis cannot be performed when the turret has been locked.

(5) Each auxiliary operation can be performed.

■Reel change setting screen

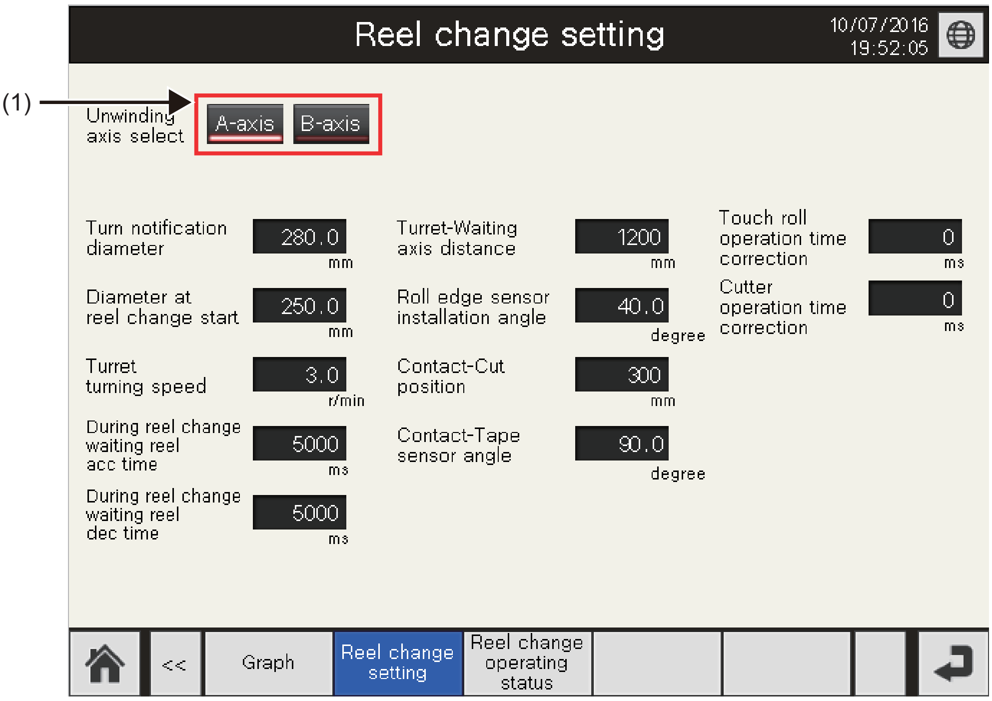


(6) Select the axis to perform the dancer control. The selected axis is displayed as the unwinder axis on the Operation monitor screen.

Operating condition of each function operation switch

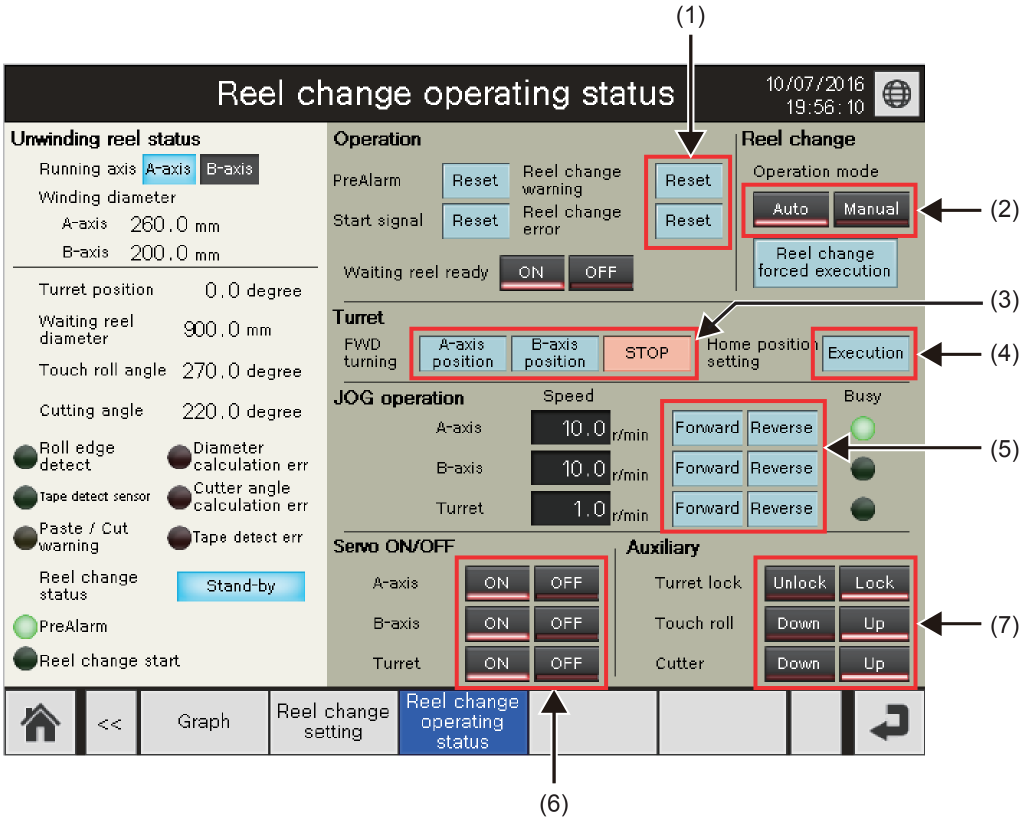
Each function operation switch is enabled under the following condition.

■Reel change setting screen



No.	Switch name	Operating condition
(1)	Unwinding axis select [A-axis]/[B-axis]	Operation mode [Manual]

■Reel change operating status screen



No.	Switch name	Operating condition
(1)	Reel change warning [Reset]	Always enabled
	Reel change error [Reset]	
(2)	Reel change: Operation mode [Auto]	• Turret lock [Lock] • Touch roll [Up] • Cutter [Up] • All axes are in the servo-on status.
	Reel change: Operation mode [Manual]	Always enabled
(3)	Turret: FWD turning [A-axis position]	• The turret axis is in the servo-on status. • Operation mode [Manual] • Auxiliary: Turret lock [Unlock]
	Turret: FWD turning [B-axis position]	
	Turret: FWD turning [STOP]	Always enabled
(4)	Turret: Home position setting [Execution]	• The turret axis is in the servo-on status. • Operation mode [Manual]
(5)	JOG operation: A-axis [Forward]/[Reverse]	• A-axis is in the servo-on status. • Running axis [B-axis]
	JOG operation: B-axis [Forward]/[Reverse]	• B-axis is in the servo-on status. • Running axis [A-axis]
	JOG operation: Turret [Forward]/[Reverse]	• The turret axis is in the servo-on status. • Operation mode [Manual] • Auxiliary: Turret lock [Unlock]
(6)	Servo ON/OFF: A-axis	• Operation mode [Manual] • Running axis [B-axis]
	Servo ON/OFF: B-axis	• Operation mode [Manual] • Running axis [A-axis]
	Servo ON/OFF: Turret	• Operation mode [Manual] • Operation monitor screen: Preparing operation [ON]
(7)	Auxiliary: Turret lock [Unlock]/[Lock]	Operation mode [Manual]
	Auxiliary: Touch roll [Down]/[Up]	
	Auxiliary: Cutter [Down]/[Up]	

5.5 Inverter

Control specifications

The tension control is started by a start signal and continuously operates until the diameter of the rewind web material reaches the set rewinding diameter.

Item	Unwinder axis	Main axis	Rewinder axis	Edge position axis
	Inverter	Servo	Inverter	Servo
Axis number	—	2	—	4
Station number	17	2	18	4
Control mode	Velocity	Velocity	Torque	Velocity
Detector	Dancer roll	—	Tension detector	Edge sensor
Tension gain auto tuning	○	—	○	—
Winding diameter calculation	Web thickness integration method	—	Feeding length method	—
Taper tension	None	—	Table method	—
Direction	Upper unwinding	—	Upper rewinding	—
Inertia compensation, friction compensation	—	—	○	—
Control cycle	1.0ms (RD77GF)			

Program configuration

The processing and interfaces required for the inverter control are added to the [Basic] program.
This application program does not have maintenance functions, such as home position return and JOG operation.
Create the functions as needed.

Language

The following languages are used in this program.
- Program comment: English
- Label comment: Japanese, English, Chinese (Simplified)

List of programs

Program name	Description	Execution type	Describing method
INVInitial	Initial parameter setting	Initial	ST
INVWinderControl	Tension control main processing • Main axis control • Unwinder axis control (speed control) • Rewinder axis control (torque control) • Edge position axis control • Web break detection	Event	FBD
INVPreOperation	Preparing operation, line operation control • Servo ON/OFF • Reset error • Start line operation	Scan	FBD
INVHMI_IF	Touch panel I/O processing	Scan	ST
INVFrictionTorqueMeasurement	Rewinder axis mechanical loss torque measurement	Fixed cycle (5 ms)	FBD

FB

■CNV_TensionControl_R (Refer to "Page 47 FB LIBRARY".)

Item	FB name	Description	Program
Activation	CNV_Activation	License activation	INVPreOperation
Tension control	CNV_WinderDancerVelocityCtrl	Dancer feedback velocity control	INVWinderControl
	CNV_WinderTensionTorqueCtrl	Tension sensor feedback torque control	INVWinderControl
Velocity generator	CNV_LineVelocityGenerator	Line velocity generator	INVWinderControl
Roll diameter calculation	CNV_DiaCalcThickness	Roll diameter calculation (Web thickness integration method)	INVWinderControl
	CNV_DiaCalcFeed	Roll diameter calculation (Feeding length method)	INVWinderControl
Torque compensation	CNV_WinderInertiaTorque	Inertia compensation torque calculation	INVWinderControl
	CNV_WinderFrictionTorque	Friction compensation value calculation	INVWinderControl
	CNV_FrictionTorqueMeasurement	Friction torque measurement	INVFrictionTorqueMeasurement
Tuning function	CNV_TaperTension	Taper tension calculation	INVWinderControl
	CNV_PIDControl	PID control (with tension PI gain auto tuning)	INVWinderControl
Additional function	CNV_EdgePositionCtrl	Edge position control	INVWinderControl
	CNV_WebBreakDetect	Web break detection	INVWinderControl
Filters	STD_Lowpass1	Low-pass filter	INVWinderControl
	STD_AverageValueFilter	Moving average filter	INVWinderControl
	STD_Limiter	Limiter	INVWinderControl
	STD_TableInterpolation	Table interpolation	INVWinderControl

■ExamplePrgCtrl (Refer to "Page 213 ExamplePrgCtrl FB".)

FB name	Description	Describing method	Program
MotionReady	Simple Motion module start processing	ST	INVPreOperation
ServoON	Servo ON processing	ST	INVPreOperation
MotionErrorReset	Error reset processing	ST	INVPreOperation
DancerPos	Dancer position A/D value conversion processing	ST	INVWinderControl
TensionAD	Tension detector A/D value conversion processing	ST	INVWinderControl
WinderSpdMonitor	Real rotation speed display processing (rewinder axis)	ST	INVWinderControl
EdgePos	A/D value conversion processing at the edge sensor detection position	ST	INVWinderControl
INVServoON	Inverter servo ON processing	ST	INVPreOperation
INVErrorReset	Inverter error reset processing	ST	INVPreOperation
INVMonitor	Inverter torque monitor processing	ST	INVFrictionTorqueMeasurement
INVSpdTrqModeChg	Inverter speed control/torque control switchover processing	ST	INVFrictionTorqueMeasurement

■INVExample (Refer to "Page 206 INVExample FB".)

FB name	Description	Describing method	Program
CCIEFINVSpdIF	CC-Link IE Field inverter speed control interface	ST	INVWinderControl
CCIEFINVTrqIF	CC-Link IE Field inverter torque interface	ST	INVWinderControl

Parameter

Parameter setting of the inverter

For the inverter, the following parameters need to be set.

For the setting of the inverter, refer to the following.

📖FR-A800-GF INSTRUCTION MANUAL (STARTUP)

📖FR-A800 INSTRUCTION MANUAL (DETAILED)

Number	Name	Setting value		Settings
		Unwinder axis (speed control)	Rewinder axis (torque control/ speed control)	
7	Acceleration time	0		
8	Deceleration time	0		
9	Electronic thermal	20.8A		
71	Applied motor	70		Set in SF-PR.
80	Motor capacity	5.5		5.5Kw
81	Number of motor poles	4		4 poles
144	Speed setting switchover	104		Set in Motor with 4 poles, speed setting.
180	RL terminal function selection	23		Set in the pre-excitation (servo-on) input command.
185	LOG terminal function selection	—	26	26: Control mode switch
191	SU terminal function selection	33		Set in the RY2 (Preparing operation completion 2) output.
340	Communication startup mode selection	10		Network operation mode at startup
369	Number of encoder pulses	2048		
434	Network number (CC-Link IE Field)	1		
435	Station number (CC-Link IE Field)	17	18	
541	Frequency command sign selection	1		Setting range: Use within -3276.8 to 3276.7r/min.
800	Control method selection	0	2	0: Speed control, 2: Speed control - Torque control switchover
802	Pre-excitation selection	1	0	0: Zero speed control, 1: Servo lock
804	Torque command source selection	—	5	Uses the setting value of Pr.805. By 0.01%
807	Speed limit selection	—	0	Uses the speed command setting value for the speed limit.
811	Set resolution switchover	1		Setting by 0.1r/min
1113	Speed limit method selection	—	9999	Speed limit mode 1
1114	Torque command reverse selection	—	0	Regardless of the operation command (STF/STR) of the inverter, the positive torque commands the operation of the forward rotation in power running mode/reverse rotation in regenerative mode, and the negative torque commands the operation of the forward rotation in regenerative mode/ reverse rotation in power running mode).

User device setting (global label setting)

For this application program example, the following devices are assigned for the link refresh of CC-Link IE Field of the inverter.

These devices are assigned to the following global labels and used in the inverter interface FB.

When changing the device for the link refresh, change the following setting as well.

Device	Use range
B	0 to FF
W	0 to 31F

■Structure definition

For the structure, define the device of the link refresh setting. The size of the arrangements of the data type of each label is the device points of the link refresh setting.

The following table shows the setting of this sample project.

Structure name: stRemoteReg

Label name	Data type	Settings
bnRX	Bit (0..n)	The number of elements in arrangement is the number of RX points. 128 points (0..127) for this application program example
bnRY	Bit (0..n)	The number of elements in arrangement is the number of RY points. 128 points (0..127) for this application program example
unRWr	Word (unsigned) (0..n)	The number of elements in arrangement is the number of RWr points. 400 points (0..399) for this application program example
unRWw	Word (unsigned) (0..n)	The number of elements in arrangement is the number of RWw points. 400 points (0..399) for this application program example

■Global label definition

The global label is defined with using the structure set above.

With GX Works3, set each item of the following labels.

- Label name: Input "G_stLinkIEF".
- Data type: Select the structure "stRemoteReg".
- Class: Select "VAR_GLOBAL".
- Assignment (device/label): Set as follows along with the element of the structure in the detailed setting.

Label name	Device	Settings
bnRX	First device of RX	"B0" for this application program example
bnRY	First device of RY	"B80" for this application program example
unRWr	First device of RWr*1	"W0" for this application program example*1
unRWw	First device of RWw*1	"W190" for this application program example*1

*1 RWr0 to RWr18F are assigned to W0 to W18F, and RWw0 to RWw18F are assigned to W190 to W31F. Because the refresh setting requires only the inverter, only RWr90 to RWr18F, RWw90 to RWw18F are set for this application program.

5

Program processing

INVInitial (Initial parameter setting)

Set event task starts, each variable's initial value, and constants.

- Setting of execution cycle
- Setting of unwinder axis
- Setting of main axis
- Setting of rewinder axis
- Setting of edge position axis
- Web break detection parameter

INVWinderControl (Tension control main processing)

The processing to control the inverter is added to the WinderControl program of the basic project.

■Main axis control (Main Axis Control)

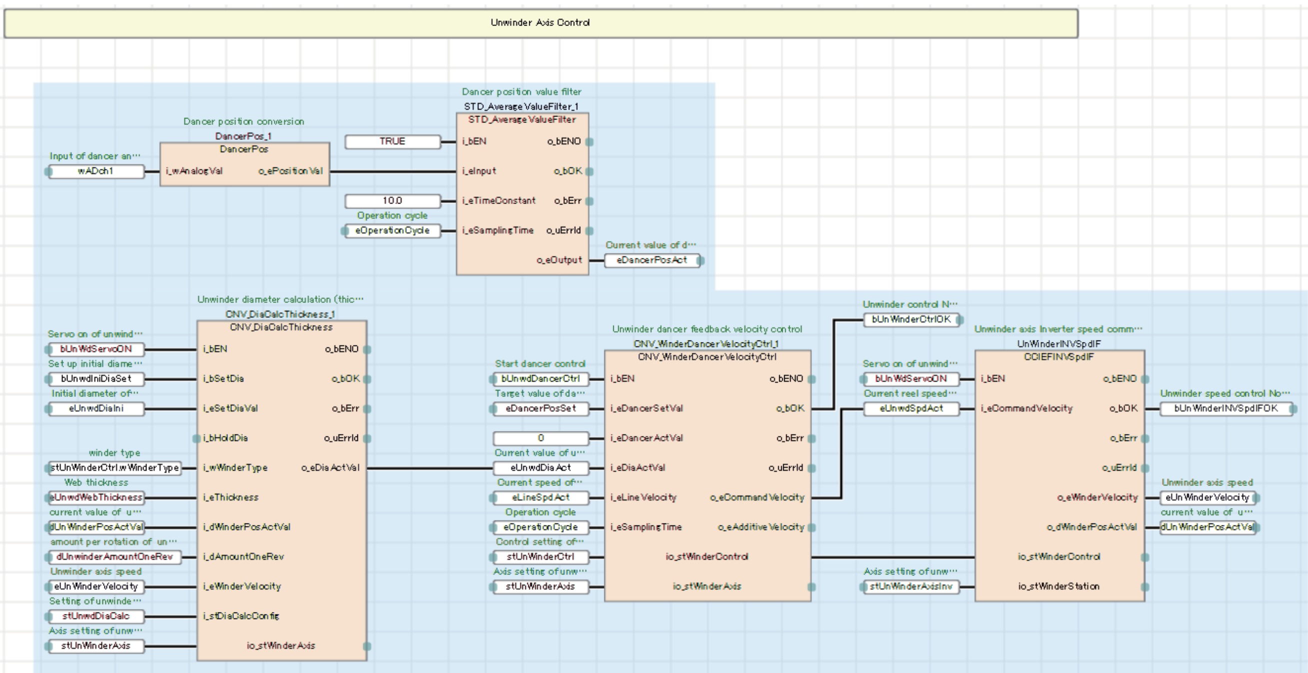
Refer to "Page 150 Main axis control".

■Unwinder axis control (Unwinder Axis Control)

When Start dancer control (bUnwdDancerCtrl) turns on, the dancer feedback velocity control FB (CNV_WinderDancerVelocityCtrl) is started.

The dancer detection analog value is converted into a position, filtered with the moving average filter (10 ms), and input in the feedback value of the velocity control FB. The speed command is created to make the dancer position reach the target position. The created speed command is input to the inverter speed interface FB (CCIEFINVSpdIF), and controls the speed of the inverter.

The inverter speed interface FB sends the position and speed of the unwinder to the roll diameter calculation (Web thickness integration method) FB. Every time the unwinder axis rotates, it decrements the thickness value and calculates the current winding diameter. The current winding diameter is input in the velocity control FB, and the velocity is controlled to make the circumferential velocity reach the line velocity.



■Rewinder axis control (Rewinder Axis Control)

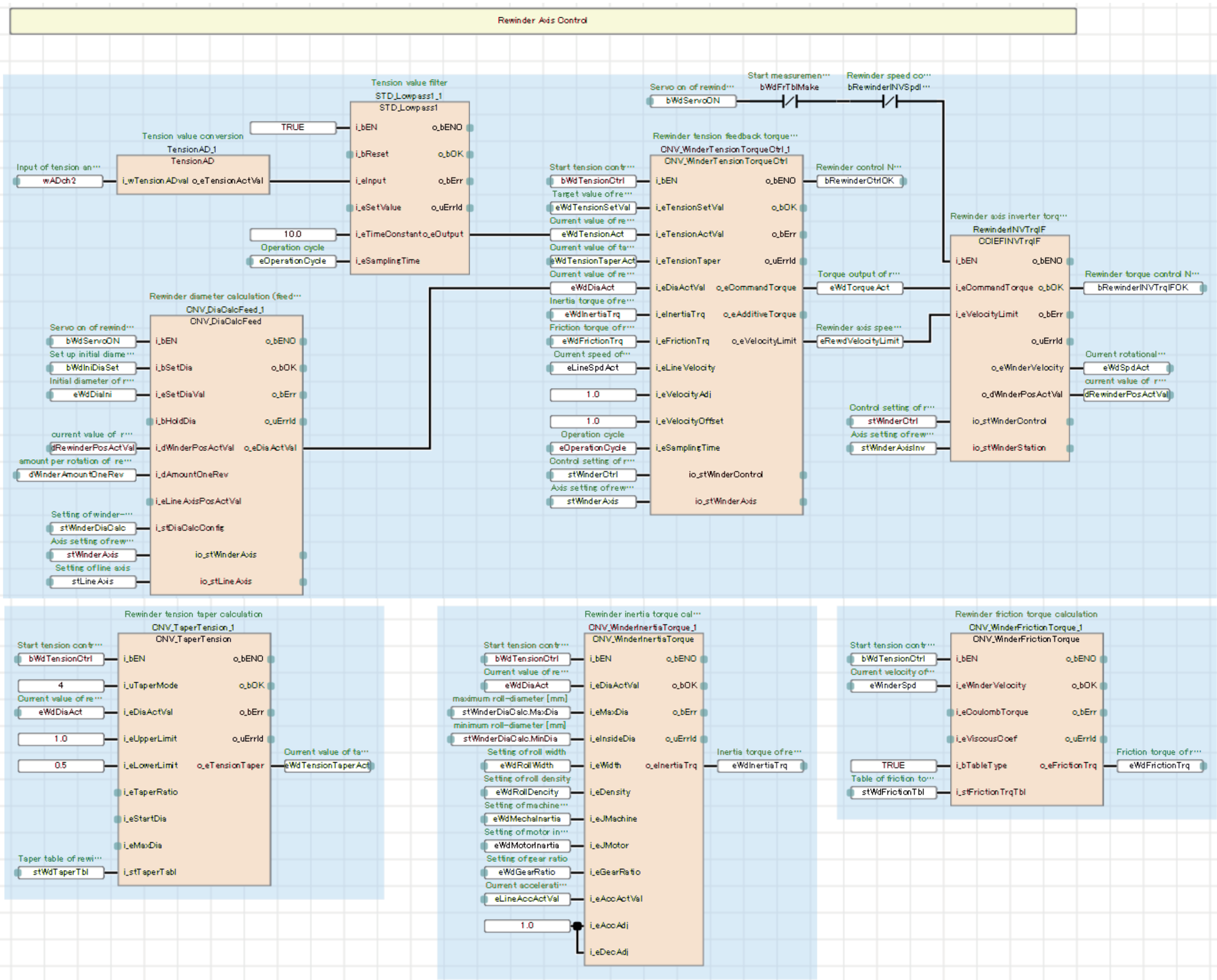
When Start tension control of rewinder (bWdTensionCtrl) turns on, the tension sensor feedback torque control FB (CNV_WinderTensionTorqueCtrl) is started.

For the feedback value of the torque control FB, the tension detection analog value is converted into a tension value and filtered with the lowpass filter (10 ms).

The roll diameter calculation (feeding length) FB receives the position and speed of the unwinder axis from the inverter torque control interface FB (CCIEFINVTrqIF) and calculates the current winding diameter based on the feeding amount of the main axis per rotation of the unwinder axis.

The current winding diameter is input to the torque control FB, and the command torque of the set tension × (current winding diameter/2) is created.

The torque command to the rewinder axis is created from the command torque and the feed back value. The created torque command is input to the inverter torque control interface FB to control the torque of the inverter.



■Edge position axis control (Edge Position Axis Control)

Refer to "Page 153 Edge position axis control".

■Web break detection (Web Break Detect)

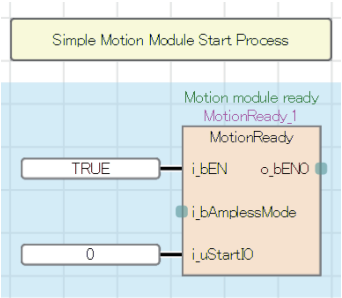
Refer to "Page 153 Web break detection".

INVPreOperation (Preparing operation, line operation control)

The axis to be used for the PreOperation program of the basic project is changed to the inverter.

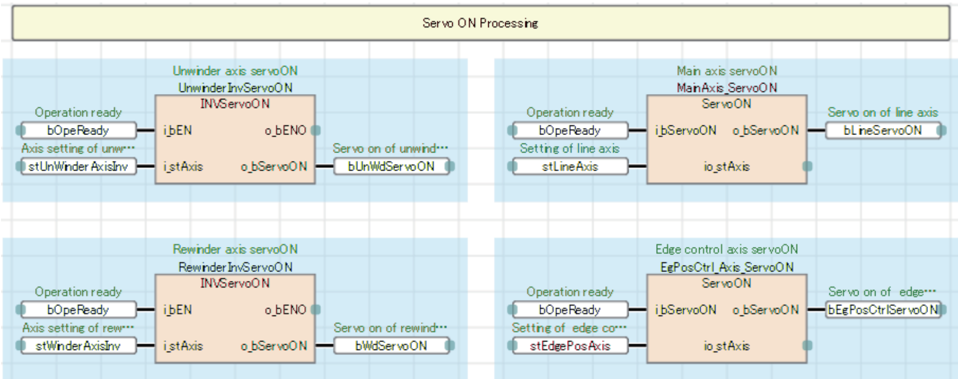
■Simple Motion module start processing

Always ON while the CPU is running

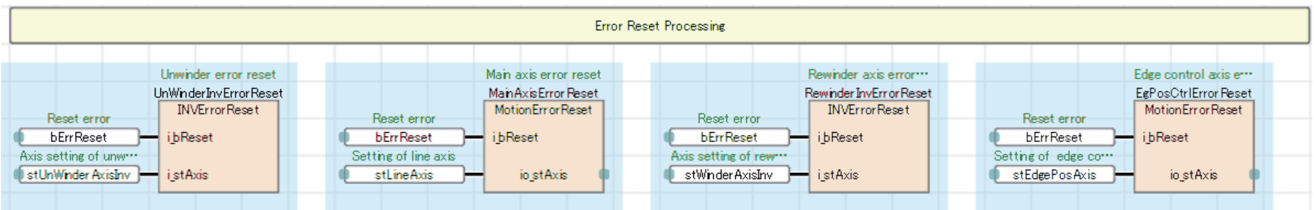


■Servo ON processing of each axis

When Preparing operation (bOpeReady) turned on in the GOT screen, the servo ON processing of each axis is performed.

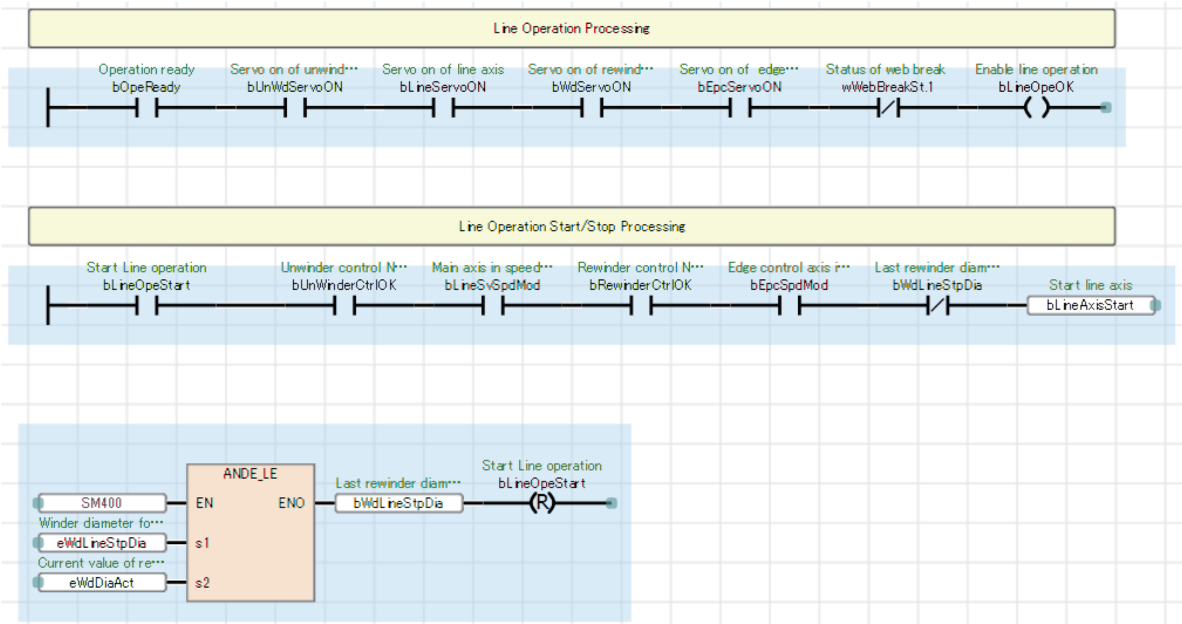


■Error reset processing of each axis



■Line operation start processing

When Start Line operation (bLineOpeStart) turns on in the GOT screen and the current rewinder diameter is equal to or smaller than the rewinder diameter for stopping line, the line operation starts.



INVHMI_IF (Touch panel I/O processing)

The processing for displaying the GOT screen is performed.

```
//HMI_IF

//////////////////// Servo Status Monitor /////////////////////////////
(* Save index registers *)
wBkp_Z19:=Z19;
wBkp_Z18:=Z18;

(* Unwinder Servo Status Monitor *)
IF (G_stnLinkIEF.bnRX[H3A]) THEN    //Error status flag Check
    wUnwdSvSt:=2;//Alarm
ELSIF (G_stnLinkIEF.bnRX[H03]) THEN //RY2 Check
    wUnwdSvSt:=1;//Servo ON
ELSE
    wUnwdSvSt:=0;
END_IF;
bUnwdSvSpdMod := bUnWinderCtrlOK;

(* Main Axis Servo Status Monitor *)
Z19:=stLineAxis.StartIO;
Z18:=(stLineAxis.AxisNo-1)*100;

IF U0Z19¥G2477Z18.7 THEN
    wLineSvSt:=2;//Alarm
ELSIF U0Z19¥G2477Z18.1 THEN
    wLineSvSt:=1;//Servo ON
ELSE
    wLineSvSt:=0;
END_IF;
OUT(U0Z19¥G2477Z18.2 AND NOT U0Z19¥G2477Z18.3,bLineSvSpdMod);//Speed Mode

(* Rewinder Axis Servo Status Monitor *)
Z19:=stWinderAxis.StartIO;
Z18:=(stWinderAxis.AxisNo-1)*100;
```

Indexes the start I/O number and axis number for specifying the buffer memory addresses of the Simple Motion module of the rewinder axis.

```

IF (G_stnLinkIEF.bnRX[H7A]) THEN    //Error status flag Check
    wWdSvSt:=2;//Alarm
ELSIF (G_stnLinkIEF.bnRX[H43]) THEN //RY2 Check
    wWdSvSt:=1;//Servo ON
ELSE
    wWdSvSt:=0;
END_IF;
bWdSvTrqMod := bRewinderCtrlOK;

eTensionCmdVal:=eWdTensionSetVal*eWdTensionTaperAct;//Command Tension Monitor
U0Z19¥G32779 := REAL_TO_INT(eWdTensionSetVal *10.0);//Target value of rewinder tension
```

Tension setting for the simulator

```
eInvTrqActVal := ( INT_TO_REAL(WORD_TO_INT(uInvTrqActVal)) * stWinderCtrl.eWinderRatedTrq) / 1000.0;
```

Creates a torque monitor value.

```
(* Edge Position Control Axis Servo Status Monitor *)
Z19:=stEdgePosAxis.StartIO;
Z18:=(stEdgePosAxis.AxisNo-1)*100;

IF U0Z19¥G2477Z18.7 THEN
    wEgPosCtrlSvSt:=2;//Alarm
    ELSIF U0Z19¥G2477Z18.1 THEN
    wEgPosCtrlSvSt:=1;//Servo ON
    ELSE
    wEgPosCtrlSvSt:=0;
END_IF;
OUT(U0Z19¥G2477Z18.2 AND NOT U0Z19¥G2477Z18.3,bEgPosCtrlSpdMod);//Speed Mode

DFROM(TRUE,stEdgePosAxis.StartIO,(2400+(stEdgePosAxis.AxisNo-1)*100),1,dEgPosCtrlPosActVal);
eEgPosCtrlPosActVal:=DINT_TO_REAL(dEgPosCtrlPosActVal)/10000.0;//Position Monitor

(* Load index registers *)
Z19:=wBkp_Z19;
Z18:=wBkp_Z18;

//////////////// Control data Set ///////////////
(* Winder Control *)
stWinderCtrl.eWinderRatedTrq:=eWdRatedTrq;
stWinderCtrl.eWinderGearRatio:=eWdGearRatio;
dWinderAmountOneRev := 8192 * REAL_TO_DINT(stWinderCtrl.eWinderGearRatio);//[Pulse]
dUnwinderAmountOneRev := 8192 * REAL_TO_DINT(stUnWinderCtrl.eWinderGearRatio);//[Pulse]
```

Indexes the start I/O number and axis number for specifying the buffer memory addresses of the Simple Motion module of the edge position axis.

Edge position axis status (wEgPosCtrlSvSt)
Alarm: 2,
Servo ON: 1,
Servo OFF: 0

*Un\G2477: Md.108 Servo status 1

Monitors the current value of the edge position axis.

Reads the backed up index register values.

Inputs the rated torque and gear ratio of the rewinder axis.

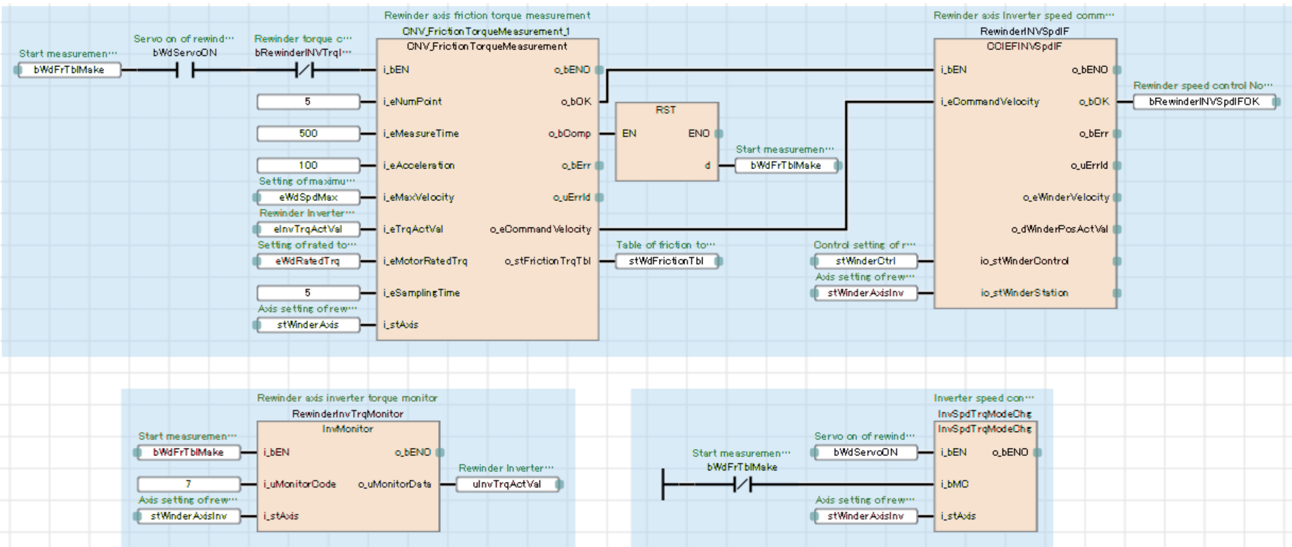
Pulse amount per rotation of rewinder/unwinder axis

INVFrictionTorqueMeasurement (Rewinder axis mechanical loss torque measurement)

When the START switch (bWdFrTblMake) in the GOT screen is touched, the torque of the rewinder axis is measured without rolls installed (five points of up to the maximum rotation speed) and the torque table for mechanical loss torque compensation is created.

At this time, the inverter starts the speed control operation, and the speed command for the measurement controls the inverter from the inverter speed interface FB (CCIEFINVSpdIF).

The torque uses the torque monitor value acquired from the inverter.



INVExample FB

This FB is for using the MELSEC iQ-R simple motion converting FB library with FR-A800-GF.
When FR-A800-GF is set to the speed control mode or torque control mode, it can be used in the following combinations with the converting FB library.

Converting library (CNV_TensionControl_R) compatible list

Item	FB name	Description	Compatible FB	
			Speed control FB CCIEFINVSpdIF	Torque control FB CCIEFINVTrqIF
Tension control	CNV_WinderTensionVelocityCtrl	Tension sensor feedback velocity control	○	—
	CNV_WinderDancerVelocityCtrl	Dancer feedback velocity control	○	—
	CNV_WinderTensionTorqueCtrl	Tension sensor feedback torque control	—	○
	CNV_WinderTensionSensorlessCtrl	Tension sensorless torque control	—	○
	CNV_DrawCtrl	Draw control	△	—
Velocity generator	CNV_LineVelocityGenerator	Line velocity generator	△	—
Roll diameter calculation	CNV_DiaCalcVelocity	Roll diameter calculation (Velocity ratio method)	○	○
	CNV_DiaCalcThickness	Roll diameter calculation (Web thickness integration method)		
	CNV_DiaCalcFeed	Roll diameter calculation (Feeding length method)		
Torque compensation	CNV_WinderInertiaTorque	Inertia compensation torque calculation	—	—
	CNV_InertiaCalc	Load inertia ratio calculation	—	—
	CNV_WinderInertiaRatioTorque	Inertia compensation torque calculation (Motor inertia ratio)	—	—
	CNV_WinderFrictionTorque	Friction compensation value calculation	—	—
	CNV_FrictionTorqueMeasurement	Friction torque measurement	○	—
Tuning function	CNV_WinderGainChange	Gain change	—	—
	CNV_TaperTension	Taper tension	—	—
	CNV_PIDControl	PID control (with Tension PI Gain auto tuning)	—	—
Additional function	CNV_EdgePositionCtrl	Edge Position Control	△	—
	CNV_WebBreakDetect	Web break detection	—	—

○: FB that can be combined directly
△: Requires the signal unit conversion
—: FB which needs not to be combined

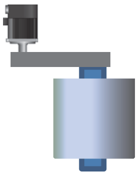
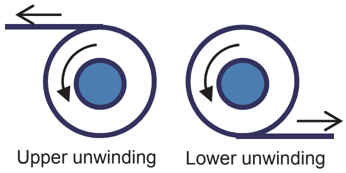
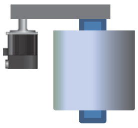
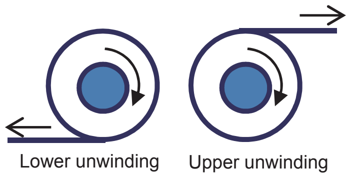
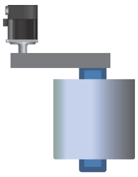
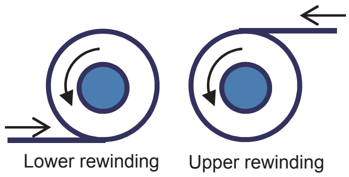
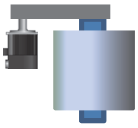
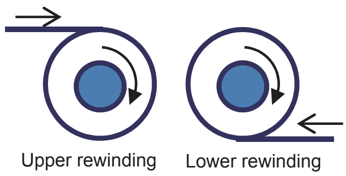
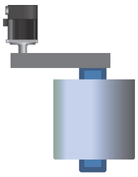
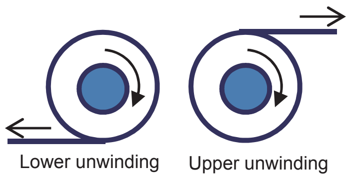
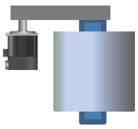
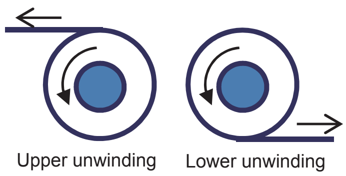
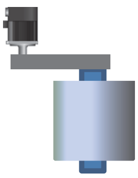
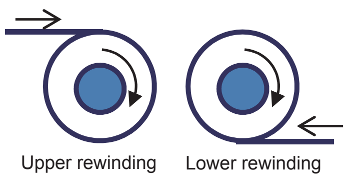
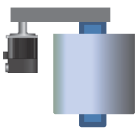
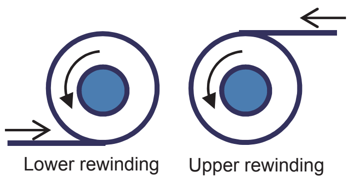
Point

For each FB of CCIEFINVSpdIF, CCIEFINVTrqIF, the device set for link refresh must be assigned to the global label for the control of CC-Link IE Field of the inverter.
Refer to the following and set the global label according to the refresh setting of the system to use.
☞ Page 199 User device setting (global label setting)

■Rotation direction setting

Set WinderType depending on the equipment. To switch an equipment to upper unwinding ⇔ lower unwinding or upper rewinding ⇔ lower rewinding, switch WinderType to 0 ⇔ 2 or 1 ⇔ 3.

Input a negative (-) speed command to the line speed input to perform rewinding with the unwinder axis or unwinding with the rewinder axis.

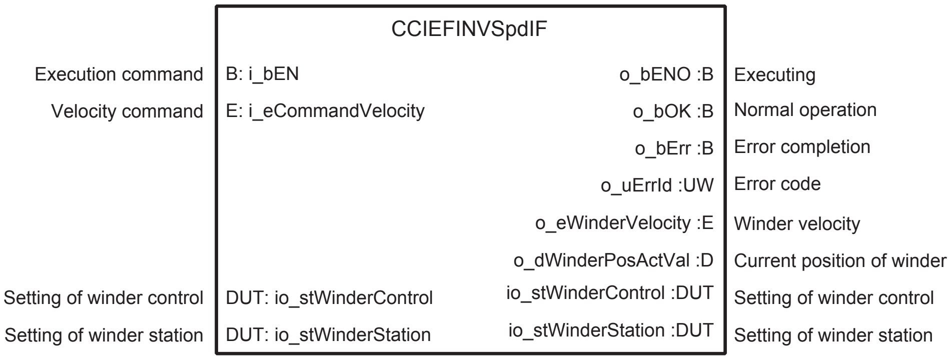
Setting	Installation direction of the motor	Equipment operation
WinderType: 0 (Forward unwinding)		
		
WinderType: 1 (Forward rewinding)		
		
WinderType: 2 (Backward unwinding)		
		
WinderType: 3 (Backward rewinding)		
		

CCIEFINVSpdIF (CC-Link IE Field inverter speed control interface)

■Name

CCIEFINVSpdIF

■Function overview

Item	Description	
Function overview	Performs speed control with the inverter.	
Symbol		
Applicable hardware and software	Applicable module	RD77GF
	Applicable CPU	MELSEC iQ-R series CPU module
	Engineering software	GX Works3
Description language	ST language	
Number of steps	1325 steps (For the macro type)	
FB dependence	None	
Function description	Sends the velocity command to the inverter specified by the setting of winder station. The inverter needs to be set to the speed control. Returns the winder velocity controlled by the inverter and the number of cumulative pulses of the encoder mounted to the motor axis as the current position of the winder.	
Compiling method	Macro type, subroutine type	
FB operation type	Real-time execution	
Restrictions and precautions	Any of FR-A8AP/FR-A8APR/FR-A8AL/FR-A8TP is required as the built-in encoder connection option. The inverter is used for the vector control with encoder. The following parameter setting is required.	

No.	Name	Setting value	Remarks
144	Speed setting switchover	100 + number of motor poles	Set the parameter to the rotation speed setting.
180	RL terminal function selection	23	Set the parameter to the pre-excitation input command.
191	SU terminal function selection	33	Set the parameter to the RY2 (Preparing operation completion 2) output.
541	Frequency command sign selection	1	Set the range within -3276.8 to 3276.7 r/min.
800	Control method selection	0	0: Speed control
802	Pre-excitation selection	1	1: Servo lock
811	Set resolution switchover	1	Unit setting of the speed setting value 0.1 r/min

■Labels

- Input labels

Name	Label name	Data type	Read timing*1	Setting range	Initial value	Description
Execution command	i_bEN	Bit	⊓	—	—	Executes the FB while it is on.
Velocity command	i_eCommandVelocity	Single precision real number	⊓	(-3276.8/gear ratio) to (3276.7/gear ratio)	—	Velocity command to the inverter [r/min] The gear ratio should be the value specified in the setting of winder control.

*1 ⊓: Always, ↑: Only when the FB is started

- Output labels

Name	Label name	Data type	Value to be held*2	Description
Executing	o_bENO	Bit	—	Turns on while Execution command is on.
Normal operation	o_bOK	Bit	—	Turns on while the FB is normally operating.
Error completion	o_bErr	Bit	—	Turns on when an error has occurred in the FB.
Error code	o_uErrId	Word [Unsigned]	—	The error code of the error that has occurred in the FB is stored. (Refer to "Page 289 List of Error Codes".)
Winder velocity	o_eWinderVelocity	Single precision real number	—	Current value of winder velocity [r/min]*3
Current position of winder	o_dWinderPosActVal	Double word [Signed]	—	Current rotational position of the winder axis [Pulse]

*2 ○: The value is held after the FB stops. —: The value is cleared after the FB stops.
*3 A conversion error occurs since it is not controlled with the ration speed but with the frequency inside the inverter.

- I/O labels

Name	Label name	Data type	Description
Setting of winder control	io_stWinderControl	WINDER_REF	Refer to the setting of winder control.
Setting of winder station	io_stWinderStation	AXIS_REF	Refer to the setting of winder station.

Setting of winder control (WINDER_REF structure)

Name	Label name	I/O	Data type	Read timing*4	Setting range	Initial value	Description
Winding method	wWinderType	IN	Word [Signed]	↑	0 to 3	—	Rewinding/unwinding setting 0: Forward unwinding 1: Forward rewinding 2: Backward unwinding 3: Backward rewinding (For details, refer to "Page 207 Rotation direction setting")
Gear ratio	eWinderGearRatio	IN	Single precision real number	↑	0.0 <	—	Gear ratio (Motor side/load side)
PLG option specification	wINVPLGOption	IN	Word [Signed]	↑	1, 2	—	Specifies the type of the built-in encoder connection option used by the inverter. 1: FR-A8AP/FR-A8APR/FR-A8AL (built-in option) 2: FR-A8TP (control terminal block option)

Setting of winder axis (AXIS_REF structure)

Name	Label name	I/O	Data type	Read timing*4	Setting range	Initial value	Description
Axis number	AxisNo	IN	Word [Unsigned]	↑	1 to 120	—	Used reading the axis number as the station number. The station number occupied in the motion mode cannot be used.
Start IO number	StartIO	IN	Word [Unsigned]	↑	0H to FEH	—	Installation address of the Simple Motion module (Upper three digits of four digits (hexadecimal))

*4 ⊓: Always, ↑: Only when the FB is started

CCIEFINVTrqIF (CC-Link IE Field inverter torque interface)

■Name

CCIEFINVTrqIF

■Function overview

Item	Description
Function overview	Performs torque control with the inverter.
Symbol	

	CCIEFINVTrqIF		
Execution command	B: i_bEN	o_bENO :B	Executing
Torque command	E: i_eCommandTorque	o_bOK :B	Normal operation
Velocity limit	E: i_eVelocityLimit	o_bErr :B	Error completion
		o_uErrId :UW	Error code
		o_eWinderVelocity :E	Winder velocity
		o_dWinderPosActVal :D	Current position of winder
Setting of winder control	DUT: io_stWinderControl	io_stWinderControl :DUT	Setting of winder control
Setting of winder station	DUT: io_stWinderStation	io_stWinderStation :DUT	Setting of winder station

Item	Description	
Applicable hardware and software	Applicable module	RD77GF
	Applicable CPU	MELSEC iQ-R series CPU module
	Engineering software	GX Works3
Description language	ST language	
Number of steps	1677 steps (For the macro type)	
FB dependence	None	
Function description	Sends the torque command and velocity limit to the inverter specified by the setting of winder station. Returns the winder velocity controlled by the inverter and the number of cumulative pulses of the encoder mounted to the motor axis as the current position of the winder. The inverter needs to be set in the torque control.	
Compiling method	Macro type, subroutine type	
FB operation type	Real-time execution	
Restrictions and precautions	Any of FR-A8AP/FR-A8APR/FR-A8AL/FR-A8TP is required as the built-in encoder connection option. The inverter is used for the vector control with encoder. The following parameter setting is required.	

No.	Name	Setting value	Remarks
144	Speed setting switchover	100 + number of motor poles	Set the parameter to the rotation speed setting.
180	RL terminal function selection	23	Set the parameter to the pre-excitation input command.
191	SU terminal function selection	33	Set the parameter to the RY2 (Preparing operation completion 2) output.
541	Frequency command sign selection	1	Set the range within -3276.8 to 3276.7 r/min.
800	Control method selection	1	1: Torque control
804	Torque command source selection	5	Use the setting value of Pr.805. By 0.01%
807	Speed limit selection	0	Use the speed command setting value for the speed limit.
811	Set resolution switchover	1	Unit setting of the speed limit value 0.1 r/min
1113	Speed limit method selection	9999	Speed limit mode 1
1114	Torque command reverse selection	0	Regardless of the operation command (STF/STR) of the inverter, the positive torque command generates the (Forward rotation in power running mode/reverse rotation in regenerative mode, and the negative torque command generates the Reverse rotation in power running mode/forward rotation in regenerative mode).

■Labels

- Input labels

Name	Label name	Data type	Read timing*1	Setting range	Initial value	Description
Execution command	i_bEN	Bit	⊓	—	—	Executes the FB while it is on.
Torque command	i_eCommandTorque	Single precision real number	⊓	(-3.2768*rated torque*gear ratio) to (3.2767*rated torque*gear ratio)	—	Torque command value for the inverter [N·m] (Motor axis conversion) The gear ratio and rated torque should be the values specified in the setting of winder control.
Velocity limit	i_eVelocityLimit	Single precision real number	⊓	(-3276.8/gear ratio) to (3276.7/gear ratio)	—	Velocity limit value for the inverter [r/min] (Motor axis conversion) The gear ratio should be the value specified in the setting of winder control.

*1 ⊓: Always, ↑: Only when the FB is started

- Output labels

Name	Label name	Data type	Value to be held*2	Description
Executing	o_bENO	Bit	—	Turns on while Execution command is on.
Normal operation	o_bOK	Bit	—	Turns on while the FB is normally operating.
Error completion	o_bErr	Bit	—	Turns on when an error has occurred in the FB.
Error code	o_uErrId	Word [Unsigned]	—	The error code of the error that has occurred in the FB is stored. (Refer to "Page 289 List of Error Codes".)
Winder velocity	o_eWinderVelocity	Single precision real number	—	Current value of winder velocity [r/min]*3
Current position of winder	o_dWinderPosActVal	Double word [Signed]	—	Current rotational position of the winder axis [Pulse]

*2 ○: The value is held after the FB stops. —: The value is cleared after the FB stops.
*3 A conversion error occurs since it is not controlled with the ration speed but with the frequency inside the inverter.

- I/O labels

Name	Label name	Data type	Description
Setting of winder control	io_stWinderControl	WINDER_REF	Refer to the setting of winder control.
Setting of winder station	io_stWinderStation	AXIS_REF	Refer to the setting of winder axis.

Setting of winder control (WINDER_REF structure)

Name	Label name	I/O	Data type	Read timing*4	Setting range	Initial value	Description
Winding method	wWinderType	IN	Word [Signed]	↑	0 to 3	—	Rewinding/unwinding setting 0: Forward unwinding 1: Forward rewinding 2: Backward unwinding 3: Backward rewinding (For details, refer to "Page 207 Rotation direction setting")
Gear ratio	eWinderGearRatio	IN	Single precision real number	↑	0.0 <	—	Gear ratio (Motor side/load side)
Rated torque	eWinderRatedTrq	IN	Single precision real number	↑	0.0 <	—	Rated torque of motor [N·m]
Inverter PLG option specification	wINVPLGOption	IN	Word [Signed]	↑	1, 2	—	Specifies the type of the built-in encoder connection option used by the inverter. 1: FR-A8AP/FR-A8APR/FR-A8AL (built-in option) 2: FR-A8TP (control terminal block option)

Setting of winder axis (AXIS_REF structure)

Name	Label name	I/O	Data type	Read timing*4	Setting range	Initial value	Description
Axis number	AxisNo	IN	Word [Unsigned]	↑	1 to 120	—	Used reading the axis number as the station number. The station number occupied in the motion mode cannot be used.
Start IO number	StartIO	IN	Word [Unsigned]	↑	0H to FEH	—	Installation address of the Simple Motion module (Upper three digits of four digits (hexadecimal))

*4 ⎍: Always, ↑: Only when the FB is started

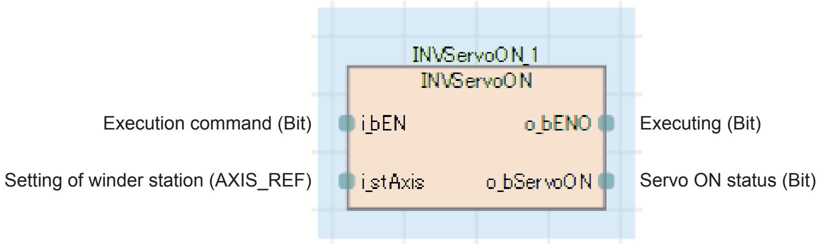
ExamplePrgCtrl FB

This section describes the FBs added for the inverter control. For the basic program example and common FBs, refer to "Page 159 ExamplePrgCtrl FB".

INVServoON

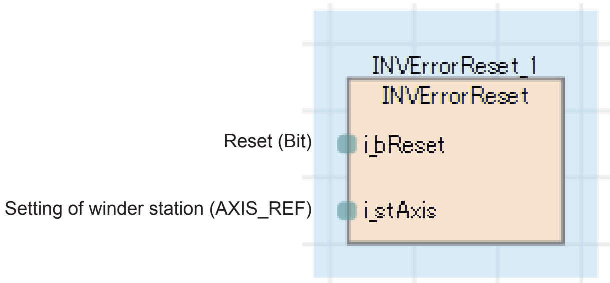
RYn8, which is the remote IO output, is turned on in the inverter specified by the setting of winder station as the servo-on (pre-excitation) command.
This FB receives the RY2 signal of the inverter from RXn3, which is the remote IO input, and sends it back as the servo-on status.
For the inverter, the following parameters needs to be set.

- "[Pr.186] CS terminal function selection" = 23
- "[Pr.191] SU terminal function selection" = 33



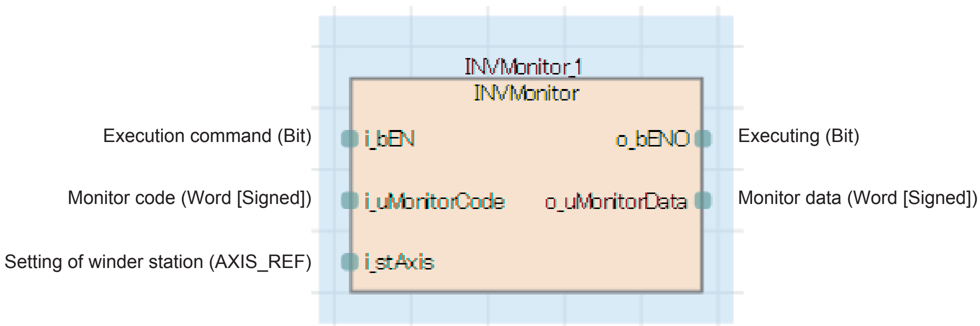
INVErrorReset

Turning on the reset command turns on the error reset request (RY(n+3)A) in the inverter specified by the setting of winder station.
When the inverter is not in the error status, the reset is not executed.



INVMonitor

Acquires the monitor data specified by the monitor code of the inverter specified by the setting of winder station.
For the format, such as the unit, of the monitor code and monitor data, refer to the following.
FR-A800 INSTRUCTION MANUAL (DETAILED)

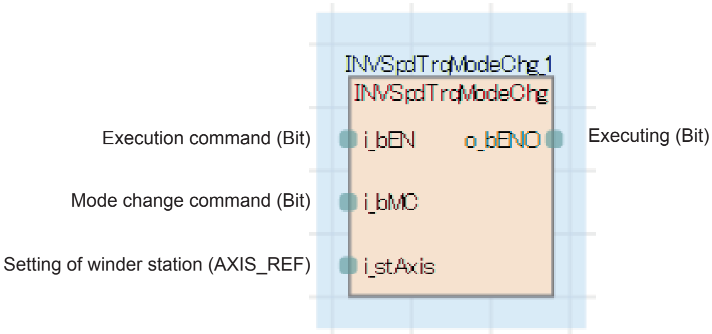


INVSpdTrqModeChg

Turns on RYn5, which is the remote IO output, in the inverter specified by the setting of winder station as the control mode switch (MC) command.

For the inverter, the following parameters needs to be set.

- "[Pr.185] JOG terminal function selection" = 26
- "[Pr.800] Control method selection" = 2, 102



Operation procedure

The operation procedure is same as the following.

☞ Page 161 Operation procedure

6 GOT APPLICATION SCREEN EXAMPLES

Precautions

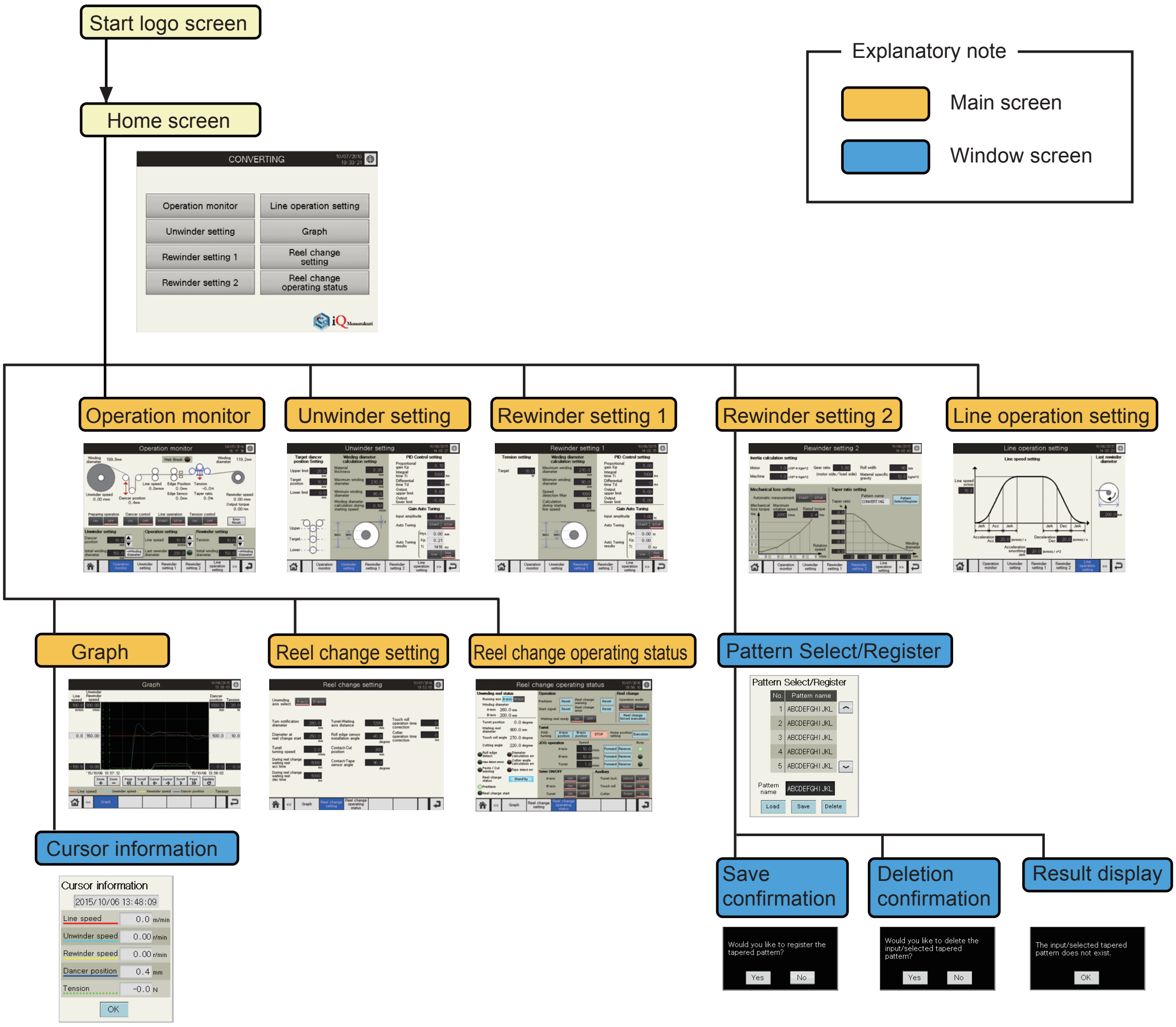
- To utilize these screen examples for an actual system, sufficiently confirm that the screens will not cause system control problems on user's own responsibility. Examine the positions where interlock conditions are required in a target system and add them.
- There are slight differences in color and layout between the actual screens and the screens described in this manual.

6.1 Screen Layout

Screen transition (All screens)

The following shows the screen transition of all screens.

- When a GOT is started, the start logo screen appears first. For details, refer to "Page 223 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 223 Operation to be performed when the GOT is started for the first time".
- For the screen transition common in all screens, refer to "Page 217 Screen transition (Common)".



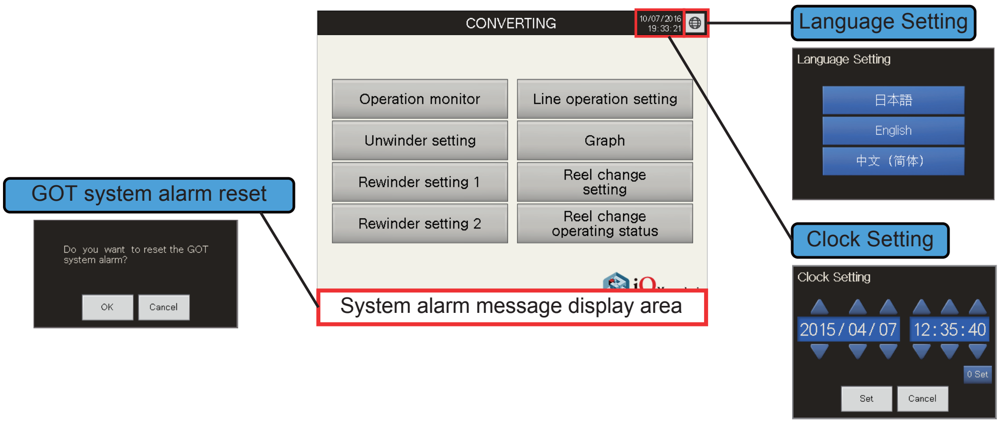
Point

When the Pattern Select/Register window screen or the Cursor information 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.

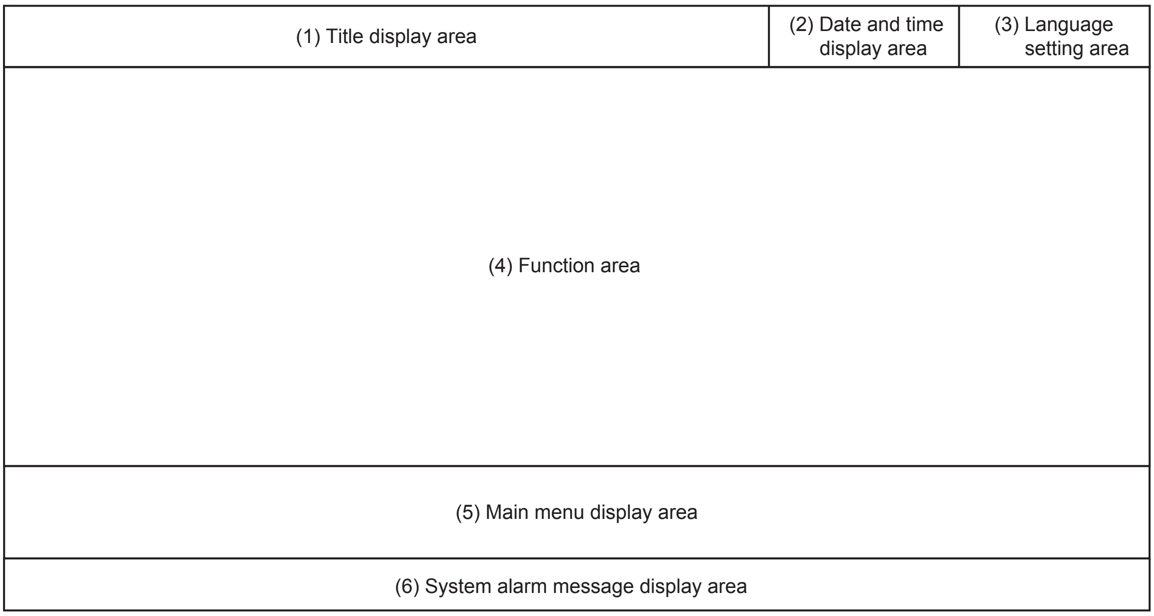
- Touching the globe mark switch displays the Language Setting window screen for language switching.
- Touching the date and time display area displays the Clock Setting window screen.
- When a GOT system alarm has occurred, touching the system alarm message display area that is to be displayed at the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



6

6.2 Basic Screen Layout

The following shows the basic layout of a main screen.



(1) Title display area

Displays the title bar.

For details, refer to "Page 221 Title bar".

(2) Date and time display area

Displays the current date (upper side) and time (lower side). Touching this display area displays the Clock Setting window screen.

For details of the Clock Setting window screen, refer to "Page 223 Clock Setting window screen".

(3) Language setting area

Touching the globe mark switch displays the Language Setting window screen.

For details of the Language Setting window screen, refer to "Page 222 Language Setting window screen".

(4) Function area

Displays the screen of each function.

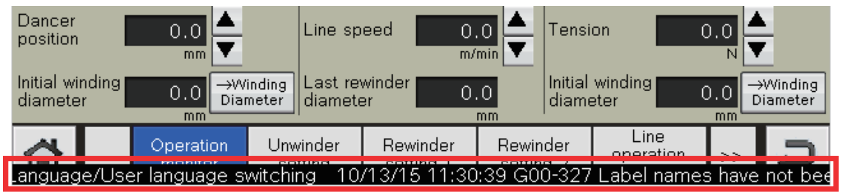
For details, refer to "Page 224 Base Screen".

(5) Main menu display area

Displays the screen transition switches to display each main screen.

For details of the main menu switches, refer to "Page 221 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 of the GOT system alarms, refer to "Page 222 GOT system alarm".

6.3 Description of Common Items

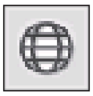
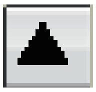
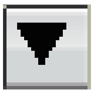
Descriptions of character colors

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

Character colors	Background colors	Description	Application example
White	Black	Displays target data values. The values can be changed using the key windows to be displayed when the display area is touched. The addition/ subtraction switches can also be used to change the values.	
Black	—	Displays target data values. The values cannot be changed.	

Switch

The following table lists switches used in common.

Display	Details
	Touch this switch to display the Language Setting window screen.
	Touch this switch to display the Clock Setting window screen.
	Touch this switch to add a value to the numerical value to be input. Touch and hold this switch to continuously perform the operation.
	Touch this switch to subtract a value from the numerical value to be input. Touch and hold this switch to continuously perform the operation.

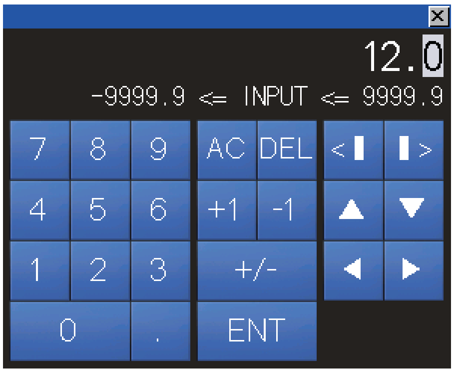
Key window

Use the following user creation key windows for inputting numerical values and characters. For types of the key windows, refer to the following.

Object	Type of key window	Window screen
Numerical value input	Decimal key window	W-30010
Character input	Uppercase alphabets + Numerical values	W-30020
	Lowercase alphabets + Numerical values	W-30021
	Symbols + Numerical values	W-30022

Numerical value input

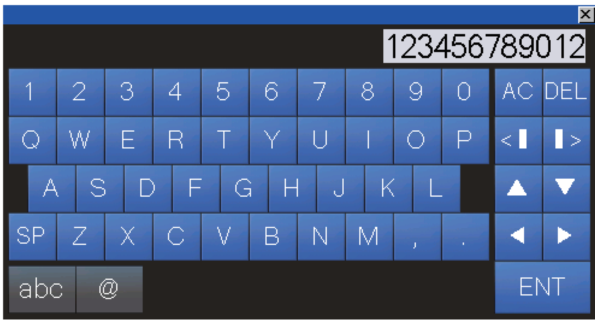
Numerical values can be input using the numeric keypad (GOT-standard key window).
The input range is displayed at the bottom of the input value area.

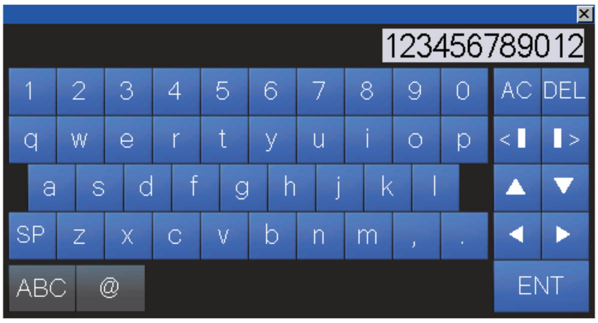


Character input

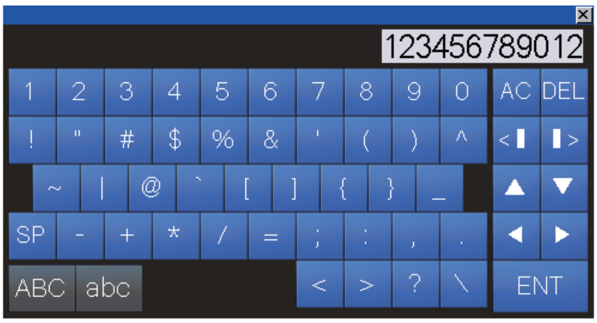
- Characters displayed on each switch can be input.
- To input a space, touch the "SP" switch.
- Touch the "abc" or "ABC" switch to switch the key window to the alphabet key windows for character input.
- Touch the "@" switch to switch the key window to the symbol key window for character input.

■Uppercase alphabets + Numerical values/Lowercase alphabets + Numerical values



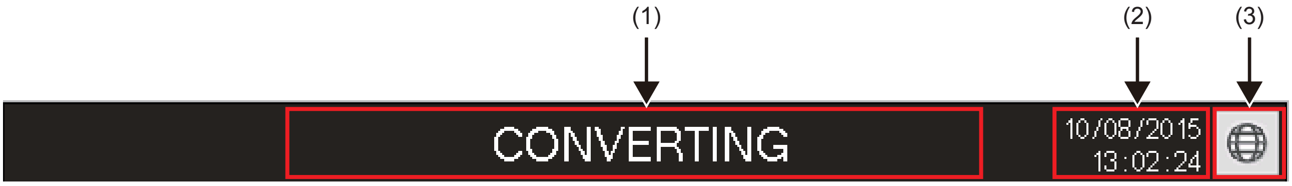


■Symbols + Numerical values



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 223 Clock Setting window screen".
- 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 222 Language Setting window screen".

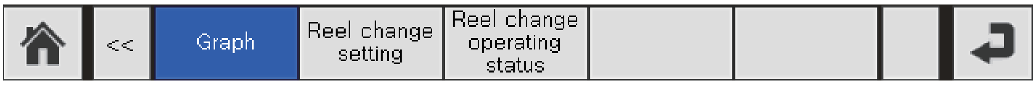
Main menu

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

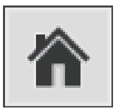
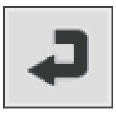
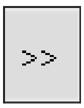
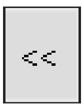
<Main menus>

Main menu 1

Main menu 2



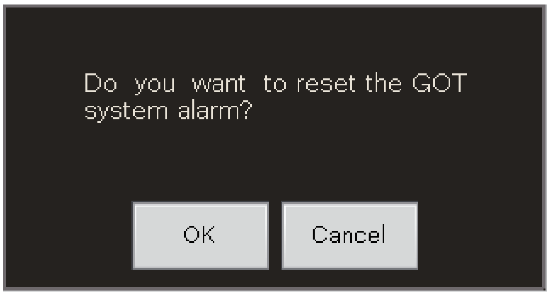
<List of switches>

Switch	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.
	Touch this switch to return to the previous screen. Up to 10 previous screens are kept in the screen history.
	Touch this switch to switch the screen to the main menu 2.
	Touch this switch to switch the screen to the main menu 1.

GOT system alarm

If a GOT system alarm has occurred, a system alarm message is popped 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. However, 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 system alarm has occurred, touching the system alarm message display area displays the GOT system alarm reset window screen.



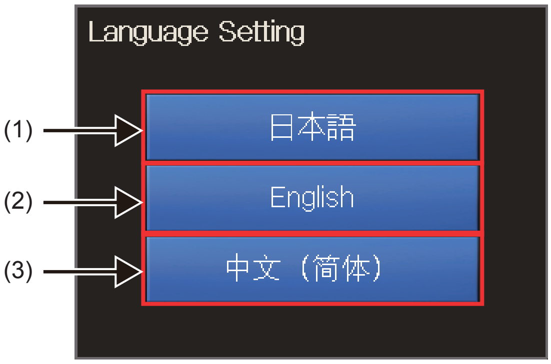
- Touch the [OK] switch when you reset the system alarm. The system alarm that cannot be reset is not cleared even though the [OK] switch is touched.
- Touch the [Cancel] switch when you do not reset the system alarm.
- Even though the main screen is switched while the GOT system alarm reset window screen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

Window screens common in all screens

The following explains window screens common in all screens.

Language Setting window screen

Switches the language displayed in the screen.



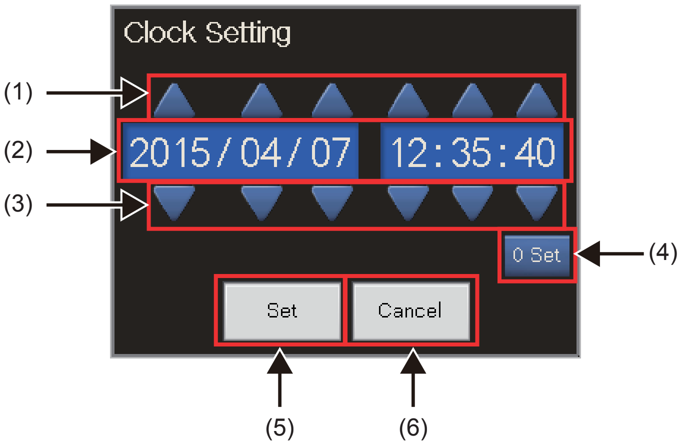
(1) Touch this switch to switch the language to Japanese.
(2) Touch this switch to switch the language to English.
(3) Touch this switch to switch the language to Chinese (Simplified).

Point

While the Language Setting window screen is being displayed, switches in the main screen cannot be operated.

Clock Setting window screen

Changes the current date and time.



(1) Date/time data addition switch

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

(2) Date and time setting

Sets the date and time (year, month, date, hour, minute, and second).

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

Touching a subtraction switch (year, month, date, hour, minute, and second) subtracts one from each value.

(4) 0 Set switch

Sets 0 for second.

(5) [Set] switch

Touching this switch sets the current date and time and closes the window screen.

(6) [Cancel] switch

Touching this switch closes the window screen without reflecting the set date and time.

Point

If setting the date and time that does not exist in the date and time setting (Ex: 2015/2/30) is attempted, touching the [Set] switch closes the window screen without reflecting the set date and time. At that time, a GOT system alarm occurs and "Clock data input out of range" is displayed in the system alarm message display area.

6.4 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 222 Language Setting window screen".

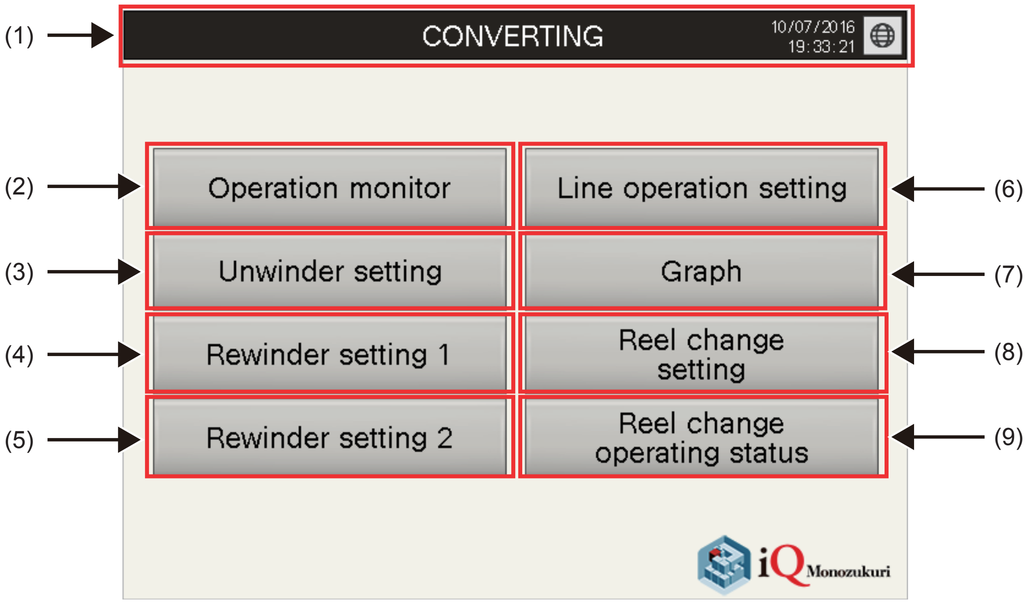
6.5 Base Screen

The following table lists base screens.

Screen No.	Screen title	Description	Reference
30000	Home	Home screen	Page 224
30050	Header	Title bar	Page 221
30100	Operation monitor	Operation monitor screen	Page 225
30200	Unwinder setting	Unwinder setting screen	Page 229
30300	Rewinder setting 1	Rewinder setting 1 screen	Page 232
30400	Rewinder setting 2	Rewinder setting 2 screen	Page 234
30500	Line operation setting	Line operation setting screen	Page 237
30600	Operation graph	Graph screen	Page 240
30700	Reel Change1	Reel change setting screen	Page 243
30800	Reel Change2	Reel change operating status screen	Page 245

Home screen

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



(1) Title bar

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

(2) Operation monitor switch

Touch this switch to switch the screen to the "Operation monitor" screen.

(3) Unwinder setting switch

Touch this switch to switch the screen to the "Unwinder setting" screen.

(4) Rewinder setting 1 switch

Touch this switch to switch the screen to the "Rewinder setting 1" screen.

(5) Rewinder setting 2 switch

Touch this switch to switch the screen to the "Rewinder setting 2" screen.

(6) Line operation setting switch

Touch this switch to switch the screen to the "Line operation setting" screen.

(7) Graph switch

Touch this switch to switch the screen to the "Graph" screen.

(8) Reel change setting switch

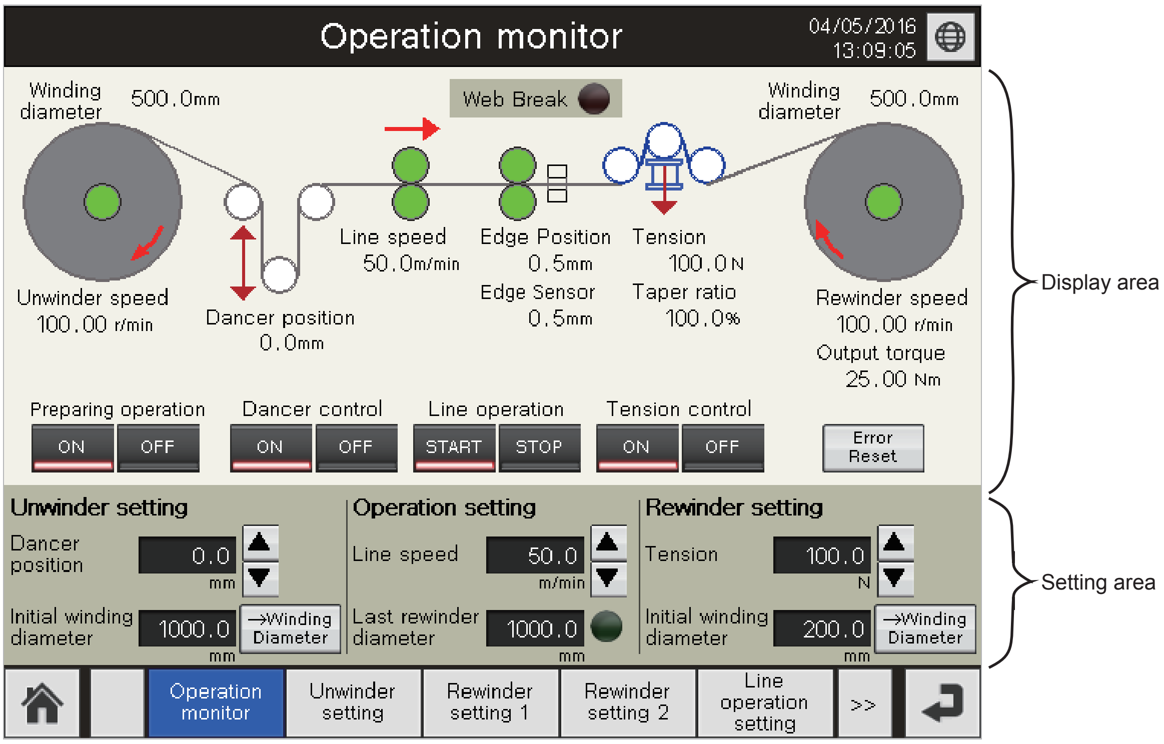
Touch this switch to switch the screen to the "Reel change setting" screen.

(9) Reel change operating status switch

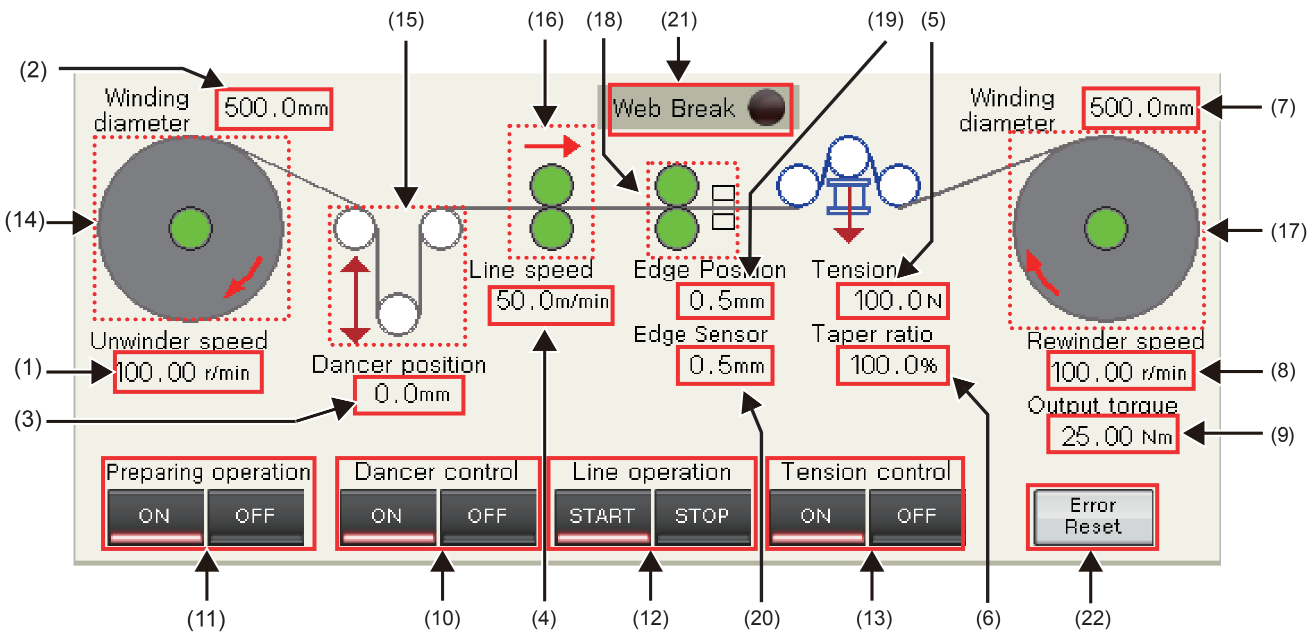
Touch this switch to switch the screen to the "Reel change operating status" screen.

Operation monitor screen

The operation of the whole line can be monitored, and the dancer control signals can be turned on/off and the line operation can be started/stopped. Basic setting values of Unwinder setting/Operation setting/Rewinder setting can be monitored and input.



Display area



(1) Unwinder speed

Displays the unwinder speed during operation.

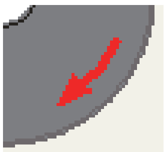
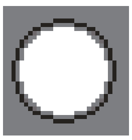
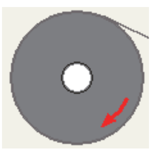
(2) Winding diameter

Displays the winding diameter at the unwinder side during operation.

(3) Dancer position

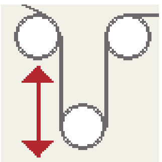
Displays the dancer position during operation.

(4) Line speed
Displays the line speed during operation.
(5) Tension
Displays the tension during operation.
(6) Taper ratio
Displays the taper ratio during operation.
(7) Winding diameter
Displays the winding diameter at the rewinder side during operation.
(8) Rewinder speed
Displays the rewinder speed during operation.
(9) Output torque
Displays the output torque during operation.
(10) Dancer control switch (ON/OFF)
Touching the [ON] switch enables the dancer control.
Touching the [OFF] switch disables the dancer control.
When one of the switches is touched, the lamp at the bottom of the switch turns on in red.
(11) Preparing operation switch (ON/OFF)
Touching the [ON] switch enables the preparing operation.
Touching the [OFF] switch disables the preparing operation.
When one of the switches is touched, the lamp at the bottom of the switch turns on in red.
(12) Line operation switch (START/STOP)
Touching the [START] switch starts the line operation.
Touching the [STOP] switch stops the line operation.
When one of the switches is touched, the lamp at the bottom of the switch turns on in red.
(13) Tension control switch (ON/OFF)
Touching the [ON] switch enables the tension control.
Touching the [OFF] switch disables the tension control.
When one of the switches is touched, the lamp at the bottom of the switch turns on in red.
(14) Unwinder axis (Monitor display)
Monitors the status of the unwinder axis during operation.

Application example	Description
	[Rotation arrow display] The flashing arrow indicates that the operation is being performed (during dancer control).
	[Servo status display] The ○ at the center of the unwinder indicates the status with the color change. ::wUnwdSvSt 0 (White): Servo OFF [Servo normal] 1 (Green): Servo ON [Servo normal] 2 (Red): Servo error
	[Winding diameter] Displays the status of the winding diameter by changing the size of a circle. The size of a circle (diameter) changes on ten scales depending on the winding diameter value.

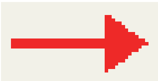
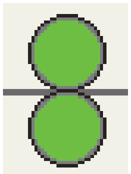
(15) Dancer position (Monitor display)

Monitors the status of the dancer position during operation.

Application example	Description
	[Dancer position] Displays the status of the dancer position by moving up and down ○. The dancer position of a circle (diameter) is moved up and down on ten scales depending on the dancer position value.

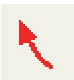
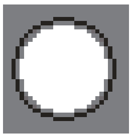
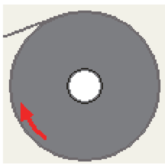
(16) Main axis (Monitor display)

Monitors the status of the main axis during operation.

Application example	Description
	[Arrow display] The flashing arrow indicates that the operation is being performed (during velocity control).
	[Servo status display] The ○ above the line speed indicates the status with the color change. ::wLineSvSt 0 (White): Servo OFF [Servo normal] 1 (Green): Servo ON [Servo normal] 2 (Red): Servo error

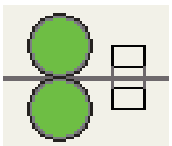
(17) Rewinder axis (Monitor display)

Monitors the status of the rewinder axis during operation.

Application example	Description
	[Rotation arrow display] The flashing arrow indicates that the operation is being performed (during torque control).
	[Servo status display] The ○ at the center of the rewinder indicates the status with the color change. ::wWdSvSt 0 (White): Servo OFF [Servo normal] 1 (Green): Servo ON [Servo normal] 2 (Red): Servo error
	[Winding diameter] Displays the status of the winding diameter by changing the size of a circle. The size of a circle (diameter) changes on ten scales depending on the winding diameter value.

(18) Edge position axis (Monitor display)

Monitors the status of the edge position axis during operation.

Application example	Description
	[Servo status display] The ○ of the edge position axis indicates the status with the color change. ::wEgPosCtrlSvSt 0 (White): Servo OFF [Servo normal] 1 (Green): Servo ON [Servo normal] 2 (Red): Servo error

(19) Edge Position

Monitors the current position value of the edge position axis.

(20) Edge Sensor

Monitors the value detected by the edge sensor.

(21) Web Break Detect (Monitor display)

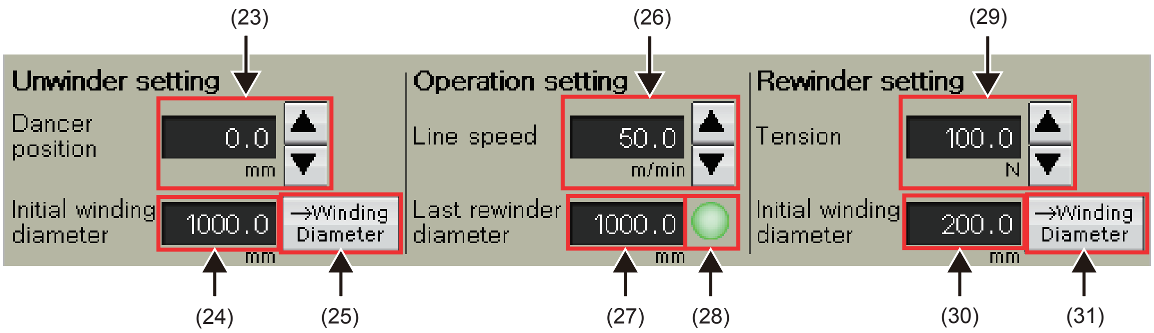
Monitors the status of the web break detection during operation.

Application example	Description
	::wWebBrkSt 0 (Black): Normal 1 (Yellow): Web break alarm 2 (Red): Web break error

(22) Error Reset switch

Resets a web break error, motion error, and servo error.

Setting area



■ Unwinder setting

(23) Dancer position

Sets the target position for the dancer control of the unwinder axis.

Touching the numerical value display area displays a numeric keypad. Input a value.

Touching the ▲/▼ switch increases/decreases the current setting value in increments of 0.1 mm.

(24) Initial winding diameter

Sets the initial winding diameter of the unwinder axis.

Touching the numerical value display area displays a numeric keypad. Input a value.

(25) → Winding diameter switch

Touching this switch sets the initial winding diameter value for the winding diameter of the unwinder side.

■Operation setting

(26) Line speed

Sets the speed of the line operation.

Touching the numerical value display area displays a numeric keypad. Input a value.

Touching the ▲/▼ switch increases/decreases the current setting value in increments of 0.1 m/min.

(27) Last rewinder diameter

Displays the last rewinder diameter of the line operation.

Touching the numerical value display area displays a numeric keypad. Input a value.

(28) Last rewinder diameter attainment lamp

Once the rewinder axis attains the last rewinder diameter, this lamp turns on (in green) and the line operation stops.

■Rewinder setting

(29) Tension

Sets the target tension for the tension control of the rewinder axis.

Touching the numerical value display area displays a numeric keypad. Input a value.

Touching the ▲/▼ switch increases/decreases the current setting value in increments of 0.1 N.

(30) Initial winding diameter

Sets the initial winding diameter of the rewinder axis.

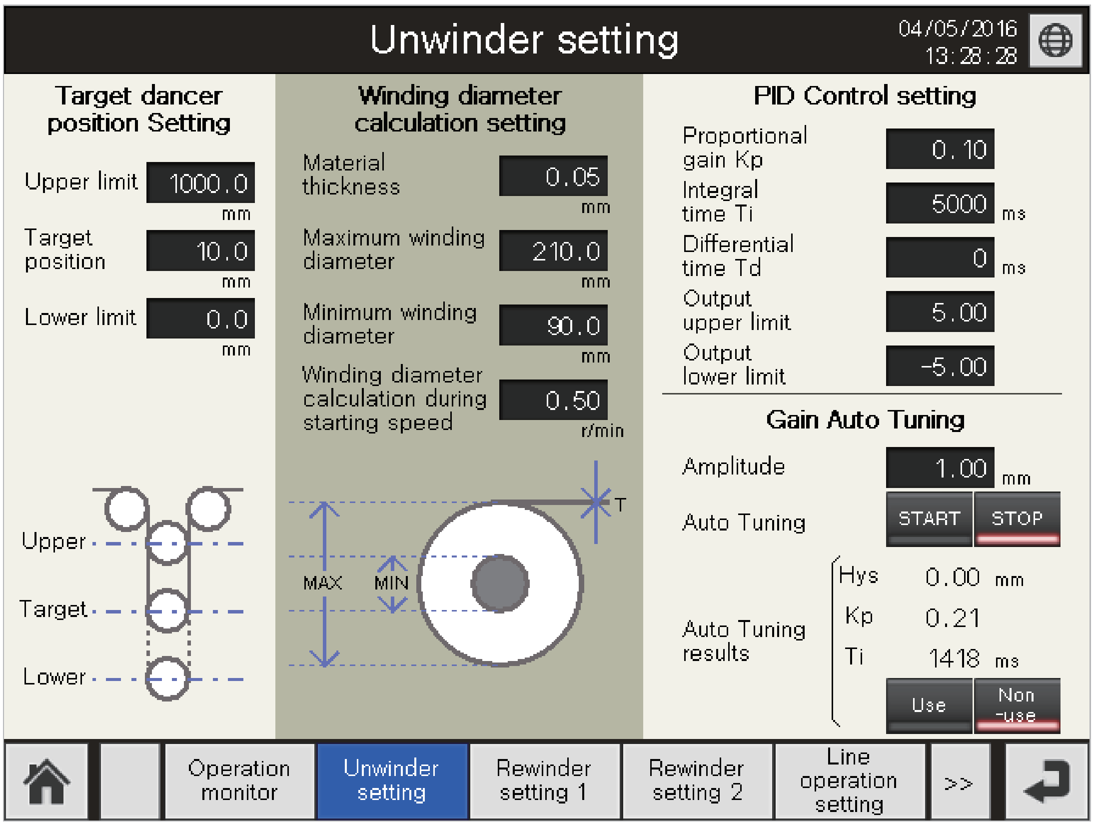
Touching the numerical value display area displays a numeric keypad. Input a value.

(31) → Winding diameter switch

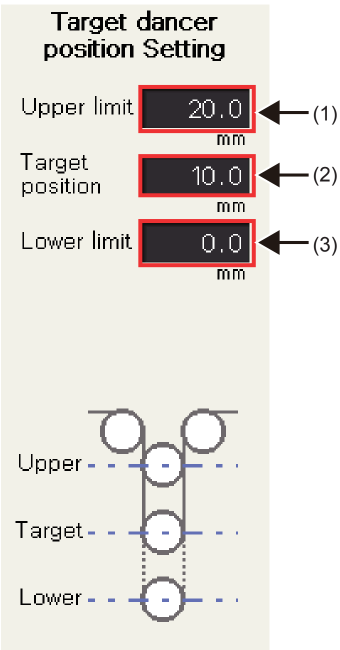
Touching this switch sets the initial winding diameter value (Rewinder setting) for the winding diameter of the rewinder side.

Unwinder setting screen

Setting values of Target dancer position Setting/Winding diameter calculation setting/PID Control setting/Gain Auto Tuning can be monitored and input. In Gain Auto Tuning, the auto tuning can be started or stopped and auto tuning results are displayed.



Target dancer position Setting



(1) Upper limit

Displays the upper limit value of Target dancer position Setting.

Touching the numerical value display area displays a numeric keypad. Input a value.

(2) Target position

Displays the target position value of Target dancer position Setting.

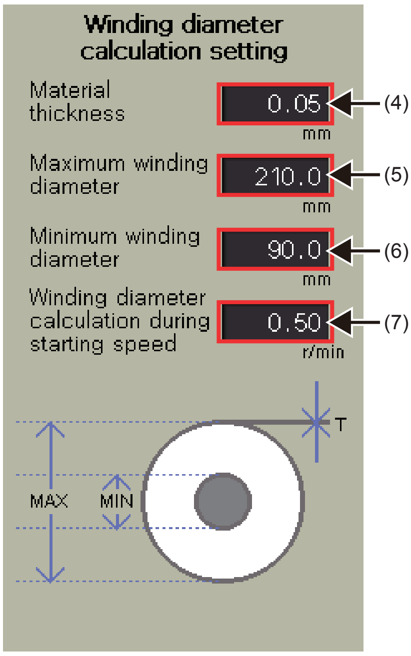
Touching the numerical value display area displays a numeric keypad. Input a value.

(3) Lower limit

Displays the lower limit value of Target dancer position Setting.

Touching the numerical value display area displays a numeric keypad. Input a value.

Winding diameter calculation setting



(4) Material thickness

Displays the material thickness of Winding diameter calculation setting.

Touching the numerical value display area displays a numeric keypad. Input a value.

(5) Maximum winding diameter

Displays the maximum winding diameter of Winding diameter calculation setting.

Touching the numerical value display area displays a numeric keypad. Input a value.

(6) Minimum winding diameter

Displays the minimum winding diameter of Winding diameter calculation setting.

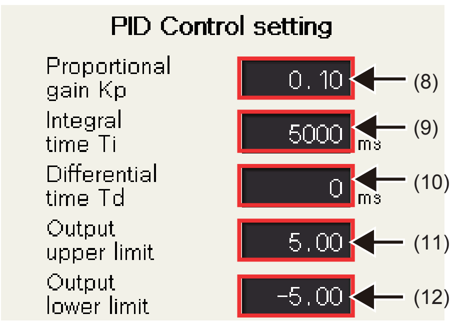
Touching the numerical value display area displays a numeric keypad. Input a value.

(7) Winding diameter calculation during starting speed

Displays the winding diameter calculation during starting speed of Winding diameter calculation setting.

Touching the numerical value display area displays a numeric keypad. Input a value.

PID Control setting



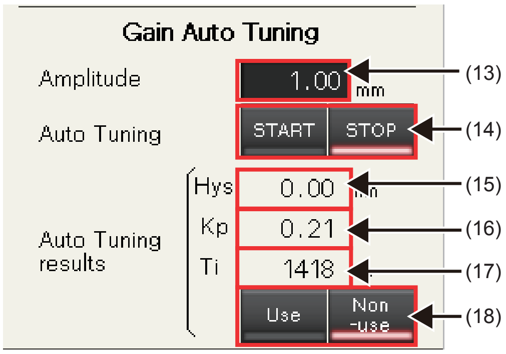
(8) Proportional gain Kp

Displays the proportional gain Kp of PID Control setting.

Touching the numerical value display area displays a numeric keypad. Input a value.

(9) Integral time Ti
Displays the integral time Ti of PID Control setting.
Touching the numerical value display area displays a numeric keypad. Input a value.
(10) Differential time Td
Displays the differential time Td of PID Control setting.
Touching the numerical value display area displays a numeric keypad. Input a value.
(11) Output upper limit
Displays the output upper limit of PID Control setting.
Touching the numerical value display area displays a numeric keypad. Input a value.
(12) Output lower limit
Displays the output lower limit of PID Control setting.
Touching the numerical value display area displays a numeric keypad. Input a value.

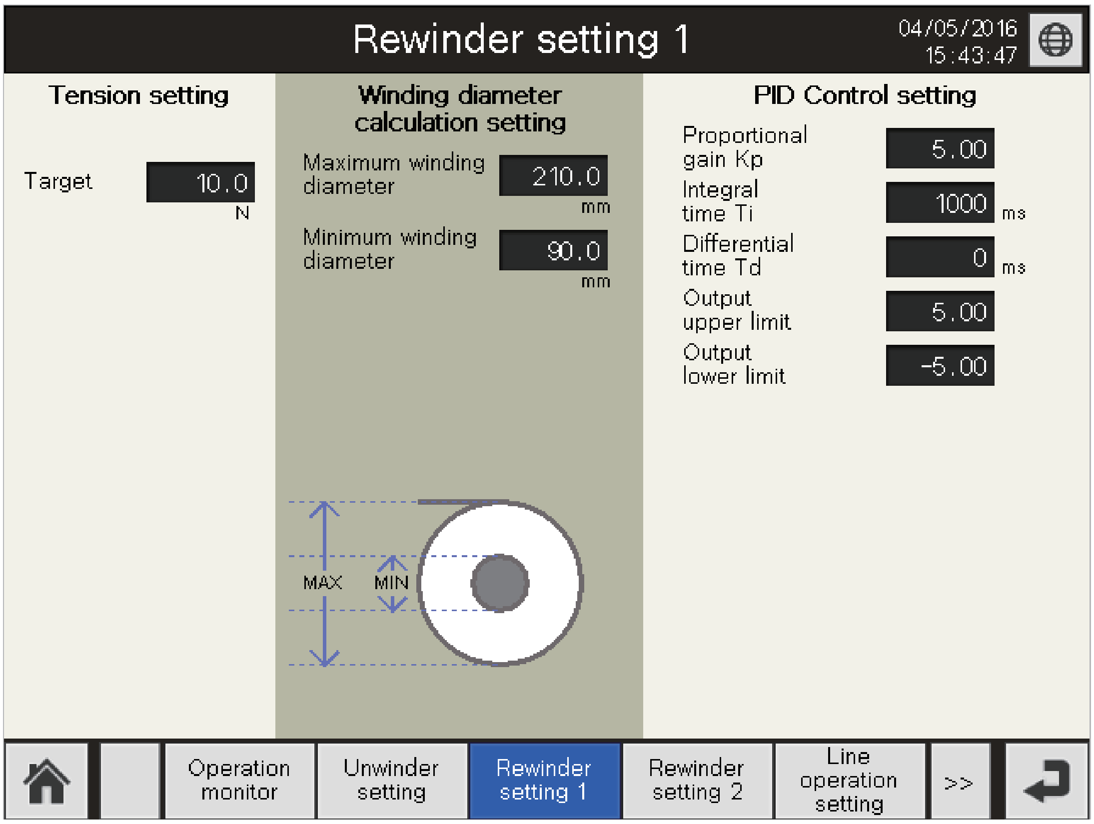
Gain Auto Tuning



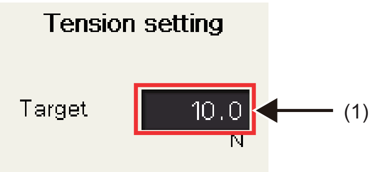
(13) Amplitude
Sets the amplitude of the gain auto tuning.
Touching the numerical value display area displays a numeric keypad. Input a value.
(14) Auto Tuning switch (START/STOP)
Touching the [START] switch starts the auto tuning.
Touching the [STOP] switch stops the auto tuning.
When one of the switches is touched, the lamp at the bottom of the switch turns on in red.
(15) Auto Tuning results Hys
Displays an auto tuning result (Hys).
(16) Auto Tuning results Kp
Displays an auto tuning result (Kp).
(17) Auto Tuning results Ti
Displays an auto tuning result (Ti).
(18) Auto Tuning results switch (Use/Non-use)
When the [Use] switch is touched, the values of Auto Tuning results are used at the line operation.
When the [Non-use] switch is touched, the values of Auto Tuning results are not used at the line operation.
When one of the switches is touched, the lamp at the bottom of the switch turns on in red.

Rewinder setting 1 screen

Setting values of Tension setting/Winding diameter calculation setting/PID Control setting can be monitored and input.



Tension setting

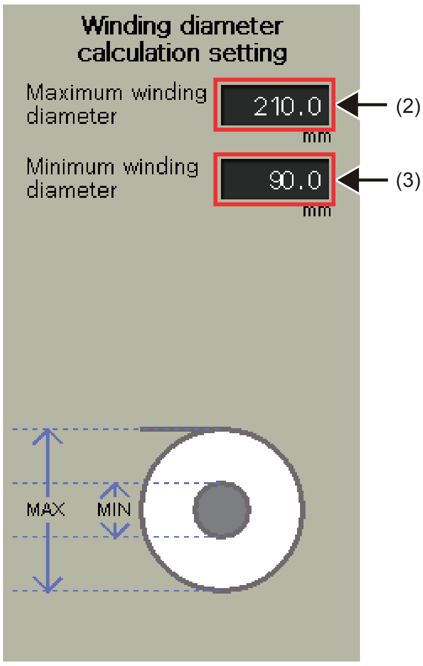


(1) Target

Displays the target value of Tension setting.

Touching the numerical value display area displays a numeric keypad. Input a value.

Winding diameter calculation setting



(2) Maximum winding diameter

Displays the maximum winding diameter of Winding diameter calculation setting.

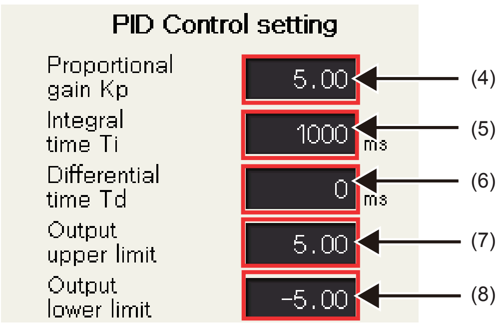
Touching the numerical value display area displays a numeric keypad. Input a value.

(3) Minimum winding diameter

Displays the minimum winding diameter of Winding diameter calculation setting.

Touching the numerical value display area displays a numeric keypad. Input a value.

PID Control setting



(4) Proportional gain Kp

Displays the proportional gain Kp of PID Control setting.

Touching the numerical value display area displays a numeric keypad. Input a value.

(5) Integral time Ti

Displays the integral time Ti of PID Control setting.

Touching the numerical value display area displays a numeric keypad. Input a value.

(6) Differential time Td

Displays the differential time Td of PID Control setting.

Touching the numerical value display area displays a numeric keypad. Input a value.

(7) Output upper limit

Displays the output upper limit of PID Control setting.

Touching the numerical value display area displays a numeric keypad. Input a value.

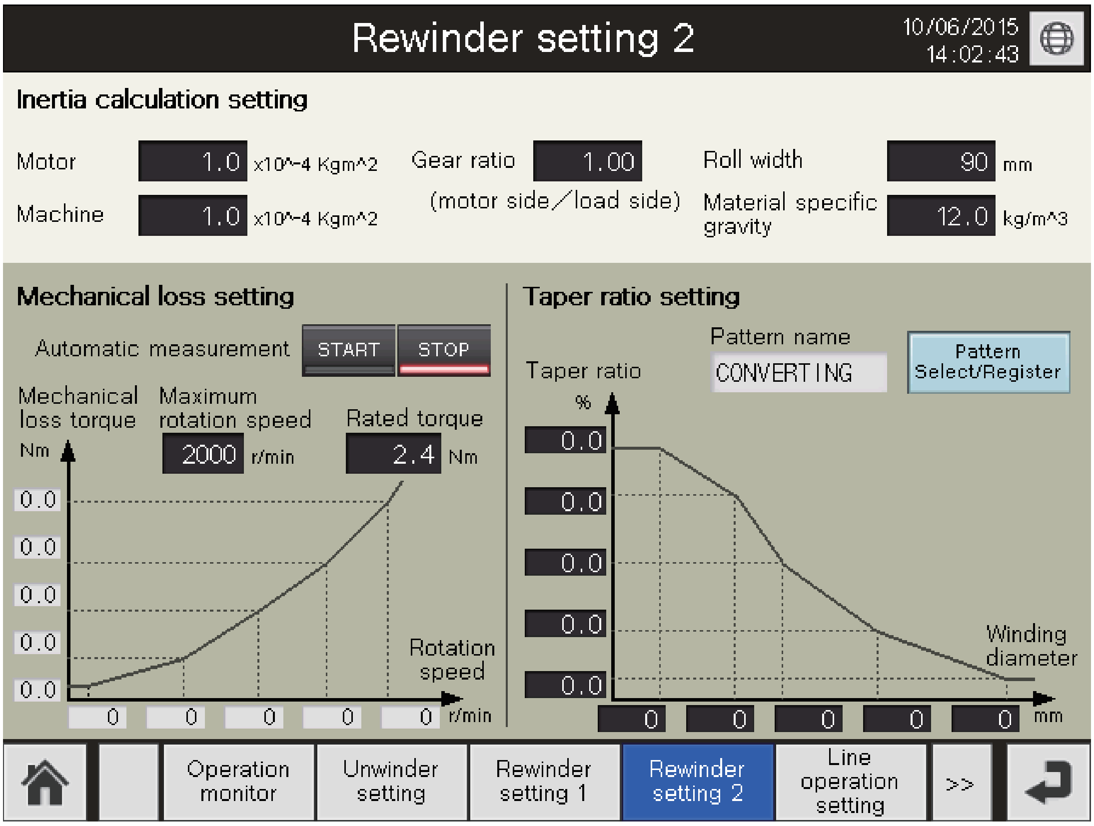
(8) Output lower limit

Displays the output lower limit of PID Control setting.

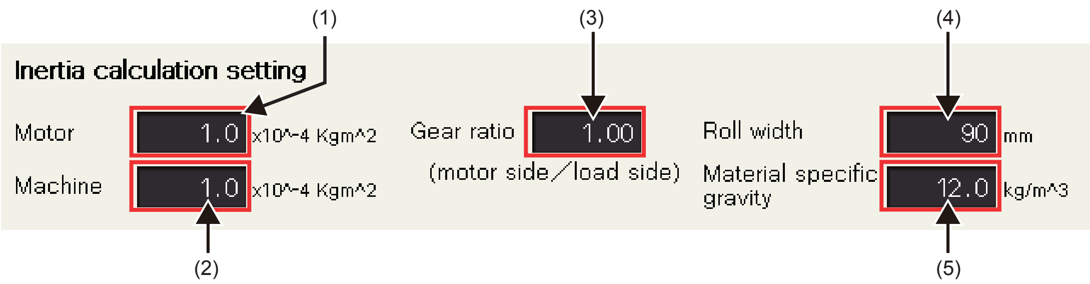
Touching the numerical value display area displays a numeric keypad. Input a value.

Rewinder setting 2 screen

Setting values of Inertia calculation setting can be monitored and input. In Mechanical loss setting, the automatic measurement can be started or stopped. In Taper ratio setting, data in Taper ratio setting (taper ratio and winding diameter) can be saved as a pattern and loaded from existing patterns.



Inertia calculation setting



(1) Motor

Displays the motor value of Inertia calculation setting.

Touching the numerical value display area displays a numeric keypad. Input a value.

(2) Machine

Displays the machine value of Inertia calculation setting.

Touching the numerical value display area displays a numeric keypad. Input a value.

(3) Gear ratio

Displays the gear ratio of Inertia calculation setting.

Touching the numerical value display area displays a numeric keypad. Input a value.

(4) Roll width

Displays the roll width of Inertia calculation setting.

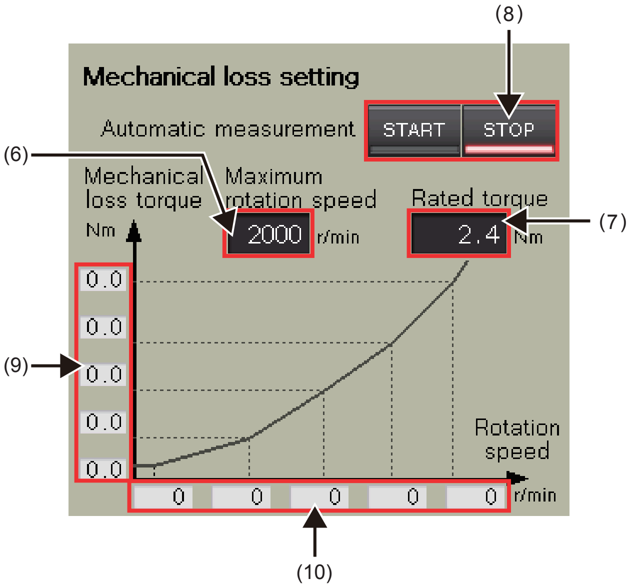
Touching the numerical value display area displays a numeric keypad. Input a value.

(5) Material specific gravity

Displays the material specific gravity of Inertia calculation setting.

Touching the numerical value display area displays a numeric keypad. Input a value.

Mechanical loss setting



(6) Maximum rotation speed

Displays the maximum rotation speed of Mechanical loss setting.

Touching the numerical value display area displays a numeric keypad. Input a value.

(7) Rated torque

Displays the rated torque of Mechanical loss setting.

Touching the numerical value display area displays a numeric keypad. Input a value.

(8) Automatic measurement switch (START/STOP)

Touching the [START] switch starts the automatic measurement.

Touching the [STOP] switch stops the automatic measurement.

When one of the switches is touched, the lamp at the bottom of the switch turns on in red.

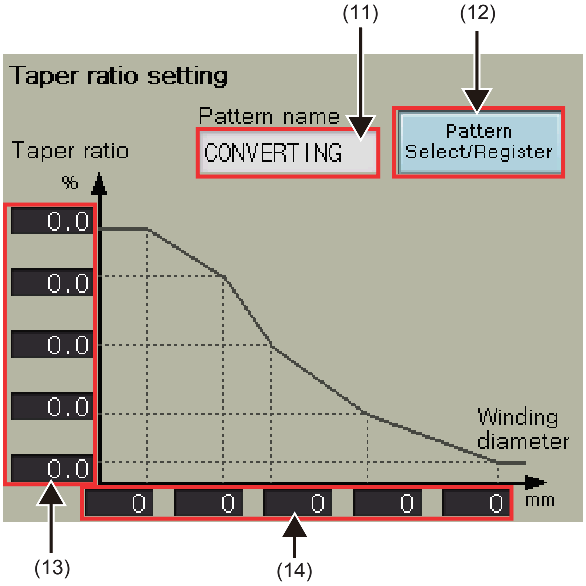
(9) Graph Y axis display (Mechanical loss torque)

Displays values of the graph axis (Mechanical loss torque).

(10) Graph X axis display (Rotation speed)

Displays values of the graph axis (Rotation speed).

Taper ratio setting



(11) Pattern name

Displays the pattern name loaded/saved (registered) in the Pattern Select/Register window screen.

(12) Pattern Select/Register switch

Touching this switch displays the Pattern Select/Register window screen.

For details, refer to "Page 252 Pattern Select/Register window screen".

(13) Graph Y axis display (Taper ratio)

Displays values of the graph axis (Taper ratio).

Touching the numerical value display area displays a numeric keypad. Input a value.

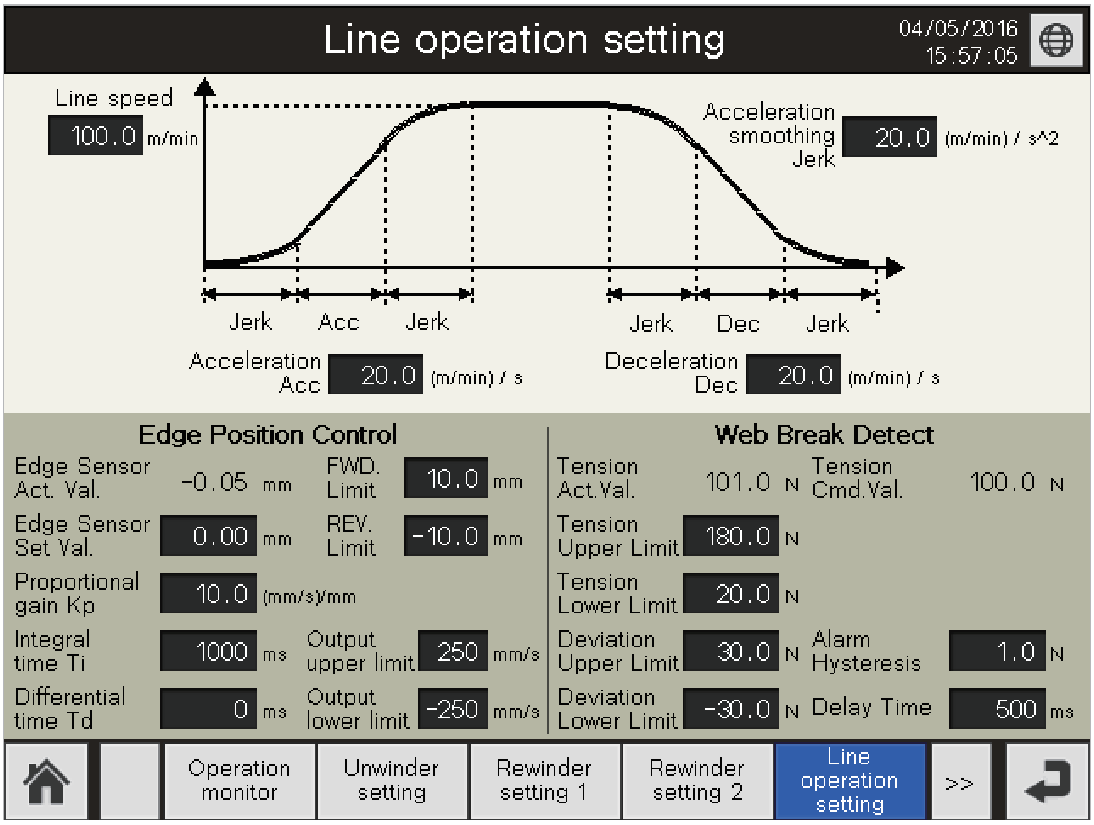
(14) Graph X axis display (Winding diameter)

Displays values of the graph axis (Winding diameter).

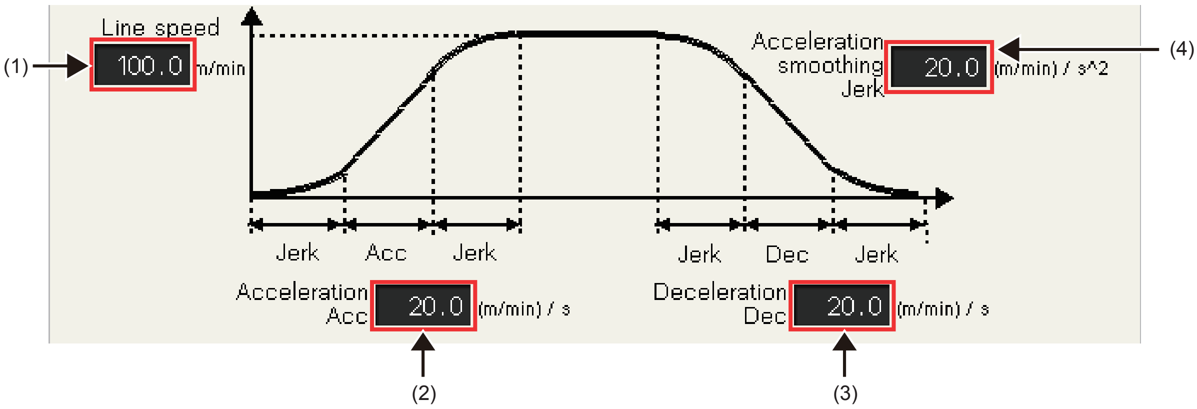
Touching the numerical value display area displays a numeric keypad. Input a value.

Line operation setting screen

Settings of the line operation (Line speed, Acceleration, Acceleration smoothing jerk, Deceleration), edge position, and web break detection can be configured.



Line speed setting



(1) Line speed

Displays the line speed of Line speed setting.

Touching the numerical value display area displays a numeric keypad. Input a value.

(2) Acceleration Acc

Displays the acceleration of Line speed setting.

Touching the numerical value display area displays a numeric keypad. Input a value.

(3) Deceleration Dec

Displays the deceleration of Line speed setting.

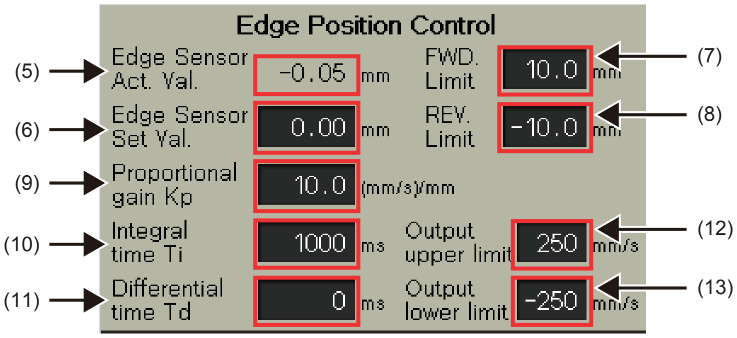
Touching the numerical value display area displays a numeric keypad. Input a value.

(4) Acceleration smoothing Jerk

Displays the acceleration smoothing jerk of Line speed setting.

Touching the numerical value display area displays a numeric keypad. Input a value.

Edge Position Control



(5) Edge Sensor Act. Val.

Displays the value (Edge position from the line center position) detected by the edge sensor.

(6) Edge Sensor Set Val.

Sets the target value of the edge sensor in the edge position control.

(7) FWD. Limit

Sets the forward end position of the edge position axis.

(8) REV. Limit

Sets the recession end position of the edge position axis.

(9) Proportional gain Kp

Sets the proportional gain value of the edge position control (velocity PID control).

(10) Integral time Ti

Sets the integral time of the edge position control (velocity PID control).

(11) Differential time Td

Sets the differential time of the edge position control (velocity PID control).

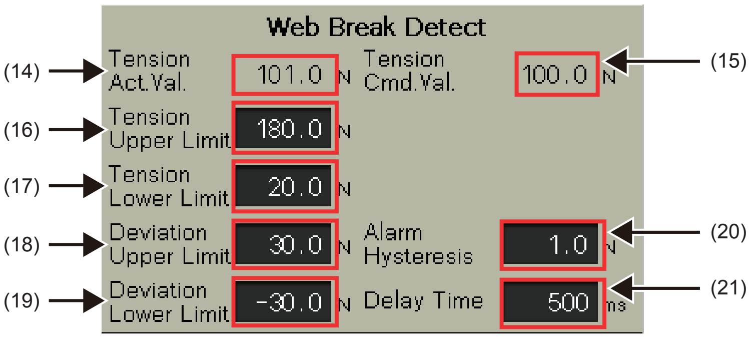
(12) Output upper limit

Sets the upper limit value of the velocity command in the edge position control (velocity PID control).

(13) Output lower limit

Sets the lower limit value of the velocity command in the edge position control (velocity PID control).

Web Break Detect



(14) Tension Act.Val.

Displays the value detected by the tension detector.

(15) Tension Cmd.Val.

Displays the tension command value of the tension control (rewinding).

(16) Tension Upper Limit

Sets the tension upper limit value to detect a web break.

(17) Tension Lower Limit

Sets the tension lower limit value to detect a web break.

(18) Deviation Upper Limit

Sets the deviation upper limit value between the tension command value and the current value of tension to detect a web alarm.

(19) Deviation Lower Limit

Sets the deviation lower limit value between the tension command value and the current value of tension to detect a web alarm.

(20) Alarm Hysteresis

Sets the hysteresis value for the deviation upper/lower limit values at a detection of a web alarm.

(21) Delay Time

Sets the delay time for the deviation upper/lower limit values at a detection of a web alarm.

Graph screen

Displays the line speed, unwinder/rewinder speed, dancer position, and tension in one historical trend graph. The data collected and accumulated in an SD memory card with the logging function is displayed in the historical trend graph. The current and past information can be displayed in the graph to use the accumulated data.

When no SD memory card has been inserted, sampling of graph data will stop in about 10 minutes.

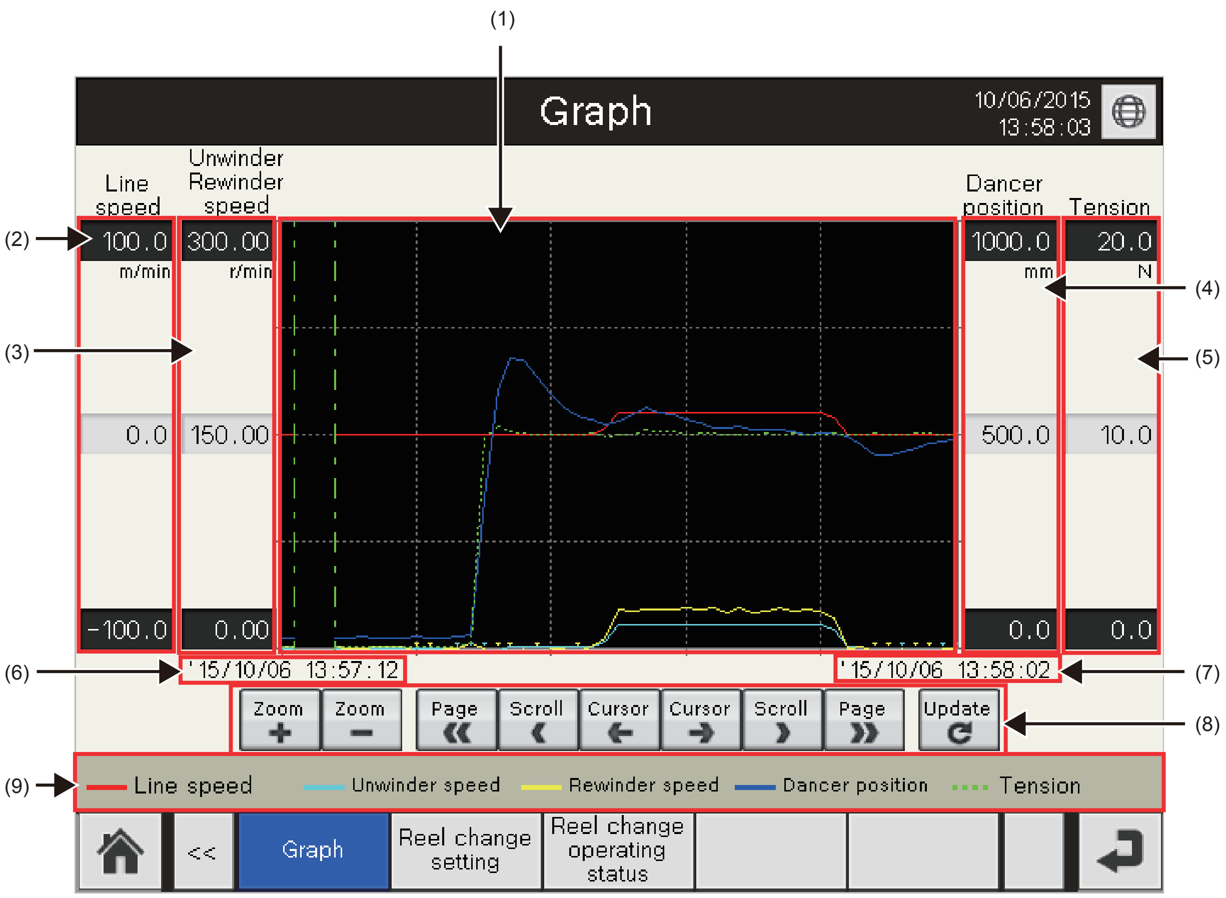
Point

<<Inputting the upper limit values and lower limit values of the graph axis (Line speed, unwinder/rewinder speed, dancer position, and tension)>>

The input ranges of the upper limit values and lower limit values do not change depending on each input value.

Always input an upper limit value larger than a lower limit value so that the lower limit value does not exceed the upper limit value.

The intermediate value is automatically calculated from the set upper limit value and lower limit value and displayed.



(1) Graph setting

Displays the line speed, unwinder/rewinder speed, dancer position, and tension in one graph.

The vertical axis of the graph is based on the line speed, and the unwinder/rewinder speed, dancer position, and tension are tuned for the axis width of the line speed (graph calculation).

The points that indicate the latest values are always at the right end of the graph.

Touching the graph being drawn displays the cursor in the touched area and displays the Cursor information window screen.

For details of the Cursor information window screen, refer to "Page 251 Cursor information window screen".

[Logging setting] The following table lists the settings.

Set	Details
Logging ID	30000
Logging name	CNV_Ldgging
Power failure holding	The GOT holds data at a power failure.
Logging method	File saving mode
Number of logs in a file	43200 logs (for 12 hours)
Logging trigger	1 second cycle (10 × 100 ms)
Number of buffering logs to be stored	600 logs (for 10 minutes)
Logging data	The following shows data to be logged. • Line speed ::eLineSpdAct • Unwinder speed ::eUnwdSpdAct • Rewinder speed ::eWdSpdAct • Dancer position ::eDancerPosAct • Tension ::eWdTensionAct

(2) Graph axis display (Line speed)

Displays values of the graph axis (Line speed). (Upper limit value, intermediate value, and lower limit value from the top)

For the upper limit value and lower limit value, touching the numerical value display area displays a numeric keypad. Input values.

(3) Graph axis display (Unwinder Rewinder speed)

Displays values of the graph axis (Unwinder Rewinder speed). (Upper limit value, intermediate value, and lower limit value from the top)

For the upper limit value and lower limit value, touching the numerical value display area displays a numeric keypad. Input values.

(4) Graph axis display (Dancer position)

Displays values of the graph axis (Dancer position). (Upper limit value, intermediate value, and lower limit value from the top)

For the upper limit value and lower limit value, touching the numerical value display area displays a numeric keypad. Input values.

(5) Graph axis display (Tension)

Displays values of the graph axis (Tension). (Upper limit value, intermediate value, and lower limit value from the top)

For the upper limit value and lower limit value, touching the numerical value display area displays a numeric keypad. Input values.

(6) Graph display end position date/time

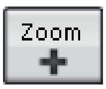
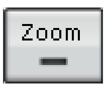
Displays the latest display end position date and time.

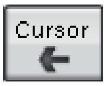
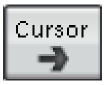
(7) Graph display start position date/time

Displays the latest display start position date and time.

(8) Switches for graph display

Touch switches for a historical trend graph. The following table lists the operations to be performed when each of the switches is touched.

Switch	Description
	Zooms in the time axis of the graph with reference to the axis of new data.
	Zooms out the time axis of the graph with reference to the axis of new data. This operation can be performed only when the time axis has been zoomed in from the default display.
	Moves the graph to the left by page.
	Moves the graph to the left.

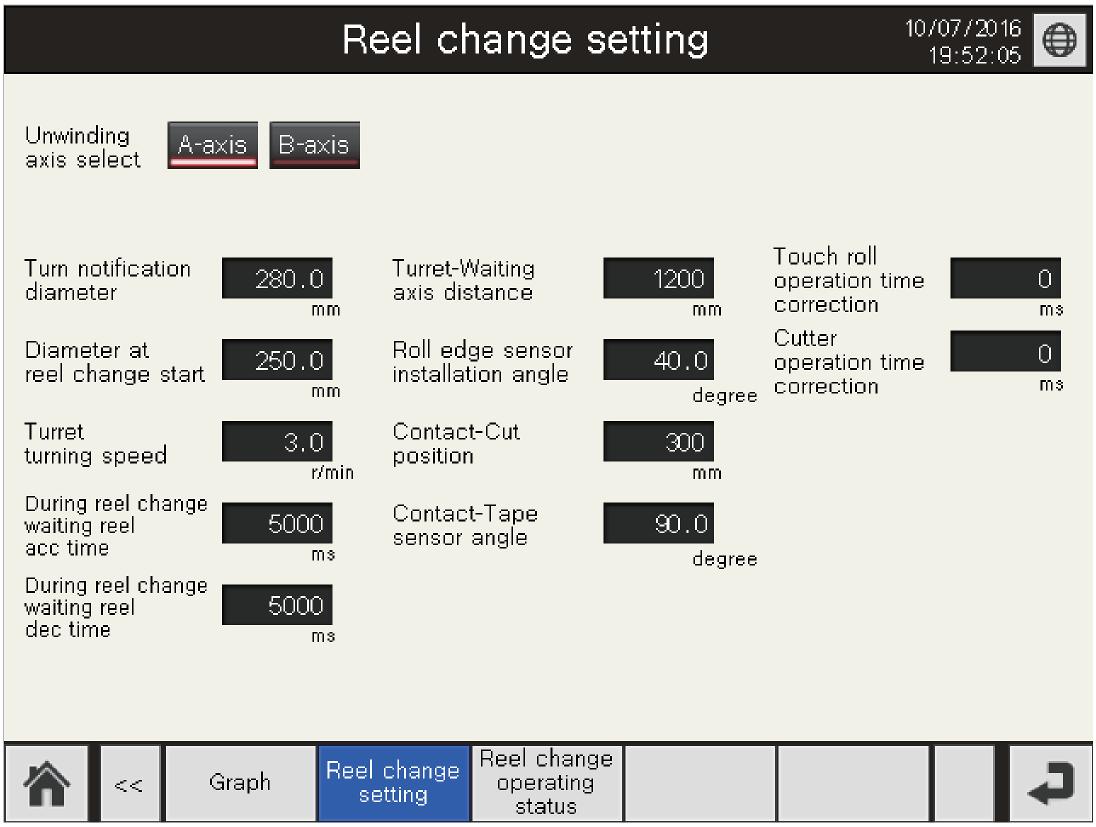
Switch	Description
	Moves the cursor to the left by one second. Moves the cursor in the direction of old data.
	Moves the cursor to the right by one second. Moves the cursor in the direction of new data.
	Moves the graph to the right.
	Moves the graph to the right by page.
	Displays the latest data.

(9) Graph color for graph display

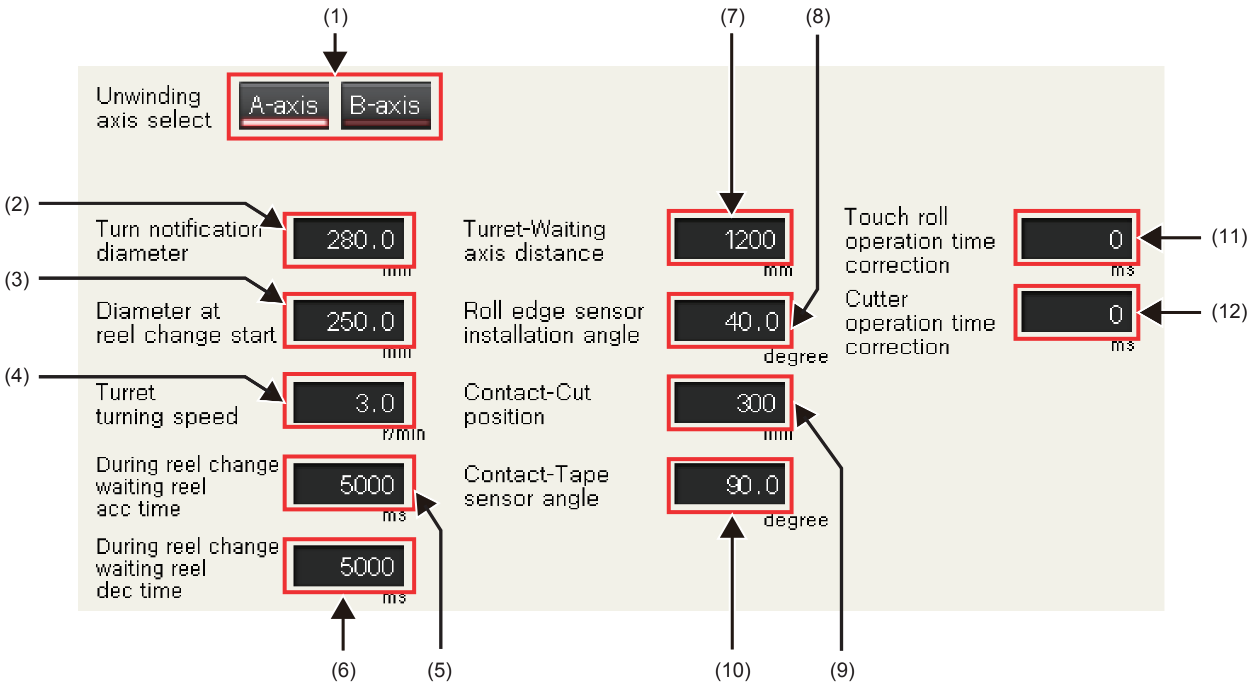
The following figure shows line colors and line types in the graph of Line speed, Unwinder/Rewinder speed, Dancer position, and Tension.

Reel change setting screen

Setting values of Reel change can be monitored and input.



Setting



(1) Unwinding axis select

Sets the current axis for unwinding.

When one of the switches is touched, the lamp at the bottom of the switch turns on in red.

(2) Turn notification diameter

Sets the winding diameter to output the reel change start prealarm.

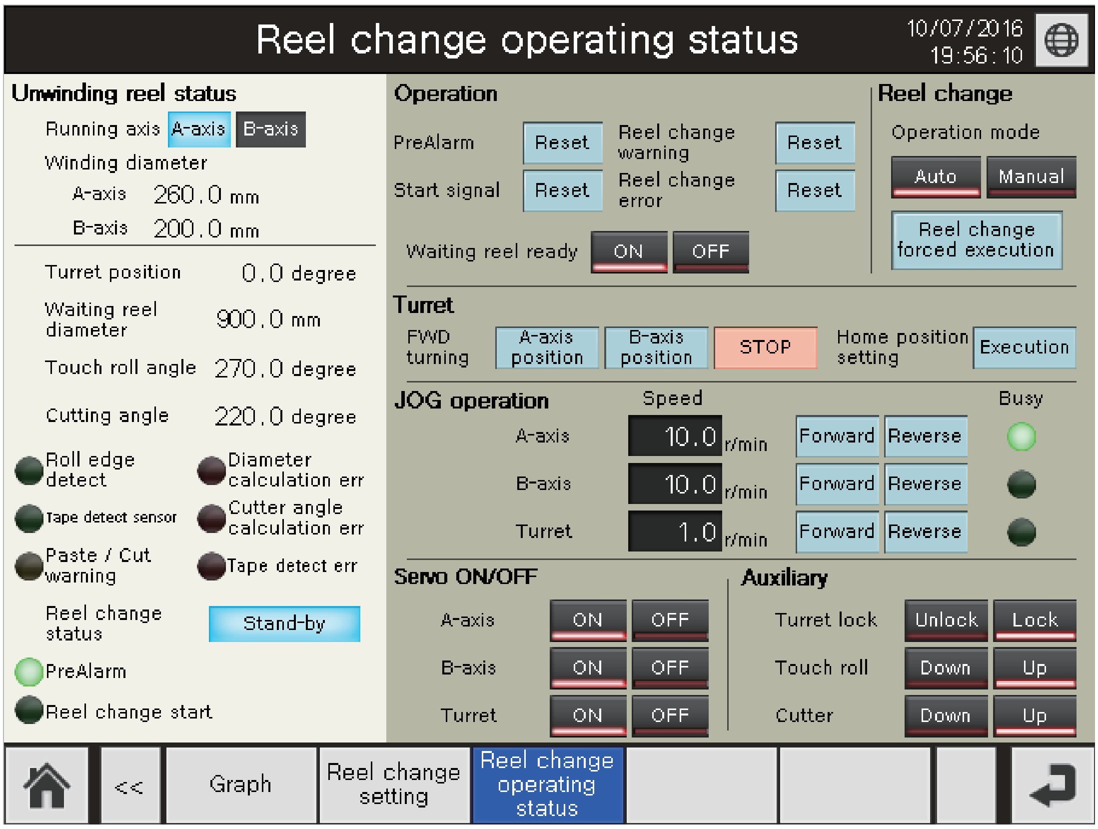
Touching the numerical value display area displays a numeric keypad. Input a value.

6

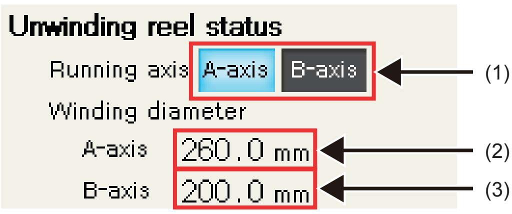
(3) Diameter at reel change start
Sets the winding diameter where the reel change (turret rotation) is started.
Touching the numerical value display area displays a numeric keypad. Input a value.
(4) Turret turning speed
Sets the turret turning speed at the reel change.
Touching the numerical value display area displays a numeric keypad. Input a value.
(5) During reel change waiting reel acc time
Sets the time taken for the speed to reach the line speed at the startup of the waiting axis.
Touching the numerical value display area displays a numeric keypad. Input a value.
(6) During reel change waiting reel dec time
Sets the time taken for the speed to reach zero when the waiting axis has stopped.
Touching the numerical value display area displays a numeric keypad. Input a value.
(7) Turret-Waiting axis distance (for waiting reel diameter calculation)
Sets the distance between the center of the turret axis and the center of the waiting axis.
Touching the numerical value display area displays a numeric keypad. Input a value.
(8) Roll edge sensor installation angle (for waiting reel diameter calculation)
Sets the installation angle of the roll edge detection sensor.
Touching the numerical value display area displays a numeric keypad. Input a value.
(9) Contact-Cut position (for touch roll & cutter operating angle calculation)
Sets the distance between the contact point of the touch roll and the cutting point of the cutter.
Touching the numerical value display area displays a numeric keypad. Input a value.
(10) Contact-Tape sensor angle (for touch roll & cutter operating angle calculation)
Sets the angle between the contact point of the touch roll and the installation position of the tape detection sensor.
Touching the numerical value display area displays a numeric keypad. Input a value.
(11) Touch roll operation time correction
Sets the correction value to be multiplied by the time taken from the detection of adhesion tape to the start of the touch roll operation.
Touching the numerical value display area displays a numeric keypad. Input a value.
(12) Cutter operation time correction
Sets the correction value to be multiplied by the time taken from the detection of adhesion tape to the start of the cutter operation.
Touching the numerical value display area displays a numeric keypad. Input a value.

Reel change operating status screen

The reel change operating status can be monitored and manual operation can be performed.



Unwinding reel status



(1) Running axis

Displays the current axis controlling the tension.

The lamp of the current axis controlling the tension turns on.

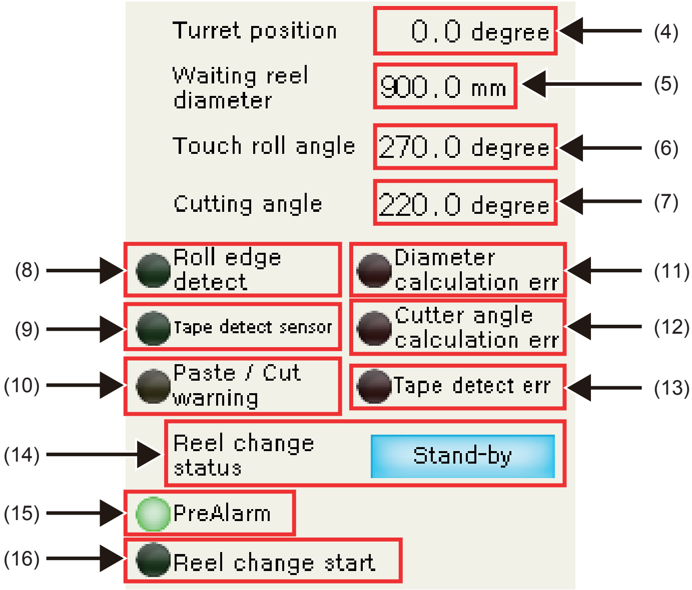
(2) Winding diameter

Displays the current winding diameter of A-axis.

(3) Winding diameter

Displays the current winding diameter of B-axis.

Reel change operating status



(4) Turret position

Displays the current turret position.

(5) Waiting reel diameter

Displays the calculation result of the waiting reel diameter at the reel change.

(6) Touch roll angle

Displays the calculated angle of the waiting axis where the touch roll starts operating at the reel change.

(7) Cutting angle

Displays the calculated angle of the waiting axis where the cutter starts operating at the reel change.

(8) Roll edge detect lamp

This lamp turns on when the waiting reel diameter calculation sensor is detected.

(9) Tape detect sensor lamp

This lamp turns on when the adhesion tape detection sensor is detected.

(10) Paste / Cut warning lamp

This lamp turns on when the tape detection sensor cannot be detected while the waiting axis rotates one revolution after the touch roll starts operating.

(11) Diameter calculation err lamp

This lamp turns on when a diameter calculation error has occurred at the reel change.

(12) Cutter angle calculation err lamp

This lamp turns on when a cutter operation angle calculation error has occurred at the reel change.

(13) Tape detect err lamp

This lamp turns on when no tape is detected at the reel change.

(14) Reel change status display

Displays the reel change status.

There are three types of status: "Stand-by", "Turret turning", and "Reel change".

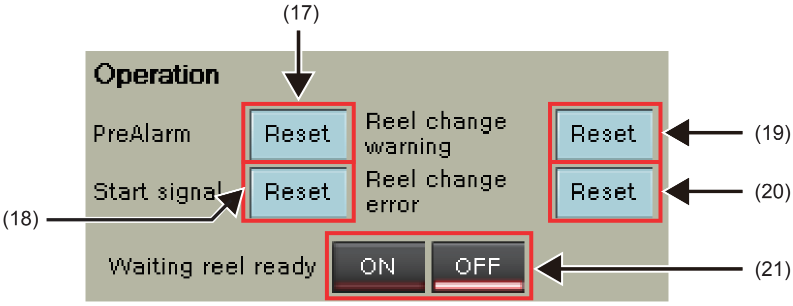
(15) PreAlarm lamp

This lamp turns on when a prealarm of the reel change is output.

(16) Reel change start lamp

This lamp turns on when an alarm of the reel change is output.

Operation



(17) PreAlarm reset switch

Touching this switch resets the prealarm of the reel change.

(18) Start signal reset switch

Touching this switch resets the reel change start signal.

(19) Reel change warning reset switch

Touching this switch resets "Paste / Cut warning" that has occurred at the reel change.

(20) Reel change error reset switch

Touching this switch resets errors (diameter calculation error, touch roll angle calculation error, cutter angle calculation error) that have occurred at the reel change.

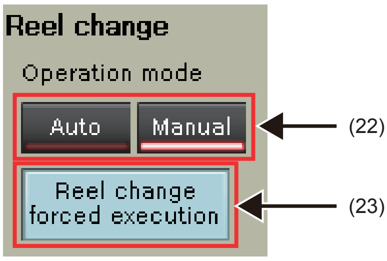
(21) Waiting reel ready switch (ON/OFF)

Touching the [ON] switch changes the status of the waiting axis to the waiting reel ready status.

Touching the [OFF] switch resets the waiting reel ready status.

When one of the switches is touched, the lamp at the bottom of the switch turns on in red.

Reel change



(22) Operation mode switch (Auto/Manual)

Selects a reel change operation mode.

Touching the [Auto] switch enables the auto mode.

Touching the [Manual] switch enables the manual mode.

Unless the turret lock is "Lock" and the touch roll and cutter are "Up", the auto mode is not enabled.

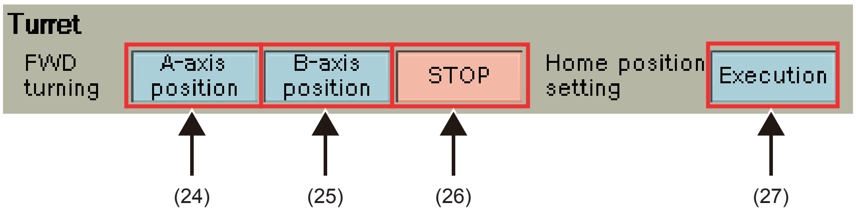
When one of the switches is touched, the lamp at the bottom of the switch turns on in red.

(23) Reel change forced execution switch

Touching this switch in the auto mode starts the reel change at a desired timing.

6

Turret



(24) A-axis position switch

When this switch is touched in the manual mode, the turret performs the forward positioning operation so that A-axis moves to the unwinding position.

(25) B-axis position switch

When this switch is touched in the manual mode, the turret performs the forward positioning operation so that B-axis moves to the unwinding position.

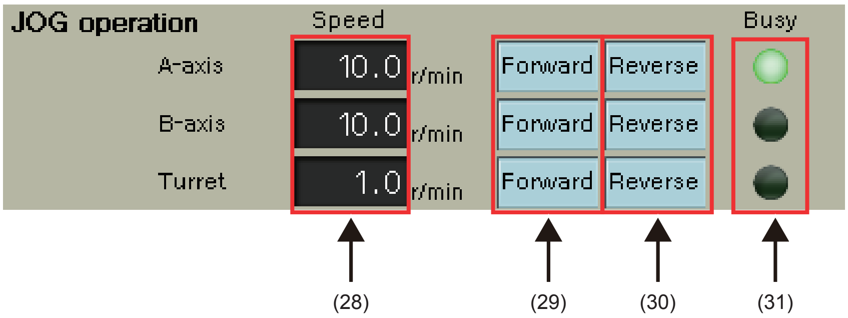
(26) STOP switch

When this switch is touched while the turret is performing the forward positioning operation triggered by the A-axis position/B-axis position switch, the turret axis is stopped.

(27) Home position setting execution switch

Touching this switch in the manual mode sets the current turret position to 0 degree.

JOG operation



(28) Speed

Displays the JOG speed of each axis.

Touching the numerical value display area displays a numeric keypad. Input a value.

(29) Forward switch

Touching this switch in the manual mode performs the forward JOG operation of each axis.

(30) Reverse switch

Touching this switch in the manual mode performs the reverse JOG operation of each axis.

(31) Busy lamp

This lamp turns on in green when each axis is in operation.

Servo ON/OFF

(32) Servo ON/OFF switches

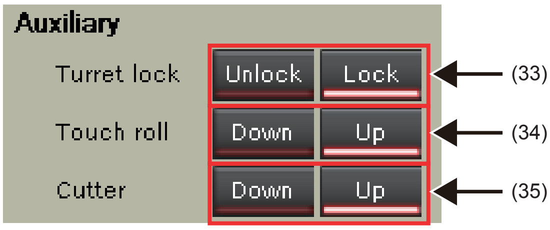
Touching the [ON] switch in the manual mode individually sets each axis to the servo-on status.

Touching the [OFF] switch in the manual mode individually sets each axis to the servo-off status.

The servo on/off is also available in the auto mode only when the waiting axis has stopped.

When one of the switches is touched, the lamp at the bottom of the switch turns on in red.

Auxiliary



(33) Turret lock switch (Unlock/Lock)

Touching the [Unlock] switch unlocks the turret lock.

Touching the [Lock] switch locks the turret.

When one of the switches is touched, the lamp at the bottom of the switch turns on in red.

(34) Touch roll switch (Down/Up)

Touching the [Down] switch lowers the height of the touch roll.

Touching the [Up] switch raises the height of the touch roll.

When one of the switches is touched, the lamp at the bottom of the switch turns on in red.

(35) Cutter switch (Down/Up)

Touching the [Down] switch lowers the height of the cutter.

Touching the [Up] switch raises the height of the cutter.

When one of the switches is touched, the lamp at the bottom of the switch turns on in red.

6

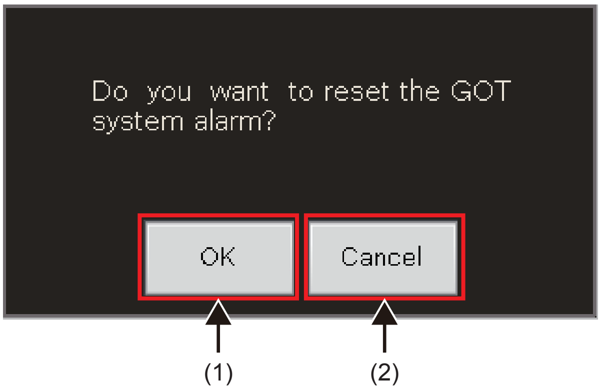
6.6 Window Screen

The following table lists window screens.

Screen No.	Screen title	Description	Reference
30000	GOT System Alarm Reset	GOT system alarm reset window screen	Page 250
30001	Language Setting	Language Setting window screen	Page 222
30002	Clock Setting	Clock Setting window screen	Page 223
30007	Footer 1	Main menu 1	Page 221
30008	Footer 2	Main menu 2	Page 221
30010	Key Window (Dec)	Numerical input [Decimal key window]	Page 220
30020	Key Window (ABC)_E	Character input [Uppercase alphabets + Numerical values]	Page 220
30021	Key Window (abc)_E	Character input [Lowercase alphabets + Numerical values]	Page 220
30022	Key Window (Symbol)_E	Character input [Symbols + Numerical values]	Page 220
30100	Cursor information	Cursor information window screen	Page 251
30200	Recipe	Pattern Select/Register window screen	Page 252
30201	Save confirmation	Save confirmation window screen	Page 254
30202	Del confirmation	Deletion confirmation window screen	Page 254
30203	Process result display	Result display window screen	Page 254

GOT system alarm reset window screen

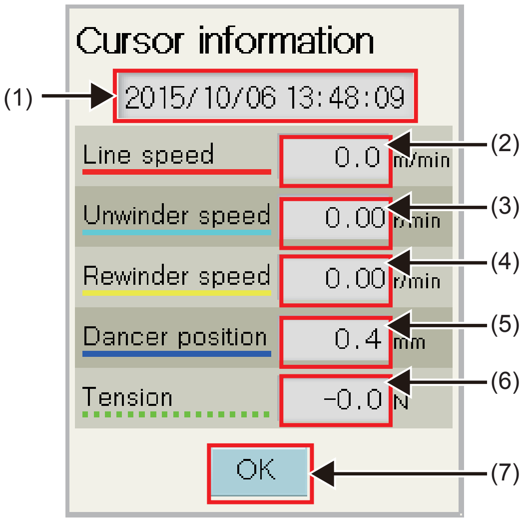
Resets a GOT system alarm.



When a GOT system alarm has occurred, touching the system alarm message display area (bottom of the screen) displays this screen.
Touching the [OK] switch resets the system alarm and closes the window screen.
Touching the [Cancel] switch closes the window screen without resetting the system alarm.

Cursor information window screen

Displays the date and time, line speed, unwinder/rewinder speed, dancer position, and tension at the position where the cursor is placed in the graph in the Graph screen.



(1) Date and time display

Displays the date and time (year, month, date, hour, minute, second) at the position where the cursor is placed.

(2) Line speed

Displays the line speed at the position where the cursor is placed.

(3) Unwinder speed

Displays the unwinder speed at the position where the cursor is placed.

(4) Rewinder speed

Displays the rewinder speed at the position where the cursor is placed.

(5) Dancer position

Displays the dancer position at the position where the cursor is placed.

(6) Tension

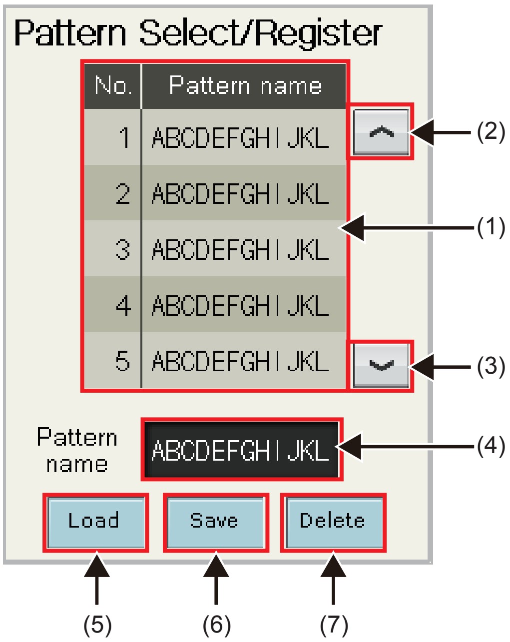
Displays the tension at the position where the cursor is placed.

(7) [OK] switch

Touching this switch closes the Cursor information window screen.

Pattern Select/Register window screen

Gives a pattern name to data of Taper ratio setting (Taper ratio/Winding diameter) input in the Rewinder setting 2 screen and saves (registers) the data. A saved pattern name can also be selected to load or delete the data of Taper ratio setting (Taper ratio/Winding diameter).



The following table lists the settings of the recipe function.

Set	Details
Recipe No.	30000
Recipe name	CNV_Recipe
Recipe file	A recipe file is used. (Write or load processing is performed.)
File type	CSV file
Drive name	A: Standard SD memory card
Folder name	Package1\CNV_Recipe
File name	CNV_Recipe(_****.CSV)
Devices from/to which recipes are loaded/saved (registered)	The number of blocks is 10. The following shows the device settings. No.1::stWdTaperTbl.eTableY[0] No.2::stWdTaperTbl.eTableY[1] No.3::stWdTaperTbl.eTableY[2] No.4::stWdTaperTbl.eTableY[3] No.5::stWdTaperTbl.eTableY[4] No.6::stWdTaperTbl.eTableX[0] No.7::stWdTaperTbl.eTableX[1] No.8::stWdTaperTbl.eTableX[2] No.9::stWdTaperTbl.eTableX[3] No.10::stWdTaperTbl.eTableX[4]

(1) Pattern name list display area

Lists the pattern names that have already been saved.

Up to five pattern names are listed in a page, and the page to be displayed can be switched using the pattern scroll up/down switch. Up to 20 pattern names can be displayed.

Touching a saved pattern name highlights the selected pattern name and displays the pattern name in Pattern name.

(2) Pattern scroll up switch

The pattern scroll up switch appears when the number of saved pattern names is 6 or more and five of the 6th to 20th pattern names are displayed in the pattern name list display area.

Touching this switch scrolls up the display in the pattern name list display area.

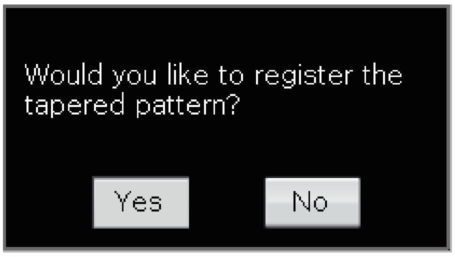
(3) Pattern scroll down switch
The pattern scroll down switch appears when the number of saved pattern names is 6 or more and five of the 1st to 15th pattern names are displayed in the pattern name list display area.
Touching this switch scrolls down the display in the pattern name list display area.
(4) Pattern name
Set a name for registering data in Taper ratio setting (Taper ratio/Winding diameter) as a pattern.
Alphabets, numbers, and symbols can be used for a pattern name and up to 12 characters can be input.
Touching the character display area of the pattern name displays a key window for character input. Input a pattern name.
Touching a pattern name displayed in the pattern name list display area also input a pattern name.
(5) [Load] switch
Touching this switch loads the data of the pattern name set in Pattern name to data in Taper ratio setting (Taper ratio/Winding diameter).
After that, the Pattern Select/Register window screen is closed.
(6) [Save] switch
Touching this switch saves data in Taper ratio setting (Taper ratio/Winding diameter) with the pattern name displayed in Pattern name.
(7) [Delete] switch
Touching this switch deletes the data of the pattern name displayed in Pattern name.

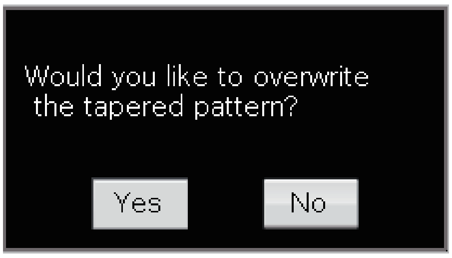
Precautions

The pattern names displayed in the pattern name list display area are not always listed in order of saving (registration). It depends on the GOT internal processing. Even when a row in the pattern name list display area is touched, the pattern name is highlighted, and a new pattern name is input and saved (registered), the pattern name is not always registered in the touched row. It depends on the GOT internal processing.

Save confirmation window screen

Displayed when data is to be saved with a new pattern name or with an existing pattern name.



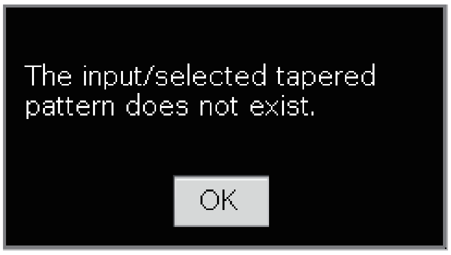


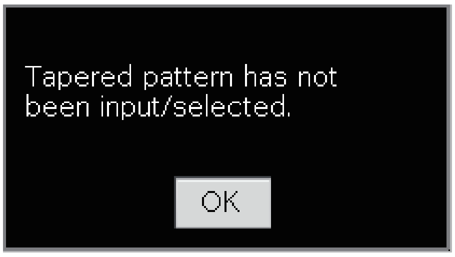
Deletion confirmation window screen

Displayed when saved data is to be deleted.

Result display window screen

- Displayed when the [Load]/[Save]/[Delete] switch is touched and no pattern name has been set or the data of the specified pattern name does not exist.



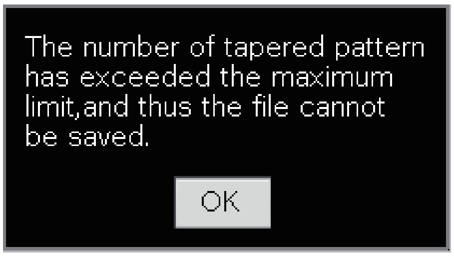


- Displayed when the [Load]/[Save]/[Delete] switch is touched but no SD memory card has been inserted.

- Displayed when the data save processing is normally completed.

• Displayed when the data deletion processing is normally completed.

• Displayed when saving data is attempted and the number of registered patterns has reached the maximum number of patterns to be registered (20 patterns).

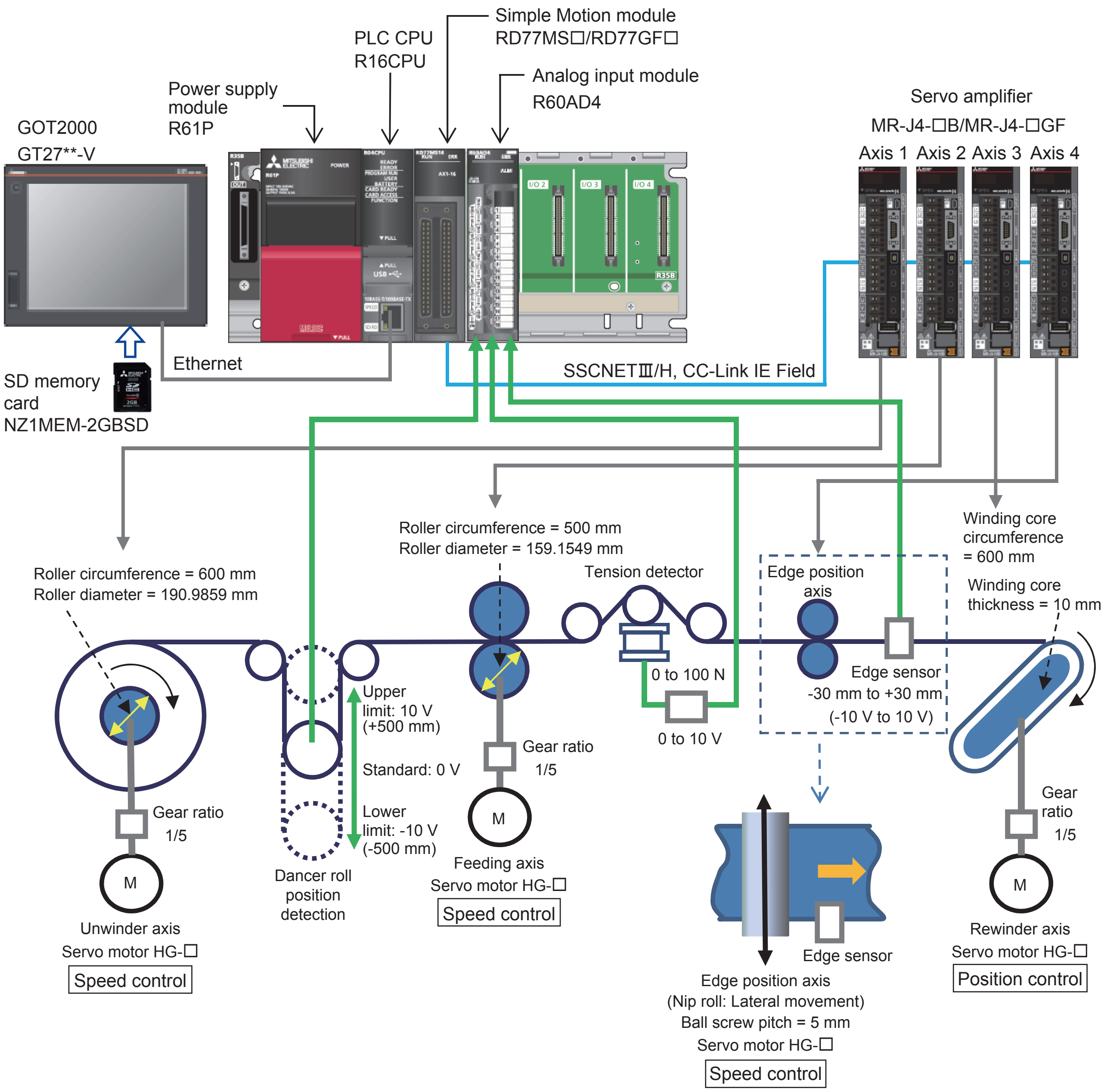


7 APPLICATION PROGRAM EXAMPLE (FLAT ROLL)

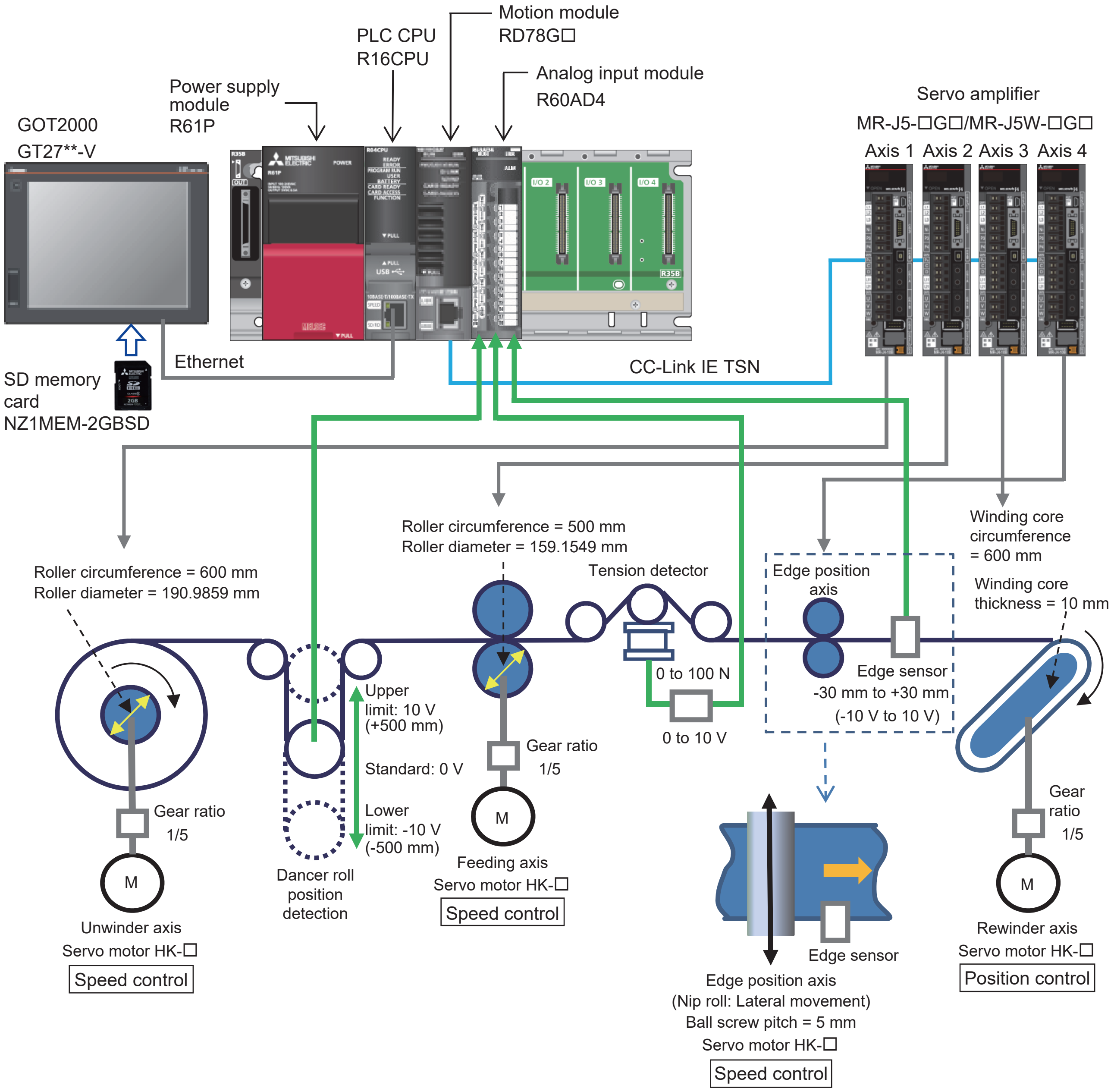
This chapter describes the system configuration and program specifications of a program example for rewinding materials with the winding core in the flat type using this application.

7.1 System Configuration

- AP20-CNV002AA-R16-77MS_FlatWind (SSCNETⅢ/H)/AP20-CNV002AA-R16-77GF_FlatWind (CC-Link IE Field)



• AP20-CNV002AA-R16-78G_FlatWind(CC-Link IE TSN)



7

7.2 Control Overview

The positioning of the virtual axis is started using the movement amount of the winding core circumference × number of windings.

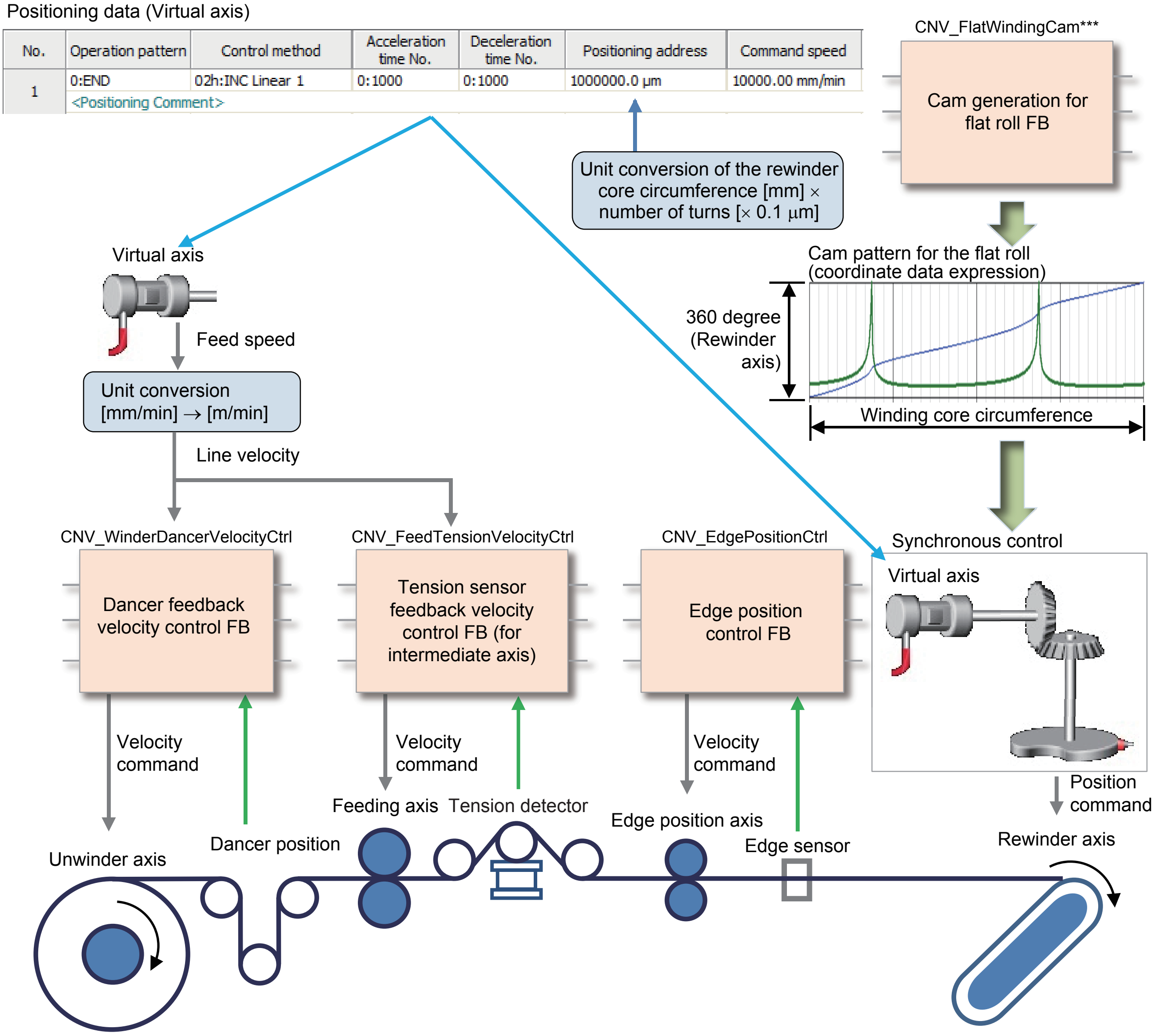
Input the command velocity of the virtual axis as a standard velocity (line velocity) to the FBs for velocity control of the unwinder axis and feeding axis to perform the dancer feedback velocity control and tension sensor feedback velocity control for the material feeding with the constant tension.

The rewinder axis performs the synchronous control using the cam pattern for the flat roll by inputting the virtual axis position so that the material rewinder speed is constant (Line velocity).

The edge sensor detects material edges between the feeding axis and rewinder axis and edge position axis corrects a horizontal deviation (Edge position control).

Positioning data (Virtual axis)

No.	Operation pattern	Control method	Acceleration time No.	Deceleration time No.	Positioning address	Command speed
1	0:END	02h:INC Linear 1	0:1000	0:1000	1000000.0 μm	10000.00 mm/min
	<Positioning Comment>					



7.3 Operation Specifications

- Line velocity: 10 m/min
- Line acceleration/deceleration time: 1000 ms
- Number of rewinding times: 50 times
- Material thickness: 0.05 mm
- Material width: 100 mm
- Minimum unwinding diameter: 200 mm
- Maximum unwinding diameter: 1000 mm
- Set tension: 10 N

7.4 Control Specifications

Item	Unwinder axis	Feeding axis	Rewinder axis	Edge position axis
Axis number	1	2	3	4
Control mode	Speed control	Speed control	Position control (Cam control)	Speed control
Detector	Dancer roll	Tension detector	—	Edge sensor
Tension gain auto tuning	○	○	—	—
Winding diameter calculation	Web thickness integration method	—	—	—
Direction	Upper unwinding	—	Upper rewinding	—
Control cycle	0.888 ms (RD77MS)/1.0 ms (RD77GF)/1.0 ms (RD78G(S))			

7.5 Program Configuration

Language

The following languages are used in this program.

- Program comment: English
- Label comment: Japanese, English, Chinese (Simplified)

List of programs

Program name	Description	Execution type	Describing method
Initial	Initial parameter setting	Initial	ST
PreOperation	Preparing operation, line operation control, and cam generation • Preparing operation (Servo ON/OFF) • Line operation control • JOG operation, home position return • Cam generation for flat roll	Scan	FBD
HMI_IF	Touch panel I/O processing	Scan	ST
TensionControl	Tension control main processing • Tension control (unwinder axis/feeding axis) • Edge position control	Event (I44) (RD77MS, RD77GF) Fixed cycle (1 ms) (RD78G(S))	FBD

FB

■CNV_TensionControl_R (Refer to "Page 47 FB LIBRARY".)

Item	FB name	Description	Program
Activation	CNV_Activation	License activation	PreOperation
Tension control	CNV_WinderDancerVelocityCtrl	Dancer feedback velocity control	TensionControl
	CNV_FeedTensionVelocityCtrl	Tension sensor feedback velocity control (Intermediate axis)	TensionControl
Roll diameter calculation	CNV_DiaCalcThickness	Roll diameter calculation (Web thickness integration method)	TensionControl
Tuning function	CNV_PIDControl	PID control (with Tension PI Gain auto tuning)	TensionControl
Additional function	CNV_EdgePositionCtrl	Edge position control	TensionControl
Flat roll	CNV_FlatWindingCamMeasurement	Cam generation for flat roll (Measurement method)	PreOperation
	CNV_FlatWindingCamCalc	Cam generation for flat roll (Calculation method)	PreOperation
Filters	STD_Limiter	Limiter	TensionControl

■ExamplePrgCtrl (Refer to "Page 269 ExamplePrgCtrl FB".)

FB name	Description	Describing method	Program
MotionReady	Simple Motion module start processing	ST	PreOperation
ServoON	Servo ON processing	ST	PreOperation
MotionErrorReset	Error reset processing	ST	PreOperation
JOG	JOG operation processing	ST	PreOperation
DancerPos	Dancer position A/D value conversion processing	ST	TensionControl
TensionAD	Tension detector A/D value conversion processing	ST	TensionControl
EdgePos	A/D value conversion processing at the edge sensor detection position	ST	TensionControl
PositioningDataSet	Positioning data for line operation setting processing	ST	PreOperation
LineSpeedCalc	Line speed conversion processing for tension control	ST	TensionControl
ReadCamData	Cam data read for monitor	ST	PreOperation

7.6 Program Processing

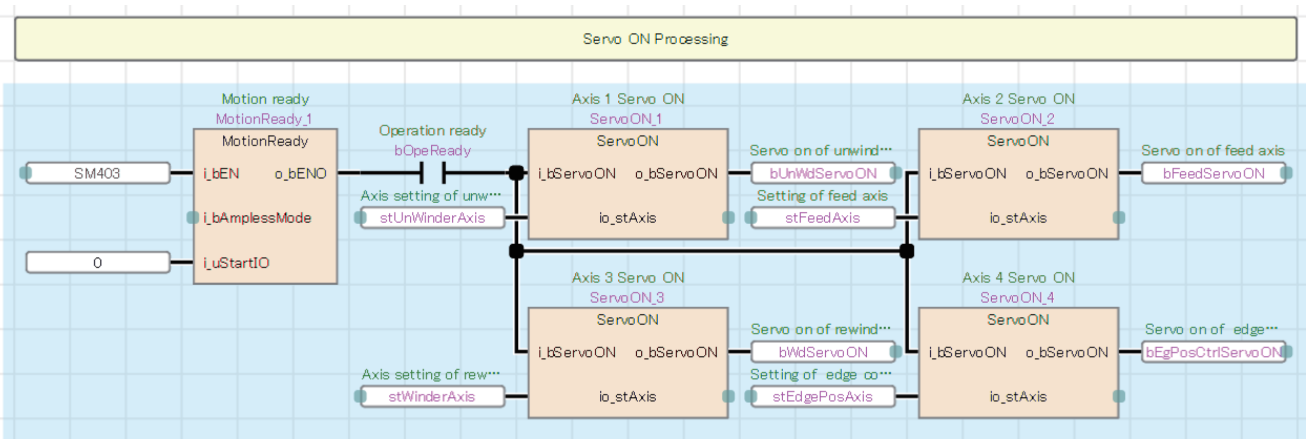
Initial (Initial parameter setting)

Set event task starts, each variable's initial value, and constants.

- Setting of execution cycle
- Setting of unwinder axis
- Setting of feed axis
- Setting of rewinder axis
- Setting of edge position axis
- Setting of virtual axis
- Setting of line operation

PreOperation (Preparing operation, Start line operation, and Cam generation)

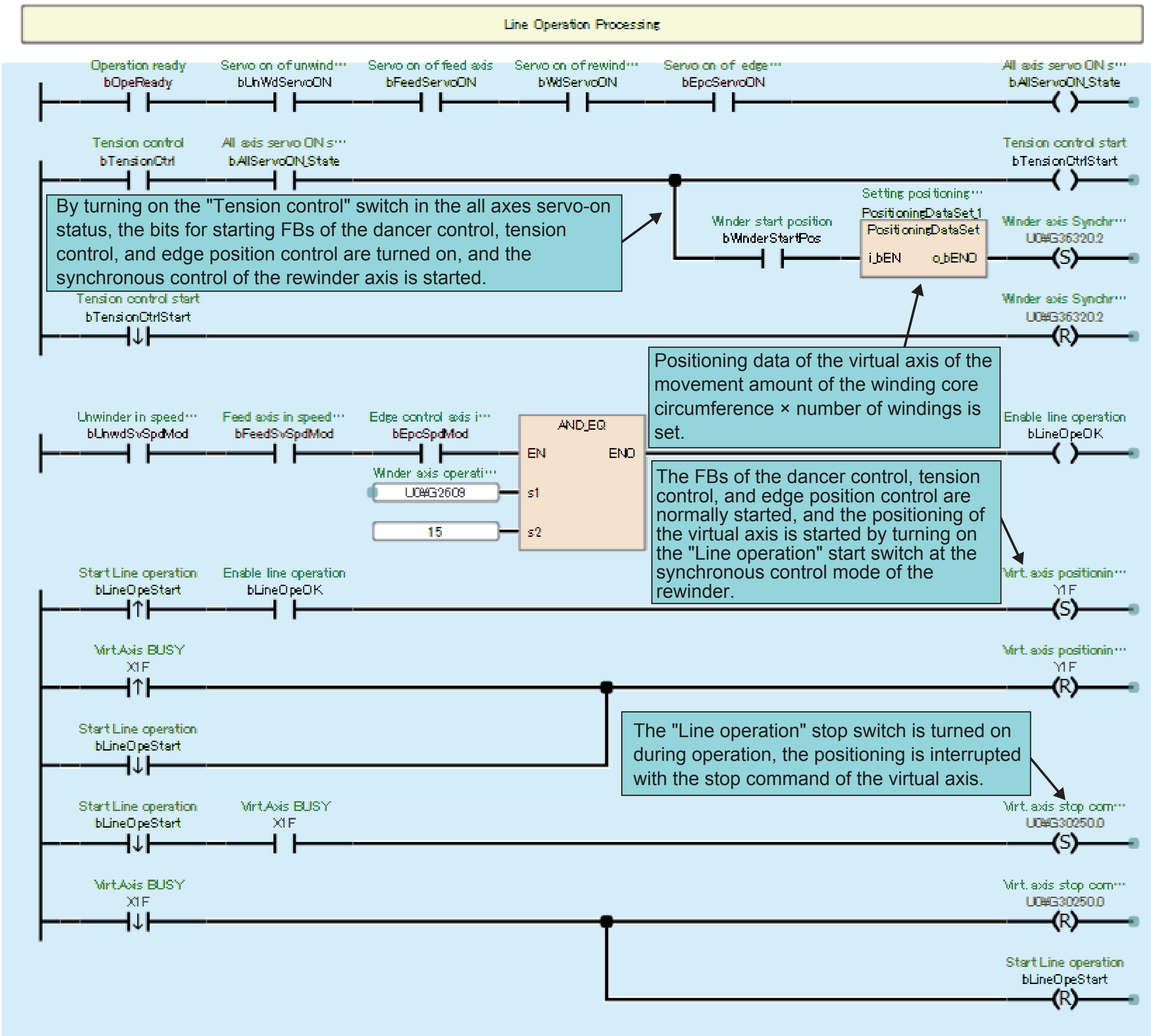
■Servo ON/OFF control



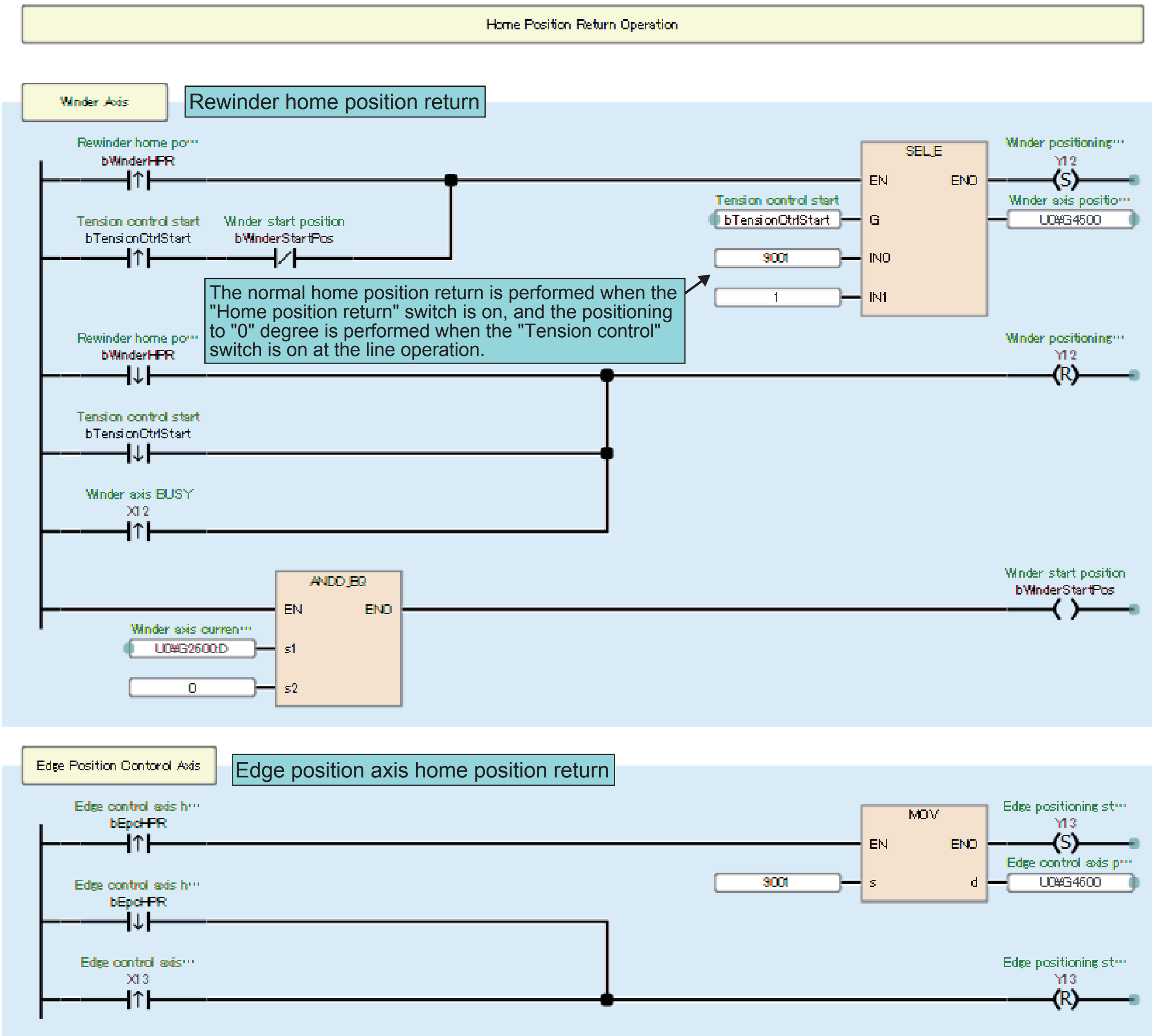
7

■Line operation start processing

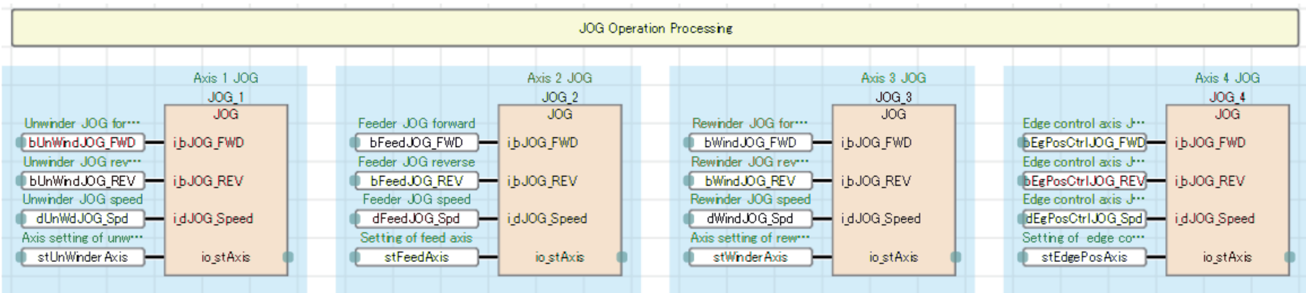
The tension control or line operation is started with the switch on the GOT screen.



■Home position return processing

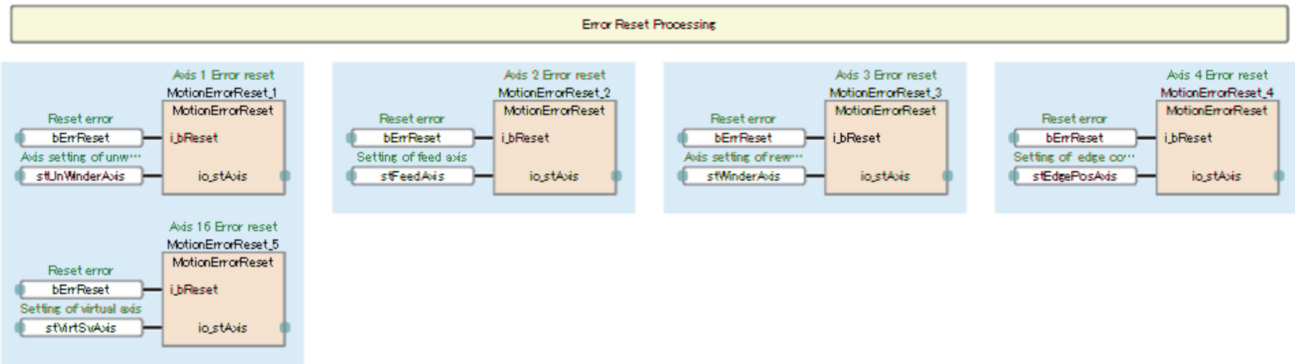


■JOG operation processing of each axis

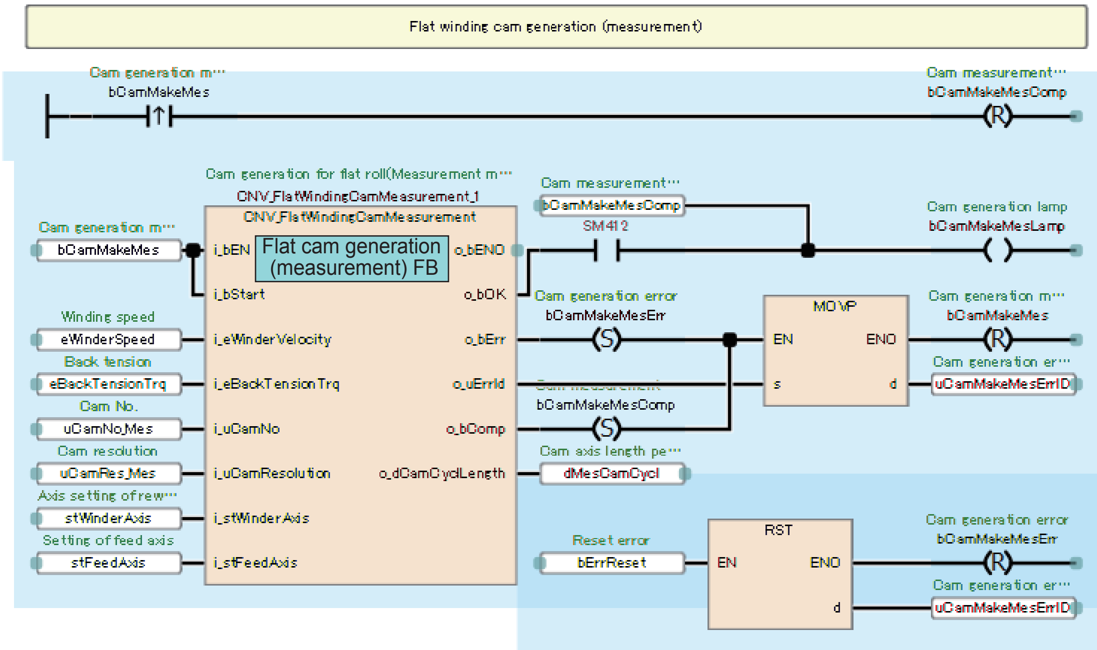


7

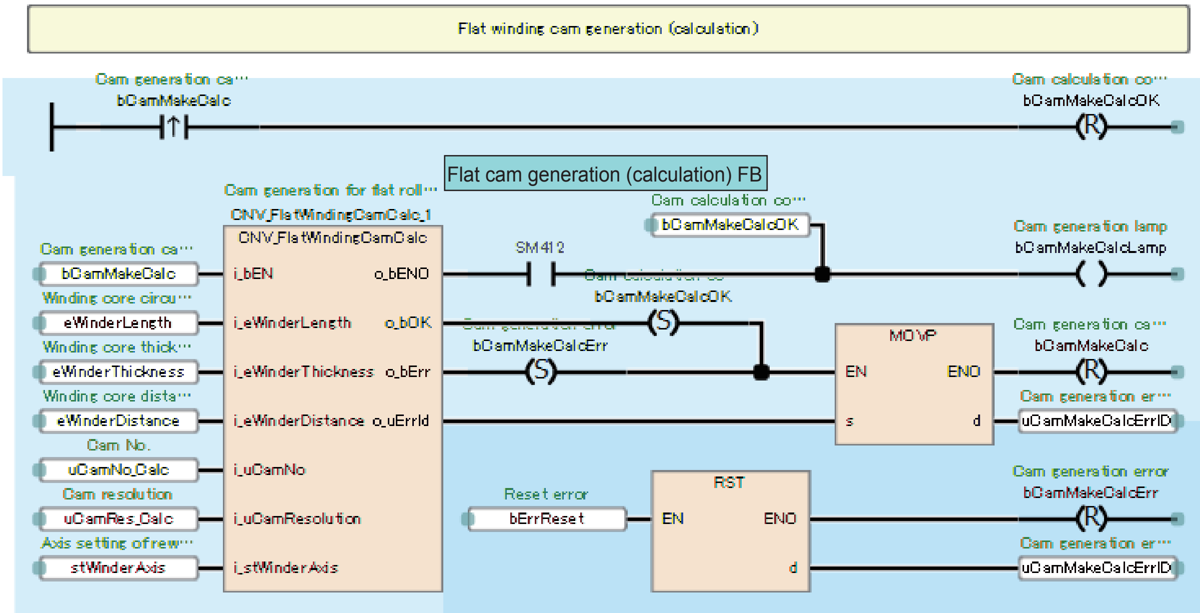
■Error reset processing of each axis



■Cam generation for flat roll (Measurement method) of the rewinder axis

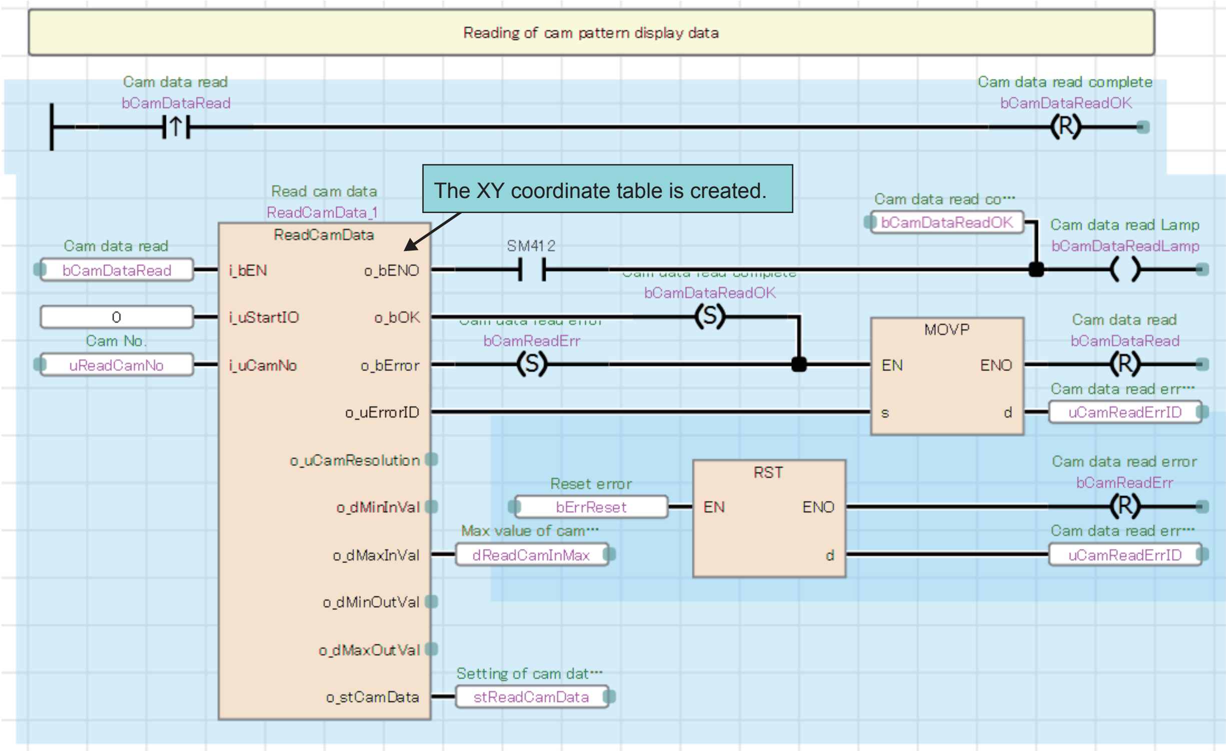


■Cam generation for flat roll (Calculation method) of the rewinder axis



■Cam data reading for displaying data

Cam data is read to display the cam pattern on the GOT screen.



7

HMI_IF (Touch panel I/O processing)

The processing for displaying the GOT screen is performed.

```
//HMI_IF

///////////////////// Servo Status Monitor //////////////////////////////

(* Unwinder Servo Status Monitor *)
IF U0¥G2477.7 THEN
    wUnwdSvSt:=2;//Alarm
ELSIF U0¥G2477.1 THEN
    wUnwdSvSt:=1;//Servo ON
ELSE
    wUnwdSvSt:=0;
END_IF;
```

U0\G2477: Md.108 Servo status 1
Servo state of unwinder (wUnwdSvSt)
Alarm: 2,
Servo ON: 1,
Servo OFF (no alarm): 0

Unwinder in speed control mode

```
OUT(U0¥G2477.2 AND NOT U0¥G2477.3,bUnwdSvSpdMod);//Speed Mode
eUnwinderPosActVal:=DINT_TO_REAL(U0¥G2400:D)/10000.0;//Position Monitor
```

Unwinder axis current value

```
(* Feed Axis Servo Status Monitor *)
IF U0¥G2577.7 THEN
    wFeedSvSt:=2;//Alarm
ELSIF U0¥G2577.1 THEN
    wFeedSvSt:=1;//Servo ON
ELSE
    wFeedSvSt:=0;
END_IF;
```

U0\G2577: Md.108 Servo status 1
Servo state of feeding axis (wFeedSvSt)
Alarm: 2,
Servo ON: 1,
Servo OFF (no alarm): 0

Feeding axis in speed mode

```
OUT(U0¥G2577.2 AND NOT U0¥G2577.3,bFeedSvSpdMod);//Speed Mode
eFeedPosActVal:=DINT_TO_REAL(U0¥G2500:D)/10000.0;//Position Monitor
```

Feeding axis current value

```
(* Rewinder Axis Servo Status Monitor *)
IF U0¥G2677.7 THEN
    wWdSvSt:=2;//Alarm
ELSIF U0¥G2677.1 THEN
    wWdSvSt:=1;//Servo ON
ELSE
    wWdSvSt:=0;
END_IF;
```

U0\G2677: Md.108 Servo status 1
Servo state of rewinder (wWdSvSt)
Alarm: 2,
Servo ON: 1,
Servo OFF (no alarm): 0

```
OUT(X1F,bWdWinding);//Winder winding
```

Rewinder axis in flat roll operation

Rewinder axis current value

```
eWinderPosActVal:=DINT_TO_REAL(U0¥G2600:D)/100000.0;//Position Monitor
bWdHPRcomp:=U0¥G2617.4;//Home position return complete
```

Completion of rewinder home position return

Rewinding completion

```
SET(U0¥G3917.F,bWindingComplete);//Winding complete
RST(X1F,bWindingComplete);

(* Edge Position Control Axis Servo Status Monitor *)
IF U0¥G2777.7 THEN
    wEgPosCtrlSvSt:=2;//Alarm
    ELSIF U0¥G2777.1 THEN
    wEgPosCtrlSvSt:=1;//Servo ON
    ELSE
    wEgPosCtrlSvSt:=0;
END_IF;
```

U0\G2777: Md.108 Servo status 1
Edge position axis status (wEgPosCtrlSvSt)
Alarm: 2,
Servo ON: 1,
Servo OFF (no alarm): 0

```
OUT(U0¥G2777.2 AND NOT U0¥G2777.3,bEgPosCtrlSpdMod);//Speed Mode
eEgPosCtrlPosActVal:=DINT_TO_REAL(U0¥G2700:D)/10000.0;//Position Monitor
bEgPosCtrlHPRcomp:=U0¥G2717.4;//Home position return complete
```

Edge position axis in speed mode

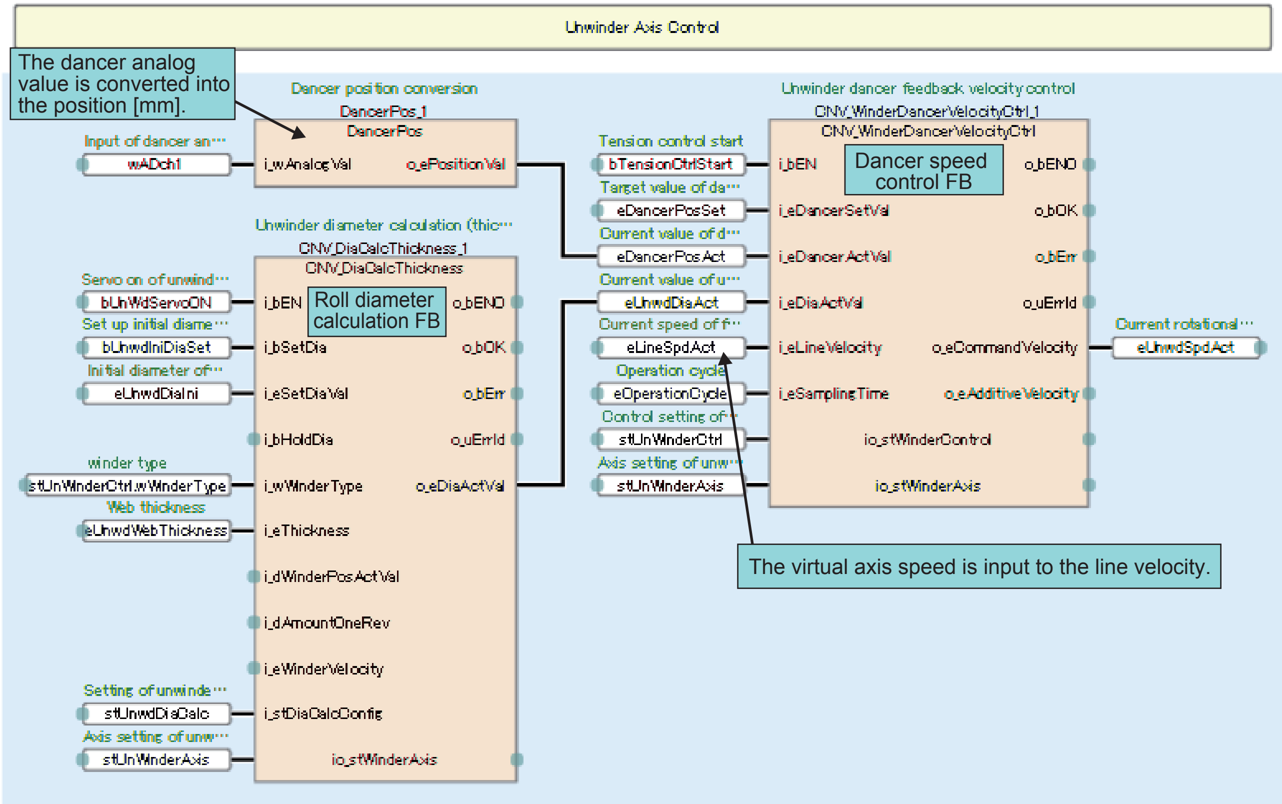
Actual current value of edge position axis

Completion of edge position axis home position return

TensionControl (Tension control (unwinder/feeding axis), Edge position control)

■Dancer control of the unwinder axis

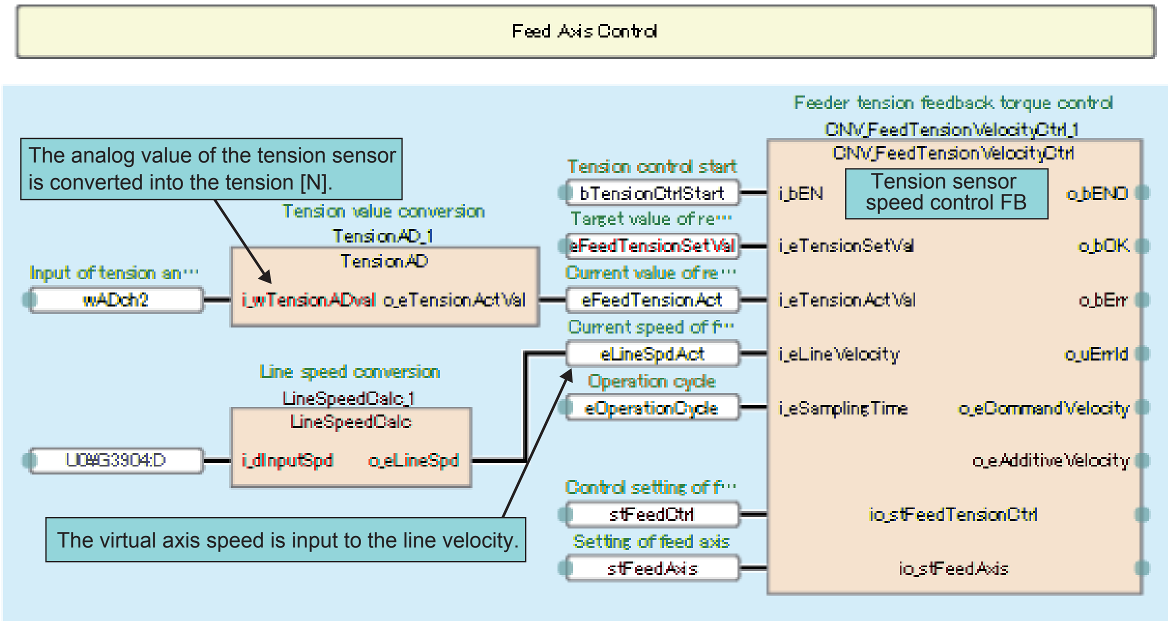
When Start tension control (bUnwdDancerCtrl) turns on, the dancer feedback velocity control FB (CNV_WinderDancerVelocityCtrl) is started. The dancer detection analog value is converted into a position and input in the feedback value of the velocity control FB. The velocity is controlled to make the dancer position reach the target position. Every time the unwinder axis rotates, the roll diameter calculation (Web thickness integration method) FB decrements the material thickness value × 2 and calculates the current winding diameter. The current winding diameter is input in the velocity control FB, and the velocity is controlled to make the circumferential velocity reach the line velocity.



7

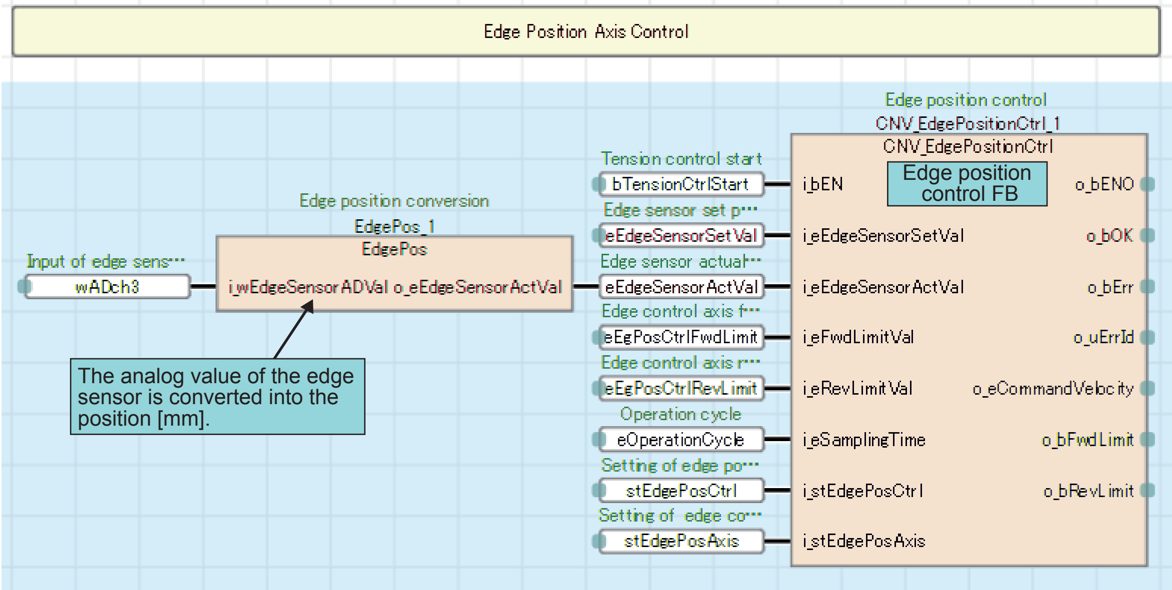
■Tension control of the feeding axis

When Start tension control (bUnwdDancerCtrl) turns on, the tension sensor feedback velocity control FB (CNV_WinderDancerVelocityCtrl) is started. The tension detection analog value is converted into a tension [N] and input in the feedback value of the velocity control FB. The velocity is controlled to make the tension reach the target position.



■Edge position axis control

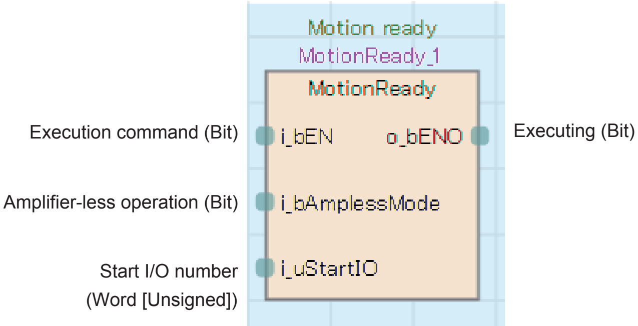
The edge position control FB (CNV_EdgePositionCtrl) is started with the Tension control ON switch on the GOT screen. The edge sensor analog value is converted into an edge position, and the velocity is controlled so that the edge position reaches the target position.



7.7 ExamplePrgCtrl FB

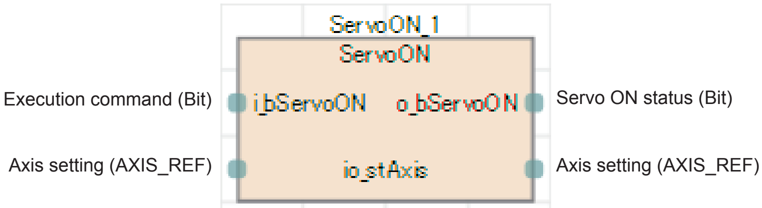
MotionReady

This FB starts the Simple Motion module for the start I/O number setting.
To perform the amplifier-less operation, turn on i_bAmplessMode to start the module.
However, this FB does not support the amplifier-less operation of the RD78G(S).



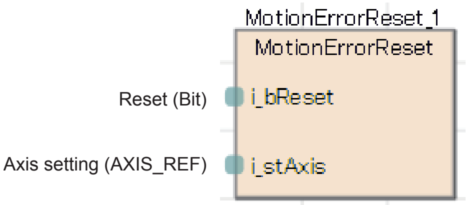
ServoON

This FB performs the servo ON processing for the corresponding axis in the axis setting.



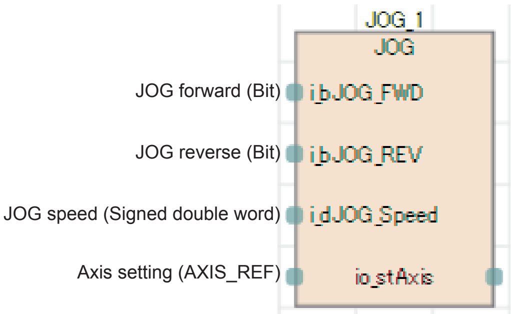
MotionErrorReset

This FB performs the motion error reset processing for the corresponding axis in the axis setting.



JOG

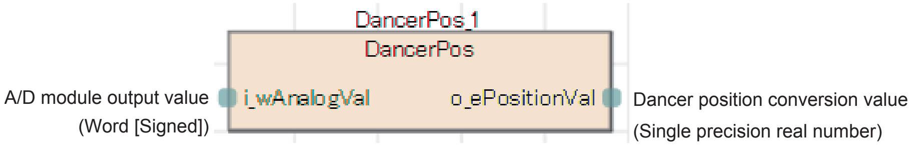
This FB performs the JOG operation for the setting axis.



7

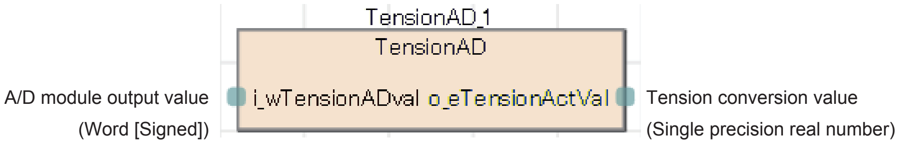
DancerPos

This FB converts an A/D output value into a dancer position (single precision real number).



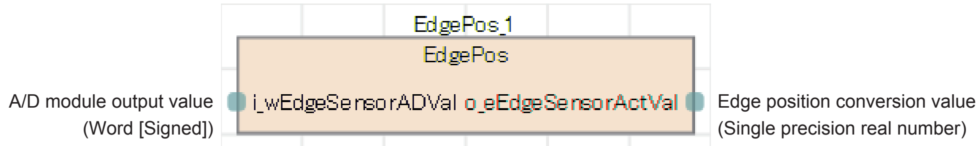
TensionAD

This FB converts an A/D output value into a tension value (single precision real number).



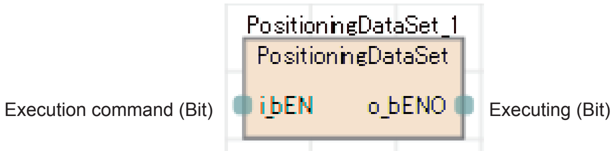
EdgePos

This FB converts an A/D output value into an edge position (single precision real number).



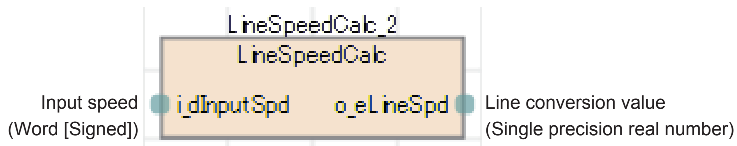
PositioningDataSet

This FB sets the positioning data for the line operation.



LineSpeedCalc

This FB converts the monitor speed [×0.01 mm/min] of the virtual axis into the line speed [m/min] for the tension control.

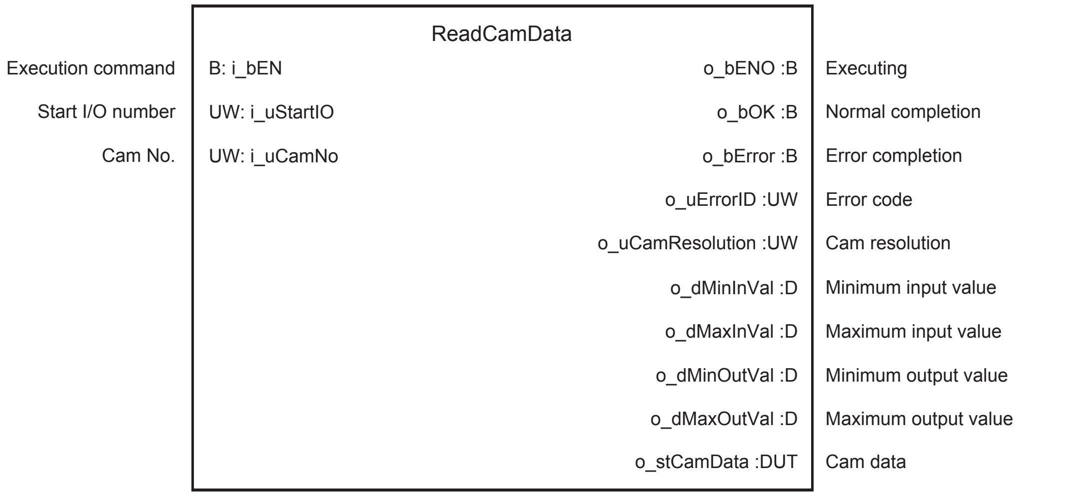
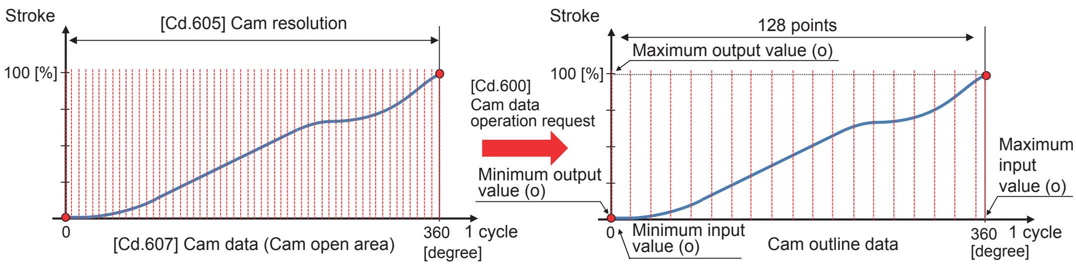


ReadCamData (Cam data read)

Name

ReadCamData

Function overview

Item	Description	
Function overview	This FB reads the cam data so that the cam outline of the cam No. specified by the Simple Motion module is recognized.	
Symbol		
Applicable hardware and software	Applicable module	RD77MS, RD77GF, RD78G(S)
	Applicable CPU	MELSEC iQ-R series CPU module
	Engineering software	GX Works3
Number of steps	1583 steps (For the macro type)	
FB dependence	None	
Function description	This FB reads the cam data to be displayed on the application screen example (cam monitor screen) of the GOT from the Simple Motion module. • When i_bEN (Execution command) is turned on, cam data reading of the specified i_uCamNo (Cam No.) is started. • The FB reads the cam data from the cam open area using "[Cd.600] Cam data operation request" of the Simple Motion module, and then reads "[Cd.605] Cam resolution" and "[Cd.607] Cam data value" condensed into 128 points from that data.  • When the cam data reading has been completed and the output label has been updated, o_bOK (Normal completion) turns on. • If an error occurs in the FB, Error is turned on and the error code is stored in ErrorID. • For details of error codes, refer to "Page 289 List of Error Codes".	
Compiling method	Macro type, subroutine type	
FB operation type	Pulsed execution (multiple scan execution type)	
Restrictions and precautions	This FB uses index registers Z17 to Z19. Do not use this index register in an interrupt program.	

Labels

■Input labels

Name	Label name	Data type	Read timing*1	Setting range	Initial value	Description
Execution command	i_bEN	Bit	⎍	ON, OFF	—	On: The FB is activated. Off: The FB is not activated.
Start I/O number	i_uStartIO	Word [Unsigned]	↑	0H ≤ start I/O number ≤ FEH	0	Installation address of the Simple Motion module (Upper three digits of four digits (hexadecimal))
Cam No.	i_uCamNo	Word [Unsigned]	↑	1 to 256 (RD77MS) 1 to 1024 (RD77GF) 1 to 256 (RD78G(S))	1	Set the Cam No. to read the data.

*1 ⎍: Always, ↑: Only when the FB is started

■Output labels

Name	Label name	Data type	Value to be held*1	Description
Executing	o_bENO	Bit	—	On: While Execution command is on Off: Execution command is off.
Normal completion	o_bOK	Bit	—	On: Indicates that the cam data reading has been completed and the output data has been normally updated. Off: Indicates that the FB operation has not completed.
Error completion	o_bError	Bit	—	On: An error has occurred in the FB. Off: No error has occurred.
Error code	o_uErrorID	Word [Unsigned]	—	The error code of the error that has occurred in the FB is stored. (Refer to "Page 289 List of Error Codes".)
Cam resolution	o_uCamResolution	Word [Unsigned]	○	The cam resolution of the read cam is stored.
Minimum input value	o_dMinInVal	Double word [Signed]	○	The minimum value of the cam data input value (cam axis 1 cycle length) is stored.
Maximum input value	o_dMaxInVal	Double word [Signed]	○	The maximum value of the cam data input value (cam axis 1 cycle length) is stored.
Minimum output value	o_dMinOutVal	Double word [Signed]	○	The minimum value of the cam data output value (cam stroke amount) is stored.
Maximum output value	o_dMaxOutVal	Double word [Signed]	○	The maximum value of the cam data output value (cam stroke amount) is stored.
Cam data	o_stCamData	CamData	○	Refer to the following cam data.

Cam data (CamData structure)

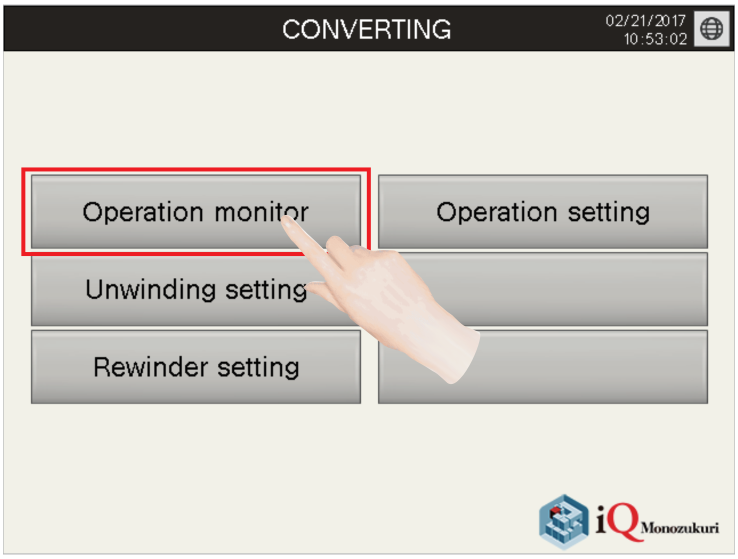
Name	Label name	Array No.	Data type	Value to be held*1	Description
Input value (Cycle point)	d128InVal_Cycle	[0]	Double word [Signed] (0..127)	○	The first point of the input value (cam axis 1 cycle length) is stored.
		[1]		○	The second point of the input value (cam axis 1 cycle length) is stored.
		⋮		○	⋮
		[127]		○	The 128th point of the input value (cam axis 1 cycle length) is stored.
Output value (Stroke amount)	d128OutVal_Stroke	[0]	Double word [Signed] (0..127)	○	The first point of the output value (cam stroke amount) is stored.
		[1]		○	The second point of the output value (cam stroke amount) is stored.
		⋮		○	⋮
		[127]		○	The 128th point of the output value (cam stroke amount) is stored.

*1 ○: The value is held after the FB stops. —: The value is cleared after the FB stops.

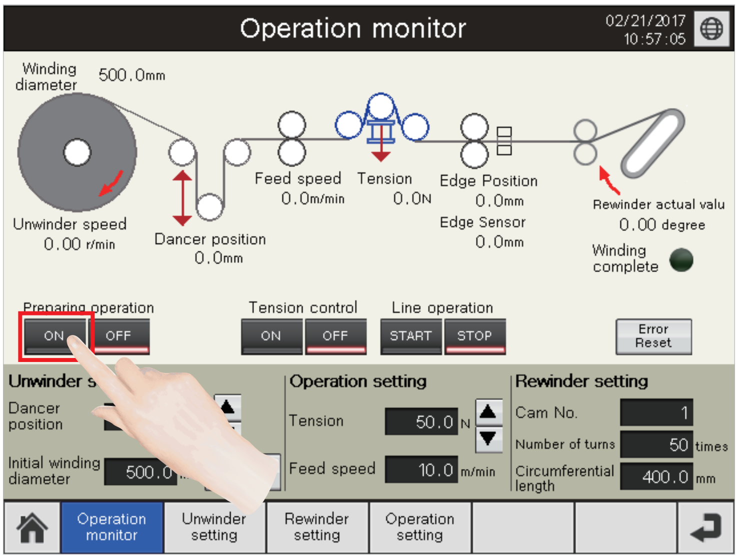
7.8 Operation Procedure

Start the operation with the following procedure.

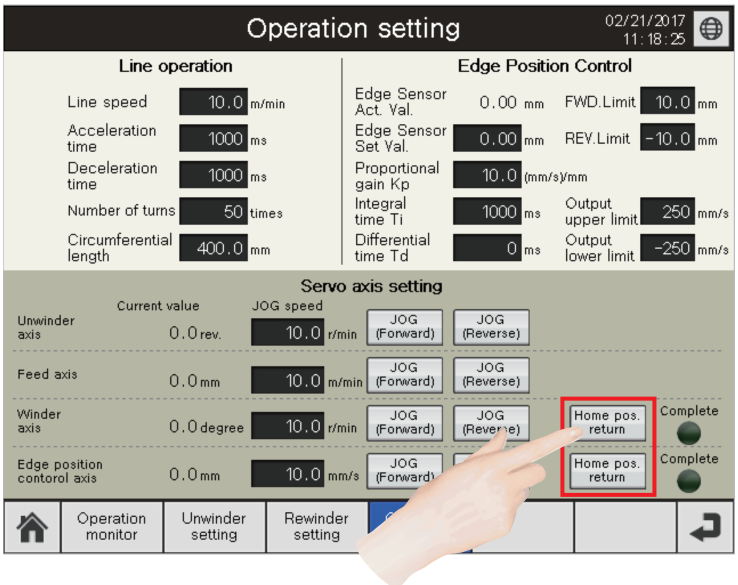
(For the function details of each screen, refer to "Page 275 APPLICATION SCREEN EXAMPLES (FLAT ROLL)".)



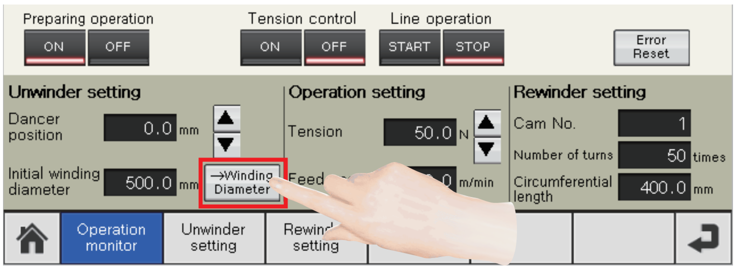
1. Write project data to the PLC CPU and GOT and start the system. Touch the [Operation monitor] switch.



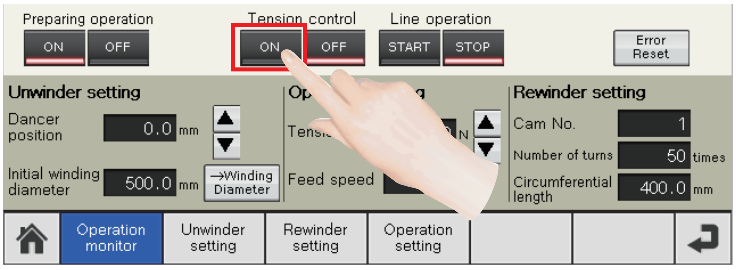
2. Touch the [ON] switch of Preparing operation. Turning on of Preparing operation sets all axes in the servo-on status.



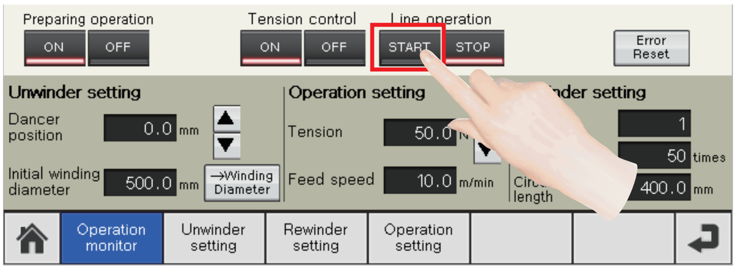
3. At the first startup, switch the screen to the "Operation setting" screen and perform "Home pos. return" of the rewinder axis and edge position axis.



4. Touch the [→Winding Diameter] switch. The initial winding diameter is set as the winding diameter (current value).



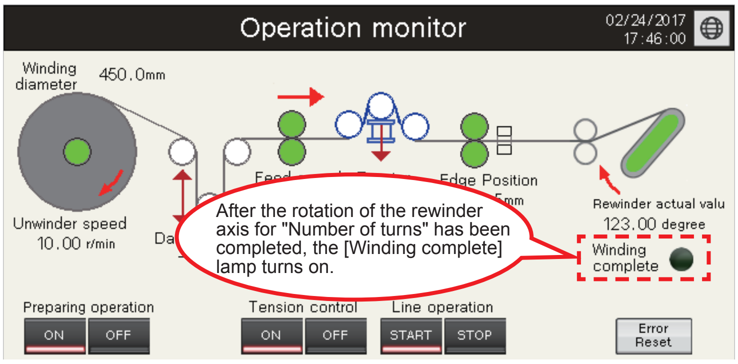
5. Touching the [ON] switch of Tension control starts the dancer control of the unwinder axis, tension control of the feeding axis, and edge position control of the edge position axis. The rewinder axis performs positioning to the starting position (0 degree).



6. Touching the [START] switch of Line operation starts operation at the set feed speed.

Point

Unless the rewinder axis is in the starting position (0 degree), the line operation does not start.



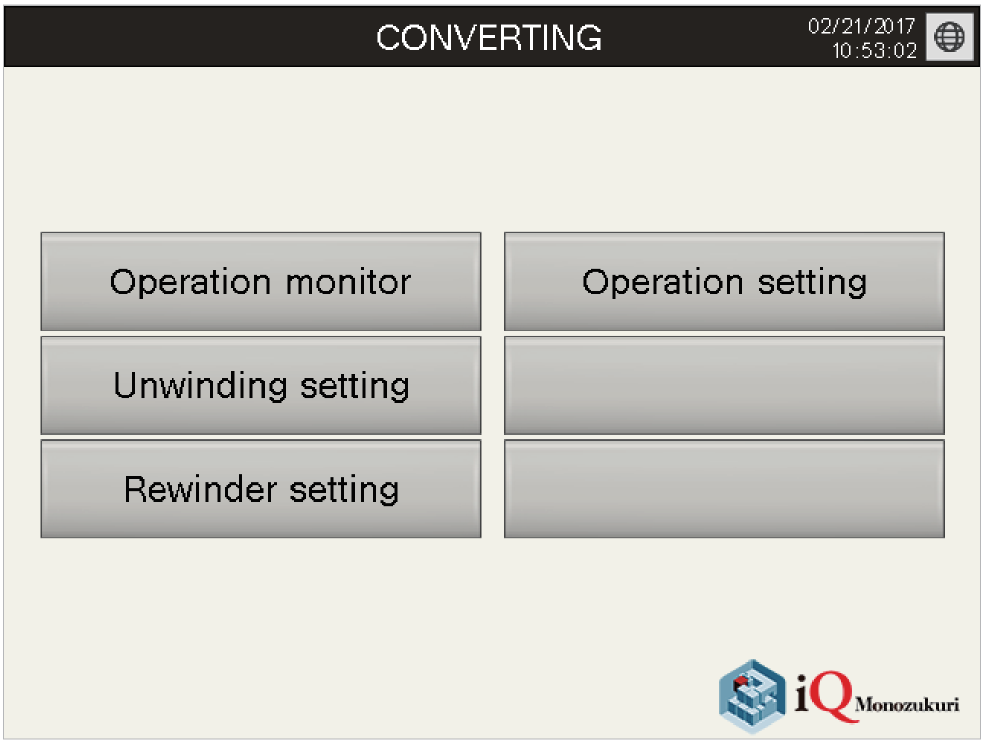
7. After the rotation of the rewinder axis for "Number of turns" has been completed, the [Winding complete] lamp turns on and the line operation stops.

8 APPLICATION SCREEN EXAMPLES (FLAT ROLL)

This chapter describes the specifications of the screen examples for rewinding with a flat type roll using this application.

8.1 Home Screen

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



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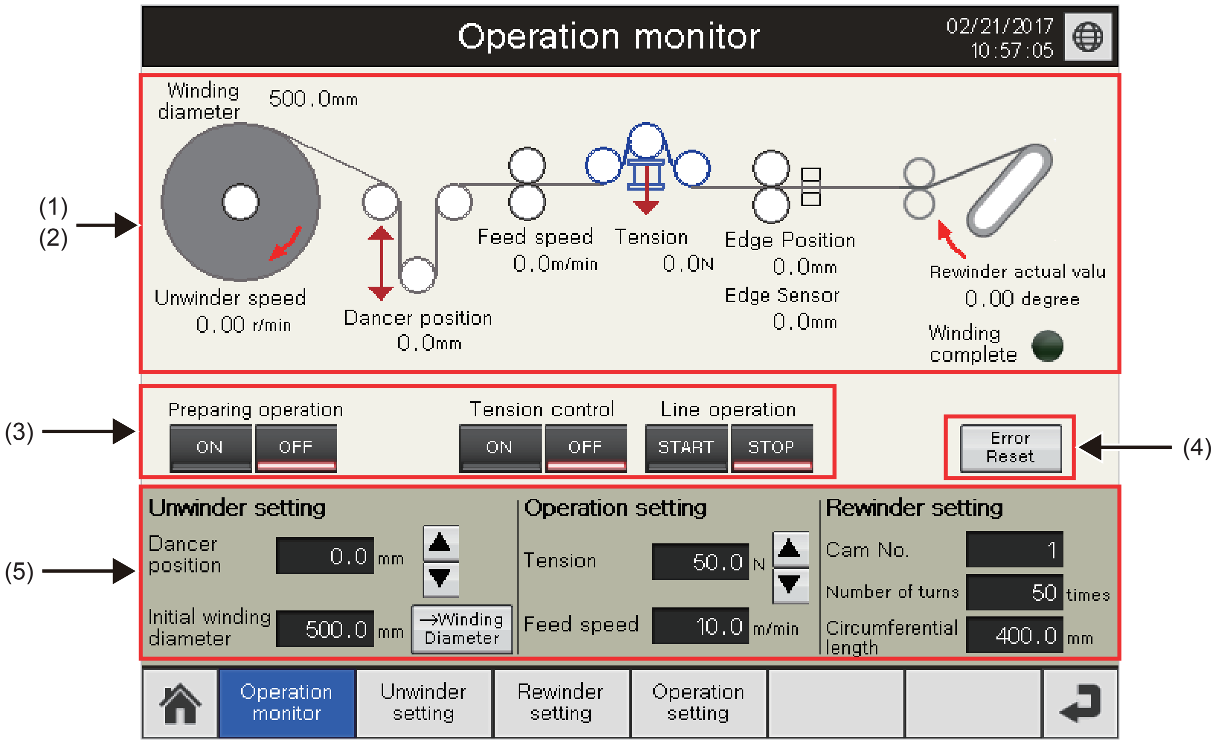
8.2 Operation Monitor Screen

The operation of the whole line can be monitored, the operation setting can be performed, and each operation can be started/stopped.



(1) Equipment monitor

Displays the axis status of each equipment.

Roller color	Status
White	Servo OFF
Green	Servo ON
Red	Servo error

(2) Current value monitor

Displays the current value of each equipment. (Numerical value: Black)

(3) Operation switch

Switch name		Operation
Preparing operation	ON	Sets all axes in the servo-on status.
	OFF	Sets all axes in the servo-off status.
Tension control	ON	Starts the dancer control of the unwinder axis, tension control of the feed axis, and edge position control.
	OFF	Stops the dancer control of the unwinder axis, tension control of the feed axis, and edge position control.
Line operation	START	Starts the rewinding operation by feeding materials with the movement amount of winding core circumference × number of windings.
	STOP	Stops the above operation.

(4) Error Reset switch

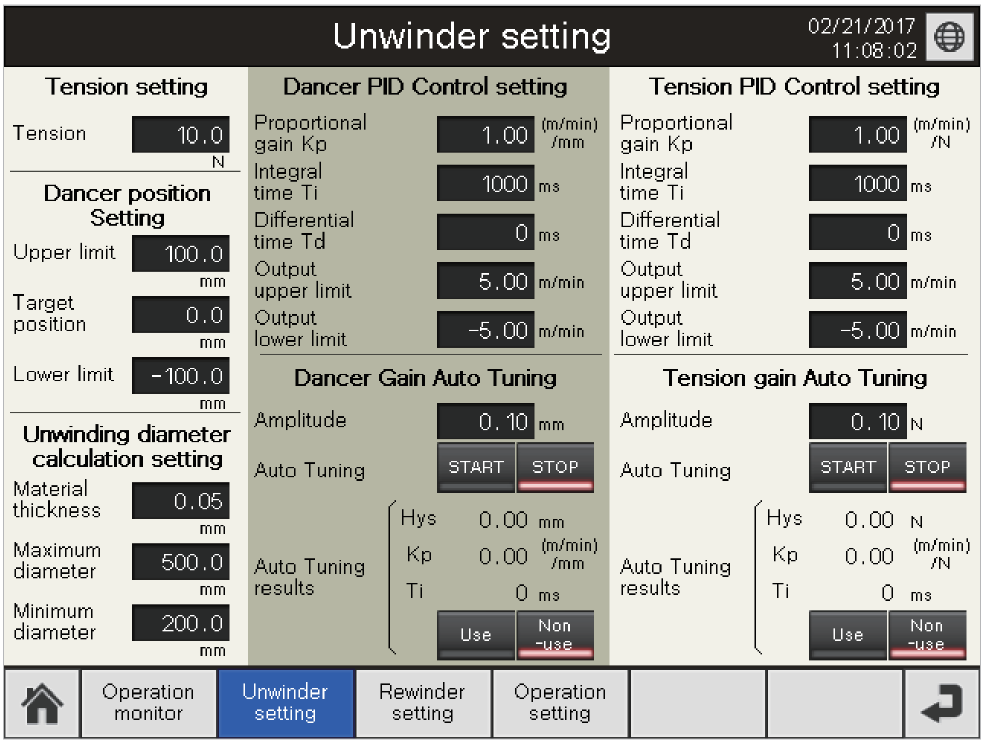
Resets the servo errors, motion errors, and FB errors.

(5) Settings

Sets the parameters for operations.

8.3 Unwinder Setting Screen

Settings for unwinding and material feeding can be set.



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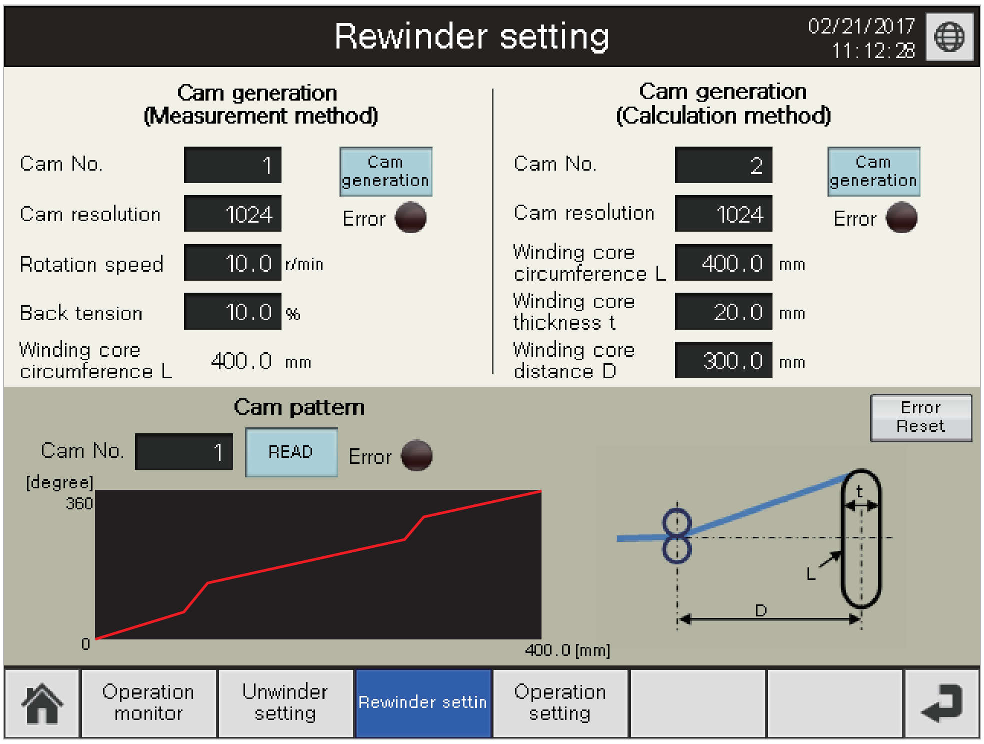
8.4 Rewinder Setting Screen

A cam pattern for rewinding control can be generated.



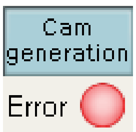
Cam pattern generation

- After inputting the parameters, touch the [Cam generation] switch.

- The switch flashes while a cam is being generated.

- The switch turns on when a cam has been generated normally.

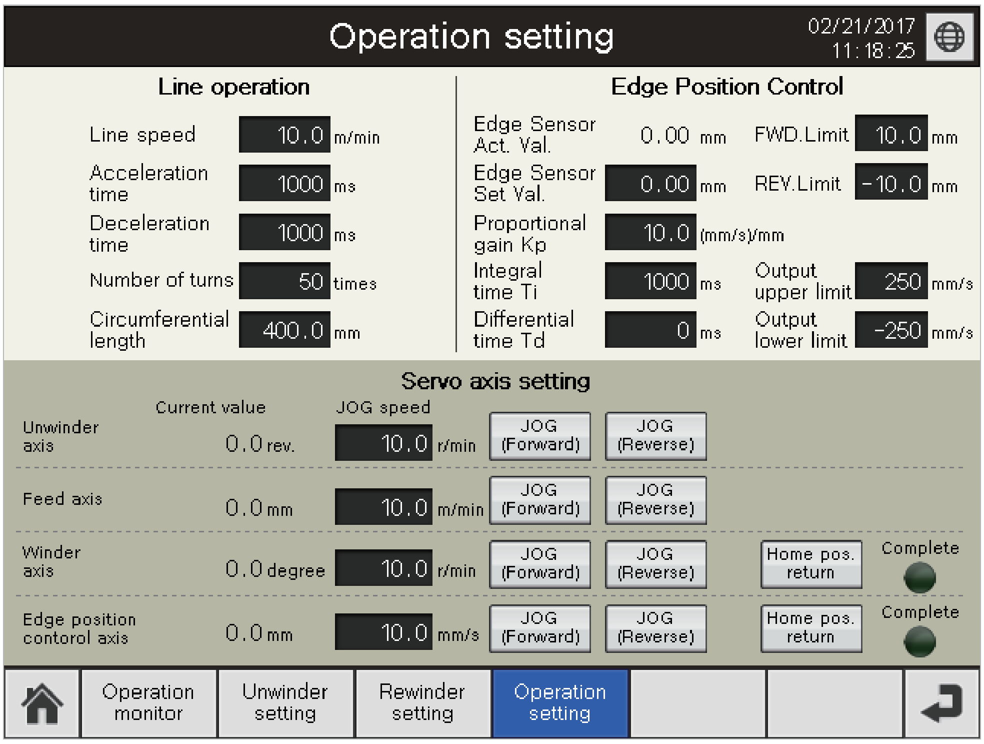
- The switch turns off and the Error lamp turns on when a cam has been generated with an error.



- Touching this switch when it is on generates a cam again.

8.5 Operation Setting Screen

Settings for line operation, JOG operation of each axis, and home position return can be set.



9 CONVERTING SIMULATOR

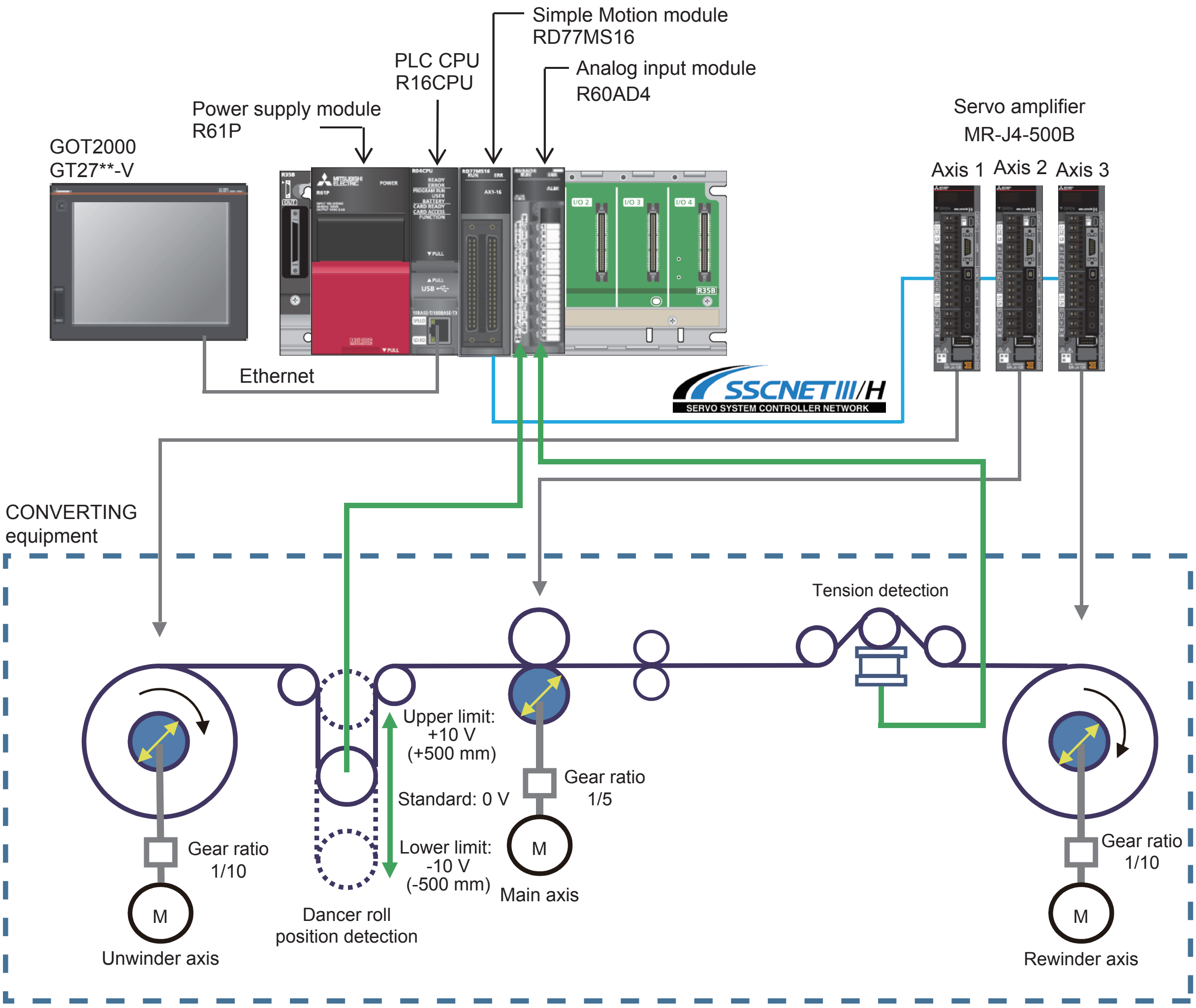
This function is for simulating and checking the operation of the tension control on a personal computer.
The converting simulation uses the converting simulator setting, GX Simulator3, GT Simulator3, and SMM Simulator in addition to the converting simulator.

9.1 Configuration and Execution Procedure of Simulator

System example

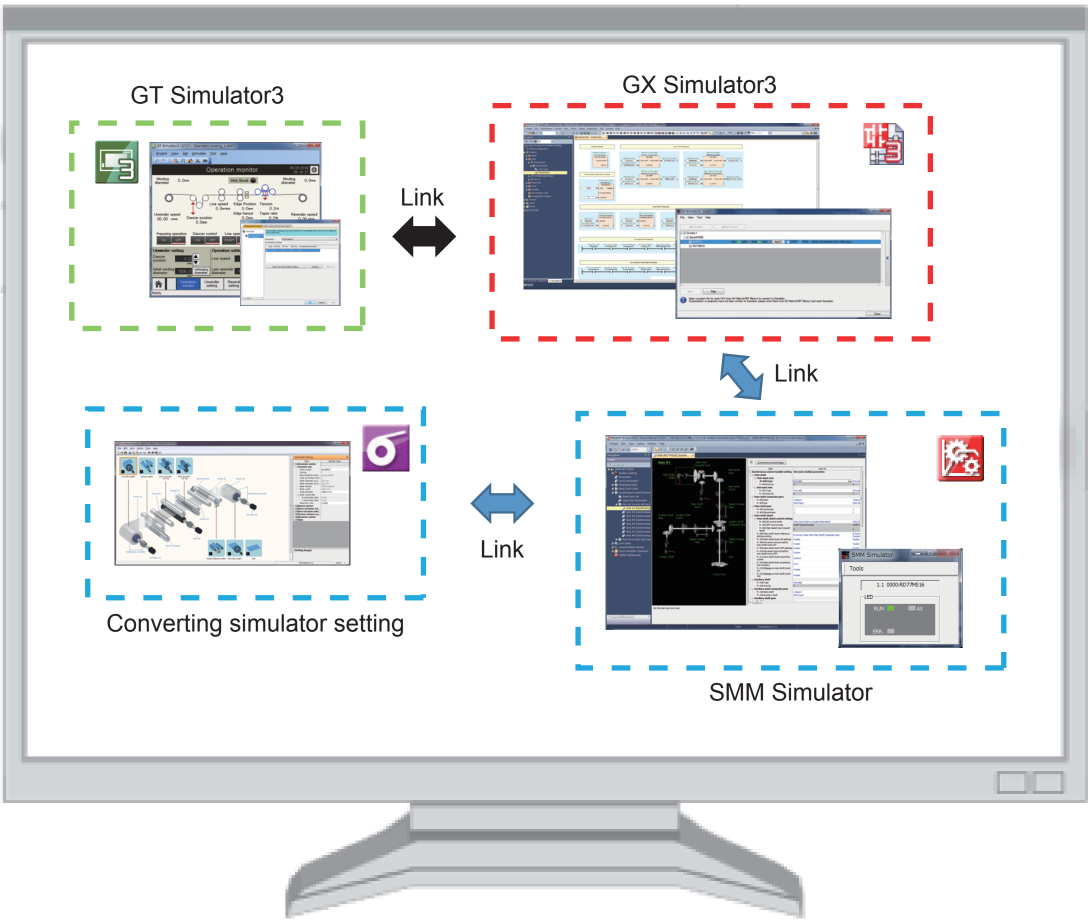
AP20-CNV002AA-R16-77MS16_****.gx3 (**** indicates the alphanumeric version.)

The following shows a system example for using the actual devices and equipment together.



Converting simulation (image)

The operation of converting system can be checked without actual devices.



Starting and closing the simulator

How to start the simulator (starting order of the program)

Follow the steps below to start the converting simulator on the personal computer on which the converting simulator setting is installed.

1. Start "AP20-CNV002AA-R16-77MS16_****.gx3" which is included in the DVD with GX Works3 and start the system simulation. (**** indicates the alphanumeric version.)
2. Write a project, parameters, and the Simple Motion module setting.
3. Start the Simple Motion module setting.
4. Start the converting simulator setting at the bottom of the navigation window of the Simple Motion module setting.
5. Input the parameter in the converting simulator setting. After writing the parameters from the menu "File" - "Converting Simulator" - "Write Parameter Data", click the [RESET] button of the PLC CPU on the GX Simulator3 screen. After that, select "RUN". (After changing parameters, click the [RESET] button of the PLC CPU on the GX Simulator3 screen.)
6. Start "AP20-CNV002AA-GT27nnV_****.GTX" which is included in the DVD with GT Works3. Start GT Simulator3 to run the converting system on the simulator. (**** indicates the alphanumeric version.)

For how to run the converting system, refer to the following.

☞ Page 161 Operation procedure

Precautions

- Write the parameter before using the converting simulator for the first time after the installation.
- The converting simulator setting is always started with the default parameters. The latest written parameters are stored in the simulator. Read the parameters from the simulator as necessary, or open the parameters saved in a file when starting the simulator.
- Set the initial diameter of the converting simulator setting to the same value as that of GT Simulator (GOT screen). A mismatch of initial diameters may result in unexpected operations.

How to close the converting simulator

Even when the converting simulator setting is closed, the converting simulator continues the operation. Close the system simulation to close the converting simulator.

Precautions

When the converting simulator is used, subsequent system simulation operates using the parameters of the converting simulator. When simulating the normal operation of Simple Motion, delete the parameter data of the converting simulator. To delete the parameter data, select the "File" - "Converting Simulator" - "Delete Parameter Data" from the menu of the converting simulator.

Restrictions and precautions

Restriction

- This simulator supports "AP20-CNV002AA-R16-77MS16_****.gx3" included in the package only. (**** indicates the alphanumeric version.)
- Edge position simulation cannot be performed.

Safety and handling precautions

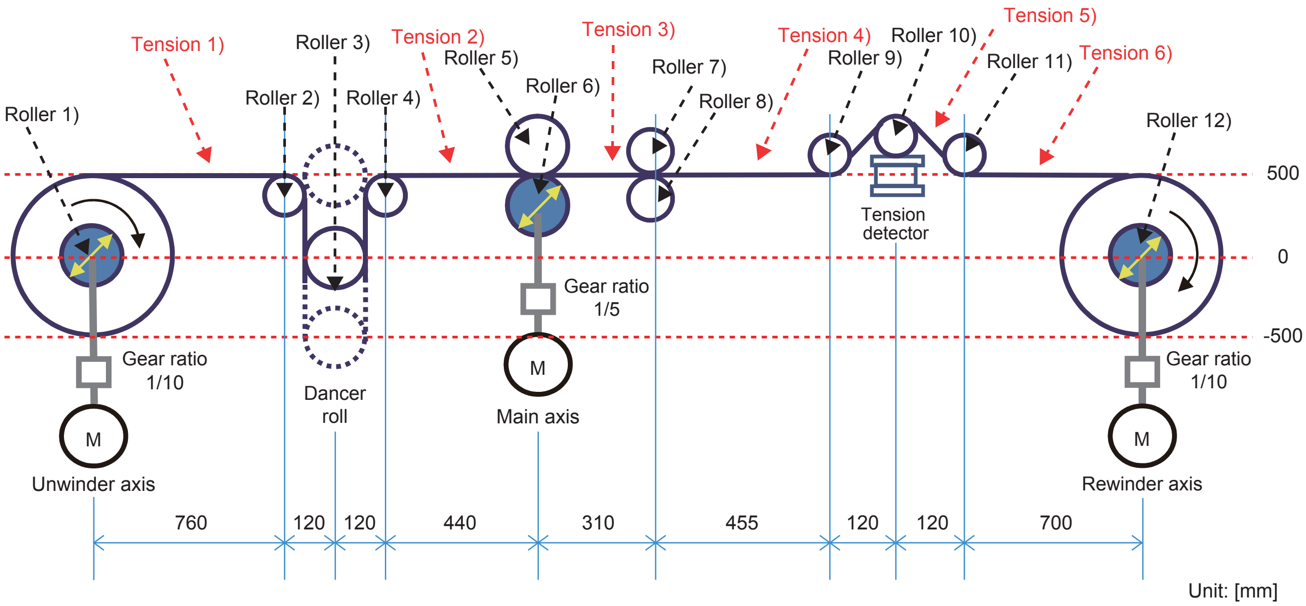
- The simulation function is used to simulate the actual devices and debug the created programs. Note that the operation of the debugged program is not guaranteed.
- After the debug process in the simulation function, perform the normal debug process with the actual devices connected before the actual operation.
- The parameter files used for the simulation are not included in the project of MELSOFT GX Works3. Manage the parameter files in conjunction with the project as necessary.

9.2 Simulator Specifications

By adjusting the material and thickness of the film, simulation can be performed using the material similar to the one to be actually used.
(The system is described in "Page 144 Equipment configuration".)

System specifications

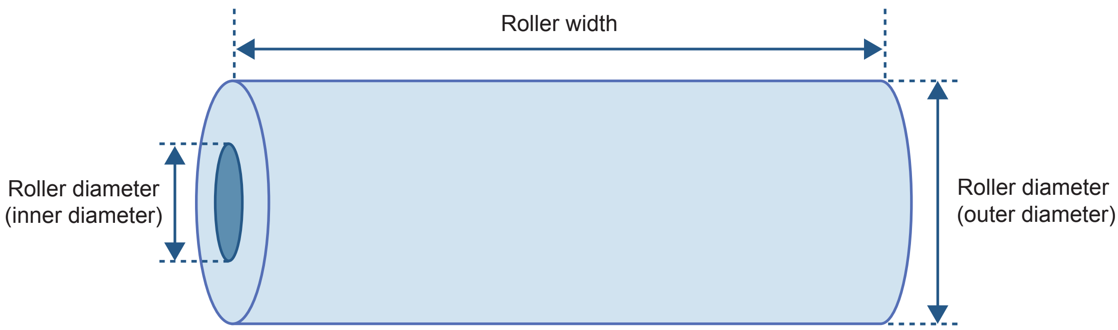
The following shows the specifications of the equipment operated by the simulator.



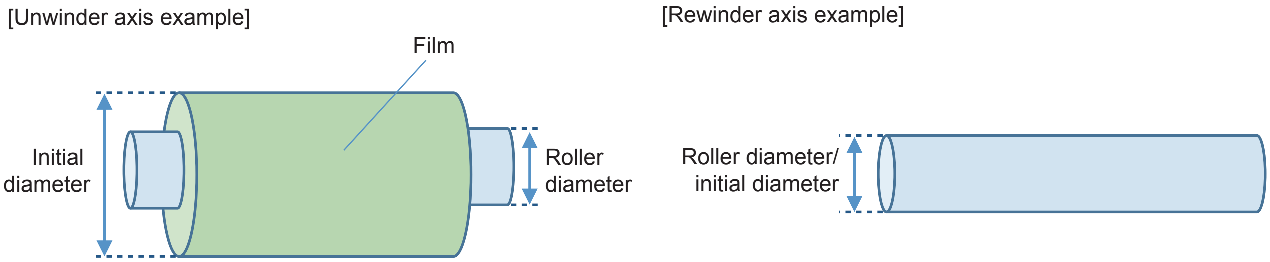
Parameter details

The following shows the parameters for the converting simulator to be set for each axis.

- Motor model: Motor model used in the module
- Axis No.: Axis No. of the module
- Roller diameter (outer diameter): Diameter of the roller
- Roller diameter (inner diameter): Inner diameter of the roller
- Roller density: Density of the roller material
- Roller width: Width of the roller



- Initial diameter: Diameter including the workpiece at start of operation



- Roller coordinate: Central coordinate of the roller when the central coordinate of the unwinder axis is (0, 0).
- Reduction ratio: Reduction ratio from the motor to the corresponding roller
- Roller mass: Mass of the dancer roll
- Guide stroke: Stroke amount of the dancer roll
- Initial slider position: Initial position of the dancer roll

Roller 1) Usage: Unwinder axis

Name	Unit	Input range	Initial value	Availability of parameter change
Motor model	—	—	HG-SR502	○
Axis No.	—	1 to 32	1	×
Rewinder/unwinder selection	—	w: Rewind uw: Unwind	uw: Unwind	×
Web connection form	—	-1, 1 to 4	1	×
Roller diameter (outer diameter)	mm	1 to 9999	191	×
Roller diameter (inner diameter)	mm	1 to 9999	161	×
Roller density	kg/m^3	0.1 to 9999.9	7874.0	×
Roller width	mm	1 to 9999	1200	×
Initial diameter	mm	191.0 to 9999.9	1000.0	○
Roller coordinate	mm	(0 to 99999, -99999 to 99999)	(0, 0)	×
Reduction ratio	—	0.001 to 999.999	10.000	○

Roller 2) Usage: Free roll for dancer roll 1

Name	Unit	Input range	Initial value	Availability of parameter change
Web connection form	—	-1, 1 to 4	3	×
Roller diameter (outer diameter)	mm	1 to 9999	80	×
Roller diameter (inner diameter)	mm	1 to 9999	60	×
Roller density	kg/m^3	0.1 to 9999.9	7874.0	×
Roller width	mm	1 to 9999	1200	×
Roller coordinate	mm	(0 to 99999, -99999 to 99999)	(760, 460)	×

Roller 3) Usage: Dancer Roll

Name	Unit	Input range	Initial value	Availability of parameter change
Web connection form	—	-1, 1 to 4	4	×
Roller diameter (outer diameter)	mm	1 to 9999	160	×
Roller diameter (inner diameter)	mm	1 to 9999	150	×
Roller density	kg/m^3	0.1 to 9999.9	2700.0	×
Roller width	mm	1 to 9999	1200	×
Roller coordinate	mm	(0 to 99999, -99999 to 99999)	(880, 0)	×
Roller mass	kg	0.001 to 999.999	7.889	×
Dancer movement direction	—	v: Vertical h: Horizontal	v: Vertical	×
Dancer load selection	—	f: Constant load s: Sapring load	f: Constant load	×
Constant load	N	1 to 999	30	×
Slider mass	kg	0.001 to 999.999	2.000	×
Guide viscosity coefficient	N/(m/s)	0.01 to 999.99	100.00	×
Guide friction coefficient	—	0.0000 to 1.0000	0.0000	×
Guide stroke	mm	1 to 9999	1000	×
Guide position	mm	-9999 to 9999	0	×
Initial slider position	mm	-9999 to 9999	0	×

Roller 4) Usage: Free roll for dancer roll 2

Name	Unit	Input range	Initial value	Availability of parameter change
Web connection form	—	-1, 1 to 4	1	×
Roller diameter (outer diameter)	mm	1 to 9999	80	×
Roller diameter (inner diameter)	mm	1 to 9999	60	×
Roller density	kg/m^3	0.1 to 9999.9	7874.0	×
Roller width	mm	1 to 9999	1200	×
Roller coordinate	mm	(0 to 99999, -99999 to 99999)	(1000, 460)	×

Roller 5) Usage: Nip roll

Name	Unit	Input range	Initial value	Availability of parameter change
Web connection form	—	-1, 1 to 4	-1	×
Roller diameter (outer diameter)	mm	1 to 9999	160	×
Roller diameter (inner diameter)	mm	1 to 9999	150	×
Roller density	kg/m^3	0.1 to 9999.9	7874.0	×
Roller width	mm	1 to 9999	1200	×
Roller coordinate	mm	(0 to 99999, -99999 to 99999)	(1440, 580)	×

Roller 6) Usage: Main axis

Name	Unit	Input range	Initial value	Availability of parameter change
Motor model	—	—	HG-SR502	○
Axis No.	—	1 to 32	2	×
Web connection form	—	-1, 1 to 4	1	×
Roller diameter (outer diameter)	mm	1 to 9999	159	×
Roller diameter (inner diameter)	mm	1 to 9999	139	×
Roller density	kg/m^3	0.1 to 9999.9	7874.0	×
Roller width	mm	1 to 9999	1200	×
Roller coordinate	mm	(0 to 99999, -99999 to 99999)	(1440, 420)	×
Reduction ratio	—	0.001 to 999.999	5.000	○

Roller 7) Usage: Nip roll for feed roll

Name	Unit	Input range	Initial value	Availability of parameter change
Web connection form	—	-1, 1 to 4	-1	×
Roller diameter (outer diameter)	mm	1 to 9999	100	×
Roller diameter (inner diameter)	mm	1 to 9999	90	×
Roller density	kg/m^3	0.1 to 9999.9	7874.0	×
Roller width	mm	1 to 9999	1200	×
Roller coordinate	mm	(0 to 99999, -99999 to 99999)	(1750, 550)	×

Roller 8) Usage: Feed roll

Name	Unit	Input range	Initial value	Availability of parameter change
Web connection form	—	-1, 1 to 4	3	×
Roller diameter (outer diameter)	mm	1 to 9999	100	×
Roller diameter (inner diameter)	mm	1 to 9999	90	×
Roller density	kg/m^3	0.1 to 9999.9	7874.0	×
Roller width	mm	1 to 9999	1200	×
Roller coordinate	mm	(0 to 99999, -99999 to 99999)	(1750, 450)	×

Roller 9) Usage: Roll for tension detector 1

Name	Unit	Input range	Initial value	Availability of parameter change
Web connection form	—	-1, 1 to 4	4	×
Roller diameter (outer diameter)	mm	1 to 9999	80	×
Roller diameter (inner diameter)	mm	1 to 9999	60	×
Roller density	kg/m^3	0.1 to 9999.9	7874.0	×
Roller width	mm	1 to 9999	1200	×
Roller coordinate	mm	(0 to 99999, -99999 to 99999)	(2205, 540)	×

Roller 10) Usage: Roll on tension detector

Name	Unit	Input range	Initial value	Availability of parameter change
Web connection form	—	-1, 1 to 4	3	×
Roller diameter (outer diameter)	mm	1 to 9999	80	×
Roller diameter (inner diameter)	mm	1 to 9999	60	×
Roller density	kg/m^3	0.1 to 9999.9	7874.0	×
Roller width	mm	1 to 9999	1200	×
Roller coordinate	mm	(0 to 99999, -99999 to 99999)	(2325, 580)	×

Roller 11) Usage: Roll for tension detector 2

Name	Unit	Input range	Initial value	Availability of parameter change
Web connection form	—	-1, 1 to 4	4	×
Roller diameter (outer diameter)	mm	1 to 9999	80	×
Roller diameter (inner diameter)	mm	1 to 9999	60	×
Roller density	kg/m^3	0.1 to 9999.9	7874.0	×
Roller width	mm	1 to 9999	1200	×
Roller coordinate	mm	(0 to 99999, -99999 to 99999)	(2445, 540)	×

Roller 12) Usage: Rewinder axis

Name	Unit	Input range	Initial value	Availability of parameter change
Motor model	—	—	HG-SR502	○
Axis No.	—	1 to 32	3	×
Rewinder/unwinder selection	—	w: Rewind uw: Unwind	w: Rewind	×
Web connection form	—	-1, 1 to 4	-1	×
Roller diameter (outer diameter)	mm	1 to 9999	191	×
Roller diameter (inner diameter)	mm	1 to 9999	161	×
Roller density	kg/m^3	0.1 to 9999.9	7874.0	×
Roller width	mm	1 to 9999	1200	×
Initial diameter	mm	191.0 to 9999.9	200.0	○
Roller coordinate	mm	(0 to 99999, -99999 to 99999)	(3145, 0)	×
Reduction ratio	—	0.001 to 999.999	10.000	○

Film

Name	Unit	Input range	Initial value*1	Availability of parameter change
Web young's modulus	GPa	0.001 to 999.999	4.000	○
Web thickness	μm	0.1 to 99999.9	50.0	○
Web width	mm	1 to 99999	1000	○
Web density	kg/m^3	0.1 to 9999.9	1350.0	○

*1 The initial value refers to the PET film value.

Monitors

The roll diameters and tension values are displayed on the simulator, and also stored in the following buffer memory addresses of the Simple Motion module.

Name	Unit	Buffer memory address	Data type	Remarks
Roll diameter (unwinder)	$\times 10^{-1}$ mm	Un\G32768	Word [Signed]	
Roll diameter (rewinder)	$\times 10^{-1}$ mm	Un\G32769	Word [Signed]	
Tension 1)	$\times 10^{-1}$ N	Un\G32770	Word [Signed]	Between unwinder axis and dancer front side
Tension 2)	$\times 10^{-1}$ N	Un\G32771	Word [Signed]	Between dancer rear side and main axis
Tension 3)	$\times 10^{-1}$ N	Un\G32772	Word [Signed]	Between main axis and feed roll
Tension 4)	$\times 10^{-1}$ N	Un\G32773	Word [Signed]	Between feed roll and tension detector front side
Tension 5)	$\times 10^{-1}$ N	Un\G32774	Word [Signed]	Tension detector
Tension 6)	$\times 10^{-1}$ N	Un\G32775	Word [Signed]	Between tension detector rear side and rewinder axis
Dancer roll position	$\times 10^{-2}$ mm	Un\G32776 Un\G32777	Double word [Signed]	
Tension detector	$\times 10^{-1}$ N	Un\G32778	Word [Signed]	

APPENDICES

Appendix 1 List of Error Codes

FB library: Warning (outside the input value range)

When an error occurs at the startup of an FB, the FB does not operate. When an error occurs while an FB is operating, the FB continuously operates with the value before the occurrence of the error.

ErrID		Description	Corrective action
Hex	Dec		
100H	256	A value outside the range is set for the axis number (station number).	Review the setting value and execute the FB again.
101H	257	The tension setting value is outside the range.	
102H	258	The coefficient of tension taper is a negative value.	
103H	259	The current value of roll diameter is outside the range. (The value is 0.0 or less or outside the range of the minimum diameter (inside diameter) to the maximum diameter.)	
104H	260	The torque of friction compensation is a negative value.	
105H	261	The coefficient of velocity limit is a negative value.	
106H	262	The offset of velocity limit is a negative value.	
107H	263	The execution cycle is 0.0 or less.	
108H	264	The winding method is set to a value other than 0 to 3.	
109H	265	The gear ratio is 0.0 or less.	
10AH	266	The rated torque is 0.0 or less.	
10BH	267	The proportionality gain is a negative value.	
10CH	268	The integral time is a negative value.	
10DH	269	The differential time is a negative value.	
10EH	270	Upper limit <= Lower limit	
10FH	271	The set deadband is a negative value.	
110H	272	The response is set to a value other than 1 to 7 when the auto tuning is started.	
111H	273	The amplitude is 0.0 or less when the auto tuning is started.	
114H	276	The draw ratio is a negative value.	
115H	277	The acceleration is 0.0 or less.	
116H	278	The deceleration is 0.0 or less.	
117H	279	The forced deceleration is 0.0 or less.	
118H	280	The jerk is 0.0 or less.	
119H	281	The direction of rotation is set to a value other than 0 and 1.	
11AH	282	The initial roll diameter is outside the range. (The value is 0.0 or less or outside the range of the minimum diameter to the maximum diameter.) The minimum roll diameter or the maximum roll diameter is outside the range. (The minimum diameter is a negative value, or the minimum roll diameter is equal to or larger than the maximum roll diameter.)	
11BH	283	The minimum line velocity is a negative value.	

ErrID		Description	Corrective action
Hex	Dec		
11CH	284	The minimum winder velocity is a negative value.	Review the setting value and execute the FB again.
11DH	285	The web thickness is 0.0 or less.	
11EH	286	The roll width is 0.0 or less.	
11FH	287	The roll density is 0.0 or less.	
120H	288	The machine inertia is a negative value.	
121H	289	The motor inertia is a negative value.	
122H	290	The coefficient of accelerating compensation is a negative value.	
123H	291	The coefficient of decelerating compensation is a negative value.	
124H	292	The ratio of load inertia moment is 0.0 or less.	
125H	293	The number of measurement points is a value other than 2 to 50.	
126H	294	The measurement time is 0.0 or less.	
127H	295	The maximum velocity is outside the range.	
128H	296	The estimate value of inertia is 0.0 or less.	
129H	297	GD2 in maximum inertia is 0.0 or less.	
12AH	298	VG2 in maximum inertia is 0.0 or less.	
12BH	299	The velocity gain factor is a value other than 0.0 to 1.0.	
12CH	300	The taper mode is set to a value other than 0 to 4.	
12DH	301	The taper minimum value is a negative value.	
12EH	302	Taper maximum value < Taper minimum value	
12FH	303	The taper ratio is a value other than 0.0 to 1.0.	
130H	304	The start diameter of roll is a negative value.	
131H	305	Maximum roll diameter <= Start diameter of roll	
133H	307	Time constant of lowpass filter < Execution cycle	
134H	308	The averaging number of the moving average filter (Filter time constant/Execution cycle) has exceeded 2000. Filter time constant < Execution cycle	
135H	309	Limiter: Setting value of upper limit <= Setting value of lower limit	
136H	310	The table interpolation and number of measuring points are outside the range.	
137H	311	Table interpolation: The X-coordinate values are not set in ascending order.	
138H	312	The acceleration time is a negative value.	
139H	313	The deceleration time is a negative value.	
140H	320	The travel distance per rotation of the winder axis is 0 or less. (Only when the axis number is 0)	
141H	321	The friction torque of coulomb is a negative value.	
142H	322	The coefficient of viscous friction is a negative value.	
143H	323	The minimum load inertia ratio is 0.0 or less.	
144H	324	Maximum load inertia ratio <= Minimum load inertia ratio	
145H	325	The measured actual torque is a negative value.	
150H	336	A value outside the range is set for the cam No.	
151H	337	A value outside the range is set for the cam resolution.	

ErrID		Description	Corrective action
Hex	Dec		
3100H	12544	Tension upper limit <= Tension lower limit	Review the setting value and execute the FB again.
3101H	12545	The alarm delay time is a negative value.	
3102H	12546	The deviation upper limit or deviation lower limit is a negative value.	
3103H	12547	Edge position Forward end setting <= Recession end setting	
3104H	12548	The web alarm delay hysteresis is a negative value.	
3105H	12549	Deviation upper limit <= Deviation lower limit	
3106H	12550	The variation limit is a negative value.	
3107H	12551	A value outside the range is set for the rewinder axis rotation speed.	
3108H	12552	A value outside the range is set for the back tension torque.	
3109H	12553	A value outside the range is set for the winding core circumference L.	
310AH	12554	A value outside the range is set for the winding core thickness t.	
310BH	12555	A value outside the range is set for the winding core distance D.	
310CH	12556	In the line velocity setting, the direction has been changed to forward or backward.	Before changing the line velocity setting to forward or backward, set the line velocity setting to 0.
310DH	12557	The auto tuning was not performed normally.	Check if the setting value of auto tuning amplitude and the dancer position or tension detection value are input normally. After that, execute the auto tuning again.
310EH	12558	Number of friction torque table points is other than 2 to 50	Review the setting value and execute the FB again.
310FH	12559	The winder velocity (X-coordinate value) of friction torque table is not set in ascending order.	
3110H	12560	A value outside the range has been set for the velocity integral compensation.	
3111H	12561	A value outside the range has been set for the correction gain.	
3112H	12562	Correction upper limit value <= Correction lower limit value	

A

FB library: Error

When an error has occurred, an FB stops its operation.

ErrID		Description	Corrective action
Hex	Dec		
200H	512	The FB is started while the target axis is operating.	Stop the target axis and execute the FB again.
201H	513	The target axis is not in the servo-on status.	Set the servo-on status for the target axis and execute the FB again.
202H	514	A motion error has occurred in the target axis.	Check the "[Md.23] Axis error No." of the target axis to check the error details and eliminate the cause of the error. After that, execute the FB again.
203H	515	The speed mode is turned off during operation.	Check if the mode switching from the speed mode to another mode has been performed or if the speed mode has not been turned off due to an axis error. Eliminate the cause of the error and execute the FB again.
204H	516	The torque mode is turned off during operation.	Check if the mode switching from the torque mode to another mode has been performed or if the torque mode has not been turned off due to an axis error. Eliminate the cause of the error and execute the FB again.
250H	592	A cam data operation warning has occurred during cam generation.	Check the "[Md.24] Axis warning No." of the axis 1 to check the warning details and eliminate the cause of the error. After that, execute the FB again.
251H	593	The FB is started while a cam is being generated in another FB or user program.	Before starting the FB, check that "0" is set to "[Cd.600] Cam data operation request".
252H	594	The rewinder axis velocity is high for the cam resolution.	Set the rewinder velocity so that the time taken for one rotation is longer than the product of the FB execution cycle and cam resolution. After that, execute the FB again.
F001H	61441	The license key of the application to be used in the PLC CPU used is not authenticated.	Certify the license key of the application to be used.
F002H	61442	A value outside the range is set for the start I/O number.	Review the setting value and execute the FB again.
F003H	61443	The module set in the start I/O number setting is not the Simple Motion module.	Specify a Simple Motion module.

Application program control FB: Warning (outside the input value range)

When an error has occurred at the startup of the FB, the FB does not operate. When an error occurs while the FB is operating, the FB continuously operates with the value before the occurrence of the error.

ErrID		Description	Corrective action
Hex	Dec		
3D00H	15616	The distance between the touch roll and cutter is a negative value.	Review the setting value and execute the FB again.
3D01H	15617	The detection sensor installation angle is outside the range of 0 to 360.	
3D02H	15618	The roll diameter is 0 or smaller.	
3D03H	15619	The detection sensor distance is outside the range of 1 to 5000.	
3D04H	15620	The detection sensor installation angle is outside the range of 1 to 179.	
3D05H	15621	The roll edge detection angle is outside the range of 1 to 179.	
3D06H	15622	A value outside the range is set for the start IO number.	
3E20H	15904	The inverter velocity command (velocity limit) cannot be written.	Change the program so that CCIEFINVSpdIF (CC-Link IE Field inverter speed control interface) and CCIEFINVTrqIF (CC-Link IE Field inverter torque interface) are not executed simultaneously for the same station.
3E21H	15905	The inverter torque command cannot be written.	Change the program so that multiple CCIEFINVTrqIF (CC-Link IE Field inverter torque interfaces) are not executed simultaneously for the same station.
3E22H	15906	The inverter velocity command (velocity limit) is outside the range.	Review the setting value and execute the FB again.
3E23H	15907	The inverter torque command is outside the range.	

Application program control FB: Error

When an error has occurred, the FB stops its operation.

ErrID		Description	Corrective action
Hex	Dec		
3DF0H	15856	A cam data operation warning has occurred at the cam operation request.	Check the "[Md.24] Axis warning No." of the axis 1 to check the warning details and eliminate the cause of the error. After that, execute the FB again.
3F00H	16128	The inverter PLG option specification is outside the range of 1 and 2.	Review the setting value and execute the FB again.
3F01H	16129	An inverter write mode error has occurred.	Set the inverter operation mode to NET operation mode and execute the FB again.
3F02H	16130	The inverter is not ready.	Refer to the following and set the inverter operation mode to "Remote station Ready". After that, execute the FB again. FR-A800 INSTRUCTION MANUAL (DETAILED)
3F03H	16131	A data link error has occurred.	Check that the slave station is connected to the network and execute the FB again.
3FFFH	16383	An inverter error of the target station number has occurred.	Check the inverter error details of the target station and eliminate the cause of the error. After that, execute the FB again.

A

Appendix 2 List of GOT 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 the details of [Batch Edit], refer to "GT Designer3 (GOT2000) Help".

Type	Device number	Use
Bit	GB40	Always ON
Bit	GB30000	Pattern save switch, script trigger
Bit	GB30001	Pattern load switch, script trigger
Bit	GB30002	Pattern deletion switch, script trigger
Bit	GB30004	Pattern scroll up switch, script trigger
Bit	GB30005	Pattern scroll down switch, script trigger
Bit	GB30006	Display condition of pattern scroll down switch
Bit	GB30007	Pattern selection switch, script trigger
Bit	GB30008	Display condition of pattern scroll up switch
Bit	GB30010 to GB300014	Pattern selection switch
Bit	GB30020	Pattern save flag
Bit	GB30030	Pattern save confirmation switch, script trigger
Bit	GB30031	Pattern deletion confirmation switch, script trigger
Bit	GD30031.b13	System signal 1-1: GOT error reset signal
Bit	GD32000.b0	Recipe common write trigger signal
Bit	GD32000.b1	Recipe common read trigger signal
Bit	GD32003.b0	Recipe common writing signal
Bit	GD32003.b1	Recipe common reading signal
Bit	GS251.b0	Drive accessible notification
Bit	GS512.b0	Time change information
Word	GD30000	Base screen switching device
Word	GD30001	Overlap window screen 1 switching device
Word	GD30004	Overlap window screen 2 switching device
Word	GD30018	Dialog window screen switching device
Word	GD30031	System signal 1-1
Word	GD30041	System signal 2-1
Word	GD30060 to GD30065	Date and time adjustment switch
Word	GD30100 to GD30123	Scale of historical trend graph
Word	GD30200 to GD30203	For calculation in the script for tension graph adjustment
Word	GD30210 to GD30213	For calculation in the script for rewinder/unwinder graph adjustment
Word	GD30220 to GD30223	For calculation in the script for dancer position adjustment
Word	GD30300 to GD30309	Graph information of historical trend graph
Word	GD30400 to GD30411	Cursor position time, display start position time, display end position time
Word	GD31000 to GD31199	Devices for storing the list of pattern files (with extension)
Word	GD31200 to GD31205	Devices for storing pattern names of the Pattern Select/Register window screen
Word	GD31250 to GD31255	Devices for storing pattern names of the base screen
Word	GD31300	Pattern file name offset device
Word	GD31301	Current page number
Word	GD31302	Maximum number of pages
Word	GD31303	Selected recipe number
Word	GD31320 to GD31324	Pattern number
Word	GD31330	Pattern number offset
Word	GD31350 to GD31356	Devices for storing corresponding pattern file names
Word	GD31600 to GD31799	Devices for storing the list of pattern files (without extension)
Word	GD31900	Devices for storing the comment number
Word	GD32000 to GD32005	Recipe common setting
Word	GD32100 to GD32102	For calculation of the part display in the B-30100 screen

Type	Device number	Use
Word	GS513 to GS516	Time after change
Word	GS650 to GS652	Current time
Word	TMP800 to TMP806 TMP810 to TMP816 TMP950 to TMP996	For calculation in the script

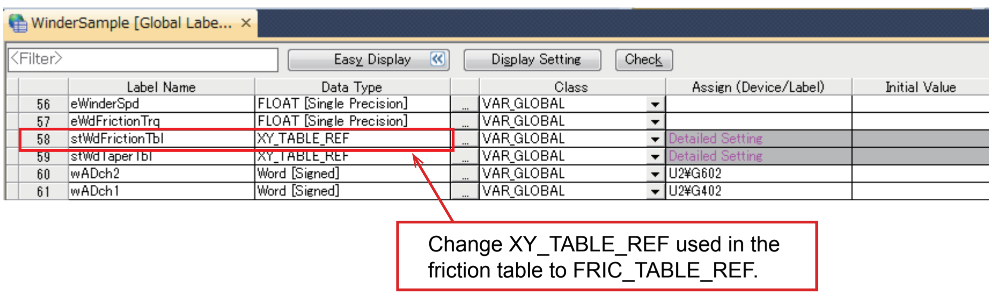
Appendix 3 Functional Restrictions by Version

Available functions depend on the version of the application package.

The following table shows combinations of each version and function.

Function		Version	Reference
FB	Roll diameter calculation (feeding length method)	Version 1.001B or later	Page 53 Details of the FB Library
	Edge position control		
	Web break detection		
	In velocity output with line velocity generator		
	Version display of FBs in registered libraries on the Element Selection window		—
MELSOFT iQ AppPortal			Page 297 Using MELSOFT iQ AppPortal
Reel change function		Version 1.003D or later	Page 163 Reel Change
FB	Ramp generator		Page 53 Details of the FB Library
Cam generation for flat roll function • Cam generation for flat roll (Measurement method) • Cam generation for flat roll (Calculation method) • Program examples and screen examples have been added.		Version 1.004E or later	Page 53 Details of the FB Library Page 256 APPLICATION PROGRAM EXAMPLE (FLAT ROLL) Page 275 APPLICATION SCREEN EXAMPLES (FLAT ROLL)
FB	Tension sensor feedback velocity control (Intermediate axis)		Page 53 Details of the FB Library
	Dancer feedback velocity control (Intermediate axis)		
Application program example with an inverter (CC-Link IE Field Network)			Page 196 Inverter
The standard Simple Motion module can be used by registering a license key.			Page 30 Registering a License Key
FB	For the moving average filter, 0 can be set as the time constant.	Version 1.006G or later	Page 53 Details of the FB Library
	For the line velocity generator, a negative speed can be set.		
Converting simulator			Page 280 CONVERTING SIMULATOR
FB	Change the structure used in the friction torque table of the following FBs from XY_TABLE_REF (2000 × 2 points) to FRIC_TABLE_REF (50 × 2 points) that is the friction torque dedicated structure.*1 • Friction compensation torque calculation • Friction torque measurement	Version 1.007H or later	Page 53 Details of the FB Library
A temporary license is available before a license key is obtained.		Version 1.008J or later	Page 30 Registering a License Key
FB	• Tension sensorless velocity control • Inertia estimation • Inertia compensation torque calculation (Inertia estimation value) • Tension deviation measurement • Table interpolation (50 points)	Version 1.010L or later	Page 53 Details of the FB Library
The data type of the AXIS_REF structure member (label) is changed.*2		Version 1.011M or later	Page 53 Details of the FB Library
RD78G4, RD78G8, and RD78G16 that operate in the Simple Motion mode are available.		Version 1.012M or later	—

*1 Change the structure used in the friction table from XY_TABLE_REF to FRIC_TABLE_REF after changing the FB.

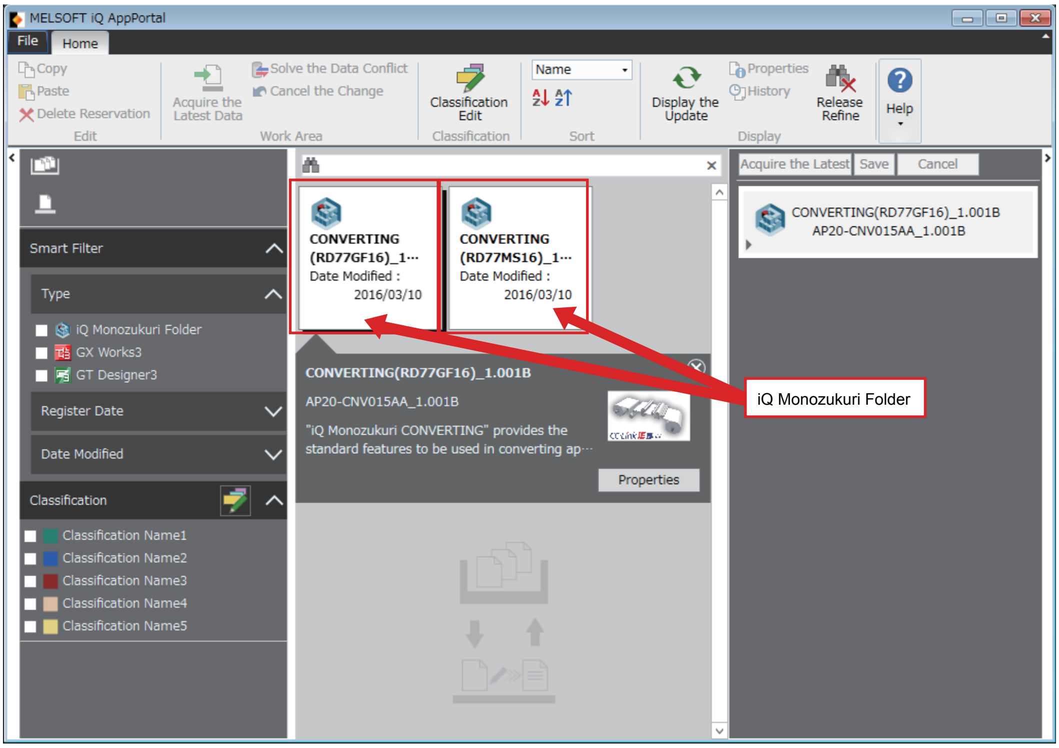


*2 When updating a project of version 1.010L or earlier to 1.011M or later, replace the project. For details, refer to the following.

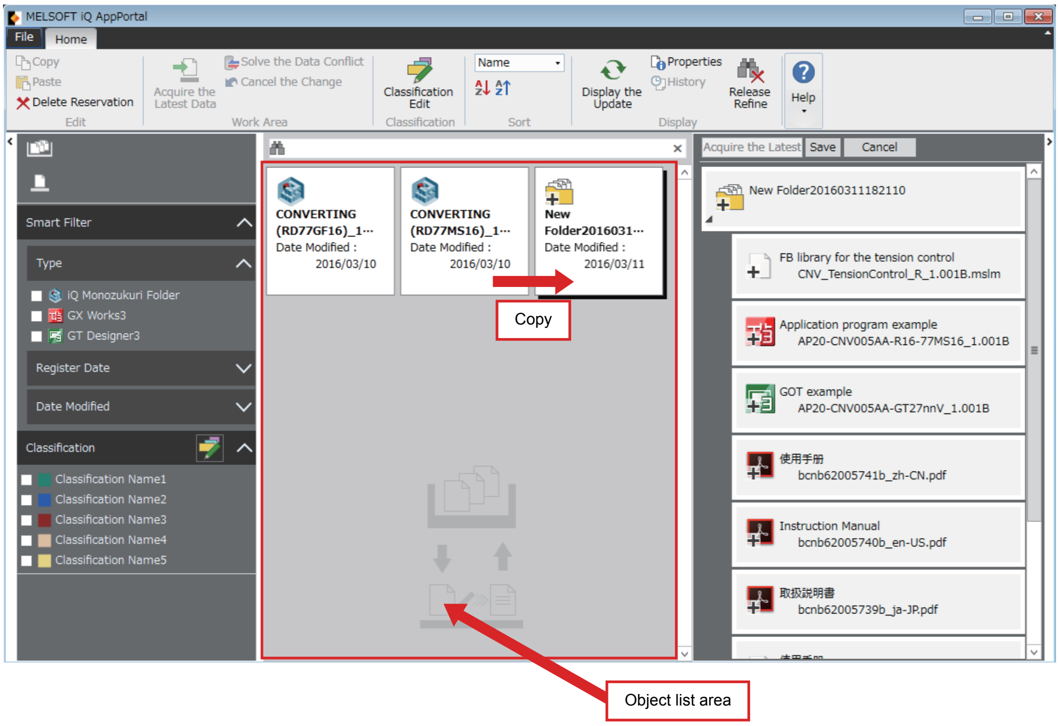
☞ Page 38 Updating Library Elements

Appendix 4 Using MELSOFT iQ AppPortal

MELSOFT iQ AppPortal, an application integrated management tool, is useful for managing projects and related files by application package. This tool can be downloaded for free from Mitsubishi Electric FA site.
By using the installer (setup.exe) in the MELSOFT iQ AppPortal/iQAP_Data folder in the DVD-ROM supplied with this application package, users can install data of iQ Monozukuri CONVERTING. (Install MELSOFT iQ AppPortal in advance.)



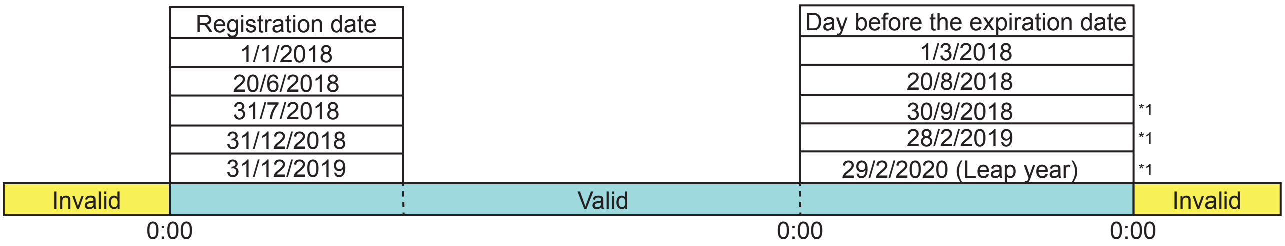
Users cannot make changes to iQ Monozukuri Folder. Copy iQ Monozukuri Folder to the object list area and build an application.



A

Appendix 5 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-CNV002AA_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) CNV_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-CNV002AA_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

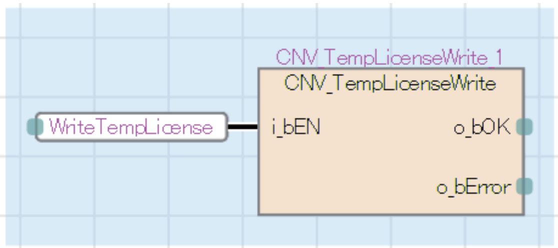
Write the program to the PLC CPU module and execute it.
- Select "Online" → "Write to PLC" from the menu and write all the program to the PLC CPU module.
- Set the PLC CPU module to the RUN state and execute the scan program. Select "Program" → "Scan" in the Navigation window and open the registered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

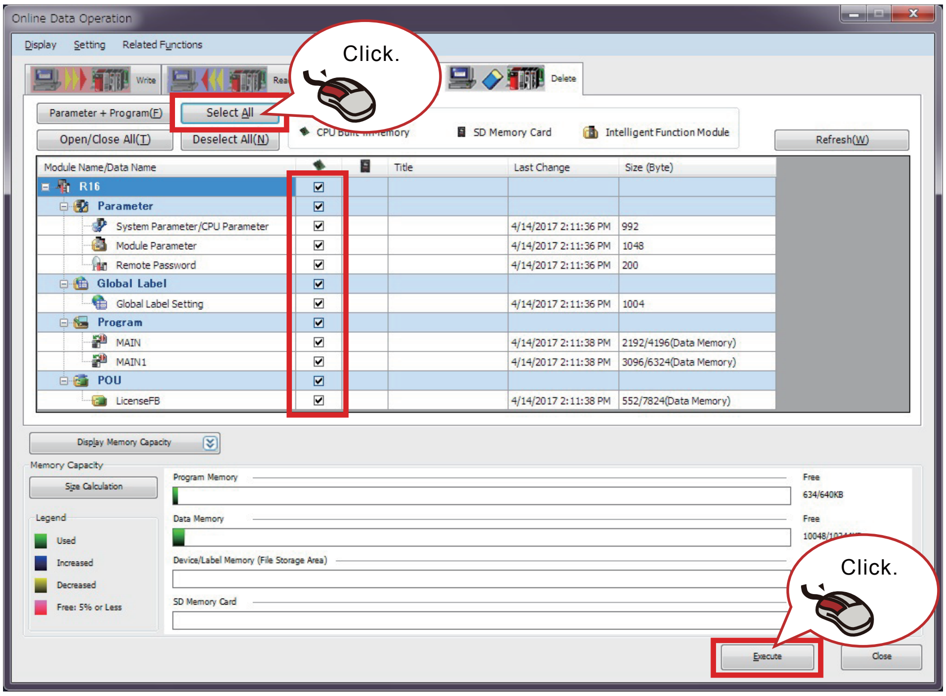
■ Registering the temporary license

Turn on the execution flag (WriteTempLicense) of the function block (CNV_TempLicenseWrite) in the scan program. Normal completion (o_bOK) or Error completion (o_bError) becomes TRUE. At the error completion, refer to Troubleshooting.
(☞ Page 299 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 "CNV_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 "CNV_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 "CNV_LicenseWrite".
After "CNV_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".

MEMO

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INSTRUCTION INDEX

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I

REVISIONS

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

Revision date	*Manual number	Description
October 2015	BCN-B62005-740-A	First edition
April 2016	BCN-B62005-740-B	■Added models AP20-CNV015AA-M0 ■Added functions CC-Link IE Field Network products have been supported, FBs (Roll diameter calculation (feeding length method), Edge position control, Web break detection) have been added, and MELSOFT iQ AppPortal has been supported. ■Added or modified parts RELEVANT MANUALS, TERMS, Section 1.4, 1.5, 1.6, 2.1, 2.2, 2.3, 3.1, 4.1, 4.2, 4.3, 5.1, 5.3, 5.4, 5.5, 5.6, 5.7, 5.8, 5.9, Chapter 6, Section 6.1, 6.3, 6.4, 6.5, Appendix 1, 2, 3
October 2016	BCN-B62005-740-C	■Added functions Reel change function and an FB (Ramp generator) have been added. ■Added or modified parts TERMS, Section 1.6, 2.1, 3.1, 4.1, 4.2, 4.3, 5.4, 5.5, 5.9, 5.10, 5.11, 5.12, 5.13, 5.14, 5.15, 5.16, 5.17, 5.18, 5.19, 5.20, 6.1, 6.3, 6.4, 6.5, Appendix 2
June 2017	BCN-B62005-740-D	■Added functions The standard Simple Motion module can be used by registering a license key, FBs have been added (Cam generation for flat roll, tension sensor feedback velocity control for intermediate axis, dancer feedback velocity control for intermediate axis), Program examples have been added (Inverter CC-Link IE Field connection, flat roll) ■Added or modified parts TERMS, REQUESTING AND REGISTERING A LICENSE KEY, Section 1.2, 1.3, 1.4, 1.5, 1.6, 2.1, 2.4, 3.1, Chapter 4, Section 4.1, 4.2, Chapter 5, Section 5.1, 5.2, 5.3, 5.4, 5.5, 5.6, 5.7, 5.8, 5.9, 5.10, 5.11, 5.12, 5.13, 5.14, 5.15, 5.16, 5.17, 5.18, 5.19, 5.20, 5.21, 6.1, 6.4, Chapter 7, 8, Appendix 1, 3, WARRANTY, TRADEMARKS
June 2018	BCN-B62005-740-E	■Added functions Converting simulator and FB functions (For the moving average filter, 0 can be set as the time constant, and for the line velocity generator, a negative speed can be set.) ■Added or modified parts TERMS, REQUESTING AND REGISTERING A LICENSE KEY, Section 1.4, 1.5, 1.6, 2.1, 2.3, 2.4, 2.5, 4.1, 4.2, Chapter 5, Section 5.1, 5.2, 5.3, 5.4, 5.5, 6.5, 7.5, 7.6, 7.7, 7.8, Chapter 9, Appendix 1, 3, 4
July 2018	BCN-B62005-740-F	■Changed functions FB functions have been changed. (The structure size of the friction torque table used in the friction compensation torque calculation and friction torque measurement is changed from 2000 points to 50 points.) ■Added or modified parts Section 4.1, 4.2, 5.1, 9.1, Appendix 1, 2, 3
October 2018	BCN-B62005-740-G	■Added functions A temporary license is available before a license key is obtained. ■Added or modified parts TERMS, Section 2.1, 2.4, 4.1, Appendix 3, 5
February 2019	BCN-B62005-740-H	■Added or modified parts Section 2.1, 4.1, 4.2
July 2019	BCN-B62005-740-J	■Added functions FB functions have been added. (Tension sensorless velocity control, inertia estimation, inertia compensation torque calculation (inertia estimation value, tension deviation measurement, table interpolation (50 points))) ■Added or modified parts Section 1.6, 4.1, 4.2, Appendix 1, 3
September 2019	BCN-B62005-740-K	■Added or modified parts Section 1.6, 2.3, 2.5, 4.1, 4.2, 5.3, 5.5, 7.6, 7.7, 9.1, Appendix 1, 3
September 2021	BCN-B62005-740-L	■Added functions RD78 simple motion mode has been supported. ■Added or modified parts TERMS, Section 1.5, 1.6, 2.2, 3.1, 3.2, 3.3, 4.1, 4.2, Chapter 5, Section 5.1, 5.3, 5.4, 5.5, 7.1, 7.4, 7.5, 7.6, 7.7, Appendix 3

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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