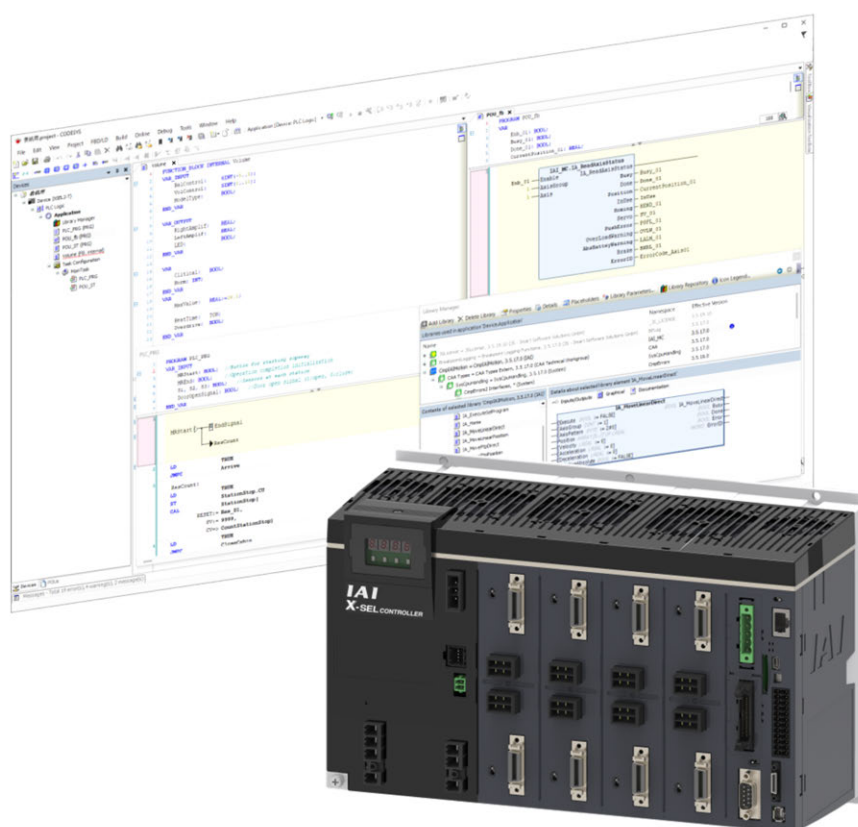


XSEL2 PLC Feature

Instruction Manual First Edition *ME0479-1A*



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Regarding Readers Subject to This Manual

This manual is made targeting the following personnels who possess knowledge of electricity (knowledge of a qualified electrician or equivalent).

- Personnel in charge to introduce FA devices
- Personnel who designs FA system
- Personnel who install or link FA devices
- Personnel who manages FA site

This manual is also made targeting personnels who understand the contents specified in the international standard IEC61131-3 or domestic standard JIS B 3503 regarding programing languages.

Please Read Before Use

Thank you for purchasing our product.

This instruction manual explains the handling methods, structure and maintenance of this product, providing the information you need in order to use the product safely.

Before using the product, be sure to read this manual and fully understand the contents explained herein to ensure safe use of the product.

Please download the user's manual from our website.

You can download it free of charge. User registration is required for the first time downloading.

URL : www.iai-robot.co.jp/data_dl/CAD_MANUAL/

When using the product, print out of the necessary portions of the relevant manual, or please display it on your computer, tablet terminal, etc. so that you can check it immediately.

After reading the instruction manual, keep it in a convenient place so that whoever is handling the product can refer to it quickly when necessary.

[Important]

- This instruction manual is an original document dedicated for this product.
- This product cannot be used in ways not shown in this instruction manual. IAI shall not be liable for any result whatsoever arising from the use of the product in any other way than what is noted in the manual.
- The information contained in this instruction manual is subject to change without notice for the purpose of product improvement.
- If any issues arise regarding the information contained in this instruction manual, contact our customer center or the nearest sales office.
- Use or reproduction of this instruction manual in full or in part without permission is prohibited.
- The company names, names of products and trademarks of each company shown in the text are registered trademarks.
- CODESYS is a registered trademark or trademark of CODESYS Development GmbH.
- EtherNet/IP™ is a trademark used under ODVA licenses.
- Windows is a registered trademark or a trademark of Microsoft Corporation in the United States of America and other countries and regions.

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Safety Guide

“Safety Guide” has been written to use the machine safely and so prevent personal injury or property damage beforehand. Make sure to read it before the operation of this product.

Safety Precautions for Our Products

The common safety precautions for the use of any of our robots in each operation.

No.	Operation Description	Description
1	Model Selection	• This product has not been planned and designed for the application where high level of safety is required, so the guarantee of the protection of human life is impossible. Accordingly, do not use it in any of the following applications. 1) Medical equipment used to maintain, control or otherwise affect human life or physical health. 2) Mechanisms and machinery designed for the purpose of moving or transporting people (For vehicle, railway facility or air navigation facility) 3) Important safety parts of machinery (Safety device, etc.) • Do not use the product outside the specifications. Failure to do so may considerably shorten the life of the product. • Do not use it in any of the following environments. 1) Location where there is any inflammable gas, inflammable object or explosive 2) Place with potential exposure to radiation 3) Location with the ambient temperature or relative humidity exceeding the specification range 4) Location where radiant heat is added from direct sunlight or other large heat source 5) Location where condensation occurs due to abrupt temperature changes 6) Location where there is any corrosive gas (sulfuric acid or hydrochloric acid) 7) Location exposed to significant amount of dust, salt or iron powder 8) Location subject to direct vibration or impact • For an actuator used in vertical orientation, select a model which is equipped with a brake. If selecting a model with no brake, the moving part may drop when the power is turned OFF and may cause an accident such as an injury or damage on the work piece.

No.	Operation Description	Description
2	Transportation	• When carrying a heavy object, do the work with two or more persons or utilize equipment such as crane. • When the work is carried out with 2 or more persons, make it clear who is to be the “leader” and who to be the “follower(s)” and communicate well with each other to ensure the safety of the workers. • When in transportation, consider well about the positions to hold, weight and weight balance and pay special attention to the carried object so it would not get hit or dropped. • Transport it using an appropriate transportation measure. The actuators available for transportation with a crane have eyebolts attached or there are tapped holes to attach bolts. Follow the instructions in the instruction manual for each model. • Do not step or sit on the package. • Do not put any heavy thing that can deform the package, on it. • When using a crane capable of 1t or more of weight, have an operator who has qualifications for crane operation and sling work. • When using a crane or equivalent equipments, make sure not to hang a load that weighs more than the equipment's capability limit. • Use a hook that is suitable for the load. Consider the safety factor of the hook in such factors as shear strength. • Do not get on the load that is hung on a crane. • Do not leave a load hung up with a crane. • Do not stand under the load that is hung up with a crane.
3	Storage and Preservation	• The storage and preservation environment conforms to the installation environment. However, especially give consideration to the prevention of condensation. • Store the products with a consideration not to fall them over or drop due to an act of God such as earthquake.
4	Installation and Start	(1) Installation of Robot Main Body and Controller, etc. • Make sure to securely hold and fix the product (including the work part). A fall, drop or abnormal motion of the product may cause a damage or injury. Also, be equipped for a fall-over or drop due to an act of God such as earthquake. • Do not get on or put anything on the product. Failure to do so may cause an accidental fall, injury or damage to the product due to a drop of anything, malfunction of the product, performance degradation, or shortening of its life. • When using the product in any of the places specified below, provide a sufficient shield. 1) Location where electric noise is generated 2) Location where high electrical or magnetic field is present 3) Location with the mains or power lines passing nearby 4) Location where the product may come in contact with water, oil or chemical droplets

No.	Operation Description	Description
4	Installation and Start	(2) Cable Wiring • Use our company's genuine cables for connecting between the actuator and controller, and for the teaching tool. • Do not scratch on the cable. Do not bend it forcibly. Do not pull it. Do not coil it around. Do not insert it. Do not put any heavy thing on it. Failure to do so may cause a fire, electric shock or malfunction due to leakage or continuity error. • Perform the wiring for the product, after turning OFF the power to the unit, so that there is no wiring error. • When the direct current power (+24V) is connected, take the great care of the directions of positive and negative poles. If the connection direction is not correct, it might cause a fire, product breakdown or malfunction. • Connect the cable connector securely so that there is no disconnection or looseness. Failure to do so may cause a fire, electric shock or malfunction of the product. • Never cut and/or reconnect the cables supplied with the product for the purpose of extending or shortening the cable length. Failure to do so may cause the product to malfunction or cause fire.
		(3) Grounding • The grounding operation should be performed to prevent an electric shock or electrostatic charge, enhance the noise-resistance ability and control the unnecessary electromagnetic radiation. • For the ground terminal (PE) on the AC power cable of the controller and the grounding plate in the control panel, make sure for grounding work. For security grounding, it is necessary to select an appropriate wire thickness suitable for the load. Perform wiring that satisfies the specifications (electrical equipment standards and criteria). For detail, follow the description in [an instruction manual of each controller or controller built-in actuator]. • Conduct functional grounding on the FG terminal for a controller supplying 24V DC or a controller built-in type actuator. In order to minimize influence to mechanical operation given by electromagnetic interference (noise) to an electrical device or insulation failure, conduct grounding on a terminal or a conductor that is electrically stable. The reference impedance should be Type D (Former Class 3, ground resistance 100Ω or less).

No.	Operation Description	Description
4	Installation and Start	(4) Safety Measures • When the work is carried out with 2 or more persons, make it clear who is to be the “leader” and who to be the “follower(s)” and communicate well with each other to ensure the safety of the workers. • When the product is under operation or in the ready mode, take the safety measures (such as the installation of safety and protection fence) so that nobody can enter the area within the robot’s movable range. When the robot under operation is touched, it may result in death or serious injury. • Make sure to install the emergency stop circuit so that the unit can be stopped immediately in an emergency during the unit operation. • Take the safety measure not to start up the unit only with the power turning ON. Failure to do so may start up the machine suddenly and cause an injury or damage to the product. • Take the safety measure not to start up the machine only with the emergency stop cancellation or recovery after the power failure. Failure to do so may result in an electric shock or injury due to unexpected power input. • When the installation or adjustment operation is to be performed, give clear warnings such as “Under Operation; Do not turn ON the power!” etc. Sudden power input may cause an electric shock or injury. • Take the measure so that the work part is not dropped in power failure or emergency stop. • Wear protection gloves, goggle or safety shoes, as necessary, to secure safety. • Do not insert a finger or object in the openings in the product. Failure to do so may cause an injury, electric shock, damage to the product or fire. • When releasing the brake on a vertically oriented actuator, exercise precaution not to pinch your hand or damage the work parts with the actuator dropped by gravity.
5	Teaching	• When the work is carried out with 2 or more persons, make it clear who is to be the “leader” and who to be the “follower(s)” and communicate well with each other to ensure the safety of the workers. • Perform the teaching operation from outside the safety protection fence, if possible. In the case that the operation is to be performed unavoidably inside the safety protection fence, prepare the “Stipulations for the Operation” and make sure that all the workers acknowledge and understand them well. • When the operation is to be performed inside the safety protection fence, the worker should have an emergency stop switch at hand with him so that the unit can be stopped any time in an emergency. • When the operation is to be performed inside the safety protection fence, in addition to the workers, arrange a watchman so that the machine can be stopped any time in an emergency. Also, keep watch on the operation so that any third person can not operate the switches carelessly. • Place a sign “Under Operation” at the position easy to see. • When releasing the brake on a vertically oriented actuator, exercise precaution not to pinch your hand or damage the work parts with the actuator dropped by gravity. * Safety protection Fence : In the case that there is no safety protection fence, the movable range should be indicated.

No.	Operation Description	Description
6	Trial Operation	• When the work is carried out with 2 or more persons, make it clear who is to be the “leader” and who to be the “follower(s)” and communicate well with each other to ensure the safety of the workers. • After the teaching or programming operation, perform the check operation one step by one step and then shift to the automatic operation. • When the check operation is to be performed inside the safety protection fence, perform the check operation using the previously specified work procedure like the teaching operation. • Make sure to perform the programmed operation check at the safety speed. Failure to do so may result in an accident due to unexpected motion caused by a program error, etc. • Do not touch the terminal block or any of the various setting switches in the power ON mode. Failure to do so may result in an electric shock or malfunction.
7	Automatic Operation	• Check before starting the automatic operation or rebooting after operation stop that there is nobody in the safety protection fence. • Before starting automatic operation, make sure that all peripheral equipment is in an automatic-operation-ready state and there is no alarm indication. • Make sure to operate automatic operation start from outside of the safety protection fence. • In the case that there is any abnormal heating, smoke, offensive smell, or abnormal noise in the product, immediately stop the machine and turn OFF the power switch. Failure to do so may result in a fire or damage to the product. • When a power failure occurs, turn OFF the power switch. Failure to do so may cause an injury or damage to the product, due to a sudden motion of the product in the recovery operation from the power failure.

No.	Operation Description	Description
8	Maintenance and Inspection	• When the work is carried out with 2 or more persons, make it clear who is to be the “leader” and who to be the “follower(s)” and communicate well with each other to ensure the safety of the workers. • Perform the work out of the safety protection fence, if possible. In the case that the operation is to be performed unavoidably inside the safety protection fence, prepare the “Stipulations for the Operation” and make sure that all the workers acknowledge and understand them well. • When the work is to be performed inside the safety protection fence, basically turn OFF the power switch. • When the operation is to be performed inside the safety protection fence, the worker should have an emergency stop switch at hand with him so that the unit can be stopped any time in an emergency. • When the operation is to be performed inside the safety protection fence, in addition to the workers, arrange a watchman so that the machine can be stopped any time in an emergency. Also, keep watch on the operation so that any third person can not operate the switches carelessly. • Place a sign “Under Operation” at the position easy to see. • For the grease for the guide or ball screw, use appropriate grease according to the instruction manual for each model. • Do not perform the dielectric strength test. Failure to do so may result in a damage to the product. • When releasing the brake on a vertically oriented actuator, exercise precaution not to pinch your hand or damage the work parts with the actuator dropped by gravity. • The slider or rod may get misaligned OFF the stop position if the servo is turned OFF. Be careful not to get injured or damaged due to an unnecessary operation. • Pay attention not to lose the removed cover or screws, and make sure to put the product back to the original condition after maintenance and inspection works. Use in incomplete condition may cause damage to the product or an injury. * Safety protection Fence : In the case that there is no safety protection fence, the movable range should be indicated.
9	Modification and Dismantle	• Do not modify, disassemble, assemble or use of maintenance parts not specified based at your own discretion.
10	Disposal	• When the product becomes no longer usable or necessary, dispose of it properly as an industrial waste. • When removing the actuator for disposal, pay attention to drop of components when detaching screws. • Do not put the product in a fire when disposing of it. The product may burst or generate toxic gases.
11	Other	• Do not come close to the product or the harnesses if you are a person who requires a support of medical devices such as a pacemaker. Doing so may affect the performance of your medical device. • See Overseas Specifications Compliance Manual to check whether complies if necessary. • For the handling of actuators and controllers, follow the dedicated instruction manual of each unit to ensure the safety.

Alert Indication

The safety precautions are divided into “Danger”, “Warning”, “Caution” and “Notice” according to the warning level, as follows, and described in the Instruction Manual for each model.

Level	Degree of Danger and Damage	Symbol
Danger	This indicates an imminently hazardous situation which, if the product is not handled correctly, will result in death or serious injury.	 Danger
Warning	This indicates a potentially hazardous situation which, if the product is not handled correctly, could result in death or serious injury.	 Warning
Caution	This indicates a potentially hazardous situation which, if the product is not handled correctly, may result in minor injury or property damage.	 Caution
Notice	This indicates lower possibility for the injury, but should be kept to use this product properly.	 Notice

Precautions for Use

- Have a safety circuit equipped outside the programming controller so the whole system activates to the safety side even when there is an error occurred on an external power source or a malfunction occurred in the programming controller itself. Otherwise, it may cause an accident due to error output or error operation.
 - (1) Construct interlock circuits for inconsistent operations such as emergency stop circuit, protection circuit and normal/reversed rotations and interlock circuits for mechanical damage prevention such as upper/lower limits of positioning outside the programming controller.
 - (2) The programming controller stops the arithmetic operation once it detects the following error conditions and the output gets to the following status.
 - All outputs turn OFF when the overvoltage protection device is activated.
 - All outputs are to be retained or turned off depending on parameter settings when an error is detected with the self-diagnosis feature such as watchdog timer error in the programming controller.
 - (3) All outputs may get turned on during an error that cannot be detected in the CPU unit such as the input and output control part. Construct a fail-safe circuit or equip a safety feature outside the programming controller so the operation of the mechanism activates in the safety side at that moment.
 - (4) Outputs may remain ON or OFF due to malfunction of an output circuit relay or transistor. Have a circuit externally to monitor such output signals that may leads to crucial accidents.
- As there is a risk of emitting smoke or fire at the output circuit when overcurrent flows for long period of time due to load current or load short-circuit above the ratings, have a safety circuit such as a fuse equipped externally.
- Construct a circuit to have an external power supply gets turned on after the power to the programming controller is turned on. Having the external power supply turned on first may cause accident due to error output or error in operation.
- Refer to a manual of each network for the operation status of each station when there is a communication error in the network. An accident may be caused due to error output or error in operation.

- When it is necessary to have a control (data change) to a programming controller under operation by connecting an external device, have an interlock circuit constructed on the program so the whole system always activate to the safety side.
Also, read the manual well to understand safety fully when conducting other controls (program change, parameter change, compulsory output or operation status change (status control)) to a programming controller under operation. Failure to do so may cause mechanical damage or accident due to operation mistakes.
- In case of control from an external device to a programming controller in a remote location, an immediate action to a trouble in the programming controller side may be difficult due to a data communication error. Construct an interlock circuit in the program. Also, set up a countermeasure as a system between the external device and the programming controller for any case of occurrence of a data communication error at the same time.
- The communication line gets unstable when a communication cable breaks, which could cause communication error in the network to several stations. Construct an interlock circuit in a program so the system activates in the safety side. An accident may be caused due to error output or error in operation.
- Implementation of a countermeasure by a user is required when it is necessary to secure safety of a programming controller from unauthorized access from an external device via network. Also, implementation of a countermeasure such as firewall is required when it is necessary to secure safety of a programming controller from unauthorized access from an external device via internet.
- Pay special attention to safety for operation such as program change or compulsory output while the system is running. It may cause damage to the machinery or accident by operation mistake.

- The CODESYS for XSEL2 window display shown in this manual may differ partially depending on the versions. See the used CODESYS for XSEL2 for the actual contents of display on the window.

- In arithmetic operation of real numbers:

- Negative square root
- Negative logarithm
- Any number less than -1 or more than +1 in ASIN/ACOS command arithmetic operation
- Arithmetic operation using NaN (Not a Number)

These factors should make the result NaN (Not a Number).

As the following arithmetic operation cannot be made properly using that result, make sure to make programing with the calculation result not to become NaN (Not a Number).

- The behavior when a value overflows:

- Overflow of integral number: Overflow occurs and proper result cannot be gain
- Overflow of real number: Makes result of Infinity (actual positive infinity) and -Infinity (actual negative infinity).

As the following arithmetic operation after overflow cannot be made properly using that result, make sure to make programing with no overflow.

Application of Product

- (1) In order to use our product, it is the condition of use that it is used for a purpose that would not cause crucial accident even in case there is a malfunction or error on the product, and that backup and fail-safe feature is performed systematically in an external device in case of malfunction or error.

- (2) IAI should not be responsible for any loss, damage or expense directly or indirectly caused even if any of IAI product, installed software, computer devices, computer programs, network or data base is infected by DDoS attack (Distributed Denial of Service Attack), computer virus, any other technically harmful program or unauthorized access.

Users must have sufficient measures for:

- 1) Anti-virus protection
- 2) Data input and output
- 3) Recovery of lost data
- 4) Protection from computer virus infection to IAI product or PC that the software is installed
- 5) Protection from unauthorized access to IAI products

- (3) IAI products are designed and manufactured as a general product subject to general industrial purpose. Therefore, application of IAI products should be exclusive from any use in such special purposes of devices and systems as shown below. IAI should not be responsible for quality, performance or safety of its products (including responsibility in debt default, responsibility in warranty against defects, responsibility in quality assurance, responsibility to illegal actions, responsibility to products and others) in case of use in such purposes.

- Purpose where influence is large to public such as a nuclear power plant or any other power plant of power companies
- Purpose where there are some requirements to IAI to construct special quality assurance organizational structure such as railway companies and the government and municipal offices
- Purpose where large influence is expected to human life, physical and properties such as aerospace, medical, railway, combustion and fuel equipment, passenger vehicle, manned transportation equipment, entertainment machinery or safety machinery

However, even in the purposes above, under a condition of the purpose is to be specified or no requirement of special quality (quality requirement above general specifications), we may permit to apply our IAI program controllers. For details, consult with our sales office or contact our call center.

Trademark and Patent

[1] About Registered Trademark

- CODESYS is a registered trademark of CODESYS Development GmbH.
- ODVA, CIP and EtherNet/IP are a trademark of ODVA, Inc.
- OPC, OPC UA are a trademark of OPC Foundation.
- Microsoft and Windows are the registered trademark or trademark of U.S. Microsoft Corporation in the United States and other countries.
- Ethernet is a registered trademark of FUJIFILM Business Innovation Corp.
- PLCopen is a registered trademark that PLCopen possesses.
- And other company names and product names described are the trademarks and registered trademarks of each company.

[2] About Patent

Screenshots are using under permission of Microsoft.

Software License Agreement

Before opening the software package, please read this Software License Agreement (hereinafter referred to as "Agreement").

This Agreement is applied to the simple installation application for this product (hereinafter referred to as "this Software", and also includes updated versions.).

Regardless of the reason, opening the this Software package will be regarded as your acknowledgement of consenting to this Agreement. You may not use this software if you do not agree to the terms of this Agreement.

IAI Corporation (hereinafter referred to as "IAI") shall grant to the user (hereinafter referred to as "the User"), and the User shall accept, a non-transferable, non-exclusive right to use the Licensed Software supplied with this Agreement, based on the following terms and conditions.

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If the User violates anything in the agreement and causes any loss to IAI, the User is to compensate the loss caused to IAI.

3. Termination of the Agreement

In the event of breach by the User of any of the terms and conditions hereunder, or upon discovery of a material cause that makes continuation of this Agreement impossible, IAI may immediately terminate this Agreement without serving any prior notice to the User.

In this case, the User should delete or dispose everything of this Software (including software copies) and dedicated connection cables within ten days after the day when the Agreement is terminated.

4. Range of Guarantee

IAI does not guarantee that this Software works in normal condition in every operational environment.

IAI may change all the specifications related to this Software without serving any prior notice. Also, IAI should not take any responsibility to any loss or damage caused as a result of use of this Software.

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Based on this Agreement, the upper limit of the responsibility that IAI may take should be the amount of money that the User has actually paid to purchase this Software.

About License of Used Software

About Software License Used for This Product

The software of IAI products include the program for the open source software (OSS) below.

- OpenSSL 3.0.11 (Apache License 2.0)

For the license terms of the applicable software, refer to [9.3 License of Software Used in CODESYS for XSEL2] in this manual.

Terms List

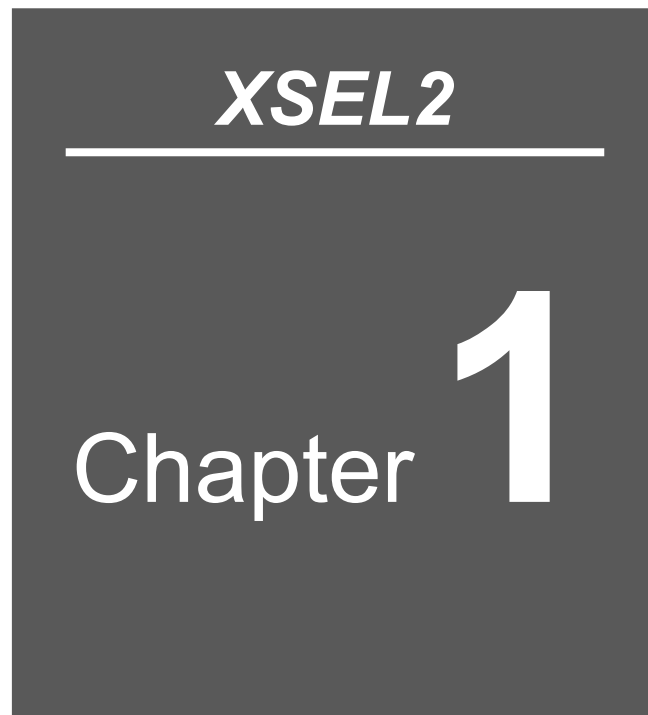
Here explains the terms used in this manual.

Terns	Explanation
CA (Certificate Authority)	It is an institution to issue digital certificate necessary for encrypted communications.
CIP	It is an abbreviation for Common Industrial Protocol. It is the standard specifications for industrial communication defined in Open DeviceNet Vendors Association (ODVA).
CODESYS for XSEL2	It is a support software of CODESYS installed in the products of IAI. It may be expressed as "CODESYS" in this manual.
EDS File	It is a file that input and output counts for EtherNet/IP devices and parameters available for setting via EtherNet/IP are written in.
FB	It is an abbreviation for Function Block.
IEC 61131-3	It is the international standard specifications as a programming language for PLC. As a programing description language, there are 5 languages specified as follows: • Ladder Diagram (LD) • Sequential Function Charts (SFC) • Function Block Diagram (FBD) • Structured Text (ST) • Instruction List (IL).
I/O Refresh	It is the periodical data exchange with external of memory area defined in advance.
ISO3166	It is the standard for the country codes issued by ISO.
MES	It is an abbreviation for Manufacturing Execution System. It is the production execution system that is the data system to grasp and manage condition of production process and to make instruction to operators.
OPC UA	It is the standard specifications for industrial communication defined in OPC Foundation.
OPC UA Client	The side to access the OPC UA server and conduct data reading/writing request is called a client. SCADA, MES and a display device are typical examples of the OPC UA client.
OPC UA Server	The data is stored in OPC UA, and the side open is called a server. In this manual, XSEL2 should activate as the OPC UA server.
PLC	It is an abbreviation of Programmable Logic Controller. Control devices used for control of devices and equipment are so-called.
PLC-MIX	It is what gives the index for the calculation performance of PLC, and is the number of commands capable of executing in a unit time prioritized following the command distribution ratio. As the related terms, there are "Basic PLC-MIX", "Practical PLC-MIX" and "Integrated PLC-MIX".
POU	It is an abbreviation for Program Organization Unit. POU (Program Organization Unit) is the minimum unit for program management constructed with several command languages, and there are three types, "Program", "Function" and "Function Block".
PTP	It is a control system with no indication of any point to go through when moving from the current position to the target position.

Terms	Explanation
RPI	It is an abbreviation of Requested Packet Interval. It is the communication period determined by the originator in communication among EtherNet/IP devices.
SCADA	It is an abbreviation for Supervisory Control and Data Acquisition. It is a type of the industrial control system, and is the data system to perform system monitoring and process control by a computer.
SEL Program	It is a program described in our own programming language of IAI. SEL is an abbreviation for Shimizukiden Ecology Language.
UTC (Coordinated Universal Time)	It is the time used as the origin of the universal standard time.
Adapter	In EtherNet/IP, the "slave" in other field network is called "adapter" instead.
Edge	Transition of boolean variance "from 0 to 1" is called rising edge, while transition of boolean variance "from 1 to 0" is called "falling edge".
End Point (URL)	It is the address of OPC UA server necessary for OPC UA clients to access. Format: opc.tcp:// [IP address]: [Port number] Example: opc.tcp://192.168.0.10:4840
Practical PLC-MIX	It is the average number of commands available to execute in 1μs when combining practical commands such as each type of calculation and transfer applicable to words (16 bits) in a certain ratio.
Pressing	It is a feature to have a rod or slider being pressed and retained towards a workpiece.
Originator	It is a device to command connection establishment in EtherNet/IP.
Basic PLC-MIX	It is the average number of commands available to execute in 1μs when combining only the input and output processes and timer/counter processes in a certain ratio.
Basic Data Types	It is the data types defined in IEC 61131-3. There are boolean datatype, bit string type, integer type, real data type, duration type, date data type, time data type, date time type and string type.
Union Type	It is the data type that enables to handle the same data in different data types.
Client Certificate	It is an electronic certificate to prove identity of OPC UA client with the application authentication. Authentication should be conducted by registering the client certificate to OPC UA server.
Global Variables	It is the variables available for reading and writing from all the POU (programs, function blocks and functions)
Home return	The datum point for positioning is called the home position and it is the operation to move an actuator to this position.
Structure Type	It is the data type that several different data types are hierarchically combined.
Comment	It is a text to write a program or an explanation of variables.
Server Certificate	It is an electronic certificate to prove identity of OPC UA server with the application authentication. Authentication should be conducted by registering the server certificate to OPC UA client.
Servo OFF	It is the status that the motor power is turned off.
Servo ON	It is the status that the motor power is turned on.

Terms	Explanation
Initial value	It is one of the attributes for variables. It is the value of variable to be set for the following. ● When power is turned on
Sustain	It is one of the attributes of a variable. The values will be maintained even during power cutoff as it is stored in non-volatile memory. The keyword "PERSISTANT" should be used in IEC 61131-3.
Scanner	In EtherNet/IP, the "master" in other field networks is called "scanner" instead.
Integrated PLC-MIX	It is the average number of commands available to execute in 1μs when combining the basic commands and the practical commands in a certain ratio.
Target	It is the devices that connection is required to be established in EtherNet/IP.
Time zone	It is the whole region that use standard time and civil time in common.
Task	The task shows a unit of execution. By registering a program in a task, the program can be executed.
Linear Interpolation	It is an interpolation control that controls the operation of an actuator/robot as a linear track.
Constant	It is one of the attributes for variables. A variable that a constant is indicated should not be available for writing in a value by a command. The keyword "CONSTANT" should be used in IEC 61131-3.
Device	It is a general term for those that a CPU unit conducts I/O Refresh. Specific examples are EtherNet/IP scanner and SEL interface.
Namespace	It is the structure to manage functions, function block definitions and data type names divided and hierarchized.
Layout Indication	It is one of the indications for variables. Elements in the same data type are consolidated and made as one variable. Each element is to be indicated in serial numbers (index) from the top.
Partial Range Indication (Subrange Indication)	It is one of the indications for variables. It clarifies that variables can be taken only from those in the specified range.
Function	It is a POU used to generate a component that an output can be determined uniquely to an input such as arithmetic processing.
Function Block	It is a POU used to generate a component that an output may differ to the same input depending on the status of timer or counter.
Program	It is a POU that operates by assigning to a task.
Variable	It is a name of a data memory domain defined by the data type and the data in the variable declaration.
Retain	It is one of the attributes for variables. The values will be maintained even during power cutoff as it is stored in non-volatile memory. The keyword "RETAIN" should be used in IEC 61131-3.
Position Data	It is data of table format to register "Target Position Coordinates", "Velocity" and "Acceleration/Deceleration" of an actuator and robot.
Command	It is a processing element in the minimum unit to be described in a POU.
Enumerated Type	It is the data type that one in a name list (enumerator) prepared in advance should be taken as a value.

Terms	Explanation
Enumerator	It is what several values that the variables in the enumerated type may take are expressed in characters. A value of variables in the enumerated type should take one in the enumerators.
Level Detection	To detect the status itself that the Boolean variable “is 1” (or “is 0”) is called the level detection (level sensing).
Local Variable	It is a variable accessible only in the defined POU.

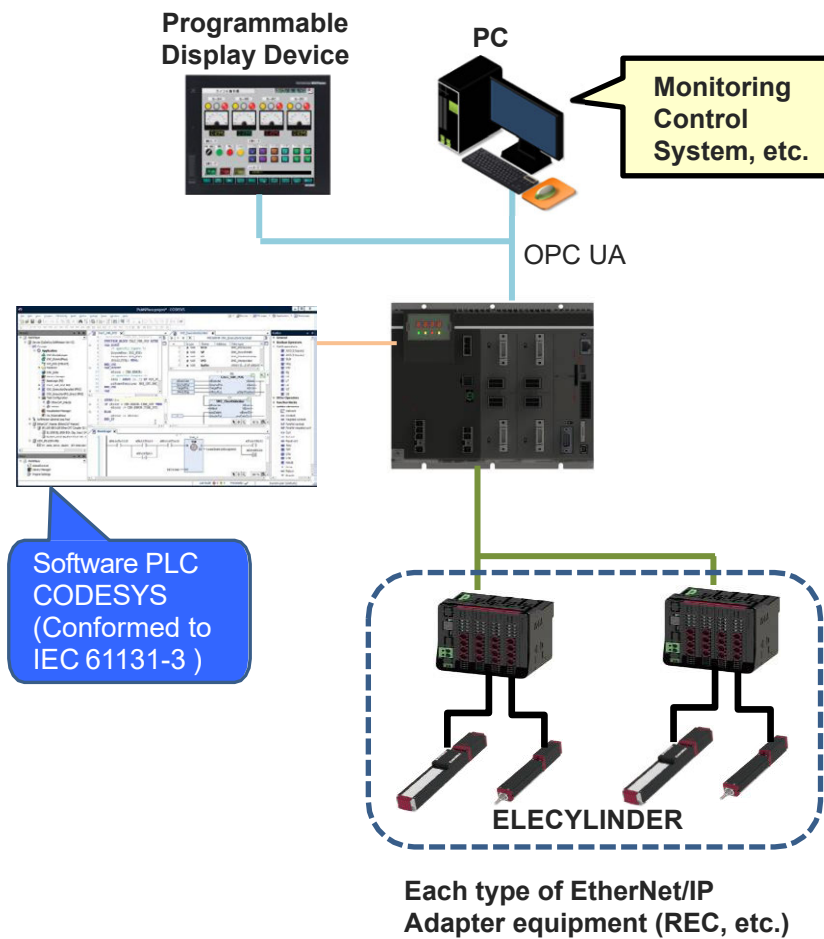


Feature Overview

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1.4	System Configuration	1-4
1.5	Names and Features of Each Part Related to PLC	1-5
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1.1 Introduction

In addition to the SEL language interpreter, the software PLC feature is capable of control complied with the PLC language international standard IEC 61131-3. Also, the software PLC is equipped with "CODESYS", and applicable for the EtherNet/IP scanner feature and the OPC UA server feature.



1.2 Subject Products

In this manual, subjects to the following products.

- XSEL2-T□
- XSEL2-T□X

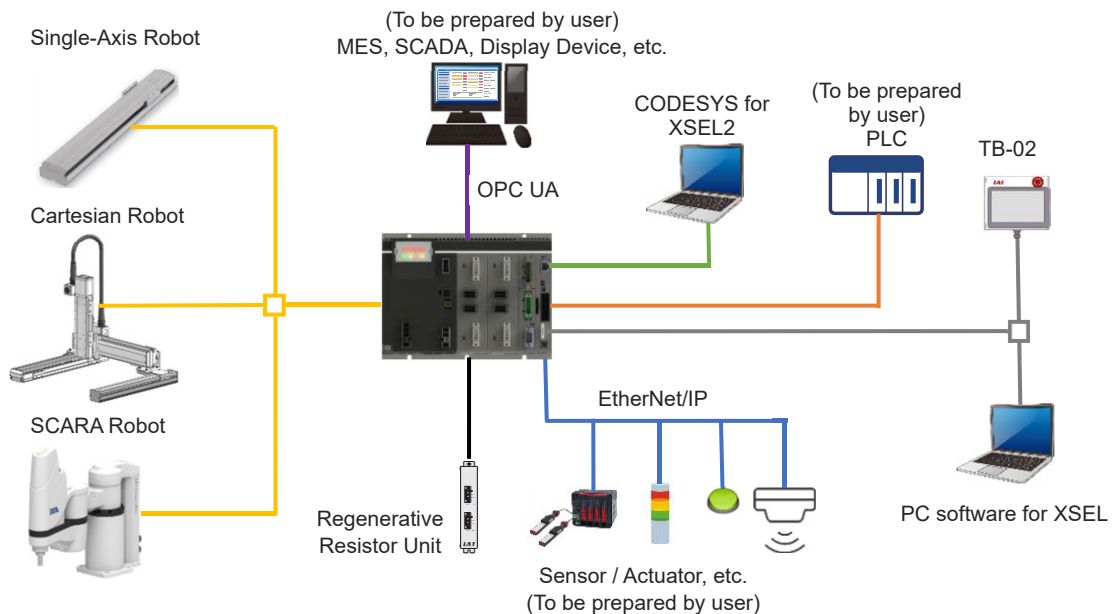
* PLC features are equipped in XSEL2 in standard.

1.3 Characteristics

- (1) Applicable for all programming languages complied with international standard IEC 61131-3
Development not dependent to vendors is enabled, which leads to efficient programming and sharing of programming properties.
- (2) Equipped with OPC UA Server Feature
OPC UA server complied with the standard communication specifications recommended in Industry 4.0.
It simplifies connection with SCADA, MES and display devices.
- (3) Applicable for EtherNet/IP Scanner Feature
As it is an open field network, connection and control of products from other companies is capable as well as IAI products.
- (4) Integrated Sequence Control and Actuator Robot Control
It provides the dedicated function block to control IAI actuators and SEL programs from a PLC.
- (5) Capable of consolidated management of PLC, EtherNet/IP scanner feature and OPC UA server feature in the CODESYS for XSEL2.

In one software, PLC setup, programming and debugging are capable, which enables efficient development works.

1.4 System Configuration



●CODESYS Support Tools

It is necessary for setting to create programs, of EtherNet/IP scanner features and OPC UA server features in PLC.

No.	Part name	Model Number
1	CODESYS for XSEL2	-

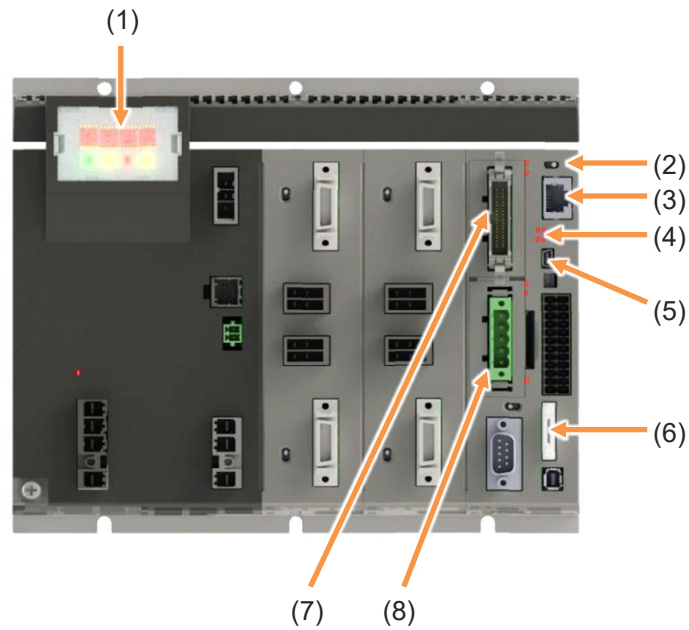
●Teaching Tool

A teaching tool is necessary for setup operations such as creating SEL programs, position setting in teaching of robot and actuators and parameter setting.

Use one of the following teaching tools.

No.	Part name	Model Number
1	XSEL PC software	IA-101-*
2	Teaching pendant (Normal / with a dead man's switch)	TB-02/TB-02D
3	Teaching pendant	TB-03

1.5 Names and Features of Each Part Related to PLC

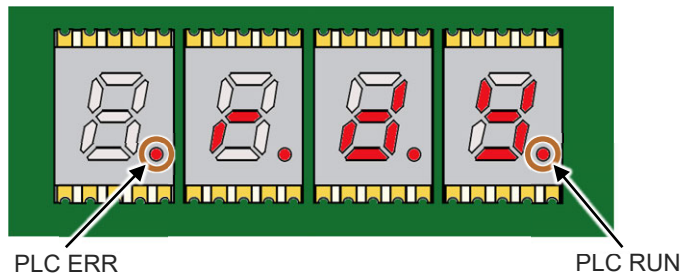


Number	Name
(1)	Panel window
(2)	Switches between AUTO/MANU mode
(3)	Ethernet connector
(4)	Status LED
(5)	USB connector
(6)	Teaching connector
(7)	I/O slot 1
(8)	I/O slot 2

(1) Panel window

The status of a controller should be displayed with the 7-segment display with 4 digits and 4 LED lamps.

The PLC status display is as shown below.

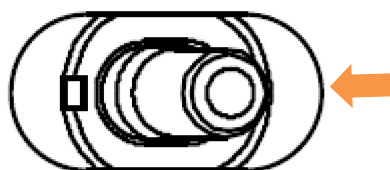


Name	Meaning
PLC RUN	Operation status of software PLC is displayed. In Operation: Illuminated, Stopped: OFF
PLC ERR	Error status of software PLC is displayed. Error Occurred: Illuminated, Error Not Occurred: OFF

Alphanumeric characters do not show the PLC status. For details about alphanumeric display, refer to the separate volume [XSEL2 Controller Instruction Manual (ME0478)].

(2) Switches between AUTO/MANU mode

It is a switch to indicate the operation mode of a controller.



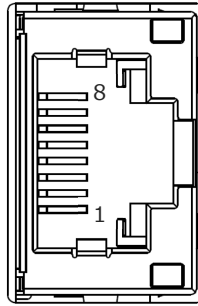
Name	Meaning
MANU (MANU mode)	Left side It is a mode to set up PLC and make a trial run. Turn the power on or reboot the system and the PLC stops operation.
AUTO (AUTO mode)	Right side It is a mode to operate PLC. Turn the power on or reboot the system and the PLC starts operation.

(3) Ethernet connector

It is a connector to link an external Ethernet communication device.

PLC uses this Ethernet port to use the following features.

- EtherNet/IP Scanner feature
- OPC UA server feature
- Connection of CODESYS for XSEL2



● Ethernet Connector Specifications

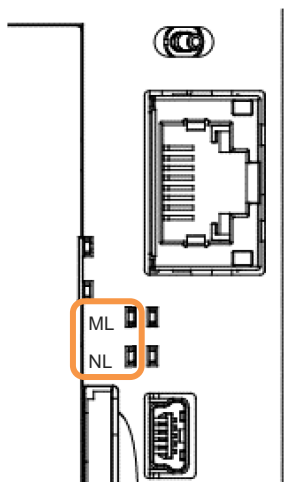
Connector to be Used	RJ-45 connector (8 Pin)	1-2301994-1 (TE)
Physical Layer Standard	10/100/1000BASE-T	
Communication speed	10/100/1000Mbps	Auto negotiation
Connected unit	PC, etc. (Ethernet)	
Connection cable	Ethernet (LAN) Cable	Recommended Cable: STP cable (Manufactured by 3M) Category 5e or higher

● Pin Assignment of Ethernet Connector

Pin No.	Signal name		Signal content
	1000Mbps	10/100Mbps	
1	TRD0+	TXP	Sending Receiving Differential + (Data 0) / Sending +
2	TRD0-	TXN	Sending Receiving Differential - (Data 0) / Sending -
3	TRD1+	RXP	Sending Receiving Differential + (Data 1) / Sending +
4	TRD2+	-	Sending Receiving Differential + (Data 2)
5	TRD2-	-	Sending Receiving Differential - (Data 2)
6	TRD1-	RXN	Sending Receiving Differential - (Data 1) / Sending -
7	TRD3+	-	Sending Receiving Differential + (Data 3)
8	TRD3-	-	Sending Receiving Differential - (Data 3)

(4) Status LED

It is the status display LED of the EtherNet/IP scanner.



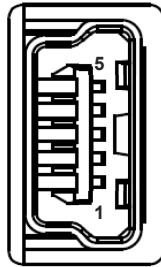
Name	Color	Display status	Content
ML	Green	Light ON	Normal operation
		Blinking	No PLC application
	Orange	Light ON	Status not capable to recover (PLC not possible to execute, etc.)
		Blinking	Status capable to recover (IEC program excluded, IEC program memory error, etc. Status capable to recover in reset of software PLC and download of application)
	-	Light OFF	Functions disabled
NL	Green	Light ON	Connection of one or more is established
		Blinking	Connection not established
	Orange	Light ON	IP addresses duplicated ((Duplication not detected in XSEL2)
		Blinking	Connection of one or more is timed out
	-	Light OFF	IP address not set, functions disabled

* ML and NL turn on in turns of Green on ML → Orange on ML → Green on NL → Orange on NL while the power gets turned on (in self-test).

(5) USB connector

It is a USB connector to connect a PC. Work such as setup of PLC is available by connecting to CODESYS for XSEL2.

The connector is mini-B. In order to operate an actuator and a robot in MANU Mode, the dummy plug needs to be inserted to the teaching connector.



- USB Connector Specifications

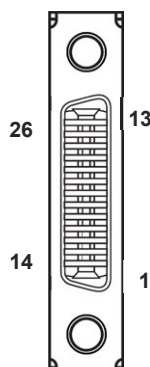
Connector to be Used	USB mini-B	51387-0530 (Molex)
Connector name	USB	
Communication Specification	Conformed to USB 2.0	480M (High Speed)/12Mbps (Full Speed)
Maximum connection distance	5m	
Connected unit	PC (USB port)	
Recommended cable	USB cable	Controller side: mini-B
Power	Bus-Power	

- Pin Assignment of USB Connector

Pin No.	Signal Name	Signal content
5	Vbus	USB Power supply input (+5V)
4	D-	USB Differential transmitted/received data - side
3	D+	USB Differential transmitted/received data + side
2	ID	USB ID (dentification) terminal (Open at cable end)
1	GND	Power supply ground
Shell	GND	Power supply ground

(6) Teaching connector

It is a connector to connect a teaching pendant or a PC (XSEL PC software). It is to be used for teaching such as operation and setup of an actuator.



● Teaching Connector Specifications

Connector model	HDR-EC26LFDT1-SLD+
Manufacturer	HONDA TSUSHIN KOGYO CO., LTD
Rated voltage	AC125Vrms
Rated current	0.5A
Voltage Endurance	AC350Vrms
Contact Resistance	70mΩ or less

● Pin Assignment of Teaching Connector

Pin No.	Signal name	Description	Pin No.	Signal name	Description
1	SG	Signal Grounding	14	CTS	Connected to RTS externally. Connector connection detection input.
2	NC		15	TXD	Transmit data
3	VCC	Power supply output (Power for teaching pendant)	16	RXD	Receive data
4	DTR	Terminal ready (Connected to DSR inside)	17	DSR	Equipment ready (Connected to DTR inside)
5	EMGS2+	Emergency Stop Contact Output 2+	18	NC	Unconnected
6	EMGS2-	Emergency Stop Contact Output 2-	19	NC	Unconnected
7	NC	Unconnected	20	NC	Unconnected
8	RSVVCC	24V power supply for teaching pendant	21	NC	Unconnected
9	EMGS1-	Emergency Stop Contact Output 1-	22	ENBS2+	Enable contact output 2 +
10	NC	Unconnected	23	ENBS1-	Enable contact output 1 -
11	NC	Unconnected	24	ENBS1+	Enable contact output 1 +
12	EMGS1+	Emergency Stop Contact Output 1+	25	ENBS2-	Enable contact output 2 -
13	RTS	Connected to CTS externally	26	SG	Signal Grounding

(7) I/O slot 1

The following option boards are available to mount. They can also be used as an external input and output interface.

Name	Expression of Model Codes	Remarks
PIO board (NPN)(16/16) type	NP	
PIO board (PNP)(16/16) type	PN	
DeviceNet board	DV	
CC-Link board	CC	
PROFIBUS-DP board	PR	
IA-NET board	IA	PIO can be increased by connecting the remote I/O unit (model code: EIOU-1).
Pulse Train Input + PIO Input and Output (4 points / 4 points) Board	PIN	It is available only for PIO input and output in PLC. The pulse train input is not available.
ELECYLINDER Connection Module Board	EL	

(8) I/O slot 2

The following option boards are available to mount. They can also be used as an external input and output interface.

Name	Expression of Model Codes	Remarks
PIO board (NPN)(16/16) type	NP	
PIO board (PNP)(16/16) type	PN	
CC-Link IE Field board	CIE	
EtherCAT board	EC	
EtherNet/IP board	EP	
PROFINET IO board	PRT	
IA-NET board	IA	PIO can be increased by connecting the remote I/O unit (model code: EIOU-1).
Pulse Train Input + PIO Input and Output (4 points / 4 points) Board	PIN	It is available only for PIO input and output in PLC. The pulse train input is not available.
ELECYLINDER Connection Module Board	EL	

(7) (8) I/O slot 1, I/O slot 2

By occupying two slots, I/O Slot 1 and I/O Slot 2, 50-pin PIO board compatible to existing XSEL. The boards can be divided to the following specifications.

As it uses I/O Slot 1 and I/O Slot 2, another field network module cannot be used. It can also be used as an external input and output interface of PLC.

Name	Expression of Model Codes	Input point	Output point	Polarity
XSEL Compatible PIO Board	N1	32	16	NPN
	P1	32	16	PNP
	N2	16	32	NPN
	P2	16	32	PNP
	N4	24	24	NPN
	P4	24	24	PNP

1.6 Flow Till Operation

Here, explains the workflow from installing the XSEL2 controller till operation.

Step1. Installation and Wiring

Install a controller, robot and connected devices, and conduct wiring.



Step2. Power on

Turn on the power to the controller and connected devices.



Step3. SEL parameter setting

Connect a teaching tool (XSEL PC software or teaching pendant) and set up the parameters.



Step4. Communication setting on Host PLC (When using the upper PLC)

Refer to [an instruction manual of PLC to be used] for the host PLC.



Step5. CODESYS Parameter Communication Feature Setup

When PLC feature is to be used, connect a teaching tool and set up the parameters to use the software PLC feature. After that, connect to CODESYS for XSEL2 to set up the SEL interface feature and EtherNet/IP scanner feature. (*1)

Refer to

- [Chapter 4 How to Use CODESYS]
- [Chapter 5 SEL Interface feature]
- [6.1 EtherNet/IP Scanner feature].

*1 As the OPC UA server feature requires variables used in the user program of CODESYS to be registered, it is necessary to set it up after the CODESYS program is created.



Step6. Confirming Establishment of Communication with Host PLC (When using the upper PLC)

Establishment of communication can be confirmed on LED for XSEL2.

For the host PLC, refer to [an instruction manual of PLC to be used].

Step7. Checking the safety circuit

Check if the emergency stop circuit (such as drive cutoff circuit) works properly.

Step8. Creating CODESYS Program

Connect to CODESYS for XSEL2 and create a program.

Refer to

- [4.5 Programming]
- Separate volume [PLC Feature Programming Manual (ME0480)].

Step9. Creating SEL Program, Setting up Position Data

Connect a teaching tool, create the SEL program, and set up the position coordinate, velocity and acceleration/deceleration to the position data.

Refer to the separate volume [PLC Feature Programming Manual (ME0480)].

Step10. Setting up OPC UA Server Feature and Confirmation of Connection (When Using OPC UA)

Connect to CODESYS for XSEL2 and set up the OPC UA server feature.

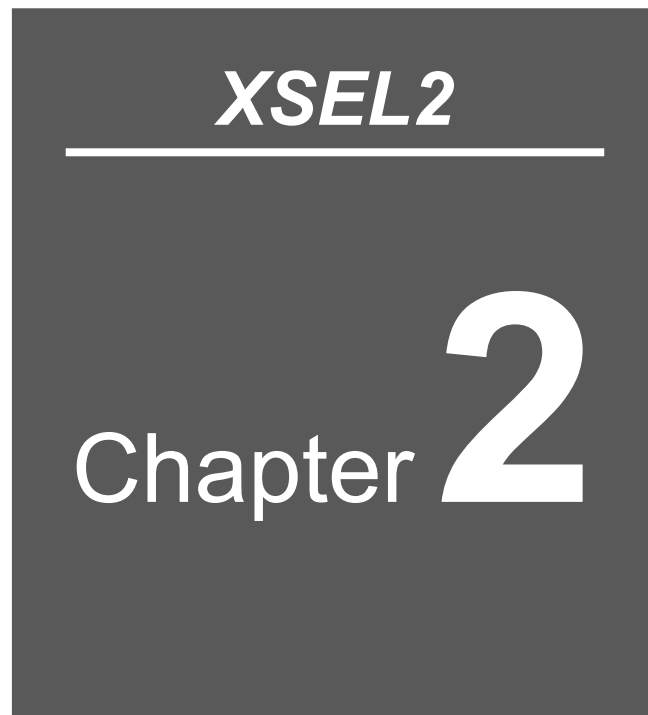
Refer to [6.2 OPC UA server feature].

Step11. Motion Check and Operation on Actual Unit

Check the motions with the actual unit.

**Caution**

- The procedures may differ depending on the environment of use for this product and used system types.



Specifications

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2.2.2	Storage/preservation environment	2-3
2.3	Components	2-4
2.3.1	Components (excluding options)	2-4

2.1 PLC Performance / Feature Specifications

Item		Specification
Runtime Version		V3.5.18.20 + EtherNet/IP 4.4.1.0
Cyclic Frequency		1ms to
IEC Program Capacity		3MB
Source Capacity		10MB
Data Capacity		1MB
Data Capacity (RETAIN)		8KB
Data Capacity (PERSISTENT)		4KB
Executed Task Count		8 (However, freewheel counted as 1)
Program specification		Conformed to IEC 61131-3, 5 languages (LD, IL, FBD, ST, SFC) + CFC
Program Type		Cyclic, Event, Status, Freewheel
Calculation Control System		Stored Program Type
Input and Output Control System		Refresh Type
Calculation Process Performance (Execution Time)	Bit Operations	5ns to
	Integer Operations (except for division)	9ns to
	Integer Operations (division)	97ns to
	Real Number Operations (except for division)	66ns to
	Real Number Operations (division)	87ns to
	Data Transfer (Integers)	5ns to
	Data Transfer (Real numbers)	5ns to
Calculation Process Performance (PLC-MIX)	Basic	15.905
	Practice	5.710
	Integrated	9.974
Connection to CODESYS for XSEL2		Ethernet, USB * CODESYS for XSEL2 not available to connect other tools (PC software and teaching pendants) at the same time when using USB
Number of Used Ethernet Ports		1740: CODESYS for XSEL2 Connection 2222, 44818: EtherNet/IP scanner 4840: OPC-UA server

2.1 PLC Performance / Feature Specifications

Item		Specification
Number of Input and Output Points to SEL Part		Input 1024 points / Output 1024 points (Fixed)
EtherNet/IP	Number of Connected Adapters	16
	Communication Cycles (RPI)	10ms to
	Status LED	ML, NL
	Address Conflict (ACD)	Not Supported
OPC UA	Information Model	PLC open Information Model for IEC 61131-3
	Connectable Client Count	2
Switches / Display	Panel window	Seven-Segment LED (PLC RUN, PLC ERR. Alphanumeric characters do not show PLC status.)
	Switches between AUTO/MANU mode	AUTO/MANU (Refer to [4.10 Operation / Stop / Reset] for operation)
Clock Feature		Retention time: Approx. 10 days, Charging time: Approx. 100 hours
External Memory		None
Startup Time		Approx. 20 seconds to 1 minutes
Instantaneous Power Failure		20ms (When power supply frequency 50Hz used) 17ms (When power supply frequency 60Hz used)
Diagnosis Feature		Memory error, watchdog timer error, etc.

2.2 Installation and Storage/preservation environment

Usage is possible in environments of pollution degree 2 ^(*) or equivalent.

*1 Pollution degree 2: Environment in which generally only nonconductive pollution occurs, but temporary conductive pollution may occur due to condensation. (IEC60664-1)

2.2.1 Installation environment

Avoid the following locations for installation.

- Where the ambient temperature exceeds the range of 0 to 55°C
- Where the temperature changes rapidly and condensation occurs
- Where the relative humidity exceeds the range of 5%RH to 85%RH
- Where the unit is exposed to odorous or combustible gases
- Where the unit is exposed to significant amounts of dust, salt or iron powder
- Where the unit is subject to direct vibration or impact
- Where the unit receives direct sunlight
- Where the unit may come in contact with water, oil or chemical spray
- Where vents are blocked (Refer to [XSEL2 Instruction manual (ME0478) 3.2 Installation and Mounting]
- Where the altitude exceeds 1,000m

If the unit is used in any of the following locations, provide sufficient shielding measures:

- Where noise is generated due to static electricity, etc.
- Where there are strong electrical or magnetic fields
- Where mains or power lines pass nearby

2.2.2 Storage/preservation environment

The storage and preservation environment are as follows.

- The storage/preservation environment is based on the installation environment. However, the ambient temperature should be -20 to 70°C and the relative humidity should be 85%RH or less. Especially when storing for a long time, please take sufficient care to prevent condensation from forming.

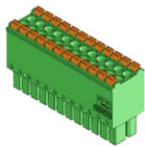
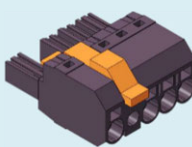
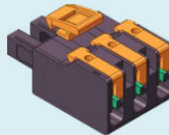
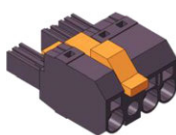
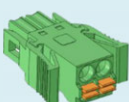
Unless especially specified, desiccant is not included in the package at shipping. If the product is to be stored/preserved in an environment where condensation is anticipated, take condensation preventive measures for the package overall from the exterior, or directly after opening the package.

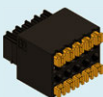
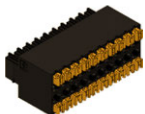
2.3 Components

2.3.1 Components (excluding options)

This product should consist of the following components for the standard structure.

If you find any fault in the contained model or any missing parts, contact us or our distributor.

No.	Part name		Model / Remarks	Quantity
1	Controller body		Refer to [How to read the model nameplate, How to Read the Model Number]	
Accessories				
2	System I/O Connector		DFMC1.5/12-ST-3.5 (Manufacturer: Phoenix Contact) * A jumper cable should be equipped on delivery. (For details, refer to [XSEL2 Instruction manual (ME0478) 3.5.2])	1
3	Motor Power Connector ●Single-Phase 200V Type ●3-Phase Type 200V Type		BVF 7.62HP/04/180MF2 SN BK BX LRP (Manufacturer: Japan Weidmüller) * The print on the connector should differ for the single-phase 200V specification and three-phase 200V specification.	1
	Motor Power Connector ●Single-Phase 100V Type		MPS 7S/03 S F 2 TN B B D (Manufacturer: Japan Weidmüller)	
4	Control power connector		BVF 7.62HP/03/180MF2 SN BK BX LRP (Manufacturer: Japan Weidmüller)	1
5	Brake power supply input connector		FMC1.5/2-ST-3.5-RF (Manufacturer: Phoenix Contact)	1
6	Dummy plug		DP-4S (For Teaching Connector)	1
7	Dummy plug		DP-6 (For Driver Stop Connector)	1
8	Brake release switch connection connector		1-1827862-5 (Manufacturer: TE)	1

No.	Part name		Model / Remarks	Quantity
9	Absolute battery box ^{*1}		UT-XSEL2-ABB Battery Model Code: AB-5 Absolute battery box connection cable (Model: CB-XSEL2-AB002) is included.	1
10	Pulse train control connector		DMFC 0,5/5-ST-2,54 (Manufacturer: Phoenix Contact) * Enclosed when PIN (pulse train input + PIO input and output (4/4)) specification for I/O slot is selected	1
11	Pulse train control connector		DFMC 0,5/10-ST-2,54 (Manufacturer: Phoenix Contact) * Enclosed when PIN (pulse train input + PIO input and output (4/4)) specification for I/O slot is selected	1
12	ELECYLINDER Connection Board 24V Power Supply Input Connector		B2CF 3.50/06/180 SN OR BX (Manufacturer: Japan Weidmüller) * Enclosed when EL (ELECYLINDER connection) specification for I/O slot is selected	1
13	Connector for CC-Link		MSTB2,5/5-STF-5,08 AU (Manufacturer: Phoenix Contact) * There should be terminal registers 110Ω and 130Ω enclosed. * Enclosed only in CC-Link specifications	1
14	Connector for DeviceNet		MSTB2,5/5-STF-5,08 AU M (Manufacturer: Phoenix Contact) * There should be no terminal registers enclosed. * Enclosed only in DeviceNet specifications	1
15	IA Net Terminal Resister		EIOU-TR * Enclosed only in IA net connection specifications	2
16	First Step Guide		ME0481	1
17	Safety Guide		M0194	1

XSEL2

Chapter 3

Wiring

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3.2	Wiring for Ethernet	3-3
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3.3.1	Wiring for Teaching port	3-5

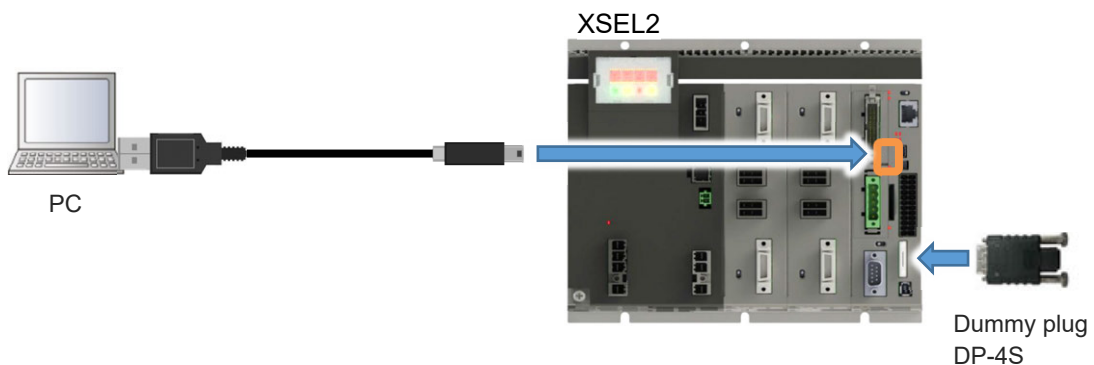
3.1 Wiring for USB port

Connect a PC to the USB port (mini-B), and CODESYS for XSEL2 and PC teaching software can be used.

When operating an actuator, insert a dummy plug (DP-4S) to the teaching connector.

A USB cable should be prepared by the user.

- Example of Wiring Between USB Port on XSEL2 and PC



Caution

- CODESYS for XSEL2 and the PC software for XSEL cannot be connected with USB at the same time and use. In case to use them at once, use different communication ports for connection.
- When CODESYS for XSEL2 is set to connect with USB, CODESYS for XSEL2 should occupy the USB port and the PC software for XSEL may not be able to connect. When trying to connect the PC software for XSEL with USB and Error No. 780 "Port Open Error" occurs, right-click "CODESYS Gateway SysTray" in the task bar and click "Stop Gateway".

(For how to operate, refer to [4.2.1 Operating environment]).

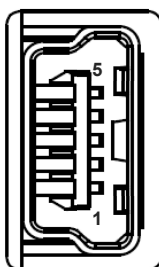
● Specifications of USB Connector

Connector to be Used	USB mini-B	51387-0530 (Molex)
Connector name	USB	
Communication Specification	Conformed to USB 2.0	12Mbps (Full Speed) /480Mbps (High Speed)
Maximum connection distance	5m	
Connected unit	PC (USB port)	
Recommended cable	USB cable	Controller side: mini-B
Power	Self-Power	

● Pin Assignment of USB Connector

Pin No.	Signal Name	Signal content
1	Vbus	USB Power supply input (+5V)
2	D-	USB Differential transmitted/received data - side
3	D+	USB Differential transmitted/received data + side
4	ID	USB ID (dentification) terminal (Open at cable end)
5	GND	Power supply ground

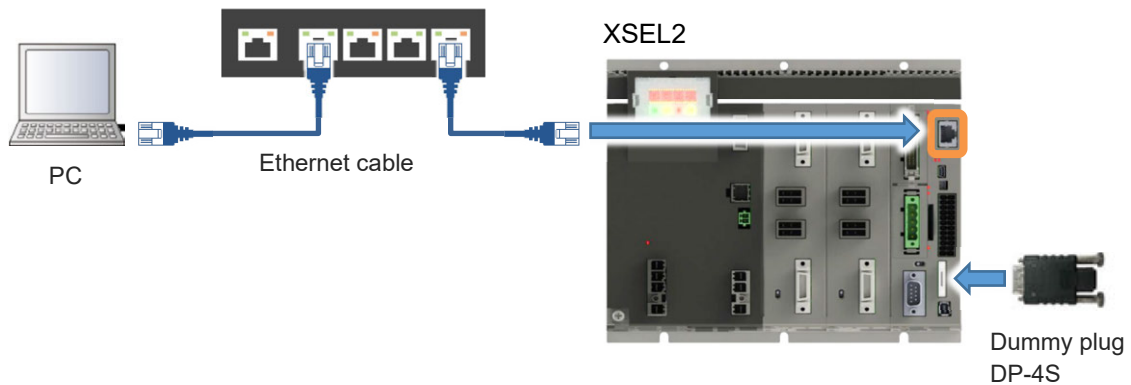
● External view of USB Connector



3.2 Wiring for Ethernet

It should be used when using the EtherNet/IP scanner features, OPC UA server features and Ethernet connection in CODESYS for XSEL2. The PC software is also available for use. When operating an actuator, insert a dummy plug (DP-4S) to the teaching connector.

- Example of Wiring Between Ethernet Port on XSEL2 and PC



- Example for Ethernet Wiring

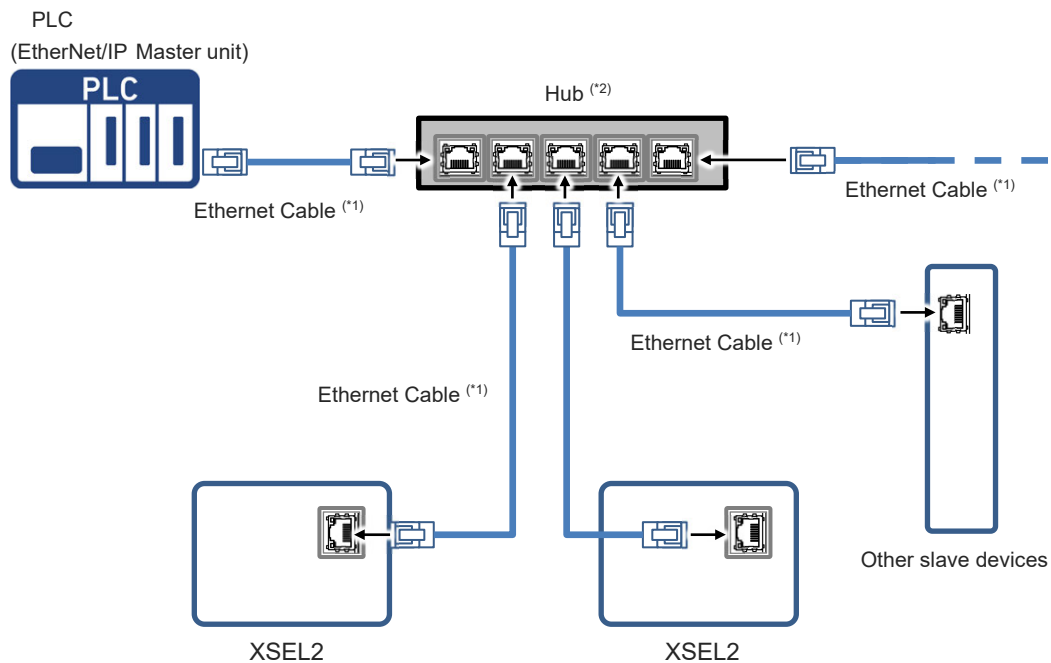


Fig. 3.2-1 Example for EtherNet/IP Wiring

- * There is no need of terminal process for connection to Ethernet.
- *1 Ethernet Cable: Straight Cable in Category 5e or higher with 100m or less
(Double shielded cable braided with aluminum tape recommended)
Also, the cable should be prepared by the user.
- *2 For the network configuration, use a switching hub, and do not use a repeater hub. Using a repeater hub may make the tag data link operate unstable.

3.3 Wiring for teaching tool

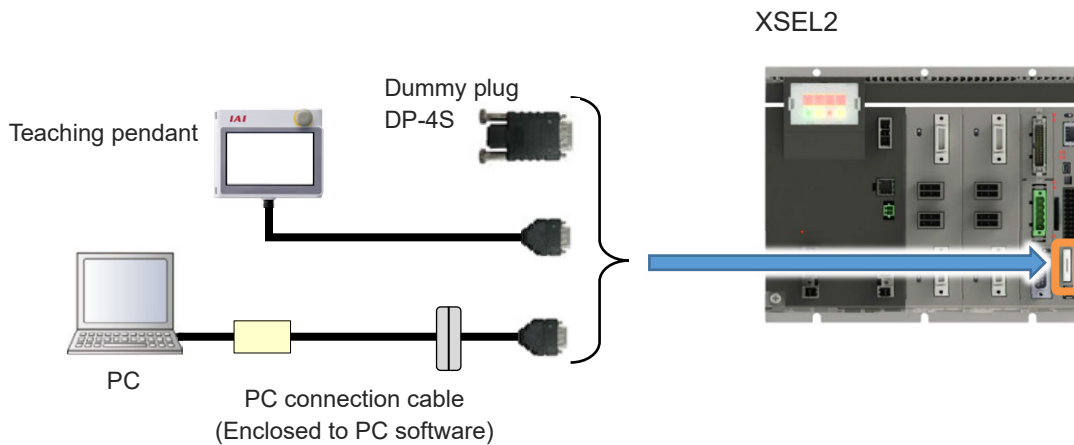
3.3.1 Wiring for Teaching port

The teaching connector is for operation and setting of equipment by connecting a teaching pendant provided by IAI or a PC (PC software).

An actuator would not activate without anything inserted to this connector.

In order to activate an actuator without a teaching tool connected, connect a dummy plug (DP-4S). When the mode switch is to be set to AUTO, connect the enclosed dummy plug to the teaching connector.

● How to Wire Teaching Tool



Caution

- This connector cannot be used for a purpose of communication with PLC features. To use the PLC features, use the USB connection or Ethernet connection.

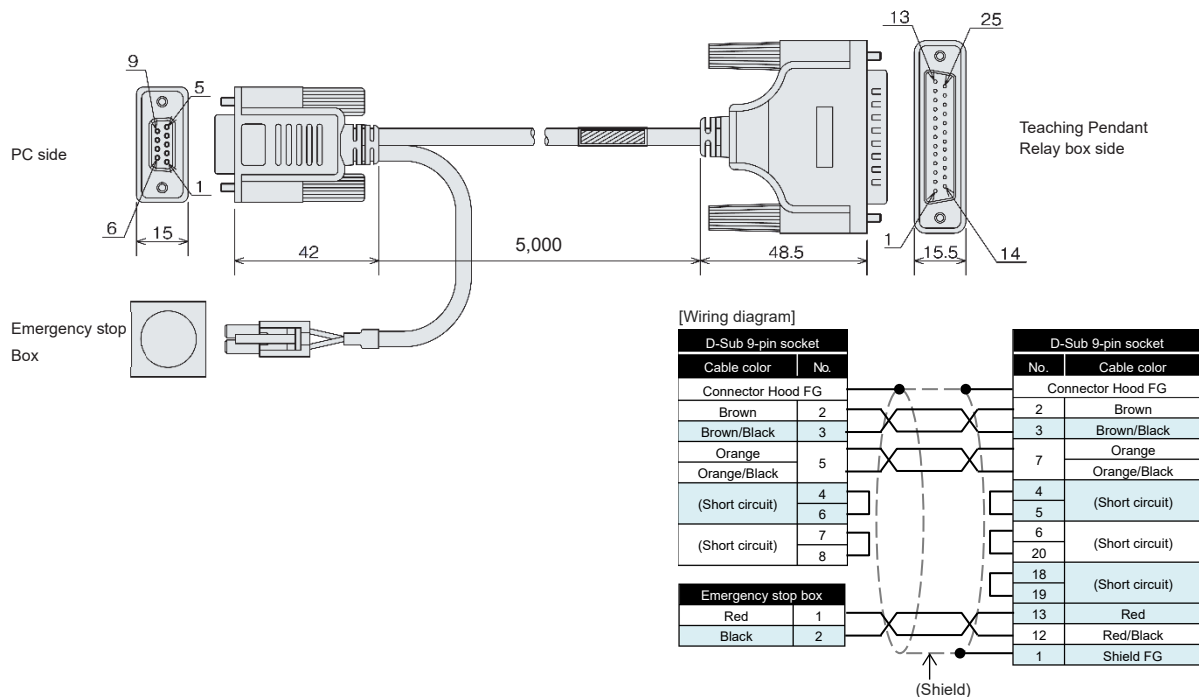
3.3 Wiring for teaching tool

● Cable Enclosed to PC Software, Conversion Unit Specification

1) PC Connection Cable 5m + Emergency Stop Box

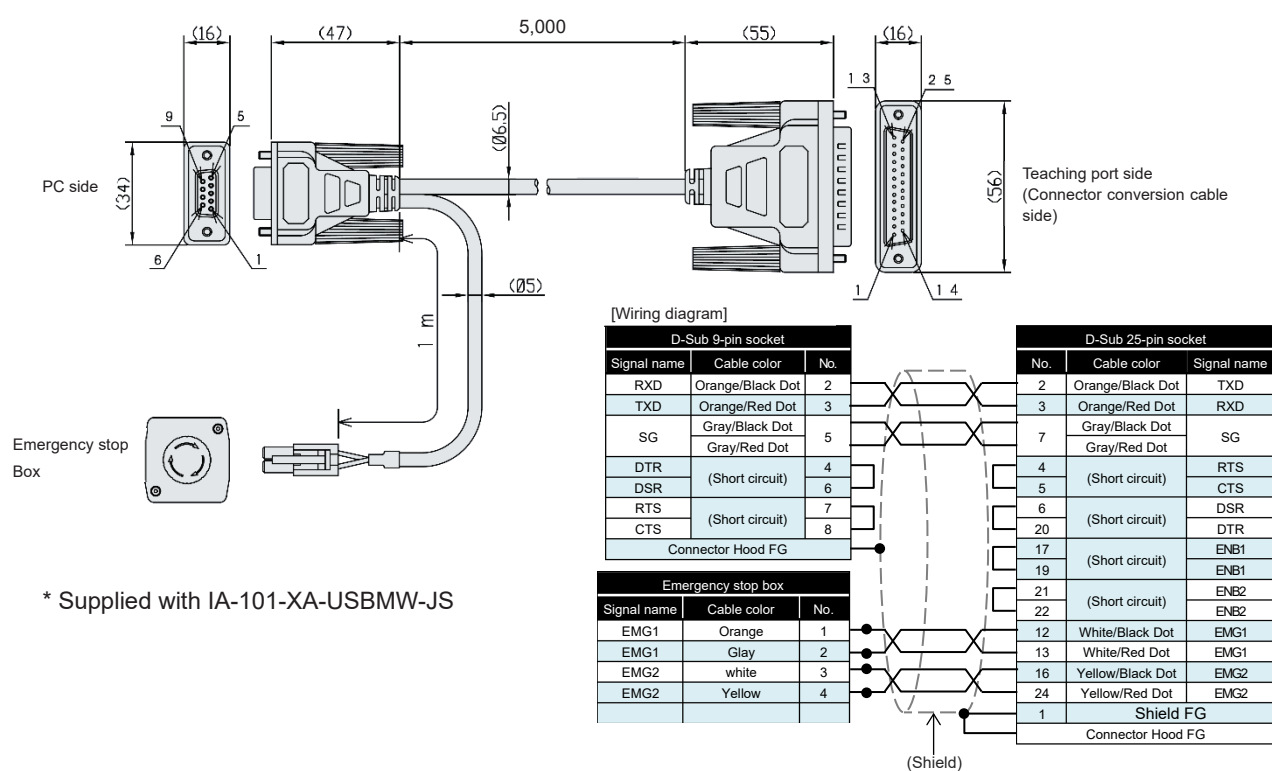
Model: CB-ST-E1MW050-EB (Model Code for Cable Only: CB-ST-E1MW050)

* Supplied with A-101-X-MW, IA-101-X-MW-JS, IA-101-X-USBMW



2) PC Connection Cable 5m Complied with Safety Category 4 + Emergency Stop Box

Model: CB-ST-A2MW050-EB (Model Code for Cable Only: CB-ST-A2MW050)

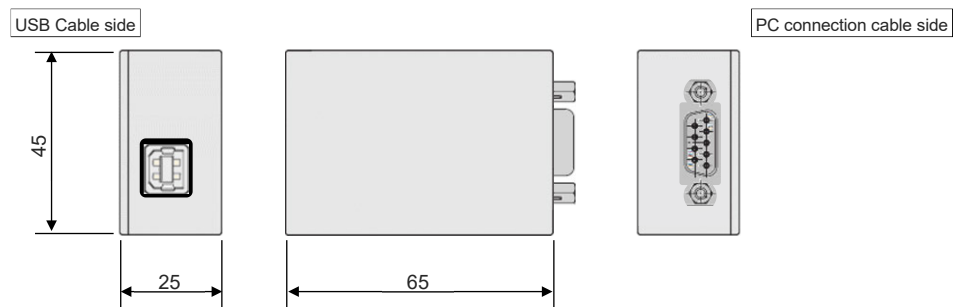


* Supplied with IA-101-XA-USBMW-JS

3) USB conversion adapter

Model: IA-CV-USB

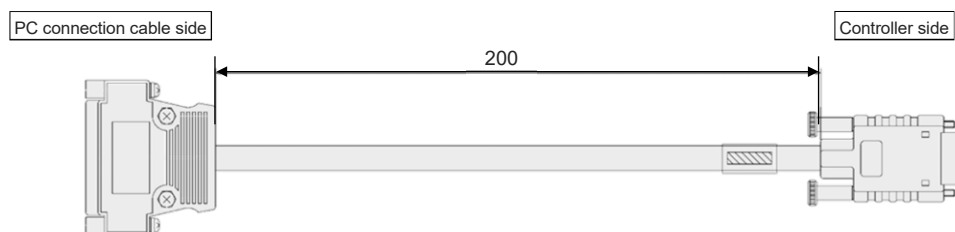
* Supplied with IA-101-XA-USBMW-JS



4) Connector conversion cable

Model: CB-SEL-SJS002 (Cable length 0.2m)

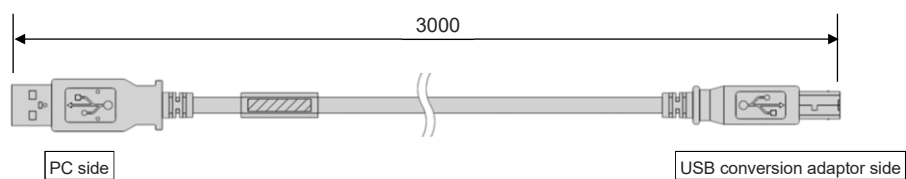
* Supplied with IA-101-XA-USBMW-JS

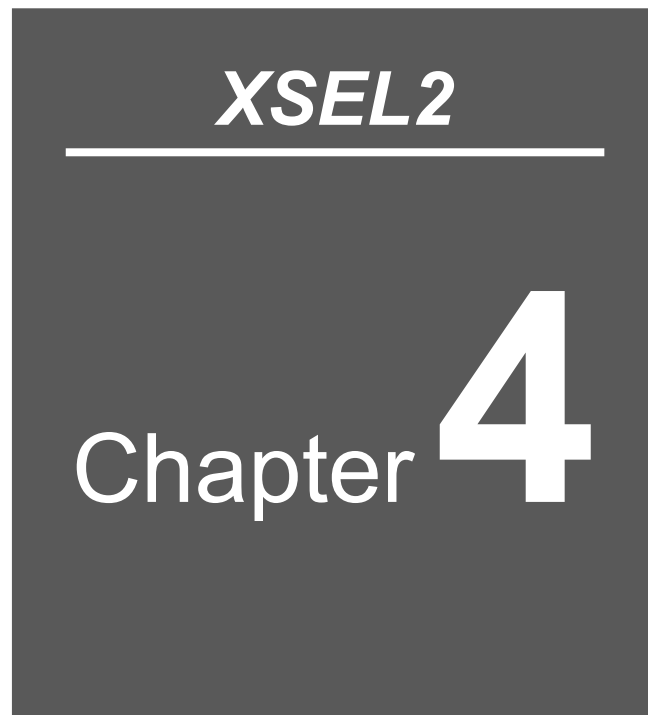


5) USB cable (3m)

Model: CB-SEL-USB030

* Supplied with IA-101-XA-USBMW-JS





How to use CODESYS

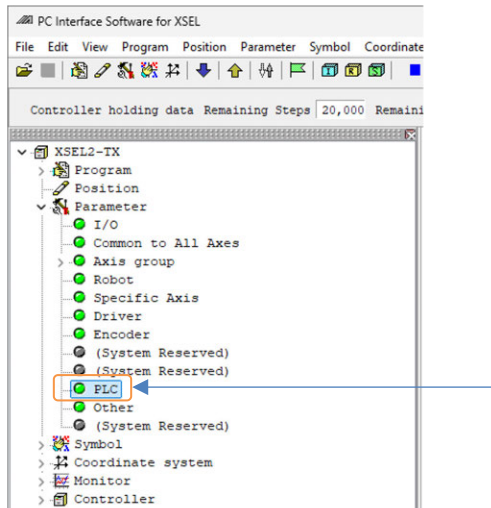
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4.1 PLC Feature Parameter Setting

The PLC feature is enabled on delivery. In order to make a change, it is necessary to connect a teaching tool.

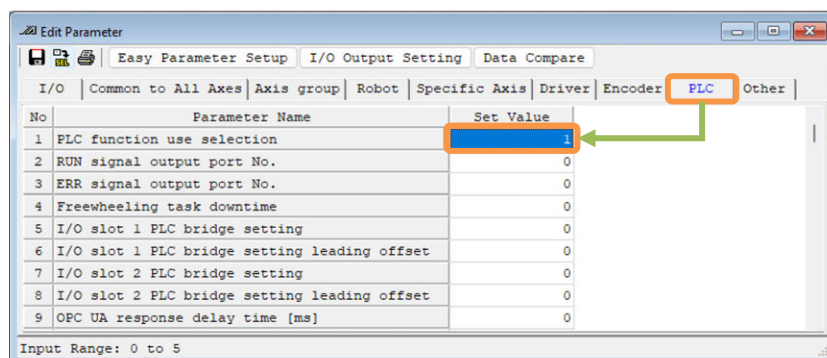
- 1) From the XSEL PC software, connect to XSEL2 and edit the PLC parameters from the tree on the left side of the window.



- 2) In the Edit Parameter window, set PLC Parameter No. 1 "PLC Feature Setup".

● PLC Parameter

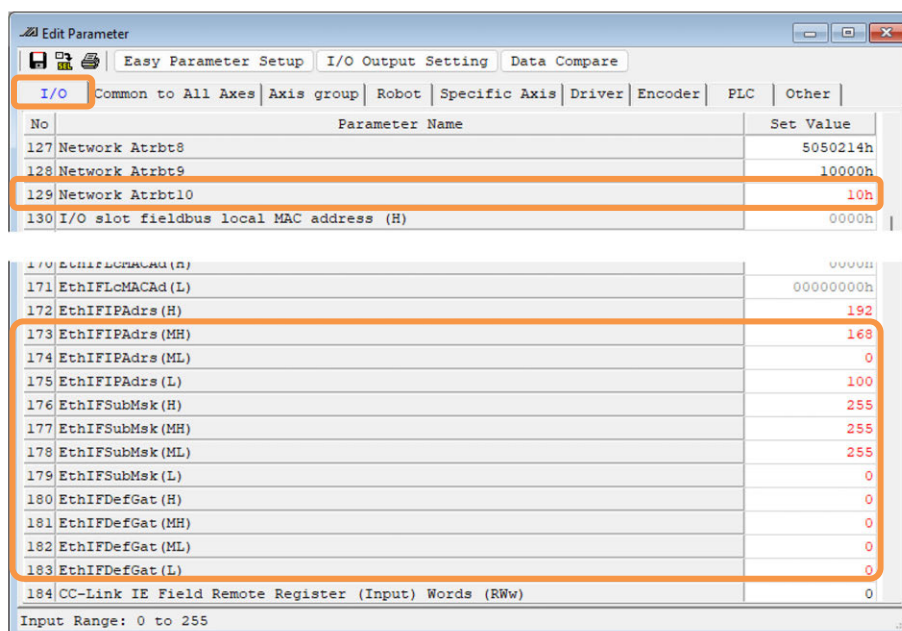
No.	Name	Set Value	Remarks
1	PLC feature Setup	1	0: Not in use 1: Used



- 3) The following I/O parameters should be set up when using the EtherNet/IP scanner features, OPC UA server features and Ethernet connection in CODESYS for XSEL2.

● I/O Parameter

No.	Name	Set Value	Remarks
129	Network Attribute 10	10h	TCP/IP message communication enabled
172 to 175	Ethernet own IP address	Adjust to network environment	IP address of XSEL2 itself (Example: 192.168.0.100)
176 to 179	Subnet Mask	Adjust to network environment	(Example: 255.255.255.0)
180 to 183	Default gateway	Adjust to network environment	(Example: 0.0.0.0)



Write the parameters in the flash ROM after the setup is completed, and reboot the power to the controller or reset the software. This is the end of the XSEL2 parameter setup.

4.2 Installing CODESYS for XSEL2

4.2.1 Operating environment

Item	Content
Operating system	Windows10 (64bit) Windows11 (64bit)
Computer body	PC available for operation of applicable OS (Windows)
CPU	x64 based processor 2.5GHz or more recommended
Main memory	8GB or more recommended
Hard disk	12GB or more recommended
Display	WXGA (1366 × 768) or more
Keyboard	Keyboard suitable for PC available for operation of applicable OS (Windows)
Pointing device	Tools such as mouse and applicable drivers
Communication Port	USB or Ethernet Port
Supported language	Japanese / English / German / Chinese (Simplified characters)

4.2.2 How to Install

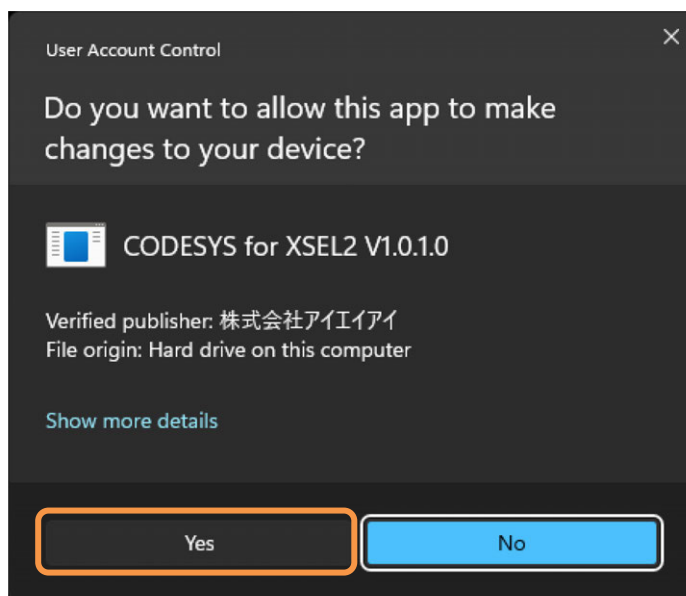
[1] Installation procedure

Double-click the installation execution file setup.exe and follow the procedures to install it.

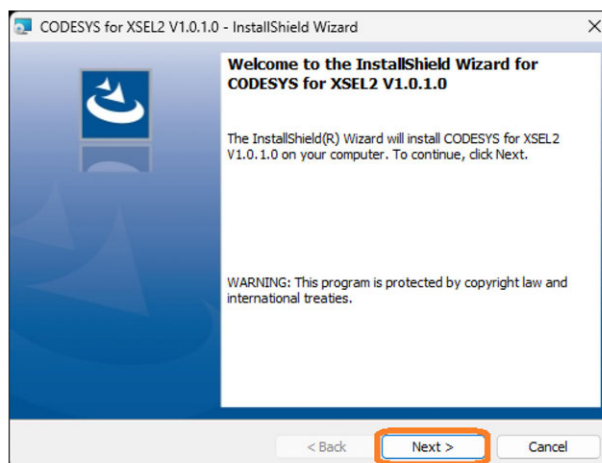
- 1) Double-click setup.exe to execute the installer. Once the User Account Control window appears, click **Yes**.



- 2) Once the User Account Control window appears, click **Yes**.



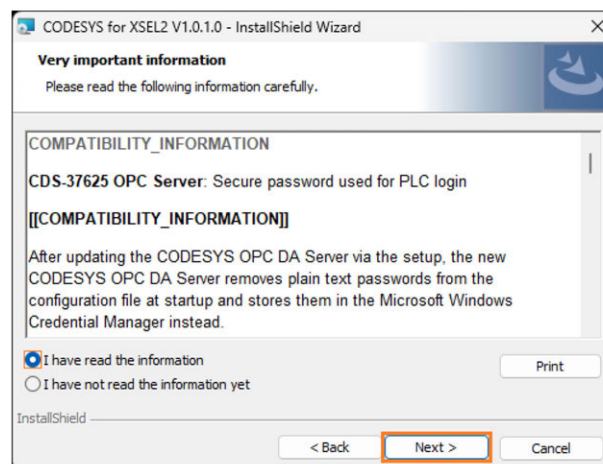
- 3) Click **Next** to continue the process.



- 4) A license agreement should be shown. Check the contents and select "I accept the terms in the license agreement" if there is no problem, and click **Next**.



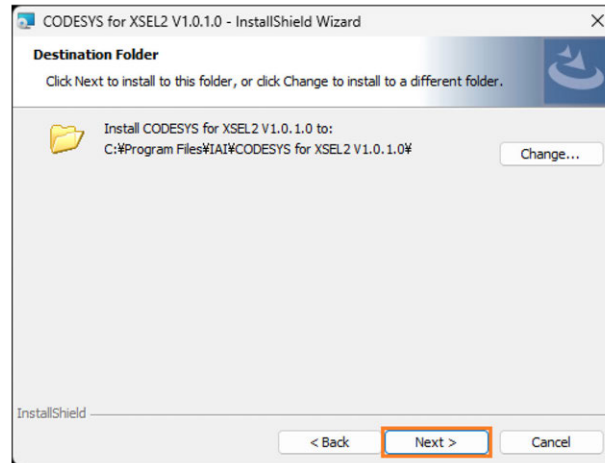
- 5) As the very important information opens, check the contents and select "I have read the information" if there is no problem, and click **Next**.



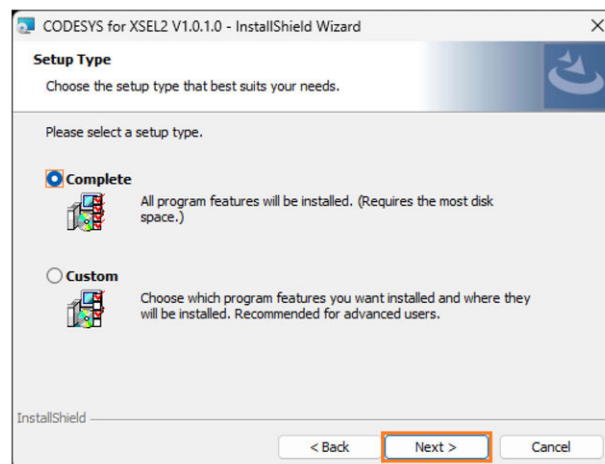
- 6) Indicate the destination for installation.

When it is desired to install to a directory other than what is displayed in default, click **Change** to change the destination directory for installation.

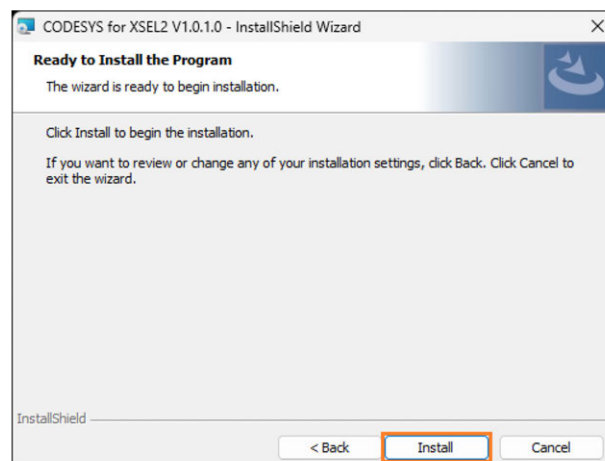
If the indication of the directory is finished, click **Next**.



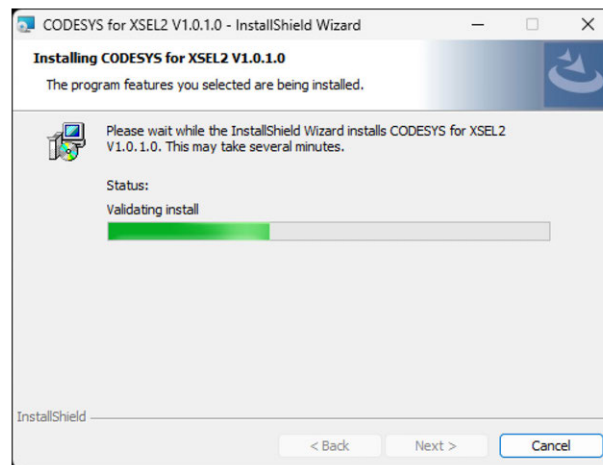
- 7) When it is required to install all the programs, select "Complete" and click **Next**.



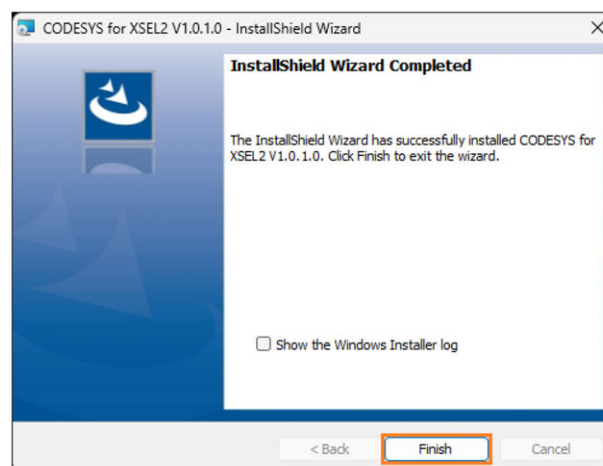
- 8) Click **Install** to start installation.



9) Installation should be executed. Installation may require several tens of minutes.



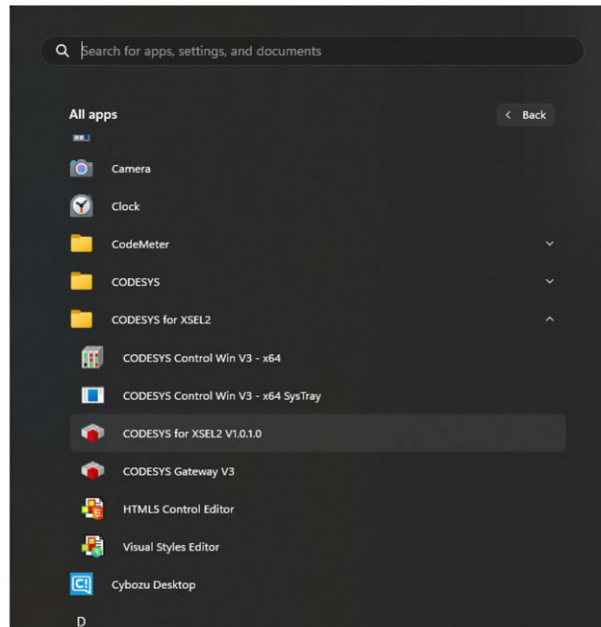
10) Once the installation is finished, the following window should appear. Click **Finish** to close the dialog.



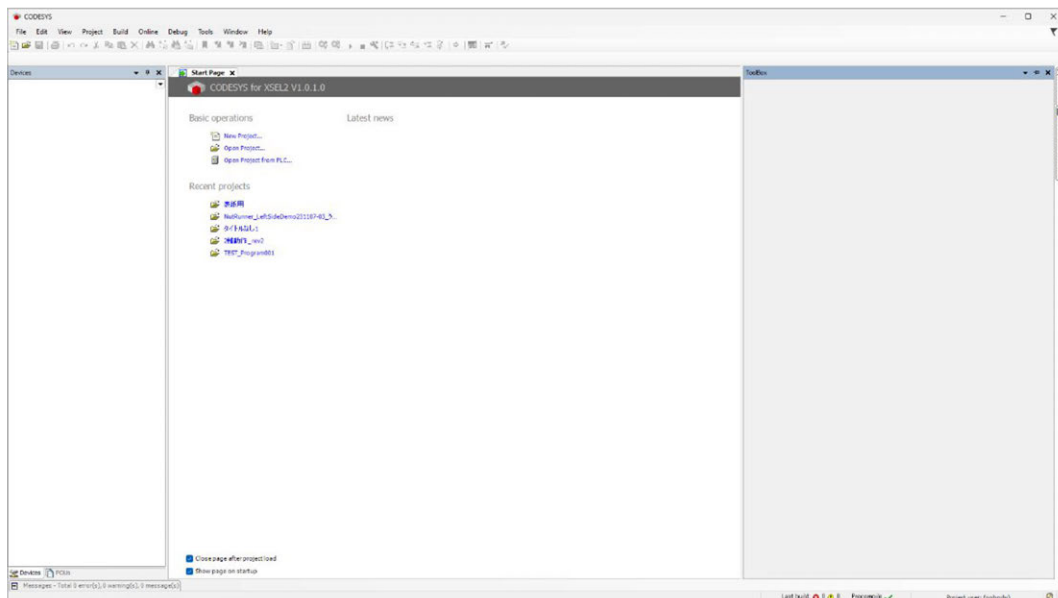
This is the end of the installation process.

4.2.3 Starting the software

- 1) After installing it, open the program tree from the Windows button, and execute "CODESYS for XSEL2 V*. *.*.*".
(V1.0.1.0 is selected in the example.)



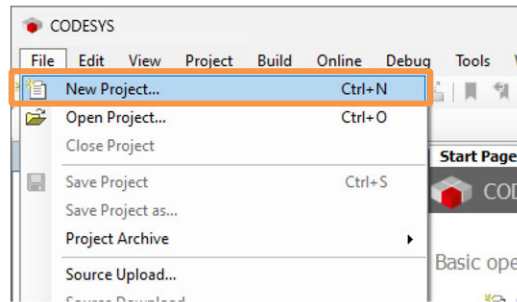
- 2) Confirm that CODESYS for XSEL2 has started up.



4.3 Creating New Project

Shown below is how to create a project.

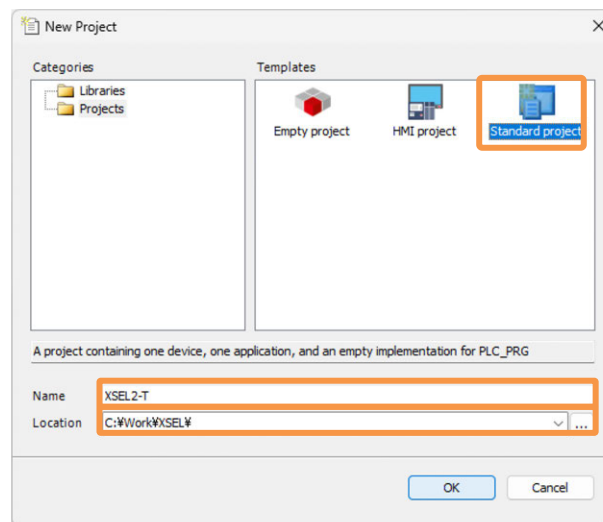
- 1) Select “File” → “New Project...” from the menu at the top.



- 2) The New Project window opens. Conduct the following operations.

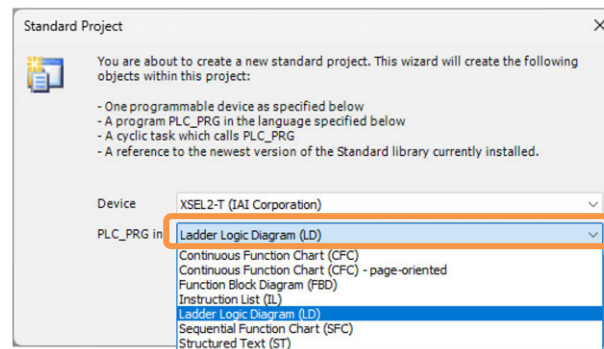
- Select “Standard Project”
- Input “Project Name”
- Select “Project to Save to”

Click after all the operations are done.

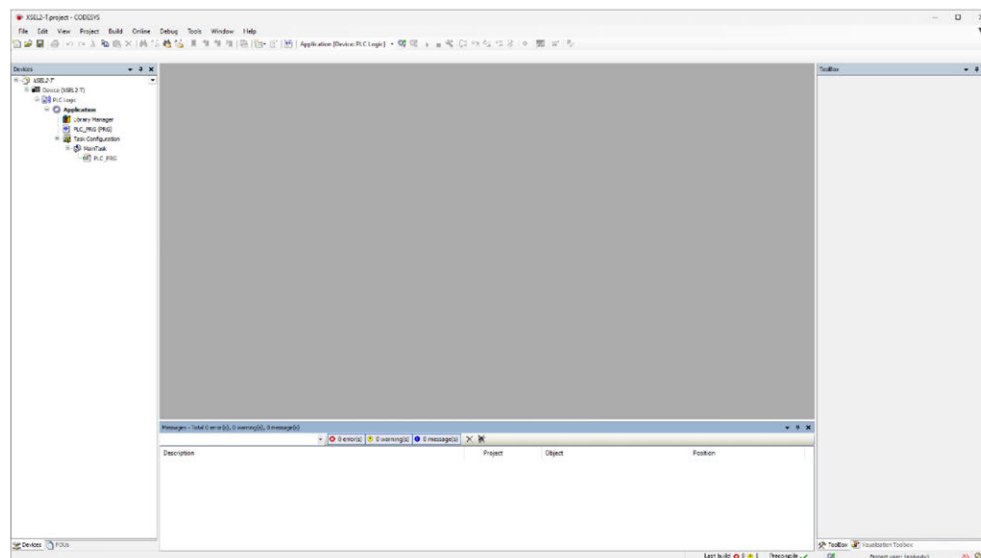


4.3 Creating New Project

- 3) The selection window for the standard project opens. Select the development language.

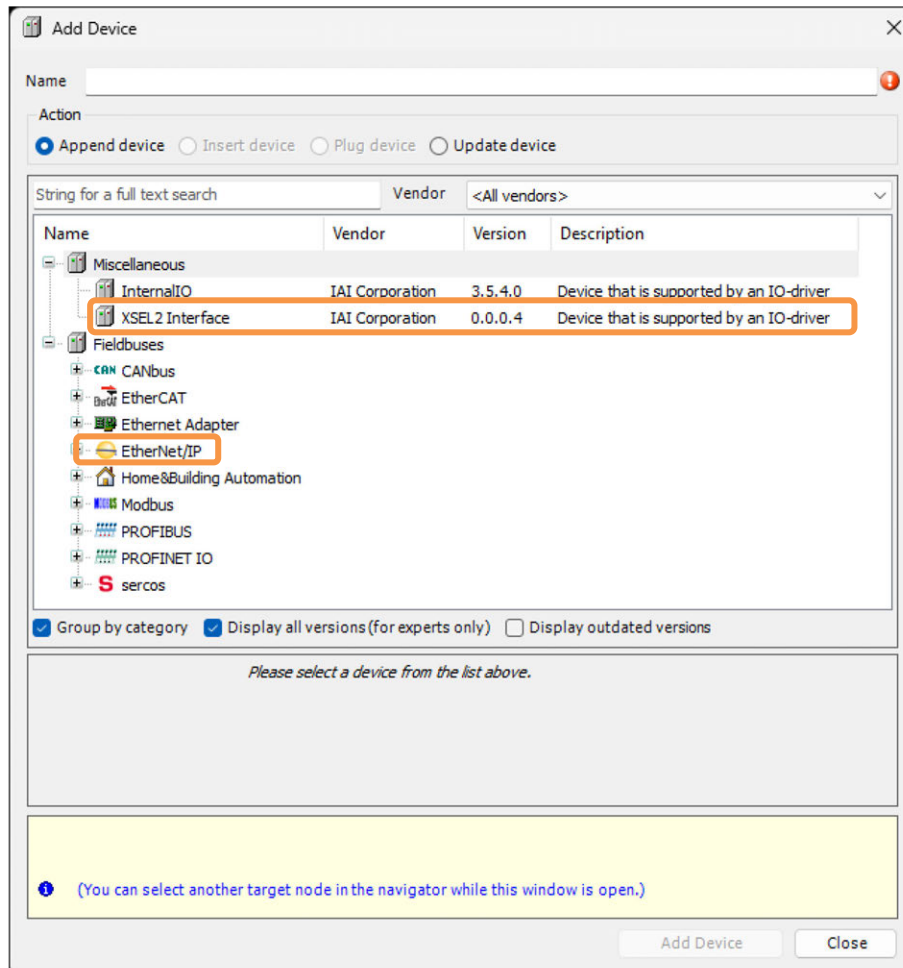


- 4) If a window like shown below comes up, the project has completed to be created.



4.4 Adding I/O Device Configuration

By adding a device object (hereinafter called as a device), exchange of data with various interfaces should become available.



In this manual, mentions the following interfaces.

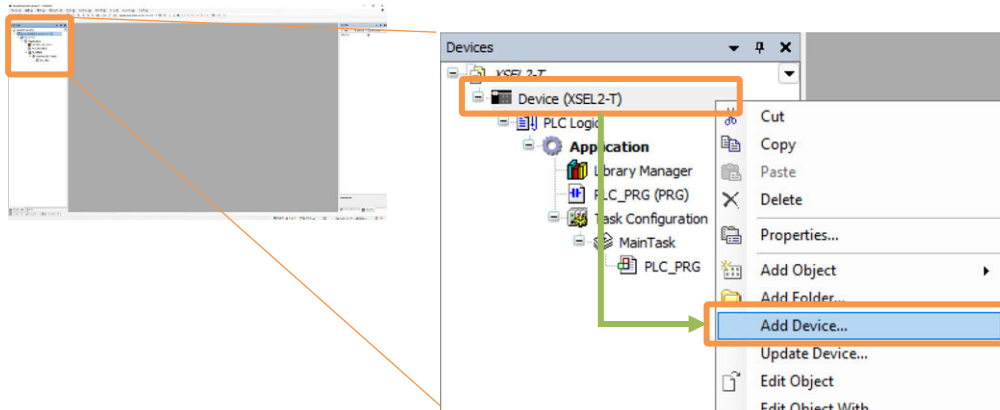
- XSEL2_Interface (Refer to [Chapter 5 SEL Interface Features])
- EtherNet/IP (Refer to [6.1 EtherNet/IP Scanner Feature])

In this chapter, having XSEL2_Interface as an example, explains how to add a new device. By adding XSEL2_Interface in the device, the input and output ports in SEL part equipped in XSEL2 in standard can be shared.

4.4.1 Adding I/O Device

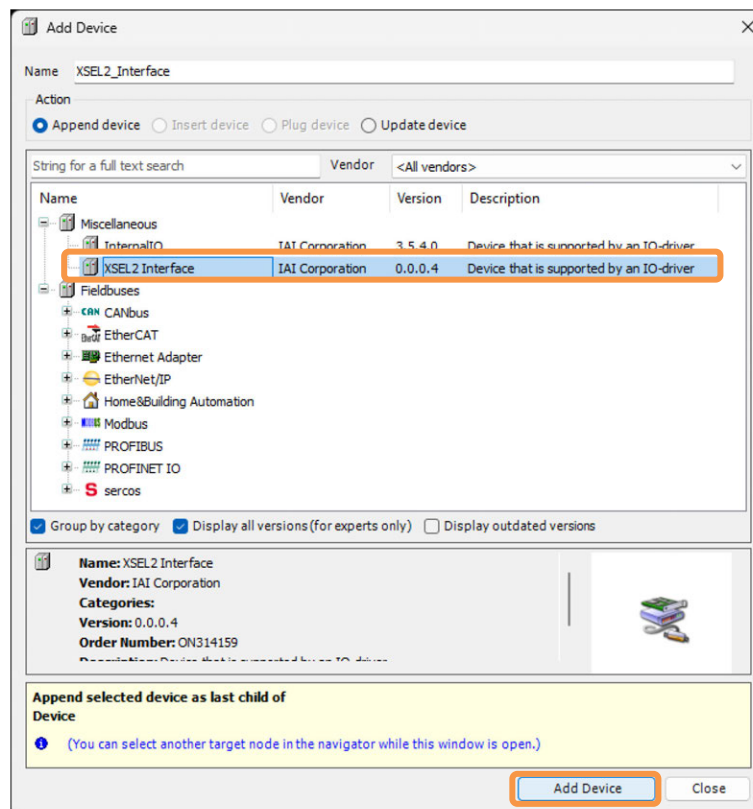
Here, shows the process to add a device.

- 1) Right-click "Device" → select "Add Device..." in the device view.

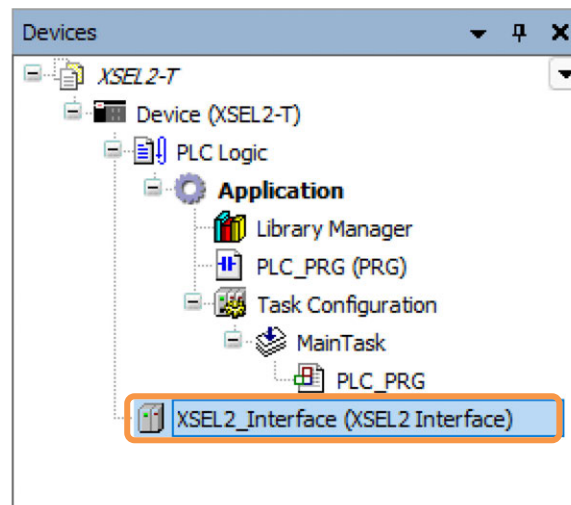


- 2) A window to add a device opens. Click "Others" to expand the tree.

- 3) After the tree is expanded, select "XSEL2_Interface" and click **Add Device**.



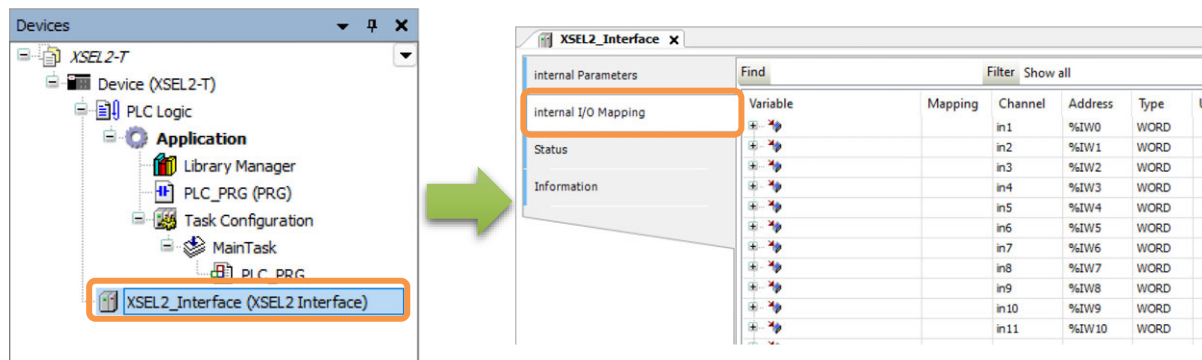
- 4) Confirm that “XSEL2_Interface (XSEL2 Interface)”, a device newly displayed in the device tree, is displayed, and it is completed to add a device.



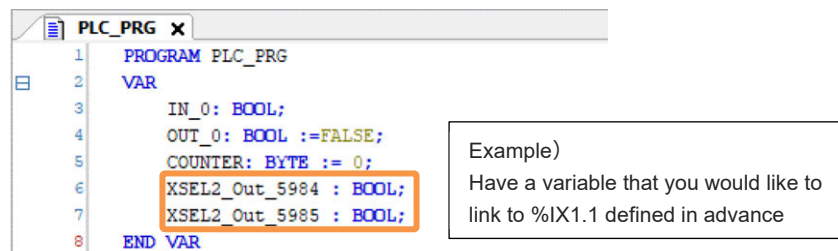
4.4.2 Defining I/O Variables

In order to perform I/O operation in CODESYS, it is necessary to define the variables for the input and output channels in an I/O device. Set up the names of variables in the I/O mapping or parameters.

- 1) Double-click “XSEL2_Interface (XSEL2 Interface)” in the device tree, and the contents of the device should be displayed in a window. Select the “Internal I/O Mapping” tab here, and the details of shared port can be confirmed.



- 2) The variables in the input and output channels should be declared in advance in the variable declaration window.



- * Double-click PLC (PRG) for the variable declaration. It should be displayed in the window same as the selected program (default setting). The variable declaration can be edited either in “Character String” or “Display Table”.

3) Click “...” In the variable line that needs to be changed (in here %X1.1).

Variable	Mapping	Channel	Address	Type
Application.PLC_PRG.XSEL2_Out_5984		Bit7	%IX0.7	BOOL
		Bit8	%IX1.0	BOOL
		Bit9	%IX1.1	BOOL
		Bit10	%IX1.2	BOOL

4) As the input assistance window opens, open the “Application” tree and select the applicable variable.

5) Once the selection of variables is completed, the display should be updated as shown below. Confirm the contents and the setup is finished.

Variable	Mapping	Channel	Address	Type
Application.PLC_PRG.XSEL2_Out_5984		Bit7	%IX0.7	BOOL
Application.PLC_PRG.XSEL2_Out_5985		Bit9	%IX1.1	BOOL
			%IX1.2	BOOL
			%IX1.3	BOOL

Make sure that the variable you set for %IX1.1 is linked.

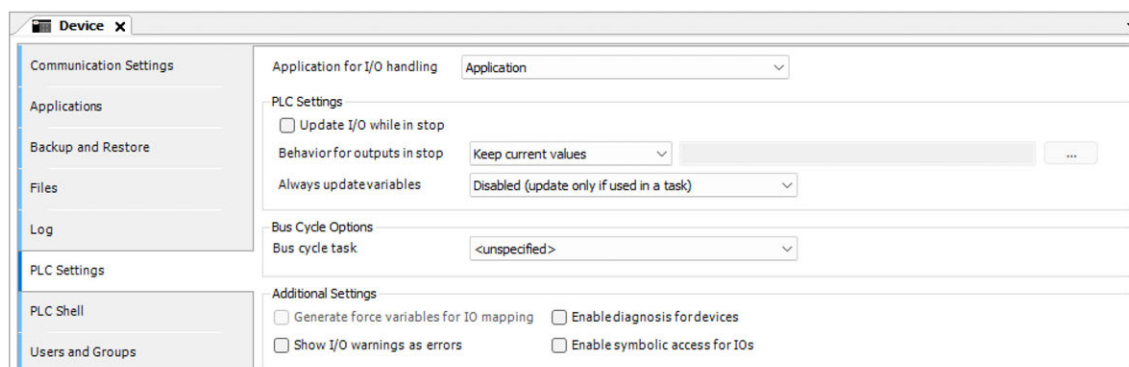


Caution

- Although there are two ways of usage in the external I/O, global variables that can be used in common in all POU and local variables effective only in each POU, it is recommended to defined as the global variables in normal use. Refer to the separate volume [PLC Feature Programming Manual (ME0480)] for how to make a variable declaration.

4.4.3 I/O Refresh

Data sending and receiving should be conducted by reading at the beginning of tasks for external input data and writing at the end of tasks for external output data. Settings related to I/O refresh should be conducted in the “PLC Setup” tab in the Device Setup window (double-click Device in the tree or right-click and select “Edit Object”). Only the I/O used in the program should be updated, and the I/O not in use should not be updated.



- Updating I/O During Stop

If there is a checkmark, refresh (update) of I/O should be performed even if the PLC is stopped.

- Output Operation During Stop

Item	Description
Retain Current Value	The current value (value just before stop) should be retained. When the refresh setting during stop is disabled, the output data should not be updated.
Set All Outputs to Default	The default values in the I/O mapping should be output.
Execute Project	Behavior of an output can be written in a program in a project. Input a name of a program to execute and it should be executed once when PLC is stopped.

- Output Operation During Stop

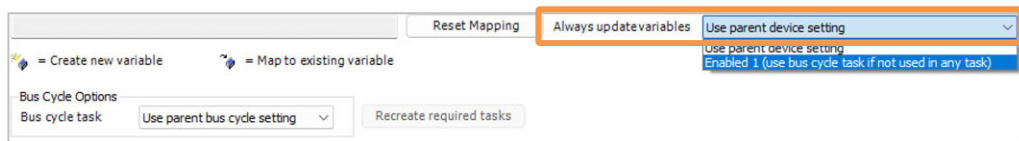
Item	Description
Disabled (Updated only when used in task)	I/O variables should be updated only when they are used in a task.
Enabled 1 (Bus cycle task to be used when not in use for any task)	When there are no I/O variables used in any other task, it should be updated in the bus cycle task.



Caution

- As an I/O not used in a program should not get updated, the status would not be monitored even if double-click on the I/O module shown in the I/O mapping table device tree in each I/O module or right-click and select Edit Object.
The following setting should be established when it is necessary to monitor an I/O not in use.

- When it is required to set it up for the whole PLC, select “Enable 1 (Use Bus Cycle Task if No Task is Used)” in “Always Update Variables” in “PLC Setting” in the previous page.
- When it is required to set it up for individual I/O modules, set “Always Update Variables” in “PLC Setting” in the previous page to “Disable (Update Only When Task is Used)”, and set “Always Update Variables” at the right bottom of the mapping table in that I/O module that you would like to set to “Enable 1 (Use Bus Cycle Task if No Task is Used)”.

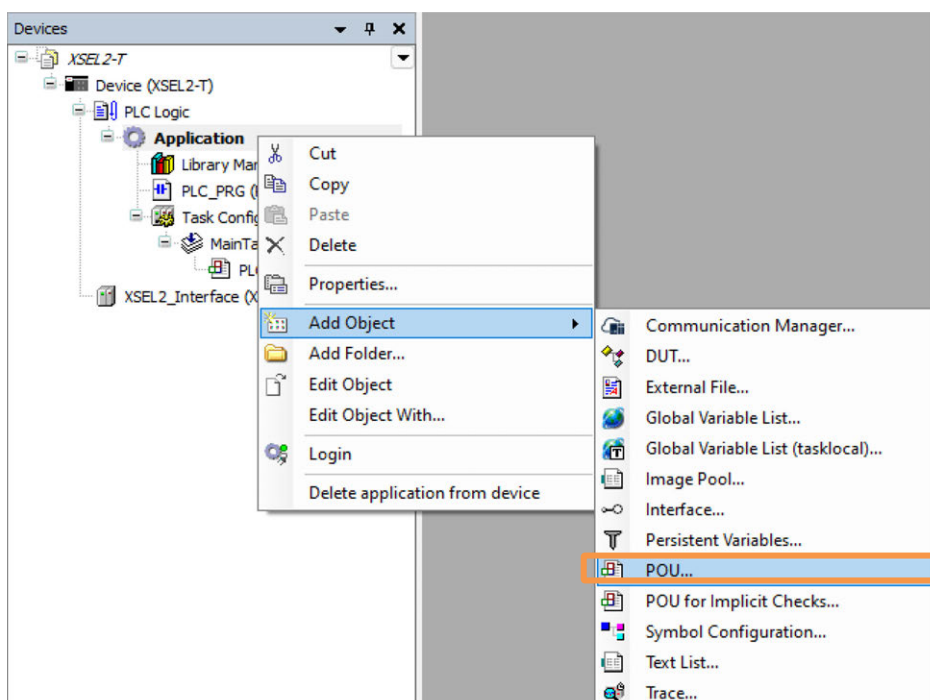


4.5 Programming

4.5.1 Creating POU (Program Organization Unit) Object

POU (Program Organization Unit) is the basic unit organizing programs and projects in IEC 61131-3. There should be only one programming language that can be used in one POU.

If it is required to use several POU or another programming language, right-click “Application” and select “Add Object” → “POU”.



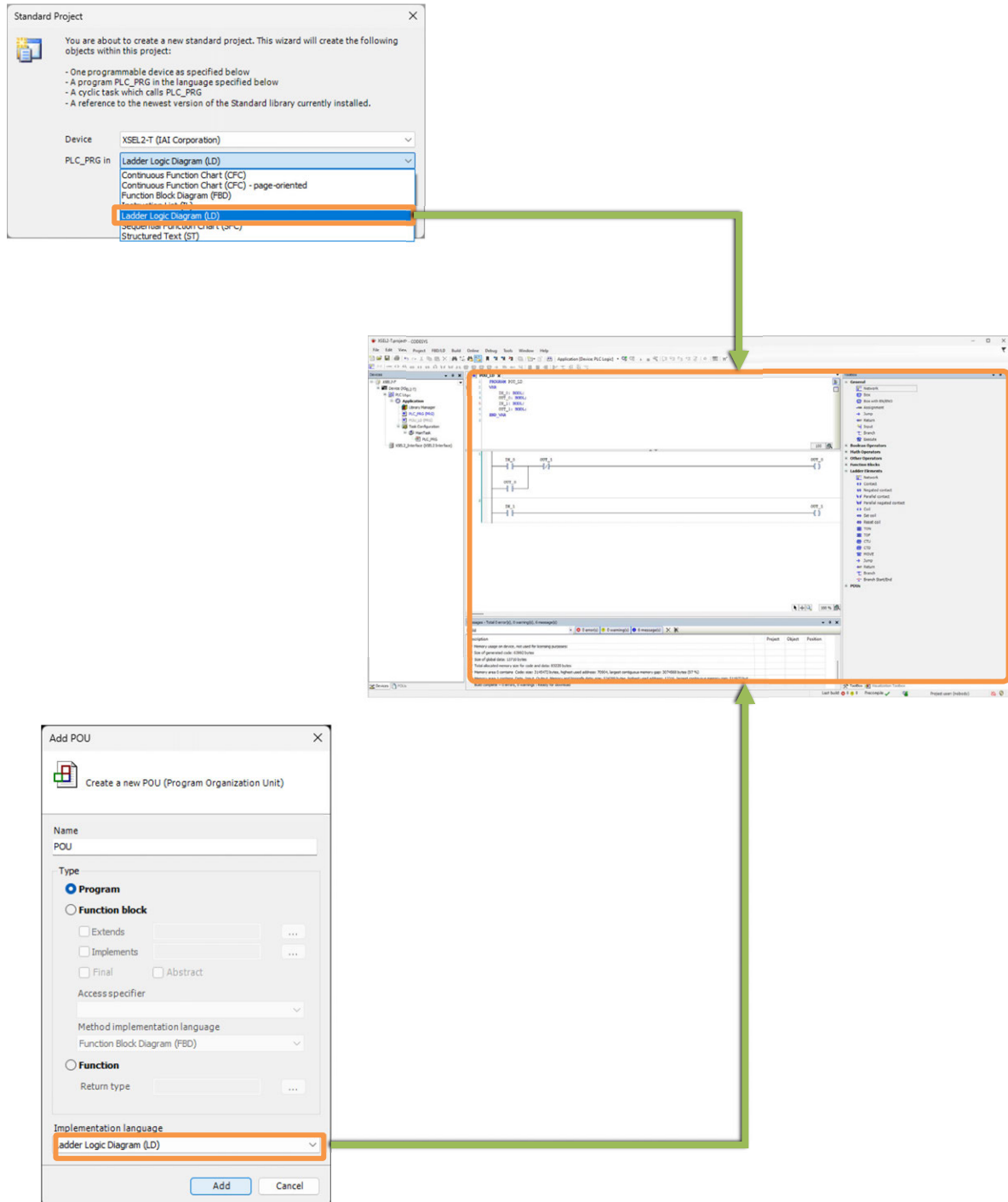
There are three types in the organizing factors of POU.

Type	Readout from Task	Readout from Other POU	Limitation in Input and Output Counts	Retaining Internal Variables
Program	○	POU name	None	○
Function Block	×	Instance	None	○
Function	×	POU name	Input: None Output: 1	×

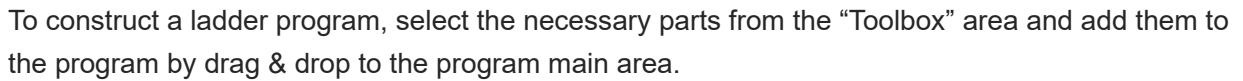
For the details of programming, refer to the separate volume [PLC Feature Programming Manual (ME0480)].

4.5.2 Ladder Logic Diagram (LD Language)

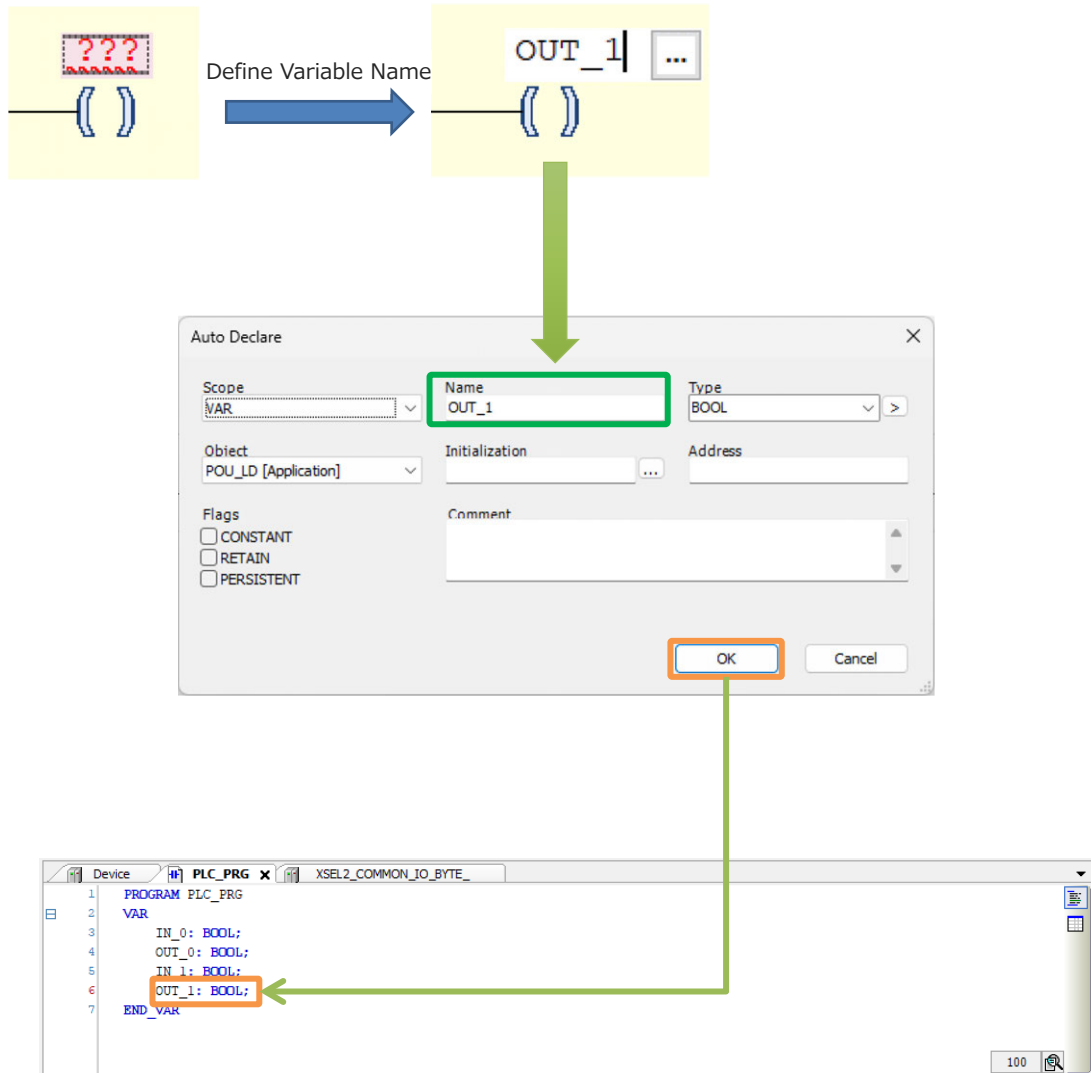
Here, explains the basis operations of CODESYS for XSEL2 in programming with LD Language. By selecting “Ladder Logic Diagram (LD)” in “Create A New Project” or when adding POU (program), a program in the ladder language can be created.



- Variable Definition Area
- Program Main Area
- Toolbox

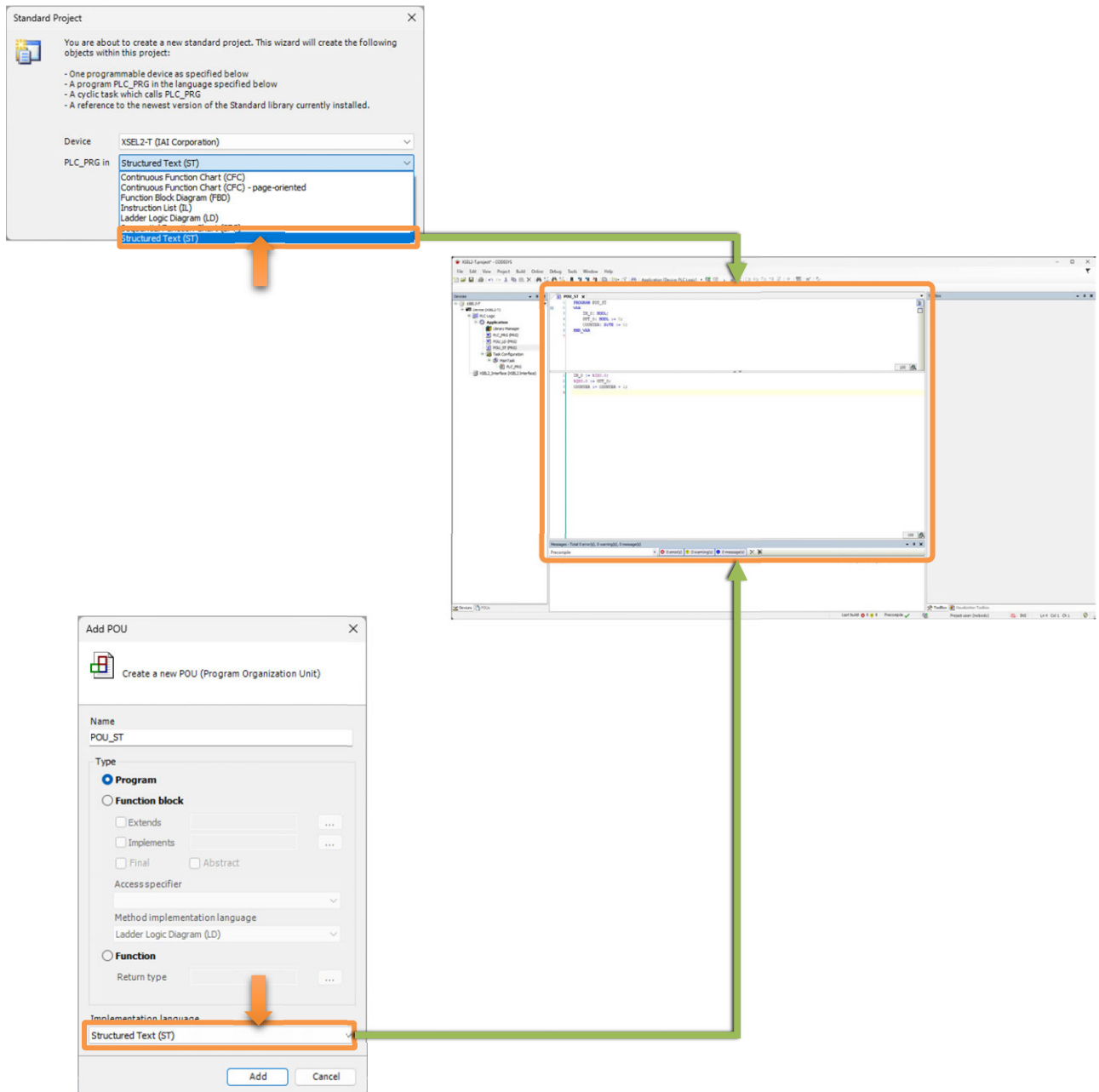


Also, when the variable of the added part is input, if the variable name is not registered in the “Variable Definition Area”, the automatic declaration window should open. Select **OK** and it should be automatically registered to the “Variable Definition Area”.



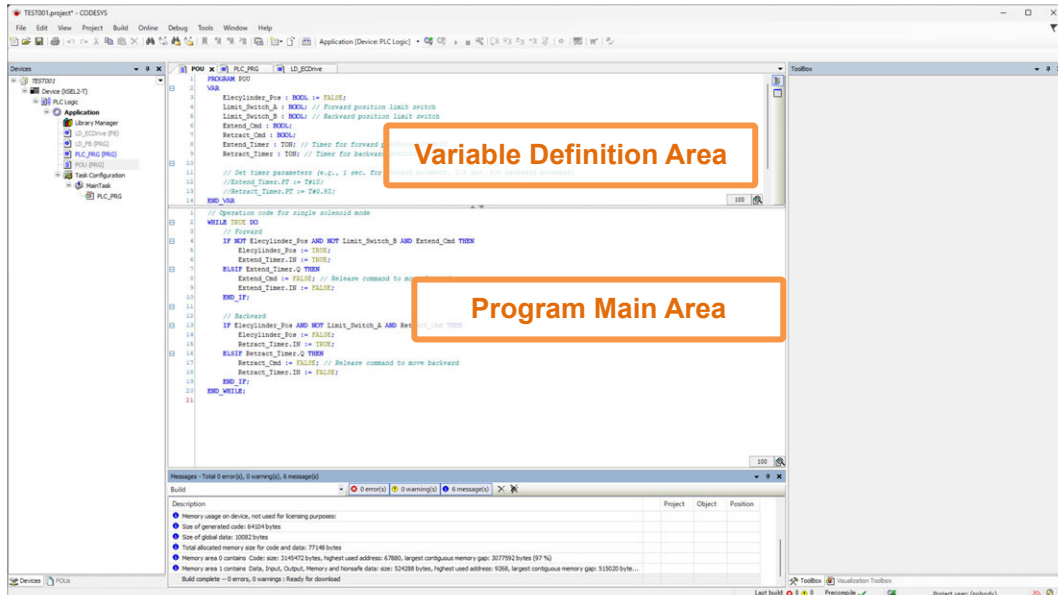
4.5.3 Structuring Text (ST Language)

Here, explains the basis operations of CODESYS for XSEL2 in programming with ST Language. By selecting “Structuring Text (ST)” in “Create A New Project” or when adding POU (program), a program in ST Language can be created.



The window for ST Language should be divided as shown below.

- Variable Definition Area
- Program Main Area



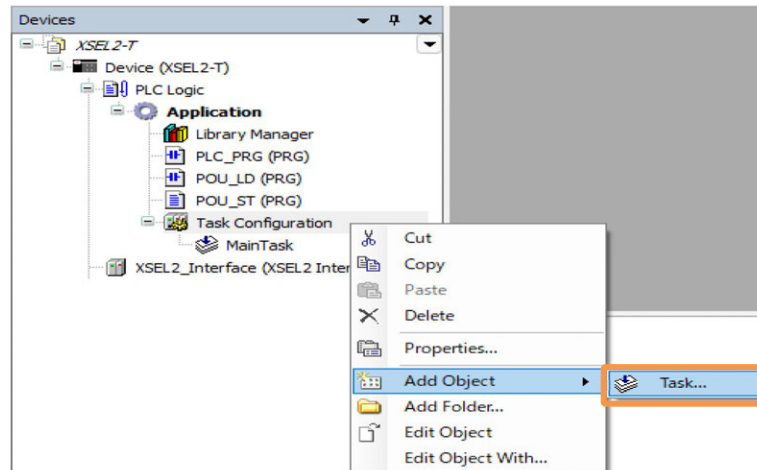
Write in a program in the “program main area” and write in the used variable in the “variable definition area”.

4.6 Task and program

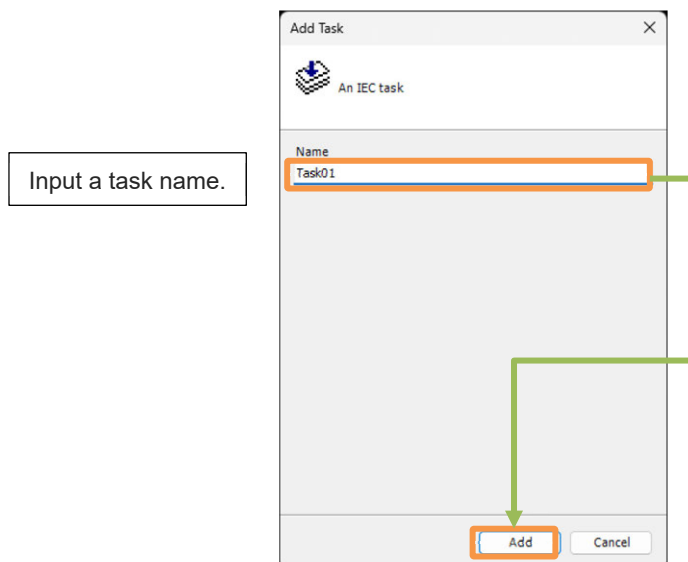
In order to execute a program, it is necessary to add the program (POU object) to a task.

4.6.1 Adding Task

- 1) Right-click **Task Configuration** in the device tree and select “Add object” → “Task”.

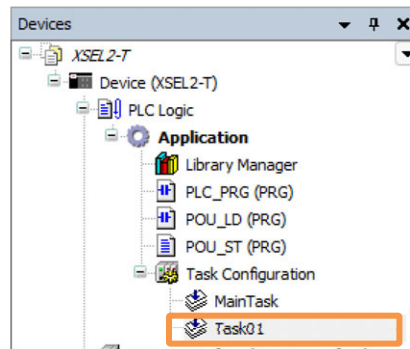


- 2) The “Add Task” dialog box should be displayed.
Input a task name and click **Add**.



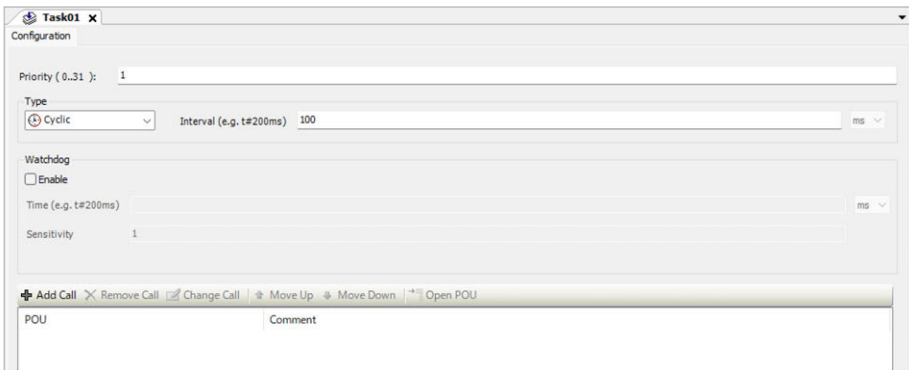
Input a task name.

- 3) An object of the task should be added.



4.6.2 Task Configuration Setting

In the task configuration window, setting related to task execution such as priority of execution, execution system, execution frequency, watchdog, etc.



Item		Description
Priority		Set range: 0 to 31 The priority of 0 is highest and that of 31 is the lowest.
Type	Cyclic	A task should be executed in a cycle of the time period set in "Frequency". If the actual programing execution time period has exceeded the indicated frequency, the next program execution should start from the next indicated frequency cycle.
	Event	It should be executed in the rising edge of the variable set in the event.
	Free Wheel	The task executes the indicated POU, and once it is executed till the end, it goes back to the top of the first POU and repeats the execution. The frequency is not defined. As this task gets executed continuously, the priority is the lowest, and in addition, there is an interval of 3ms in one cycle so tasks in higher priority can be executed.
	Status	It should be executed when the variable set in the event is true.
Watchdog		Once the watchdog is set enabled, as soon as the program execution time has exceeded the set time, the task goes to an error status and the operation stops. There are two conditions as stated below when it stops. • When the program execution time has executed the count set in the sensitivity or the time set in the time continuously • When the program execution time has executed Sensitivity × Time in one cycle (Example: When the sensitivity is "and time" is t#, it should stop if the execution time in one cycle has exceeded 15ms.) When a task has stopped by the watchdog, it should be recorded in the log tab of the device editor.

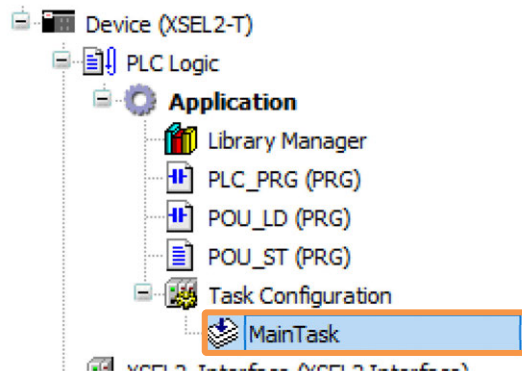
**Caution**

- In order to avoid the XSEL2 system to stop when the calculated load in the CPU of XSEL2, monitoring of timeout should always be executed. Even when the watchdog option is not activated in the task configuration window, it may stop with an exception error as the CPU calculated load gets increased.
-

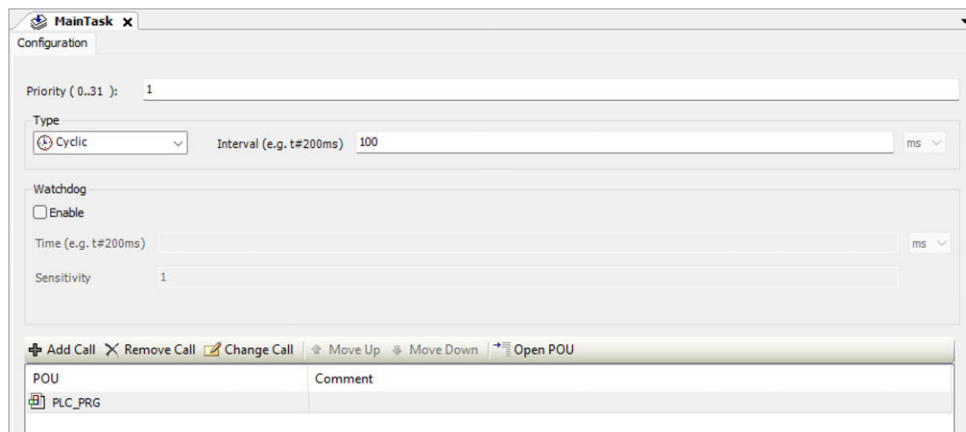
4.6.3 Adding Program to Task

Adding POU (PRG) to MainTask as an example, here shows the procedures.

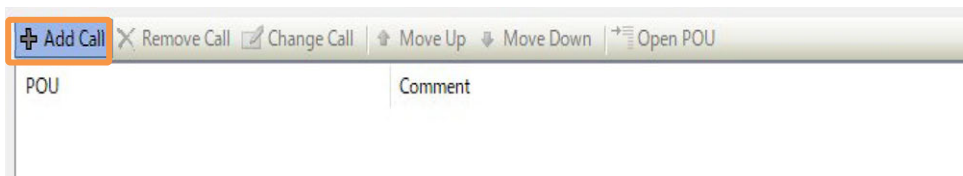
- 1) Double-click **MainTask** in the Device tree.



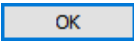
- 2) The configuration window of MainTask should open.

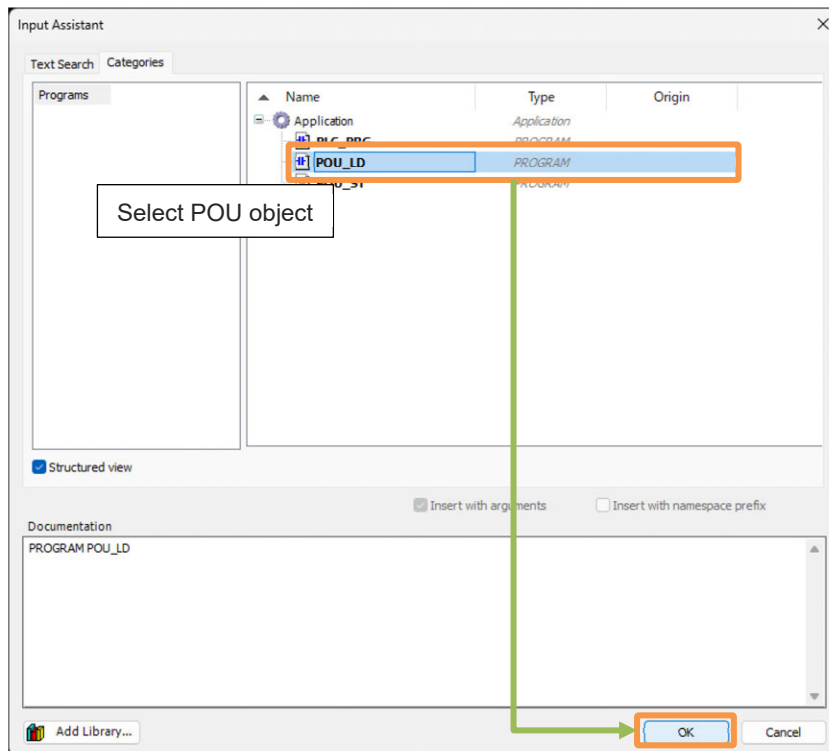


- 3) Click **Add Call**.

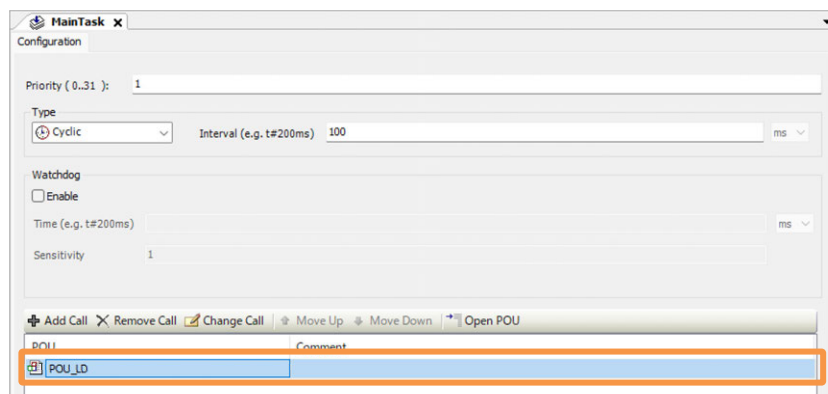


4) The “Input Assistant” dialog box should be displayed.

Select a POU object (POU) of a program to be added in the task, and click .



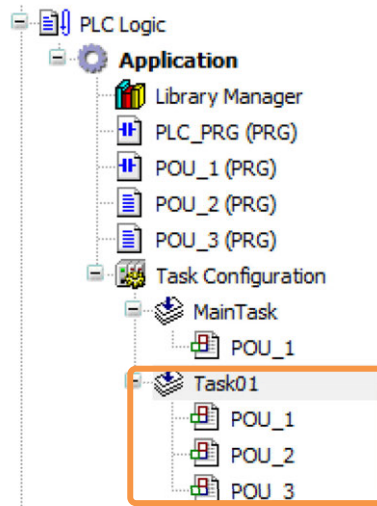
5) The POU object of the program should be added in the task.



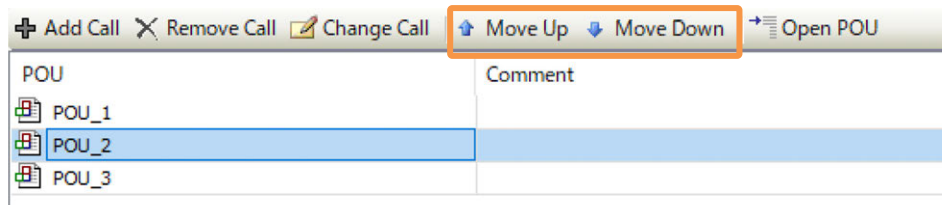
4.6.4 Orders to Execute POU

POU registered in a task should be executed in the order of being registered.

If there are three units of POU registered in Task01 as shown in the figure below, startup “Task01” and the POU should be executed in the order of “POU_1” → “POU_2” → “POU_3”.



The order to execute POU change swapped with “Move Up” and “Move Down” buttons in the POU registration part in the task setup window.

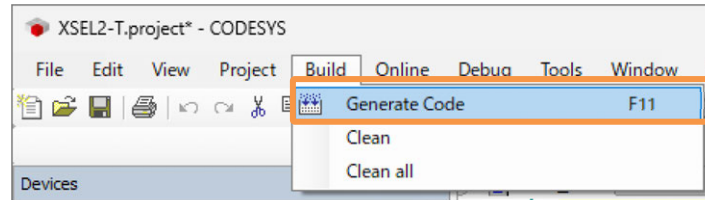


4.6.5 Precautions

- When creating a program using several tasks with different priorities, it is necessary to design the time schedule.
- As a task with higher priority should be executed when the startup frequency is in the same timing, a task with lower priority may have dispersion in executed frequency. Also, when a design is made to have long time to execute a task with higher priority, it may be disabled to secure time for operation of a task with lower priority.
- When the watchdog feature of a task with low priority is activated, be cautious that the execution of a program should stop as the CPU detects a watchdog error.

4.7 Building Program

- 1) For a build, select “Build” → “Generate Code” in the menu.



- 2) The result of a build should get displayed in a message window.
 If there is an error being occurred, double-click an error message and it leads to a point that needs correction. Make a correction there.
 Remove all errors and a build should complete.



Caution

- If there is any unknown error message displayed, execute “Build”, “Clear All” and execute “Creating Code” again.
 Execute “Clear All” and old data already compiled should be all deleted.

4.8 Downloading program

To download and execute a program, it is necessary to connect CODESYS for XSEL2 and XSEL2 and activate them.



Caution

- When having a change to a program during operation, pay attention well to safety before conducting.
It may cause damage to the machinery or accident by operation mistake.

4.8.1 Preparation for USB Connection

When CODESYS for XSEL2 and XSEL2 are to be connected with USB, follow the procedures below in this chapter.

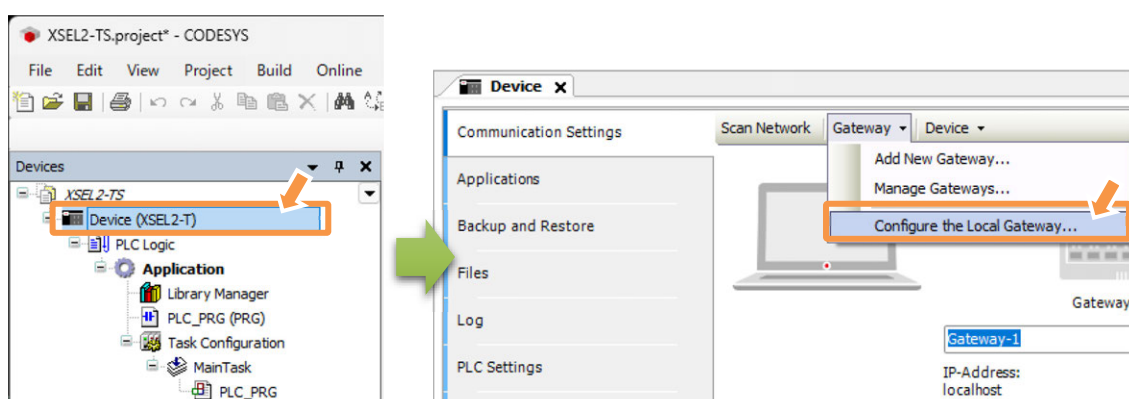
- 1) Connect a PC and an XSEL2 controller with a USB cable.



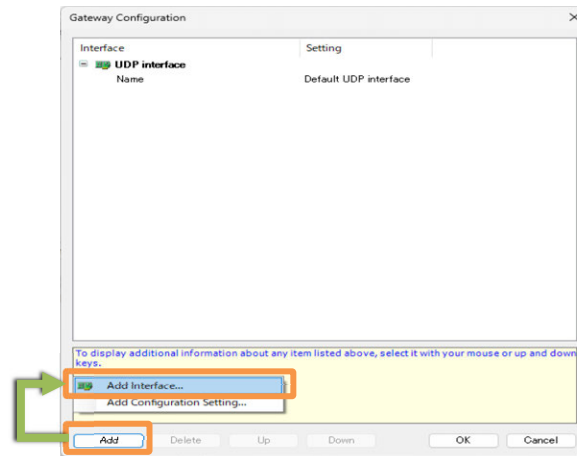
Caution

- When connection is established with USB, do not attempt to connect between a PC and XSEL2 with an Ethernet cable. As Ethernet should be prioritized to USB, USB connection may not be established.

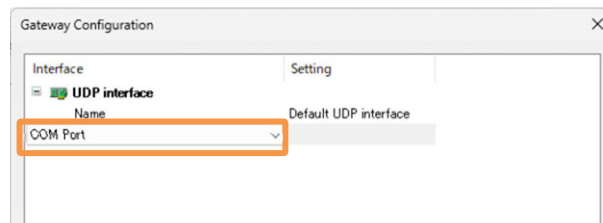
- 2) Double-click "Device" and open the pulldown menu in "Gateway".
Next, click "Configure the Local Gateway..."



- 3) Once the gateway configuration window opens, select **Add** in the left, and select “Add Interface” in the open tree.

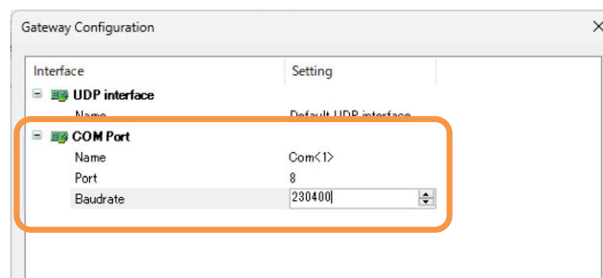


- 4) Add “COM Port” in the interface.



- 5) Change the setting in the COM port.

- Name: Change it to an easy name (optional)
- Port: Input a COM port number that the USB is assigned (COM6 in this example)
- Baud rate: It is not necessary to change the value from the default. Regardless of the setting value, the baud rate should be constant.

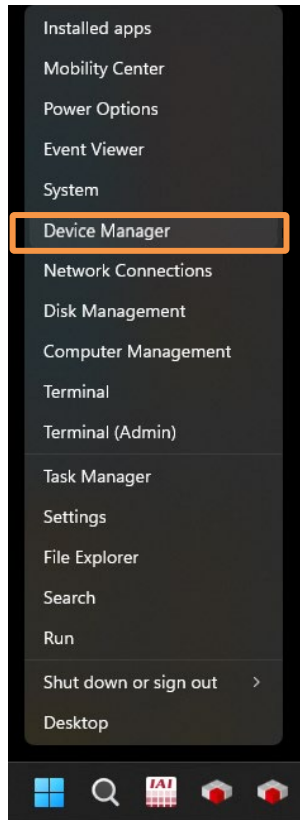


Caution

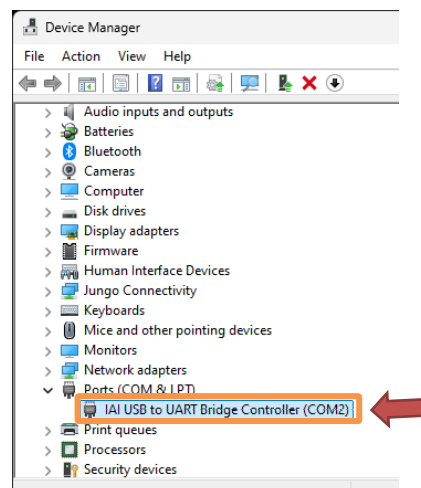
- In order to reflect the setting in the COM port, it is necessary to reboot the gateway. Reboot the gateway on the next page [Complement How to Check COM Port Number after Procedure 6)].

Complement How to Check COM Port Number

- 1) Connect PC and XSEL2 with a USB cable, and turn the power to XSEL2 on.
- 2) Right-click the Start button of Windows and click **Device Manager**.



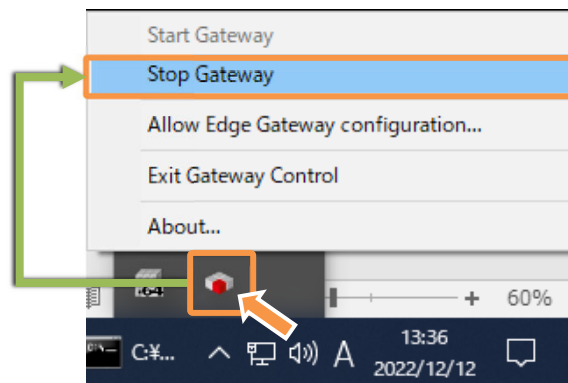
- 3) Double-click [Port (COM and LPT)] in the Device Manager window.



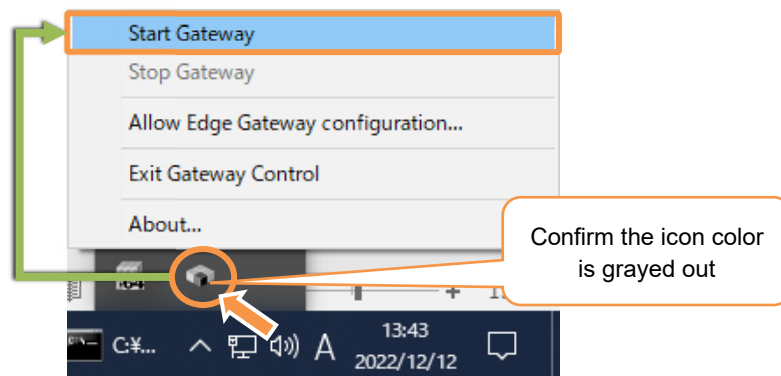
The COM port number at the (COM**) part should differ depending on the condition of use of a PC.

6) Reboot the gateway.

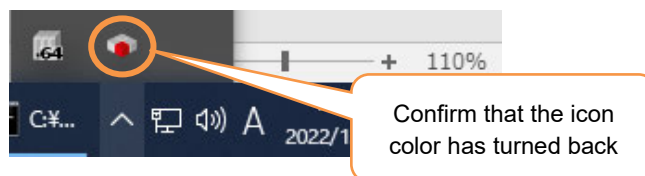
Click the CODESYS icon  at the right bottom of the window, and select "Stop Gateway".



7) Confirm the red color in the icon gets turned off, click the CODESYS icon in the same way and select "Start Gateway".



8) Confirm that the CODESYS icon has turned into red again, and the reboot has completed.



4.8.2 Setup for Connection to XSEL2

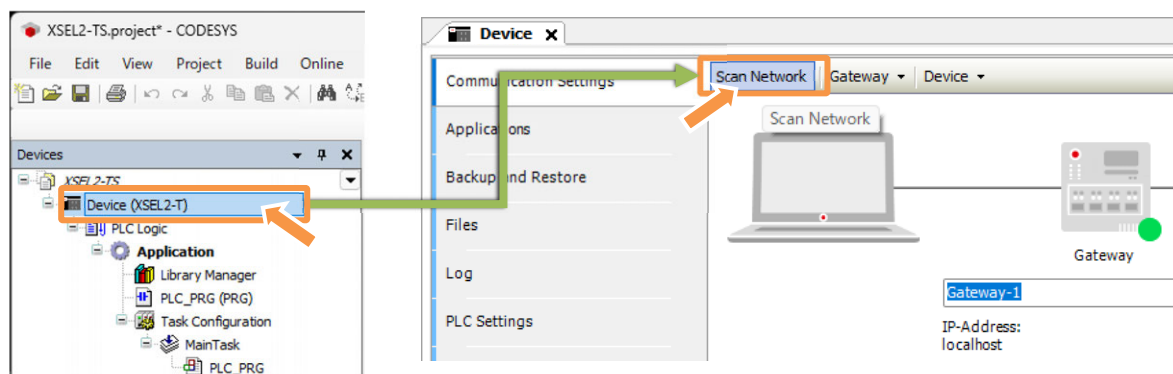
- 1) Link a PC and a controller with a USB cable or Ethernet cable.



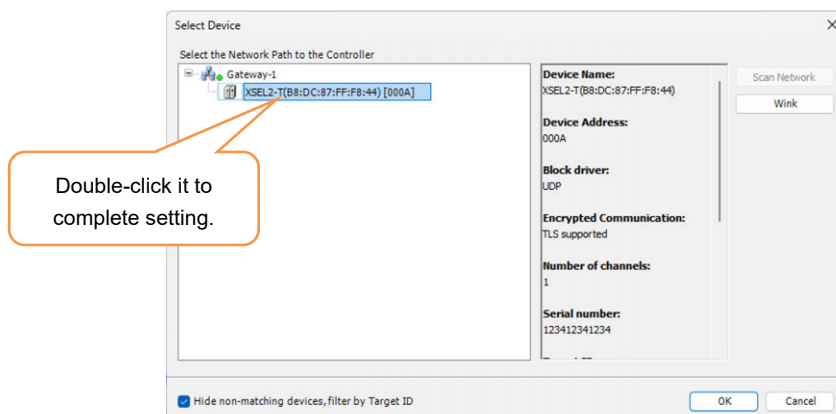
Caution

- Set a cable only to the communication port that will actually be used.
When there are a USB and Ethernet cables are wired at the same time, as USB should be prioritized, Ethernet connection should not be established.

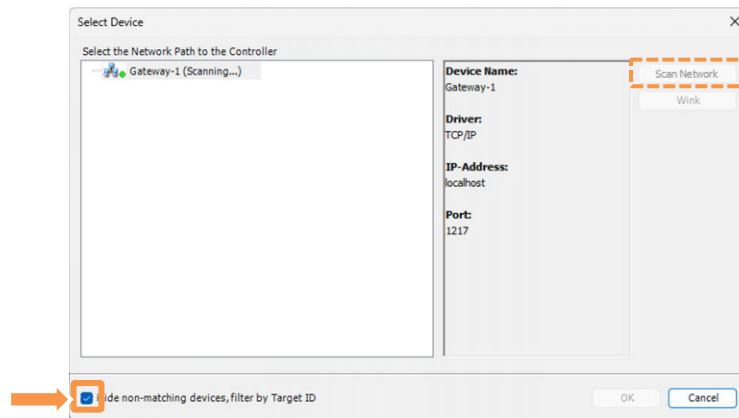
- 2) Double-click "Device" and click **Scan Network**.



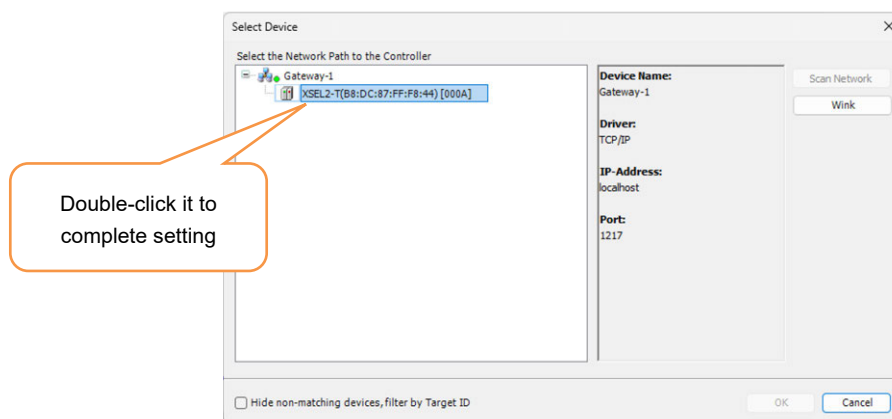
- 3) As the Select Device window opens, XSEL2 in the network should automatically be scanned. Once the detected device got displayed, select it with double-click to complete the setting. Confirm the setting in Procedure 7).



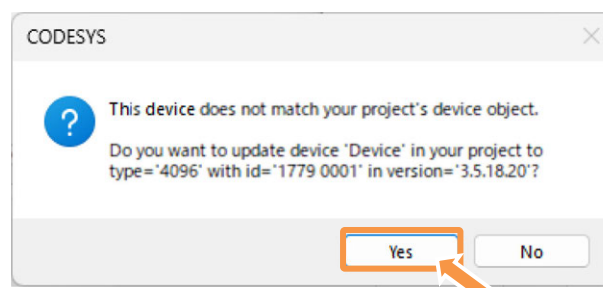
- 4) If the device is not detected, remove the checkbox at “Hide non matching devices, filter by Target ID”. Scanning automatically begins again.
(If required to scan again actively, select “Scan Network” on the top right)



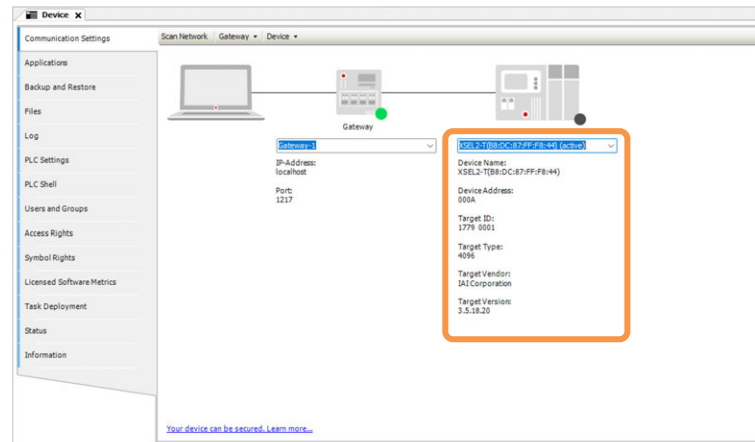
- 5) Double-click the detected device.



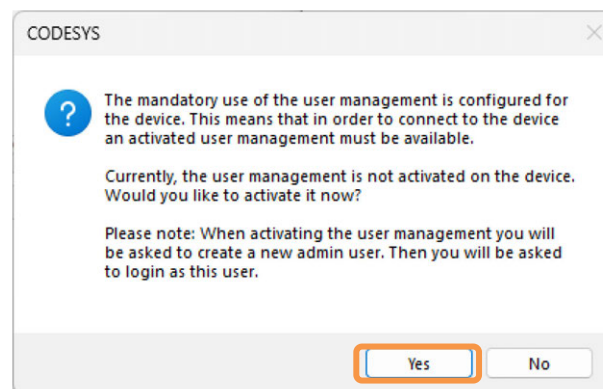
- 6) When a window to confirm the update of the device, select **Yes**.



- 7) Once the selected device is shown in the window, build and transference of the source gets available.



- 8) If it is the connection for the first time, a confirmation window for administration should appear. (It should not show up once the administration (adding device user) setup is completed.) Select "Yes".

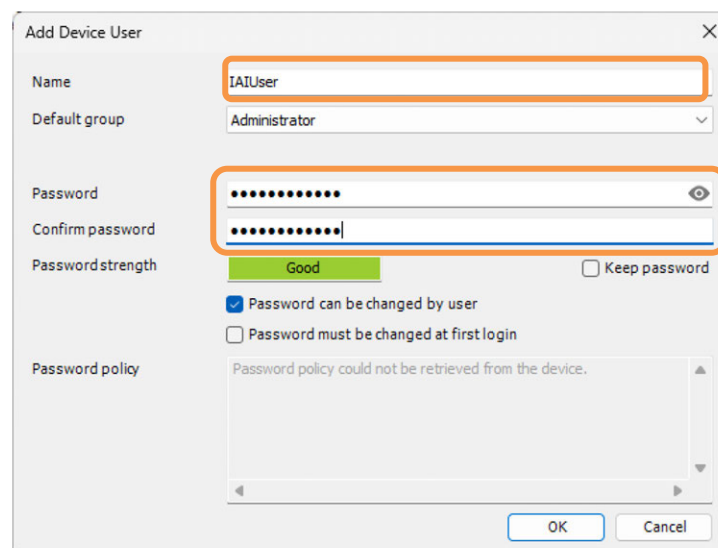


The "Register Device User" dialog box should open.

"Administrator" for the administrator privilege should be requested as the default group.

Set up the username and password for an administrator.

Refer to [7.2.1 Device User Feature] for the user groups.





Caution

- If you forget the username and password, you will not be able to log in.
Be careful not to forget.

As the login window should open, input the username and password that you have just set to log in.

Device User Logon

You are currently not authorized to perform this operation on the device. Please enter the name and password of an user account which has got the sufficient rights.

Device name:

Device address: 000A

User name: IAIUser

Password:

Operation: View
Object: Device

OK Cancel

For how to register / change / delete a user, refer to [7.2.1 Device User Feature].

4.8.3 Login / Logout

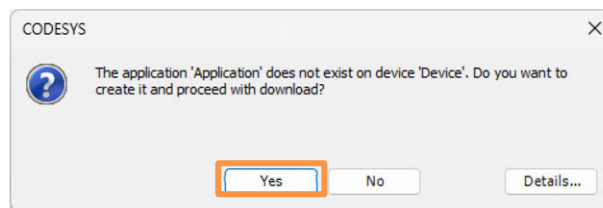
[1] Login

When writing in a program to XSEL2 after the build is established, it is necessary to log in. To log in, select the “Login” or go to “Login” from the “Online” menu.



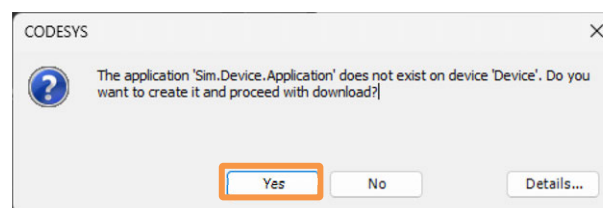
If the application (program) is not found, the following message should be displayed.

Click and the download should start.

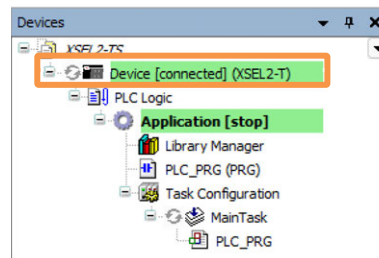


If there is an unknown application in the PLC, the following message should be displayed.

Click and the download should start.



Log in, and it should show “Connect Complete” in the “Device” box in the device tree.



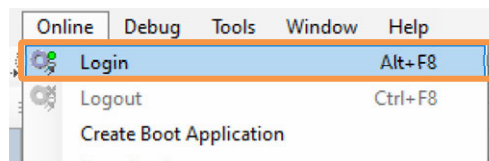
Online Change:

The online change is a feature to change a program without stopping operation while the PLC is operating. The online change downloads only program parts that were changed.

How to Make Online Change

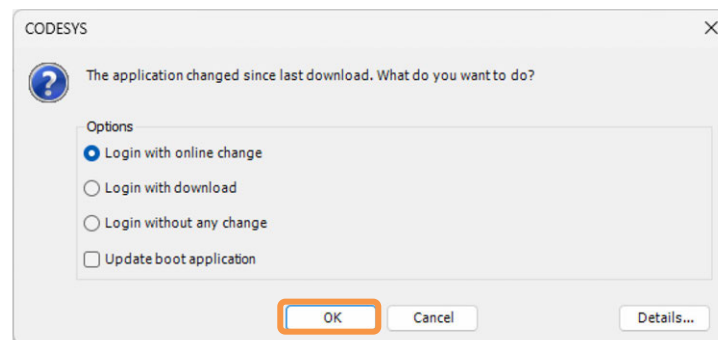
When it is necessary to change a PLC program in operation, it is required to log out before changing the program.

Select “Online” → “Login” after that.



As the following dialog will be shown, select “Login after Online Change”.

The detail of operation for each option is as described below.



- Login after Online Change: Only differential programs should be transferred without stopping other programs.
- Download and Login: All programs should be transferred. All the programs should be compulsorily stopped.
- Login without Change: Only login should be conducted without transferring the changed programs.

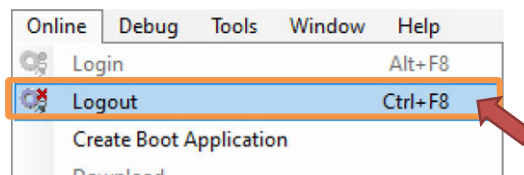


Caution

- The online change should change programs in execution and reboot. Some systems may make error to operation of devices, which could cause damage or accident. Have enough validation to ensure that a new program operates in normal condition in the applicable system.
- The pointer variables when the online change is conducted, the last value in a cycle should be retained. When the pointer points at a variable that the size has been changed as a result of the online change, it gets unavailable to refer to the correct value. Confirm that the pointers are reallocated in each cycle.

[2] Logout

Click the icon or select "Online" → "Logout".

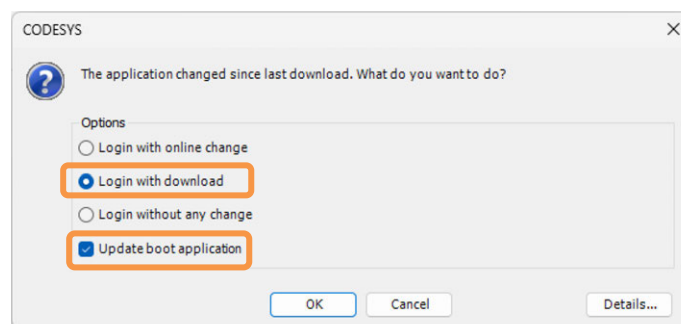


4.8.4 Creating Boot Application

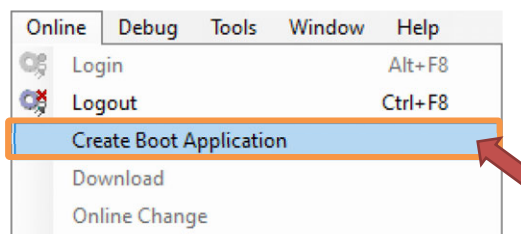
It should not be written in as a boot application in the default setting when logging in after a build. Therefore, once the power gets turned off, the transferred application should be erased.

In order to make the application launched even after the power gets turned on again, it is necessary whether to update the boot application at the same time as download at login or to write in the boot application by executing “Generate Boot Application” from the “Online” menu.

- Option Setting at Download
 - Select “Login with download”
 - Put a checkmark at “Update boot application”.



- Execute “Create Boot Application” from the “Online” menu.



Caution

- The downloaded application requires to have a few tens of seconds or a few minutes to write into the flash ROM. While in process, do not attempt to “reset”, “reboot” or “turn the power OFF”.

4.8.5 Precautions

In CODESYS for XSEL2, there are status of “logged in” and “logged out” which are switched over during development.

- Status Logged Out

It is the status that CODESYS for XSEL2 is launched.

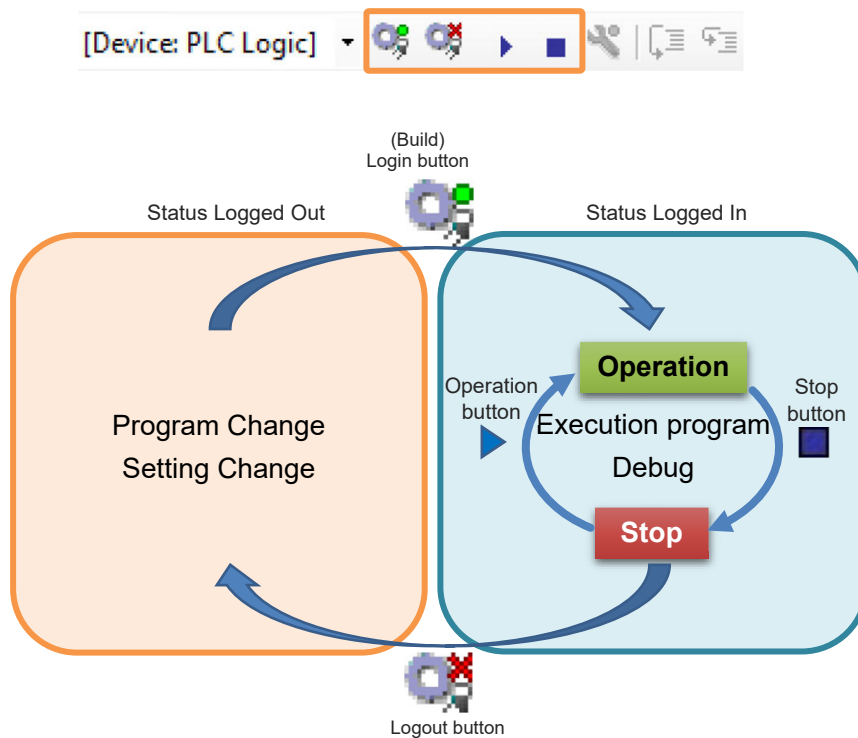
Change in codings and settings can be made.

- Status Logged In

Operation and debugging in a program can be made.

Also, when the status is logged in, operation and stop in a program can be switched over.

Work	Status Logged In	Status Logged Out
Program Change	available	unavailable
Setting Change	available	unavailable
Switchover between Operation/Stop in Program	unavailable	available
Break Point and Step Movement	unavailable	available
Watch Feature	unavailable	available
Connection to XSEL2	Unnecessary	Unnecessary



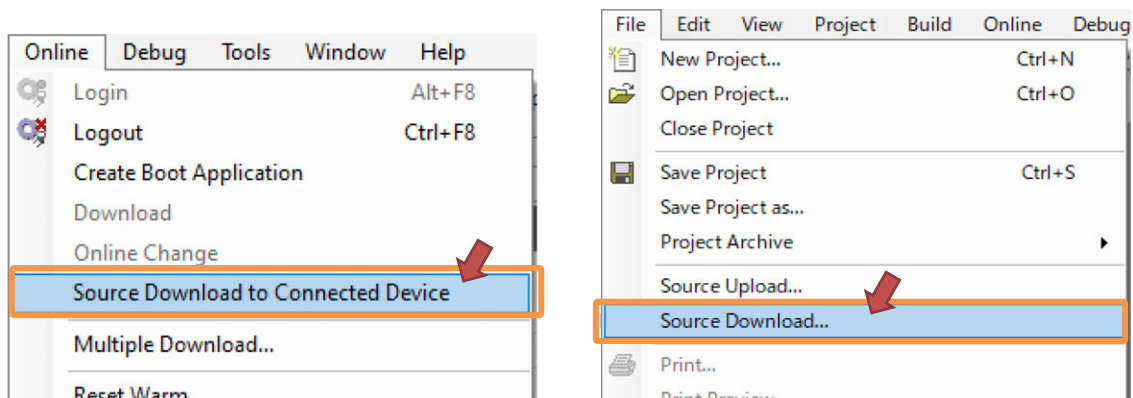
4.9 Downloading / Uploading of Source

The source file is a base file for an application file that PLC executes that includes all the data such as variable name, comment and program languages.

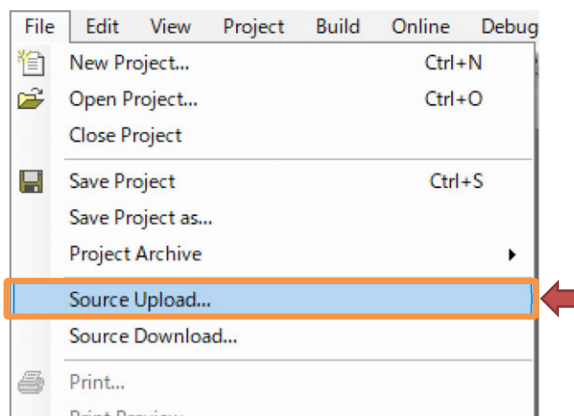
To write a source file into PLC, go to “Online (O)” → “Source Download to Connected Device” or “File (F)” → “Source Download...”.

To read a source file out from PLC, to to “File (F)” → “Source Upload...”.

● Writing to PLC



● Readout from PLC

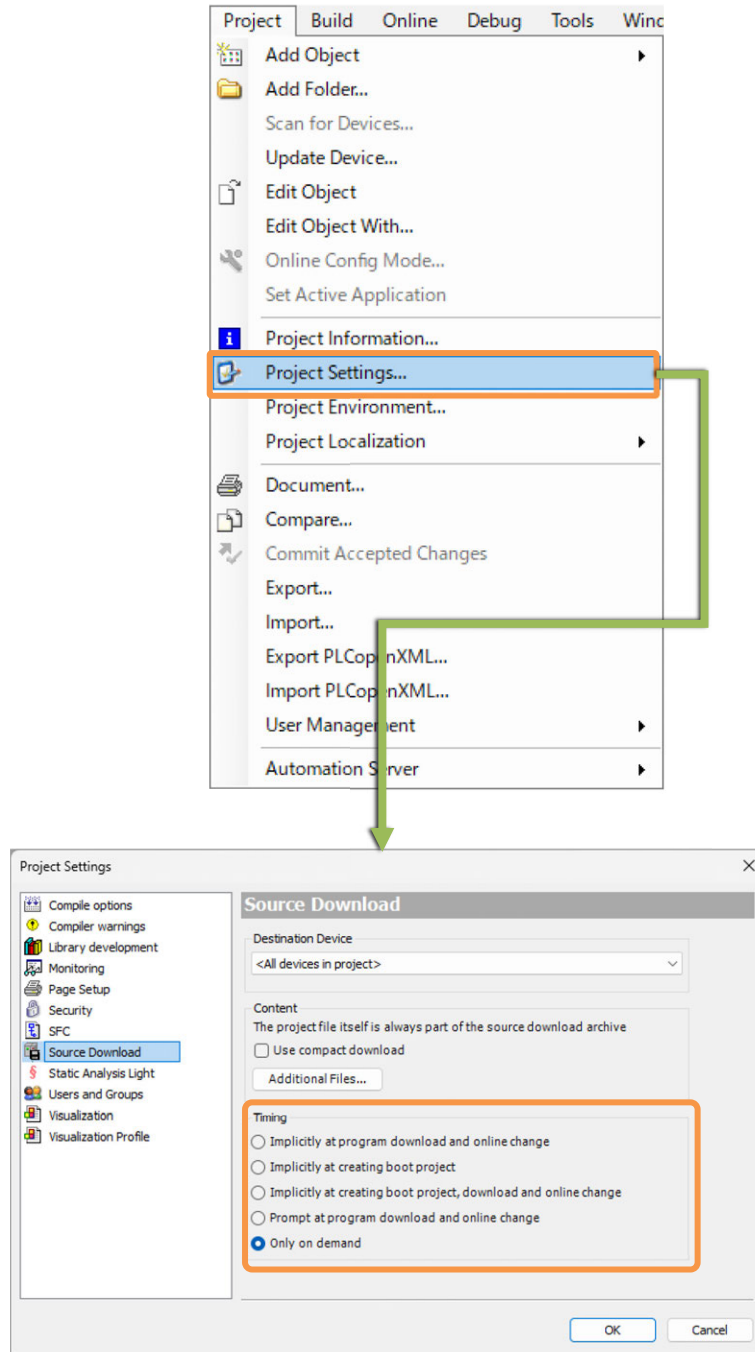


Point ! When there is no CODESYS project file which a user program was created with, it is recommended to save it to PLC as the user program cannot make any change without a source file.

● Transfer Timing

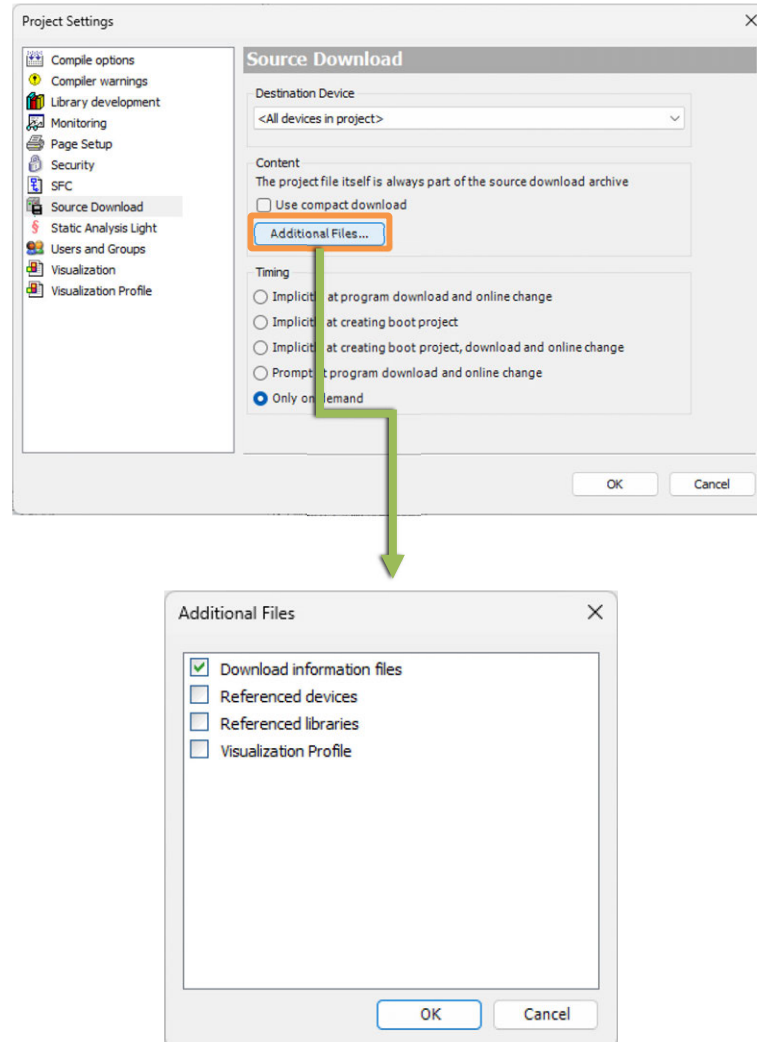
The timing to transfer the source file can be changed at “Project” in the menu from “Project Settings” → (Project window opens) → “Source Download”.

It is set to “Transfer Only when Required” in the default setting. When it is required to change an application program and always to link, select “Create Boot Application, Download, Implicitly Transfer in Online Change”.



- Download Data File

What data is to be included in the source file can be selected as required in “Project” → “Project Settings” → “Source Download” → **Additional Files...**.



The “download data file” in the additional files is necessary when conducting online change without stopping PLC. When there is a source file including the download data in PLC, online change gets available by uploading the source.

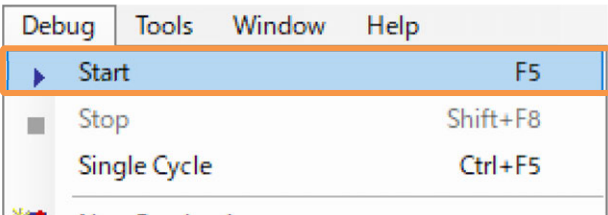
4.10 Operation / Stop / Reset

4.10.1 Operation / Stop

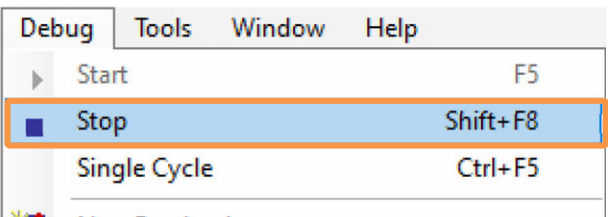
Operation / stop of a program should be conducted with “Start” / “Stop” in the CODESYS for XSEL2 “Debug Menu” or AUTO/MANU switch on an XSEL2 Controller.
The position of the switches and PLC status by user operation are as shown below.

User Operation \ Switch Position	MANU	AUTO
Power On or System Reboot	Stop	Operation
Operation from CODESYS for XSEL2	Start	Operation
Stop from CODESYS for XSEL2	Operation	Stop

- Operation methods
Click the icon or select the debug “Start”.



- Stop methods
Click the icon or select the debug “Stop”.

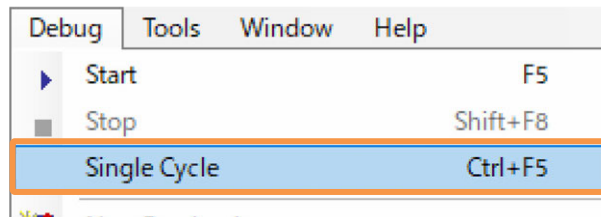


4.10.2 Single Cycle

In order to check that the created program will be executed as expected, the application can be run for one cycle only.

Press "Single Cycle" in "Debug Menu" in CODESYS for XSEL2, and the program should be executed for one cycle only.

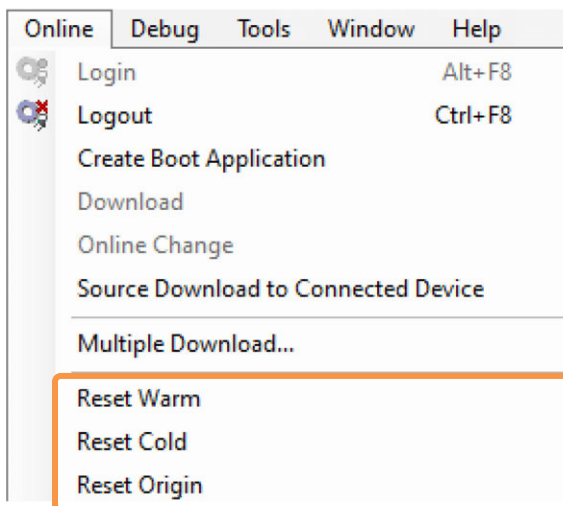
If there are several tasks, regardless of the task frequency, all the tasks should be executed for one cycle only.



4.10.3 Reset

When an “exception error” such as a watchdog error and division by zero is occurred, the program should stop. If CODESYS for XSEL2 is connected, the exception display should be shown at the bottom of the window.

Have a reset operation to cancel the exception error. Make operation without the reset operation, and it will stop again. Select Reset Warm / Reset Cold / Reset Origin from the “Online” menu.



There are “Reset Warm” and “Reset Cold” in the reset, and the details of initialization should differ. For initialization, refer to [4.10.4 Initialization].

4.10.4 Initialization

It is necessary to conduct the initializing operation to cancel an exception error and initialize the contents of the non-volatile memory.

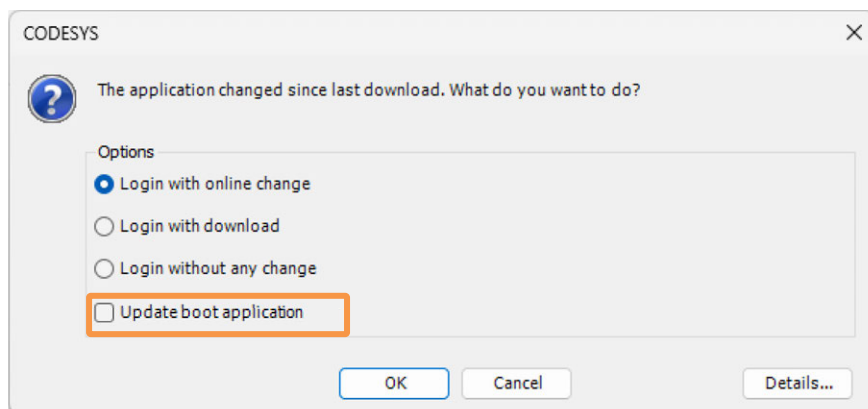
The impact to data by reset operation and user operation are shown in the table below.

O: Retention, ×: Initialization

User operation \ Data	Standard Variable (VER)	Retaining Variable (VER RETAIN)	Persistent Variable (VER PERSISTENT)	Application (Volatile memory)	Boot Application (Non-volatile memory)
Stop	O	O	O	O	O
Warm Reset	×	O	O	O	O
Cold Reset	×	×	O	O	O
Reset (PLC initialization)	×	×	×	×	×
Download	×	×	O	Update	Update* ¹
Online Change	O	O	O	Update	Update* ²
System restart		O	O	×	O

*¹ If Select Option is shown, it should follow that settings, and update will be done when it is not shown.

*² If Select Option is shown, it should follow that settings, and update will not be done when it is not shown.



4.11 Debug

4.11.1 Monitoring

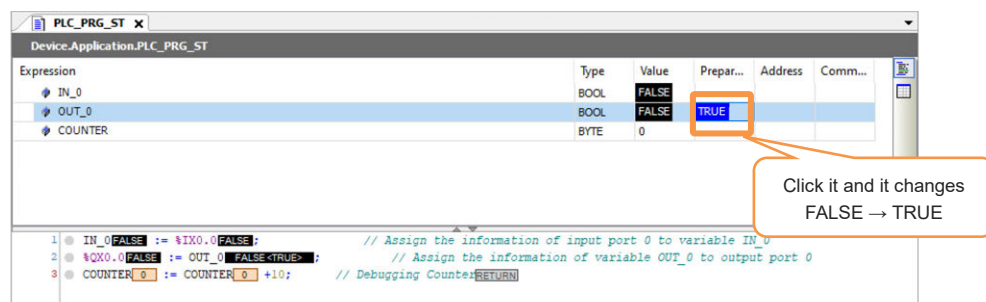
Log in, and the current values of the variables can be checked in the variable declaration part and in the program window.

● Monitoring in Variable Declaration Part

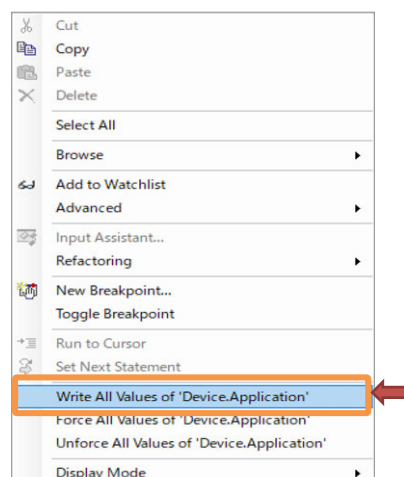


Variables can be written over as required. The procedures are as below.

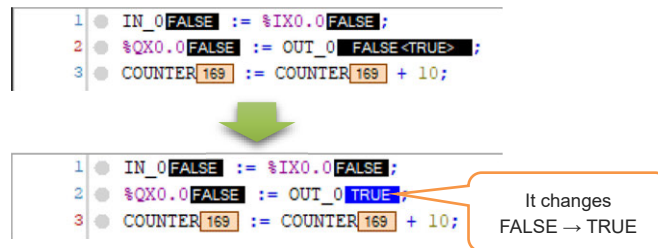
- 1) Click "Values Already Set" in the variable definition part, and make a change to the settings. If the variables are in such as BYTE Format, input a desired number directly.



- 2) Right-click the setting after changed to show the menu tree, select "Write All Values of 'Device.Application'" and the changed values should be reflected to the variables.



- 3) The indicated variables should be overwritten. Confirm that it is reflected to the output.



● In-Line Monitoring in Program Window

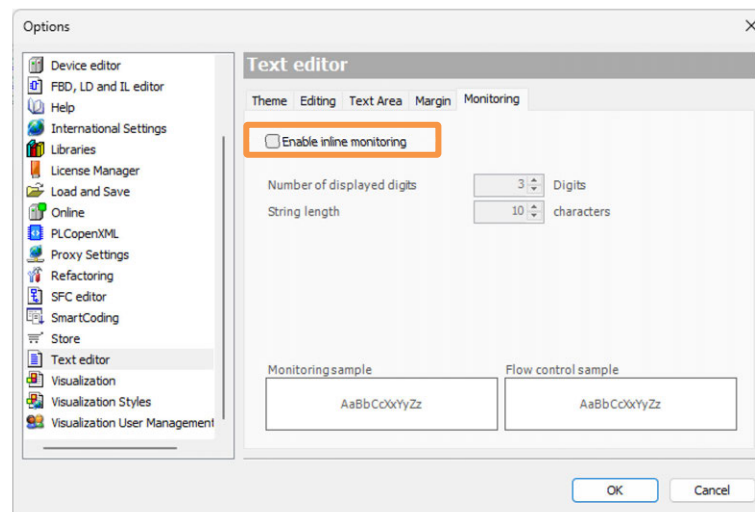
```
IF ((udiCnt 16#10940B50 MOD 10#1000000) = 10#0) THEN
  xSel TRUE := NOT xSel TRUE;
  bySel 16#00 := bySel 16#00 + 1;
  IF (bySel 16#00 > 2) THEN
    bySel 16#00 := 0;
  END_IF;
END_IF;
```

The current value should be shown beside the variables.

For the contact, coil and link line should be displayed in blue when the current value is “TRUE”.

The in-line monitoring should get disabled.

Show the option window in “Tool” → “Option” and remove the checkmark at “Enable In-Line Monitoring” from the “Monitoring” tab in the “Text Editor” category.

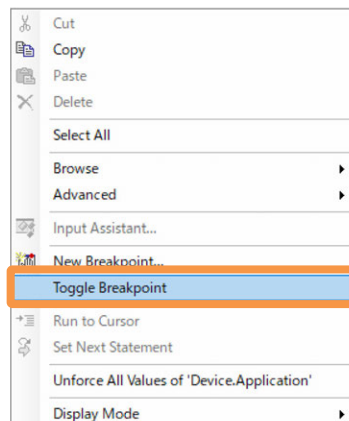


4.11.2 Break Point

By setting up a break point in a program, execution of the program can be paused. After the pause, the operation should be able to check one line by one by executing steps.

[1] Break Point Setting

In order to set up a break point, right-click at the applicable line in Online Mode and select "Toggle Breakpoint".



Example) When setting a break point to the 3rd line

```

1  IN_0 FALSE := %IX0.0 FALSE;
2  %QX0.0 FALSE := OUT_0 FALSE;
3  COUNTER_249 := COUNTER_249 + 1;

```

Start operation, and the operation should stop at the point where the break point was set.

```

1  IN_0 FALSE := %IX0.0 FALSE;
2  %QX0.0 FALSE := OUT_0 FALSE;
3  COUNTER_250 := COUNTER_250 + 1;

```

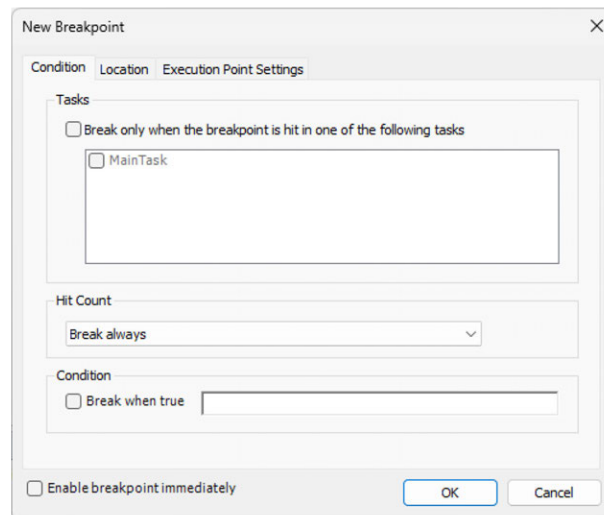
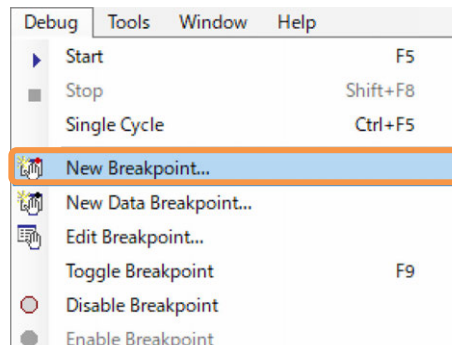
The following debugging operation are available to execute while in stop.

- Step Over
- Step In
- Step Out
- Execution up to cursor line
- Set to next sentence
- Show current sentence

To delete a set break point, right-click again and select "Switch Break Point".

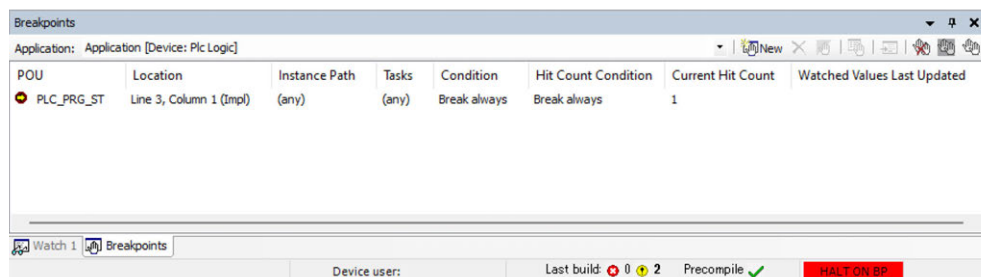
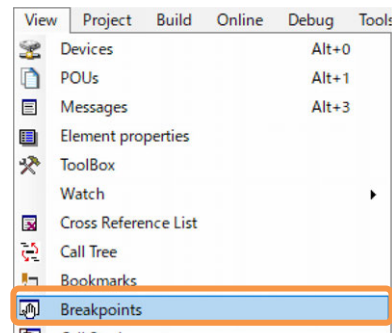
A condition to stop operation at a break point can be set. Select “Debug” → “New Breakpoint” in the menu bar, and the “New Breakpoint” dialog box should open.

Select the “Condition” tab, and input a condition to stop at a break point.



In the break point view, the settings of break points can be checked in a list. A position of a break point, break condition and reached count can be checked. Adding, deleting, activating and deactivating of a break point is also available.

To display the break point view, select “Menu bar Display” → “Breakpoints”.

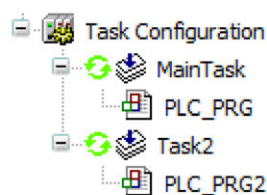


Caution

- If a break point is set in the following conditions, a PLC program should stop and connection to CODESYS for XSEL2 may get disabled. In order to recover the communication, reboot of XSEL2 should be required.

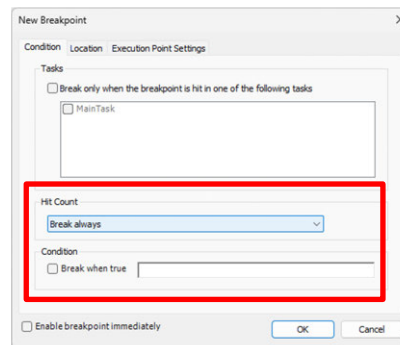
[Conditions Tend to Occur]

- (1) When PLC programs are used in multi-tasks

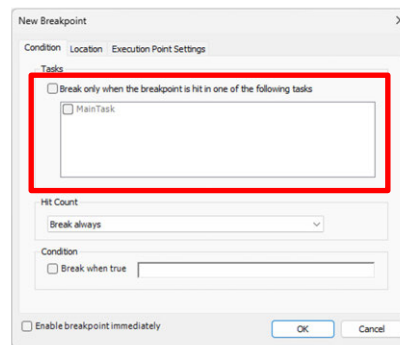


(Next page)

- (2) When “Reached Count” and “Conditions” are indicated in the conditions at the same time



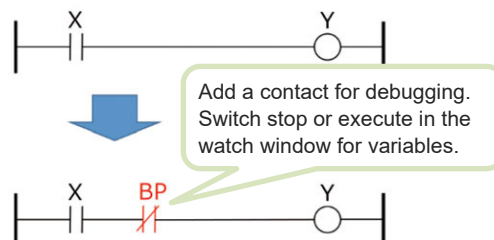
- (3) When “Break only when the breakpoint is hit in one of the following tasks” option is activated in the conditions



- (4) When a break point is set in another program during stop at a break point

[Example of Countermeasure when Problem Occurred]

Do not use the break point feature in CODESYS for XSEL2, add a contact (“BP” in the following example) used as a pseudo break point to a position that you would like to stop at a break point in a PLC program, and switch the contact for debugging from true (stop) to false (execute) from the watch window to conduct a debugging.

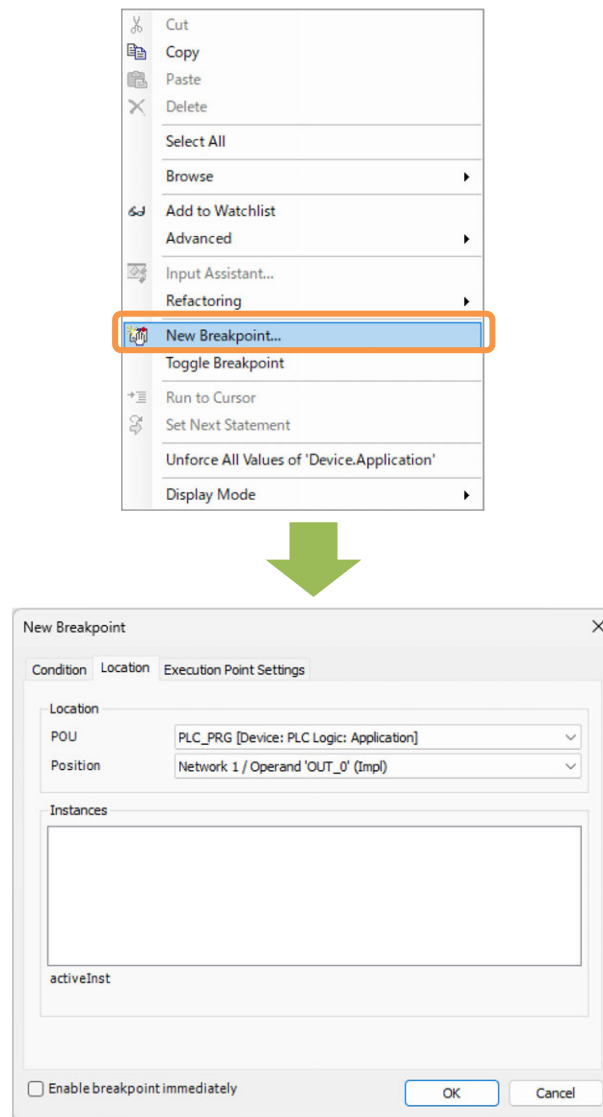


[2] Setting Execution Point

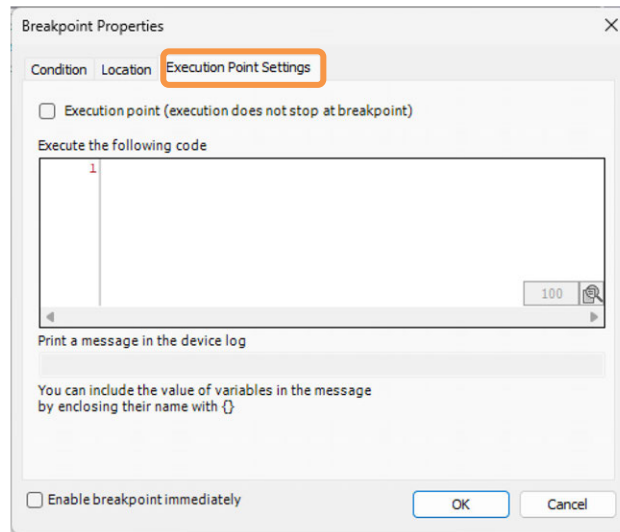
Set an execution point, and the process indicated the point set as the execution point in advance should be executed and can be output to the device log. The application should not stop at the position set as the execution point.

[Setting Procedures]

- 1) Select a point that you would like to set the execution point, select "Debug" → "New Breakpoint" in the menu bar, and the "New Breakpoint" dialog box should open.

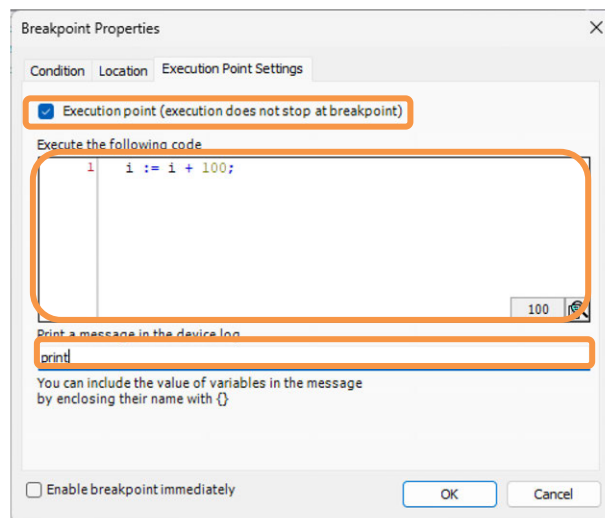


- 2) Click the “Execution Point Settings” tab, and the setting window for the execution point should open.



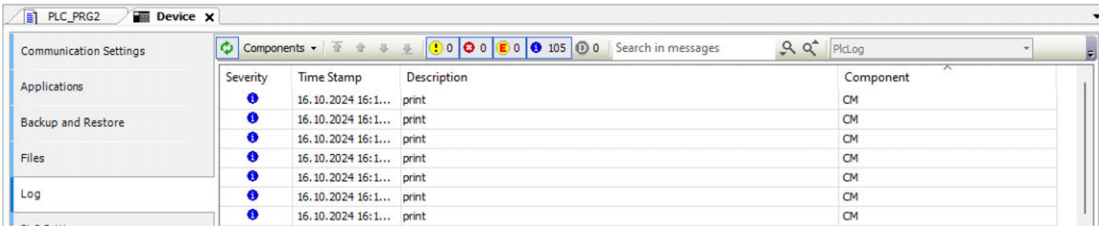
- 3) Put a checkmark to “Execution Point” and input the “Executed Code” and “Message to Output to Log” in the execution point.

In parallel, describe an execution code in the ST program in the “Execute the following code” box, and input a message to output to a log in the “Output a message to device log” box.



- 4) Click **OK**, and the execution point should be set.

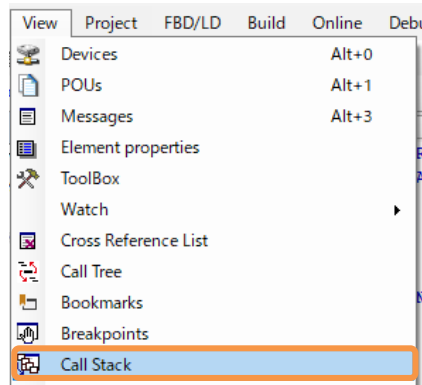
5) When it is output to a device log, it should get displayed in the device log window.



[3] Callout History View

In the callout history view, the stop position can be checked during a stop at a break point and so on. When the position is called out from another block, that point can also be checked.

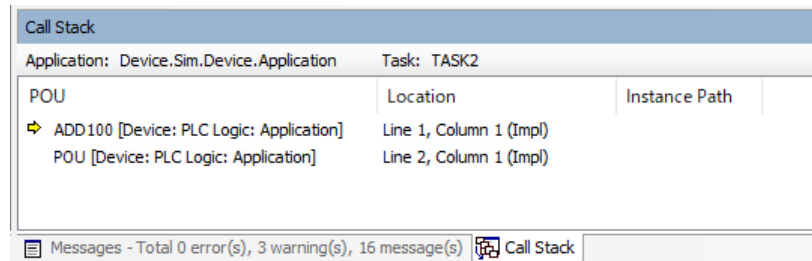
- Select “Display” → “Call Stack” in the menu bar, and the callout history view can be displayed.



- Set a break point and stop the application.

The stop position and the POU calling out the POU at the stop position should be shown.

Example) When stopped at the 1st line of “ADD 100” function and the “POU” is calling out “ADD 100”.

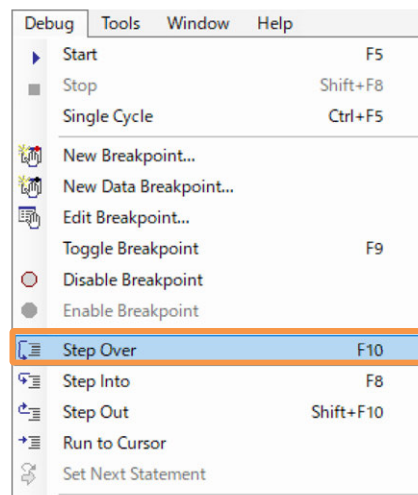


4.11.3 Executing Steps

There are four types of the step execution feature. The step execution feature should come available after a break point is set in a user program and the program is paused.

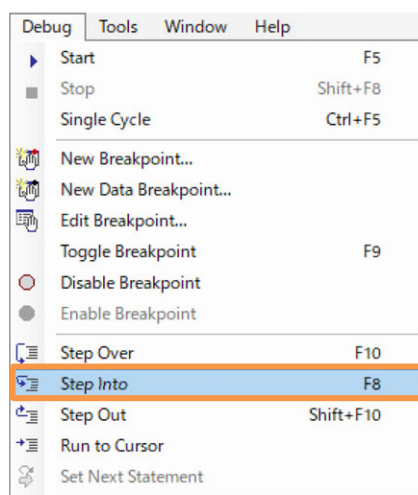
- Step Over

The steps should be executed one by one, and if the current execution step is under a callout of POU, all the POU to call out should be executed and then it goes back to the next step to the one that called POU.



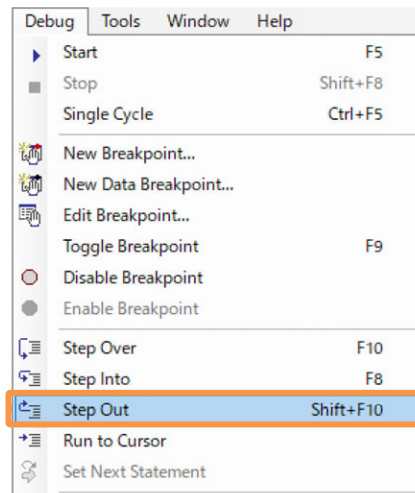
- Step Into

The steps should be executed one by one, and if the current execution step is under a callout of POU, it should go into the called POU.



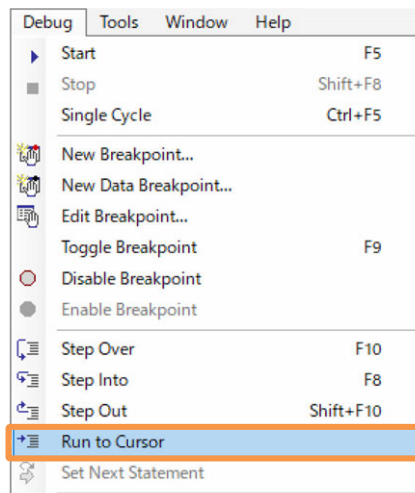
- Step Out

All the remaining programs should be executed and it goes back to the top program. If the current execution step is inside the called out POU, all the programs in that POU should be executed and then it goes back to the next step to the one that called POU.



- Run to Cursor

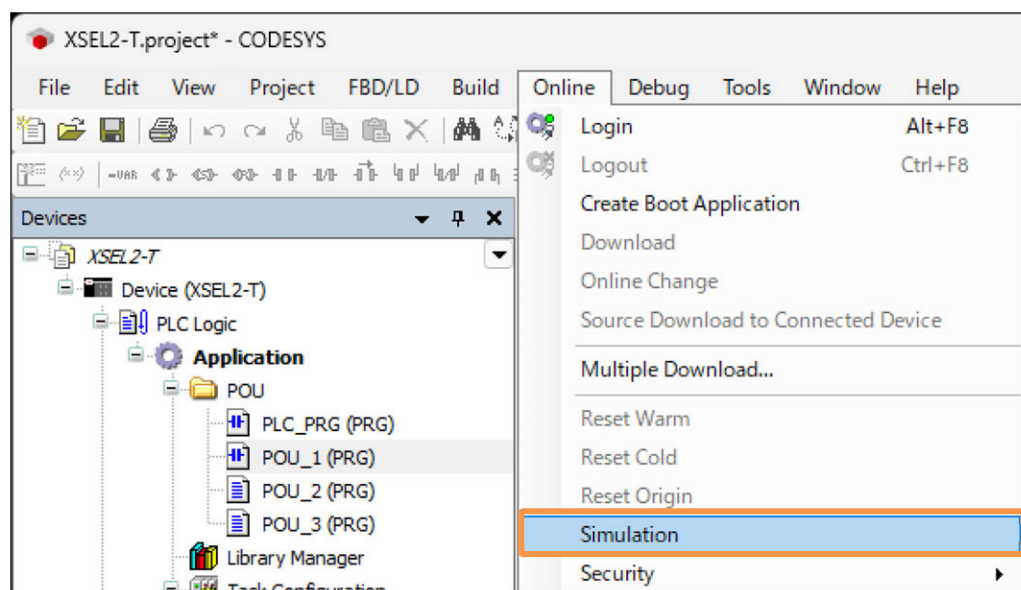
Programs up to one line before a position where a cursor is placed should be executed.



4.12 Simulation

In the simulation feature of CODESYS for XSEL2, a program can be transferred to the virtual controller inside a PC and be executed without an actual device of XSEL2.

Select “Online” → “Simulation” and it goes to the simulation mode. After that, log in the same way as normal online operation and conduct operation / debug. To cancel the simulation mode, select “Simulation” again.



4.13 Tracing Feature

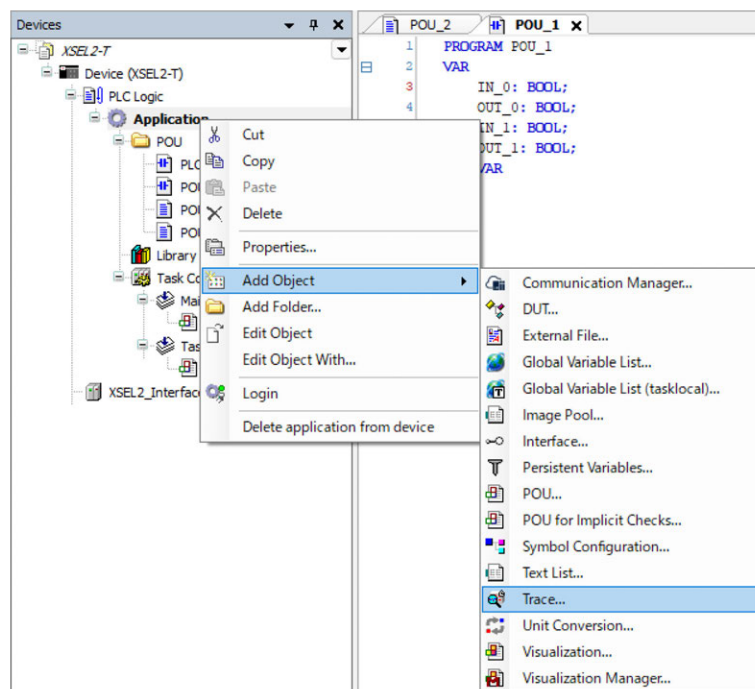
Use the tracing feature, and the variables history of CODESYS in XSEL2 Controller can be checked in CODESYS for XSEL2.

The timing to start tracing can be indicated in the option. The recorded data can be checked in a graph.

Also, data acquired by the tracing feature can be stored in a PC.

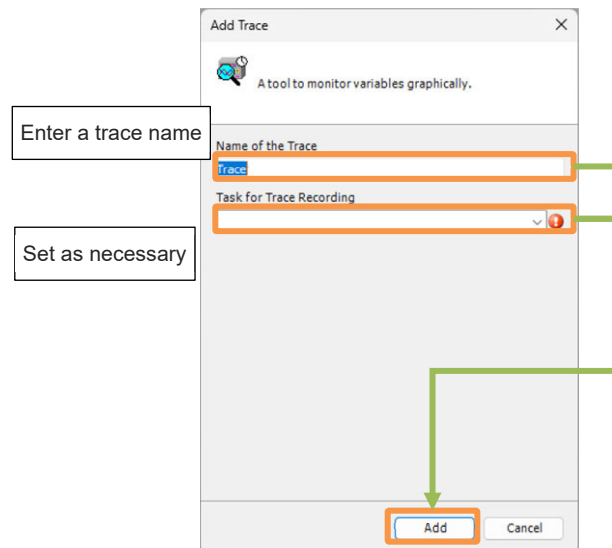
4.13.1 Setting up Tracing

- 1) Right-click "Application" displayed in the device tree, and select "Add Object" → "Trace...".



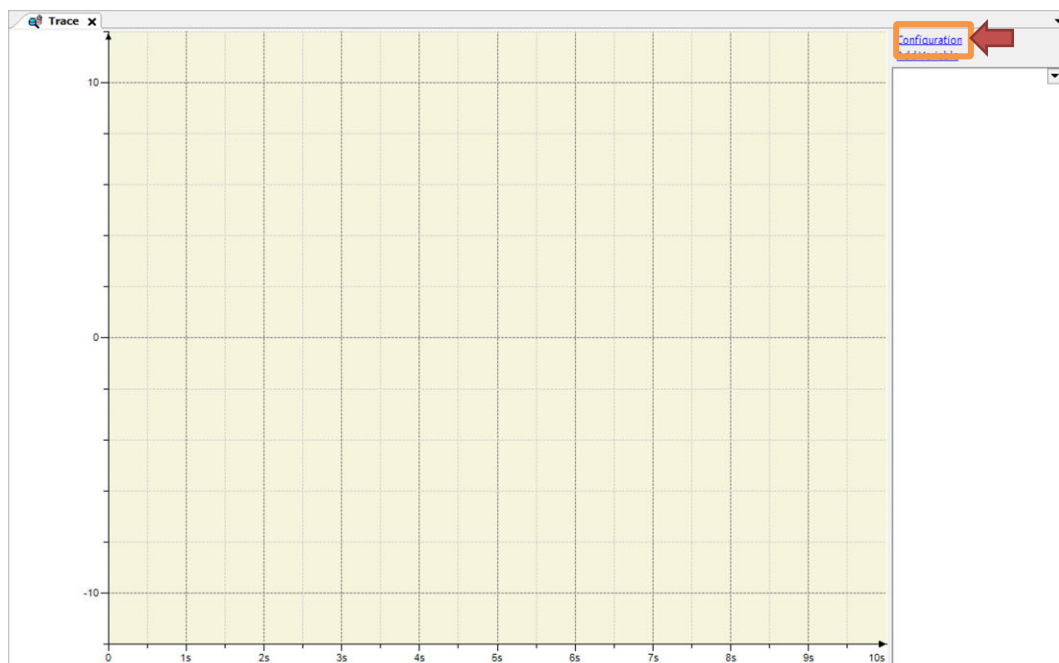
- 2) Set up the “tracing name”. Set up “Task for Trace Recording” as necessary. The execution frequency of a task set here will be the sampling frequency in tracing.

Click **Add** once setting is complete.

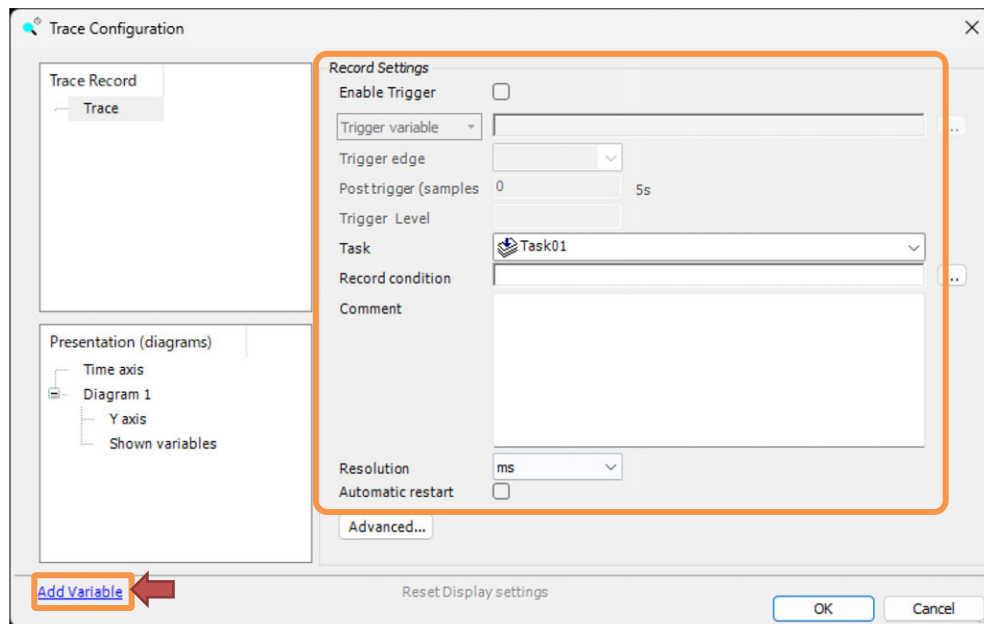


Point ! If the load of tracing tasks is too high, it may impact the process in the user program. It is recommended to lower the priority of the tracing tasks.

- 3) Click **Configuration** in the Trace window.

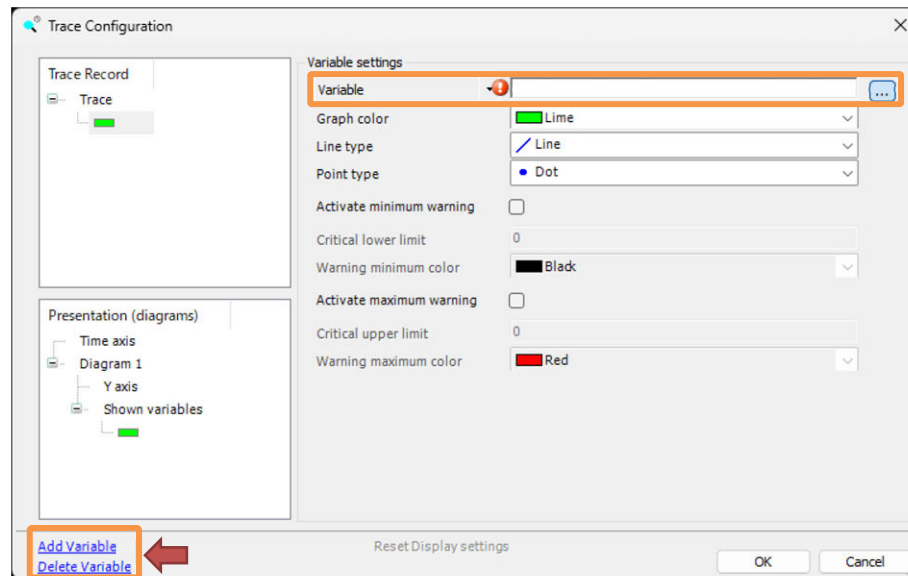


- 4) Once the Trace Configuration window has shown up, set up tasks to trace in “Task”. Set up others as necessary. Once the setup is finished, click **Add Variable**.

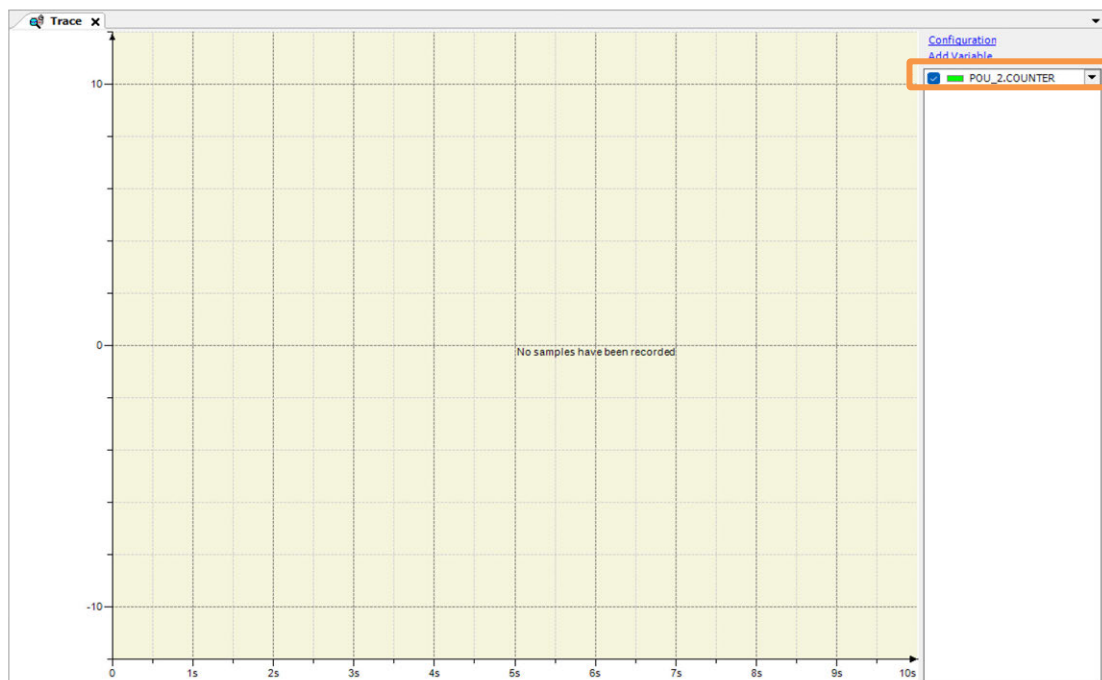


Item	Description
Trigger Variables	Input a variable to be used as a trigger. String Type, WString Type and Array Variables are no available as a trigger.
Trigger Edge	Select an edging condition for triggering. - Positive: Rising edge for boolean variables For those other than boolean variables, when raised to trigger level value - Negative: Falling edge for boolean variables For those other than boolean variables, when fell to trigger level value - Both: For boolean variables, when a value changed For those other than boolean variables, when reached trigger level value
Post Trigger (Sample)	Input the record count for each trace variable put in buffer after triggering. Default: 50, Value Range : 0 to $(2^{32} - 1)$
Trigger level	Input a value in trigger level.
Task	Select a task to trace.
Record condition	Input the record condition. Input it referring to the online help.
Comments	Input a comment.
Precision	Select a unit of the recorded time stamp. - ms : Millisecond - μs : Microsecond
Automatic resume	Select enable/disable of automatic resume. Put a checkmark on this and tracing should automatically start if triggering still continues even after a device gets rebooted.

- 5) Set up a variable to trace in "Variable" box. Set up others as necessary. In the same way, click **Add Variable** to set it up when a new variable is required to be added. Once the setup is finished, click **OK**.

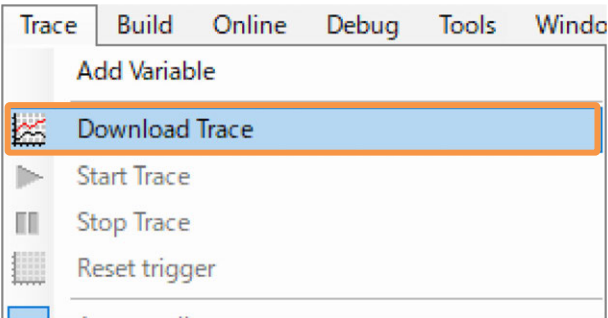


- 6) The variable subject to tracing should be added.

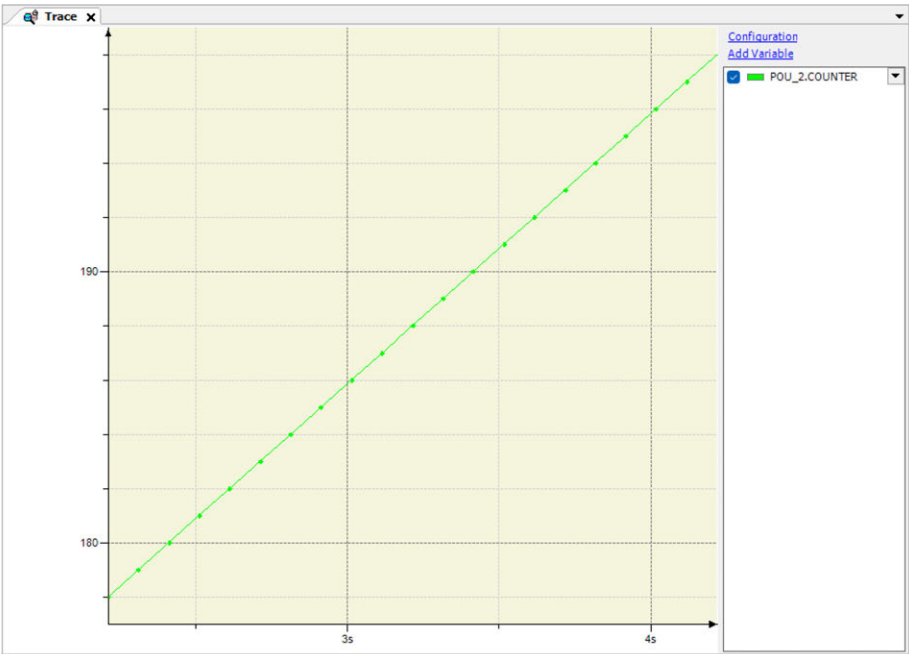


4.13.2 Executing and Stopping Tracing

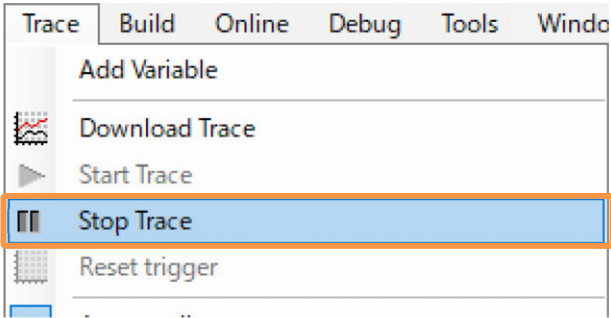
After login, click “Trace” → “Download Trace” in the menu to download the tracing data.



The tracing data should be shown following the set contents.

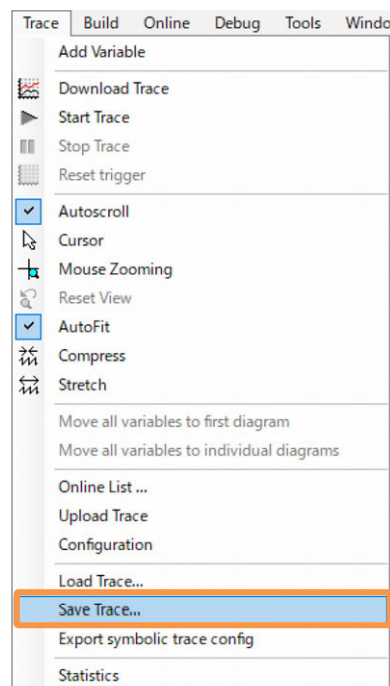


To stop tracing, click “Stop Trace” in the trace menu to stop it.

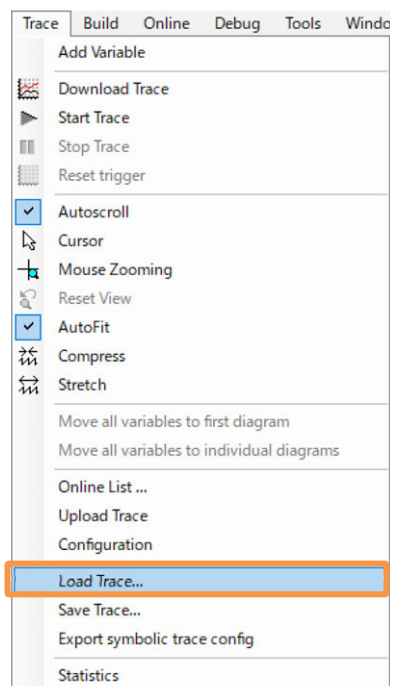


4.13.3 Tracing Result, Saving and Loading

To save the result of tracing, select “Save Trace...” in the trace menu.

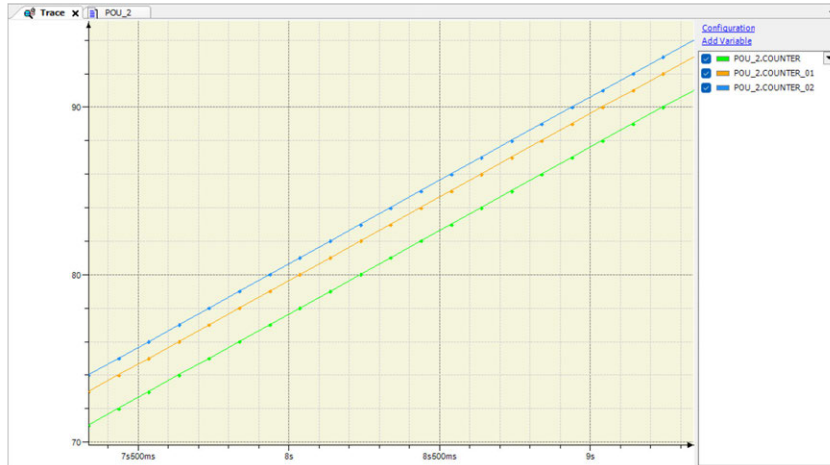


To load the result of tracing, select “Load Trace...” in the trace menu.

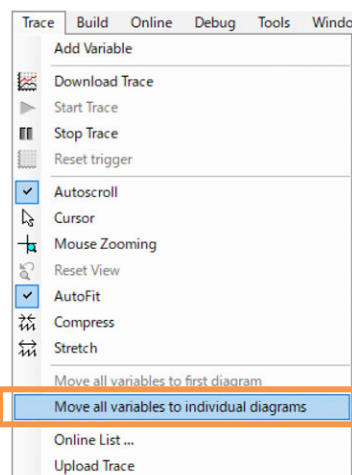


4.13.4 Showing Multiple Channels

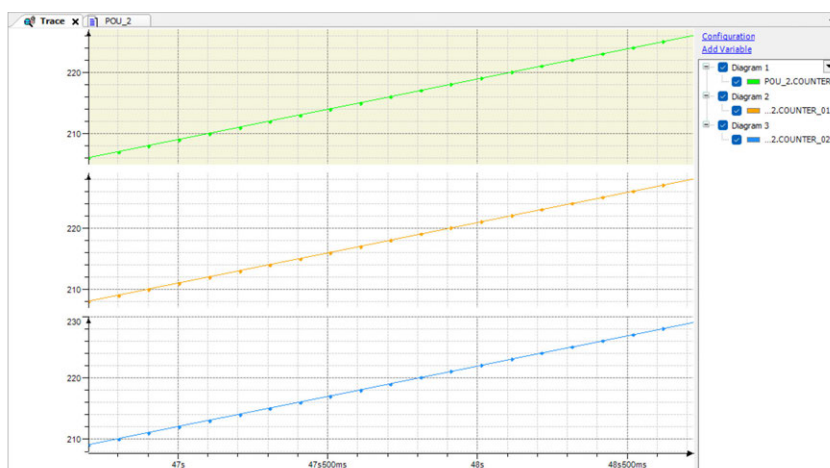
To trace multiple variables, there are the single channel display and multiple channel display available to select from. The figure below is the signal channel display.



In order to show the multiple channel display, select “Trace” → “Move all variables to individual diagrams”.



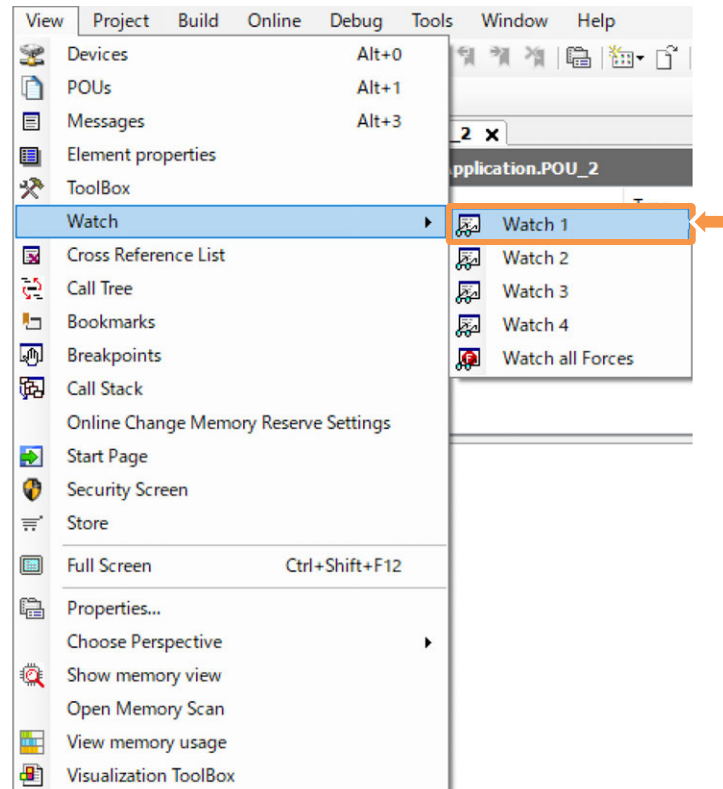
The multiple channels shows display as shown below.



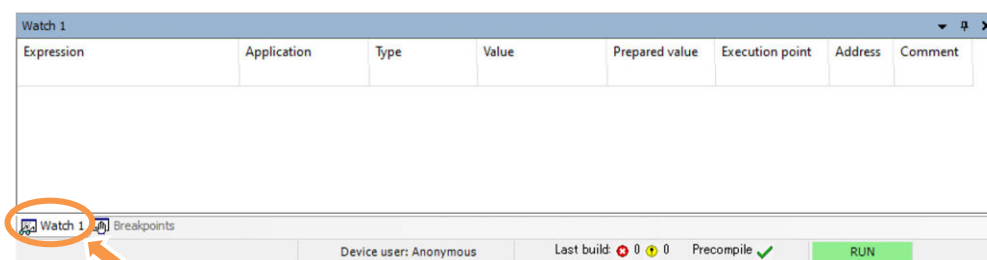
4.14 Watch

By registering variables in the Watch window, the indicated variable values can be monitored in real time.

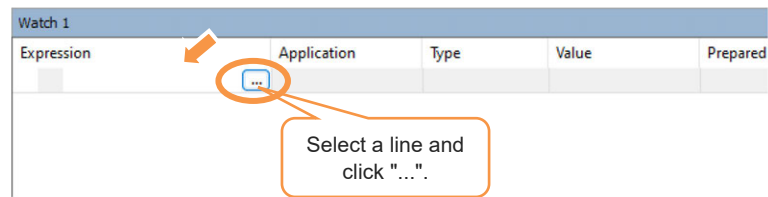
- 1) From the top menu, select “Display” → “Watch” → “Watch 1”.



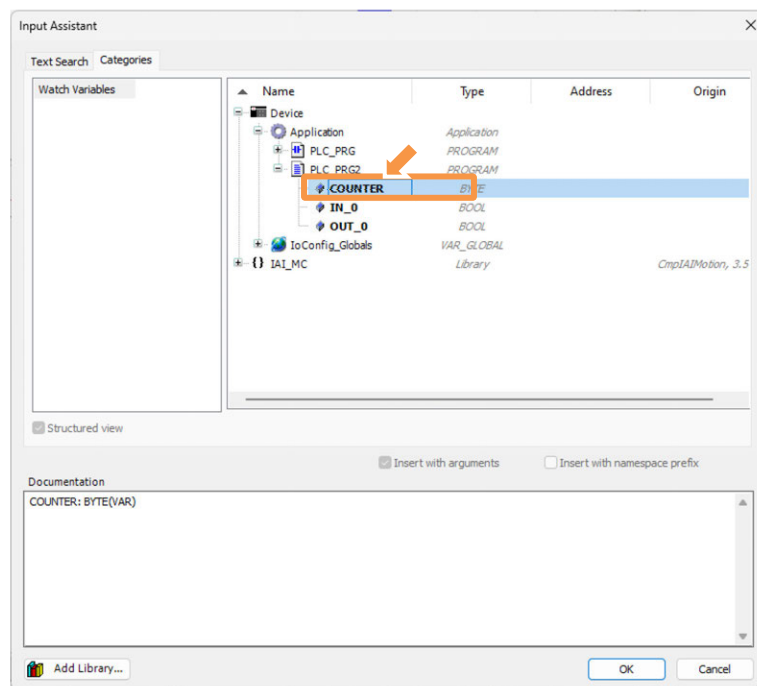
- 2) The “Watch 1” tab should be added in the message window.



- 3) Select the blank “Format” box in the “Watch 1” tab and then select “...”, and the input assistant window should appear.

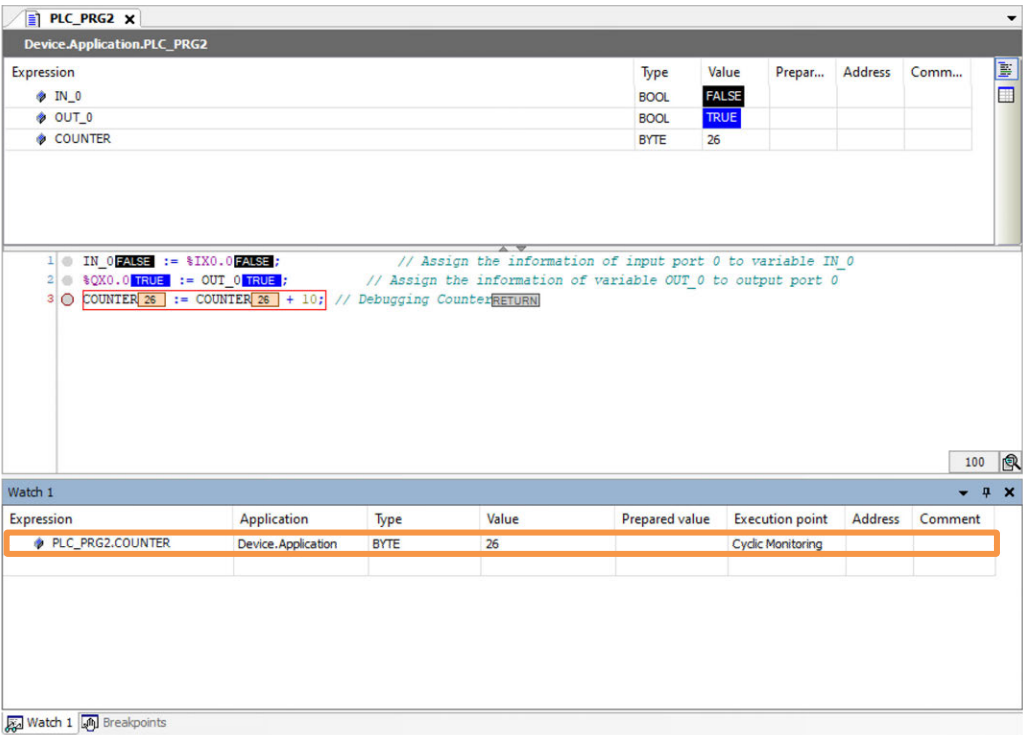


- 4) From the Input Assistant window, open the tree and select a variable that you would like to monitor.



Note In the example of the window, “COUNTER” Variable is selected.

- 5) A variable subject to monitoring should be added in the “Watch 1” tab, and you will be able to know the details of the variables in the “Value” box in real time.

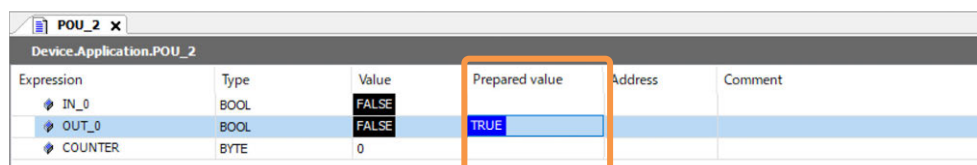


4.15 Write-in of Values

When it is required to update the setting values in the I/O Mapping window, conduct it as shown below.

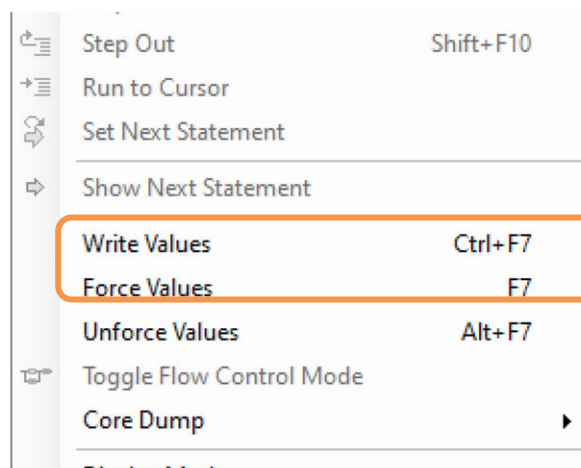
Note Change is available even for the values not used in programs.

- 1) Set up a value in "Prepared value".



Expression	Type	Value	Prepared value	Address	Comment
IN_0	BOOL	FALSE			
OUT_0	BOOL	FALSE	TRUE		
COUNTER	BYTE	0			

- 2) Select either "Write Values" or "Force Values" from the debug menu.

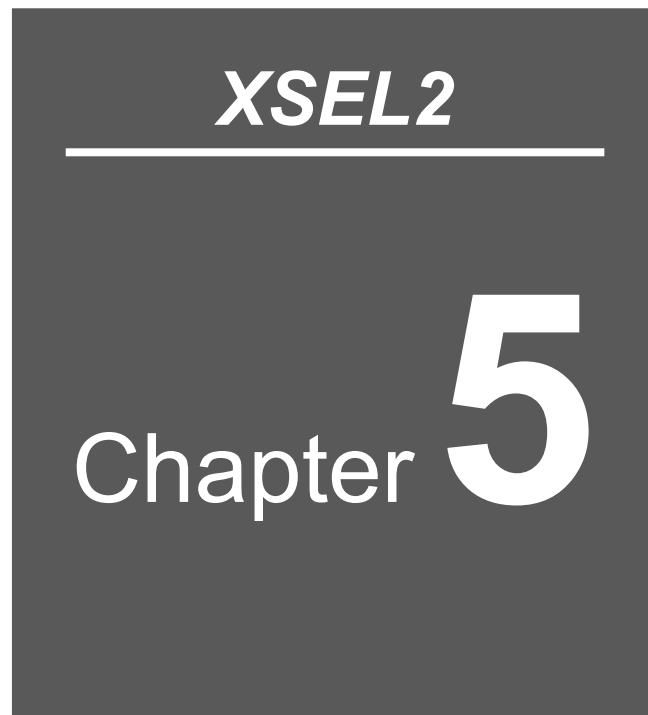


When "Compulsory of Values" is selected, overwriting should be compulsorily conducted at the start and finish of a program.



Caution

- Pay special attention to safety when conducting the compulsory of values and write-in of values. It may cause damage to the machinery or accident by operation mistake.



SEL Interface Feature

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5.1 Features overview

The SEL interface feature is a function to perform the followings:

- Data sending and receiving between PLC and SEL system
- External input and output from PLC to I/O option equipped in XSEL2

Between the software PLC and the SEL system, signals and data can be sent and received without external wiring connections.

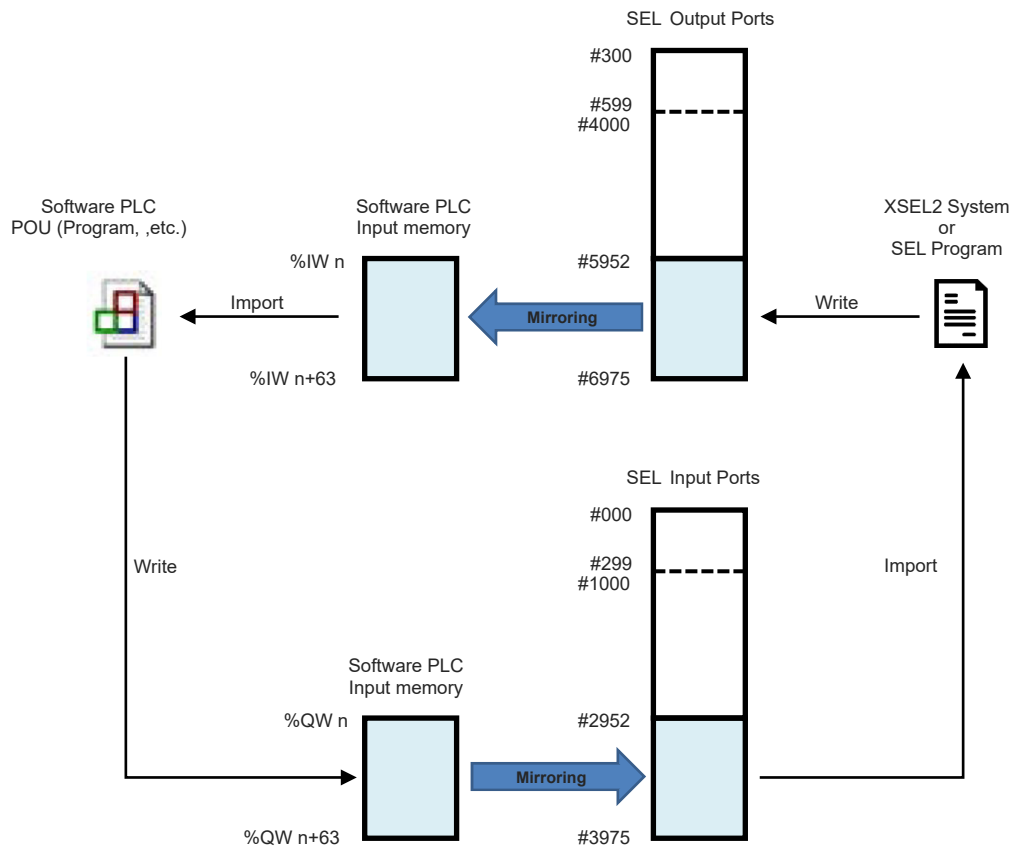
Also, as the XSEL2 equipped I/O options can be directly controlled from the software PLC, it can be used as the external input and output of PLC by adding some necessary option boards.

5.2 Specifications

PLC and the SEL system have mirroring for:

- Input memory 64 words in PLC and output port 2024 bits in SEL system
- Output memory 64 words in PLC and input port 2024 bits in SEL system

which enables sending and receiving of signals and data.



5.2.1 Relation Between PLC Input Addresses and SEL Output Port Numbers

The PLC input address n should be automatically assigned by CODESYS for XSEL2.

As the assigned value should vary depending on the order for being added in an I/O device, it is recommended to have the I/O variable defined and perform PLC programming by using variables.

[1] Word address

The applicable output port numbers in SEL are shown below.

Address	Bit No.															
	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
%IW n	5967	5966	5965	5964	5963	5962	5961	5960	5959	5958	5957	5956	5955	5954	5953	5952
%IW n+1	5983	5982	5981	5980	5979	5978	5977	5976	5975	5974	5973	5972	5971	5970	5969	5968
%IW n+2	5999	5998	5997	5996	5995	5994	5993	5992	5991	5990	5989	5988	5987	5986	5985	5984
%IW n+3	6015	6014	6013	6012	6011	6010	6009	6008	6007	6006	6005	6004	6003	6002	6001	6000
%IW n+4	6031	6030	6029	6028	6027	6026	6025	6024	6023	6022	6021	6020	6019	6018	6017	6016
%IW n+5	6047	6046	6045	6044	6043	6042	6041	6040	6039	6038	6037	6036	6035	6034	6033	6032
%IW n+6	6063	6062	6061	6060	6059	6058	6057	6056	6055	6054	6053	6052	6051	6050	6049	6048
%IW n+7	6079	6078	6077	6076	6075	6074	6073	6072	6071	6070	6069	6068	6067	6066	6065	6064
%IW n+8	6095	6094	6093	6092	6091	6090	6089	6088	6087	6086	6085	6084	6083	6082	6081	6080
%IW n+9	6111	6110	6109	6108	6107	6106	6105	6104	6103	6102	6101	6100	6099	6098	6097	6096
%IW n+10	6127	6126	6125	6124	6123	6122	6121	6120	6119	6118	6117	6116	6115	6114	6113	6112
%IW n+11	6143	6142	6141	6140	6139	6138	6137	6136	6135	6134	6133	6132	6131	6130	6129	6128
%IW n+12	6159	6158	6157	6156	6155	6154	6153	6152	6151	6150	6149	6148	6147	6146	6145	6144
%IW n+13	6175	6174	6173	6172	6171	6170	6169	6168	6167	6166	6165	6164	6163	6162	6161	6160
%IW n+14	6191	6190	6189	6188	6187	6186	6185	6184	6183	6182	6181	6180	6179	6178	6177	6176
%IW n+15	6207	6206	6205	6204	6203	6202	6201	6200	6199	6198	6197	6196	6195	6194	6193	6192
%IW n+16	6223	6222	6221	6220	6219	6218	6217	6216	6215	6214	6213	6212	6211	6210	6209	6208
%IW n+17	6239	6238	6237	6236	6235	6234	6233	6232	6231	6230	6229	6228	6227	6226	6225	6224
%IW n+18	6255	6254	6253	6252	6251	6250	6249	6248	6247	6246	6245	6244	6243	6242	6241	6240
%IW n+19	6271	6270	6269	6268	6267	6266	6265	6264	6263	6262	6261	6260	6259	6258	6257	6256
%IW n+20	6287	6286	6285	6284	6283	6282	6281	6280	6279	6278	6277	6276	6275	6274	6273	6272
%IW n+21	6303	6302	6301	6300	6299	6298	6297	6296	6295	6294	6293	6292	6291	6290	6289	6288
%IW n+22	6319	6318	6317	6316	6315	6314	6313	6312	6311	6310	6309	6308	6307	6306	6305	6304
%IW n+23	6335	6334	6333	6332	6331	6330	6329	6328	6327	6326	6325	6324	6323	6322	6321	6320
%IW n+24	6351	6350	6349	6348	6347	6346	6345	6344	6343	6342	6341	6340	6339	6338	6337	6336
%IW n+25	6367	6366	6365	6364	6363	6362	6361	6360	6359	6358	6357	6356	6355	6354	6353	6352
%IW n+26	6383	6382	6381	6380	6379	6378	6377	6376	6375	6374	6373	6372	6371	6370	6369	6368
%IW n+27	6399	6398	6397	6396	6395	6394	6393	6392	6391	6390	6389	6388	6387	6386	6385	6384
%IW n+28	6415	6414	6413	6412	6411	6410	6409	6408	6407	6406	6405	6404	6403	6402	6401	6400
%IW n+29	6431	6430	6429	6428	6427	6426	6425	6424	6423	6422	6421	6420	6419	6418	6417	6416
%IW n+30	6447	6446	6445	6444	6443	6442	6441	6440	6439	6438	6437	6436	6435	6434	6433	6432
%IW n+31	6463	6462	6461	6460	6459	6458	6457	6456	6455	6454	6453	6452	6451	6450	6449	6448
%IW n+32	6479	6478	6477	6476	6475	6474	6473	6472	6471	6470	6469	6468	6467	6466	6465	6464
%IW n+33	6495	6494	6493	6492	6491	6490	6489	6488	6487	6486	6485	6484	6483	6482	6481	6480
%IW n+34	6511	6510	6509	6508	6507	6506	6505	6504	6503	6502	6501	6500	6499	6498	6497	6496
%IW n+35	6527	6526	6525	6524	6523	6522	6521	6520	6519	6518	6517	6516	6515	6514	6513	6512
%IW n+36	6543	6542	6541	6540	6539	6538	6537	6536	6535	6534	6533	6532	6531	6530	6529	6528
%IW n+37	6559	6558	6557	6556	6555	6554	6553	6552	6551	6550	6549	6548	6547	6546	6545	6544

5.2 Specifications

Address	Bit No.															
	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
%IW n+38	6575	6574	6573	6572	6571	6570	6569	6568	6567	6566	6565	6564	6563	6562	6561	6560
%IW n+39	6591	6590	6589	6588	6587	6586	6585	6584	6583	6582	6581	6580	6579	6578	6577	6576
%IW n+40	6607	6606	6605	6604	6603	6602	6601	6600	6599	6598	6597	6596	6595	6594	6593	6592
%IW n+41	6623	6622	6621	6620	6619	6618	6617	6616	6615	6614	6613	6612	6611	6610	6609	6608
%IW n+42	6639	6638	6637	6636	6635	6634	6633	6632	6631	6630	6629	6628	6627	6626	6625	6624
%IW n+43	6655	6654	6653	6652	6651	6650	6649	6648	6647	6646	6645	6644	6643	6642	6641	6640
%IW n+44	6671	6670	6669	6668	6667	6666	6665	6664	6663	6662	6661	6660	6659	6658	6657	6656
%IW n+45	6687	6686	6685	6684	6683	6682	6681	6680	6679	6678	6677	6676	6675	6674	6673	6672
%IW n+46	6703	6702	6701	6700	6699	6698	6697	6696	6695	6694	6693	6692	6691	6690	6689	6688
%IW n+47	6719	6718	6717	6716	6715	6714	6713	6712	6711	6710	6709	6708	6707	6706	6705	6704
%IW n+48	6735	6734	6733	6732	6731	6730	6729	6728	6727	6726	6725	6724	6723	6722	6721	6720
%IW n+49	6751	6750	6749	6748	6747	6746	6745	6744	6743	6742	6741	6740	6739	6738	6737	6736
%IW n+50	6767	6766	6765	6764	6763	6762	6761	6760	6759	6758	6757	6756	6755	6754	6753	6752
%IW n+51	6783	6782	6781	6780	6779	6778	6777	6776	6775	6774	6773	6772	6771	6770	6769	6768
%IW n+52	6799	6798	6797	6796	6795	6794	6793	6792	6791	6790	6789	6788	6787	6786	6785	6784
%IW n+53	6815	6814	6813	6812	6811	6810	6809	6808	6807	6806	6805	6804	6803	6802	6801	6800
%IW n+54	6831	6830	6829	6828	6827	6826	6825	6824	6823	6822	6821	6820	6819	6818	6817	6816
%IW n+55	6847	6846	6845	6844	6843	6842	6841	6840	6839	6838	6837	6836	6835	6834	6833	6832
%IW n+56	6863	6862	6861	6860	6859	6858	6857	6856	6855	6854	6853	6852	6851	6850	6849	6848
%IW n+57	6879	6878	6877	6876	6875	6874	6873	6872	6871	6870	6869	6868	6867	6866	6865	6864
%IW n+58	6895	6894	6893	6892	6891	6890	6889	6888	6887	6886	6885	6884	6883	6882	6881	6880
%IW n+59	6911	6910	6909	6908	6907	6906	6905	6904	6903	6902	6901	6900	6899	6898	6897	6896
%IW n+60	6927	6926	6925	6924	6923	6922	6921	6920	6919	6918	6917	6916	6915	6914	6913	6912
%IW n+61	6943	6942	6941	6940	6939	6938	6937	6936	6935	6934	6933	6932	6931	6930	6929	6928
%IW n+62	6959	6958	6957	6956	6955	6954	6953	6952	6951	6950	6949	6948	6947	6946	6945	6944
%IW n+63	6975	6974	6973	6972	6971	6970	6969	6968	6967	6966	6965	6964	6963	6962	6961	6960

[2] Bit address

The applicable output port numbers in SEL are shown below.

Address	Bit No.							
	b7	b6	b5	b4	b3	b2	b1	b0
%IX n	5959	5958	5957	5956	5955	5954	5953	5952
%IX n+1	5967	5966	5965	5964	5963	5962	5961	5960
%IX n+2	5975	5974	5973	5972	5971	5970	5969	5968
%IX n+3	5983	5982	5981	5980	5979	5978	5977	5976
%IX n+4	5991	5990	5989	5988	5987	5986	5985	5984
%IX n+5	5999	5998	5997	5996	5995	5994	5993	5992
%IX n+6	6007	6006	6005	6004	6003	6002	6001	6000
%IX n+7	6015	6014	6013	6012	6011	6010	6009	6008
%IX n+8	6023	6022	6021	6020	6019	6018	6017	6016
%IX n+9	6031	6030	6029	6028	6027	6026	6025	6024
%IX n+10	6039	6038	6037	6036	6035	6034	6033	6032
%IX n+11	6047	6046	6045	6044	6043	6042	6041	6040
%IX n+12	6055	6054	6053	6052	6051	6050	6049	6048
%IX n+13	6063	6062	6061	6060	6059	6058	6057	6056
%IX n+14	6071	6070	6069	6068	6067	6066	6065	6064
%IX n+15	6079	6078	6077	6076	6075	6074	6073	6072
%IX n+16	6087	6086	6085	6084	6083	6082	6081	6080
%IX n+17	6095	6094	6093	6092	6091	6090	6089	6088
%IX n+18	6103	6102	6101	6100	6099	6098	6097	6096
%IX n+19	6111	6110	6109	6108	6107	6106	6105	6104
%IX n+20	6119	6118	6117	6116	6115	6114	6113	6112
%IX n+21	6127	6126	6125	6124	6123	6122	6121	6120
%IX n+22	6135	6134	6133	6132	6131	6130	6129	6128
%IX n+23	6143	6142	6141	6140	6139	6138	6137	6136
%IX n+24	6151	6150	6149	6148	6147	6146	6145	6144
%IX n+25	6159	6158	6157	6156	6155	6154	6153	6152
%IX n+26	6167	6166	6165	6164	6163	6162	6161	6160
%IX n+27	6175	6174	6173	6172	6171	6170	6169	6168
%IX n+28	6183	6182	6181	6180	6179	6178	6177	6176
%IX n+29	6191	6190	6189	6188	6187	6186	6185	6184
%IX n+30	6199	6198	6197	6196	6195	6194	6193	6192
%IX n+31	6207	6206	6205	6204	6203	6202	6201	6200
%IX n+32	6215	6214	6213	6212	6211	6210	6209	6208
%IX n+33	6223	6222	6221	6220	6219	6218	6217	6216
%IX n+34	6231	6230	6229	6228	6227	6226	6225	6224
%IX n+35	6239	6238	6237	6236	6235	6234	6233	6232
%IX n+36	6247	6246	6245	6244	6243	6242	6241	6240
%IX n+37	6255	6254	6253	6252	6251	6250	6249	6248
%IX n+38	6263	6262	6261	6260	6259	6258	6257	6256
%IX n+39	6271	6270	6269	6268	6267	6266	6265	6264
%IX n+40	6279	6278	6277	6276	6275	6274	6273	6272
%IX n+41	6287	6286	6285	6284	6283	6282	6281	6280

Address	Bit No.							
	b7	b6	b5	b4	b3	b2	b1	b0
%IX n+42	6295	6294	6293	6292	6291	6290	6289	6288
%IX n+43	6303	6302	6301	6300	6299	6298	6297	6296
%IX n+44	6311	6310	6309	6308	6307	6306	6305	6304
%IX n+45	6319	6318	6317	6316	6315	6314	6313	6312
%IX n+46	6327	6326	6325	6324	6323	6322	6321	6320
%IX n+47	6335	6334	6333	6332	6331	6330	6329	6328
%IX n+48	6343	6342	6341	6340	6339	6338	6337	6336
%IX n+49	6351	6350	6349	6348	6347	6346	6345	6344
%IX n+50	6359	6358	6357	6356	6355	6354	6353	6352
%IX n+51	6367	6366	6365	6364	6363	6362	6361	6360
%IX n+52	6375	6374	6373	6372	6371	6370	6369	6368
%IX n+53	6383	6382	6381	6380	6379	6378	6377	6376
%IX n+54	6391	6390	6389	6388	6387	6386	6385	6384
%IX n+55	6399	6398	6397	6396	6395	6394	6393	6392
%IX n+56	6407	6406	6405	6404	6403	6402	6401	6400
%IX n+57	6415	6414	6413	6412	6411	6410	6409	6408
%IX n+58	6423	6422	6421	6420	6419	6418	6417	6416
%IX n+59	6431	6430	6429	6428	6427	6426	6425	6424
%IX n+60	6439	6438	6437	6436	6435	6434	6433	6432
%IX n+61	6447	6446	6445	6444	6443	6442	6441	6440
%IX n+62	6455	6454	6453	6452	6451	6450	6449	6448
%IX n+63	6463	6462	6461	6460	6459	6458	6457	6456
%IX n+64	6471	6470	6469	6468	6467	6466	6465	6464
%IX n+65	6479	6478	6477	6476	6475	6474	6473	6472
%IX n+66	6487	6486	6485	6484	6483	6482	6481	6480
%IX n+67	6495	6494	6493	6492	6491	6490	6489	6488
%IX n+68	6503	6502	6501	6500	6499	6498	6497	6496
%IX n+69	6511	6510	6509	6508	6507	6506	6505	6504
%IX n+70	6519	6518	6517	6516	6515	6514	6513	6512
%IX n+71	6527	6526	6525	6524	6523	6522	6521	6520
%IX n+72	6535	6534	6533	6532	6531	6530	6529	6528
%IX n+73	6543	6542	6541	6540	6539	6538	6537	6536
%IX n+74	6551	6550	6549	6548	6547	6546	6545	6544
%IX n+75	6559	6558	6557	6556	6555	6554	6553	6552
%IX n+76	6567	6566	6565	6564	6563	6562	6561	6560
%IX n+77	6575	6574	6573	6572	6571	6570	6569	6568
%IX n+78	6583	6582	6581	6580	6579	6578	6577	6576
%IX n+79	6591	6590	6589	6588	6587	6586	6585	6584
%IX n+80	6599	6598	6597	6596	6595	6594	6593	6592
%IX n+81	6607	6606	6605	6604	6603	6602	6601	6600
%IX n+82	6615	6614	6613	6612	6611	6610	6609	6608
%IX n+83	6623	6622	6621	6620	6619	6618	6617	6616
%IX n+84	6631	6630	6629	6628	6627	6626	6625	6624
%IX n+85	6639	6638	6637	6636	6635	6634	6633	6632
%IX n+86	6647	6646	6645	6644	6643	6642	6641	6640

Address	Bit No.							
	b7	b6	b5	b4	b3	b2	b1	b0
%IX n+87	6655	6654	6653	6652	6651	6650	6649	6648
%IX n+88	6663	6662	6661	6660	6659	6658	6657	6656
%IX n+89	6671	6670	6669	6668	6667	6666	6665	6664
%IX n+90	6679	6678	6677	6676	6675	6674	6673	6672
%IX n+91	6687	6686	6685	6684	6683	6682	6681	6680
%IX n+92	6695	6694	6693	6692	6691	6690	6689	6688
%IX n+93	6703	6702	6701	6700	6699	6698	6697	6696
%IX n+94	6711	6710	6709	6708	6707	6706	6705	6704
%IX n+95	6719	6718	6717	6716	6715	6714	6713	6712
%IX n+96	6727	6726	6725	6724	6723	6722	6721	6720
%IX n+97	6735	6734	6733	6732	6731	6730	6729	6728
%IX n+98	6743	6742	6741	6740	6739	6738	6737	6736
%IX n+99	6751	6750	6749	6748	6747	6746	6745	6744
%IX n+100	6759	6758	6757	6756	6755	6754	6753	6752
%IX n+101	6767	6766	6765	6764	6763	6762	6761	6760
%IX n+102	6775	6774	6773	6772	6771	6770	6769	6768
%IX n+103	6783	6782	6781	6780	6779	6778	6777	6776
%IX n+104	6791	6790	6789	6788	6787	6786	6785	6784
%IX n+105	6799	6798	6797	6796	6795	6794	6793	6792
%IX n+106	6807	6806	6805	6804	6803	6802	6801	6800
%IX n+107	6815	6814	6813	6812	6811	6810	6809	6808
%IX n+108	6823	6822	6821	6820	6819	6818	6817	6816
%IX n+109	6831	6830	6829	6828	6827	6826	6825	6824
%IX n+110	6839	6838	6837	6836	6835	6834	6833	6832
%IX n+111	6847	6846	6845	6844	6843	6842	6841	6840
%IX n+112	6855	6854	6853	6852	6851	6850	6849	6848
%IX n+113	6863	6862	6861	6860	6859	6858	6857	6856
%IX n+114	6871	6870	6869	6868	6867	6866	6865	6864
%IX n+115	6879	6878	6877	6876	6875	6874	6873	6872
%IX n+116	6887	6886	6885	6884	6883	6882	6881	6880
%IX n+117	6895	6894	6893	6892	6891	6890	6889	6888
%IX n+118	6903	6902	6901	6900	6899	6898	6897	6896
%IX n+119	6911	6910	6909	6908	6907	6906	6905	6904
%IX n+120	6919	6918	6917	6916	6915	6914	6913	6912
%IX n+121	6927	6926	6925	6924	6923	6922	6921	6920
%IX n+122	6935	6934	6933	6932	6931	6930	6929	6928
%IX n+123	6943	6942	6941	6940	6939	6938	6937	6936
%IX n+124	6951	6950	6949	6948	6947	6946	6945	6944
%IX n+125	6959	6958	6957	6956	6955	6954	6953	6952
%IX n+126	6967	6966	6965	6964	6963	6962	6961	6960
%IX n+127	6975	6974	6973	6972	6971	6970	6969	6968

5.2.2 Relation Between PLC Input Addresses and SEL Input Port Numbers

The PLC output address n should be automatically assigned by CODESYS for XSEL2.

As the assigned value should vary depending on the order for being added in an I/O device, it is recommended to have the I/O variable defined and perform PLC programming by using variables.

[1] Word address

The applicable input port numbers in SEL are shown below.

Address	Bit No.															
	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
%QW n	2967	2966	2965	2964	2963	2962	2961	2960	2959	2958	2957	2956	2955	2954	2953	2952
%QW n+1	2983	2982	2981	2980	2979	2978	2977	2976	2975	2974	2973	2972	2971	2970	2969	2968
%QW n+2	2999	2998	2997	2996	2995	2994	2993	2992	2991	2990	2989	2988	2987	2986	2985	2984
%QW n+3	3015	3014	3013	3012	3011	3010	3009	3008	3007	3006	3005	3004	3003	3002	3001	3000
%QW n+4	3031	3030	3029	3028	3027	3026	3025	3024	3023	3022	3021	3020	3019	3018	3017	3016
%QW n+5	3047	3046	3045	3044	3043	3042	3041	3040	3039	3038	3037	3036	3035	3034	3033	3032
%QW n+6	3063	3062	3061	3060	3059	3058	3057	3056	3055	3054	3053	3052	3051	3050	3049	3048
%QW n+7	3079	3078	3077	3076	3075	3074	3073	3072	3071	3070	3069	3068	3067	3066	3065	3064
%QW n+8	3095	3094	3093	3092	3091	3090	3089	3088	3087	3086	3085	3084	3083	3082	3081	3080
%QW n+9	3111	3110	3109	3108	3107	3106	3105	3104	3103	3102	3101	3100	3099	3098	3097	3096
%QW n+10	3127	3126	3125	3124	3123	3122	3121	3120	3119	3118	3117	3116	3115	3114	3113	3112
%QW n+11	3143	3142	3141	3140	3139	3138	3137	3136	3135	3134	3133	3132	3131	3130	3129	3128
%QW n+12	3159	3158	3157	3156	3155	3154	3153	3152	3151	3150	3149	3148	3147	3146	3145	3144
%QW n+13	3175	3174	3173	3172	3171	3170	3169	3168	3167	3166	3165	3164	3163	3162	3161	3160
%QW n+14	3191	3190	3189	3188	3187	3186	3185	3184	3183	3182	3181	3180	3179	3178	3177	3176
%QW n+15	3207	3206	3205	3204	3203	3202	3201	3200	3199	3198	3197	3196	3195	3194	3193	3192
%QW n+16	3223	3222	3221	3220	3219	3218	3217	3216	3215	3214	3213	3212	3211	3210	3209	3208
%QW n+17	3239	3238	3237	3236	3235	3234	3233	3232	3231	3230	3229	3228	3227	3226	3225	3224
%QW n+18	3255	3254	3253	3252	3251	3250	3249	3248	3247	3246	3245	3244	3243	3242	3241	3240
%QW n+19	3271	3270	3269	3268	3267	3266	3265	3264	3263	3262	3261	3260	3259	3258	3257	3256
%QW n+20	3287	3286	3285	3284	3283	3282	3281	3280	3279	3278	3277	3276	3275	3274	3273	3272
%QW n+21	3303	3302	3301	3300	3299	3298	3297	3296	3295	3294	3293	3292	3291	3290	3289	3288
%QW n+22	3319	3318	3317	3316	3315	3314	3313	3312	3311	3310	3309	3308	3307	3306	3305	3304
%QW n+23	3335	3334	3333	3332	3331	3330	3329	3328	3327	3326	3325	3324	3323	3322	3321	3320
%QW n+24	3351	3350	3349	3348	3347	3346	3345	3344	3343	3342	3341	3340	3339	3338	3337	3336
%QW n+25	3367	3366	3365	3364	3363	3362	3361	3360	3359	3358	3357	3356	3355	3354	3353	3352
%QW n+26	3383	3382	3381	3380	3379	3378	3377	3376	3375	3374	3373	3372	3371	3370	3369	3368
%QW n+27	3399	3398	3397	3396	3395	3394	3393	3392	3391	3390	3389	3388	3387	3386	3385	3384
%QW n+28	3415	3414	3413	3412	3411	3410	3409	3408	3407	3406	3405	3404	3403	3402	3401	3400
%QW n+29	3431	3430	3429	3428	3427	3426	3425	3424	3423	3422	3421	3420	3419	3418	3417	3416
%QW n+30	3447	3446	3445	3444	3443	3442	3441	3440	3439	3438	3437	3436	3435	3434	3433	3432
%QW n+31	3463	3462	3461	3460	3459	3458	3457	3456	3455	3454	3453	3452	3451	3450	3449	3448
%QW n+32	3479	3478	3477	3476	3475	3474	3473	3472	3471	3470	3469	3468	3467	3466	3465	3464
%QW n+33	3495	3494	3493	3492	3491	3490	3489	3488	3487	3486	3485	3484	3483	3482	3481	3480
%QW n+34	3511	3510	3509	3508	3507	3506	3505	3504	3503	3502	3501	3500	3499	3498	3497	3496
%QW n+35	3527	3526	3525	3524	3523	3522	3521	3520	3519	3518	3517	3516	3515	3514	3513	3512
%QW n+36	3543	3542	3541	3540	3539	3538	3537	3536	3535	3534	3533	3532	3531	3530	3529	3528
%QW n+37	3559	3558	3557	3556	3555	3554	3553	3552	3551	3550	3549	3548	3547	3546	3545	3544

Address	Bit No.															
	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
%QW n+38	3575	3574	3573	3572	3571	3570	3569	3568	3567	3566	3565	3564	3563	3562	3561	3560
%QW n+39	3591	3590	3589	3588	3587	3586	3585	3584	3583	3582	3581	3580	3579	3578	3577	3576
%QW n+40	3607	3606	3605	3604	3603	3602	3601	3600	3599	3598	3597	3596	3595	3594	3593	3592
%QW n+41	3623	3622	3621	3620	3619	3618	3617	3616	3615	3614	3613	3612	3611	3610	3609	3608
%QW n+42	3639	3638	3637	3636	3635	3634	3633	3632	3631	3630	3629	3628	3627	3626	3625	3624
%QW n+43	3655	3654	3653	3652	3651	3650	3649	3648	3647	3646	3645	3644	3643	3642	3641	3640
%QW n+44	3671	3670	3669	3668	3667	3666	3665	3664	3663	3662	3661	3660	3659	3658	3657	3656
%QW n+45	3687	3686	3685	3684	3683	3682	3681	3680	3679	3678	3677	3676	3675	3674	3673	3672
%QW n+46	3703	3702	3701	3700	3699	3698	3697	3696	3695	3694	3693	3692	3691	3690	3689	3688
%QW n+47	3719	3718	3717	3716	3715	3714	3713	3712	3711	3710	3709	3708	3707	3706	3705	3704
%QW n+48	3735	3734	3733	3732	3731	3730	3729	3728	3727	3726	3725	3724	3723	3722	3721	3720
%QW n+49	3751	3750	3749	3748	3747	3746	3745	3744	3743	3742	3741	3740	3739	3738	3737	3736
%QW n+50	3767	3766	3765	3764	3763	3762	3761	3760	3759	3758	3757	3756	3755	3754	3753	3752
%QW n+51	3783	3782	3781	3780	3779	3778	3777	3776	3775	3774	3773	3772	3771	3770	3769	3768
%QW n+52	3799	3798	3797	3796	3795	3794	3793	3792	3791	3790	3789	3788	3787	3786	3785	3784
%QW n+53	3815	3814	3813	3812	3811	3810	3809	3808	3807	3806	3805	3804	3803	3802	3801	3800
%QW n+54	3831	3830	3829	3828	3827	3826	3825	3824	3823	3822	3821	3820	3819	3818	3817	3816
%QW n+55	3847	3846	3845	3844	3843	3842	3841	3840	3839	3838	3837	3836	3835	3834	3833	3832
%QW n+56	3863	3862	3861	3860	3859	3858	3857	3856	3855	3854	3853	3852	3851	3850	3849	3848
%QW n+57	3879	3878	3877	3876	3875	3874	3873	3872	3871	3870	3869	3868	3867	3866	3865	3864
%QW n+58	3895	3894	3893	3892	3891	3890	3889	3888	3887	3886	3885	3884	3883	3882	3881	3880
%QW n+59	3911	3910	3909	3908	3907	3906	3905	3904	3903	3902	3901	3900	3899	3898	3897	3896
%QW n+60	3927	3926	3925	3924	3923	3922	3921	3920	3919	3918	3917	3916	3915	3914	3913	3912
%QW n+61	3943	3942	3941	3940	3939	3938	3937	3936	3935	3934	3933	3932	3931	3930	3929	3928
%QW n+62	3959	3958	3957	3956	3955	3954	3953	3952	3951	3950	3949	3948	3947	3946	3945	3944
%QW n+63	3975	3974	3973	3972	3971	3970	3969	3968	3967	3966	3965	3964	3963	3962	3961	3960

[2] Bit address

The applicable input port numbers in SEL are shown below.

Address	Bit No.							
	b7	b6	b5	b4	b3	b2	b1	b0
%QX n	2959	2958	2957	2956	2955	2954	2953	2952
%QX n+1	2967	2966	2965	2964	2963	2962	2961	2960
%QX n+2	2975	2974	2973	2972	2971	2970	2969	2968
%QX n+3	2983	2982	2981	2980	2979	2978	2977	2976
%QX n+4	2991	2990	2989	2988	2987	2986	2985	2984
%QX n+5	2999	2998	2997	2996	2995	2994	2993	2992
%QX n+6	3007	3006	3005	3004	3003	3002	3001	3000
%QX n+7	3015	3014	3013	3012	3011	3010	3009	3008
%QX n+8	3023	3022	3021	3020	3019	3018	3017	3016
%QX n+9	3031	3030	3029	3028	3027	3026	3025	3024
%QX n+10	3039	3038	3037	3036	3035	3034	3033	3032
%QX n+11	3047	3046	3045	3044	3043	3042	3041	3040
%QX n+12	3055	3054	3053	3052	3051	3050	3049	3048
%QX n+13	3063	3062	3061	3060	3059	3058	3057	3056
%QX n+14	3071	3070	3069	3068	3067	3066	3065	3064
%QX n+15	3079	3078	3077	3076	3075	3074	3073	3072
%QX n+16	3087	3086	3085	3084	3083	3082	3081	3080
%QX n+17	3095	3094	3093	3092	3091	3090	3089	3088
%QX n+18	3103	3102	3101	3100	3099	3098	3097	3096
%QX n+19	3111	3110	3109	3108	3107	3106	3105	3104
%QX n+20	3119	3118	3117	3116	3115	3114	3113	3112
%QX n+21	3127	3126	3125	3124	3123	3122	3121	3120
%QX n+22	3135	3134	3133	3132	3131	3130	3129	3128
%QX n+23	3143	3142	3141	3140	3139	3138	3137	3136
%QX n+24	3151	3150	3149	3148	3147	3146	3145	3144
%QX n+25	3159	3158	3157	3156	3155	3154	3153	3152
%QX n+26	3167	3166	3165	3164	3163	3162	3161	3160
%QX n+27	3175	3174	3173	3172	3171	3170	3169	3168
%QX n+28	3183	3182	3181	3180	3179	3178	3177	3176
%QX n+29	3191	3190	3189	3188	3187	3186	3185	3184
%QX n+30	3199	3198	3197	3196	3195	3194	3193	3192
%QX n+31	3207	3206	3205	3204	3203	3202	3201	3200
%QX n+32	3215	3214	3213	3212	3211	3210	3209	3208
%QX n+33	3223	3222	3221	3220	3219	3218	3217	3216
%QX n+34	3231	3230	3229	3228	3227	3226	3225	3224
%QX n+35	3239	3238	3237	3236	3235	3234	3233	3232
%QX n+36	3247	3246	3245	3244	3243	3242	3241	3240
%QX n+37	3255	3254	3253	3252	3251	3250	3249	3248
%QX n+38	3263	3262	3261	3260	3259	3258	3257	3256
%QX n+39	3271	3270	3269	3268	3267	3266	3265	3264
%QX n+40	3279	3278	3277	3276	3275	3274	3273	3272
%QX n+41	3287	3286	3285	3284	3283	3282	3281	3280

Address	Bit No.							
	b7	b6	b5	b4	b3	b2	b1	b0
%QX n+42	3295	3294	3293	3292	3291	3290	3289	3288
%QX n+43	3303	3302	3301	3300	3299	3298	3297	3296
%QX n+44	3311	3310	3309	3308	3307	3306	3305	3304
%QX n+45	3319	3318	3317	3316	3315	3314	3313	3312
%QX n+46	3327	3326	3325	3324	3323	3322	3321	3320
%QX n+47	3335	3334	3333	3332	3331	3330	3329	3328
%QX n+48	3343	3342	3341	3340	3339	3338	3337	3336
%QX n+49	3351	3350	3349	3348	3347	3346	3345	3344
%QX n+50	3359	3358	3357	3356	3355	3354	3353	3352
%QX n+51	3367	3366	3365	3364	3363	3362	3361	3360
%QX n+52	3375	3374	3373	3372	3371	3370	3369	3368
%QX n+53	3383	3382	3381	3380	3379	3378	3377	3376
%QX n+54	3391	3390	3389	3388	3387	3386	3385	3384
%QX n+55	3399	3398	3397	3396	3395	3394	3393	3392
%QX n+56	3407	3406	3405	3404	3403	3402	3401	3400
%QX n+57	3415	3414	3413	3412	3411	3410	3409	3408
%QX n+58	3423	3422	3421	3420	3419	3418	3417	3416
%QX n+59	3431	3430	3429	3428	3427	3426	3425	3424
%QX n+60	3439	3438	3437	3436	3435	3434	3433	3432
%QX n+61	3447	3446	3445	3444	3443	3442	3441	3440
%QX n+62	3455	3454	3453	3452	3451	3450	3449	3448
%QX n+63	3463	3462	3461	3460	3459	3458	3457	3456
%QX n+64	3471	3470	3469	3468	3467	3466	3465	3464
%QX n+65	3479	3478	3477	3476	3475	3474	3473	3472
%QX n+66	3487	3486	3485	3484	3483	3482	3481	3480
%QX n+67	3495	3494	3493	3492	3491	3490	3489	3488
%QX n+68	3503	3502	3501	3500	3499	3498	3497	3496
%QX n+69	3511	3510	3509	3508	3507	3506	3505	3504
%QX n+70	3519	3518	3517	3516	3515	3514	3513	3512
%QX n+71	3527	3526	3525	3524	3523	3522	3521	3520
%QX n+72	3535	3534	3533	3532	3531	3530	3529	3528
%QX n+73	3543	3542	3541	3540	3539	3538	3537	3536
%QX n+74	3551	3550	3549	3548	3547	3546	3545	3544
%QX n+75	3559	3558	3557	3556	3555	3554	3553	3552
%QX n+76	3567	3566	3565	3564	3563	3562	3561	3560
%QX n+77	3575	3574	3573	3572	3571	3570	3569	3568
%QX n+78	3583	3582	3581	3580	3579	3578	3577	3576
%QX n+79	3591	3590	3589	3588	3587	3586	3585	3584
%QX n+80	3599	3598	3597	3596	3595	3594	3593	3592
%QX n+81	3607	3606	3605	3604	3603	3602	3601	3600
%QX n+82	3615	3614	3613	3612	3611	3610	3609	3608
%QX n+83	3623	3622	3621	3620	3619	3618	3617	3616
%QX n+84	3631	3630	3629	3628	3627	3626	3625	3624
%QX n+85	3639	3638	3637	3636	3635	3634	3633	3632
%QX n+86	3647	3646	3645	3644	3643	3642	3641	3640

Address	Bit No.							
	b7	b6	b5	b4	b3	b2	b1	b0
%QX n+87	3655	3654	3653	3652	3651	3650	3649	3648
%QX n+88	3663	3662	3661	3660	3659	3658	3657	3656
%QX n+89	3671	3670	3669	3668	3667	3666	3665	3664
%QX n+90	3679	3678	3677	3676	3675	3674	3673	3672
%QX n+91	3687	3686	3685	3684	3683	3682	3681	3680
%QX n+92	3695	3694	3693	3692	3691	3690	3689	3688
%QX n+93	3703	3702	3701	3700	3699	3698	3697	3696
%QX n+94	3711	3710	3709	3708	3707	3706	3705	3704
%QX n+95	3719	3718	3717	3716	3715	3714	3713	3712
%QX n+96	3727	3726	3725	3724	3723	3722	3721	3720
%QX n+97	3735	3734	3733	3732	3731	3730	3729	3728
%QX n+98	3743	3742	3741	3740	3739	3738	3737	3736
%QX n+99	3751	3750	3749	3748	3747	3746	3745	3744
%QX n+100	3759	3758	3757	3756	3755	3754	3753	3752
%QX n+101	3767	3766	3765	3764	3763	3762	3761	3760
%QX n+102	3775	3774	3773	3772	3771	3770	3769	3768
%QX n+103	3783	3782	3781	3780	3779	3778	3777	3776
%QX n+104	3791	3790	3789	3788	3787	3786	3785	3784
%QX n+105	3799	3798	3797	3796	3795	3794	3793	3792
%QX n+106	3807	3806	3805	3804	3803	3802	3801	3800
%QX n+107	3815	3814	3813	3812	3811	3810	3809	3808
%QX n+108	3823	3822	3821	3820	3819	3818	3817	3816
%QX n+109	3831	3830	3829	3828	3827	3826	3825	3824
%QX n+110	3839	3838	3837	3836	3835	3834	3833	3832
%QX n+111	3847	3846	3845	3844	3843	3842	3841	3840
%QX n+112	3855	3854	3853	3852	3851	3850	3849	3848
%QX n+113	3863	3862	3861	3860	3859	3858	3857	3856
%QX n+114	3871	3870	3869	3868	3867	3866	3865	3864
%QX n+115	3879	3878	3877	3876	3875	3874	3873	3872
%QX n+116	3887	3886	3885	3884	3883	3882	3881	3880
%QX n+117	3895	3894	3893	3892	3891	3890	3889	3888
%QX n+118	3903	3902	3901	3900	3899	3898	3897	3896
%QX n+119	3911	3910	3909	3908	3907	3906	3905	3904
%QX n+120	3919	3918	3917	3916	3915	3914	3913	3912
%QX n+121	3927	3926	3925	3924	3923	3922	3921	3920
%QX n+122	3935	3934	3933	3932	3931	3930	3929	3928
%QX n+123	3943	3942	3941	3940	3939	3938	3937	3936
%QX n+124	3951	3950	3949	3948	3947	3946	3945	3944
%QX n+125	3959	3958	3957	3956	3955	3954	3953	3952
%QX n+126	3967	3966	3965	3964	3963	3962	3961	3960
%QX n+127	3975	3974	3973	3972	3971	3970	3969	3968

5.3 SEL System Feature Setup

5.3.1 Adding SEL Interface Device

Referring to [4.4 Add I/O Device Structure], a SEL interface device should be added.

5.3.2 Setting up SEL Parameters, etc.

By connecting a teaching tool (XSEL PC teaching software or teaching pendant), it is necessary to set up parameters and settings.

For details on the SEL parameter, refer to the separate volume [XSEL2 controller Instruction Manual].

[1] Additional Setup to Assign Dedicated Signal Features

The SEL input and output port numbers for the input and output feature select signals, zones, simple interference check zones and XSEL I/O output setting should be assigned to the following ports that are in mirroring with PLC.

- Input Port Numbers: #2952 to #3975
- Output Port Numbers: #5952 to #6975

But setting up this, mirroring of the software PLC input and output memories should be established to the SEL input and output ports.

Example 1) When inputting READY Signal of SEL to %IWn.0 of PLC

- 1) Check the SEL input and output port numbers in response to the PLC input and output memory addresses.

The SEL output port number equivalent to %IWn.0 should be #5952.

- 2) Setup to input and output the applicable signals to the SEL system should be established.

Set it up as follows so READY Signal outputs Output Feature Select 301 of the I/O parameters from Output Port Number 5952.

● I/O parameter

No.	Parameter name	Set Value	Input range	Unit	Remarks
47	Output Feature Select 301	1	0 to 20	-	0: Universal output 1: READY output (PIO trigger program operation available) 2: READY output (PIO trigger program operation available and without occurrence of any error at the operation cancellation level or more) 3: READY output (PIO trigger program operation available, and without occurrence of any error at the cold start level or more) Note: The port number assigned to this function can be changed using I/O Parameter No. 300 "Port number assigned to output feature selection 301".
301	Port number assigned to output feature selection 301	5952	0, 300 to 599 4000 to 6999	-	Specify the port number to be assigned to the function of I/O Parameter No. 47, "Output feature selection 301". * If "0" is set, the function will be assigned to output port No. 310.

Example 2) When Error Reset SEL with Rising Edge of QWn.1 in PLC

- 1) Check the SEL input and output port numbers in response to the PLC input and output memory addresses.

The SEL input port number equivalent to QWn.1 should be #2953.

- 2) Setup to input and output the applicable signals to the SEL system should be established.

Set it up as follows so the error reset signal inputs Input Feature Select 013 of the I/O parameters from Input Port Number 2977.

● I/O parameter

No.	Parameter name	Set Value	Input range	Unit	Remarks
43	Input feature selection 013	2	0 to 5	-	0: General-purpose input 1: Program number specified for program start 2: Error reset (ON edge) Note: The assignment changes depending on the value set in "I/O Parameter No. 30, Input feature selection 000". Reference: The port number assigned to this function can be changed using I/O Parameter No. 296, "Port number assigned to input feature selection 013".
296	Port number assigned to input feature selection 013	2953	-1, 0 to 299 1000 to 3999	-	Specify the port number to be assigned to the function of I/O Parameter No. 43, "Input feature selection 013". * If a negative value is set, the function will be assigned to input port No. 13. * If "Program number specified for program start" has been specified for input feature selection 013, specify in this parameter an input port number whose LSB contains the next higher value to the LSB of the program number specified for program start.

[2] Additional Setting for External Input and Output from I/O Options

- 1) Whether to use an I/O option board or not and to establish the input and output port number assignment should be performed.

Referring to [XSEL2 Controller Instruction Manual (ME0478)], assign each I/O slot input and output port number.

An I/O option board should be assigned in the port ranges below.

- Input Port: 000 to 299, 1000 to 2951
- Output Port: 300 to 599, 4000 to 5951

- 2) Setting to have the PLC use an I/O option board should be established.

● Related PLC parameters

No.	Parameter name	Set Value	Input range	Unit	Remarks
5	I/O slot 1 PLC Bridge Setting	0	0 to 5	-	0: Bridge Disabled 1: Bridge Enabled
6	I/O slot 1 PLC Bridge Top Offset	0	0 to 63	-	To be set up with top offset word address on software PLC side when bridge enabled
7	I/O slot 2 PLC Bridge Setting	0	0 to 5	-	0: Bridge Disabled 1: Bridge Enabled
8	I/O slot 2 PLC Bridge Top Offset	0	0 to 63	-	To be set up with top offset word address on software PLC side when bridge enabled

Example 1) When PIO in I/O Slot 1 Used in PLC



● PLC parameter

No.	Parameter name	Set Value	Input range	Unit	Remarks
5	I/O slot 1 PLC Bridge Setting	1	0 to 5	-	0: Bridge Disabled 1: Bridge Enabled
6	I/O slot 1 PLC Bridge Top Offset	2	0 to 63	-	To be set up with top offset word address on software PLC side when bridge enabled

When setting above is established, PIO signals should be assigned to:

- %IW n+2 to
- %QW n+2 to

in PLC.

At this time, the PLC input and output address “n” should automatically be assigned in CODESYS for XSEL2. The assigned value should vary depending on the order for being added in an I/O device.

Example 2) When CC-Link (Remote Device Station) in I/O Slot 2 Used in PLC



● PLC parameter

No.	Parameter name	Set Value	Input range	Unit	Remarks
7	I/O slot 2 PLC Bridge Setting	0	0 to 5	-	0: Bridge Disabled 1: Bridge Enabled
8	I/O slot 2 PLC Bridge Top Offset	0	0 to 63	-	To be set up with top offset word address on software PLC side when bridge enabled

When setting above is established, CC-Link (Remote device station) signals should be assigned to:

- %IW n+32 to
- %QW n+32 to

in PLC.

At this time, the PLC input and output address “n” should automatically be assigned in CODESYS for XSEL2. The assigned value should vary depending on the order for being added in an I/O device.

5.3.3 PIO pin arrangement

[1] 32 Input points, 16 Output points (Display of XSEL2 Mode Code: N1, P1)

Pin No.	Cable color	Category	Address		Function
			Word	Bit	
1	Brown-1	Power supply	-	-	+24V input
2	Red-1	Input	%IWm.0	%IXn.0	General purpose input
3	Orange-1		%IWm.1	%IXn.1	General purpose input
4	Yellow-1		%IWm.2	%IXn.2	General purpose input
5	Green-1		%IWm.3	%IXn.3	General purpose input
6	Blue-1		%IWm.4	%IXn.4	General purpose input
7	Purple-1		%IWm.5	%IXn.5	General purpose input
8	Gray-1		%IWm.6	%IXn.6	General purpose input
9	White-1		%IWm.7	%IXn.7	General purpose input
10	Black-1		%IWm.8	%IX(n+1).0	General purpose input
11	Brown-2		%IWm.9	%IX(n+1).1	General purpose input
12	Red-2		%IWm.10	%IX(n+1).2	General purpose input
13	Orange-2		%IWm.11	%IX(n+1).3	General purpose input
14	Yellow-2		%IWm.12	%IX(n+1).4	General purpose input
15	Green-2		%IWm.13	%IX(n+1).5	General purpose input
16	Blue-2		%IWm.14	%IX(n+1).6	General purpose input
17	Purple-2		%IWm.15	%IX(n+1).7	General purpose input
18	Gray-2		%IW(m+1).0	%IX(n+2).0	General purpose input
19	White-2		%IW(m+1).1	%IX(n+2).1	General purpose input
20	Black-2		%IW(m+1).2	%IX(n+2).2	General purpose input
21	Brown-3		%IW(m+1).3	%IX(n+2).3	General purpose input
22	Red-3		%IW(m+1).4	%IX(n+2).4	General purpose input
23	Orange-3		%IW(m+1).5	%IX(n+2).5	General purpose input
24	Yellow-3		%IW(m+1).6	%IX(n+2).6	General purpose input
25	Green-3		%IW(m+1).7	%IX(n+2).7	General purpose input
26	Blue-3		%IW(m+1).8	%IX(n+3).0	General purpose input
27	Purple-3		%IW(m+1).9	%IX(n+3).1	General purpose input
28	Gray-3		%IW(m+1).10	%IX(n+3).2	General purpose input
29	White-3		%IW(m+1).11	%IX(n+3).3	General purpose input
30	Black-3		%IW(m+1).12	%IX(n+3).4	General purpose input
31	Brown-4		%IW(m+1).13	%IX(n+3).5	General purpose input
32	Red-4		%IW(m+1).14	%IX(n+3).6	General purpose input
33	Orange-4		%IW(m+1).15	%IX(n+3).7	General purpose input
34	Yellow-4	Output	%QWm.0	%QXn.0	General purpose output
35	Green-4		%QWm.1	%QXn.1	General purpose output
36	Blue-4		%QWm.2	%QXn.2	General purpose output
37	Purple-4		%QWm.3	%QXn.3	General purpose output
38	Gray-4		%QWm.4	%QXn.4	General purpose output
39	White-4		%QWm.5	%QXn.5	General purpose output
40	Black-4		%QWm.6	%QXn.6	General purpose output
41	Brown-5		%QWm.7	%QXn.7	General purpose output
42	Red-5		%QWm.8	%QX(n+1).0	General purpose output
43	Orange-5		%QWm.9	%QX(n+1).1	General purpose output
44	Yellow-5		%QWm.10	%QX(n+1).2	General purpose output
45	Green-5		%QWm.11	%QX(n+1).3	General purpose output
46	Blue-5		%QWm.12	%QX(n+1).4	General purpose output
47	Purple-5		%QWm.13	%QX(n+1).5	General purpose output
48	Gray-5		%QWm.14	%QX(n+1).6	General purpose output
49	White-5		%QWm.15	%QX(n+1).7	General purpose output
50	Black-5	Power supply	-	-	0V

Note In here, "m" and "n" are the top addresses that input and output are to be assigned. They should automatically be assigned in CODESYS for XSEL2.

5.3 SEL System Feature Setup

[2] 16 Input points, 32 Output points (Display of XSEL2 Mode Code: N2, P2)

Pin No.	Cable color	Category	Address		Function
			Word	Bit	
1	Brown-1	Power supply	-	-	+24V Input
2	Red-1	Input	%IWm.0	%IXn.0	General purpose input
3	Orange-1		%IWm.1	%IXn.1	General purpose input
4	Yellow-1		%IWm.2	%IXn.2	General purpose input
5	Green-1		%IWm.3	%IXn.3	General purpose input
6	Blue-1		%IWm.4	%IXn.4	General purpose input
7	Purple-1		%IWm.5	%IXn.5	General purpose input
8	Gray-1		%IWm.6	%IXn.6	General purpose input
9	White-1		%IWm.7	%IXn.7	General purpose input
10	Black-1		%IWm.8	%IX(n+1).0	General purpose input
11	Brown-2		%IWm.9	%IX(n+1).1	General purpose input
12	Red-2		%IWm.10	%IX(n+1).2	General purpose input
13	Orange-2		%IWm.11	%IX(n+1).3	General purpose input
14	Yellow-2		%IWm.12	%IX(n+1).4	General purpose input
15	Green-2		%IWm.13	%IX(n+1).5	General purpose input
16	Blue-2		%IWm.14	%IX(n+1).6	General purpose input
17	Purple-2		%IWm.15	%IX(n+1).7	General purpose input
18	Gray-2	Output	%QWm.0	%QXn.0	General purpose output
19	White-2		%QWm.1	%QXn.1	General purpose output
20	Black-2		%QWm.2	%QXn.2	General purpose output
21	Brown-3		%QWm.3	%QXn.3	General purpose output
22	Red-3		%QWm.4	%QXn.4	General purpose output
23	Orange-3		%QWm.5	%QXn.5	General purpose output
24	Yellow-3		%QWm.6	%QXn.6	General purpose output
25	Green-3		%QWm.7	%QXn.7	General purpose output
26	Blue-3		%QWm.8	%QX(n+1).0	General purpose output
27	Purple-3		%QWm.9	%QX(n+1).1	General purpose output
28	Gray-3		%QWm.10	%QX(n+1).2	General purpose output
29	White-3		%QWm.11	%QX(n+1).3	General purpose output
30	Black-3		%QWm.12	%QX(n+1).4	General purpose output
31	Brown-4		%QWm.13	%QX(n+1).5	General purpose output
32	Red-4		%QWm.14	%QX(n+1).6	General purpose output
33	Orange-4		%QWm.15	%QX(n+1).7	General purpose output
34	Yellow-4		%QW(m+1).0	%QX(n+2).0	General purpose output
35	Green-4		%QW(m+1).1	%QX(n+2).1	General purpose output
36	Blue-4		%QW(m+1).2	%QX(n+2).2	General purpose output
37	Purple-4		%QW(m+1).3	%QX(n+2).3	General purpose output
38	Gray-4		%QW(m+1).4	%QX(n+2).4	General purpose output
39	White-4		%QW(m+1).5	%QX(n+2).5	General purpose output
40	Black-4		%QW(m+1).6	%QX(n+2).6	General purpose output
41	Brown-5		%QW(m+1).7	%QX(n+2).7	General purpose output
42	Red-5		%QW(m+1).8	%QX(n+3).0	General purpose output
43	Orange-5		%QW(m+1).9	%QX(n+3).1	General purpose output
44	Yellow-5		%QW(m+1).10	%QX(n+3).2	General purpose output
45	Green-5		%QW(m+1).11	%QX(n+3).3	General purpose output
46	Blue-5		%QW(m+1).12	%QX(n+3).4	General purpose output
47	Purple-5		%QW(m+1).13	%QX(n+3).5	General purpose output
48	Gray-5		%QW(m+1).14	%QX(n+3).6	General purpose output
49	White-5		%QW(m+1).15	%QX(n+3).7	General purpose output
50	Black-5	Power supply	-	-	0V

Note In here, "m" and "n" are the top addresses that input and output are to be assigned.

They should automatically be assigned in CODESYS for XSEL2.

[3] 24 Input points, 24 Output Points (Display of XSEL2 Mode Code: N4, P4)

Pin No.	Cable color	Category	Address		Function
			Word	Bit	
1	Brown-1	Power supply	-	-	+24V Input
2	Red-1	Input	%IWm.0	%IXn.0	General purpose input
3	Orange-1		%IWm.1	%IXn.1	General purpose input
4	Yellow-1		%IWm.2	%IXn.2	General purpose input
5	Green-1		%IWm.3	%IXn.3	General purpose input
6	Blue-1		%IWm.4	%IXn.4	General purpose input
7	Purple-1		%IWm.5	%IXn.5	General purpose input
8	Gray-1		%IWm.6	%IXn.6	General purpose input
9	White-1		%IWm.7	%IXn.7	General purpose input
10	Black-1		%IWm.8	%IX(n+1).0	General purpose input
11	Brown-2		%IWm.9	%IX(n+1).1	General purpose input
12	Red-2		%IWm.10	%IX(n+1).2	General purpose input
13	Orange-2		%IWm.11	%IX(n+1).3	General purpose input
14	Yellow-2		%IWm.12	%IX(n+1).4	General purpose input
15	Green-2		%IWm.13	%IX(n+1).5	General purpose input
16	Blue-2		%IWm.14	%IX(n+1).6	General purpose input
17	Purple-2		%IWm.15	%IX(n+1).7	General purpose input
18	Gray-2		%IW(m+1).0	%IX(n+2).0	General purpose input
19	White-2		%IW(m+1).1	%IX(n+2).1	General purpose input
20	Black-2		%IW(m+1).2	%IX(n+2).2	General purpose input
21	Brown-3		%IW(m+1).3	%IX(n+2).3	General purpose input
22	Red-3		%IW(m+1).4	%IX(n+2).4	General purpose input
23	Orange-3		%IW(m+1).5	%IX(n+2).5	General purpose input
24	Yellow-3		%IW(m+1).6	%IX(n+2).6	General purpose input
25	Green-3		%IW(m+1).7	%IX(n+2).7	General purpose input
26	Blue-3	Output	%QWm.0	%QXn.0	General purpose output
27	Purple-3		%QWm.1	%QXn.1	General purpose output
28	Gray-3		%QWm.2	%QXn.2	General purpose output
29	White-3		%QWm.3	%QXn.3	General purpose output
30	Black-3		%QWm.4	%QXn.4	General purpose output
31	Brown-4		%QWm.5	%QXn.5	General purpose output
32	Red-4		%QWm.6	%QXn.6	General purpose output
33	Orange-4		%QWm.7	%QXn.7	General purpose output
34	Yellow-4		%QWm.8	%QX(n+1).0	General purpose output
35	Green-4		%QWm.9	%QX(n+1).1	General purpose output
36	Blue-4		%QWm.10	%QX(n+1).2	General purpose output
37	Purple-4		%QWm.11	%QX(n+1).3	General purpose output
38	Gray-4		%QWm.12	%QX(n+1).4	General purpose output
39	White-4		%QWm.13	%QX(n+1).5	General purpose output
40	Black-4		%QWm.14	%QX(n+1).6	General purpose output
41	Brown-5		%QWm.15	%QX(n+1).7	General purpose output
42	Red-5		%QW(m+1).0	%QX(n+2).0	General purpose output
43	Orange-5		%QW(m+1).1	%QX(n+2).1	General purpose output
44	Yellow-5		%QW(m+1).2	%QX(n+2).2	General purpose output
45	Green-5		%QW(m+1).3	%QX(n+2).3	General purpose output
46	Blue-5		%QW(m+1).4	%QX(n+2).4	General purpose output
47	Purple-5		%QW(m+1).5	%QX(n+2).5	General purpose output
48	Gray-5		%QW(m+1).6	%QX(n+2).6	General purpose output
49	White-5		%QW(m+1).7	%QX(n+2).7	General purpose output
50	Black-5	Power supply	-	-	0V

Note In here, "m" and "n" are the top addresses that input and output are to be assigned.

They should automatically be assigned in CODESYS for XSEL2.

[4] 16 Input points, 16 Output points (Display of XSEL2 Mode Code: NP, PN)

Pin No.	Cable color	Category	Address		Function
			Word	Bit	
1	Brown-1	Power supply	-	-	+24V Input
2	Red-1		-	-	+24V Input
3	Orange-1	NC	-	-	Not connected
4	Yellow-1		-	-	Not connected
5	Green-1	Input	%IWm.0	%IXn.0	General purpose input
6	Blue-1		%IWm.1	%IXn.1	General purpose input
7	Purple-1		%IWm.2	%IXn.2	General purpose input
8	Gray-1		%IWm.3	%IXn.3	General purpose input
9	White-1		%IWm.4	%IXn.4	General purpose input
10	Black-1		%IWm.5	%IXn.5	General purpose input
11	Brown-2		%IWm.6	%IXn.6	General purpose input
12	Red-2		%IWm.7	%IXn.7	General purpose input
13	Orange-2		%IWm.8	%IX(n+1).0	General purpose input
14	Yellow-2		%IWm.9	%IX(n+1).1	General purpose input
15	Green-2		%IWm.10	%IX(n+1).2	General purpose input
16	Blue-2		%IWm.11	%IX(n+1).3	General purpose input
17	Purple-2		%IWm.12	%IX(n+1).4	General purpose input
18	Gray-2		%IWm.13	%IX(n+1).5	General purpose input
19	White-2		%IWm.14	%IX(n+1).6	General purpose input
20	Black-2		%IWm.15	%IX(n+1).7	General purpose input
21	Brown-3	Output	%QWm.0	%QXn.0	General purpose input
22	Red-3		%QWm.1	%QXn.1	General purpose input
23	Orange-3		%QWm.2	%QXn.2	General purpose input
24	Yellow-3		%QWm.3	%QXn.3	General purpose input
25	Green-3		%QWm.4	%QXn.4	General purpose input
26	Blue-3		%QWm.5	%QXn.5	General purpose output
27	Purple-3		%QWm.6	%QXn.6	General purpose output
28	Gray-3		%QWm.7	%QXn.7	General purpose output
29	White-3		%QWm.8	%QX(n+1).0	General purpose output
30	Black-3		%QWm.9	%QX(n+1).1	General purpose output
31	Brown-4		%QWm.10	%QX(n+1).2	General purpose output
32	Red-4		%QWm.11	%QX(n+1).3	General purpose output
33	Orange-4		%QWm.12	%QX(n+1).4	General purpose output
34	Yellow-4		%QWm.13	%QX(n+1).5	General purpose output
35	Green-4		%QWm.14	%QX(n+1).6	General purpose output
36	Blue-4		%QWm.15	%QX(n+1).7	General purpose output
37	Purple-4	NC	-	-	Not connected
38	Gray-4		-	-	Not connected
39	White-4	Power supply	-	-	0V
40	Black-4		-	-	0V

Note In here, "m" and "n" are the top addresses that input are to be assigned, "n" are the top addresses that output are to be assigned. They should automatically be assigned in CODESYS for XSEL2.

[5] Remote I/O unit (Model: EIOU-1)

● Input specifications

SA Rotary Switch Setting	Pin No.	Cable color	Address		Function
			Word	Bit	
0	1A	Brown-1	-	-	NC
	2A	Red-1	-	-	NC
	3A	Orange-1	-	-	NC
	4A	Yellow-1	-	-	NC
	5A	Green-1	%IWm.0	%IXn.0	General purpose input
	6A	Blue-1	%IWm.1	%IXn.1	General purpose input
	7A	Purple-1	%IWm.2	%IXn.2	General purpose input
	8A	Gray-1	%IWm.3	%IXn.3	General purpose input
	9A	White-1	%IWm.4	%IXn.4	General purpose input
	10A	Black-1	%IWm.5	%IXn.5	General purpose input
	11A	Brown-2	%IWm.6	%IXn.6	General purpose input
	12A	Red-2	%IWm.7	%IXn.7	General purpose input
	13A	Orange-2	%IWm.8	%IX(n+1).0	General purpose input
	14A	Yellow-2	%IWm.9	%IX(n+1).1	General purpose input
	15A	Green-2	%IWm.10	%IX(n+1).2	General purpose input
	16A	Blue-2	%IWm.11	%IX(n+1).3	General purpose input
	17A	Purple-2	%IWm.12	%IX(n+1).4	General purpose input
	18A	Gray-2	%IWm.13	%IX(n+1).5	General purpose input
	19A	White-2	%IWm.14	%IX(n+1).6	General purpose input
	20A	Black-2	%IWm.15	%IX(n+1).7	General purpose input
	1B	Brown-3	%IW(m+1).0	%IX(n+2).0	General purpose input
	2B	Red-3	%IW(m+1).1	%IX(n+2).1	General purpose input
	3B	Orange-3	%IW(m+1).2	%IX(n+2).2	General purpose input
	4B	Yellow-3	%IW(m+1).3	%IX(n+2).3	General purpose input
	5B	Green-3	%IW(m+1).4	%IX(n+2).4	General purpose input
	6B	Blue-3	%IW(m+1).5	%IX(n+2).5	General purpose input
	7B	Purple-3	%IW(m+1).6	%IX(n+2).6	General purpose input
	8B	Gray-3	%IW(m+1).7	%IX(n+2).7	General purpose input
	9B	White-3	%IW(m+1).8	%IX(n+3).0	General purpose input
	10B	Black-3	%IW(m+1).9	%IX(n+3).1	General purpose input
	11B	Brown-4	%IW(m+1).10	%IX(n+3).2	General purpose input
	12B	Red-4	%IW(m+1).11	%IX(n+3).3	General purpose input
	13B	Orange-4	%IW(m+1).12	%IX(n+3).4	General purpose input
	14B	Yellow-4	%IW(m+1).13	%IX(n+3).5	General purpose input
	15B	Green-4	%IW(m+1).14	%IX(n+3).6	General purpose input
	16B	Blue-4	%IW(m+1).15	%IX(n+3).7	General purpose input
	17B	Purple-4	-	-	NC
	18B	Gray-4	-	-	NC
	19B	White-4	-	-	NC
	20B	Black-4	-	-	NC

5.3 SEL System Feature Setup

SA Rotary Switch Setting	Pin No.	Cable color	Address		Function
			Word	Bit	
1	1A	Brown-1	-	-	NC
	2A	Red-1	-	-	NC
	3A	Orange-1	-	-	NC
	4A	Yellow-1	-	-	NC
	5A	Green-1	%IW(m+2).0	%IX(n+4).0	General purpose input
	6A	Blue-1	%IW(m+2).1	%IX(n+4).1	General purpose input
	7A	Purple-1	%IW(m+2).2	%IX(n+4).2	General purpose input
	8A	Gray-1	%IW(m+2).3	%IX(n+4).3	General purpose input
	9A	White-1	%IW(m+2).4	%IX(n+4).4	General purpose input
	10A	Black-1	%IW(m+2).5	%IX(n+4).5	General purpose input
	11A	Brown-2	%IW(m+2).6	%IX(n+3).6	General purpose input
	12A	Red-2	%IW(m+2).7	%IX(n+4).7	General purpose input
	13A	Orange-2	%IW(m+2).8	%IX(n+5).0	General purpose input
	14A	Yellow-2	%IW(m+2).9	%IX(n+5).1	General purpose input
	15A	Green-2	%IW(m+2).10	%IX(n+5).2	General purpose input
	16A	Blue-2	%IW(m+2).11	%IX(n+5).3	General purpose input
	17A	Purple-2	%IW(m+2).12	%IX(n+5).4	General purpose input
	18A	Gray-2	%IW(m+2).13	%IX(n+5).5	General purpose input
	19A	White-2	%IW(m+2).14	%IX(n+5).6	General purpose input
	20A	Black-2	%IW(m+2).15	%IX(n+5).7	General purpose input
	1B	Brown-3	%IW(m+3).0	%IX(n+6).0	General purpose input
	2B	Red-3	%IW(m+3).1	%IX(n+6).1	General purpose input
	3B	Orange-3	%IW(m+3).2	%IX(n+6).2	General purpose input
	4B	Yellow-3	%IW(m+3).3	%IX(n+6).3	General purpose input
	5B	Green-3	%IW(m+3).4	%IX(n+6).4	General purpose input
	6B	Blue-3	%IW(m+3).5	%IX(n+6).5	General purpose input
	7B	Purple-3	%IW(m+3).6	%IX(n+6).6	General purpose input
	8B	Gray-3	%IW(m+3).7	%IX(n+6).7	General purpose input
	9B	White-3	%IW(m+3).8	%IX(n+7).0	General purpose input
	10B	Black-3	%IW(m+3).9	%IX(n+7).1	General purpose input
	11B	Brown-4	%IW(m+3).10	%IX(n+7).2	General purpose input
	12B	Red-4	%IW(m+3).11	%IX(n+7).3	General purpose input
	13B	Orange-4	%IW(m+3).12	%IX(n+7).4	General purpose input
	14B	Yellow-4	%IW(m+3).13	%IX(n+7).5	General purpose input
	15B	Green-4	%IW(m+3).14	%IX(n+7).6	General purpose input
	16B	Blue-4	%IW(m+3).15	%IX(n+7).7	General purpose input
	17B	Purple-4	-	-	NC
	18B	Gray-4	-	-	NC
	19B	White-4	-	-	NC
	20B	Black-4	-	-	NC
:	:	:	:	:	
:	:	:	:	:	

SA Rotary Switch Setting	Pin No.	Cable color	Address		Function
			Word	Bit	
7	1A	Brown-1	-	-	NC
	2A	Red-1	-	-	NC
	3A	Orange-1	-	-	NC
	4A	Yellow-1	-	-	NC
	5A	Green-1	%IW(m+14).0	%IX(n+28).0	General purpose input
	6A	Blue-1	%IW(m+14).1	%IX(n+28).1	General purpose input
	7A	Purple-1	%IW(m+14).2	%IX(n+28).2	General purpose input
	8A	Gray-1	%IW(m+14).3	%IX(n+28).3	General purpose input
	9A	White-1	%IW(m+14).4	%IX(n+28).4	General purpose input
	10A	Black-1	%IW(m+14).5	%IX(n+28).5	General purpose input
	11A	Brown-2	%IW(m+14).6	%IX(n+28).6	General purpose input
	12A	Red-2	%IW(m+14).7	%IX(n+28).7	General purpose input
	13A	Orange-2	%IW(m+14).8	%IX(n+29).0	General purpose input
	14A	Yellow-2	%IW(m+14).9	%IX(n+29).1	General purpose input
	15A	Green-2	%IW(m+14).10	%IX(n+29).2	General purpose input
	16A	Blue-2	%IW(m+14).11	%IX(n+29).3	General purpose input
	17A	Purple-2	%IW(m+14).12	%IX(n+29).4	General purpose input
	18A	Gray-2	%IW(m+14).13	%IX(n+29).5	General purpose input
	19A	White-2	%IW(m+14).14	%IX(n+29).6	General purpose input
	20A	Black-2	%IW(m+14).15	%IX(n+29).7	General purpose input
	1B	Brown-3	%IW(m+15).0	%IX(n+30).0	General purpose input
	2B	Red-3	%IW(m+15).1	%IX(n+30).1	General purpose input
	3B	Orange-3	%IW(m+15).2	%IX(n+30).2	General purpose input
	4B	Yellow-3	%IW(m+15).3	%IX(n+30).3	General purpose input
	5B	Green-3	%IW(m+15).4	%IX(n+30).4	General purpose input
	6B	Blue-3	%IW(m+15).5	%IX(n+30).5	General purpose input
	7B	Purple-3	%IW(m+15).6	%IX(n+30).6	General purpose input
	8B	Gray-3	%IW(m+15).7	%IX(n+30).7	General purpose input
	9B	White-3	%IW(m+15).8	%IX(n+31).0	General purpose input
	10B	Black-3	%IW(m+15).9	%IX(n+31).1	General purpose input
	11B	Brown-4	%IW(m+15).10	%IX(n+31).2	General purpose input
	12B	Red-4	%IW(m+15).11	%IX(n+31).3	General purpose input
	13B	Orange-4	%IW(m+15).12	%IX(n+31).4	General purpose input
	14B	Yellow-4	%IW(m+15).13	%IX(n+31).5	General purpose input
	15B	Green-4	%IW(m+15).14	%IX(n+31).6	General purpose input
	16B	Blue-4	%IW(m+15).15	%IX(n+31).7	General purpose input
	17B	Purple-4	-	-	NC
	18B	Gray-4	-	-	NC
	19B	White-4	-	-	NC
	20B	Black-4	-	-	NC

Note In here, “m” and “n” are the top addresses that input are to be assigned.

They should automatically be assigned in CODESYS for XSEL2.

● Output specifications

SA Rotary Switch Setting	Pin No.	Cable color	Address		Function
			Word	Bit	
0	1A	Brown-1	-	-	NC
	2A	Red-1	-	-	NC
	3A	Orange-1	-	-	NC
	4A	Yellow-1	-	-	NC
	5A	Green-1	%QWm.0	%QXn.0	General purpose output
	6A	Blue-1	%QWm.1	%QXn.1	General purpose output
	7A	Purple-1	%QWm.2	%QXn.2	General purpose output
	8A	Gray-1	%QWm.3	%QXn.3	General purpose output
	9A	White-1	%QWm.4	%QXn.4	General purpose output
	10A	Black-1	%QWm.5	%QXn.5	General purpose output
	11A	Brown-2	%QWm.6	%QXn.6	General purpose output
	12A	Red-2	%QWm.7	%QXn.7	General purpose output
	13A	Orange-2	%QWm.8	%QX(n+1).0	General purpose output
	14A	Yellow-2	%QWm.9	%QX(n+1).1	General purpose output
	15A	Green-2	%QWm.10	%QX(n+1).2	General purpose output
	16A	Blue-2	%QWm.11	%QX(n+1).3	General purpose output
	17A	Purple-2	%QWm.12	%QX(n+1).4	General purpose output
	18A	Gray-2	%QWm.13	%QX(n+1).5	General purpose output
	19A	White-2	%QWm.14	%QX(n+1).6	General purpose output
	20A	Black-2	%QWm.15	%QX(n+1).7	General purpose output
	1B	Brown-3	%QW(m+1).0	%QX(n+2).0	General purpose output
	2B	Red-3	%QW(m+1).1	%QX(n+2).1	General purpose output
	3B	Orange-3	%QW(m+1).2	%QX(n+2).2	General purpose output
	4B	Yellow-3	%QW(m+1).3	%QX(n+2).3	General purpose output
	5B	Green-3	%QW(m+1).4	%QX(n+2).4	General purpose output
	6B	Blue-3	%QW(m+1).5	%QX(n+2).5	General purpose output
	7B	Purple-3	%QW(m+1).6	%QX(n+2).6	General purpose output
	8B	Gray-3	%QW(m+1).7	%QX(n+2).7	General purpose output
	9B	White-3	%QW(m+1).8	%QX(n+3).0	General purpose output
	10B	Black-3	%QW(m+1).9	%QX(n+3).1	General purpose output
	11B	Brown-4	%QW(m+1).10	%QX(n+3).2	General purpose output
	12B	Red-4	%QW(m+1).11	%QX(n+3).3	General purpose output
	13B	Orange-4	%QW(m+1).12	%QX(n+3).4	General purpose output
	14B	Yellow-4	%QW(m+1).13	%QX(n+3).5	General purpose output
	15B	Green-4	%QW(m+1).14	%QX(n+3).6	General purpose output
	16B	Blue-4	%QW(m+1).15	%QX(n+3).7	General purpose output
	17B	Purple-4	-	-	NC
	18B	Gray-4	-	-	NC
	19B	White-4	-	-	NC
	20B	Black-4	-	-	NC

SA Rotary Switch Setting	Pin No.	Cable color	Address		Function
			Word	Bit	
1	1A	Brown-1	-	-	NC
	2A	Red-1	-	-	NC
	3A	Orange-1	-	-	NC
	4A	Yellow-1	-	-	NC
	5A	Green-1	%QW(m+2).0	%QX(n+4).0	General purpose output
	6A	Blue-1	%QW(m+2).1	%QX(n+4).1	General purpose output
	7A	Purple-1	%QW(m+2).2	%QX(n+4).2	General purpose output
	8A	Gray-1	%QW(m+2).3	%QX(n+4).3	General purpose output
	9A	White-1	%QW(m+2).4	%QX(n+4).4	General purpose output
	10A	Black-1	%QW(m+2).5	%QX(n+4).5	General purpose output
	11A	Brown-2	%QW(m+2).6	%QX(n+4).6	General purpose output
	12A	Red-2	%QW(m+2).7	%QX(n+4).7	General purpose output
	13A	Orange-2	%QW(m+2).8	%QX(n+5).0	General purpose output
	14A	Yellow-2	%QW(m+2).9	%QX(n+5).1	General purpose output
	15A	Green-2	%QW(m+2).10	%QX(n+5).2	General purpose output
	16A	Blue-2	%QW(m+2).11	%QX(n+5).3	General purpose output
	17A	Purple-2	%QW(m+2).12	%QX(n+5).4	General purpose output
	18A	Gray-2	%QW(m+2).13	%QX(n+5).5	General purpose output
	19A	White-2	%QW(m+2).14	%QX(n+5).6	General purpose output
	20A	Black-2	%QW(m+2).15	%QX(n+5).7	General purpose output
	1B	Brown-3	%QW(m+3).0	%QX(n+6).0	General purpose output
	2B	Red-3	%QW(m+3).1	%QX(n+6).1	General purpose output
	3B	Orange-3	%QW(m+3).2	%QX(n+6).2	General purpose output
	4B	Yellow-3	%QW(m+3).3	%QX(n+6).3	General purpose output
	5B	Green-3	%QW(m+3).4	%QX(n+6).4	General purpose output
	6B	Blue-3	%QW(m+3).5	%QX(n+6).5	General purpose output
	7B	Purple-3	%QW(m+3).6	%QX(n+6).6	General purpose output
	8B	Gray-3	%QW(m+3).7	%QX(n+6).7	General purpose output
	9B	White-3	%QW(m+3).8	%QX(n+7).0	General purpose output
	10B	Black-3	%QW(m+3).9	%QX(n+7).1	General purpose output
	11B	Brown-4	%QW(m+3).10	%QX(n+7).2	General purpose output
	12B	Red-4	%QW(m+3).11	%QX(n+7).3	General purpose output
	13B	Orange-4	%QW(m+3).12	%QX(n+7).4	General purpose output
	14B	Yellow-4	%QW(m+3).13	%QX(n+7).5	General purpose output
	15B	Green-4	%QW(m+3).14	%QX(n+7).6	General purpose output
	16B	Blue-4	%QW(m+3).15	%QX(n+7).7	General purpose output
	17B	Purple-4	-	-	NC
	18B	Gray-4	-	-	NC
	19B	White-4	-	-	NC
	20B	Black-4	-	-	NC
:	:	:	:	:	
:	:	:	:	:	

5.3 SEL System Feature Setup

SA Rotary Switch Setting	Pin No.	Cable color	Address		Function
			Word	Bit	
7	1A	Brown-1	-	-	NC
	2A	Red-1	-	-	NC
	3A	Orange-1	-	-	NC
	4A	Yellow-1	-	-	NC
	5A	Green-1	%QW(m+14).0	%QX(n+28).0	General purpose output
	6A	Blue-1	%QW(m+14).1	%QX(n+28).1	General purpose output
	7A	Purple-1	%QW(m+14).2	%QX(n+28).2	General purpose output
	8A	Gray-1	%QW(m+14).3	%QX(n+28).3	General purpose output
	9A	White-1	%QW(m+14).4	%QX(n+28).4	General purpose output
	10A	Black-1	%QW(m+14).5	%QX(n+28).5	General purpose output
	11A	Brown-2	%QW(m+14).6	%QX(n+28).6	General purpose output
	12A	Red-2	%QW(m+14).7	%QX(n+28).7	General purpose output
	13A	Orange-2	%QW(m+14).8	%QX(n+29).0	General purpose output
	14A	Yellow-2	%QW(m+14).9	%QX(n+29).1	General purpose output
	15A	Green-2	%QW(m+14).10	%QX(n+29).2	General purpose output
	16A	Blue-2	%QW(m+14).11	%QX(n+29).3	General purpose output
	17A	Purple-2	%QW(m+14).12	%QX(n+29).4	General purpose output
	18A	Gray-2	%QW(m+14).13	%QX(n+29).5	General purpose output
	19A	White-2	%QW(m+14).14	%QX(n+29).6	General purpose output
	20A	Black-2	%QW(m+14).15	%QX(n+29).7	General purpose output
	1B	Brown-3	%QW(m+15).0	%QX(n+30).0	General purpose output
	2B	Red-3	%QW(m+15).1	%QX(n+30).1	General purpose output
	3B	Orange-3	%QW(m+15).2	%QX(n+30).2	General purpose output
	4B	Yellow-3	%QW(m+15).3	%QX(n+30).3	General purpose output
	5B	Green-3	%QW(m+15).4	%QX(n+30).4	General purpose output
	6B	Blue-3	%QW(m+15).5	%QX(n+30).5	General purpose output
	7B	Purple-3	%QW(m+15).6	%QX(n+30).6	General purpose output
	8B	Gray-3	%QW(m+15).7	%QX(n+30).7	General purpose output
	9B	White-3	%QW(m+15).8	%QX(n+31).0	General purpose output
	10B	Black-3	%QW(m+15).9	%QX(n+31).1	General purpose output
	11B	Brown-4	%QW(m+15).10	%QX(n+31).2	General purpose output
	12B	Red-4	%QW(m+15).11	%QX(n+31).3	General purpose output
	13B	Orange-4	%QW(m+15).12	%QX(n+31).4	General purpose output
	14B	Yellow-4	%QW(m+15).13	%QX(n+31).5	General purpose output
	15B	Green-4	%QW(m+15).14	%QX(n+31).6	General purpose output
	16B	Blue-4	%QW(m+15).15	%QX(n+31).7	General purpose output
	17B	Purple-4	-	-	NC
	18B	Gray-4	-	-	NC
	19B	White-4	-	-	NC
	20B	Black-4	-	-	NC

Note In here, “m” and “n” are the top addresses that output are to be assigned.
They should automatically be assigned in CODESYS for XSEL2.

XSEL2

Chapter 6

Communication Feature

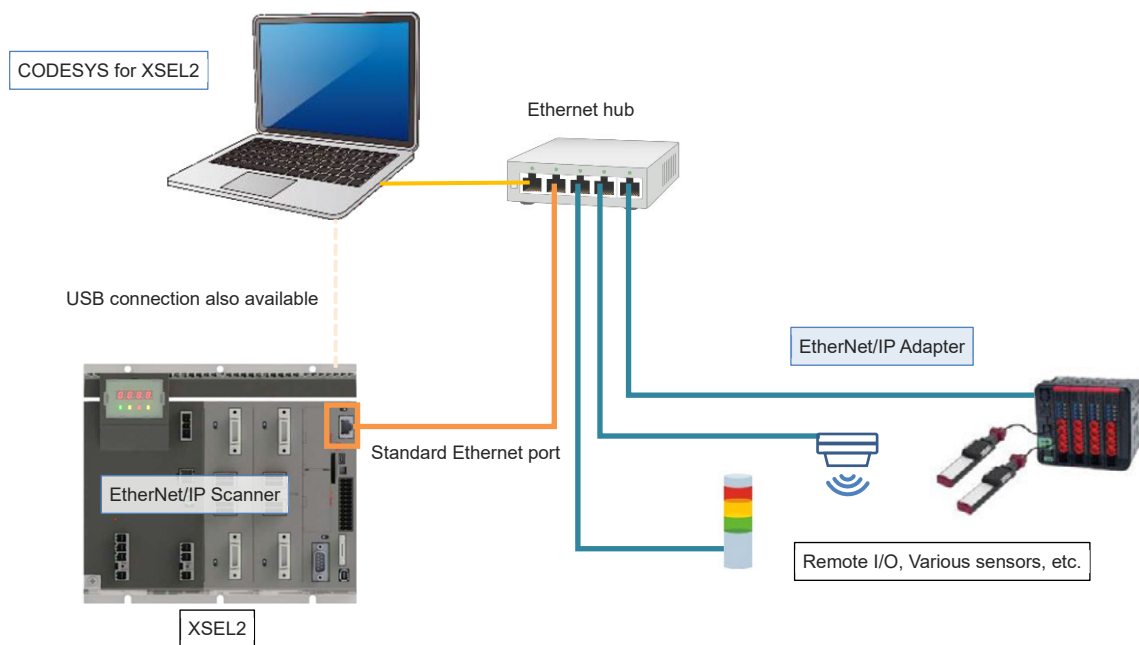
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6.1 EtherNet/IP Scanner Feature

EtherNet/IP (Ethernet Industrial Protocol) is an open and global industrial ethernet which executes the communication protocol for CIP (Common Industrial Protocol) Control in the application layer in the standard ethernet.

As the standard ethernet is adopted, it can be used in mix with general-purposed ethernet devices. Also, its specifications are maintained and managed by ODVA (Open DeviceNet Vendors Association, Inc.).

In EtherNet/IP, the side to demand connection start is called an originator, the one to be demanded is called a target, a device equipped with the originator feature is called a scanner, and a device with no originator feature is called an adopter. XSEL2 is applicable to the scanner feature.



6.1.1 Feature Specification

Shown below are the specifications of the EtherNet/IP scanner features.

Item			Details
Cyclic communication	Number of connections		16
	Connection type		Point-to-Point Multicast
	Send Trigger		Cyclic
	Max. Data Size for 1 Connection		1444 Byte
	RPI (*1)		Min. 10ms
	Cyclic Communication Allowable Communication Band (*2)		1600pps
Message communication	Class3	Number of connections	16
	UCMM	Number of connections	16
EtherNet/IP Conformance Test			CT19.1

- The EtherNet/IP scanner features should use the standard ethernet port.
- Communication status can be checked at the network monitoring LED.

* Refer to [1.5 Names and Features of Each Part Related to PLC] for details of display.

*1 The cyclic communication cycle should be shown.

Even though a cycle not satisfy the specification can also be set, shorter the cycle is more load should be applied for the process of the system, which may cause a controller to have an error stop (watchdog).

Also, RPI must be a cycle in an integer multiple to the cycle of the scanner IO task (ENIPScannerIOTask), and it is recommended to set the same value.

*2 It should show the transmitted packet count capable of process in one second.

Confirm that the transmitted packet count in one second that can be calculated from RPI and the connection count is in the specification range.

6.1.2 Cyclic Communication Feature

The cyclic communication is a feature to have a scanner conducting a connection start demand to an adapter, and once connection is established (opened), to send and receive data mutually in a specified constant frequency (RPI (Requested Packet Interval)).

There are types available for sending and receiving (Exclusive Owner) and available only for sending (Input Only) in connection, and point-to-point connection in 1:1 and multicast connection in 1:N are available. Different RPI for different destination for communication can be set up. It is suitable for purpose of transiting real time data, and it can be used to monitor the condition of a sensor all the time for an instance.

6.1.3 Message Communication Feature

The message communication is a feature to have data sent or received in point-to-point of 1:1 in any timing to a designated destination for communication.

As connection types in the message communication, there are "Class3 (Connection Type)" that conducts the message communication by establishing connection (open) and "UCMM (Non-Connection Type)" that conducts the message communication without establishing connection. It should be used in a purpose where data sending and receiving is required only at startup of a device that has low necessity of continuous data update or monitoring such as readout/write-in of setting values for an instance.

XSEL2 can be used as a message communication server and a client.

When XSEL2 is to be used as the message communication server, it is applicable for the objects and services described in [6.1.5 [3] CIP Support Objects].

When XSEL2 is to be used as a client, the dedicated function block commands should be used. For details, refer to EtherNet/IP commands in the separate volume [PLC Feature Programming Manual (ME0480)].

6.1.4 Setup of EtherNet/IP Scanner

Here, explains the flow to operate the EtherNet/IP scanner feature.

Step1. Install EDS File

Install the EDS file of the EtherNet/IP adapter subject to connection.
It is not necessary to conduct this process if it is already installed.
Refer to [6.1.4 [1] Install EDS File].

**Step2. Adding Scanner and Adapter Device**

Add the device to a project.
Refer to [6.1.4 [2] Adding Scanner and Adapter Device].

**Step3. Defining I/O Variables**

Conduct the variable definition for the EtherNet/IP input and output.
Refer to [6.1.4 [3] I/O Variable Setting].

**Step4. Option Setup for I/O Refresh**

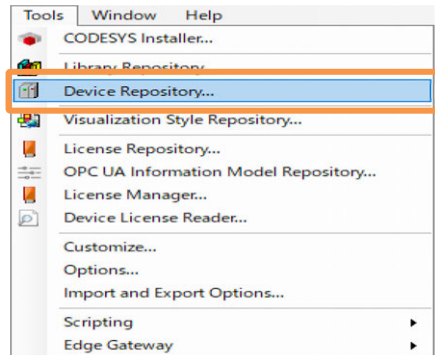
Set up the output at stop as necessary.
Refer to [4.4.3 I/O Refresh].

[1] Install EDS File

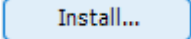
Install the EDS file of the connected EtherNet/IP adapter device. It is not necessary to conduct this process if it is already installed.

* Consult with each manufacturer for how to obtain the EDS file.

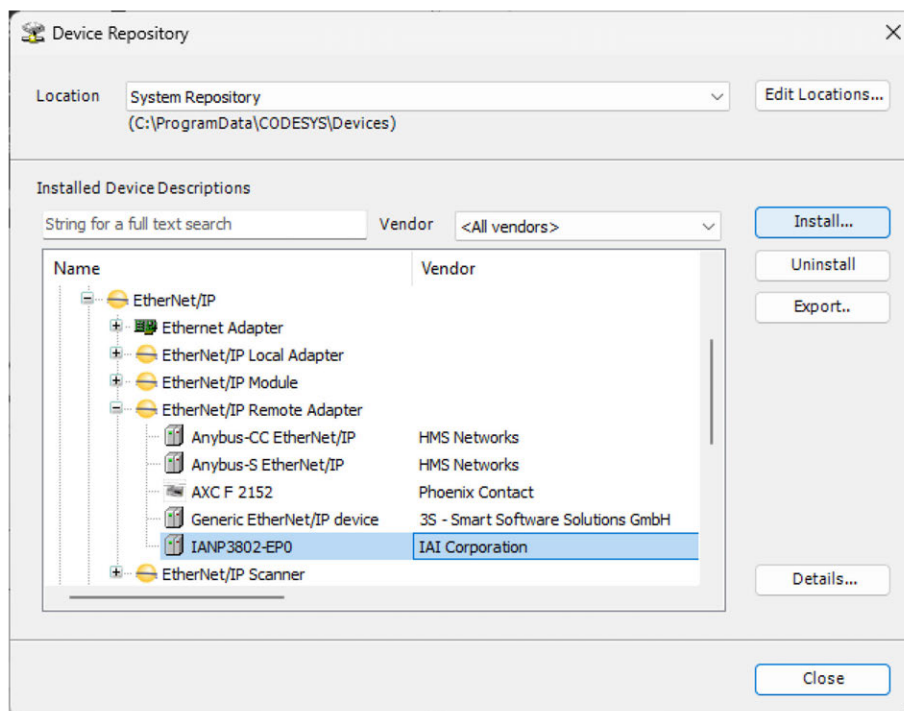
- 1) Click  **Device Repository...** from “Tools” in the menu bar.



- 2) The device repository window should open.

Click  to install the EDS file. Once the installation is complete, the device added to “EtherNet/IP Remote Adapter” should be displayed.

(Hereinafter, shows a case of IAI EtherNet/IP adapter “IANP3802-EP0”)

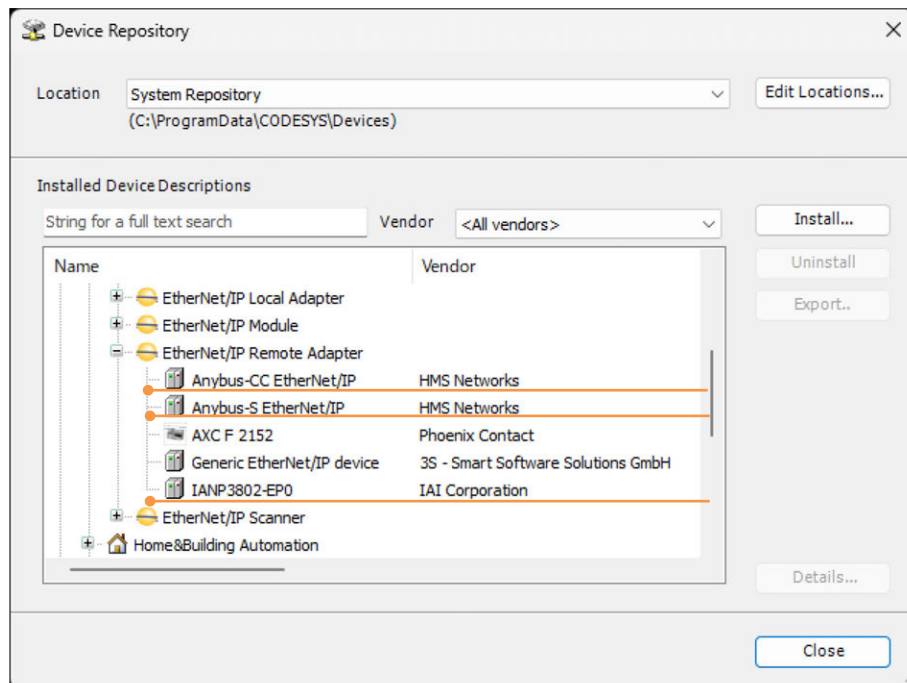




Caution

- As the EDS file for IAI product is enclosed in the XSEL2-T CODESYS package, it is not necessary to install it additionally. Pay attention when use as there are some controllers that the vendor's name is not IAI Corporation.

Controller name	Applicable Device Name	Vendor
PCON-C/CG/CF ACON-C/CG SCON-CA MSEP-C PCON-CA/CFA MSCON XSEL-R/S/RX/SX/RXD/SXD ERC3 Gateway	Anybus CC EtherNet /IP	HMS Networks
XSEL-P/Q/PCT/QCT XSEL-PX/QX	Anybus S EtherNet/IP	HMS Networks
Other than above	IANP3802-EP0	IAI Corporation



[2] Adding Scanner and Adapter Device

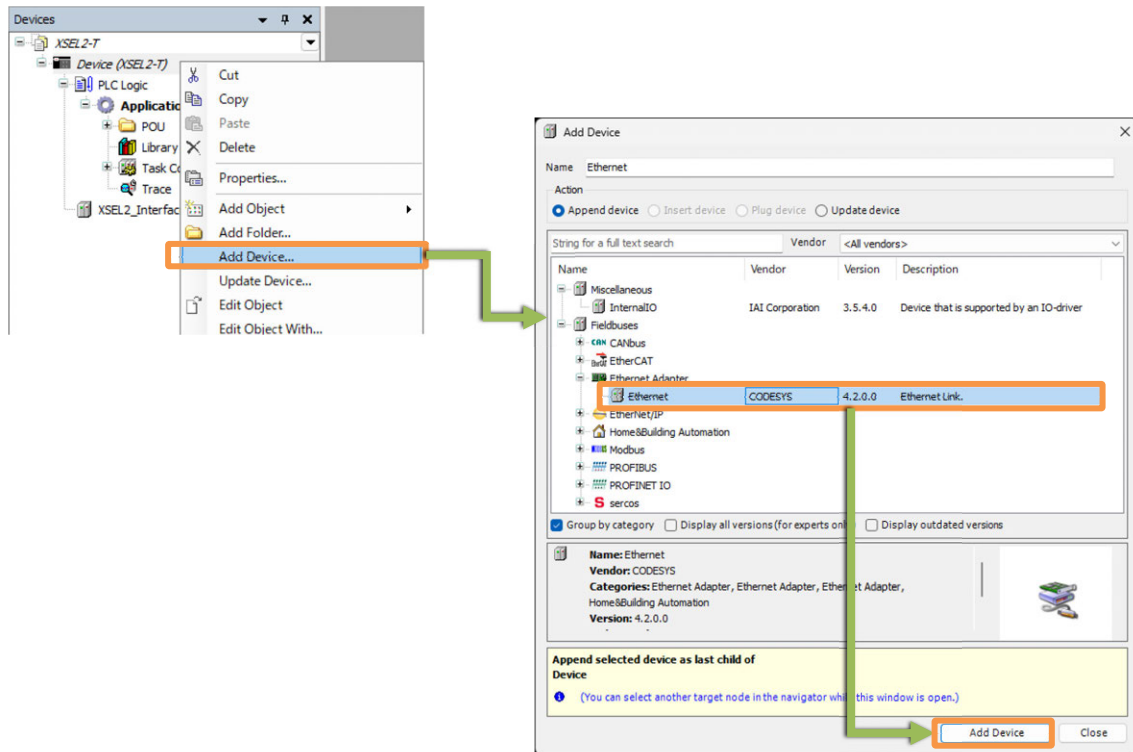
Add the ethernet interface, EtherNet/IP scanner and remote adapter under the device tree "Device (XSEL2-T)".

● Adding Ethernet Interface

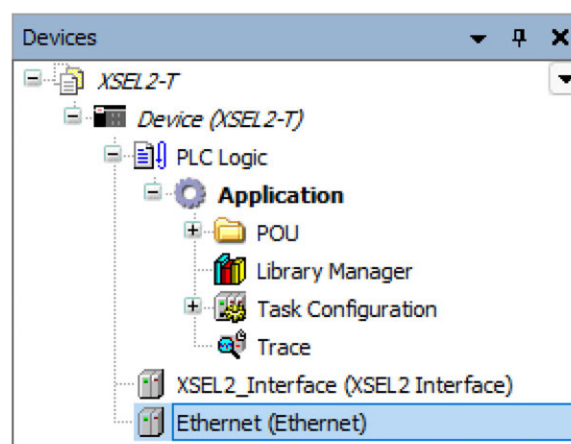
Right-click "Device (XSEL2-T)" and select "Add Device..."

Select Ethernet from "Fieldbus" → "Ethernet Adapter" in the device list, and click

Add Device



* Once the Ethernet adapter is added, the following display should be shown.

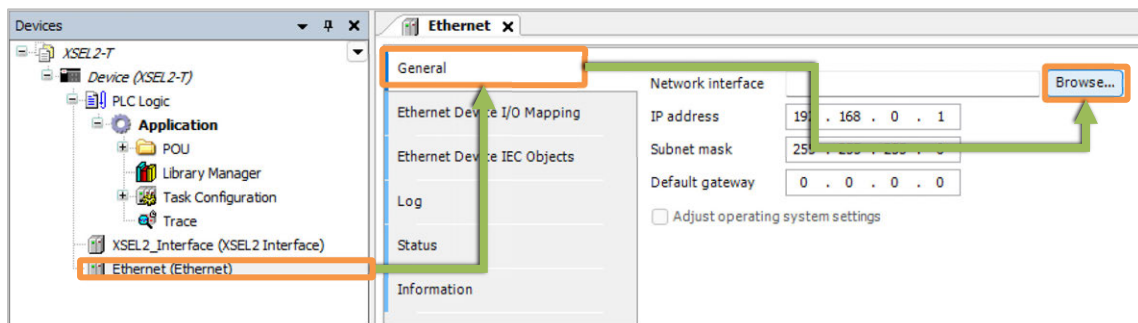


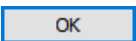


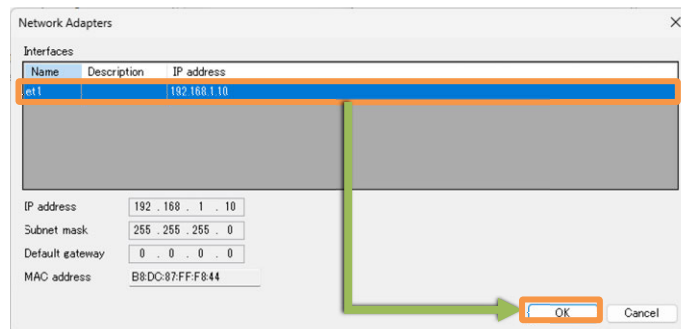
Caution

- The following work cannot be conducted in a condition not available to connect to XSEL2.
Conduct it in a condition that connection is available.

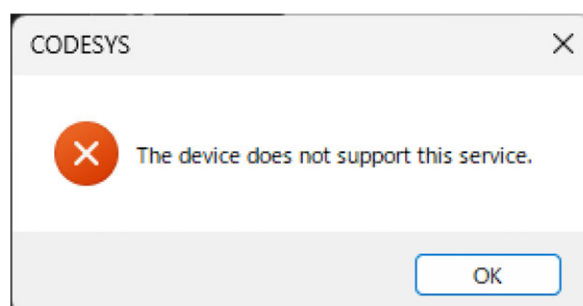
- Double-click  **Ethernet (Ethernet)** in the device tree.
- Select "General" in the Ethernet tab, and click  in the network interface.



- Select an Ethernet adapter to establish the EtherNet/IP connection with the XSEL2 subject to connection, and click .



- ◆ In case the XSEL2 subject to connection could not be detected, check in [4.1 PLC Feature Parameter Setting] and [4.8.2 Setup for Connection to XSEL2].

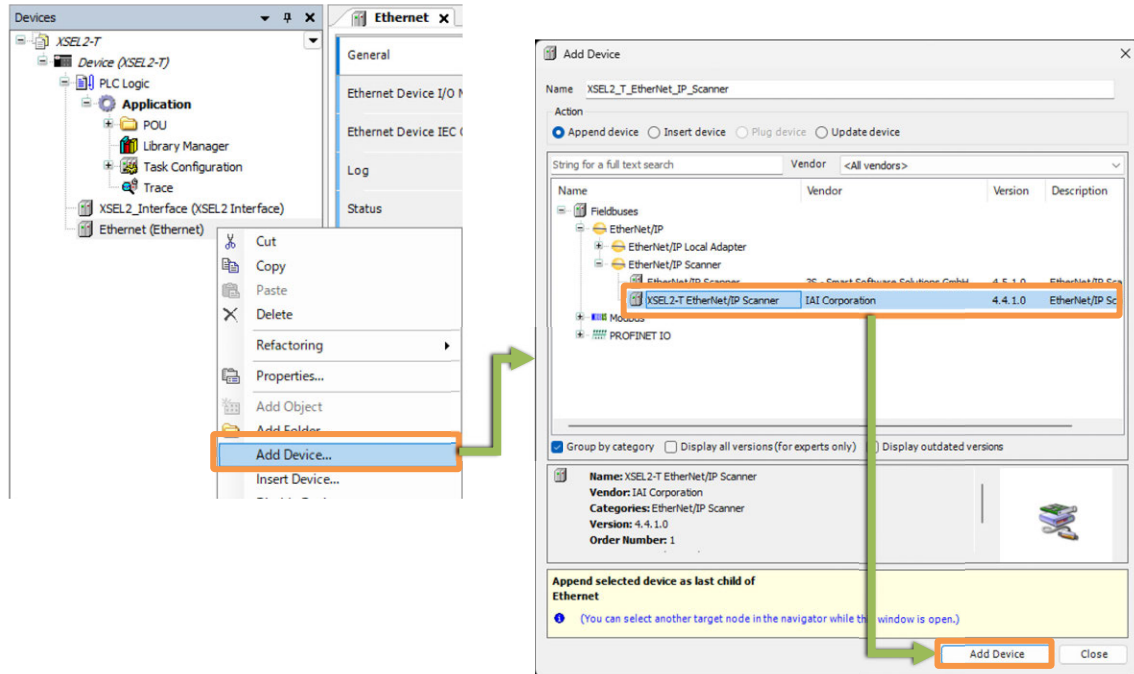


● Adding EtherNet/IP Scanner

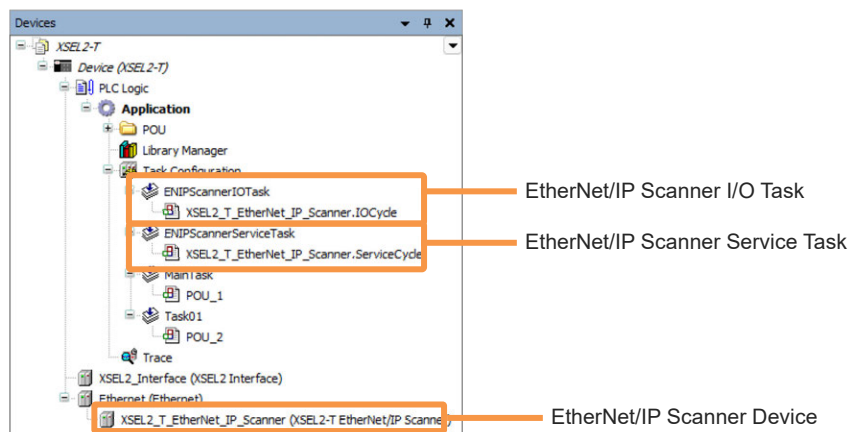
Right click “Ethernet (Ethernet)” and select “Add Device...”.

Select “EtherNet/IP Scanner” for the EtherNet/IP scanner from the device list, and click

Add Device



* Once the EtherNet/IP scanner is added, the following display should be shown.

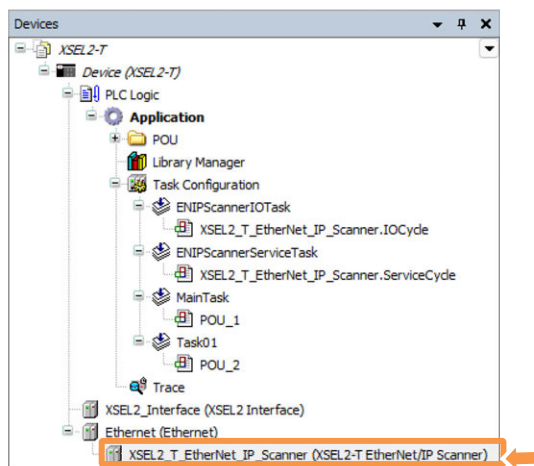


Caution

- Once a device is added, the tasks should automatically be generated, but they should be used for I/O refresh. Do not attempt to delete the tasks and POU that are automatically generated.

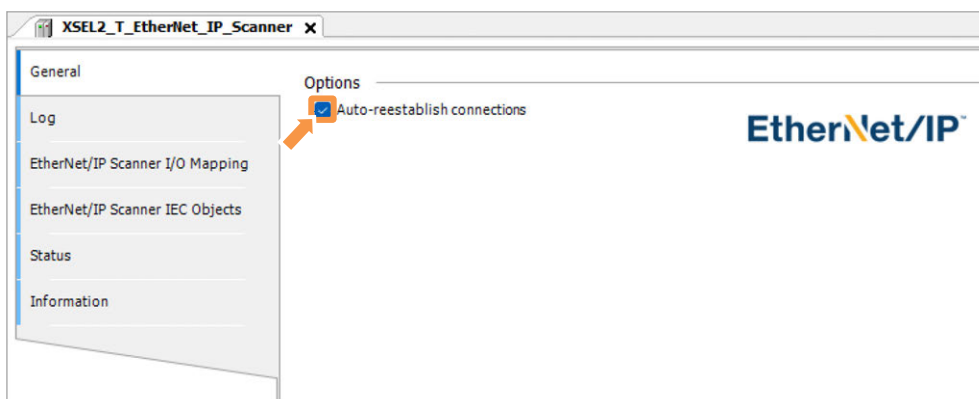
Establish the option setting for the EtherNet/IP scanner as necessary.

- 1) Double-click "XSEL2_T_EtherNet_IP_Scanner (XSEL2-T EtherNet/Ip Scanner)" from Ethernet (Ethernet) in the device tree.



- 2) Select "General" in the "EtherNet_IP_Scanner" tab, and set up "Auto-reestablish connection" in the option.

- ☒ (With Checkmark): The device should establish connection again automatically when a communication error is occurred.
- ☐ (With No Checkmark): The device should stop and not establish connection again when a communication error is occurred.



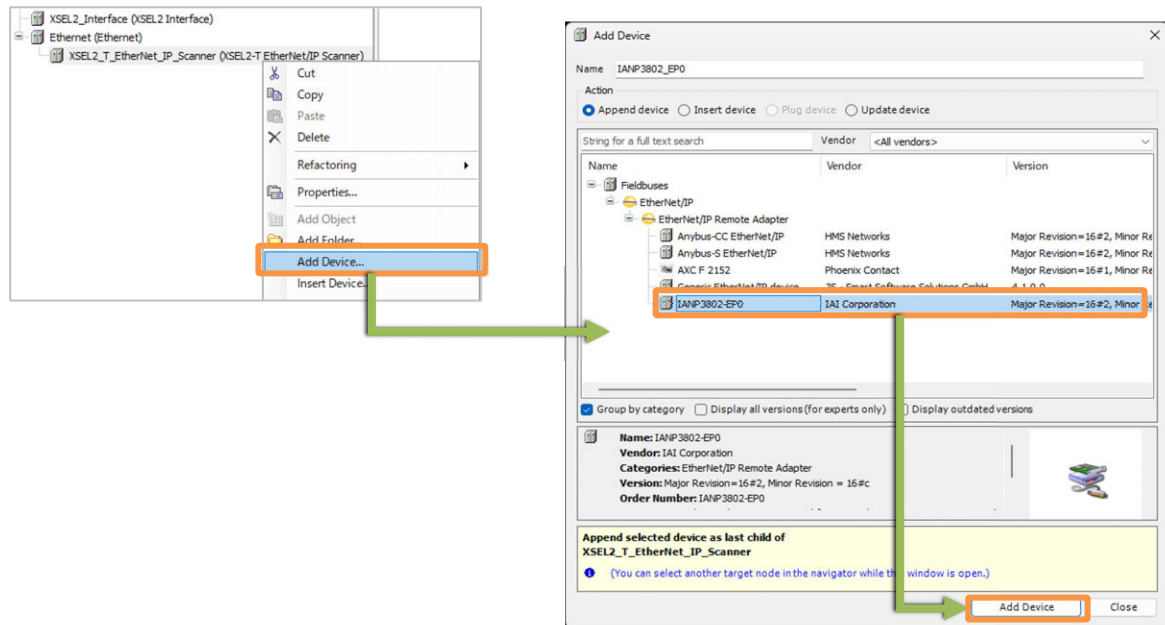
Caution

- In case that "Do not establish connection again automatically" is to be set, consider to have connection established again by the user.
Execute a reset with RemoteAdapter Command from a PLC program, and connection again to the applicable adapter should be attempted.
For the details of RemoteAdapter Command, refer to the separate volume [PLC Feature Programming Manual (ME0480)].

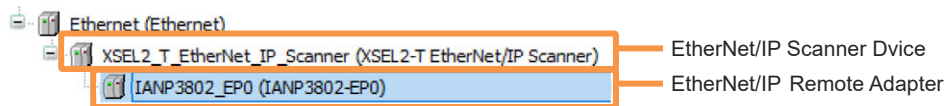
● Adding EtherNet/IP Remote Adapter

Right click "EtherNet_IP_Scanner (EtherNet/IP Scanner)" and select "Add Device...".

Select the EtherNet/IP remote adapter subject to connection from the device list and click "Add Device". (Below, describes the case of EtherNet/IP Adapter IANP3802_EP0)



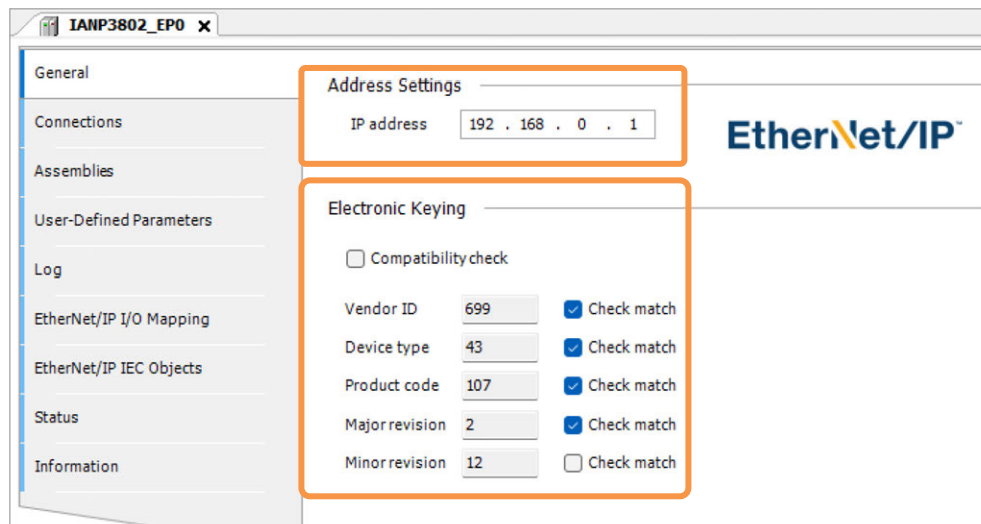
* Once the EtherNet/IP Remote Adapter is added, the following display should be shown.



Have the EtherNet/IP remote adapter set up.

The setting contents for the EtherNet/IP remote adapter may differ depending on the EDS file. Below, explains an example for EtherNet/IP Adapter IANP3802_EP0 manufactured by IAI.

- 1) Double-click the EtherNet/IP remote adapter device in the device tree to open the Edit Object window (hereinafter, adapter setting window) in the remote adapter.
- 2) Select "General" in the adapter setting window and set up the check items at connection to the IP address.

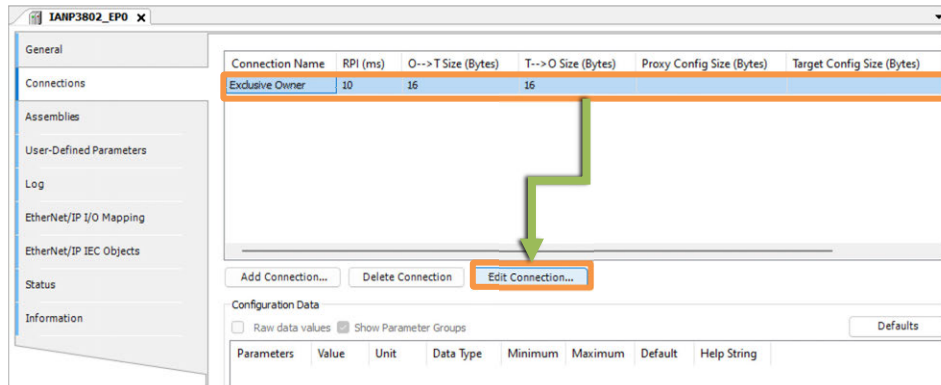


- Address settings
The IP address of the EtherNet/IP adapter device should be set up.
- Electronic keying
The items to be checked at connection should be set up.
(Normally, there should be no problem with the default setting.)

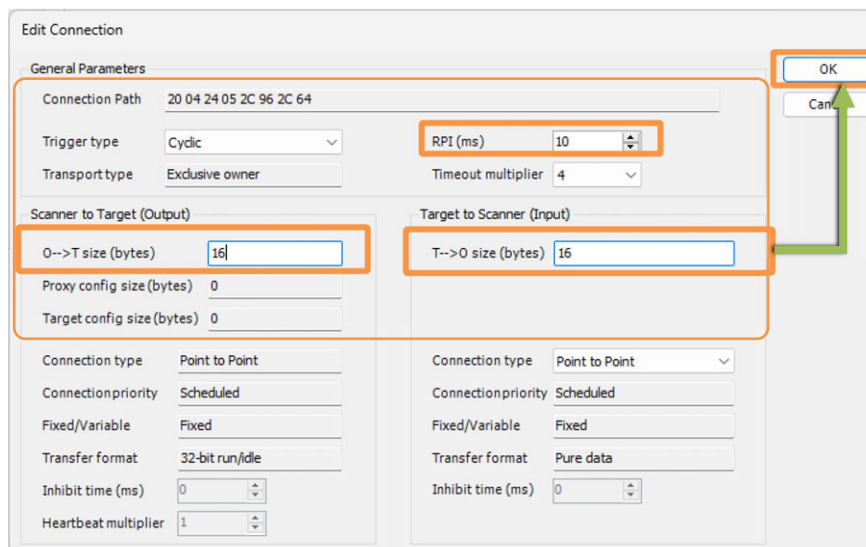
Compatibility Check

- ☒ (With Checkmark): Compatibility check unique to the adapter device should be conducted.
- ☐ (With No Checkmark): Compatibility check unique to the adapter device should not be conducted, and set up the items necessary to have matching check individually.

- 3) Select "Connection" from the adapter setting window and set up the connection parameters.
 - (1) Select "Exclusive Owner", and click **Edit Connection**.



- (2) Set up the parameters necessary for connection, and click **OK**.



- RPI (ms)
Data update frequency (packet interval) between the scanner and remote adapter should be set up.
- O→T size (bytes)
The output size from XSEL2 to the remote adapter should be set up in the byte unit.
- T→O size (bytes)
The Input size from the remote adapter to XSEL2 should be set up in the byte unit.



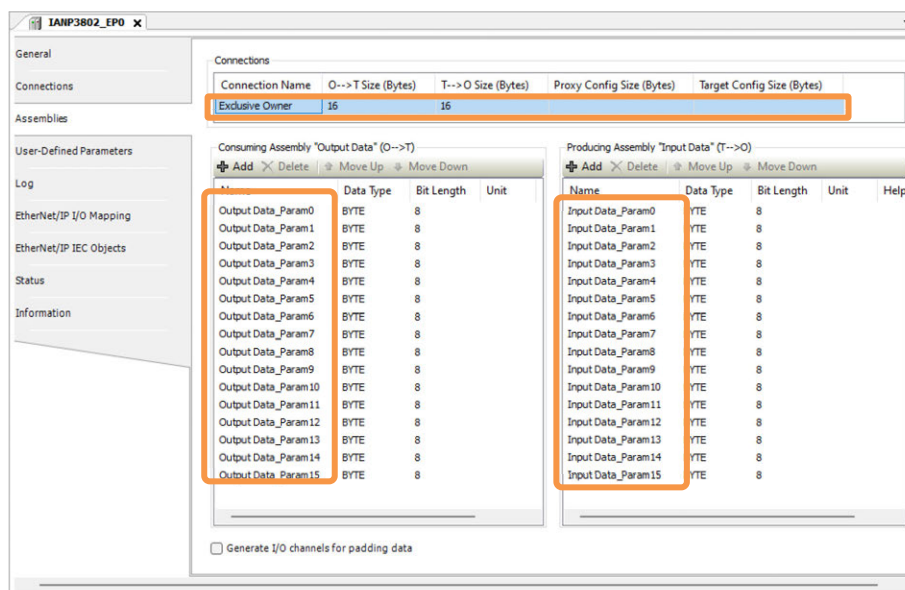
Caution

- When connected to an EtherNet/IP adapter device manufactured by IAI, set RPI to 2ms or more.
- Pay attention to the number of connected units of EtherNet/IP adapter devices and RPI (communication cycles) otherwise load to the CPU may exceed the allowable range and may cause an exception error.

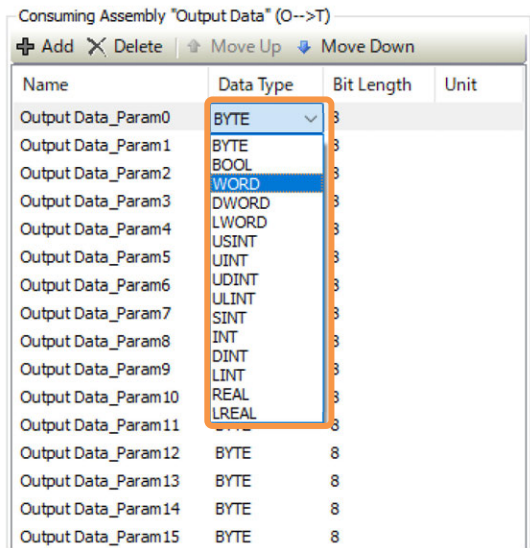
In such a case, it is necessary to either change the RPI setting to a larger value or reduce the number of connected units of adapter devices.

- For the RPI (communication cycles) value, it is necessary to set up the value that is applicable for an EtherNet/IP device. Refer to the manual of the EtherNet/IP device to set RPI to the value applicable for the device.

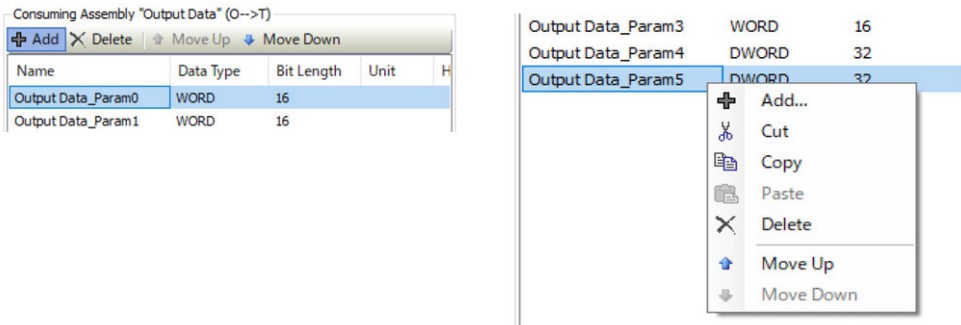
- 4) Select “Assembly” from the adapter setting window to set up the data configuration. Set the sizes of O→T / T→O to 16 (bytes), and each of them comes to the data configuration with 16 byte-types as shown below in the default.



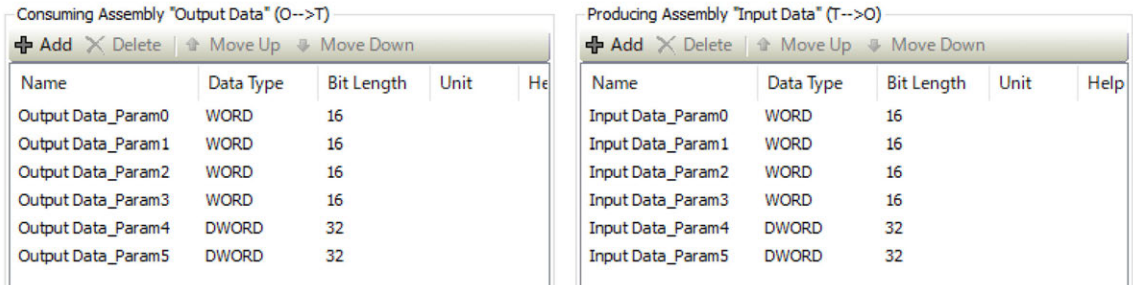
To change the data configuration, click a data type subject to change to select it.



To add or delete data, click “+ Add” or “x Delete”. It is also available to right-click individual data to select it.



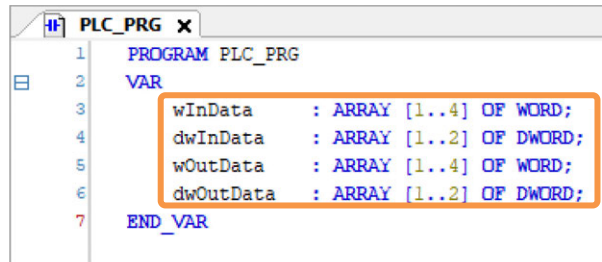
The figure below shows an example of changing the data configuration of 16 byte-types of input and output data to the input and output data configuration with 4 WORD types and 2 DWORD types.



[3] I/O Variable Setting

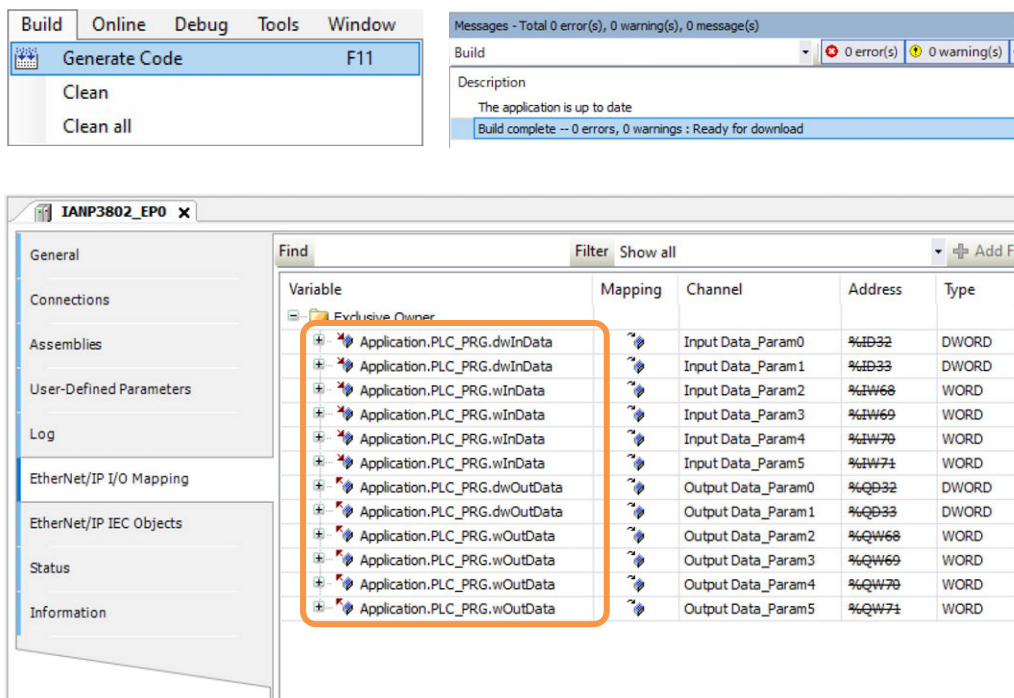
The assembly data with data types set should be defined as the variables to be used in a PLC program, and it should be mapped to the input and output data of an EtherNet/IP remote adapter.

- 1) Double-click "PLC_PRG (PRG)" in the device tree to open the POU editor.
- 2) Create variables to be used in a PLC program in the POU variable definition area.



- 3) Select "EtherNet/IP I/O Mapping" in the "IANP3802_EP0" tab, and input variables names applicable in the I/O mapping table.

To confirm that the I/O mapping is conducted correctly, select "Build" → "Generate Code" in the menu while there is no description in the PLC program main body to confirm the build completes in normal condition.



6.1.5 Accessories in EtherNet/IP Scanner Features

[1] Remote Adapter Connection Confirm

Here, explains how to confirm connection of XSEL2 and a EtherNet/IP remote adapter.

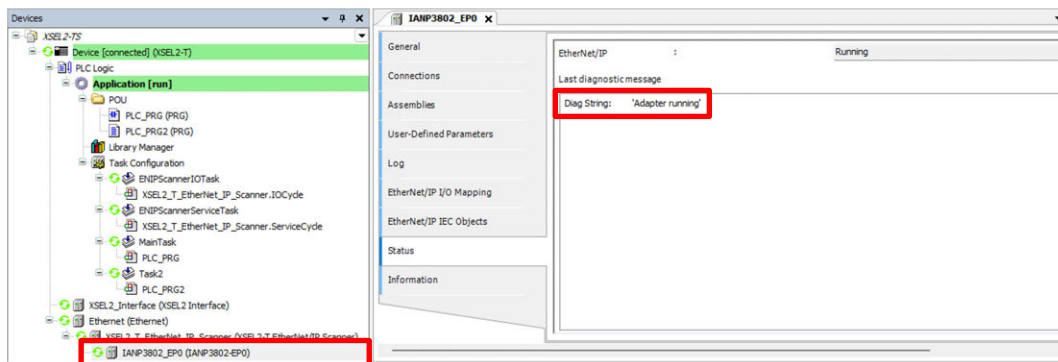
- 1) Double-click the remote adapter device in the device tree, select “Status” in the Edit Object window of the opened remote adapter, and confirm that it transmits to execution in process (Adapter running). (e.g., for “IANP3802_EP0”)

In case it would not transmit to execution in process, check if there is any discrepancy to the IP address, input and output point counts and so on in the remote adapter compared to the setting values in this device.

● For Operation Mode

Execution in Process: “Adapter running”

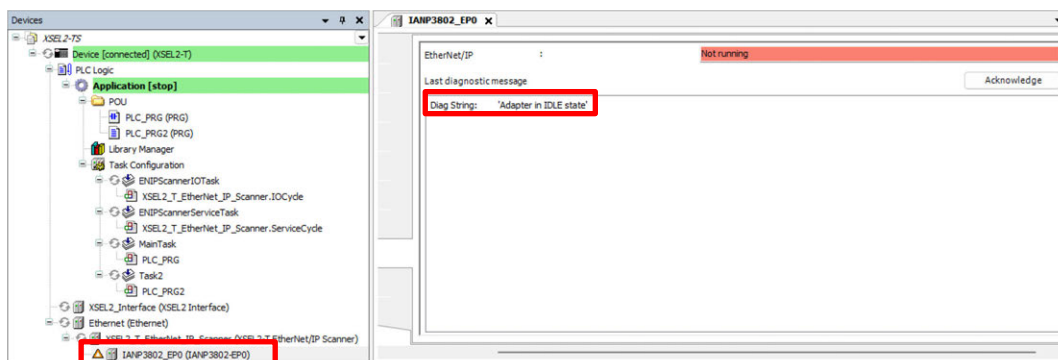
(When adapter connected: “Configure encapsulation layer...”)



● For Stop Mode

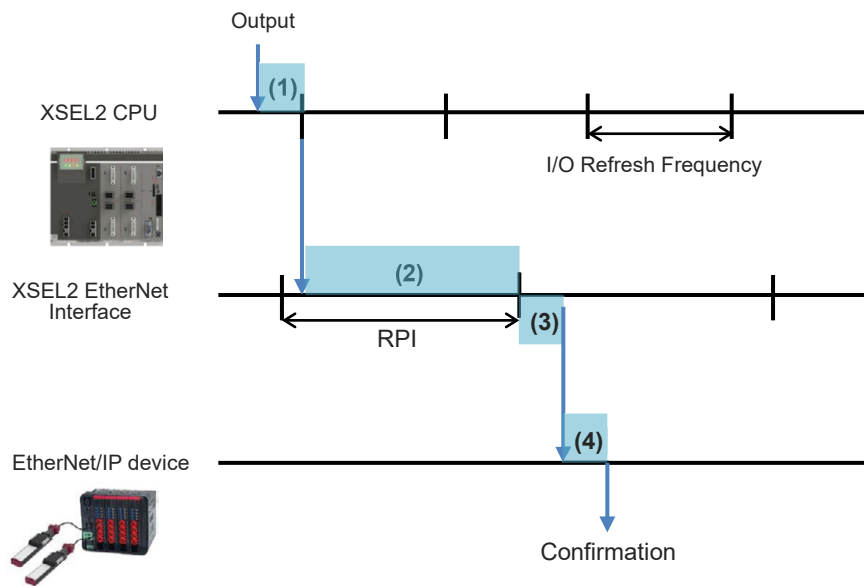
While Operation Stopped: “Adapter in IDLE state”

(When adapter not detected: “Adapter not configured yet...”)



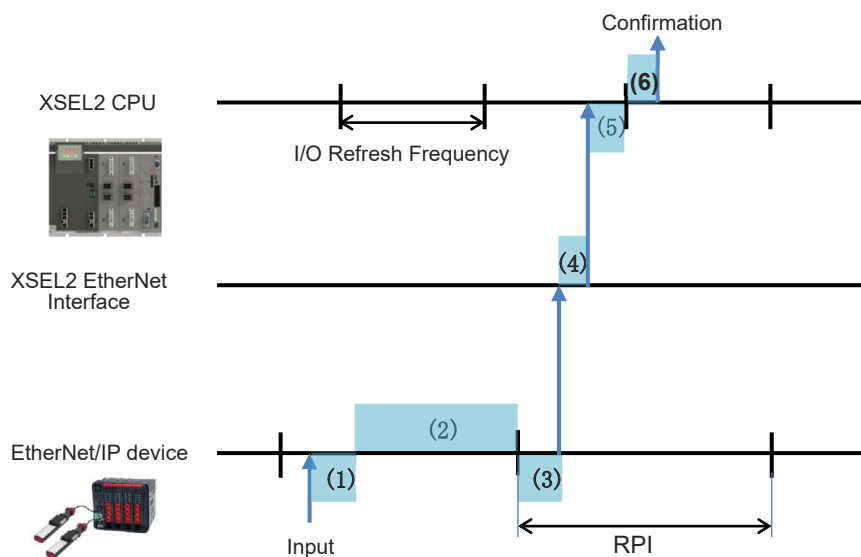
[2] Cyclic Communication Latency

● Latency in Sending



No.	Item	Content
(1)	Latency till I/O Refresh	It is the time after output with a command till the I/O refresh is conducted.
(2)	Time till EtherNet/IP Sent	It is the time till communication cycles determined by RPI (Requested Packet Interval). In case a communication retry occurs, add for count of retries and it makes delay.
(3)	EtherNet/IP Sending Process Latency	The following latency should occur when communication data is sent to each device. $0.026 \times \text{Connection Count [ms]}$
(4)	Internal Process of EtherNet/IP Device	It is the internal process time for a connected EtherNet/IP device. Refer to manuals related to each network device.

● Latency in Receiving



No.	Item	Content
(1)	Internal Process Time for EtherNet/IP Device	It is the internal process time for a connected EtherNet/IP device. Refer to manuals related to each network device.
(2)	Time till EtherNet/IP Sent	It is the time till communication cycles determined by RPI (Requested Packet Interval). In case a communication retry occurs, add for count of retries and it makes delay.
(3)	EtherNet/IP Sending Process Latency	It is the latency in data sending process of a connected EtherNet/IP. Refer to manuals related to each network device.
(4)	EtherNet/IP Receiving Process Latency	The following latency should occur when receiving communication data from each device. $0.008 \times \text{Connection Count} + 0.000004 \times \text{Total Data Size [byte] [ms]}$
(5)	Latency till I/O Refresh	It is the time till I/O refresh is conducted.
(6)	Latency till Confirmation	It is the time till confirmed in a command from PLC.

[3] CIP Support Object

(1) Identity Object (Class ID: 01_H)

● Class

● Class Service

It is applicable for Get_Attribute_Single (0E_H) and Get_Attributes_All (01_H).

● Class Attribute (Instance ID: 0)

ID	Name	Attributes	Data type	Explanation	Value
1	Revision	Get	UINT	Revision of Object	2
2	Max Instance	Get	UINT	Max. Instance Number	1
6	Maximum ID Number Class Attributes	Get	UINT	Max. Attribute ID in Class Attribute	7
7	Maximum ID Number Instance Attributes	Get	UINT	Max. Attribute ID in Instance Attributes	7

● Instance

● Instance Service

It is applicable for Get_Attribute_Single (0E_H), Get_Attributes_All (01_H).

● Instance Attribute (Instance ID: 1)

ID	Name	Attributes	Data type	Explanation	Value
1	Vendor ID	Get	UINT	Vendor Identification Number	699 (IAI Corporation)
2	Device Type	Get	UINT	Device type	12 (Communications Adapter)
3	Product Code	Get	UINT	Product Identification Code	109
4	Revision	Get	Structure	Revision	---
	Major Revision	Get	USINT	Major Revision	1
	Minor Revision	Get	USINT	Minor Revision	1
5	Status	Get	WORD	Status	Current value
6	Serial Number	Get	UINT	Serial number	Serial number
7	Product Name	Get	SHORT_STRING	Product name	XSEL2-T

(2) Connection Manager Object (Class ID: 06_H)

- Class
 - Class Service / Class Attribute
 - …There is no Class Service / Class Attribute.
- Instance
 - Instance service
 - It is applicable for Forward_Open (54_H), Large_Forward_Open (5B_H), Forward_Close (4E_H).
 - Instance Attribute
 - …There is no Instance Attributes.

(3) TCP/IP Interface Object (Class ID: F5_H)

● Class

● Class Service

It is applicable for Get_Attribute_Single (0E_H).

● Class Attribute (Instance ID: 0)

ID	Name	Attributes	Data type	Explanation	Value
1	Revision	Get	UINT	Revision of Object	4
2	Max Instance	Get	UINT	Max. Instance Number	1
3	Number of Instances	Get	UINT	Object Instance Count	1

● Instance

● Instance Service

It is applicable for Get_Attribute_Single (0E_H).

● Instance Attribute (Instance ID: 1)

ID	Name	Attributes	Data type	Explanation	Value
1	Status	Get	DWORD	Status	00000002 _H
2	Configuration Capability	Get	DWORD		00000020 _H
3	Configuration Control	Get	DWORD		00000000 _H
4	Physical Link Object	Get	Structure	Path to Physical Link Object	---
	Path size		UINT	Path Size	2
	Path		Padded EPATH	Segment to Specify Physical Link Object	20F62401 _H
5	Interface Configuration	Get	Structure	Interface Configuration	---
	IP Address		UDINT	IP Address	Set value
	Network Mask		UDINT	Subnet mask	Set value
	Gateway Address		UDINT	Default gateway	Set value
	Name Server		UDINT	Primary name server	0 (Not supported)
	Name Server 2		UDINT	Secondary Name Server	0 (Not supported)
	Domain Name		STRING	Domain name	NULL (Not supported)

(4) Ethernet Link Object (Class ID: F6_H)

● Class

● Class Service

It is applicable for Get_Attribute_Single (0E_H), Get_Attributes_All (01_H).

● Class Attribute (Instance ID : 0)

ID	Name	Attributes	Data type	Explanation	Value
1	Revision	Get	UINT	Revision of Object	4
2	Max Instance	Get	UINT	Max. Instance Number	1
3	Number of Instances	Get	UINT	Object Instance Count	1

● Instance

● Instance Service

Get_Attribute_Single (0E_H)

● Instance Attribute (Instance ID: 1)

ID	Name	Attributes	Data type	Explanation	Value
1	Interface Speed	Get	UDINT	Interface communication speed (Mbps)	Current value
2	Interface Flags	Get	DWORD	Interface Status Flag	Current value (Refer to table below)
3	Physical Address	Get	USINT array	MAC Address (6 octet)	Current value
11	Interface Capability	Get	Structure	Interface Support Information	---
	Capability Bits		DWORD	Support Information	6
	Speed/Duplex Options		Structure	Baud Rate / Duplicated Mode Option	---
	Speed/Duplex Array Count		USINT	Option Count	0

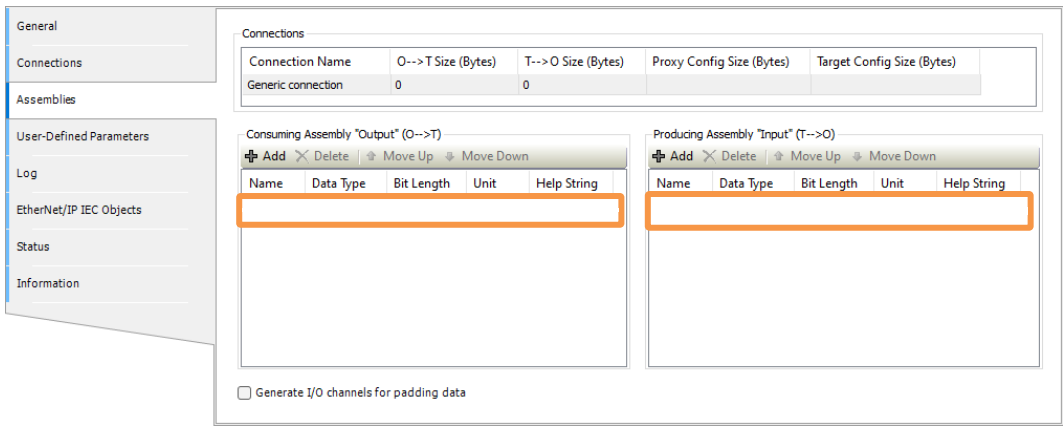
● Interface Flags details

Bit	Name	Attributes	Explanation	Value
0	Link Status	Get	Network Link Status 0: Non-Active 1: Active	Current value
1	Half/Full Duplex	Get	Duplicated Mode Status 0: Half Duplex 1: Full Duplex	Current value
2 to 4	Negotiation Status	Get	Automatic Negotiation Status 0: Negotiation in Process 1: Negotiation Failed (both baud rate and duplicated mode) 2: Negotiation Failed (Only baud rate succeeded) 3: Negotiation Succeeded 4: Negotiation Not Executed	Current value
5	Manual Setting Requires Reset	Get	Reset Operation at Negotiation Setup Change 0: Unnecessary (Automatic Negotiation Setting fixed) 1: Necessary	0
6	Local Hardware Fault	Get	Hardware Error Status 0: Normal 1: Error	Current value
7 to 31	Reserved	Get	Reserve	0

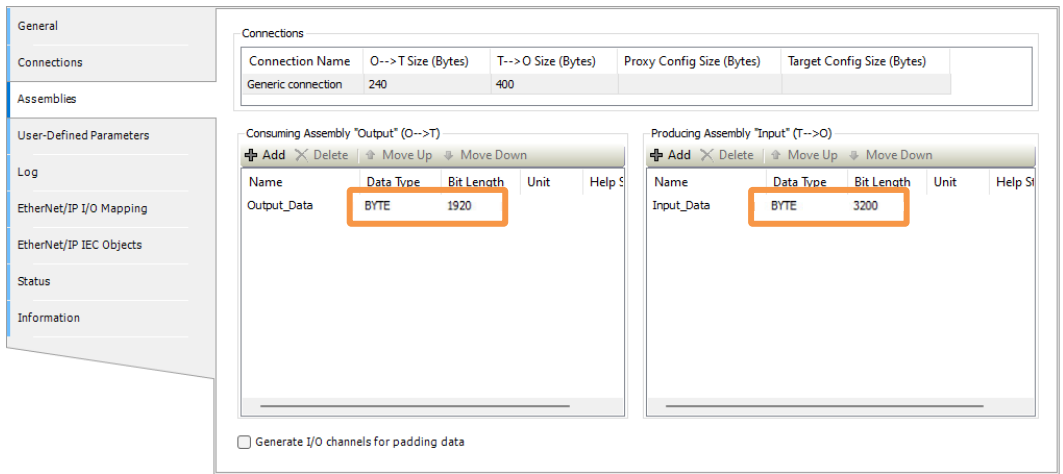
6.1.6 Caution for EDS File

If there is a problem in the definition in the EDS file to use, the contents of the EDS file would not be recognized by CODESYS for XSEL2, and input and output data may not get mapped. There are the following two types for those that input and output data are not mapped.

(1) When data is not assigned to the input / output assembly

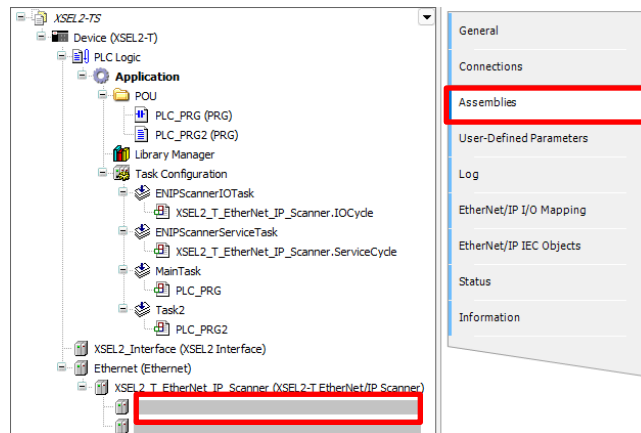


(2) Relation between data type in input / output assembly and bit length is not appropriate.
(e.g. Data type is Byte Type but bit length is not Byte Type, etc.)

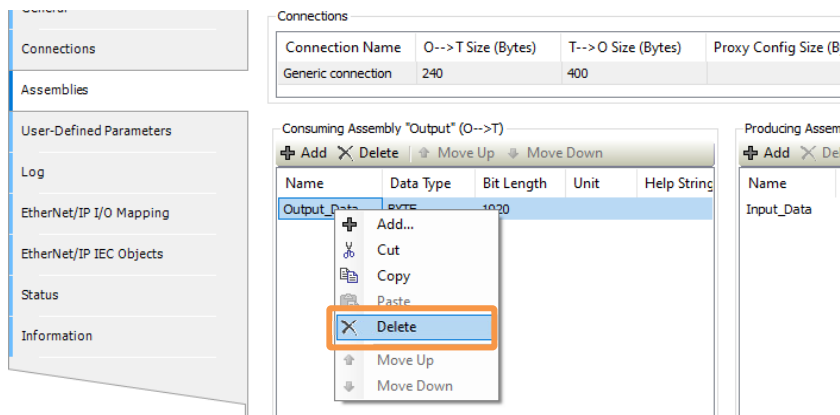


In such a case as above, conduct the operation described in the following pages.

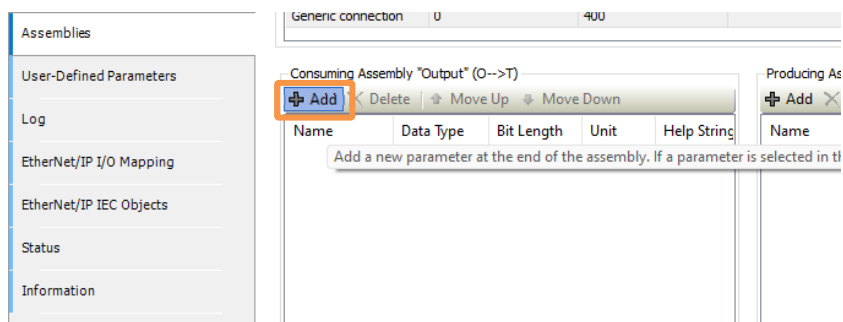
- 1) Open Assembly in the EtherNet/IP adapter.



- 2) If the instance in the input / output assembly is not appropriate, select “Delete” from the right-click menu.



- 3) Click “+ Add” in the input / output assembly.



- 4) Click the name same as the previous instance, and confirm that the same name is input in the “Name” box. (e.g.: Output Data)
- 5) Input the data type to be used in the I/O mapping in the “Data Types” box. (e.g.: BYTE)
- 6) Input the data count to be conducted I/O mapping in the “Count” box. (e.g.: 15)

RPI	Status	Monitor Data Size	External Input Size	Input Data	Output Data
112	0	100	WORD	500	10000000
			WORD	0	65535
			UINT	2	400
			UINT	0	240
			BYTE	0	255
			BYTE	0	255

4)

Name: Output Data

Unit:

Help String:

Data type: BYTE 5)

Bit length: 8

Count: 15 6)

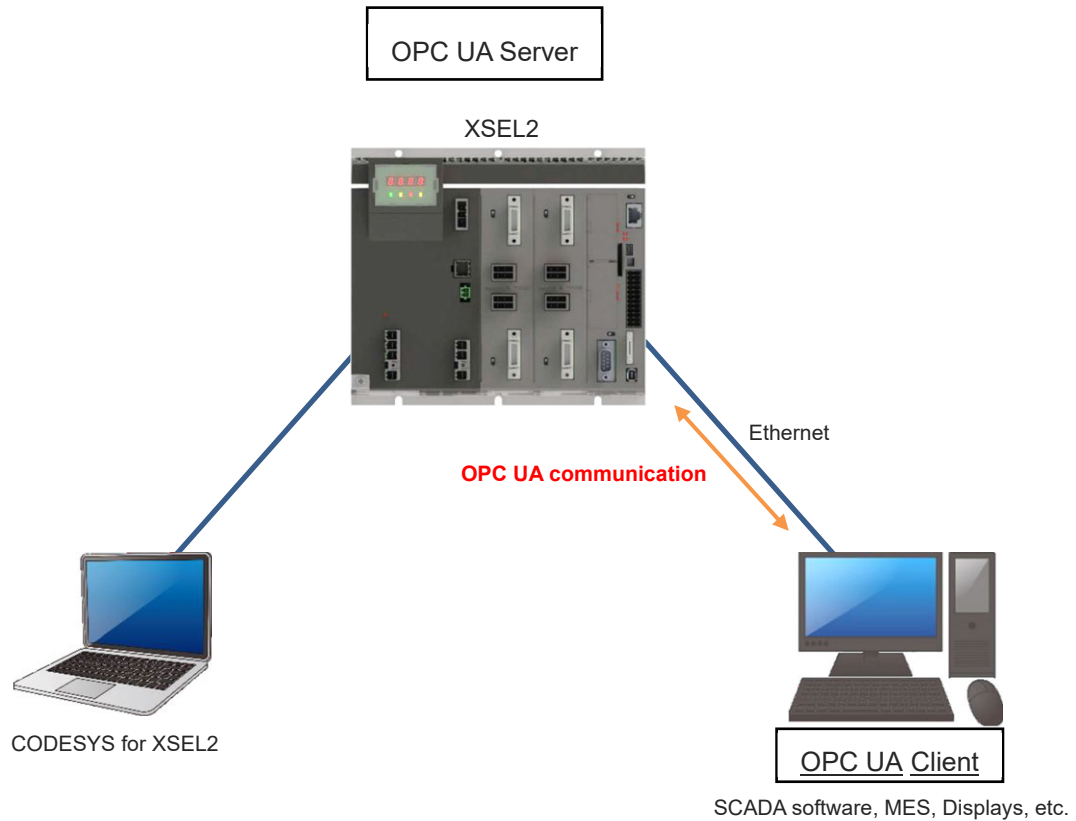
- 7) Confirm that the instance added in Step 4) to 6) in the EtherNet/IP I/O mapping is displayed.

Variable	Mapping	Channel	Address	Type	Unit	Descr
Input_Data		Input_Data	%IB 144	BYTE		
Output_Data		Output_Data	%QB 144	BYTE		
Bit0		Bit0	%QX 144.0	BOOL		
Bit1		Bit1	%QX 144.1	BOOL		
Bit2		Bit2	%QX 144.2	BOOL		
Bit3		Bit3	%QX 144.3	BOOL		
Bit4		Bit4	%QX 144.4	BOOL		
Bit5		Bit5	%QX 144.5	BOOL		
Bit6		Bit6	%QX 144.6	BOOL		
Bit7		Bit7	%QX 144.7	BOOL		
Output_Data		Output_Data	%QB 145	BYTE		
Output_Data		Output_Data	%QB 146	BYTE		
Output_Data		Output_Data	%QB 147	BYTE		
Output_Data		Output_Data	%QB 148	BYTE		
Output_Data		Output_Data	%QB 149	BYTE		
Output_Data		Output_Data	%QB 150	BYTE		
Output_Data		Output_Data	%QB 151	BYTE		
Output_Data		Output_Data	%QB 152	BYTE		
Output_Data		Output_Data	%QB 153	BYTE		
Output_Data		Output_Data	%QB 154	BYTE		
Output_Data		Output_Data	%QB 155	BYTE		
Output_Data		Output_Data	%QB 156	BYTE		
Output_Data		Output_Data	%QB 157	BYTE		
Output_Data		Output_Data	%QB 158	BYTE		

Reset Mapping Always update variables Us

6.2 OPC UA server feature

OPC UA Server Feature actuates XSEL2 as OPC UA Server and use the OPC UA communication to enable reading and writing of variables disclosed in CODESYS from the OPC UA client side. In OPC UA, certification and encryption of communication are defined in the standard, which enables secured communication.



6.2.1 Feature Specification

Below shows the feature specifications of OPC UA Server.

Item		Detail
Used Connection Port		CPU Unit Built-in Ethernet Port * Use in parallel with other Ethernet communications
Profile		Embedded UA Server Profile 1.04
Information Model		PLCopen Information Model for IEC 61131-3
Transport		UA TCP
URL (End Point URL) Indication System		opc.tcp://[IP Address]:[Port No.] e.g.) opc.tcp://192.168.0.10:4840
Session (Client) Max. Count		2
Monitoring Item Count		200
Variable Types not Available to Disclose		• Character String Type (STRING available, WSTRING not available) • Clock Type (Only LDATE_AND_TIME (LDT) available, other types not available) • Constant Type (const), Interface, Properties • Common Body, Pointer
Limitation in Variable Names		• Max. Number of Characters 255 Characters • Half-width characters (alphanumeric characters and symbols)
OPC UA Security Mode		• None: Sign-in or Encrypt Unnecessary • Sign: Only Sign-in Necessary • Sign&Encrypt: Sign-in and Encrypt Necessary
OPC UA Security Policy		• Basic256Sha256 • Aes128_Sha256_RsaOaep • Aes256_Sha256_RsaPss
Application authentication*	Certificate	• Own Certificates: Own Certificates • Trusted Certificates: Trusted Certificates • UnTrusted Certificates: Untrusted Certificates • Quarantined Certificates: Quarantined Certificates *Available to register 8 for each
	Certificate Specification	X.509 compliant
User certification		• Username&Password (Username and Password) *Anonymous users should not use it in security viewpoint

* The sampling frequency should be set in the OPC UA client. In OPC UA Server for XSEL2, 100ms, 300ms, 500ms, 1000ms, 2500ms and 5000ms should be selected from the sampling frequency set in the client for operation.

6.2.2 Flow from Setup to Connection

As the setup to disclose variables used in a program in CODESYS, set up the OPC UA Server Feature after the program is created in CODESYS.

Setup on OPC UA Server Side

The operation to set up on the OPC UA Server side should be conducted in CODESYS for XSEL2.

- 1) OPC UA Server Feature Setup
 - Activation of the OPC UA feature and setup of variables to be disclosed should be conducted.
Refer to [6.2.3 OPC UA Server Setup]
 - Set up the user certification.
Refer to [6.2.4 [3] User Certificate Setting]
- 2) Server Certificate Setup

Create a server certification. (*1)
Refer to [6.2.4 [4] Server Certificate]

Setup on OPC UA Client

For the setup on the OPC UA client side, refer to the instruction manual of the client.

- 3) Setting up Destination for Connection

Indicate the end point URL, and connect to OPC UA Server.
It is necessary to select a security policy applicable for OPC UA Server.
- 4) Registration of Server Certificate

Register the server certificate provided by the server to the OPC UA client software.
- 5) Client Certificate Setup

Create a client certification.
A client certificate should be sent at the time of connection request.
- 7) Reading and Writing of Variables

Reading and writing of CODESYS variables in accordance with the address space in the OPC UA client should be conducted.

- 6) Registration of Client Certificate

A client certificate provided by the OPC UA client should be registered. *1
Refer to [7.2.4 [5] Client Certificate]

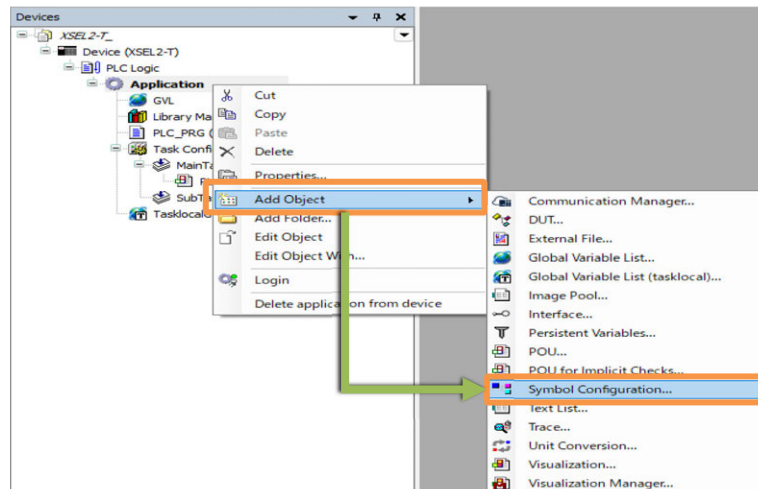


*1 If the security mode is set to “None”, communication can be established even without exchanging the server certificate and client certificate.

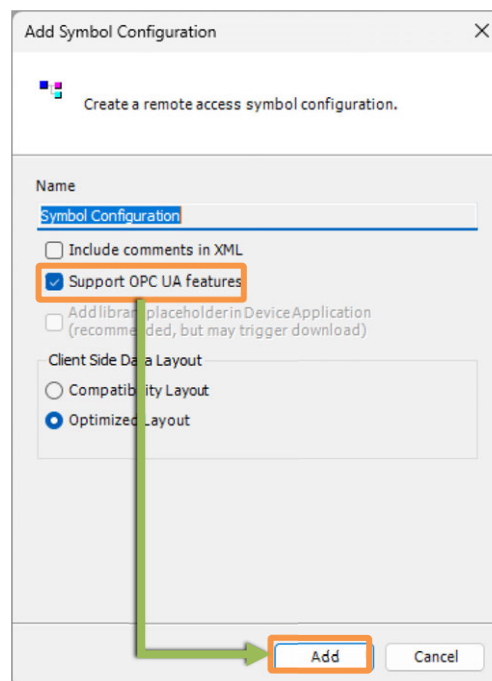
6.2.3 OPC UA Server Setup

In order to use the OPC UA server feature, it is necessary to activate the OPC UA feature and to register variables to be disclosed to a client. Shown below is how to set it up.

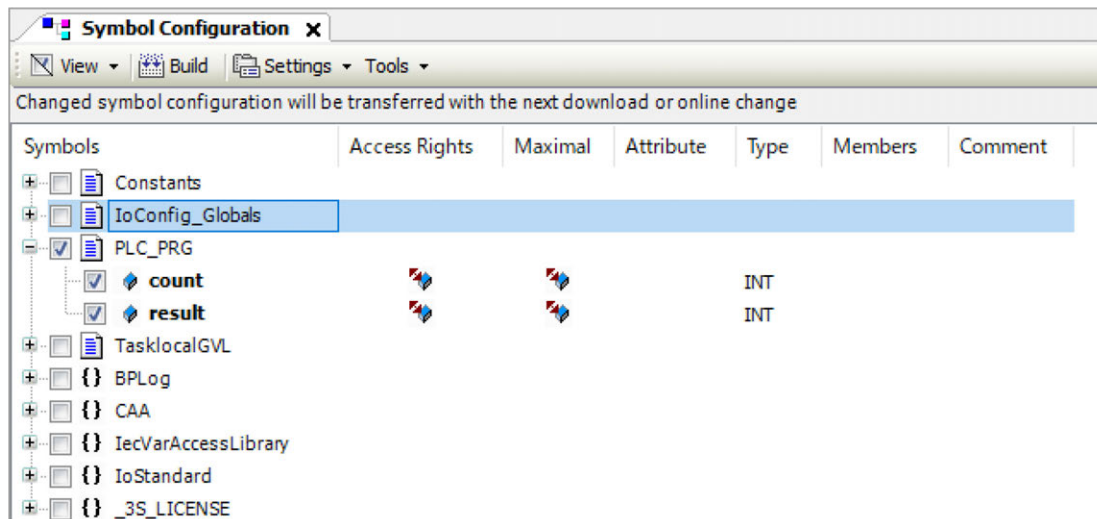
- 1) Right-click “Application” displayed in the device view, and select “Add Object” → “Symbol Configuration...”.



- 2) In the “Add Symbol Configuration” dialog, put a checkmark at “Support OPC UA Features” and click **Add**.



- 3) As symbol configuration window opens, select a “variable to disclose from the list”.



The right to access to disclose can be changed. The right to access can be changed every time it is clicked.

- : Read only
- : Write only
- : Read Write

- 4) Build a program and check that there is no error occurred, and log in to the controller to have the operation started.

6.2.4 Security Feature

[1] Guideline of Security Feature

In the OPC UA Server feature, security is secured by two steps of certificate, application certificate and user certificate, to connection from the OPC UA client.

- User certification

It is a system that the OPC UA server certifies the OPC UA client that tries to access OPC UA Server by a username and password.

A user to permit connection should register its username and password to the OPC UA server. The username and password should be required at connection from the OPC UA client for certification.

- Application certification

The application certificate is a system to certify the identification of each other by having the OPC UA server and the OPC UA client exchange the electric certificate with each other.

The application certificate for XSEL2 supports the certificate in X.509 specification.

[2] Security Policy

The security policy is an agreement that settings necessary to secure security such as existence of signing and encrypt to messages exchanged in a communication and encryption algorithm are combined. The security policy to messages should be set up to have safe communication.

By setting the same security policy to the OPC UA client connected to the OPC UA server, communication can be established.

● Security Policy Available for Setting

The security policies available for setting are as follows.

Security Policy	Authority	Encrypt	Explanation
Basic256Sha256-Sign	Basic256Sha256	None	By signing in, completeness of data (countermeasures to such as falsification) can be secured.
Aes128_Sha256_RsaOaep-Sign	Aes128_Sha256_RsaOaep		
Aes256_Sha256_RsaPss-Sign	Aes256_Sha256_RsaPss		
Basic256Sha256-SignAndEncrypt	Basic256Sha256	Basic256Sha256	By signing in and encrypting, completeness of data (countermeasures to such as falsification) and reliability (countermeasures to such as eavesdropping) can be secured.
Aes128_Sha256_RsaOaep-SignAndEncrypt	Aes128_Sha256_RsaOaep	Aes128_Sha256_RsaOaep	
Aes256_Sha256_RsaPss-SignAndEncrypt	Aes256_Sha256_RsaPss	Aes256_Sha256_RsaPss	

[3] User Certificate Setting

OPC UA Server Feature is applicable for user authentication by a password. The username and password used for user certificate should be added as the device user for CODESYS. For how to add a user, refer to [7.2.1 Device User Feature].



Caution

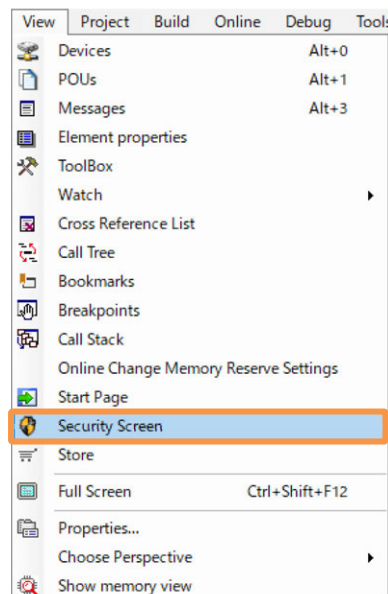
- When OPC UA communication cannot be established properly, check also that the communication permitted users for XSEL2 and the OPC UA client are matched with each other.
-

[4] Server Certificate

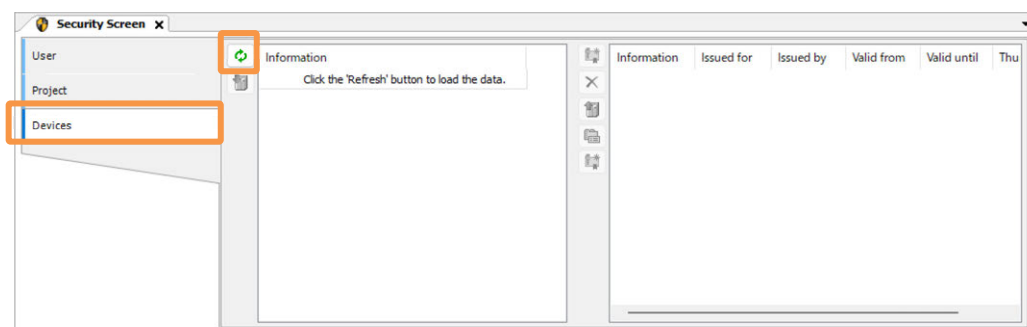
The server certificate is to certify the identification of the OPC UA server. When using the security policy, connection can be established by registering the server certificate to the OPC UA client. To connect from the OPC UA client, it is necessary that the generated server certificate is registered to the OPC UA client. The server certificate should be provided at a connection request from the OPC UA client, and connection to the client should be established by registering it on the client side.

Below shows how to create a server certificate.

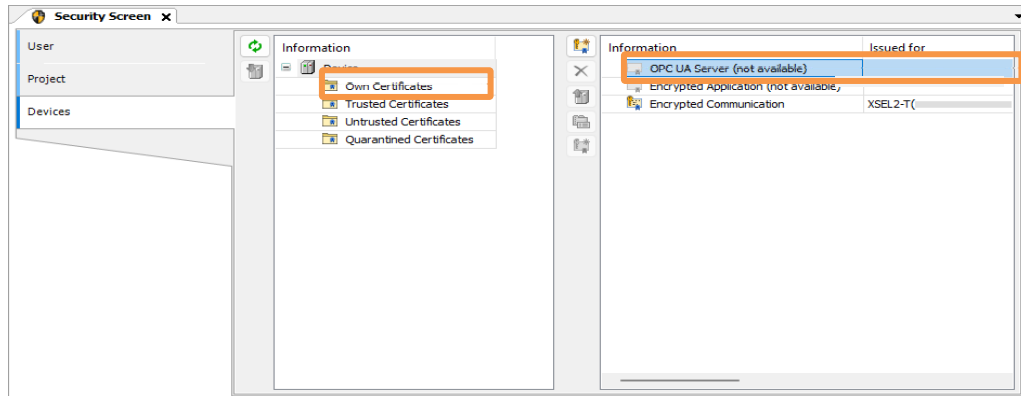
- 1) Click **Display** → **Security Screen** from the menu.

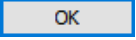


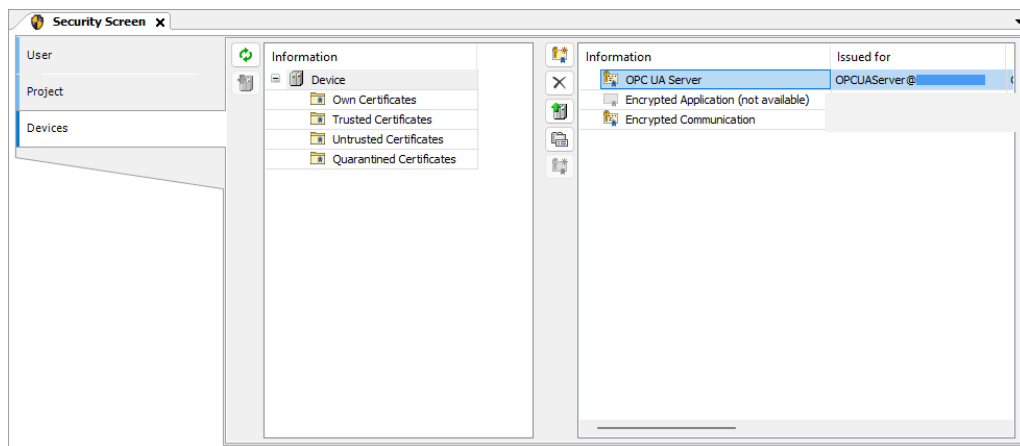
- 2) Select the "Devices" tab and click .



- 3) The status of the certificate in the device should be shown.
Indicate “Own Certificates” and select “OPC UA Server”.



- 4) Create a certificate. Click the  icon, and the “Certificate Settings” dialog should open.
- 5) Once the “Certificate Settings” dialog opens, set up the length and the expiry date for the certificate key, and click  and the certificate should be created.



* It may take a five minute to issue a certificate.

- 6) Indicate [Own Certificates] to confirm that “OPC UA Server” Certificate has been issued, and turn off the power to the XSEL2 controller and reboot it.

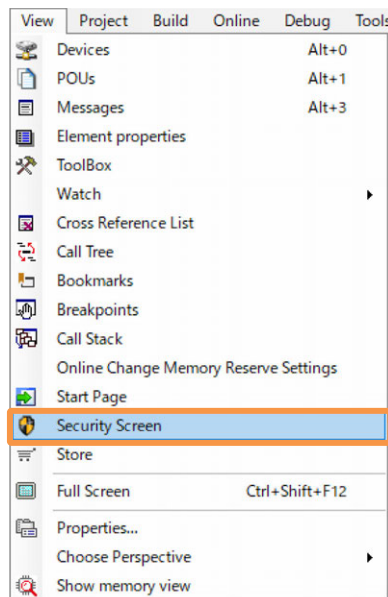
* The issued certificate should get valid after the reboot.

[5] Client Certificate

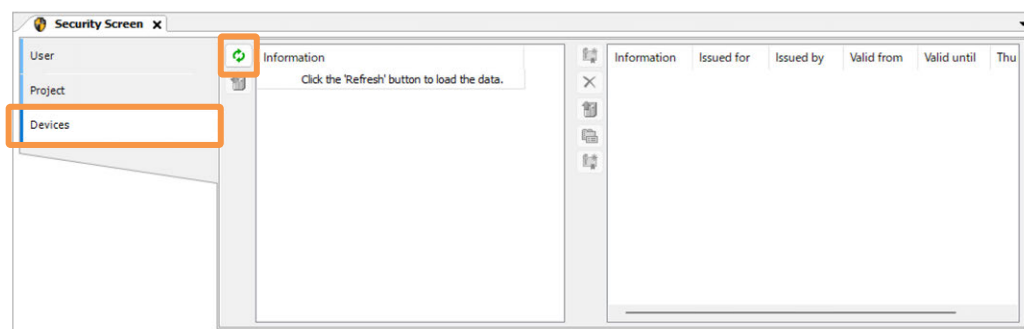
The client certificate is to certify the identification of the OPC UA client. When using the security policy, connection can be established by registering the client certificate to the OPC UA server. Compare the client certificate sent at a connection start request from the OPC UA client with the client certificate in Trusted Certificate, and connection should be permitted when it is the registered client certificate.

Below shows how to register the client certificate of own signed.

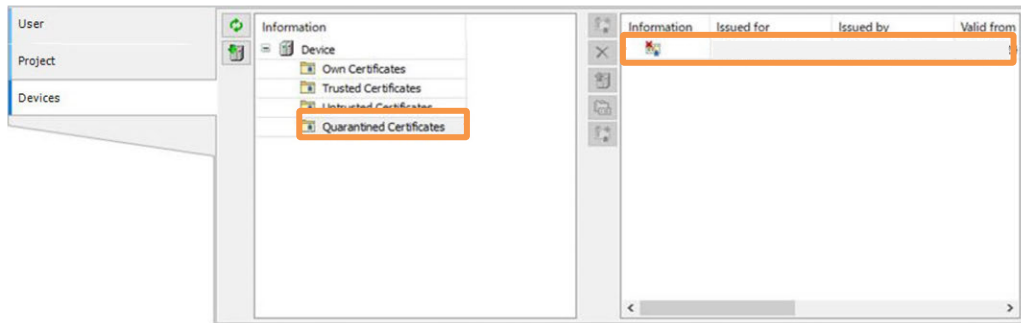
- 1) Click **Display** → **Security Screen** from the menu.



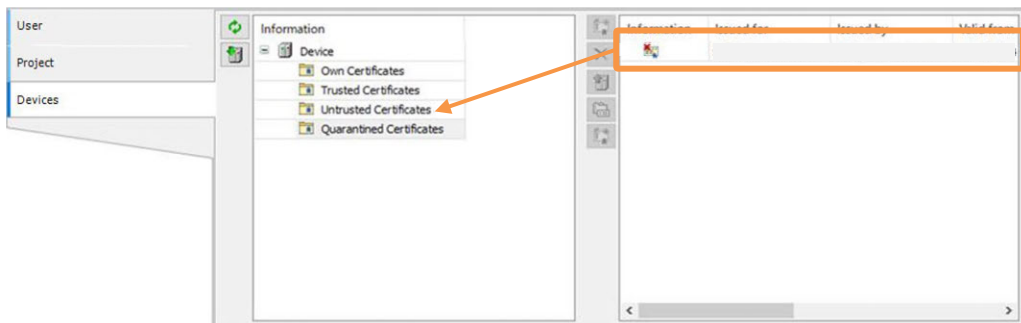
- 2) Select the "Devices" tab and click .



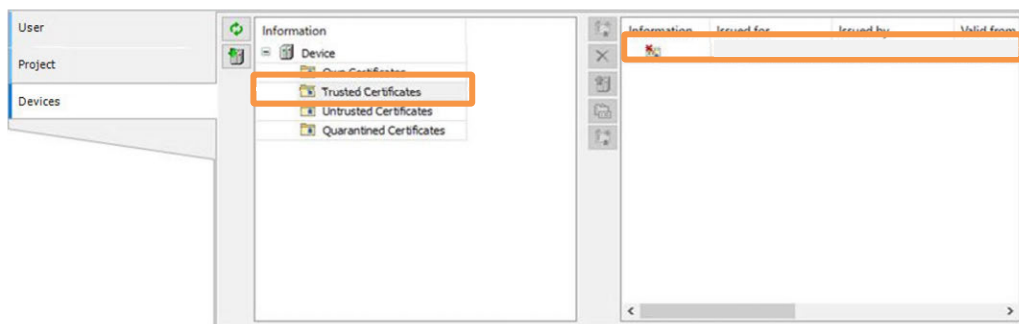
3) Select “Quarantined Certificates” and the certificate of the client should get displayed.



4) Drag & drop the trustable client certificate to “Untrusted Certificates”.



5) The client certificate should be added to Trusted Certificates.



Caution

- Do not attempt to move the certificate to Own Certificates. Movement should be made only among the following folders.
 - Trusted Certificates
 - Untrusted Certificates
 - Quarantined Certificates

6.2.5 Connection from OPC UA Client and Reading and Writing of Variables

[1] How to Connect to OPC UA Server

[URL for Connection Destination]

Indicate the end point URL of the OPC UA server as the destination of connection for the OPC UA client.

Format: `opc.tcp://[XSEL2 IP address]:4840`

e.g.) `opc.tcp://192.168.0.10:4840`



Caution

- For the IP address indicate the IP address of the Ethernet built in XSEL2.
- For some OPC UA client applications, indication of a port number may not be necessary.
`opc.tcp://<XSEL2 IP address>`
e.g.) `opc.tcp://192.168.0.10`
- Some OPC UA client describes URI (Uniform Resource Identifier), not URL, but there is no problem to set up the same as URL.

[User certification]

In case user certification is conducted at connection to the OPC UA server, it is necessary to set up the username and password.

[2] Reading and Writing of Variables from OPC UA Client

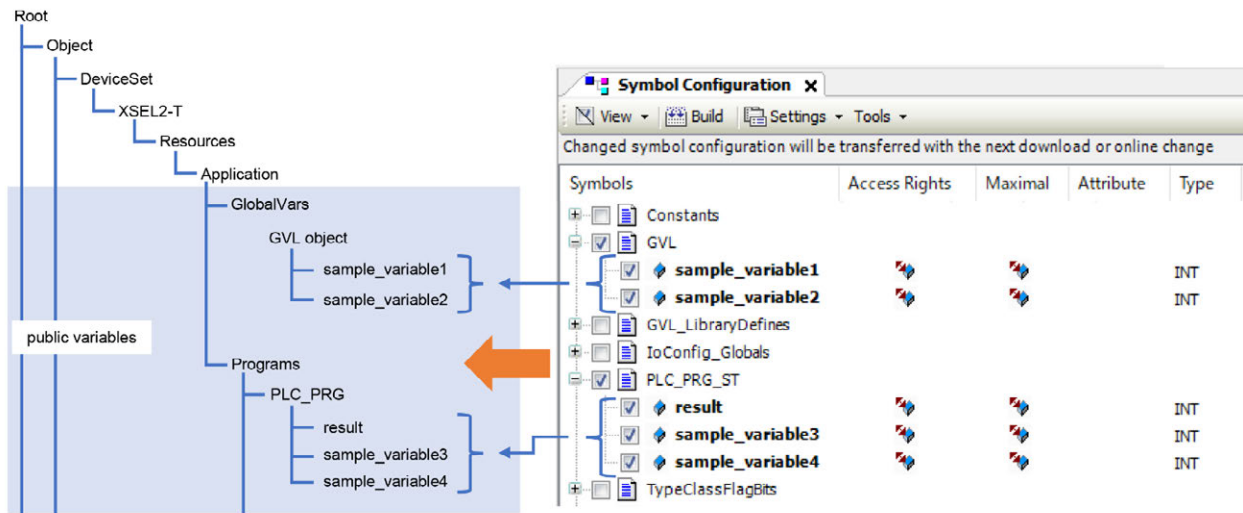
- OPC UA Address Space and Application of Variables

From the OPC UA client, indication should be made in the address space of OPC UA.

The address space of XSEL2 should be disclosed as follows.

- Mapping of Variables and Attributes

Settings of names, data types and values of variables should be mapped to the data types of each node in the address space.



- Mapping of Variables and Attributes

Settings of names, data types and values of variables should be mapped to the data types of each node in the address space.

Variable Attribute of CODESYS	Attribute of OPC UA	Explanation
Variable name	BrowseName or DisplayName	There is no identification of capital and small letters.
Data type	DataType	For mapping of the datatype of CODESYS and datatype of OPC UA, refer to [the table in the next page].
Value	Value	Values corresponding to the datatype should be set.

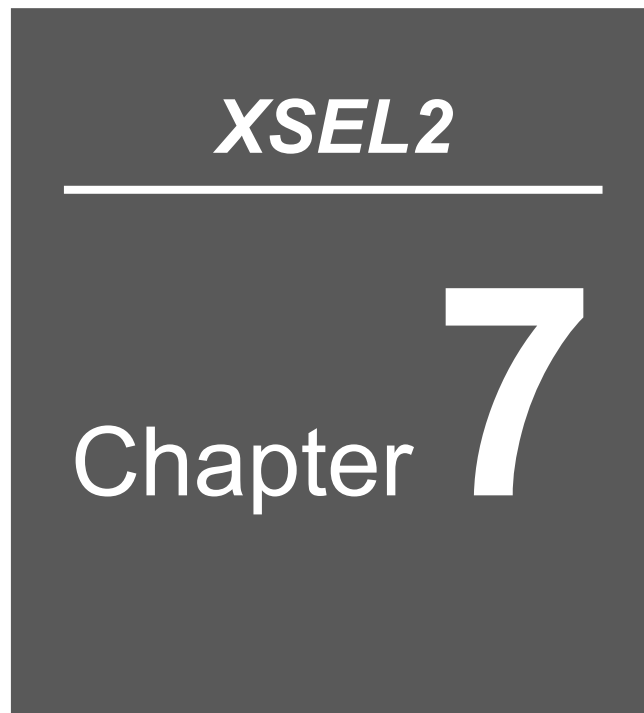
● CODESYS Datatypes and OPC UA Datatypes

CODESYS data type	OPC UA data type	Explanation of OPC UA Datatypes
BOOL	Boolean	Values expressed with 8-bit values to show status of two
SINT	SByte	Integers with 8-bit symbols
BYTE, USINT	Byte	Integers without 8-bit symbols
INT	Int16	Integers with 16-bit symbols
UINT, WORD	UInt16	Integers without 16-bit symbols
DINT	Int32	Integers with 32-bit symbols
UDINT, DWORD	UInt32	Integers without 32-bit symbols
LINT	Int64	Integers with 64-bit symbols
ULINT, LWORD	UInt64	Integers without 64-bit symbols
REAL	Float	IEEE754 Single-Precision Floating-Point Numbers
LREAL	Double	IEEE754 Double-Precision Floating-Point Numbers
LDATE_AND_TIME	DateTime	Date Clock 64 bits, 100ns time from 1601/1/1
LTIME	UtcTime	Time 64-bit
STRING	String	UTF-8 Character String Ending with Null

* Members of structured variables and each element in the array type should be deployed as the child nodes of variables.

6.2.6 Precautions

- Having a warm reset during monitoring of XSEL2 data from the OPC UA client device, and monitoring of the OPC UA client could stop and get necessary for registration on the OPC UA client side again.
- Security on the system should be established by the user.
Shown below is an example of network security measures.
 - (1) Use this product in a network using such as Firewall.
 - (2) Confirm that check to infection to computer viruses and malware programs is conducted regularly and exterminated if the product is connected to a PC.
 - (3) It is not installed to a place where anonymous people can touch, or lock the place where the device is installed.
 - (4) Use it in an environment with VPN (Virtual Private Network) or dedicated online network being established.
 - (5) Limit accessible users by using the user certificate feature.
 - (6) Certify identification of each other between devices by using the application certificate.
- There is an expiry date to the electric certificate.
If the certificate set to the OPC UA server and client is expired in the OPC UA communication, the communication should stop.
In order to avoid expiry of a certificate, it is necessary to regularly check the expiry date of the certificate and update it.
There may be a concern that the clock data inside the XSEL2 controller gets lost and the certificate expires. If necessary, it is required to set up the current time to XSEL2 with using a teaching tool.
- In order to change the IP address of XSEL2, it is necessary to connect a teaching tool (XSEL PC software or teaching pendant (TB02/TB03)).
Make a change referring to how to set up IP address described in [4.1 PLC Feature Parameter Setting].



Other Features of CODESYS

7.1	Feature of POU for implicit checks	7-1
7.1.1	Setup for Automatic Confirmation POU	7-1
7.2	Security Protection Support Feature	7-3
7.2.1	Device User Feature	7-3
7.2.2	Encrypting CODESYS Project File	7-7
7.2.3	Ethernet Communication / Control System	7-9
7.3	Interface Object	7-12
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7.5.1 Saving archive	7-23
7.5.2 Unzipping Archives	7-25

7.1 Feature of POU for implicit checks

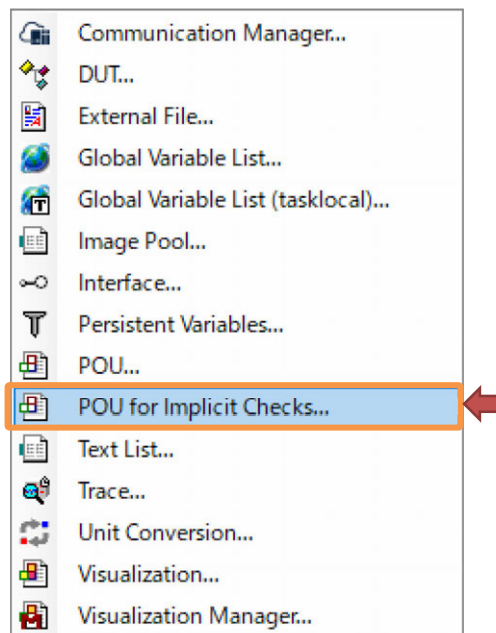
The POU for implicit checks are feature to check the array range, range of subrange type variables, division by zero and pointer address.

By adding this object to a project, the function should be implicitly called out in the program and have checking.

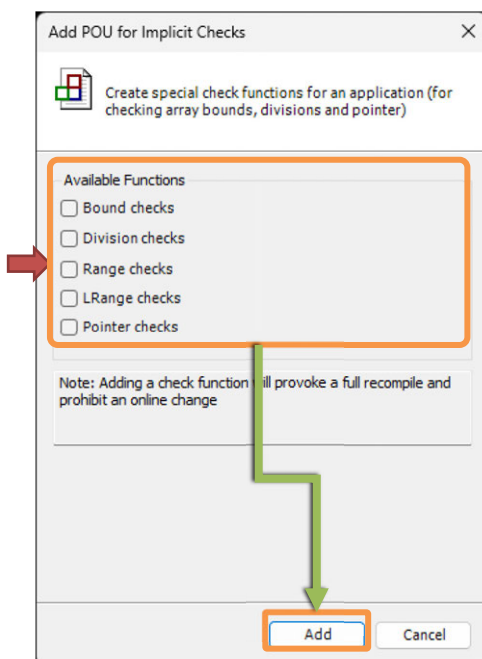
7.1.1 Setup for Automatic Confirmation POU

Shown below is how to Setup for Automatic Confirmation POU.

- 1) Right-click “Application” shown in the device view, and select “Add Object” → “POU for Implicit Checks...”.



- 2) In the “Add POU for Implicit Checks” dialog, put a checkmark to a function that you would like to add and click **Add**.



The following functions (objects) should be added in accordance with selected items.

As a standard check process is quipped in the added objects, edit it as necessary.

However, a standard check process is not equipped to “Pointer Check”, equip it referring to the online help.

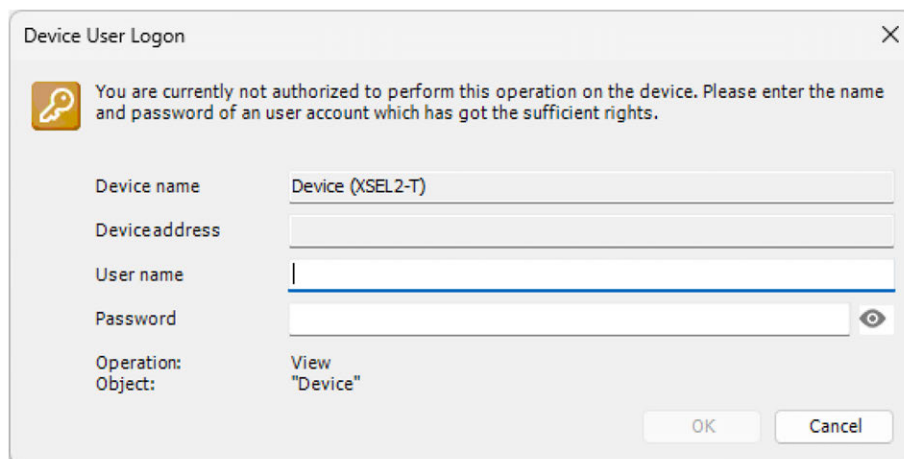
Check Type	Check Contents	Function (Object) name
Bound checks	Check index of array	CheckBounds
Division checks	Check if divided by 0	CheckDivDInt
		CheckDivLInt
		CheckDivLReal
		CheckDivReal
Range checks	Check range of DINT and UDINT type variables	CheckRangeSigned
		CheckRangeUnsigned
LRange checks	Check range of LINT and ULINT type variables	CheckLRangeSigned
		CheckLRangeUnsigned
Pointer checks	Check if pointer type variables refer to effective addresses	CheckPointer

7.2 Security Protection Support Feature

7.2.1 Device User Feature

It is a function to limit users capable to log in to XSEL2. By registering a name and password, only the registered users can log in.

After device users are registered, the following dialog should get displayed after login. Input the registered name and password.



The dialog box is titled "Device User Ligon" and contains a message: "You are currently not authorized to perform this operation on the device. Please enter the name and password of an user account which has got the sufficient rights." Below the message are four input fields: "Device name" (containing "Device (XSEL2-T)"), "Device address", "User name", and "Password". There is also a "View" button next to the "Password" field. At the bottom, there are "OK" and "Cancel" buttons. The "Operation:" field shows "View" and the "Object:" field shows "Device".



Caution

- If you forget the user name and password, you will not be able to log in. Be careful not to forget.

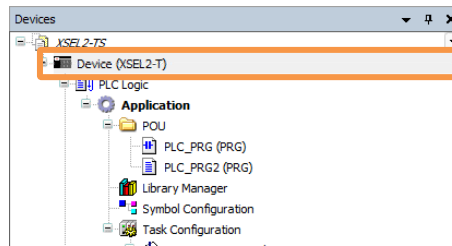
A user should belong to one of the four types of groups (Administrator / Developer / Service / Watch), and the authority for each user group should be shown as follows.

No.	Administrator	Developer	Service	Watch	Remarks
Connection to XSEL2	○	○			
Program Transfer	○	○	×	×	
Device User Administration	○	×	×	×	
File Transfer	○	○	○	Only Display Available	Not available with XSEL2
Security settings	○	Only Display Available	Only Display Available	Only Display Available	Not available with XSEL2
Certificate Administrator	○	×	×	×	
OPC UA Variable Display	○	○	○	○	
OPC UA Variable Overwrite	○	×	×	×	

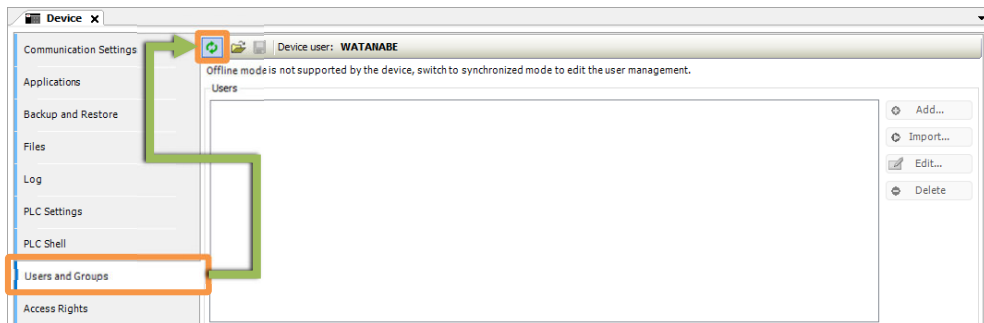
7.2 Security Protection Support Feature

Here, shows how to add a device user.

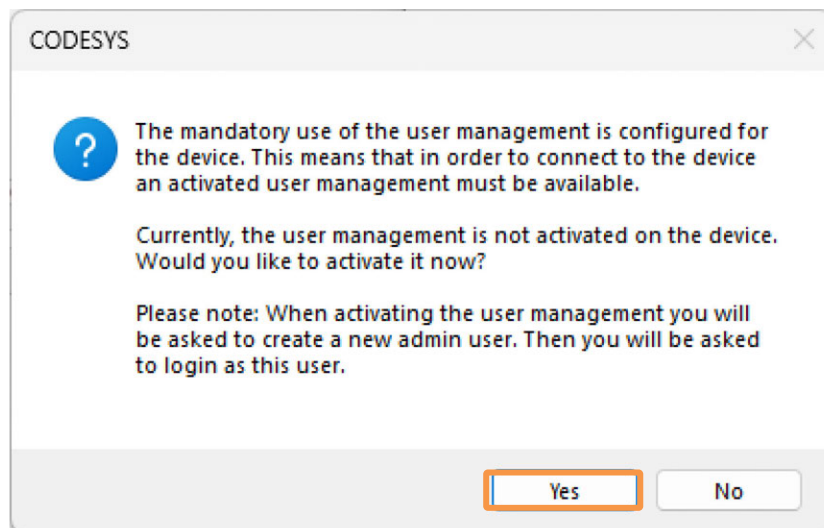
- 1) Double-click "Device" shown in the device view.



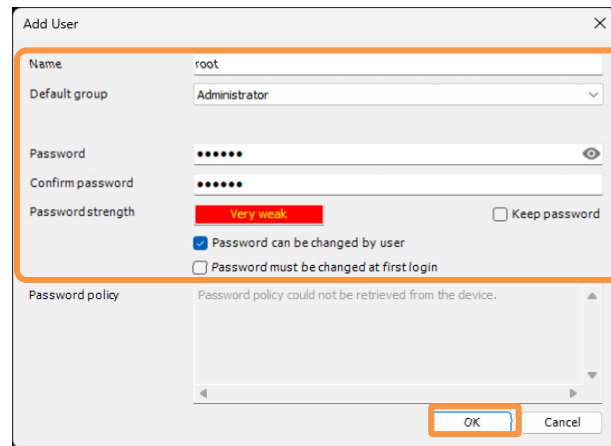
- 2) Click **User and Groups** in the Device Setup window and click .



- 3) If the user administration is not set, the following window should show up. Click **Yes**.



- 4) If the user administration is not set, you will be requested to add a user with administrator rights. Input necessary items and click **OK**.



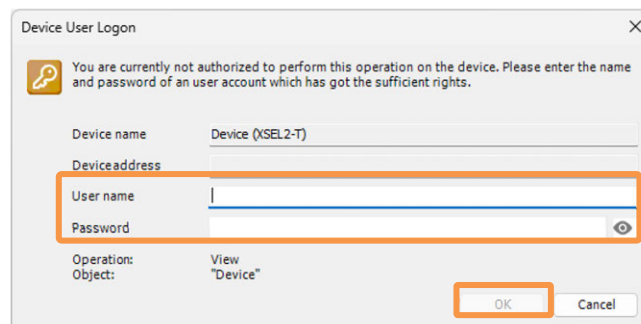
The "Add User" dialog box is shown. It contains the following fields and options:

- Name:** root
- Default group:** Administrator
- Password:** [masked with dots]
- Confirm password:** [masked with dots]
- Password strength:** Very weak (indicated by a red bar)
- ☐ Keep password
- ☒ Password can be changed by user
- ☐ Password must be changed at first login
- Password policy:** Password policy could not be retrieved from the device.

The **OK** button is highlighted with an orange box.

- * After a new user is added, login with the username and password kept blank will become unavailable. Make sure that you keep a copy of the set password.

- 5) The "Device User Login" window should appear. Input the username and password for user with administrator rights and click **OK**.

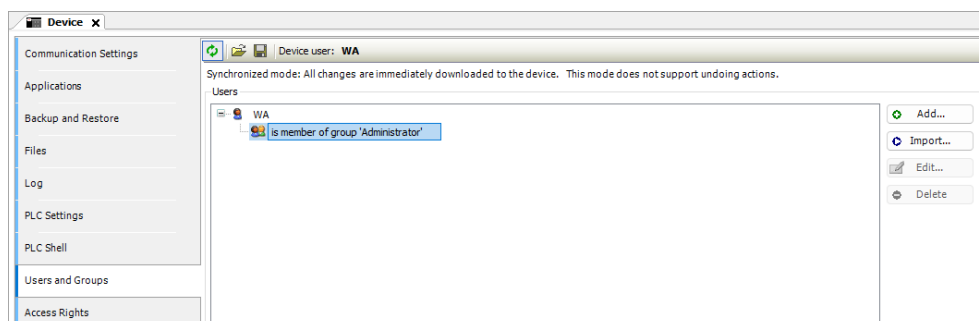


The "Device User Login" dialog box is shown. It contains the following fields and options:

- Device name:** Device (XSEL2-T)
- Device address:** [empty]
- User name:** [empty]
- Password:** [masked with dots]
- Operation:** View
- Object:** "Device"

The **OK** button is highlighted with an orange box.

- 6) It gets to the login status of the user with administrator rights.

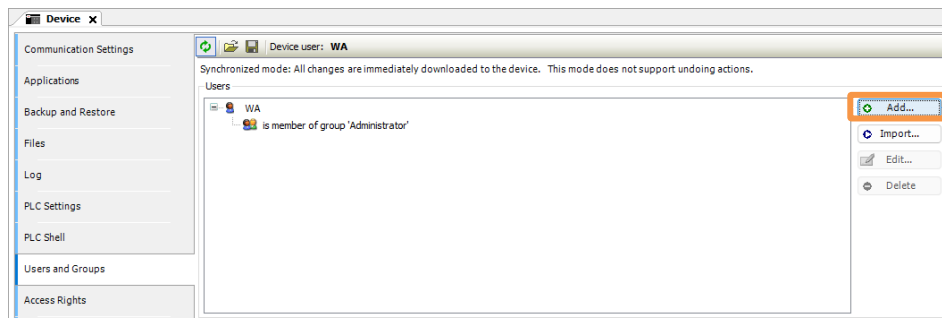


The "Device Users" window is shown. It displays the user "WA" and its status:

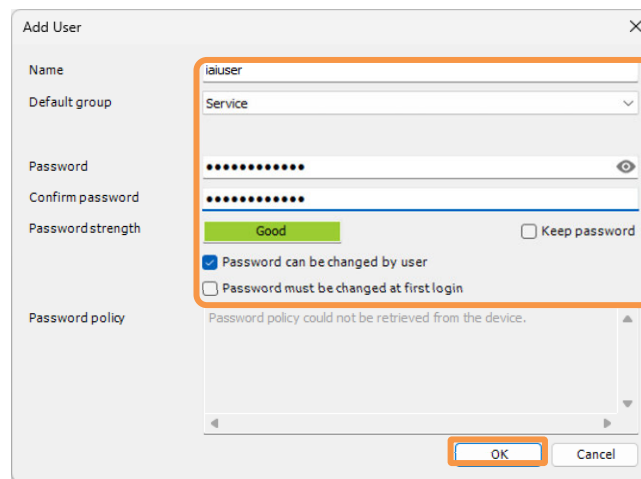
- Device user:** WA
- Synchronized mode:** All changes are immediately downloaded to the device. This mode does not support undoing actions.
- Users:** WA is member of group "Administrator"

The **OK** button is highlighted with an orange box.

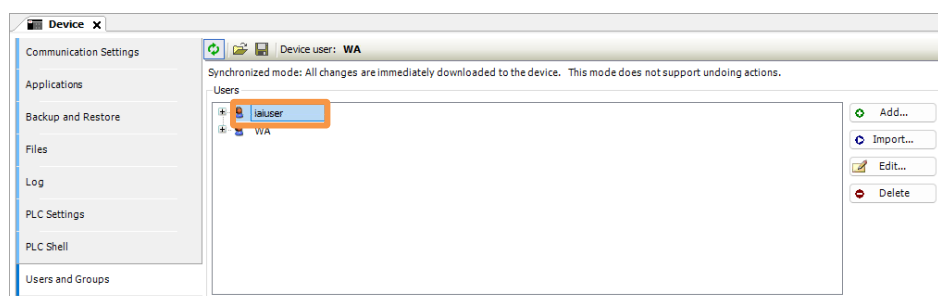
7) To add a user to access the device, click **Add...**.



8) The Add User window should open. Set necessary information such as a username and password, and click **OK**.



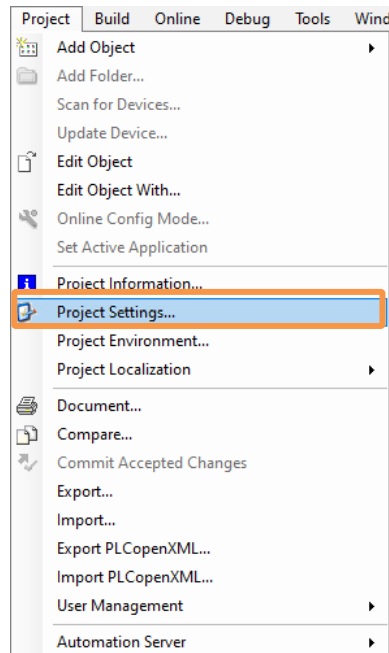
9) The user should be added.

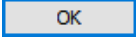


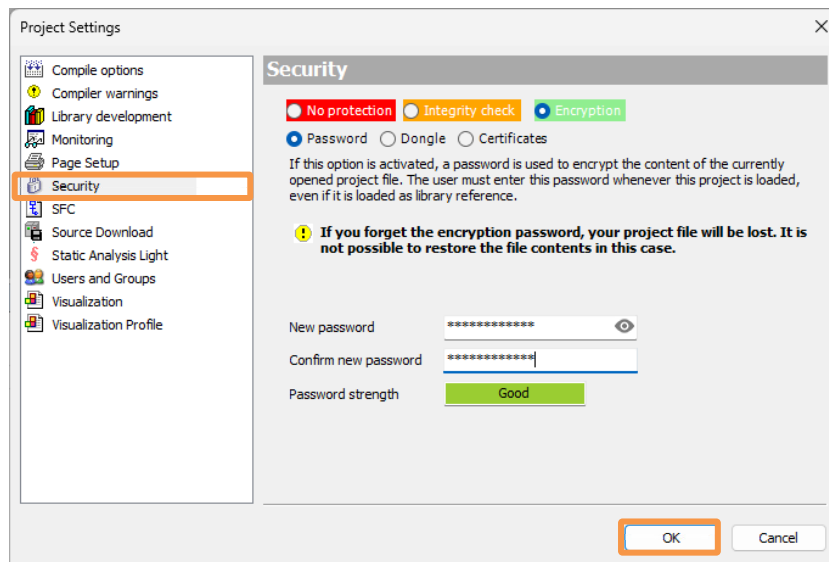
7.2.2 Encrypting CODESYS Project File

The CODESYS project files can be encrypted using a password.

Setting a password, and the password will be required when opening the project file.

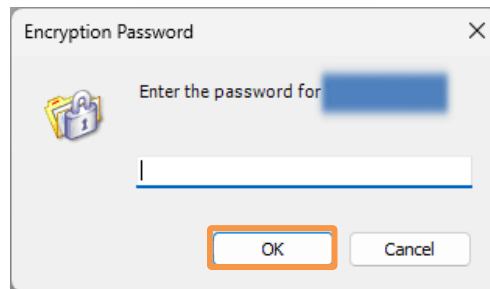


Open the dialog from “Project Settings” → “Security”. Check at “Encrypt” and select “Password”. Input Current Password, New Password, Confirm New Password and click .



This is the end of password setup.

A window to request to input the password when opening a project file. Input the password you have set.



Caution

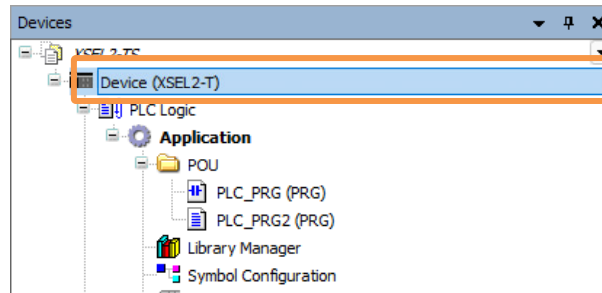
- If you forget the password for encrypt, you will not be able to open the project.
Be careful not to forget.

7.2.3 Ethernet Communication / Control System

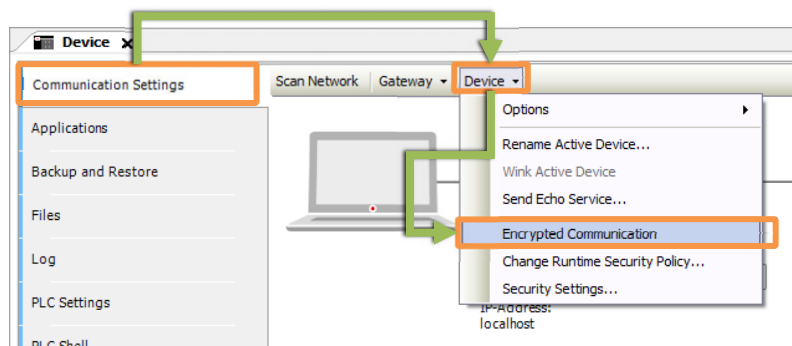
Using the electronic certificate, communication between CODESYS for XSEL2 and XSEL2 can be encrypted.

Here, explains how to encrypt communication using the own certificate of XSEL2.

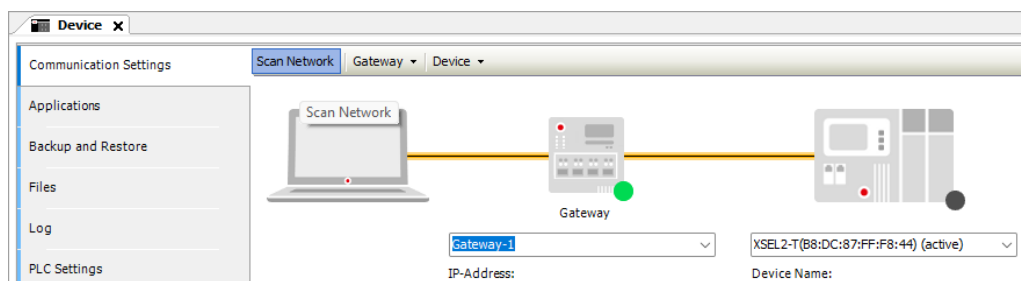
- 1) Double-click the [Device] object in the device tree.



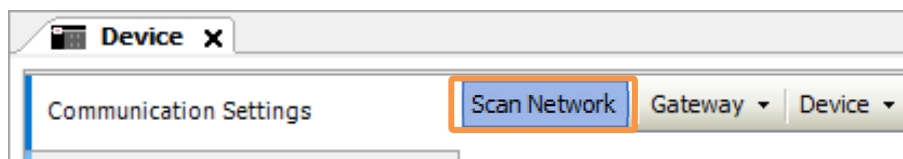
- 2) Activate “Encrypted Communication” in the device menu.



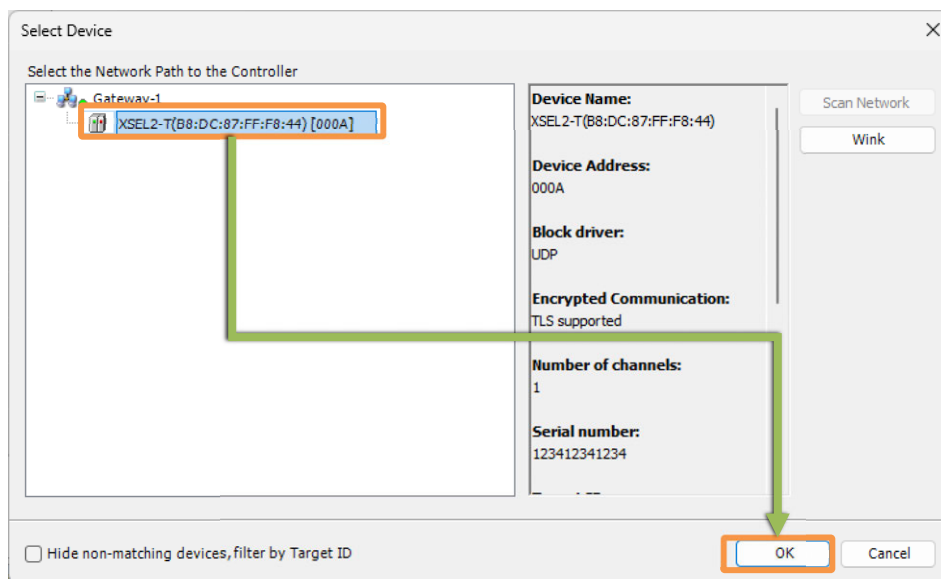
- 3) Once “Encrypted Communication” is activated, the link line among the CODESYS for XSEL2, gateway and controller will be displayed in yellow.



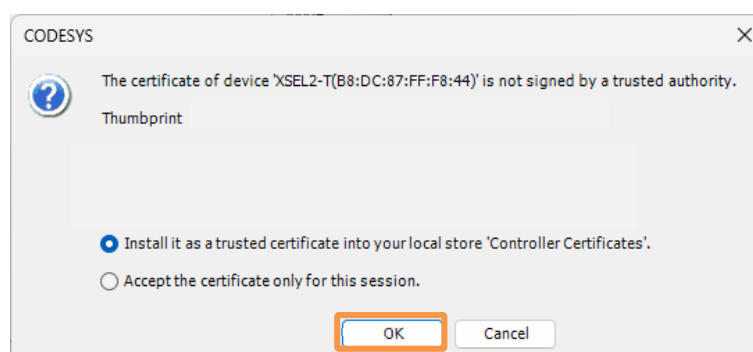
- 4) Click Scan Network menu.



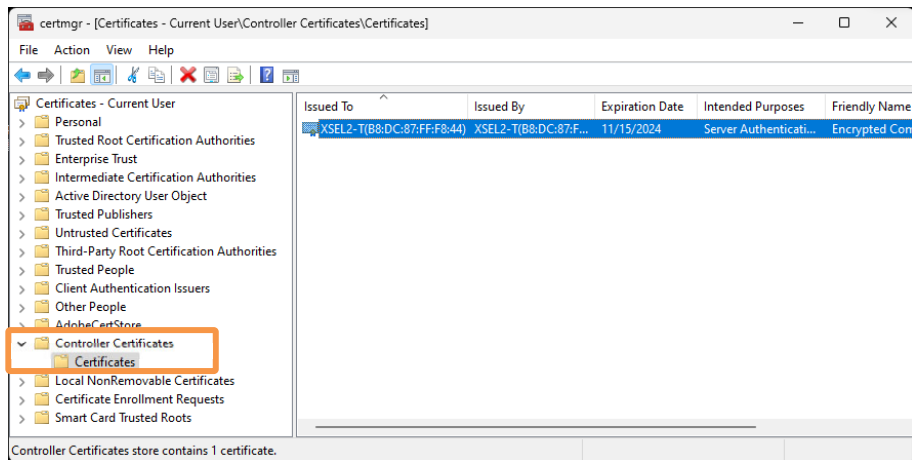
- 5) The Select Device window should appear. Select a connected controller and click **OK**.



- 6) A message stating the certificate of the controller is not signed by a trusted organization. Click **OK** and the certificate shown in the message should get identified as a trusted certificate and it will be installed to the local "controller certificate" store on a PC, and then communication can get encrypted.



- 7) The registered controller certificate can be confirmed with “certmgr.msc” in “C:¥Windows¥System32 Folder”.



Caution

- If the validated date is expired for the electronic certificate, there should be a message stating validated date expired for certificate should be displayed. Click and the validated date for the certificate should be extended.
- There may be a concern that the clock data inside the XSEL2 controller gets lost and the certificate expires. If necessary, it is required to set up the current time to XSEL2 with using a teaching tool.

7.3 Interface Object

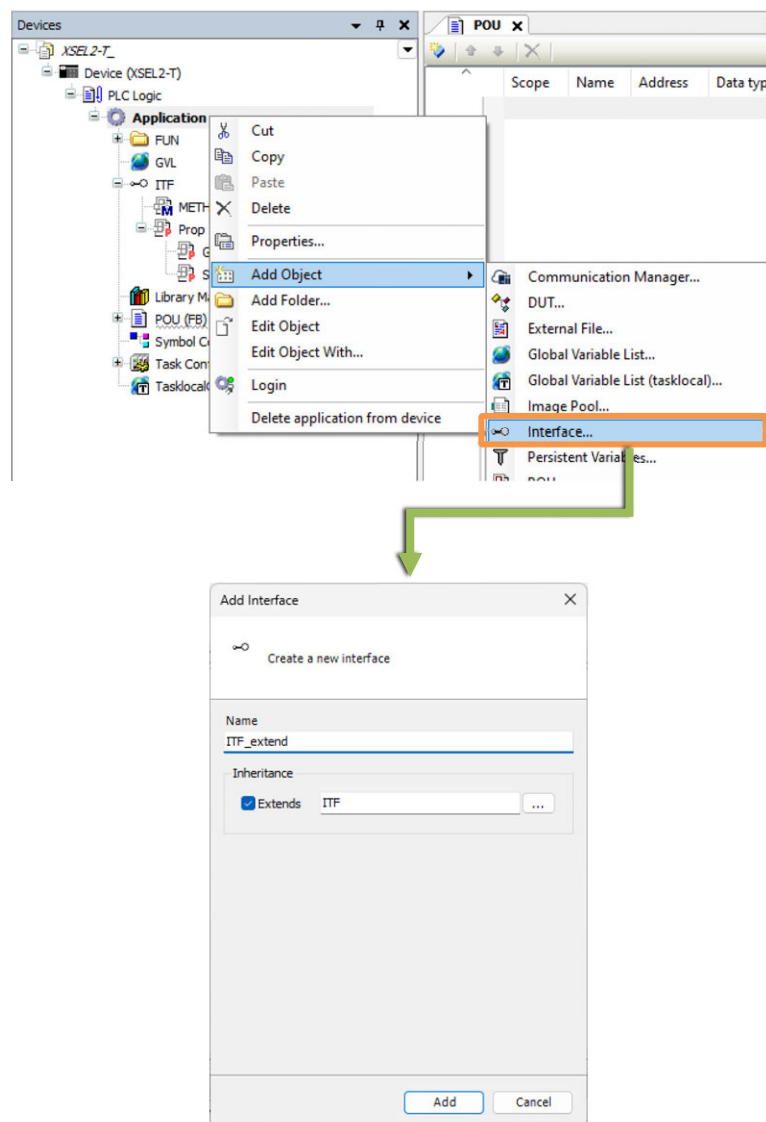
The interface object can define methods and properties in common used in the same system among different function blocks with a mounting measure of object oriented programming. The interface object includes only the declaration of methods and properties, but does not include mounting.

7.3.1 Setting up Interface Object

Here, explains how to add an object for the interface.

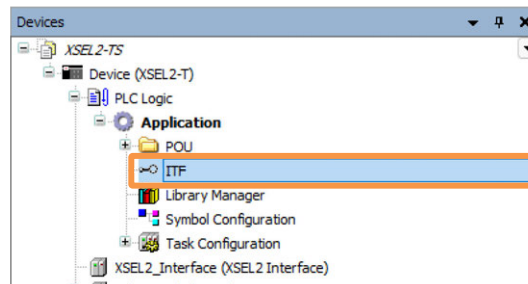
- 1) Right-click the “Application” object in the device view, and select “Add Object” → “Interface...” from the displayed menu.

The “Add Interface” dialog should be displayed.

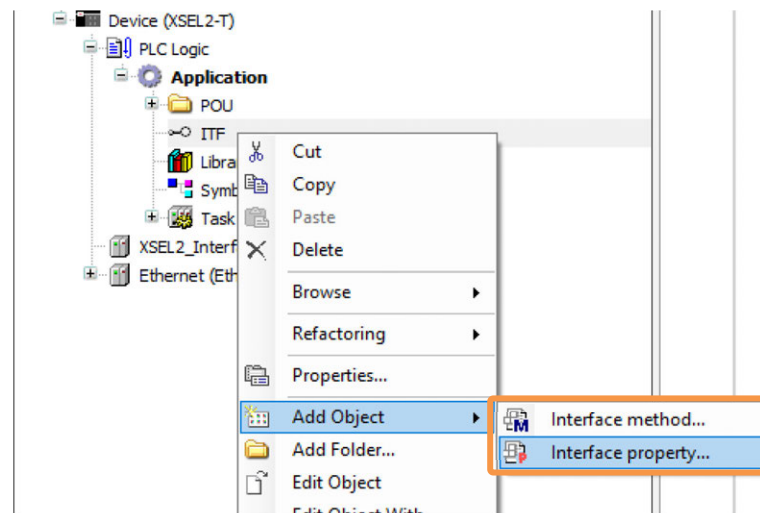


- 2) Input a name and click **Add**. An interface object should be added.

Also, by enabling the inheritance, an interface input in the input field should be inherited and expanded.



- 3) Right-click the “ITF” object added in the device view, and select “Add Object” → “Interface Property...” or “Interface Method...” from the menu displayed.

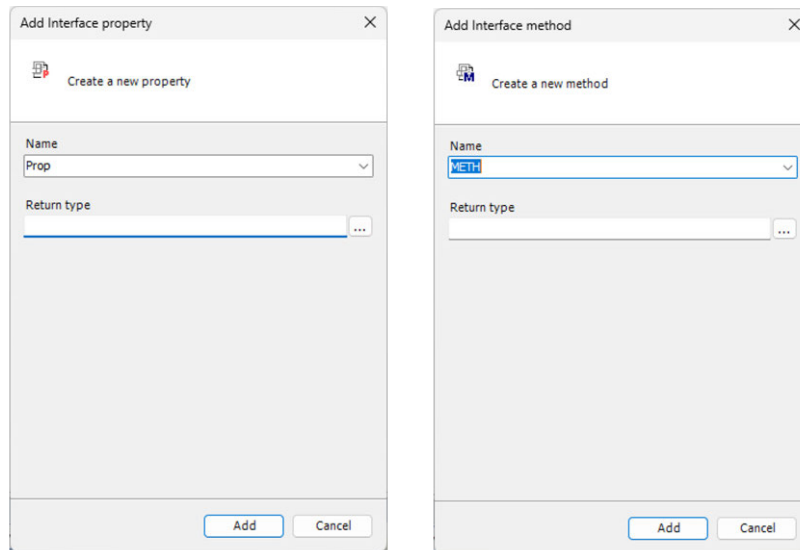


The “Add Interface Property” dialog box or the “Add Interface Method” dialog box should be displayed.

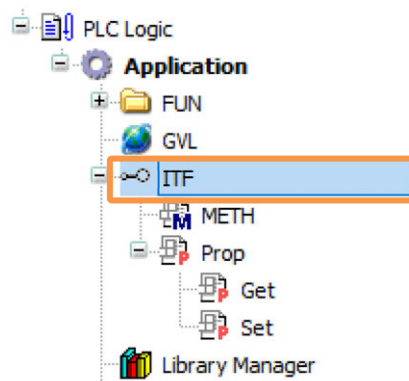
- 4) Input a name and click **Add**.

The interface property always requires input of the return type.

The "Prop" object or "METH" object should be added under the "ITF" object.



- * The property requires the return value.



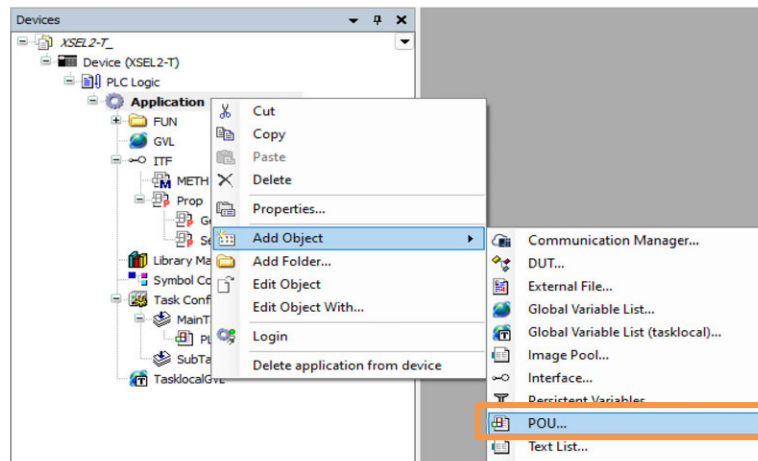
- 5) Define the method in the added METH object and property in the Prop object.
It is the end of creating an interface.

7.3.2 Mounting to New Function Block

Here, explains how to mount an interface to a function block newly created.

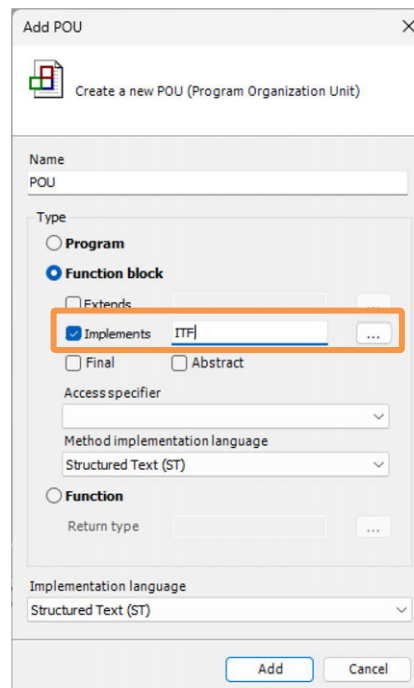
- 1) Right-click the “Application” object in the device view, and select “Add Object” → “POU...” from the displayed menu.

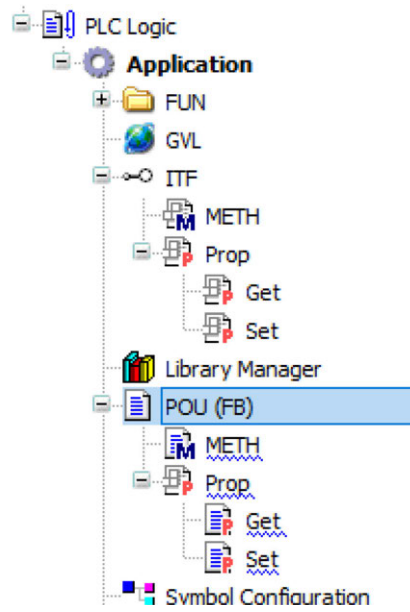
The “Add POU” dialog should be displayed.



- 2) Input a name, change the type to the function block, enable “Mount”, in put the interface and click **Add**.

A function block mounting an interface should be added under the “Application” object.



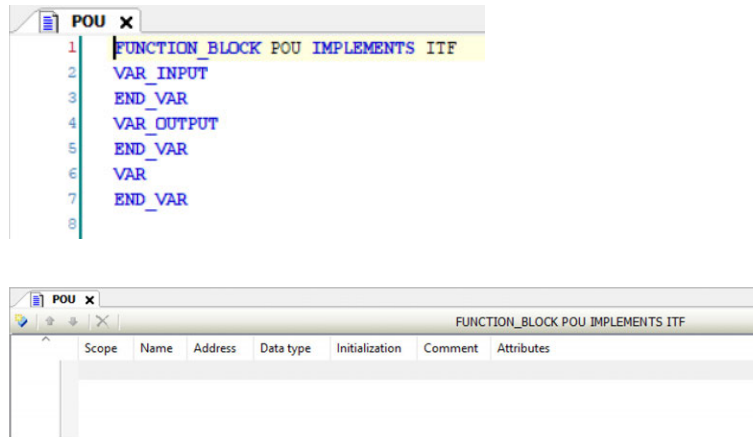


- 3) Open the editor of the added “METH” object and “Prop” object, and mount the internal process for the method and property.

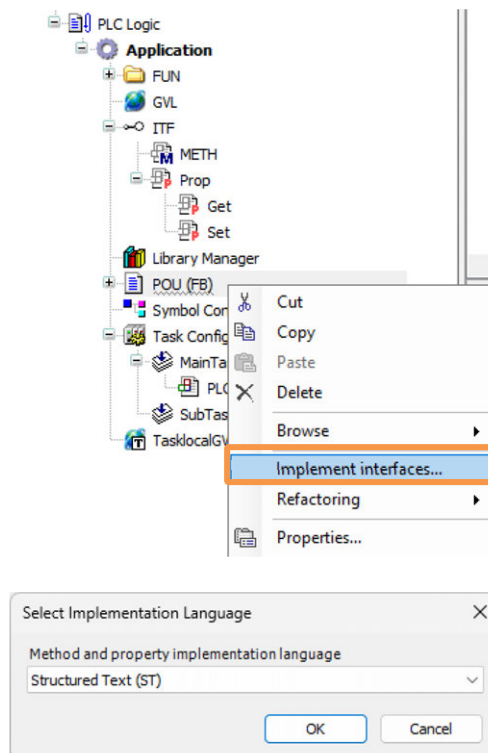
7.3.3 Mounting to Existing Function Block

Here, explains how to mount an interface to an existing function block.

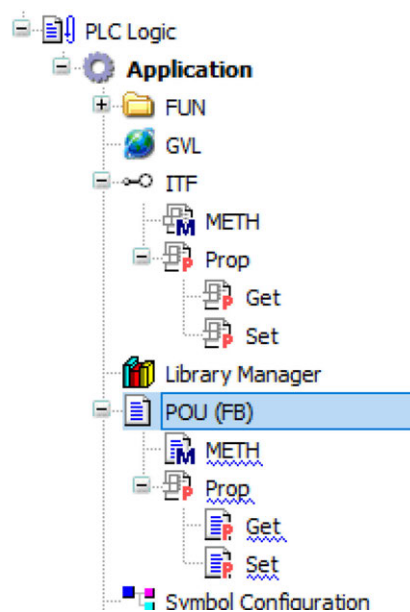
- 1) Open the editor of an existing function block from the device view.



- 2) Right-click an existing function block from the device view, and select “Implement interfaces...” from the displayed menu. The “Select Implementation Language” dialog box should be displayed.



- 3) Select a describing language, click , and then a method and property should be added under the function block.



- 4) Open the editor of the added “METH” object and “Prop” object, and mount the internal process for the method and property.

7.3.4 Extension of Interface

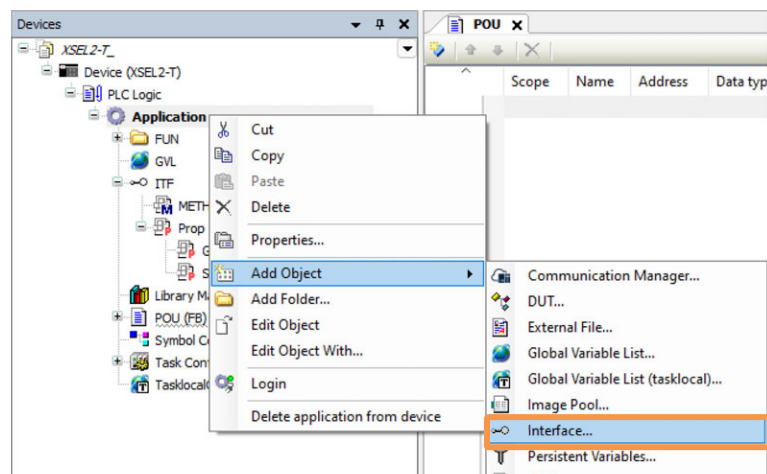
An existing interface can be inherited and extended.

Extend the existing interface “ITF” and create the interface “ITF_extend”.

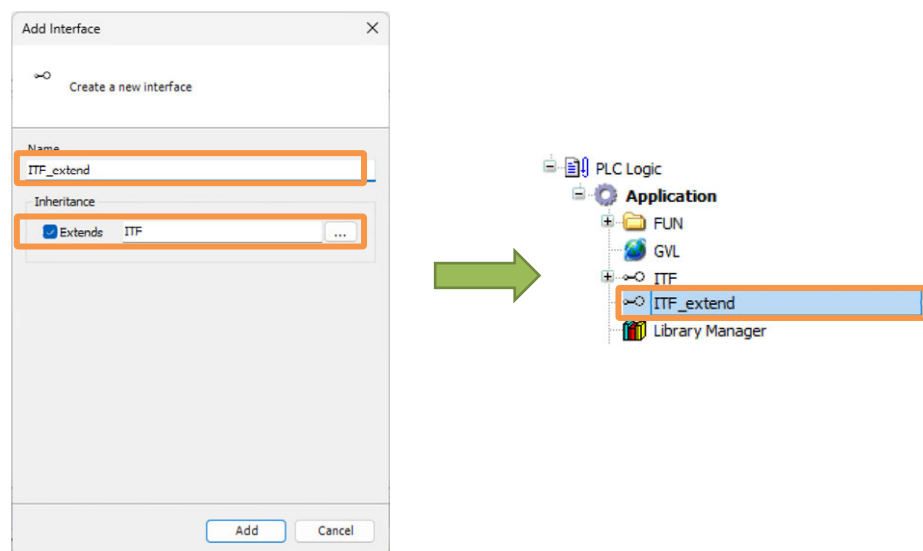
With the interface “ITF” being existed, an interface should be created.

- 1) Right-click the “Application” object in the device view, and select “Add Object” → “Interface...” from the displayed menu.

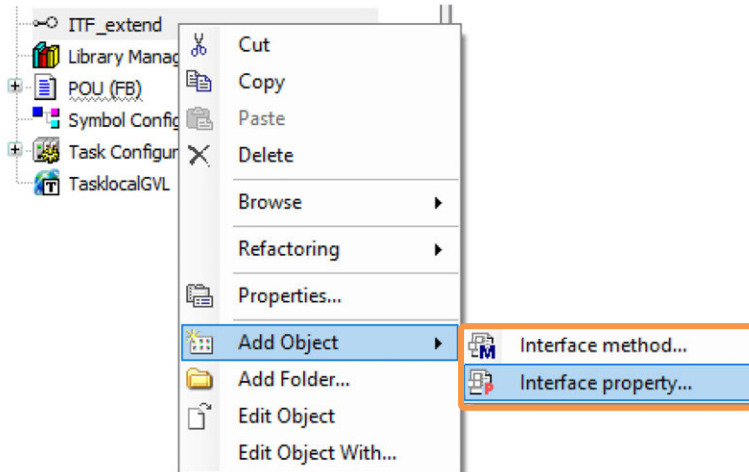
The “Add Interface” dialog should be displayed.



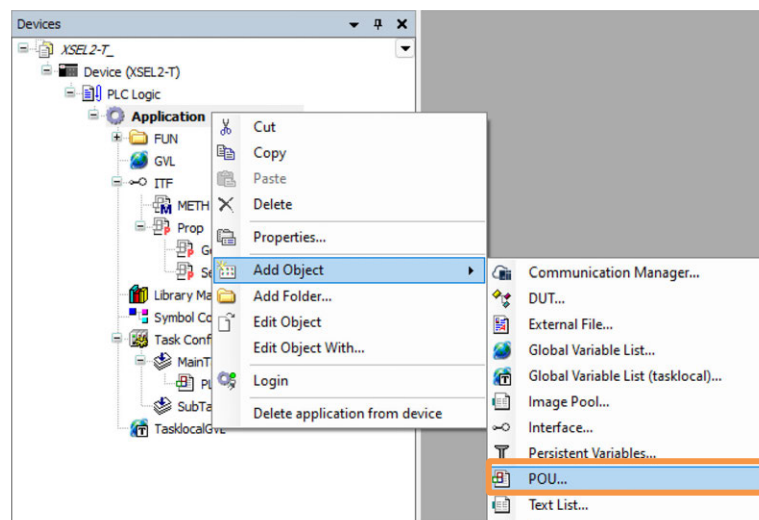
- 2) Put a checkmark at “Extend” in the “Add Interface” dialog, and input an interface to be inherited. The interface “ITF_extend” should be created.



- 3) Right-click the “ITF_extend” object that was added in the device view, select “Add Object” → “Interface Property” or “Interface Method...” in the displayed menu, and add the “ITF_extend” object property and a method.

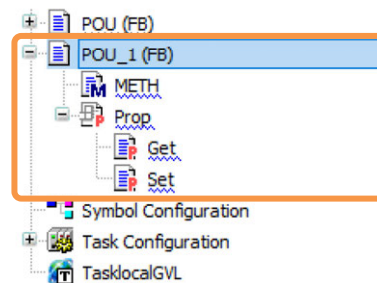
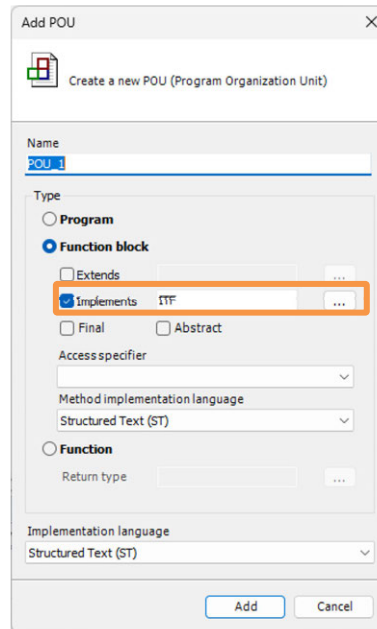


- 4) Right-click the “Application” object in the device view, and select “Add Object” → “POU...” from the displayed menu.
The “Add POU” dialog should be displayed.



- 5) Input a name, change the type to a function block, activate “Implement”, input “ITF_extend”. And click **Add**.

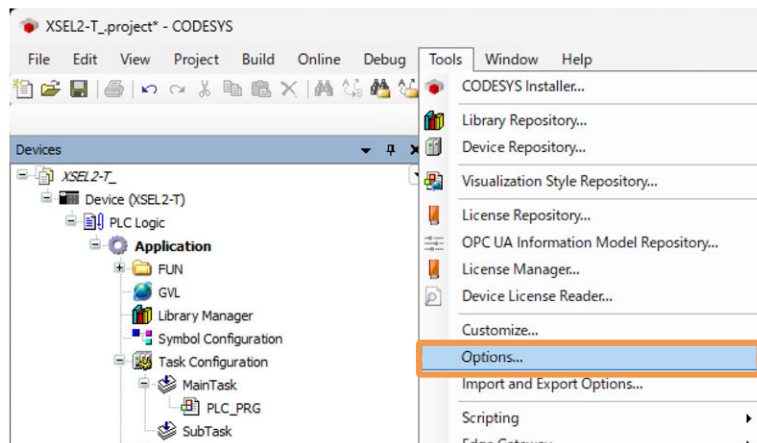
A function block with properties and methods of the both interfaces “ITF_extend” and “ITF” should be added under the “Application” object.



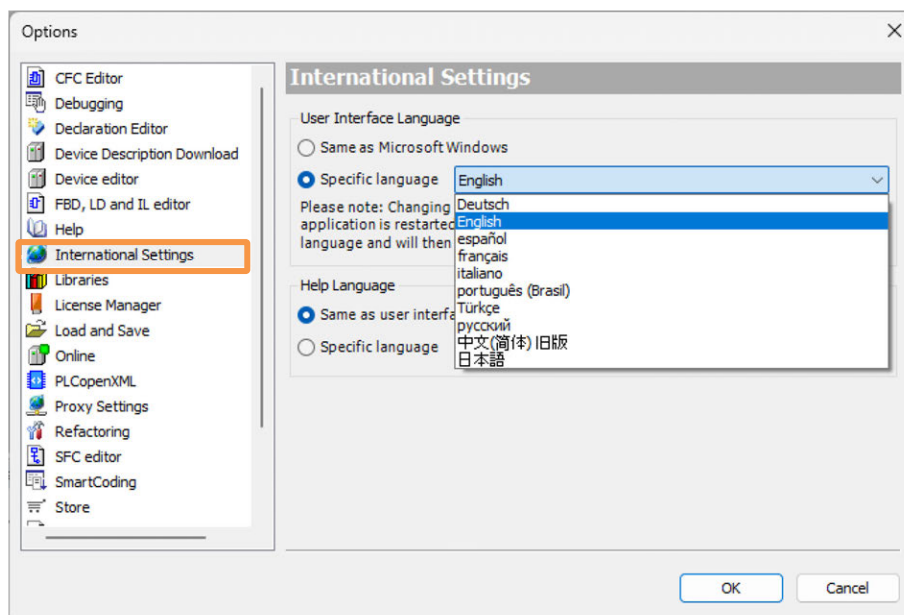
7.4 Changing Displayed Language

The language to display in CODESYS for XSEL2 can be changed. The languages available to select are Germany / English / Chinese (Simplified Characters) / Japanese. Here, explains how to change the displayed language.

- 1) Select "Tool" → "Options..." in the menu.



- 2) Select  **International Settings** in the left box in the option window, and change "User Interface Language" and "Help Language" to a requested language.

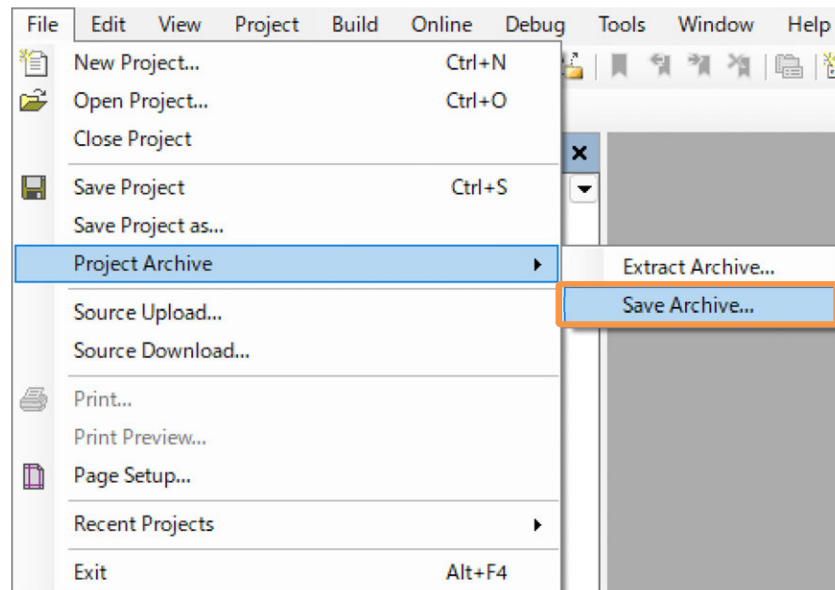


7.5 Project archive

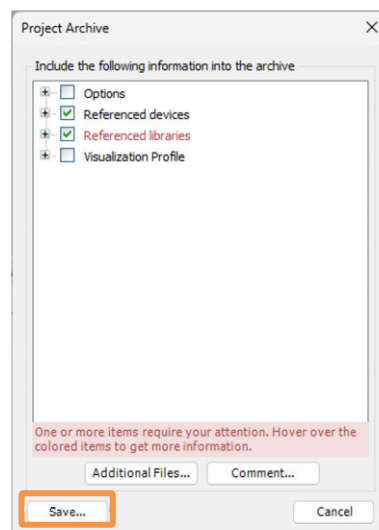
In the archive file (*.projectarchive), all the referred data included in the project currently open can be saved. All files related to a project such as library and devices can be provided to other users.

7.5.1 Saving archive

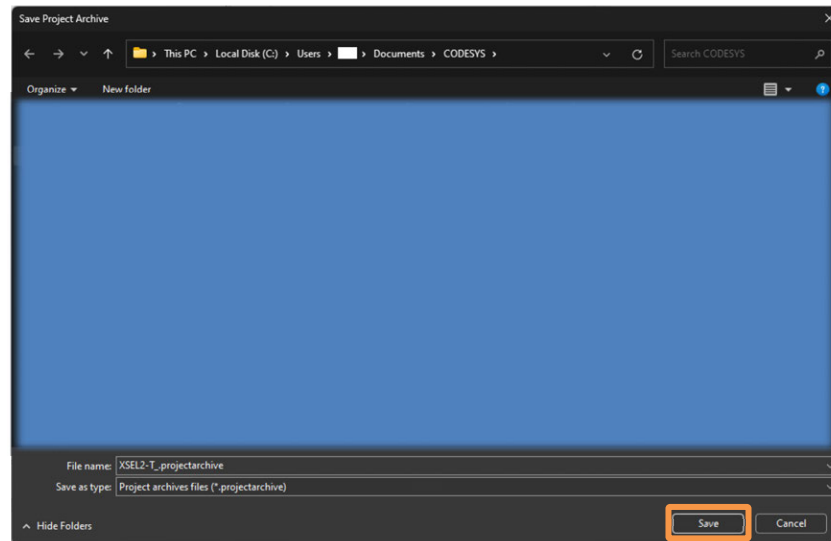
- 1) Select “File” → “Project Archive” → “Save Archive...”.



- 2) Select an object to save to the archive in the project archive dialog, and click **Save...**.

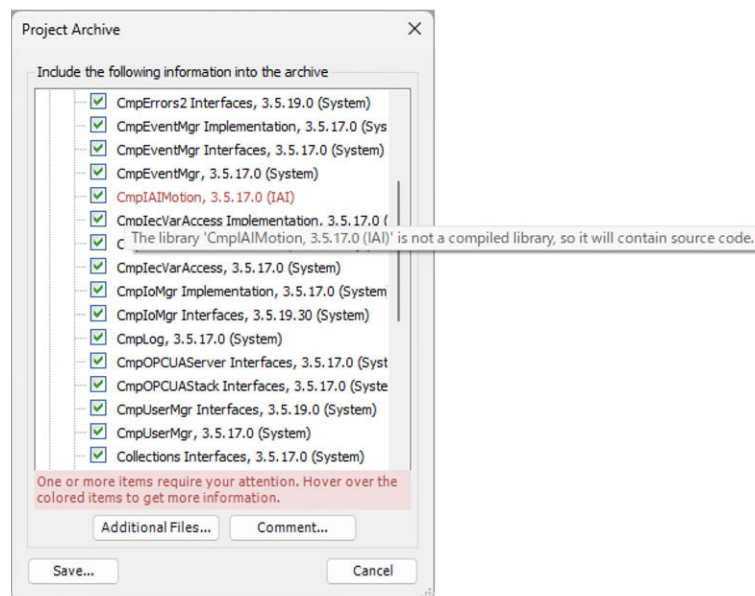


- 3) Input a storage location and file name, and click **Save**.



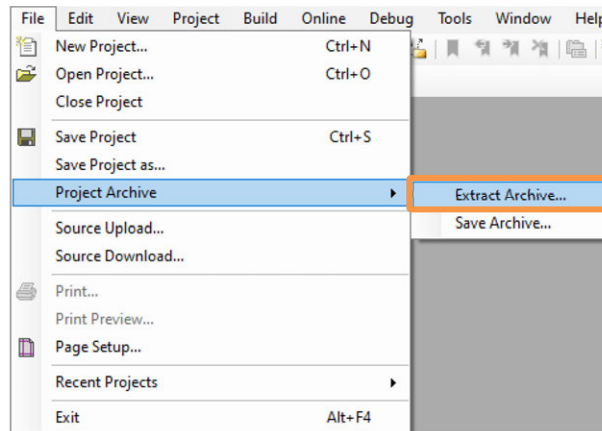
Caution

- Even though a message describing that it is not “a library already compiled” in the library (CmplAIMotion) of IAI, saving can be done. Disregard this warning.

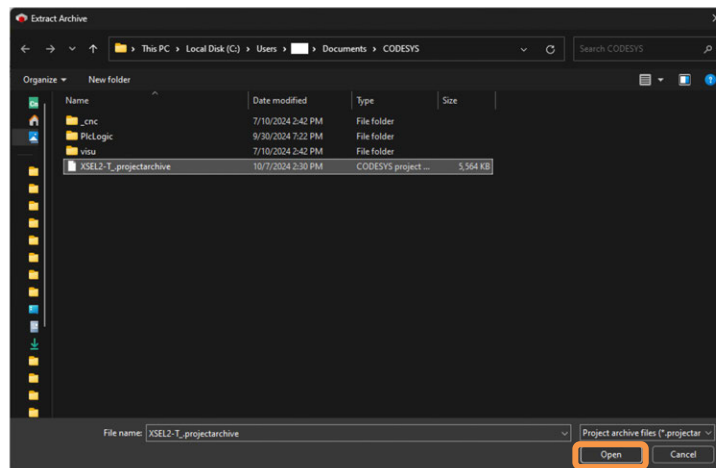


7.5.2 Unzipping Archives

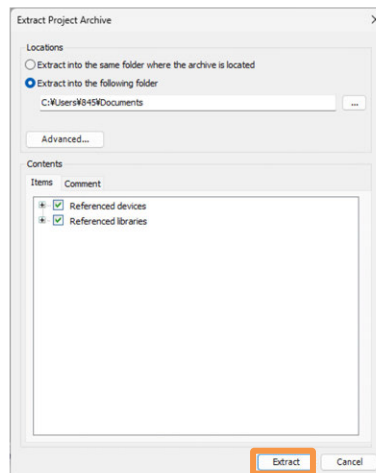
- 1) Select “File” → “Project Archive” → “Extract Archive...”.

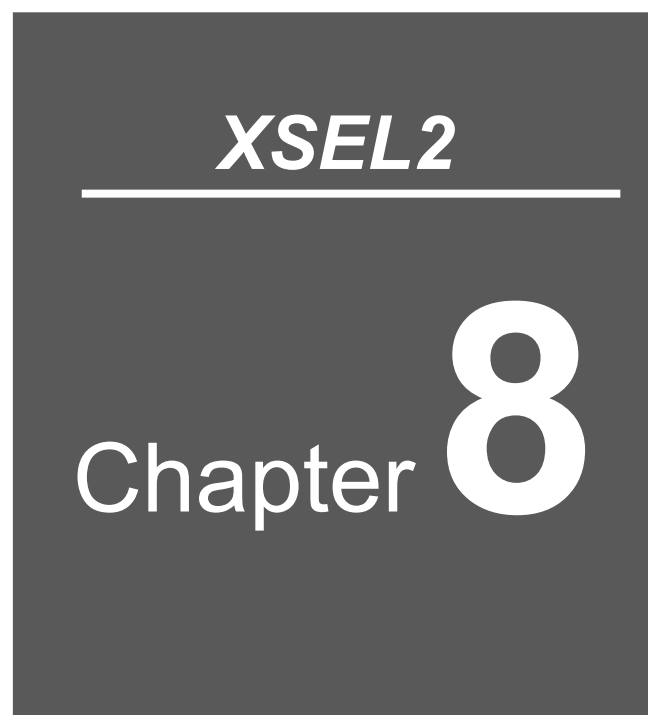


- 2) Select a storage location and file name, and click **Open**.



- 3) Select an storage location and item, and click **Extract**.





Troubleshooting

8.1	Error	8-1
8.1.1	Confirming Error During PLC Operation	8-1
8.1.2	PLC Exception Error List	8-6
8.1.3	List of PLC Related Errors Occurred in SEL System (XSEL2)	8-9
8.1.4	Operation at PLC Error Occurred	8-11
8.1.5	Outputting PLC Operation Error Status	8-12
8.2	Power Cutoff Operation	8-13
8.3	Restrictions	8-14
8.4	Precautions	8-15

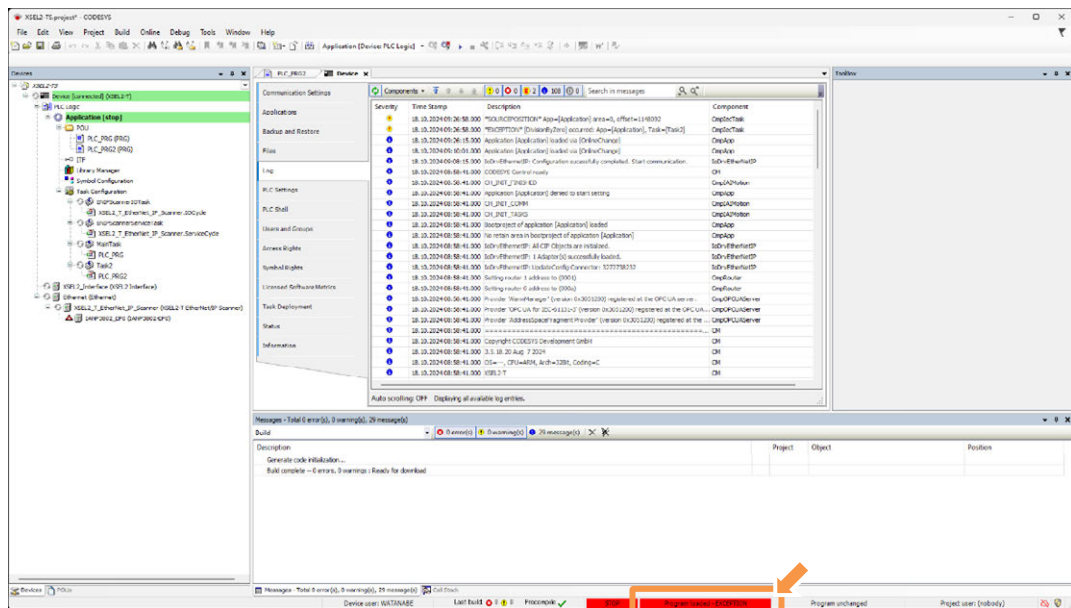
8.1 Error

8.1.1 Confirming Error During PLC Operation

[1] How to Confirm Error Online

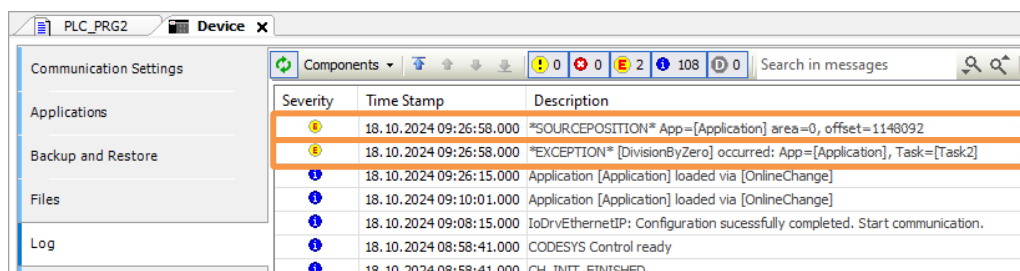
When the PLC is stopped during operation due to an error or exception error, the details can be confirmed by connecting to CODESYS for XSEL2 and referring to “Device Log”.

- Double-click the area blinking in red below, and the Device Log window should open.



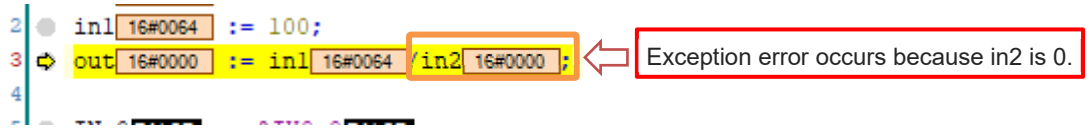
- Refer to the “Log” tab in the Device Setting window, and the Device Log window should open.

E in the figure below shows that an exception error is being occurred.



“EXCEPTION” [DivisionByZero] shows that an exception error due to division by zero is occurred.

“SOURCEPOSITION” shows a location of occurrence. Double-click this line and the screen transits to the program that the exception error has been occurred.



Resolve the cause of the exception error.



Caution

- As the device log should be saved in the volatile memory, the recorded data will not be saved if the power is shut.

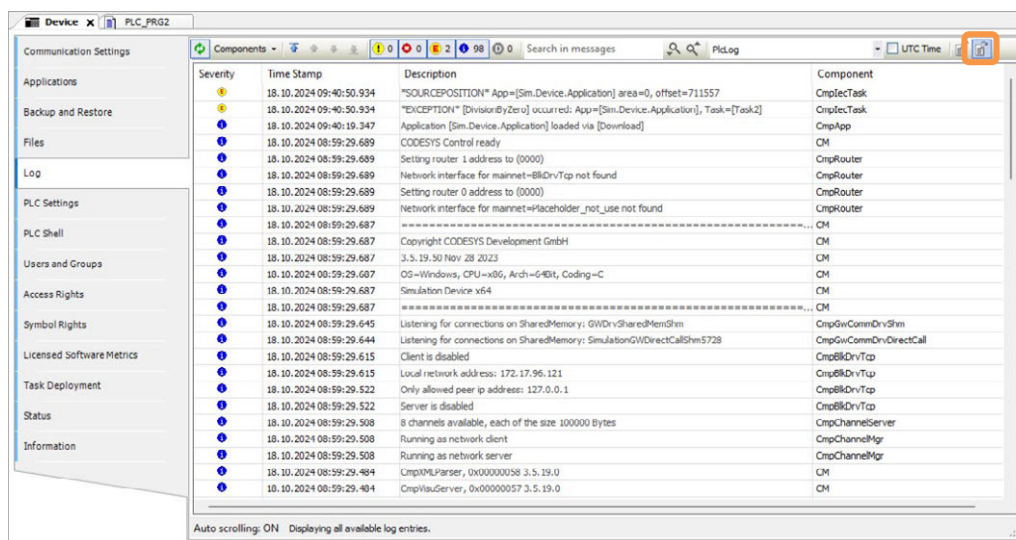
Confirm errors in operation while the power is on to XSEL2.

[2] Export / Import of Device Log

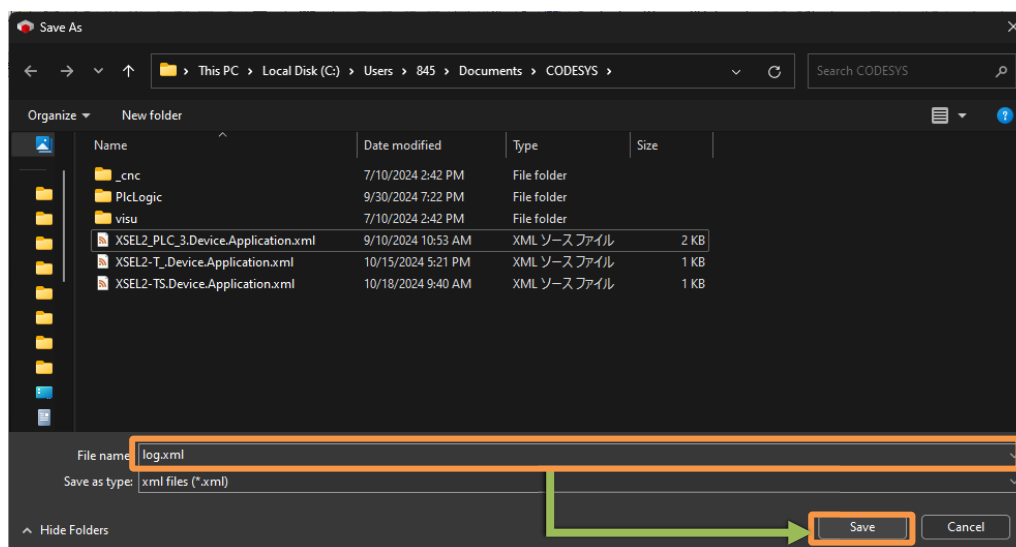
The device log data is available for export (write into file) and import (read in from file).

● Export Process

- 1) Click the  icon in the device log window.



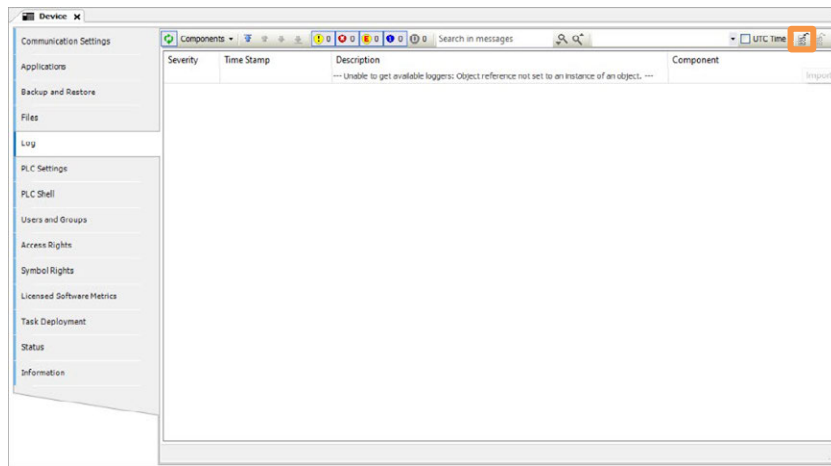
- 2) Input a file name, and click **Save**.



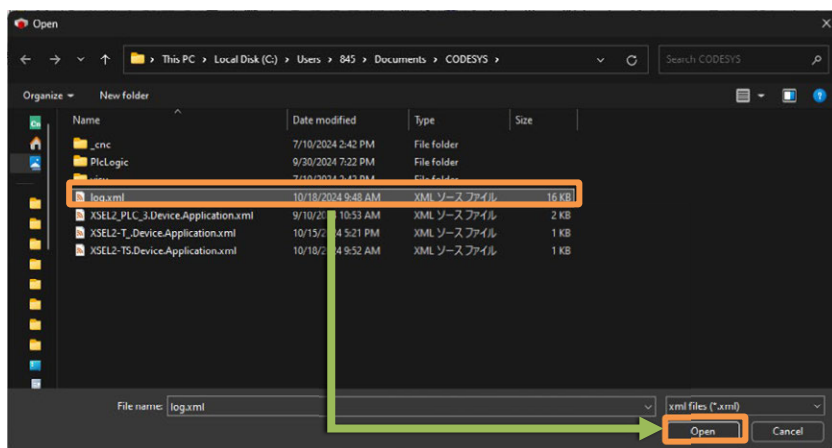
8.1 Error

● Import Process

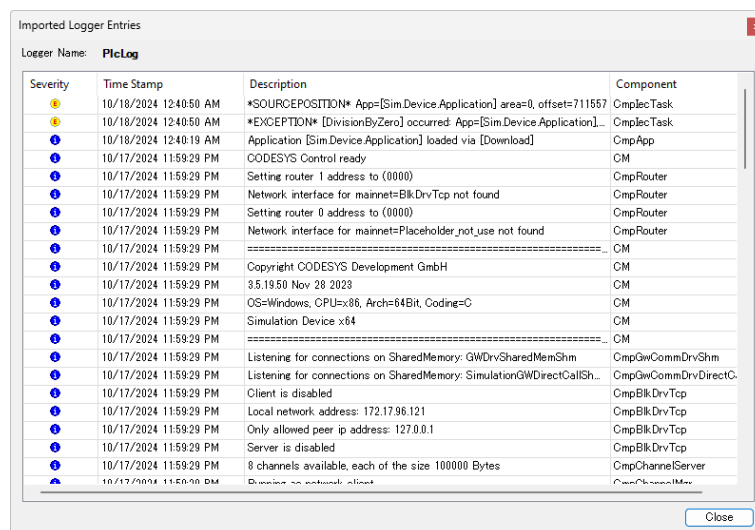
1) Click the  icon in the device log window.



2) Select a file, and click **Open**.



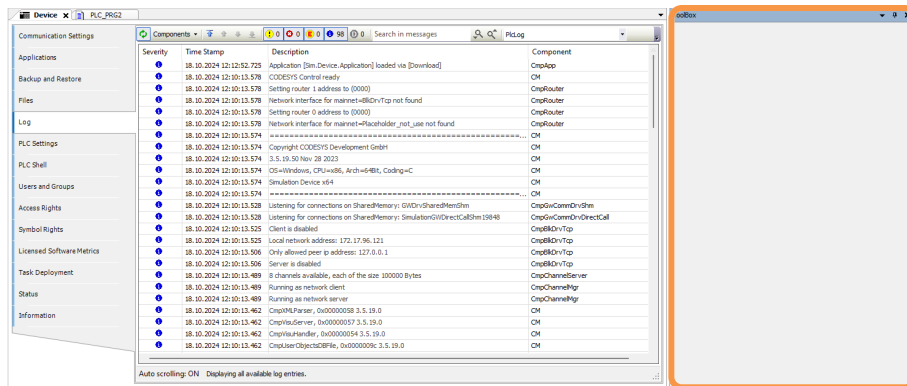
3) A log should be displayed.



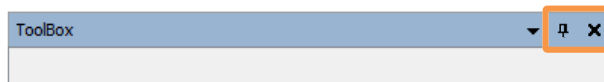


Caution

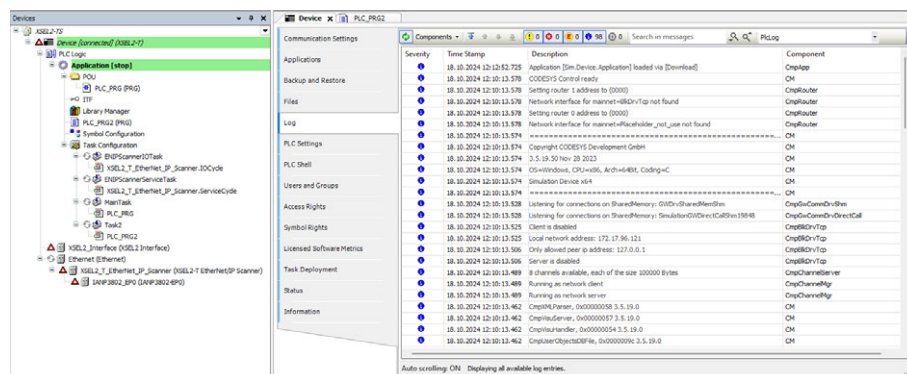
- Hidden behind the ToolBox window, the icons for import / export may not be displayed.



If it is not displayed, click either “Auto Hide” or “Close” in the ToolBox window.



- There may be a case that the icons for import / export cannot be shown even if the notification window is unhidden.



If it is not displayed, click either “Auto Hide” or “Close” in the device view.



8.1.2 PLC Exception Error List

Name	Explanation	Countermeasure
UNKNOWN	Unknown	Reboot the power. Consult with IAI if it frequently occurs.
WATCHDOG	Software Watchdog Timeout	1) Revise the priority of tasks and program process. 2) Revise the time and sensitive of the watchdog timer.
HARDWAREWATCHDOG	Hardware Watchdog Timeout	Reboot the power. Consult with IAI if it frequently occurs.
IO_CONFIG_ERROR	IO Configuration Error	Download the project again.
PROGRAMCHECKSUM	Program Checksum Error	Download the program again.
FIELDBUS_ERROR	Fieldbus Error	Reboot the power. Consult with IAI if it frequently occurs.
IOUPDATE_ERROR	IO Update Error	Reboot the power. Consult with IAI if it frequently occurs.
CYCLE_TIME_EXCEED	Cycle Time Exceeded	Revise the details of PLC program process.
ONLCHANGE_PROGRAM_EXCEEDED	Online Change Program Excessive	Online change cannot be made as it exceeds the program size available for change online. Download the program.
UNRESOLVED_EXTREFS	Unsolved External Reference	Reboot the power. Consult with IAI if it frequently occurs.
DOWNLOAD_REJECTED	Download Denied	Check if download is prohibited by the user administration feature or access right administration feature. Consult with IAI if it frequently occurs in a condition that download is not prohibited.
BOOTPROJECT_REJECTED_DUE_RETAIN_ERROR	Boot Project Cannot be Loaded as RETAIN Variables Cannot be Reallocated	Download the program again.
LOADBOOTPROJECT_FAILED	Loading Boot Project Failed	1) Reboot the power. 2) Redownload the program if it frequently occurs even after rebooting the power. 3) Consult with IAI if it frequently occurs even after redownloading.
OUT_OF_MEMORY	Out of Heap Memory	Reboot the power. Consult with IAI if it frequently occurs.
RETAIN_MEMORY_ERROR	RETAIN Memory is Destroyed or Not Available for Mapping	Download the program again.
BOOTPROJECT_CRASH	Boot Project Cannot be Loaded as Crashed	Redownload the program and generate the boot application.
BOOTPROJECTTARGETMISMATCH	Boot Project is Unmatched	Redownload the program and generate the boot application.
SCHEDULEERROR	Error in Scheduling Task	Reboot the power. Consult with IAI if it frequently occurs.

Name	Explanation	Countermeasure
FILE_CHECKSUM_ERR	Checksum of Download File is Unmatched	Download again.
RETAIN_IDENTITY_MISMATCH	RETAIN ID Unmatched with Boot Project Program ID	Download again.
IEC_TASK_CONFIG_ERROR	IEC Task Configuration Failed	Reboot the power. Consult with IAI if it frequently occurs.
APP_TARGET_MISMATCH	Application is operated in a wrong target. It can be used for library protection.	Reboot the power. Consult with IAI if it frequently occurs.
ILLEGAL_INSTRUCTION	Inappropriate Command	Reboot the power. Consult with IAI if it frequently occurs.
ACCESS_VIOLATION	Access Violation	It can be considered that the pointer type variables are indirectly referred (address contents indicated by pointer variables are used for arithmetic) while substitution of an address to the pointer type variable is forgotten or an inappropriate address is substituted. Correct the program.
PRIV_INSTRUCTION	Privileged Command	Reboot the power. Consult with IAI if it frequently occurs.
IN_PAGE_ERROR	Page Violation	Reboot the power. Consult with IAI if it frequently occurs.
STACK_OVERFLOW	Stack Overflow	Correct the program to reduce the usage of stacks. As a factor that the stack overflow gets occurred, there are: • Recursive call of function or function block • Array factors too large
INVALID_DISPOSITION	Ineffective Process	Reboot the power. Consult with IAI if it frequently occurs.
INVALID_HANDLE	Ineffective Operation	Reboot the power. Consult with IAI if it frequently occurs.
GUARD_PAGE	Guard Page	Reboot the power. Consult with IAI if it frequently occurs.
DOUBLE_FAULT	Double Fault	Reboot the power. Consult with IAI if it frequently occurs.
INVALID_OPCODE	Ineffective Operation Code	Reboot the power. Consult with IAI if it frequently occurs.
MISALIGNMENT	Misalignment of Data Type	Reboot the power. Consult with IAI if it frequently occurs.
ARRAYBOUNDS	Array Boundary Exceeded	Correct the program to use it in the array index declared in the variable definition.
DIVIDEBYZERO	Division by Zero	Correct the program so the denominator of division calculation would not be zero.
OVERFLOW	Overflow	Correct the program so an overflow would not be occurred.
NONCONTINUABLE	Not Available to Continue	Reboot the power. Consult with IAI if it frequently occurs.

8.1 Error

Name	Explanation	Countermeasure
PROCESSORLOAD_WATCHDOG	Processor Load Watchdog Detected in All IEC Tasks	It has exceeded the processor load allowed in the software PLC system. Revise the process of the PLC program. Effective ways to reduce process time are: • to delete infinite loop • reduce loop process count • to delete unnecessary process
FPU_ERROR	FPU: Unknown Error	Reboot the power. Consult with IAI if it frequently occurs.
FPU_DENORMAL_OPERAND	FPU: Denormalized Operant	Reboot the power. Consult with IAI if it frequently occurs.
FPU_DIVIDEBYZERO	FPU: Division by Zero	Make correction to the program to have the denominator of devision in calculation of real numbers not to become zero.
FPU_INEXACT_RESULT	FPU: Inappropriate Result	Reboot the power. Consult with IAI if it frequently occurs.
FPU_INVALID_OPERATION	FPU: Invalid Operation	Reboot the power. Consult with IAI if it frequently occurs.
FPU_OVERFLOW	FPU: Overflow	Reboot the power. Consult with IAI if it frequently occurs.
FPU_STACK_CHECK	FPU: Stack check	Reboot the power. Consult with IAI if it frequently occurs.
FPU_UNDERFLOW	FPU: Underflow	Reboot the power. Consult with IAI if it frequently occurs.

8.1.3 List of PLC Related Errors Occurred in SEL System (XSEL2)

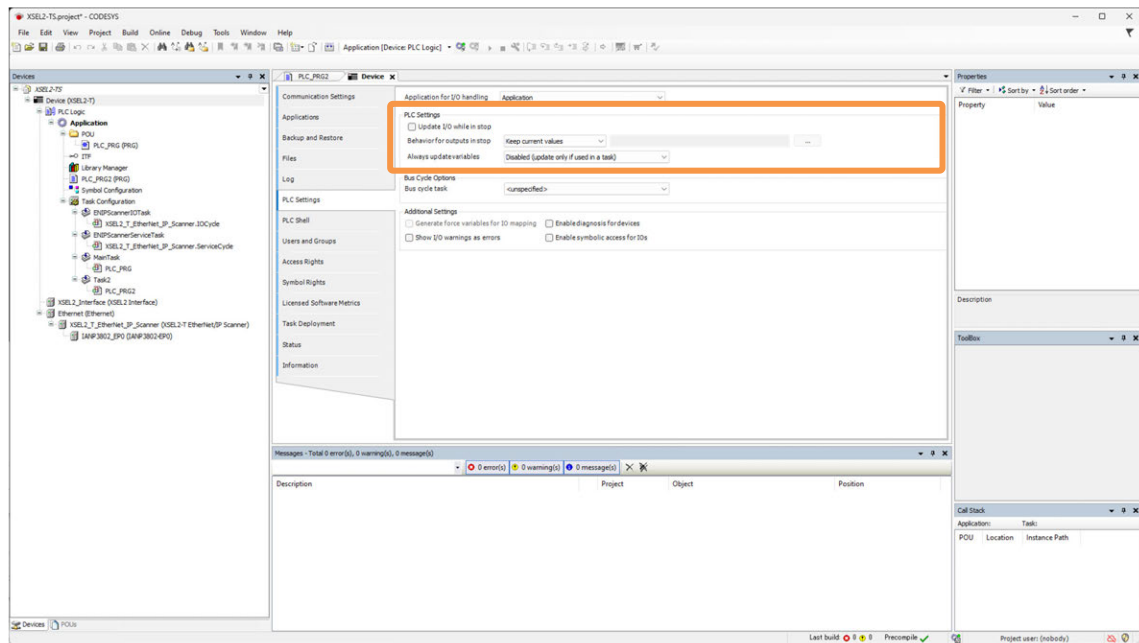
No.	Level	Name	Contents and Causes / Countermeasures
252	Message	Software PLC Exception Error	[Contents and Causes] An exception error has occurred in the software PLC and the software PLC has stopped. [Countermeasures] Connect to CODESYS for XSEL2 and solve a cause of the exception error.
253	Message	Software PLC Data Error	[Contents and Causes] The software PLC data (program, variable domain) that the flash ROM or backup memory is saved has been damaged. The followings can be considered as a cause. 1) The power was cut off during download of the software PLC. 2) Data corrupted due to noise applied [Countermeasures] 1) Download the application from CODESYS for XSEL2 again or initialize the software PLC data from a teaching tool. 2) Have a countermeasure for noise to the controller (if frequently occurs)
255	Message	Software PLC User Account Error	[Contents and Causes] The software PLC data stored in the flash ROM or the backup memory (user account, certificate or key) has been damaged. The followings can be concerned. 1) Power supply was cut off during write-in of the software PLC user account. 2) Data corrupted due to noise applied [Countermeasures] 1) Deactivate the PLC feature, initialize the PLC data in a teaching tool, and then reboot the controller. 2) Have a countermeasure for noise to the controller (if frequently occurs)
4C4	Operation Cancel	Software PLC Out of resources error	[Contents and Causes] Memory is not enough in the software PLC. [Countermeasures] Consider the following three countermeasures. • Simplify programs • Delete unnecessary programs • Communize similar processes with FB (function blocks)

No.	Level	Name	Contents and Causes / Countermeasures
632	Cold Start	I/O Assignment Parameter Error	[Contents and Causes] 1) The input (output) port start number and the input (output) used port count at the fixed assignment were set as follows: • Other than Port No. 0-299, 300-599, 1000-3999 or 4000-6999 • Not a multiple of 8 2) Assignment duplication due to parameter setting error 3) Assignment count exceeded due to parameter setting error 4) Assignment error in signals or input and output port domains related to software PLC due to parameter setting error [Countermeasures] 1) Set the input (output) port start number and the input (output) used port count at the fixed assignment to appropriate values 2) Check the input and output used port count and input and output port start number set in the following parameters and confirm that there is no duplication in assignment. • I/O parameter No.14 to 15 "I/O1 Fieldbus Remote Input (Output) Used Port Count" • I/O parameter No.16 to 17 "I/O1 Input (Output) Port Start Number at Fixed Assignment" • I/O parameter No.687 to 688 "Remote I/O Unit (IN (OUT) Specification) Connected Unit Count" • I/O parameter No.689 to 690 "Remote I/O Unit Input (Output) Port Start Number at Fixed Assignment" 3) Check the input and output used port count and input and output port start number set in the following parameters to confirm that there is no excess of assignment count to the specification. • I/O parameter No.14 to 15 "I/O1 Fieldbus Remote Input (Output) Used Port Count" • I/O parameter No.16 to 17 "I/O1 Input (Output) Port Start Number at Fixed Assignment" • I/O parameter No.687 to 688 "Remote I/O Unit (IN (OUT) Specification) Connected Unit Count" • I/O parameter No.689 to 690 "Remote I/O Unit Input (Output) Port Start Number at Fixed Assignment" 4) Check the input and output used port count and input and output port start number set in the following parameters to confirm that assignment is performed following the specification. • PLC parameter No.2 "RUN signal Output Port No." • PLC parameter No.3 "ERR signal Output Port No."

8.1.4 Operation at PLC Error Occurred

If an error is occurred in PLC, the operation of PLC should stop. For the output signal at stop, follow “Output Setting at Stop” at the “PLC Setting” tab in the Device Setting window.

For details, refer to [4.4.3 I/O Refresh].



8.1.5 Outputting PLC Operation Error Status

The operation / error status of PLC can be externally output. Connect the XSEL PC software or a teaching pendant and set up the following parameters.

●PLC Parameter

No.	Parameter name	Setting at Delivery	Input range	Unit	Explanation
2	RUN signal Output Port No.	0	0 300 to 599, 4000 to 5951	-	It should be "invalid" when it is set to "0" or a port number is used duplicated to other output features. When 300 to 599 and 4000 to 5951 are set, • PLC in Operation: ON • PLC in Stop: OFF should be output.
3	ERR signal Output Port No.	0	0 300 to 599, 4000 to 5951	-	It should be "invalid" when it is set to "0" or a port number is used duplicated to other output features. When 300 to 599 and 4000 to 5951 are set, • PLC in Error Occurred: ON • PLC in Error Not Occurred: OFF should be output.

8.2 Power Cutoff Operation

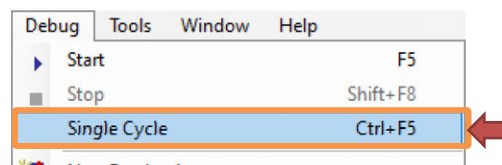
When the control power voltage is dropped to 60V or less, the software PLC should stop operation and the output should turn off.

- Even if instantaneous power failure less than 20ms (for power frequency 50Hz) / 17ms (for less than 60Hz) occurs, there should be no response and the operation should continue.
- When instantaneous power failure for 20ms (for power frequency 50Hz) / 17ms (for less than 60Hz) or more occurs, operation should stop and the output should turn OFF.

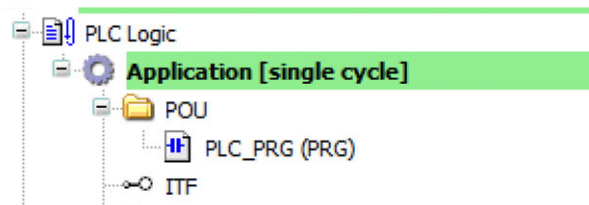
When operation stops by instantaneous power failure, turn the power on again for recovery.

8.3 Restrictions

- The operation commands of an actuator / robot is first come first processed, and the next operation command should not be received until the first one is terminated.
Be aware that, while operating an actuator / robot in a SEL program or with the XSEL PC teaching software / teaching pendant, the actuator or robot cannot be operated from the software PLC.
- If the software reset is executed from the XSEL PC teaching software, TB-02/03, IAI Protocol Format B or input feature select signal, CODESYS should also be rebooted. Confirm that there is a measure against the equipment to run out of control during CODESYS system reboot, and pay attention for execution.
- In CODESYS Runtime V3.5.18.20, while an exception error is being occurred,
 - 1) Execute "Debug" → "Single Cycle"



- 2) Even though the application gets to the single cycle status, a program should not be executed and the single cycle status should be kept.

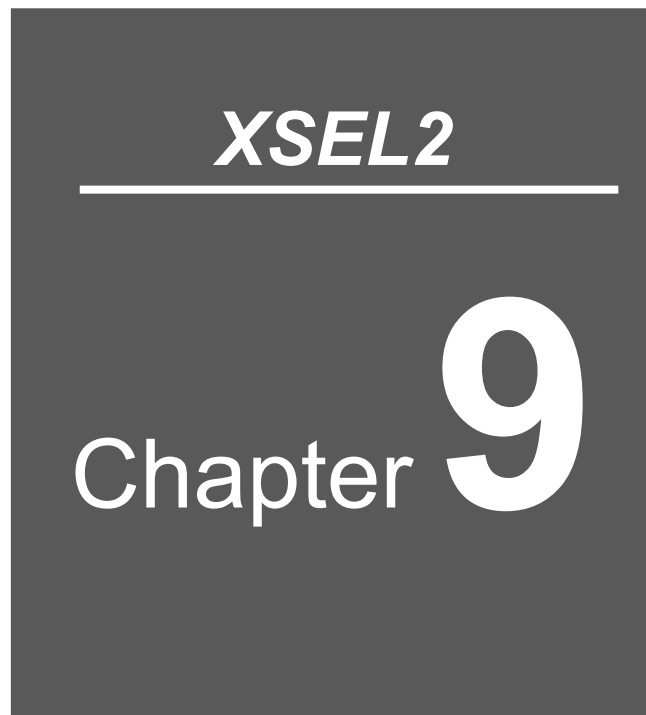


- 3) Press the stop button while in the condition of 2), the application cannot be stopped, communication to the CODESYS for XSEL2 should be cut, and the software PLC will not operate in normal condition after that. In case such a phenomenon has occurred, reboot the power.
- Even if the emergency stop input, enable input or driver stop input is made to XSEL2, PLC should not stop.

8.4 Precautions

- Set up a safety circuit that does not pass through this product so the whole system should work to the safety side even when there is any error occurred to this product.
- There is a concern that the product may not control and operate properly due to malfunction of output circuit or internal circuit. Make sure to have a safety circuit for controls that may cause fire or serious accident.
- Conduct a risk assessment for the whole equipment to make sure that appropriate risk reduction measures are taken when this product is installed. Take appropriate protection measures without passing through this product so the whole equipment works safely even when an error is occurred.
- In order to prevent inappropriate access from an external device via internet or information leak, have sufficient network security measures by the user.
Below shows some examples of network security measures.
 - (1) Use this product in a network using such as Firewall.
 - (2) Confirm that check to infection to computer viruses and malware programs is conducted regularly and exterminated if the product is connected to a PC.
 - (3) It is not installed to a place where anonymous people can touch, or lock the place where the device is installed.
 - (4) Use it in an environment with VPN (Virtual Private Network) or dedicated online network being established.
 - (5) Limit accessible users by setting up a username and password.
 - (6) Certify identification of each other between devices by exchanging the electronic certificate.
- Pay special attention to safety for operation such as program change or compulsory output while the system is running.
It may cause damage to the machinery or accident by operation mistake.
- Refer to manuals related to each network device for the operational conditions when there is a communication error in a network including Fieldbus. There is a concern of an accident due to error output or error operation.

- The screen display of CODESYS for XSEL2 described in this manual may differ in some parts depending on versions. Confirm the actual screen display in the used CODESYS for XSEL2.
- Never attempt to use this product in a purpose of protecting a human body or a part of human body.
- Confirm that there is a measure against the equipment to run out of control during reboot of machinery or equipment, and pay attention for execution.
- Make a backup of the CODESYS project file as a preparation to malfunction.
Data such as PLC programs should be written in the flash ROM. Usually, this data should not be lost even if the power is cut. However, the latest data should be saved so that recovery process can be quickly taken in case when this controller must be replaced with an alternative due to such as malfunction.



Appendix

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9.1 Time Setting

9.1.1 XSEL2 Parameter settings

In order to adjust the clock display of the software PLC, it is necessary to conduct the parameter setting of offset from the coordinated universal time.

● Other Parameters

No.	Parameter Name	Setting at Delivery	Input range	Unit	Explanation
13	Offset (Hours) from Coordinated Universal Time (UTC)	9	-23 to 23	Hour	
14	Offset (Minutes) from Coordinated Universal Time (UTC)	0	0 to 59	Minute	

For the offset hour and minute, refer to the offset table from UTC for each timezone to set the timezone values in the XSEL PC software and TB-02/03.

● Offset from UTC for Each Timezone

ISO 3166	Timezone	Offset from UTC		Timezone description
		Hours	Minutes	
AF	Afghanistan Standard Time	+4	30	Kabul
AX	FLE Standard Time	+2	0	Helsinki, Kyiv, Riga, Sofia, Tallinn, Vilnius
AL	Central Europe Standard Time	+1	0	Belgrade, Bratislava, Budapest, Ljubljana, Prague
DZ	W. Central Africa Standard Time	+1	0	West Central Africa
AS	UTC-11	-11	0	Coordinated Universal Time-11
AD	W. Europe Standard Time	+1	0	Amsterdam, Berlin, Bern, Rome, Stockholm, Vienna
AO	W. Central Africa Standard Time	+1	0	West Central Africa
AI	SA Western Standard Time	-4	0	Georgetown, La Paz, Manaus, San Juan
AQ	Pacific SA Standard Time	-3	0	Santiago
AG	SA Western Standard Time	-4	0	Georgetown, La Paz, Manaus, San Juan
AR	Argentina Standard Time	-3	0	City of Buenos Aires
AM	Caucasus Standard Time	+4	0	Yerevan
AW	SA Western Standard Time	-4	0	Georgetown, La Paz, Manaus, San Juan
AU	AUS Eastern Standard Time	+10	0	Canberra, Melbourne, Sydney
AT	W. Europe Standard Time	+1	0	Amsterdam, Berlin, Bern, Rome, Stockholm, Vienna
AZ	Azerbaijan Standard Time	+4	0	Baku
BS	Eastern Standard Time	-5	0	Eastern Time (US & Canada)
BH	Arab Standard Time	+3	0	Kuwait, Riyadh
BD	Bangladesh Standard Time	+6	0	Dhaka
BB	SA Western Standard Time	-4	0	Georgetown, La Paz, Manaus, San Juan

9.1 Time Setting

ISO 3166	Timezone	Offset from UTC		Timezone description
		Hours	Minutes	
BY	Belarus Standard Time	+3	0	Minsk
BE	Romance Standard Time	+1	0	Brussels, Copenhagen, Madrid, Paris
BZ	Central America Standard Time	-6	0	Central America
BJ	W. Central Africa Standard Time	+1	0	West Central Africa
BM	Atlantic Standard Time	-4	0	Atlantic Time (Canada)
BT	Bangladesh Standard Time	+6	0	Dhaka
VE	Venezuela Standard Time	-4	30	Caracas
BO	SA Western Standard Time	-4	0	Georgetown, La Paz, Manaus, San Juan
BQ	SA Western Standard Time	-4	0	Georgetown, La Paz, Manaus, San Juan
BA	Central European Standard Time	+1	0	Sarajevo, Skopje, Warsaw, Zagreb
BW	South Africa Standard Time	+2	0	Harare, Pretoria
BV	UTC	0	0	Coordinated Universal Time
BR	E. South America Standard Time	-3	0	Brasilia
IO	Central Asia Standard Time	+6	0	Astana
BN	Singapore Standard Time	+8	0	Kuala Lumpur, Singapore
BG	FLE Standard Time	+2	0	Helsinki, Kyiv, Riga, Sofia, Tallinn, Vilnius
BF	Greenwich Standard Time	0	0	Monrovia, Reykjavik
BI	South Africa Standard Time	+2	0	Harare, Pretoria
CV	Cape Verde Standard Time	-1	0	Cabo Verde Is.
KH	SE Asia Standard Time	+7	0	Bangkok, Hanoi, Jakarta
CM	W. Central Africa Standard Time	+1	0	West Central Africa
CA	Eastern Standard Time	-5	0	Eastern Time (US & Canada)
KY	SA Pacific Standard Time	-5	0	Bogota, Lima, Quito, Rio Branco
CF	W. Central Africa Standard Time	+1	0	West Central Africa
TD	W. Central Africa Standard Time	+1	0	West Central Africa
CL	Pacific SA Standard Time	-3	0	Santiago
CN	China Standard Time	+8	0	Beijing, Chongqing, Hong Kong SAR, Urumqi
CX	SE Asia Standard Time	+7	0	Bangkok, Hanoi, Jakarta
CC	Myanmar Standard Time	+6	30	Yangon (Rangoon)
CO	SA Pacific Standard Time	-5	0	Bogota, Lima, Quito, Rio Branco
KM	E. Africa Standard Time	+3	0	Nairobi
CG	W. Central Africa Standard Time	+1	0	West Central Africa
CD	W. Central Africa Standard Time	+1	0	West Central Africa
CK	Hawaiian Standard Time	-10	0	Hawaii

ISO 3166	Timezone	Offset from UTC		Timezone description
		Hours	Minutes	
CR	Central America Standard Time	-6	0	Central America
CI	Greenwich Standard Time	0	0	Monrovia, Reykjavik
HR	Central European Standard Time	+1	0	Sarajevo, Skopje, Warsaw, Zagreb
CU	Eastern Standard Time	-5	0	Eastern Time (US & Canada)
CW	SA Western Standard Time	-4	0	Georgetown, La Paz, Manaus, San Juan
CY	E. Europe Standard Time	+2	0	E. Europe
CZ	Central Europe Standard Time	+1	0	Belgrade, Bratislava, Budapest, Ljubljana, Prague
TL	Tokyo Standard Time	+9	0	Osaka, Sapporo, Tokyo
DK	Romance Standard Time	+1	0	Brussels, Copenhagen, Madrid, Paris
DJ	E. Africa Standard Time	+3	0	Nairobi
DM	SA Western Standard Time	-4	0	Georgetown, La Paz, Manaus, San Juan
DO	SA Western Standard Time	-4	0	Georgetown, La Paz, Manaus, San Juan
EC	SA Pacific Standard Time	-5	0	Bogota, Lima, Quito, Rio Branco
EG	Egypt Standard Time	+2	0	Cairo
SV	Central America Standard Time	-6	0	Central America
GQ	W. Central Africa Standard Time	+1	0	West Central Africa
ER	E. Africa Standard Time	+3	0	Nairobi
EE	FLE Standard Time	+2	0	Helsinki, Kyiv, Riga, Sofia, Tallinn, Vilnius
ET	E. Africa Standard Time	+3	0	Nairobi
FK (FK)	SA Eastern Standard Time	-3	0	Cayenne, Fortaleza
FO	GMT Standard Time	0	0	Dublin, Edinburgh, Lisbon, London
FJ	Fiji Standard Time	+12	0	Fiji
FI	FLE Standard Time	+2	0	Helsinki, Kyiv, Riga, Sofia, Tallinn, Vilnius
FR	Romance Standard Time	+1	0	Brussels, Copenhagen, Madrid, Paris
GF	SA Eastern Standard Time	-3	0	Cayenne, Fortaleza
PF	Hawaiian Standard Time	-10	0	Hawaii
TF	West Asia Standard Time	+5	0	Ashgabat, Tashkent
GA	W. Central Africa Standard Time	+1	0	West Central Africa
GM	Greenwich Standard Time	0	0	Monrovia, Reykjavik
GE	Georgian Standard Time	+4	0	Tbilisi
DE	W. Europe Standard Time	+1	0	Amsterdam, Berlin, Bern, Rome, Stockholm, Vienna
GH	Greenwich Standard Time	0	0	Monrovia, Reykjavik
GI	W. Europe Standard Time	+1	0	Amsterdam, Berlin, Bern, Rome, Stockholm, Vienna
GR	GTB Standard Time	+2	0	Athens, Bucharest
GL	Greenland Standard Time	-3	0	Greenland
GD	SA Western Standard Time	-4	0	Georgetown, La Paz, Manaus, San Juan

9.1 Time Setting

ISO 3166	Timezone	Offset from UTC		Timezone description
		Hours	Minutes	
GP	SA Western Standard Time	-4	0	Georgetown, La Paz, Manaus, San Juan
GU	West Pacific Standard Time	+10	0	Guam, Port Moresby
GT	Central America Standard Time	-6	0	Central America
GG	GMT Standard Time	0	0	Dublin, Edinburgh, Lisbon, London
GN	Greenwich Standard Time	0	0	Monrovia, Reykjavik
GW	Greenwich Standard Time	0	0	Monrovia, Reykjavik
GY	SA Western Standard Time	-4	0	Georgetown, La Paz, Manaus, San Juan
HT	Eastern Standard Time	-5	0	Eastern Time (US & Canada)
HM	Mauritius Standard Time	+4	0	Port Louis
HN	Central America Standard Time	-6	0	Central America
HK	China Standard Time	+8	0	Beijing, Chongqing, Hong Kong SAR, Urumqi
HU	Central Europe Standard Time	+1	0	Belgrade, Bratislava, Budapest, Ljubljana, Prague
IS	Greenwich Standard Time	0	0	Monrovia, Reykjavik
IN	India Standard Time	+5	30	Chennai, Kolkata, Mumbai, New Delhi
id	SE Asia Standard Time	+7	0	Bangkok, Hanoi, Jakarta
IR	Iran Standard Time	+3	30	Tehran
IQ	Arabic Standard Time	+3	0	Baghdad
IE	GMT Standard Time	0	0	Dublin, Edinburgh, Lisbon, London
IL	Israel Standard Time	+2	0	Middle East
IT	W. Europe Standard Time	+1	0	Amsterdam, Berlin, Bern, Rome, Stockholm, Vienna
JM	SA Pacific Standard Time	-5	0	Bogota, Lima, Quito, Rio Branco
SJ	W. Europe Standard Time	+1	0	Amsterdam, Berlin, Bern, Rome, Stockholm, Vienna
JP	Tokyo Standard Time	+9	0	Osaka, Sapporo, Tokyo
JE	GMT Standard Time	0	0	Dublin, Edinburgh, Lisbon, London
JO	Jordan Standard Time	+2	0	Amman
KZ	Central Asia Standard Time	+6	0	Astana
KE	E. Africa Standard Time	+3	0	Nairobi
KI	UTC+12	+12	0	Coordinated Universal Time+12
KR	Korea Standard Time	+9	0	Seoul
XK	Central European Standard Time	+1	0	Sarajevo, Skopje, Warsaw, Zagreb
KW	Arab Standard Time	+3	0	Kuwait, Riyadh
KG	Central Asia Standard Time	+6	0	Astana
LA	SE Asia Standard Time	+7	0	Bangkok, Hanoi, Jakarta
LV	FLE Standard Time	+2	0	Helsinki, Kyiv, Riga, Sofia, Tallinn, Vilnius
LB	Middle East Standard Time	+2	0	Beirut
LS	South Africa Standard Time	+2	0	Harare, Pretoria

ISO 3166	Timezone	Offset from UTC		Timezone description
		Hours	Minutes	
LR	Greenwich Standard Time	0	0	Monrovia, Reykjavik
LY	E. Europe Standard Time	+2	0	E. Europe
LI	W. Europe Standard Time	+1	0	Amsterdam, Berlin, Bern, Rome, Stockholm, Vienna
LT	FLE Standard Time	+2	0	Helsinki, Kyiv, Riga, Sofia, Tallinn, Vilnius
LU	W. Europe Standard Time	+1	0	Amsterdam, Berlin, Bern, Rome, Stockholm, Vienna
MO	China Standard Time	+8	0	Beijing, Chongqing, Hong Kong SAR, Urumqi
MK	Central European Standard Time	+1	0	Sarajevo, Skopje, Warsaw, Zagreb
MG	E. Africa Standard Time	+3	0	Nairobi
MW	South Africa Standard Time	+2	0	Harare, Pretoria
MY	Singapore Standard Time	+8	0	Kuala Lumpur, Singapore
MV	West Asia Standard Time	+5	0	Ashgabat, Tashkent
ML	Greenwich Standard Time	0	0	Monrovia, Reykjavik
MT	W. Europe Standard Time	+1	0	Amsterdam, Berlin, Bern, Rome, Stockholm, Vienna
IM	GMT Standard Time	0	0	Dublin, Edinburgh, Lisbon, London
MH	UTC+12	+12	0	Coordinated Universal Time+12
MQ	SA Western Standard Time	-4	0	Georgetown, La Paz, Manaus, San Juan
MR	Greenwich Standard Time	0	0	Monrovia, Reykjavik
MU	Mauritius Standard Time	+4	0	Port Louis
YT	E. Africa Standard Time	+3	0	Nairobi
MX	Central Standard Time (Mexico)	-6	0	Guadalajara, Mexico City, Monterrey
FM	West Pacific Standard Time	+10	0	Guam, Port Moresby
MD	GTB Standard Time	+2	0	Athens, Bucharest
MC	W. Europe Standard Time	+1	0	Amsterdam, Berlin, Bern, Rome, Stockholm, Vienna
MN	Ulaanbaatar Standard Time	+8	0	Ulaanbaatar
ME	Central European Standard Time	+1	0	Sarajevo, Skopje, Warsaw, Zagreb
MS	SA Western Standard Time	-4	0	Georgetown, La Paz, Manaus, San Juan
MA	Morocco Standard Time	0	0	Casablanca
MZ	South Africa Standard Time	+2	0	Harare, Pretoria
MM	Myanmar Standard Time	+6	30	Yangon (Rangoon)
NA	Namibia Standard Time	+1	0	Windhoek
NR	UTC+12	+12	0	Coordinated Universal Time+12
NP	Nepal Standard Time	+5	45	Kathmandu
NL	W. Europe Standard Time	+1	0	Amsterdam, Berlin, Bern, Rome, Stockholm, Vienna
NC	Central Pacific Standard Time	+11	0	Solomon Is., New Caledonia
NZ	New Zealand Standard Time	+12	0	Auckland, Wellington
NI	Central America Standard Time	-6	0	Central America

9.1 Time Setting

ISO 3166	Timezone	Offset from UTC		Timezone description
		Hours	Minutes	
NE	W. Central Africa Standard Time	+1	0	West Central Africa
NG	W. Central Africa Standard Time	+1	0	West Central Africa
NU	UTC-11	-11	0	Coordinated Universal Time-11
NF	Central Pacific Standard Time	+11	0	Solomon Is., New Caledonia
KP	Korea Standard Time	+9	0	Seoul
MP	West Pacific Standard Time	+10	0	Guam, Port Moresby
NO	W. Europe Standard Time	+1	0	Amsterdam, Berlin, Bern, Rome, Stockholm, Vienna
OM	Arabian Standard Time	+4	0	Abu Dhabi, Muscat
PK	Pakistan Standard Time	+5	0	Islamabad, Karachi
PW	Tokyo Standard Time	+9	0	Osaka, Sapporo, Tokyo
PS	Egypt Standard Time	+2	0	Cairo
PA	SA Pacific Standard Time	-5	0	Bogota, Lima, Quito, Rio Branco
PG	West Pacific Standard Time	+10	0	Guam, Port Moresby
PY	Paraguay Standard Time	-4	0	Asuncion
PE	SA Pacific Standard Time	-5	0	Bogota, Lima, Quito, Rio Branco
PH	Singapore Standard Time	+8	0	Kuala Lumpur, Singapore
PN	Pacific Standard Time	-8	0	Pacific Time (US & Canada)
PL	Central European Standard Time	+1	0	Sarajevo, Skopje, Warsaw, Zagreb
PT	GMT Standard Time	0	0	Dublin, Edinburgh, Lisbon, London
PR	SA Western Standard Time	-4	0	Georgetown, La Paz, Manaus, San Juan
QA	Arab Standard Time	+3	0	Kuwait, Riyadh
RE	Mauritius Standard Time	+4	0	Port Louis
RO	GTB Standard Time	+2	0	Athens, Bucharest
RU	Russian Standard Time	+3	0	Moscow, St. Petersburg, Volgograd (RTZ 2)
RW	South Africa Standard Time	+2	0	Harare, Pretoria
BL	SA Western Standard Time	-4	0	Georgetown, La Paz, Manaus, San Juan
SH	Greenwich Standard Time	0	0	Monrovia, Reykjavik
KN	SA Western Standard Time	-4	0	Georgetown, La Paz, Manaus, San Juan
LC	SA Western Standard Time	-4	0	Georgetown, La Paz, Manaus, San Juan
MF	SA Western Standard Time	-4	0	Georgetown, La Paz, Manaus, San Juan
PM	Greenland Standard Time	-3	0	Greenland
VC	SA Western Standard Time	-4	0	Georgetown, La Paz, Manaus, San Juan
WS	Samoa Standard Time	+13	0	Samoa
SM	W. Europe Standard Time	+1	0	Amsterdam, Berlin, Bern, Rome, Stockholm, Vienna
ST	Greenwich Standard Time	0	0	Monrovia, Reykjavik
SA	Arab Standard Time	+3	0	Kuwait, Riyadh

ISO 3166	Timezone	Offset from UTC		Timezone description
		Hours	Minutes	
SN	Greenwich Standard Time	0	0	Monrovia, Reykjavik
RS	Central Europe Standard Time	+1	0	Belgrade, Bratislava, Budapest, Ljubljana, Prague
SC	Mauritius Standard Time	+4	0	Port Louis
SL	Greenwich Standard Time	0	0	Monrovia, Reykjavik
SG	Singapore Standard Time	+8	0	Kuala Lumpur, Singapore
SX	SA Western Standard Time	-4	0	Georgetown, La Paz, Manaus, San Juan
SK	Central Europe Standard Time	+1	0	Belgrade, Bratislava, Budapest, Ljubljana, Prague
SI	Central Europe Standard Time	+1	0	Belgrade, Bratislava, Budapest, Ljubljana, Prague
SB	Central Pacific Standard Time	+11	0	Solomon Is., New Caledonia
SO	E. Africa Standard Time	+3	0	Nairobi
ZA	South Africa Standard Time	+2	0	Harare, Pretoria
GS	UTC-02	-2	0	Coordinated Universal Time-02
SS	E. Africa Standard Time	+3	0	Nairobi
ES	Romance Standard Time	+1	0	Brussels, Copenhagen, Madrid, Paris
LK	Sri Lanka Standard Time	+5	30	Sri Jayawardenepura
SD	E. Africa Standard Time	+3	0	Nairobi
SR	SA Eastern Standard Time	-3	0	Cayenne, Fortaleza
SJ	W. Europe Standard Time	+1	0	Amsterdam, Berlin, Bern, Rome, Stockholm, Vienna
SZ	South Africa Standard Time	+2	0	Harare, Pretoria
SE	W. Europe Standard Time	+1	0	Amsterdam, Berlin, Bern, Rome, Stockholm, Vienna
CH	W. Europe Standard Time	+1	0	Amsterdam, Berlin, Bern, Rome, Stockholm, Vienna
SY	Syria Standard Time	+2	0	Damascus
TW	Taipei Standard Time	+8	0	Taipei
TJ	West Asia Standard Time	+5	0	Ashgabat, Tashkent
TZ	E. Africa Standard Time	+3	0	Nairobi
TH	SE Asia Standard Time	+7	0	Bangkok, Hanoi, Jakarta
TG	Greenwich Standard Time	0	0	Monrovia, Reykjavik
TK	Tonga Standard Time	+13	0	Nuku'alofa
TO	Tonga Standard Time	+13	0	Nuku'alofa
TT	SA Western Standard Time	-4	0	Georgetown, La Paz, Manaus, San Juan
TN	W. Central Africa Standard Time	+1	0	West Central Africa
TR	Türkiye Standard Time	+2	0	Istanbul
TM	West Asia Standard Time	+5	0	Ashgabat, Tashkent
TC	Eastern Standard Time	-5	0	Eastern Time (US & Canada)
TV	UTC+12	+12	0	Coordinated Universal Time+12
UM	UTC-11	-11	0	Coordinated Universal Time-11

9.1 Time Setting

ISO 3166	Timezone	Offset from UTC		Timezone description
		Hours	Minutes	
UG	E. Africa Standard Time	+3	0	Nairobi
UA	FLE Standard Time	+2	0	Helsinki, Kyiv, Riga, Sofia, Tallinn, Vilnius
AE	Arabian Standard Time	+4	0	Abu Dhabi, Muscat
GB	GMT Standard Time	0	0	Dublin, Edinburgh, Lisbon, London
US	Mountain Standard Time	-7	0	Mountain Time (US & Canada)
US	Pacific Standard Time	-8	0	Pacific Time (US & Canada)
UY	Montevideo Standard Time	-3	0	Montevideo
UZ	West Asia Standard Time	+5	0	Ashgabat, Tashkent
VU	Central Pacific Standard Time	+11	0	Solomon Is., New Caledonia
VA	W. Europe Standard Time	+1	0	Amsterdam, Berlin, Bern, Rome, Stockholm, Vienna
VN	SE Asia Standard Time	+7	0	Bangkok, Hanoi, Jakarta
VI	SA Western Standard Time	-4	0	Georgetown, La Paz, Manaus, San Juan
VG	SA Western Standard Time	-4	0	Georgetown, La Paz, Manaus, San Juan
WF	UTC+12	+12	0	Coordinated Universal Time+12
YE	Arab Standard Time	+3	0	Kuwait, Riyadh
ZM	South Africa Standard Time	+2	0	Harare, Pretoria
ZW	South Africa Standard Time	+2	0	Harare, Pretoria

Example) Example of Parameter Setting for West Europe Standard Time

ISO 3166	Timezone	Offset from UTC	
		Time	Minutes
DE	W. Europe Standard Time	+1	0

● Other Parameters

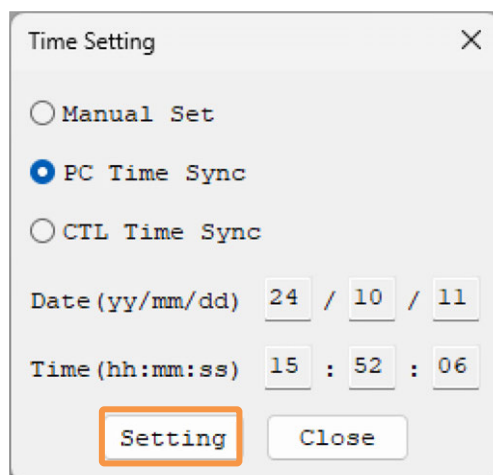
No.	Parameter Name	Setting at Delivery	Input range	Unit
13	Offset (Time) from Coordinated Universal Time (UTC)	1	-23 to 23	Time
14	Offset (Minutes) from Coordinated Universal Time (UTC)	0	0 to 59	Minutes

9.1.2 Operation Process of Teaching Tool

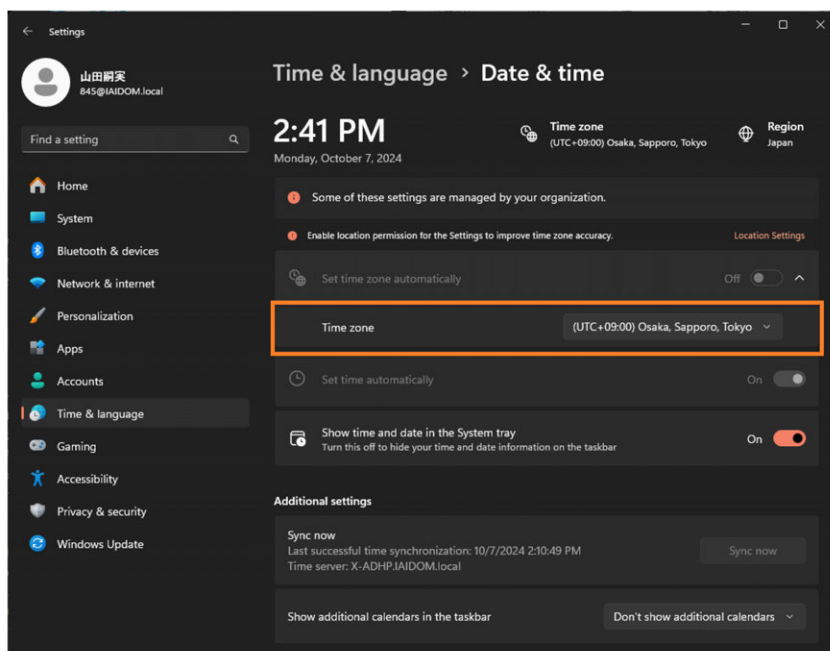
[1] For XSEL PC Teaching Software

Select “Controller (C)” → “Time Setting (T)” in the menu, and the Time Setting window should be displayed. Select either “Manual Input” or “Display PC Time”, input necessary values and click

Set.

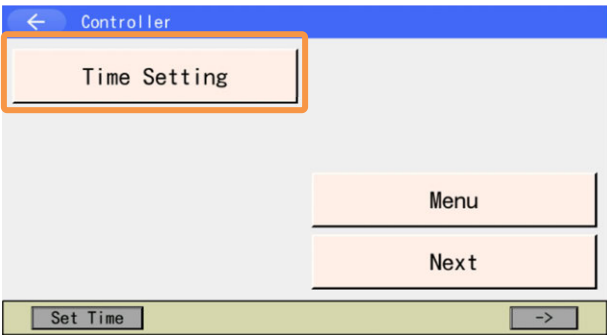


When set to “Display PC Time”, and the current time in the timezone set in the PC should be set. The timezone setting in the PC can be checked in “Timezone” in the window of “Start” → “Setting” → “Time and Language” → “Date and Time” in Windows.

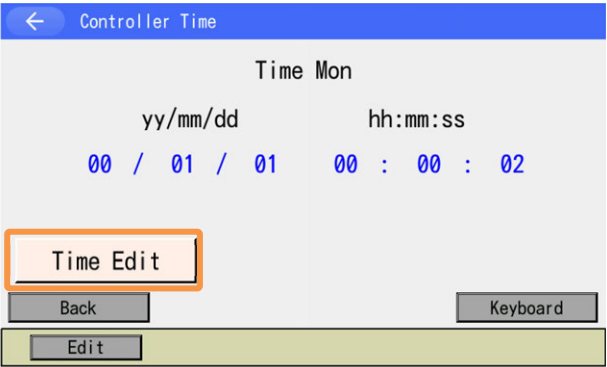


[2] For TB-02/03

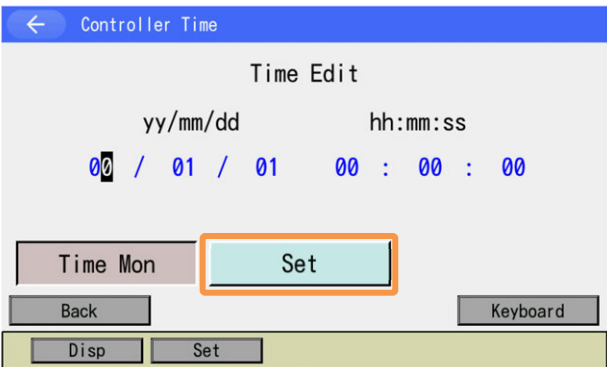
For TB-02/TB-03, touch **Time Setting** in the controller menu window.



The controller time should be displayed. Touch **Time Edit** and the screen transits to the edit window.



Input time using a keyboard and touch **Set**.



9.1.3 Time Retain Period While Power is OFF

Even though an XSEL2 controller memorizes the current time, the time retain period while the power is off should be about ten days.

If the retain period is exceeded and the clock data is lost, Error Code: 202 “Calendar Feature Error” could occur and that may make the certificate look the valid date expired.

If Error Code: 202 is occurred, follow [9.1.2 Operation Process of Teaching Tool] to set the current time again.

9.2 Keyboard shortcuts

It is a list of the effective keyboard shortcut in CODESYS for XSEL2.

● File

Feature	Shortcut keys
New Project	Ctrl + N
Open Project	Ctrl + O
Save Project	Ctrl + S
End	Alt + F4

● Edit

Feature	Shortcut keys
Restore	Ctrl + Z
Redo	Ctrl + Y
Cut	Ctrl + X
Copy	Ctrl + Insert
Paste	Ctrl + V
Delete	Delete
Select all	Ctrl + A
Open typing assistant	F2
Automatic Declaration	Shift + F2
Next message	F4
Previous message	Shift + F4
Switch over Bookmark	Ctrl + F12
Next bookmark	F12
Previous bookmark	Shift + F12

● Display

Feature	Shortcut keys
Device display	Alt + 0
POU display	Alt + 1
Full screen	Ctrl + Shift + F12
Close editor	Ctrl + F4

● FBD/LD/IL Editor

Feature	Shortcut keys
Insert Network	Ctrl + I
Insert Network (Below)	Ctrl + T
Switch Network Comment Status	Ctrl + O
Insert Assignment	Ctrl + A
Insert Coil	Ctrl + A
Insert Contacts	Ctrl + K
Insert Contacts (Right)	Ctrl + D
Insert Parallel Contacts Above	Ctrl + P
Insert Parallel Contacts Below	Ctrl + R
Insert Box	Ctrl + B
Insert Empty Box	Ctrl + Shift + B
Insert Box with EN/ENO	Ctrl + Shift + E
Insert Jump	Ctrl + L
Insert Input	Ctrl + Q
Insert Deny	Ctrl + N
Insert Edge Detection	Ctrl + E
Insert SET/RESET	Ctrl + M
Set Output Connection	Ctrl + W
Insert Branch	Ctrl + Shift + V
Update Parameter	Ctrl + U
Delete IL Line	Ctrl + Delete
Show as FBD	Ctrl + 1
Show as LD	Ctrl + 2
Show as IL	Ctrl + 3

● Build

Feature	Shortcut keys
Generate code	F11

● Online

Feature	Shortcut keys
Login	Alt + F8
Logout	Ctrl + F8

● Debug

Feature	Shortcut keys
Operation	F5
Stop	Shift + F8
Single Cycle	Ctrl + F5
Switch Break Point	F9
Step Over	F10
Step In	F8
Step Out	Shift + F10
Cancel Compulsion of Value	Alt + F7
Compulsory of Values	F7
Write-in of Values	Ctrl + F7

● Window

Feature	Shortcut keys
Show Next Editor	Ctrl + F6
Show Previous Editor	Ctrl + Shift + F6
Show Next Frame	F6
Show Previous Frame	Shift + F6
Switch 1st Frame	Alt + F6

● Help

Feature	Shortcut keys
Open table of contents	Ctrl + Shift + F1
Open index	Ctrl + Shift + F2

In CODESYS for XSEL2, it is available to customize keyboard shortcuts previously defined and extend them. Click “Tool” → “Customize” to open the customize dialog, and then select the “Keyboard” tab to establish settings.

For details, refer to [CODESYS online help (<https://www.helpme-codesys.com/>)] to set it up.

9.3 License of Software Used in CODESYS for XSEL2

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