The right choice for the ultimate yield!

LS ELECTRIC strives to maximize your profits in gratitude for choosing us as your partner.
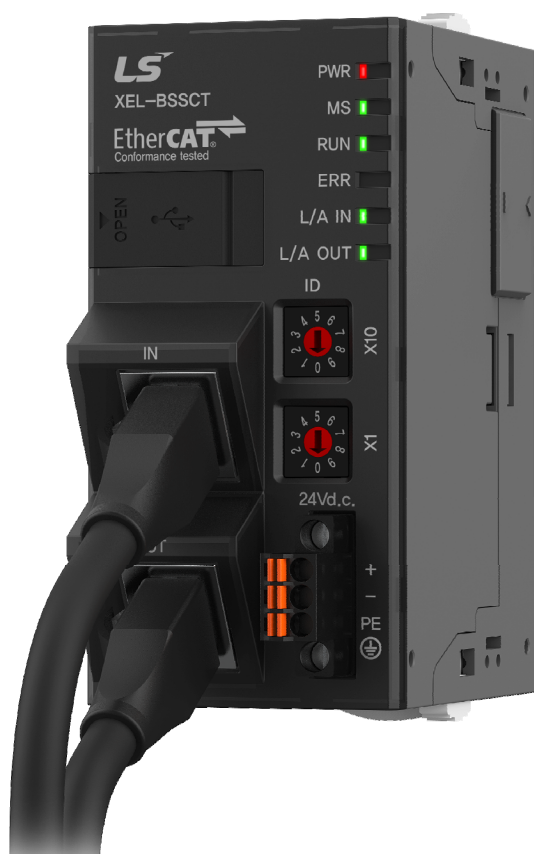
Programmable Logic Control

EtherCAT Smart I/O

XGT Series

User Manual

XEL-BSSCT

⚠ Safety Instructions

- Read this manual carefully before installing, wiring, operating, servicing or inspecting this equipment.

- Keep this manual within easy reach for quick reference.

LS ELECTRIC

Before using the product …

For your safety and effective operation, please read the safety instructions thoroughly before using the product.

► Safety Instructions should always be observed in order to prevent accident or risk with the safe and proper use the product.

► Instructions are divided into "Warning" and "Caution", and the meaning of the terms is as follows.

⚠ **Warning**   This symbol indicates the possibility of serious injury or death if some applicable instruction is violated.

⚠ **Caution**   This symbol indicates the possibility of severe or slight injury, and property damages if some applicable instruction is violated.

Moreover, even classified events under its caution category may develop into serious accidents relying on situations. Therefore we strongly advise users to observe all precautions properly just like warnings.

► The marks displayed on the product and in the user's manual have the following meanings.

　　⚠　　Be careful! Danger may be expected.

　　⚡　　Be careful! Electric shock may occur.

► The user's manual even after read shall be kept available and accessible to any user of the product.

Safety Instructions for Design Process

⚠ **Warning**

▸ **Please install a protection circuit on the exterior of PLC so that the whole system may operate safely regardless of failures from external power or PLC.** Any abnormal output or operation from PLC may cause serious problems to safety in whole system.

- Install protection units on the exterior of PLC like an interlock circuit that deals with opposite operations such as emergency stop, protection circuit, and forward/reverse rotation or install an interlock circuit that deals with high/low limit under its position controls.

- If any system error (watch-dog timer error, module installation error, etc.) is detected during CPU operation in PLC, all output signals are designed to be turned off and stopped for safety. However, there are cases when output signals remain active due to device failures in Relay and TR which can't be detected. Thus, you are recommended to install an addition circuit to monitor the output status for those critical outputs which may cause significant problems.

▸ **Never overload more than rated current of output module nor allow to have a short circuit**. Over current for a long period time may cause a fire.

▸ **Never let the external power of the output circuit to be on earlier than PLC power**, which may cause accidents from abnormal output operation.

▸ **Please install interlock circuits in the sequence program for safe operations in the system when exchange data with PLC or modify operation modes using a computer or other external equipments** Read specific instructions thoroughly when conducting control

Safety Instructions for Design Process

⚠ Caution

▸ **I/O signal or communication line shall be wired at least 100mm away from a high-voltage cable or power line.** Fail to follow this.

Safety Instructions on Installation Process

⚠ Caution

▸ **Use PLC only in the environment specified in PLC manual or general standard of data sheet.** If not, electric shock, fire, abnormal operation of the product may be caused.

▸ **Before install or remove the module, be sure PLC power is off.** If not, electric shock or damage on the product may be caused.

▸ **Be sure that every module is securely attached after adding a module or an extension connector.** If the product is installed loosely or incorrectly, abnormal operation, error or dropping may be caused. In addition, contact failures under poor cable installation will be causing malfunctions as well.

▸ **Be sure that screws get tighten securely under vibrating environments.** Fail to do so will put the product under direct vibrations which will cause electric shock, fire and abnormal operation.

▸ **Do not come in contact with conducting parts in each module**, which may cause electric

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Safety Instructions for Wiring Process

⚠ Warning

▸ **Prior to wiring works, make sure that every power is turned off.** If not, electric shock or damage on the product may be caused.

▸ **After wiring process is done, make sure that terminal covers are installed properly before its use.** Fail to install the cover may cause electric shocks.

⚠ Caution

▸ **Check rated voltages and terminal arrangements in each product prior to its wiring process.** Applying incorrect voltages other than rated voltages and misarrangement among terminals may cause fire or malfunctions.

▸ **Secure terminal screws tightly applying with specified torque.** If the screws get loose, short circuit, fire or abnormal operation may be caused. Securing screws too tightly will cause damages to the module or malfunctions, short circuit, and dropping.

▸ **Be sure to earth to the ground using Class 3 wires for PE terminals which is exclusively used for PLC**. If the terminals not grounded correctly, abnormal operation or electric shock may be caused.

▸ **Don't let any foreign materials such as wiring waste inside the module while wiring,** which may cause fire, damage on the product or abnormal operation.

▸ **Make sure that pressed terminals get tighten following the specified torque. External connector type shall be pressed or soldered using proper equipments.**

Safety Instructions for Test-Operation and Maintenance

⚠ **Warning**

▸ **Don't touch the terminal when powered**. Electric shock or abnormal operation may occur.

▸ **Prior to cleaning or tightening the terminal screws, let all the external power off including PLC power.** If not, electric shock or abnormal operation may occur.

▸ **Don't let the battery recharged, disassembled, heated, short or soldered**. Heat, explosion or ignition may cause injuries or fire.

⚠ **Caution**

▸ **Do not make modifications or disassemble each module.** Fire, electric shock or abnormal operation may occur.

▸ **Prior to installing or disassembling the module, let all the external power off including PLC power.** If not, electric shock or abnormal operation may occur.

▸ **Keep any wireless equipment such as walkie-talkie or cell phones at least 30cm away from PLC**. If not, abnormal operation may be caused.

▸ **When making a modification on programs or using run to modify functions under PLC operations, read and comprehend all contents in the manual fully.** Mismanagement will cause damages to products and accidents.

▸ **Avoid any physical impact to the battery and prevent it from dropping as well.** Damages to battery may cause leakage from its fluid. When battery was dropped or exposed under strong impact, never reuse the battery again. Moreover skilled workers are needed when exchanging batteries.

Safety Instructions for Waste Disposal

⚠ **Caution**
‣ **Product or battery waste shall be processed as industrial waste.** The waste may discharge toxic materials or explode itself.

Revision History

Version	Date	Remark	Part	Page
V 1.0	2018.12	1. First Edition	-	-
V 1.1	2020.06	1. Changed company name to LS ELECTRIC	-	-

About User's Manual

Congratulations on purchasing PLC of LS ELECTRIC Co., Ltd.

Before use, make sure to carefully read and understand the User's Manual about the functions, performances, installation and programming of the product you purchased in order for correct use and importantly, let the end user and maintenance administrator to be provided with the User's Manual.

The User's Manual describes the product. If necessary, you may refer to the following description and order accordingly. In addition, you may connect our website (http://www.lselectric.co.kr/) and download the information as a PDF file.

Relevant User's Manuals

Title	Description	No. of User Manual
XG5000 User's Manual	It describes how to use XG5000 software especially about online functions such as programming, printing, monitoring and debugging by using XGT series products.	10310000512
XGK/XGB Series Instruction & Programming	It describes how to use the instructions for programming using XGK/XGB series.	10310000510
XMC Motion controller User's Manual	It describes how to use XMC motion controller unit, specifications, system configuration, program function, wiring, Built-in functions.	-
XGB Analog User's Manual	It describes how to use the specification of analog input/analog output/temperature input module, system configuration and built-in PID control for XGB main unit.	10310000920
XGB High speed counter module User's Manual	It describes how to use High speed counter(XBF-HO02A, XBF-HD02A)	10310001240
XGB Load cell input module User's Manual	It describes how to use the specification of load cell input module, system configuration and programing.	-

◎ **Contents** ◎

Contents

Appendix

Chapter 1 Overview

1.1 Composition of User's Manual

This user's manual contains information regarding the specification, handling method, wiring method and methods to use functions that are necessary for using this product. It is recommended to fully understand the performance and functions of the product through the user's manual before applying the product to the system. Also, place this user's manual near the product for reference at any time during operation.

> **Notes**
>
> Only the method to use the EtherCAT adapter 'XEL-BSSCT' is described in this manual.
> For the method to use the EtherCAT master and XGB extension module necessary for system configuration, refer to the user's manual for each product. EtherCAT® is the registered copyright and the patent technology permitted through Beckhoff Automation GmbH in Germany.

1.2 Features

LS ELECTRIC Co., Ltd.'s extension type EtherCAT adapter XEL-BSSCT (EtherCAT adapter) has the following features.
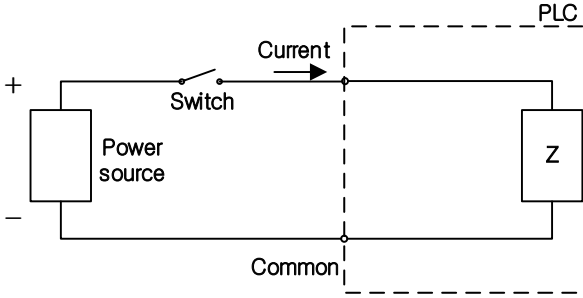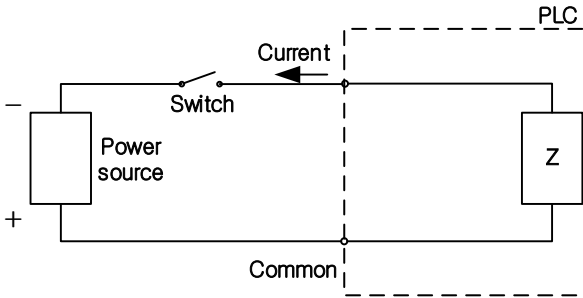
(1) Observation of EtherCAT standard
   Since this product is designed in accordance with the EtherCAT MDP standard, this product can be applied easily to various environments.

(2) Support of two device identification types
   Two identification methods through the external rotary switch (Explicit ID) of the product and the parameter station address setting function are supported.

(3) Free Run / Refresh Sync
   This is the EtherCAT slave device in Free Run method. When DC Sync is used in the EtherCAT master, the Refresh Sync function for the I/O refresh synchronization between our EtherCAT adapters in Free Run state is supported. By using this function, it is possible to match the I/O Refresh time and estimate the output time using the DC sync0 signal.
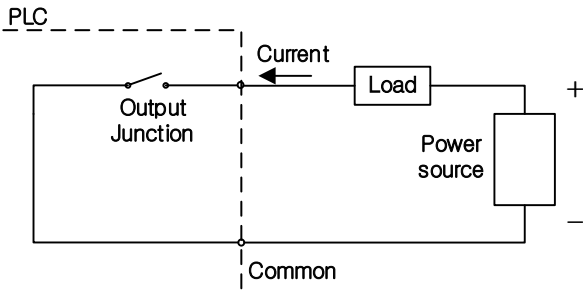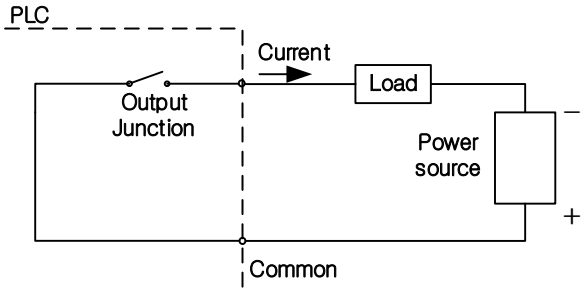
   ※ Only the synchronization between XEL-BSSCT is supported.

(4) Support of XG5000 setting function
   In XG5000, the product parameter setting through USB or the test operation mode can be used.

(5) Compatibility of XGB extension module
   The extension I/O and special modules of XGB can be used.

1.3 Explanation of Terms

An explanation of the terms used in this user's manual is provided.

1.3.1 General Term

Term	Definition	Note
Module (Module)	This is the standardized element with a certain function that configures the system and it includes devices such as I/O board.	i.e.) Extension module, special module, communication module
Unit (Unit)	Module or group of modules that becomes the minimum unit in the operation of the PLC system and is connected to another module or another group of modules, composing the PLC system.	i.e.) Basic unit
PLC System (PLC System)	A system which consists of the PLC and peripheral devices and is configured to be controlled by the user program.	
XG5000	Integrated software that carries out the function to write, edit, debug and diagnose the parameters of the program and the communication module.	
I/O image area	Internal memory area of the XGB PLC for expressing input and output status.	
Sink input	A method that the current flows in from the switch to the PLC input terminal when the input signal is turned on.	Z: Input impedance
Source input	Method that the current flows out from the PLC input terminal to the switch when the input signal is turned on.	Z: Input impedance

Sink output	Method that the current flows in from the load to the output terminal when the PLC output contact is turned on. PLC Current Output Junction — Load — + Power source − Common
Source output	Method that the current flows out from the output terminal when the PLC output contact is turned on. PLC Current Output Junction — Load — − Power source + Common

1.3.2 Terms of EtherCAT

The general terms of EtherCAT are described. More information can be obtained through http://www.ethercat.org.

1) EtherCAT

EtherCAT is the protocol registered in the IEC 61158 International Standards. The Ethernet standards defined in IEEE 802.3 are used without modification. It features fast speed, flexible topology and easy configuration.

2) Object Dictionary

This is the table created for accessing data, parameters and functions using index and sub index, and all devices have the same basic structure.

3) Service Data Object (SDO)

A direct address of an object can be accessed using index and sub-index based on the client server module. It is generally used for transmitting larger data or changing a parameter. It communicates with CoE through MailBox.

4) Process Data Object (PDO)

It is used for transmitting data based on the producer consumer model. Unlike SDO, the protocol overhead is not included. PDO is driven by internal events such as a timer and trigger event or periodic transmission condition.

5) CANopen

This is the standard of CAN-in_Automation (CiA), and the core element of CANopen is the data communication technology through the object dictionary.

6) CoE (CANopen application protocol over EtherCAT)

EtherCAT provides the communication mechanism such as CANopen. Object Dictionary, PDO mapping and SDO also have similar network management method.

7) FoE (File Access over EtherCAT)

This is a protocol similar to TFTP, and it enables access to a file in the device. Through FoE, it is possible to upload the firmware of the network device. It is useful since the TCP/IP stack is not necessary.

8) ESI (EtherCAT Slave Information)

The ESI file is the file that includes all the unique information of the EtherCAT slave and this is the specification file in the XML format for communicating with the slave from the master. The ESI file is provided in the XG5000 by default, and the latest ESI file can be downloaded from our homepage. ESI is the document prepared based on XML.

9) Explicit Device Identification

Explicit Device Identification is one of Device Identification methods and this is the ID number that can be set through the external rotary switch (ID-Selector) of the product. This function can be used usefully for connecting and disconnecting the product in some applications and preventing incorrect fitting of the cable during the EtherCAT wiring work. When an ID is requested, the ID saved in ESC Register 0x0134 will be issued.

10) Configured Alias Address

Configured Alias Address is the function used under the name of "Second Address" in the previous EtherCAT specification, and when Alias Address set for the EEPROM is booted up, it will be loaded to the ESC Register 0x0012 and the relevant address will be issued when it is requested.

Chapter 2 System Configuration

This product is the EtherCAT adapter that enables extension module installation, and various systems can be configured using the I/O and special modules.
In this chapter, an explanation of how to configure the system using the EtherCAT adapter is provided.

2.1 List of components

Modules that can be installed and used on the EtherCAT adapter are as follows.

Classification	Model name	Contents	Note
Extension I/O module	XBE-DC08A	DC24V input 8 points	
	XBE-DC16A	DC24V input 16 points	
	XBE-DC32A	DC24V input 32 points	
	XBE-DC16B	DC12V/24V input 16 points	
	XBE-RY08A	Replay output 8 points	
	XBE-RY08B	Replay output 8 points (separate contact points)	
	XBE-RY16A	Replay output 16 points	
	XBE-DR16A	DC24V input 8 points, relay output 8 points	
	XBE-TN08A	Transistor output 8 points (sync type)	
	XBE-TN16A	Transistor output 16 points (sync type)	
	XBE-TN32A	Transistor output 32 points (sync type)	
	XBE-TP08A	Transistor output 8 points (source type)	
	XBE-TP16A	Transistor output 16 points (source type)	
	XBE-TP32A	Transistor output 32 points (source type)	
	XBE-DN32A	DC24V input 16 points, transistor output 16 points (sync type)	
Extension Special module	XBF-AD04A	Current/voltage input 4 channels, 1/4000 resolution	
	XBF-AD04C	Current/voltage input 4 channels, 1/16000 resolution	
	XBF-AD08A	Current/voltage input 8 channels, 1/4000 resolution	
	XBF-DC04A	Current output 4 channels, 1/4000 resolution	
	XBF-DC04C	Current output 4 channels, 1/16000 resolution	
	XBF-DV04A	Voltage output 4 channels, 1/4000 resolution	
	XBF-DV04C	Voltage output 4 channels, 1/16000 resolution	
	XBF-AH04A	Current/voltage input 2 channels, output 2 channels, 1/4000 resolution	
	XBF-RD04A	RTD input 4 channels, Pt100, Jpt100	
	XBF-RD01A	RTD input 1 channel, Pt100, Jpt100	
	XBF-TC04S	Thermocouple input 4Ch, Thermocouple K/J/T/R types (0~65,535)	
	XBF-HO02A	High-speed counter open collector, 2 channels	
	XBF-HD02A	High-speed counter line driver, 2 channels	
	XBF-LD02S	Load cell input, insulation-type 2 channels	
Accessories	USB-301A	Connection cable for USB (download)	

Notes

LS ELECTRIC Co., Ltd. develops and releases a new product continuously.
For a new product not stated in this user's manual, contact a nearby exclusive agency.

2.2 Classification and type of product model name

2.2.1 Classification of extension type smart I/O

The product name for the classification of extension type smart I/O is stated as follows.

| X | E | L | — | B | S | S | C | T |

Series: X: XGT

Type: E: Ethernet

Communication module: L: Communication module

Module type(1): B: XGB Platform

Module type(2): S: Slave module

Specification: S: Standard

Protocol:
A: Modbus/TCP
B: Ethernet/IP
R: RAPIEnet/IP
C: EtherCAT

Media Type:
T: Electrical
F: Optical
H: Hybrid

2.2.2 Classification and type of extension I/O module

The product name of the extension I/O module is stated as follows.

Series — XGB PLC

Type:
E : I/O expansion module
F : Expansion special module
L : Expansion communication module
O : Option module

XB E — DC 32 A

DC : DC Input
RY : Relay output
TN : Sink type transistor output
TP : Sourece type transistor output
DN : DC input + sink type TR output
DP : DC input + source type TR output
DR : DC input + relay output

H/W

No. of I/O point 08~32
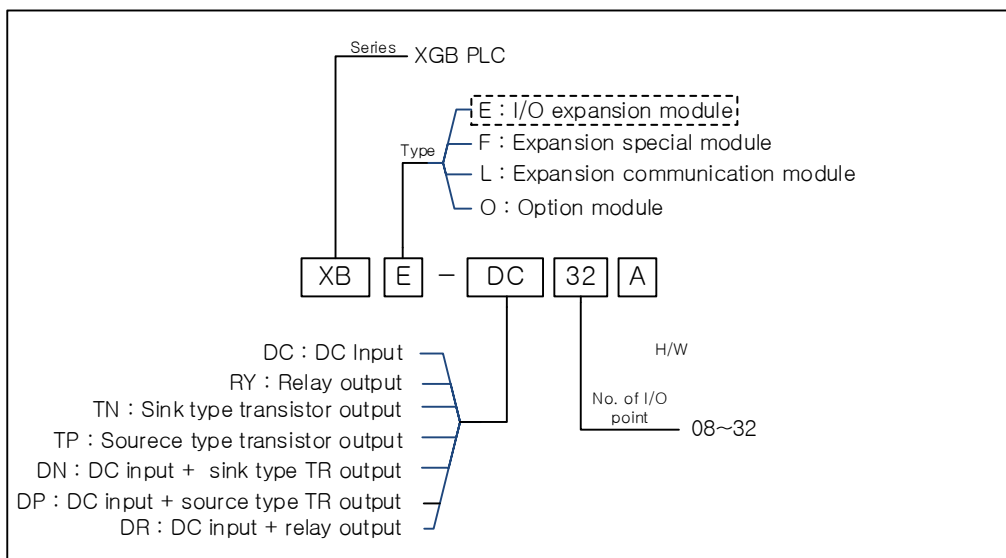
Model name	DC input	Replay output	Transistor output	Note
XBE-DC08A	8 points	None	None	-
XBE-DC16A/B	16 points	None	None	
XBE-DC32A	32 points	None	None	
XBE-RY08A/B	None	8 points	None	
XBE-RY16 A	None	16 points	None	
XBE-TN08A	None	None	8 points	Sync type
XBE-TN16A	None	None	16 points	
XBE-TN32A	None	None	32 points	
XBE-TP08A	None	None	8 points	Source type
XBE-TP16A	None	None	16 points	
XBE-TP32A	None	None	32 points	
XBE-DR16A	8 points	8 points	None	-
XBE-DN32A	16 points	None	16 points	Sync type

2.2.3 Classification and type of special module

The product name of the extension type special module is stated as follows.
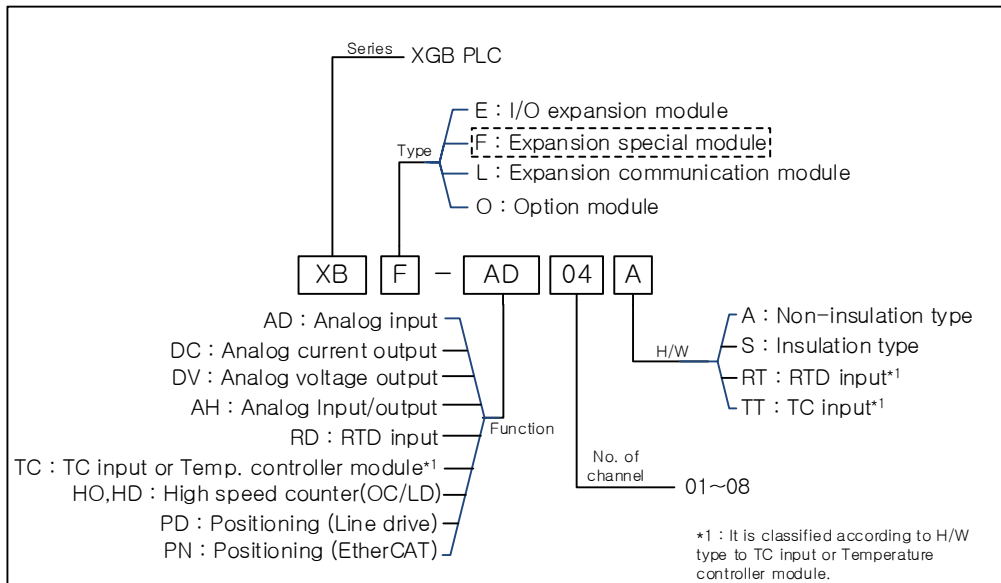
Classification	Model name	Number of input channels	Input type	Number of output channels	Output type
Analog input	XBF-AD04A	4	Voltage/current	None	-
	XBF-AD08A	8	Voltage/current	None	-
	XBF-AD04C	4	Voltage/current	None	-
Analog output	XBF-DC04A	None	-	4	Current
	XBF-DV04A	None	-	4	Voltage
	XBF-DC04C	None	-	4	Current
	XBF-DV04C	None	-	4	Voltage
Analog I/O	XBF-AH04A	2	Voltage/current	2	Voltage/current
RTD input	XBF-RD01A	1	PT100/JPT100	None	-
	XBF-RD04A	4	PT100/JPT100	None	-
Thermocouple input	XBF-TC04S	4	K, J, T, R	None	-
High-speed counter	XBF-HO02A	2	Open collector	4	Voltage
	XBF-HD02A	2	Line driver	4	Voltage
Load cell input	XBF-LD02S	2	Voltage	None	-

2.3 System Configuration

2.3.1 Devices required for EtherCAT system configuration

Various devices are necessary for the configuration of EtherCAT network.
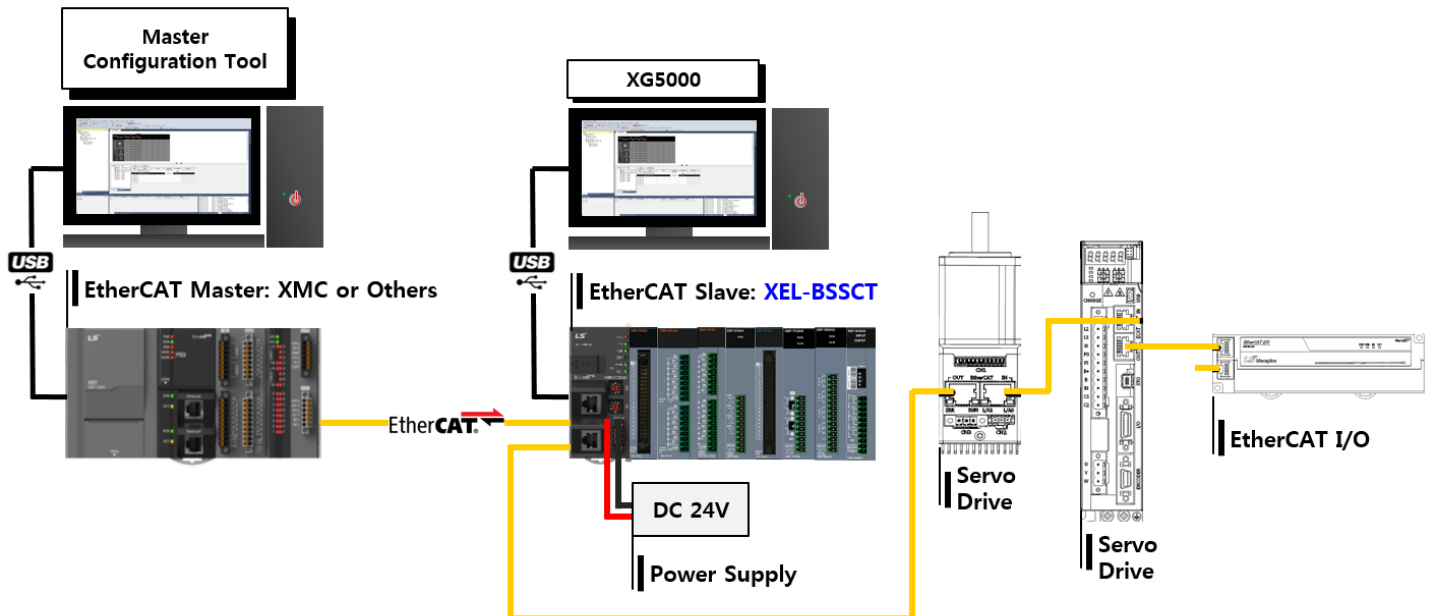
(1) EtherCAT master

The EtherCAT master manages the network and checks the state of each slavein addition to the exchange of I/O data.

(2) EtherCAT adapter

The EtherCAT adapter is the slave module where the previous XGB extension module can be mounted, and the I/O configuration is available according to the user's needs.

(3) EtherCAT slave

The EtherCAT slave is the device that exchanges I/O data with the master.

(4) XG5000

This is the PC program that provides various functions for setting the operation of the EtherCAT master and the EtherCAT adapter and configuring the EtherCAT network.

(4) Communication cable

The communication cable which is appropriate for the specifications of the EtherCAT should be used. The cable with CATEGORY 5 and STP or higher should be used. For the details, refer to Paragraph 3.5 Specifications of EtherCAT communication.

(5) ESI (EtherCAT Slave Information)

The ESI file is the file that includes all the unique information of the EtherCAT slave and this is the specification file in the XML format for communicating with the slave from the master. The ESI file is provided in the XG5000 by default, and the latest ESI file can be downloaded from our homepage.

(6) Power supply

This is the device for supplying power to each device, and an appropriate power supply for the power specifications should be selected.

2.3.2 Extension module configuration method

XEL-BSSCT can configure the system as follows.The existing XGB extension module can be used for the extension module and up to 8 modules can be mounted.

Item		Content
Number of units that can connect to the extension module	Digital I/O module	• Up to 8 modules
	Special module	• Up to 8 modules
	communication module	• Cannot be mounted
	High speed extension module	• Cannot be mounted
	Option module	• Cannot be mounted
Extension module	Digital I/O module	• XBE-DC08/16/32A • XBE-TN08/16/32A • XBE-RY08/16A • XBE-DC16B • XBE-TP08/16/32A • XBE-RY08B • XBE-DR16A • XBE-DN32A
	Special module	• XBF-AD04A • XBF-DC04A • XBF-HO02A • XBF-AD04C • XBF-DC04C • XBF-HD02A • XBF-AD08A • XBF-DV04A • XBF-LD02S • XBF-AH04A • XBF-DV04C • XBF-RD04A • XBF-TC04S

Notes

In XEL-BSSCT, the extension product mounted first occupies No. 0 slot.
Slots from No. 0 slot to No. 7 slot are assigned.
Configure and manage the extension module by referring to the above information.

Chapter 3 Specifications

3.1 Name and features

3.1.1 Name of each part and features
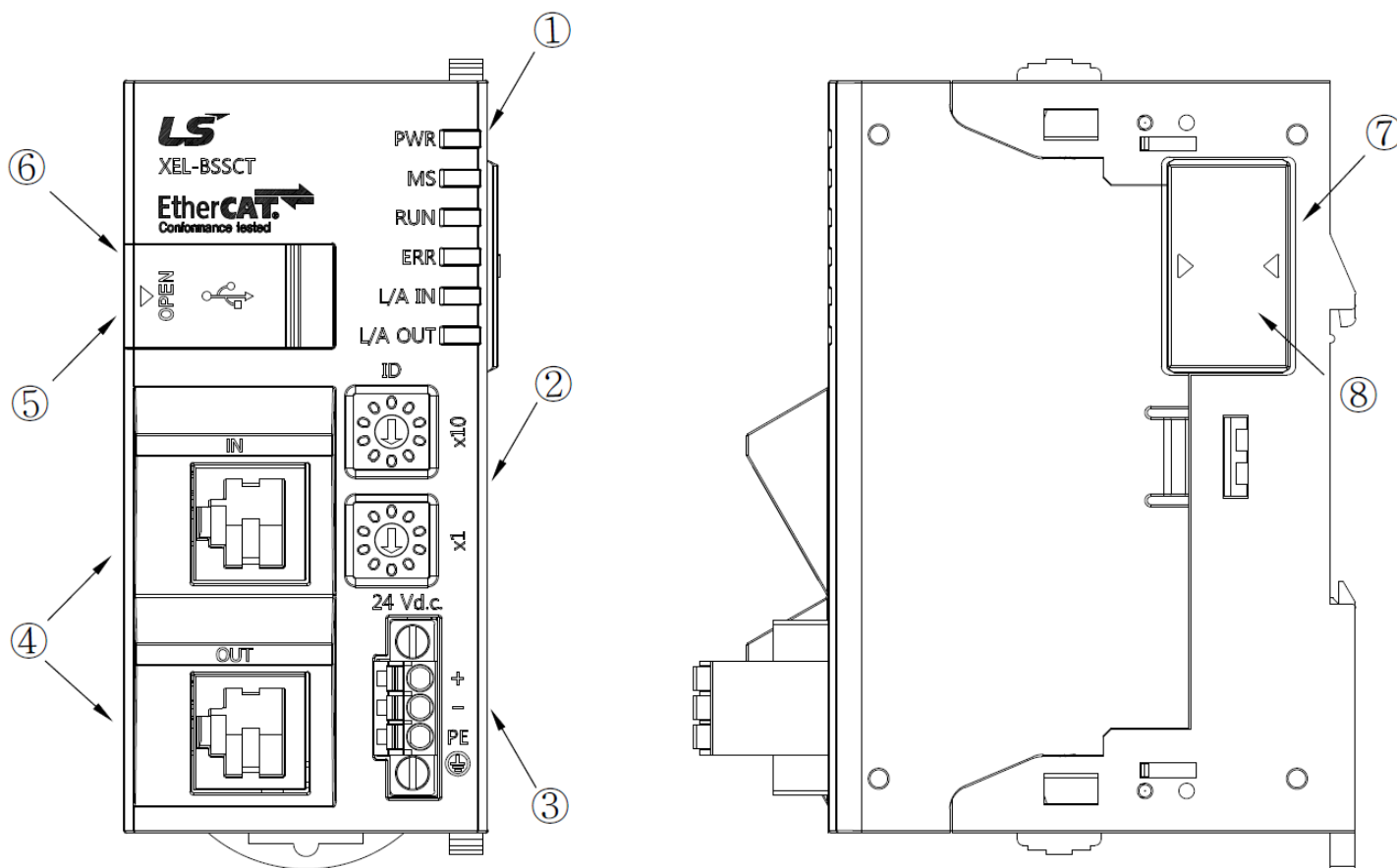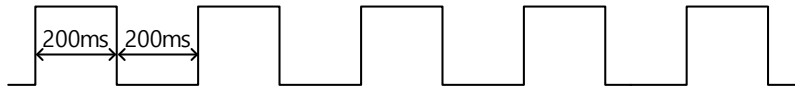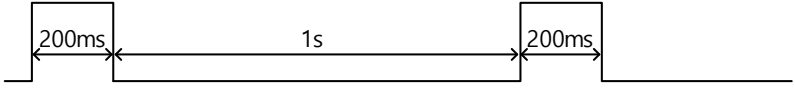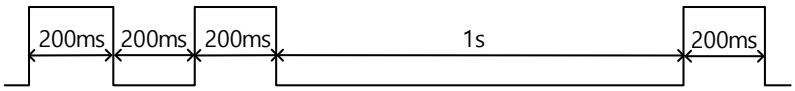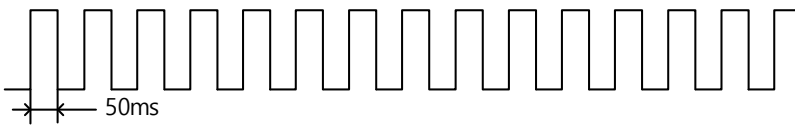
No	Name	Usage
①	Status indicator LED	■ LED that indicates the operation status of EtherCAT adapter and network connection status
②	Rotary switch	■ Rotary switch for setting Node Address(Explicit ID)
③	Power connector	■ Connector for DC24V power connection
④	EtherCAT connector	■ IN and OUT connector for EtherCAT network connection
⑤	Connector for PADT connection	■ USB connector for connecting to XG5000
⑥	USB cover	■ Cover for protecting the USB port
⑦	Extension cover	■ Cover for protecting the extension connector
⑧	Extension connector	■ Connector for connecting to the extension module

3.1.2 Name and Functions of LED

RUN, ERR, L/A IN and L/A OUT LEDs operate according to the EtherCAT specification.

Name	Color	Status		Normal/Error	Operation by status
PWR	Red	Off		-	Power Off
		On		-	Power On
RUN	Green	Off		-	INIT status
		Blinking		-	PRE-OP status
		Single Flash		-	SAFE-OP status
		Flickering		-	Initialization or BOOTSTRAP status
		On		-	OP status
MS	Red/Green	Green	On	-	RUN mode
			Off	-	When an error where the STOP mode or the operation is unavailable has occurred
		Red	On	Error	When an error that cannot be recovered has occurred
			1s Flickering	Warning	Occurrence of an error which can be recovered or has no significant effect on the operation
			500ms Flickering	Light error	Occurrence of a light error, an error that has no significant effect on the operation
			100ms Flickering	Critical error	Occurrence of a critical error which has an effect on the operation
ERR	Red	Off		-	No error
		Blinking		Error	General setting error such as register or object setting, or invalid H/W setting
		Single Flash		Error	The EtherCAT state cannot be changed to OP due to a local error.
		Double Flash		Error	Occurrence of sync manager watchdog timeout
		Flickering		Error	Booting error
		On		Error	Occurrence of ESC failure which is a hardware failure.
[1]L/A IN	Green	Off		-	The connection to the Master is not established. No communication.
		On		-	The connection to the Master is established. No communication.
		Flickering		-	The connection to the Master is established. Communicating.
[1]L/A OUT	Green	Off		-	The connection to the Master is not established. No communication.
		On		-	The connection to the Master is established. No communication.
		Flickering		-	The connection to the Master is established. Communicating.

The flickering specification of the LED is as follows.

Blinking	200ms 200ms
Single Flash	200ms 1s 200ms
Double Flash	200ms 200ms 200ms 1s 200ms
Flickering	50ms

3.2 General specification

The general specification of the EtherCAT adapter is as follows.

No.	Item	Specification				Reference
1	Service temperature	0℃~55℃				
2	Storage temperature	-25℃~70℃				
3	Service humidity	5~95%RH (Non-condensing)				
4	Storage humidity	5~95%RH (Non-condensing)				
5	Vibration resistance	In case of occasional vibration				IEC 61131-2
		Frequency	Acceleration	Amplitude	Time	
		5≤f< 8.4㎐	-	3.5mm	X,Y, Z Each direction 10 times	
		8.4≤f≤150㎐	9.8㎧²(1G)	-		
		In case of continuous vibration				
		Frequency	Acceleration	Amplitude		
		5≤f< 8.4㎐	-	1.75 mm		
		8.4≤f≤150㎐	4.9㎧²(0.5G)	-		
6	Shock resistance	* Peak impact acceleration: 147㎧²(15G) * Duration: 11㎳ * Pulse wave form: Half-sine (3 times per each direction of X, Y and Z)				IEC 61131-2
7	Noise resistance	Square wave impulse noise		DC system: ± 900 V		Internal test specification of LS ELECTRIC Co., Ltd.
		Electrostatic discharge		Voltage: ±4 kV (Contact discharge)		IEC 61131-2, IEC 61000-4-2
		Radiated electromagnetic field noise		80 ~ 1,000MHz, 10 V/m		IEC 61131-2, IEC 61000-4-3
		Fast Transient /Burst Noise	Classification	Power Module	Digital/analog input and output, communication interface		IEC 61131-2, IEC 61000-4-4
			Voltage	2 kV	1 kV	
8	Ambient environment	Free from corrosive gases and excessive dust.				
9	Altitude	Below 2000m				
10	Pollution degree	2 or less				
11	Cooling method	Naturally air-cooled				

Notes

1) IEC (International Electrotechnical Commission): It is an international private organization that promotes international cooperation in the standardization in the electricity and electronics fields, publishes international standards and operates the relevant conformance evaluation system.

2) Pollution degree: This is the index that indicates the pollution degree of the service environment that decides the insulation performance of the device. Pollution degree 2 is the state that only non-conductive pollution occurs generally. However, temporary conduction occurs due to moisture in this state.

3.3 Power specification

It indicates the power specification of the EtherCAT adapter.

Item		Specification	Condition
Input	Rated input voltage	DC24V	
	Input voltage range	DC20.4 ~ 28.8V (-15%, + 20%)	Within -15% and +20% of the rated input
	Input current	Less than 1.3A (Typ.1A)	Input +DC28.8V, maximum load
	Inrush current	50A peak or less	Input +DC28.8V, maximum load
	Efficiency	80 % or more	Input +DC28.8V, maximum load
	Permitted instantaneous interruption	Within 10 ms	Input +DC28.8V, maximum load
Output	Rated output voltage	DC5V (±2%)	
	Output current	3.0A	
Indication of voltage status		LED On when the output voltage is normal	
Cable specification		22 ~ 20 AWG (0.3 ~ 0.5mm2)	

*It is recommended to use a power supply that has an up to 4A fuse in order to protect the power supply.

> **Notes**
> 1. Permitted instantaneous interruption time
>   This is the time that the normal output voltage is maintained (normal operation) in the state that the input voltage (DC24V) is below the rated value (DC20.4V).
> 2. Use a UL-certified power supply.
>   - Use a power supply that satisfies Class 2 or LVLC (Limited voltage Limited circuit).

3.3.1 Current consumption by module

The current consumption of each module that can be used in the EtherCAT adapter is explained.

(Unit: mA)

Item name	Model name	Content	Current consumption
EtherCAT adapter	XEL-BSSCT	Extension type EtherCAT adapter	300
Extension I/O module	XBE-DC32A	DC24V input 32 points	50
	XBE-DC16A/B	DC24V input 32 points, DC12V/24V input 16 points	40
	XBE-DC08A	DC24V input 8 points	20
	XBE-RY16A	Replay output 16 points	440
	XBE-RY08A/B	Relay output 8 points, relay output 8 points (separate contact points)	240
	XBE-TN32/16/08A	Transistor output 32/16/8 points (sync type)	80/50/40
	XBE-DR16A	DC24V input 8 points, relay output 8 points	250
	XBE-TP32/16/08A	Transistor output 32/16/8 points (source type)	80/50/40
Extension special module	XBF-AD04A	Current/voltage input 4 channels, 1/4000 resolution	120
	XBF-AD08A	Current/voltage input 8 channels, 1/4000 resolution	105
	XBF-AH04A	Current/voltage input 2 channels, output 2 channels, 1/4000 resolution	120
	XBF-DV04A	Voltage output 4 channels, 1/4000 resolution	110
	XBF-DC04A	Current output 4 channels, 1/4000 resolution	110
	XBF-RD04A	RTD input 4 channels, Pt100, Jpt100	100
	XBF-RD01A	RTD input 1 channel, Pt100, Jpt100	100
	XBF-TC04S	Thermocouple input 4Ch, Thermocouple K/J/T/R types (0~65,535)	100
	XBF-HO02A	High-speed counter open collector, 2 channels	270
	XBF-HD02A	High-speed counter line driver, 2 channels	330
	XBF-AD04C	Current/voltage input 4 channels, 1/16000 resolution	105
	XBF-DC04C	Current output 4 channels, 1/16000 resolution	70
	XBF-DV04C	Voltage output 4 channels, 1/16000 resolution	70
	XBF-LD02S	Load cell input module	110

3.3.2 Example of current consumption/power calculation

Configure the extension of the EtherCAT adapter not to exceed the current output capacity by checking the current consumption of each module as shown in the following example. For the current consumption of each module, refer to Paragraph 3.3.1.

(1) Example of system configuration 1

Type	Model name	Number of units to be mounted	Internal 5V Current consumption (Unit: mA)	Note
EtherCAT adapter	XEL-BSSCT	1	300	When the contact is On (Maximum current consumption)
Extension module	XBE-DC32A	2	50	
	XBE-TN32A	2	80	
	XBF-AD04A	1	120	Use of all channels (Maximum current consumption)
	XBF-DC04A	1	110	
	XBL-AD04C	1	105	
Current consumption	895mA			-
Power consumption	4.48W			0.895A x 5V = 4.475W

When the system is configured as shown above, the 5V current consumption will be 895mA, and the 5V output of the adapter is up to 3.0A, so normal system configuration is possible.

(2) Example of system configuration 2

Type	Model name	Number of units to be mounted	Internal 5V Current consumption (Unit: mA)	Note
EtherCAT adapter	XEL-BSSCT	1	300	When all contacts are On (Maximum current consumption)
Extension module	XBE-DR16A	2	250	
	XBE-RY16A	5	440	
	XBF-AD04A	1	120	Use of all channels
Current consumption	3,120mA			-
Power consumption	15.6W			4.22A x 5V = 21.1W

When the system is configured as shown above, the 5V current consumption will be 3,120mA, exceeding the maximum 5V output of the adapter, so the system configuration is impossible. Of course, the above example of current consumption calculation is based on the assumption that all I/O contacts are On at the same time. However, be sure to configure the system within the 5V output current of the EtherCAT adapter for the stability of the system.

3.4 Performance specification

The performance specification of the EtherCAT adapter is as follows.

Classification	Item			Specification
Performance specification of adapter	Maximum number of levels for the extension			8 levels
	Operation mode			RUN, STOP (The test operation through the XG5000 is only available in STOP mode.)
	Refresh time			DC Sync0 time x refresh time (0 ~ 100)
	Standard input filter			1, 3, 5, 10, 20, 70, 100ms
	Self-diagnosis function			Indication of a current error and warning
	EEPROM	Self-recovery function		Enable/disable automatic recovery
		EEPROM size		4 KB
	Memory	System flag area	F area	2 KB
		Extension module mapping area	I area	2 KB
			Q area	2 KB
			U area	1 KB
	External connection terminal	Programming port		USB 1 channel
		Communication port		RJ45 2 ports (Response to shield)
		Power port		3-Pin push-in/screw fixing type connector
	Status indicator LED			6 types including PWR, MS, RUN, ERR, IN and OUT
Communication specification of EtherCAT	Maximum number of extension modules to be mounted			8 modules
	Communication protocol			EtherCAT
	Data transfer speed			100Mbps
	Physical layer			100BASE-TX (IEEE 802.3)
	Topology			Conforms to the specification of EtherCAT master.
	Transmission media			STP (Shielded Twisted-pair) cable with Category 5 or higher
	Transmission distance			100m or less between the nodes
	Size of PDO data for transmission and reception			Input: Up to 1,024 byte, output: Up to 1,024 byte
	Size of mailbox data			Input: Up to 256 byte, output: Up to 256 byte
	Mailbox support command			SDO requests, SDO information
	Refresh method			Free-Run, Refresh Sync mode (For LS ELECTRIC Co., Ltd. only)
	Node address setting method			Rotary switch, master, PADT
	Node address setting range			Explicit ID(1 ~ 99)
				Alias Address(1 ~ 65535)
				Applies the EEPROM value set by the master when setting PADT 0
Weight	130g			

Chapter 4 Installation and Wiring

4.1 Safety precautions

⚠ **Danger**

▸ Please design protection circuit at the external of PLC for entire system to operate safely because an abnormal output or an malfunction may cause accident when any error of external power or malfunction of PLC module.

  (1) It should be installed at the external side of PLC to emergency stop circuit, protection circuit, interlock circuit of opposition action such as forward /reverse operation and interlock circuit for protecting machine damage such as upper/lower limit of positioning.

  (2) If PLC detects the following error, all operation stops and all output is off.

    (Available to hold output according to parameter setting)

    (a) When over current protection equipment or over voltage protection operates

    (b) When self diagnosis function error such as WDT error in PLC CPU occurs

▸ When error about IO control part that is not detected by PLC CPU, all output is off.

  Design Fail Safe circuit at the external of PLC for machine to operate safely. Refer to 4.1.1 Fail Safe circuit.

  (1) Because of error of output device, Relay, TR, etc., output may not be normal. About output signal that may cause the heavy accident, design supervisory circuit to external.

▸ When load current is more than rating or over current by load short flows continuously, danger of heat, fire may occur so design safety circuit to external such as fuse.

▸ Design for external power supply to be done first after PLC power supply is done. If external power supply is done first, it may cause accident by misoutput, misoperation.

▸ In case communication error occurs, for operation status of each station, refer to each communication manual.

▸ In case of controlling the PLC while peripheral is connected to CPU module, configure the interlock circuit for system to operate safely. During operation, in case of executing program change, operation status change, familiarize the manual and check the safety status. Especially, in case of controlling long distance PLC, user may not response to error of PLC promptly because of communication error or etc.

  Limit how to take action in case of data communication error between PLC CPU and external device adding installing interlock circuit at the PLC program.

⚠ **Danger**

▸ Don't close the control line or communication cable to main circuit or power line. Distance should be more than 100mm. It may cause malfunction by noise.

▸ In case of controlling lamp load, heater, solenoid valve, etc. in case of Off -> On, large current (10 times of normal current) may flows, so consider changing the module to module that has margin at rated current.

▸ Process output may not work properly according to difference of delay of PLC main power and external power for process (especially DC in case of PLC power On-Off and of start time.
For example, in case of turning on PLC main power after supplying external power for process, DC output module may malfunction when PLC is on, so configure the circuit to turn on the PLC main power first
Or in case of external power error or PLC error, it may cause the malfunction.

▸ Not to lead above error to entire system, part causing breakdown of machine or accident should be configured at the external of PLC

4.1.1 Calculation of current consumption

(1) Power consumption of each part

(a) Power consumption of module
The power conversion efficiency of the power module is approximately 70%, and the remaining 30% is consumed through heating,and 3/7 of the output power becomes its power consumption.   Therefore, the calculation formula is as follows.
- $Wpw = 3/7 \{(I5V \times 5) + (I24V \times 24)\}$ (W)
I5V: Current consumption of each module DC5V circuit (Internal current consumption)
I24V: Average DC24V current consumption used inside of the output module
(Current consumption of concurrent On point)
It does not apply if DC24V is supplied from the outside or if the power module with no DC24V output is used.

(b) Sum of DC5V circuit power consumption
The power consumption of DC5V output circuit in the power module is sum of power consumption of each module.
- $W_{5V} = I_{5V} \times 5$ (W)

(c) Average DC24V power consumption (power consumption of concurrent On point)
Average power consumption of DC24V output circuit in the power module is the total power consumption of each module.
- $W24V = I24V \times 24$ (W)

(d) Average power consumption of output module by output voltage drop (power consumption of concurrent On point)
- $Wout = Iout \ \times \ Vdrop \ \times$ output point $\times$ ratio of concurrent On (W)
Iout : Output current (Actual service current) (A)
Vdrop: Voltage drop of each output module (V)
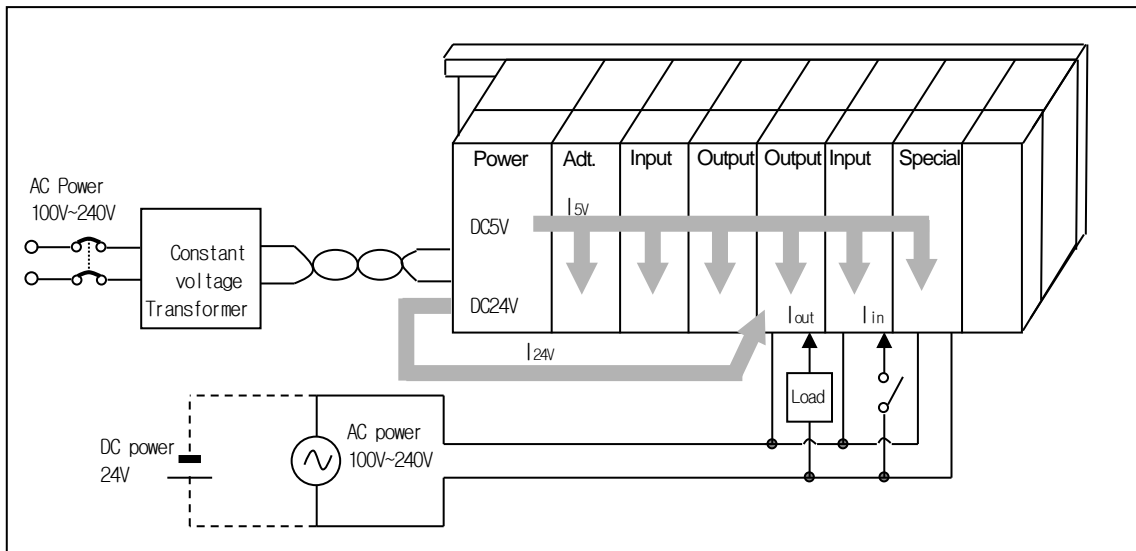
(e) Average power consumption of input unit in the input module (power consumption of concurrent On point)
- W_{in} = lin X E X input point X ratio of concurrent On (W)

lin: Input current (virtual value in case of alternating current) (A)

E : Input voltage (Actual service voltage) (V)

(f) Power consumption of special module power unit
- W_S = I5V X 5 + I24V X 24 + I100V X 100 (W)

The sum of power consumption calculated for each block becomes the overall power consumption of the PLC system.
- W = W_{PW} + W_{5V} + W_{24V} + W_{out} + W_{in} + W_s (W)

Review a temperature rise in the control panel by calculating the caloric value according to whole power consumption (W).

The approximate calculation formula for a temperature rise in the control panel is displayed as follows.

T = W / UA [°C]

W : Overall power consumption of the PLC system (Value obtained above)

A : Surface area in the control panel [m2]

U : If a constant temperature in the control panel is maintained by a fan : 6

If the air in the control panel is not circulated : 4

If the temperature inside the control panel exceeds the regulated range, mount a fan to maintain the temperature inside the control panel within the regulated temperature. If the fan is used, dust will be brought in along with the air from the outside and such dust may affect the PLC. Caution should be taken.

4.2 Mounting and separation of module

4.2.1 Mounting and separation of module

⚠ **Caution**

▸ Be sure to fix the module after mounting the module fixing protrusion on the module fixing hole properly.
  If the module is attached forcibly, it may be damaged. If the module is not mounted correctly, malfunction and a failure may occur.

▸ Do not drop the module case and terminal connector or apply strong impact.

▸ Do not separate the PCB substrate of the module from the case.

(1) Mounting of the module
 • Remove the extension cover at the bottom right side of the product you intend to connect to.
 • Connect the protrusion for connection to the position fixing protrusion on four corners by pushing them to each other.
 • After connection, lower the module fixing hook down and fix it firmly.

Boss for fixation

Expansion Cover

Hook for fixation

Boss for connection
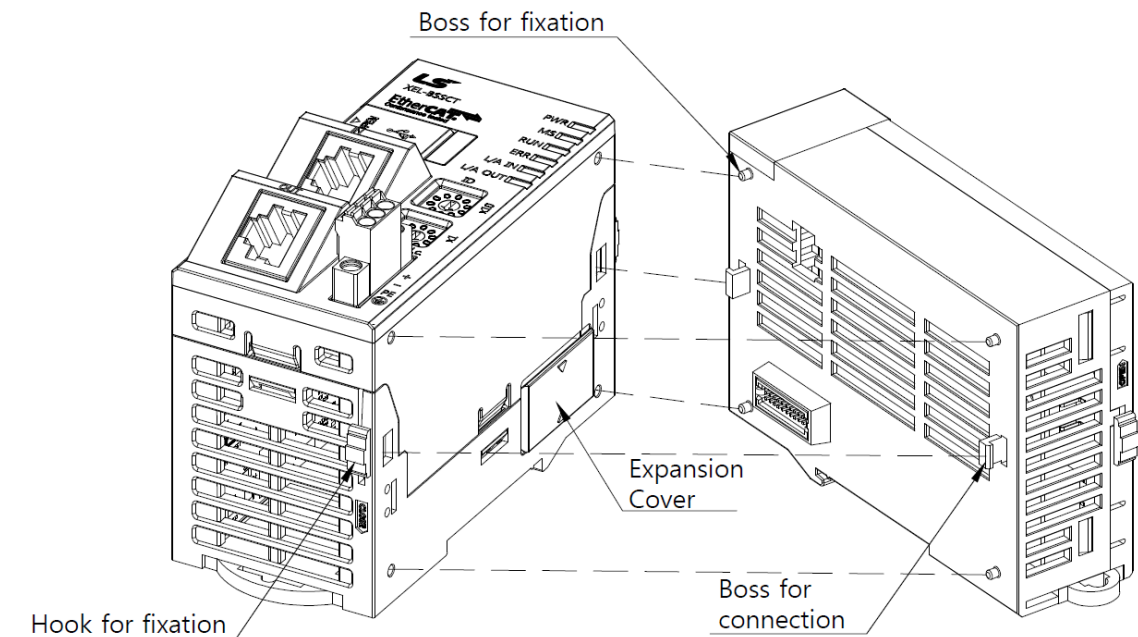
(2) Detachment of the module
 • Lift the fixing hook up and hold the product with both hands and detach it. (Do not apply excessive force.)

Notes

Use the PLC in the range of general specifications presented in this user's manual.
Using it beyond the range may cause electric shock, fire, malfunction, product damage or burning.

(3) Installation of module

The XGB PLC has the hook for DIN rail (width of rail - 35mm) mounted on the basic unit and the extension module as standard, so it can be installed on the DIN rail.

(a) If it is installed on the DIN rail

- Pull the hook for installation on the DIN rail at the bottom of the module to enable installation on the DIN rail.
- Install the module on the DIN rail and push the hook to fix the module to the DIN rail.

Hook for installation on the DIN rail
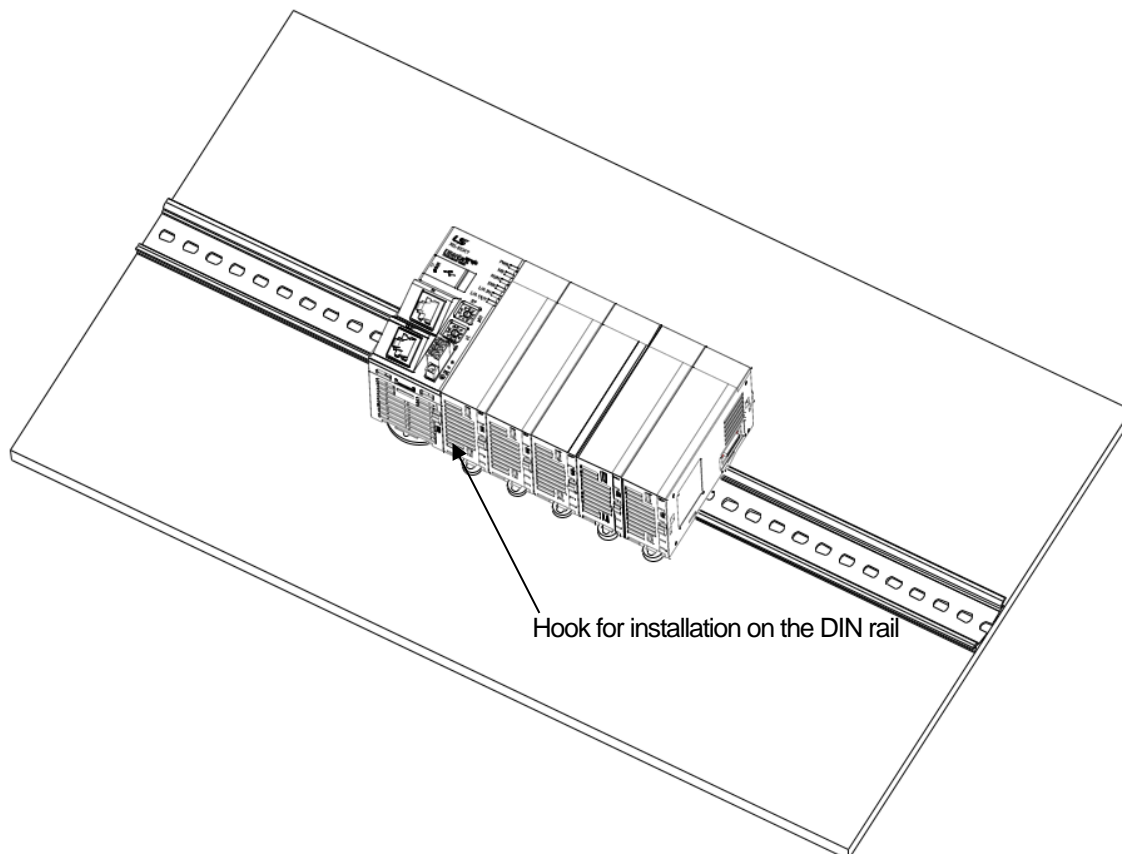
(B) If it is installed on the panel directly

- The basic unit can be installed on the panel directly using the screw mounting hole.
- Use the M4 type fixing screw for installing the product on the panel directly.

Panel

2-Ø4.5 mounting hole
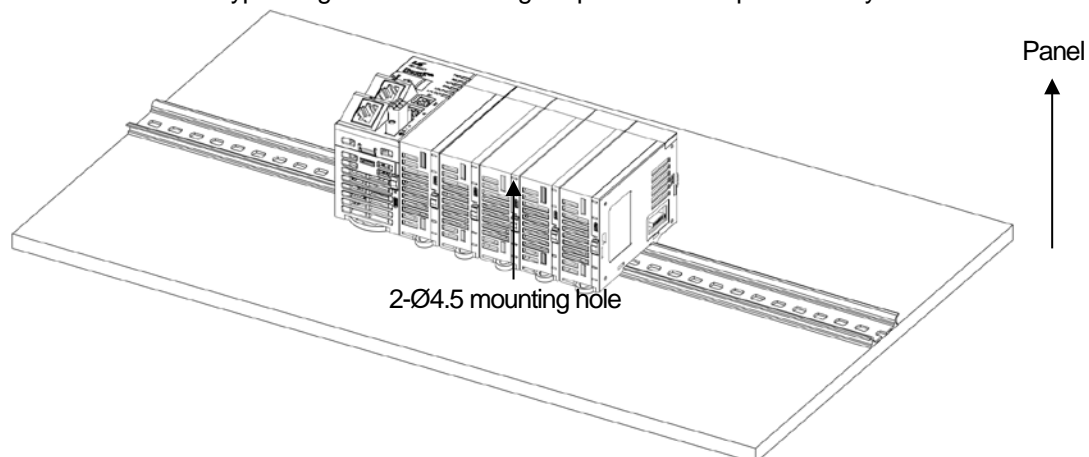
(4) Module mounting position

Install the module at intervals of the distance specified below from the structure or a part on top of or at the bottom of the module to facilitate ventilation or module replacement.

30㎜ or more[1]

30㎜ or more[1]

Door
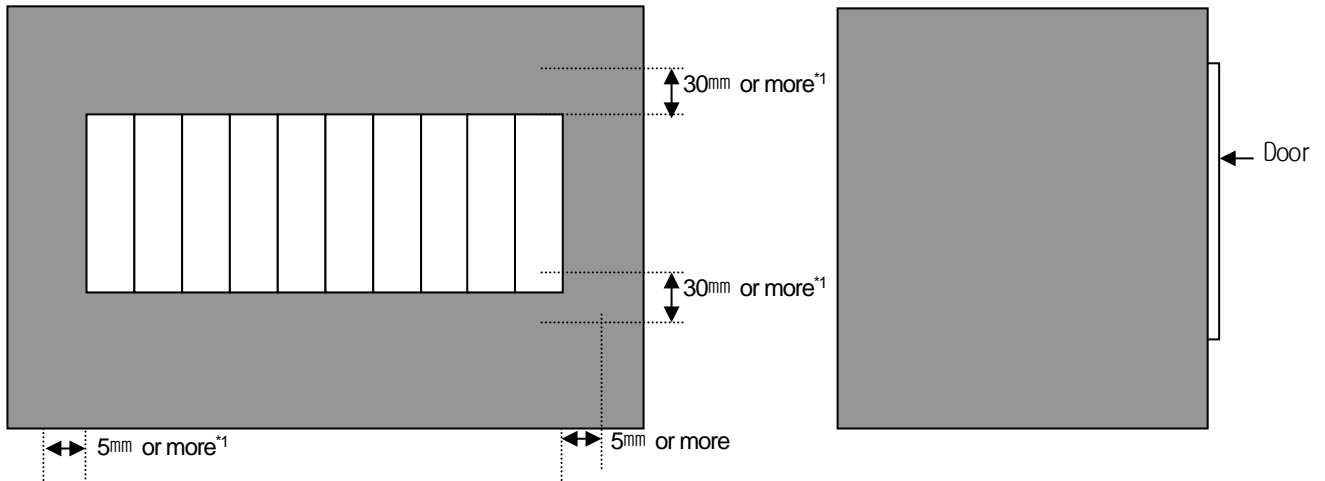
5㎜ or more[1]

5㎜ or more

*1 : If the height of wiring duct is 50 ㎜ or less (40 ㎜ or more for all other cases)

*2 : 20 ㎜ or more for the case that cable is mounted without removing an adjacent module

*3 : 20 ㎜ or more for the case of connector type

(5) Module mounting direction

(a) Install the PLC in the direction as shown in the figure below where is well-ventilated for the radiation of heat.
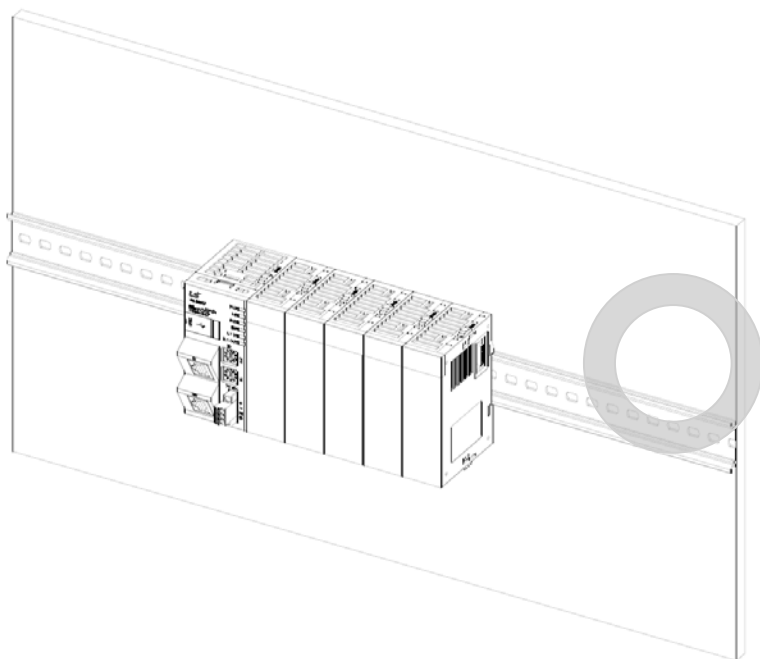
(b) Do not install it in the direction as shown in the figure below.
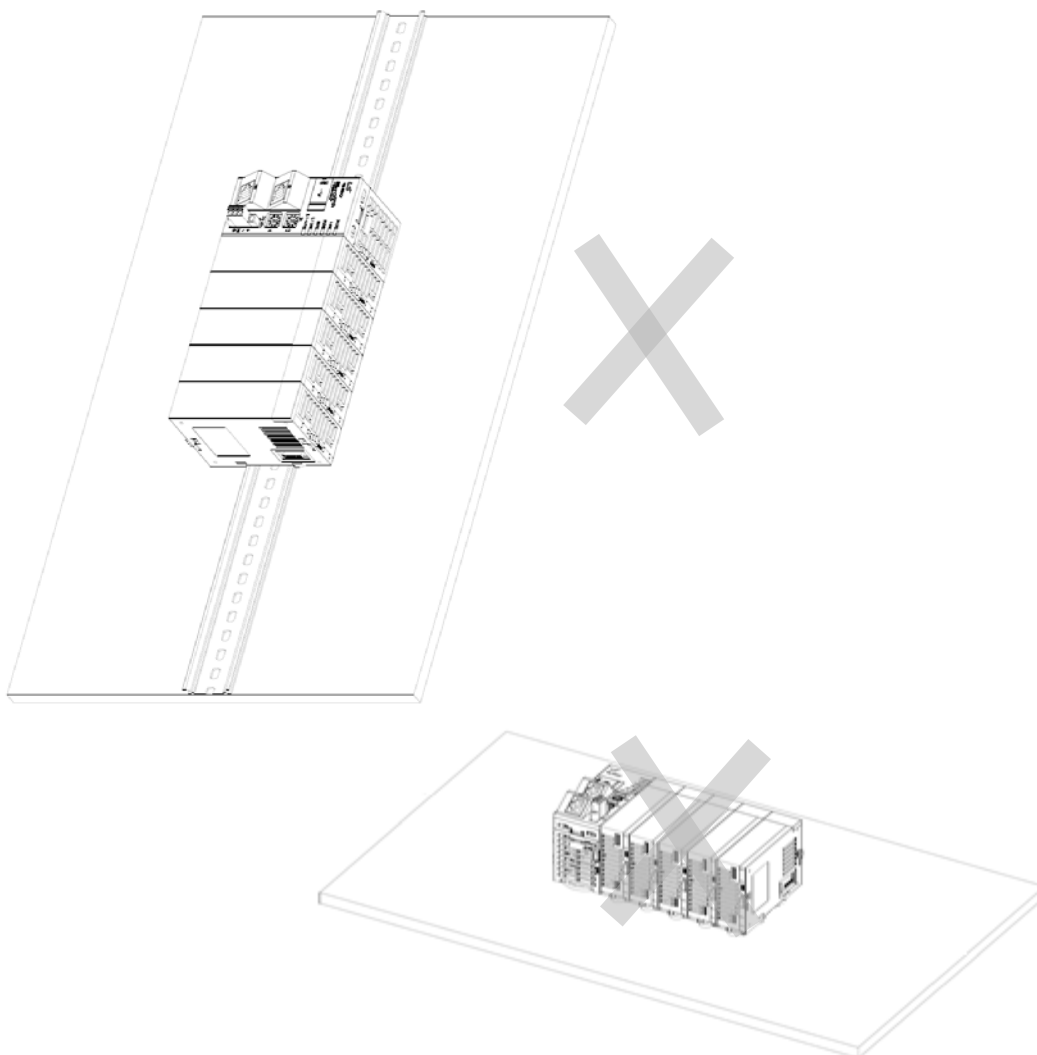
(6) Distance from another device

Install the PLC for the following distance away from the device (connector and relay) in order to avoid the effect of radiation noise or heat.

100mm or more

50mm or more

50mm or more
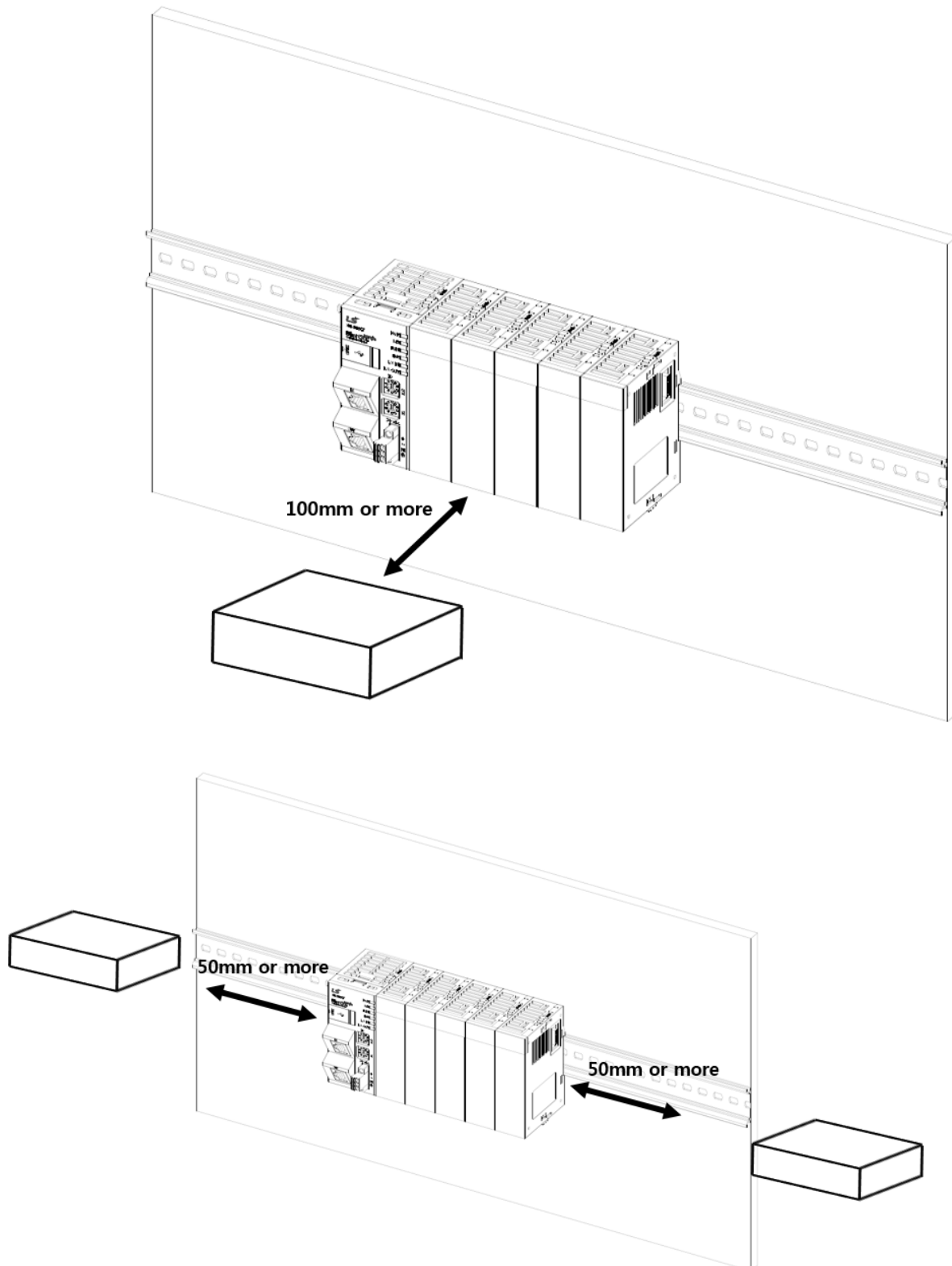
4.2.2 Handling Precautions

An explanation of handling precautions for each module from opening to the installation is provided.
- Do not drop or apply a strong impact.
- Do not separate PCB from the case. Doing so may cause a failure.
- During wiring, caution should be taken so that foreign materials such as wiring remnants enter on top of the module. If any foreign material has entered, remove it.

(1) Cautions in handling the I/O module
An explanation of cautions for handling or installing the I/O module is provided.

(a) Check the specification of I/O module again
Caution should be taken on the input voltage for the input module, and in case of the output module, the voltage that exceeds the maximum open/close capacity of the output module is applied, it may cause failure, destruction or fire.

(b) Cable
The cable should be selected in consideration of surrounding temperature and permitted current, and the minimum specification of the cable should be at least AWG22 (0.3mm2).

(c) Environment
When wiring the I/O module, if it is too close to a device or material that generates high heat or the wire comes into contact with oil for a long period of time, a short circuit, damage or malfunction may occur.

(d) Polarity
For a module that has polarity in its terminal, the polarity should be checked before the power is supplied.

(e) Wiring
- If I/O wiring is carried out together with high-tension line or power line wiring, an inductive obstruction may occur, causing malfunction or failure.
- The cable should be pass in front of the I/O operation display unit (LED).
(I/O mark cannot be identified accurately.)
- If the inductive load is connected to the output module, connect the surge killer or the diode to the load in parallel. Connect the cathode of the diode to the + side of the power supply.
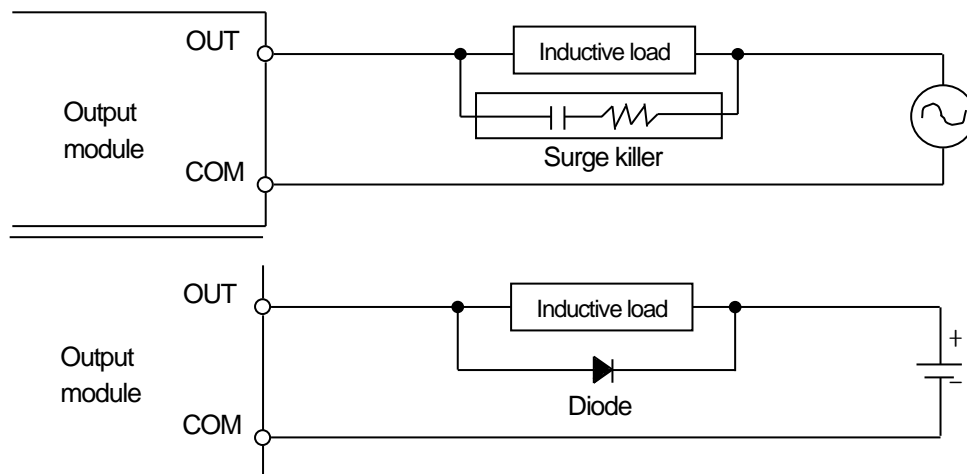
(f) Terminal
Check the adhesion status of the terminal, and in case of terminal writing or processing the screw hole, wiring remnants may enter into the PLC, so caution should be taken, Failure to do so may cause malfunction and a failure.

(g) Do not apply strong impact to the I/O module or separate the PCB substrate from the case except for the cases listed above.

4.3 Wiring

An explanation of cautions regarding wiring for using the system is provided.

⚠ **Danger**

‣ Make sure to disconnect all power supplies from the outside before wiring.

‣ If all external power supplies are not disconnected, an electric shock or damage to the product may occur.

‣ Always use the terminal cover included with the product when applying the current or carrying out operation after wiring. Failure to do so may cause an electric shock.

⚠ **Caution**

‣ Ground the FG and LG terminals with exclusive D class grounding (Class III grounding) or higher. Failure to do so may cause an electric shock or malfunction.

‣ Carry out module wiring properly after checking the rated voltage and the terminal layout of the product. Connecting or wiring the power supply that is different from the rated power supply may cause a fire or failure.

‣ For external connecting connector, use a device and a solder designated by the manufacturer. Unsafe connection may cause a short circuit, fire or malfunction.

‣ Tighten the terminal screw within the range of regulated torque. If the terminal screw is loose, it may cause a short circuit, fire or malfunction.

‣ Caution should be taken that a foreign material such as a disconnected piece or wiring remnants will not enter into the module. Failure to do so may cause a fire, failure or malfunction.

4.3.1   Power wiring

(1) Twist the AC100V wire, AC220V wire and DC24V wire as densely as possible and connect them at the shortest distance.
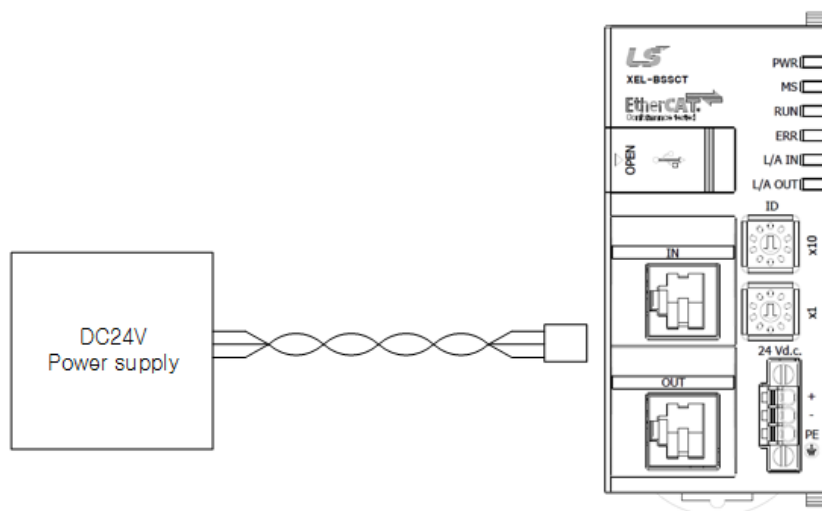
(2) Use the DC power supply that has the capacity of 1A or higher.
(3) Separate the system of supper supply for the PLC, I/O device and power unit as shown below.
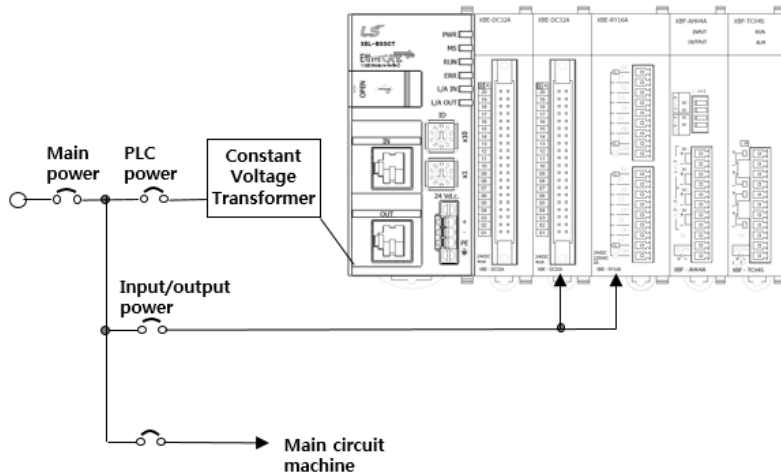
(4) For AC110V wire and AC220V wire, use as a wire that is as thick as possible (2mm2) for reducing a voltage drop.
(5) Do not place the AC110V wire and the DC24V wire near the main circuit (high voltage, high current) wire and the I/O signal wire. Place these wires at least 100mm away.
(6) Use the lightning surge absorber as shown in the figure below for a lightning surge measure.

Surge absorber to prevent lighting
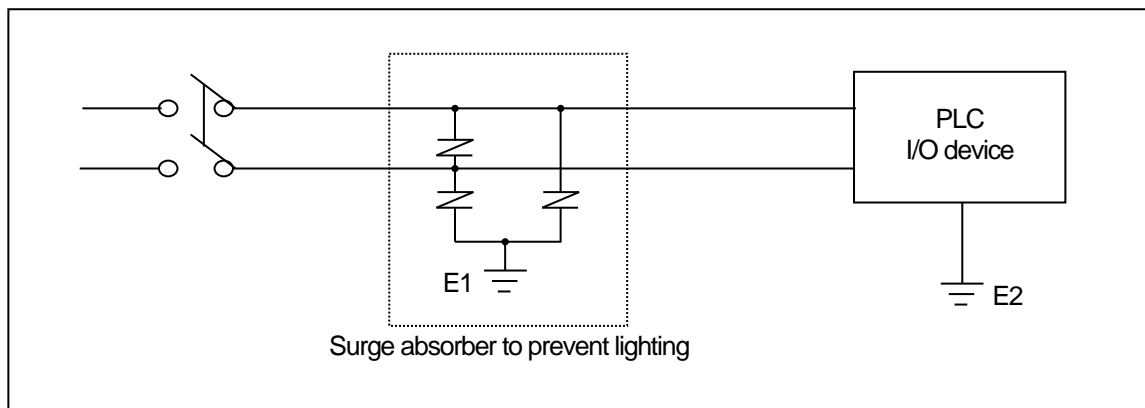
(7) Use an insulated shielding transformer or noise filter when there is a possibility of noise interference.
(8) Twist each input power wire as shortly as possible, and do not route the wire of insulated shielding transformer or noise filter through the duct.

Notes
(1) Isolate the grounding (E1) of lightning surge absorber from the grounding (E2) of the PLC. (2) Select the surge absorber in the way that its maximum allowable voltage will not be exceeded even if the power supply voltage increases to its maximum.

4.3.2 I/O device wiring

(1) The specification of wire for I/O wiring is 0.3~2 mm2. Select a wire in consideration of convenience in wiring within the specification.
(2) Wire the input wire and the output wire separately.
(3) Wire the I/O signal fire for more than 100mm away from high voltage ·and high current main circuit wire.
(4) If the main circuit wire cannot be separated from the power wire, use one shield cable and ground the PLC side.
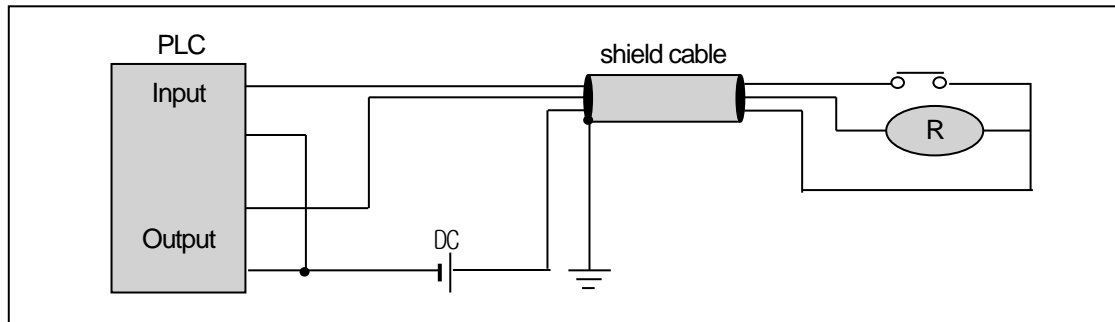
(5) Ground the pipe in case of piping and wiring.

4.3.3 Ground wiring

(1) Proper noise measures are carried out for this PLC. However, it is recommended to apply and use grounding unless there is a special reason. Refer to the following items for grounding.
(2) Use the exclusive grounding if possible. Apply Class III grounding (ground resistance less than 100Ω).
(3) If the exclusive grounding is not available, apply common grounding as shown in the figure (b) below.
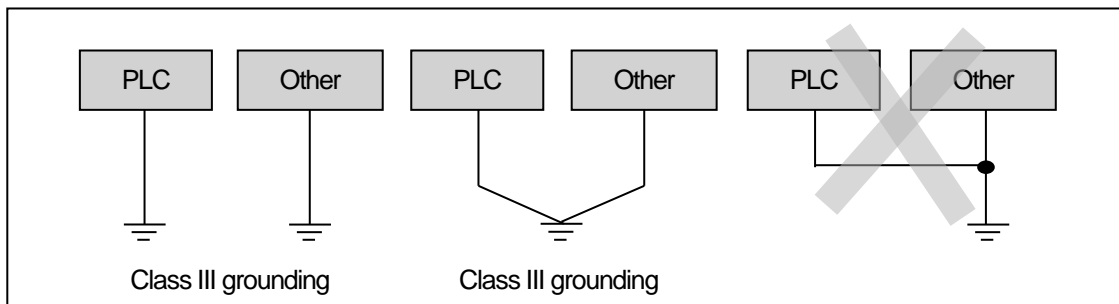
(a) Exclusive grounding: Best   (b) Common grounding: Satisfactory   (c) Common grounding: Defective

(4) Use the grounding wire of 2 mm2 or larger. Place the grounding point as closely as possible to the PLC to shorten the length of the grounding wire.
(5) If malfunction occurs due to the grounding, separate FG from the grounding.

4.3.4 Specification of wiring cable

The specification of cable used for wiring is as follows.

Types of external connection	Specification of cable (mm^2)	
	Low limit	High limit
Digital input	0.18 (AWG24)	1.5 (AWG16)
Digital output	0.18 (AWG24)	2.0 (AWG14)
Analogue input and output	0.18 (AWG24)	1.5 (AWG16)
Main power	1.5 (AWG16)	2.5 (AWG12)
Protective grounding	1.5 (AWG16)	2.5 (AWG12)

Chapter 5 Maintenance

Carry out daily and periodic inspections in order to maintain EtherCAT adapter in its best condition always.

5.1 Repair and inspection

The I/O module mainly consists of semiconductor devices and its service life is semi-permanent. However, ambient environment may cause damage to the devices, so periodic inspection is necessary. Refer to the following items for maintenance.

Inspection item		Judgment	Corrective action
Power supply		Within the power variation range (Refer to general specification)	Maintain the supplied power to be in the permitted voltage variation range.
Power supply for input/output		Input/Output specification of each module	Maintain the supplied power to be in the permitted voltage variation range of each module.
Ambient environment	Temperature measurement	0 ~ + 55℃	Adjust the service temperature and humidity properly.
	Humidity measurement	5 ~ 95%RH	
	Vibration	No vibration	Use the vibration proof rubber or other vibration prevention methods.
Movement of each module		No movement allowed	All modules should be tightened securely.
Connecting conditions of terminal screws		Screws should not be loose.	Re-tighten terminal screws.
Spare parts		Check the number of spare parts and their storage condition.	Fill the shortage and improve the storage condition.

5.2 Daily inspection

The following items require daily inspection.

Inspection item		Inspection contents	Judgment	Corrective action
Panel attachment condition of the PL		Check for attach screws for loosening	The screws should be attached firmly.	Re-tighten screws.
Attachment condition of I/O module		Check the condition of module fixing hooks	The hooks should be in CLOSE position.	Fix the Hooks to close position
Connection conditions of terminal and I/O connector		Connecting conditions of terminal screws	Screws should not be loose.	Re-tighten screws.
		Distance between solderless terminals	Proper distance should be provided.	Correct
		I/O connector unit	The connector should not be loose.	Correct
Indicator LED	Power LED	Check that the LED is On.	On (Off indicates abnormal power.)	
	MS LED	Check that the LED is On in Run state.	Green lighting is normal.	
	MS LED	Check that the LED is Off in Run state.	Red lighting or flickering is abnormal.	
	IN LED	Check that the LED turns On and Off.	Flickering in case of normal connection and operation	
	OUT LED	Check that the LED turns On and Off.	Flickering in case of normal connection and operation	

5.3   Periodic inspection

Inspect the following items one or two times every month and take necessary actions.

Inspection item		Inspection method	Judgment	Corrective action
Ambient environment	Ambient temperature	Measure using the thermometer and hygrometer	0 ~ 55 °C	Adjust according to general specification (Environment standard in the control panel)
	Ambient humidity		5 ~ 95%RH	
	Ambient pollution level	Measure corrosive gas	There should be no corrosive gases.	
PLC condition	Loosening, shaking	Move each module.	The module should be mounted securely.	Tighten the screws and hooks.
	Attachment of dust or foreign material	Inspect visually	No dust or foreign material should be attached.	
Connection condition	Loosening of screws	Tighten using a screw driver.	Screws should not be loose.	Tighten
	Distance between solderless terminals	Inspect visually	Proper distance should be provided.	Correct
	Loosening of connector	Inspect visually	Connectors should not be loose.	Tighten the connector fixing screws.
Check power supply voltage		Check the power supply through the power input terminal using a tester.	Refer to general specification	Change power supply

Chapter 6 Troubleshooting

In this chapter, an explanation of the details of various errors that occur during the system operation, causes of such errors, how to detect such errors and measures is provided.

6.1   Initial troubleshooting procedure

It is important to use a highly reliable device in order to improve the reliability of the system, but it is also important to take measures promptly when an error occurs.

It is most important to discover the cause of trouble and take action promptly for operating the system promptly. Basic matters requiring caution for troubleshooting are as follows.

(1) Visual check

Check the following items visually.

- Operation status of equipment (stop status, operation status)
- Power supply status
- I/O device status
- Wiring status (I/O wiring, communication cable)
- Check the indication status of various indicators (PWR LED, ERR LED, RUN LED, MS LED, IN/OUT ACT LED, etc.), connect a peripheral device and check the operation status of the adapter and parameter values such as station address.

(2) Limitation of range

Estimate the cause of a failure from the following.

- EtherCAT adapter's own problem An external factor
- I/O module Other factors
- EtherCAT Configuration

6.2   Troubleshooting

An explanation of method to discover an error, the contents of the error according to the error code and actions is provided separately for each symptom.

```
┌─────────────────┐
│    Symptoms     │
└─────────────────┘
```

Is the power LED turned off?	→	Flowchart used when the POWER LED is turned Off.
Is the ERR LED flickering?	→	Flowchart used when the ERR LED is flickering.
Is the red MS LED flickering?	→	Flowchart used when the red MS LED is flickering
Are the LA 1, 2 LED turned off?	→	Flowchart used when the Link/Act LED turned off.
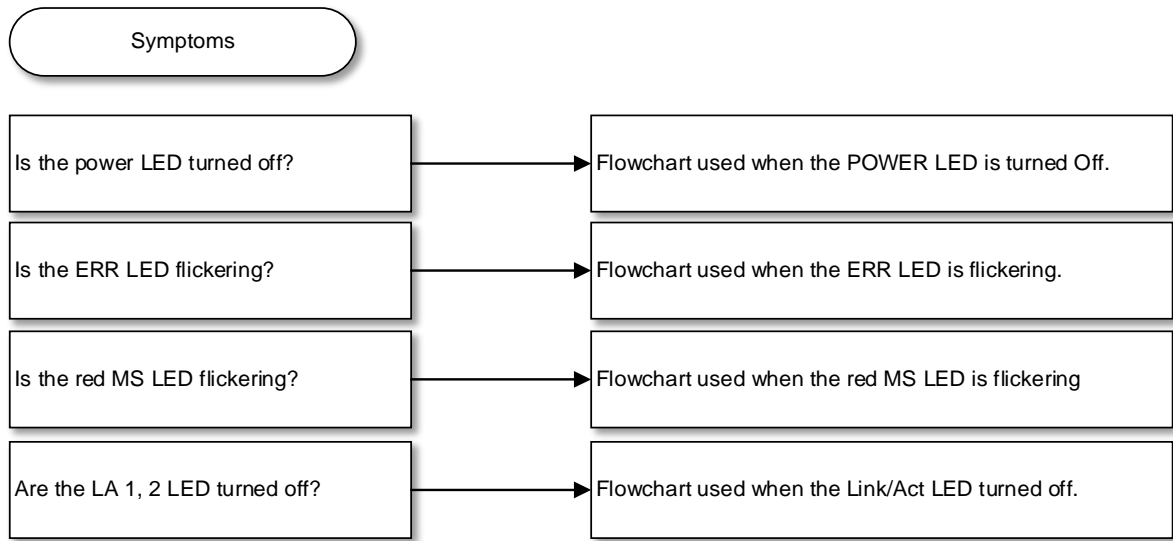
6.2.1 Actions when the PWR (Power) LED is turned off

An explanation of troubleshooting order in case the PWR LED is turned off when power is supplied or during operation is provided.

```
        ┌─────────────────────────┐
        │  Power LED is turned Off.│
        └─────────────────────────┘
                    │
                    ▼
          ╱────────────────╲        No      ┌──────────────────────┐
         ╱ Is the power supply╲──────────────▶│  Supply the power.   │
         ╲   operating?       ╱               └──────────────────────┘
          ╲────────────────╱                            │
                    │                                    ▼
                  Yes                 No        ╱────────────────╲   Yes
                    ◀───────────────────────────╲ Does the power LED╲────▶
                    │                             ╲   turns On?      ╱
                    ▼                              ╲────────────────╱
          ╱────────────────╲        No      ┌──────────────────────────┐
         ╱ Is the voltage within╲────────────▶│ Supply the power properly.│
         ╲  the rated power?   ╱              └──────────────────────────┘
          ╲────────────────╱                           │
                    │                  Yes              ▼
                  Yes                          ╱────────────────╲   Yes
                    ◀───────────────────────────╲ Does the power LED╲────▶
                    │                             ╲   turns On?      ╱
                    ▼                              ╲────────────────╱
          ╱────────────────────╲
         ╱ Over current protection╲──────────┐
         ╲  device activated?     ╱           │
          ╲────────────────────╱              ▼
                    │              ┌────────────────────────────────┐
                    │              │1) Eliminate the excess current │
                    │              │2) Switch the input power Off   │
                  No               │   then On.                     │
                    │              └────────────────────────────────┘
                    │                          │
                    ▼                          ▼
  ┌──────────────────────────────┐    ╱────────────────╲   Yes
  │ Write down the troubleshooting│ No ╲ Does the power LED╲────▶
  │ Questionnaire and contact     ◀────╲   turns On?      ╱
  │ the nearest service center.   │     ╲────────────────╱
  └──────────────────────────────┘
                                          ┌──────────┐
                                          │ Complete │
                                          └──────────┘
```

6.2.2 Actions in case the ERR (Error) LED is on or flickering

An explanation of troubleshooting order in case the ERR LED flickers when the power is supplied, the operation begins or during operation is provided.

```
        ┌──────────────────────┐
        │  ERR LED flickering   │
        │    or turned on       │
        └──────────┬───────────┘
                   │
                   ▼
          ◇ Is the ERR LED turned on? ◇ ──Yes──▶ ┌─────────────────────────────┐
                   │                              │ Hardware abnormal.          │
                   No                             │ Contact the nearest         │
                   │                              │ service center.             │
                   ▼                              └─────────────────────────────┘
      ◇ Is the LED flickering every 50ms? ◇ ──Yes──▶ ┌─────────────────────────────┐
                   │                                  │ EtherCAT Slave Controller   │
                   No                                 │ abnormal. Contact the       │
                   │                                  │ nearest service center.     │
                   ▼                                  └─────────────────────────────┘
      ◇ Is the LED flickering every 200ms? ◇ ──Yes──▶ ┌──────────────────────────────────┐
                   │                                   │ EEPROM access is not possible or │
                   No                                  │ there is an invalid setting in   │
                   │                                   │ the configuration setting.       │
                   │                                   │ Check the Watchdog, Sync manager,│
                   │                                   │ Mailbox, EEPROM value etc.       │
                   ▼                                   └──────────────────────────────────┘
      ◇ Is the LED flickering once per second? ◇ ──Yes──▶ ┌──────────────────────────────┐
                   │                                       │ The Synchronization or DC PLL│
                   No                                      │ error has occured. Check the │
                   │                                       │ Synchronization and DC PLL   │
                   │                                       │ setting.                     │
                   ▼                                       └──────────────────────────────┘
      ◇ Is the LED flickering twice per second? ◇ ──Yes──▶ ┌──────────────────────────────┐
                   │                                        │ The Sync Manager Watchdog    │
                   No                                       │ error has occurred. Check the│
                   │                                        │ Sync Manager Watchdog        │
                   │                                        │ setting.                     │
                   ▼                                        └──────────────────────────────┘
        ┌──────────────────────────────┐
        │ Write down the Troubleshooting│
        │ Questionnaires and contanct   │
        │ the nearest service center.   │
        └──────────────────────────────┘
```

Notes

The ERR LED operates according to the EtherCAT standard.

6.2.3 Actions in case the red MS LED is on or flickering

An explanation of actions in case the red MS LED is flickering or on, although it is set to operate normally after the power is supplied, is provided.

```
        ┌─────────────────────────────────────┐
        │  MS LED is flickering or turned on  │
        └─────────────────────────────────────┘
                          │
                          │ No
                          ▼
              ◇ Is the LED flickering every 100ms? ◇ ──Yes──▶ ┌──────────────────────────────┐
                          │                                    │ Alarm has occurred.          │
                          │ No                                 │ Check the status by XG5000.  │
                          ▼                                    └──────────────────────────────┘
              ◇ Is the LED flickering every 500ms? ◇ ──Yes──▶ ┌──────────────────────────────┐
                          │                                    │ Waring has occurred.         │
                          │ No                                 │ Check the status by XG500.   │
                          ▼                                    └──────────────────────────────┘
              ◇ Is the LED flickering every second? ◇ ──Yes──▶ ┌──────────────────────────────┐
                                                                │ The processing time has      │
                                                                │ exceeded the set refresh     │
                                                                │ cycle or parameter setting   │
                                                                │ error.                       │
                                                                │ Download the parameter to    │
                                                                │ create new project.          │
                                                                │ If the symptom persists,     │
                                                                │ please contact nearest       │
                                                                │ service center.              │
                                                                └──────────────────────────────┘
```

6.2.4 Actions in case the Link/Act LED is not on or flickering

```
                    ╭──────────────────────╮
                    │    LA LED abnormal    │
                    ╰──────────────────────╯
                               │
                               ▼
                          ╱◇◇◇◇◇◇◇◇◇◇╲                    ┌────────────────────────────────────┐
                        ╱              ╲      Yes         │ If the data exchanged but not       │
                       ◇  Is the data    ◇───────────────▶│ flickering, the LED or RJ45         │
                        ╲ exchange      ╱                 │ connector may be burned out.        │
                          ╲ normal?   ╱                   │ Connect the nearest service center. │
                            ╲◇◇◇◇◇◇╱                      └────────────────────────────────────┘
                               │ No
                               ▼
                          ╱◇◇◇◇◇◇◇◇◇◇╲                    ┌────────────────────────────────────┐
                        ╱              ╲      No          │ The cable is not physically         │
                       ◇  Is the LED     ◇───────────────▶│ connected to opposite EtherCAT      │
                        ╲ turned on?   ╱                  │ device.                             │
                          ╲          ╱                    │ If the symptom persists after       │
                            ╲◇◇◇◇◇◇╱                      │ changing the opposite device or     │
                               │ Yes                      │ cable, contact the nearest service  │
                               │                          │ center.                             │
                               ▼                          └────────────────────────────────────┘
                          ╱◇◇◇◇◇◇◇◇◇◇╲                    ┌────────────────────────────────────┐
                        ╱              ╲      No          │ If the LED is not flickering, check │
                       ◇  Is the LED     ◇───────────────▶│ the status of the EtherCAT master.  │
                        ╲ flickering?  ╱                  │ Check the state machine of the      │
                          ╲          ╱                    │ master.                             │
                            ╲◇◇◇◇◇◇╱                      └────────────────────────────────────┘
```

6.3 Troubleshooting Questionnaire

If an error has occurred while using the product, fill out this questionnaire and contact the A/S center by phone or FAX.

• For an error related to the special or communication module, fill out the questionnaire attached to the user's manual of the relevant product.

1. Contact information of the user :   Tel)
                                                                     FAX)
2. Type :   (   )
3. Details of the applied device
   − Details of CPU module: − OS version (   ),   − Serial No. of the product (   )
   − XG5000 version number used for program compiling: (   )
4. Brief description of target device and system for control
5. CPU module used :
   − Operation by key switch (   ),   − Operation through XG5000 or communication (   )
   − Memory module operation   (   )
6. Is the STOP LED of the CPU module On?   Yes(   ),   No(   )
7. Contents of error message from XG5000:
8. Situation of attempting an action for the error code specified in Paragraph 7 :
9. Other troubleshooting methods used for solving the error:
10. Characteristics of the error
    • Recursive (   ) : Periodic (   ),   Related to a certain sequence level (   )
                         Related to the environment (   )
    • Occasional (   ) : general error interval :
11. Detailed description of the error:
12. Configuration diagram of applied system:

6.4 Various cases

An explanation of types of trouble or actions for various circuits is provided.

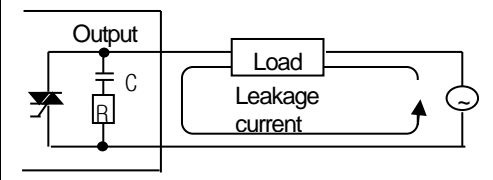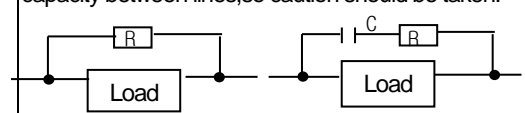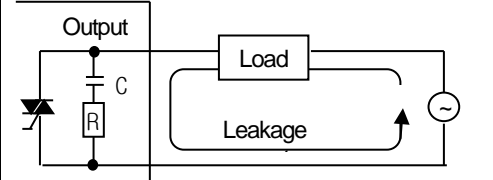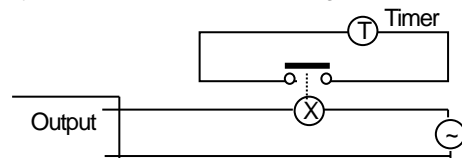### 6.4.1 Type of trouble for input circuit and actions

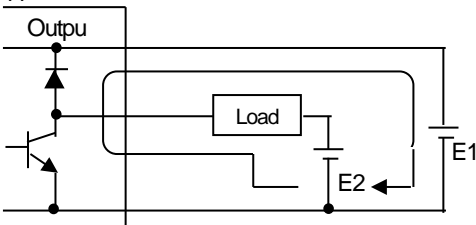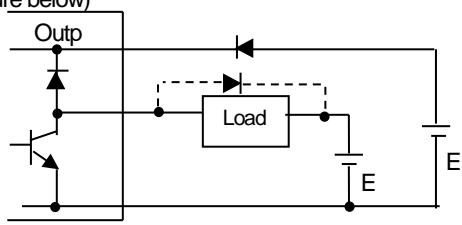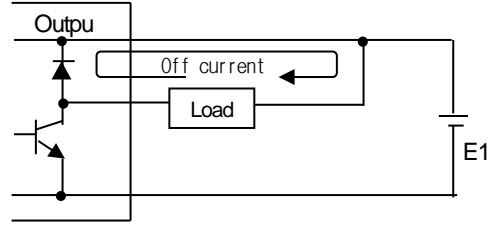An explanation of and example of trouble in the input circuit and relevant actions is provided.
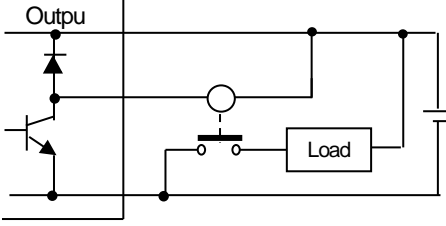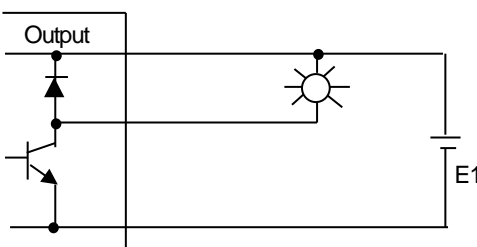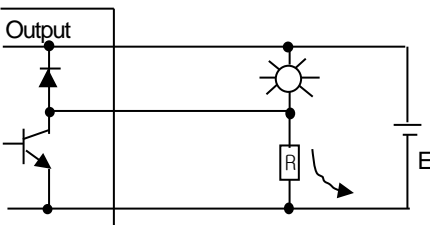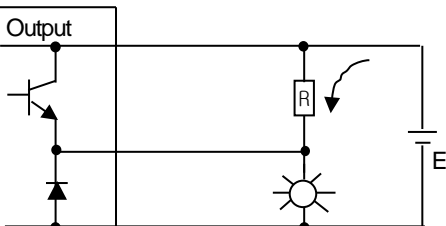
Symptom	Cause	Actions
The input signal cannot be turned off.	Leakage current of external device (If driven by a proximity switch)	• Connect an appropriate resistor and capacitor so that the voltage between the terminals of the input module is lower than the return voltage.
The input signal cannot be turned off. (There is also a case that the neon lamp is on.)	Leakage current of external device (Driven by the limit switch where the neon lamp is attached)	• CR values are determined by the leakage current value. − Recommended value C : 0.1 ~ 0.47Uf R : 47 ~ 120 Ω (1/2W) Or, install the circuit that is displayed separately by separating the circuit completely.
The input signal cannot be turned off.	Leakage current by the capacity between wiring cables	• Install the power supply on the external device as shown in the figure below
The input signal cannot be turned off.	Leakage current of external device (Driven by the switch where the LED display is attached)	• Connect an appropriate resistor as shown in the figure below so that the voltage between the input module terminaland the common terminal is higher than the off voltage.
The input signal cannot be turned off.	• Circulating current by the use of a number of different power supplies • Circulated in case of E1 > E2	• Use a number of power supplies as the single power supply. • Connect the circulating current prevention diode (figure below)

6.4.2 Type of trouble for output circuit and actions

An explanation of example of trouble for the output circuit and relevant actions is provided.

Symptom	Cause	Actions
When the output contact is Off, excessive voltage is applied to the load.	•If the load is half-wave rectified inside (This case occurs in the solenoid value.) •If the polarity of the power supply is ←, C will be charged. If the polarity is ↑, the voltage charged in C is added to the power supply voltage and it is applied to the both ends of the diode(D). The maximum voltage is approximately 2√2. Note) If it is used in this way, there will be no problem in the output element, but the performance of diode(D) will be degraded, causing a problem.	• Connect the resistor of tens kΩ to hundreds kΩ to the load in parallel.
The load cannot be turned off.	• Leakage current due to the surge absorbing circuit connected to the device in parallel 	• Connect the resistor of tens kΩ or CR with the equal impedance to the load in parallel. Note) If the length of cable from the output module to the load is long, there is also leakage current by capacity between lines,so caution should be taken.
If the load is C–R type timer Time error	• Leakage current due to the surge absorbing circuit connected to the device in parallel 	• Drive the C–R type timer through the relay. • A timer other than the C–R type timer is used. Note) Caution should be taken that the internal circuit may be half-wave rectified according to the timer.

Type of trouble for output circuit (continued)

Symptom	Cause	Actions
The load cannot be turned off. (For direct current)	• Circulating current by the use of two different power supplies • Circulated in case of E1< E2 • Circulated also if E1 is Off(E2 is On)	• Use a number of power supplies as the single power supply. • Connect the circulating current prevention diode (figure below) Note) If the load is relay, etc., it is necessary to connect to the diode for absorbing counter electromotive voltage as shown in the dotted line.
The off response time of the load is strangely long.	• Transient current at the time of Off [In case of driving inductive load (one with large time constant L/R) of large current such as solenoid directly with the transistor output • The current flows across the diode at the off time of the transistor output, so there is also a case that it is delayed for more than 1 second according to the load.	• Insert a magnetic contactor with small time constant and drive the load with each contact.
For output The transistor is destroyed.	Inrush current of incandescent current There is a case that more than 10 times of inrush current flows at the time of on.	• In order to reduce the inrush current, let the dark current that is 1/3 ~ 1/5 of the rated current of incandescent lamp flow. sync type transistor output Source type transistor output

6.5 List of Error Codes

Error code (Dec)	Cause of error	Actions	Error type	MS LED status	Diagnosis time
24	I/O parameter error	Upload I/O parameter and check its preservation status. If it is broken, modify and download it again and check the operation. If the error persists, replace the basic unit.	Light error	0.5 second Red flickering	reset, after download is completed
25	Basic parameter error	Upload the basic parameter and check its preservation status If it is broken, modify and download it again and check the operation. If the error persists, replace the basic unit.	Light error	0.5 second Red flickering	reset, after download is completed
30	The module set for the parameter does not match with the actually mounted module.	Modify the parameter and download it again	Light error	0.5 second Red flickering	reset, after download is completed
31	Detachment of extension module	Needs to take an action for the detached extension module	Critical error	0.1 second Red flickering	Regularly
33	During operation I/O module data cannot be accessed normally.	Check the position of the slot in XG5000 where an access error has occurred, replace the module and operate again (in accordance with the parameter)	Critical error	0.1 second Red flickering	Regularly
34	Data of special/communication module cannot be accessed during operation normally.	Check the position of the slot where the access error occurred using XG5000, replace the module and run the product again.	Critical error	0.1 second Red flickering	Regularly
38	The extension module has been exceeded	The extension module is mounted for more than 8 levels.	Critical error	0.1 second Red flickering	When booting initially or switching from the test mode to the run mode
39	PLC CPU runaway or error	The system is shut down abnormally due to noise or hardware error. 1) If it occurs repeatedly when the power is supplied again, request A/S. 2) Carry out an action for noise.	Critical error	0.1 second Red flickering	Regularly

Chapter 7 EMC Specifications

7.1 Requirements for Conformance to EMC Directive

The EMC Directive specifies the products must "be so constructed that they do not cause excessive electromagnetic interference (emissions) and are not unduly affected by electromagnetic interference (Immunity)". The applicable products are requested to meet these requirements.

This section summarizes the precautions on conformance to the EMC Directive of the machinery assembled using PLC XGB series. The contents described below are the summary of the requirements or specification in the EMC regulations we obtained, but it does not guarantee that all the machinery conforms to the following specification.

The method for conforming to the EMC directive or the compliance should be determined finally by the manufacturer of the machinery.

7.1.1 EMC Specifications

The EMC specification applied in the PLC is as shown in the table below.

Specification	Test item	Test details	Specification value
EN50081-2	EN55011 radiation noise [2]	Measure the wave emitted by the product.	30~230 MHz QP : 50 dBμV/m [1] 230~1000 MHz QP : 57 dBμV/m
	EN55011 conduction noise	Measure the noise that the product releases to the power supply line.	150~500 kHz QP : 79 dB Mean : 66 dB 500~230 MHz QP : 73 dB Mean : 60 dB
EN61131-2	EN61000-4- Electrostatic immunity	Immunity test in which static electricity is applied to the case of the equipment	15 kV aerial discharge 8 kV contact discharge
	EN61000-4-4 Fast transient burst noise	Immunity test in which fast noise is applied to the power line and the signal line	Power line: 2 kV Digital I/O: 1 kV Analog I/O, signal line: 1 kV
	EN61000-4-3 Radiation field AM modulation	Immunity test in which an electric field is exposed to the product	10Vm,26~1000 MHz 80%AM modulation@ 1 kHz
	EN61000-4-12 Damped oscillatory wave immunity	Immunity test in which a damped oscillatory wave is superimposed on the power wire	Power line: 1 kV Digital I/O (24V or higher) : 1 kV

＊1 : QP(Quasi Peak) : Quasi Peak, Mean : Mean

＊2 : The PLC is an open type device (device assembled to another device) and must be installed in the control panel.

7.1.2 Control Panel

The PLC is an open-type device (device assembled to another device) and it should be installed in the control panel. It's because it prevents a person from touching the product (XGB PLC) and causing an accident such as an electric shock and the control panel reduces a noise that is generated in the PLC. PLC should be installed in a metallic control panel in order to reduce a wave (EMI) radiated from the product. The specifications for the control panel are as follows.

(1) Control panel

The PLC control panel must have the following features.

(a) Use SPCC (Cold Rolled Mild Steel) for the control panel.
(b) The steel plate should be at least 1.6 ㎜ or thicker.
(c) Use an insulation transformer for all the power supplied to the control panel in order to protect from external surge voltage.
(d) The control panel should have a structure that prevents the radio wave leaking to the outside. For example, the door should be made in the form of box and the body of the control panel should be made in a structure that overlaps the door. This is to reduce any radiation noise that is generated in the PLC.
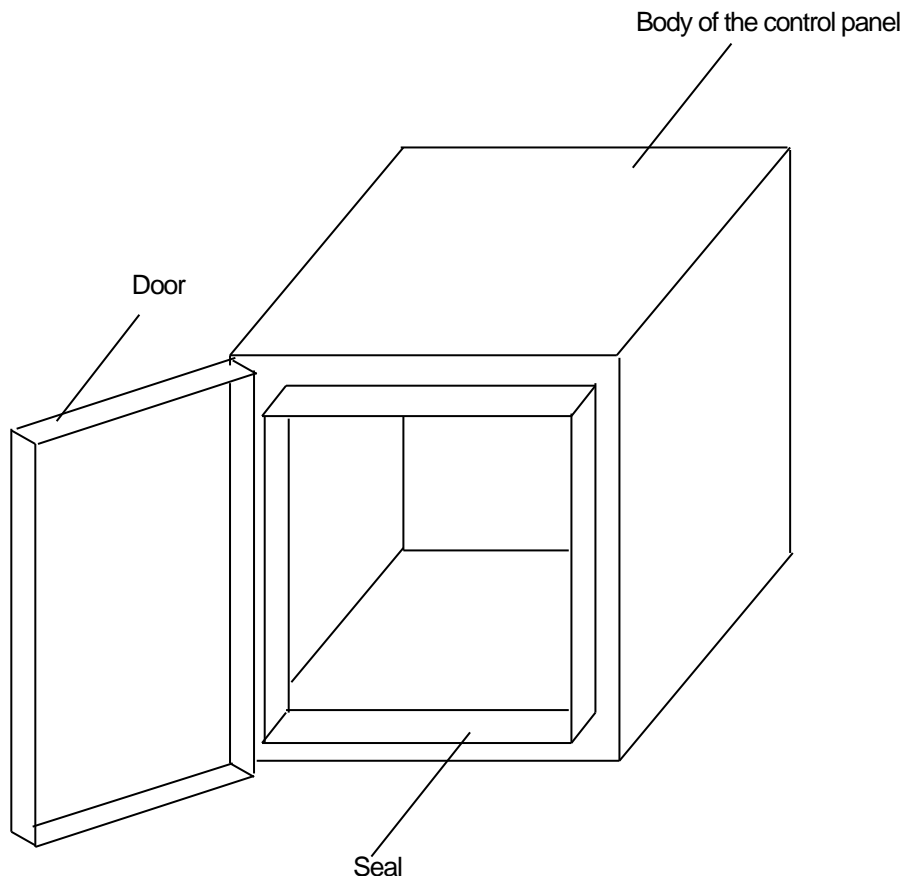
(e) In order to secure the electrical contact with the body of the control panel, peel off the paint on the fixing bolt part for the inner plate inside the control panel and secure the conductivity with as wide a surface as possible.

(2) Power and ground wiring

Grounding and power wiring of the PLC should be carried out as follows.

(a) Ground the control panel with a short and thick grounding wire so that a low impedance can be secured at a high frequency.

(b) The FG terminal plays the role of passing noise that is generated inside the PLC to the ground.
Therefore, use a grounding wire that has as low impedance as possible.

(c) The grounding wire can generate a noise, so grounding with a short and thick grounding wire prevents such wire from acting as an antenna.

(d) Attach ferrite core to the power cable as shown in the figure below in order to secure the compliance to the CE specification.
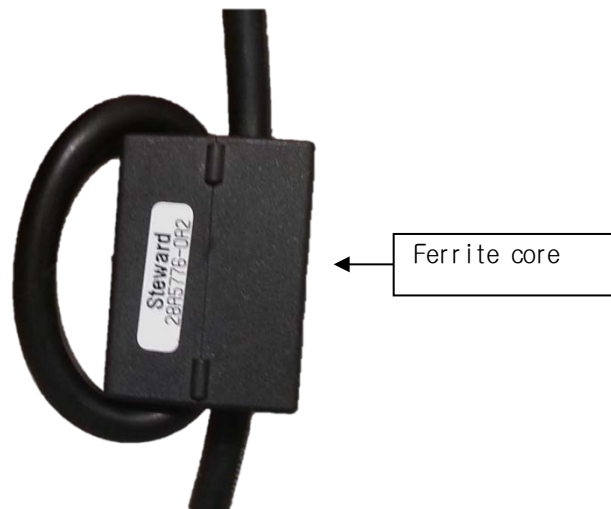
Ferrite core

[Product for reference - Ferrite core]

Manufacturer	Model name of product	External dimension (mm)				Maximum diameter of cable (mm)	Note
		A	B	C	D		
Laird	28A3851-0A2	30.00	13.00	33.70	30.00	12.85	www.lairdtech.com
Laird	28A5776-0A2	29.20	20.00	42.00	42.00	19.40	www.lairdtech.com
Coilmaster	C2L RU130B	31.50	13.00	33.00	31.50	13.00	www.coilmaster.com.tw
TDK	ZCAT3035-1330	30.00	13.00	34.00	30.00	13.00	www.tdk.com
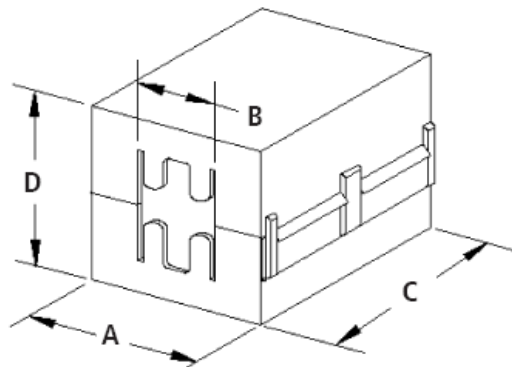
7.2   Requirements for Conformance to Low-voltage Directive

The low-voltage directive requires a device driven by the power supply ranging from AC50V to AC1000V and from DC75V to DC1500V to satisfy the safety requirements. Cautions for installation and wiring of the GB PLC are summarized below for conformance to the low-voltage directive. Also, the contents described are prepared according to the requirements or specification in the regulations of which we are aware, but it does not guarantee that all machinery produced in accordance with these contents conform to the above directive. The method for conforming to the low-voltage directive or the compliance should be determined by the manufacturer of the machinery.

7.2.1 Specification applied to the XGB PLC series

The XGB PLC series conform to EN6100-1 (safety of devices used in the measurement and control laboratories).
The XGB PLC series have been developed in accordance with the above specification for the module that operates at the rated voltage of AC50V/DC75V or higher.

7.2.2 Selection of XGB PLC

(1) Extension type EtherCAT adapter
The rated voltage of the adapter is the rated DC24V or less, so it is not included in the target of low-voltage directive.

(2) I/O module
The I/O modules whose rated voltage is AC110/220V series have dangerous voltages (peak 42.4V or higher) inside, so CE mark-compliant models feature enhanced insulation between the primary and secondary windings. I/O modules of the rated DC24V or less are not included in the target range of low-voltage directive.

(3) Special and communication modules
The rated voltage of special and communication modules is less than DC24V, so these modules are not included in the target of low-voltage directive.

Chapter 8 EtherCAT Communication

8.1 Operation method of EtherCAT

XEL-BSSCT is the extension type adapter(EtherCAT adapter) using the EtherCAT (Ethernet Control Automation Technology) network and up to eight extension modules can be mounted and used through the EtherCAT. The EtherCAT is the Ethernet-based fast and effective network technology. Each node of EtherCAT delivers the Ethernet frame in high speed and communicates in a short communication cycle.

The EtherCAT uses general-purpose Ethernet physical layers, so a compatible Ethernet cable can be used.

8.1.1 Example of EtherCAT network configuration

In this paragraph, a configuration example of EtherCAT network where XMC-E32A which is the LS ELECTRIC Co.,Ltd.'s EtherCAT master device as the master is explained.
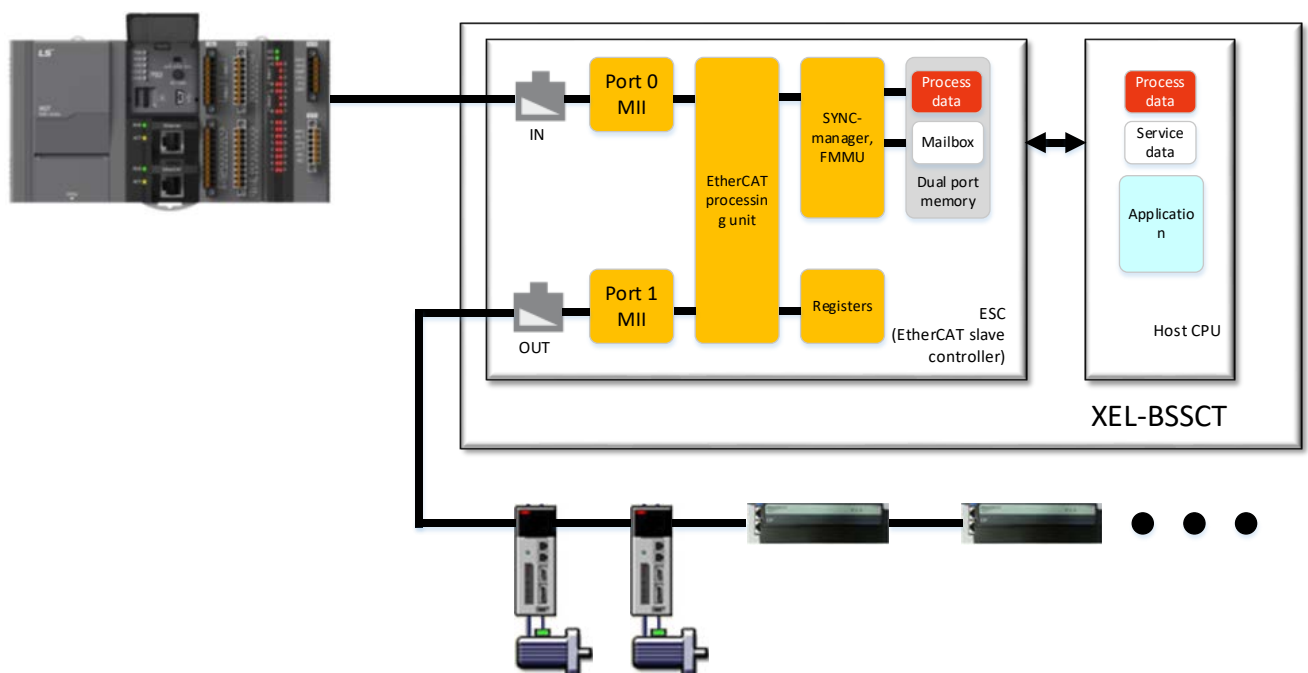
This product has a built-in ESC (EtherCAT Slave Controller), and the ESC delivers the EtherCAT frame to the next node and reads or writes necessary data from or on the EtherCAT adapter at the same time.

In this way, the EtherCAT adapter operates in the EtherCATnetwork as a node and the number of EtherCAT adapters that can be installed in the network is the same as the maximum number of nodes in the master.

8.1.2 Necessary tools for EtherCAT network configuration

The EtherCAT network consists of the master that manages the network, the slave that plays a role of network node and the configuration tool that configures the network information by interpreting the ESI of the slave (refer to 8.1.7 ESI) and delivers the configuration information to the master.

XMC-E32A which is the LS ELECTRIC Co.,Ltd.'s EtherCAT master product uses XG5000 as the configuration tool.

8.1.2.1 EtherCAT master

The EtherCAT master creates the EtherCAT frame that passes through each node and sends it to the first slave. The EtherCAT frame contains at least one datagram and each datagram type includes read, write and read/write. For addressing the slave device, logical addressing and direct addressing are used, and logical addressing is used for periodic exchange of process data. Direct addressing is mainly used for initializing the network such as the determination of non-periodic communication or network topology.

8.1.2.2 EtherCAT slave

The EtherCAT slave uses ESC in order to process a frame delivered from the previous node promptly. It exchanges periodic or non-periodic data with the master, with periodic data mainly data requiring prompt update such as I/O information, and it reads or writes fixed size data for each frame from/on DPRAM. Non-periodic data is used for setting a parameter, and when a request frame such as writing or reading is sent from the master, the slave provides the requested service.

8.1.2.3 Configuration tool

EtherCAT slave contains each piece of information in the ESI. The configuration tool checks the slave information using the ESI, configures the PDO of the whole network including the PDO setting, summarizes and delivers the synchronization mode and initialization command, etc., for network configuration to the master in an ENI file (EtherCAT Network Information).

8.1.3 General operation method

The EtherCAT adapter supports the CAN application protocol over EtherCAT(CoE) among various protocols of EtherCAT. CoE is the protocol created for providing compatibility between EtherCAT devices.

In the CAN application protocol, the object dictionary is classified into PDO (Process data objects) and SDO (Service data objects). The PDO is included in the object dictionary and it can be mapped to some elements of the object dictionary. The PDO is the area that exchanges data with the master periodically.

The SDO is an object that can read or write. The SDO is the area that exchanges data with the master non-periodically. The relevant area can be accessed using the SDO read/write function of the EtherCAT master. The SDO communication is carried out through the Mailbox of the ESC.

PDO is set for the I/O contact or U device area of the extension module by default and is updated periodically. Settings such as SDO communication and read are possible for the parameter area of the extension module.

In this way, the EtherCAT adapter manages the data of the extension module as an object. For detailed contents regarding the object, refer to Appendix 2 List of Objects.

8.1.4 State Machine

The state machine is implemented in the EtherCAT adapter. In each state, it carries out the defined communication service. The state when the power is supplied initially is Init state; the state can be changed in the arrow direction indicated below. For example, the state can be changed from OP (Operational) state to the Init state directly, but the state from the Init state to the OP state cannot be changed directly. In order to change the state from the Init state to the OP state, the Pre-Operational state and the Safe-Operational state should be passed through.

The Bootstrap state is used for updating the OS of the EtherCAT adapter, and only the Init state can be changed to the Bootstrap state, and the Bootstrap state can be changed to the Init state only.
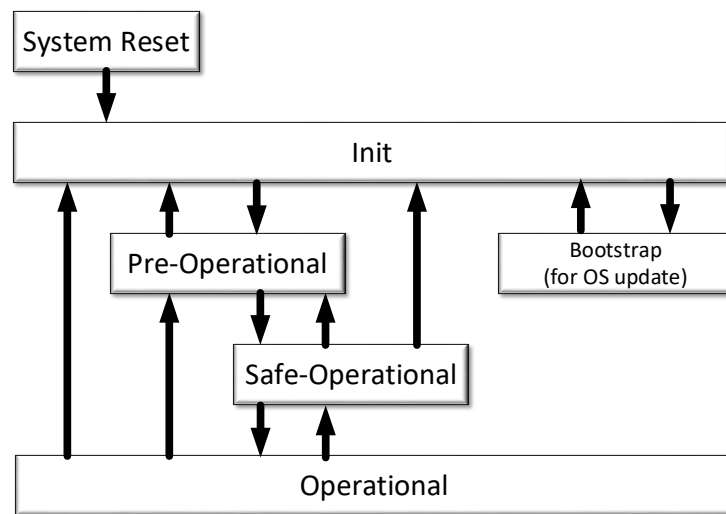
8.1.3.1 Init state

Each node of the EtherCAT network becomes the Init state when the power is supplied. In the Init state, the process data communication or Mailbox communication for the master application is impossible. The EtherCAT master can initialize Syncmanager channel 0 and 1 through the Mailbox communication. Syncmanager channel 0 and 1 are the settings for Mailbox communication.

8.1.3.2 Pre-Operational(Pre-Op)

The mailbox communication is available in pre-operational state. In this state, the SDO access using the Mailbox is also possible. The EtherCAT master initializes the Syncmanager channel 2 (TxPDO area). It checks whether the mailbox is initialized when the state is changed from Init to Pre-OP precisely or not. The PDO communication in Pre-Op state is impossible.

8.1.3.3 Safe-Operational(Safe-Op)

In this state, input data is updated periodically. For example, the digital input contact or the analog input value is updated periodically. The access to SDO that can be carried out in the Pre-Op state is also possible.

8.1.3.4 Operational(Op)

In this state, the operation carried out in Safe-Op and output data are updated periodically. For example, digital output contact or analog output value is periodically updated and applies to actual output.

8.1.3.5 Bootstrap(Boot)

This is the state used for updating the OS of the EtherCAT adapter through the EtherCAT master. In the EtherCAT adapter, the OS update through the bootstrap and the OS update through the USB are possible.

8.1.5 Free Run operation method

In the Free Run mode, the EtherCAT slave carries out extension module refresh separately from the communication interval. The Free Run method does not use the sequence for matching with the synchronization, so an unclear time difference in the application of output for each node occurs.

8.1.6 Distributed Clock(DC) operation method

In the Distributed Clock mode, the EtherCAT slave synchronizes to the DC Sync event defined by the master and carries out extension module refresh. It is used to match the time that the output signal is applied for each node. However, a time difference taken for refreshing each extension module occurs at this time.

8.1.7 ESI

The setting information of the EtherCAT slave is provided in the ESI (EtherCAT slave information) file. The setting of the EtherCAT communication is defined by the ESI file of the connected slave and the network connection information.
The ESI file is used in the Configuration tool which is used in the EtherCAT master, and in XMC-E32A, XG5000 is used as the configuration tool. The ESI file is the data related to the EtherCAT network connection and operation in addition to the product information from the manufacturer, and if it is modified arbitrarily, the product operation cannot be guaranteed. The ESI of the XEL-BSSCT can be obtained from the XG5000 installation folder or the download center at www.lselectric.co.kr

8.2 Types of EtherCAT communication

The EtherCAT communication includes the process communication and the mailbox communication. Process communication is used for reading and writing a fixed object at the communication intervals of the master and exchanging data with the Mailbox slave non-periodically, and the EtherCAT adapter provides CoE and FoE.

8.2.1 Process data communication

Process data communication has real-time characteristics and it is used for exchanging data between the master and the slave periodically. Just as the I/O contact or U device area of the previous XGB extension module is updated at the scan intervals of the PLC CPU unit, the process data is exchanged at the span program intervals of the EtherCAT master. Process data is divided into RxPDO and TxPDO. In the EtherCAT adapter, the refresh area of each extension module is set as PDO by default. Word type data in the Refresh area can be added and deleted using the PDO add/delete function of the configuration tool.

8.2.1.1 RxPDO

RxPDO is the data that the slave will receive from the EtherCAT master. For example, digital output contact information is data that will be delivered from the EtherCAT master, and digital output value received through RxPDO is delivered to the extension module at next extension module refresh.

8.2.1.2 TxPDO

TxPDO is the data that the slave will send to the EtherCAT master. For example, digital input contact information is data to be delivered to the EtherCAT master, and input contact data delivered through the extension module refresh is delivered to the master at next process data communication.

8.2.1.3 PDO Mapping

Each PDO can be deleted or added as needed. In the EtherCAT adapter, a word-type PDO item can be deleted or added.
For the PDO list by EtherCAT adapter and extension module, refer to Appendix 2 List of Objects.

8.2.1.4 PDO mapping using XG5000

When a project is created in XG5000 with XMC-E32A as the master and the EtherCAT adapter is registered as the slave, PDO mapping will be possible. The basic refresh area for the EtherCAT adapter and the extension module is registered as PDO. The 16Bit type PDO item can delete a registered PDO or add it again as needed. The order of PDO items that can be deleted or added also can be changed.

The following is an example of the method to delete or add PDO after XBF-AD04A is registered to No. 0 slot.
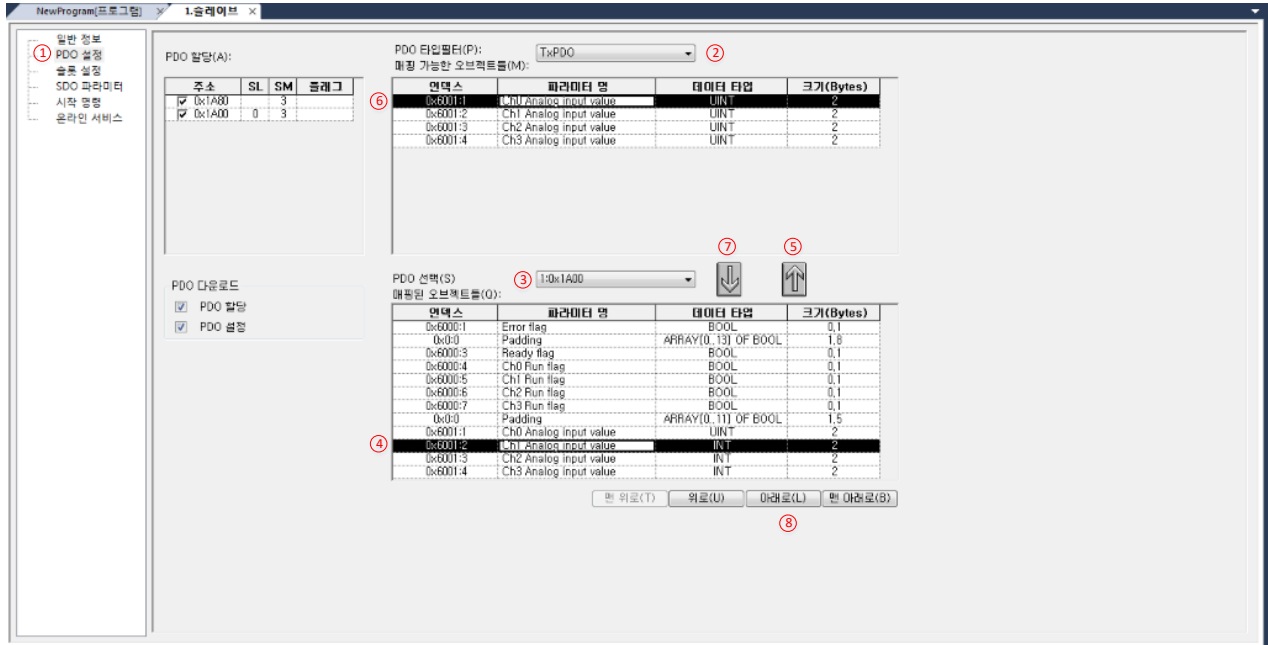
①   Click PDO setting on the slave setting window.

②   In XBF-AD04A, the analog input value has been mapped to TxPDO.

③   Select 0x1A00 which is TxPDO of No. 0 slot.

④   Click an item you wish to delete from the PDO item. At this time, only an item that is of 16-bit size can be deleted.

⑤   After selecting the item you wish to delete, delete the item from the PDO list by clicking the Up arrow.

⑥   Items that can be mapped to PDO are listed in the objects that can be mapped, Click an item you wish to add to the PDO item.

⑦   Add the item to the PDO list by clicking the Down arrow.

⑧   The order of objects that can be deleted or added among the PDO list can be switched amongst each other. You can select an object and change its order in a downward direction or an upward direction. However, the order of an object whose order you wish to change cannot be changed to the position of a fixed object which is in a higher position.

8.2.2 Mailbox communication

Mailbox communication is used for exchanging data with the EtherCAT master non-periodically. The EtherCAT adapter provides CoE and FoE during the Mailbox communication.

8.2.2.1 CoE

Data is accessed using the Index and Subindex of the object dictionary. Index and SubIndex are defined in the ESI file and the list can be confirmed through the SDO confirmation window of the Configuration tool. For example, in case of EtherCAT adapter's Index: 3000, SubIndex: 01, it is Refresh_Period_Time, and the relevant area can be read or written through the SDO read/write function.

When an inappropriate access or condition occurs in the SDO communication, the master returns the error code, and the following is the description of the error code for the EtherCAT adapter displayed in the master.

Value	Description
05030000 hex	Toggle bit error
05040000 hex	Timeout
05040001 hex	Unsupported command
05040005 hex	The memory range has been exceeded.
06010000 hex	Access to the object is restricted.
06010001 hex	Reading an object that only Write is available has been attempted
06010002 hex	Writing an object that only Read is available has been attempted
06010004 hex	Connection to an area that cannot be connected using complete access has been attempted
06020000 hex	Access to an object that does not exist.
06070010 hex	Object length error
06090011 hex	SunIndex error
08000020 hex	Data cannot be read or saved.
08000022 hex	State that data cannot be read or saved.

8.2.2.2 FoE

For the EtherCAT adapter, this is the communication used for updating the OS, and it is used to download the provided OS through the EtherCAT master. When the OS is downloaded through FoE, the product will operate in the OS of the downloaded version only when power is supplied again. If a communication error such as the detachment of a cable occurs while downloading OS through FoE, download OS again after supplying power again.

Chapter 9 Operation Method of the Adapter

9.1 Operation mode of the adapter

In this chapter, an explanation of operation of the EtherCAT adapter (EtherCAT adapter) is provided.

9.1.1 Basic operation

The EtherCAT adapter delivers refresh data sent from the EtherCAT master to the extension module and sends refresh data received from the extension module to the EtherCAT master. The extension module including the EtherCAT adapter operates a parameter for setting the operation and this parameter can be set through the SDO service. An object can be accessed using the CoE protocol and all the information for operating the EtherCAT adapter and the extension module is listed in the object. The following table is used for each object address area.

Index (hex)	SubIndex (hex)	Name	Description	Content	Access
1000	-	Device type	This indicates the value of the slave device.	1389(hex, indicates the MDP product)	RO
1008	-	Device name	The product name is displayed.	EtherCAT adapter EtherCAT Slave(MDP)	RO
1009	-	Hardware version	This indicates the hardware version.	Hardware version	RO
100A	-	Software version	This indicates the software version.	Software version	RO
1010	-	Parameter save	This indicates an object related to parameter save.	-	-
	00	Number of items	-	-	RO
	01	SAVE ALL	This is the object for saving a parameter.	When "save" is entered, the parameter will be saved.	RW
1018	-	Device information	This is the object for the manufacturer of the product and the product ID, etc.	Vendor ID/Product code/Revision number	-
	00	Number of items	-	-	RO
	01	Vendor ID	This indicates the manufacturer's ID.	000005E1(hex)	RO
	02	Product code	This indicates the product code.	00005FC1(hex)	RO
	03	Revision number	This indicates the product revision number.	Revision number	RO
10F1	-	Error setting	This is the object for EtherCAT communication error setting.	-	-
	00	Number of items	-	-	RO
	02	Sync Error Counter Limit	This is the limit of sync error with process data when the DC sync function is used. When the value where the Sync error count is set is exceeded, a sync error occurs.	Error Count Limit	RW

Index (hex)	SubIndex (hex)	Name	Description	Content	Access
16xx	-	RxPDO entry	This is the RxPDO registration area.	For detailed contents, refer to Appendix 2.3 PDO List.	-
1Axx	-	TxPDO entry	This is the TxPDO registration area.	For detailed contents, refer to Appendix 2.3 PDO List.	-
1C00	-	Sync manager type	This is the area where the type of each sync manager is saved.	-	-
	00	Number of items	-	-	RO
	01	SubIndex 001	This indicates the type of Sync manager 0(SM0).	1(Mail box receive, master -> slave)	RO
	02	SubIndex 002	This indicates the type of Sync manager 1(SM1).	2(Mail box send, slave -> master)	RO
	03	SubIndex 003	This indicates the type of Sync manager 2(SM2).	3(Process data output, master -> slave)	RO
	04	SubIndex 004	This indicates the type of Sync manager 3(SM3).	4(Process data input, slave -> master)	RO
1C12	-	SM2 PDO assigned item(RxPDO)	This is the PDO list assigned to SM2. This is the area filled automatically by the master while the state of the adapter is changing from the Init state to the Op state. Do not change it arbitrarily.	-	-
	00	Number of items	-	-	RW
	01~14	SubIndex 000~020	This is the index of PDO registration area to be used as PDO. Up to 20 index No. of PDO registration area can be assigned.	Index No, of PDO registration area for the adapter and the extension module	RW
1C13	-	SM3 PDO assigned item(TxPDO)	This is the PDO list assigned to SM3. This is the area filled automatically by the master while the state of the adapter is changing from the Init state to the Op state. Do not change it arbitrarily.	-	-
	00	Number of items	-	-	RW
	01~14	SubIndex 000~020	This is the index of PDO registration area to be used as PDO. Up to 20 index No. of PDO registration area can be assigned.	Index No, of PDO registration area for the adapter and the extension module	RW

Index (hex)	SubIndex (hex)	Name	Description	Content	Access
1C32	-	SM input setting value	This is the area for setting the communication mode of the SM3. Since this area is controlled by the master, do not change it arbitrarily.		
	00	Number of items	-	-	RO
	01	Synchronization Type	The communication mode of the Sync Manager 3 can be checked.	0000(hex): Fres-Run mode 0002(hex): DC mode(Sync0)	RW
	04	Synchronization Types supported	The synchronization modes that can be supported are displayed. The EtherCAT adapter supports the Free Run mode the DC Sync0 mode.	Free Run and DC Sync0 supported	RO
	05	Minimum Cycle Time	This is the minimum DC Sync0 Event cycle.	1000000	RO
	06	Calc and Copy Time	This is the normal time taken for processing process output data.	50000	
	09	Delay Time	This is the delay time taken for executing refresh after DC Sync0 event.	200000	
	0A	Sync0 Chcle Time	This indicates the DC Sync0 cycle.	This indicates the DC Sync0 cycle.	RW
	0B	SM-Event Missed	This is the object for checking a sync error between process data and DC Sync0 event. If it is larger than the sync error counter limit, a sync error will be issued.	Increases by 3 when a sync error occurs, decreases by 1 when a process data event occurs	RO
	0C	Cycle Time Too Small	Counts the number of times that process data cannot be processed.	The count value is displayed.	RO
	20	Sync Error	It indicates the error occurrence status.	Set when an error occurs	RO

Index (hex)	SubIndex (hex)	Name	Description	Content	Access
1C33	-	SM input setting value	This is the area for setting the communication mode of the SM3. Since this area is controlled by the master, do not change it arbitrarily.		
	00	Number of items	-	-	RO
	01	Synchronization Type	The communication mode of the Sync Manager 3 can be checked.	0000(hex): Fres-Run mode 0002(hex): DC mode(Sync0)	RW
	04	Synchronization Types supported	The synchronization modes that can be supported are displayed. The EtherCAT adapter supports the Free Run mode the DC Sync0 mode.	Free Run and DC Sync0 supported	RO
	05	Minimum Cycle Time	This is the minimum DC Sync0 Event cycle.	1000000	RO
	06	Calc and Copy Time	This is the normal time taken for processing process output data.	50000	
	09	Delay Time	This is the delay time taken for executing refresh after DC Sync0 event.	200000	
	0A	Sync0 Chcle Time	This indicates the DC Sync0 cycle.	This indicates the DC Sync0 cycle.	RW
	0B	SM-Event Missed	This is the object for checking a sync error between process data and DC Sync0 event. If it is larger than the sync error counter limit, a sync error will be issued.	Increases by 3 when a sync error occurs, decreases by 1 when a process data event occurs	RO
	0C	Cycle Time Too Small	Counts when the next process data event occurs before process data is processed	Increase by 1 when the next process data event occurs before process data is processed	RO
	20	Sync Error	It indicates the error occurrence status.	Set when an error occurs	RO

Index (hex)	SubIndex (hex)	Name	Description	Content	Access
2000	-	System Status	This is the flag information that indicates the system status.	For detailed contents, refer to Appendix 2.1 Flag object list.	-
2010	-	System error (critical error)	This is the flag information that indicates a critical error of the system.	For detailed contents, refer to Appendix 2.1 Flag object list.	-
2020	-	System error (light error)	This is the flag information that indicates a light error in the system.	For detailed contents, refer to Appendix 2.1 Flag object list.	-
2030	-	System status data	This is data that indicates the system status.	For detailed contents, refer to Appendix 2.1 Flag object list.	-
2040	-	System control flag	This is the flag information that indicates the error status of system control and the extension module.	For detailed contents, refer to Appendix 2.1 Flag object list.	-
3000	-	Adapter parameter	This is the parameter of the adapter.	For detailed contents, refer to Appendix 2.2 Parameter object list.	
6xxx	-	TxPDO data	This is the list of data assigned to the TxPDO of each extension module.	For detailed contents, refer to Appendix 2.3 PDO list.	-
7xxx	-	RxPDO data	This is the list of data assigned to RxPDO of each extension module.	For detailed contents, refer to Appendix 2.3 PDO list.	-
8xxx	-	Extension module parameter	This is the parameter of each extension module.	For detailed contents, refer to Appendix 2.2 Parameter object list.	
F000	-	Modular Device Profile	This is the configuration information of Modular Device Profile.		
	00	Number of items	-	-	RO
	01	Module Index Distance	This is the index for each slot of data assigned to PDO.	10(hex)	
	02	Maximum Number of Modules	This the maximum number of modules that can be mounted.	8(hex)	
F030	-	Set module configuration	This is the module configuration set from the configuration tool.	When the module configuration download set from the master is enabled, the module configuration set from the configuration tool will be displayed.	-
	00	Number of items	-	-	RW
	01~08	SubIndex 001~008	This is the module ID set from the configuration tool for each slot.	Set module ID	RW
F030	-	Set module configuration	This is the configuration of module actually mounted for each slot.	-	-
	00	Number of items	-	-	RO
	01~08	SubIndex 001~008	This is the ID of the module actually mounted for each slot.	Set module ID	RO

9.1.2 Free-Run refresh

In Free Run mode, the extension module refresh operates regardless of DC Sync0 signal. Since there is no waiting time for DC Sync0 event, the extension module refresh is carried out on the fastest cycle. Since the refresh is carried out for each adapter according to separate processing times, if a number of adapters are used, the times to begin refresh for each adapter do not match. When the other services of the adapter are processed as shown in the figure below, the extension module refresh will be carried out immediately.

When the adapter operation is divided into DC Event process, other services and extension module refresh as shown in the figure below, the extension module refresh will be carried out right after the DC event process and other services are completed. At this time, the time to begin the extension module refresh is irrelevant to DC Sync0 Event.In order to operate the EtherCAT adapter in Free-Run mode, set Free Run for the operation mode of the EtherCAT adapter in the master.
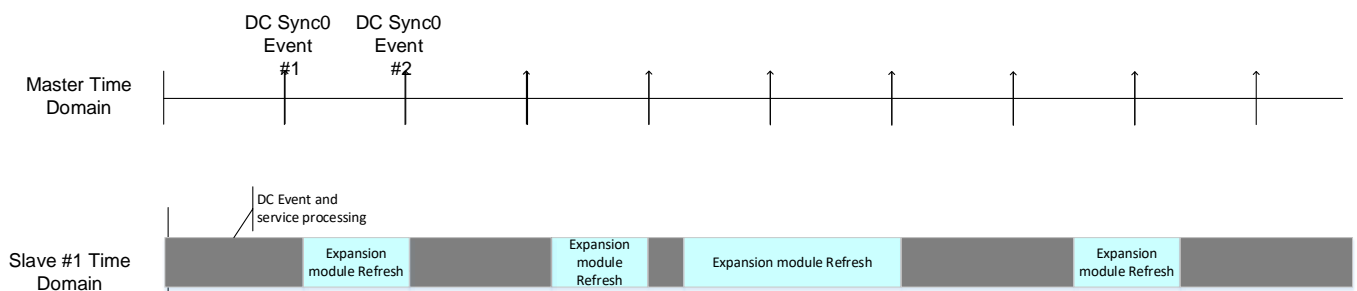
9.1.3 Refresh synchronization between adapters using DC Sync

In the DC Sync mode, the extension module refresh is carried out through synchronization with the DC Sync0 signal. The EtherCAT adapter carries out the extension module refresh with one-on-one method in series. Therefore, the time taken for carrying out one refresh may vary according to the module configuration

If the refresh execution time is longer than the DC Sync0 event cycle, the refresh can be carried out in multiples of DC Sync0 event cycle using the refresh period time among the adapter parameters. For example, if 3 is set for the refresh period time, the refresh is carried out in 3 time cycles of DC Sync0 event cycle. If the refresh cannot be completed within the set refresh time, a refresh time excess warning error will occur. If the Refresh Period Time is 0, the refresh is carried out in the same way with the case that 1 is set for the Refresh Period Time, but the refresh time excess warning error will not occur. The following is the operation in case 3 is set for the Refresh Period Time. If the DC Sync0 cycle is 1ms, the extension module refresh will be carried out every 3ms.
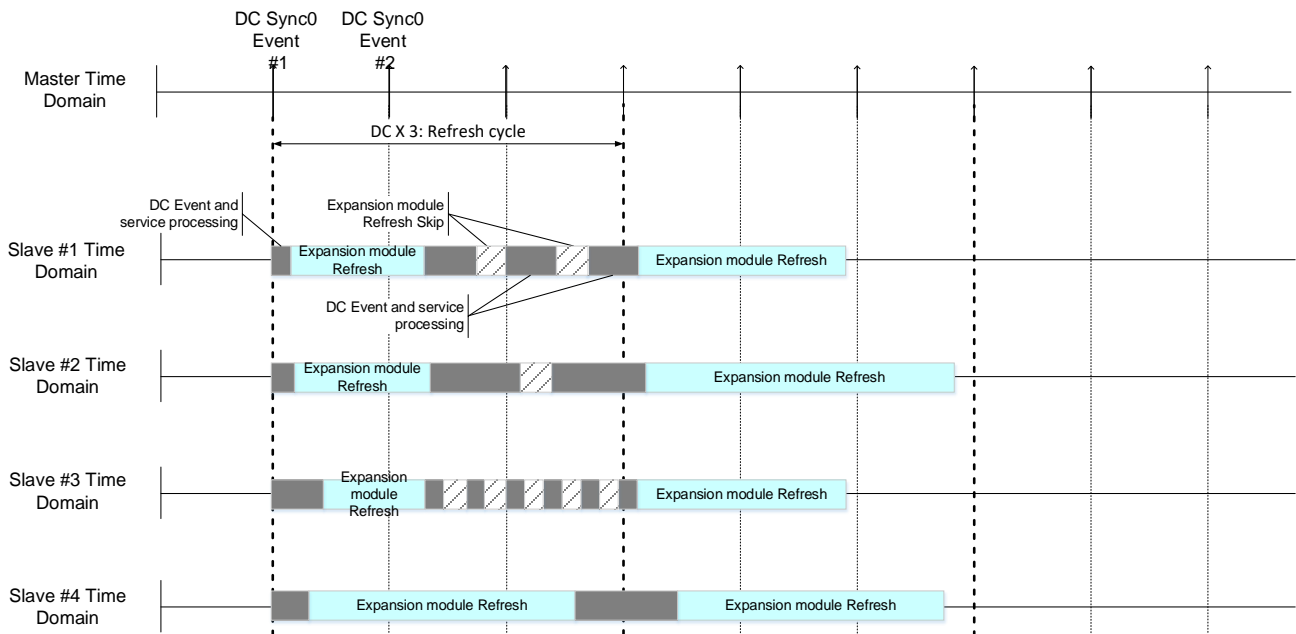
When the set refresh time arrives, the extension module refresh will be carried out. However, the extension module refresh will be carried out after DC event and other services with higher priority are processed first.

If the refresh period time is larger than 1, the DC Sync0 event will be counted for each adapter, and if the count value is the same as the refresh period time, the refresh will be carried out. Therefore, if a number of adapters are used, the time to carry out refresh may vary according to the time to count a DC Sync0 event.

The following shows the method to match the time to carry out refresh when a number of adapters are used.

    (1) Set the same refresh period time for each adapter.
    (2) Change the operation mode of each adapter to the Op mode.
    (3) (2) Next, the 2040:03(_DC_SYNC_COUNT_CLT) value of each adapter is turned on at the same time.
    (4) Each adapter resets the DC Sync0 event count to 0 when the 2040:03 value is set, and the time to begin the extension module refresh for each adapter will be the same from the next refresh.

9.2 Refresh performance

9.2.1 Time taken for refresh by extension module

Various extension modules including simple digital I/O modules and 2-channel load cell module can be mounted on the EtherCAT adapter.The EtherCAT adapter carries out the extension module refresh with one-on-one method in series; the time taken for refresh may vary according to the extension module. The following table shows the time taken for carrying out refresh for each extension module.

Type	Basic operation processing time	Refresh processing time
EtherCAT adapter		-
XBE-DC08A		0.4ms
XBE-DC16A/B		0.4ms
XBE-DC32A		0.5ms
XBE-TN/TP08A		0.4ms
XBE-TN/TP16A		0.4ms
XBE-TN/TP32A		0.5ms
XBE-RY08A/B		0.4ms
XBE-RY16A		0.4ms
XBE-DR16A		0.7ms
XBE-DN32A		0.7ms
XBF-AD04A		0.7ms
XBF-AD08A		1.0ms
XBF-AD04C	0.4ms	1.1ms
XBF-DV04A		1.0ms
XBF-DC04A		1.0ms
XBF-DC04B		1.0ms
XBF-DV04C		1.5ms
XBF-DC04C		1.5ms
XBF-AH04A		1.1ms
XBF-RD04A		1.6ms
XBF-RD01A		1.4ms
XBF-TC04B		2.6ms
XBF-TC04S		2.6ms
XBF-LD02S		2.9ms
XBF-HO02A		3.1ms
XBF-HD02A		3.1ms

For example, the case of using one XBE-DC08A and one XBF-HD02A is as follows.

Basic operation processing time (0.4ms) + refresh processing time by module (0.4ms+3.1ms) = 3.9ms

In other word, the refresh period time is approximately 3.9ms. ±1ms deviation on the refresh period time may occur for each module during the product operation.   Also, data which should be processed occurs when connecting to and monitoring XG5000, so the refresh period time may be 200~400us longer than normal refresh period time. When DC Sync0 event synchronization refresh is set, set the Refresh Period Time(3000:01) by referring to the DC Sync0 cycle set from the master and the above table.

9.3   Parameter operation method

The EtherCAT adapter operates the EtherCAT adapter's own parameter (adapter's unique parameter) and the extension module parameter.When the parameter is saved (Enter "save" on 1010:01), the adapter's unique parameter, extension module parameter and extension module configuration information will be saved in the built-in non-volatile memory of the EtherCAT adapter.When the power is supplied to the EtherCAT adapter, the extension module configuration information saved in the non-volatile memory is compared with the configuration information of the actual module mounted, and if they match, the parameter saved in the non-volatile memory will be delivered to the extension module. If they do not match, an extension module type mismatch error (Set _IO_DEER, 2010:02) will occur and the initialized parameter will be delivered to the extension module actually mounted. However, the previously saved data will be maintained in the non-volatile memory at this time. The case of saving currently configured module information and the parameter in the non-volatile memory is as follows.

(1)   When entering "save" on 1010:01
(2)   When writing a parameter using XG5000
(3)   When executing the I/O synchronization function from Menu-Online-Diagnosis-I/O information of XG5000
(4)   When Initial parameter value applies for each slot, the initialized parameter will be saved.

For the method to change the extension module parameter and time that the changed parameter applies, refer to the following table.

Parameter setting tool	Method to change	Time of operation with the changed parameter
XG5000	Execute Online-Write (Write is possible only when the adapter has stopped)	When the adapter enters the run state after Write is completed, the changed parameter will apply.
	Execute Monitor-Special module monitor-Test (Test is possible only when the adapter has stopped)	When Test is clicked, the changed parameter will apply immediately, but if the adapter enters the Run state after the test is completed, it will operate with the previous parameter.
EtherCAT Master	SDO service	After SDO Write is completed, the changed parameter will apply immediately.

9.3.1 Parameter memory structure

The EtherCAT adapter shares and uses the extension module mounted on LS ELECTRIC Co., Ltd.'s XGB series CPU module. The XGB CPU unit specifies the address to the memory of the PUT/GET area for the extension module parameter. The EtherCAT adapter assigns and uses the same memory area to an object. SubIndex and module area address (memory address of PUT/GET area) are summarized in Appendix 2.2 List of Parameter Objects. Refer to Appendix 2.2 List of Parameter Objects for checking the internal memory from the user's manual of the extension module.

9.3.2 Automatic setting of initial parameter value

The EtherCAT adapter can operate with the initial parameter value of each module even if the parameter of the extension module is not set by the master or XG5000. The following is the case that the EtherCAT adapter initializes the parameter of the extension module to the initial value and begins operation.
If the extension module is mounted on the slot but nothing is set in the module configuration information in the non-volatile memory of the EtherCAT adapter, operation will begin with the initial parameter value based on the extension module actually mounted. At this time, a module type mismatch error does not occur.
If the extension module mounted on the slot is different from the extension module saved in the configuration information in the non-volatile memory, operation will begin with the initial parameter value based on the extension module actually mounted. At this time, a module type mismatch error occurs.

Even if the operation begins with the initial value due to the condition specified in (1) and (2) above, the initial parameter value will not be saved in the non-volatile memory of the EtherCAT adapter. In order to save the currently set parameter in the non-volatile memory, execute the operation corresponding to the case of saving listed parameters in 9.3 Parameter operation method. If the saved parameter is different from the extension module actually mounted, carry out I/O synchronization to XG5000 or correct the slot setting of the master and save using Save parameter (INDEX 1010:0). When it is saved, if the module type set as the parameter matches with the module type actually mounted, the module type mismatch error will be cleared together.

9.4 Test mode

The EtherCAT adapter allows you to use all functions through object setting using the EtherCAT master, but when configuring the initial system, the test function using XG5000 is provided for convenience.

The test function provides an environment to change the parameter and refresh data arbitrarily using XG5000.

However, the EtherCAT adapter is the product controlled basically by the EtherCAT master, so refresh data will be updated to the value delivered from the master each time when process data is processed. Therefore, in order to change refresh data arbitrarily in XG5000, the operation state of the EtherCAT adapter should be changed to the Stop state. If the EtherCAT adapter is in the Stop state, refresh data delivered through the master will be discarded. After the test is completed, refresh data can be applied normally through the master only when the state of the EtherCAT adapter is changed to the Run state.

In this paragraph, an explanation of test method through the special module monitor of XG5000 using XBF-AD04A as an example is provided.For EtherCAT adapter connection and setting, install the latest version of XG5000.

9.4.1 How to use the test mode

The EtherCAT adapter can connect to XG5000 through the USB. Due to the characteristics of ESC used in the EtherCAT slave, connection to XG5000 using the RJ45 port included in the product cannot be made.

Use the test mode in the following order.

(1) Execute XG5000.
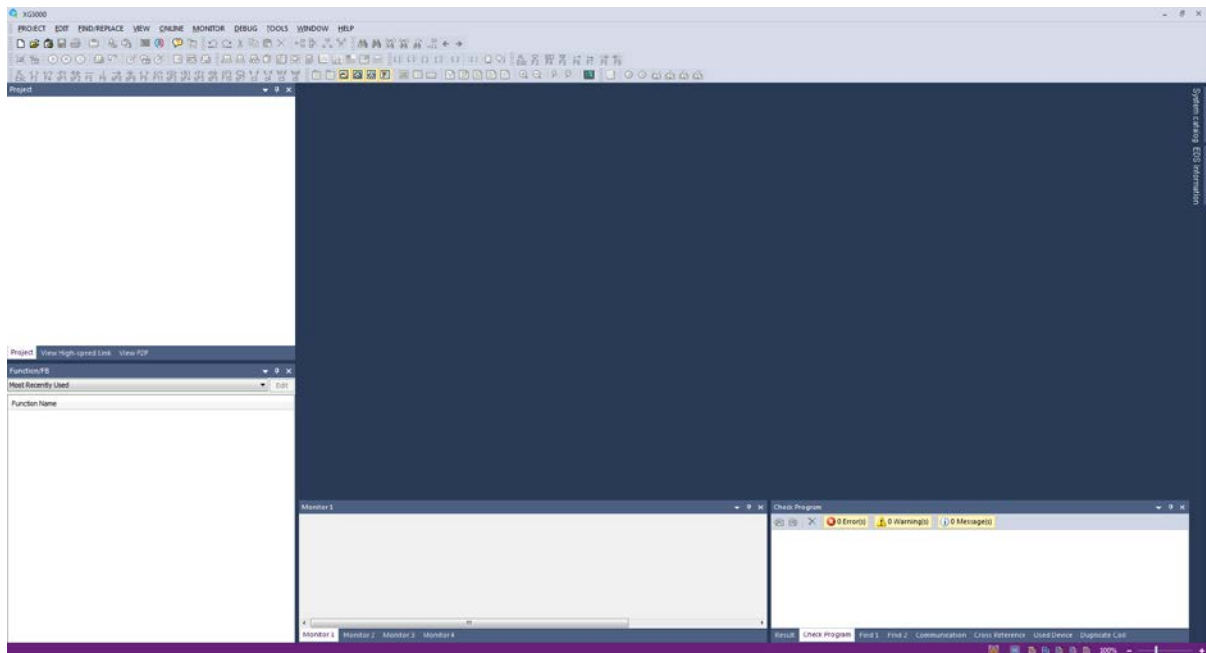
(2) Execute Open from the project-PLC on the menu.
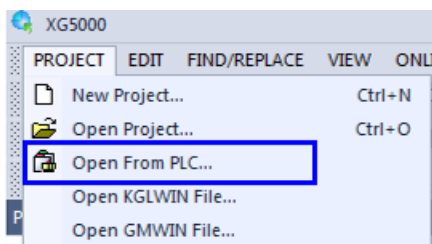
(3)　When Read is completed normally, the dialog box will be displayed as shown below. If Read is not carried out normally, install the latest version of XG5000 or check the USB connection status between the EtherCAT adapter and the PC.
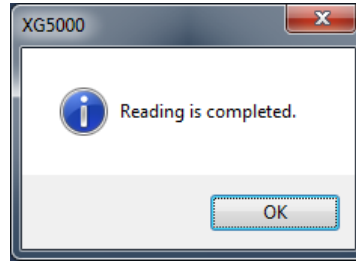
(4)　Double click I/O parameter on the project tree and see if XBF-AD04A (or a special module you wish to use) is displayed normally. In this window, you can check the extension module configuration read from the module or configure the extension module in a desired configuration. You can set the parameter of the relevant module directly by double clicking the set slot. When you execute Online-Write, the set parameter will be applied to the EtherCAT adapter.
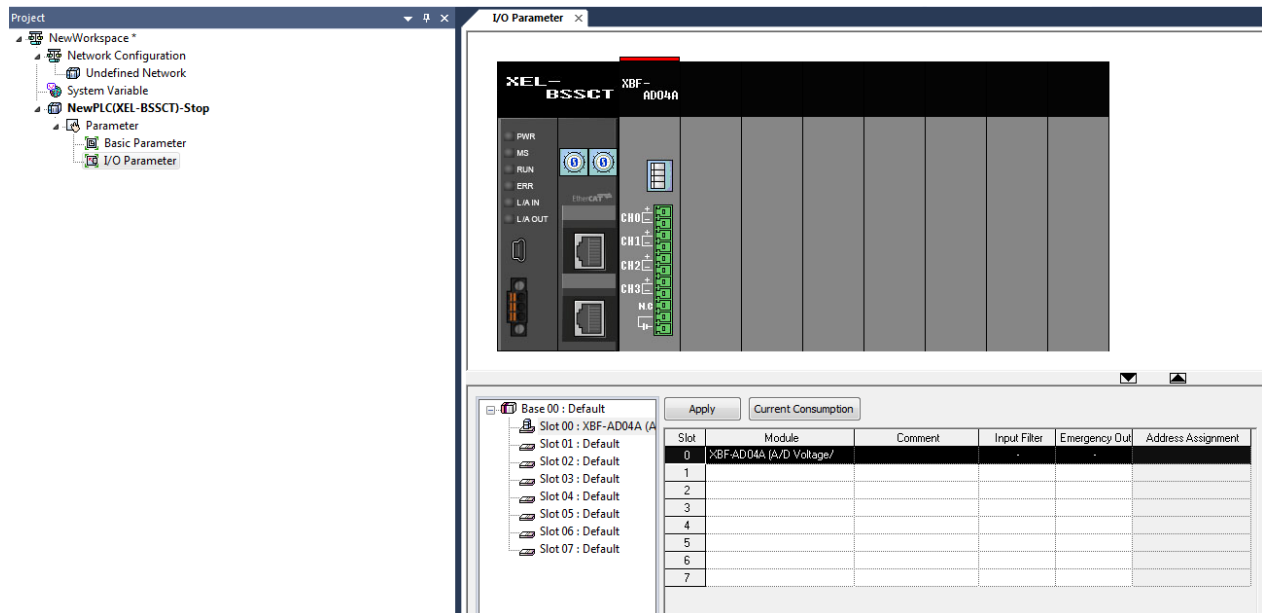
(5)   Execute Monitor-Special module monitor from the menu. At this time, in order to carry out the test, the mode of the EtherCAT adapter should be changed to the Stop mode. If the mode of the EtherCAT adapter is Run mode, test cannot be carried out and only monitoring is possible. Before executing the special module monitor for carrying out the test, check if the EtherCAT adapter is in the Stop state. The EtherCAT adapter operates in Run state if the operation state is not changed using XG5000.
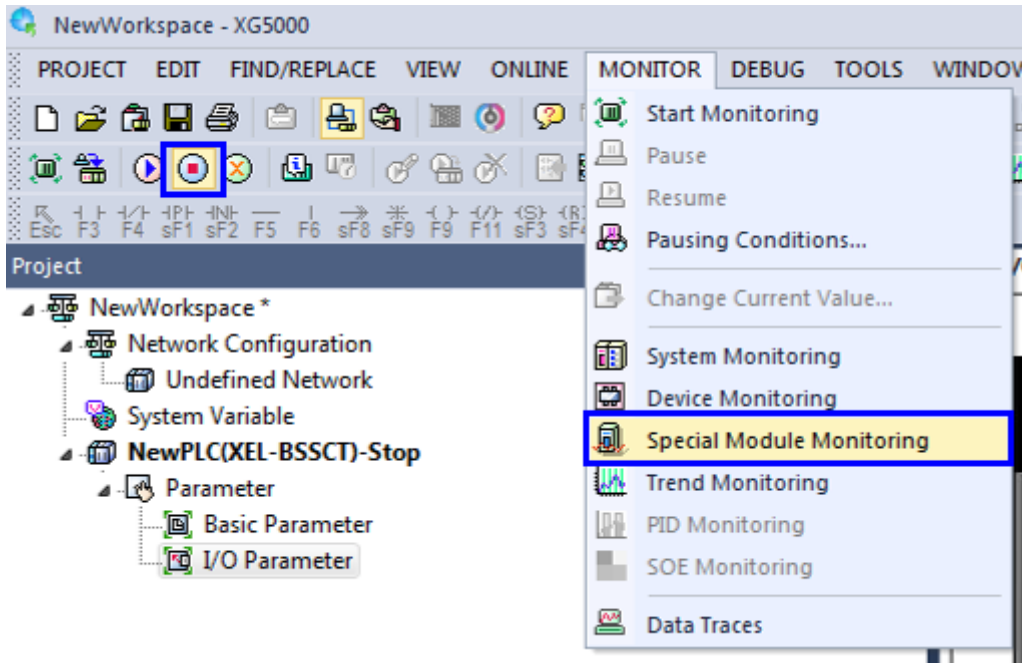
(6) The special module list window will be executed and the set special module will be displayed. Select a module you wish to test and click the Monitor button.
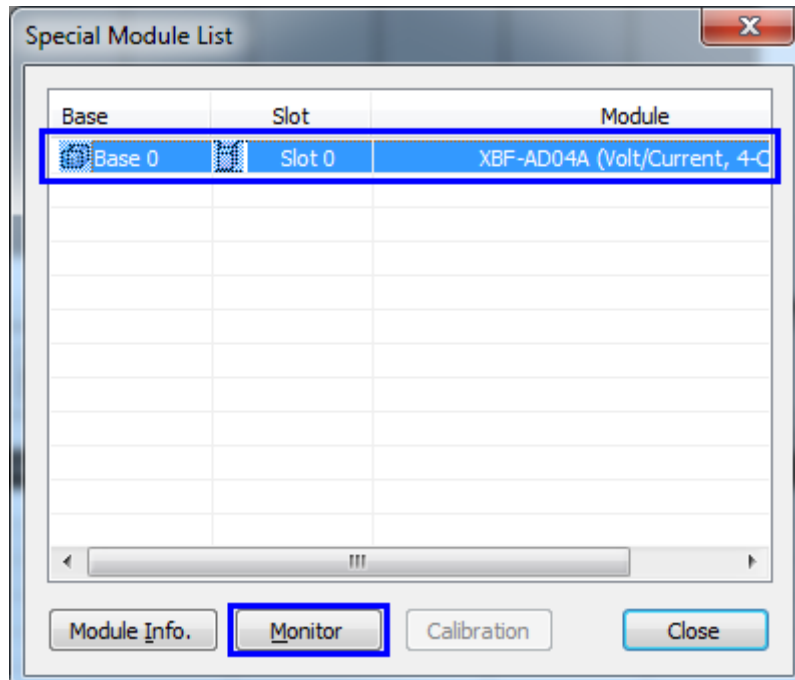
(7) When you click Start Monitoring on the special module monitor window, refresh data will be displayed.
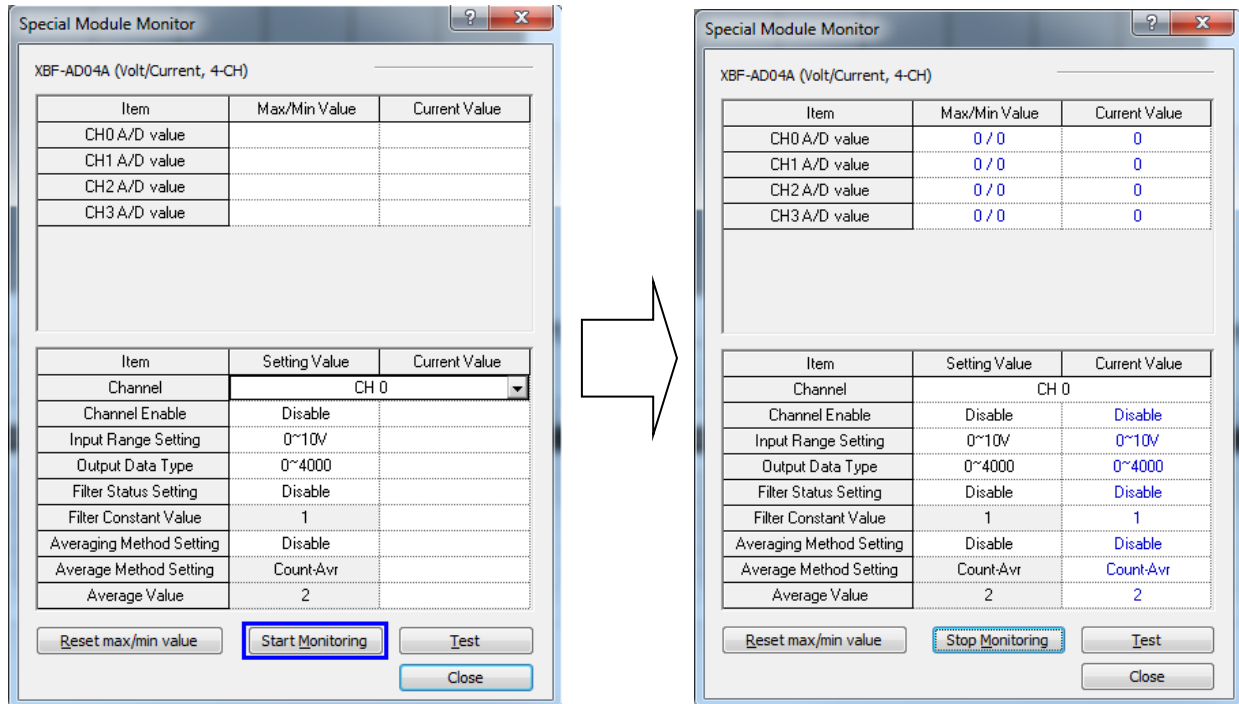
(8) When you change the parameter to a value you wish to test and click Test, the changed parameter will apply and operation will begin. The following example is the case that the operation channel among the parameters of channel 0 is changed to operation and it is checked through refresh data if channel 0 operates.
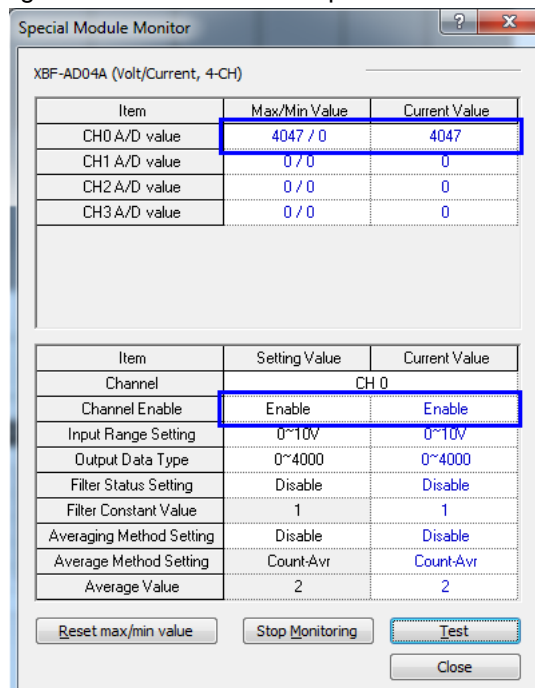
(9) When the EtherCAT adapter enters Run state, it reads a parameter saved in the non-volatile memory, delivers it to the extension module and begins operation. Therefore, data changed in the test mode will be destroyed when the EtherCAT adapter enters the Run state.

Chapter 10 Additional Functions

10.1 Overview

In this chapter, an explanation of built-in additional functions and the function of XEL-BSSCT (EtherCAT adapter) is provided.

10.1.1 Overview of functions

The extension type EtherCAT adapter XEL-BSSCT supports the following additional functions.

Function	Description
Station address setting function	The function to set station address for identification which is not an address assigned automatically by the master
EEPROM recovery function	If the status of EEPROM is abnormal, this function notifies and recovers it by itself.
Parameter save	This function can apply a parameter which has been used as the SDO service permanently so that operation with the relevant parameter can be done at reboot.
Parameter initialization	This function initializes all parameters of the relevant slot.
Reset function	This function resets the EtherCAT adapter remotely through the master.
Status diagnosis function	This function checks whether an error has occurred in each module or not.

Notes

1) For matters regarding the refresh of the EtherCAT adapter, refer to Chapter 9. Operation Method of the Adapter in this User's Manual.
2) For the extension module function, download and refer to the manual from our homepage (http://www.lselectric.co.kr).

10.2 Station address setting function

The station address of EtherCAT is used for the device identification. XEL-BSSCT supports the Explicit ID method and the Station Address method as the device identification method. In LS ELECTRIC Co., Ltd.'s EtherCAT adapter XEL-BSSCT, the Explicit ID and the Station Address operate separately. Each device identification station address can be set as follows.

Identification method	Setting method
Station Address	Station Address Change Command of the master
	XG5000's station address parameter
Explicit ID	Adjust the rotary switch

10.2.1 Explicit Device Identification (Explicit ID)

Explicit Device Identification is the station address set by the external rotary switch placed on the front of the product. The rotary switch is classified by tens and units places, and it is written as a decimal number. This station address is convenient since the ID of the relevant slave can be seen intuitively. No. 0 to No. 99 can be set for Explicit ID. However, it is recommended to set and use station address from No. 1 to No. 99 except for No. 0 for clear setting of an station address.

10.2.2 Configured Station Address

Configured Station Address is the slave identification address saved in EEPROM. EEPROM's Station Address can be changed through X5000's station address setting or the master's station address setting. However, the station address changed from the master only operates if XG5000's set station address value is 0. If the parameter is downloaded by entering a value which is not 0 for the station address in XG5000, the station address of the parameter will overwrite the station address changed from the master at reboot. It is recommended to set the station address except for No. 0 for clear setting.

10.3 EEPROM recovery function

If EEPROM write is not restricted by the master, EEPROM may be altered by various causes. When this function is used, EEPROM's data forgery will be checked and recovered when the power is supplied to the adapter again or the adapter is reset. Error recovery is classified into three types.

10.3.1 Data structure of EEPROM

The data structure of EEPROM is configured as follows.

Content
Slave Controller Configuration Area
Vendor ID
Product Codes
Revision Number
Serial Number
MailBox Boot Strap Config
MailBox Configuration
EEPROM Size in Kbit - 1
Version Information
Category Strings
Category Generals
Category FMMU
Category SyncManager
Category Tx-/RxPDO for each PDO

10.3.2 Setting EEPROM recovery function

EEPROM's recovery function can be enabled by downloading the parameter through XG5000 or SDO parameter setting through the master.

(1) Enabling the recovery function using XG5000

Open the EtherCAT adapter project and execute the basic parameter. Put a check mark on [Set EEPROM RECOVERY function] among the basic parameter items and download the parameter.
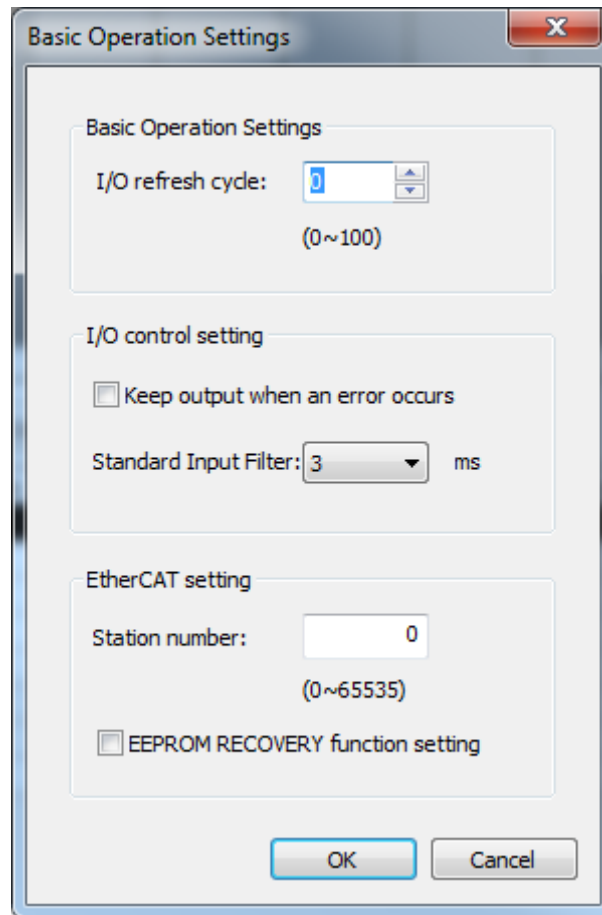
(2) Enabling the recovery function using the SDO service of the master

Set 1 for EEPROM_RECOVERY_MODE of [Basic parameter of EtherCAT adapter] in index [3000:06] among the slave CoE service items of the master. However, after the function is set through the master, the parameter should be saved permanently using the parameter SAVE function.

Flag	Area	Description
_EEPROM_RECOVERY_MODE	-	Enable/disable recovery mode

10.3.3 EEPROM recovery type

EEPROM's recovery is processed separately into three types according to the level of data damage.

(1) Critical error recovery

When a critical error has occurred, the whole data of EEPROM will be rewritten.At this time, data that becomes the standard is imported from data saved permanently in the OS to prevent forgery.

The case where a critical error occurs is a situation in which the Micro Controller and the EtherCAT Slave Controller cannot communicate with each other normally due to the forgery of [Slave Controller Configuration Area] occurs.If this error occurs, the EtherCAT function cannot be used.

(2) CRC value error recovery

The CRC value error recovery function loads controller setting from EEPROM when the EtherCAT Slave Controller boots up, and if CRC data is incorrect at this time, it will be judged as an error.

In such a case, the CRC value error recovery function operates, calculates the CRC value again and writes on only the CRC value area again.

(3) Recovery of general data error

For a general data error, it is the case that an error occurs in all parts except for items (1) and (2) above. Since this error is not critical to the operation but it may affect the operation, carry out the recovery from data saved in the OS permanently for preventing forgery.

10.3.4 EEPROM recovery diagnosis

If recovery is necessary or recovery is carried out due to EEPROM error, a flag is provided in order to notify the user. The flag is displayed even if EEPROM recovery function is not used, so if an error has occurred and an EEPROM error is suspected, it can be checked through this flag.

Flag	Area	Value	Description
_EEPROM_STATUS	%FW143	-	Word-type flag that allows the user to check the status of the EEPROM comprehensively
_EEPROM_RECOVERY_MODE	%FX2288	1	EEPROM recovery mode is enabled.
		0	EEPROM recovery mode is disabled.
_EEPROM_RECOVERY_EXECUTED	%FX2289	1	Data error has occurred when booting and the EEPROM recovery has been carried out.
		0	There is no data error or the recovery mode is disabled.
_EEPROM_PRIMARY_DATA_ERR	%FX2290	1	Abnormal data exists among critical data of EEPROM.
		0	Main data of EEPROM is normal.
_EEPROM_GENERAL_DATA_ERR	%FX2291	1	Abnormal data exists among general data of EEPROM.
		0	General data of EEPROM is normal.
_EEPROM_CRC_DATA_ERR	%FX2292	1	An error exists in CRC data of EEPROM.
		0	CRC data of EEPROM is normal.

10.3.5 Constraint condition

For data errors except for CRC value error, basic data saved in the OS for preventing forgery is used for recovery. Therefore, if the revision number of ESI(EtherCAT Slave Information) used currently for the EtherCAT master is different from the OS version of the EtherCAT adapter, communication may be unavailable. Match the ESI version or the OS version to be compatible.

10.4 Saving parameter

A parameter can be changed immediately through the SDO service of the master, but it is saved in volatile memory, so when the adapter is reset or the power is supplied again, all parameters set through the SDO will be deleted and the parameters backed up permanently will be loaded again. Therefore, if you wish to back up a parameter set as SDO permanently, you need to save the parameter. You can save the parameter set as the SDO service by entering 'SAVE' or 'save' on the Save parameter index in the index 1010 among the objects of the slave.

Notes
1) If the parameter cannot be saved for each slot, when the SAVE command is given, all parameters will be saved at the same time.   2) XG5000 has no Save parameter flag.   3) If a parameter is downloaded to XG5000, it will be saved in non-volatile memory, so SAVE is not necessary.   4) For relevant contents, refer to Chapter 9 of this user's manual.

10.5 Parameter initialization

Even if actions such as changing or saving a parameter permanently have been carried out, all parameters can be initialized using the parameter initialization function. In the parameter initialization, parameters will be written in the non-volatile memory that is preserved permanently, so a separate save process is not necessary. When the parameter initialization is carried out, initialized parameters will be loaded even if the system is reset or the power is supplied again. Parameter initialization can be applied for each slot, and it can be carried out through the following XG5000 flag or the SDO service.

10.5.1 XG5000 Flag

Flag	Area	Description
_PARAM_INIT_SLT_0	%FX2320	Initializes the parameter of No. 0 slot
_PARAM_INIT_SLT_1	%FX2321	Initializes the parameter of No. 1 slot
_PARAM_INIT_SLT_2	%FX2322	Initializes the parameter of No. 2 slot
_PARAM_INIT_SLT_3	%FX2323	Initializes the parameter of No. 3 slot
_PARAM_INIT_SLT_4	%FX2324	Initializes the parameter of No. 4 slot
_PARAM_INIT_SLT_5	%FX2325	Initializes the parameter of No. 5 slot
_PARAM_INIT_SLT_6	%FX2326	Initializes the parameter of No. 6 slot
_PARAM_INIT_SLT_7	%FX2327	Initializes the parameter of No. 7 slot

10.5.2 EtherCAT SDO Service

Name	Area	Description
_PARAM_INIT_SLT_0	2040:0A	Initializes the parameter of No. 0 slot
_PARAM_INIT_SLT_1	2040:0B	Initializes the parameter of No. 1 slot
_PARAM_INIT_SLT_2	2040:0C	Initializes the parameter of No. 2 slot
_PARAM_INIT_SLT_3	2040:0D	Initializes the parameter of No. 3 slot
_PARAM_INIT_SLT_4	2040:0E	Initializes the parameter of No. 4 slot
_PARAM_INIT_SLT_5	2040:0F	Initializes the parameter of No. 5 slot
_PARAM_INIT_SLT_6	2040:10	Initializes the parameter of No. 6 slot
_PARAM_INIT_SLT_7	2040:11	Initializes the parameter of No. 7 slot

10.6 Reset Function

If it is necessary to reset the EtherCAT slave, it can be reset through the SDO service without separate XG5000 connection. This reset is the function at the same level as the reset function in XG5000. This is the method to enter a character in order to prevent reset by simple incorrect input. When 'RSET' is entered on Write Only area, it will be reset immediately.

Name	Area	Description
_RESET_ADT	2040:2B	EtherCAT Adapter Overall Reset

10.7 Status diagnosis function

If it is difficult to check the detailed error for all slots every time, the error status of the relevant slot can be judged through the status diagnosis flag. If an error has occurred on the slot, the relevant flag will be 'ON'. For detailed error diagnosis, check XG5000 or the error code for each module.

10.7.1 XG5000 Flag

Name	Area	Description
_EXT_ERR_FLAG_0SLT	%FX2336	An error occurred at No. 0 slot
_EXT_ERR_FLAG_1SLT	%FX2337	An error occurred at No. 1 slot
_EXT_ERR_FLAG_2SLT	%FX2338	An error occurred at No. 2 slot
_EXT_ERR_FLAG_3SLT	%FX2339	An error occurred at No. 3 slot
_EXT_ERR_FLAG_4SLT	%FX2340	An error occurred at No. 4 slot
_EXT_ERR_FLAG_5SLT	%FX2341	An error occurred at No. 5 slot
_EXT_ERR_FLAG_6SLT	%FX2342	An error occurred at No. 6 slot
_EXT_ERR_FLAG_7SLT	%FX2343	An error occurred at No. 7 slot

10.7.2 EtherCAT SDO Service

Name	Area	Description
_EXT_ERR_FLAG_0SLT	2040:1A	An error occurred at No. 0 slot
_EXT_ERR_FLAG_1SLT	2040:1B	An error occurred at No. 1 slot
_EXT_ERR_FLAG_2SLT	2040:1C	An error occurred at No. 2 slot
_EXT_ERR_FLAG_3SLT	2040:1D	An error occurred at No. 3 slot
_EXT_ERR_FLAG_4SLT	2040:1E	An error occurred at No. 4 slot
_EXT_ERR_FLAG_5SLT	2040:1F	An error occurred at No. 5 slot
_EXT_ERR_FLAG_6SLT	2040:20	An error occurred at No. 6 slot
_EXT_ERR_FLAG_7SLT	2040:21	An error occurred at No. 7 slot

10.7.3 EtherCAT PDO Service

An error flag is also provided as PDO in order to be updated always without separate access to CoE from the master.

PDO Name	Description
_EXT_ERR_FLAG_0SLT	An error occurred at No. 0 slot
_EXT_ERR_FLAG_1SLT	An error occurred at No. 1 slot
_EXT_ERR_FLAG_2SLT	An error occurred at No. 2 slot
_EXT_ERR_FLAG_3SLT	An error occurred at No. 3 slot
_EXT_ERR_FLAG_4SLT	An error occurred at No. 4 slot
_EXT_ERR_FLAG_5SLT	An error occurred at No. 5 slot
_EXT_ERR_FLAG_6SLT	An error occurred at No. 6 slot
_EXT_ERR_FLAG_7SLT	An error occurred at No. 7 slot

Chapter 11 Example of EtherCAT Usage

11.1 Overview
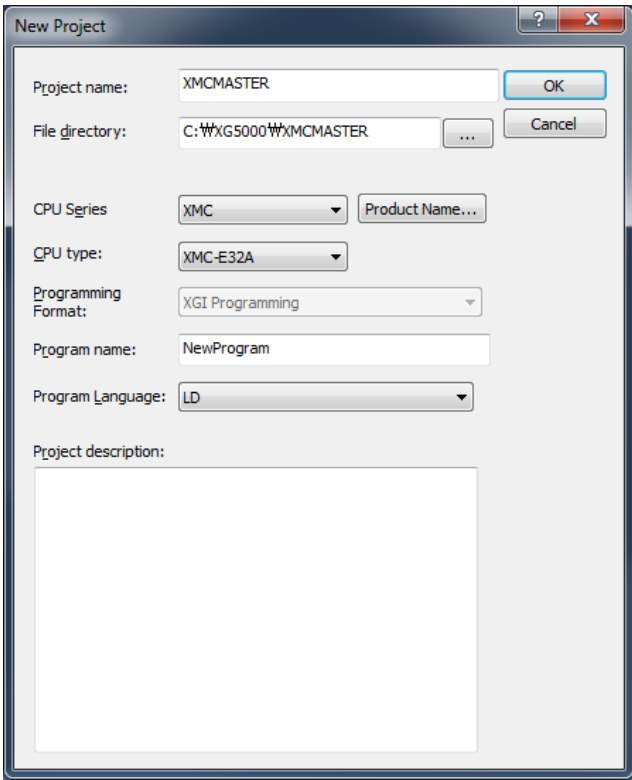
In this chapter, an explanation of an example of usage to configure the network by connecting the EtherCAT master and the EtherCAT adapter (hereinafter referred to as the EtherCAT adapter) is provided. Follow this example and learn how to configure the EtherCAT network and use the product. In this example, XMC-E32A which is our EtherCAT master product and Beckhoff's TwinCAT Master.

11.2 Example of network configuration using XMC-E32A

The example of basic usage to configure the network using XMC-E32A which is our EtherCAT master product and the EtherCAT adapter is explained. In the example, the XBE-TN32A output module is mounted and used on the EtherCAT adapter.

11.2.1 Configuration of XMC-E32A master

1	
	(1) Select [Project] → [New Project]. (2) Specify the project name and the file location. (3) Select [XMC] for [CPU Series] and select [XMC-E32A/C] for [CPU Type]. (4) Check each item and if there is no abnormality, press OK to complete the creation of a new project finally.
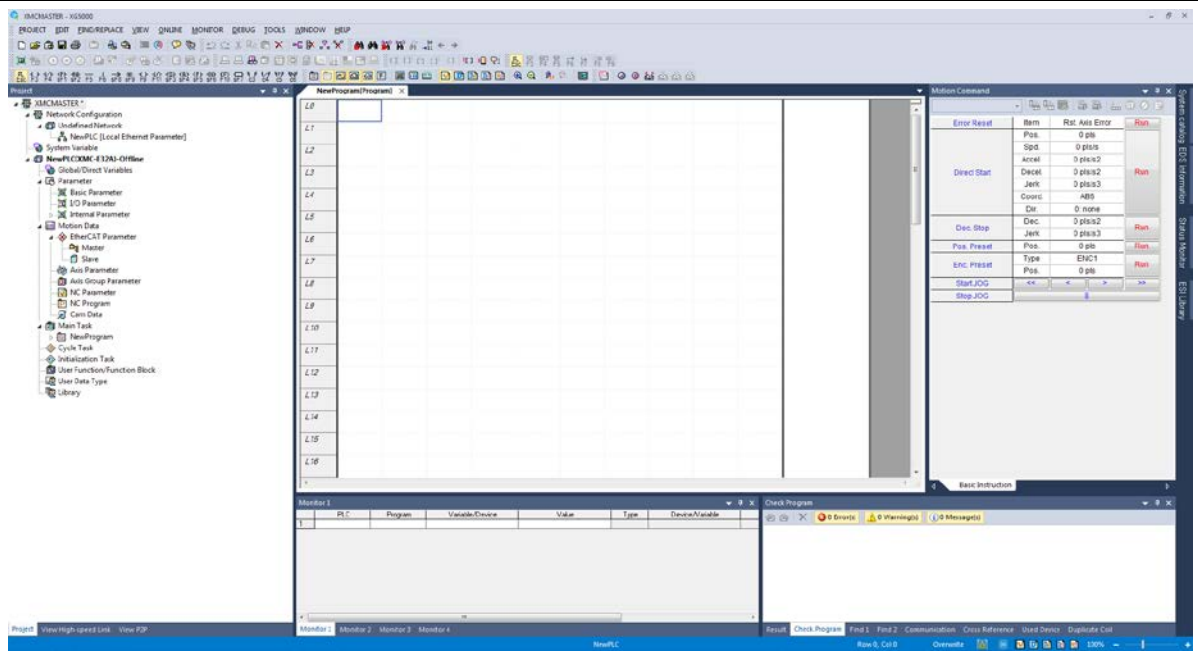
2	
	(1) When a new project has been created, the above screen will be displayed.
	※ The screen may vary according to the XG5000 window setting of the user, and layout can be initialized through [Window] → [Reset the layout of window] on the top menu bar.
3	
	(1) Expand the [Motion Data] tree on the left project tab.
	(2) Expand the [EtherCAT Parameter] tree.
	(3) Press the [Slave] item with the right mouse button and select [Add Item] → [Add Slave...].
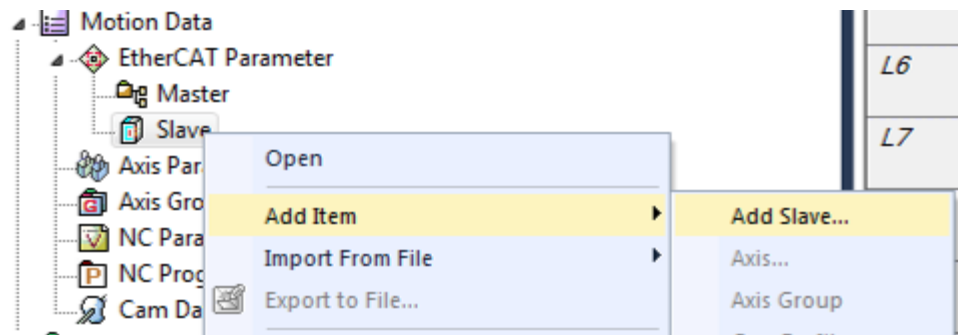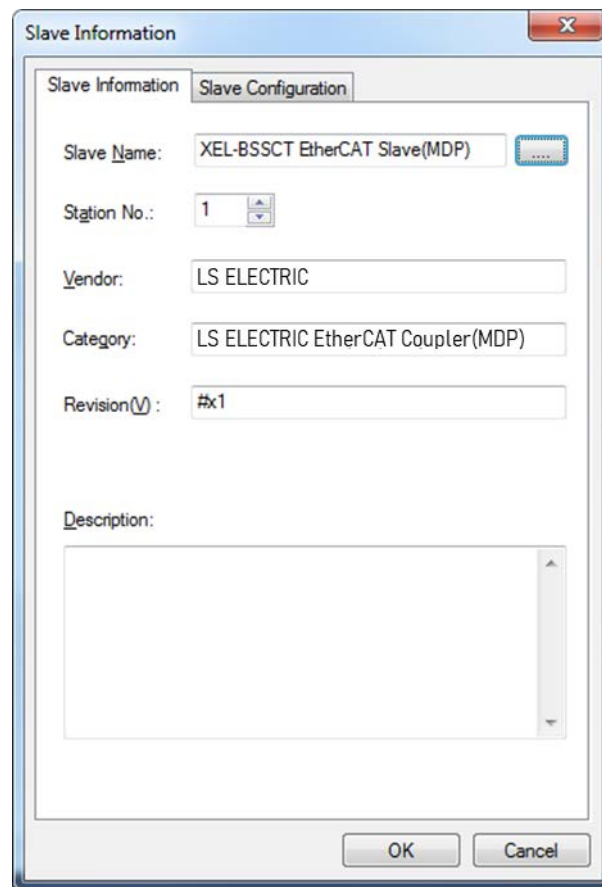
4	
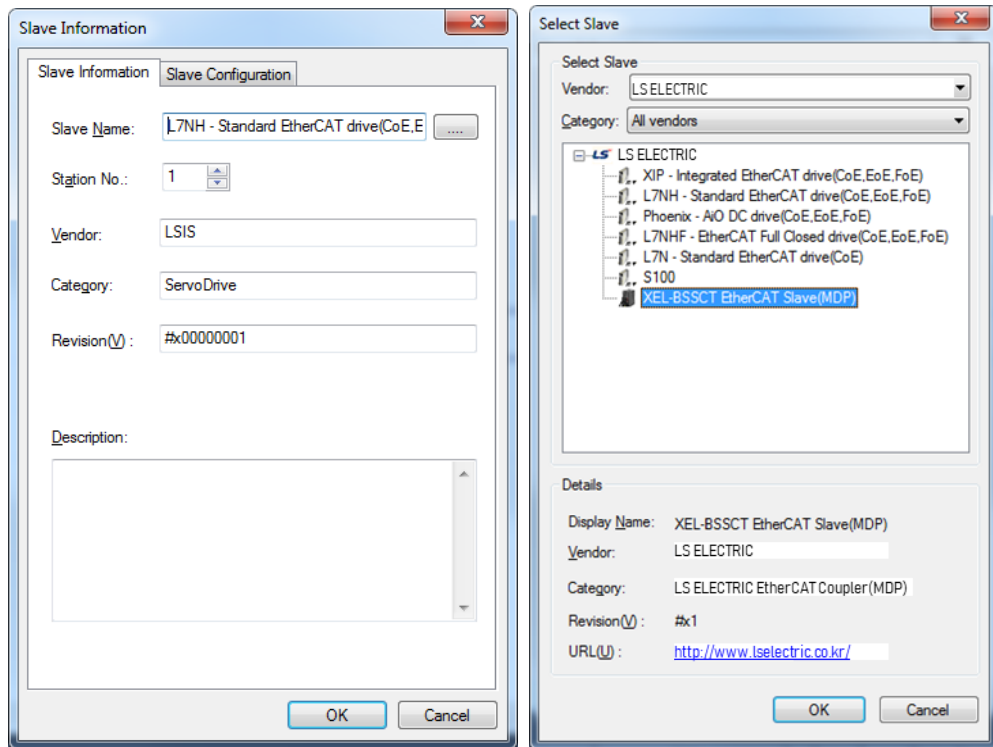
(1) Click the [....] Button on the right side of [Slave Name] in the [Slave Information] window with the left mouse button.

(2) Select LS ELECTRIC for the supplier from the Select Slave screen.

(3) Select EtherCAT Adapter EtherCAT Slave(MDP) and press OK to finish.

※ If the EtherCAT adapter is not displayed, install the latest XG5000 or download the latest ESI file of the EtherCAT

adapter from the archives of our homepage to the EtherCATXML folder in the folder where XG5000 is installed and

execute XG5000 again and check.

5	
	(1) Check if the slave name has been changed to EtherCAT Adapter EtherCAT Slave(MDP). (2) Enter the value set for the rotary switch of the EtherCAT adapter on the Station Address field. ※ XMC-E32A only supplies Explicit ID identification.
6	
	(1) If the slave has been added normally, it will be stated as shown above.
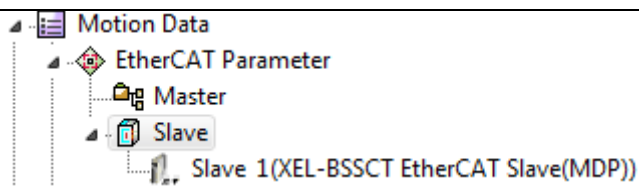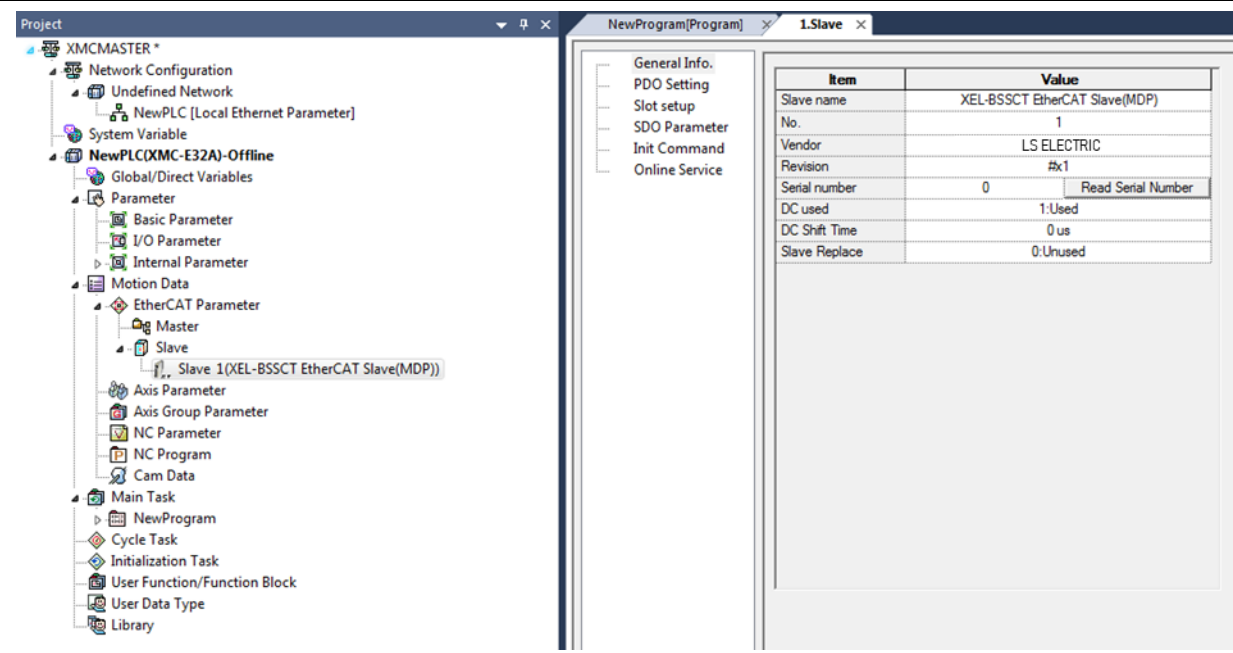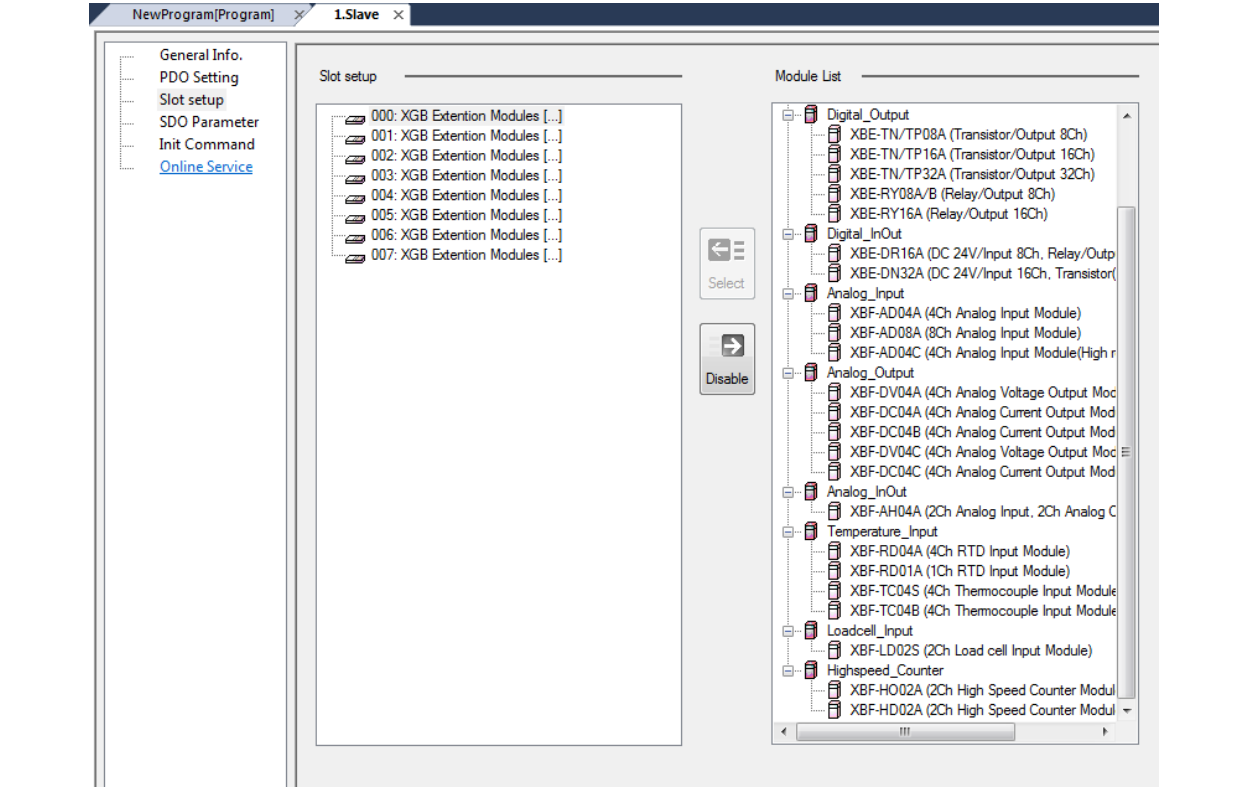
7	
	(1) Double click the EtherCAT adapter.
	(2) The slave tab will be created on the right side.
8	
	(1) Select the [Set Slot] menu from the menus on the created slave tab.
	(2) The window for setting slots from 000 to 007 will be created.
	(3) In the example, only XBE-TN32A is mounted on No. 0 slot, so insert XBE-TN32A to No. 0 slot.
	(4) If a different configuration is used, complete the slot information with the same configuration with the module currently mounted on the EtherCAT adapter.

9	
	(1) The slot configuration has been completed.
10	
	(1) Connect to the master using XG5000 in order to write the set parameters on the master.
	(2) Select [Online] → [Connection Settings] from the menu bar and set [USB] and [Local] for the connection option.
	(3) When the setting has been completed, connect to the master by pressing Connect.

11	

(1) Import the parameter to XMC-E32A through [Online]→[Write] from the top menu bar.
(2) The basic preparation process of the master to connect to the slave has been completed.
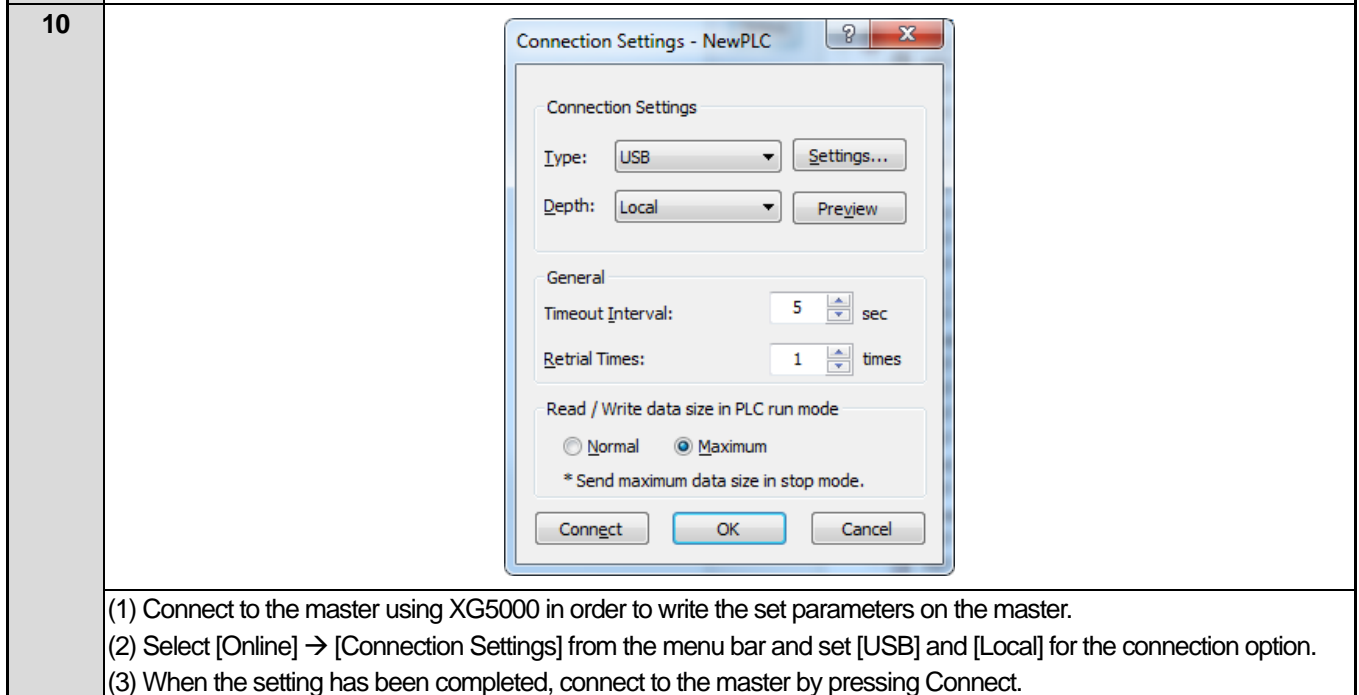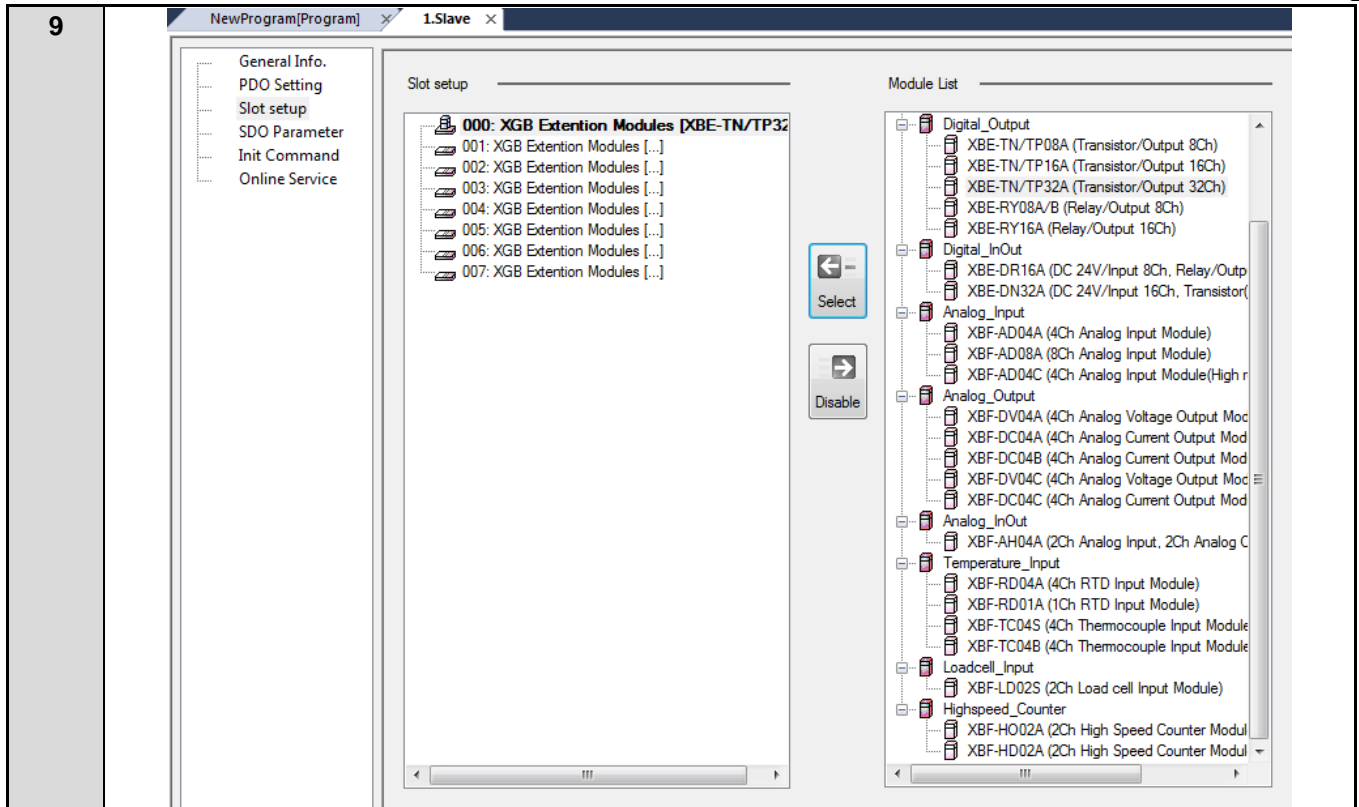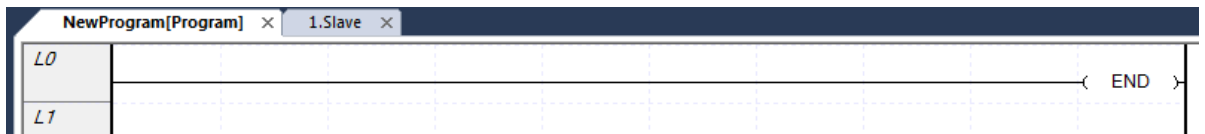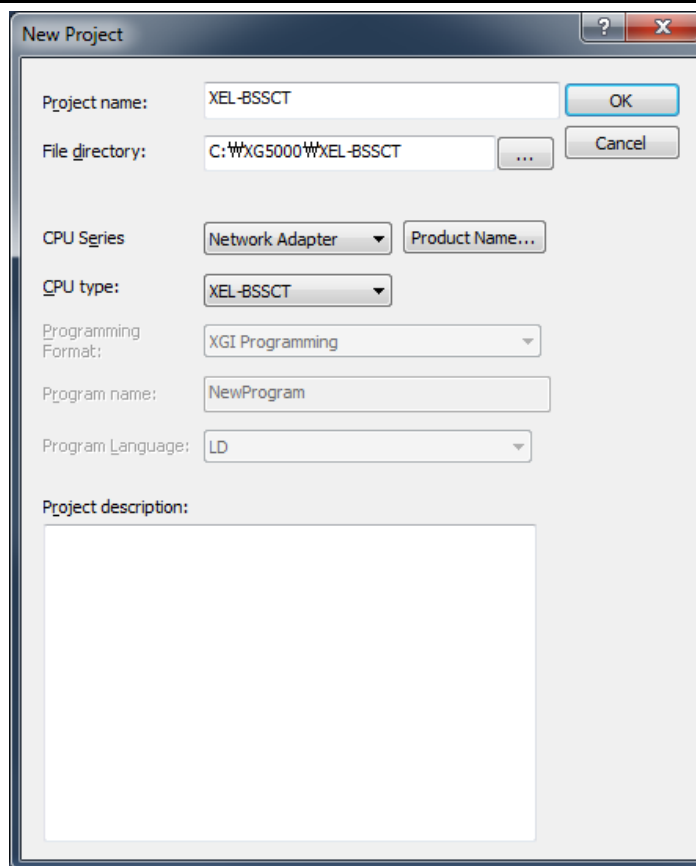
※ If a parameter cannot be downloaded, check the program inspection window and solve all errors or warnings. This example has no task program setting, so you can proceed by inserting the End function to the task program.

11.2.2 Setting of EtherCAT adapter slave

1	
	(1) The EtherCAT adapter supports two identification methods. (2) The rotary switch is used as the Explicit ID, and the station address set as the parameter is used as the Station Address. (3) Since XMC only supports the Explicit ID, the station address should set to the rotary switch. (4) Set 01 for the station address.

2	
	(1) Execute XG5000.
	(2) Select [Project] → [New project] from the top menu and create a new project of XEL-BSSCT.
3	
	(1) Open the I/O parameter window and insert XBE-TN32A into No. 0 slot.

4	
	(1) Connect to the master using XG5000 in order to write the set parameters on the master. (2) Select [Online] → [Connection Settings] from the menu bar and set [USB] and [Local] for the connection option. (3) When the setting has been completed, connect to XEL-BSSCT by pressing Connect. (4) Write the parameter by pressing [Online] → [Write].
5	(1) If additional setting of EtherCAT slave is necessary according to the user's needs, connect the USB cable to the EtherCAT adapter, connect to the XG5000 and carry out setting. In this example, the network configuration is available without separate XG5000 connection and setting, you just need to proceed continuously according to the example.

11.2.3 Connection (Manual Connection)
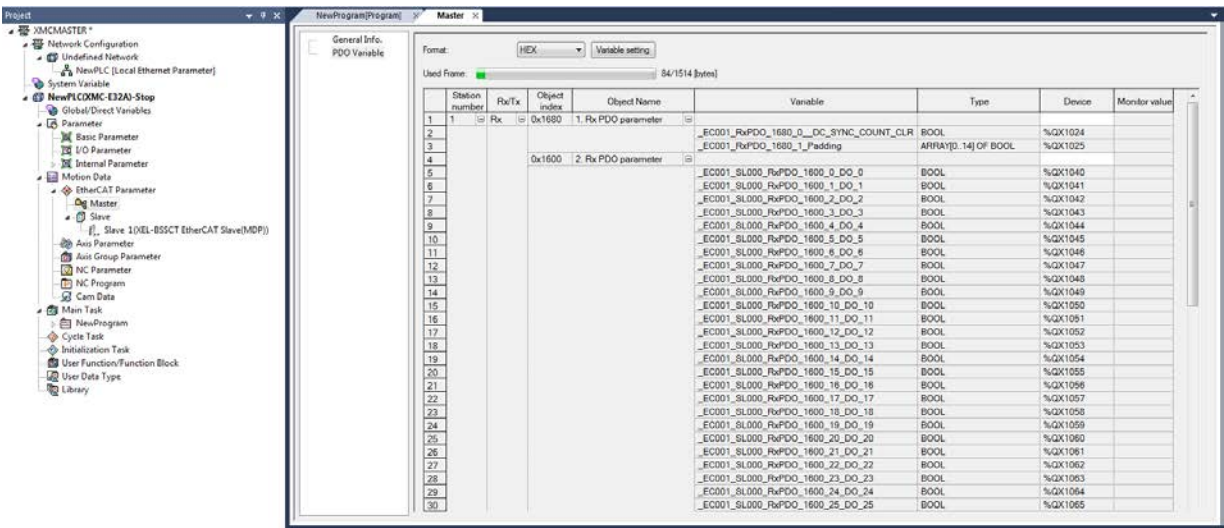
1	
	(1) Open the XG5000 master project. (2) Connect to the master by pressing [Online] → [Connect] from the top menu. (3) Check if XMC-E32A is in STOP state currently, and if it is in RUN state, switch its state to STOP state. (4) Select [Online] → [EtherCAT slave] → [Connect] from the top menu.
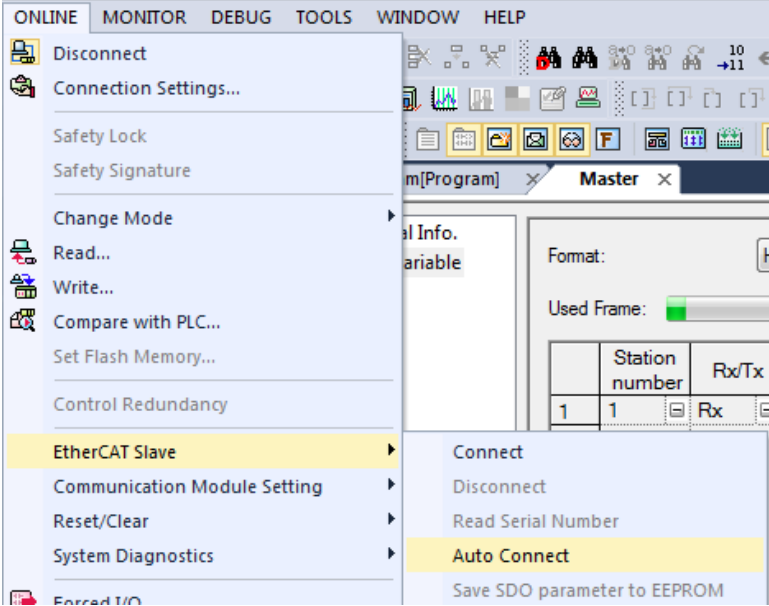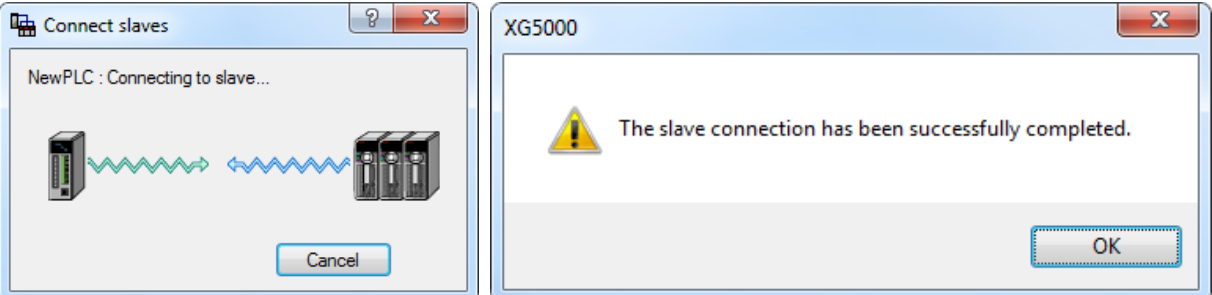
2	
	(1) A slave connection pop-up will be displayed, attempting to connect. (2) When the connection is completed, a pop-up message saying that the connection to the slave has been completed successfully will be displayed as shown above.
3	
	(1) [Double click] the master menu from the left project tab for simple operation check. (2) The master tab is newly created on the right side. Select [PDO Variable Information]. (3) Check a device is assigned automatically to the RxPDO of the output module. (4) In this example, the device has been assigned from QX1024 to QX1055.
4	
	(1) Switch the master to [RUN] mode. (2) When it is switched to RUN mode, register a device in the variable monitor window at the bottom. (3) Change the device value on the monitor window to see if the relevant bit is ON for the output module.
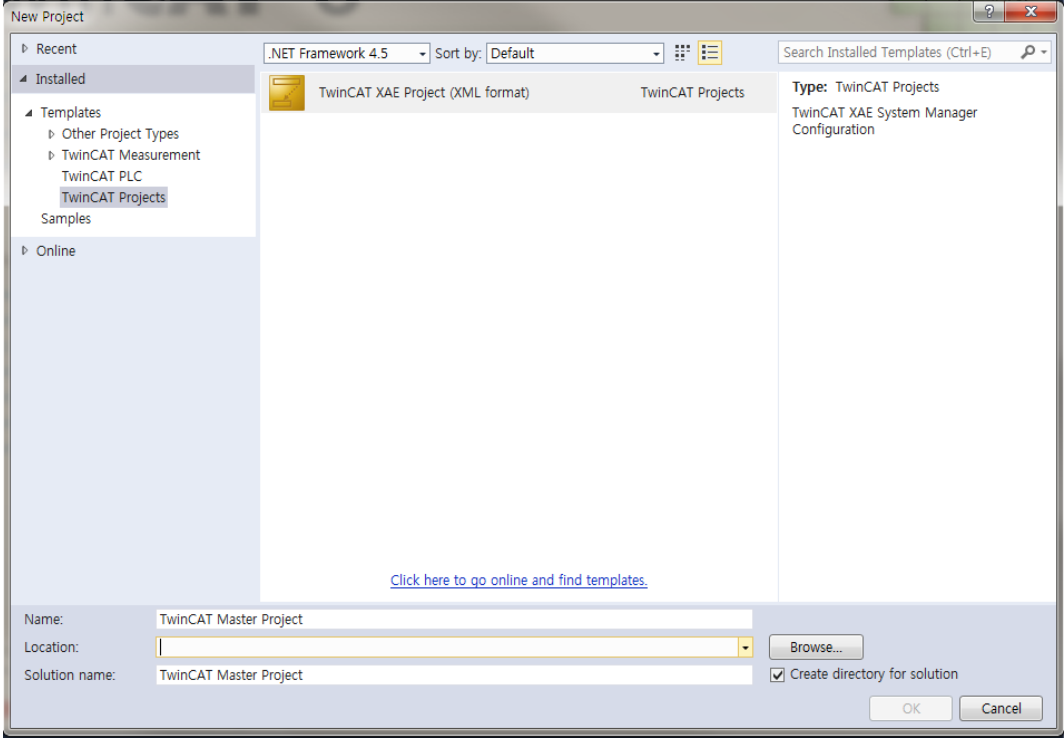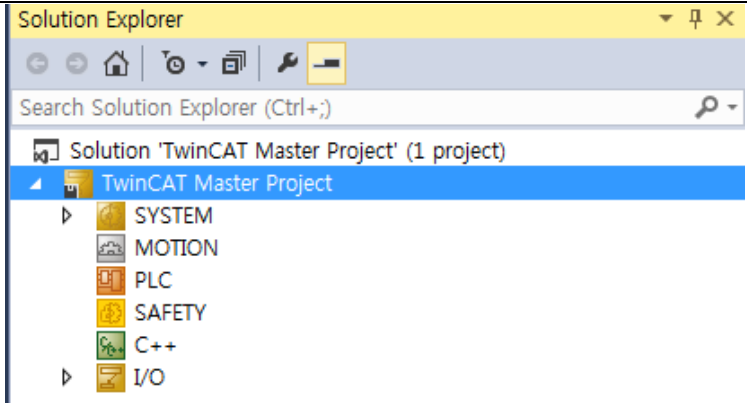
11.2.4 Connection (Automatic Connection)
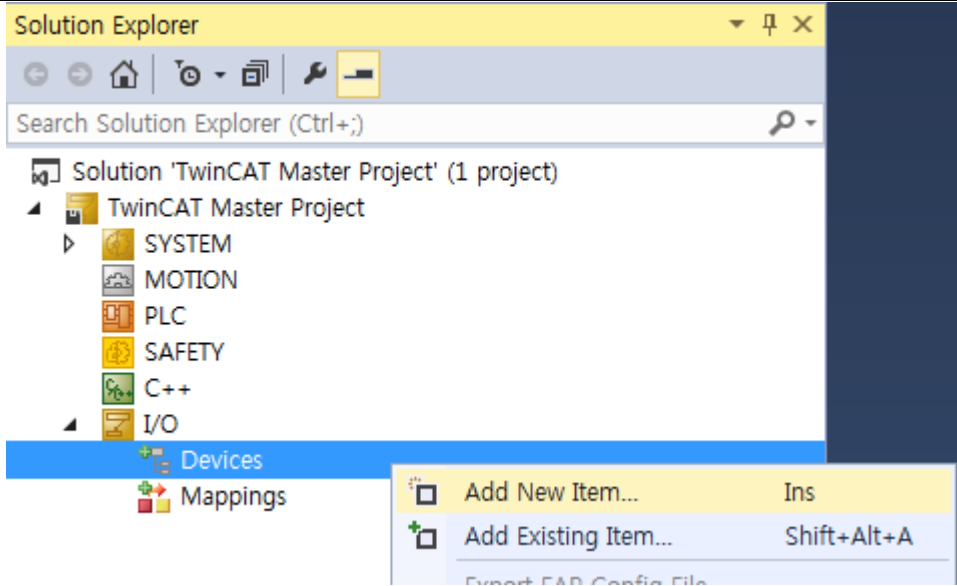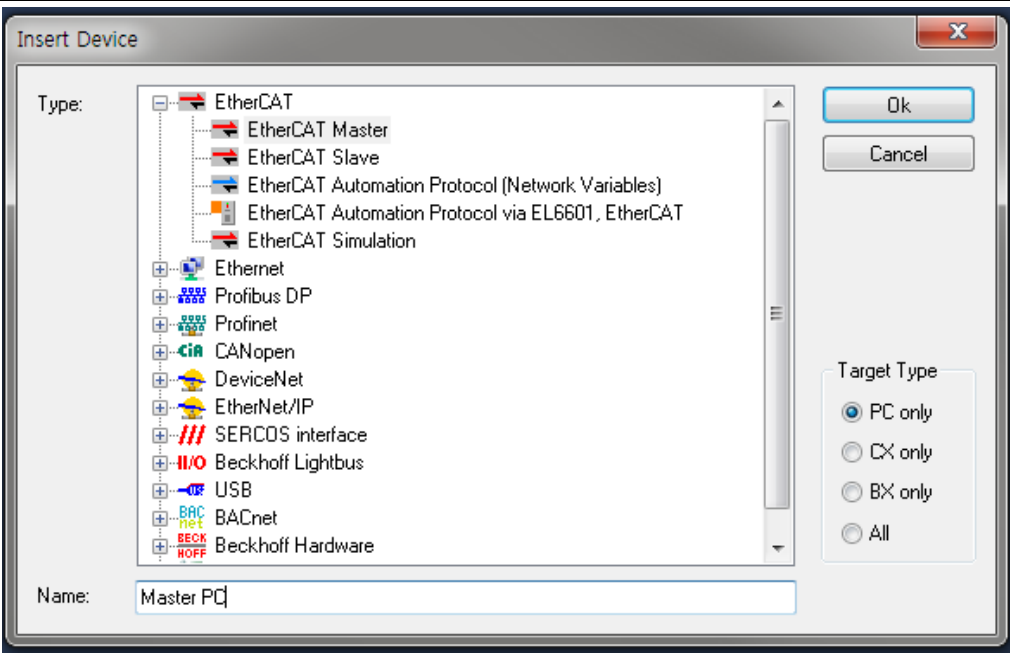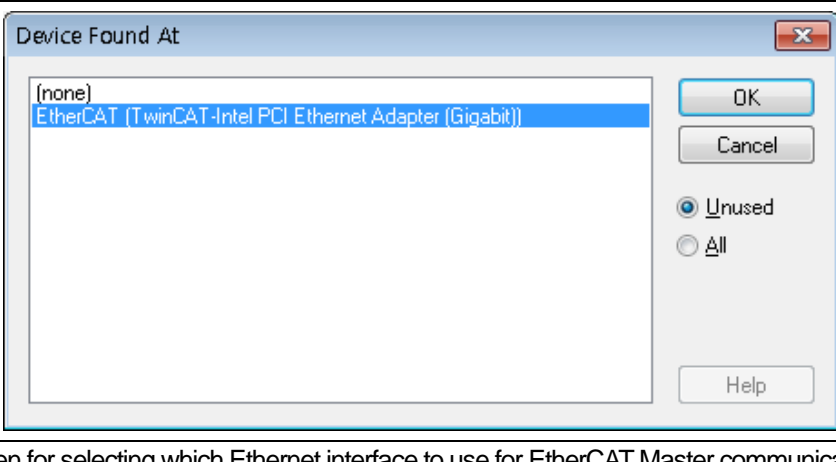
1	
	(1) Automatic connection is carried out on the condition that up to No. 2 in 11.2.1 has been carried out.
	(2) It is carried out on the condition that the master is connected using the XG5000 while nothing is set related to the slave.
	(3) Check if the XMC-E32A is in the STOP state, and if it is in the RUN state, change its state to the STOP state.
	(4) In STOP state, select [Online] → [EtherCAT slave] → [Automatic Connection].
2	
	(1) A slave connection pop-up will be displayed, attempting to connect.
	(2) When the connection is completed, a pop-up message saying that the connection to the slave has been completed successfully will be displayed as shown above.
3	(1) When the connection to the slave has been completed, the slave will be added automatically.
	(2) In the next step, carry out the process such as manual connection and check if the system operates normally.

11.3 Example of network configuration using TwinCAT

An explanation of a basic usage example to configure the EtherCAT adapter and the EtherCAT network using the Master function of Beckhoff's TwinCAT is provided.

11.3.1 Setting of TwinCAT master

1	
	(1) Execute the installed TwinCAT. (2) Select [FILE] → [NEW] → [Project] from the top menu. (3) When the New Project window is created, select [TwinCAT Projects]. (4) Create a project using [TwinCAT XAE Project (XML format)].
2	
	(1) When a new project is created, the solution explorer structure will be created as shown below.

3	
	(1) Expand the [I/O] tree. (2) Click [Devices] below [I/O] with the right mouse button and select [Add New Item].
4	
	(1) In order to operate as the master, select EtherCAT Master and press [OK].
5	
	(1) This is the screen for selecting which Ethernet interface to use for EtherCAT Master communication.

	(2) Select the network card you wish to use and press [OK].
6	 (1) When the master has been added, the master will be displayed as shown above.
7	 (1) To add a slave, click EtherCAT master with the right mouse button and select [Add New Item].
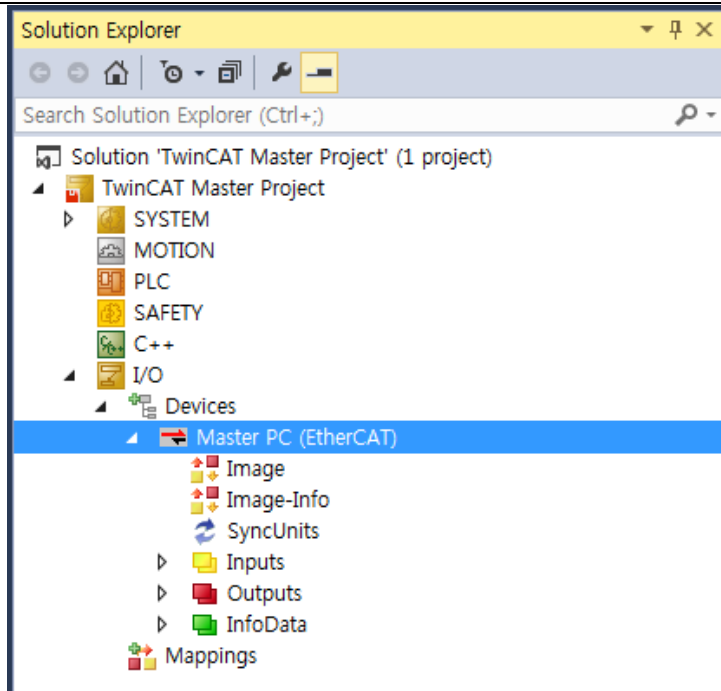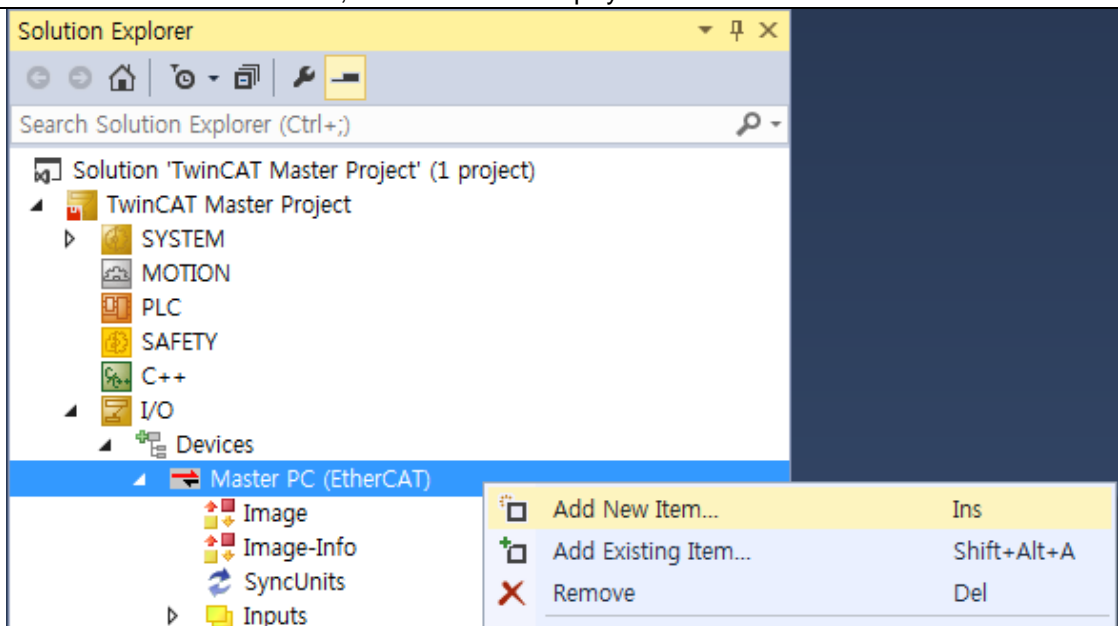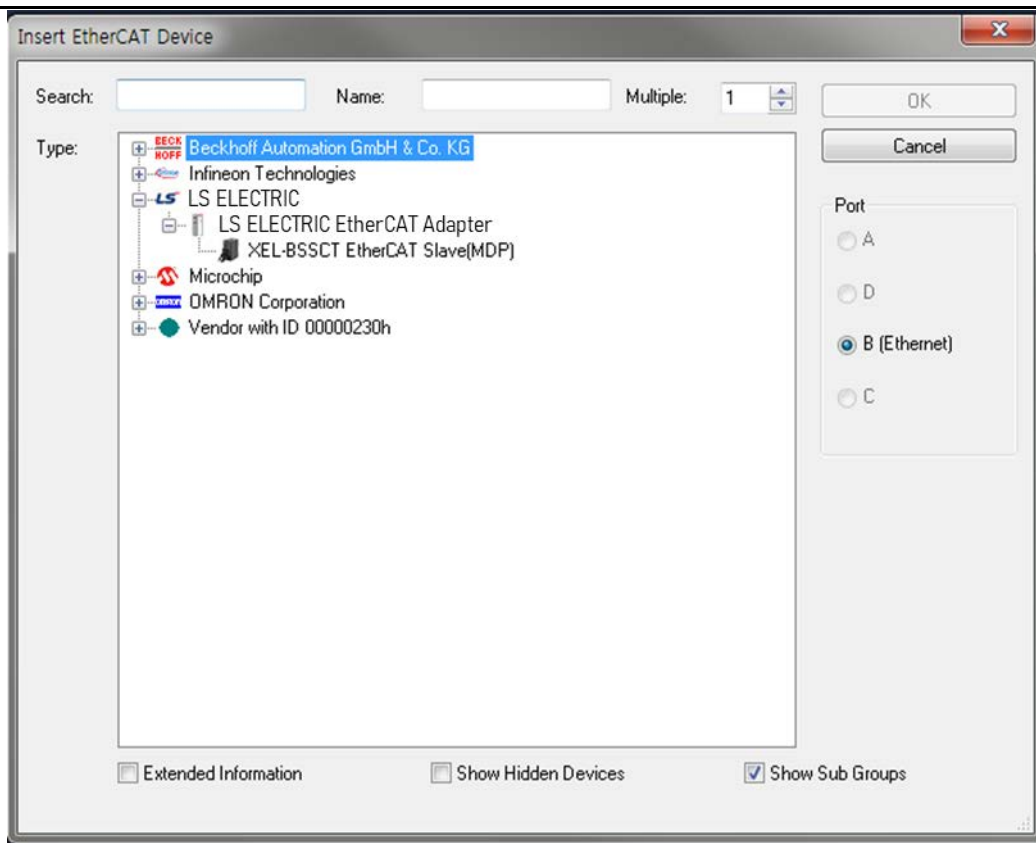
8	
	(1) When the [Insert EtherCAT Device] window is created, select the EtherCAT adapter from the LS ELECTRIC tree and press [OK].
	※ If the EtherCAT adapter is not displayed, download the latest ESI file of theEtherCAT adapter from the download center at our homepage to the following path in the folder where TwinCAT is installed and execute TwinCAT again and check if it is displayed.
	'Example of path: C:\TwinCAT\3.1\Config\Io\EtherCAT'
9	
	(1) Create the slave tab by [double clicking] the added slave.
	(2) Move to the slot tab of the created slave tab.
	(3) In the example, only XBE-TN32A is mounted on No. 0 slot, so insert XBE-TN32A to No. 0 slot.
	(4) If a different configuration is used, complete the slot information with the same configuration with the module currently mounted on the EtherCAT adapter.
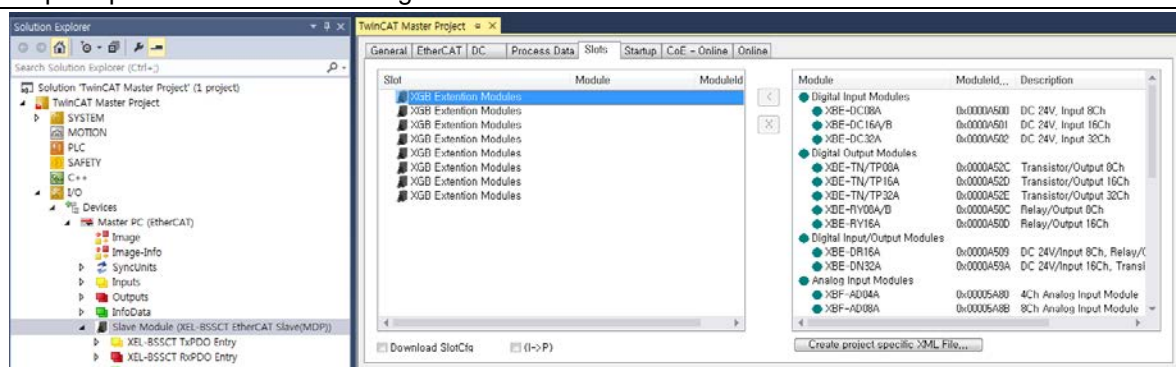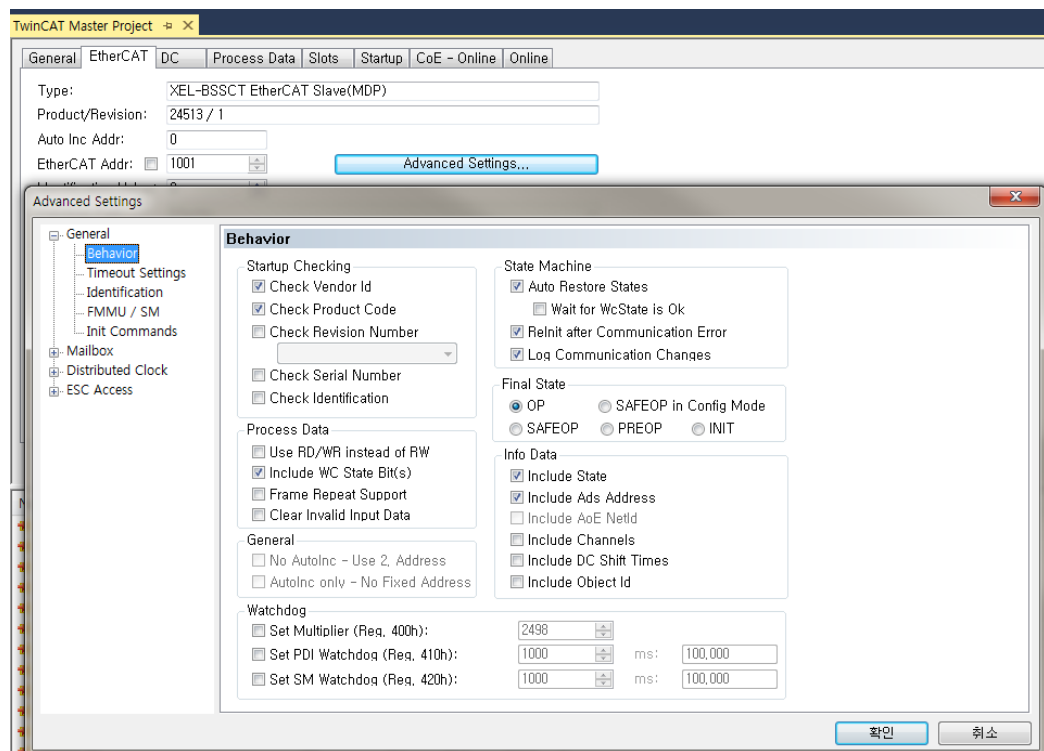
10	
	(1) To specify the slave identification method, select the [EtherCAT] tab from the slave screen and execute the Advanced Settings.
11	
	(1) Put a check mark on [Check Identification] from [General] → [Behavior]. (2) Select [Explicit Device Identification] from [General] → [Identification].
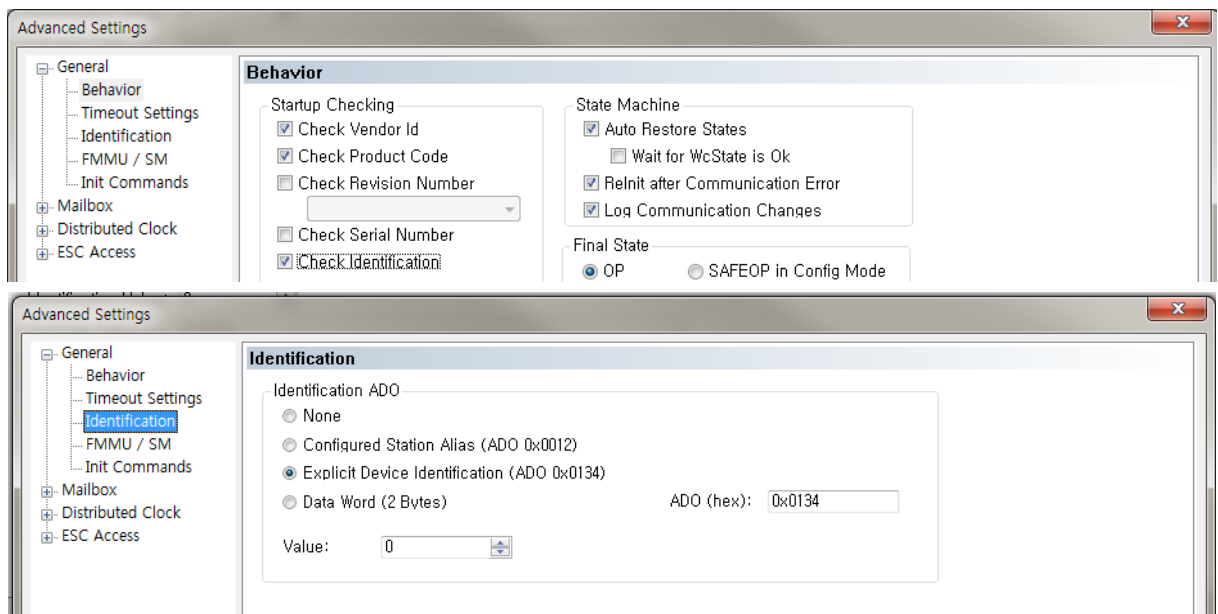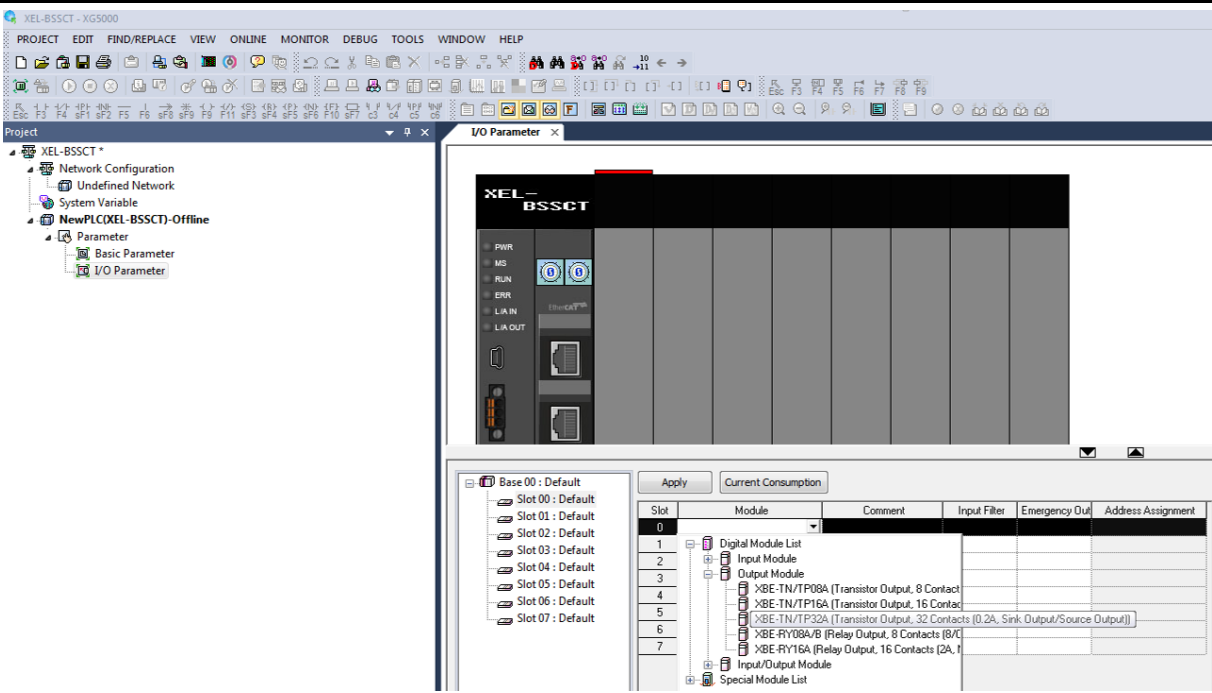
12	
	(1) After exiting from Step 11 above by pressing OK, enter 1 for Identification Value on the EtherCAT tab. '1' is the rotary switch value set for the EtherCAT adapter. (2) If the rotary switch value is different, enter the relevant value.

11.3.2 Setting of EtherCAT adapter slave

1	
	(1) The EtherCAT adapter supports two identification methods.
	(2) The rotary switch is used as the Explicit ID, and the station address set as the parameter is used as the Station Address.
	(3) Since XMC only supports the Explicit ID, the station address should set to the rotary switch.
	(4) Set 01 for the station address.
2	
	(1) Execute XG5000.
	(2) Select [Project] → [New project] from the top menu and create a new project of XEL-BSSCT.

3	
	(1) Open the I/O parameter window and insert XBE-TN32A into No. 0 slot.
4	
	(1) Connect to the master using XG5000 in order to write the set parameters on the master. (2) Select [Online] → [Connection Settings] from the menu bar and set [USB] and [Local] for the connection option. (3) When the setting has been completed, connect to XEL-BSSCT by pressing Connect. (4) Write the parameter by pressing [Online] → [Write].
5	(1) If additional setting of EtherCAT slave is necessary according to the user's needs, connect the USB cable to the EtherCAT adapter, connect to the XG5000 and carry out setting. In this example, the network configuration is available without separate XG5000 connection and setting, you just need to proceed continuously according to the example.

11.3.3 Connection

1	
	(1) Execute Restart TwinCAT from TwinCAT.
2	
	(2) Check if both the master and the slave are in OP state.

3		
	(3) In order to check the operation, select RxPDO of the relevant slot, set 'ON' for any bit and check if the bit is actually outputted.	

11.4 Example of parameter setting through SDO

This is an example of changing a parameter of the extension module through the SDO service.

In this example, an explanation of an example to change the parameter through XMC-E32A is provided.

11.4.1 Reading the current parameter

1	
	(1) Open [slave] from the master project and check [SDO parameter].
	(2) It increases by 10 from index 8000, indicating the parameter of each slot.
2	
	(1) Select [Online] → [EtherCAT slave] → [Read SDO...] from the top menu.

3	
	(1) When reading is completed, the current parameter value on the non-volatile memory for the whole extension will be read.
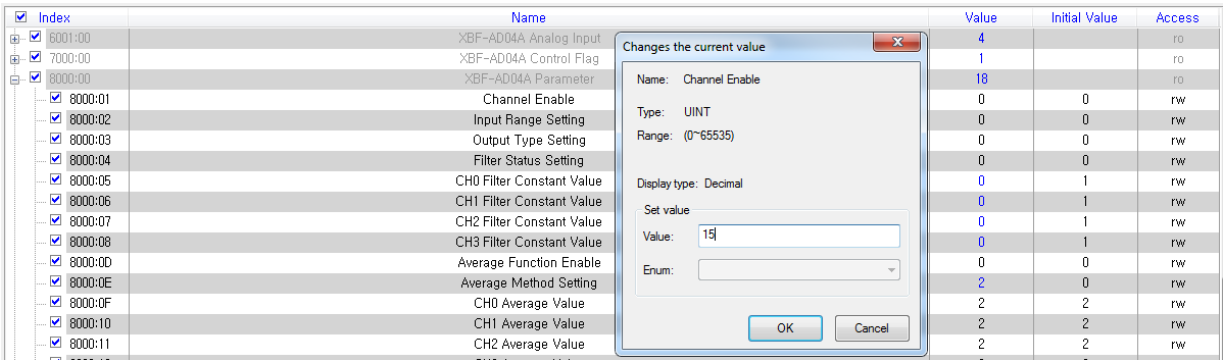
11.4.2 Writing a parameter
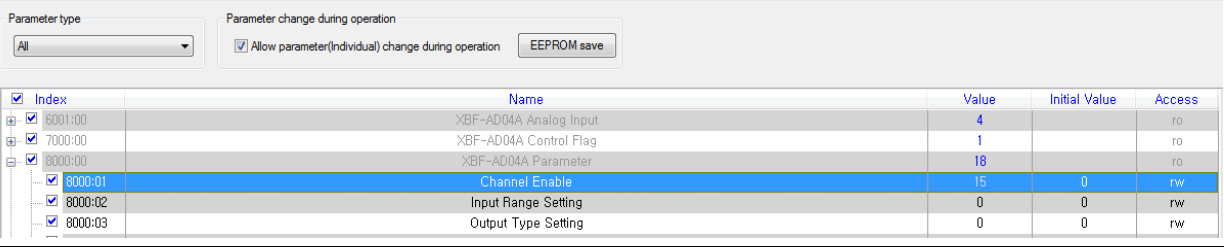
1	
	(1) In order to change each parameter separately, put a check mark on Allow parameter (Individual) change during operation.
2	
	(1) Change the parameter to enable all channels of the XBF-AD04A. (2) Double click the relevant parameter and enter a decimal number.
3	
	(1) The parameter has been changed to 15, and when the parameter is read in the same way with 11.4.1, 15 will be read. (2) However, the current parameter is saved in volatile memory, so when the EtherCAT adapter is rebooted, all changed parameters will become volatile.
4	
	(1) If you wish to set a number of parameters of the parameter or a number of modules of parameter together,
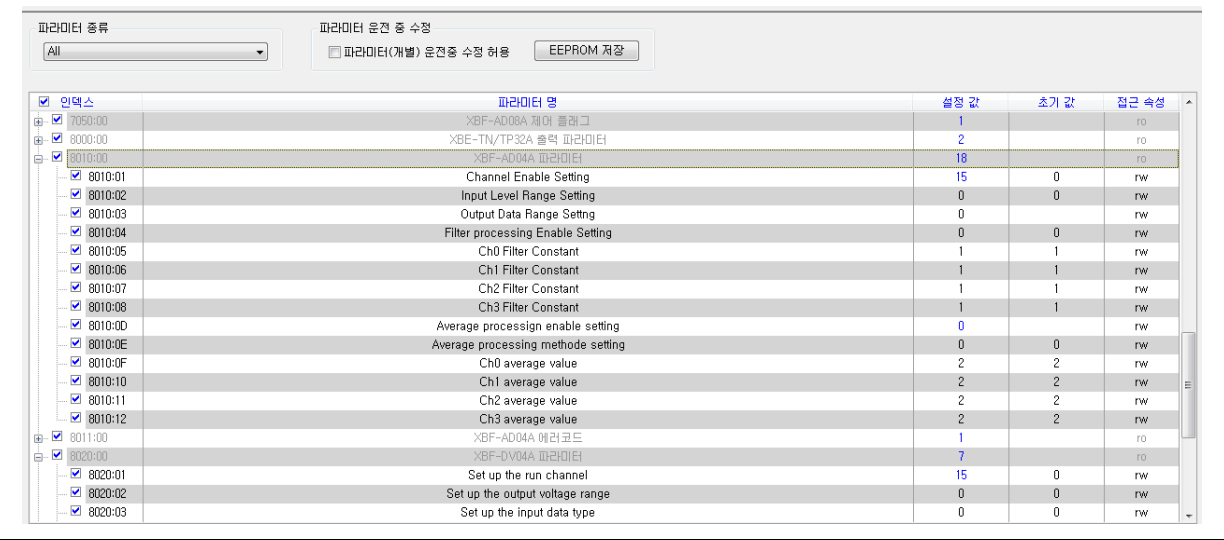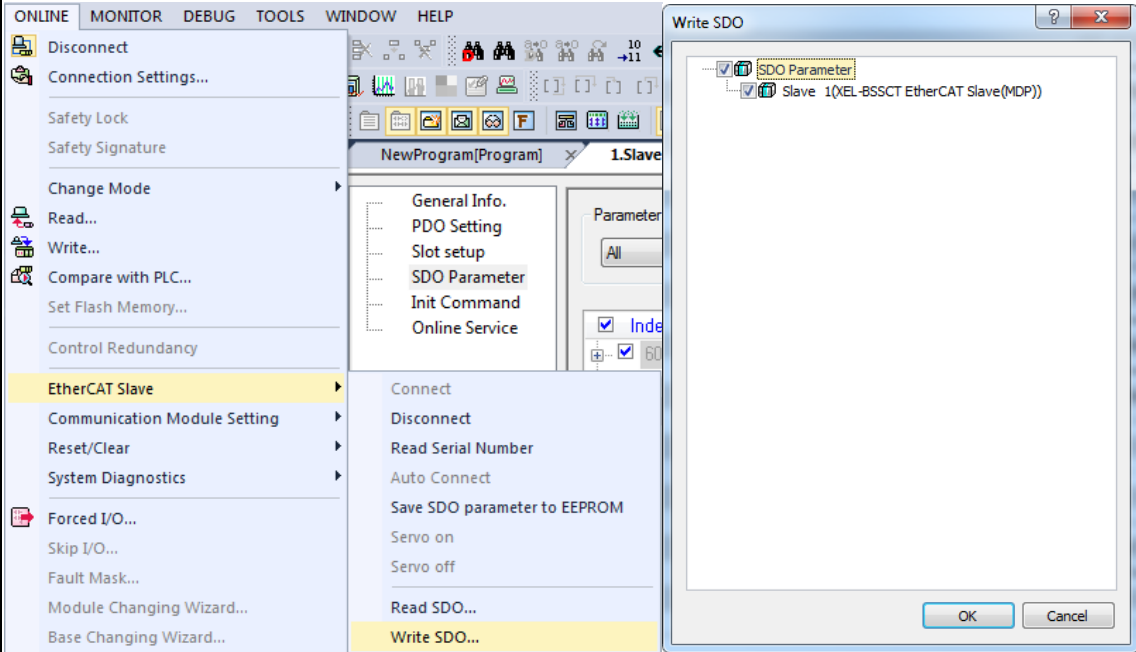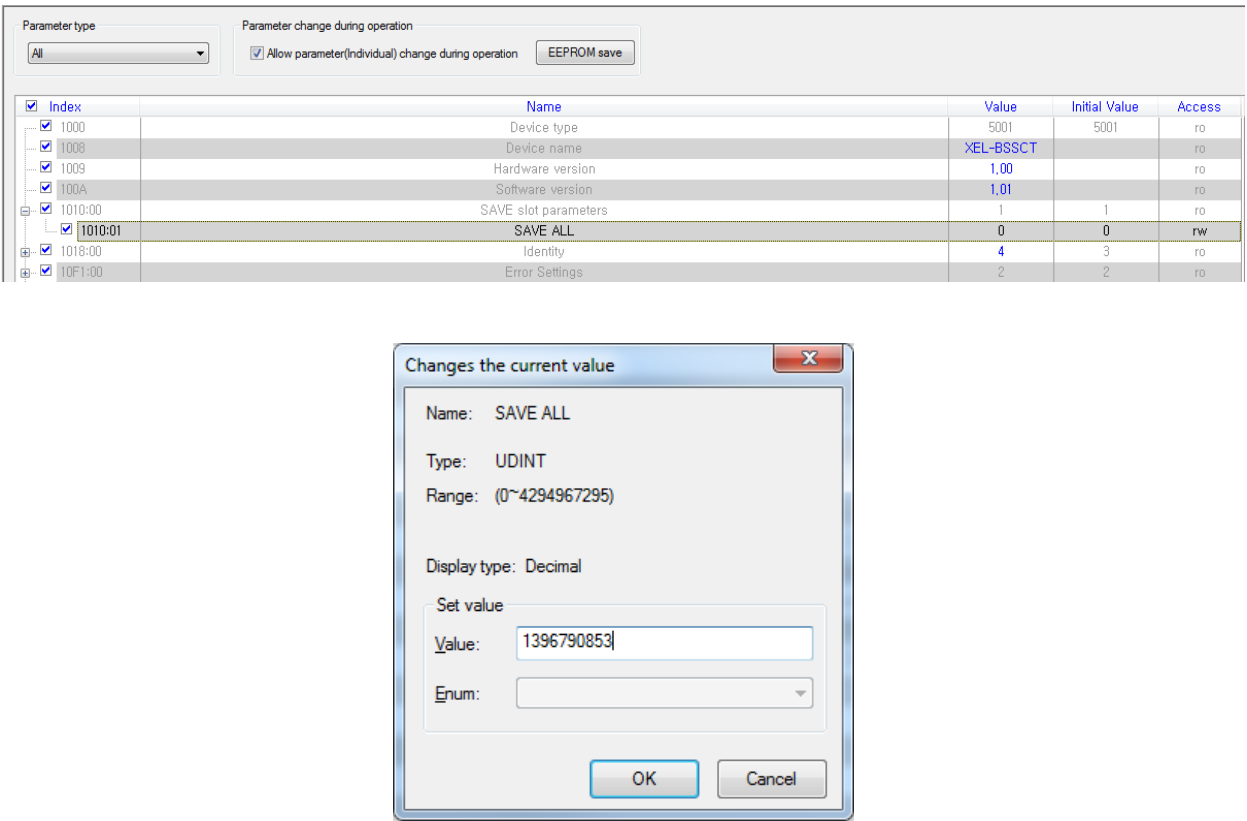
5	deselect [Allow parameter (Individual) change during operation].
	(2) Change the parameters you wish to change.
	(1) After setting the parameters, execute [Online] → [EtherCAT slave] → [Write SDO...] from the top menu.
	(2) The relevant parameters are also saved in the volatile area, so when the EtherCAT adapter is rebooted, all parameters will become volatile.

11.4.3 Saving a parameter permanently

(1) This is the method to move to a parameter saved in the volatile area to the non-volatile area and save it permanently.

(2) Put a check mark on [Allow Edit of Parameter (Separate) Active].

(3) Enter 'save' or 'SAVE' on the SAVE ALL parameter in the index 1010 area.

(4) Since a character cannot be entered, enter '1396790853' as a decimal value.

(5) Now, if you reboot the EtherCAT adapter, the changed parameter value will be backed up and read permanently.

Appendix 1 List of Flags

Word	Bit	Variable	Function	Description
%FW0~1	%FD0	_SYS_STATE	State	Indicates the state of PLC.
	%FX0	_RUN	RUN	Indicates the Run state.
	%FX1	_STOP	STOP	Indicates the Stop state.
	%FX2	_ERROR	ERROR	Indicates the Error state.
%FW2~3	%FD1	_CNF_ER	System error	Reports the critical error state of system.
	%FX33	_IO_TYER	Module type error	Module type does not match.
	%FX34	_IO_DEER	Module detachment error	The module has been detached.
	%FX36	_IO_RWER	Module I/O error	A problem has occurred in module I/O.
	%FX37	_IP_IFER	Module interface error	A problem has occurred in special and communication module interface.
	%FX40	_BPRM_ER	Basic parameter	The basic parameter is abnormal.
	%FX41	_IOPRM_ER	IO parameter	IO configuration parameter is abnormal.
	%FX42	_SPPRM_ER	Special module parameter	The special module parameter is abnormal.
	%FX46	_SWDT_ER	Abnormal termination or failure of CPU	Abnormal failure has occurred in CPU.
	%FX53	_IO_OVER_ER	Extension module excess	The number of extension modules that can be mounted has been exceeded.
%FW4~5	%FD2	_CNF_WAR	System warning	Reports the light error state of the system.
	%FX92	_CONSTANT_ER	Refresh time excess warning	The processing time is longer than the refresh time.
%FW8	-	_CPU_TYPE	CPU Type	Indicates information regarding the CPU type.
%FD5		_OS_VER_PATCH	OS version	Indicates OS version.
%FD6	-	_OS_DATE	OS Date	Indicates OS distribution date.
%FW14	-	_SCAN_MAX	Maximum scan time	Indicates the maximum scan time.
%FW15	-	_SCAN_MIN	Minimum scan time	Indicates the minimum scan time.
%FW16	-	_SCAN_CUR	Current scan time	Indicates the current scan time.
%FW17		_IO_TYER_N	Mismatched slot	Indicates slot No. where module type mismatch has occurred
%FW18	-	_IO_DEER_N	Detached slot	Indicates slot No. where the module detachment has occurred
%FW20	-	_IO_RWER_N	RW error slot	Indicates slot No. where the module read/write error has occurred
%FW21	-	_IP_IFER_N	IF error slot	Indicates slot No. where the module interface error has occurred
%FW22	-	_IO_TYERR	Module type mismatch error	Indicates module type mismatch error.
%FW46	-	_IO_RWER0	Module RW 0 error	Main base module read/write error
%FW54	-	_IO_IFER_0	Module IF 0 error	Main base module interface error
%FD53	-	_REF_COUNT	Refresh	Increase when the module refresh is executed.
%FD54	-	_H_REF_ERR_CNT	Abnormal execution of refresh	Increase when the refresh is executed abnormally.
%FD55	-	_H_REF_LIM_CNT	Refresh timeout	Increase in case of refresh timeout
%FD56	-	_REF_NG_CNT	Refresh NG	Increase when the module refresh is abnormal.
%FD57	-	_REF_OK_CNT	Refresh OK	Increase when the module refresh is normal.
%FD62	-	_REFRESH_TIME	Refresh time	Refresh time count setting value
%FW142	-	_EXPLICIT_ID_NUM	Rotary switch value	Explicit ID setting value

Word	Bit	Variable	Function	Description
%FW143	-	_EEPROM_STATUS	EEPROM status information	Indicates EEPROM status information
	%FX2288	_EEPROM_RECOVERY_MODE	EEPROM mode setting	Indicates that the EEPROM recovery mode is enabled.
	%FX2289	_EEPROM_RECOVERY_EXECUTED	Execution of EEPROM recovery	Indicates whether or not to execute EEPROM recovery
	%FX2290	_EEPROM_PRIMARY_DATA_ERR	EEPROM primary data	Indicates EEPROM primary data error
	%FX2291	_EEPROM_GENERAL_DATA_ERR	EEPROM general data	Indicates EEPROM general data error
	%FX2292	_EEPROM_CRC_DATA_ERR	EEPROM CRC data	Indicates EEPROM CRC data error
%FW144	-	_USER_WRITE_F	Enables the writing of program	Contact point available in the program
	FX2305	_REFRESH_WR	Initialization of the scan value	Scan value Initialization flag.
%FX2320		_PARAM_INIT_SLT_0	Initialization of No. 0 slot parameter	Parameter initialization command flag
%FX2321		_PARAM_INIT_SLT_1	Initialization of No. 1 slot parameter	Parameter initialization command flag
%FX2322		_PARAM_INIT_SLT_2	Initialization of No. 2 slot parameter	Parameter initialization command flag
%FX2323		_PARAM_INIT_SLT_3	Initialization of No. 3 slot parameter	Parameter initialization command flag
%FX2324		_PARAM_INIT_SLT_4	Initialization of No. 4 slot parameter	Parameter initialization command flag
%FX2325		_PARAM_INIT_SLT_5	Initialization of No. 5 slot parameter	Parameter initialization command flag
%FX2326		_PARAM_INIT_SLT_6	Initialization of No. 6 slot parameter	Parameter initialization command flag
%FX2327	-	_PARAM_INIT_SLT_7	Initialization of No. 7 slot parameter	Parameter initialization command flag
%FX2336		_EXT_ERR_FLAG_0SLT	No. 0 slot error flag	Indicates the slot error
%FX2337		_EXT_ERR_FLAG_1SLT	No. 1 slot error flag	Indicates the slot error
%FX2338		_EXT_ERR_FLAG_2SLT	No. 2 slot error flag	Indicates the slot error
%FX2339		_EXT_ERR_FLAG_3SLT	No. 3 slot error flag	Indicates the slot error
%FX2340		_EXT_ERR_FLAG_4SLT	No. 4 slot error flag	Indicates the slot error
%FX2341		_EXT_ERR_FLAG_5SLT	No. 5 slot error flag	Indicates the slot error
%FX2342		_EXT_ERR_FLAG_6SLT	No. 6 slot error flag	Indicates the slot error
%FX2343		_EXT_ERR_FLAG_7SLT	No. 7 slot error flag	Indicates the slot error
%FD75	-	_ADT_RESET	Adapter reset	Reset command flag

Appendix 2 List of Objects

Appendix 2.1 List of Flag Objects

XEL-BSSCT provides flags that indicate the operation status of the adapter. The following table shows the flags of XEL-BSSCT.

Index (hex)	SubIndex (hex)	Flag Name	Description	Type	R/W Property
2000		System Status			
	01	_RUN	Status that data is updated through PDO	bit	R
	02	_STOP	Status that data is not updated through PDO	bit	R
	03	_ERROR	An adapter error has occurred.	bit	R
2010		System error (critical error)			
	02	_IO_TYER	Module type mismatch error	bit	R
	03	_IO_DEER	Module detachment error	bit	R
	05	_IO_RWER	Read and write error of input and output modules (failure)	bit	R
	06	_IP_IFER	Special/communication module interface error (failure)	bit	R
	08	_BPRM_ER	Basic parameter error	bit	R
	09	_IOPRM_ER	IO configuration parameter error	bit	R
	0A	_SPPRM_ER	Special module parameter error	bit	R
	0B	_CPPRM_ER	Communication module parameter error	bit	R
	0D	_SWDT_ER	Abnormal termination or failure of CPU	bit	R
	10	_IOSIZE_ER	Maximum extension module excess error	bit	R
2020		System warning			
	02	_REFRESH_OT_WAR	Refresh time excess warning	bit	R
2030		System status data			
	02	_CPU_TYPE	CPU type information	word	R
	03	_CPU_VER	CPU version No.	word	R
	04	_OS_VER_PATCH	OS Patch Version	dword	R
	05	_OS_DATE	OS Date	dword	R
	06	_REFRESH_MAX	Maximum refresh time	word	R
	07	_REFRESH_MIN	Minimum refresh time	word	R
	08	_REFRESH_CUR	Current refresh time	word	R
	09	_IO_TYER_N	Slot No. where module type mismatch occurred	word	R
	0A	_IO_DEER_N	Slot No. where module detachment occurred	word	R
	0C	_IO_RWER_N	Slot No. where a read and write error of input and output modules occurred	word	R
	0D	_IP_IFER_N	Slot No. where a special/communication module interface error (failure) occurred	word	R
	25	__H_REF_CNT	Increase when the module refresh is executed.	UDINT	R
	26	__H_REF_ERR_CNT	Increase when the module refresh is carried out	UDINT	R

			abnormally.		
	27	__H_REF_LIM_CNT	Increase when the module refresh is carried out abnormally. (TIME OUT)	UDINT	R
	28	__H_REF_NG_CNT	Increase when the module refresh is carried out abnormally.	UDINT	R
	29	__H_REF_OK_CNT	Increase when the module refresh is carried out normally.	UDINT	R
	31	_EXPLICIT_ID_NUMBER	Rotary switch station No. information (Explicit ID)	word	R
	32	_EEPROM_RECOVERY_MODE	EEPROM recovery mode is set.	bit	R
	33	_EEPROM_RECOVERY_EXECUTED	EEPROM recovery is executed.	bit	R
	34	_EEPROM_PRIMARY_DATA_ERR	Critical error of EEPROM data	bit	R
	35	_EEPROM_GENERAL_DATA_ERR	General error of EEPROM data	bit	R
	36	_EEPROM_CRC_DATA_ERR	EEPROM CRC data error	bit	R
2040			System control and extension module error status flag		
	02	_REFRESH_WR	Refresh time has been initialized.	bit	R/W
	03	_DC_SYNC_COUNT_CLR	DC Sync count has been cleared.	bit	W
	0A	_PARAM_INIT_SLT_0	Slot 0 parameter has been initialized.	bit	R/W
	0B	_PARAM_INIT_SLT_1	Slot 1 parameter has been initialized.	bit	R/W
	0C	_PARAM_INIT_SLT_2	Slot 2 parameter has been initialized.	bit	R/W
	0D	_PARAM_INIT_SLT_3	Slot 3 parameter has been initialized	bit	R/W
	0E	_PARAM_INIT_SLT_4	Slot 4 parameter has been initialized.	bit	R/W
	0F	_PARAM_INIT_SLT_5	Slot 5 parameter has been initialized.	bit	R/W
	10	_PARAM_INIT_SLT_6	Slot 6 parameter has been initialized.	bit	R/W
	11	_PARAM_INIT_SLT_7	Slot 7 parameter has been initialized.	bit	R/W
	1A	_EXT_ERR_FLAG_0SLT	Slot 0 error flag	bit	R
	1B	_EXT_ERR_FLAG_1SLT	Slot 1 error flag	bit	R
	1C	_EXT_ERR_FLAG_2SLT	Slot 2 error flag	bit	R
	1E	_EXT_ERR_FLAG_3SLT	Slot 3 error flag	bit	R
	1F	_EXT_ERR_FLAG_4SLT	Slot 4 error flag	bit	R
	20	_EXT_ERR_FLAG_5SLT	Slot 5 error flag	bit	R
	21	_EXT_ERR_FLAG_6SLT	Slot 6 error flag	bit	R
	2B	_EXT_ERR_FLAG_7SLT	Slot 7 error flag	bit	R

Appendix 2.2 List of Parameter Objects

Extension modules including XEL-BSSCT have parameters for setting. For the detailed explanation of each parameter, refer to the user's manual of each parameter. The following are parameter objects.

(1) XEL-BSSCT Parameter Objects

Index(hex)	SubIndex (hex)	SubIndex (dec)	Parameter Name	Description	Bit size	R/W Property
3000	01	01	REFRESH_PERIOD_TIME	Refresh time (Multiples of DC Sync0 time)	16	R/W
	02	02	ERROR_MODE_OUTPUT_PARAMETER	Set hold of output from the digital output module in error status	16	R/W
	03	03	STANDARD_INPUT_FILTER_TIME	Standard input filter	16	R/W
	05	05	ETHERCAT_ALIAS_NUMBER	EtherCAT node address (parameter)	16	R/W
	06	06	EEPROM_RECOVERY_MODE	Recovery mode in case of EEPROM data error	16	R/W

(2) XBE-DC08A Parameter Object

Index(hex)	SubIndex (hex)	SubIndex (dec)	Parameter Name	Description	Bit size	R/W Property
80x0 (x: Slot No.)	01	01	Input Filter	Input filter	16	R/W

(3) XBE-DC16A/B Parameter Object

Index(hex)	SubIndex (hex)	SubIndex (dec)	Parameter Name	Description	Bit size	R/W Property
80x0 (x: Slot No.)	01	01	Input Filter	Input filter	16	R/W

(4) XBE-DC32A Parameter Object

Index(hex)	SubIndex (hex)	SubIndex (dec)	Parameter Name	Description	Bit size	R/W Property
80x0 (x: Slot No.)	01	01	Input Filter	Input filter	16	R/W

(5) XBE-TN/TP08A Parameter Object

Index(hex)	SubIndex (hex)	SubIndex (dec)	Parameter Name	Description	Bit size	R/W Property
80x0 (x: Slot No.)	02	02	Emergency Out Mode	Output hold/disable setting	16	R/W

(6) XBE-TN/TP16A Parameter Object

Index(hex)	SubIndex (hex)	SubIndex (dec)	Parameter Name	Description	Bit size	R/W Property
80x0 (x: Slot No.)	02	02	Emergency Out Mode	Output hold/disable setting	16	R/W

(7) XBE-TN/TP32A Parameter Object

Index(hex)	SubIndex (hex)	SubIndex (dec)	Parameter Name	Description	Bit size	R/W Property
80x0 (x: Slot No.)	02	02	Emergency Out Mode	Output hold/disable setting	16	R/W

(8) XBE-RY08A/B Parameter Object

Index(hex)	SubIndex (hex)	SubIndex (dec)	Parameter Name	Description	Bit size	R/W Property
80x0 (x: Slot No.)	02	02	Emergency Out Mode	Output hold/disable setting	16	R/W

(9) XBE-RY16A Parameter Object

Index(hex)	SubIndex (hex)	SubIndex (dec)	Parameter Name	Description	Bit size	R/W Property
80x0 (x: Slot No.)	02	02	Emergency Out Mode	Output hold/disable setting	16	R/W

(10) XBE-DR16A Parameter Object

Index(hex)	SubIndex (hex)	SubIndex (dec)	Parameter Name	Description	Bit size	R/W Property
80x0 (x: Slot No.)	01	01	Input Filter	Input filter	16	R/W
	02	02	Emergency Out Mode	Output hold/disable setting	16	R/W

(11) XBE-DN32A Parameter Object

Index(hex)	SubIndex (hex)	SubIndex (dec)	Parameter Name	Description	Bit size	R/W Property
80x0 (x: Slot No.)	01	01	Input Filter	Input filter	16	R/W
	02	02	Emergency Out Mode	Output hold/disable setting	16	R/W

(12) XBF-AD04A

1) List of Parameter Objects

Index(hex)	SubIndex (hex)	SubIndex (dec)	Module Area Address	Parameter Name	Description	Bit size	R/W Property
80x0 (x: Slot No.)	01	01	0	Channel Enable	Active channel setting	16	R/W
	02	02	1	Input Range Setting	Input range setting	16	R/W
	03	03	2	Output Type Setting	Output data type setting	16	R/W
	04	04	3	Filter Status Setting	Filter process setting	16	R/W
	05	05	4	Ch0 Filter Constant Value	Filter constant value setting for channel 0	16	R/W
	06	06	5	Ch1 Filter Constant Value	Filter constant value setting for channel 1	16	R/W
	07	07	6	Ch2 Filter Constant Value	Filter constant value setting for channel 2	16	R/W
	08	08	7	Ch3 Filter Constant Value	Filter constant value setting for channel 3	16	R/W
	0D	13	12	Average Function Enable	Average process setting	16	R/W
	0E	14	13	Average Method Setting	Average process method setting	16	R/W
	0F	15	14	Ch0 Average Value	Average value setting for channel 0	16	R/W
	10	16	15	Ch1 Average Value	Average value setting for channel 1	16	R/W
	11	17	16	Ch2 Average Value	Average value setting for channel 2	16	R/W
	12	18	17	Ch3 Average Value	Average value setting for channel 3	16	R/W
80x1 (x: Slot No.)	01	01	22	Error code	Error information	16	R

2) List of Parameter Settings

Parameter Name	Bit																Settings
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
Channel Enable	-												CH3	CH2	CH1	CH0	Bit Off (0): Stop Bit On (1): Run
Input Range Setting	-								CH3		CH2		CH1		CH0		00: 0 ~ 10V(4 ~ 20mA) 01: 0 ~ 20mA 10: 4 ~ 20mA
Output Type Setting	-								CH3		CH2		CH1		CH0		00: 0 ~ 4000 01: -2000 ~ 2000 10: Precise value 11: 0 ~ 1000 - in case of precise value 0 ~ 10V: 0 ~ 1000 4 ~ 20 mA: 400 ~ 2000 0 ~ 20 mA: 0 ~ 2000
Filter Status Setting	-												CH3	CH2	CH1	CH0	Bit On (1): Filter used Bit Off (0): Filter not used
Ch0 Filter Constant Value	CH0																Filter Constant: 1~99
Ch1 Filter Constant Value	CH1																
Ch2 Filter Constant Value	CH2																
Ch3 Filter Constant Value	CH3																
Average Function Enable	-												CH3	CH2	CH1	CH0	Bit Off (0): Average not used Bit On (1): Average used
Average Method Setting	-								CH3		CH2		CH1		CH0		00: Count average 01: Time average
Ch0 Average Value	CH0																In case of count average: 2~64000 In case of time average: 4~16000
Ch1 Average Value	CH1																
Ch2 Average Value	CH2																
Ch3 Average Value	CH3																
Error code	-																0: Normal operation 50#: Filter constant value setting range exceeded 60#: Time average setting range exceeded 70#: Count average setting range exceeded 80# Analog input range setting error

(13) XBF-AD08A

1) List of Parameter Objects

Index(hex)	SubIndex (hex)	SubIndex (dec)	Module Area Address	Parameter Name	Description	Bit size	R/W Property
80x0 (x: Slot No.)	01	01	0	Channel Enable	Active channel setting	16	R/W
	02	02	1	Input Range Setting (Ch0~Ch3)	Input range setting (Channel 0 ~ Channel 3)	16	R/W
	03	03	2	Input Range Setting (Ch4~Ch7)	Input range setting (Channel 4 ~ Channel 7)	16	R/W
	04	04	3	Output Type Setting	Output data type setting	16	R/W
	05	05	4	Ch0 Filter Constant Value	Filter constant value setting for channel 0	16	R/W
	06	06	5	Ch1 Filter Constant Value	Filter constant value setting for channel 1	16	R/W
	07	07	6	Ch2 Filter Constant Value	Filter constant value setting for channel 2	16	R/W
	08	08	7	Ch3 Filter Constant Value	Filter constant value setting for channel 3	16	R/W
	09	09	8	Ch4 Filter Constant Value	Filter constant value setting for channel 4	16	R/W
	0A	10	9	Ch5 Filter Constant Value	Filter constant value setting for channel 5	16	R/W
	0B	11	10	Ch6 Filter Constant Value	Filter constant value setting for channel 6	16	R/W
	0C	12	11	Ch7 Filter Constant Value	Filter constant value setting for channel 7	16	R/W
	0D	13	12	Average Method Setting	Average process method setting	16	R/W
	0E	14	13	Ch0 Average Value	Average value setting for channel 0	16	R/W
	0F	15	14	Ch1 Average Value	Average value setting for channel 1	16	R/W
	10	16	15	Ch2 Average Value	Average value setting for channel 2	16	R/W
	11	17	16	Ch3 Average Value	Average value setting for channel 3	16	R/W
	12	18	17	Ch4 Average Value	Average value setting for channel 4	16	R/W
	13	19	18	Ch5 Average Value	Average value setting for channel 5	16	R/W
	14	20	19	Ch6 Average Value	Average value setting for channel 6	16	R/W
	15	21	20	Ch7 Average Value	Average value setting for channel 7	16	R/W
80x1 (x: Slot No.)	01	01	21	Error code	Error information	16	R

2) List of Parameter Settings

Parameter Name	Bit																Settings
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
Channel Enable	-								CH7	CH6	CH5	CH4	CH3	CH2	CH1	CH0	Bit Off (0): Stop Bit On (1): Run
Input Range Setting (Ch0~Ch3)	CH3				CH2				CH1				CH0				0000 : 4 ~ 20 mA 0001 : 0 ~ 20 mA 0010 : 1 ~ 5 V 0011 : 0 ~ 5 V 0100 : 0 ~ 10 V
Input Range Setting (Ch4~Ch7)	CH7				CH6				CH5				CH4				
Output Type Setting	CH7		CH6		CH5		CH4		CH3		CH2		CH1		CH0		00 : 0 ~ 4000 01 : -2000 ~ 2000 10 : Precise value 11 : 0 ~ 1000 - in case of precise value 4 ~ 20 mA: 400 ~ 2000 0 ~ 20 mA: 0 ~ 2000 1 ~ 5 V: 100 ~ 500 0 ~ 5 V: 0 ~ 500 0 ~ 10 V: 0 ~ 1000
Ch0 Filter Constant Value	CH0																Filter Constant: 0, 4~64000
Ch1 Filter Constant Value	CH1																
Ch2 Filter Constant Value	CH2																
Ch3 Filter Constant Value	CH3																
Ch4 Filter Constant Value	CH4																
Ch5 Filter Constant Value	CH5																
Ch6 Filter Constant Value	CH6																
Ch7 Filter Constant Value	CH7																
Average Method Setting	CH7		CH6		CH5		CH4		CH3		CH2		CH1		CH0		00: Sampling process 01: Time average process 10: Count average process 11: Moving average process
Ch0 Average Value	CH0																Time average: 4 ~ 16000 [ms] Count average: 2 ~ 64000 [Count] Moving average: 2 ~ 100 [EA]
Ch1 Average Value	CH1																
Ch2 Average Value	CH2																
Ch3 Average Value	CH3																
Ch4 Average Value	CH4																
Ch5 Average Value	CH5																
Ch6 Average Value	CH6																
Ch7 Average Value	CH7																
Error code	-																0: Normal operation 10#: Channel range setting error 20#: Channel filter value setting error 30#: Average value setting error

(14) XBF-AD04C

1) List of Parameter Objects

Index(hex)	SubIndex (hex)	SubIndex (dec)	Module Area Address	Parameter Name	Description	Bit size	R/W Property
80x0 (x: Slot No.)	01	01	0	Channel Enable	Active channel setting	16	R/W
	02	02	1	Input Range Setting	Input range setting	16	R/W
	04	04	3	Output Type Setting	Output data type setting	16	R/W
	05	05	4	Ch0 Filter Constant Value	Filter constant value setting for channel 0	16	R/W
	06	06	5	Ch1 Filter Constant Value	Filter constant value setting for channel 1	16	R/W
	07	07	6	Ch2 Filter Constant Value	Filter constant value setting for channel 2	16	R/W
	08	08	7	Ch3 Filter Constant Value	Filter constant value setting for channel 3	16	R/W
	0D	13	12	Average Method Setting	Average process setting	16	R/W
	0E	14	13	Ch0 Average Value	Average value setting for channel 0	16	R/W
	0F	15	14	Ch1 Average Value	Average value setting for channel 1	16	R/W
	10	16	15	Ch2 Average Value	Average value setting for channel 2	16	R/W
	11	17	16	Ch3 Average Value	Average value setting for channel 3	16	R/W
	16	22	21	Hold Last Value	Valid converted value hold setting	16	R/W
80x1 (x: Slot No.)	01	01	22	Error code	Error information	16	R

2) List of Parameter Settings

Parameter Name	Bit																Settings
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
Channel Enable	-												CH3	CH2	CH1	CH0	Bit Off (0): Stop Bit On (1): Run
Input Range Setting	CH3				CH2				CH1				CH0				0000 : 4 ~ 20 mA 0001 : 0 ~ 20 mA 0010 : 1 ~ 5 V 0011 : 0 ~ 5 V 0100 : 0 ~ 10 V 0101 : -10 ~ 10V
Output Type Setting	-								CH3		CH2		CH1		CH0		00: 0 ~ 16000 01: -8000 ~ 8000 10: Precise value 11: 0 ~ 10000 - in case of precise value 4 ~ 20 mA: 4000 ~ 20000 0 ~ 20 mA: 0 ~ 20000 1 ~ 5V : 1000 ~ 5000 0 ~ 5V : 0 ~ 5000 0 ~ 10V : 0 ~ 10000 -10 ~ 10V : -10000 ~ 10000
Ch0 Filter Constant Value	CH0																Filter Constant: 0, 4 ~ 64000[ms]
Ch1 Filter Constant Value	CH1																
Ch2 Filter Constant Value	CH2																
Ch3 Filter Constant Value	CH3																
Average Method Setting	-								CH3		CH2		CH1		CH0		00: Sampling process 01: Time average process 10: Count average process
Ch0 Average Value	CH0																Time average: 4~16000[ms] In case of count average: 2~64000[Count]
Ch1 Average Value	CH1																
Ch2 Average Value	CH2																
Ch3 Average Value	CH3																
Hold Last Value	-												CH3	CH2	CH1	CH0	Bit Off (0): Stop Bit On (1): Enable
Error code	-																0: Normal operation 10#: Channel range setting error 20#: Channel filter value setting error 30#: Average value setting error

(15) XBF-DV04A

1) List of Parameter Objects

Index(hex)	SubIndex (hex)	SubIndex (dec)	Module Area Address	Parameter Name	Description	Bit size	R/W Property
80x0 (x: Slot No.)	01	01	0	Channel Enable	Active channel setting	16	R/W
	02	02	1	Output Range Setting	Output range setting	16	R/W
	03	03	2	Input Type Setting	Input data type setting	16	R/W
	04	04	3	CH0 Output Type Setting	Output status setting for channel 0	16	R/W
	05	05	4	CH1 Output Type Setting	Output status setting for channel 1	16	R/W
	06	06	5	CH2 Output Type Setting	Output status setting for channel 2	16	R/W
	07	07	6	CH3 Output Type Setting	Output status setting for channel 3	16	R/W
80x1 (x: Slot No.)	01	01	11	CH0 Error Code	Error information of channel 0	16	R
	02	02	12	CH1 Error Code	Error information of channel 1	16	R
	03	03	13	CH2 Error Code	Error information of channel 2	16	R
	04	04	14	CH3 Error Code	Error information of channel 3	16	R

2) List of Parameter Settings

Parameter Name	Bit																Settings
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
Channel Enable	-												CH3	CH2	CH1	CH0	Bit Off (0): Stop Bit On (1): Run
Output Range Setting	-								CH3		CH2		CH1		CH0		00 : 0 ~ 10V
Input Type Setting	-								CH3		CH2		CH1		CH0		00: 0 ~ 4000 01: -2000 ~ 2000 10: 0 ~ 1000 11: 0 ~ 1000
CH0 Output Type Setting	-															CH0	00: Output the previous value
CH1 Output Type Setting	-															CH1	01: Output the minimum value
CH2 Output Type Setting	-															CH2	10: Output the middle value
CH3 Output Type Setting	-															CH3	11: Output the maximum value
CH0 Error Code	CH0																0: Normal operation
CH1 Error Code	CH1																31#: Parameter range excess error
CH2 Error Code	CH2																41#: Digital input value range excess error
CH3 Error Code	CH3																

(16) XBF-DC04A

1) List of Parameter Objects

Index(hex)	SubIndex (hex)	SubIndex (dec)	Module Area Address	Parameter Name	Description	Bit size	R/W Property
80x0 (x: Slot No.)	01	01	0	Channel Enable	Active channel setting	16	R/W
	02	02	1	Output Range Setting	Output range setting	16	R/W
	03	03	2	Input Type Setting	Input data type setting	16	R/W
	04	04	3	CH0 Output Type Setting	Output status setting for channel 0	16	R/W
	05	05	4	CH1 Output Type Setting	Output status setting for channel 1	16	R/W
	06	06	5	CH2 Output Type Setting	Output status setting for channel 2	16	R/W
	07	07	6	CH3 Output Type Setting	Output status setting for channel 3	16	R/W
80x1 (x: Slot No.)	01	01	11	CH0 Error Code	Error information of channel 0	16	R
	02	02	12	CH1 Error Code	Error information of channel 1	16	R
	03	03	13	CH2 Error Code	Error information of channel 2	16	R
	04	04	14	CH3 Error Code	Error information of channel 3	16	R

2) List of Parameter Settings

Parameter Name	Bit																Settings
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
Channel Enable	-												CH3	CH2	CH1	CH0	Bit Off (0): Stop Bit On (1): Run
Output Range Setting	-								CH3		CH2		CH1		CH0		00 : 4 ~ 20mA 01 : 0 ~ 20mA
Input Type Setting	-								CH3		CH2		CH1		CH0		00: 0 ~ 4000 01: -2000 ~ 2000 10: Precise value 11: 0 ~ 1000 - in case of precise value 4 ~ 20 mA: 400 ~ 2000 0 ~ 20 mA: 0 ~ 2000
CH0 Output Type Setting	-															CH0	00: Output the previous value
CH1 Output Type Setting	-															CH1	01: Output the minimum value
CH2 Output Type Setting	-															CH2	10: Output the middle value
CH3 Output Type Setting	-															CH3	11: Output the maximum value
CH0 Error Code	CH0																0: Normal operation
CH1 Error Code	CH1																31#: Parameter range excess error
CH2 Error Code	CH2																41#: Digital input value range excess error
CH3 Error Code	CH3																

(17) XBF-DC04B

1) List of Parameter Objects

Index(hex)	SubIndex (hex)	SubIndex (dec)	Module Area Address	Parameter Name	Description	Bit size	R/W Property
80x0 (x: Slot No.)	01	01	0	Channel Enable	Active channel setting	16	R/W
	02	02	1	Output Range Setting	Output range setting	16	R/W
	03	03	2	Input Type Setting	Input data type setting	16	R/W
	04	04	3	CH0 Output Type Setting	Output status setting for channel 0	16	R/W
	05	05	4	CH1 Output Type Setting	Output status setting for channel 1	16	R/W
	06	06	5	CH2 Output Type Setting	Output status setting for channel 2	16	R/W
	07	07	6	CH3 Output Type Setting	Output status setting for channel 3	16	R/W
80x1 (x: Slot No.)	01	01	11	CH0 Error Code	Error information of channel 0	16	R
	02	02	12	CH1 Error Code	Error information of channel 1	16	R
	03	03	13	CH2 Error Code	Error information of channel 2	16	R
	04	04	14	CH3 Error Code	Error information of channel 3	16	R

2) List of Parameter Settings

Parameter Name	Bit																Settings
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
Channel Enable	-												CH3	CH2	CH1	CH0	Bit Off (0): Stop Bit On (1): Run
Output Range Setting	-								CH3		CH2		CH1		CH0		00 : 0 ~ 1.2mA
Input Type Setting	-								CH3		CH2		CH1		CH0		00: 0 ~ 4000 01: -2000 ~ 2000 10: 0 ~ 1200 11: 0 ~ 1000
CH0 Output Type Setting	-															CH0	00: Output the previous value
CH1 Output Type Setting	-															CH1	01: Output the minimum value
CH2 Output Type Setting	-															CH2	10: Output the middle value
CH3 Output Type Setting	-															CH3	11: Output the maximum value
CH0 Error Code	CH0																0: Normal operation
CH1 Error Code	CH1																31#: Parameter range excess error
CH2 Error Code	CH2																41#: Digital input value range excess
CH3 Error Code	CH3																error

(18) XBF-DV04C

1) List of Parameter Objects

Index(hex)	SubIndex (hex)	SubIndex (dec)	Module Area Address	Parameter Name	Description	Bit size	R/W Property
80x0 (x: Slot No.)	01	01	0	Channel Enable	Active channel setting	16	R/W
	02	02	1	Output Range Setting	Output range setting	16	R/W
	03	03	2	Input Type Setting	Input data type setting	16	R/W
	04	04	3	CH0 Output Type Setting	Output status setting for channel 0	16	R/W
	05	05	4	CH1 Output Type Setting	Output status setting for channel 1	16	R/W
	06	06	5	CH2 Output Type Setting	Output status setting for channel 2	16	R/W
	07	07	6	CH3 Output Type Setting	Output status setting for channel 3	16	R/W
	0C	12	11	Interpolation Method Setting	Interpolation method setting	16	R/W
	0D	13	12	Interpolation Time Setting	Interpolation time setting	16	R/W
80x1 (x: Slot No.)	01	01	13	CH0 Error Code	Error information of channel 0	16	R
	02	02	14	CH1 Error Code	Error information of channel 1	16	R
	03	03	15	CH2 Error Code	Error information of channel 2	16	R
	04	04	16	CH3 Error Code	Error information of channel 3	16	R
	05	05	17	CH0 Interpolation Data	Interpolation value of channel 0	16	R
	06	06	18	CH1 Interpolation Data	Interpolation value of channel 1	16	R
	07	07	19	CH2 Interpolation Data	Interpolation value of channel 2	16	R
	08	08	20	CH3 Interpolation Data	Interpolation value of channel 3	16	R

2) List of Parameter Settings

Parameter Name	Bit																Settings
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
Channel Enable	-												CH3	CH2	CH1	CH0	Bit Off (0): Stop Bit On (1): Run
Output Range Setting	-								CH3		CH2		CH1		CH0		00: 1 ~ 5V 01: 0 ~ 5V 10: 0 ~ 10V 11: -10 ~ 10V
Input Type Setting	-								CH3		CH2		CH1		CH0		00: 0 ~ 16000 01: -8000 ~ 8000 10: Precise value 11: 0 ~ 10000 - in case of precise value 1 ~ 5V: 1000 ~ 5000 0 ~ 5V: 0 ~ 5000 0 ~ 10V: 0 ~ 10000 -10 ~ 10V: -10000 ~ 10000
CH0 Output Type Setting	-															CH0	00: Output the previous value
CH1 Output Type Setting	-															CH1	01: Output the minimum value
CH2 Output Type Setting	-															CH2	10: Output the middle value
CH3 Output Type Setting	-															CH3	11: Output the maximum value
Interpolation Method Setting	-								CH3		CH2		CH1		CH0		00: Disable 01: Linear Interpolation 10: S-shaped Interpolation
Interpolation Time Setting	-								CH3		CH2		CH1		CH0		00: 10 [ms] 01: 100 [ms] 10: 1 [s] 11: 60 [s]
CH0 Error Code	CH0																0: Normal operation
CH1 Error Code	CH1																31#: Parameter range excess error
CH2 Error Code	CH2																41#: Digital input value range excess error
CH3 Error Code	CH3																51#: Interpolation method setting range excess error
CH0 Interpolation Data	CH0																Interpolation value of channel 0
CH1 Interpolation Data	CH1																Interpolation value of channel 1
CH2 Interpolation Data	CH2																Interpolation value of channel 2
CH3 Interpolation Data	CH3																Interpolation value of channel 3

(19) XBF-DC04C

1) List of Parameter Objects

Index(hex)	SubIndex (hex)	SubIndex (dec)	Module Area Address	Parameter Name	Description	Bit size	R/W Property
80x0 (x: Slot No.)	01	01	0	Channel Enable	Active channel setting	16	R/W
	02	02	1	Output Range Setting	Output range setting	16	R/W
	03	03	2	Input Type Setting	Input data type setting	16	R/W
	04	04	3	CH0 Output Type Setting	Output status setting for channel 0	16	R/W
	05	05	4	CH1 Output Type Setting	Output status setting for channel 1	16	R/W
	06	06	5	CH2 Output Type Setting	Output status setting for channel 2	16	R/W
	07	07	6	CH3 Output Type Setting	Output status setting for channel 3	16	R/W
	0C	12	11	Interpolation Method Setting	Interpolation method setting	16	R/W
	0D	13	12	Interpolation Time Setting	Interpolation time setting	16	R/W
80x1 (x: Slot No.)	01	01	13	CH0 Error Code	Error information of channel 0	16	R
	02	02	14	CH1 Error Code	Error information of channel 1	16	R
	03	03	15	CH2 Error Code	Error information of channel 2	16	R
	04	04	16	CH3 Error Code	Error information of channel 3	16	R
	05	05	17	CH0 Interpolation Data	Interpolation value of channel 0	16	R
	06	06	18	CH1 Interpolation Data	Interpolation value of channel 1	16	R
	07	07	19	CH2 Interpolation Data	Interpolation value of channel 2	16	R
	08	08	20	CH3 Interpolation Data	Interpolation value of channel 3	16	R

2) List of Parameter Settings

Parameter Name	Bit																Settings
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
Channel Enable	-												CH3	CH2	CH1	CH0	Bit Off (0): Stop Bit On (1): Run
Output Range Setting	-								CH3		CH2		CH1		CH0		00: 4 ~ 20mA 01: 0 ~ 20mA
Input Type Setting	-								CH3		CH2		CH1		CH0		00: 0 ~ 16000 01: -8000 ~ 8000 10: Precise value 11: 0 ~ 10000 - in case of precise value 4 ~ 20mA: 4000 ~ 20000 0 ~ 20mA: 0 ~ 20000
CH0 Output Type Setting	-														CH0		00: Output the previous value
CH1 Output Type Setting	-														CH1		01: Output the minimum value
CH2 Output Type Setting	-														CH2		10: Output the middle value
CH3 Output Type Setting	-														CH3		11: Output the maximum value
Interpolation Method Setting	-								CH3		CH2		CH1		CH0		00: Disable 01: Linear Interpolation 10: S-shaped Interpolation
Interpolation Time Setting	-								CH3		CH2		CH1		CH0		00: 10 [ms] 01: 100 [ms] 10: 1 [s] 11: 60 [s]
CH0 Error Code	CH0																0: Normal operation
CH1 Error Code	CH1																31#: Parameter range excess error
CH2 Error Code	CH2																41#: Digital input value range excess error
CH3 Error Code	CH3																51#: Interpolation method setting range excess error
CH0 Interpolation Data	CH0																Interpolation value of channel 0
CH1 Interpolation Data	CH1																Interpolation value of channel 1
CH2 Interpolation Data	CH2																Interpolation value of channel 2
CH3 Interpolation Data	CH3																Interpolation value of channel 3

(20) XBF-AH04A

1) List of Parameter Objects

Index(hex)	SubIndex (hex)	SubIndex (dec)	Module Area Address	Parameter Name	Description	Bit size	R/W Property
80x0 (x: Slot No.)	01	01	0	AD/DA Channel Enable	Active channel setting	16	R/W
	02	02	1	AD Input/ DA Output Range Setting	Input/output range setting	16	R/W
	03	03	2	AD Output/DA Input Data Type Setting	Input/output data type setting	16	R/W
	04	04	3	AD0 Filter Constant Value	Filter constant value setting for input channel 0	16	R/W
	05	05	4	AD1 Filter Constant Value	Filter constant value setting for input channel 1	16	R/W
	06	06	5	Average Method Setting	Average process method setting	16	R/W
	07	07	6	AD0 Average Value	Average value setting for input channel 0	16	R/W
	08	08	7	AD1 Average Value	Average value setting for input channel 1	16	R/W
	09	09	8	Analog Output Type Setting	Channel output status setting	16	R/W
80x1 (x: Slot No.)	01	01	9	Error code	Error information	16	R

2) List of Parameter Settings

Parameter Name	Bit																Settings
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
AD/DA Channel Enable	-												DA CH 1	DA CH 0	AD CH 1	AD CH 0	Bit Off (0): Stop Bit On (1): Run
AD Input/ DA Output Range Setting	DA CH1			DA CH0				AD CH1				AD CH0					0000 : 4 ~ 20 mA 0001 : 0 ~ 20 mA 0010 : 1 ~ 5 V 0011 : 0 ~ 5 V 0100 : 0 ~ 10 V
AD Output/ DA Input Data Type Setting	DA CH1			DA CH0				AD CH1				AD CH0					0000 : 0 ~ 4000 0001 : -2000 ~ 2000 0010 : Precise value 0011 : 0 ~ 1000 - in case of precise value 4 ~ 20 mA: 400 ~ 2000 0 ~ 20 mA: 0 ~ 2000 1 ~ 5 V: 100 ~ 500 0 ~ 5 V: 0 ~ 500 0 ~ 10 V: 0 ~ 1000
AD0 Filter Constant Value	AD CH0																0, 4~64000
AD1 Filter Constant Value	AD CH1																
Average Method Setting	-								AD CH1				AD CH0				0000: Sampling process 0001: Time average process 0010: Count average process 0011: Moving average process
AD0 Average Value	AD CH0																Time average: 4 ~ 16000 [ms]
AD1 Average Value	AD CH1																Count average: 2 ~ 64000 [Count] Moving average: 2 ~ 100 [EA]
Analog Output Type Setting	-								DA CH1				DA CH0				0000: Output the previous value 0001: Output the minimum value 0010: Output the middle value 0011: Output the maximum value
Error code	-																0: Normal operation 10#: Input range setting error 20#: Input data type setting error 30#: Input filter value setting error 40#: Input average process setting error 50#: Input average value setting error 60#: Output range setting error 70#: Output status setting error 80#: Output input value range excess error

(21) XBF-RD04A

1) List of Parameter Objects

Index(hex)	SubIndex (hex)	SubIndex (dec)	Module Area Address	Parameter Name	Description	Bit size	R/W Property
80x0 (x: Slot No.)	01	01	0	Channel Enable	Active channel setting	16	R/W
	02	02	1	CH0 Sensor Type Setting	Sensor type setting for channel 0	16	R/W
	03	03	2	CH1 Sensor Type Setting	Sensor type setting for channel 1	16	R/W
	04	04	3	CH2 Sensor Type Setting	Sensor type setting for channel 2	16	R/W
	05	05	4	CH3 Sensor Type Setting	Sensor type setting for channel 3	16	R/W
	06	06	5	Temperature Unit Setting	Temperature display unit setting	16	R/W
	07	07	6	CH0 Filter Constant Value	Filter constant value setting for channel 0	16	R/W
	08	08	7	CH1 Filter Constant Value	Filter constant value setting for channel 1	16	R/W
	09	09	8	CH2 Filter Constant Value	Filter constant value setting for channel 2	16	R/W
	0A	10	9	CH3 Filter Constant Value	Filter constant value setting for channel 3	16	R/W
	13	19	18	Scaling Enable	Scaling setting	16	R/W
80x1 (x: Slot No.)	01	01	68	CH0 Disconnection Info	Disconnection information of channel 0	16	R
	02	02	69	CH1 Disconnection Info	Disconnection information of channel 1	16	R
	03	03	70	CH2 Disconnection Info	Disconnection information of channel 2	16	R
	04	04	71	CH3 Disconnection Info	Disconnection information of channel 3	16	R

2) List of Parameter Settings

Parameter Name	Bit																Settings
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
Channel Enable	-												CH3	CH2	CH1	CH0	Bit Off (0): Stop Bit On (1): Run
CH0 Sensor Type Setting	CH0																0: PT100 1: JPT100
CH1 Sensor Type Setting	CH1																
CH2 Sensor Type Setting	CH2																
CH3 Sensor Type Setting	CH3																
Temperature Unit Setting	-												CH3	CH2	CH1	CH0	Bit Off (0): Celsius Bit On (1): Fahrenheit
CH0 Filter Constant Value	CH0																0, 160~64000
CH1 Filter Constant Value	CH1																
CH2 Filter Constant Value	CH2																
CH3 Filter Constant Value	CH3																
Scaling Enable	-												CH3	CH2	CH1	CH0	Bit Off (0): Disable Bit On (1): Enable
CH0 Disconnection Info	CH0																0: Normal 1: Sensor A disconnection 2: Sensor B disconnection
CH1 Disconnection Info	CH1																
CH2 Disconnection Info	CH2																
CH3 Disconnection Info	CH3																

(22) XBF-RD01A

1) List of Parameter Objects

Index(hex)	SubIndex (hex)	SubIndex (dec)	Module Area Address	Parameter Name	Description	Bit size	R/W Property
80x0 (x: Slot No.)	01	01	0	Channel Enable	Active channel setting	16	R/W
	02	02	1	CH0 Sensor Type Setting	Sensor type setting for channel 0	16	R/W
	06	06	5	Temperature Unit Setting	Temperature display unit setting	16	R/W
	07	07	6	CH0 Filter Constant Value	Filter constant value setting for channel 0	16	R/W
	13	19	18	Scaling Enable	Scaling setting	16	R/W
80x1 (x: Slot No.)	01	01	68	CH0 Disconnection Info	Disconnection information of channel 0	16	R

2) List of Parameter Settings

Parameter Name	Bit																Settings
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
Channel Enable	-												CH3	CH2	CH1	CH0	Bit Off (0): Stop Bit On (1): Run
CH0 Sensor Type Setting	CH0																0: PT100 1: JPT100
Temperature Unit Setting	-												CH3	CH2	CH1	CH0	Bit Off (0): Celsius Bit On (1): Fahrenheit
CH0 Filter Constant Value	CH0																0, 160~64000
Scaling Enable	-												CH3	CH2	CH1	CH0	Bit Off (0): Disable Bit On (1): Enable
CH0 Disconnection Info	CH0																0: Normal 1: Sensor A disconnection 2: Sensor B disconnection

(23) XBF-TC04B

1) List of Parameter Objects

Index (hex)	SubIndex (hex)	SubIndex (dec)	Module Area Address	Parameter Name	Description	Bit size	R/W Property
80x0 (x: Slot No.)	01	01	0	Channel Enable	Active channel setting	16	R/W
	02	02	1	CH0 Sensor Type Setting	Sensor type setting for channel 0	16	R/W
	03	03	2	CH1 Sensor Type Setting	Sensor type setting for channel 1	16	R/W
	04	04	3	CH2 Sensor Type Setting	Sensor type setting for channel 2	16	R/W
	05	05	4	CH3 Sensor Type Setting	Sensor type setting for channel 3	16	R/W
	06	06	5	Temp. Unit Setting	Channel temperature display unit setting	16	R/W
	07	07	6	CH0 Filter Constant Value	Filter constant value setting for channel 0	16	R/W
	08	08	7	CH1 Filter Constant Value	Filter constant value setting for channel 1	16	R/W
	09	09	8	CH2 Filter Constant Value	Filter constant value setting for channel 2	16	R/W
	0A	10	9	CH3 Filter Constant Value	Filter constant value setting for channel 3	16	R/W
	0B	11	10	CH0 Average Method Setting	Average process setting for channel 0	16	R/W
	0C	12	11	CH1 Average Method Setting	Average process setting for channel 1	16	R/W
	0D	13	12	CH2 Average Method Setting	Average process setting for channel 2	16	R/W
	0E	14	13	CH3 Average Method Setting	Average process setting for channel 3	16	R/W
	0F	15	14	CH0 Average Data	Average value setting for channel 0	16	R/W
	10	16	15	CH1 Average Data	Average value setting for channel 1	16	R/W
	11	17	16	CH2 Average Data	Average value setting for channel 2	16	R/W
	12	18	17	CH3 Average Data	Average value setting for channel 3	16	R/W
	13	19	18	Scaling Type Setting	Scaling process type setting	16	R/W
	14	20	19	CH0 Scaling Min. Value	Scaling minimum value setting for channel 0	16	R/W
	15	21	20	CH0 Scaling Max. Value	Scaling maximum value setting for channel 0	16	R/W
	16	22	21	CH1 Scaling Min. Value	Scaling minimum value setting for channel 1	16	R/W
	17	23	22	CH1 Scaling Max. Value	Scaling maximum value setting for channel 1	16	R/W
	18	24	23	CH2 Scaling Min. Value	Scaling minimum value setting for channel 2	16	R/W
	19	25	24	CH2 Scaling Max. Value	Scaling maximum value setting for channel 2	16	R/W
	1A	26	25	CH3 Scaling Min. Value	Scaling minimum value setting for channel 3	16	R/W
	1B	27	26	CH3 Scaling Max. Value	Scaling maximum value setting for channel 3	16	R/W
80x1 (x: Slot No.)	01	01	27	CH0 Error Code	Error information of channel 0	16	R
	02	02	28	CH1 Error Code	Error information of channel 1	16	R
	03	03	29	CH2 Error Code	Error information of channel 2	16	R
	04	04	30	CH3 Error Code	Error information of channel 3	16	R
	05	05	31	CH0 Cold Junction Compensation Temp. Data	Cold junction compensation temperature of channel 0	16	R
	06	06	32	CH1 Cold Junction Compensation Temp. Data	Cold junction compensation temperature of channel 1	16	R
	07	07	33	CH2 Cold Junction Compensation Temp. Data	Cold junction compensation temperature of channel 2	16	R
	08	08	34	CH3 Cold Junction Compensation Temp. Data	Cold junction compensation temperature of channel 3	16	R

2) List of Parameter Settings

Parameter Name	Bit																Settings
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
Channel Enable	-												CH3	CH2	CH1	CH0	Bit Off (0): Stop Bit On (1): Run
CH0 Sensor Type Setting	CH0																0: K Type, 1: J Type 2: T Type, 3: R Type 4: 0 ~ 100mA
CH1 Sensor Type Setting	CH1																
CH2 Sensor Type Setting	CH2																
CH3 Sensor Type Setting	CH3																
Temp. Unit Setting	-												CH3	CH2	CH1	CH0	Bit Off (0): Celsius Bit On (1): Fahrenheit
CH0 Filter Constant Value	CH0																0, 200~64000
CH1 Filter Constant Value	CH1																
CH2 Filter Constant Value	CH2																
CH3 Filter Constant Value	CH3																
CH0 Average Method Setting	CH0																0: Sampling 1: Time average 2: Count average 3: Moving average
CH1 Average Method Setting	CH1																
CH2 Average Method Setting	CH2																
CH3 Average Method Setting	CH3																
CH0 Average Data	CH0																Time average: 400~60000ms Count average: 2~64000 times Moving average: 2~100EA
CH1 Average Data	CH1																
CH2 Average Data	CH2																
CH3 Average Data	CH3																
Scaling Type Setting	-												CH3	CH2	CH1	CH0	Bit Off (0): Sign Bit On (1): No Sign
CH0 Scaling Min. Value	CH0																Minimum Value Sign -32768~[Maximum-1] No Sign 0~[Maximum-1] Maximum Value Sign [Minimum+1]~32767 No Sign [Minimum+1]~655535
CH0 Scaling Max. Value	CH0																
CH1 Scaling Min. Value	CH1																
CH1 Scaling Max. Value	CH1																
CH2 Scaling Min. Value	CH2																
CH2 Scaling Max. Value	CH2																
CH3 Scaling Min. Value	CH3																
CH3 Scaling Max. Value	CH3																
CH0 Error Code	CH0																Bit 0 : Sensor type setting error Bit 1 : Filter constant value setting error
CH1 Error Code	CH1																Bit 2: Average process method setting error
CH2 Error Code	CH2																Bit 3: Time average value setting error Bit 4: Count average value setting error
CH3 Error Code	CH3																Bit 5: Moving average value setting error Bit 6: Scaling range setting error

Parameter Name	Bit																Settings
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
CH0 Cold Junction Compensation Temp. Data	CH0																Cold junction compensation temperature of channel 0
CH1 Cold Junction Compensation Temp. Data	CH1																Cold junction compensation temperature of channel 1
CH2 Cold Junction Compensation Temp. Data	CH2																Cold junction compensation temperature of channel 2
CH3 Cold Junction Compensation Temp. Data	CH3																Cold junction compensation temperature of channel 3

(24) XBF-TC04S

1) List of Parameter Objects

Index (hex)	SubIndex (hex)	SubIndex (dec)	Module Area Address	Parameter Name	Description	Bit size	R/W Property
80x0 (x: Slot No.)	01	01	0	Channel Enable	Active channel setting	16	R/W
	02	02	1	CH0 Sensor Type Setting	Sensor type setting for channel 0	16	R/W
	03	03	2	CH1 Sensor Type Setting	Sensor type setting for channel 1	16	R/W
	04	04	3	CH2 Sensor Type Setting	Sensor type setting for channel 2	16	R/W
	05	05	4	CH3 Sensor Type Setting	Sensor type setting for channel 3	16	R/W
	06	06	5	Temp. Unit Setting	Channel temperature display unit setting	16	R/W
	07	07	6	CH0 Filter Constant Value	Filter constant value setting for channel 0	16	R/W
	08	08	7	CH1 Filter Constant Value	Filter constant value setting for channel 1	16	R/W
	09	09	8	CH2 Filter Constant Value	Filter constant value setting for channel 2	16	R/W
	0A	10	9	CH3 Filter Constant Value	Filter constant value setting for channel 3	16	R/W
	0B	11	10	CH0 Average Method Setting	Average process setting for channel 0	16	R/W
	0C	12	11	CH1 Average Method Setting	Average process setting for channel 1	16	R/W
	0D	13	12	CH2 Average Method Setting	Average process setting for channel 2	16	R/W
	0E	14	13	CH3 Average Method Setting	Average process setting for channel 3	16	R/W
	0F	15	14	CH0 Average Data	Average value setting for channel 0	16	R/W
	10	16	15	CH1 Average Data	Average value setting for channel 1	16	R/W
	11	17	16	CH2 Average Data	Average value setting for channel 2	16	R/W
	12	18	17	CH3 Average Data	Average value setting for channel 3	16	R/W
	13	19	18	Scaling Type Setting	Scaling process type setting	16	R/W
	14	20	19	CH0 Scaling Min. Value	Scaling minimum value setting for channel 0	16	R/W
	15	21	20	CH0 Scaling Max. Value	Scaling maximum value setting for channel 0	16	R/W
	16	22	21	CH1 Scaling Min. Value	Scaling minimum value setting for channel 1	16	R/W
	17	23	22	CH1 Scaling Max. Value	Scaling maximum value setting for channel 1	16	R/W
	18	24	23	CH2 Scaling Min. Value	Scaling minimum value setting for channel 2	16	R/W
	19	25	24	CH2 Scaling Max. Value	Scaling maximum value setting for channel 2	16	R/W
	1A	26	25	CH3 Scaling Min. Value	Scaling minimum value setting for channel 3	16	R/W
	1B	27	26	CH3 Scaling Max. Value	Scaling maximum value setting for channel 3	16	R/W
80x1 (x: Slot No.)	01	01	27	CH0 Error Code	Error information of channel 0	16	R
	02	02	28	CH1 Error Code	Error information of channel 1	16	R
	03	03	29	CH2 Error Code	Error information of channel 2	16	R
	04	04	30	CH3 Error Code	Error information of channel 3	16	R
	05	05	31	CH0 Cold Junction Compensation Temp. Data	Cold junction compensation temperature of channel 0	16	R
	06	06	32	CH1 Cold Junction Compensation Temp. Data	Cold junction compensation temperature of channel 1	16	R
	07	07	33	CH2 Cold Junction Compensation Temp. Data	Cold junction compensation temperature of channel 2	16	R
	08	08	34	CH3 Cold Junction Compensation Temp. Data	Cold junction compensation temperature of channel 3	16	R

2) List of Parameter Settings

Parameter Name	Bit																Settings
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
Channel Enable	-												CH3	CH2	CH1	CH0	Bit Off (0): Stop Bit On (1): Run
CH0 Sensor Type Setting	CH0																0: K Type, 1: J Type 2: T Type, 3: R Type
CH1 Sensor Type Setting	CH1																
CH2 Sensor Type Setting	CH2																
CH3 Sensor Type Setting	CH3																
Temp. Unit Setting	-												CH3	CH2	CH1	CH0	Bit Off (0): Celsius Bit On (1): Fahrenheit
CH0 Filter Constant Value	CH0																0, 200~64000
CH1 Filter Constant Value	CH1																
CH2 Filter Constant Value	CH2																
CH3 Filter Constant Value	CH3																
CH0 Average Method Setting	CH0																0: Sampling 1: Time average 2: Count average 3: Moving average
CH1 Average Method Setting	CH1																
CH2 Average Method Setting	CH2																
CH3 Average Method Setting	CH3																
CH0 Average Data	CH0																Time average: 400~60000ms Count average: 2~64000 times Moving average: 2~100EA
CH1 Average Data	CH1																
CH2 Average Data	CH2																
CH3 Average Data	CH3																
Scaling Type Setting	-												CH3	CH2	CH1	CH0	Bit Off (0): Sign Bit On (1): No Sign
CH0 Scaling Min. Value	CH0																Minimum Value Sign -32768~[Maximum-1] No Sign 0~[Maximum-1] Maximum Value Sign [Minimum+1]~32767 No Sign [Minimum+1]~655535
CH0 Scaling Max. Value	CH0																
CH1 Scaling Min. Value	CH1																
CH1 Scaling Max. Value	CH1																
CH2 Scaling Min. Value	CH2																
CH2 Scaling Max. Value	CH2																
CH3 Scaling Min. Value	CH3																
CH3 Scaling Max. Value	CH3																
CH0 Error Code	CH0																Bit 0 : Sensor type setting error Bit 1 : Filter constant value setting error Bit 2: Average process method setting error Bit 3: Time average value setting error Bit 4: Count average value setting error Bit 5: Moving average value setting error Bit 6: Scaling range setting error
CH1 Error Code	CH1																
CH2 Error Code	CH2																
CH3 Error Code	CH3																

Parameter Name	Bit																Settings
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
CH0 Cold Junction Compensation Temp. Data	CH0																Cold junction compensation temperature of channel 0
CH1 Cold Junction Compensation Temp. Data	CH1																Cold junction compensation temperature of channel 1
CH2 Cold Junction Compensation Temp. Data	CH2																Cold junction compensation temperature of channel 2
CH3 Cold Junction Compensation Temp. Data	CH3																Cold junction compensation temperature of channel 3

(25) XBF-LD02S

1) List of Parameter Objects

Index (hex)	SubIndex (hex)	SubIndex (dec)	Module Area Address	Parameter Name	Description	Bit size	R/W Property
80x0 (x: Slot No.)	01	01	0	Channel Enable	Active channel setting	16	R/W
	02	02	1	Weighing Mode/Zero Backup Mode	Weighing mode/zero backup setting	16	R/W
	03	03	2	CH0 Free Fall Compensation Cycle	Free fall compensation cycle of input channel 0	16	R/W
	04	04	3	CH1 Free Fall Compensation Cycle	Free fall compensation cycle of input channel 1	16	R/W
	05	05	4	CH0 Free Fall Coefficient	Free fall coefficient of input channel 0	16	R/W
	06	06	5	CH1 Free Fall Coefficient	Free fall coefficient of input channel 1	16	R/W
	07	07	6	CH0 Averaging Mode Setting	Average process setting for input channel 0	16	R/W
	08	08	7	CH1 Averaging Mode Setting	Average process setting for input channel 1	16	R/W
	09	09	8	CH0 Moving Average Value	Moving average value of input channel 0	16	R/W
	0A	10	9	CH1 Moving Average Value	Moving average value of input channel 1	16	R/W
	0B	11	10	CH0 Count Average Value	Count average value of input channel 0	16	R/W
	0C	12	11	CH1 Count Average Value	Count average value of input channel 1	16	R/W
	0D	13	12	CH0 Time Average Value	Time average value of input channel 0	16	R/W
	0E	14	13	CH1 Time Average Value	Time average value of input channel 1	16	R/W
	0F	15	14	CH0 Stable Range Value	Stable judgment range of input channel 0	16	R/W
	10	16	15	CH1 Stable Range Value	Stable judgment range of input channel 1	16	R/W
	11	17	16	CH0 Stable Time Value	Stable judgment time of input channel 0	16	R/W
	12	18	17	CH1 Stable Time Value	Stable judgment time of input channel 1	16	R/W
	13	19	18	CH0 Zero Tracking Range Value	Zero tracking range of input channel 0	16	R/W
	14	20	19	CH1 Zero Tracking Range Value	Zero tracking range of input channel 1	16	R/W
	15	21	20	CH0 Zero Tracking Time Value	Zero tracking time of input channel 0	16	R/W
	16	22	21	CH1 Zero Tracking Time Value	Zero tracking time of input channel 1	16	R/W
	17	23	22	CH0 Near Zero Range Value	Near zero range of input channel 0	16	R/W
	18	24	23	CH1 Near Zero Range Value	Near zero range of input channel 1	16	R/W
	19	25	24	Sampling Cycle/Alarm Setting	Sampling cycle/alarm setting	16	R/W
	1A	26	25	Near Zero Input Range	Near zero setting	16	R/W
	1B	27	26	CH0 Gross Weight HH Value(Lower)	Gross weight HH vValue (Lower) of input channel 0	16	R/W
	1C	28	27	CH0 Gross Weight HH Value(Upper)	Gross weight HH value (Upper) of input channel 0	16	R/W
	1D	29	28	CH0 Gross Weight H Value(Lower)	Gross weight H value (Lower) of input channel 0	16	R/W
	1E	30	29	CH0 Gross Weight H Value(Upper)	Gross weight H value (Upper) of input channel 0	16	R/W
	1F	31	30	CH0 Gross Weight L Value(Lower)	Gross weight L value (Lower) of input channel 0	16	R/W
	20	32	31	CH0 Gross Weight L Value(Upper)	Gross weight L value (Upper) of input channel 0	16	R/W
	21	33	32	CH0 Gross Weight LL Value (Lower)	Gross weight LL value (Lower) of input channel 0	16	R/W
	22	34	33	CH0 Gross Weight LL Value (Upper)	Gross weight LL value (Upper) of input channel 0	16	R/W
	23	35	34	CH1 Gross Weight HH Value(Lower)	Gross weight HH value (Lower) of input channel 1	16	R/W
	24	36	35	CH1 Gross Weight HH Value(Upper)	Gross weight HH value (Upper) of input channel 1	16	R/W
	25	37	36	CH1 Gross Weight H Value(Lower)	Gross weight H value (Lower) of input channel 1	16	R/W

Index (hex)	SubIndex (hex)	SubIndex (dec)	Module Area Address	Parameter Name	Description	Bit size	R/W Property
	26	38	37	CH1 Gross Weight H Value(Upper)	Gross weight H value (Upper) of input channel 1	16	R/W
	27	39	38	CH1 Gross Weight L Value(Lower)	Gross weight L value (Lower) of input channel 1	16	R/W
	28	40	39	CH1 Gross Weight L Value(Upper)	Gross weight L value (Upper) of input channel 1	16	R/W
	29	41	40	CH1 Gross Weight LL Value (Lower)	Gross weight LL value (Lower) of input channel 1	16	R/W
	2A	42	41	CH1 Gross Weight LL Value (Upper)	Gross weight LL value (Upper) of input channel 1	16	R/W
	2B	43	42	CH0 Final Gross Weight Value(Lower)	Final set gross weight value (Lower) of input channel 0	16	R/W
	2C	44	43	CH0 Final Gross Weight Value(Upper)	Final set gross weight value (Upper) of input channel 0	16	R/W
	2D	45	44	CH0 Step 1 Gross Weight Value(Lower)	Step 1 gross weight value (Lower) of input channel 0	16	R/W
	2E	46	45	CH0 Step 1 Gross Weight Value(Upper)	Step 1 gross weight value (Upper) of input channel 0	16	R/W
	2F	47	46	CH0 Step 2 Gross Weight Value(Lower)	Step 2 gross weight value (Lower) of input channel 0	16	R/W
	30	48	47	CH0 Step 2 Gross Weight Value(Upper)	Step 2 gross weight value (Upper) of input channel 0	16	R/W
	31	49	48	CH0 Free Fall Weight Value(Lower)	Free fall weight value (Lower) of input channel 0	16	R/W
	32	50	49	CH0 Free Fall Weight Value(Upper)	Free fall weight value (Upper) of input channel 0	16	R/W
	33	51	50	CH0 Weight Lack Value	Weight lack value of input channel 0	16	R/W
	34	52	51	CH0 Weight Over Value	Weight over value of input channel 0	16	R/W
	35	53	52	CH1 Final Gross Weight Value(Lower)	Final set gross weight value (Lower) of input channel 1	16	R/W
	36	54	53	CH1 Final Gross Weight Value(Upper)	Final set gross weight value (Upper) of input channel 1	16	R/W
	37	55	54	CH1 Step 1 Gross Weight Value (Lower)	Step 1 gross weight value (Lower) of input channel 1	16	R/W
	38	56	55	CH1 Step 1 Gross Weight Value (Upper)	Step 1 gross weight value (Upper) of input channel 1	16	R/W
	39	57	56	CH1 Step 2 Gross Weight Value (Lower)	Step 2 gross weight value (Lower) of input channel 1	16	R/W
	3A	58	57	CH1 Step 2 Gross Weight Value (Upper)	Step 2 gross weight value (Upper) of input channel 1	16	R/W
	3B	59	58	CH1 Free Fall Weight Value(Lower)	Free fall weight value (Lower) of input channel 1	16	R/W
	3C	60	59	CH1 Free Fall Weight Value(Upper)	Free fall weight value (Upper) of input channel 1	16	R/W
	3D	61	60	CH1 Weight Lack Value	Weight lack value of input channel 1	16	R/W
	3E	62	61	CH1 Weight Over Value	Weight over value of input channel 1	16	R/W
	3F	63	62	CH0 Maximum Capacity(Lower)	Maximum load cell capacity (Lower) of input channel 0	16	R/W
	40	64	63	CH0 Maximum Capacity(Upper)	Maximum load cell capacity (Upper) of input channel 0	16	R/W
	41	65	64	CH0 Standard Capacity(Lower)	Standard load cell capacity (Lower) of input channel 0	16	R/W
	42	66	65	CH0 Standard Capacity(Upper)	Standard load cell capacity (Upper) of input channel 0	16	R/W

Index (hex)	SubIndex (hex)	SubIndex (dec)	Module Area Address	Parameter Name	Description	Bit size	R/W Property
	43	67	66	CH0 Unit Setting	Calibration parameter CH0 (Specification of unit) of input channel 0	16	R/W
	44	68	67	CH0 Scale Setting	Calibration parameter CH0 (Specification of scale) of input channel 0	16	R/W
	45	69	68	CH0 Decimal Point Setting	Calibration parameter CH0 (Decimal Point) of input channel 0	16	R/W
	46	70	69	CH0 Sensitivity Value	Load cell sensitivity value (mV/V) of input channel 0	16	R/W
	47	71	70	CH1 Maximum Capacity(Lower)	Maximum load cell capacity (Lower) of input channel 1	16	R/W
	48	72	71	CH1 Maximum Capacity(Upper)	Maximum load cell capacity (Upper) of input channel 1	16	R/W
	49	73	72	CH1 Standard Capacity(Lower)	Standard load cell capacity (Lower) of input channel 1	16	R/W
	4A	74	73	CH1 Standard Capacity(Upper)	Standard load cell capacity (Upper) of input channel 1	16	R/W
	4B	75	74	CH1 Unit Setting	Calibration parameter CH1 (Specification of unit) of input channel 1	16	R/W
	4C	76	75	CH1 Scale Setting	Calibration parameter CH1 (Specification of scale) of input channel 1	16	R/W
	4D	77	76	CH1 Decimal Point Setting	Calibration parameter CH1 (Decimal Point) of input channel 1	16	R/W
	4E	78	77	CH1 Sensitivity Value	Load cell sensitivity value (mV/V) of input channel 1	16	R
80x1 (x: Slot No.)	01	01	78	Error	Error information	16	R
	02	02	79	CH0 Internal AD DATA(low)	Internal AD value (low) of input channel 0	16	R
	03	03	80	CH0 Internal AD DATA(high)	Internal AD value (high) of input channel 0	16	R
	04	04	81	CH1 Internal AD DATA(low)	Internal AD value (low) of input channel 1	16	R
	05	05	82	CH1 Internal AD DATA(high)	Internal AD value (high) of input channel 1	16	R
	06	06	83	Calibration Value Backup Setting	Calibration value internal parameter backup command	16	R/W

2) List of Parameter Settings

Parameter Name	Bit 15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	Settings
Channel Enable						-									CH1	CH0	Bit Off (0): Stop Bit On (1): Run
Weighing Mode/Zero Backup Mode	CH1 Zero Backup				CH0 Zero Backup				CH1 Weighing				CH0 Weighing				Zero backup mode 0: Disable 1: Unable (calibration standard) 2: Unable (Operation standard) Measurement mode 0:Simple measurement 1:Supply (simple comparison) 2:Supply (Sequence comparison) 3:Discharge (simple comparison) 4:Discharge (Sequence comparison)
CH0 Free Fall Compensation Cycle						-									CH0		0: Disable free fall compensation
CH1 Free Fall Compensation Cycle						-									CH1		1~9
CH0 Free Fall Coefficient						-									CH0		0:1 1:1/4
CH1 Free Fall Coefficient						-									CH1		2:2/4 3:3/4
CH0 Averaging Mode Setting						-									CH0		0: Moving average
CH1 Averaging Mode Setting						-									CH1		1: Moving/count average 2. Moving/time average
CH0 Moving Average Value						-					CH0						0 ~ 9 [2^0 ~ 2^9]
CH1 Moving Average Value						-					CH1						
CH0 Count Average Value						CH0											1 ~ 999 [Count]
CH1 Count Average Value						CH1											
CH0 Time Average Value						-					CH0						1 ~ 99 [0.1s]
CH1 Time Average Value						-					CH1						
CH0 Stable Range Value						CH0											0 ~ 999 [Scale]
CH1 Stable Range Value						CH1											
CH0 Stable Time Value						-					CH0						0 ~ 99 [0.1s]
CH1 Stable Time Value						-					CH1						
CH0 Zero Tracking Range Value						-					CH0						0, 1 ~ 99 [Scale]
CH1 Zero Tracking Range Value						-					CH1						
CH0 Zero Tracking Time Value						-					CH0						0 ~ 99 [0.1s]
CH1 Zero Tracking Time Value						-					CH1						
CH0 Near Zero Range Value						-					CH0						1 ~ 99 [%]
CH1 Near Zero Range Value						-					CH1						
Sampling Cycle/Alarm Setting	CH1 Sampling Cycle				CH0 Sampling Cycle					-					CH1	CH0	Sampling cycle 0: 400Hz 1: 200Hz 2: 50Hz 3: 20Hz Sequence alarm 0: Disable 1: Enable

Parameter Name	Bit																Settings
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
Near Zero Input Range				CH1								CH0					0 ~ 99
CH0 Gross Weight HH Value(Lower)								CH0									0 ~ 999,999
CH0 Gross Weight HH Value(Upper)																	
CH0 Gross Weight H Value(Lower)								CH0									0 ~ 999,999
CH0 Gross Weight H Value(Upper)																	Gross Weight L Value ~ HH Value
CH0 Gross Weight L Value(Lower)								CH0									0 ~ 999,999
CH0 Gross Weight L Value(Upper)																	Gross Weight LL Value ~ H Value
CH0 Gross Weight LL Value (Lower)								CH0									0 ~ 999,999
CH0 Gross Weight LL Value (Upper)																	0 ~ Gross Weight L Value
CH1 Gross Weight HH Value(Lower)								CH1									0 ~ 999,999
CH1 Gross Weight HH Value(Upper)																	
CH1 Gross Weight H Value(Lower)								CH1									0 ~ 999,999
CH1 Gross Weight H Value(Upper)																	Gross Weight L Value ~ HH Value
CH1 Gross Weight L Value(Lower)								CH1									0 ~ 999,999
CH1 Gross Weight L Value(Upper)																	Gross Weight LL Value ~ H Value
CH1 Gross Weight LL Value (Lower)								CH1									0 ~ 999,999
CH1 Gross Weight LL Value (Upper)																	0 ~ Gross Weight L Value
CH0 Final Gross Weight Value (Lower)								CH0									0 ~ 999,999
CH0 Final Gross Weight Value (Upper)																	
CH0 Step 1 Gross Weight Value (Lower)								CH0									0 ~ 999,999
CH0 Step 1 Gross Weight Value (Upper)																	
CH0 Step 2 Gross Weight Value (Lower)								CH0									0 ~ 999,999
CH0 Step 2 Gross Weight Value (Upper)																	
CH0 Free Fall Weight Value(Lower)								CH0									0 ~ 999,999
CH0 Free Fall Weight Value(Upper)																	
CH0 Weight Lack Value								CH0									0 ~ 9,999
CH0 Weight Over Value								CH0									0 ~ 9,999
CH1 Final Gross Weight Value (Lower)								CH1									0 ~ 999,999
CH1 Final Gross Weight Value (Upper)																	
CH1 Step 1 Gross Weight Value (Lower)								CH1									0 ~ 999,999
CH1 Step 1 Gross Weight Value (Upper)																	
CH1 Step 2 Gross Weight Value (Lower)								CH1									0 ~ 999,999
CH1 Step 2 Gross Weight Value (Upper)																	

Parameter Name	Bit																Settings
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
CH1 Free Fall Weight Value(Lower)	CH1																0 ~ 999,999
CH1 Free Fall Weight Value(Upper)																	
CH1 Weight Lack Value	CH1																0 ~ 9,999
CH1 Weight Over Value	CH1																0 ~ 9,999
CH0 Maximum Capacity(Lower)	CH0																0 ~ 999,999
CH0 Maximum Capacity(Upper)																	
CH0 Standard Capacity(Lower)	CH0																0 ~ Standard Load Cell Capacity
CH0 Standard Capacity(Upper)																	
CH0 Unit Setting	CH0																0x6B67: Kg 0x0067: g 0x0074: t
CH0 Scale Setting	-												CH0				0000 : 1 (default) 0001 : 2 0010 : 5 0011 : 10
CH0 Decimal Point Setting	-												CH0				0000 : 1 (default) 0001 : 0.1 0010 : 0.01 0011 : 0.001
CH0 Sensitivity Value	CH0																0 ~ 60000 [mV/V] Enter five decimal places Ex) 2.2mV/V = 22000
CH1 Maximum Capacity(Lower)	CH1																0 ~ 999,999
CH1 Maximum Capacity(Upper)																	
CH1 Standard Capacity(Lower)	CH1																0 ~ Standard Load Cell Capacity
CH1 Standard Capacity(Upper)																	
CH1 Unit Setting	CH1																0x6B67: Kg 0x0067: g 0x0074: t
CH1 Scale Setting	-												CH1				0000 : 1 (default) 0001 : 2 0010 : 5 0011 : 10
CH1 Decimal Point Setting	-												CH1				0000 : 1 (default) 0001 : 0.1 0010 : 0.01 0011 : 0.001
CH1 Sensitivity Value	CH1																0 ~ 60000 [mV/V] Enter five decimal places Ex) 2.2mV/V = 22000

Parameter Name	Bit																Settings
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
Error									-								0: Normal operation 100: External power error 11#: ADC defect 12#: Wiring status error 13#: Initial zero setting error 20#: Calibration zero setting error 21#: Calibration span setting error 22#: Calibration resolution excess error 23#: Calibration internal resolution error 24#: Calibration request flag setting error 30#: Zero setting error 31#: Tare setting error 32#: Maximum weight excess error 40#: Near zero setting error 41#: Stable judgment range setting error 42#: Stable judgment time setting error 43#: Zero tracking range setting error 44#: Zero tracking time setting error 45#: Moving average process setting error 46#: Count average process setting error 47#: Time average process setting error 48#: Warning upper/lower limit setting error 49#: Step 1 and Step 2 free fall setting error #: Input channel No.
CH0 Internal AD DATA(low)	CH0																Internal AD value (low) of input channel 0
CH0 Internal AD DATA(high)																	Internal AD value (high) of input channel 0
CH1 Internal AD DATA(low)	CH1																Internal AD value (low) of input channel 1
CH1 Internal AD DATA(high)																	Internal AD value (high) of input channel 1
Calibration Value Backup Setting	CH1								CH0								Calibration value internal parameter backup command 0x66: Read internal parameter 0x99: Write internal parameter

(26) XBF-HO02A/HD02A

1) List of Parameter Objects

Index (hex)	SubIndex (hex)	SubIndex (dec)	Module Area Address	Parameter Name	Description	Bit size	R/W Property
80x0 (x: Slot No.)	01	01	0	CH0 Counter Mode Setting	Counter mode setting for channel 0	16	R/W
	02	02	1	CH0 Pulse Mode Setting	Pulse input mode setting for channel 0	16	R/W
	03	03	2	CH0 Preset Value Lower	Preset value setting for channel 0	16	R/W
	04	04	3	CH0 Preset Value Upper		16	R/W
	05	05	4	CH0 Ring Count Min. Value Lower	Minimum ring count value of channel 0	16	R/W
	06	06	5	CH0 Ring Count Min. Value Upper		16	R/W
	07	07	6	CH0 Ring Count Max. Value Lower	Maximum ring count value of channel 0	16	R/W
	08	08	7	CH0 Ring Count Max. Value Upper		16	R/W
	09	09	8	CH0 Compare 0 Type Setting	Comparison output 0 mode of channel 0	16	R/W
	0A	10	9	CH0 Compare 1 Type Setting	Comparison output 1 mode of channel 0	16	R/W
	0B	11	10	CH0 Compare 0 Min. Value Lower	Comparison output 0 minimum setting value of channel 0	16	R/W
	0C	12	11	CH0 Compare 0 Min. Value Upper		16	R/W
	0D	13	12	CH0 Compare 0 Max. Value Lower	Comparison output 0 maximum setting value of channel 0	16	R/W
	0E	14	13	CH0 Compare 0 Max. Value Upper		16	R/W
	0F	15	14	CH0 Compare 1 Min. Value Lower	Comparison output 1 minimum setting value of channel 0	16	R/W
	10	16	15	CH0 Compare 1 Min. Value Upper		16	R/W
	11	17	16	CH0 Compare 1 Max. Value Lower	Comparison output 1 maximum setting value of channel 0	16	R/W
	12	18	17	CH0 Compare 1 Max. Value Upper		16	R/W
	13	19	18	CH0 Auxiliary Mode Setting	Auxiliary function mode of channel 0	16	R/W
	14	20	19	CH0 Time Value	Section setting value [ms] of channel 0	16	R/W
	15	21	20	CH0 Pulses Per Revolution Value	Number of pulses per revolution of channel 0	16	R/W
	16	22	21	CH0 Frequency Unit Setting	Frequency display mode of channel 0	16	R/W
	17	23	22	CH0 Active Level Setting	Pulse input level of channel 0	16	R/W
	18	24	23	CH0 Compare Output Status Setting	Output status setting for channel 0	16	R/W
	1A	26	25	CH1 Counter Mode Setting	Counter mode setting for channel 1	16	R/W
	1B	27	26	CH1 Pulse Mode Setting	Pulse input mode setting for channel 1	16	R/W
	1C	28	27	CH1 Preset Value Lower	Preset value setting for channel 1	16	R/W
	1D	29	28	CH1 Preset Value Upper		16	R/W
	1E	30	29	CH1 Ring Count Min. Value Lower	Minimum ring count value of channel 1	16	R/W
	1F	31	30	CH1 Ring Count Min. Value Upper		16	R/W
	20	32	31	CH1 Ring Count Max. Value Lower	Maximum ring count value of channel 1	16	R/W
	21	33	32	CH1 Ring Count Max. Value Upper		16	R/W
	22	34	33	CH1 Compare 0 Type Setting	Comparison output 0 mode of channel 1	16	R/W
	23	35	34	CH1 Compare 1 Type Setting	Comparison output 1 mode of channel 1	16	R/W
	24	36	35	CH1 Compare 0 Min. Value Lower	Comparison output 0 minimum setting	16	R/W

Index (hex)	SubIndex (hex)	SubIndex (dec)	Module Area Address	Parameter Name	Description	Bit size	R/W Property
	25	37	36	CH1 Compare 0 Min. Value Upper	value of channel 1	16	R/W
	26	38	37	CH1 Compare 0 Max. Value Lower	Comparison output 0 maximum setting value of channel 1	16	R/W
	27	39	38	CH1 Compare 0 Max. Value Upper		16	R/W
	28	40	39	CH1 Compare 1 Min. Value Lower	Comparison output 1 minimum setting value of channel 1	16	R/W
	29	41	40	CH1 Compare 1 Min. Value Upper		16	R/W
	2A	42	41	CH1 Compare 1 Max. Value Lower	Comparison output 1 maximum setting value pf channel 1	16	R/W
	2B	43	42	CH1 Compare 1 Max. Value Upper		16	R/W
	2C	44	43	CH1 Auxiliary Mode Setting	Auxiliary function mode of channel 1	16	R/W
	2D	45	44	CH1 Time Value	Section setting value [ms] of channel 1	16	R/W
	2E	46	45	CH1 Pulses Per Revolution Value	Number of pulses per revolution of channel 1	16	R/W
	2F	47	46	CH1 Frequency Unit Setting	Frequency display mode of channel 1	16	R/W
	30	48	47	CH1 Active Level Setting	Pulse input level of channel 1	16	R/W
	31	49	48	CH1 Compare Output Status Setting	Output status setting for channel 1	16	R/W
80x1 (x: Slot No.)	01	01	51	Error code	Error information	16	R

2) List of Parameter Settings

Parameter Name	Bit																Settings
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
CH0 Counter Mode Setting								CH0									0: Linear count, 1: Ring count
CH0 Pulse Mode Setting								CH0									0: 2-phase 1-multiplication 1: 2-phase 2-multiplication 2: 2-phase 4-multiplication 3: CW/CCW 4: 1-phase 1-input 1-multiplication 5: 1-phase 1-input 2-multiplication 6: 1-phase 2-input 1-multiplication 7: 1-phase 2-input 2-multiplication
CH0 Preset Value Lower CH0 Preset Value Upper								CH0									-2,147,483,648 ~ 2,147,483,647
CH0 Ring Count Min. Value Lower CH0 Ring Count Min. Value Upper								CH0									-2,147,483,648 ~ 2,147,483,647
CH0 Ring Count Max. Value Lower CH0 Ring Count Max. Value Upper								CH0									-2,147,483,648 ~ 2,147,483,647
CH0 Compare 0 Type Setting								CH0									0: < Reference value for comparison 1: ≤ Reference value for comparison 2: = Reference value for comparison 3: ≥ Reference value for comparison 4: ≥ Reference value for comparison
CH0 Compare 1 Type Setting								CH0									5: Min. Comparison Value ≤ Current Value ≤ Max. Comparison Value 6: Min. Comparison Value ≥ Current Value Current Value ≥ Max. Comparison Value
CH0 Compare 0 Min. Value Lower CH0 Compare 0 Min. Value Upper								CH0									-2,147,483,648 ~ 2,147,483,647
CH0 Compare 0 Max. Value Lower CH0 Compare 0 Max. Value Upper								CH0									-2,147,483,648 ~ 2,147,483,647
CH0 Compare 1 Min. Value Lower CH0 Compare 1 Min. Value Upper								CH0									-2,147,483,648 ~ 2,147,483,647
CH0 Compare 1 Max. Value Lower CH0 Compare 1 Max. Value Upper								CH0									-2,147,483,648 ~ 2,147,483,647
CH0 Auxiliary Mode Setting								CH0									0: Do not use auxiliary functions 1: Clear count 2: Latch count 3: Count section 4: Measure input frequency 5: Measure revolution count per unit time 6: Disable count
CH0 Time Value								CH0									0 ~ 60,000
CH0 Pulses Per Revolution Value								CH0									0 ~ 60,000
CH0 Frequency Unit Setting								CH0									0: 1Hz, 1: 10Hz, 2: 100Hz 3: 1000Hz(=1KHz)
CH0 Active Level Setting								CH0									0: Low Active, 1: High Active
CH0 Compare Output Status Setting								CH0									0: Disable Output, 1: Enable Output

Parameter Name	Bit																Settings
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
CH1 Counter Mode Setting								CH1									0: Linear count, 1: Ring count
CH1 Pulse Mode Setting								CH1									0: 2-phase 1-multiplication 1: 2-phase 2-multiplication 2: 2-phase 4-multiplication 3: CW/CCW 4: 1-phase 1-input 1-multiplication 5: 1-phase 1-input 2-multiplication 6: 1-phase 2-input 1-multiplication 7: 1-phase 2-input 2-multiplication
CH1 Preset Value Lower CH1 Preset Value Upper								CH1									-2,147,483,648 ~ 2,147,483,647
CH1 Ring Count Min. Value Lower CH1 Ring Count Min. Value Upper								CH1									-2,147,483,648 ~ 2,147,483,647
CH1 Ring Count Max. Value Lower CH1 Ring Count Max. Value Upper								CH1									-2,147,483,648 ~ 2,147,483,647
CH1 Compare 0 Type Setting								CH1									0: < Reference value for comparison 1: ≤ Reference value for comparison 2: = Reference value for comparison 3: ≥ Reference value for comparison 4: ≥ Reference value for comparison
CH1 Compare 1 Type Setting								CH1									5: Min. Comparison Value ≤ Current Value ≤ Max. Comparison Value 6: Min. Comparison Value ≥ Current Value Current Value ≥ Max. Comparison Value
CH1 Compare 0 Min. Value Lower CH1 Compare 0 Min. Value Upper								CH1									-2,147,483,648 ~ 2,147,483,647
CH1 Compare 0 Max. Value Lower CH1 Compare 0 Max. Value Upper								CH1									-2,147,483,648 ~ 2,147,483,647
CH1 Compare 1 Min. Value Lower CH1 Compare 1 Min. Value Upper								CH1									-2,147,483,648 ~ 2,147,483,647
CH1 Compare 1 Max. Value Lower CH1 Compare 1 Max. Value Upper								CH1									-2,147,483,648 ~ 2,147,483,647
CH1 Auxiliary Mode Setting								CH1									0: Do not use auxiliary functions 1: Clear count 2: Latch count 3: Count section 4: Measure input frequency 5: Measure revolution count per unit time 6: Disable count
CH1 Time Value								CH1									0 ~ 60,000
CH1 Pulses Per Revolution Value								CH1									0 ~ 60,000
CH1 Frequency Unit Setting								CH1									0: 1Hz, 1: 10Hz, 2: 100Hz 3: 1000Hz(=1KHz)
CH1 Active Level Setting								CH1									0: Low Active, 1: High Active
CH1 Compare Output Status Setting								CH1									0: Disable Output, 1: Enable Output

Parameter Name	Bit																Settings
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
Error code								-									10: Module error (ASIC reset error) 11: Module error (ASIC memory error) 12: Module error (ASIC register error) #20: Count type setting error #21: Pulse input type setting error #22: Auxiliary function type setting error #23: Auxiliary function unit time setting error #24: Comparison output 0 type setting error #25: Comparison output 1 type setting error #26: Preset value setting error #27: Ring count range setting error 　　　(Min. ring count value ≥ max. value) #28: Comparison output 0 min. comparison value setting error #29: Comparison output 0 max. comparison value setting error #30: Comparison output 0 range setting error 　　　(Min. comparison value > max. comparison value) #31: Comparison output 1 min. comparison value setting error #32: Comparison output 1 max. comparison value setting error #33: Comparison output 1 range setting error 　　　(Min. comparison value > max. comparison value) #34: Pulse value per 1 revolution range setting error #35: Frequency input unit range setting error #36: Hold comparison output when stopping the basic unit Parameter error

Appendix 2.3 PDO List

XEL-BSSCT PDO List

Device Name	PDO Type	Index:SubIndex	Item Name	Data Type
XEL-BSSCT	TxPDO (0x1A80)	2000:01	_RUN	BIT
		2000:03	_ERROR	BIT
		2010:02	_IO_TYER	BIT
		2010:03	_IO_DEER	BIT
		2010:05	_IO_RWER	BIT
		2010:06	_IP_IFER	BIT
		2010:08	_BPRM_ER	BIT
		2010:09	_IOPRM_ER	BIT
		2010:0A	_SPPRM_ER	BIT
		2010:0B	_CPPRM_ER	BIT
		2010:0D	_SWDT_ER	BIT
		2010:10	_IOSIZE_ER	BIT
		2020:02	_REFRESH_OT_WAR	BIT
		2040:1A	_EXT_ERR_FLAG_0SLT	BIT
		2040:1B	_EXT_ERR_FLAG_1SLT	BIT
		2040:1C	_EXT_ERR_FLAG_2SLT	BIT
		2040:1D	_EXT_ERR_FLAG_3SLT	BIT
		2040:1E	_EXT_ERR_FLAG_4SLT	BIT
		2040:1F	_EXT_ERR_FLAG_5SLT	BIT
		2040:20	_EXT_ERR_FLAG_6SLT	BIT
		2040:21	_EXT_ERR_FLAG_7SLT	BIT
		2030:06	_REFRESH_MAX	word
		2030:07	_REFRESH_MIN	word
		2030:08	_REFRESH_CUR	word
	RxPDO (0x1680)	2040:03	_DC_SYNC_COUNT_CLR	BIT

XBE-DC08A PDO List

Device Name	PDO Type	Index:SubIndex	Item Name	Data Type
XBE-DC08A	TxPDO (0x1A0x) X: Slot No.	60x0:01(x: Slot No.)	DI 0	BIT
		60x0:02	DI 1	BIT
		60x0:03	DI 2	BIT
		60x0:04	DI 3	BIT
		60x0:05	DI 4	BIT
		60x0:06	DI 5	BIT
		60x0:07	DI 6	BIT
		60x0:08	DI 7	BIT

XBE-DC16A/B PDO List

Device Name	PDO Type	Index:SubIndex	Item Name	Data Type
XBE-DC16A/B	TxPDO (0x1A0x) X: Slot No.	60x0:01(x: Slot No.)	DI 0	BIT
		60x0:02	DI 1	BIT
		60x0:03	DI 2	BIT
		60x0:04	DI 3	BIT
		60x0:05	DI 4	BIT
		60x0:06	DI 5	BIT
		60x0:07	DI 6	BIT
		60x0:08	DI 7	BIT
		60x0:09	DI 8	BIT
		60x0:0A	DI 9	BIT
		60x0:0B	DI 10	BIT
		60x0:0C	DI 11	BIT
		60x0:0D	DI 12	BIT
		60x0:0E	DI 13	BIT
		60x0:0F	DI 14	BIT
		60x0:10	DI 15	BIT

XBE-DC32A PDO List

Device Name	PDO Type	Index:SubIndex	Item Name	Data Type
XBE-DC32A	TxPDO (0x1A0x) X: Slot No.	60x0:01(x: Slot No.)	DI 0	BIT
		60x0:02	DI 1	BIT
		60x0:03	DI 2	BIT
		60x0:04	DI 3	BIT
		60x0:05	DI 4	BIT
		60x0:06	DI 5	BIT
		60x0:07	DI 6	BIT
		60x0:08	DI 7	BIT
		60x0:09	DI 8	BIT
		60x0:0A	DI 9	BIT
		60x0:0B	DI 10	BIT
		60x0:0C	DI 11	BIT
		60x0:0D	DI 12	BIT
		60x0:0E	DI 13	BIT
		60x0:0F	DI 14	BIT
		60x0:10	DI 15	BIT
		60x0:11	DI 16	BIT
		60x0:12	DI 17	BIT
		60x0:13	DI 18	BIT
		60x0:14	DI 19	BIT
		60x0:15	DI 20	BIT
		60x0:16	DI 21	BIT
		60x0:17	DI 22	BIT
		60x0:18	DI 23	BIT
		60x0:19	DI 24	BIT
		60x0:1A	DI 25	BIT
		60x0:1B	DI 26	BIT
		60x0:1C	DI 27	BIT
		60x0:1D	DI 28	BIT
		60x0:1E	DI 29	BIT
		60x0:1F	DI 30	BIT
		60x0:20	DI 31	BIT

XBE-TN/TP08A PDO List

Device Name	PDO Type	Index:SubIndex	Item Name	Data Type
XBE-TN/TP08A	RxPDO (0x160x) X: Slot No.	70x0:01(x: Slot No.)	DO 0	BIT
		70x0:02	DO 1	BIT
		70x0:03	DO 2	BIT
		70x0:04	DO 3	BIT
		70x0:05	DO 4	BIT
		70x0:06	DO 5	BIT
		70x0:07	DO 6	BIT
		70x0:08	DO 7	BIT

XBE-TN/TP16A PDO List

Device Name	PDO Type	Index:SubIndex	Item Name	Data Type
XBE-TN/TP16A	RxPDO (0x160x) X: Slot No.	70x0:01(x: Slot No.)	DO 0	BIT
		70x0:02	DO 1	BIT
		70x0:03	DO 2	BIT
		70x0:04	DO 3	BIT
		70x0:05	DO 4	BIT
		70x0:06	DO 5	BIT
		70x0:07	DO 6	BIT
		70x0:08	DO 7	BIT
		70x0:09	DO 8	BIT
		70x0:0A	DO 9	BIT
		70x0:0B	DO 10	BIT
		70x0:0C	DO 11	BIT
		70x0:0D	DO 12	BIT
		70x0:0E	DO 13	BIT
		70x0:0F	DO 14	BIT
		70x0:10	DO 15	BIT

XBE-TN/TP32A PDO List

Device Name	PDO Type	Index:SubIndex	Item Name	Data Type
XBE-TN/TP32A	RxPDO (0x160x) X: Slot No.	70x0:01(x: Slot No.)	DO 0	BIT
		70x0:02	DO 1	BIT
		70x0:03	DO 2	BIT
		70x0:04	DO 3	BIT
		70x0:05	DO 4	BIT
		70x0:06	DO 5	BIT
		70x0:07	DO 6	BIT
		70x0:08	DO 7	BIT
		70x0:09	DO 8	BIT
		70x0:0A	DO 9	BIT
		70x0:0B	DO 10	BIT
		70x0:0C	DO 11	BIT
		70x0:0D	DO 12	BIT
		70x0:0E	DO 13	BIT
		70x0:0F	DO 14	BIT
		70x0:10	DO 15	BIT
		70x0:11	DO 16	BIT
		70x0:12	DO 17	BIT
		70x0:13	DO 18	BIT
		70x0:14	DO 19	BIT
		70x0:15	DO 20	BIT
		70x0:16	DO 21	BIT
		70x0:17	DO 22	BIT
		70x0:18	DO 23	BIT
		70x0:19	DO 24	BIT
		70x0:1A	DO 25	BIT
		70x0:1B	DO 26	BIT
		70x0:1C	DO 27	BIT
		70x0:1D	DO 28	BIT
		70x0:1E	DO 29	BIT
		70x0:1F	DO 30	BIT
		70x0:20	DO 31	BIT

XBE-RY08A/B PDO List

Device Name	PDO Type	Index:SubIndex	Item Name	Data Type
XBE-RY08A/B	RxPDO (0x160x) X: Slot No.	70x0:01(x: Slot No.)	DO 0	BIT
		70x0:02	DO 1	BIT
		70x0:03	DO 2	BIT
		70x0:04	DO 3	BIT
		70x0:05	DO 4	BIT
		70x0:06	DO 5	BIT
		70x0:07	DO 6	BIT
		70x0:08	DO 7	BIT

XBE-RY16A PDO List

Device Name	PDO Type	Index:SubIndex	Item Name	Data Type
XBE-RY16A	RxPDO (0x160x) X: Slot No.	70x0:01(x: Slot No.)	DO 0	BIT
		70x0:02	DO 1	BIT
		70x0:03	DO 2	BIT
		70x0:04	DO 3	BIT
		70x0:05	DO 4	BIT
		70x0:06	DO 5	BIT
		70x0:07	DO 6	BIT
		70x0:08	DO 7	BIT
		70x0:09	DO 8	BIT
		70x0:0A	DO 9	BIT
		70x0:0B	DO 10	BIT
		70x0:0C	DO 11	BIT
		70x0:0D	DO 12	BIT
		70x0:0E	DO 13	BIT
		70x0:0F	DO 14	BIT
		70x0:10	DO 15	BIT

XBE-DR16A PDO List

Device Name	PDO Type	Index:SubIndex	Item Name	Data Type
XBE-DR16A	TxPDO (0x1A0x) X: Slot No.	60x0:01(x: Slot No.)	DI 0	BIT
		60x0:02	DI 1	BIT
		60x0:03	DI 2	BIT
		60x0:04	DI 3	BIT
		60x0:05	DI 4	BIT
		60x0:06	DI 5	BIT
		60x0:07	DI 6	BIT
		60x0:08	DI 7	BIT
	RxPDO (0x160x) X: Slot No.	70x0:01(x: Slot No.)	DO 0	BIT
		70x0:02	DO 1	BIT
		70x0:03	DO 2	BIT
		70x0:04	DO 3	BIT
		70x0:05	DO 4	BIT
		70x0:06	DO 5	BIT
		70x0:07	DO 6	BIT
		70x0:08	DO 7	BIT

XBE-DN32A PDO List

Device Name	PDO Type	Index:SubIndex	Item Name	Data Type
XBE-DN32A	TxPDO (0x1A0x) X: Slot No.	60x0:01(x: Slot No.)	DI 0	BIT
		60x0:02	DI 1	BIT
		60x0:03	DI 2	BIT
		60x0:04	DI 3	BIT
		60x0:05	DI 4	BIT
		60x0:06	DI 5	BIT
		60x0:07	DI 6	BIT
		60x0:08	DI 7	BIT
		60x0:09	DI 8	BIT
		60x0:0A	DI 9	BIT
		60x0:0B	DI 10	BIT
		60x0:0C	DI 11	BIT
		60x0:0D	DI 12	BIT
		60x0:0E	DI 13	BIT
		60x0:0F	DI 14	BIT
		60x0:10	DI 15	BIT
	RxPDO (0x160x) X: Slot No.	70x0:01(x: Slot No.)	DO 0	BIT
		70x0:02	DO 1	BIT
		70x0:03	DO 2	BIT
		70x0:04	DO 3	BIT
		70x0:05	DO 4	BIT
		70x0:06	DO 5	BIT
		70x0:07	DO 6	BIT
		70x0:08	DO 7	BIT
		70x0:09	DO 8	BIT
		70x0:0A	DO 9	BIT
		70x0:0B	DO 10	BIT
		70x0:0C	DO 11	BIT
		70x0:0D	DO 12	BIT
		70x0:0E	DO 13	BIT
		70x0:0F	DO 14	BIT
		70x0:10	DO 15	BIT

XBF-AD04A PDO List

Device Name	PDO Type	Index:SubIndex	Item Name	Description	Data Type
XBF-AD04A	TxPDO (0x1A0x) X: Slot No.	60x0:01 (x: Slot No.)	Error Flag	Module error	BIT
		60x0:03	Ready Flag	Module ready	BIT
		60x0:04	CH0 Activation Status	Channel 0 is active	BIT
		60x0:05	CH1 Activation Status	Channel 1 is active	BIT
		60x0:06	CH2 Activation Status	Channel 2 is active	BIT
		60x0:07	CH3 Activation Status	Channel 3 is active	BIT
		60x1:01	CH0 Digital Output Data	Converted value of channel 0	word
		60x1:02	CH1 Digital Output Data	Converted value of channel 1	word
		60x1:03	CH2 Digital Output Data	Converted value of channel 2	word
		60x1:04	CH3 Digital Output Data	Converted value of channel 3	word
	RxPDO (0x160x) X: Slot No.	70x0:01 (x: Slot No.)	Error Clear Request	Error clear request	BIT

XBF-AD08A PDO List

Device Name	PDO Type	Index: SubIndex	Item Name	Description	Data Type
XBF-AD08A	TxPDO (0x1A0x) X: Slot No.	60x0:01 (x: Slot No.)	Module Error	Module error	BIT
		60x0:03	Module Ready	Module ready	BIT
		60x0:04	CH0 Activation Status	Channel 0 is active	BIT
		60x0:05	CH1 Activation Status	Channel 1 is active	BIT
		60x0:06	CH2 Activation Status	Channel 2 is active	BIT
		60x0:07	CH3 Activation Status	Channel 3 is active	BIT
		60x0:08	CH4 Activation Status	Channel 4 is active	BIT
		60x0:09	CH5 Activation Status	Channel 5 is active	BIT
		60x0:0A	CH6 Activation Status	Channel 6 is active	BIT
		60x0:0B	CH7 Activation Status	Channel 7 is active	BIT
		60x0:0C	CH0 Error	Channel 0 error	BIT
		60x0:0D	CH1 Error	Channel 1 error	BIT
		60x0:0E	CH2 Error	Channel 2 error	BIT
		60x0:0F	CH3 Error	Channel 3 error	BIT
		60x0:10	CH4 Error	Channel 4 error	BIT
		60x0:11	CH5 Error	Channel 5 error	BIT
		60x0:12	CH6 Error	Channel 6 error	BIT
		60x0:13	CH7 Error	Channel 7 error	BIT
		60x2:01	CH0 Disconnection Flag	Disconnection detected from channel 0	BIT
		60x2:02	CH1 Disconnection Flag	Disconnection detected from channel 1	BIT
		60x2:03	CH2 Disconnection Flag	Disconnection detected from channel 2	BIT
		60x2:04	CH3 Disconnection Flag	Disconnection detected from channel 3	BIT
		60x2:05	CH4 Disconnection Flag	Disconnection detected from channel 4	BIT
		60x2:06	CH5 Disconnection Flag	Disconnection detected from channel 5	BIT
		60x2:07	CH6 Disconnection Flag	Disconnection detected from channel 6	BIT
		60x2:08	CH7 Disconnection Flag	Disconnection detected from channel 7	BIT
		60x1:01	CH0 Digital Output Data	Converted value of channel 0	word
		60x1:02	CH1 Digital Output Data	Converted value of channel 1	word
		60x1:03	CH2 Digital Output Data	Converted value of channel 2	word
		60x1:04	CH3 Digital Output Data	Converted value of channel 3	word
		60x1:05	CH4 Digital Output Data	Converted value of channel 4	word
		60x1:06	CH5 Digital Output Data	Converted value of channel 5	word
		60x1:07	CH6 Digital Output Data	Converted value of channel 6	word
		60x1:08	CH7 Digital Output Data	Converted value of channel 7	word
	RxPDO (0x160x) X: Slot No.	70x0:01 (x: Slot No.)	Error Clear Request	Error clear request	BIT

XBF-AD04C PDO List

Device Name	PDO Type	Index: SubIndex	Item Name	Description	Data Type
XBF-AD04C	TxPDO (0x1A0x) X: Slot No.	60x0:01 (x: Slot No.)	Module Error	Module error	BIT
		60x0:03	Module Ready	Module ready	BIT
		60x0:04	CH0 Activation Status	Channel 0 is active	BIT
		60x0:05	CH1 Activation Status	Channel 1 is active	BIT
		60x0:06	CH2 Activation Status	Channel 2 is active	BIT
		60x0:07	CH3 Activation Status	Channel 3 is active	BIT
		60x0:09	CH0 Error	Channel 0 error	BIT
		60x0:0A	CH1 Error	Channel 1 error	BIT
		60x0:0B	CH2 Error	Channel 2 error	BIT
		60x0:0C	CH3 Error	Channel 3 error	BIT
		60x2:01	CH0 Disconnection Flag	Disconnection detected from channel 0	BIT
		60x2:02	CH1 Disconnection Flag	Disconnection detected from channel 1	BIT
		60x2:03	CH2 Disconnection Flag	Disconnection detected from channel 2	BIT
		60x2:04	CH3 Disconnection Flag	Disconnection detected from channel 3	BIT
		60x2:06	CH0 Upper Alarm	Channel 0 Upper Alarm	BIT
		60x2:07	CH1 Upper Alarm	Channel 1 Upper Alarm	BIT
		60x2:08	CH2 Upper Alarm	Channel 2 Upper Alarm	BIT
		60x2:09	CH3 Upper Alarm	Channel 3 Upper Alarm	BIT
		60x2:0B	CH0 Lower Alarm	Channel 0 Lower Alarm	BIT
		60x2:0C	CH1 Lower Alarm	Channel 1 Lower Alarm	BIT
		60x2:0D	CH2 Lower Alarm	Channel 2 Lower Alarm	BIT
		60x2:0E	CH3 Lower Alarm	Channel 3 Lower Alarm	BIT
		60x1:01	CH0 Digital Output Data	Converted value of channel 0	word
		60x1:02	CH1 Digital Output Data	Converted value of channel 1	word
		60x1:03	CH2 Digital Output Data	Converted value of channel 2	word
		60x1:04	CH3 Digital Output Data	Converted value of channel 3	word
	RxPDO (0x160x) X: Slot No.	70x0:01 (x: Slot No.)	Error Clear Request	Error clear request	BIT

XBF-DV04A PDO List

Device Name	PDO Type	Index:SubIndex	Item Name	Description	Data Type
XBF-DV04A	TxPDO (0x1A0x) X: Slot No.	60x0:01 (x: Slot No.)	CH0 Error	Channel 0 error	BIT
		60x0:02	CH1 Error	Channel 1 error	BIT
		60x0:03	CH2 Error	Channel 2 error	BIT
		60x0:04	CH3 Error	Channel 3 error	BIT
		60x0:06	Ready Flag	Module ready	BIT
		60x0:07	CH0 Activation Status	Channel 0 is active	BIT
		60x0:08	CH1 Activation Status	Channel 1 is active	BIT
		60x0:09	CH2 Activation Status	Channel 2 is active	BIT
		60x0:0A	CH3 Activation Status	Channel 3 is active	BIT
	RxPDO (0x160x) X: Slot No.	70x0:01	CH0 Output Enable	Output status setting for channel 0	BIT
		70x0:02	CH1 Output Enable	Output status setting for channel 1	BIT
		70x0:03	CH2 Output Enable	Output status setting for channel 2	BIT
		70x0:04	CH3 Output Enable	Output status setting for channel 3	BIT
		70x1:01	CH0 Digital Input Value	Input value of channel 0	word
		70x1:02	CH1 Digital Input Value	Input value of channel 1	word
		70x1:03	CH2 Digital Input Value	Input value of channel 2	word
		70x1:04	CH3 Digital Input Value	Input value of channel 3	word

XBF-DC04A PDO List

Device Name	PDO Type	Index:SubIndex	Item Name	Description	Data Type
XBF-DC04A	TxPDO (0x1A0x) X: Slot No.	60x0:01 (x: Slot No.)	CH0 Error	Channel 0 error	BIT
		60x0:02	CH1 Error	Channel 1 error	BIT
		60x0:03	CH2 Error	Channel 2 error	BIT
		60x0:04	CH3 Error	Channel 3 error	BIT
		60x0:06	Ready Flag	Module ready	BIT
		60x0:07	CH0 Activation Status	Channel 0 is active	BIT
		60x0:08	CH1 Activation Status	Channel 1 is active	BIT
		60x0:09	CH2 Activation Status	Channel 2 is active	BIT
		60x0:0A	CH3 Activation Status	Channel 3 is active	BIT
	RxPDO (0x160x) X: Slot No.	70x0:01	CH0 Output Enable	Output status setting for channel 0	BIT
		70x0:02	CH1 Output Enable	Output status setting for channel 1	BIT
		70x0:03	CH2 Output Enable	Output status setting for channel 2	BIT
		70x0:04	CH3 Output Enable	Output status setting for channel 3	BIT
		70x1:01	CH0 Digital Input Value	Input value of channel 0	word
		70x1:02	CH1 Digital Input Value	Input value of channel 1	word
		70x1:03	CH2 Digital Input Value	Input value of channel 2	word
		70x1:04	CH3 Digital Input Value	Input value of channel 3	word

XBF-DC04B PDO List

Device Name	PDO Type	Index:SubIndex	Item Name	Description	Data Type
XBF-DC04B	TxPDO (0x1A0x) X: Slot No.	60x0:01 (x: Slot No.)	CH0 Error	Channel 0 error	BIT
		60x0:02	CH1 Error	Channel 1 error	BIT
		60x0:03	CH2 Error	Channel 2 error	BIT
		60x0:04	CH3 Error	Channel 3 error	BIT
		60x0:06	Ready Flag	Module ready	BIT
		60x0:07	CH0 Activation Status	Channel 0 is active	BIT
		60x0:08	CH1 Activation Status	Channel 1 is active	BIT
		60x0:09	CH2 Activation Status	Channel 2 is active	BIT
		60x0:0A	CH3 Activation Status	Channel 3 is active	BIT
	RxPDO (0x160x) X: Slot No.	70x0:01 (x: Slot No.)	CH0 Output Enable	Output status setting for channel 0	BIT
		70x0:02	CH1 Output Enable	Output status setting for channel 1	BIT
		70x0:03	CH2 Output Enable	Output status setting for channel 2	BIT
		70x0:04	CH3 Output Enable	Output status setting for channel 3	BIT
		70x1:01	CH0 Digital Input Value	Input value of channel 0	word
		70x1:02	CH1 Digital Input Value	Input value of channel 1	word
		70x1:03	CH2 Digital Input Value	Input value of channel 2	word
		70x1:04	CH3 Digital Input Value	Input value of channel 3	word

XBF-DV04C PDO List

Device Name	PDO Type	Index:SubIndex	Item Name	Description	Data Type
XBF-DV04C	TxPDO (0x1A0x) X: Slot No.	60x0:01 (x: Slot No.)	CH0 Error	Channel 0 error	BIT
		60x0:02	CH1 Error	Channel 1 error	BIT
		60x0:03	CH2 Error	Channel 2 error	BIT
		60x0:04	CH3 Error	Channel 3 error	BIT
		60x0:06	Ready Flag	Module ready	BIT
		60x0:07	CH0 Activation Status	Channel 0 is active	BIT
		60x0:08	CH1 Activation Status	Channel 1 is active	BIT
		60x0:09	CH2 Activation Status	Channel 2 is active	BIT
		60x0:0A	CH3 Activation Status	Channel 3 is active	BIT
		60x0:0C	CH0 Interpolation Status	Interpolation output in progress in channel 0	BIT
		60x0:0D	CH1 Interpolation Status	Interpolation output in progress in channel 1	BIT
		60x0:0E	CH2 Interpolation Status	Interpolation output in progress in channel 2	BIT
		60x0:0F	CH3 Interpolation Status	Interpolation output in progress in channel 3	BIT
		60x0:10	CH0 Disconnection flag	Output disconnection detected from channel 0	BIT
		60x0:11	CH1 Disconnection flag	Output disconnection detected from channel 1	BIT
		60x0:12	CH2 Disconnection flag	Output disconnection detected from channel 2	BIT
		60x0:13	CH3 Disconnection flag	Output disconnection detected from channel 3	BIT
	RxPDO (0x160x) X: Slot No.	70x0:01 (x: Slot No.)	CH0 Output Enable	Output status setting for channel 0	BIT
		70x0:02	CH1 Output Enable	Output status setting for channel 1	BIT
		70x0:03	CH2 Output Enable	Output status setting for channel 2	BIT
		70x0:04	CH3 Output Enable	Output status setting for channel 3	BIT
		70x1:01	CH0 Digital Input Value	Input value of channel 0	word
		70x1:02	CH1 Digital Input Value	Input value of channel 1	word
		70x1:03	CH2 Digital Input Value	Input value of channel 2	word
		70x1:04	CH3 Digital Input Value	Input value of channel 3	word

XBF-DC04C PDO List

Device Name	PDO Type	Index:SubIndex	Item Name	Description	Data Type
XBF-DC04C	TxPDO (0x1A0x) X: Slot No.	60x0:01 (x: Slot No.)	CH0 Error	Channel 0 error	BIT
		60x0:02	CH1 Error	Channel 1 error	BIT
		60x0:03	CH2 Error	Channel 2 error	BIT
		60x0:04	CH3 Error	Channel 3 error	BIT
		60x0:06	Ready Flag	Module ready	BIT
		60x0:07	CH0 Activation Status	Channel 0 is active	BIT
		60x0:08	CH1 Activation Status	Channel 1 is active	BIT
		60x0:09	CH2 Activation Status	Channel 2 is active	BIT
		60x0:0A	CH3 Activation Status	Channel 3 is active	BIT
		60x0:0C	CH0 Interpolation Status	Interpolation output in progress in channel 0	BIT
		60x0:0D	CH1 Interpolation Status	Interpolation output in progress in channel 1	BIT
		60x0:0E	CH2 Interpolation Status	Interpolation output in progress in channel 2	BIT
		60x0:0F	CH3 Interpolation Status	Interpolation output in progress in channel 3	BIT
		60x0:10	CH0 Disconnection flag	Output disconnection detected from channel 0	BIT
		60x0:11	CH1 Disconnection flag	Output disconnection detected from channel 1	BIT
		60x0:12	CH2 Disconnection flag	Output disconnection detected from channel 2	BIT
		60x0:13	CH3 Disconnection flag	Output disconnection detected from channel 3	BIT
	RxPDO (0x160x) X: Slot No.	70x0:01 (x: Slot No.)	CH0 Output Enable	Output status setting for channel 0	BIT
		70x0:02	CH1 Output Enable	Output status setting for channel 1	BIT
		70x0:03	CH2 Output Enable	Output status setting for channel 2	BIT
		70x0:04	CH3 Output Enable	Output status setting for channel 3	BIT
		70x1:01	CH0 Digital Input Value	Input value of channel 0	word
		70x1:02	CH1 Digital Input Value	Input value of channel 1	word
		70x1:03	CH2 Digital Input Value	Input value of channel 2	word
		70x1:04	CH3 Digital Input Value	Input value of channel 3	word

XBF-AH04A PDO List

Device Name	PDO Type	Index:SubIndex	Item Name	Description	Data Type
XBF-AH04A	TxPDO (0x1A0x) X: Slot No.	60x0:01 (x: Slot No.)	Error Flag	Module error	BIT
		60x0:03	Ready Flag	Module ready	BIT
		60x0:04	AD0 Activation Status	Input channel 0 is active	BIT
		60x0:05	AD1 Activation Status	Input channel 1 is active	BIT
		60x0:06	DA0 Activation Status	Output Channel0 is active	BIT
		60x0:07	DA1 Activation Status	Output Channel1 is active	BIT
		60x0:08	AD0 Disconnection flag	Disconnection detected from input channel 0	BIT
		60x0:09	AD1 Disconnection flag	Disconnection detected from input channel 1	BIT
		60x0:0B	AD0 Error code	Input channel 0 error	BIT
		60x0:0C	AD1 Error code	Input channel 1 error	BIT
		60x0:0D	DA0 Error code	Output Channel 0 error	BIT
		60x0:0E	DA1 Error code	Output Channel 1 error	BIT
		60x1:01	AD0 Digital Output Data	Converted value of input channel 0	word
		60x1:02	AD1 Digital Output Data	Converted value of input channel 1	word
	RxPDO (0x160x) X: Slot No.	70x0:01 (x: Slot No.)	DA0 Output Enable	Output status setting for channel 0	BIT
		70x0:02	DA1 Output Enable	Output status setting for channel 1	BIT
		70x1:01	DA0 Digital Input Data	Input value of output channel 0	word
		70x1:02	DA1 Digital Input Data	Input value of output channel 1	word

XBF-RD04A PDO List

Device Name	PDO Type	Index:SubIndex	Item Name	Description	Data Type
XBF-RD04A	TxPDO (0x1A0x) X: Slot No.	60x0:01 (x: Slot No.)	Error Flag	Module error	BIT
		60x0:03	Ready Flag	Module ready	BIT
		60x0:04	CH0 Activation Status	Channel 0 is active	BIT
		60x0:05	CH1 Activation Status	Channel 1 is active	BIT
		60x0:06	CH2 Activation Status	Channel 2 is active	BIT
		60x0:07	CH3 Activation Status	Channel 3 is active	BIT
		60x0:08	CH0 Disconnection flag	Channel 0 disconnection	BIT
		60x0:09	CH1 Disconnection flag	Channel 1 disconnection	BIT
		60x0:0A	CH2 Disconnection flag	Channel 2 disconnection	BIT
		60x0:0B	CH3 Disconnection flag	Channel 3 disconnection	BIT
		60x1:01	CH0 Temp. Data	Converted temperature value of channel 0	word
		60x1:02	CH1 Temp. Data	Converted temperature value of channel 1	word
		60x1:03	CH2 Temp. Data	Converted temperature value of channel 2	word
		60x1:04	CH3 Temp. Data	Converted temperature value of channel 3	word
		60x1:05	CH0 Scaling Data	Scaling operation value of channel 0	word
		60x1:06	CH1 Scaling Data	Scaling operation value of channel 1	word
		60x1:07	CH2 Scaling Data	Scaling operation value of channel 2	word
		60x1:08	CH3 Scaling Data	Scaling operation value of channel 3	word

XBF-RD01A PDO List

Device Name	PDO Type	Index:SubIndex	Item Name	Description	Data Type
XBF-RD01A	TxPDO (0x1A0x) X: Slot No.	60x0:01 (x: Slot No.)	Error Flag	Module error	BIT
		60x0:03	Ready Flag	Module ready	BIT
		60x0:04	CH0 Activation Status	Channel 0 is active	BIT
		60x0:08	CH0 Disconnection flag	Channel 0 disconnection	BIT
		60x1:01	CH0 Temp. Data	Converted temperature value of channel 0	word
		60x1:05	CH0 Scaling Data	Scaling operation value of channel 0	word

XBF-TC04B PDO List

Device Name	PDO Type	Index: SubIndex	Item Name	Description	Data Type
XBF-TC04B	TxPDO (0x1A0x) X: Slot No.	60x0:01 (x: Slot No.)	CH0 Offset/Gain Error Flag	Offset/gain adjustment error in channel 0	BIT
		60x0:02	CH1 Offset/Gain Error Flag	Offset/gain adjustment error in channel 1	BIT
		60x0:03	CH2 Offset/Gain Error Flag	Offset/gain adjustment error in channel 2	BIT
		60x0:04	CH3 Offset/Gain Error Flag	Offset/gain adjustment error in channel 3	BIT
		60x0:06	Offset/Gain Backup Error Flag	Module offset/gain backup error	BIT
		60x0:07	H/W Error Flag	Module H/W error	BIT
		60x0:08	Ready Flag	Module ready	BIT
		60x0:09	CH0 Activation Status	Channel 0 is active	BIT
		60x0:0A	CH1 Activation Status	Channel 1 is active	BIT
		60x0:0B	CH2 Activation Status	Channel 2 is active	BIT
		60x0:0C	CH3 Activation Status	Channel 3 is active	BIT
		60x0:0D	CH0 Disconnection flag	Channel 0 disconnection	BIT
		60x0:0E	CH1 Disconnection flag	Channel 1 disconnection	BIT
		60x0:0F	CH2 Disconnection flag	Channel 2 disconnection	BIT
		60x0:10	CH3 Disconnection flag	Channel 3 disconnection	BIT
		60x0:11	CH0 Error code	Channel 0 setting error	BIT
		60x0:12	CH1 Error code	Channel 1 setting error	BIT
		60x0:13	CH2 Error code	Channel 2 setting error	BIT
		60x0:14	CH3 Error code	Channel 3 setting error	BIT
		60x1:01	CH0 Temp. Data	Converted temperature value of channel 0	word
		60x1:02	CH1 Temp. Data	Converted temperature value of channel 1	word
		60x1:03	CH2 Temp. Data	Converted temperature value of channel 2	word
		60x1:04	CH3 Temp. Data	Converted temperature value of channel 3	word
		60x1:05	CH0 Scaling Data	Scaling operation value of channel 0	word
		60x1:06	CH1 Scaling Data	Scaling operation value of channel 1	word
		60x1:07	CH2 Scaling Data	Scaling operation value of channel 2	word
		60x1:08	CH3 Scaling Data	Scaling operation value of channel 3	word
		60x1:09	CH0 Temp. Min. Data	Min. converted temperature value of channel 0	word
		60x1:0A	CH0 Temp. Max. Data	Max. converted temperature value of channel 0	word
		60x1:0B	CH1 Temp. Min. Data	Min. converted temperature value of channel 1	word
		60x1:0C	CH1 Temp. Max. Data	Max. converted temperature value of channel 1	word
		60x1:0D	CH2 Temp. Min. Data	Min. converted temperature value of channel 2	word
		60x1:0E	CH2 Temp. Max. Data	Max. converted temperature value of channel 2	word
		60x1:0F	CH3 Temp. Min. Data	Min. converted temperature value of channel 3	word
		60x1:10	CH3 Temp. Max. Data	Max. converted temperature value of channel 3	word

Device Name	PDO Type	Index: SubIndex	Item Name	Description	Data Type
XBF-TC04B	RxPDO (0x160x) X: Slot No.	70x0:01 (x: Slot No.)	CH0 Max./Min. Search Enable	Enable/disable max./min. value search function for channel 0	BIT
		70x0:02	CH1 Max./Min. Search Enable	Enable/disable max./min. value search function for channel 1	BIT
		70x0:03	CH2 Max./Min. Search Enable	Enable/disable max./min. value search function for channel 2	BIT
		70x0:04	CH3 Max./Min. Search Enable	Enable/disable max./min. value search function for channel 3	BIT
		70x0:06	CH0 Cold Junction Compensation Enable	Enable/disable cold junction compensation function for channel 0	BIT
		70x0:07	CH1 Cold Junction Compensation Enable	Enable/disable cold junction compensation function for channel 1	BIT
		70x0:08	CH2 Cold Junction Compensation Enable	Enable/disable cold junction compensation function for channel 2	BIT
		70x0:09	CH3 Cold Junction Compensation Enable	Enable/disable cold junction compensation function for channel 3	BIT

XBF-TC04S PDO List

Device Name	PDO Type	Index: SubIndex	Item Name	Description	Data Type
XBF-TC04S	TxPDO (0x1A0x) X: Slot No.	60x0:01 (x: Slot No.)	CH0 Offset/Gain Error Flag	Offset/gain adjustment error in channel 0	BIT
		60x0:02	CH1 Offset/Gain Error Flag	Offset/gain adjustment error in channel 1	BIT
		60x0:03	CH2 Offset/Gain Error Flag	Offset/gain adjustment error in channel 2	BIT
		60x0:04	CH3 Offset/Gain Error Flag	Offset/gain adjustment error in channel 3	BIT
		60x0:06	Offset/Gain Backup Error Flag	Module offset/gain backup error	BIT
		60x0:07	H/W Error Flag	Module H/W error	BIT
		60x0:08	Ready Flag	Module ready	BIT
		60x0:09	CH0 Activation Status	Channel 0 is active	BIT
		60x0:0A	CH1 Activation Status	Channel 1 is active	BIT
		60x0:0B	CH2 Activation Status	Channel 2 is active	BIT
		60x0:0C	CH3 Activation Status	Channel 3 is active	BIT
		60x0:0D	CH0 Disconnection flag	Channel 0 disconnection	BIT
		60x0:0E	CH1 Disconnection flag	Channel 1 disconnection	BIT
		60x0:0F	CH2 Disconnection flag	Channel 2 disconnection	BIT
		60x0:10	CH3 Disconnection flag	Channel 3 disconnection	BIT
		60x0:11	CH0 Error code	Channel 0 setting error	BIT
		60x0:12	CH1 Error code	Channel 1 setting error	BIT
		60x0:13	CH2 Error code	Channel 2 setting error	BIT
		60x0:14	CH3 Error code	Channel 3 setting error	BIT
		60x1:01	CH0 Temp. Data	Converted temperature value of channel 0	word
		60x1:02	CH1 Temp. Data	Converted temperature value of channel 1	word
		60x1:03	CH2 Temp. Data	Converted temperature value of channel 2	word
		60x1:04	CH3 Temp. Data	Converted temperature value of channel 3	word
		60x1:05	CH0 Scaling Data	Scaling operation value of channel 0	word
		60x1:06	CH1 Scaling Data	Scaling operation value of channel 1	word
		60x1:07	CH2 Scaling Data	Scaling operation value of channel 2	word
		60x1:08	CH3 Scaling Data	Scaling operation value of channel 3	word
		60x1:09	CH0 Temp. Min. Data	Minimum converted temperature value of channel 0	word
		60x1:0A	CH0 Temp. Max. Data	Maximum converted temperature value of channel 0	word
		60x1:0B	CH1 Temp. Min. Data	Minimum converted temperature value of channel 1	word
		60x1:0C	CH1 Temp. Max. Data	Maximum converted temperature value of channel 1	word
		60x1:0D	CH2 Temp. Min. Data	Minimum converted temperature value of channel 2	word
		60x1:0E	CH2 Temp. Max. Data	Maximum converted temperature value of channel 2	word
		60x1:0F	CH3 Temp. Min. Data	Minimum converted temperature value of channel 3	word
		60x1:10	CH3 Temp. Max. Data	Maximum converted temperature value of channel 3	word

Device Name	PDO Type	Index: SubIndex	Item Name	Description	Data Type
	RxPDO (0x160x) X: Slot No.	70x0:01 (x: Slot No.)	CH0 Max./Min. Search Enable	Enable/disable max./min. value search function for channel 0	BIT
		70x0:02	CH1 Max./Min. Search Enable	Enable/disable max./min. value search function for channel 1	BIT
		70x0:03	CH2 Max./Min. Search Enable	Enable/disable max./min. value search function for channel 2	BIT
		70x0:04	CH3 Max./Min. Search Enable	Enable/disable max./min. value search function for channel 3	BIT
		70x0:06	CH0 Cold Junction Compensation Enable	Enable/disable cold junction compensation function for channel 0	BIT
		70x0:07	CH1 Cold Junction Compensation Enable	Enable/disable cold junction compensation function for channel 1	BIT
		70x0:08	CH2 Cold Junction Compensation Enable	Enable/disable cold junction compensation function for channel 2	BIT
		70x0:09	CH3 Cold Junction Compensation Enable	Enable/disable cold junction compensation function for channel 3	BIT

XBF-LD02S PDO List

Device Name	PDO Type	Index: SubIndex	Item Name	Description	Data Type
XBF-LD02S	TxPDO (0x1A0x) X: Slot No.	60x0:01 (x: Slot No.)	Error Flag	Module error	BIT
		60x0:03	Module Ready	Module ready	BIT
		60x0:04	CH0 Run Status	Channel 0 is active	BIT
		60x0:05	CH1 Run Status	Channel 1 is active	BIT
		60x0:07	CH0 Calibration Status	Channel 0 calibration mode	BIT
		60x0:08	CH1 Calibration Status	Channel 1 calibration mode	BIT
		60x0:0A	CH0 Error	Channel 0 error	BIT
		60x0:0B	CH1 Error	Channel 1 error	BIT
		60x0:0C	CH0 Stable Status	Stable status of channel 0	BIT
		60x0:0D	CH1 Stable Status	Stable status of channel 1	BIT
		60x0:0E	CH0 Zero Status	Zero status of channel 0	BIT
		60x0:0F	CH1 Zero Status	Zero status of channel 1	BIT
		60x0:10	CH0 Weighing Complete Status	Channel 0 weighing complete status	BIT
		60x0:11	CH1 Weighing Complete Status	Channel 1 weighing complete status	BIT
		60x0:12	CH0 Step 1 Status	Step 1 status of channel 0	BIT
		60x0:13	CH0 Step 2 Status	Step 2 status of channel 0	BIT
		60x0:14	CH0 Step 3 Status	Step 3 status of channel 0	BIT
		60x0:15	CH0 Lack Status	Lack status of channel 0	BIT
		60x0:16	CH0 Over Status	Over status of channel 0	BIT
		60x0:17	CH1 Step 1 Status	Step 1 status of channel 1	BIT
		60x0:18	CH1 Step 2 Status	Step 2 status of channel 1	BIT
		60x0:19	CH1 Step 3 Status	Step 3 status of channel 1	BIT
		60x0:1A	CH1 Lack Status	Lack status of channel 1	BIT
		60x0:1B	CH1 Over Status	Over status of channel 1	BIT
		60x0:1C	CH0 Zero Calibration Status	Channel 0 zero calibration complete	BIT
		60x0:1D	CH1 Zero Calibration Status	Channel 1 zero calibration complete	BIT
		60x0:1E	CH0 Span Calibration Status	Channel 0 span calibration complete	BIT
		60x0:1F	CH1 Span Calibration Status	Channel 1 span calibration complete	BIT
		60x0:20	CH0 Save Complete Flag	Channel 0 calibration save complete	BIT
		60x0:21	CH1 Save Complete Flag	Channel 1 calibration save complete	BIT
		60x0:22	CH0 Equivalent Calibration Status	Channel 0 equivalent circuit calibration complete	BIT
		60x0:23	CH1 Equivalent Calibration Status	Channel 1 equivalent circuit calibration complete	BIT
		60x0:25	CH0 Zero Setting Status	Zero setting status of channel 0	BIT
		60x0:26	CH1 Zero Setting Status	Zero setting status of channel 1	BIT
		60x0:27	CH0 Zero Reset Status	Zero reset status of channel 0	BIT
		60x0:28	CH1 Zero Reset Status	Zero reset status of channel 1	BIT
		60x0:29	CH0 Tare Setting Status	Tare setting status of channel 0	BIT

Device Name	PDO Type	Index: SubIndex	Item Name	Description	Data Type
		60x0:2A	CH1 Tare Setting Status	Tare setting status of channel 1	BIT
		60x0:2B	CH0 Output Hold Status	Output hold status of channel 0	BIT
		60x0:2C	CH1 Output Hold Status	Output hold status of channel 1	BIT
		60x0:2D	CH0 Min./Max. Hold Status	Maximum/minimum hold status of channel 0	BIT
		60x0:2E	CH1 Min./Max. Hold Status	Maximum/minimum hold status of channel 1	BIT
		60x0:2F	CH0 Near Zero Status	Near zero status of channel 0	BIT
		60x0:30	CH1 Near Zero Status	Near zero status of channel 1	BIT
		60x0:31	CH0 Gross Weight Negative Status	Gross weight negative status of channel 0	BIT
		60x0:32	CH1 Gross Weight Negative Status	Gross weight negative status of channel 1	BIT
		60x0:33	CH0 Net Weight Negative Status	Net weight negative status of channel 0	BIT
		60x0:34	CH1 Net Weight Negative Status	Net weight negative status of channel 1	BIT
		60x0:35	CH0 Upper Alarm	Upper alarm occurred from channel 0	BIT
		60x0:36	CH1 Upper Alarm	Upper alarm occurred from channel 1	BIT
		60x0:37	CH0 Lower Alarm	Lower alarm occurred from channel 0	BIT
		60x0:38	CH1 Lower Alarm	Lower alarm occurred from channel 1	BIT
		60x0:3A	CH0 High High Status	High high status of channel 0	BIT
		60x0:3B	CH0 High Status	High status of channel 0	BIT
		60x0:3C	CH0 Low Status	Low status of channel 0	BIT
		60x0:3D	CH0 Low Low Status	Low low status of channel 0	BIT
		60x0:3E	CH1 High High Status	High high status of channel 1	BIT
		60x0:3F	CH1 High Status	High status of channel 1	BIT
		60x0:40	CH1 Low Status	Low status of channel 1	BIT
		60x0:41	CH1 Low Low Status	Low low status of channel 1	BIT
		60x1:01	CH0 Gross Weight Data(Lower)	Gross weight value (Lower) of channel 0	word
		60x1:02	CH0 Gross Weight Data(Upper)	Gross weight value (Upper) of channel 0	word
		60x1:03	CH1 Gross Weight Data(Lower)	Gross weight value (Lower) of channel 1	word
		60x1:04	CH1 Gross Weight Data (Upper)	Gross weight value (Upper) of channel 1	word
		60x1:05	CH0 Tare Weight Data(Lower)	Tare weight value (Lower) of channel 0	word
		60x1:06	CH0 Tare Weight Data(Upper)	Tare weight value (Upper) of channel 0	word
		60x1:07	CH1 Tare Weight Data(Lower)	Tare weight value (Lower) of channel 1	word
		60x1:08	CH1 Tare Weight Data(Upper)	Tare weight value (Upper) of channel 1	word
		60x1:09	CH0 Net Weight Data(Lower)	Net weight value (Lower) of channel 0	word
		60x1:0A	CH0 Net Weight Data(Upper)	Net weight value (Upper) of channel 0	word
		60x1:0B	CH1 Net Weight Data(Lower)	Net weight value (Lower) of channel 1	word
		60x1:0C	CH1 Net Weight Data(Upper)	Net weight value (Upper) of channel 1	word
		60x1:0D	CH0 Gross Weight Max. Data(Lower)	Gross weight maximum value (Lower) of channel 0	word
		60x1:0E	CH0 Gross Weight Max. Data(Upper)	Gross weight maximum value (Upper) of channel 0	word
		60x1:0F	CH0 Gross Weight Min. Data(Lower)	Gross weight minimum value (Lower) of channel 0	word
		60x1:10	CH0 Gross Weight Min. Data(Upper)	Gross weight minimum value (Upper) of channel 0	word

Device Name	PDO Type	Index: SubIndex	Item Name	Description	Data Type
		60x1:11	CH1 Gross Weight Max. Data(Lower)	Gross weight maximum value (Lower) of channel 1	word
		60x1:12	CH1 Gross Weight Max. Data(Upper)	Gross weight maximum value (Upper) of channel 1	word
		60x1:13	CH1 Gross Weight Min. Data(Lower)	Gross weight minimum value (Lower) of channel 1	word
		60x1:14	CH1 Gross Weight Min. Data(Upper)	Gross weight minimum value (Upper) of channel 1	word
		60x1:15	CH0 Free Fall Data	Current free fall value of channel 0	word
		60x1:16	CH1 Free Fall Data	Current free fall value of channel 1	word
		60x1:17	Error code	Error code	word
		70x0:01 (x: Slot No.)	CH0 1-Point Calibration Request	1-point calibration mode request for channel 0	BIT
		70x0:02	CH1 1-Point Calibration Request	1-point calibration mode request for channel 1	BIT
		70x0:03	CH0 2-Point Calibration Request	2-point calibration mode request for channel 0	BIT
		70x0:04	CH1 2-Point Calibration Request	2-point calibration mode request for channel 1	BIT
		70x0:05	CH0 Equivalent Calibration Request	2-point equivalent circuit calibration mode request for channel 0	BIT
		70x0:06	CH1 Equivalent Calibration Request	2-point equivalent circuit calibration mode request for channel 1	BIT
		70x0:08	CH0 Zero Calibration Request	Zero calibration request for channel 0	BIT
		70x0:09	CH1 Zero Calibration Request	Zero calibration request for channel 1	BIT
		70x0:0A	CH0 Span Calibration Request	Span calibration request for channel 0	BIT
		70x0:0B	CH1 Span Calibration Request	Span calibration request for channel 1	BIT
	RxPDO (0x160x) X: Slot No.	70x0:0C	CH0 Save Request	Calibration value save request for channel 0	BIT
		70x0:0D	CH1 Save Request	Calibration value save request for channel 1	BIT
		70x0:0F	CH0 Zero Setting Request	Zero setting request for channel 0	BIT
		70x0:10	CH1 Zero Setting Request	Zero setting request for channel 1	BIT
		70x0:11	CH0 Zero Reset Request	Zero reset request for channel 0	BIT
		70x0:12	CH1 Zero Reset Request	Zero reset request for channel 1	BIT
		70x0:13	CH0 Tare Setting	Tare setting for channel 0	BIT
		70x0:14	CH1 Tare Setting	Tare setting for channel 1	BIT
		70x0:15	CH0 Output Hold Request	Output hold request for channel 0	BIT
		70x0:16	CH1 Output Hold Request	Output hold request for channel 1	BIT
		70x0:17	CH0 Min./Max. Hold Request	Maximum/minimum hold request for channel 0	BIT
		70x0:18	CH1 Min./Max. Hold Request	Maximum/minimum hold request for channel 1	BIT
		70x0:19	CH0 Sequential Control Request	Sequential control request for channel 0	BIT
		70x0:1A	CH1 Sequential Control Request	Sequential control request for channel 1	BIT
		70x0:1B	CH0 Tare Release Request	Tare release request for channel 0	BIT
		70x0:1C	CH1 Tare Release Request	Tare release request for channel 1	BIT

XBF-HO02A PDO List

Device Name	PDO Type	Index: SubIndex	Item Name	Description	Data Type
XBF-HO02A	TxPDO (0x1A0x) X: Slot No.	60x0:01 (x: Slot No.)	CH0 Count Direction Status	Count addition/subtraction status of channel 0	BIT
		60x0:02	CH0 Preset Ext. Input Flag	External preset input detected from channel 0	BIT
		60x0:04	CH0 Carry Flag	Carry detected from channel 0	BIT
		60x0:05	CH0 Borrow Flag	Borrow detected from channel 0	BIT
		60x0:06	CH0 Auxiliary Function Status	Auxiliary function in use in channel 0	BIT
		60x0:07	CH0 Compare 0 Output Status	Comparison output 0 status of channel 0	BIT
		60x0:08	CH0 Compare 1 Output Status	Comparison output 1 status of channel 0	BIT
		60x0:0A	CH0 Error Flag	Error detected from channel 0	BIT
		60x0:0B	Module Ready	Module operation preparation complete	BIT
		60x0:0C	CH1 Count Direction Status	Count addition/subtraction status of channel 1	BIT
		60x0:0D	CH1 Preset Ext. Input Flag	External preset input detected from channel 1	BIT
		60x0:0F	CH1 Carry Flag	Carry detected from channel 1	BIT
		60x0:10	CH1 Borrow Flag	Borrow detected from channel 1	BIT
		60x0:11	CH1 Auxiliary Function Status	Auxiliary function in use in channel 1	BIT
		60x0:12	CH1 Compare 0 Output Status	Comparison output 0 status of channel 1	BIT
		60x0:13	CH1 Compare 1 Output Status	Comparison output 1 status of channel 1	BIT
		60x0:15	CH1 Error Flag	Error detected from channel 1	BIT
		60x1:01	CH0 Count Data	Current count of channel 0	dword
		60x1:02	CH0 Latch Count Data	Count latch of channel 0	dword
		60x1:03	CH0 Sampling Count Data	Section count of channel 0	dword
		60x1:04	CH0 Input Frequency Data	Input frequency of channel 0	dword
		60x1:05	CH0 Rev./Unit Time Data	Revolution count per unit time of channel 0	dword
		60x1:06	CH1 Count Data	Current count of channel 1	dword
		60x1:07	CH1 Latch Count Data	Count latch of channel 1	dword
		60x1:08	CH1 Sampling Count Data	Section count of channel 1	dword
		60x1:09	CH1 Input Frequency Data	Input frequency of channel 1	dword
		60x1:0A	CH1 Rev./Unit Time Data	Revolution count per unit time of channel 1	dword
	RxPDO (0x160x) X: Slot No.	70x0:01 (x: Slot No.)	CH0 Enable Counter	Enable count for channel 0	BIT
		70x0:02	CH0 Preset Enable	Enable preset for channel 0	BIT
		70x0:03	CH0 Count Direction Select	Select addition/subtraction count for channel 0	BIT
		70x0:04	CH0 Auxiliary Function Request	Enable auxiliary function for channel 0	BIT
		70x0:05	CH0 Enable Compare Function	Enable comparison for channel 0	BIT
		70x0:06	CH0 Enable Compare Output Signal	Enable comparison result output for channel 0	BIT
		70x0:07	CH0 Compare 0 EQUAL Reset	Reset comparison output 0 equal (=) for channel 0	BIT
		70x0:08	CH0 Compare 1 EQUAL Reset	Reset comparison output 1 equal (=) for channel 0	BIT
		70x0:0A	CH0 Carry/Borrow Reset Request	Reset carry/borrow for channel 0	BIT
		70x0:0B	CH0 Preset Ext. Input Enable	Select external preset for channel 0	BIT

| Device Name	PDO Type	Index: SubIndex	Item Name	Description	Data Type
		70x0:0C	CH0 Enable Aux-Func Ext. Input	Select external auxiliary function for channel 0	BIT
		70x0:0D	CH0 Preset Ext. Input Reset Request	Reset external preset detection for channel 0	BIT
		70x0:0F	CH1 Enable Counter	Enable count for channel 1	BIT
		70x0:10	CH1 Preset Enable	Enable preset for channel 1	BIT
		70x0:11	CH1 Count Direction Select	Select addition/subtraction count for channel 1	BIT
		70x0:12	CH1 Auxiliary Function Request	Enable auxiliary function for channel 1	BIT
		70x0:13	CH1 Enable Compare Function	Enable comparison for channel 1	BIT
		70x0:14	CH1 Enable Compare Output Signal	Enable comparison result output for channel 1	BIT
		70x0:15	CH1 Compare 0 EQUAL Reset	Reset comparison output 0 equal (=) for channel 1	BIT
		70x0:16	CH1 Compare 1 EQUAL Reset	Reset comparison output 1 equal (=) for channel 1	BIT
		70x0:18	CH1 Carry/Borrow Reset Request	Reset carry/borrow for channel 1	BIT
		70x0:19	CH1 Preset Ext. Input Enable	Select external preset for channel 1	BIT
		70x0:1A	CH1 Enable Aux-Func Ext. Input	Select external auxiliary function for channel 1	BIT
		70x0:1B	CH1 Preset Ext. Input Reset Request	Reset external preset detection for channel 1	BIT

XBF-HD02A PDO List

| Device Name	PDO Type	Index: SubIndex	Item Name	Description	Data Type
XBF-HO02A	TxPDO (0x1A0x) X: Slot No.	60x0:01 (x: Slot No.)	CH0 Count Direction Status	Count addition/subtraction status of channel 0	BIT
		60x0:02	CH0 Preset Ext. Input Flag	External preset input detected from channel 0	BIT
		60x0:04	CH0 Carry Flag	Carry detected from channel 0	BIT
		60x0:05	CH0 Borrow Flag	Borrow detected from channel 0	BIT
		60x0:06	CH0 Auxiliary Function Status	Auxiliary function in use in channel 0	BIT
		60x0:07	CH0 Compare 0 Output Status	Comparison output 0 status of channel 0	BIT
		60x0:08	CH0 Compare 1 Output Status	Comparison output 1 status of channel 0	BIT
		60x0:0A	CH0 Error Flag	Error detected from channel 0	BIT
		60x0:0B	Module Ready	Module operation preparation complete	BIT
		60x0:0C	CH1 Count Direction Status	Count addition/subtraction status of channel 1	BIT
		60x0:0D	CH1 Preset Ext. Input Flag	External preset input detected from channel 1	BIT
		60x0:0F	CH1 Carry Flag	Carry detected from channel 1	BIT
		60x0:10	CH1 Borrow Flag	Borrow detected from channel 1	BIT
		60x0:11	CH1 Auxiliary Function Status	Auxiliary function in use in channel 1	BIT
		60x0:12	CH1 Compare 0 Output Status	Comparison output 0 status of channel 1	BIT
		60x0:13	CH1 Compare 1 Output Status	Comparison output 1 status of channel 1	BIT
		60x0:15	CH1 Error Flag	Error detected from channel 1	BIT
		60x1:01	CH0 Count Data	Current count of channel 0	dword
		60x1:02	CH0 Latch Count Data	Count latch of channel 0	dword
		60x1:03	CH0 Sampling Count Data	Section count of channel 0	dword
		60x1:04	CH0 Input Frequency Data	Input frequency of channel 0	dword
		60x1:05	CH0 Rev./Unit Time Data	Revolution count per unit time of channel 0	dword
		60x1:06	CH1 Count Data	Current count of channel 1	dword
		60x1:07	CH1 Latch Count Data	Count latch of channel 1	dword
		60x1:08	CH1 Sampling Count Data	Section count of channel 1	dword
		60x1:09	CH1 Input Frequency Data	Input frequency of channel 1	dword
		60x1:0A	CH1 Rev./Unit Time Data	Revolution count per unit time of channel 1	dword
	RxPDO (0x160x) X: Slot No.	70x0:01 (x: Slot No.)	CH0 Enable Counter	Enable count for channel 0	BIT
		70x0:02	CH0 Preset Enable	Enable preset for channel 0	BIT
		70x0:03	CH0 Count Direction Select	Select addition/subtraction count for channel 0	BIT
		70x0:04	CH0 Auxiliary Function Request	Enable auxiliary function for channel 0	BIT
		70x0:05	CH0 Enable Compare Function	Enable comparison for channel 0	BIT
		70x0:06	CH0 Enable Compare Output Signal	Enable comparison result output for channel 0	BIT
		70x0:07	CH0 Compare 0 EQUAL Reset	Reset comparison output 0 equal (=) for channel 0	BIT
		70x0:08	CH0 Compare 1 EQUAL Reset	Reset comparison output 1 equal (=) for channel 0	BIT
		70x0:0A	CH0 Carry/Borrow Reset Request	Reset carry/borrow for channel 0	BIT
		70x0:0B	CH0 Preset Ext. Input Enable	Select external preset for channel 0	BIT

Device Name	PDO Type	Index: SubIndex	Item Name	Description	Data Type
		70x0:0C	CH0 Enable Aux-Func Ext. Input	Select external auxiliary function for channel 0	BIT
		70x0:0D	CH0 Preset Ext. Input Reset Request	Reset external preset detection for channel 0	BIT
		70x0:0F	CH1 Enable Counter	Enable count for channel 1	BIT
		70x0:10	CH1 Preset Enable	Enable preset for channel 1	BIT
		70x0:11	CH1 Count Direction Select	Select addition/subtraction count for channel 1	BIT
		70x0:12	CH1 Auxiliary Function Request	Enable auxiliary function for channel 1	BIT
		70x0:13	CH1 Enable Compare Function	Enable comparison for channel 1	BIT
		70x0:14	CH1 Enable Compare Output Signal	Enable comparison result output for channel 1	BIT
		70x0:15	CH1 Compare 0 EQUAL Reset	Reset comparison output 0 equal (=) for channel 1	BIT
		70x0:16	CH1 Compare 1 EQUAL Reset	Reset comparison output 1 equal (=) for channel 1	BIT
		70x0:18	CH1 Carry/Borrow Reset Request	Reset carry/borrow for channel 1	BIT
		70x0:19	CH1 Preset Ext. Input Enable	Select external preset for channel 1	BIT
		70x0:1A	CH1 Enable Aux-Func Ext. Input	Select external auxiliary function for channel 1	BIT
		70x0:1B	CH1 Preset Ext. Input Reset Request	Reset external preset detection for channel 1	BIT

Appendix 3 Dimension (unit: mm)
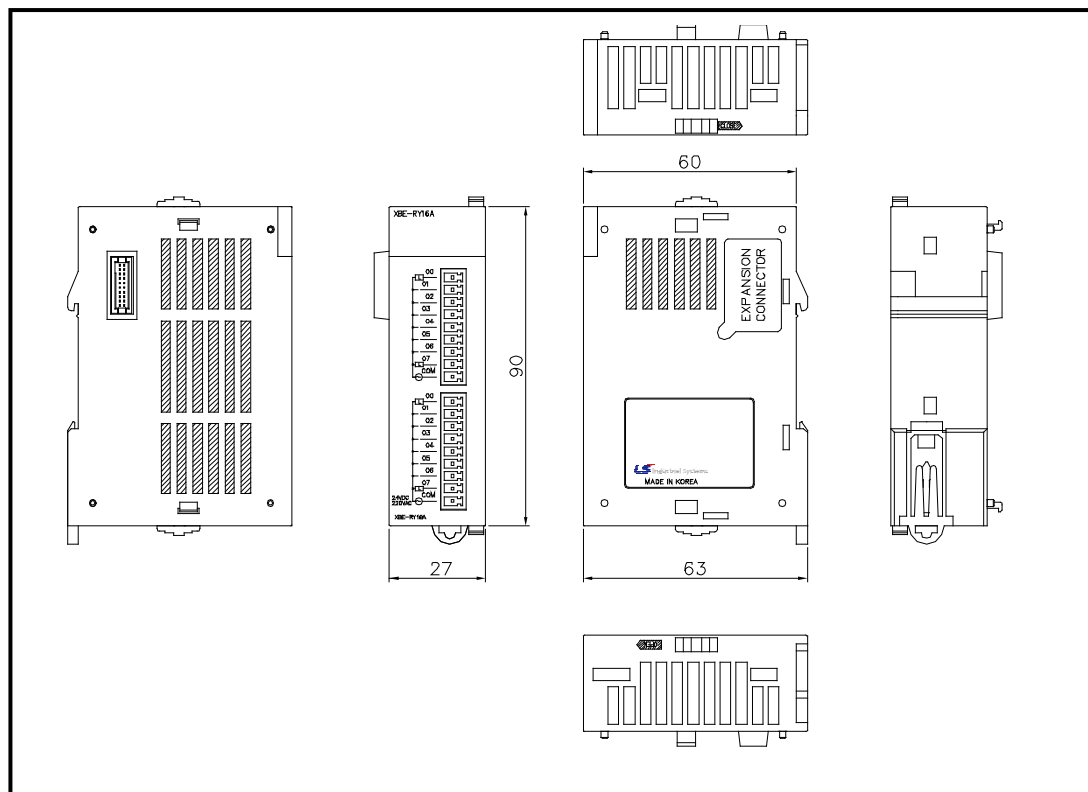
(1) XEL-BSSCT
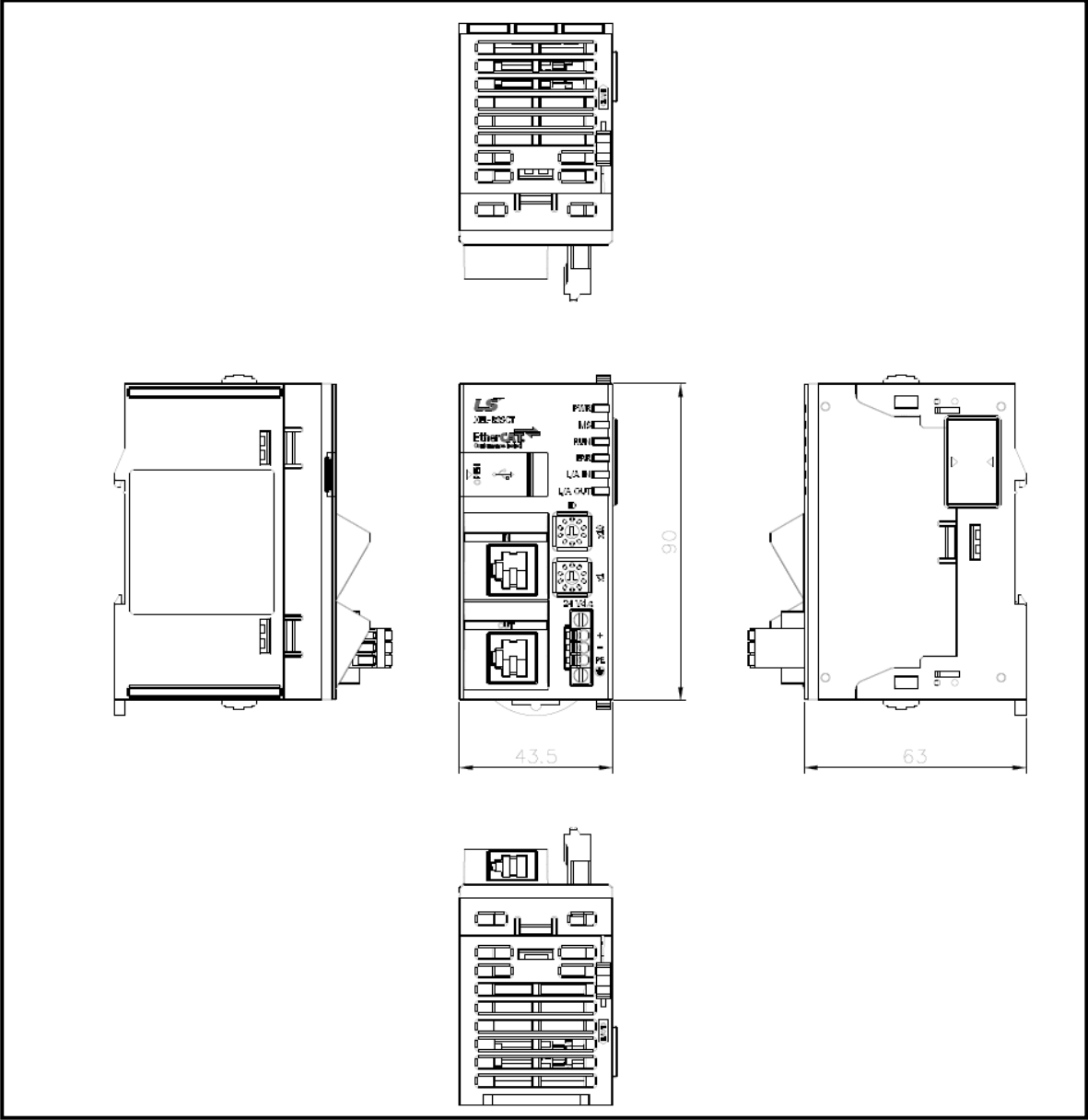
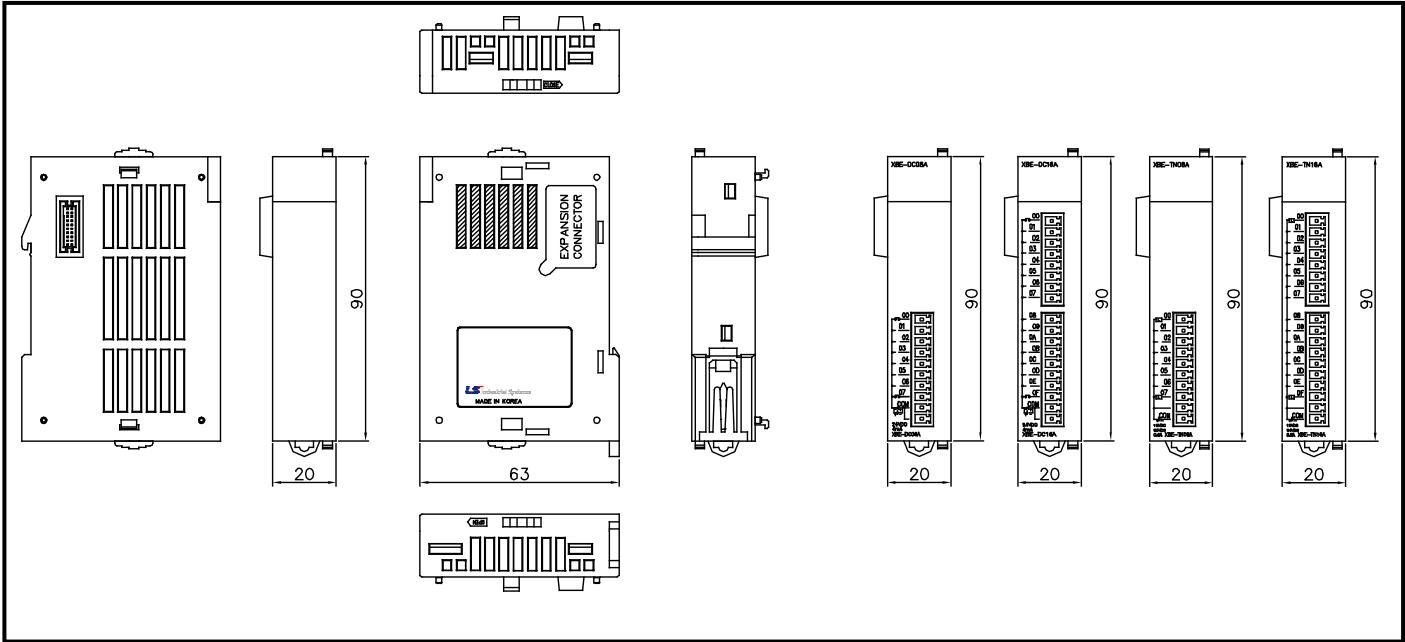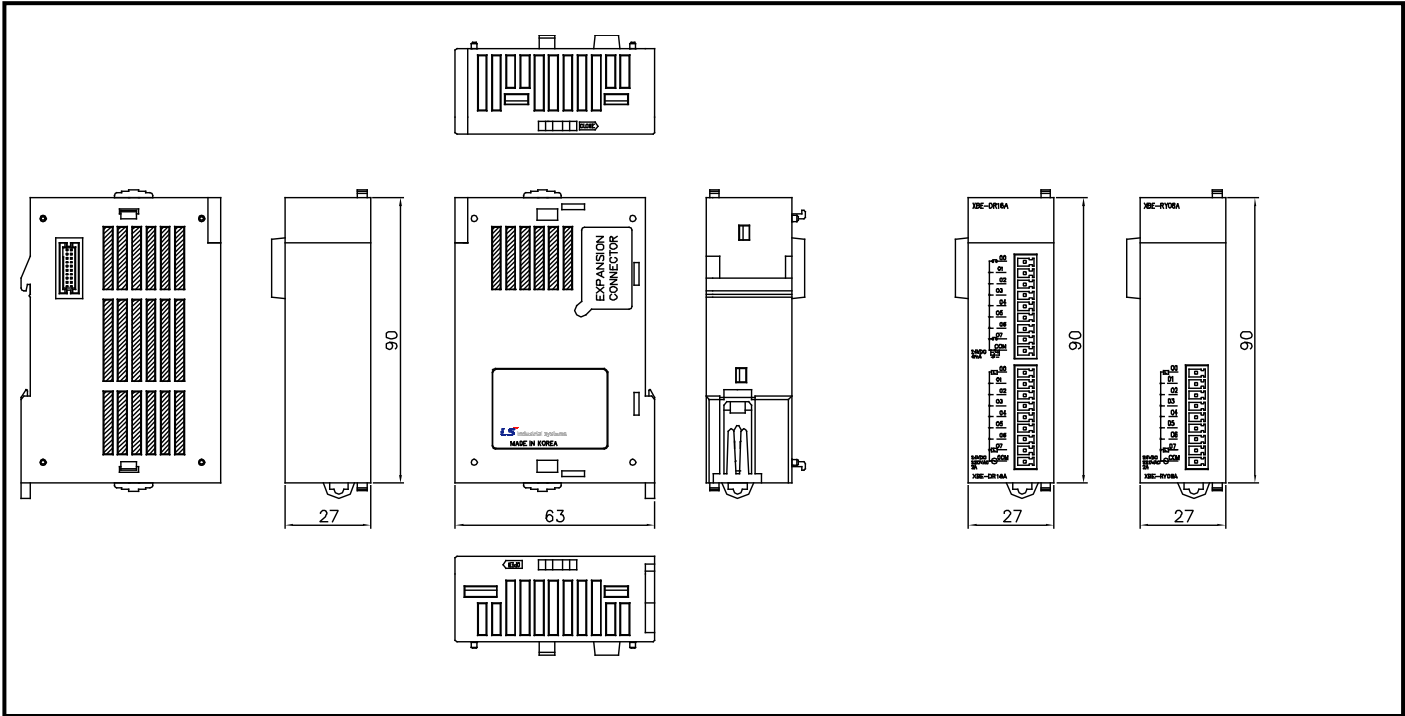(2) Digital Input/Output module
-. XBE-DC32A, XBE-TR32A
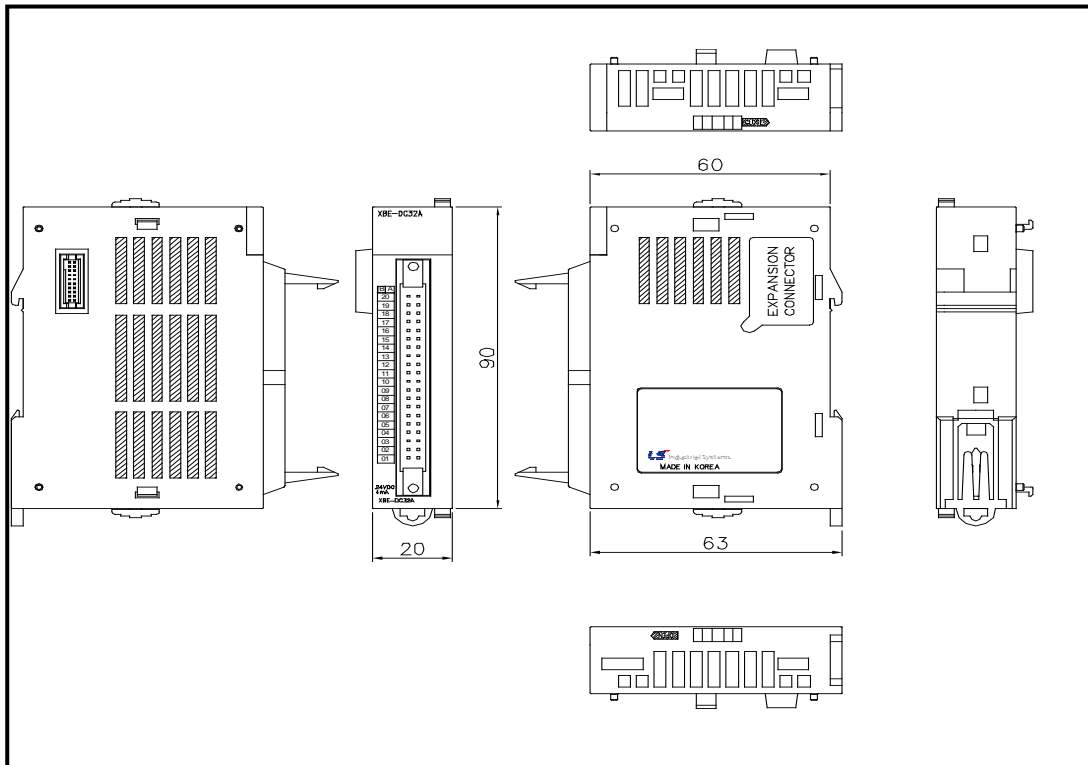
-. XBE-RY16A

-. XBE-DC08A, XBE-DC16A, XBE-TN08A, XBE-TN16A

-. XBE-DR16A, XBE-RY08A

Warranty

1. Warranty Period
   The product you purchased will be guaranteed for 18 months from the date of manufacturing.

2. Scope of Warranty
   Any trouble or defect occurring for the above-mentioned period will be partially replaced or repaired. However, please note the following cases will be excluded from the scope of warranty.

   (1) Any trouble attributable to unreasonable condition, environment or handling otherwise specified in the manual,
   (2) Any trouble attributable to others' products,
   (3) If the product is modified or repaired in any other place not designated by the company,
   (4) Due to unintended purposes
   (5) Owing to the reasons unexpected at the level of the contemporary science and technology when delivered.
   (6) Not attributable to the company; for instance, natural disasters or fire

3. Since the above warranty is limited to PLC unit only, make sure to use the product considering the safety for system configuration or applications.

Environmental Policy

LS ELECTRIC Co., Ltd supports and observes the environmental policy as below.

Environmental Management

LS ELECTRIC considers the environmental preservation as the preferential management subject and every staff of LS ELECTRIC use the reasonable endeavors for the pleasurably environmental preservation of the earth.

About Disposal

LS ELECTRIC PLC unit is designed to protect the environment. For the disposal, separate aluminum, iron and synthetic resin (cover) from the product as they are reusable.

Distinguished Choice, Profound Satisfaction

www.ls-electric.com

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