User's Manual

YFGW410
PROFINET Interface

YOKOGAWA ◆

Yokogawa Electric Corporation

YFGW410 PROFINET Interface

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Introduction

This manual (IM 01W02D01-21EN) describes the PROFINET interface of YFGW410 (hereafter referred to as "YFGW410 PROFINET interface" or "PROFINET interface").

Before you read this document further, read "Read Me First" (IM 01W02D01-11EN) thoroughly first. Then, read the User's Manual of YFGW410 Field Wireless Management Station (IM 01W02D01-01EN).

This document describes the differences from the User's Manual of YFGW410. The description in this document supersedes the description in the User's Manual of YFGW410. Here you can find information on how to setup and operate YFGW410 PROFINET interface.

The table below lists the related YFGW410 documents including this document.

Title	Document No.
Read Me First User's Manual	IM 01W02D01-11EN
YFGW410 Field Wireless Management Station User's Manual	IM 01W02D01-01EN
YFGW410 PROFINET Interface User's Manual	IM 01W02D01-21EN
YFGW410 Field Wireless Management Station General Specifications	GS 01W02D01-01EN

This document refers to GasSecure's GS01 Wireless Infrared Hydrocarbon Gas Detector as a wireless safety device connectable to YFGW410. The table below lists the manuals of GS01. Refer to those document for details how to set up and use GS01.

Title	Document No.
GasSecure GS01 and GS01-EA Wireless Infrared Hydrocarbon Gas Detector, User Manual	document ID 112464
GasSecure GS01 Wireless Infrared Hydrocarbon Gas Detector, Safety Manual	document ID 21440
GSD-1429-4 Setting up a wireless gas detection system	GSD-1429-4

■ Trademark Acknowledgments

PROFINET and PROFIsafe are registered trademarks of PROFIBUS and PROFINET International.

ProSafe-RS is a registered trademark of Yokogawa Electric Corporation.

GS01 is a registered trademark of GasSecure AS.

S7 and STEP 7 are registered trademarks of Siemens AG.

Also refer to "Copyright and Trademark Notices" part of "Read Me First" (IM 01W02D01-11EN).

Safety Precautions

Safety precautions of YFGW410 PROFINET interface follow "Safety Precautions" part of "Read Me First" (IM 01W02D01-11EN) and the User's Manual of YFGW410 (IM 01W02D01-01EN). Refer to those documents.

Document Conventions

● **Typographical Conventions used to show key or button operations**

Characters enclosed in square brackets ([ ]) show either a key on the operation keyboard, a button name on a window, or an item displayed on a window.

Example:

To perform the function, press the [OK] key.

● **Drawing Conventions**

Some drawings may be partially emphasized, simplified or omitted for the convenience of description.

Some screen image depicted in this document may have different display positions or character types (e.g., upper/lower case). Also note that some of the images contained in this document are display examples.

Information of Revision

Material Name : **YFGW410 PROFINET Interface**
Material Number : **IM 01W02D01-21EN**

Edition	Date	Page	Revised Item
1st	June 2017	-	New Issue
2nd	October 2017	D3-2	Add notes about the range of F-Parameter "F_Dest_Add".
		D3-9	Update notes about IO controller program.
		D4-13	Add description about the exchange of the mapping information with ProSafe-RS.
		D4-13	Update notes about download settings.
		G3-1	Add connectivity verified host system model.

Part A Overview of PROFINET Interface

A1. Introduction

YFGW410 PROFINET interface is a function of YFGW410. It has the following roles:

● **Role of PROFINET interface in the Field Wireless System**

YFGW410 PROFINET interface operates as one of a gateway interface accessible from upper host system/controller, and transfers the communication from/to field wireless devices.

● **Role of PROFINET interface in the PROFINET IO System**

YFGW410 PROFINET interface operates as a PROFINET IO Device accessible from the PROFINET IO Controller.

YFGW410 PROFINET interface can transfer PROFIsafe functional safety communication messages between Safety Instrumented Systems (SIS) and wireless safety devices. The SIS must support PROFIsafe over PROFINET. A specific example of such an SIS is Yokogawa ProSafe-RS (R4.03.10 or later). The wireless safety device must support PROFIsafe over ISA100 Wireless. A specific example of such a device is GasSecure GS01.

A2. System Configuration

A2.1 Minimum System Configuration

Figure A2-1 shows a minimum configuration with a single YFGW410, which has PROFINET interface. This figure corresponds to Figure A1-1 of the User's Manual of YFGW410 (IM 01W02D01-01EN). In PROFINET system, host system consists of PROFINET IO Controller and PROFINET Engineering Tool and Host application.
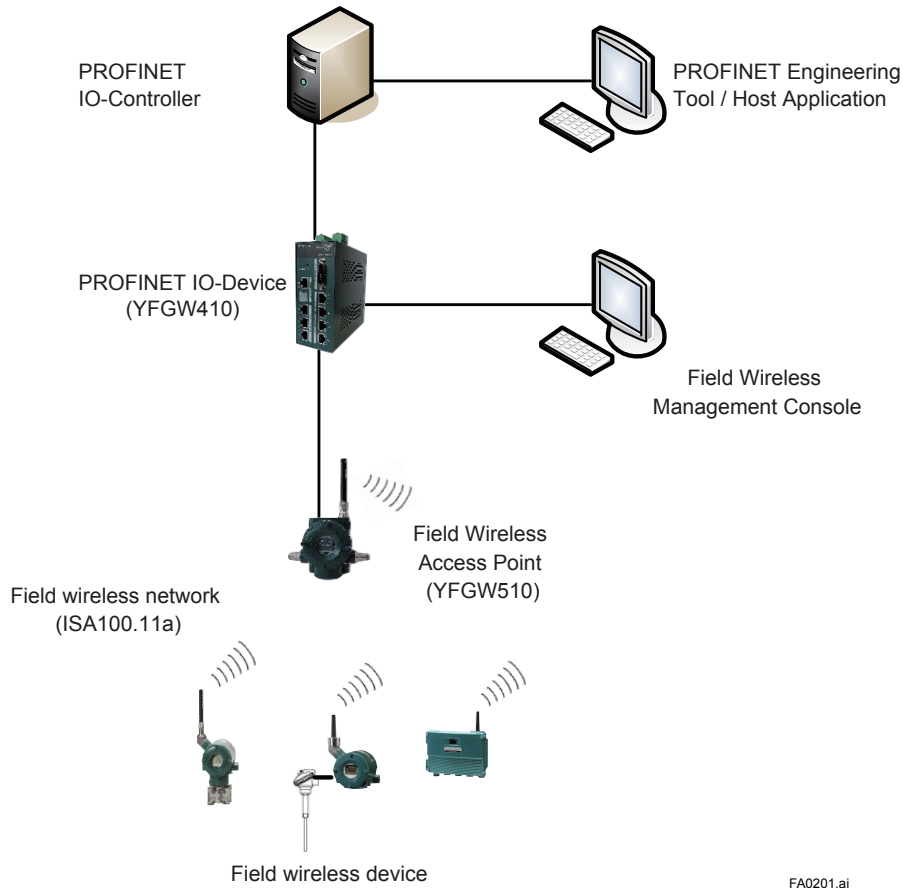
PROFINET
IO-Controller

PROFINET Engineering
Tool / Host Application

PROFINET IO-Device
(YFGW410)

Field Wireless
Management Console

Field Wireless
Access Point
(YFGW510)

Field wireless network
(ISA100.11a)

Field wireless device

FA0201.ai

Figure A2-1 Minimum system configuration example

A2.2 YFGW410 in Redundant Configuration with Single PROFINET IO Controller

Figure A2-2 shows a typical configuration with a redundant YFGW410 which has PROFINET interface. This figure corresponds to Figure A3-1 of the User's Manual of YFGW410 (IM 01W02D01-01EN). Note that host system is not a redundant configuration but a single configuration.

In this example, the both of YFGW410 and YFGW510 are made redundant system. By using Duocast, the paths between the field wireless device and YFGW510 are made redundant.

Two YFGW410 virtually operate as a single PROFINET IO Device, and the backbone devices and host system access to this virtual device.

In case one of YFGW410 is out of service by failure, another YFGW410 continues operation. One failure does not affect a field wireless system.

⚠ IMPORTANT

YFGW410 PROFINET interface does not support PROFINET standard redundancy features such as System Redundancy and Media Redundancy. Therefore, the combination of the YFGW410 (redundant or single configuration) and the PROFINET IO controller redundant configuration which assumes PROFINET standard redundancy does not work.
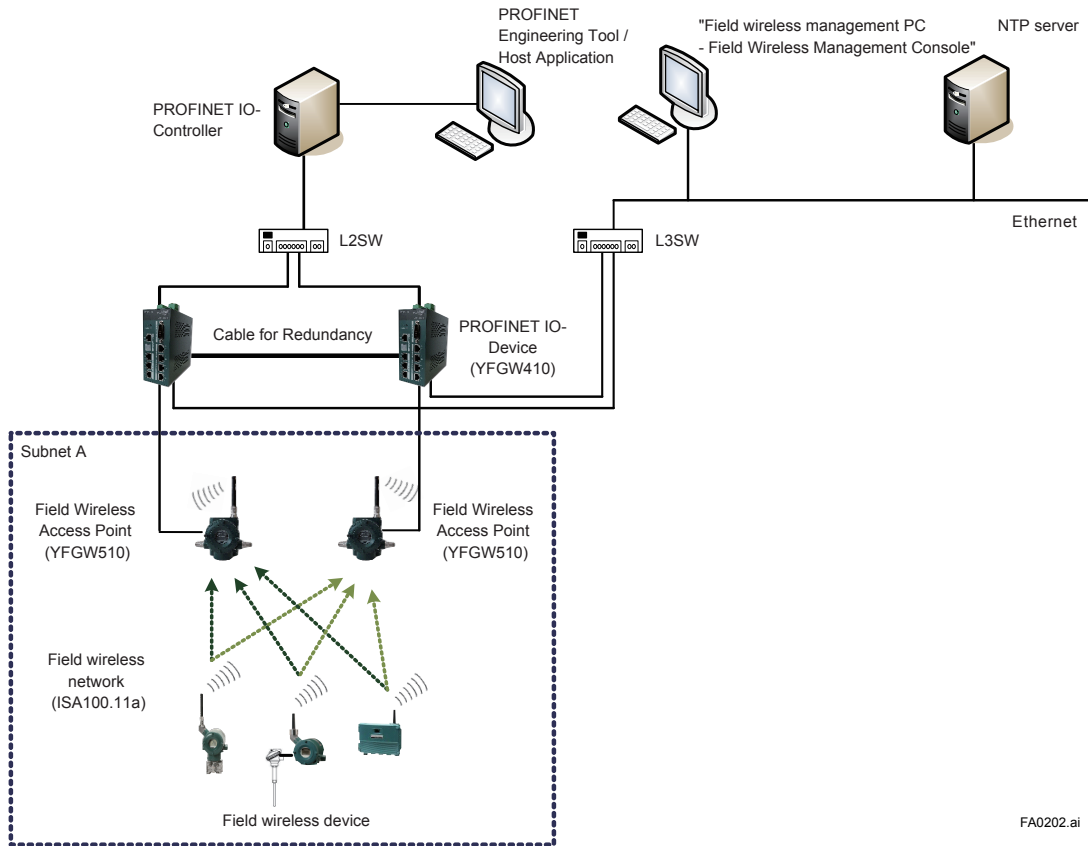
Figure A2-2 Redundant system configuration of YFGW410 (with single PROFINET IO Controller)

Part B Product Description

This part outlines the product of YFGW410 PROFINET interface.

B1.   Function Outline of PROFINET Interface

Figure B1-1 shows the functional structure of YFGW410 PROFINET interface and the relation with other devices.

In the PROFINET network, YFGW410 PROFINET interface operates as a PROFINET IO Device accessed from PROFINET IO Controllers. YFGW410 PROFINET interface translates PROFINET cyclic communication from/to ISA100 Wireless cyclic I/O communication according to the predefined mapping. The I/O data transferred by YFGW410 PROFINET interface includes not only general I/O data but also PROFIsafe safety Protocol Data Unit (PDU).

Figure B1-1 Functions of PROFINET Interface

Part C Installation

Refer to the "Part C Installation" of the User's Manual of YFGW410 (IM 01W02D01-01EN) for the details of installation such as hardware installation, power, ground and cabling.
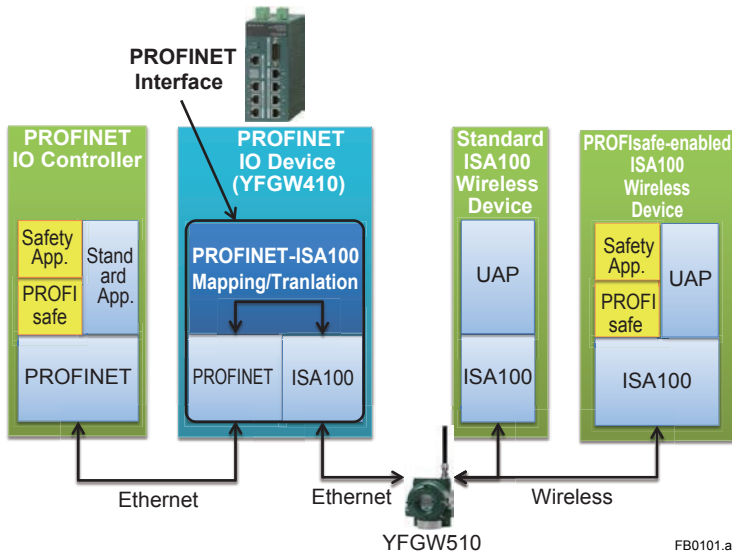
Part D Engineering

This part describes the work flow and content content of the engineering in order to use YFGW410 PROFINET interface.

D1.   Engineering Procedure
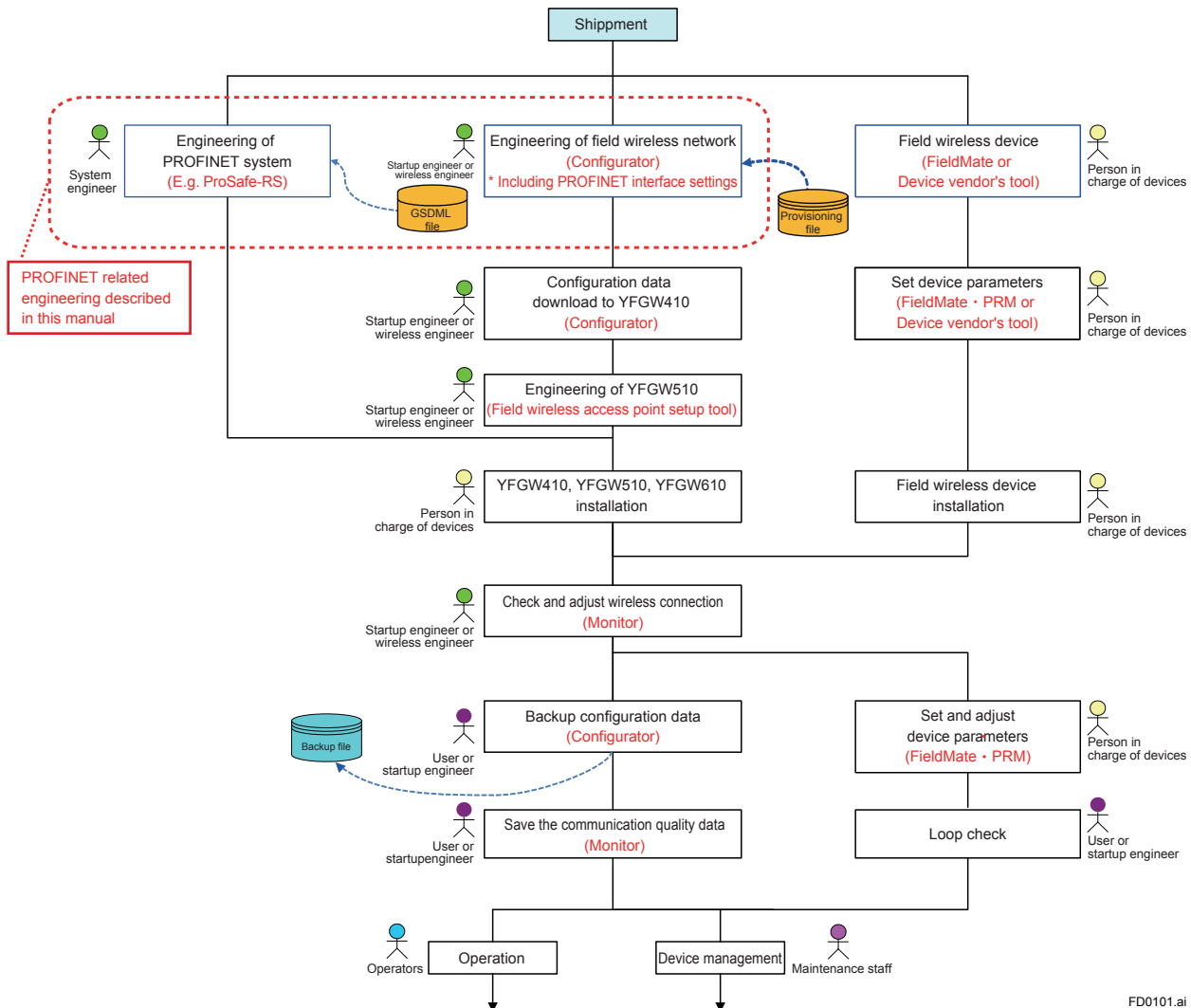
Figure D1-1 Engineering Flow in Field Wireless System Construction

Figure D1-1 corresponds to Figure D1-1 of the User's Manual of YFGW410 (IM 01W02D01-01EN) and shows the full picture of the field wireless system construction. The dashed rounded rectangle part is the engineering flow related to PROFINET. It consists of the following two parts:

- Engineering of PROFINET system including setting of PROFINET IO Controller and YFGW410 as a PROFINET IO Device

- Engineering of field wireless system including settings of YFGW410 PROFINET interface

This document describes the above mentioned PROFINET-related engineering. Regarding field wireless system engineering with FWMC (Field Wireless Management Console) Configurator, this document only describes the items specific to YFGW410 PROFINET interface. Refer to the User's Manual of YFGW410 (IM 01W02D01-01EN) for the full topics of field wireless system engineering.

D2.   Tools Used for Engineering

This chapter corresponds to Chapter "D2. Tools to be Used for the Engineering" of the User's Manual of YFGW410 (IM 01W02D01-01EN). Refer to the chapter of the User's Manual for details such as how to launch FWMC Configurator and how to set up field wireless network.

Table D2-1 shows the engineering procedure and tools used for the engineering.

Table D2-1 Engineering Procedure and Tools

Item	Procedure	Tool
Engineering of PROFINET system (Refer to Chapter D3)	Configuration of PROFINET IO Controller • Setting IO Controller's IP address, etc.	Engineering tool provided by PROFINET IO Controller vendor
	Configuration of PROFINET IO Device • Importing GSDML file of YFGW410 PROFINET IO Device • Specifying the method to assign IP address of YFGW410 PROFINET IO Device • Setting PROFIsafe F-Parameter • Setting IO Cycle Time	
	Assignment of PROFINET slots • Inserting I/O modules to slots of the IO Device	
	Programming PROFINET IO Controller • Make program with PLC programming language	
Engineering of PROFINET interface (Refer to Chapter D4)	Configuration of field wireless system related to PROFINET interface • Selecting and enabling the field network port of YFGW410 on which PROFINET interface operates • Configuring the publication data from/to field wireless device • Mapping between PROFINET slots and publication data	FWMC Configurator

D3. Engineering of PROFINET System

A PROFINET system consists of IO Controllers and IO Devices. YFGW410 PROFINET interface functions as a PROFINET IO Device. PROFINET IO Controller and IO Device are configured by using PROFINET engineering tool.

Because the actual procedure differs depending on the specific PROFINET engineering tools, this chapter only describes the outline of general procedures and items to be set by PROFINET engineering tools. For specific operation, refer to the document of the PROFINET engineering tool to be used.

D3.1 Configuration of PROFINET IO Controller

Configure attributes and properties (e.g. IP address) of IO Controller which connects to YFGW410 PROFINET IO Device by using the PROFINET engineering tool. You will also need to let the IO Controller know the name and IP address of the YFGW410 PROFINET IO Device by using the PROFINET engineering tool.

D3.2 Configuration of YFGW410 PROFINET IO Device

■ Importing GSDML Device Description File

General Station Description Markup Language (GSDML) is an XML based description language for PROFINET IO Devices. GSDML file for an IO Device contains the description of the IO device such as capabilities of the device, I/O data type declarations for the device and F-Parameter for PROFIsafe communication. The GSDML files of YFGW410 PROFINET IO Device are contained in the bundled DVD media. The name of the GSDML files and related files are as follows:

File Name	Description
GSDML-V2.2-Yokogawa-YFGW410-*YYYYMMDD*.xml GSDML-V2.3-Yokogawa-YFGW410-*YYYYMMDD*.xml (*YYYYMMDD* is the release date (e.g., 20170102) of this file.)	GSDML device description files (V2.2 and V2.3) for YFGW410 PROFINET IO Device
GSDML-0037-0001-YFGW410.bmp GSDML-0037-0001-YFGW410.ico	Bitmap and Icon image data files referred from the GSDML files. - Bitmap format: 70x40 pixels, 16 colors (depth: 4) - Icon format: multi icon (16x16/32x32/48x48 pixels, 16/256 colors)

To configure YFGW410 as a PROFINET IO Device, you first need to import the GSDML files of YFGW410 by PROFINET engineering tools.

■ Specifying the Method to Assign IP Address

PROFINET engineering tools have a function to set the IP address of the PROFINET IO Device by using PROFINET Discovery and Configuration Protocol (DCP) or other means. However do not assign the IP address of YFGW410 with PROFINET engineering tools because the IP address of YFGW410 PROFINET IO Device will be configured with FWMC Configurator as described in Section D4.2.

■ Setting PROFIsafe F-Parameter

In order to perform PROFIsafe communication between the PROFINET IO controller and the wireless safety device i.e. GS01, it is necessary to set the F-Parameter (safety parameter of PROFIsafe) both the controller and the device. Although the default values of the each F-Parameter are defined in the GSDML file of YFGW410, you might need to change the value of some F-Parameter. For example, you will need to adjust the F-Parameter "F_Dest_Add" to the value expected by the correspondent GS01.

Set the F-Parameter of the controller by using the PROFINET engineering tool that supports PROFIsafe setting. For details on how to set the F-Parameter of GS01, refer to the documents of GS01.

⚠ IMPORTANT

The specification of PROFIsafe defines the range of F-Parameter "F_Dest_Add" as 1 to 65534. However, the range that can be specified with the GSDML file of YFGW410 is 1 to 65000.

When setting "F_Dest_Add" of the wireless safety device, please be careful to specify it in the range of 1 to 65000 which is supported by the GSDML file of YFGW410.

■ Setting IO Cycle Time

Set IO Cycle Time and Threshold (Watchdog) for communication with YFGW410 by using the PROFINET engineering tool. Threshold is the number of communication cycles without valid data after which an error is assumed. YFGW410 supports 64, 128, 256 and 512 milliseconds as IO Cycle Time.

⚠ IMPORTANT

When IO Cycle Time for the communication with YFGW410 is set to 64 milliseconds, set Threshold to 6 or more.

D3.3   Assignning Slots of YFGW410 PROFINET IO Device

GSDML file declares data types called "module", which can be inserted/assigned to "slot" of PROFINET IO Device. Each module is corresponding to the I/O data handled by the IO Device.

Table D3-1 lists the modules declared in the GSDML file of YFGW410.

Table D3-1 Useable Modules of YFGW410 PROFINET IO Device

Module ID	Description	Slot number can be assigned
GS01_SAFE	PROFIsafe safety PDU of GS01 (input and output)	1-260
GS01_SAFE_2	PROFIsafe safety PDU of GS01 (input and output) [1]	1-260
GS01_SAFE_RS	PROFIsafe safety PDU of GS01 (input and output) [2]	1-260
GS01_REGULAR	Non-safety input data of GS01 (combination of PV, timestamp and CRC)	1-260
DIAG_STATUS	DIAG_STATUS attribute of UAPMO object of field wireless device (input data)	1-260
PV	PV attribute of AI object of field wireless device (input data)	1-260
OP	OP attribute of AO object of field wireless device (output data)	1-260
READBACK	READBACK attribute of AO object of field wireless device (input data)	1-260
PV_B	PV_B attribute of BI object of field wireless device (input data)	1-260
OP_B	OP_B attribute of BO object of field wireless device (output data)	1-260
READBACK_B	Readback_B attribute of BO object of field wireless device (input data)	1-260
GW_STATUS	Status of YFGW410 (input data)	1-260
BBR_STATUS	Status of YFGW510 (input data)	1-260
BATTERY_LIFE	EnergyLeft attribute of dlmo11a object of field wireless device (input data)	1-260

[1]   GS01_SAFE_2 can be used for Siemens S7-300F controller which does not support Float32 as the type of PV. Instead of Float32, Unsigned32 can be used as the type.

[2]   GS01_SAFE_RS is the same as GS01_SAFE except that the range of the watchdog timer is diffrent.

Figure D3-1 illustrates the structure of YFGW410 PROFINET IO Device. The IO Device has slots, into which the modules listed in Table D3-1 can be inserted. By using PROFINET engineering tool, you can insert/assign the I/O modules to the slots of the IO Device. Each slot is designated by slot and subslot number. It may be also necessary to associate slots with some information depending on the IO Controller.
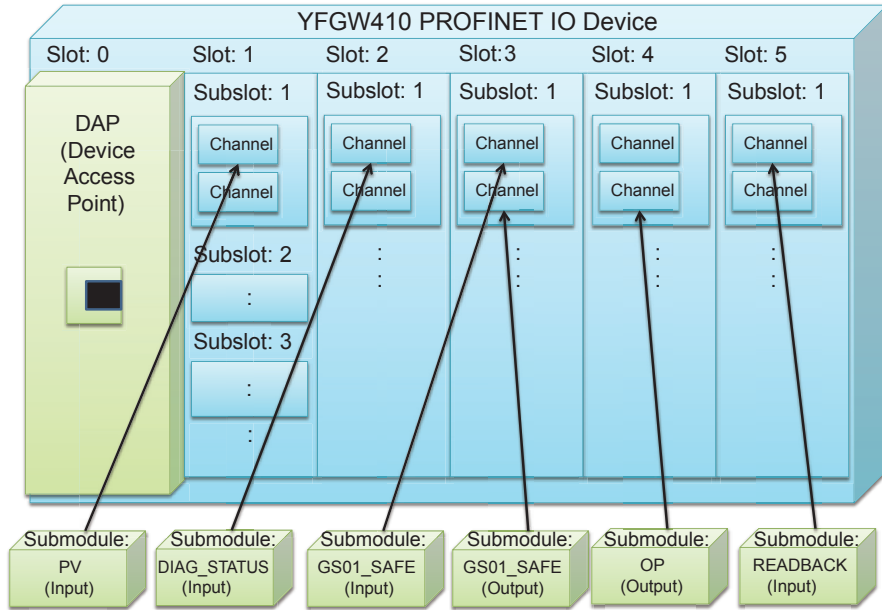
FD0301.ai

Figure D3-1 Device Model of YFGW410 PROFINET IO Device (Inserting Modules to Slots)

■ Module Format

● GS01_SAFE

Safety PDU to communicate with GS01. It is a pair of input and output, and input and output are assigned the same slot/subslot number. It is intended for hosts that can use 32 bit floating point type as safety data.

Table D3-2 GS01_SAFE (Input)

Data Type	Contents
Unsigned8	PV Status
Float32	PV Value
F_MessageTrailer4Byte	PROFIsafe trailer byte

Table D3-3 GS01_SAFE (Output)

Data Type	Contents
F_MessageTrailer4Byte	PROFIsafe trailer byte

● GS01_SAFE_2

Safety PDU to communicate with GS01. It is a pair of input and output, and input and output are assigned the same slot/subslot number. It is intended for hosts that cannot use 32 bit floating point type as safety data. (e.g. Siemens S7-300)

Table D3-4 GS01_SAFE_2 (Input)

Data Type	Contents
Unsigned8	PV Status
Unsigned32	PV Value
F_MessageTrailer4Byte	PROFIsafe trailer byte

Table D3-5 GS01_SAFE_2 (Output)

Data Type	Contents
F_MessageTrailer4Byte	PROFIsafe trailer byte

● GS01_SAFE_RS

Safety PDU to communicate with GS01. It is a pair of input and output, and input and output are assigned the same slot/subslot number. The data format is same as GS01_SAFE, but the available range of PROFIsafe watchdog time is different as shown in Table D3-8.

Table D3-6 GS01_SAFE_RS (Input)

Data Type	Contents
Unsigned8	PV Status
Float32	PV Value
F_MessageTrailer4Byte	PROFIsafe trailer byte

Table D3-7 GS01_SAFE_RS (Output)

Data Type	Contents
F_MessageTrailer4Byte	PROFIsafe trailer byte

Table D3-8 Difference between GS01_SAFE and GS01_SAFE_RS

Parameter	GS01_SAFE	GS01_SAFE_RS
F_WD_Time::AllowedValues	15000..60000	30000..60000

● GS01_REGULAR

Non-safety data for communicating with GS01.

Table D3-9 GS01_REGULAR (Input)

Data Type	Contents
Unsigned8	Padding
Integer8	PV Status
Float32	PV Value
Unsigned16	Timestamp
Unsigned16	Reserved
Unsigned16	CRC16

● DIAG_STATUS

DIAG_STATUS of the device.

Table D3-10 DIAG_STATUS (Input)

Data Type	Contents
Unsigned32	DIAG_STATUS

● PV

Analog input value.

Table D3-11 PV (Input)

Data Type	Contents
Unsigned8	Status
Float32	Value

● OP

Analog output value.

Table D3-12 OP (Output)

Data Type	Contents
Unsigned8	Status
Float32	Value

● **READBACK**

Analog output read back value.

Table D3-13 READBACK (Input)

Data Type	Contents
Unsigned8	Status
Float32	Value

● **PV_B**

Binary input value.

Table D3-14 PV_B (Input)

Data Type	Contents
Unsigned8	Status
Unsigned8	Value

● **OP_B**

Binary output value.

Table D3-15 OP_B (Output)

Data Type	Contents
Unsigned8	Status
Unsigned8	Value

● **READBACK_B**

Binary output read back value.

Table D3-16 READBACK_B (Input)

Data Type	Contents
Unsigned8	Status
Unsigned8	Value

● GW_STATUS

YFGW410 operating status information. The data structure and the contents of status information are as follows. Regardless of YFGW410 single or redundant configuration, only one module can be inserted.

Table D3-17 GW_STATUS (Input)

Data Type	Contents
Unsigned16	GW_STATUS_DETAIL

Table D3-18 GW_STATUS_DETAIL

Bits	Contents
Bit15 (MSB)	GW1 Error 0: Good, 1: Bad
Bit14	GW2 Error *1 0: Good, 1: Bad
Bit13-Bit12	GW1 Status 00: Ready, 01: Active, 10: Standby
Bit11-Bit10	GW2 Status *2 00: Ready, 01: Active, 10: Standby, 11: not used
Bit09	Field Wireless Device Status 0: Good (All the wireless field devices are properly connected on the field wireless network) 1: Bad (At least one wireless field device is not properly connected on the field wireless network)
Bit08-Bit00	Reserved Always 0

*1:   If YFGW410 is in single configuration, GW2 Error is 0.
*2:   If YFGW410 is in single configuration, GW2 Status is 11.

● BBR_STATUS

YFGW510 operating status information. The data structure and the contents of status information are as follows. Only one module can be inserted per YFGW510.

Table D3-19 BBR_STATUS (Input)

Data Type	Contents
Unsigned16	BBR_STATUS_DETAIL

Table D3-20 BBR_STATUS_DETAIL

Data Type	Contents
Bit15(MSB)	Field Wireless Access Point Status 0: Joined, 1: Not joined
Bit14-Bit00	Reserved Always 0

● BATTERY_LIFE

EnergyLeft value of the device. Only one module can be inserted per one device.

Table D3-21 BATTERY_LIFE (Input)

Data Type	Contents
Integer16	Energy Left >0: Days, <0: Hours, 0x7FFF: Infinite

D3.4 Programming PROFINET IO Controller

In order to perform data communication using PROFINET and PROFIsafe, it may be necessary to create, compile and download the controller program (e.g. IEC 61131-3).

⚠ IMPORTANT

Programs running on the Siemens S7 controller may require error handling specific to the S7 controller.

The type of errors described in the following table will be detected in the program when the status change specific to YFGW410 PROFINET interface happens. The program must handle those errors by using the Organization Block (OB) corresponding to the error type.

Type of Error	OB	Specific Meaning of PROFINET Interface
Insert/Remove Module Interrupt	OB83	STEP7 program will detect this error when S7 controller receives "Return of Submodule" alarm from PROFINET IO Devices. YFGW410 PROFINET IO Device sends the alarm to the IO Controller when the YFGW410 starts to send publish to a field wireless device and when the field wireless device starts to send publish to the YFGW410.
Rack Failure	OB86	STEP7 program will detect this error when the communication between the S7 controller and PROFINET IO Devices is disrupted. This includes the case of YFGW410 redundancy switchover happens.

D4. Engineering of ISA100 System for PROFINET Interface

This chapter corresponds to Chapter "D4. Constructing a Field Wireless System" of the User's Manual of YFGW410 (IM 01W02D01-01EN). Refer to the chapter for the full topics of ISA100-related engineering. This document only describes the key points of the settings related to PROFINET interface.

D4.1 Setting PROFINET IO Device Name

In the initial window of FWMC Configurator (Figure D4-1), set the device tag of YFGW410. This device tag is also used as the name of PROFINET IO Device. Regarding with input character restrictions, follow the rule of PROFINET standard.*1

*1 PROFINET standard specifies that the PROFINET IO Device name must be unique within PROFINET network. The name should also follow the specific rule summarized as follows:
- Labels consist of 'a' to 'z', '0' to '9' and '-'.
- Labels do not start with '-'
- Labels do not end with '-'
For details, refer to the PROFINET standard. Although FWMC Configurator only accepts uppercase characters as an ISA100 device tag input, uppercase characters are converted to lowercase characters when it is used as the name of PROFINET IO Device.
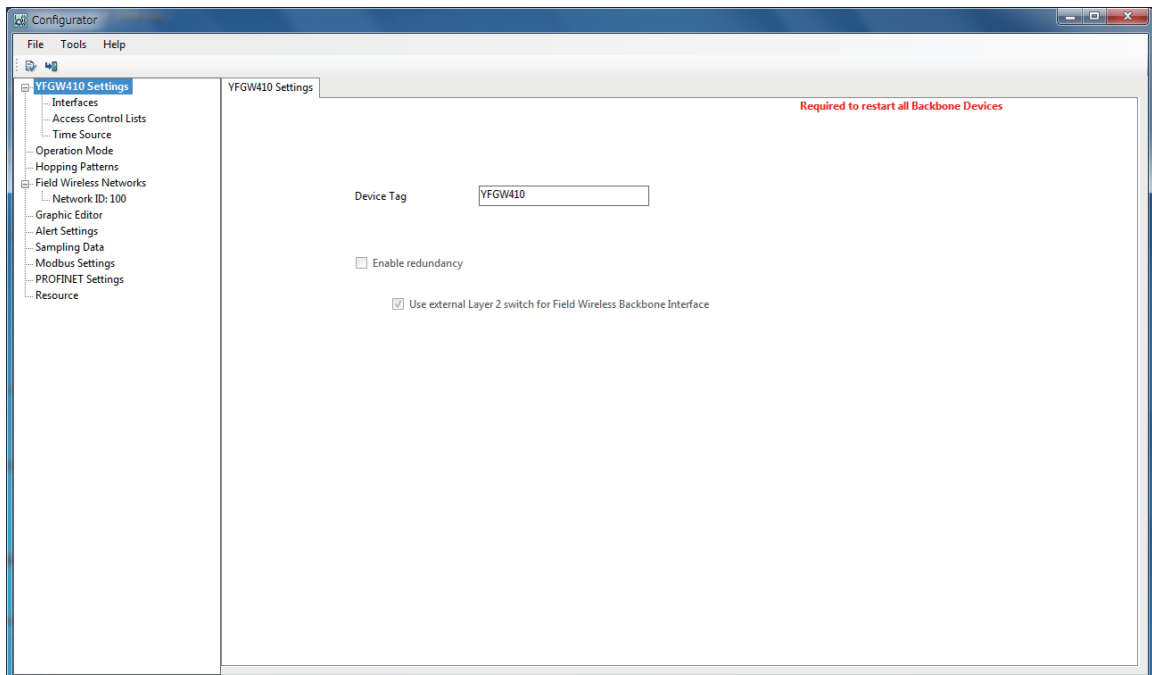
FD0401.ai

Figure D4-1 FWMC Configurator initial window

⚠ IMPORTANT

Do not change the name of YFGW410 PROFINET IO Device by Discovery and Configuration Protocol (DCP) using PROFINET engineering tool.
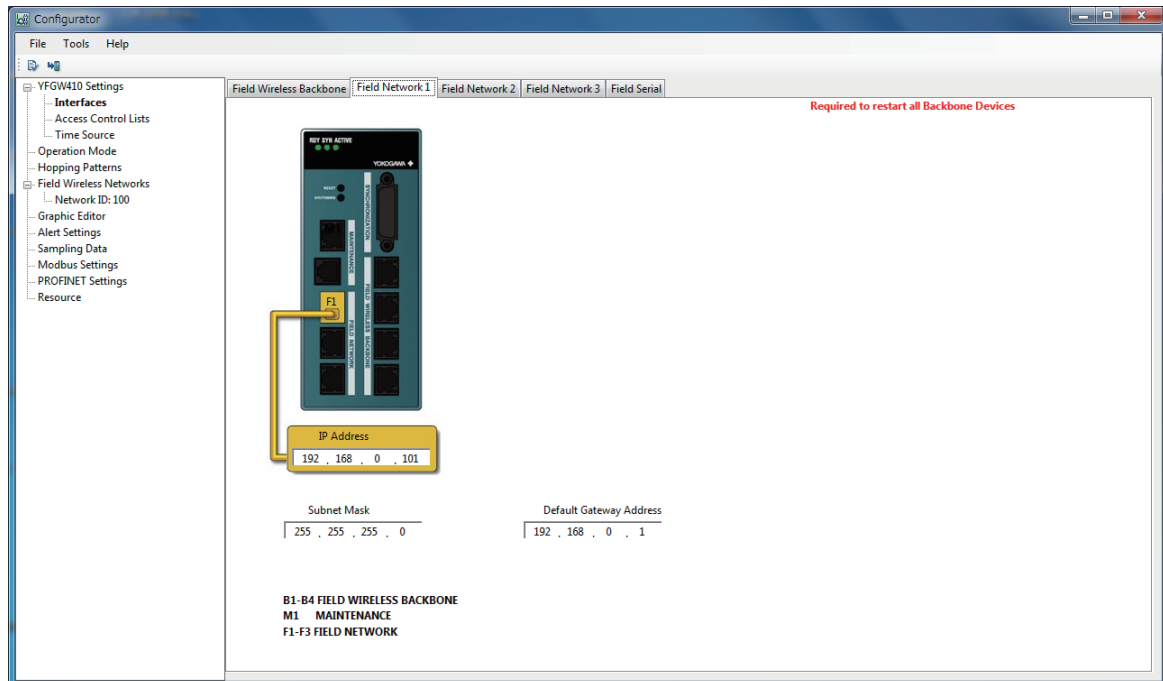
- PROFINET IO Device name of YFGW410 also can be assigned/changed by DCP protocol using PROFINET engineering tool. However the change will not be reflected to the device tag in FWMC Configurator. Also, once you change the PROFINET IO Device name via DCP, changing the device tag displayed in FWMC Configurator will not be reflected to the PROFINET IO Device name.

- In that case, in order to reflect the change of the device tag by FWMC Configurator to the PROFINET IO Device name, temporarily change the PROFINET IO Device name by DCP using PROFINET engineering tool to the same name as the device tag displayed in FWMC Configurator. After that, if you change the device tag with FWMC Configurator, it will be reflected to the PROFINET IO Device name.

D4.2   Setting Field Network Interface Used for PROFINET

PROFINET interface can be used at one of the field network ports: F1, F2 and F3.

By default, F1 port is enabled for Ethernet communication. If you would like to use F1 port for PROFINET communication and change the IP address of the F1 port from the default value (192.168.0.101), as shown in Figure D4-2, select [Interfaces] in the menu tree of FWMC Configurator, and select [Field Network 1], and specify the IP address you would like to set to the [IP Address] field.

To use the PROFINET interface with a port other than F1 port, for example F2 port, select [Interfaces] in the menu tree of FWMC Configurator, select the [Field Network 2] tab, and select [Enable F2 port] check box.

FD0402.ai

Figure D4-2 Field Network 1 Setting Tab (for Single Operation)
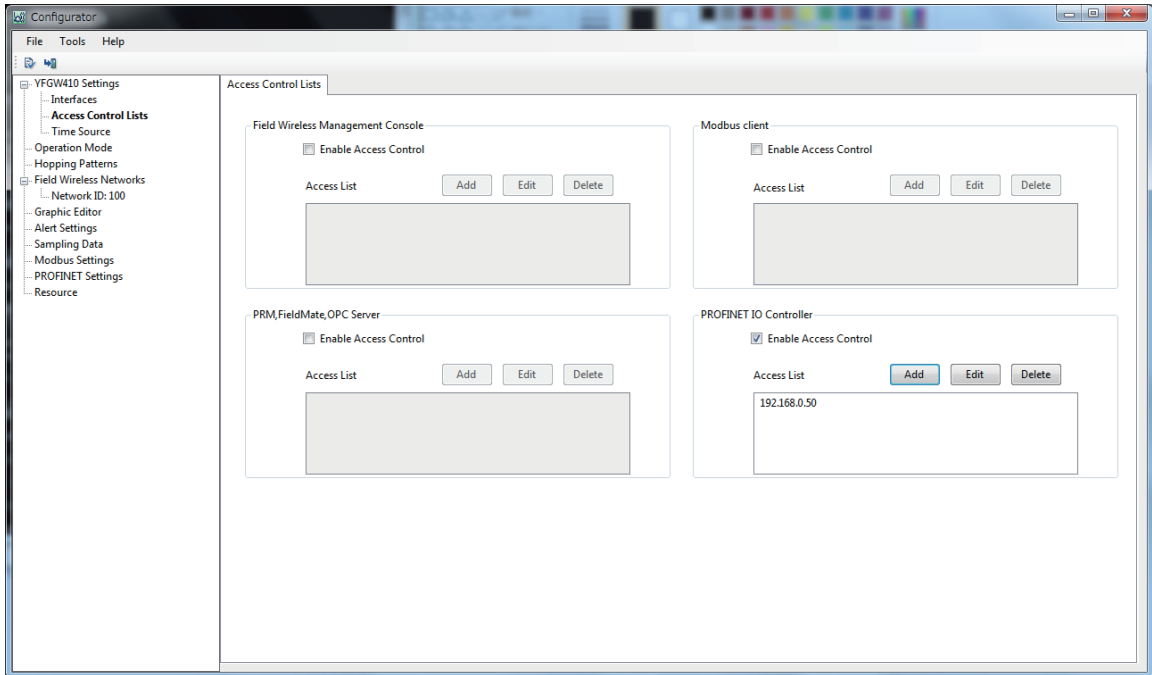
⚠ IMPORTANT

Do not change the IP address of YFGW410 PROFINET IO Device by DCP using PROFINET engineering tool.

- The IP address of PROFINET IO Device (IP address of YFGW410 used for PROFINET communication) also can be assigned/changed by DCP protocol using PROFINET engineering tool. However the change will not be reflected to the IP address appears in FWMC Configurator. Also, once you change the IP address of PROFINET IO Device via DCP, changing the IP address in FWMC Configurator will not be reflected to the IP address used for PROFINET communication.

- In that case, in order to reflect the change of the IP address by FWMC Configurator to the IP address used for PROFINET communication, temporarily change the IP address of PROFINET communication via DCP to the same value as the IP address displayed in FWMC Configurator. After that, if you change the IP address with FWMC Configurator, it will be reflected to the IP address used for PROFINET communication.

D4.3   Setting Access Control List for PROFINET

In the access control list (ACL), IP address and netmask of PROFINET IO Controller that is permitted to access the YFGW410 can be registered and restrictions can be set for access to the YFGW410 by unregistered devices.

To set the ACL, as shown in Figure D4-3, select [Access Control Lists] in the menu tree of FWMC Configurator, and in the [PROFINET IO Controller] section, register the IP address of the PROFINET IO Controller or the network address and netmask where the PROFINET IO Controller belongs.

FD0403.ai

Figure D4-3 Access Control Lists Tab

⚠ IMPORTANT

The ACL is only applicable for TCP/UDP/IP layer. The ACL can prevent PROFINET RPC services (connection, release, read, write, and control) sent via UDP from unexpected IO controllers.

However, it cannot prevent other PROFINET services that are not sent over UDP, such as PROFINET RTC (real time cyclic) service used for cyclic I/O data communication.

D4.4 Setting Publication Data from/to ISA100 Device

To send or receive I/O data from/to a field wireless device through YFGW410 PROFINET interface, you need to add the device, then set the route and configure the publication of I/O data from/to the devices by using FWMC Configurator. Refer to the User's Manual of YFGW410 (IM 01W02D01-01EN) for the detailed operation of FWMC Configurator.

This section describes the key points of the setting the publication of I/O data by using FWMC Configurator.

To set publication, as shown in Figure D4-4, select [Sampling Data] in the menu tree of FWMC Configurator, then click [Add] button.
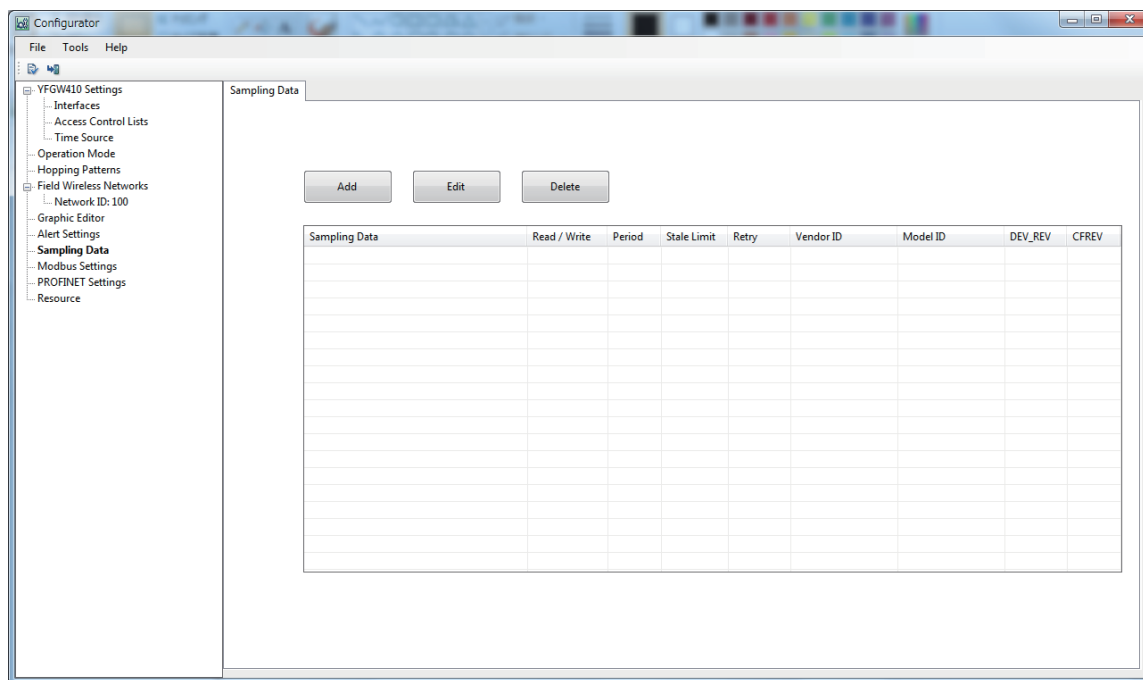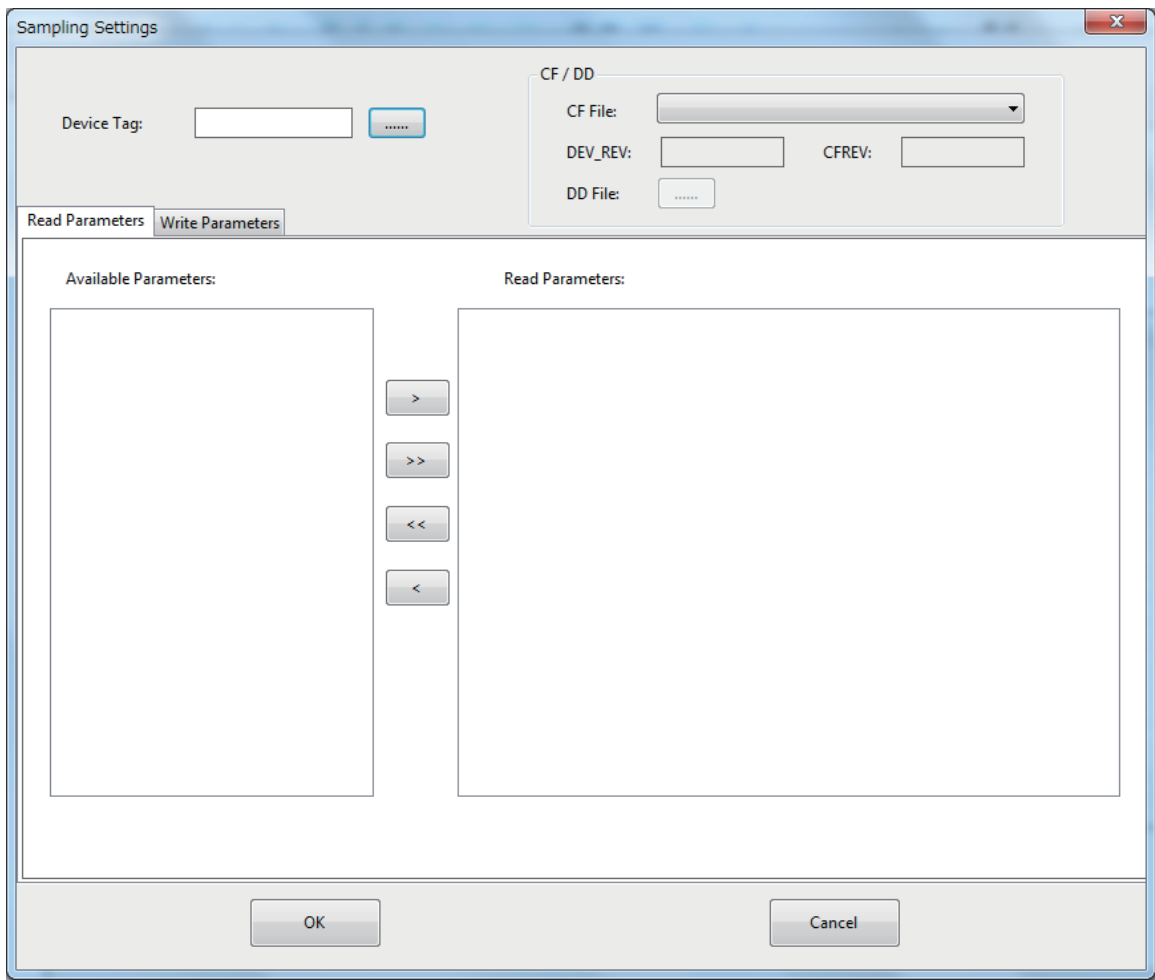

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Figure D4-4 Sampling Data Tab

When the [Add] button in Figure D4-4 is clicked, the window shown in Figure D4-5 appears.

In this window, load the CF File for the device you would like to add and select device tag for the device, then set the publication data by selecting the [Read Parameters] and [Write Parameters] tabs.

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Figure D4-5 Sampling Settings Window

Figure D4-6 and Figure D4-7 are example settings of the PROFIsafe-enabled GasSecure GS01. Because PROFIsafe-enabled GS01 has both of the input and output safety data for publication, you need to set both of them by FWMC Configurator. Figure D4-6 shows the setting of the input data and Figure D4-7 shows the setting of the output data.

Refer to the documents of GS01 for the specific values should be set to the parameters of PROFIsafe-enabled GS01.
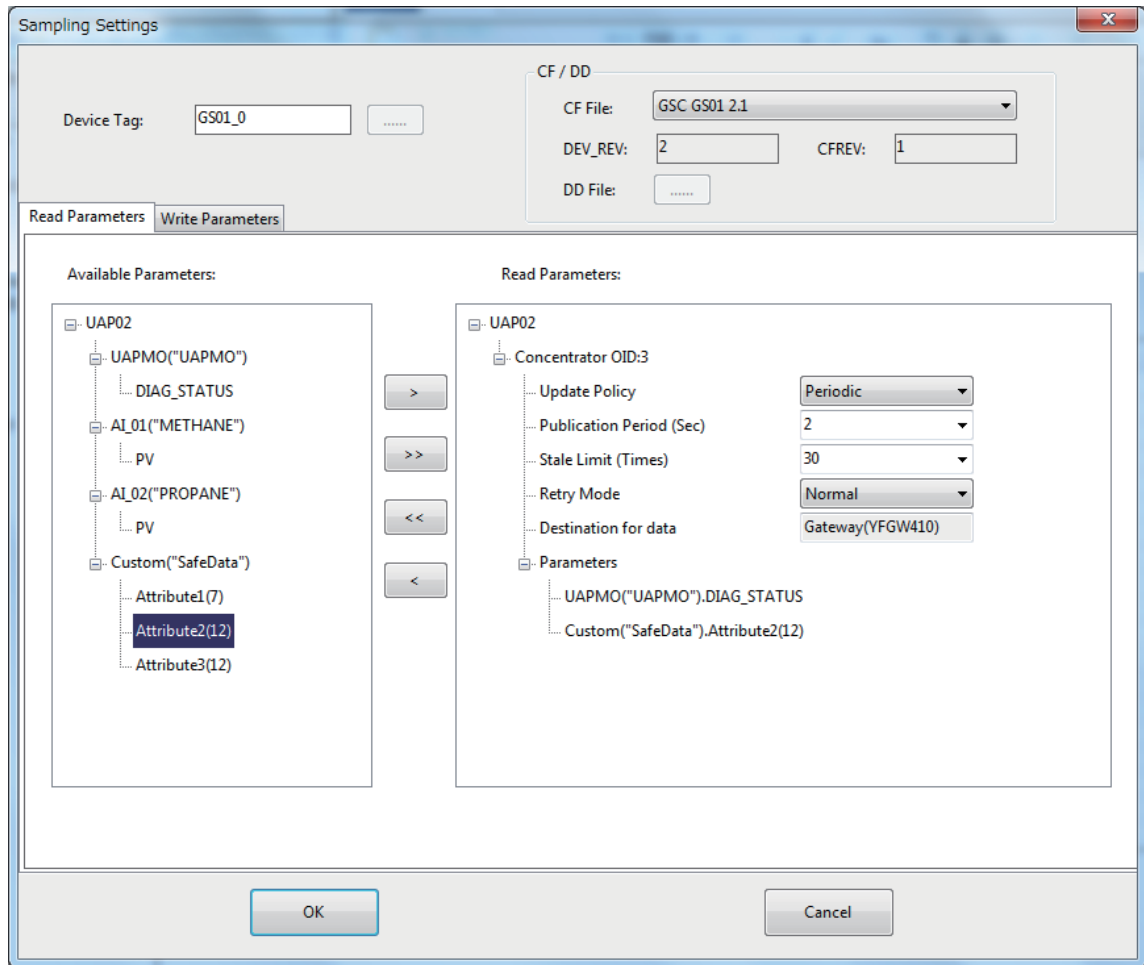
FD0406.ai

Figure D4-6 Example Setting of Safety Input Data for PROFIsafe-enabled GS01
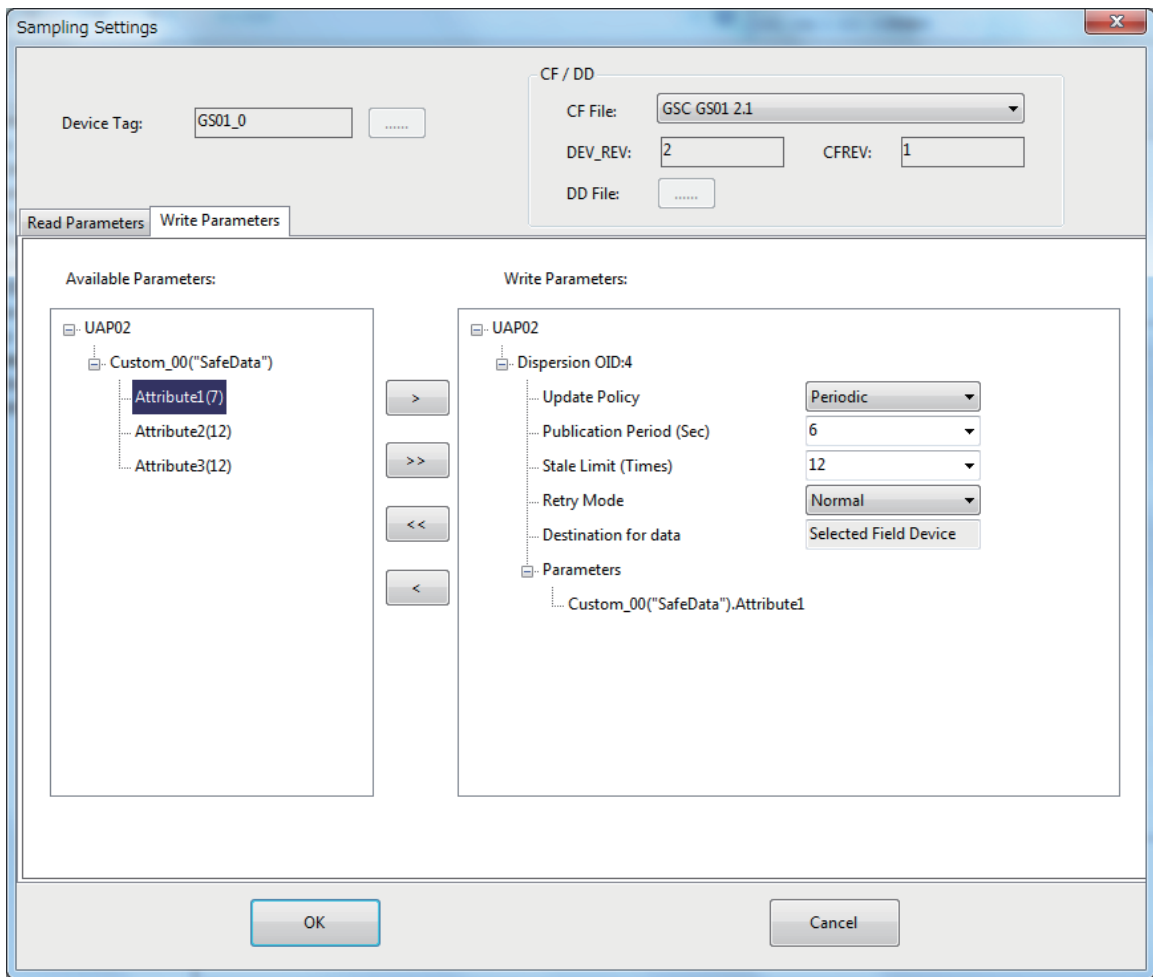
FD0407.ai

Figure D4-7 Example Setting of Safety Output Data for PROFIsafe-enabled GS01

D4.5 Enabling PROFINET Interface

When [PROFINET Settings] is selected in the menu tree of the Configurator, the tab shown in Figure D4-8 appears in the main window.

Click [PROFINET Port] drop-down box and select the port on which PROFINET will run.
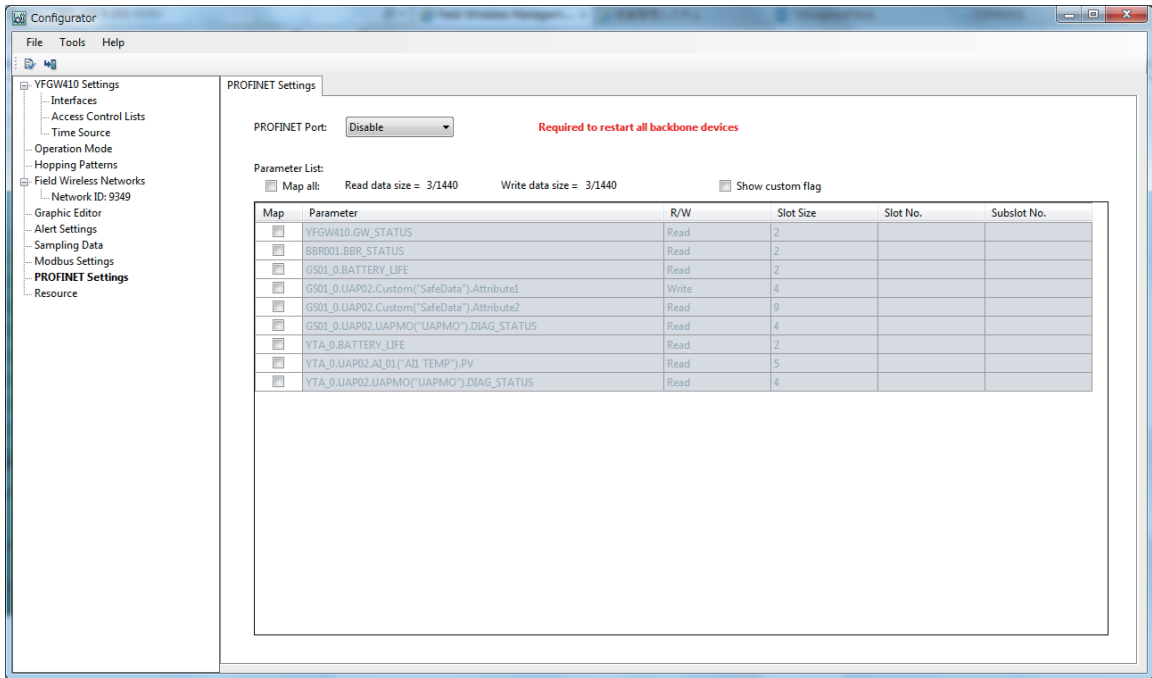
FD0408.ai

Figure D4-8 PROFINET Settings Tab (Initial Condition)

The function of [PROFINET Port] is as follows.

Item	Description	Possible setting (Default)
PROFINET Port	The Field Network port (F1, F2 or F3) on which PROFINET operates. When "Disable" is selected, PROFINET does not operate on any ports.	F1, F2, F3, Disable (Disable)

D4.6 Mapping PROFINET Slots and ISA100 Attributes

As described in D3.3, the modules are inserted in the slots of YFGW410 PROFINET IO Device. Figure D4-9 illustrates the structure of YFGW410 PROFINET IO Device. This section explains how to associate the attributes of the actual field wireless devices with the slots/modules of the YFGW410 PROFINET IO Device.
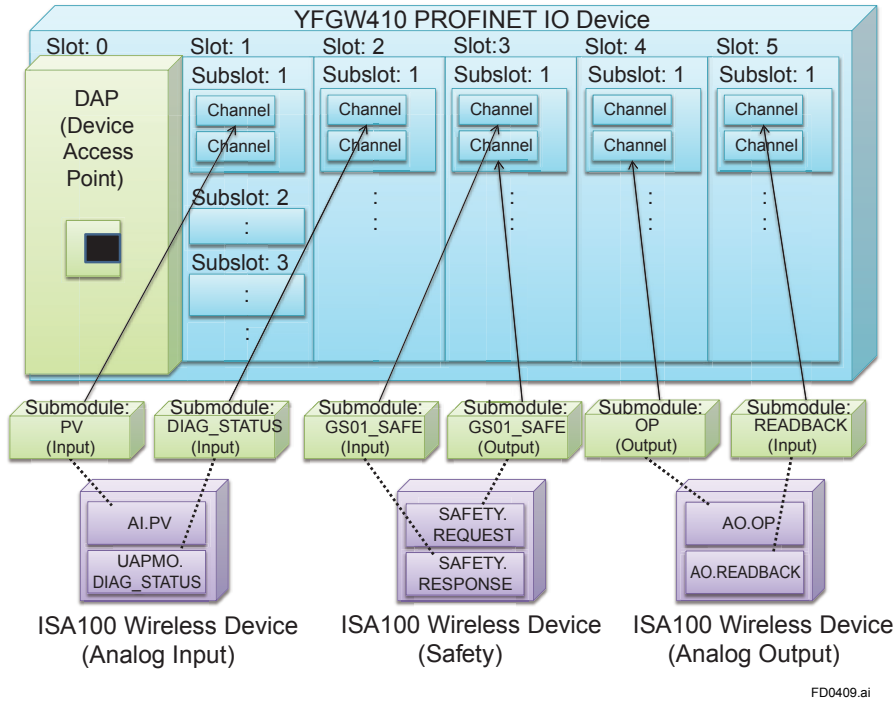
Figure D4-9 Mapping PROFINET Slots/Modules and ISA100 Attributes

When the publications of I/O data from/to the devices are configured, those I/O data (parameters) are appeared in [Parameter List] section of [PROFINET Settings] as shown in Figure D4-8.

To map those data to PROFINET slots of YFGW410, select [Map] check box of [Parameter List] as shown in Figure D4-10. Also specify PROFINET slot and subslot number by editing [Slot No.] and [Subslot No.] as show in Figure D4-11. Use the slot and subslot number determined with PROFINET engineering tool as described in D3.3.
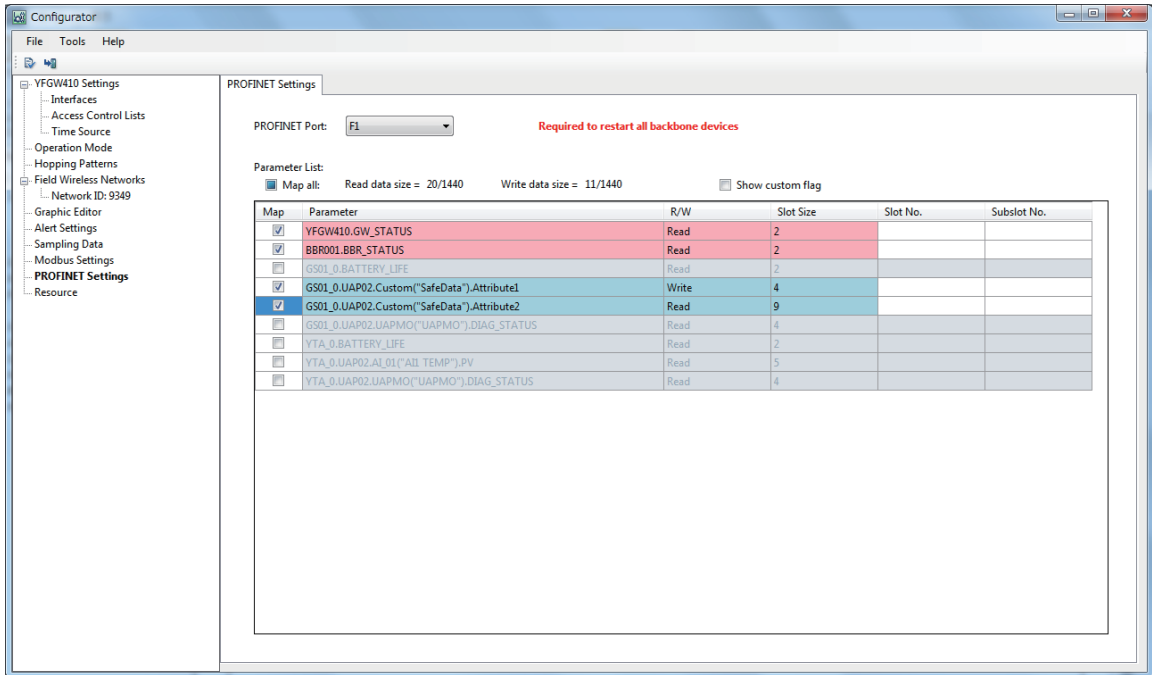
FD0410.ai

Figure D4-10 PROFINET Settings Tab (After Selecting Parameters Mapped to PROFINET Slots)

The items shown in the section of [Parameter Lists] are as follows.

Item	Description	Default setting
Map all	☑: Map all parameters ☐: Does not map any parameters ◼: Some parameters are mapped	Checkbox cleared (disabled)
Read data size / Write data size	Total size of read data and total size of write data. Those sizes are limited by maximum size of PROFINET RT frame i.e. 1440 bytes. FWMC Configurator calculates this size automatically. The formula is shown as follows: Read size = (Total slot size of all read parameters) + (Total number of all parameters) +3 Write size = (Total slot size of all write parameters) + (Total number of all parameters) +3	3
Show custom flag	Displays a field that specifies whether the attribute of the device has GS01-dependent 3 byte header. If the device is GS01 with this header in attribute ID 1 and 2, it will be automatically specified appropriately, so normally you do not need to manipulate this item.	Checkbox cleared (disabled)
Parameter List	See table below	See table below
Map	This check box indicates whether this parameter is mapped on PROFINET slot. To map this parameter, check this check box.	Checkbox cleared (disabled)
Parameter	This field indicates publication item of field wireless device. The notation of this field is same as Sampling Data*1 configured by FWMC Configurator.	-
R/W	This field indicates that the parameter is used for reading or writing.	-
Slot Size	This field indicates slot size of PROFINET. (Excludes the size of GS01-dependent header.)	-
Custom Flag	Select this when the device uses 3 byte header.	Checkbox cleared (disabled)
Slot No.	Specify slot number. (Range: 1-260)	-
Subslot No.	Specify subslot number. (Range: 1-9)	-

*1   Notation of Sampling Data is as follows:
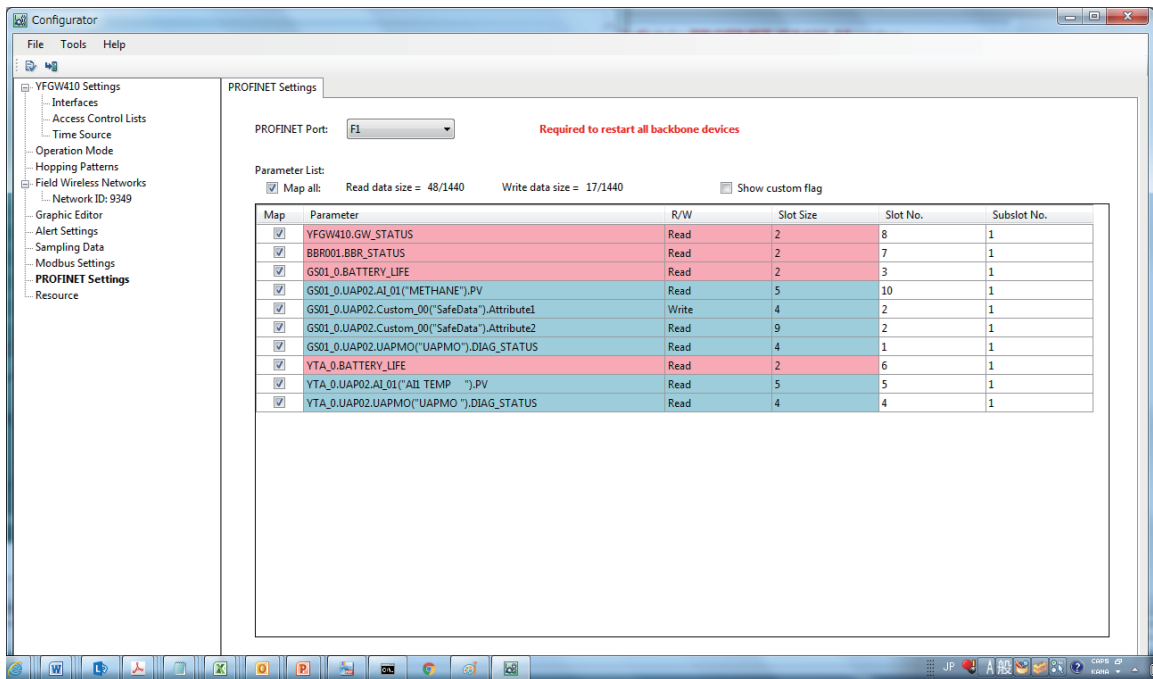   [DeviceTag].UAP[UAPID].[ObjectName_NN]("[BLOCK_DESCRIPTION]").[Attribute Name]

FD0411.ai

Figure D4-11 PROFINET Settings Tab (After Specifying Slot and Subslot No.)

■ Exchange of Mapping Information with ProSafe-RS

When YFGW410 PROFINET interface function is available, the following menu items are added to the [File] menu of the Configurator: [Export for ProSafe-RS], [Import from ProSafe-RS]. By functions of those menu, you can exchange the mapping information with Yokogawa's ProSafe-RS SIS.

● Export for ProSafe-RS

This function outputs the mapping information as a CSV-formatted text file for ProSafe-RS.

When [File] and then [Export for ProSafe-RS] are clicked, the output window appears. Select the file directory and file name, and then output the file.

● Import from ProSafe-RS

This function imports the mapping information such as PROFINET slot number and subslot number determined by ProSafe-RS.

When [File] and then [Import from ProSafe-RS] are clicked, a window to select the CSV file to be imported appears. Import the required file. Imported setting information is reflected in the [Slot No.] and [Subslot No.] columns of the [Parameter] section of the [PROFINET Setting] tab.

D4.7 Downloading PROFINET Interface Settings

When you change the settings of PROFINET interface, download the settings to the YFGW410 by the procedure described in "D4.2.10 Downloading Wireless Network Settings" of the User's Manual of YFGW410.

⚠ IMPORTANT

I/O data of PROFINET will not be updated for up to 3 seconds during setup download.

Depending on the setting contents, restart of YFGW410, YFGW510, wireless subnet, wireless device may be required.

When the YFGW410 or wireless subnet restarts, all devices under YFGW410 or wireless subnet will leave from the network and communication with those devices will stop for several minutes.

In this case, host system (such as SIS) is required to "lock" the communication data with the wireless device to be restarted.

You can know whether you need to restart with the setting with check box in the "Download Configuration" window of Configurator.

When the check box in the window is checked, the corresponding equipment or wireless subnet will be restarted.

Part E Operation and Maintenance

Refer to the "Part E Operation and Maintenance" of the User's Manual of YFGW410 (IM 01W02D01-01EN) for operation and maintenance of the field wireless system and YFGW410.

Part F Troubleshooting

For the troubleshooting of field wireless system including YFGW410, refer to "Part F Trouble-shooting" of the User's Manual of YFGW410 (IM 01W02D01-01EN).

If it is clear that the problem arises with a field wireless device, you should contact the relevant manufacturer of the device.

If it is clear that the problem is experienced with a PROFINET controller or a PROFIsafe safety controller which connects to YFGW410 PROFINET interface, you should contact the relevant manufacturer of the controller.

F1.　Status Information of PROFINET

YFGW410 PROFINET interface assigns the "joining" and "publication" status of field wireless devices to the bits of PROFINET IOxS bits. IOxS is abbreviation of IOPS (I/O Provider Status) and IOCS (I/O Consumer Status). Those are PROFINET I/O Communication statuses, and they are set and monitored by IO Controller and IO Device of communication partner.

The following table shows the assignment of field wireless device's status to IOxS each bits.

Bit 7 (MSB)	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0 (LSB)
DataState	Instance		Reserved				Extension
0 = Bad Data field may not contain valid user data – the receiver shall use its pre-configured values (zero, last valid value, or default value) instead of transmitted data field values SubstituteDataValid = FALSE	0x00 = Detected by subslot *1 *4						0x00 = No IOxS octet follows *3
	0x01 = Detected by slot						
	0x02 = Detected by IO device *2						
	0x03 = Detected by IO controller						
1 = Good *5 *6 Data field shall contain valid user data SubstituteDataValid = TRUE	0x00						

*1　For publication items, this value means that ISA100 device left network or does not send publish.
*2　This value means that YFGW410 failure has occurred. In redundant configuration of YFGW410, this value is shown only when a failure occurs in the active YFGW 410 and the standby YFGW 410 is stopped.
*3　The Extension bit always has this value.
*4　For BATTERY_LIFE, this value means that the corresponding ISA100 device has not joined.
*5　For GW_STATUS, the DataState is "Good" regardless of the value of GW_STATUS.
*6　For BBR_STATUS, the DataState is "Good" regardless of BBR join/leave condition.

F2. Relation between ISA100 PV Data Status and PROFINET IOxS

Figure F2-1 depicts the various statuses in YFGW410 and the relation between them. The dashed rounded rectangle part depicts PROFINET related status i.e. PROFINET IOxS and ISA100 PV data status stored in PROFINET slot/subslot.

The PROFINET interface sets "Good" value to the DataStatus bit of IOxS when the corresponding ISA100 device joined and started to send/receive publish. The PROFINET interface sets "Bad" value to the DataStatus bit of IOxS when the corresponding ISA100 device does not join or not start to send/receive publish (or the device reached to its stale limit).

The PROFINET interface does not change/override the PV data status. PROFINET IO Controller should use PV data only when its data status is "Good".

IOxS of BATTERY_LIFE is affected by device join/leave condition. The PROFINET interface sets "Good" value to the DataStatus bit of IOxS when the corresponding ISA100 device joined. Note that the value of BATTERY_LIFE may appear as 0 until after the PROFINET interface gets the value of BATTERY_LIFE from the corresponding ISA100 device.

IOxS of GW_STATUS and BBR_STATUS are not affected by device/BBR join/leave condition.
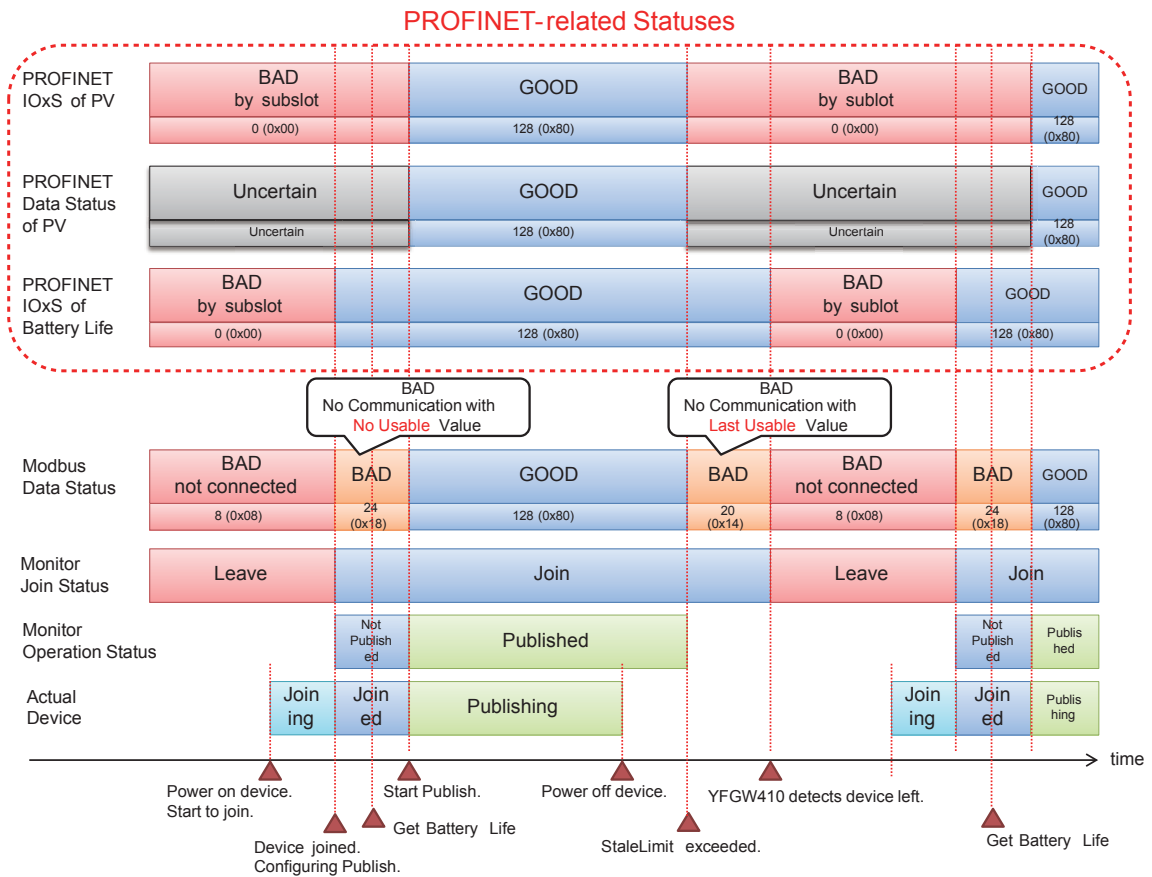

Figure F2-1 Example of Relation between ISA100 device status and YFGW410 status

Part G Specifications

G1. PROFINET Interface Specification

By selecting "B" (Modbus, OPC, PROFINET) from Communication Protocol, PROFINET interface function becomes available. YFGW410 is certified by PROFIBUS Nutzerorganisation e.V. (PNO) as the PROFINET IO Device with Conformance Class A and Realtime Class RT_CLASS_1.

YFGW410 PROFINET interface supports I/O data access from one PROFINET IO controller to a field wireless device. PROFINET interface also supports PROFIsafe transfer between the SIS and the safety device. YFGW410 PROFINET interface function can be enabled or disabled by using FWMC Configurator. When enabled, network size and maximum connection to YFGW410 are reduced as follows:

Network size: 120 devices

Maximum connection of Modbus/TCP: 4 clients

Item		Specification	
Communication Interface	100BASE-TX Port	One of the field network interface ports (F1, F2 or F3 port) is available for PROFINET interface	
Communication Protocol	PROFINET	Node Class	IO Device
		Conformance Class	CC-A *1
		Communication Class	RT_CLASS_1
		IO Cycle Time	64, 128, 256, 512 milliseconds *2
PROFINET Interface	Maximum number of PROFINET host systems connected to PROFINET interface	IO Controller	1
	Gateway/Translator function	Translation between ISA100 I/O data and PROFINET I/O data	
		Transfer PROFIsafe safety PDU between PROFIsafe-enabled GasSecure GS01 field wireless device and PROFIsafe controller	
	Maximum number of field wireless devices mapped to slots of PROFINET interface	Process value or PROFIsafe safety PDU	120
		Process value and PROFIsafe safety PDU	60

*1   YFGW410 PROFINET interface does not support PROFINET standard redundancy function such as System Redundancy and Media Redundancy.
*2   When IO Cycle Time is set to 64 millisecond, set "Threshold" to 6 or more. "Threshold" is the number of communication cycles without valid data after which an error is assumed.

G2. Model and Suffix Codes

Model	Suffix Code						Descriptions
YFGW410	....						Field Wireless Management Station
General Specifications	Output signal	-A...					Always A
	License		-B..				Single License (10 Field wireless devices connectable) *1
			-C..				Redundant License (100 Field wireless devices connectable) *2
			-S..				Redundant License (500 Field wireless devices connectable)
	Manual Language	1	....				English
	Software Media		0	....			Provided with DVD-R
			1	....			None
	Mounting Bracket			D....................................			DIN RAIL Mounting
	Sync Connector Termination				0		With Terminator *3
					1		With Cable for Redundancy *4
	---					A	Always A
	Communication Protocols						A..............	Modbus, OPC
							B..............	Modbus, OPC, PROFINET *5
Option Codes							/□ Optional Specifications

*1: One YFGW510 and one field wireless subnet are connectable.
*2: Two YFGW510s and one field wireless subnet are connectable.
*3: For single behavior, terminate the Sync Connector by the terminator.
*4: For redundant behavior, connect the cable for Redundancy between two YFGW410s.
*5: Applicable for License "-S".

G3. Connectivity Verified Model of PROFINET IO Controller

The following table describes the IO Controller models which are verified the connectivity with YFGW410 PROFINET interface.

■ Yokogawa ProSafe-RS Safety Instrumented System

Items	Model
Safety Control Unit	S2SC70S
Duplexed Safety Control Unit	S2SC70D
Fire and Gas Communication Module	S2LP131
Safety System Engineering and Maintenance Function	RS4E5100
Engineering Server Function	RS4E5000
I/O List Engineering Package	RS4E5210
Safety Control Function (for S2SC70□)	RS4F1500

■ Siemens SIMATIC S7-300 Advanced Controller

Items	Model
CPU315F-2PN/DP	6ES7 315-2FJ14-0AB0
512KB MMC memory	6ES7 953-8LJ30-0AA0
S7-300 power module	6ES7 307-1BA01-0AA0
STEP7 V5.5	6ES7 810-4CC10-0JA5
S7 Distributed Safety V5.4	6ES7 833-1FC02-0YA5

G4. Restrictions

G4.1 Redundancy

YFGW410 PROFINET interface does not support PROFINET standard redundancy features such as System Redundancy and Media Redundancy. Therefore, the combination of the YFGW410 (redundant or single configuration) and the PROFINET IO controller redundant configuration which assumes PROFINET standard redundancy does not work.

From a PROFINET IO Controller, a redundant pair of two YFGW410s looks like a single PROFINET IO Device which has a "virtual" IP address as shown in Figure G4-1. The IO Controller establishes connections with the "virtual" single IO Device. From the PROFINET IO Controller, YFGW410 redundancy switchover looks as if a single PROFINET IO Device replacement occurred. The following functions are required to PROFINET IO Controllers which access redundant pair of YFGW410s:

- With a switchover of YFGW410, it is required for the IO Controller to detect disconnection (disappearance) of PROFINET connections (i.e., AR: Application Relation and CR: Communication Relation). And it is required for the IO Controller to reestablish PROFINET connections.

- Because MAC address of "virtual" YFGW410 changes before and after the switchover, it is required for the IO Controller to resolve the MAC address by using ARP (Address Resolution Protocol).
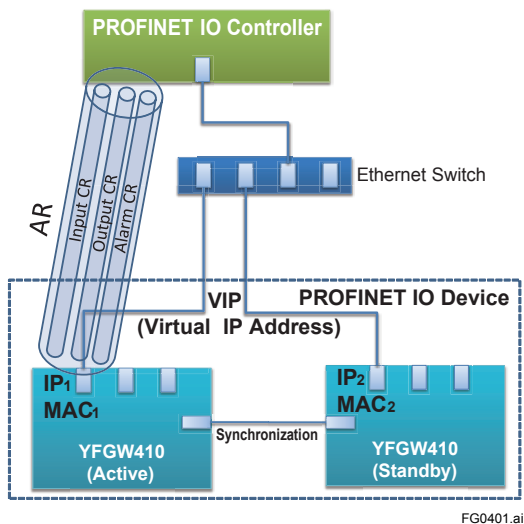
Figure G4-1 Redundant pair of YFGW410s as a single PROFINET IO Device

G4.2 PROFINET-ISA100 Translation

YFGW410 PROFINET interface only translates cyclic I/O communication between PROFINET and ISA100. It does not translate acyclic communication between PROFINET and ISA100.

The field wireless devices connecting to YFGW410 PROFINET interface shall send/receive I/O data via Publish service. And the I/O data should be the standard attribute of YFGW410 or the custom attribute of YFGW410 defined as an attribute of UAP Object.

G4.3 PROFIsafe Transfer

PROFIsafe-enabled field wireless devices (which supports PROFIsafe safety PDU transfer over ISA100 Wireless) connecting to YFGW410 PROFINET interface shall send/receive PROFIsafe safety PDU via Publish service.

The PROFIsafe safety PDU shall be the value of the custom attributes of YFGW410 defined as an attribute of a UAP Object.

YFGW410 PROFINET interface does not support PROFIsafe F-Parameter setting for the field wireless device via PROFINET and ISA100 Wireless communication. F-Parameter of the device should be configured with the method other than PROFINET and ISA100 Wireless communication.

G4.4 ISA100 Engineering from PROFINET Host System

YFGW410 PROFINET interface does not support ISA100-related engineering via PROFINET communication.